PHILIPS

Data handbook

Electronic components and materials

Semiconductors and integrated circuits

Part 4a December 1978

Transmitting transistors and modules

SEMICONDUCTORS AND INTEGRATED CIRCUITS

PART 4a — DECEMBER 1978

TRANSMITTING TRANSISTORS AND MODULES

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS AND INTEGRATED CIRCUITS	RED
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

Part 1a	December 1975	ET1a 12-75	**Transmitting tubes for communication, tubes for r.f. heating** Types PE05/25 to TBW15/25
Part 1b	August 1977	ET1b 08-77	**Transmitting tubes for communication, tubes for r.f. heating, amplifier circuit assemblies**
Part 2a	November 1977	ET2a 11-77	**Microwave tubes** Communication magnetrons, magnetrons for microwave heating, klystrons, travelling-wave tubes, diodes, triodes T-R switches
Part 2b	May 1978	ET2b 05-78	**Microwave semiconductors and components** Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub-assemblies, circulators and isolators
Part 3	January 1975	ET3 01-75	**Special Quality tubes, miscellaneous devices**
Part 4	March 1975	ET4 03-75	**Receiving tubes**
Part 5a	March 1978	ET5a 03-78	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
Part 5b	December 1978	ET5b 12-78	**Camera tubes and accessories,image intensifiers**
Part 6	January 1977	ET6 01-77	**Products for nuclear technology** Channel electron multipliers, neutron tubes, Geiger-Müller tubes
Part 7a	March 1977	ET7a 03-77	**Gas-filled tubes** Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes
Part 7b	March 1977	ET7b 03-77	**Gas-filled tubes** Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units
Part 8	May 1977	ET8 05-77	**TV picture tubes**
Part 9	March 1978	ET9 03-78	**Photomultiplier tubes; phototubes**

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

Part 1a	**August 1978**	**SC1a 08-78**	**Rectifier diodes, thyristors, triacs** Rectifier diodes, voltage regulator diodes (> 1,5 W), transient suppressor diodes, rectifier stacks, thyristors, triacs
Part 1b	**May 1977**	**SC1b 05-77**	**Diodes** Small signal germanium diodes, small signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes
Part 2	**November 1977**	**SC2 11-77**	**Low-frequency and dual transistors**
Part 3	**January 1978**	**SC3 01-78**	**High-frequency, switching and field-effect transistors**
Part 4a	**December 1978**	**SC4a 12-78**	**Transmitting transistors and modules**
Part 4b	**September 1978**	**SC4b 09-78**	**Devices for optoelectronics** Photosensitive diodes and transistors, light emitting diodes, photocouplers, infrared sensitive devices, photoconductive devices
Part 4c	**July 1978**	**SC4c 07-78**	**Discrete semiconductors for hybrid thick and thin-film circuits**
Part 5a	**November 1976**	**SC5a 11-76**	**Professional analogue integrated circuits**
Part 5b	**March 1977**	**SC5b 03-77**	**Consumer integrated circuits** Radio-audio, television
Part 6	**October 1977**	**SC6 10-77**	**Digital integrated circuits** LOCMOS HE4000B family
Signetics integrated circuits 1978			Bipolar and MOS memories Bipolar and MOS microprocessors Analogue circuits Logic - TTL

COMPONENTS AND MATERIALS (GREEN SERIES)

Part 1	June 1977	CM1 06-77	**Assemblies for industrial use** High noise immunity logic FZ/30-series, counter modules 50-series, NORbits 60-series, 61-series, circuit blocks 90-series, circuit block CSA70(L), PLC modules, input/output devices, hybrid circuits, peripheral devices, ferrite core memory products
Part 2a	October 1977	CM2a 10-77	**Resistors** Fixed resistors, variable resistors, voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC), test switches
Part 2b	February 1978	CM2b 02-78	**Capacitors** Electrolytic and solid capacitors, film capacitors, ceramic capacitors, variable capacitors
Part 3	January 1977	CM3 01-77	**Radio, audio, television** Components for black and white television, components for colour television
Part 3a	September 1978	CM3a 09-78	**FM tuners, television tuners, surface acoustic wave filters**
Part 3b	October 1978	CM3b 10-78	**Loudspeakers**
Part 4a	November 1978	CM4a 11-78	**Soft ferrites** Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferroxcube transformer cores
Part 4b	December 1976	CM4b 12-76	**Piezoelectric ceramics, permanent magnet materials**
Part 6	April 1977	CM6 04-77	**Electric motors and accessories** Small synchronous motors, stepper motors, miniature direct current motors
Part 7	September 1971	CM7 09-71	**Circuit blocks** Circuit blocks 100 kHz-series, circuit blocks 1-series, circuit blocks 10-series, circuit blocks for ferrite core memory drive
Part 8	February 1977	CM8 02-77	**Variable mains transformers**
Part 9	March 1976	CM9 03-76	**Piezoelectric quartz devices**
Part 10	April 1978	CM10 04-78	**Connectors**

INDEX OF TYPE NUMBERS

Data Handbooks SC1a to SC4c

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	part	section	type no.	part	section	type no.	part	section
AA119	1b	PC	BA217	1b	WD	BAW62	1b	WD
AAZ15	1b	GB	BA218	1b	WD	BAX12	1b	WD
AAZ17	1b	GB	BA219	1b	WD	BAX12A	1b	WD
AAZ18	1b	GB	BA220	1b	WD	BAX13	1b	WD
AC125	2	LF	BA221	1b	WD	BAX14	1b	WD
AC126	2	LF	BA222	1b	WD	BAX14A	1b	WD
AC127	2	LF	BA243	1b	T	BAX15	1b	WD
AC128	2	LF	BA244	1b	T	BAX16	1b	WD
AC128/01	2	LF	BA280	1b	T	BAX17	1b	WD
AC132	2	LF	BA314	1b	Vrg	BAX18	1b	WD
AC187	2	LF	BA314A	1b	Vrg	BAX18A	1b	WD
AC187/01	2	LF	BA315	1b	Vrg	BB105A	1b	T
AC188	2	LF	BA316	1b	WD	BB105B	1b	T
AC188/01	2	LF	BA317	1b	WD	BB105G	1b	T
AD161	2	P	BA318	1b	WD	BB106	1b	T
AD162	2	P	BA379	1b	T	BB110B	1b	T
AF367	3	HFSW	BAS16	4c	Mm	BB110G	1b	T
ASZ15	2	P	BAT17	4c	Mm	BB117	1b	T
ASZ16	2	P	BAT18	4c	Mm	BB119	1b	T
ASZ17	2	P	BAV10	1b	WD	BB204B	1b	T
ASZ18	2	P	BAV18	1b	WD	BB204G	1b	T
BA100	1b	AD	BAV19	1b	WD	BB205A	1b	T
BA102	1b	T	BAV20	1b	WD	BB205B	1b	T
BA145	1a	R	BAV21	1b	WD	BB205G	1b	T
BA148	1a	R	BAV45	1b	Sp	BBY31	4c	Mm
BA157	1a	R	BAV70	4c	Mm	BC107	2	LF
BA158	1a	R	BAV99	4c	Mm	BC108	2	LF
BA159	1a	R	BAW21A	1b	WD	BC109	2	LF
BA182	1b	T	BAW21B	1b	WD	BC140	2	LF
BA216	1b	WD	BAW56	4c	Mm	BC141	2	LF

AD = Silicon alloyed diodes
GB = Germanium gold bonded diodes
HFSW = High-frequency and switching transistors
LF = Low-frequency transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors
PC = Germanium point contact diodes
R = Rectifier diodes
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

DT = Dual transistors
FET = Field-effect transistors
LF = Low-frequency transistors

Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors

FET = Field-effect transistors
HFSW = High-frequency and switching transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits

P = Low-frequency power transistors

INDEX

FET = Field-effect transistors
HFSW = High-frequency and switching transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
R = Rectifier diodes
Tra = Transmitting transistors and modules

+ = series.

FET = Field-effect transistors
HFSW = High-frequency and switching transistors
Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors
PDT = Photodiodes or transistors
Th = Thyristors
Tra = Transmitting transistors and modules
Tri = Triacs

type no.	part	section	type no.	part	section	type no.	part	section
BU205	2	P	BY478	1a	R	BZV38	1b	Vrf
BU206	2	P	BYW19 +	1a	R	BZW10	1a	TS
BU207A	2	P	BYW29 +	1a	R	BZW70 +	1a	TS
BU208A	2	P	BYW30 +	1a	R	BZW86 +	1a	TS
BU209A	2	P	BYW31 +	1a	R	BZW91 +	1a	TS
BU326A	2	P	BYW54	1a	R	BZW93 +	1a	TS
BUX80	2	P	BYW55	1a	R	BZW95 +	1a	TS
BUX81	2	P	BYW56	1a	R	BZW96 +	1a	TS
BUX82	2	P	BYW92 +	1a	R	BZX55 +	1b	Vrg
BUX83	2	P	BYX10	1a	R	BZX61 +	1b	Vrg
BUX84	2	P	BYX22 +	1a	R	BZX70 +	1a	Vrg
BUX85	2	P	BYX25 +	1a	R	BZX75 +	1b	Vrg
BUX86	2	P	BYX29 +	1a	R	BZX79 +	1b	Vrg
BUX87	2	P	BYX30 +	1a	R	BZX84 +	4c	Mm
BY126	1a	R	BYX32 +	1a	R	BZX87 +	1b	Vrg
BY127	1a	R	BYX35	1a	R	BZX90	1b	Vrf
BY164	1a	R	BYX36 +	1a	R	BZX91	1b	Vrf
BY176	1a	R	BYX38 +	1a	R	BZX92	1b	Vrf
BY179	1a	R	BYX39 +	1a	R	BZX93	1b	Vrf
BY184	1a	R	BYX42 +	1a	R	BZY78	1b	Vrf
BY187	1a	R	BYX45 +	1a	R	BZY88 +	1b	Vrg
BY188 +	1a	R	BYX46 +	1a	R	BZY91 +	1a	Vrg
BY206	1a	R	BYX49 +	1a	R	BZY93 +	1a	Vrg
BY207	1a	R	BYX50 +	1a	R	BZY95 +	1a	Vrg
BY208 +	1a	R	BYX52 +	1a	R	BZY96 +	1a	Vrg
BY209	1a	R	BYX55 +	1a	R	BZZ14	1a	Vrg
BY223	1a	R	BYX56 +	1a	R	BZZ15	1a	Vrg
BY224 +	1a	R	BYX71 +	1a	R	BZZ16	1a	Vrg
BY225 +	1a	R	BYX90	1a	R	BZZ17	1a	Vrg
BY226	1a	R	BYX91 +	1a	R	BZZ18	1a	Vrg
BY227	1a	R	BYX96 +	1a	R	BZZ19	1a	Vrg
BY228	1a	R	BYX97 +	1a	R	BZZ20	1a	Vrg
BY277 +	1a	R	BYX98 +	1a	R	BZZ21	1a	Vrg
BY406	1a	R	BYX99 +	1a	R	BZZ22	1a	Vrg
BY407	1a	R	BZV10	1b	Vrf	BZZ23	1a	Vrg
BY409	1a	R	BZV11	1b	Vrf	BZZ24	1a	Vrg
BY409A	1a	R	BZV12	1b	Vrf	BZZ25	1a	Vrg
BY476	1a	R	BZV13	1b	Vrf	BZZ26	1a	Vrg
BY476A	1a	R	BZV14	1b	Vrf	BZZ27	1a	Vrg
BY477	1a	R	BZV15 +	1a	Vrg	BZZ28	1a	Vrg

+ = series.

Mm = Discrete semiconductors for hybrid thick and thin-film circuits
P = Low-frequency power transistors
R = Rectifier diodes
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes

AD = Silicon alloyed diodes
GB = Germanium gold bonded diodes
I = Infrared devices
LED = Light-emitting diodes
PC = Germanium point contact diodes
Ph = Photoconductive devices
PhC = Photocouplers
R = Rectifier diodes
St = Rectifier stacks
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

type no.	part	section	type no.	part	section	type no.	part	section
1N5756B	1b	Vrg	2N3866	4a	Tra	56231	1a	HE
1N5757B	1b	Vrg	2N3924	4a	Tra	56233	1a	A
2N918	3	HFSW	2N3926	4a	Tra	56234	1a	A
2N929	2	LF	2N3927	4a	Tra	56245	2,3,	
2N930	2	LF	2N3966	3	FET		4a	A
2N1613	3	HFSW	2N4030	3	HFSW	56246	1a	
2N1711	3	HFSW	2N4031	3	HFSW		to 4a	A
2N1893	3	HFSW	2N4032	3	HFSW	56253	1a	DH
2N2218	3	HFSW	2N4033	3	HFSW	56256	1a	DH
2N2218A	3	HFSW	2N4036	3	HFSW	56261	2	A
2N2219	3	HFSW	2N4091	3	FET	56261a	2	A
2N2219A	3	HFSW	2N4092	3	FET	56262A	1a	A
2N2221	3	HFSW	2N4093	3	FET	56263	1a	
2N2221A	3	HFSW	2N4347	2	P		to 4a	A
2N2222	3	HFSW	2N4391	3	FET	56264A	1a	A
2N2222A	3	HFSW	2N4392	3	FET	56268	1a	DH
2N2297	3	HFSW	2N4393	3	FET	56271	1a	DH
2N2368	3	HFSW	2N4427	4a	Tra	56278	1a	DH
2N2369	3	HFSW	2N4856	3	FET	56280	1a	DH
2N2369A	3	HFSW	2N4857	3	FET	56290	1a	HE
2N2483	2	LF	2N4858	3	FET	56293	1a	HE
2N2484	2	LF	2N4859	3	FET	56295	1a	A
2N2894	3	HFSW	2N4860	3	FET	56299	1a	A
2N2894A	3	HFSW	2N4861	3	FET	56309B	1a	A
2N2904	3	HFSW	2N5415	3	HFSW	56309R	1a	A
2N2904A	3	HFSW	2N5416	3	HFSW	56312	1a	DH
2N2905	3	HFSW	61SV	4b	I	56313	1a	DH
2N2905A	3	HFSW	40820	3	HFSW	56314	1a	DH
2N2906	3	HFSW	40835	3	HFSW	56315	1a	DH
2N2906A	3	HFSW	40838	3	HFSW	56316	1a	A
2N2907	3	HFSW	56200	2,3,		56318	1a	DH
2N2907A	3	HFSW		4a	A	56319	1a	DH
2N3019	3	HFSW	56201	2	A	56326	2,3	A
2N3020	3	HFSW	56201c	2	A	56333	2,3	A
2N3055	2	P	56201d	2	A	56334	1a	DH
2N3375	4a	Tra	56201j	2	A	56337	1a	A
2N3442	2	P	56203	2	A	56339	2	A
2N3553	4a	Tra	56218	2,3,		56348	1a	DH
2N3632	4a	Tra		4a	A	56349	1a	DH
2N3823	3	FET	56230	1a	HE	56350	1a	DH

A = Accessories
DH = Diecast heatsinks
FET = Field-effect transistors
HE = Heatsink extrusions
HFSW = High-frequency and switching transistors
I = Infrared devices
LF = Low-frequency transistors
P = Low-frequency power transistors
Tra = Transmitting transistors and modules
Vrg = Voltage regulator diodes

type no.	part	section	type no.	part	section	type no.	part	section
56351	2	A	56358	1a	A	56363	1a,2	A
56352	2	A	56359	2	A	56364	1a,2	A
56353	2	A	56359a	2	A	56366	1a	A
56354	2	A	56360	2	A	56367	2	A
56356	2,3	A	56360a	2	A	56368	2	A
						56369	2	A

A = Accessories

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices — as opposed to integrated circuits —, multiples of such devices and semiconductor chips.

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	R.M.S. value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)
Example I_B

b) instantaneous total values
Example i_B

c) average total values
Example $I_{B(AV)}$

d) peak total values
Example I_{BM}

e) root-mean-square total values
Example $I_{B(RMS)}$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values
Example i_b

b) root-mean-square values
Example $I_{b(rms)}$

c) peak values
Example I_{bm}

d) average values
Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

V_{B2-E} = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

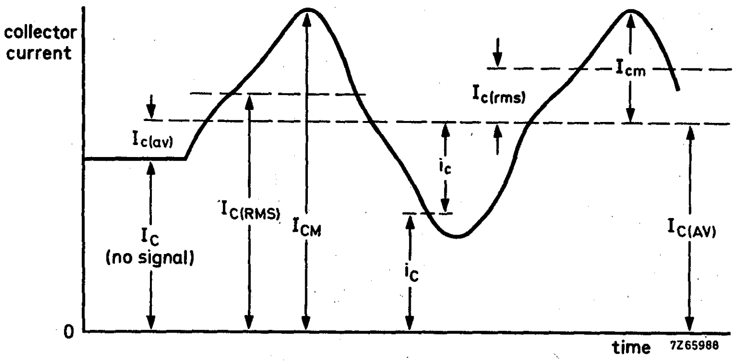
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f	=	forward; forward transfer
I, i (or 1)	=	input
L, l	=	load
O, o (or 2)	=	output
R, r	=	reverse; reverse transfer
S, s	=	source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)

R_E = d.c. value of the external emitter resistance.

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration

$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

Examples: h_i (or h_{11})
h_o (or h_{22})
h_f (or h_{21})
h_r (or h_{12})

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

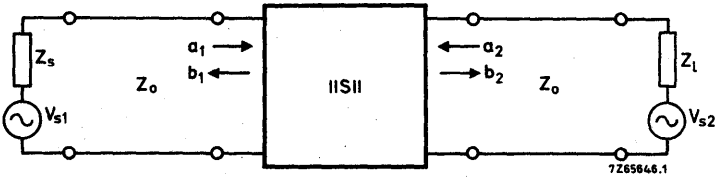
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}} \qquad {}^{1)}$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_o}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_o}}$$

Z_o = characteristic impedance of the transmission line in which the two-port is connected.

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \left.\frac{b_1}{a_1}\right|_{a_2 = 0}$$

$$s_r = s_{12} = \left.\frac{b_1}{a_2}\right|_{a_1 = 0}$$

$$s_f = s_{21} = \left.\frac{b_2}{a_1}\right|_{a_2 = 0}$$

$$s_o = s_{22} = \left.\frac{b_2}{a_2}\right|_{a_1 = 0}$$

1) The squares of these quantities have the dimension of power.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_l = Z_o$ and $V_{s2} = 0$.

$s_r = s_{12}$ = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

$s_f = s_{21}$ = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_l = Z_o$ and $V_{s2} = 0$

$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o$ and $V_{s1} = 0$.

TRANSMITTING TRANSISTORS AND MODULES

Type number survey
Selection guide
Line-ups
Envelopes
Soldering recommendations

In this alphanumeric list we present all transmitting transistors and modules mentioned in this handbook together with the most important data.

type number	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB
BFQ42	TO-39	c.w. class-B	13,5	175	2	11
BFQ43	TO-39	c.w. class-B	13,5	175	4	12
BFS22A	TO-39	c.w. class-B	13,5	175	4	8
BFS23A	TO-39	c.w. class-B	28	175	4	10
BGY22	SOT-75A	c.w.	13,5	380-512	2,5	17
BGY22A	SOT-75A	c.w.	12,5	420-480	2,5	17
BGY23	SOT-75A	c.w.	13,5	380-480	7	4,5
BGY23A	SOT-75A	c.w.	12,5	420-480	7	4,5
BGY32	SOT-132	c.w.	12,5	68-88	18	22,6
BGY33	SOT-132	c.w.	12,5	80-108	18	22,6
BGY35	SOT-132	c.w.	12,5	132-156	18	20,8
BGY36	SOT-132	c.w.	12,5	148-174	18	20,8
BLV10	SOT-123	c.w. class-B	13,5	175	8	9
BLV11	SOT-123	c.w. class-B	13,5	175	15	8
BLV20	SOT-123	c.w. class-B	28	175	8	12
BLV21	SOT-123	c.w. class-B	28	175	15	10
BLW29	SOT-120	c.w. class-B	13,5	175	15	10
BLW31	SOT-120	c.w. class-B	13,5	175	28	9
BLW32	SOT-122	class-A	25	860	0,5 (note 1)	11
BLW33	SOT-122	class-A	25	860	1,0 (note 1)	10
BLW34	SOT-122	class-A	25	860	1,8 (note 1)	9
BLW60	SOT-56	c.w. class-B	12,5	175	45	5,5
		s.s.b. class-AB	12,5	1,6-28	3-30 (note 2)	19,5
BLW60C	SOT-120	c.w. class-B	12,5	175	45	5,5
		s.s.b. class-AB	12,5	1,6-28	3-30 (note 2)	19,5
BLW64	SOT-56	class-A	25	224,25	10 (note 3)	9,5
BLW75	SOT-105	class-A	25	224,25	14 (note 3)	8
BLW76	SOT-121A	s.s.b. class-AB	28	1,6-28	8-80 (note 2)	13
		c.w. class-B	28	108	80	7,9
BLW77	SOT-121B	s.s.b. class-AB	28	1,6-28	15-130 (note 2)	12
		c.w. class-B	28	87,5	130	7,5
BLW78	SOT-121A	c.w. class-B	28	150	100	6
		s.s.b. class-A	26	28	30 (note 4)	19,5
BLW79	SOT-122	c.w. class-B	12,5	470	2	9
		c.w. class-B	12,5	175	2	13,5
BLW80	SOT-122	c.w. class-B	12,5	470	4	8
		c.w. class-B	12,5	175	4	15

Notes:
1. $P_{o\ sync}$ at $d_{im} < -60$ dB.
2. P.E.P. at $d_3 < -30$ dB.
3. $P_{o\ sync}$ at $d_{im} < -55$ dB.
4. P.E.P. at $d_3 < -40$ dB.

type number	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB
BLW81	SOT-122	c.w. class-B	12,5	470	10	6
		c.w. class-B	12,5	175	10	13,5
BLW82	SOT-119	c.w. class-B	12,5	470	30	5
		c.w. class-B	13,5	470	30	6,1
BLW83	SOT-123	s.s.b. class-A	26	1,6-28	0-10	20
		s.s.b. class-AB	28	1,6-28	3-30	21
BLW84	SOT-123	c.w. class-B	28	175	25	9
BLW85	SOT-123	c.w. class-B	12,5	175	45	5
		s.s.b. class-AB	12,5	1,6-28	3-30 (note 1)	19,5
BLW86	SOT-123	c.w. class-B	28	175	45	7,5
		s.s.b. class-AB	28	1,6-28	5-47,5 (note 1)	19
		s.s.b. class-A	26	1,6-28	17 (note 2)	22
BLW87	SOT-123	c.w. class-B	13,5	175	25	6
BLW95	SOT-121A	s.s.b. class-AB	50	28	160	14
BLW98	SOT-122	class-A	25	860	3,5 (note 3)	6,5
BLX13	SOT-56	s.s.b. class-A	26	28	0-8 (note 2)	18
		s.s.b. class-AB	28	28	25 (note 1)	18
		c.w. class-B	28	70	25	17
BLX13C	SOT-120	s.s.b. class-A	26	1,6-28	0-8 (note 2)	20
		s.s.b. class-AB	28	1,6-28	3-25 (note 1)	21
BLX14	SOT-55	s.s.b. class-A	28	1,6-28	15 (note 2)	13
		s.s.b. class-AB	28	1,6-28	7,5-50 (note 1)	13
		c.w. class-B	28	70	50	7,5
		c.w. class-B	28	30	50	16
BLX15	SOT-55	s.s.b. class-AB	50	1,6-28	20-150 (note 1)	14
		s.s.b. class-A	40	1,6-28	30 (note 2)	14
		c.w. class-B	50	70	150	10
		c.w. class-B	50	108	150	7,5
BLX39	SOT-120	c.w. class-B	28	175	45	7,5
		s.s.b. class-AB	28	1,6-28	5-42,5 (note 1)	19
		s.s.b. class-A	26	1,6-28	15 (note 2)	20
BLX65	TO-39	c.w. class-B	12,5	470	2	6
		c.w. class-B	12,5	175	2	12
BLX66	SOT-48	c.w. class-B	12,5	470	2,5	8,5
		c.w. class-B	12,5	175	3	20
BLX67	SOT-48	c.w. class-B	12,5	470	2,5	8,5
		c.w. class-B	12,5	175	3	20
BLX68	SOT-48	c.w. class-B	12,5	470	7	5
		c.w. class-B	12,5	175	7,2	12,6
BLX69A	SOT-48	c.w. class-B	13,5	470	20	4
BLX91A	SOT-48	c.w. class-B	28	470	1	11
BLX92A	SOT-48	c.w. class-B	28	470	2,5	11
BLX93A	SOT-48	c.w. class-B	28	470	7	8,5
BLX94A	SOT-48	c.w. class-B	28	470	25	6

Notes:
1. P.E.P. at $d_3 < -30$ dB. 2. P.E.P. at $d_3 < -40$ dB. 3. $P_{o\ sync}$ at $d_{im} < -60$ dB.

type number	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB
BLX95	SOT-56	c.w. class-B	28	470	40	4,5
BLX96	SOT-48	class-A	25	860	0,5 (note 1)	6
BLX97	SOT-48	class-A	25	860	1,0 (note 1)	5,5
BLX98	SOT-48	class-A	25	860	3,5 (note 1)	5
BLY87A	SOT-48	c.w. class-B	13,5	175	8	9
BLY87C	SOT-120	c.w. class-B	13,5	175	8	12
BLY88A	SOT-48	c.w. class-B	13,5	175	15	7,5
BLY88C	SOT-120	c.w. class-B	13,5	175	15	8
BLY89A	SOT-56	c.w. class-B	13,5	175	25	6
BLY89C	SOT-120	c.w. class-B	13,5	175	25	6
BLY90	SOT-55	c.w. class-B	12,5	175	50	5
BLY91A	SOT-48	c.w. class-B	28	175	8	12
BLY91C	SOT-120	c.w. class-B	28	175	8	12
BLY92A	SOT-48	c.w. class-B	28	175	15	10
BLY92C	SOT-120	c.w. class-B	28	175	15	10
BLY93A	SOT-56	c.w. class-B	28	175	25	9
BLY93C	SOT-120	c.w. class-B	28	175	25	9
BLY94	SOT-55	c.w. class-B	28	175	50	7
2N3375	TO-60	c.w. class-B	28	100	7,5	8,8
		c.w. class-B	28	400	3	4,8
2N3553	TO-39	c.w. class-B	28	175	2,5	10
2N3632	TO-60	c.w. class-B	28	175	13,5	5,9
2N3866	TO-39	c.w. class-B	28	400	1	10
2N3924	TO-39	c.w. class-B	13,5	175	4	6
2N3926	TO-60	c.w. class-B	13,5	175	7	5,4
2N3927	TO-60	c.w. class-B	13,5	175	12	4,8
2N4427	TO-39	c.w. class-B	12	175	1	10

Note:
1. $P_{o\ sync}$ at $d_{im} < -60$ dB.

In this list we present a survey of all transmitting transistors and modules grouped in accordance with the main r.f. power application area together with the most important data.

	type number	envelope	V_{CE} V	P_L (P.E.P.) W	G_p dB
s.s.b. class-AB; f = 28 MHz; d_3; d_5 < −30 dB	BLY92A	SOT-48	28	10	20
	BLY92C	SOT-120	28	10	20
	BLV21	SOT-123	28	10	20
	BLX13	SOT-56	28	25	18
	BLX13C	SOT-120	28	25	18
	BLW83	SOT-123	28	25	18
	BLX39	SOT-120	28	40	17
	BLW86	SOT-123	28	45	17
	BLX14	SOT-55	28	50	13
	BLW76	SOT-121A	28	80	13
	BLW77	SOT-121B	28	130	12
	BLX15	SOT-55	50	150	14
	BLW95	SOT-121A	50	160	14
s.s.b. class-A; f = 28 MHz; d_3; d_5 < −40 dB	BLY91A	SOT-48	26	1,3	20
	BLY91C	SOT-120	26	1,3	20
	BLV20	SOT-123	26	1,3	20
	BLY92A	SOT-48	26	2,5	20
	BLY92C	SOT-120	26	2,5	20
	BLV21	SOT-123	26	2,5	20
	BLX13	SOT-56	26	8	18
	BLX13C	SOT-120	26	8	20
	BLW83	SOT-123	26	10	20
	BLX39	SOT-120	26	15	18
	BLW86	SOT-123	26	17	20
	BLW78	SOT-121A	26	30	18
s.s.b. class-AB; f = 28 MHz; d_3; d_5 < −30 dB	BLY88A	SOT-48	13,5	10	18
	BLY88C	SOT-120	13,5	10	18
	BLV11	SOT-123	13,5	10	18
	BLY89A	SOT-56	13,5	15	18
	BLY89C	SOT-120	13,5	15	18
	BLW87	SOT-123	13,5	15	18
	BLW60	SOT-56	12,5	30	18
	BLW60C	SOT-120	12,5	30	18
	BLW85	SOT-123	12,5	30	18
s.s.b. class-A; f = 28 MHz; d_3; d_5 < −40 dB	BLY87A	SOT-48	12	1	18
	BLY87C	SOT-120	12	1	18
	BLV10	SOT-123	12	1	18
	BLY88A	SOT-48	12	2	18
	BLY88C	SOT-120	12	2	18
	BLV11	SOT-123	12	2	18
	BLY89A	SOT-56	12	6	18
	BLY89C	SOT-120	12	6	18
	BLW87	SOT-123	12	6	18

	type number	envelope	V_{CE} V	f MHz	P_L W	G_p dB
v.h.f. base stations; class-B operation	2N3866	TO-39	28	175	1	15
	BFS23A	TO-39	28	175	4	10
	BLY91A	SOT-48	28	175	8	12
	BLY91C	SOT-120	28	175	8	12
	BLV20	SOT-123	28	175	8	12
	BLY92A	SOT-48	28	175	15	10
	BLY92C	SOT-120	28	175	15	10
	BLV21	SOT-123	28	175	15	10
	BLY93A	SOT-56	28	175	25	9
	BLY93C	SOT-120	28	175	25	9
	BLW84	SOT-123	28	175	25	9
	BLX39	SOT-120	28	175	45	7,5
	BLW86	SOT-123	28	175	45	7,5
	BLY94	SOT-55	28	175	50	7
	BLW76	SOT-121A	28	108	80	8
	BLW78	SOT-121A	28	150	100	6
	BLW77	SOT-121B	28	87,5	130	7,5
	BLX15	SOT-55	50	108	150	7,5
	BLW95	SOT-121A	50	108	160	7,0
v.h.f. mobile transmitters; class-B operation	2N4427	TO-39	12	175	1	10
	BFQ42	TO-39	13,5	175	2	11
	BFS22A	TO-39	13,5	175	4	8
	BFQ43	TO-39 ▲	13,5	175	4	12
	BLY87A	SOT-48	13,5	175	8	9
	BLY87C	SOT-120	13,5	175	8	12
	BLV10	SOT-123	13,5	175	8	9
	BLW29	SOT-120	13,5	175	15	10
	BLY88A	SOT-48	13,5	175	15	7,5
	BLY88C	SOT-120	13,5	175	15	7,5
	BLV11	SOT-123	13,5	175	15	7,5
	BLY89A	SOT-56	13,5	175	25	6
	BLY89C	SOT-120	13,5	175	25	6
	BLW87	SOT-123	13,5	175	25	6
	BLW31	SOT-120	13,5	175	28	9
	BLW60	SOT-56	12,5	175	45	5,5
	BLW60C	SOT-120	12,5	175	45	5,5
	BLW85	SOT-123	12,5	175	45	5
	BLY90	SOT-55	12,5	175	50	5

▲ Emitter connected to case.

	type number	envelope	V_B V	f MHz	P_L W	G_p dB
v.h.f. modules for mobile transmitters	BGY32	SOT-132	12,5	68-88	18	22,6
	BGY33	SOT-132	12,5	80-108	18	22,6
	BGY35	SOT-132	12,5	132-156	18	20,8
	BGY36	SOT-132	12,5	148-174	18	20,8
u.h.f. modules for mobile transmitters	BGY22	SOT-75A	13,5	380-512	2,5	17
	BGY22A	SOT-75A	12,5	420-480	2,5	17
	BGY23	SOT-75A	13,5	380-480	7,0	4,5
	BGY23A	SOT-75A	12,5	420-480	7,0	4,5

	type number	envelope	V_{CE} V	f MHz	P_L W	G_p dB
u.h.f. base stations class-B operation	2N3866	TO-39	28	470	1	7
	BLX91A	SOT-48	28	470	1	11
	BLX92A	SOT-48	28	470	2,5	11
	BLX93A	SOT-48	28	470	7	8,5
	BLX94A	SOT-48	28	470	25	6
	BLX95	SOT-56	28	470	40	4,5
u.h.f. mobile transmitters class-B operation	BLX65	TO-39	12,5	470	2	6
	BLW79	SOT-122	12,5	470	2	9
	BLX66	SOT-48 ▲	12,5	470	2,5	8,5
	BLX67	SOT-48	12,5	470	2,5	8,5
	BLW80	SOT-122	12,5	470	4	8
	BLX68	SOT-48	12,5	470	7	5
	BLW81	SOT-122	12,5	470	10	6
	BLX69A	SOT-48	13,5	470	20	4
	BLW82	SOT-119	12,5	470	30	5

	type number	envelope	f MHz	$P_{o\ sync}$ W	d_{im} dB	G_p dB	V_{CE} V	I_C mA
TV transposer circuits band III; class-A operation	BLX91A	SOT-48	225	0,45	55	17	25	75
	BLX92A	SOT-48	225	0,7	55	17	25	115
	BLX93A	SOT-48	225	1,6	55	15	25	260
	BLX94A	SOT-48	225	5	55	12	25	800
	BLW64	SOT-56	225	10	55	10	25	1600
	BLW75	SOT-105	225	14	55	8	25	2400
TV transposer circuits band IV-V; class-A operation	BFR96 ●	SOT-37	860	0,08	60	10	10	50
	BFQ34 ●	SOT-122	860	0,3	60	10	15	120
	BLW32	SOT-122	860	0,5	60	12	25	150
	BLX96	SOT-48	860	0,5	60	6	25	250
	BLW33	SOT-122	860	1,0	60	10	25	300
	BLX97	SOT-48	860	1,0	60	5,5	25	500
	BLW34	SOT-122	860	1,8	60	9	25	600
	BLX98	SOT-48	860	3,5	60	5	25	850
	BLW98	SOT-122	860	3,5	60	6,5	25	850

▲ Without stud.
● See Handbook SC3.

In this section we present information on recommended circuit line-ups in the main r.f. power application areas. A comprehensive range of output power levels is indicated together with our recommended types in the particular line-up configuration. The necessary drive power level for each line-up is indicated in the first column.

More detailed application information as well as computer aided design parameters are available on request.

S.S.B. TRANSMITTERS (1,5 MHz – 30 MHz)

input power mW	1st stage	2nd stage	3rd stage	P_L (P.E.P.) W	V_{CE} V	stud S flange F
30	BLY87C *	2 x BLY89C		30	13	S
30	BLV10 *	2 x BLW87		30	13	F
50	BLY88C *	2 x BLW60C		50	13	S
50	BLV11 *	2 x BLW85		50	13	F
100	BLY89C *	4 x BLW60C		100	13	S
100	BLW87 *	4 x BLW85		100	13	F
50	BLY91C *	2 x BLX13C		50	28	S
50	BLV20 *	2 x BLW83		50	28	F
150	BLW83 *	2 x BLW76		150	28	F
250	2 x BLW83 *	2 x BLW77		250	28	F
500	2 x BLW86 *	4 x BLW77		450	28	F
300	2 x BLX13C **	2 x BLX15		300	50	S
300	2 x BLW83 **	2 x BLW95		300	50	F
600	2 x BLX39 **	4 x BLX15		550	50	S
600	2 x BLW86 **	4 x BLW95		550	50	F
40	BLY91C **	2 x BLW78 **	8 x BLX15	1000	50	S/F
40	BLV20 **	2 x BLW78 **	8 x BLW95	1000	50	F

MILITARY COMMUNICATION TRANSMITTERS (25 MHz – 80 MHz)

Input power mW	1st stage	2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
30	2N4427 *	2 x BLY87C		15	13	S
30	2N4427 *	2 x BLV10		15	13	F
60	BLY87C *	2 x BLY88C		25	13	S
60	BLV10 *	2 x BLV10		25	13	F
100	BLY87C	2 x BLY89C		50	13	S
100	BLV10	2 x BLW87		50	13	F
50	BLY91C	2 x BLX13C		60	28	S
50	BLV20	2 x BLW83		60	28	F
100	BLY91C	2 x BLX39		90	28	S
100	BLV20	2 x BLW86		90	28	F
15	BLV20 *	2 x BLV20	2 x BLW78	200	28	F
25	BLV20 *	2 x BLW83	2 x BLW77	250	28	F

* Class-A operation.
** 28 V supply voltage; class-A operation.

MOBILE TRANSMITTERS (68 MHz – 87,5 MHz)

input power mW	1st stage	2nd stage		P_L W	V_{CE} V	stud S flange F
20	2N4427	BLY87C		8	13	S
20	2N4427	BLV10		8	13	F
35	2N4427	BLW29		14	13	S
10	BSX19 ●	BGY32		18	13	F
70	BFQ42	BLW31		28	13	S
160	BFQ43	BLW60C		45	13	S
160	BFQ43	BLW85		45	13	F

BASE STATIONS (68 MHz – 87,5 MHz)

input power mW	1st stage	2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
65	BFS23A	BLY93C		25	28	S
65	BFS23A	BLW84		25	28	F
125	BLX92A	BLX39		50	28	S
15	2N3866	BLV21	BLW78	100	28	F
50	2N3866 **	BLY93C **	BLX15	150	50	S
50	2N3866 **	BLW84 **	BLW95	150	50	F

F.M. BROADCAST TRANSMITTERS (87,5 MHz – 108 MHz)

input power mW	1st stage	2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
100	BGY33	2 x BLW85		80	13	F
140	BLX92A	BLX39		50	28	S
40	2N3866	BLV21	BLW78	100	28	F
75	BLX92A **	BLX39 **	BLX15	150	50	S
75	BLX92A **	BLW86 **	BLW95	150	50	S/F
140	BLX92A **	BLX39 **	2 x BLX15	250	50	S
140	BLX92A **	BLW86 **	2 x BLW95	250	50	S/F

A.M. AIRCRAFT TRANSMITTERS (118 MHz – 136 MHz)

input power mW	1st stage	2nd stage	3rd stage	$P_{L(carr)}$ W	V_{CE} V	stud S flange F
110	BLX92A	BLY93C		6	13/28	S
240	BLY91C	BLX39		12	13/28	S
240	BLV20	BLW86		12	13/28	F
100	BLX92A	BLY93C	BLW78	25	13/28	S/F
100	BLX92A	BLW84	BLW78	25	13/28	S/F

● See Handbook SC3.
** 28 V supply voltage.

PORTABLE AND MOBILE TRANSMITTERS (132 MHz – 174 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
40	2N4427	BFQ43			2	7,5	–
100	2N4427	BLY87C			8	13	S
100	2N4427	BLV10			8	13	F
125	BFQ42	BLW29			14	13	S
150	BGY36				18	13	F
250	BFQ43	BLW31			28	13	S
120	BFQ42	BLW29	BLW60C		45	13	S
150	BGY36	BLW85			45	13	F

BASE STATIONS (132 MHz – 174 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
200	BLY91C	BLY93C			25	28	S
200	BLV20	BLW84			25	28	F
25	2N3866	BLY91C	BLX39		50	28	S
25	2N3866	BLV20	BLW86		50	28	F
200	BFS23A	BLY93C	2 x BLX39		100	28	S
200	BFS23A	BLW84	2 x BLW86		100	28	F

TV TRANSMITTERS AND TRANSPOSERS (Band III: 174 MHz – 230 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	$P_{o\ sync}$ W	V_{CE} V	stud S flange F
15	BLX93A	BLW64	2 x BLW75		25	25	S
60	BLX94A	BLW75	4 x BLW75		50	25	S
10	BLX93A	BLW64	2 x BLW75	8 x BLW75	100	25	S

PORTABLE AND MOBILE TRANSMITTERS (400 MHz – 470 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_L W	V_{CE} V	stud S flange F
15	BFR96 ●	BLW79	BLW80		2	7,5	S
50	BLW79	BLW80	BLW81		10	13	S
220	BLW79	BLW81	BLX69A		18	13	S
50	BLW79	BLW80	BLW81	BLW82	30	13	S/F

● See Handbook SC3.

BASE STATIONS (400 MHz – 470 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_L W	V_{CE} V	stud S flange F
70	BLX91A	BLX93A	BLX94A		**25**	28	S
70	BLX91A	BLX93A	BLX94A	2 x BLX95	**72**	28	S

TV TRANSMITTERS AND TRANSPOSERS (Band IV/V: 470 MHz – 860 MHz)

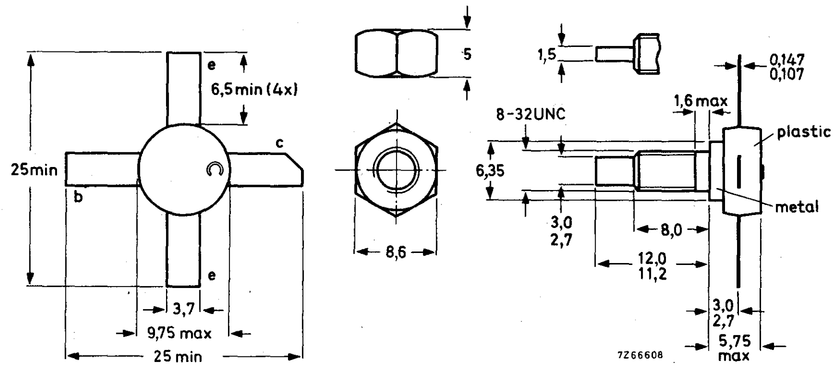
input power mW	1 st stage	2nd stage	3rd stage	4th stage	$P_{o\ sync}$ W	V_{CE} V	stud S flange F
7	BFQ34 ●	BLW34	BLW98		**3**	25	S
3	BFQ34 ●	BLW33	BLW98	2 x BLW98	**6**	25	S
5	BLW32	BLW34	2 x BLW98	4 x BLW98	**12**	25	S

● See Handbook SC3.

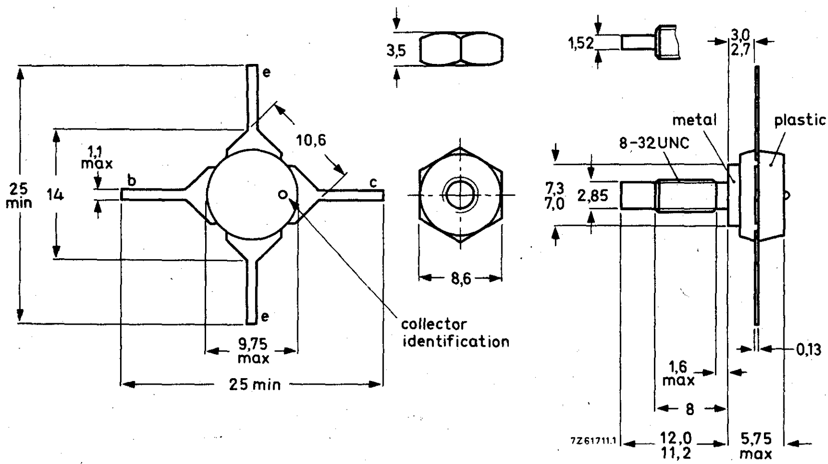
MECHANICAL DATA

Dimensions in mm

SOT-48



SOT-48

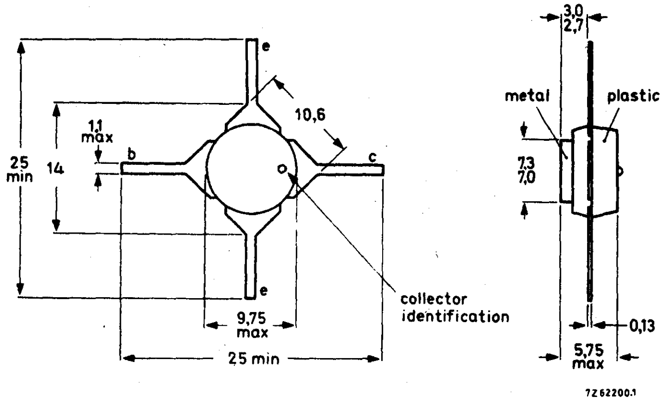


This envelope is also supplied with different collector identification (bevelled collector lead).

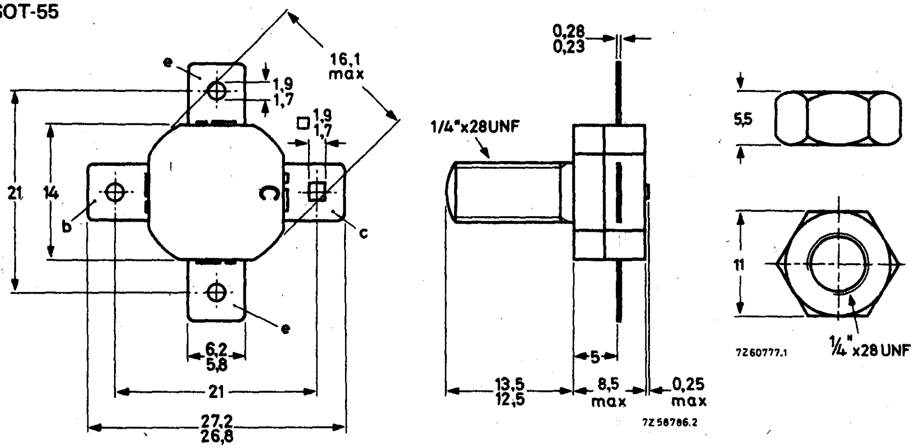
MECHANICAL DATA

Dimensions in mm

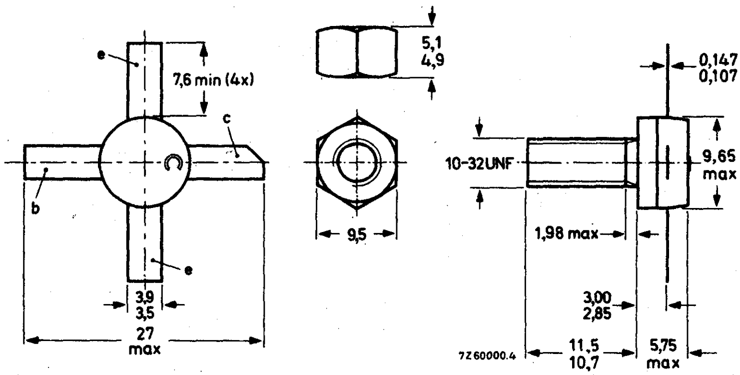
SOT-48



SOT-55



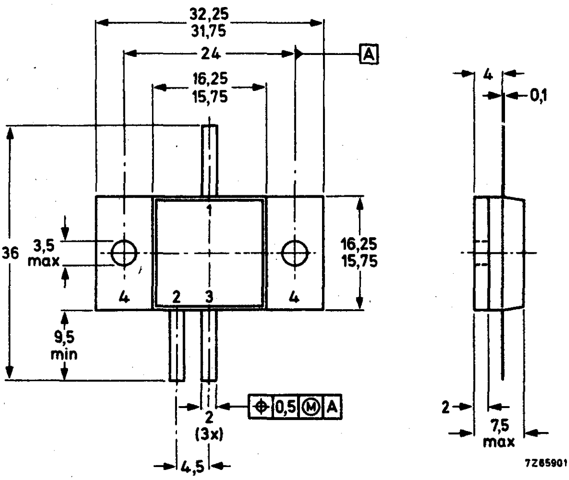
SOT-56



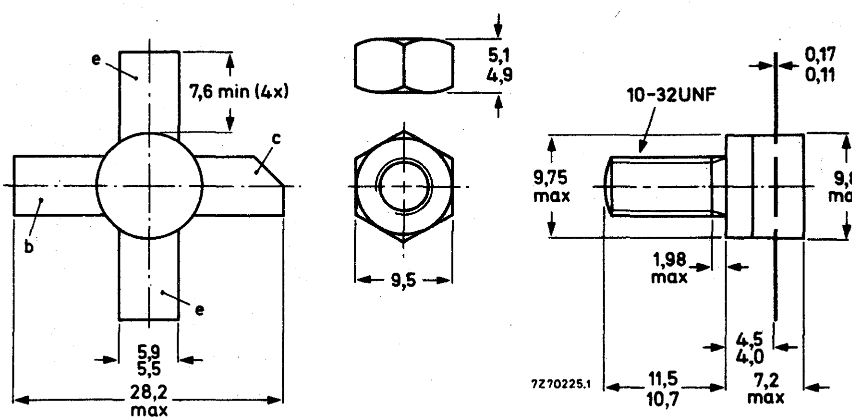
MECHANICAL DATA

Dimensions in mm

SOT-75A

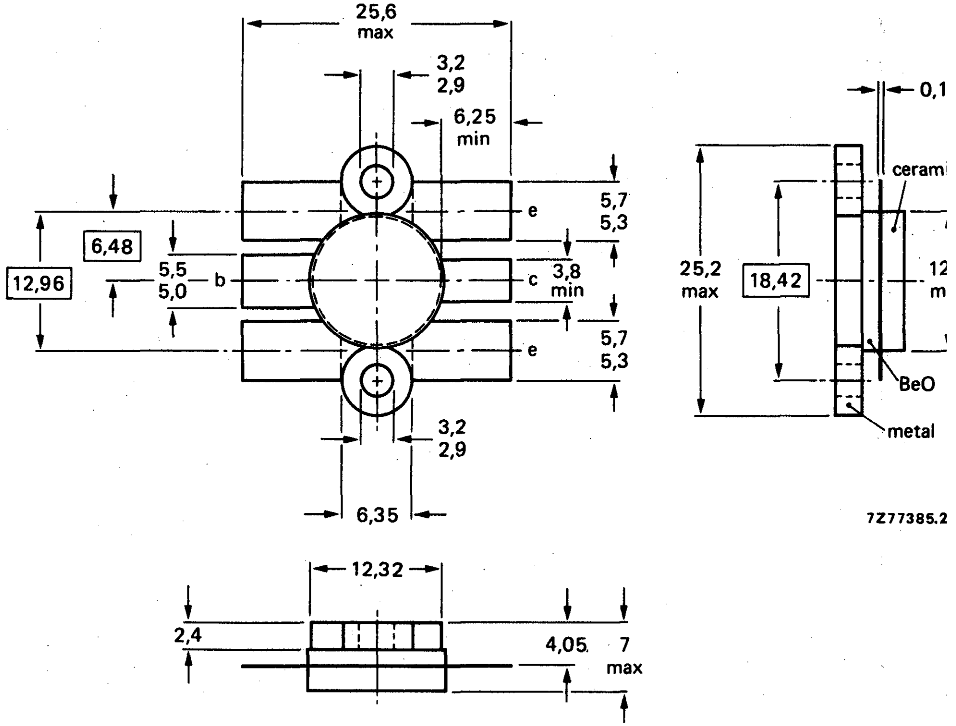


SOT-105

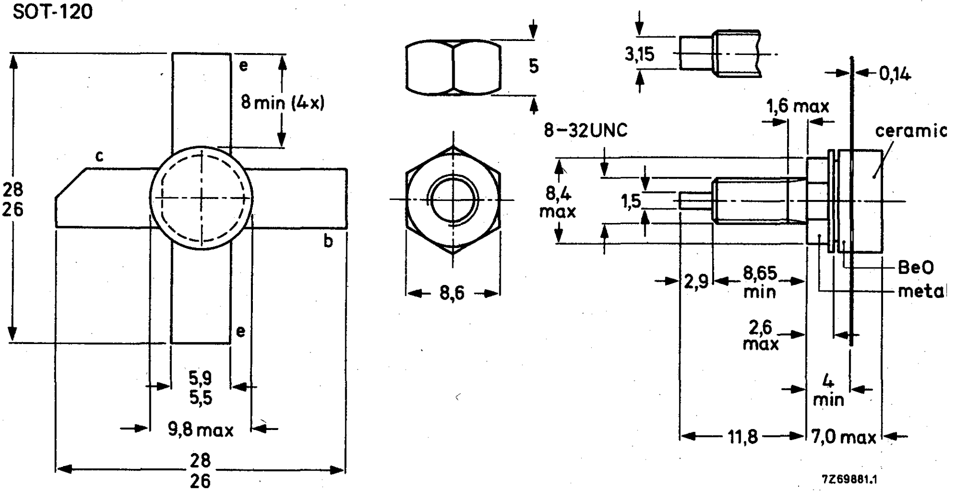


MECHANICAL DATA Dimensions in mm

SOT-119



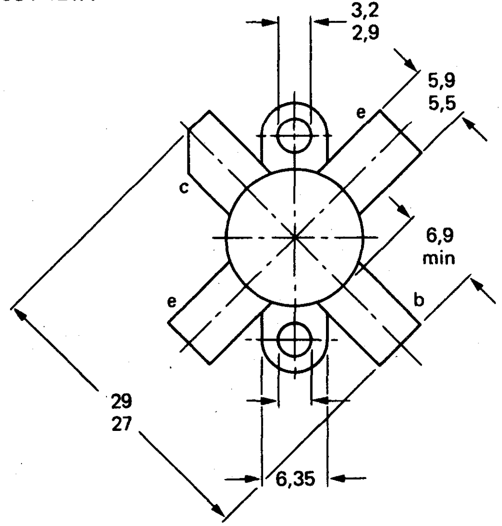
SOT-120

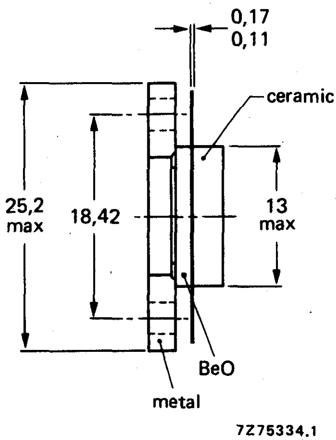


MECHANICAL DATA

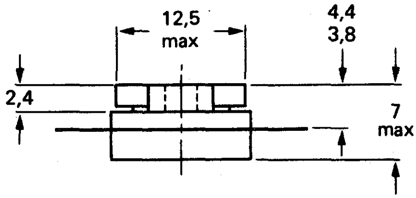
Dimensions in mm

SOT-121A

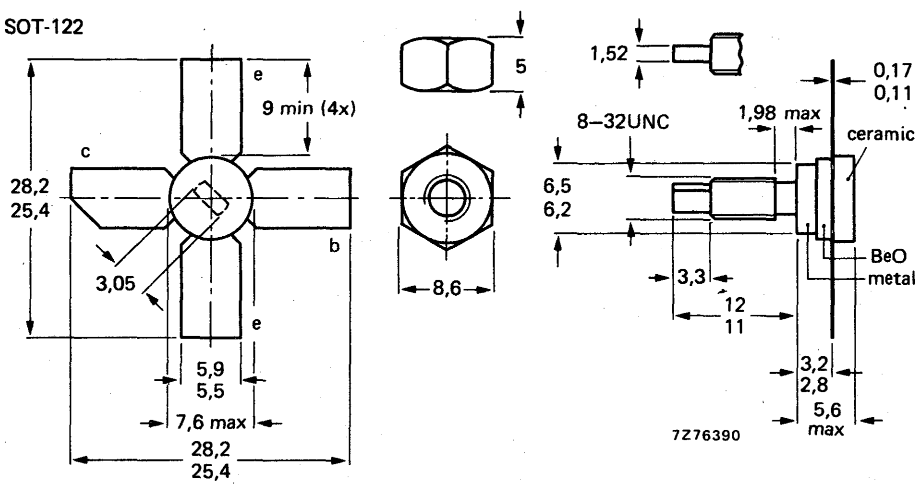




SOT-121B is identical to SOT-121A except for the thickness of the leads which lies between 0,23 and 0,27 mm.

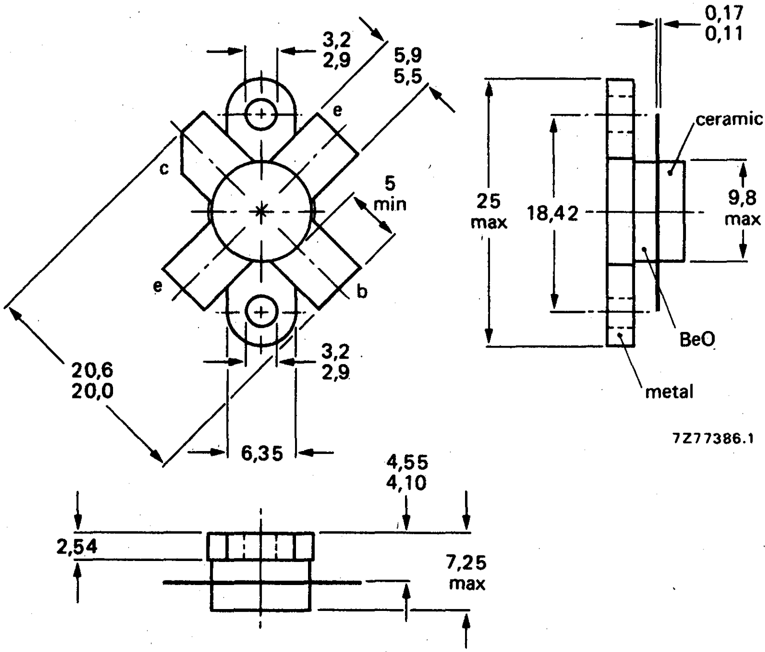


SOT-122



MECHANICAL DATA Dimensions in mm

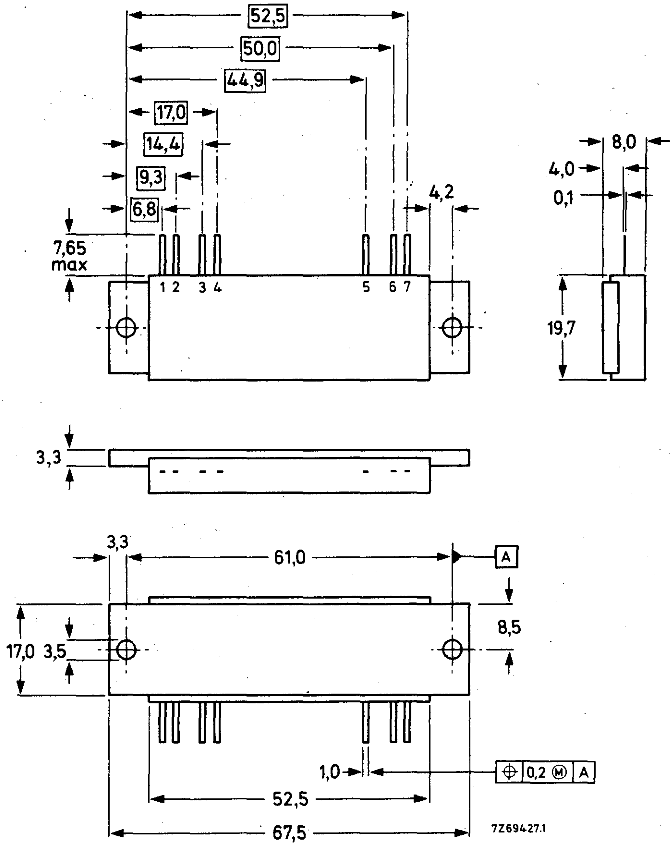
SOT-123



MECHANICAL DATA

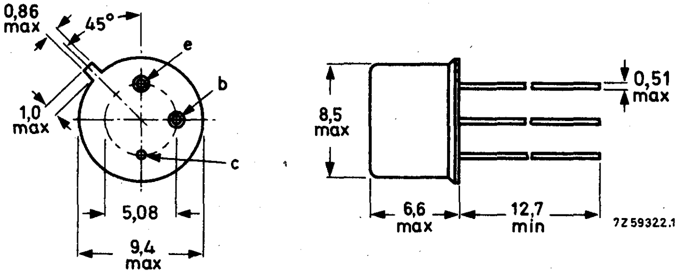
SOT-132

Dimensions in mm

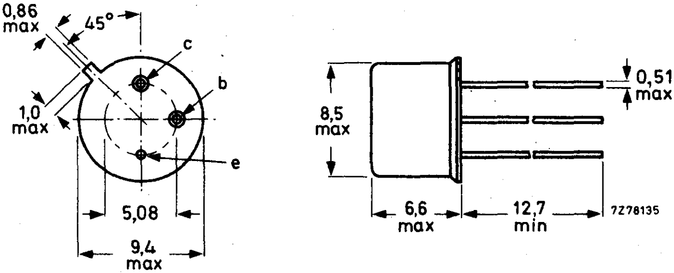


MECHANICAL DATA Dimensions in mm

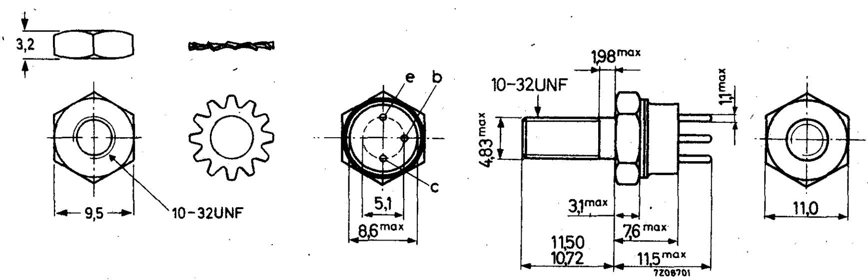
TO-39; collector connected to case.



TO-39; emitter connected to case.



TO-60



RULES FOR MOUNTING QUARTER-INCH CAPSTAN HEADERS AS USED FOR R.F. POWER TRANSISTORS

A 5 mm thick brass nut is supplied with each transistor for securing it to a heatsink. To ensure optimum heat transfer and avoid damage to the threaded stud of the transistor the following recommendations should be observed:

- Diameter of mounting hole in heatsink: 4,10 mm (+0,05; −0,00)
- Heatsink to be at least 3 mm thick.
  Attachment to a thinner heatsink may damage the mounting stud.
- Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxidation.
- Mounting nut torque: 0,80 Nm (+0,05; −0,00)
  8,0 kg cm (+0,5 ; −0,0)
  If security against vibration is required, use a locking compound such as Lock-tite.
  Do not use washers; they impair the heat transfer.
- Recommended distance from the top surface of heatsink to surface of printed wiring board: 2,9 mm (0,0; −0,2)
  Tension in the transistor leads sets the limit on spacing between heatsink and printed wiring board; in general, the leads can withstand more pull in the downward than in the upward direction.
- Solder the leads to the connection pads with resin-cored lead-tin solder, using an iron of normal temperature. Soldering iron temperatures as high as 350 °C are safely tolerable; the transistor can withstand an interior temperature of 250 °C for about ten minutes.
  The leads may be tinned, if required, by dipping them into a solder bath at about 230 °C; each lead may be dipped up to its full length. A flux of the quality of Super-Safe is recommended; after tinning, surplus flux should be rinsed away in tap water.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ42 is especially suited as a driver transistor for the BLW29 in a two-stage wide-band or semi-wide-band v.h.f. amplifier delivering 15 W output power.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

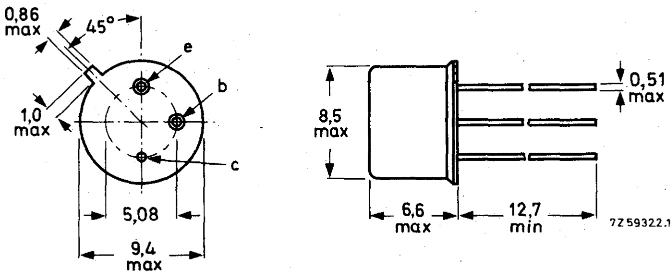
R.F. performance up to T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. class-B	**13,5**	**175**	**2**	**> 11**	**> 60**	**7,8 – j4,6**	**22 – j18**
c.w. class-B	12,5	175	2	typ. 10,5	typ. 65	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



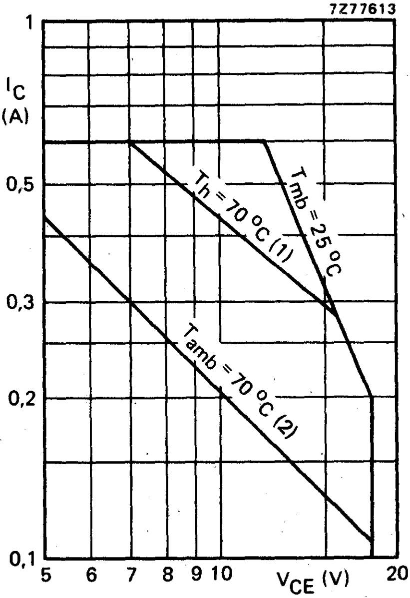
Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories supplied on request: 56218 (package); 56245 (distance disc).

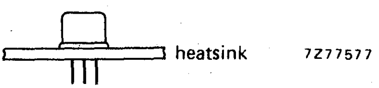
RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0,6	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	1,8	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7,2	W
Storage temperature	T_{stg}		−65 to + 200	°C
Junction temperature	T_j	max.	200	°C



(1) Mounted on a heatsink.



(2) Free-air operation; using a spring cooling clip.

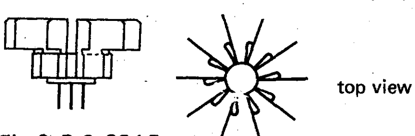
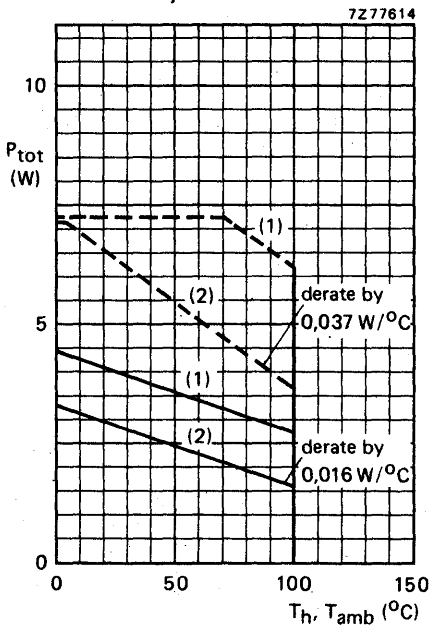


Fig. 2 D.C. SOAR.



(1) Short-time r.f. operation during mismatch; $R_{th\ mb\text{-}h}$ = 3 °C/W; $R_{th\ c\text{-}a}$ = 32 °C/W; f ⩾ 1 MHz.

(2) Continuous d.c. and r.f. operation; $R_{th\ mb\text{-}h}$ = 3 °C/W; $R_{th\ c\text{-}a}$ = 32 °C/W.

Fig. 3 Total power dissipation; V_{CE} ⩽ 16,5 V.
– – – Mounted on a heatsink.
——— Free-air operation; using a spring cooling clip having a thermal resistance of 32 °C/W.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	24 °C/W
From junction to case	$R_{th\ j\text{-}c}$	=	29 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	3 °C/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0,25$ A; $V_{CE} = 5$ V	h_{FE}		typ. 30 10 to 60
Collector-emitter saturation voltage* $I_C = 0,75$ A; $I_B = 0,15$ A	V_{CEsat}		typ. 0,9 V
Transition frequency at f = 100 MHz * $-I_E = 0,25$ A; $V_{CB} = 13,5$ V	f_T		typ. 750 MHz
$-I_E = 0,75$ A; $V_{CB} = 13,5$ V	f_T		typ. 625 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c		typ. 8,6 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 13,5$ V	C_{re}		typ. 3,8 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

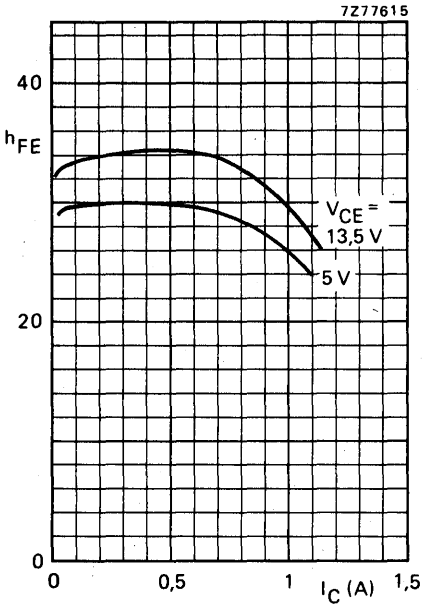


Fig. 4 Typical values; T_j = 25 °C.

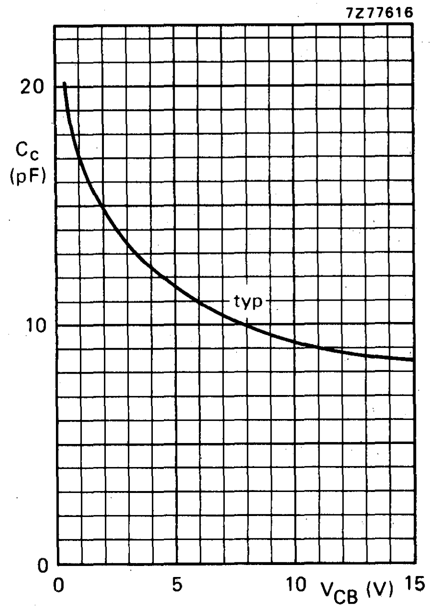


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

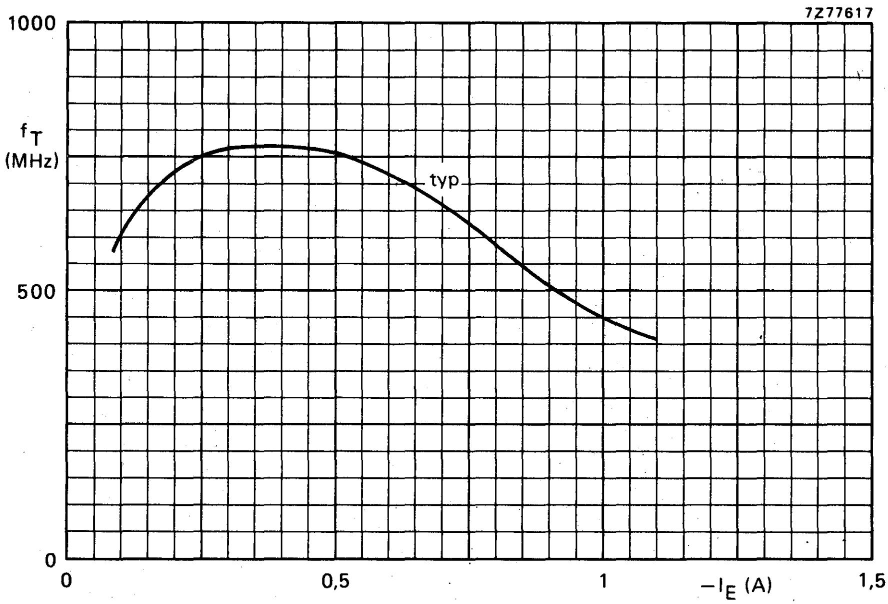


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**2**	**< 0,16**	**> 11**	**< 0,25**	**> 60**	**7,8 − j4,6**	**22 − j18**
175	12,5	2	–	typ. 10,5		typ. 65	–	–

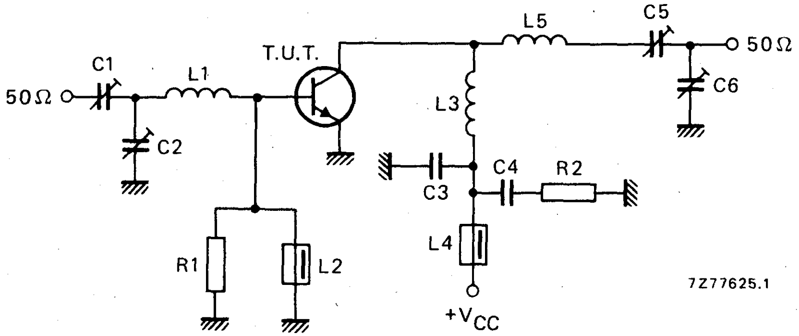


Fig. 7 Test circuit; c.w. class-B.

List of components:

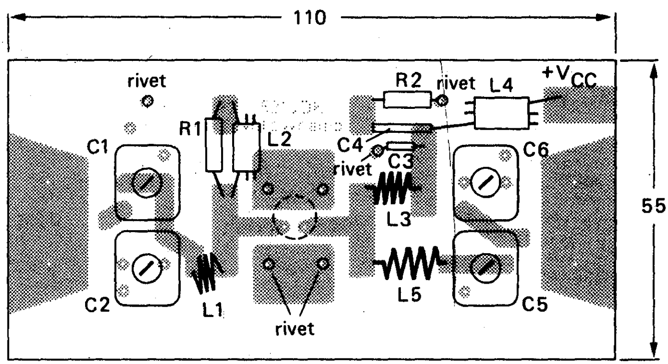
C1 = C2 = C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor
C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)

L1 = 3 turns enamelled Cu wire (1,0 mm); int. dia. 4,0 mm; length 4 mm; leads 2 x 5 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L5 = 4 turns Cu wire (1,0 mm); int. dia. 6,0 mm; length 6 mm; leads 2 x 5 mm

R1 = 220 Ω carbon resistor
R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



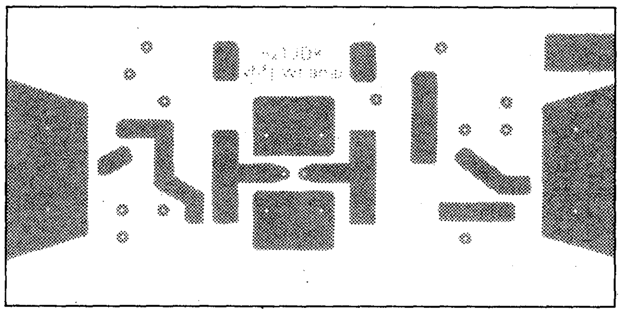


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1,6 mm epoxy fibre-glass.

The length of the external emitter lead is 1,2 mm.

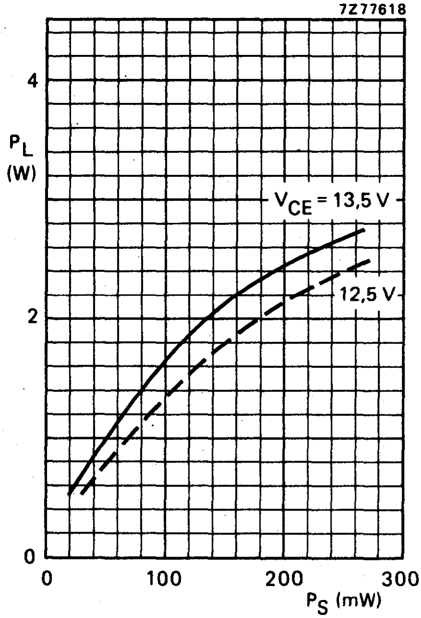


Fig. 9 Typical values; f = 175 MHz;
T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W.

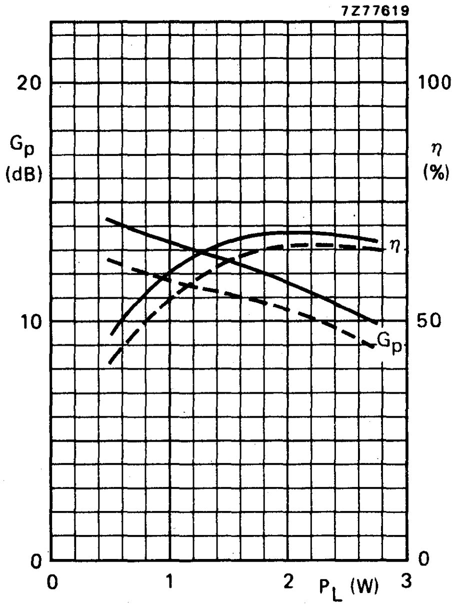


Fig. 10 Typical values; f = 175 MHz;
T_{amb} = 25 °C; —— V_{CE} = 13,5 V;
– – – V_{CE} = 12,5 V; $R_{th\ c\text{-}a}$ = 32 °C/W.

APPLICATION INFORMATION (continued).

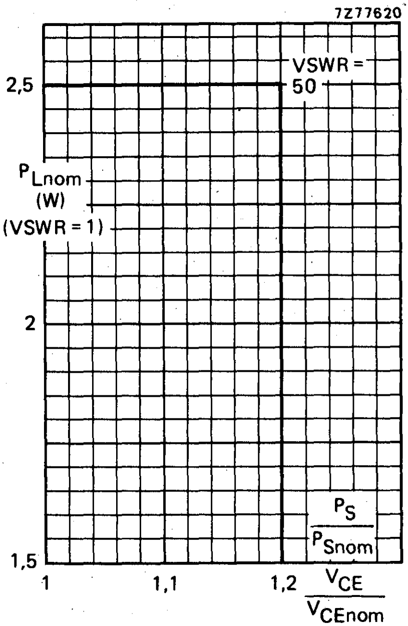


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

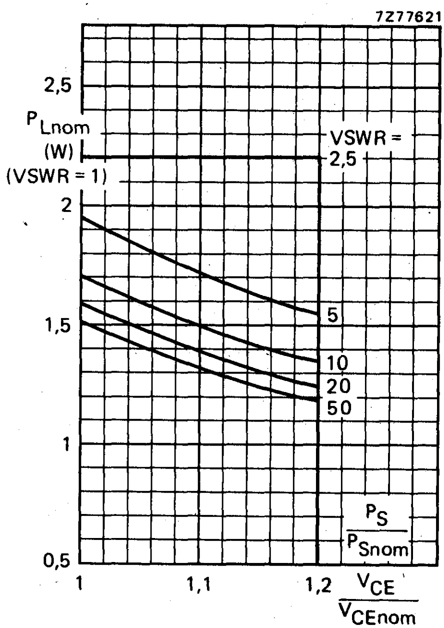


Fig. 12 R.F. SOAR (short-time operation during mismatch); f = 175 °C; T_{amb} = 70 °C; $R_{th\ c\text{-}a}$ = 32 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Figs 11 and 12:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 22 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

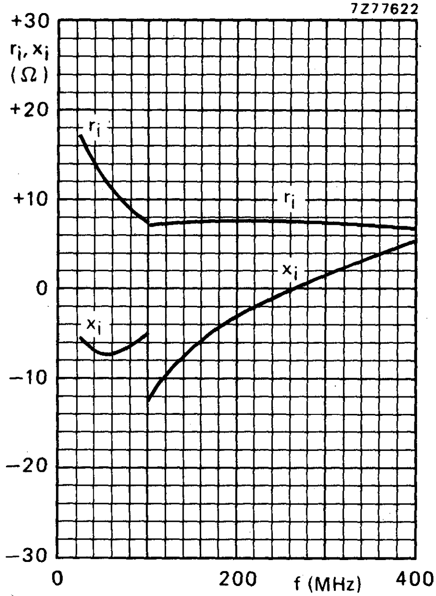


Fig. 13.

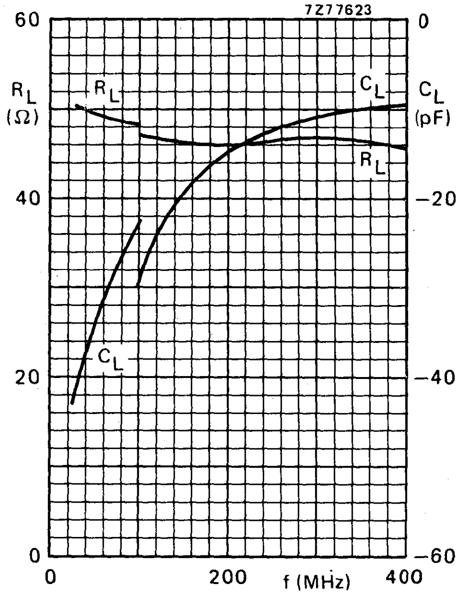
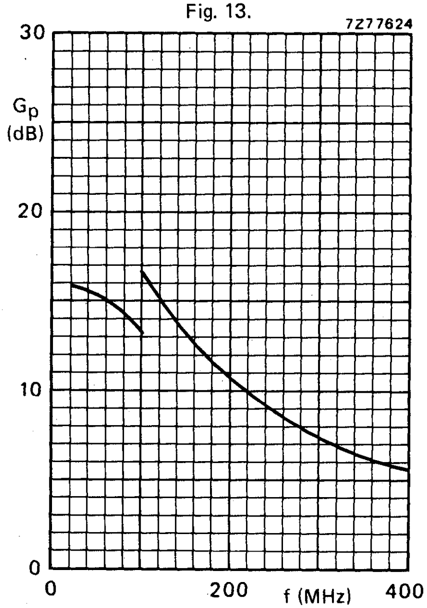


Fig. 14.



Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 13,5 V; P_L = 2 W; T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W.

Fig. 15.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ43 is especially suited as a driver transistor for the BLW31 in a two-stage wide-band or semi-wide-band v.h.f. amplifier delivering 28 W output power.

It has a TO-39 metal envelope with the emitter connected to the case, which enables excellent heatsinking and emitter grounding.

QUICK REFERENCE DATA

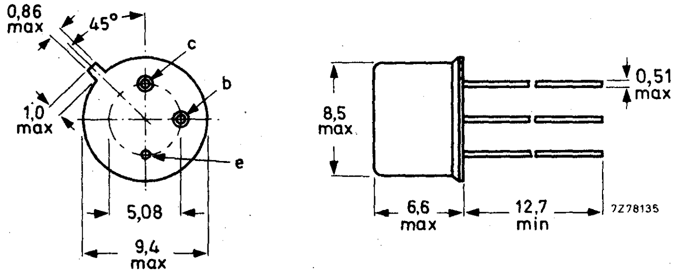
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. class-B	13,5	175	4	> 12	> 55	3,2 + j0,03	53 − j29
c.w. class-B	12,5	175	4	typ. 12	typ. 60	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; emitter connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories supplied on request: 56218 (package); 56245 (distance disc).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,25	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	3,75	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	12	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

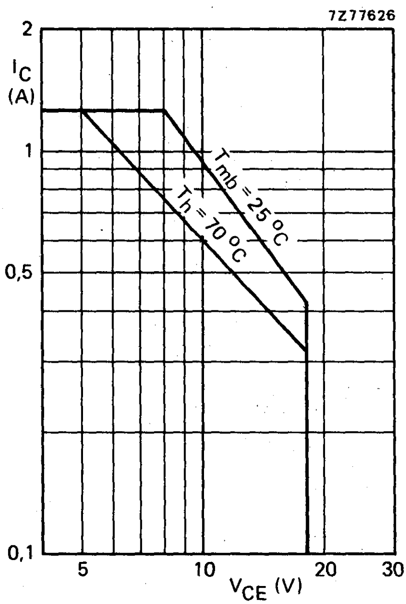
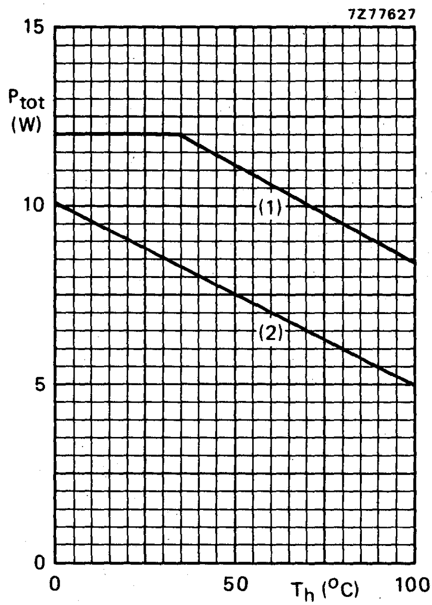


Fig. 2 D.C. SOAR.



(1) Short-time r.f. operation during mismatch; f ⩾ 1 MHz.

(2) Continuous d.c. and r.f. operation; derate by 0,05 W/°C.

Fig. 3 Total power dissipation; V_{CE} ⩽ 16,5 V.

THERMAL RESISTANCE (dissipation = 4 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	18 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 80
Collector-emitter saturation voltage * $I_C = 1,5$ A; $I_B = 0,3$ A	V_{CEsat}	typ.	0,9 V
Transition frequency at f = 100 MHz * $-I_E = 0,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	750 MHz
$-I_E = 1,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	15 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	7,3 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

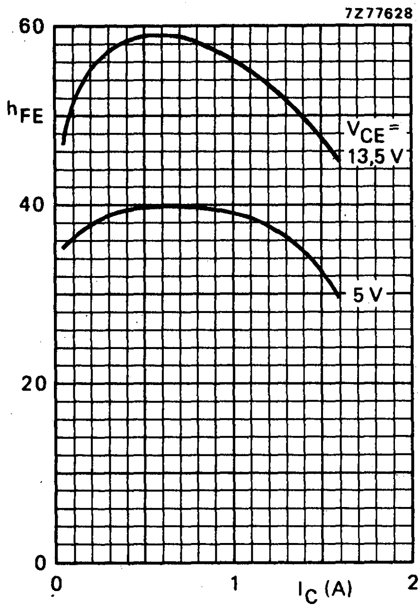


Fig. 4 Typical values; T_j = 25 °C.

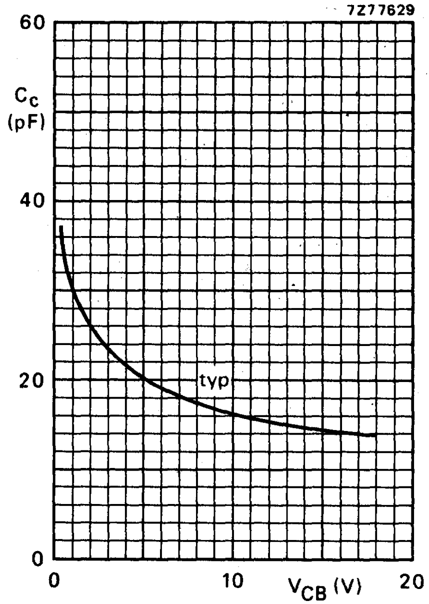


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

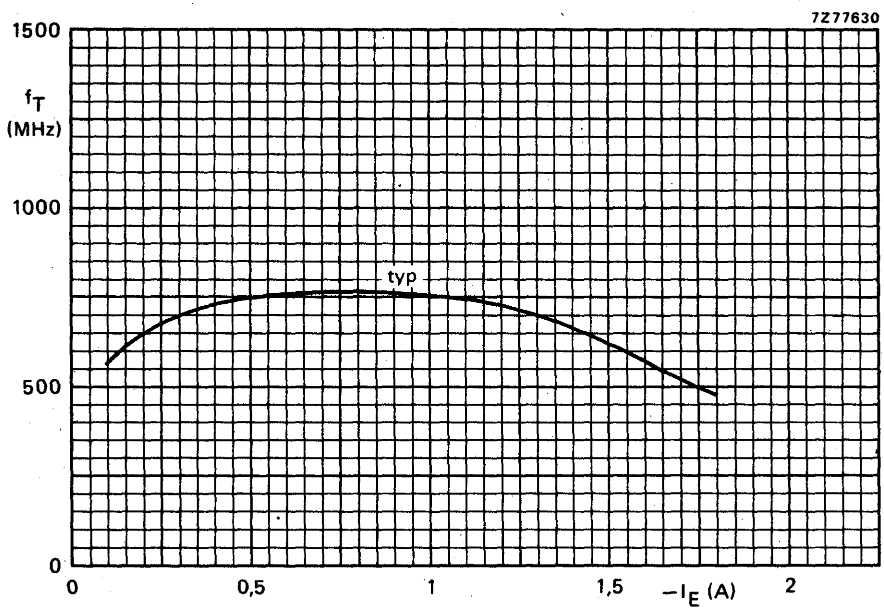


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**4**	**< 0,25**	**> 12**	**< 0,54**	**> 55**	**3,2 + j0,03**	**53 – j29**
175	12,5	4	–	typ. 12	–	typ. 60	–	–

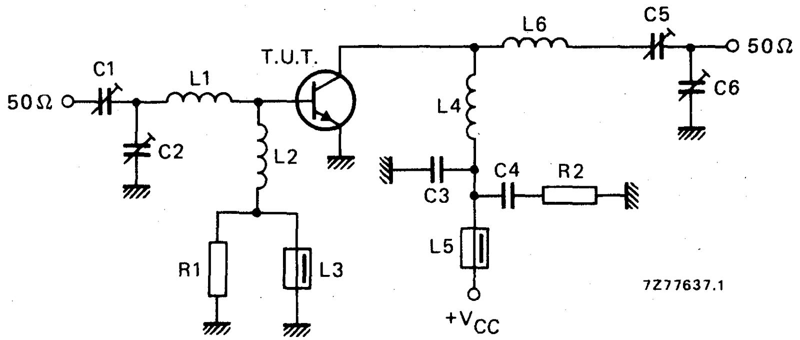


Fig. 7 Test circuit; c.w. class-B.

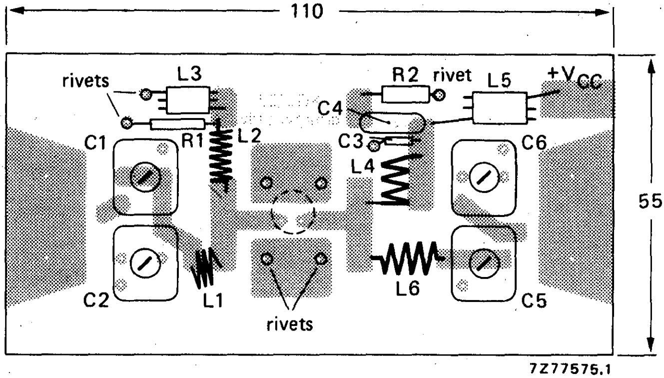
List of components:
C1 = C5 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor

L1 = 2 turns Cu wire (1,0 mm); int. dia. 4,0 mm; length 3 mm; leads 2 x 5 mm
L2 = 7 turns enamelled Cu wire (0,5 mm); int. dia. 3,0 mm; length 4 mm; leads 2 x 5 mm
L3 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 4 turns enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; length 5 mm; leads 2 x 5 mm
L6 = 5 turns enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; length 7,5 mm; leads 2 x 5 mm

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



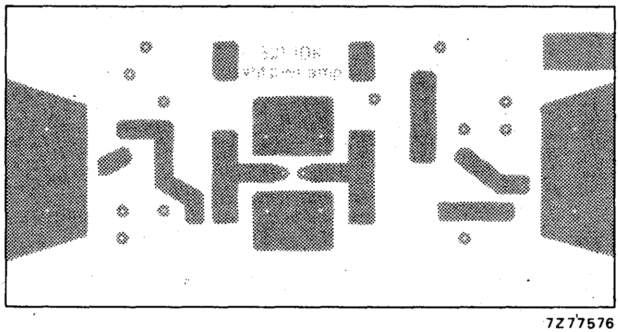


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1,6 mm epoxy fibre-glass.

The case is directly grounded on the printed-circuit board.

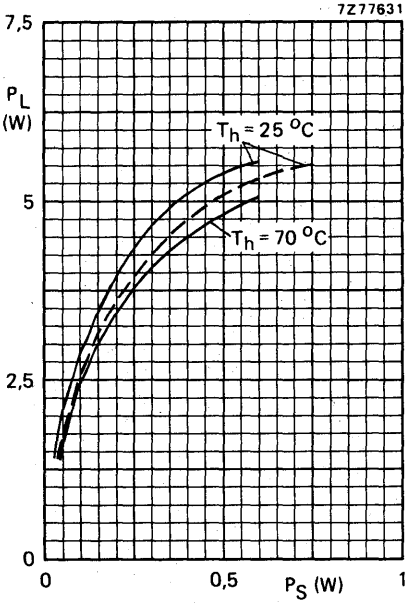


Fig. 9 Typical values; f = 175 MHz; —— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

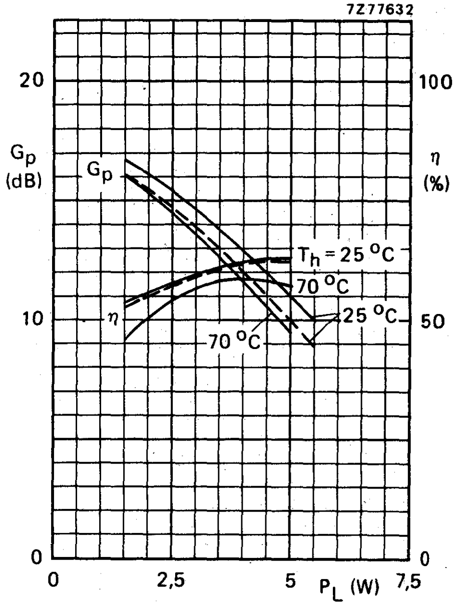


Fig. 10 Typical values; f = 175 MHz; —— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

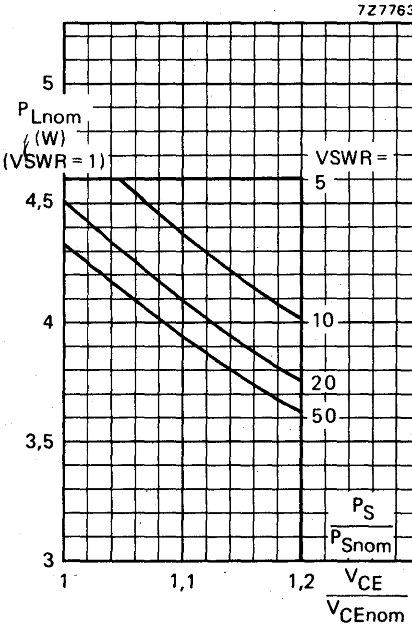


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C. $R_{th\ mb\text{-}h}$ = 3 °C/W; V_{CEnom} = 13,5 or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 140 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

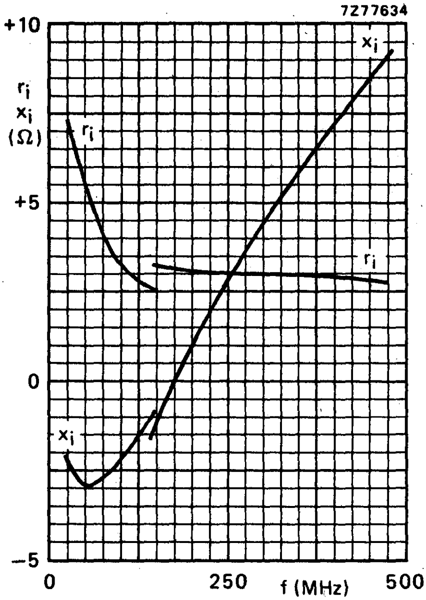


Fig. 12.

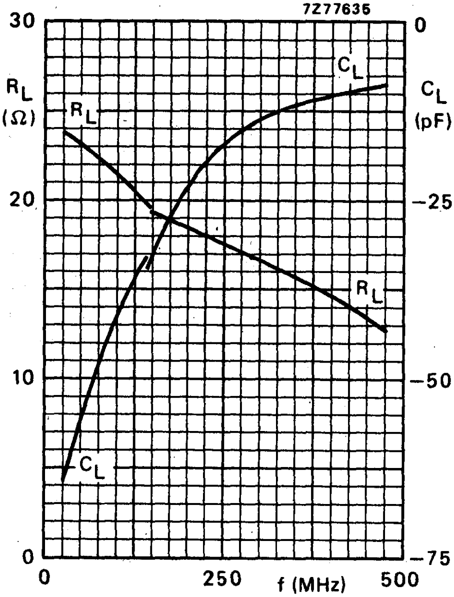
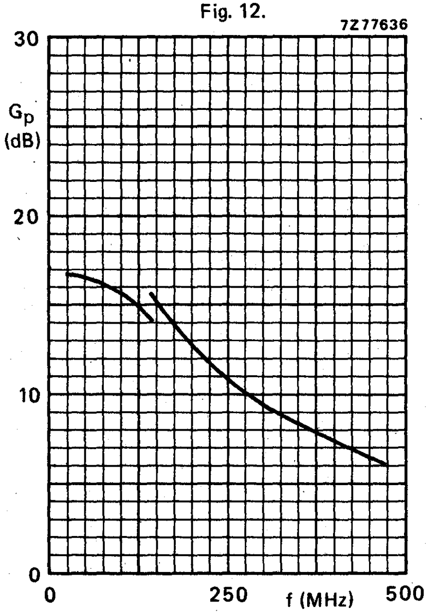


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 4 W; T_h = 25 °C.

Fig. 14.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

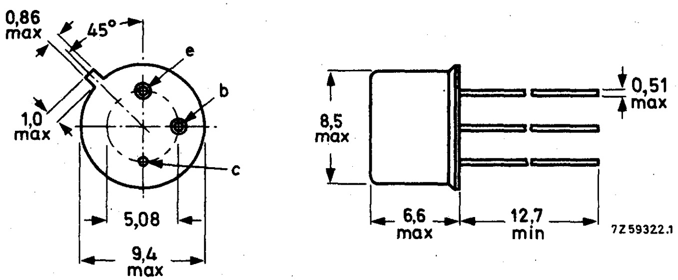
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	4	> 8	> 60	3,9 + j2,2	37 − j22
c.w.	12,5	175	4	typ. 8	typ. 60	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56218 (package); 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

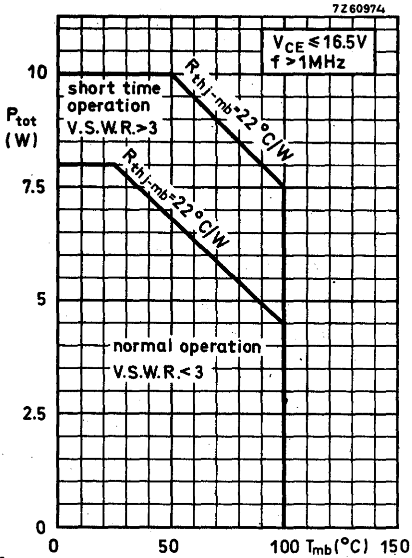
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

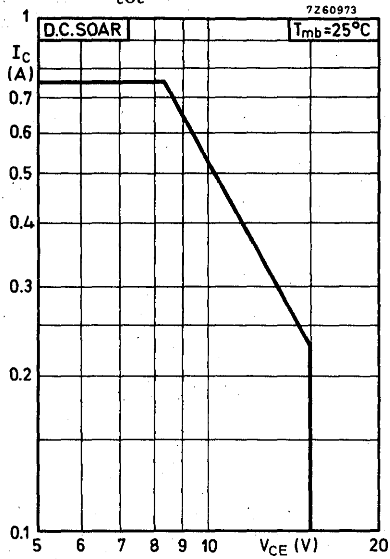
Currents

Collector current (average)	$I_{C(AV)}$	max.	0.75	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.25	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	8	W





Temperature

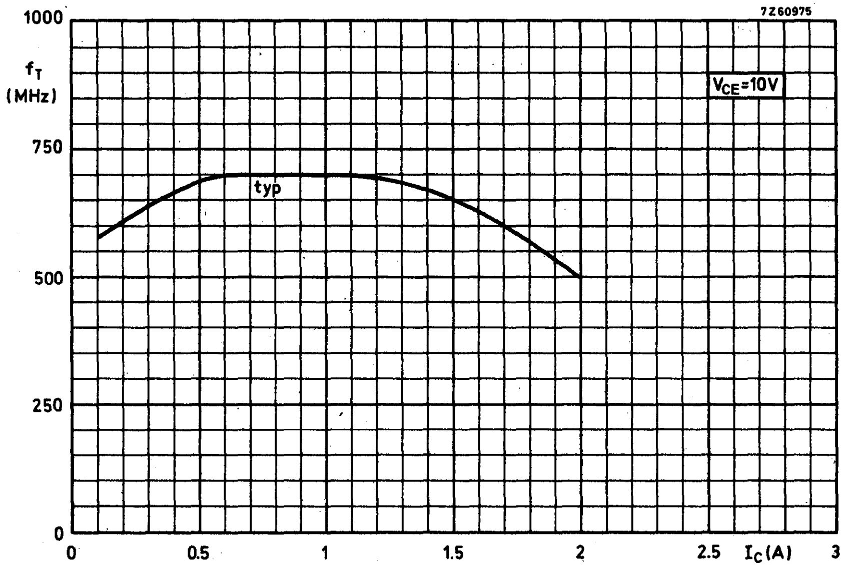
Storage temperature	T_{stg}		-65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

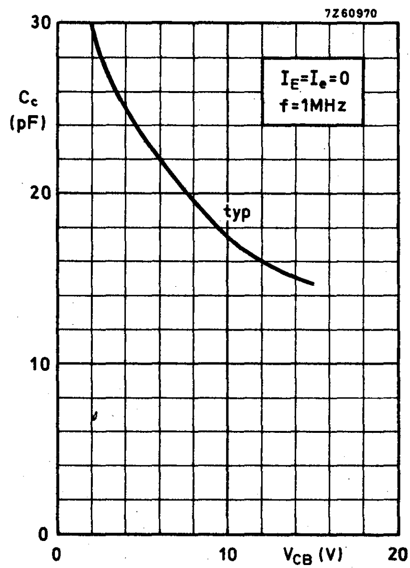
THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j\text{-}mb}$	=	22	°C/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\,mb\text{-}h}$	=	2.5	°C/W

CHARACTERISTICS $T_j = 25\,^{o}C$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14\,V$	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 1$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz				
open base	E	>	0.5	mWs
$-V_{BE} = 1.5\,V$; $R_{BE} = 33\,\Omega$	E	>	0.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 350$ mA; $V_{CE} = 10$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	15	pF
		<	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 15$ V	C_{re}	typ.	11	pF


7Z60975
1000
f_T
(MHz)
750
500
250
0
typ
V_{CE}=10V
0
0.5
1
1.5
2
2.5
I_C (A)
3


7Z60970
30
C_c
(pF)
20
10
0
typ
$I_E = I_e = 0$
f = 1MHz
0
10
V_{CB} (V)
20

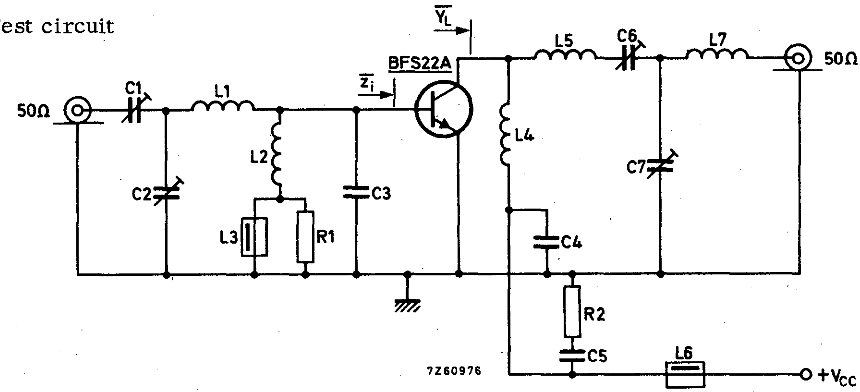
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C(A)	G_p(dB)	η(%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$(mA/V)
13.5	< 0.63	4	< 0.49	> 8	> 60	3.9+j2.2	37−j22
12.5	typ. 0.63	4	typ. 0.53	typ. 8	typ. 60	–	–

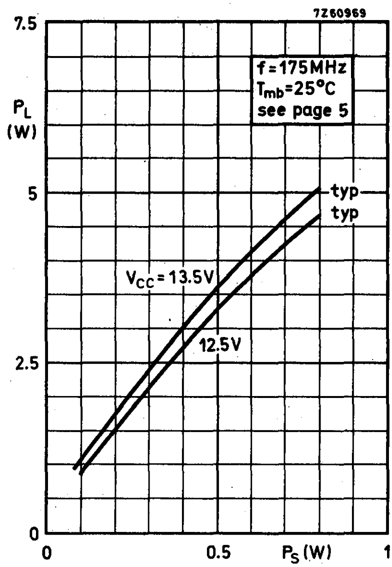
Test circuit

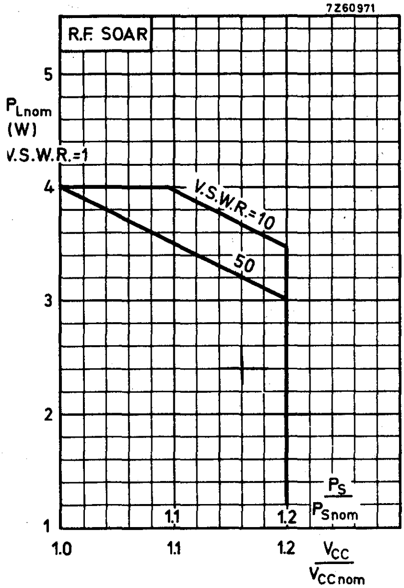


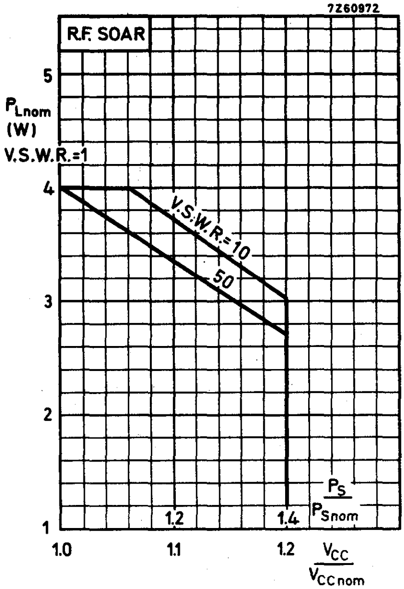
C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

L1 = 1 turn enamelled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 7 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm

R1 = R2 = 10 Ω carbon


7Z60969
7.5
P_L
(W)
5
2.5
0
f = 175MHz
T_{mb}=25°C
see page 5
typ
typ
V_{CC} = 13.5V
12.5V
0
0.5
P_S (W)
1





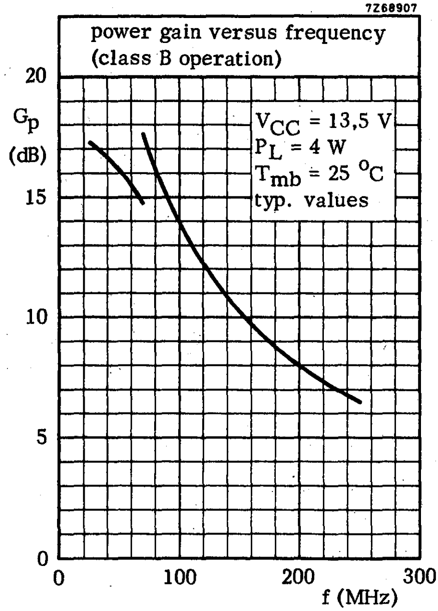
Conditions for R.F. SOAR:

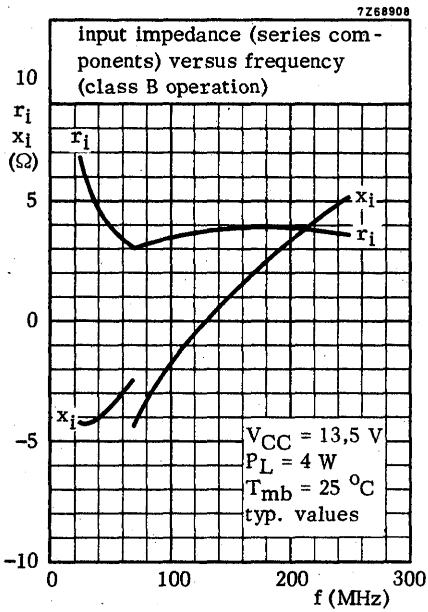
f = 175 MHz
T_{mb} = 70 °C
V_{CCnom} = 12.5 or 13.5 V

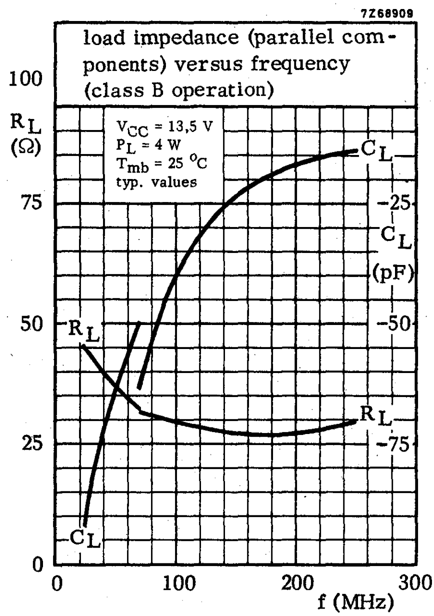
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V. S. W. R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

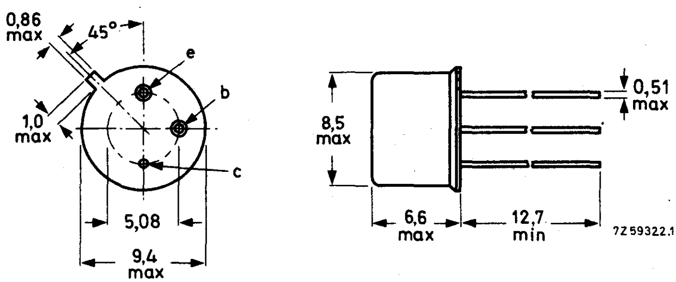
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	4	> 10	> 65	2,3 + j1,6	8,9 – j18,1

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56218 (package); 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

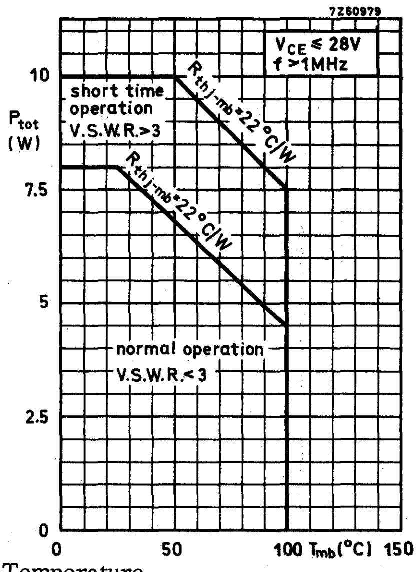
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

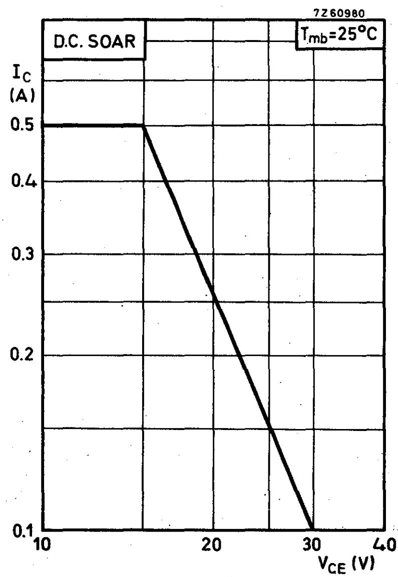
Currents

Collector current (average)	$I_{C(AV)}$	max.	0.5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1.5	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	8	W





Temperature

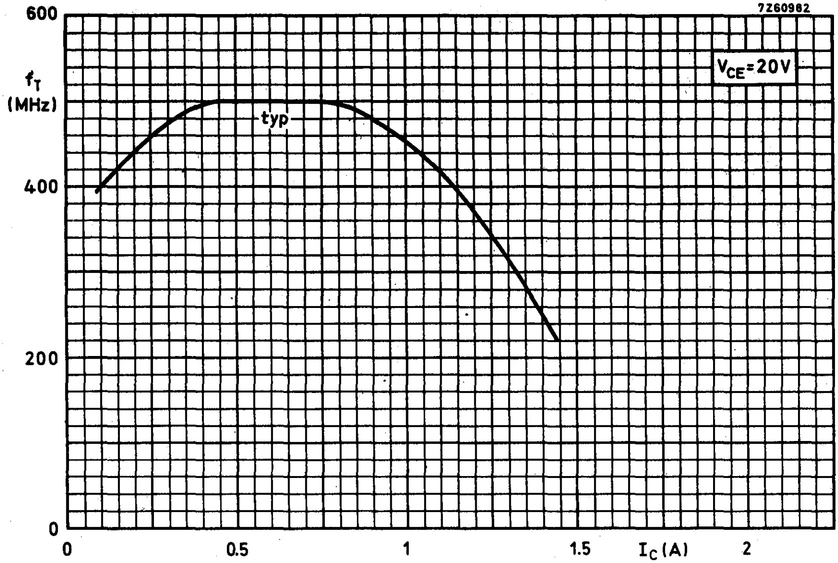
Storage temperature	T_{stg}	−65 to	+200	°C
Operating junction temperature	T_j	max.	200	°C

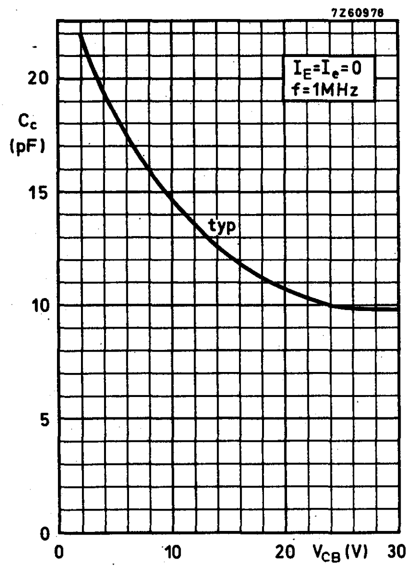
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	22	°C/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	2.5	°C/W

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 1$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	0.5	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	0.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	10	pF
		<	15	pF
Feedback capacitance at f = 1 MHz				
$I_C = 25$ mA; $V_{CE} = 30$ V	C_{re}	typ.	7.5	pF


7Z60982
600
f_T
(MHz)
400
200
0
typ
$V_{CE} = 20V$
0
0.5
1
1.5
I_C (A)
2


7Z60976
20
C_c
(pF)
15
10
5
0
typ
$I_E = I_e = 0$
f = 1MHz
0
10
20
V_{CB} (V)
30

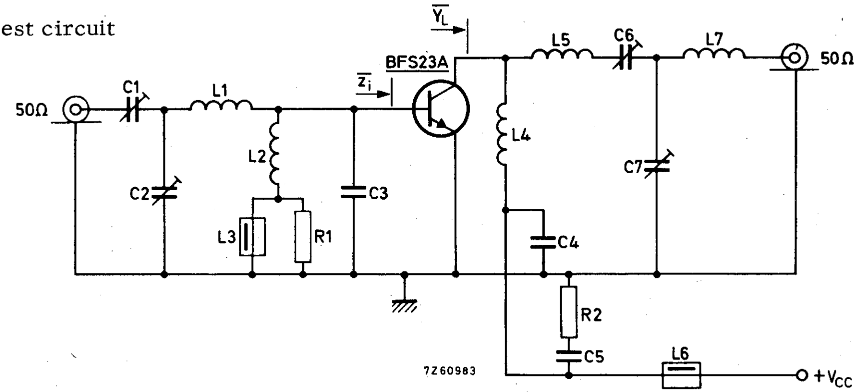
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	< 0.40	4	< 0.22	> 10	> 65	2.3+j1.6	8.9 − j18.1

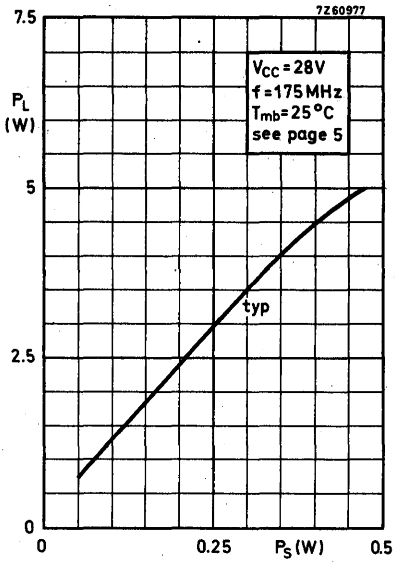
Test circuit

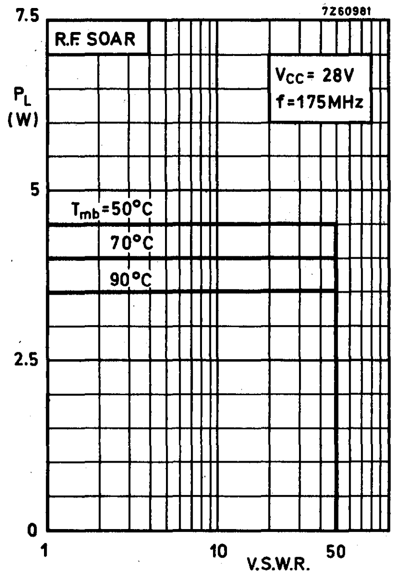


C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

L1 = 1 turn enamelled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 4 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm

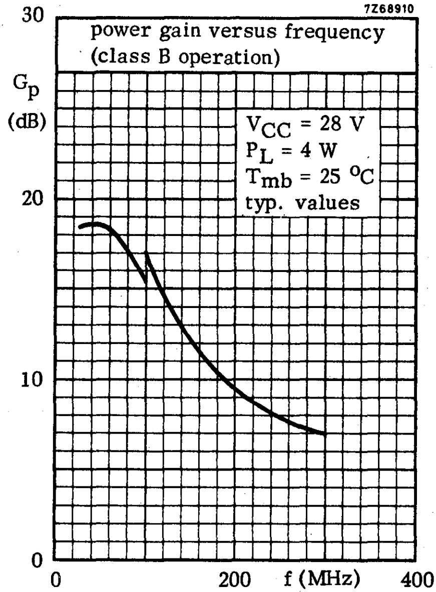
R1 = R2 = 10 Ω carbon

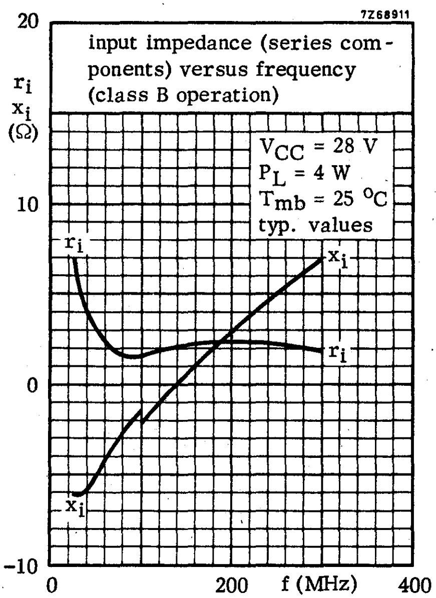


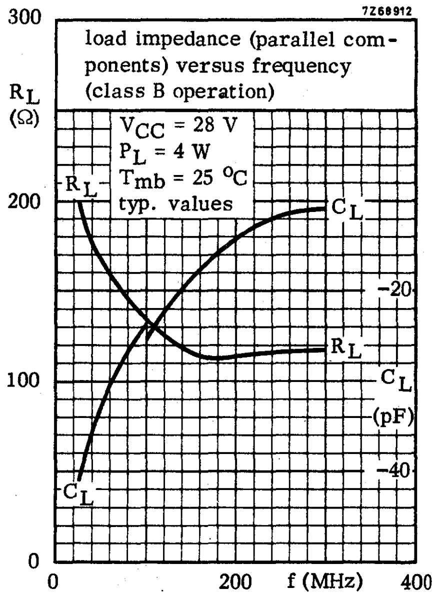


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







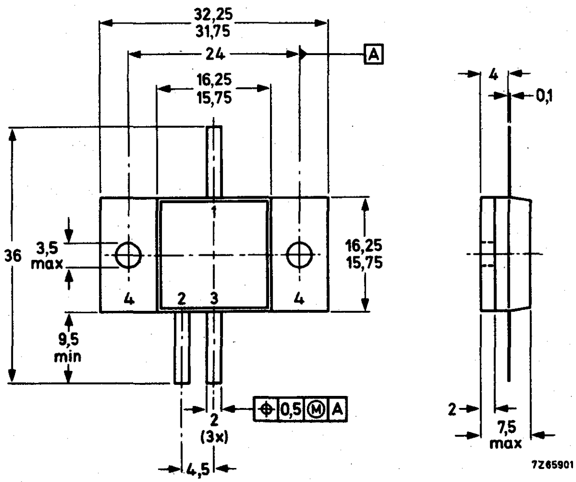
U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The module will produce 2,5 W output into a 50 Ω load over the bands 380 to 512 MHz for the BGY22, and 420 to 480 MHz for the BGY22A.

QUICK REFERENCE DATA							
Type number	Mode of operation	Freq. range (MHz)	V_B (V)	P_D (mW)	P_L (W)	η (%)	$Z_S = Z_L$ (Ω)
BGY22	c.w.	380 to 512	13,5	50	> 2,5	> 40	50
BGY22	c.w.	380 to 512	13,5	50	typ. 2,9	typ. 50	50
BGY22A	c.w.	420 to 480	12,5	50	> 2,5	> 40	50

MECHANICAL DATA Dimensions in mm

SOT-75A



Terminal connections

1 = input lead
2 = $+V_B$
3 = output lead
4 = r.f. and d.c. ground

To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

Devices may be soldered directly into a circuit with a soldering iron at a maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

Supply terminal	V_B	max.	18	V
Input terminal	$\pm V_I$	max.	25	V
Output terminal	$\pm V_O$	max.	25	V

Current

Supply current (d.c.)	I_{tot}	max.	800	mA

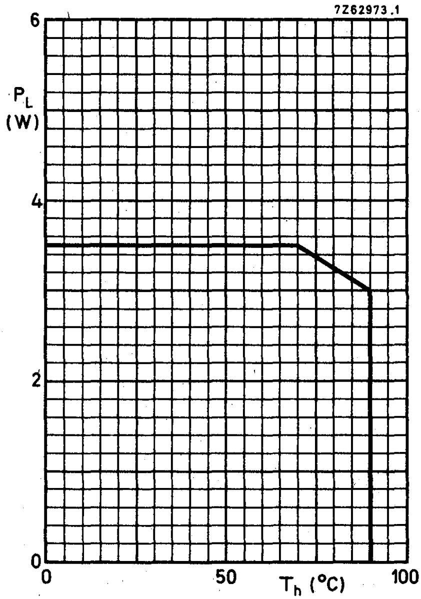
Drive power

$V_B = 13,5$ V; $Z_L = 50\ \Omega$	P_D	max.	150	mW

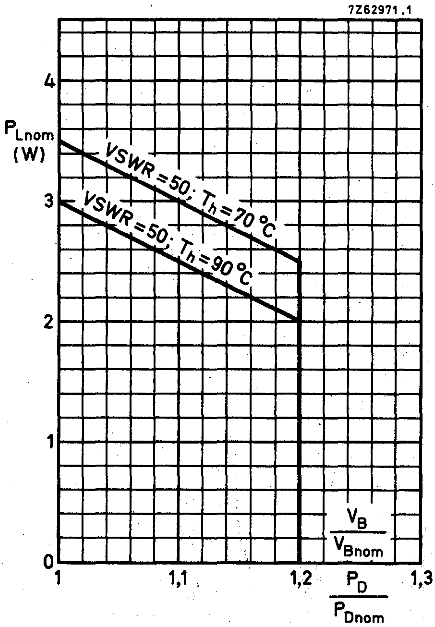
Temperatures

Storage temperature	T_{stg}	−40 to	+100	°C
Operating heatsink temperature	T_h	max.	90	°C

P_L for normal operation



P_L for fault condition



Where $P_{Lnom} = P_L$ at $V_B = 13,5$ V; $Z_L = 50\ \Omega$ (BGY22)
and $P_{Lnom} = P_L$ at $V_B = 12,5$ V; $Z_L = 50\ \Omega$ (BGY22A)

CHARACTERISTICS T_h = 25 °C unless otherwise specified

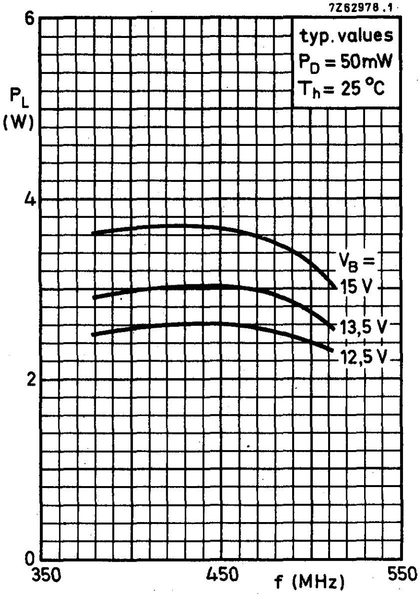
Reference planes at r.f. input and output terminals are 1 mm from the plastic encapsulation.

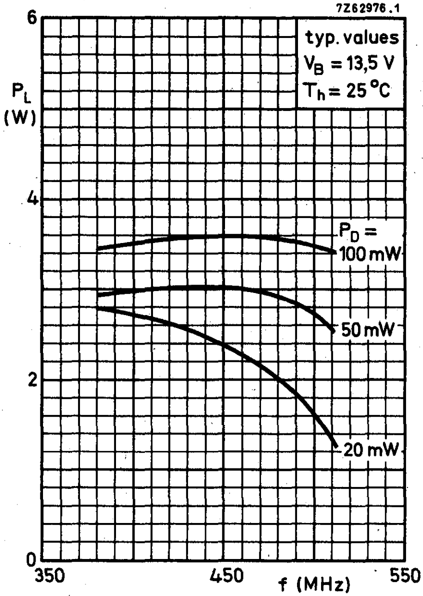
Frequency range 380-512 MHz; V_B = 13,5 V (BGY22)
Frequency range 420-480 MHz; V_B = 12,5 V (BGY22A)

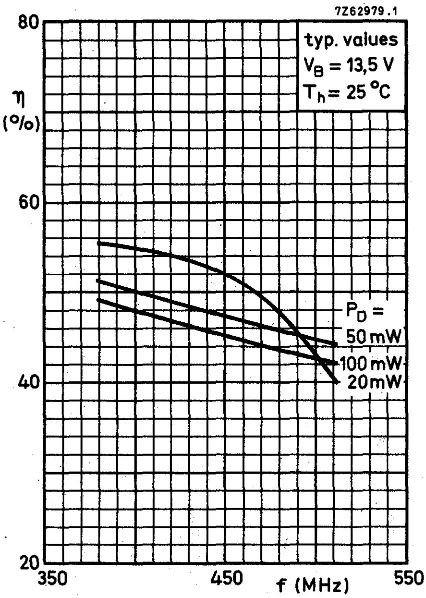
Quiescent current			
$P_D = 0$	I_{BQ}	4,0 to 12,0	mA
Load power			
P_D = 50 mW	P_L	2,5 to 3,5	W
Efficiency			
P_D = 50 mW	η	> 40	%
Supply current			
P_D = 50 mW	I_{tot}	typ. 475	mA
Harmonic content			
P_D = 50 mW	Any harmonic is at least 20 dB down relative to carrier		
Input VSWR with respect to 50 Ω			
P_D = 50 mW	VSWR	< 2	
Temperature coefficient of P_L			
P_D = 50 mW; T_h = 25 to 70 °C		typ. −10	mW/°C

Stability

V_B = 10,5 to 15 V; P_D = 10 mW to 100 mW
T_h = −40 to +90 °C
Output load VSWR ≤ 3, all phases — No instabilities
Output load VSWR ≤ 10, all phases — No appreciable instabilities


7Z62978.1
typ. values
P_D = 50mW
T_h = 25 °C
P_L (W)
V_B =
15 V
13,5 V
12,5 V
f (MHz)
0
2
4
6
350
450
550


7Z62976.1
typ. values
V_B = 13,5 V
T_h = 25 °C
P_L (W)
P_D =
100 mW
50 mW
20 mW
f (MHz)
0
2
4
6
350
450
550


7Z62979.1
typ. values
V_B = 13,5 V
T_h = 25 °C
η (%)
P_D =
50 mW
100 mW
20mW
f (MHz)
20
40
60
80
350
450
550

APPLICATION INFORMATION

R.F. performance in c.w. operation; T_h = 25 °C

Drive source and load impedance $Z_S = Z_L = 50\ \Omega$

Type number	f (MHz)	V_B (V)	P_D (mW)	P_L (W)	η (%)
BGY22	380 to 512	15, 0	50	typ. 3, 5	typ. 47
BGY22	380 to 512	13, 5	50	> 2, 5	> 40
BGY22	380 to 512	13, 5	50	typ. 2, 9	typ. 47
BGY22	380 to 512	12, 5	50	typ. 2, 5	typ. 47
BGY22A	420 to 480	12, 5	50	> 2, 5	> 40

The modules are designed to withstand full load mismatch under the following conditions:

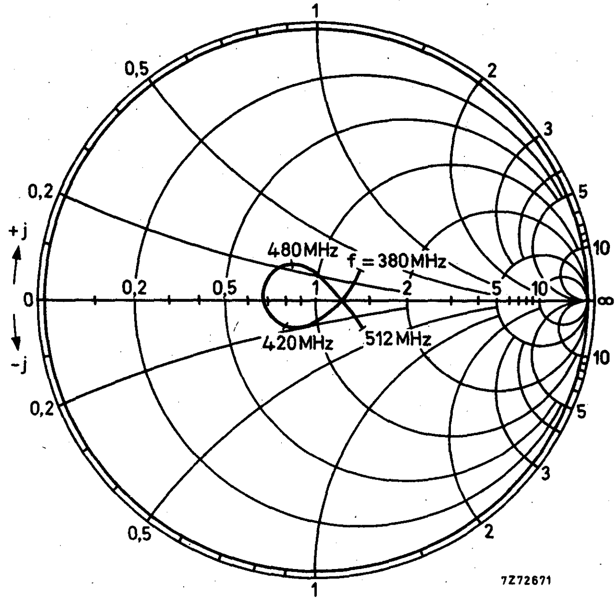
$P_D = P_{Dnom} + 20\%$; T_h = 70 °C

V_B = 16, 5 V (BGY22)

V_B = 15, 0 V (BGY22A)

VSWR = 50 at any phase

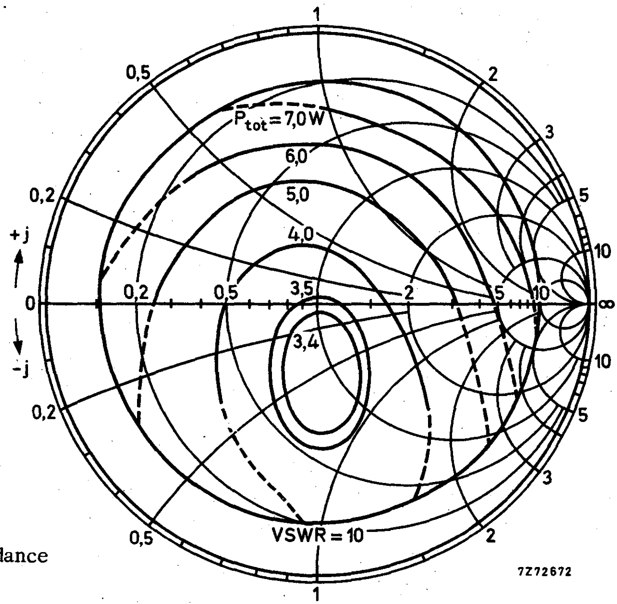
where $P_{Dnom} = P_D$ for 2, 5 W module output under nominal conditions.



Typical variation of input impedance with frequency

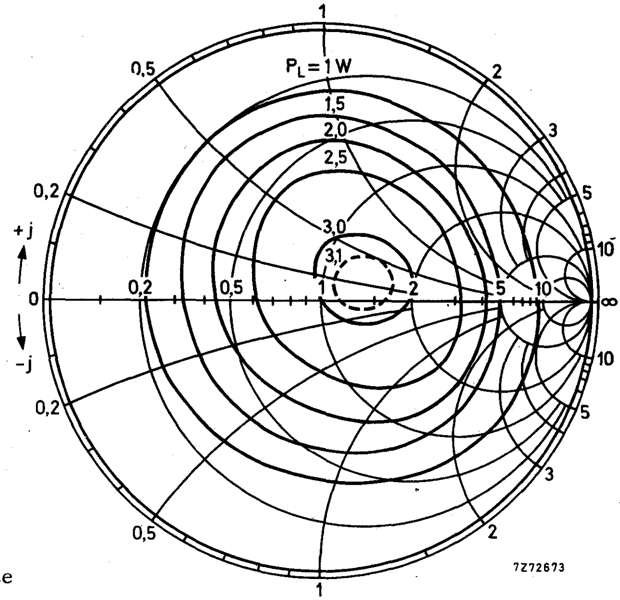
V_B = 13,5 V

f = 470 MHz



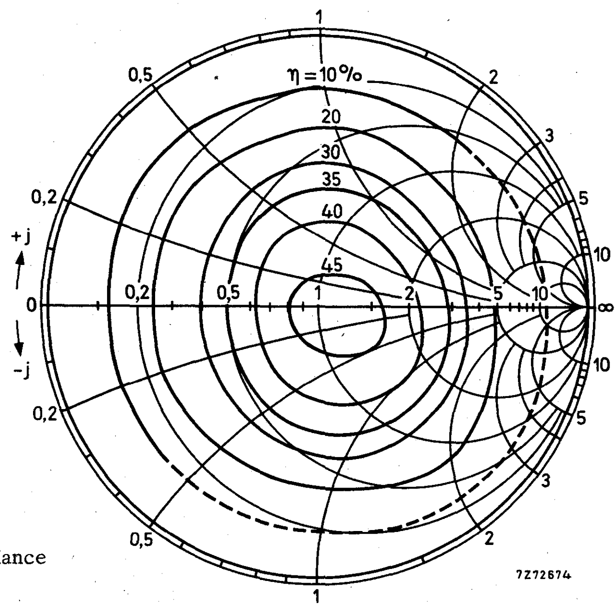
Typical variation of power dissipation with load impedance

V_B = 13,5 V
P_D = 50 mW
f = 470 MHz



Typical variation of load power with load impedance

V_B = 13,5 V
P_D = 50 mW
f = 470 MHz



Typical variation of efficiency with load impedance

U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The modules are suitable for driving directly from the BGY22 and BGY22A respectively, and when so driven will produce 7 W output into a 50 Ω load over the band 380 to 480 MHz for the BGY23, and 7 W over the band 420 to 480 MHz for the BGY23A.

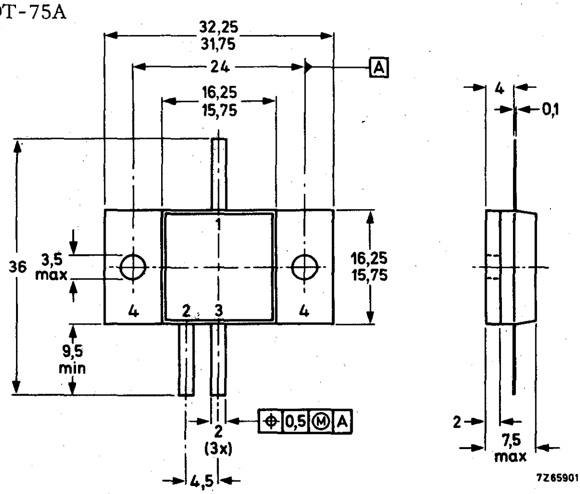
QUICK REFERENCE DATA

Type number	Mode of operation	Freq. range (MHz)	V_B (V)	P_D (W)	P_L (W)	η (%)	$Z_S = Z_L$ (Ω)
BGY23	c.w.	380 - 480	13,5	2,5	> 7,0	> 60	50
BGY23	c.w.	380 - 480	13,5	2,5	typ. 8,3	typ. 71	50
BGY23	c.w.	480 - 512	13,5	2,5	typ. 7,5	typ. 69	50
BGY23A	c.w.	420 - 480	12,5	2,5	> 7,0	> 60	50

MECHANICAL DATA

Dimensions in mm

SOT-75A



Terminal connections

1 = input lead
2 = $+V_B$
3 = output lead
4 = r.f. and d.c. ground

To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

Devices may be soldered directly into a circuit with a soldering iron at a maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

Supply terminal	V_B	max.	18	V
Input terminal (no external d.c. connection)	$\pm V_I$	max.	0,5	V
Output terminal	$\pm V_O$	max.	25	V

Current

Supply current (d.c.)	I_{tot}	max.	1,7	A

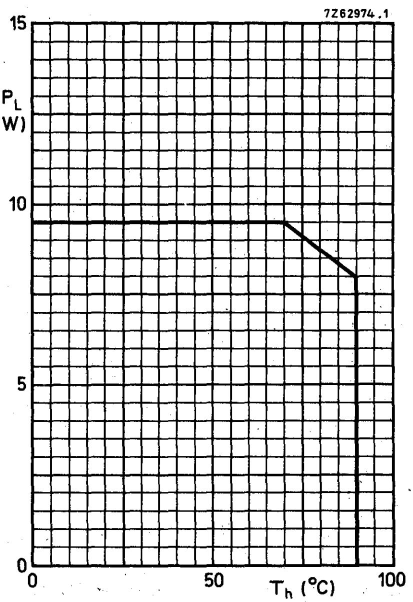
Drive power

V_B = 13,5 V; Z_L = 50 Ω	P_D	max.	3,5	W

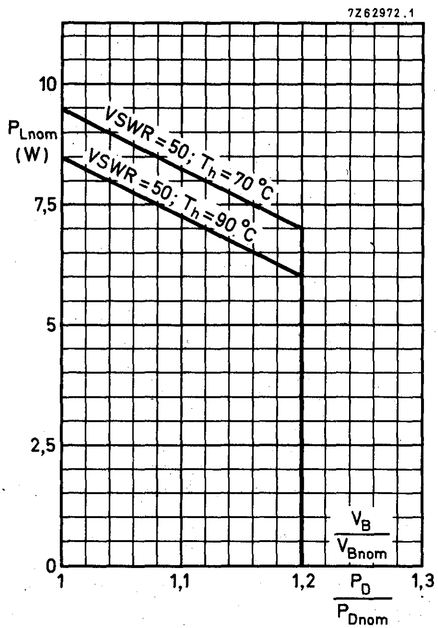
Temperatures

Storage temperature	T_{stg}	−40 to +100		°C
Operating heatsink temperature	T_h	max.	90	°C

P_L for normal operation



P_L for fault condition



Where P_{Lnom} = P_L at V_B = 13,5 V; Z_L = 50 Ω (BGY23)
and P_{Lnom} = P_L at V_B = 12,5 V; Z_L = 50 Ω (BGY23A)

CHARACTERISTICS T_h = 25 °C unless otherwise specified

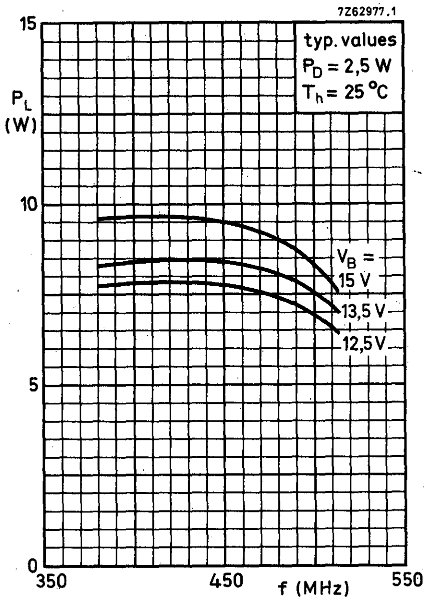
Reference planes at r.f. input and output terminals are 1 mm from the plastic encapsulation.

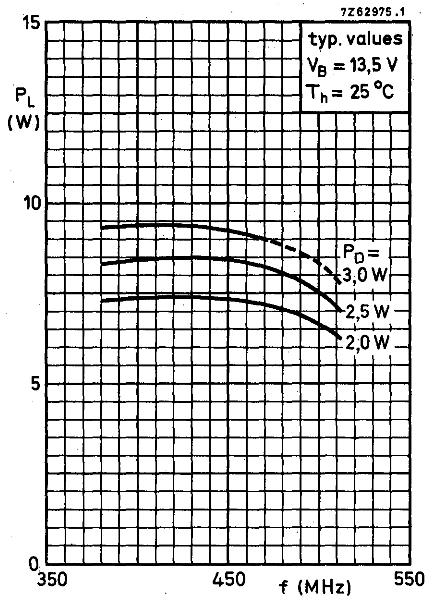
Frequency range 380-512 MHz; V_B = 13,5 V (BGY23)
Frequency range 420-480 MHz; V_B = 12,5 V (BGY23A)

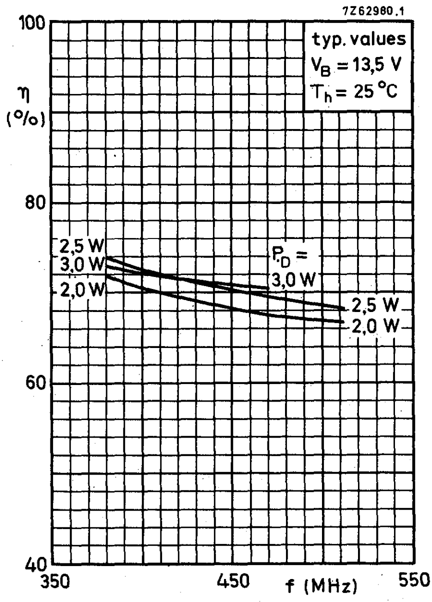
Quiescent current					
P_D = 0		I_{BQ}	<	5,0	mA
Load power					
P_D = 2,5 W; f = 380-480 MHz	BGY23	P_L		7,0 to 9,5	W
P_D = 2,5 W; f = 480-512 MHz	BGY23	P_L	typ.	7,5	W
P_D = 2,5 W; f = 420-480 MHz	BGY23A	P_L		7,0 to 9,5	W
Efficiency					
P_D = 2,5 W		η	>	60	%
Supply current					
P_D = 2,5 W		I_{tot}	typ.	900	mA
Harmonic content					
P_D = 2,5 W		Any harmonic is at least 20 dB down relative to carrier			
Input VSWR with respect to 50 Ω					
P_D = 2,5 W		VSWR	<	2	
Temperature coefficient of P_L					
P_D = 2,5 W; T_h = 25 to 70 °C			typ.	−20	mW/°C

Stability

V_B = 10,5 V to 15 V; P_D = 1 W to 3,5 W
T_h = −40 °C to +90 °C
Output load VSWR ≤ 3, all phases — No instabilities
Output load VSWR ≤ 10, all phases — No appreciable instabilities


7Z62977.1
typ. values
P_D = 2,5 W
T_h = 25 °C
P_L
(W)
15
10
5
0
V_B =
15 V
13,5 V
12,5 V
350
450
f (MHz)
550


7Z62975.1
typ. values
V_B = 13,5 V
T_h = 25 °C
P_L
(W)
15
10
5
0
P_D =
3,0 W
2,5 W
2,0 W
350
450
f (MHz)
550


7Z62980.1
typ. values
V_B = 13,5 V
T_h = 25 °C
η
(%)
100
80
60
40
2,5 W
3,0 W
2,0 W
P_D =
3,0 W
2,5 W
2,0 W
350
450
f (MHz)
550

APPLICATION INFORMATION

R.F. performance in c.w. operation; T_h = 25 °C

Drive source and load impedance $Z_S = Z_L$ = 50 Ω

Type number	f (MHz)	V_B (V)	P_D (W)	P_L (W)	η (%)
BGY23	380 to 512	15,0	2,5	typ. 9,0	typ. 65
BGY23	380 to 480	13,5	2,5	> 7,0	> 60
BGY23	380 to 480	13,5	2,5	typ. 8,3	typ. 71
BGY23	480 to 512	13,5	2,5	typ. 7,5	typ. 69
BGY23	380 to 512	12,5	2,5	typ. 7,4	typ. 70
BGY23A	420 to 480	12,5	2,5	> 7,0	> 60

Connection of the BGY22/BGY22A to the BGY23/BGY23A respectively can be either by 50 Ω transmission line or directly with a total lead length not greater than 2 mm.

The modules are designed to withstand full load mismatch under the following conditions:

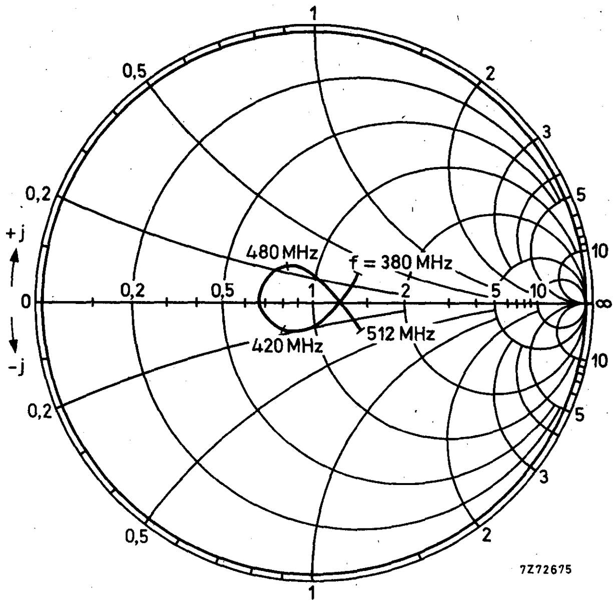
$P_D = P_{Dnom}$ + 20%; T_h = 70 °C

V_B = 16,5 V (BGY23)

V_B = 15,0 V (BGY23A)

VSWR = 50 at any phase

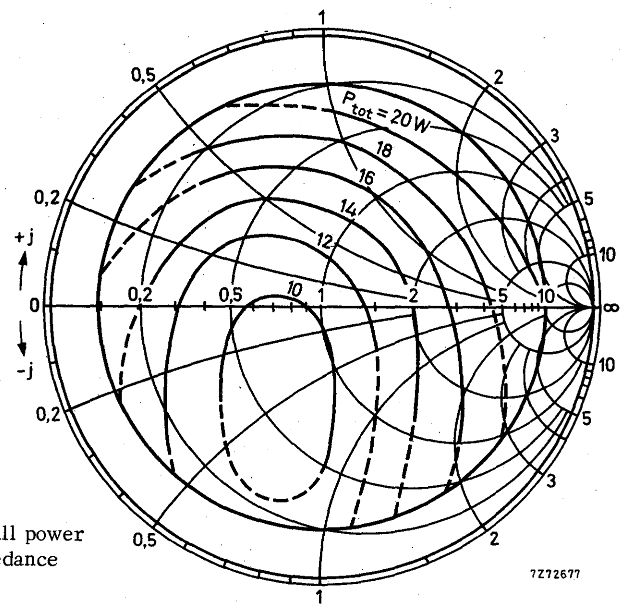
where $P_{Dnom} = P_D$ for 7,0 W module output under nominal conditions.



Typical variation of input impedance with frequency

V_B = 13, 5 V

f = 470 MHz



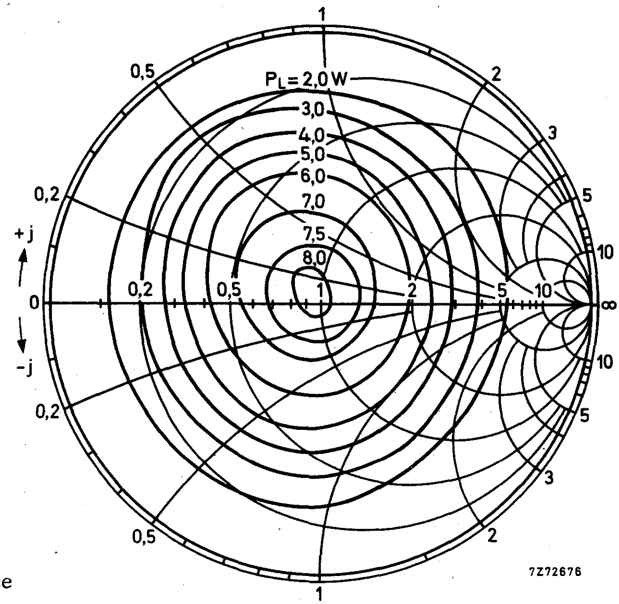
BGY22/23 or
BGY22A/23A
cascaded amplifier

Typical variation of overall power dissipation with load impedance

V_B = 13, 5 V

f = 470 MHz

BGY22/23 or
BGY22A/23A
cascaded amplifier

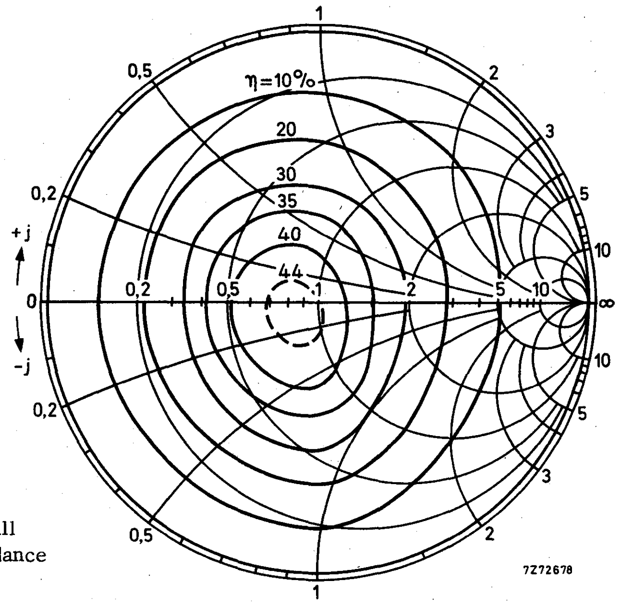


Typical variation of load power with load impedance

V_B = 13, 5 V

f = 470 MHz

BGY22/23 or
BGY22A/23A
cascaded amplifier



Typical variation of overall efficiency with load impedance

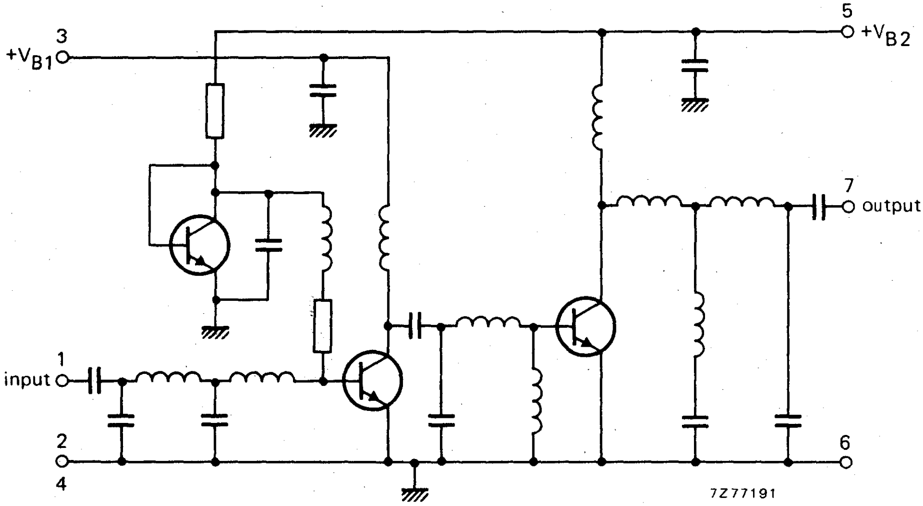
V.H.F. POWER AMPLIFIER MODULES

A range of broadband amplifier modules designed for mobile communications equipments, operating directly from 12 V vehicle electrical systems. The devices will produce 18 W output into a 50 Ω load. The modules consist of a two stage r.f. amplifier using n-p-n transistor chips, together with lumped-element matching components.

QUICK REFERENCE DATA

type number	mode of operation	frequency range f (MHz)	nominal supply voltages $V_{B1} = V_{B2}$ (V)	drive power P_D (mW)	load power P_L (W)	nominal input impedance z_i (Ω)	nominal load impedance Z_L (Ω)
BGY32	c.w.	68 to 88	12,5	100	> 18 typ 23	50	50
BGY33	c.w.	80 to 108	12,5	100	> 18 typ 22	50	50
BGY35	c.w.	132 to 156	12,5	150	> 18 typ 22	50	50
BGY36	c.w.	148 to 174	12,5	150	> 18 typ 21	50	50

CIRCUIT DIAGRAM

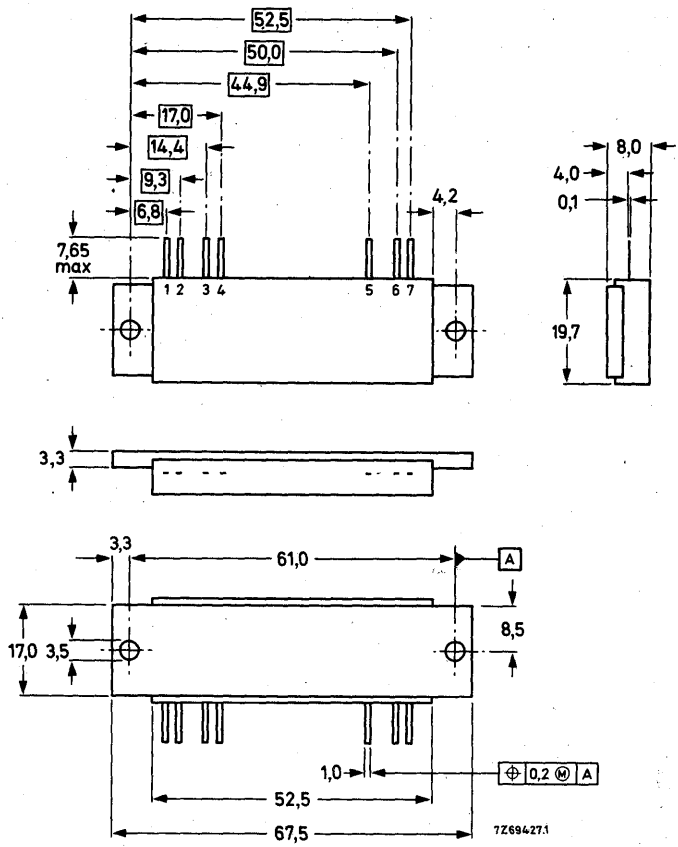


CAUTION These devices incorporate beryllium oxide, the dust of which is toxic. The devices are entirely safe provided that they are not dismantled.

→ **MECHANICAL DATA**

Dimensions in mm

Fig. 1 SOT-132.



Lead reference

1 = Input
2 = Earth
3 = Supply $+V_{B1}$
4 = Earth
5 = Supply $+V_{B2}$
6 = Earth
7 = Output

Mounting and soldering recommendations

To ensure good thermal transfer the module should be mounted using heatsink compound onto a heatsink with a flat surface; if an isolation washer is used heatsink compound should be used on both sides of the insulator. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to torques of 0,5 Nm minimum.

Devices may be soldered directly into a circuit with a soldering iron at maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

RATINGS

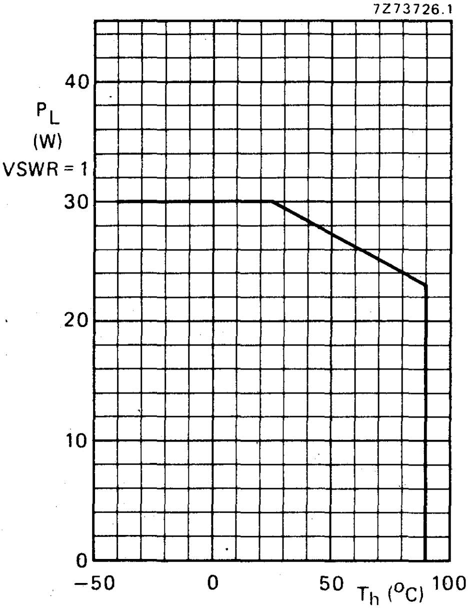
Limiting values in accordance with the Absolute Maximum System (IEC 134)

D.C. voltages (with respect to flange)

D.C. supply terminals	V_{B1} and V_{B2}	max	15	V
R.F. input terminal	$\pm V_I$	max	25	V
R.F. output terminal	$\pm V_O$	max	25	V

Power

Input drive power BGY32 and BGY33	P_D	max	200	mW
Input drive power BGY35 and BGY36	P_D	max	300	mW
Load power	P_L	max	30	W



Temperatures

Storage temperature	T_{stg}		−40 to 100	°C
Operating heatsink temperature	T_h	max	90	°C

CHARACTERISTICS

$T_h = 25\ ^oC$

			BGY32	BGY33	BGY35	BGY36	
Quiescent current $V_{B1} = V_{B2} = 12{,}5$ V; $P_D = 0$; $R_S = R_L = 50\ \Omega$	I_{BQ1}	typ	6	6	6	6	mA
	I_{BQ2}	typ	13	13	13	13	mA
Frequency range	f	>	68	80	132	148	MHz
		<	88	108	156	174	MHz
Load power $V_{B1} = V_{B2} = 12{,}5$ V; $R_S = R_L = 50\ \Omega$ **BGY32** and **BGY33**; $P_D = 100$ mW	P_L	>	18	18	–	–	W
		typ	23	22			W
	η	>	40	40	–	–	%
		typ	50	50			%
BGY35 and **BGY36**; $P_D = 150$ mW	P_L	>	–	–	18	18	W
		typ			22	21	W
	η	>	–	–	40	40	%
		typ			50	50	%

Harmonic output — Any single harmonic will be at least 25 dB down relative to carrier

Input VSWR with respect to 50 Ω — typ 1,5

Stability — The module is stable with load VSWR up to 3 (all phases) when operated with matched output power greater than 6 W.

Ruggedness

The modules are capable of withstanding load mismatch of up to 50 VSWR for short period overload conditions, with P_D, V_{B1} and V_{B2} at maximum values providing the combination does not result in the matched r.f. output power rating being exceeded.

APPLICATION INFORMATION

Supply

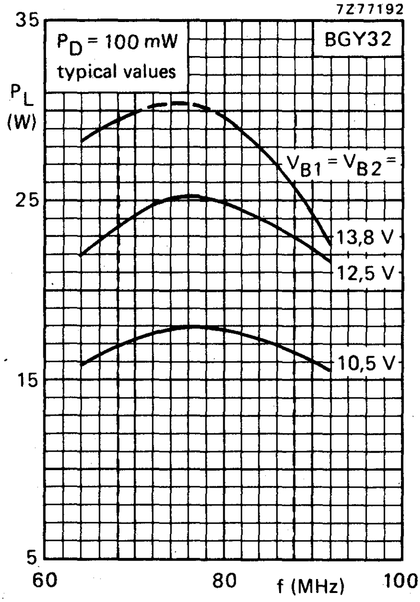
An electrolytic capacitor of 10 μF (25 V), in parallel with a polyester capacitor of 100 nF to earth, is recommended as decoupling arrangement for each power supply pin.

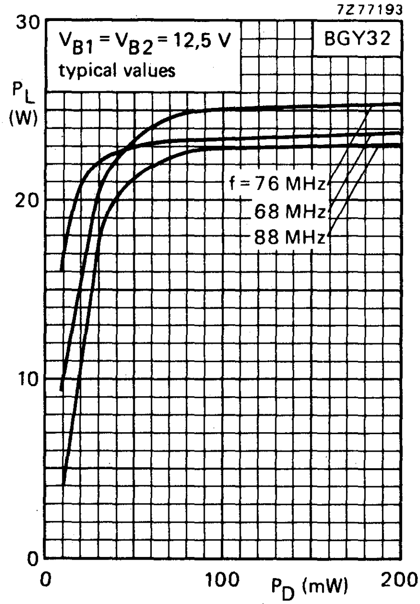
Power rating

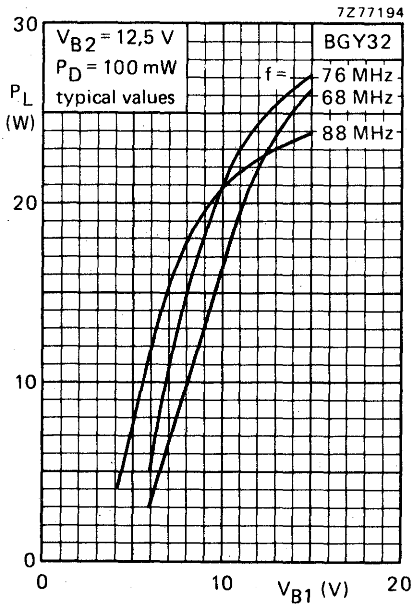
In general it is recommended that the output power from the module under nominal design conditions should not exceed 23 W in order to provide adequate safety margin under fault conditions.

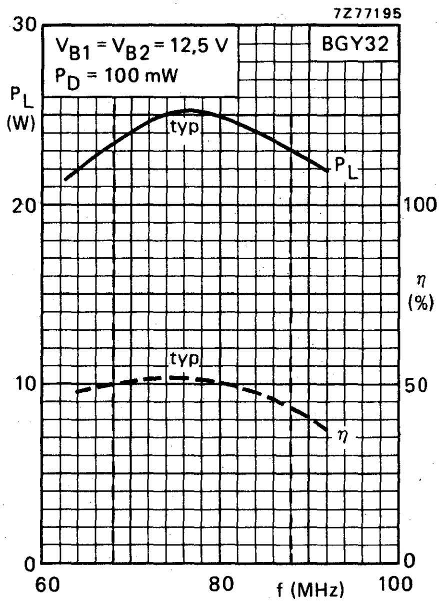
Gain control

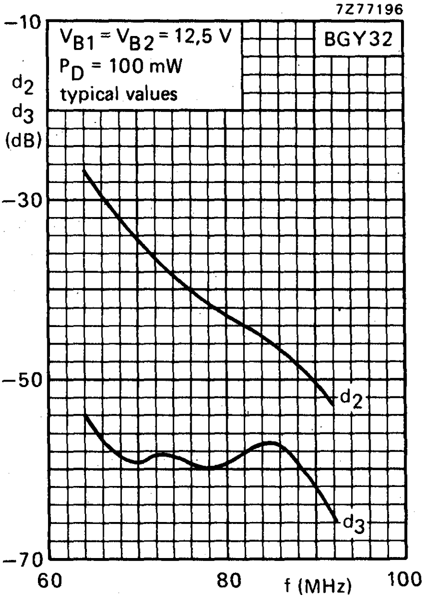
Power output can be controlled by variation of the driver stage supply voltage V_{B1}. The supply required is a voltage regulator with a current rating of 0,75 A, and an output voltage range of 3 V to 12 V.

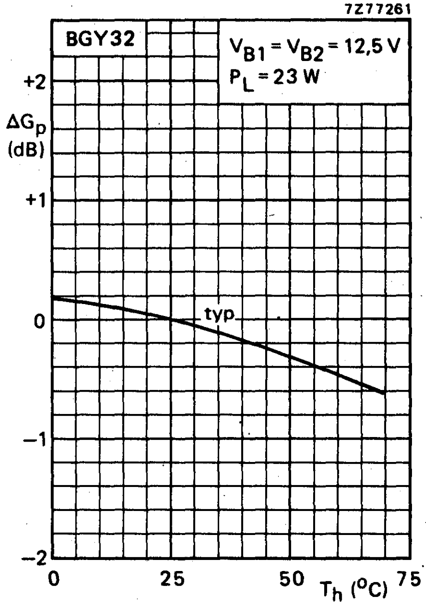

7Z77192
P_D = 100 mW
typical values
BGY32
P_L (W)
$V_{B1} = V_{B2}$ =
13,8 V
12,5 V
10,5 V
35
25
15
5
60
80
100
f (MHz)

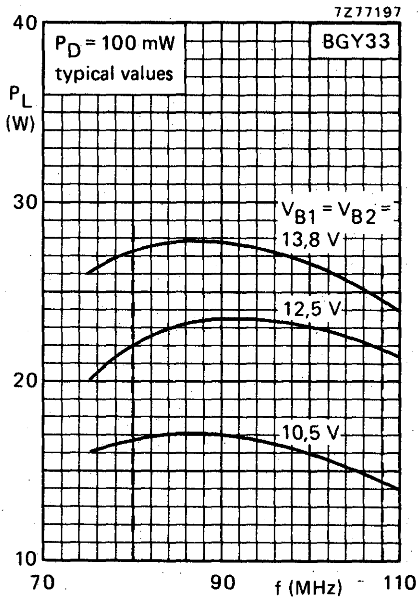

7Z77193
$V_{B1} = V_{B2}$ = 12,5 V
typical values
BGY32
P_L (W)
f = 76 MHz
68 MHz
88 MHz
30
20
10
0
0
100
200
P_D (mW)

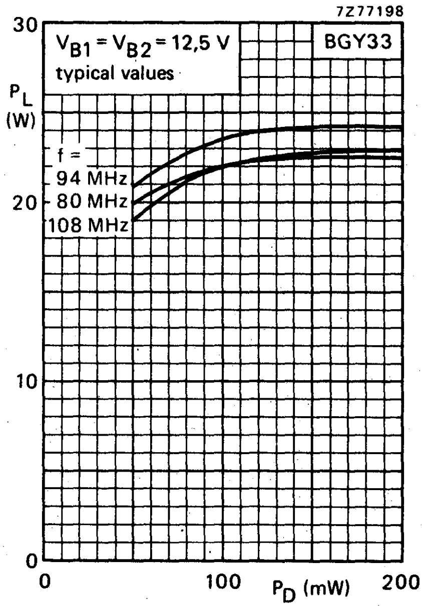

7Z77194
V_{B2} = 12,5 V
P_D = 100 mW
typical values
BGY32
P_L (W)
f =
76 MHz
68 MHz
88 MHz
30
20
10
0
0
10
20
V_{B1} (V)

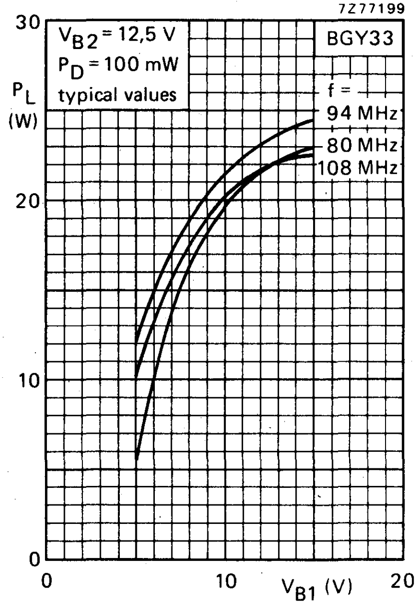

7Z77195
$V_{B1} = V_{B2}$ = 12,5 V
P_D = 100 mW
BGY32
P_L (W)
typ
P_L
typ
η
η (%)
30
20
10
0
100
50
0
60
80
100
f (MHz)

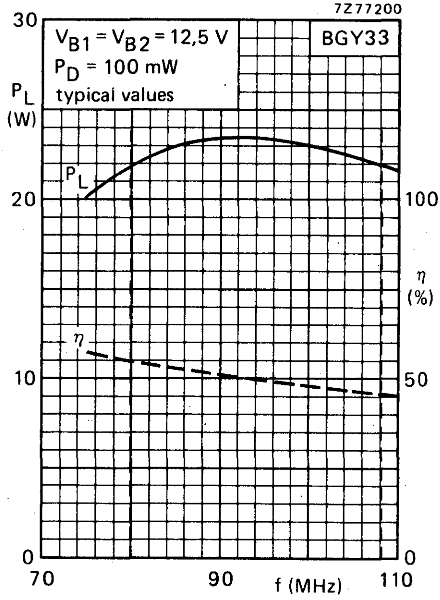

7Z77196
$V_{B1} = V_{B2} = 12,5$ V
P_D = 100 mW
typical values
BGY32
d_2
d_3
(dB)
−10
−30
−50
−70
60
80
100
f (MHz)
d_2
d_3

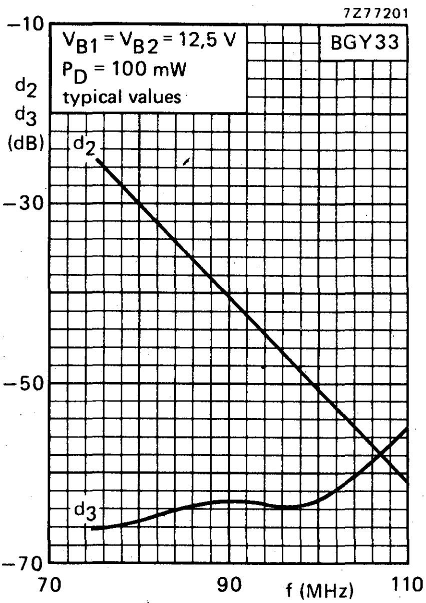

7Z77261
BGY32
$V_{B1} = V_{B2} = 12,5$ V
P_L = 23 W
ΔG_p
(dB)
+2
+1
0
−1
−2
typ
0
25
50
75
T_h (°C)

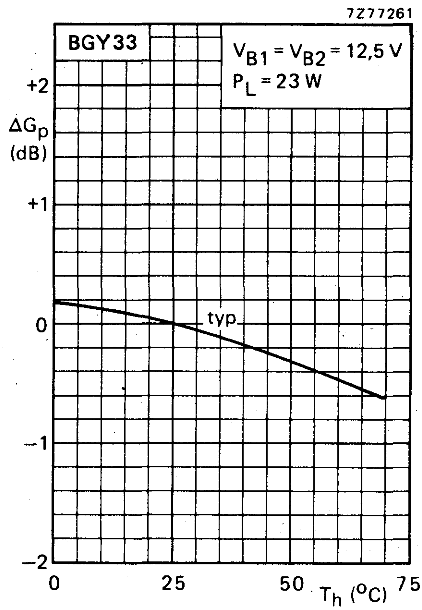

7Z77197
P_D = 100 mW
typical values
BGY33
P_L
(W)
40
30
20
10
$V_{B1} = V_{B2} =$
13,8 V
12,5 V
10,5 V
70
90
110
f (MHz)

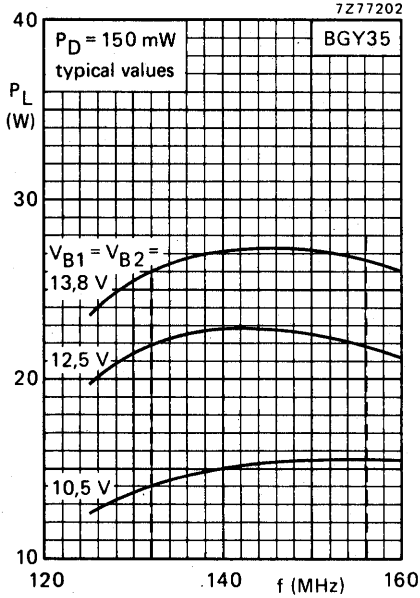

7Z77198
$V_{B1} = V_{B2} = 12,5$ V
typical values
BGY33
P_L
(W)
30
20
10
0
f =
94 MHz
80 MHz
108 MHz
0
100
200
P_D (mW)

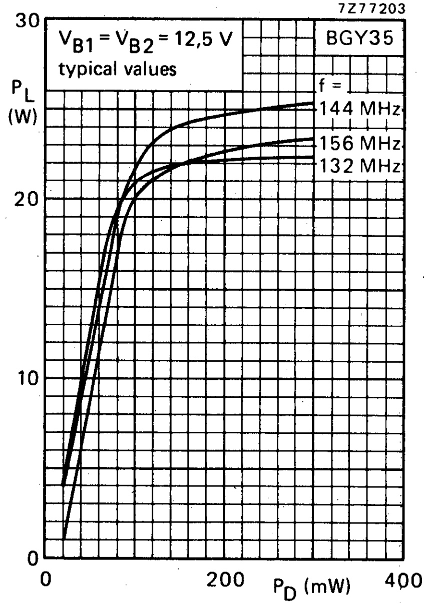

7Z77199
BGY33
VB2 = 12,5 V
PD = 100 mW
typical values
PL (W)
f =
94 MHz
80 MHz
108 MHz
VB1 (V)

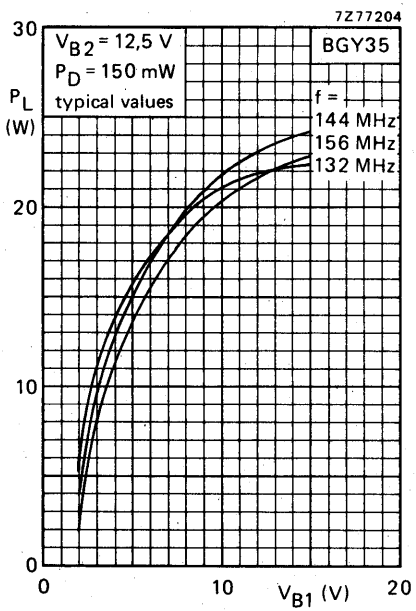

7Z77200
BGY33
VB1 = VB2 = 12,5 V
PD = 100 mW
typical values
PL (W)
PL
η
η (%)
f (MHz)

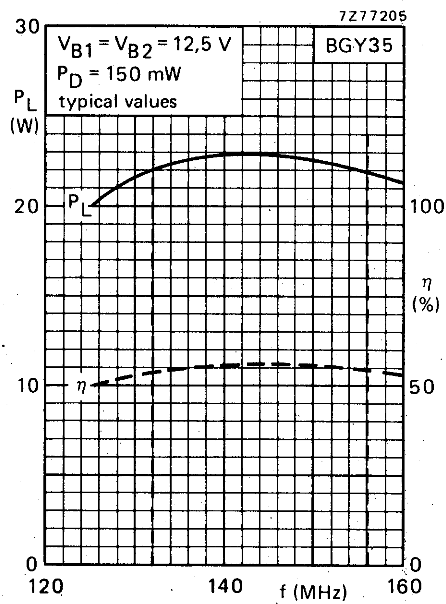

7Z77201
BGY33
VB1 = VB2 = 12,5 V
PD = 100 mW
typical values
d2 d3 (dB)
d2
d3
f (MHz)

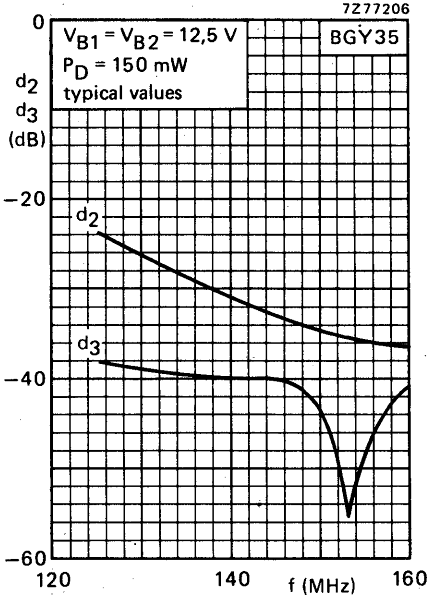

7Z77261
BGY33
VB1 = VB2 = 12,5 V
PL = 23 W
ΔGp (dB)
typ
Th (°C)

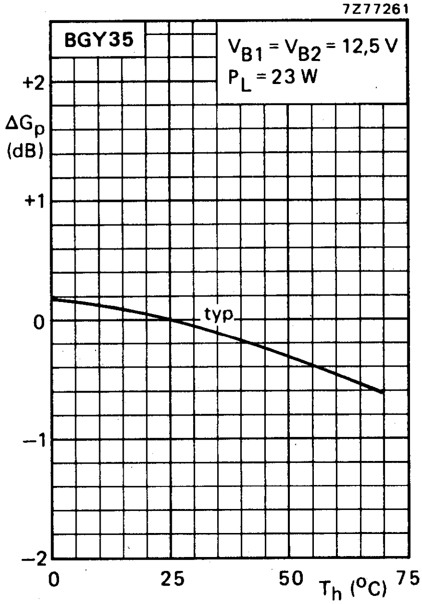

7Z77202
P_D = 150 mW
typical values
BGY35
P_L
(W)
$V_{B1} = V_{B2}$ =
13,8 V
12,5 V
10,5 V
40
30
20
10
120
140
160
f (MHz)

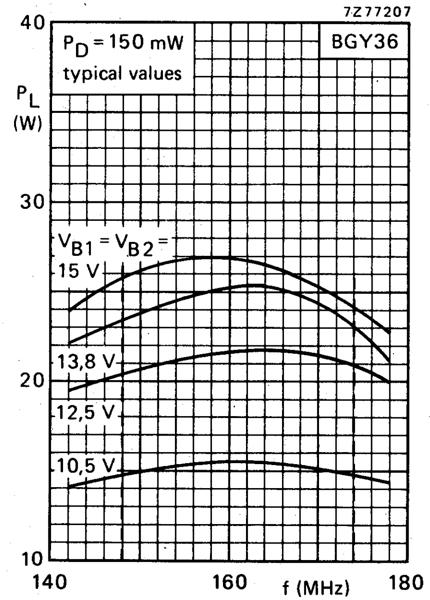

7Z77203
$V_{B1} = V_{B2}$ = 12,5 V
typical values
BGY35
P_L
(W)
f =
144 MHz
156 MHz
132 MHz
30
20
10
0
0
200
400
P_D (mW)

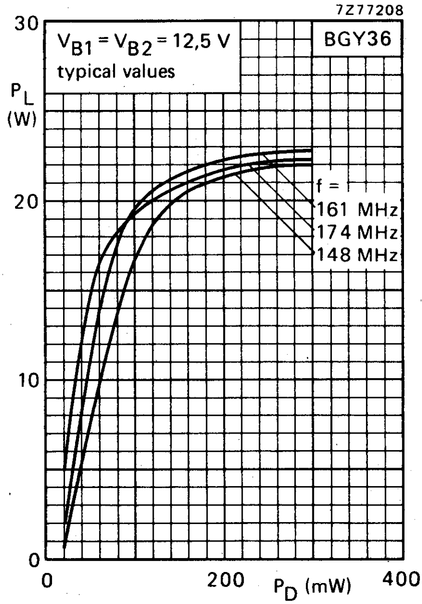

7Z77204
V_{B2} = 12,5 V
P_D = 150 mW
typical values
BGY35
P_L
(W)
f =
144 MHz
156 MHz
132 MHz
30
20
10
0
0
10
20
V_{B1} (V)

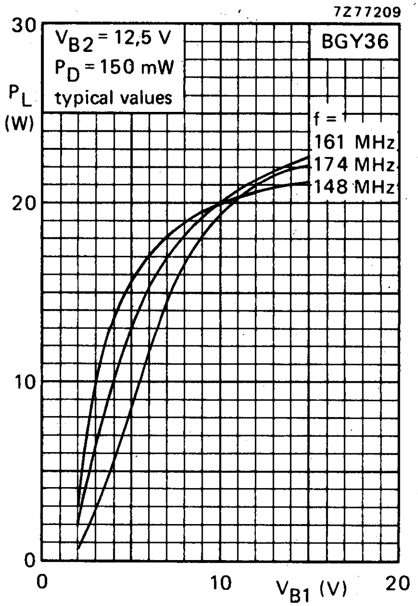

7Z77205
$V_{B1} = V_{B2}$ = 12,5 V
P_D = 150 mW
typical values
BGY35
P_L
(W)
P_L
η
η
(%)
30
20
10
0
100
50
0
120
140
160
f (MHz)

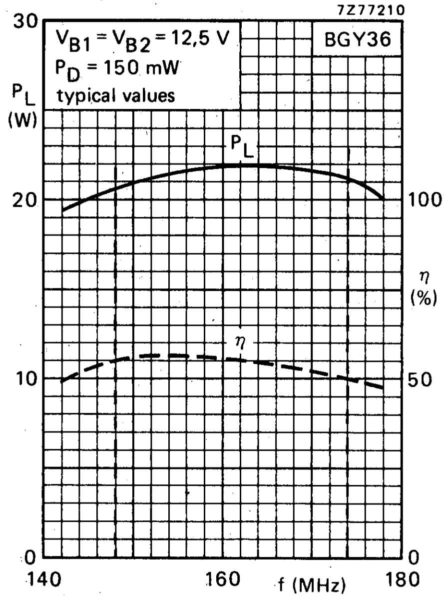

7Z77206
BGY35
$V_{B1} = V_{B2} = 12,5$ V
$P_D = 150$ mW
typical values
d_2
d_3
(dB)
0
−20
−40
−60
120
140
160
f (MHz)

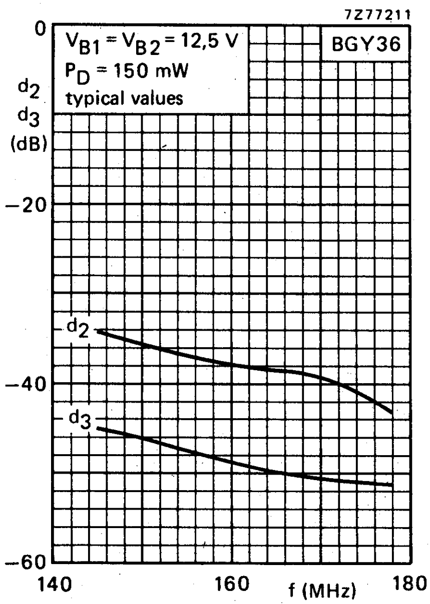

7Z77261
BGY35
$V_{B1} = V_{B2} = 12,5$ V
$P_L = 23$ W
ΔG_p
(dB)
+2
+1
0
−1
−2
typ.
0
25
50
75
T_h (°C)

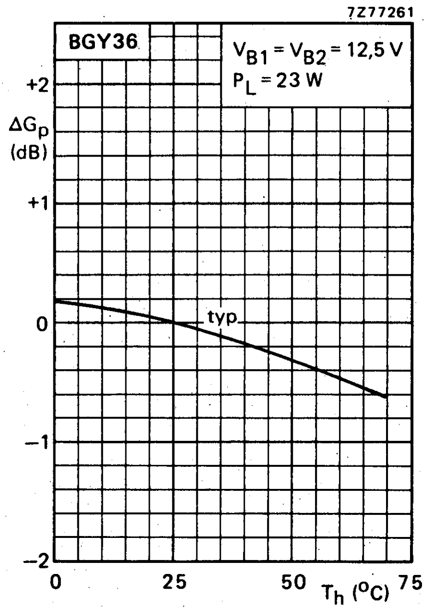

7Z77207
BGY36
$P_D = 150$ mW
typical values
P_L
(W)
40
30
20
10
$V_{B1} = V_{B2} =$
15 V
13,8 V
12,5 V
10,5 V
140
160
180
f (MHz)


7Z77208
BGY36
$V_{B1} = V_{B2} = 12,5$ V
typical values
P_L
(W)
30
20
10
0
f =
161 MHz
174 MHz
148 MHz
0
200
400
P_D (mW)


7Z77209
VB2 = 12,5 V
PD = 150 mW
typical values
BGY36
PL
(W)
f =
161 MHz
174 MHz
148 MHz
30
20
10
0
0
10
20
VB1 (V)


7Z77210
VB1 = VB2 = 12,5 V
PD = 150 mW
typical values
BGY36
PL
(W)
PL
η
η
(%)
30
20
10
0
100
50
0
140
160
180
f (MHz)


7Z77211
VB1 = VB2 = 12,5 V
PD = 150 mW
typical values
BGY36
d2
d3
(dB)
d2
d3
0
−20
−40
−60
140
160
180
f (MHz)


7Z77261
BGY36
VB1 = VB2 = 12,5 V
PL = 23 W
ΔGp
(dB)
typ
+2
+1
0
−1
−2
0
25
50
75
Th (°C)

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

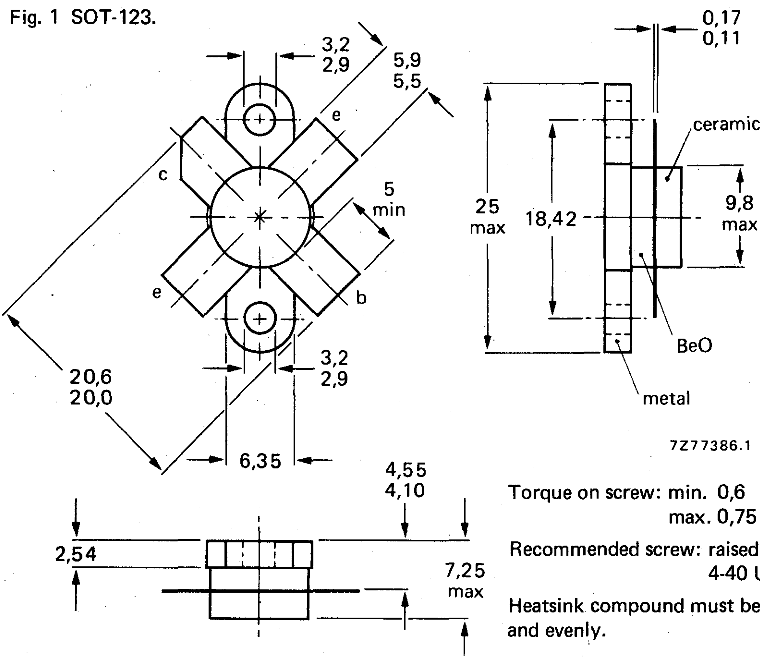
R.F. performance up to T_h = 25 ^oC in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**8**	> **9,0**	> **70**	**2,8 + j1,2**	**76 − j16**
c.w.	12,5	175	8	typ. 10,5	typ. 75	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	4,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

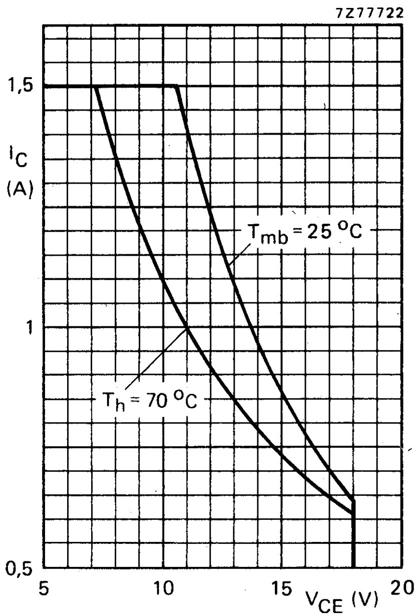


Fig. 2 D.C. SOAR.

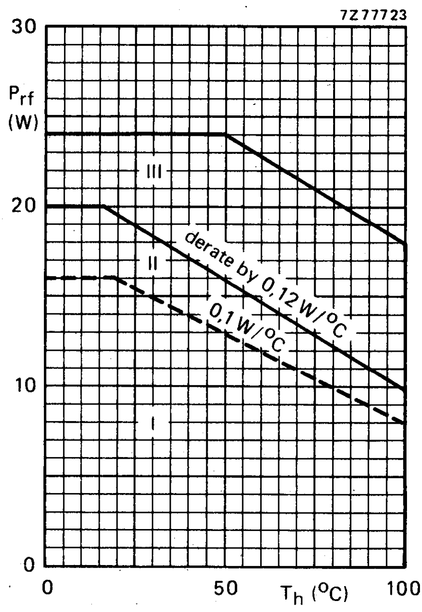


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 72,4 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0{,}75$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage * $I_C = 2$ A; $I_B = 0{,}4$ A	V_{CEsat}	typ.	0,85 V
Transition frequency at f = 100 MHz * $-I_E = 0{,}75$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	950 MHz
$-I_E = 2$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	850 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13{,}5$ V	C_c	typ.	16,5 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 13{,}5$ V	C_{re}	typ.	12 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

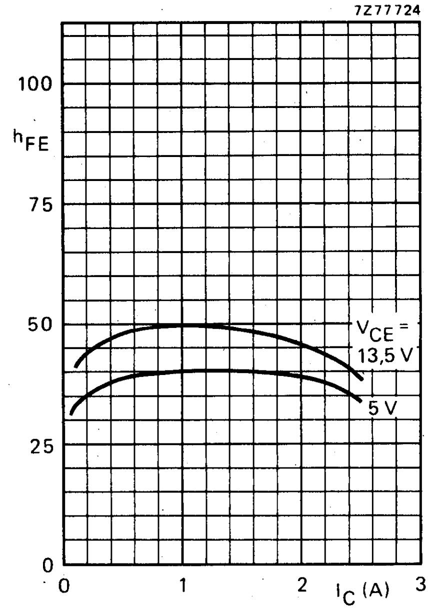


Fig. 4 Typical values; T_j = 25 °C.

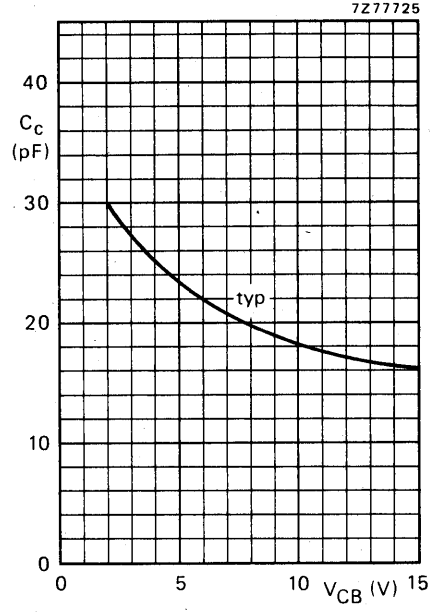


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

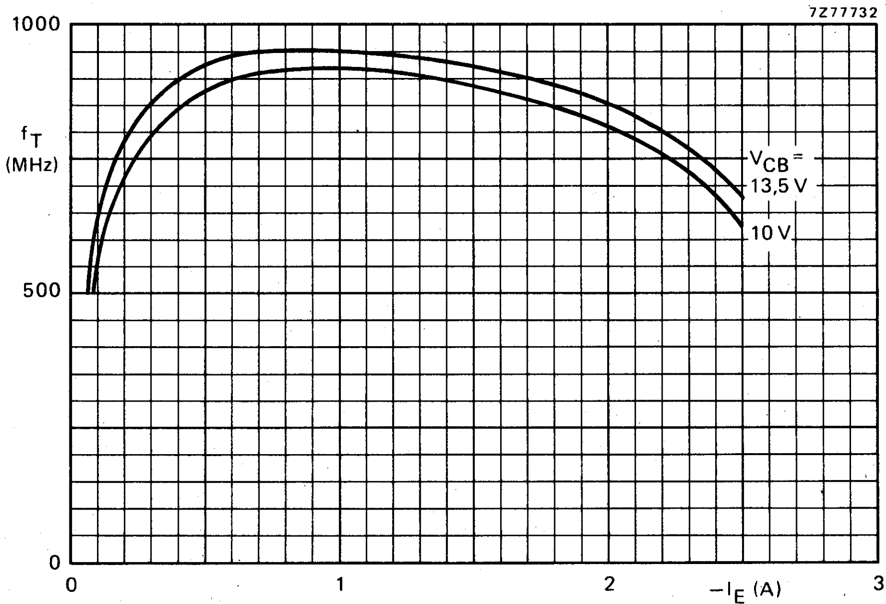


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^{o}C$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**8**	**< 1,0**	**> 9,0**	**< 0,85**	**> 70**	**2,8 + j1,2**	**76 – j16**
175	12,5	8	–	typ. 10,5	–	typ. 75	–	–

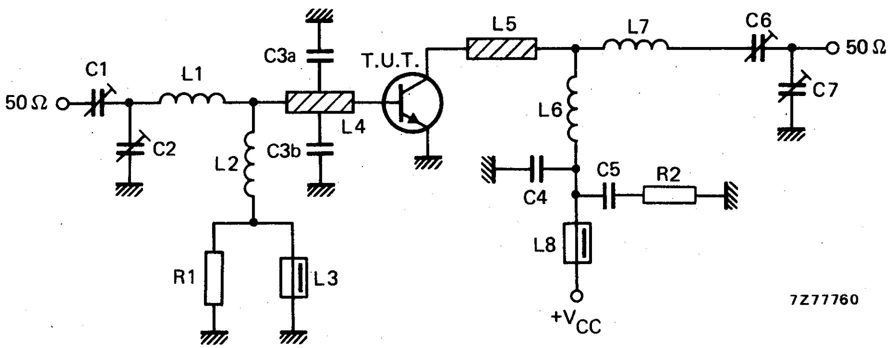


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

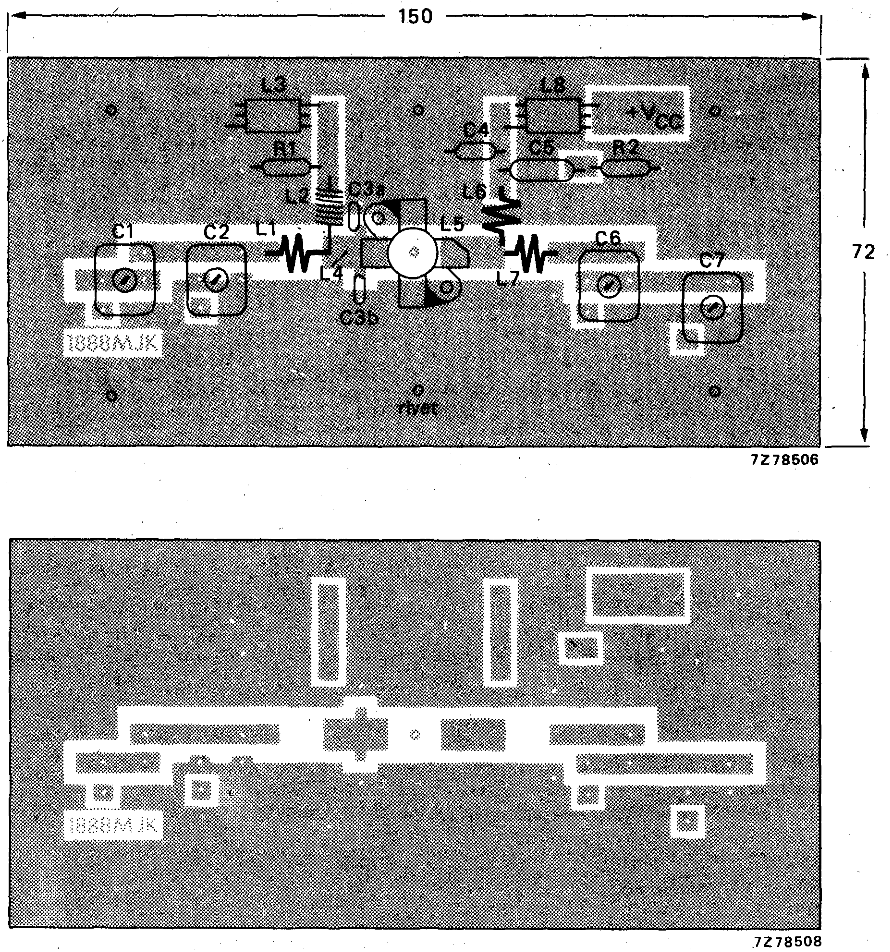


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

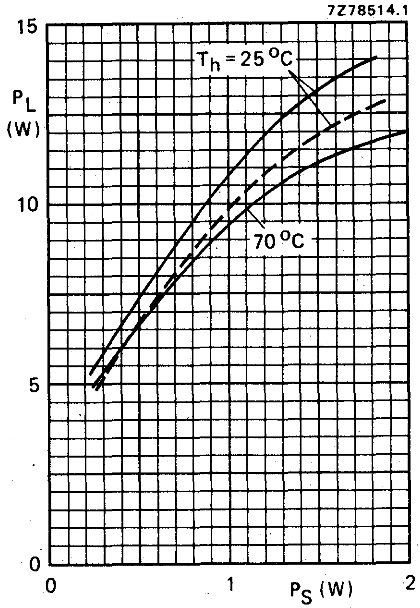


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; ---- V_{CE} = 12,5 V.

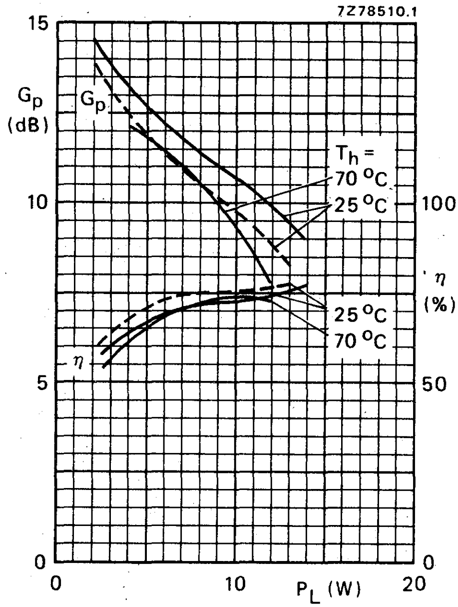


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; ---- V_{CE} = 12,5 V.

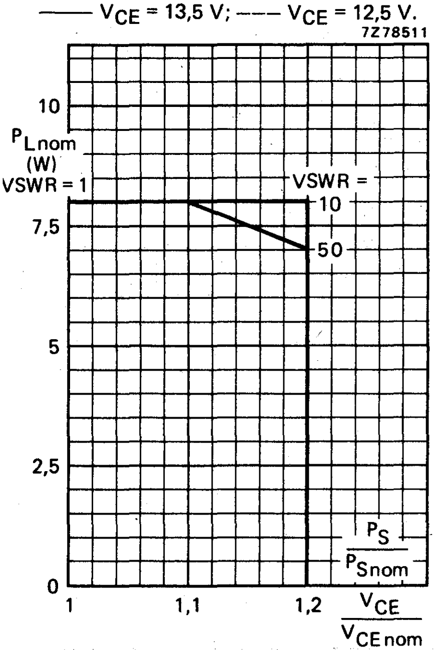


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

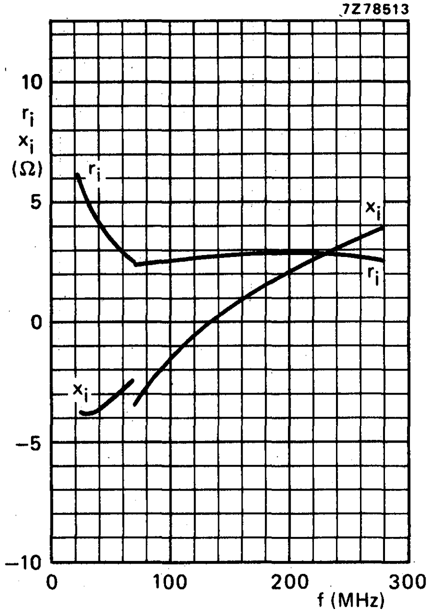


Fig. 12 Input impedance (series components).

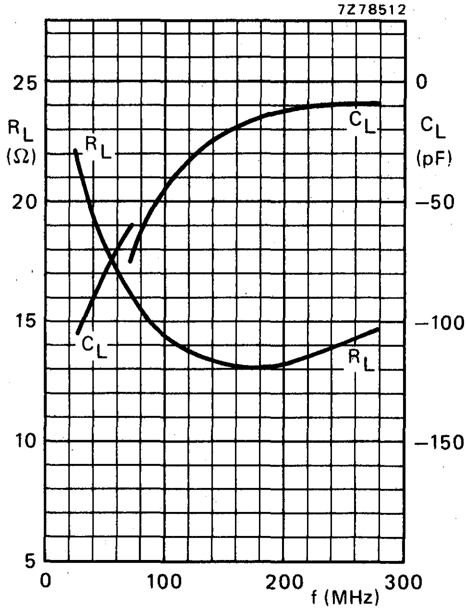


Fig. 13 Load impedance (parallel components).

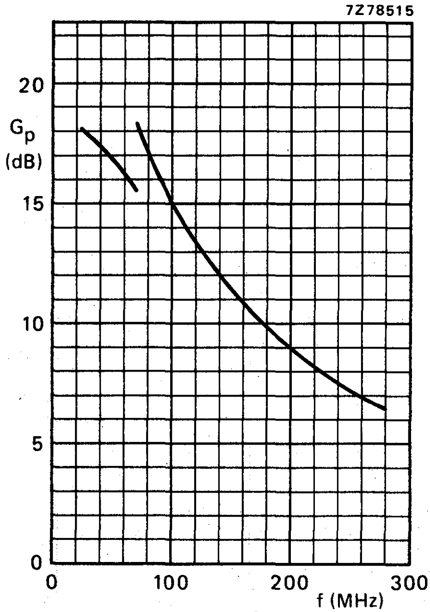


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 8 W;
T_h = 25 °C.

OPERATING NOTE

Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

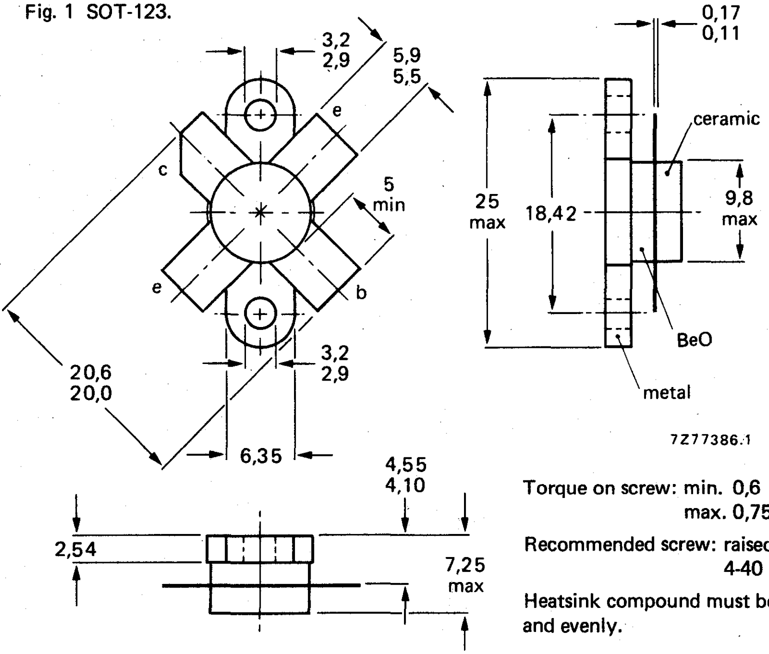
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**15**	**> 8,0**	**> 60**	**2,3 + j2,2**	**130 − j4,4**
c.w.	12,5	175	15	typ. 7,5	typ. 67	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

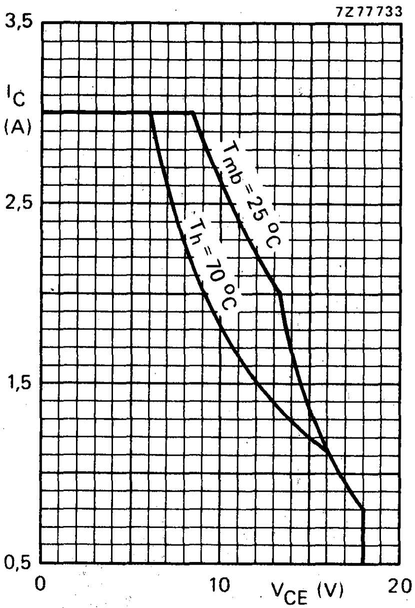


Fig. 2 D.C. SOAR.

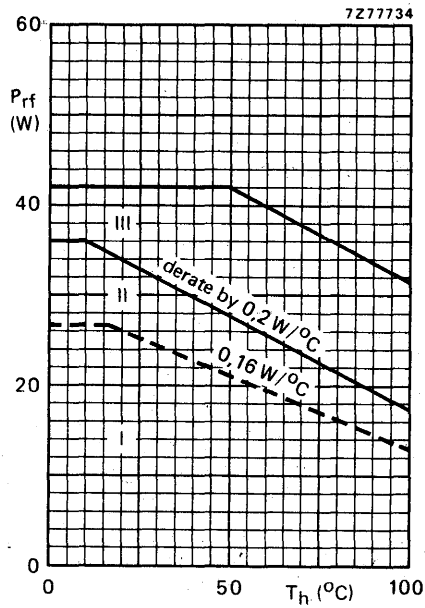


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 74,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5	mJ
D.C. current gain * $I_C = 1,5$ A; $V_{CE} = 5$ V	h_{FE}	typ. 	40 10 to 100	
Collector-emitter saturation voltage * $I_C = 4,5$ A; $I_B = 0,9$ A	V_{CEsat}	typ.	1,0	V
Transition frequency at f = 100 MHz * $-I_E = 1,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850	MHz
$-I_E = 4,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	800	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	32	pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	23	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

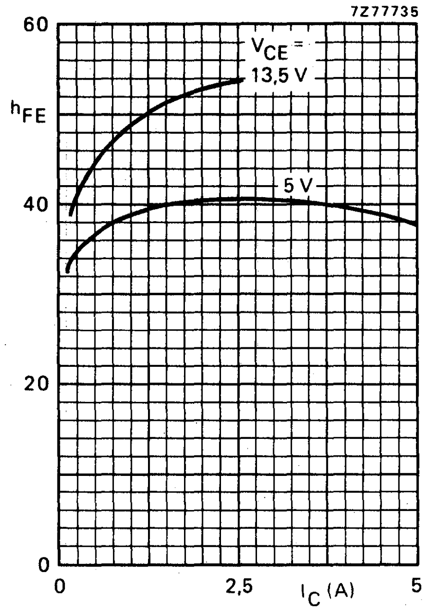


Fig. 4 Typical values; T_j = 25 °C.

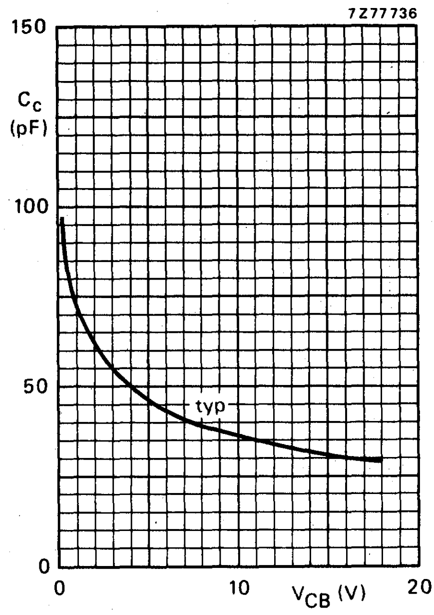


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

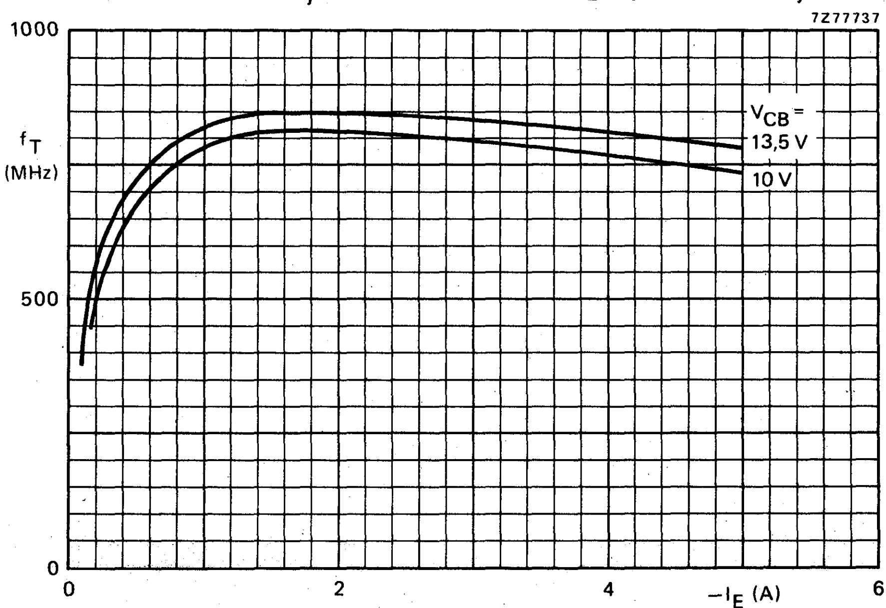


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**15**	**< 2,4**	**> 8,0**	**< 1,85**	**> 60**	**2,3 + j2,2**	**130 – j4,4**
175	12,5	15	–	typ. 7,5	–	typ. 67	–	–

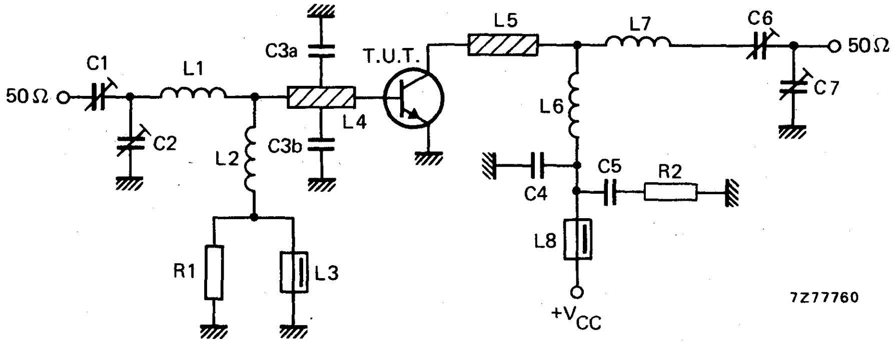


Fig. 7 Test circuit; c.w. class-B.

List of components:

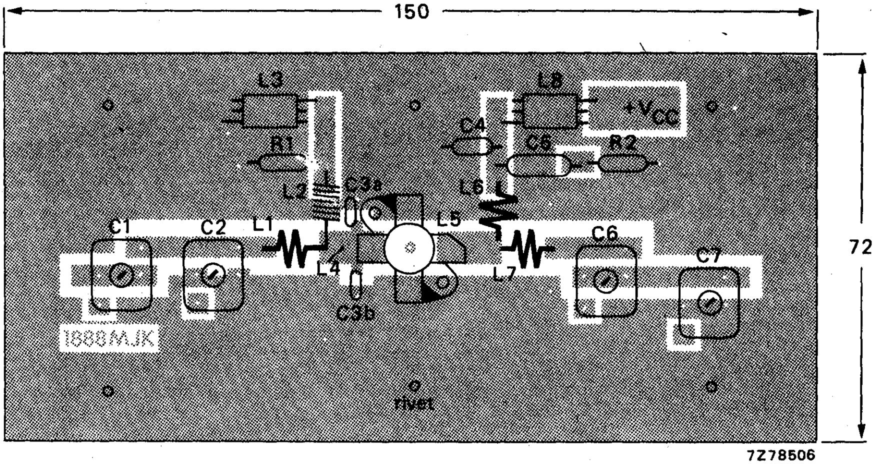
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



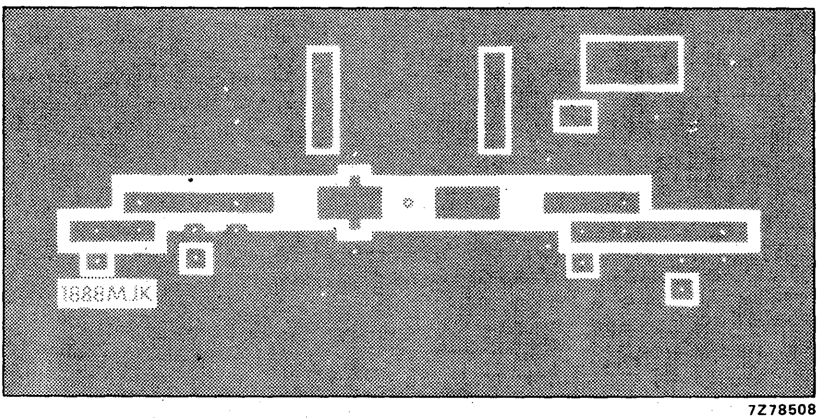


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

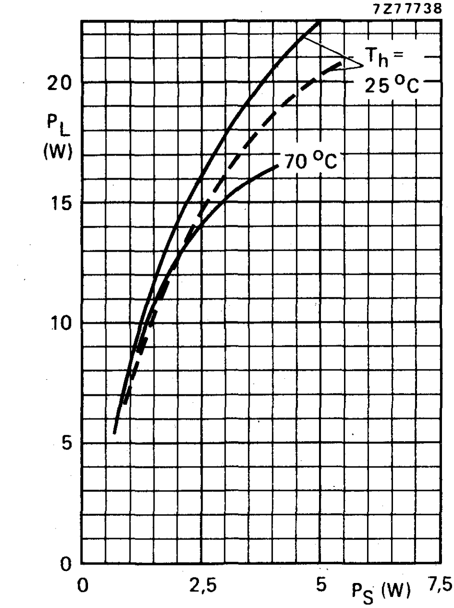


Fig. 9 Typical values; f = 175 MHz; —— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

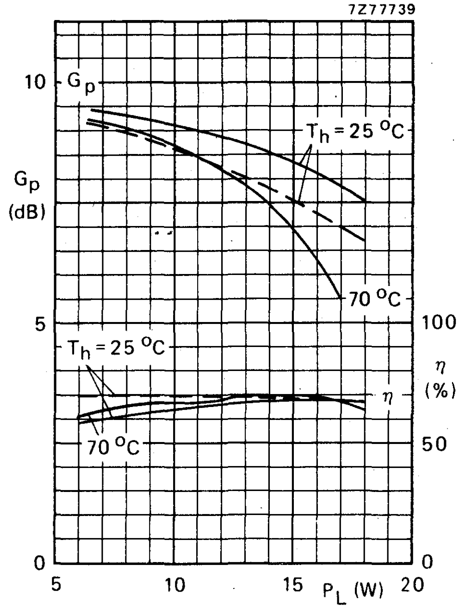


Fig. 10 Typical values; f = 175 MHz; —— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

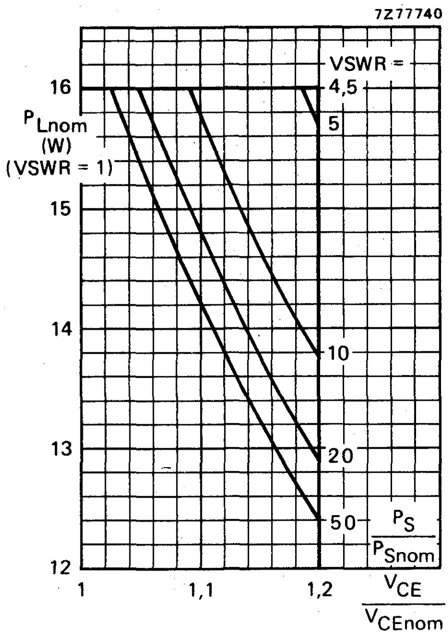


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

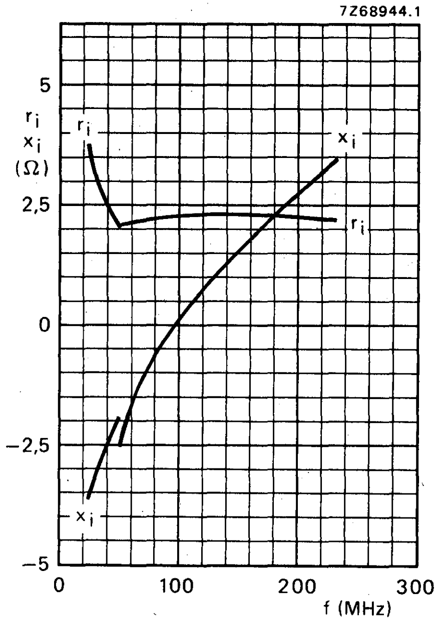


Fig. 12 Input impedance (series components).

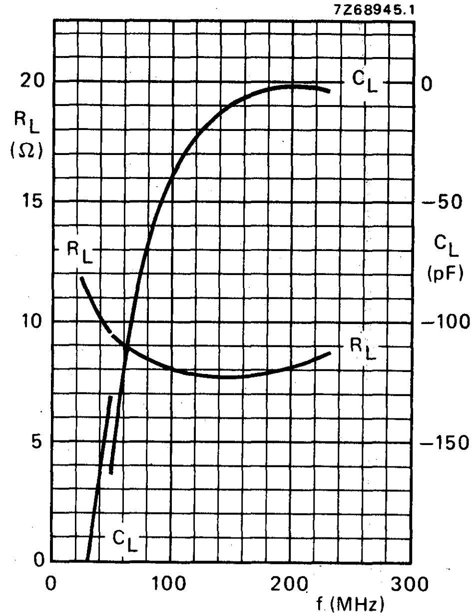
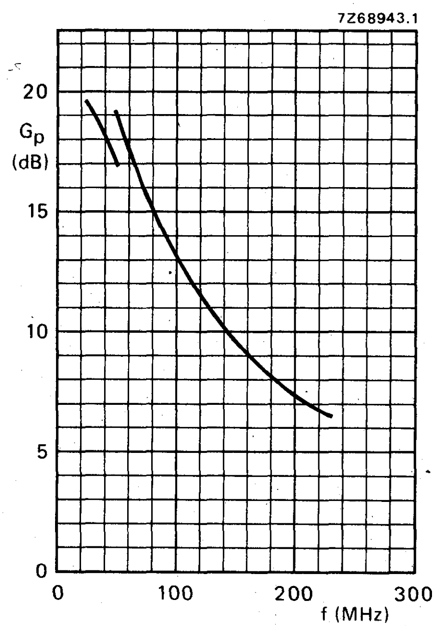


Fig. 13 Load impedance (parallel components).



Conditions for Figs 12, 13 and 14:

Typical values: V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Fig. 14.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

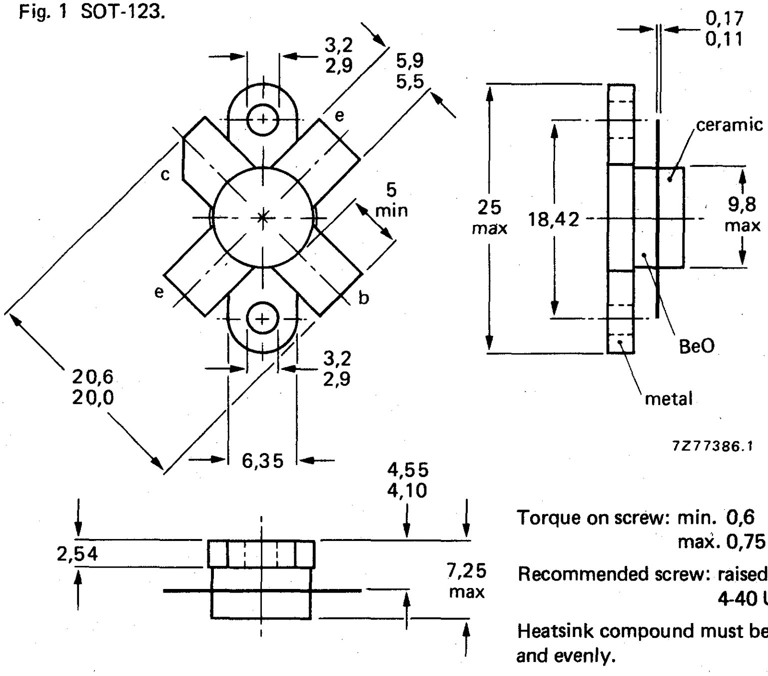
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 − j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0,9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	2,5	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

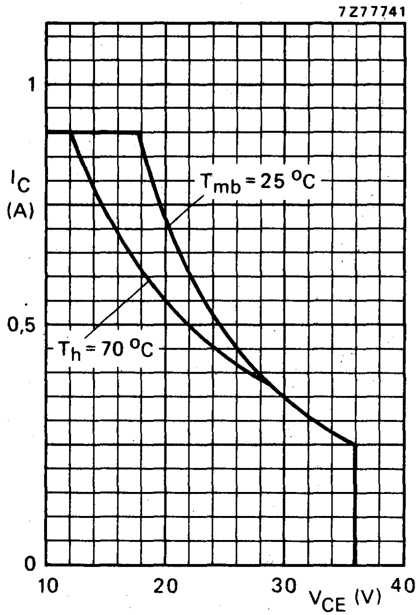


Fig. 2 D.C. SOAR.

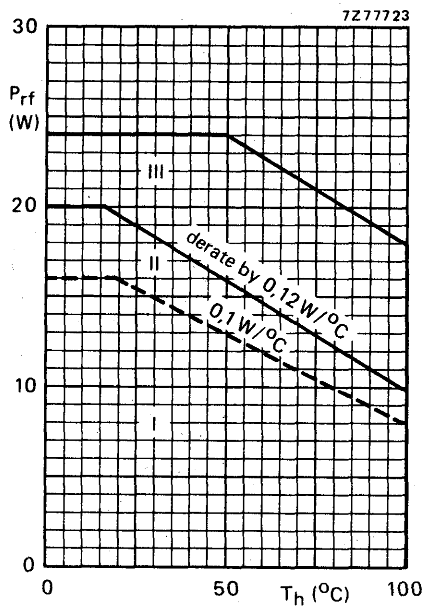


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 72,4 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 2 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	1	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	0,5	mJ
D.C. current gain * I_C = 0,4 A; V_{CE} = 5 V	h_{FE}	typ.	50	
			10 to 100	
Collector-emitter saturation voltage * I_C = 1,25 A; I_B = 0,25 A	V_{CEsat}	typ.	0,8	V
Transition frequency at f = 100 MHz * $-I_E$ = 0,4 A; V_{CB} = 28 V	f_T	typ.	600	MHz
$-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	520	MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	10	pF
Feedback capacitance at f = 1 MHz I_C = 50 mA; V_{CE} = 28 V	C_{re}	typ.	7,1	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

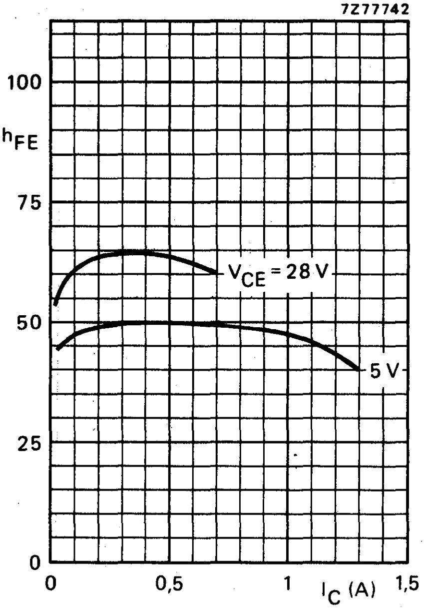


Fig. 4 Typical values; T_j = 25 °C.

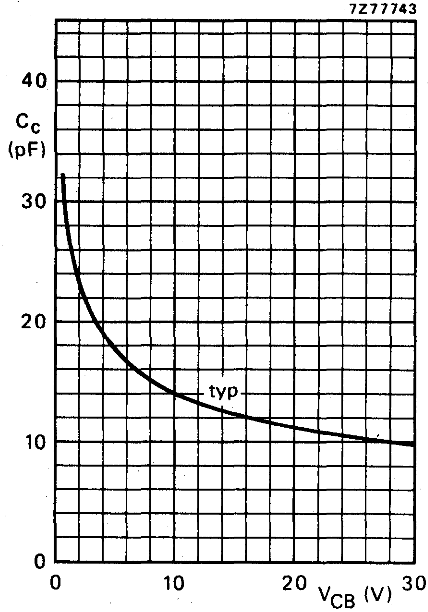


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

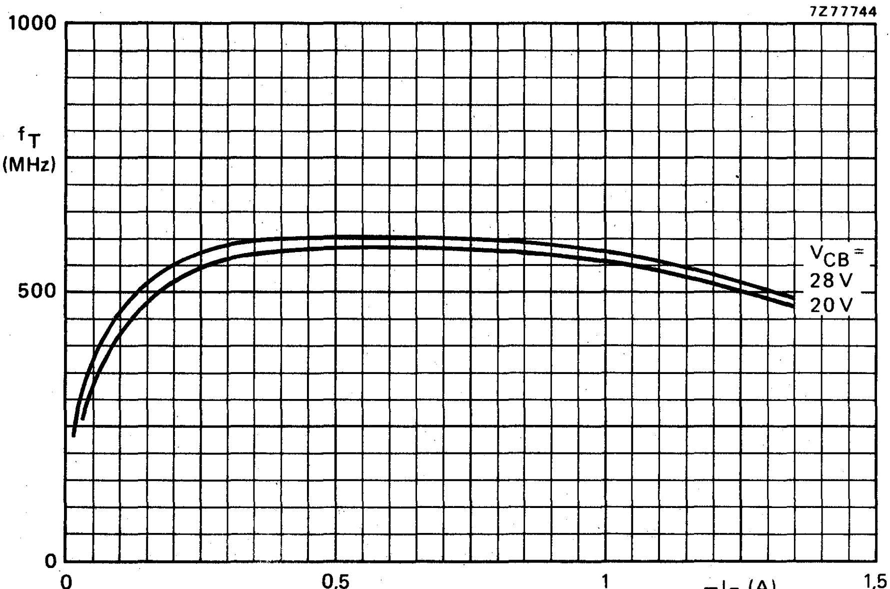


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	8	< 0,5	> 12	< 0,44	> 65	1,8 + j0,7	18 – j20

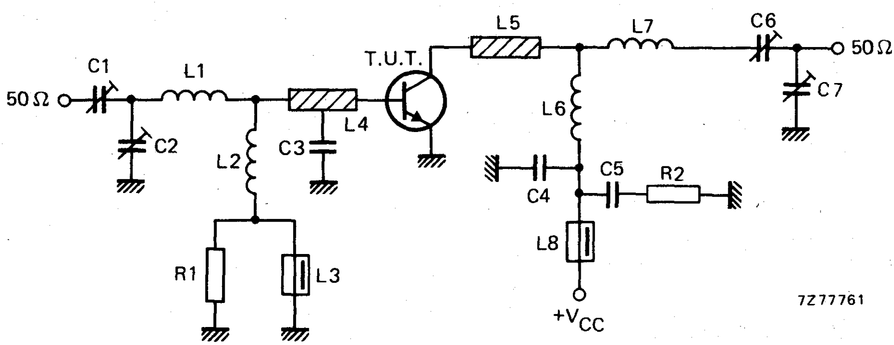


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; length 9,2 mm; leads 2 x 5 mm
L7 = 4 turns enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; length 5,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

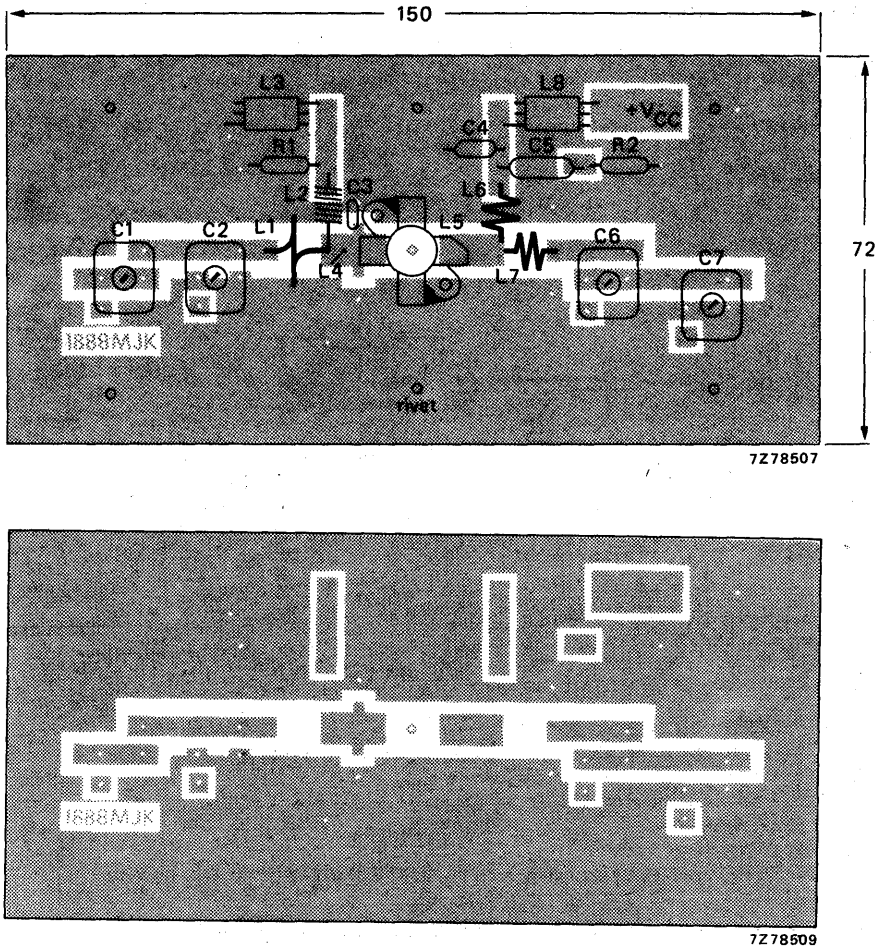


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

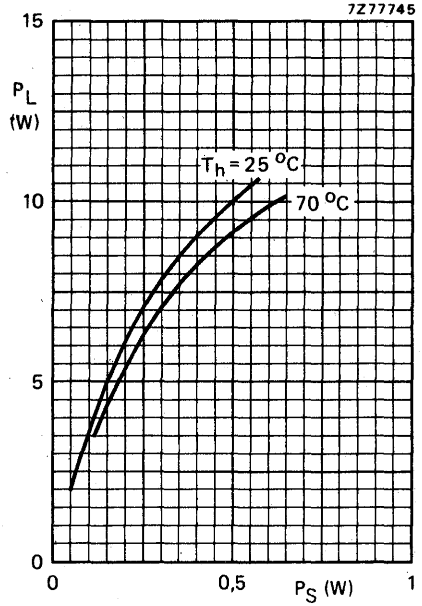


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

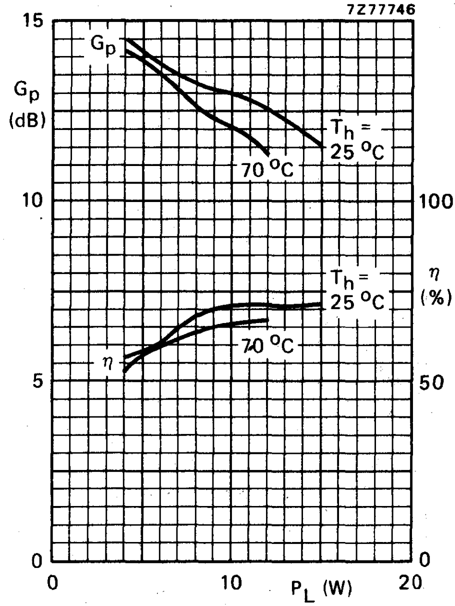


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

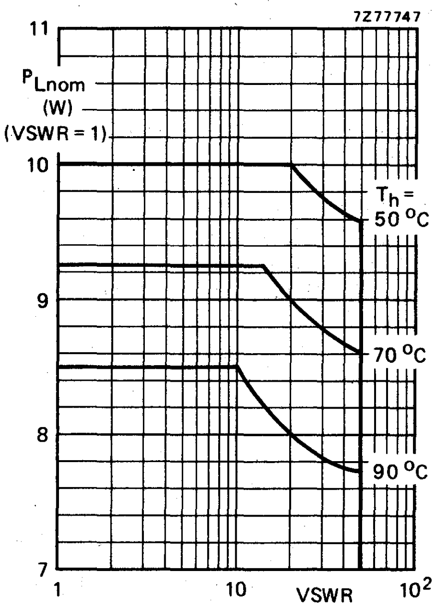


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

DEVELOPMENT SAMPLE DATA

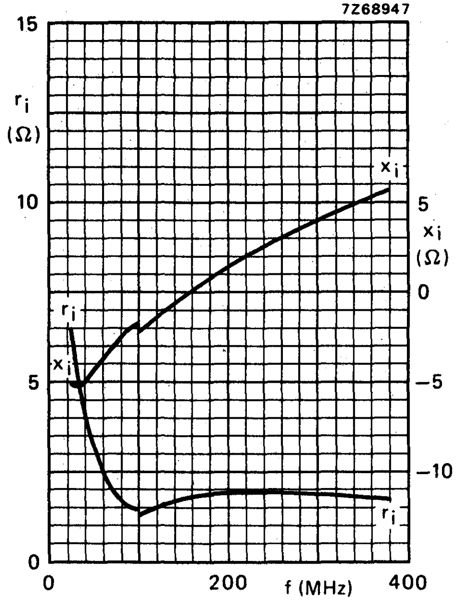


Fig. 12 Input impedance (series components).

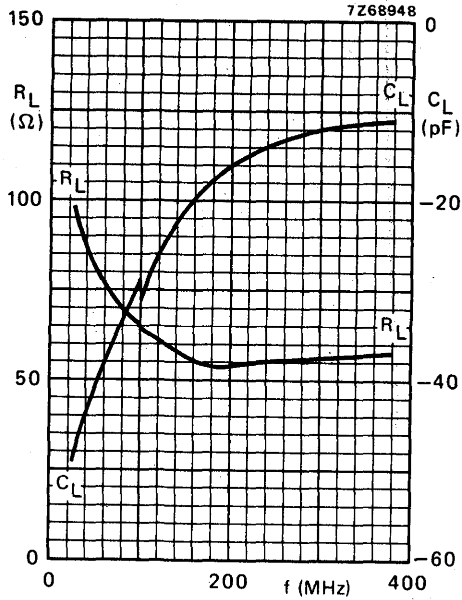


Fig. 13 Load impedance (parallel components).

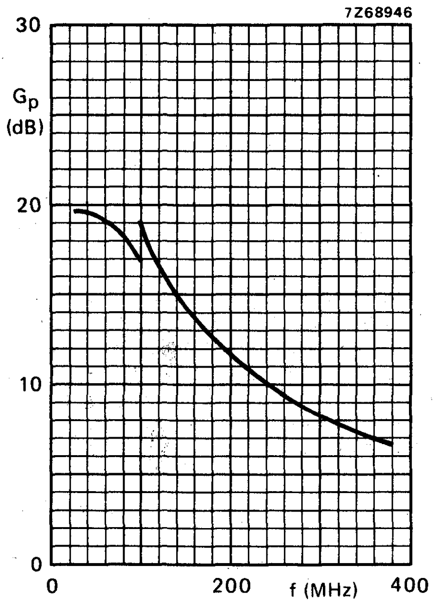


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

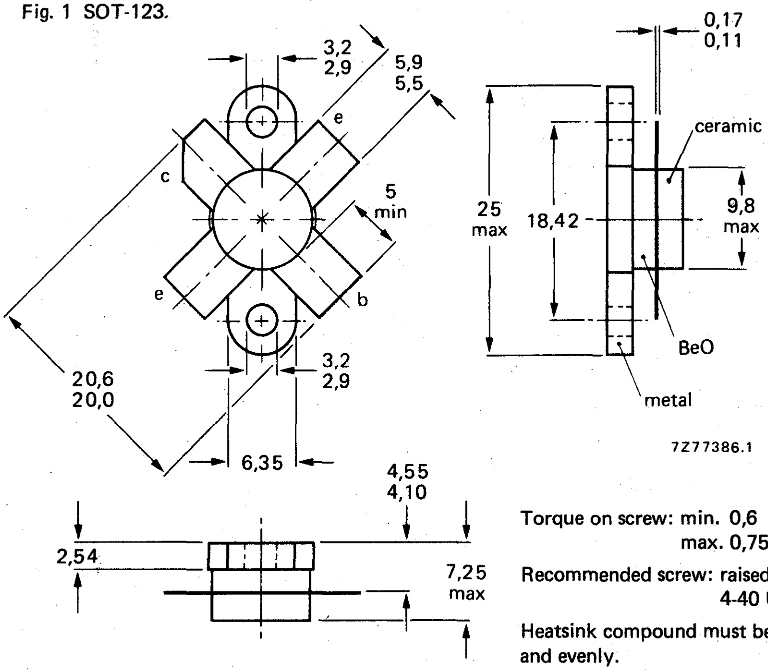
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 – j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,75	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	5,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

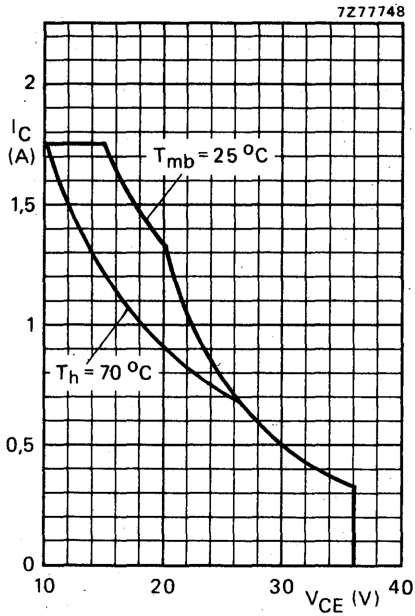


Fig. 2 D.C. SOAR.

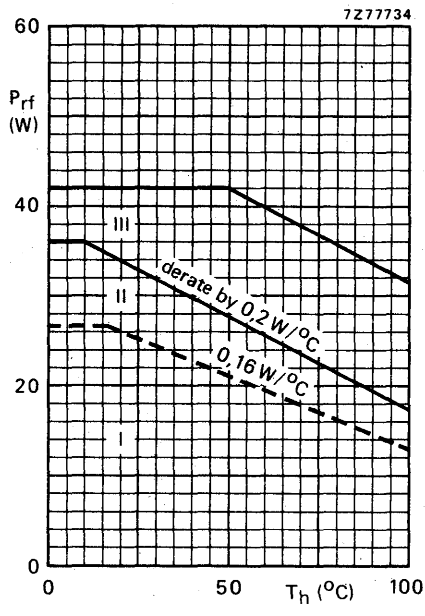


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 74,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5	mJ
D.C. current gain * $I_C = 0{,}7$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 100	
Collector-emitter saturation voltage * $I_C = 2$ A; $I_B = 0{,}4$ A	V_{CEsat}	typ.	0,65	V
Transition frequency at f = 100 MHz * $-I_E = 0{,}7$ A; $V_{CB} = 28$ V	f_T	typ.	650	MHz
$-I_E = 2$ A; $V_{CB} = 28$ V	f_T	typ.	625	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	18	pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	12,8	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

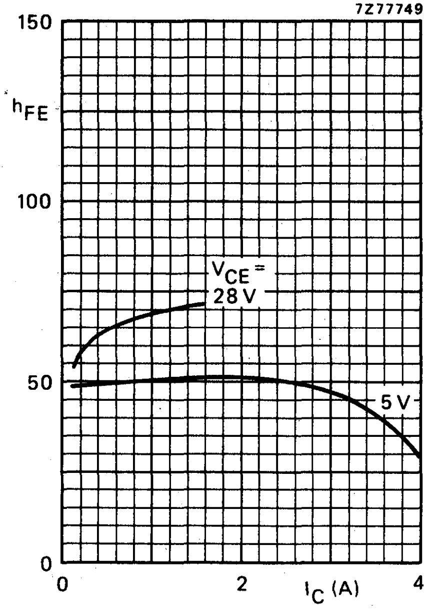


Fig. 4 Typical values; T_j = 25 °C.

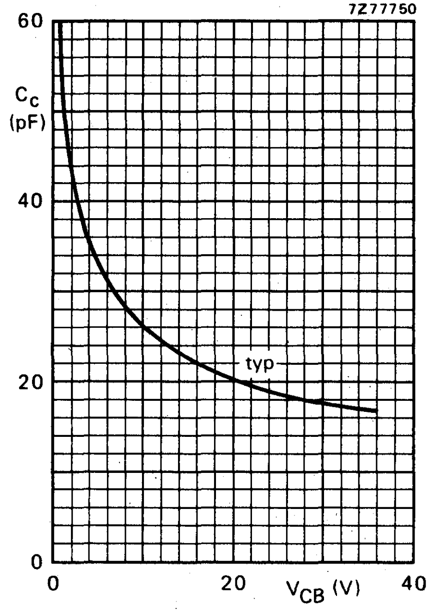


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

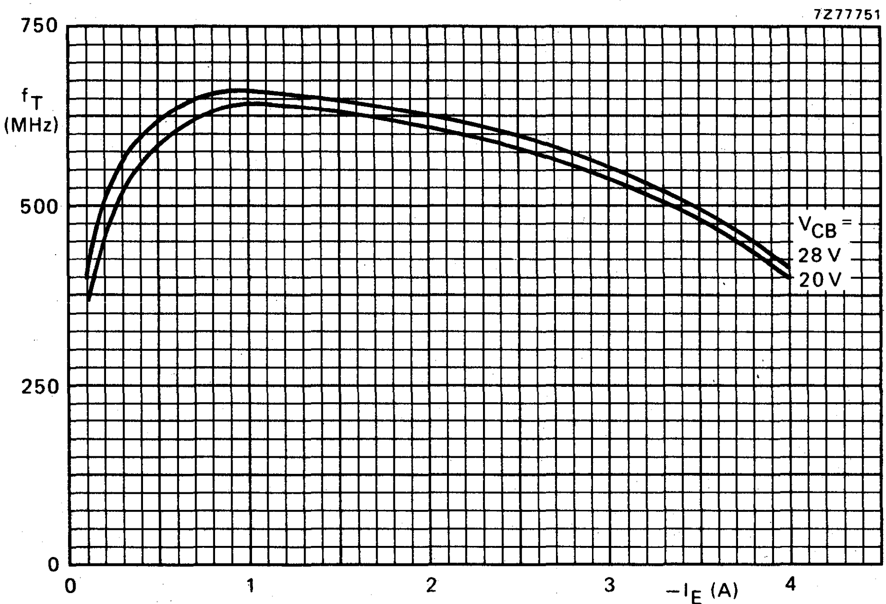


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 – j27,5

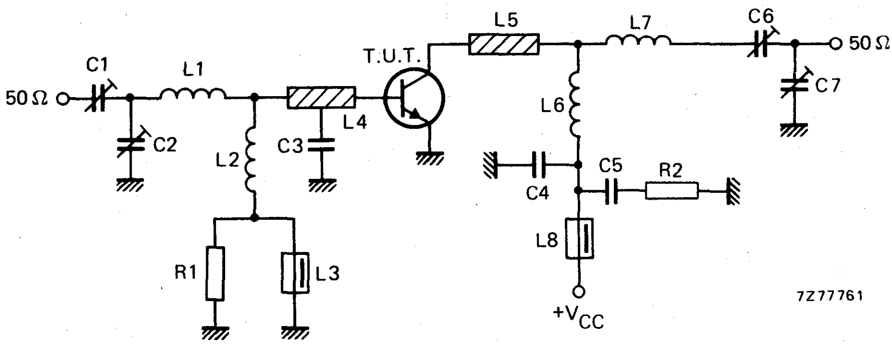


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; length 9,2 mm; leads 2 x 5 mm
L7 = 4 turns enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; length 5,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

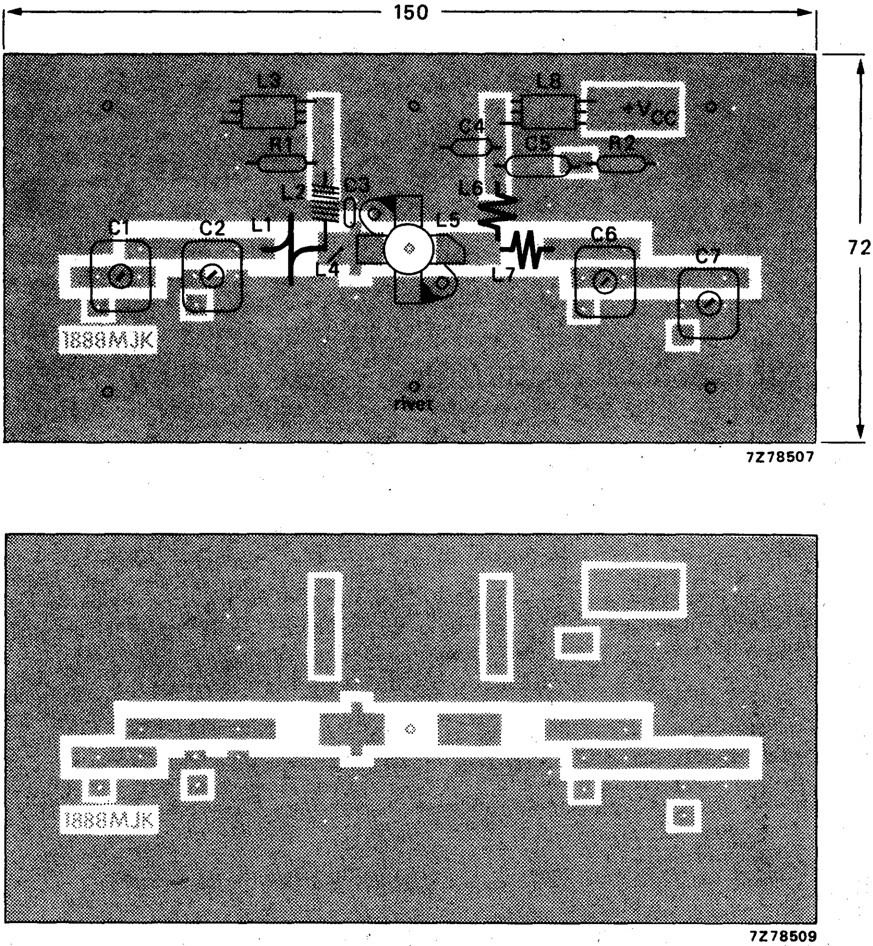


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

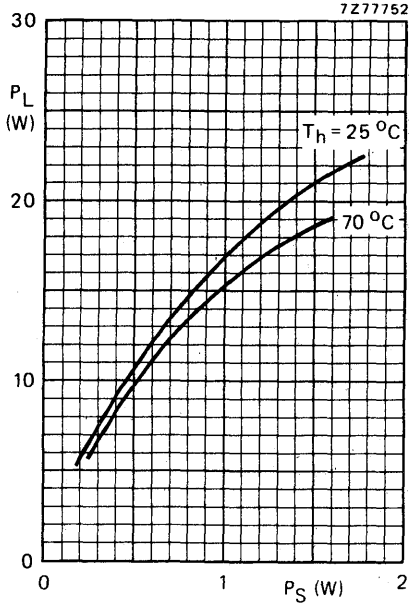


Fig. 9 Typical values; $V_{CE} = 28$ V; f = 175 MHz.

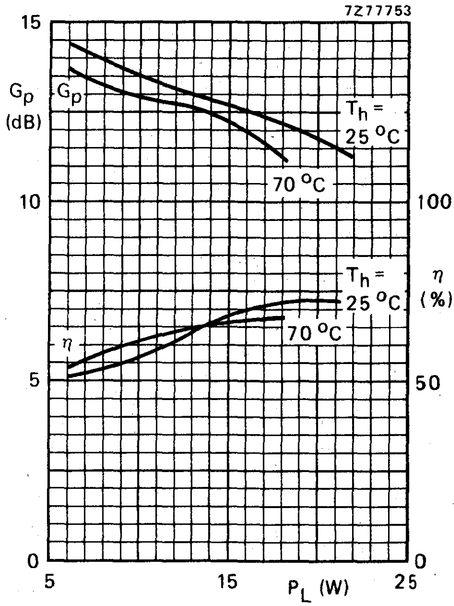


Fig. 10 Typical values; $V_{CE} = 28$ V; f = 175 MHz.

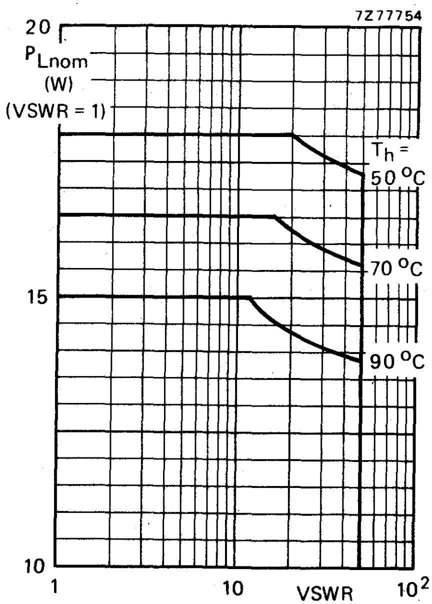


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; $V_{CE} = 28$ V; $R_{th\ mb\text{-}h} = 0{,}3\ ^oC/W$. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

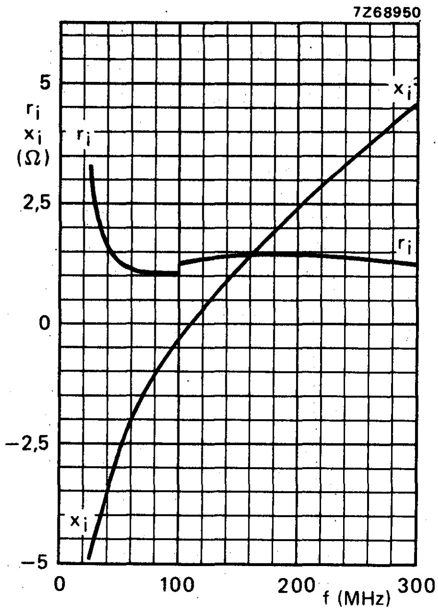


Fig. 12 Input impedance (series components).

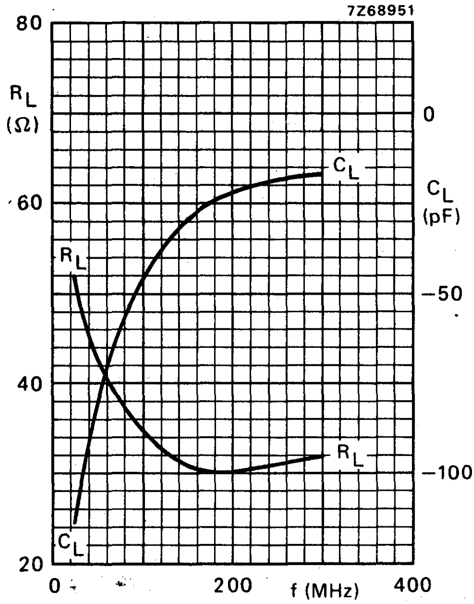


Fig. 13 Load impedance (parallel components).

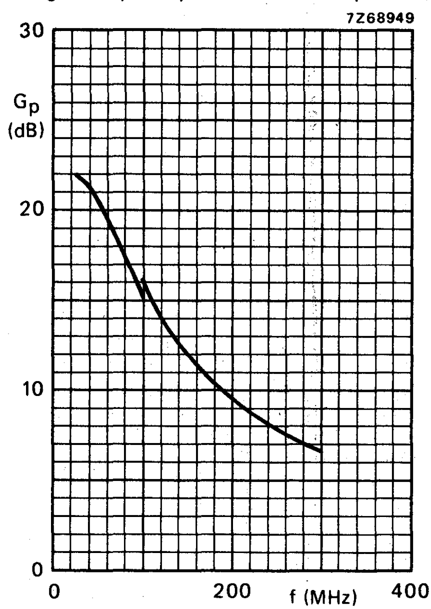


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 15 W;
T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ42 driver stage, the chain can deliver 15 W with a maximum drive power of 120 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

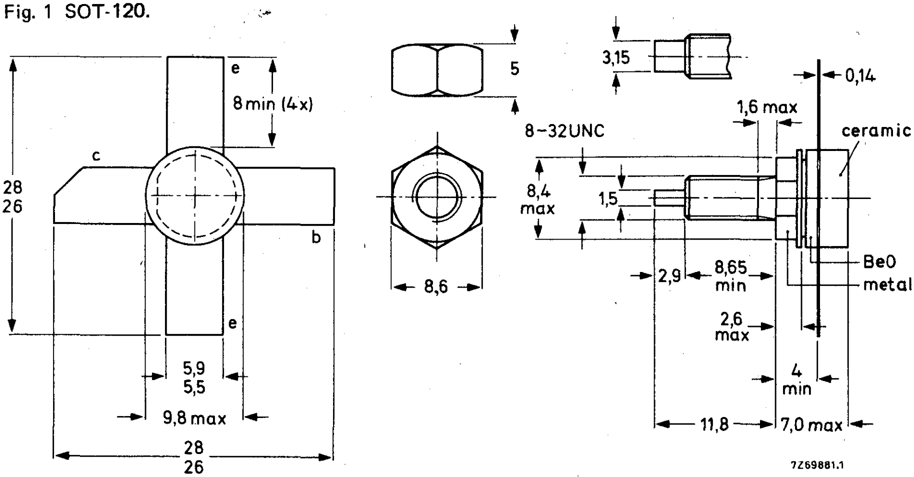
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. class-B	**13,5**	**175**	**15**	**> 10**	**> 60**	**1,3 + j0,68**	**180 − j54**
c.w. class-B	12,5	175	15	typ. 10,5	typ. 67	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION ***This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.***

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	2,75 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	53 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

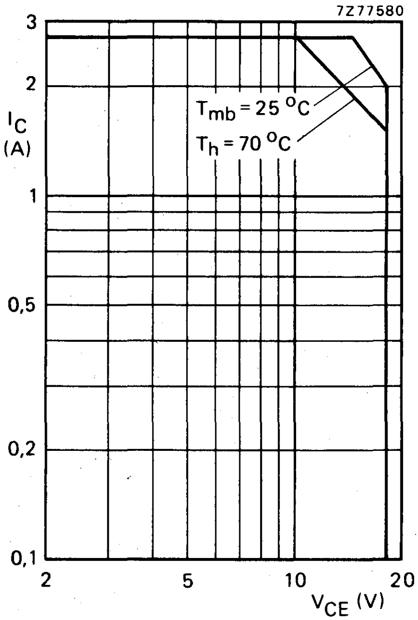


Fig. 2 D.C. SOAR.

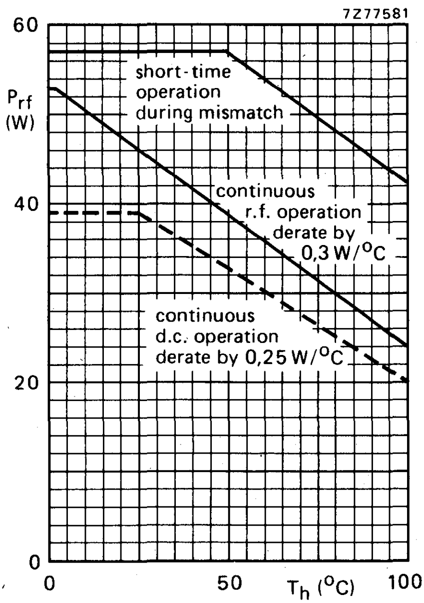


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f ≥ 1 MHz.

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,7 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	3,05 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 15$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	5 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	4 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	4 mJ
D.C. current gain* $I_C = 1{,}75$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 80
Collector-emitter saturation voltage* $I_C = 5$ A; $I_B = 1$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E = 1{,}75$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	900 MHz
$-I_E = 5$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	825 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13{,}5$ V	C_c	typ.	43 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 13{,}5$ V	C_{re}	typ.	27 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

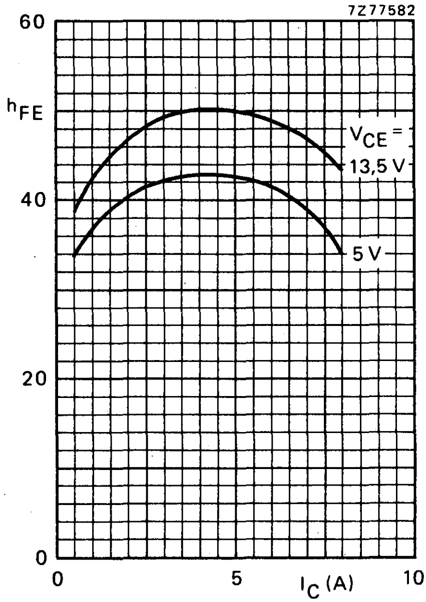


Fig. 4 Typical values; T_j = 25 °C.

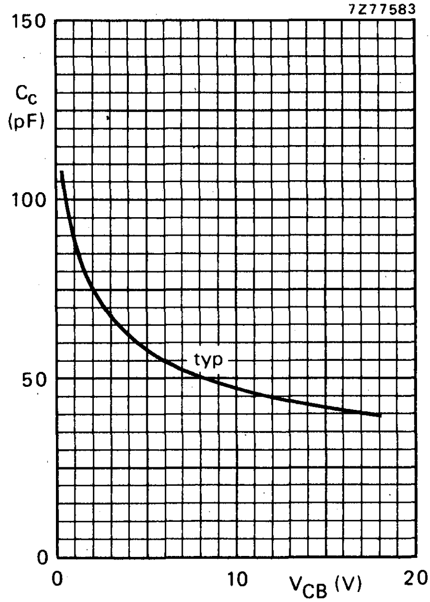


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

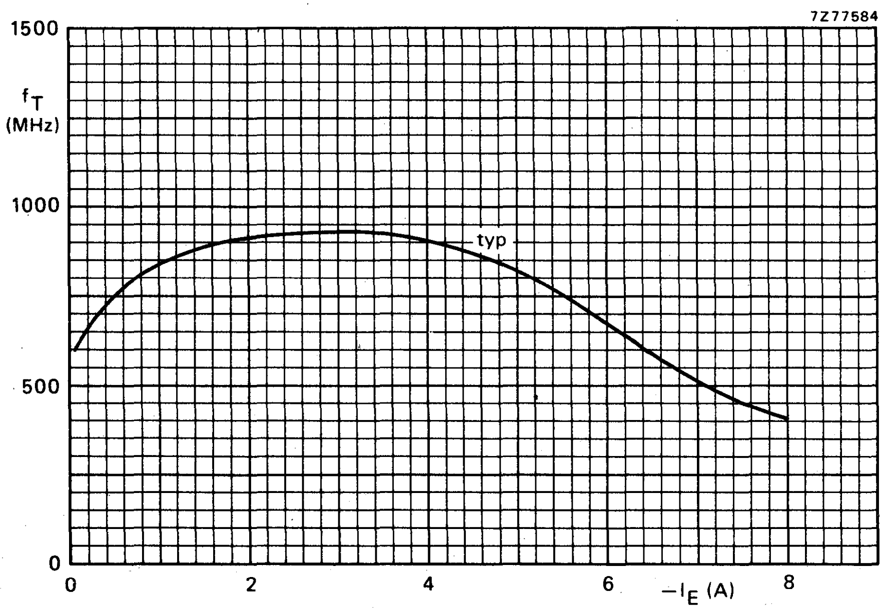


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**15**	**< 1,5**	**> 10**	**< 1,85**	**> 60**	**1,3 + j0,68**	**180 – j54**
175	12,5	15	typ. 1,34	typ. 10,5	typ. 1,8	typ. 67	–	–

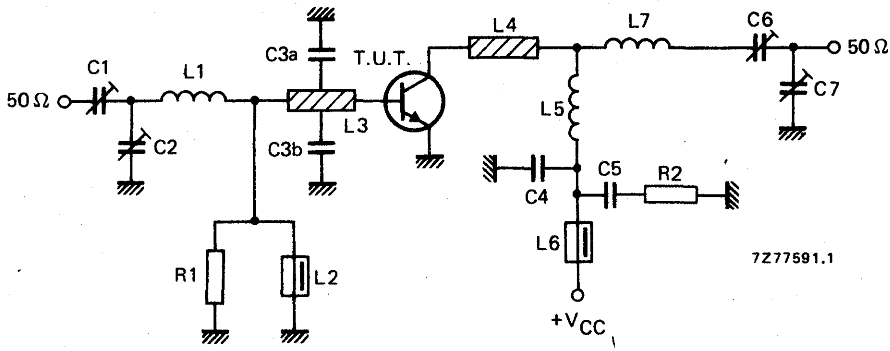


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 1 nF ceramic capacitor
C5 = 100 nF polyester capacitor

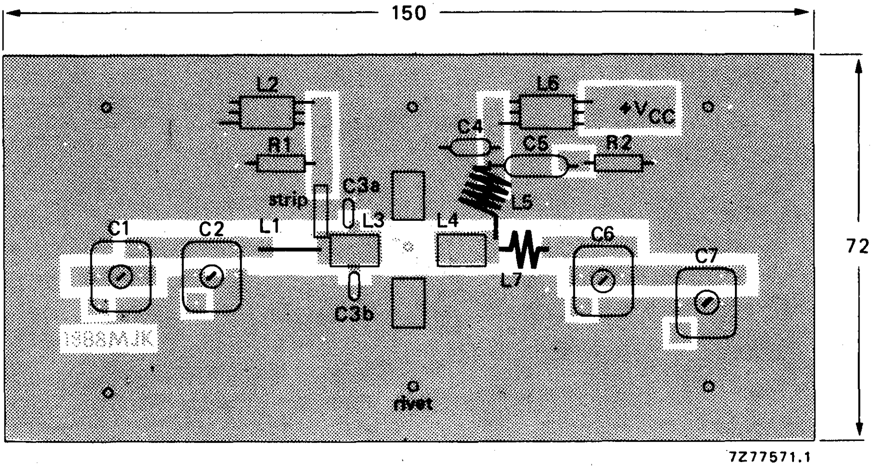
L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L5 = 4½ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L7 = 2 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



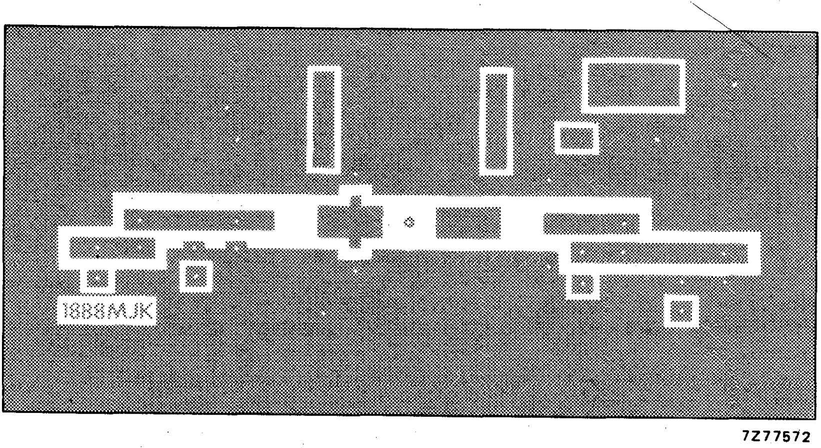


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

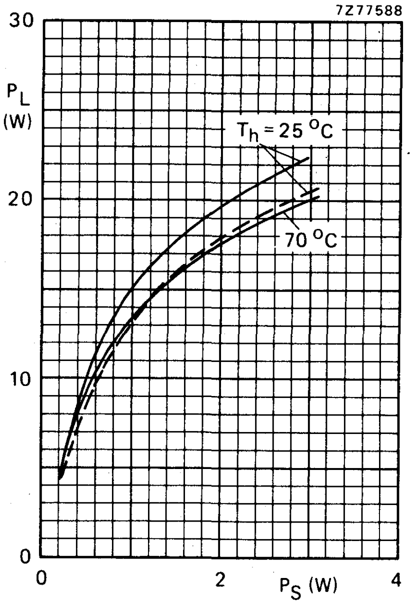


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

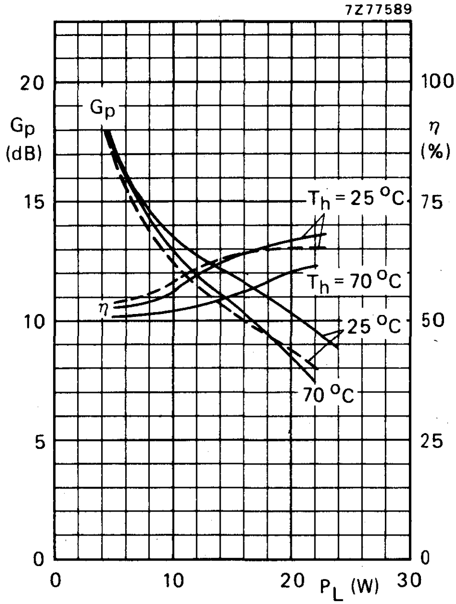


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

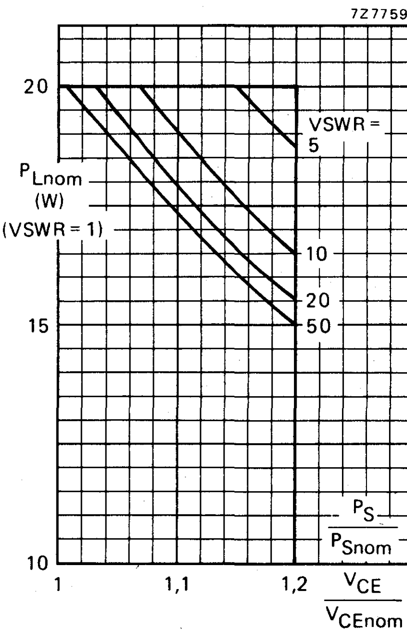


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 ^oC; $R_{th\ mb-h}$ = 0,45 $^oC/W$; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

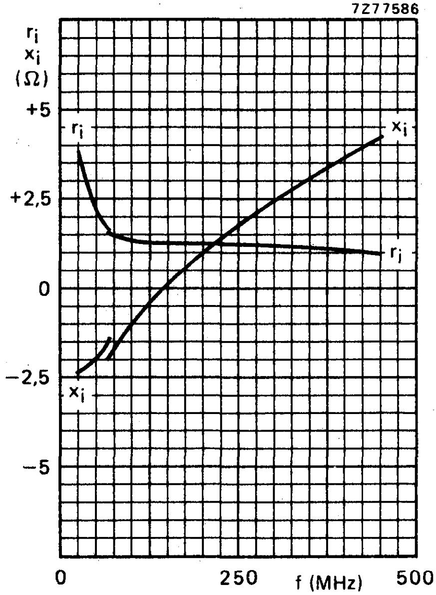


Fig. 12.

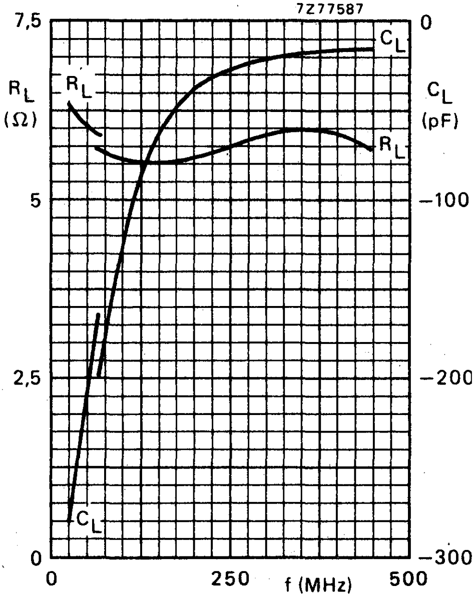
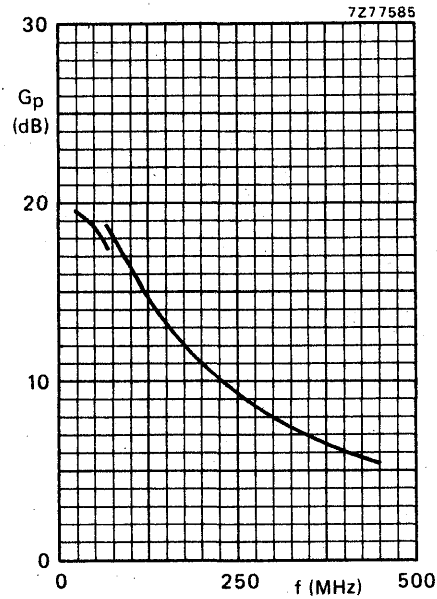


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

Fig. 14.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ43 driver stage, the chain can deliver 28 W with a maximum drive power of 250 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

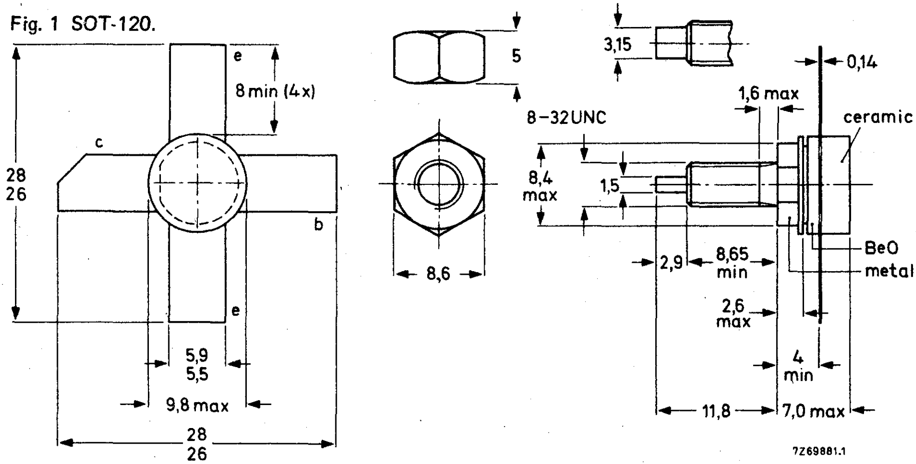
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. class-B	**13,5**	**175**	**28**	**> 9**	**> 60**	**0,9 + j0,9**	**380 + j40**
c.w. class-B	12,5	175	28	typ. 9,5	typ. 70	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	15 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	96 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

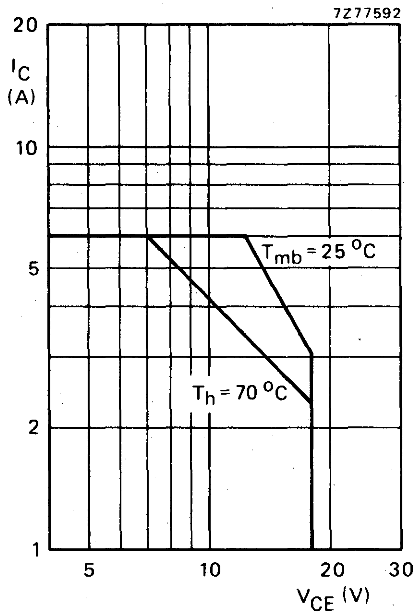


Fig. 2 D.C. SOAR.

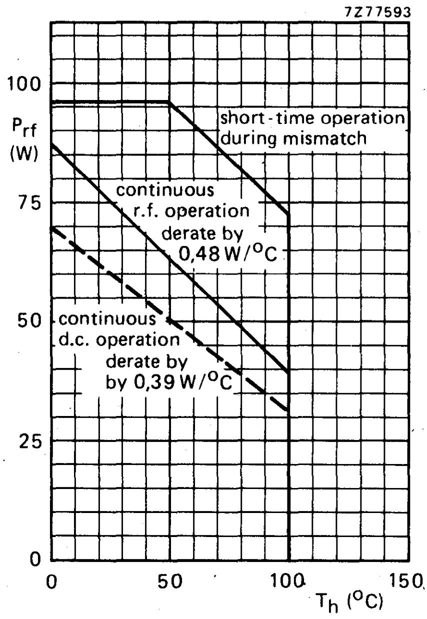


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f $\geqslant$ 1 MHz.

THERMAL RESISTANCE (dissipation = 25 W; T_{mb} = 81 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,4 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,85 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage				
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage				
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage				
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8	mJ
D.C. current gain*				
$I_C = 3,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40	
			10 to 80	
Collector-emitter saturation voltage*				
$I_C = 10$ A; $I_B = 2$ A	V_{CEsat}	typ.	1,8	V
Transition frequency at f = 100 MHz*				
$-I_E = 3,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850	MHz
$-I_E = 10$ A; $V_{CB} = 13,5$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	92	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	58	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

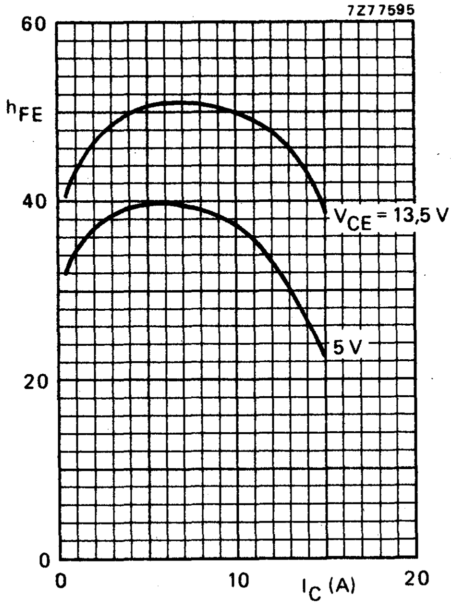


Fig. 4 Typical values; T_j = 25 °C.

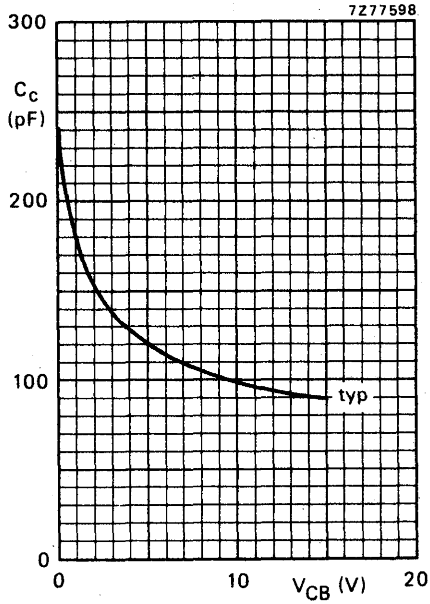


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

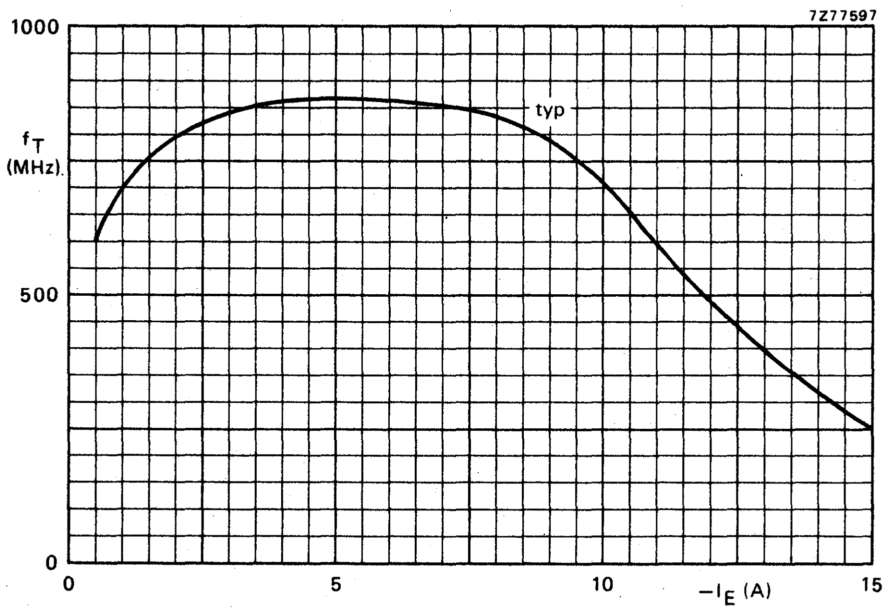


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**28**	**< 3,5**	**> 9**	**< 3,45**	**> 60**	**0,9 + j0,9**	**380 + j40**
175	12,5	28	typ. 3,15	typ. 9,5	typ. 3,2	typ. 70	–	–

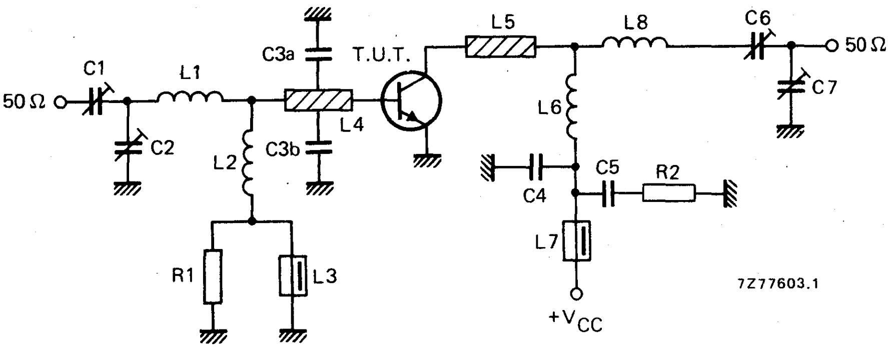


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)

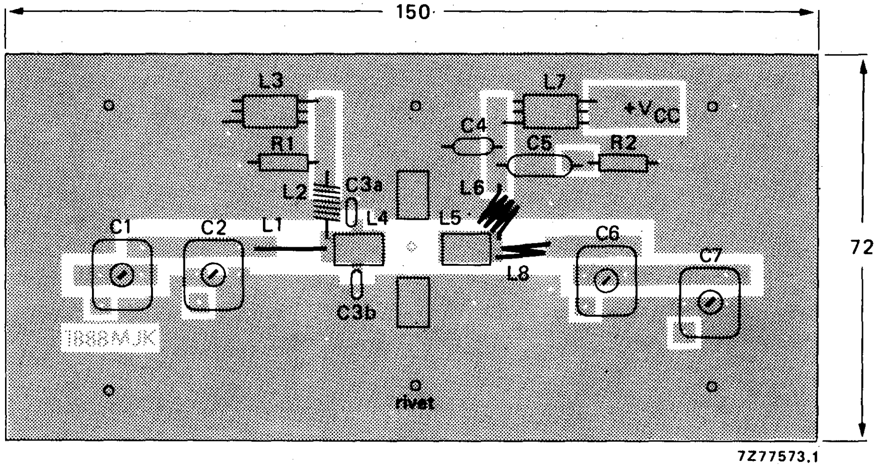
L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 3½ turns closely wound enamelled Cu wire (1,6 mm) int. dia. 6,0 mm; leads 2 x 5 mm
L8 = 1 turn Cu wire (1,6 mm) int. dia. 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



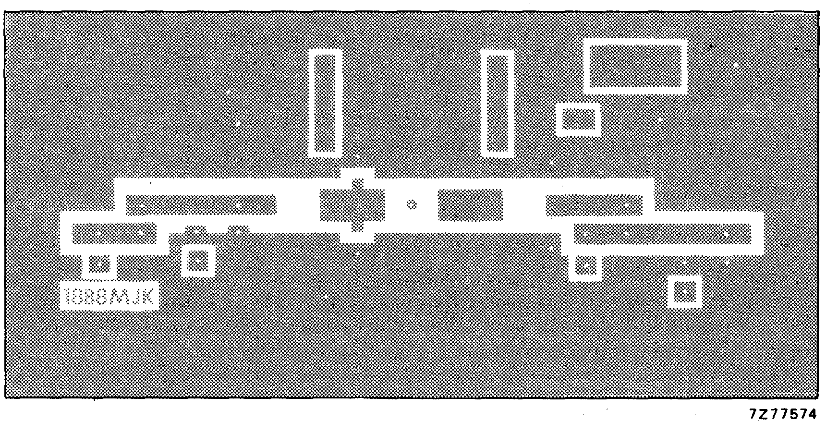


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

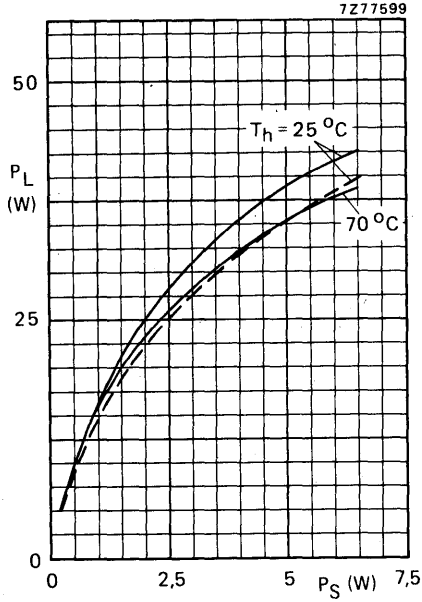


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

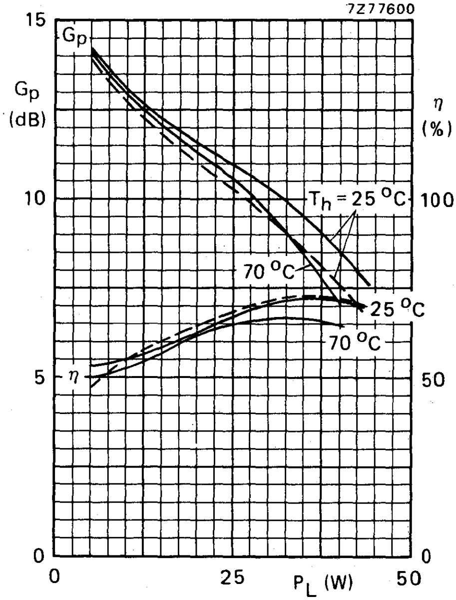


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

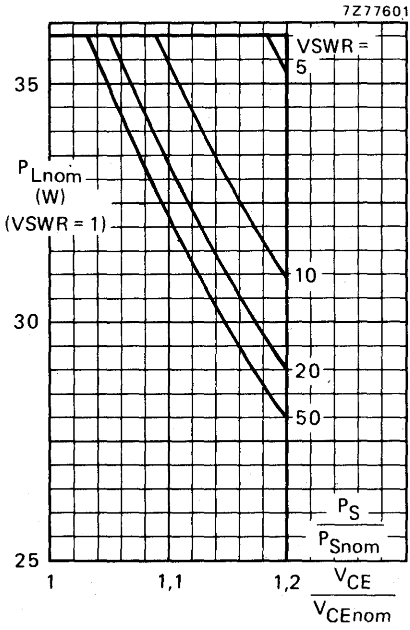


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,45 °C/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

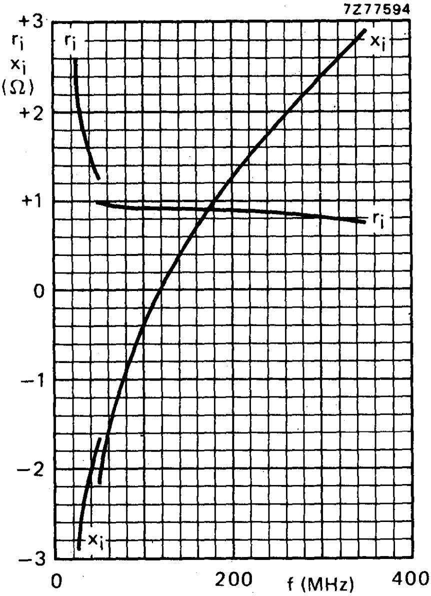


Fig. 12.

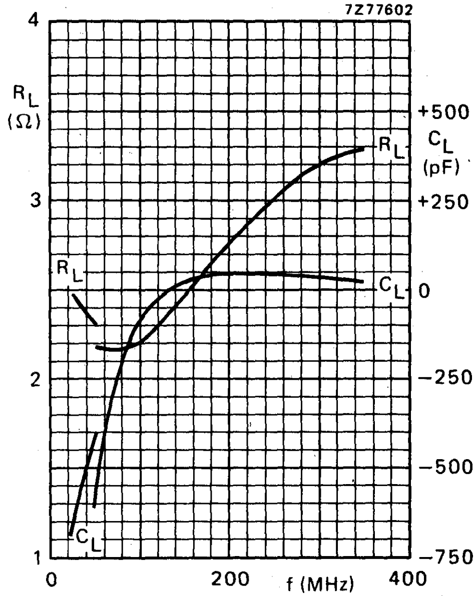
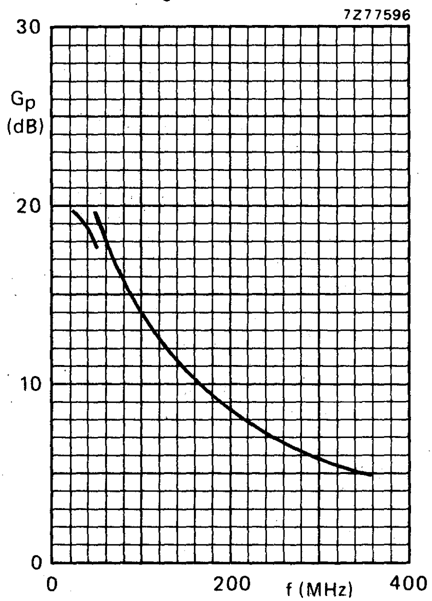


Fig. 13.



Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 13,5 V; P_L = 28 W; T_h = 25 °C.

Fig. 14.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

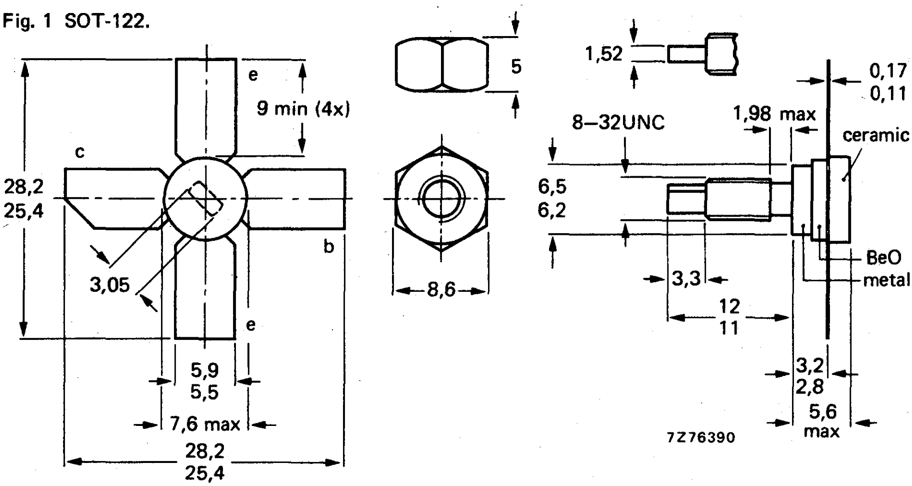
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	150	70	−60	> 0,5	> 11
	860	25	150	25	−60	typ. 0,63	typ. 12,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

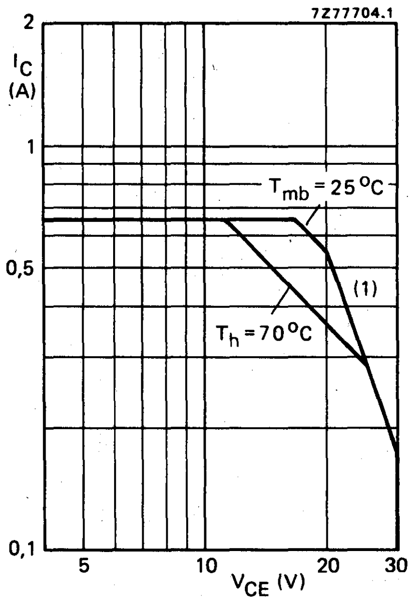
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C	max.	650	mA
(peak value); $f > 1$ MHz	I_{CM}	max.	1000	mA
Total power dissipation up to $T_{mb} = 25\ ^oC$	P_{tot}	max.	10,8	W
Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

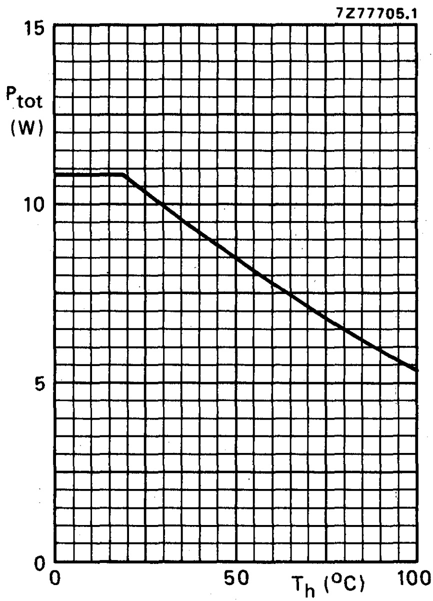


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 3,75 W; $T_{mb} = 72,3\ ^oC$; i.e. $T_h = 70\ ^oC$)	$R_{th\ j\text{-}mb}$	=	15,0	$^oC/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	$^oC/W$

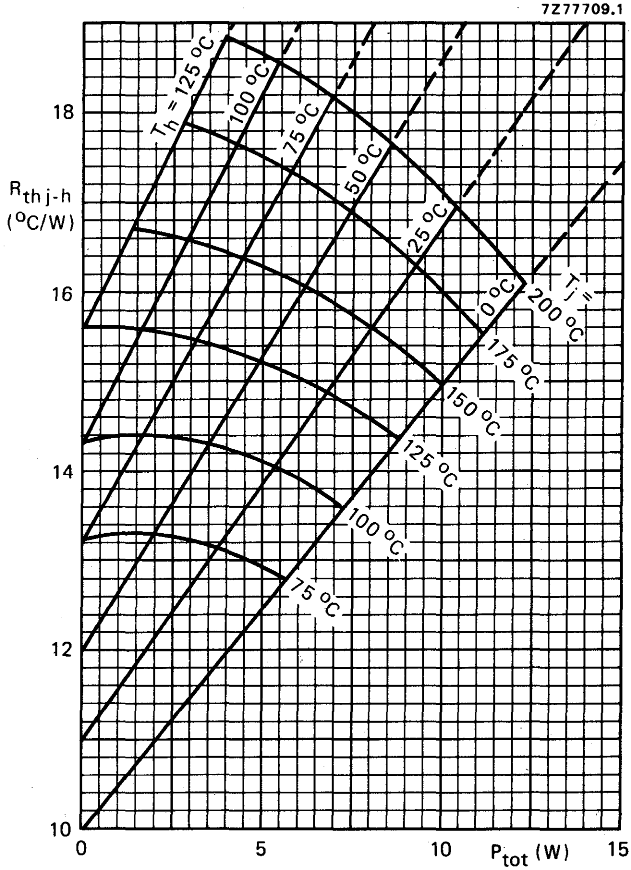


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 °C/W).

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 150 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j\text{-}h}$	max.	15,6	°C/W
	T_j	max.	130	°C
Typical device:	$R_{th\,j\text{-}h}$	typ.	13,5	°C/W
	T_j	typ.	120	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	50 V
open base; $I_C = 15$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	0,5 mA
$V_{BE} = 0$; $V_{CE} = 30$ V; $T_j = 175$ °C	I_{CES}	<	1,2 mA
D.C. current gain *			
$I_C = 150$ mA; $V_{CE} = 25$ V	h_{FE}	>	20
		typ.	40
$I_C = 150$ mA; $V_{CE} = 25$ V; $T_j = 175$ °C	h_{FE}	<	120
Collector-emitter saturation voltage *			
$I_C = 300$ mA; $I_B = 30$ mA	V_{CEsat}	typ.	500 mV
Transition frequency at f = 500 MHz **			
$-I_E = 150$ mA; $V_{CB} = 25$ V	f_T	typ.	3,5 GHz
$-I_E = 300$ mA; $V_{CB} = 25$ V	f_T	typ.	3,4 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	3,7 pF
Feedback capacitance at f = 1 MHz			
$I_C = 10$ mA; $V_{CE} = 25$ V	C_{re}	typ.	1,9 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

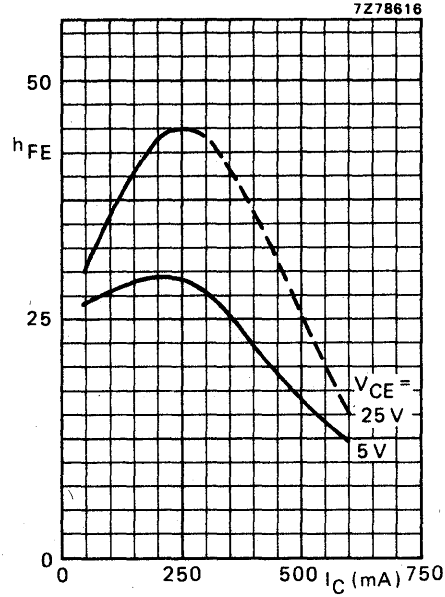


Fig. 5 Typical values; T_j = 25 °C.

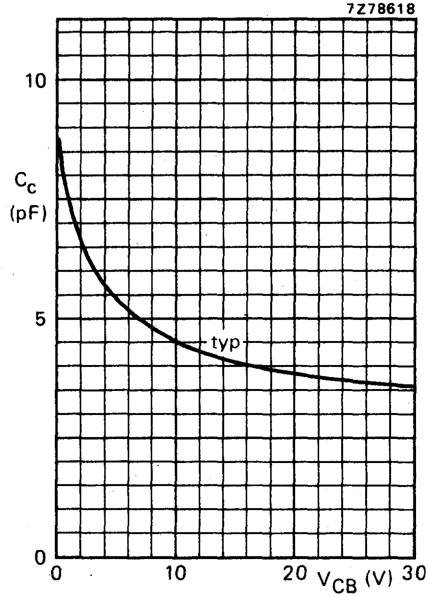


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

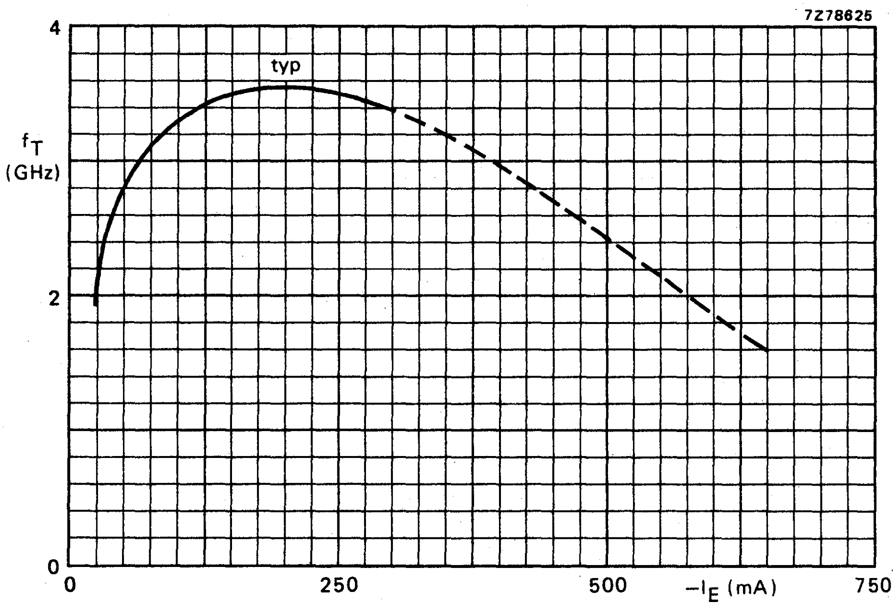


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	150	70	−60	> 0,5	> 11
860	25	150	70	−60	typ. 0,58	typ. 12,2
860	25	150	25	−60	typ. 0,63	typ. 12,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

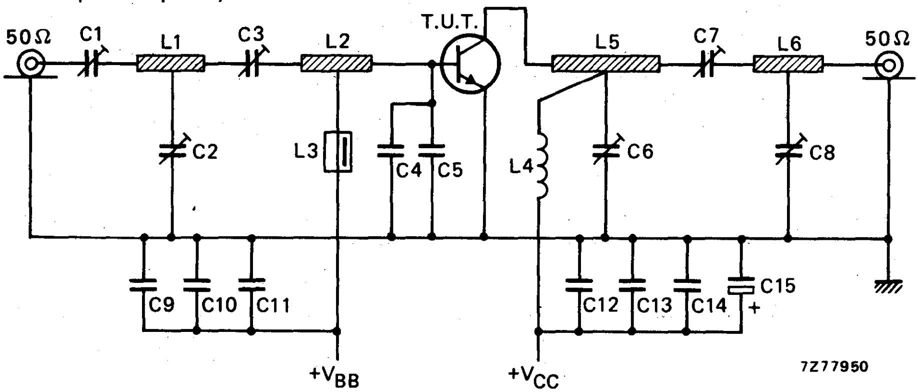


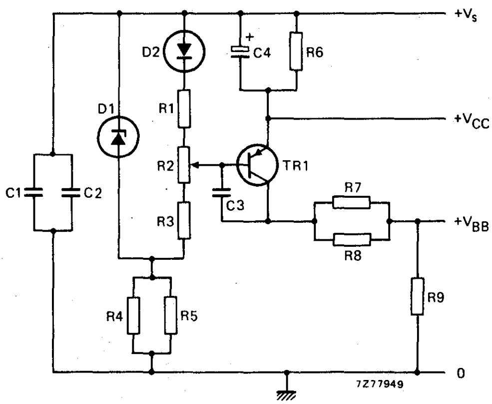
Fig. 8 Test circuit at f_{vision} = 860 MHz.

List of components:

C1 = C3 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = C5 = 3 pF chip capacitor
C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = C12 = 1 nF chip capacitor
C10 = 100 nF polyester capacitor
C11 = C13 = 470 nF polyester capacitor
C14 = 10 nF polyester capacitor
C15 = 3,3 μF/40 V solid aluminium electrolytic capacitor

L1 = stripline (13,2 mm x 4,3 mm)
L2 = stripline (15,2 mm x 4,3 mm)
L3 = micro choke 0,47 μH (4322 057 04770)
L4 = 4 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 5 mm
L5 = stripline (37,0 mm x 4,3 mm)
L6 = stripline (13,5 mm x 4,3 mm)

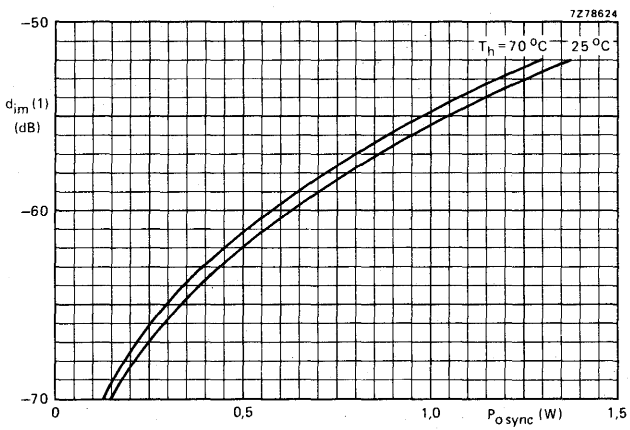
L1; L2; L5 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.



List of components:
C1 = C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω carbon resistor (0,25 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 12 Ω carbon resistor (0,5 W)
R7 = R8 = 820 Ω carbon resistor (0,5 W)
R9 = 33 Ω carbon resistor (0,25 W)

D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 9 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.



(1) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level. Intermodulation distortion of input signal ⩽ −75 dB.

Fig. 10 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 25 V; I_C = 150 mA; f_{vision} = 860 MHz.

Information for wide-band application from 470 to 860 MHz available on request.

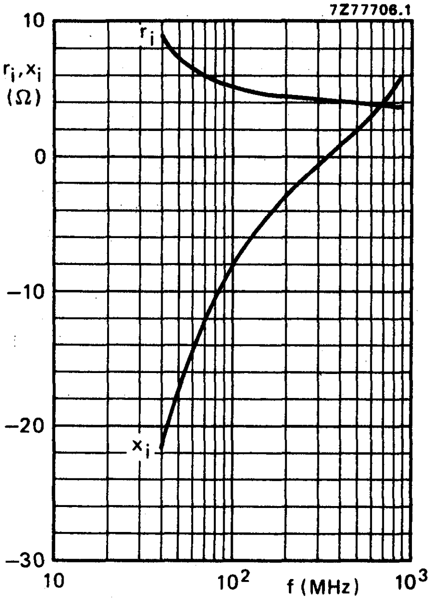


Fig. 11 Input impedance (series components).

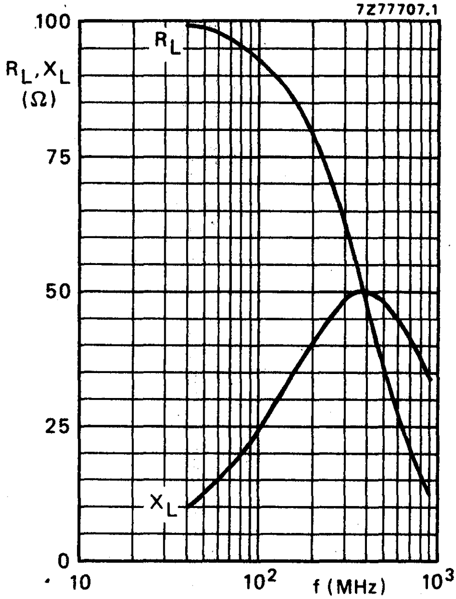


Fig. 12 Load impedance (series components).

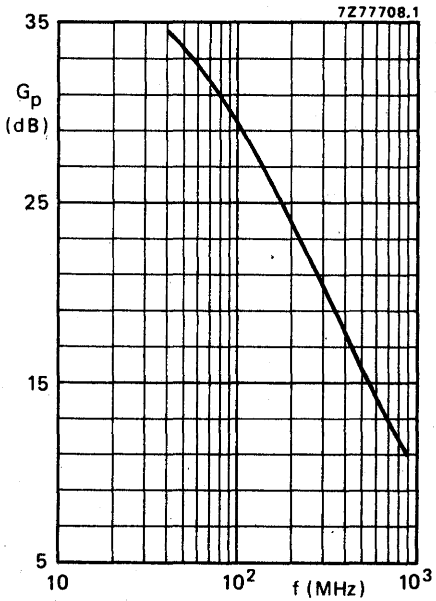


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 25 V; I_C = 150 mA; T_h = 70 °C.

Ruggedness

The BLW32 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 150 mA; T_h = 70 °C and $P_{L(AV)}$ = 1 W.
This holds for single-tone as well as for two-tone operation (vision and sound).

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

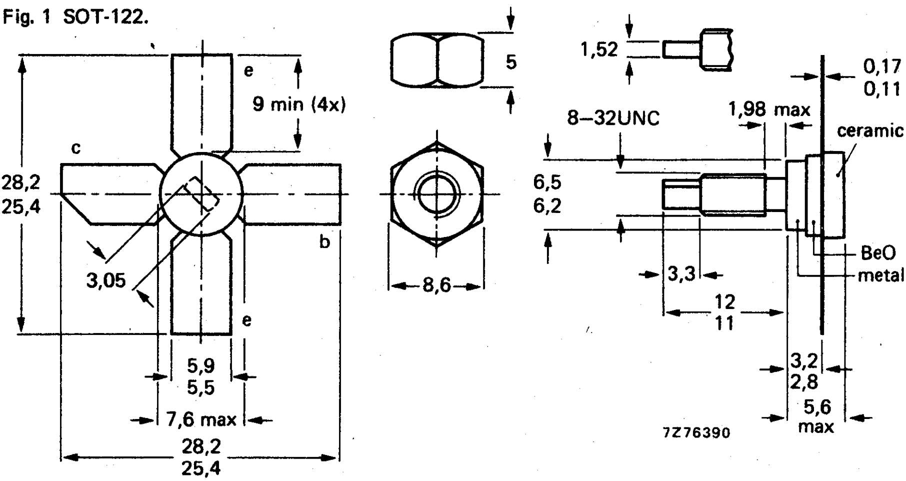
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	300	70	−60	> 1,0	> 10,0
	860	25	300	25	−60	typ. 1,15	typ. 10,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

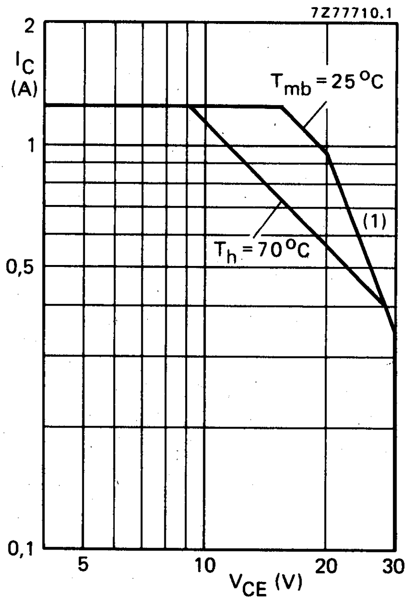
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C	max.	1,25 A
(peak value); f > 1 MHz	I_{CM}	max.	1,9 A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	19,3 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

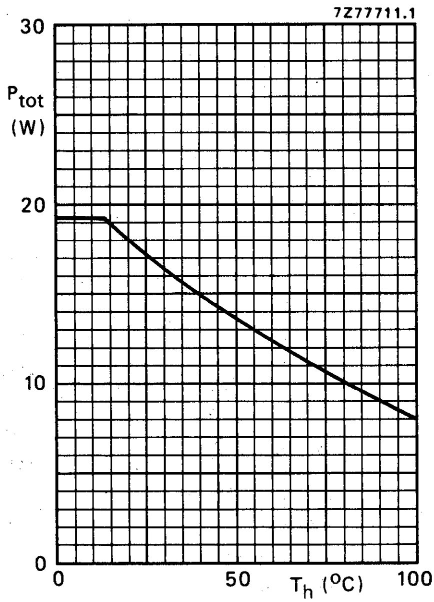


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 7,5 W; T_{mb} = 74,5 °C; i.e. T_h = 70 °C)	$R_{th\ j\text{-}mb}$	=	10,1 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

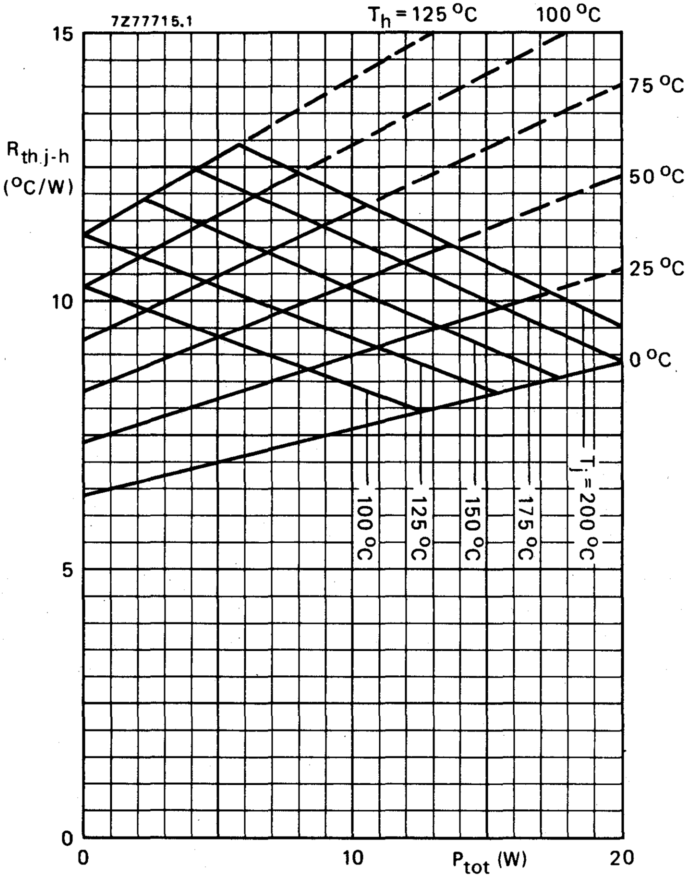


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb-h}$ = 0,6 °C/W).

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j-h}$	max.	10,7	°C/W
	T_j	max.	150	°C
Typical device:	$R_{th\,j-h}$	typ.	8,25	°C/W
	T_j	typ.	132	°C

CHARACTERISTICS

$T_j = 25\ ^{\circ}C$ unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 4$ mA	$V_{(BR)CES}$	>	50 V
open base; $I_C = 30$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	1,0 mA
$V_{BE} = 0$; $V_{CE} = 30$ V; $T_j = 175\ ^{\circ}C$	I_{CES}	<	2,5 mA
D.C. current gain			
$I_C = 300$ mA; $V_{CE} = 25$ V	h_{FE}	> typ.	20 40
$I_C = 300$ mA; $V_{CE} = 25$ V; $T_j = 175\ ^{\circ}C$	h_{FE}	<	120
Collector-emitter saturation voltage *			
$I_C = 600$ mA; $I_B = 60$ mA	V_{CEsat}	typ.	450 mV
Transition frequency at f = 500 MHz **			
$-I_E = 300$ mA; $V_{CB} = 25$ V	f_T	typ.	3,4 GHz
$-I_E = 600$ mA; $V_{CB} = 25$ V	f_T	typ.	3,1 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	6,6 pF
Feedback capacitance at f = 1 MHz			
$I_C = 20$ mA; $V_{CE} = 25$ V	C_{re}	typ.	3,5 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

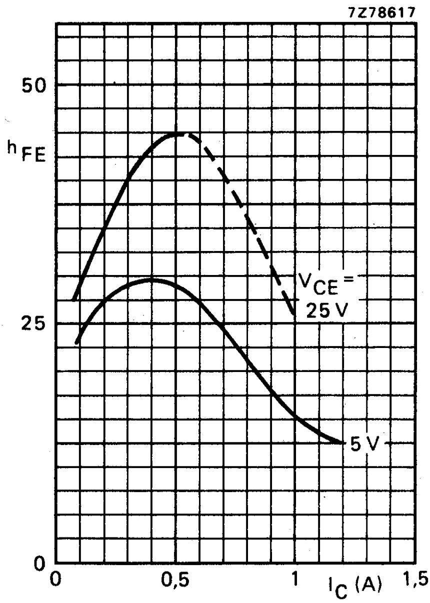


Fig. 5 Typical values; T_j = 25 °C.

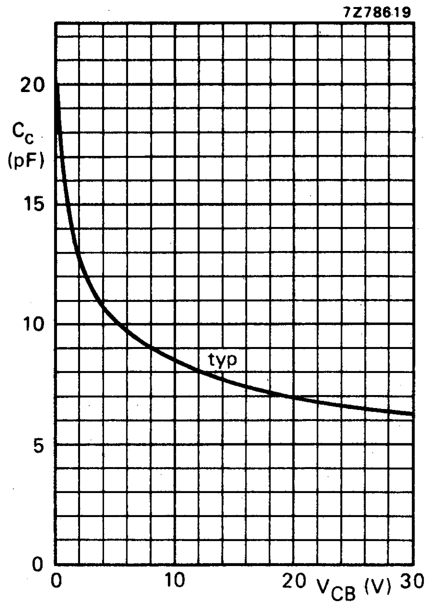


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

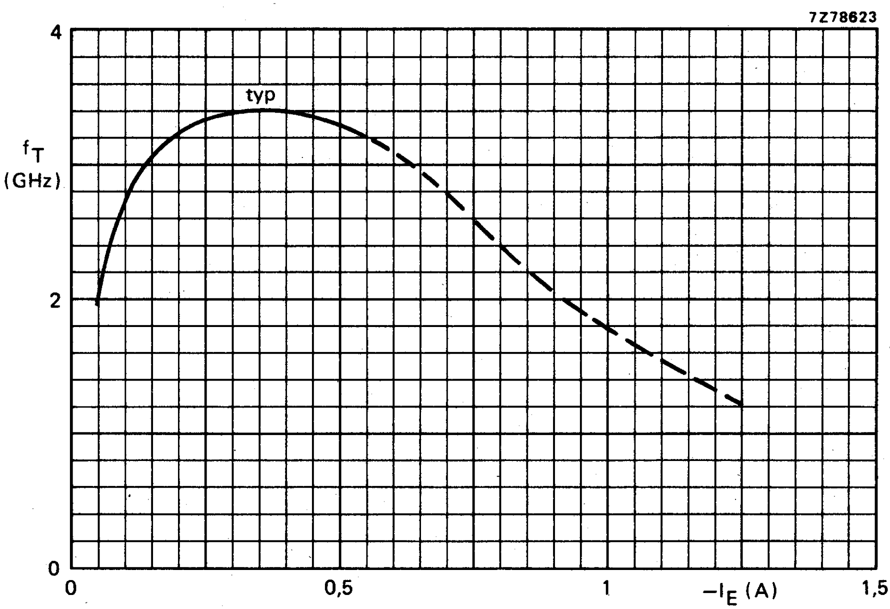


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	300	70	−60	> 1,0	> 10
860	25	300	70	−60	typ. 1,07	typ. 10,5
860	25	300	25	−60	typ. 1,15	typ. 10,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

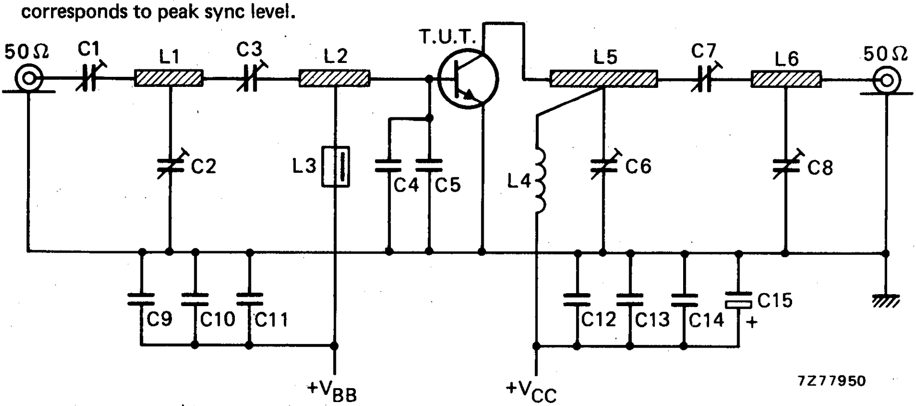


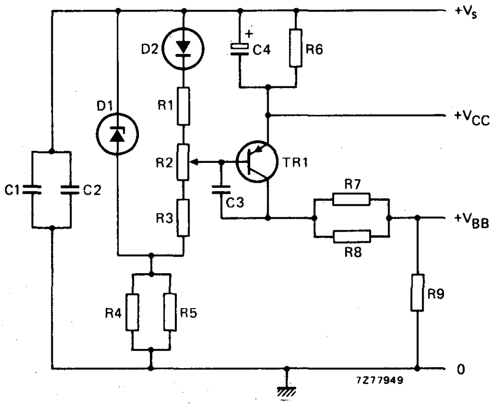
Fig. 8 Test circuit at f_{vision} = 860 MHz.

List of components:

C1 = C3 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = C5 = 3 pF chip capacitor
C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = C12 = 1 nF chip capacitor
C10 = 100 nF polyester capacitor
C11 = C13 = 470 nF polyester capacitor
C14 = 10 nF polyester capacitor
C15 = 3,3 μF/40 V solid aluminium electrolytic capacitor

L1 = stripline (13,2 mm x 4,3 mm)
L2 = stripline (15,2 mm x 4,3 mm)
L3 = micro choke 0,47 μH (4322 057 04770)
L4 = 4 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 5 mm
L5 = stripline (37,0 mm x 4,3 mm)
L6 = stripline (13,5 mm x 4,3 mm)

L1; L2; L5 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.



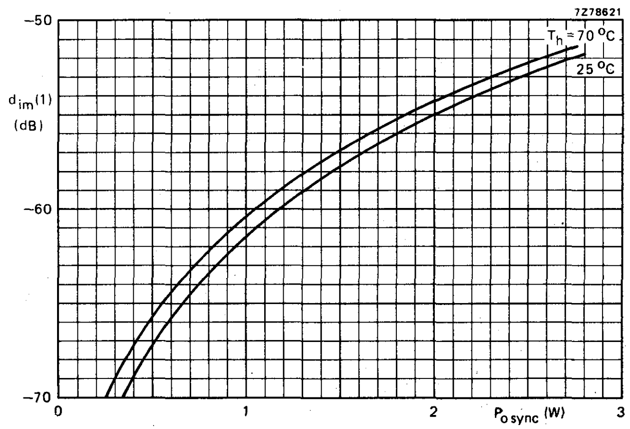
List of components:

C1 = C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor

R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω carbon resistor (0,25 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 5,6 Ω carbon resistor (1 W)
R7 = R8 = 820 Ω carbon resistor (0,5 W)
R9 = 33 Ω carbon resistor (0,25 W)

D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 9 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.



(1) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level. Intermodulation distortion of input signal ⩽ −75 dB.

Fig. 10 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 25 V; I_C = 300 mA; f_{vision} = 860 MHz.

Information for wide-band application from 470 to 860 MHz available on request.

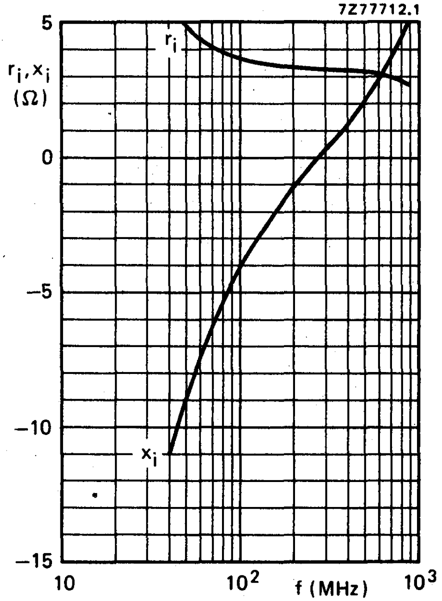


Fig. 11 Input impedance (series components).

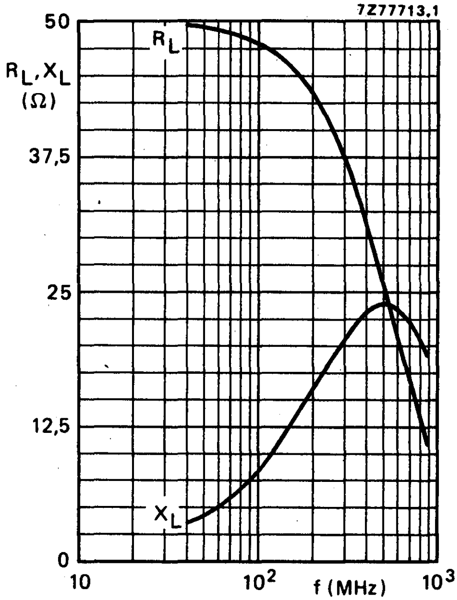


Fig. 12 Load impedance (series components).

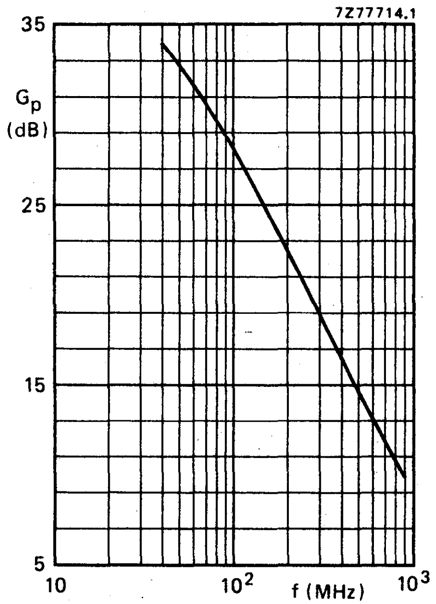


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C.

Ruggedness

The BLW33 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C and $P_{L(AV)}$ = 2 W.
This holds for single-tone as well as for two-tone operation (vision and sound).

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

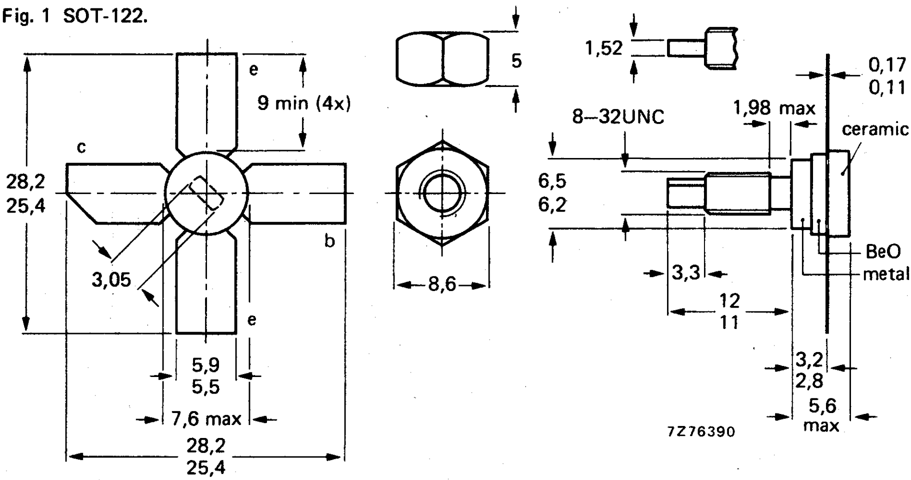
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	600	70	−60	> 1,8	> 9
	860	25	600	25	−60	typ. 2,15	typ. 10,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

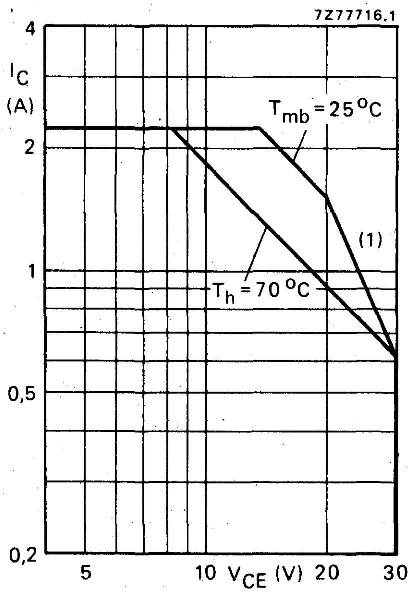
When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C	max.	2,25	A
(peak value); f > 1 MHz	I_{CM}	max.	3,5	A
→ Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	31	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

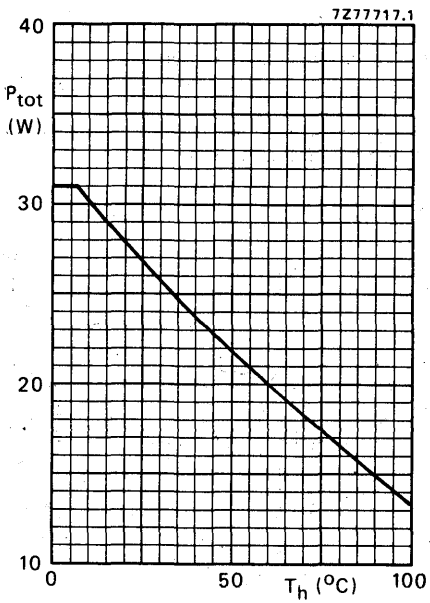


Fig. 3 Power derating curve vs. temperature.

→ THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 15 W; T_{mb} = 79 °C; i.e. T_h = 70 °C)	$R_{th\ j\text{-}mb}$	=	6,2	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

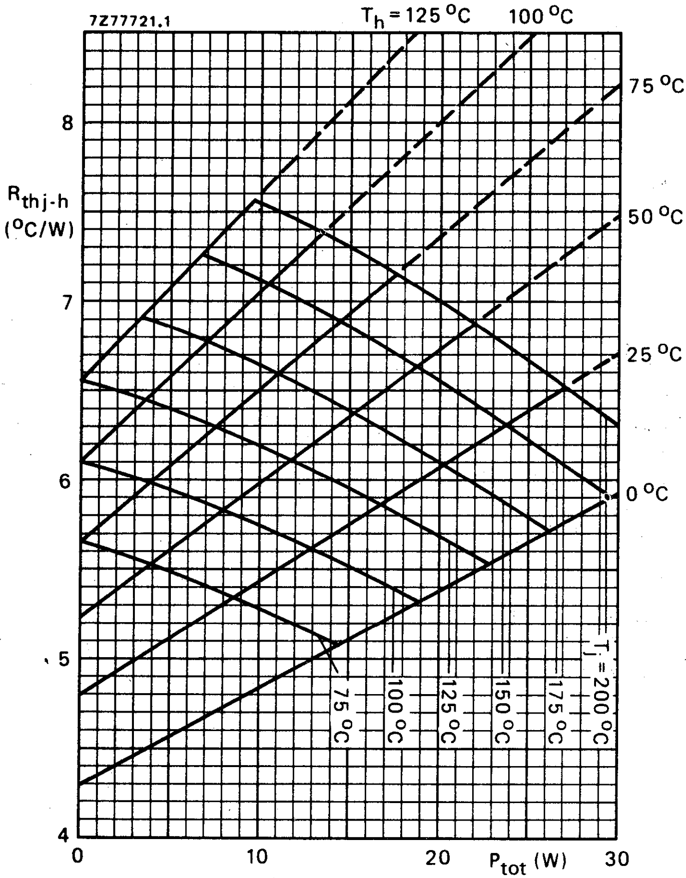


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 °C/W).

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 600 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	6,75 °C/W
	T_j	max.	170 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	5,45 °C/W
	T_j	typ.	152 °C

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 8$ mA	$V_{(BR)CES}$	>	50 V
open base; $I_C = 60$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	2,0 mA
$V_{BE} = 0$; $V_{CE} = 30$ V; $T_j = 175\ ^oC$	I_{CES}	<	5,0 mA
D.C. current gain			
$I_C = 600$ mA; $V_{CE} = 25$ V	h_{FE}	> typ.	20 40
$I_C = 600$ mA; $V_{CE} = 25$ V; $T_j = 175\ ^oC$	h_{FE}	<	120
Collector-emitter saturation voltage *			
$I_C = 1{,}2$ A; $I_B = 0{,}12$ A	V_{CEsat}	typ.	450 mV
Transition frequency at f = 500 MHz **			
$-I_E = 0{,}6$ A; $V_{CB} = 25$ V	f_T	typ.	3,3 GHz
$-I_E = 1{,}2$ A; $V_{CB} = 25$ V	f_T	typ.	3,0 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	13,5 pF
Feedback capacitance at f = 1 MHz			
$I_C = 40$ mA; $V_{CE} = 25$ V	C_{re}	typ.	8,4 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

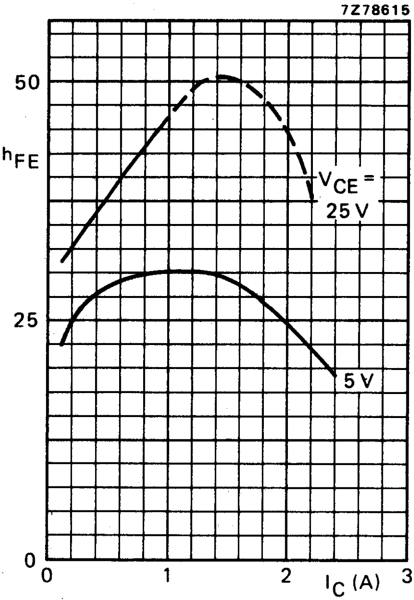


Fig. 5 Typical values; T_j = 25 °C.

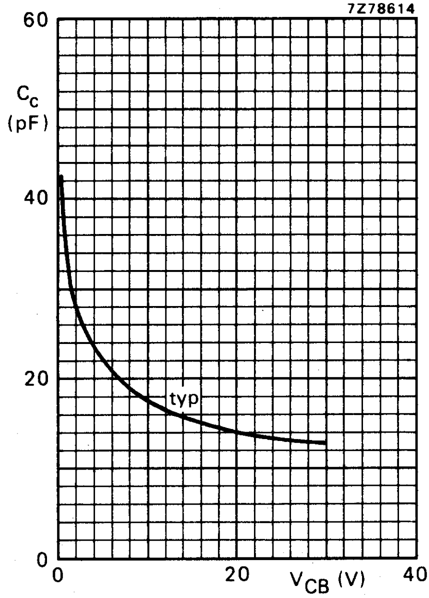


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

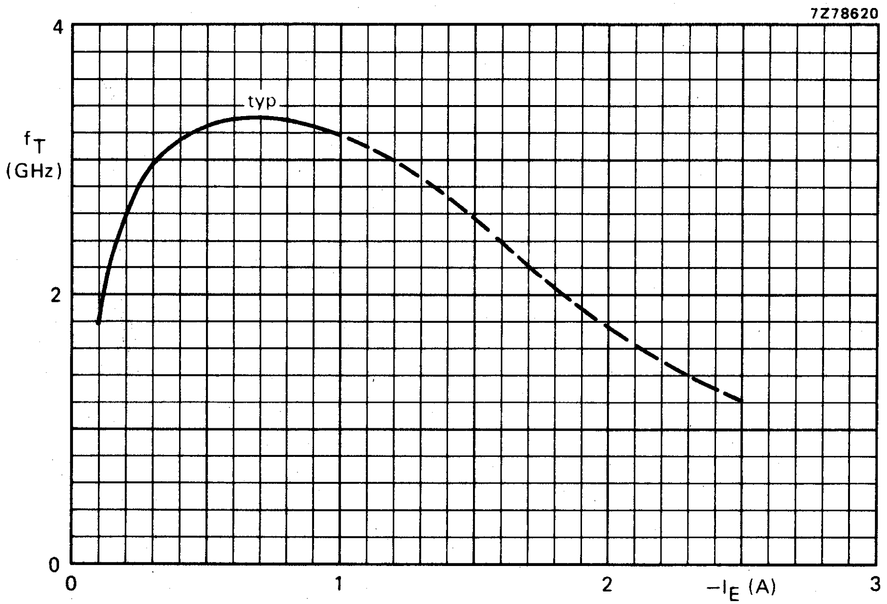


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	600	70	−60	> 1,8	> 9
860	25	600	70	−60	typ. 1,9	typ. 10,2
860	25	600	25	−60	typ. 2,15	typ. 10,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

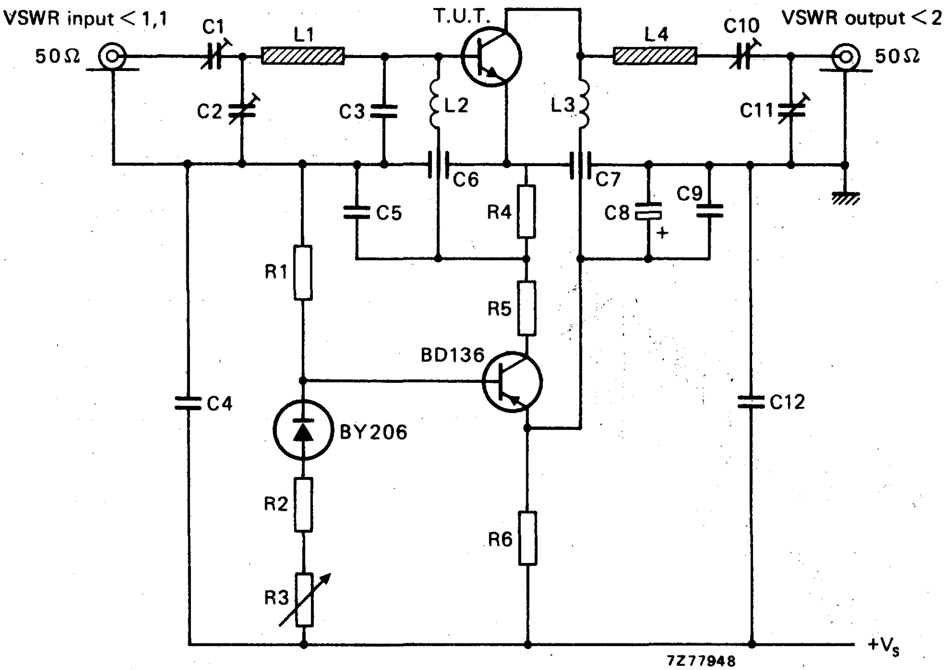


Fig. 8 Test circuit at f_{vision} = 860 MHz.

List of components:

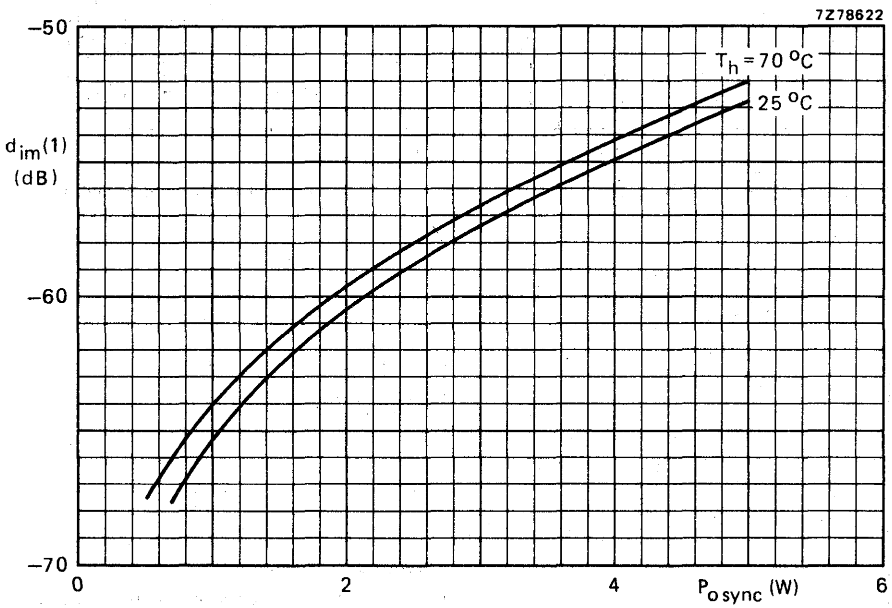
C1 = C2 = 1,4 pF to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 2 x 5,6 pF chip capacitors (in parallel)
C4 = C5 = 100 nF polyester capacitor
C6 = C7 = 1 nF feed-through capacitor
C8 = 10 μF/40 V solid aluminium electrolytic capacitor
C9 = 470 nF polyester capacitor
C10 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C11 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C12 = 5,6 pF ceramic capacitor

List of components (continued):

R1 = 1,8 kΩ carbon resistor (0,5 W)
R2 = 150 Ω carbon resistor (0,25 W)
R3 = 100 Ω wirewound potentiometer (3 W)
R4 = 33 Ω carbon resistor (0,5 W)
R5 = 220 Ω carbon resistor (1 W)
R6 = 3 Ω; parallel connection of 4 x 12 Ω carbon resistors (1 W each)

L1 = stripline (13,6 mm x 6,9 mm)
L2 = microchoke 0,47 μH (cat. no. 4322 057 04770)
L3 = 1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm
L4 = stripline (40,8 mm x 6,9 mm)

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.



(1) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level. Intermodulation distortion of input signal ⩽ −75 dB.

Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 25 V; I_C = 600 mA; f_{vision} = 860 MHz.

Information for wide-band application from 470 to 860 MHz available on request.

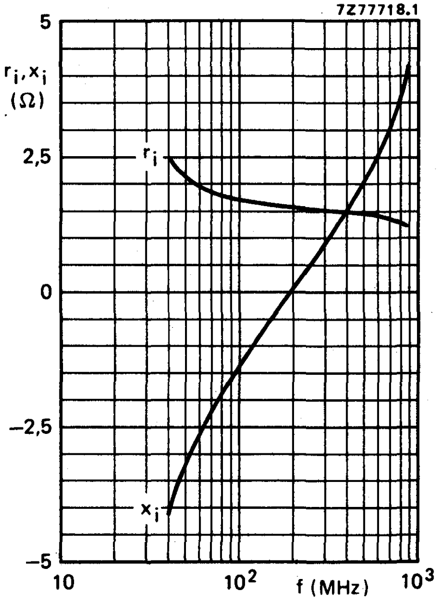


Fig. 10 Input impedance (series components).

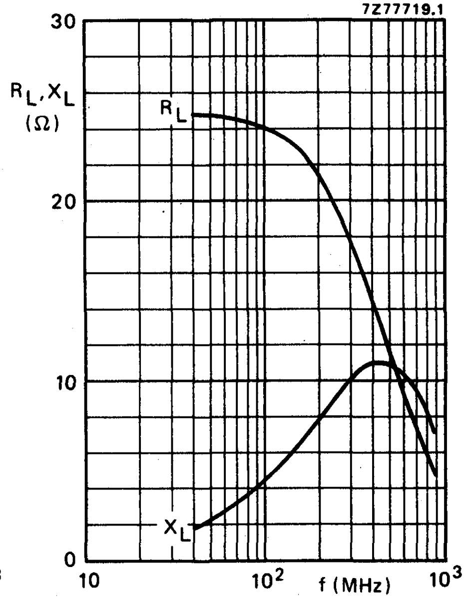


Fig. 11 Load impedance (series components).

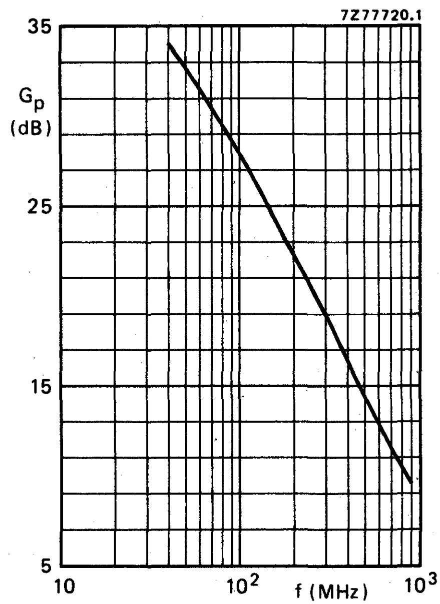


Fig. 12.

Conditions for Figs 10, 11 and 12:
Typical values; V_{CE} = 25 V; I_C = 600 mA;
T_h = 70 °C.

Ruggedness

The BLW34 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 600 mA;
T_h = 70 °C and $P_{L(AV)}$ = 4 W.
This holds for single-tone as well as for two-tone operation (vision and sound).

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. Matched h_{FE} groups are available on request.

It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

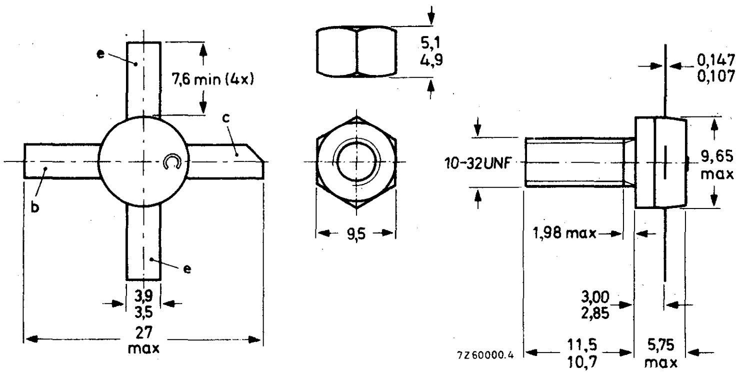
R.F. performance up to $T_h = 25\ ^oC$

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	**> 5,5**	**> 75**	**1,1 + j1,4**	**310 + j95**	–
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	–	–	typ. –33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 5,0 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

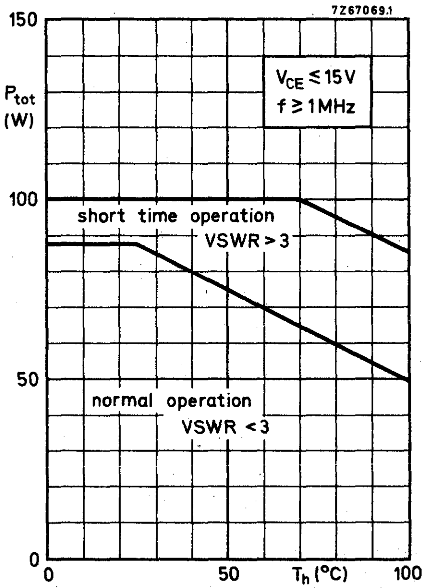
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

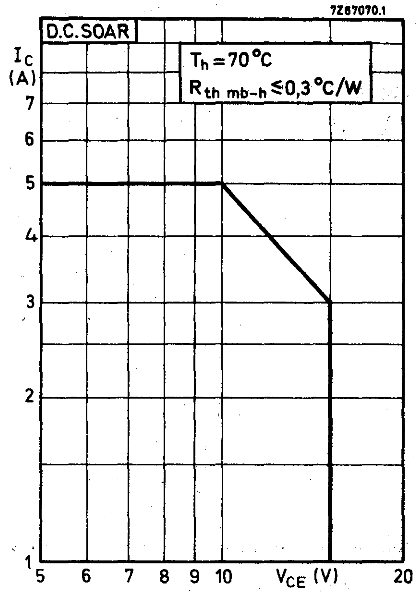
Currents

Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value); f ≥ 1MHz	I_{CM}	max.	20	A

Power dissipation

Total power dissipation at T_h = 70 °C f ≥ 1 MHz; V_{CE} ≤ 15 V; $R_{th\ mb-h}$ ≤ 0,3 °C/W Derate by 0,5 W/°C for 50 °C ≤ T_h ≤ 100 °C	P_{tot}	max.	65	W





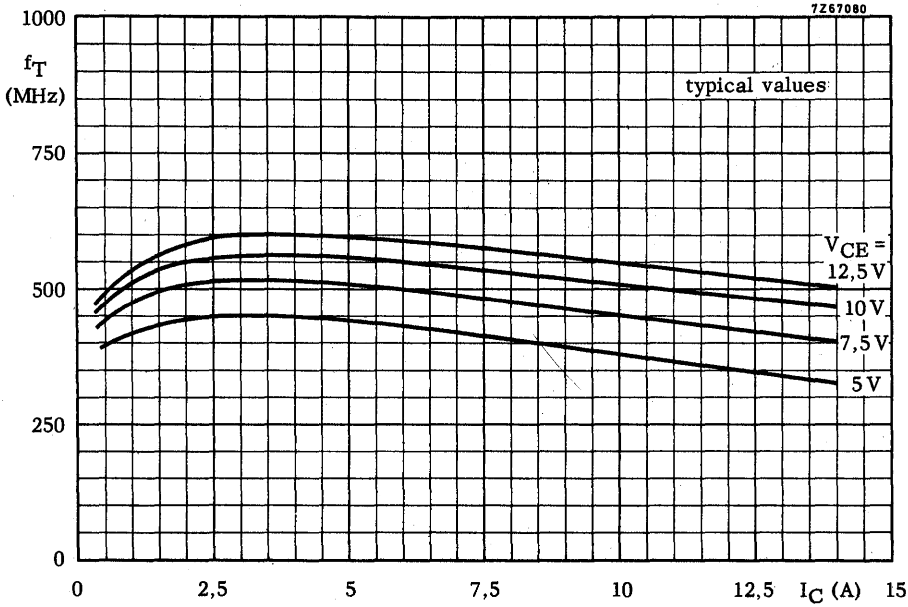
Temperature

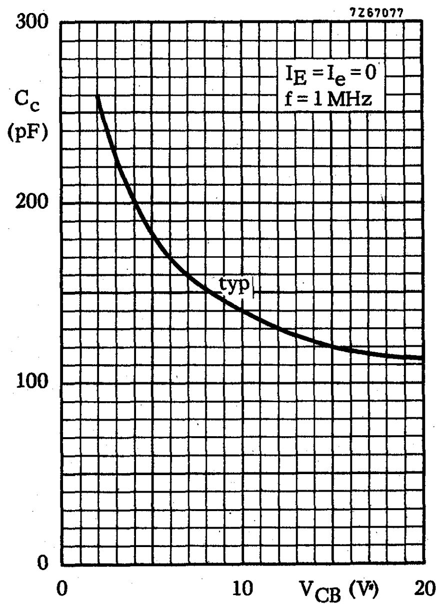
Storage temperature	T_{stg}	−65 to +200	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter; I_C = 100 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; I_E = 25 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	mWs
$-V_{BE}$ = 1, 5 V; R_{BE} = 33 Ω	E	>	8	mWs
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}		20 to 100	
D.C. current gain ratio of matched devices				
I_C = 1 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1, 2	
Transition frequency				
I_C = 6 A; V_{CE} = 10 V	f_T	typ.	550	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ. <	120 160	pF pF
Feedback capacitance				
I_C = 200 mA; V_{CE} = 15 V	C_{re}	typ.	80	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67080
1000
f_T
(MHz)
750
500
250
0
typical values
V_{CE} =
12,5 V
10 V
7,5 V
5 V
0
2,5
5
7,5
10
12,5
I_C (A)
15


7Z67077
300
C_c
(pF)
200
100
0
$I_E = I_e = 0$
f = 1 MHz
typ
0
10
V_{CB} (V)
20

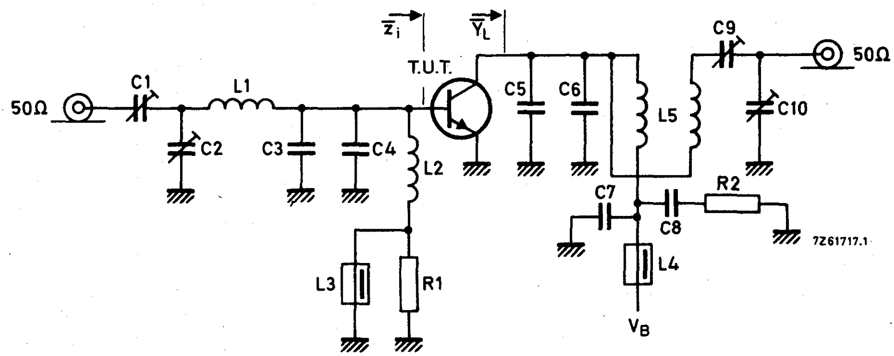
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

f = 175 MHz; T_h up to 25 °C; $R_{th\ mb-h} \leq$ 0,3 °C/W.

V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
12,5	< 12,7	45	< 4,8	> 5,5	> 75	1,1 + j1,4	310 + j95

Test circuit for 175 MHz:



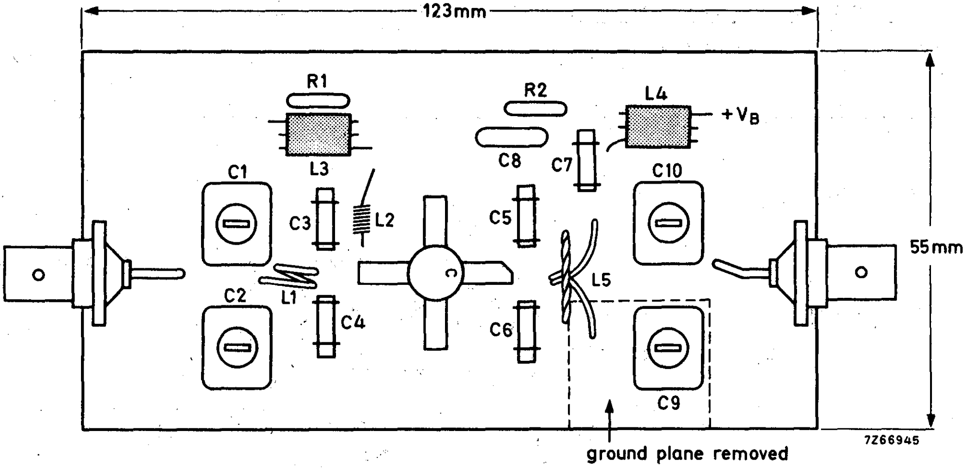
C1 = 2 to 20 pF film dielectric trimmer
C2 = 4 to 40 pF film dielectric trimmer
C3 = C4 = C5 = C6 = 56 pF ceramic capacitor
C7 = 100 pF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 4 to 80 pF film dielectric trimmer
C10 = 4 to 60 pF film dielectric trimmer

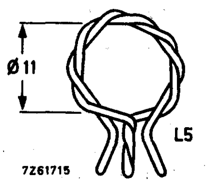
L1 = 1,5 turns enamelled Cu wire (1,5 mm); int. diam. 6 mm; length 4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. diam. 3 mm; leads 2 x 5 mm
L3 = L4 = ferroxcube choke (code number 4312 020 36640)
L5 = bifilar wound enamelled Cu wire (1,0 mm); see figure on page 6

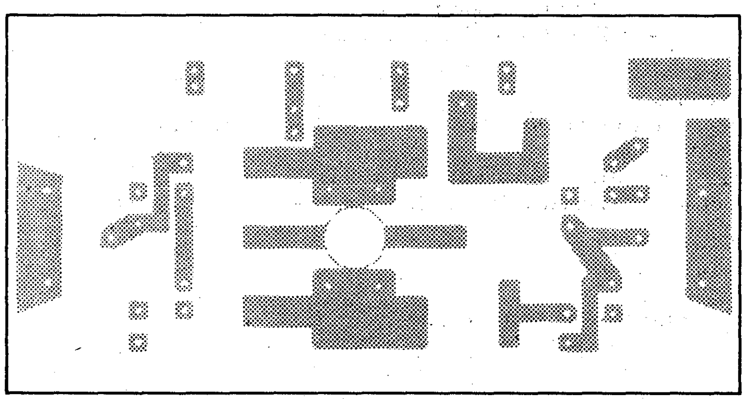
R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component lay-out for 175 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

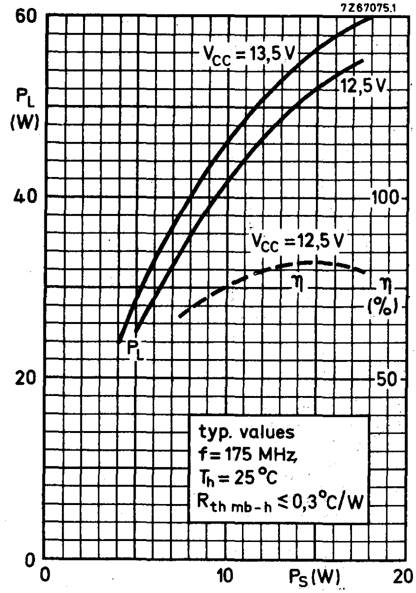




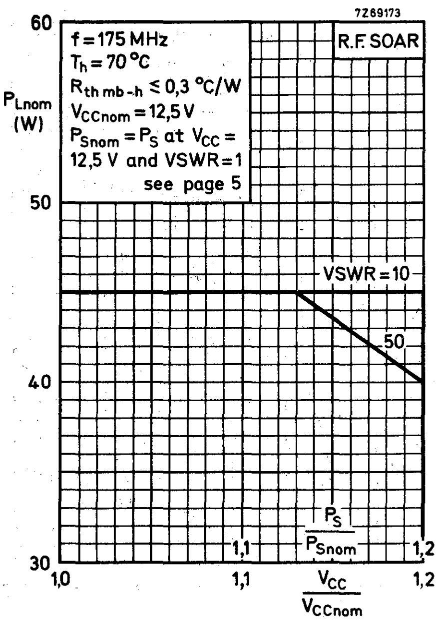


7Z66943

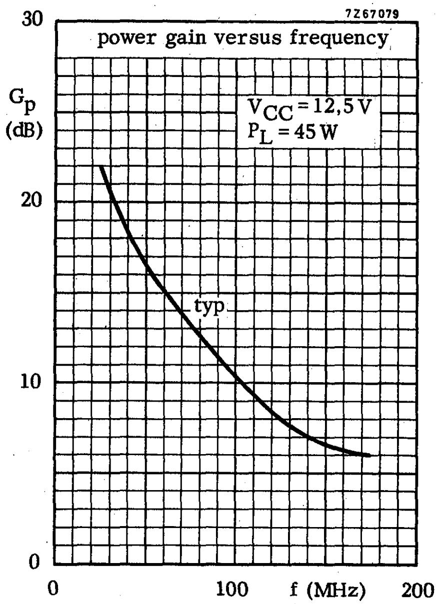
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

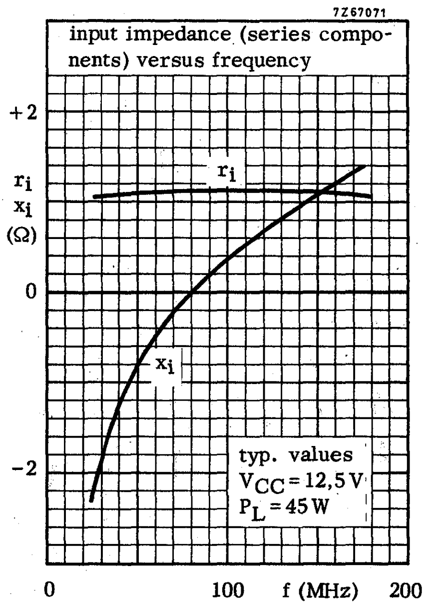


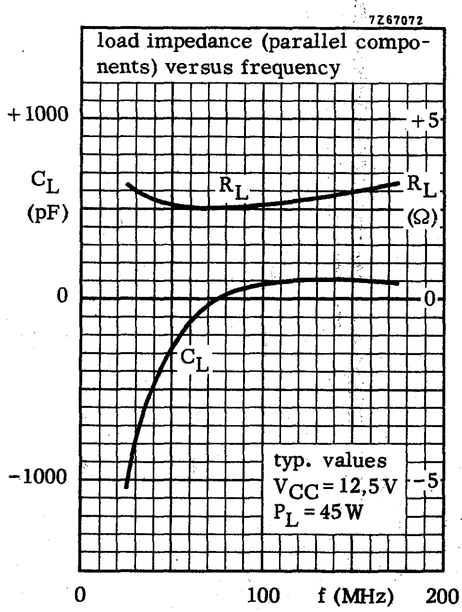
At P_L = 45 W and V_{CC} = 12, 5 V, the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by 60 mW/°C.



The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power (P_{Lnom}) must be derated in accordance with the adjacent graph for safe operation at supply voltages other than nominal.
The graph shows the allowable output power under nominal conditions as a function of the supply overvoltage ratio with VSWR as parameter. The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio (V_{CC}/V_{CCnom}).


7Z67079
power gain versus frequency
G_p (dB)
30
20
10
0
V_{CC} = 12,5 V
P_L = 45 W
typ
0
100
f (MHz)
200


7Z67071
input impedance (series components) versus frequency
r_i x_i (Ω)
+2
0
−2
r_i
x_i
typ. values
V_{CC} = 12,5 V
P_L = 45 W
0
100
f (MHz)
200


7Z67072
load impedance (parallel components) versus frequency
C_L (pF)
+1000
0
−1000
R_L
C_L
R_L (Ω)
+5
0
−5
typ. values
V_{CC} = 12,5 V
P_L = 45 W
0
100
f (MHz)
200

APPLICATION INFORMATION (continued)

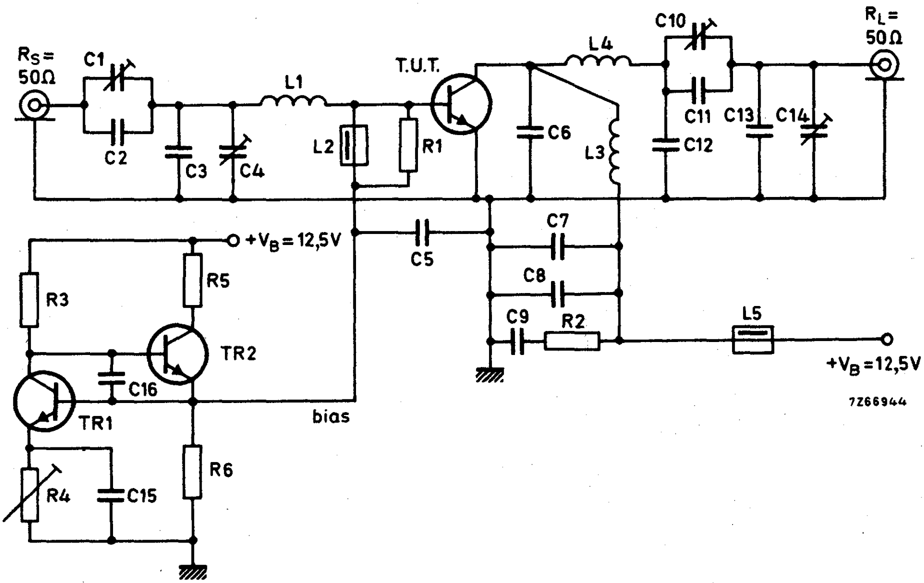
R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb\text{-}h} \leqslant$ 0,3 °C/W

f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ. 19,5	typ. 35	typ. –33	typ. –36	25

Test circuit; s.s.b. class-AB.



List of components on page 10.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

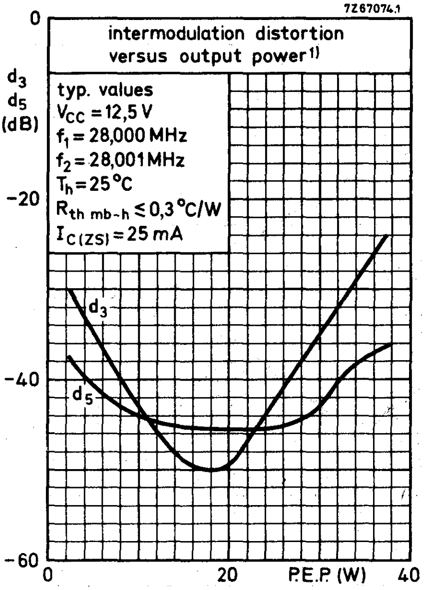
List of components:

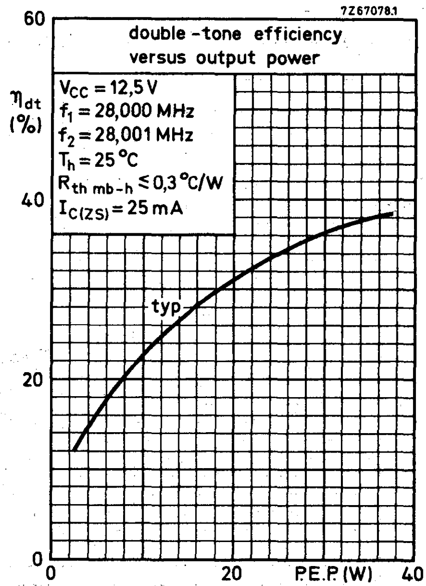
Tr1 = Tr2 = BD137

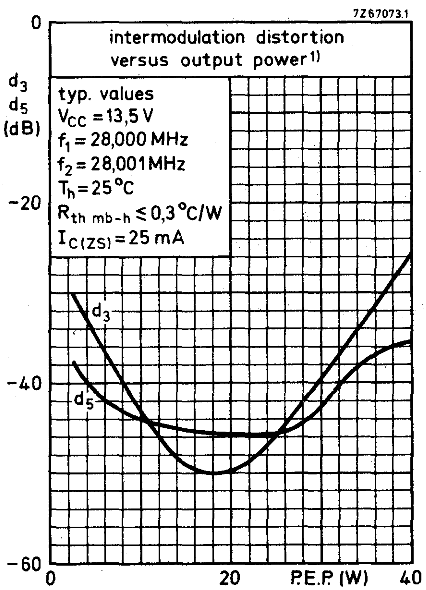
C1 = 100 pF air dielectric capacitor (single insulated rotor)
C2 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor (±10%)
C9 = 2,2 μF moulded metallized polyester capacitor
C10 = 2 x 385 pF film dielectric trimmers in parallel
C11 = 68 pF ceramic capacitor
C12 = 2 x 82 pF ceramic capacitors in parallel
C13 = 47 pF ceramic capacitor
C14 = 385 pF film dielectric trimmer

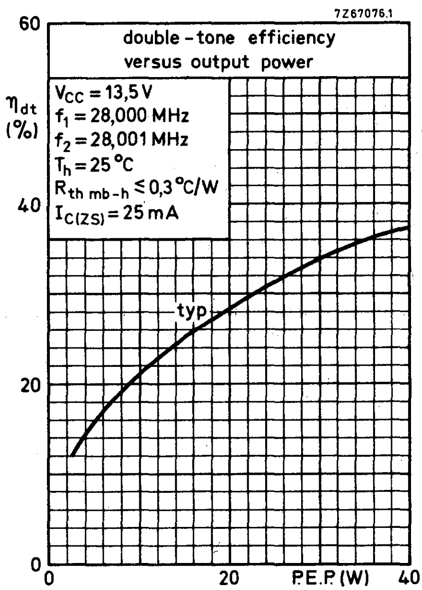
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 8 mm; coil length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; coil length 7,6 mm; leads 2 x 5 mm

R1 = 27 Ω carbon resistor (±5%)
R2 = 4,7 Ω carbon resistor (±5%)
R3 = 1,5 kΩ carbon resistor (±5%)
R4 = 10 Ω wire-wound potentiometer (3 W)
R5 = 47 Ω wire-wound resistor (5,5 W)
R6 = 150 Ω carbon resistor (±5%)

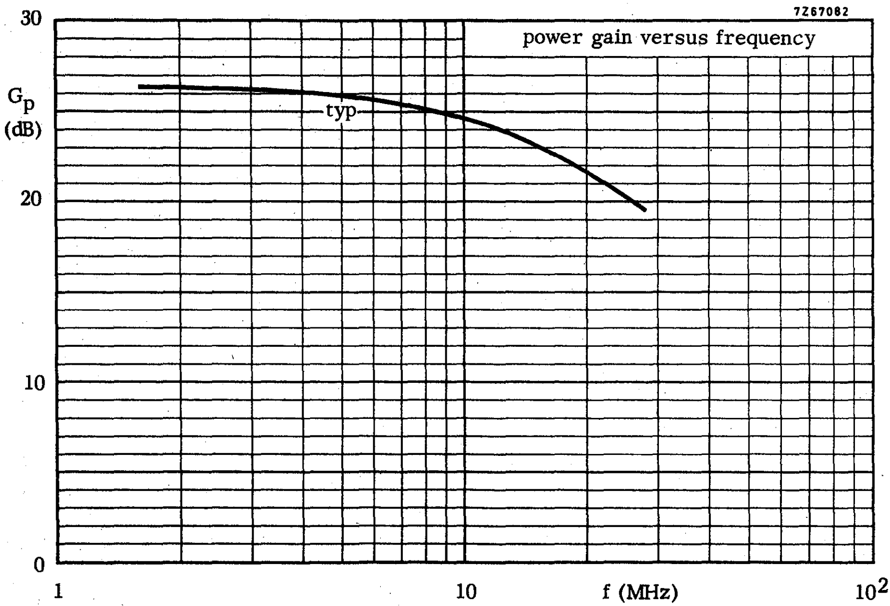








[1]) Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

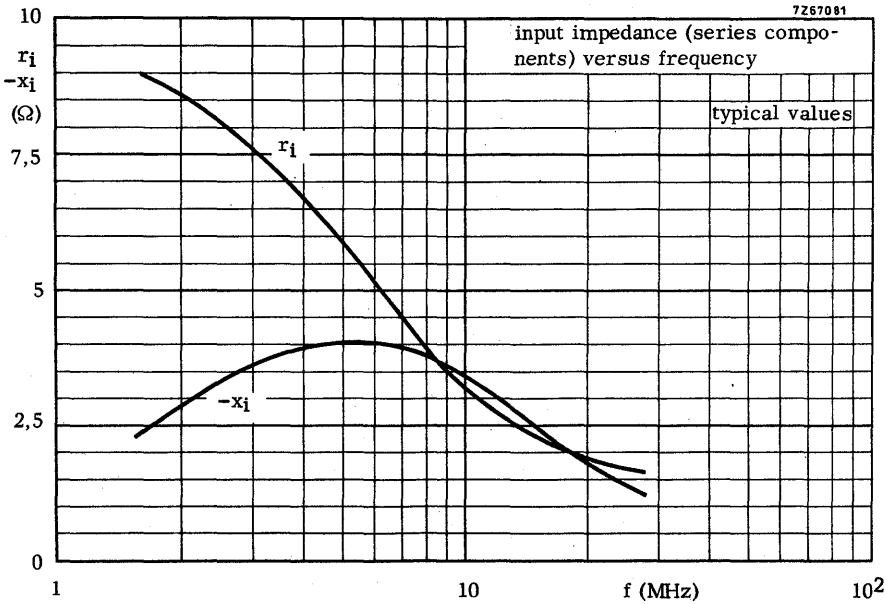


S.S.B. class AB operation

Conditions:

P_L	= 30 W (PEP)	P_L	= 35 W (PEP)
V_{CC}	= 12,5 V	V_{CC}	= 13,5 V
$I_{C(ZS)}$	= 25 mA	$I_{C(ZS)}$	= 25 mA
T_h	= 25 °C	T_h	= 25 °C
$R_{th\ mb\text{-}h}$	≤ 0,3 °C/W	$R_{th\ mb\text{-}h}$	≤ 0,3 °C/W
Z_L	= 1,9 Ω	Z_L	= 1,9 Ω

The curve (both conditions) holds for an unneutralized amplifier.



S.S.B. class AB operation

Conditions:

P_L	= 30 W (PEP)		P_L	= 35 W (PEP)	
V_{CC}	= 12,5 V		V_{CC}	= 13,5 V	
$I_{C(ZS)}$	= 25 mA		$I_{C(ZS)}$	= 25 mA	
T_h	= 25 °C		T_h	= 25 °C	
$R_{th\ mb\text{-}h}$	≤ 0,3 °C/W		$R_{th\ mb\text{-}h}$	≤ 0,3 °C/W	
Z_L	= 1,9 Ω		Z_L	= 1,9 Ω	

The curve (both conditions) holds for an unneutralized amplifier.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

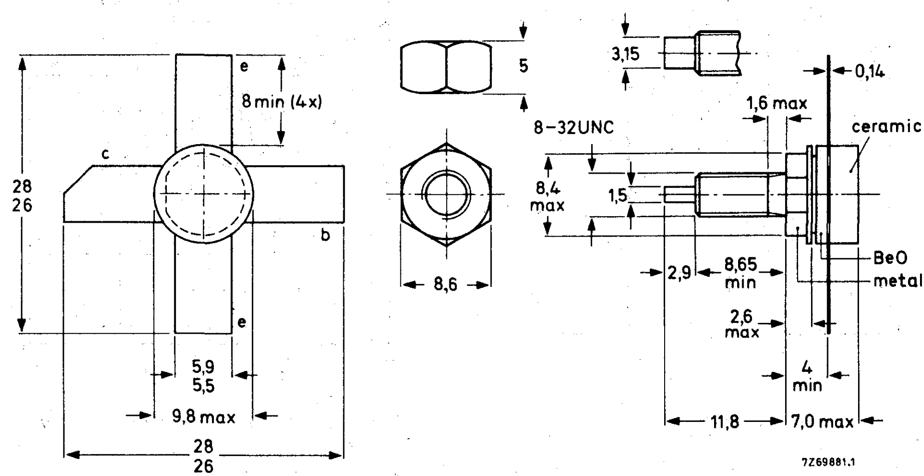
R.F. performance up to T_h = 25 °C

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	**> 5,5**	**> 75**	**1,1 + j1,4**	**310 + j95**	–
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ 19,5	typ 35	–	–	typ –33

MECHANICAL DATA

Dimensions in mm

SOT-120



Torque on nut: min 0,75 Nm (7,5 kg cm)
max 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	22	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

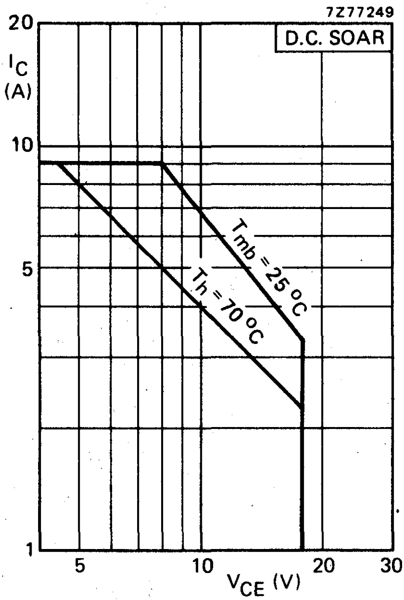


Fig. 2 D.C. SOAR.

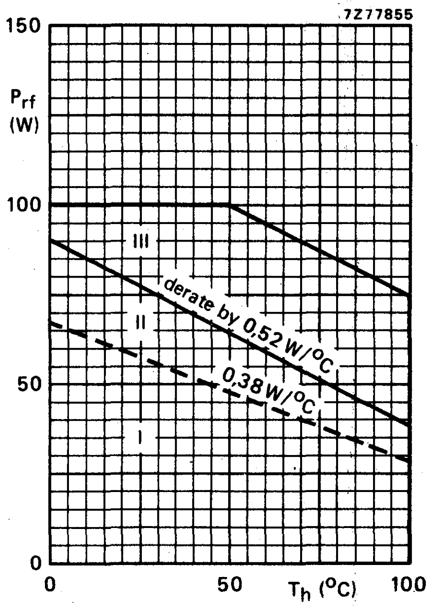


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16{,}5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 88 °C, i.e. T_h = 70 °C)

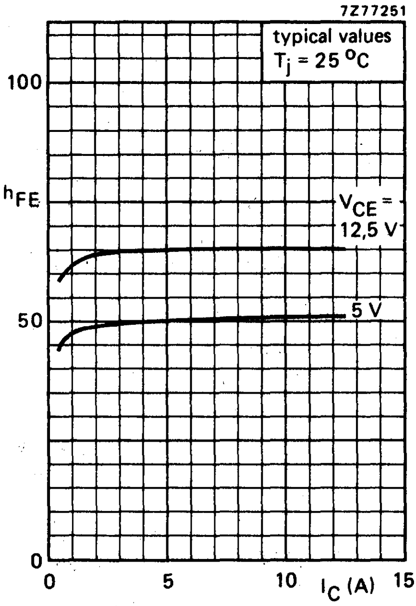
From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,05	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	°C/W

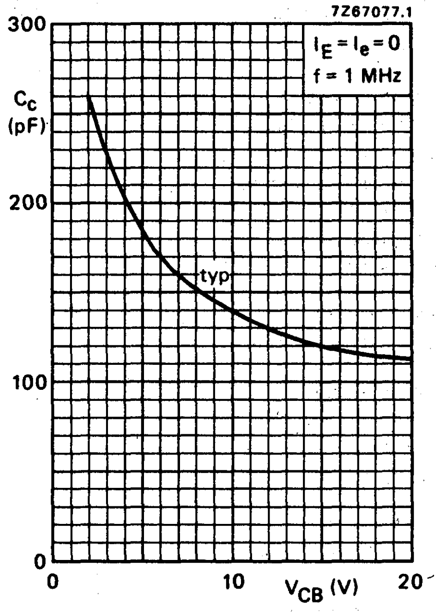
CHARACTERISTICS

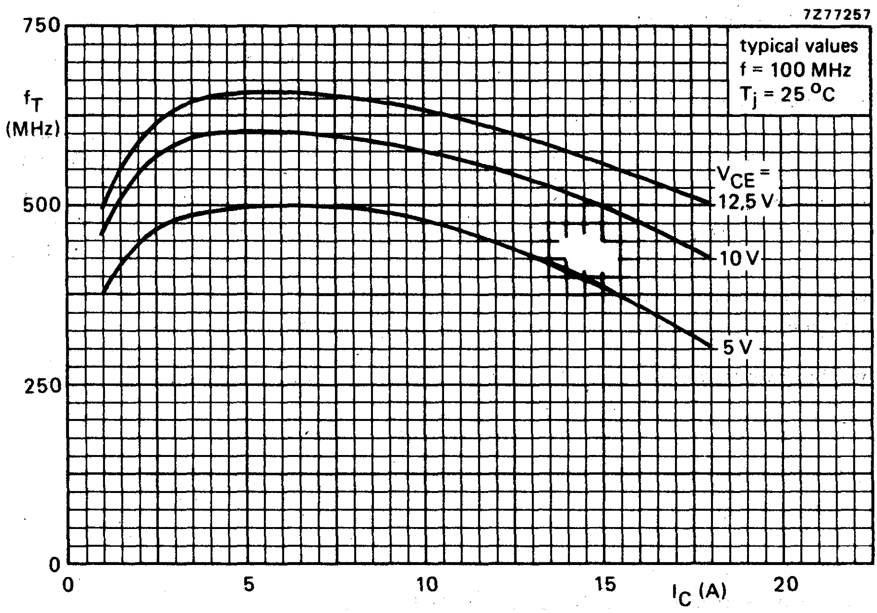
$T_j = 25\ ^oC$

Breakdown voltage				
Collector-emitter voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 15$ V	I_{CES}	<	25	mA
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	mWs
$-V_{BE} = 1,5$ V; $R_{BE} = 33\ \Omega$	E	>	8	mWs
D.C. current gain *				
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ	50	
			10 to 80	
D.C. current gain ratio of matched devices *				
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2	
Collector-emitter saturation voltage *				
$I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ	1,5	V
Transition frequency at f = 100 MHz *				
$I_C = 4$ A; $V_{CE} = 12,5$ V	f_T	typ	650	MHz
$I_C = 12,5$ A; $V_{CE} = 12,5$ V	f_T	typ	600	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ	120	pF
		<	160	pF
Feedback capacitance at f = 1 MHz				
$I_C = 200$ mA; $V_{CE} = 15$ V	C_{re}	typ	80	pF
Collector-stud capacitance	C_{cs}	typ	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77251
typical values
Tj = 25 °C
100
hFE
VCE =
12,5 V
50
5 V
0
0
5
10
IC (A)
15


7Z67077.1
300
IE = Ie = 0
f = 1 MHz
Cc
(pF)
200
typ
100
0
0
10
VCB (V)
20


7Z77257
750
typical values
f = 100 MHz
Tj = 25 °C
fT
(MHz)
500
VCE =
12,5 V
10 V
5 V
250
0
0
5
10
15
IC (A)
20

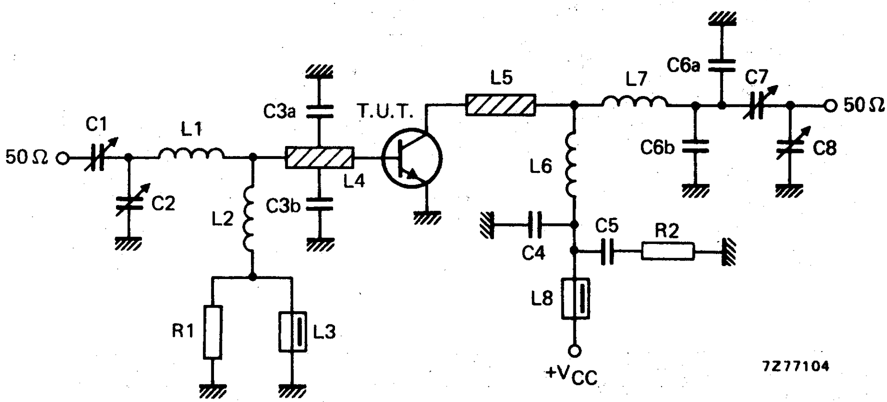
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CC} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**12,5**	**45**	**< 12,7**	**> 5,5**	**< 4,8**	**> 75**	**1,1 + j1,4**	**310 + j95**
175	13,5	45	–	typ 6,0	–	typ 75	–	–

Test circuit for 175 MHz



List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

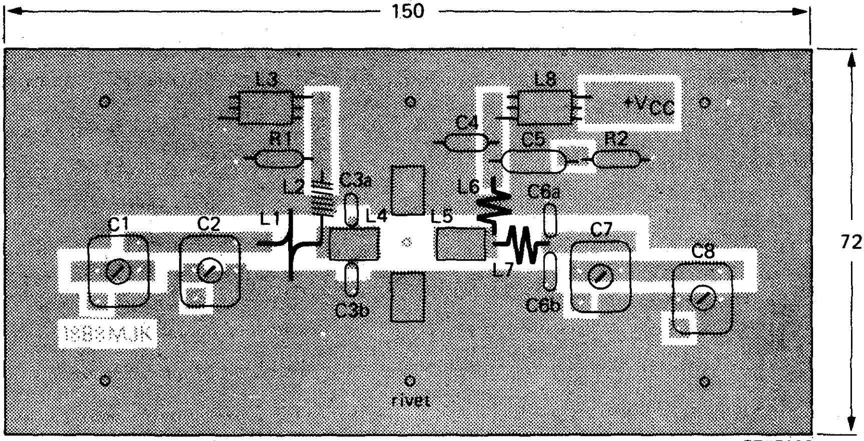
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (±10%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor

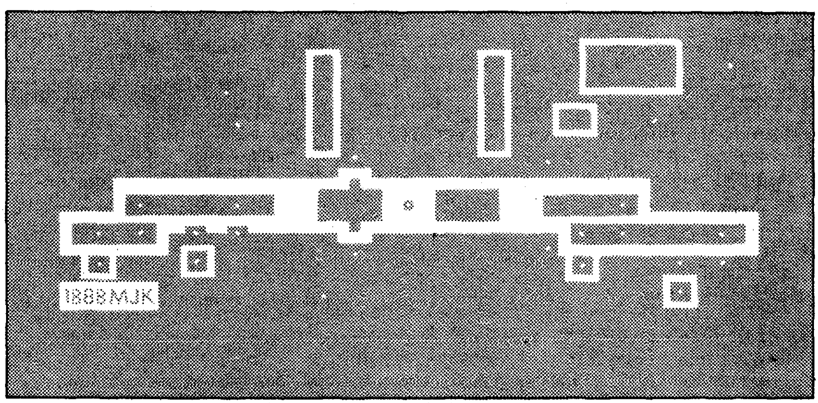
Component layout and printed-circuit board for 175 MHz test circuit on page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 175 MHz test circuit.

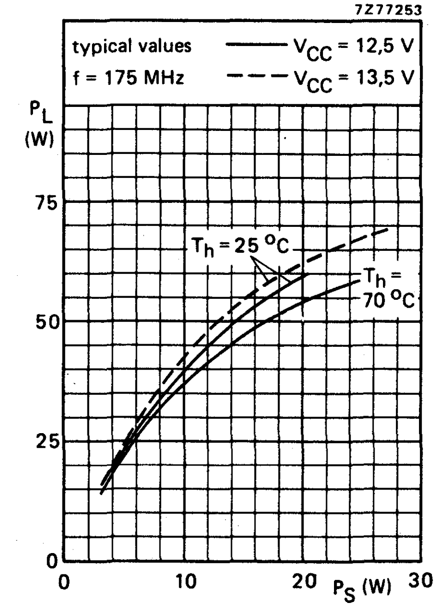


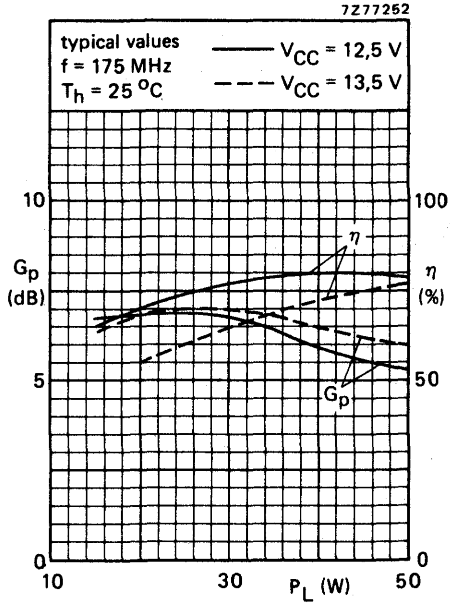
7Z77102

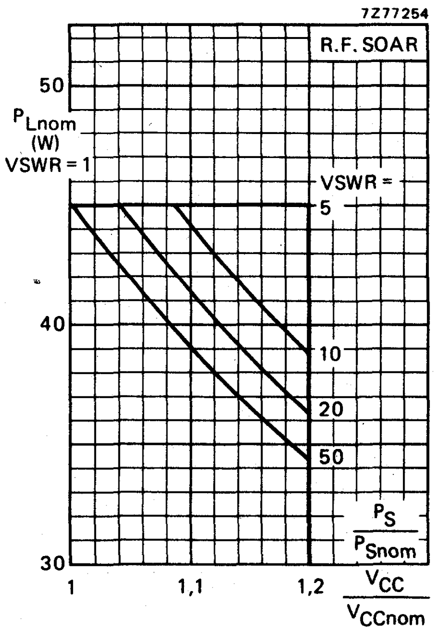


7Z77103

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.





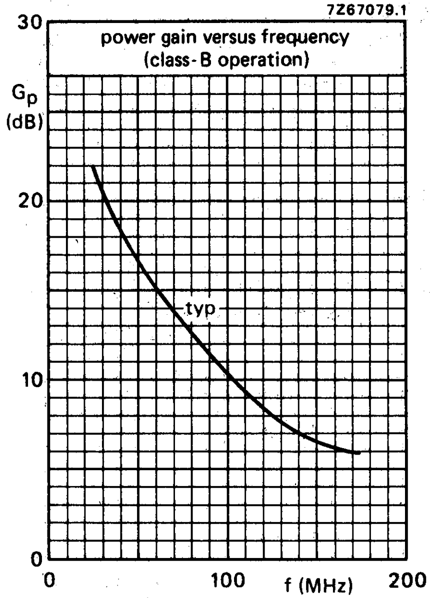


Conditions for R.F. SOAR

f = 175 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,45 °C/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

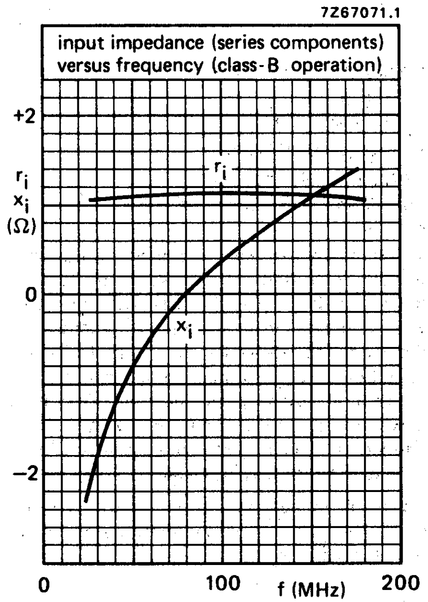
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

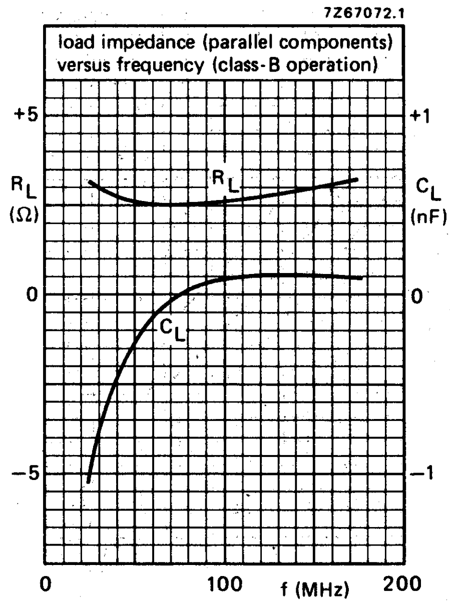
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 45 W
T_h = 25 °C
typical values





APPLICATION INFORMATION (continued)

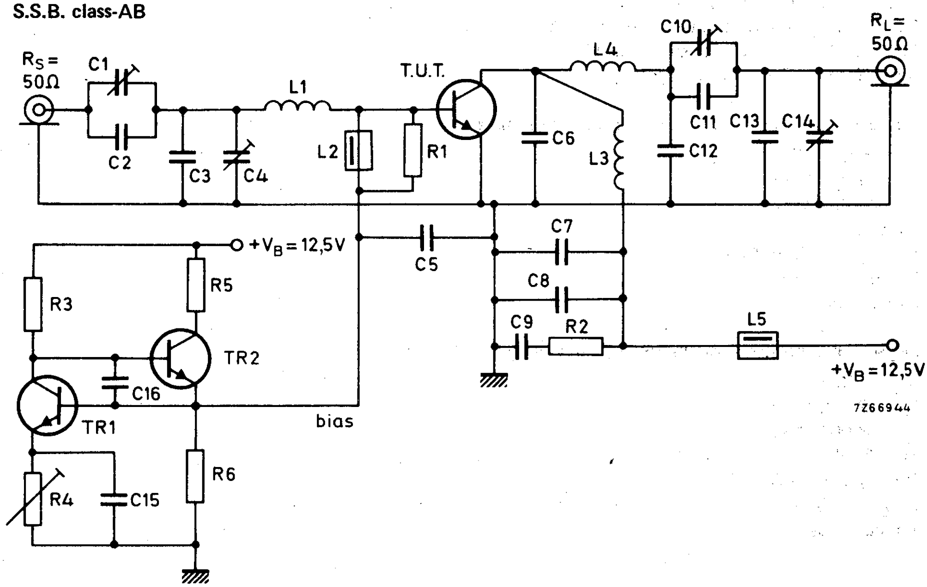
R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb\text{-}h} \leqslant$ 0,45 °C/W
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ 19,5	typ 35	typ −33	typ −36	25

Test circuit

S.S.B. class-AB



List of components:

TR1 = TR2 = BD137

C1 = 100 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C5 = C7 = 3,9 nF polyester capacitor
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C10 = 2 x 385 pF film dielectric trimmer
C11 = 68 pF ceramic capacitor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel
C13 = 47 pF ceramic capacitor
C14 = 385 pF film dielectric trimmer

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm

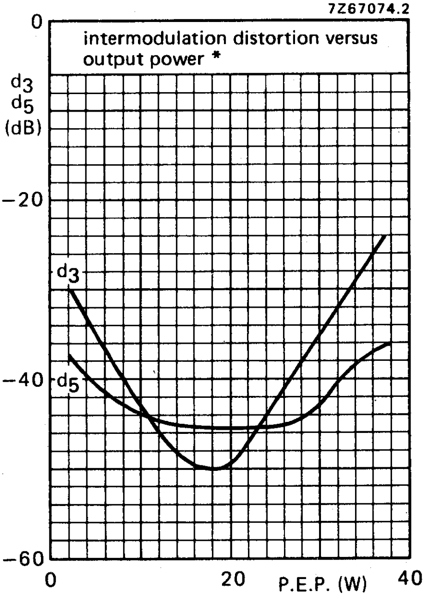
R1 = 27 Ω (±5%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor
R3 = 1,5 kΩ (±5%) carbon resistor
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor

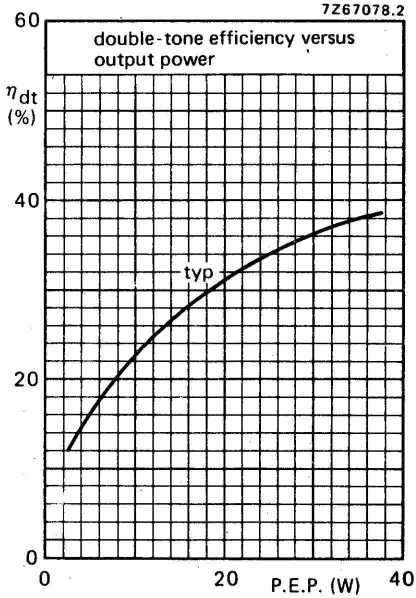
Measuring conditions for the upper graphs on page 11

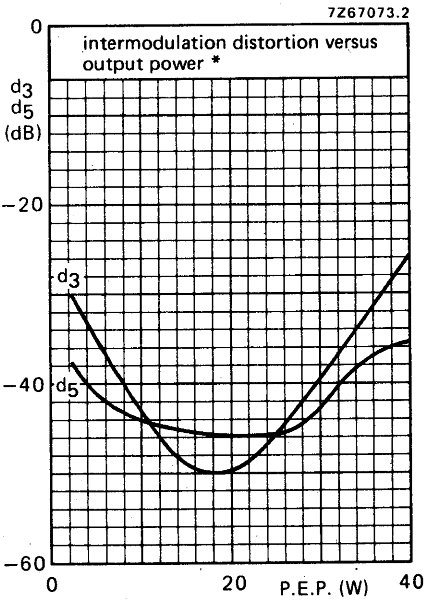
V_{CC} = 12,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,45 °C/W
$I_{C(ZS)}$ = 25 mA
typical values

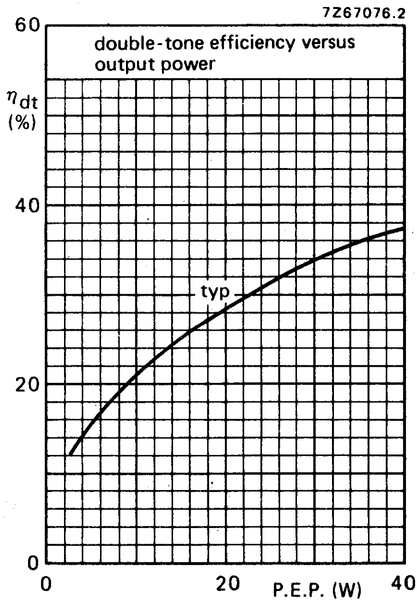
Measuring conditions for the lower graphs on page 11

V_{CC} = 13,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,45 °C/W
$I_{C(ZS)}$ = 25 mA
typical values

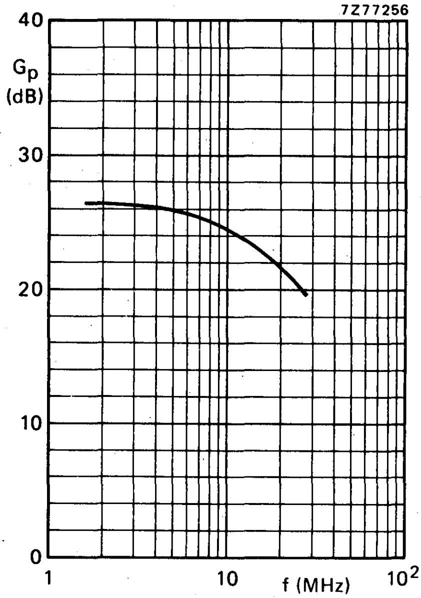


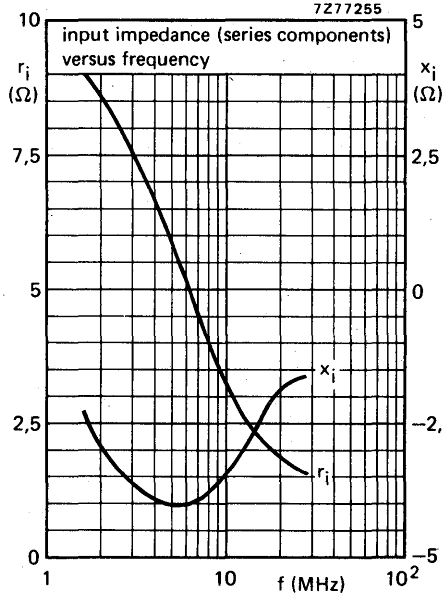






* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.





S.S.B. class-AB operation

Conditions for the graphs above:

V_{CC} = 12,5 V	V_{CC} = 13,5 V
P_L = 30 W (P.E.P.)	P_L = 35 W (P.E.P.)
T_h = 25 °C	T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,45 °C/W	$R_{th\ mb\text{-}h} \leqslant$ 0,45 °C/W
$I_{C(ZS)}$ = 25 mA	$I_{C(ZS)}$ = 25 mA
Z_L = 1,9 Ω	Z_L = 1,9 Ω

The typical curves (both conditions) hold for an unneutralized amplifier.

TV TRANSPOSER TRANSISTOR FOR BAND III

N-P-N silicon planar epitaxial transistor assembled in a plastic encapsulated stripline package all leads of which are isolated from the stud. Excellent d.c. dissipation properties have been obtained by means of internal emitter-ballasting resistors and gold metallization. Detailed information is presented for application of this device in preamplifiers for television transposers and transmitters in band III.

QUICK REFERENCE DATA

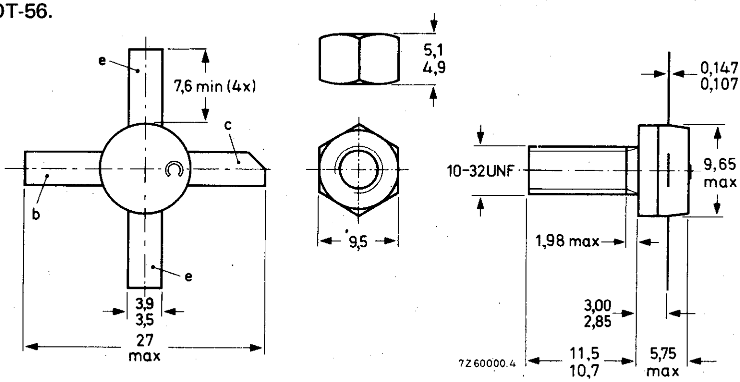
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
D.C. power dissipation up to T_h = 70 °C	P_{tot}	max.	40	W
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	3,0	°C/W
Transition frequency				
I_C = 4,0 A; V_{CE} = 25 V	f_T	typ.	900	MHz
Output power at f_{vision} = 224,25 MHz *				
I_C = 1,6 A; V_{CE} = 25 V; T_h = 70 °C; d_{im} = −55 dB	$P_{o\ sync}$	>	10,0	W
I_C = 1,6 A; V_{CE} = 25 V; T_h = 70 °C; d_{im} = −52 dB	$P_{o\ sync}$	typ.	13,5	W
Power gain at f_{vision} = 224,25 MHz				
I_C = 1,6 A; V_{CE} = 25 V; T_h = 70 °C	G_p	>	9,5	dB

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 5,0 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

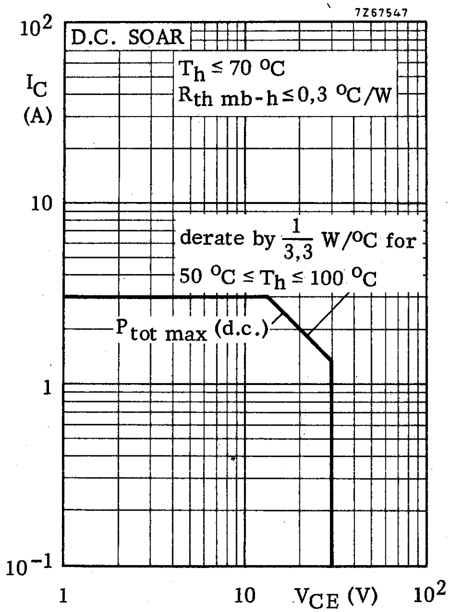
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	60	V
Collector-emitter voltage (R_{BE} = 10 Ω) peak value	V_{CERM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	3,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	9,0	A

Power dissipation

D.C. power dissipation up to T_h = 70 °C	P_{tot}	max.	40	W



Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

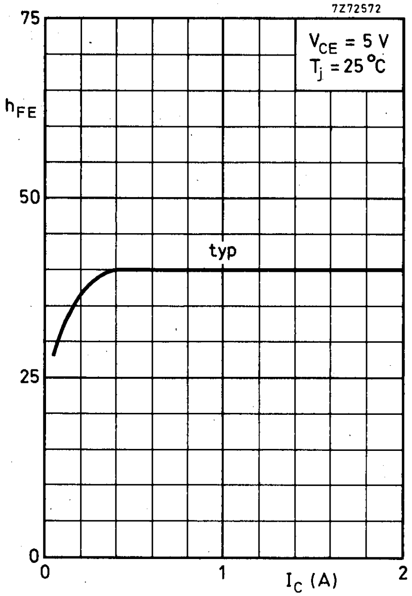
THERMAL RESISTANCE

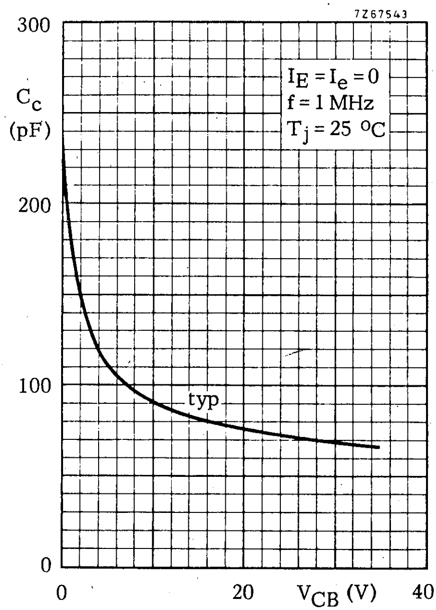
From junction to mounting base	$R_{th\ j-mb}$	=	3,0	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,3	°C/W

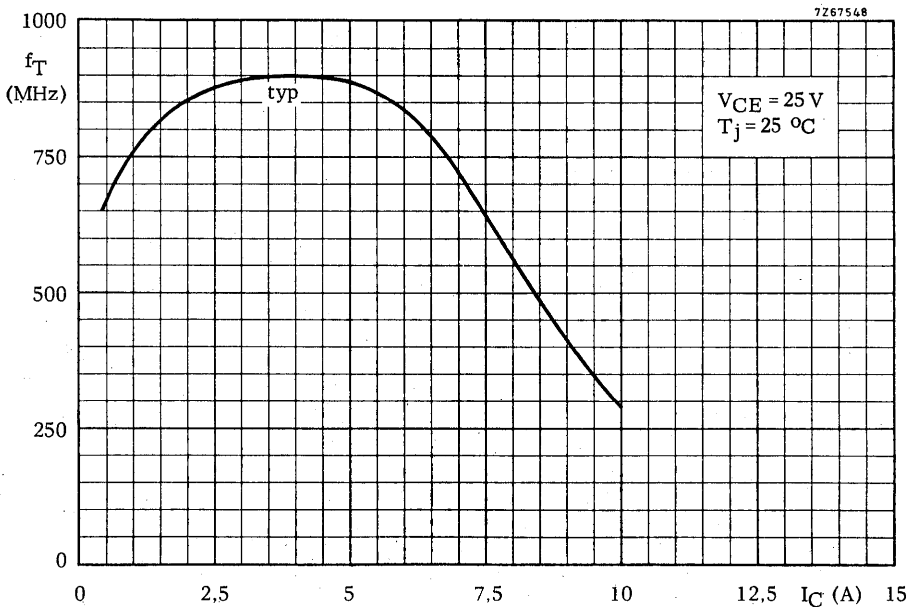
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage, open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	60	V
Collector-emitter voltage, R_{BE} = 10 Ω, I_C = 50 mA	$V_{(BR)CER}$	>	60	V
Collector-emitter voltage, open base, I_C = 50 mA	$V_{(BR)CEO}$	>	32	V
Emitter-base voltage, open collector, I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	4,5	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	4,5	mWs
D.C. current gain				
I_C = 1,0 A; V_{CE} = 5 V	h_{FE}	>	25	
		typ.	40	
Transition frequency				
I_C = 4 A; V_{CE} = 25 V	f_T	typ.	900	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	68	pF
		<	80	pF
Feedback capacitance at f = 1 MHz				
I_C = 200 mA; V_{CE} = 30 V	C_{re}	typ.	39	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z72572
75
50
25
0
hFE
VCE = 5 V
Tj = 25 °C
typ
0
1
2
IC (A)


7Z67543
300
200
100
0
Cc
(pF)
IE = Ie = 0
f = 1 MHz
Tj = 25 °C
typ
0
20
40
VCB (V)

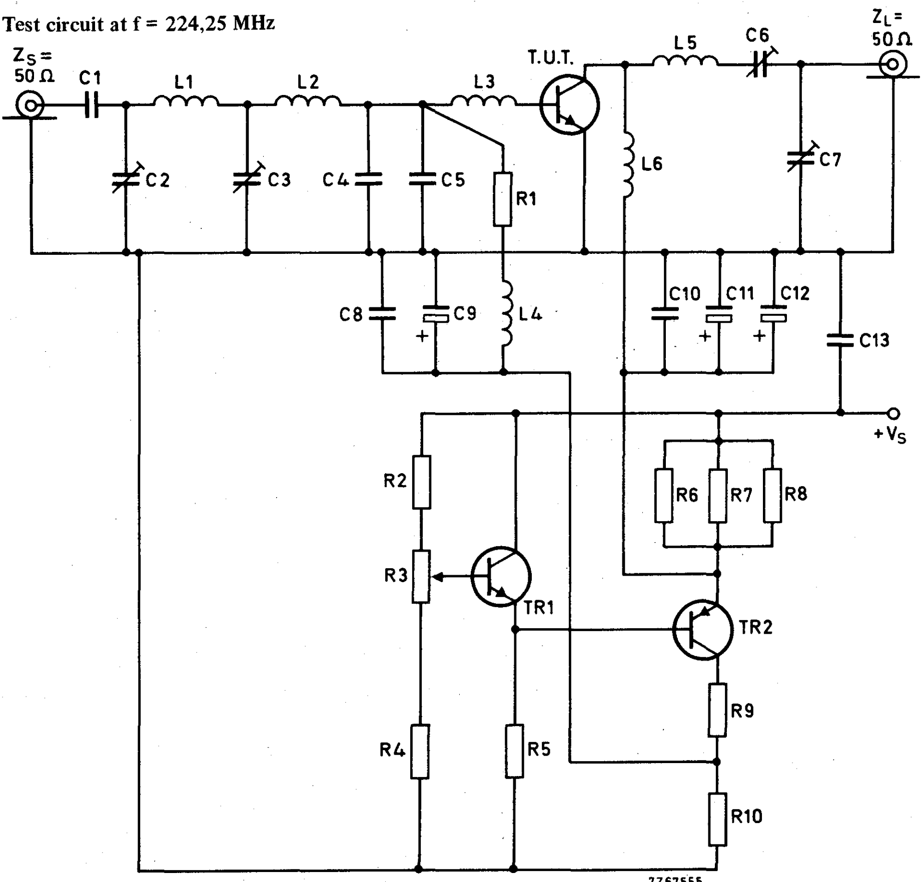

7Z67548
1000
750
500
250
0
fT
(MHz)
typ
VCE = 25 V
Tj = 25 °C
0
2,5
5
7,5
10
12,5
15
IC (A)

APPLICATION INFORMATION

d_{im} *) (dB)	f_{vision} (MHz)	V_{CE} (V)	I_C (A)	G_p (dB)	$P_{o\ sync}$ *) (W)	T_h (°C)	$R_{th\ mb-h}$ (°C/W)
−55	224, 25	25	1, 6	> 9, 5	> 10, 0	70	≤ 0, 3
−52	224, 25	25	1, 6	> 9, 5	typ. 13, 5	70	≤ 0, 3

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, side band signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f = 224,25 MHz



List of components: see page 6.

Component lay-out and printed circuit board for f = 224,25 MHz test circuit on page 7.

APPLICATION INFORMATION (continued)

List of components:

Tr 1 = BD135
Tr 2 = BD136

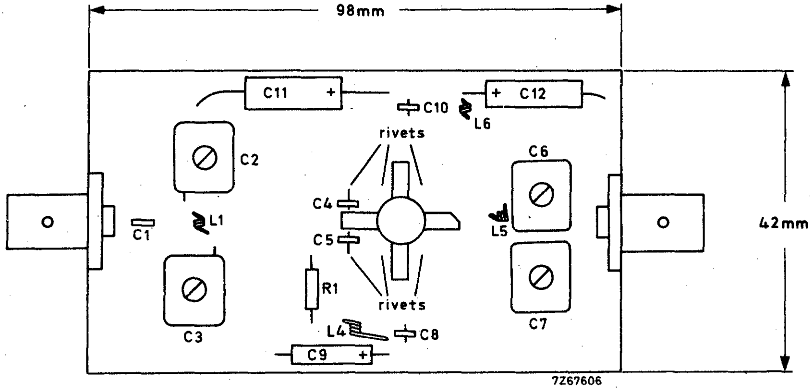
C1 = 330 pF chip capacitor
C2 = 4 to 40 pF film dielectric trimmer
C3 = 4 to 60 pF film dielectric trimmer
C4 = C5 = 82 pF chip capacitor, placed 5 mm from transistor edge
C6 = 4 to 100 pF film dielectric trimmer
C7 = 4 to 60 pF film dielectric trimmer
C8 = C10 = 820 pF chip capacitor
C9 = 47 μF electrolytic capacitor 6, 3 V
C11 = 22 μF electrolytic capacitor 40 V
C12 = 47 μF electrolytic capacitor 40 V
C13 = 100 nF polyester capacitor

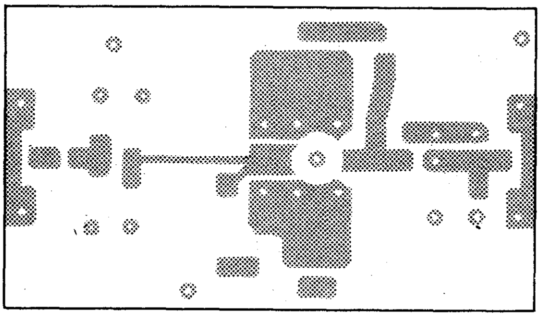
L1 = 24, 7 nH; 1, 5 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 4, 5 mm; leads 2 x 5 mm.
L2 = 8, 3 nH formed by metallization on printed board.
L3 = formed by metallization on printed board.
L4 = 100 nH; 3, 5 turns closely wound enamelled Cu wire (0, 7 mm); int. diam. 5, 5 mm; leads 2 x 5 mm.
L5 = 22 nH; 1, 5 turns closely wound enamelled Cu wire (1, 6 mm); int. diam. 4, 5 mm; leads 2 x 8 mm.
L6 = 36 nH; 1, 5 turns closely wound enamelled Cu wire (1, 6 mm); int. diam. 4, 0 mm; leads 2 x 10 mm.

R1 = 4, 7 Ω carbon resistor
R2 = 330 Ω
R3 = 470 Ω potentiometer
R4 = 4, 7 kΩ
R5 = 2, 7 kΩ
R6 = R7 = R8 = 4, 7 Ω (5, 5 W)
R9 = 180 Ω (5, 5 W)
R10 = 68 Ω

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for f = 224,25 MHz test circuit.

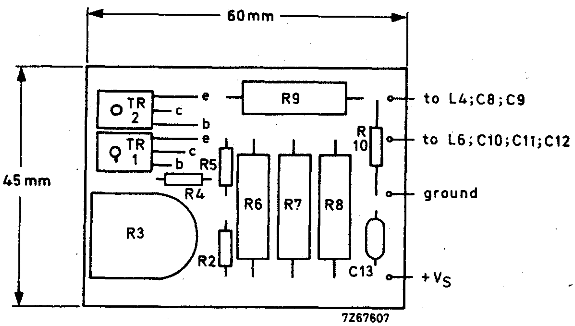


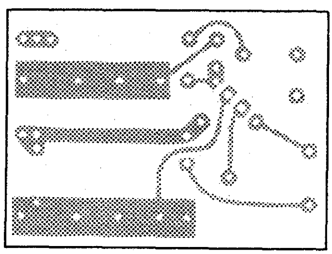


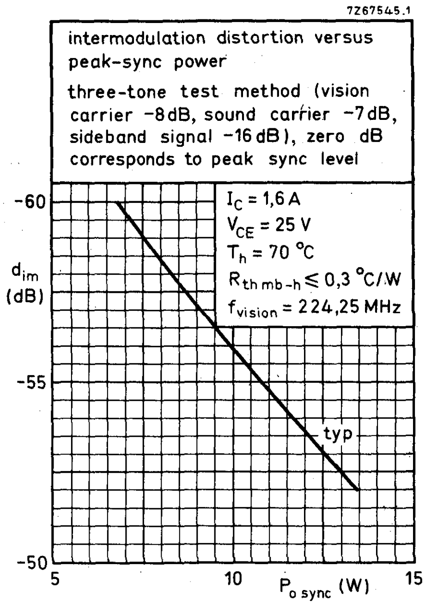
Thickness: 1,6 mm

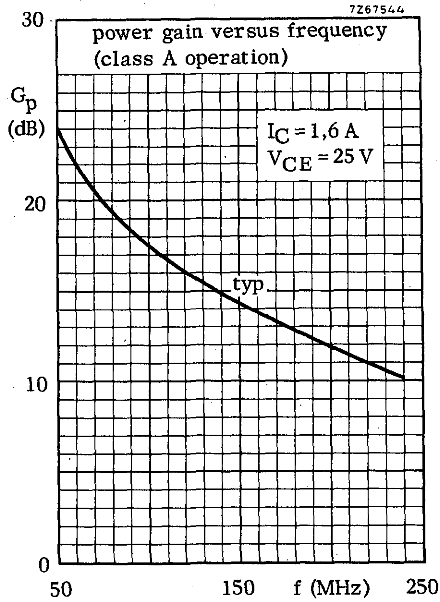
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

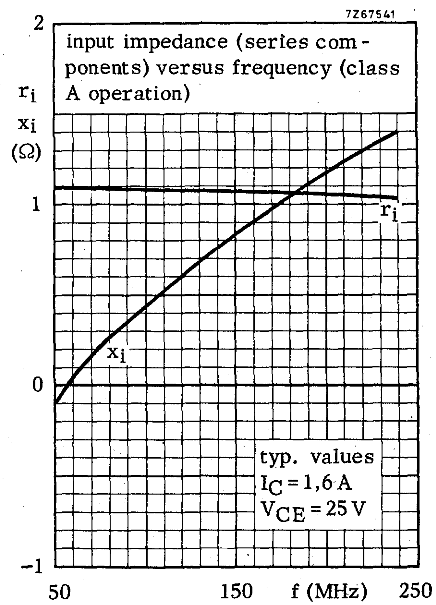
Component lay-out and printed circuit board for bias circuit.

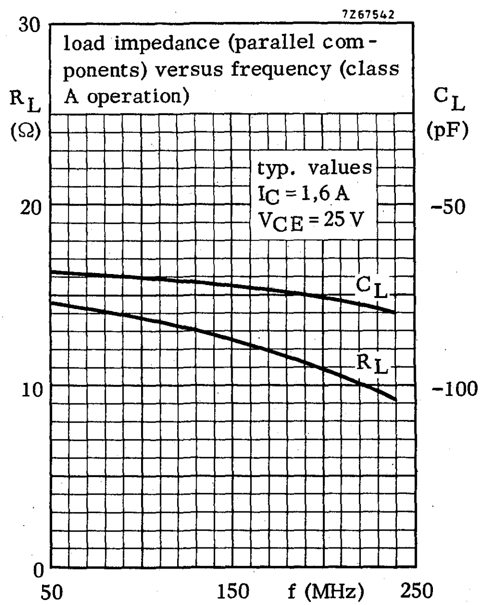





7Z67545.1
intermodulation distortion versus peak-sync power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level
I_C = 1,6 A
V_{CE} = 25 V
T_h = 70 °C
$R_{th\,mb-h} \leq$ 0,3 °C/W
f_{vision} = 224,25 MHz
typ
d_{im} (dB)
−60
−55
−50
5
10
15
$P_{o\,sync}$ (W)


7Z67544
power gain versus frequency (class A operation)
I_C = 1,6 A
V_{CE} = 25 V
typ
G_p (dB)
30
20
10
0
50
150
f (MHz)
250


7Z67541
input impedance (series components) versus frequency (class A operation)
r_i
x_i
(Ω)
typ. values
I_C = 1,6 A
V_{CE} = 25 V
2
1
0
−1
50
150
f (MHz)
250


7Z67542
load impedance (parallel components) versus frequency (class A operation)
R_L (Ω)
C_L (pF)
typ. values
I_C = 1,6 A
V_{CE} = 25 V
C_L
R_L
30
20
10
0
−50
−100
50
150
f (MHz)
250

TV TRANSPOSER TRANSISTOR FOR BAND III

N-P-N silicon planar epitaxial transistor assembled in a stripline package with a ceramic cap. All leads are isolated from the stud. Excellent d.c. dissipation properties have been obtained by means of internal emitter-ballasting resistors and gold metallization. Detailed information is presented for application of this device in preamplifiers for television transposers and transmitters in band III.

QUICK REFERENCE DATA

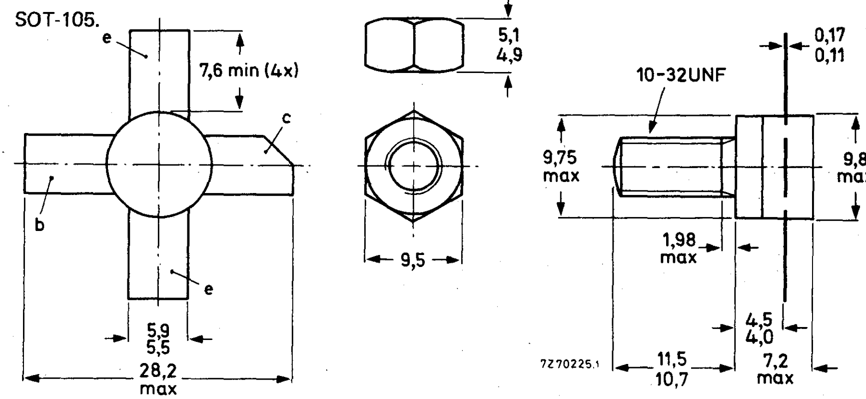
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Collector current (average)	$I_{C(AV)}$	max.	4	A
D.C. power dissipation at $T_h = 70\ ^oC$	P_{tot}	max.	60	W
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,9	$^oC/W$
Transition frequency				
$I_C = 6{,}0$ A; $V_{CE} = 25$ V	f_T	typ.	800	MHz
Output power at $f_{vision} = 224{,}25$ MHz *				
$I_C = 2{,}4$ A; $V_{CE} = 25$ V; $T_h = 70\ ^oC$; $d_{im} = -55$ dB	$P_{o\ sync}$	>	14,0	W
$I_C = 2{,}4$ A; $V_{CE} = 25$ V; $T_h = 70\ ^oC$; $d_{im} = -52$ dB	$P_{o\ sync}$	typ.	19,5	W
Power gain at $f_{vision} = 224{,}25$ MHz				
$I_C = 2{,}4$ A; $V_{CE} = 25$ V; $T_h = 70\ ^oC$	G_p	>	8,0	dB

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-105.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 5,0 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

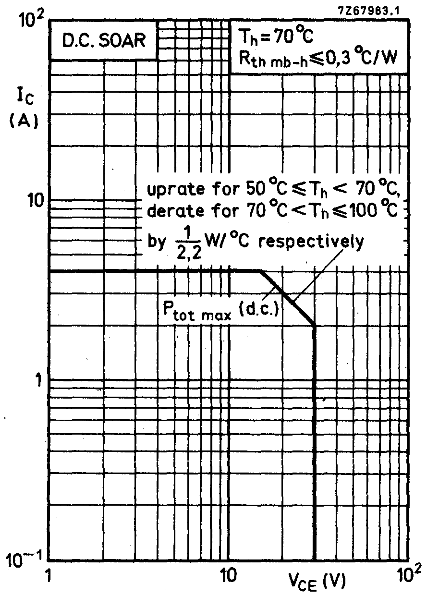
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	60	V
Collector-emitter voltage (R_{BE} = 10 Ω) peak value	V_{CERM}	max.	60	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	4,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12,0	A

Power dissipation

D.C. power dissipation at T_h = 70 °C	P_{tot}	max.	60	W



Temperatures

Storage temperature	T_{stg}	−65 to +125		°C
Operating junction temperature	T_j	max.	200	°C

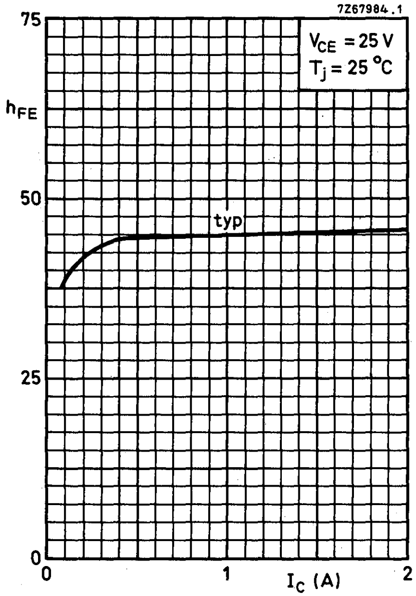
THERMAL RESISTANCE

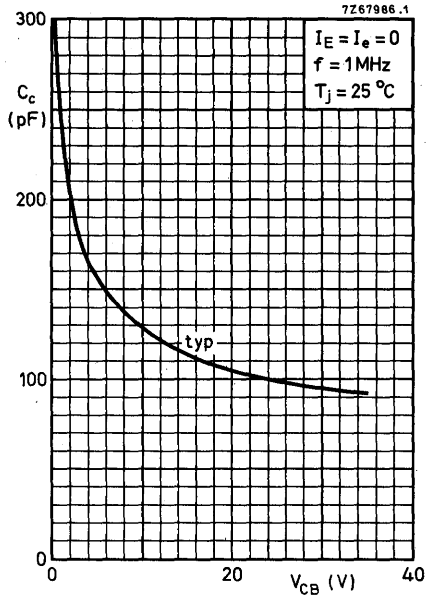
From junction to mounting base	$R_{th\ j-mb}$	=	1,9	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,3	°C/W

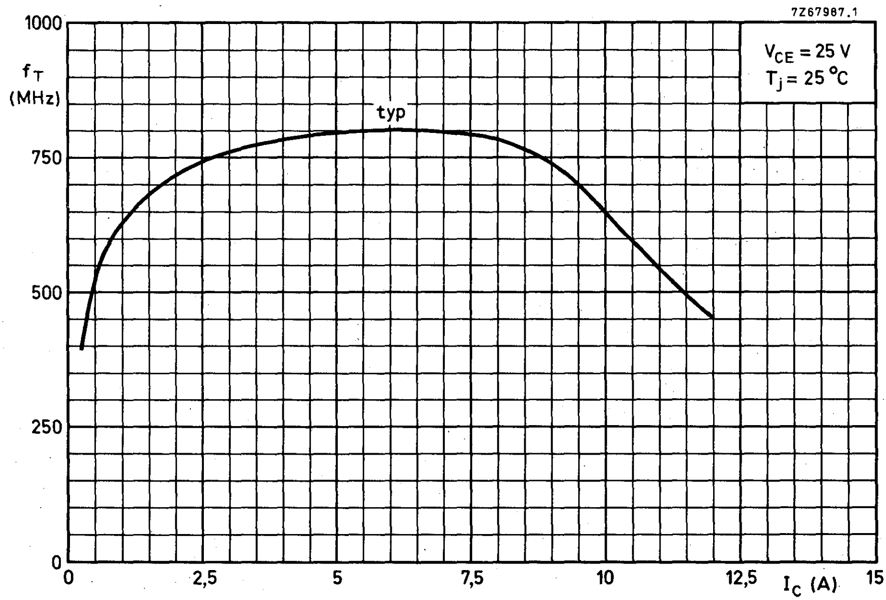
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	60	V
Collector-emitter voltage R_{BE} = 10 Ω, I_C = 50 mA	$V_{(BR)CER}$	>	60	V
Collector-emitter voltage open base, I_C = 50 mA	$V_{(BR)CEO}$	>	32	V
Emitter-base voltage open collector, I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8,0	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	8,0	mWs
D.C. current gain				
I_C = 2,0 A; V_{CE} = 25 V	h_{FE}	> typ.	20 45	
Transition frequency				
I_C = 6,0 A; V_{CE} = 25 V	f_T	typ.	800	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ. <	95 120	pF pF
Feedback capacitance at f = 1 MHz				
I_C = 0,2 A; V_{CE} = 30 V	C_{re}	typ.	55	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67984.1
V_{CE} = 25 V
T_j = 25 °C
h_{FE}
75
50
25
0
typ
0
1
2
I_C (A)


7Z67986.1
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c (pF)
300
200
100
0
typ
0
20
40
V_{CB} (V)

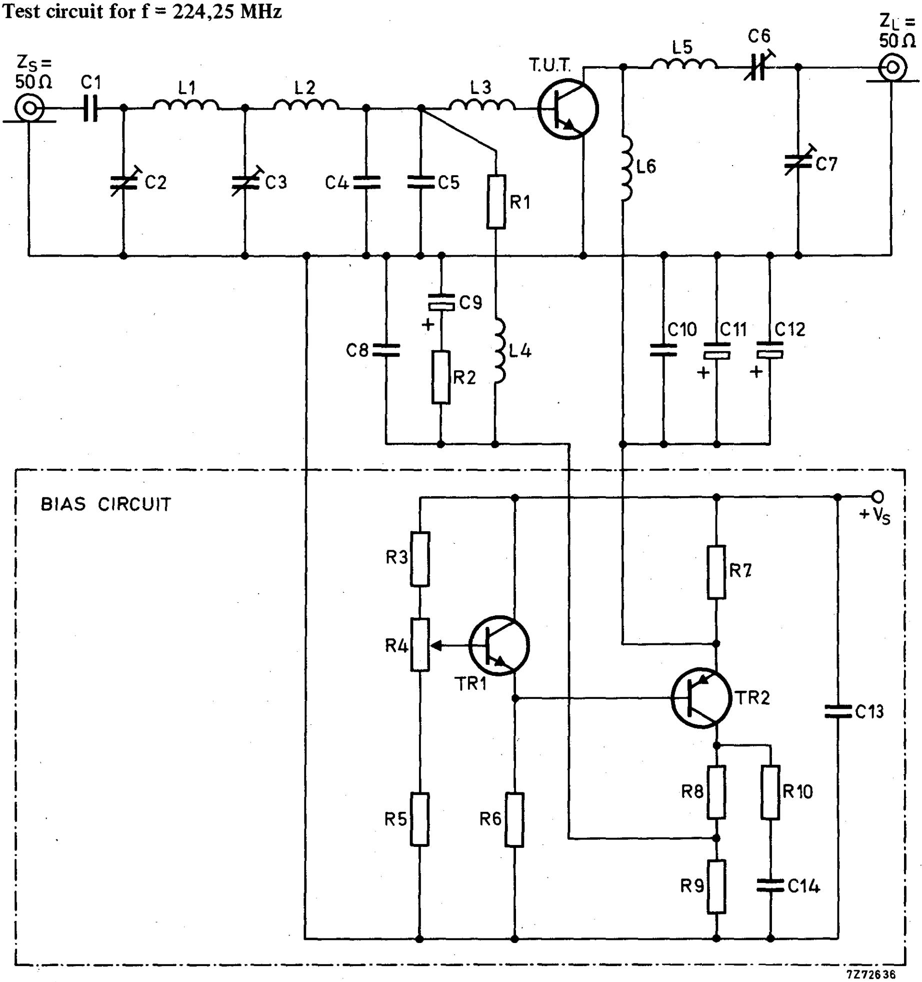

7Z67987.1
V_{CE} = 25 V
T_j = 25 °C
f_T (MHz)
1000
750
500
250
0
typ
0
2,5
5
7,5
10
12,5
15
I_C (A)

APPLICATION INFORMATION

d_{im} *) (dB)	f_{vision} (MHz)	V_{CE} (V)	I_C (A)	G_p (dB)	P_o sync *) (W)	T_h (°C)	$R_{th\ mb-h}$ (°C/W)
−55	224, 25	25	2, 4	> 8, 0	> 14, 0	70	≤ 0, 3
−52	224, 25	25	2, 4	> 8, 0	typ. 19, 5	70	≤ 0, 3

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit for f = 224,25 MHz



List of components: see page 6.

Component layout and printed-circuit board for f = 224, 25 MHz test circuit on page 7.

APPLICATION INFORMATION (continued)

List of components:

TR1 = BD135
TR2 = BD136

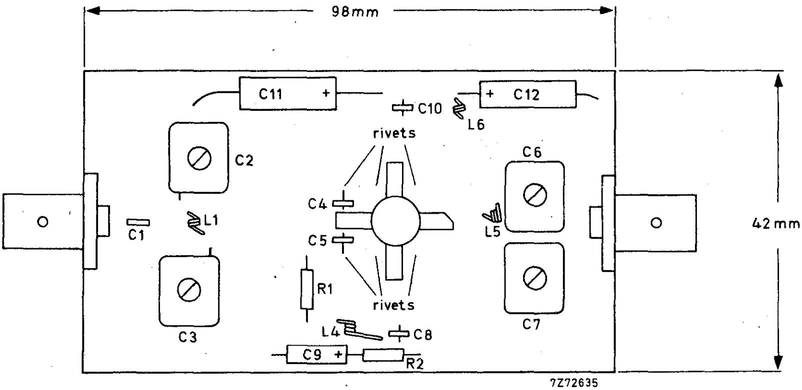
C1 = 220 pF ceramic plate capacitor
C2 = 4 to 40 pF film dielectric trimmer
C3 = 5 to 60 pF film dielectric trimmer
C4 = C5 = 82 pF chip capacitor, placed 1 mm from transistor edge
C6 = 7 to 100 pF film dielectric trimmer
C7 = 4 to 40 pF film dielectric trimmer
C8 = C10 = 820 pF chip capacitor
C9 = 220 μF electrolytic capacitor 10 V
C11 = 47 μF electrolytic capacitor 40 V
C12 = 47 μF electrolytic capacitor 40 V
C13 = 100 nF polyester capacitor
C14 = 33 nF polyester capacitor

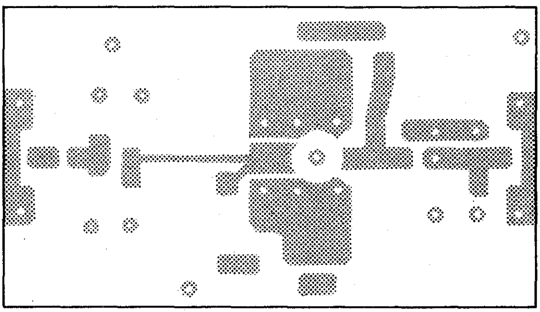
L1 = 24,7 nH; 1,5 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4,5 mm; leads 2 x 5 mm.
L2 = 8,3 nH formed by metallization on printed-circuit board
L3 = 0,7 nH formed by metallization on printed-circuit board
L4 = 100 nH; 3,5 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 5,5 mm; leads 2 x 5 mm.
L5 = 15,0 nH; 1 turn enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; leads 2 x 8 mm.
L6 = 26,4 nH; 1,5 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 5,1 mm; leads 2 x 10 mm.

R1 = 4,7 Ω carbon resistor
R2 = 15 Ω carbon resistor
R3 = 180 Ω carbon resistor (1 W)
R4 = 470 Ω potentiometer
R5 = 4,7 kΩ carbon resistor
R6 = 2,7 kΩ carbon resistor
R7 = 4 x 4,7 Ω (2 W); in parallel
R8 = 150 Ω (5,5 W)
R9 = 68 Ω carbon resistor (1 W)
R10 = 10 Ω carbon resistor

APPLICATION INFORMATION (continued)

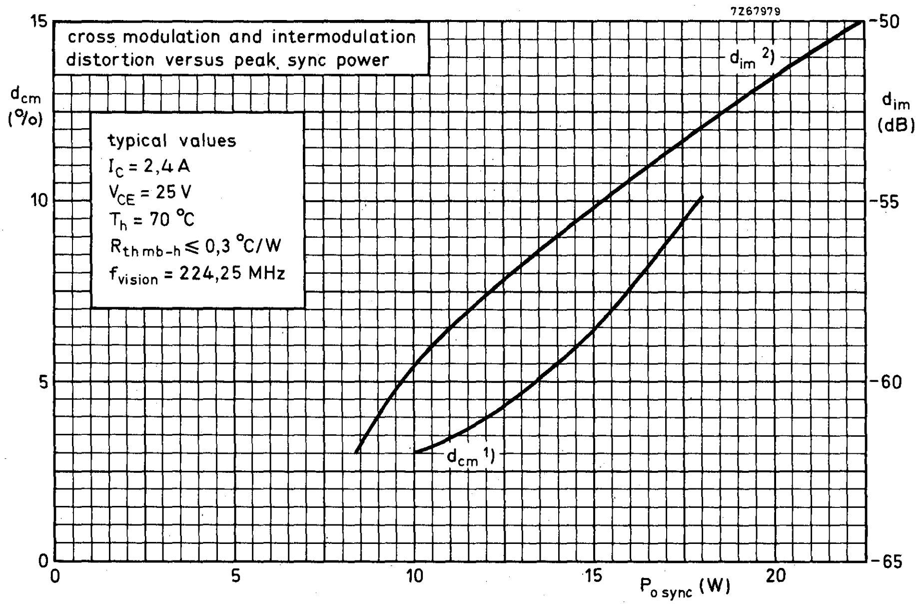
Component layout and printed-circuit board for f = 224, 25 MHz test circuit without bias circuit.





Thickness: 1, 6 mm

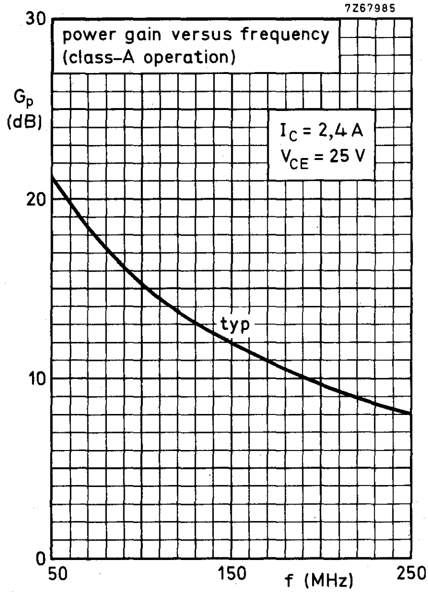
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

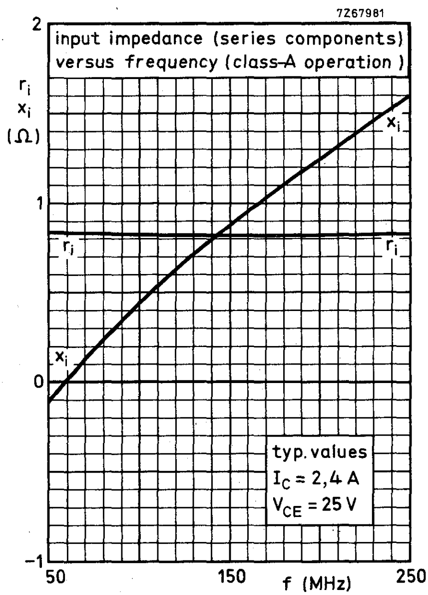


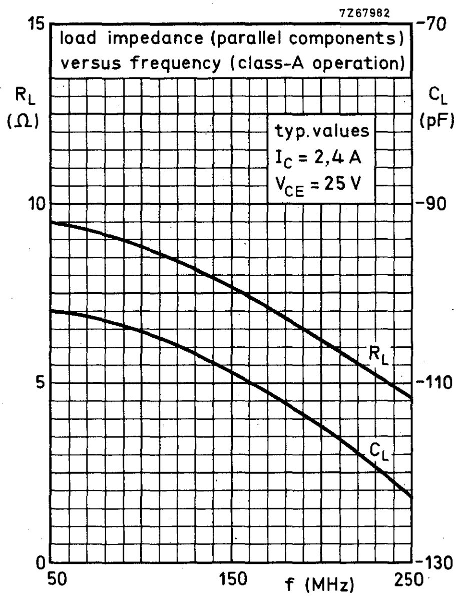
1) Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.

2) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

In the application information a collector-emitter voltage V_{CE} = 25 V and collector current I_C = 2,4 A are recommended.
If a higher collector voltage (within the limiting values) is used, precautions must be taken to ensure that the impedance presented to the collector circuit does not vary excessively with frequency. This is especially important in wideband circuits where a relatively wide variation of load impedance over the frequency band may be expected. Tuning of the output circuit at high level should be avoided or, if essential, it should be performed very carefully, otherwise very high load impedances may occur during which the maximum ratings of the transistor can be exceeded.


7Z67985
power gain versus frequency
(class-A operation)
G_p
(dB)
I_C = 2,4 A
V_{CE} = 25 V
typ
30
20
10
0
50
150
250
f (MHz)


7Z67981
input impedance (series components)
versus frequency (class-A operation)
r_i
x_i
(Ω)
typ. values
I_C = 2,4 A
V_{CE} = 25 V
2
1
0
−1
50
150
250
f (MHz)


7Z67982
load impedance (parallel components)
versus frequency (class-A operation)
R_L
(Ω)
C_L
(pF)
typ. values
I_C = 2,4 A
V_{CE} = 25 V
15
10
5
0
−70
−90
−110
−130
50
150
250
f (MHz)

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched h_{FE} groups.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3 dB
s.s.b. (class-AB)	**28**	**0,05**	**1,6–28**	**8–80 (P.E.P.)**	**> 13**	**> 35***	**< –30**
c.w. (class-B)	28	–	108	80	typ. 7,9	typ. 70	–

* At 80 W P.E.P.

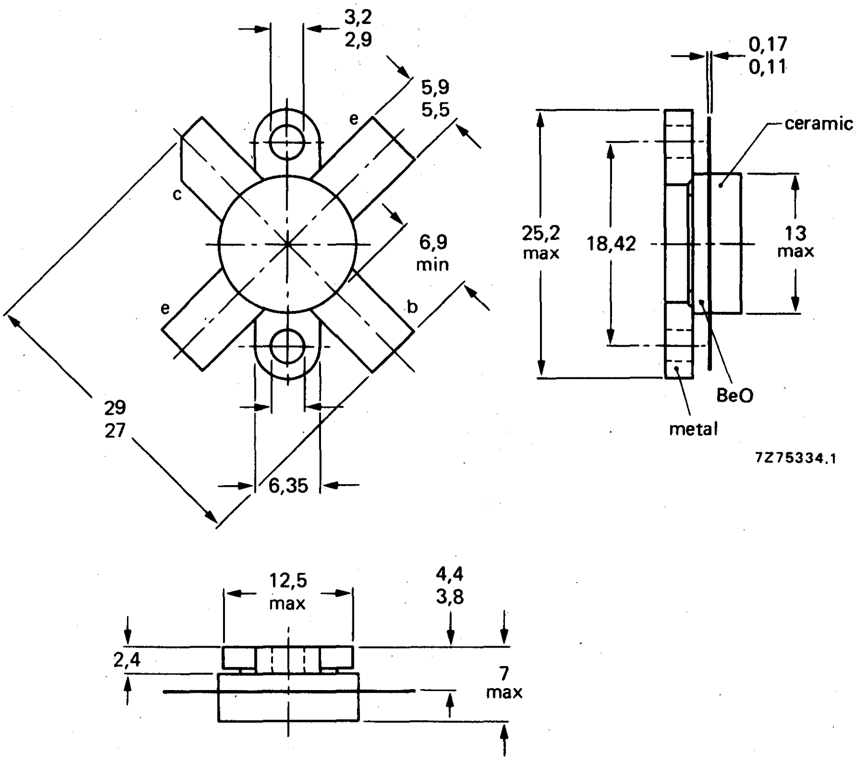
MECHANICAL DATA

SOT-121A (see page 2)

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT–121A.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	70 V
Collector-emitter voltage (open base)	V_{CEO}	max.	35 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	8 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	20 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	140 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

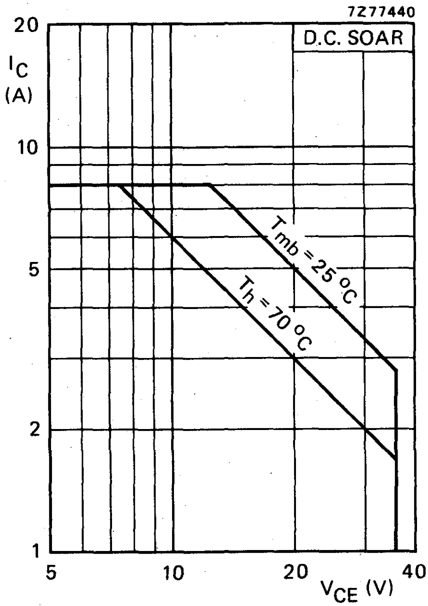


Fig. 2 D.C. SOAR.

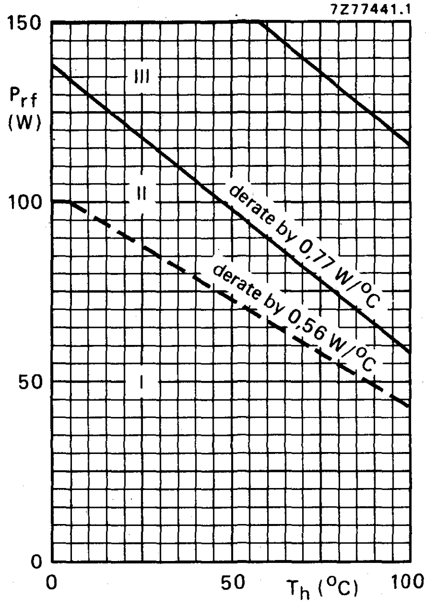


Fig. 3 R.F. power dissipation; $V_{CE} \leq$ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 60 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,92 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,33 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 °C/W

CHARACTERISTICS

$T_j = 25\ ^{o}C$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	70 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	35 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 35$ V	I_{CES}	<	10 mA
D.C. current gain* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}		15 to 80
D.C. current gain ratio of matched devices* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* $I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ.	2,5 V
Transition frequency at f = 100 MHz* $-I_E = 4$ A; $V_{CB} = 28$ V	f_T	typ.	315 MHz
$-I_E = 12,5$ A; $V_{CB} = 28$ V	f_T	typ.	305 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	125 pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 28$ V	C_{re}	typ.	85 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

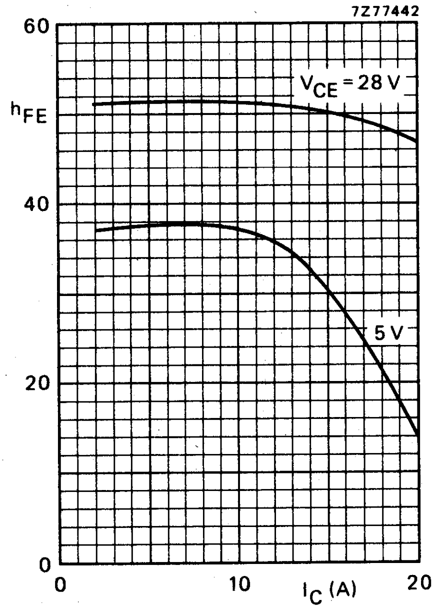


Fig. 4 Typical values; T_j = 25 °C.

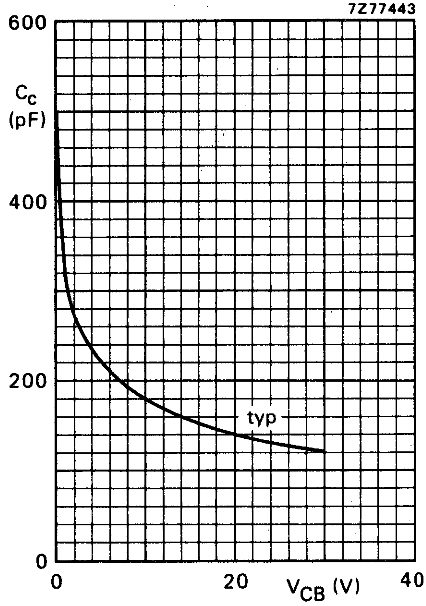


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

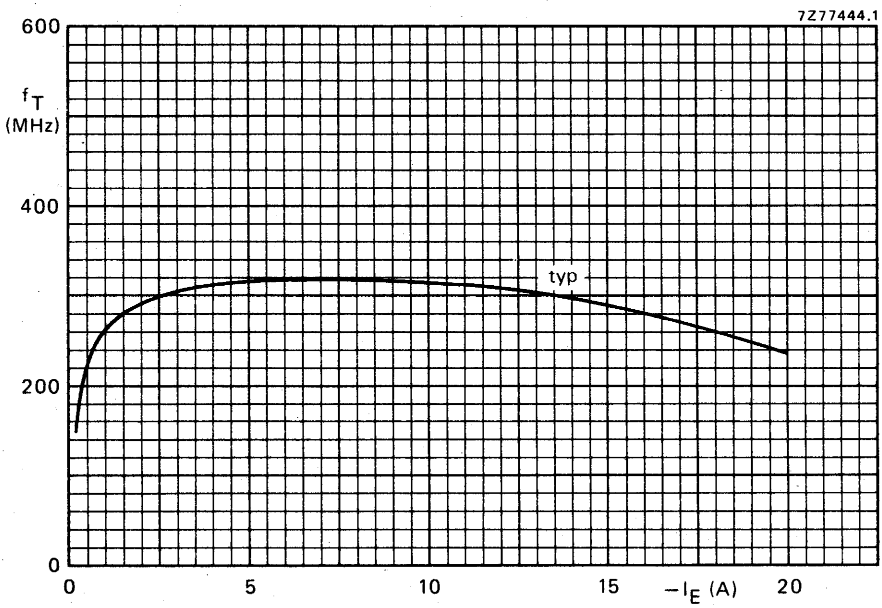


Fig. 6 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 80 W P.E.P.	I_C(A) at 80 W P.E.P.	d_3 dB	d_5 dB	$I_{C(ZS)}$ A
8 to 80 (P.E.P.)	**> 13**	**> 35**	**< 4,1**	**< −30**	**< −30**	**0,05**

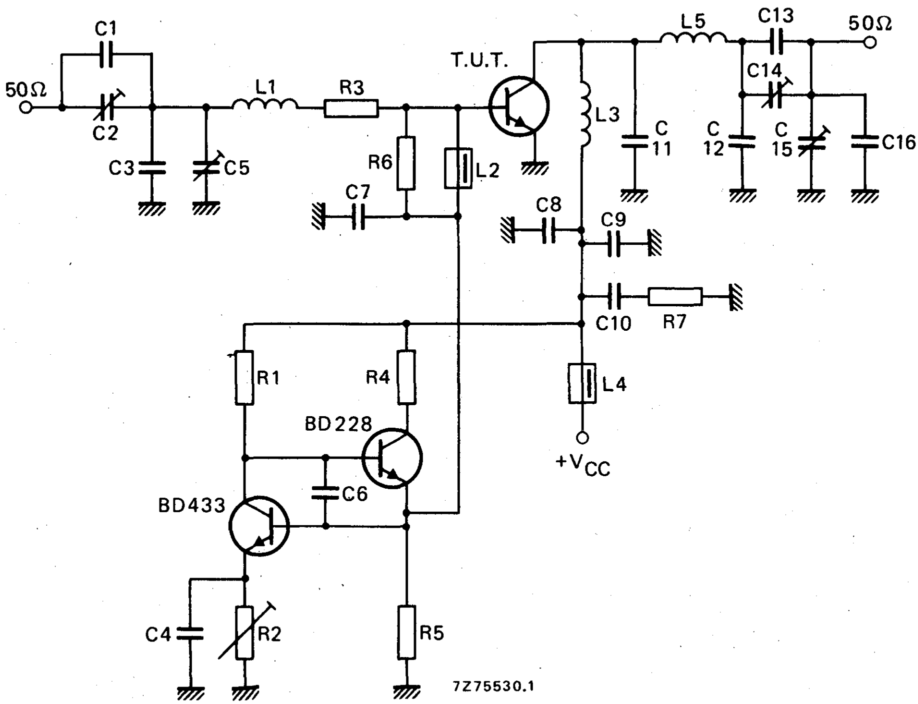


Fig. 7 Test circuit; s.s.b. class-AB.

List of components:

C1 = 27 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 100 pF polystyrene capacitor
C4 = C6 = C9 = 100 nF polyester capacitor
C5 = 280 pF air dielectric trimmer (single non-insulated rotor type)
C7 = C8 = 3,9 nF ceramic capacitor
C10 = 2,2 µF moulded metallized polyester capacitor
C11 = 180 pF polystyrene capacitor
C12 = 2 x 68 pF ceramic capacitors in parallel (500 V)
C13 = 120 pF polystyrene capacitor

C14 = C15 = 280 pF air dielectric trimmer (single insulated rotor type)
C16 = 56 pF ceramic capacitor (500 V)

L1 = 108 nH; 4 turns Cu wire (1,6 mm); int. dia. 8,7 mm; length 11,2 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 88 nH; 3 turns Cu wire (1,6 mm); int. dia. 8,0 mm; length 8,0 mm; leads 2 x 7 mm
L5 = 120 nH; 4 turns Cu wire (1,6 mm); int. dia. 9,3 mm; length 11,2 mm; leads 2 x 7 mm

R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 10 Ω wirewound potentiometer (3 W)
R3 = 0,9 Ω; parallel connection of 2 x 1,8 Ω carbon resistors (± 5%; 0,5 W each)
R4 = 60 Ω; parallel connection of 2 x 120 Ω wirewound resistors (5,5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0,5 W)
R6 = 33 Ω (± 5%) carbon resistor (0,5 W)
R7 = 4,7 Ω (± 5%) carbon resistor (0,5 W)

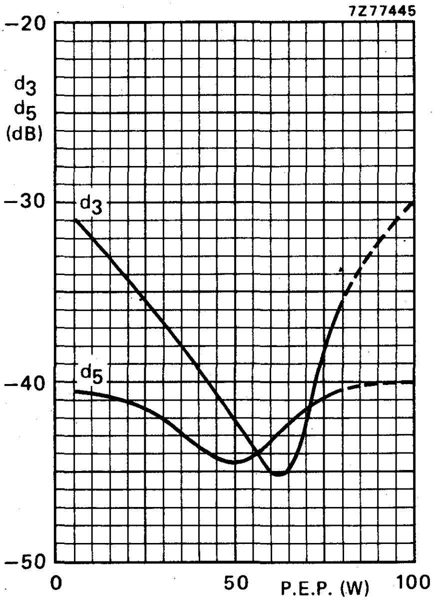


Fig. 8 Intermodulation distortion as a function of output power.*

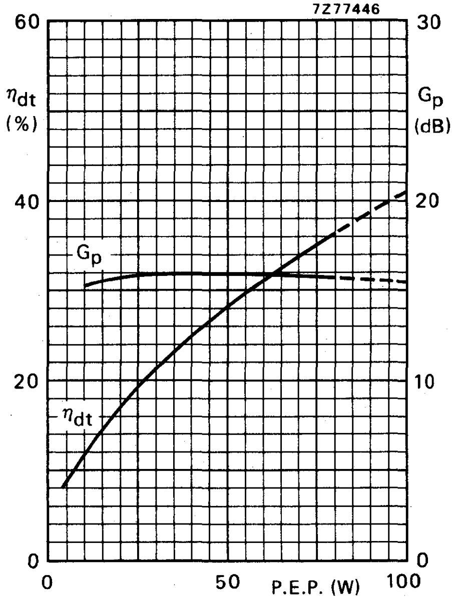


Fig. 9 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 8 and 9:
V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

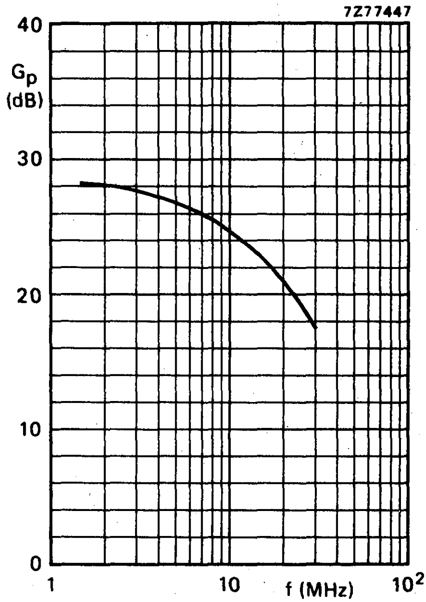


Fig. 10 Power gain as a function of frequency.

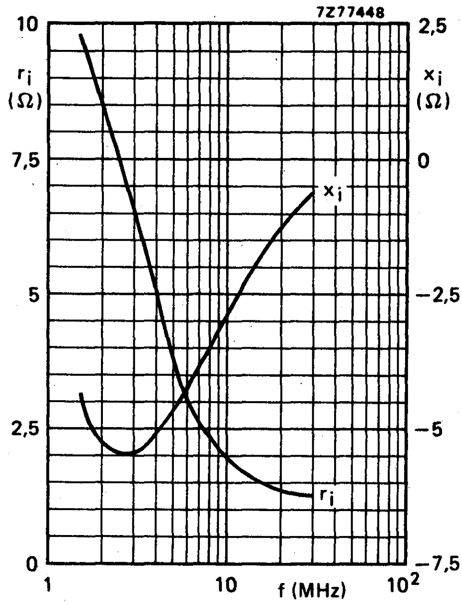


Fig. 11 Input impedance (series components) as a function of frequency.

Figs 10 and 11 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 80 W; T_h = 25 °C; Z_L = 3,9 Ω.

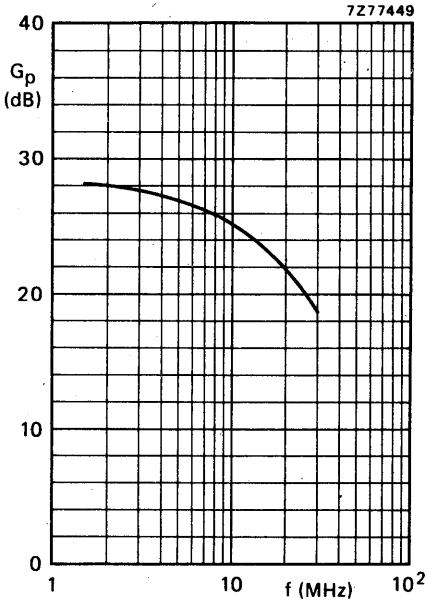


Fig. 12 Power gain as a function of frequency.

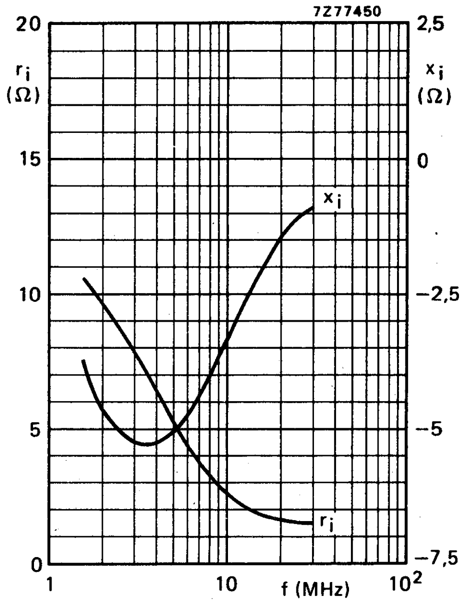


Fig. 13 Input impedance (series components) as a function of frequency.

Figs 12 and 13 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 80 W; T_h = 25 °C; Z_L = 3,9 Ω; neutralizing capacitor: 68 pF.

APPLICATION INFORMATION (continued)

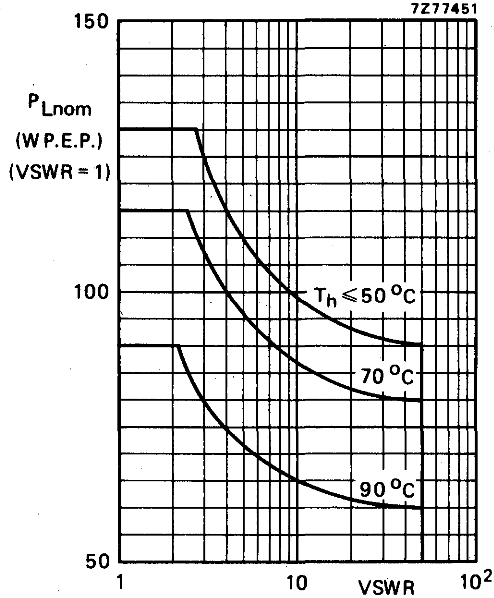


Fig. 14 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 °C/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
108	**28**	**80**	typ. **13**	typ. **7,9**	typ. **4,1**	typ. **70**	**0,85 + j1,0**	**174 – j40**

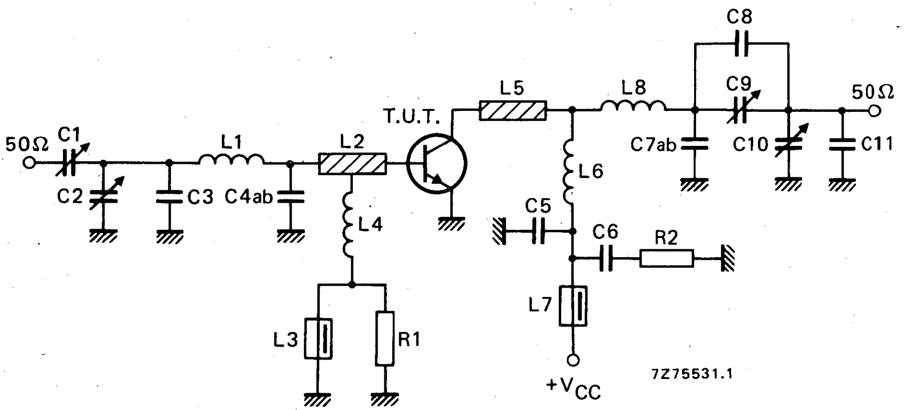


Fig. 15 Test circuit; c.w. class-B.

List of components:

C1 = C9 = C10 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 22 pF ceramic capacitor (500 V)
C4ab = 2 x 82 pF ceramic capacitors in parallel (500 V)
C5 = 270 pF polystyrene capacitor
C6 = 100 nF polyester capacitor
C7a = 8,2 pF ceramic capacitor (500 V)
C7b = 10 pF ceramic capacitor (500 V)
C 8 = 5,6 pF ceramic capacitor (500 V)
C11 = 10 pF ceramic capacitor (500 V)

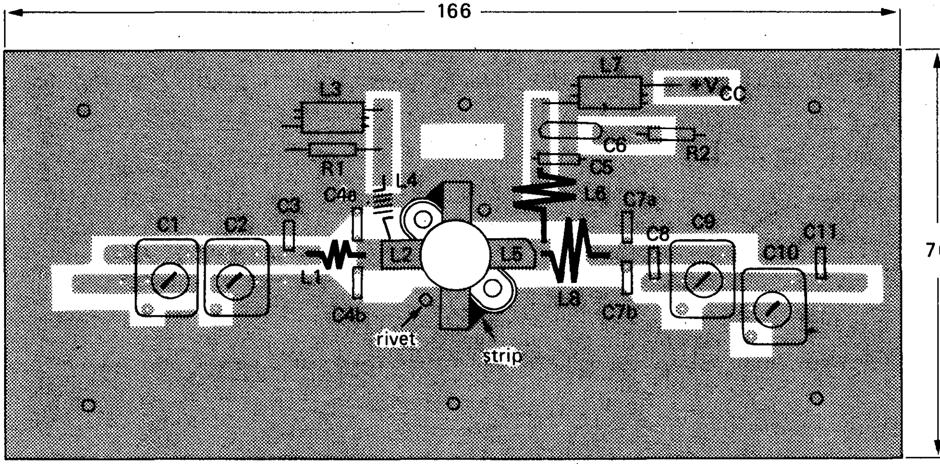
L1 = 21 nH; 2 turns Cu wire (1,0 mm); int. dia. 4,0 mm; length 3,5 mm; leads 2 x 5 mm
L2 = L5 = 2,4 nH; strip (12 mm x 6 mm); tap for L4 at 6 mm from transistor
L3 = L 7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 49 nH; 2 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 4,7 mm; leads 2 x 5 mm
L8 = 56 nH; 2 turns Cu wire (1,6 mm); int. dia. 10,0 mm; length 4,5 mm; leads 2 x 5 mm

L2 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.

R1 = R2 = 10 Ω (± 10%) carbon resistor

Component layout and printed-circuit board for 108 MHz test circuit are shown in Fig. 16.

APPLICATION INFORMATION (continued)



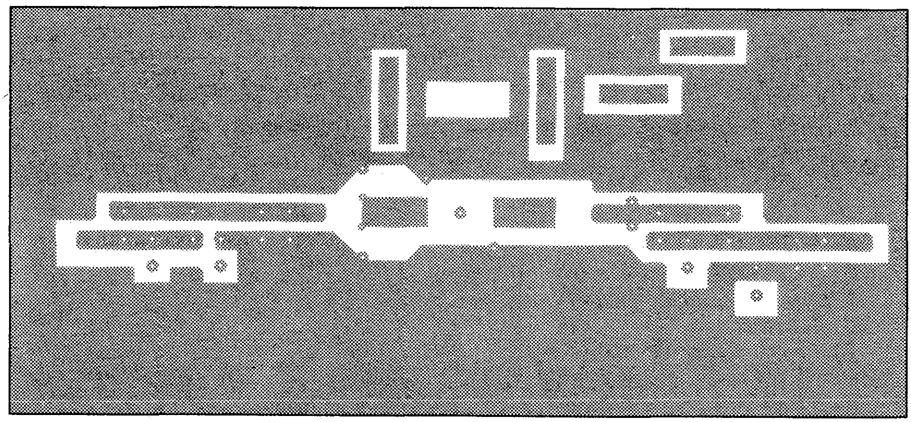


Fig. 16 Component layout and printed-circuit board for 108 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

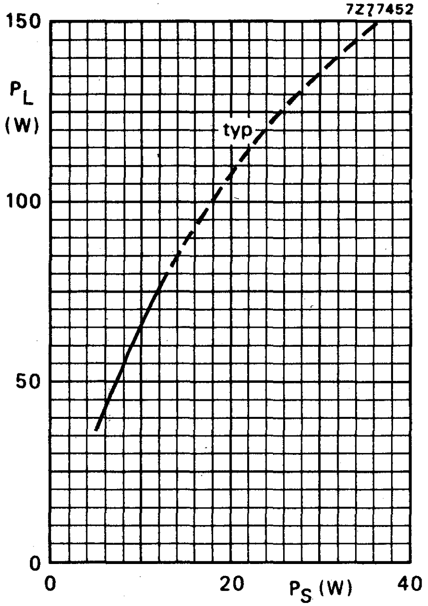


Fig. 17 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C.

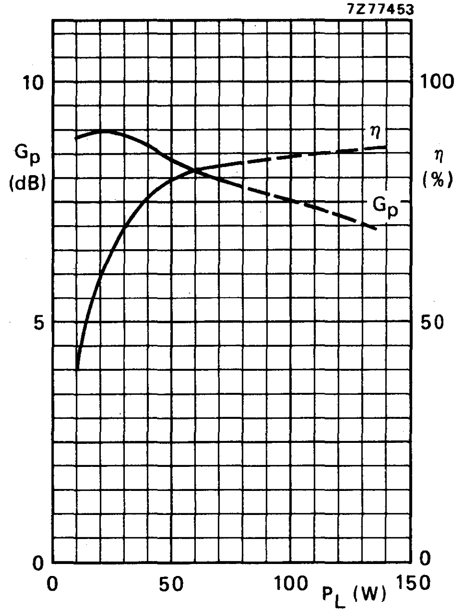


Fig. 18 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C; typical values.

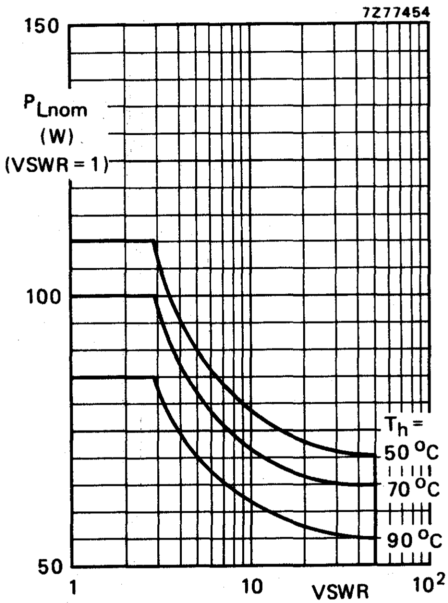


Fig. 19 R.F. SOAR; c.w. class-B operation; f = 108 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

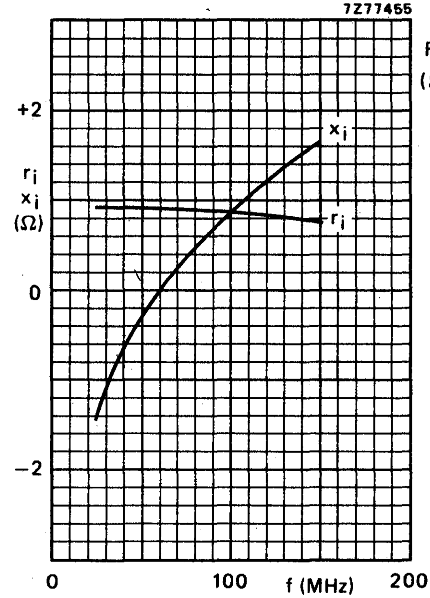


Fig. 20 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C typical values.

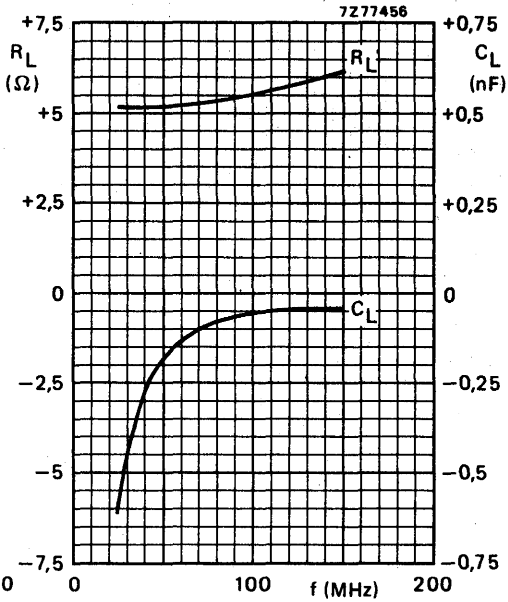


Fig. 21 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C; typical values.

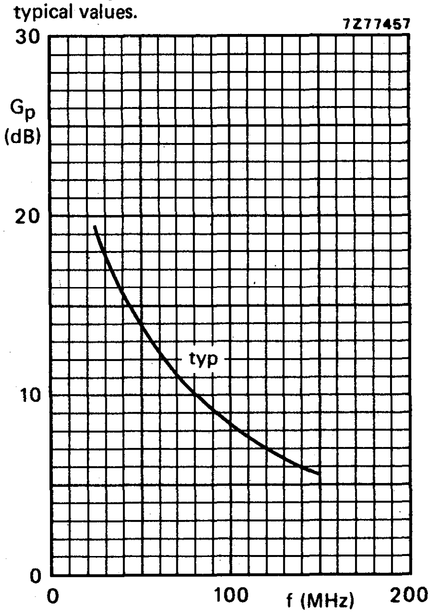


Fig. 22 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched h_{FE} groups.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3 dB
s.s.b. (class-AB)	**28**	**0,1**	**1,6–28**	**15–130** (P.E.P.)	**> 12**	**> 37,5***	**< –30**
c.w. (class-B)	28	–	87,5	130	typ. 7,5	typ. 75	–

* At 130 W P.E.P.

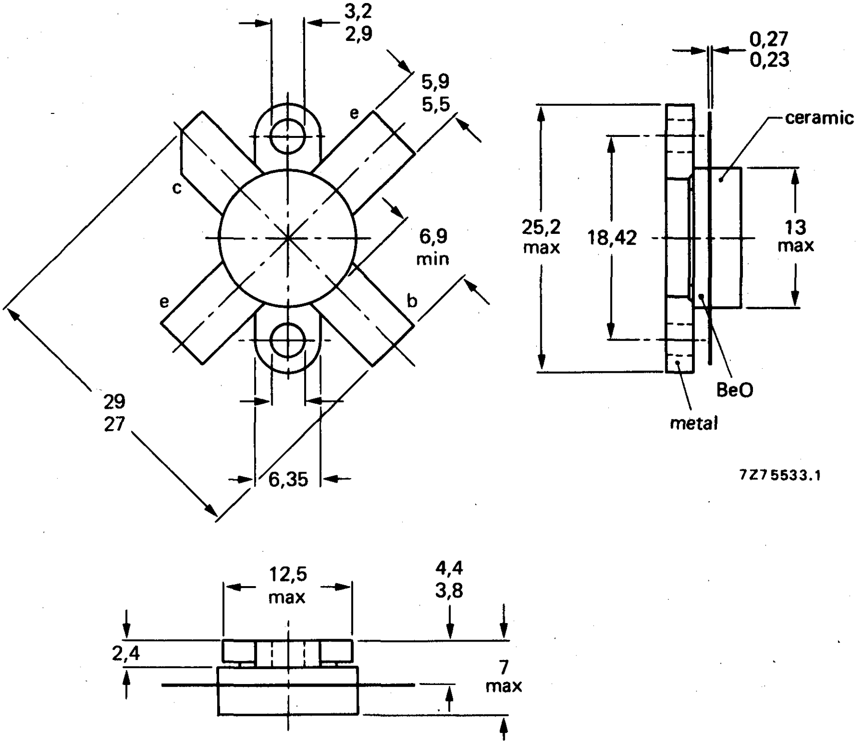
MECHANICAL DATA

SOT-121B (see page 2)

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT–121B.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	70 V
Collector-emitter voltage (open base)	V_{CEO}	max.	35 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	12 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	30 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	245 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

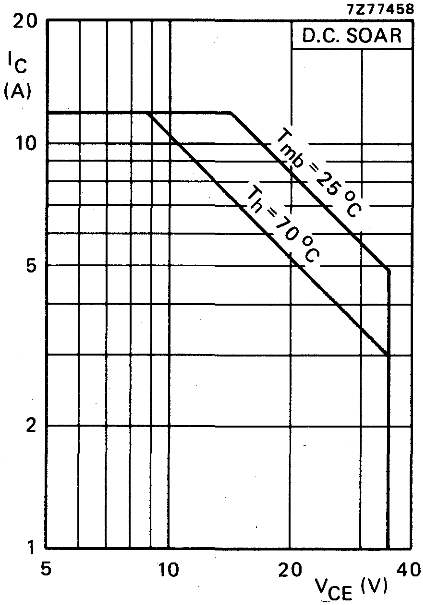


Fig. 2 D.C. SOAR.

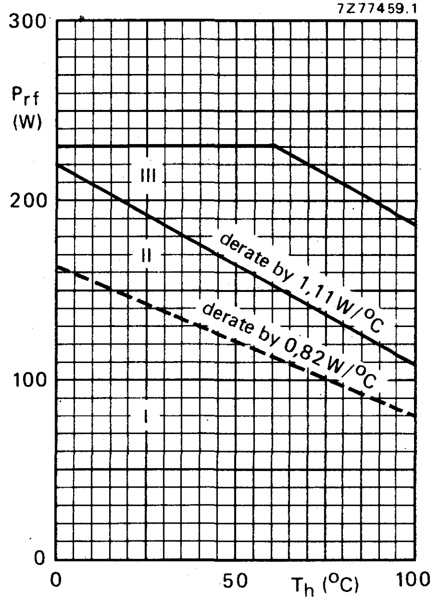


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 90 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,03 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,71 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	70 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	35 V
Emitter-base breakdown voltage open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 35$ V	I_{CES}	<	20 mA
D.C. current gain* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE}		15 to 80
D.C. current gain ratio of matched devices* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* $I_C = 20$ A; $I_B = 4$ A	V_{CEsat}	typ.	2 V
Transition frequency at f = 100 MHz* $-I_E = 7$ A; $V_{CB} = 28$ V	f_T	typ.	320 MHz
$-I_E = 20$ A; $V_{CB} = 28$ V	f_T	typ.	300 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	255 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	175 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

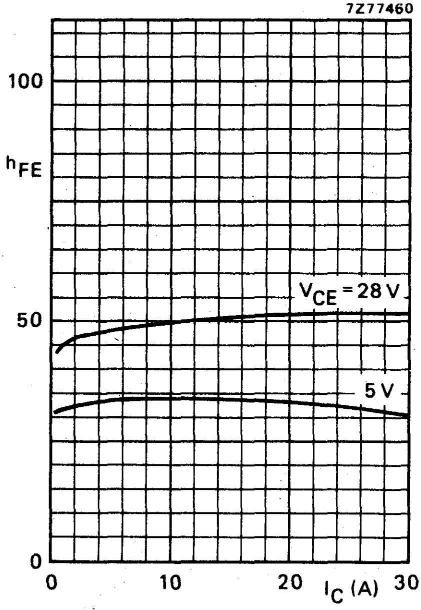


Fig. 4 Typical values; T_j = 25 °C.

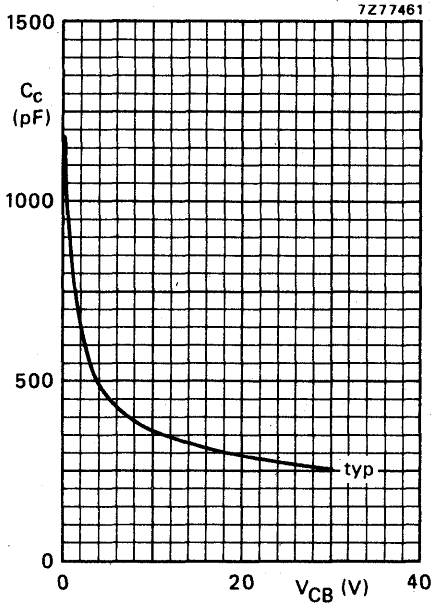


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

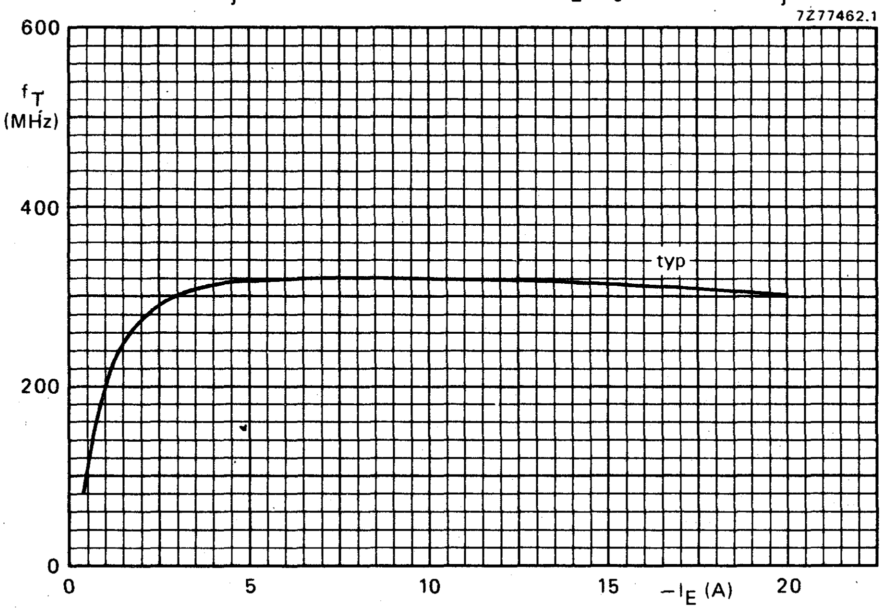


Fig. 6 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 130 W P.E.P.	I_C (A) at 130 W P.E.P.	d_3 dB	d_5 dB	$I_{C(ZS)}$ A
15 to 130 (P.E.P.)	> **12**	> **37,5**	< **6,2**	< **–30**	< **–30**	**0,1**

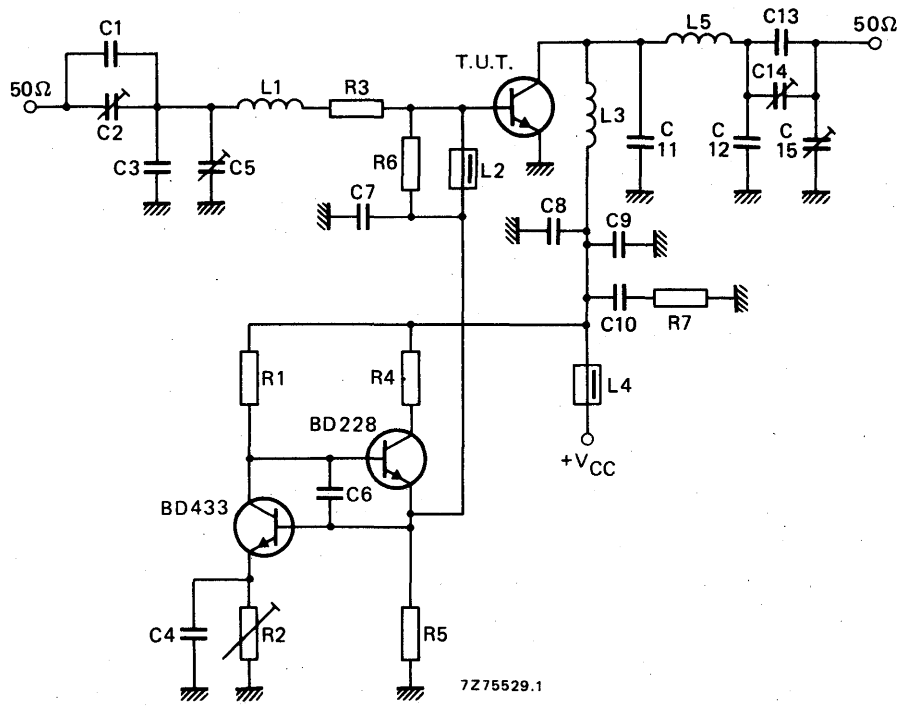


Fig. 7 Test circuit; s.s.b. class-AB.

List of components:

C1 = 27 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 180 pF polystyrene capacitor
C4 = C6 = C9 = 100 nF polyester capacitor
C5 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C7 = C8 = 3,9 nF ceramic capacitor
C10 = 2,2 μF moulded metallized polyester capacitor
C11 = 2 x 180 pF polysterene capacitors in parallel
C12 = 3 x 56 pF and 33 pF ceramic capacitors in parallel (500 V)
C13 = 4 x 56 pF and 68 pF ceramic capacitors in parallel (500 V)

C14 = 360 pF air dielectric trimmer (single insulated rotor type)
C15 = 360 pF air dielectric trimmer (single non-insulated rotor type)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L5 = 80 nH; 2,5 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 10,0 mm; leads 2 x 7 mm

R1 = 470 Ω wirewound resistor (5,5 W)
R2 = 4,7 Ω wirewound potentiometer (3 W)
R3 = 0,55 Ω; parallel connection of 4 x 2,2 Ω carbon resistors (± 5%; 0,5 W each)
R4 = 45 Ω; parallel connection of 4 x 180 Ω wirewound resistors (5,5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0,5 W)
R6 = 27 Ω (± 5%) carbon resistor (0,5 W)
R7 = 4,7 Ω (± 5%) carbon resistor (0,5 W)

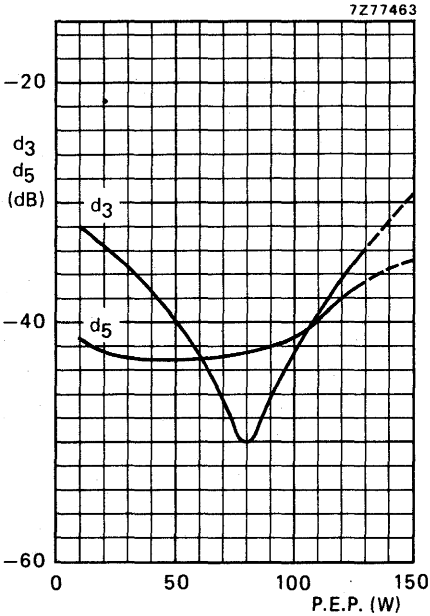


Fig. 8 Intermodulation distortion as a function of output power.*

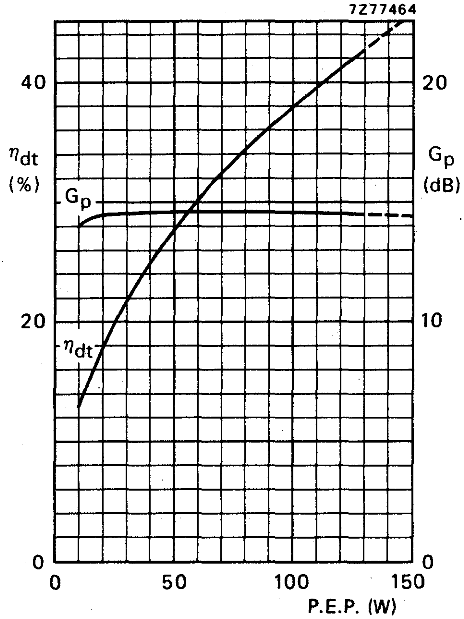


Fig. 9 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 8 and 9:

V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

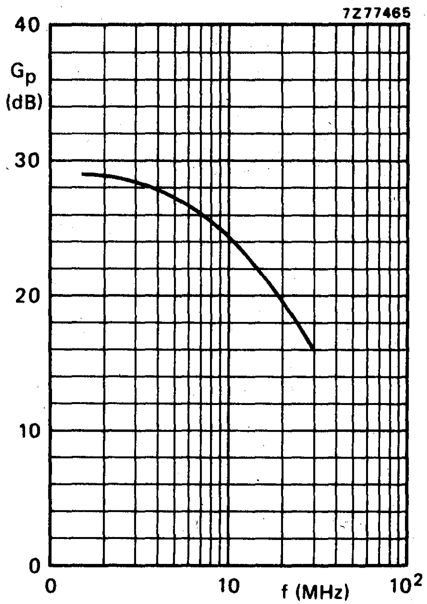


Fig. 10 Power gain as a function of frequency.

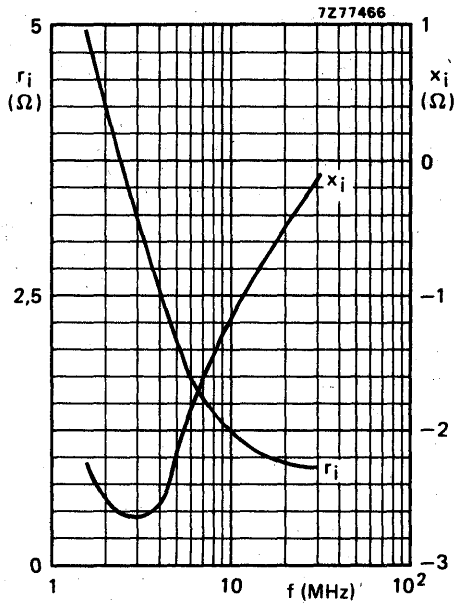


Fig. 11 Input impedance (series components) as a function of frequency.

Figs 10 and 11 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.
Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; P_L = 130 W; T_h = 25 °C; Z_L = 2,5 Ω.

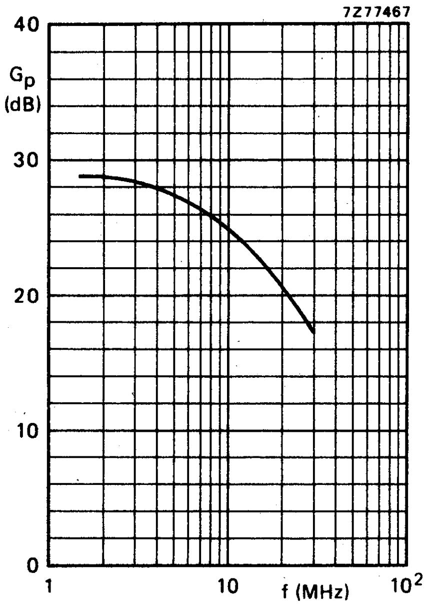


Fig. 12 Power gain as a function of frequency.

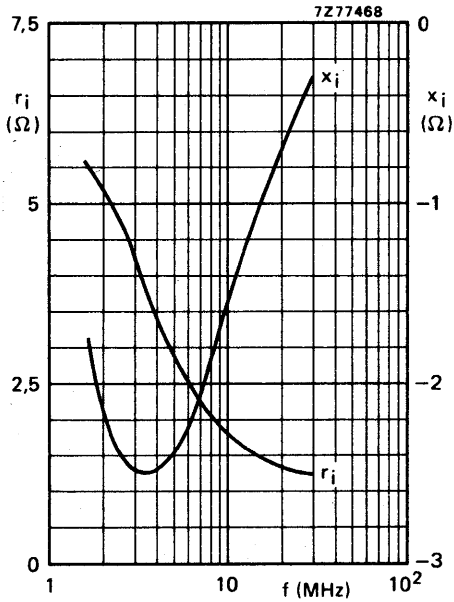


Fig. 13 Input impedance (series components) as a function of frequency.

Figs 12 and 13 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b class-AB operation.

Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; P_L = 130 W; T_h = 25 °C; Z_L = 2,5 Ω; neutralizing capacitor: 150 pF.

APPLICATION INFORMATION (continued)

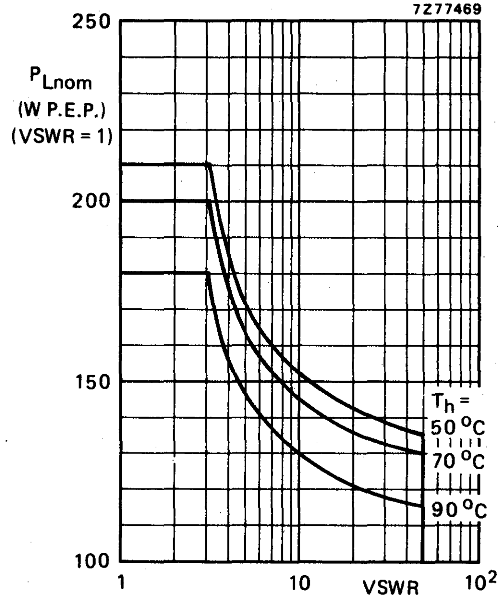


Fig. 14 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 °C/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
T_h = 25 °C

f (MHz)	V_{CE}(V)	P_L (W)	P_S(W)	G_p (dB)	I_C (A)	η (%)	$\bar{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
87,5	28	130	typ. 23,2	typ. 7,5	typ. 6,2	typ. 75	0,62 + j0,73	273 – j42

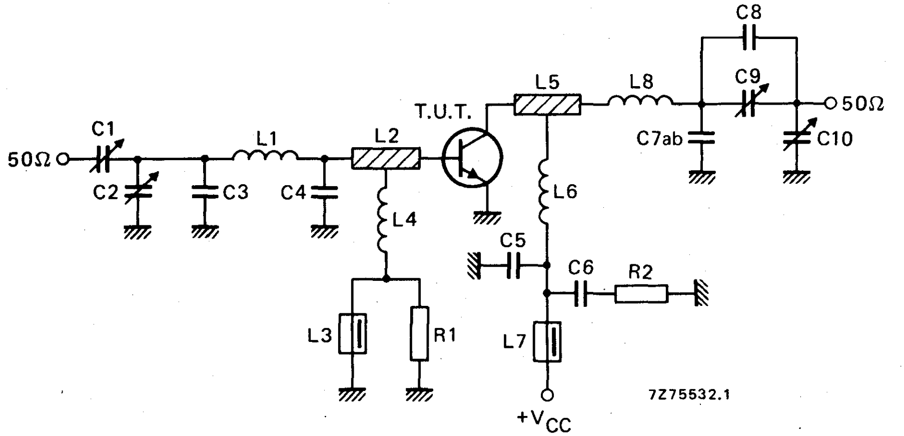


Fig. 15 Test circuit; c.w. class-B.

List of components:

C1 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = C9 = C10 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
C3 = C8 = 22 pF ceramic capacitor (500 V)
C4 = 4 x 82 pF ceramic capacitors in parallel (500 V)
C5 = 390 pF polystyrene capacitor
C6 = 220 nF polyester capacitor
C7a = 2 x 10 pF ceramic capacitors in parallel (500 V)
C7b = 2 x 8,2 pF ceramic capacitors in parallel (500 V)

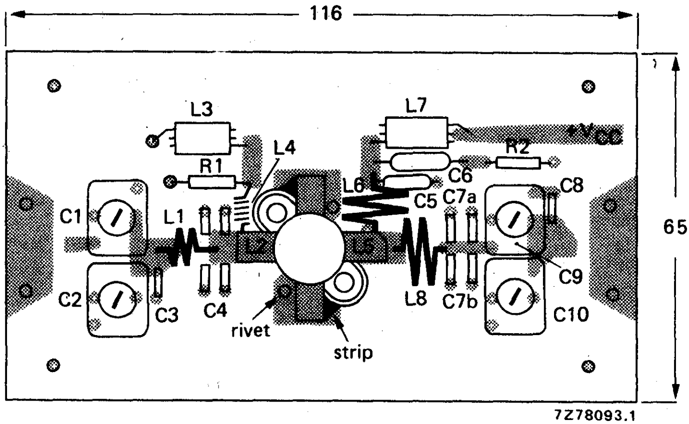
L1 = 25 nH; 2 turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 4,6 mm; leads 2 x 5 mm
L2 = L5 = 2,4 nH; strip (12 mm x 6 mm); tap for L4 and L6 at 5 mm from transistor
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 46 nH; 2 turns Cu wire (2,0 mm); int. dia. 9,0 mm; length 6,0 mm; leads 2 x 5 mm
L8 = 44 nH; 2 turns Cu wire (2,0 mm); int. dia. 9,0 mm; length 6,7 mm; leads 2 x 5 mm

L2 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.

R1 = 10 Ω (± 10%) carbon resistor
R2 = 4,7 Ω (± 10%) carbon resistor

Component layout and printed-circuit board for 87,5 MHz test circuit are shown in Fig. 16.

APPLICATION INFORMATION (continued)



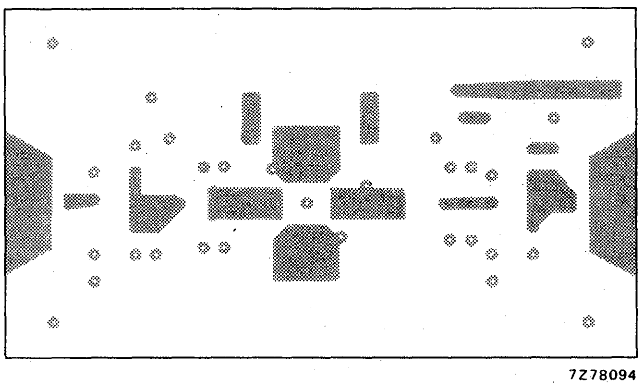


Fig. 16 Component layout and printed-circuit board for 87,5 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

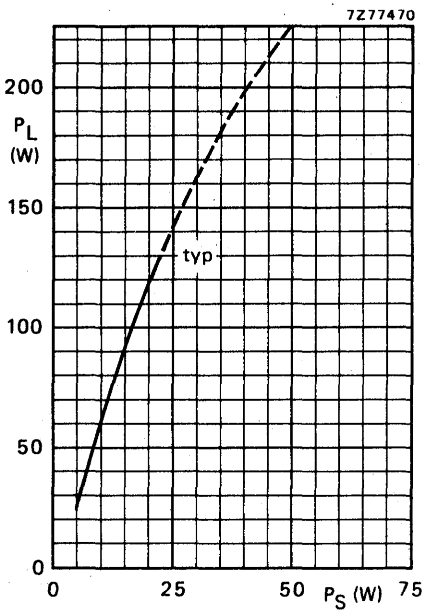


Fig. 17 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C.

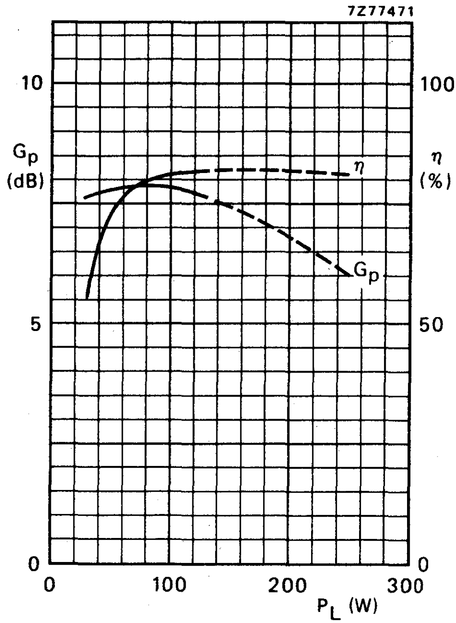


Fig. 18 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C; typical values.

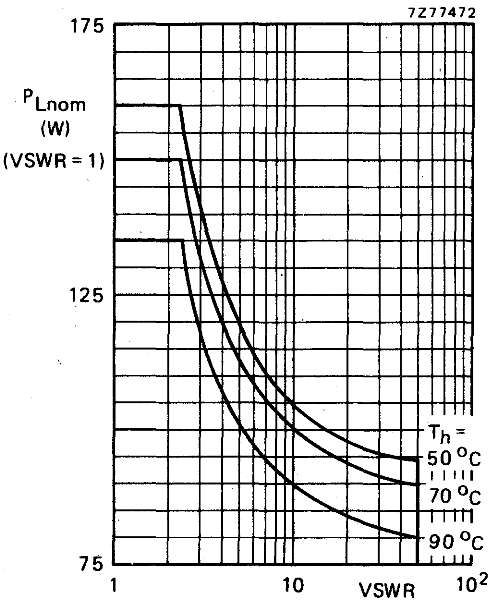


Fig. 19 R.F. SOAR; c.w. class-B operation; f = 87,5 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

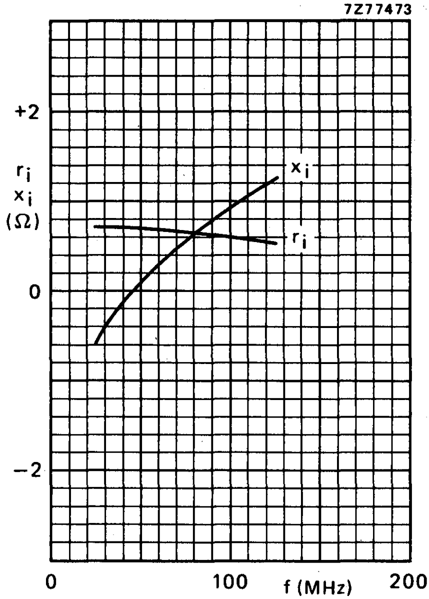


Fig. 20 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

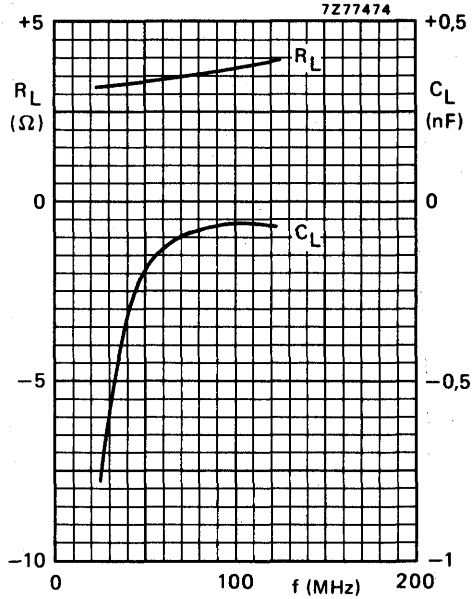


Fig. 21 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

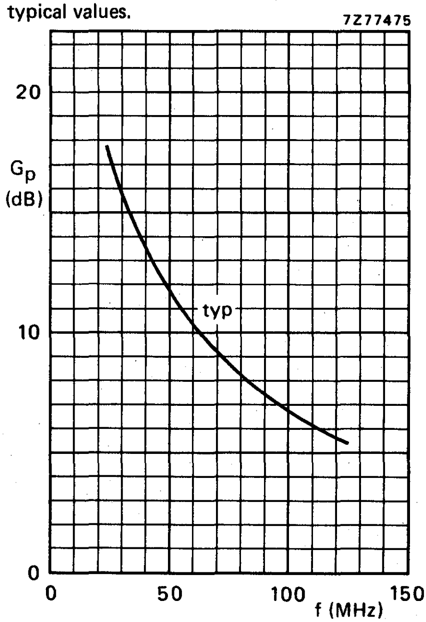


Fig. 22 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB or B operated mobile, industrial and military transmitters in the h.f. and v.h.f. bands. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	P_S W	G_p dB	η %	d_3 dB
c.w. (class-B)	**28**	**150**	**100**	**< 25**	**> 6**	**> 70**	–
s.s.b. (class-A; I_C = 3 A)	26	28	35 (P.E.P.)	typ. 0,4	typ. 19,5	–	typ. –40

MECHANICAL DATA

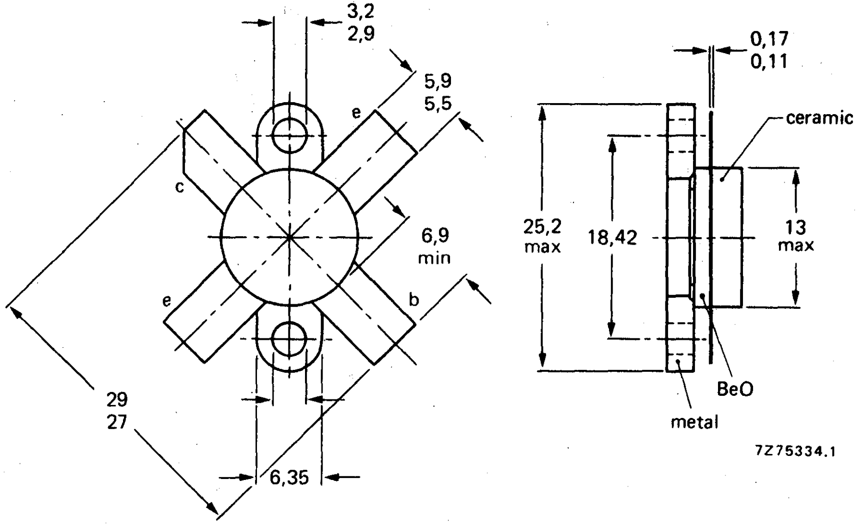
SOT-121A (see page 2)

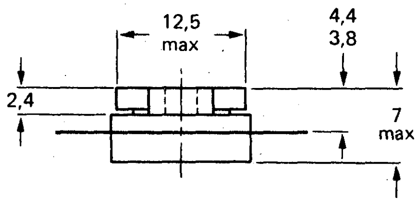
CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121A.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40UNC/2A

Heatsink compound must be applied sparingly and evenly.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	70 V
Collector-emitter voltage (open base)	V_{CEO}	max.	35 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	10 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	25 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C)	P_{rf}	max.	160 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

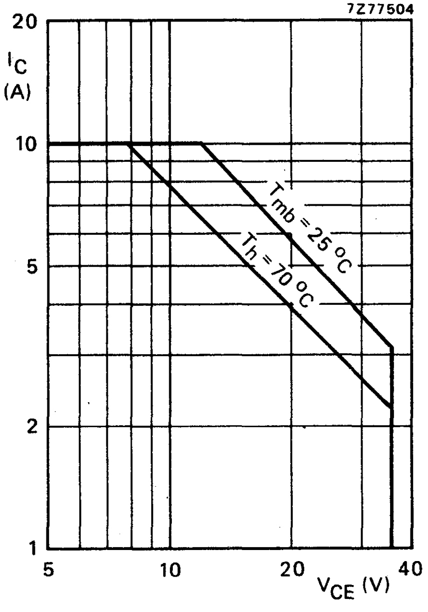


Fig. 2 D.C. SOAR.

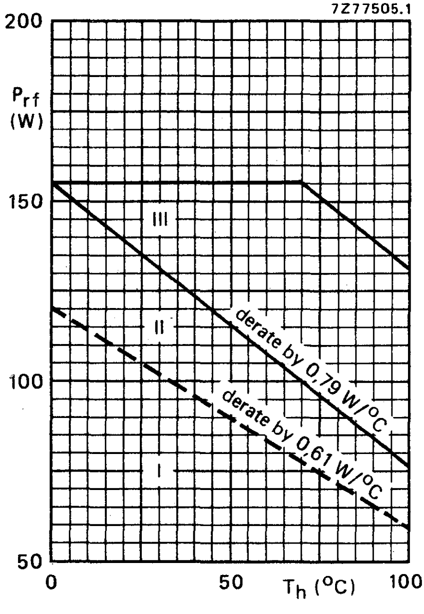


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 80 W; T_{mb} = 86 °C; i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,45 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,06 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	70 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	35 V
Emitter-base breakdown voltage open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 35$ V	I_{CES}	<	5 mA
D.C. current gain* $I_C = 5$ A; $V_{CE} = 5$ V	h_{FE}		20 to 85
Collector-emitter saturation voltage $I_C = 15$ A; $I_B = 3$ A	V_{CEsat}	typ.	2 V
Transition frequency at f = 100 MHz* $-I_E = 5$ A; $V_{CB} = 28$ V	f_T	typ.	370 MHz
$-I_E = 15$ A; $V_{CB} = 28$ V	f_T	typ.	350 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	155 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	102 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

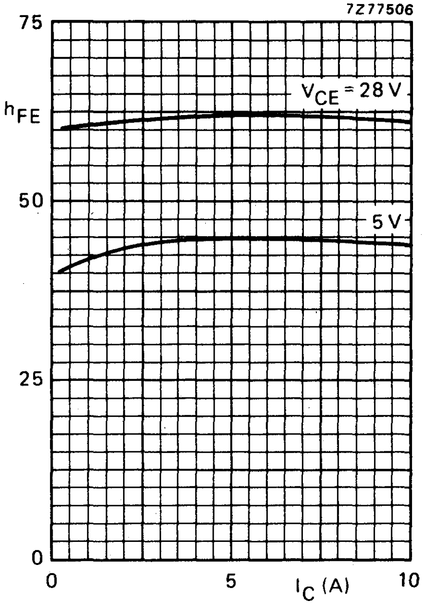


Fig. 4 Typical values; T_j = 25 °C.

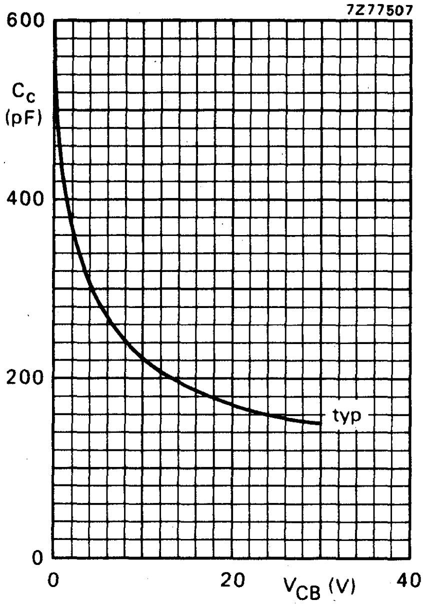


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

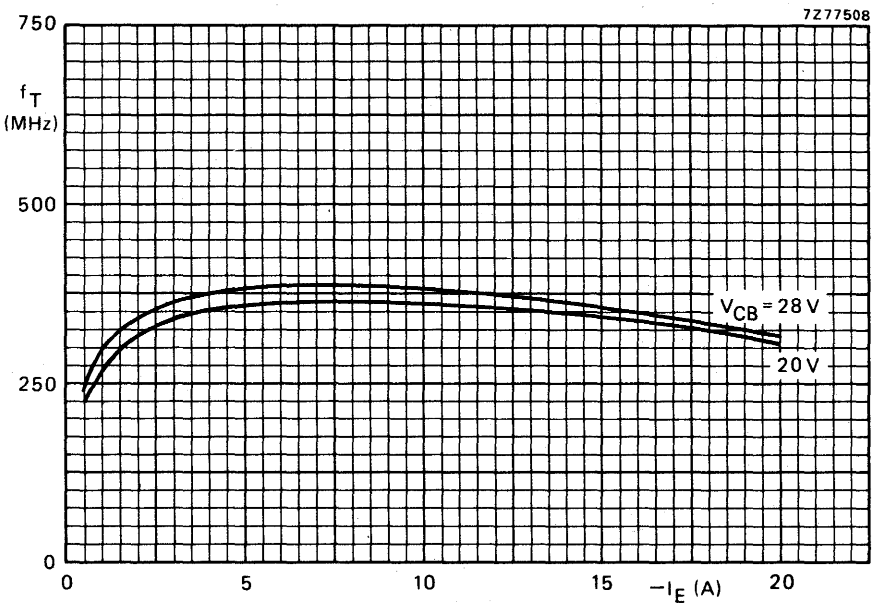


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit); T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_D (W)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
150	28	100	≤ 25	≥ 70	0,73 + j1,35	225 − j35

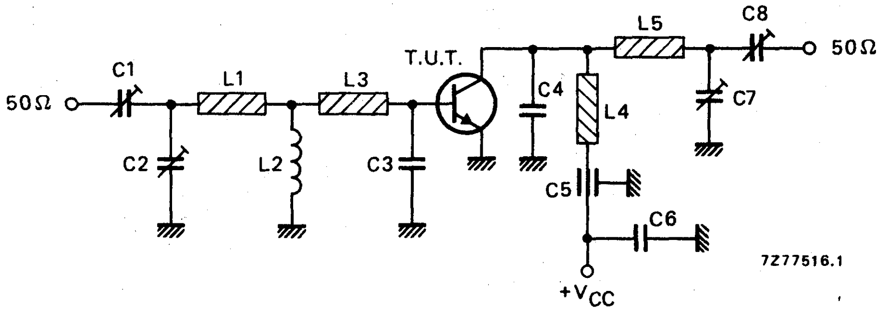


Fig. 7 Test circuit; c.w. class-B; f = 150 MHz.

List of components:

C1 = C2 = C7 = C8 = 5 to 100 pF film dielectric trimmer
C3 = 203 pF; 2 x 82 pF and 39 pF ceramic capacitors in parallel (500 V)
C4 = 39 pF ceramic capacitor (500 V)
C5 = 1 nF feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = strip (30 mm x 8 mm); bent to form inverted 'U' shape with top 15 mm above heatsink, and bottom 5 mm above heatsink
L2 = 1 μH r.f. choke
L3 = strip; shape as shown in Fig. 8; 5 mm above heatsink
L4 = strip (40 mm x 8 mm); bent in form ⎽⎽⎾⎺⎺⎺, 25 mm at 15 mm above heatsink, 5 mm at 5 mm above heatsink
L5 = strip (75 mm long; width 8 mm); 5 mm above base

L1, L3, L4, and L5 are copper strips with a thickness of 0,6 mm.

Heatsink: aluminium; 0,9 °C/W

At P_L = 100 W and V_{CE} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 0,12 W/°C.

Component layout on an aluminium heatsink for 150 MHz test circuit is shown in Fig. 8.

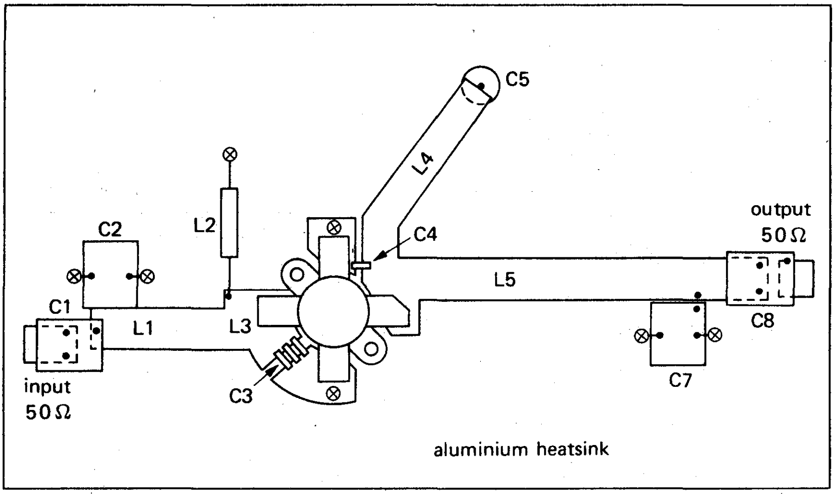


Fig. 8 Component layout on an aluminium heatsink for 150 MHz test circuit. ⊗ Earthing bolts.

APPLICATION INFORMATION (continued)

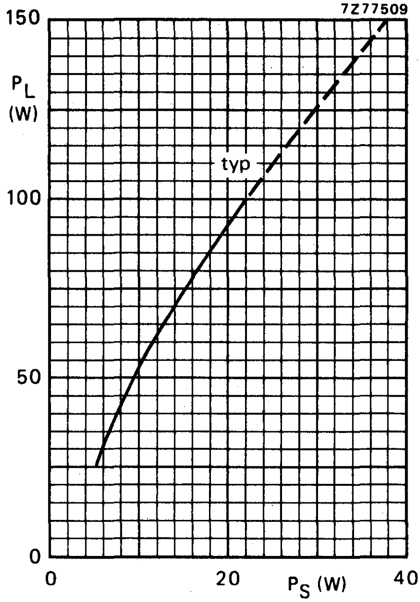


Fig. 9 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C.

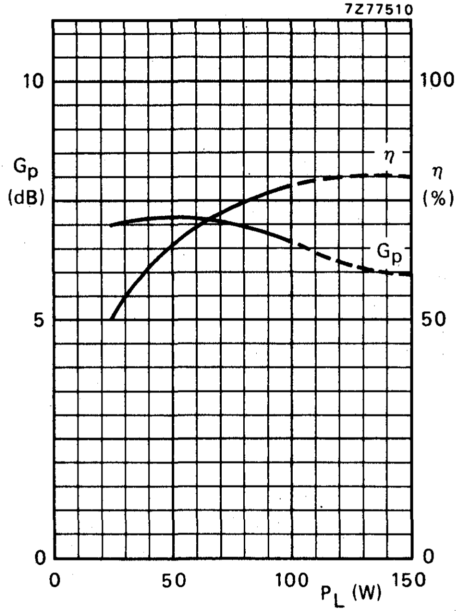


Fig. 10 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C; typical values.

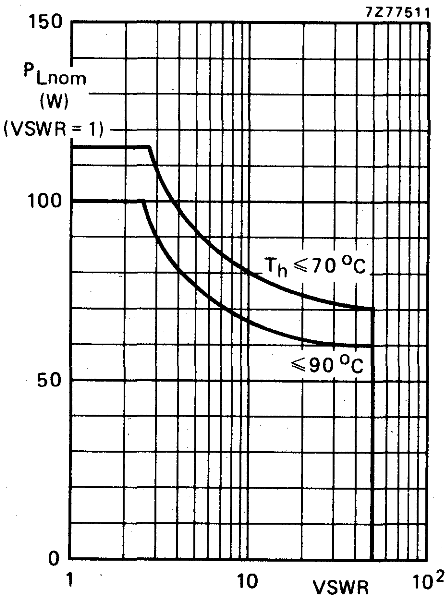


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 150 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 4,7 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

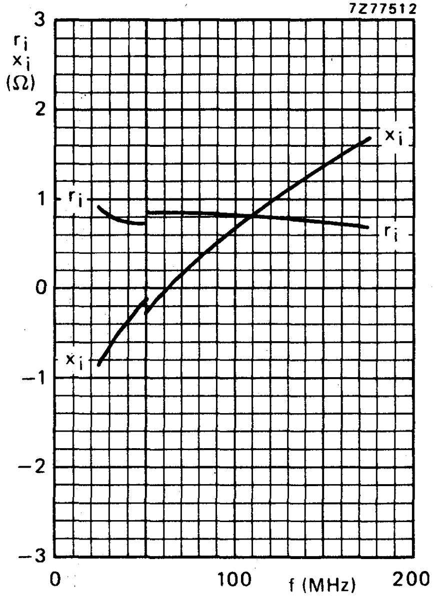


Fig. 12.

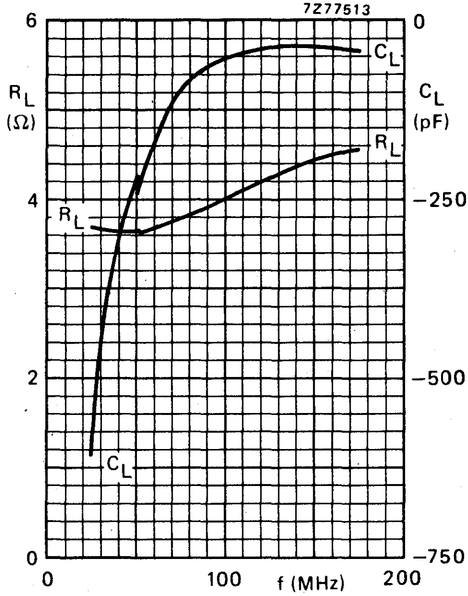


Fig. 13.

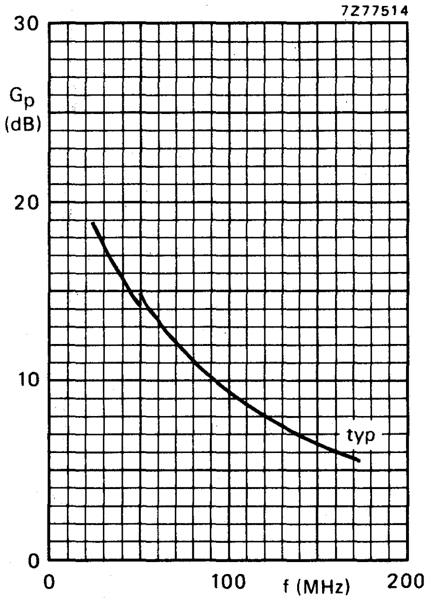


Fig. 14.

Conditions for Figs 12, 13 and 14:
V_{CE} = 28 V; P_L = 100 W; T_h = 25 °C; typical values.

APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. class-A operation

→ V_{CE} = 26 V; T_h = 40 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB
35 (P.E.P.)	typ. 19,5	3	typ. −40

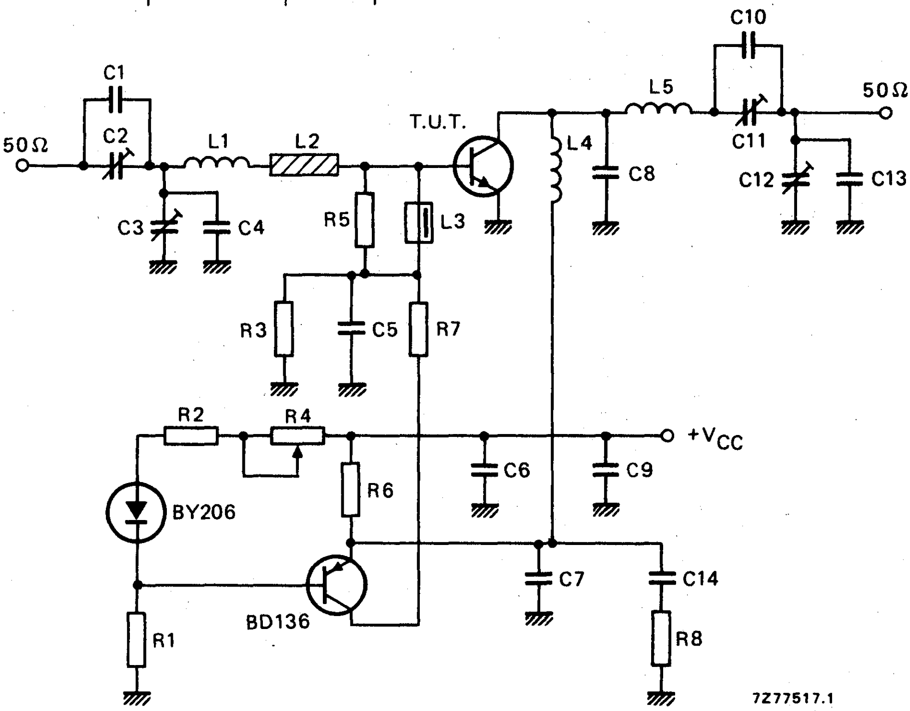


Fig. 15 Test circuit; s.s.b. class-A; f = 28 MHz.

List of components:

C1 = 33 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 280 pF air dielectric trimmer (single non-insulated rotor type)
C4 = 180 pF polystyrene capacitor
C5 = C6 = C7 = 3,9 nF ceramic capacitor
C8 = 2 x 33 pF ceramic capacitors in parallel (500 V)
C9 = 330 nF polyester capacitor
C10 = 82 pF ceramic capacitor (500 V)
C11 = 100 pF air dielectric trimmer (single insulated rotor type)
C12 = 180 pF air dielectric trimmer (single non-insulated rotor type)
C13 = 150 pF polystyrene capacitor
C14 = 390 nF polyester capacitor

List of components in Fig. 15 (continued):

L1 = 72 nH; 3 turns Cu wire (1,0 mm); int. dia. 7 mm; length 4,8 mm; leads 2 x 5 mm
L2 = Cu strip (28 mm x 5 mm x 0,2 mm); 18 mm at 3 mm above printed-circuit board
L3 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = 297 nH; 6 turns Cu wire (1,5 mm); int. dia. 12 mm; length 16 mm; leads 2 x 5 mm
L5 = 331 nH; 7 turns Cu wire (1,5 mm); int. dia. 12 mm; length 20,8 mm; leads 2 x 5 mm

R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 100 Ω (± 5%) carbon resistor (0,5 W)
R3 = 68 Ω (± 5%) carbon resistor (0,5 W)
R4 = 100 Ω wirewound potentiometer (1 W)
R5 = 33 Ω (± 5%) carbon resistor (0,5 W)
R6 = 0,68 Ω (± 10%) wirewound resistor (7 W)
R7 = 120 Ω wirewound resistor (8 W)
R8 = 10 Ω (± 10%) carbon resistor (0,5 W)

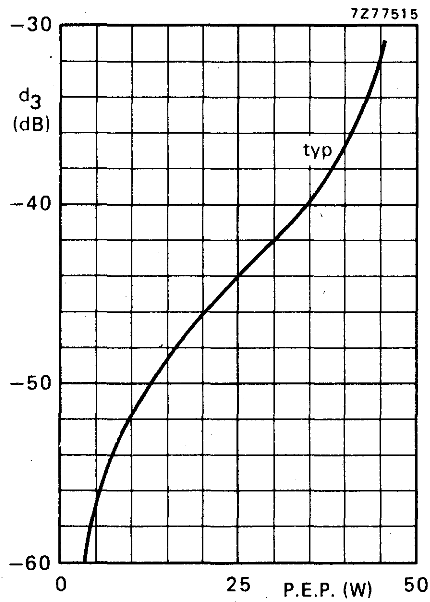


Fig. 16 Intermodulation distortion as a function of output power; V_{CE} = 26 V; I_C = 3 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 40 °C.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V. The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

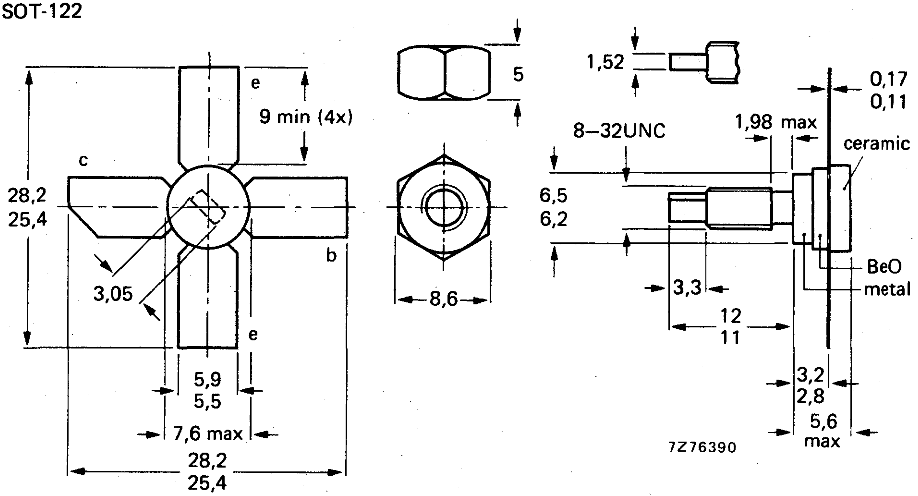
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**2**	**> 9,0**	**> 60**	**3,5 + j0,4**	**28 – j38**
c.w.	12,5	175	2	typ 13,5	typ 60	4,2 – j3,4	25 – j24

MECHANICAL DATA

Dimensions in mm

SOT-122



Torque on nut: min 0,75 Nm
(7,5 kg cm)
max 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

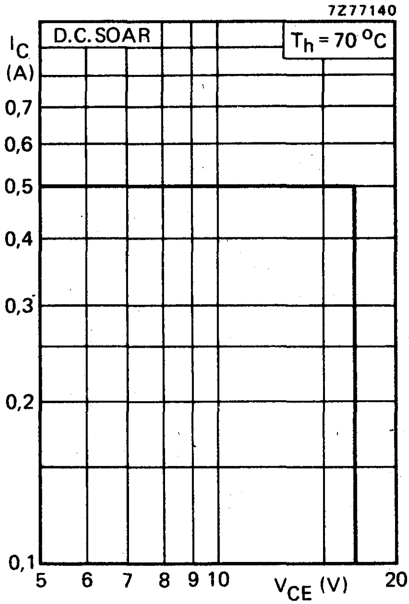
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	17 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

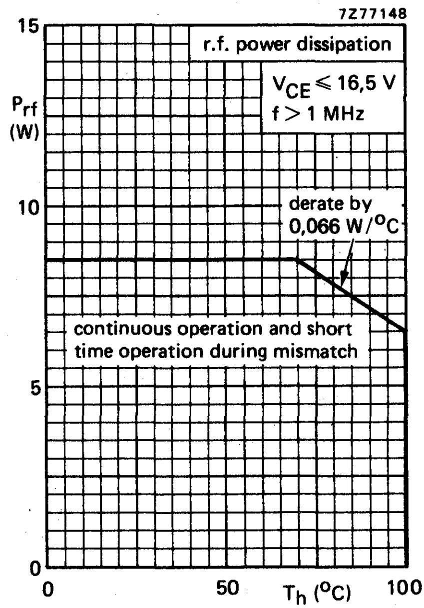
Currents

Collector current (d.c.)	I_C	max	0,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	1,5 A

Power dissipation

Total power dissipation (d.c. and r.f.) up to T_h = 70 °C	P_{tot}	max	8,5 W





Temperatures

Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max	200 °C

THERMAL RESISTANCE

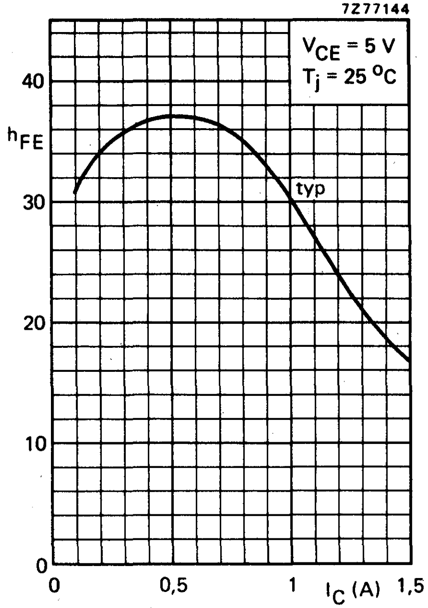
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	14,5 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

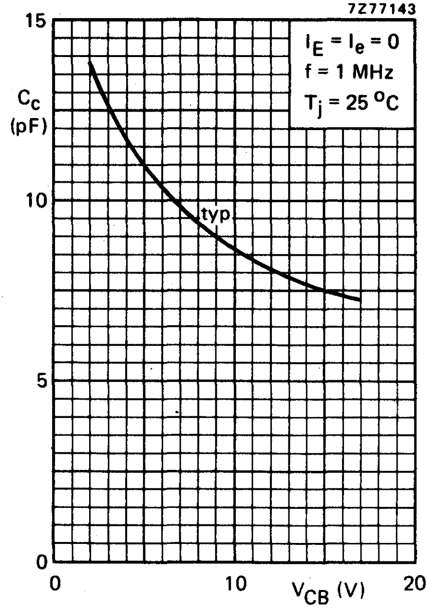
CHARACTERISTICS

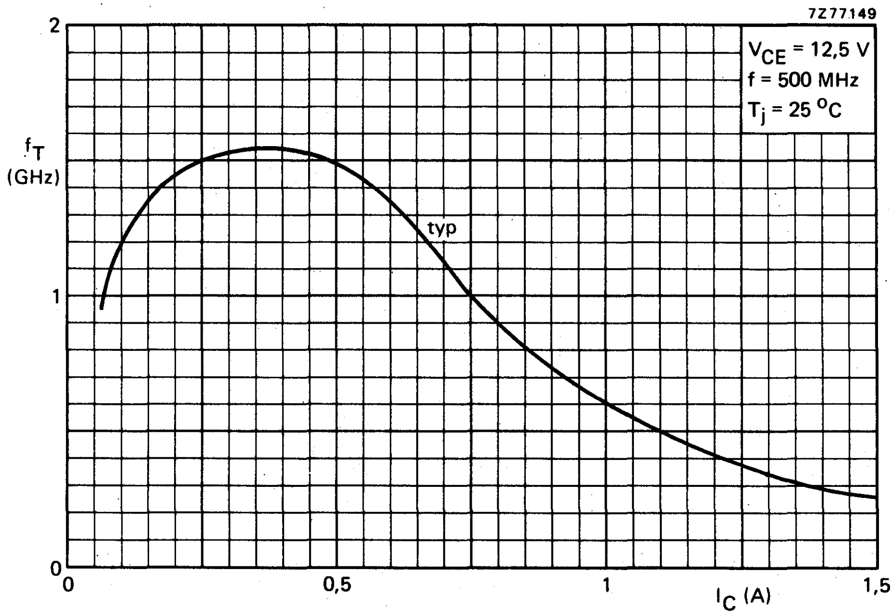
$T_j = 25\ ^oC$

Breakdown voltages			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	2 mA
D.C. current gain *			
$I_C = 250$ mA; $V_{CE} = 5$ V	h_{FE}	> typ	10 35
Collector-emitter saturation voltage *			
$I_C = 750$ mA; $I_B = 150$ mA	V_{CEsat}	typ	0,6 V
Transition frequency at f = 500 MHz *			
$I_C = 250$ mA; $V_{CE} = 12,5$ V	f_T	typ	1,5 GHz
$I_C = 750$ mA; $V_{CE} = 12,5$ V	f_T	typ	1,0 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	8 pF
Feedback capacitance at f = 1 MHz			
$I_C = 20$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	3,6 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77144
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
typ
40
30
20
10
0
0
0,5
1
I_C (A)
1,5


7Z77143
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c (pF)
typ
15
10
5
0
0
10
V_{CB} (V)
20


7Z77149
V_{CE} = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T (GHz)
typ
2
1
0
0
0,5
1
I_C (A)
1,5

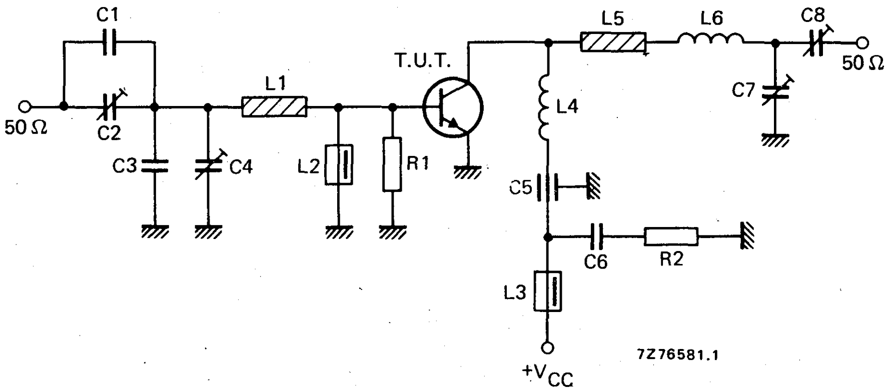
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**2**	**< 0,25**	**> 9,0**	**< 0,27**	**> 60**	**3,5 + j0,4**	**28 – j38**
470	13,5	2	–	typ 10,5	–	typ 70	–	–
175	12,5	2	–	typ 13,5	–	typ 60	4,2 – j3,4	25 – j24

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C4 = C7 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 3,3 pF (± 0,25 pF) ceramic capacitor
C5 = 100 pF ceramic feed-through capacitor
C6 = 100 nF polyester capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)

L1 = stripline (35,6 mm x 6,0 mm)
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 178 nH; 4 turns Cu wire (1 mm); int. dia. 6 mm; length 7 mm; leads 2 x 5 mm
L5 = stripline (10,0 mm x 6,0 mm)
L6 = 28 nH; ½ turn Cu wire (1 mm); int. dia. 10 mm

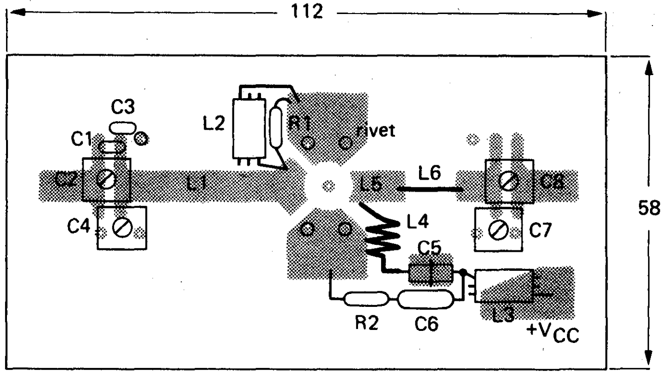
L1 and L5 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 100 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

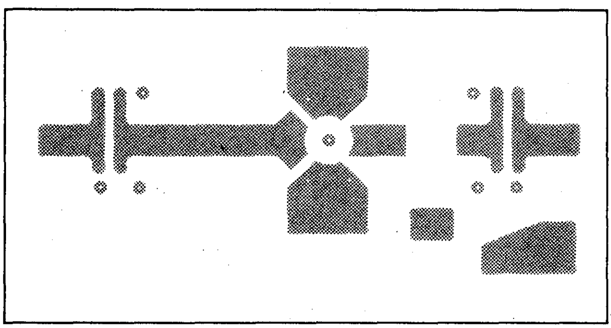
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

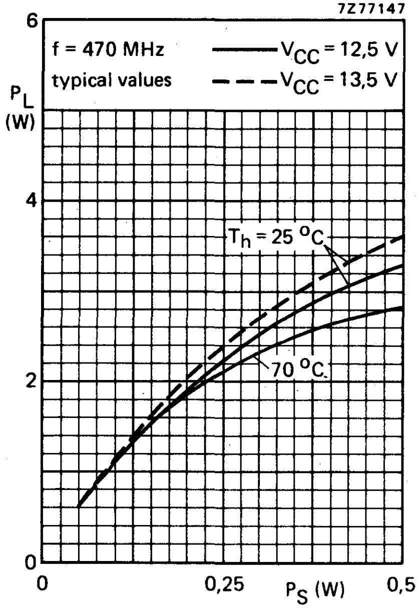


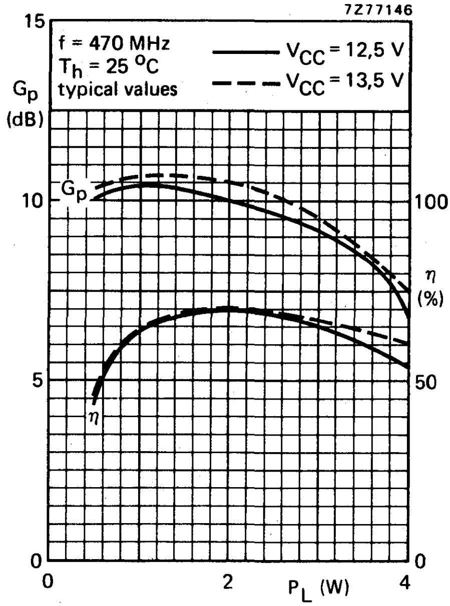
7Z76579

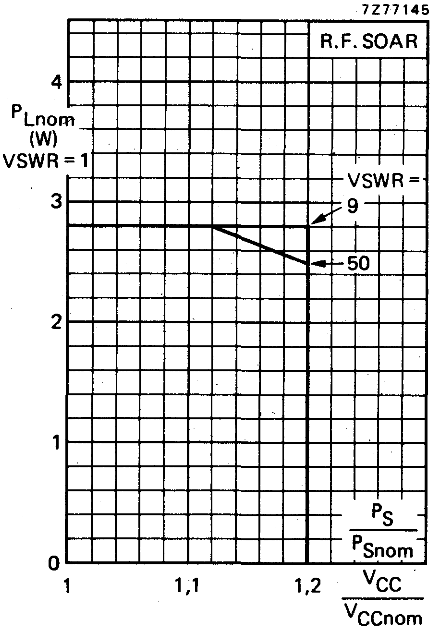


7Z76580

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







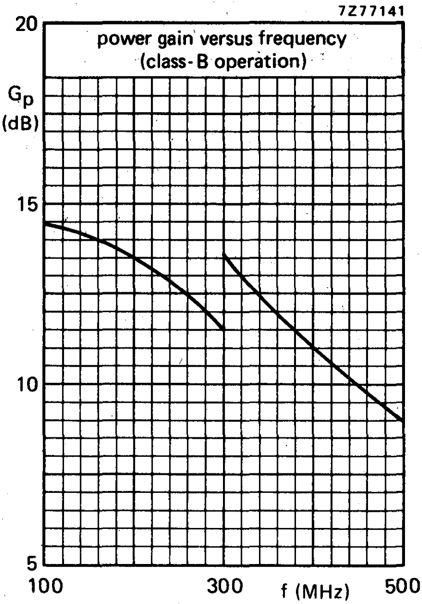
Conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,6 °C/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

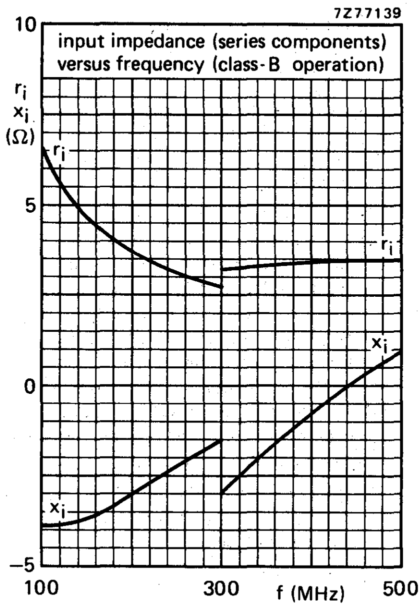
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

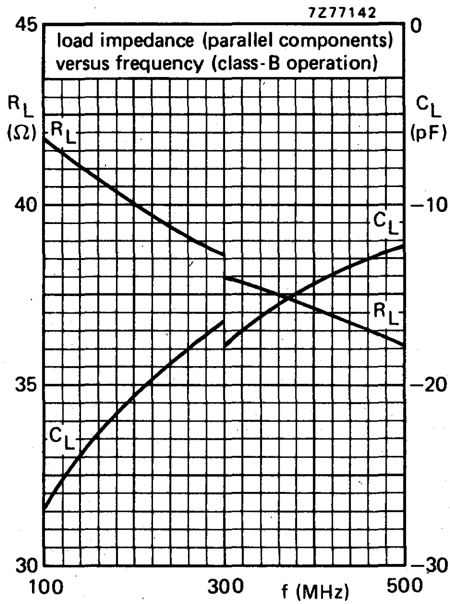
OPERATING NOTE Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 2 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V.
The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼″ capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

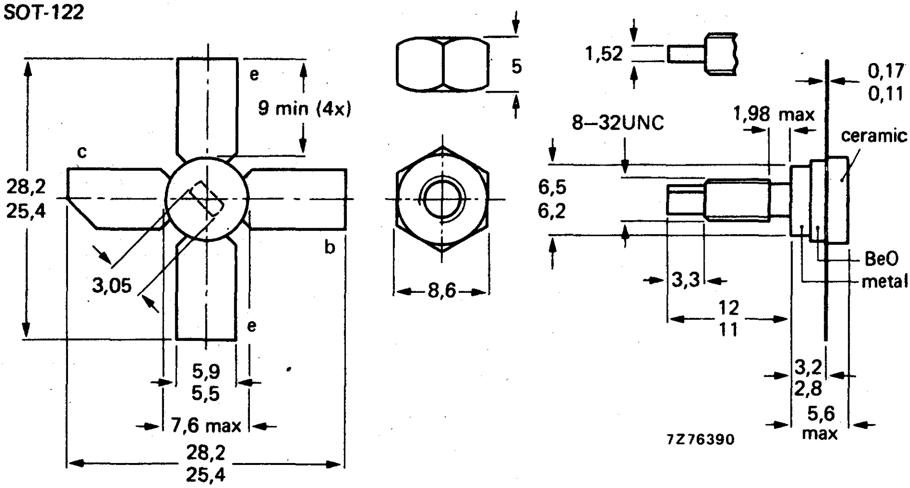
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**4**	**> 8,0**	**> 60**	**2,1 + j2,3**	**57 – j56**
c.w.	12,5	175	4	typ 15,0	typ 60	2,0 – j2,2	51 – j48

MECHANICAL DATA

Dimensions in mm

SOT-122



Torque on nut: min 0,75 Nm (7,5 kg cm)
max 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

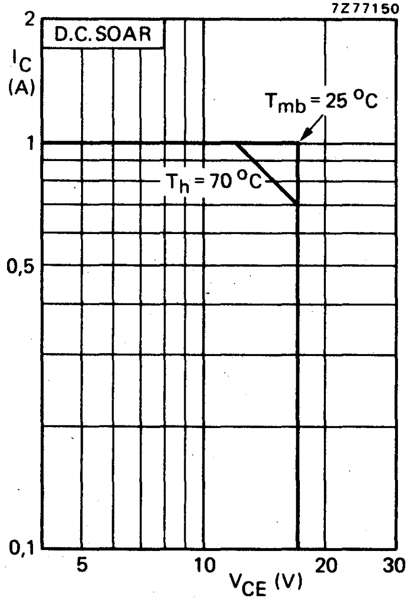
Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	17 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

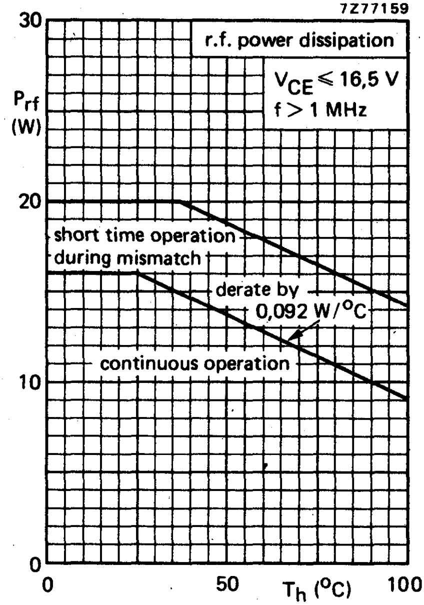
Currents

Collector current (d.c.)	I_C	max	1 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	3 A

Power dissipation

Total power dissipation (d.c. and r.f.) up to $T_{mb} = 25$ °C	P_{tot}	max	17 W





Temperatures

Storage temperature	T_{stg}	−65 to +150	°C
Operating junction temperature	T_j	max 200	°C

THERMAL RESISTANCE

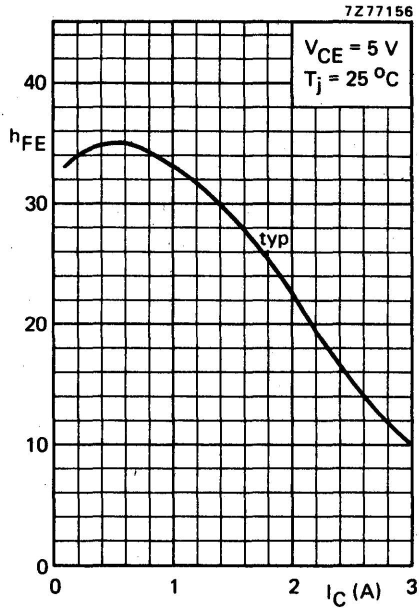
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	10,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

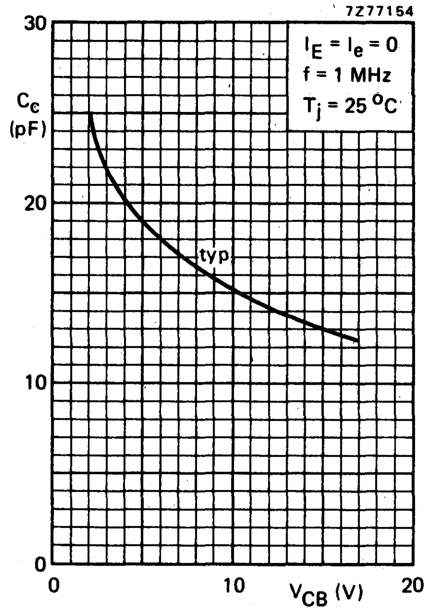
CHARACTERISTICS

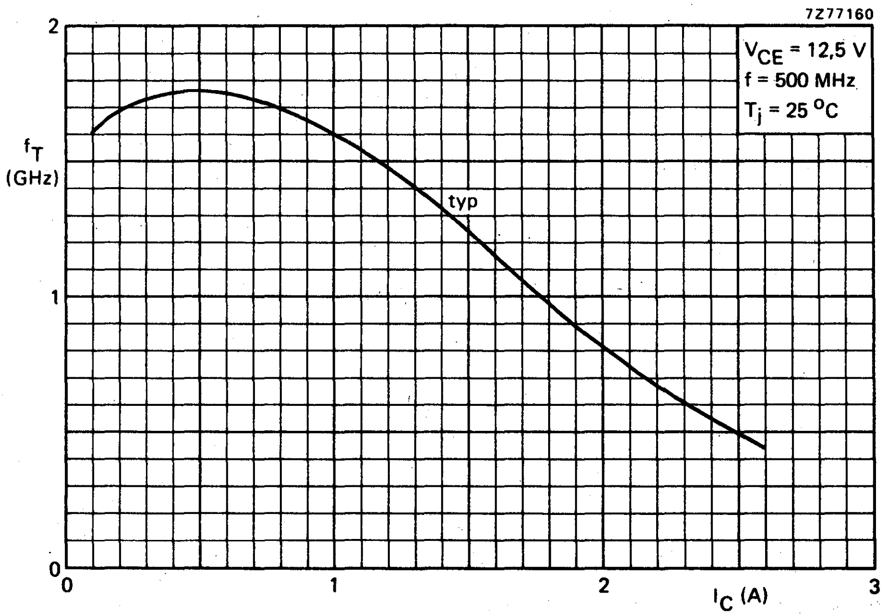
$T_j = 25\ ^{\circ}C$

Breakdown voltages			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	4 mA
D.C. current gain *			
$I_C = 0,5$ A; $V_{CE} = 5$ V	h_{FE}	>	10
		typ	35
Collector-emitter saturation voltage *			
$I_C = 1,5$ A; $I_B = 0,3$ A	V_{CEsat}	typ	0,75 V
Transition frequency at f = 500 MHz *			
$I_C = 0,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,75 GHz
$I_C = 1,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,25 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	14 pF
Feedback capacitance at f = 1 MHz			
$I_C = 40$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	7,1 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77156
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
40
30
20
10
0
typ
0
1
2
3
I_C (A)


7Z77154
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c (pF)
30
20
10
0
typ
0
10
20
V_{CB} (V)


7Z77160
V_{CE} = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T (GHz)
2
1
0
typ
0
1
2
3
I_C (A)

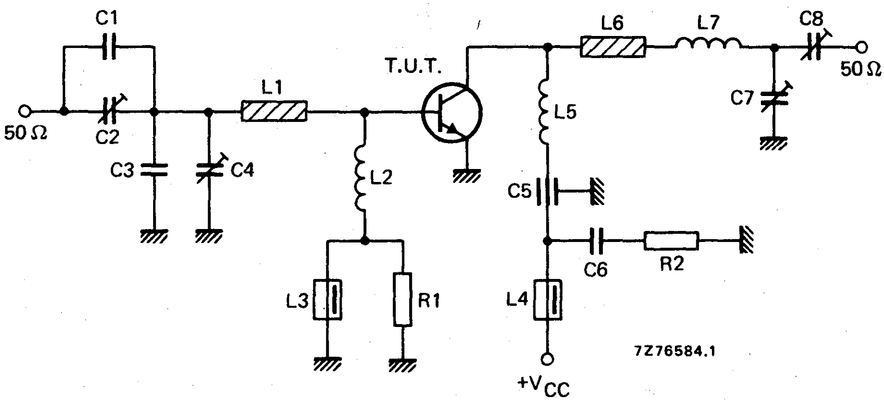
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**4**	**< 0,63**	**> 8,0**	**< 0,53**	**> 60**	**2,1 + j2,3**	**57 – j56**
470	13,5	4	–	typ 9,5	–	typ 65	–	–
175	12,5	4	–	typ 15,0	–	typ 60	2,0 – j2,2	51 – j48

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 5,6 pF (± 0,25 pF) ceramic capacitor
C4 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C5 = 100 pF ceramic feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = stripline (22,5 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 51 nH; 3,5 turns Cu wire (1 mm); int. dia. 6 mm; coil length 7 mm; leads 2 x 5 mm
L6 = stripline (10,0 mm x 6,0 mm)
L7 = 15 nH; 1 turn Cu wire (1 mm); int. dia. 5 mm; leads 2 x 5 mm

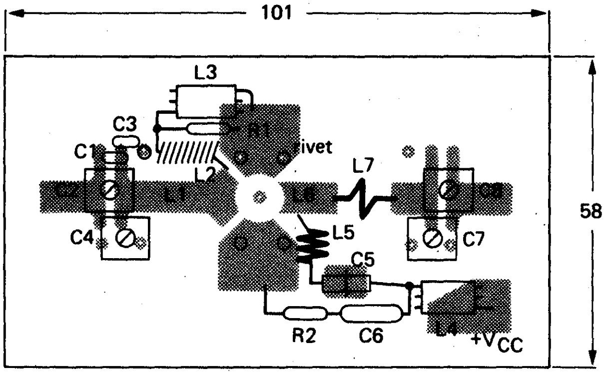
L1 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = R2 = 10 Ω (± 5%) carbon resistor

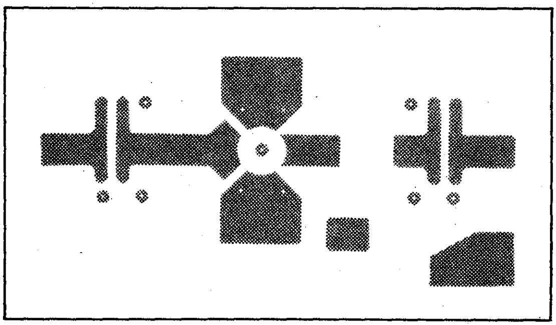
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

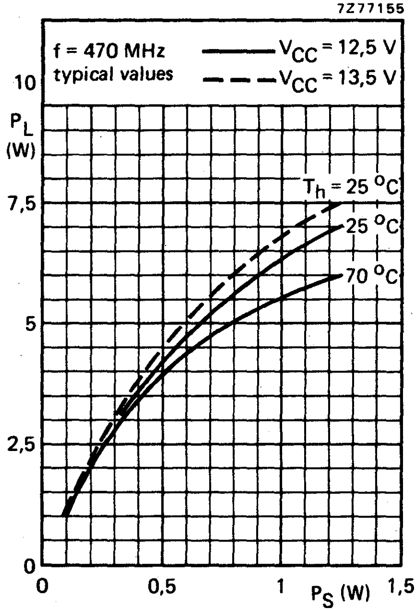


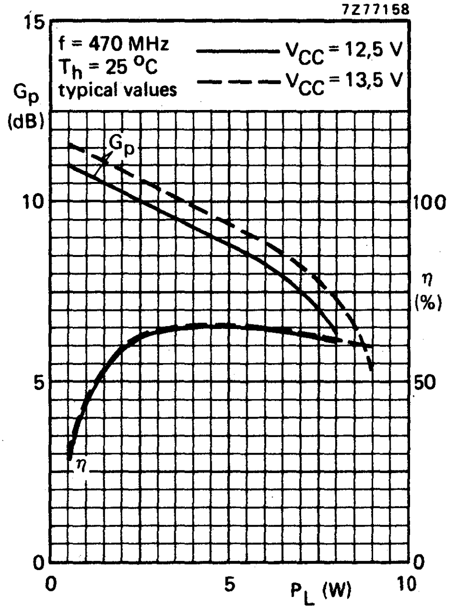
7Z76582

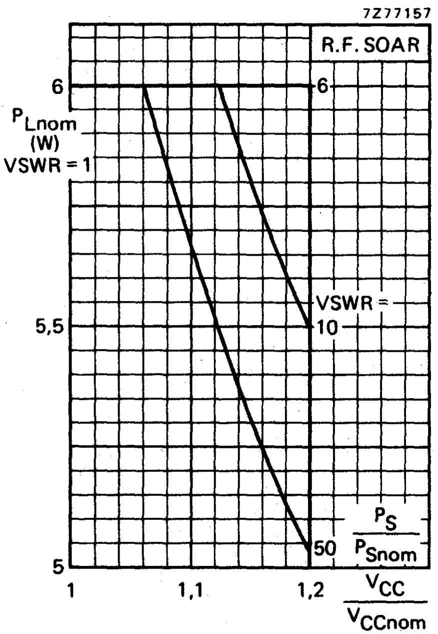


7Z76583

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







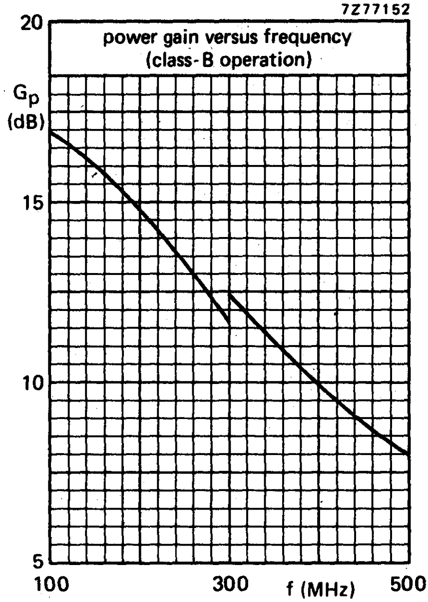
Conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,6 °C/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other that the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

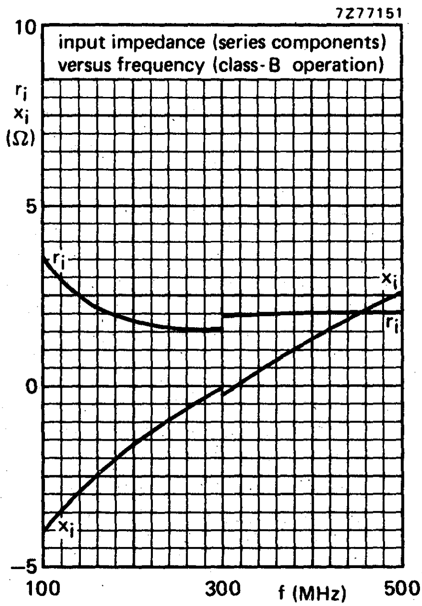
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

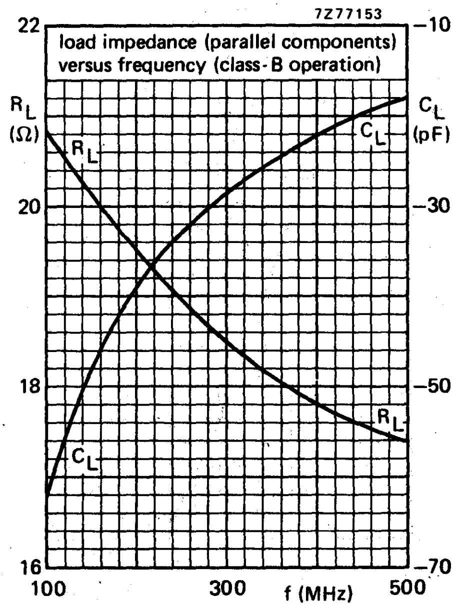
OPERATING NOTE Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 4 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V.
The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

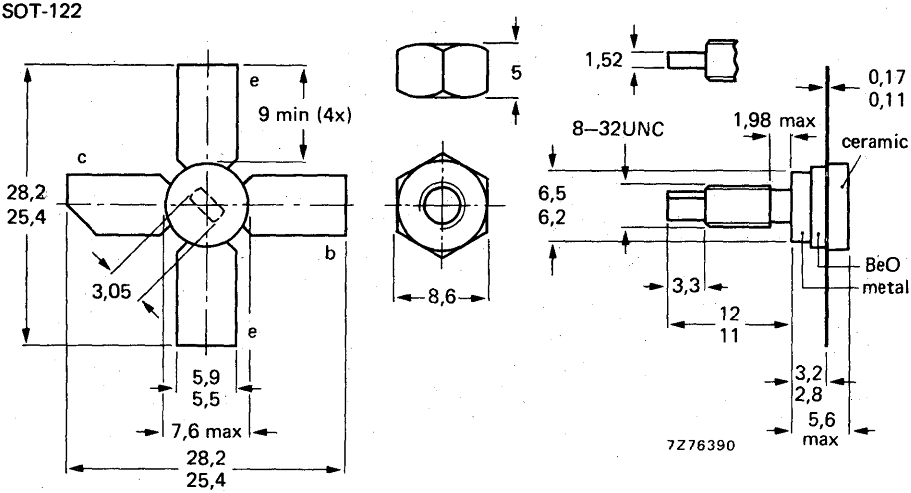
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**10**	**> 6,0**	**> 60**	**1,3 + j2,5**	**150 − j66**
c.w.	12,5	175	10	typ 13,5	typ 60	1,2 − j0,6	140 − j80

MECHANICAL DATA

Dimensions in mm

SOT-122



Torque on nut: min 0,75 Nm (7,5 kg cm)
max 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

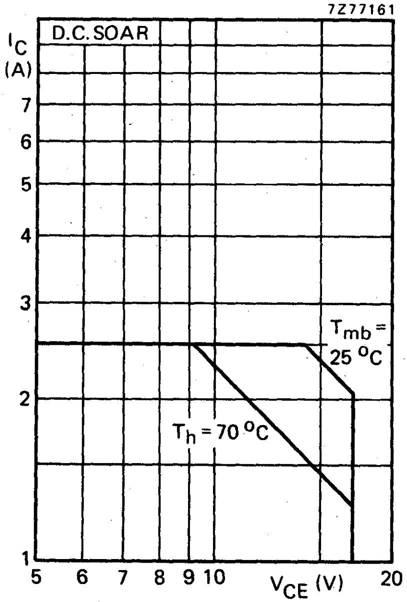
Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	17 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

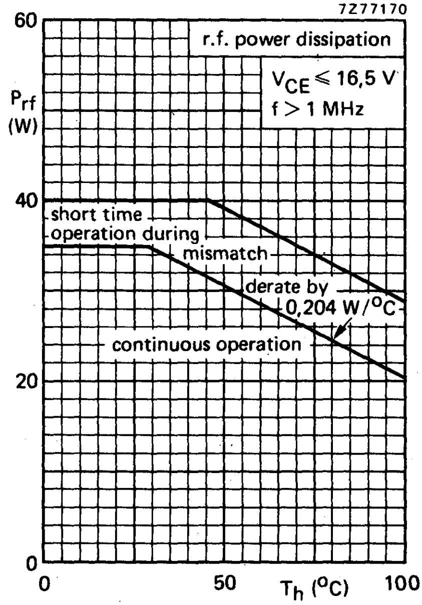
Currents

Collector current (d.c. or average)	I_C	max	2,5 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	7,5 A

Power dissipation

R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{tot}	max	40 W





Temperatures

Storage temperature	T_{stg}	−65 to +150	°C
Operating junction temperature	T_j	max 200	°C

THERMAL RESISTANCE

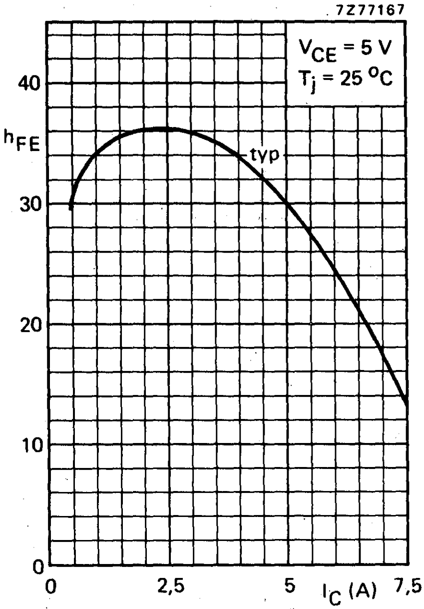
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

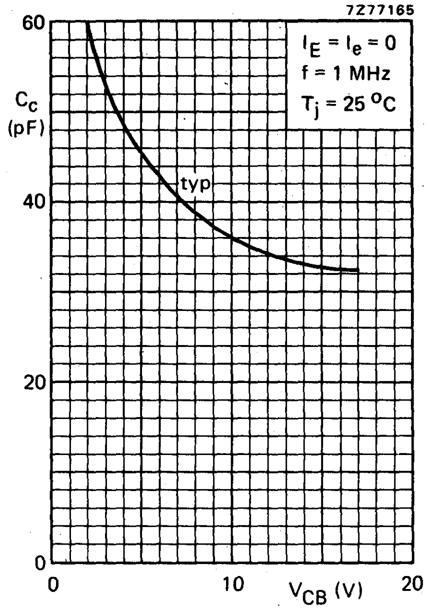
CHARACTERISTICS

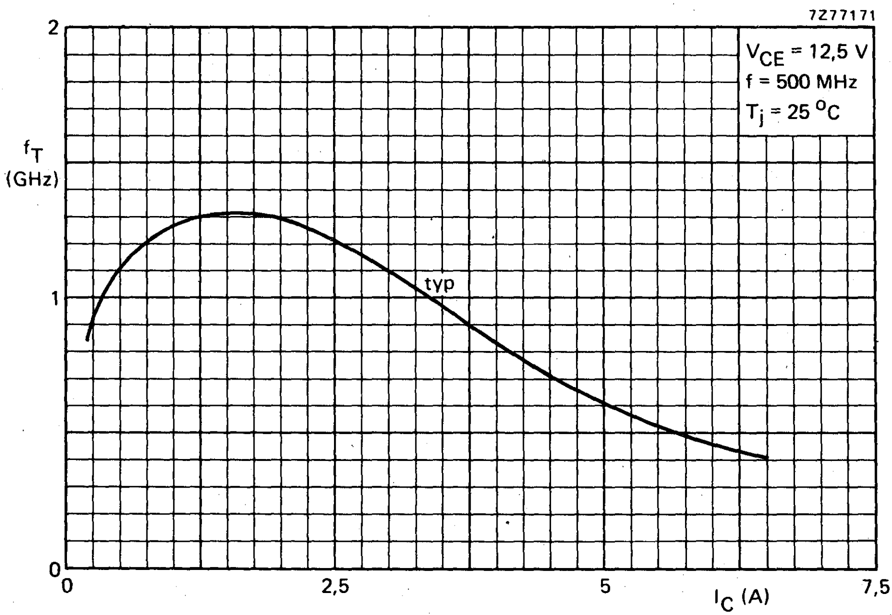
$T_j = 25\ ^oC$

Breakdown voltages			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	10 mA
D.C. current gain * $I_C = 1{,}25$ A; $V_{CE} = 5$ V	h_{FE}	> typ	10 35
Collector-emitter saturation voltage * $I_C = 3{,}75$ A; $I_B = 0{,}75$ A	V_{CEsat}	typ	0,75 V
Transition frequency at f = 500 MHz *			
$I_C = 1{,}25$ A; $V_{CE} = 12{,}5$ V	f_T	typ	1,3 GHz
$I_C = 3{,}75$ A; $V_{CE} = 12{,}5$ V	f_T	typ	0,9 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 12{,}5$ V	C_c	typ	34 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 12{,}5$ V	C_{re}	typ	18 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.


7Z77167
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
typ
0
10
20
30
40
0
2,5
5
7,5
I_C (A)


7Z77165
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c (pF)
typ
0
20
40
60
0
10
20
V_{CB} (V)


7Z77171
V_{CE} = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T (GHz)
typ
0
1
2
0
2,5
5
7,5
I_C (A)

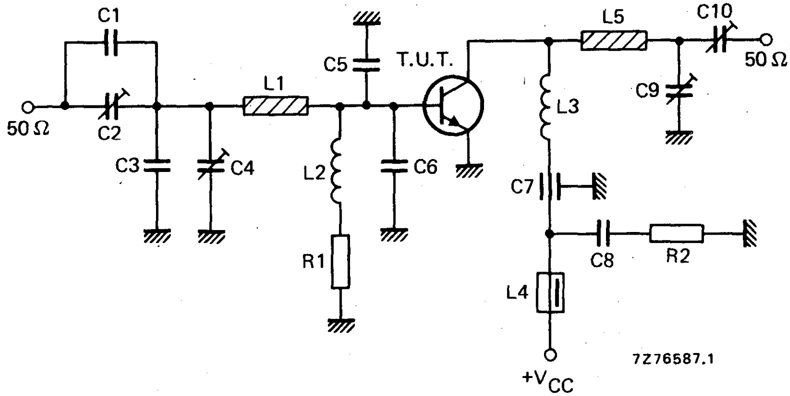
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**10**	**< 2,5**	**> 6,0**	**< 1,33**	**> 60**	**1,3 + j2,5**	**150 – j66**
470	13,5	10	typ 1,9	typ 7,2	–	typ 75	–	–
175	12,5	10	typ 0,45	typ 13,5	–	typ 60	1,2 – j0,6	140 – j80

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C9 = C10 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C3 = 3,9 pF (± 0,25 pF) ceramic capacitor
C4 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C5 = C6 = 15 pF ceramic chip capacitor (cat. no. 2222 851 13159)
C7 = 100 pF ceramic feed-through capacitor
C8 = 100 nF polyester capacitor

L1 = stripline (27,9 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. = 4 mm; leads 2 x 5 mm
L3 = 17 nH; 1½ turns enamelled Cu wire (1 mm); spacing 1 mm; int. dia. = 6 mm; leads 2 x 5 mm
L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = stripline (45,8 mm x 6,0 mm)

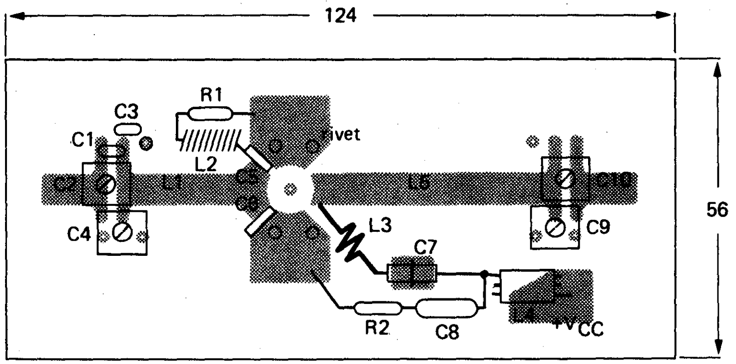
L1 and L5 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 1 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

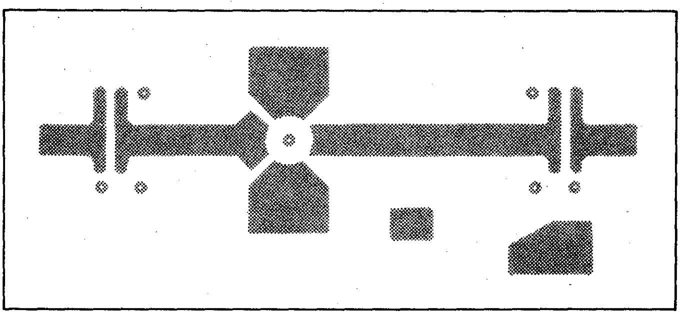
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

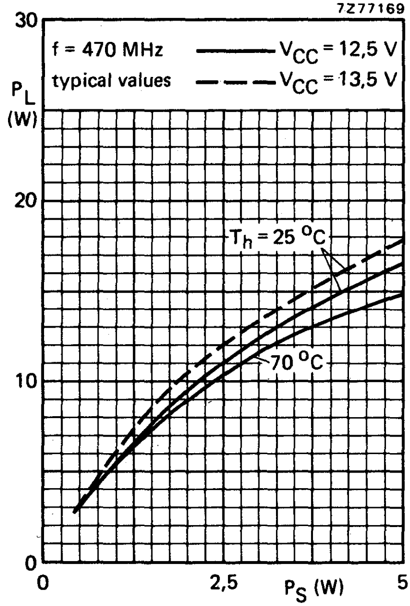


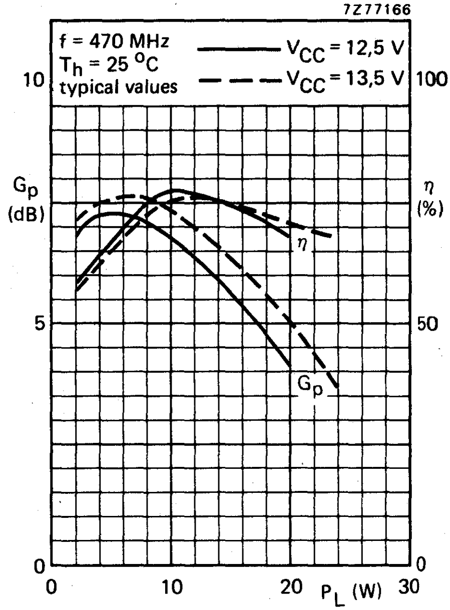
7Z76585

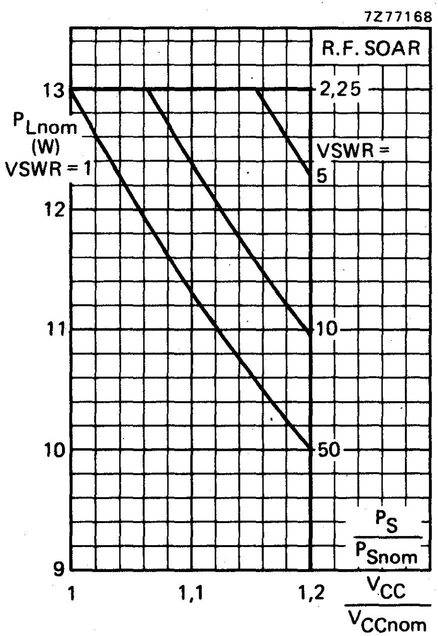


7Z76586

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







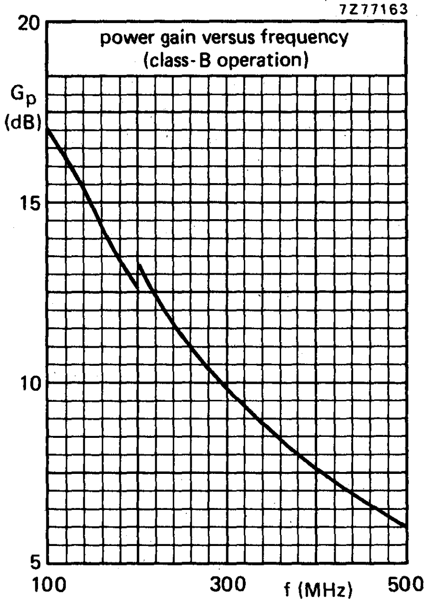
Measuring conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,6 °C/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

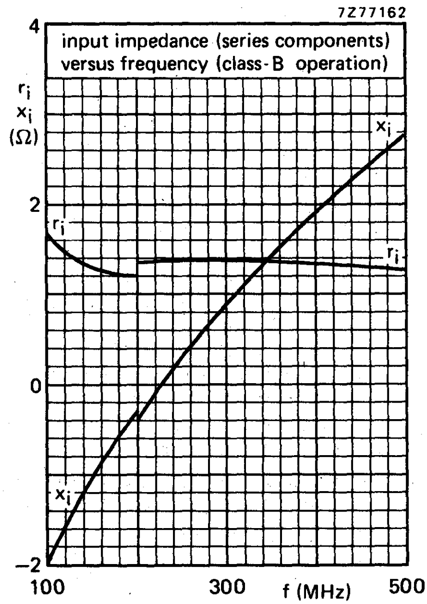
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

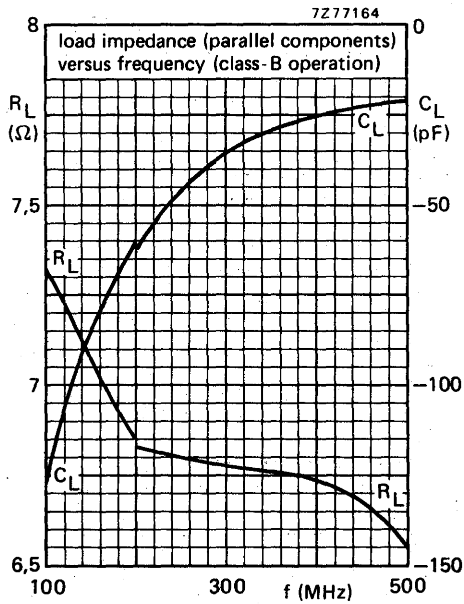
OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 10 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

Internally matched n-p-n silicon planar epitaxial transistor intended for use in **high-power wide-band** and **semi-wide-band u.h.f. amplifiers** with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Diffused emitter-ballasting resistors and the application of a **gold sandwich metallization** give optimum features of ruggedness and reliability.

The transistor is especially suited as **add-on-final stage** for low-power modules.

The transistor has a ½" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**12,5**	**470**	**30**	**> 5**	**> 60**	**1,4 + j3,0**	**250 + j200**
c.w.	13,5	470	30	typ. 6,1	typ. 65	–	–

MECHANICAL DATA

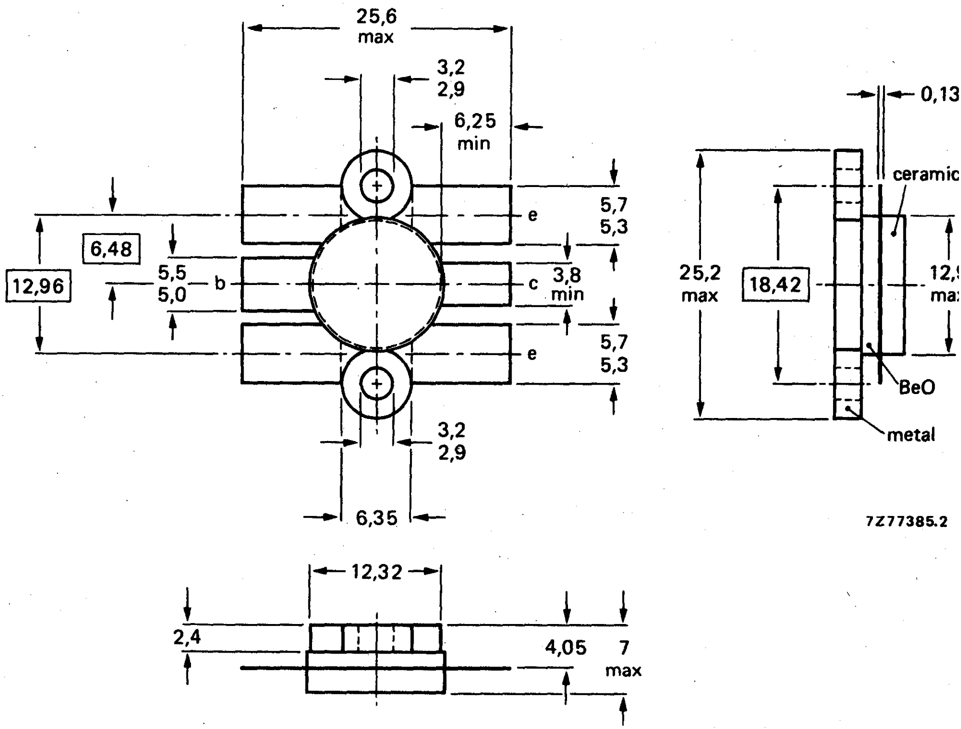
SOT-119 (see page 2).

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	17	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	7	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	18	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

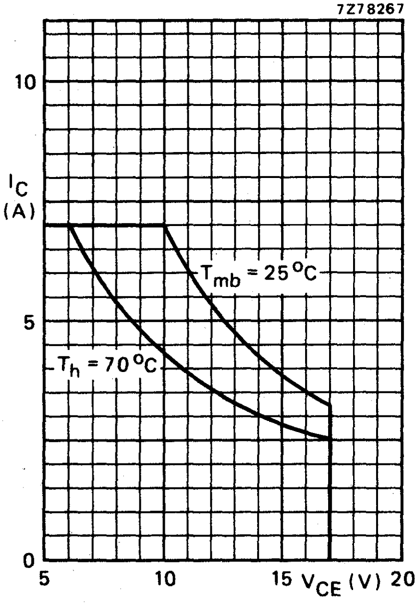


Fig. 2 D.C. SOAR.

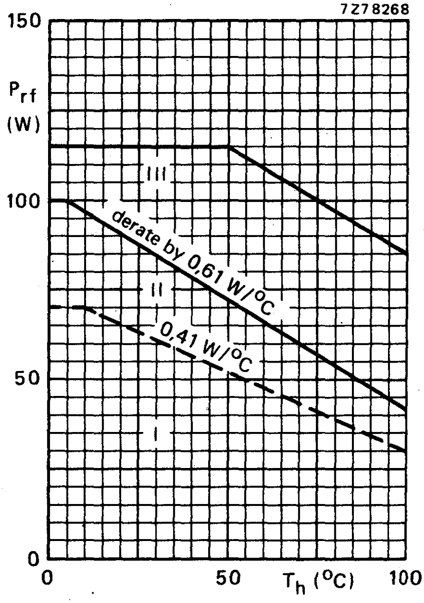


Fig. 3 R.F. power dissipation; $V_{CE} \leq 16{,}5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 78 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,95	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base breakdown voltage open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	20 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	4,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	4,5 mJ
D.C. current gain * $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 80
Collector-emitter saturation voltage * $I_C = 12$ A; $I_B = 2,4$ A	V_{CEsat}	typ.	1,4 V
Transition frequency at f = 500 MHz * $-I_E = 4$ A; $V_{CB} = 12,5$ V	f_T	typ.	2,2 GHz
$-I_E = 12$ A; $V_{CB} = 12,5$ V	f_T	typ.	1,5 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ.	88 pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 12,5$ V	C_{re}	typ.	56 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

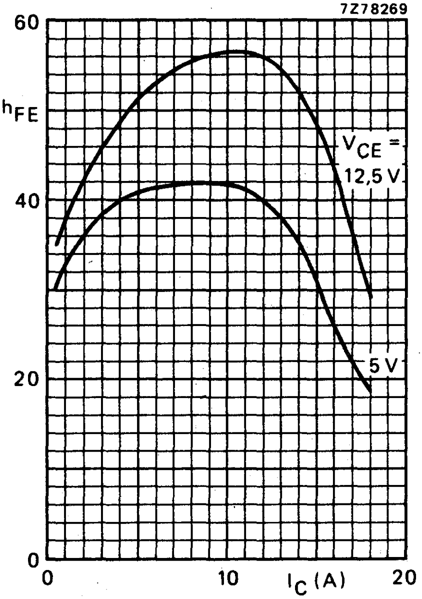


Fig. 4 Typical values; T_j = 25 °C.

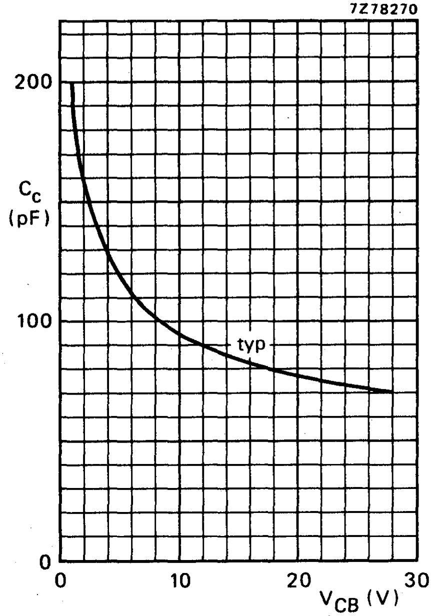


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

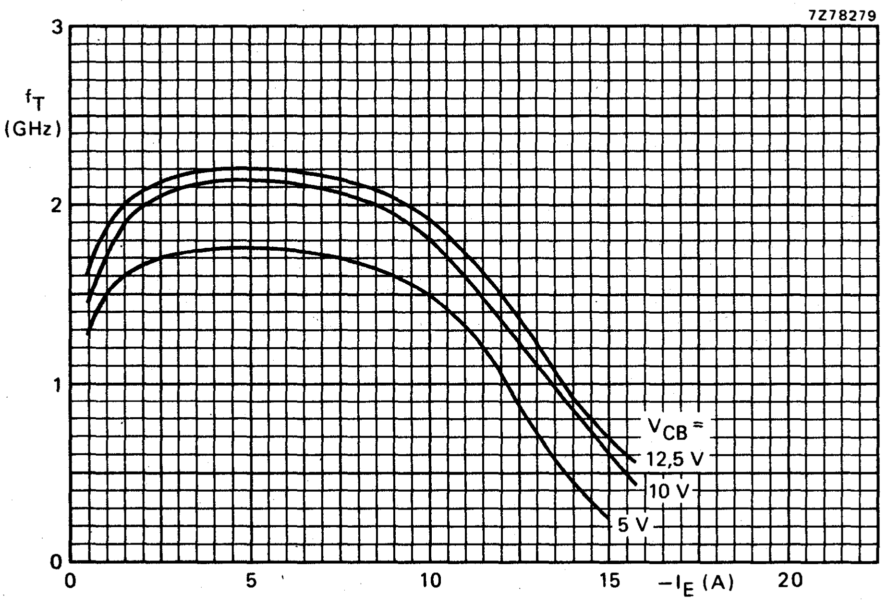


Fig. 6 Typical values; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	**12,5**	**30**	**< 9,5**	**> 5**	**< 4**	**> 60**	**1,4 + j3,0**	**250 + j200**
470	13,5	30	–	typ. 6,1	–	typ. 65	–	–

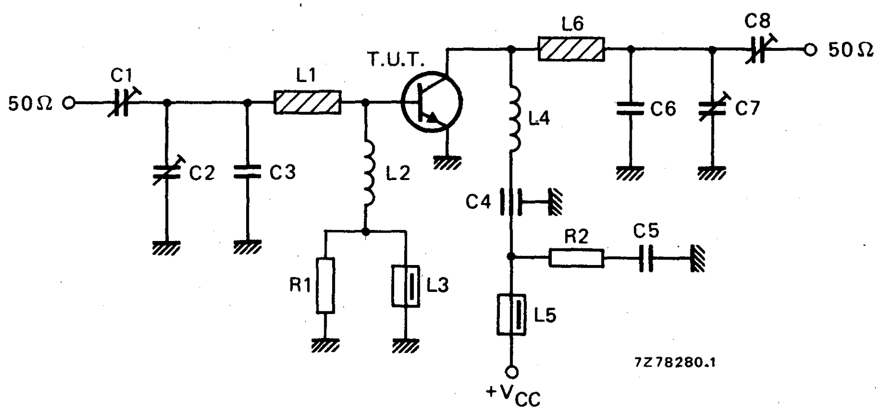


Fig. 7 Test circuit; c.w. class-B.

List of components:

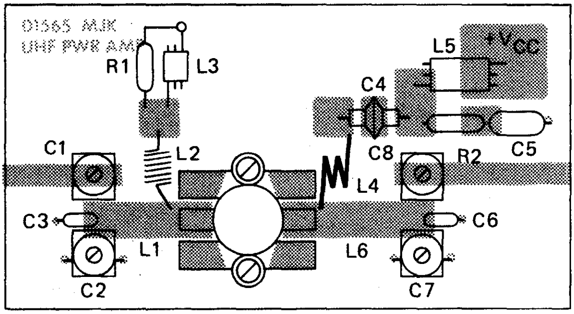
C1 = C2 = C7 = C8 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C6 = 3,9 pF ceramic capacitor (500 V)
C4 = 100 pF feed-through capacitor
C5 = 100 nF polyester capacitor

L1 = stripline (24,0 mm x 6,7 mm)
L2 = 10 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 4 mm
L3 = 2 turns enamelled Cu wire (0,6 mm); Ferroxcube tube core, grade 3B5 (cat. no. 4313 020 15170)
L4 = 12,6 nH; 2,5 turns enamelled Cu wire (0,7 mm); int. dia. 4 mm; length 3 mm; leads 2 x 5 mm
L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L6 = stripline (28,4 mm x 6,7 mm)

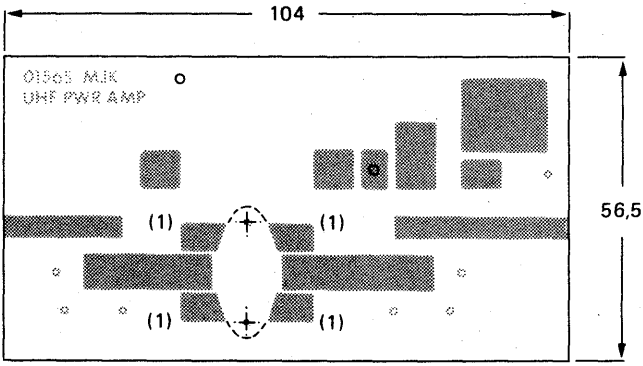
L1 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.



7Z78204.1



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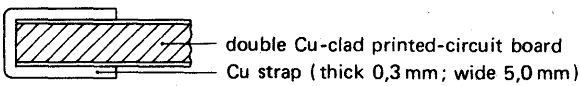
(1)



7Z78206

Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

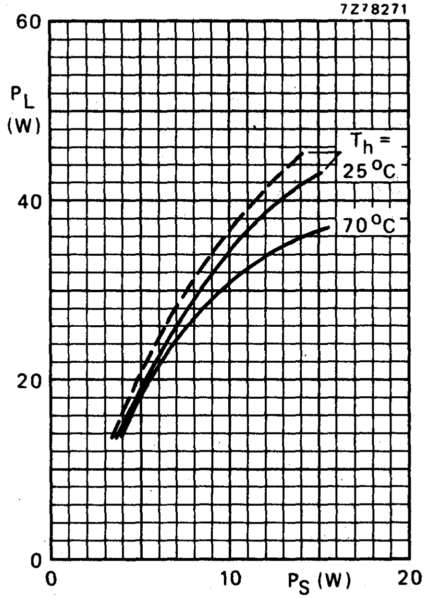


Fig. 9.

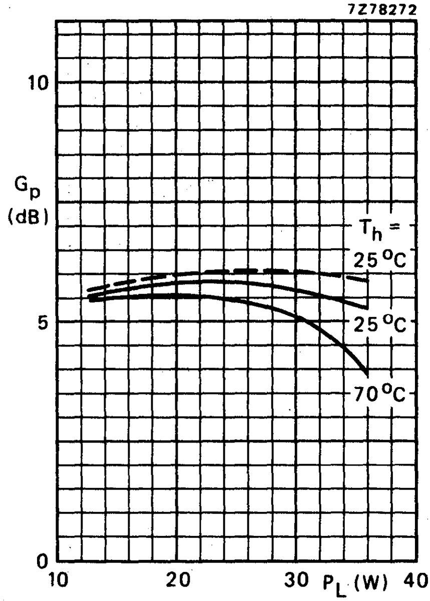


Fig. 10.

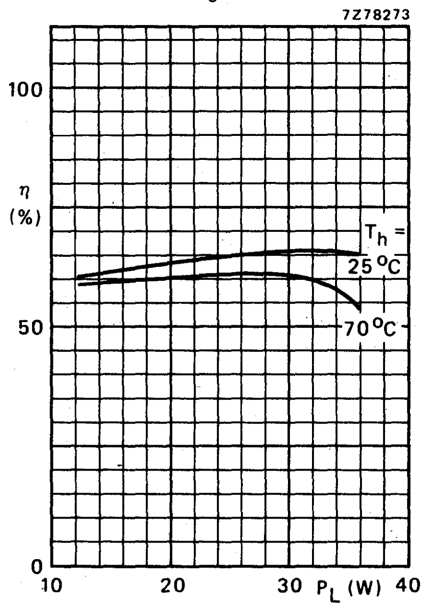


Fig. 11.

Conditions for Figs 9, 10 and 11:

Typical values; f = 470 MHz;

—— V_{CE} = 12,5 V; ---- V_{CE} = 13,5 V.

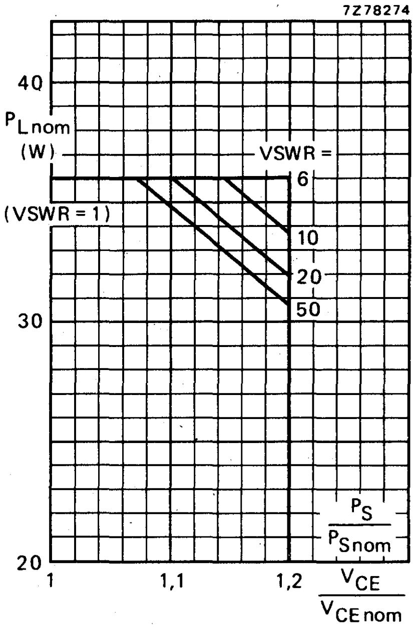


Fig. 12 R.F. SOAR (short-time operation during mismatch); f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 °C/W; V_{CEnom} = 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

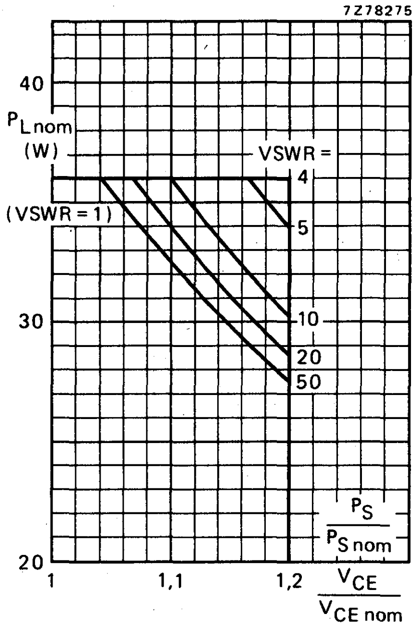


Fig. 13 R.F. SOAR (short-time operation during mismatch); f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 °C/W; V_{CEnom} = 13,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Figs 12 and 13:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

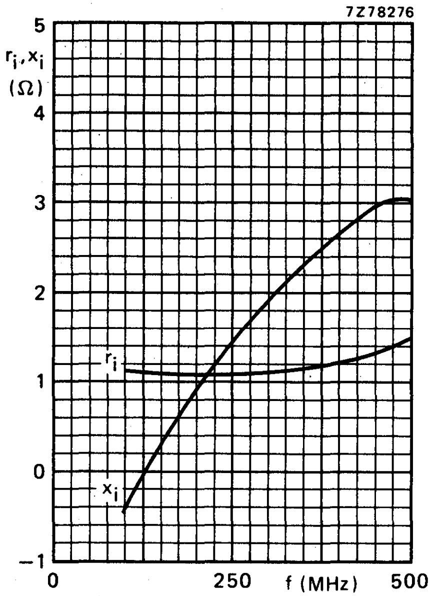


Fig. 14 Input impedance (series components).

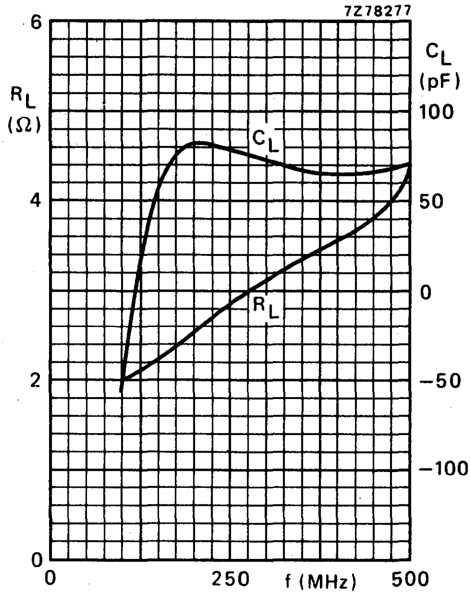


Fig. 15 Load impedance (parallel components).

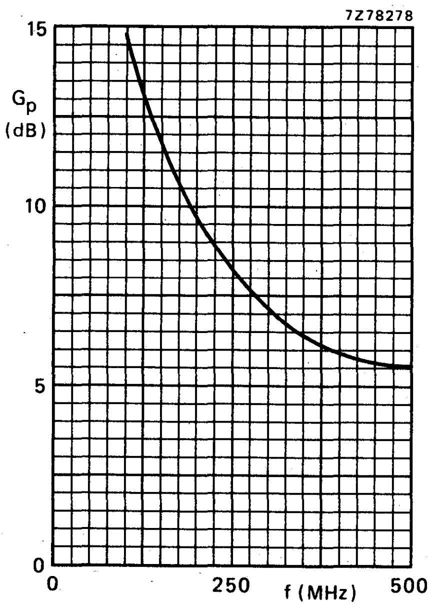


Fig. 16.

Conditions for Figs 14, 15 and 16:

Typical values; V_{CE} = 12,5 V; P_L = 30 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

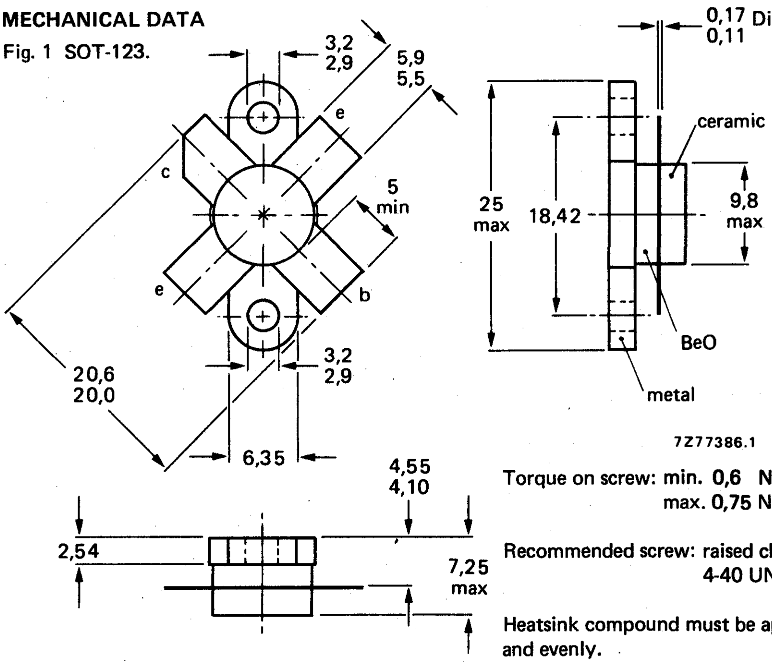
R.F. performance

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 10** (P.E.P.)	> **20**	–	**1,35**	< **–40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. –30	25

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

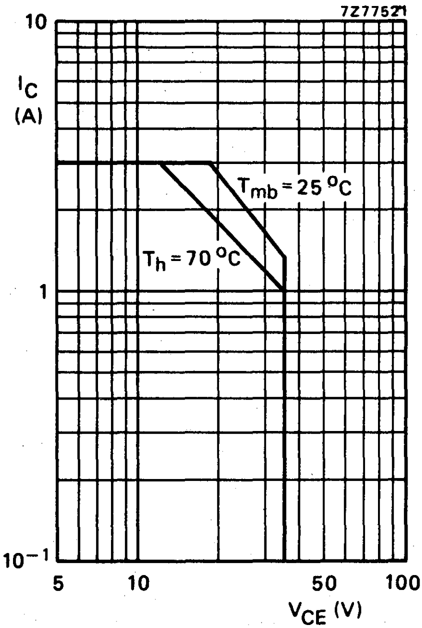


Fig. 2 D.C. SOAR.

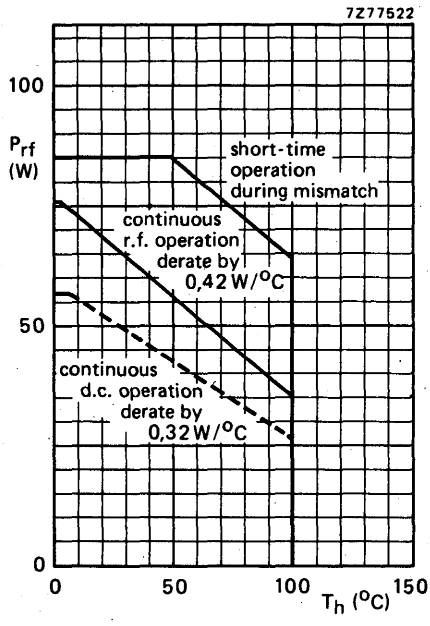


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 35 W; T_{mb} = 80 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,15	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,35	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 1,25$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 100
D.C. current gain ratio of matched devices* $I_C = 1,25$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* $I_C = 3,75$ A; $I_B = 0,75$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	530 MHz
$-I_E = 3,75$ A; $V_{CB} = 28$ V	f_T	typ.	530 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	31 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

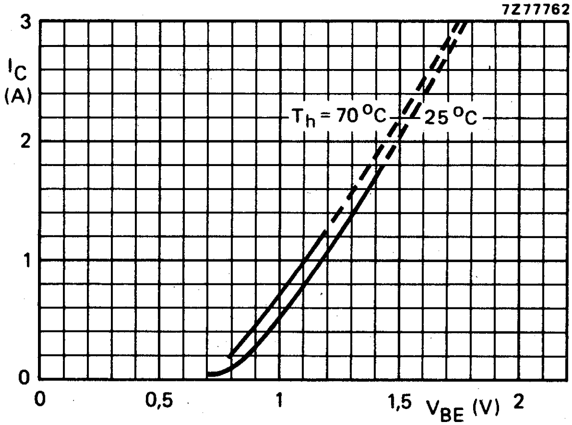


Fig. 4 Typical values; $V_{CE} = 28$ V.

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

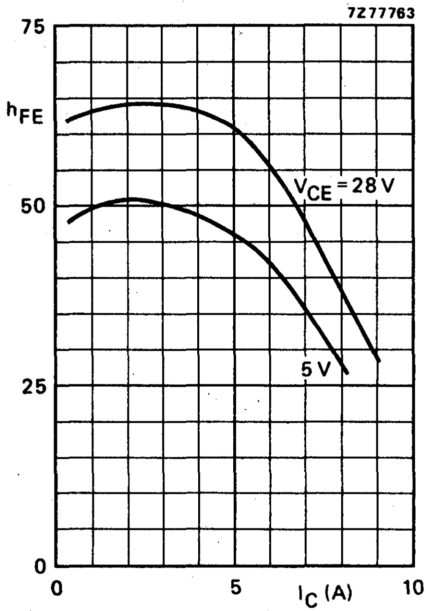


Fig. 5 Typical values; T_j = 25 °C.

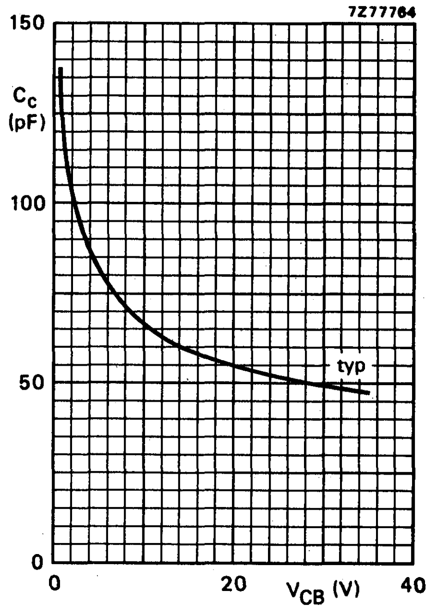


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

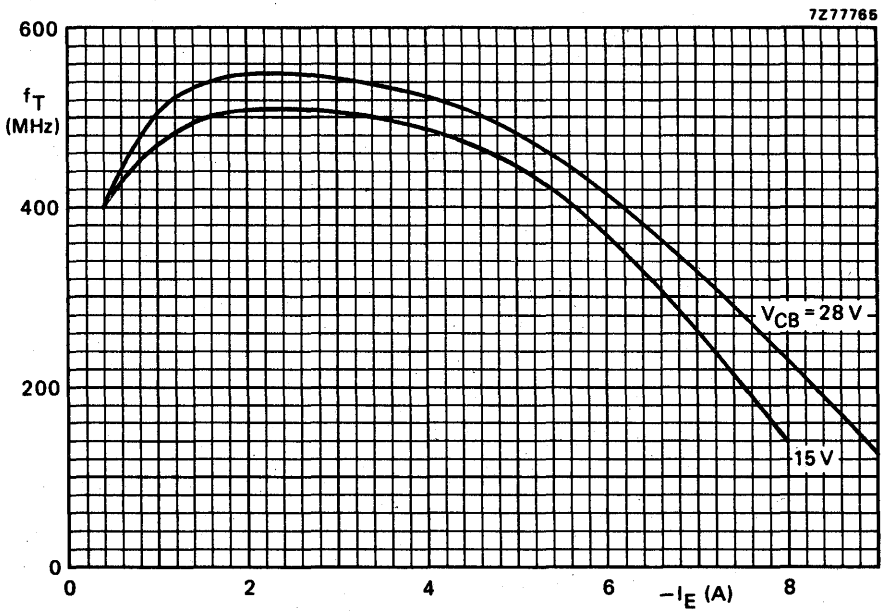


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB*	d_5 dB*	T_h °C
> 10 (P.E.P.) typ. 11 (P.E.P.)	> 20	1,35	−40	< −40	70
typ. 12 (P.E.P.)	typ. 24	1,35	−40	< −40	25

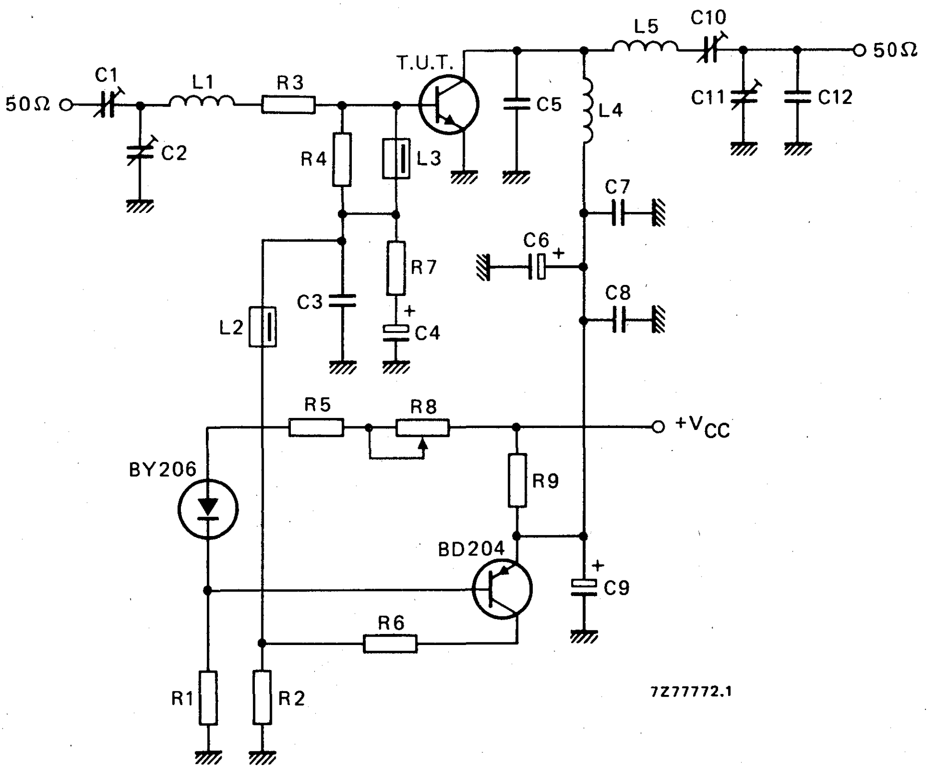


Fig. 8 Test circuit; s.s.b. class-A.

List of components on page 6.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = C11 = 7 to 100 pF film dielectric trimmer
C12 = 82 pF ceramic capacitor (500 V)

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads to 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0,5 W each)
R2 = 15 Ω carbon resistor (±5%; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0,125 W each)
R4 = 33 Ω carbon resistor (±5%; 0,25 W)
R5 = 18 Ω carbon resistor (±5%; 0,25 W)
R6 = 120 Ω wirewound resistor (±5%; 5,5 W)
R7 = 1 Ω carbon resistor (±5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (±5%; 5,5 W each)

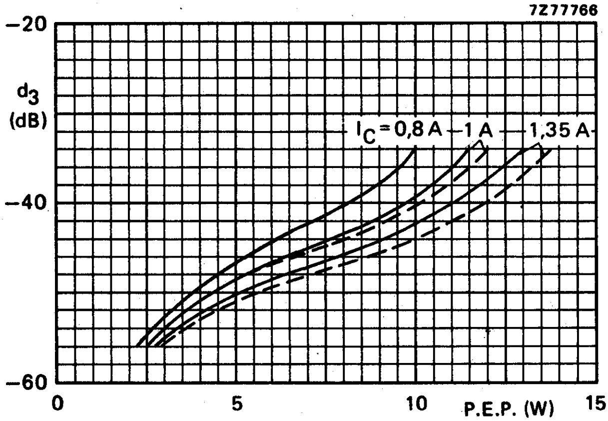


Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; —— T_h = 70 °C; – – – T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 30 W P.E.P.	I_C (A) at 30 W P.E.P.	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
3 to 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. −30	< −30	25	25
3 to 25 (P.E.P.)	typ. 21	–	–	typ. −30	< −30	25	70

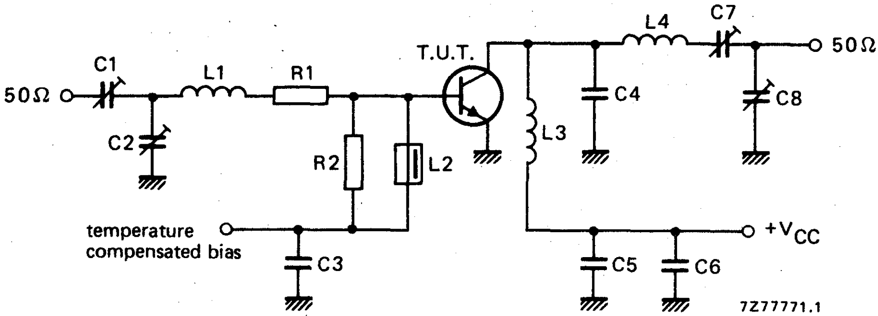


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

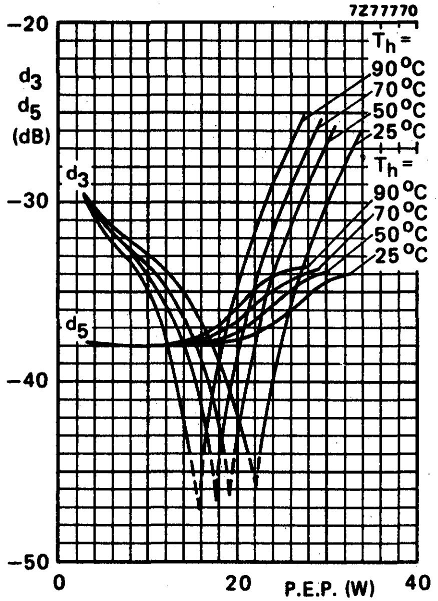


Fig. 11 Intermodulation distortion as a function of output power.*

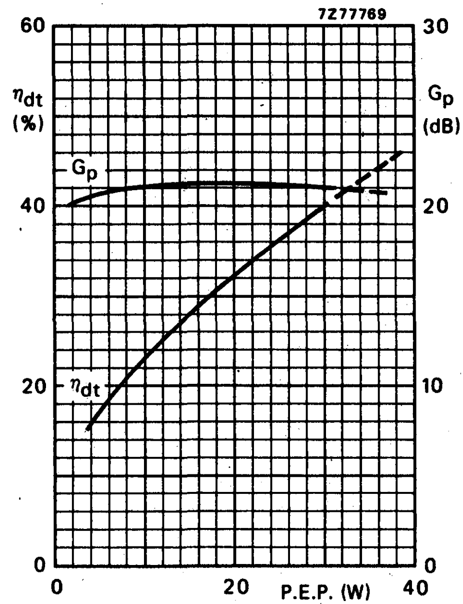


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 11:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 12:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on page 7.

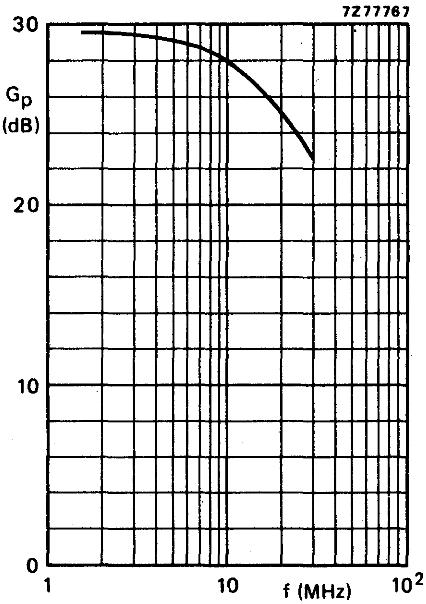


Fig. 13 Power gain as a function of frequency.

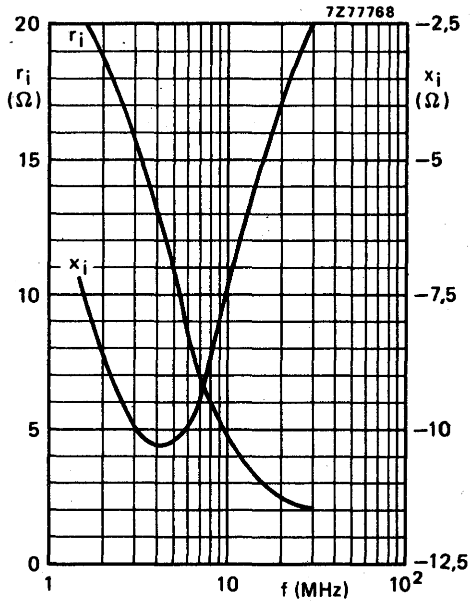


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 30 W; T_h = 25 °C; Z_L = 9,5 Ω.

Ruggedness in s.s.b. operation

The BLW83 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 35 W (P.E.P.).

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

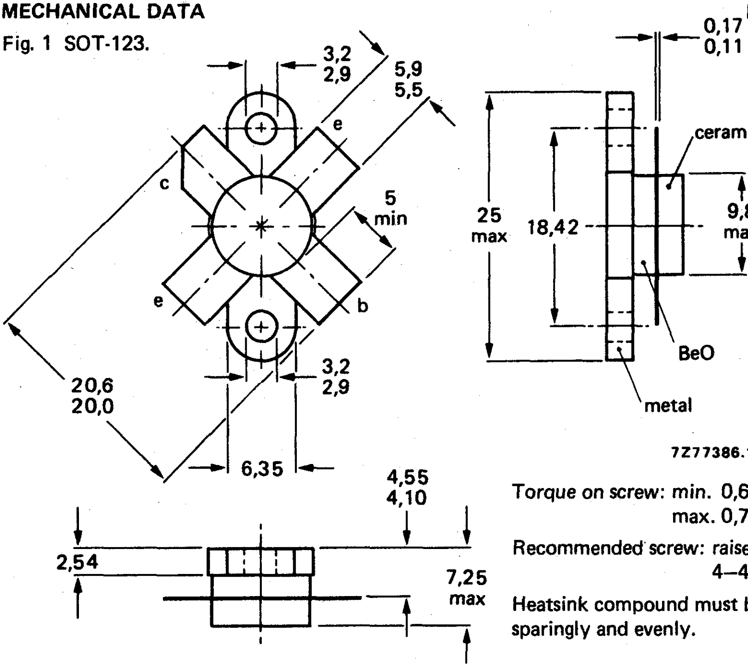
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**28**	**175**	**25**	**> 9**	**> 60**	**1,0 + j1,2**	**59 – j54**

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4–40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

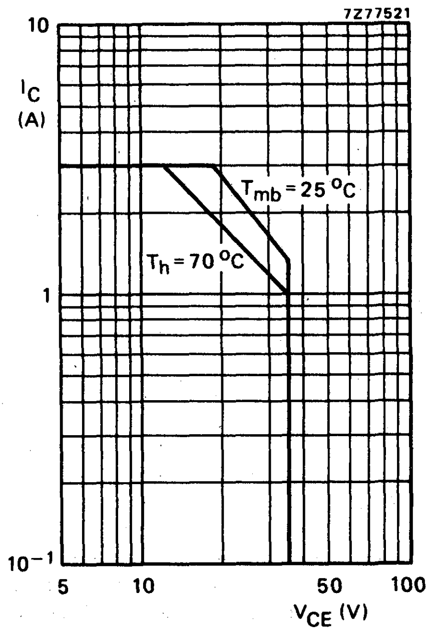


Fig. 2 D.C. SOAR.

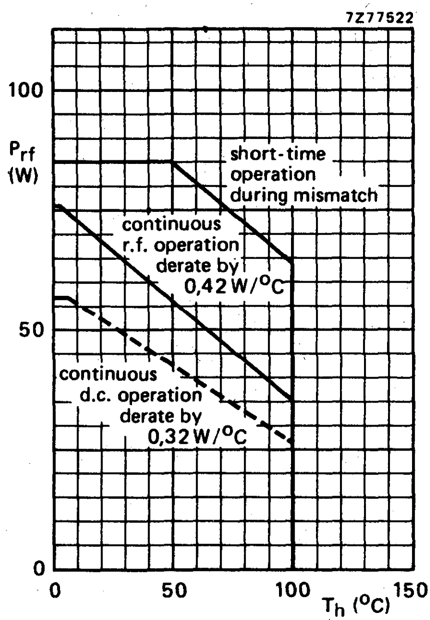


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb\ (dc)}$	=	3,0 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb\ (rf)}$	=	2,25 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain * $I_C = 1,25$ A; $V_{CE} = 5$ V	h_{FE}	typ.	45 10 to 100
Collector-emitter saturation voltage * $I_C = 3,75$ A; $I_B = 0,75$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	650 MHz
$-I_E = 3,75$ A; $V_{CB} = 28$ V	f_T	typ.	650 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	45 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	28 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

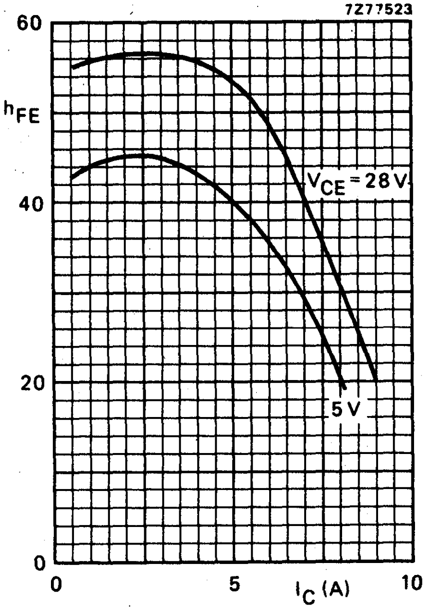


Fig. 4 Typical values; T_j = 25 °C.

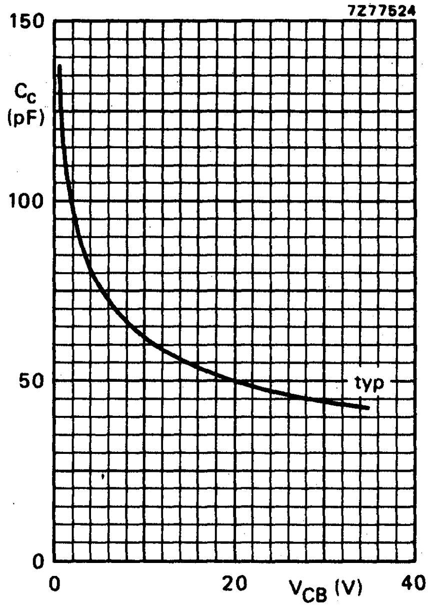


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

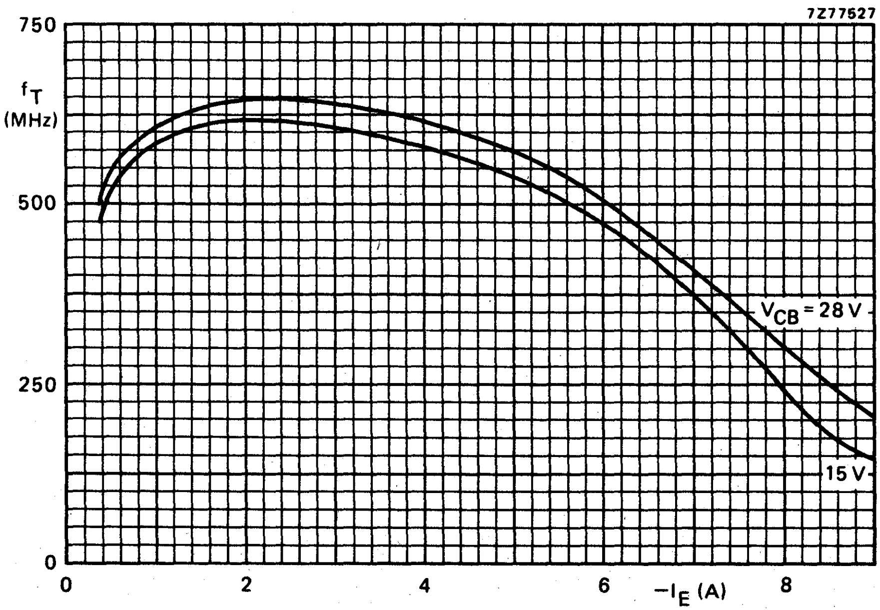


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**28**	**25**	**< 3,15**	**> 9**	**< 1,49**	**> 60**	**1,0 + j1,2**	**59−j54**

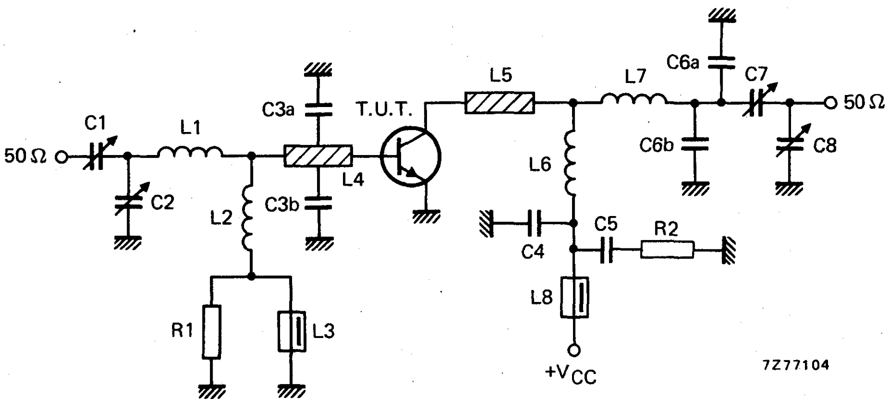


Fig. 7 Test circuit; c.w. class-B.

List of components
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF (± 10%) polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

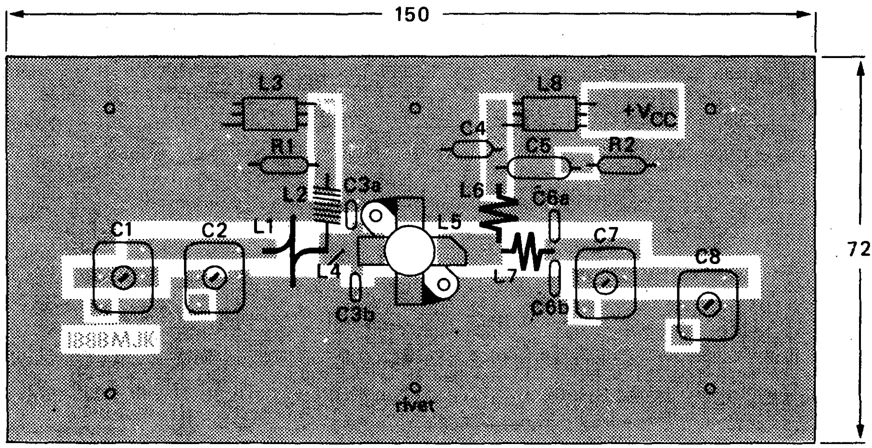
L1 = 14 nH; 1 turn enamelled Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω (± 10%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



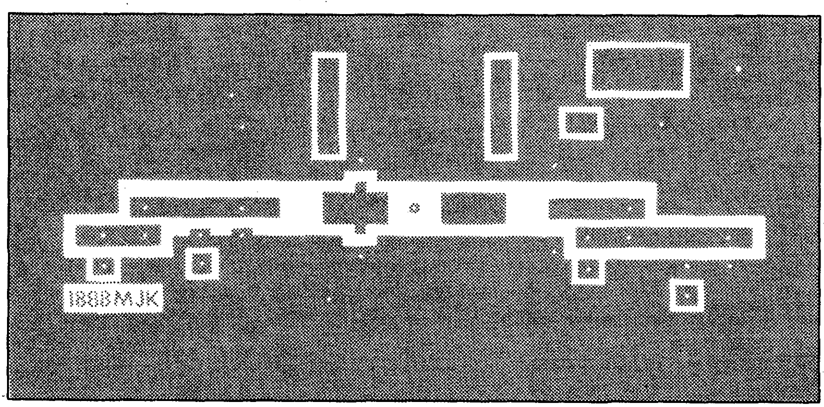


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

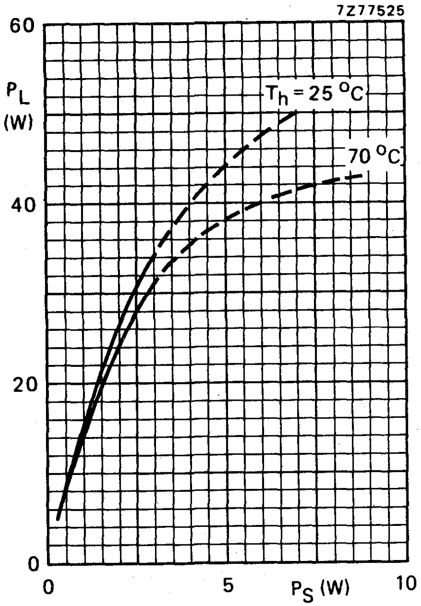


Fig. 9 $V_{CE} = 28$ V; f = 175 MHz; typical values.

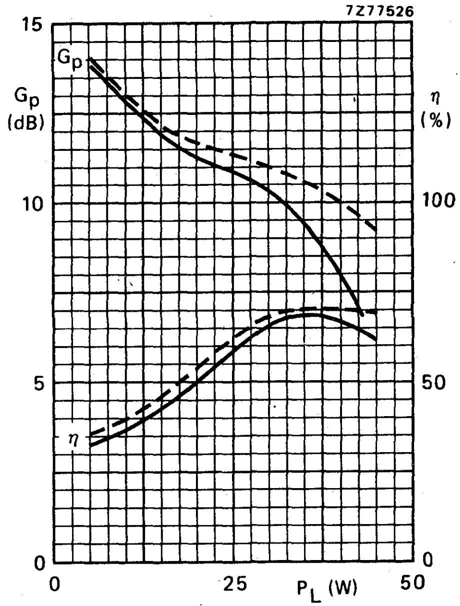


Fig. 10 $V_{CE} = 28$ V; f = 175 MHz; typical values; – – – $T_h = 25\ ^oC$; ——— $T_h = 70\ ^oC$.

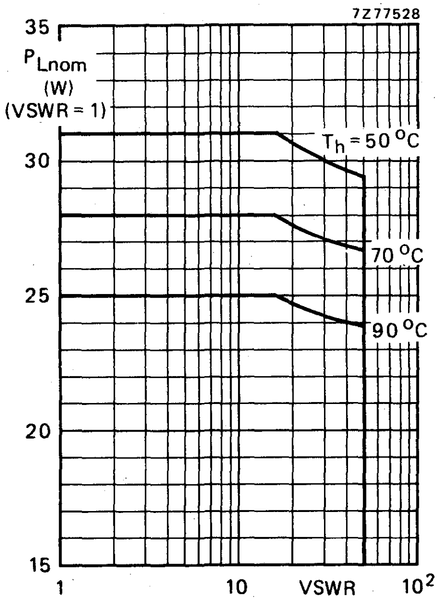


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; $V_{CE} = 28$ V; $R_{th\ mb\text{-}h} = 0{,}3\ ^oC/W$.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

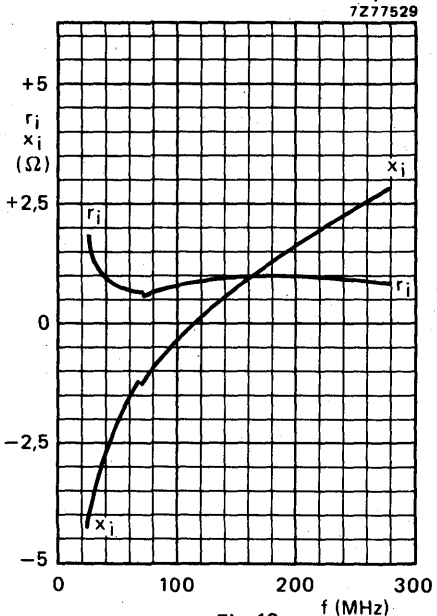


Fig. 12.

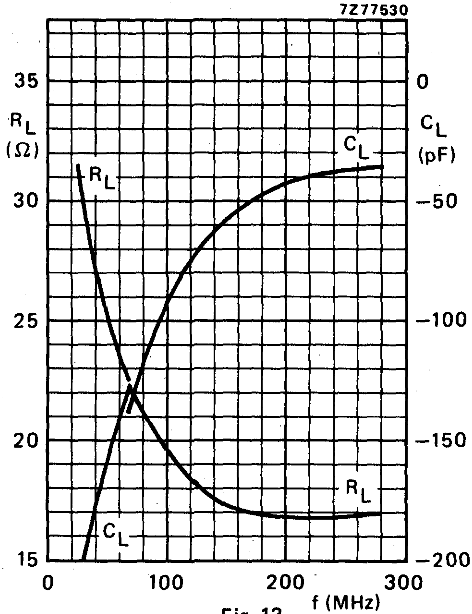
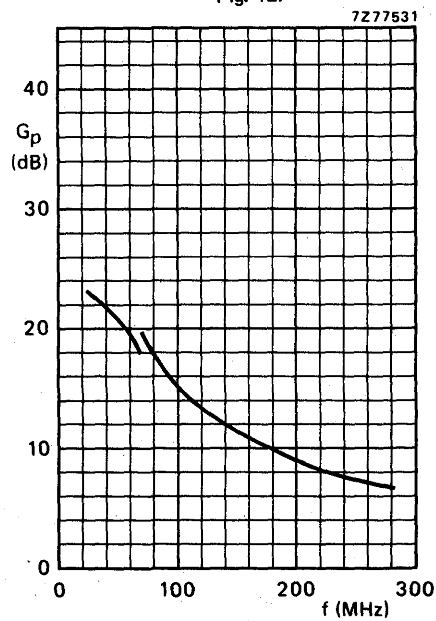


Fig. 13.



Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 28 V; P_L = 25 W; T_h = 25 °C.

Fig. 14.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

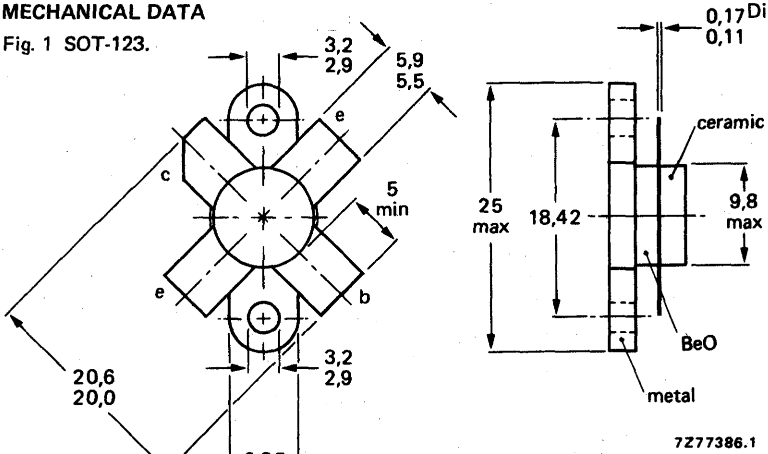
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	**> 5**	**> 75**	**1,2 + j1,4**	**320 + j150**	**–**
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	–	–	typ. –33

MECHANICAL DATA

Fig. 1 SOT-123.

Dimensions in mm



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	9 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	22 A
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	105 W
Storage temperature	T_{stg}	− 65 to + 150	^oC
Operating junction temperature	T_j	max.	200 ^oC

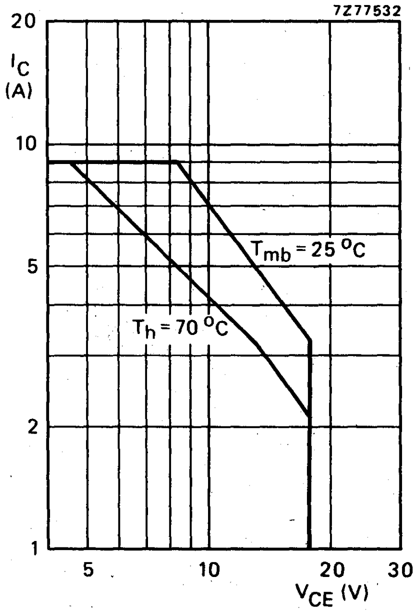


Fig. 2 D.C. SOAR.

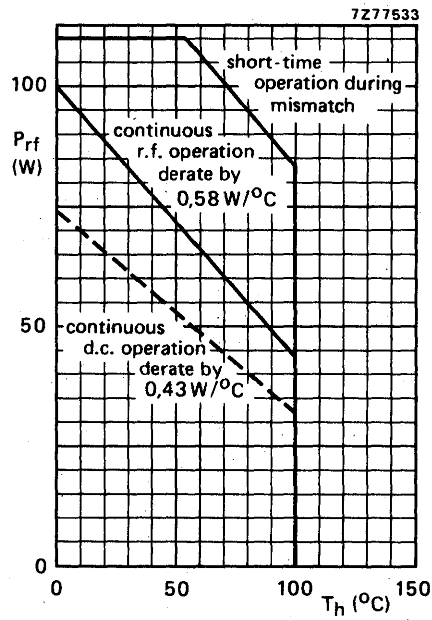


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f $\geqslant$ 1 MHz.

THERMAL RESISTANCE (dissipation = 30 W; $T_{mb} = 79\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,5 $^oC/W$
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,8 $^oC/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 $^oC/W$

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	25 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 80
D.C. current gain ratio of matched devices* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* $I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E = 4$ A; $V_{CB} = 12,5$ V	f_T	typ.	650 MHz
$-I_E = 12,5$ A; $V_{CB} = 12,5$ V	f_T	typ.	600 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	120 pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 15$ V	C_{re}	typ.	82 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

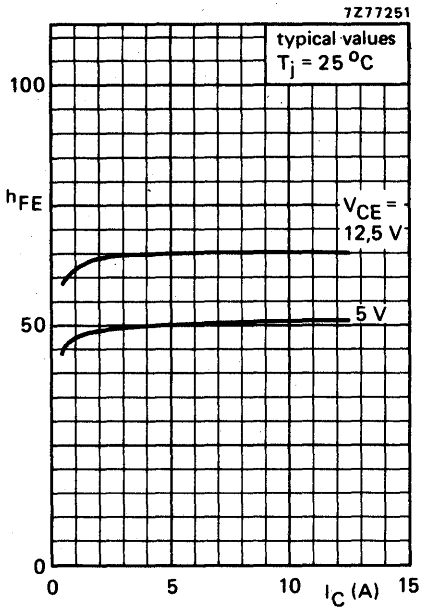


Fig. 4.

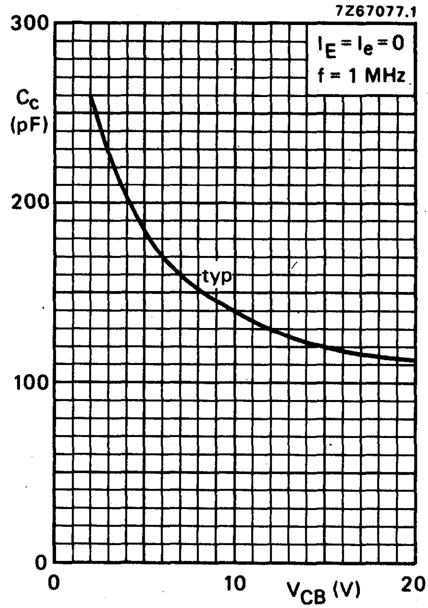


Fig. 5 $T_j = 25\ ^oC$.

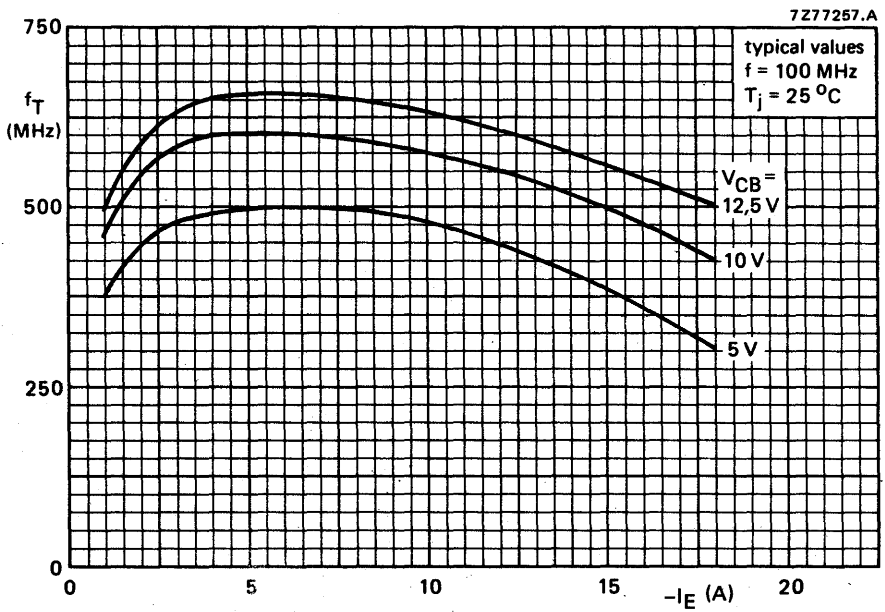


Fig. 6.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**12,5**	**45**	**< 14,2**	**> 5**	**< 4,8**	**> 75**	**1,2 + j1,4**	**320 + j150**
175	13,5	45	–	typ. 6,0	–	typ. 75	–	–

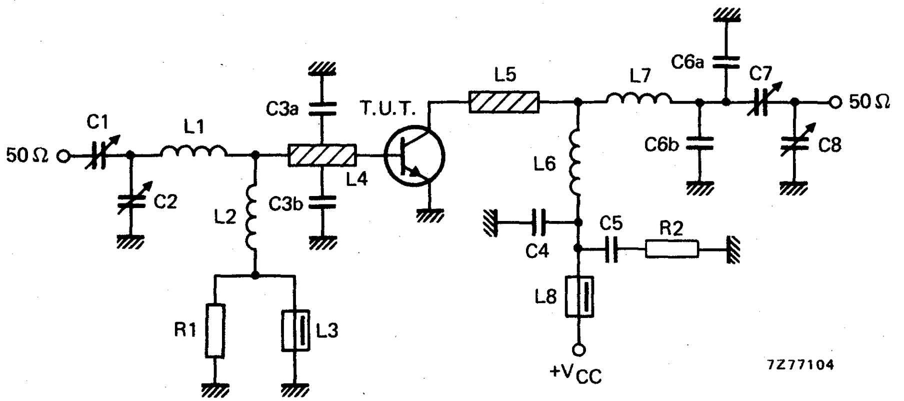


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

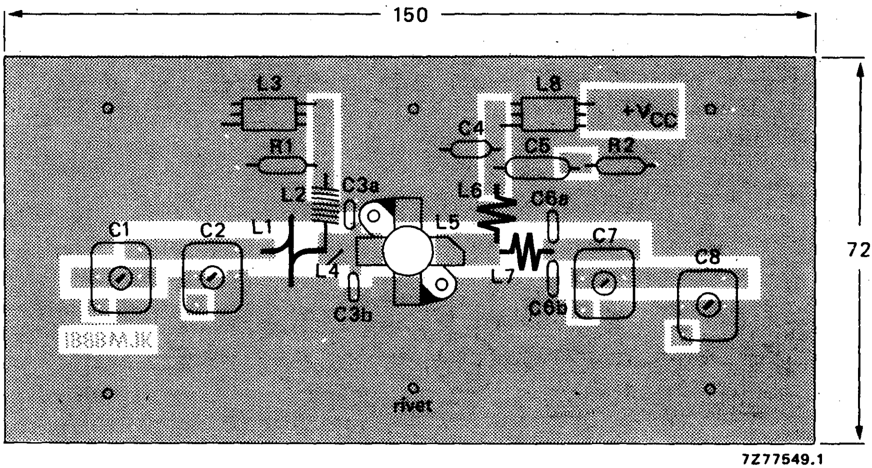
L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (±10%) carbon resistor (0,25 W)
R2 = 4,7 Ω (±5%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



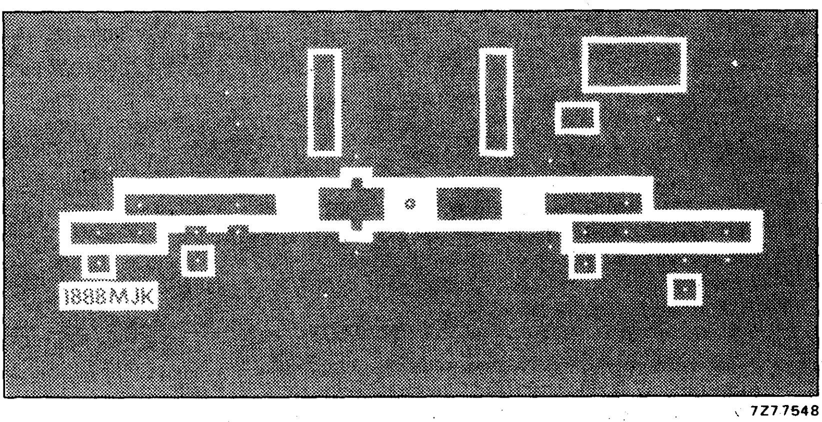


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

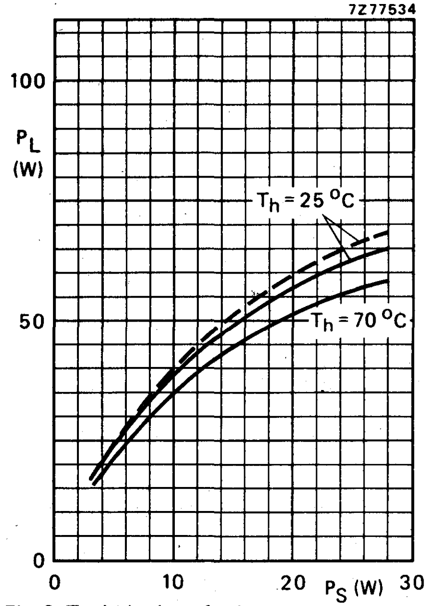


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 12,5 V; – – – V_{CE} = 13,5 V.

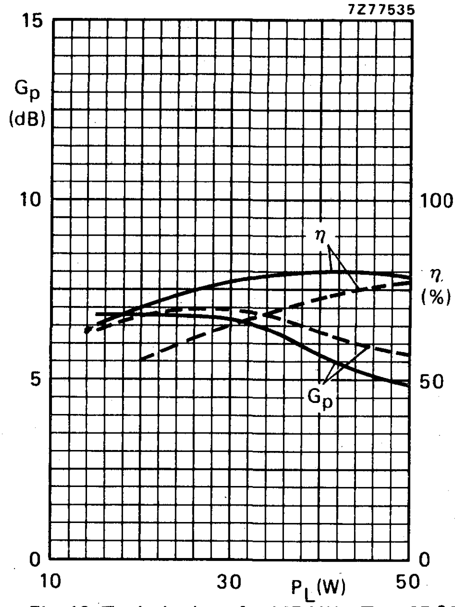


Fig. 10 Typical values; f = 175 MHz; T_h = 25 °C;
—— V_{CE} = 12,5 V; – – – V_{CE} = 13,5 V.

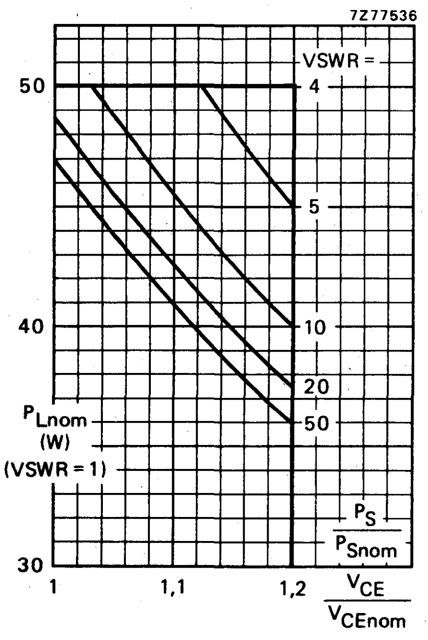


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 °C/W; V_{CEnom} = 12,5 V or 13,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

APPLICATION INFORMATION (continued)

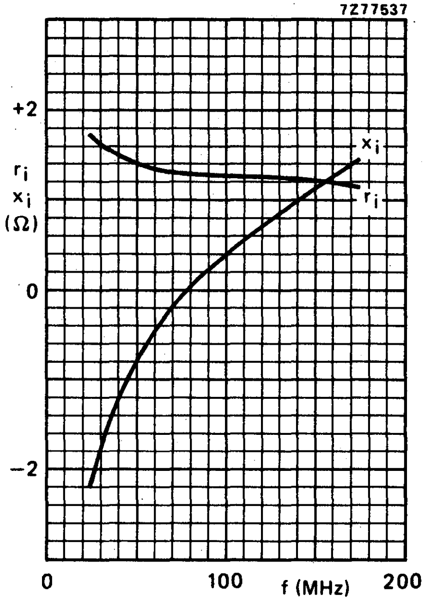


Fig. 12.

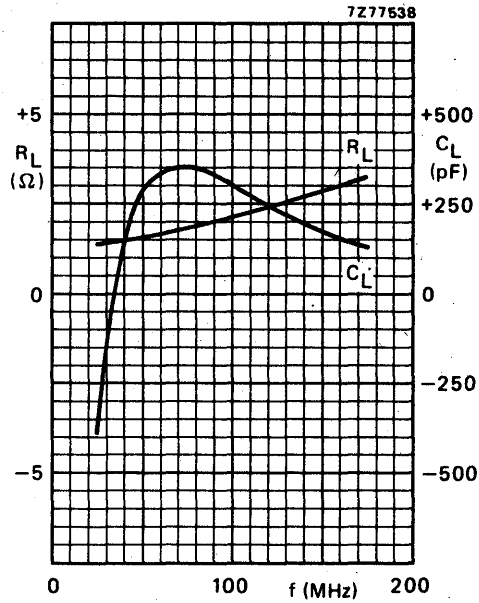


Fig. 13.

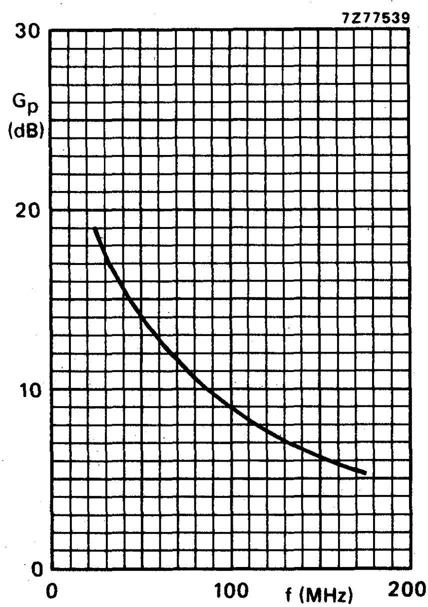


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 12,5 V; P_L = 45 W; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb\text{-}h} \leq 0,3$ °C/W
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ. 19,5	typ. 35	typ. −33	typ. −36	25

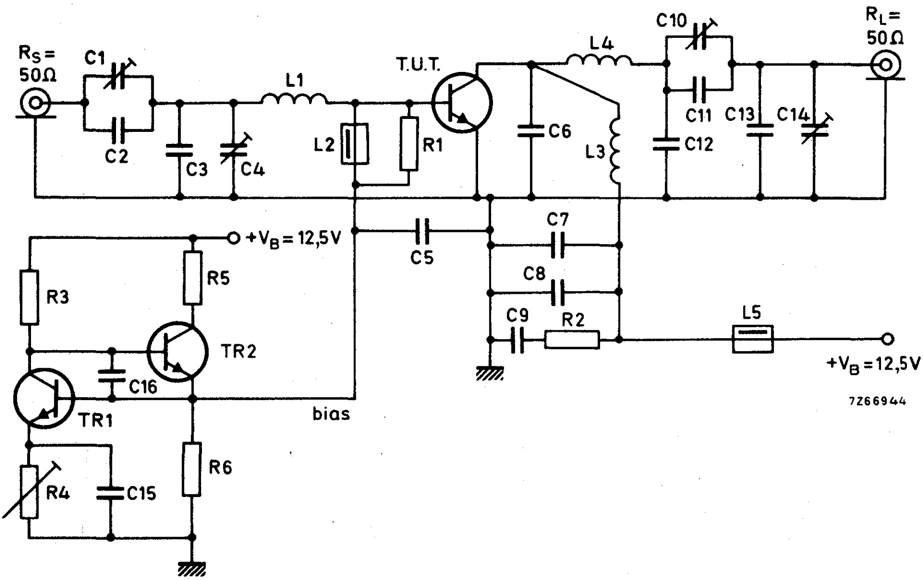


Fig. 15 Test circuit; s.s.b. class-AB.

List of components:

TR1 = TR2 = BD137

C1 = 100 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor (500 V)
C3 = 180 pF polystyrene capacitor
C4 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C5 = C7 = 3,9 nF polyester capacitor
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C10 = 2 x 385 pF (sections in parallel) film dielectric trimmer
C11 = 68 pF ceramic capacitor (500 V)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel (500 V)
C13 = 47 pF ceramic capacitor (500 V)
C14 = 385 pF film dielectric trimmer

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm

R1 = 27 Ω (±5%) carbon resistor (0,5 W)
R2 = 4,7 Ω (±5%) carbon resistor (0,25 W)
R3 = 1,5 kΩ (±5%) carbon resistor (0,5 W)
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor (0,25 W)

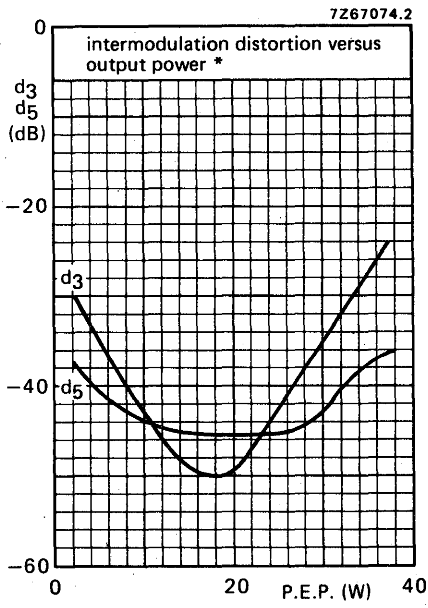


Fig. 16.

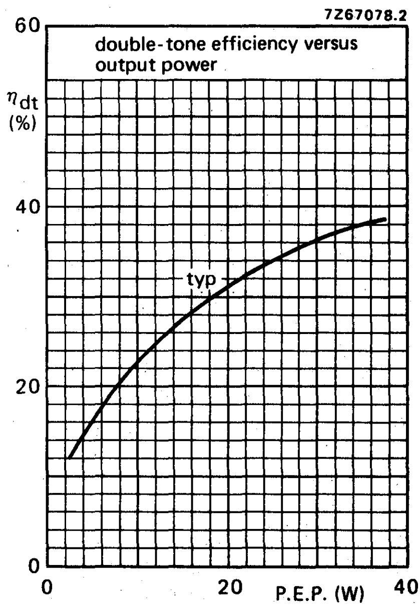


Fig. 17.

Conditions for Figs 16 and 17:

V_{CE} = 12,5 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h} \leqslant$ 0,3 °C/W; $I_{C(ZS)}$ = 25 mA; typical values.

* See page 11.

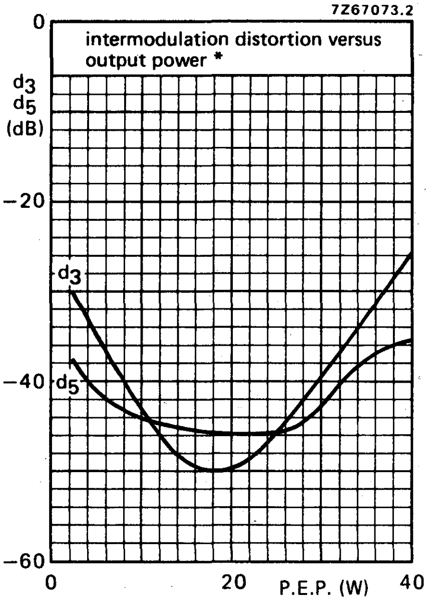


Fig. 18.

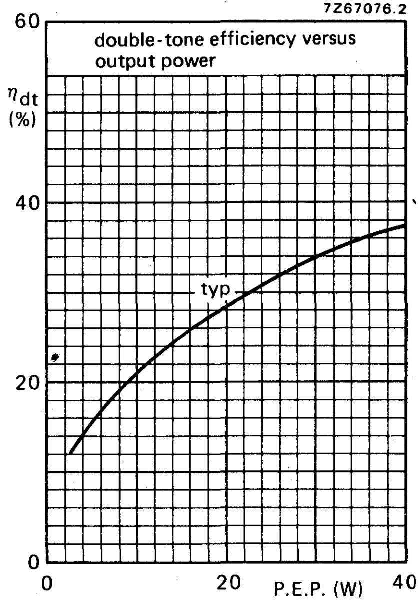


Fig. 19.

Conditions for Figs 18 and 19:

V_{CE} = 13,5 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h} \leqslant 0,3$ °C/W; $I_{C(ZS)}$ = 25 mA; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

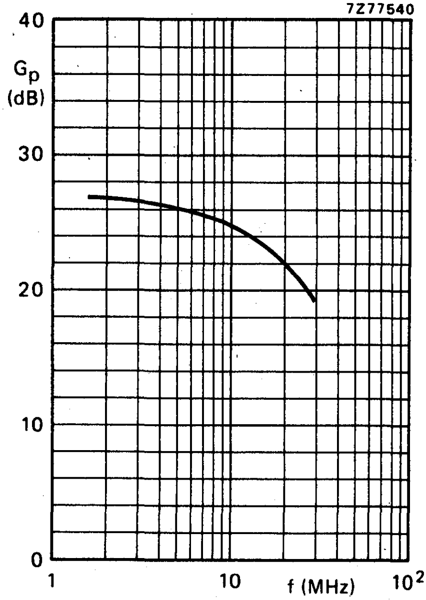


Fig. 20 Power gain as a function of frequency.

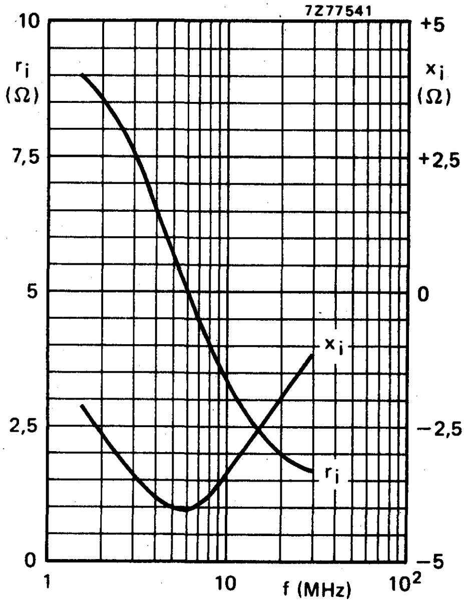


Fig. 21 Input impedance (series components) as a function of frequency.

Fig. 20 and 21 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 12,5 V	V_{CE} = 13,5 V
P_L = 30 W (P.E.P.)	P_L = 35 W (P.E.P.)
T_h = 25 °C	T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,3 °C/W	$R_{th\ mb\text{-}h} \leqslant$ 0,3 °C/W
$I_{C(ZS)}$ = 25 mA	$I_{C(ZS)}$ = 25 mA
Z_L = 1,8 Ω	Z_L = 1,8 Ω

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.
It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

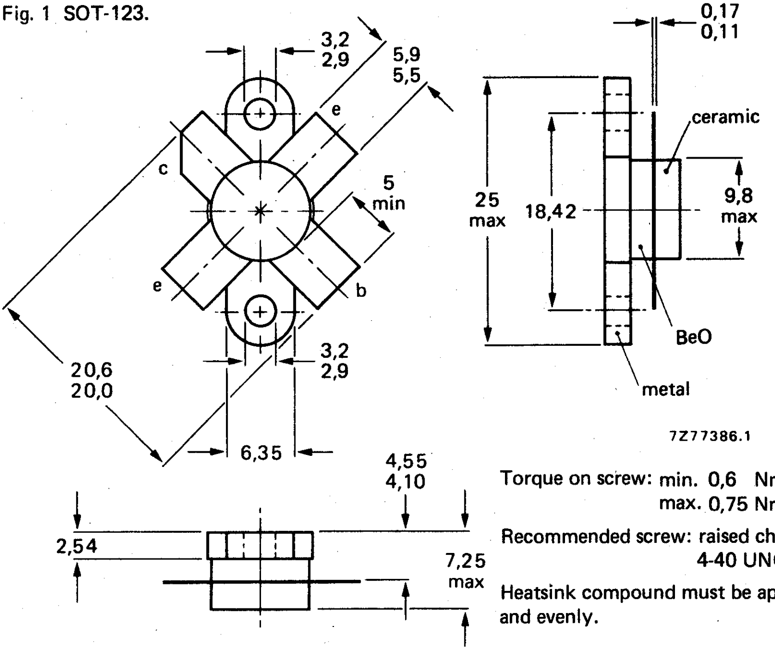
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V	d_3 dB
c.w. (class-B)	**28**	**175**	**45**	**> 7,5**	**> 70**	**0,7 + j1,3**	**110 – j62**	–
s.s.b. (class-AB)	28	1,6 – 28	5–47,5(P.E.P.)	typ. 19	typ. 45	–	–	typ. –30
s.s.b. (class-A)	26	1,6 – 28	17(P.E.P.)	typ. 22	–	–	–	typ. –42

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	4	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	105	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

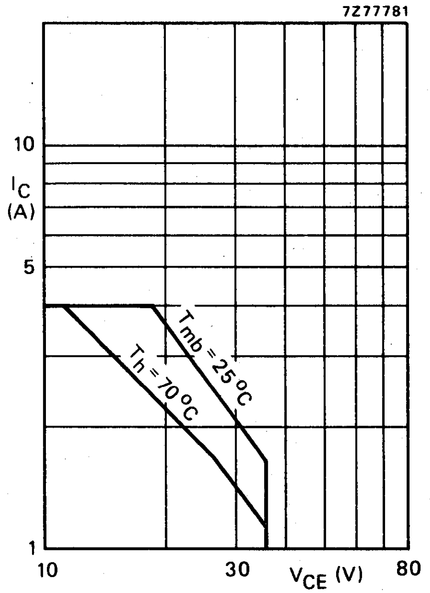


Fig. 2 D.C. SOAR.

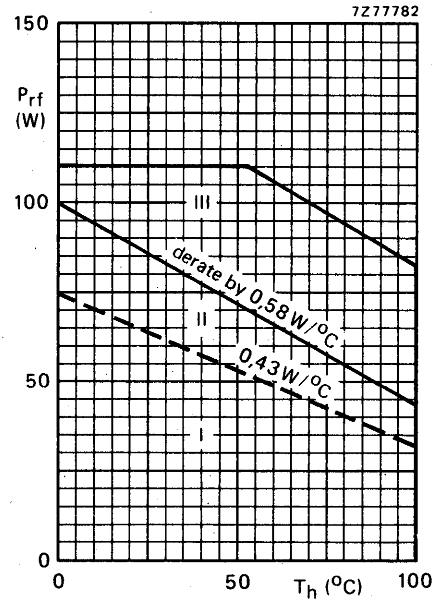


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 45 W; T_{mb} = 83,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,65	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,95	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage			
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage			
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain*			
I_C = 2,5 A; V_{CE} = 5 V	h_{FE}	typ.	45
			10 to 80
D.C. current gain ratio of matched devices*			
I_C = 2,5 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage*			
I_C = 7,5 A; I_B = 1,5 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz*			
$-I_E$ = 2,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
$-I_E$ = 7,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	82 pF
Feedback capacitance at f = 1 MHz			
I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	54 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

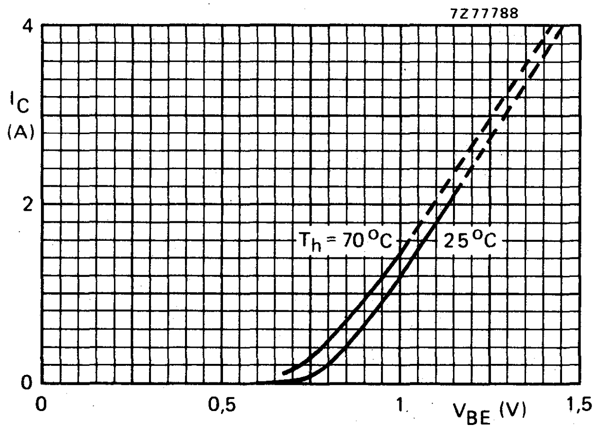


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

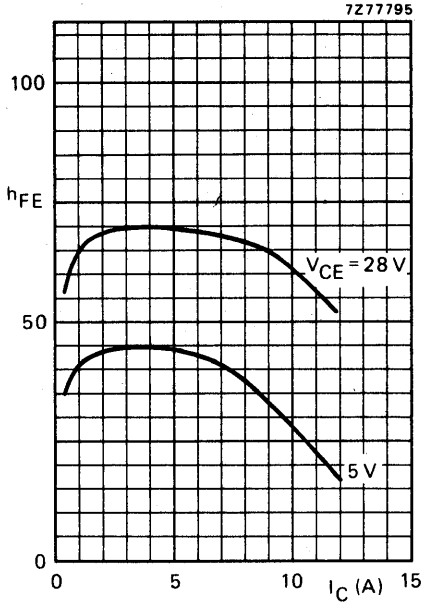


Fig. 5 Typical values; T_j = 25 °C.

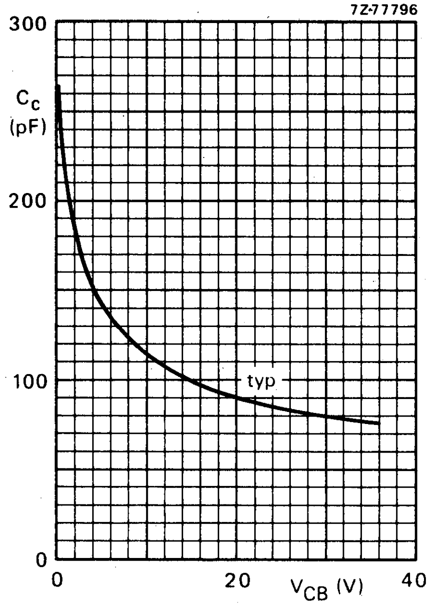


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

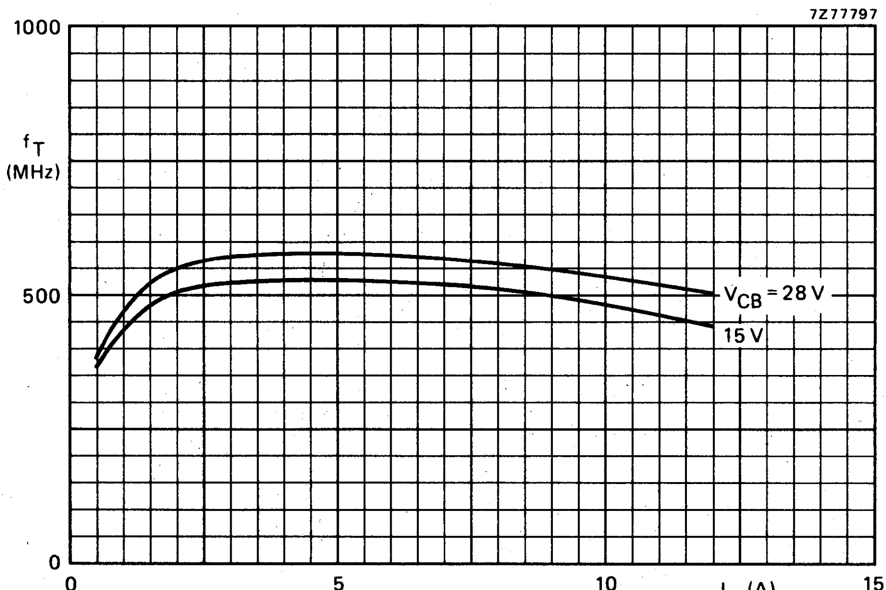


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	45	< 8	> 7,5	< 2,47	> 70	0,7 + j1,3	110 – j62

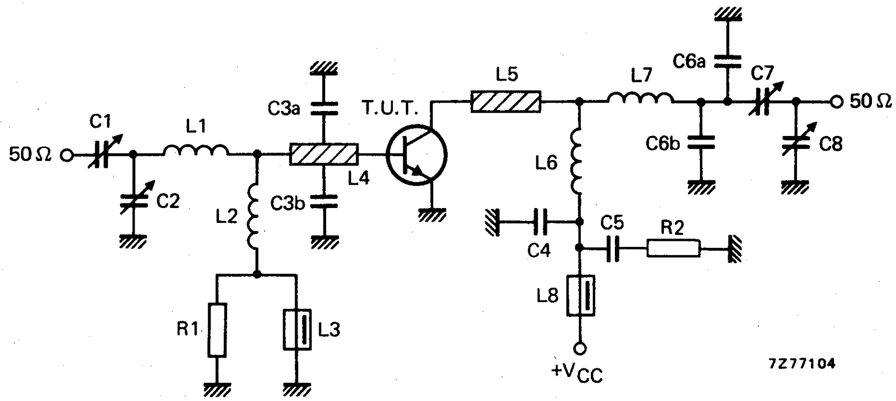


Fig. 8 Test circuit; c.w. class-B.

List of components:

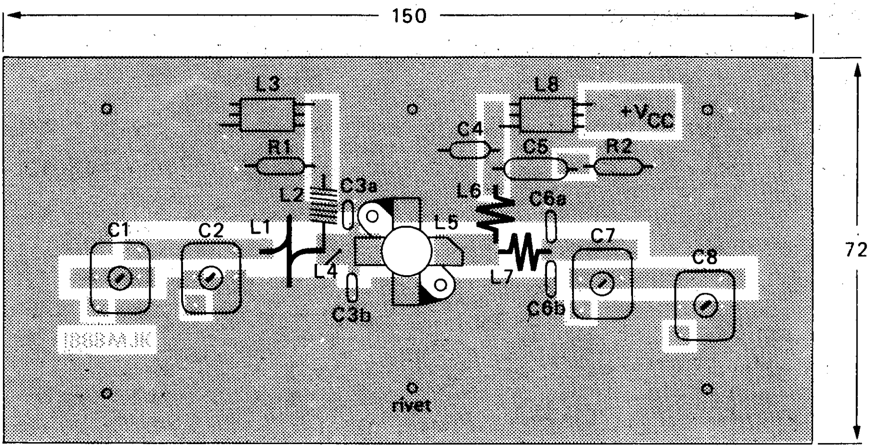
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.



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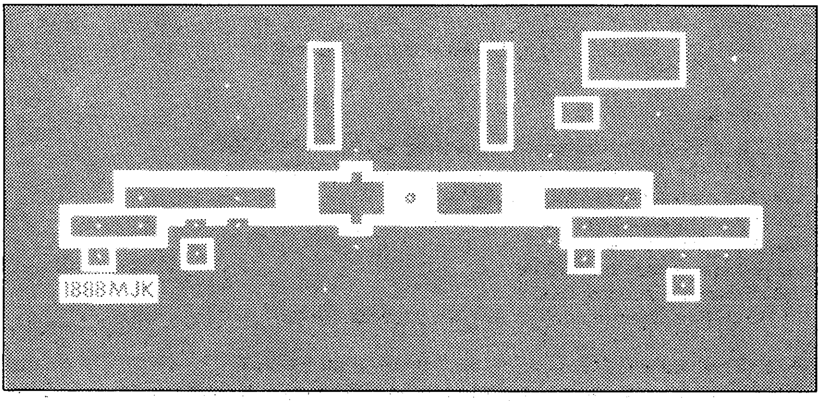

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Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

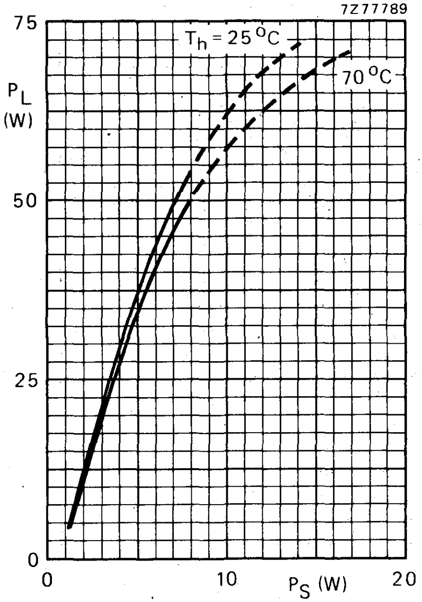


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

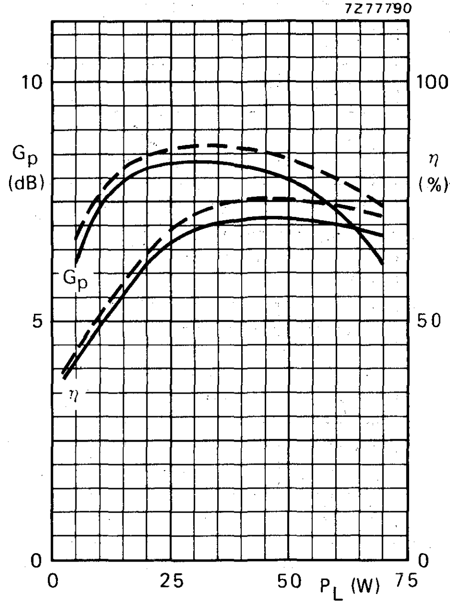


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

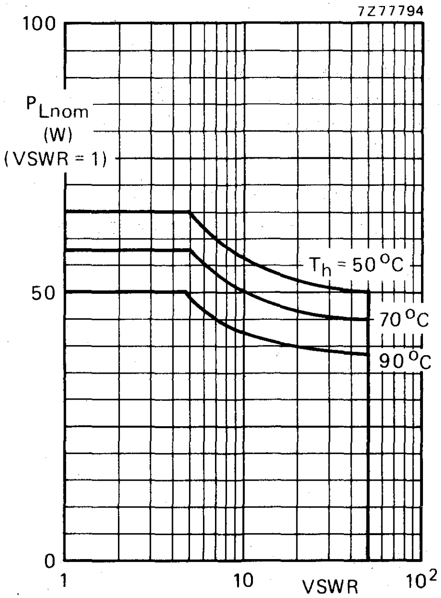


Fig. 12 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

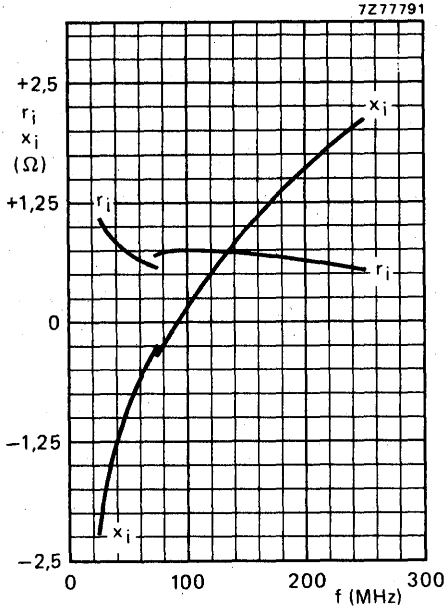


Fig. 13 Input impedance (series components).

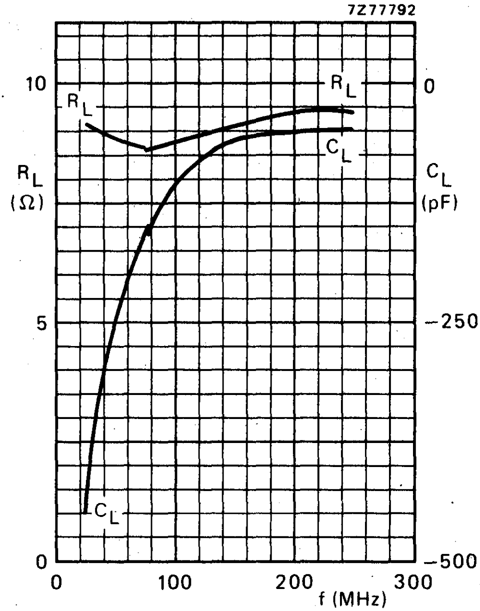


Fig. 14 Load impedance (parallel components).

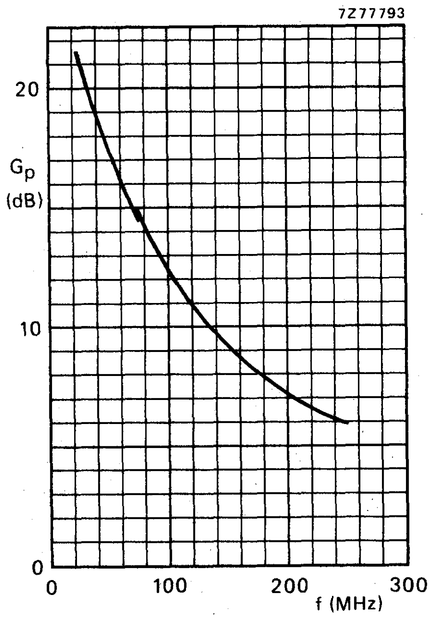


Fig. 15 Power gain versus frequency.

OPERATING NOTE

Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.

Typical values; V_{CE} = 28 V; P_L = 45 W; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 47,5 W (P.E.P.)	I_C (A) at 47,5 W (P.E.P.)	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
5 to 47,5 (P.E.P.)	typ. 19	typ. 45	typ. 1,9	typ. –30	< –30	50	25
5 to 42,5 (P.E.P.)	typ. 19	–	–	typ. –30	< –30	50	70

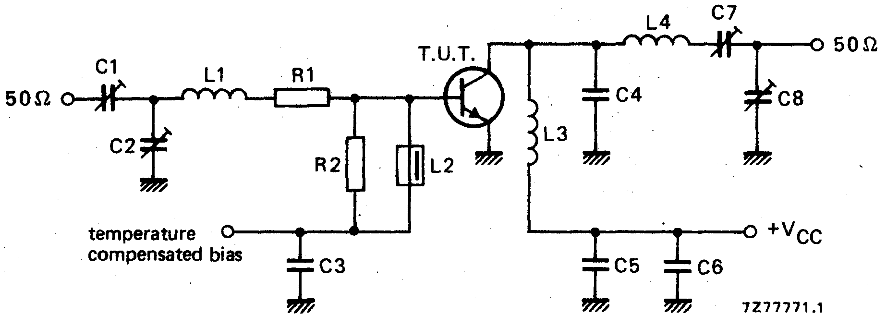


Fig. 16 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

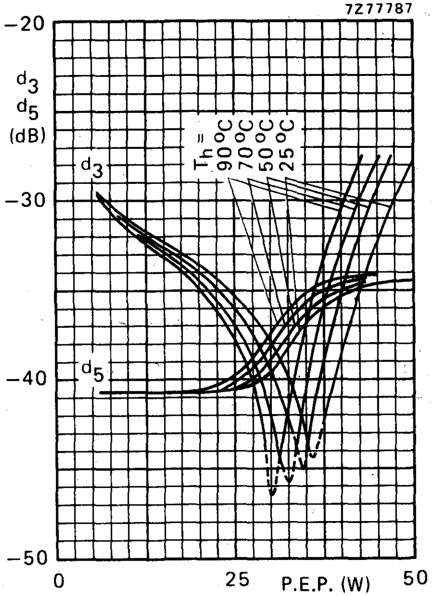


Fig. 17 Intermodulation distortion as a function of output power.*

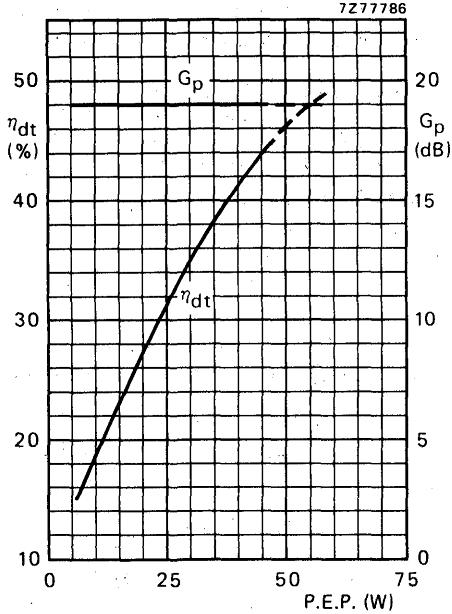


Fig. 18 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 17:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 18:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on page 9.

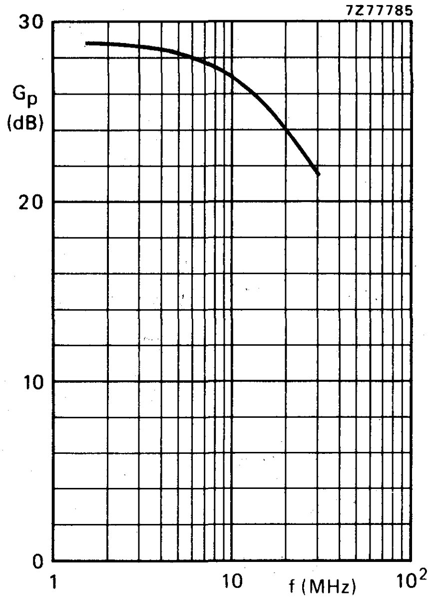


Fig. 19 Power gain as a function of frequency.

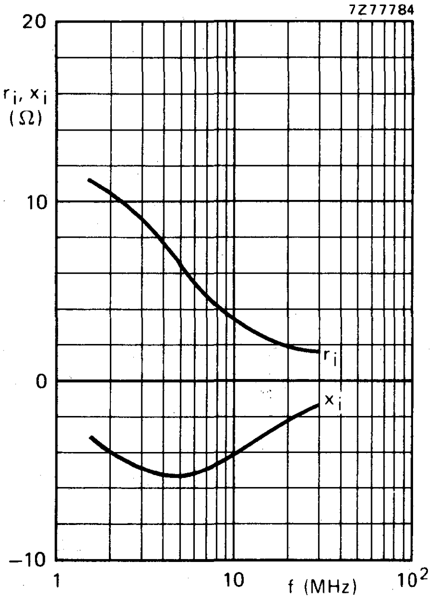


Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 47,5 W; T_h = 25 °C; Z_L = 6,4 Ω.

Ruggedness in s.s.b. operation

The BLW86 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 50 W P.E.P.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB*	d_5 dB*	T_h °C
17 (P.E.P.)	typ. 22	1,7	typ. −40	< −40	70
17 (P.E.P.)	typ. 22	1,7	typ. −42	< −40	25

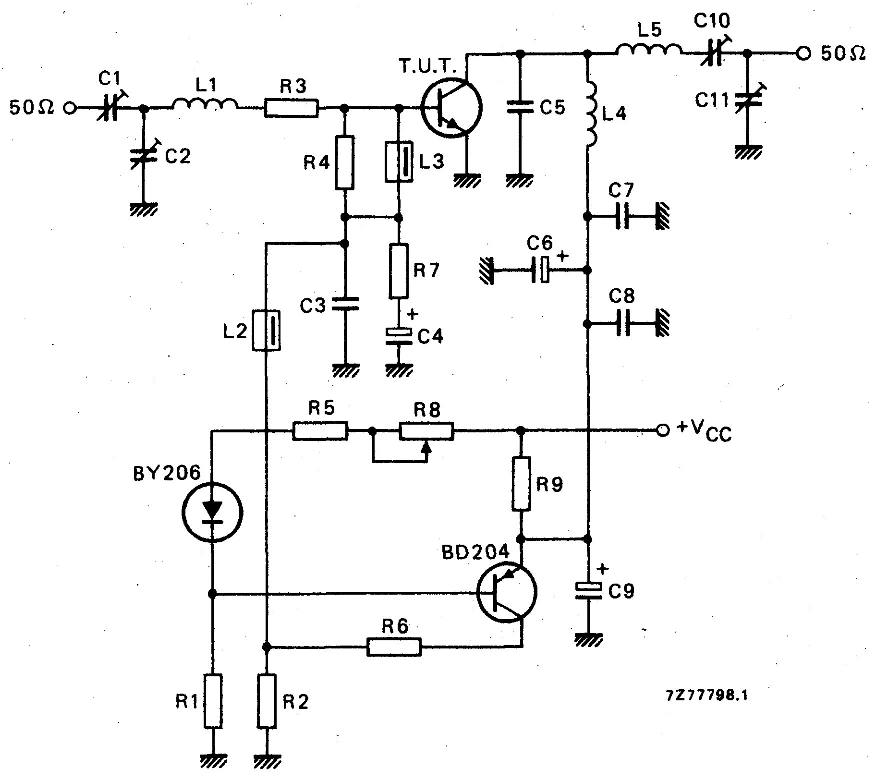


Fig. 21 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 21:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 pF film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0,5 W each)
R2 = 15 Ω carbon resistor (±5%; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0,125 W each)
R4 = 33 Ω carbon resistor (±5%; 0,25 W)
R5 = 18 Ω carbon resistor (±5%; 0,25 W)
R6 = 120 Ω wirewound resistor (±5%; 5,5 W)
R7 = 1 Ω carbon resistor (±5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (±5%; 5,5 W each)

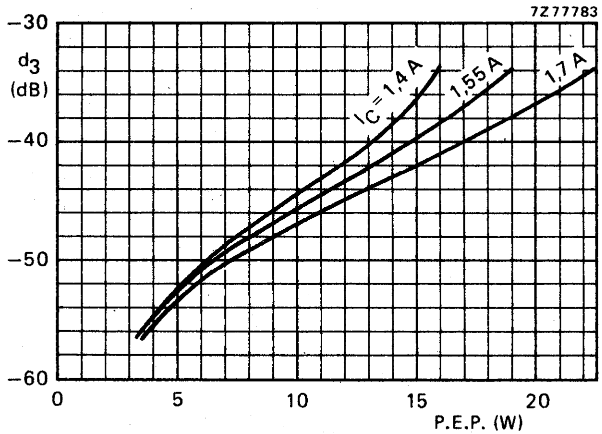


Fig. 22 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

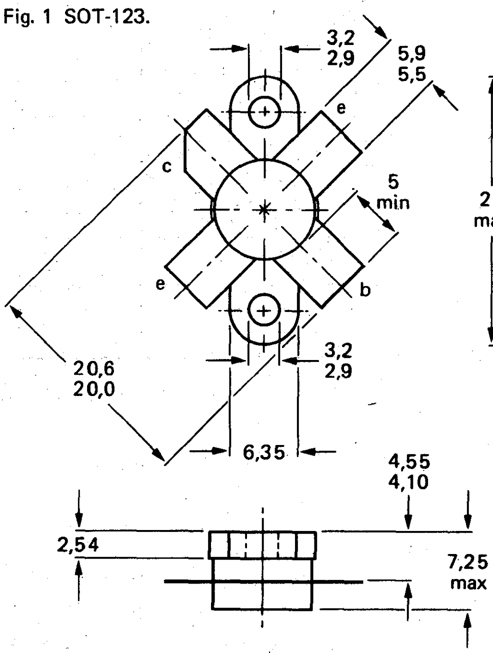
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**25**	**> 6**	**> 70**	**1,6 + j1,4**	**210 + j5,5**

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}	− 65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

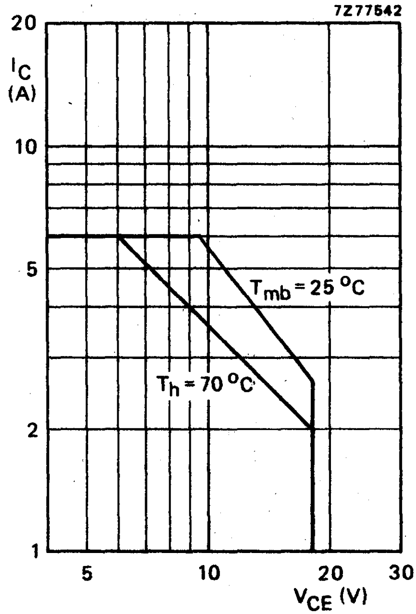


Fig. 2 D.C. SOAR.

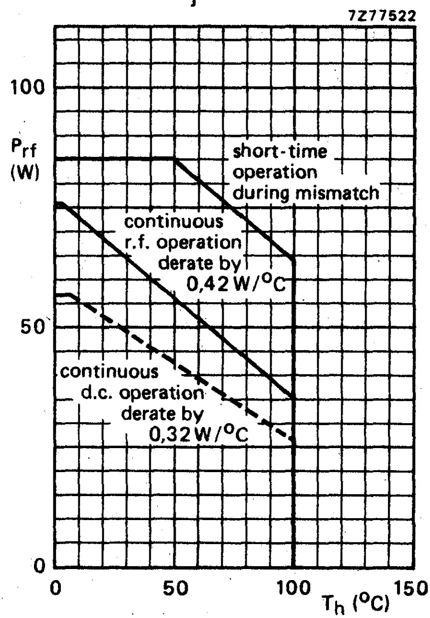


Fig. 3 R.F. power dissipation; $V_{CE} \leq$ 16,5 V; f ≥ 1 MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C; i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,0 °C
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,25 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8	mJ
D.C. current gain* $I_C = 2,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 80	
Collector-emitter saturation voltage* $I_C = 7,5$ A; $I_B = 1,5$ A	V_{CEsat}	typ.	1,7	V
Transition frequency at f = 100 MHz* $-I_E = 2,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	800	MHz
$-I_E = 7,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	750	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	65	pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	41	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

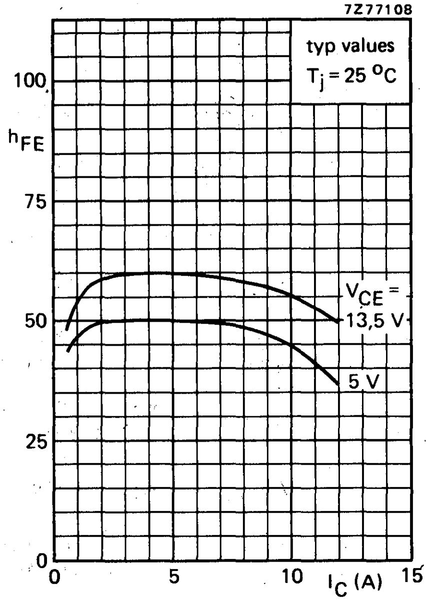


Fig. 4.

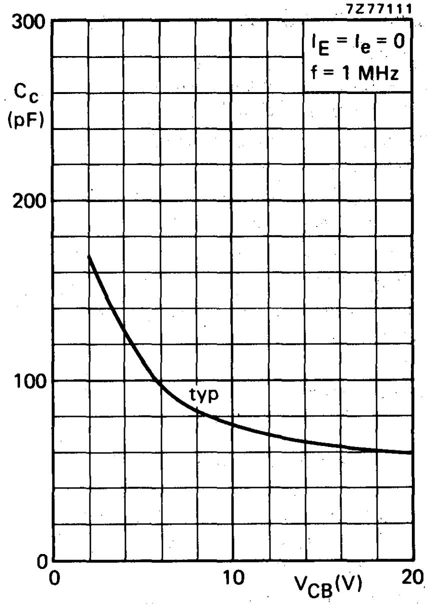


Fig. 5 T_j = 25 °C.

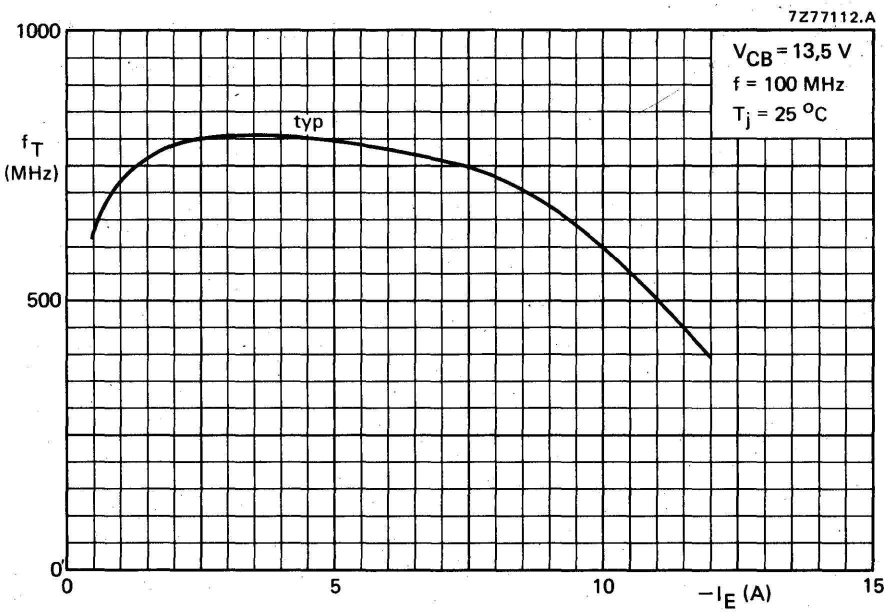


Fig. 6.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**25**	**< 6,25**	**> 6**	**< 2,64**	**> 70**	**1,6 + j1,4**	**210 + j5,5**
175	12,5	25	–	typ. 6,6	–	typ. 75	–	–

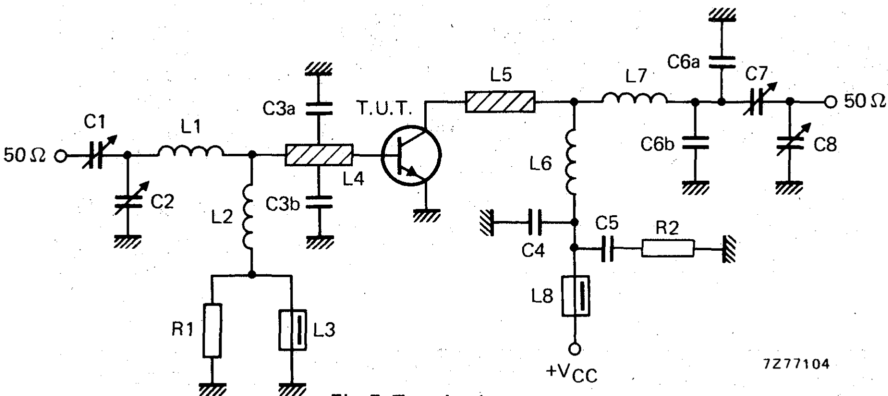


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

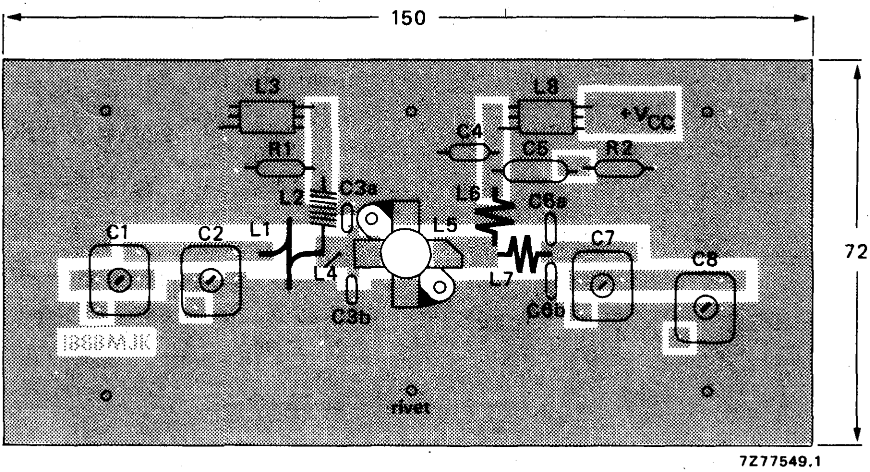
L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (± 10%) carbon resistor (0,25 W)
R2 = 4,7 Ω (± 5%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



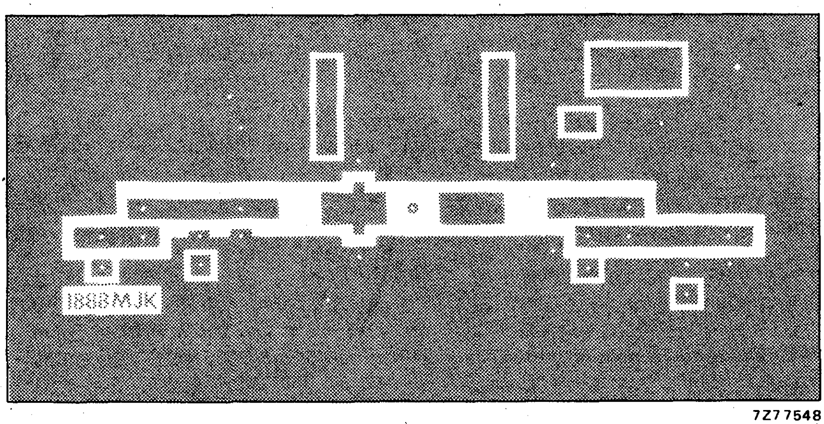


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

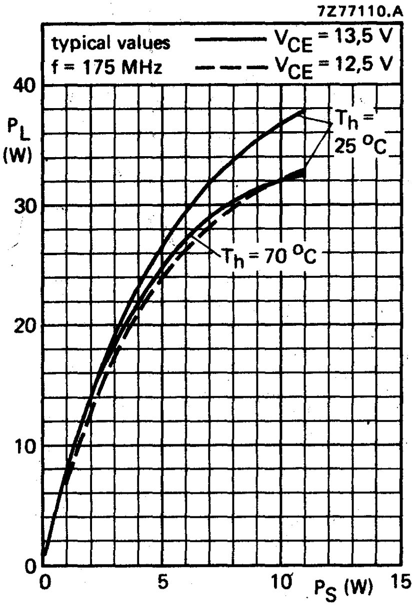


Fig. 9.

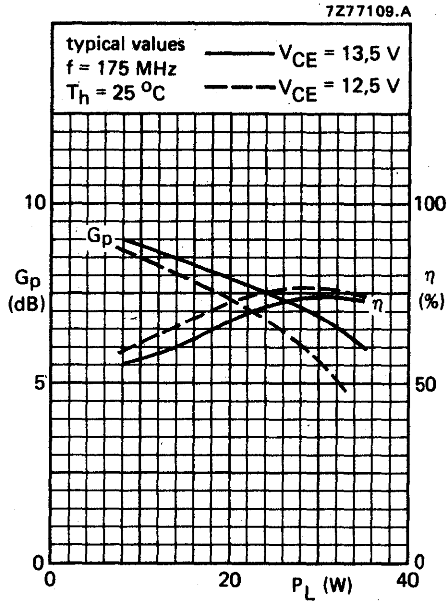


Fig. 10.

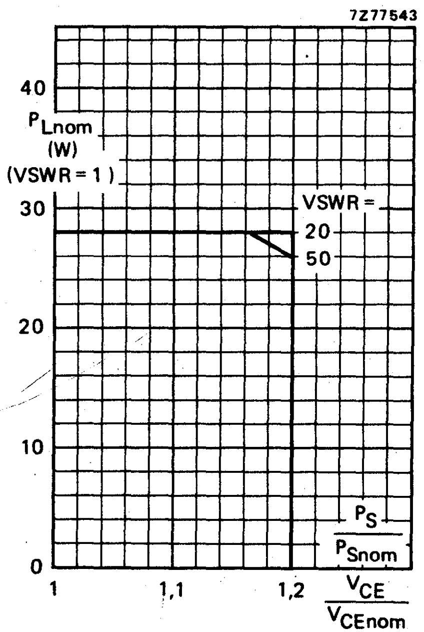


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

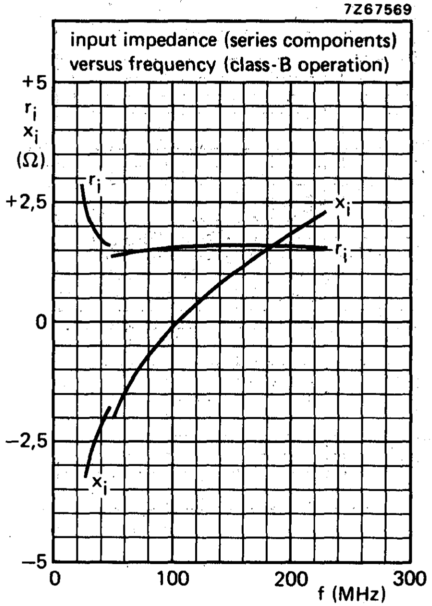


Fig. 12.

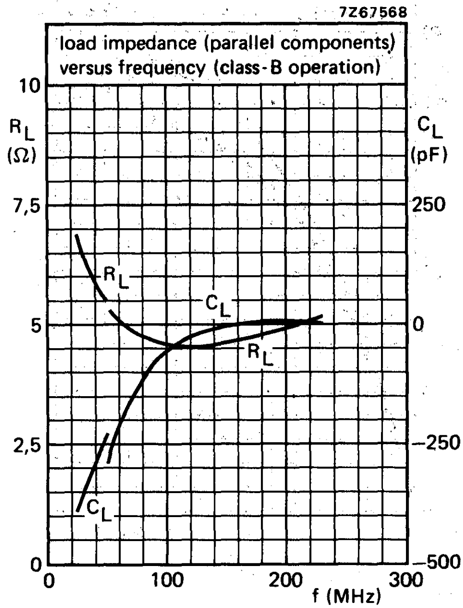
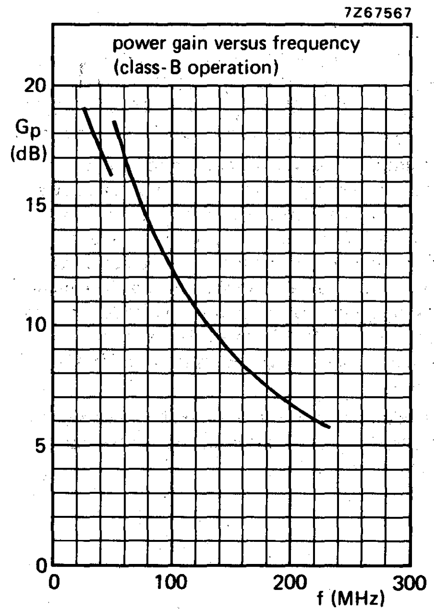


Fig. 13.



Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 13,5 V; P_L = 25 W; T_h = 25 °C.

Fig. 14.

H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB operated high power industrial and military transmitting equipment in the h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η_{dt} %	d_3 dB
s.s.b. (class-AB)	50	0,1	1,6 – 28	20 – 160 (P.E.P.)	> 14	> 40*	< –30

* At 160 W P.E.P.

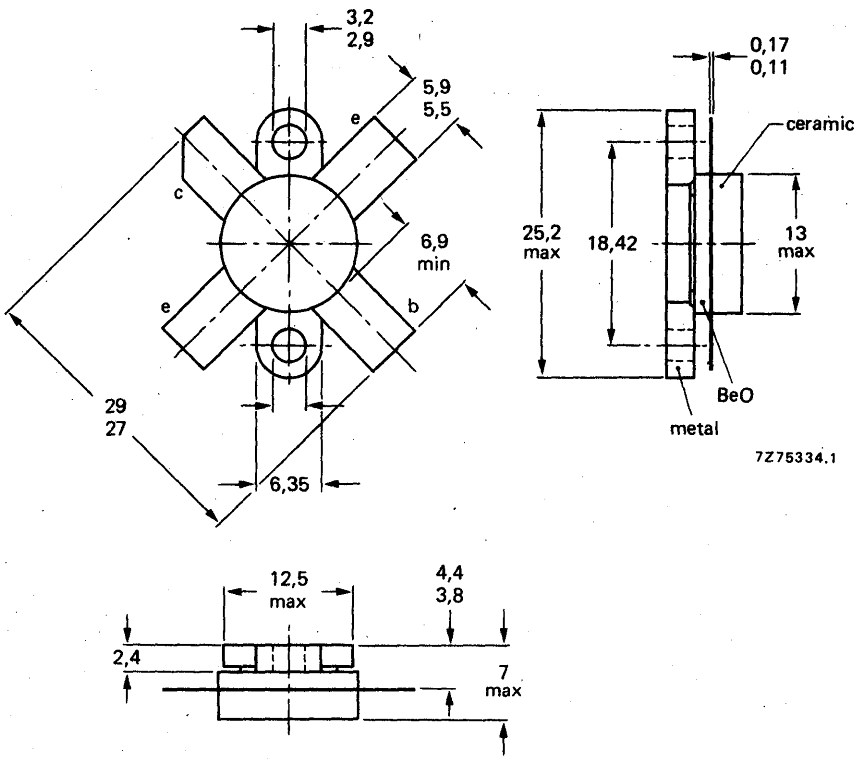
MECHANICAL DATA

SOT-121A (see page 2)

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-121A.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: raised cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	110 V
Collector-emitter voltage (open base)	V_{CEO}	max.	53 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	8 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	20 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	245 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

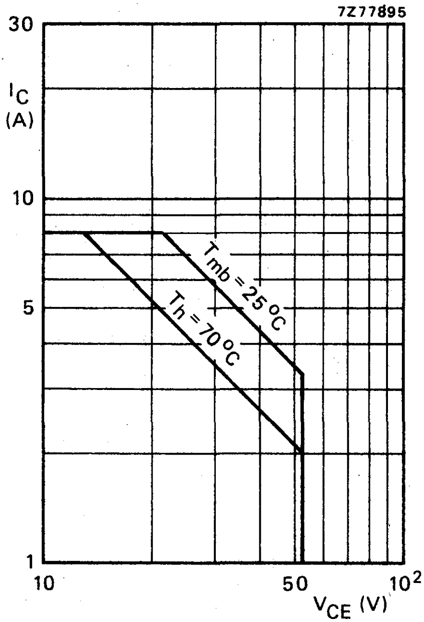


Fig. 2 D.C. SOAR.

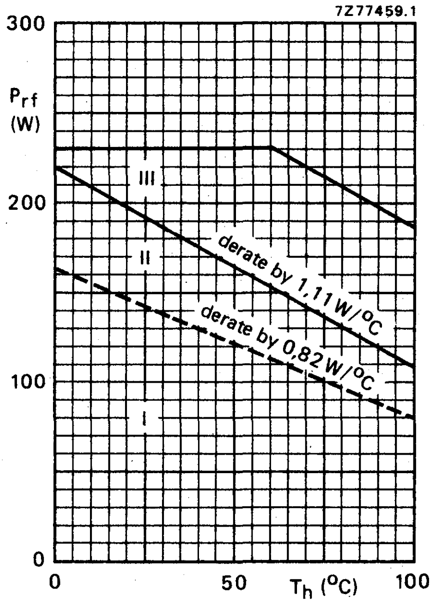


Fig. 3 R.F. power dissipation; $V_{CE} \leq 50$ V; f ≥ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 90 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,0 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,7 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	110 V
Collector-emitter breakdown voltage			
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	53 V
Emitter-base breakdown voltage			
open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 53$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	12,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	12,5 mJ
D.C. current gain *			
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	30
			15 to 50
D.C. current gain ratio of matched devices *			
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	≤	1,2
Collector-emitter saturation voltage *			
$I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ.	2,2 V
Transition frequency at f = 100 MHz *			
$-I_E = 4$ A; $V_{CB} = 40$ V	f_T	typ.	270 MHz
$-I_E = 12,5$ A; $V_{CB} = 40$ V	f_T	typ.	285 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 50$ V	C_c	typ.	185 pF
Feedback capacitance at f = 1 MHz			
$I_C = 150$ mA; $V_{CE} = 50$ V	C_{re}	typ.	115 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

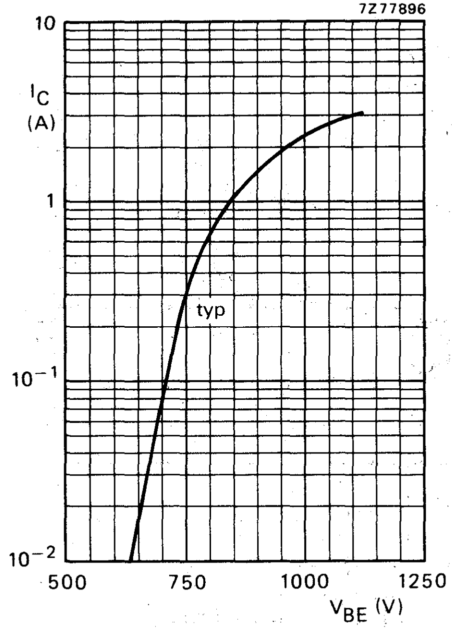


Fig. 4 V_{CE} = 40 V; T_h = 25 °C.

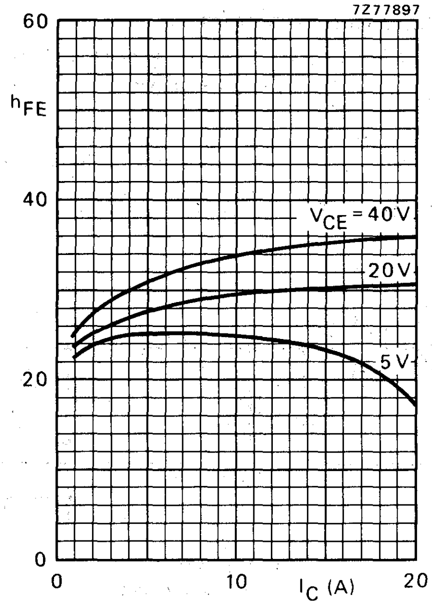


Fig. 5 Typical values; T_j = 25 °C.

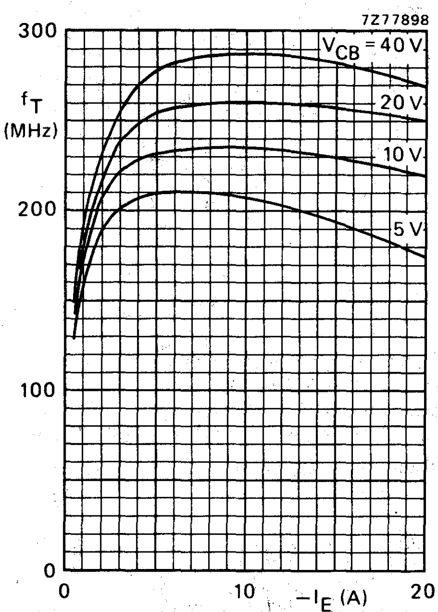


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

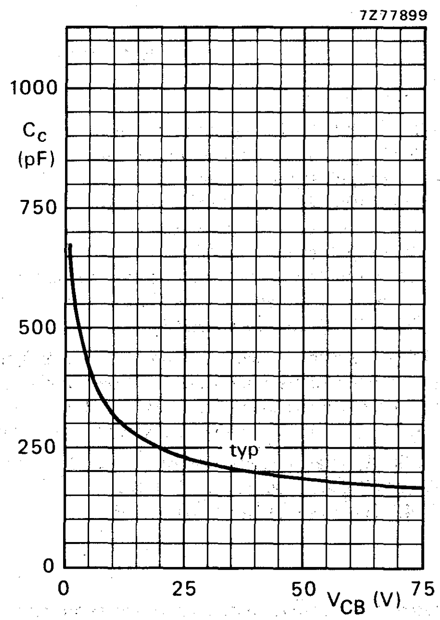


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 160 W (P.E.P.)	I_C (A) at 160 W (P.E.P.)	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ A
20 to 160 (P.E.P.)	> 14	> 40	< 4,0	< −30	< −30	0,1

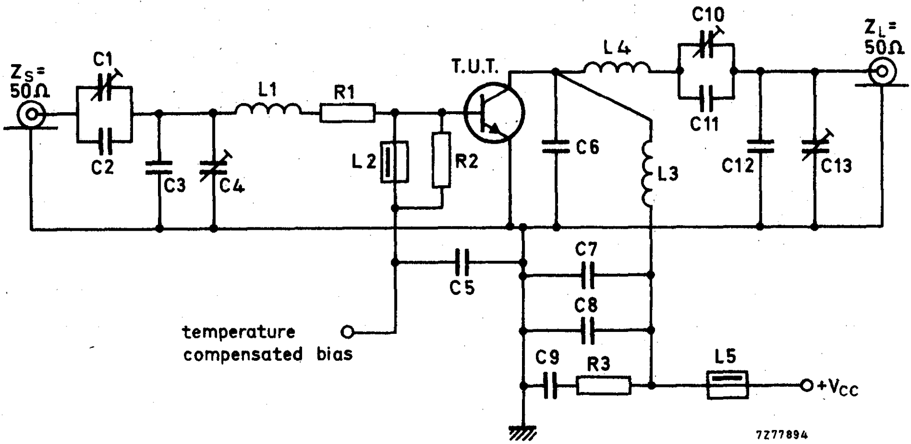


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = C10 = 100 pF film dielectric trimmer
C2 = C6 = 27 pF ceramic capacitor (500 V)
C3 = 220 pF polystyrene capacitor
C4 = C13 = 100 pF film dielectric trimmer
C5 = C7 = 3,9 nF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor (500 V)
C12 = 220 pF polystyrene capacitor

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 19,1 mm; leads 2 x 10 mm

R1 = 0,66 Ω; parallel connection of 5 x 3,3 Ω carbon resistors (± 5%; 0,5 W each)
R2 = 27 Ω carbon resistor (± 5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

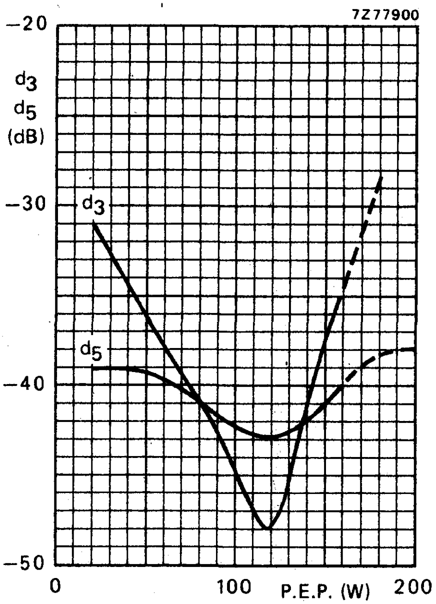


Fig. 9 Intermodulation distortion as a function of output power.*

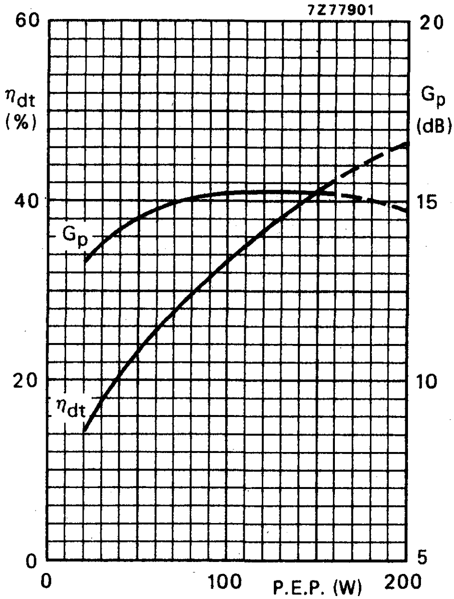


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness

The BLW95 is capable of withstanding full load mismatch (VSWR = 50) up to 150 W (P.E.P.) under the following conditions:

V_{CE} = 45V; f = 28 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 °C/W.

* See note on page 6.

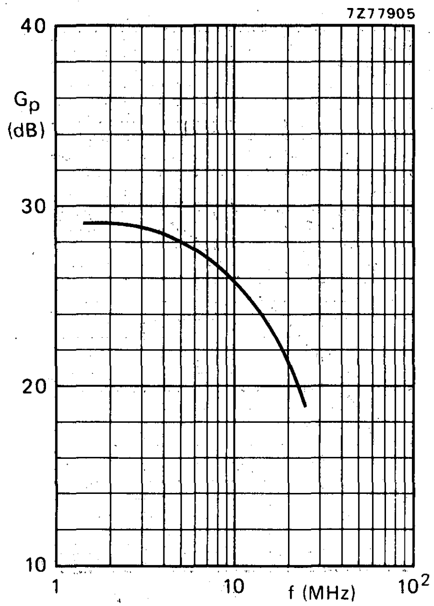


Fig. 11 Power gain as a function of frequency.

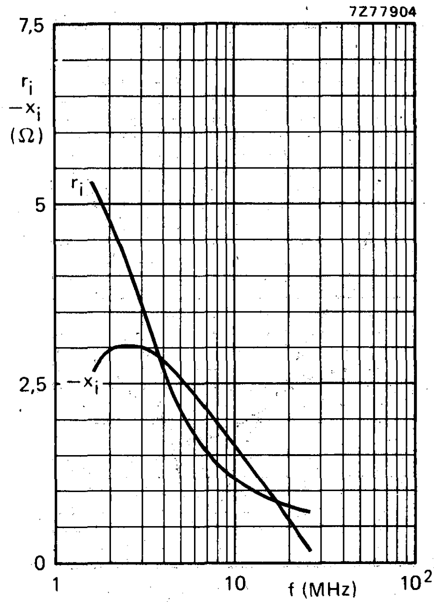


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 160 W (P.E.P.); T_h = 25 °C; Z_L = 6,25 Ω in series with 7,3 nH (in parallel with −188 pF).

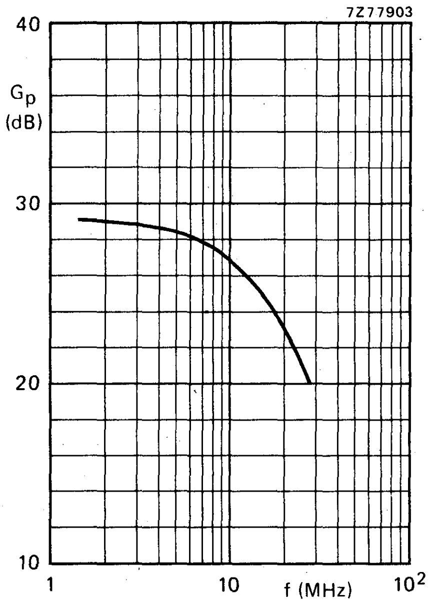


Fig. 13 Power gain as a function of frequency.

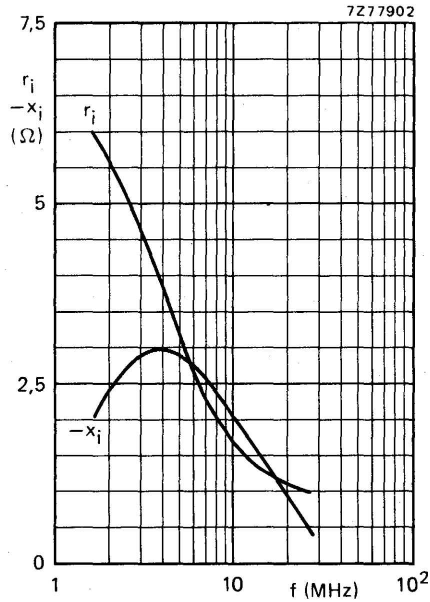


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 160 W (P.E.P.); T_h = 25 °C; Z_L = 6,25 Ω in series with 10,4 nH (in parallel with −267 pF); neutralizing capacitor: 82 pF.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in u.h.f. power amplifiers, where optimum linearity is required. The transistor is specially suited for all transistorized television transposers and transmitters in band IV and V, as well as for driver stages in tube systems. The combination of excellent d.c. dissipation properties, which have been obtained by means of diffused emitter-ballasting resistors and the application of a Ti-Pt-Au sandwich metallization, gives an optimum reliability.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

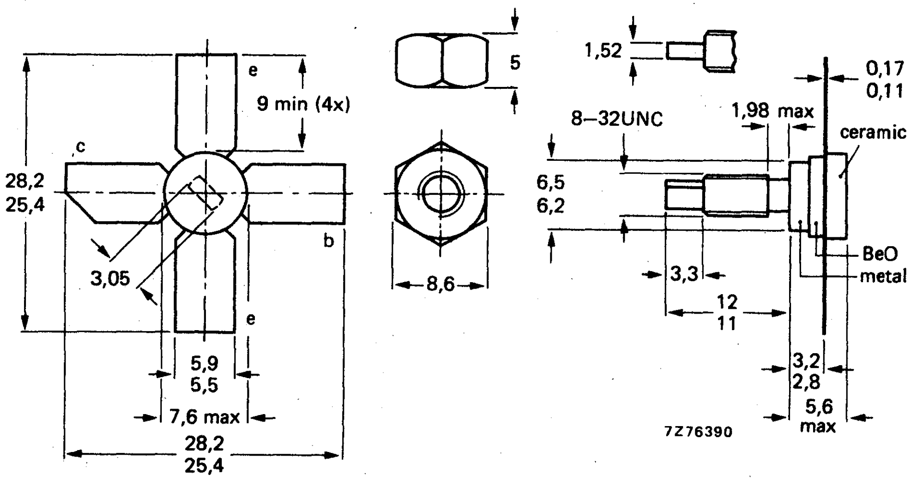
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A; linear amplifier	860	25	850	70	−60	> 3,5	> 6,5
	860	25	850	25	−60	typ. 4,4	typ. 7

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT−122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	50 V
Collector-emitter voltage (open base)	V_{CEO}	max.	27 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current (d.c.)	I_C	max.	2 A
Collector current (peak value) $f > 1$ MHz	I_{CM}	max.	4 A
Total power dissipation at $T_h = 70$ °C	P_{tot}	max	21,5 W
Storage temperature	T_{stg}		–65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

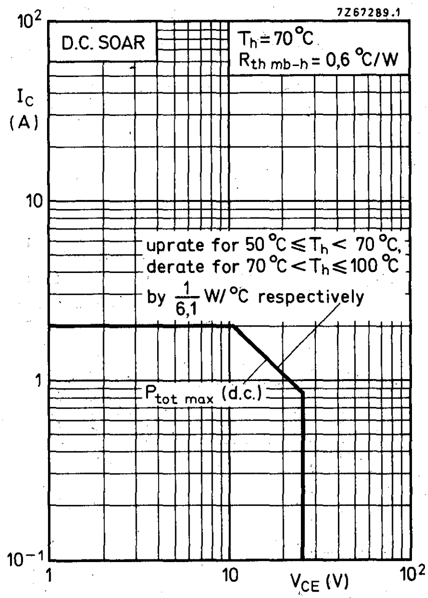


Fig. 2 D.C. SOAR.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	5,5 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-base breakdown voltage open emitter; $I_C = 10$ mA	$V_{(BR)CBO}$	>	50 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	27 V
Emitter-base breakdown voltage open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	>	3,5 V
D.C. current gain* $I_C = 0{,}85$ A; $V_{CE} = 25$ V	h_{FE}	> typ.	15 40
Collector-emitter saturation voltage* $I_C = 500$ mA; $I_B = 100$ mA	V_{CEsat}	typ.	0,25 V
Transition frequency at f = 500 MHz* $-I_E = 0{,}85$ A; $V_{CB} = 25$ V	f_T	typ.	2,5 GHz ←
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ. <	24 pF 30 pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 25$ V; $T_{mb} = 25\ ^oC$	C_{re}	typ.	15 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions; $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

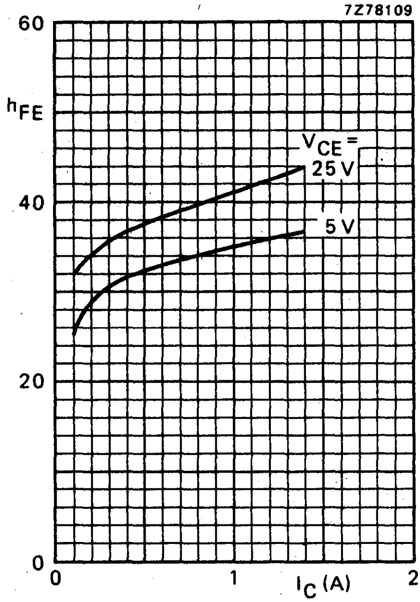


Fig. 3 Typical values; $T_j = 25\ ^oC$.

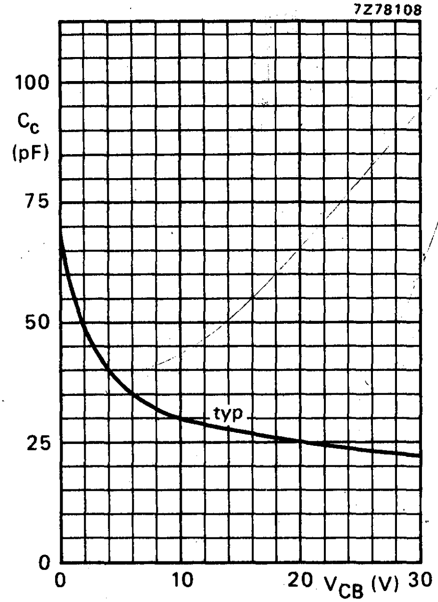


Fig. 4 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25\ ^oC$.

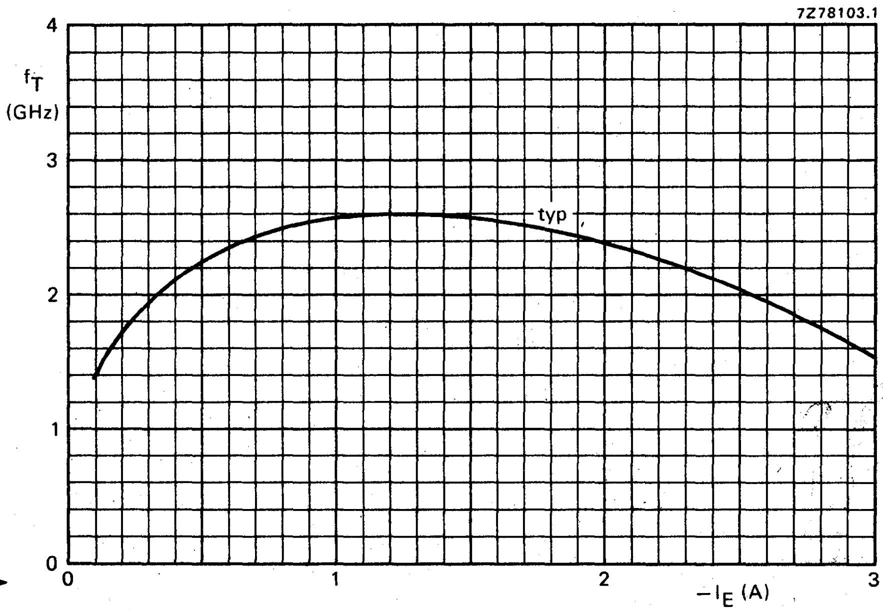


Fig. 5 V_{CB} = 25 V; f = 500 MHz; $T_j = 25\ ^oC$.

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB)*	$P_{o\ sync}$ (W)*	G_p (dB)
860	25	850	70	−60	> 3,5	> 6,5
860	25	850	70	−60	typ. 3,8	typ. 7
860	25	850	25	−60	typ. 4,4	typ. 7

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

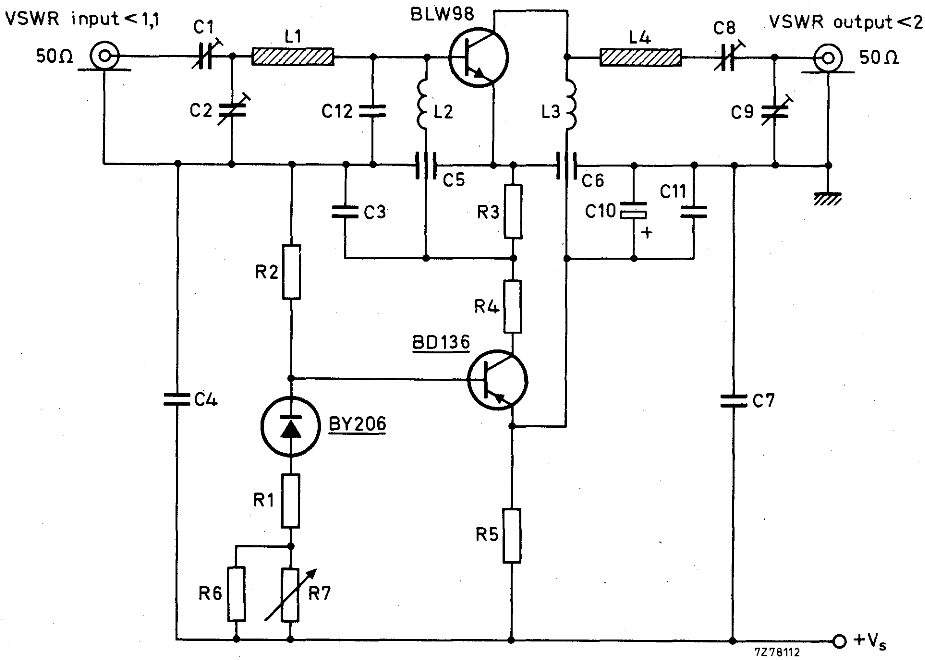


Fig. 6 Test circuit at f_{vision} = 860 MHz.

List of components (see also page 6):

C1 = C2 = 1,4 to 5,5 pF film dielectric trimmers (cat. no. 2222 809 09001)
C3 = C4 = 100 nF polyester capacitors
C5 = C6 = 1 nF feed-through capacitors
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C10 = 10 μF/40 V solid aluminium electrolytic capacitor
C11 = 470 nF polyester capacitor
C12 = 2 x 3,3 pF chip capacitors (in parallel)

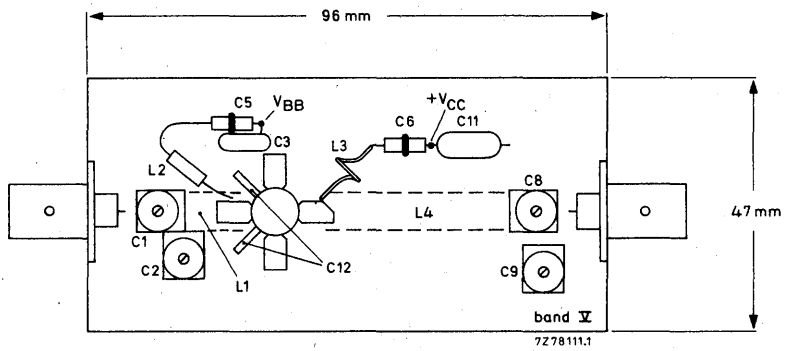
APPLICATION INFORMATION (continued)

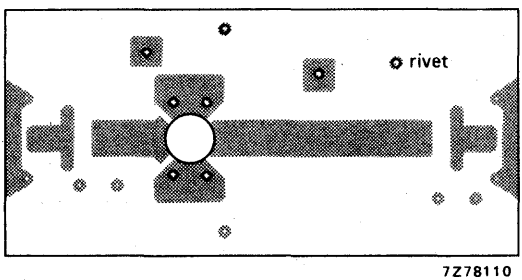
List of components (continued)

R1 = 150 Ω carbon resistor (0,25 W)
R2 = 1,8 kΩ carbon resistor (0,5 W)
R3 = 33 Ω carbon resistor (0,5 W)
R4 = 220 Ω carbon resistor (1 W)
R5 = 4 x 12 Ω carbon resistors in parallel (1 W each)
R6 = 1 kΩ carbon resistor (0,25 W)
R7 = 220 Ω carbon potentiometer (0,25 W)

L1 = stripline (13,6 mm x 6,9 mm)
L2 = microchoke 0,47 μH (cat. no. 4322 057 04770)
L3 = 1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm
L4 = stripline (40,8 mm x 6,9 mm)

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.

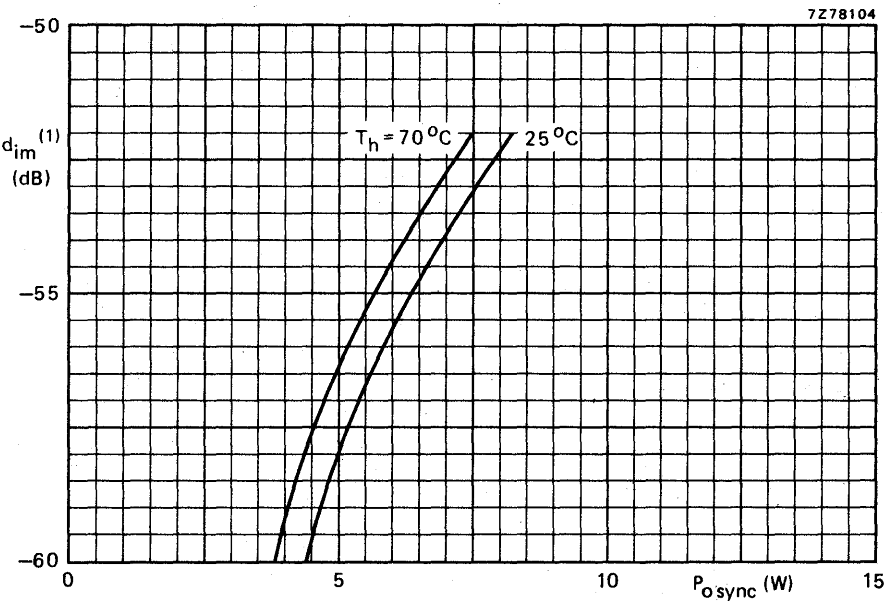




Note
Hole in printed-circuit board: ϕ 9,7 mm.

Fig. 7 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.



(1) Three-tone-test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level. Intermodulation distortion of input signal ⩽ −75 dB.

Fig. 8 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 25 V; I_C = 850 mA; f_{vision} = 860 MHz.

Information for wide-band application from 470 to 860 MHz available on request.

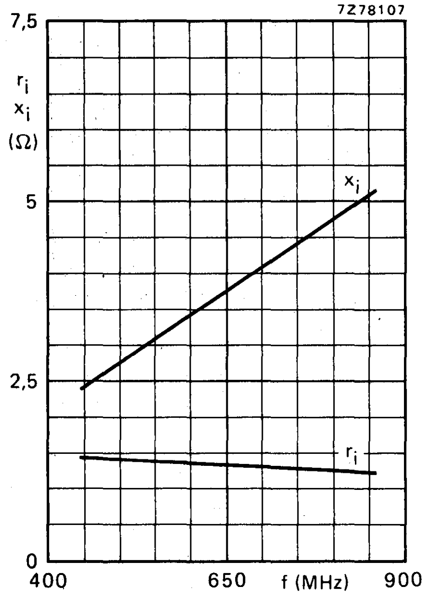


Fig. 9 Input impedance (series components) as a function of frequency.

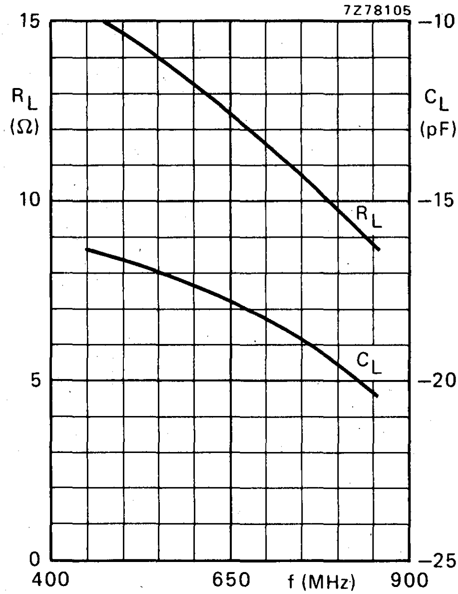
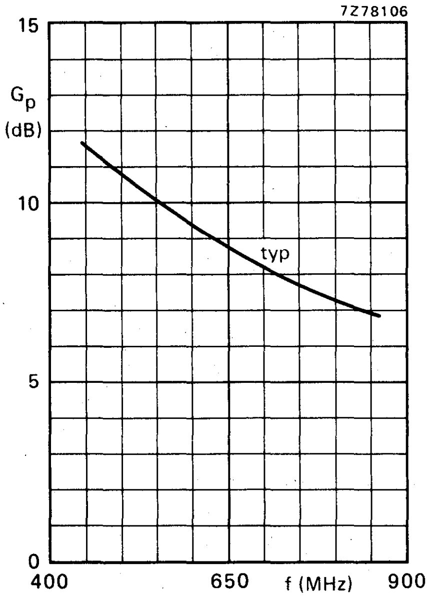


Fig. 10 Load impedance (parallel components) as a function of frequency.



Conditions for Figs 9, 10 and 11

V_{CE} = 25 V; I_C = 850 mA; typical values.

Fig. 11 Power gain as a function of frequency.

H.F./V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for s.s.b. in class-A and AB and in f.m. transmitting applications in class-C with a supply voltage up to 28 V. The transistor is resistance stabilized and tested under severe load mismatch conditions. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

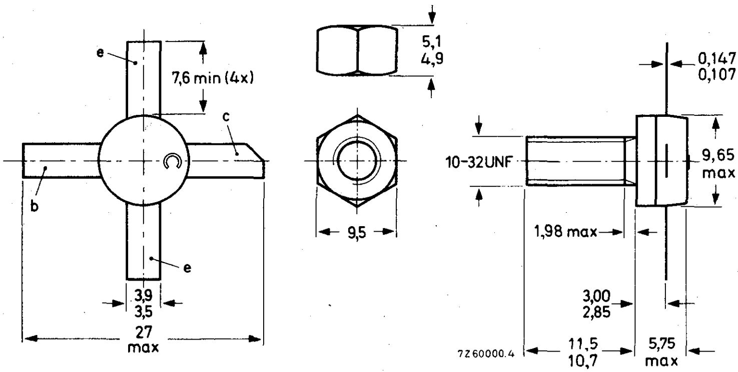
mode of operation	V_{CE} V	f_1 MHz	f_2 MHz	P_L W	G_p dB	d_3 dB	I_C A	η_{dt} %
s.s.b. (class-A)	26	28,000	28,001	0-8(P.E.P.)	> 18	< −40	< 1,2	–
s.s.b. (class-AB)	28	28,000	28,001	25(P.E.P.)	> 18	typ. −35	typ. 1,28	typ. 35

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	G_p dB	I_C A	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w. (class-B)	28	70	typ. 0,5	25	typ. 17	typ. 1,49	typ. 60	0,53 − j1,4	42,5 − j54

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 5,0 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

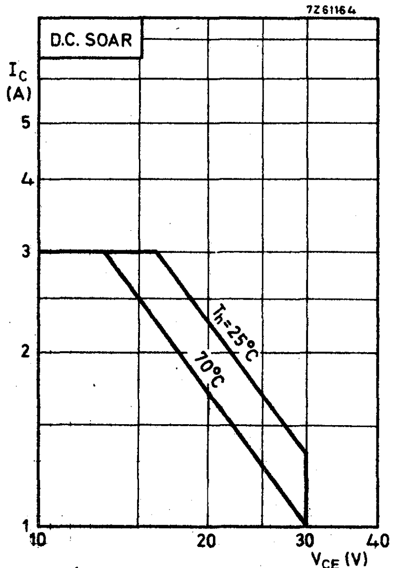
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4.0	V

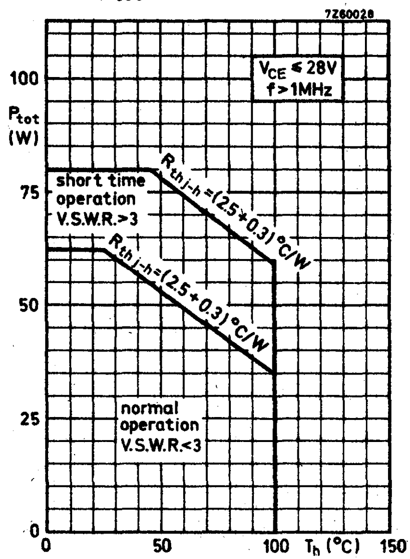
Currents

Collector current (average)	$I_{C(AV)}$	max.	3.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	6	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	62.5	W





Temperature

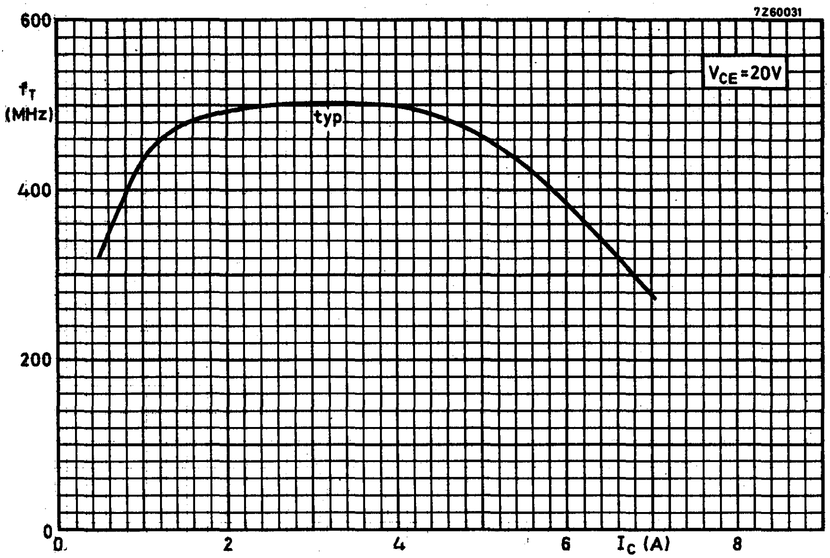
Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

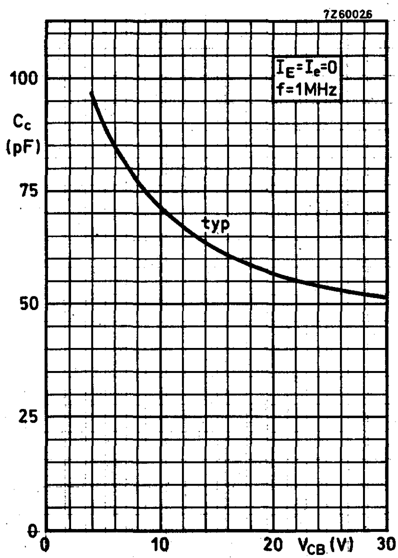
THERMAL RESISTANCE

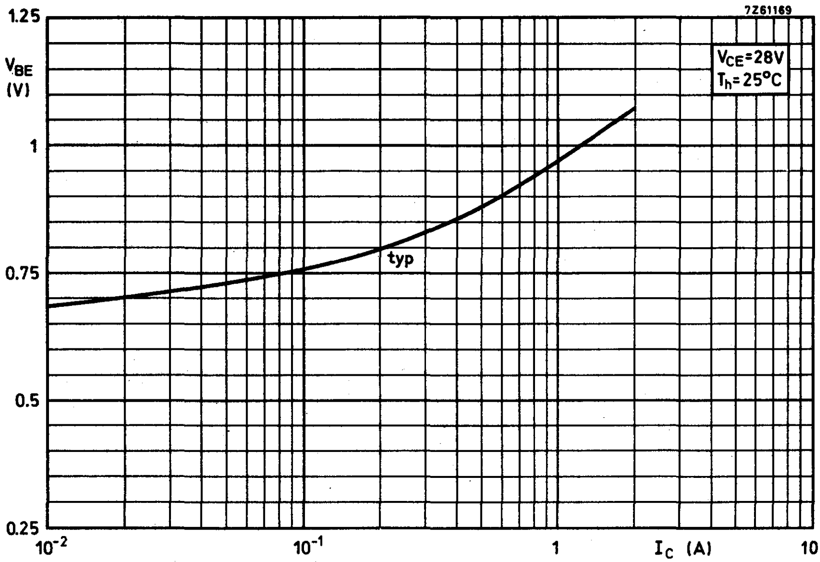
From junction to mounting base	$R_{th\,j-mb}$	=	2.5	°C/W
From mounting base to heatsink	$R_{th\,mb-h}$	=	0.3	°C/W

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage				
open emitter; I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage				
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4.0	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	mWs
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	mWs
D.C. current gain				
I_C = 1.0 A; V_{CE} = 5 V	h_{FE}	typ.	50	
		10	to 100	
Transition frequency				
I_C = 3.0 A; V_{CE} = 20 V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	50	pF
		<	65	pF
Feedback capacitance				
I_C = 100 mA; V_{CE} = 30 V	C_{re}	typ.	31	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60031
600
f_T
(MHz)
400
200
0
0
2
4
6
I_C (A)
8
V_{CE} = 20V
typ


7Z60026
100
C_c
(pF)
75
50
25
0
0
10
20
V_{CB} (V)
30
$I_E = I_e = 0$
f = 1MHz
typ


7Z61169
V_{BE} (V)
1.25
1
0.75
0.5
0.25
V_{CE} = 28V
T_h = 25°C
typ
10^{-2}
10^{-1}
1
10
I_C (A)

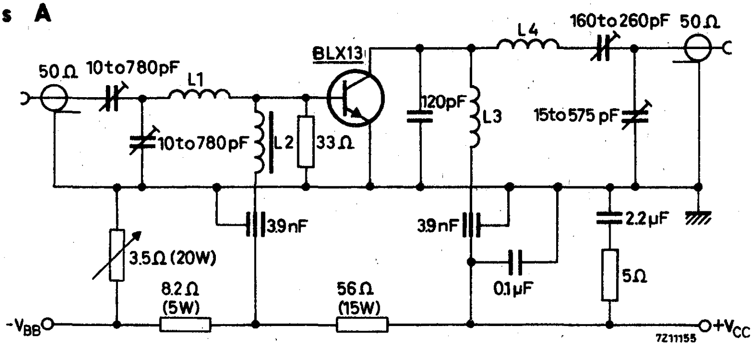
APPLICATION INFORMATION

R.F. performance in S.S.B. operation (linear power amplifier)

V_{CE} = 26 V; T_h up to 25 °C
f_1 = 28.000 MHz; f_2 = 28.001 MHz

output power (W)	G_p (dB)	d_3 (dB) [1]	I_C (A)	Class
0-8 (PEP)	> 18	< −40	< 1.2	A

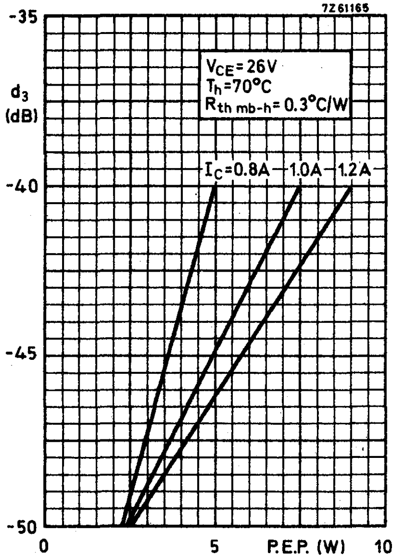
Test circuit:



L1 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 7 mm leads 50 mm totally
L2 = 7 turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 µH (code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 10 mm
L4 = 7 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 12 mm

Detailed information for a wide band application
1.6 to 28 MHz available on request

[1]) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal ampl. tones. Relative to the according peak envelope power these figures should be increased by 6 dB.


7Z61165
V_{CE} = 26 V
T_h = 70 °C
$R_{th\ mb-h}$ = 0.3 °C/W
I_C = 0.8 A
1.0 A
1.2 A
d_3 (dB)
-35
-40
-45
-50
0
5
10
P.E.P. (W)

APPLICATION INFORMATION

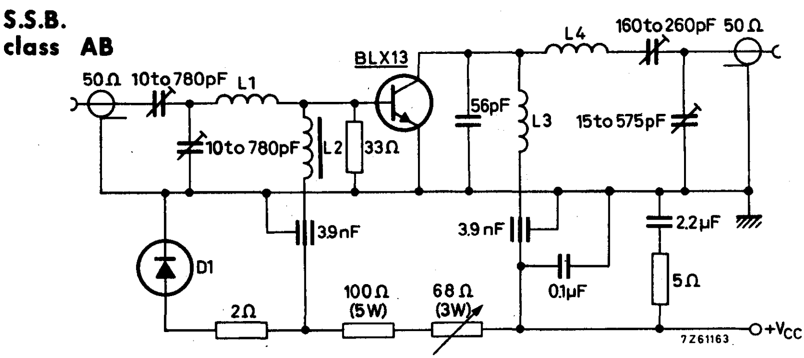
R.F. performance in S.S.B. operation (linear power amplifier)

V_{CC} = 28 V; T_h up to 25 °C

f_1 = 28.000 MHz; f_2 = 28.001 MHz

output power (W)	G_p (dB)	dt (%)	d_3 (dB) [1]	I_{CZS} (mA)	I_C (A)	Class
25 PEP	> 18	typ. 35	typ. −35	25	typ. 1.28	AB

Test circuit:



D1 = AYY10/120

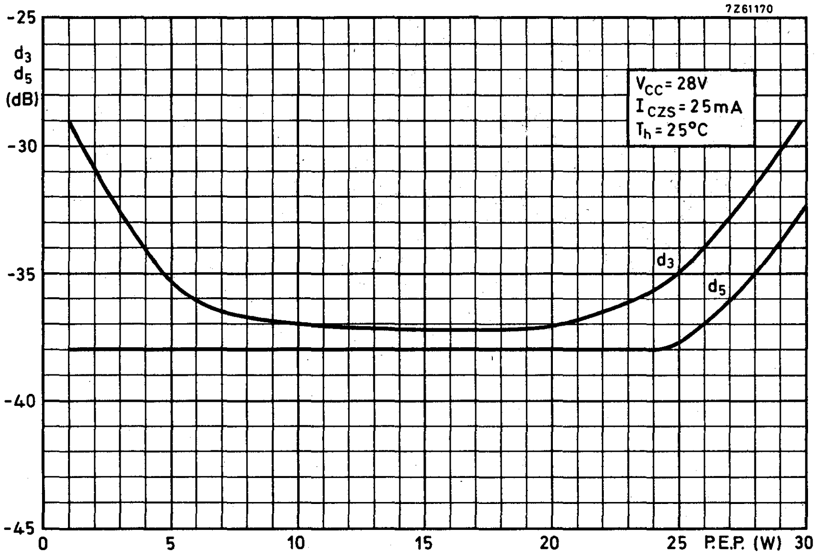
L1 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 7 mm leads 50 mm totally

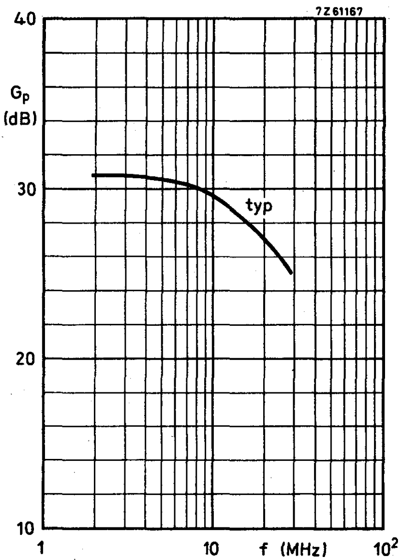
L2 = 7 turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 μH (code number of 3H1: 4322 020 36620)

L3 = 4 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 10 mm

L4 = 7 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 12 mm

[1]) Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.





Conditions:

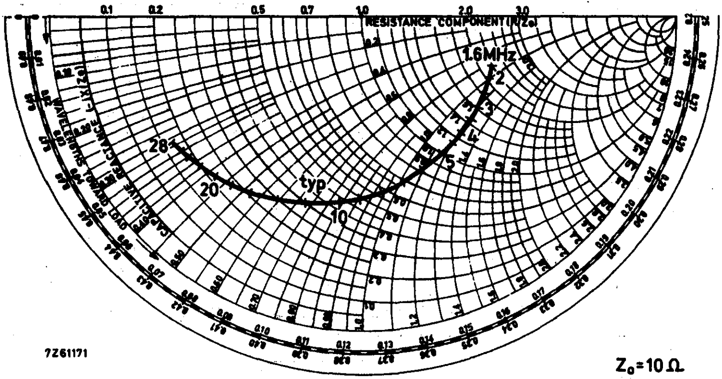
P_L = 25 W PEP

V_{CC} = 28 V

I_{CZS} = 25 mA

Z_L = 12.5 Ω

T_h = 25 °C



Conditions:

P_L = 25 W PEP

V_{CC} = 28 V

I_{CZS} = 25 mA

Z_L = 12.5 Ω

T_h = 25 °C

APPLICATION INFORMATION

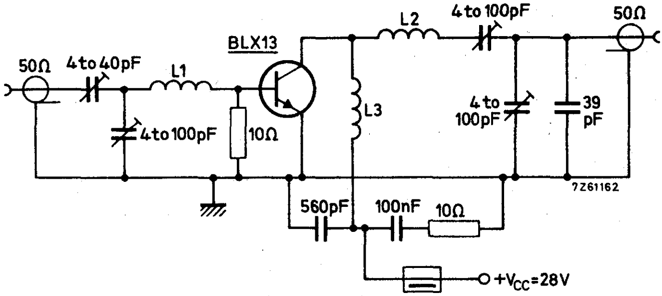
R.F. performance in c.w. operation (class B)

V_{CC} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
70	typ. 0.5	25	typ. 1.49	typ. 17	typ. 60	0.53-j1.4	42.5-j54

Test circuit:

C.W. class B

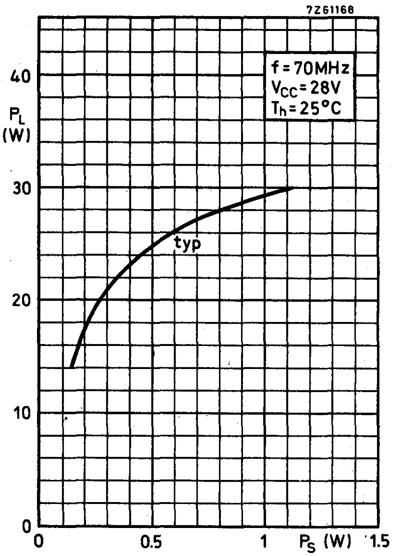


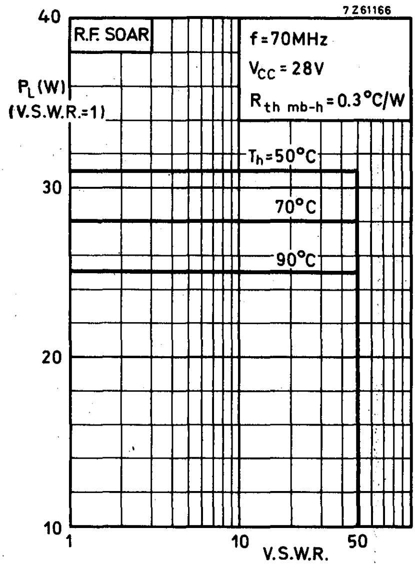
L1 = 93 nH; 3 turns enamelled Cu wire (1.5 mm); int. diam. 10 mm; length 8 mm; leads 2 x 5 mm

L2 = 147 nH; 5 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 14 mm; leads 2 x 5 mm

L3 = 118 nH; 4 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 10.5 mm; leads 2 x 5 mm

L4 = FXC choke (code number 4312 020 36640)





For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

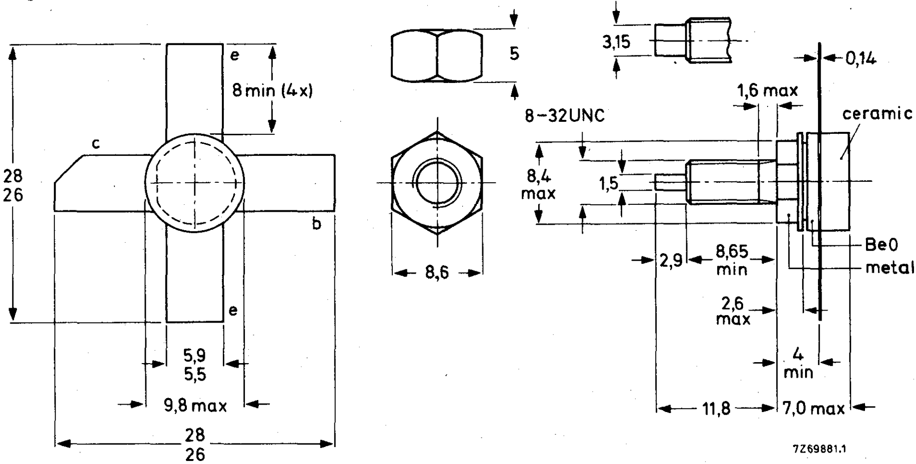
R.F. performance

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 8 (P.E.P.)**	**> 20**	**–**	**1,25**	**< –40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 25 (P.E.P.)	typ. 21	typ. 45	typ. 1,0	typ. –30	25

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	73	W
Storage temperature	T_{stg}	–65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

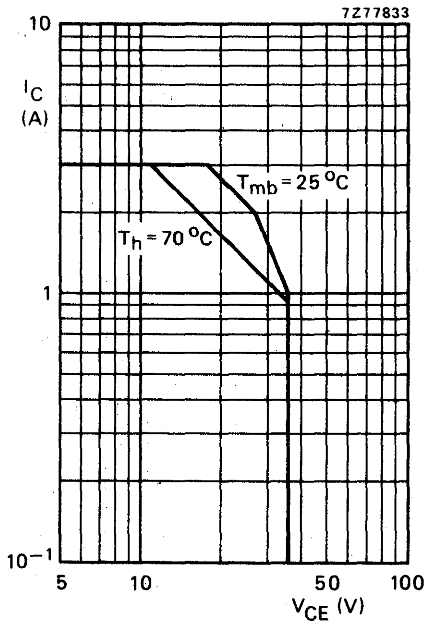


Fig. 2 D.C. SOAR.

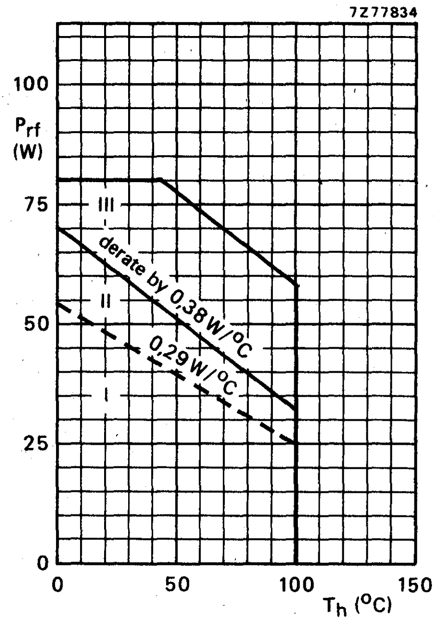


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 28 V; f $\geqslant$ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operating during mismatch

THERMAL RESISTANCE (dissipation = 32,5 W; T_{mb} = 85 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,55	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,65	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain * I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	50
			10 to 100
D.C. current gain ratio of matched devices * I_C = 1,25 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage * I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	530 MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	530 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	31 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

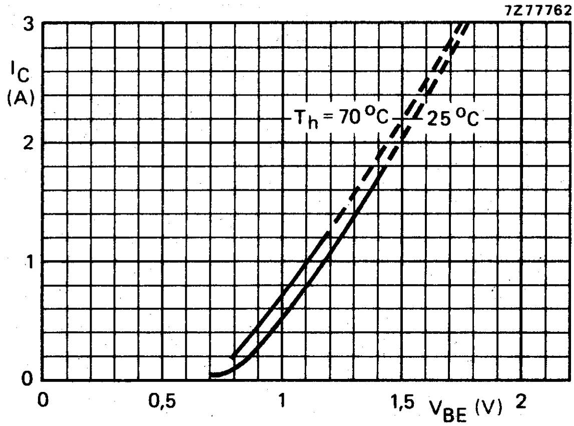


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

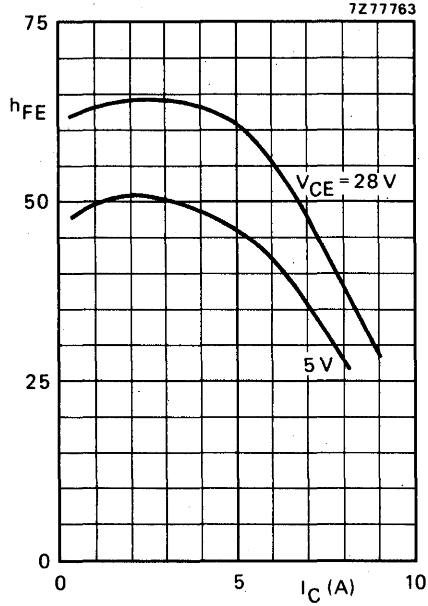


Fig. 5 Typical values; T_j = 25 °C.

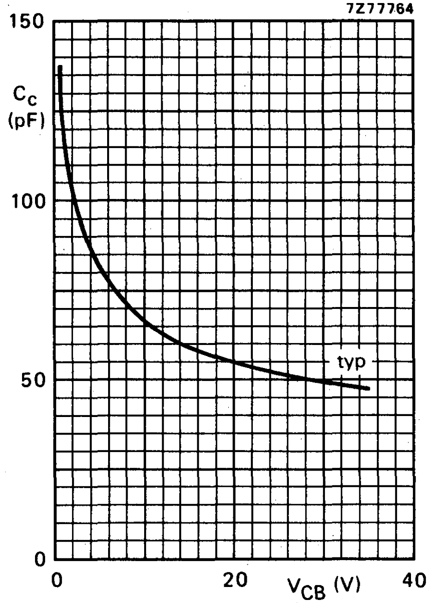


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

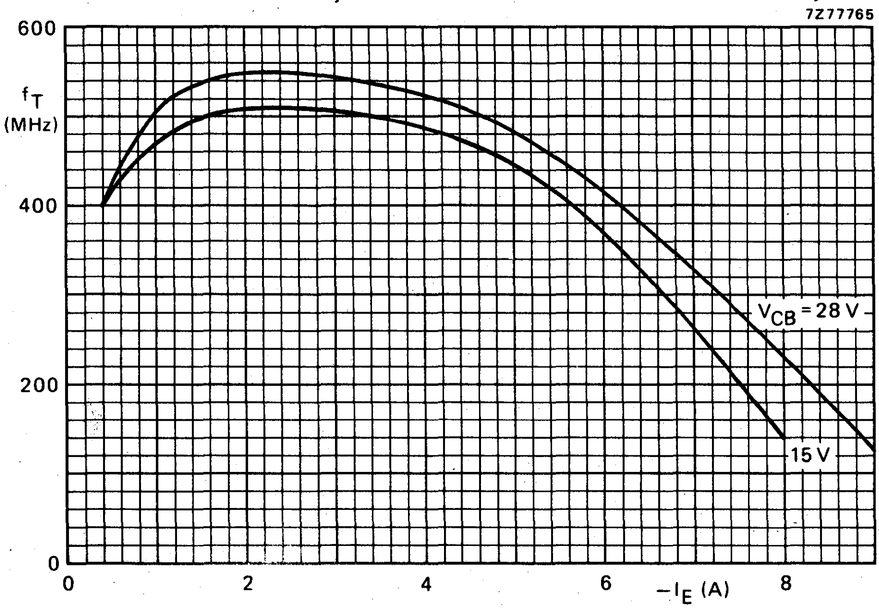


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB *	d_5 dB *	T_h °C
> 8 (P.E.P.)	> 20	1,25	−40	< −40	70
typ. 10 (P.E.P.)	typ. 24	1,25	−40	< −40	25

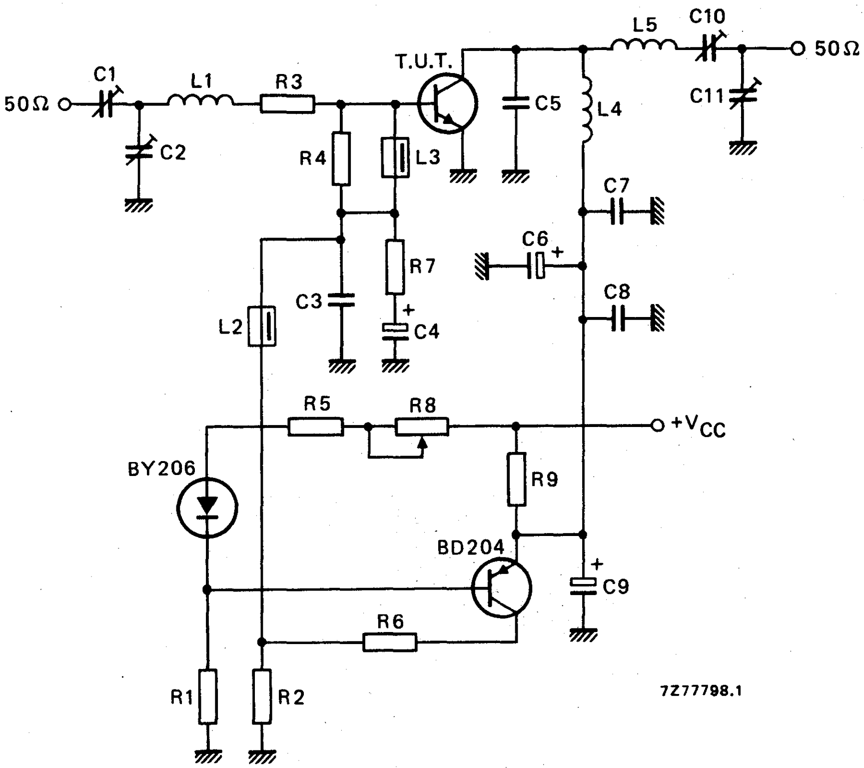


Fig. 8 Test circuit; s.s.b. class-A.

List of components on page 6.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5%; 0,5 W each)
R2 = 15 Ω carbon resistor (± 5%; 0,25 W)
R3 = 1,2 Ω parallel connection of 4 x 4,7 Ω carbon resistors (± 5%; 0,125 W each)
R4 = 33 Ω carbon resistor (± 5%; 0,25 W)
R5 = 18 Ω carbon resistor (± 5%; 0,25 W)
R6 = 120 Ω wirewound resistor (± 5%; 5,5 W)
R7 = 1 Ω carbon resistor (± 5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (± 5%; 5,5 W each)

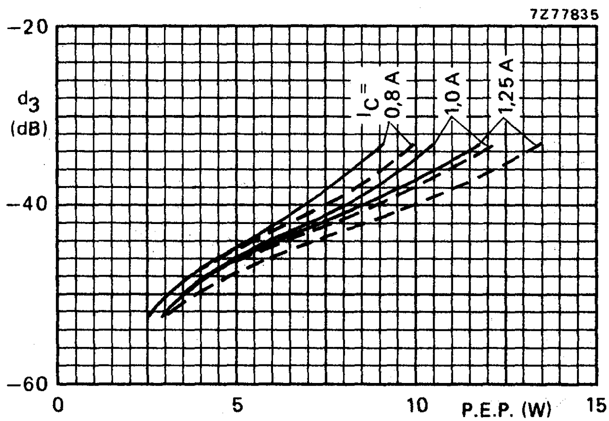


Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz;
—— T_h = 70 °C; – – – T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 25 W P.E.P.	I_C (A) at 25 W P.E.P.	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA	T_h °C
3 to 25 (P.E.P.)	typ. 21	typ. 45	typ. 1,0	typ. −30	< −30	25	25
3 to 22 (P.E.P.)	typ. 21	–	–	typ. −30	< −30	25	70

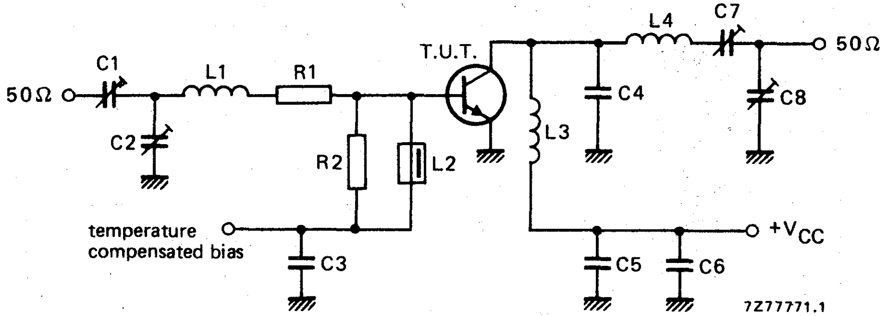


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

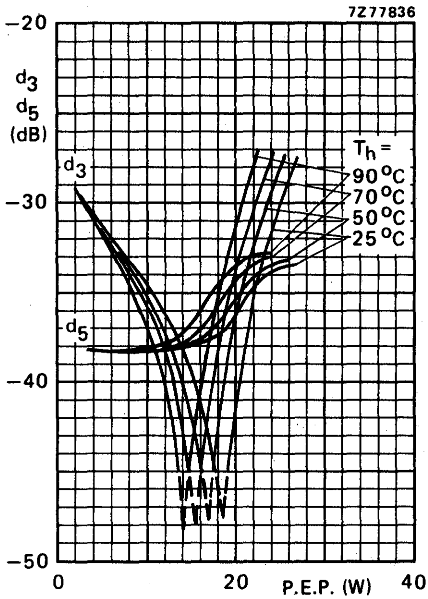


Fig. 11 Intermodulation distortion as a function of output power. *

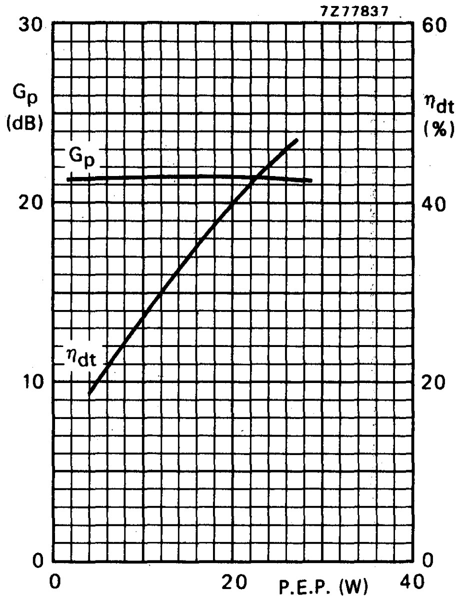


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 11:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 12:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on page 7.

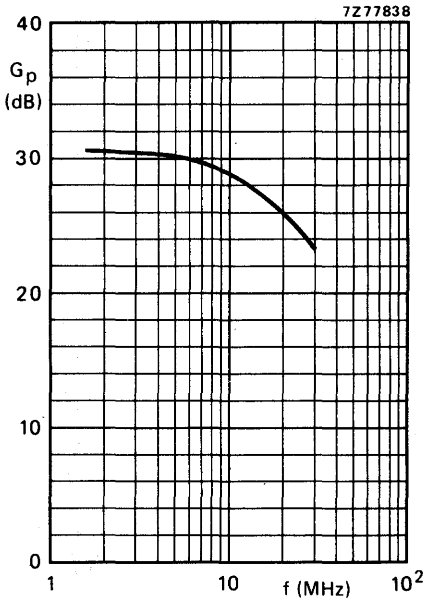


Fig. 13 Power gain as a function of frequency.

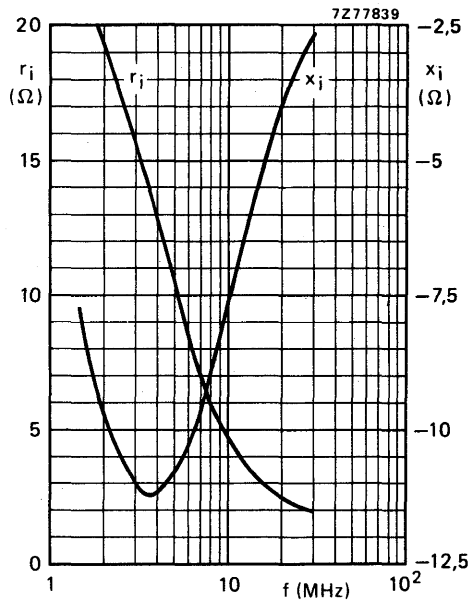


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 25 W; T_h = 25 °C; Z_L = 12 Ω.

Ruggedness in s.s.b. operation

The BLX13C is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 30 W (P.E.P.).

H.F./V.H.F. POWER TRANSISTOR

Silicon n-p-n power transistor for use in industrial and military s.s.b. and c.w. equipment operating in the h.f. and v.h.f. band:

- rated for 50 W P.E.P. at 1,6 MHz to 28 MHz (intermodulation distortion better than 30 dB down); full load mismatch permissible at stud temperatures up to 70 °C
- rated at 50 W for frequencies up to 70 MHz in c.w. operation
- supply voltage 28 V
- plastic stripline package

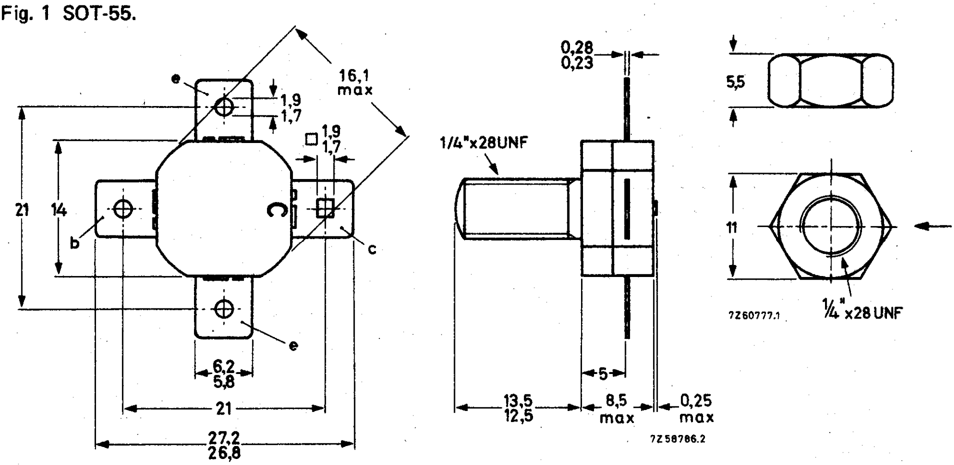
QUICK REFERENCE DATA

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	d_3 dB	$I_{C(ZS)}$ A
s.s.b. (class-A)	28	1,6 to 28	15 (P.E.P.)	> 13	typ. −40	2,0
s.s.b. (class-AB)	28	1,6 to 28	7,5-50 (P.E.P.)	> 13	< −30	0,1
c.w. (class-B)	28	70	50	> 7,5		
c.w. (class-B)	28	30	50	typ. 16		

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,5 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

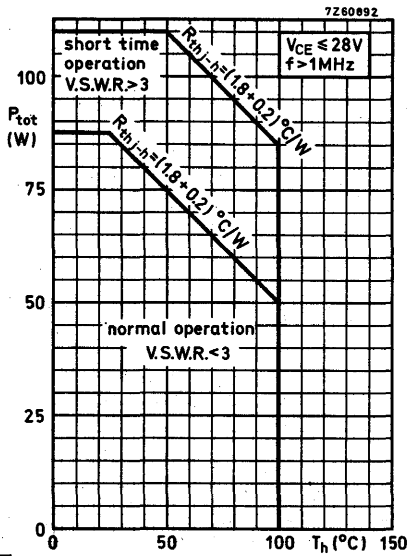
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	85	V
Collector-emitter voltage (R_{BE} = 10 Ω) peak value	V_{CERM}	max.	85	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4.0	V

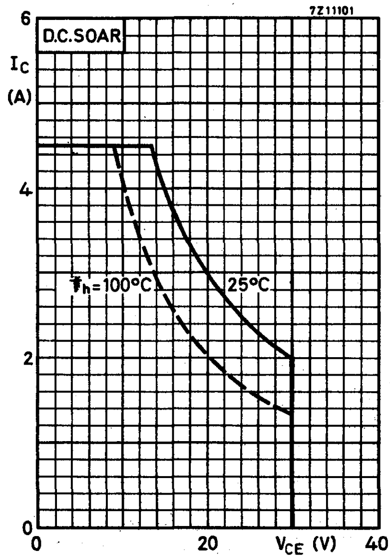
Currents

Collector current (average)	I_{CAV}	max.	4.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	88	W





Temperature

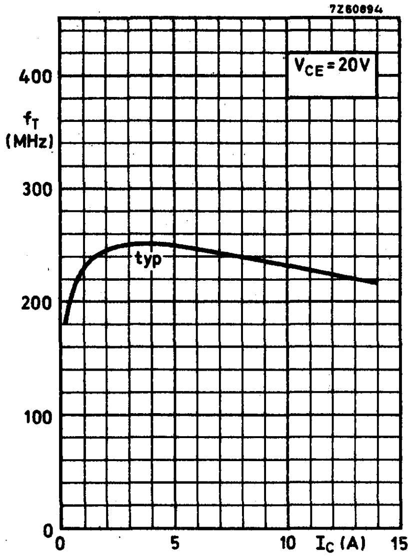
Storage temperature	T_{stg}	−65 to +200	°C
Operating junction temperature	T_j	max. +200	°C

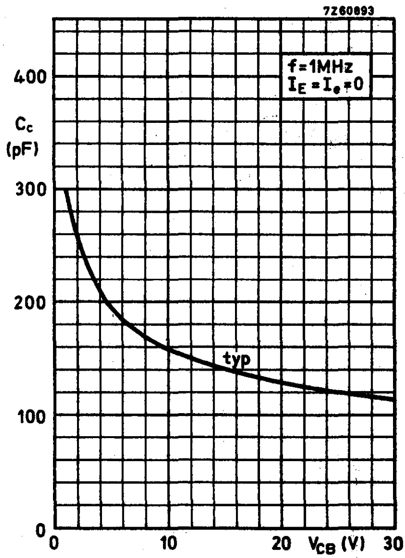
THERMAL RESISTANCE

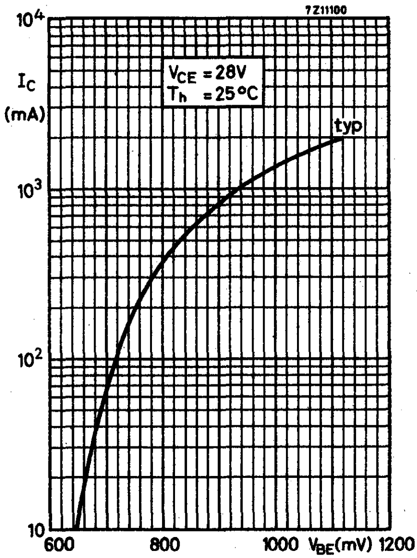
From junction to mounting base	$R_{th\,j-mb}$	=	1.8	°C/W
From mounting base to heatsink	$R_{th\,mb-h}$	=	0.2	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter; $I_C = 25$ mA	$V_{(BR)CBO}$	>	85	V
Collector-emitter voltage $R_{BE} = 10\ \Omega$; $I_C = 25$ mA	$V_{(BR)CER}$	>	85	V
Collector-emitter voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4.0	V
Collector-emitter saturation voltage				
$I_C = 0.7$ A; $I_B = 0.14$ A	V_{CEsat}	<	1.0	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz				
open base	E	>	8	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\Omega$	E	>	8	mWs
D.C. current gain				
$I_C = 1.4$ A; $V_{CE} = 6$ V	h_{FE}	15 to 100		
Transition frequency				
$I_C = 3.0$ A; $V_{CE} = 10$ V	f_T	typ.	250	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	115	pF
		<	125	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	90	pF
Collector-stud capacitance	C_{cs}	typ.	3.5	pF


7Z60894
V_{CE} = 20V
400
f_T
(MHz)
300
200
100
0
typ
0
5
10
I_C (A)
15


7Z60893
f = 1MHz
I_E = I_e = 0
400
C_c
(pF)
300
200
100
0
typ
0
10
20
V_{CB} (V)
30


7Z11100
10^4
I_C
(mA)
V_{CE} = 28V
T_h = 25 °C
typ
10^3
10^2
10
600
800
1000
V_{BE}(mV)
1200

APPLICATION INFORMATION

R.F. performance in S.S.B. operation (linear power amplifier)

V_{CC} = 28 V; T_h up to 25 °C

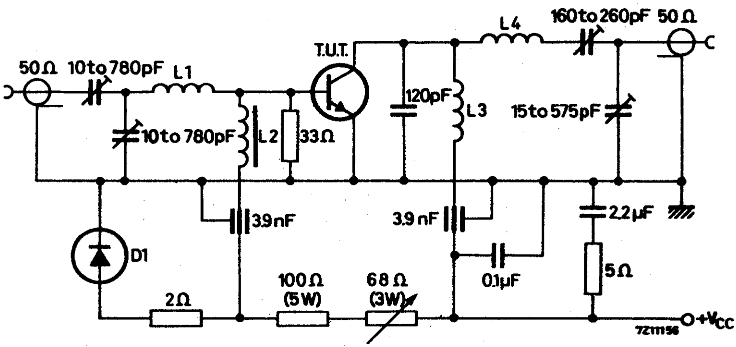
f_1 = 28.000 MHz; f_2 = 28.001 MHz

output power (W)	G_p (dB)	η_{dt} (%)	d_3 (dB) [1]	d_5 (dB) [1]	I_{CZS} (A)	I_C (A)	Class
7.5 to 50 (PEP)	>13	>35	< −30	< −30	0.1	<2.55	AB

At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by a factor −40 mW/°C

The transistor is designed to withstand a full load mismatch operating under 50 W PEP at V_{CC} = 28 V and T_h = 70 °C

Test circuit:
S.S.B.
class A-B



D1 = AYY10/120

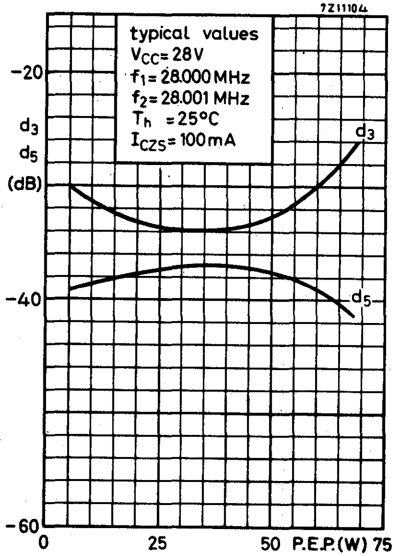
L1 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 7 mm leads 50 mm totally

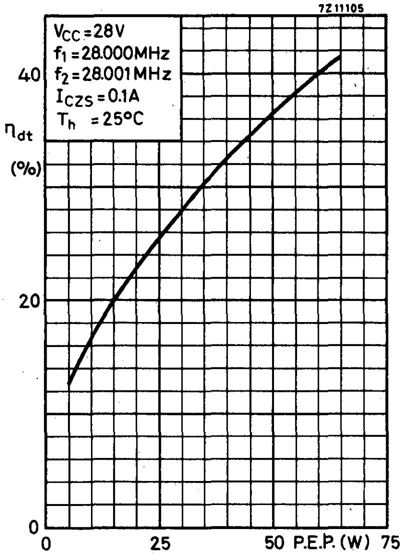
L2 = 7 turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 μH (code number of 3H1: 4322 020 36620)

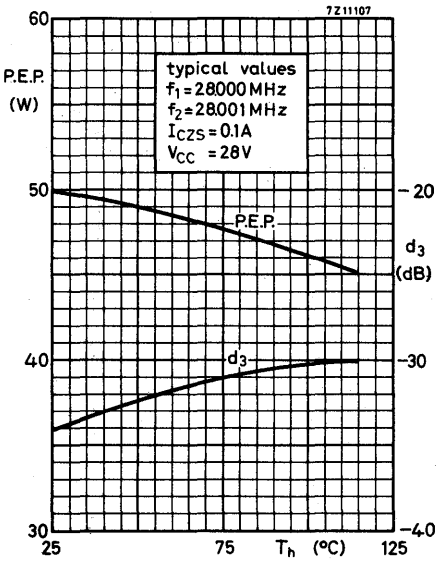
L3 = 4 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 10mm

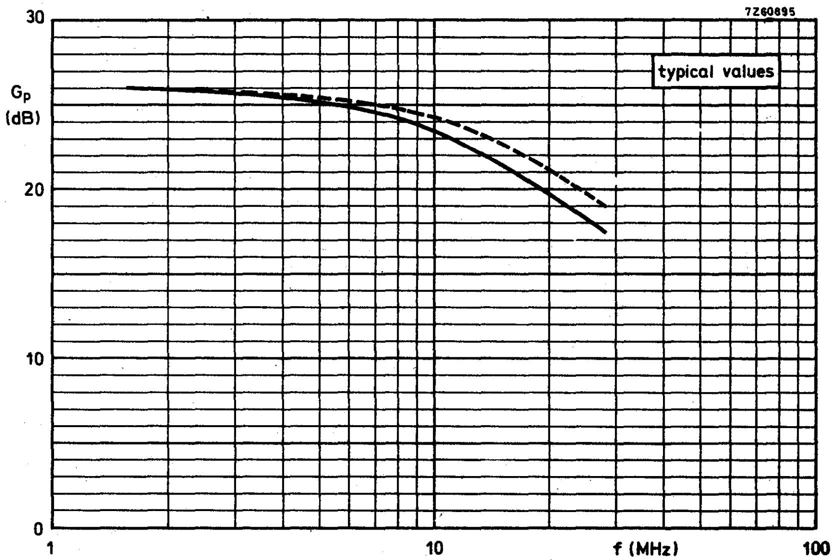
L4 = 7 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 12mm

[1]) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal ampl. tones. Relative to the according peak envelope power these figures should be increased by 6 dB.


7Z11104
typical values
V_{CC} = 28 V
f_1 = 28.000 MHz
f_2 = 28.001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
(dB)
−20
−40
−60
0
25
50
P.E.P. (W)
75


7Z11105
V_{CC} = 28 V
f_1 = 28.000 MHz
f_2 = 28.001 MHz
I_{CZS} = 0.1 A
T_h = 25 °C
η_{dt}
(%)
40
20
0
25
50
P.E.P. (W)
75


7Z11107
typical values
f_1 = 28.000 MHz
f_2 = 28.001 MHz
I_{CZS} = 0.1 A
V_{CC} = 28 V
P.E.P.
(W)
60
50
40
30
P.E.P.
d_3
d_3
(dB)
−20
−30
−40
25
75
T_h (°C)
125

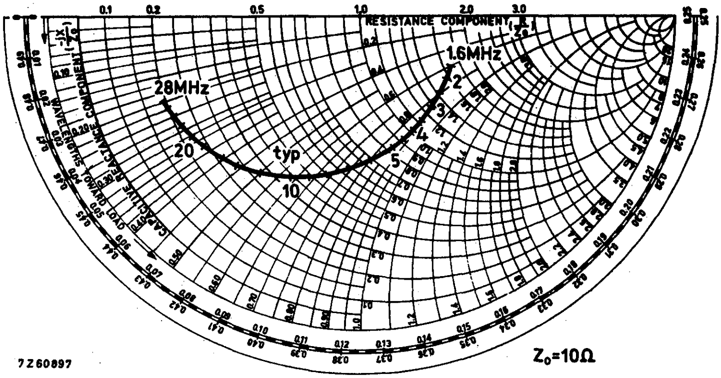


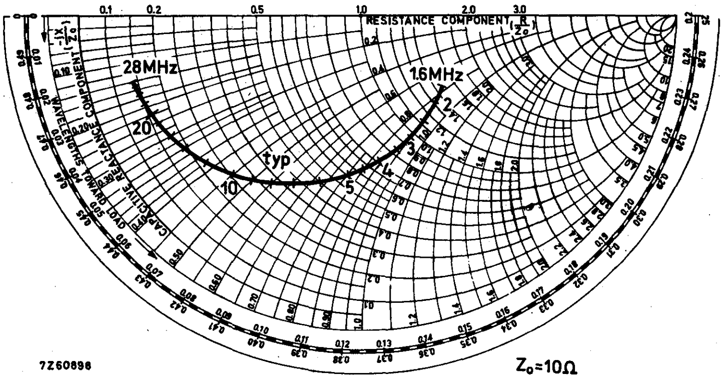
S.S.B. class AB operation

P_L = 50 W PEP
V_{CC} = 28 V
I_C = 100 mA
Z_L = 6.25 Ω
T_h = 25 °C

The drawn curve holds for an unneutralized amplifier.

The dashed curve holds for a push-pull amplifier with cross neutralization.
Collector-base neutralizing capacitor: 82 pF





S.S.B. class AB operation

P_L = 50 W PEP
V_{CC} = 28 V
I_C = 100 mA
Z_L = 6.25 Ω
T_h = 25 °C

The upper graph holds for a push-pull amplifier with cross neutralization.
Collector-base neutralizing capacitor: 82 pF

The lower graph holds for an unneutralized amplifier.

APPLICATION INFORMATION (continued)

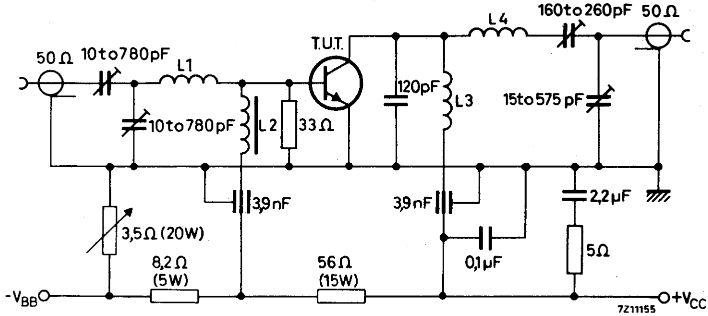
R.F. performance in s.s.b. operation (linear power amplifier)

V_{CC} = 28 V; T_h up to 25 °C
f_1 = 28,000 MHz; f_2 = 28,001 MHz

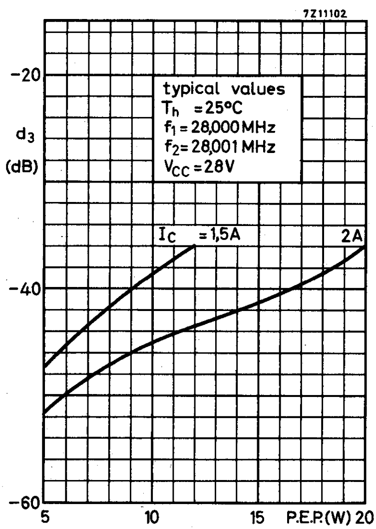
output power (W)	G_p (dB)	d_3 (dB) [1]	d_5 (dB) [1]	I_C (A)	Class
15 PEP	> 13	typ. −40	typ. −45	2,0	A

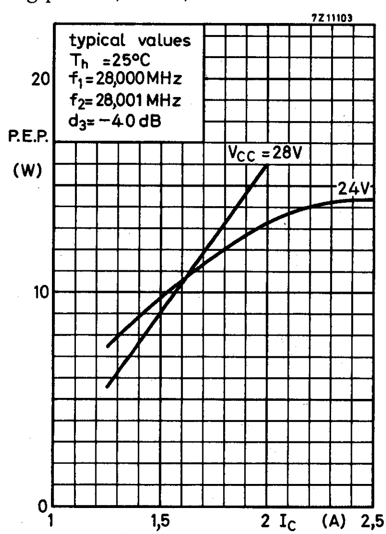
Test circuit:

S.S.B. class-A



L1 = 3 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7 mm leads 50 mm totally
L2 = 7 turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 µH (code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
L4 = 7 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm





APPLICATION INFORMATION

R.F. performance in c.w. operation (class B)

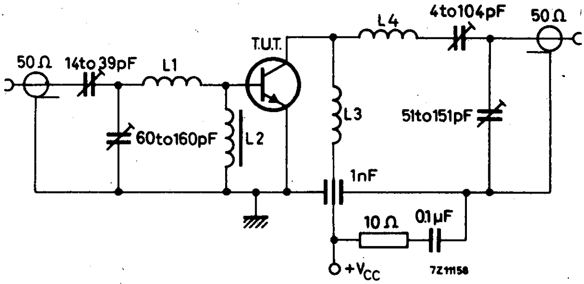
V_{CC} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
70	< 8.9	50	< 3.25	> 7.5	> 55	1.0+j0.2	120 − j75
50	typ. 4	50	typ. 3.25	typ. 11	typ. 55	–	–
30	typ. 1.2	50	typ. 3.25	typ. 16	typ. 55	–	–

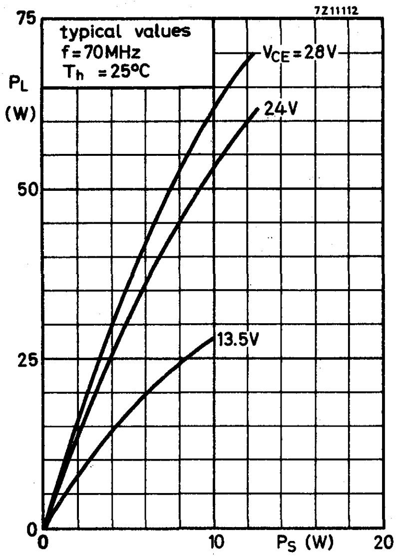
At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by a factor −40 mW/°C.

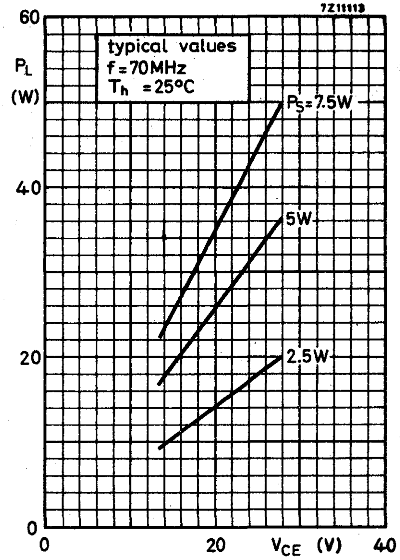
Test circuit :

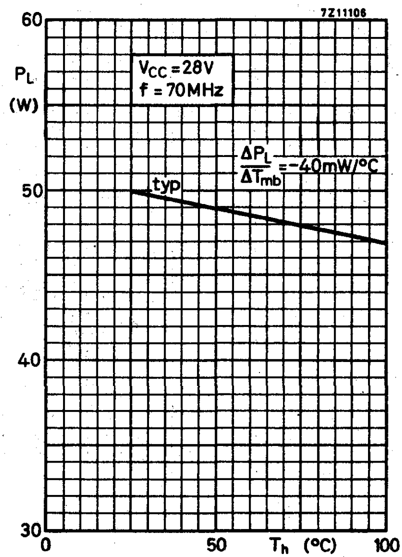
C.W.
70 MHz



L1 = 60 mm straight enamelled Cu wire (1.5 mm); 9 mm above chassis
L2 = FXC choke coil (code number 4322 020 36640)
L3 = 2 turns enamelled Cu wire (1.5 mm); winding pitch 2 mm; internal diam. 10 mm; leads 55 mm totally
L4 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; internal diam. 10 mm; leads 50 mm totally


7Z11112
typical values
f = 70MHz
Th = 25°C
PL
(W)
VCE = 28V
24V
13.5V
PS (W)
75
50
25
0
0
10
20

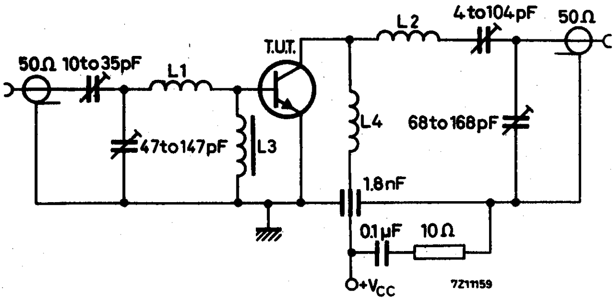

7Z11113
typical values
f = 70MHz
Th = 25°C
PL
(W)
PS = 7.5W
5W
2.5W
VCE (V)
60
40
20
0
0
20
40


7Z11106
VCC = 28V
f = 70MHz
PL
(W)
ΔPL/ΔTmb = -40mW/°C
typ
Th (°C)
60
50
40
30
0
50
100

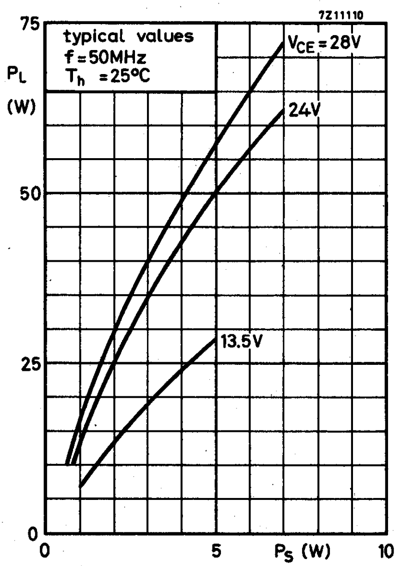
APPLICATION INFORMATION (continued)

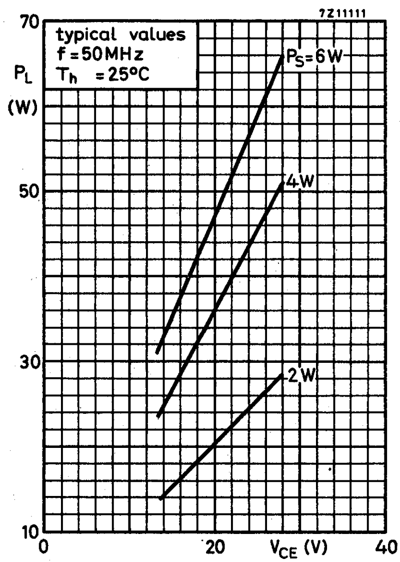
Test circuit:

C.W.
50 MHz



L1 = 1 turn enamelled Cu wire (1.5 mm); int. diam. 10 mm; leads 40 mm totally
L2 = 4 turns enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 40 mm totally
winding pitch 2 mm
L3 = FXC choke coil (code number 4322 020 36640)
L4 = 3 turns enamelled Cu wire (1.5 mm); int. diam. 10 mm; leads 40 mm totally
winding pitch 2 mm

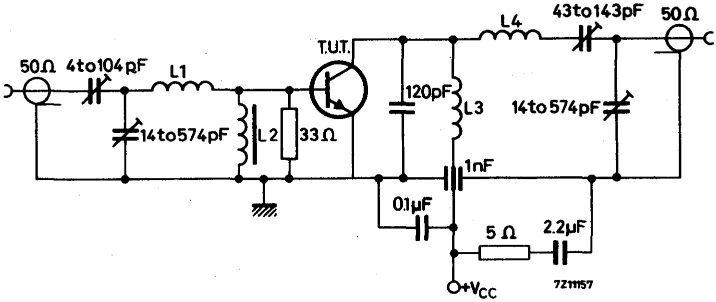




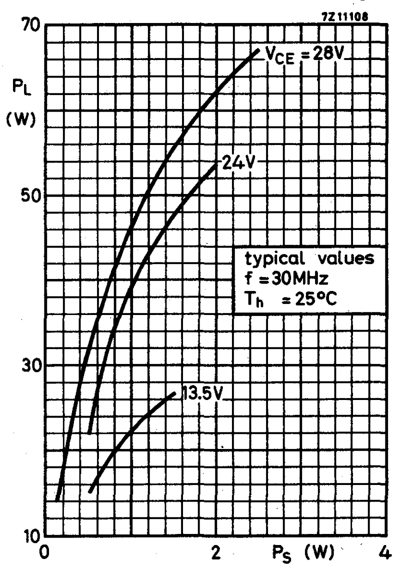
APPLICATION INFORMATION (continued)

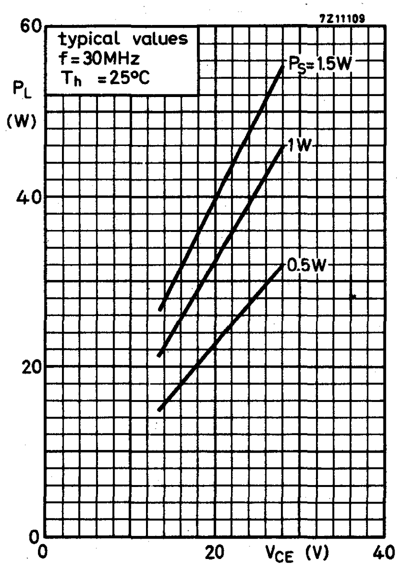
Test circuit :

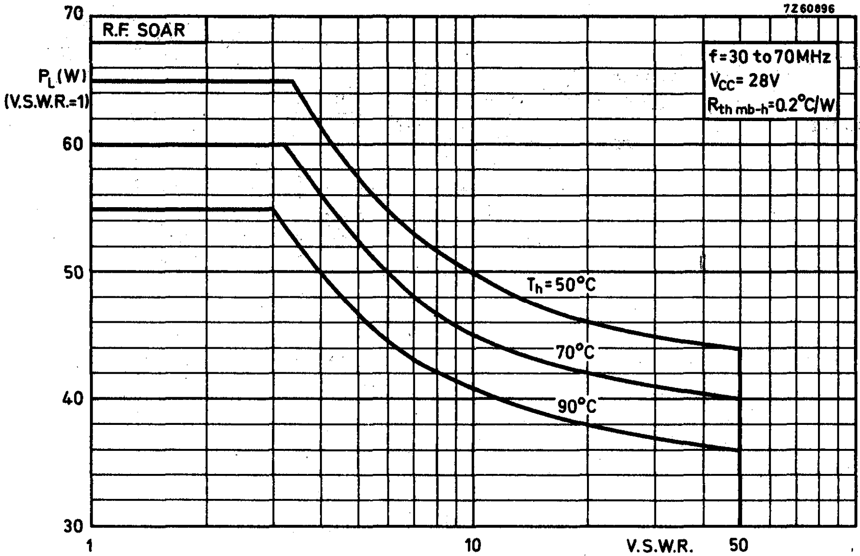
C.W.
30 MHz



L1 = 2 turns enamelled Cu wire (1.5 mm); winding pitch 2 mm; int. diam. 10 mm leads 60 mm totally
L2 = 7 turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 μH (code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1.5 mm); winding pitch 2 mm; int. diam. 10 mm leads 50 mm totally
L4 = 6 turns enamelled Cu wire (1.5 mm); winding pitch 2 mm; int. diam. 12 mm leads 50 mm totally

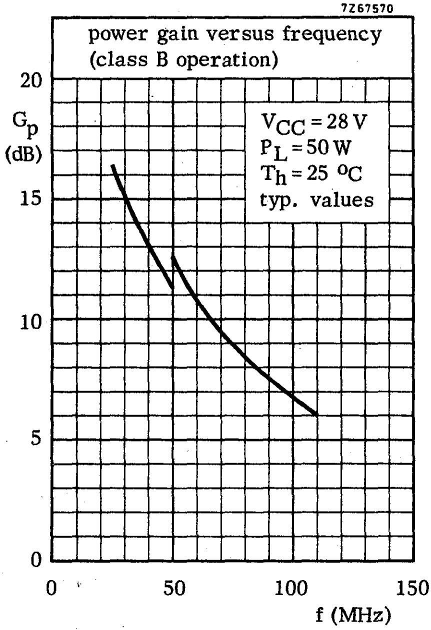


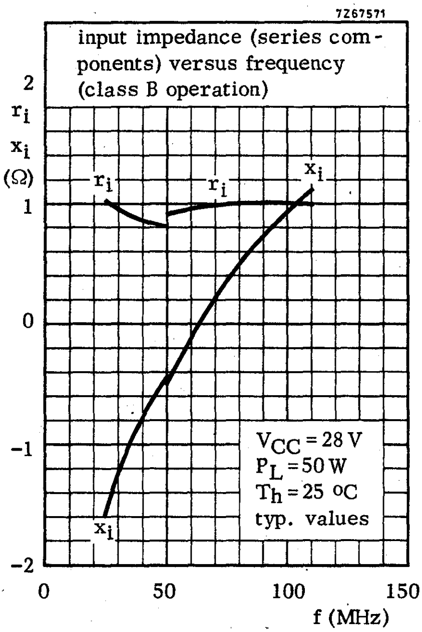


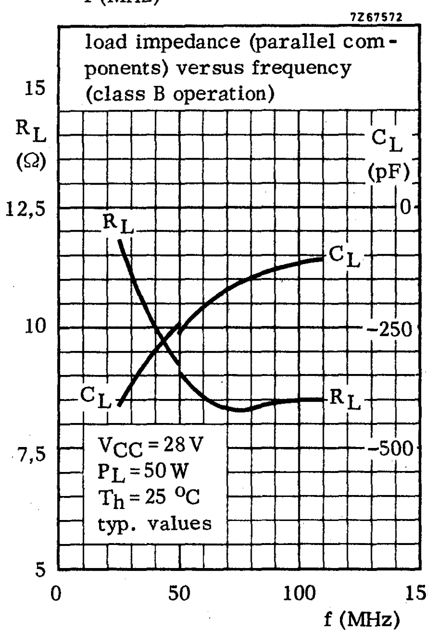


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heatsink temperature as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 6,8 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







H.F./V.H.F. POWER TRANSISTOR

Silicon n-p-n power transistor for use in industrial and military s.s.b. and c.w. equipment operating in the h.f. and v.h.f. band:

- rated for 150 W P.E.P. at 1,6 MHz to 28 MHz
  (intermodulation distortion better than 30 dB down)
- rated at 150 W output power for frequencies up to 108 MHz in c.w. operation
- supply voltage up to 50 V
- plastic encapsulated stripline package
- delivered in matched h_{FE} groups

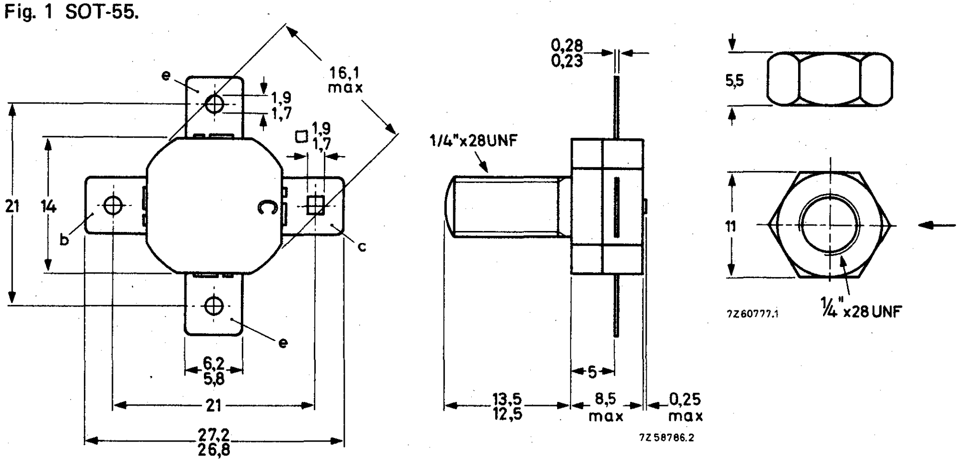
QUICK REFERENCE DATA

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	d_3 dB	$I_{C(ZS)}$ A
s.s.b. (class-AB)	50	1,6 to 28	20 to 150 (P.E.P.)	> 14	< −30	0,10
s.s.b. (class-A)	40	1,6 to 28	typ. 30 (P.E.P.)	> 14	< −40	2,5
c.w. (class-B)	50	70	150	> 10	–	–
c.w. (class-B)	50	108	150	typ. 7,5	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,5 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

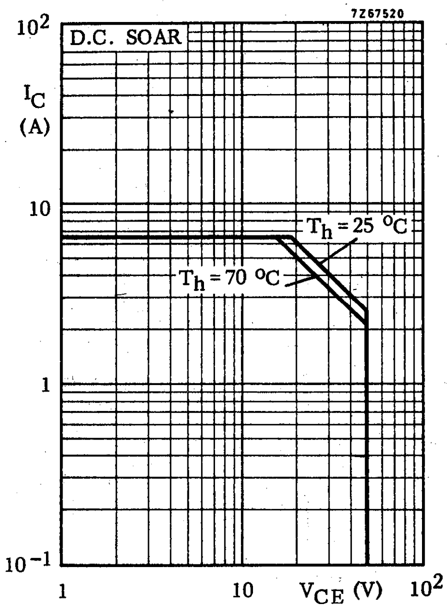
Voltages

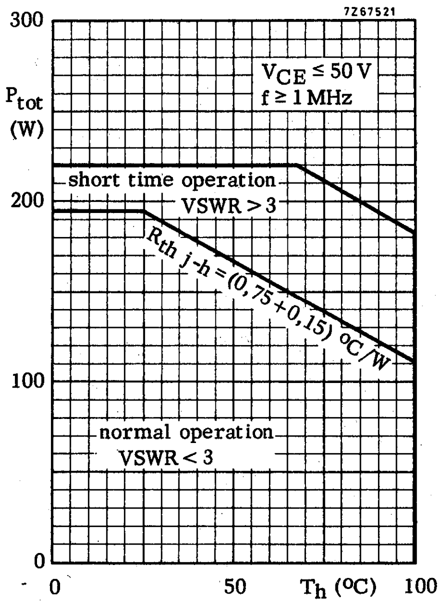
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	110	V
Collector-emitter voltage ($R_{BE} = 10\,\Omega$) peak value	V_{CERM}	max.	110	V
Collector-emitter voltage (open base)	V_{CEO}	max.	53	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	6,5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	20	A

Power dissipation





Temperatures

Storage temperature	T_{stg}	−65 to +200	^oC
Junction temperature	T_j	max. 200	^oC

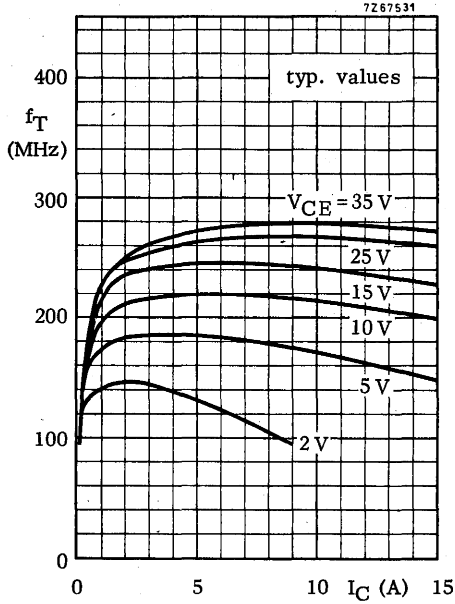
THERMAL RESISTANCE

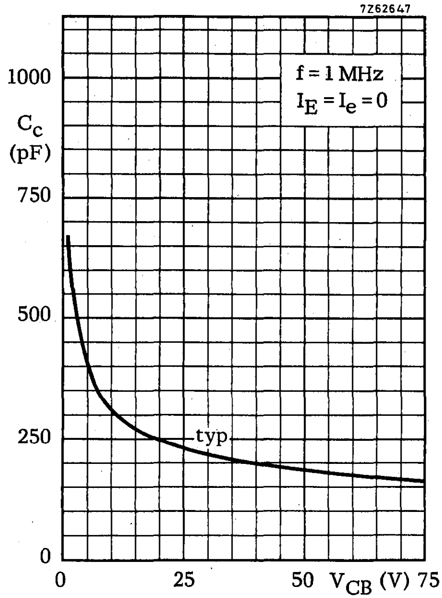
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,75	$^oC/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,15	$^oC/W$

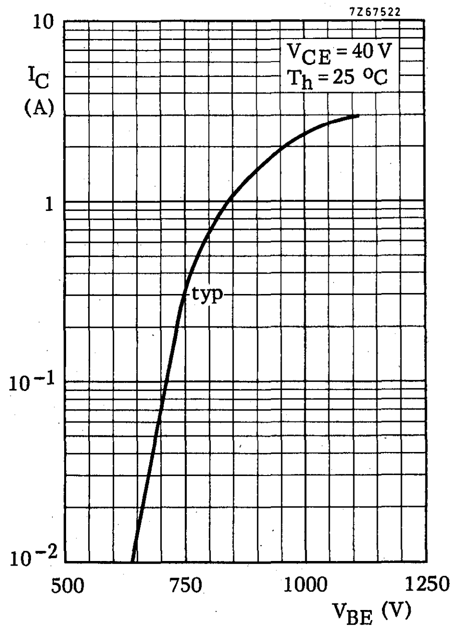
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter ; I_C = 100 mA	$V_{(BR)CBO}$	>	110	V
Collector-emitter voltage R_{BE} = 5 Ω ; I_C = 100 mA	$V_{(BR)CER}$	>	110	V
Collector-emitter voltage open base ; I_C = 100 mA	$V_{(BR)CEO}$	>	53	V
Emitter-base voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	>	4,0	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	12,5	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	12,5	mWs
D.C. current gain				
I_C = 1,4 A ; V_{CE} = 6 V	h_{FE}		15 to 50	
D.C. current gain ratio of matched devices				
I_C = 1,4 A ; V_{CE} = 6 V	h_{FE1}/h_{FE2}	<	1,2	
Transition frequency				
I_C = 6,0 A ; V_{CE} = 35 V	f_T	typ.	275	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; V_{CB} = 50 V	C_c	typ. <	185 220	pF pF
Feedback capacitance at f = 1 MHz				
I_C = 150 mA; V_{CE} = 50 V	C_{re}	typ.	115	pF
Collector-stud capacitance	C_{cs}	typ.	3,5	pF


7Z67531
typ. values
400
f_T
(MHz)
300
200
100
0
V_{CE} = 35 V
25 V
15 V
10 V
5 V
2 V
0
5
10
I_C (A)
15


7Z62647
f = 1 MHz
$I_E = I_e = 0$
1000
C_c
(pF)
750
500
250
0
typ
0
25
50
V_{CB} (V)
75


7Z67522
10
I_C
(A)
1
10^{-1}
10^{-2}
V_{CE} = 40 V
T_h = 25 °C
typ
500
750
1000
1250
V_{BE} (V)

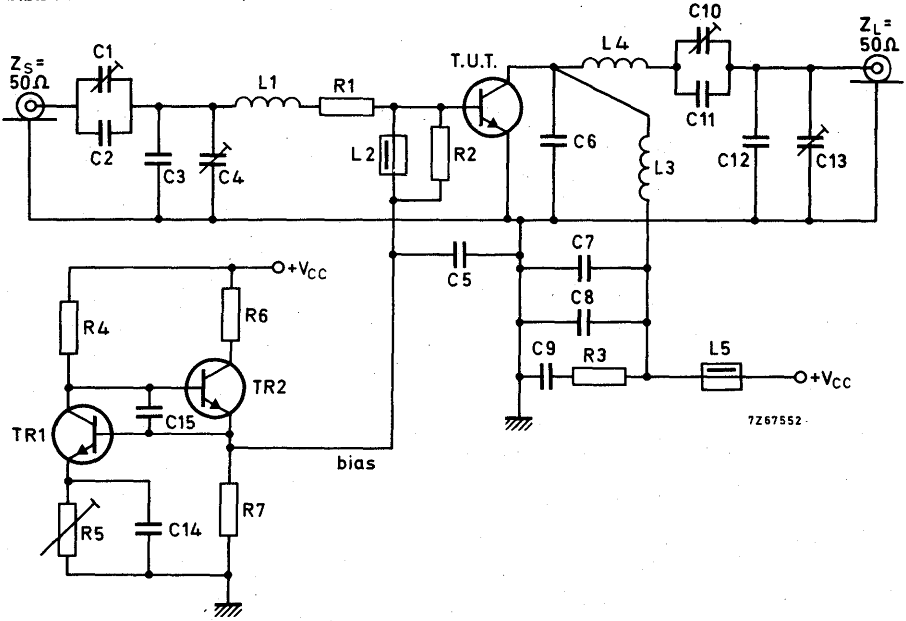
APPLICATION INFORMATION

R.F. performance in s.s.b. operation (linear power amplifier)

T_h up to 25 °C
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power (W)	G_p (dB)	η_{dt} (%)	d_3 (dB) 1)	d_5 (dB) 1)	I_{CZS} (A)	I_C (A)	V_{CE} (V)	Class
20 to 150 (PEP)	> 14	> 37,5	< −30	< −30	0,10	< 4	50	AB
typ. 30 (PEP)	> 14	typ. 15	< −40	< −40	2,5	–	40	A

S.S.B. test circuit class AB; f = 28 MHz



List of components: see page 6.

1) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope power these figures should be increased by 6dB.

APPLICATION INFORMATION (continued)

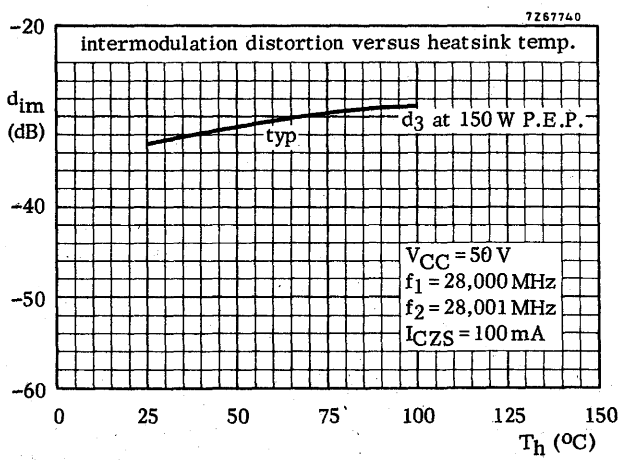
List of components:

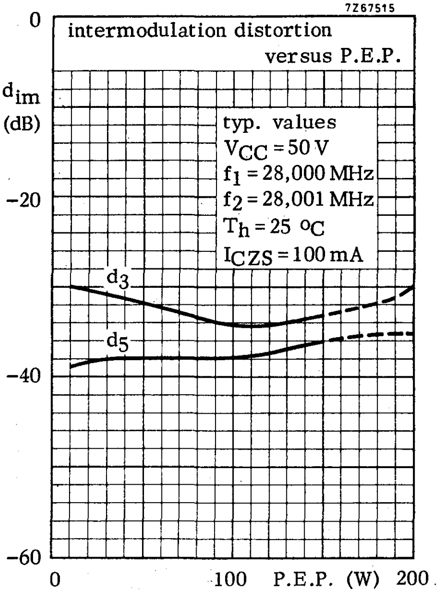
Tr1 = BD135
Tr2 = BD228

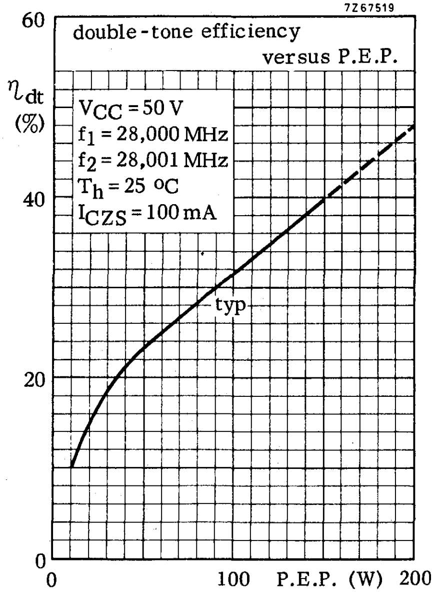
C1 = C10 =	100 pF	air dielectric capacitor (single insulated rotor type)
C2 = C6 =	27 pF	ceramic capacitor
C3 =	180 pF	ceramic capacitor
C4 = C13 =	100 pF	air dielectric capacitor (single non-insulated rotor)
C5 = C7 =	3,9 nF	polyester capacitor (±10%)
C8 = C14 = C15 =	100 nF	polyester capacitor (±10%)
C9 =	2,2 μF	moulded metallized polyester capacitor
C11 =	68 pF	ceramic capacitor
C12 =	220 pF	ceramic capacitor

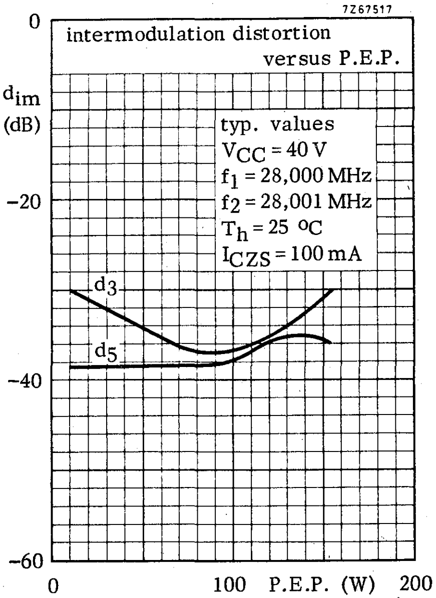
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm

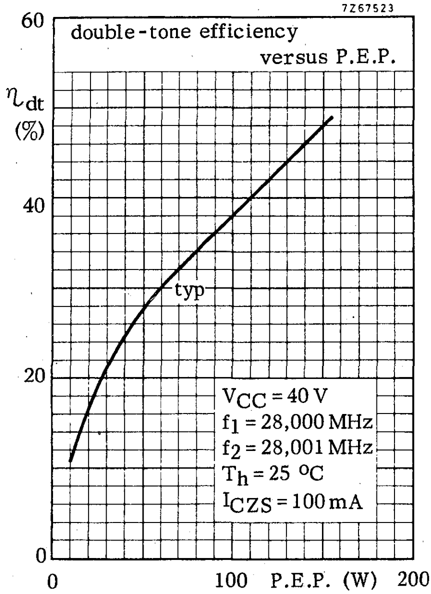
R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 5,6 kΩ carbon resistor (±5%; 1 W)
R5 = 15 Ω wire-wound potentiometer (3W)
R6 = 157 Ω parallel connection of 3 x 470 Ω wire-wound resistors (5,5W each)
R7 = 68 Ω carbon resistor (±5%; 0,5 W)

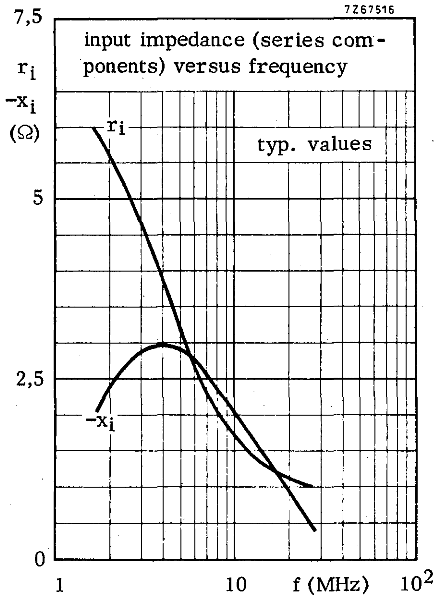


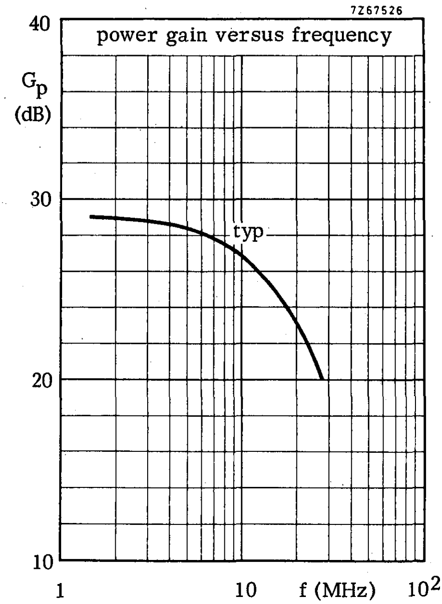

7Z67515
intermodulation distortion versus P.E.P.
typ. values
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
d_{im} (dB)
0
−20
−40
−60
0
100
P.E.P. (W)
200


7Z67519
double-tone efficiency versus P.E.P.
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
typ
η_{dt} (%)
60
40
20
0
0
100
P.E.P. (W)
200


7Z67517
intermodulation distortion versus P.E.P.
typ. values
V_{CC} = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
d_{im} (dB)
0
−20
−40
−60
0
100
P.E.P. (W)
200


7Z67523
double-tone efficiency versus P.E.P.
typ
V_{CC} = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
η_{dt} (%)
60
40
20
0
0
100
P.E.P. (W)
200

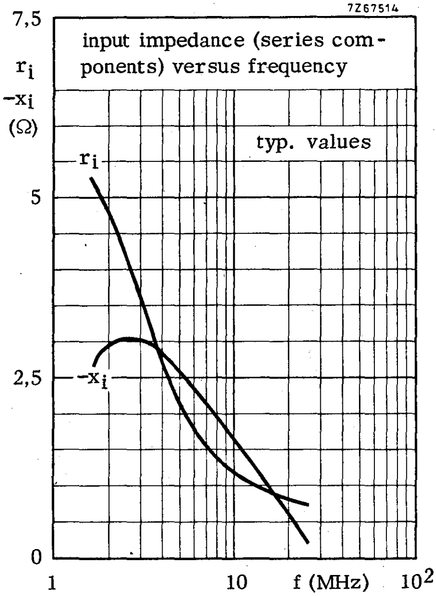


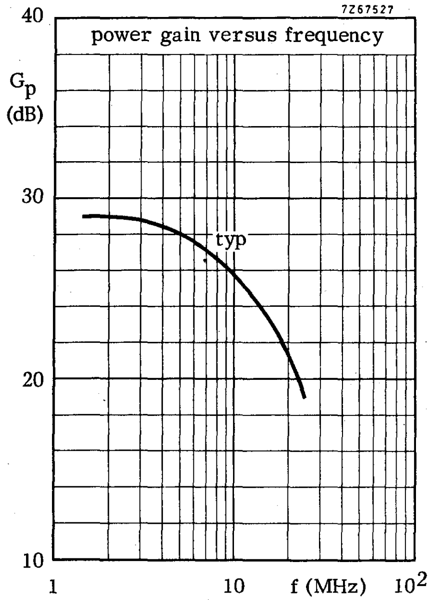


S.S.B. class AB operation

P_L = 150 W (PEP)
V_{CC} = 50 V
I_{CZS} = 100 mA
T_h = 25 °C
Z_L = 6,25 Ω in series with 10,4 nH (in parallel with −267 pF)

The graphs hold for one transistor of a push-pull amplifier with cross neutralization; collector (Tr1) - base (Tr2), neutralizing capacitor: 82 pF.





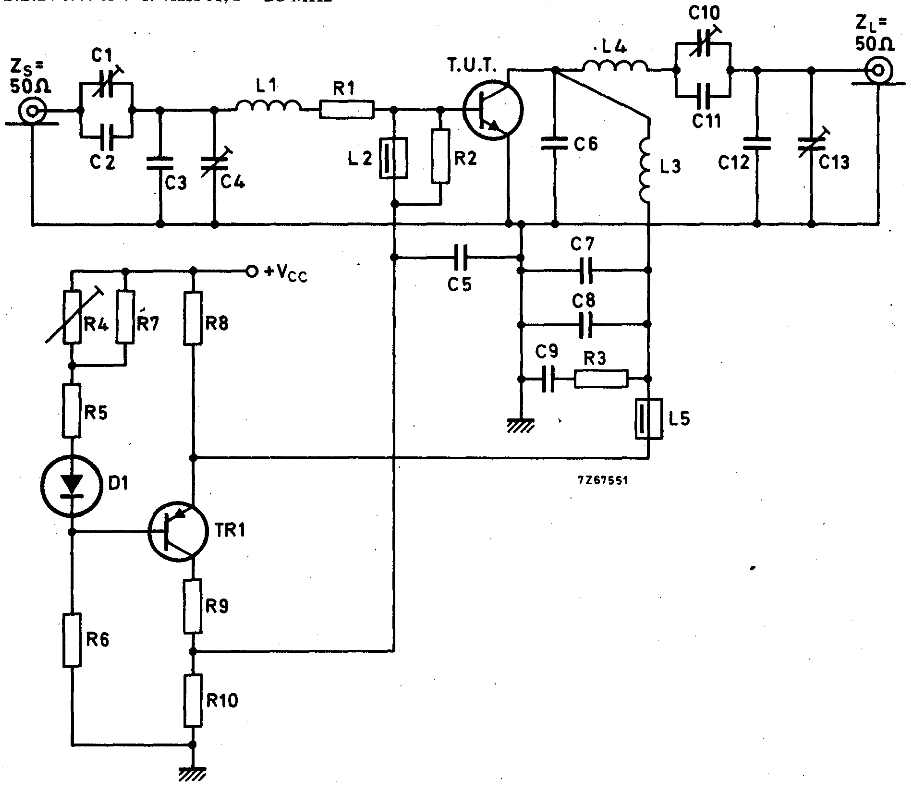
S.S.B. class AB operation

P_L = 150 W (PEP)
V_{CC} = 50 V
I_{CZS} = 100 mA
T_h = 25 °C
Z_L = 6,25 Ω in series with 7,3 nH (in parallel with −188 pF)

The graphs hold for an unneutralized amplifier.

APPLICATION INFORMATION (continued)

S.S.B. test circuit class-A; f = 28 MHz



List of components: (see also page 11)

D1 = BY206
TR1 = BD204

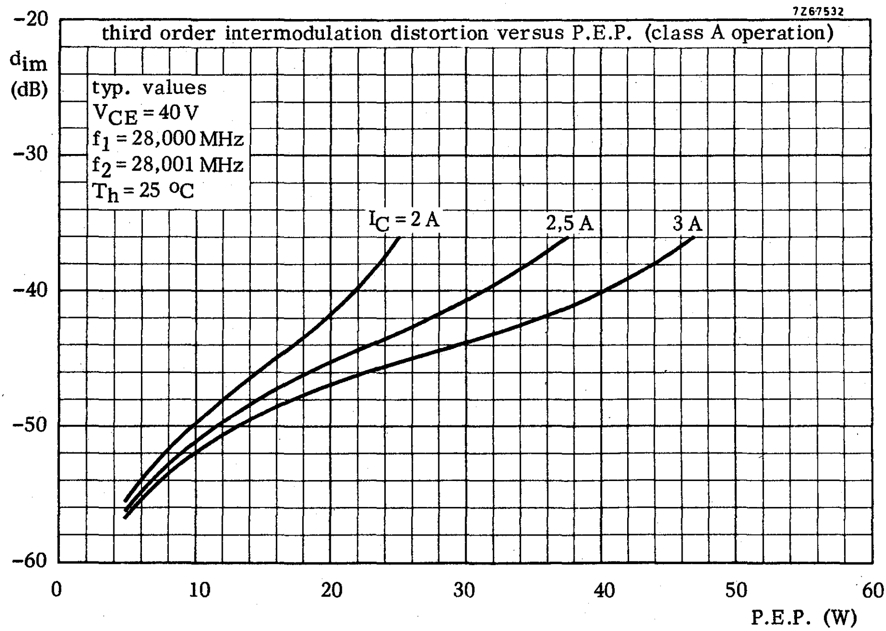
C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C8 = 100 nF polyester capacitor (±10%)
C9 = 2,2 µF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor
C12 = 220 pF ceramic capacitor

APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36440)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm

R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 50 Ω wire-wound potentiometer (1 W)
R5 = 10 Ω carbon resistor (±5%; 1 W)
R6 = 560 Ω enamelled wire-wound resistor (5,5 W)
R7 = 270 Ω carbon resistor (±5%; 1 W)
R8 = 0,6 Ω parallel connection of 3 x 1,8 Ω wire-wound resistors (8 W each)
R9 = 90 Ω parallel connection of 3 x 270 Ω enamelled wire-wound resistor (5,5 W each)
R10 = 12 Ω carbon resistor (±5%; 1 W)



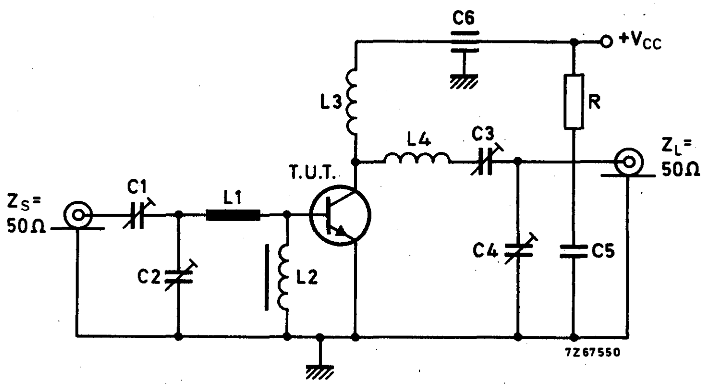
APPLICATION INFORMATION (continued)

R.F. performance in c.w. operation (class-B circuit)

V_{CE} = 50 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)
70	< 15	150	< 4,6	> 10	> 65
108	typ. 30	150	typ. 4,0	typ. 7,5	typ. 75

Test circuit: 70 MHz; c.w. class-B.



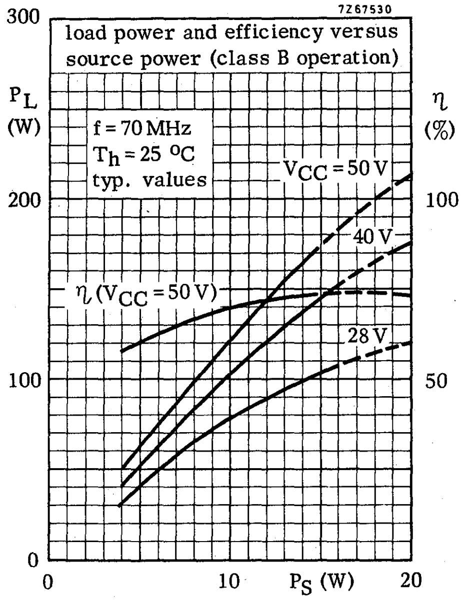
List of components:

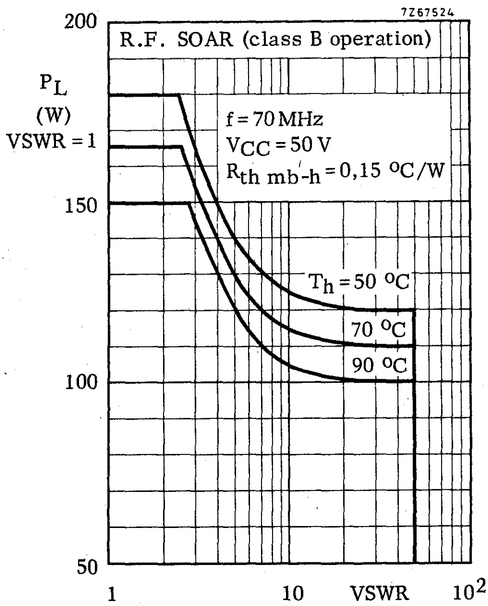
L1 = 60 mm straight enamelled Cu wire (1,6 mm); 9 mm above chassis
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 18 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2 mm; leads 55 mm totally
L4 = 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2,5 mm; leads 50 mm totally

C1 = 4 to 29 pF concentric air trimmer in parallel with 10 pF ceramic capacitor
C2 = 4 to 104 pF film dielectric trimmer in parallel with 56 pF ceramic capacitor
C3 = 4 to 104 pF film dielectric trimmer
C4 = 4 to 104 pF film dielectric trimmer in parallel with 47 pF ceramic capacitor
C5 = 100 nF polyester capacitor (± 10%)
C6 = 1 nF ceramic feed-through capacitor

R = 10 Ω carbon resistor (0,5 W)

At P_L = 150 W and V_{CE} = 50 V, the output power at heatsink temperatures between 25 °C and 75 °C relative to that at 25 °C is diminished by 100 mW/°C.



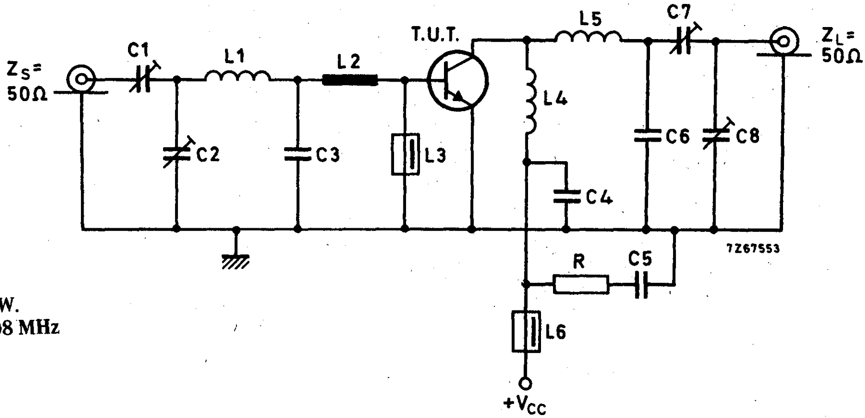


Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 180 W load power in the test amplifier on page 12 and subsequently subjected to various mismatch conditions at 50 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

APPLICATION INFORMATION (continued)

Test circuit:



C.W.
108 MHz

List of components:

C1 = C2 = 40 pF film dielectric trimmer
C3 = 400 pF parallel connection of 4 x 100 pF ceramic capacitors
C4 = 270 pF ceramic capacitor
C5 = 100 nF polyester capacitor (±10%)
C6 = 20 pF parallel connection of 2 x 10 pF ceramic capacitors
C7 = C8 = 60 pF film dielectric trimmer

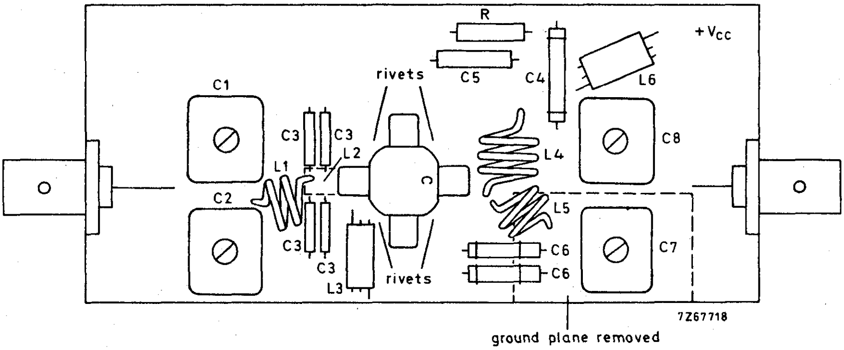
L1 = 49 nH; 2 turns enamelled Cu wire (1,5 mm); internal diameter 9 mm; coil length 4,8 mm; leads 2 x 5 mm
L2 = strip-line (7,7 mm x 6 mm); tap for C3 is 7,5 mm from transistor edge
L3 = L6 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L4 = 67 nH; 3 turns enamelled Cu wire (1,5 mm); internal diameter 8 mm; coil length 8,3 mm; leads 2 x 5 mm
L5 = 57 nH; 2 turns enamelled Cu wire (1,5 mm); internal diameter 10 mm; coil length 4,5 mm; leads 2 x 5 mm

R = 10 Ω carbon resistor (0,5 W)

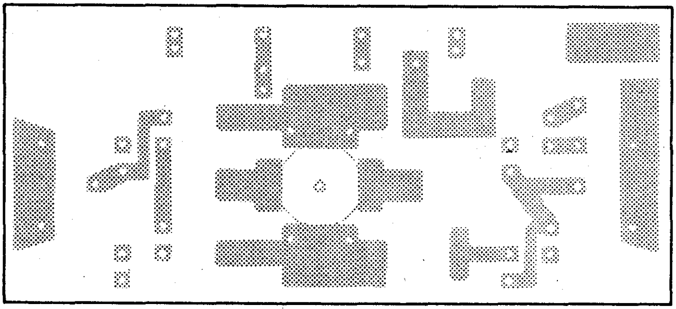
Component lay-out for 108 MHz test circuit see page 15.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 108 MHz test circuit.

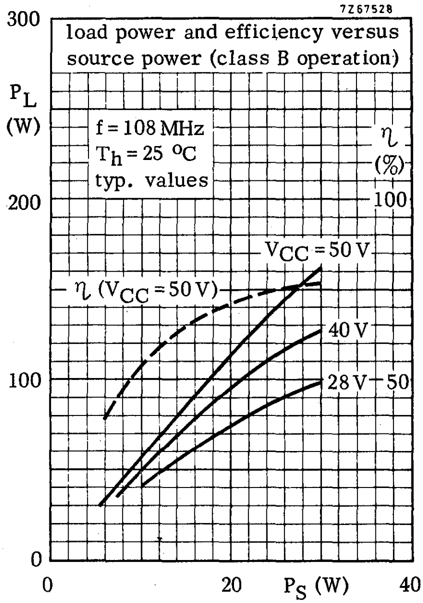


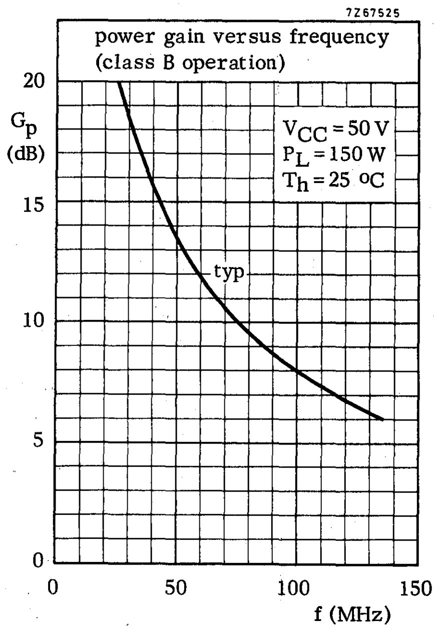
Dimensions of printed circuit board 123 mm x 55 mm.

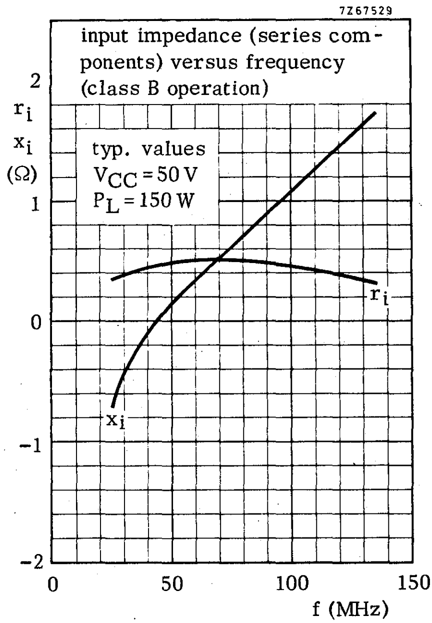


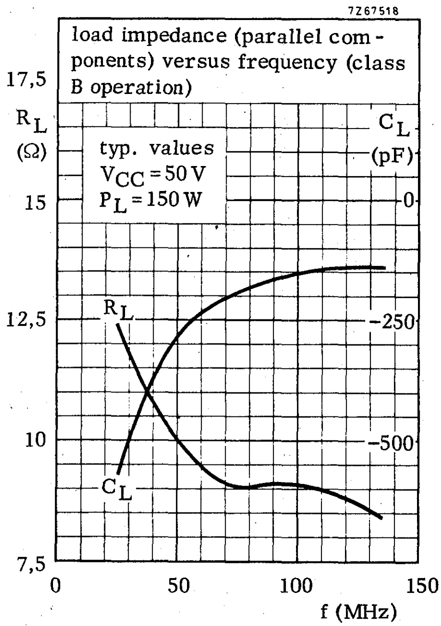
7Z67664

The circuit has been built on epoxy fibre-glass double copper clad printed circuit board (thickness 1/16"). To minimize the dielectric losses, the ground plane under the interconnection of L5, C6 and C7 has been removed.


7Z67528
load power and efficiency versus source power (class B operation)
P_L (W)
300
200
100
0
f = 108 MHz
T_h = 25 °C
typ. values
η (%)
100
50
η (V_CC = 50 V)
V_CC = 50 V
40 V
28 V
0
20
40
P_S (W)


7Z67525
power gain versus frequency (class B operation)
G_p (dB)
20
15
10
5
0
V_CC = 50 V
P_L = 150 W
T_h = 25 °C
typ
0
50
100
150
f (MHz)


7Z67529
input impedance (series components) versus frequency (class B operation)
r_i
x_i
(Ω)
2
1
0
−1
−2
typ. values
V_CC = 50 V
P_L = 150 W
r_i
x_i
0
50
100
150
f (MHz)


7Z67518
load impedance (parallel components) versus frequency (class B operation)
R_L (Ω)
17,5
15
12,5
10
7,5
C_L (pF)
0
−250
−500
typ. values
V_CC = 50 V
P_L = 150 W
R_L
C_L
0
50
100
150
f (MHz)

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

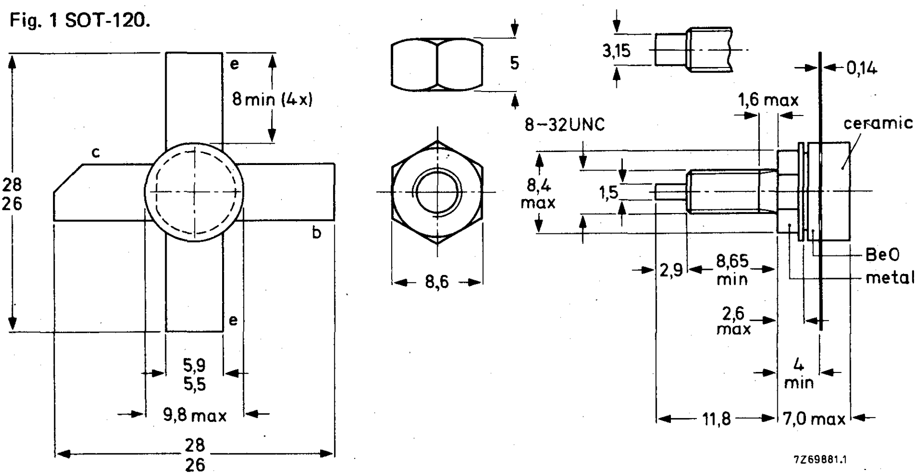
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V	d_3 dB
c.w. (class-B)	28	175	45	> 7,5	> 70	0,7 + j1,3	110 − j62	−
s.s.b. (class-AB)	28	1,6–28	5–42,5(P.E.P)	typ. 19	typ. 50	−	−	typ. −30
s.s.b. (class-A)	26	1,6–28	15 (P.E.P)	typ. 20	−	−	−	typ. −42

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	4 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100 W
Storage temperature	T_{stg}		− 65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

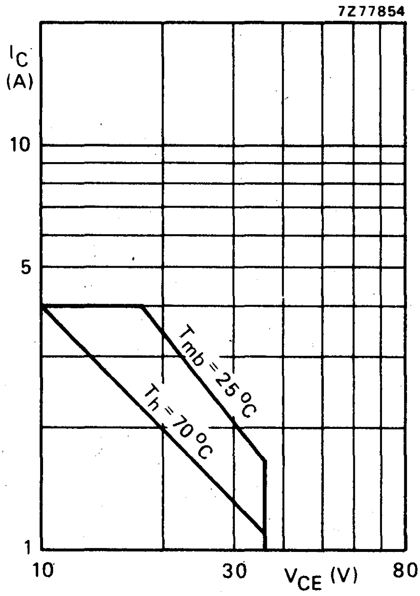


Fig. 2 D.C. SOAR.

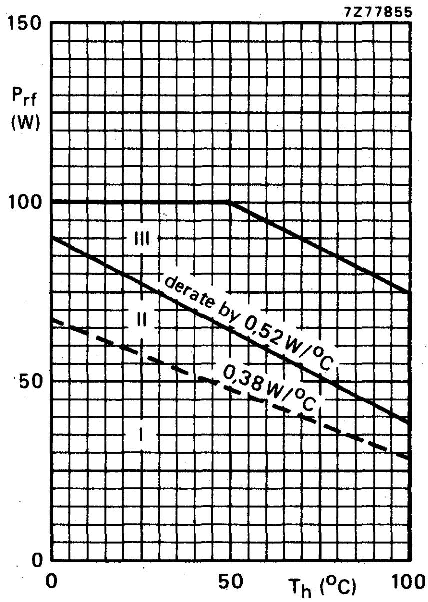


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 88 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,05 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain * I_C = 2,5 A; V_{CE} = 5 V	h_{FE}	typ.	45 10 to 80
D.C. current gain ratio of matched devices * I_C = 2,5 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage * I_C = 7,5 A; I_B = 1,5 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E$ = 2,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
$-I_E$ = 7,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	82 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	54 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

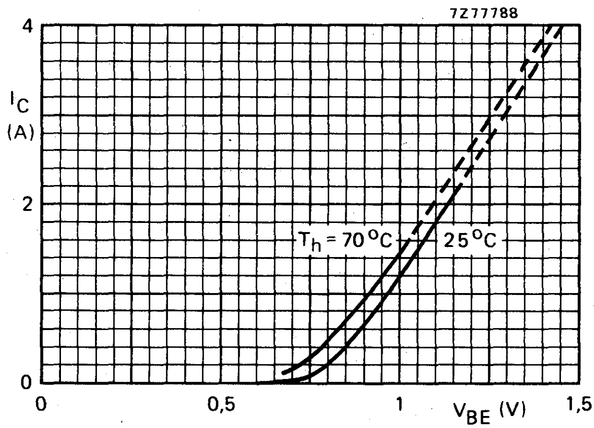


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

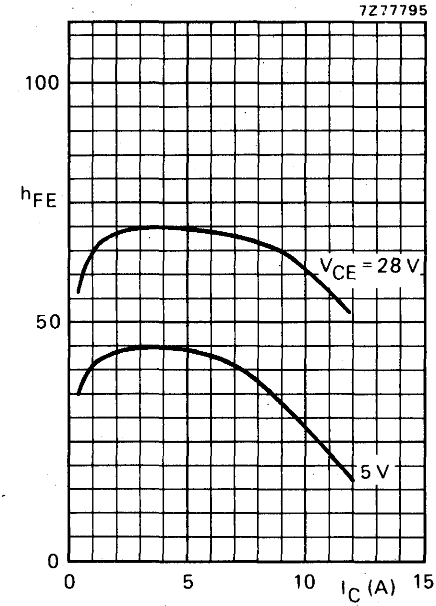


Fig. 5 Typical values; T_j = 25 °C.

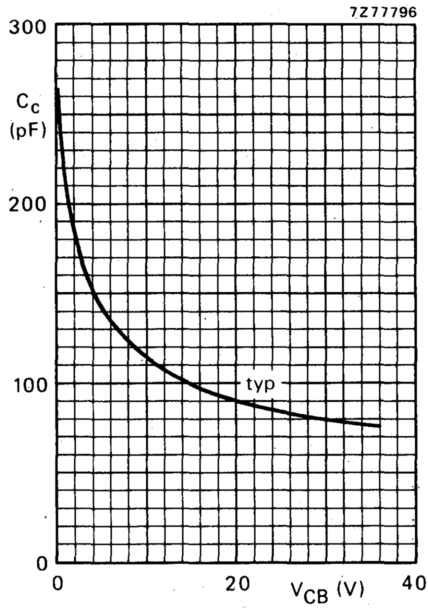


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

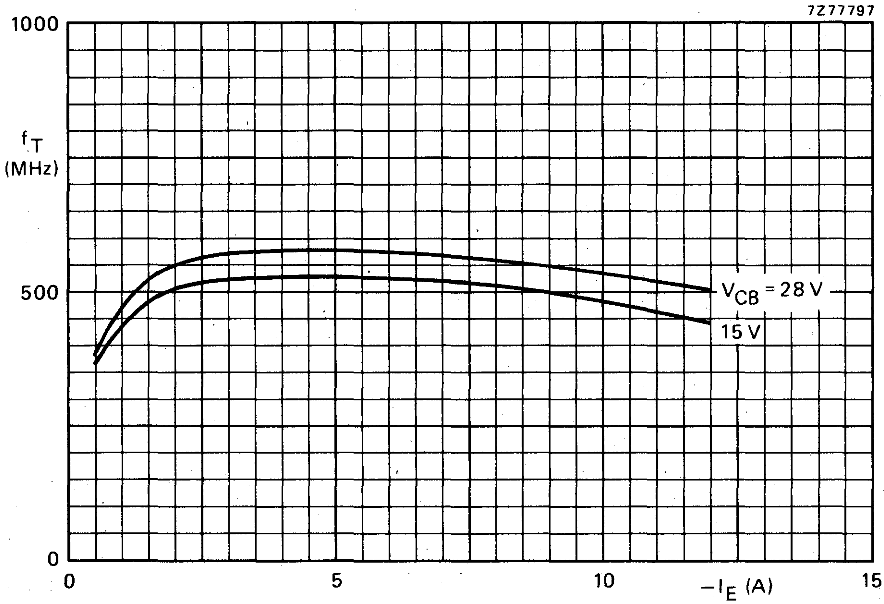


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	45	< 8	> 7,5	< 2,47	> 70	0,7 + j1,3	110 − j62

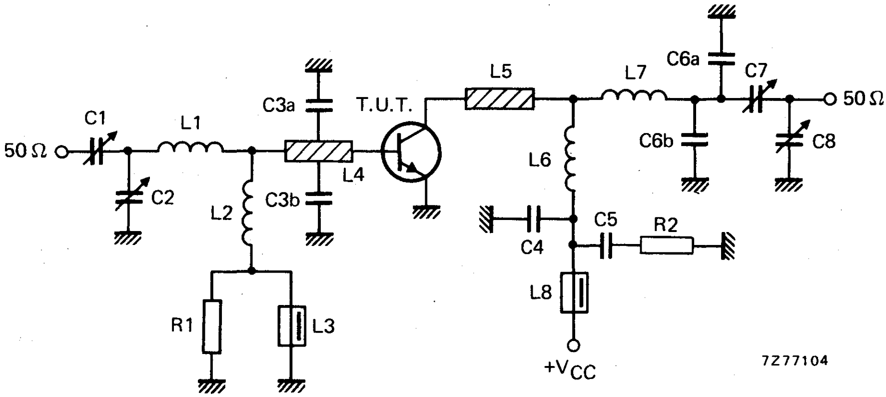


Fig. 8 Test circuit; c.w. class-B.

List of components:

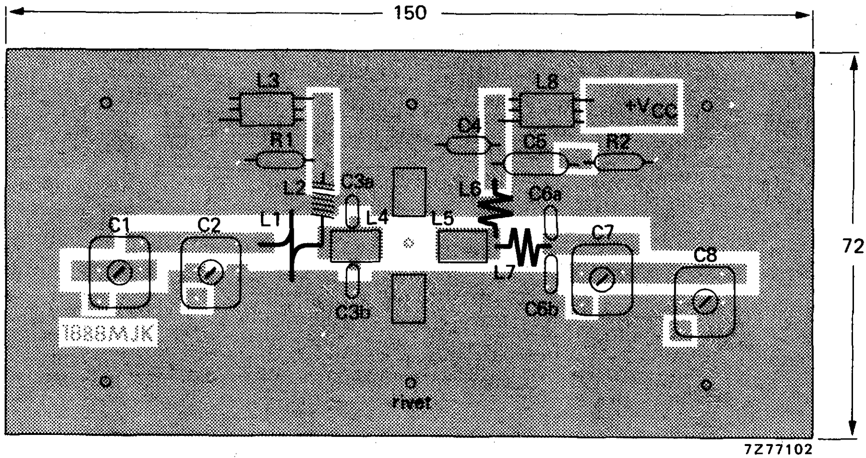
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor.

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.



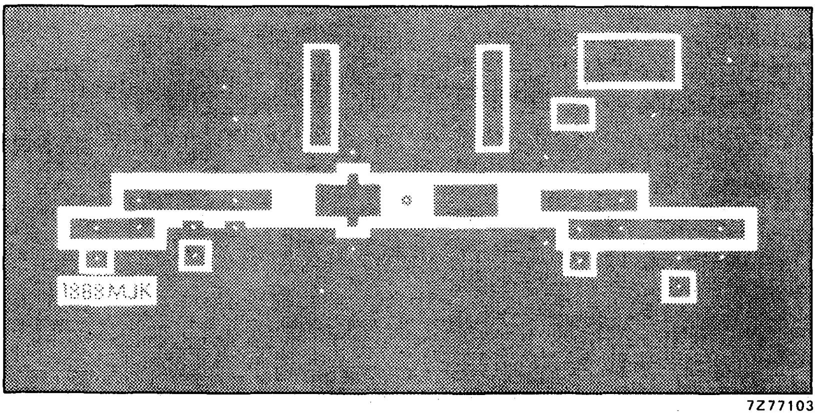


Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

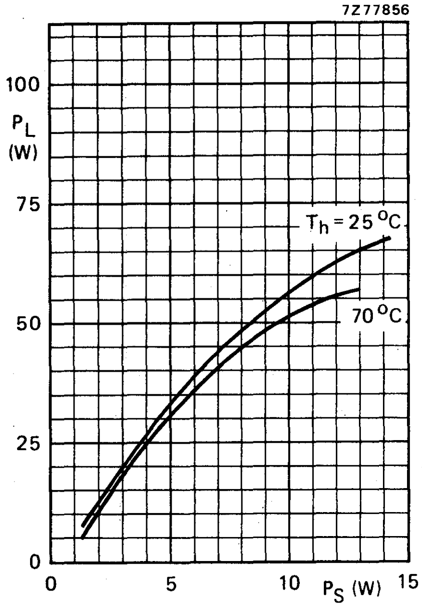


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

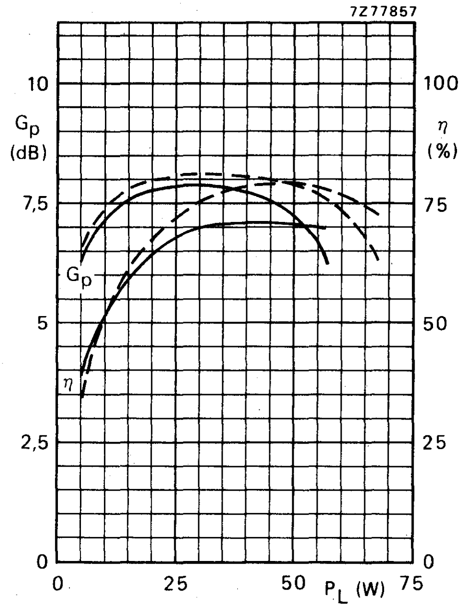


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz; – – – T_h = 25 ^oC; —— T_h = 70 ^oC.

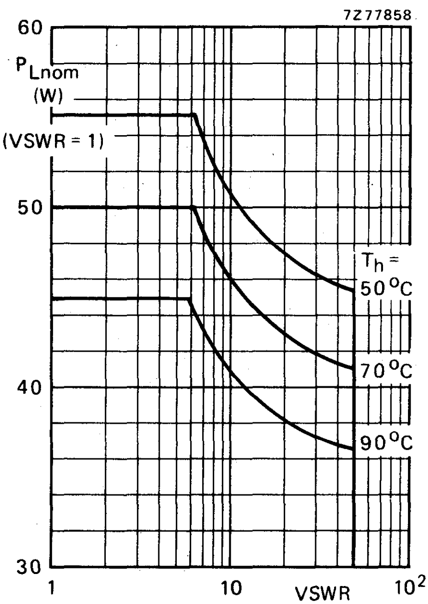


Fig. 12 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 $^oC/W$.

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

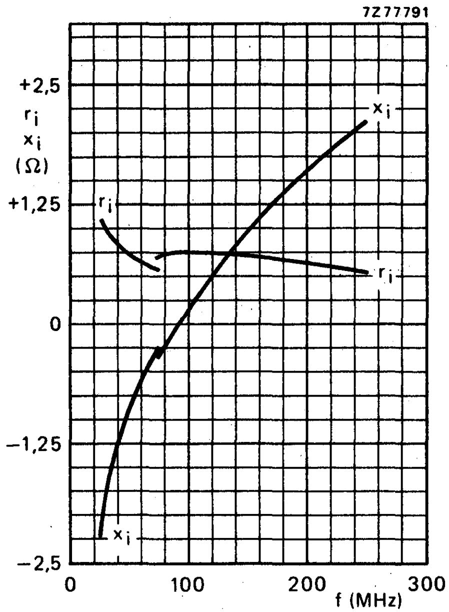


Fig. 13 Input impedance (series components).

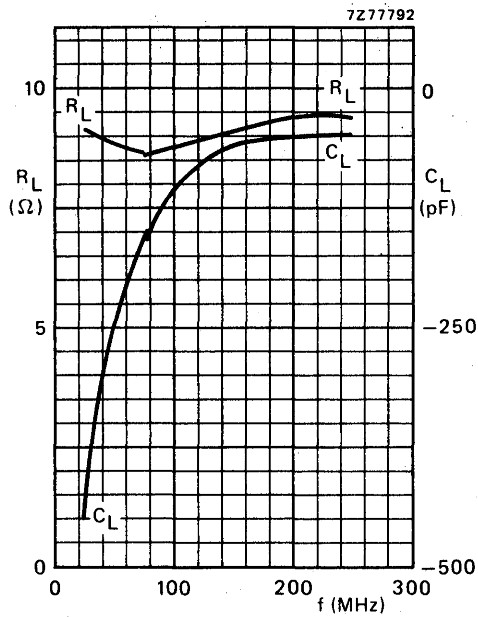


Fig. 14 Load impedance (parallel components).

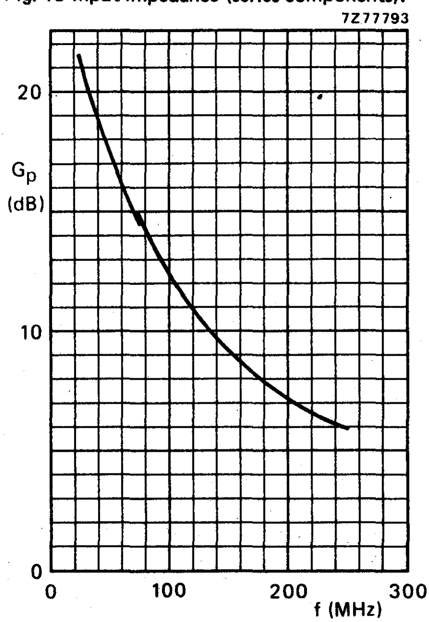


Fig. 15 Power gain versus frequency.

OPERATING NOTE

Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.

Typical values; V_{CE} = 28 V; P_L = 45 W; T_h = 25 ^oC.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt}(%) at 42,5 W (P.E.P)	I_C (A) at 42,5 W (P.E.P)	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
5 to 42,5(P.E.P)	typ. 19	typ. 50	typ. 1,52	typ. −30	< −30	50	25
5 to 37,5(P.E.P)	typ. 19	−	−	typ. −30	< −30	50	70

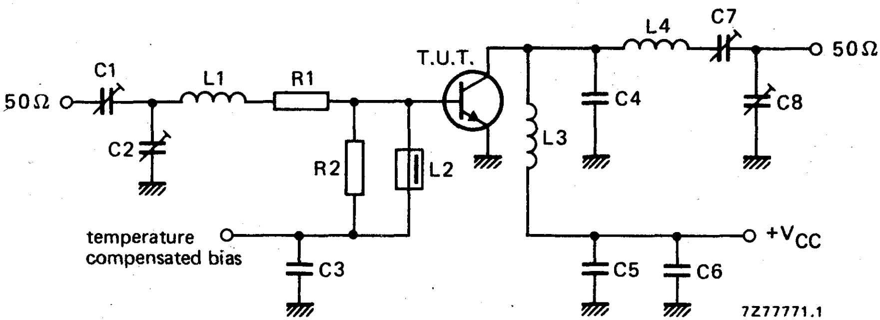


Fig. 16 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric capacitor

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

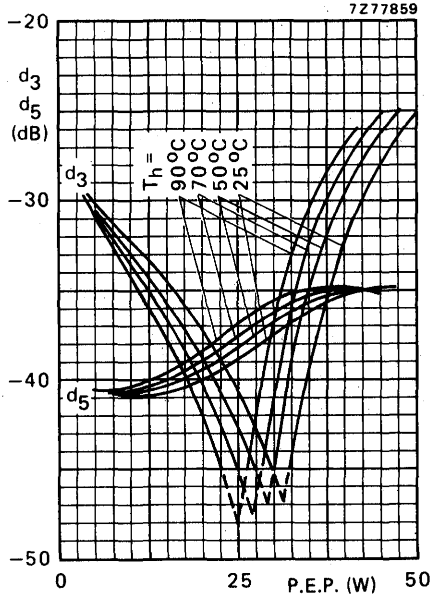


Fig. 17 Intermodulation distortion as a function of output power.*

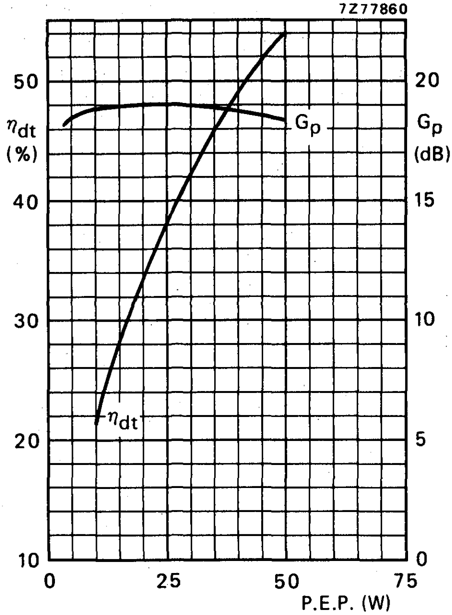


Fig. 18 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 17:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 18:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; typical values.

* See note on page 9.

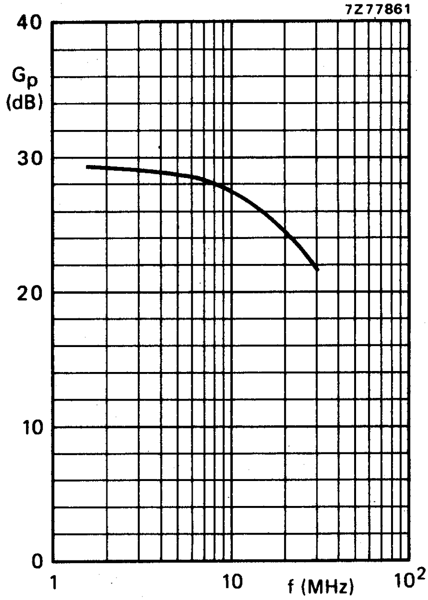


Fig. 19 Power gain as a function of frequency.

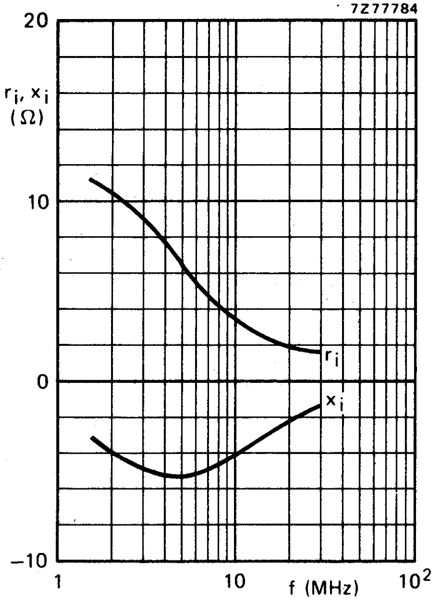


Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 42,5 W; T_h = 25 °C; Z_L = 7,4 Ω.

Ruggedness in s.s.b. operation

The BLX39 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:
Class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 45 W P.E.P.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB *	d_5 dB *
15 (P.E.P)	typ. 20	1,55	typ. −42	< −40

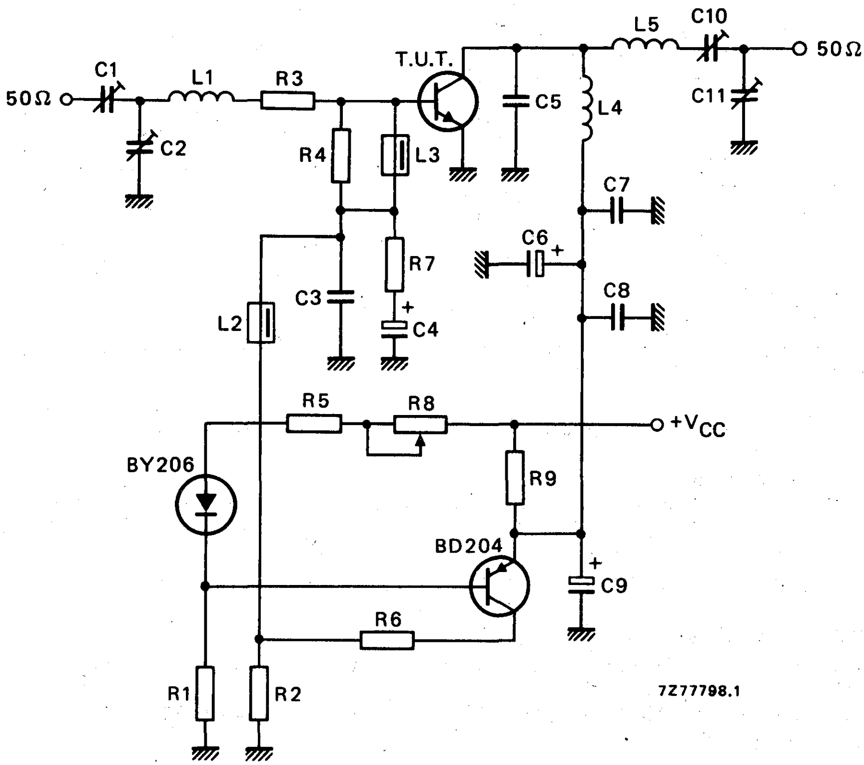


Fig. 21 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 21:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 pF film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5% ; 0,5 W each)
R2 = 15 Ω carbon resistor (± 5% ; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (± 5% ; 0,125 W each)
R4 = 33 Ω carbon resistor (± 5% ; 0,25 W)
R5 = 18 Ω carbon resistor (± 5% ; 0,25 W)
R6 = 120 Ω wirewound resistor (± 5% ; 5,5 W)
R7 = 1 Ω carbon resistor (± 5% ; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (± 5% ; 5,5 W each)

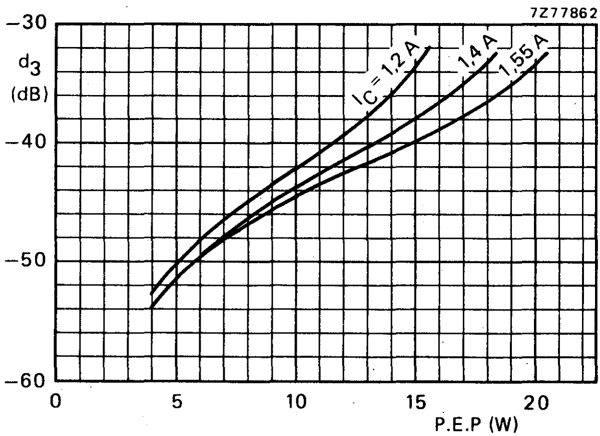


Fig. 22 Intermodulation distortion as a function of output power. Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

U.H.F./V.H.F. TRANSMITTING TRANSISTOR

N-P-N transistor intended for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V. It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

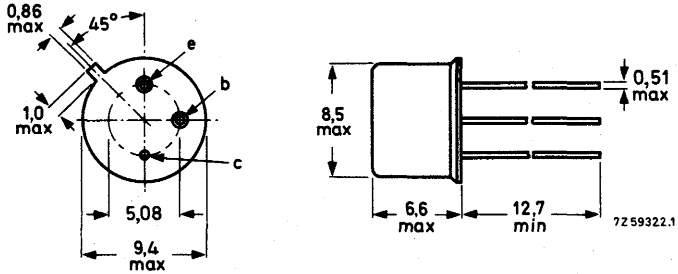
R.F. performance up to T_{case} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,8	470	typ. 0,4	2,0	typ. 0,22	typ. 7	typ. 66	5 + j11	17 − j19
c.w.	12,5	470	< 0,5	2,0	< 0,25	> 6	> 65	−	−
c.w.	12,5	175	typ. 0,12	2,0	typ. 0,21	typ. 12	typ. 75	−	−

MECHANICAL DATA

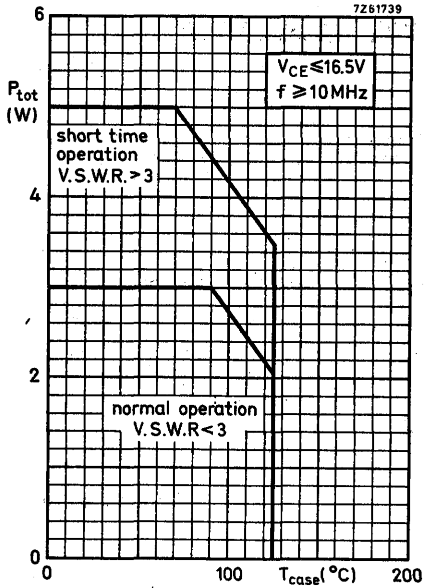
Dimensions in mm

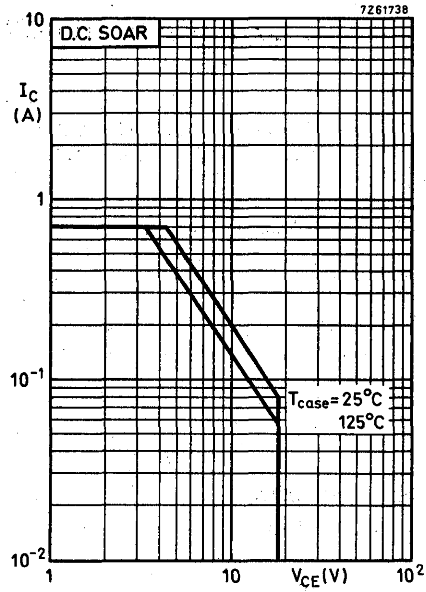
Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56218 (package); 56245 (distance disc).


7Z61739
$V_{CE} \leq 16.5V$
$f \geq 10MHz$
P_{tot} (W)
short time operation V.S.W.R.>3
normal operation V.S.W.R<3
T_{case} (°C)
0
100
200
0
2
4
6


7Z61738
D.C. SOAR
I_C (A)
T_{case} = 25°C
125°C
V_{CE} (V)
1
10
10^2
10^{-2}
10^{-1}
1
10

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

<u>Voltages</u>				
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
<u>Currents</u>				
Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A
<u>Power dissipation</u>				
Total power dissipation up to T_{case} = 90 °C f > 10 MHz	P_{tot}	max.	3.0	W
<u>Temperatures</u>				
Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max	165	°C

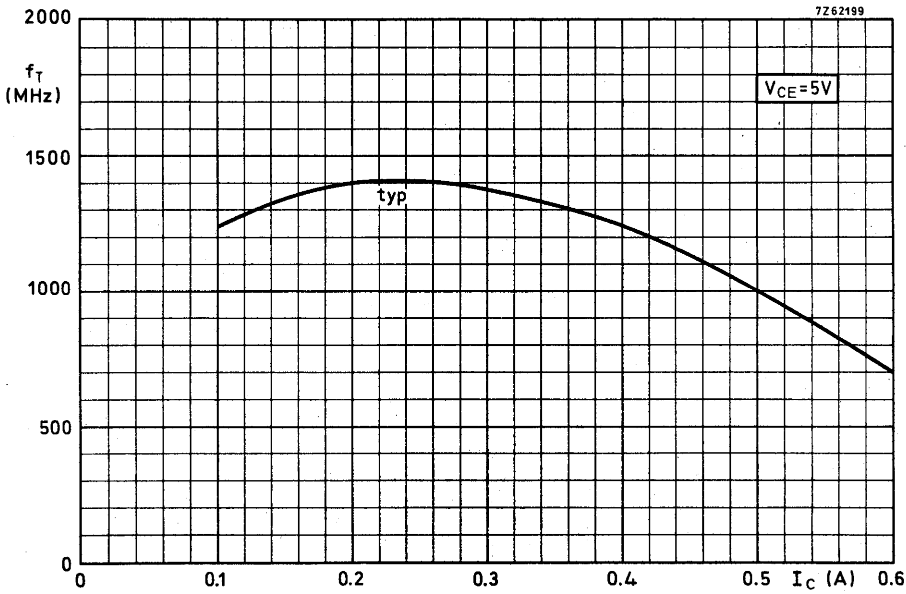
THERMAL RESISTANCE

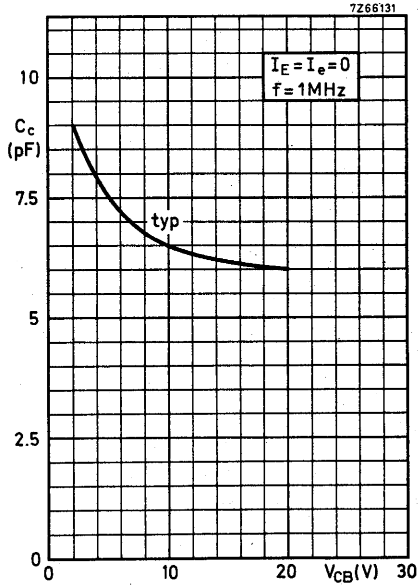
From junction to case	$R_{th\ j\text{-}c}$	=	25	°C/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	2.5	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1.0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0.1	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	> typ.	10 40	
Transition frequency				
I_C = 200 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ. <	6.5 9.0	pF pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	4.8	pF


7Z62199
2000
f_T
(MHz)
1500
1000
500
0
$V_{CE}=5V$
typ
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6


7Z66131
10
C_c
(pF)
7.5
5
2.5
0
$I_E=I_e=0$
f=1MHz
typ
0
10
20
V_{CB}(V)
30

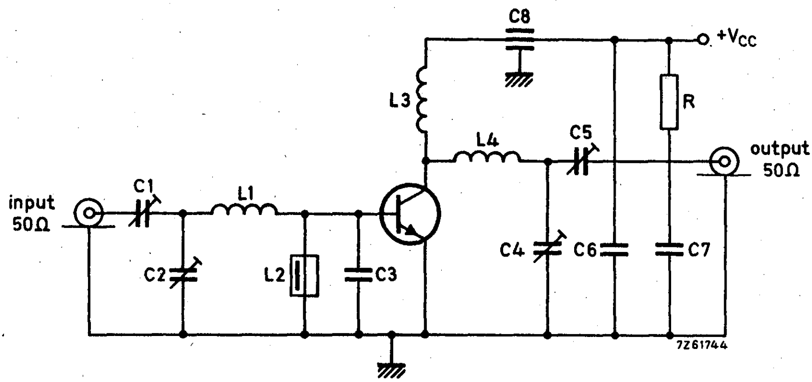
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_{case} up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	13.8	typ. 0.4	2.0	typ. 0.22	typ. 7	typ. 66	5 + j11	17 − j19
470	12.5	< 0.5	2.0	< 0.25	< 6	> 65	–	–
175	12.5	typ. 0.12	2.0	typ. 0.21	typ. 12	typ. 75	–	–

Test circuit:



To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 22 pF disc ceramic capacitor
C6 = 10 nF ceramic capacitor
C7 = 0.1 μF polyester capacitor
C8 = 4 nF feed-through capacitor

L1 = 1 turn Cu wire (1 mm); int. diam. 5 mm, max. lead length 1 mm
L2 = 0.22 μH choke
L3 = 1 turn Cu wire (1 mm); int. diam. 7 mm; lead length 2 mm
L4 = 1 turn Cu wire (1 mm); int. diam. 5 mm; lead length 2 mm

R = 10 Ω carbon

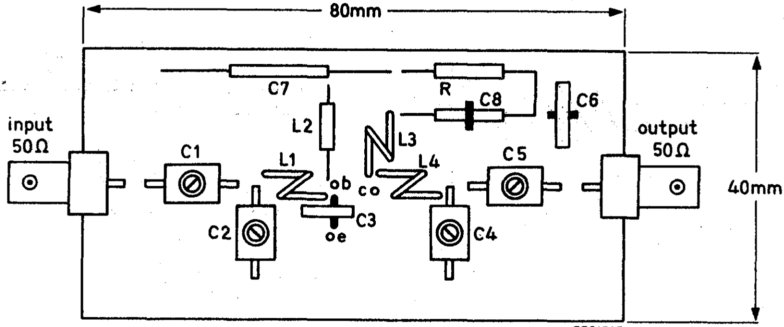
At P_L = 2.0 W and V_{CC} = 12.5 V the output power at case temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C.

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_{case} = 70 °C
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 1.4 W transistor output into 50 Ω load at V_{CC} = 13.8 V.

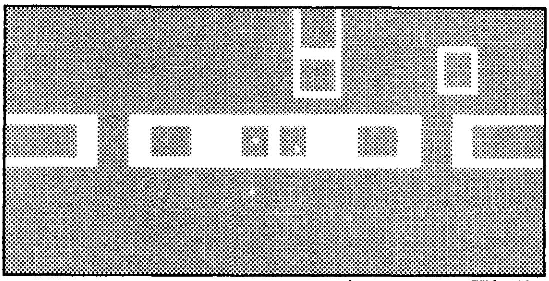
Component lay-out for 470 MHz see page 7.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.



7Z61747

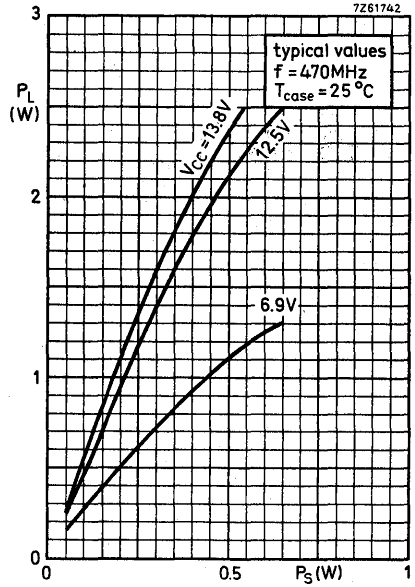


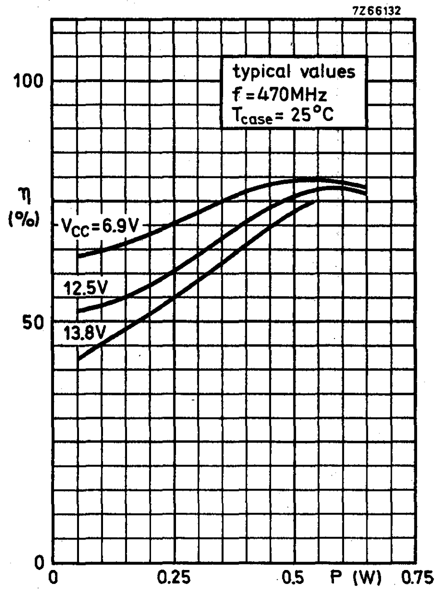
7Z61746.1

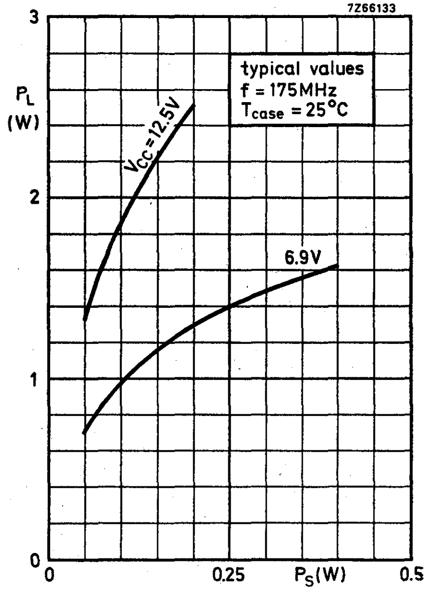
Shaded area copper

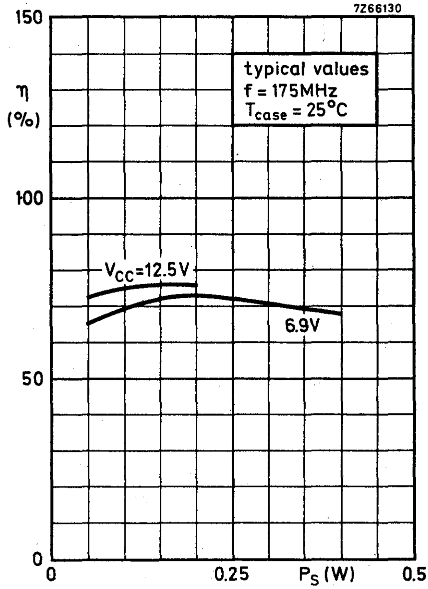
Back area not metalized

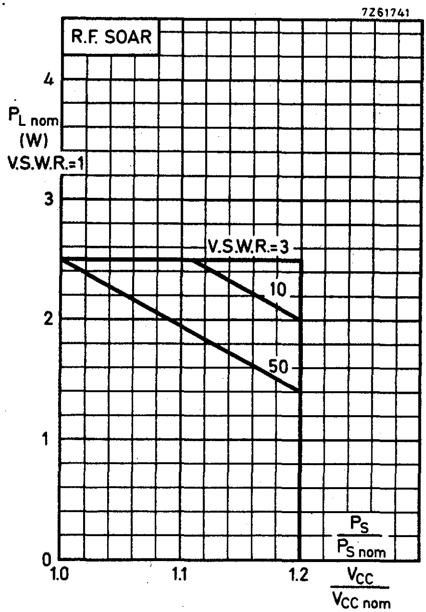
Material of printed circuit board: 1.5 mm epoxy fibre-glass


7Z61742
typical values
f = 470MHz
T_{case} = 25 °C
P_L (W)
V_{CC} = 13.8V
12.5V
6.9V
P_S (W)
0
0.5
1
2
3


7Z66132
typical values
f = 470MHz
T_{case} = 25 °C
η (%)
V_{CC} = 6.9V
12.5V
13.8V
P (W)
0
0.25
0.5
0.75
50
100


7Z66133
typical values
f = 175MHz
T_{case} = 25 °C
P_L (W)
V_{CC} = 12.5V
6.9V
P_S (W)
0
0.25
0.5
1
2
3


7Z66130
typical values
f = 175MHz
T_{case} = 25 °C
η (%)
V_{CC} = 12.5V
6.9V
P_S (W)
0
0.25
0.5
50
100
150



Conditions for R.F. SOAR

f = 470 MHz

T_{case} = 70 °C

V_{CCnom} = 13.8 V

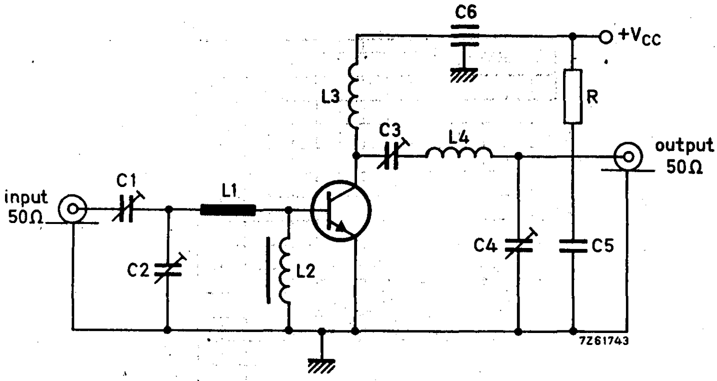
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in the circuit given on page 6. Supply voltage was varied from V_{CCnom} to 1.2 V_{CCnom}, and V.S.W.R. from 1 to 50. It shows the maximum allowable output power under nominal conditions in order not to exceed the maximum allowable power dissipation under conditions of supply overvoltage ($V_{CC} > V_{CCnom}$) and load mismatch (V.S.W.R. > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz



To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

C1 = C4 = 60 pF concentric air trimmer
C2 = C3 = 30 pF concentric air trimmer
C5 = 0.25 µF polyester capacitor
C6 = 4 nF feed-through capacitor

L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on ferrite FX1115, d = 2 mm, D = 4 mm, 1 = 5 mm, material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm

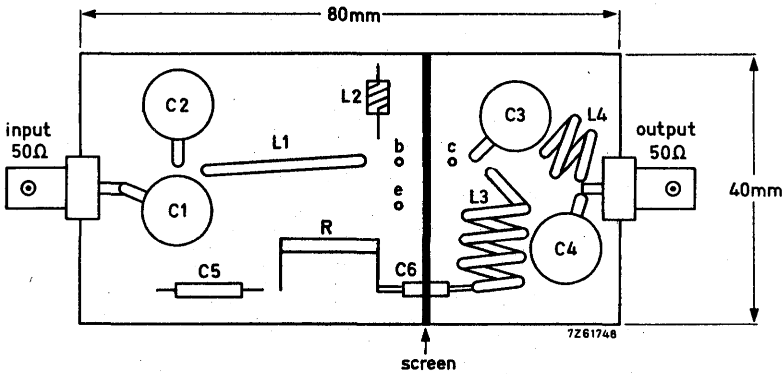
R = 10 Ω carbon

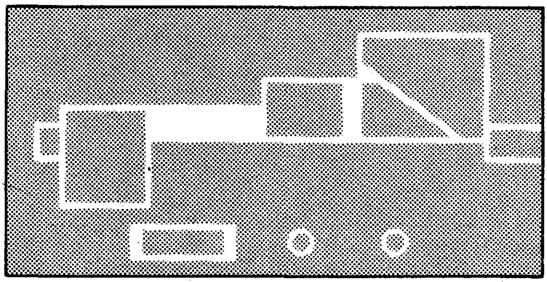
Graphs (P_L versus P_S and η versus P_S) for 175 MHz on page 8.

Component lay-out for 175 MHz on page 11.

APPLICATION INFORMATION (continued)

Component lay-out and printed cicuit board for 175 MHz test circuit:





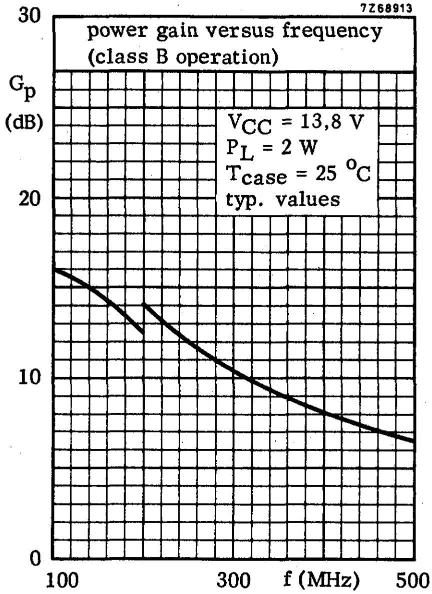
7Z61745.1

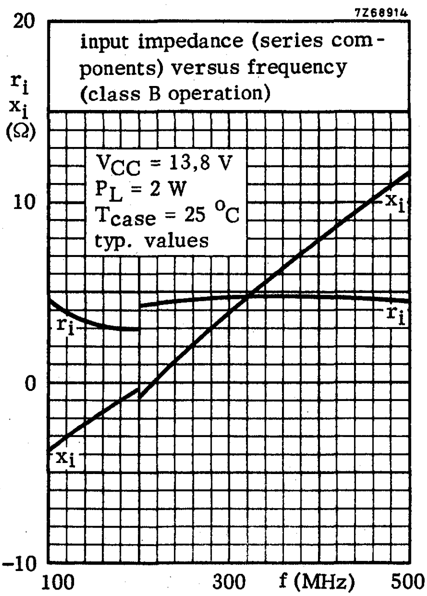
Shaded area copper

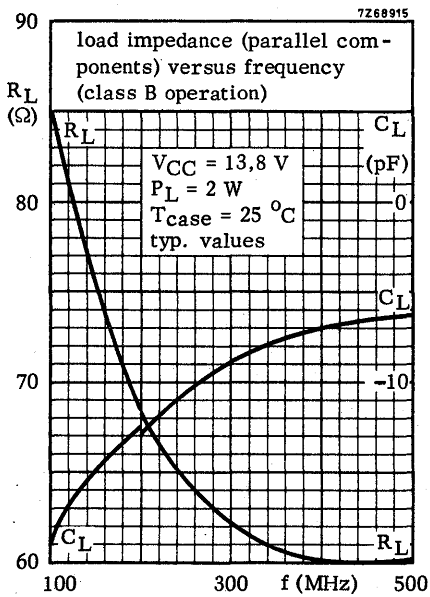
Back area not metallized

Material of printed circuit board: 1.5 mm epoxy fibre-glass

OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F./V.H.F. TRANSMITTING TRANSISTOR

N-P-N transistor intended for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V. It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

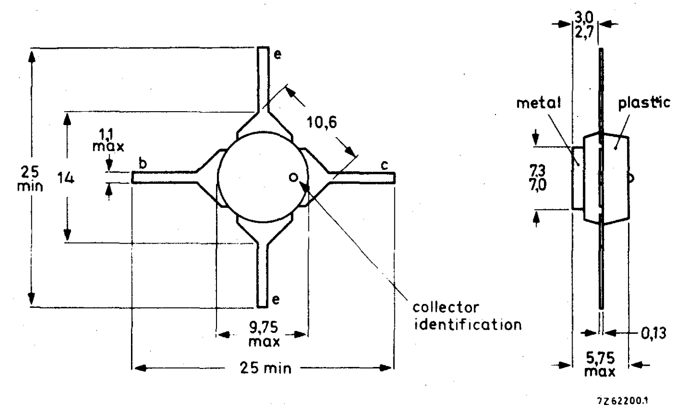
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

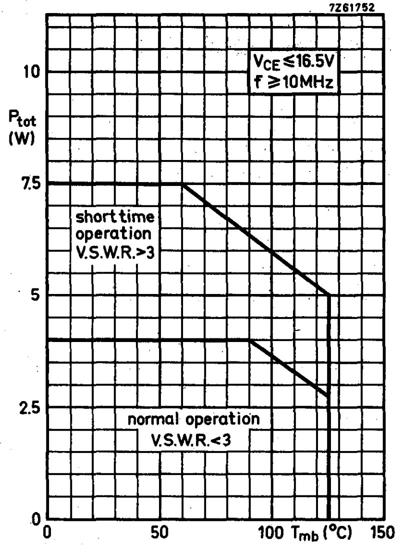
mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,8	470	typ. 0,15	1,5	typ. 0,17	typ. 10	typ. 65	–	–
c.w.	13,8	470	typ. 0,28	2,5	typ. 0,24	typ. 9,5	typ. 75	2,6 + j4,8	23 – j23
c.w.	12,5	470	< 0,35	2,5	< 0,31	> 8,5	> 65	–	–
c.w.	12,5	175	typ. 0,03	3,0	typ. 0,29	typ. 20	typ. 84	–	–

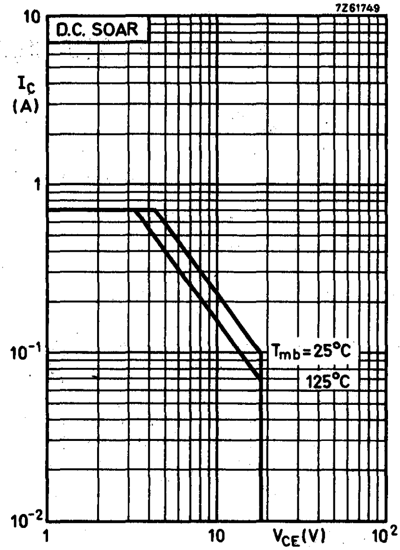
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48 (without stud).




7Z61752
$V_{CE} \leq 16.5V$
$f \geq 10MHz$
P_{tot} (W)
10
7.5
5
2.5
0
short time operation V.S.W.R.>3
normal operation V.S.W.R.<3
0
50
100
T_{mb} (°C)
150


7Z61749
D.C. SOAR
I_C (A)
10
1
10^{-1}
10^{-2}
$T_{mb} = 25°C$
125°C
1
10
V_{CE} (V)
10^2

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

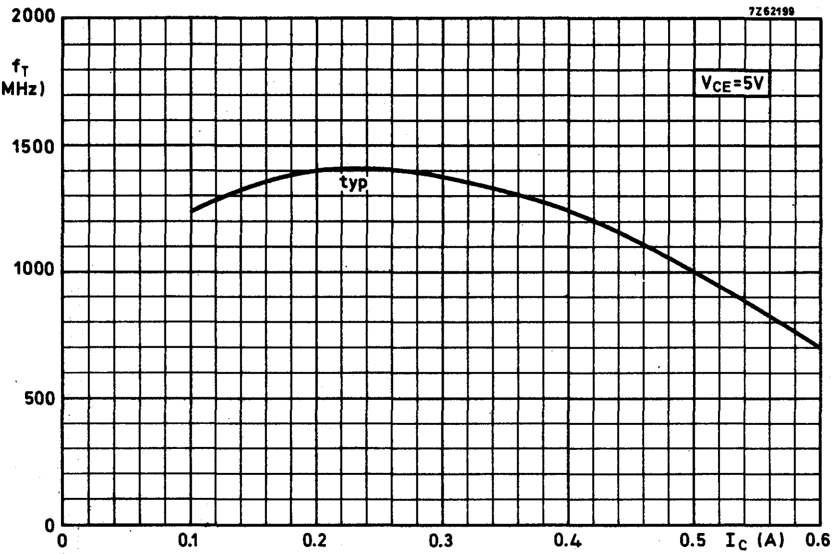
Voltages				
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Currents				
Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A
Power dissipation				
Total power dissipation up to T_{mb} = 90 °C f > 10 MHz	P_{tot}	max.	4.0	W
Temperatures				
Storage temperature	T_{stg}		-65 to +150	°C
Junction temperature	T_j	max.	150	°C

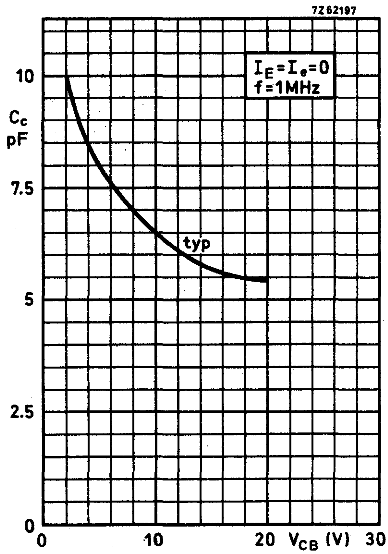
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	12	°C/W

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,1	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	10	
		typ.	40	
Transition frequency				
I_C = 200 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	6,5	pF
		<	9,0	pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62199
2000
f_T
(MHz)
1500
1000
500
0
V_{CE}=5V
typ
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6


7Z62197
10
C_c
pF
7.5
5
2.5
0
$I_E=I_e=0$
f=1MHz
typ
0
10
20
V_{CB} (V)
30

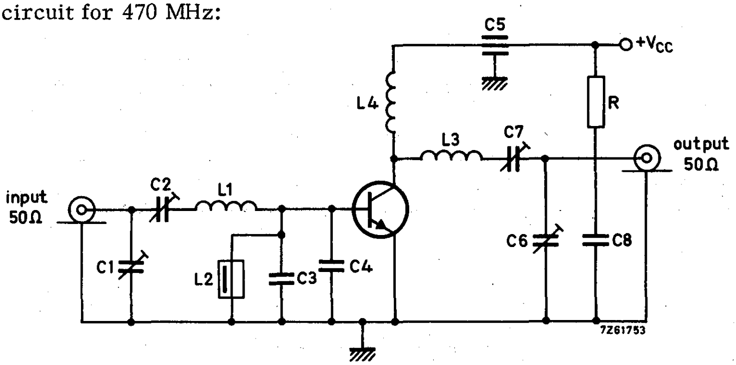
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_{mb} = 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
470	13.8	typ. 0.15	1.5	typ. 0.17	typ. 10	typ. 65	-	-
470	13.8	typ. 0.28	2.5	typ. 0.24	typ. 9.5	typ. 75	2.6+j4.8	23 − j23
470	12.5	< 0.35	2.5	< 0.31	> 8.5	> 65	-	-
175	12.5	typ. 0.03	3.0	typ. 0.29	typ. 20	typ. 84	-	-

Test circuit for 470 MHz:



C1 = C2 = C6 = C7 = 1.8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 4 nF feed-through capacitor
C8 = 0.1 μF polyester capacitor

L1 = 1 turn Cu wire (1.2 mm); int. diam. 6 mm; max. lead length 1 mm.
L2 = 1 μH choke
L3 = 30 mm straight Cu wire (2 mm); height above print 2 mm.
L4 = 2 turns closely wound Cu wire (0.5 mm); int. diam. 3 mm; max. lead length 8 mm.

R = 10 Ω carbon

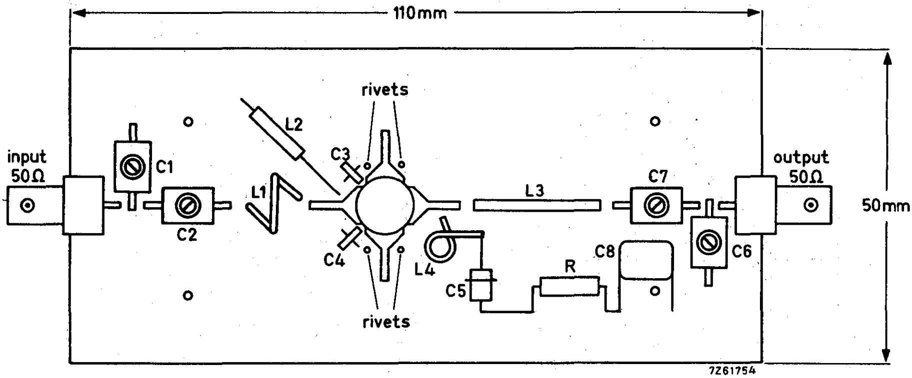
At P_L = 2.5 W and V_{CC} = 12.5 V the output power at mounting-base temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C

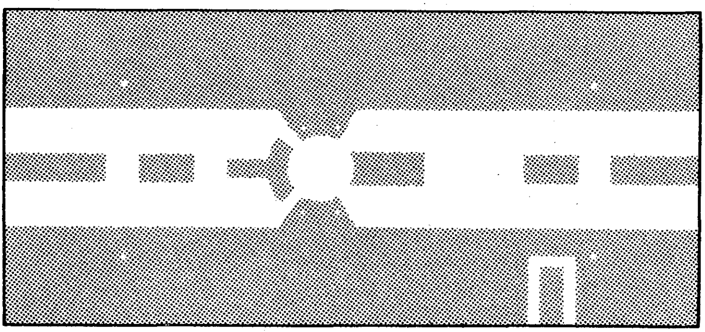
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_{mb} = 70 °C;
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 2.5 W transistor output into 50 Ω load at V_{CC} = 13.8 V

Component lay-out for 470 MHz see page 7

APPLICATION INFORMATION (continued)

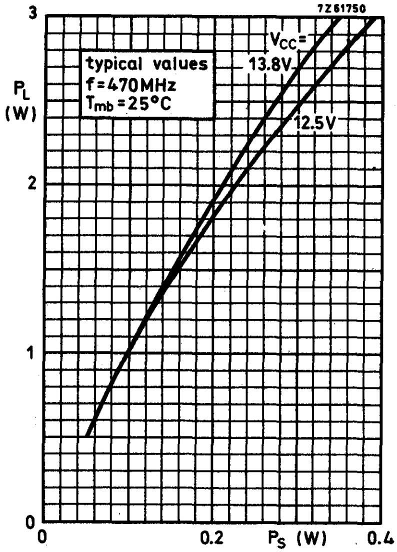
Component lay-out and printed circuit board for 470 MHz test circuit.

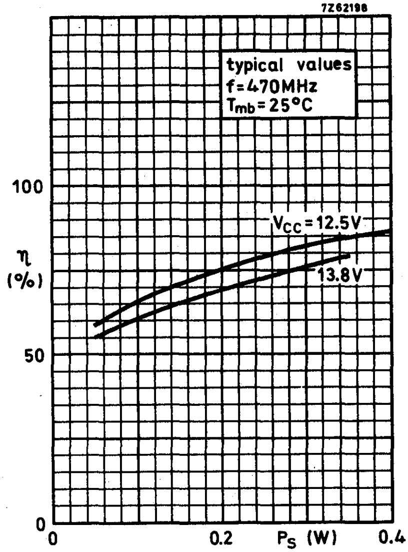


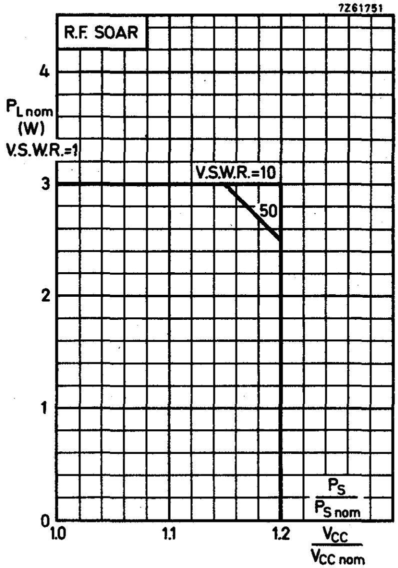


7Z61755.1

Shaded area copper
Back area completely copper clad
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z61750
typical values
f=470MHz
T_{mb}=25°C
P_L
(W)
V_{CC}=
13.8V
12.5V
3
2
1
0
0
0.2
P_S (W)
0.4


7Z62198
typical values
f=470MHz
T_{mb}=25°C
η
(%)
V_{CC}=12.5V
13.8V
100
50
0
0
0.2
P_S (W)
0.4



Conditions for R.F. SOAR

f = 470 MHz

T_{mb} = 70 °C

V_{CCnom} = 13.8 V

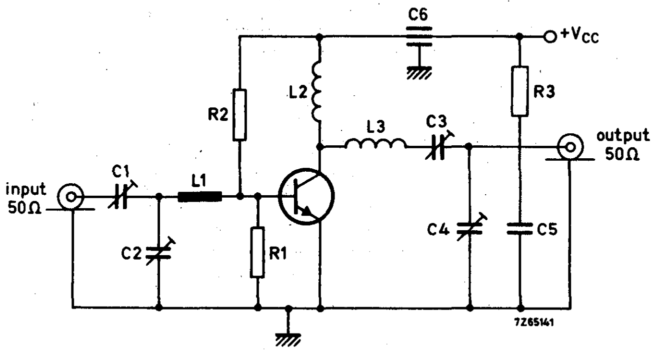
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in the circuit given on page 6. Supply voltage was varied from V_{CCnom} to $1.2\,V_{CCnom}$, and V.S.W.R. from 1 to 50. It shows the max. allowable output power under nominal conditions in order not to exceed the max. allowable power dissipation under conditions of supply overvoltage ($V_{CC} > V_{CCnom}$) and load mismatch (V.S.W.R. > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



C1 = C3 = C4 = 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4 nF feed-through capacitor

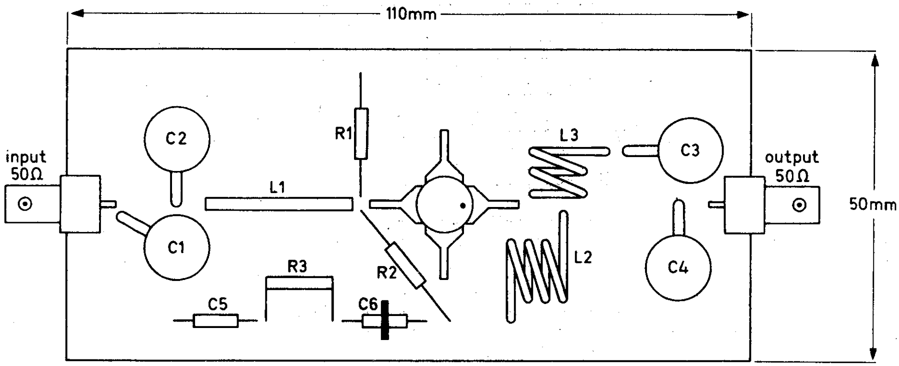
L1 = 25 mm straight Cu wire (1.2 mm); height above print max. 3 mm
L2 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; max. lead lenght 5 mm
L3 = 2 turns closely wound Cu wire (1.7 mm); int. diam. 12 mm; max. lead lenght 5 mm

R1 = 50 Ω carbon
R2 = 1.2 kΩ carbon
R3 = 5 Ω carbon

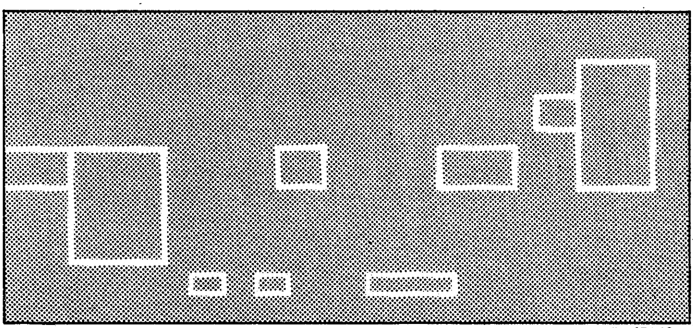
Component lay-out for 175 MHz see page 11.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.



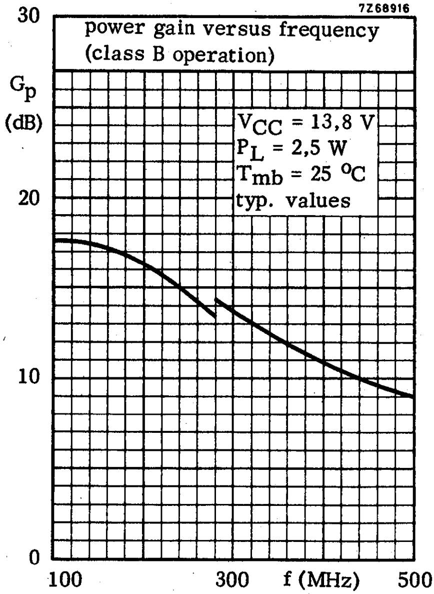
7Z65142

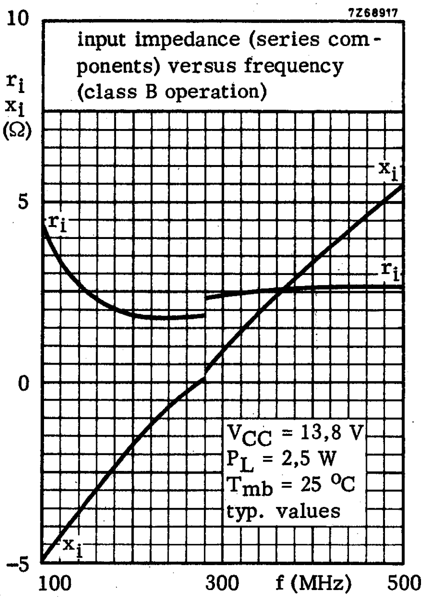


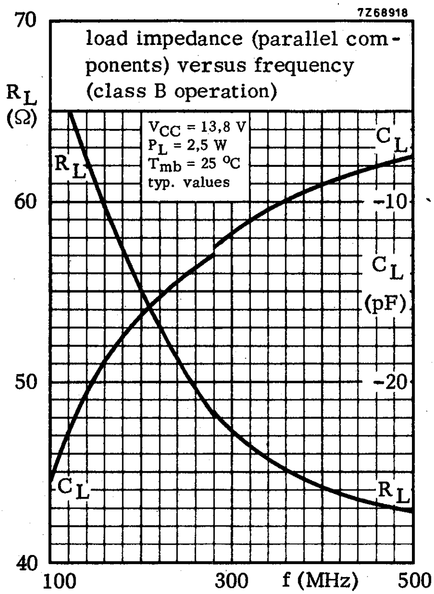
7Z65143.1

Shaded area copper
Back area not metallized
Material of printed circuit board: 1.5 mm epoxy fibre glass

OPERATING NOTE Below 280 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F./V.H.F. TRANSMITTING TRANSISTOR

N-P-N transistor intended for use in class B and C operated mobile, industrial and military transmitters with a supply voltage of 13.8 V. It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

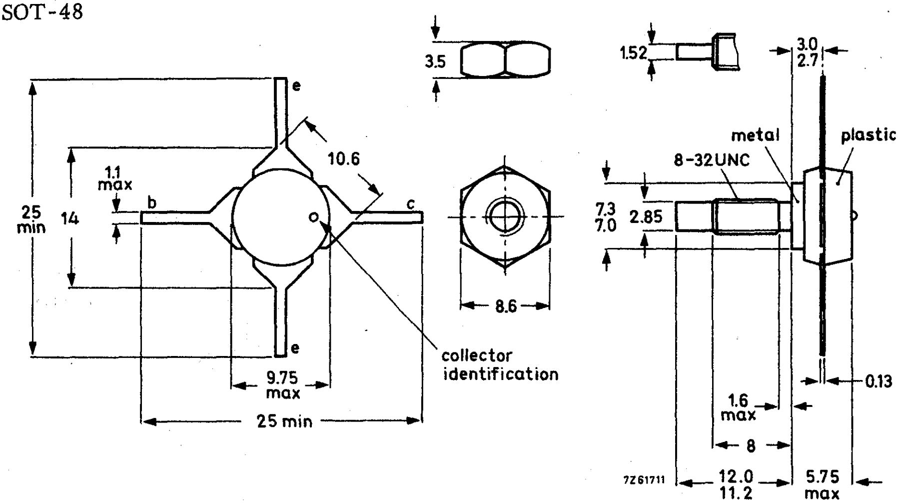
QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class B circuit

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
c.w.	13.8	470	typ. 0.15	1.5	typ. 0.17	typ. 10	typ. 65	-	-
c.w.	13.8	470	typ. 0.35	3.0	typ. 0.28	typ. 9.3	typ. 79	2.9+j5.1	27 − j21
c.w.	12.5	470	< 0.35	2.5	< 0.31	> 8.5	> 65	-	-
c.w.	12.5	175	typ. 0.03	3.0	typ. 0.29	typ. 20	typ. 84	-	-

MECHANICAL DATA Dimensions in mm

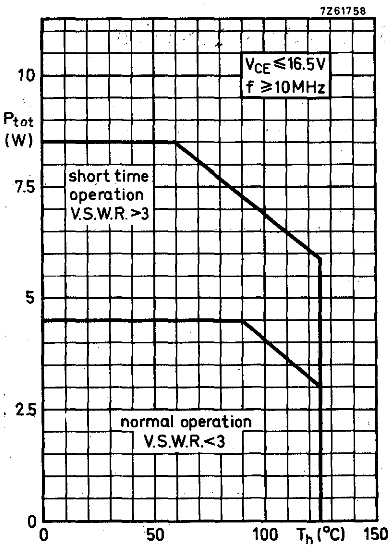
SOT-48

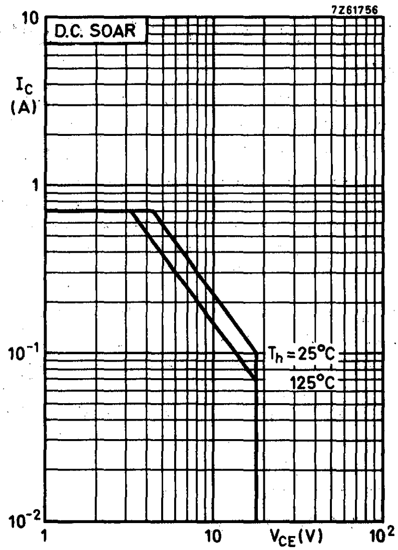


When locking is required an adhesive instead of a lock washer is preferred

Torque on nut: min. 7.5 kg cm
(0.75 Newton metres)
max. 8.5 kg cm
(0.85 Newton metres)

Diameter of clearance hole in heatsink: max. 4.17 mm.
Mounting hole to have no burrs at either end
De-burring must leave surface flat; do not chamfer or countersink either end of hole.


7Z61758
$V_{CE} \leqslant 16.5$ V
f $\geqslant$ 10 MHz
P_{tot} (W)
short time operation V.S.W.R. >3
normal operation V.S.W.R.<3
T_h (°C)
0
50
100
150
2.5
5
7.5
10


7Z61756
D.C. SOAR
I_C (A)
T_h = 25°C
125°C
V_{CE} (V)
10
1
10^{-1}
10^{-2}
10^2

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A

Power dissipation

Total power dissipation up to T_h = 90 °C f > 10 MHz	P_{tot}	max.	4.5	W

Temperature

Storage temperature	T_{stg}	−65 to	+150	°C
Junction temperature	T_j	max.	150	°C

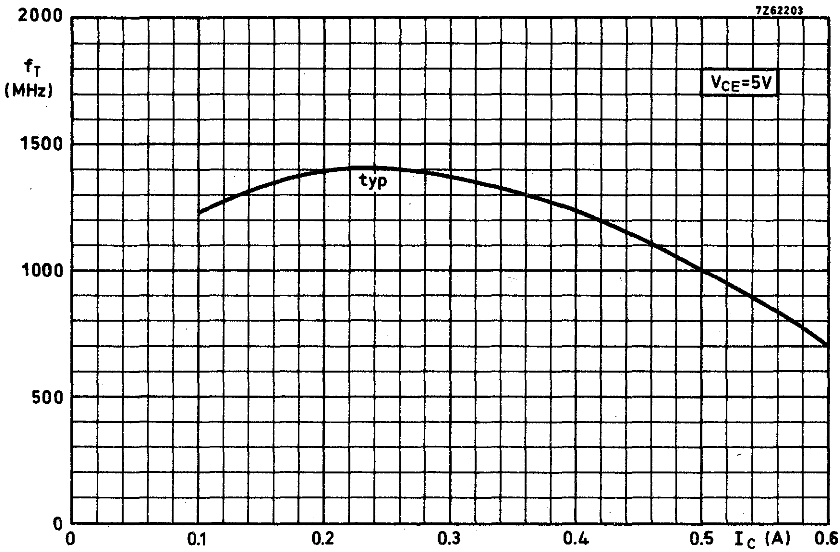
THERMAL RESISTANCE

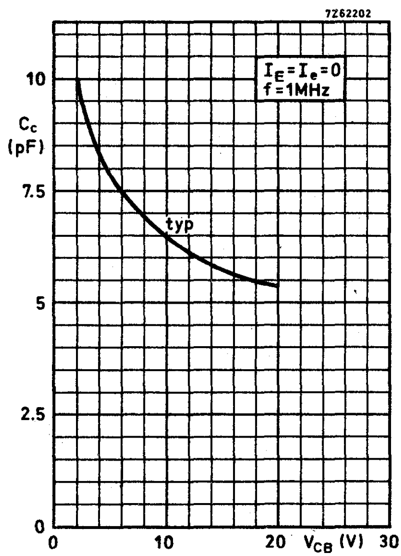
From junction to mounting base	$R_{th\ j\text{-}mb}$ =	12	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$ =	0.6	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,1	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	> typ.	10 40	
Transition frequency				
I_C = 0,2 A; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ. <	6,5 9,0	pF pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62203
2000
1500
1000
500
0
f_T (MHz)
V_{CE}=5V
typ
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6


7Z62202
10
7.5
5
2.5
0
C_c (pF)
I_E=I_e=0
f=1MHz
typ
0
10
20
V_{CB} (V)
30

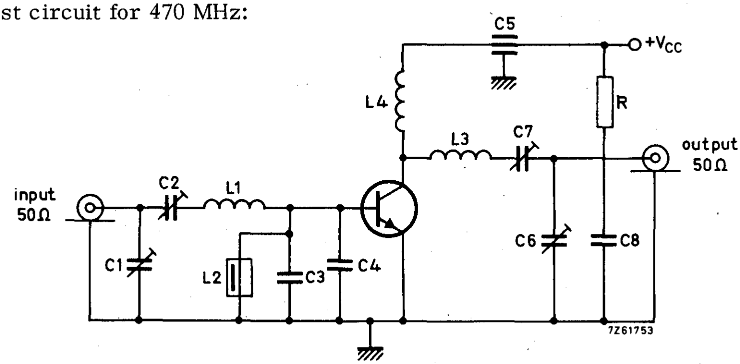
APPLICATION INFORMATION T_j = 25 °C unless otherwise specified

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_h up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	13.8	typ. 0.15	1.5	typ. 0.17	typ. 10	typ. 65	-	-
470	13.8	typ. 0.35	3.0	typ. 0.28	typ. 9.3	typ. 79	2.9 + j5.1	27 − j21
470	12.5	< 0.35	2.5	< 0.31	> 8.5	> 65	-	-
175	12.5	typ. 0.03	3.0	typ. 0.29	typ. 20	typ. 84	-	-

Test circuit for 470 MHz:



C1 = C2 = C6 = C7 = 1.8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 4 nF feed-through capacitor
C8 = 0.1 μF polyester capacitor

L1 = 1 turn Cu wire (1.2 mm); int. diam. 6 mm; max. lead length 1 mm
L2 = 1 μH choke
L3 = 30 mm straight Cu wire (2 mm); height above print 2 mm
L4 = 2 turns closely wound Cu wire (0.5 mm); int. diam. 3 mm; max. lead length 8 mm

R = 10 Ω carbon

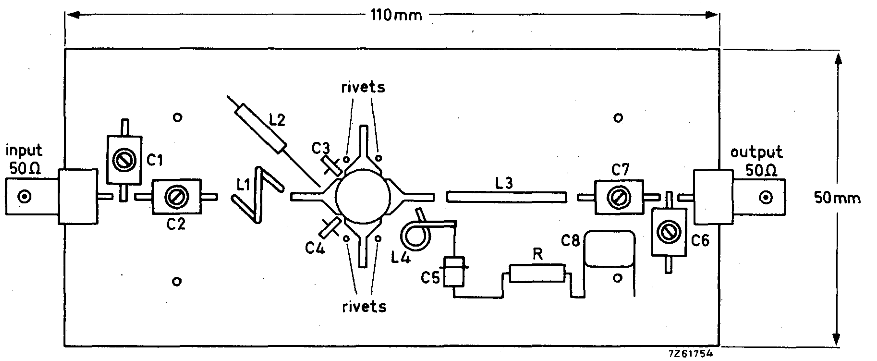
At P_L = 2.5 W and V_{CC} = 12.5 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C.

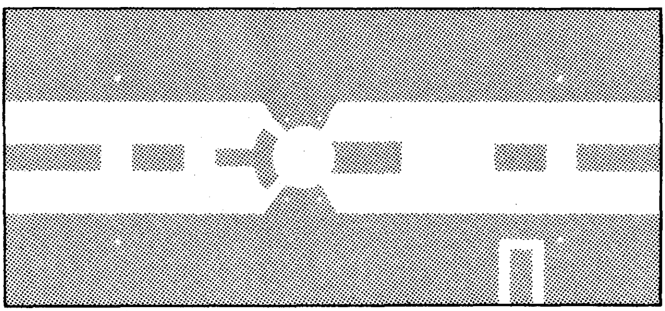
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_h = 70 °C;
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 2.5 W transistor output into 50 Ω load and V_{CC} = 13.8 V

Component lay-out for 470 MHz see page 7

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.

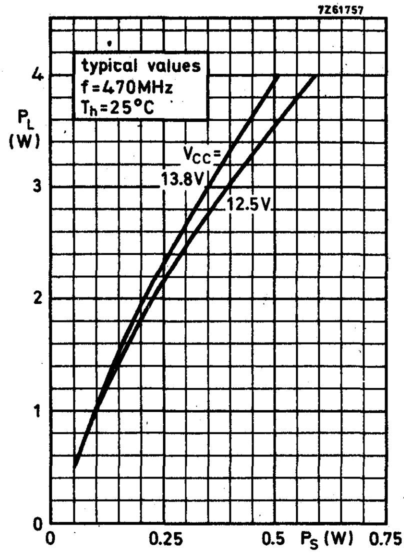


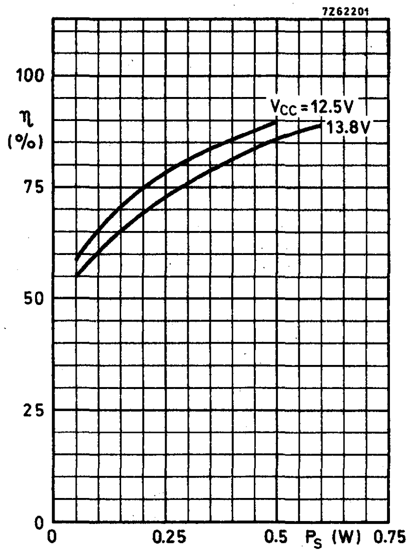


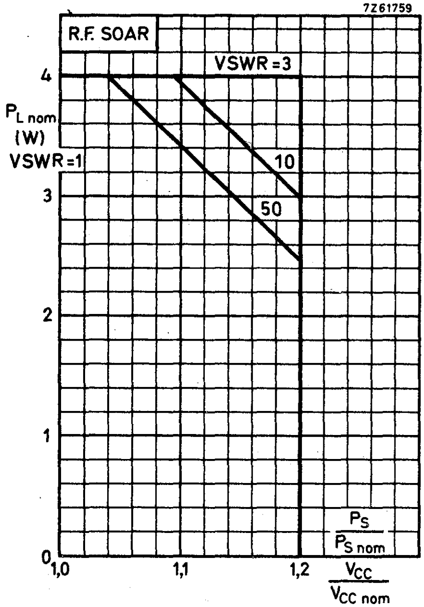
Shaded area copper

Back area completely copper clad.

Material of printed circuit board: 1,5 mm epoxy fibre glass.


7Z61757
typical values
f=470MHz
T_h=25°C
P_L (W)
V_{CC}=
13.8V
12.5V
0
1
2
3
4
0.25
0.5
P_S (W)
0.75


7Z62201
η (%)
V_{CC}=12.5V
13.8V
0
25
50
75
100
0.25
0.5
P_S (W)
0.75



Conditions for R.F. SOAR

f = 470 MHz

T_h = 70 °C

V_{CCnom} = 13,8 V

$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and VSWR = 1

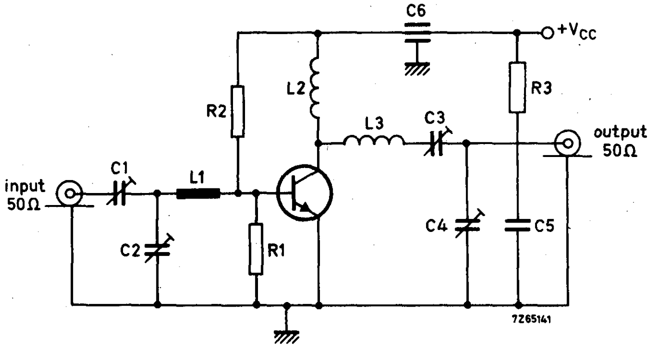
$R_{th\ mb\text{-}h}$ = 0,6 °C/W

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in the circuit given on page 6.
Supply voltage was varied from V_{CCnom} to 1,2 V_{CCnom}, and VSWR from 1 to 50.
It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ($V_{CC} > V_{CCnom}$) and load mismatch (VSWR > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



C1 = C3 = C4= 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF ceramic capacitor
C6 = 4 nF polyester capacitor

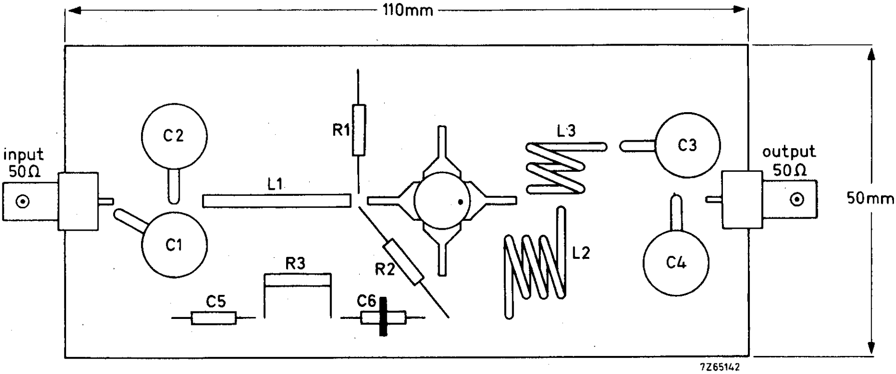
L1 = 25 mm straight Cu wire (1.2 mm); height above print max. 3 mm
L2 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L3 = 2 turns closely wound Cu wire (1.7 mm); int. diam. 12 mm; lead length 5 mm

R1 = 50 Ω carbon
R2 = 1.2 kΩ carbon
R3 = 5 Ω carbon

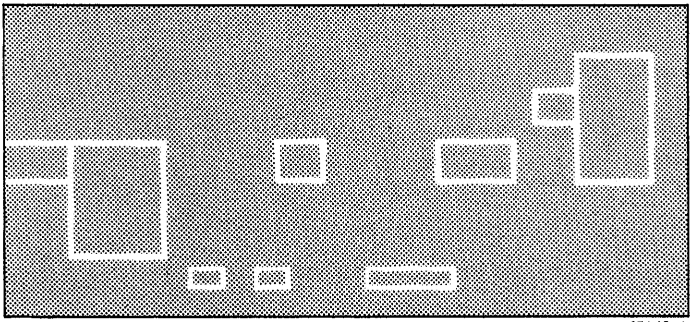
Component lay-out for 175 MHz see page 11.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175MHz test circuit.

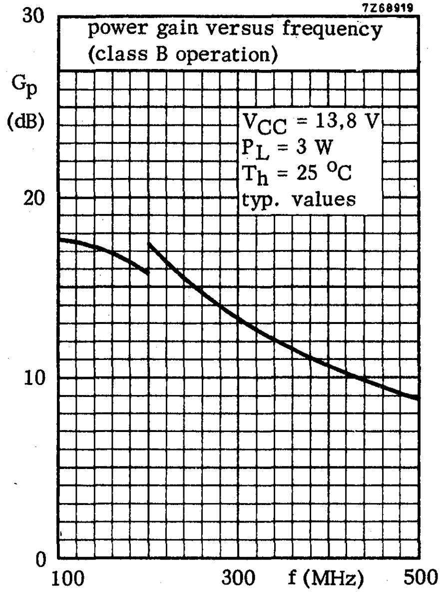


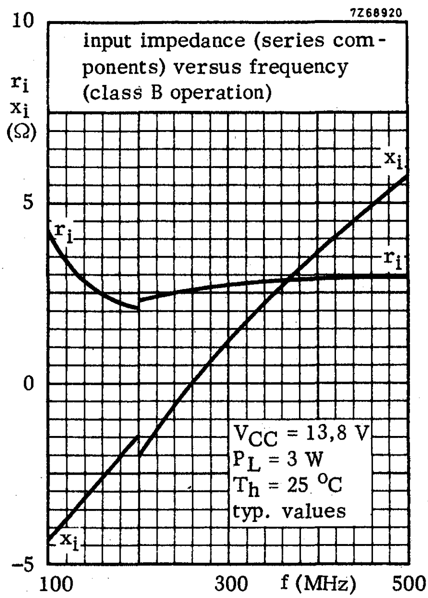
Shaded area copper
Back area not metalized
Material of pcb : 1.5 mm epoxy fibre glass

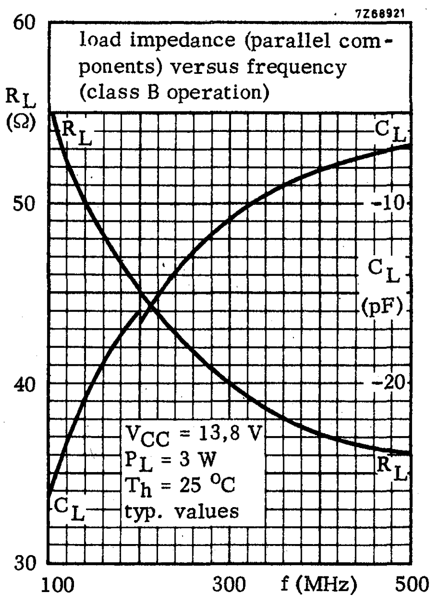


7Z65143.1

OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F./ V.H.F. POWER TRANSISTOR

N-P-N- transistor intended for use in class B and C operated mobile, industrial and military transmitters with a supply voltage of 13.8 V. It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

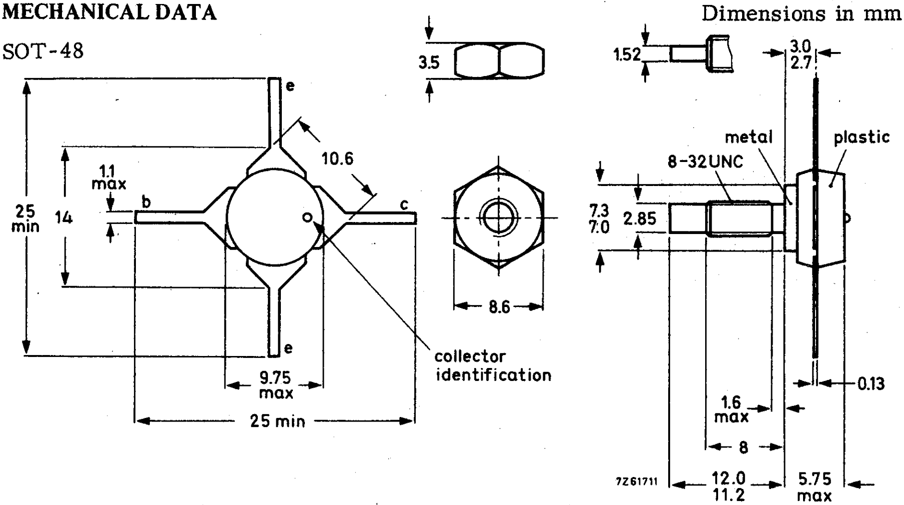
R.F. performance up to T_h = 25 °C in an unneutralised common-emitter class B circuit.

Mode of operation	V_{CC} (V)	f MHz	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w	13.8	470	< 2.0	7.0	< 0.78	> 5.4	> 65	–	–
c.w	13.8	470	typ. 2.0	7.8	typ. 0.81	typ. 5.9	typ. 70	2.4+j6.7	60 – j20
c.w.	12.5	470	< 2.2	7.0	< 0.86	> 5.0	> 65	–	–
c.w.	12.5	175	typ. 0.4	7.2	typ. 0.87	typ. 12.6	typ. 66	–	–

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 7.5 kg cm
(0.75 Newton metres)
max. 8.5 kg cm
(0.85 Newton metres)

Diameter of clearance hole in heatsink: max. 4.17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	1.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4.0	A

Power dissipation

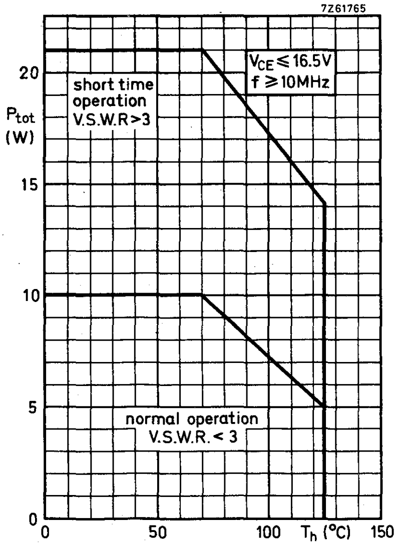
Total power dissipation up to T_h = 70 °C f > 10 MHz	P_{tot}	max.	10	W

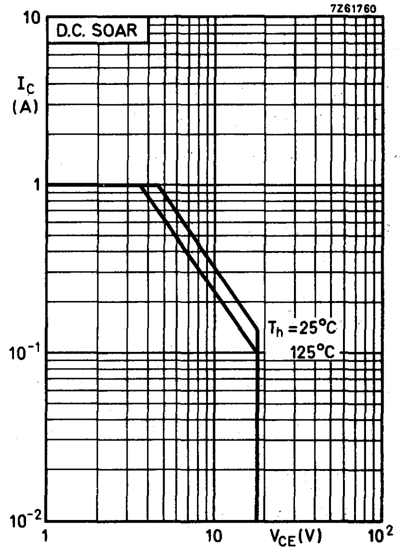
Temperatures

Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	7.0	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	°C/W


7Z61765
$V_{CE} \leq 16.5V$
$f \geq 10MHz$
short time operation V.S.W.R>3
P_{tot} (W)
normal operation V.S.W.R. < 3
T_h (°C)
0
50
100
150
5
10
15
20


7Z61760
D.C. SOAR
I_C (A)
$T_h = 25°C$
125°C
V_{CE}(V)
10
1
10^{-1}
10^{-2}
10^2

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1.0 mA	$V_{(BR)EBO}$	>	4	V

Collector-emitter saturation voltage

I_C = 500 mA; I_B = 100 mA	V_{CEsat}	typ.	0.2	V

D.C. current gain

I_C = 500 mA; V_{CE} = 5 V	h_{FE}	> typ.	10 40	

Transition frequency

I_C = 500 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1300	MHz

Collector capacitance at f = 1 MHz

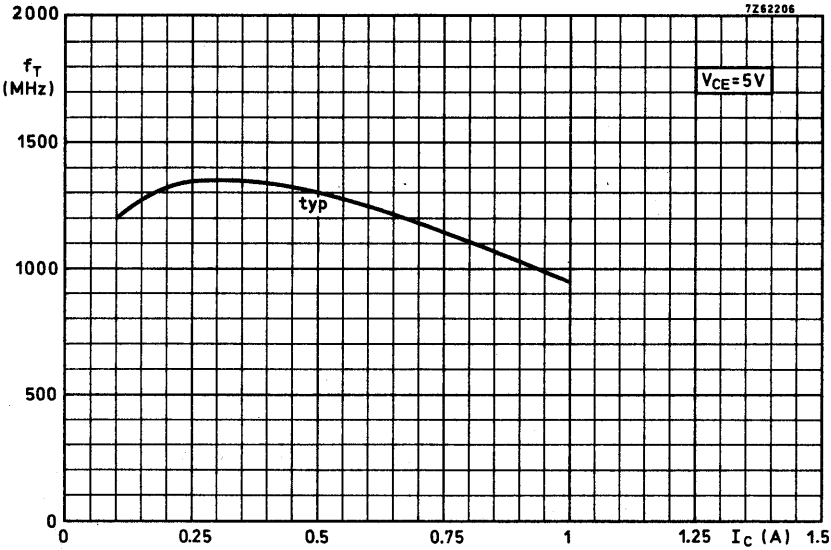
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ. <	14 20	pF pF

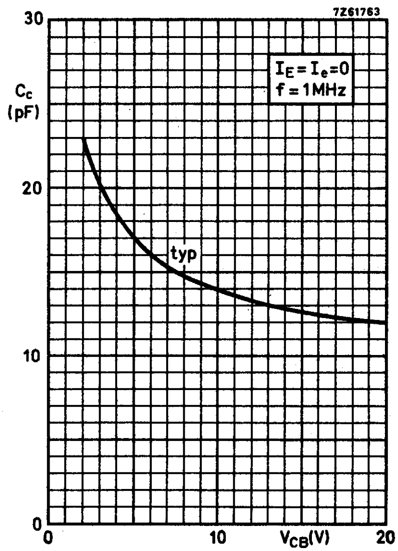
Emitter capacitance at f = 1 MHz

$I_C = I_c$ = 0; V_{EB} = 0	C_e	typ.	65	pF

Feedback capacitance at f = 1 MHz

I_C = 50 mA; V_{CE} = 10 V	C_{re}	typ.	10.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62206
2000
f_T
(MHz)
1500
1000
500
0
V_{CE} = 5 V
typ
0
0.25
0.5
0.75
1
1.25
I_C (A)
1.5


7Z61763
30
C_c
(pF)
20
10
0
$I_E = I_e = 0$
f = 1 MHz
typ
0
10
V_{CB}(V)
20

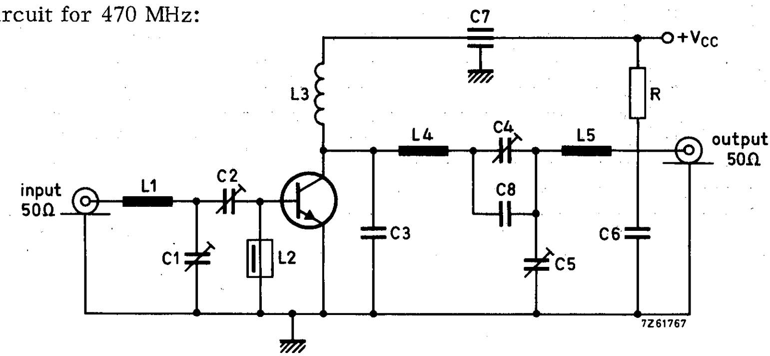
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_h up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z}_i$ (Ω)	$\overline{Y}_L$ (mA/V)
470	13.8	< 2.0	7.0	< 0.78	> 5.4	> 65	–	–
470	13.8	typ. 2.0	7.8	typ. 0.81	typ. 5.9	typ. 70	2.4 + j6.7	60 – j20
470	12.5	< 2.2	7.0	< 0.86	> 5.0	> 65	–	–
175	12.5	typ. 0.4	7.2	typ. 0.87	typ. 12.6	typ. 66	–	–

Test circuit for 470 MHz:



C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 6.8 pF ceramic capacitor
C6 = 0.1 µF polyester capacitor
C7 = 4 nF feed-through capacitor
C8 = 10 pF ceramic capacitor

L1 = L4 = L5 = 20 mm straight Cu wire (1.2 mm); height above print 12 mm
L2 = 0.47 µH choke
L3 = 1 turn Cu wire (1.7 mm); int. diam. 10 mm; max. lead length 5 mm

R = 10 Ω carbon

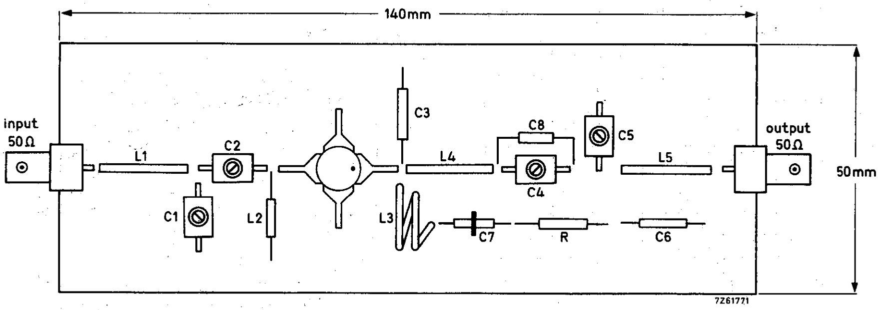
At P_L = 7.0 W and V_{CC} = 12.5 V the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/°C

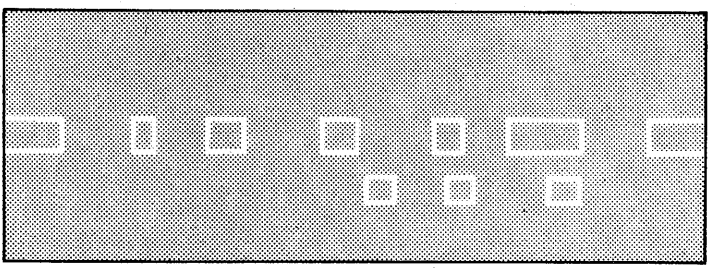
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_h = 70 °C;
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 7.0 W transistor output into 50 Ω load at V_{CC} = 13.8 V

Component lay-out for 470 MHz see page 7

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.



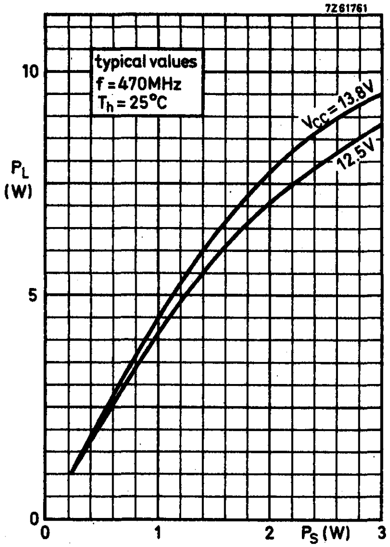


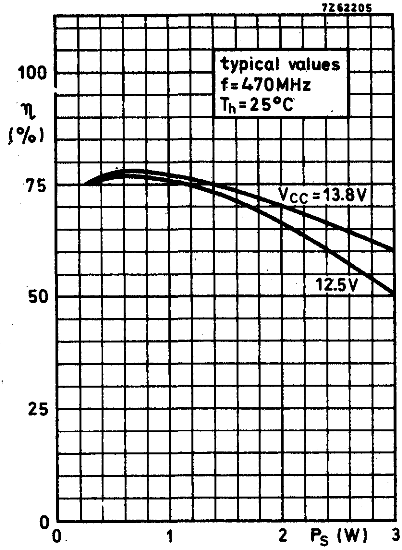
7Z61770.1

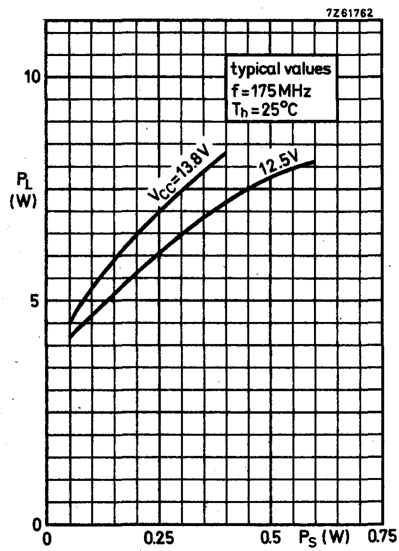
Shaded area copper

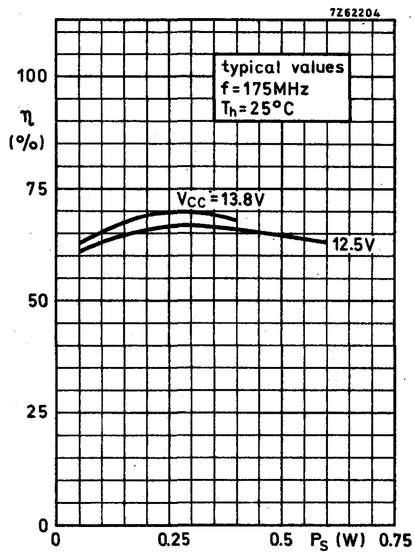
Back area completely copper clad

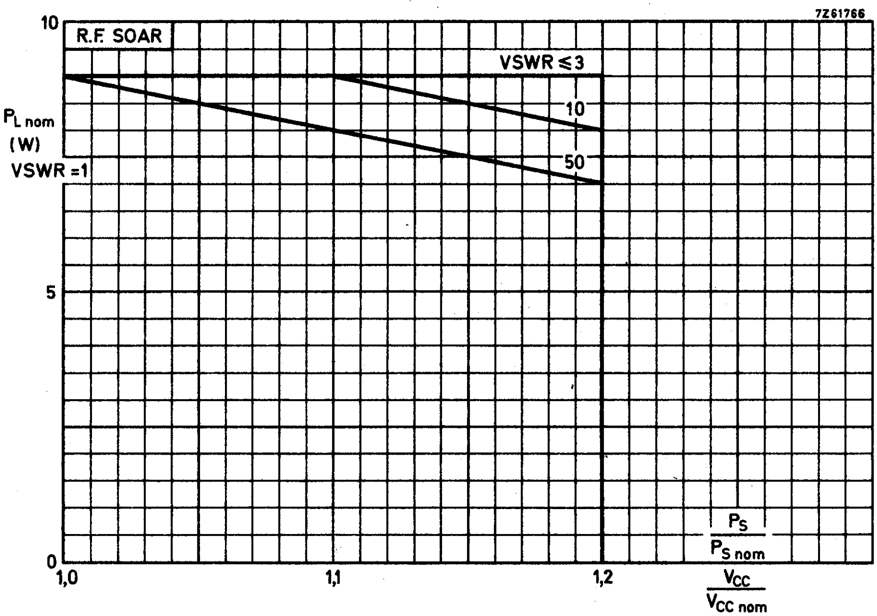
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z61761
typical values
f = 470MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
P_L (W)
P_S (W)
0
1
2
3
5
10


7Z62205
typical values
f = 470MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
η (%)
P_S (W)
0
1
2
3
25
50
75
100


7Z61762
typical values
f = 175MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
P_L (W)
P_S (W)
0
0.25
0.5
0.75
5
10


7Z62204
typical values
f = 175MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
η (%)
P_S (W)
0
0.25
0.5
0.75
25
50
75
100



Conditions for R.F. SOAR :

f = 470 MHz

T_h = 70 °C

V_{CCnom} = 13,8 V

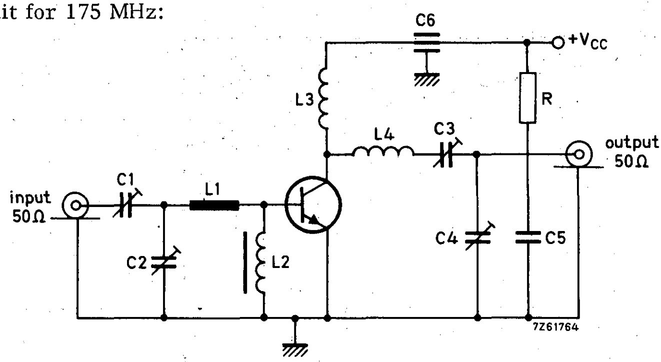
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and VSWR = 1

see also page 6

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in the circuit given on page 6.
Supply voltage was varied from V_{CCnom} to 1,2 V_{CCnom}, and VSWR from 1 to 50.
It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ($V_{CC} > V_{CCnom}$) and load mismatch (VSWR > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



C1 = C3 = C4 = 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4.0 nF feed-through capacitor

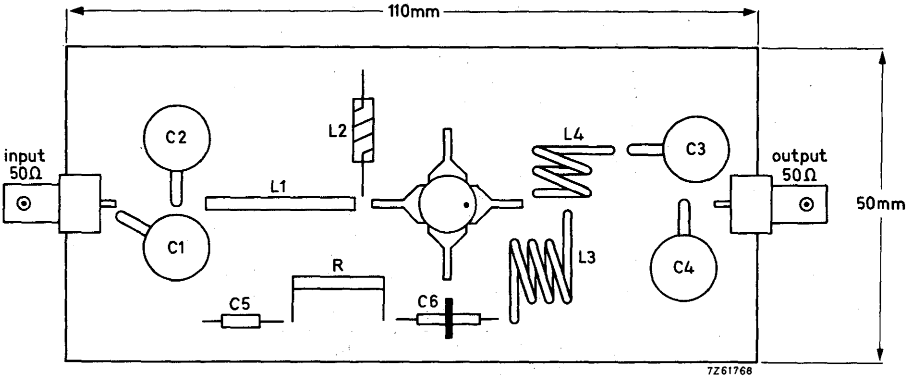
L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on Ferrite FX1115, d = 2 mm, D = 4 mm, 1 = 5 mm material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm

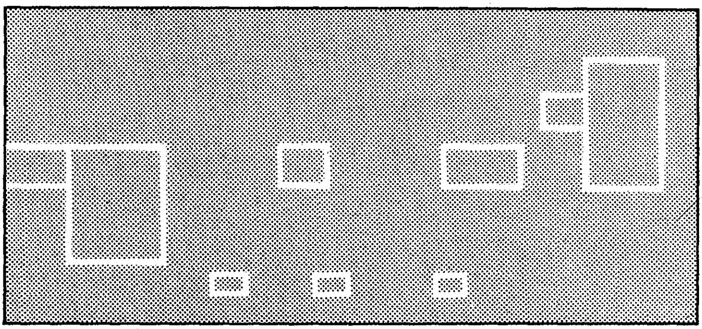
R = 10 Ω carbon

Graphs (P_L versus P_S and η versus P_S) for 175 MHz on page 8.
Component lay-out for 175 MHz on page 11.

APPLICATION INFORMATION (continued)

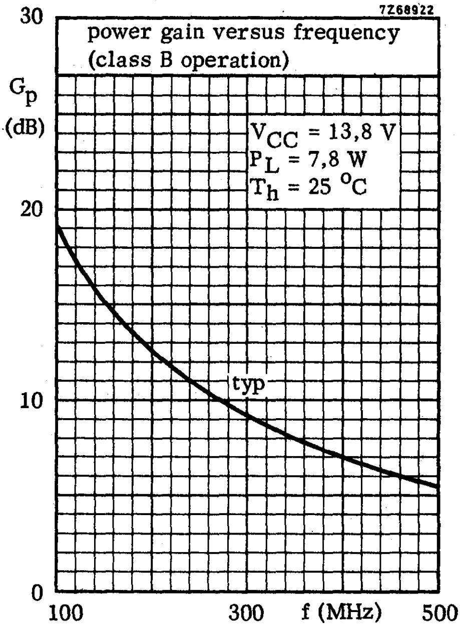
Component lay-out and printed circuit board for 175 MHz test circuit

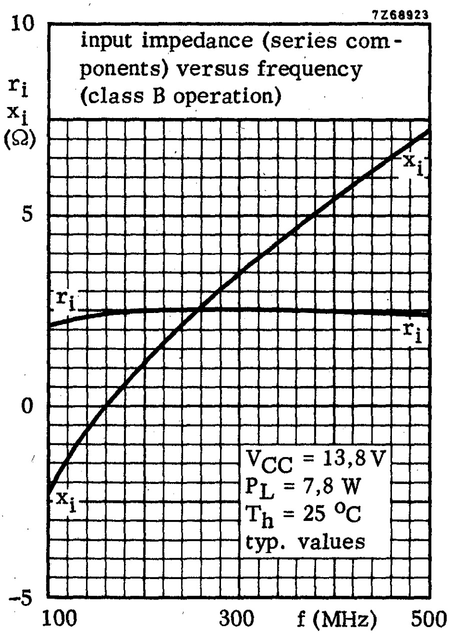


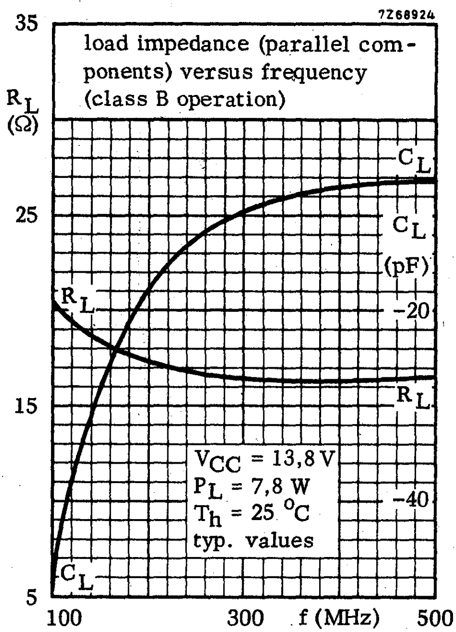


7Z61769.1

Shaded area copper
Back area not metalized
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z68922
power gain versus frequency
(class B operation)
G_p
(dB)
30
20
10
0
V_{CC} = 13,8 V
P_L = 7,8 W
T_h = 25 °C
typ
100
300
f (MHz)
500


7Z68923
input impedance (series components) versus frequency
(class B operation)
r_i
x_i
(Ω)
10
5
0
−5
x_i
r_i
r_i
x_i
V_{CC} = 13,8 V
P_L = 7,8 W
T_h = 25 °C
typ. values
100
300
f (MHz)
500


7Z68924
load impedance (parallel components) versus frequency
(class B operation)
R_L
(Ω)
35
25
15
5
C_L
C_L
(pF)
−20
−40
R_L
R_L
C_L
V_{CC} = 13,8 V
P_L = 7,8 W
T_h = 25 °C
typ. values
100
300
f (MHz)
500

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V.
The transistor is resistance stabilized. Gold metallization ensures extremely high reliability. Every transistor is tested under severe load mismatch conditions with a supply overvoltage to 16,5 V.
It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

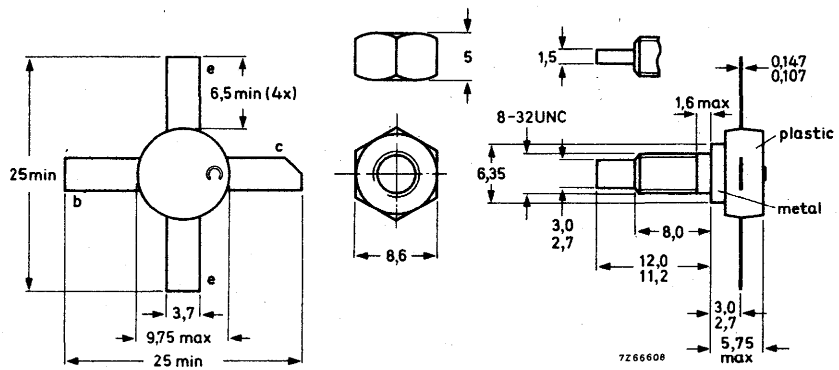
QUICK REFERENCE DATA

R.F. performance up to T_{mb} = 25 °C in an unneutralised common-emitter class B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	13,5	470	< 8,0	20	< 2,28	> 4	> 65	1,2 + j4,5	163 − j35
c.w.	12,5	470	< 6,8	17	< 2,09	> 4	> 65	–	–

MECHANICAL DATA Dimensions in mm

SOT-48



When locking is required, an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

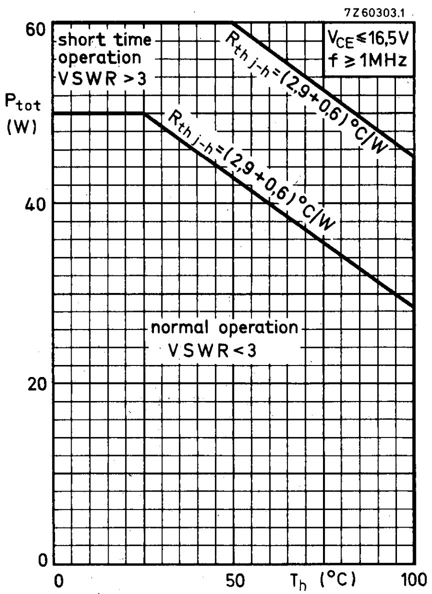
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

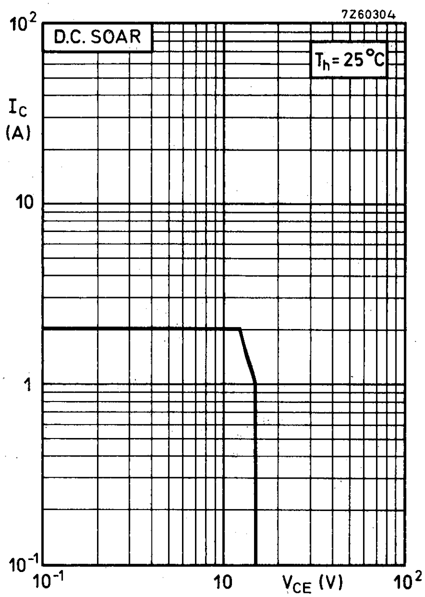
Currents

Collector current (average)	$I_{C(AV)}$	max.	3,5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10	A

Power dissipation

Total power dissipation up to T_h = 25 °C f ≥ 1 MHz	P_{tot}	max.	50	W





Temperatures

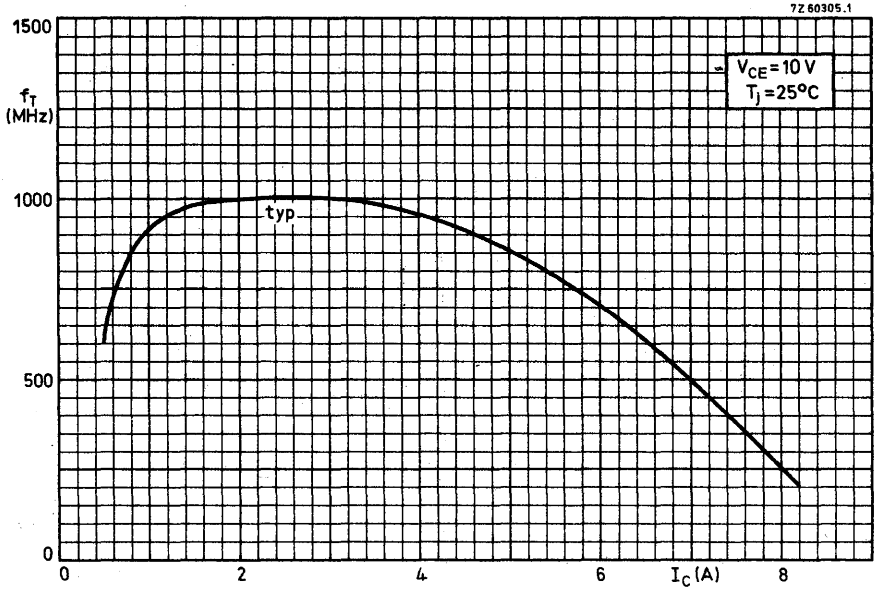
Storage temperature	T_{stg}	−65 to +200		°C
Junction temperature	T_j	max.	200	°C

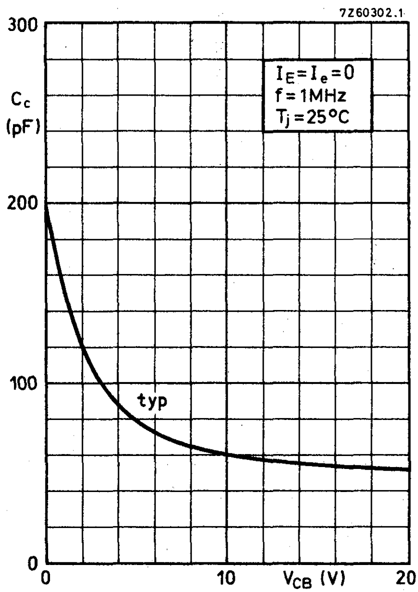
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	2,9	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage				
open emitter ; $I_C = 25$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage				
open base ; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage				
open collector ; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz				
open base	E	>	3, 1	mWs
$-V_{BE} = 1,5$ V; $R_{BE} = 33\ \Omega$	E	>	3, 1	mWs
D.C. current gain				
$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	>	10	
		typ.	30	
Transition frequency				
$I_C = 2$ A; $V_{CE} = 10$ V	f_T	typ.	1, 0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	55	pF
		<	70	pF
Feedback capacitance				
$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	32	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z 60305.1
1500
f_T
(MHz)
1000
500
0
typ
V_{CE} = 10 V
T_j = 25 °C
0
2
4
6
I_C (A)
8


7Z60302.1
300
C_c
(pF)
200
100
0
typ
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
0
10
V_{CB} (V)
20

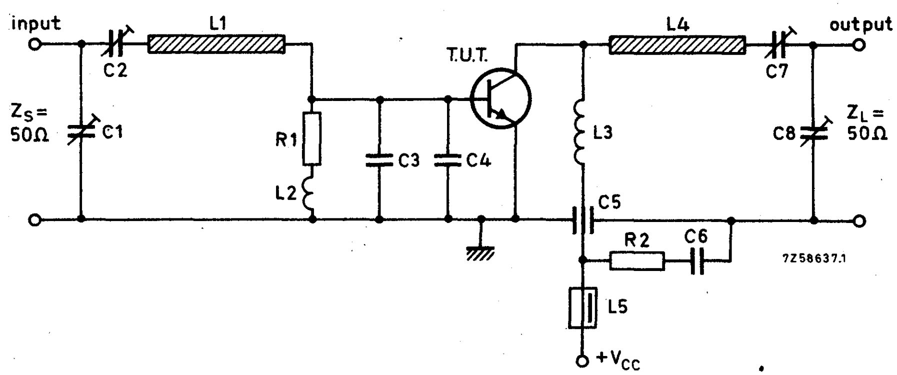
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_{mb} up to 25 °C

f (MHz)	V_{CE} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
470	13,5	< 8,00	20	< 2,28	> 4	> 65	1,2 + j4,5	163 – j35
470	12,5	< 6,80	17	< 2,09	> 4	> 65	–	–
175	12,5	typ. 1,35	17	typ. 2,30	typ. 11	typ. 60	–	–

Test circuit: 470 MHz; c.w. class-B.



List of components:

C1 = C2 = C7 = C8 = 2,0 to 9,0 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor

R1 = 1 Ω carbon resistor
R2 = 10 Ω carbon resistor

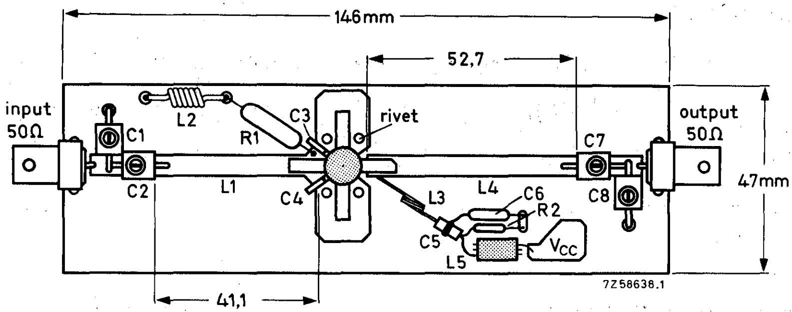
L1 = stripline (41,1 mm x 5,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm (0,32 μH)
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4 mm; leads 2 x 5 mm
L4 = stripline (52,7 mm x 5,0 mm)
L5 = Ferroxcube choke coil. Z (at f = 50 MHz) = 750 Ω ± 20% (cat. no. 4312 020 36640)

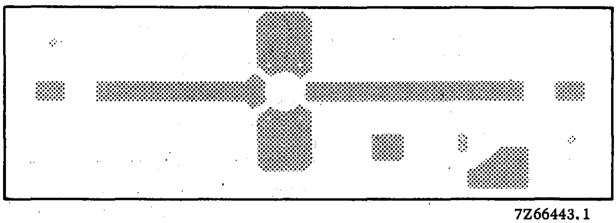
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1,45 mm.

Component layout and printed-circuit board for 470 MHz test circuit see page 6.

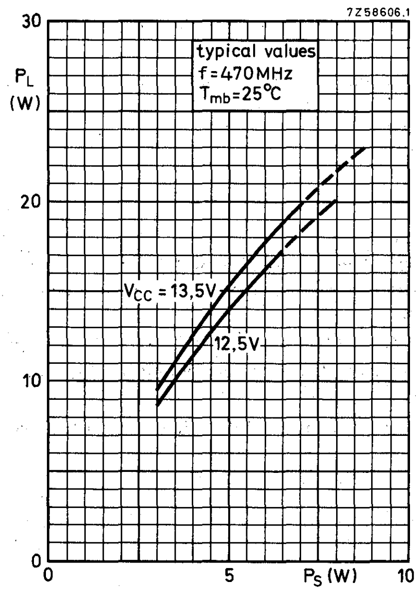
APPLICATION INFORMATION (continued)

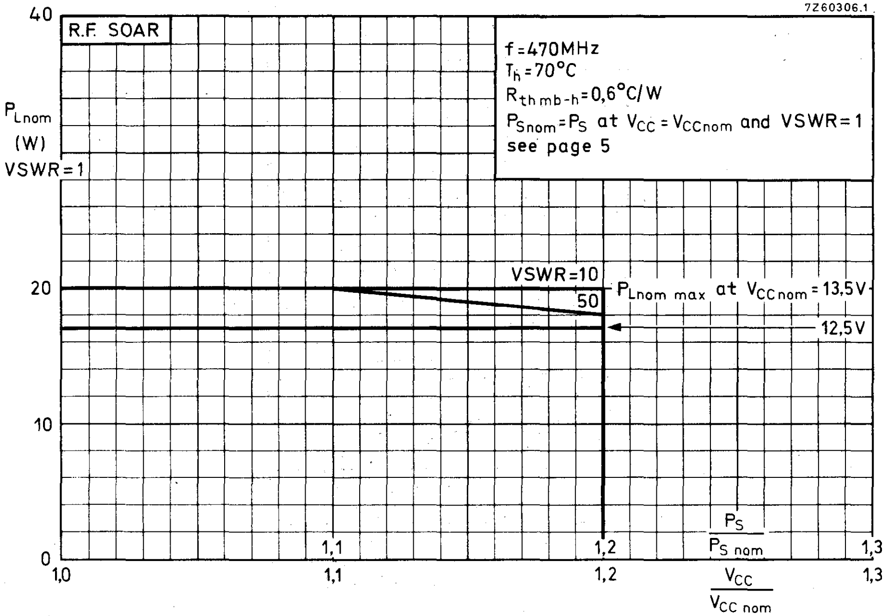
Component layout and printed-circuit board for 470 MHz test circuit.





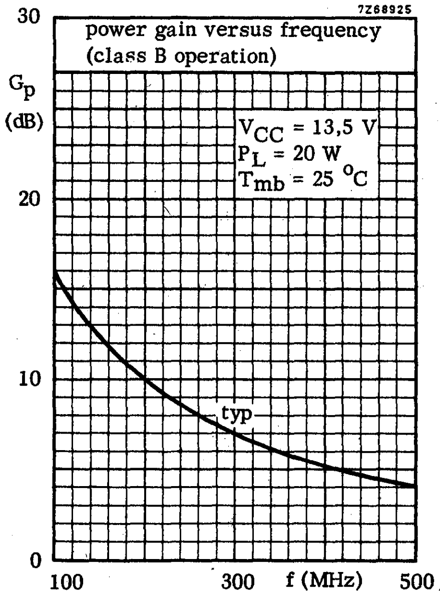
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

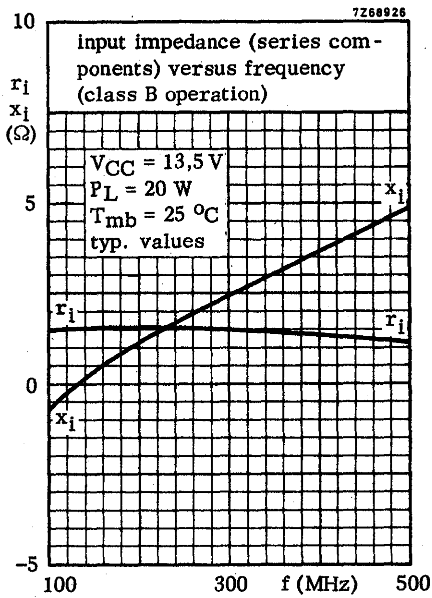


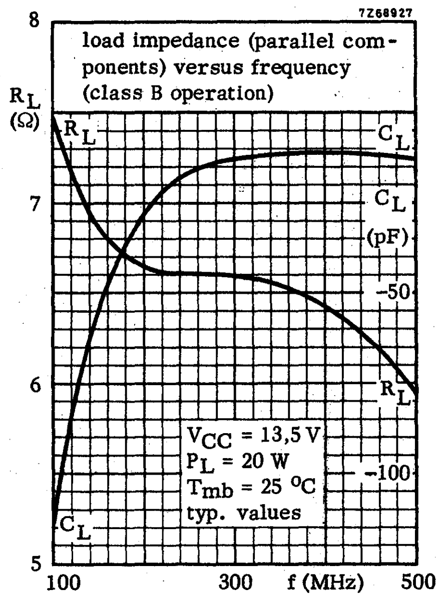


The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph above for safe operation at supply voltages other than the nominal. The graph shows the allowable output power, under nominal conditions, as a function of the supply overvoltage ratio, with VSWR as parameter.
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with the supply overvoltage ratio.

The horizontal line at 20 W applies at V_{CCnom} = 13,5 V.
For V_{CCnom} = 12,5 V, P_L should be derated to 17 W.


7Z68925
power gain versus frequency
(class B operation)
Gp
(dB)
30
20
10
0
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ
100
300
f (MHz)
500


7Z68926
input impedance (series components) versus frequency
(class B operation)
ri
xi
(Ω)
10
5
0
−5
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ. values
xi
ri
100
300
f (MHz)
500


7Z68927
load impedance (parallel components) versus frequency
(class B operation)
RL
(Ω)
8
7
6
5
CL
(pF)
−50
−100
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ. values
RL
CL
100
300
f (MHz)
500

U.H.F. TRANSMITTING TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V.
The transistor is resistance stabilized and is tested under severe load mismatch conditions. Gold metallization ensures extremely high reliability.
It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

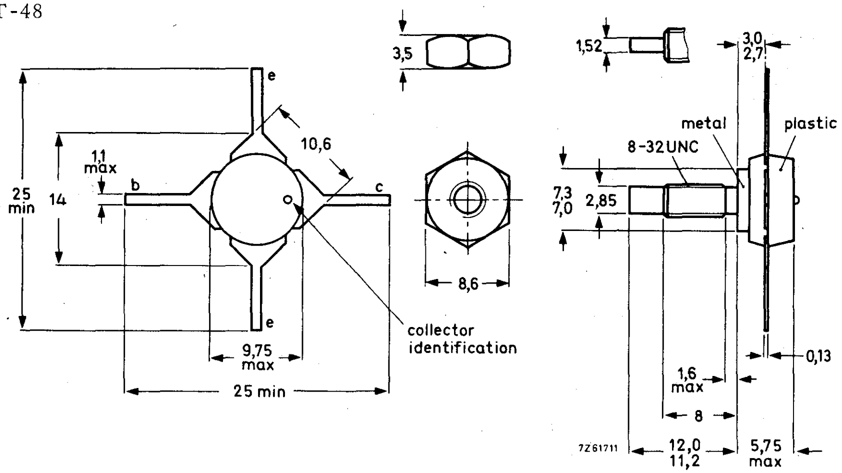
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (mW)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
c.w.	28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
c.w.	28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16
c.w.	28	1000	typ. 400	1,4	typ. 100	typ. 5,4	typ. 50	–	–

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (d.c.)	I_C	max.	400	mA
Collector current (peak value); f ≥ 10 MHz	I_{CM}	max.	800	mA

Power dissipation

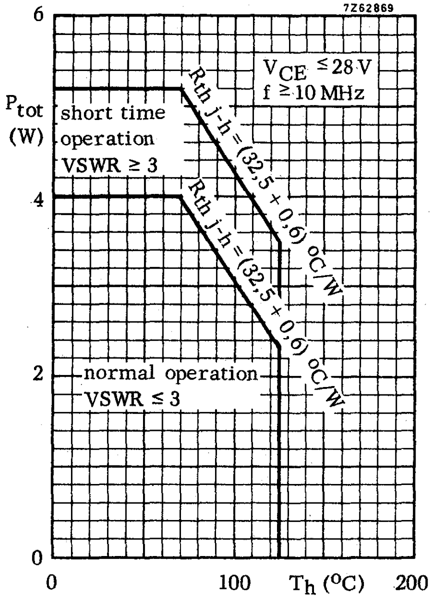
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	4,0	W

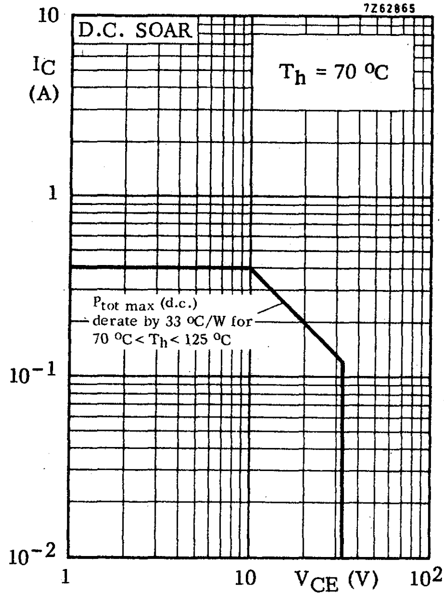
Temperatures

Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	32,5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	°C/W

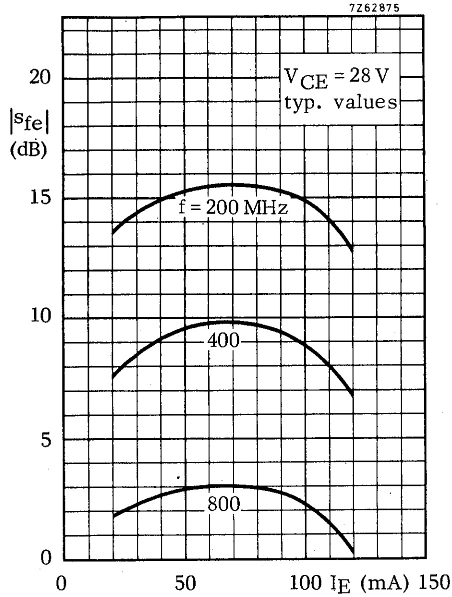

7Z62869
6
4
2
0
Ptot
(W)
short time
operation
VSWR ≥ 3
VCE ≤ 28 V
f ≥ 10 MHz
Rth j-h = (32,5 + 0,6) °C/W
Rth j-h = (32,5 + 0,6) °C/W
normal operation
VSWR ≤ 3
0
100
Th (°C)
200

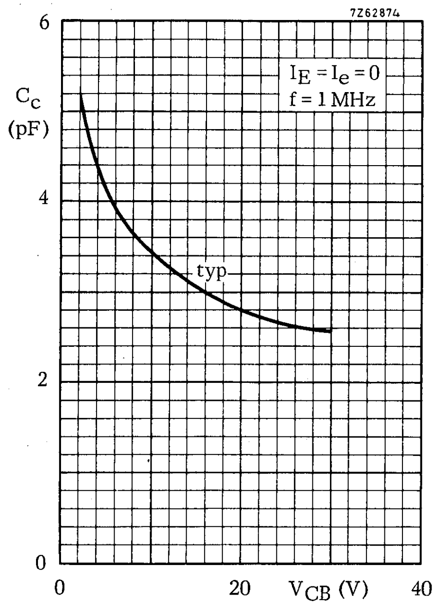

7Z62865
D.C. SOAR
10
IC
(A)
1
10⁻¹
10⁻²
Th = 70 °C
Ptot max (d.c.)
derate by 33 °C/W for
70 °C < Th < 125 °C
1
10
VCE (V)
10²

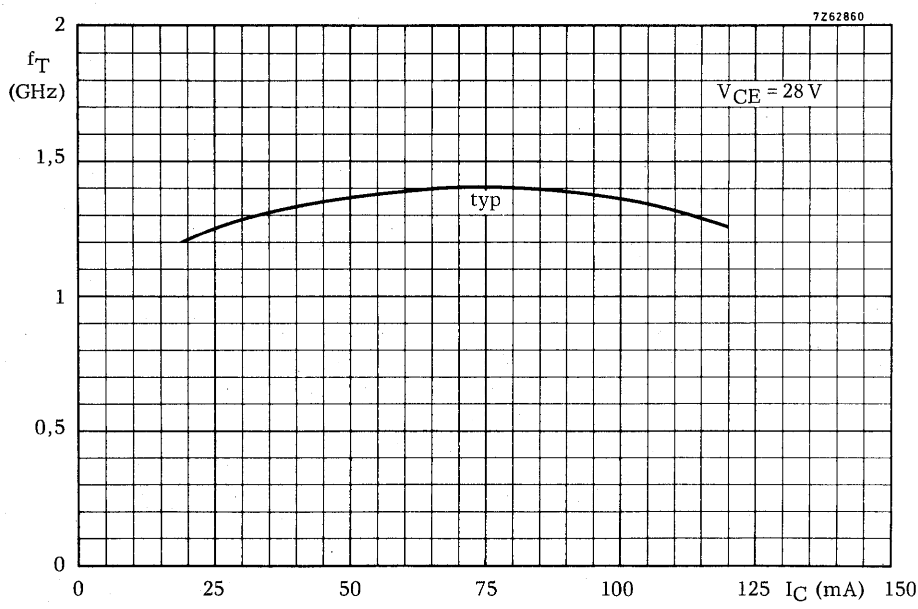
CHARACTERISTICS

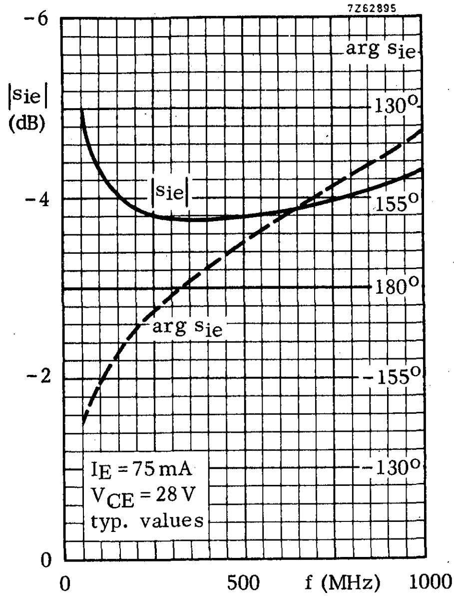
T_j = 25 °C unless otherwise specified

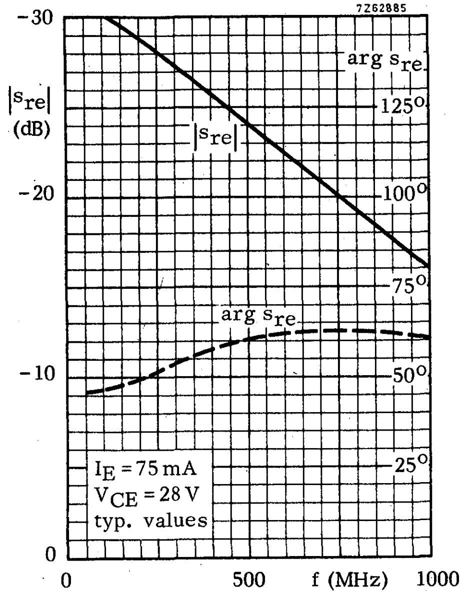
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage V_{BE} = 0, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 35	
Transition frequency				
I_C = 50 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	3,5	pF
Emitter capacitance at f = 1 MHz				
I_C = I_c = 0; V_{EB} = 0	C_e	typ.	11	pF
Feedback capacitance at f = 1 MHz				
I_C = 5 mA; V_{CE} = 10 V	C_{re}	typ.	2,5	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

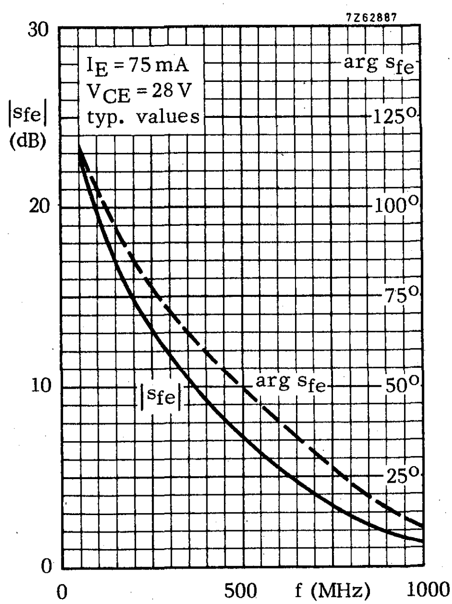

7Z62875
20
15
10
5
0
|sfe|
(dB)
VCE = 28 V
typ. values
f = 200 MHz
400
800
0
50
100 IE (mA) 150

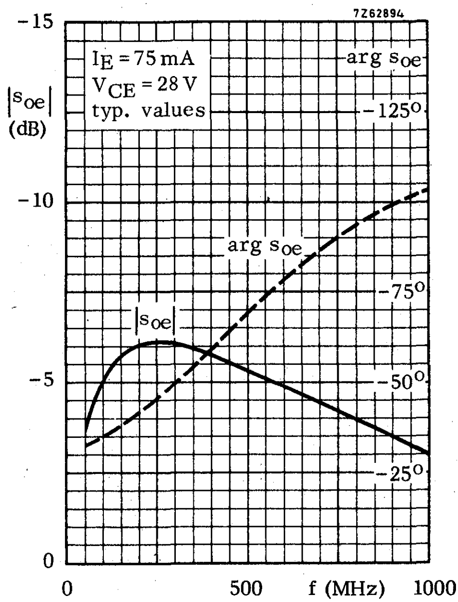

7Z62874
6
4
2
0
Cc
(pF)
IE = Ie = 0
f = 1 MHz
typ
0
20
VCB (V)
40


7Z62860
2
1,5
1
0,5
0
fT
(GHz)
VCE = 28 V
typ
0
25
50
75
100
125 IC (mA) 150


7Z62895
-6
-4
-2
0
|sie|
(dB)
arg sie
130°
155°
180°
-155°
-130°
|sie|
arg sie
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000


7Z62885
-30
-20
-10
0
|sre|
(dB)
arg sre
125°
100°
75°
50°
25°
|sre|
arg sre
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000


7Z62887
30
20
10
0
|sfe|
(dB)
IE = 75 mA
VCE = 28 V
typ. values
arg sfe
125°
100°
75°
50°
25°
|sfe|
arg sfe
0
500
f (MHz)
1000


7Z62894
-15
-10
-5
0
|soe|
(dB)
IE = 75 mA
VCE = 28 V
typ. values
arg soe
-125°
-75°
-50°
-25°
arg soe
|soe|
0
500
f (MHz)
1000

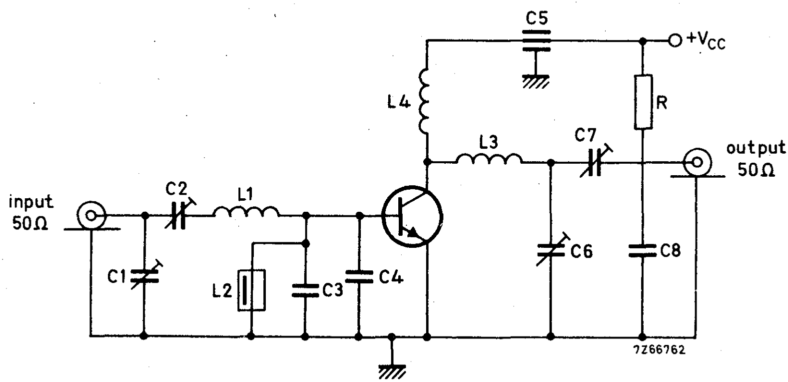
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

V_{CC} (V)	f (MHz)	P_S (mW)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16
28	1000	typ. 400	1,4	typ. 100	typ. 5,4	typ. 50	–	–

Test circuit for 470 MHz:



C1 = C2 = C7 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 4 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 5 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; lead length = 5 mm

R = 10 Ω carbon

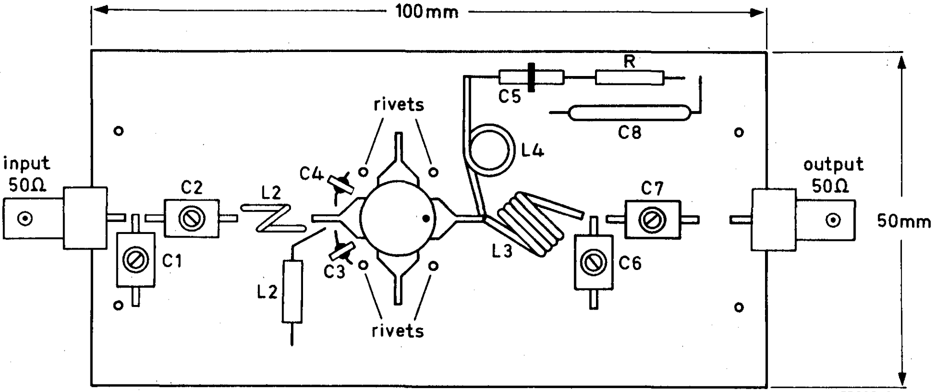
At P_L = 1,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 2 mW/°C.

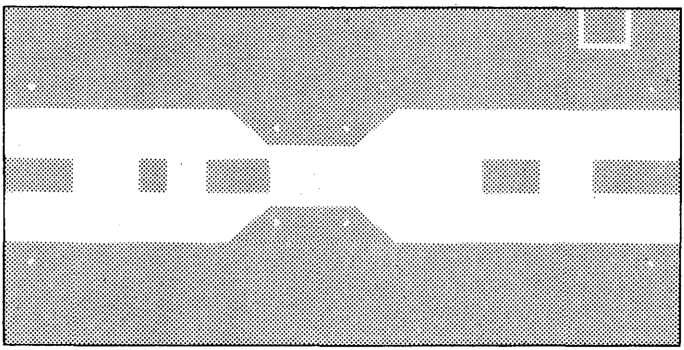
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 1,2 W.

Component layout for 470 MHz test circuit see page 8.

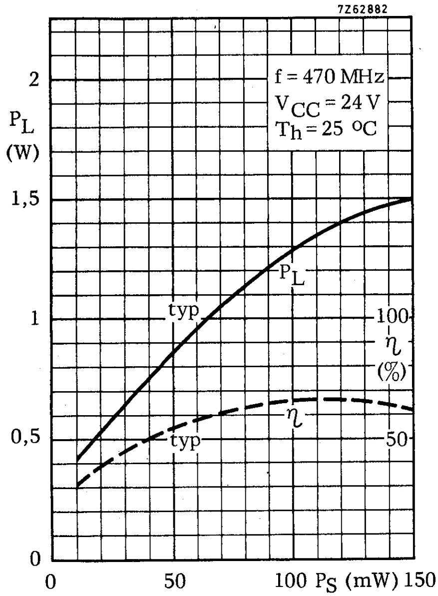
APPLICATION INFORMATION (continued)

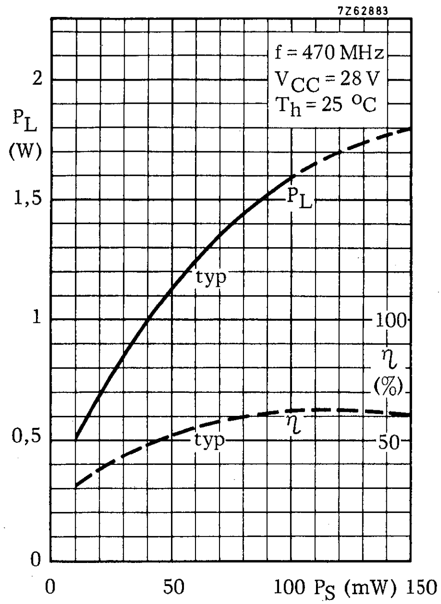
Component layout and printed-circuit board for 470 MHz test circuit.

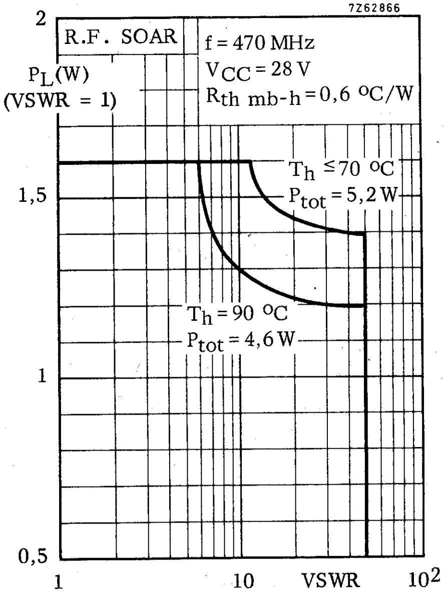



7Z66743.1

Shaded area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



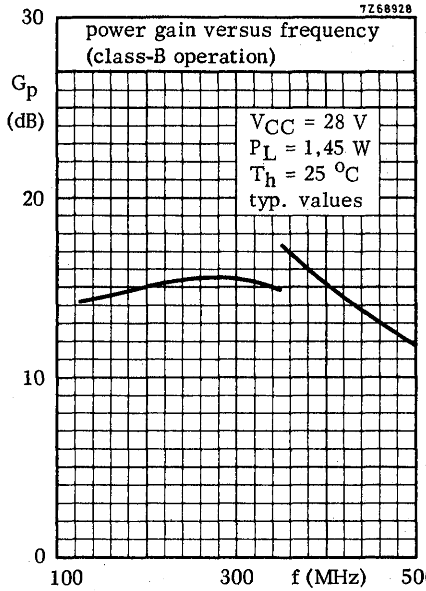


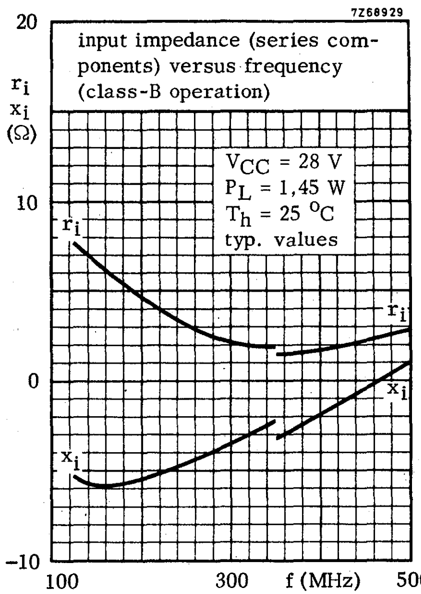


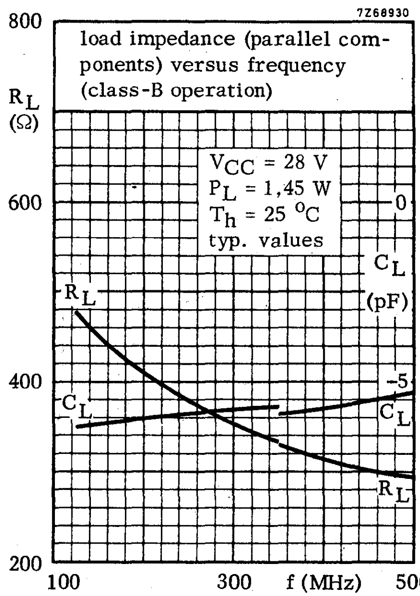
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 1,6 W load power in the test amplifier on page 7 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. TRANSMITTING TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V.
The transistor is resistance stabilized and is tested under severe load mismatch conditions.
Gold metallization ensures extremely high reliability.
It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

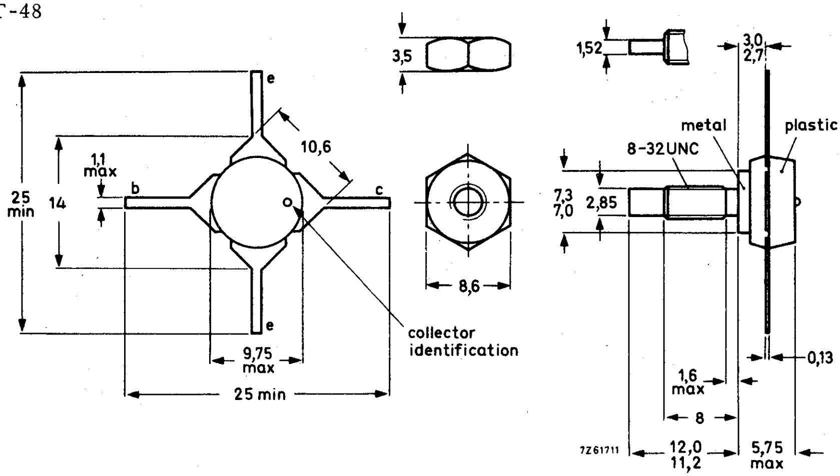
QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	24	470	typ. 0,2	2,4	typ. 143	typ. 10,8	typ. 70	–	–
c.w.	28	470	< 0,2	2,5	< 149	> 11,0	> 60	–	–
c.w.	28	470	typ. 0,2	3,0	typ. 162	typ. 11,7	typ. 66	1,8 + j2,8	7,2 – j24
c.w.	28	1000	typ. 0,7	2,5	typ. 179	typ. 5,5	typ. 50	–	–

MECHANICAL DATA Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (d.c.)	I_C	max.	0,7	A
Collector current (peak value) f ≥ 10 MHz	I_{CM}	max.	2,0	A

Power dissipation

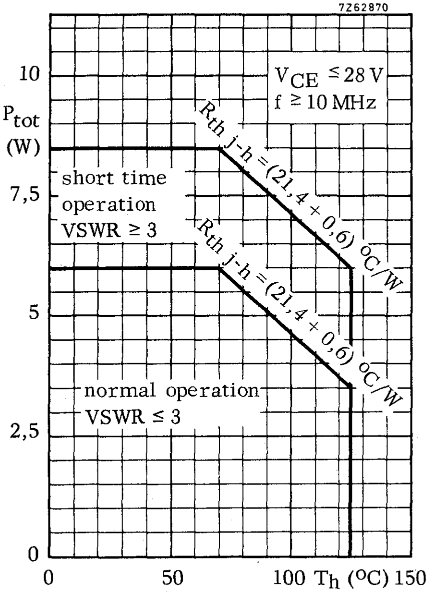
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	6,0	W

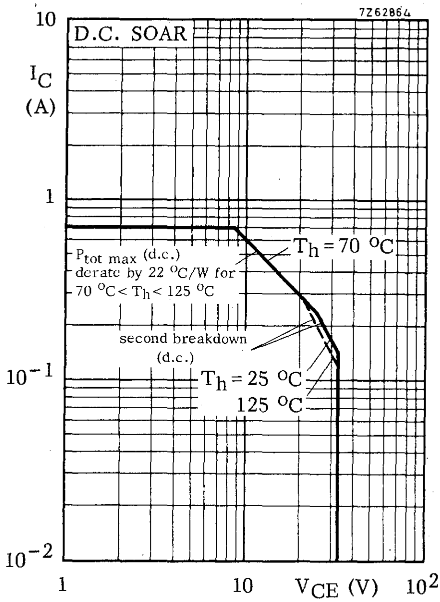
Temperatures

Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	21,4	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	°C/W

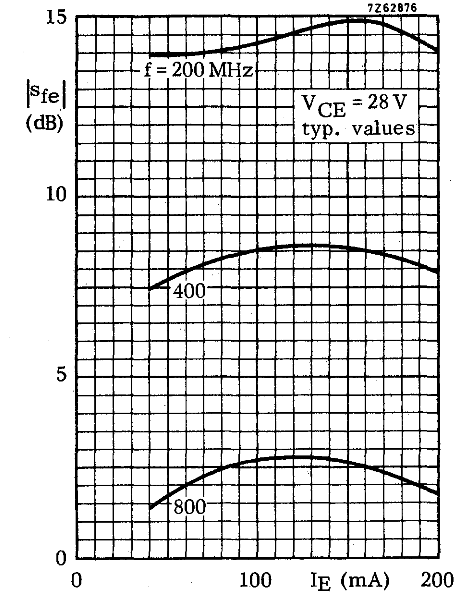

7Z62870
10
Ptot
(W)
7,5
5
2,5
0
0
50
100 Th (°C) 150
VCE ≤ 28 V
f ≥ 10 MHz
Rth j-h = (21,4 + 0,6) °C/W
Rth j-h = (21,4 + 0,6) °C/W
short time
operation
VSWR ≥ 3
normal operation
VSWR ≤ 3

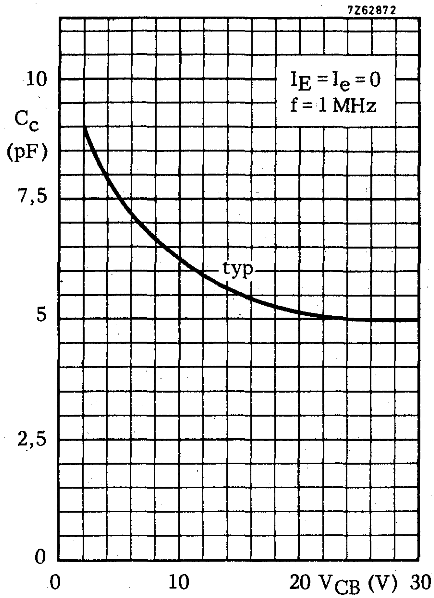

7Z62864
D.C. SOAR
IC
(A)
10
1
10^-1
10^-2
1
10
VCE (V)
10^2
Th = 70 °C
Ptot max (d.c.)
derate by 22 °C/W for
70 °C < Th < 125 °C
second breakdown
(d.c.)
Th = 25 °C
125 °C

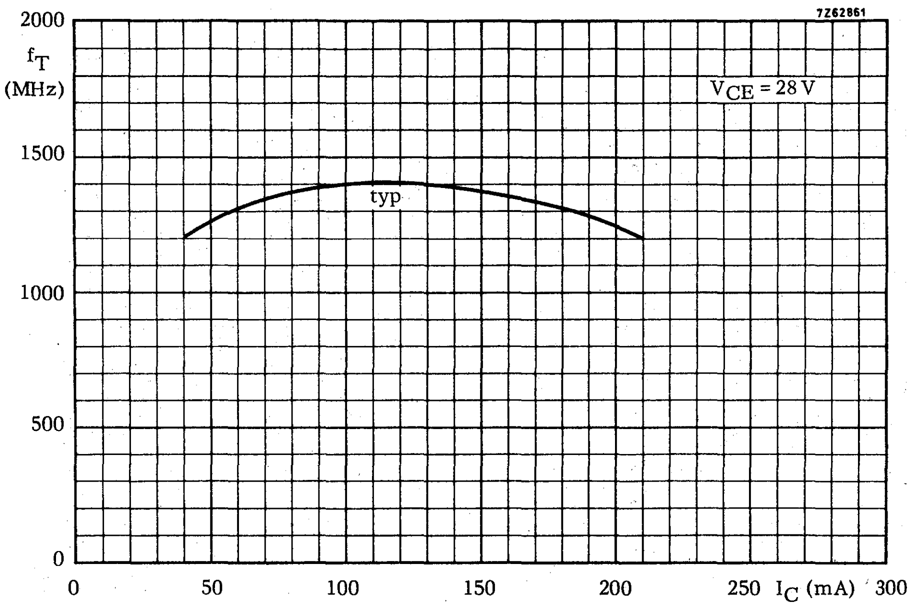
CHARACTERISTICS

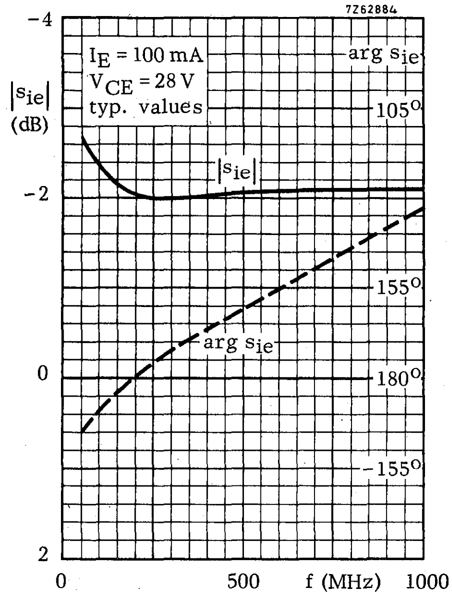
T_j = 25 °C unless otherwise specified

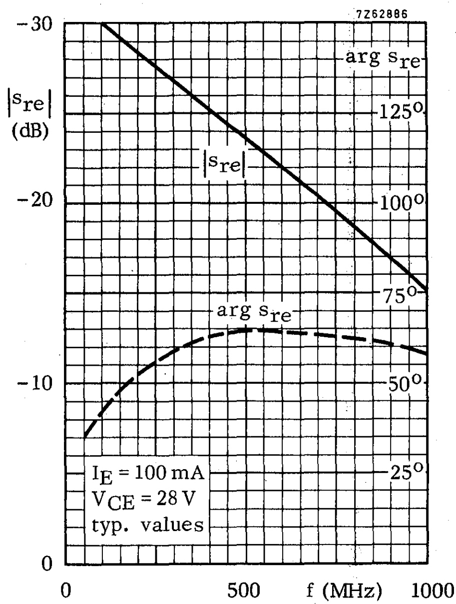
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage V_{BE} = 0, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,17	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	>	10	
		typ.	40	
Transition frequency				
I_C = 100 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	6,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	typ.	25	pF
Feedback capacitance at f = 1 MHz				
I_C = 10 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

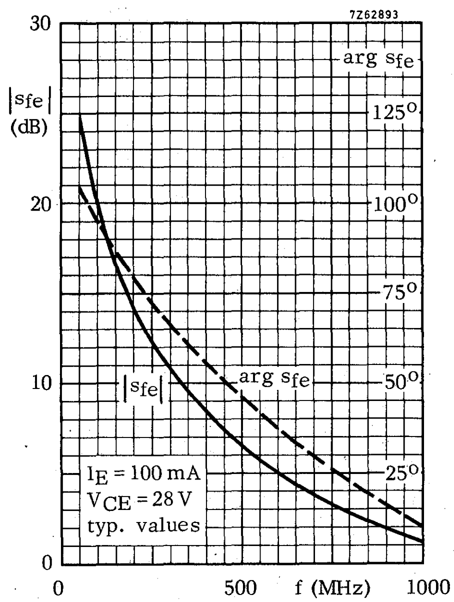

7Z62876
15
10
5
0
|s_fe| (dB)
f = 200 MHz
400
800
V_CE = 28 V
typ. values
0
100
I_E (mA)
200

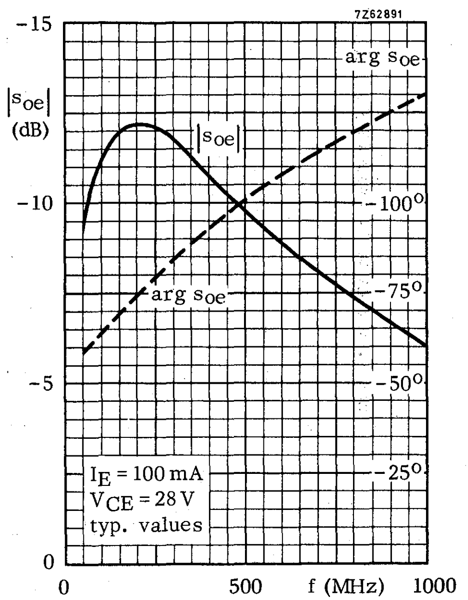

7Z62872
10
7,5
5
2,5
0
C_c (pF)
I_E = I_e = 0
f = 1 MHz
typ
0
10
20 V_CB (V) 30


7Z62861
2000
1500
1000
500
0
f_T (MHz)
V_CE = 28 V
typ
0
50
100
150
200
250 I_C (mA) 300


7Z62884
I_E = 100 mA
V_{CE} = 28 V
typ. values
$|s_{ie}|$
(dB)
arg s_{ie}
-4
-2
0
2
105°
155°
180°
-155°
$|s_{ie}|$
arg s_{ie}
0
500
f (MHz)
1000


7Z62886
$|s_{re}|$
(dB)
arg s_{re}
-30
-20
-10
0
125°
100°
75°
50°
25°
$|s_{re}|$
arg s_{re}
I_E = 100 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000


7Z62893
$|s_{fe}|$
(dB)
arg s_{fe}
30
20
10
0
125°
100°
75°
50°
25°
$|s_{fe}|$
arg s_{fe}
I_E = 100 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000


7Z62891
$|s_{oe}|$
(dB)
arg s_{oe}
-15
-10
-5
0
-100°
-75°
-50°
-25°
$|s_{oe}|$
arg s_{oe}
I_E = 100 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000

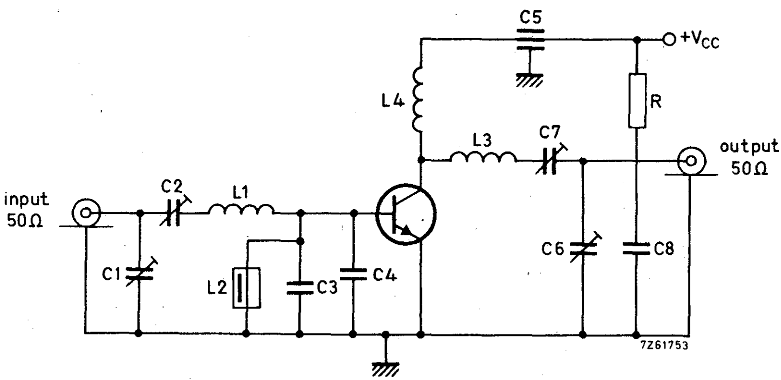
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
24	470	typ. 0,2	2,4	typ. 143	typ. 10,8	typ. 70	–	–
28	470	< 0,2	2,5	< 149	> 11,0	> 60	–	–
28	470	typ. 0,2	3,0	typ. 162	typ. 11,7	typ. 66	1,8 + j2,8	7,2 – j24
28	1000	typ. 0,7	2,5	typ. 179	typ. 5,5	typ. 50	–	–

Test circuit for 470 MHz:



C1 = C2 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = C7 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 2 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 3 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm

R = 10 Ω carbon

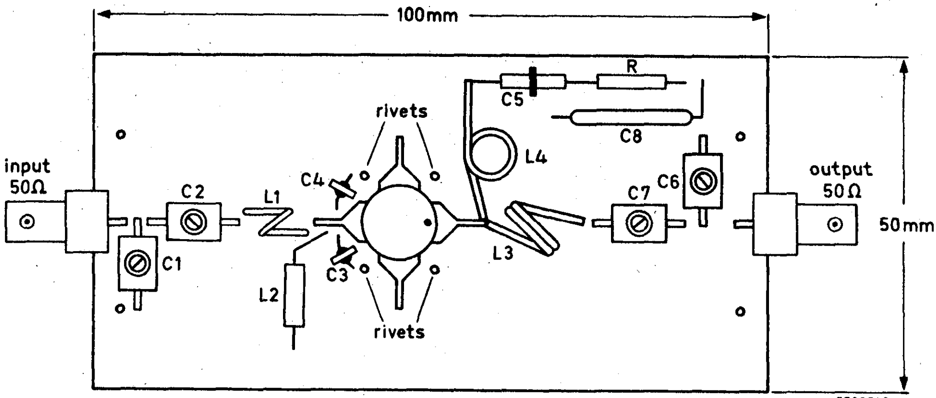
At P_L = 2,5 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/°C.

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 2,5 W.

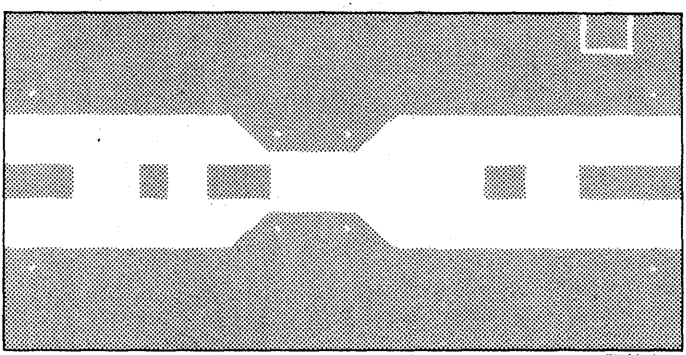
Component layout for 470 MHz test circuit see page 8.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

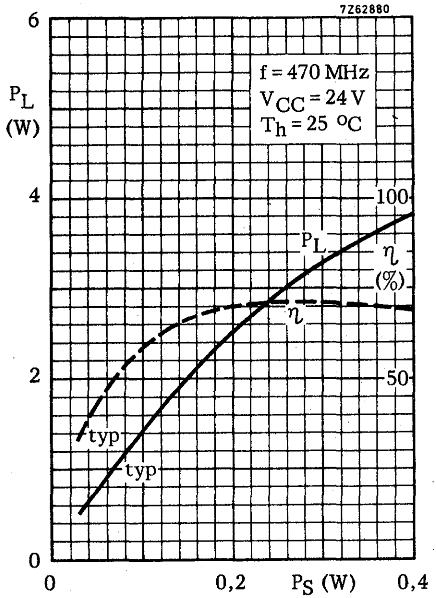


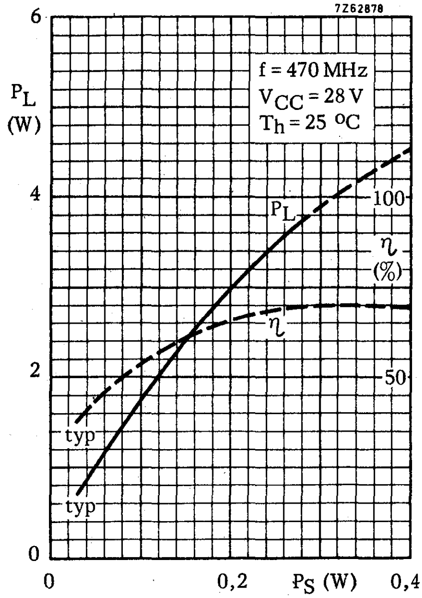
7Z66740

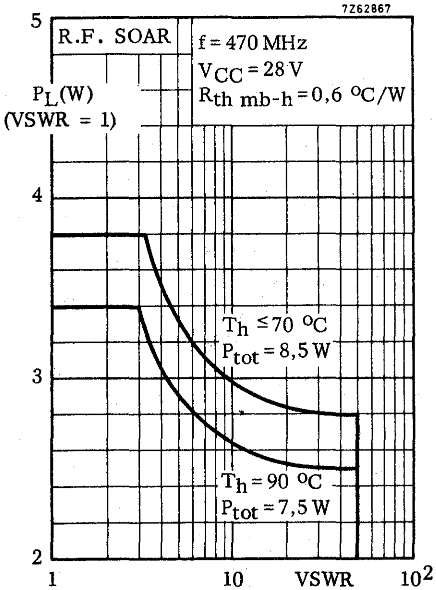


7Z66741.1

Shade area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



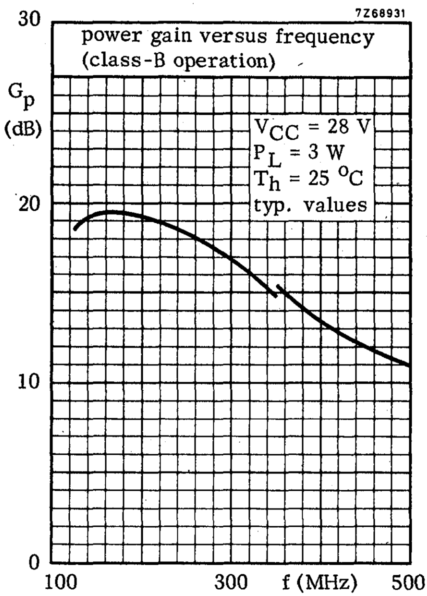


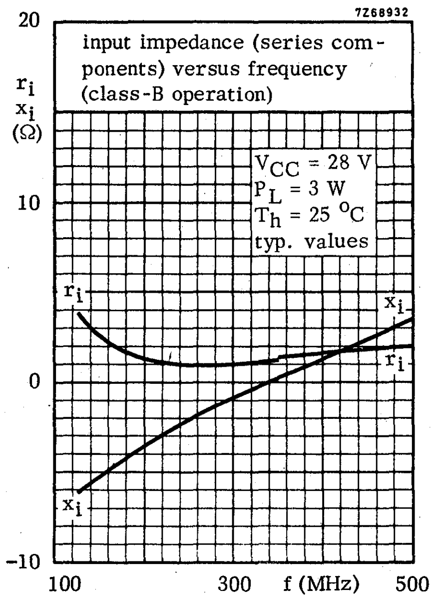


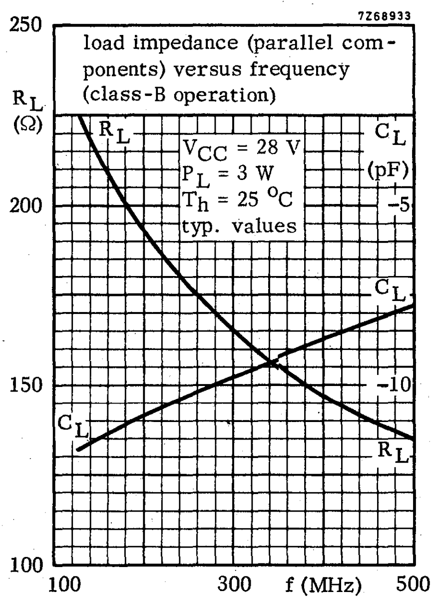
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 3,8 W load power in the test amplifier on page 7 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. TRANSMITTING TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V.
The transistor is resistance stabilized and is tested under severe load mismatch conditions.
Gold metallization ensures extremely high reliability.
It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

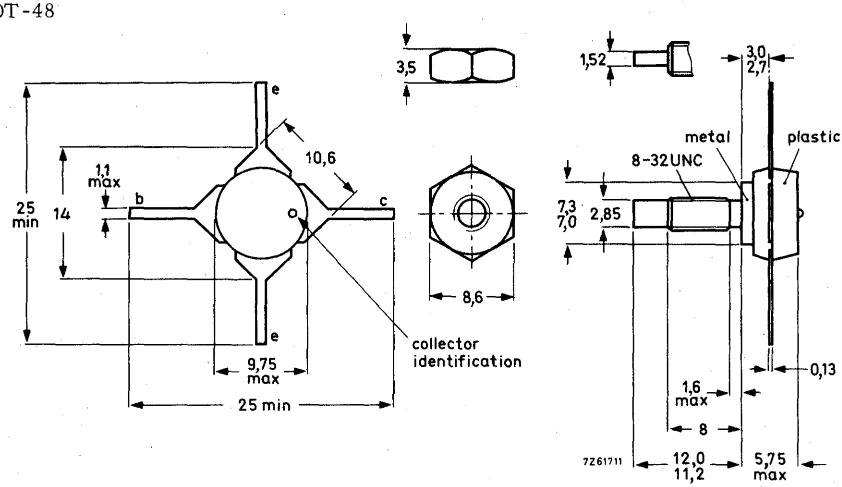
QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	–	–
c.w.	28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	–	–
c.w.	28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 – j32
c.w.	28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	–	–

MECHANICAL DATA Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (d.c.)	I_C	max.	1,0	A
Collector current (peak value) f ≥ 10 MHz	I_{CM}	max.	3,0	A

Power dissipation

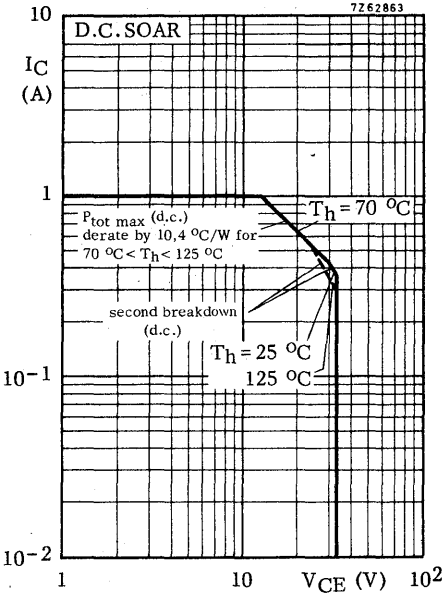
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	12,5	W

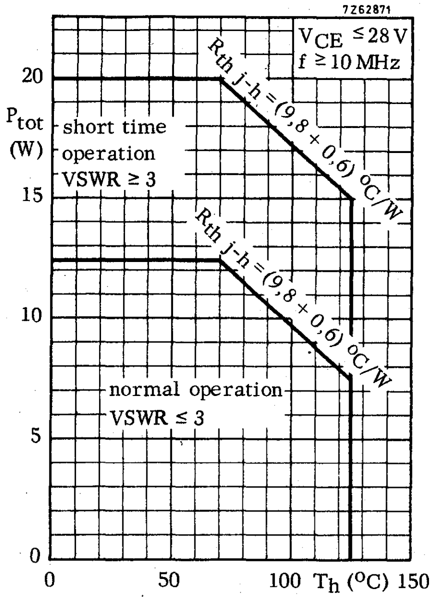
Temperatures

Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

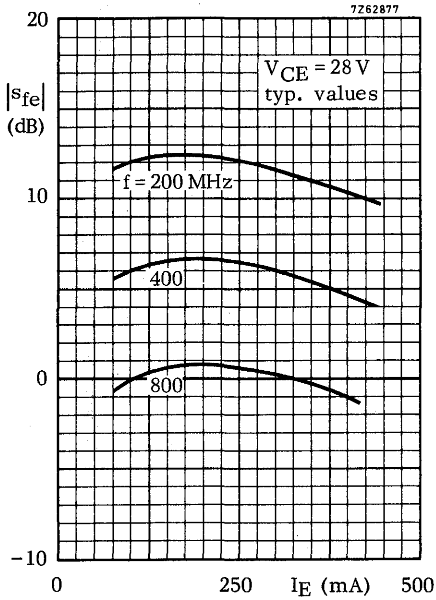
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	9,8	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

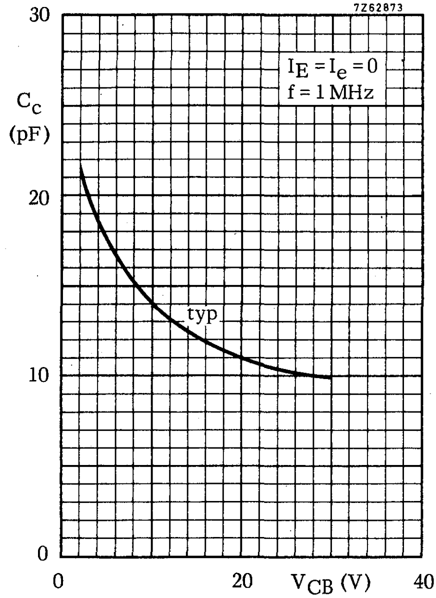

7Z62863
D.C. SOAR
I_C (A)
$P_{tot\ max}$ (d.c.)
derate by 10,4 °C/W for
70 °C < T_h < 125 °C
T_h = 70 °C
second breakdown (d.c.)
T_h = 25 °C
125 °C
V_{CE} (V)

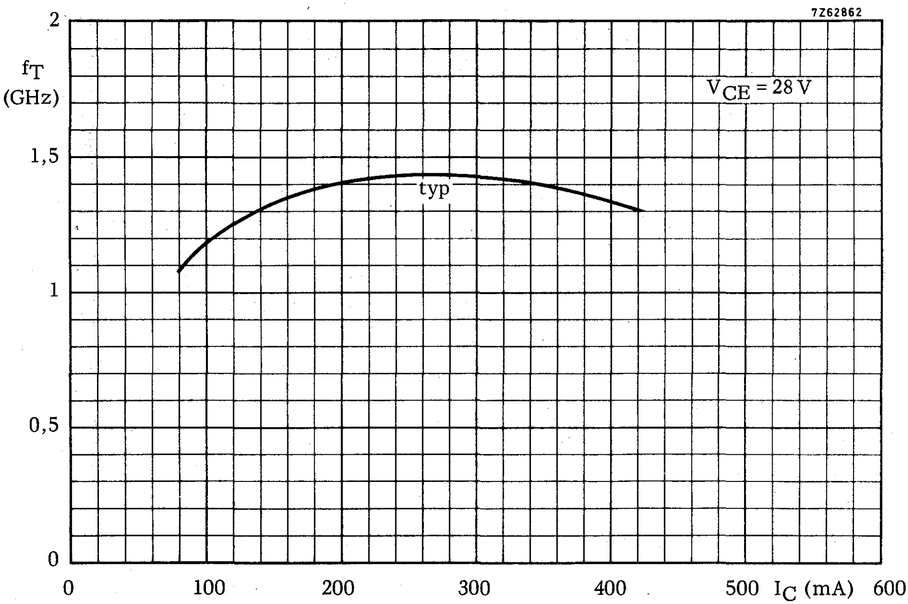

7Z62871
V_{CE} ≤ 28 V
f ≥ 10 MHz
P_{tot} (W)
short time operation
VSWR ≥ 3
$R_{th\ j-h}$ = (9,8 + 0,6) °C/W
$R_{th\ j-h}$ = (9,8 + 0,6) °C/W
normal operation
VSWR ≤ 3
T_h (°C)

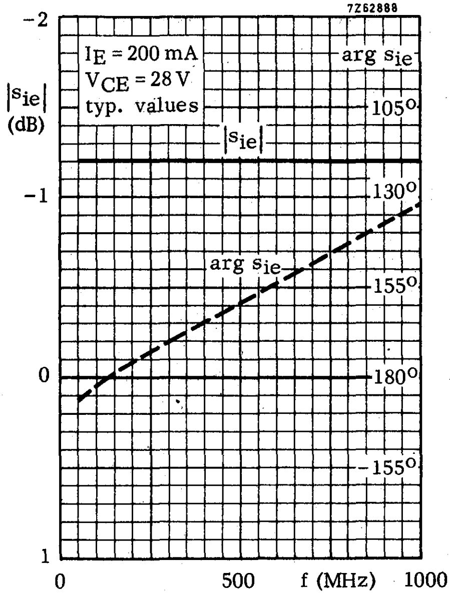
CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

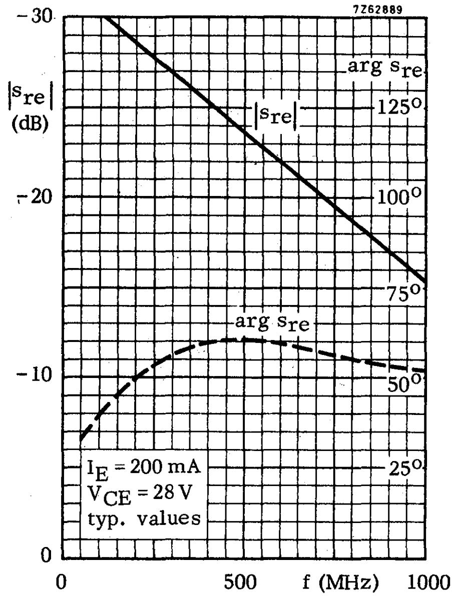
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 35	
Transition frequency				
I_C = 200 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	14	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 0$	C_e	typ.	60	pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	10	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

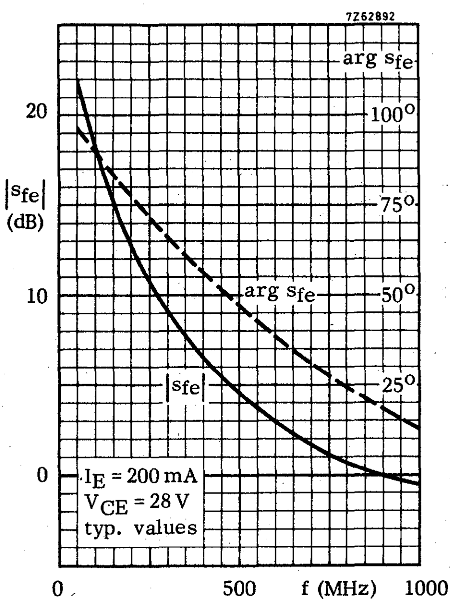

7Z62877
20
10
0
−10
|s_fe| (dB)
V_CE = 28 V
typ. values
f = 200 MHz
400
800
0
250
I_E (mA)
500

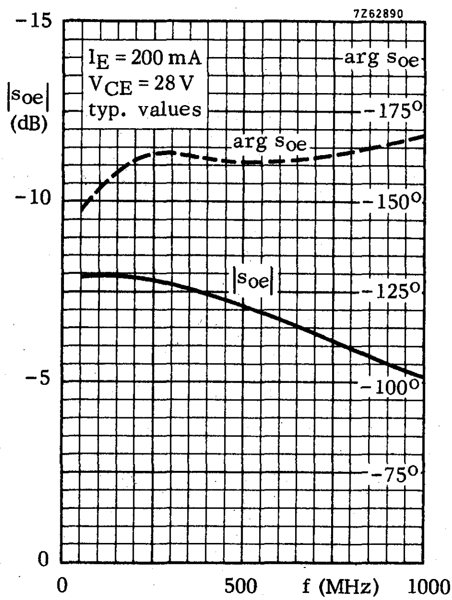

7Z62873
30
20
10
0
C_c (pF)
I_E = I_e = 0
f = 1 MHz
typ
0
20
V_CB (V)
40


7Z62862
2
1,5
1
0,5
0
f_T (GHz)
V_CE = 28 V
typ
0
100
200
300
400
500
I_C (mA)
600


7Z62888
I_E = 200 mA
V_{CE} = 28 V
typ. values
arg s_{ie}
$|s_{ie}|$ (dB)
105°
130°
155°
180°
-155°
-2
-1
0
1
0
500
f (MHz)
1000


7Z62889
-30
-20
-10
0
$|s_{re}|$ (dB)
arg s_{re}
125°
100°
75°
50°
25°
I_E = 200 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000


7Z62892
arg s_{fe}
100°
75°
50°
25°
$|s_{fe}|$ (dB)
20
10
0
I_E = 200 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000


7Z62890
-15
-10
-5
0
$|s_{oe}|$ (dB)
I_E = 200 mA
V_{CE} = 28 V
typ. values
arg s_{oe}
-175°
-150°
-125°
-100°
-75°
0
500
f (MHz)
1000

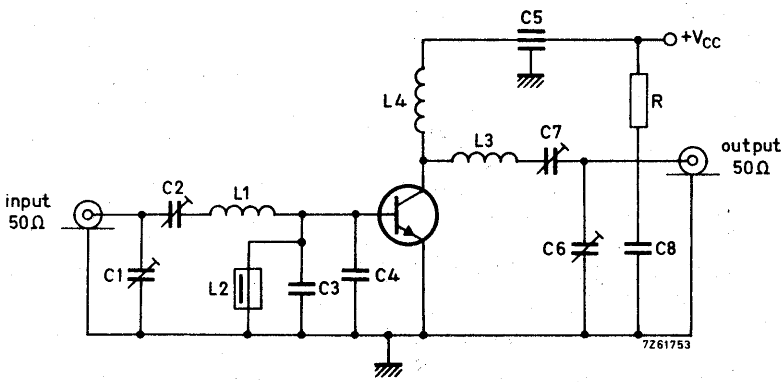
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter **class-B circuit**)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	–	–
28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	–	–
28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 – j32
28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	–	–

Test circuit for 470 MHz:



C1 = C2 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = C7 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 2 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 3 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm

R = 10 Ω carbon

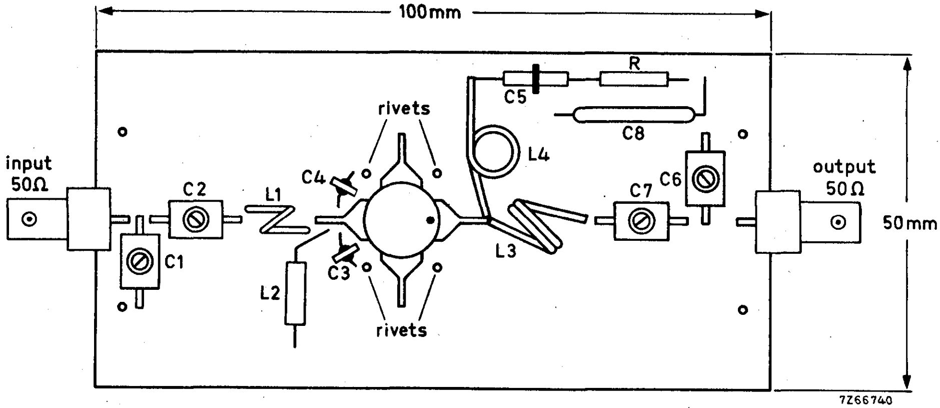
At P_L = 7,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/°C.

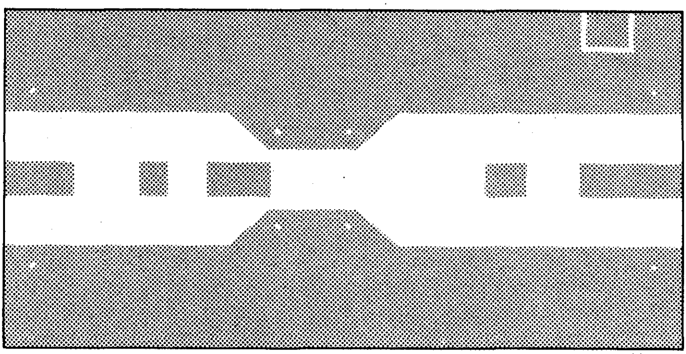
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 7,0 W.

Component layout for 470 MHz test circuit see page 8.

APPLICATION INFORMATION (continued)

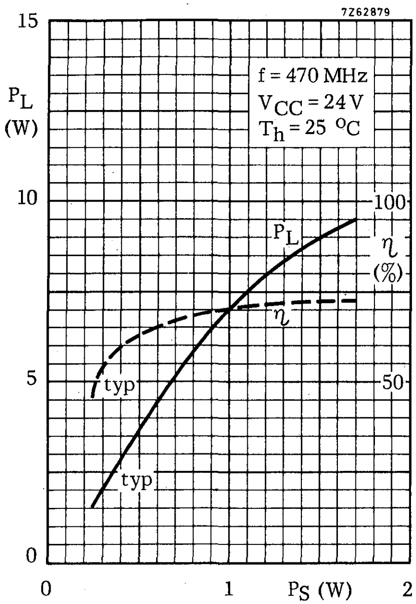
Component layout and printed-circuit board for 470 MHz test circuit.

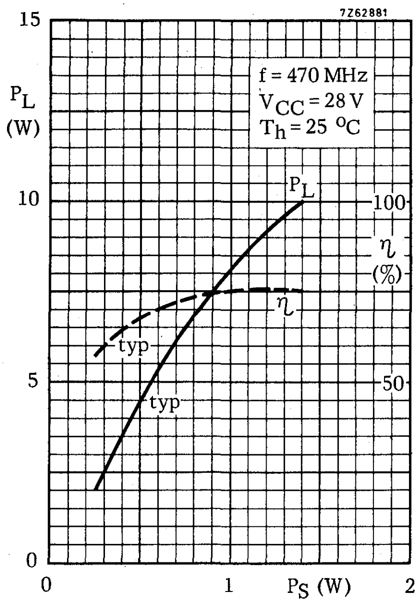


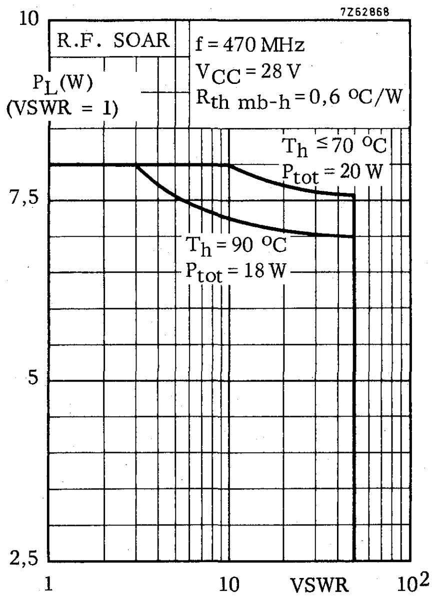


7Z66741.1

Shaded area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



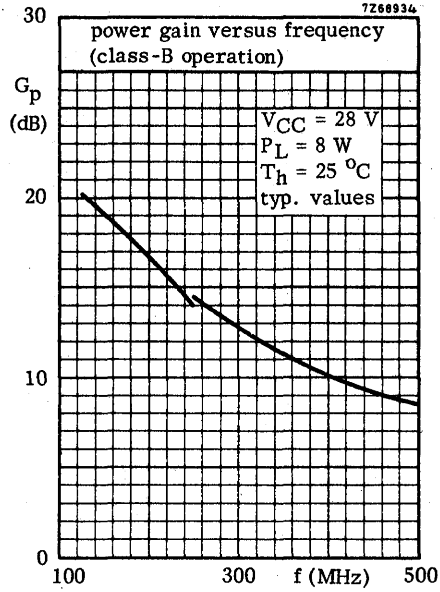


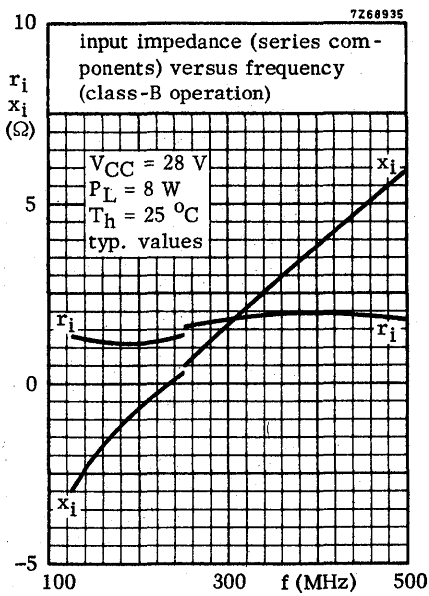


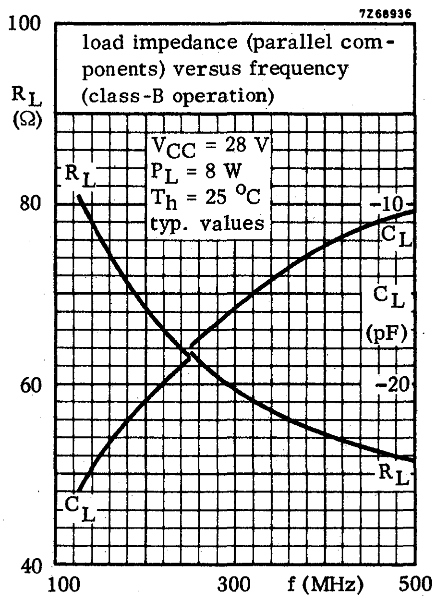
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 8 W load power in the test amplifier on page 7 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 250 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class A, B or C amplifiers in U.H.F. transmitters with supply voltages up to 28 V.
The transistor is resistance stabilized and tested under conditions of severe load mismatch. Gold metallization ensures extremely high reliability.
The transistor is housed in a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

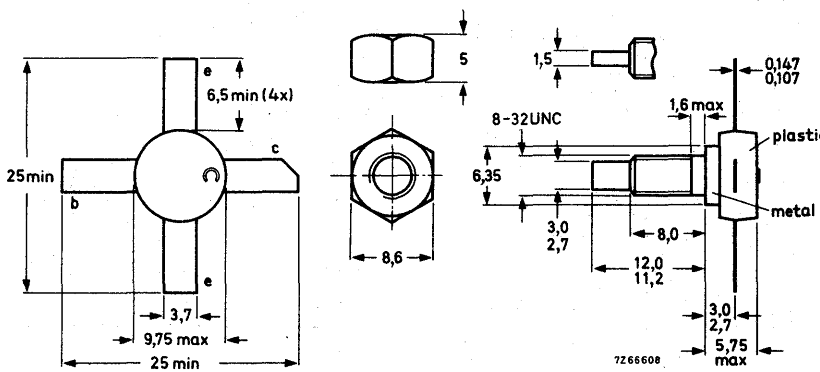
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	28	470	< 6, 25	25	< 1, 62	> 6	> 55	0, 8 + j4, 3	62 - j64

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required, an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0, 75 Nm (7, 5 kg cm)
max. 0, 85 Nm (8, 5 kg cm)

Diameter of clearance hole in heatsink: max. 4, 17 mm.
Mountinghole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

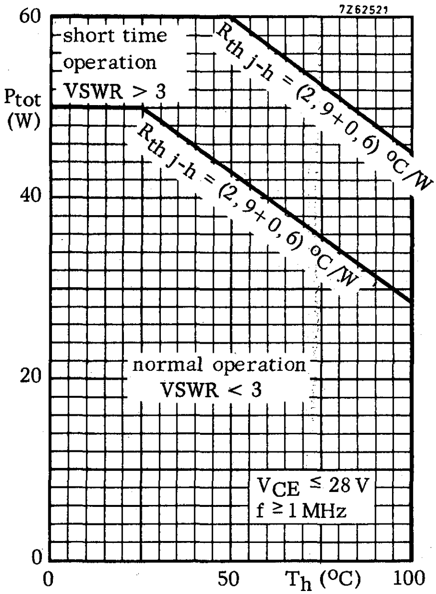
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

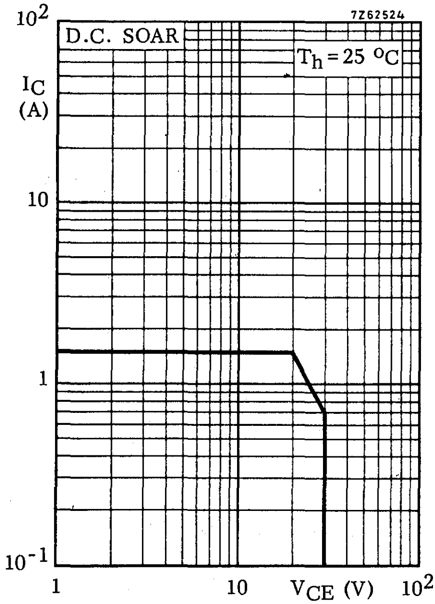
Currents

Collector current (average)	$I_{C(AV)}$	max.	2,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	6,0	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	50	W





Temperatures

Storage temperature	T_{stg}	−65 to +200		°C
Junction temperature	T_j	max.	200	°C

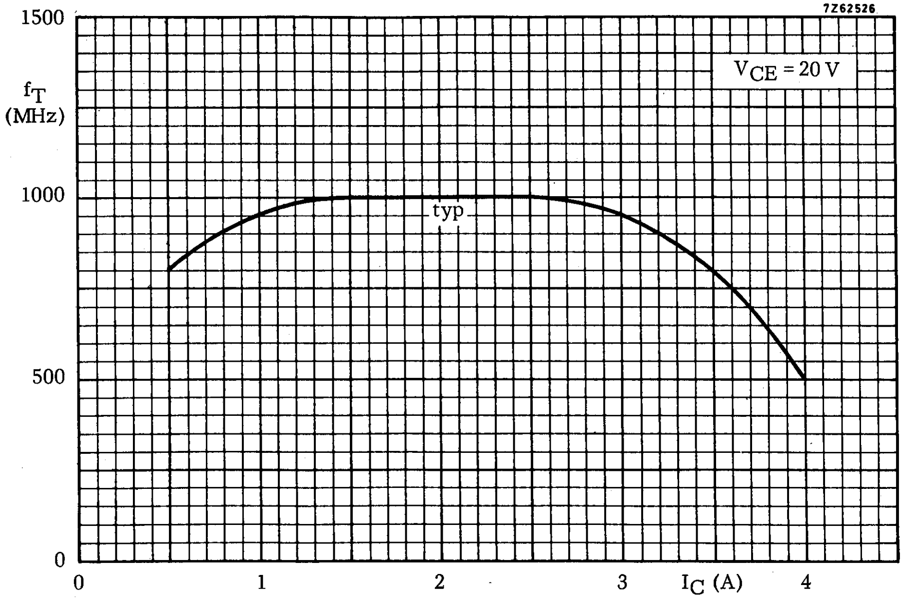
THERMAL RESISTANCE

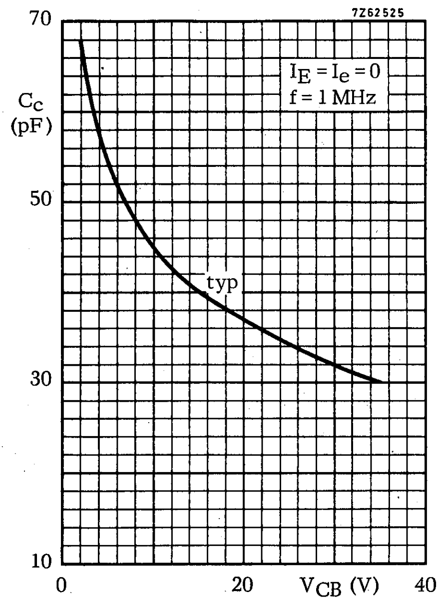
From junction to mounting base	$R_{th\,j\text{-}mb}$	=	2,9	°C/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	=	0,6	°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	10	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 25$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	30	V
Emitter-base voltage open collector, $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	3	mWs
$-V_{BE} = 1{,}5$ V; $R_{BE} = 33\ \Omega$	E	>	3	mWs
D.C. current gain				
$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	>	15	
		typ.	50	
Transition frequency				
$I_C = 2$ A; $V_{CE} = 20$ V	f_T	typ.	1,0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	32	pF
		<	50	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	18	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62526
1500
f_T
(MHz)
1000
500
0
$V_{CE} = 20$ V
typ
0
1
2
3
4
I_C (A)


7Z62525
70
C_c
(pF)
50
30
10
$I_E = I_e = 0$
f = 1 MHz
typ
0
20
40
V_{CB} (V)

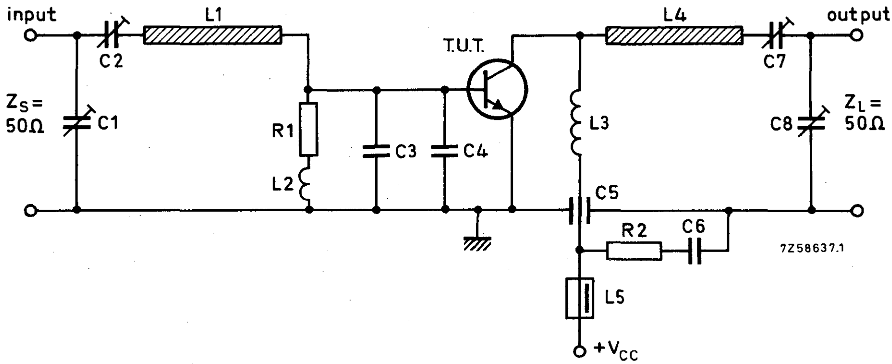
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

f = 470 MHz; T_{mb} = 25 °C

V_{CE} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
28	< 6,25	25	< 1,62	> 6	> 55	0,8 + j4,3	62 – j64

Test circuit: 470 MHz; c.w. class-B.



List of components:

C1 = C2 = C8 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor
C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)

R1 = 1 Ω carbon resistor
R2 = 10 Ω carbon resistor

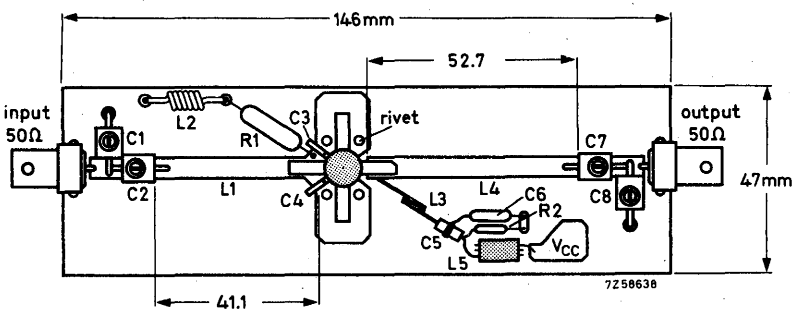
L1 = stripline (40,8 mm x 5,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4 mm; leads 2 x 5 mm
L4 = stripline (52,4 mm x 5,0 mm)
L5 = Ferroxcube choke coil. Z (at f = 50 MHz) = 750 Ω ± 20% (cat. no. 4312 020 36640)

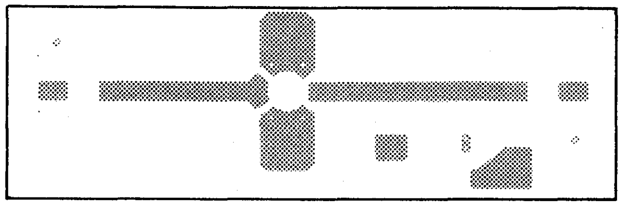
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1,45 mm.

Component layout and printed-circuit board for 470 MHz test circuit see page 6.

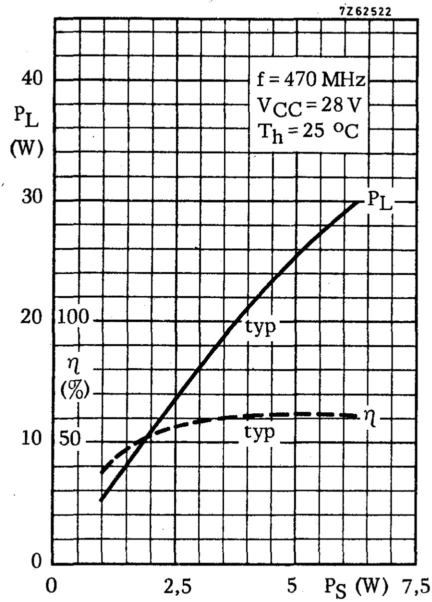
APPLICATION INFORMATION (continued)

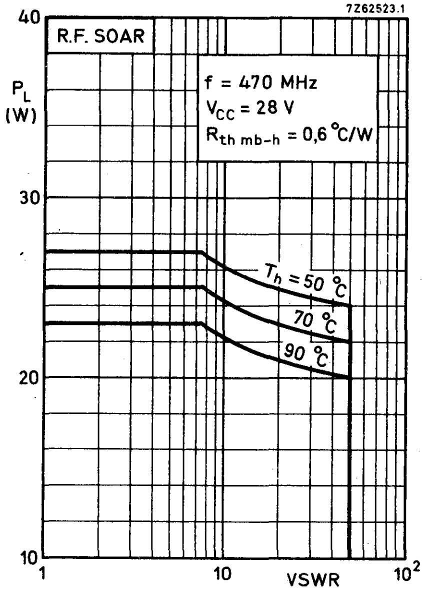
Component layout and printed-circuit board for 470 MHz test circuit.



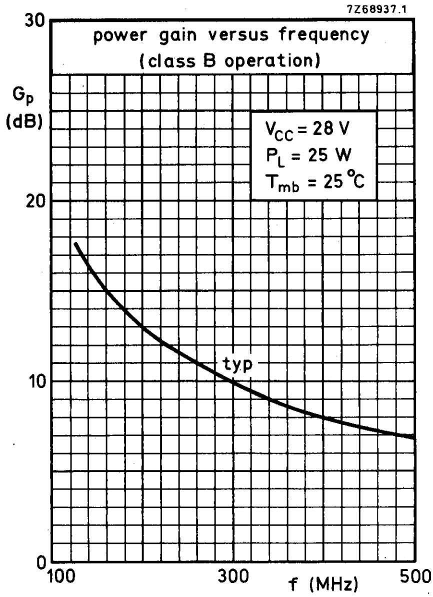


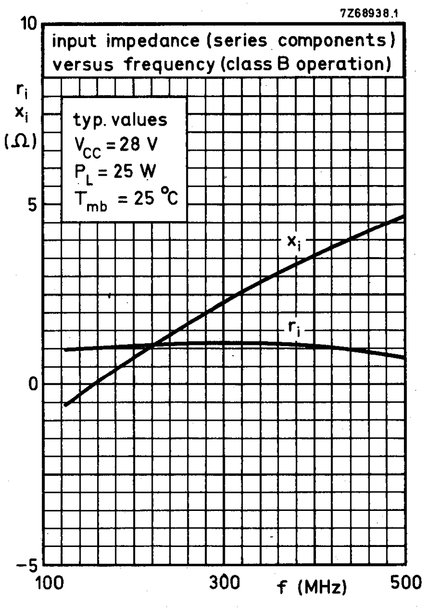
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

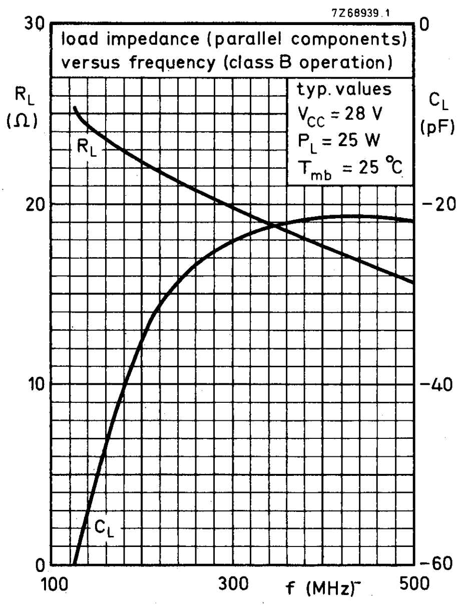




For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the VSWR, with heatsink temperature as parameter.


7Z68937.1
power gain versus frequency
(class B operation)
G_p
(dB)
V_{CC} = 28 V
P_L = 25 W
T_{mb} = 25 °C
typ
30
20
10
0
100
300
500
f (MHz)


7Z68938.1
input impedance (series components)
versus frequency (class B operation)
r_i
x_i
(Ω)
typ. values
V_{CC} = 28 V
P_L = 25 W
T_{mb} = 25 °C
x_i
r_i
10
5
0
−5
100
300
500
f (MHz)


7Z68939.1
load impedance (parallel components)
versus frequency (class B operation)
R_L
(Ω)
typ. values
V_{CC} = 28 V
P_L = 25 W
T_{mb} = 25 °C
C_L
(pF)
R_L
C_L
30
20
10
0
0
−20
−40
−60
100
300
500
f (MHz)

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. frequency range for supply voltages up to 28 V. The transistor is resistance stabilized and is tested under severe load mismatch conditions. Due to a gold metallization excellent reliability properties have been obtained. The transistor is housed in a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

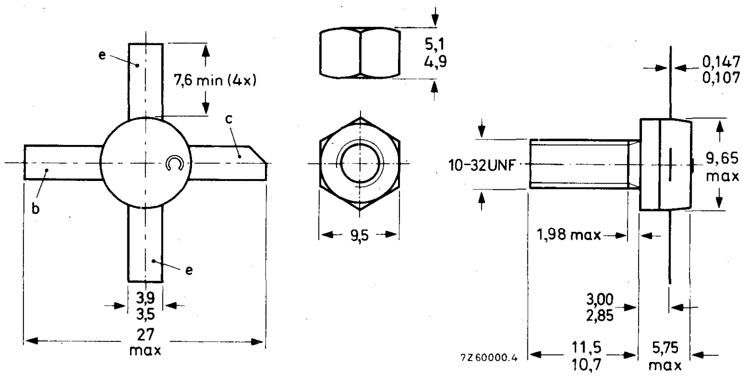
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %
c.w.	28	470	< 14,2	40	< 2,4	< 4,5	> 60
c.w.	28	175	typ. 3,2	40	typ. 1,9	typ. 11	typ. 75

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 5,0 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

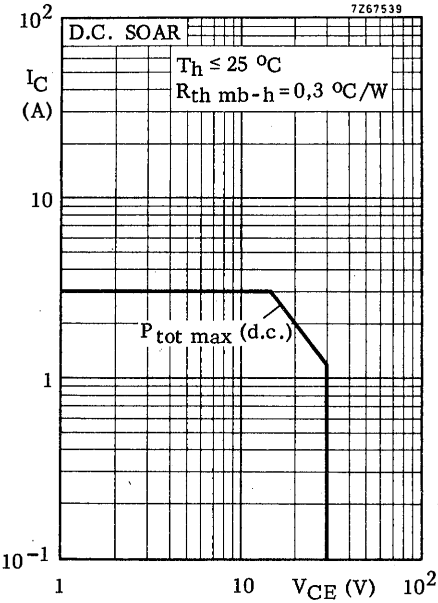
Voltages

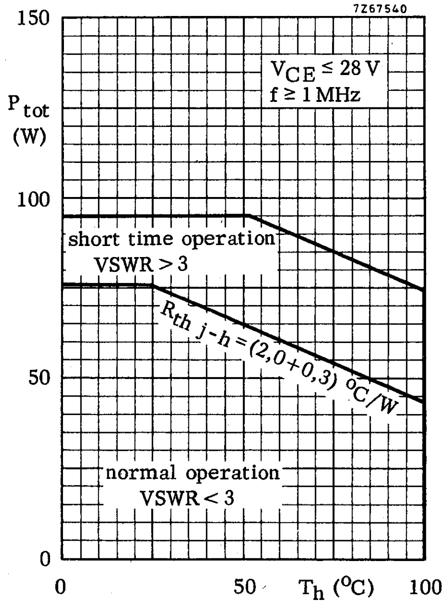
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage ($R_{BE} = 10\,\Omega$) peak value	V_{CERM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

Currents

Collector current (average)	$I_{C(AV)}$	max.	3,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10,0	A

Power dissipation





Temperatures

Storage temperature	T_{stg}	−65 to +200	°C
Junction temperature	T_j	max. 200	°C

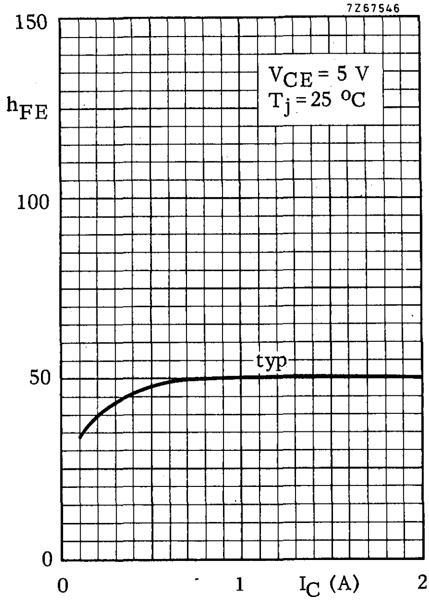
THERMAL RESISTANCE

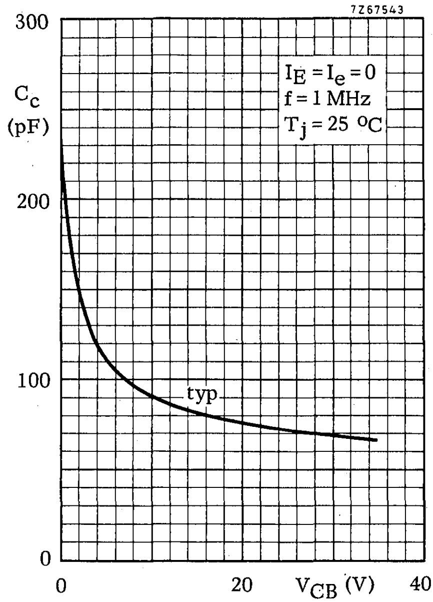
From junction to mounting base	$R_{th\ j-mb}$	=	2,0	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,3	°C/W

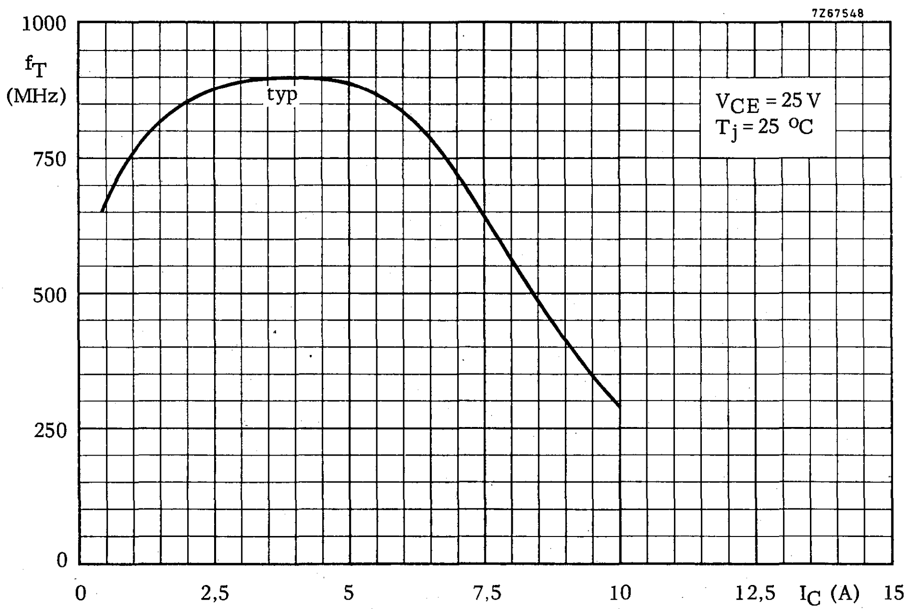
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage R_{BE} = 10 Ω, I_C = 50 mA	$V_{(BR)CER}$	>	65	V
Collector-emitter voltage open base, I_C = 50 mA	$V_{(BR)CEO}$	>	30	V
Emitter-base voltage open collector, I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	4,5	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	4,5	mWs
D.C. current gain				
I_C = 1,0 A; V_{CE} = 5 V	h_{FE}	25 to 100		
Transition frequency				
I_C = 4 A; V_{CE} = 25 V	f_T	typ.	900	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; V_{CB} = 30 V	C_c	typ.	68	pF
		<	80	pF
Feedback capacitance at f = 1 MHz				
I_C = 200 mA; V_{CE} = 30 V	C_{re}	typ.	39	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67546
150
100
50
0
h_{FE}
V_{CE} = 5 V
T_j = 25 °C
typ
0
1
I_C (A)
2


7Z67543
300
200
100
0
C_c
(pF)
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
typ
0
20
V_{CB} (V)
40


7Z67548
1000
750
500
250
0
f_T
(MHz)
typ
V_{CE} = 25 V
T_j = 25 °C
0
2,5
5
7,5
10
12,5
I_C (A)
15

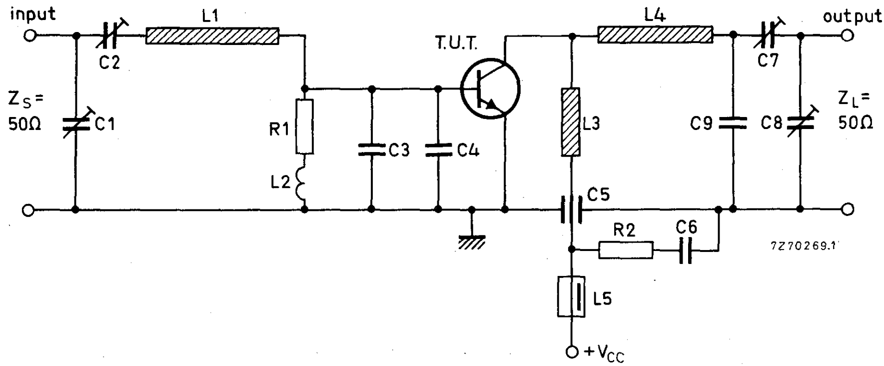
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

V_{CE} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)
470	< 14,2	40	< 2,4	> 4,5	> 60
175	typ. 3,2	40	typ. 1,9	typ. 11	typ. 75

Test circuit: 470 MHz; c.w. class-B.



List of components:

C1 = C7 = C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C2 = 1,8 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 18 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor
C9 = 2 x 3,3 pF miniature ceramic plate capacitors (in parallel)

R1 = 1 Ω carbon resistor (0,25 W)
R2 = 10 Ω carbon resistor (0,25 W)

L1 = stripline (21,4 mm x 5,3 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); internal diameter 4,0 mm
L3 = stripline (43,8 mm x 3,0 mm)
L4 = stripline (45,5 mm x 5,3 mm)
L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)

L1; L3; L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1/32".

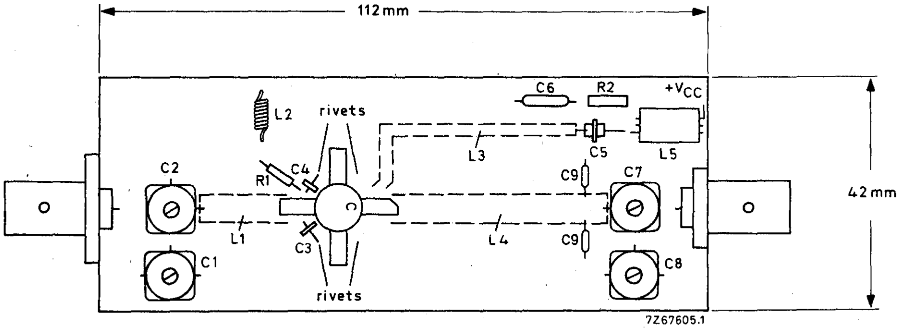
At P_L = 40 W and V_{CE} = 28 V, the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by typ. 50 mW/°C.

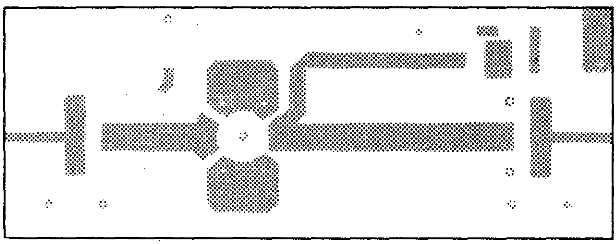
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C.
VSWR = 50 through all phases; P_L = 36 W.

Component layout and printed-circuit board for 470 MHz test circuit see page 6.

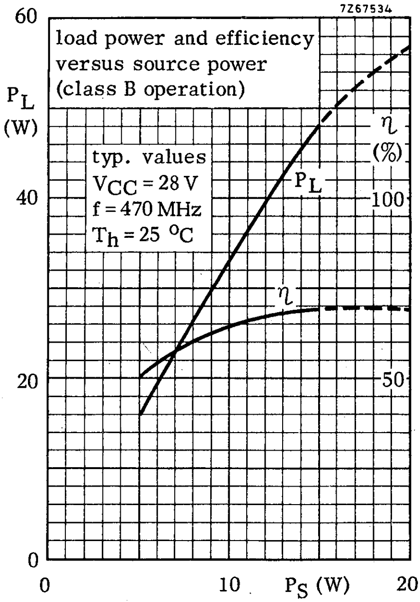
APPLICATION INFORMATION (continued)

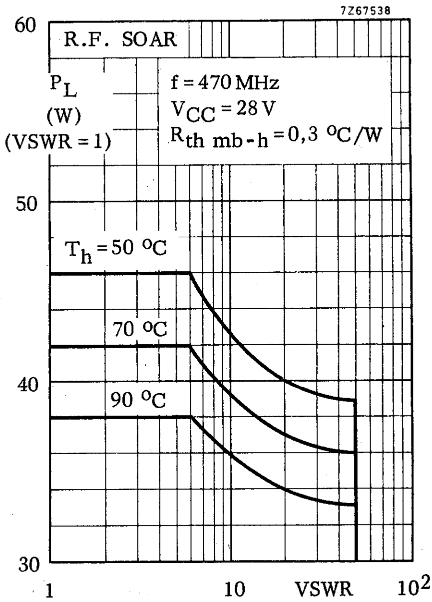
Component layout and printed-circuit board for 470 MHz test circuit.





The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.



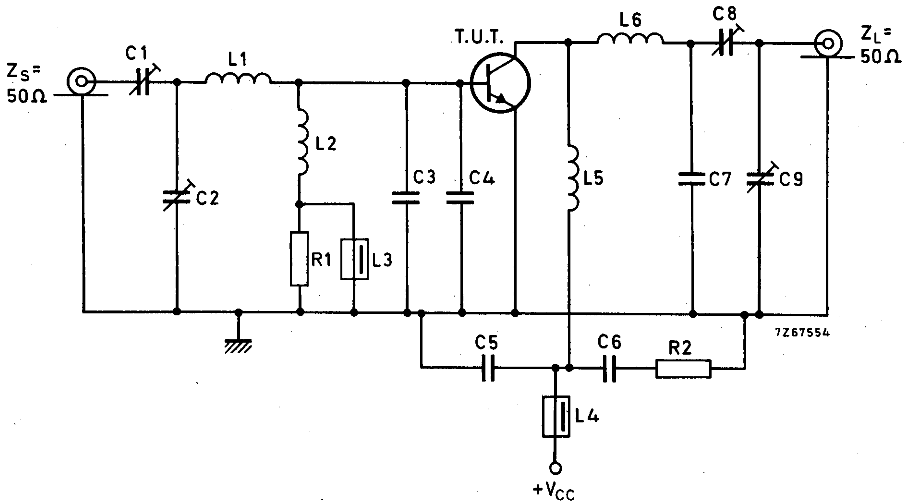


Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 46 W load power in the test amplifier on page 5 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 = 47 pF ceramic capacitor
C5 = 100 pF ceramic capacitor
C6 = 100 nF polyester capacitor
C7 = 6,8 pF ceramic capacitor
C8 = 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
C9 = 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)

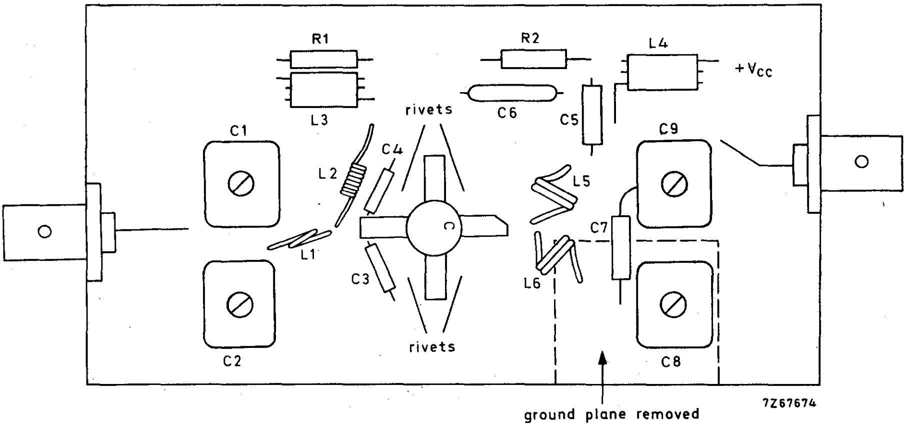
L1 = 0,5 turn enamelled Cu wire (1,5 mm); int. diam. 6 mm; lead length 2 x 6 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. diam. 3 mm; lead length 2 x 5 mm
L3 = L4 = ferroxcube choke coil (code number 4312 020 36640)
L5 = 53 nH; 2 turns enamelled Cu wire (1,5 mm); int. diam. 10 mm; coil length 5,2 mm; lead length 2 x 5 mm
L6 = 46 nH; 2 turns enamelled Cu wire (1,5 mm); int. diam. 9 mm; coil length 5,4 mm; lead length 2 x 5 mm

R1 = R2 = 10 Ω carbon resistor (0,25W)

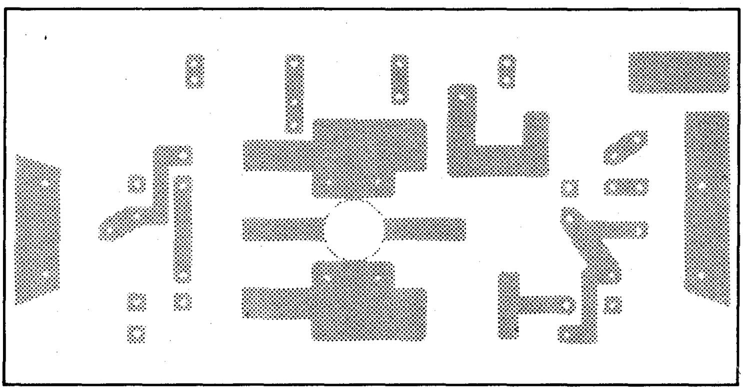
Component lay-out for 175 MHz test circuit see page 9.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

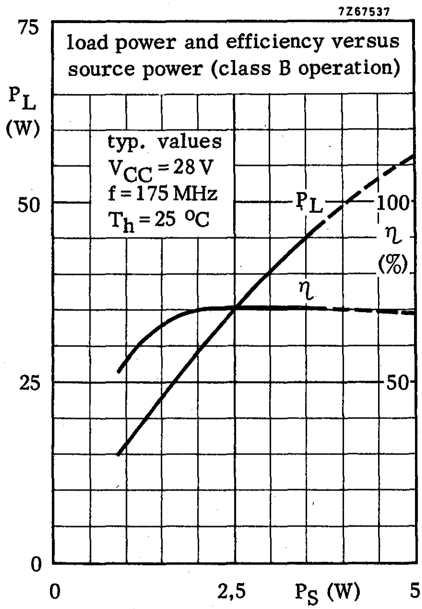


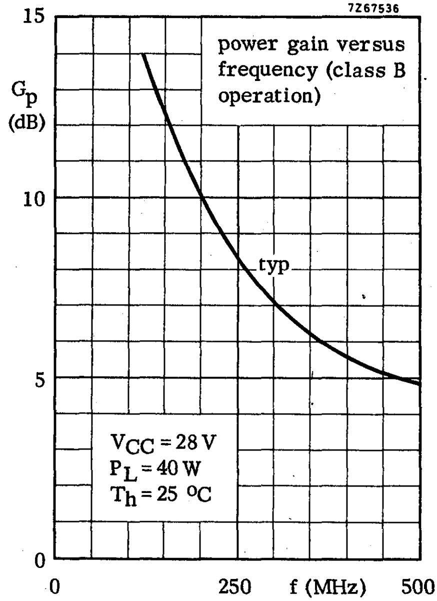
Dimensions of printed circuit board 123 mm x 55 mm.

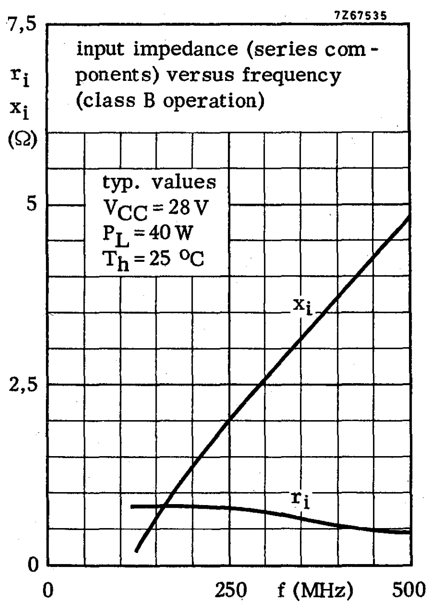


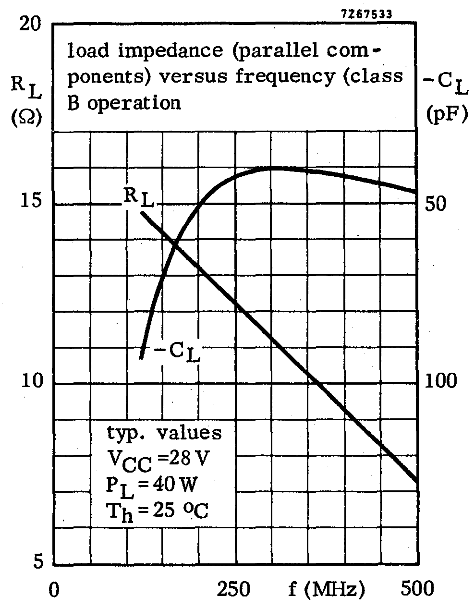
7Z66943

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.


7Z67537
load power and efficiency versus source power (class B operation)
typ. values
V_{CC} = 28 V
f = 175 MHz
T_h = 25 °C
P_L (W)
P_L
η
η (%)
100
50
75
50
25
0
0
2,5
P_S (W)
5


7Z67536
power gain versus frequency (class B operation)
G_p (dB)
typ
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
15
10
5
0
0
250
f (MHz)
500


7Z67535
input impedance (series components) versus frequency (class B operation)
r_i
x_i
(Ω)
typ. values
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
x_i
r_i
7,5
5
2,5
0
0
250
f (MHz)
500


7Z67533
load impedance (parallel components) versus frequency (class B operation)
R_L (Ω)
$-C_L$ (pF)
R_L
$-C_L$
typ. values
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
20
15
10
5
50
100
0
250
f (MHz)
500

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter silicon transistor in a capstan envelope. It has extremely good intermodulation properties and high power gain.
The device is primarily intended for pre-amplifiers in television transmitters and transposers.

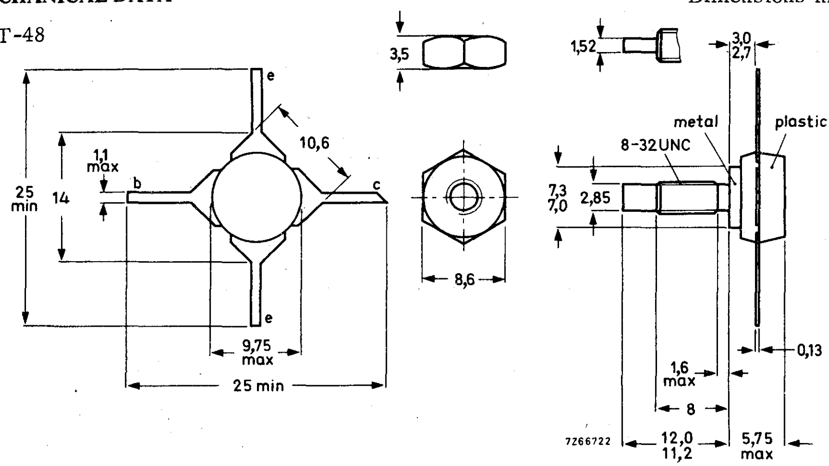
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Collector current (peak value)	I_{CM}	max.	1	A
Junction temperature	T_j	max.	200	°C
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	15	°C/W
Transition frequency				
I_C = 200 mA; V_{CE} = 20 V	f_T	>	1,2	GHz
Output power at f_{vision} = 860 MHz *)				
I_C = 250 mA; V_{CE} = 25 V; T_h = 25 °C; d_{im} = −60 dB	$P_{o\ sync}$	>	0,5	W
Power gain at f_{vision} = 860 MHz				
I_C = 250 mA; V_{CE} = 25 V; T_h = 25 °C	G_p	>	6	dB

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, side band signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mountinghole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

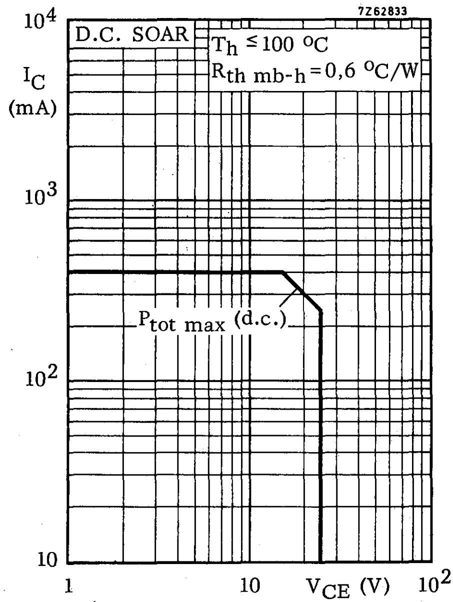
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3, 5	V

Currents

Collector current (d.c.)	I_C	max.	0, 4	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1	A

Power dissipation

Total power dissipation up to T_h = 100 °C	P_{tot}	max.	6, 25	W



Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

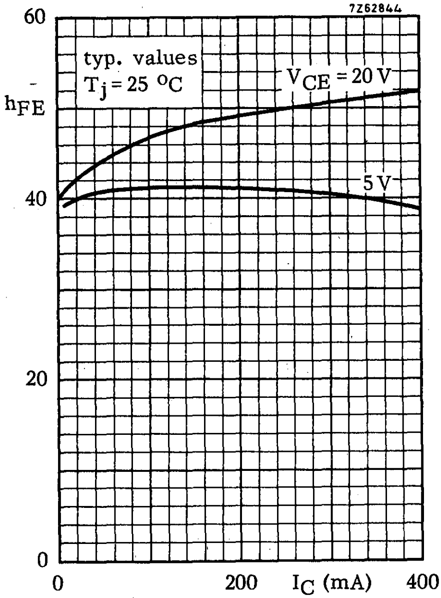
THERMAL RESISTANCE

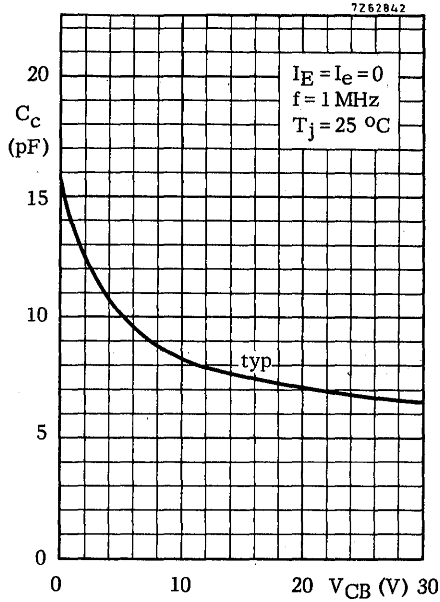
From junction to mounting base	$R_{th\ j-mb}$	=	15	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0, 6	°C/W

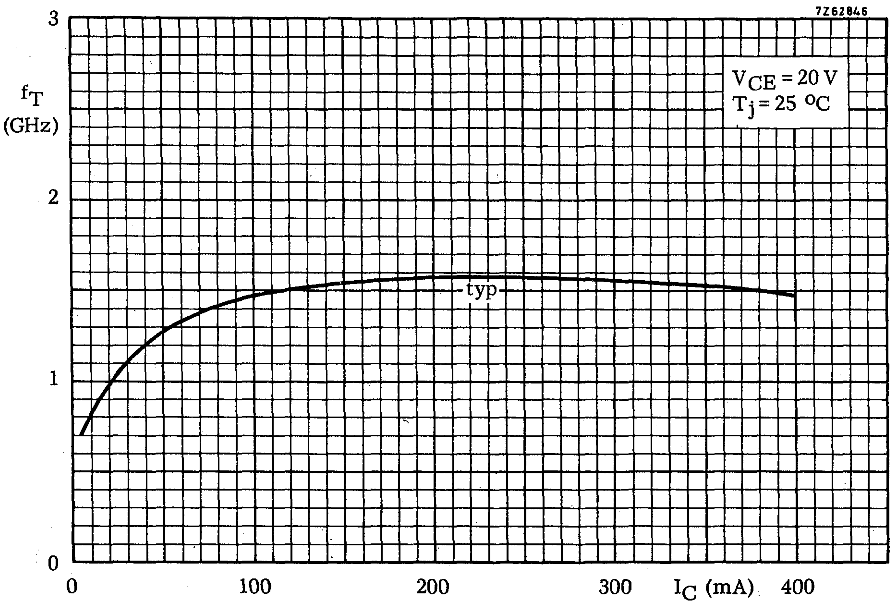
CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	μA
Breakdown voltages				
Collector-base voltage open emitter; $I_C = 1$ mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage $R_{BE} = 10\ \Omega$; $I_C = 5$ mA	$V_{(BR)CER}$	>	40	V
open base; $I_C = 5$ mA	$V_{(BR)CEO}$	>	27	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	3, 5	V
Saturation voltage				
$I_C = 200$ mA; $I_B = 20$ mA	V_{CEsat}	<	0, 75	V
D.C. current gain				
$I_C = 200$ mA; $V_{CE} = 20$ V	h_{FE}	>	30	
$I_C = 400$ mA; $V_{CE} = 20$ V	h_{FE}	>	20	
Transition frequency				
$I_C = 200$ mA; $V_{CE} = 20$ V	f_T	>	1, 2	GHz
$I_C = 350$ mA; $V_{CE} = 20$ V	f_T	>	1, 0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	10	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 20$ V; $T_{mb} = 25\ ^oC$	C_{re}	typ.	3, 5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62844
typ. values
$T_j = 25\ ^oC$
$V_{CE} = 20\ V$
5 V
h_{FE}
60
40
20
0
0
200
I_C (mA)
400


7Z62842
$I_E = I_e = 0$
f = 1 MHz
$T_j = 25\ ^oC$
C_c
(pF)
typ
20
15
10
5
0
0
10
20
V_{CB} (V)
30

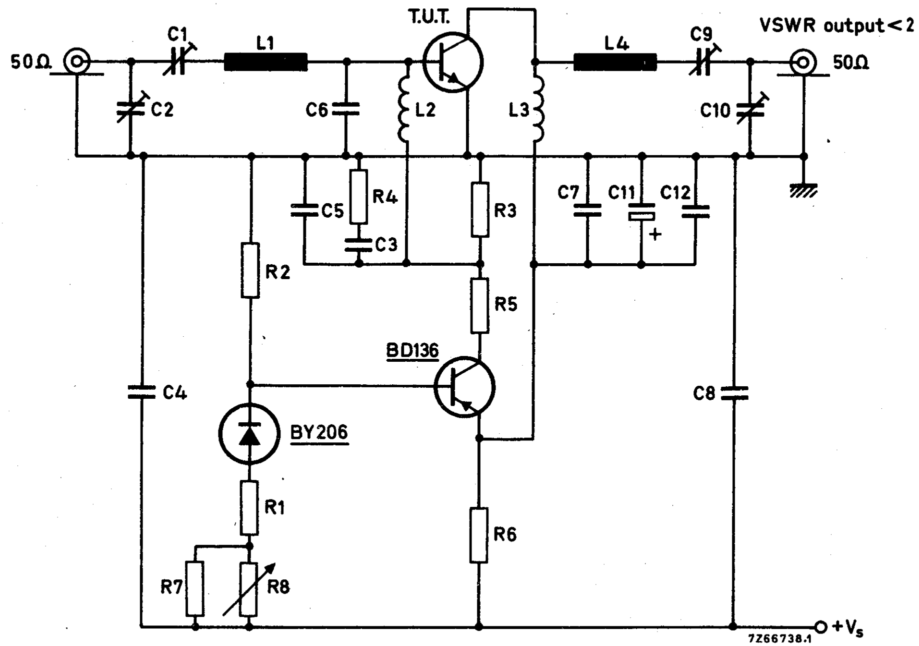

7Z62846
$V_{CE} = 20\ V$
$T_j = 25\ ^oC$
f_T
(GHz)
typ
3
2
1
0
0
100
200
300
I_C (mA)
400

APPLICATION INFORMATION

d_{im}(dB) *)	f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	G_p (dB)	$P_{o\ sync}$ (W) *)	T_h (°C)
−60	860	25	250	> 6	> 0,5	25
−60	860	25	250	typ. 7	typ. 0,6	25

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f_{vision} = 860 MHz



List of components: (see also page 6)

C1 = C2 = C10 = 2 to 9 pF film dielectric trimmers
C3 = C4 = C12 = 100 nF polyester capacitors
C5 = C7 = C8 = 100 pF feed-through capacitors
C6 = 2 x 2,7 pF in parallel, chip capacitors
C9 = 2 to 18 pF film dielectric trimmer
C11 = 10 μF/40 V solid aluminium electrolytic capacitor

R1 = 220 Ω
R2 = 4,7 kΩ
R3 = 100 Ω
R4 = 10 Ω
R5 = 470 Ω (1 W)
R6 = 3 x 22 Ω in parallel; (1 W)
R7 = 12 kΩ
R8 = 1 kΩ

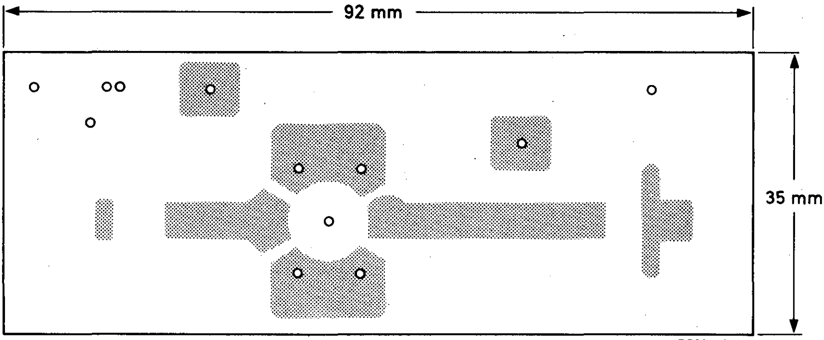
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14,8 mm x 4,3 mm)
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4,5 mm; leads 2 x 5 mm
L4 = stripline (29,5 mm x 4,3 mm)

L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,45 mm.

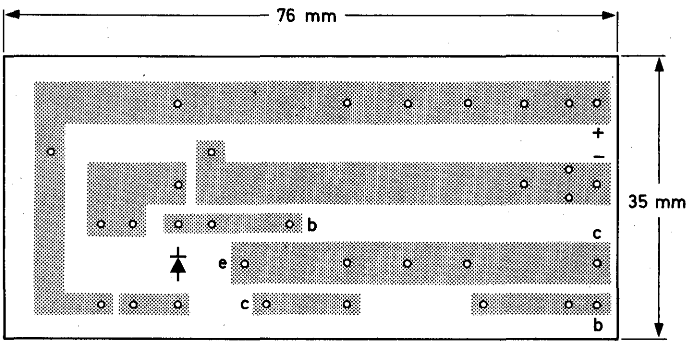
Layout of printed-circuit board for 860 MHz test circuit.



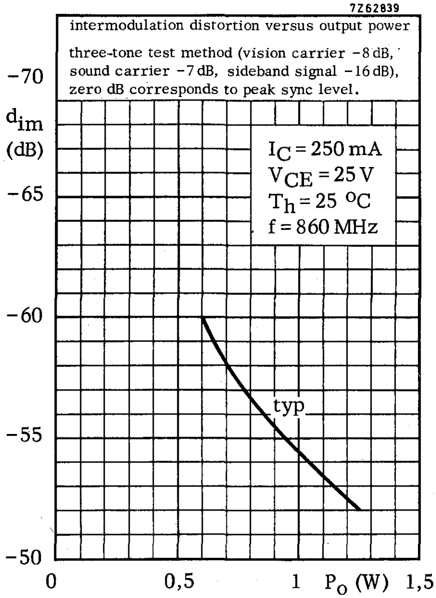
7Z66736.1

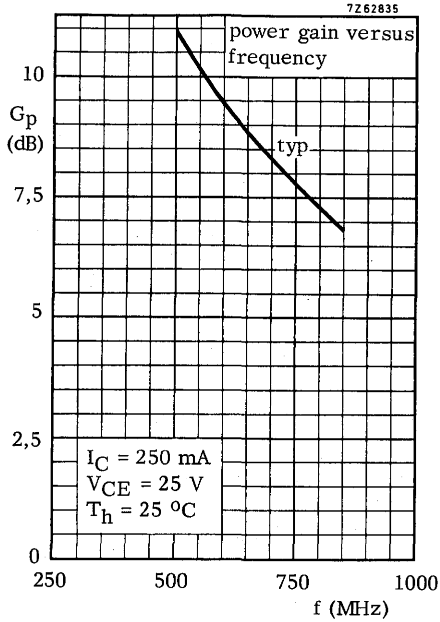
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

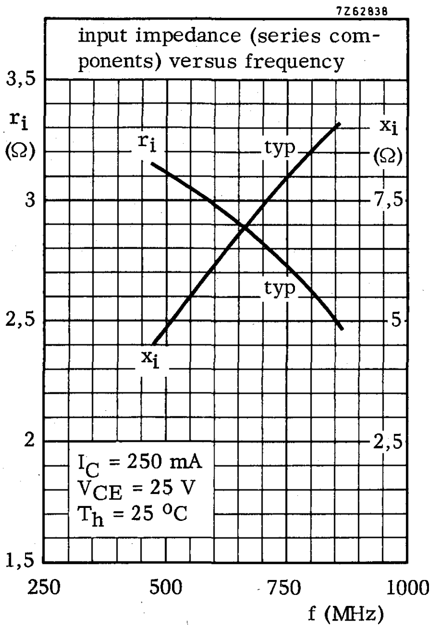
Layout of printed board bias circuit.

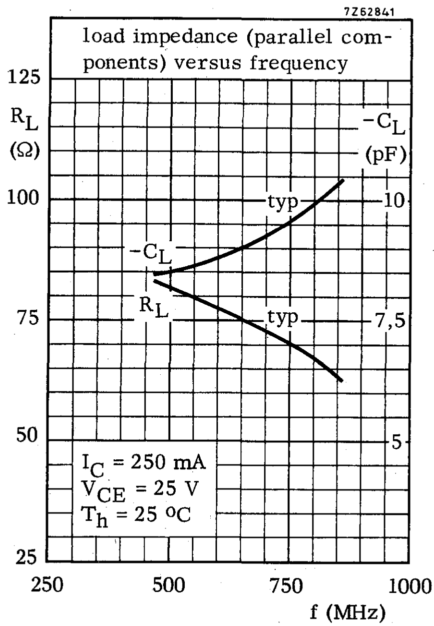


7Z66737.1


7Z62839
intermodulation distortion versus output power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
f = 860 MHz
typ
d_{im} (dB)
−70
−65
−60
−55
−50
0
0,5
1
P_o (W)
1,5


7Z62835
power gain versus frequency
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
G_p (dB)
10
7,5
5
2,5
0
250
500
750
1000
f (MHz)


7Z62838
input impedance (series components) versus frequency
r_i (Ω)
x_i (Ω)
r_i
x_i
typ
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
3,5
3
2,5
2
1,5
7,5
5
2,5
250
500
750
1000
f (MHz)


7Z62841
load impedance (parallel components) versus frequency
R_L (Ω)
$-C_L$ (pF)
$-C_L$
R_L
typ
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
125
100
75
50
25
10
7,5
5
250
500
750
1000
f (MHz)

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N multi-emitter silicon transistor in a capstan envelope. It has extremely good intermodulation properties and high power gain.
The device is primarily intended for pre-amplifiers in television transmitters and transposers.

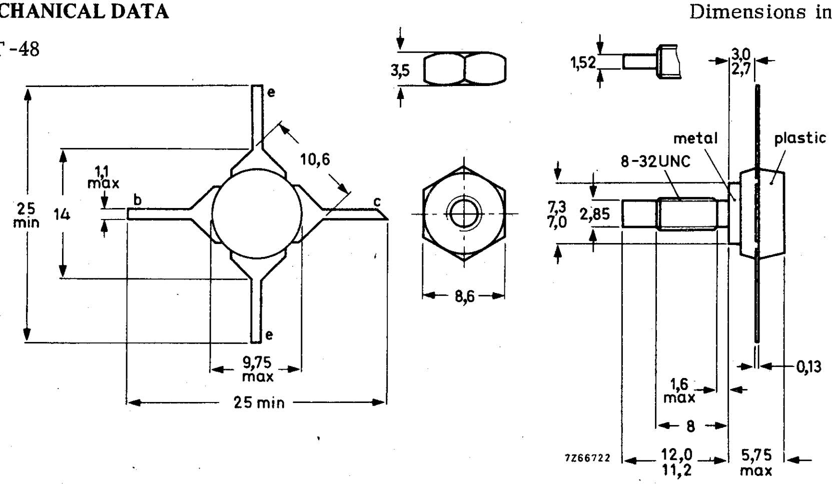
QUICK REFERENCE DATA

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Collector current (peak value)	I_{CM}	max.	2	A
Junction temperature	T_j	max.	200	°C
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	7,5	°C/W
Transition frequency				
I_C = 400 mA; V_{CE} = 20 V	f_T	>	1,2	GHz
Output power at f_{vision} = 860 MHz *)				
I_C = 500 mA; V_{CE} = 25 V; T_h = 25 °C; d_{im} = −60 dB	$P_{o\ sync}$	>	1,0	W
Power gain at f_{vision} = 860 MHz				
I_C = 500 mA; V_{CE} = 25 V; T_h = 25 °C	G_p	>	5,5	dB

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, side band signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

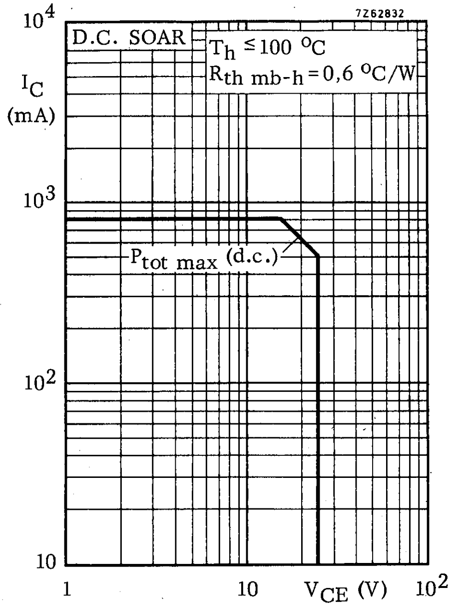
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage ($R_{BE} = 10\ \Omega$; peak value)	V_{CERM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V

Currents

Collector current (d.c.)	I_C	max.	0,8	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2	A

Power dissipation

Total power dissipation up to $T_h = 100\ ^oC$	P_{tot}	max.	12,5	W



Temperatures

Storage temperature	T_{stg}	-65 to +200		^oC
Junction temperature	T_j	max.	200	^oC

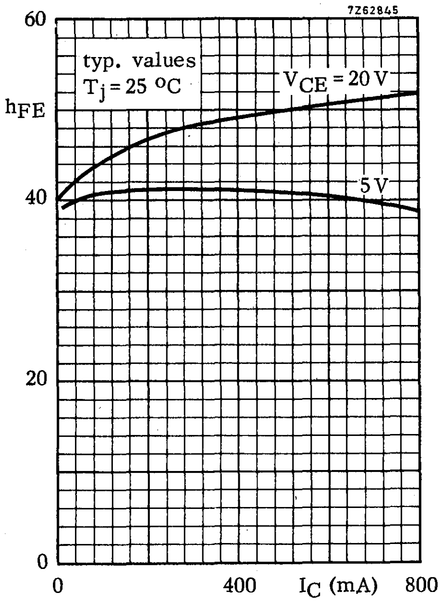
THERMAL RESISTANCE

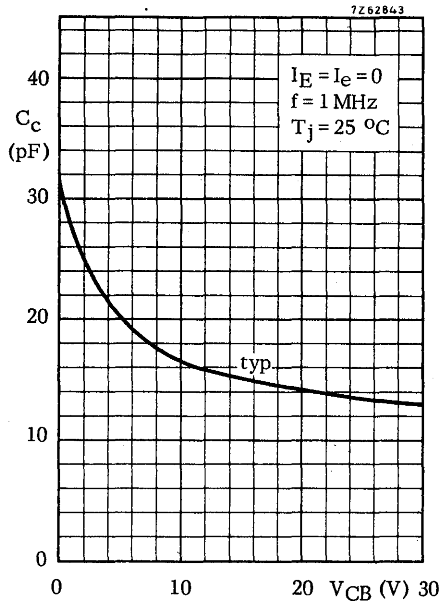
From junction to mounting base	$R_{th\ j-mb}$	=	7,5	$^oC/W$
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	$^oC/W$

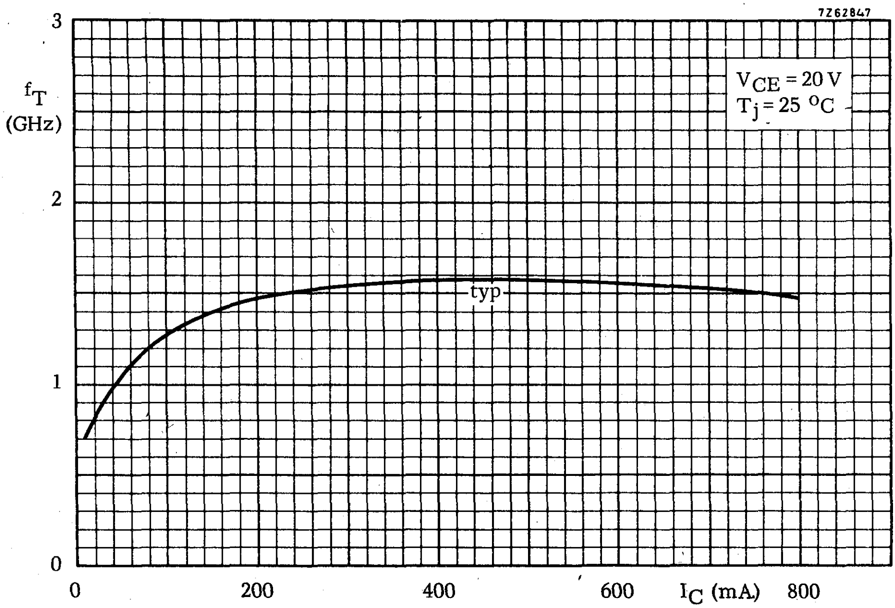
CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	200	μA
Breakdown voltages				
Collector-base voltage open emitter; $I_C = 2$ mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage $R_{BE} = 10\ \Omega$; $I_C = 10$ mA	$V_{(BR)CER}$	>	40	V
open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	27	V
Emitter-base voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	3, 5	V
Saturation voltage				
$I_C = 400$ mA; $I_B = 40$ mA	V_{CEsat}	<	0, 75	V
D.C. current gain				
$I_C = 400$ mA; $V_{CE} = 20$ V	h_{FE}	>	30	
$I_C = 800$ mA; $V_{CE} = 20$ V	h_{FE}	>	20	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	>	1, 2	GHz
$I_C = 700$ mA; $V_{CE} = 20$ V	f_T	>	1, 0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 20$ mA; $V_{CE} = 20$ V; $T_{mb} = 25\ ^oC$	C_{re}	typ.	7	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62845
typ. values
T_j = 25 °C
h_{FE}
V_{CE} = 20 V
5 V
60
40
20
0
0
400
I_C (mA)
800


7Z62843
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c
(pF)
typ.
40
30
20
10
0
0
10
20
V_{CB} (V)
30

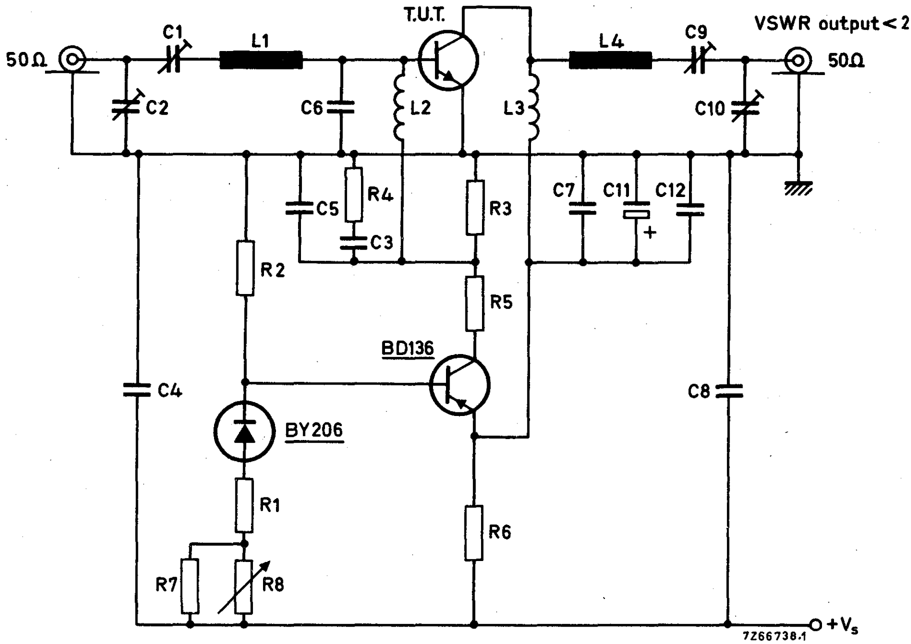

7Z62847
V_{CE} = 20 V
T_j = 25 °C
f_T
(GHz)
typ
3
2
1
0
0
200
400
600
I_C (mA)
800

APPLICATION INFORMATION

d_{im} (dB) *)	f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	G_p (dB)	$P_{o\ sync}$ (W) *)	T_h (°C)
−60	860	25	500	> 5,5	> 1,0	25
−60	860	25	500	typ. 6,5	typ. 1,1	25

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f_{vision} = 860 MHz



List of components: (see also page 6)

C1 = C2 = C10 = 2 to 9 pF film dielectric trimmers
C3 = C4 = C12 = 100 nF polyester capacitors
C5 = C7 = C8 = 100 pF feed-through capacitors
C6 = 2 x 2,7 pF in parallel, chip capacitors
C9 = 2 to 18 pF film dielectric trimmer
C11 = 10 μF/40 V solid aluminium electrolytic capacitor

R1 = 220 Ω
R2 = 4,7 kΩ
R3 = 100 Ω
R4 = 10 Ω
R5 = 470 Ω (1 W)
R6 = 3 x 22 Ω in parallel; (1 W)
R7 = 12 kΩ
R8 = 1 kΩ

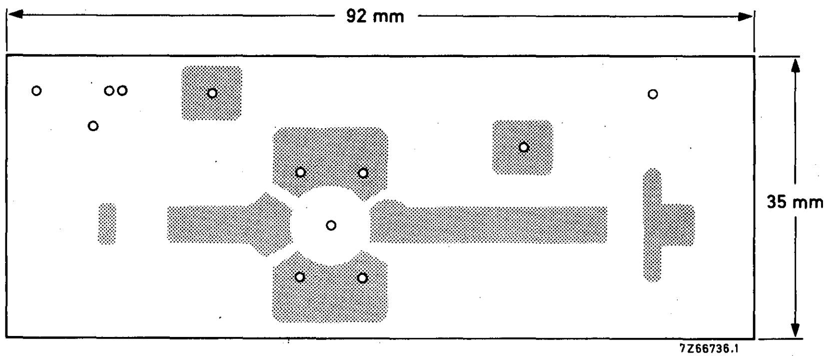
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14,8 mm x 4,3 mm)
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4,5 mm; leads 2 x 5 mm
L4 = stripline (29,5 mm x 4,3 mm)

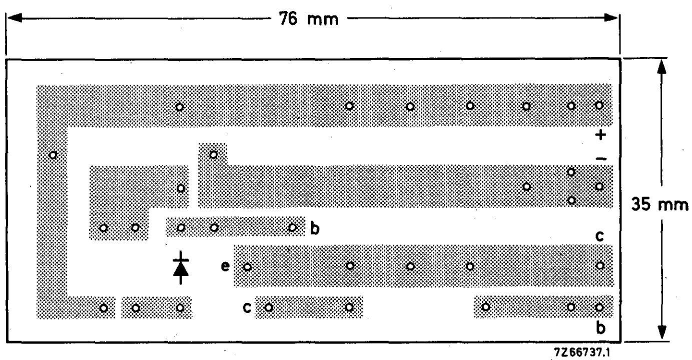
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,45 mm.

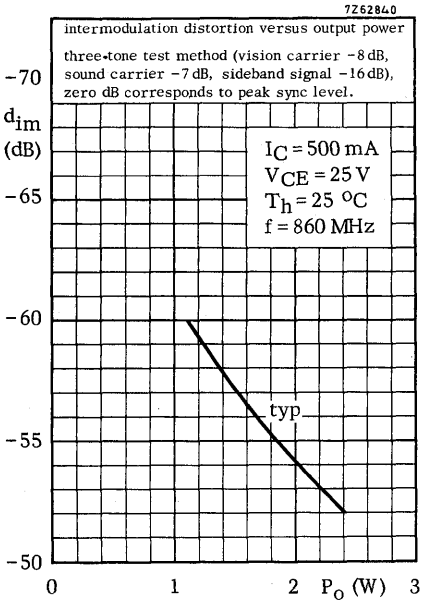
Layout of printed-circuit board for 860 MHz test circuit.

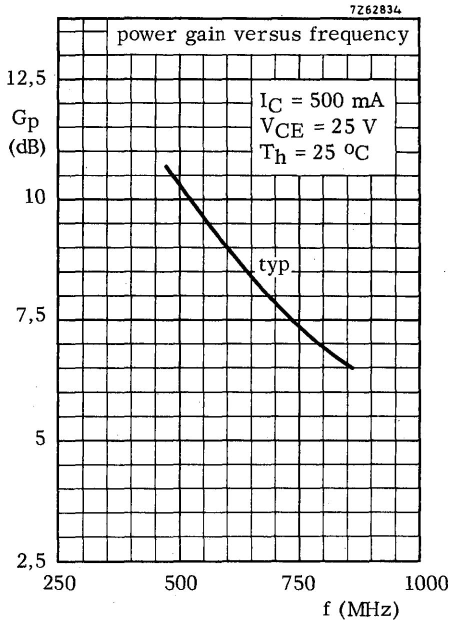


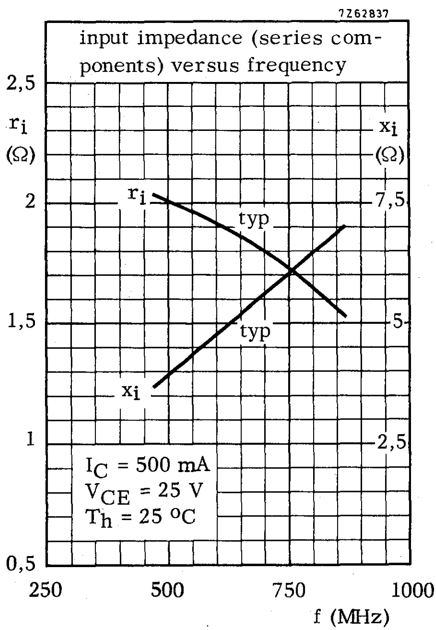
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

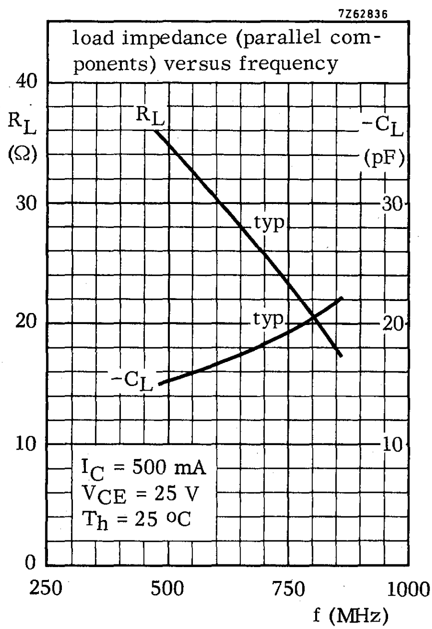
Layout of printed board bias circuit.




7Z62840
intermodulation distortion versus output power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
f = 860 MHz
d_{im} (dB)
−70
−65
−60
−55
−50
typ
0
1
2
3
P_o (W)


7Z62834
power gain versus frequency
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
G_p (dB)
12,5
10
7,5
5
2,5
typ
250
500
750
1000
f (MHz)


7Z62837
input impedance (series components) versus frequency
r_i (Ω)
x_i (Ω)
2,5
2
1,5
1
0,5
7,5
5
2,5
r_i
x_i
typ
typ
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)


7Z62836
load impedance (parallel components) versus frequency
R_L (Ω)
$-C_L$ (pF)
40
30
20
10
0
30
20
10
R_L
$-C_L$
typ
typ
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor assembled in a plastic encapsulated stripline package all leads of which are isolated from the stud. Excellent d.c. dissipation properties have been obtained by means of internal emitter-ballasting resistors and gold metallization. Detailed information is presented for application of this device in preamplifiers for television transposers and transmitters in band IV - V.

QUICK REFERENCE DATA

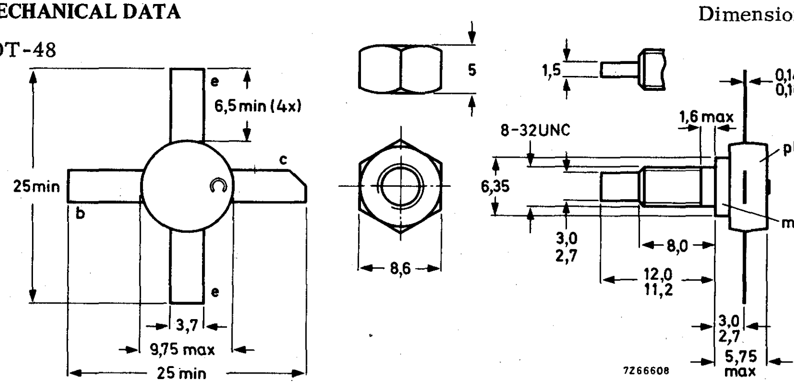
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Collector current (peak value)	I_{CM}	max.	4	A
Junction temperature	T_j	max.	200	^oC
Thermal resistance from junction to mounting base	$R_{th\ j\text{-}mb}$	=	5,5	$^oC/W$
Transition frequency				
I_C = 1 A; V_{CE} = 25 V	f_T	typ.	2,5	GHz
Output power at f_{vision} = 860 MHz *)				
I_C = 850 mA; V_{CE} = 25 V; T_h = 70 ^oC; d_{im} = −60 dB	$P_{o\ sync}$	>	3,5	W
Power gain at f_{vision} = 860 MHz				
I_C = 850 mA; V_{CE} = 25 V; T_h = 70 ^oC	G_p	>	5,0	dB

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

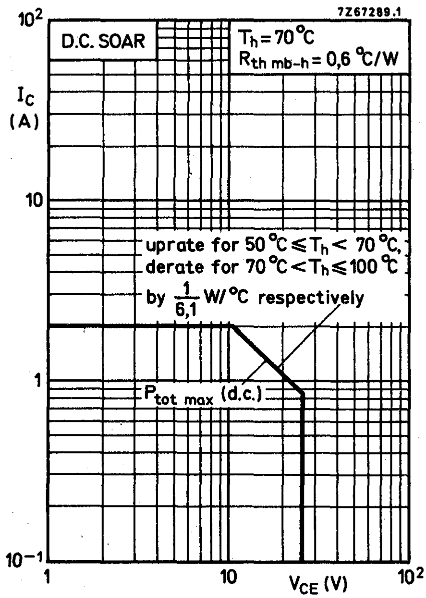
Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V

Currents

Collector current (d.c.)	I_C	max.	2	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4	A

Power dissipation

Total power dissipation at T_h = 70 °C	P_{tot}	max.	21,5	W



Temperatures

Storage temperature	T_{stg}	−65 to +200		°C
Junction temperature	T_j	max.	200	°C

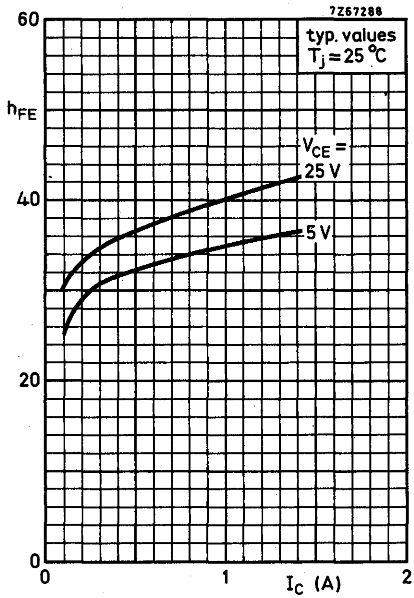
THERMAL RESISTANCE

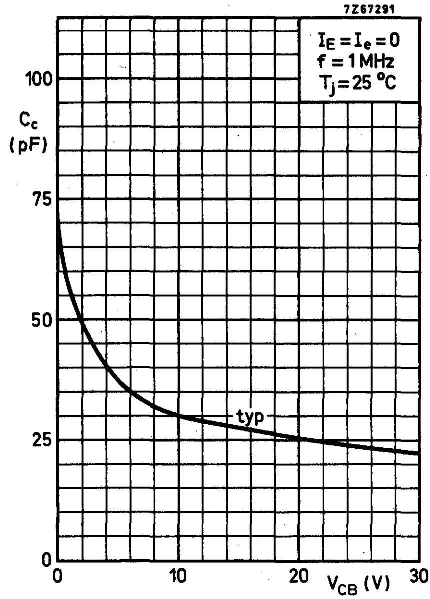
From junction to mounting base	$R_{th\ j-mb}$	=	5,5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	°C/W

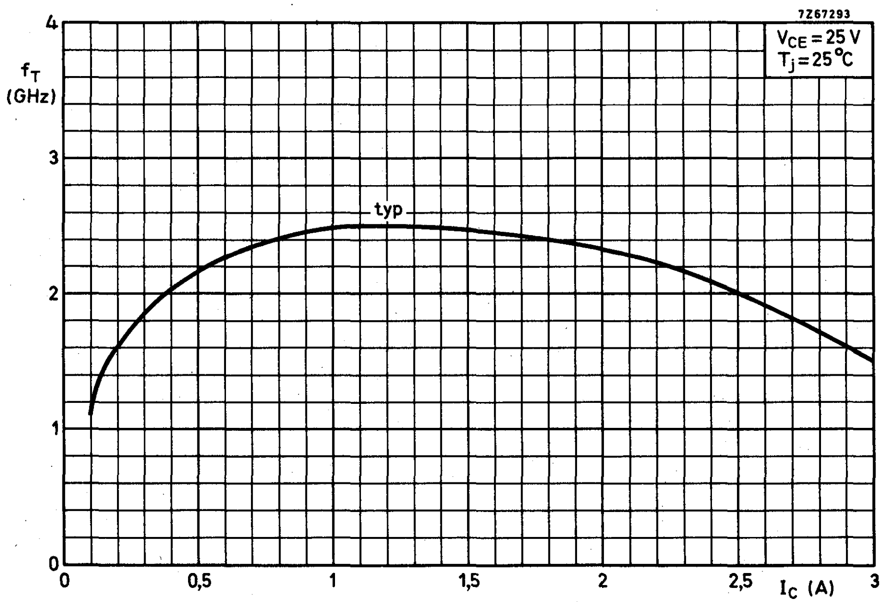
CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter; $I_C = 10$ mA	$V_{(BR)CBO}$	>	50	V
Collector-emitter voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	27	V
Emitter-base voltage open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	>	3,5	V
Saturation voltage				
$I_C = 500$ mA; $I_B = 100$ mA	V_{CEsat}	<	0,75	V
D.C. current gain				
$I_C = 1$ A; $V_{CE} = 25$ V	h_{FE}	> typ.	15 40	
Transition frequency				
$I_C = 1$ A; $V_{CE} = 25$ V	f_T	typ.	2,5	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ. <	24 30	pF pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 25$ V; $T_{mb} = 25\ ^oC$	C_{re}	typ.	15	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67288
typ. values
$T_j = 25\,^{\circ}C$
h_{FE}
$V_{CE} =$ 25 V
5 V
60
40
20
0
0
1
2
I_C (A)


7Z67291
$I_E = I_e = 0$
f = 1 MHz
$T_j = 25\,^{\circ}C$
C_c (pF)
typ
100
75
50
25
0
0
10
20
30
V_{CB} (V)

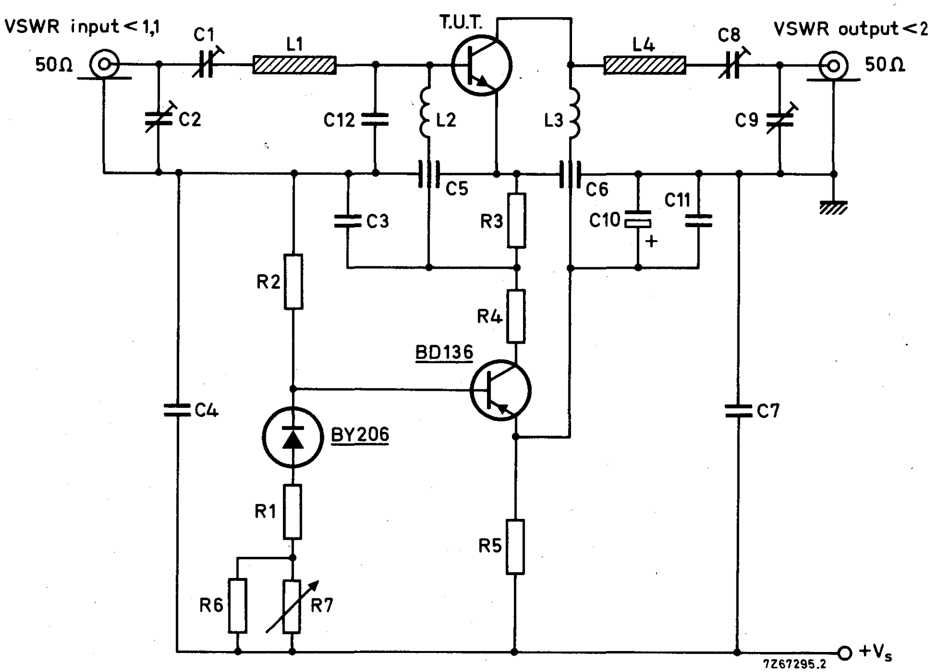

7Z67293
$V_{CE} = 25$ V
$T_j = 25\,^{\circ}C$
f_T (GHz)
typ
4
3
2
1
0
0
0,5
1
1,5
2
2,5
3
I_C (A)

APPLICATION INFORMATION

d_{im} (dB) *)	f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	G_p (dB)	$P_{o\ sync}$ (W) *)	T_h (°C)
−60	860	25	850	> 5,0	> 3,5	70
−60	860	25	850	typ. 5,5	typ. 4,0	70

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f_{vision} = 860 MHz



List of components: (see also page 6)

C1 = C2 = 1,4 to 5,5 pF film dielectric trimmers (2222 809 09001)
C3 = C4 = 100 nF polyester capacitors
C5 = C6 = 1 nF feed-through capacitors
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (2222 809 09002)
C10 = 10 μF/40 V solid aluminium electrolytic capacitor
C11 = 470 nF polyester capacitor
C12 = 2 x 3,3 pF chip capacitors (in parallel)

APPLICATION INFORMATION (continued)

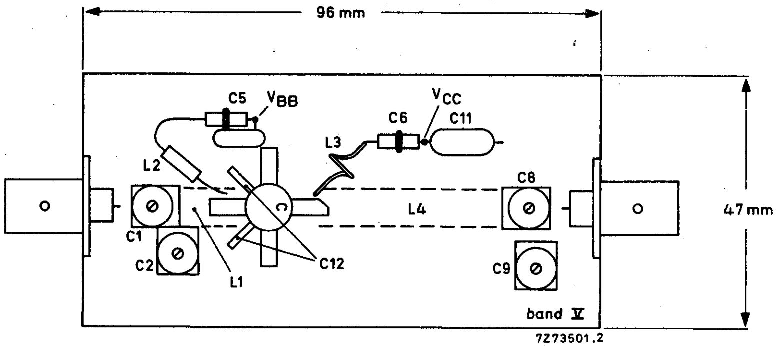
List of components: (continued)

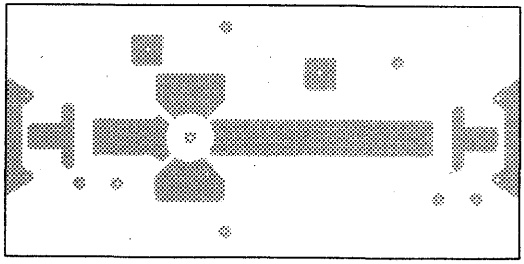
R1 = 150 Ω
R2 = 1,8 kΩ
R3 = 33 Ω
R4 = 220 Ω (1 W)
R5 = 4 x 12 Ω in parallel (4 x 1 W)
R6 = 1 kΩ
R7 = 220 Ω (potentiometer)

L1 = stripline (13,6 mm x 6,9 mm)
L2 = micro choke 0,47 μH (cat. no. 4322 057 04770)
L3 = 1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm
L4 = stripline (40,8 mm x 6,9 mm)

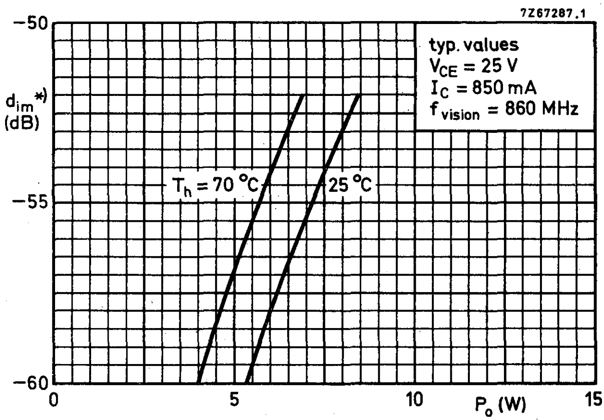
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,45 mm.

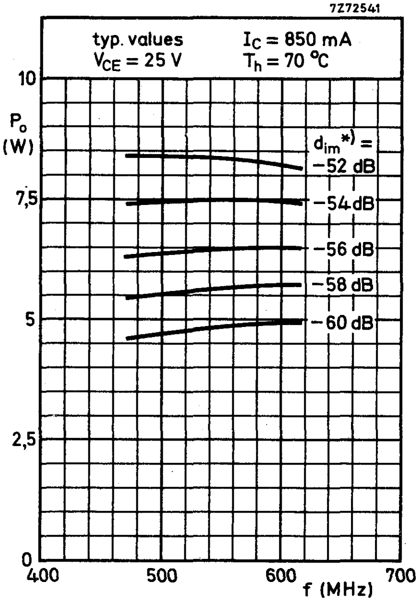
Component layout and printed-circuit board for 860 MHz test circuit.



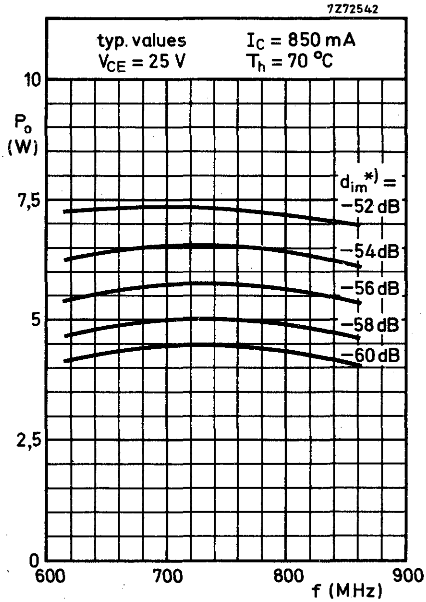


The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.





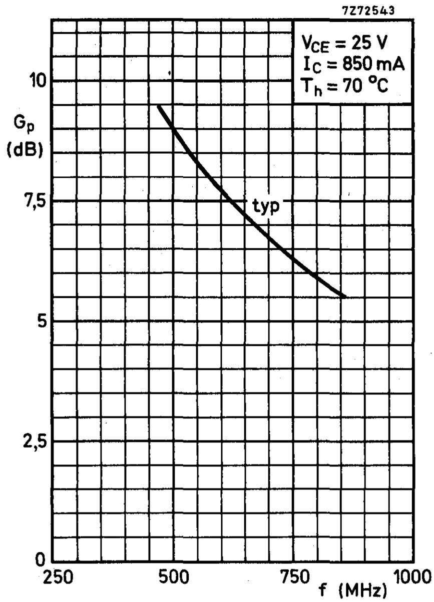
Measured in a TV band IV circuit.

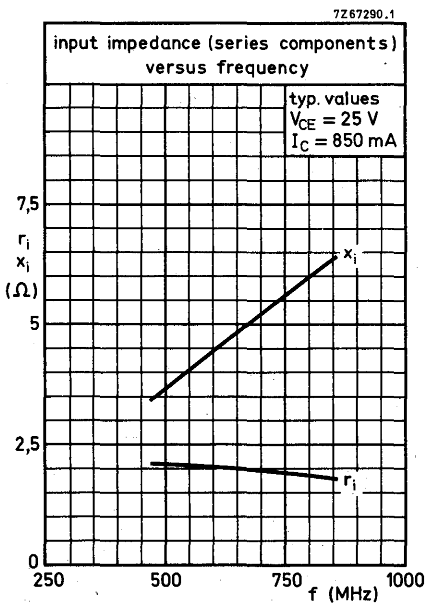


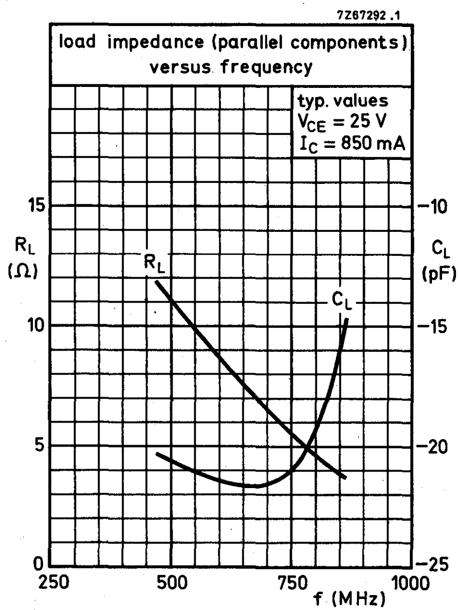
Measured in a TV band V circuit.

Detailed information concerning these circuits, available on request.

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ≤ −75 dB.


7Z72543
V_{CE} = 25 V
I_C = 850 mA
T_h = 70 °C
G_p (dB)
10
7,5
5
2,5
0
typ
250
500
750
1000
f (MHz)


7Z67290.1
input impedance (series components) versus frequency
typ. values
V_{CE} = 25 V
I_C = 850 mA
r_i x_i (Ω)
7,5
5
2,5
0
x_i
r_i
250
500
750
1000
f (MHz)


7Z67292.1
load impedance (parallel components) versus frequency
typ. values
V_{CE} = 25 V
I_C = 850 mA
R_L (Ω)
15
10
5
0
C_L (pF)
−10
−15
−20
−25
R_L
C_L
250
500
750
1000
f (MHz)

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13.5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply overvoltage to 16.5 V. It has a $\frac{1}{4}$" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

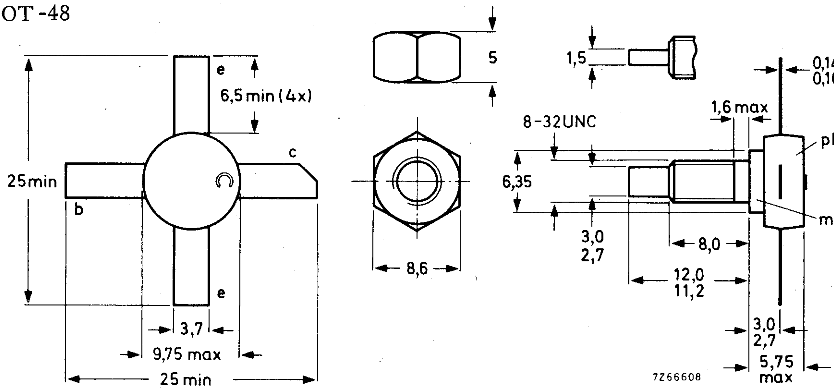
R.F. performance up to T_{mb} = 25 °C in an unneutralised common-emitter class B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	13.5	175	< 1.0	8	< 0.85	> 9	> 70	2.8 + j1.2	76 − j16
c.w.	12.5	175	typ. 1.0	8	typ. 0.91	typ. 9	typ. 70	–	–

MECHANICAL DATA

Dimensions in mm

SOT-48



Torque on nut: min. 7.5 kg cm
(0.75 Newton metres)
max. 8.5 kg cm
(0.85 Newton metres)

Diameter of clearance hole in heatsink: max. 4.17 mm.
Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required, an adhesive instead of a lock washer is preferred.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

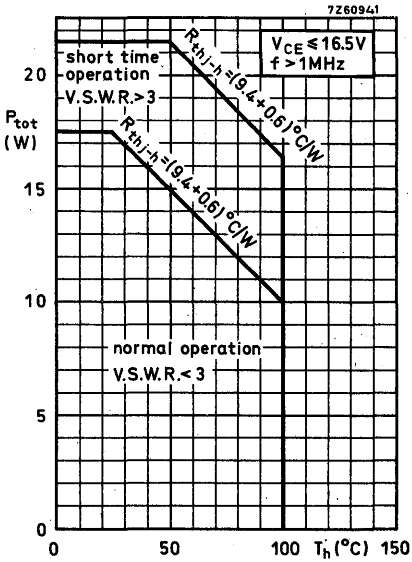
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

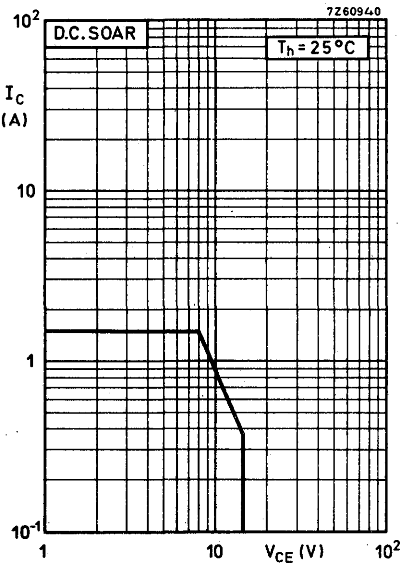
Currents

Collector current (average)	$I_{C(AV)}$	max.	1.25	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	3.75	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	17.5	W





Temperature

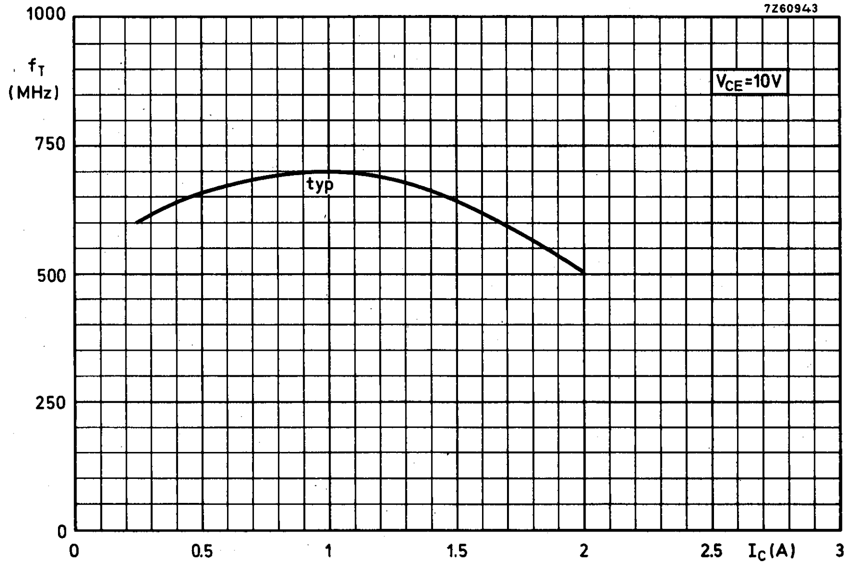
Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

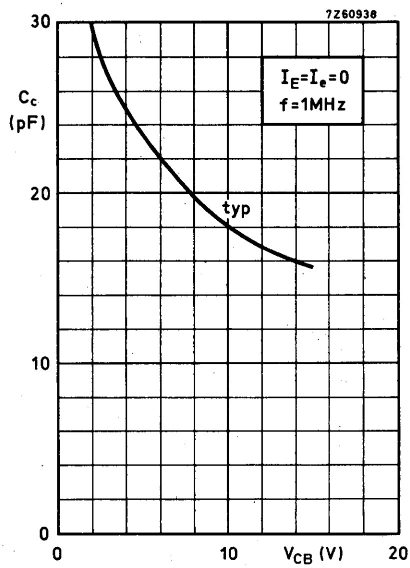
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	9.4	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.6	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14\ V$	I_{CEO}	$<$	5	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 1$ mA	$V_{(BR)CBO}$	$>$	36	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	$>$	18	V
Emitter-base voltage open collector, $I_E = 1$ mA	$V_{(BR)EBO}$	$>$	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz; open base	E	$>$	0.5	mWs
$L = 25$ mH; $f = 50$ Hz; $-V_{BE} = 1.5\ V$; $R_{BE} = 33\ \Omega$	E	$>$	0.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	$>$	5	
Transition frequency				
$I_C = 500$ mA; $V_{CE} = 10$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	15	pF
		$<$	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	11	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60943
1000
f_T
(MHz)
750
500
250
0
V_{CE}=10V
typ
0
0.5
1
1.5
2
2.5
I_C (A)
3


7Z60938
30
C_c
(pF)
20
10
0
I_E=I_e=0
f=1MHz
typ
0
10
V_{CB} (V)
20

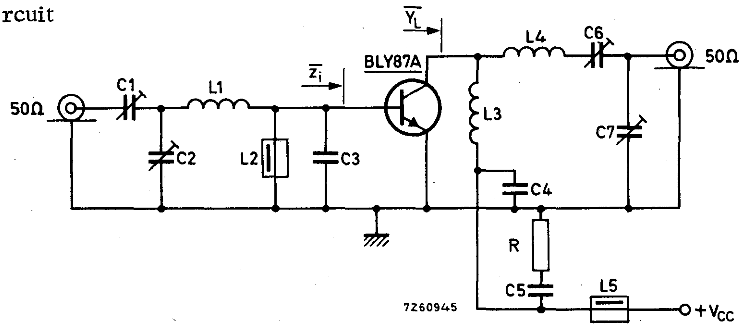
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C (A)	G_p(dB)	η(%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$(mA/V)
13.5	< 1.0	8	< 0.85	> 9	> 70	2.8 + j1.2	76 − j16
12.5	typ. 1.0	8	typ. 0.91	typ. 9	typ. 70	–	–

Test circuit



C1 = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = 47 pF ceramic
C4 = 100 pF ceramic
C5 = 150 nF polyester

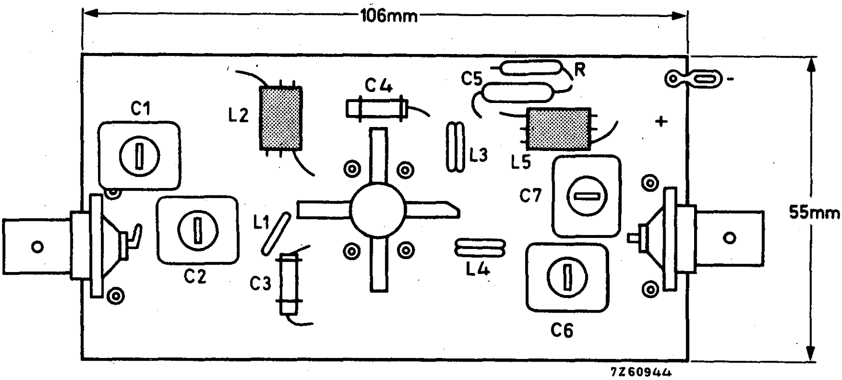
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2 = L5 = ferroxcube choke (code number 4312 020 36640)
L3 = 2.5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L4 = 4.5 turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm

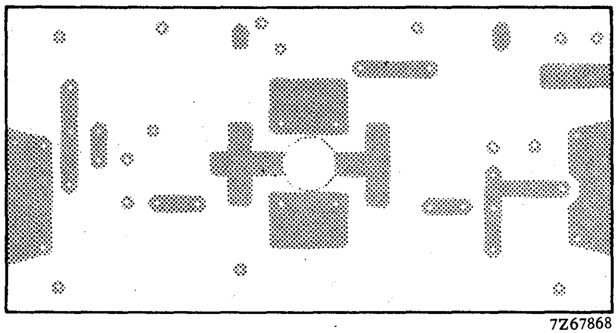
R = 10 Ω carbon

Component lay-out for 175 MHz test circuit see page 6

APPLICATION INFORMATION (continued)

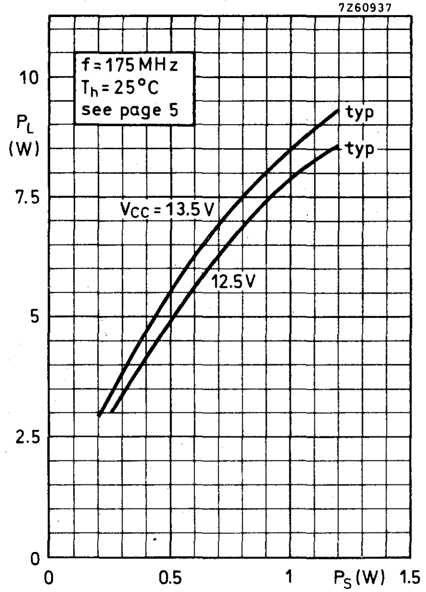
Component lay-out and printed circuit board for 175 MHz test circuit.

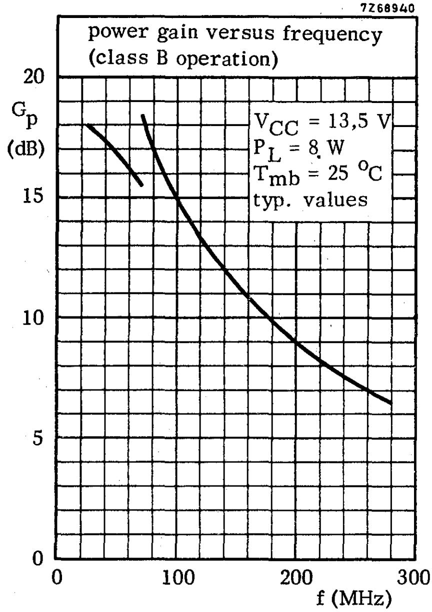


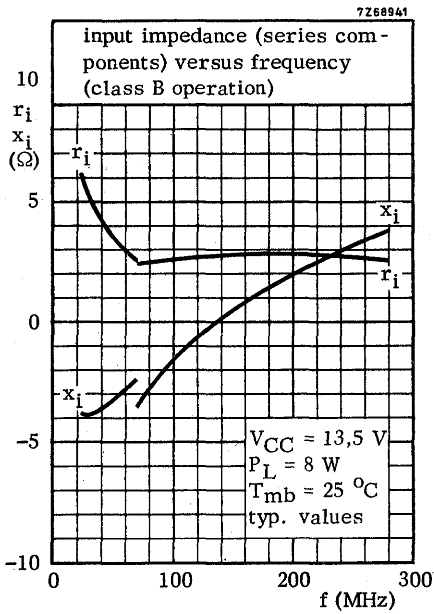


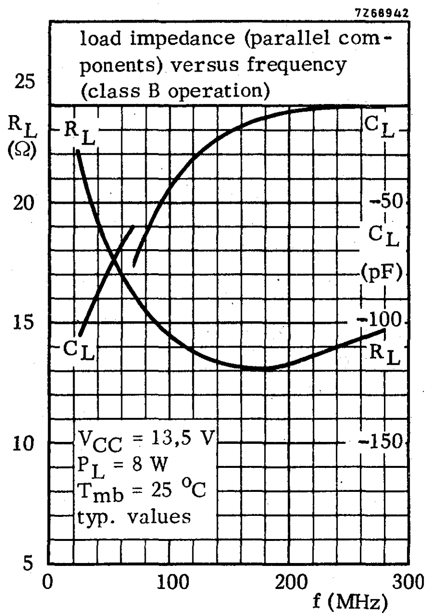
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

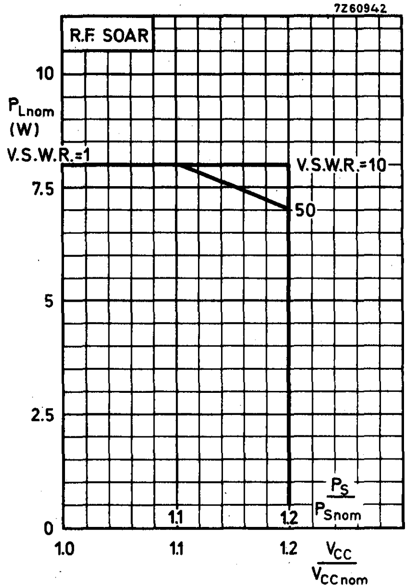
OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

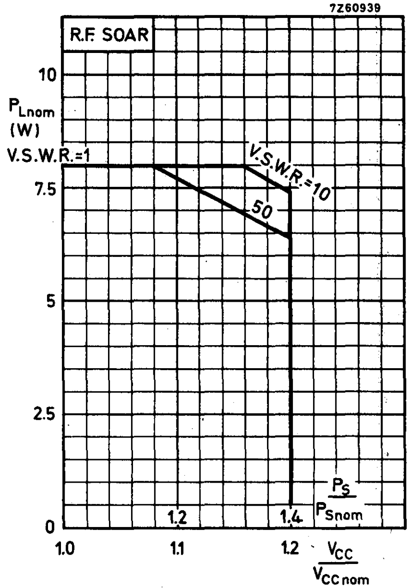












Conditions for R.F. SOAR:

f	= 175 MHz	$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
T_h	= 70 °C	$R_{th\ mb\text{-}h} \leq 0.6$ °C/W
V_{CCnom}	= 12.5 or 13.5 V	see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.

The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.

The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).

Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

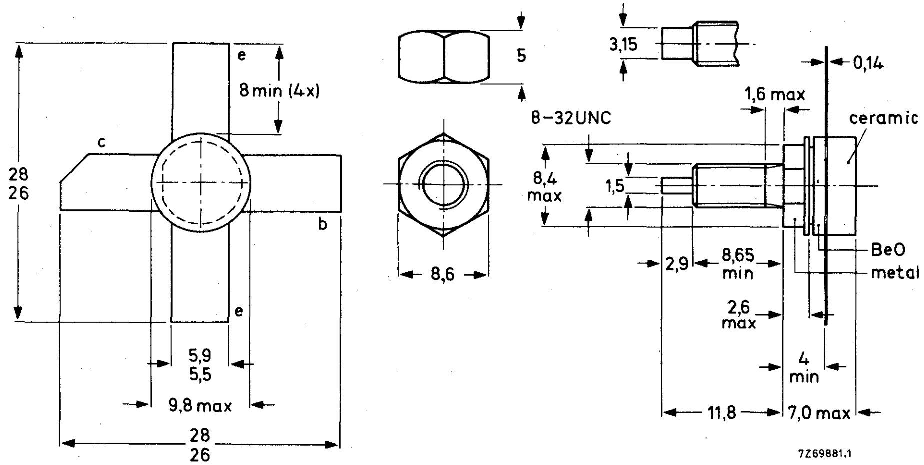
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**13,5**	**175**	**8**	**> 12,0**	**> 60**	**2,2 + j0,4**	**96 – j28**
c.w.	12,5	175	8	typ. 11,5	typ. 65	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	4,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W

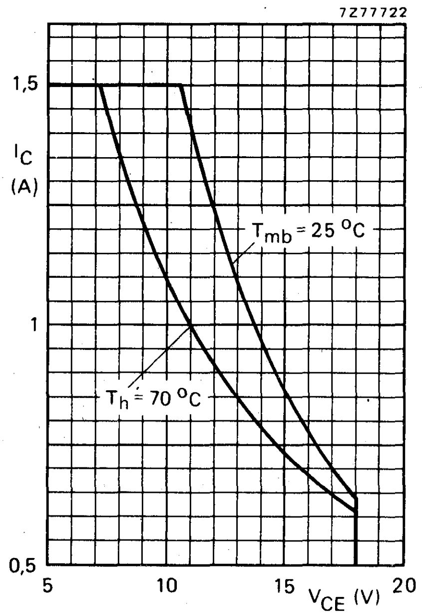


Fig. 2 D.C. SOAR.

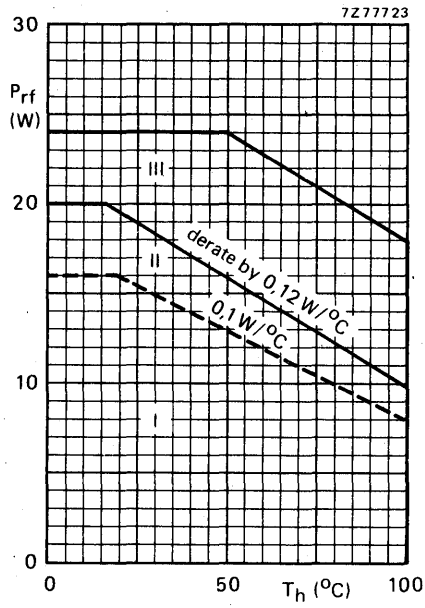


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage			
open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage			
open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain *			
$I_C = 0{,}75$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage *			
$I_C = 2$ A; $I_B = 0{,}4$ A	V_{CEsat}	typ.	0,85 V
Transition frequency at f = 100 MHz *			
$-I_E = 0{,}75$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	950 MHz
$-I_E = 2$ A; $V_{CB} = 13{,}5$ V	f_T	typ.	850 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 13{,}5$ V	C_c	typ.	16,5 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 13{,}5$ V	C_{re}	typ.	12 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

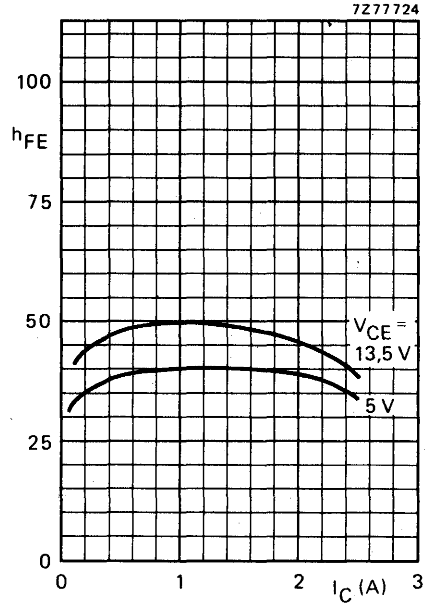


Fig. 4 Typical values; T_j = 25 °C.

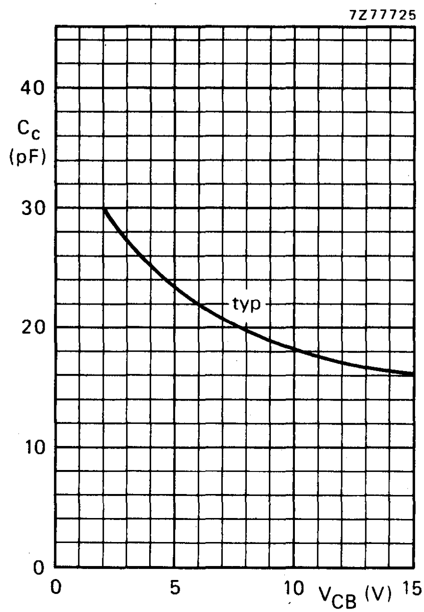


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

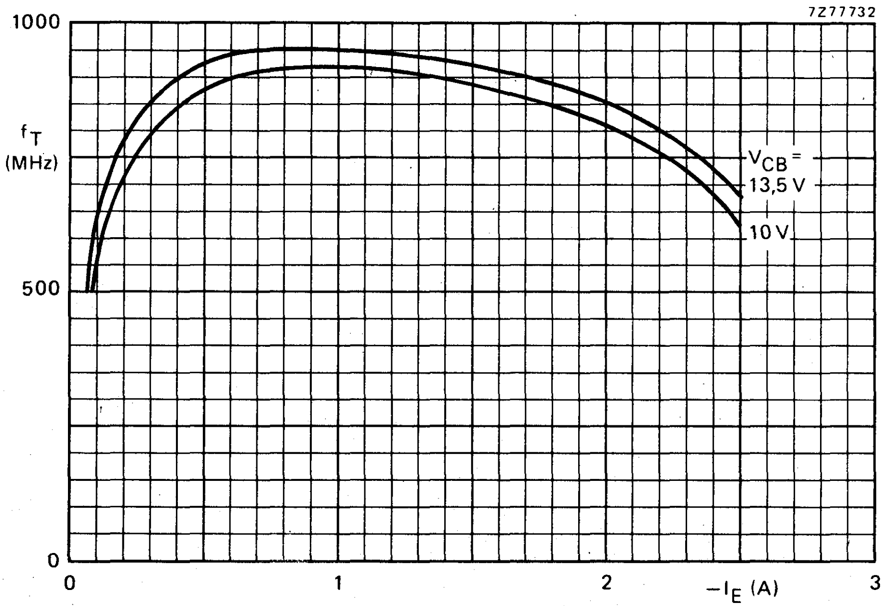


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**13,5**	**8**	**< 0,5**	**> 12,0**	**< 0,99**	**> 60**	**2,2 + j0,4**	**96 – j28**
175	12,5	8	–	typ. 11,5	–	typ. 65	–	–

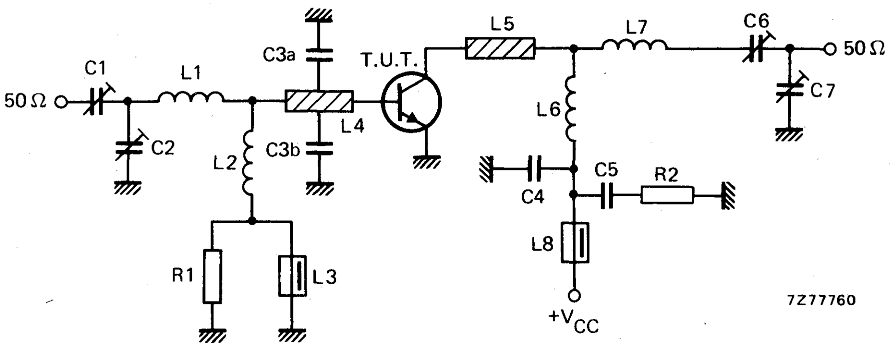


Fig. 7 Test circuit; c.w. class-B.

List of components:

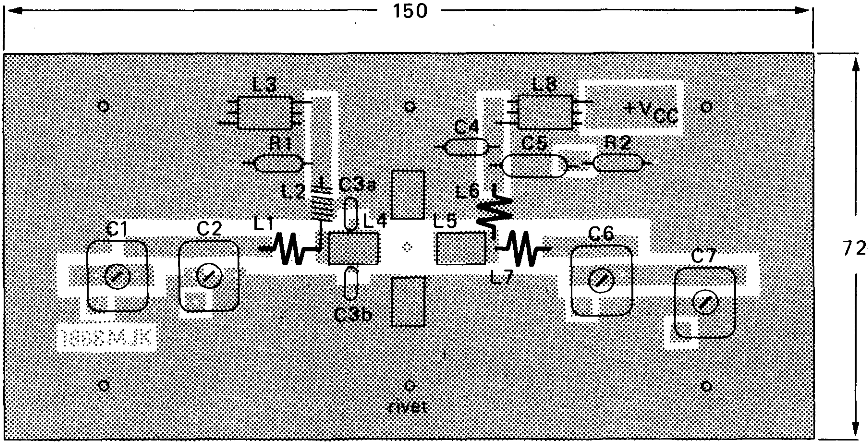
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



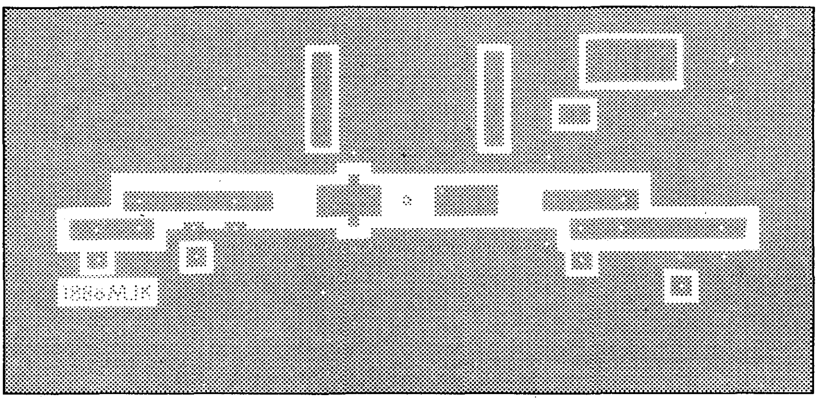


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

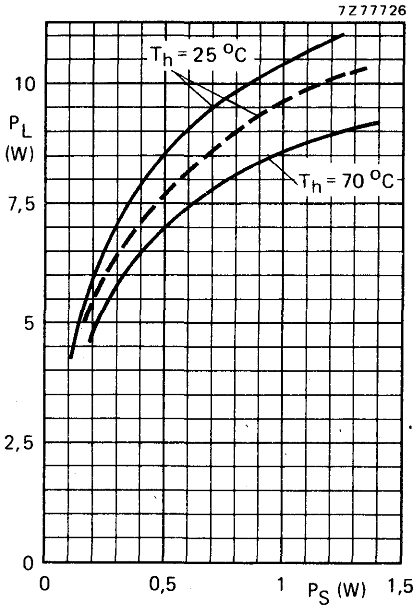


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

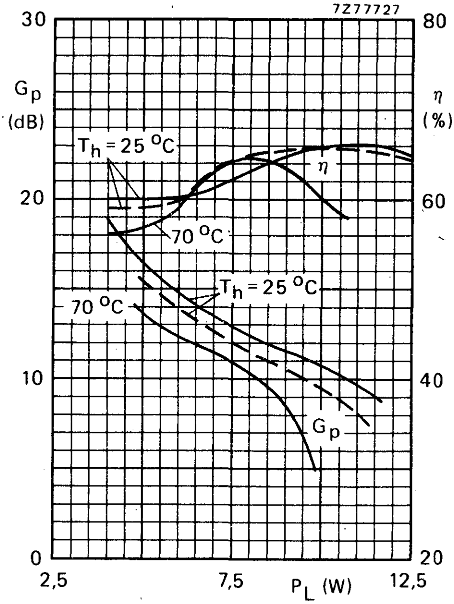


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

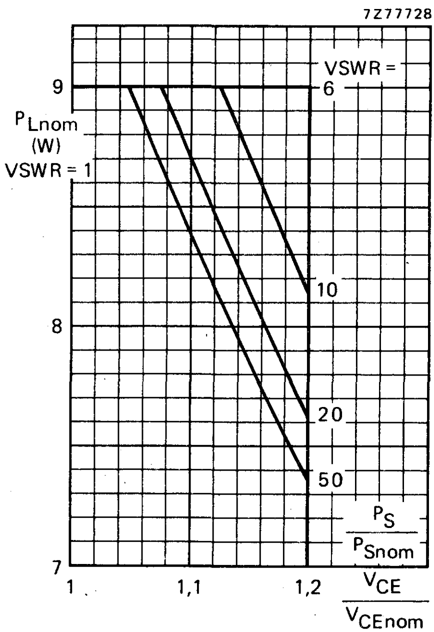


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,45 °C/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

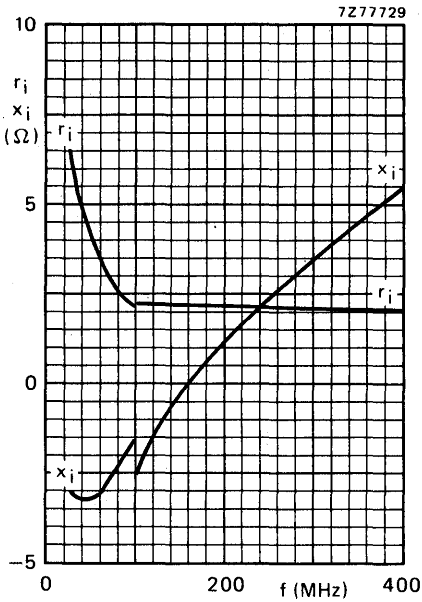


Fig. 12 Input impedance (series components).

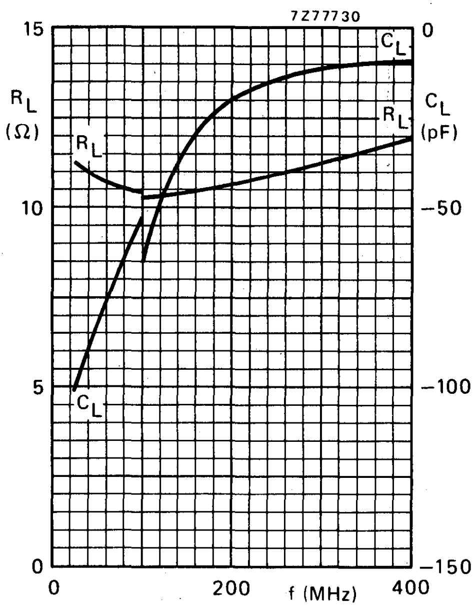


Fig. 13 Load impedance (parallel components).

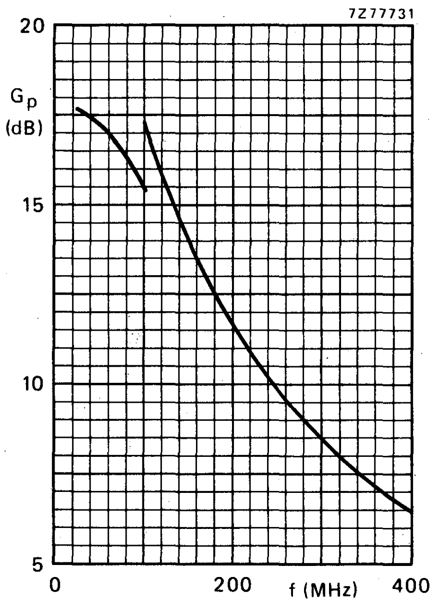


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13.5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply overvoltage to 16.5 V. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

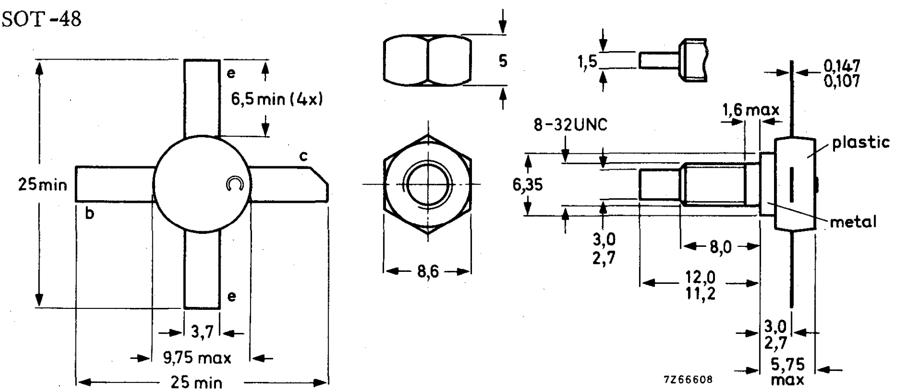
R.F. performance up to T_{mb} = 25 °C in an unneutralised common-emitter class B circuit.

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
c.w.	13.5	175	< 2.65	15	< 1.71	> 7.5	> 65	2.3+j2.2	128−j4.4
c.w.	12.5	175	typ. 2.65	15	typ. 1.85	typ. 7.5	typ. 65	−	−

MECHANICAL DATA

Dimensions in mm

SOT-48



Torque on nut: min. 7.5 kg cm
(0.75 Newton metres)
max. 8.5 kg cm
(0.85 Newton metres)

Diameter of clearance hole in heatsink: max. 4.17 mm.
Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required, an adhesive instead of a lock washer is preferred.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

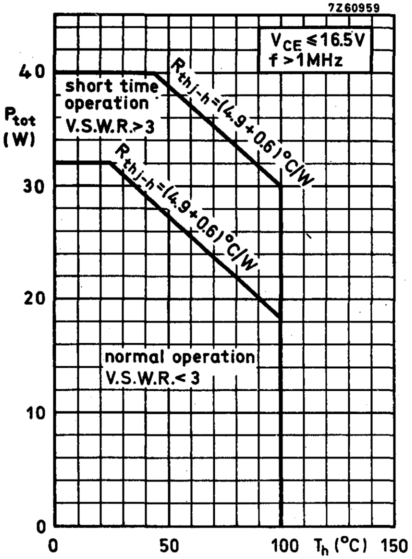
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

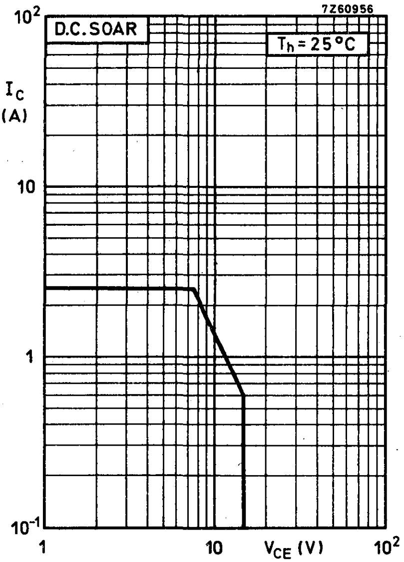
Currents

Collector current (average)	$I_{C(AV)}$	max.	2.5	A
Collector (peak value) f > 1 MHz	I_{CM}	max.	7.5	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	32	W





Temperature

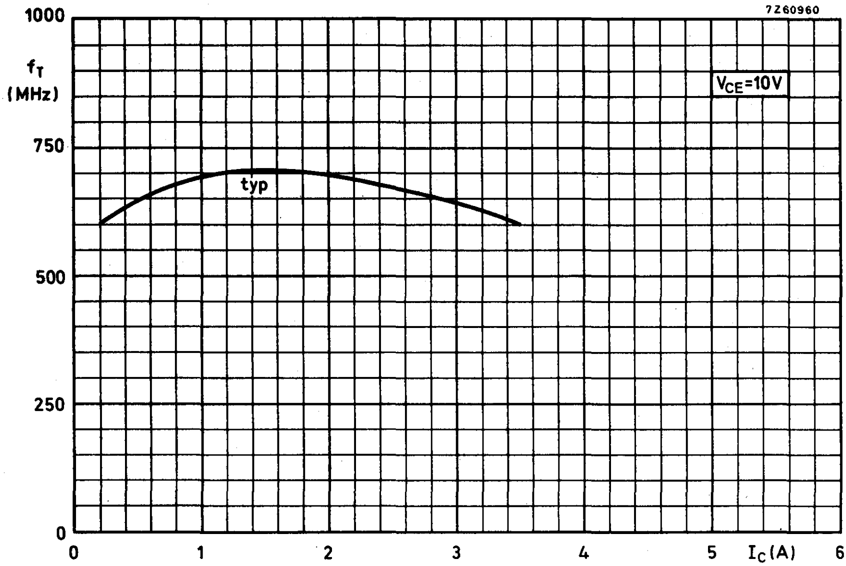
Storage temperature	T_{stg}	-30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

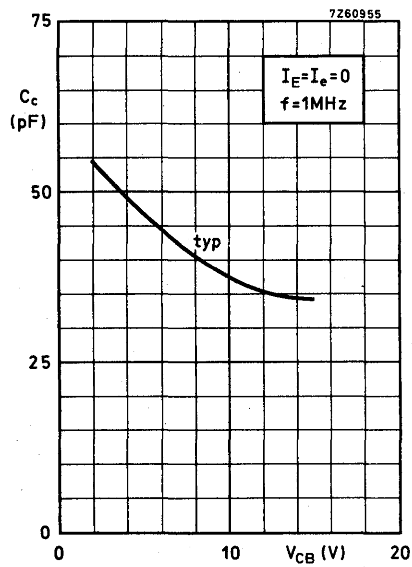
THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j-mb}$	=	4.9	°C/W
From mounting base to heatsink	R_{mb-h}	=	0.6	°C/W

CHARACTERISTICS $T_j = 25\,^{o}C$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ V	I_{CEO}	<	10	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 3$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; $I_E = 3$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz				
open base	E	>	2.0	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\,\Omega$	E	>	4.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 1$ A; $V_{CE} = 10$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	34	pF
		<	40	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	25	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60960
1000
f_T
(MHz)
750
500
250
0
V_{CE}=10V
typ
0
1
2
3
4
5
I_C (A)
6


7Z60955
75
C_c
(pF)
50
25
0
I_E=I_e=0
f=1MHz
typ
0
10
V_{CB} (V)
20

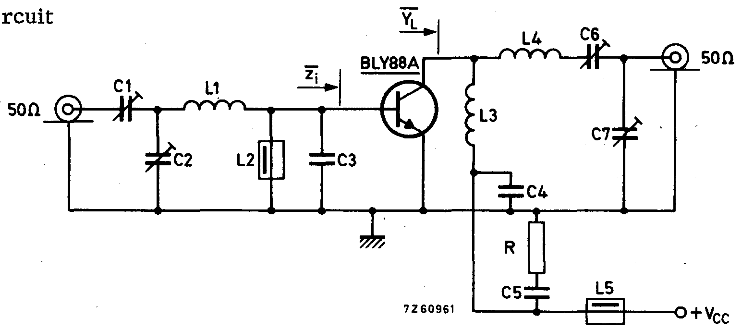
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C(A)	G_p(dB)	η(%)	$\bar{z}_i$(Ω)	$\bar{Y}_L$(mA/V)
13.5	< 2.65	15	< 1.71	> 7.5	> 65	2.3+j2.2	128−j4.4
12.5	typ. 2.65	15	typ. 1.85	typ. 7.5	typ. 65	–	–

Test circuit



C1= 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2=C6=C7= 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3= 47 pF ceramic
C4= 100 pF ceramic
C5= 150 nF polyester

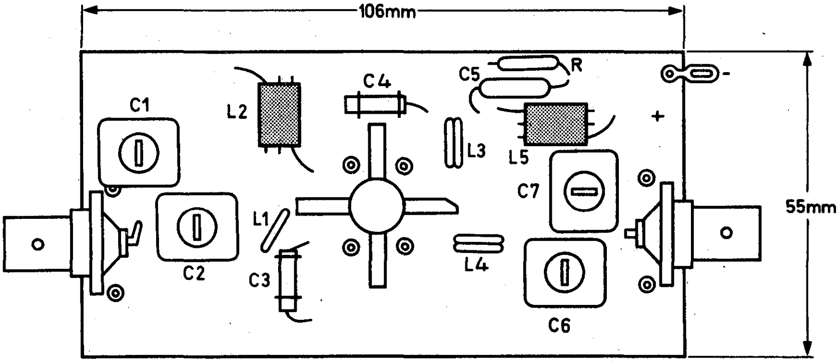
L1= 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2=L5= ferroxcube choke (code number 4312 020 36640)
L3= 2.5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L4= 2.5 turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm

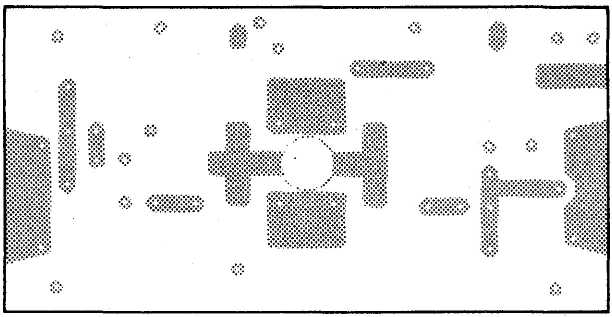
R = 10 Ω carbon

Component lay-out for 175 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

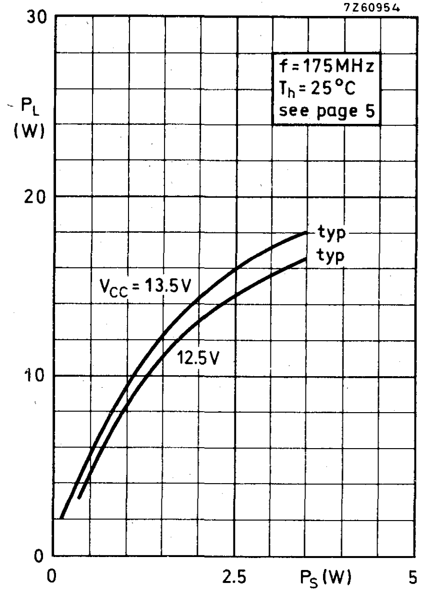


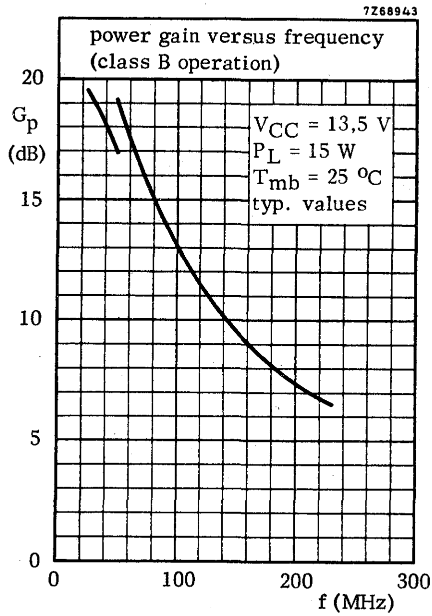


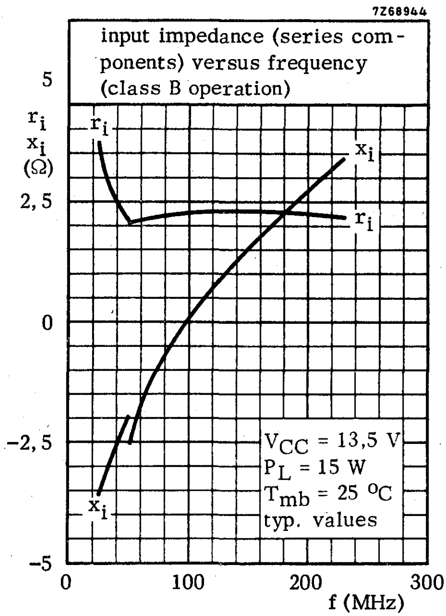
7Z67868

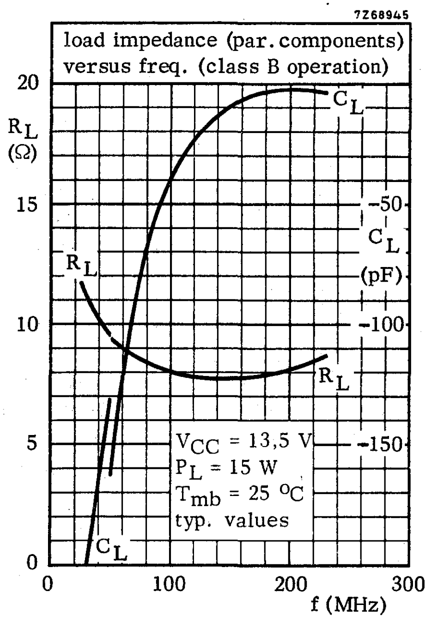
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

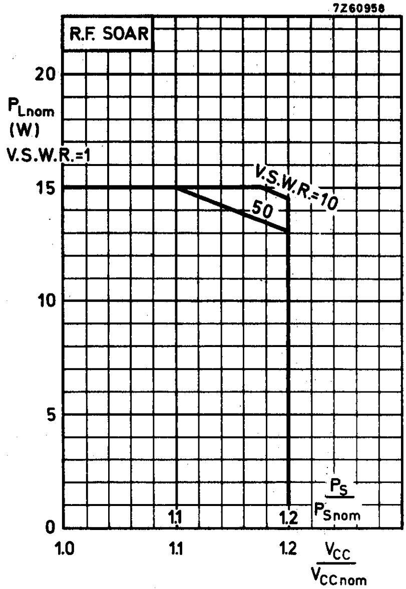
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

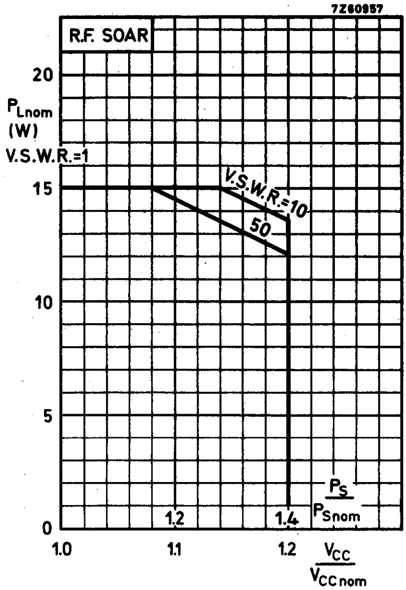












Conditions for R.F. SOAR:

f = 175 MHz $\quad P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
T_h = 70 °C $\quad R_{th\ mb-h} = 0.6$ °C/W
V_{CCnom} = 12.5 or 13.5 V see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

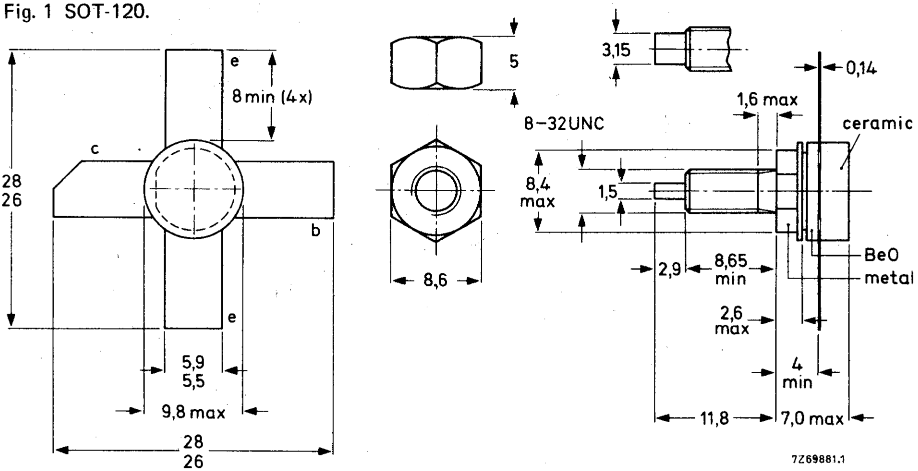
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	15	> 8,0	> 60	2,3 + j2,2	130 – j4,4
c.w.	12,5	175	15	typ. 7,5	typ. 67	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

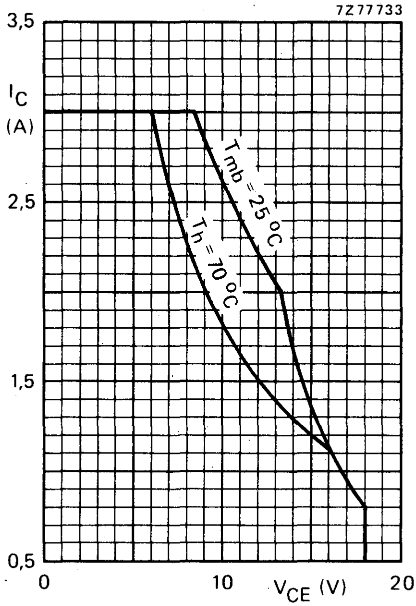


Fig. 2 D.C. SOAR.

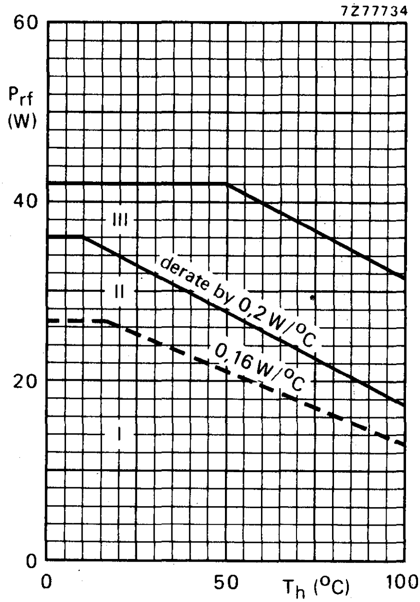


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\,j\text{-}mb(dc)}$	= 6,55 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\,j\text{-}mb(rf)}$	= 4,95 °C/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	= 0,45 °C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage			
open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage			
open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	2,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5 mJ
D.C. current gain*			
$I_C = 1,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage*			
$I_C = 4,5$ A; $I_B = 0,9$ A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 100 MHz*			
$-I_E = 1,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850 MHz
$-I_E = 4,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	800 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	32 pF
Feedback capacitance at f = 1 MHz			
$I_C = 200$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	23 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

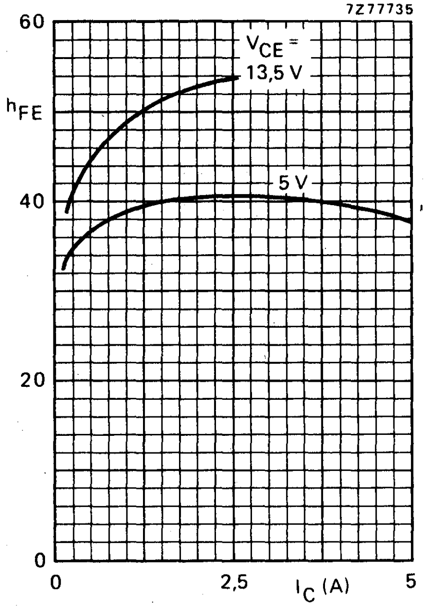


Fig. 4 Typical values; T_j = 25 °C.

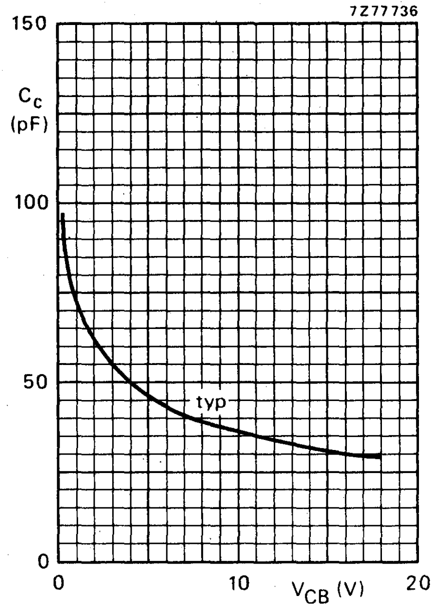


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

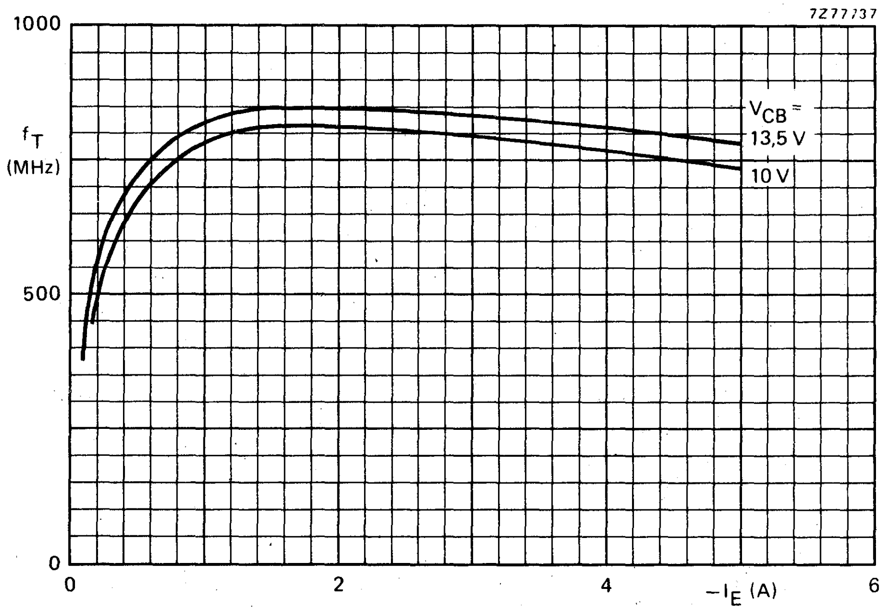


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	13,5	15	< 2,4	> 8,0	< 1,85	> 60	2,3 + j2,2	130 – j4,4
175	12,5	15	–	typ. 7,5	–	typ. 67	–	–

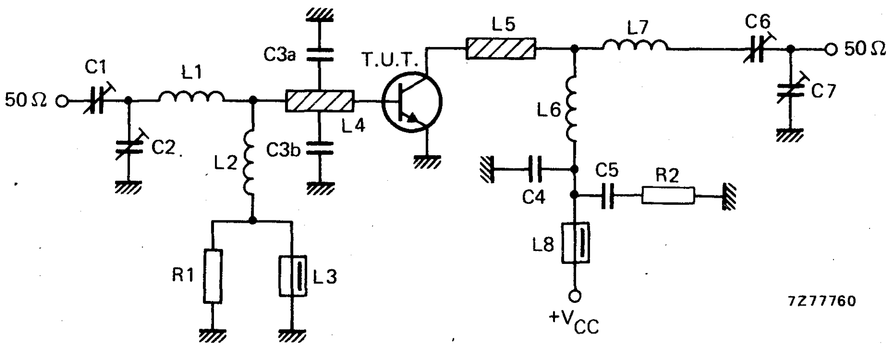


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

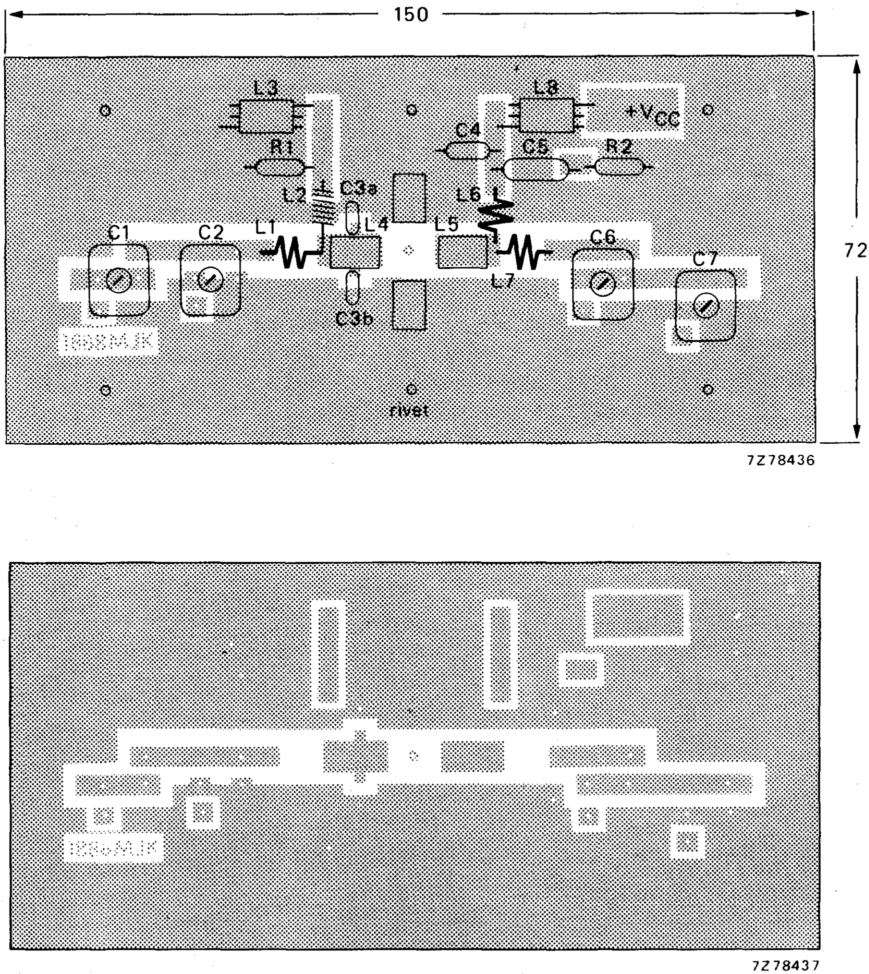


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

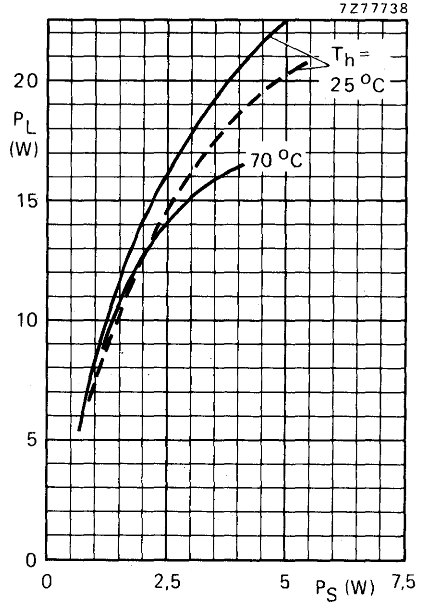


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

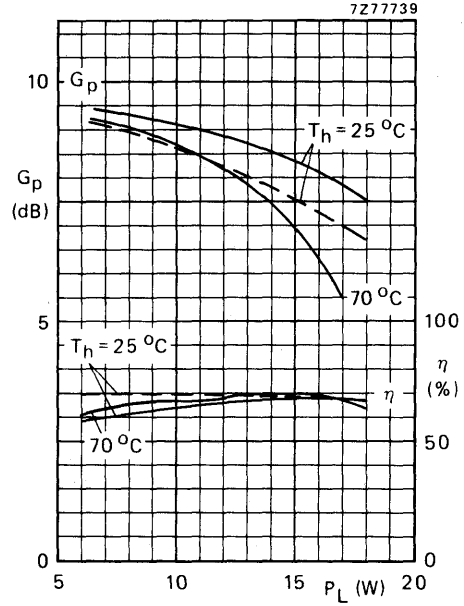


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

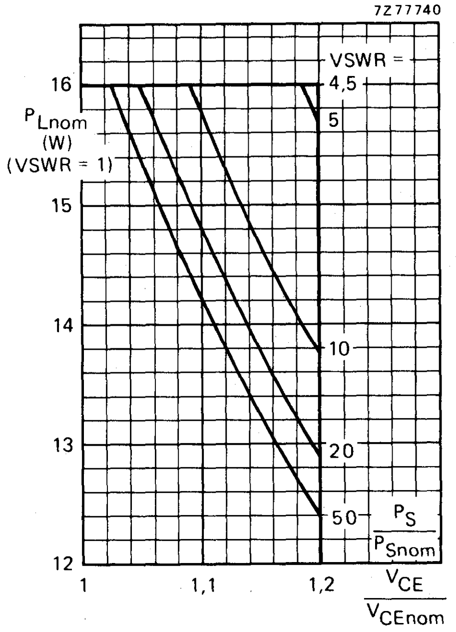


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\,mb\text{-}h}$ = 0,45 °C/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

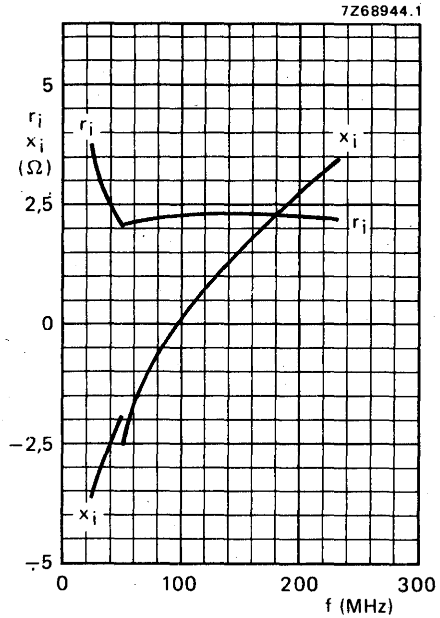


Fig. 12 Input impedance (series components).

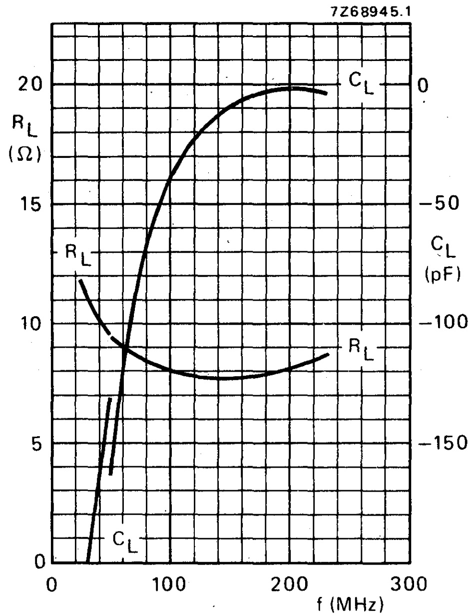


Fig. 13 Load impedance (parallel components).

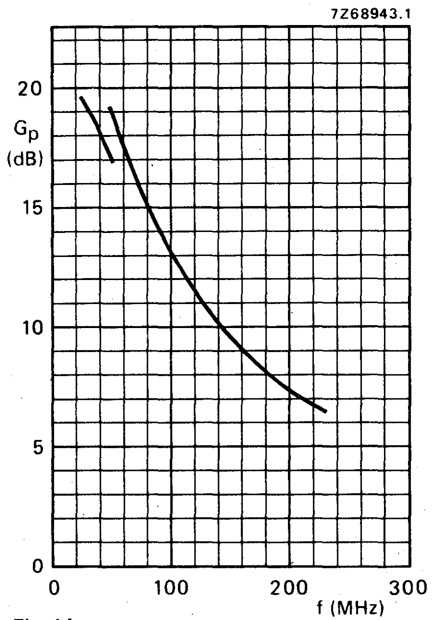


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values: V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

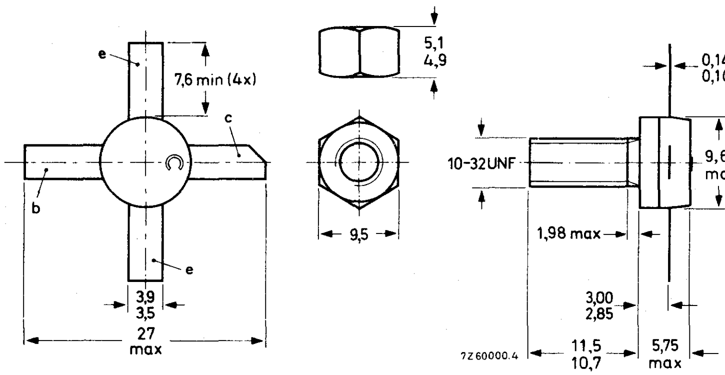
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	< 6,25	25	< 2,64	> 6	> 70	1,6 + j1,4	213 + j5,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 5,0 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

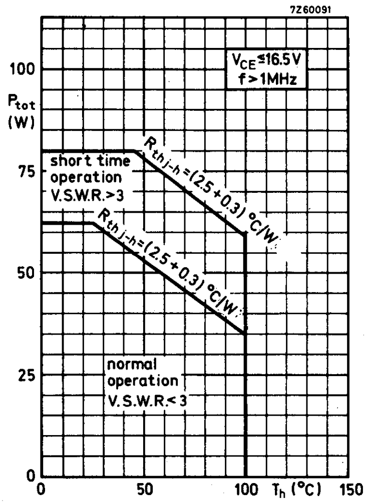
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

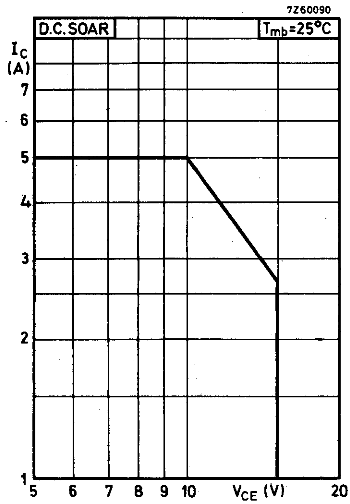
Currents

Collector current (average)	$I_{C(AV)}$	max.	5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	70	W





Temperature

Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	2.5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.3	°C/W

CHARACTERISTICS $T_j = 25\,^oC$ unless otherwise specified

Breakdown voltages

Collector-base voltage open emitter, $I_C = 50$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 50$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V

Transient energy

$L = 25$ mH; $f = 50$ Hz

open base	E	>	8	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\,\Omega$	E	>	8	mWs

D.C. current gain

$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50	
		10 to	120	

Transition frequency

$I_C = 4$ A; $V_{CE} = 10$ V	f_T	typ.	650	MHz

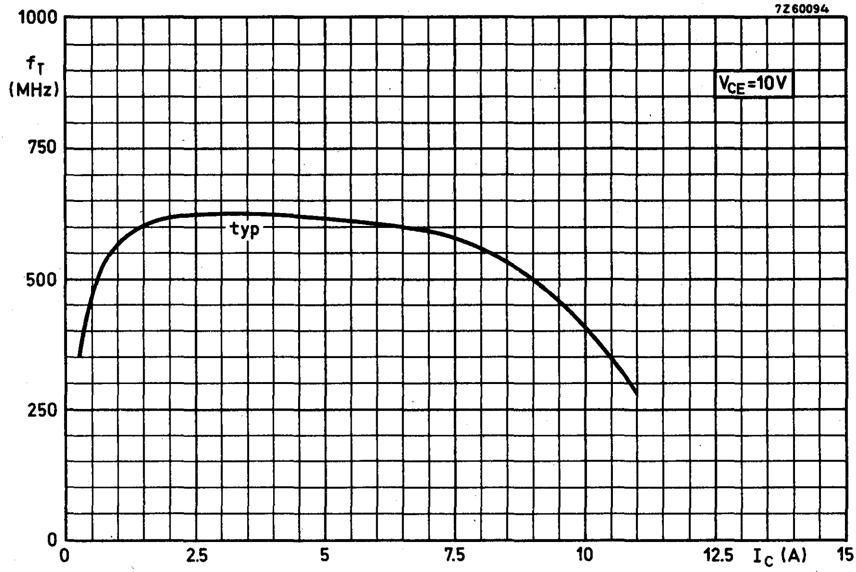
Collector capacitance at $f = 1$ MHz

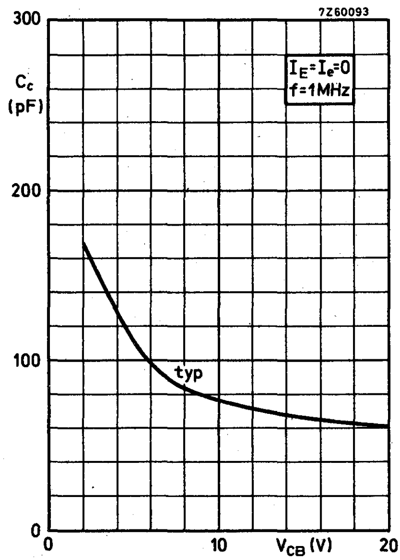
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	65	pF
		<	90	pF

Feedback capacitance at $f = 1$ MHz

$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	41	pF

Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60094
1000
f_T
(MHz)
750
500
250
0
$V_{CE}=10V$
typ
0
2.5
5
7.5
10
12.5
I_C (A)
15


7Z60093
300
C_c
(pF)
200
100
0
$I_E=I_e=0$
f=1MHz
typ
0
10
V_{CB} (V)
20

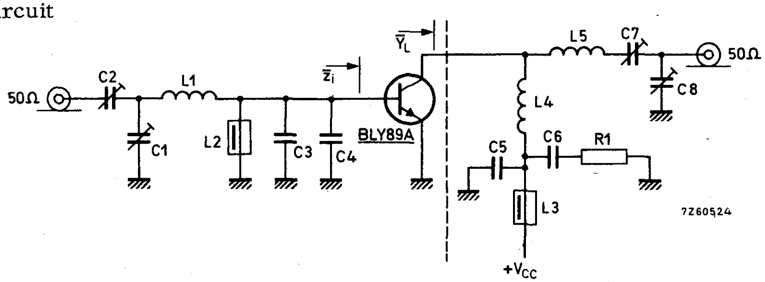
APPLICATION INFORMATION

R. F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 13.5 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
175	< 6.25	25	< 2.64	> 6	> 70	1.6+j1.4	213 + j5.5

Test circuit



C1 =	4 to 44 pF	film dielectric trimmer (code number 2222 809 07008)
C2 =	2 to 22 pF	film dielectric trimmer (code number 2222 809 07004)
C3 = C4 =	47 pF	ceramic
C5 =	100 pF	ceramic
C6 =	150 nF	polyester
C7 =	4 to 104 pF	film dielectric trimmer (code number 2222 809 07015)
C8 =	4 to 64 pF	film dielectric trimmer (code number 2222 809 07011)

L1 = 0.5 turn enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm

L2 = L3 = ferroxcube choke (code number 4312 020 36640)

L4 = 3.5 turns closely wound enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm

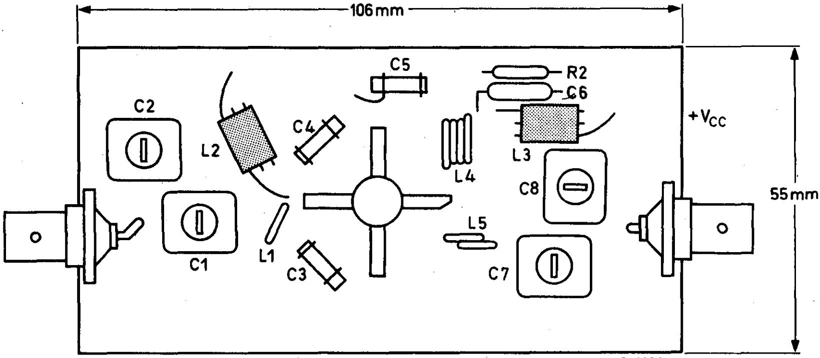
L5 = 1 turn enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm

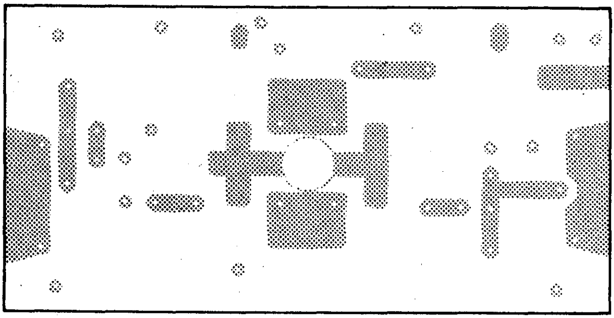
R1 = 10 Ω carbon

Component lay-out for 175 MHz see page 6.

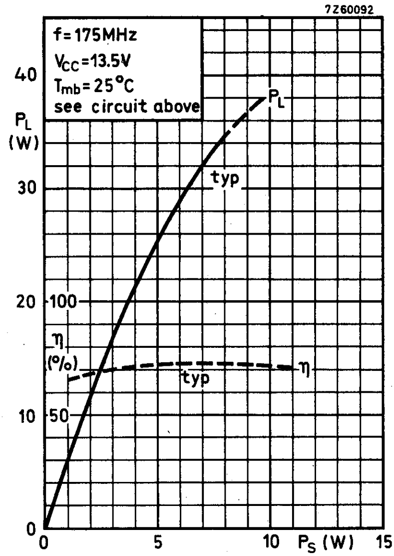
APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.




7Z67868

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

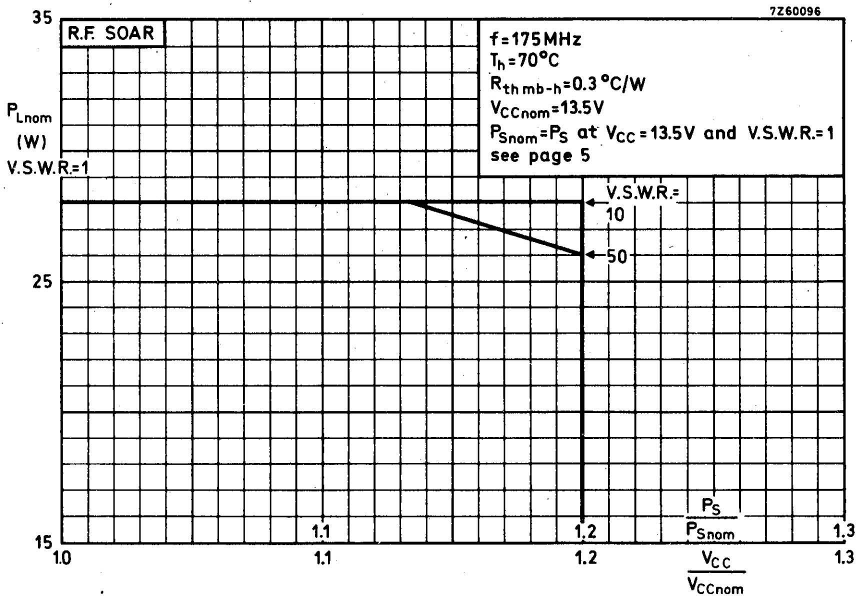


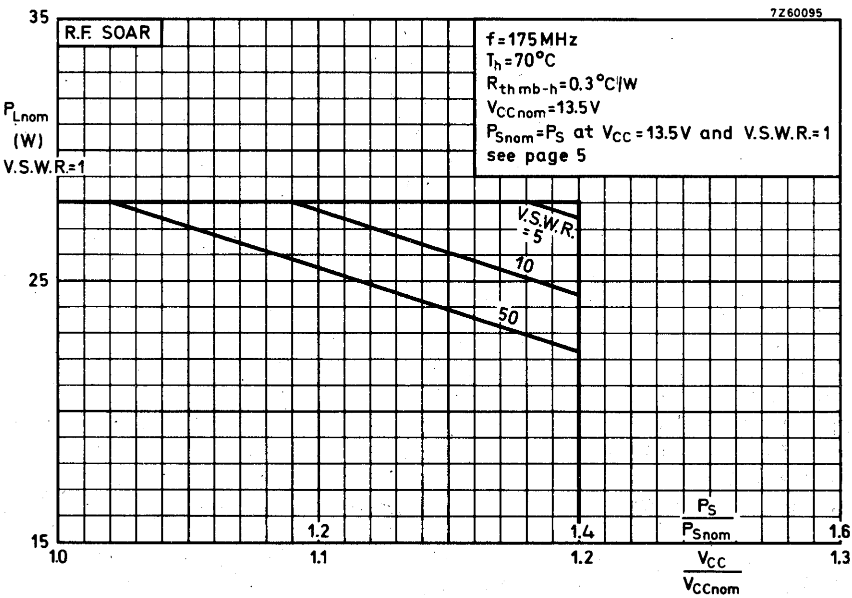
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs on page 8 for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter

The upper graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.

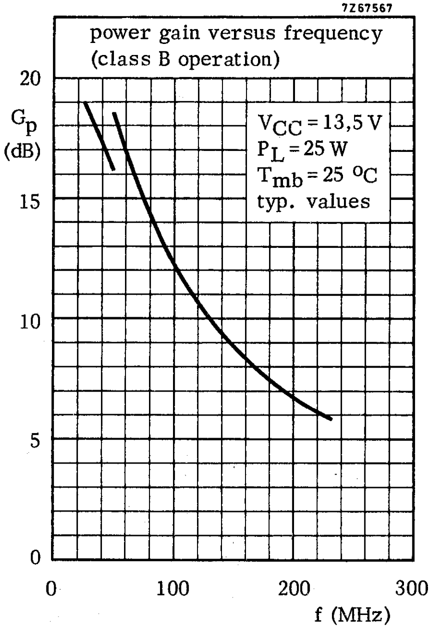
The lower graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).

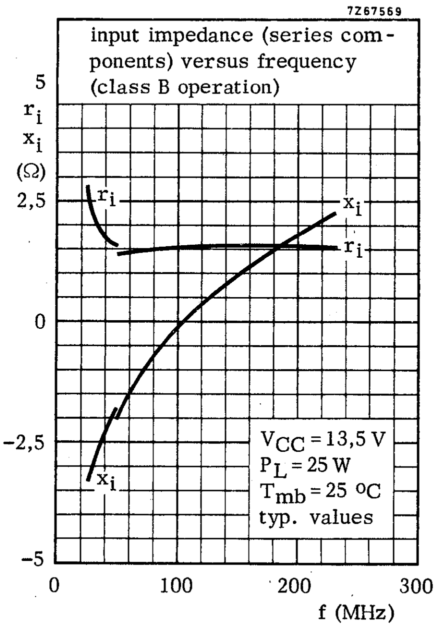
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

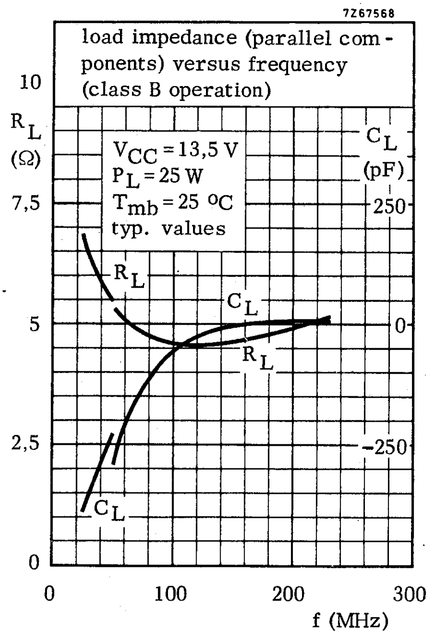

7Z60096
R.F. SOAR
35
25
15
P_{Lnom} (W) V.S.W.R.=1
f=175 MHz
T_h=70°C
$R_{th\,mb-h}$=0.3 °C/W
V_{CCnom}=13.5V
P_{Snom}=P_S at V_{CC}=13.5V and V.S.W.R.=1
see page 5
V.S.W.R.=
10
50
$\frac{P_S}{P_{Snom}}$
1.1
1.2
1.3
1.0
1.1
1.2
1.3
$\frac{V_{CC}}{V_{CCnom}}$


7Z60095
R.F. SOAR
35
25
15
P_{Lnom} (W) V.S.W.R.=1
f=175 MHz
T_h=70°C
$R_{th\,mb-h}$=0.3 °C/W
V_{CCnom}=13.5V
P_{Snom}=P_S at V_{CC}=13.5V and V.S.W.R.=1
see page 5
V.S.W.R. = 5
10
50
$\frac{P_S}{P_{Snom}}$
1.2
1.4
1.6
1.0
1.1
1.2
1.3
$\frac{V_{CC}}{V_{CCnom}}$

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

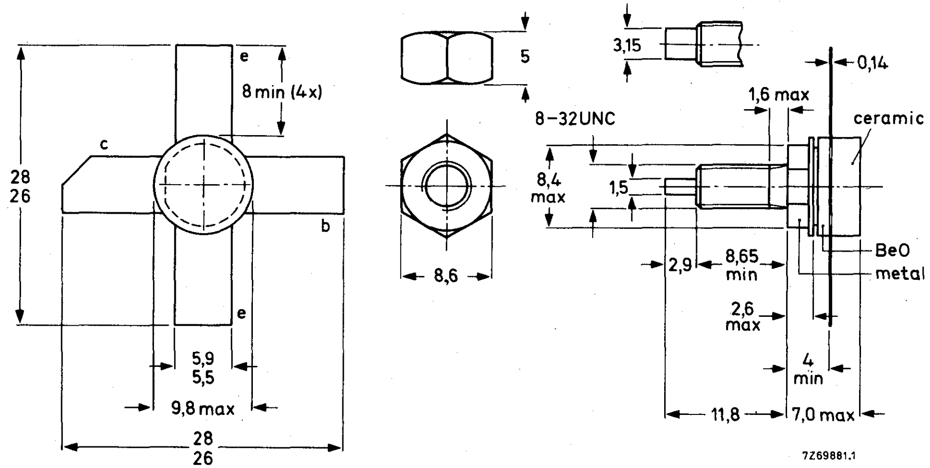
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	13,5	175	25	> 6	> 70	1,6 + j1,4	210 + j5,5

MECHANICAL DATA

Dimensions in mm

SOT-120



Torque on nut: min 0,75 Nm
(7,5 kg cm)
max 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

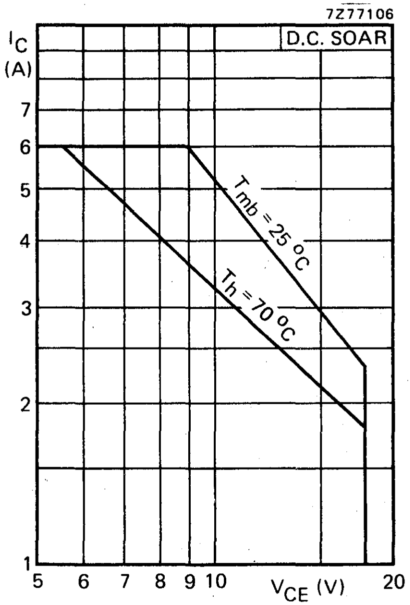
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	18 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V

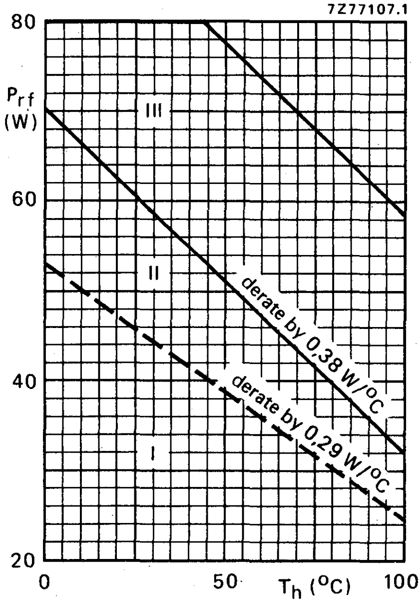
Currents

Collector current (average)	$I_{C(AV)}$	max	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	12 A

Power dissipation

R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max	73 W





R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation 20 W; T_{mb} = 79 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,1 °C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 °C/W

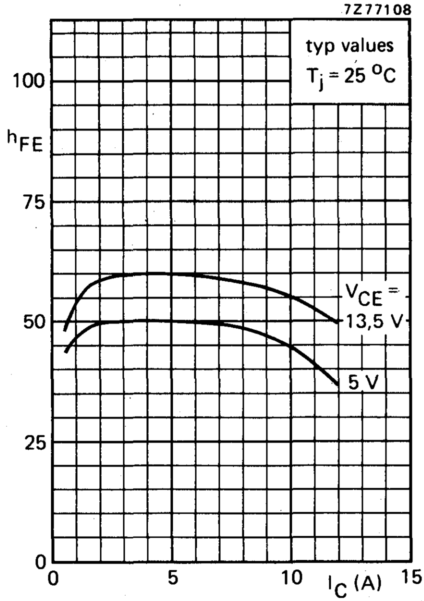
CHARACTERISTICS

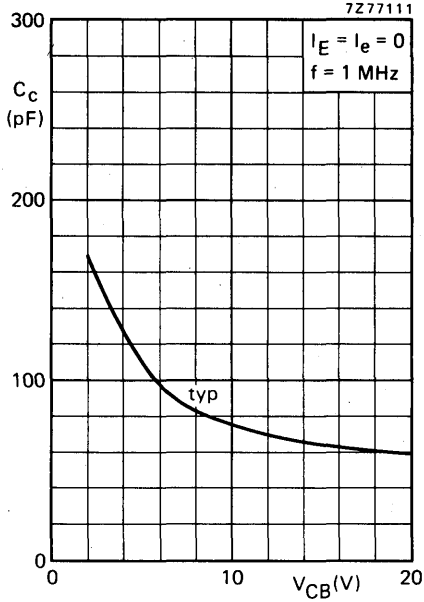
$T_j = 25\ ^oC$

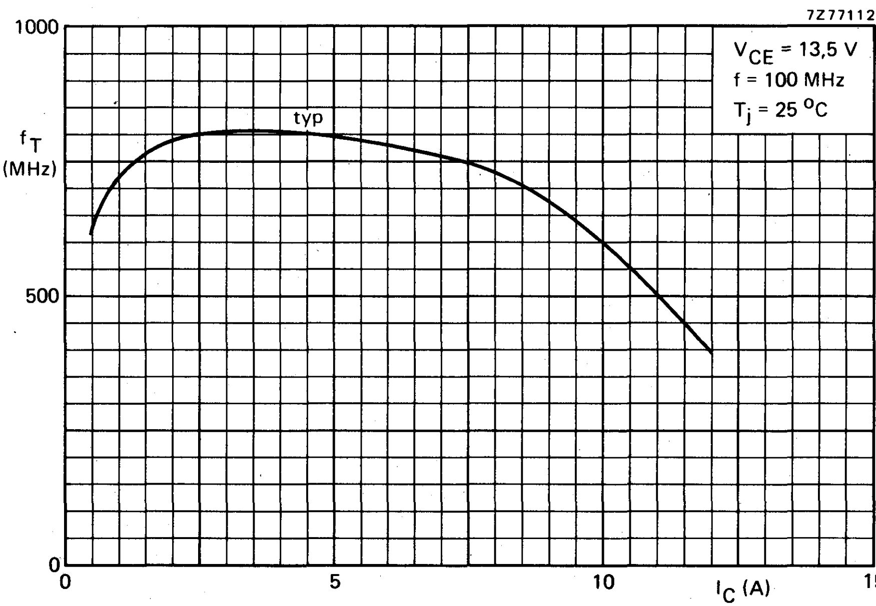
Breakdown voltage

Collector-emitter voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10 mA
Transient energy			
L = 25 mH; f = 50 Hz open base	E	>	8 mWs
$-V_{BE} = 1,5$ V; $R_{BE} = 33\ \Omega$	E	>	8 mWs
D.C. current gain*			
$I_C = 2,5$ A; $V_{CE} = 5$ V	h_{FE}	typ	50
			10 to 80
Collector-emitter saturation voltage*			
$I_C = 7,5$ A; $I_B = 1,5$ A	V_{CEsat}	typ	1,7 V
Transition frequency at f = 100 MHz*			
$I_C = 2,5$ A; $V_{CE} = 13,5$ V	f_T	typ	800 MHz
$I_C = 7,5$ A; $V_{CE} = 13,5$ V	f_T	typ	750 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ	65 pF
		<	90 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ	41 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.


7Z77108
typ values
T_j = 25 °C
100
h_{FE}
75
50
25
0
0
5
10
15
I_C (A)
V_{CE} =
13,5 V
5 V


7Z77111
I_E = I_e = 0
f = 1 MHz
300
C_c
(pF)
200
100
0
0
10
20
V_{CB}(V)
typ


7Z77112
V_{CE} = 13,5 V
f = 100 MHz
T_j = 25 °C
1000
f_T
(MHz)
500
0
0
5
10
15
I_C (A)
typ

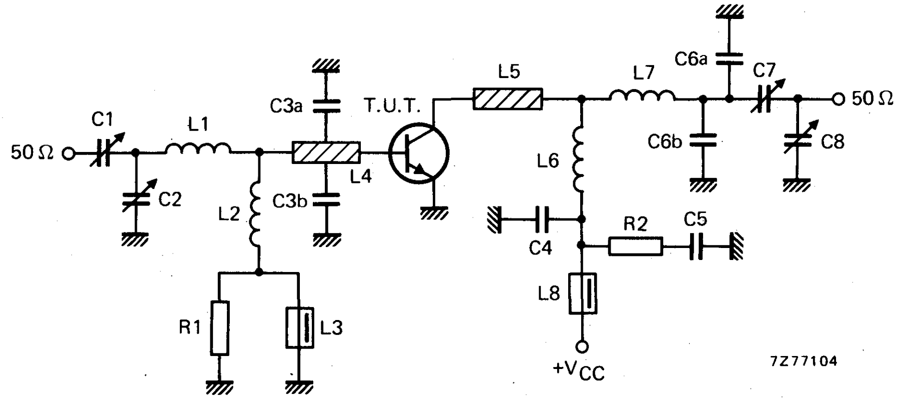
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CC}(V)	P_L(W)	P_S(W)	G_p(dB)	I_C(A)	η (%)	$\overline{z_i}$(Ω)	$\overline{Y_L}$(mA/V)
175	13,5	25	<6,25	> 6	<2,64	> 70	1,6 + j1,4	210 + j5,5
175	12,5	25	–	typ 6,6	–	typ 75	–	–

Test circuit for 175 MHz



List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 1 turn enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

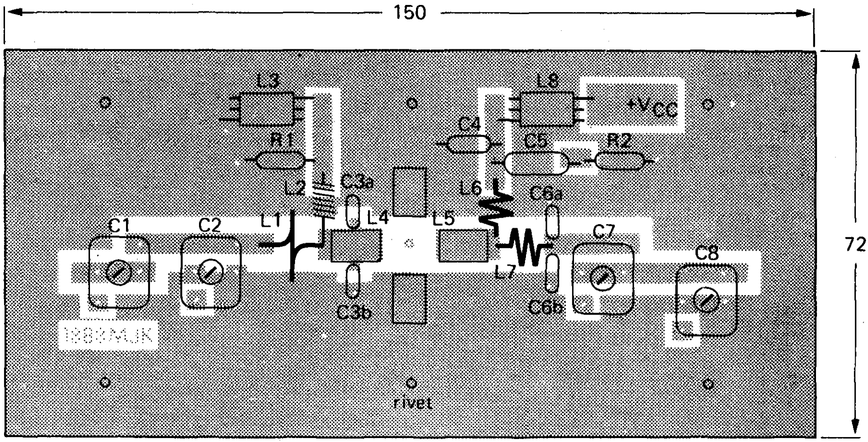
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (±10%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor

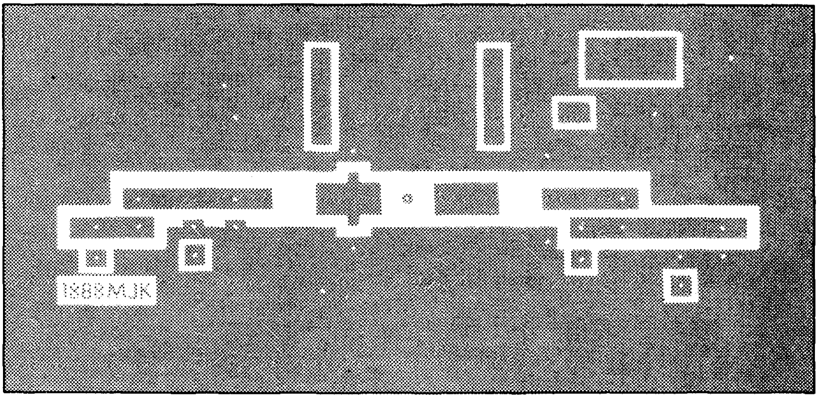
Component layout and printed-circuit board for 175 MHz test circuit on page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 175 MHz test circuit.

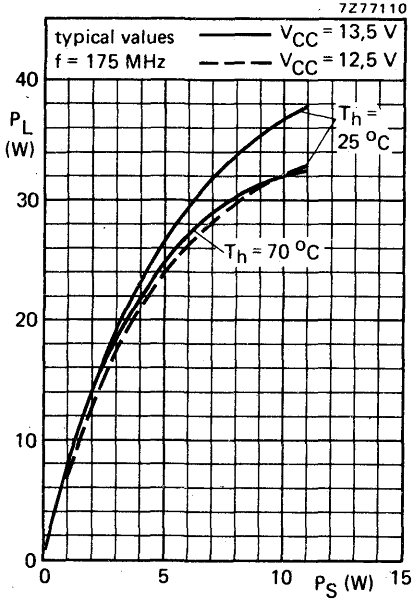


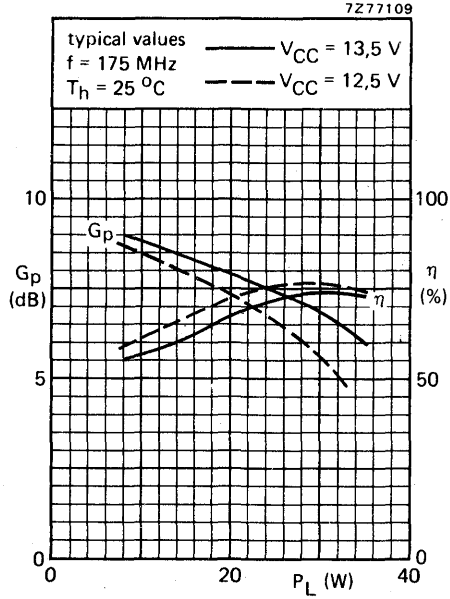
7Z77102

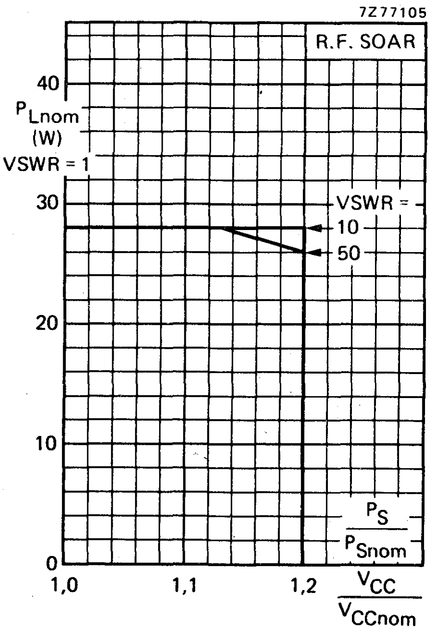


7Z77103

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.







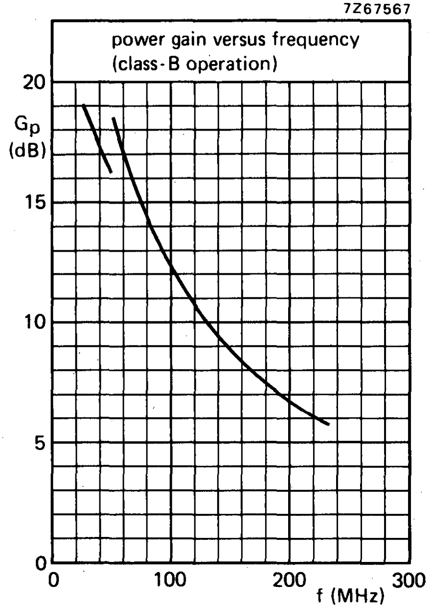
Conditions for R.F. SOAR

f = 175 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,45 °C/W
V_{CCnom} = 13,5 V
P_S = P_{Snom} at V_{CCnom} = 13,5 V and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

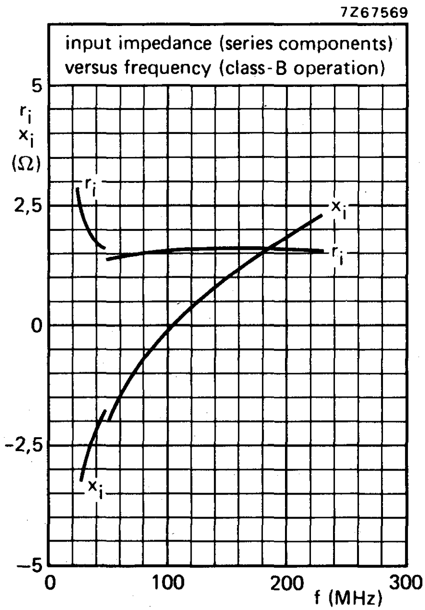
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

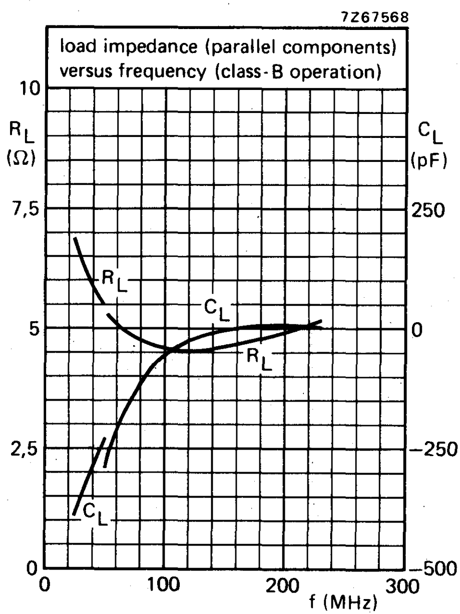
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 13,5 V
P_L = 25 W
T_h = 25 °C
typical values





V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 12,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

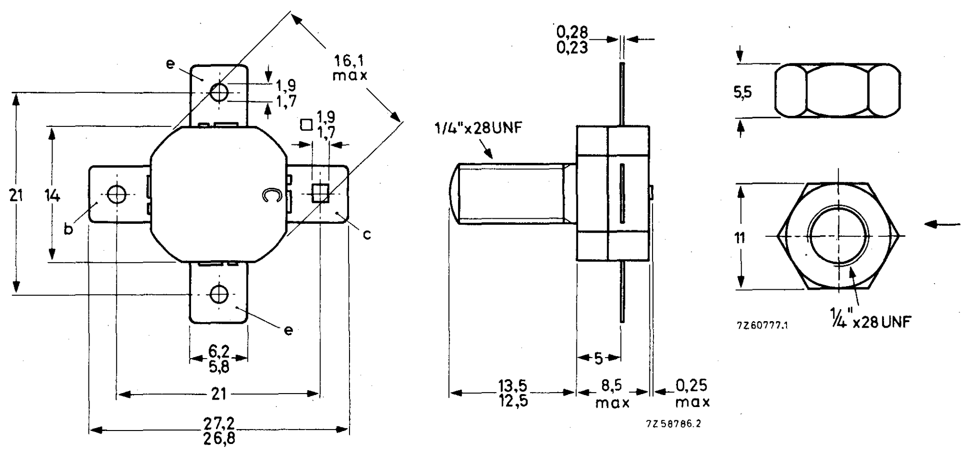
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	12,5	175	< 15,8	50	< 5,33	> 5,0	> 75	1,3 + j1,6	270 + j170

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 2,3 Nm
(23 kg cm)
max. 2,7 Nm
(27 kg cm)

Diameter of clearance hole in heatsink: max. 6,5 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

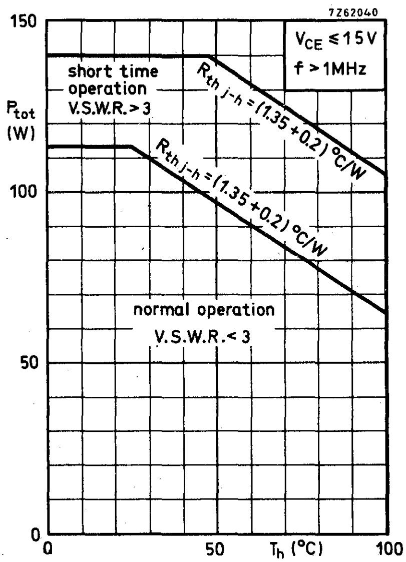
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

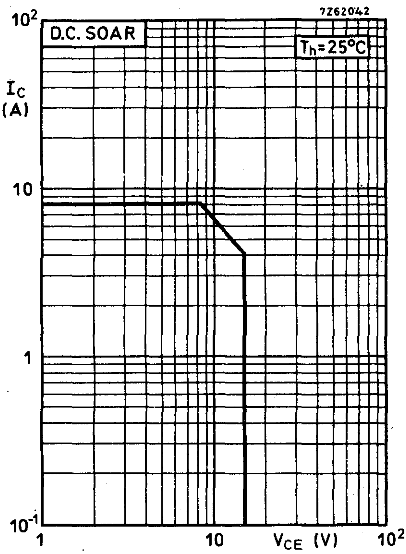
Currents

Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	20	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	130	W





Temperature

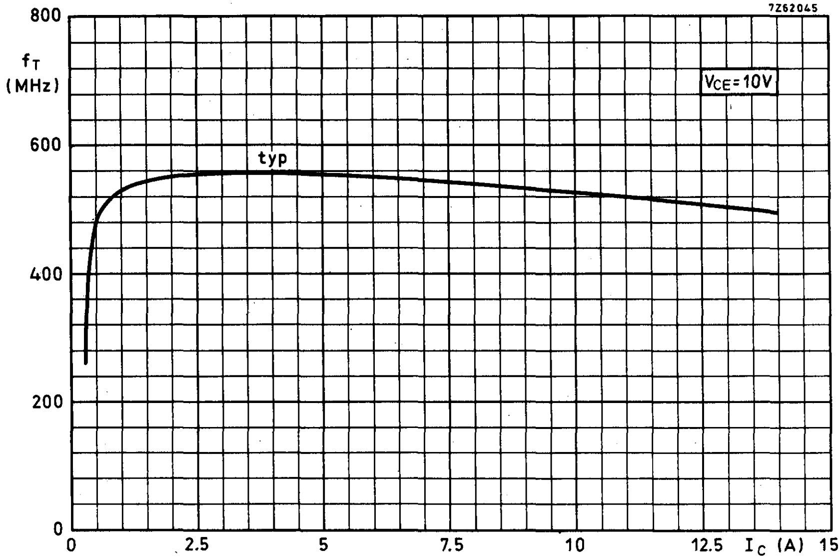
Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

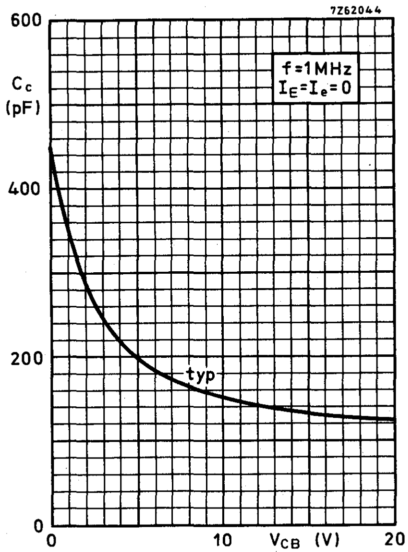
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.35	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2	°C/W

CHARACTERISTICS T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 100 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, I_C = 100 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 25 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	mWs
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	mWs
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}	>	10	
		typ.	50	
Transition frequency				
I_C = 6 A; V_{CE} = 10 V	f_T	typ.	550	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ.	130	pF
		<	160	pF
Feedback capacitance				
I_C = 200 mA; V_{CE} = 15 V	C_{re}	typ.	82	pF
Collector-stud capacitance	C_{cs}	typ.	3.5	pF


7Z62045
800
f_T
(MHz)
600
400
200
0
typ
V_{CE} = 10V
0
2.5
5
7.5
10
12.5
I_C (A)
15


7Z62044
600
C_c
(pF)
400
200
0
typ
f = 1 MHz
$I_E = I_e = 0$
0
10
V_{CB} (V)
20

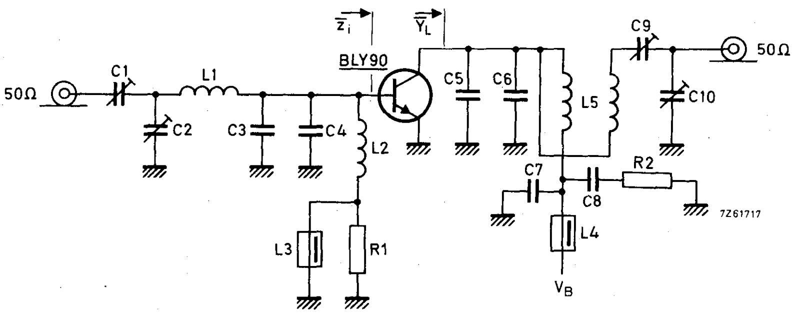
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

f = 175 MHz; T_h up to 25 °C

V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
12,5	< 15,8	50	< 5,33	> 5,0	> 75	1,3 + j 1,6	270+ j 170

Test circuit for 175 MHz:



C1 = 2 to 20 pF film dielectric trimmer
C2 = 4 to 40 pF film dielectric trimmer
C3 = C4 = 27 pF ceramic capacitor
C5 = C6 = 56 pF ceramic capacitor
C7 = 100 pF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 4 to 80 pF film dielectric trimmer
C10 = 4 to 60 pF film dielectric trimmer

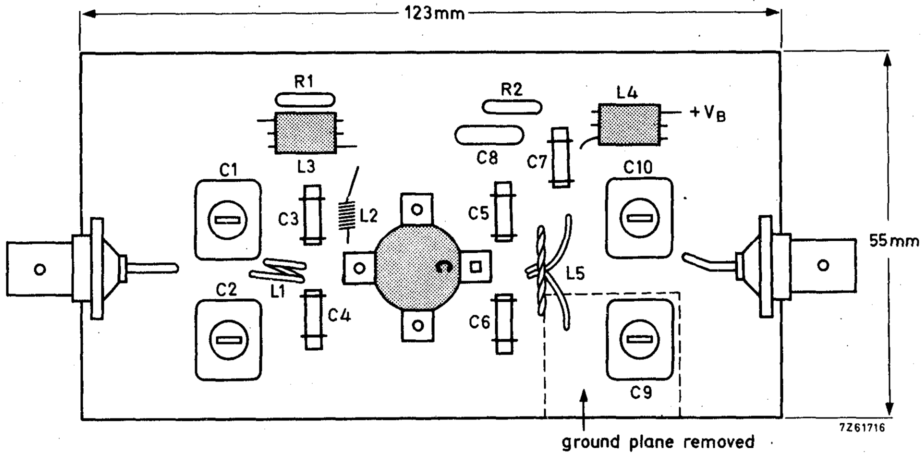
L1 = 1,5 turns enamelled Cu wire (1,5 mm); int. dia. 6 mm; length 4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube choke (code number 4312 020 36640)
L5 = bifilar wound enamelled Cu wire (1,0 mm); see figure on page 6

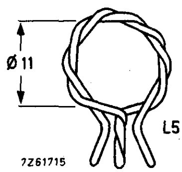
R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

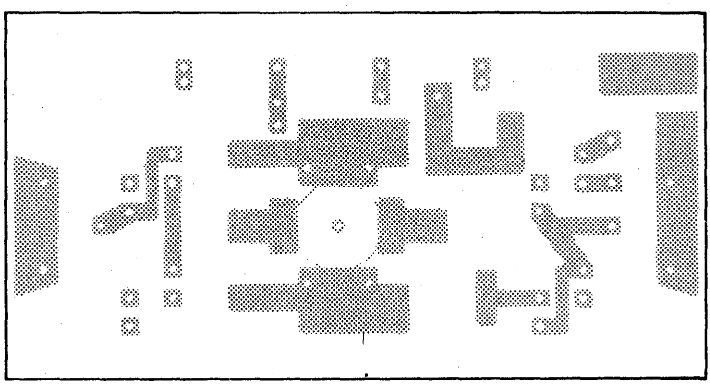
Component layout and printed-circuit board for 175 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

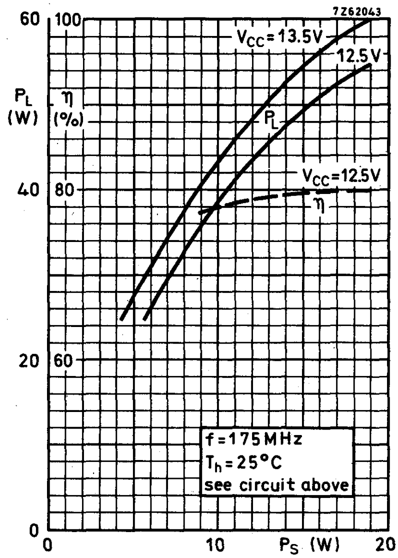
Component lay-out and printed circuit board for 175 MHz test circuit.

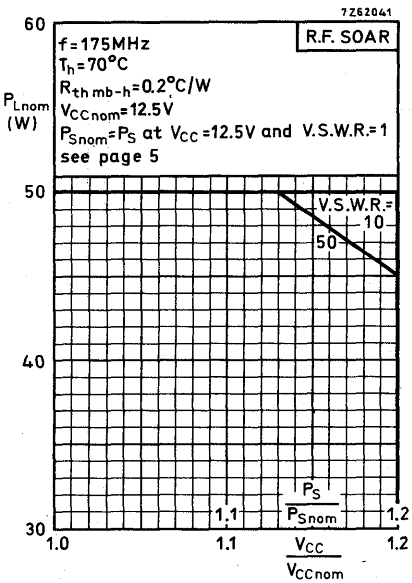




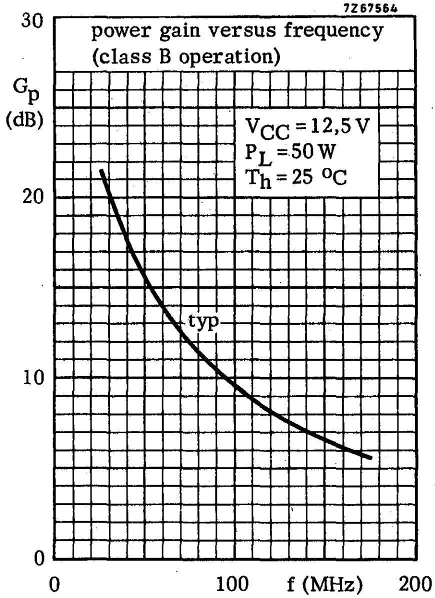


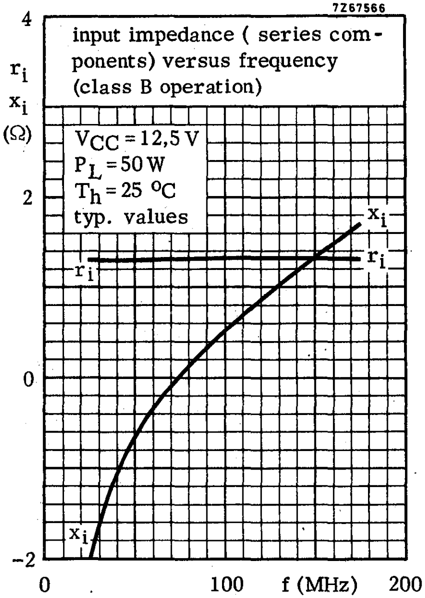
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

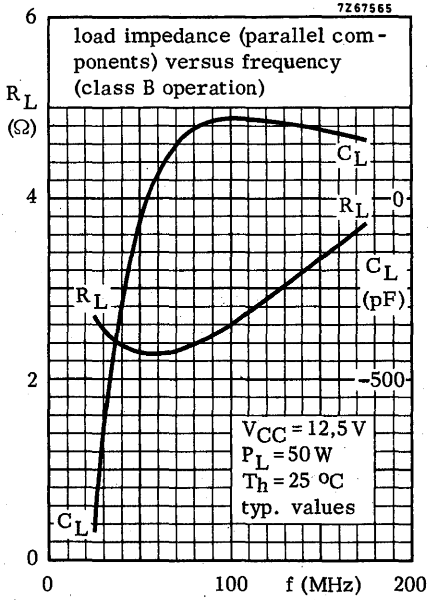




The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power (P_{Lnom}) must be derated in accordance with the adjacent graph for safe operation at supply voltage other than the nominal. The graph shows the allowable output power under nominal conditions, as a function of the supply overvoltage ratio with V.S.W.R. as parameter. The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio (V_{CC} / V_{CCnom}).


7Z67564
power gain versus frequency
(class B operation)
G_p
(dB)
30
20
10
0
$V_{CC} = 12,5$ V
$P_L = 50$ W
$T_h = 25$ °C
typ
0
100
f (MHz)
200


7Z67566
input impedance (series components) versus frequency
(class B operation)
r_i
x_i
(Ω)
4
2
0
−2
$V_{CC} = 12,5$ V
$P_L = 50$ W
$T_h = 25$ °C
typ. values
x_i
r_i
r_i
x_i
0
100
f (MHz)
200


7Z67565
load impedance (parallel components) versus frequency
(class B operation)
R_L
(Ω)
6
4
2
0
C_L
R_L
0
C_L
(pF)
R_L
−500
$V_{CC} = 12,5$ V
$P_L = 50$ W
$T_h = 25$ °C
typ. values
C_L
0
100
f (MHz)
200

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a $\frac{1}{4}$" capstan envelope with a moulded cap. All leads are isolated from the stud.

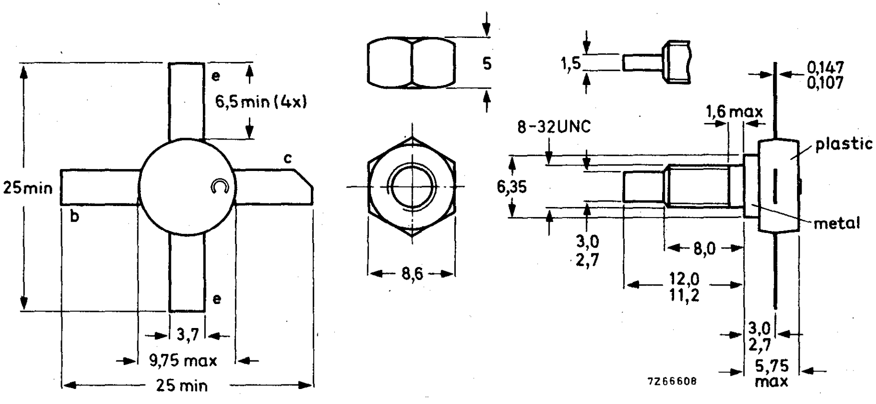
QUICK REFERENCE DATA

R.F. performance up to T_{mb} = 25 °C in an unneutralised common-emitter class B circuit

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	28	175	< 0.50	8	< 0.44	> 12	> 65	1.8+j0.7	18−j20

MECHANICAL DATA Dimensions in mm

SOT-48



Torque on nut: min. 7.5 kg cm
(0.75 Newton metres)
max. 8.5 kg cm
(0.85 Newton metres)

Diameter of clearance hole in heatsink: max. 4.17 mm
Mounting hole to have no burrs at either end
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required, an adhesive instead of a lock washer is preferred.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

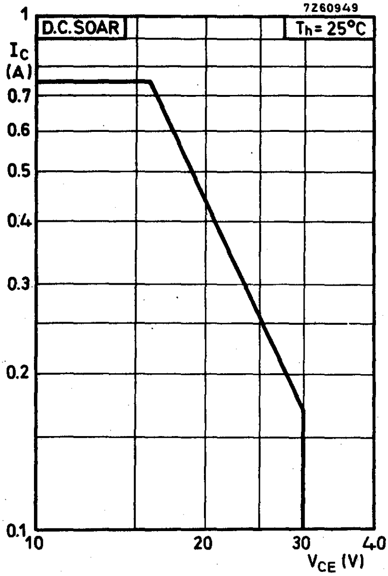
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

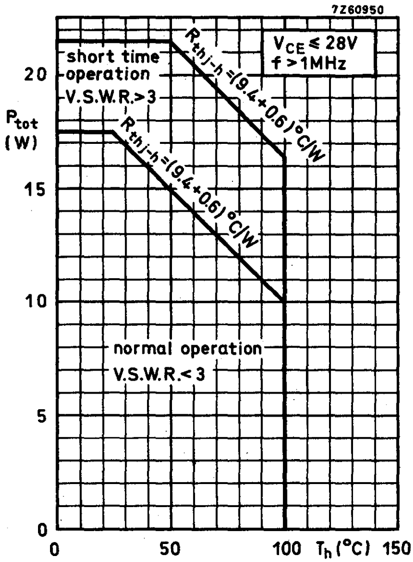
Currents

Collector current (average)	$I_{C(AV)}$	max.	0.75	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.25	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	17.5	W





Temperatures

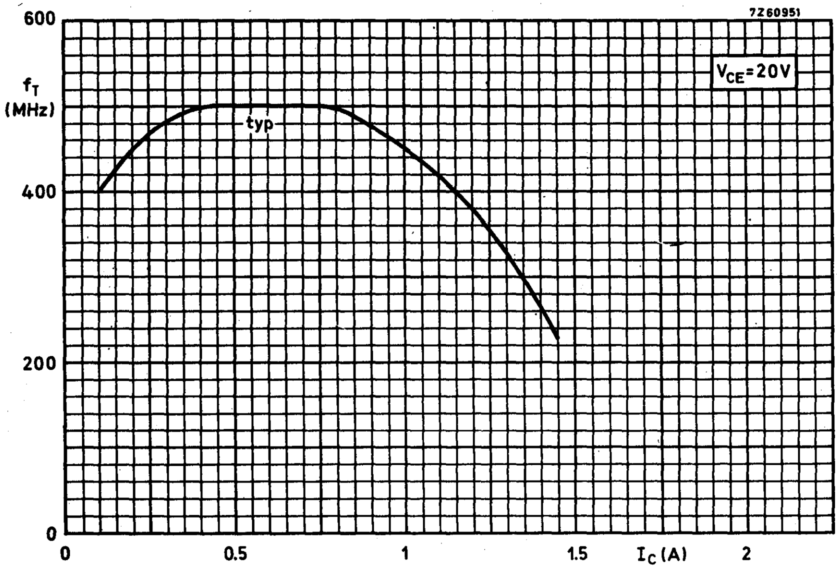
Storage temperature	T_{stg}	−30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

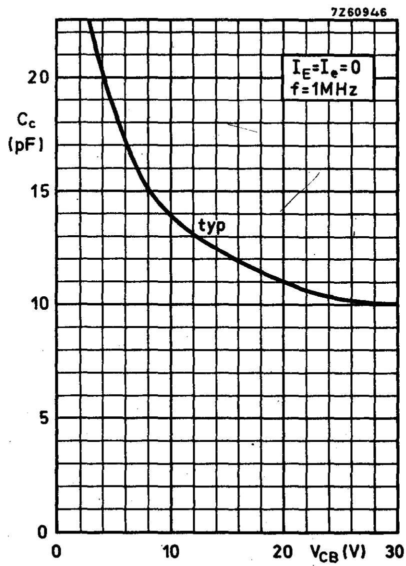
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	9.4	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.6	°C/W

CHARACTERISTICS $T_j = 25\ ^{o}C$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter; $I_C = 1$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz				
open base	E	>	0.5	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	0.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	10	pF
		<	15	pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 30$ V	C_{re}	typ.	7.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60951
600
400
200
0
f_T (MHz)
V_{CE}=20V
typ
0
0.5
1
1.5
I_C (A)
2


7Z60946
20
15
10
5
0
C_c (pF)
I_E=I_e=0
f=1MHz
typ
0
10
20
V_{CB} (V)
30

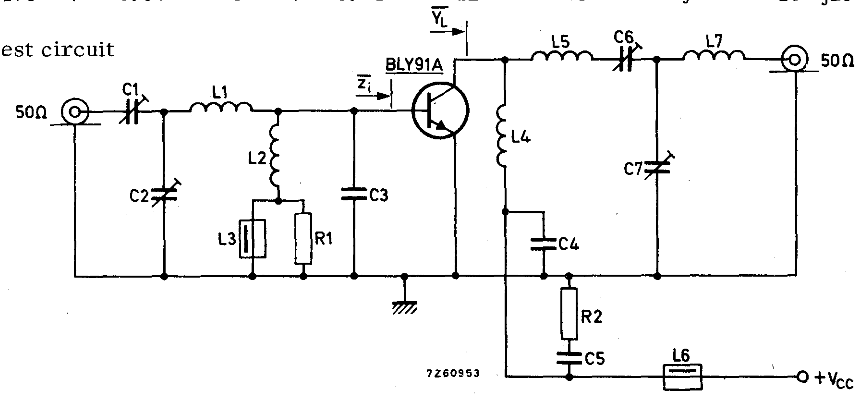
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η(%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	< 0.50	8	< 0.44	> 12	> 65	1.8+j0.7	18−j20

Test circuit



C1 = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = 47 pF ceramic
C4 = 100 pF ceramic
C5 = 150 nF polyester

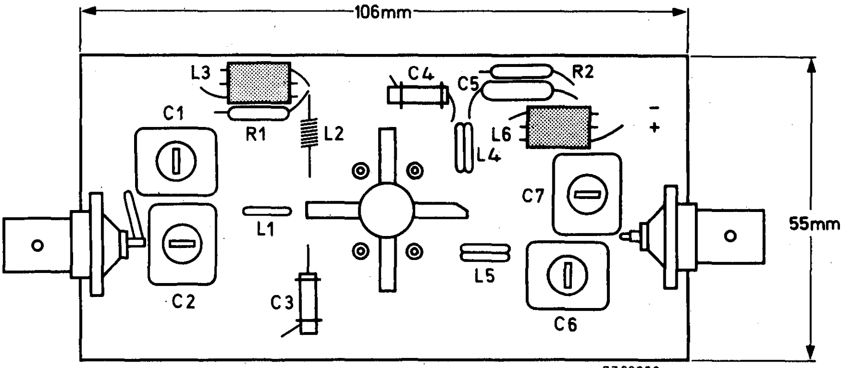
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2 = 6.5 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 7.5 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
L5 = 4.5 turns enamelled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm
L7 = 3.5 turns enamelled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm

R1 = R2 = 10 Ω carbon

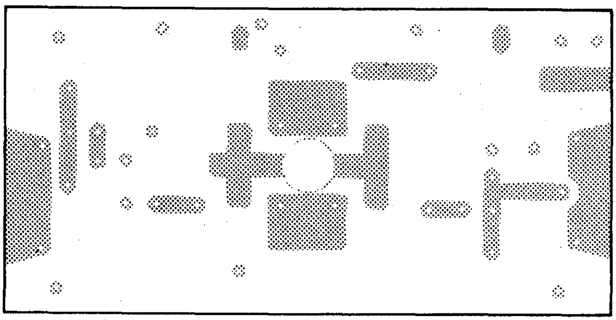
Component lay-out for 175 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

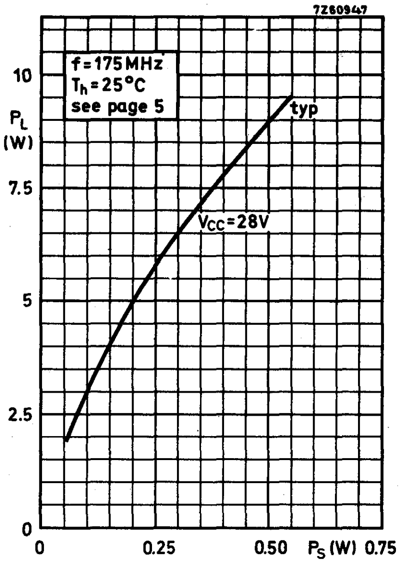


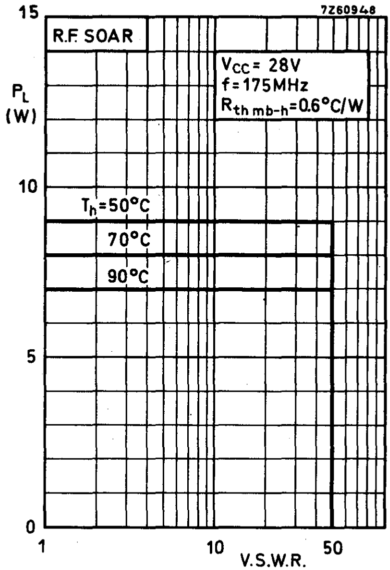
7Z60952



7Z67868

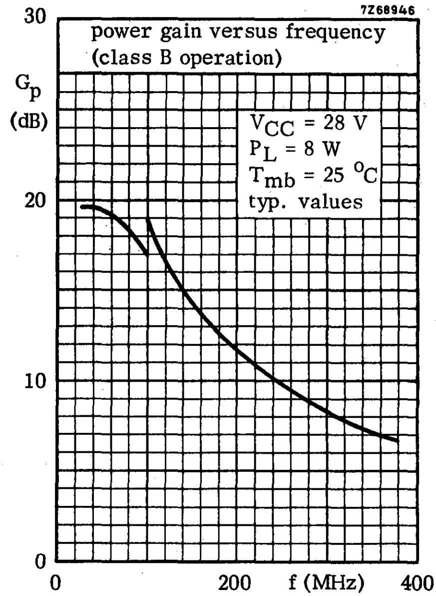
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

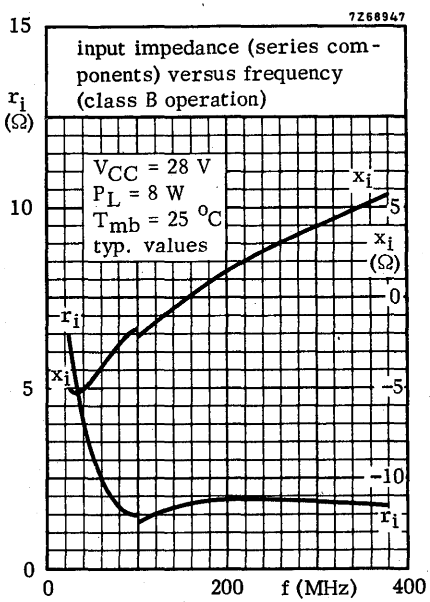


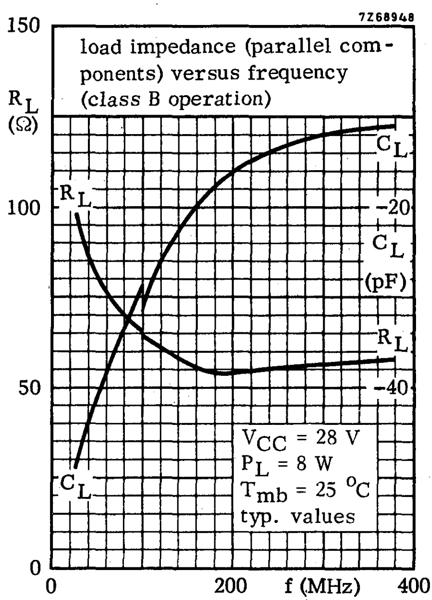


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

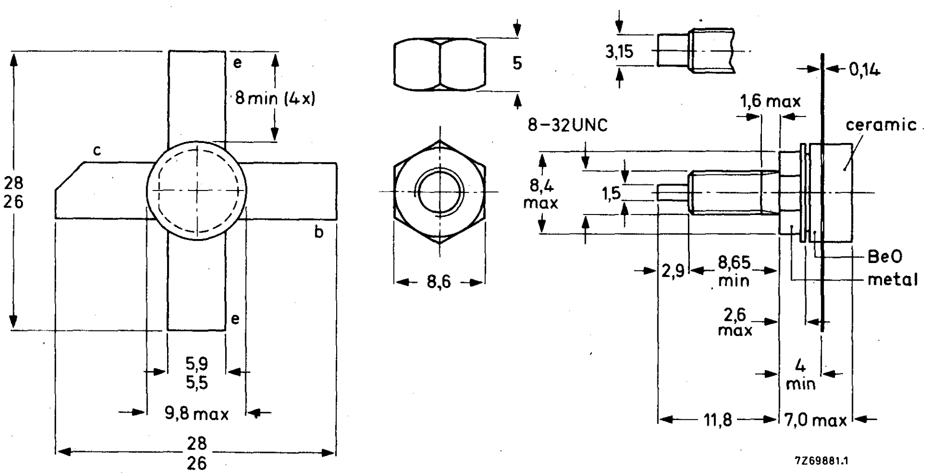
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 – j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0,9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	2,5	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

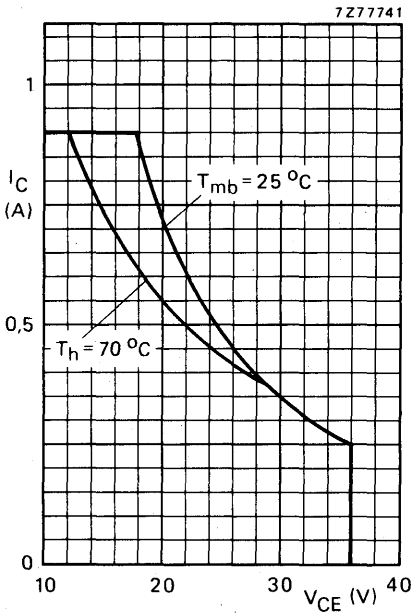


Fig. 2 D.C. SOAR.

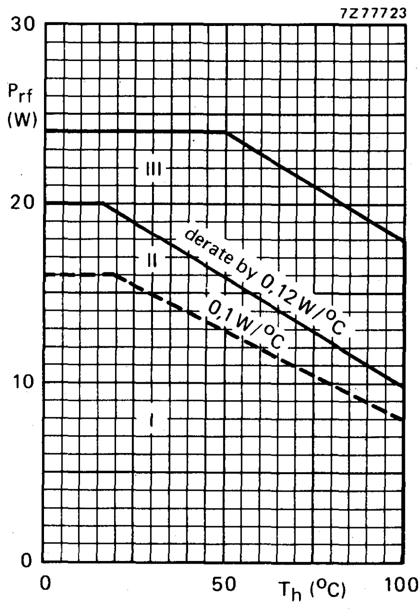


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73,6 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain* $I_C = 0,4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50
			10 to 100
Collector-emitter saturation voltage* $I_C = 1,25$ A; $I_B = 0,25$ A	V_{CEsat}	typ.	0,8 V
Transition frequency at f = 100 MHz* $-I_E = 0,4$ A; $V_{CB} = 28$ V	f_T	typ.	600 MHz
$-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	525 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	10 pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 28$ V	C_{re}	typ.	7,1 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

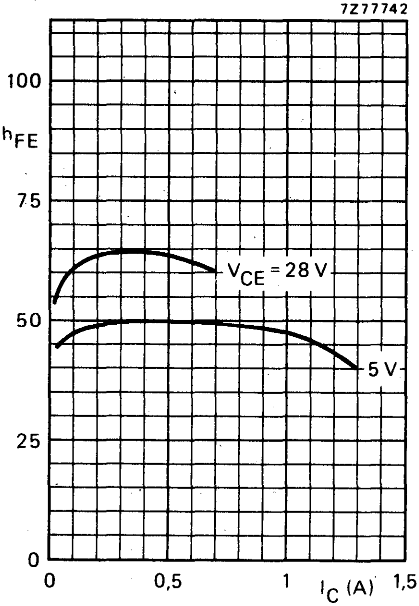


Fig.4 Typical values; T_j = 25 °C.

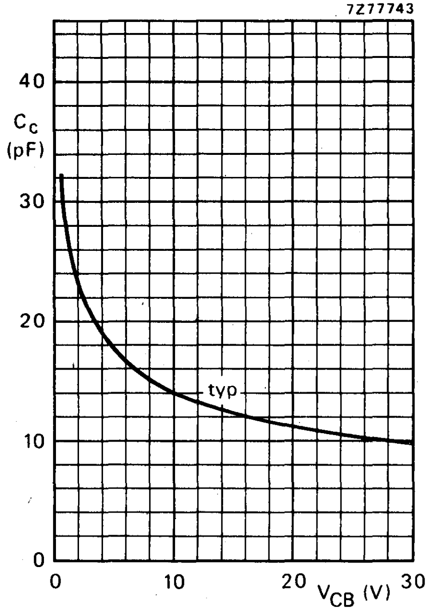


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

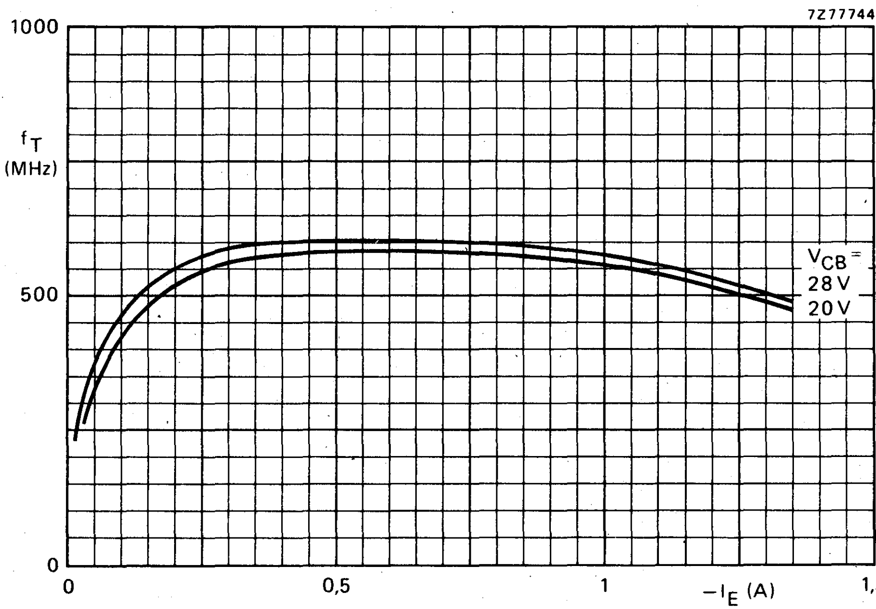


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	8	<0,5	> 12	<0,44	> 65	1,8 + j0,7	18 – j20

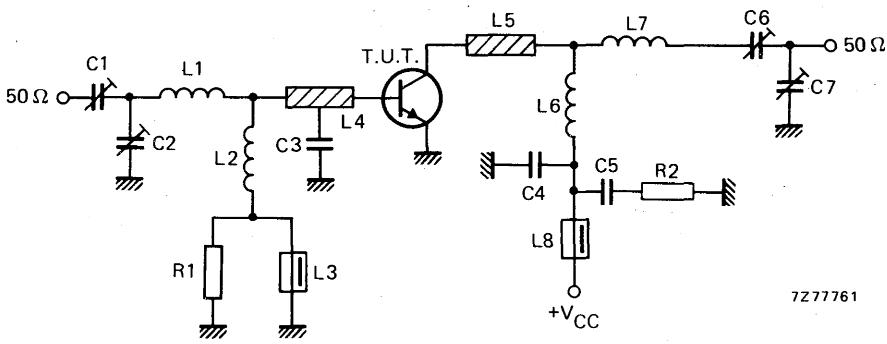


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; length 9,2 mm; leads 2 x 5 mm
L7 = 4 turns enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; length 5,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

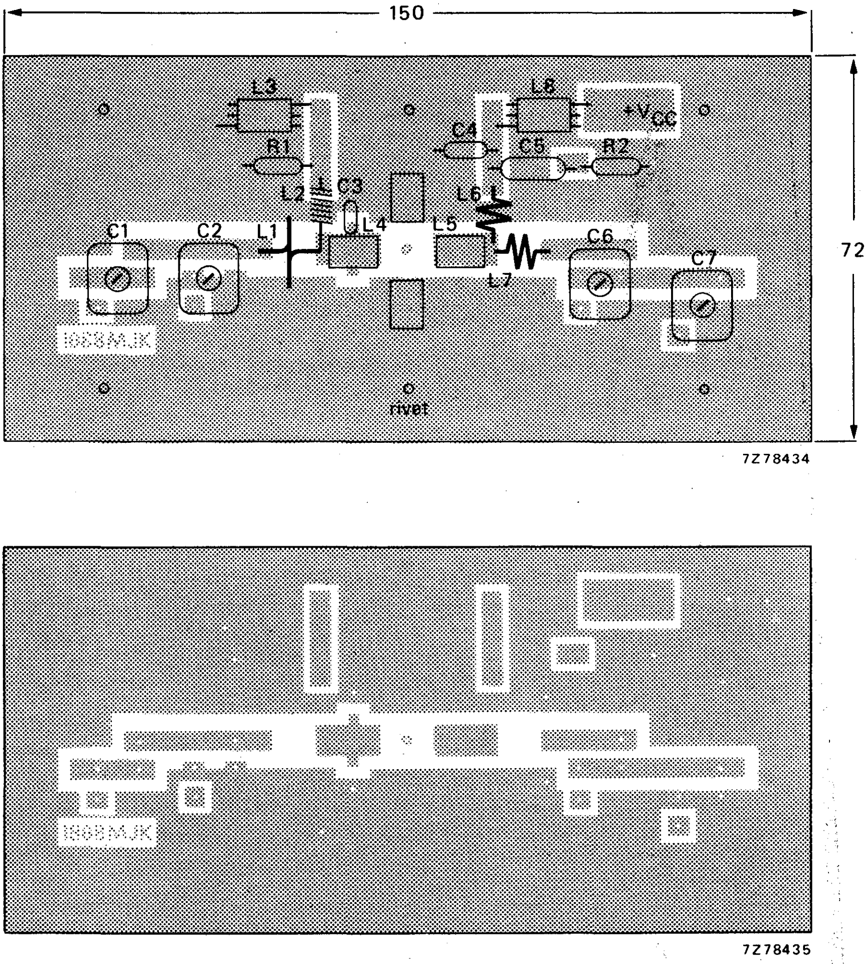


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

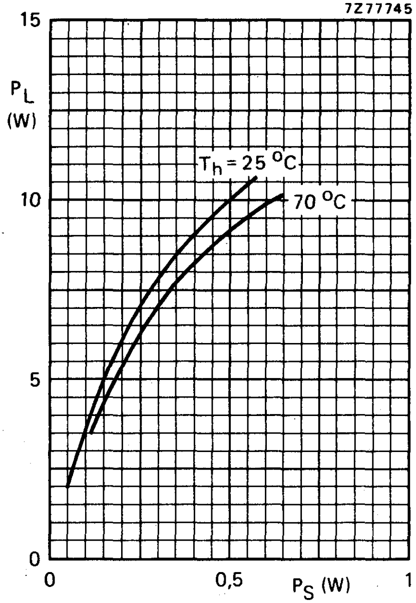


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

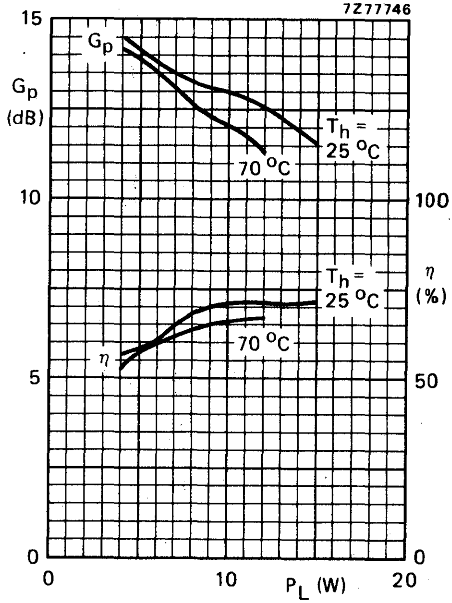


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

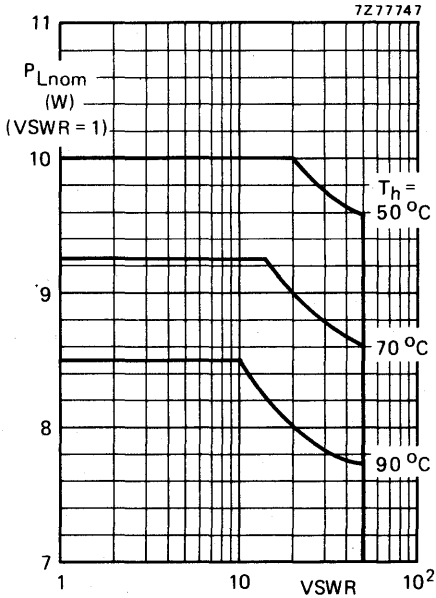


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

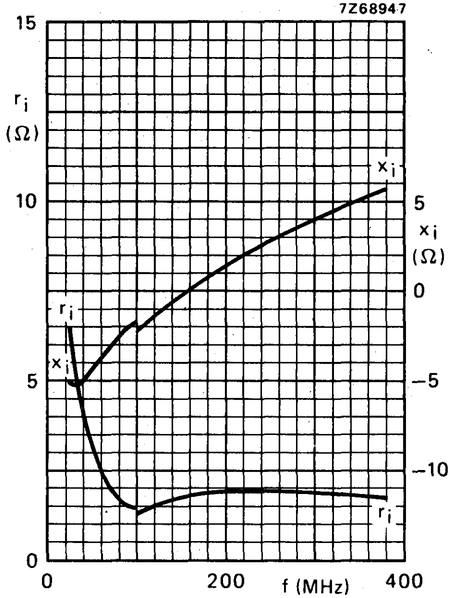


Fig. 12 Input impedance (series components).

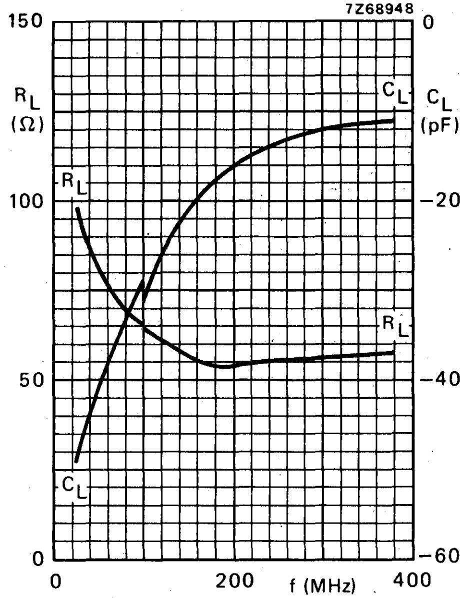


Fig. 13 Load impedance (parallel components).

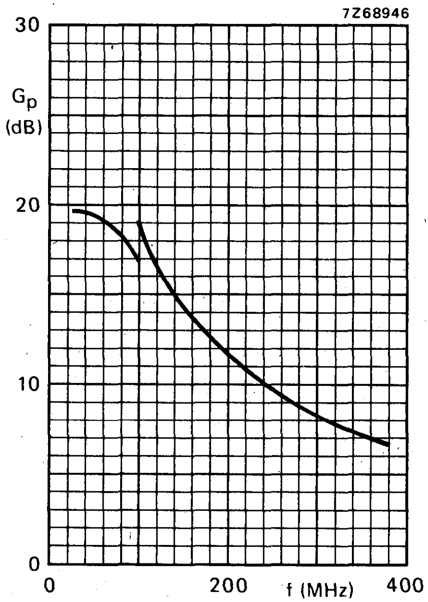


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a $\frac{1}{4}$" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

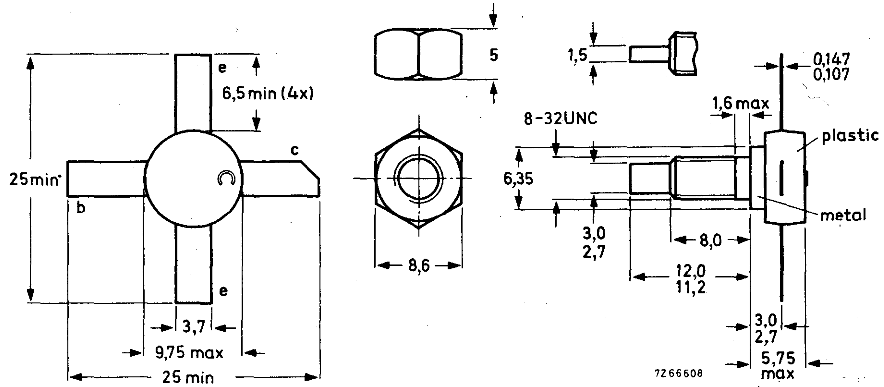
R.F. performance up to T_{mb} = 25 °C in an unneutralised common-emitter class B circuit

Mode of operation	V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
c.w.	28	175	< 1.5	15	< 0.83	> 10	> 65	1.4+j1.85	33−j27.5

MECHANICAL DATA

Dimensions in mm

SOT-48



When locking is required, an adhesive instead of a lock washer is preferred.

Torque on nut: min. 0.75 Nm (7.5 kg cm)
max. 0.85 Nm (8.5 kg cm)

Diameter of clearance hole in heatsink: max. 4.17 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat: do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

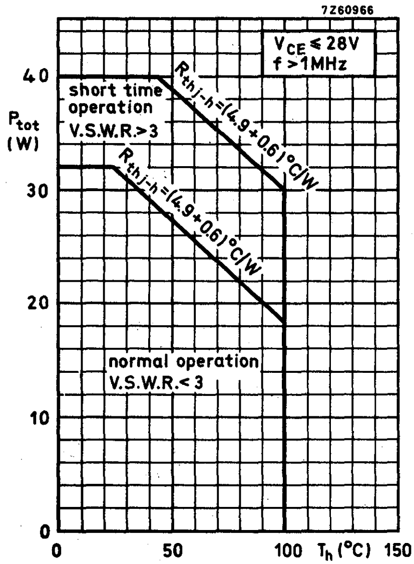
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

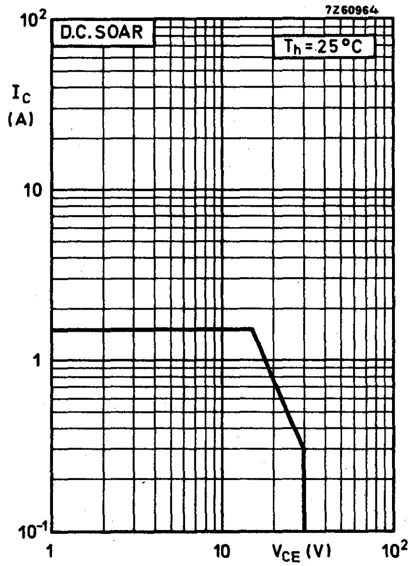
Currents

Collector current (average)	$I_{C(AV)}$	max.	1.5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4.5	A

Power dissipation

Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	32	W





Temperatures

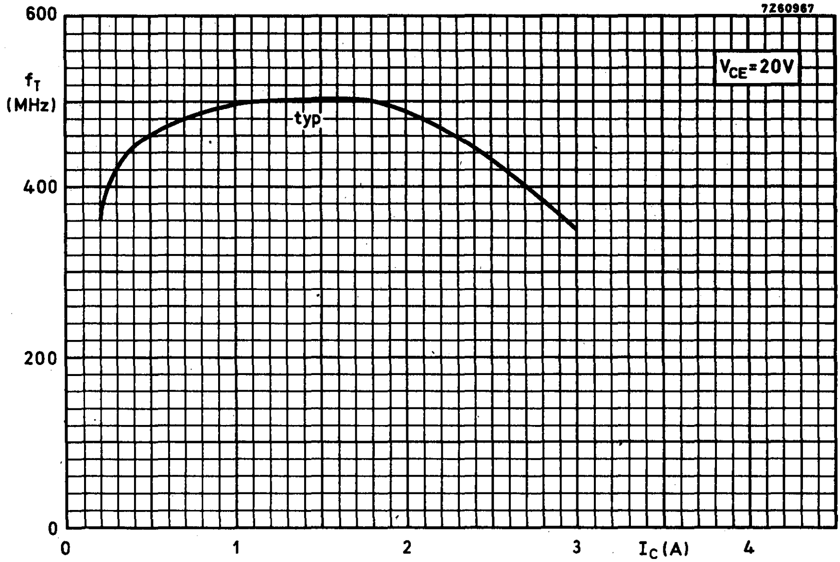
Storage temperature	T_{stg}	−30 to	+200	°C
Operating junction temperature	T_j	max.	200	°C

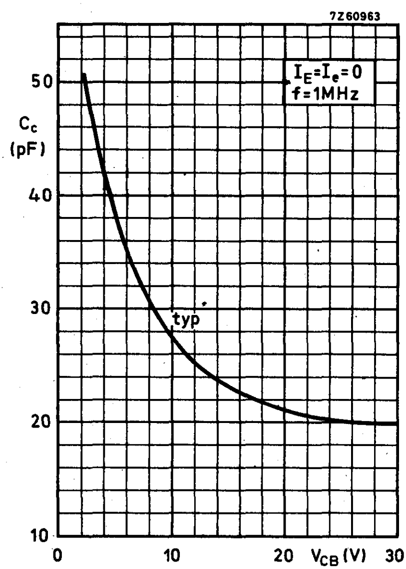
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4.9	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	10	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 3$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 3$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	2.0	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	4.5	mWs
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 600$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	20	pF
		<	30	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	15	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60967
600
400
200
0
f_T
(MHz)
V_{CE} = 20V
typ
0
1
2
3
4
I_C (A)


7Z60963
50
40
30
20
10
C_c
(pF)
$I_E = I_e = 0$
f = 1MHz
typ
0
10
20
30
V_{CB} (V)

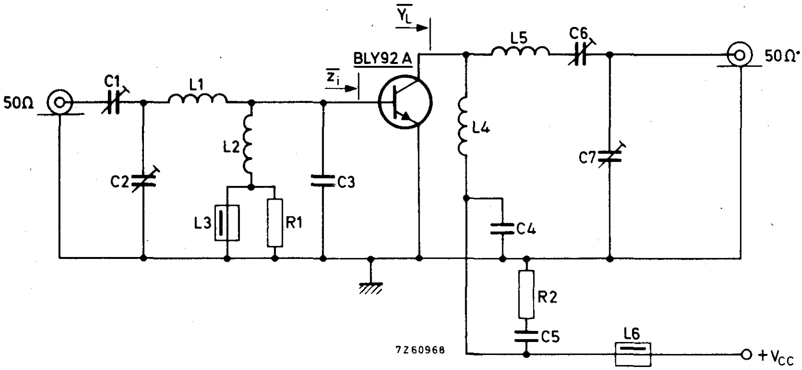
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

V_{CE} = 28 V; T_{mb} up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	< 1,5	15	< 0,83	> 10	> 65	1,4 + j1,85	33 – j27,5

Test circuit: 175 MHz; c.w. class-B.



C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor
C4 = 100 pF ceramic capacitor
C5 = 150 nF polyester capacitor

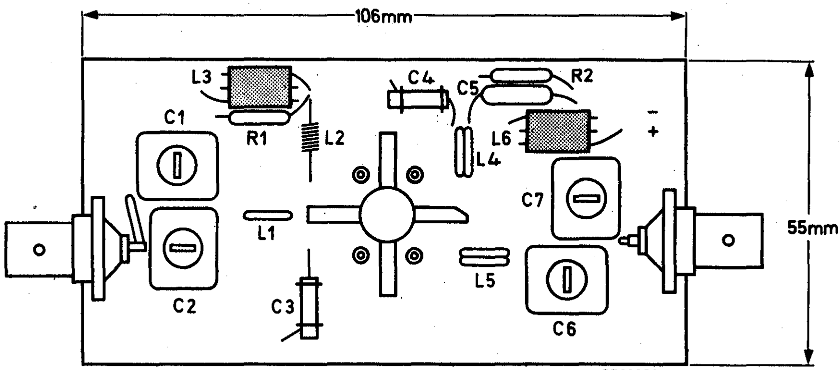
L1 = 0,5 turn enamelled Cu wire (1,6 mm); int. dia. 6 mm; leads 2 x 10 mm
L2 = 6,5 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 2,5 turns enamelled Cu wire (0,7 mm); int. dia. 6 mm; leads 2 x 7 mm
L6 = 4,5 turns enamelled Cu wire (0,7 mm); int. dia. 6 mm; leads 2 x 7 mm

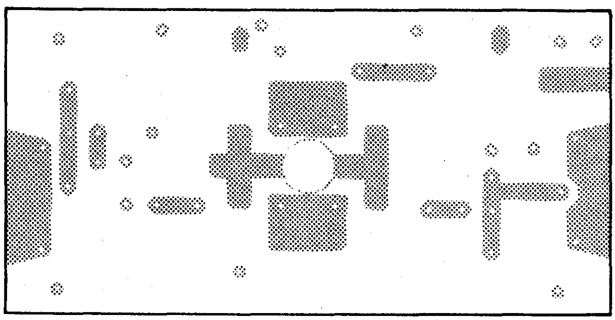
R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see page 6.

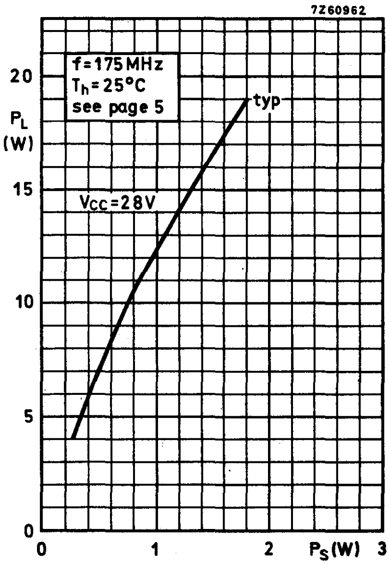
APPLICATION INFORMATION (continued)

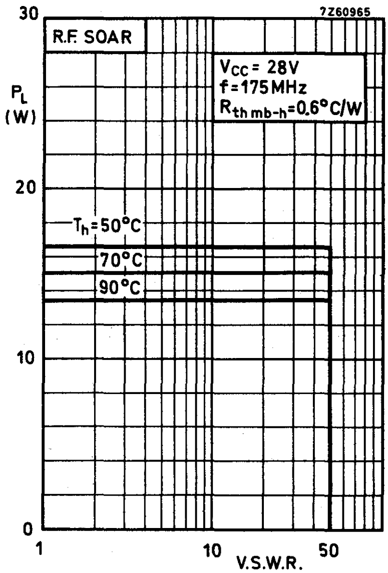
Component lay-out and printed circuit board for 175 MHz test circuit.





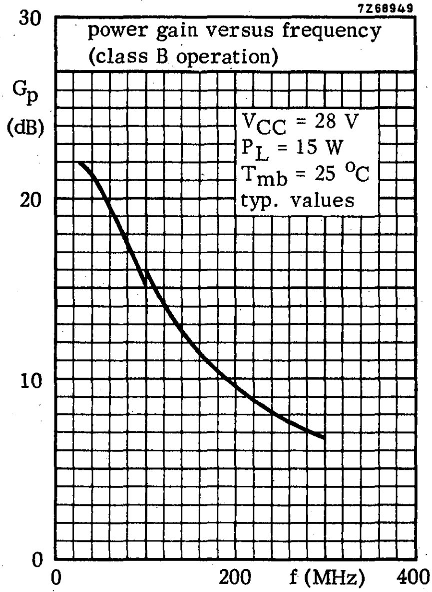
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

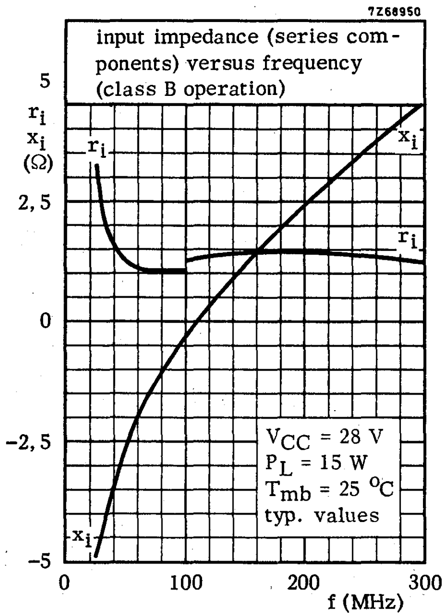


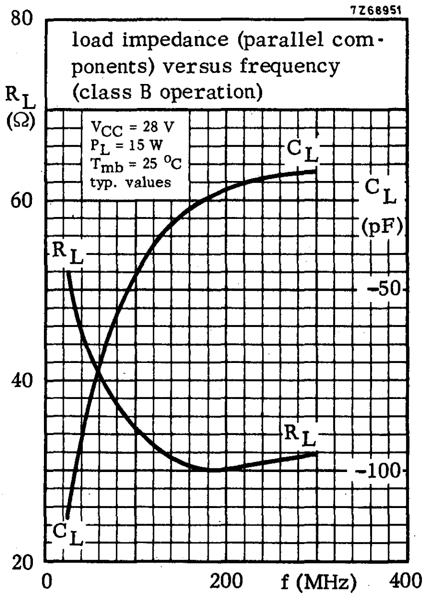


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

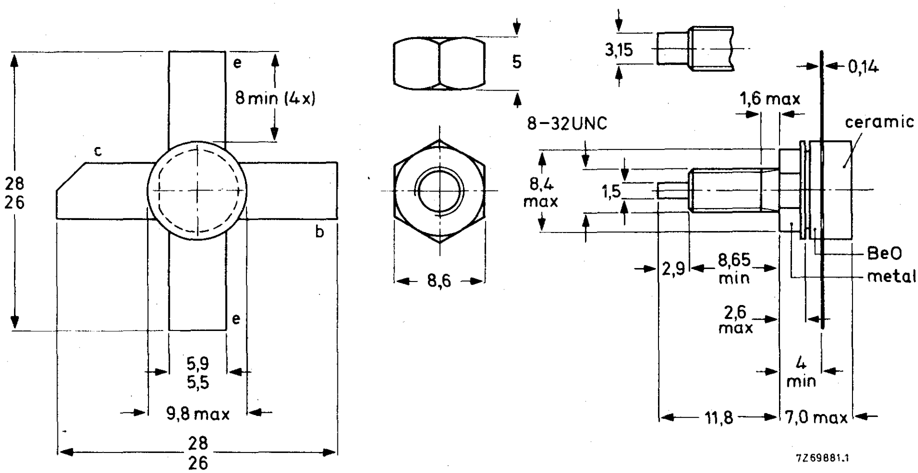
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 – j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,75	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	5,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

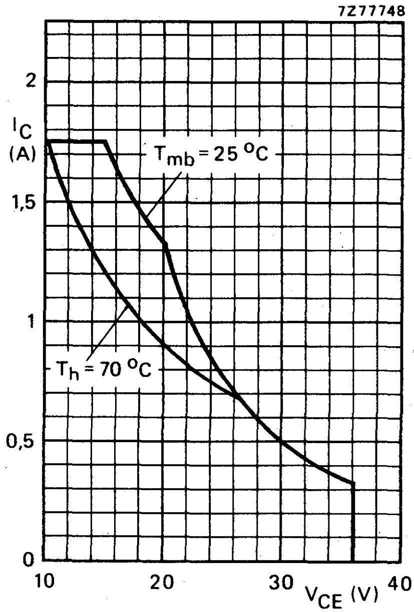


Fig. 2 D.C. SOAR.

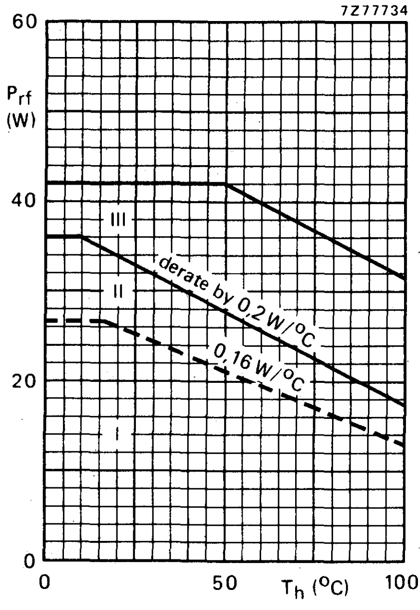


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage			
open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage			
open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	2 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	2,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5 mJ
D.C. current gain*			
$I_C = 0,7$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50
			10 to 100
Collector-emitter saturation voltage*			
$I_C = 2$ A; $I_B = 0,4$ A	V_{CEsat}	typ.	0,65 V
Transition frequency at f = 100 MHz*			
$-I_E = 0,7$ A; $V_{CB} = 28$ V	f_T	typ.	650 MHz
$-I_E = 2$ A; $V_{CB} = 28$ V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	18 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	12,8 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

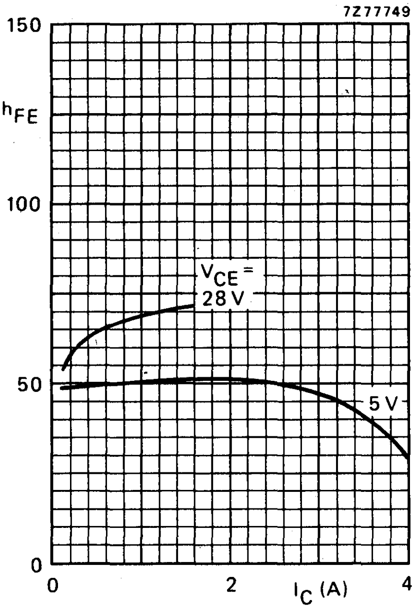


Fig. 4 Typical values; T_j = 25 °C.

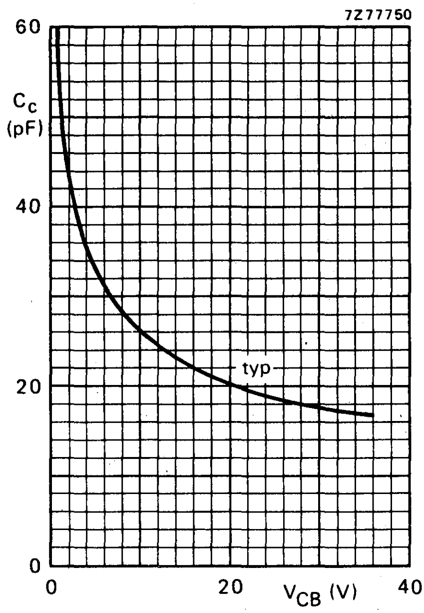


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

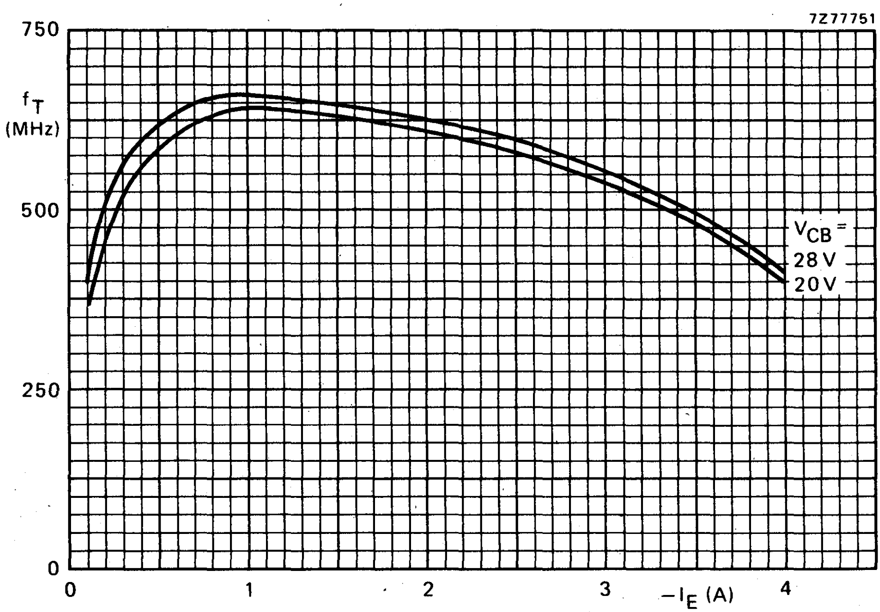


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	28	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 – j27,5

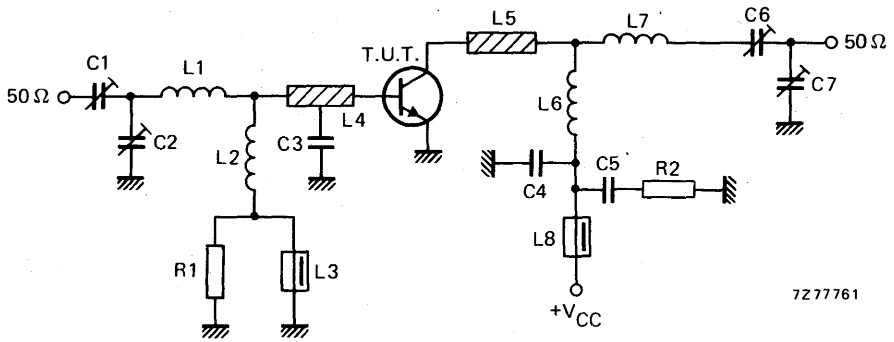


Fig. 7 Test circuit; c.w. class-B.

List of components:

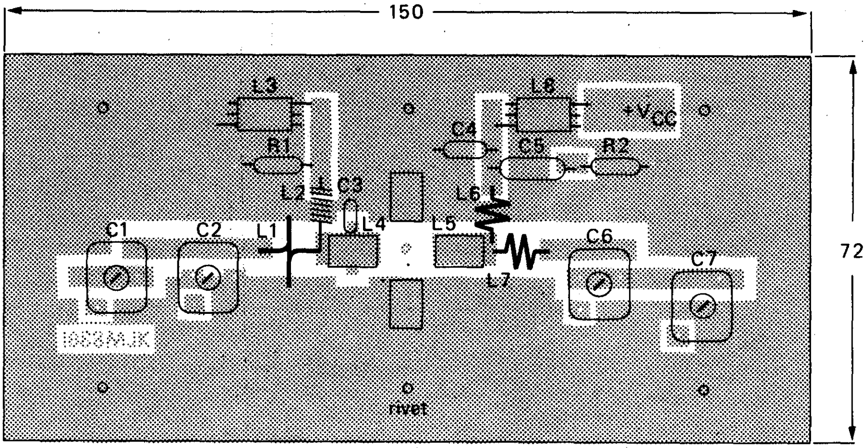
C1 = C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; length 9,2 mm; leads 2 x 5 mm
L7 = 4 turns enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; length 5,0 mm; leads 2 x 5 mm

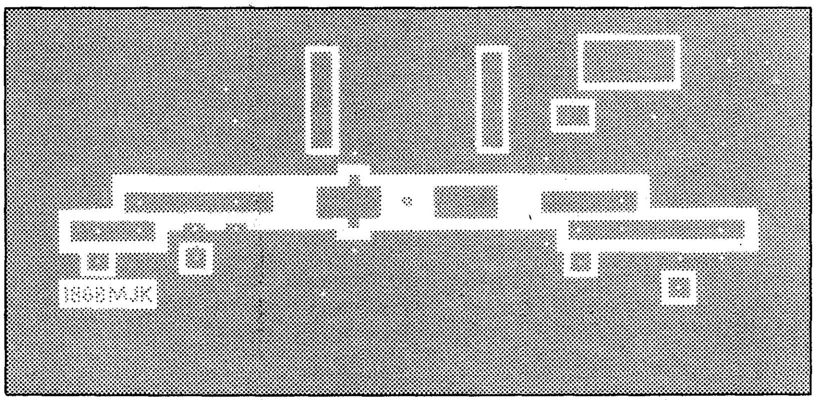
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



7Z78434



7Z78435

Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

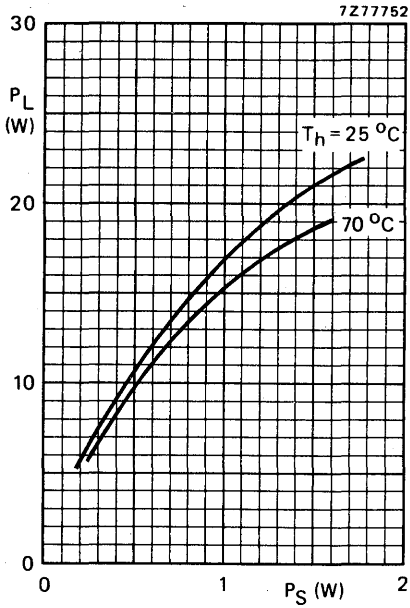


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

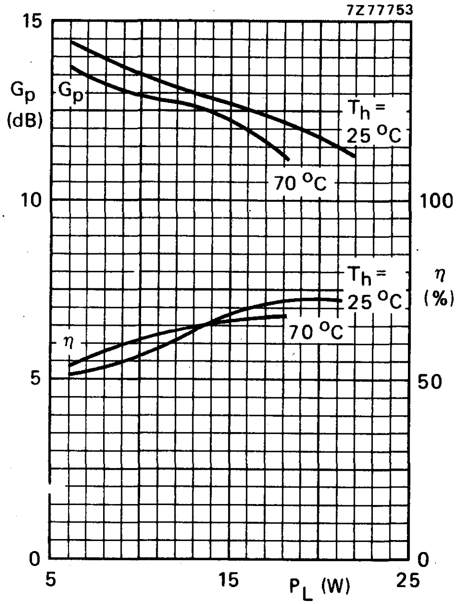


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

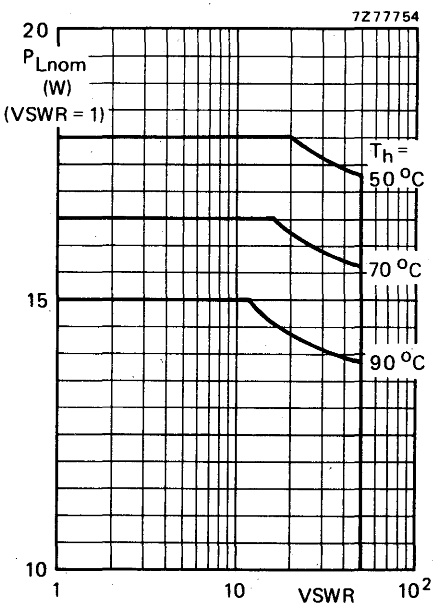


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,45 °C/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

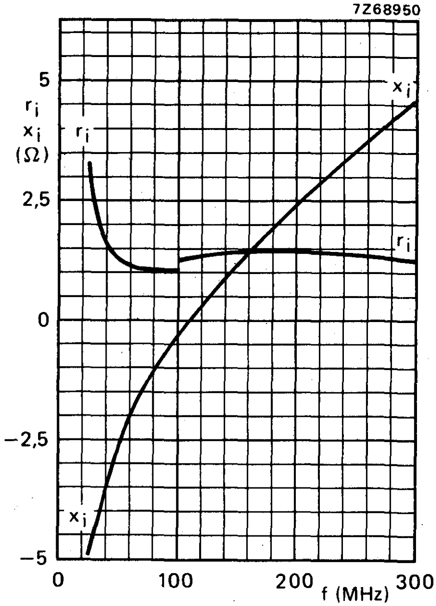


Fig. 12 Input impedance (series components).

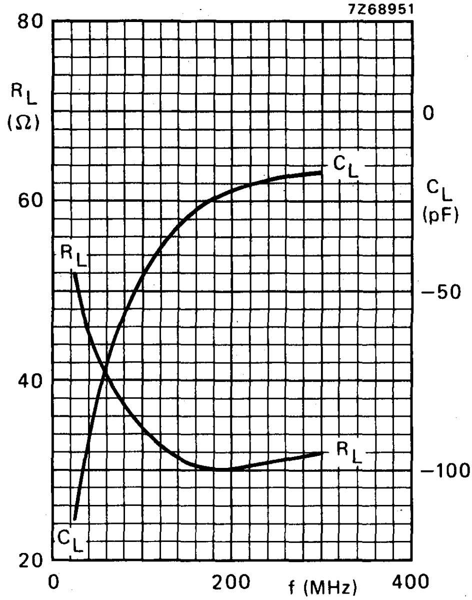


Fig. 13 Load impedance (parallel components).

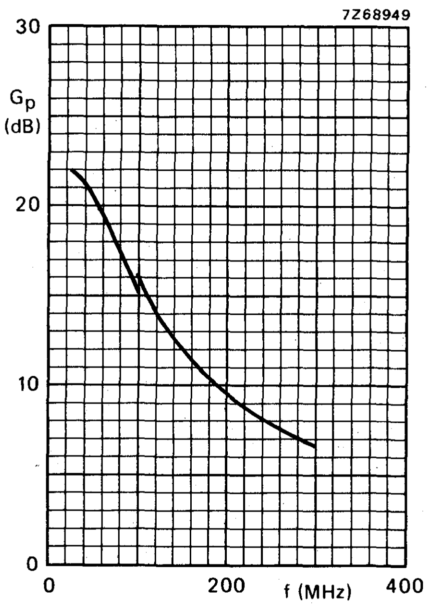


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

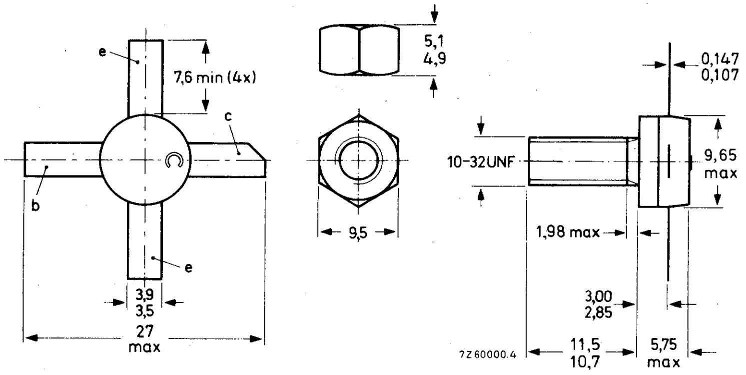
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	< 3,1	25	< 1,5	> 9	> 60	1,0 + j1,2	58,8 − j53,8

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

Diameter of clearance hole in heatsink: max. 5,0 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

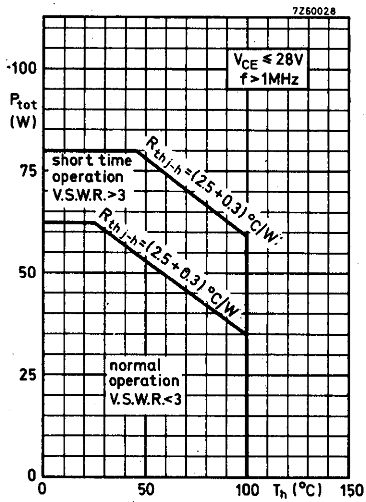
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

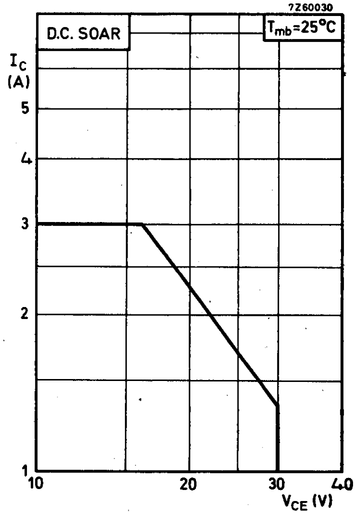
Currents

Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	9	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	70	W





Temperature

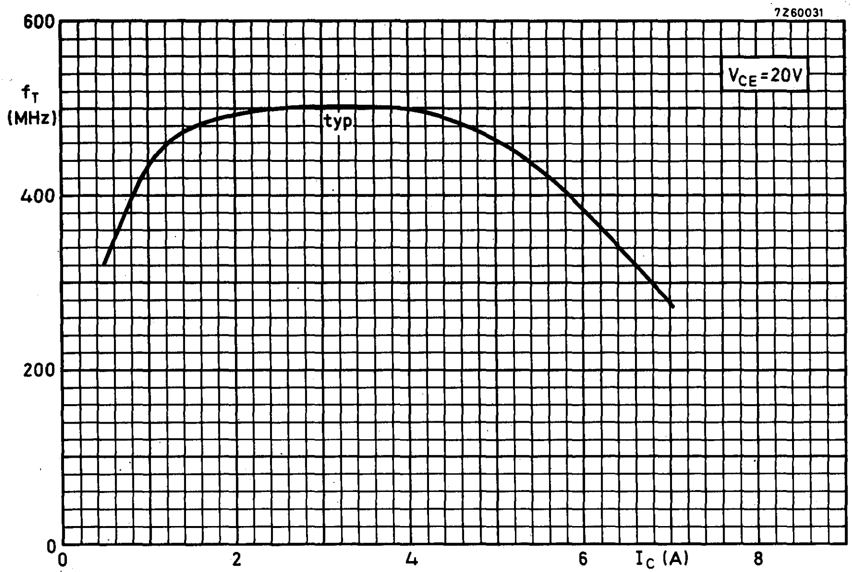
Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

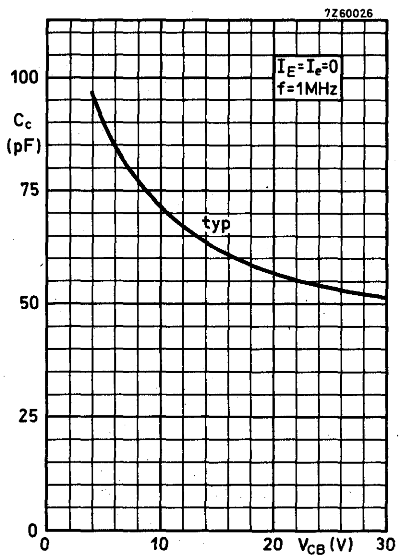
THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	2.5	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.3	°C/W

CHARACTERISTICS $T_j = 25\ ^oC$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, $I_C = 50$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 50$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz				
open base	E	>	8	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	8	mWs
D. C. current gain				
$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50	
			10 to 120	
Transition frequency				
$I_C = 3$ A; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	50	pF
		<	65	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	31	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60031
600
400
200
0
f_T
(MHz)
$V_{CE} = 20V$
typ
0
2
4
6
I_C (A)
8


7Z60026
100
C_c
(pF)
75
50
25
0
$I_E = I_e = 0$
f = 1MHz
typ
0
10
20
V_{CB} (V)
30

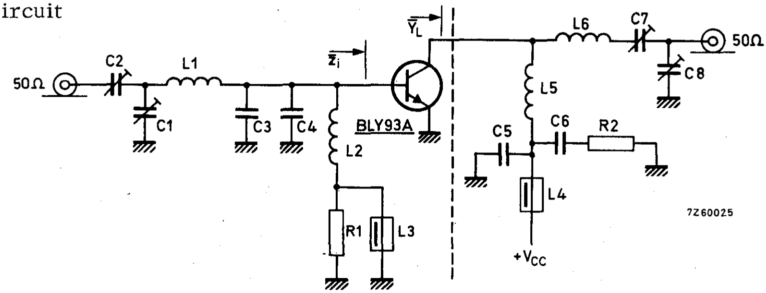
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} = 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mA/V)
175	< 3.1	25	< 1.5	> 9	> 60	1.0+j1.2	58.8−j53.8

Test circuit



C1 = 4 to 44 pF film dielectric trimmer (code number 2222 809 07008)
C2 = 2 to 22 pF film dielectric trimmer (code number 2222 809 07004)
C3 = C4 = 47 pF ceramic
C5 = 100 pF ceramic
C6 = 150 nF polyester
C7 = 4 to 104 pF film dielectric trimmer (code number 2222 809 07015)
C8 = 4 to 64 pF film dielectric trimmer (code number 2222 809 07011)

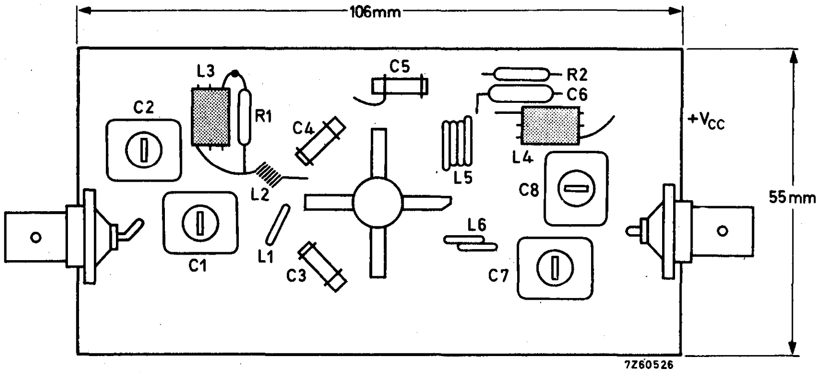
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int.diam.6 mm; leads 2x6 mm
L2 = 6 turns closely wound enamelled Cu wire (0.7 mm); int.diam.4 mm; leads 2x4 mm
L3 = L4 = ferroxcube choke (code number 4312 020 36640)
L5 = 3.5 turns enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm
L6 = 1.5 turns enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm

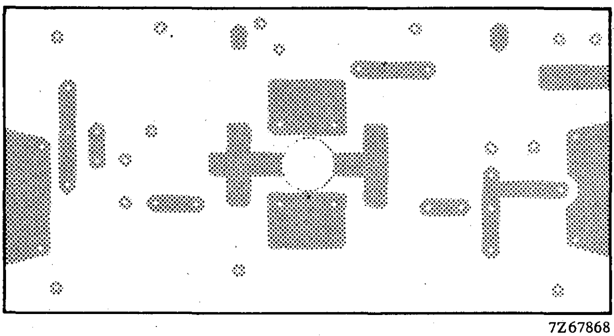
R1 = R2 = 10 Ω carbon

Component lay-out for 175 MHz see page 6.

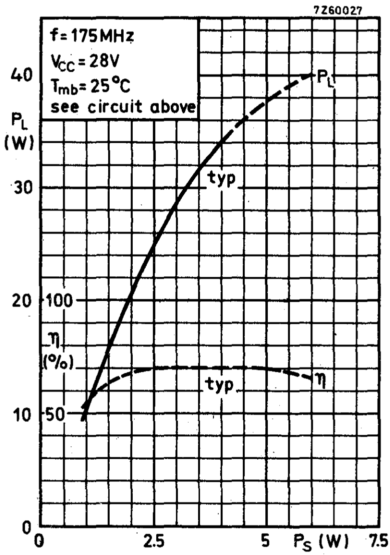
APPLICATION INFORMATION (continued)

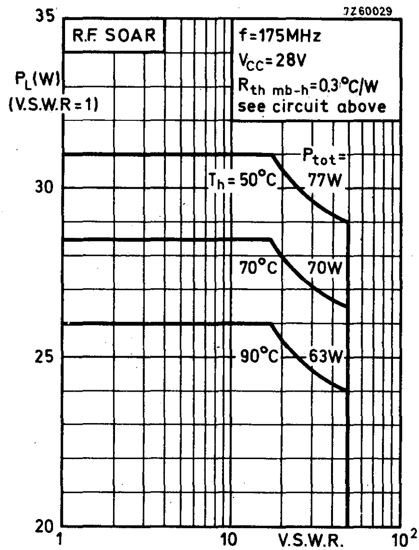
Component lay-out and printed circuit board for 175 MHz test circuit.





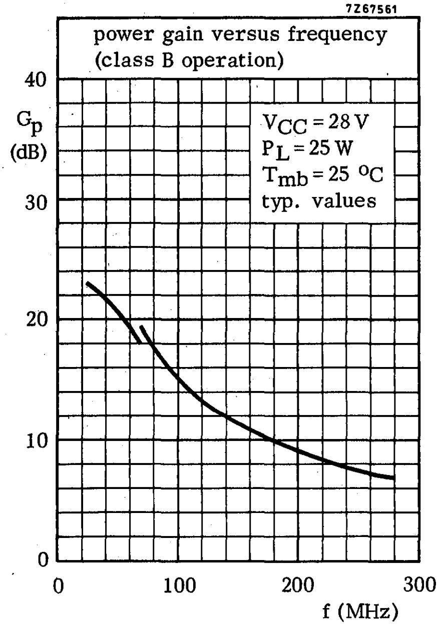
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

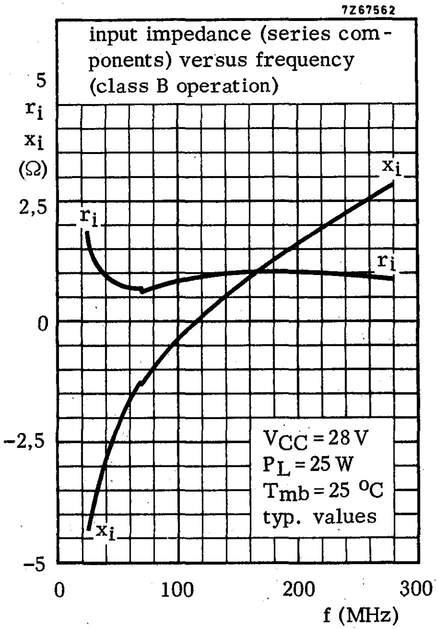


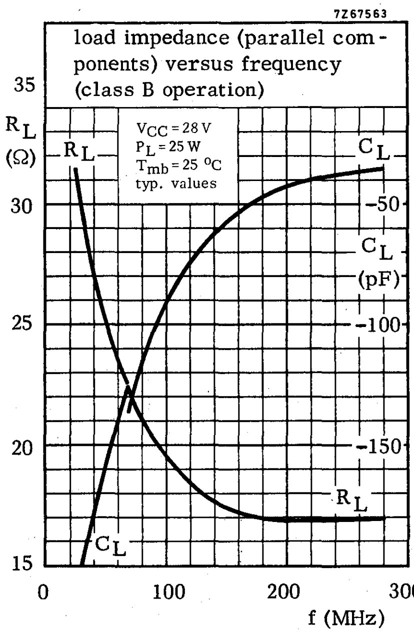


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

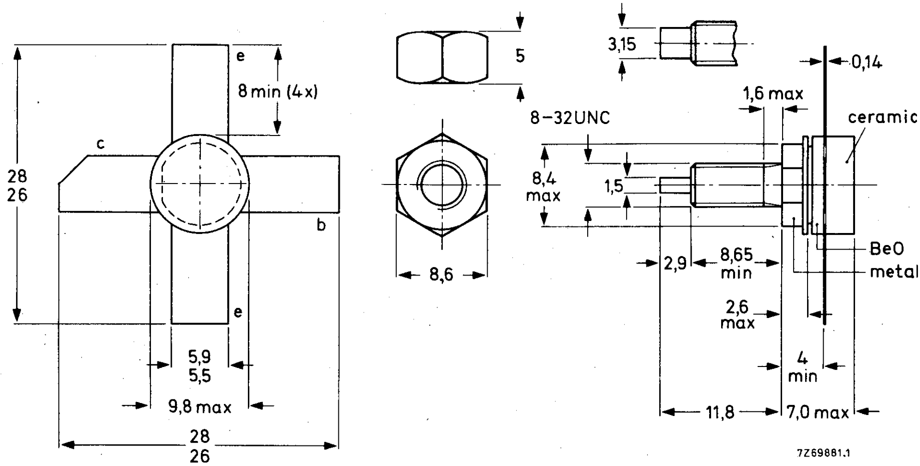
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	**28**	**175**	**25**	**> 9**	**> 60**	**1,0 + j1,2**	**59–j54**

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

CAUTION This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	70	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

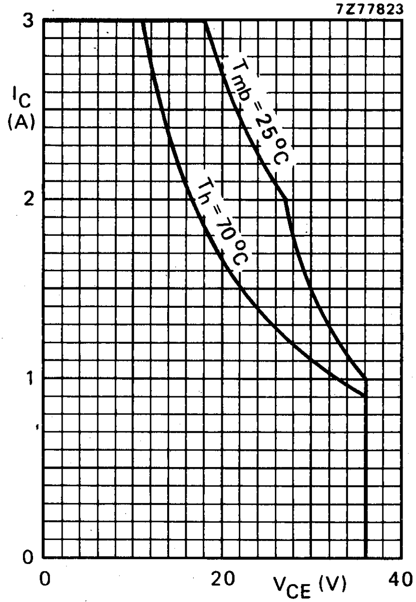


Fig. 2 D.C. SOAR.

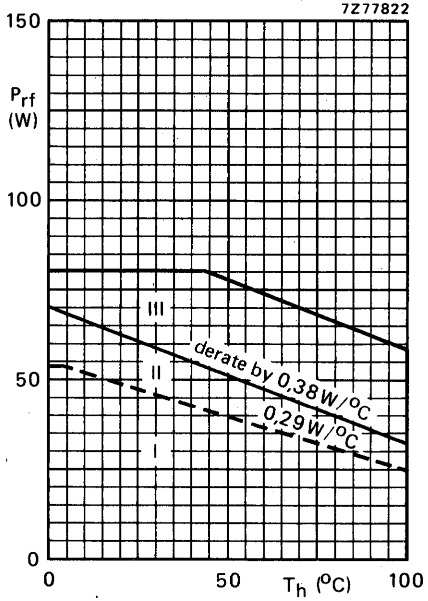


Fig. 3 R.F. power dissipation; $V_{CE} \leq$ 28 V; f ⩾ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 79 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb\ (dc)}$	=	3,1	°C/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb\ (rf)}$	=	2,3	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	°C/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage				
$V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage				
open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage				
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8	mJ
D.C. current gain *				
$I_C = 1,25$ A; $V_{CE} = 5$ V	h_{FE}	typ.	45	
			10 to 100	
Collector-emitter saturation voltage *				
$I_C = 3,75$ A; $I_B = 0,75$ A	V_{CEsat}	typ.	1,5	V
Transition frequency at f = 100 MHz *				
$-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	625	MHz
$-I_E = 3,75$ A; $V_{CB} = 28$ V	f_T	typ.	625	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	45	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	28	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

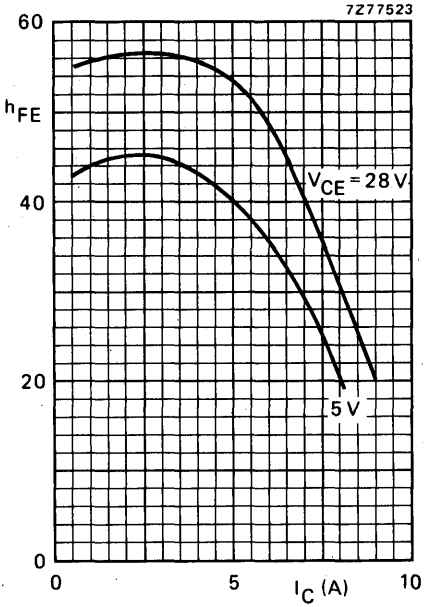


Fig. 4 Typical values; T_j = 25 °C.

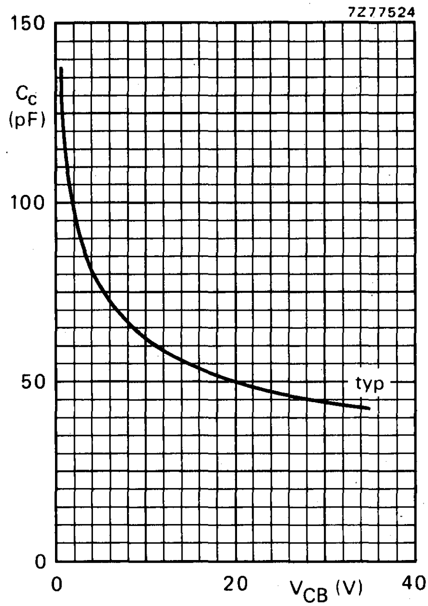


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

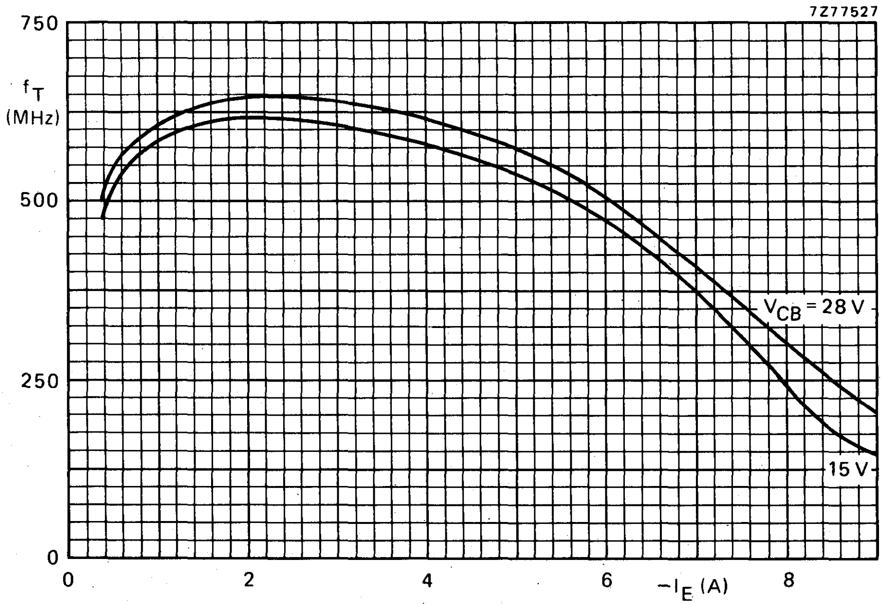


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^{o}C$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
175	**28**	**25**	**< 3,15**	**> 9**	**< 1,5**	**> 60**	**1,0 + j1,2**	**59–j54**

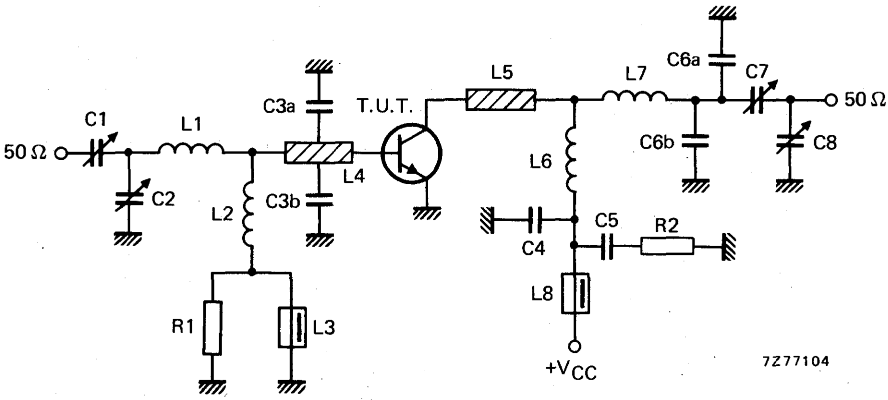


Fig. 7 Test circuit; c.w. class-B.

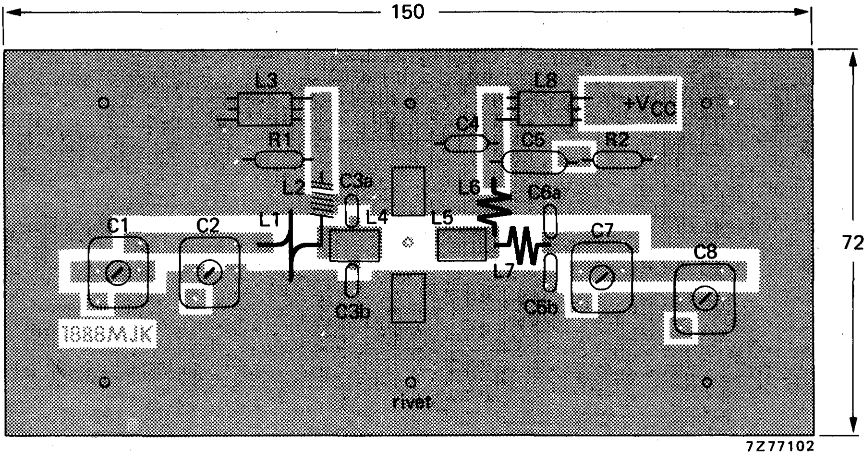
List of components
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



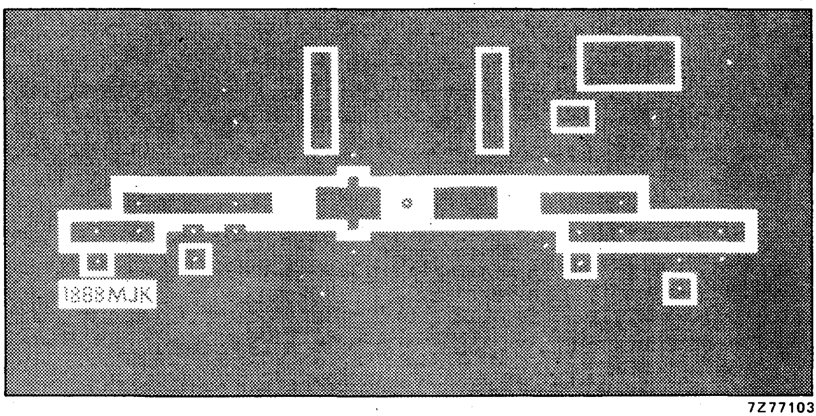


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

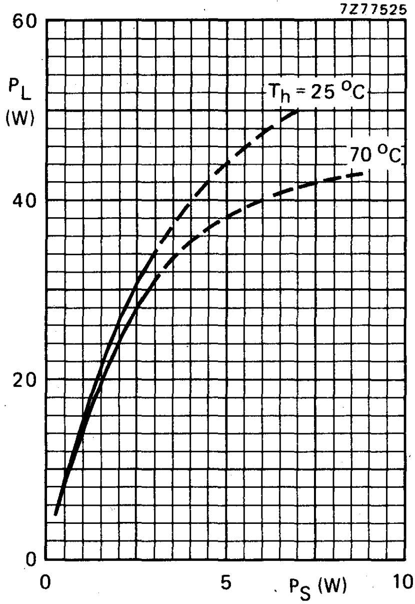


Fig. 9 V_{CE} = 28 V; f = 175 MHz; typical values.

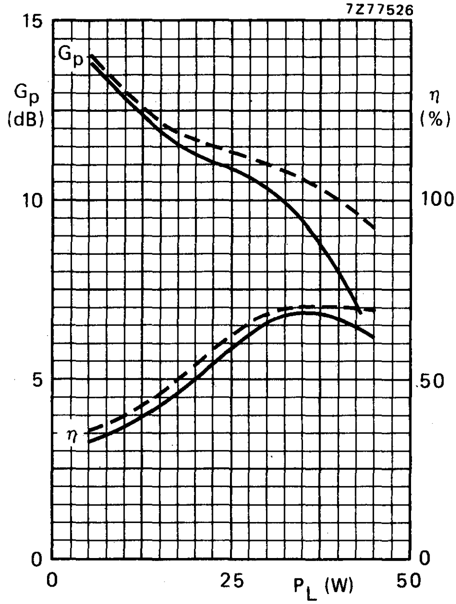


Fig. 10 V_{CE} = 28 V; f = 175 MHz; typical values; – – – T_h = 25 °C; —— T_h = 70 °C.

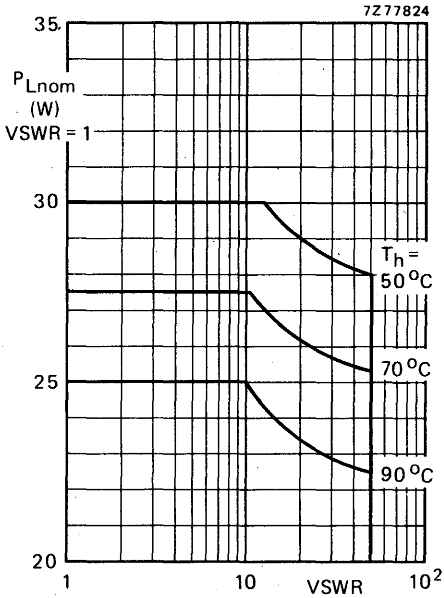


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 °C/W.

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

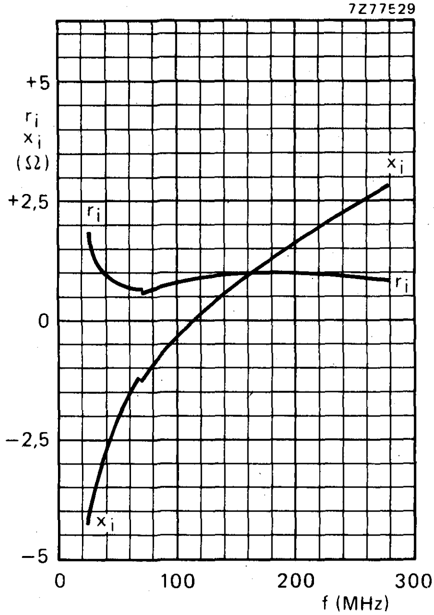


Fig. 12 Input impedance (series components).

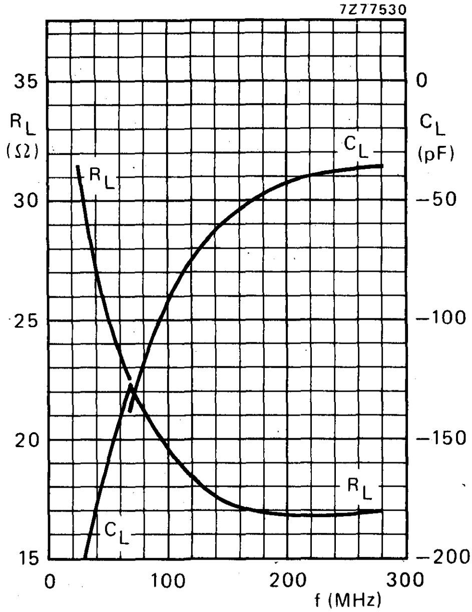


Fig. 13 Load impedance (parallel components).

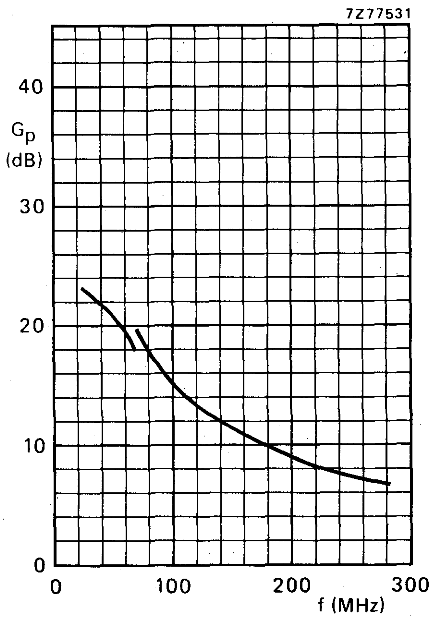


Fig. 14 Power gain versus frequency.

OPERATING NOTE

Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W; T_h = 25 °C.

V.H.F. POWER TRANSISTOR

N-P-N planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

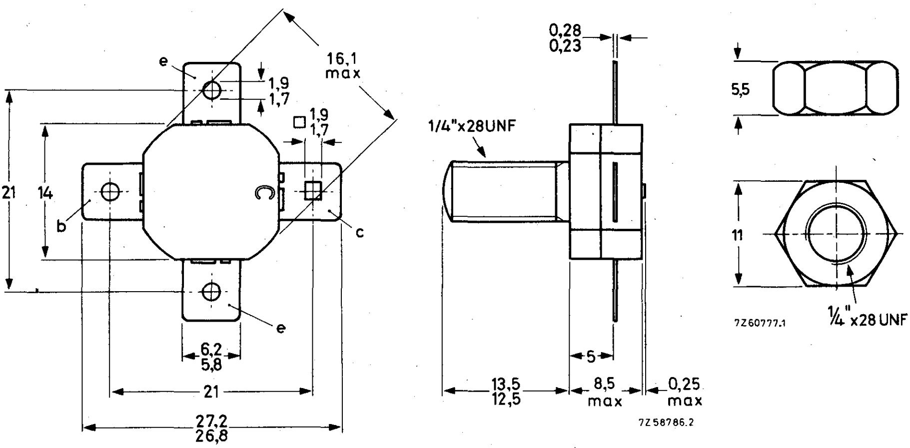
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mA/V
c.w.	28	175	< 10	50	< 2,75	> 7	> 65	0,8 + j1,45	125 − j66

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



When locking is required an adhesive is preferred instead of a lock washer.

Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,5 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

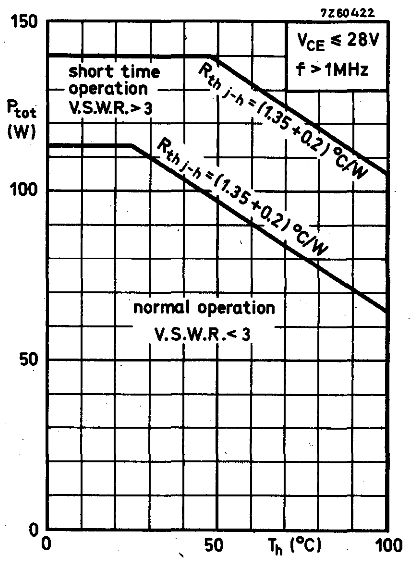
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

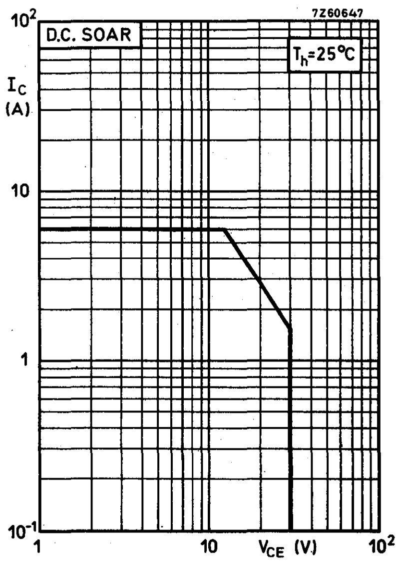
Currents

Collector current (average)	$I_{C(AV)}$	max.	6	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12	A

Power dissipation

Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	130	W





Temperature

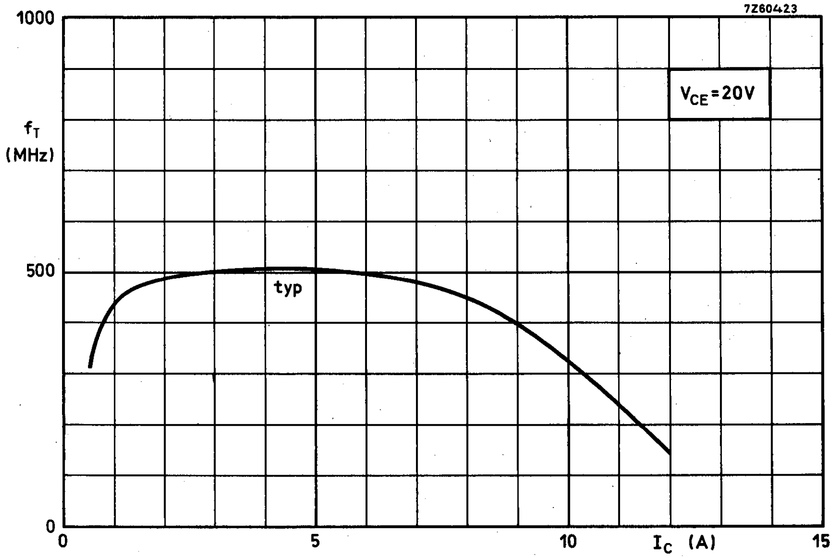
Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

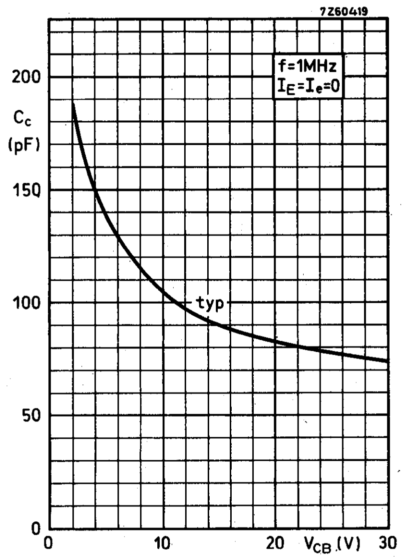
THERMAL RESISTANCE

From junction to mounting base	$R_{th\,j\text{-}mb}$	=	1.35	°C/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	=	0.2	°C/W

CHARACTERISTICS $T_j = 25\,^{o}C$ unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, $I_C = 100$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 100$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
$L = 25$ mH; $f = 50$ Hz open base	E	>	8	mWs
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	8	mWs
D.C. current gain				
$I_C = 1$ A; $V_{CE} = 5$ V	h_{FE}	10 to 120		
Transition frequency				
$I_C = 6$ A; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	75	pF
		<	130	pF
Feedback capacitance				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	47	pF
Collector-stud capacitance	C_{cs}	typ.	3.5	pF


7Z60423
1000
f_T
(MHz)
500
0
$V_{CE}=20V$
typ
0
5
10
I_C (A)
15


7Z60419
200
C_c
(pF)
150
100
50
0
f=1MHz
$I_E=I_e=0$
typ
0
10
20
V_{CB} (V)
30

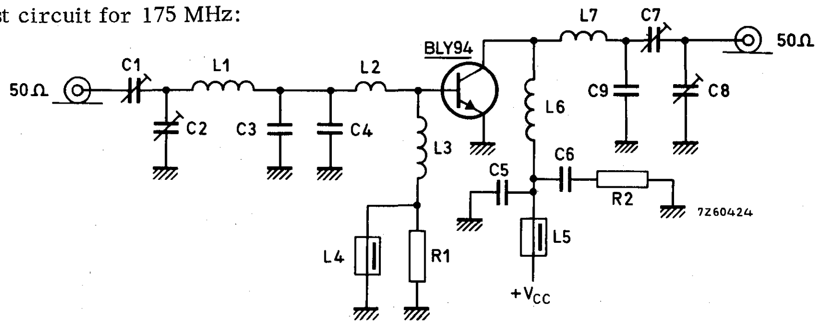
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mA/V)
28	< 10	50	< 2.75	> 7	> 65	0.8+j1.45	125 − j66

Test circuit for 175 MHz:



List of components:

C1 = 2 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 = 56 pF ceramic
C5 = 100 pF ceramic
C6 = 100 nF polyester
C7 = 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
C8 = 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)
C9 = 6.8 pF ceramic

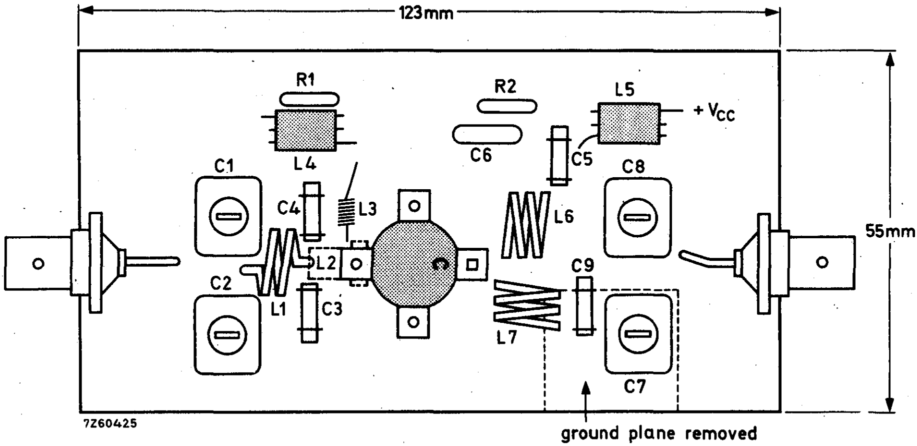
L1 = 36 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 7 mm; length 5 mm; lead length 2 x 5 mm
L2 = formed by the metallization on the p.c. board; see component lay-out
L3 = 100 nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam 3 mm; lead length 2 x 5 mm
L4 = L5 = ferroxcube choke (code number 4312 020 36640)
L6 53 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 10 mm; length 5.2 mm; lead length 2 x 5 mm
L7 = 46 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 5.4 mm; lead length 2 x 5 mm

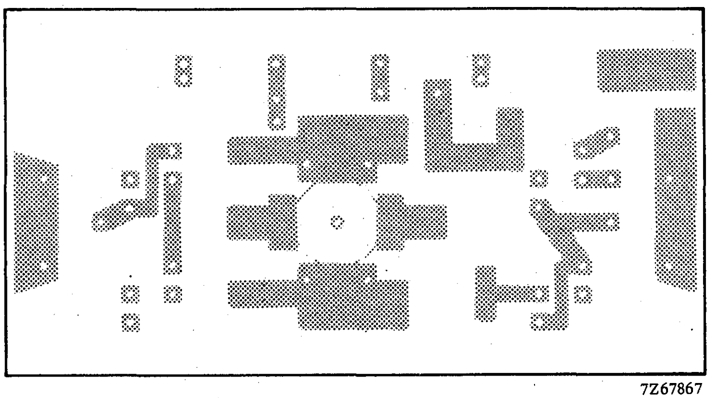
R1 = R2 = 10 Ω carbon

Component lay-out see page 6

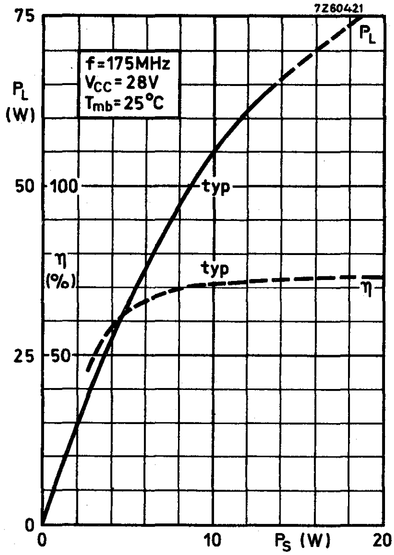
APPLICATION INFORMATION (continued)

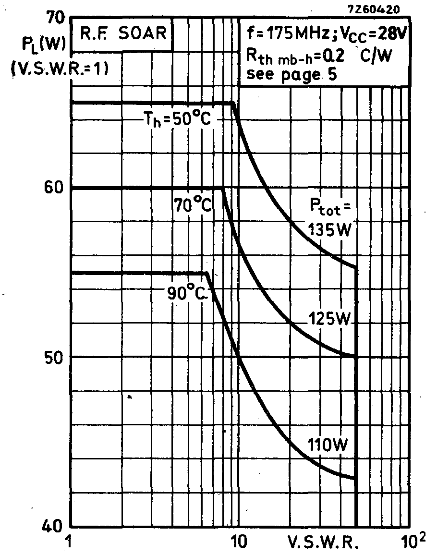
Component lay-out and printed circuit board for 175 MHz test circuit.





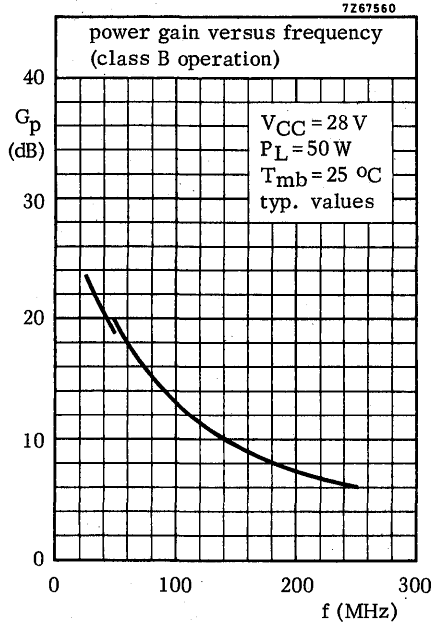
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

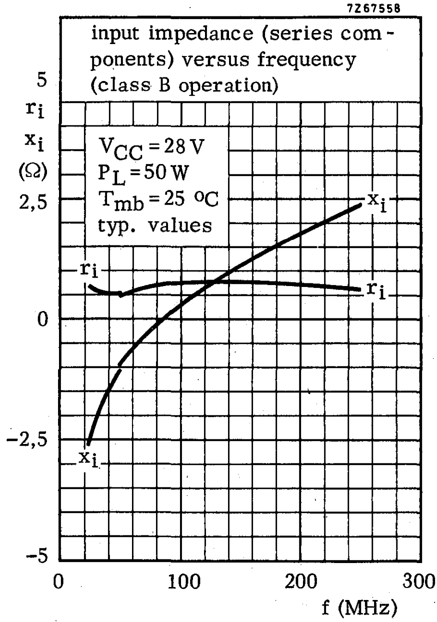


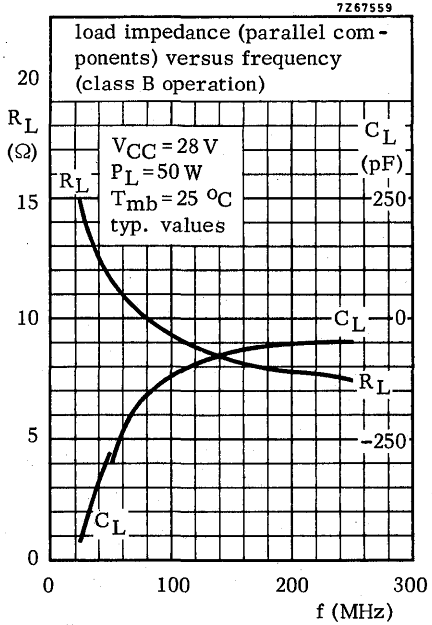


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







SILICON EPITAXIAL PLANAR OVERLAY TRANSISTORS

The **2N3553** is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case. The **2N3375** and the **2N3632** are n-p-n overlay transistors in TO-60 metal envelopes with the electrodes insulated from the studs.
The **2N3553** and the **2N3375** are intended for v.h.f./u.h.f. and the **2N3632** for v.h.f. transmitting applications.

QUICK REFERENCE DATA

			2N3553	2N3375	2N3632	
Collector-emitter voltage $-V_{BE}$ = 1,5 V	V_{CEX}	max.	65	65	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	40	40	V
Collector current (peak value)	I_{CM}	max.	1,0	1,5	3,0	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11,6	23	W
Junction temperature	T_j	max.	200	200	200	°C
Transition frequency I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500	–	MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.	–	–	400	MHz

R.F. performance at V_{CE} = 28 V

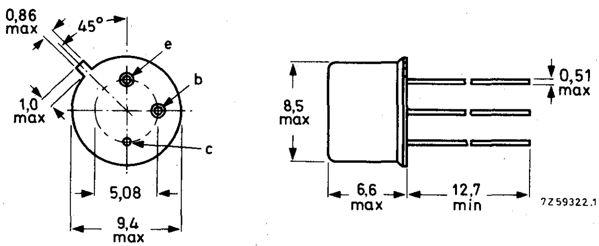
type number	f (MHz)	P_o (W)	P_i (W)	η (%)
2N3553	175	2,5	< 0,25	> 50
2N3375	100	7,5	< 1	> 65
2N3375	400	> 3	1	> 40
2N3632	175	> 13,5	3,5	> 70

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

2N3553



Maximum lead diameter is guaranteed only for 12,7 mm.
Accessories: 56218 (package); 56245 (distance disc).

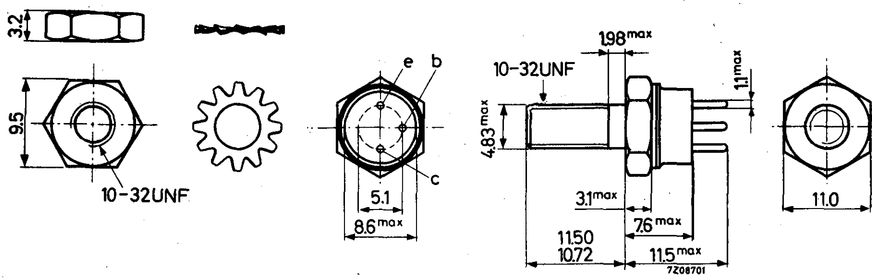
MECHANICAL DATA (continued)
2N3375
2N3632

Dimensions in mm

TO-60
The top pins should not be bent

Torque on nut: min. 8 cm kg
max. 17 cm kg

Diameter of hole in heatsink: 4.8 to 5.2 mm



RATINGS (Limiting values) [1]

Voltages [2]

Collector-base voltage (open emitter)	V_{CBO}	max.	65	V
Collector-emitter voltage I_C up to 200 mA; $-V_{BE}$ = 1.5 V	V_{CEX}	max.	65	V
Collector-emitter voltage (open base) I_C up to 200 mA	V_{CEO}	max.	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

			2N3553	2N3375	2N3632	
Currents [2]						
Collector current (d.c.)	I_C	max.	0.35	0.5	1	A
Collector current (peak value)	I_{CM}	max.	1.0	1.5	3	A
Power dissipation [2]						
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11.6	23	W

Temperatures

Storage temperature	T_{stg}	−65 to +200	°C
Junction temperature	T_j	max. 200	°C

1) Limiting values according to the Absolute Maximum System as defined in IEC publication 134.
2) See also areas of permissible operation at pages 10 and 11.

THERMAL RESISTANCE

		2N3553	2N3375	2N3632	
From junction to mounting base	$R_{th\ j\text{-}mb}$ =	25	15	7.5	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$ =		0.6	0.6	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218	$R_{th\ mb\text{-}h}$ =	1.0			°C/W
top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$ =	**2.5**			°C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N3553	2N3375	2N3632	
Collector cut-off current						
$I_B = 0$; $V_{CE} = 30$ V	I_{CEO}	<	100	100	250	μA
Breakdown voltages						
$I_E = 0$; $I_C = 250$ μA	$V_{(BR)CBO}$	>	65	65	65	V
I_C up to 200 mA $-V_{BE} = 1.5$ V; $R_B = 33\ \Omega$ [1]	$V_{(BR)CEX}$	>	65	65	65	V
$I_B = 0$ [1]	$V_{(BR)CEO}$	>	40	40	40	V
$I_C = 0$; $I_E = 250$ μA	$V_{(BR)EBO}$	>	4	4	4	V
Base-emitter voltage						
$I_C = 250$ mA; $V_{CE} = 5$ V	V_{BE}	<	1.5			V
$I_C = 500$ mA; $V_{CE} = 5$ V	V_{BE}	<		1.5		V
$I_C = 1000$ mA; $V_{CE} = 5$ V	V_{BE}	<			1.5	V
Saturation voltage						
$I_C = 250$ mA; $I_B = 50$ mA	V_{CEsat}	<	1.0			V
$I_C = 500$ mA; $I_B = 100$ mA	V_{CEsat}	<		1.0		V
$I_C = 1000$ mA; $I_B = 200$ mA	V_{CEsat}	<			1.0	V

[1]) Pulsed through an inductor of 25 mH; $\delta = 0.5$; f = 50 Hz

CHARACTERISTICS (continued) T_j = 25 °C unless otherwise specified

			2N3553	2N3375	2N3632	
D.C. current gain						
I_C = 125 mA; V_{CE} = 5 V	h_{FE}	>	15	15		
		<	200	200		
I_C = 250 mA; V_{CE} = 5 V	h_{FE}	>	10	10	10	
		<	100	100	150	
I_C = 1000 mA; V_{CE} = 5 V	h_{FE}	>			5	
		<			110	
Collector capacitance at f = 1 MHz						
$I_E = I_e = 0$; V_{CB} = 28 V	C_c	<	10	10	20	pF
Collector-case capacitance		<		6	6	pF
Transition frequency						
I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500		MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.			400	MHz
Real part of input impedance at f = 200 MHz						
I_C = 125 mA; V_{CE} = 28 V	$Re(h_{ie})$	<	20	20		Ω
I_C = 250 mA; V_{CE} = 28 V	$Re(h_{ie})$	<			20	Ω

R.F. performance at V_{CE} = 28 V

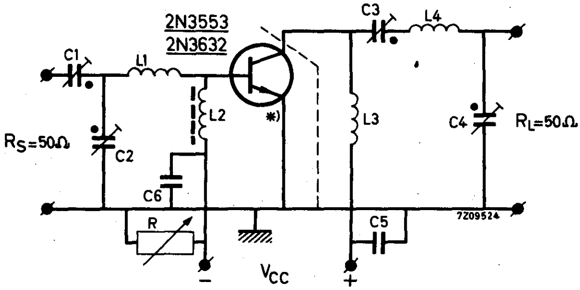
	f (MHz)	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit at page
2N3553	175	2.5	< 0.25	< 180	> 50	5
2N3375	100	7.5	< 1	< 410	> 65	6
2N3375	400	> 3	1	270	> 40	7
2N3632	175	> 13.5	3.5	690	> 70	5

NOTE

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit with the 2N3553 or the 2N3632 at f = 175 MHz



*) The length of the external emitter wire of the 2N3553 is 1.6 mm.
The emitter of the 2N3632 should be connected to the case as short as possible.

Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	10 nF	polyester
C6 =	100 pF	ceramic

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20% (code number 4312 020 36640)

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

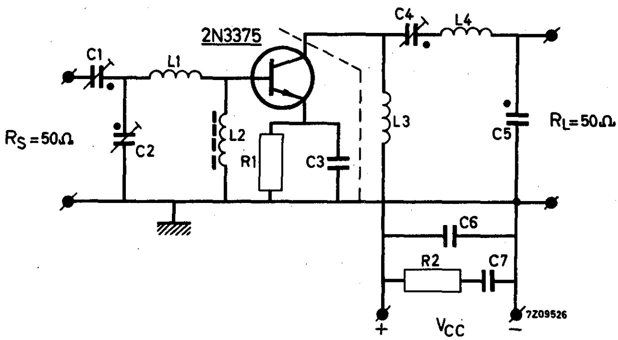
L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

R = 0 for the 2N3553

R = 0 to 2 Ω for the 2N3632

CHARACTERISTICS (continued)

Test circuit with the 2N3375 at f = 100 MHz



Components

C1 = C2 =	3.5 to 61.5 pF	air trimmer
C3 =	10 nF	polyester
C4 = C5 =	4 to 29 pF	air trimmer
C6 =	330 pF	ceramic
C7 =	10 nF	polyester

L1 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 100 MHz) = 700 Ω ± 20%
(code number 4312 020 36640)

L3 = 23 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 6 mm

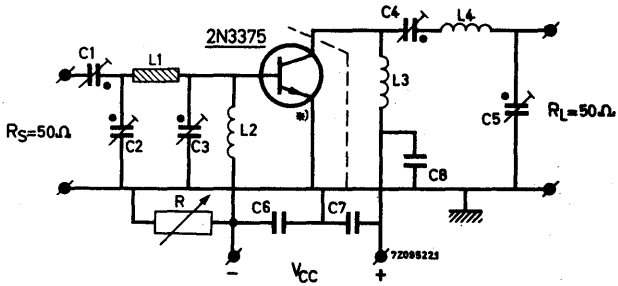
L4 = 5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 10 mm

R1 = 1.35 Ω carbon

R2 = 10 Ω carbon

CHARACTERISTICS (continued)

Test circuit with the 2N3375 at f = 400 MHz



*) The emitter should be connected to the case as short as possible.

Components

C1 = C2 =	0.7 to 6.7 pF	ceramic trimmer
C3 =	0.5 to 3.5 pF	ceramic trimmer
C4 = C5 =	3 to 19 pF	air trimmer
C6 = C7 =	15 pF	ceramic
C8 =	4700 pF	ceramic

L1 = 20 mm straight Cu wire; diam. 1.5 mm; spaced 8 mm from chassis

L2 = 17 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

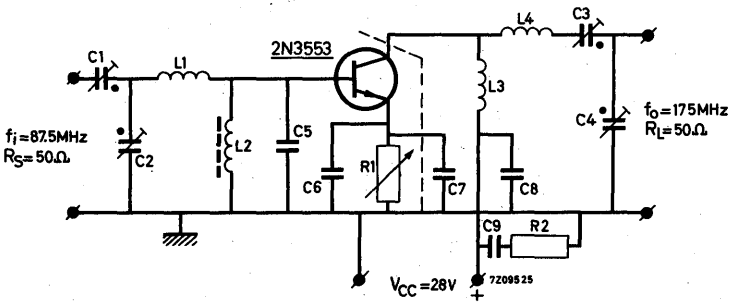
L3 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

L4 = 1 turn Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 5 mm

R = 0 to 5 Ω

APPLICATION INFORMATION

The 2N3553 used in a frequency doubler circuit 87.5 - 175 MHz



Components

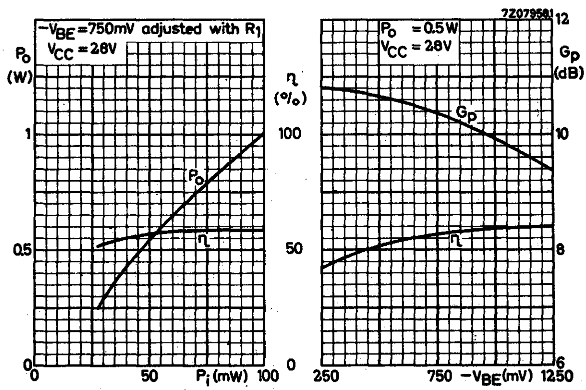
C1 = C2 = C3 = 4 to	29 pF	air trimmer	R_1 = 0 to 50 Ω		
C4 =	3.5 to 61.5 pF	air trimmer	R_2 =	10 Ω	carbon
C5 =	56 pF	ceramic			
C6 =	680 pF	ceramic			
C7 =	150 pF	ceramic			
C8 =	100 pF	ceramic			
C9 =	10 nF	polyester			

L1 = 5 turns Cu wire (1 mm); winding pitch 1.5 mm; int. diam. 6 mm; leads 2 x 12 mm

L2 = Ferroxcube choke coil; Z (at f = 87.5 MHz) = 750 Ω ± 20% (code number 4312 020 36640)

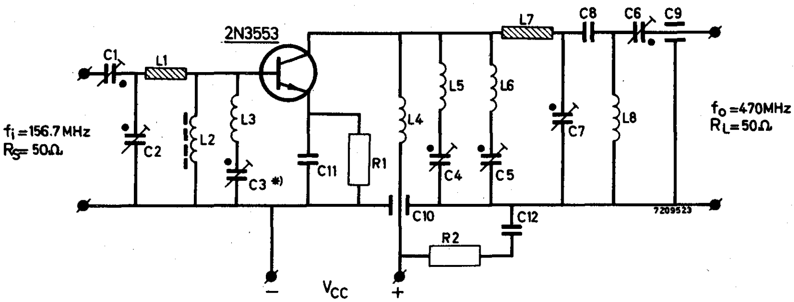
L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

L4 = 6 turns Cu wire (1 mm); winding pitch 1.5 mm; int. diam. 6 mm; leads 2 x 12 mm



APPLICATION INFORMATION (continued)

The 2N3553 used in a parametric frequency tripler 156.7 - 470 MHz



*) C3 tuned to second harmonic frequency

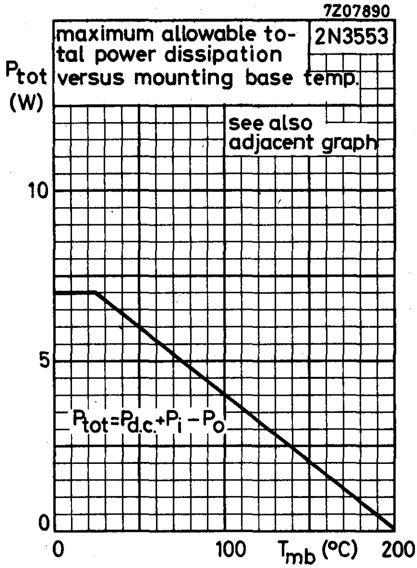
Components

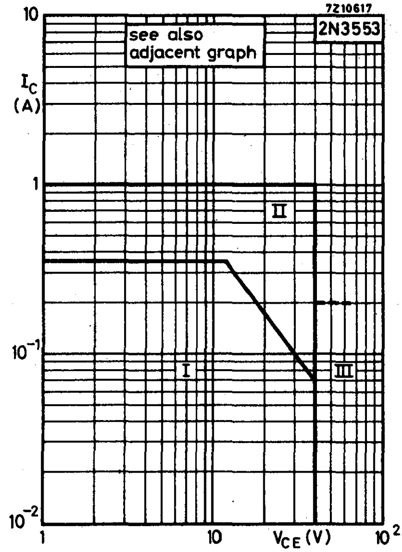
C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer	R_1 =	2.2 Ω	carbon
C5 = C6 = C7 =	4 to 10.4 pF	air trimmer	R_2 =	10 Ω	carbon
C8 =	1.0 pF	ceramic			
C9 =	12 pF	ceramic; feed through			
C10 =	100 pF	ceramic; feed through			
C11 =	1000 pF	ceramic			
C12 =	15 nF	polyester			

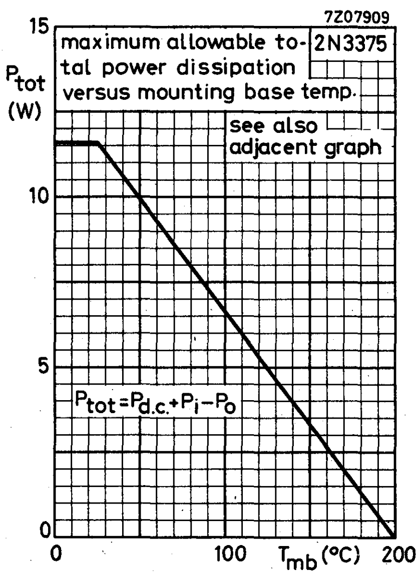
L1 = 35 mm straight Cu wire; diam. 1 mm; spaced 5.5 mm from chassis
L2 = Ferroxcube choke coil; Z (at f = 156.7 MHz) = 600 Ω ± 20% (code number 4312 020 36640)
L3 = 18 mm straight Cu wire; diam. 1 mm; spaced 5.5. mm from chassis
L4 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3.5 mm
L5 = 3 turns Cu wire (1 mm); winding pitch 1.7 mm; int. diam. 8.5 mm; leads 2 x 10 mm
L6 = 2 turns Cu wire (1 mm); winding pitch 1.7 mm; int. diam. 7 mm; leads 2 x 10 mm
L7 = 40 mm straight Cu wire; diam. 1.5 mm; spaced 5.5 mm from chassis
L8 = 1 turn Cu wire; int. diam. 7 mm; leads 2 x 5 mm

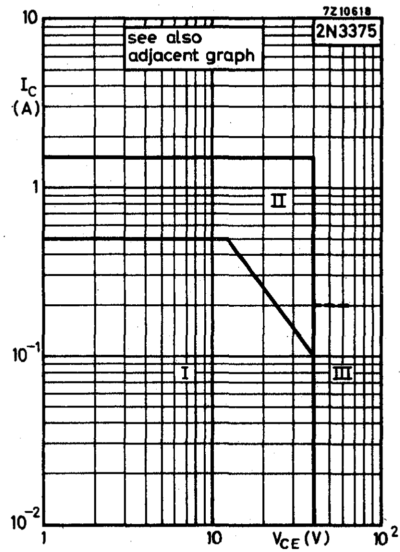
Typical performance at V_{CC} = 28 V

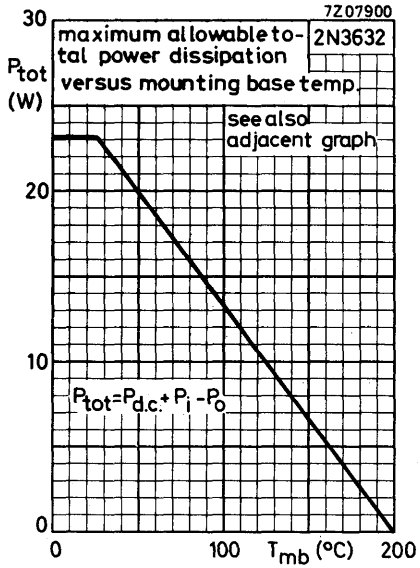
P_o (W)	P_i (W)	G_p (dB)	I_C (mA)	η %
1.5	0.27	7.5	125	43
2.0	0.39	7.1	156	46

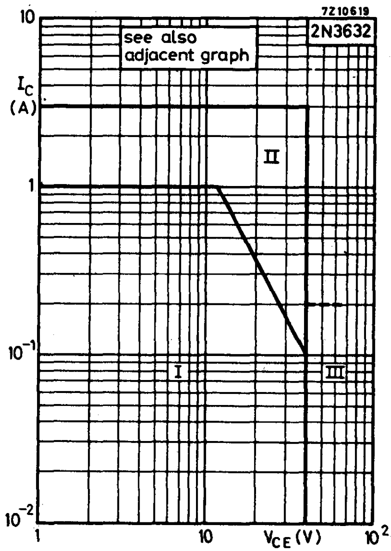

7Z07890
maximum allowable total power dissipation versus mounting base temp.
2N3553
Ptot (W)
see also adjacent graph
10
5
0
Ptot=Pd.c.+Pi −Po
0
100
Tmb (°C)
200


7Z10617
2N3553
see also adjacent graph
10
IC (A)
1
II
10−1
I
III
10−2
1
10
VCE (V)
10 2


7Z07909
15
maximum allowable total power dissipation versus mounting base temp.
2N3375
Ptot (W)
see also adjacent graph
10
5
Ptot=Pd.c.+Pi−Po
0
0
100
Tmb (°C)
200


7Z10618
2N3375
see also adjacent graph
10
IC (A)
1
II
10−1
I
III
10−2
1
10
VCE (V)
10 2

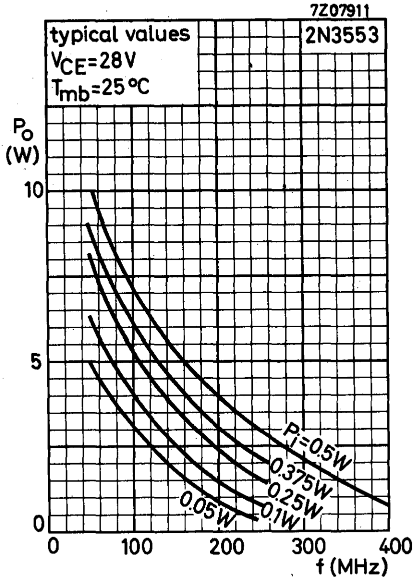


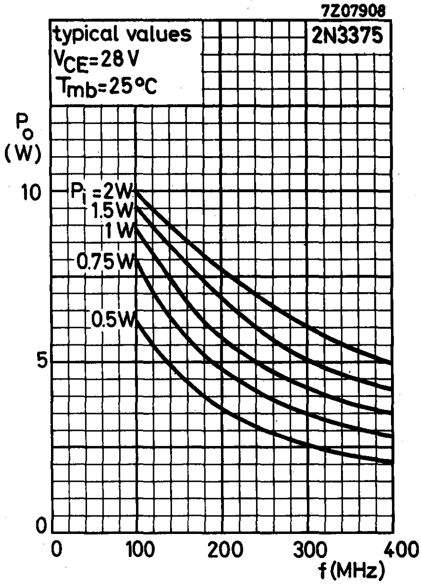


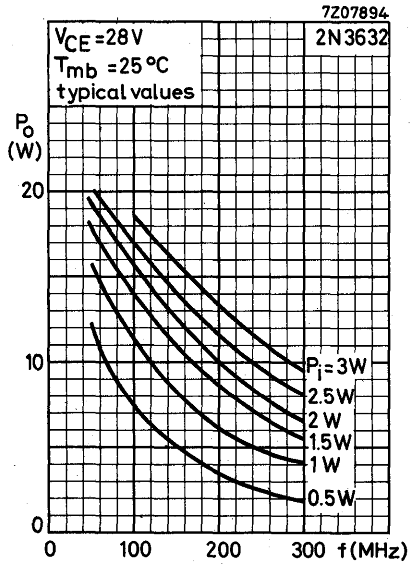
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

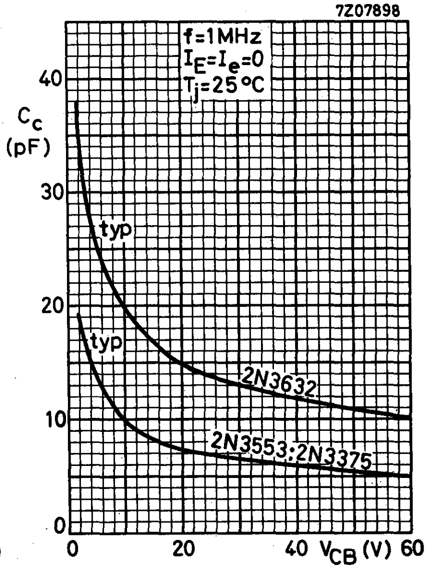
II Additional region of operation at $f \geq 1$ MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

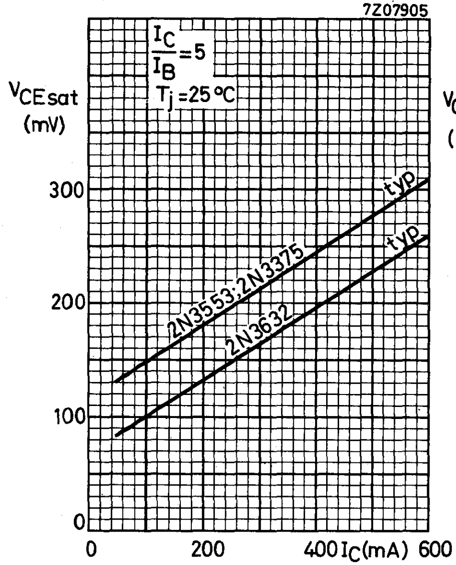
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 200$ mA and the transient energy does not exceed 0.5 mWs.

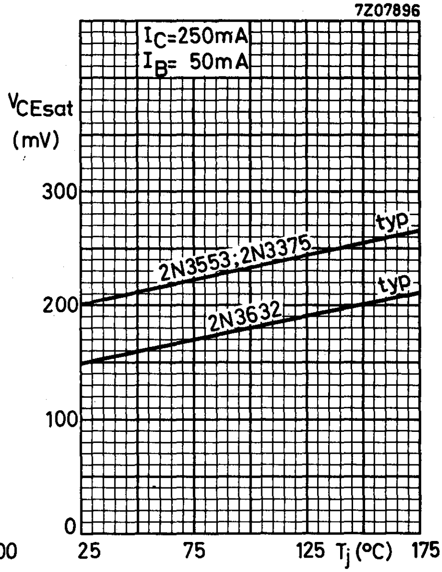

7Z07911
typical values
V_{CE}=28 V
T_{mb}=25 °C
2N3553
P_o (W)
10
5
0
P_i=0.5W
0.375W
0.25W
0.1W
0.05W
0
100
200
300
400
f (MHz)

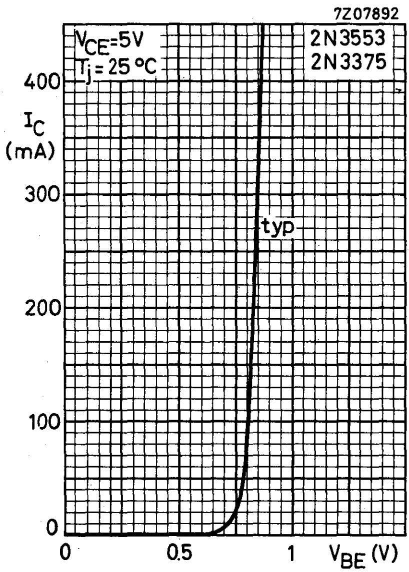

7Z07908
typical values
V_{CE}=28 V
T_{mb}=25 °C
2N3375
P_o (W)
10
5
0
P_i=2W
1.5W
1W
0.75W
0.5W
0
100
200
300
400
f (MHz)

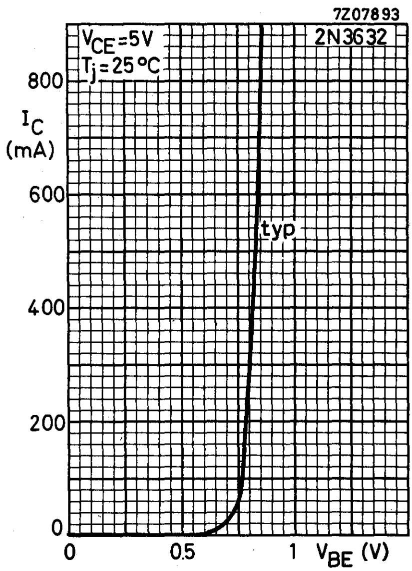

7Z07894
V_{CE}=28 V
T_{mb} =25 °C
typical values
2N3632
P_o (W)
20
10
0
P_i=3W
2.5W
2 W
1.5W
1 W
0.5W
0
100
200
300
f (MHz)

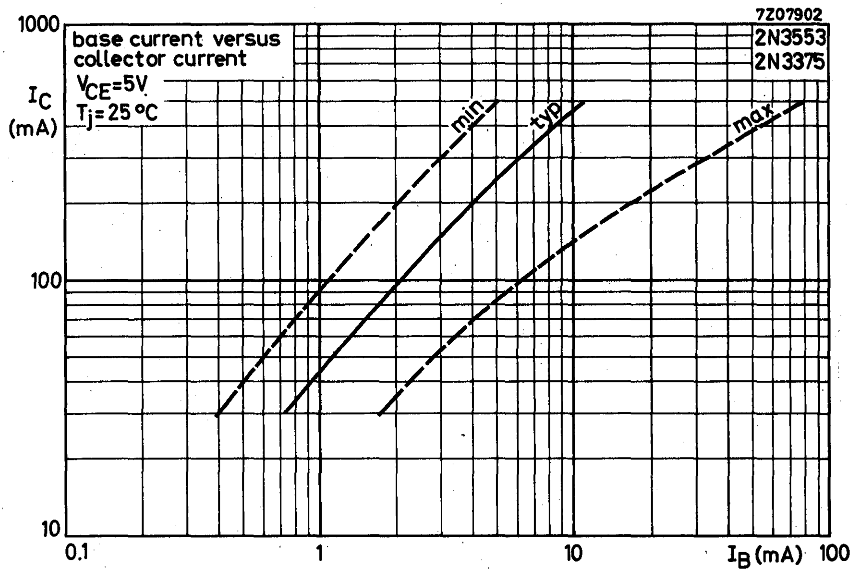

7Z07898
f=1 MHz
I_E=I_e=0
T_j=25 °C
C_c (pF)
40
30
20
10
0
typ
typ
2N3632
2N3553;2N3375
0
20
40
V_{CB} (V)
60

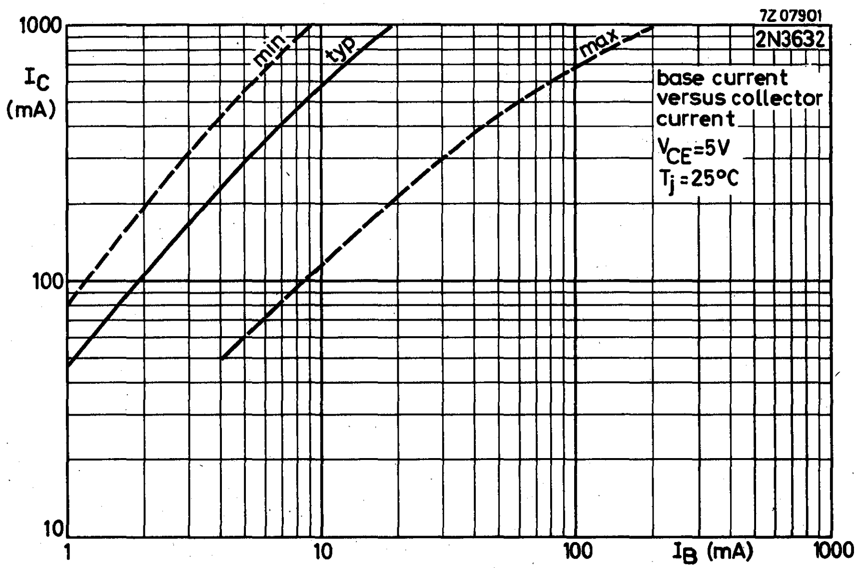

7Z07905
$\frac{I_C}{I_B}=5$
$T_j=25\,^\circ C$
V_{CEsat} (mV)
300
200
100
0
typ
typ
2N3553;2N3375
2N3632
0
200
400 I_C(mA) 600

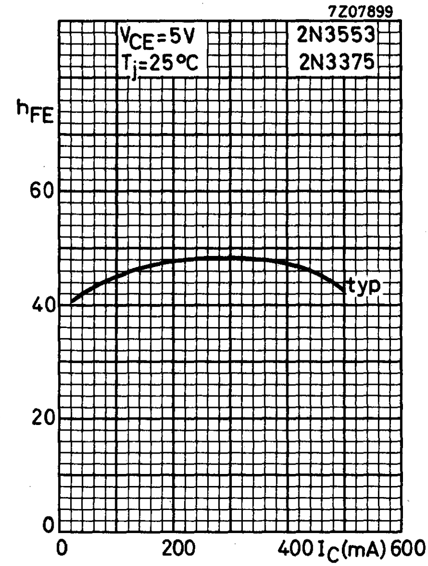

7Z07896
$I_C=250$mA
$I_B=50$mA
V_{CEsat} (mV)
300
200
100
0
typ
typ
2N3553;2N3375
2N3632
25
75
125 T_j (°C) 175

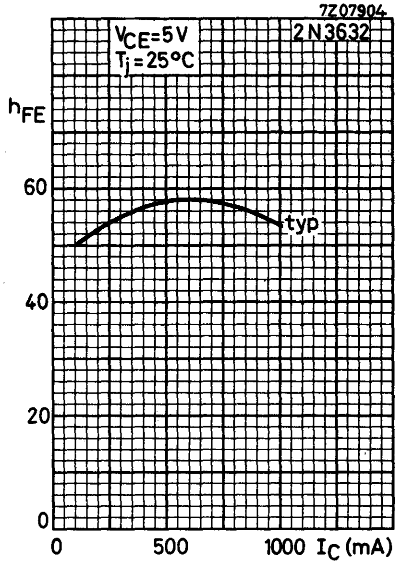

7Z07892
$V_{CE}=5V$
$T_j=25\,^\circ C$
2N3553
2N3375
400
I_C (mA)
300
200
100
0
typ
0
0.5
1 V_{BE} (V)

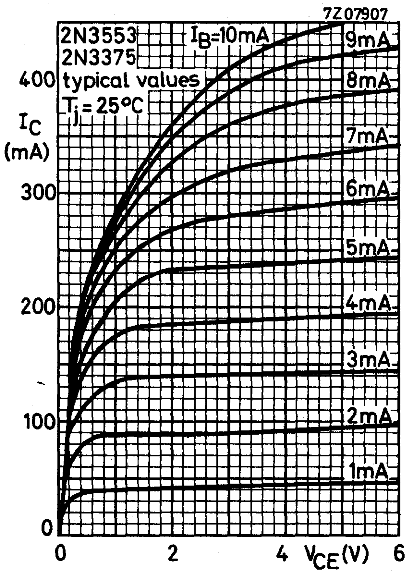

7Z07893
$V_{CE}=5V$
$T_j=25\,^\circ C$
2N3632
800
I_C (mA)
600
400
200
0
typ
0
0.5
1 V_{BE} (V)

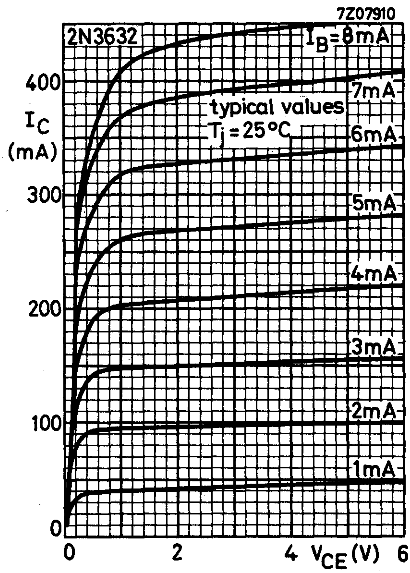

7Z07902
2N3553
2N3375
base current versus
collector current
V_{CE}=5V
T_j=25 °C
I_C
(mA)
1000
100
10
min
typ
max
0.1
1
10
I_B (mA)
100

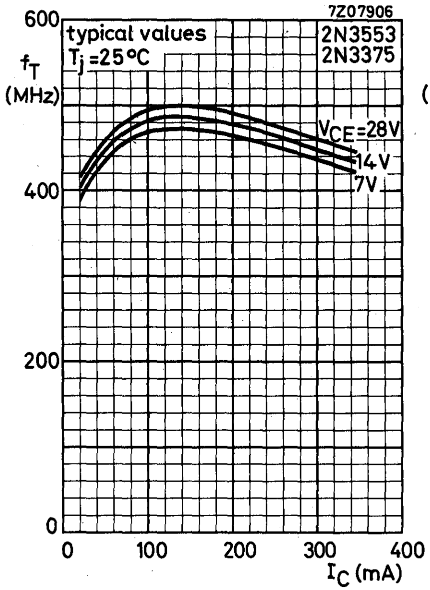

7Z 07901
2N3632
base current
versus collector
current
V_{CE}=5V
T_j=25°C
I_C
(mA)
1000
100
10
min
typ
max
1
10
100
I_B (mA)
1000

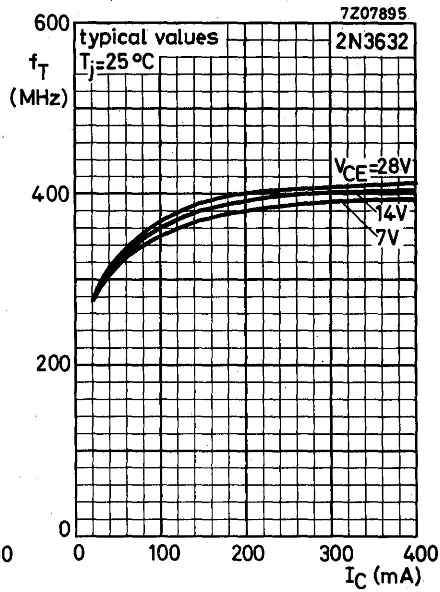

7Z07899
V_{CE}=5V
T_j=25°C
2N3553
2N3375
h_{FE}
typ
60
40
20
0
0
200
400
I_C(mA)
600

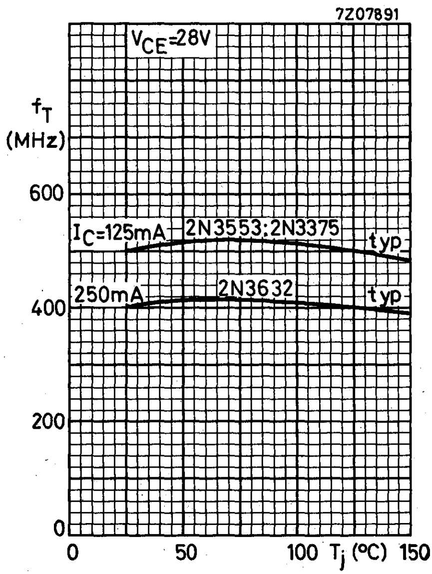

7Z07904
V_{CE}=5V
T_j=25°C
2N3632
h_{FE}
typ
60
40
20
0
0
500
1000
I_C (mA)

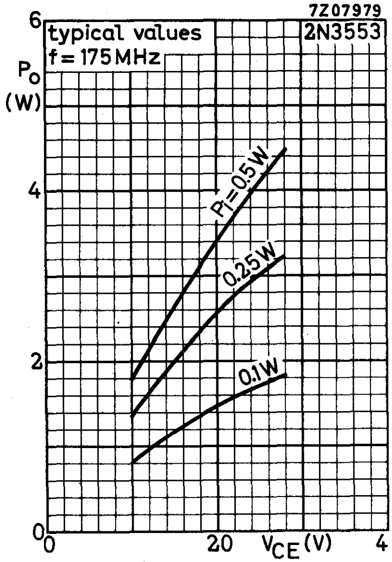

7Z07907
2N3553
2N3375
typical values
T_j=25°C
I_B=10mA
9mA
8mA
7mA
6mA
5mA
4mA
3mA
2mA
1mA
I_C
(mA)
400
300
200
100
0
0
2
4
V_{CE}(V)
6

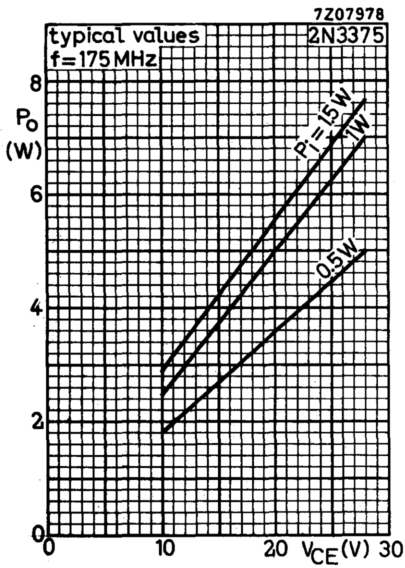

7Z07910
2N3632
I_B=8mA
7mA
typical values
T_j=25°C
6mA
5mA
4mA
3mA
2mA
1mA
I_C
(mA)
400
300
200
100
0
0
2
4
V_{CE}(V)
6

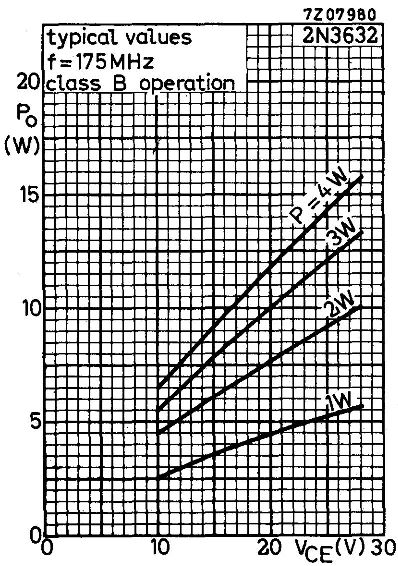

7Z07906
typical values
T_j = 25 °C
2N3553
2N3375
f_T (MHz)
V_{CE}=28V
14V
7V
I_C (mA)
0
100
200
300
400
600


7Z07895
typical values
T_j=25 °C
2N3632
f_T (MHz)
V_{CE}=28V
14V
7V
I_C (mA)
0
100
200
300
400
600


7Z07891
V_{CE}=28V
f_T (MHz)
I_C=125mA
2N3553;2N3375
typ
250mA
2N3632
typ
T_j (°C)
0
50
100
150
200
400
600


7Z07979
typical values
f = 175 MHz
2N3553
P_o (W)
6
4
2
0
P_i = 0.5 W
0.25 W
0.1 W
0
20
V_{CE} (V)
4


7Z07978
typical values
f = 175 MHz
2N3375
P_o (W)
8
6
4
2
0
P_i = 1.5 W
1 W
0.5 W
0
10
20
V_{CE} (V)
30


7Z07980
typical values
f = 175 MHz
class B operation
2N3632
P_o (W)
20
15
10
5
0
P_i = 4 W
3 W
2 W
1 W
0
10
20
V_{CE} (V)
30

SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

N-P-N overlay transistors in TO-39 metal envelopes with the collector connected to the case. The devices are primarily intended for class-A, B or C amplifiers, frequency multiplier and oscillator circuits.

The transistors are suitable in output, driver or pre-driver stages in v.h.f. and u.h.f. equipment.

QUICK REFERENCE DATA

			2N3866	2N4427	
Collector-emitter voltage $R_{BE} = 10\ \Omega$	V_{CER}	max.	55	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	20	V
Collector current (d.c. or averaged over any 20 ms period)	I_C	max.	0,4	0,4	A
Total power dissipation up to $T_{mb} = 25\ ^oC$	P_{tot}	max.	5	3,5	W
Junction temperature	T_j	max.	200	200	^oC
Transition frequency $I_C = 25$ mA; $V_{CE} = 15$ V; f = 100 MHz	f_T	typ.	700	–	MHz
$I_C = 25$ mA; $V_{CE} = 10$ V; f = 100 MHz	f_T	typ.	–	700	MHz

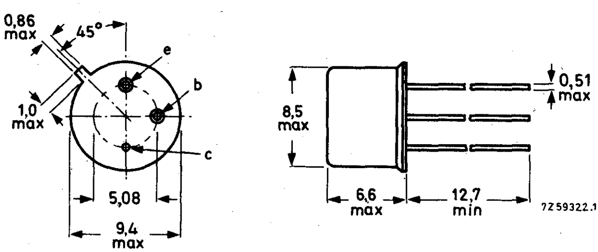
R.F. performance

type number	f (MHz)	V_{CE} (V)	P_o (W)	P_i (W)	η (%)
2N3866	400	28	1	< 0,1	> 45
2N4427	175	12	1	< 0,1	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56218 (package); 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

			2N3866	2N4427	
<u>Voltages</u> [1]					
Collector-base voltage (open emitter)	V_{CBO}	max.	55	40	V
Collector-emitter voltage R_{BE} = 10 Ω	V_{CER}	max.	55	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3.5	2.0	V
<u>Currents</u> [1]					
Collector current (d.c. or averaged over any 20 ms period)	I_C	max.	0.4	0.4	A
Collector current (peak value)	I_{CM}	max.	0.4	0.4	A
<u>Power dissipation</u> [1]					
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	5	3.5	W

<u>Temperatures</u>				
Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	200	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	35	°C/W
From mounting base to heatsink mounted with top clamping washer of 56218	$R_{th\ mb\text{-}h}$	=	1.0	°C/W
top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	2.5	°C/W

[1] See also areas of permissible operation on page 6 .

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N3866	2N4427	
Collector cut-off current					
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	20		μA
$I_B = 0$; $V_{CE} = 12$ V	I_{CEO}	<		20	μA
Breakdown voltages					
$I_E = 0$; $I_C = 100$ μA	$V_{(BR)CBO}$	>	55	40	V
$I_C = 5$ mA; $R_{BE} = 10\ \Omega$	$V_{(BR)CER}$	>	55	40	V
$I_B = 0$; $I_C = 5$ mA	$V_{(BR)CEO}$	>	30	20	V
$I_C = 0$; $I_E = 100$ μA	$V_{(BR)EBO}$	>	3.5	2	V
Collector-emitter saturation voltage					
$I_C = 100$ mA; $I_B = 20$ mA	V_{CEsat}	<	1.0	0.5	V
D.C. current gain					
$I_C = 50$ mA; $V_{CE} = 5$ V	h_{FE}		10 to 200		
$I_C = 100$ mA; $V_{CE} = 5$ V	h_{FE}			10 to 200	
$I_C = 360$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	5	
Transition frequency					
$I_C = 25$ mA; $V_{CE} = 15$ V; f = 100 MHz	f_T	typ.	700		MHz
$I_C = 25$ mA; $V_{CE} = 10$ V; f = 100 MHz	f_T	typ.		700	MHz
Collector capacitance					
$V_{CB} = 28$ V; $I_E = I_e = 0$; f = 1 MHz	C_c	<	3		pF
$V_{CB} = 12$ V; $I_E = I_e = 0$; f = 1 MHz	C_c	<		4	pF

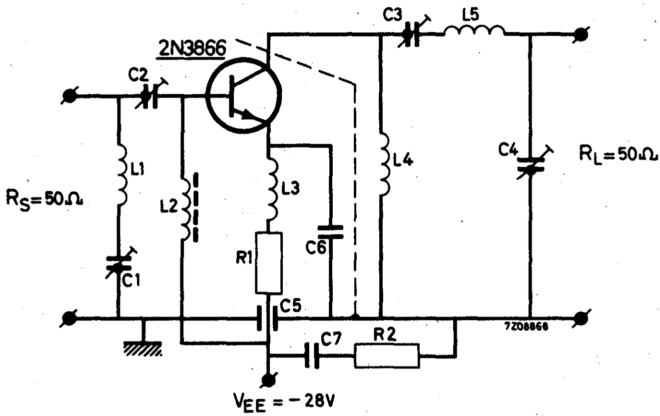
R.F. performance at T_{mb} = 25 °C

	f (MHz)	V_{CE} (V)	P_o (W)	P_i (W)	I_C (mA)	η (%)	Test circuit on page
2N3866	100	28	1.8	0.05	< 107	> 60	
2N3866	250	28	1.5	0.1	< 107	> 50	
2N3866	400	28	1.0	< 0.1	< 79	> 45	4 *
2N4427	175	12	1.0	< 0.1	< 167	> 50	5 *
2N4427	470	12	0.4	0.1	67	50	

*) The transistor can withstand an output V.S.W.R. of 3 : 1 varied through all phases for conditions, mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit with the 2N3866 at f = 400 MHz

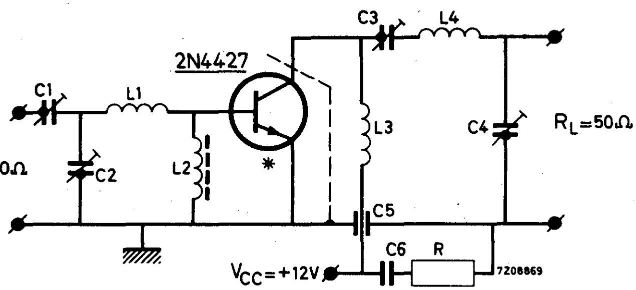


C1 = C2 = C3 =	4 to 29 pF	air trimmer
C4 =	4 to 14 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 pF	
C7 =	12 nF	
R1 =	5.6 Ω	
R2 =	10 Ω	

L1 = 2 turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 3 mm
L2 = Ferroxcube choke coil; Z (at f = 250 MHz) = 450 Ω (code number 4312 020 36690)
L3 = L4 = 6 turns enamelled Cu wire (0.5 mm); int. diam. 3.5 mm (100 nH)
L5 = 2 turns Cu wire (1 mm); int. diam. 7 mm; winding pitch 2.5 mm; leads 2x15 mm.

CHARACTERISTICS (continued)

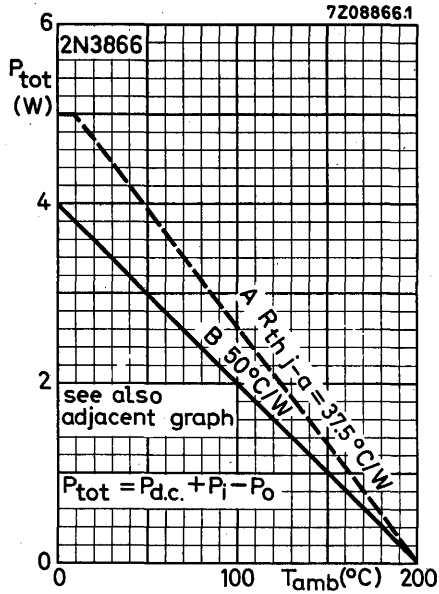
Test circuit with the 2N4427 at f = 175 MHz

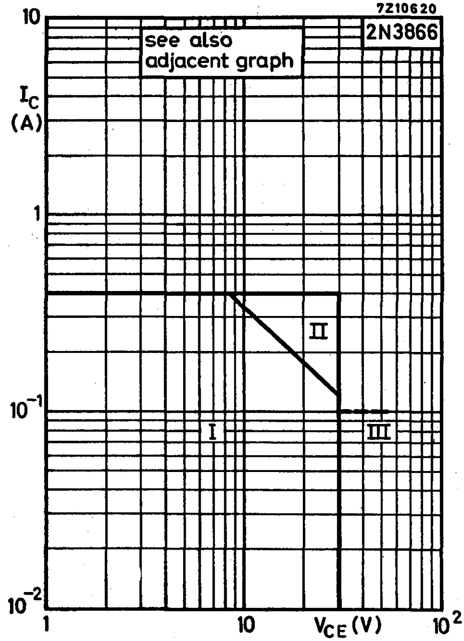


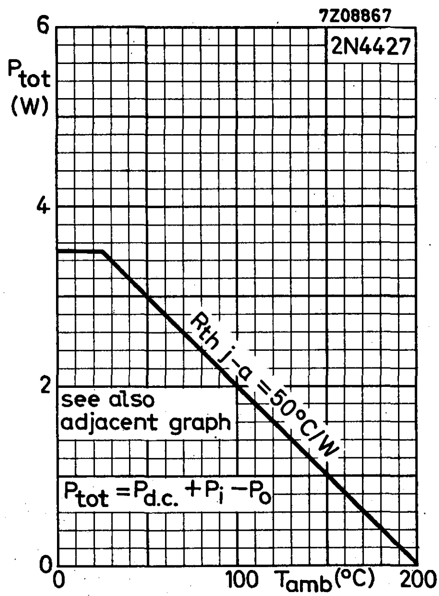
*) The length of the external emitter wire is 1.6 mm

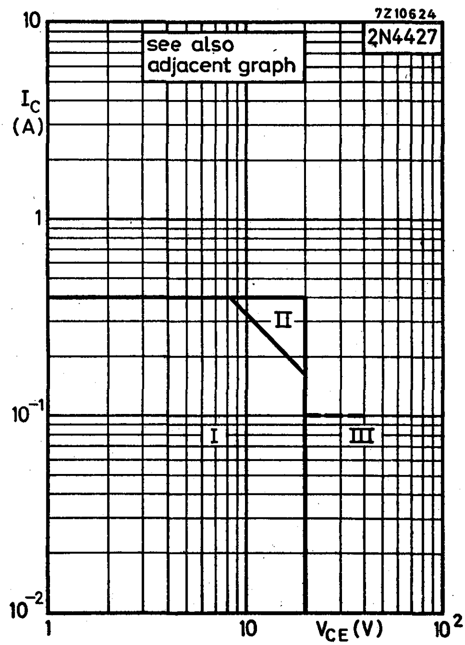
C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 nF	
R =	10 Ω	

L1 = 2 turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 2 mm; leads 2x10 mm
L2 = Ferroxcube choke coil; Z (at f = 175 MHz) = 550 Ω (code number 4312 020 36640)
L3 = 2 turns Cu wire (1 mm); int. diam. 5 mm; winding pitch 2 mm; leads 2x10 mm
L4 = 3 turns Cu wire (1.5 mm); int. diam. 10 mm; winding pitch 2 mm; leads 2x15 mm


7Z08866.1
2N3866
Ptot (W)
6
4
2
0
0
100
Tamb (°C)
200
A Rth j-a = 37.5 °C/W
B 50 °C/W
see also adjacent graph
Ptot = Pd.c. + Pi − Po


7Z10620
2N3866
see also adjacent graph
IC (A)
10
1
10⁻¹
10⁻²
1
10
VCE (V)
10²
I
II
III

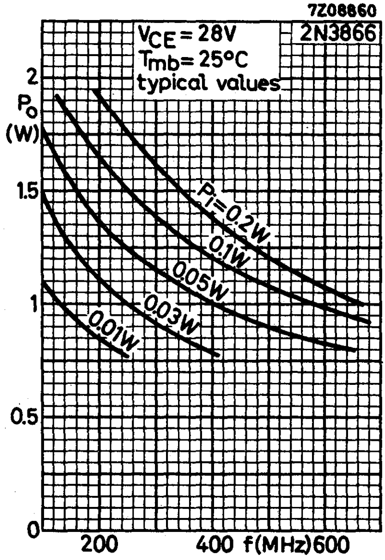

7Z08867
2N4427
Ptot (W)
6
4
2
0
0
100
Tamb (°C)
200
Rth j-a = 50 °C/W
see also adjacent graph
Ptot = Pd.c. + Pi − Po

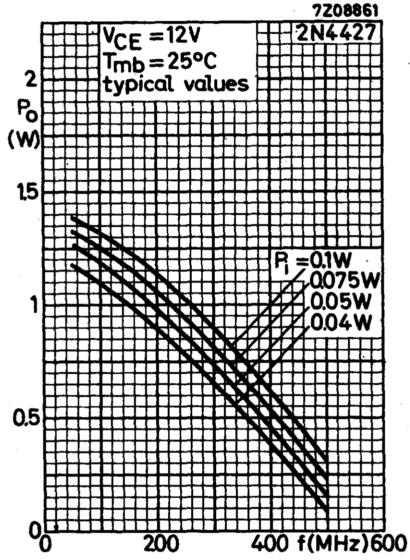

7Z10624
2N4427
see also adjacent graph
IC (A)
10
1
10⁻¹
10⁻²
1
10
VCE (V)
10²
I
II
III

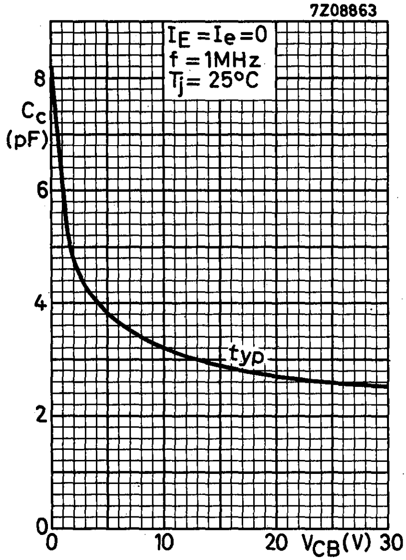
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

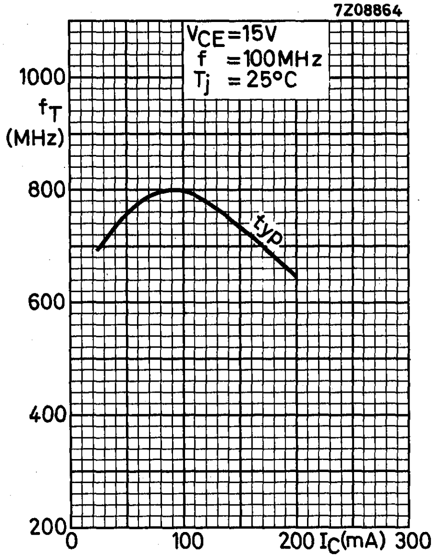
II Additional region of operation at f $\geq$ 1 MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 100$ mA and the transient energy does not exceed 0.125 mWs.

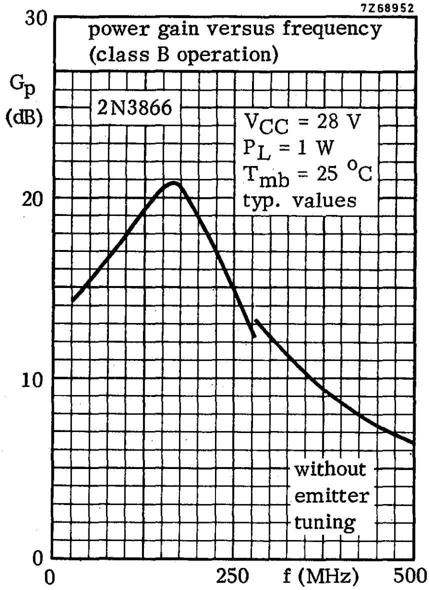


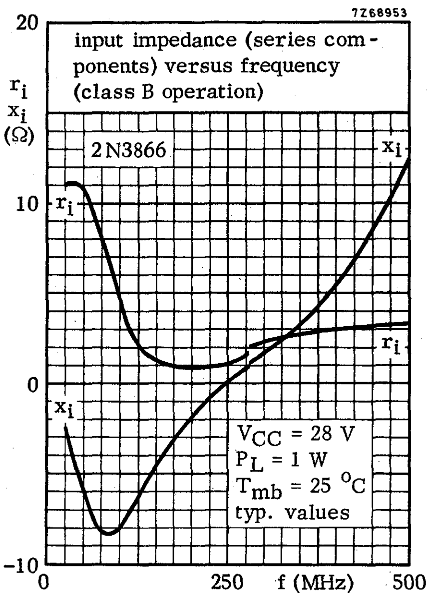


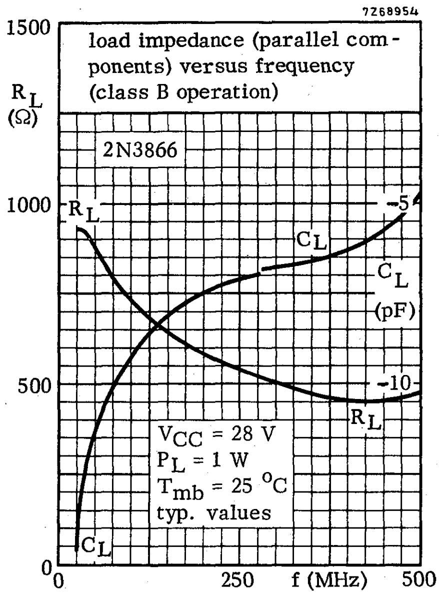

7Z08863
$I_E = I_e = 0$
f = 1MHz
T_j = 25°C
typ
C_c (pF)
8
6
4
2
0
0
10
20
V_{CB}(V)
30


7Z08864
V_{CE}=15V
f = 100MHz
T_j = 25°C
typ
f_T (MHz)
1000
800
600
400
200
0
100
200
I_C(mA)
300

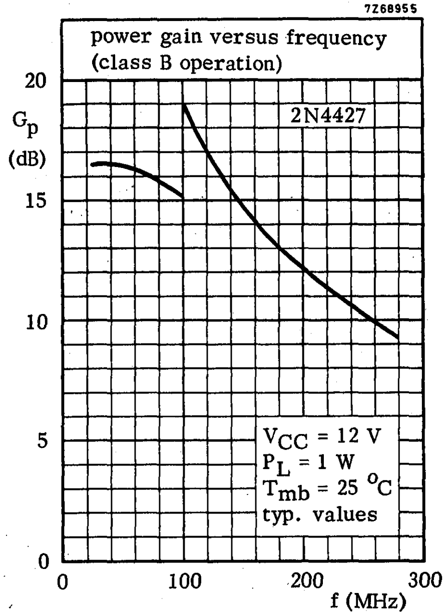
OPERATING NOTE Below 280 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

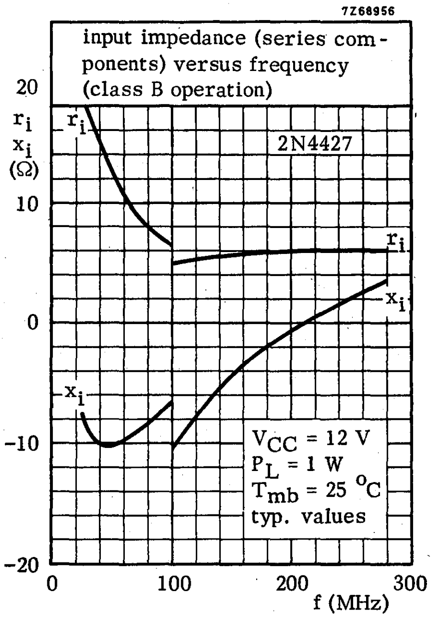


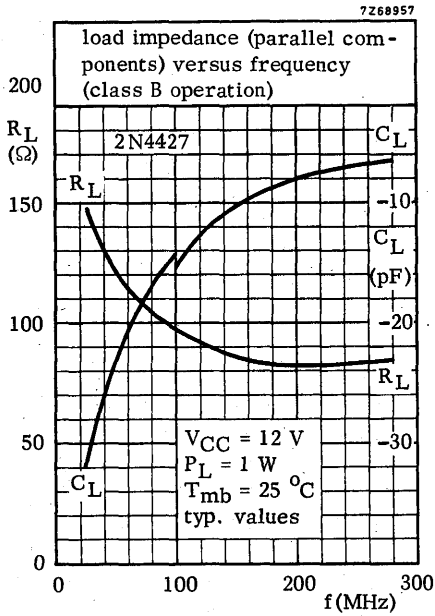




OPERATING NOTE Below 100 MHz a base-emitter resistor of 22 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

The **2N3924** is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case. The **2N3926** and the **2N3927** are n-p-n overlay transistors in TO-60 metal envelopes with the emitter connected to the case.
The transistors are intended for v.h.f. transmitting applications.

QUICK REFERENCE DATA

			2N3924	2N3926	2N3927	
Collector-emitter voltage $-V_{BE}$ = 1,5 V	V_{CEX}	max.	36	36	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	18	18	V
Collector current (peak value)	I_{CM}	max.	1,5	3,0	4,5	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11,6	23	W
Junction temperature	T_j	max.	200	200	200	°C
Transition frequency I_C = 100 mA; V_{CE} = 13,5 V	f_T	>	250	250	–	MHz
I_C = 200 mA; V_{CE} = 13,5 V	f_T	>	–	–	200	MHz

R.F. performance at V_{CE} = 13,5 V; f = 175 MHz

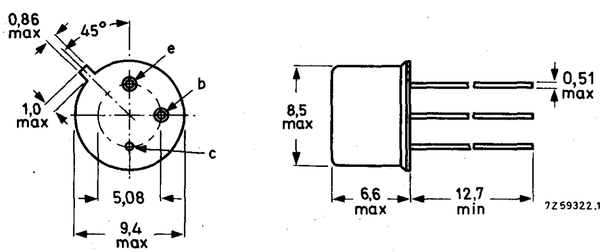
type number	P_o (W)	P_i (W)	η (%)
2N3924	4	< 1	> 70
2N3926	7	< 2	> 70
2N3927	12	< 4	> 80

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

2N3924



Maximum lead diameter is guaranteed only for 12,7 mm.
Accessories: 56218 (package); 56245 (distance disc).

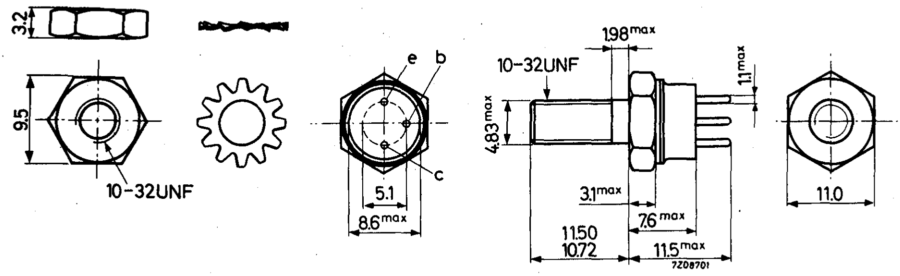
MECHANICAL DATA (continued)

Dimensions in mm

2N3926
2N3927
TO-60
The emitter connected to the case
The top pins should not be bent

Diameter of hole in heatsink: 4.8 to 5.2 mm
The device is supplied with nut and lock washer

Torque on nut: min. 8 cm kg
max. 17 cm kg



RATINGS (Limiting values) [1]

Voltages [2]

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage I_C up to 400 mA; $-V_{BE}$ = 1.5 V	V_{CEX}	max.	36	V
Collector-emitter voltage (open base) I_C up to 400 mA	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

			2N3924	2N3926	2N3927	
Currents [2]						
Collector current (d.c.)	I_C	max.	0.5	1.0	1.5	A
Collector current (peak value)	I_{CM}	max.	1.5	3.0	4.5	A
Power dissipation [2]						
Total power dissipation up to T_{mb} = 25 ^oC	P_{tot}	max.	7	11.6	23	W

Temperatures

Storage temperature	T_{stg}		−65 to +200	^oC
Junction temperature	T_j	max.	200	^oC

[1] Limiting values according to the Absolute Maximum System as defined in IEC publication 134.
[2] See also areas of permissible operation at pages 8 and 9.

THERMAL RESISTANCE

			2N3924	2N3926	2N3927	
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	25	15	7.5	$^oC/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=		0.6	0.6	$^oC/W$
From mounting base to heatsink mounted with top clamping washer of 56218	$R_{th\ mb\text{-}h}$	=	1.0			$^oC/W$
top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	**2.5**			$^oC/W$

CHARACTERISTICS

T_j = 25 ^oC unless otherwise specified

			2N3924	2N3926	2N3927	
Collector cut-off current						
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	100	100	**250**	μA
$I_E = 0$; $V_{CB} = 15$ V; $T_j = 150$ ^oC	I_{CBO}	<	5	5	**10**	mA
Breakdown voltages						
$I_E = 0$; $I_C = 250$ μA	$V_{(BR)CBO}$	>	36	36	36	V
I_C up to 400 mA; $-V_{BE} = 1.5$ V; $R_B = 33\ \Omega$ [1]	$V_{(BR)CEX}$	>	36	36	36	V
I_C up to 400 mA; $I_B = 0$ [1]	$V_{(BR)CEO}$	>	18	18	18	V
$I_C = 0$; $I_E = 250$ μA	$V_{(BR)EBO}$	>	4	4	4	V
Base-emitter voltage						
$I_C = 250$ mA; $V_{CE} = 5$ V	V_{BE}	<	1.5			V
$I_C = 500$ mA; $V_{CE} = 5$ V	V_{BE}	<		1.5		V
$I_C = 1000$ mA; $V_{CE} = 5$ V	V_{BE}	<			1.5	V
Saturation voltage						
$I_C = 250$ mA; $I_B = 50$ mA	V_{CEsat}	<	0.75			V
$I_C = 500$ mA; $I_B = 100$ mA	V_{CEsat}	<		0.75		V
$I_C = 1000$ mA; $I_B = 200$ mA	V_{CEsat}	<			1.0	V

[1]) Pulsed through an inductor of 25 mH; $\delta = 0.5$; f = 50 Hz

CHARACTERISTICS (continued) T_j = 25 ^{o}C unless otherwise specified

			2N3924	2N3926	2N3927	
D.C. current gain						
I_C = 250 mA; V_{CE} = 5 V	h_{FE}	> <	10 150			
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	> <		5 150		
I_C = 1000 mA; V_{CE} = 5 V	h_{FE}	> <			5 150	
Collector capacitance at f = 1 MHz						
$I_E = I_e$ = 0; V_{CB} = 13.5 V	C_c	<	20	20	45	pF
Transition frequency						
I_C = 100 mA; V_{CE} = 13.5 V	f_T	>	250	250		MHz
I_C = 200 mA; V_{CE} = 13.5 V	f_T	>			200	MHz
Real part of input impedance at f = 200 MHz						
I_C = 100 mA; V_{CE} = 13.5 V	$Re(h_{ie})$	<	20	20		Ω
I_C = 200 mA; V_{CE} = 13.5 V	$Re(h_{ie})$	<			20	Ω

R.F. performance at V_{CE} = 13.5 V; f = 175 MHz

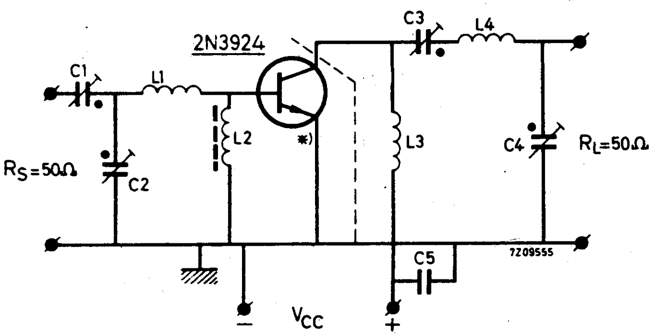
	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit at page
2N3924	4	< 1	< 420	> 70	5
2N3926	7	< 2	< 740	> 70	6
2N3927	12	< 4	< 1100	> 80	6

NOTE

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit with the 2N3924 at f = 175 MHz



*) The length of the external emitter wire of the 2N3924 is 1.6 mm.

Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	10 nF	polyester

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

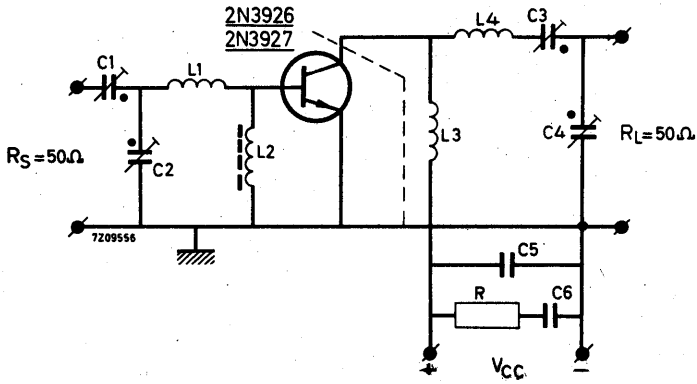
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20% (code number 4312 020 36640)

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

CHARACTERISTICS (continued)

Test circuit with the 2N3926 or 2N3927 at f = 175 MHz



Components

C1 = C2 = C3 = C4 = 4 to 29 pF air trimmer

C5 = 100 pF ceramic

C6 = 10 nF polyester

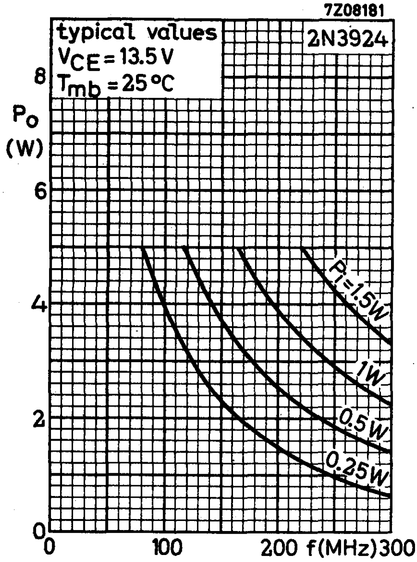
L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

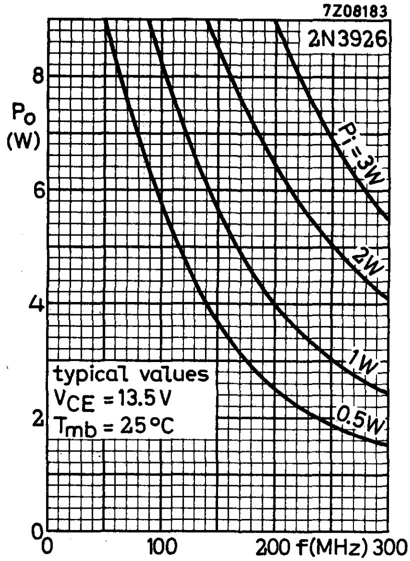
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20%
(code number 4312 020 **36640**)

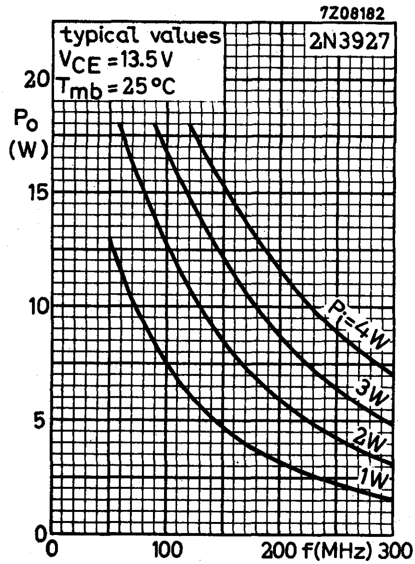
L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

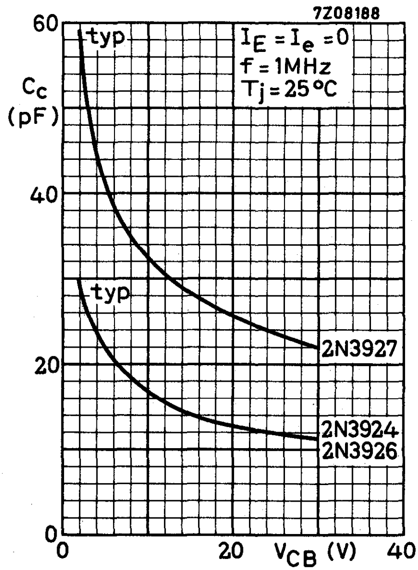
L4 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 8.5 mm; leads 2 x 20 mm

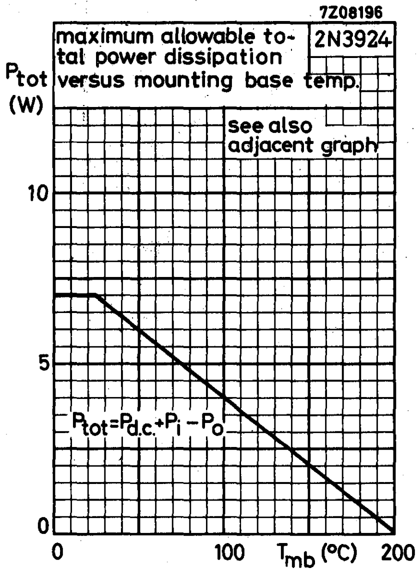
R = 10 Ω carbon

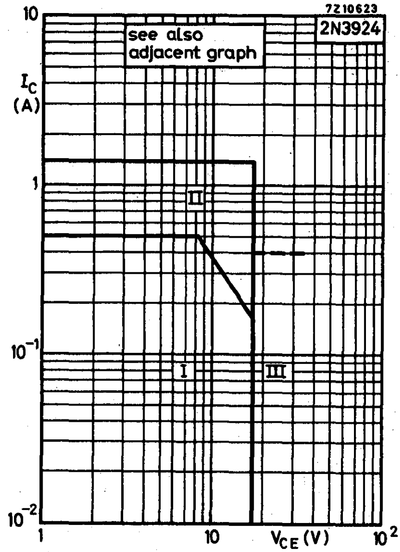

7Z08181
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
2N3924
P_o
(W)
P_i = 1.5 W
1 W
0.5 W
0.25 W
f (MHz)
0
100
200
300
2
4
6
8

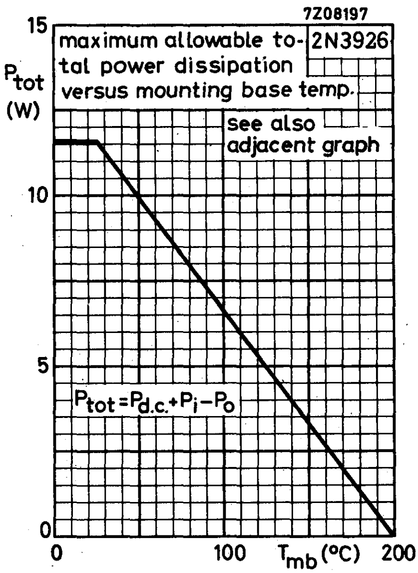

7Z08183
2N3926
P_o
(W)
P_i = 3 W
2 W
1 W
0.5 W
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
f (MHz)
0
100
200
300
2
4
6
8

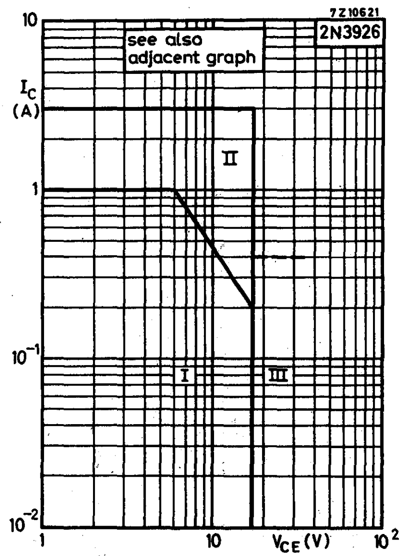

7Z08182
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
2N3927
P_o
(W)
P_i = 4 W
3 W
2 W
1 W
f (MHz)
0
100
200
300
5
10
15
20

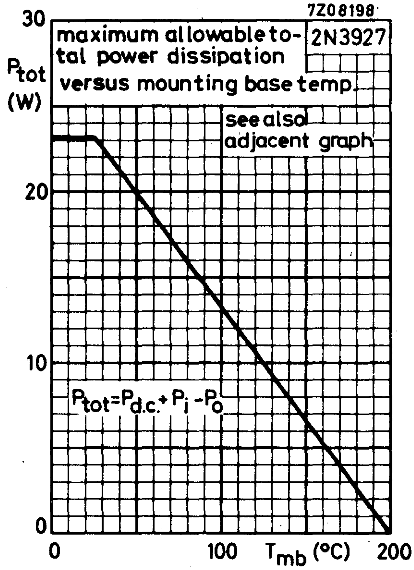

7Z08188
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c
(pF)
typ
typ
2N3927
2N3924
2N3926
V_{CB} (V)
0
20
40
20
40
60

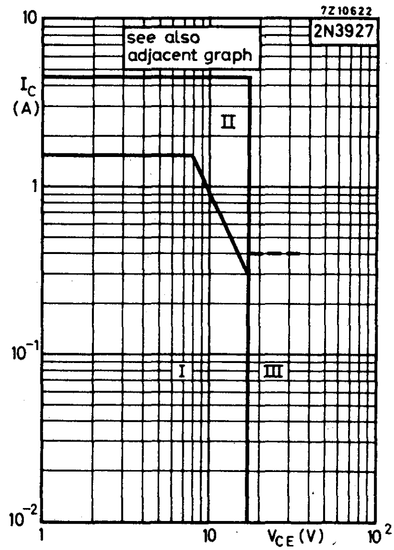

7Z08196
maximum allowable total power dissipation versus mounting base temp.
2N3924
P_{tot} (W)
see also adjacent graph
10
5
0
$P_{tot}=P_{d.c.}+P_i-P_o$
0
100
T_{mb} (°C)
200


7Z10623
10
see also adjacent graph
2N3924
I_C (A)
1
II
10^{-1}
I
III
10^{-2}
1
10
V_{CE} (V)
10^2


7Z08197
15
maximum allowable total power dissipation versus mounting base temp.
2N3926
P_{tot} (W)
see also adjacent graph
10
5
$P_{tot}=P_{d.c.}+P_i-P_o$
0
0
100
T_{mb} (°C)
200


7Z10621
10
see also adjacent graph
2N3926
I_C (A)
II
1
10^{-1}
I
III
10^{-2}
1
10
V_{CE} (V)
10^2

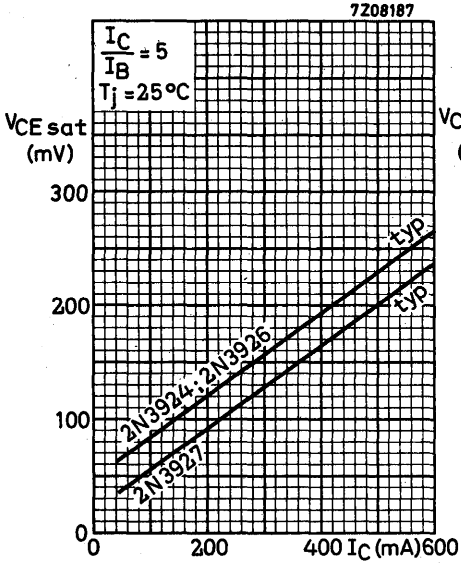


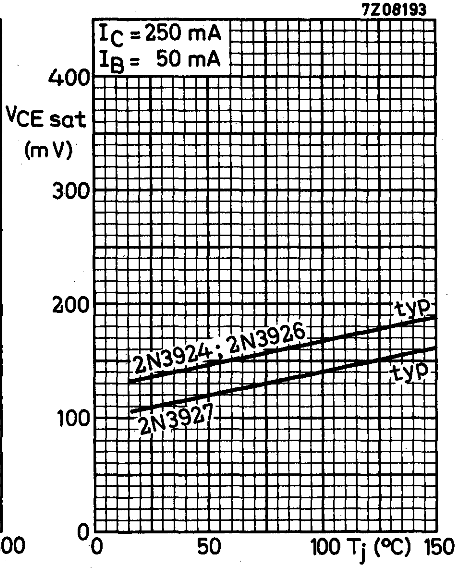


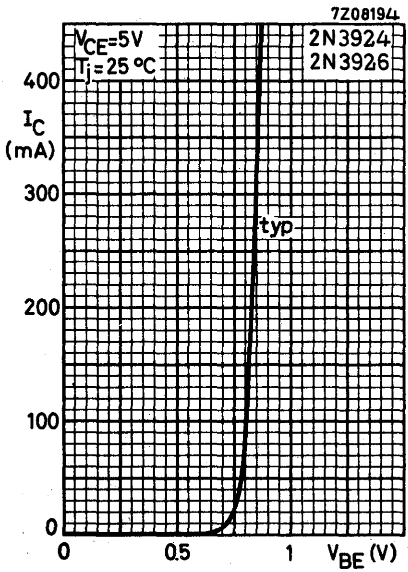
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

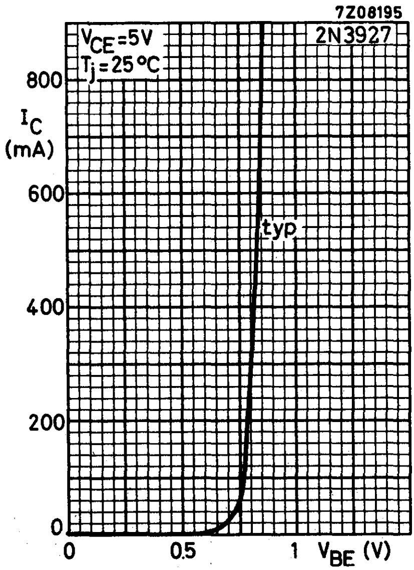
II Additional region of operation at $f \geq 1$ MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

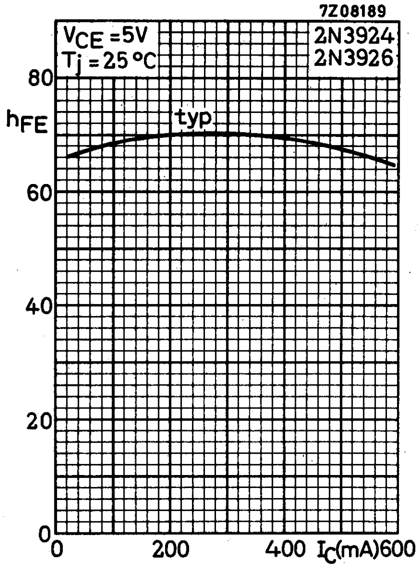
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 400$ mA and the transient energy does not exceed 2 mWs.

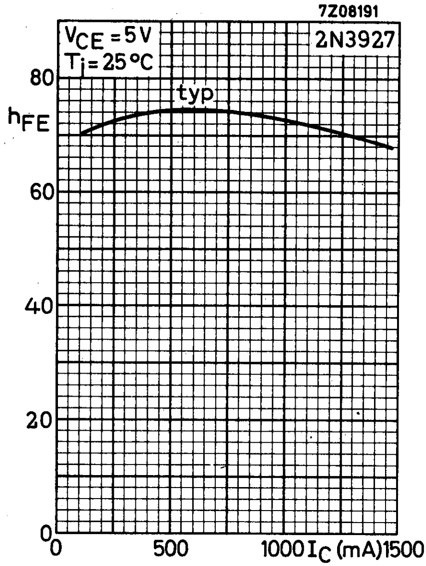

7Z08187
$I_C/I_B = 5$
$T_j = 25\,°C$
$V_{CE\,sat}$ (mV)
300
200
100
0
0
200
400 I_C (mA) 600
typ
typ
2N3924; 2N3926
2N3927

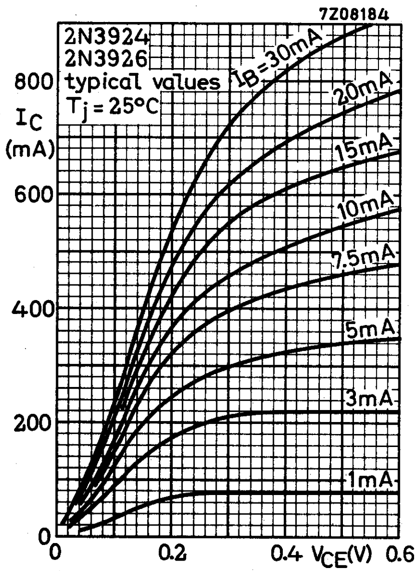

7Z08193
$I_C = 250$ mA
$I_B = 50$ mA
400
$V_{CE\,sat}$ (mV)
300
200
100
0
0
50
100 T_j (°C) 150
typ
typ
2N3924; 2N3926
2N3927

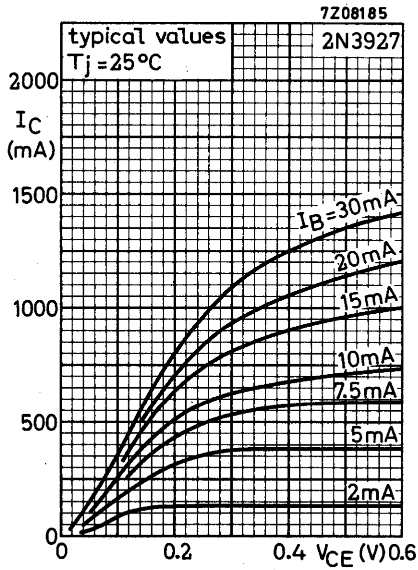

7Z08194
$V_{CE} = 5$ V
$T_j = 25\,°C$
2N3924
2N3926
400
I_C (mA)
300
200
100
0
0
0.5
1
V_{BE} (V)
typ

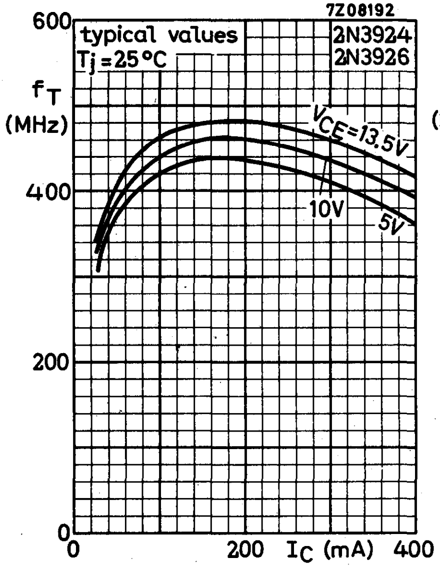

7Z08195
$V_{CE} = 5$ V
$T_j = 25\,°C$
2N3927
800
I_C (mA)
600
400
200
0
0
0.5
1
V_{BE} (V)
typ

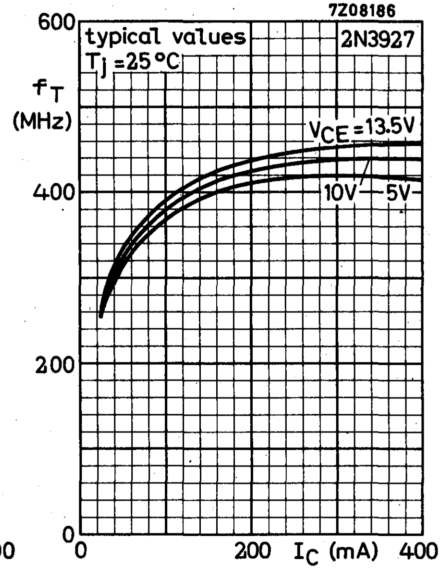

7Z08189
V_{CE} = 5V
T_j = 25 °C
2N3924
2N3926
typ
h_{FE}
80
60
40
20
0
0
200
400
I_C(mA)
600

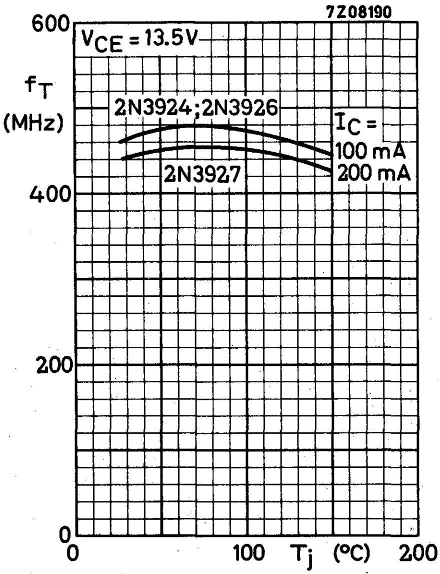

7Z08191
V_{CE} = 5 V
T_j = 25 °C
2N3927
typ
h_{FE}
80
60
40
20
0
0
500
1000
I_C (mA)
1500


7Z08184
2N3924
2N3926
typical values
T_j = 25°C
I_B=30mA
20mA
15mA
10mA
7.5mA
5mA
3mA
1mA
I_C
(mA)
800
600
400
200
0
0
0.2
0.4
V_{CE}(V)
0.6


7Z08185
typical values
T_j = 25°C
2N3927
I_B=30mA
20mA
15mA
10mA
7.5mA
5mA
2mA
I_C
(mA)
2000
1500
1000
500
0
0
0.2
0.4
V_{CE} (V)
0.6


7Z08192
typical values
Tj = 25 °C
2N3924
2N3926
fT
(MHz)
VCE=13.5V
10V
5V
IC (mA)


7Z08186
typical values
Tj = 25 °C
2N3927
fT
(MHz)
VCE = 13.5V
10V
5V
IC (mA)


7Z08190
VCE = 13.5V
fT
(MHz)
2N3924;2N3926
2N3927
IC =
100 mA
200 mA
Tj (°C)

SILICON EPITAXIAL PLANAR OVERLAY TRANSISTOR

For data of this transistor please refer to type 2N3866

ACCESSORIES

General note on flat heatsinks

All information on thermal resistances of the accessories combined with flat heatsinks is valid for *square* heatsinks of *1,5 mm blackened aluminium.*

For a few variations the thermal resistance may be derived as follows:

- Rectangular heatsinks (sides a and 2a)
  When mounted with long side horizontal, multiply by 0,95.
  When mounted with short side horizontal, multiply by 1,10.
- Unblackened or thinner heatsinks
  Multiply by the factor given in Fig. 1 as a function of the heatsink size A.

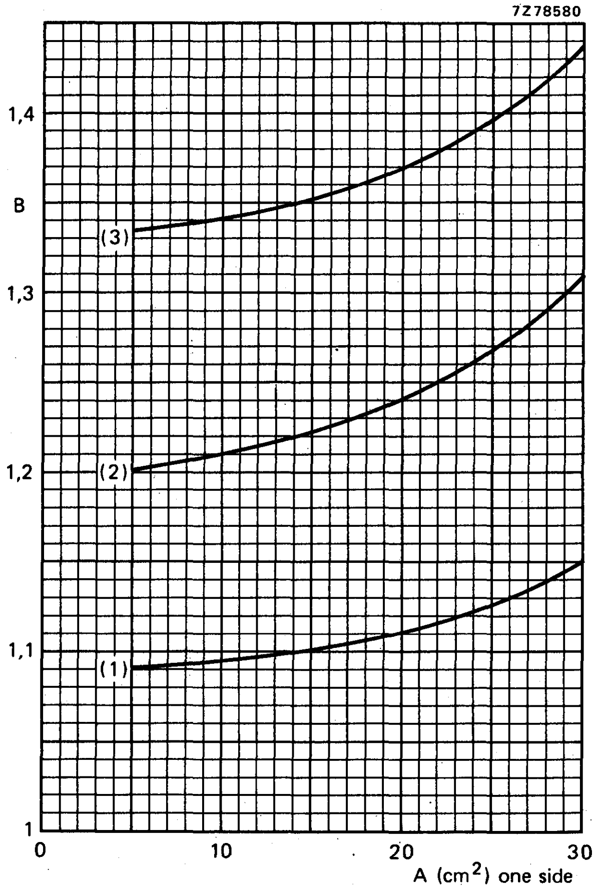


Fig. 1 Multiplication factor (B) as a function of heatsink area (A).
(1) 1 mm blackened aluminium.
(2) 1,5 mm unblackened aluminium.
(3) 1 mm unblackened aluminium.

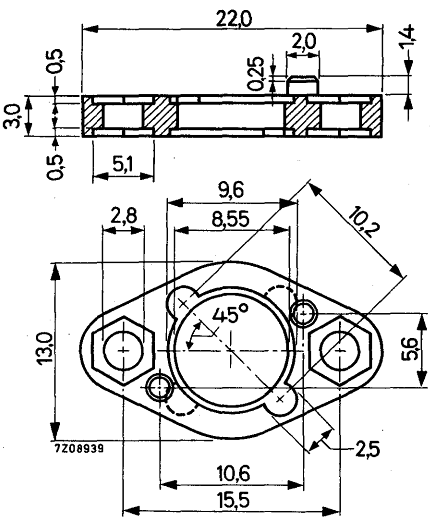
MOUNTING ACCESSORIES

Mounting accessories for TO-5 and TO-39 envelopes; the package consists of:

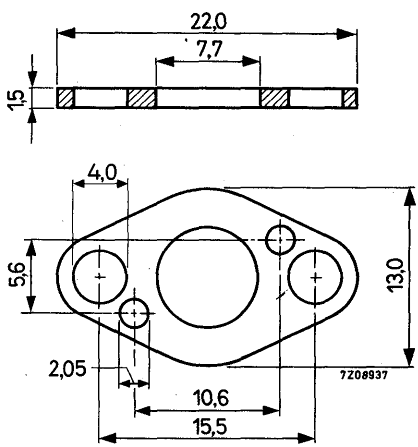
1 top clamping piece
1 bottom clamping piece
1 mylar insulator

MECHANICAL DATA

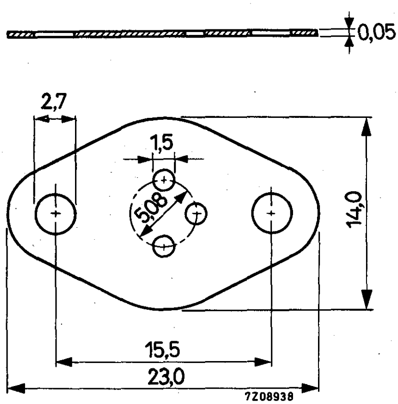
Dimensions in mm



Top clamping piece of insulating material.



Bottom clamping piece; material: brass, tin plated.



Mylar insulator.

56218

TEMPERATURE

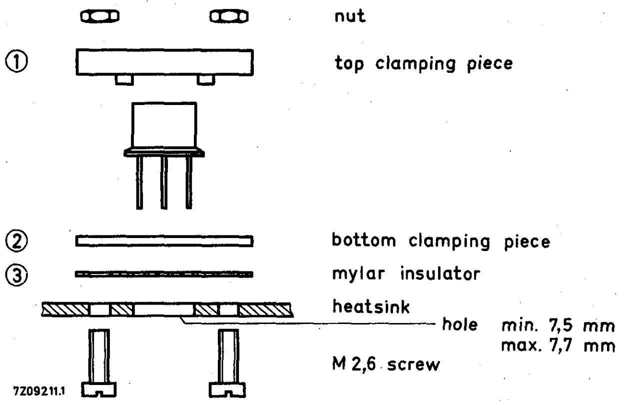
Maximum permissible temperature	T_{max}		100 °C

THERMAL RESISTANCE

From mounting base to heatsink			
direct mounting	$R_{th\ mb\text{-}h}$	=	3 °C/W
insulated mounting	$R_{th\ mb\text{-}h}$	=	6 °C/W

MOUNTING INSTRUCTIONS

Insulated mounting



Direct mounting: without items 2 and 3; item 1 to be mounted upside-down.

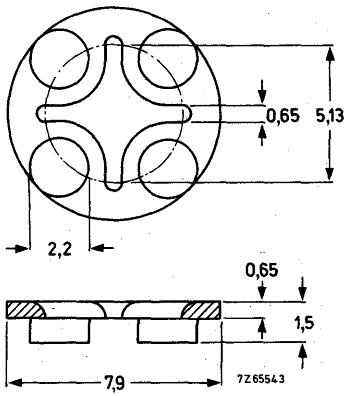
56245 DISTANCE DISC

MECHANICAL DATA

TO-5 or TO-39

Dimensions in mm

Insulating material.



Argentina: FAPESA I.y.C., Av. Crovara 2550, Tablada, Prov. de BUENOS AIRES, Tel. 652-7438/7478.
Australia: PHILIPS INDUSTRIES HOLDINGS LTD., Elcoma Division, 67 Mars Road, LANE COVE, 2066, N.S.W., Tel. 427 08 88.
Austria: ÖSTERREICHISCHE PHILIPS BAUELEMENTE Industrie G.m.b.H., Triester Str. 64, A-1101 WIEN, Tel. 62 91 11.
Belgium: M.B.L.E., 80, rue des Deux Gares, B-1070 BRUXELLES, Tel. 523 00 00.
Brazil: IBRAPE, Caixa Postal 7383, Av. Paulista 2073-S/Loja, SAO PAULO, SP, Tel. 284-4511.
Canada: PHILIPS ELECTRONICS LTD., Electron Devices Div., 601 Milner Ave., SCARBOROUGH, Ontario, M1B 1M8, Tel. 292-5161.
Chile: PHILIPS CHILENA S.A., Av. Santa Maria 0760, SANTIAGO, Tel. 39-40 01.
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Denmark: MINIWATT A/S, Emdrupvej 115A, DK-2400 KØBENHAVN NV., Tel. (01) 69 16 22.
Finland: OY PHILIPS AB, Elcoma Division, Kaivokatu 8, SF-00100 HELSINKI 10, Tel. 1 72 71.
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Greece: PHILIPS S.A. HELLENIQUE, Elcoma Division, 52, Av. Syngrou, ATHENS, Tel. 915 311.
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India: PHILIPS INDIA LTD., Elcoma Div., Band Box House, 254-D, Dr. Annie Besant Rd., Prabhadevi, BOMBAY-25-DD, Tel. 457 311-5.
Indonesia: P.T. PHILIPS-RALIN ELECTRONICS, Elcoma Division, 'Timah' Building, Jl. Jen. Gatot Subroto, JAKARTA, Tel. 44 163.
Ireland: PHILIPS ELECTRICAL (IRELAND) LTD., Newstead, Clonskeagh, DUBLIN 14, Tel. 69 33 55.
Italy: PHILIPS S.p.A., Sezione Elcoma, Piazza IV Novembre 3, I-20124 MILANO, Tel. 2-6994.
Japan: NIHON PHILIPS CORP., Shuwa Shinagawa Bldg., 26-33 Takanawa 3-chome, Minato-ku, TOKYO (108), Tel. 448-5611.
(IC Products) SIGNETICS JAPAN, LTD., TOKYO, Tel. (03) 230-1521.
Korea: PHILIPS ELECTRONICS (KOREA) LTD., Elcoma Division, Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. 794-4202.
Mexico: ELECTRONICA S.A. de C.V., Varsovia No. 36, MEXICO 6, D.F., Tel. 533-11-80.
Netherlands: PHILIPS NEDERLAND B.V., Afd. Elonco, Boschdijk 525, NL 5600 PD EINDHOVEN, Tel. (040) 79 33 33.
New Zealand: PHILIPS Electrical Ind. Ltd., Elcoma Division, 2 Wagener Place, St. Lukes, AUCKLAND, Tel. 867 119.
Norway: NORSK A/S PHILIPS, Electronica Sørkedalsveien 6, P.O. Box 5040-Naj., OSLO 3, Tel. 46 38 90.
Peru: CADESA, Rocca de Vergallo 247, LIMA 17, Tel. 62 85 99.
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