MST-1
Module Data

TABLE OF CONTENTS

This pocket-size document has been published as a reference design handbook

for users of the MST-1 circuit family. It contains a summary of information

on the MST-1 family and is intended to serve as a reference supplement of the

MST-1 Circuit Manual Book 03-07, (TEB 2-6400-100).

The complete MST-1 module set is presented as it appears at the time of pub-

lication of this document. This document will be revised on a periodic basis

to insure an accurate and current content.

Any questions concerning the content of this document should be directed as

noted in the appendix. Distribution problems should be directed to the

Technology Information Center, Department 424.

Distribution of this document is on a need-to-know basis, controlled by

R. A. Katz, MST Circuit Applications, Department 122, Fishkill.

II. GENERAL

MST-1 provides a system designer with a low cost, versatile monolithic circuit family having a typical "packaged" performance of 8 - 12ns. A high packaging density is achieved by the use of integrated circuit chips on 16 pin SLT modules and "SLT-like" cards with improved wireability. The use of "clamped" CSEF circuits results in excellent logical power, wide environmental operating ranges and power supply tolerances as high as $\pm 12\%$ in some applications.

The basic circuit family utilizes a single -4v power supply. A reference voltage is supplied at card level by a bias circuit contained in the basic module set.

Second level packaging is achieved by the use of cards and boards similar to SLT but with modified internal planes to accomodate the MST voltage distribution. Long line communication is achieved by the use of modified SLT AOI$_{11}$ flat cable.

Minimal resistive termination is required since the basic circuit is designed to drive up to 15 inches of unterminated printed line. A logic line driver is provided for requirements in excess of 15 inches. Load resistors have been virtually eliminated by the flexibility of the module set provided.

III. REFERENCES

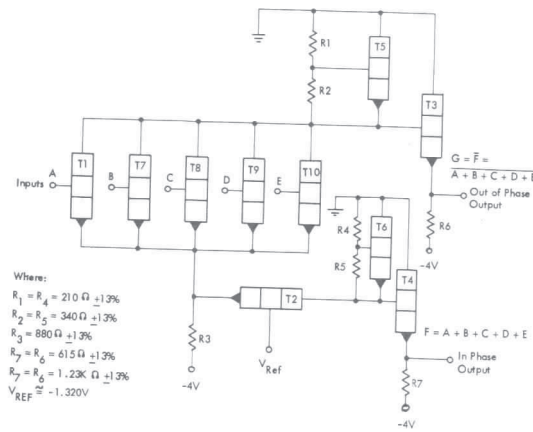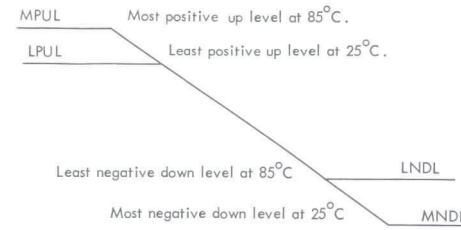|	
MST-1 Circuit Manual	IBM Stds Book 03-07 TEB 2-6400-100
MST Packaging Ground Rules and Description	IBM Stds Book 03-10 DEP 2-6400-500 etc.
Design Automation	IBM Stds Book 00-04 DEP 0-2815

IV. LOGIC CIRCUIT SCHEMATIC —

Where:

$R_1 = R_4 = 210\ \Omega\ \pm 13\%$
$R_2 = R_5 = 340\ \Omega\ \pm 13\%$
$R_3 = 880\ \Omega\ \pm 13\%$
$R_7 = R_6 = 615\ \Omega\ \pm 13\%$
$R_7 = R_6 = 1.23K\ \Omega\ \pm 13\%$
$V_{REF} \cong -1.320V$

Basic MST – I Logic Circuit

V. GENERAL INPUT/OUTPUT REQUIREMENTS

A. Voltage Levels

MPUL   Most positive up level at $85^\circ C$.

LPUL   Least positive up level at $25^\circ C$.

Least negative down level at $85^\circ C$ LNDL

Most negative down level at $25^\circ C$ MNDL

Supply Tolerances
Table 5.1

| Case	I ($+4.0\%$)	II ($+7.0\%$)	III ($+10\%$)	IV ($+12\%$)	ET–I* ($\pm 5.0\%$)
MPUL	−0.613v	−0.613v	−0.613v	−0.613v	−0.613v
LPUL	−0.964v	−0.965v	−0.967v	−0.969v	−0.987v
LPUL'	−0.980v	−0.985v	−0.991v	−0.995v	−1.011v
LNDL	−1.570v	−1.560v	−1.550v	−1.522v	−1.567v
MNDL	−2.353v	−2.353v	−2.353v	−2.353v	−2.383v

NOTE: LPUL'=Minimum output voltage level when collectors are wired on the module. All logic support designs should use this level as the minimum input level and establish LPUL as the minimum output voltage level.

*ET–1 = Extended Temperature Operating Levels ($10^\circ C$ to $85^\circ C$)

B. Summary of Loading Rules

	Case I (4.0%)	Case II (7.0%)	Case III (10.0%)	Case IV (12.0%)	ET-1 (5.0%)
Fan In	5	5	5	5	5
Fan Out, Ref=615 Ω	11/5LD	II/5LD	II/5LD	11/5LD	11/5LD
Fan Out, Ref=1.23K Ω	22/10LD	22/10LD	22/10LD	22/10LD	22/10LD
Dotted Collector Nodes					
Out-of-Phase	2	2	2	2	2
Comb. of $\overline{\phi}$ & Φ	2	2	2	2	2
In Phase	4	4	4	4	4
Dotted Emit. followers (Ref=615 Ω)	8	6	4	4	8
Dotted Emit. followers (Ref=1.23K Ω)	4	3	2	2	4
P.S. (at the mod. pin) V $V_2 1$	GND −4+4%	GND −4+7%	GND −4.00 + 10% −3.91 ∓ 8% −3.79 ∓ 5% −4.20 ∓ 4.5% −3.71 ± 3%	GND −4.00 + 12% −4.20 ∓ 6.5%	GND −4.00 ± 5%
V_{REF} (Nom.)	−1.320	−1.320	−1.295	−1.295	−1.320
Operating Junction Temp. Range	25 to 85°C	25 to 85°C	25 to 85°C	25 to 85°C	10 to 85°C
Δ T Allowable between Communicating Circuits	50°C	50°C	50°C	50°C	50°C

LD=Line Driver

VI. DEFINITION OF LOGIC NOTATION

A. Current Switch

INPUT   OUTPUT
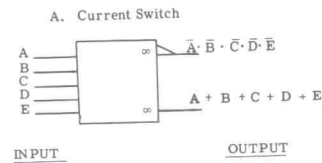
The block notation represents the basic current switch function and, unless otherwise noted within the block, is considered to perform the OR function. The presence of an infinity sign within the block implies no clamp circuit at the adjacent output.
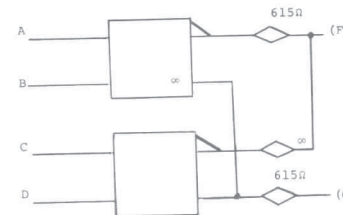
B. Emitter Follower

As the MST-1 circuits may be internally collector dotted to perform the AND function, the diamond symbol is employed to distinguish between collector and emitter dots and the presence or lack of an emitter follower at the block output.

C. Emitter Follower Load State

The symbol adjacent to the diamond denotes the load state of that emitter follower, e.g., ∞ implies an unloaded emitter, 615 Ω implies an emitter loaded internally with 615 Ω.
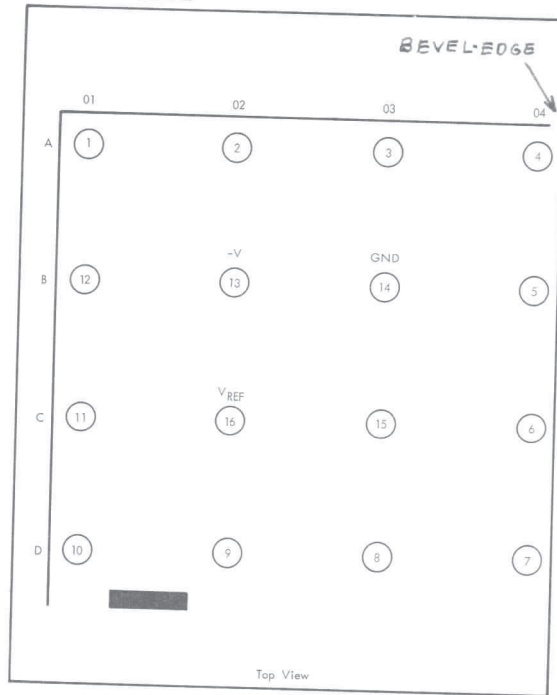
D. Dot Functions

The dotted connection outside the emitter follower represents the DOT-OR connection, e.g.

$$F = \overline{A}\,\overline{B} + \overline{C}\,\overline{D}$$

The dotted connection inside the emitter follower represents the collector DOT-AND function, e.g.

$$G = (A + B)(C + D)$$

BEVEL-EDGE

Top View

The following module part numbers are included in the present module set:

D/N	P/N	DESCRIPTION
16T-1621	254 1621	1-5w & 1-4w both φ
16T-1623	254 1623	Exclusive - OR
16T-1625	254 1625	5-2w φ
16T-1626	255 1626	2-2w, 1-3w, 1-4w AO
16T-1627	253 1627	1-2, 3-3w AO
16T-1629	253 1629	1-5wφ, 1-5w both φ
16T-1631	253 1631	4-3w φ
16T-1632	254 1632	3-2w AO
16T-1633	255 1633	2-3wφ̄, 1-3w both φ
16T-1635	255 1635	Subtractor AND-OR
16T-1636	255 1636	OE Parity Tree
16T-1637	255 1637	3 (2-2w) AO
16T-1638	255 1638	Polarity Hold
16T-1639	255 1639	2-3wφ, 1-3w both φ
16T-1640	255 1640	3-2wφ Latch
16T-1642	255 1642	2 (3-2w) AO
16T-1646	254 lo46	multi-purpose φ CS
16T-1647	253 1647	multi-purpose δ̄ CS
16T-1648	255 1648	3-2wφ̄, 1-2w both φ TLD
16T-1649	254 1649	2-4w both φ TLD
16T-1650	255 1650	MST-2 to MST-1 converter
16T-1651	255 1651	NPL/SLT to MST-1/MST-2 converter
16T-1652	255 1652	Single Shot
16T-1654	255 1654	2-A.C. Trigger
16T-1655	255 1655	3-A.C. Trigger
16T-1656	255 1656	A.C. Trigger
16A-0294	2395143	MST-1 to SLT
16T-1658	255 1658	CS to SLT/NPL converter
16T-1659	255 1659	photo device amplifier
16T-1660	255 1660	local store
16T-1665	255 1665	3-2wφ TLD, 1-2w both φ TLD
16T-1667	255 1667	transistor power driver
16T-1668	255 1668	TLD, Type 2 Bias Network
16T-1670	253 1670	2-3w φ, 1-3w both φ
16T-1672	253 1672	3-4wφ Latch
16T-1673	253 1673	4-3w φ
16T-1674	253 1674	1-(2w,3w) AO; 1-(2w,2w) AO
16T-1675	253 1675	2-D.C. Trigger
16T-1676	253 1676	3-2wφ̄ and 1-2w both φ

The following modules have been obsoleted from the module set.

2531620	2541630
2531622	2531634
2551624	2531671
2551628	

MS 47 MODULE CHIP CROSS REFERENCE

MODULE PN	N of CHIPS	CHIP PN
254 1621	2	2393 604
254 1623	2	2393 605
254 1625	2	2393 602
	2	2393 604
255 1626	4	2393 607
253 1627	4	2393 607
253 1629	2	2393 604
253 1o31	4	2393 604
254 1632	3	2393 602
25 1633	3	2393 604
255 1635	3	2393 509
	1	2393 605
255 1636	4	2393 605
255 1637	3	2393 602
255 1638	1	2393 600
	3	2393 601
255 1639	3	2393 604
255 1640	2	2393 602
	2	2393 604
255 1642	2	2393 607
	2	2393 611
254 1646	4	2393 607
253 1647	4	2393 613
255 1648	4	2393 613
254 1649	2	2393 613
255 1650	4	2393 612
255 1651	2	2393 508
255 1652	1	2393 609
	1	2393 613
	1	2393 507
255 1654	2	2393 506
255 1655	3	2393 506
255 1656	1	2393 506
255 1659	4	2393 741
255 1660	3	2393 510
255 1665	4	2393 613
255 1667	1	2393 742
	(3)	2393 499 SLT CHIPS
	(6)	2393 500 SLT CHIPS
255 1668	1	2393 505
253 1670	3	2393 613
253 1672	3	2393 604
253 1673	3	2393 503
253 1674	4	2393 604
253 1675	2	2393 503
	2	2393 504
253 1676	2	2393 603
	4	2593 604
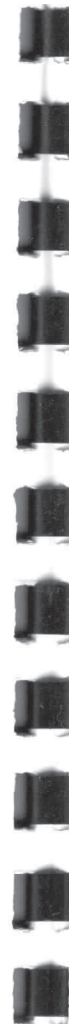
MS 98 AND MS 127 MODULE CHIP CROSS REFERENCE

| MODULE	N of CHIPS	CHIP PN
254 1621	1	2394 621
254 1623	1	2394 623
254 1625	1	2394 625
255 1626	1	2394 626
253 1627	1	2394 627
253 1629	1	2394 629
253 1631	1	2394 631
254 1632	1	2394 632
255 1633	1	2394 633
255 1635	1	2394 695
	1	2394 635
255 1636	2	2394 636
255 1637	1	2394 637
255 1638	2	2394 638
255 1639	1	2394 639
255 1640	1	2394 640
255 1642	2	2394 642
254 1646	1	2394 646
253 1647	1	2394 647
255 1648	1	2394 648
254 1649	1	2394 649
255 1650	2	2394 650
255 1651	2	2394 651
255 1652	1	2394 652
255 1654	1	TBD
255 1655	2	TBD
255 1656	1	TBD
255 1659		TBD
255 1660	TBD	TBD
255 1665	1	2394 665
255 1667	1	2394 667
	3	2393 499 SLT
	6	2393 500 SLT
255 1668	1	2394 696
	1	2394 668
253 1670	1	2394 670
253 1672	1	2394 672
253 1673	1	2394 673
253 1674	1	2394 674
253 1675	2	2394 675
253 1676	1	2394 676

(MS 127 brace spans rows 255 1654 through 255 1659)

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1-5 w, 1-4 w, both φ

B02 −4.0 V
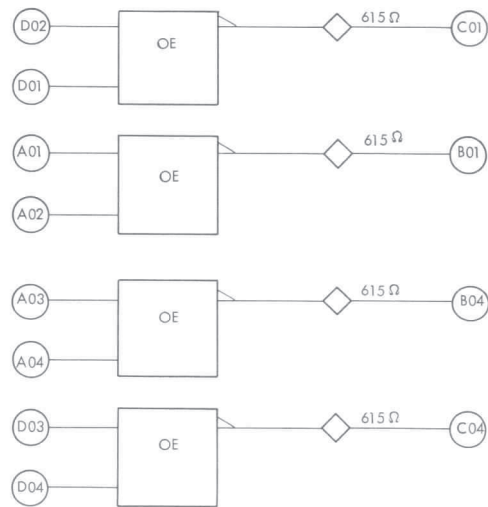B03 GND
C02 V_{REF}
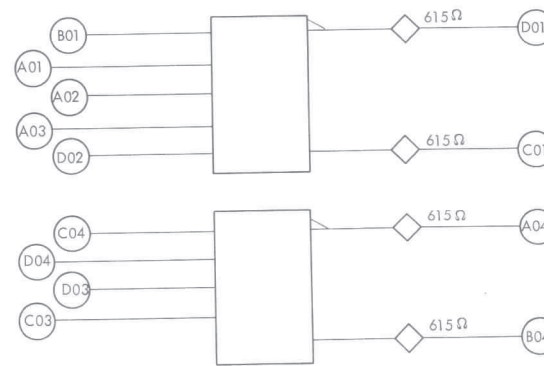
Pd−Maximum

Case I   − 98 mw
Case II − 105 mw
Case III − 112 mw
Case IV − 117 mw
ET I   − 101 mw

Circuit Flyers

Module −   2413856
Combined − XLLDD
Basic   − XLLCC
         − XCABA

P/N 2541623

B02 −4.0 V
B03 GND
C02 V$_{REF}$

EXCLUSIVE-OR

(D02) ── [OE] ── ◇ 615 Ω ── (C01)
(D01) ──

(A01) ── [OE] ── ◇ 615 Ω ── (B01)
(A02) ──

(A03) ── [OE] ── ◇ 615 Ω ── (B04)
(A04) ──

(D03) ── [OE] ── ◇ 615 Ω ── (C04)
(D04) ──

Pd−Maximum

Case I   − 200 mw
Case II − 213 mw
Case III − 227 mw
Case IV − 236 mw
ET I   − 204 mw

Circuit Flyers

Module − 2413858
Combined − XUAAA
Basic   − XLLAA
          XLCAC
          XCABA

P/N 2541625

5−2 w $\overline{\phi}$

B02 −4.0 V
B03 GND
C02 V$_{REF}$

(D02) ── [ ] ── ◇ 615 Ω ── (C01)
(D01) ──

(A01) ── [ ] ── ◇ 615 Ω ── (B01)

(A02) ── [ ] ── ◇ 615 Ω ── (A03)
(A04) ──

(B04) ── [ ] ── ◇ 615 Ω ── (C04)

(D04) ── [ ] ── ◇ 615 Ω ── (C03)
(D03) ──
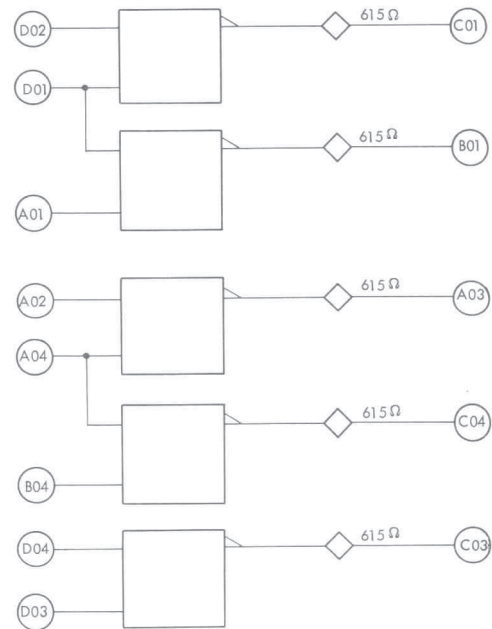
Pd−Maximum

Case I   − 160 mw
Case II − 177 mw
Case III − 183 mw
Case IV − 191 mw
ET I   − 164 mw

Circuit Flyers

Module − 2413860
Combined − XLLDD
Basic   − XLLCC
        − XCABA

P/N 2551626

B02 −4.0 V
B03 GND
C02 V$_{REF}$

2-2w, 1-3w, 1-4w AO
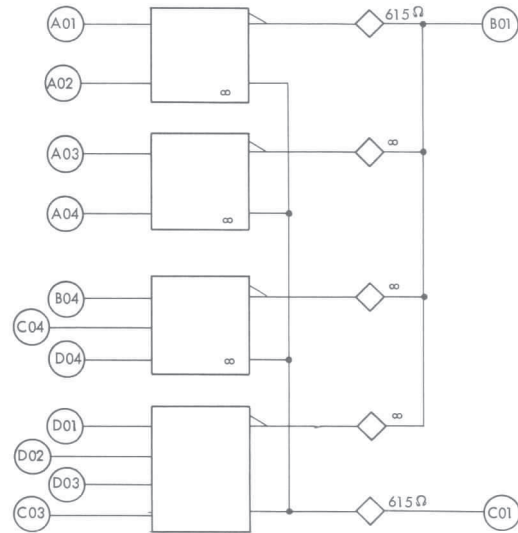
A01
A02
∞

615 Ω
B01
∞

A03
A04
∞
∞

B04
C04
D04
∞
∞

D01
D02
D03
C03
∞
∞

615 Ω
C01

Pd−Maximum

Case I   − 93 mw
Case II − 99 mw
Case III − 106 mw
Case IV − 111 mw
ET I   − 95 mw

Circuit Flyers

Module   − 2413861
Combined − XMLAC
Basic   − XLLCA
           XLCAC
           XCABA

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P/N 2531627

1-2w, 3-3 w AO

B02 −4.0 V
B03 GND
C02 V$_{REF}$
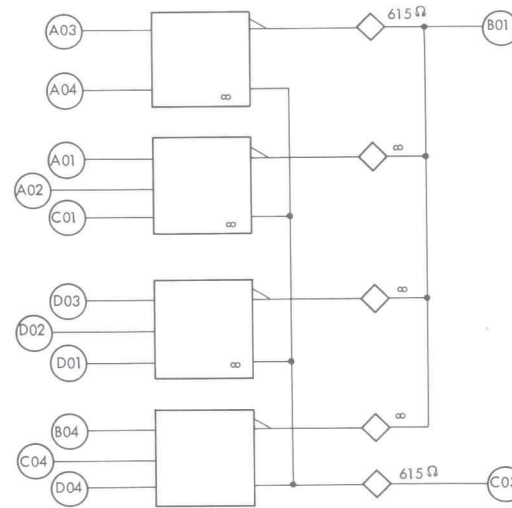
A03
A04
∞

615 Ω
B01
∞

A01
A02
C01
∞
∞

D03
D02
D01
∞
∞

B04
C04
D04
∞
∞

615 Ω
C03

Pd− Maximum

Case I   − 93 mw
Case II − 99 mw
Case III − 106 mw
Case IV − 111 mw
ET I   − 95 mw

Circuit Flyers

Module   − 2413862
Combined − XMLAC
Basic   − XLLCA
           XLCAC
           XCABA

IBM Confidential

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P/N 2531629

B02 −4.0 V
B03 GND
CO2 V_{REF}

1−5w φ̄   1−5w both φ
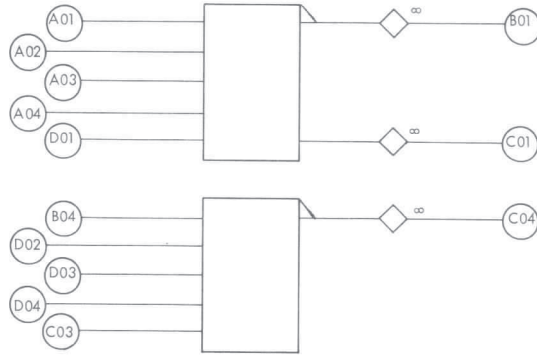
Pd−Maximum

Case I   − 45 mw
Case II − 47 mw
Case III − 50 mw
Case IV − 52 mw
ET I   − 46 mw

Circuit Flyers

Module − 2413864
Combined − N/A
Basic − XLLCC

P/N 2531631

4−3 w φ

B02 −4.0 V
B03 GND
C02 V_{REF}
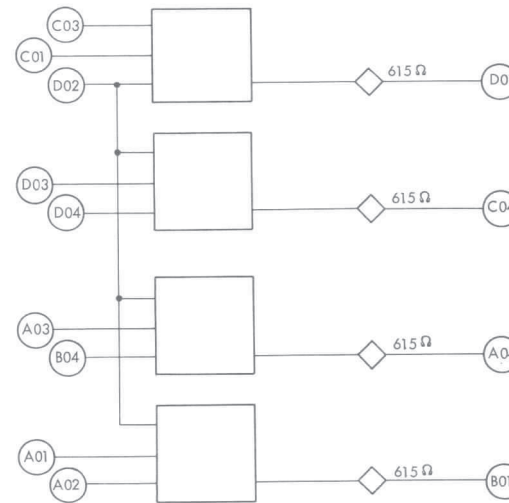
Pd−Maximum

Case I   − 141 mw
Case II − 151 mw
Case III − 160 mw
Case IV − 167 mw
ET I   − 145 mw

Circuit Flyers

Module − 2413866
Combined − XLLDD
Basic   − XLLCC
          XCABA

B02 −4.0 V
B03 GND
C02 V$_{REF}$

2 (3−2w AO)

615 Ω

A01
A02
B01

D01
C01
∞

A03
A04
∞

615 Ω
D04
B04

D03
D02
∞

C04
C03
∞
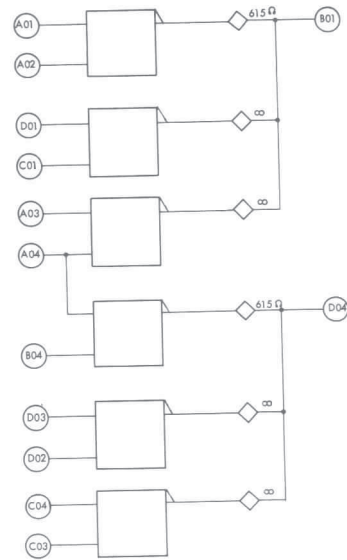
Pd − Maximum

Case I − 122 mw
Case II − 131 mw
Case III − 140 mw
Case IV − 146 mw
ET I − 125 mw

Circuit Flyers

Module − 2413867
Combined − XMLAB
Basic − XLLCC
XCABA

2−3 w $\overline{\phi}$, 1−3 w both φ

B02 −4.0 V
B03 GND
C02 V$_{REF}$

C03
D02
D03
∞
A03

A04
C04
D04
∞
B04

A01
A02
D01
∞
B01
∞
C01
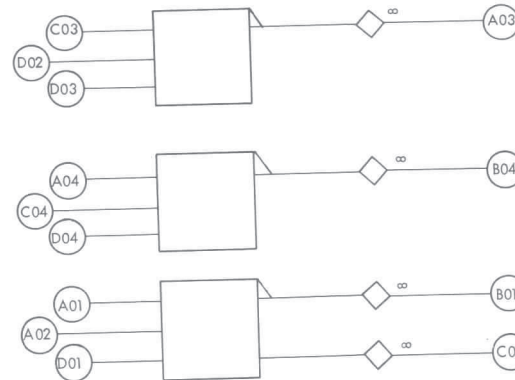
Pd−Maximum

Case I − 66 mw
Case II − 70 mw
Case III − 74 mw
Case IV − 77 mw
ET I − 67 mw

Circuit Flyers

Module − 2413868
Combined − N/A
Basic − XLLCC

P/N 2551635

B02 −4.0v
B03 GND
C02 V$_{REF}$

Subtractor − AND − OR

1.23kΩ

D04
D03
A02

1.23kΩ

B04

615Ω
A04   OE   A01

A03

1.23kΩ

D01

C03   OE   615Ω   B01
C01
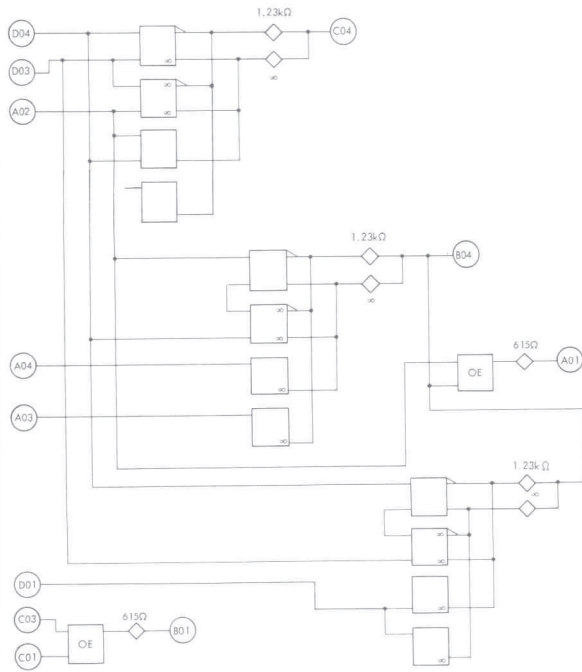
Pd − Maximum
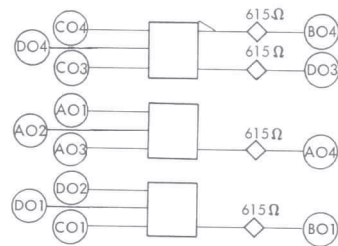Case I   −TBD
Case II −TBD
Case III −TBD
Case IV −TBD
ET I   −TBD

Circuit Flyers
Module   2413991
Combined   XMLAI
            XUAAC
            XMLAC
Basic   XLLAA
            XLCAC
            XCABA
            XLLCA
            XLCDA

P/N 2551636

EXCLUSIVE OR Parity Tree   B02   −4.0v
                                B03   GND
                                C02   V$_{REF}$

A02   OE   615Ω   OE   615Ω   C03
A03
D04   OE   615Ω
D03
D02   OE   615Ω   OE   615Ω   OE   615Ω   A01
D01
B01   OE   615Ω
C01
C04   OE   615Ω   A04
B04
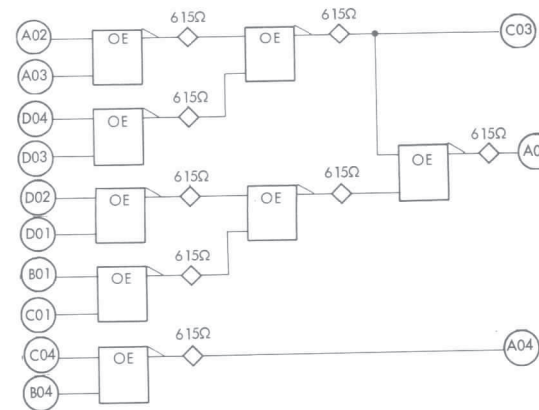
Pd − Maximum

Case I   − TBD
Case II − TBD
Case III − TBD
Case IV − TBD
ET I   − TBD

Circuit Flyers

Module   − 2413971
Combined − XUAAA
           XUAAB
Basic   − XLLAA
           XLCAC
           XCABA
           XCAAB

P/N 2551637

B02 − 4.0v   3(2-2w) AO
B03   GND
C02 V_{REF}
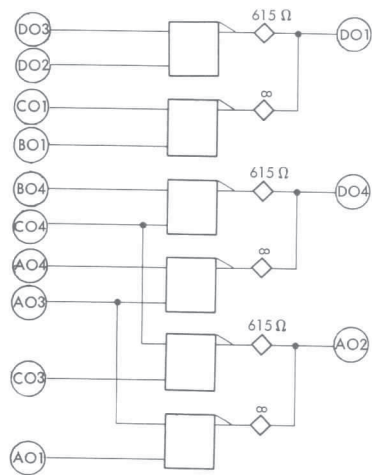
DO3
DO2   615 Ω DO1
CO1
BO1

BO4   615 Ω DO4
CO4
AO4
AO3   615 Ω AO2
CO3
AO1

Pd − Maximum   Circuit Flyers

Case I	− 132 mw	Module	2413970
Case II	− 141 mw	Combined	XMLAK
Case III	− 151 mw	Basic	XLLCA
Case IV	− 157 mw		XLCAC
ET I	− 135 mw		XCABA

P/N 2551638

POLARITY HOLD   B02 −4.0v
B03 GND
C02 V_{REF}
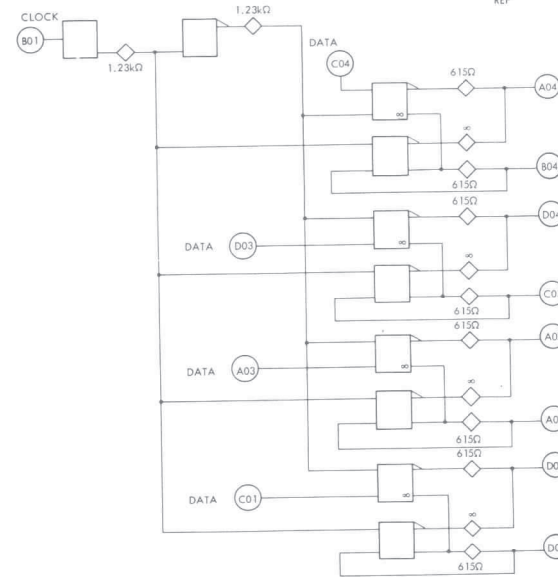
CLOCK   1.23kΩ
B01   DATA
1.23kΩ   C04   615Ω A04
615Ω B04
615Ω
615Ω D04
DATA D03
615Ω C03
615Ω
DATA A03   615Ω A02
615Ω A01
615Ω
DATA C01   615Ω D01
D02
615Ω

Pd − Maximum   Circuit Flyers

Case I	− TBD	Module	2413973
Case II	− TBD	Combined	XMLAK
Case III	− TBD		XLLEE
Case IV	− TBD	Basic	XLLCC
ET I	− TBD		XCAAB
			XLLCA
			XLCAC
			XCABA

P/N 2551639

B02 – 4.0v 2-3w φ , 1-3w both φ
B03 GND
C02. V_{REF}

Pd – Maximum

Case I   – 120 mw
Case II – 128 mw
Case III – 137 mw
Case IV – 142 mw
ET I   – 123 mw

Circuit Flyers

Module   2413969
Combined   XLLDD
Basic   XLLCC
                 XCABA

P/N 2551640

3-2W φ LATCH   B02 – 4.0v
                B03 GND
                C02 V_{REF}
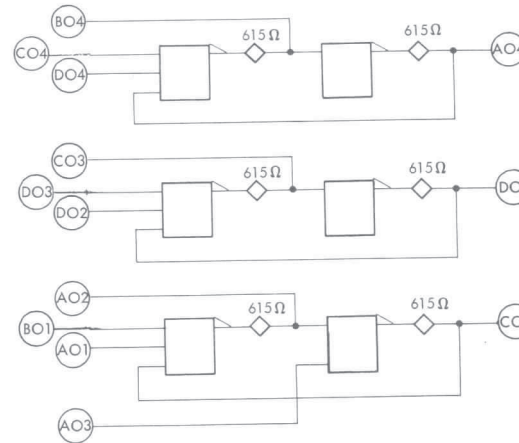
Pd – Maximum

Case I   – 180 mw
Case II – 192 mw
Case III – 206 mw
Case IV – 215 mw
ET I   – 184 mw

Circuit Flyers

Module   2413968
Combined   XLLDD
Basic   XLLCC
                 XCABA

P/N 2551642

B02 - 4.0v   2(3-2w) AO
B03   GND
C02 V_{REF}
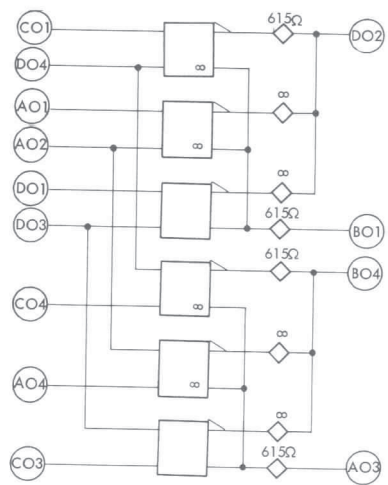
Pd – Maximum   Circuit Flyers

Case I   – 157 mw   Module   2413967
Case II – 168 mw   Combined   XMLAI
Case III – 180 mw   Basic   XLLCA
Case IV – 187 mw   XLCAC
ET I   – 161 mw   XCABA

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Module Part No: 2541646

Power Supplies Required: Standard MST – 1

Input Levels: MST – 1

Output Levels: Clamped Collector of Common Base Transistor

Description: This module provides four in-phase outputs, each output being
the clamped collector of a common base stage. The clamp is
implemented by a diode to ground as shown schematically
below.

When used in conjunction with P/N 2551658, conversion can
be made between MST – 1 levels and SLT or NPL levels.*
The module can also be used as an indicator driver for the
standard IBM SCRID assembly or other special applications.

In general, this circuit provides a sink for current into the
output. The maximum current the output will accept is
3.15ma. The maximum voltage which can be applied to the
output of the circuit without component damage is:

Maximum Positive Voltage   + 2.00V
Maximum Negative Voltage   – 0.715V

The input loading is equivalent to that of a standard logic
block.

*See P/N2551658
 for NPL application

Output

V_Ref

–4.0
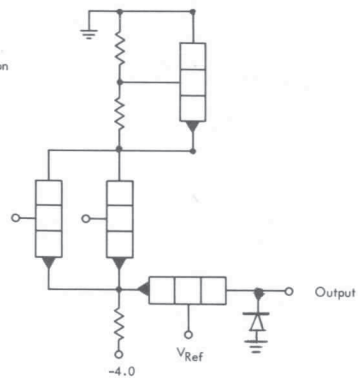
Multi-Purpose In-Phase CS   B02 – 4.0v
                               B04   GND
                               C02 V_{REF}

*Special Clamp

Pd: Circuit Flyers

Maximum = 87 mw   Module   – 2413869
Nominal = 57 mw   Combined – N/A
                             Basic   – XLLGG

Module Part No: 2531647

Power Supplies Required: MST – 1

Input Levels: MST – 1

Output Levels: Clamped collector of input transistor

Description: This module provides four out-of-phase outputs, each output
being the clamped collector of the input transistor. The
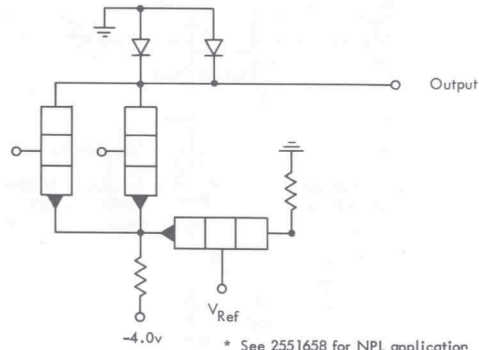clamp is provided by two parallel diodes to ground as shown
schematically below.

When used in conjunction with the module P/N 2551658,
conversion can be accomplished between MST-1 levels and
SLT or NPL levels.*

The module can also be used as an indicator driver for the
standard IBM SCRID assembly on other special applications.

In general, the output provides a sink for current into the
output. The maximum current the output will accept is
8.78 ma. The maximum voltage which can be applied to
the output terminal without component damage is:

Maximum Positive Voltage   + 2.00V
Maximum Negative Voltage   – 0.715V

The input loading is equivalent to 2.2 times that for a
standard logic block.

Output

V_{Ref}

–4.0v   * See 2551658 for NPL application

Multi-Purpose Out-of-Phase CS   B02 – 4.0v
                                     B03   GND
                                     C02 V_{REF}

*Special Clamp
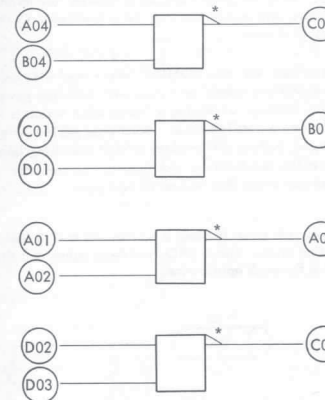
Pd:

Maximum = 189 mw
Nominal = 120 mw

Circuit Flyers
                        MST – 1   MST – 2
Module   – 2413841   2413834
Combined – N/A   N/A
Basic   XLHGG   ALHGG

Module Part No: 2551648

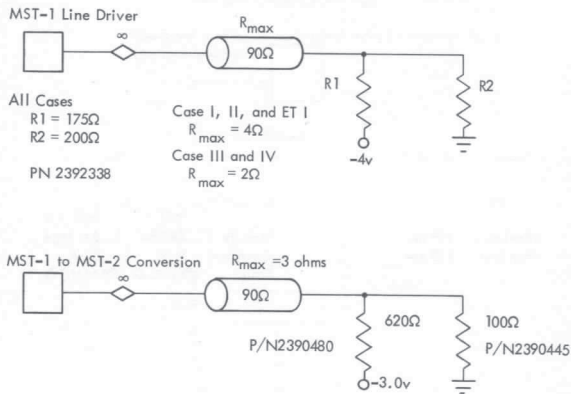Power Supplies Required: MST-1 or MST-1 and MST-2

Input Levels: MST-1

Output Levels: MST-1 or MST-2

Description: This module contains circuits which have the capability
of driving terminated and unterminated 90 ohm transmission
lines. With the proper choice of emitter and terminator
resistors, the driven line may have a series D.C. resistance
of up to 4 ohms.

The circuit has the capability, when used with an addit-
ional positive supply on a card with modified power
supply bussing, of driving a transmission which is term-
inated on an MST-2 card. Worst case MST-1 levels
into the module will produce MST-2 switching levels
across the termination. For this application, the
maximum series line resistance is 3 ohms.

The circuit input loading is equivalent to 2.2 logic
loading units. The R-PACs and their values are shown
below for each application:

MST-1 Line Driver

All Cases
    R1 = 175Ω
    R2 = 200Ω

    PN 2392338

Case I, II, and ET I
    $R_{max} = 4Ω$
Case III and IV
    $R_{max} = 2Ω$

MST-1 to MST-2 Conversion $R_{max} = 3$ ohms

620Ω   100Ω
P/N2390480   P/N2390445

-3.0v

3-2w $\overline{\phi}$,   1-2w Both ϕ B02 - 4.0v
Transmission Line Driver   B03   GND
                                                    C02 V_{REF}

Pd: Circuit Flyers

Maximum - 195 mw   Module   - 2413870
Nominal - 110 mw   Combined - N/A
                             Basic   - XLHCC

Module Part No: 2541649

Power Supplies Required: MST – 1 or MST – 1 and MST – 2
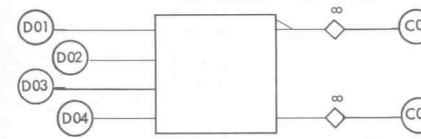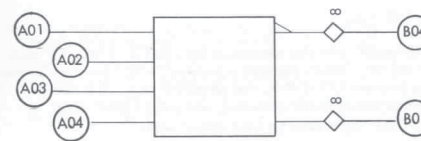
Input Levels: MST – 1

Output Levels: MST – 1 or MST – 2

Description: The circuits contained in this module are equivalent to those contained in module 2551648, the difference between the modules being circuit count and output options. The applications and passive component requirements described for 2551648 are applicable to this part number.

2 – 4W both φ Transmission Line Driver   B02 – 4.0v
                                            B03   GND
                                            C02 V_{REF}

Pd: Circuit Flyers

Maximum – 107 mw   Module   – 2413871
Nominal – 70 mw   Combined – N/A
                             Basic   – XLHCC

Module Part No: 2551650

Power Supplies Required: Standard MST – 1

Input Levels: MST – 1 and MST – 2

Output Levels: MST – 1

Description: This module provides conversion from MST-2 to MST-1. Each of the four circuits performs a positive "AND" function between the common MST-1 line, and an MST-2 line. The output emitter followers are unloaded, and a 615 Ω RPAC, P/N 2390384 is required for each output used.

Input current requirements are as follows:

MST-1 input   0.119ma max.
MST-2 input   0.175ma max.

MST-2 to MST-1 Converter   B02 – 4.0v
                                  B03 GND
                                  C02 V_REF
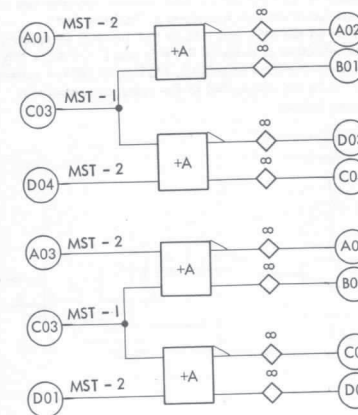
Pd:

Maximum – 260 mw
Nominal – 177 mw

Circuit Flyers

Module   – 2413809
Combined – N/A
Basic   – PXVCC

Module Part No: 2551651

Power Supplies Required: MST and +6.0 ±10%

Input Levels: MST, NPL, SLT

Output Levels: MST

Description: This module provides the conversion between the NPL interface or SLT and MST. Each module contains two convert functions which perform a "Positive And" function on the MST and NPL or SLT inputs. By appropriate selection of external R-PACs and R-C-PACs, this module can be used in MST-1, MST-2, or MST-4 systems. The circuits are connected to the external components as shown below:
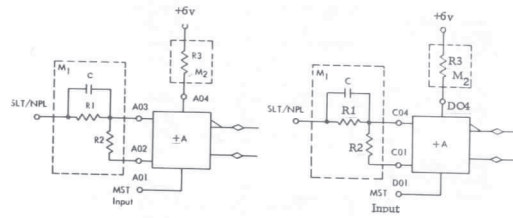
	M_1	M_2
MST-1	P/N 2392344 R_1= 6.04k R_2= 2.35k C = 20pf	P/N 2390525 R_3= 2.2k
MST-2 MST-4	P/N 2390399C R_1= 6.04k R_2=10k C = 20pf	P/N 2390507 R_3= 1.6k

	MST-1	MST-2 MST-4
B02	−4v	−3v
B03	GND	+1.25
C02	V_{REF}	GND

NPL/SLT To MST-1/MST-2 Converter
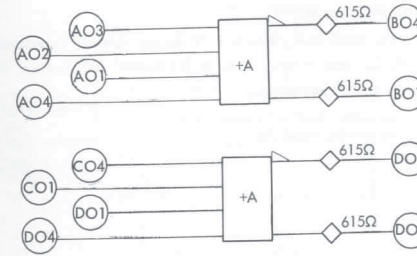
Pd:

Maximum − 265 mw
Nominal − 166 mw

Circuit Flyers

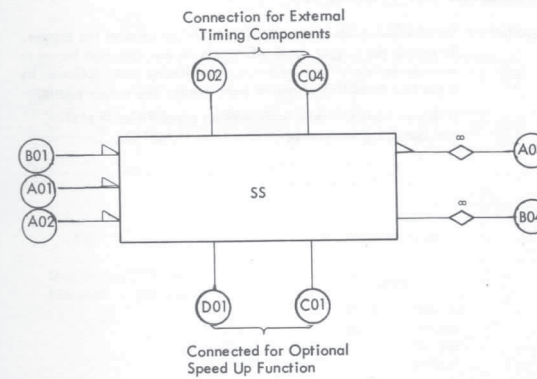|	MST − 1	MST GEN
Module	− N/A	N/A
Combined	− XXAAB	PXAAD
Basic	− PCAAH PCCCL PCCCM	PCAAH PCCCJ PCCCK

Module Part No: 2551652

Power Supplies Required: MST-1 or MST-2

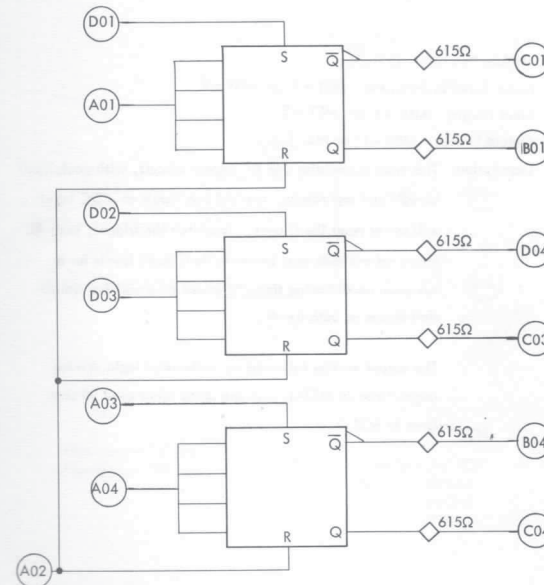Input Levels: MST-1 or MST-2

Output Levels: MST-1 or MST-2

Description: Pulse width from 138ns to 1.19 seconds obtained by external
R. C. combinations. Refer to TEB 2-6400-100, Section 19

for R. C. combinations.

The output emitter followers have
TLD driving capability.

P/N 2551652

Single Shot

B02	– 4.0v
D04	– 4.0v
B03	GND
C02	V_{REF}

Connection for External
Timing Components

Connected for Optional
Speed Up Function

Pd:

Maximum – 199 mw
Nominal   140 mw

Circuit Flyers

MST-1	MST-2
XSGAA	ASGAA
XSGAF	ASGAF
XSGAG	ASGAG
XSGAC	ASGAC
XSGAD	ASGAD
XSGAB	ASGAB

Module Part No: 2551654

Power Supplies Required: MST – 1 or MST – 2

Input Levels: MST – 1 or MST – 2

Output Levels: MST – 1 or MST – 2

Description: Positive (one) inputs on a DC input will set or reset the trigger. To switch the trigger, both AC inputs on one side must be set to their down levels for a minimum conditioning time, followed by a positive transition of one or both inputs. The output emitter

followers have standard logic driving capabilities in MST-1, and can drive terminated 90 ohm lines in MST-2.

2 – A.C. Trigger

B02 – 4.0v
B03   GND
C02 V_{REF}
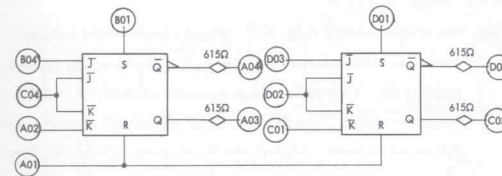
Pd:

Maximum – 274 mw
Nominal – 216 mw

Circuit Flyers

MST_{GEN}

Module – 2413810
Basic   – PFSAA
            PFSAB
            PFSAC

Module Part No: 2551655

Power Supplies Required: MST-1 or MST-2

Input Levels: MST-1 or MST-2

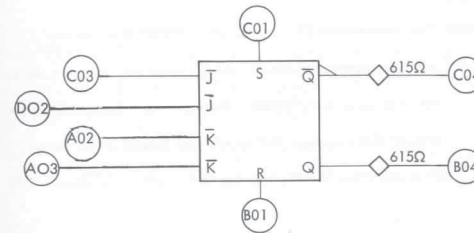Output Levels: MST-1 or MST-2

Description: This module contains three A. C. trigger circuits with a common reset line. On each circuit all the A. C. inputs are tied together, enabling the circuit to be used as a counter element. A positive transition applied to the AC input of the circuit will cause the outputs to switch states. Logical one inputs to the "S" and "R" lines will set or reset the circuit.

The output emitter followers have standard logic driving capabilities in MST-1, and can drive terminated 90 ohm lines in MST-2.

3-A.C. Trigger

B02 - 4.0v
B03 GND
C02 V$_{REF}$

Pd:

Maximum - 411 mw
Nominal - 324 mw

Circuit Flyers
MST$_{GEN}$

Module - 2413838
Basic - PFSAA
         PFSAB
         PFSAC

A. C. Trigger

B02 – 4.0v
B03 – GND
C02 – V_{REF}

Module Part No: 2551656

Power Supplies Required: MST – 1 or MST – 2

Input Levels: MST – 1 or MST – 2

Output. Levels: MST – 1 or MST – 2

Description: This module contains one AC trigger circuit, with each input brought out separately. Logical one inputs on a DC input will set or reset the trigger. To switch the trigger, both AC inputs on one side must be set to their down levels for a minimum conditioning time, followed by a positive transition of one or both inputs.

The output emitter followers have standard logic driving capabilities in MST-1, and can drive terminated 90 ohm lines in MST-2.

Pd:

Maximum – 137 mw
Nominal – 108 mw

Circuit Flyers
MST_{GEN}

Module – 2413837
Basic – PFSAA
PFSAB
PFSAC

Module Part No: 2395143

Power Supplies Required: +6v ± 4%, −4v ± 12%, −1.320 (V$_{REF}$), GND

Input Levels: MST − 1

Output Levels: SLD

Description: Two independent CS circuits, one of which is permanently

wired for in-phase operation and the other externally wireable

for in phase or out-of-phase operation. For out-of-phase oper-

ation of D01, connect D02 to A03 and Ground A01. For in-

phase operation of D01, connect A01 to D02, and Ground A03.

MST to SLD Converter

B02 −4.0V
C03 +6.0V
A04 ⎫
D03 ⎬ GND
B03 ⎭
C02 V$_{REF}$

(C04)————┌────────┐
         │   │   IN φ
(B04)————│   │————(D04)
         └────────┘

(B01)————┌────────┐
         │   │   IN φ or $\overline{\phi}$
(C01)————│   │————(D01)
         └────────┘
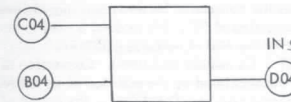
Pd:

Maximum − 210 mw

Circuit Flyer

In Phase Option	Out of Phase Option
2413977	2413981
XXRAC	XXRAC
XNRAA	XNRAA
XLRAE	XLRAF

Module Part No: 2551658

Power Supplies Required: +6.0V ± 10%

Input Levels: Output of MST – 1 or MST – 2 CS Module

Output Levels: SLT

Description: This module provides the conversion between MST signal levels and SLT. When converting to SLT, this module is used in conjunction with either of the MST-1 modules (2531647, 2541646) or the MST-2 CS module (2551899). Conversion to NPL levels may be accomplished by the addition of an R-PAC (2390306) and a discrete transistor (2391329) to the output of the SLT converter. (Refer to TEB 2-6400-100 section 16.5 for description of NPL conversion).

The resistor shown in the block diagram is a programmable collector load for SLT applications.

P/N 2551658

CS to SLT/NPL Converter   C02   GND
                          C03 + 6.0v
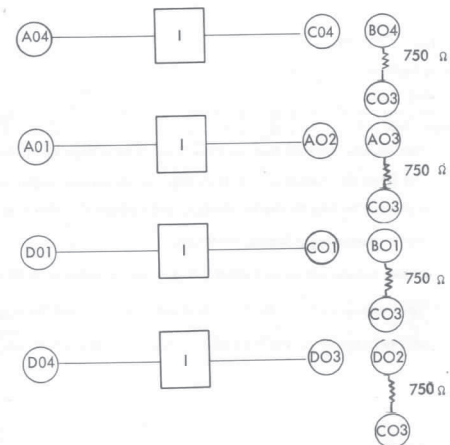
Pd:

Maximum – 284 mw
Nominal – 138 mw

Circuit Flyers

Module – 2413803
         2413842
Basic – PXAAA
         PXAAB
         PXAAC
         PCCBY
         PCCBZ
         PCCZZ
         PCAZZ

Module Part No: 2551659

Power Supplies Required: −4 ±12%, Gnd

Input: See description

Output Levels: MST − 1

Description: This module contains four separate current to voltage amplifiers.
The function of each circuit is to amplify the current output of
a photo-transistor or similar device, and convert this signal to
MST-1 output logic levels. A 20 μ a change in input current
causes a complete logic switch (.6 volt) at the output. A 95 μ a
input reference is set during module manufacture, and the output
will switch with an input current change about this reference.

Photo Device Amplifier   B02   −4.0v
                                B03   GND
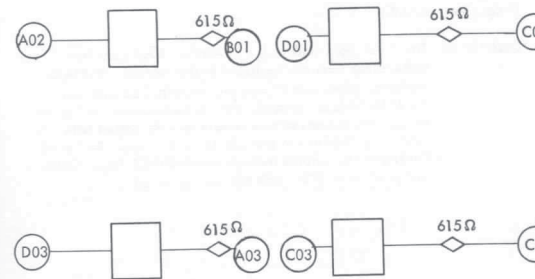
Pd: Circuit Flyers

Maximum − 200 mw   Module − 2413943
Nominal − 120 mw   Basic   − XARAD

Module Part No: 2551660

Power Supplies Required: MST - 1

Input Levels: MST - 1

Output Levels: MST - 1

Description: The local store module is a 4 word by 3 bit module with the write/sense circuitry included in the module. 2551660 modules, when used in conjunction with 2551668 and 2551648 modules, provide scratch pad memory configurations. The outputs of this module may be dotted with other L.S. modules to provide 16 by 9 arrays. By further OR'ing of the outputs through standard MST Logic Gates, arrays of up to 320 words can be assembled.

Local Store

B01 ⎫
C02 ⎬ V_REF
C04 ⎭
B02 - 4v
B03 GND
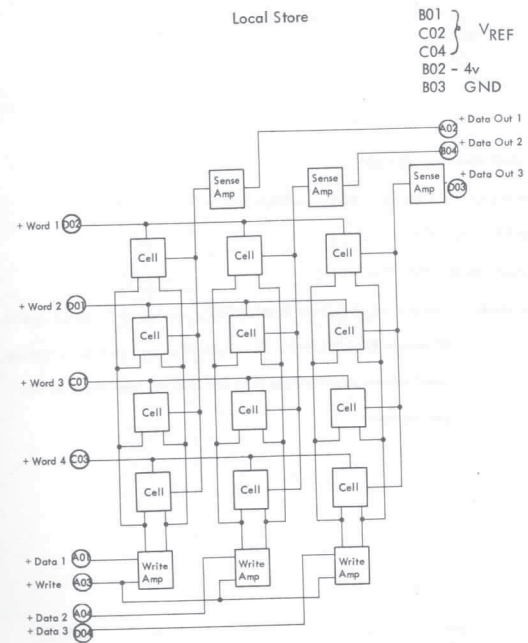
Pd:

Max 320mw
Nom 210mw

Circuit Flyers

Module 2413833
Combined N/A
Basic P5SAA

Module Part No: 2551665

Power Supplies Required: MST-1 or MST-1 and MST-2

Input Levels: MST-1

Output Levels: MST-1 or MST-2

Description: The circuits contained in this module provide an in-phase version
of module P/N 2551648. The application and passive component
requirements described for P/N 2551648 are applicable to this
part number.

3 - 2 wφ, 1 - 2w Both φ   B02 - 4.0v
Transmission Line Driver   B03   GND
                                  C02 V_{REF}

Pd: Circuit Flyers

Maximum - 187 mw   Module - 2413965
Nominal - 130 mw   Combined - N/A
                                  Basic - XLHCC

58   IBM Confidential   IBM Confidential   59
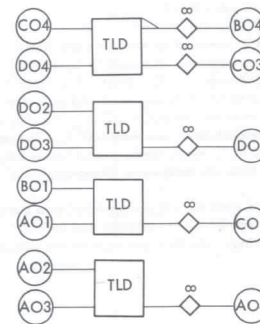
Module Part No: 2551667

Power Supplies Required: MST – 1 and +6.0V $\pm$ 10%

Input Levels: MST – 1

Output Levels: 100 ma DC per circuit

Description: This module is intended to serve as a pre-driver for medium
to high current drivers. The module contains three circuits,
each with a 2-way "-AND" input. The current output is
limited to an absolute maximum of 100 ma, with appropriate
duty cycle, and/or cooling to maintain the output device
junction temperature at less than 100°C. The nominal design
current is 50 to 75 ma depending upon power supply toler-
ances, and external component tolerance.

The output of each circuit is connected in a Darlington Con-
figuration, with both the collector and emitter brought out
for load driving. The Vce maximum of the output devices
is 13 volts.

Transistor Power Driver

B02 – 4.0v
B03 GND
C03 GND
C02 V_{REF}
A02 +6.0v
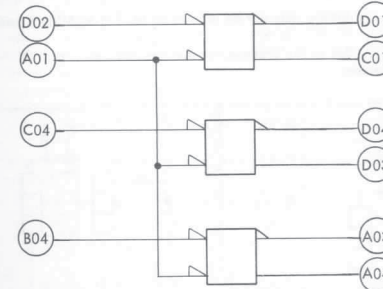
Pd:

Pd is a function of output
loading and duty cycle.

Circuit Flyers

Module – 2413949
Combined – N/A
Basic XPRAE

Module Part No: 2551668

Power Supplies Required: MST-1

Input Levels: MST-1

Output Levels: MST-1

Description: The circuits contained in this module are similar to those
of P/N 2551648. The applications and passive component
requirements described for P/N 2551648 are applicable
to this part number with the exception that this part
number may not be used as an MST-1 to MST-2 converter
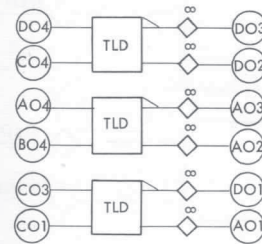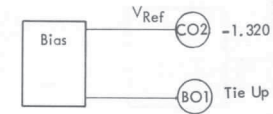due to the presence of the bias network.

Bias Network Schematic

Tie Up Voltage
≈ -0.75v

R_{TH} is an SLT trim resistor which ranges from 120 ohms to 400 ohms

$P_{dmax} = 132$ mw

$P_{dnom} = 101$ mw

-4v
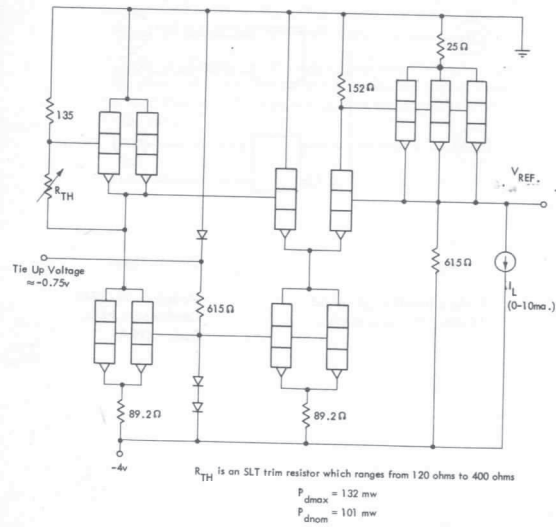
TYPE 2 BIAS NETWORK & 3-2w both φ   B02 -4.0v
                                          B03 GND
Transmission Line Driver   C02 V_{REF}

V_{Ref} CO2 -1.320

BO1 Tie Up

Pd – Maximum

Case I   – 275 mw
Case II – 284 mw
Case III – 291 mw
Case IV – 297 mw
ET I   – 278 mw

Circuit Flyers

Module   – 2413966
Combined – N/A
Basic   – XLHCC
            XVHLM

B02 −4.0 V
B03 GND
C02 V$_{REF}$

2 − 3w $\overline{\phi}$, 1 − 3w both ϕ

A03
A04
A01
615 Ω
A02

D01
C01
B01
615 Ω
D02

B04
D04
C03
615 Ω
C04
615 Ω
D03
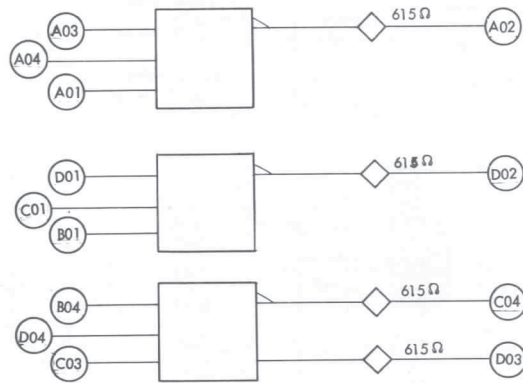
Pd−Maximum

Case I − 114 mw
Case II − 121 mw
Case III − 130 mw
Case IV − 135 mw
ET I − 116 mw

Circuit Flyers

Module − 2413960
Combined − XLLDD
Basic − XLLCC
XCABA

3−4w ϕ LATCH

B02 −4.0 V
B03 GND
CO2 V$_{REF}$
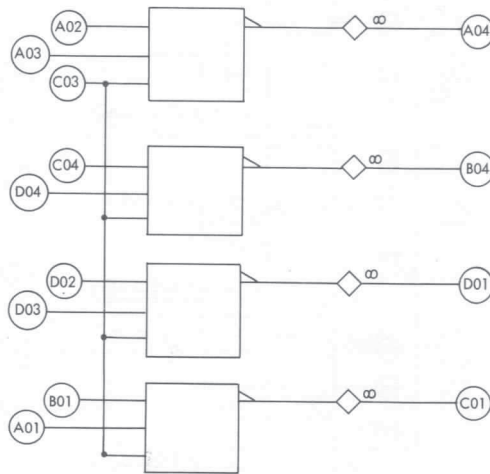
D03
C03

C04
D04
615 Ω
B04

C01
B01

D02
615 Ω
D01

A01
A02

A03
615 Ω
A04
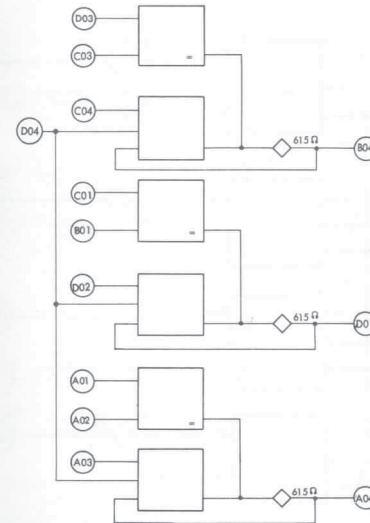
Pd − Maximum

Case I − 150 mw
Case II − 160 mw
Case III − 170 mw
Case IV − 178 mw
ET I − 153 mw

Circuit Flyers

Module − 2413962
Combined − XMLAA
Basic − XLLCA
XLCAC
XCAAB
XCABA

B02 – 4.0v
B03　GND
C02　V_{REF}

4-3w $\overline{\phi}$

Pd – Maximum
Case I　　– 81 mw
Case II　　– 87 mw
Case III　– 93 mw
Case IV　– 96 mw
ET I　　　– 84 mw

Circuit Flyers

Module　　– 2413963
Combined – N/A
Basic　　 – XLLCC

B02　–4
B03　G
C02　V
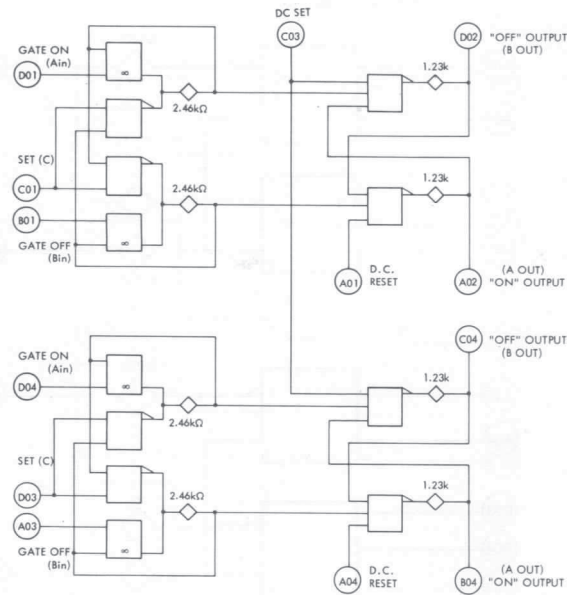
1 – (2w, 2w) A0
1 – (2w, 3w) A0

615Ω

$\dfrac{Pd}{TBD}$ maximum

Circuit Flyer
Module　2413979
Combined　XMLAK
Basic　XLLCA
　　　　XLCAC
　　　　XCABA

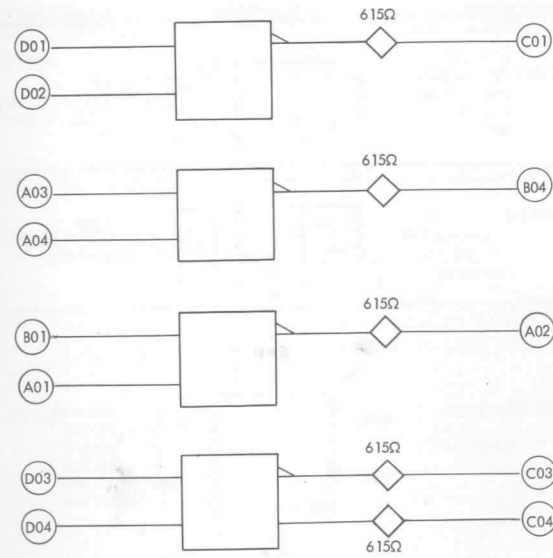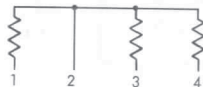P/N 2531675

B02 −4v
B03 GND
C02 V$_{REF}$

2 DC TRIGGER

DC SET
C03

GATE ON
(Ain)
D01

∞

2.46kΩ

SET (C)
C01

B01

GATE OFF
(Bin)

∞

2.46kΩ

1.23k

D02 "OFF" OUTPUT
(B OUT)

1.23k

A01 D.C.
RESET

A02 "ON" OUTPUT
(A OUT)

GATE ON
(Ain)
D04

∞

2.46kΩ

SET (C)
D03

A03

GATE OFF
(Bin)

∞

2.46kΩ

C04 "OFF" OUTPUT
(B OUT)

1.23k

1.23k

A04 D.C.
RESET

B04 "ON" OUTPUT
(A OUT)
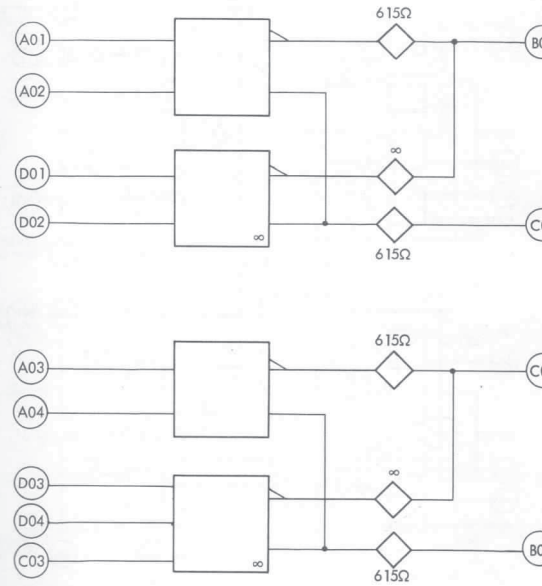
Pd − Maximum

TBD

Circuit Flyer
Module   2413980
Combined XMLAJ
Basic   XLLAA
        XLCAC
        XCACA
        XLLCC
        XCAAB

P/N 2551676

B02 = 4v
B03 = GND
C02 = V$_{REF}$

3 − 2 ω φ̄
1 − 2 ω Both φ

D01

D02

615Ω

C01

A03

A04

615Ω

B04

B01

A01

615Ω

A02

D03

D04

615Ω

C03

615Ω

C04
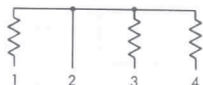
$\dfrac{Pd}{TBD}$
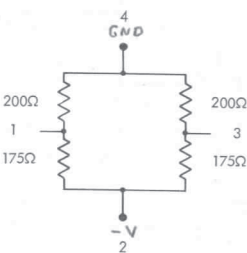
Circuit Flyer
Module   2413978
Combined XLLDD
Basic   XLLCC
        XCABA
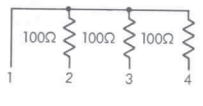
1X PASSIVE COMPONENT DESCRIPTIONS

PART NUMBER	DESCRIPTIONS		WHERE USED
2390384	615Ω All 1 2 3 4		REF STANDARD LOGIC CIRCUITS AND TLD
2390383	1.23Ω All 1 2 3 4		2 REF STANDARD LOGIC CIRCUITS
2392338	4 GND 200Ω 200Ω 1 3 175Ω 175Ω –V 2		TLD P/N 2551648 2541649 2551652 2551665 2551668
2390445	100Ω 100Ω 100Ω 1 2 3 4		MST–1 TO MST–2 CONVERT PN 2551648 2551649 2551665
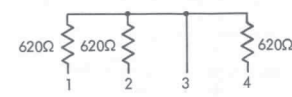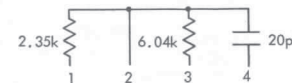
PART NUMBER	DESCRIPTION	WHERE USED
2390480	620Ω 620Ω 620Ω 1 2 3 4	MST–1 to MST–2 CONVERT PN 2551648 2541649 2551665
2392344	2.35k 6.04k 20pf 1 2 3 4	NPL/SLT TO MST–1 PN 2551651
2390525	2.2k 2.2k 1 2 3 4	NPL/SLT TO MST–1 PN 2551651
2390306	70Ω 1 2 3 4	SLT TO NPL PN 2551658

NPL/SLT
TO MST 2 and 4

P

2390399

10k ⋛   ⋛ 6.04k ⊥ 20pf
   1   2   3   4

2390507   NPL/SLT
                           TO MST 2 and 4

      ⋛ 1.6k   ⋛ 1.6k
   1   2   3   4

X CONTACTS FOR ADDITIONAL INFORMATION

MST 1 and 2	Circuit Engineering W. H. Hosick Dept 132 7666C
MST 1 and 2	Specification and Analysis N. Callaghan Dept 789 7974C
MST 1 and 2	Circuit Design R. Spadavecchia Dept 130 7892C
MST 1 and 2	System Applications and Reliability B. E. Cunningham Dept 704 7668C
MST 1 and 2	Applications R. A. Katz Dept 122 7670C
MST 1 and 2	Reliability E. Nielsen Dept 814 4594C