NEC Electronics Inc.

NEC

PRODUCT SELECTION GUIDE

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DATA BOOK

NEC

1985 PRODUCT SELECTION GUIDE

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NEC

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GENERAL INFORMATION

Section 1 — General Information

INTRODUCTION

NEC, the world's second largest semiconductor supplier, offers one of the most diversified product lines in the industry. This Selection Guide has been developed to illustrate that point, as well as provide one major listing of all NEC products.

Memory Products

NEC offers the broadest line of exceptionally high quality standard memory products. This line includes seven configurations of 256K DRAMs, SRAMs available in a wide choice of technologies, high density masked ROMs both in CMOS and NMOS, UV and OTP EPROMs, Bipolar PROMs with shorted junction technology, and the fastest ECL RAMs on the market.

Microcomputer Products

NEC's microcomputer product line offers more variety than most. From microprocessors and single-chip microcomputers to complex peripherals, and digital signal processors — NEC has what you need.

A new family of CMOS microprocessors with a strategy for success, our V-Series is designed for immediate performance gains with minimum engineering effort. Features include CMOS technology, advanced architecture for faster execution, greater power reductions in standby mode and more.

The 7800 Series (single chip microcomputers) is the ultimate in design flexibility. It includes both CMOS and NMOS variations, full duplex USARTs, A/D or comparator ports, and up to 44 general purpose I/O lines. All are based on a high-performance 8/16-bit architecture.

NEC is also a leading supplier of high-quality, multifunctional peripherals and digital signal processing chips, all of which reduce system design time and cost while increasing reliability. Our devices are used in the leading personal computer systems, high performance color terminals, HP1B compatible instruments, speech, high-performance modem and advanced video image processing systems.

Linear Products

NEC offers an extensive line of linear products to answer your design problems. Our data conversion products feature 8, 10 and 12-bit (CMOS) analog-to-digital converters and 8 and 12-bit digital-to-analog converters. Consumer circuits include digital tuning, power amps, hybrid amps, monolithic microwave, and I/R remote control.

NEC's standard linear products feature operational amplifiers, comparators, timers, and voltage regulators.

Optoelectronic Devices

The wide variety of NEC optoelectronic devices offers designers and manufacturers greater alternatives and the ability to choose the parts that truly fit their product needs. Designed to satisfy industrial, communication, instrumentation, and consumer applications, NEC's broad line includes both fashion and standard LEDs (in red, green, amber and infrared wavelengths), photo couplers in both standard and proprietary high performance models, photo interrupters in standard and unique sizes, and a wide variety of photo transistors and photo diodes. All NEC optoelectronic components have superior efficiency, stability and operating characteristics.

Fiber Optic Components

NEC offers virtually all the components you need to implement a leading edge fiber optic system for data communications or telecommunications. Also available are a variety of gas and semiconductor lasers for beam applications. The FOC line includes active and passive devices, data links, and optical measuring equipment.

Gate Array Products

NEC is making a major commitment to provide full customer satisfaction in semi-custom ICs. Our gate arrays are available in three versions — CMOS (12 densities), TTL (6 densities), and ECL (5 densities). We are the world leader in providing high-density arrays (11,000-gate, 2 micron CMOS), and our user-friendly design CAD tools are part of the package.

Fluorescent Indicator Panel Displays

NEC offers vacuum fluorescent indicator panel (FIPs®) displays for all major market applications. With low-voltage operation and large, bright characters in blue, green and all other visible colors, FIPs® are a more effective and reliable display than most LEDs and gas discharge displays. NEC's FIPs® are available in a wide variety of standard sizes, characters and number of digits.

Capacitor Products

NEC is an innovator in the capacitor market, offering high volume, high quality products. NEC's tantalum and axial molded capacitors, and super capacitors (Supercaps™) offer the designer advanced technological design and excellent performance characteristics for filtering, bypassing, coupling, decoupling, blocking, filtering and RC timing circuits. They are used extensively in industrial, commercial, entertainment, and medical electronic equipment.

QUALITY AND RELIABILITY

Section 2 — Quality and Reliability

INTRODUCTION

As very large-scale integration (VLSI) reaches a higher level of density, reliability of devices imposes a profound impact on system reliability. And as device reliability becomes a major factor, test methods to assure acceptable reliability become more complicated. Simply performing a reliability test according to a conventional method cannot satisfy NEC's demanding requirements for higher reliability. At these new, higher levels of VLSI density, it is increasingly difficult to activate all the elements in the internal circuits. Therefore, a different philosophy and methodology is needed for reliability assurance.

In order to improve and guarantee a certain level of reliability of products, it is essential to build quality and reliability into the product — at every phase of operation. NEC has introduced the concept of Total Quality Control (TQC) across its entire semiconductor product line. By adopting TQC, NEC builds high quality into its products and thus assures higher reliability. The concept and methodology of TQC are company-wide activities — involving workers, engineers, quality control staff, and all levels of management.

NEC's goal is to further improve the superior product that has become synonymous with the NEC name. That's why research and development efforts to achieve even higher standards are an ongoing process. Extensive failure analysis is performed and corrective actions taken as preventative measures.

Quality Control Implementation

Building excellence into a product requires the earliest possible detection of failure in each phase. Immediate action must be taken to remove the cause of failure. Fixed-station quality inspection often precludes the ability to take immediate action. It is, therefore, necessary to perform quality control functions at each step — especially at the conceptual stage.

Significant quality stages include:

- Product Development
- Wafer Processing
- Assembly
- Electrical Testing and Screening
- Pre-Inventory Inspection
- Reliability Assurance Test

Product Development

The product development phase includes product conception, review of the device proposal, organization and physical element design, engineering evaluations, and transfer of the product to manufacturing.

In every step of the product development phase, quality and reliability requirements *must* be satisfied. Utilizing the TQC approach has shortened the product development cycle by two to three months. At NEC, building superiority into the product is essential.

Wafer Processing

During the wafer processing stage, the in-process quality inspections that occur are as follows:

Process	Inspection Item
Wafer	Resistivity, Dimension, and Appearance, Lot Sampling Inspection
Photo-Lithography	Alignment and Etching, 100 percent inspection
Diffusion and Oxidation	Oxide Thickness, Sheet Resistivity, Lot Sampling Inspection
Metallization and Passivation	Thickness, V_{th}, C-V Characteristics, and Lot Sampling
Wafer Sort and Scribe	DC Parameters, 100 Percent Inspection
Die Sort	100 Percent Visual Inspection

Assembly

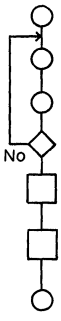
The in-process quality inspections performed during the chip-mounting and packaging stage are as follows:

Process	Inspection Item
Die	Incoming Material Inspection
Die Attach	Appearance, Lot Sampling Inspection
Wire Bonding	Bond Strength, Appearance, Lot Sampling
Packaging	100 Percent Appearance Inspection
Fine Leak*	Lot Sampling
Gross Leak*	100 Percent Inspection

Note: *For ceramic package devices only.

ELECTRICAL TESTING AND SCREENING

Electrical testing and infant mortality screening are performed at this stage. The flow chart below depicts the process. (Please note: The following diagram illustrates NEC's basic flow and is similar to most processes. Some product lines may have variations. However, in all cases NEC strives for zero defects.)



Flow	Process	Frequency
	1st Electrical	100%
	Burn-in	100%
	2nd Electrical	100%
No	PDA	100%
	Pre-Inventory Inspection	Every lot
	Reliability Assurance Tests	Every lot or every month
	Warehouse/Finished Goods	

During the first electrical test, DC parameters are tested in accordance with electrical specifications, on 100% of each lot. This prescreen performance is prior to the infant mortality testing. As an integral part of the standard production process, 100% burn-in is performed.

In the second electrical test, AC functional as well as DC parameter tests are performed. If the percentage of defective units exceeds a set limit, the lot is subjected to an additional burn-in. During this second burn-in, the defective units undergo a failure analysis. The results of this analysis are then fed back for appropriate corrective action.

Pre-Inventory Inspection

Prior to warehouse storage, lots are subjected to an incoming inspection according to the following sampling plan:

Electrical test:	DC parameters	LTPD 3%
	Function test	LTPD 3%
Appearance		LTPD 3%

Reliability Assurance Testing

A large part of NEC's Total Quality Control program involves various types of reliability assurance tests performed to ensure the highest product quality and reliability possible.

The High Temperature Operating Life Test is used to accelerate failure mechanisms by operating the devices at an elevated temperature. The data obtained is then translated to a lower temperature.

Integrated circuits are highly sensitive to the general accelerating effect of humidity in causing electrolytic corrosion between biased lines. High Temperature and High Humidity Tests are performed to detect failure mechanisms which are accelerated by these conditions. It is especially effective in accelerating leakage-related failures and drifts in device parameters due to process instability.

Another common test is the High Temperature Storage Test. In this test, devices are subjected to elevated temperatures with no applied bias. This test is used to detect any mechanical problems or process instability.

The Environmental Test is performed to detect problems related to packaging, material, susceptibility to environmental extremes, and problems related to usage of the devices.

Summary

Building quality and reliability into products is the most efficient way to ensure product excellence. NEC's adoption of quality control functions at each process step forms a consolidated quality control system, which guarantees a superior product.

The introduction of 100% burn-in and the performance of monthly Reliability Assurance Tests, have established a singularly high standard of excellence for all NEC devices.

With company-wide practice of Total Quality Control, NEC is committed to producing superior products. Through continuous research and development, extensive failure analysis and process improvements, higher standards of quality and reliability are continuously set and maintained.

MEMORY PRODUCTS

Section 3 — Memory Products

Dynamic RAM

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Max. Power Dissipation (mW) Standby	Active	Package	Pins
μPD416-2	16K x 1	NMOS	200	375	+12, +5, −5	20	462	C/D	16
μPD416-3			150	320					
μPD416-5			120	320					
μPD4164-10	64K x 1	NMOS	100	200	+5	28	330	C/D*	16
μPD4164-12			120	230			303		
μPD4164-15			150	260			275		
μPD4164-20			200	330			248		
μPD4168-15	8K x 8	NMOS	150	260	+5	28	330	C	28
μPD4168-20			200	330			275		
μPD4265-20	64K x 1	MIX-MOS	200	335	+5	5.5	193	C/D*	16
μPD4265-25			250	410			165		
μPD41221-75	224K x 1	NMOS	75	90	+5	82	385	C	14
μPD41464-15	64K x 4	NMOS	150	270	+5	28	413	C/D/L	18
μPD41464-20			200	335			355		
μPD41256-12	256K x 1	NMOS	120	220	+5	28	457	C/D*/L	16
μPD41256-15			150	270			385		
μPD41256-20			200	335			330		
μPD41257-15	256K x 1	NMOS	150	270	+5	28	385	C/D/L	16
μPD41257-20			200	335					
μPD41832-10	32K x 8	NMOS	100	180	+5	14[1] 28	468	C/G	28
μPD41832-12			120	210			413		
μPD41832-15			150	260			330		
μPD41264-12	64K x 4 dual port	NMOS	120 port A[3] 30 port B[4]	220 port A 40 port B	+5	83	1045	C	24
μPD41264-15			150 port A 40 port B	270 port A 60 port B					
μPD41416-12	16K x 4	NMOS	120	220	+5	28	303	C	18
μPD41416-15			150	260			275		
μPD41416-20			200	330			248		
μPD42832-10	32K x 8	NMOS	100	160	+5	.55[1] 5.5[2]	330	C/G	28
μPD42832-12			120	190			275		
μPD42832-15			150	235			220		

Notes: Package: C = Plastic DIP D = Ceramic DIP D* = CERDIP L = PLCC G = Miniflat

1. When used in the self refresh mode.
2. Standby power = 2.8 mW when CE = OE = V_{DD}.
3. Port A = random access port.
4. Port B = serial access port.

Static RAM

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Max. Power Dissipation (mW) Standby	Active	Package	Pins
μPD446	2K x 8	CMOS	450	450	+5	.055	100	C/G	24
μPD446-1			250	250			143		
μPD446-2			200	200			165		
μPD446-3			150	150			210		
μPD449	2K x 8	CMOS	450	450	+5	.055	100	C	24
μPD449-1			250	250			143		
μPD449-2			200	200			165		
μPD449-3			150	150			210		
μPD2147A-25	4K x 1	NMOS	25	25	+5	110	880	D*	18
μPD2147A-35			35	35					
μPD2147A-45			45	45					
μPD2167-2	16K x 1	NMOS	70	70	+5	165	990	D	20
μPD2167-3			55	55					
μPD4016-1	2K x 8	NMOS	250	250	+5	82	330	C	24
μPD4016-2			200	200					
μPD4016-3			150	150					
μPD4016-5			120	120					
μPD4361-40	64K x 1	MIX-MOS	40	40	+5	110	660	K	22
μPD4361-45			45	45				C/K	
μPD4361-55			55	55				C/K	
μPD4361-70			70	70				C	
μPD4364-12	8K x 8	MIX-MOS	120	120	+5	11	220	C	28
μPD4364-12L			120	120		.55[1]	220	C/G	
μPD4364-12LL			120	120		.275[2]	220	C/G	
μPD4364-15			150	150		11	192	C	
μPD4364-15L			150	150		.55[1]	192	C/G	
μPD4364-15LL			150	150		.275[2]	192	C/G	
μPD4364-20			200	200		11	165	C	
μPD4364-20L			200	200		.55[1]	165	C/G	
μPD4364-20LL			200	200		.275[2]	165	C/G	
μPD43256-10	32K x 8	MIX-MOS	100	100	+5	11	385	C	28
μPD43256-10L			100	100		.55			
μPD43256-12			120	120		11			
μPD43256-12L			120	120		.55			
μPD43256-15			150	150		11			
μPD43256-15L			150	150		.55			
μPD4464-15	8K x 8	CMOS	150	150	+5	.055	220	C/G	28
μPD4464-15L			150	150		.005	220		
μPD4464-20			200	200		.055	192		
μPD4464-20L			200	200		.005	192		

Notes: Package: C = Plastic DIP D = Ceramic DIP D* = CERDIP G = Miniflat K = Ceramic Leadless Chip Carrier (LCC)

1. .110 mW at 40°C
2. .082 mW at 40°C

ECL RAM

Device	Organization	Process	Address Access Time (ns)	Chip Select Access Time (ns)	Supply Voltage	Max. Power Dissipation (mW)	Package	Pins
μPB10422-10	256 x 4	10K	10	5[1]	−5.2	1200	D	24
μPB10422-70			7	5[1]				
μPB10470-10	4K x 1	10K	10	6	−5.2	1200	D	18
μPB10470-15			15	8				
μPB10474-10	1K x 4	10K	10	6	−5.2	1200	D	24
μPB10474-15			15	8				
μPB100422-10	256 x 4	100K	10	5[1]	−4.5	1000	B/D	24
μPB100422-70			7	5[1]				
μPB100470-10	4K x 1	100K	10	6	−4.5	1000	D	18
μPB100470-15			15	8		1000	D	
μPB100474-10	1K x 4	100K	10	6	−4.5	1000	B/D	24
μPB100474-15			15	8		1000	B/D	
μPB100474-60			6	4		2000	B/K	
μPB100474-80			8	5		2000	B/K	

Note: Package: B = Ceramic Flat Pack D = Ceramic DIP K = Ceramic Leadless Chip Carrier (LCC)
1. Block Select Access Time (ns)

Masked ROM

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Operation	Max. Power Dissipation (mW)[1] Standby	Active	Package	Pins
μPD2364A	8K x 8	NMOS	200	200	Static	83	385	C	24
μPD2364A-1			150	150		83	385		24
μPD2364E			250	250		105	420		28
μPD2364E-1			200	200		105	420		28
μPD23128A	16K x 8	NMOS	200	300	Edge-trig	83	220	C	28
μPD23128E			250	250	Static	138	495		
μPD23256A	32K x 8	NMOS	200	300	Edge-trig	83	193	C	28
μPD231000	128K x 8	NMOS	350	450	Edge-trig	83	275	C	28
μPD231000-1			300	400					
μPD23C64E	8K x 8	CMOS	200	200	Static	0.165	138	C	28
μPD23C64E-1			150	150			165		
μPD23C128E	16K x 8	CMOS	200	200	Static	0.165	138	C	28
μPD23C128E-1			150	150			165		
μPD23C256E	32K x 8	CMOS	200	200	Static	0.165	138	C/G	28
μPD23C256E-1			150	150			165		

Note: Package: C = Plastic DIP D = Ceramic DIP G = Miniflat
1. Supply Voltage: +5 V for all ROMs above.

EPROM

Device	Organization	Process	Access[1] Time (ns)	Program Option	Supply Voltage	Max. Power Dissipation (mW) Standby	Active	Package	Pins
μPD2764	8K x 8	NMOS	250	UV/OTP	+5	210	498	C/D	28
μPD2764-2			200	UV				D	
μPD2764-3			300	UV/OTP				C/D	
μPD2764-4			450	UV/OTP				C/D	
μPD27128	16K x 8	NMOS	250	UV/OTP	+5	210	603	C/D	28
μPD27128-2			200	UV				D	
μPD27128-3			300	UV/OTP				C/D	
μPD27128-4			450	UV				D	
μPD27256	32K x 8	NMOS	250	UV/OTP	+5	210	603	C/D	28
μPD27256-2			200	UV				D	
μPD27256-3			300	UV/OTP				C/D	
μPD27C64-20	8K x 8	CMOS	200	UV	+5	1.1	165	D	28
μPD27C64-25			250	UV				D	
μPD27C64-30			300	UV/OTP				C/D	
μPD27C256-15	32K x 8	CMOS	150	UV	+5	1.1	165	D	28
μPD27C256-20			200	UV/OTP				C/D	
μPD27C256-25			250	UV/OTP				C/D	
μPD27C256A-15	32K x 8	CMOS	150	UV	+5	1.1	165	D	28
μPD27C256A-20			200	UV/OTP				C/D	
μPD27C256A-25			250	UV/OTP				C/D	

Notes: 1. V_{CC} = 5 V ±5% for NMOS, Temperature = 0°C to +70°C.
2. V_{CC} = 5 V ±10% for CMOS, Temperature = 0°C to +70°C.
3. Packages: C = Plastic DIP D = CERDIP with quartz window.
4. High speed programming on all devices.
5. Standard parts V_{PP} = +21 V ±0.5 V; Suffix part with (A) V_{PP} = +12.5 V ±0.3 V.
6. UV = Ultraviolet Erasable.
7. OTP = One-Time Programmable (Plastic DIP).

Bipolar PROM

Device	Organization	Process	Address Access Time (ns)	Chip Select Cycle Time (ns)	Supply Voltage	Max. Power Dissipation (mW)	Package	Pins
μPB426	1K x 4	TTL	70	45	+5	825	C/D	18
μPB426-1			60	40				
μPB426-2			50	30				
μPB426-3			35	30				
μPB429	2K x 8	TTL	70	50	+5	880	C/D	24
μPB429-1			60	40				
μPB429-2			50	30				
μPB429-3			45	30				

Note: Package: C = Plastic DIP D = Ceramic DIP

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MICROCOMPUTER PRODUCTS

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Section 4 — Microcomputer Products

Single-Chip 4-Bit Microcomputers

Device	Special Features	ROM (x8)	RAM (x4)	I/O	Process	Output	Cycle (kHz)	Supply Voltage	Pins DIP or QUIP /Flat
μPD7500H	CMOS Microcomputer	external	256	46	CMOS	TS, BD	700	4.5 - 5.5 V	64/—
μPD7501	LCD Controller/Driver	1K	96	24	CMOS	TS, BD	400	2.7 - 5.5 V	—/64
μPD7502	LCD Controller/Driver	2K	128	23	CMOS	TS, BD	400	2.7 - 5.5 V	—/64
μPD7503	LCD Controller/Driver	4K	224	23	CMOS	TS, BD	400	2.7 - 5.5 V	—/64
μPD7506C	CMOS Microcomputer	1K	64	22	CMOS	TS, BD	400	2.5 - 6.0 V	28/52
μPD7507C	CMOS Microcomputer	2K	128	32	CMOS	TS, BD	400	2.5 - 6.0 V	40/52
μPD7507S	CMOS Microcomputer	2K	128	20	CMOS	TS, BD	400	2.2 - 6.0 V	28/—
μPD7507H	CMOS Microcomputer	2K	128	32	CMOS	TS, BD	4.19 MHz	2.7 - 6.0 V	40/—
μPD7508A	FIP Controller/Driver	4K	208	32	CMOS	TS, BD	400	2.7 - 5.5 V	40/—
μPD7508C	CMOS Microcomputer	4K	224	32	CMOS	TS, BD	400	2.5 - 6.0 V	40/52
μPD75CG08	FIP Contrl/Dvr w/Piggy EPROM	4K	224	32	CMOS	TS, BD	400	4.5 - 5.5 V	40/—
μPD7508H	CMOS Microcomputer	4K	224	32	CMOS	TS, BD	4.19 MHz	2.7 - 6.0 V	40/—
μPD75CG08H	CMOS Micro w/Piggy EPROM	4K	224	32	CMOS	TS, BD	4.19 MHz	4.5 - 5.5 V	40/—
μPD7514	LCD Controller/Driver	4K	256	31	CMOS	TS, BD	500	2.7 - 6.0 V	—/80
μPD7516H	FIP Controller/Driver	6K	256	28	CMOS	TS, BD	6.55 MHz	2.5 - 6.0 V	64/64
μPD75CG16H	FIP Contrl/Dvr w/Piggy EPROM	6K	256	28	CMOS	TS, BD	6.55 MHz	4.5 - 5.5 V	64/—
μPD7519	FIP Controller/Driver	4K	256	28	CMOS	TS, BD	4.19 MHz	2.5 - 5.5 V	64/64
μPD75CG19	FIP Contrl/Dvr w/Piggy EPROM	4K	256	28	CMOS	TS, BD	4.19 MHz	4.5 - 5.5 V	64/—
μPD7519H	FIP Controller/Driver	4K	256	28	CMOS	TS, BD	6.55 MHz	2.5 - 6.0 V	64/64
μPD75CG19H	FIP Contrl/Dvr w/Piggy EPROM	4K	256	28	CMOS	TS, BD	6.55 MHz	4.5 - 5.5 V	64/—
μPD7527	FIP Controller/Driver	2K	128	31	CMOS	TS, BD	500	2.7 - 6.0 V	42/42
μPD7528	FIP Controller/Driver	4K	160	31	CMOS	TS, BD	500	2.7 - 6.0 V	42/42
μPD75CG28	FIP Contrl/Dvr w/Piggy EPROM	4K	160	31	CMOS	TS, BD	500	4.5 - 5.5 V	42/—
μPD7537	FIP Controller/Driver	2K	128	31	CMOS	TS, BD	500	2.7 - 6.0 V	42/42
μPD7538	FIP Controller/Driver	4K	160	31	CMOS	TS, BD	500	2.7 - 6.0 V	42/42
μPD75CG38	FIP Contrl/Dvr w/Piggy EPROM	4K	160	31	CMOS	TS, BD	500	4.5 - 5.5 V	42/—
μPD7533	CMOS Microcomputer w/A/D	4K	160	30	CMOS	TS, BD	400	2.7 - 6.0 V	42/44
μPD75CG33	CMOS Micro w/A/D w/Piggy EPROM	4K	160	30	EPROM	TS, BD	400	4.5 - 5.5 V	42/—
μPD7554	CMOS Microcomputer w/R Osc	1K	64	16	CMOS	TS, BD	660	2.5 - 6.0 V	20/—
μPD7556	CMOS Microcomputer w/R Osc	1K	64	20	CMOS	TS, BD	660	2.5 - 6.0 V	24/—
μPD7564	CMOS Microcomputer w/Ceramic Osc	1K	64	16	CMOS	TS, BD	660	2.5 - 6.0 V	20/—
μPD7566	CMOS Microcomputer w/Ceramic Osc	1K	64	20	CMOS	TS, BD	660	2.5 - 6.0 V	24/—

New Single-Chip 4-Bit Microcomputers

Device	Special Features	ROM (x8)	RAM (x4)	I/O	Process	Output	Cycle (kHz)	Supply Voltage	Pins DIP or QUIP /Flat
μPD75104	High Performance Micro	4K	320	58	CMOS	TS, BD	4.19 MHz	2.5 - 6.0 V	64/64
μPD75106	High Performance Micro	6K	320	58	CMOS	TS, BD	4.19 MHz	2.5 - 6.0 V	64/64
μPD75P108	High Perform Micro w/Piggy EPROM	8K	512	58	CMOS	TS, BD	4.19 MHz	2.5 - 6.0 V	64/—

LCD Peripherals

μPD7225	Alphanumeric LCD Contrl/Dvr-16 Digits Alpha, 8 Char Numer				CMOS			2.7 - 5.5 V	—/52
μPD7227	Dot-Matrix LCD Contrl/Dvr-5 x 7 Matrix 8 Row 40 Column				CMOS			4.5 - 5.5 V	—/64
μPD7228	Dot-Matrix LCD Contrl/Dvr-64 Char Alpha, 96 Char JIS				CMOS			4.5 - 5.5 V	—/80
μPD6307	LCD Row Driver — 32 Rows, Casc to 128/21 Voltage Output				CMOS			4.5 - 5.5 V	—/54
μPD6308	LCD Column Driver — 40 Columns, Cascadable/21 Voltage Output				CMOS			4.5 - 5.5 V	—/54
μPD72030	LCD Display Control — Editing, Scroll, Cursor Manip, Blink				CMOS			4.5 - 5.5 V	—/64

Single-Chip 8-Bit Microcomputers

Device	Special Features	ROM	RAM	I/O	Process	Output	Cycle (MHz)	Supply Voltage	Pins
μPD78C05A	CMOS Micro	external	128x8	46	CMOS	TS,BD	6	2.7 to 5.5	64
μPD78C06A	CMOS Micro	4kx8	128x8	46	CMOS	TS,BD	6	2.7 to 5.5	64
μPD78C10	CMOS 7810	external	256x8	44	CMOS	TS,BD	12	+5	64
μPD78C11	CMOS 7811	4kx8	256x8	44	CMOS	TS,BD	12	+5	64
μPD7807	ROMLESS 7808/09	external	256x8	40	NMOS	TS,BD	12	+5	64
μPD7808	4k 7809	4kx8	256x8	40	NMOS	TS,BD	12	+5	64
μPD7809	8-bit comparator/8/16-bit	8kx8	256x8	40	NMOS	TS,BD	12	+5	64
μPD7810H	Hi speed 7810	external	256x8	40	NMOS	TS,BD	12	+5	64
μPD7811H	Hi speed 7811	4kx8	256x8	40	NMOS	TS,BD	15	+5	64
μPD78PG11E	7811 w/Piggy EPROM	4kx8	256x8	40	Piggy	TS,BD	12	+5	64
μPD7816	w/A/D	4kx8	128x8	40	NMOS	TS,BD	12	+5	64
μPD78310	High Performance Motor Control	external	256x8	40	CMOS	TS,BD	12	+5	64
μPD78312	High Performance Motor Control	8kx8	256x8	40	CMOS	TS,BD	12	+5	64
μPD80C40	CMOS 8040	external	256x8	27	CMOS	TS,BD	8	2.7 to 5.5	40
μPD80C42	CMOS 8042	2kx8	128x8	18	CMOS	TS,BD	8	2.7 to 5.5	40
μPD80C50H	CMOS 8050	4kx8	256x8	27	CMOS	TS,BD	8	2.7 to 5.5	40
μPD8748C	One-time Programmable	1kx8	64x8	27	EPROM	TS,BD	6	+5	40
μPD8749C	One-time Programmable	2kx8	128x8	27	EPROM	TS,BD	6	+5	40
μPD8035HL	μPD8048 w/External Memory	external	64x8	27	HMOS	TS,BD	6	+5	40
μPD8039HL	μPD8049 w/External	external	128x8	27	HMOS	TS,BD	11	+5	40
μPD8041A	Enhanced μPD8041	1024x8	64x8	18	NMOS	TS,BD	6	+5	40
μPD8048H	Expansion Bus	1024x8	64x8	27	HMOS	TS,BD	6	+5	40
μPD8049H	High Speed μPD8049	2048x8	128x8	27	HMOS	TS,BD	11	+5	40
μPD8741A	UV-EPROM μPD8041A	1024x8	64x8	18	NMOS	TS,BD	6	+5	40
μPD8748	UV-EPROM μPD8048	1024x8	64x8	27	NMOS	TS,BD	6	+5	40
μPD8748H	UV-EPROM μPD8048H	1024x8	64x8	27	NMOS	TS,BD	6	+5	40
μPD8749H	UV-EPROM μPD8049	2048x8	128x8	27	HMOS	TS,BD	11	+5	40
μPD80C35	CMOS 8035	external	64x8	27	CMOS	TS,BD	6	2.7 to 5.5	40
μPD80C48	CMOS 8048	1024x8	64x8	27	CMOS	TS,BD	6	2.7 to 5.5	40
μPD80C39	CMOS 8039	external	128x8	27	CMOS	TS,BD	8	2.7 to 5.5	40
μPD80C39H	CMOS 8039H	external	128x8	27	CMOS	TS,BD	12	2.7 to 5.5	40
μPD80C49	CMOS 8049	2048x8	128x8	27	CMOS	TS,BD	8	2.7 to 5.5	40
μPD80C49H	CMOS 8049H	2048x8	128x8	27	CMOS	TS,BD	12	2.7 to 5.5	40
μPD7810	ROMless μPD7811	external	256x8	44	NMOS	TS,BD	12	+5	64
μPD7811	8 Channel A/D/8-16 Bit Micro	4096x8	128x8	44	NMOS	TS,BD	12	+5	64

CMOS Microprocessors

Device	Description	Data Bits	Clock Freq. (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
μPD70008C	8 Bit Microprocessor	8	4	+5	30	.5	Plastic	40
μPD70008AC	8 Bit Microprocessor	8	6	+5	30	.4	Plastic	40
μPD70108D	16 Bit Microprocessor	8	5.8	+5	45	6	CERDIP	40
μPD70108C	16 Bit Microprocessor	8	5.8	+5	45	6	Plastic[1]	40
μPD70108G	16 Bit Microprocessor	8	5.8	+5	45	6	Flatpak[2]	52
μPD70116D	16 Bit Microprocessor	16	5.8	+5	45	6	CERDIP	40
μPD70116C	16 Bit Microprocessor	16	5.8	+5	45	6	Plastic[1]	40
μPD70116G	16 Bit Microprocessor	8	5.8	+5	45	6	Flatpak[2]	52

Notes: 1. 1H86
2. 2Q85

System Support Products

Device	Product	Size	Process	Output	Cycle (MHz)	Supply Voltage	Pins
μPD765A	Dbl Sided/Dbl Density	8-bit	NMOS	3-State	8	+5	40
μPB9201	Floppy Disk Interface	—	Bipolar	3-State	16	+5	40
μPD7201A	Multi-Protocol Serial Controller	8-bit	NMOS	3-State	4	+5	40
μPD7210	IEEE Controller (Talker, Listener, Controller)	8-bit	NMOS	3-State	8	+5	40
μPD7220A	Color Graphic Display Controller	8-bit	NMOS	3-State	8	+5	40
μPD7720	General Purpose Digital Signal Processor	16-bit	NMOS	3-State	8	+5	28
μPD77P20	EPROM Version of μPD7720	16-bit	NMOS	3-State	8	+5	28
μPD7281	Image Pipeline Processor	16-bit	NMOS	3-State	5 MIPS/chip	+5	40
μPD7261A	Hard Disk Controller	8-bit	NMOS	3-State	12	+5	40
μPD9306	Hard Disk Interface	—	CMOS	3-State	10	+5	28
μPD8155H	256x8 RAM with I/O Ports and Timer	8-bit	HMOS	3-State	—	+5	40
μPD8155-2	256x8 RAM with I/O Ports and Timer	8-bit	NMOS	3-State	—	+5	40
μPD8156H	256x8 RAM with I/O Ports and Timer	8-bit	HMOS	3-State	—	+5	40
μPD8156-2	256x8 RAM with I/O Ports and Timer	8-bit	NMOS	3-State	—	+5	40
μPB8212	I/O Port	8-bit	Bipolar	3-State	—	+5	24
μPB8216	Bus Driver Non-Inverting	4-bit	Bipolar	3-State	—	+5	16
μPB8226	Bus Driver Inverting	4-bit	Bipolar	3-State	—	+5	16
μPD8237A-5	Programmable DMA Controller	8-bit	NMOS	3-State	5	+5	40
μPD8243	I/O Expander	4x4 bits	NMOS	3-State	—	+5	24
μPD82C43	I/O Expander	4x4 bits	CMOS	3-State	—	+5	24
μPD8251A/AF	Programmable Communications Interface (Async/Sync)	8-bit	NMOS	3-State	—	+5	28
μPD8253-2/5	Programmable Timer	8-bit	NMOS	3-State	4	+5	24
μPD8255A-2/5	Peripheral Interface	8-bit	NMOS	3-State	—	+5	40
μPD8257-2/5	Programmable DMA Controller	8-bit	NMOS	3-State	4	+5	40
μPD8279-2/5	Programmable Keyboard/Display Interface	8-bit	NMOS	3-State	—	+5	40
μPB8282/8283	8-bit Latches	—	Bipolar	3-State	5	+5	20
μPB8284A	Clock Driver	—	Bipolar	3-State	5	+5	18

System Support Products (cont)

Device	Product	Size	Process	Output	Cycle (MHz)	Supply Voltage	Pins
μPB8286/8287	8-bit Bus Transceivers	—	Bipolar	3-State	5	+5	20
μPB8288	Bus Controller	—	Bipolar	3-State	5	+5	20
μPB8289	Bus Arbiter	—	Bipolar	3-State	5	+5	20
μPD8755A	2048x8 EPROM with I/O Ports	8-bit	NMOS	3-State	—	+5	40
μPD8259A/A-2	Programmable Interrupt Controller	8-bit	HMOS	3-State	5/8	+5	28
μPD71051	Programmable Communications Interface	8-bit	CMOS	3-State	8	+5	28
μPD71054	Programmable Interval Timer	8-bit	CMOS	3-State	8	+5	24
μPD71055	Programmable Peripheral Interface	8-bit	CMOS	3-State	8	+5	40
μPD71059	Programmable Interrupt Controller	8-bit	CMOS	3-State	8	+5	28
μPD71071	DMA Controller	16-bit	CMOS	3-State	8	+5	48
μPD71082	Octal Latch	8-bit	CMOS	3-State	8	+5	20
μPD71083	Octal Latch (Inverting)	8-bit	CMOS	3-State	8	+5	20
μPD71086	8-bit Bus Transceiver	8-bit	CMOS	3-State	8	+5	20
μPD71087	8-bit Transceiver (Inverting)	8-bit	CMOS	3-State	8	+5	20
μPD71088	CPU System Bus Controller	8-bit	CMOS	3-State	8	+5	20
μPD71011	Clock Generator/Driver for V-Series CPUs	—	CMOS	3-State	8	+5	18
μPD71084	Clock Generator/Driver for 80C88/80C86	—	CMOS	3-State	8	+5	18
μPD780-1	Microprocessor	8-bit	NMOS	3-State	4	+5	40
μPD780-2	Microprocessor	8-bit	NMOS	3-State	6	+5	40
μPD8085A	Microprocessor	8-bit	NMOS	3-State	3	+5	40
μPD8085A-2	Microprocessor	8-bit	NMOS	3-State	5	+5	40
μPD8085AH	Microprocessor	8-bit	NMOS	3-State	3	+5	40
μPD8085AH-2	Microprocessor	8-bit	NMOS	3-State	5	+5	40
μPD8086	Microprocessor	16-bit	NMOS	3-State	5	+5	40
μPD8086-2	Microprocessor	16-bit	NMOS	3-State	8	+5	40
μPD8088	Microprocessor	8-bit	NMOS	3-State	5	+5	40
Speech Products							
μPD7761	K 3 Chip Speech Recognition Chip Set	16-bit	NMOS	3-State	8	+5	28
μPD7762		8-bit	NMOS	3-State	4	+5	64
μMC-4760		—	Hybrid	3-State	2	+5,±12	24
μPD7730	ADPCM Speech Encoder/Decoder	8-bit	NMOS	3-State	8	+5	28

LINEAR PRODUCTS

Section 5 — Linear Products

Operational Amplifiers

Temperature Range: C Package (plastic molded DIP) 0°C to +70°C
G2 Package (plastic molded SO) 0°C to +70°C
D Package (ceramic cavity DIP) −20°C to +80°C

*Unless otherwise specified, $V^{\pm} = \pm 15$ V, $T_A = 25°C$

NEC No.	Package	Generic	V_{CC}[1] (+/−V) Rec.	I_{CC} (mA) Max.	V_{IO} (mV) Max.	I_{IO} (nA) Max.	I_B (nA) Max.	A_V (dB) Min.	E_N[2] (nV/√Hz) Typ.	f_{UNITY} (MHz) Typ.	Slew Rate (V/μs) Typ.
Single Operational Amplifiers											
μPC301A	C/8	LM301A	5-16	3	7.5	50	250	88	25	prog	prog
μPC318	C/8	LM318	5-16	10	10	200	500	88	15	10	70
μPC356	C/8	LF356	5-16	10	5	0.05	0.2	88	20	5	12
μPC357	C/8	LF357	5-16	10	5	0.05	0.2	88	20	20 ($A_V \geq 5$) (GBW at 10 kHz)	50 ($A_V \geq 5$)
μPC741	C/8 G2/8	μA741	7-16	2.8	6	200	500	88	25	0.6	0.5
μPC811[3]	C/8 G2/8	ORIG	5-16	3.5	2.5	0.05	0.2	88	20	4	15
μPC813[3]	C/8 G2/8	ORIG	5-16	3.5	2.5	0.05	0.2	88	20	8	25
μPC4061[3]	C/8 G2/8	TL061	2-16	0.25	10	0.05	0.1	69	30	1	3
μPC4071	C/8 G2/8	TL071	5-16	2.7	10	0.05	0.2	88	18	3	13
μPC4081	C/8 G2/8	TL081	5-16	2.8	15	0.1	0.4	88	25	3	13
μPC4250	C/8 G2/8	LM4250	1-16	prog	6	prog	prog	96	25	prog	prog

Notes: 1. Recommended supply voltage range.
2. Input equivalent noise density at 1 kHz ($R_S = 100\ \Omega$).
3. New product (Preliminary data).

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Operational Amplifiers (cont)

Temperature Range: C Package (plastic molded DIP) 0°C to +70°C
G2 Package (plastic molded SO) 0°C to +70°C
D Package (ceramic cavity DIP) −20°C to +80°C

* Unless otherwise specified, $V^{\pm} = \pm 15$ V, $T_A = 25°C$

NEC No.	Package	Generic	V_{CC}[1] (+/−V) Rec.	I_{CC} (mA) Max.	V_{IO} (mV) Max.	I_{IO} (nA) Max.	I_B (nA) Max.	A_V (dB) Min.	E_N[2] (nV/√Hz) Typ.	f_{UNITY} (MHz) Typ.	Slew Rate (V/μs) Typ.
					Dual Operational Amplifiers						
μPC358	C/8 G2/8	LM358	3-30 (Single Supply)	1.2	7.0	50	250	88	32	0.5	0.2
* Specified at $V^{\pm} = +5$ V.											
μPC812[3]	C/8	ORIG	5-16	6.8	3.0	0.05	0.2	88	20	4	15
μPC814[3]	C/8	ORIG	5-16	6.8	3.0	0.05	0.2	88	20	8	25
μPC1458	C/8 G2/8	MC1458	7-16	5.6	6	200	500	88	25	0.6	0.5
μPC4062[3]	C/8 G2/8	TL062	2-16	0.50	10	0.05	0.1	69	30	1	3
μPC4072	C/8 G2/8	TL072	5-16	5.0	10	0.05	0.2	88	18	3	13
μPC4082	C/8 G2/8	TL082	5-16	5.6	15	0.1	0.4	88	25	3	13
μPC4556	C/8 G2/8	ORIG	4-16	5.6	6.0	200	500	86	12	20 ($A_V \geq 10$) (GBW at 10 kHz)	5.0 ($A_V \geq 10$)
μPC4557	C/8	ORIG	4-16	5.6	6.0	200	500	86	12	2	1
μPC4558	C/8 G2/8	RC4558	4-16	5.6	6.0	200	500	86	12	2	1
μPC4559	C/8	RC4559	4-16	5.6	6.0	200	500	86	12	3	2
μPC4560	C/8 G2/8	ORIG	4-16	5.6	6.0	200	500	86	7	10 (GBW at 10 kHz)	2.8
μPC4570[3]	C/8 G2/8	ORIG	4-16	8.0	5.0	200	1000	90	4.5	15 (GBW at 10 kHz)	7

Notes: 1. Recommended supply voltage range.
2. Input equivalent noise density at 1 kHz ($R_S = 100\ \Omega$).
3. New product (Preliminary data).

Operational Amplifiers (cont)

Temperature Range: C Package (plastic molded DIP) 0°C to +70°C
G2 Package (plastic molded SO) 0°C to +70°C
D Package (ceramic cavity DIP) −20°C to +80°C

*Unless otherwise specified, $V^{\pm} = \pm 15$ V, $T_A = 25°C$

NEC No.	Package	Generic	V_{CC}[1] (+/−V) Rec.	I_{CC} (mA) Max.	V_{IO} (mV) Max.	I_{IO} (nA) Max.	I_B (nA) Max.	A_V (dB) Min.	E_N[2] (nV/√Hz) Typ.	f_{UNITY} (MHz) Typ.	Slew Rate (V/μs) Typ.
					Quad Operational Amplifiers						
μPC324	C/14 G2/14	LM324	3-30 (Single Supply)	2.0	7.0	50	250	88	32	0.5	0.25
*Specified at $V^{\pm} = +5$ V.											
μPC3403	C/14 G2/14	MC3403	3-32 (Single Supply)	7.0	7.0	50	250	88	32	1	0.6
*Specified at $V^{\pm} = +5$ V.											
μPC4064[3]	C/14 G2/14	TL064	2-16	1.0	10	0.05	0.1	69	30	1	3
μPC4074	C/14 G2/14	TL074	5-16	10.0	10	0.05	0.2	88	18	3	13
μPC4084	C/14	TL084	5-16	10.0	15	0.2	0.4	88	25	3	13
μPC4741	C/14 G2/14	HA4741	2-16	7.0	5.0	50	300	88	10	3	1.6

Notes: 1. Recommended supply voltage range.
2. Input equivalent noise density at 1 kHz ($R_S = 100\ \Omega$).
3. New product (preliminary data).

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Comparators

Temperature Range: C Package 0°C to +70°C
G2 Package (plastic molded SO) 0°C to +70°C
* Unless otherwise specified, $V^{\pm} = \pm 15$ V, $T_A = 25°C$

NEC No.	Package	Generic	V_{CC}[1] (+/−V)	I_{CC} Max. (mA)	V_{IO} Max. (mV)	I_{IO} Max. (nA)	I_B Max. (nA)	A_V Typ. (dB)	I_{SINK}[2] Typ. (mA)	Response Time[3] (ns)
μPC311 (Single)	C/8 G2/8	LM311	4-18 5-36 (Single Supply)	7.5	7.5	50	250	106	8.0	200
μPC319 (Dual)	C/14 G2/14	LM319	5-18 5-18 (Single Supply)	12.5	8.0	200	1000	92	3.2	80
μPC339 (Quad)	C/14 G2/14	LM339	2-32 (Single Supply)	2.0	5.0	50	250	106	4.0	1300
*Specified at $V^+ = +5$ V.										
μPC393 (Dual)	C/8 G2/8	LM393	2-32 (Single Supply)	1.0	5.0	50	250	106	4.0	1300
*Specified at $V^+ = +5$ V.										

Notes: 1. Recommended supply voltage range.
2. $V^+ = +5$ V, $V_{OL} = 0.4$ V.
3. 100 mV input step with 5 mV overdrive.

Voltage Regulators

Device	Original	Operating Temperature Range (°C)	V_{OUT} (V)	V_{IN} (V)		I_O Max. (A)	P_T Max. (W)	Package
				Min.	Max.			
μPC305C	305	0~+70	4.5~30	8.0	40	0.05	0.35	8 pin DIP
μPC78L05	78L05	−20~+150[1]	5[2]	7	30	0.1	0.8	
μPC78L08	78L08	−20~+150[1]	8[2]	10.5	30	0.1	0.8	
μPC78L12	78L12	−20~+150[1]	12[2]	14.5	35	0.1	0.8	
μPC78L15	78L15	−20~+150[1]	15[2]	17.5	35	0.1	0.8	
μPC78M05H	78M05	−20~+80	5[3]	7	35	0.5	20	
μPC78M08H	78M08	−20~+80	8[3]	10.5	35	0.5	20	TO-220AB
μPC78M10H	—	−20~+80	10[3]	12.5	35	0.5	20	TO-220AB
μPC78M12H	78M12	−20~+80	12[3]	14.5	35	0.5	20	TO-220AB
μPC78M15H	78M15	−20~+80	15[3]	17.5	35	0.5	20	TO-220AB
μPC78M18H	78M18	−20~+80	18[3]	21	35	0.5	20	TO-220AB
μPC78M24H	78M24	−20~+80	24[3]	27	40	0.5	20	TO-220AB
μPC7805H	7805	−20~+80	5[3]	7	35	1.0	20	TO-220AB
μPC7808H	7808	−20~+80	8[3]	10.5	35	1.0	20	TO-220AB
μPC7812H	7812	−20~+80	12[3]	14.5	35	1.0	20	TO-220AB
μPC7815H	7815	−20~+80	15[3]	17.5	35	1.0	20	TO-220AB
μPC7818H	7818	−20~+80	18[3]	21	35	1.0	20	TO-220AB
μPC7824H	7824	−20~+80	24[3]	27	40	1.0	20	TO-220AB
μPC7905H	7905	−20~+80	−5[3]	−7	−35	1.0	20	TO-220AB
μPC7908H	7908	−20~+80	−8[3]	−10.5	−35	1.0	20	TO-220AB
μPC7912H	7912	−20~+80	−12[3]	−14.5	−35	1.0	20	TO-220AB
μPC7915H	7915	−20~+80	−15[3]	−17.5	−35	1.0	20	TO-220AB
μPC7918H	7918	−20~+80	−18[3]	−21	−35	1.0	20	TO-220AB
μPC7924H	7924	−20~+80	−24[3]	−27	−40	1.0	20	TO-220AB

Notes: 1. Junction temperature.
2. Output voltage accuracy ±10%.
3. Output voltage accuracy ±5%.

Digital to Analog Converters

Part No.	Resolution	Non-Linearity	Conversion Speed	Supply Voltage	Features
μPC603	6 Bit	0.4%	3 μs	±15	Onboard V_{REF} — Output Buffer
μPC610	10 Bit	0.2%	6 μs	±15	Onboard V_{REF} — Output Buffer
μPC624	8 Bit	0.19%	150 ns	±5 ±15	Current Output
μPC648 μPC6012	12 Bit	0.05%	400 ns	+5-+15 −12/−15	Current Output
μPC7011 μPC7011C-1	8 Bit	0.4% 0.2%	3 μs	+5	Current Output

Analog to Digital Converters

Part No.	Resolution	Non-Linearity	Conversion Speed	Supply Voltage	Features
μPC646/ μPC647	4.5 Digit	0.002%	200 ms	±5 to ±15	BCD Dynamic Outputs
μPD650	12 Bit	0.05%	45 μs	+5 −15	Parallel Out
μPD7001	8 Bit	0.8%	140 μs	+5	Serial Output
μPD7002 μPD7002C-1	10 Bit	0.2% 0.1%	15 ms	+5	Three State Output
μPD7003	8 Bit	0.49%	4 μs	+5	Three State Output
μPD7004	10 Bit	0.15%	104 μs	+5	Serial/Parallel

Functional Blocks*

Device No.	Description
μPC398	Monolithic sample and hold circuit
μPC494	Switching regulator (SMPS) controller
μPC751	Quad read/write amp for hard disk media
μPC1555	Precision Timer (NE 555 direct cross)
μPC1060	2.5 V precision voltage reference, for use with D/A and A/D converters
μPC1042	Switching regulator (SMPS) controller

* Contact manufacturer for specifications.

Charge Coupled Devices [CCD Sensors]

Device No.	Description
μPD791D	4096 Bit Array
μPD795D	1024 Bit Array
μPD799D	2048 Bit Array

OPTOELECTRONIC DEVICES

Section 6 — Optoelectronic Devices

Infrared — Light Emitting Diodes

NEC Part Number	Maximum P_D (mW)	Maximum I_F (mW)	Typical V_F (mA)	Typical I_R (μA)	Typical I_V (mcd)	Wavelength (nm)
SE301A	150	100	1.2/50	0.01	6	940
SE302A	75	50	1.2/30	0.01	1.5	940
SE303A	150	100	1.25/50	0.01	6.5	940
SE306	100	50	1.1/10	10	0.5	940
SE307	150	100	1.45/50	N/A	15	940
SE308	100	50	1.14/20	10	0.85	940
SE1003	150	50	1.25/50	0.01	20	950

Notes: I_R tested at $V_R = 3$ V.
P_O tested at $I_F = 30$ mA.
Wavelength measured at $I_F = 30$ mA.
$T_A = 25°C$ for all data.

Red — Light Emitting Diodes

NEC Part Number	Maximum P_D (mW)	Maximum I_F (mW)	Typical V_F (mA)	Typical I_R (μA)	Typical I_V (mcd)	Wavelength (nm)
SR106D/C	80	40	1.6	0.01	1.5/2.5	660
SR503D/C/W	60	30	2.0	0.01	5/10/5	695
SR505D/C/W	60	30	2.0	0.01	3.5/6/3.5	695
SR506D/C	60	30	2.0	0.01	1/2	695
SR513D/C/W	60	30	2.0	0.01	5/10/5	695
SR531D	60	30	2.0	0.01	0.5	695
SR533D	60	30	2.0	0.01	0.5	695
SR535D	60	30	2.0	0.01	0.5	695
SR536D	60	30	2.0	0.01	0.5	695
SR537D	60	30	2.0	0.01	0.5	695
SR538D	60	30	2.0	0.01	0.5	695
SR539D	60	30	2.0	0.01	0.5	695
SR540D	60	30	2.0	0.01	0.7	695
SR603D/C/W	100	50	2.0	0.01	3/6/3	630
SR605D/C/W	80	40	2.0	0.01	5/10/5	630
SR613D/C/W	100	50	2.0	0.01	7/20/7	630
SR615D/C/W	100	50	2.0	0.01	8/16/8	630
SR632D	100	40	2.0	0.01	1.2	630
SR661D	100	40	2.0	0.01	1.0	630

Notes: V_F measured at $I_F = 10$ mA, except SR 106 $I_F = 20$ mA.
I_R measured at $V_R = 4.5$ V, except SR 106 $V_R = 3$ V.
I_V measured at $I_F = 10$ mA, except SR106 $I_F = 20$ mA.
Wavelength measured at $I_F = 10$ mA.

Green — Light Emitting Diodes

NEC Part Number	Maximum P_D (mW)	Maximum I_F (mW)	Typical V_F (mA)	Typical I_R (μA)	Typical I_V (mcd)	Wavelength (nm)
SG203DA/TA	100	40	2.0	0.01	8/13	565
SG205D/T	100	40	2.0	0.01	3/5	565
SG206D/T	100	40	2.0	0.01	1.5/3	565
SG213D/T	100	40	2.0	0.01	15/45	565
SG215D/T	100	40	2.0	0.01	10/20	565
SG231D	100	40	2.0	0.01	1.0	565
SG233D	100	40	2.0	0.01	1.0	565
SG235D	100	40	2.0	0.01	1.0	565
SG236D	100	40	2.0	0.01	1.0	565
SG237D	100	40	2.0	0.01	1.0	565
SG238D	100	40	2.0	0.01	1.0	565
SG239D	100	40	2.0	0.01	1.0	565
SG240D	100	40	2.0	0.01	1.5	565
SG261D	100	40	2.0	0.01	1.5	565

Notes: V_F measured at $I_F = 10$ mA.
I_R measured at $V_R = 4.5$ V.
I_V measured at $I_F = 10$ mA.
Wavelength measured at $I_F = 10$ mA.

Amber/Yellow — Light Emitting Diodes

NEC Part Number	Maximum P_D (mW)	Maximum I_F (mW)	Typical V_F (mA)	Typical I_R (μA)	Typical I_V (mcd)	Wavelength (nm)
SY403DA/TA	100	40	2.0	0.01	10/30	590
SY405D/T	100	40	2.2	0.01	2/4	590
SY406D/T	100	40	2.0	0.01	3/4	590
SY413D/T	100	40	2.0	0.01	10/30	590
SY415D/T	100	40	2.0	0.01	10/20	590
SY431D	100	40	2.0	0.01	1.0	590
SY432D	100	40	2.0	0.01	1.2	590
SY433D	100	40	2.0	0.01	1.0	590
SY435D	100	40	2.0	0.01	1.0	590
SY436D	100	40	2.0	0.01	1.0	590
SY437D	100	40	2.0	0.01	1.0	590
SY438D	100	40	2.0	0.01	1.0	590
SY439D	100	40	2.0	0.01	1.0	590
SY440D	100	40	2.0	0.01	1.5	590
SY461D	100	40	2.0	0.01	1.5	590

Notes: V_F measured at $I_F = 10$ mA.
I_R measured at $V_R = 4.5$ V.
I_V measured at $I_F = 10$ mA.
Wavelength measured at $I_F = 10$ mA.

Photo Couplers

NEC Part Number	Maximum I_F (mA)	Maximum I_C (mA)	Maximum V_{ISO} (VAC)	V_F/I_F (V/mA)	I_{CEO} (nA)	CTR/I_F (%/mA)	$V_{CE(sat)}$ (I_C = 2 mA)	BV_{CEO} (V)
4N25	80	100	2500*	1.4/10	50	20/20	0.3	30
MCT2	80	100	2000	1.4/10	50	20/20	0.3	30
PS2002B	50	50	2500*	1.9/5	400	100/5	1.2	40
PS2004B	50	200	2000	1.4/20	400	1300/5	1.2	30
PS2005B	150	50	2000	2.0/100	200	10/100	0.3 (4 mA)	30
PS2006B	25	8	3000*	1.7/16	N/A	15	N/A	—
PS2007B	10	50	3000*	1.7/10	TTL	600	TTL out	—
PS2010	80	100	2000	1.4/10	50	20/20	0.3	30
PS2021	80	100	4000	1.4/10	50	50/10	0.3	40
PS2022	80	100	4000	1.4/10	100	200/10	1.0	40
PS2031	80	100	2000	1.4/10	50	20/20	0.3	200
PS2401A	80	80	5000	1.4/10	100	80/5	0.3	40

Note: I_{CEO} measured at V_{CE} = 10 V and I_F = 0.
* Denotes DC volts; all others in AC volts.

Photo Couplers — SCR Type

NEC Part Number	Maximum V_{DRM} (V)	Maximum I_T (mA)	Maximum V_{ISO} (V_{RMS})	V_F/I_F (V/mA)	I_{DRM}* (μA)	V_{TM} (V)	I_{FT}* (mA)
PS3001	200	300	2000	1.4/20	100	1.3	12
PS3002	400	300	2000	1.4/20	100	1.3	12
PS3001(1)	200	300	2500	1.4/20	100	1.3	12
PS3002(1)	400	11	2500	1.4/20	100	1.3	12

Notes: I_{DRM} with R_{GK} = 27 kΩ and T_A = 100°C.
V_{TM} with I_T = 300 mA.
I_{FT} with V_D = 6 V and R_{GK} = 27 Ω.
* Maximum value.

Photo Transistors

NEC Part Number	Maximum P_C (mW)	Maximum I_C (mA)	Maximum V_{CEO} (V)	Maximum I_{CEO} (nA)	$V_{CE(sat)}$ (V)	I_L* (mA)
PH101	100	50	20	500	1.5	4
PH102	100	40	30	200	0.3	0.050
PH103	100	50	30	400	1.5	2
PH104	100	40	30	100	0.3	0.020
PH106	100	40	30	100	0.3	0.060
PH108	100	40	30	100	0.3 (I_C = 0.5 mA) (H = 5.0 mW/cm²)	0.3 (V_{CE} = 5 V) H = 0.5 mW/cm²)

Notes: I_{CEO} tested at V_{CE} = 10 V — L = 0.
$V_{CE(sat)}$ tested at L = 1000 lx.
I_L tested at V_{CE} = 2 V — L = 100 lx.
* Minimum value.

Photo Diodes

NEC Part Number	Maximum V_R (V)	Maximum P_C (mW)	I_F (mA)	Sensitivity (nA/lx)	I_D* (V)	t_R (ns)
PHS201A	5	N/A	1	90**	3.0	150 μs
PH302	32	150	N/A	50	30	50
PH302B	32	150	N/A	32	30	50
PH305	20	150	N/A	30	10	30
PH309	20	150	N/A	50	30	30

Notes: t_R tested at R_L = 1 kΩ.
I_D tested at V_R = 10 V, except PH201 V_R = 2.0 V.
Sensitivity in units of nA/lx, except PH201 L = 100 lx.
Wavelength of maximum sensitivity is 940 nm.
* Maximum value.
** Measured in nA.

Photo Interrupters

NEC Part Number	Maximum I_F (mA)	Maximum V_{CEO} (V)	Maximum I_C (mA)	V_F (V)	I_{CEO} (V)	$V_{CE(sat)}$ (mA)	CTR (%)
PS4001	50	30	50	1.1	400	1.2	20
PS4003	50	30	50	1.1	400	1.2	15
PS4005	50	30	50	1.1	400	1.2	20
PS4007	50	30	50	1.1	400	1.2	20
PS4008	50	30	40	1.1	100	0.3	0.5
PS4009	50	30	50	1.1	400	1.2	20
PS4010	50	30	50	1.1	400	1.2	20
PS4011	50	30	50	1.1	400	1.2	20
PS4014	50	30	40	1.1	100	0.3	0.5
PS6001	50	30	40	1.4	N/A	0.3	N/A

Notes: V_F tested at $I_F = 20$ mA, except PS6001A $I_F = 30$ mA.
I_{CEO} tested at $V_{CE} = 10$ V and $I_F = 0$.
$V_{CE(sat)}$ tested at $I_F = 10$ mA – I_C 0.5 mA.
CTR tested at $I_F = 10$ mA – $V_{CE} = 2$ V.
The PS6001 is a photo reflective sensor.

FIBER OPTIC COMPONENTS

Section 7 — Fiber Optic Components

Active Devices

Avalanche Photo Diodes and Avalanche Photo Diode Modules

Device	Description	Wavelength (nm)	Quantum Efficiency (%) (Typ.)	Rise Time/ Fall Time (ns) (Typ.)	Dark Current (nA) (Max.)
NDL1102	Silicon Avalanche Photo Diode	850	65	10.0/10.0	1.0
NDL1202	Silicon Avalanche Photo Diode	850	70	1.0/1.0	1.0
NDL1202P	Silicon Avalanche Photo Diode with Fiber Pigtail	850	70	1.0/1.0	1.0
NDL5100	Germanium Avalanche Photo Diode	1300	75	0.2/0.4	500
NDL5100P	Germanium Avalanche Photo Diode with Fiber Pigtail	1300	75	0.2/0.4	500
NDL5102	Germanium Avalanche Photo Diode	1300	75	0.3/0.3	200
NDL5102P	Germanium Avalanche Photo Diode with Fiber Pigtail	1300	75	0.5/0.5	200
OD8406	Silicon Avalanche Photo Diode Module	850	75	1.5/1.5	1.0
OD8409	Germanium Avalanche Photo Diode Module	1300	75	0.5/0.5	500
OD8412	Germanium Avalanche Photo Diode Module with Fiber Pigtail	850	75	1.5/1.5	1.0
OD8413	Germanium Avalanche Photo Diode Module with Fiber Pigtail	1300	75	0.5/0.5	500

PIN Photo Diode Modules

Device	Description	Wavelength (nm) (Max.)	Quantum Efficiency (%) (Typ.)	Rise Time/ Fall Time (ns) (Typ.)	Dark Current (nA) (Max.)
NDL2102	Silicon PIN Photo Diode	1100	70	1.0/1.0	1.0
NDL2102P	Silicon PIN Photo Diode with Fiber Pigtail	1000	70	1.0/1.0	1.0
NDL2104	Silicon PIN Photo Diode	1100	70	4.0/4.0	1.0
NDL2208	Silicon PIN Photo Diode	1100	85	10.0/10.0	1.0
NDL2208P	Silicon PIN Photo Diode with Fiber Pigtail	1000	85	10.0/10.0	1.0
NDL5200	Germanium PIN Photo Diode	1600	75	1.5/1.5	1.0 μA
OD8454D	Silicon PIN Module	950	65	1.5/1.5	1.0
OD8456	Silicon PIN Module — Plastic	1000	85	10.0/10.0	1.0
OD8457	Silicon PIN Module with Fiber Pigtail	950	65	1.5/1.5	1.0

Light Emitting Diodes and LED Modules

Device	Description	Wavelength (nm) (Typ.)	Optical Power Output (Typ.)	Rise Time/ Fall Time (ns) (Typ.)	Spectral Half Width (nm) (Max.)
NDL4103A	AlGaAS LED	850	2.0 mW	10.0/10.0	50
NDL4103P	AlGaAs LED with Fiber Pigtail	850	50 μW	10.0/10.0	50
NDL4105	AsGaAs LED	850	3.5 mW		50
NDL4105A	AlGaAs LED	850	3.5 mW		50
NDL4105B	AlGaAs LED	850	55 μW		50
NDL4105-78	AlGaAs LED	780	3.5 mW		50
NDL4105-88	AlGaAs LED	880	3.5 mW		50
NDL4201	AlGaAs LED	850	1.0 mW		50
NDL5300	InGaAsP LED	1300	0.6 mW	12.0/12.0	140
NDL5300P	InGaAsP LED with Fiber Pigtail	1300	30 μW	12.0/12.0	140
NDL5302	InGaAsP LED	1300	25 μW	3.0/4.0	150
NDL5302P	InGaAsP LED with Fiber Pigtail	1300	25 μW	3.0/4.0	150
NDL5303P	InGaAsP LED Module with Fiber Pigtail	1300	25 μW	2.0/3.0	150
OD8358D	InGaAsP LED Module	770-890	80 μW	15.0/15.0	50
OD8363D	InGaAsP LED Module	1300	25 μW	12.0/12.0	140
OD8364	AlGaAs LED Module — Plastic	865	30 μW	15.0/15.0	50
OD8365	AlGaAs LED Module with Fiber Pigtail	770-890	100 μW	15.0/15.0	50
OD8366	InGaAsP LED Module with Fiber Pigtail	1300	25 μW	12.0/12.0	140

Laser Diodes and Laser Diode Modules

Device	Description	Wavelength (nm) (Typ.)	Output Power (mW) (Typ.)	Threshold Current (mA) (Typ.)	Rise Time/ Fall Time (ns) (Max.)	Operating Temperature
NDL3006	AlGaAs Laser Diode	780	5.0	50	—	−10 to +70°C
NDL3007	AlGaAs Laser Diode	780	5.0	50	—	−10 to +70°C
NDL3008	AlGaAs Laser Diode	780	15.0 max	50	—	−10 to +70°C
NDL3009	AlGaAs Laser Diode	780	15.0 max	50	—	−10 to +70°C
NDL3108	AlGaAs Laser Diode	850	8.0	100	0.5/0.5	−40 to +70°C
NDL3108P	AlGaAs Laser Diode with Fiber Pigtail	850	2.5	100	0.5/0.5	−40 to +70°C
NDL3108P2	AlGaAs Laser Diode with Fiber Pigtail	850	3.5 max.	100	1.0/1.0	−20 to +60°C
NDL5000	InGaAsP Laser Diode	1300	5.0	70	0.5/0.5	−40 to +70°C
NDL5003	InGaAsP Laser Diode	1300	8.0	20	1.0/1.0	−40 to +70°C
NDL5003C	InGaAsP Laser Diode	1300	8.0	20	1.0/1.0	−40 to +70°C
NDL5004	InGaAsP Laser Diode	1300	5.0	20	1.0/1.0	−40 to +70°C
NDL5004P	InGaAsP Laser Module with Fiber Pigtail	1300	2.5	20	1.0/1.0	−20 to +65°C
NDL5005P	InGaAsP Laser Diode with Fiber Pigtail	1300	3.0	20	1.0/1.0	−20 to +65°C
NDL5006P	InGaAsP Laser Diode with Fiber Pigtail	1300	3.0	20	1.0/1.0	−20 to +65°C
NDL5007P	InGaAsP Laser Diode with Fiber Pigtail	1300	3.0	20	1.0/1.0	−20 to +65°C
NDL5008	InGaAsP Laser Diode	1200	7.0	25	1.0/1.0	−40 to +70°C
NDL5011P	InGaAsP Laser Diode with Fiber Pigtail	1200	2.5	25	1.0/1.0	−20 to +60°C
NDL5015P	InGaAsP Laser Diode with Single Mode Fiber Pigtail	1300	1.5	20	1.0/1.0	−20 to +65°C
NDL5017P	InGaAsP Laser Diode with Single Mode Fiber Pigtail	1300	1.5	20	1.0/1.0	−20 to +65°C
NDL5050	InGaAsP Laser Diode	1550	5.0	35	0.5/0.5	−40 to +70°C
OD8303D	AlGaAs LD Module	850	2.0	90	0.5/0.5	−10 to +60°C
OD8325	AlGaAs LD Module with Fiber Pigtail	*	1.0	20	0.5/0.5	−10 to +60°C
OD8326	InGaAs LD Module with Fiber Pigtail	*	1.5	20	0.5/0.5	−10 to +50°C
OD8328	InGaAsP LD Module with Single Mode Fiber Pigtail	1300	1.3	20	0.5/0.5	−10 to +50°C

*Contact manufacturer

Passive Devices

Optical Isolators

Device	Description	Center Wavelength (nm)	Isolation (dB) (Typ.)	Attenuation (dB) (Typ.)	Insertion Loss (dB) (Typ.)	Splitting Ratio
OD8312	Optical Isolator	850	>25		<1.5	
OD8313	Optical Isolator	1300	>20		<1.5	
OD8313C	Optical Isolator	1550	>20		<1.5	

Attenuators

Device	Description	Center Wavelength (nm)	Isolation (dB) (Typ.)	Attenuation (dB) (Typ.)	Insertion Loss (dB) (Typ.)	Splitting Ratio
OD8501	Step Optical Attenuator	850, 1300		3.0–50	3.0	
OD8511	Continuous Optical Attenuator, Multimode Fiber	850, 1300		0–65	<3.0	
OD8511DSB	Continuous Optical Attenuator, Single Mode Fiber	1300		0–60	<5.5	
OD8530	Optical Attenuator, Programmable	850, 1300, 1550		0–59	<2.0	
OD8550	Fixed Optical Attenuator	850, 1300		3.0–40	Included	
OD9701	Fixed Optical Attenuator	850, 1300		3.0–30	Included	
OD9704	SM Fixed Optical Attenuator	1300		5.0–20	Included	

Couplers

Device	Description	Center Wavelength (nm)	Isolation (dB) (Typ.)	Attenuation (dB) (Typ.)	Insertion Loss (dB) (Typ.)	Splitting Ratio
OD8601	Optical Directional Coupler 3-port	850, 1300	15 @ 1:1 20 @ 10:1 30 @ 100:1		<2	1:1 10:1 100:1
OD8602	Optical Directional Coupler 4-port	850, 1300	15 @ 1:1 20 @ 10:1 30 @ 100:1		<2	1:1 10:1 100:1
OD8605	Optical Directional Coupler with Fiber Pigtails, 3-port	850, 1300	>35		<1.5	1:1 10:1
ODS010	Optical Directional Coupler with Single Mode Fiber Pigtails, with SMF Secondary Port	1300	>30		<6	1:1
ODS011	Optical Directional Coupler with Single Mode Fiber Pigtails, with MMF Secondary Port	1300	>30		<6	1:1

Line Monitor/Band Pass Filter

Device	Description	Center Wavelength (nm)	Isolation (dB) (Typ.)	Attenuation (dB) (Typ.)	Insertion Loss (dB) (Typ.)	Splitting Ratio
OD8650	Line Monitor	850			<5	1:1 10:1 100:1
OD8670	Optical Band Pass Filter	*			<3.5	

Passive Devices (Cont.)

Wavelength Division Multiplexers/Demultiplexers

Device	Description	Center Wavelength (nm)	Isolation (dB) (Typ.)	Attenuation (dB) (Typ.)	Insertion Loss (dB) (Typ.)	Splitting Ratio
OD8674A	Wavelength Division Multiplexer with Fiber Pigtails	850/1300	>36*	—	<2.0 @ 1250 nm <2.0 @ 850 nm	
OD8674B	Wavelength Division Multiplexer with Fiber Pigtails	1200/1300	>30*		<2.0 @ 1300 nm <3.0 @ 1200 nm	
OD8674C	Wavelength Division Multiplexer with Fiber Pigtails	1200/1300	>30*		<2.0 @ 1200 nm <3.0 @ 1300 nm	
OD8677DFA	Wavelength Division Multiplexer	800/830/860/890	>50*		*	
OD8677DFB	Wavelength Division Multiplexer	800/830/860/890	>25*		*	

Switches

Device	Description	Center Wavelength (nm)	Repeatability (Typ.)	Rise/Fall Time (Typ.)	Insertion Loss (dB) (Typ.)
OD8752	1-2 Optical Switch	850, 1300	0.03	2	1.2
OD8754	1-2 Optical Switch	850, 1300	0.03	2	1.4
OD8756	1-2 Optical Switch with Fiber Pigtail	850, 1300	0.03	3	0.8
OD8764	2-2 Optical Switch	850, 1300	0.04	4	1.6
OD8767	2-2 Optical Switch with Fiber Pigtail	850, 1300	0.05	7	1.0

Acousto-Optic Modulators

Devices	Description	Wavelength (nm)	Active Aperture (mm)	Center Carrier Frequency (MHz)	Rise Time (Typ.)*	DC Contrast Ratio
OD8810	Acousto-Optic Modulator	633	2	80	<170 ns	>1000:1
OD8811	Acousto-Optic Modulator	633	1	80	<40 ns	>1000:1
OD8813	Acousto-Optic Modulator	633	1	140	<15 ns	>1000:1
OD8823	Acousto-Optic Modulator/Driver	633	2	80	<50 ns	>1000:1

*Contact Manufacturer

Connectors

Device*	Decription	Mode Single Mode - SM Mult-Mode - MM	Inner Diameter Range	Connecting Loss (dB)	Application	
					Field Assy	Factory Assy
0D9311	FC Ferrule	MM	0.123 to 0.129 mm		X	
0D9312	D3 Ferrule and Housing	SM	0.123 to 0.129 mm		X	
0D9313	D3 Ferrule and Housing	MM	0.123 to 0.129 mm		X	
0D9314	FC Ferrule	SM	0.123 to 0.129 mm		X	
0D9321	FC Ferrule Housing	MM			X	
0D9324	FC Ferrule Housing	SM			X	
0D9370	FC Fiber Pigtail or Patchcord	MM		<0.7		X
0D9371	FC Fiber Pigtail or Patchcord	SM		<0.7		X
0D9373	D3 Fiber Pigtail or Patchcord	MM		<0.7		X
0D9374	D3 Fiber Pigtail or Patchcord	SM		<1.0		X
0D9380	D3 or FC Through Adapter	MM				X
0D9384	D3 or FC Through Adapter	SM				X
0D9390	D3 or FC Receptacle	MM				X
0D9411	D4 Ferrule	MM	0.125 to 0.150 nom.	<0.7	X	
0D9414	D4 Ferrule	SM	0.123 to 0.129 mm	<1.0	X	
0D9416	Plastic Ferrule and Housing	MM	0.125, 0.140, 0.250	<1.5	X	
0D9418	Plastic Snap-on Terminal and Housing	MM	0.125, 0.140, 0.250	<1.0	X	
0D9420	D4 Ferrule Housing	MM			X	
0D9424	D4 Ferrule Housing	SM			X	
0D9470	D4 Fiber Pigtail or Patchcord	MM		<0.7		X
0D9474	D4 Fiber Pigtail or Patchcord	SM		<1.0		X
0D9476	Fiber Pigtail or Patchcord — Plastic Conn.	MM		<1.5	X	
0D9478	Fiber Pigtail or Patchcord — Plastic Snap-on Conn.	MM		<1.0	X	
0D9480	D4 Through Adapter	MM				X
0D9484	D4 Through Adapter	SM				X
0D9488	Through Adapter — Plastic Snap-on	MM				X
0D9490	D4 Receptacle	MM				X
0D9498	Receptacle — Plastic Snap-on	MM				X
0D9500	FOC Terminating Kit D4 Conn.	MM			X	
0D9610	Portable Polishing Equipment				X	X
0D9620	Resin Curing Instrument				X	X

* See product data sheets for ordering information. Complete P/N for cable assembly may include up to 6 extra digits for specifying pigtail or patchcord, length of fiber, size of fiber and source for fiber (NEC a customer). Complete P/N for separate connectors for field assembly may include extra digits for specifying inner diameter of ferrule to match customer's fiber size.

Data Links

Device	Description	Light Source	Bit Rate (NRZ)	Rise Time/ Fall Time (ns) (Typ.)	Operating Temperature
ODN1D(4)	Neolink	LED	DC–1 Mb/s	200/100	0 to +50°C
ODN1D	Neolink	LED	DC–10 Mb/s	40	0 to +50°C
ODN35D	Neolink	LED	DC–35 Mb/s	10	0 to +50°C
ODN3501	Neolink	LED	DC–35 Mb/s	10	0 to +70°C
ODN2011	Neolink	LED	50–200 Mb/s	2/3	+10 to +50°C

Gas Lasers

Device	Description	Wavelength (nm)	Output Power (mW) (Min.)	Polarization	Beam Diameter (at $1/e^2$ points) (Approx. mm)
GLT172	HeNe Plasma Tube Internal Mirrors	632.8	0.8	Random	0.66
GLT179	HeNe Plasma Tube Internal Mirrors	632.8	0.5	Random	0.52
GLT1650	HeNe Plasma Tube Internal Mirrors	632.8	1.0	Linear > 100:1	0.72
GLT2080	HeNe Plasma Tube Internal Mirrors	632.8	2.0	Linear > 100:1	0.75
GLT2120	HeNe Plasma Tube Internal Mirrors	632.8	2.0	Random	0.75
GLT2140	HeNe Plasma Tube Internal Mirrors	632.8	5.0	Linear > 100:1	0.83
GLT2150	HeNe Plasma Tube Internal Mirrors	632.8	5.0	Random	0.83
GLT2180	HeNe Plasma Tube Internal Mirrors	632.8	5.0	Random	2.00
GLG3020	Argon Laser	488	15	Linear > 50:1, Vert.	0.65
GLG3021	Argon Laser	488	5	Linear > 50:1, Vert.	0.65
GLG3025	Argon Laser	514.5	5	Linear > 50:1, Vert.	0.65
GLG5002	HeNe Laser with Integral PS	632.8	0.5	Random	0.65
GLG5012	HeNe Laser with Integral PS	632.8	1.0	Random	0.80
GLG5017	HeNe Laser with Integral PS	632.8	1.0	Random	0.70
GLG5022	HeNe Laser with Integral PS	632.8	2.0	Random	0.80
GLG5260	HeNe Laser Packaged Head	632.8	5	Random	0.80
GLG5360	HeNe Laser Packaged Head	632.8	5	Linear > 100:1	0.80
GLG5600	HeNe Laser	632.8	15	Horizontal	1.10
GLG5601	HeNe Laser	632.8	15	Vertical	1.10
GLG5610	HeNe Laser	1153	5	Horizontal	1.50
GLG5611	HeNe Laser	1153	5	Vertical	1.50
GLG5700	HeNe Laser	632.8	25	Horizontal	1.20
GLG5710	HeNe Laser	1153	7	Horizontal	1.60
GLG5730	HeNe Laser	632.8	25	Horizontal	1.20
GLG5732	HeNe Laser	1153	7.0	Horizontal	1.60
GLG5800	HeNe Laser	632.8	50	Horizontal	1.70
GLG5810	HeNe Laser	1153	15	Horizontal	2.30

Gas Laser Power Supplies

Device	Description	Input Voltage (V)	Input Current (mA)	Output Connector
GLS3020	Argon Ion Laser PS	95-110 VAC	18,000	Spl.
GLS3021	Argon Ion Laser PS	110-127 VAC	17,000	Spl.
GLS5230	OEM	10-14 VDC	1500	Leads
GLS5231	OEM	10-14 VDC	1700	BNC
GLS5240	OEM	90-120 VAC	150	Lead
GLS5241	OEM	90-120 VAC	150	BNC
GLS5251	OEM	10-12 VDC	3000	BNC
GLS5252	OEM	10-12 VDC	3000	Alden
GLS5261	OEM	90-120 VAC	500	BNC
GLS5262	OEM	90-120 VAC	500	Alden
GLS5270	OEM	10-14 VDC	3000	Leads
GLS5271	OEM	10-14 VDC	3000	Alden
GLS5290	OEM	90-132 VAC, 180-264 VAC	0.35, 0.175	Leads
GLS5292	OEM	90-132 VAC, 180-264 VAC	0.35, 0.175	Alden
GLS5360	Packaged	90-132 VAC	0.35	Alden
GLS5362	Packaged	180-264 VAC	0.175	Alden
GLS5730	Packaged	110-127 VAC	11.5	Alden

GATE ARRAY PRODUCTS

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Section 8 — Gate Array Products

CMOS

Device	Integration (Gate)	Delay Time: Gate (ns)	Delay Time: Output Buffer (ns)	Delay Time: Input Buffer (ns)	Number of Buffers: Output	Number of Buffers: Input	Power Dissipation
3-Micron							
μPD65003	400	3	12	5	36	38	30 μW/MHz/Gate 1.5 mW/OUtput
μPD65002	800	3	12	5	48	48	
μPD65010	1300	3	12	5	64	64	
μPD65020	2100	3	12	5	78	78	
2-Micron							
μPD65004	800	2	10	3	60	60	20 μW/MHz/Gate 1.5 mW/OUtput
μPD65011	1500	2	10	3	71	71	
μPD65021	2100	2	10	3	67	69	
μPD65030	3300	2	10	3	94	111	
μPD65040	4100	2	10	3	116	120	
μPD65060	6500	2	10	3	136	144	
μPD65080	8000	2	10	3	148	160	
μPD65100	11,000	2	10	3	168	188	

Notes: 1. Numbers of macros: 140
2. Ambient temperature: -40°C to +85°C (0°C to 70°C for TTL interface)
3. Power source: 5 V ± 10% single (5 V ± 5% for TTL interface)
4. Input/output interface: TTL/CMOS compatible
5. Technology: silicon gate CMOS 2 layer Al metallization

ECL

Device	Integration (Gate)	Delay Time: Gate (ns)	Delay Time: Output Buffer (ns)	Delay Time: Input Buffer (ns)	Number of Buffers: Output	Number of Buffers: Input	Power Dissipation/ Gate (mW)	Number of Macros
100K								
μPB6301	300	0.5	0.8	0.5	28	56	5.4	55
μPB6310	1200	0.7	1.0	0.6	48	88	1.9	70
μPB6320	2000	0.7	1.0	0.6	48	108	1.9	70
10KH								
μPB6311[3]	1200	1.0	1.7	1.0	48	88	1.1	70
μPB6321[3]	2000	1.0	1.7	1.0	48	108	1.1	70
μPB6330[3]	3000	1.0	1.7	1.0	80	180	1.1	70

Notes: 1. Ambient temperature: 0°C + 70°C
2. Power source: −4.5 V ± 0.5 V
3. Power source: −5.2 V ± 10%
4. Technology: advanced bipolar process

TTL

Device	Integration (Gate)	Delay Time (Gate) (ns)	Delay Time Output Buffer (ns)	Delay Time Input Buffer (ns)	Number of Buffers Output	Number of Buffers Input	Power Dissipation/ Gate (mW)	Number of Macros
TTL-2								
μPB6101	250	2.5	7.3	2.3	30	42	1.4	30
μPB6102	550	2.5	7.3	2.3	52	64	1.4	30
μPB6103	850	2.5	7.3	2.3	64	64	1.4	30
TTL-3								
μPB6111*	1000	2.0	7	2.0	52	68	1.0	140
μPB6120*	2000	2.0	7	2.0	68	80	1.0	140

Notes: 1. Ambient temperature: 0°C ± 85°C
2. Power source: 5V ± 10% single
3. Input/output interface: 74ALS
4. *Ambient temperature: 0°C ± 85°C
5. Technology: 74 ALS
6. *Technology: PSA

FLUORESCENT INDICATOR PANEL DISPLAYS

Section 9 — Fluorescent Indicator Panel Displays

Abbreviations Used In the FIPs Section

Type No.	Type number
No. of Digits	Number of digits
C.H.	Character height or pattern height
C.W.	Character width or pattern width
P.H.	Panel height
P.L.	Panel length
P.T.	Panel thickness
L.P.	Lead pitch
L.L.	Lead length
Fig. No.	Figure number (outline drawing)
Mode of Fil.	Mode of filament (AC or DC)
E_f	Filament voltage (AC: unit in V_{RMS}, DC: unit in V_{DC})
I_f	Filament current (AC: unit in mA_{RMS}, DC: unit in mA_{DC})
Mode of Ope.	Mode of operation (static driving or multiplex driving)
e_B, e_C	Peak anode voltage and peak grid voltage
E_B, E_C	DC anode voltage and DC grid voltage
Duty	Duty cycle or duty factor
E_k	Cathode bias voltage or cut-off bias voltage
i_b/dig.	Peak anode current per digit or per bar (in case of multiplex operation mode)
	DC anode current per digit or per bar (in case of static operation mode)
i_c/dig	Peak grid current per digit (in case of multiplex operation mode)
	DC grid current per panel (in case of static operation mode)
L	Brightness in cd/m² (SI unit)
	Bright value [cd/m²] shown in the table is the calculated value according to the equation. 1 [ft.L] = 3.43 [cd/m²]

The **FIP**s on this table are as of October 1984.
Please refer to an individual data sheet or catalog on detailed specifications.
Please contact your nearest NEC office before planning or use.

Data Terminal, Dot Type, Graphic Type

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP16X1EA	16	5x7	3.95	2.3	$26.0^{+0.8}_{-0.3}$	$82.0^{+0.8}_{-0.3}$	2.54	14.0	22
FIP16X1CA	16	5x7	5.05	3.3	$34.0^{+0.8}_{-0.3}$	$100.0^{+0.8}_{-0.3}$	2.54	14.0	28
FIP16X1BA/ FIP16B6X	16	5x7, DP	6.0	4.2	34.0±1.0	125.0±1.0	2.54	14.0	35
FIP16X1FA	16	5.7	9.1	6.28	$41.0^{+0.8}_{-0.5}$	170.0±1.0	2.54	14.0	35
FIP16XM1BA/ FIP16B11X	16	5x7, DP, COMMA	11.3	7.25	$41.0^{+0.8}_{-0.3}$	$208.0^{+0.8}_{-0.3}$	2.54	14.0	35
FIP16XM1CA/ FIP16C11X	16	5x7, DP, COMMA, CURSOR	11.3	7.25	43.2 MAX.	$208.0^{+0.8}_{-0.3}$	2.54	14.0	43
FIP16XM1DA/ FIP16D11X	16	5x7, DP, COMMA, CURSOR	11.3	7.25	43.2 MAX.	$208.0^{+0.8}_{-0.3}$	2.54	14.0	43
FIP16X1DA	16	5x12	11.7	4.7	42.0±1.0	138.0±1.0	2.54	14.0	35
FIP20X1LB	20	5x7	5.0	3.5	$20.5^{+0.7}_{-0.5}$	$115.7^{+0.8}_{-0.5}$	2.54	6.2	27
FIP20X1AA/ FIP20A5X	20	5x7, CURSOR	5.05	3.55	$34.0^{+1.0}_{-0.5}$	138.0±0.7	2.54	14.0	35
FIP20X1EA/ FIP20D9X	20	5x12	8.75	3.5	33.0±1.0	144.0±1.0	2.54	5.5	25
FIP20X1CA/ FIP20B9X	20	5x12	8.8	3.55	$41.0^{+0.8}_{-0.3}$	$138.0^{+0.6}_{-0.3}$	2.54	7.4	35
FIP20X1DB	20	5x7	9.0	6.3	41.0±0.5	$208.0^{+1.0}_{-0.5}$	2.54	14.0	35
FIP20X1KA	20	5x12	15.85	6.4	42.4±1.0	208.0±1.0	2.54	14.0	35
FIP24X1AA/ FIP24A7X	24	5x7	6.75	4.75	33.0±1.0	185.0±1.0	2.54	13.0	40
FIP26X1AA/ FIP26A9X	26	5x12	8.75	3.0	43.0±0.5	160.5±0.5	2.54	14.0	40
FIP16XM2AA/ FIP32A11X	32 16x2 line	5x7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	208.0±1.0	2.54	14.0	35
FIP32X1BA/ FIP32B5X	32	5x7, CURSOR	5.35	3.55	$34.0^{+1.5}_{-0.5}$	185.0±0.5	2.54	14.0	45
FIP32X1CA/ FIP32A9X	32	5x12	8.8	3.55	$41.0^{+0.8}_{-0.3}$	208.0±1.0	2.54	14.0	42
FIP18X2AA	36 18x2 line	5x7, DP, COMMA, 2 line	9.1	6.4	60.0±1.0	208.0±1.0	2.54	14.0	45
FIP20X2AA/ FIP40C5X	40 20x2 line	5x7, 2 line	5.05	3.55	$41.0^{+0.8}_{-0.3}$	$125.0^{+0.8}_{-0.3}$	2.54	14.0	50
FIP20X2CA	40 20x2 line	5x7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	252.0±1.0	2.54	16.0	35
FIP20X2BA	40 20x2 line	5x12, 2 line	15.85	6.4	68.0±1.0	208.0±1.0	2.54	14.0	45

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

Data Terminal, Dot Type, Graphic Type (cont)

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP40X1AA/ FIP40A5X	40	5x7, CURSOR	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	2.54	7.0	45
FIP40X1BA/ FIP40B5X	40	5x7, CURSOR	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	2.54	80.0	45
FIP40X1DA/ FIP40E5X	40	5x7	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	2.54	8.76	45
FIP40X1HA/ FIP40F5X	40	5x7, CURSOR	5.05	3.55	$34.0^{+0.8}_{-0.5}$	220.0±0.7	2.54	14.0	45
FIP40X1FB/ FIP40B9AX	40	5x12	8.8	3.55	$41.0^{+0.8}_{-0.3}$	$240.0^{+0.8}_{-0.3}$	2.54	14.0	45
FIP40X1GA/ FIP40C9X	40	5x12, CURSOR	8.8	3.55	$41.0^{+0.8}_{-0.3}$	$240.0^{+0.8}_{-0.3}$	2.54	9.5	43
FIP20X3AA/ FIP60A5X	60 20x3 line	5x7, 3 line	5.05	3.55	48.0±1.0	138.0±1.0	2.0	10.2	48
FIP32X2AA	64 32x2 line	5x7, CURSOR, 2 line	5.35	3.55	$50.0^{+0.8}_{-0.3}$	185.0±0.7	2.54	14.0	45
FIP40X2CB	80 40x2 line	5x7, CURSOR, 2 line	5.35	3.55	$50.0^{+0.8}_{-0.3}$	220.0±0.7	2.54	14.0	45
FIP40X2BA/ FIP80A9X	80 40x2 line	5x12, 2 line	9.35	3.55	60.0±1.0	238.0±1.0	2.54	14.0	45
FIP42X2AA	84 42x2 line	5x7, CURSOR, 2 line	5.35	3.55	67.0±1.0	228.75±1.0	2.54	14.0	45
FIP80X1AA/ FIP80A6X	80	5x12	6.29	1.8	$44.0^{+0.8}_{-0.3}$	$298.0^{+0.8}_{-0.3}$	2.54	7.0	55
FIP80X2AA/ FIP160A4X	160 80x2 line	5x7, CURSOR, 2 line	3.55	2.05	$44.0^{+0.8}_{-0.3}$	$298.0^{+0.8}_{-0.3}$	2.54	7.0	48
FIP40X6AA	240 40x6 line	5x7, CURSOR, 6 line	5.0	3.5	90.0 MAX.	250.0±1.0	2.0	20.0	50
FIP48GX7AA/ FIP48A8XT	—	48x7, GRAPHIC	7.9	57.1	34.0±1.0	93.0±1.0	2.54	7.4	35
FIP36GX20AA/ FIP20A30XT	—	36x20, GRAPHIC	29.5	53.5	57.0±1.0	91.0±1.0	1.27	10.0	38
FIP128GX20AA/ FIP36A10XT	—	128x20, GRAPHIC	29.7	191.7	60.0±1.0	138.0±1.0	2.54	14.0	60
FIP180GX48BA	—	180x48, GRAPHIC	29.54	111.38	60.0±1.0	156.0±1.0	1.27	20.0	52
FIP280GX60AA/ FIP240A4XT	—	280x60, GRAPHIC	38.75	181.75	70.0±1.0	265.0±1.0	1.27	20.0	$e_b = 100$ $e_c = 50$

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

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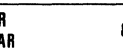
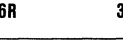
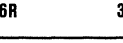
Data Terminal, Dot Type, Graphic Type (cont)

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP6A8R	6		8.15	4.4	28.0±1.0	78.0±1.0	2.54	20.0	26
FIP8A5R FIP8A5AR	8		5.0	3.0	$24.5^{+0.5}_{-0.3}$	65.5 MAX.	2.54	14.0 7.0	24
FIP8A6R	8		5.5	3.0	20.0±1.0	70.0±1.0	2.54	9.2	30
FIP9A5AR	9		5.0	3.0	$23.0^{+0.5}_{-0.3}$	71.5 MAX.	2.54	7.0	24
FIP10C5R	10		5.0	3.0	20.0±1.0	76.0±1.0	2.54	10.0	26
FIP10A6R	10		6.0	3.0	22.8±1.0	75.2±0.7	2.54	24.0	26
FIP12A11R	12		10.7	6.35	31.0±1.0	160.0±1.5	2.54	14.0	28
FIP16A5R FIP16A5CR	16		5.0	3.0	20.0±1.0	110.0±1.5	2.54	10.0	24
FIP16A11R	16		10.77	6.35	31.0±1.0	200.0±1.5	2.54	7.4	28
FIP16B13R	16		12.5	7.0	33.0±1.0	205.0±1.0	5.08	10.0	47
FIP18A14R	18		13.5	7.0	39.0±1.0	250.0±1.5	5.08	10.0	45
FIP20B6R	20		6.0	3.0	22.8±1.0	134.0±1.0	2.54	14.0	32
FIP20B9AR	20		9.0	5.0	33.0±1.0	205.0±1.0	2.54	14.0	35
FIP32A6R	32		6.0	3.0	30.0±1.0	202.0±1.5	2.54	14.0	38
FIP32B6R	32		6.0	3.5	$41.0^{+0.8}_{-0.3}$	$208.0^{+0.8}_{-0.3}$	2.54	14.0	45
FIP32D6R	32		6.0	3.2	$41.0^{+0.8}_{-0.3}$	$208.0^{+0.8}_{-0.3}$	2.54	14.0	45

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

Automotive

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP4C5	4	18:8.8	5.0	2.4	14.5±1.0	41.0±1.0	2.0	6.0	22
FIP4B6S	4	38:8.8	6.0	3.0	18.5±1.0	44.0±1.0	2.0	8.7	*12
FIP4E6S	4	88:88	6.0	3.0	18.5±10.0	44.0±1.0	2.0	8.7	*12
FIP4F6S	4	28:88	6.0	3.0	18.5±1.0	44.0±1.0	2.0	5.21	*10.5
LD8164/ FIP4A8S	4	88:88	7.6	4.0	24.5±1.0	55.4±1.0	2.54	8.7	*12
FIP4B8	4	88:88	7.6	4.0	24.5±1.0	55.4±1.0	2.54	10.5	24
FIP4B8AS	4	88:88	7.6	4.3	24.5±1.0	55.4±1.0	2.54	8.7	*18
FIP4E8S	4	18:88	7.6	4.0	20.0±1.0	48.0±1.0	2.54	8.7	*12
FIP4E8BS	4	18:88	7.6	4.0	20.0±1.0	48.0±1.0	2.54	8.2	*12
FIP4Y8S	4	18:88	7.6	4.0	20.0±1.0	48.0±1.0	2.54	8.7	*12
FIP4S8S	4	H8:88	7.6	4.0	24.5±1.0	55.4±1.0	2.54	8.2	*12
FIP4Q8S	4	18:88	8.0	4.4	20.0±1.0	48.0±1.0	2.54	8.2	*12
FIP4E13S	4	88:88	12.6	6.6	29.0 MAX.	79.0 MAX.	2.0	10.0	*12
FIP5C8S	5	AM PM 88:88.	7.6	3.6	24.5±1.0	55.4±1.0	2.54	8.7	*12
FIP6F6	6	AM FM 18:8.8 ME ST	6.0	2.7	17.0±1.0	62.5±1.0	2.54	8.0	21
FIP6F8	6	88:88.8.	7.6	4.0	22.8±1.0	75.2±1.0	2.54	10.5	24
FIP9B8Y	9	C ▼ ▼ ▼ H	7.6	28.2	24.5±1.0	55.4±1.0	2.54	12.5	*12
LD8180/ FIP14A8T	11	E ▼ ▼ ▼ F	7.6	28.4	24.5±1.0	55.4±1.0	2.54	12.5	*12

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

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Audio, Analog Instruments

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP2A13	2		12.5	6.6	$28.0^{+1.5}_{-0.5}$	50.0±1.0	2.54	10.0	24
FIP2A15S	2		15.0	8.0	33.0±1.0	55.0±1.0	2.54	10.0	*18
FIP4H5	4		5.0	2.5	14.5±1.0	41.0±1.0	2.54	8.0	22
FIP6A8B	6		7.62	3.8	22.8±1.0	75.2±1.0	2.54	10.0	24
FIP6A8S	6		8.0	4.8	28.0±1.0	78.0±1.0	2.0	7.5	*15
FIP6C8	6		8.0	4.8	28.0±1.0	78.0±1.0	2.54	4.7	26
FIP7A8S FIP7A8AS	7		8.0	4.8	28.0±1.0	78.0±1.0	2.0	7.5 3.5	*15
FIP7B8S FIP7B8AS	7		8.0	4.8	28.0±1.0	78.0±1.0	2.0	7.5 3.5	*15
FIP7D8 FIP7D8A FIP7D8F	7		8.0	4.6	28.0±1.0	78.0±1.0	2.54	7.5 2.7 3.2	26
FIP7E8S	7		8.0	4.5	24.5±1.0	85.0±1.0	2.0	7.7	*15
FIP7F8S	7		8.0	4.5	24.5±1.0	85.0±1.0	2.0	7.7	*15
FIP7G8 FIP7G8A FIP7G8D	7		8.0	4.6	28.0±1.0	78.0±1.0	2.54	7.5 3.2 3.2	24
FIP7A13 FIP7A13A	7		12.5	6.0	28.5±1.0	$102.0^{+1.0}_{-0.5}$	2.54	10.0 5.2	26
FIP7C13	7		12.5	6.0	28.0±1.0	102.0±1.0	2.54	10.2	25
FIP12AW7YS	12		7.0	71.05	20.0±1.0	98.0±1.0	2.54	7.5	*15
FIP24A15YS	24		15.0	71.7	33.0±1.0	98.0±1.0	2.54	7.0	*16
FIP24A17YS	24		17.0	73.7	33.0±1.0	98.0±1.0	2.54	7.0	*16
FIP24AW16YS	24		16.0	73.7	33.0±1.0	98.0±1.0	2.54	8.0	*16
FIP24BW16YS	24		16.0	73.7	33.0±1.0	98.0±1.0	2.54	8.0	*19
FIP60B30T	60		35.0	50.0	55.0±1.0	91.0±1.0	2.0	4.5	$e_b = 30$ $e_c = 15$
FIP60C30T	60		35.0	40.0	60.0±1.0	70.0±1.0	2.54	8.0	26
FIP101B8AY	101		7.6	127.5	24.5±1.0	158.8±1.5	5.08	12.5	24

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

Digital Clock, Timer, Measuring Meter

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP4A6	4	88:88	5.5	2.7	20.0±1.0	48.0±1.0	2.54	12.5	19
FIP4B8B	4	88:88	7.6	4.0	24.5±1.0	55.4±1.0	2.54	10.5	24
FIP4F8S	4	8.8:8.8	7.6	3.6	24.5±1.0	55.4±1.0	2.54	8.7	*12
FIP4B9	4	88:88	8.5	5.0	28.5±1.0	78.2±1.0	2.54	20.0	26
FIP4C9	4	88:88	8.5	5.0	28.0±1.0	78.0±1.0	2.54	16.0	24
FIP4C9B	4	88:88	8.5	5.0	28.5±1.0	78.2±1.0	2.54	20.0	24
LD8213/ FIP4A13S	4	88:88	12.6	6.6	29.0 MAX.	79.0 MAX.	2.0	10.0	*15
LD8241/ FIP4B13	4	88:88	12.6	6.6	28.0±1.0	78.0±1.0	2.54	10.0	30
FIP4C13A/ FIP4C13C	4	88:88	12.5	7.0	28.0±1.0	78.0±1.0	2.54	9.7 20.5	26
FIP4F13S	4	88:88	12.5	6.8	28.0±1.0	78.0±1.0	2.0	8.2	*15
FIP4A15A	4	88:88	15.0	8.4	33.0±1.0	98.0±1.0	2.54	6.2	30
FIP4B15S	4	88:88	15.0	8.4	33.0±1.0	98.0±1.0	2.54	10.5	*18
FIP4C15	4	88:88	15.0	8.4	33.0±1.0	98.0±1.0	2.54	10.5	25
FIP5A8B	5	88888	7.6	3.6	24.5±1.0	55.4±1.0	2.54	10.5	24
FIP5D8S	5	AM PM 18:88	7.6	3.6	24.5±1.0	55.4±1.0	2.54	8.7	*12
FIP5D8	5	▼8888	7.6	3.6	24.5±1.0	55.4±1.0	2.54	10.8	30
FIP5F8S	5	188:8.8	7.6	3.6	24.5±1.0	55.4±1.0	2.54	8.7	*12
FIP5B13S	5	AM PM 88:88	12.6	6.0	28.5±1.0	78.2±1.0	2.0	10.0	*24
FIP5D13A	5	AM PM 18:88	12.5	6.6	$28.0^{+1.5}_{-0.8}$	$78.0^{+1.2}_{-0.8}$	2.54	9.7	26
FIP5H13S	5	AM PM 8:88	12.5	6.8	28.0±1.0	78.0±1.0	2.0	8.2	*15
FIP5B15	5	88888	15.0	8.0	33.0±1.0	98.0±1.0	2.54	5.2	38
FIP5D15S	5	AM PM 18:88	15.0	8.4	33.0±1.0	98.0±1.0	2.54	10.5	*18
FIP5D15AS	5	AM PM 18:88	15.0	8.4	33.0±1.0	98.0±1.0	2.54	10.5	*18

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Digital Clock, Timer, Measuring Meter (cont)

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP5E15S	5		15.0	8.4	33.0±1.0	98.0±1.0	2.54	8.25	*18
FIP5H15	5		15.0	8.0	33.0±1.0	98.0±1.0	4.0	10.5	30
FIP5K15S	5		15.0	8.0	33.0±1.0	98.0±1.0	2.54	10.5	*18
FIP6F13	6		12.5	6.8	33.0±1.0	98.0±1.0	2.54	5.2	42
FIP6L13	6		12.5	6.8	33.0±1.0	98.0±1.0	2.54	10.0	26
FIP6C15/ FIP6C15A	6		15.0	8.0	33.0±1.0	110.0±1.0	4.0	10.5	30
FIP6D15A/ FIP6D15B	6		15.0	7.5	33.0±1.0	98.0±1.0	2.54	15.0 6.5	35
FIP7AM15	7		15.0	8.4	39.0±1.0	$108.0^{+2.0}_{-0.5}$	2.54	10.5	30
FIP7B25	7		25.4	12.0	48.0±1.0	164.0±1.0	4.0	10.5	34.5
FIP9D7	9		6.5	3.4	20.0±1.0	86.0±1.0	2.54	6.5	22

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

ECR

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP6C13	6		12.5	6.8	33.0±1.0	98.0±1.0	4.0	10.5	26
FIP6A13	6		13.0	6.5	39.0±1.0	$108.0^{+2.0}_{-0.5}$	2.54	10.0	35
FIP7B13	7		13.0	6.0	33.0±1.0	98.0±1.0	2.54	7.4	35
FIP8B11	8		10.5	5.0	33.0±1.0	98.0±1.0	2.54	5.2	45
LD8217/ FIP8A11	8		11.0	5.3	31.0±1.0	112.0±1.5	5.08	10.0	42
FIP9J5	9		5.0	2.4	20.0±1.0	65.8±1.0	2.54	10.0	32
FIP9K5A	9		5.0	2.4	21.0 MAX.	66.0 MAX.	2.54	14.0	24
FIP9B8 FIP9B8B	9		7.6	4.0	24.5±1.0	100.0±1.0	2.54	16.5 12.5	25
FIP9F8	9		7.6	4.0	26.0±1.0	$93.0^{+1.5}_{-0.5}$	2.54	35.0	25
FIP9C10	9		9.5	4.0	$38.0^{+0.8}_{-0.3}$	$100.0^{+0.8}_{-0.3}$	2.54	14.0	33
FIP9B10	9		10.0	4.8	31.0±1.0	112.0±1.5	2.54	11.0	30
LD8185/ FIP9A12/ FIP9A12A	9		12.4	5.2	31.0±1.0	127.0±1.5	5.08	10.5 3.7	45
FIP9A13A	9		12.5	6.8	33.0±1.0	135.0±1.0	4.0	10.0	45
FIP9C13	9		12.5	6.2	39.0±1.0	125.0±1.5	2.54	14.0	29
LD8221/ FIP10B13/ FIP10B13A	10		13.0	6.5	39.0±1.0	$160.0^{+2.0}_{-0.5}$	5.08	10.0 5.0	35
FIP10D13	10		13.0	6.5	40.0±0.7	160.0±0.7	2.54	14.0	35
FIP10A20	10		20.0	10.0	48.0±1.0	196.0±1.5	4.0	10.0	43
FIP11F10	11		9.6	4.2	24.5±1.0	113.0±1.0	2.54	16.0	25
FIP11A13	11		12.5	6.1	33.0±1.0	147.0±1.0	4.0	10.0	35
FIP11B13	11		13.0	6.0	36.0±1.0	147.0±1.0	2.54	7.4	35
FIP11A15	11		15.0	8.0	39.0±1.0	185.0±1.0	4.0	15.0	45
FIP12A13	12		13.0	6.0	$40.0^{+0.8}_{-0.3}$	$160.0^{+0.8}_{-0.3}$	2.54	14.0	28

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

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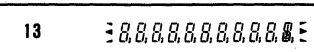
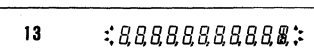
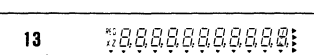
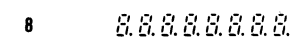
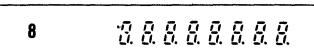
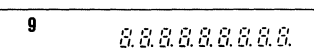
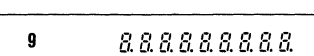
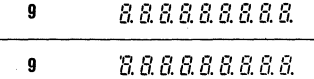
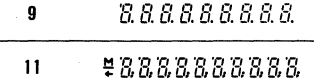
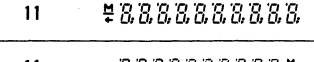
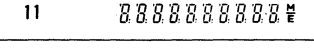
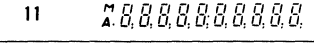
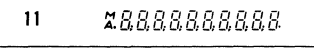
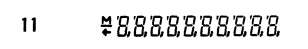
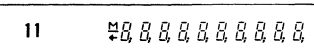
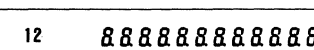
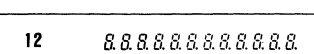
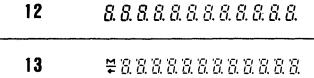
ECR (cont)

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP13D8	13		8.0	3.3	$25.5^{+1.5}_{-1.0}$	$112.0^{+1.5}_{-0.5}$	2.54	36.0	30
FIP13K10	13		9.5	4.3	39.0±1.0	$138.0^{+2.0}_{-0.5}$	2.54	36.0	30
FIP13B13	13		13.0	6.5	39.0±1.0	166.0±1.5	2.54	5.2	42

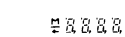
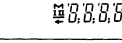
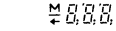
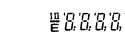
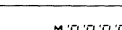
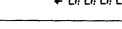
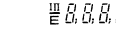
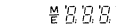
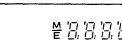
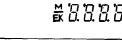
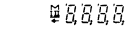
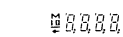
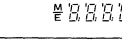
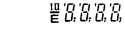
Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

Calculator

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
LD8225/ FIP8A5	8		4.5	2.3	17.0±1.0	58.0±1.0	2.54	6.2	22
LD8228/ FIP8B5	8		5.0	2.0	19.0±1.0	$55.3^{+0.8}_{-1.0}$	2.54	7.0	24
FIP9D5	9		4.5	2.3	17.0±1.0	62.5±1.0	2.54	6.2	22
LD8191/ FIP9A5	9		5.0	2.4	20.0±1.0	65.8±1.0	2.54	10.0	24
LD8231/ FIP9C5	9		5.0	2.4	21.0 MAX.	66.0 MAX.	2.54	15.0	24
FIP11A6A	11		5.5	2.45	22.8±1.0	75.2±0.7	2.54	25.0	24
FIP11D6A	11		6.01	2.4	20.0±1.0	76.0±1.0	2.54	16	20
FIP11F6	11		6.0	2.4	22.8±1.0	75.2±1.0	2.54	21.5	24
FIP11B8A	11		8.0	3.6	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	2.54	14.0	26
FIP11C8A/ FIP11C8B	11		8.0	3.6	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	2.54	14.0 36.0	26
FIP11B10A	11		9.5	4.0	39.0±1.0	$138.0^{+2.0}_{-0.5}$	2.54	14.0	30
LD8197A/ FIP12A4	12		4.2	2.08	17.0±1.0	70.0±1.0	2.54	5.8	24
FIP12A5A/ FIP12A5B	12		5.2	2.4	20.0±1.0	81.0±1.0	2.54	9.5 11.0	22
FIP13E5A	13		5.2	2.4	20.0±1.0	86.0±1.5	2.54	35.0	24
FIP13F5	13		5.3	2.4	$20.0^{+1.2}_{-0.5}$	$86.0^{+1.5}_{-0.5}$	2.54	34.0	24

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

Calculator (cont)

Device	No. of Digits	Character, Format, Symbol	Character Dimensions		Outline Dimensions				Recommended Electrical Ratings
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	L.P. (mm)	L.L. (mm)	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})
FIP13A7B	13		6.5	3..0	24.5±1.0	113.0±1.5	2.54	24.0	26
FIP13C7	13		7.0	2.8	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	2.54	36.0	26
FIP13F7	13		6.5	2.9	$25.0^{+0.5}_{-0.3}$	94.5 MAX.	2.54	34.0	18
FIP13B8	13		8.0	3.3	$25.5^{+1.5}_{-0.5}$	$112.0^{+1.5}_{-1.0}$	2.54	34.0	26
FIP13C8/ FIP13C8A	13		8.0	3.3	$25.5^{+1.5}_{-1.0}$	$112.0^{+1.5}_{-1.0}$	2.54	36.0 14.0	26
FIP13E8	13		8.0	3.3	$25.0^{+1.0}_{-0.3}$	$112.0^{+1.5}_{-0.5}$	2.54	34.0	26
FIP13G8	13		7.6	3.55	21.5±1.0	114.4±1.0	2.54	15.5	21.5
FIP13H8	13		7.6	3.55	24.5±1.0	114.4±1.0	2.54	15.5	21.5
LD8214/ FIP13A10	13		9.5	4.3	31.0±1.0	138.0±1.0	2.54	11.0	30
FIP13C10A/ FIP13C10B	13		9.5	4.2	31.0±1.0	138.0±1.0	2.54	24.0 6.2	30
FIP13D10A	13		9.5	4.0	39.0±1.0	$138.0^{+2.0}_{-0.5}$	2.54	36.0	26
FIP13D10B	13		9.5	4.0	39.0±1.0	$138.0^{+2.0}_{-0.5}$	2.54	36.0	26
FIP13H10	13		9.5	4.2	31.0±1.0	138.0±1.0	2.54	24.0	30
LD8232/ FIP14A5	14		5.2	2.4	20.0±1.0	$90.5^{+1.5}_{-1.0}$	2.54	10.0	24
FIP15B7	15		6.5	2.9	$25.0^{+1.0}_{-0.3}$	$112.0^{+1.5}_{-0.5}$	2.54	34.0	26
FIP17A5	17		4.5	1.9	20.0±1.0	92.0±1.0	2.54	16.0	22
LD8230/ FIP17A10	17		9.5	4.0	30.0±1.0	164.0±2.0	2.54	10.0	38

Note: These characteristics are given when the panels are turned on at the recommended electrical ratings and when e_b or e_c is also supplied from the center top of the filament transformer. (In case of E_f AC mode.)

9

DOT Type Fluorescent Indicator Modules

Device	No. of Digits	Character Dimensions		Outline Dimensions			Character Pitch	
		C.H. (mm)	C.W. (mm)	HT. (mm)	Width (mm)	Depth (max/min)	Row (mm)	Column (mm)
FM20X1AA-B 5x7 dot, cursor	20	5.05	3.55	80	180	20	—	5.2
FM20X1DB-A 5x7 dot	20	9.0	6.3	73	240	20	—	8.3
FM40X1AA-A[1] 5x7 dot, cursor	40	5.05	3.55	70	250	20	—	4.75
FM40X2AA-A 5x7 dot, cursor	80	5.35	3.55	64	264	43	11.94	4.75
FM40X6AA-A 5x7 dot, cursor	240	5.0	3.5	110	294	45	8.0	4.75
FM80X2AA-A 5x7 dot, cursor	160	3.5	2.05	66	388	43	5.25	3.2
FM180GX48AA-A[2]	—	—	—	90	200	45	—	—

Notes: 1. Power polarity is different from other modules.
2. Number of display dots (row × column) = 48 × 180 = 8640

DOT Type Fluorescent Indictor Modules (cont)

Dot Pitch		Dot Size		Temperature Range		Mating Coupler			Display Supply	
						Power		Signal		
Vert. (mm)	Horiz. (mm)	W (mm)	H (mm)	Operating (°C)	Storage (°C)	Housing	Pin		Current (Typ.)	Voltage (Typ.)
0.75	0.75	0.55	0.55	−5~60	−20~70	171822-2	170204-2	172083-4	0.6	5
1.35	1.35	—	—	−5~60	−20~70	171822-2	170204-2	172083-4	0.8	5
0.75	0.75	0.55	0.55	−5~60	−20~70	171822-2	170204-2	172083-4	1.0	5
0.8	0.75	0.55	0.55	−5~60	−20~70	171822-2	170204-2	172083-5	1.3	5
0.75	0.75	0.5	0.5	−5~60	−20~70	171822-2	170204-2	172083-5	2.5	5
0.55	0.45	0.25	0.25	−5~60	−20~70	171822-2	170204-2	172083-5	1.3	5
—	0.6	—	0.4	−5~60	−20~70	171822-2	170204-2	172083-4	1.2	5

CAPACITOR PRODUCTS

10

Section 10 — Capacitor Products

A-Series Subminiature Molded Axial Solid Tantalum Capacitors

Standard Ratings

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
50V Rating at 85°C, 33V Rating at 125°C				
*NAA104 [1] 50M	0.1	A	0.5	3
NAA124 [1] 50M	0.12	A	0.5	3
*NAA154 [1] 50M	0.15	A	0.5	3
NAA184 [1] 50M	0.18	A	0.5	3
*NAA224 [1] 50M	0.22	A	0.5	3
NAA274 [1] 50M	0.27	A	0.5	3
*NAB334 [1] 50M	0.33	B	0.5	3
NAB394 [1] 50M	0.39	B	0.5	3
*NAB474 [1] 50M	0.47	B	0.5	3
NAB564 [1] 50M	0.56	B	0.5	3
*NAB684 [1] 50M	0.68	B	0.5	3
NAB824 [1] 50M	0.82	B	0.5	3
*NAB105 [1] 50M	1	B	0.5	3
NAC125 [1] 50M	1.2	C	0.6	4
*NAC155 [1] 50M	1.5	C	0.7	4
NAC185 [1] 50M	1.8	C	0.9	4
*NAC225 [1] 50M	2.2	C	1.1	4
NAD275 [1] 50M	2.7	D	1.3	4
*NAD335 [1] 50M	3.3	D	1.6	4
NAD395 [1] 50M	3.9	D	1.9	4
*NAD475 [1] 50M	4.7	D	2.3	4
35V Rating at 85°C, 23V Rating at 125°C				
*NAA104 [1] 35M	0.1	A	0.5	3
NAA124 [1] 35M	0.12	A	0.5	3
*NAA154 [1] 35M	0.15	A	0.5	3
NAA184 [1] 35M	0.18	A	0.5	3
*NAA224 [1] 35M	0.22	A	0.5	3
NAA274 [1] 35M	0.27	A	0.5	3
*NAA334 [1] 35M	0.33	A	0.5	3
NAA394 [1] 35M	0.39	A	0.5	3
*NAA474 [1] 35M	0.47	A	0.5	3
NAB564 [1] 35M	0.56	B	0.5	3
*NAB684 [1] 35M	0.68	B	0.5	3
NAB824 [1] 35M	0.82	B	0.5	3
*NAB105 [1] 35M	1	B	0.5	3
NAB125 [1] 35M	1.2	B	0.5	4
*NAB155 [1] 35M	1.5	B	0.5	4
NAC185 [1] 35M	1.8	C	0.6	4
*NAC225 [1] 35M	2.2	C	0.6	4
NAC275 [1] 35M	2.7	C	0.9	4

Standard Ratings (cont)

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
35V Rating at 85°C, 23V Rating at 125°C (Cont.)				
*NAC335 [1] 35M	3.3	C	1.1	4
NAC395 [1] 35M	3.9	C	1.3	4
*NAC475 [1] 35M	4.7	C	1.6	4
NAD565 [1] 35M	5.6	D	1.9	4
*NAD685 [1] 35M	6.8	D	2.3	6
NAD825 [1] 35M	8.2	D	2.8	6
*NAD106 [1] 35M	10	D	3.5	6
25V Rating at 85°C, 17V Rating at 125°C				
NAA474 [1] 25M	0.47	A	0.5	3
NAA564 [1] 25M	0.56	A	0.5	3
NAA684 [1] 25M	0.68	A	0.5	3
NAA824 [1] 25M	0.82	A	0.5	3
*NAA105 [1] 25M	1	A	0.5	3
NAB125 [1] 25M	1.2	B	0.5	4
NAB155 [1] 25M	1.5	B	0.5	4
NAB185 [1] 25M	1.8	B	0.5	4
NAB225 [1] 25M	2.2	B	0.5	4
NAB275 [1] 25M	2.7	B	0.6	4
*NAB335 [1] 25M	3.3	B	0.8	4
NAC395 [1] 25M	3.9	C	0.9	4
NAC475 [1] 25M	4.7	C	1.1	4
NAC565 [1] 25M	5.6	C	1.4	4
*NAC685 [1] 25M	6.8	C	1.7	6
NAC825 [1] 25M	8.2	C	2.0	6
*NAC106 [1] 25M	10	C	2.5	6
NAD126 [1] 25M	12	D	3.0	6
*NAD156 [1] 25M	15	D	3.7	6
20V Ratings at 85°C, 13V Rating at 125°C				
NAA105 [1] 20M	1	A	0.5	3
NAA125 [1] 20M	1.2	A	0.5	3
*NAA155 [1] 20M	1.5	A	0.5	4
NAB185 [1] 20M	1.8	B	0.5	4
NAB225 [1] 20M	2.2	B	0.5	4
NAB275 [1] 20M	2.7	B	0.5	4
NAB335 [1] 20M	3.3	B	0.6	4
NAB395 [1] 20M	3.9	B	0.7	4
*NAB475 [1] 20M	4.7	B	0.9	4
NAC565 [1] 20M	5.6	C	1.1	4
NAC685 [1] 20M	6.8	C	1.3	6

Notes: 1. To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%, J = ±5%.
2. Part numbers with (*) are standard values, others are available upon request.

A-Series (cont)

Standard Ratings

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
NAC825 Ⓤ 20M	8.2	C	1.6	4
*NAC106 Ⓤ 20M	10	C	2.0	4
NAD126 Ⓤ 20M	12	D	2.0	4
*NAD156 Ⓤ 20M	15	D	3.0	4
NAD186 Ⓤ 20M	18	D	4.4	4
*NAD226 Ⓤ 20M	22	D	4.4	4
15V Rating at 85°C, 10V Rating at 125°C				
NAA155 Ⓤ 15M	1.5	A	0.5	4
NAA185 Ⓤ 15M	1.8	A	0.5	4
*NAA225 Ⓤ 15M	2.2	A	0.5	4
NAB275 Ⓤ 15M	2.7	B	0.5	4
NAB335 Ⓤ 15M	3.3	B	0.5	4
NAB395 Ⓤ 15M	3.9	B	0.5	4
NAB475 Ⓤ 15M	4.7	B	0.7	4
NAB565 Ⓤ 15M	5.6	B	0.8	4
*NAB685 Ⓤ 15M	6.8	B	1.0	6
NAC825 Ⓤ 15M	8.2	C	1.2	6
NAC106 Ⓤ 15M	10	C	1.5	6
NAC126 Ⓤ 15M	12	C	1.8	6
*NAC156 Ⓤ 15M	15	C	2.2	6
NAD186 Ⓤ 15M	18	D	2.7	6
NAD226 Ⓤ 15M	22	D	3.3	6
NAD276 Ⓤ 15M	27	D	4.0	6
*NAD336 Ⓤ 15M	33	D	4.9	6
10V Rating at 85°C, 7V Rating at 125°C				
NAA225 Ⓤ 10M	2.2	A	0.5	4
NAA275 Ⓤ 10M	2.7	A	0.5	4
*NAA335 Ⓤ 10M	3.3	A	0.5	4
NAB395 Ⓤ 10M	3.9	B	0.5	4
NAB475 Ⓤ 10M	4.7	B	0.5	4
NAB565 Ⓤ 10M	5.6	B	0.5	4
NAB685 Ⓤ 10M	6.8	B	0.6	6
NAB825 Ⓤ 10M	8.2	B	0.8	6
*NAB106 Ⓤ 10M	10	B	1.0	6
NAC126 Ⓤ 10M	12	C	1.2	6
NAC156 Ⓤ 10M	15	C	1.5	6
NAC186 Ⓤ 10M	18	C	1.8	6
*NAC226 Ⓤ 10M	22	C	2.2	6
NAC276 Ⓤ 10M	27	C	2.7	6
NAC336 Ⓤ 10M	33	C	3.3	6
NAD396 Ⓤ 10M	39	D	3.9	6
*NAD476 Ⓤ 10M	47	D	4.7	6

Standard Ratings (cont)

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
6V Rating at 85°C, 4V Rating at 125°C				
NAA335 Ⓤ 6M	3.3	A	0.5	4
NAA395 Ⓤ 6M	3.9	A	0.5	4
*NAA475 Ⓤ 6M	4.7	A	0.5	4
NAB565 Ⓤ 6M	5.6	B	0.5	4
NAB685 Ⓤ 6M	6.8	B	0.5	6
NAB825 Ⓤ 6M	8.2	B	0.5	6
NAB106 Ⓤ 6M	10	B	0.6	6
NAB126 Ⓤ 6M	12	B	0.7	6
*NAB156 Ⓤ 6M	15	B	0.9	6
NAC186 Ⓤ 6M	18	C	1.0	6
NAC226 Ⓤ 6M	22	C	1.3	6
NAC276 Ⓤ 6M	27	C	1.6	6
*NAC336 Ⓤ 6M	33	C	2.0	6
NAD396 Ⓤ 6M	39	D	2.3	6
NAD476 Ⓤ 6M	47	D	2.8	6
NAD566 Ⓤ 6M	56	D	3.3	6
*NAD686 Ⓤ 6M	68	D	4.0	6
4V Rating at 85°C, 2.7V Rating at 125°C				
NAA475 Ⓤ 4M	4.7	A	0.5	8
NAA565 Ⓤ 4M	5.6	A	0.5	8
*NAA685 Ⓤ 4M	6.8	A	0.5	8
NAB825 Ⓤ 4M	8.2	B	0.5	8
NAB106 Ⓤ 4M	10	B	0.5	8
NAB126 Ⓤ 4M	12	B	0.5	8
NAB156 Ⓤ 4M	15	B	0.6	8
NAB186 Ⓤ 4M	18	B	0.7	8
*NAB226 Ⓤ 4M	22	B	0.8	8
NAC276 Ⓤ 4M	27	C	1.0	8
NAC336 Ⓤ 4M	33	C	1.3	8
NAC396 Ⓤ 4M	39	C	1.5	8
*NAC476 Ⓤ 4M	47	C	1.8	8
NAD566 Ⓤ 4M	56	D	2.2	8
*NAD686 Ⓤ 4M	68	D	2.7	8

Notes: 1. To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%, J = ±5%.

2. Part numbers with (*) are standard values, others are available upon request.

C-Series Unencapsulated Chip Solid Tantalum Capacitors

Standard Ratings

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
35V Rating				
NCA104 [1] 35	0.1	A	1.0	4
NCA154 [1] 35	0.15	A	1.0	4
NCA224 [1] 35	0.22	A	1.0	4
NCA334 [1] 35	0.33	A	1.0	4
NCB474 [1] 35	0.47	B	1.0	4
NCB684 [1] 35	0.68	B	1.0	4
NCB105 [1] 35	1.0	B	1.0	4
NCC155 [1] 35	1.5	C	1.0	6
NCC225 [1] 35	2.2	C	1.5	6
NCC335 [1] 35	3.3	C	2.3	6
25V Rating				
NCA474 [1] 25	0.47	A	1.0	4
NCB155 [1] 25	1.5	B	1.0	6
NCC475 [1] 25	4.7	C	2.3	6
20V Rating				
NCA684 [1] 20	0.68	A	1.0	4
NCB225 [1] 20	2.2	B	1.0	6
NCC685 [1] 20	6.8	C	2.7	6
16V Rating				
NCA105 [1] 16	1.0	A	1.0	4
NCB335 [1] 16	3.3	B	1.1	6
NCC106 [1] 16	10	C	3.2	6
10V Rating				
NCA155 [1] 10	1.5	A	1.0	6
NCB475 [1] 10	4.7	B	1.0	6
NCC156 [1] 10	15	C	3.0	6
6.3V Rating				
NCA225 [1] 06	2.2	A	1.0	6
NCB685 [1] 06	6.8	B	1.0	6
NCC226 [1] 06	22	C	2.7	6

Note: 1. To complete part number insert capacitance tolerance symbol M = ±20% K = ±10%.

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D-Series Epoxy Dipped Radial Solid Tantalum Capacitors

Standard Ratings

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
50V Rating				
NDA104 [1] 50 [2]	0.1	A	0.5	4
NDA154 [1] 50 [2]	0.15	A	0.5	4
NDA224 [1] 50 [2]	0.22	A	0.5	4
NDB334 [1] 50 [2]	0.33	B	0.5	4
NDB474 [1] 50 [2]	0.47	B	0.5	4
NDC684 [1] 50 [2]	0.68	C	0.5	4
NDD105 [1] 50 [2]	1.0	D	0.5	4
NDE155 [1] 50 [2]	1.5	E	0.7	6
NDF225 [1] 50 [2]	2.2	F	1.1	6
NDG335 [1] 50 [2]	3.3	G	1.6	6
35V Rating				
NDA104 [1] 35 [2]	0.1	A	0.5	4
NDA154 [1] 35 [2]	0.15	A	0.5	4
NDA224 [1] 35 [2]	0.22	A	0.5	4
NDA334 [1] 35 [2]	0.33	A	0.5	4
NDA474 [1] 35 [2]	0.47	A	0.5	4
NDA684 [1] 35 [2]	0.68	A	0.5	4
NDA105 [1] 35 [2]	1.0	A	0.5	4
NDB155 [1] 35 [2]	1.5	B	0.5	6
NDC225 [1] 35 [2]	2.2	C	0.7	6
NDD335 [1] 35 [2]	3.3	D	1.1	6
NDE475 [1] 35 [2]	4.7	E	1.6	6
NDF685 [1] 35 [2]	6.8	F	2.3	6
NDG106 [1] 35 [2]	10	G	3.5	8
NDK156 [1] 35 [2]	15	K	5.0	8
NDL226 [1] 35 [2]	22	L	7.7	8
NDN336 [1] 35 [2]	33	N	10.0	8
NDP476 [1] 35 [2]	47	P	10.0	8

Notes: 1. In the dash (—), capacitance tolerance (M, K or J).
2. In the dash add lead type S, C, K, F, S/T for tape and reeling with negative lead coming off reel first and STP for positive lead coming off reel first. Use S/P for ammo pack.

Standard Ratings (cont)

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
25V Rating				
NDA105 [1] 25 [2]	1.0	A	0.5	4
NDA155 [1] 25 [2]	1.5	A	0.5	6
NDB225 [1] 25 [2]	2.2	B	0.5	6
NDC335 [1] 25 [2]	3.3	C	0.8	6
NDD475 [1] 25 [2]	4.7	D	1.1	6
NDE685 [1] 25 [2]	6.8	E	1.7	6
NDF106 [1] 25 [2]	10	F	2.5	8
NDJ156 [1] 25 [2]	15	J	3.7	8
NDK226 [1] 25 [2]	22	K	5.5	8
NDL336 [1] 25 [2]	33	L	8.2	8
NDN476 [1] 25 [2]	47	N	10.0	8
NDP686 [1] 25 [2]	68	P	10.0	8
20V Rating				
NDA155 [1] 20 [2]	1.5	A	0.5	6
NDB225 [1] 20 [2]	2.2	B	0.5	6
NDC335 [1] 20 [2]	3.3	C	0.6	6
NDD475 [1] 20 [2]	4.7	D	0.9	6
NDE685 [1] 20 [2]	6.8	E	1.3	6
NDF106 [1] 20 [2]	10	F	2.0	8
NDG156 [1] 20 [2]	15	G	3.0	8
NDH226 [1] 20 [2]	22	H	4.4	8
NDJ336 [1] 20 [2]	33	J	6.6	8
NDK476 [1] 20 [2]	47	K	9.4	8
NDL686 [1] 20 [2]	68	L	10.0	8
NDN107 [1] 20 [2]	100	N	10.0	10
16V Rating				
NDA225 [1] 16 [2]	2.2	A	0.5	6
NDB335 [1] 16 [2]	3.3	B	0.5	6
NDC475 [1] 16 [2]	4.7	C	0.7	6
NDD685 [1] 16 [2]	6.8	D	1.0	6
NDE106 [1] 16 [2]	10	E	1.6	8
NDF156 [1] 16 [2]	15	F	2.4	8
NDG226 [1] 16 [2]	22	G	3.5	8
NDH336 [1] 16 [2]	33	H	5.0	8
NDJ476 [1] 16 [2]	47	J	7.5	8
NDK686 [1] 16 [2]	68	K	10.0	8
NDL107 [1] 16 [2]	100	L	10.0	10
NDN157 [1] 16 [2]	150	N	10.0	10

D-Series

Standard Ratings (cont)

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
10V Rating				
NDA335 [1] 10 [2]	3.3	A	0.5	5
NDB475 [1] 10 [2]	4.7	B	0.5	6
NDC685 [1] 10 [2]	6.8	C	0.6	6
NDD106 [1] 10 [2]	10	D	1.0	8
NDE156 [1] 10 [2]	15	E	1.5	8
NDF226 [1] 10 [2]	22	F	2.2	8
NDG336 [1] 10 [2]	33	G	3.3	8
NDH476 [1] 10 [2]	47	H	4.7	8
NDJ686 [1] 10 [2]	68	J	6.8	8
NDK107 [1] 10 [2]	100	K	10.0	10
NDL157 [1] 10 [2]	150	L	10.0	10
NDM227 [1] 10 [2]	220	M	10.0	10
6.3V Rating				
NDA475 [1] 06 [2]	4.7	A	0.5	6
NDB685 [1] 06 [2]	6.8	B	0.5	6
NDC106 [1] 06 [2]	10	C	0.6	8
NDD156 [1] 06 [2]	15	D	0.9	8
NDE226 [1] 06 [2]	22	E	1.3	8
NDF336 [1] 06 [2]	33	F	2.0	8
NDG476 [1] 06 [2]	47	G	2.9	8
NDH686 [1] 06 [2]	68	H	4.2	8
NDJ107 [1] 06 [2]	100	J	6.3	10
NDK157 [1] 06 [2]	150	K	9.4	10
NDL227 [1] 06 [2]	220	L	10.0	10
NDM337 [1] 06 [2]	330	M	10.0	10
4V Rating				
NDA685 [1] 04 [2]	6.8	A	0.5	6
NDA106 [1] 04 [2]	10	A	0.5	8
NDB156 [1] 04 [2]	15	B	0.6	8
NDC226 [1] 04 [2]	22	C	0.8	8
NDD336 [1] 04 [2]	33	D	1.3	8
NDE476 [1] 04 [2]	47	E	1.8	8
NDF686 [1] 04 [2]	68	F	2.7	8
NDG107 [1] 04 [2]	100	G	4.0	10

Notes: 1. In the dash (—), capacitance tolerance (M, K or J).
2. In the dash add lead type S, C, K, F, S/T for tape and reeling with negative lead coming off reel first and STP for positive lead coming off reel first. Use S/P for ammo pack.

P-Series Miniature Epoxy Dipped Solid Tantalum Capacitors

Standard Ratings

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
35V Rating				
NPA103M35	0.01	A	0.5	4
NPA153M35	0.015	A	0.5	4
NPA223M35	0.022	A	0.5	4
NPA333M35	0.033	A	0.5	4
NPA473M35	0.047	A	0.5	4
NPA683M35	0.068	A	0.5	4
NPA104M35	0.10	A	0.5	4
NPA154M35	0.15	A	0.5	4
NPA224M35	0.22	A	0.5	4
NPB474M35	0.47	B	0.5	4
25V Rating				
NPA334M25	0.33	A	0.5	4
NPB684M25	0.68	B	0.5	4
16V Rating				
NPA684M16	0.68	A	0.5	4
NPB155M16	1.5	B	0.5	4
10V Rating				
NPA105M10	1.0	A	0.5	4
NPB225M10	2.2	B	0.5	6
6.3V Rating				
NPA155M06	1.5	A	0.5	6
NPB335M06	3.3	B	0.5	6
3V Rating				
NPA225M03	2.2	A	0.5	6
NPB475M03	4.7	B	0.5	6

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R-Series Miniature Encapsulated Chip Solid Tantalum Capacitors

Standard Ratings

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
35V Rating at 85°C, 23V Rating at 125°C				
NRA103 [M] 35	0.01	A	0.5	4
NRA153 [M] 35	0.015	A	0.5	4
NRA223 [M] 35	0.022	A	0.5	4
NRA333 [M] 35	0.033	A	0.5	4
NRA473 [M] 35	0.047	A	0.5	4
NRA683 [M] 35	0.068	A	0.5	4
NRA104 [M] 35	0.10	A	0.5	4
NRA154 [M] 35	0.15	A	0.5	4
NRA224 [M] 35	0.22	A	0.5	4
NRB334 [M] 35	0.33	A1, B	0.5	4
NRB474 [M] 35	0.47	B, B2	0.5	4
NRB684 [M] 35	0.68	B, B2	0.5	4
NRB105 [M] 35	1.0	B, B2	0.5	4
NRC155 [M] 35	1.5	C	0.5	4
NRC225 [M] 35	2.2	C	0.7	4
NRD335 [M] 35	3.3	D	1.2	4
NRD475 [M] 35	4.7	D	1.6	4
NRD685 [M] 35	6.8	D1	2.3	6
25V Rating at 85°C, 17V Rating at 125°C				
NRA334 [M] 25	0.33	A	0.5	4
NRA474 [M] 25	0.47	A1	0.5	4
NRB155 [M] 25	1.5	B, B2	0.5	4
NRC335 [M] 25	3.3	C	0.8	4
NRD685 [M] 25	6.8	D	1.7	6
NRD106 [M] 25	10.0	D1	2.5	6
20V Rating at 85°C, 13V Rating at 125°C				
NRA474 [M] 20	0.47	A	0.5	4
NRA684 [M] 20	0.68	A1	0.5	4
NRB225 [M] 20	2.2	B1, B2	0.5	4
NRC475 [M] 20	4.7	C1	0.9	4
NRD156 [M] 20	15.0	D1	3.0	6

Standard Ratings [cont]

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
16V Rating at 85°C, 10V Rating at 125°C				
NRA684 [M] 16	0.68	A	0.5	4
NRA105 [M] 16	1.0	A1	0.5	4
NRB225 [M] 16	2.2	B	0.5	4
NRB335 [M] 16	3.3	B1, B2	0.5	4
NRC475 [M] 16	4.7	C	0.7	4
NRC685 [M] 16	6.8	C1	1.0	6
NRD106 [M] 16	10.0	D	1.6	6
NRD226 [M] 16	22.0	D1	3.5	6
10V Rating at 85°C, 7V Rating at 125°C				
NRA105 [M] 10	1.0	A	0.5	4
NRA155 [M] 10	1.5	A1	0.5	4
NRB335 [M] 10	3.3	B	0.5	4
NRB475 [M] 10	4.7	B1, B2	0.5	4
NRC685 [M] 10	6.8	C	0.7	6
NRC106 [M] 10	10.0	C1	1.0	6
NRD156 [M] 10	15.0	D	1.5	6
NRD226 [M] 10	22.0	D	2.2	6
NRD336 [M] 10	33.0	D1	3.3	6
6V Rating at 85°C, 4V Rating at 125°C				
NRA155 [M] 06	1.5	A	0.5	4
NRA225 [M] 06	2.2	A1	0.5	4
NRB475 [M] 06	4.7	B	0.5	4
NRB685 [M] 06	6.8	B1, B2	0.5	6
NRC106 [M] 06	10.0	C	0.6	6
NRC156 [M] 06	15.0	C1	0.9	6
NRD336 [M] 06	33.0	D	2.0	6
NRD476 [M] 06	47.0	D1	3.0	6
4V Rating at 85°C, 2.5V Rating at 125°C				
NRA225 [M] 04	2.2	A	0.5	4
NRA335 [M] 04	3.3	A1	0.5	4
NRB685 [M] 04	6.8	B	0.5	6
NRB106 [M] 04	10.0	B1, B2	0.5	6
NRC156 [M] 04	15.0	C	0.6	6
NRC226 [M] 04	22.0	C1	0.6	6
NRD476 [M] 04	47.0	D	1.9	6
NRD686 [M] 04	68.0	D1	2.7	6

Note: 1. To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%.
When ordering parts available in other case size change part number accordingly, i.e. if ordering NRB474-35 in B2 case part number should be NRB2474-35.

U-Series Subminiature Metal Can, Epoxy End Seal, Axial

Standard Ratings

Part Number	Capacitance (μF)	Case	Maximum Leakage Current (μA)	Maximum Dissipation Factor (%)
		35V Rating		
*NUA103M35	0.010	A	0.05	3
*NUA153M35	0.015	A	0.05	3
*NUA223M35	0.022	A	0.05	3
*NUA333M35	0.033	A	0.05	3
*NUA473M35	0.047	A	0.05	3
NUA683M35	0.068	A	0.05	3
NUA104M35	0.10	A	0.05	3
NUB154M35	0.15	B	0.05	3
NUB224M35	0.22	B	0.05	3
NUB334M35	0.33	B	0.05	3
NUB474M35	0.47	B	0.08	3
NUC684M35	0.68	C	0.11	3
NUC105M35	1.0	C	0.17	3
NUC155M35	1.5	C	0.26	4
		25V Rating		
NUA154M25	0.15	A	0.05	3
NUB684M25	0.68	B	0.08	3
NUC225M25	2.2	C	0.27	4
		15V Rating		
NUA224M15	0.22	A	0.05	3
NUB105M15	1.0	B	0.07	3
NUC335M15	3.3	C	0.24	4
		10V Rating		
NUA334M10	0.33	A	0.05	3
NUB155M10	1.5	B	0.07	4
NUC475M10	4.7	C	0.23	4
		6V Rating		
NUA474M06	0.47	A	0.05	3
NUB225M06	2.2	B	0.02	4
NUC685M06	6.8	C	0.06	6
		3V Rating		
NUA684M03	0.68	A	0.05	3
NUB335M03	3.3	B	0.05	4
NUC106M03	10	C	0.15	6

FA-Series Supercap™ Electric Double Layer Capacitor

Specifications

Part Number	Capacitance (Farads)	Rated V (VDC)	Max WV (VDC)	Max ESR (Ω at 1 kHz)
FA0H473Z	0.047	5	5.5	20
FA0H104Z	0.1	5	5.5	8
FA0H224Z	0.22	5	5.5	5
FA0H474Z	0.47	5	5.5	3.5
FA0H105Z	1.0	5	5.5	2.5
FA1A223Z	0.022	10	11	20
FA1A104Z	0.1	10	11	8
FA1A224Z	0.22	10	11	6
FA1A474Z	0.47	10	11	4

FS-Series Supercap™ Electric Double Layer Capacitor

Specifications

Part Number	Capacitance (Farads)	Rated V (VDC)	Max WV (VDC)	Max ESR (Ω at 1 kHz)
FS0H473Z	0.047	5	5.5	40
FS0H104Z	0.1	5	5.5	25
FS0H224Z	0.22	5	5.5	25
FS0H474Z	0.47	5	5.5	13
FS0H105Z	1	5	5.5	7

FZ-Series Supercap™ Electric Double Layer Capacitor

Specifications

Part Number	Capacitance (Farads)	Rated V (VDC)	Max WV (VDC)	Max ESR (Ω at 1 kHz)
FZ0H223Z	0.022	5	5.5	50
FZ0H473Z	0.047	5	5.5	40
FZ0H104Z	0.1	5	5.5	45
FZ0H224Z	0.22	5	5.5	25
FZ0H474Z	0.47	5	5.5	13
FZ0H105Z	1.0	5	5.5	7

NEC

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