NEC

NEC Electronics Inc.

Product Selection Guide

1988

NEC

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PRODUCT SELECTION GUIDE

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NEC

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GENERAL INFORMATION 1

Section 1 — General Information **Page**

Introduction

NEC, the world's largest semiconductor supplier, offers one of the most diversified product lines in the industry. This Selection Guide provides a major listing of all the following NEC products. Contact your local NEC sales representative or use the toll free literature line, listed on the back cover of this book, for additional product information.

Memory Products

NEC's total memory line is the broadest in the industry. NEC memories give you a wider selection of device types and various configurations and process technologies within a specific type of device. The variety of NEC memories offers greater design alternatives and the choice of a part that truly fits your product. Product listings are given for each of NEC's major memory groups: Application-Specific Devices (ASDs), RAM Modules, DRAMs, XRAMs, MOS SRAMs, EPROMs, EEPROMs, and Masked ROM. New products in development include application-specific devices for video, data processing, and other specialized requirements. Dynamic RAM modules based on 1 Mb DRAMs are being introduced in 1987. Higher-density products will be available for DRAMs, XRAMs, MOS Static RAMs, and all other product areas.

Single-Chip Microcomputer Products [4-bit, 8-bit, or 16-bit]

NEC offers a wide variety of single-chip microcomputer products that range from 4-bit, 8-bit, or 16-bit microcomputers, plus LCD peripheral products, in both NMOS and CMOS technology and in a variety of packages.

The μPD7500 series of 4-bit, single-chip CMOS microcomputers is a broad line of devices designed for a variety of applications including electronic games, home electronic devices and automotive applications. The 75000 series and the cost-effective, low-end 755x/756x series known as mini-microcomputers complete this product line. The 8-bit products include the popular 80xx/87xx and 80Cxx series together with the high end 7800 and 78000 series. The μPD70320/70322 (V25™) are high performance, 16-bit, single-chip microcomputers with an 8-bit external data bus. Peripherals include LCD controller-driver products for alphanumeric, dot-addressable, and large-area LCD displays.

A comprehensive line of development hardware and software tools support NEC's single-chip microcomputer families. This extraordinary selection provides greater design alternatives that truly fit your needs in data processing, communication, instrumentation, automotive, and consumer applications.

Microprocessor Products

NEC is a leading supplier of high quality, multifunctional peripherals and processors. These are divided into six groups: 1. standard NMOS and CMOS 8-bit and 1-bit processors/peripherals; e.g., μPD8088, μPD70108 (V20®), 82XX and 710XX; 2. communications controllers; e.g., μPD7201A, μPD72001; 3. graphics controllers; e.g., μPD7220A, advanced graphics display controller (μPD72120); 4. magnetic media controllers; e.g., floppy disk controllers μPD9765A, μPD72065 (CMOS 765A) and hard disk controllers (ESDI, ST506, SMD, ESMD); 5. digital signal processors (μPD7720A, μPD77C20A, μPD77230); and 6. speech controllers (775X — speech generation, 776X speech recognition). All NEC microprocessor products provide users with cost effective system solutions in silicon.

The V-Series is a family of CMOS microprocessors designed for high performance and low-power consumption. The μPD78108/78116 (V20/V30®) provide immediate performance gain over the 8086/88. The μPD70208/78216 (V40™/V50™) combine CPU and many peripheral devices into a single device which results in great savings for a total system. The μPD70616/70632 (V60™/V70™) are designed with the new 32-bit architecture and memory management aimed at more sophisticated applications.

ASIC Products

NEC is committed to becoming the leading supplier of Application Specific Integrated Circuits (ASICs). Our semiconductor technology is second to none, and we offer gate array products in 1.5 micron CMOS, exciting BiCMOS, and high performance ECL. NEC's packaging technology is leading the way in the ASIC industry with advanced packages like 160-pin flat, 84-pin PLCC, 280-pin pin grid arrays, and Tape Automated Bonding (TAB). NEC will soon lead the technology again with 1.2 micron CMOS and 45,000 gate densities. ASIC

product technology, coupled with state of the art design tools and CAD systems, will give your products a leading edge.

Capacitors

NEC is an innovator in the capacitor market, offering high volume, high quality products. NEC's tantalum R Series molded chip capacitors, dipped radial and molded axial capacitors offer advanced technological design and excellent performance characteristics for filtering, bypassing, coupling, decoupling, blocking, filtering and RC timing circuits. These capacitors are used exclusively in industrial, commercial, entertainment, and medical electronic equipment. NEC's super capacitors (Supercaps™) are used for applications requiring battery back-up for CMOS SRAMs and microprocessors. NEC's new product line, multilayer ceramic capacitors, offers a high capacitance, resin dipped, multilayer capacitor for high-frequency switching power supplies.

Fluorescent Indicator Panel Displays [FIPs]

NEC offers vacuum fluorescent indicator panel (FIP®) 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.

NEC's FIP module line has recently been expanded to include the new Chip-in-Glass which offers low power, compact, and inexpensive display modules. A full character set, power supply, electronics to drive the FIP, and an on-board microprocessor are features of these modules. The mounting of the driver chips inside the glass envelope and the use of surface mount technology make the NEC Chip-in-Glass modules one of the most compact and inexpensive vacuum fluorescent display modules available.

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 interrupters in standard and unique sizes, and a wide variety of photo couplers, photo transistors, and photo diodes. All NEC optoelectronic components have superior efficiency, stability and operating characteristics.

Industrial Linear Products

NEC has an extensive line of linear products to meet virtually any need. This includes hard to find pin and performance compatible surface mount opamps, which eliminate design and hardware changes when changing from feed through to surface mount technology. NEC also offers 9-pin SIP packages for higher packing density dual opamp requirements.

In addition to our standard linear items (opamps, comparators, timers and regulators), our bipolar and CMOS D/A converters have conversion speeds of up to 50 MHz, and A/D converters with input multiplexing, full microprocessor control, serial or parallel output or both. NEC has new 6-bit and 8-bit flash converters ideal for video conversion or any high-speed signal processing.

NEC is a leader in cost effective high performance CCD products. Our advanced product line includes Charge Coupled Devices (CCDs), both linear and array image sensors, used in fax, optical character reader (OCR), document scanning and video cameras.

Power MOSFETs [Discrete Products]

NEC's newest product line, Power MOSFETs, includes N-channel devices from 30 V to 900 V, P-channel devices through −100 V, N- and P-channel arrays (four devices per single-in-line package) through ±100 V, 1.5 amp N- and P-channel surface mount packages (MP-3), isolated power plastic packages with ratings up to 40 amps, and a family of devices of 4 V gate drives with breakdown voltages of up to 100 V.

Computer simulation and the most advanced processing technologies have enabled NEC to produce a family of Power MOSFETs with 4 V gate drives. These devices can be driven using an IC with an operating voltage of 5 V, which results in a simplified, small sized, lower cost drive circuit.

Other discrete products available from NEC include bipolar transistor arrays, isolated power plastic bipolars, UHF and VHF tuner diodes.

Consumer ICs

NEC offers a complete line of consumer ICs geared to the entertainment market which include: digital tuning systems (DTS); prescalers; phase-locked loops (PLLs); audio, radio, TV, CATV, VCR, compact disk, watch and clock ICs; infrared (IR) remote control circuits; display drivers; and monolithic and hybrid broadband amplifiers.

The μPD1700 series (DTS) is a family of single-chip 4-bit CMOS microprocessors with built-in PLLs. PLLs employing a pulse swallowing method in frequency dividing allows higher frequency operation. The μPD1700 series is suitable for audio, video, automotive, and portable radio applications.

The infrared remote control family includes a wide variety of receivers, receiver pre-amplifiers and transmitters. NEC's GaAs LEDs and PIN photo diode families complete the remote control circuit requirements.

NEC's CMOS display driver family includes clock, latch, and driver circuits for LCD, FIP (vacuum fluorescence), plasma and electroluminescent displays.

Telecom and Datacom Fiber Optics

NEC offers all the high reliability fiber optic components (emitters, detectors and passive components) needed to build long-haul and loop telecommunications and local area network data communications equipment.

NEC's commitment to advanced fiber optic technology and high volume manufacturing techniques provides a complete framework for your fiber optic needs.

Office Automation Beam Lasers

NEC is a leading manufacturer of Helium-Neon and Argon Ion gas lasers, including types ranging from 0.5 mW to 50 mW output power. A line of high reliability power supplies completes the offering.

In development are beam laser diodes covering a range of wavelengths from 830 to the visible.

Telecommunication ICs

NEC offers a line of custom and commodity CMOS telecom ICs for telephone sets, terminals, pagers, mobile telephones, telephone exchanges, switching and data communications along with fiber optic components.

QUALITY AND RELIABILITY

Section 2 — Quality and Reliability **Page**

Introduction

As large-scale integration 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 the demanding requirements for higher reliability. At these new, higher levels of LSI density, it is increasingly difficult to activate all the elements in the internal circuits. A different philosophy and methodology is needed for reliability assurance. Moreover, as integration density increases, the degradation of internal elements in an LSI device is seldom detected by measuring characteristics across external terminals.

In order to improve and guarantee a certain level of reliability for large-scale integrated circuits, it is essential to build quality and reliability into the product. Then, the conventional reliability tests are followed to ensure that the product demonstrates an acceptable level of reliability.

NEC has introduced the concept of total quality control (TQC) across its entire semiconductor product line. By adopting TQC, NEC can build quality into the product and thus assure higher reliability. The concept and methodology of total quality control are company-wide activities involving workers, engineers, quality control staffs, and all levels of management.

NEC has also introduced a prescreening method into the production line that helps eliminate potentially defective units. The combination of building quality in and screening projected early failures out has resulted in superior quality and excellent reliability.

Technology Description

Most large-scale integrated circuits utilize high-density, MOS technology. State-of-the-art high performance has been achieved by introducing fine-line generation techniques. By reducing physical parameters, circuit density and performance increase while active circuit power dissipation decreases. The data presented here shows that this advanced technology yields products as reliable as those from previous technologies.

Reliability Testing

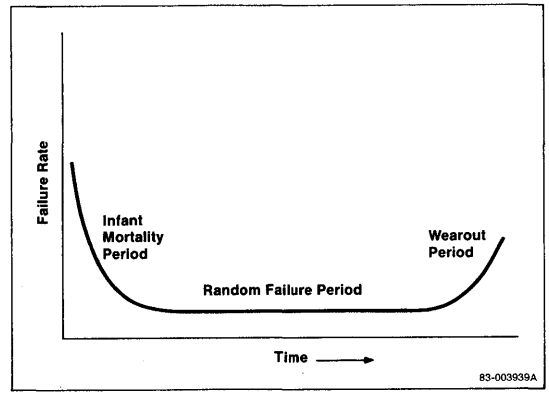
Reliability is defined as the characteristics of an item expressed by the probability that it will perform a required function under stated conditions for a stated period of time. This involves the concept of probability, definition of required function(s), and the critical time used in defining the reliability.

Definition of a required function, by implication, treats the definition of a failure. Failure is defined as the termination of the ability of a device to perform its required function. Furthermore, a device is said to have failed if it shows inability to perform within quaranteed parameters as given in an electrical specification.

Discussion of reliability and failure can be approached in two ways: with respect to systems or to individual devices. The accumulation of normal device failure rates constitutes the expected failure rate of the system hardware. Important considerations here are the constant failure period, the early failure (infant mortality) period, and overall reliability level. With regard to individual devices, areas of prime interest include specific failure mechanisms, failures in accelerated tests, and screening tests.

Some of these failure considerations pertain to both systems and devices. The probability of no failures in a system is the product of the probability of no failure in each of its components. The failure rate of system hardware is then the sum of the failure rates of the components used to construct the system.

Figure 1. Reliability Life (Bathtub) Curve



Life Distribution

The fundamental principles of reliability engineering predict that the failure rate of a group of devices will follow the well-known bathtub curve in figure 1. The curve is divided into three regions: infant mortality, random failures, and wearout failures.

Infant mortality, as the name implies, represents the early-life failures of devices. These failures are usually associated with one or more manufacturing defects.

After some period of time, the failure rate reaches a low value. This is the random failure portion of the curve, representing the useful portion of the life of a device. During this random failure period, there is a decline in the failure rate due to the depletion of potential random failures from the general population.

The wearout failures occur at the end of the device's useful life. They are characterized by a rapidly rising failure rate over time as devices wear out both physically and electrically.

Thus, for devices that have very-long life expectancies compared to those of systems, the areas of concern will be the infant mortality and the random failure portions of the population.

The system failure rates are related to the collective device failure rates. In a given system, after elimination of the early failures, the system will be left to the failure rate of its components. In order to make proper projections of the failure rate in the operating environment, time-to-failure must be accelerated in tests in a predictable way.

Failure Distribution at NEC

Integrated circuits returned to NEC from the field underwent extensive failure analysis at NEC's Integrated Circuit Division.

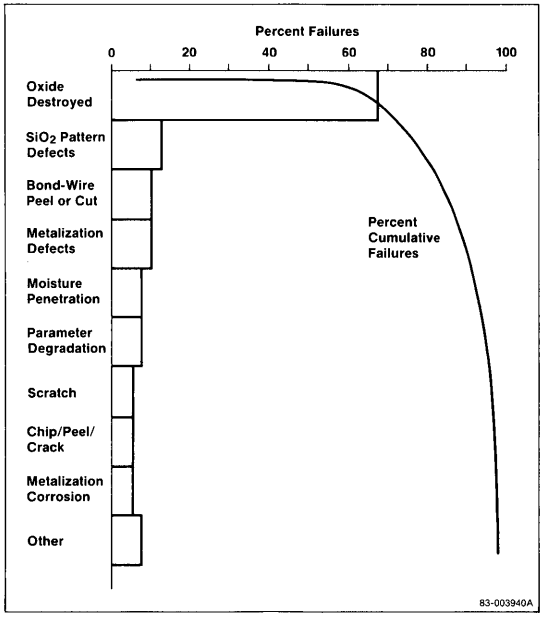
First, approximately 50 percent of the field returns were found to be damaged either from improper handling or misuse of the devices. These units were eliminated from the analysis. The remaining failed units were classified by their failure mechanisms as depicted in figure 2. These failures were then related to the major integrated circuit failure mechanisms and to their origins in a particular manufacturing step.

As shown in figure 2, the first four failure mechanisms accounted for more than 90 percent of total failures. As a result, NEC improved processes and material to reduce these failures. Additionally, NEC introduced screening procedures to detect and eliminate defective devices.

Temperature, humidity, and bias tests are used for testing the moisture resistance of plastic encapsulated integrated circuits. NEC developed a special process to improve the plastic encapsulation material. As a result, moisture-related—thus packaging-related—failures have been drastically reduced.

As a preventive measure, NEC has introduced a special screening procedure embedded in the production line. A burn-in at an elevated temperature is performed for 100 percent of the lots. This burn-in effectively removes the potentially defective units. In addition, improvement of the plastic encapsulation material has lowered the failures in a high-temperature and high-humidity environment.

Figure 2. Failure Distribution of MOS Integrated Circuits



Accelerated Reliability Testing

As an example, assume that an electronic system contains 1000 integrated circuits and can tolerate 1 percent system failures per month. The failure rate per component is:

$$\frac{0.01 \text{ Failures}}{720\text{K Device Hours}} = 13.888 \times 10^{-9} \text{ Failures/Hour or } 13.8888 \text{ FITs}$$

where FIT = Failure units per 10^9 device hours

To demonstrate this failure rate, note that 13.8888 FITs corresponds to one failure in about 7000 devices during an operating test of 10,000 hours. It is quickly apparent that a test condition is required to accelerate the time-to-failure in a predictable and understandable way. The implicit requirement for the accelerated stress test is that the relationship between the accelerated stress testing condition and the condition of actual use be known.

A most common time-to-failure relationship involves the effect of temperature, which accelerates many physiochemical reactions leading to device failure. Other environmental conditions are voltage, current, humidity, vibration, or some combination of these. Table 1 lists the reliability assurance tests performed at NEC for integrated circuits.

Table 1. Monthly NEC Reliability Tests

Test	MIL-STD-883 Method	Test Conditions
Life Test		
High-temperature, operating	1005	T_A = 100 to 125°C for 1000 hours
High-temperature, storage	1008	T_A = 150°C for 1000 hours
High-temperature, high-humidity test	—	T_A = 85°C at 85% RH for 1000 hours
Pressure cooker test	—	T_A = 125°C at 2.3 atm for 168 hours
Environmental Test		
Soldering heat test	2031 (MIL-STD-750)	T = 260°C for 10 s without flux
Temperature cycle	1010	T = −65 to +150°C for 10 cycles
Thermal shock	1011	T = 0 to 100°C for 15 cycles
Lead fatigue	2004	at 250 gm: 3 leads, 3 bends
Solderability	2003	T = 230°C for 5 s with flux

Temperature Effect. The effect of temperature that concerns us is that which responds to the Arrhenius relationship. This relates the reaction rate to temperature.

$$R = R_o \exp(-E_a/kT)$$

where R_o = Constant
E_a = Activation energy in eV
k = Boltzmann's constant
= 8.617×10^{-5} eV/K
T = Absolute temperature in kelvin (K)

The significance of this relationship is that the failure mechanisms of semiconductor devices are directly applicable to it. A linear relationship between failure mechanism and time is assumed.

Activation Energy. Associated with each failure mechanism is an activation energy value. Table 2 lists some of the more common failure mechanisms and the associated activation energy of each.

Table 2. Activation Energy and Detection of Failure Mechanisms

Failure Mechanism	Activation Energy	Detection
Oxide defect	0.3 eV	High-temperature operating life test
Silicon defect	0.3 eV	
Ionic contamination	1.0-1.35 eV	
Electromigration	0.4-0.8 eV	
Charge injection	1.3 eV	
Gold-aluminum interface	0.8 eV	
Metal corrosion	0.7 eV	High-humidity operating life test

High-Temperature Operating Life Test. This test is used to accelerate failure mechanisms by operating the devices at an elevated temperature of 125°C. The data obtained is translated to a lower temperature by using the Arrhenius relationship.

High-Temperature and High-Humidity Test. Semiconductor integrated circuits are highly sensitive to the general accelerating effect of humidity in causing electrolytic corrosion between biased lines. The high-temperature and high-humidity test is performed to detect failure mechanisms that are accelerated by these conditions. This test is effective in accelerating leakage-related failures and drifts in device parameters due to process instability.

High-Temperature Storage Test. Another common test is the high-temperature storage test in which devices are subjected to elevated temperatures with no applied bias. This test is used to detect mechanical problems and process instability.

Environmental Test. Other environmental tests are performed to detect problems related to the package, material, susceptibility to extremes in environment, and problems related to usage of the devices.

Failure Rate Calculation and Prediction

Analysis of integrated circuit failure rates can serve many useful purposes. For example, the early-life failure rate helps establish a warranty period, while the mature-life failure rate aids in estimating repair costs, spare parts stock requirements, or product downtime. Accurate prediction of failure rates can also be used for process control.

The following sections describe the failure rate calculation and prediction methods used by NEC's Integrated Circuit Division.

The Arrhenius Model

Most integrated circuit failure mechanisms depend to some degree on temperature. This relationship can be represented by the Arrhenius model, which includes the effects of temperature and activation energy of the failure mechanisms.

As applied to accelerated life testing of integrated circuits, the Arrhenius model assumes that degradation of a performance parameter is linear with time. Temperature dependence is taken to be the exponential function that defines the probability of occurrence. The relationship of failure rate to temperature is expressed as:

$$F_1 = F_2 \exp[(E_a/k) \times (1/T_1 - 1/T_2)]$$

Where: F_2 = Failure rate at T_2
F_1 = Failure rate at T_1
E_a = Activation energy in eV
k = Boltzmann's constant
T = Operating junction temperature in kelvin (K)

The equation explains the thermal dependence of integrated circuit failure rates and is used for derating the resulting failure rate to a more realistic temperature.

Acceleration Factor

The acceleration factor is the factor by which the failure rate can be accelerated by increased temperature. This factor is derived from the Arrhenius failure rate expression, resulting in the following form.

$$A = F_1/F_2 = \exp[(E_a/k) \times (1/T_1 - 1/T_2)]$$

where A = Acceleration factor
F_2 = Failure rate at T_2
F_1 = Failure rate at T_1

In calculating the field reliability of an integrated circuit, it is necessary to calculate the junction temperature. In general, the junction temperature will depend on the ambient temperature, cooling, package type, operating cycle time, and power dissipation of the circuit itself. In these terms, the junction temperature (T_J) is expressed as:

$$T_J = T_A + P_d A_f \theta_{JA}$$

where T_J = Junction temperature
T_A = Ambient temperature
P_d = Power dissipation
A_f = Air flow factor
θ_{JA} = Package thermal resistance

Table 3 lists derating factors of various failure mechanisms. This table is generated assuming that an accelerated test is performed at a junction temperature of 125°C. The result is then derated to 55°C junction temperature. The acceleration factor may then be obtained by taking the inverse of the derating factor.

Table 3. Derating Factors of Failure Mechanisms

Failure Mechanisms	Activation Energy, eV	Derating Factor
Oxide defect	0.3	0.1546
Silicon defect	0.3	0.1546
Ionic contamination	1.0	0.001984
Electromigration	0.4	0.08307
Charge injection	1.3	0.0003067
Metal corrosion	0.7	0.01315
Gold-aluminum interface	0.8	0.006886

The acceleration of failure mechanisms in a high-humidity and high-temperature environment must be expressed as a function not only of temperature but also of humidity.

According to the reliability test statistics, the acceleration factor in such an environment can best be approximated with Peck's model as follows.

$$A = \exp[(E_a/k) \times (1/T_1 - 1/T_2)] \times (H_2/H_1)^{4.5}$$

where E_a = Activation energy
k = Boltzmann's constant
T = Junction temperature
H = Relative humidity

For example, the acceleration factor for high-humidity and high-temperature or pressure cooker tests ranges from 100 to 1000 times that of the normal operating environment.

Failure Rate Calculation

As an example, suppose that product samples are submitted to a 1000-hour life test at 125°C junction temperature and two failures are encountered: one oxide and one metalization defect. The sample size is 885 units.

Thus, the oxide failure rate is 0.11 percent per 1000 hours and the metalization failure rate is 0.11 percent per 1000 hours. Therefore, the total failure rate at 125°C sums to 0.22 percent per 1000 hours at 1K hours.

Failure Rate Prediction

To derate these failure rates to a normal operating environment, use the derating factors listed in table 3.

Oxide failures = 0.11 x 0.1546 = 0.01701% per 1K hrs
Metal failures = 0.11 x 0.01315 = 0.00145% per 1K hrs
Total failures = 0.01846% per 1K hrs

Note that the example above is a snapshot of the high-temperature life test performed on a particular lot. It is not accumulated data that can be used to represent overall reliability. This conservative illustration, however, shows that the failure rate in a normal operating environment is approximately one-twelfth the failure rate in a higher-temperature environment.

The failure rate prediction takes different activation energies into account whenever the causes of failures are known through performing failure analysis. In some cases, however, an activation energy is assumed in order to accomplish a quick first-order approximation. To yield a conservative estimate of failure rates, NEC assumes an average activation energy of 0.7 eV whenever the exact failure mechanism is not known.

Reliability Test Results

Before introducing new technologies or products, NEC's internal reliability goals must be attained. Several categories of testing are used in the internal qualification program to assure that product reliability meets NEC's reliability goals. Once the product is qualified, its reliability level is regularly monitored in a monthly reliability test.

NEC's Goals on Failure Rates

NEC's approach to achieving high reliability is to build quality into the product, as opposed to merely screening out defective units. The use of distributed control methods embedded in the production line, in conjunction with conventional screening methods, results in the highest reliability at the lowest cost.

NEC's maximum failure rate goals for infant mortality and long-term device operation are listed in table 4.

Table 4. Infant Mortality and Long-Term Failure Rates

Type	Failure Rate Percent/1000 Hours
Infant mortality	0.10 max
Long-term	
1.2M device hours average	0.02 max
3.0M device hours average	0.01 max

Infant Mortality Failure Rate

The infant mortality goal for each product group is set at 0.10 percent maximum. When a failure rate exceeds this level, there is prompt remedial action.

Long-Term Failure Rate

The long-term failure rate goal is based on the following conditions:

- A minimum of 1.2 million device hours at 125°C is accumulated to resolve 0.02 percent per 1000 hours at 55°C with a 60-percent confidence level.
- A minimum of 3 million device hours at 125°C is accumulated to resolve 0.01 percent per 1000 hours at 55°C with a 60-percent confidence level.

Infant Mortality Failure Screening

It is logical to assume the integrated circuit that fails at one temperature would also fail at another temperature, except it would fail sooner at a higher temperature. As can be expected, the failure rate is a function of activation energy. Establishing infant mortality screening, therefore, requires knowledge of the likely failure mechanisms and their associated activation energy.

The most likely mechanisms associated with infant mortality failures are generally manufacturing defects and process anomalies. These generally consist of contamination, cracked chips, wire bond shorts, or bad wire bonds. Since these describe a number of possible mechanisms, any one of which might predominate at a given time, the activation energy for infant mortality might be expected to vary considerably.

The effectiveness of a screening condition, preferably at some stress level in order to shorten the time, varies greatly with the failure mechanism being screened for. Another factor is the economics of the screening process introduced into the production line. Optimal conditions and duration of a screening process will be a compromise of these two factors.

For example, failures due to ionic contamination have an activation energy of approximately 1.0 eV. Therefore, a 15-hour stress at 125 °C junction temperature would be the equivalent of approximately 90 days of operation at a junction temperature of 55 °C. On the other hand, failures due to oxide defects have an activation energy of approximately 0.3 eV, and a 15-hour stress at 125 °C junction temperature would be the equivalent of approximately one week's operation at 55 °C junction temperature. As indicated by this, the condition and duration of infant mortality screening would be a strong function of the allowable component failures, hence the system failure, in the field.

Empirical data, gathered over more than a year at NEC, indicates that early failure does occur after less than 4 hours of stress at 125 °C ambient temperature. This fact is supported by the life test of the same lot, where the failure rate shows random distribution, as opposed to a decreasing failure rate that then runs into the random failure region.

NEC has adopted the initial infant mortality burn-in at 125 °C as a standard production screening procedure. As a result, the field reliability of NEC devices is an order of magnitude higher than the goals set for NEC's integrated circuit products.

Life Tests

The most significant difference between NEC's products and those of other integrated circuit manufacturers is that NEC's have been prescreened for their infant mortality defects. The products delivered to customers are operating at the beginning of the random failure region of the life curve. The life test data also reflects this fact, as will be shown.

The failure mechanism distribution from field failures, as previously shown in figure 2, also contains a very low percentage due to infant mortality. The majority of failures are long-term life failures, and these can be eliminated by stringent process control. Usually, these failure mechanisms have low activation energy associated with them.

Another significant improvement devised by NEC is plastic encapsulation and passivation. As a result, NEC products show excellent reliability in both high-humidity and high-temperature environments. Following is life test data accumulated over more than a year for large-scale integrated circuits.

High-Temperature Operating Life Test

This test is used to accelerate failure mechanisms by operating the devices at an elevated temperature. For large-scale integrated circuits, the failure rate is 0.242 percent per 1000 hours at 125 °C. This is equivalent to 0.0071 percent per 1000 hours in an operating environment of 55 °C (table 5).

Table 5. High-Temperature Operating Life Test

Number of Samples	Number of Failures at				
	48 hrs	96 hrs	168 hrs	500 hrs	1K hrs
3317	0	0	1	4	3

Total number of failures at 1K hrs = 8
Failure rate at 1K hrs at 125 °C = 0.242% per 1K hrs
Projected failure rate at 1K hrs at 55 °C = 0.007% per 1K hrs

High-Temperature and High-Humidity Life Test

This test is used to accelerate failure mechanisms by operating the devices at high temperature and high humidity. Leakage-related failures and device parameter drift are accelerated by this test. For these large-scale integrated circuits, the failure rate is 0.091 percent per 1000 hours. This is equivalent to 0.0027 percent per 1000 hours in an operating environment of 55 °C. The test conditions are $T_A = 85$ °C and relative humidity (RH) = 80% (table 6).

Table 6. High-Temperature and High-Humidity Life Test

Number of Samples	Number of Failures at 48 hrs	96 hrs	168 hrs	500 hrs	1K hrs
2190	0	0	0	0	2
Total number of failures at 1K hrs	= 2				
Failure rate at 1K hrs at 85°C/80% RH	= 0.091% per 1K hrs				
Projected failure rate at 1K hrs at 55°C/60% RH	= 0.003% per 1K hrs				

High-Temperature Storage Life Test

This test is effective in accelerating the failure mechanisms related to mechanical reliability problems and process instability. For these LSI devices, the failure rate is 0.207 percent per 1000 hours at 125°C. This is equivalent to 0.0061 percent per 1000 hours in an operating environment of 55°C (table 7).

Table 7. High-Temperature Storage Life Test

Number of Samples	Number of Failures at 48 hrs	96 hrs	168 hrs	500 hrs	1K hrs
2410	0	0	0	1	4
Total number of failures at 1K hrs	= 5				
Failure rate at 1K hrs at 125°C	= 0.207% per 1K hrs				
Projected failure rate at 1K hrs at 55°C	= 0.006% per 1K hrs				

Pressure Cooker Test

This test is effective in accelerating failure mechanisms related to metalization corrosion due to moisture. The failure rate is 0.52 percent per 1000 hours at T_A = 125°C and 2.3 atm at 100 percent humidity. This is equivalent to 0.0013 percent per 1000 hours at 55°C and an environment of 60 percent humidity (table 8).

Table 8. Pressure Cooker Test

Number of Samples	Number of Failures at 48 hrs	96 hrs	168 hrs	500 hrs	1K hrs
1718	0	4	5	No test performed	
Total number of failures at 168 hrs	= 9				
Failure rate at 125°C	= 0.54% per 1K hrs				
Projected failure rate at 55°C	= 0.001% per 1K hrs				

Life Test Data Summary

Table 9 summarizes the life test results and projected failure rates in the normal operating environment. The failure rate shows random distribution as opposed to a decreasing failure rate. This is a result of infant mortality screening.

Table 9. Life Test Data

Test Time	Number of Samples	Number of Failures at 96 hrs	168 hrs	500 hrs	1K hrs	Total Number of Failures
High-temperature life test	3317	0	1	4	3	8
High-humidity life test	2190	0	0	0	2	2
High-temperature storage life test	2410	0	0	1	4	5
Pressure cooker test	1718	4	5	No test performed		9
Total	9635	4	6	5	9	24

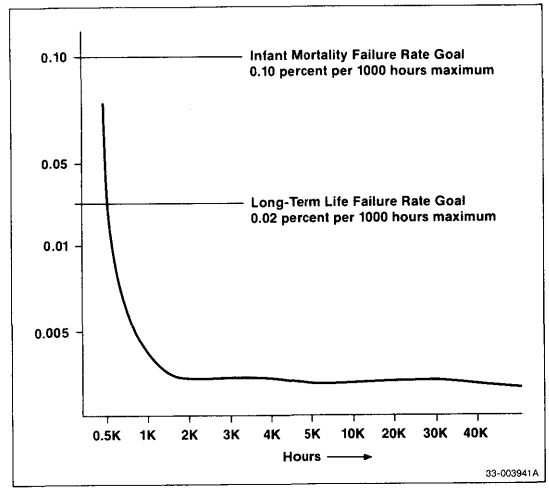
The projected failure rate in the normal operating environment is calculated assuming that the average activation energy is 0.7 eV.

Figure 3 shows the life distribution of NEC integrated circuits as a form of the bathtub curve.

This life test data shows improvements of approximately an order of magnitude better than NEC's goal. The hours of operation are equivalent to the normal operating environment. Wear-out failures, which had been the main target for reliability improvement, have also been significantly reduced. This result comes mainly from process improvements and stringent manufacturing process control.

NEC's main goal has been to improve reliability with respect to infant mortality and long-term life failures. This can be achieved by introducing an effective screening method for infant mortality and building quality into the product.

Figure 3. Plot of Life Test Results



Thermal Stress Tests

Temperature cycling and thermal shock test the thermal compatibility of material and metal used to make integrated circuits. Table 10 lists the reliability test results of thermal stress tests.

Table 10. Thermal Stress Tests

Test Item	Number of Samples	Number of Failures
Soldering heat test $T_A = 260°C$ for 10 seconds	1891	0
Temperature cycle $T_A = -65$ to $+150°C$, 10 cycles	1891	0
Thermal shock test $T_A = 0$ to $+100°C$, 15 cycles	1891	0

Mechanical Stress Tests

In addition to the device life test, NEC performs mechanical stress tests to detect reliability problems related to the package, material, and device susceptibility to an extreme environment. Table 11 lists mechanical stress test results.

Table 11. Mechanical Stress Tests

Test Item	Number of Samples	Number of Failures
Mechanical shock test at 15 kg, 3 axis	315	0
Vibration test at 100 Hz to 2 kHz, 20 g	315	0
Constant acceleration at 20 kg, 3 axis	315	0
Lead fatigue test at 240 grams	538	0
Solderability test at 230°C for 5 seconds	638	0

Built-In Quality and Reliability

As large-scale integration reaches even higher levels of density, simple quality inspections cannot assure adequate levels of product quality and reliability. In order to ensure the reliability of state-of-the-art VLSI, NEC has adopted another approach. Highest reliability and superior quality of a device can only be achieved by building these characteristics into the product at each process step. NEC, therefore, has introduced the notion of total quality control (TQC) into its entire semiconductor production line. Quality control is distributed into each process step and then summed to form a consolidated system.

Approaches to Total Quality Control

First, the quality control function is embedded into each process. This method enables early detection of possible causes of failure and immediate feedback.

Second, the reliability and quality assurance policy is an integral part of the entire organization. This enables a companywide quality control activity. At NEC, everyone in the company is involved with the concept and methodology of total quality control.

Third, there is an ongoing research and development effort to set even higher standards of device quality and reliability.

Fourth, extensive failure analysis is performed periodically and corrective actions are taken as preventive measures. Process control is based on statistical data gathered from this analysis.

The goal is to maintain the superior product quality and reliability that has become synonymous with the NEC name. The new standard is continuously upgraded and the iterative process continues.

Implementation of Distributed Quality Control

Building quality into a product requires early detection of possible causes of failure at each process step. Then, immediate feedback to remove the causes is a must. A fixed station quality inspection is often lacking in immediate feedback. It is, therefore, necessary to distribute quality control functions to each process step, including the conceptual stage. NEC has implemented a distributed quality control function at each step of the process. Following is a breakdown of the significant steps:

- Product development phase
- Wafer processing
- Chip mounting and packaging
- Electrical testing and thermal aging
- Incoming material inspection

Product Development Phase. The product development phase includes conception of a product, review of the device proposal, organization and physical element design, engineering evaluation, and finally, transfer of the product to manufacturing. Quality and reliability are considered at every step. More significantly, at the design review stage and prior to product transfer, the quality and reliability requirements have to be examined and determined to be satisfactory. This often adds 2 to 3 months to the product development cycle. Building in high reliability, however, cannot be sacrificed.

Wafer Processing Stage Inspection. The in-process quality inspections that occur at the wafer fabrication stage are listed in table 12.

Table 12. Wafer Processing Inspection

Process	Inspection Item
Wafer	Resistivity, dimension, and appearance, (lot sampling inspection)
Mask	
Photolithography	Alignment and etching (100% inspection)
Cleaning	
Diffusion and oxidation	Oxide thickness, sheet resistivity (lot sampling inspection)
Metalization and passivation	Thickness, V_{th}, C-V characteristics (lot sampling)
Wafer sort and scribe	Dc parameters (100% inspection)
Die sort	100% visual inspection

Chip Mounting and Packaging. The in-process quality inspections done at the chip mounting and packaging stage are listed in table 13.

Table 13. Chip Mounting and Packaging Inspection

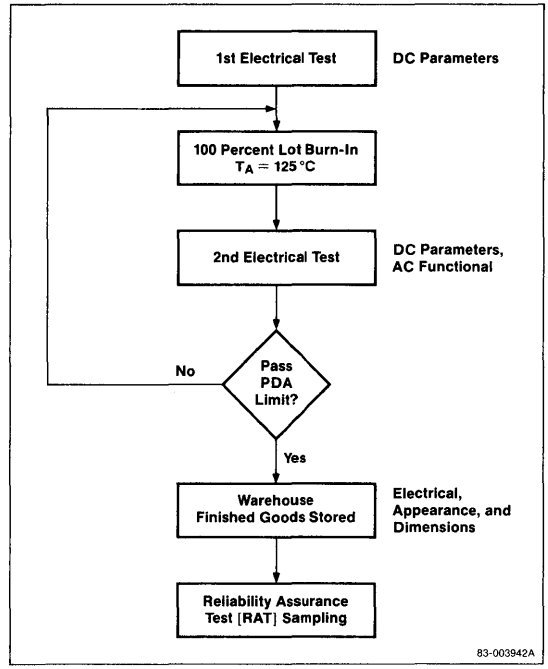
Process	Inspection Item
Die	Incoming material Inspection
Die attach	Appearance (lot sampling inspection)
Wire bonding	Bond strength, appearance (lot sampling)
Packaging	100% appearance inspection
Fine leak*	Lot sampling
Gross leak*	100% inspection

*For ceramic package devices only.

Electrical Testing and Screening. Electrical testing and infant mortality screening are performed at this stage. A flowchart of the process is depicted in figure 4.

At the first electrical test, dc parameters are tested according to the electrical specifications on 100% of each lot. This is a prescreening prior to the infant mortality test. At the second electrical test, ac functional tests as well as dc parameter tests are performed on 100% of the subjected lot. If the percentage of defective units exceeds the limit, the lot is subjected to an additional burn-in. During this time, the defective units are undergoing a failure analysis, the results of which are then fed back into the process for corrective action.

Figure 4. Electrical Testing and Screening



Incoming Material Inspection. Prior to warehouse storage, lots are subjected to an incoming inspection according to the following sampling plan.

- Electrical test: Dc parameters LTPD 3%
  Functional test LTPD 3%
- Appearance LTPD 3%

Reliability Assurance Test

Samples are continually taken from the warehouse and subjected to monthly reliability tests as discussed previously. They are taken from similar process groups so that it can be assumed that any device is representative of the reliability of the group.

In-Process Screening

Perhaps the most significant preventive measure that NEC has implemented is the introduction of 100% burn-in as an integral part of the standard production process. Most of the potential infant failures are effectively screened from every lot, thereby improving reliability. Assuming average activation energy of 0.7 eV, burn-in at $T_A = 125\,°C$ for 4 hours is equivalent to a week's operation in a normal operating environment. This appears to be ample time for accelerating the time-to-failure mechanisms for early failures.

Process automation, as previously mentioned, has also contributed a great deal toward improving reliability. Since its introduction, assembly related failure mechanisms have been substantially reduced. And, in combination with in-process screening and materials improvement, it has helped establish quality and reliability above NEC's initial goals.

Summary and Conclusion

As has been discussed, building quality and reliability into products is the most efficient way to ensure product reliability. NEC's approach of distributing quality control functions to process steps, then forming a consolidated quality control system, has produced superior quality and excellent reliability.

Prescreening, introduced as an integral part of large-scale integrated circuit protection, has been a major factor in improving reliability. The most recent year's production clearly demonstrates continuation of NEC's high reliability and the effectiveness of this method.

Reliability assurance tests (RATs), performed monthly, have ensured high outgoing quality levels. The combination of building quality into products, effective prescreening of potential failures, and the reliability assurance test has established a singularly high standard of quality and reliability for NEC's large-scale integrated circuits.

With a companywide quality control program, NEC is committed to building superior quality and highest reliability into all its products. Through continuous research and development activities, extensive failure analysis, and process improvements, a higher standard of quality and reliability will continuously be set and maintained.

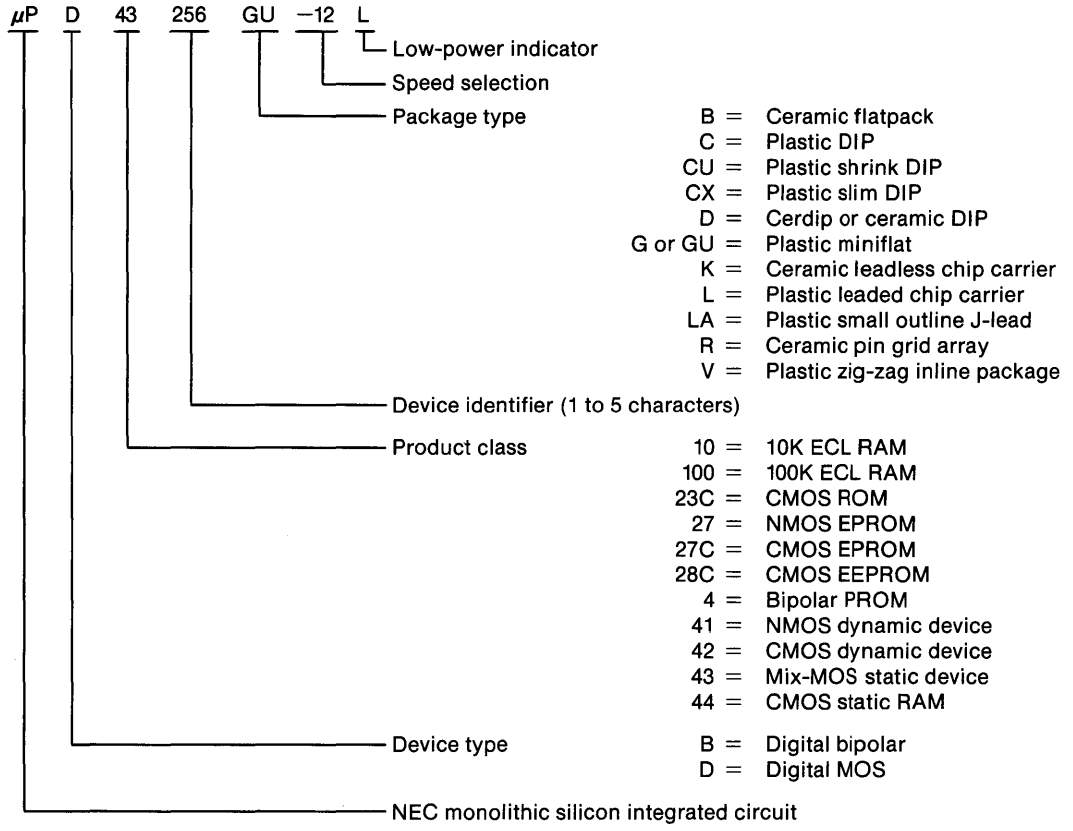
NEC

MEMORY PRODUCTS 3

Section 3 — Memory Products **Page**

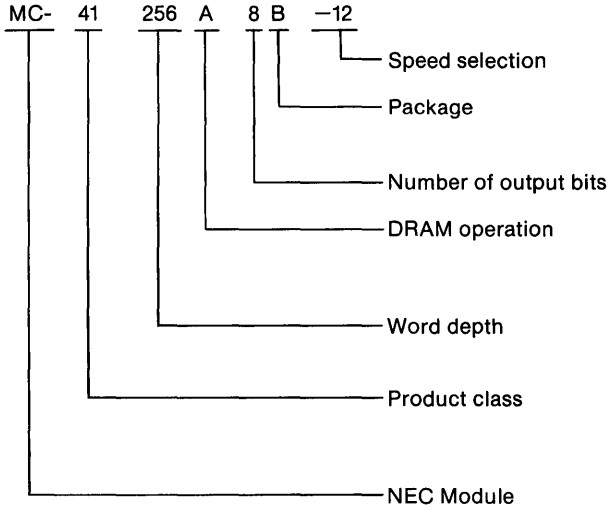
Part Numbering System

Monolithic



Part Numbering System

Module



A	=	Leaded SIMM
B	=	Socket mountable SIMM
A	=	Page or fast page mode
B	=	Nibble mode
C	=	Static column mode
256	=	256K words
1000	=	1M words
1xx	=	Special module
41	=	NMOS dynamic RAM
42	=	CMOS dynamic RAM

Memory Product Overview

Density	Application Specific	RAM					EPROM		EEPROM	ROM
		Module	Dynamic	XRAM	MOS Static	ECL	UV	OTP		
1K						μPB10422 μPB100422				
4K						μPB10470 μPB10474 μPB100470 μPB100474				
8K	μPD41101 μPD41102									
16K					μPD446 μPD449 μPD4311 μPD4314	μPB10480 μPB10484 μPB100480 μPB100484				
40K	μPD42505									
64K	μPD43608			μPD4168	μPD4361 μPD4362 μPD4363 μPD4364				μPD28C64	
256K	μPD41221 μPD41264 μPD42232 μPD42264 μPD42532		μPD41256 μPD41257 μPD41464	μPD42832	μPD43254 μPD43256 μPD43257		μPD27256 μPD27256A μPD27C256 μPD27C256A	μPD27256A μPD27C256 μPD27C256A		μPD23C256E μPD23C256EA
512K							μPD27512 μPD27C512	μPD27512 μPD27C512		μPD23C512E
1M	μPD42270 μPD42601		μPD421000 μPD421001 μPD421002 μPD424256 μPD424258				μPD27C1000 μPD27C1001 μPD27C1024			μPD23C1000 μPD23C1010
2M		MC-41256A8 MC-41256A9								μPD23C2000 μPD23C2001E
4M		MC-421000A4 MC-421000B4 MC-421000C4 MC-421000A5 MC-421000B5 MC-421000C5								μPD23C4000 μPD23C4001E
8M		MC-421000A8 MC-421000B8 MC-421000C8 MC-421000A9 MC-421000B9 MC-421000C9								

Application-Specific Devices

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Maximum Power Dissipation (mW) Standby	Active	Package	Pins
μPD41101-3	910 x 8	NMOS	27	34	+5	—	495	C/G	24
μPD41101-2			27	34(R)/69(W)					
μPD41101-1			49	69					
μPD41102-1S	1135 x 8	NMOS	27	34	+5	—	495	C/G	24
μPD41102-1			40	56					
μPD41221-70	224K x 1	NMOS	55	70	+5	83	385	C	14
μPD41221-90			75	90					
μPD41264-12	64K x 4 with	NMOS	120 Port A 40 Port B	220 Port A 40 Port B	+5	66	853	C/V	24
μPD41264-15	dual ports		150 Port A 60 Port B	270 Port A 60 Port B			715		
μPD42232-12	32K x 8 with	CMOS	120 Port A 40 Port B	230 Port A 40 Port B	+5	16.5	495	CU	40
μPD42232-15	triple ports		150 Port A 60 Port B	270 Port A 60 Port B			440		
μPD42264	64K x 4 with dual ports	CMOS	100 Port A 30 Port B 120 Port A 40 Port B 150 Port A 60 Port B	190 Port A 30 Port B 220 Port A 40 Port B 260 Port A 60 Port B	+5	28	660 550 440	C/LA/V	24
μPD42270	910 x 263 x 4	CMOS	40	60	+5	—	440	C	28
μPD42505-50	5048 x 8	CMOS	40	50	+5	—	660	C	24
μPD42505-75			55	75					
μPD42532	32K x 8	CMOS	50	100	+5	—	440	C	40
μPD42601	1M x 1	CMOS	600 (Single) 100 (Sector)	1000 (Single) 200 (Sector)	+5	0.165	66	C/LA/V	C = 18, LA = 26/20, V = 20
μPD43608	512 x 32 x 4 or 1K x 16 x 4	Mix-MOS	85	125	+5	—	1485	R	132

Note:

(1) Packages: C = plastic DIP; CU = plastic shrink DIP; G = plastic miniflat package; R = ceramic pin grid array; LA = small outline J-lead package; V = zig-zag inline package

RAM Modules

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Maximum Power Dissipation (mW)		Package	Pins
						Standby	Active		
MC-41256A8-10	256K x 8	NMOS	100	200	+5	220	3652	A/B	30
MC-41256A8-12	(page)		120	220			3080		
MC-41256A8-15			150	260			2640		
MC-41256A9-10	256K x 9	NMOS	100	200	+5	248	4109	A/B	30
MC-41256A9-12	(page)		120	220			3465		
MC-41256A9-15			150	260			2970		
MC-421000A4-80	1M x 4	CMOS	80	160	+5	22	1540	A/B	20
MC-421000A4-10	(fast page)		100	190			1320		
MC-421000A4-12			120	220			1100		
MC-421000B4-80	1M x 4	CMOS	80	160	+5	22	1540	A/B	20
MC-421000B4-10	(nibble)		100	190			1320		
MC-421000B4-12			120	220			1100		
MC-421000C4-80	1M x 4	CMOS	80	160	+5	22	1540	A/B	20
MC-421000C4-10	(stat clmn)		100	190			1320		
MC-421000C4-12			120	220			1100		
MC-421000A5-80	1M x 5	CMOS	80	160	+5	27.5	1925	A/B	20
MC-421000A5-10	(fast page)		100	190			1650		
MC-421000A5-12			120	220			1375		
MC-421000B5-80	1M x 5	CMOS	80	160	+5	27.5	1925	A/B	20
MC-421000B5-10	(nibble)		100	190			1650		
MC-421000B5-12			120	220			1375		
MC-421000C5-80	1M x 5	CMOS	80	160	+5	27.5	1925	A/B	20
MC-421000C5-10	(stat clmn)		100	190			1650		
MC-421000C5-12			120	220			1375		
MC-421000A8-80	1M x 8	CMOS	80	160	+5	44	3080	A/B	30
MC-421000A8-10	(fast page)		100	190			2640		
MC-421000A8-12			120	220			2200		
MC-421000B8-80	1M x 8	CMOS	80	160	+5	44	3080	A/B	30
MC-421000B8-10	(nibble)		100	190			2640		
MC-421000B8-12			120	220			2200		
MC-421000C8-80	1M x 8	CMOS	80	160	+5	44	3080	A/B	30
MC-421000C8-10	(stat clmn)		100	190			2640		
MC-421000C8-12			120	220			2200		
MC-421000A9-80	1M x 9	CMOS	80	160	+5	49.5	3465	A/B	30
MC-421000A9-10	(fast page)		100	190			2970		
MC-421000A9-12			120	220			2475		
MC-421000B9-80	1M x 9	CMOS	80	160	+5	49.5	3465	A/B	30
MC-421000B9-10	(nibble)		100	190			2970		
MC-421000B9-12			120	220			2475		
MC-421000C9-80	1M x 9	CMOS	80	160	+5	49.5	3465	A/B	30
MC-421000C9-10	(stat clmn)		100	190			2970		
MC-421000C9-12			120	220			2475		

Note:

(1) Packages: A = single inline memory module (SIMM), leaded, glass-epoxy substrate; 3A = SIMM, leaded, reduced height; B = SIMM, socket mountable

Dynamic RAMs

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Maximum Power Dissipation (mW)		Package	Pins
						Standby	Active		
μPD41256-10	256K x 1	NMOS	100	200	+5	28	457	C/L/V	C = 16,
μPD41256-12	(page)		120	220			385		L = 18,
μPD41256-15			150	260			330		V = 16
μPD41256-20			200	330			330		
μPD41257-12	256K x 1	NMOS	120	220	+5	28	413	C/L/V	C = 16,
μPD41257-15	(nibble)		150	260			385		L = 18,
μPD41257-20			200	335			330		V = 16
μPD41464-10	64K x 4	NMOS	100	200	+5	28	440	C/L/V	C = 18,
μPD41464-12			120	220			413		L = 18,
μPD41464-15			150	260			385		V = 20
μPD421000-80	1M x 1	CMOS	80	160	+5	5.5	385	C/LA/V	C = 18,
μPD421000-10	(fast page)		100	190			330		LA = 26/20,
μPD421000-12			120	220			275		V = 20
μPD421001-80	1M x 1	CMOS	80	160	+5	5.5	385	C/LA/V	C = 18,
μPD421001-10	(nibble)		100	190			330		LA = 26/20,
μPD421001-12			120	220			275		V = 20
μPD421002-80	1M x 1	CMOS	80	160	+5	5.5	385	C/LA/V	C = 18,
μPD421002-10	(stat clmn)		100	190			330		LA = 26/20,
μPD421002-12			120	220			275		V = 20
μPD424256-80	256K x 4	CMOS	80	160	+5	5.5	385	C/LA/V	C = 20,
μPD424256-10	(fast page)		100	190			330		LA = 26/20,
μPD425256-12			120	220			275		V = 20
μPD424258-80	256K x 4	CMOS	80	160	+5	5.5	385	C/LA/V	C = 20,
μPD424258-10	(stat clmn)		100	190			330		LA = 26/20,
μPD425258-12			120	220			275		V = 20

Note:

(1) Packages: C = plastic DIP; L = plastic leaded chip carrier; V = zig-zag inline package; LA = small outline J-lead package

XRAMs

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Maximum Power Dissipation (mW)		Package	Pins
						Standby	Active		
μPD4168-12	8K x 8	NMOS	120	220	+5	28	358	C	28
μPD4168-15			150	260			330		
μPD4168-20			200	330			303		
μPD42832-12	32K x 8	CMOS	120	190	+5	2.8	275	C/GU	28
μPD42832-15			150	235			220		

Note:

(1) Packages: C = plastic DIP; GU = plastic miniflat package

MOS Static RAMs

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Maximum Power Dissipation (mW) Standby	Active	Package	Pins
μPD446-3	2K x 8	CMOS	150	150	+5	0.055	209	C/G	24
μPD446-2	($\overline{CS}$, $\overline{OE}$)		200	200		(Note 2)	165		
μPD446-1			250	250			143		
μPD449-3	2K x 8	CMOS	150	150	+5	0.055	209	C	24
μPD449-2	($\overline{CE_1}$, $\overline{CE_2}$)		200	200		(Note 2)	165		
μPD449-1			250	250			143		
μPD4311-35	16K x 1	Mix-MOS	35	35	+5	11	440	C	20
μPD4311-45			45	45					
μPD4311-55			55	55					
μPD4314-35	4K x 4	Mix-MOS	35	35	+5	11	440	C	20
μPD4314-45			45	45					
μPD4314-55			55	55					
μPD4361-40	64K x 1	Mix-MOS	40	40	+5	11	660	K	22
μPD4361-45			45	45				C/K	
μPD4361-55			55	55				C/K	
μPD4361-70			70	70				C	
μPD4362-25	16K x 4	Mix-MOS	25	25	+5	11	495	C	22
μPD4362-35	($\overline{CS}$ only)		35	35					
μPD4362-45			45	45					
μPD4362-55			55	55					
μPD4362-70			70	70					
μPD4363-45	16K x 4	Mix-MOS	45	45	+5	11	495	C	24
μPD4363-55	($\overline{CS}$, $\overline{OE}$)		55	55					
μPD4363-70			70	70					
μPD4364-10	8K x 8	Mix-MOS	100	100	+5	11/0.55	248	C/CX/G	28
μPD4364-12			120	120			220	C/CX/G	
μPD4364-15			150	150			220	C/CX/G	
μPD4364-20			200	200			193	C/G	
μPD4464-12	8K x 8	CMOS	120	120	+5	0.055	220	C/G	28
μPD4464-15			150	150		(Note 2)	220		
μPD4464-20			200	200			193		
μPD43254-35	64K x 4	Mix-MOS	35	35	+5	11	660	C	24
μPD43254-45			45	45					
μPD43254-55			55	55					
μPD43256-10	32K x 8	Mix-MOS	100	100	+5	11/0.55	385	C/CX/GU	28
μPD43256-12	($\overline{CS}$, $\overline{OE}$)		120	120					
μPD43256-15			150	150					
μPD43257-10	32K x 8	Mix-MOS	100	100	+5	0.55	385	C/GU	28
μPD43257-12	($\overline{CE_1}$, CE_2)		120	120					
μPD43257-15			150	150					

Notes:

(1) Packages: C = plastic DIP; CX = plastic slim DIP; G or GU = plastic miniflat package; K = ceramic leadless chip carrier (LCC)

(2) Lower power version available; refer to the data sheet for more detail.

ECL RAMs

Device	Organization	Process	Address Access Time (ns)	Chip Select Access Time (ns)	Supply Voltage	Maximum Power Dissipation (mW)	Package	Pins
μPB10422-7	256 x 4	10K	7	5 (Note 2)	−5.2	1144	D	24
μPB10422-10			10	5 (Note 2)				
μPB10470-10	4K x 1	10K	10	6	−5.2	1144	D	18
μPB10470-15			15	8				
μPB10474-8	1K x 4	10K	8	5	−5.2	1144	D	24
μPB10474-10			10	6				
μPB10474-15			15	8				
μPB10480-10	16K x 1	10K	10	5	−5.2	1352	B/D	20
μPB10480-15			15	8		1248		
μPB10484-10	4K x 4	10K	10	6	−5.2	1352	B/D	28
μPB10484-15			15	8		1248		
μPB100422-7	256 x 4	100K	7	5 (Note 2)	−4.5	990	B/D	24
μPB100422-10			10	5 (Note 2)				
μPB100470-10	4K x 1	100K	10	6	−4.5	990	D	18
μPB100470-15			15	8				
μPB100474-4.5	1K x 4	100K	4.5	4	−4.5	2025	K	24
μPB100474-6			6	4		2025	B/K	
μPB100474-8			8	5		990	B/D	
μPB100474-10			10	6		990	B/D	
μPB100474-15			15	8		990	B/D	
μPB100480-10	16K x 1	100K	10	5	−4.5	1170	B/D	20
μPB100480-15			15	8		1080		
μPB100484-10	4K x 4	100K	10	6	−4.5	1170	B/D	28
μPB100484-15			15	8		1080		

Notes:

(1) Packages: D = ceramic DIP; B = ceramic flat package; K = ceramic leadless chip carrier (LCC)

(2) Block Select Access Time (ns).

EPROMs

Device	Organization	Process	Access Time (ns)	Programming Option	Supply Voltage	Maximum Power Dissipation (mW) Standby	Active	Package	Pins
μPD27256	32K x 8	NMOS	250	UV	+5	210	604	D	28
μPD27256A-2 μPD27256A	32K x 8	NMOS	200 250	UV UV/OTP	+5 (Note 2)	132	526	C/D	28
μPD27512-2 μPD27512	64K x 8	NMOS	200 250	UV UV/OTP	+5 (Note 2)	131	525	D C/D	28
μPD27C256-15 μPD27C256-20 μPD27C256-25	32K x 8	CMOS	150 200 250	UV UV/OTP UV/OTP	+5	0.55	165	D C/D C/D	28
μPD27C256A-12 μPD27C256A-15 μPD27C256A-20	32K x 8	CMOS	120 150 200	UV UV/OTP UV/OTP	+5 (Note 2)	0.55	165	D/K C/D/G/K C/D/G/K	28 (except K = 32)
μPD27C512-15 μPD27C512-20 μPD27C512-25	64K x 8	CMOS	150 200 250	UV/OTP	+5 (Note 2)	0.55	165	C/D/G/K	28 (except K = 32)
μPD27C1000-15 μPD27C1000-20 μPD27C1000-25	128K x 8 (ROM Comp.)	CMOS	150 200 250	UV	+5 (Note 2)	0.55	275	D	32
μPD27C1001-15 μPD27C1001-20 μPD27C1001-25	128K x 8 (JEDEC)	CMOS	150 200 250	UV	+5 (Note 2)	0.55	275	D	32
μPD27C1024-15 μPD27C1024-20 μPD27C1024-25	64K x 16	CMOS	150 200 250	UV	+5 (Note 2)	0.55	275	D	40

Notes:

(1) Packages: C = plastic DIP for OTP (one time programmable) EPROMs; G = plastic miniflat package for OTP; D = ceramic DIP with quartz window; K = ceramic leadless chip carrier with quartz window

(2) Programming voltage = 12.5 V ±0.3

EEPROMs

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Maximum Power Dissipation (mW) Standby	Active	Package	Pins
μPD28C64-20 μPD28C64-25	8K x 8	CMOS	200 250	200 250	+5	0.55	275	C	28

Note:

(1) Package: C = plastic DIP

Mask-Programmable ROMs

Device	Organization	Process	Access Time (ns)	Cycle Time (ns)	Supply Voltage	Maximum Power Dissipation (mW)		Package	Pins
						Standby	Active		
μPD23C256E-1 μPD23C256E	32K x 8	CMOS	150 200	150 200	+5	0.165	165 138	C/G	28
μPD23C256EA	32K x 8	CMOS	200	200	+5	0.55	138	C/G	28
μPD23C512E	64K x 8	CMOS	200	200	+5	0.55	193	C/G	28
μPD23C1000-1 μPD23C1000	128K x 8 ($\overline{CE}$)	CMOS	200 250	200 250	+5	0.55	220	C/G	28/52
μPD23C1010	128K x 8 ($\overline{OE}$)	CMOS	250	250	+5	N/A	220	C	28
μPD23C2000	128K x 16 or 256K x 8	CMOS	250	250	+5	0.55	220	C/G	40/52
μPD23C2001E	256K x 8	CMOS	250	250	+5	0.55	220	C	32
μPD23C4000	256K x 16 or 512K x 8	CMOS	250	250	+5	0.55	220	C/G	40/64
μPD23C4001E	512K x 8	CMOS	250	250	+5	TBD	TBD	C	32

Note:

(1) Packages: C = plastic DIP; G = plastic miniflat package

NEC

MICROCOMPUTER PRODUCTS

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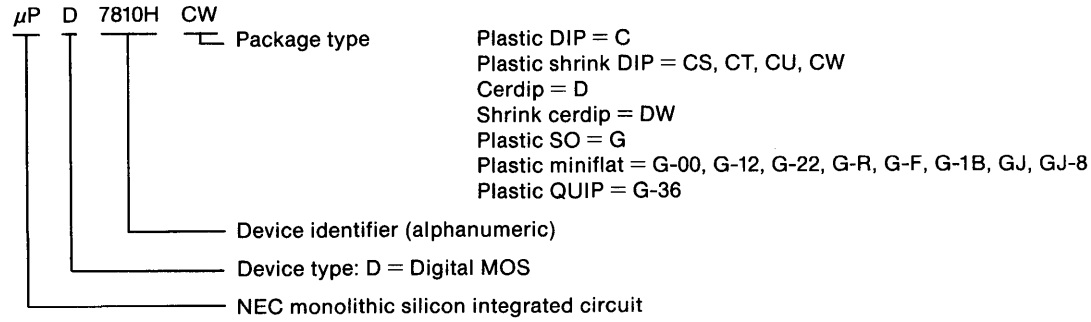
Section 4 — Microcomputer Products **Page**

Part Numbering System



4-Bit, Single-Chip CMOS Microcomputers

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X4)	I/O	Package	Pins
μPD7500HG-36	Microcomputer	0.7	4.5 to 5.5	External	256	46	Plastic QUIP	64
μPD7500H-EG-36	Microcomputer	0.2	4.5 to 5.5	External	256	46	Plastic QUIP	64
μPD7501G-12	Microcomputer with LCD controller/driver	0.4	2.5 to 6.0	1K	96	24	Plastic miniflat	64
μPD7502G-12	Microcomputer with LCD controller/driver	0.4	2.7 to 6.0	2K	128	23	Plastic miniflat	64
μPD7503G-12	Microcomputer with LCD controller/driver	0.4	2.7 to 6.0	4K	224	23	Plastic miniflat	64
μPD7506C	Microcomputer	0.4	2.5 to 6.0	1K	64	22	Plastic DIP	28
μPD7506CT	Microcomputer	0.4	2.5 to 6.0	1K	64	22	Plastic shrink DIP	28
μPD7506G-00	Microcomputer	0.4	2.5 to 6.0	1K	64	22	Plastic miniflat	52
μPD7507C	Microcomputer	0.4	2.5 to 6.0	2K	128	32	Plastic DIP	40
μPD7507CU	Microcomputer	0.4	2.5 to 6.0	2K	128	32	Plastic shrink DIP	40
μPD7507G-00	Microcomputer	0.4	2.5 to 6.0	2K	128	32	Plastic miniflat	52
μPD7507HC	Microcomputer	4.19	2.7 to 6.0	2K	128	32	Plastic DIP	40
μPD7507HCU	Microcomputer	4.19	2.7 to 6.0	2K	128	32	Plastic shrink DIP	40
μPD7507HG-22	Microcomputer	4.19	2.7 to 6.0	2K	128	32	Plastic miniflat	44
μPD7507SC	Microcomputer	0.4	2.2 to 6.0	2K	128	20	Plastic DIP	28
μPD7507SCT	Microcomputer	0.4	2.2 to 6.0	2K	128	20	Plastic shrink DIP	28
μPD7508C	Microcomputer	0.4	2.5 to 6.0	4K	224	32	Plastic DIP	40
μPD7508CU	Microcomputer	0.4	2.5 to 6.0	4K	224	32	Platic shrink DIP	40
μPD7508G-00	Microcomputer	0.4	2.5 to 6.0	4K	224	32	Plastic miniflat	52
μPD75CG08E	Piggyback EPROM microcomputer	0.4	4.5 to 5.5	4K	224	32	Ceramic DIP	40
μPD7508HC	Microcomputer	4.19	2.7 to 6.0	4K	224	32	Plastic DIP	40

4-Bit, Single-Chip CMOS Microcomputers (cont)

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X4)	I/O	Package	Pins
μPD7508HCU	Microcomputer	4.19	2.7 to 6.0	4K	224	32	Plastic shrink DIP	40
μPD7508HG-22	Microcomputer	4.19	2.7 to 6.0	4K	224	32	Plastic miniflat	44
μPD75CG08HE	Piggyback EPROM microcomputer	4.19	4.5 to 5.5	4K	224	32	Ceramic DIP	40
μPD7508AC	Microcomputer with FIP driver	0.4	2.7 to 5.5	4K	208	32	Plastic DIP	40
μPD7514G-12	Microcomputer with LCD controller/driver	0.5	2.7 to 6.0	4K	256	31	Plastic miniflat	80
μPD7516HG-12	Microcomputer with FIP controller/driver	6.55	2.5 to 6.0	6K	256	53	Plastic miniflat	64
μPD7516HG-36	Microcomputer with FIP controller/driver	6.55	2.5 to 6.0	6K	256	53	Plastic QUIP	64
μPD7516HCW	Microcomputer with FIP controller/driver	6.55	2.5 to 6.0	6K	256	53	Plastic shrink DIP	64
μPD75CG16HE	Piggyback EPROM microcomputer with FIP controller/driver	6.55	4.5 to 5.5	6K	256	53	Ceramic QUIP	64
μPD7519G-12	Microcomputer with FIP controller/driver	4.19	2.5 to 6.0	4K	256	53	Plastic miniflat	64
μPD7519G-36	Microcomputer with FIP controller/driver	4.19	2.5 to 6.0	4K	256	53	Plastic QUIP	64
μPD7519CW	Microcomputer with FIP controller/driver	4.19	2.5 to 6.0	4K	256	53	Plastic shrink DIP	64
μPD75CG19E	Piggyback EPROM microcomputer with FIP controller/driver	4.19	4.5 to 5.5	4K	256	53	Ceramic DIP	64
μPD7519HG-12	Microcomputer with FIP controller/driver	6.55	2.5 to 6.0	4K	256	53	Plastic miniflat	64
μPD7519HG-36	Microcomputer with FIP controller/driver	6.55	2.5 to 6.0	4K	256	53	Plastic QUIP	64
μPD7519HCW	Microcomputer with FIP controller/driver	6.55	2.5 to 6.0	4K	256	53	Plastic shrink DIP	64
μPD75CG19HE	Piggyback EPROM microcomputer with FIP controller/driver	6.55	4.5 to 5.5	4K	256	53	Ceramic DIP	64
μPD7527AC	Microcomputer with FIP display	0.6	2.7 to 6.0	2K	128	35	Plastic DIP	42
μPD7527ACU	Microcomputer with FIP display	0.6	2.7 to 6.0	2K	128	35	Plastic shrink DIP	42
μPD7528AC	Microcomputer with FIP display	0.6	2.7 to 6.0	4K	160	35	Plastic DIP	42
μPD7528ACU	Microcomputer with FIP display	0.6	2.7 to 6.0	4K	160	35	Plastic shrink DIP	42
μPD75CG28E	Piggyback EPROM microcomputer with FIP display	0.5	4.5 to 5.5	4K	160	35	Ceramic DIP	42
μPD7533C	Microcomputer with A/D converter	0.5	2.7 to 6.0	4K	160	34	Plastic DIP	42

4-Bit, Single-Chip CMOS Microcomputers (cont)

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X4)	I/O	Package	Pins
μPD7533CU	Microcomputer with A/D converter	0.5	2.7 to 6.0	4K	160	34	Plastic shrink DIP	42
μPD7533G-22	Microcomputer with A/D converter	0.5	2.7 to 6.0	4K	160	34	Plastic miniflat	44
μPD75CG33E	Piggyback EPROM microcomputer with A/D converter	0.5	4.5 to 5.5	4K	160	34	Ceramic DIP	42
μPD7537AC	Microcomputer with FIP driver	0.6	2.7 to 6.0	2K	128	35	Plastic DIP	42
μPD7537ACU	Microcomputer with FIP driver	0.6	2.7 to 6.0	2K	128	35	Plastic shrink DIP	42
μPD7538AC	Microcomputer with FIP driver	0.6	2.7 to 6.0	4K	160	35	Plastic DIP	42
μPD7538ACU	Microcomputer with FIP driver	0.6	2.7 to 6.0	4K	160	35	Plastic shrink DIP	42
μPD75CG38E	Piggyback EPROM microcomputer with FIP driver	0.5	4.5 to 5.5	4K	160	35	Ceramic DIP	42
μPD7554CS	Microcomputer with serial I/O	0.7	2.5 to 6.0	1K	64	16	Plastic shrink DIP	20
μPD7554G	Microcomputer with serial I/O	0.7	2.5 to 6.0	1K	64	16	Plastic SO	20
μPD7556CS	Microcomputer with comparator	0.7	2.5 to 6.0	1K	64	20	Plastic shrink DIP	24
μPD7556G	Microcomputer with comparator	0.7	2.5 to 6.0	1K	64	20	Plastic SO	24
μPD7564CS	Microcomputer with serial I/O	0.7	2.7 to 6.0	1K	64	15	Plastic shrink DIP	20
μPD7564G	Microcomputer with serial I/O	0.7	2.7 to 6.0	1K	64	15	Plastic SO	20
μPD7566CS	Microcomputer with comparator	0.7	2.7 to 6.0	1K	64	19	Plastic shrink DIP	24
μPD7566G	Microcomputer with comparator	0.7	2.7 to 6.0	1K	64	19	Plastic SO	24
μPD75P54CS011	Microcomputer with on-chip OTPROM with RC clock	0.7	2.5 to 6.0	1K	64	16	Plastic shrink DIP	20
μPD75P54CS012	Microcomputer with on-chip OTPROM with external clock	0.7	2.5 to 6.0	1K	64	16	Plastic shrink DIP	20
μPD75P54G511	Microcomputer with on-chip OTPROM with RC clock	0.7	2.5 to 6.0	1K	64	16	Plastic small outline	20
μPD75P54G512	Microcomputer with on-chip OTPROM with external clock	0.7	2.5 to 6.0	1K	64	16	Plastic small outline	20
μPD75P64CS011	Microcomputer with on-chip OTPROM with ceramic clock	0.7	2.5 to 6.0	1K	64	15	Plastic small outline	20

4-Bit, Single-Chip CMOS Microcomputers (cont)

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X4)	I/O	Package	Pins
μPD75P64G512	Microcomputer with on-chip OTPROM with ceramic clock	0.7	2.5 to 6.0	1K	64	15	Plastic small outline	20
μPD75104CW	Microcomputer	4.19	2.5 to 6.0	4K	320	58	Plastic shrink DIP	64
μPD75104G-1B	Microcomputer	4.19	2.5 to 6.0	4K	320	58	Plastic miniflat	64
μPD75106CW	Microcomputer	4.19	2.5 to 6.0	(6016)	320	58	Plastic shrink DIP	64
μPD75106G-1B	Microcomputer	4.19	2.5 to 6.0	(6016)	320	58	Plastic miniflat	64
μPD75108CW	Microcomputer	4.19	2.5 to 6.0	8K	512	58	Plastic shrink DIP	64
μPD75108G-1B	Microcomputer	4.19	2.5 to 6.0	8K	512	58	Plastic miniflat	64
μPD75P108CW	Microcomputer with on-chip OTPROM	4.19	2.5 to 6.0	8K	512	58	Plastic shrink DIP	64
μPD75P108DW	Microcomputer with on-chip EPROM	4.19	2.5 to 6.0	8K	512	58	Plastic shrink DIP	64
μPD75P108G-1B	Microcomputer with on-chip OTPROM	4.19	2.5 to 6.0	8K	512	58	Plastic miniflat	64
μPD75206CW	Microcomputer with FIP driver	4.19	2.7 to 6.0	6K	369	55	Plastic shrink DIP	64
μPD75206G	Microcomputer with FIP driver	4.19	2.7 to 6.0	6K	369	55	Plastic miniflat	64
μPD75208CW	Microcomputer with FIP driver	4.19	2.7 to 6.0	8K	497	55	Plastic shrink DIP	64
μPD75208G	Microcomputer with FIP driver	4.19	2.7 to 6.0	8K	497	55	Plastic miniflat	64
μPD75216CW	Microcomputer with FIP driver	4.19	2.7 to 6.0	16K	512	55	Plastic shrink DIP	80
μPD75216AGF	Microcomputer with FIP driver	4.19	2.7 to 6.0	16K	512	55	Plastic miniflat	80
μPD75CG08E	Piggyback EPROM with FIP driver	4.19	4.5 to 5.5	8K	497	55	Ceramic DIP	64
μPD75308GF	Microcomputer with LCD driver	4.19	2.7 to 6.0	8K	512	32	Plastic miniflat	80
μPD75P308K	LCC EPROM with LCD	4.19	2.7 to 6.0	8K	512	32	Ceramic DIP	80
μPD75P308GF	Microcomputer with on-chip EPROM with LCD	4.19	2.7 to 6.0	8K	512	32	Plastic miniflat	80

8-Bit, Single-Chip NMOS/CMOS Microcomputers

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X8)	I/O	Package	Pins
μPD7807CW	NMOS microcomputer with comparator	12	4.5 to 5.5	External	256	28	Plastic shrink DIP	64
μPD7807G-36	NMOS microcomputer with comparator	12	4.5 to 5.5	External	256	28	Plastic QUIP	64
μPD7808CW	NMOS microcomputer with comparator	12	4.5 to 5.5	4K	256	40	Plastic shrink DIP	64
μPD7808G-36	NMOS microcomputer with comparator	12	4.5 to 5.5	4K	256	40	Plastic QUIP	64
μPD7809CW	NMOS microcomputer with comparator	12	4.5 to 5.5	8K	256	40	Plastic shrink DIP	64
μPD7809G-36	NMOS microcomputer with comparator	12	4.5 to 5.5	8K	256	40	Plastic QUIP	64
μPD78P09R	NMOS microcomputer with comparator	12	4.5 to 5.5	EPROM 8K	256	40	Ceramic QUIP with window	64
μPD78C10CW	CMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	32	Plastic shrink DIP	64
μPD78C10G-1B	CMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	32	Plastic miniflat	64
μPD78C10G-36	CMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	32	Plastic QUIP	64
μPD78C10L	CMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	32	PLCC	68
μPD7810HCW	NMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	32	Plastic shrink DIP	64
μPD7810HG-36	NMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	32	Plastic QUIP	64
μPD7811HCW	NMOS microcomputer with A/D converter	15	4.5 to 5.5	4K	256	44	Plastic shrink DIP	64
μPD7811HG-36	CMOS microcomputer with A/D converter	15	4.5 to 5.5	4K	256	44	Plastic QUIP	64
μPD78C11CW	CMOS microcomputer with A/D converter	15	4.5 to 5.5	4K	256	44	Plastic shrink DIP	64
μPD78C11G-36	CMOS microcomputer with A/D converter	15	4.5 to 5.5	4K	256	44	Plastic miniflat	64
μPD78C11G-36	CMOS microcomputer with A/D converter	15	4.5 to 5.5	4K	256	44	Plastic QUIP	64
μPD78C11L	CMOS microcomputer with A/D converter	15	4.5 to 5.5	4K	256	44	PLCC	68

8-Bit, Single-Chip NMOS/CMOS Microcomputers (cont)

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X8)	I/O	Package	Pins
μPD78PG11E	Piggyback EPROM NMOS microcomputer with A/D converter	12	4.5 to 5.5	4K	256	44	Ceramic QUIP	64
μPD78PG11HE	Piggyback EPROM NMOS microcomputer with A/D converter	15	4.5 to 5.5	4K	256	44	Ceramic QUIP	64
μPD78C14CW	CMOS microcomputer with A/D converter	15	4.5 to 5.5	16K	256	44	Plastic shrink DIP	64
μPD78C14G-1B	CMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	44	Plastic miniflat	64
μPD78C14G-36	CMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	44	Plastic QUIP	64
μPD78C14L	CMOS microcomputer with A/D converter	15	4.5 to 5.5	External	256	44	PLCC	68
μPD78310CW	CMOS microcomputer	12	4.5 to 5.5	External	256	28	Plastic shrink DIP	64
μPD78310G-1B	CMOS microcomputer	12	4.5 to 5.5	External	256	28	Plastic miniflat	64
μPD78310G-36	CMOS microcomputer	12	4.5 to 5.5	External	256	28	Plastic QUIP	64
μPD78310L	CMOS microcomputer	12	4.5 to 5.5	External	256	28	PLCC	68
μPD78312CW	CMOS microcomputer	12	4.5 to 5.5	8K	256	40	Plastic shrink DIP	64
μPD78312G-1B	CMOS microcomputer	12	4.5 to 5.5	8K	256	40	Plastic miniflat	64
μPD78312G-36	CMOS microcomputer	12	4.5 to 5.5	8K	256	40	Plastic QUIP	64
μPD78312L	CMOS microcomputer	12	4.5 to 5.5	8K	256	40	PLCC	68
μPD78P312G-36	EPROM microcomputer	12	4.5 to 5.5	8K	256	40	Plastic QUIP	64
μPD8035HLC	HMOS microcomputer	6	4.5 to 5.5	External	64	27	Plastic DIP	40
μPD8039HLC	HMOS microcomputer	11	4.5 to 5.5	External	128	27	Plastic DIP	40
μPD80C39HC	CMOS microcomputer	12	2.5 to 6.0	External	128	27	Plastic DIP	40
μPD80C40HC	CMOS microcomputer	12	2.5 to 6.0	External	256	27	Plastic DIP	40
μPD8041AHC	NMOS microcomputer with universal PPI	11	4.5 to 5.5	1K	64	18	Plastic DIP	40
μPD80C42C	CMOS microcomputer with universal PPI	12	4.5 to 5.5	2K	128	18	Plastic DIP	40
μPD80C42G-22	CMOS microcomputer with universal PPI	12	4.5 to 5.5	2K	128	18	Plastic miniflat	44
μPD8048HC	HMOS microcomputer	6	4.5 to 5.5	1K	64	27	Plastic DIP	40
μPD80C48G-00	CMOS microcomputer	6	2.5 to 6.0	1K	64	27	Plastic miniflat	52
μPD48G-22	CMOS microcomputer	6	2.5 to 6.0	1K	64	27	Plastic miniflat	44
μPD8049HC	HMOS microcomputer	11	4.5 to 5.5	2K	128	27	Plastic DIP	40
μPD80C49HC	CMOS microcomputer	12	2.5 to 6.0	2K	128	27	Plastic DIP	40
μPD80C49G-00	CMOS microcomputer	12	2.5 to 6.0	2K	128	27	Plastic miniflat	52
μPD49HG-22	CMOS microcomputer	12	2.5 to 6.0	2K	128	27	Plastic miniflat	44

8-Bit, Single-Chip NMOS/CMOS Microcomputers (cont)

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X8)	I/O	Package	Pins
μPD80C50HC	CMOS microcomputer	12	2.5 to 6.0	4K	256	27	Plastic DIP	40
μPD50HG-22	CMOS microcomputer	12	2.5 to 6.0	4K	256	27	Plastic miniflat	44
μPD8741AD	NMOS microcomputer with universal PPI	6	4.5 to 5.5	1K	64	18	Cerdip with window	40
μPD8748HC	NMOS microcomputer with UV EPROM	11	4.5 to 5.5	1K	64	27	Plastic DIP	40
μPD8748HD	NMOS microcomputer with UV EPROM	11	4.5 to 5.5	1K	64	27	Cerdip with window	40
μPD8749HC	HMOS microcomputer	11	4.5 to 5.5	2K	128	27	Plastic DIP	40
μPD8749HD	HMOS microcomputer	11	4.5 to 5.5	2K	128	27	Cerdip with window	40

16-Bit, Single-Chip CMOS Microcomputers

Device	Description	Clock (MHz)	Supply Voltage (V)	ROM (X8)	RAM (X8)	I/O	Package	Pins
μPD70320L	CMOS microcomputer, ROM-less	5	4.5 to 5.5	—	256	32	PLCC	84
μPD70320L-8	CMOS microcomputer, ROM-less	8	4.5 to 5.5	—	256	32	PLCC	84
μPD70320GJ	CMOS microcomputer, ROM-less	5	4.5 to 5.5	—	256	32	Plastic miniflat	94
μPD70320GJ-8	CMOS microcomputer, ROM-less	8	4.5 to 5.5	—	256	32	Plastic miniflat	94
μPD70322L	CMOS microcomputer, mask ROM	5	4.5 to 5.5	16K	256	32	PLCC	84
μPD70322L-8	CMOS microcomputer, mask ROM	8	4.5 to 5.5	16K	256	32	PLCC	84
μPD70322GJ	CMOS microcomputer, mask ROM	5	4.5 to 5.5	16K	256	32	Plastic miniflat	94
μPD70322GJ-8	CMOS microcomputer, mask ROM	8	4.5 to 5.5	16K	256	32	Plastic miniflat	94
μPD70P322L	CMOS microcomputer, OTP EPROM	5	4.5 to 5.5	16K	256	32	PLCC	84
μPD70P322K	CMOS microcomputer, UV erasable EPROM	5	4.5 to 5.5	16K	256	32	Ceramic LCC	84

CMOS LCD Controller/Drivers

Device	Description	No. of Rows	No. of Column	Clock (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
μPD6307G-F	LCD row driver	32	—	2.5	4.5 to 5.5	1	—	Plastic miniflat	54
μPD6307G-R	LCD row driver	32	—	2.5	4.5 to 5.5	1	—	Plastic miniflat, reverse leads	54
μPD6308G-F	LCD column driver	—	40	2	4.5 to 5.5	1.2	—	Plastic miniflat	54
μPD6308G-R	LCD column driver	—	40	2	4.5 to 5.5	1.2	—	Plastic miniflat, reverse leads	54
μPD7225G-00	LCD controller/driver	4	32	0.2	2.7 to 5.5	0.1	—	Plastic miniflat	52
μPD7227G-12	LCD controller/driver	8	40	1	+5	0.2	—	Plastic miniflat	64
μPD7228G-12	LCD controller/driver	8/16	42/50	1.1	+5	0.2	0.02	Plastic miniflat	80
μPD72030G-12	LCD display controller	—	—	6	+5	5	0.001	Plastic miniflat	64

μPD7500 Series Hardware Development Tools

Part Number	Emulator	Add-On Board (Required)	System Evaluation Board	EPROM Device
μPD7501	EVAKIT-7500B	EV7514	SE-7514A	—
μPD7502	EVAKIT-7500B	EV7514	SE-7514A	—
μPD7503	EVAKIT-7500B	EV7514	SE-7514A	—
μPD7506	EVAKIT-7500B	—	SE-7508	—
μPD7507	EVAKIT-7500B	—	—	μPD75CG08E
μPD7507H	EVAKIT-7500B	EV7508H	—	μPD75CG08HE
μPD7507S	EVAKIT-7500B	—	SE-7508	—
μPD7508	EVAKIT-7500B	—	—	μPD75CG08E
μPD7508A	EVAKIT-7500B	—	SE-7508	—
μPD7508H	EVAKIT-7500B	EV7508H	—	μPD75CG08HE
μPD7514	EVAKIT-7500B	EV7514	SE-7514A	—
μPD7516H	EVAKIT-7500B	EV7500FIP	—	μPD75CG16HE
μPD7519	EVAKIT-7500B	EV7500FIP	—	μPD75CG19E
μPD7519H	EVAKIT-7500B	EV7500FIP	—	μPD75CG19HE
μPD7527	EVAKIT-7500B	EV7528	—	μPD75CG28E
μPD7528	EVAKIT-7500B	EV7528	—	μPD75CG28E
μPD7533	EVAKIT-7500B	EV7533	—	μPD75CG33E
μPD7537	EVAKIT-7500B	EV7528	—	μPD75CG38E
μPD7538	EVAKIT-7500B	EV7528	—	μPD75CG38E
μPD7554	EVAKIT-7500B	EV7554A	SE-7554A	μPD75P54
μPD7556	EVAKIT-7500B	EV7554A	SE-7554A	—
μPD7564	EVAKIT-7500B	EV7554A	SE-7554A	μPD75P64
μPD7566	EVAKIT-7500B	EV7554A	SE-7554A	—

μPD75000 Series Hardware Development Tools

Part Number	Emulator	Add-on Board (Required)	Emulation Probe (Required)
μD75104CW	EVAKIT-75X	EV-75108	—
μD75106CW	EVAKIT-75X	EV-75108	—
μD75108CW	EVAKIT-75X	EV-75108	—
μD75104G	EVAKIT-75X	EV-75108	EP-75108G
μD75106G	EVAKIT-75X	EV-75108	EP-75108G
μD75108G	EVAKIT-75X	EV-75108	EP-75108G
μD75206CW	EVAKIT-75X	EV-75216A	—
μD75208CW	EVAKIT-75X	EV-75216A	—
μD75206G	EVAKIT-75X	EV-75216A	EP-75216AG
μD75208G	EVAKIT-75X	EV-75216A	EP-75216AG
μD75216ACW	EVAKIT-75X	EV-75216A	—
μD75216AG	EVAKIT-75X	EV-75216A	EP-75216AG
μD75308G-F	EVAKIT-75X	EV-75308	—

μPD7800 Series Hardware Development Tools

Part Number	Emulator	Real-time Trace Board	Add-on Board	System Evaluation Board	EPROM Device	Software (Note 2) Absolute Assembler	Software (Note 2) Relocatable Assembler
μPD78C05A	EVAKIT-87LC [Note 1]	EV87LCRTT	EV78C06A	SE-78C06	—	ASM87-XXX	RA87-XXX
μPD78C06A	EVAKIT-87LC	EV87LCRTT	EV78C06A	SE-78C06	—	ASM87-XXX	RA87-XXX
μPD7807	IE-7809-M	—	—	—	μPD78P09R	—	RA87-XXX
μPD7808	IE-7809-M	—	—	—	μPD78P09R	—	RA87-XXX
μPD7809	IE-7809-M	—	—	—	μPD78P09R	—	RA87-XXX
μPD7810	EVAKIT-87AD [Note 1]	EV87ADRTT	—	—	—	ASM87-XXX	RA87-XXX
	IE-87AD-M	—	—	—	—	ASM87-XXX	RA87-XXX
μPD7810H	IE-7811H	—	—	—	—	ASM87-XXX	RA87-XXX
μPD7811	EVAKIT-87AD [Note 1]	EV87ADRTT	—	—	μPD78PG11E	ASM87-XXX	RA87-XXX
	IE-87AD-M	—	—	—	μPD78PG11E	ASM87-XXX	RA87-XXX
μPD7811H	IE-7811H	—	—	—	μPD78PG11HE	ASM87-XXX	RA87-XXX
μPD78C10/11	IE-78C11-M	—	—	—	μPD78CG14E	—	RA87-XXX
μPD78C14	IE-78C11-M	—	—	—	μPD78CG14E	—	RA87-XXX

Notes:

(1) Addresses 0-0FFFH access memory on the Evakit only.

(2) Software can be supplied on a variety of media as defined by the suffix "XXX" [i.e. XXX = D52 (MS-DOS 5-1/4" diskette), XXX = M81 (CPM-86 8" diskette), XXX = U81 (ISIS-II 8" diskette), XXX = F9T (Fortran IV ANSI 1966 x 3.9 for mainframes) plus many others.]

(3) μPD7800 Series additional tools: product number DDK-78C10 - Design/development kit for the 78C10/C11/C14 and 7810H/11H

(4) 7800 Series Development Systems are also available from Tektronix, Inc. (503) 629-1143 and Sophia Systems 1-800-824-9294.

μPD78000 Series Hardware Development Tools

Device	Description
IE-310-R	Stand-alone in-circuit emulator
DDK-78310	Design/development kit

μPD70320/322 (V25) Hardware Development Tools

Device	Description
IE-70320	Portable stand-alone in-circuit emulator
EBIBM-V25 MINI-IE	PC based mini ICE for 70320 (V25)

μPD8048 Series Hardware Development Tools

Part Number	Emulator	System Evaluation Board	EPROM Device
μPD8035H	EVAKIT-84C-1	—	—
μPD8048H	EVAKIT-84C-1	—	μPD8748H (Note 1)
μPD8039H	EVAKIT-84C-1	—	—
μPD8049H	EVAKIT-84C-1	—	μPD8749H (Note 1)
μPD80C39H	EVAKIT-84C-1	—	—
μPD80C48	EVAKIT-84C-1	SE-80C50H	—
μPD80C35	EVAKIT-84C-1	—	—
μPD80C49H	EVAKIT-84C-1	SE-80C50H	—
μPD80C40H	EVAKIT-84C-1	—	—
μPD80C50H	EVAKIT-84C-1	SE-80C50H	—
μPD80C42	EVAKIT-80C42	—	μPD8741A

Note:

(1) μPD8748H and μPD8749H are both available in erasable windowed packages or in the economical one time programmable plastic package.

EV-9001/EV-9002 Conversion Boards

Conversion Board	Function
EV-9001-64	64-pin QUIP to 64-pin shrink DIP
EV-9002-42	42-pin standard DIP to 42-pin shrink DIP
EV-9002-40	40-pin standard DIP to 40-pin shrink DIP
EV-9002-28	28-pin standard DIP to 28-pin shrink DIP
EV-9200G-64	64-pin LCC to miniflat conversion
EV-9200G-80	80-pin LCC socket with 80-pin miniflat leads

MD-086 Series Microcomputer Development Systems

Device	Description
MD-086FD-10	MD-086 series, floppy-disk based system
MD-086HD-10	MD-086 series, floppy-hard-disk based system
MD-086DK	Hard-disk upgrade for MD-086FD-10
MD-910TM	Character display terminal

MD-910TM Character Display Terminal Development System

Device	Description
MD-910TM	Character display terminal

PG1000 PROM Programmers

Device	Description
PG1000	Main frame programmer
PG1003	Plug-in personality module
PG1005A	Plug-in personality module for 755X/75X OTP devices
PG2000	Main frame programmer
PA-75P54/64CS	Program adapter for μD75P54/64
PA-75P108G	Program adapter for μD75P108G-1B
PA-75P108CW	Program adapter for μD75P108CW/DW
PA-75P308K	Program adapter for μD75P308K
PA-75P308G	Program adapter for μD75P308G-F

NEC

MICROPROCESSOR PRODUCTS

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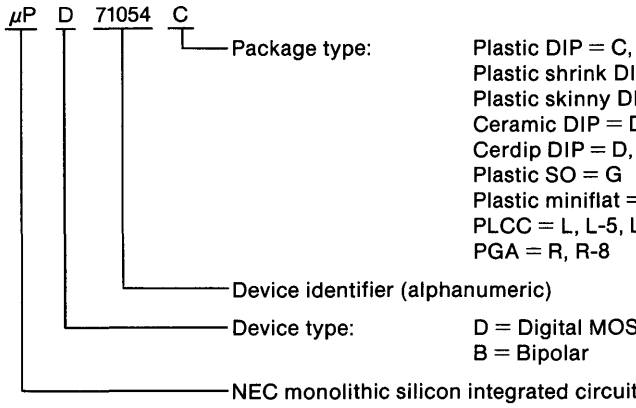
Section 5 — Microprocessor Products **Page**

Part Numbering System



CMOS Microprocessors

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation		Package	Pins
					Active (mA) (typ)	Standby (mA)		
μPD70008C	Microprocessor (CMOS Z80)	8	4	+5	30	.5	Plastic DIP	40
μPD70008AC-4	Microprocessor (CMOS Z80)	8	4	+5	30	.4	Plastic DIP	40
μPD70008AG-4	Microprocessor (CMOS Z80)	8	4	+5	30	.4	Plastic miniflat	44
μPD70008AL-4	Microprocessor (CMOS Z80)	8	4	+5	30	.4	PLCC	44
μPD70008AC-6	Microprocessor (CMOS Z80)	8	6	+5	30	.4	Plastic DIP	40
μPD70008AG-6	Microprocessor (CMOS Z80)	8	6	+5	30	.4	Plastic miniflat	44
μPD70008AL-6	Microprocessor (CMOS Z80)	8	6	+5	30	.4	PLCC	44
μPD70008AC-8	Microprocessor (CMOS Z80)	8	8	+5	30	.4	Plastic DIP	40
μPD70008AG-8	Microprocessor (CMOS Z80)	8	8	+5	30	.4	Plastic miniflat	44
μPD70008AL-8	Microprocessor (CMOS Z80)	8	8	+5	30	.4	PLCC	44
μPD70108C-5	Microprocessor	8/16	5	+5	45	6	Plastic DIP	40
μPD70108C-8	Microprocessor	8/16	8	+5	45	6	Plastic DIP	40
μPD70108C-10	Microprocessor	8/16	10	+5	45	6	Plastic DIP	40
μPD70108D-5	Microprocessor	8/16	5	+5	45	6	Ceramic DIP	40
μPD70108D-8	Microprocessor	8/16	8	+5	45	6	Ceramic DIP	40
μPD70108D-10	Microprocessor	8/16	10	+5	45	6	Ceramic DIP	40
μPD70108G-5	Microprocessor	8/16	5	+5	45	6	Plastic miniflat	52
μPD70108G-8	Microprocessor	8/16	8	+5	45	6	Plastic miniflat	52

CMOS Microprocessors (cont)

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation		Package	Pins
					Active (mA) (typ)	Standby (mA)		
μPD70108L-5	Microprocessor	8/16	5	+5	45	6	PLCC	44
μPD70108L-8	Microprocessor	8/16	8	+5	45	6	PLCC	44
μPD70116C-5	Microprocessor	16	5	+5	45	6	Plastic DIP	40
μPD70116C-8	Microprocessor	16	8	+5	45	6	Plastic DIP	40
μPD70116C-10	Microprocessor	16	10	+5	45	6	Plastic DIP	40
μPD70116D-5	Microprocessor	16	5	+5	45	6	Ceramic DIP	40
μPD70116D-8	Microprocessor	16	8	+5	45	6	Ceramic DIP	40
μPD70116D-10	Microprocessor	16	10	+5	45	6	Ceramic DIP	40
μPD70116G-5	Microprocessor	16	5	+5	45	6	Plastic miniflat	52
μPD70116G-8	Microprocessor	16	8	+5	45	6	Plastic miniflat	52
μPD70116L-5	Microprocessor	16	5	+5	45	6	PLCC	44
μPD70116L-8	Microprocessor	16	8	+5	45	6	PLCC	44
μPD70208R-8	Microprocessor	8/16	8	+5	50	10	PGA	68
μPD70208R-10	Microprocessor	8/16	10	+5	50	10	PGA	68
μPD70208L-8	Microprocessor	8/16	8	+5	50	10	PLCC	68
μPD70208L-10	Microprocessor	8/16	10	+5	50	10	PLCC	68
μPD70208G-8	Microprocessor	8/16	8	+5	50	10	Plastic miniflat	80
μPD70216R-8	Microprocessor	16/16	8	+5	50	10	PGA	68
μPD70216R-10	Microprocessor	16/16	10	+5	50	10	PGA	68
μPD70216L-8	Microprocessor	16/16	8	+5	50	10	PLCC	68
μPD70216L-10	Microprocessor	16/16	10	+5	50	10	PLCC	68
μPD70216G-8	Microprocessor	16/16	8	+5	50	10	Plastic miniflat	80
μPD70616R-16	Microprocessor	16/32	16	+5	200	NA	PGA	68
μPD70632R-20	Microprocessor	32/32	20	+5	200	NA	PGA	132

NMOS and HMOS Microprocessors

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation		Package	Pins
					Active (mA)	Standby (mA)		
μPD780C	NMOS Microprocessor	8	2.5	+5	150	—	Plastic DIP	40
μPD780C-1	NMOS Microprocessor	8	4	+5	200	—	Plastic DIP	40
μPD780C-2	NMOS Microprocessor	8	6	+5	200	—	Plastic DIP	40
μPD8085AC-2	NMOS Microprocessor	8	5	+5	170	—	Plastic DIP	40
μPD8085AHC	HMOS Microprocessor	8	3	+5	135	—	Plastic DIP	40
μPD8085AHC-2	HMOS Microprocessor	8	5	+5	135	—	Plastic DIP	40
μPD8086D	HMOS Microprocessor	16	5	+5	340	—	Ceramic DIP	40
μPD8086D	HMOS Microprocessor	16	5	+5	340	—	Cerdip	40
μPD8086D-2	HMOS Microprocessor	16	8	+5	350	—	Cerdip	40
μPD8088D	HMOS Microprocessor	8	5	+5	340	—	Ceramic DIP	40
μPD8088D-2	HMOS Microprocessor	8	8	+5	350	—	Ceramic DIP	40

Digital Signal Processor and Speech

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation		Package	Pins
					Active (mA)	Standby (mA)		
μPD7281D	NMOS Image Pipelined Processor	16	5	+5	500	—	Ceramic DIP	40
μPD9305R	CMOS IMPP Support Chip	8/16	10	+5	100	—	PGA	132
μPD7720AC	NMOS Digital Signal Processor	16	8	+5	120	—	Plastic DIP	28
μPD7720AD	NMOS Digital Signal Processor	16	8	+5	120	—	Ceramic DIP	28
μPD7720D	NMOS Digital Signal Processor	16	8	+5	180	—	Ceramic DIP	28
μPD77C20AC	CMOS Digital Signal Processor	16	8	+5	24	—	Plastic DIP	28
μPD77C20AL	CMOS Digital Signal Processor	16	8	+5	24	—	PLCC	44
μPD77P20D	NMOS/EPROM Digital Signal Processor	16	8	+5	270	—	Cerdip	28
μPD77C25C	CMOS Digital Signal Processor	16	8	+5	24	12	Plastic DIP	28
μPD77C25L	CMOS Digital Signal Processor	16	8	+5	24	12	PLCC	28
μPD7761D	NMOS Speech Analyzer	—	2/8	+5	180	—	Ceramic DIP	28
μPD7762G-36	NMOS Speech Recognition System Controller	—	4	+5	110	—	QUIP	64
MC4760C	Hybrid Speech Analog Interface	—	2	+5, +12, −12	200	—	Plastic DIP	24
μPD7763C	CMOS Speech Spectrum Analyzer	8	4	+5	35	—	Plastic DIP	28

Digital Signal Processor and Speech (cont)

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
μPD7764D	NMOS Speech Recognition	16	8	+5	280	—	Ceramic DIP	40
μPD77230R	CMOS Advanced Signal Processor	32	13.3	+5	160	—	PGA	68
μPD7730C	NMOS ADPCM Speech Encoder/Decoder	8	8	+5	210	—	Plastic DIP	28
μPD77C30C	CMOS ADPCM Speech Encoder/Decoder	8	8	+5	210	—	Plastic DIP	28
μPD7755C	CMOS ADPCM Speech Synthesizer	—	.7	2.7 to 5.5	0.6	—	Plastic DIP	18
μPD7756C	CMOS ADPCM Speech Synthesizer	—	.7	2.7 to 5.5	0.6	—	Plastic DIP	18
μPD7759C	CMOS ADPCM Speech Synthesizer	—	.7	2.7 to 5.5	0.6	—	Plastic DIP	40

Intelligent Peripheral Controllers

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
Magnetic Media Controllers								
μPD765AC	NMOS Single/ Double Density FDC	8	8	+5	150	—	Plastic DIP	40
μPD765AC-2	NMOS Single/ Double Density FDC	8	8	+5	150	—	Plastic DIP	40
μPD7265C	NMOS Single/ Double Density FDC	8	8	+5	150	—	Plastic DIP	40
μPD7265C-2	NMOS Single/ Double Density FDC	8	8	+5	150	—	Plastic DIP	40
μPD72065C	CMOS Single/ Double Density FDC	8	8	+5	10	.5	Plastic DIP	40
μPD72065G	CMOS Single/ Double Density FDC	8	8	+5	10	.5	Plastic Miniflat	52
μPD72065L	CMOS Single/ Double Density FDC	8	8	+5	10	.5	PLCC	44
μPD72066C	CMOS Single/ Double Density FDC	8	8	+5	10	.5	Plastic DIP	40
μPD72066G	CMOS Single/ Double Density FDC	8	8	+5	10	.5	Plastic Miniflat	52
μPD72066L	CMOS Single/ Double Density FDC	8	8	+5	10	.5	PLCC	44
μPB9201C	Bipolar Floppy Disk Interface	—	16	+5	270	—	Plastic DIP	40

Intelligent Peripheral Controllers (cont)

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
Magnetic Media Controllers [cont]								
μPD71065G	CMOS Analog Phase-Locked Loop	—	19.2	+5	25	—	Plastic SO	28
μPD71066CT	CMOS Analog Phase-Locked Loop	—	19.2	+5	25	—	Plastic Shrink DIP	30
μPD7261AD	NMOS Hard Disk Controller	8	12	+5	320	—	Ceramic DIP	40
μPD7261BD-18	NMOS Hard Disk Controller	8	18	+5	320	—	Ceramic DIP	40
μPD7261BD-23	NMOS Hard Disk Controller	8	23	+5	320	—	Ceramic DIP	40
μPD9306C	CMOS Hard Disk Interface	—	10	+5	30	—	Plastic DIP	28
μPD7262D	NMOS ESDI Controller	8	18	+5	320	—	Ceramic DIP	40
Communications Controllers								
μPD7201AC	NMOS MPS Communications Controller	8	4	+5	230	—	Plastic DIP	40
μPD7201AD	NMOS MPS Communications Controller	8	4	+5	230	—	Ceramic DIP	40
μPD72001C	CMOS MPS Communications Controller	8	8	+5	40	2	Plastic DIP	40
μPD72001L	CMOS MPS Communications Controller	8	8	+5	40	2	PLCC	44
μPD72105C	CMOS Omninet Local Network Controller	8	8	+5	40	2	Plastic DIP	48
μPD72105L	CMOS Omninet Local Network Controller	8	8	+5	40	2	PLCC	52
μPD7210C	NMOS Intelligent GPIB Controller	8	8	+5	180	—	Plastic DIP	40
Graphics Controllers								
μPD7220AD	NMOS Graphics Display Controller	8	6	+5	270	—	Ceramic DIP	40
μPD7220AD-1	NMOS Graphics Display Controller	8	7	+5	270	—	Ceramic DIP	40
μPD7220AD-2	NMOS Graphics Display Controller	8	8	+5	270	—	Ceramic DIP	40

CMOS System Support Products

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
μPD71011C	Clock Pulse Generator/Driver	—	20	4.5 to 5.5	30	—	Plastic DIP	18
μPD71011C-10	Clock Pulse Generator/Driver	—	20	4.5 to 5.5	30	—	Plastic DIP	18
μPD71011G	Clock Pulse Generator/Driver	—	20	4.5 to 5.5	30	—	Plastic SO	20
μPD71011G-10	Clock Pulse Generator/Driver	—	20	4.5 to 5.5	30	—	Plastic SO	20
μPD71051C/C-10	Serial Control Unit	8	8/10	4.5 to 5.5	10	.05	Plastic DIP	28
μPD71051G/GF-10	Serial Control Unit	8	8/10	4.5 to 5.5	10	.05	Plastic Miniflat	44
μPD71051L/L-10	Serial Control Unit	8	8/10	4.5 to 5.5	10	.05	PLCC	28
μPD71054C	Programmable Timer/Counter	8	8/10	4.5 to 5.5	30	.05	Plastic DIP	24
μPD71054G	Programmable Timer/Counter	8	8/10	4.5 to 5.5	30	.05	Plastic Miniflat	44
μPD71054L	Programmable Timer/Counter	8	8/10	4.5 to 5.5	30	.05	PLCC	28
μPD71055C	Parallel Interface Unit	8	8/10	4.5 to 5.5	15	.05	Plastic DIP	40
μPD71055G	Parallel Interface Unit	8	8/10	4.5 to 5.5	15	.05	Plastic Miniflat	44
μPD71055L	Parallel Interface Unit	8	8/10	4.5 to 5.5	15	.05	PLCC	44
μPD71059C	Interrupt Control Unit	8	8/10	4.5 to 5.5	9	.05	Plastic DIP	28
μPD71059G	Interrupt Control Unit	8	8/10	4.5 to 5.5	9	.05	Plastic Miniflat	44
μPD71059L	Interrupt Control Unit	8	8/10	4.5 to 5.5	9	.05	PLCC	28
μPD71071C	DMA Controller	8/16	8/10	4.5 to 5.5	30	.01	Plastic DIP	48
μPD71071D	DMA Controller	8/16	8/10	4.5 to 5.5	30	.01	Ceramic DIP	48
μPD71071G	DMA Controller	8/16	8/10	4.5 to 5.5	30	.01	Plastic Miniflat	52
μPD71071L	DMA Controller	8/16	8/10	4.5 to 5.5	30	.01	PLCC	52
μPD71082C	Transparent Latch	8	8	4.5 to 5.5	20	.08	Plastic DIP	20
μPD71082G	Transparent Latch	8	8	4.5 to 5.5	20	.08	Plastic SO	20
μPD71083C	Transparent Latch	8	8	4.5 to 5.5	20	.08	Plastic DIP Inverted	20
μPD71083G	Transparent Latch	8	8	4.5 to 5.5	20	.08	Plastic SO	20
μPD71084C	Clock Pulse Generator/Driver	—	25	4.5 to 5.5	30	—	Plastic DIP	18
μPD71084G	Clock Pulse Generator/Driver	—	25	4.5 to 5.5	30	—	Plastic SO	20
μPD71086C	Bus Buffer/Driver	8	8	4.5 to 5.5	40	.08	Plastic DIP	20
μPD71086G	Bus Buffer/Driver	8	8	4.5 to 5.5	40	.08	Plastic SO	20
μPD71087C	Bus Buffer/Driver	8	8	4.5 to 5.5	40	.08	Plastic DIP Inverted	20
μPD71087G	Bus Buffer/Driver	8	8	4.5 to 5.5	40	.08	Plastic SO	20
μPD71088C/C-10	System Bus Controller	—	8/10	4.5 to 5.5	20	.08	Plastic DIP	20
μPD71088G/G-10	System Bus Controller	—	8/10	4.5 to 5.5	20	.08	Plastic SO	20
μPD82C43C	Input/Output Expander	—	5	4.5 to 5.5	40	—	Plastic DIP	24
μPD82C43CX	Input/Output Expander	—	5	4.5 to 5.5	40	—	Plastic Skinny DIP	24

NMOS System Support Products

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
μPD8155C	256 x 8 RAM with I/O Ports and Timer	8	3	4.5 to 5.5	180	—	Plastic DIP	40
μPD8155C-2	256 x 8 RAM with I/O Ports and Timer	8	5	4.5 to 5.5	180	—	Plastic DIP	40
μPD8155HC	256 x 8 RAM with I/O Ports and Timer	8	3	4.5 to 5.5	180	—	Plastic DIP	40
μPD8155HC-2	256 x 8 RAM with I/O Ports and Timer	8	5	4.5 to 5.5	180	—	Plastic DIP	40
μPD8156C	256 x 8 RAM with I/O Ports and Timer	8	3	4.5 to 5.5	180	—	Plastic DIP	40
μPD8156C-2	256 x 8 RAM with I/O Ports and Timer	8	5	4.5 to 5.5	180	—	Plastic DIP	40
μPD8156HC	256 x 8 RAM with I/O Ports and Timer	8	3	4.5 to 5.5	180	—	Plastic DIP	40
μPD8156HC-2	256 x 8 RAM with I/O Ports and Timer	8	5	4.5 to 5.5	180	—	Plastic DIP	40
μPD8216C	Parallel Bidirectional Bus Driver	4	—	4.5 to 5.5	130	—	Plastic DIP	16
μPB8226C	Parallel Bidirectional Bus Driver	4	—	4.5 to 5.5	120	—	Plastic DIP	16
μPD8237AC-5	Programmable DMA Controller	8	5	4.5 to 5.5	150	–	Plastic DIP	40
μPD8243C	Input/Output Expander	—	5	4.5 to 5.5	20	—	Plastic DIP	24
μPD8243HC	HMOS Input/Output Expander	—	5	4.5 to 5.5	20	—	Plastic DIP	24
μPD8251AC	Programmable Communication Interface	8	3/5	4.5 to 5.5	100	—	Plastic DIP	28
μPD8251AFC	Programmable Communication Interface	8	3/5	4.5 to 5.5	100	—	Plastic DIP	28
μPD8253C-2	Programmable Internal Timer	8	5	4.5 to 5.5	140	—	Plastic DIP	24
μPD8253C-5	Programmable Internal Timer	8	4	4.5 to 5.5	140	—	Plastic DIP	24
μPD8255AC-2	Programmable Peripheral Interface	8	5	4.5 to 5.5	120	—	Plastic DIP	40
μPD8255AC-5	Programmable Peripheral Interface	8	4	4.5 to 5.5	120	—	Plastic DIP	40
μPD8257C-2	Programmable DMA Controller	8	5	4.5 to 5.5	100	—	Plastic DIP	40
μPD8257C-5	Programmable DMA Controller	8	3	4.5 to 5.5	120	—	Plastic DIP	40
μPD8259AC	Programmable Interrupt Controller	8	4	4.5 to 5.5	85	—	Plastic DIP	28

NMOS System Support Products (cont)

Device	Description	Data Bits	Clock (MHz)	Supply Voltage (V)	Power Dissipation Active (mA)	Power Dissipation Standby (mA)	Package	Pins
μPD8259AC-2	Programmable Interrupt Controller	8	5	4.5 to 5.5	85	—	Plastic DIP	28
μPD8279C-2	Programmable Keyboard/Display Interface	—	5	4.5 to 5.5	120	—	Plastic DIP	40
μPD8279C-5	Programmable Keyboard/Display Interface	—	3	4.5 to 5.5	120	—	Plastic DIP	40
μPB8282C	Octal Latch	8	8	4.5 to 5.5	160	—	Plastic DIP	20
μPB8283C	Octal Latch	8	8	4.5 to 5.5	160	—	Plastic DIP	20
μPB8284AD	Clock Generator/ Driver	—	24	4.5 to 5.5	140	—	Cerdip	18
μPB8286C	Octal Bus Transceiver	8	8	4.5 to 5.5	160	—	Plastic DIP	20
μPB8287C	Octal Bus Transceiver	8	8	4.5 to 5.5	130	—	Plastic DIP	20
μPB8288D	CPU System Bus Controller	—	10	4.5 to 5.5	230	—	Cerdip	20
μPB8289D	Bus Arbiter	—	8	4.5 to 5.5	165	—	Cerdip	20

μPD7720 Hardware Development Tool

Device	Description
EVAKIT-7720B	Stand-alone Evakit for μPD7720 Digital Signal Processor

μPD70208/216 Hardware Development Tools

Device	Description
IE-70208-S008	In-circuit emulator for μPD70208 (with V40 pod)
IE-70216-S008	In-circuit emulator for μPD70216 (with V50 pod)
IE-70208-1008	Optional pod unit for IE-70208-S008
IE-70216-1008	Optional pod unit for IE-70216-S008
IE-70216-1508	Converts IE-70108/70116-S to IE-70208/70216-S008
IE-70208-A008	In-circuit emulator for μPD70208 (Anritsu type, new model)
IE-70216-A008	In-circuit emulator for μPD70216 (Anritsu type, new model)
IE-70208-2008	Optional pod unit for IE-70208-A008
IE-70216-2008	Optional pod unit for IE-70216-A008
IE-70000-2954	Logic probe for Anritsu IE
IE-70000-2958	PLCC socket attachment for Anritsu IE
IE-70000-2959	PGA socket attachment for Anritsu IE
IE-70616-A016	In-circuit emulator for μPD70616
EP-9100-R68	PGA socket attachment for IE-70616-A016

μPD7281 Software Development Tools

Device	Description
SW7281-D52	MS-DOS, 5-1/4" double-density floppy diskette
SW7281-M52	CP/M-86, 5-1/4" double-density floppy diskette
SW7281-M81	CP/M-86, 8" single-density floppy diskette

CP/M-86 is a registered trademark of Digital Research Corporation.

MS-DOS is a registered trademark of Microsoft Corporation.

μPD7720 Software Development Tools

Device	Description
ASM77-C81	CP/M-80, 8" single-density floppy diskette
ASM77-D52	MS-DOS, 5-1/4" double-density floppy diskette
ASM77-I81	ISIS-II, 8" single-density floppy diskette
ASM77-I82	ISIS-II, 8" double-density floppy diskette
ASM77-M52	CP/M-86, 5-1/4" double-density floppy diskette
ASM77-M81	CP/M-86, 8" single-density floppy diskette
ASM77-F9T1	Fortran IV ANSI X3.9-1966 source program 9-track 1600 BPI magnetic tape
SIM77-C81	CP/M-80, 8" single-density floppy diskette
SIM77-D52	MS-DOS, 5-1/4" double-density floppy diskette
SIM77-I81	ISIS-II, 8" single-density floppy diskette
SIM77-I82	ISIS-II, 8" double-density floppy diskette
SIM77-M52	CP/M-86, 5-1/4" double-density floppy diskette
SIM77-M81	CP/M-86, 8" single-density floppy diskette

μPD70108/116/208/216 Software Relocatable Assembler Development Tools

Device	Description
RA70116-D52	MS-DOS, 5-1/4" double-density floppy diskette
RA70116-I81	ISIS-II, 8" single-density floppy diskette
RA70116-I82	ISIS-II, 8" double-density floppy diskette
RA70116-M52	CP/M-86, 5-1/4" double-density floppy diskette
RA70116-M81	CP/M-86, 8" single-density floppy diskette
RA70116-VVT1	VAX/VMS, 9-track 1600 BPI magnetic tape
RA70116-VXT1	VAX/UNIX, 9-track 1600 BPI magnetic tape

μPD70108/116/208/216 Software C Compiler Development Tools

Device	Description
CC70116-D52	MS-DOS, 5" double-density floppy diskette
CC70116-I81	ISIS-II, 8" single-density floppy diskette
CC70116-I82	ISIS-II, 8" double-density floppy diskette
CC70116-M52	CP/M-86, 5" double-density floppy diskette
CC70116-M81	CP/M-86, 8" single-density floppy diskette
CC70116-VVT1	VAX/VMS, 9-track 1600 BPI magnetic tape
CC70116-VXT1	VAX/UNIX, 9-track 1600 BPI magnetic tape

UNIX is a trademark of AT&T.

VAX and VMS are trademarks of Digital Equipment Corporation.

MD-086 Series Microcomputer Development Systems

Device	Description
MD-086FD-10	MD-086 series, floppy-disk based system
MD-086HD-10	MD-086 series, floppy-/hard-disk based system
MD-086DK	Hard-disk upgrade for MD-086FD-10
MD-910TM	Character display terminal

MD-910TM Character Display Terminal Development Tool

Device	Description
MD-910TM	Character display terminal

PG1000 PROM Programmers

Device	Description
PG1003	Plug-in personality module
PG1005	Plug-in personality module

NEC

ASIC PRODUCTS 6

Section 6 — ASIC Products **Page**

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
100K (ECL-2) (Note 1)							
μPD6301 (Note 4)	300	0.5	0.8	0.5	28	56	5.4 mW
μPD6310 (Note 5)	1200	0.7	1	0.6	48	88	1.9 mW
μPD6320 (Note 5)	2000	0.7	1	0.6	48	108	
10KH (ECL-3) (Note 2)							
μPD6311 (Note 5)	1200	1	1.7	1	48	88	1.1 mW
μPD6321 (Note 5)	2000	1	1.7	1	48	108	
μPD6330 (Note 5)	3000	1	1.7	1	80	180	
100KH, 10KH, TTL (ECL-3A) (Note 3)							
μPD6340 (Note 6)	4000	0.7	1.6 (ECL) 4.8 (TTL)	0.7 (ECL) 0.9 (TTL)	72	156	1.9 mW
μPD6350 (Note 6)	5000	0.7	1.6 (ECL) 4.8 (TTL)	0.7 (ECL) 0.9 (TTL)	80	172	

Notes:

(1) Power source: −4.5 V ±10%

(2) Power source: −5.2 V ±10%

(3) Power source: −4.5 V ±10% (100K); −5.2 V ±10% (10KH); +5 V ±5% (TTL)

(4) Number of macros: 55

(5) Number of macros: 70

(6) Number of macros: 72

(7) Ambient temperature: 0 to 70°C

(8) Technology: advanced bipolar process

(9) All gate delay is under the loading of fan-out of 3 and 3 mm wiring.

CMOS-2,-3

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
CMOS-2 (3-micron)							
μPD65003	400	3	12	5	36	38	30 μW/MHz/gate
μPD65002	800	3	12	5	48	48	
μPD65010	1300	3	12	5	64	64	
μPD65020	2100	3	12	5	78	78	
CMOS-3 (2-micron)							
μPD65004	888	2	10	3	60	60	20 μW/MHz/gate
μPD65011	1598	2	10	3	69	71	
μPD65021	2160	2	10	3	69	71	
μPD65030	3312	2	10	3	94	111	
μPD65040	4104	2	10	3	116	120	
μPD65060	6528	2	10	3	136	144	
μPD65080	8056	2	10	3	148	160	
μPD65100	11,250	2	10	3	168	188	

Notes:

(1) Number of macros: 140

(2) Ambient temperature: −40 to +85 °C

(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, two-layer Al metalization

CMOS-4

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
CMOS-4 (1.5-micron)							
μPD65022	2128	1.4	4.2	2	84	84	15 μW/gate
μPD65031	3575	1.4	4.2	2	108	108	
μPD65042	4727	1.4	4.2	2	124	124	
μPD65050	5742	1.4	4.2	2	142	142	
μPD65070	7164	1.4	4.2	2	152	152	
μPD65081	8510	1.4	4.2	2	180	180	
μPD65101	10,496	1.4	4.2	2	198	198	
μPD65150	14,943	1.4	4.2	2	234	234	
μPD65200	19,551	1.4	4.2	2	266	266	

Notes:

(1) Number of macros: 180

(2) Ambient temperature: −40 to 85 °C

(3) Power source: 5 V ±10% (5 V ±5% for TTL interface)

(4) Input/output interface: TTL/CMOS compatible

(5) Technology: silicon gate CMOS, two-layer Al metalization

CMOS-4A

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
CMOS-4A (1.5-micron)							
μPD65005	320	1.4	4	2	54	54	15 μW/gate
μPD65006	504	1.4	4	2	62	62	
μPD65012	1088	1.4	4	2	82	82	
μPD65013	1584	1.4	4	2	100	100	
μPD65024	2360	1.4	4	2	108	108	

Notes:

(1) Number of macros: 180

(2) Ambient temperature: −40 to 85 °C; (0 to 70 °C for TTL interface)

(3) Power source: 5 V ±10% (5 V ±5% for TTL interface)

(4) Input/output interface: TTL/CMOS compatible

(5) Technology: silicon gate CMOS, two-layer Al metalization

CMOS-4R

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
CMOS-4R (1.5-micron)							
μPD65023	2240	1.4	4.2	2	120	120	15 μW/gate
μPD65043	4440	1.4	4.2	2	180	180	

Notes:

(1) Number of macros: 180

(2) Ambient temperature: −40 to 85 °C

(3) Power source: 5 V ±5% (TTL level); 5 V ±10% (CMOS level)

(4) Technology: silicon gate CMOS, two-layer Al metalization

BiCMOS-4

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
μPD67001	624	0.8	3	1.2	64	64	18 mW/MHz (F/O = 3, L = 3 mm)
μPD67010	1124	0.8	3	1.2	84	84	
μPD67020	2248	0.8	3	1.2	120	120	
μPD67030	3140	0.8	3	1.2	140	140	

Notes:

(1) Number of macros: 146

(2) Ambient temperature: 0 to 85 °C

(3) Power source: 5 V ±0.5 V

(4) Input/output interface: CMOS, ALS-TTL (input/output)

(5) Technology: 1.5 μCMOS and Bipolar with fT = 4 GHz

Standard Cell

Device	Integration (Gate)	Delay Time: Gate (ns)	Delay Time: Output Buffer (ns)	Delay Time: Input Buffer (ns)	Number of Buffers Input/Output Total	Power Dissipation	RAM	ROM
(1.5-micron)								
μPD91000	17,000 (25,000) (Note 6)	1.4	4	2	256	15 μW/gate	1 port: 64 Kb max; 2 port: 16 Kb max	None
μPD92000	17,000 (25,000) (Note 6)	1.4	4	2	256	15 μW/gate	1 port: 64 Kb max; 2 port: 16 Kb max	256 Kb max

Notes:

(1) Number of macros: 180

(2) Ambient temperature: −40 to 85 °C

(3) Power source: 5 V ±10% for CMOS; 5 V ±5% for TTL

(4) Input/output interface: TTL, CMOS compatible

(5) Technology: silicon gate CMOS, two-layer Al metalization

(6) 25,000 available during second quarter 1987

TTL

Device	Integration (Gate)	Delay Time			Number of Buffers		Power Dissipation
		Gate (ns)	Output Buffer (ns)	Input Buffer (ns)	Output	Input	
TTL-2A (Note 1)							
μPB6104	250	2.5	7	2.3	32	42	1 mW/gate
μPB6105	550	2.5	7	2.3	52	64	
μPB6106	850	2.5	7	2.3	52	64	
TTL-3 (Note 2)							
μPB6111	1000	2	7	2	48	100	1 mW/gate
μPB6120	2000	2	7	2	60	116	

Notes:

(1) Number of macros: 30

(2) Number of macros: 109

(3) Ambient temperature: 0 to 85 °C

(4) Power source: 5 V ±10%

(5) Input/output interface: 74 ALS compatible

(6) Technology: ALS

CAPACITORS 7

Section 7 — Capacitors **Page**

Capacitors Cross Reference

AVX	NEC
TAP	D-Series (ND)
TAM	P-Series (NP)
TAR	A-Series (NA)
TAR/TAJ	R-Series (NE)

Kemet	NEC
T350	D-Series (ND)
T360	D-Series (ND)
T411	C-Series (NC)
T421	C-Series (NC)
T322	U-Series (NU)
T322	A-Series (NA)
T310	A-Series (NA)
T491	R-Series (NR)

Mallory	NEC
TDC	D-Series (ND)
TDL	D-Series (ND)
TDM	Q-Series (NQ)
TAC	A-Series (NA)

Matsuo	NEC
22IL	D-Series (ND)
202	D-Series (ND)
267	R-Series (NR)
268	R-Series (NR)

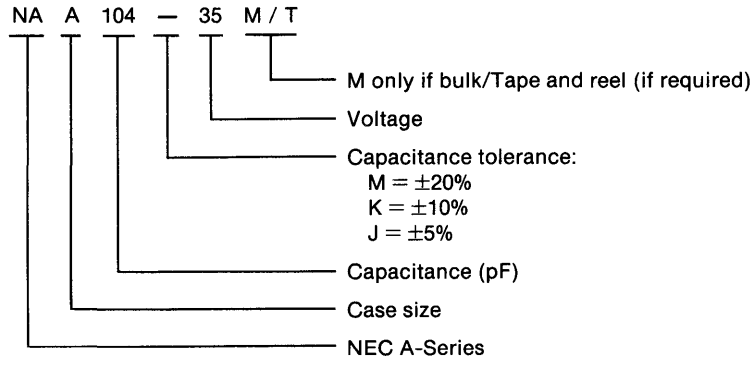
MEPCO	NEC
41DS	D-Series (ND)
41GS	D-Series (ND)
49BC	R-Series (NR)
40CS	U-Series (NU)
40CS	A-Series (NA)
40ES	A-Series (NA)
49MC	R-Series (NR)

Panasonic	NEC
SQ	D-Series (ND)
TE	R-Series (NR)
YE	R-Series (NR)

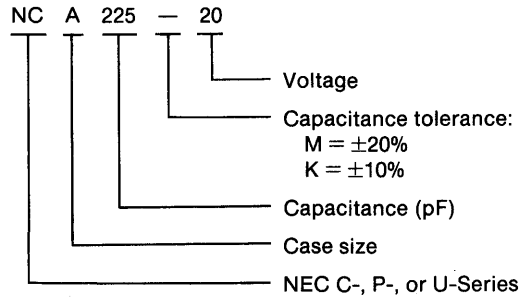
Sprague	NEC
199D	D-Series (ND)
196D	Q-Series (NQ)
186D	P-Series (NP)
195D	R-Series (NR)
193D	R-Series (NR)
182D	U-Series (NU)
188D	U-Series (NU)
162D	A-Series (NA)
173D	A-Series (NA)
293D	R-Series (NR)

Part Numbering System

A-Series

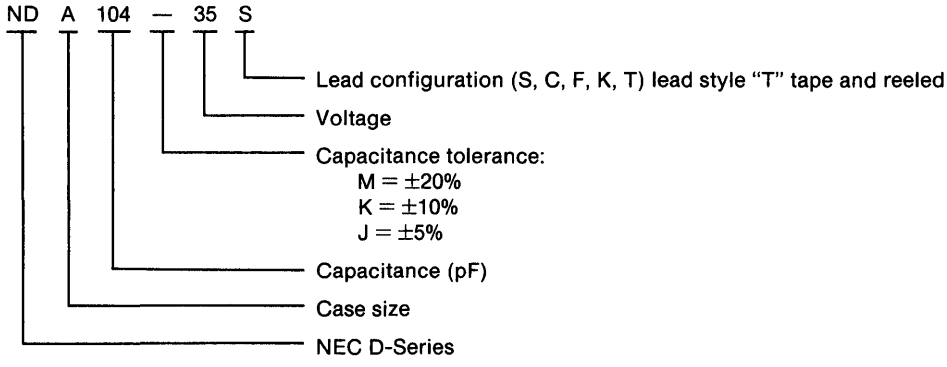


C-, P-, U-Series

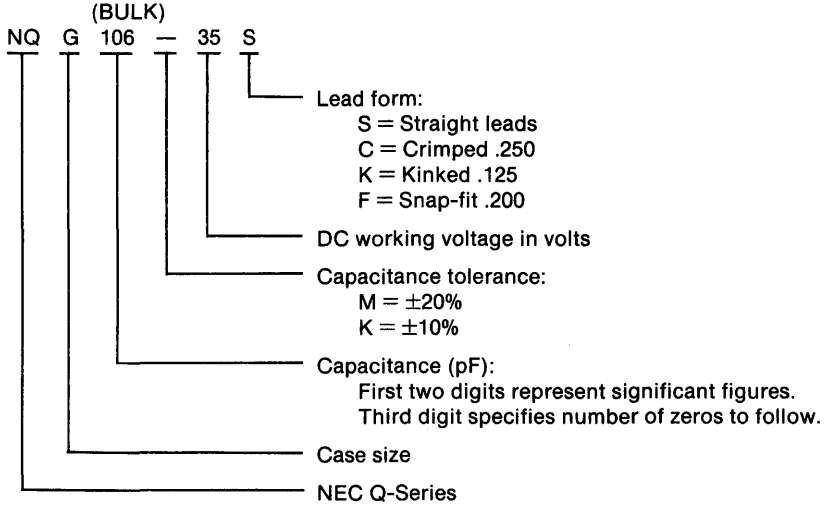


Part Numbering System

D-Series



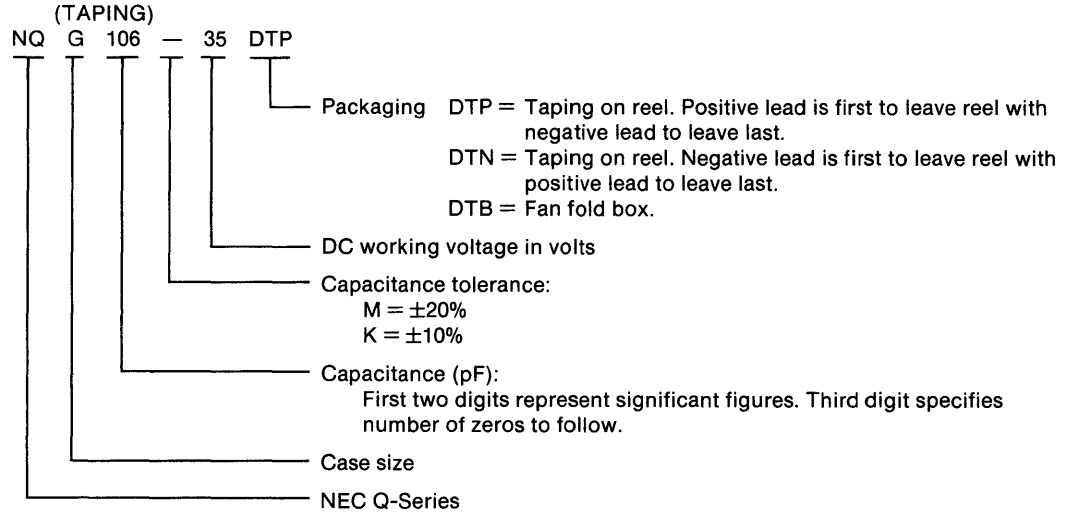
Q-Series



Note: Crimped, kinked, and snap-fit leads are available.

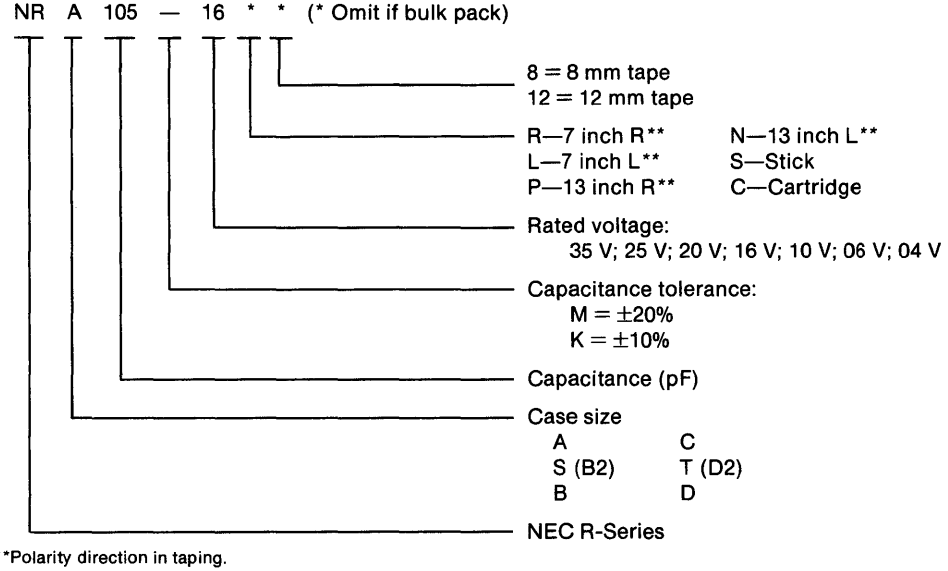
Part Numbering System

Q-Series (cont)



Note: Parts are taped per EIA standard RS-488.

R-Series



**Polarity direction in taping.

Part Numbering System

FA-Series

FA 0H 105 Z

- Z: Capacitance tolerance: Z = +80%, −20%
- 105: Capacitance: First two digits represent significant figures. Third digit specifies number of zeros to follow Microfarad code.
- 0H: Rated voltage: 0H = 5.5 V DC, 1A = 11 V DC
- FA: Supercap series

FS-, FZ-Series

FS 0H 473 Z

- Z: Capacitance tolerance: Z = +80%, −20%
- 473: Capacitance: First two digits represent significant figures. Third digit specifies number of zeros to follow Microfarad code.
- 0H: Rated voltage: 0H = 5.5 V DC
- FS: Supercap series

High-Capacitance, Resin Dipped

DB Y5V 1N 106 Z 1

- 1: New design
- Z: Capacitance tolerance: Z = +80%, −20%
- 106: Capacitance (pF): First two digits represent significant figures. Third digit specifies number of zeros to follow.
- 1N: Working voltage: 1N = 75 V DC, 1H = 50 V DC, 1E = 25 V DC
- Y5V: Temperature characteristic
- DB: Case size

A-Series Subminiature, Molded Axial, Solid Tantalum Capacitors

Standard Ratings

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25 °C μA Max	Dissipation Factor @ 25 °C, 120 Hz % Max
50 V Rating at 85 °C, 33 V Rating at 125 °C				
NAA104 __ 50M*	0.1	A	0.5	3
NAA124 __ 50M	0.12	A	0.5	3
NAA154 __ 50M*	0.15	A	0.5	3
NAA184 __ 50M	0.18	A	0.5	3
NAA224 __ 50M*	0.22	A	0.5	3
NAA274 __ 50M	0.27	A	0.5	3
NAB334 __ 50M*	0.33	B	0.5	3
NAB394 __ 50M	0.39	B	0.5	3
NAB474 __ 50M*	0.47	B	0.5	3
NAB564 __ 50M	0.56	B	0.5	3
NAB684 __ 50M*	0.68	B	0.5	3
NAB824 __ 50M	0.82	B	0.5	3
NAB105 __ 50M*	1	B	0.5	3
NAC125 __ 50M	1.2	C	0.6	4
NAC155 __ 50M*	1.5	C	0.7	4
NAC185 __ 50M	1.8	C	0.9	4
NAC225 __ 50M*	2.2	C	1.1	4
NAD275 __ 50M	2.7	D	1.3	4
NAD335 __ 50M*	3.3	D	1.6	4
NAD395 __ 50M	3.9	D	1.9	4
NAD475 __ 50M*	4.7	D	2.3	4
35 V Rating at 85 °C, 23 V Rating at 125 °C				
NAA104 __ 35M*	0.1	A	0.5	3
NAA124 __ 35M	0.12	A	0.5	3
NAA154 __ 35M*	0.15	A	0.5	3
NAA184 __ 35M	0.18	A	0.5	3
NAA224 __ 35M*	0.22	A	0.5	3
NAA274 __ 35M	0.27	A	0.5	3
NAA334 __ 35M*	0.33	A	0.5	3
NAA394 __ 35M	0.39	A	0.5	3
NAA474 __ 35M*	0.47	A	0.5	3
NAB564 __ 35M	0.56	B	0.5	3
NAB684 __ 35M*	0.68	B	0.5	3
NAB824 __ 35M	0.82	B	0.5	3
NAB105 __ 35M*	1	B	0.5	3
NAB125 __ 35M	1.2	B	0.5	4
NAB155 __ 35M*	1.5	B	0.5	4
NAC185 __ 35M	1.8	C	0.6	4
35 V Rating at 85 °C, 23 V Rating at 125 °C (cont)				
NAC225 __ 35M*	2.2	C	0.6	4
NAC275 __ 35M	2.7	C	0.9	4
NAC335 __ 35M*	3.3	C	1.1	4
NAC395 __ 35M	3.9	C	1.3	4
NAC475 __ 35M*	4.7	C	1.6	4
NAD565 __ 35M	5.6	D	1.9	4
NAD685 __ 35M*	6.8	D	2.3	6
NAD825 __ 35M	8.2	D	2.8	6
NAD106 __ 35M*	10	D	3.5	6
25 V Rating at 85 °C, 17 V Rating at 125 °C				
NAA474 __ 25M	0.47	A	0.5	3
NAA564 __ 25M	0.56	A	0.5	3
NAA684 __ 25M	0.68	A	0.5	3
NAA824 __ 25M	0.82	A	0.5	3
NAA105 __ 25M*	1	A	0.5	3
NAB125 __ 25M	1.2	B	0.5	4
NAB155 __ 25M	1.5	B	0.5	4
NAB185 __ 25M	1.8	B	0.5	4
NAB225 __ 25M	2.2	B	0.5	4
NAB275 __ 25M	2.7	B	0.6	4
NAB335 __ 25M*	3.3	B	0.8	4
NAC395 __ 25M	3.9	C	0.9	4
NAC475 __ 25M	4.7	C	1.1	4
NAC565 __ 25M	5.6	C	1.4	4
NAC685 __ 25M*	6.8	C	1.7	6
NAC825 __ 25M	8.2	C	2.0	6
NAC106 __ 25M*	10	C	2.5	6
NAD126 __ 25M	12	D	3.0	6
NAD156 __ 25M*	15	D	3.7	6
20 V Rating at 85 °C, 13 V Rating at 125 °C				
NAA105 __ 20M	1	A	0.5	3
NAA125 __ 20M	1.2	A	0.5	4
NAA155 __ 20M*	1.5	A	0.5	4
NAB185 __ 20M	1.8	B	0.5	4

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 Subminiature, Molded Axial, Solid Tantalum Capacitors

Standard Ratings [cont]

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
20 V Rating at 85°C, 13 V Rating at 125°C (cont)				
NAB225 __ 20M	2.2	B	0.5	4
NAB275 __ 20M	2.7	B	0.5	4
NAB335 __ 20M	3.3	B	0.6	4
NAB395 __ 20M	3.9	B	0.7	4
NAB475 __ 20M*	4.7	B	0.9	4
NAC565 __ 20M	5.6	C	1.1	4
NAC685 __ 20M	6.8	C	1.3	6
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
15 V Rating at 85°C, 10 V 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
10 V Rating at 85°C, 7 V 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

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
10 V Rating at 85°C, 7 V Rating at 125°C (cont)				
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
6 V Rating at 85°C, 4 V Rating at 125°C				
NAA335 __ 06M	3.3	A	0.5	4
NAA395 __ 06M	3.9	A	0.5	4
NAA475 __ 06M*	4.7	A	0.5	4
NAB565 __ 06M	5.6	B	0.5	4
NAB685 __ 06M	6.8	B	0.5	6
NAB825 __ 06M	8.2	B	0.5	6
NAB106 __ 06M	10	B	0.6	6
NAB126 __ 06M	12	B	0.7	6
NAB156 __ 06M*	15	B	0.9	6
NAC186 __ 06M	18	C	1.0	6
NAC226 __ 06M	22	C	1.3	6
NAC276 __ 06M	27	C	1.6	6
NAC336 __ 06M*	33	C	2.0	6
NAD396 __ 06M	39	D	2.3	6
NAD476 __ 06M	47	D	2.8	6
NAD566 __ 06M	56	D	3.3	6
NAD686 __ 06M*	68	D	4.0	6
4 V Rating at 85°C, 2.7 V Rating at 125°C				
NAA475 __ 04M	4.7	A	0.5	8
NAA565 __ 04M	5.6	A	0.5	8
NAA685 __ 04M*	6.8	A	0.5	8
NAB825 __ 04M	8.2	B	0.5	8
NAB106 __ 04M	10	B	0.5	8
NAB126 __ 04M	12	B	0.5	8
NAB156 __ 04M	15	B	0.6	8
NAB186 __ 04M	18	B	0.7	8
NAB226 __ 04M*	22	B	0.8	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 resquest.

A-Series Subminiature, Molded Axial, Solid Tantalum Capacitors

Standard Ratings [cont]

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
4 V Rating at 85°C, 2.7 V Rating at 125°C (cont)				
NAC276 __ 04M	27	C	1.0	8
NAC336 __ 04M	33	C	1.3	8
NAC396 __ 04M	39	C	1.5	8
NAC476 __ 04M*	47	C	1.8	8
NAD566 __ 04M	56	D	2.2	8
NAD686 __ 04M*	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 resquest.

Case Size Dimensions

Case Size	Diameter (Max)	Length (Max)	Lead Diameter
A	2.41 (0.095)	6.60 (0.260)	0.51 (0.020)
B	2.79 (0.110)	7.37 (0.290)	0.51 (0.020)
C	4.57 (0.180)	8.76 (0.345)	0.51 (0.020)
D	4.57 (0.180)	10.67 (0.420)	0.51 (0.020)

Note:

(1) Dimensions: mm (inch)

C-Series Unencapsulated Chip, Solid Tantalum Capacitors

Standard Ratings

Part Number (Note 1)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
35 V Rating				
NCA104 __ 35	0.1	A	1.0	4
NCA154 __ 35	0.15	A	1.0	4
NCA224 __ 35	0.22	A	1.0	4
NCA334 __ 35	0.33	A	1.0	4
NCB474 __ 35	0.47	B	1.0	4
NCB684 __ 35	0.68	B	1.0	4
NCB105 __ 35	1.0	B	1.0	4
NCC155 __ 35	1.5	C	1.0	6
NCC225 __ 35	2.2	C	1.5	6
NCC335 __ 35	3.3	C	2.3	6
25 V Rating				
NCA474 __ 25	0.47	A	1.0	4
NCB155 __ 25	1.5	B	1.0	6
NCC475 __ 25	4.7	C	2.3	6
20 V Rating				
NCA684 __ 20	0.68	A	1.0	4
NCB225 __ 20	2.2	B	1.0	6
NCC685 __ 20	6.8	C	2.7	6
16 V Rating				
NCA105 __ 16	1.0	A	1.0	4
NCB335 __ 16	3.3	B	1.1	6
NCC106 __ 16	10	C	3.2	6
10 V Rating				
NCA155 __ 10	1.5	A	1.0	6
NCB475 __ 10	4.7	B	1.0	6
NCC156 __ 10	15	C	3.0	6
6.3 V Rating				
NCA225 __ 06	2.2	A	1.0	6
NCB685 __ 06	6.8	B	1.0	6
NCC226 __ 06	22	C	2.7	6

Note:

(1) To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%.

Case Size Dimensions

Case Size	L	W	H	M
A	4.2 (0.165)	2.1 (0.083)	1.7 (0.067)	1.8 (0.071)
B	5.5 (0.217)	3.6 (0.142)	1.8 (0.071)	2.3 (0.091)
C	6.5 (0.265)	3.7 (0.146)	2.2 (0.087)	2.3 (0.091)

Note:

(1) Dimensions: mm (inch)

D-Series Resin Dipped Radial, Solid Tantalum Capacitors

Standard Ratings

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
50 V Rating				
NDA104 __ 50 __	0.1	A	0.5	4
NDA154 __ 50 __	0.15	A	0.5	4
NDA224 __ 50 __	0.22	A	0.5	4
NDB334 __ 50 __	0.33	B	0.5	4
NDB474 __ 50 __	0.47	B	0.5	4
NDC684 __ 50 __	0.68	C	0.5	4
NDD105 __ 50 __	1.0	D	0.5	4
NDE155 __ 50 __	1.5	E	0.7	6
NDF225 __ 50 __	2.2	F	1.1	6
NDG335 __ 50 __	3.3	G	1.6	6
35 V Rating				
NDA104 __ 35 __	0.1	A	0.5	4
NDA154 __ 35 __	0.15	A	0.5	4
NDA224 __ 35 __	0.22	A	0.5	4
NDA334 __ 35 __	0.33	A	0.5	4
NDA474 __ 35 __	0.47	A	0.5	4
NDA684 __ 35 __	0.68	A	0.5	4
NDA105 __ 35 __	1.0	A	0.5	4
NDB155 __ 35 __	1.5	B	0.5	6
NDC225 __ 35 __	2.2	C	0.7	6
NDD335 __ 35 __	3.3	D	1.1	6
NDE475 __ 35 __	4.7	E	1.6	6
NDF685 __ 35 __	6.8	F	2.3	6
NDG106 __ 35 __	10	G	3.5	8
NDK156 __ 35 __	15	K	5.0	8
NDK226 __ 35 __	22	L	7.0	8
NDK336 __ 35 __	33	N	10.0	8
NDK476 __ 35 __	47	P	10.0	8
25 V Rating				
NDA105 __ 25 __	1.0	A	0.5	4
NDA155 __ 25 __	1.5	A	0.5	6
NDB225 __ 25 __	2.2	B	0.5	6
NDC335 __ 25 __	3.3	C	0.8	6
NDD475 __ 25 __	4.7	D	1.1	6
NDE685 __ 25 __	6.8	E	1.7	6
NDF106 __ 25 __	10	F	2.5	8
NDJ156 __ 25 __	15	J	3.7	8

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
25 V Rating (cont)				
NDK226 __ 25 __	22	K	5.5	8
NDL336 __ 25 __	33	L	8.2	8
NDN476 __ 25 __	47	N	10.0	8
NDP686 __ 25 __	68	P	10.0	8
20 V Rating				
NDA155 __ 20 __	1.5	A	0.5	6
NDB225 __ 20 __	2.2	B	0.5	6
NDC335 __ 20 __	3.3	C	0.6	6
NDD475 __ 20 __	4.7	D	0.9	6
NDE685 __ 20 __	6.8	E	1.3	6
NDF106 __ 20 __	10	F	2.0	8
NDG156 __ 20 __	15	G	3.0	8
NDH226 __ 20 __	22	H	4.4	8
NDJ336 __ 20 __	33	J	6.6	8
NDK476 __ 20 __	47	K	9.4	8
NDL686 __ 20 __	68	L	10.0	8
NDN107 __ 20 __	100	N	10.0	10
16 V Rating				
NDA225 __ 16 __	2.2	A	0.5	6
NDB335 __ 16 __	3.3	B	0.5	6
NDC475 __ 16 __	4.7	C	0.7	6
NDD685 __ 16 __	6.8	D	1.0	6
NDE106 __ 16 __	10	E	1.6	8
NDF156 __ 16 __	15	F	2.4	8
NDG226 __ 16 __	22	G	3.5	8
NDH336 __ 16 __	33	H	5.0	8
NDJ476 __ 16 __	47	J	7.5	8
NDK686 __ 16 __	68	K	10.0	8
NDL107 __ 16 __	100	L	10.0	10
NDN157 __ 16 __	150	N	10.0	10

Notes:

(1) In the first dash to complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%, J = ±5%.

(2) In the second 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.

D-Series Resin Dipped Radial, Solid Tantalum Capacitors

Standard Ratings [cont]

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
10 V Rating				
NDA335 __ 10 __	3.3	A	0.5	6
NDB475 __ 10 __	4.7	B	0.5	6
NDC685 __ 10 __	6.8	C	0.6	6
NDD106 __ 10 __	10	D	1.0	8
NDE156 __ 10 __	15	E	1.5	8
NDF226 __ 10 __	22	F	2.2	8
NDG336 __ 10 __	33	G	3.3	8
NDH476 __ 10 __	47	H	4.7	8
NDJ686 __ 10 __	68	J	6.8	8
NDK107 __ 10 __	100	K	10.0	10
NDL157 __ 10 __	150	L	10.0	10
NDM227 __ 10 __	220	M	10.0	10
6.3 V Rating				
NDA475 __ 06 __	4.7	A	0.5	6
NDB685 __ 06 __	6.8	B	0.5	6
NDC106 __ 06 __	10	C	0.6	8
NDD156 __ 06 __	15	D	0.9	8
NDE226 __ 06 __	22	E	1.3	8
NDF336 __ 06 __	33	F	2.0	8
NDG476 __ 06 __	47	G	2.9	8
NDH686 __ 06 __	68	H	4.2	8
NDJ107 __ 06 __	100	J	6.3	10
NDK157 __ 06 __	150	K	9.4	10
NDL227 __ 06 __	220	L	10.0	10
NDM337 __ 06 __	330	M	10.0	10
4 V Rating				
NDA685 __ 04 __	6.8	A	0.5	6
NDA106 __ 04 __	10	A	0.5	8
NDB156 __ 04 __	15	B	0.6	8
NDC226 __ 04 __	22	C	0.8	8
NDD336 __ 04 __	33	D	1.3	8
NDE476 __ 04 __	47	E	1.8	8
NDF686 __ 04 __	68	F	2.7	8
NDG107 __ 04 __	100	G	4.0	10

Notes:

(1) In the first dash (—) to complete part number, insert capacitance tolerance symbol M = ±20%, K =± 10%, J = ±5%.

(2) In the second 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.

Case Size Dimensions

Case	Diameter Maximum	Height Maximum H_1	H_2	H_3	H_4	Lead Spacing S ±0.020
A	4.5 (0.18)	7.0 (0.28)	10.5 (0.41)	9.0 (0.35)	10.5 (0.41)	2.5 (0.098)
B	5.0 (0.20)	7.5 (0.30)	11.0 (0.43)	9.5 (0.37)	11.0 (0.43)	2.5 (0.098)
C	5.5 (0.22)	8.0 (0.32)	11.5 (0.45)	10.0 (0.39)	11.5 (0.45)	2.5 (0.098)
D	5.5 (0.22)	8.5 (0.34)	12.0 (0.47)	10.5 (0.41)	12.0 (0.47)	2.5 (0.098)
E	5.5 (0.22)	9.0 (0.35)	12.5 (0.49)	11.0 (0.43)	12.5 (0.49)	2.5 (0.098)
F	6.5 (0.26)	9.5 (0.37)	13.0 (0.51)	11.5 (0.45)	13.0 (0.51)	2.5 (0.098)
G	7.0 (0.28)	10.0 (0.39)	13.5 (0.53)	12.0 (0.47)	13.5 (0.53)	2.5 (0.098)
H	7.5 (0.30)	11.0 (0.43)	14.5 (0.57)			2.5 (0.098)
J	7.5 (0.30)	11.0 (0.43)	14.5 (0.57)			2.5 (0.098)
K	9.0 (0.35)	14.5 (0.57)	18.0 (0.71)			5.0 (0.20)
L	10.0 (0.39)	14.5 (0.57)	18.0 (0.71)			5.0 (0.20)
M	11.0 (0.43)	17.0 (0.67)	20.5 (0.81)			5.0 (0.20)
N	11.0 (0.43)	17.0 (0.67)	20.5 (0.81)			5.0 (0.20)
P	11.0 (0.43)	17.0 (0.67)	20.5 (0.81)			5.0 (0.20)

Note

(1) Dimensions: mm (inch)

P-Series Miniature, Epoxy Dipped, Solid Tantalum Capacitors

Standard Ratings

Part Number (Note 1)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
35 V Rating				
NPA103 __ 35	0.01	A	0.5	4
NPA153 __ 35	0.015	A	0.5	4
NPA223 __ 35	0.022	A	0.5	4
NPA333 __ 35	0.033	A	0.5	4
NPA473 __ 35	0.047	A	0.5	4
NPA683 __ 35	0.068	A	0.5	4
NPA104 __ 35	0.10	A	0.5	4
NPB154 __ 35	0.15	B	0.5	4
NPB224 __ 35	0.22	B	0.5	4
NPC334 __ 35	0.33	C	0.5	4
NPD474 __ 35	0.47	D	0.5	4
NPE684 __ 35	0.68	E	0.5	4
NPF105 __ 35	1.0	F	0.5	4
25 V Rating				
NPC334 __ 25	0.33	C	0.5	4
NPC474 __ 25	0.47	C	0.5	4
NPD684 __ 25	0.68	D	0.5	4
NPE105 __ 25	1.0	E	0.5	4
NPF155 __ 25	1.5	F	0.5	6
20 V Rating				
NPC474 __ 20	0.47	C	0.5	4
NPD684 __ 20	0.68	D	0.5	4
NPE105 __ 20	1.0	E	0.5	4
NPF155 __ 20	1.5	F	0.5	6
NPG225 __ 20	2.2	G	0.5	6
16 V Rating				
NPC684 __ 16	0.68	C	0.5	4
NPD105 __ 16	1.0	D	0.5	4
NPE155 __ 16	1.5	E	0.5	6
NPF225 __ 16	2.2	F	0.5	6
NPG335 __ 16	3.3	G	0.5	6
NPH475 __ 16	4.7	H	0.7	6
NPJ685 __ 16	6.8	J	1.0	6
NPK106 __ 16	10	K	1.6	8
NPL156 __ 16	15	L	2.4	8
NPM226 __ 16	22	M	3.5	8

Part Number (Note 1)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
10 V Rating				
NPB105 __ 10	1.0	B	0.5	4
NPC155 __ 10	1.5	C	0.5	6
NPD225 __ 10	2.2	D	0.5	6
NPE335 __ 10	3.3	E	0.5	6
NPF475 __ 10	4.7	F	0.5	6
NPG685 __ 10	6.8	G	0.6	6
NPH106 __ 10	10	H	1.0	8
NPJ156 __ 10	15	J	1.5	8
NPK226 __ 10	22	K	2.2	8
NPL336 __ 10	33	L	3.3	8
NPM476 __ 10	47	M	4.7	8
6.3 V Rating				
NPB155 __ 06	1.5	B	0.5	6
NPC225 __ 06	2.2	C	0.5	6
NPD335 __ 06	3.3	D	0.5	6
NPE475 __ 06	4.7	E	0.5	6
NPF685 __ 06	6.8	F	0.5	6
NPG106 __ 06	10	G	0.6	8
NPH156 __ 06	15	H	0.9	8
NPJ226 __ 06	22	J	1.3	8
NPK336 __ 06	33	K	2.0	8
NPL476 __ 06	47	L	2.9	8
NPM686 __ 06	68	M	4.2	8
4 V Rating				
NPB225 __ 04	2.2	B	0.5	6
NPC335 __ 04	3.3	C	0.5	6
NPD475 __ 04	4.7	D	0.5	6
NPE685 __ 04	6.8	E	0.5	6
NPF106 __ 04	10	F	0.5	8
NPG156 __ 04	15	G	0.6	8
NPH226 __ 04	22	H	0.8	8
NPJ336 __ 04	33	J	1.3	8
NPK476 __ 04	47	K	1.8	8
NPL686 __ 04	68	L	2.7	8
NPM107 __ 04	100	M	4.0	10

Note:

(1) To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%.

Case Size Dimensions

Case Code	D_1	D_2	H
A	2.0 (0.079)	3.0 (0.118)	4.3 (0.170)
B	2.3 (0.091)	3.0 (0.118)	4.5 (0.177)
C	2.3 (0.091)	3.2 (0.126)	4.8 (0.189)
D	2.5 (0.098)	3.2 (0.126)	5.0 (0.197)
E	2.6 (0.102)	3.2 (0.126)	5.0 (0.197)
F	2.8 (0.110)	3.2 (0.126)	5.1 (0.201)
G	3.0 (0.118)	3.4 (0.134)	5.2 (0.205)
H	3.4 (0.134)	3.8 (0.150)	5.4 (0.213)
J	3.7 (0.146)	4.1 (0.162)	5.6 (0.220)
K	4.0 (0.157)	4.3 (0.170)	6.2 (0.244)
L	4.5 (0.177)	4.5 0.177)	6.4 (0.252)
M	4.7 (0.185)	4.7 (0.185)	7.0 (0.276)

Note

(1) Dimensions: mm (inch)

Q-Series Resin
Solid Dipped, Tantalum Capacitors

Standard Ratings

Part Number (Note 1, 2)	Capacitance at 25°C, 120 Hz (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
35 V Rating at 85°C, 22 V Rating at 125°C				
NQA104 __ 35 __	0.1	A	0.3	4
NQA154 __ 35 __	0.15	A	0.3	4
NQA224 __ 35 __	0.22	A	0.3	4
NQA334 __ 35 __	0.33	A	0.3	4
NQA474 __ 35 __	0.47	A	0.3	4
NQA684 __ 35 __	0.68	A	0.3	4
NQA105 __ 35 __	1.0	A	0.3	4
NQB155 __ 35 __	1.5	B	0.3	6
NQC225 __ 35 __	2.2	C	0.3	6
NQD335 __ 35 __	3.3	D	0.5	6
NQE475 __ 35 __	4.7	E	0.8	6
NQF685 __ 35 __	6.8	F	1.1	6
NQG106 __ 35 __	10	G	1.7	6
25 V Rating at 85°C, 15 V Rating at 125°C				
NQA105 __ 25 __	1.0	A	0.3	4
NQA155 __ 25 __	1.5	A	0.3	6
NQB225 __ 25 __	2.2	B	0.3	6
NQC335 __ 25 __	3.3	C	0.4	6
NQD475 __ 25 __	4.7	D	0.5	6
NQE685 __ 25 __	6.8	E	0.8	6
NQF106 __ 25 __	10	F	1.2	6
20 V Rating at 85°C, 13 V Rating at 125°C				
NQA155 __ 20 __	1.5	A	0.3	6
NQB225 __ 20 __	2.2	B	0.3	6
NQC335 __ 20 __	3.3	C	0.3	6
NQD475 __ 20 __	4.7	D	0.4	6
NQE685 __ 20 __	6.8	E	0.6	6
NQF106 __ 20 __	10	F	1.0	6
NQG156 __ 20 __	15	G	1.5	6
16 V Rating at 85°C, 10 V Rating at 125°C				
NQA225 __ 16 __	2.2	A	0.3	6
NQB335 __ 16 __	3.3	B	0.3	6
NQC475 __ 16 __	4.7	C	0.3	6
NQD685 __ 16 __	6.8	D	0.5	6
NQE106 __ 16 __	10	E	0.8	6
NQF156 __ 16 __	15	F	1.1	6
NQG226 __ 16 __	22	G	1.7	6
NQH336 __ 16 __	33	H	2.6	6
10 V Rating at 85°C, 6.3 V Rating at 125°C				
NQA335 __ 10 __	3.3	A	0.3	6
NQB475 __ 10 __	4.7	B	0.3	6
NQC685 __ 10 __	6.8	C	0.3	6
NQD106 __ 10 __	10	D	0.5	6
NQE156 __ 10 __	15	E	0.7	6
NQF226 __ 10 __	22	F	1.1	6
NQG336 __ 10 __	33	G	1.6	6
6.3 V Rating at 85°C, 4 V Rating at 125°C				
NQA475 __ 06 __	4.7	A	0.3	6
NQB685 __ 06 __	6.8	B	0.3	6
NQC106 __ 06 __	10	C	0.3	6
NQD156 __ 06 __	15	D	0.4	6
NQE226 __ 06 __	22	E	0.6	6
NQF336 __ 06 __	33	F	1.0	6
NQG476 __ 06 __	47	G	1.4	6

Notes:

(1) In the first dash (—) to complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%.

(2) In the second dash (—), add lead type C, K, F, DTP, DTN, or DTB.

Case Size Dimensions

Case Code	φD	H
A	4.5 (0.177)	7.0 (0.276)
B	5.0 (0.197)	7.5 (0.295)
C	5.0 (0.197)	8.0 (0.315)
D	5.0 (0.197)	8.5 (0.335)
E	5.5 (0.217)	9.0 (0.354)
F	6.0 (0.236)	9.5 (0.374)
G	6.5 (0.258)	10.5 (0.413)
H	7.5 (0.295)	12.0 (0.472)

Note: Dimensions: mm (inch)

R-Series Miniature Encapsulated Chip, Solid Tantalum Capacitors

Standard Ratings

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25 °C μA Max	Dissipation Factor @ 25 °C, 120 Hz % Max
35 V Rating at 85 °C, 22 V Rating at 125 °C				
NRA103 __ 35	0.01	A	0.5	4
NRA153 __ 35	0.015	A	0.5	4
NRA223 __ 35	0.022	A	0.5	4
NRA333 __ 35	0.033	A	0.5	4
NRA473 __ 35	0.047	A	0.5	4
NRA683 __ 35	0.068	A	0.5	4
NRA104 __ 35	0.10	A	0.5	4
NRA154 __ 35	0.15	A	0.5	4
NRA224 __ 35	0.22	A	0.5	4
NRB334 __ 35	0.33	A, B	0.5	4
NRB474 __ 35	0.47	B	0.5	4
NRS474 __ 35	0.47	B2	0.5	4
NRB684 __ 35	0.68	B	0.5	4
NRS684 __ 35	0.68	B2	0.5	4
NRB105 __ 35	1.0	B	0.5	4
NRS105 __ 35	1.0	B2	0.5	4
NRC155 __ 35	1.5	C	0.5	4
NRC225 __ 35	2.2	C	0.7	4
NRD335 __ 35	3.3	C, D	1.2	4
NRD475 __ 35	4.7	D	1.6	4
NRT475 __ 35	4.7	D2	1.6	4
NRD685 __ 35	6.8	D	2.3	6
NRT685 __ 35	6.8	D2	2.3	6
25 V Rating at 85 °C, 16 V Rating at 125 °C				
NRA334 __ 25	0.33	A	0.5	4
NRA474 __ 25	0.47	A	0.5	4
NRB155 __ 25	1.5	B	0.5	4
NRS155 __ 25	1.5	B2	0.5	4
NRC335 __ 25	3.3	C	0.8	4
NRC475 __ 25	4.7	C	1.1	4
NRD685 __ 25	6.8	D	1.7	6
NRT685 __ 25	6.8	D2	1.7	6
NRD106 __ 25	10.0	D	2.5	6
NRT106 __ 25	10.0	D2	2.5	6

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25 °C μA Max	Dissipation Factor @ 25 °C, 120 Hz % Max
20 V Rating at 85 °C, 13 V Rating at 125 °C				
NRA474 __ 20	0.47	A	0.5	4
NRA684 __ 20	0.68	A	0.5	4
NRB225 __ 20	2.2	B	0.5	4
NRS225 __ 20	2.2	B2	0.5	4
NRC475 __ 20	4.7	C	0.9	4
NRC685 __ 20	6.8	C	1.4	6
NRT106 __ 20	10.0	D2	2.0	6
NRD156 __ 20	15.0	D	3.0	6
NRT156 __ 20	15.0	D2	3.0	6
NRD226 __ 20	22.0	D	4.4	6
NRT226 __ 20	22.0	D2	4.4	6
16 V Rating at 85 °C, 10 V Rating at 125 °C				
NRA684 __ 16	0.68	A	0.5	4
NRA105 __ 16	1.0	A	0.5	4
NRA155 __ 16	1.5	A	2.4	4
NRB225 __ 16	2.2	B	0.5	4
NRB335 __ 16	3.3	B	0.5	4
NRS335 __ 16	3.3	B2	0.5	4
NRC475 __ 16	4.7	C	0.7	4
NRC685 __ 16	6.8	C	1.0	6
NRD106 __ 16	10.0	C, D	1.6	6
NRT156 __ 16	15.0	D2	2.4	6
NRD226 __ 16	22.0	D	3.5	6
NRT226 __ 16	22.0	D2	3.5	6
NRD336 __ 16	33.0	D	5.2	6
NRT336 __ 16	33.0	D2	5.2	6
10 V Rating at 85 °C, 6.3 V Rating at 125 °C				
NRA105 __ 10	1.0	A	0.5	4
NRA155 __ 10	1.5	A	0.5	4

Note:

(1) To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%.

R-Series Miniature Encapsulated Chip, Solid Tantalum Capacitors

Standard Ratings [cont]

Part Number (Note 1)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
10 V Rating at 85°C, 6.3 V Rating at 125°C (cont)				
NRA225 __ 10	2.2	A	2.2	4
NRB335 __ 10	3.3	B	0.5	4
NRB475 __ 10	4.7	B	0.5	4
NRS475 __ 10	4.7	B2	0.5	4
NRC685 __ 10	6.8	C	0.7	6
NRC106 __ 10	10.0	C	1.0	6
NRD156 __ 10	15.0	C, D	1.5	6
NRD226 __ 10	22.0	D	2.2	6
NRT226 __ 10	22.0	D2	2.2	6
NRD336 __ 10	33.0	D	3.3	6
NRT336 __ 10	33.0	D2	3.3	6
NRD476 __ 10	47.0	D	4.7	6
NRT476 __ 10	47.0	D2	4.7	6
6.3 V Rating at 85°C, 4 V Rating at 125°C				
NRA155 __ 06	1.5	A	0.5	4
NRA225 __ 06	2.2	A	0.5	4
NRA335 __ 06	3.3	A	2.1	4
NRB475 __ 06	4.7	B	0.5	4
NRB685 __ 06	6.8	B	0.5	6
NRS685 __ 06	6.8	B2	0.5	6
NRC106 __ 06	10.0	C	0.6	6
NRC156 __ 06	15.0	C	0.9	6
NRC226 __ 06	22.0	C	1.4	6

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
6.3 V Rating at 85°C, 4 V Rating at 125°C (cont)				
NRD336 __ 06	33.0	D	2.0	6
NRT336 __ 06	33.0	D2	2.0	6
NRD476 __ 06	47.0	D	3.0	6
NRT476 __ 06	47.0	D2	3.0	6
NRD686 __ 06	68.0	D	4.2	6
NRT686 __ 06	68.0	D2	4.2	6
4 V Rating at 85°C, 2.5 V Rating at 125°C				
NRA225 __ 04	2.2	A	0.5	4
NRA335 __ 04	3.3	A	0.5	4
NRA475 __ 04	4.7	A	1.9	4
NRB685 __ 04	6.8	B	0.5	6
NRB106 __ 04	10.0	B	0.5	6
NRS106 __ 04	10.0	B2	0.5	6
NRC156 __ 04	15.0	C	0.6	6
NRC226 __ 04	22.0	C	0.6	6
NRC336 __ 04	33.0	C	1.3	6
NRD476 __ 04	47.0	D	1.9	6
NRT476 __ 04	47.0	D2	1.9	6
NRD686 __ 04	68.0	D	2.7	6
NRT686 __ 04	68.0	D2	2.7	6
NRD107 __ 04	100.0	D	4.0	6
NRT107 __ 04	100.0	D2	4.0	6

Note:

(1) To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%.

Case Size Dimensions

Case Size	L	W_1	W_2	H	Z	Y	Taping
A	3.2 ± 0.2 0.126 ± 0.008	1.6 ± 0.2 0.063 ± 0.008	1.2 ± 0.1 0.047 ± 0.004	1.6 ± 0.2 0.063 ± 0.008	0.8 ± 0.3 0.031 ± 0.012	— —	W 8mm Q 2000P
B_2 (S)	3.5 ± 0.2 0.138 ± 0.008	2.8 ± 0.2 0.110 ± 0.008	2.3 ± 0.1 0.091 ± 0.004	1.9 ± 0.2 0.075 ± 0.008	0.8 ± 0.3 0.031 ± 0.012	— —	W 8mm Q 2000P
B	4.7 ± 0.3 0.185 ± 0.012	2.6 ± 0.3 0.102 ± 0.012	1.4 ± 0.1 0.055 ± 0.004	2.1 ± 0.3 0.083 ± 0.012	0.8 ± 0.3 0.031 ± 0.012	0.4C 0.016C	W 12mm Q 1500P
C	6.0 ± 0.3 0.236 ± 0.012	3.2 ± 0.3 0.126 ± 0.012	1.8 ± 0.1 0.071 ± 0.004	2.5 ± 0.3 0.098 ± 0.012	1.3 ± 0.3 0.051 ± 0.012	0.4C 0.016C	W 12mm Q 500P
D_2 (T)	5.8 ± 0.3 0.228 ± 0.012	4.6 ± 0.3 0.181 ± 0.012	2.4 ± 0.1 0.095 ± 0.004	3.2 ± 0.3 0.126 ± 0.012	1.3 ± 0.3 0.051 ± 0.012	— —	W 12mm Q 500P
D	7.3 ± 0.3 0.287 ± 0.012	4.3 ± 0.3 0.169 ± 0.012	2.4 ± 0.1 0.095 ± 0.004	2.8 ± 0.3 0.110 ± 0.012	1.3 ± 0.3 0.051 ± 0.012	0.5C 0.020C	W 12mm Q 500P

Note:

(1) Dimensions: mm (inch)

U-Series Subminiature Metal Can, Epoxy End Seal, Axial Solid Tantalum Capacitors

Standard Ratings

Part Number (Note 1, 2)	Capacitance (μF)	Case	Leakage Current @ 25°C μA Max	Dissipation Factor @ 25°C, 120 Hz % Max
35 V 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
NUA683 __ 35	0.068	A	0.05	3
NUA104 __ 35	0.10	A	0.05	3
NUB154 __ 35	0.15	B	0.05	3
NUB224 __ 35	0.22	B	0.05	3
NUB334 __ 35	0.33	B	0.05	3
NUB474 __ 35	0.47	B	0.08	3
NUC684 __ 35	0.68	C	0.11	3
NUC105 __ 35	1.0	C	0.17	3
NUC155 __ 35	1.5	C	0.26	4
25 V Rating				
NUA154 __ 25	0.15	A	0.05	3
NUB684 __ 25	0.68	B	0.08	3
NUC225 __ 25	2.2	C	0.27	4
15 V Rating				
NUA224 __ 15	0.22	A	0.05	3
NUB105 __ 15	1.0	B	0.07	3
NUC335 __ 15	3.3	C	0.24	4
10 V Rating				
NUA334 __ 10	0.33	A	0.05	3
NUB155 __ 10	1.5	B	0.07	4
NUC475 __ 10	4.7	C	0.23	4
6 V Rating				
NUA474 __ 06	0.47	A	0.05	3
NUB225 __ 06	2.2	B	0.06	4
NUC685 __ 06	6.8	C	0.02	6
3 V Rating				
NUA684 __ 03	0.68	A	0.05	3
NUB335 __ 03	3.3	B	0.05	4
NUC106 __ 03	10	C	0.15	6

Notes:

(1) K tolerance parts are not available for part number with (*).

(2) To complete part number, insert capacitance tolerance symbol M = ±20%, K = ±10%.

Case Size Dimensions

Case	Length	Diameter
A	3.0 (0.118)	1.1 (0.043)
B	3.5 (0.138)	1.6 (0.063)
C	4.5 (0.177)	2.0 (0.079)

Note

(1) Dimensions: mm (inch)

FA-Series Supercap Electric Double Layer Capacitor

Specifications

Catalog	Capacitance	Rated V	Max WV	Max ESR	Dimensions mm (inches)						Weight
NBR	(Farads)	(VDC)	(VDC)	(Ω at 1 kHz)	D	H Max	P	d_1	d_2	l_1	g (oz.)
FA0H473Z	0.047	5	5.5	20	16.0 (0.630)	15.5 (0.610)	5 (0.197)	0.6 (0.024)	1.2 (0.047)	5.0 (0.197)	6.2 (0.219)
FA0H104Z	0.1	5	5.5	8	21.5 (0.846)	15.5 (0.610)	7.5 (0.295)	0.6 (0.024)	1.2 (0.047)	5.5 (0.217)	12 (0.423)
FA0H224Z	0.22	5	5.5	5	28.5 (1.122)	16.5 (0.650)	10 (0.394)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)	25 (0.882)
FA0H474Z	0.47	5	5.5	3.5	36.5 (1.437)	16.5 (0.650)	15 (0.591)	0.6 (0.024)	1.7 (0.067)	9.5 (0.374)	42 (1.482)
FA0H105Z	1.0	5	5.5	2.5	44.5 (1.752)	18.5 (0.728)	20 (0.787)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)	65 (2.293)
FA1A223Z	0.022	10	11	20	16.0 (0.630)	25.0 (0.984)	5 (0.197)	0.6 (0.024)	1.2 (0.047)	5.0 (0.197)	7.5 (0.265)
FA1A104Z	0.1	10	11	8	28.5 (1.122)	25.5 (1.004)	10 (0.394)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)	32 (1.129)
FA1A224Z	0.22	10	11	6	36.5 (1.437)	27.5 (1.083)	15 (0.591)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)	55 (1.940)
FA1A474Z	0.47	10	11	4	44.5 (1.752)	28.5 (1.122)	20 (0.787)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)	83 (2.928)

Notes:

(1) Capacitance tolerance: +80%, −20%

(2) Weight is typical

FS-Series Supercap Electric Double Layer Capacitor

Specifications

Catalog	Capacitance	Rated V	Max WV	Max ESR	Dimensions mm (inches)						Weight
NBR	(Farads)	(VDC)	(VDC)	(Ω at 1 kHz)	D	H Max	P	d_1	d_2	l_1	g (oz.)
FS0H473Z	0.047	5	5.5	40	13.0 (0.512)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)	2.6 (0.092)
FS0H104Z	0.1	5	5.5	25	16.5 (0.650)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)	4.1 (0.145)
FS0H224Z	0.22	5	5.5	25	16.5 (0.650)	13.0 (0.512)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)	5.3 (0.187)
FS0H474Z	0.47	5	5.5	13	21.5 (0.846)	13.0 (0.512)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)	10 (0.353)
FS0H105Z	1	5	5.5	7	28.5 (1.122)	14.0 (0.551)	10.16 (0.400)	0.6 (0.024)	1.4 (0.055)	6.1 (0.240)	18 (0.635)

Notes:

(1) Capacitance tolerance: +80%, −20%

(2) Weight is typical

FZ-Series Supercap Electric Double Layer Capacitor

Specifications

Catalog	Capacitance	Rated V	Max WV	Max ESR	Dimensions mm (inches)						Weight
NBR	(Farads)	(VDC)	(VDC)	(Ω at 1 kHz)	D	H Max	P	d_1	d_2	l_1	g (oz.)
FZ0H223Z	0.022	5	5.5	50	13.0 (0.512)	15 (0.591)	5.1 (0.201)	0.4 (0.016)	1.2 (0.047)	3.9 (0.154)	3.0 (0.106)
FZ0H473Z	0.047	5	5.5	40	14.0 (0.571)	15 (0.591)	5.1 (0.201)	0.4 (0.016)	1.2 (0.047)	4.2 (0.165)	3.5 (0.123)
FZ0H104Z	0.1	5	5.5	45	14.5 (0.571)	24 (0.945)	5.1 (0.201)	0.4 (0.016)	1.2 (0.047)	4.6 (0.181)	7.0 (0.247)
FZ0H224Z	0.22	5	5.5	25	16.5 (0.650)	25 (0.984)	5.1 (0.201)	0.4 (0.016)	1.2 (0.047)	5.2 (0.205)	8.0 (0.282)
FZ0H474Z	0.47	5	5.5	13	21.5 (0.846)	25 (0.984)	7.6 (0.299)	0.6 (0.024)	1.2 (0.047)	5.9 (0.232)	14.0 (0.494)
FZ0H105Z	1.0	5	5.5	7	28.5 (1.122)	25 (0.984)	10.2 (0.402)	0.6 (0.024)	1.4 (0.055)	9.5 (0.374)	24.0 (0.847)

Notes

(1) Capacitance tolerance: +80%, −20%

(2) Weight is typical

High-Capacitance, Resin Dipped Multilayer Ceramic Capacitors

Standard Ratings

Part Number	Capacitance at 25 °C, 1 kHz (μF)	Case	Insulation Resistance (25 °C) MΩ Min	Dissipation Factor (25 °C, 1 kHz) % Max
75 V Rating				
DBY5V1N106Z1	10	DB	50	5
DBY5V1N156Z1	15	DB	33	5
DBY5V1N226Z1	22	DB	22	5
DCY5V1N336Z1	33	DC	15	5
DCY5V1N476Z1	47	DC	10	5
50 V Rating				
DAY5V1H106Z1	10	DA	50	5
DBY5V1H156Z1	15	DB	33	5
DBY5V1H226Z1	22	DB	22	5
DBY5V1H336Z1	33	DB	15	5
DBY5V1H476Z1	47	DB	10	5
DCY5V1H686Z1	68	DC	7	5
DCY5V1H107Z1	100	DC	5	5
25 V Rating				
DAY5V1E106Z1	10	DA	50	5
DAY5V1E156Z1	15	DA	33	5
DBY5V1E226Z1	22	DB	22	5
DBY5V1E336Z1	33	DB	15	5
DBY5V1E476Z1	47	DB	10	5
DBY5V1E686Z1	68	DB	7	5
DCY5V1E107Z1	100	DC	5	5

FLUORESCENT INDICATOR PANEL DISPLAYS (FIPs)

8

Section 8 — Fluorescent Indicator Panel Display (FIPs) **Page**

Part Numbering System

FIP 5 A — 15 A S

- S: Special classification: Use following alphabets according to the structure of the FIP
  - R = Alpha-numeric type
  - S = Static driving type
    Multiplex driving type of FIP has no letter
  - T = Graphic type
  - X = Dot-matrix type
  - Y = Bar-graphic type

  } Old numbering system
- A: Serial number of minor change:
  Use in alphabetical order from A to N (The original FIP has no letters.)
- 15: Character height or pattern height:
  Use Arabic numerals with unit in mm
- —: Special classification:
  Use "M" only for multidisplay type of FIP
  Use "W" only for multidisplay (level meter) type of FIP
- A: Special number of development:
  Use in alphabetical order. (I, M, O, U, V, W and Z are not used.)
- 5: Number of digits:
  Use Arabic numerals
- FIP: NEC's abbreviation for fluorescent indicator panel

FIP 20 X — 1 A A

- A: Serial number of minor change:
  Use in alphabetical order from B to N (The original FIP has A.)
- A: Special number of development:
  Use in alphabetical order (I, M, O, U, V, W and Z are not used.)
- 1: Number of line:
  Use arabic numerals. (Use perpendicular dot numbers in case of graphic type.)
- —: Special classification: Use "M" only for multidisplay type of FIP
- X: Classification
  - X = Dot matrix type
  - GX = Graphic type
- 20: Number of digits/line:
  Use arabic numerals for number of digits per one line.
  (Use horizontal dot numbers in case of graphic type.)
- FIP: NEC's abbreviation for fluorescent indicator panel

Abbreviations used in these tables

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 Oper.	=	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_b/1seg	=	Peak anode current per segment (in case of multiplex operation mode) DC anode current per segment (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/m^2 (SI unit) Bright value (cd/m^2) shown in the table is the calculated value according to the equation. 1 (ft. L) = 3.43 (cd/m^2)

Data Terminal and Others (Dot Type and Graphic Type)

Type No. (Note 1)	No. of Digits	Character Format, Symbol	Display Config Drawing (Note 2)	Outline Dimensions (in millimeters)						
				Character		Panel			Lead	
				Height	Width	Height	Length	Thickness	Pitch	Length
FIP16X1EA	16	5x7	A	3.95	2.3	26.0 $^{+0.8}_{-0.3}$	82.0 $^{+0.8}_{-0.3}$	7.4 max	2.54	14.0
FIP16X1CA	16	5x7	A	5.05	3.3	34.0 $^{+0.8}_{-0.3}$	100.0 $^{+0.8}_{-0.3}$	8.5 max	2.54	14.0
FIP16XBA/FIP16B6X	16	5x7, DP	B	6.0	4.2	34.0 ±1.0	125.0 ±1.0	9.5 max	2.54	14.0
FIP16X1FA	16	5x7	A	9.1	6.28	41.0 $^{+0.8}_{-0.5}$	170.0 ±1.0	8.5 max	2.54	14.0
FIP16X1KA	16	5x7	A	5.0	3.22	19.5 ±0.5	96.7 ±0.5	6.5 ±0.5	2.54	6.2
FIP16XM1BA/FIP16B11X	16	5x7, DP, COMMA	C	11.3	7.25	41.0 $^{+0.8}_{-0.3}$	208.0 $^{+0.8}_{-0.3}$	9.85 max	2.54	14.0
FIP16XM1CA/FIP16C11X	16	5x7, DP, COMMA, CURSOR	D	11.3	7.25	43.2 max	208.0 $^{+0.8}_{-0.3}$	9.85 max	2.54	14.0
FIP16XM1DA/FIP16D11X	16	5x7, DP, COMMA, CURSOR	D	11.3	7.25	43.2 max	208.0 $^{+0.8}_{-0.3}$	9.9 max	2.54	14.0
FIP17X1AA	17	5x7	A	6.0	3.8	19.6 ±1.0	118.0 ±1.0	6.5 ±0.7	2.54	9.5
FIP10XM2AA	20	5x7, DP, COMMA, DCT	E	11.3	7.25	70.0 ±1.0	140.0 ±1.0	12.3 ±0.7	2.54	7.4
FIP20X1LB	20	5x7	A	5.0	3.5	20.5 $^{+0.7}_{-0.5}$	115.7 $^{+0.8}_{-0.5}$	6.1 ±0.7	2.54	6.2
FIP20X1AA/FIP20A5X	20	5x7, CURSOR	F	5.05	3.55	34.0 $^{+1.0}_{-0.5}$	138.0 ±0.7	8.5 max	2.54	14.0
FIP20X1EA/FIP20D9X	20	5x12	G	8.75	3.5	33.0 ±1.0	144.0 ±1.0	7.8 $^{+1.5}_{-0.5}$	2.54	5.5
FIP20X1CA/FIP20B9X	20	5x12	G	8.8	3.55	41.0 $^{+0.8}_{-0.3}$	138.0 $^{+0.6}_{-0.3}$	8.3 $^{+1.0}_{-0.8}$	2.54	7.4
FIP20X1DB	20	5x7	A	9.0	6.3	41.0 ±0.5	208.0 $^{+1.0}_{-0.5}$	8.0 ±0.7	2.54	14.0
FIP20X1KA	20	5x12	G	15.85	6.4	42.4 ±1.0	208.0 ±1.0	9.5 ±0.7	2.54	14.0
FIP20X1MA	20	5x7	A	8.99	6.3	41.0 ±0.5	202.5 $^{+0.8}_{-0.3}$	8.0 ±0.7	2.54	14.0
FIP20XM1AA	20	5x7, DP, DCT	H	11.3	7.25	49.0 ±1.0	244.0 ±1.0	11.3 ±0.7	2.54	14.0
FIP20XM1BA	20	5x7, DP, COMMA, DCT	D	11.3	7.25	42.4 ±1.0	244.0 ±1.0	9.2 ±0.7	2.54	14.0
FIP12XM2AA	24	5x7, DP, COMMA, DCT	I	8.15	5.25	58.0 ±1.0	130.0 ±1.0	11.3 ±0.7	2.54	14.0
FIP24X1AA/FIP24A7X	24	5x7	A	6.75	4.75	33.0 ±1.0	185.0 ±1.0	8.5 $^{+1.0}_{-0.7}$	2.54	13.0
FIP26X1AA/FIP26A9X	26	5x12	G	8.75	3.0	43.0 ±0.5	160.5 ±0.5	10.0 max	2.54	14.0
FIP16XM2AA/FIP32A11X	32 16x2 line	5x7, DP, COMMA, 2 line	J	11.3	7.25	60.0 ±1.0	208.0 ±1.0	13.0 max	2.54	14.0
FIP32X1BA/FIP32B5X	32	5x7, CURSOR	F	5.35	3.55	34.0 $^{+1.5}_{-0.5}$	185.0 ±0.5	10.0 max	2.54	14.0
FIP32X1CA/FIP32A9X	32	5x12	G	8.8	3.55	41.0 $^{+0.8}_{-0.3}$	208.0 ±1.0	10.2 max	2.54	14.0
FIP18X2AA	36 18x2 line	5x7, DP, COMMA, 2 line	J	9.1	6.4	60.0 ±1.0	208.0 ±1.0	11.3 ±0.7	2.54	14.0
FIP20X2AA/FIP40C5X	40 20x2 line	5x7, 2 line	A	5.05	3.55	41.0 $^{+0.8}_{-0.3}$	125.0 $^{+0.8}_{-0.3}$	7.8 ±0.7	2.54	14.0
FIP20X2CA	40 20x2 line	5x7, DP, COMMA, 2 line	J	11.3	7.25	60.0 ±1.0	252.0 ±1.0	12.0 max	2.54	16.0
FIP20X2BA	40 20x2 line	5x12, 2 line	G	15.85	6.4	68.0 ±1.0	208.0 ±1.0	12.3 ±0.7	2.54	14.0

Notes:

(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

(2) See the display configuration drawing table that follows to match the example of the display with the letter codes in the display configuration drawing column.

Recommended Electrical Ratings										
Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper.	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (—)	E_k (V_{dc})	I_b/dig. (mA) *i_b/1 seg	i_c/dig. (mA)	L (cd/m^2)	L (ft.L)
AC	4.2	22	dynamic	22	1/18	4.5	1.6	1.4	690	(200)
AC	5.2	23	dynamic	28	1/20	5	2.5	2.0	690	(200)
AC	4.3	78	dynamic	35	1/20	5	2.3	2.4	690	(200)
AC	4.8	120	dynamic	35	1/20	5.5	10.0	10.0	690	(200)
AC	5.2	34	dynamic	25	1/20	5.0	2.5	2.5	860	(250)
AC	8.3	106	dynamic	35	1/20	7	20.0	12.0	1030	(300)
AC	8.3	133	dynamic	43	1/38	8	28.0	20.0	1720	(500)
AC	8.3	133	dynamic	43	1/38	8	26.0	23.0	1720	(500)
AC	4.4	78	dynamic	50	1/20	7	6.0	7.0	2740	(800)
AC	5.0	260	dynamic	35	1/23	6	10.0	10.0	1200	(350)
AC	5.6	38	dynamic	27	1/25	6	2.7	2.9	690	(200)
AC	5.7	56	dynamic	35	1/24	5.5	3.5	3.5	1030	(300)
AC	5.0	78	dynamic	25	1/25	5.5	4.5	5.5	690	(200)
AC	5.1	78	dynamic	35	1/24	6	10.0	6.0	690	(200)
AC	6.4	120	dynamic	35	1/24	8.5	9.0	9.0	1030	(300)
AC	8.3	130	dynamic	35	1/24	9	16.0	14.0	690	(200)
AC	6.4	120	dynamic	45	1/76.8	10.0	21.0	15.0	860	(250)
AC	9.6	156	dynamic	45	1/25	10.0	20.0	25.0	1710	(500)
AC	9.6	130	dynamic	45	1/25	10.0	20.0	25.0	1710	(500)
AC	4.6	189	dynamic	45	1/26	6	15.0	22.0	1710	(500)
AC	6.5	75	dynamic	40	1/30	13	5.4	6.6	690	(200)
AC	5.7	78	dynamic	40	1/32	7	5.0	3.0	690	(200)
AC	8.3	212	dynamic	35	1/20	10	30.0	25.0	1030	(300)
AC	6.8	78	dynamic	45	1/35	7	3.0	2.4	690	(200)
AC	8.4	78	dynamic	42	1/40	8.5	8.0	7.0	690	(200)
AC	8.0	208	dynamic	45	1/45	9	14.0	15.0	690	(200)
AC	6.0	125	dynamic	50	1/45	5	4.0	4.0	860	(250)
AC	9.5	212	dynamic	35	1/24	10	30.0	25.0	860	(250)
AC	8.0	260	dynamic	45	1/50	9	20.0	18.0	690	(200)

Data Terminal and Others (Dot Type and Graphic Type)

Type No. (Note 1)	No. of Digits	Character Format, Symbol	Display Config Drawing (Note 2)	Outline Dimensions (in millimeters)						
				Character		Panel			Lead	
				Height	Width	Height	Length	Thickness	Pitch	Length
FIP40X1AA/FIP40A5X	40	5x7, CURSOR	K	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0 ±0.7	10.0 max	2.54	7.0
FIP40X1DA/FIP40E5X	40	5x7	A	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0 ±0.7	10.0 max	2.54	8.76
FIP40X1HB	40	5x7, CURSOR	F	5.05	3.55	$34.0^{+0.8}_{-0.5}$	220.0 ±0.7	8.0 ±0.7	2.54	14.0
FIP40X1FB/FIP40B9AX	40	5x12	G	8.8	3.55	$41.0^{+0.8}_{-0.3}$	$240.0^{+0.8}_{-0.3}$	$10.0^{+1.0}_{-0.8}$	2.54	14.0
FIP40X1GA/FIP40C9X	40	5x12, CURSOR	L	8.8	3.55	$41.0^{+0.8}_{-0.3}$	$240.0^{+0.8}_{-0.3}$	11.0 max	2.54	9.5
FIP20X3AA/FIP60A5X	60 20x3 line	5x7, 3 line	A	5.05	3.55	49.0 ±1.0	138.0 ±1.0	11.0 max	2.0	10.2
FIP32X2AA	64 32x2 line	5x7, CURSOR, 2 line	F	5.35	3.55	$50.0^{+0.8}_{-0.3}$	185.0 ±0.7	10.3 ±0.7	2.54	14.0
FIP20X4AA	80 20x4 line	5x7, 4 line	A	11.3	7.25	90.0 ±1.0	240.0 ±1.0	13.3 ±0.7	2.54	10.0
FIP40X2CB	80 40x2 line	5x7, CURSOR, 2 line	F	5.35	3.55	$50.0^{+0.8}_{-0.3}$	220.0 ±0.7	12.2 max	2.54	14.0
FIP40X2CC	80	5x7, CURSOR	F	5.05	3.55	$49.0^{+0.8}_{-0.3}$	220.0 ±0.7	12.2 max	2.54	14.0
FIP40X2BA/FIP80A9X	80 40x2 line	5x12, 2 line	G	9.35	3.55	60.0 ±1.0	238.0 ±1.0	12.0 max	2.54	14.0
FIP42X2AA	84 42x2 line	5x7, CURSOR, 2 line	F	5.35	3.55	67.0 ±1.0	228.75 ±1.0	11.0 ±0.7	2.54	14.0
FIP80X1AA/FIP80A6X	80	5x12	G	6.29	1.8	$44.0^{+0.8}_{-0.3}$	$298.0^{+0.8}_{-0.3}$	10.0 ±0.5	2.54	7.0
FIP80X2AA/FIP160A4X	160 80x2 line	5x7, CURSOR, 2 line	F	3.55	2.05	$44.0^{+0.8}_{-0.3}$	$298.0^{+0.8}_{-0.3}$	10.0 ±0.7	2.54	7.0
FIP40X6AA	240 40x6 line	5x7, CURSOR, 6 line	A	5.0	3.5	90.0 max	250.0 ±1.0	14.0 max	2.0	20.0
FIP48GX7AA/FIP48A8XT	—	48x7, GRAPHIC	—	7.9	57.1	34.0 ±1.0	93.0 ±1.0	9.5 max	2.54	7.4
FIP72GX7AA	—	72x7, GRAPHIC	—	7.9	85.9	32.7 ±1.0	122.5 ±1.0	9.5 max	2.54	14.0
FIP128GX20AA/ FIP36A10XT	—	128x20, GRAPHIC	—	29.7	191.7	60.0 ±1.0	238.0 ±1.0	13.0 max	2.54	14.0
FIP180GX48BA	—	180x48, GRAPHIC	—	29.54	111.38	60.0 ±1.0	156.0 ±1.0	11.0 max	1.27	20.0
FIP280GX60AA/ FIP240A4XT	—	280x60, GRAPHIC	—	38.75	181.75	70.0 ±1.0	265.0 ±1.0	12.0 max	1.27	20.0

Notes:

(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

(2) See the display configuration drawing table that follows to match the example of the display with the letter codes in the display configuration drawing column.

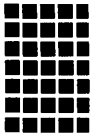
Recommended Electrical Ratings										
Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper.	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (—)	E_K (V_{dc})	I_b/dig. (mA) *i_b/1 seg	i_c/dig. (mA)	L (cd/m²)	L (ft.L)
AC	8.9	78	dynamic	45	1/50	8	4.4	3.5	690	(200)
AC	8.9	78	dynamic	45	1/50	10	7.0	6.0	690	(200)
AC	9.0	78	dynamic	45	1/50	7	7.5	7.0	690	(200)
AC	9.7	78	dynamic	45	1/50	9	15.0	10.0	690	(200)
AC	9.7	104	dynamic	43	1/50	9	15.0	12.0	690	(200)
AC	4.8	156	dynamic	48	1/25	9	5.0	15.0	1270	(400)
AC	6.8	156	dynamic	45	1/40	8	15.0	15.0	860	(250)
AC	9.0	432	dynamic	35	1/24	10	14.0	60.0	600	(175)
AC	9.0	156	dynamic	45	1/50	8	15.0	15.0	860	(250)
AC	9.0	156	dynamic	45	1/45	8	8.0	15.0	690	(200)
AC	9.7	156	dynamic	45	1/50	8	15.0	15.0	860	(250)
AC	9.2	156	dynamic	45	1/50	10	6.0	22.0	690	(200)
AC	9.3	160	dynamic	55	1/113	15	10.0 max	5.0	690	(200)
AC	8.2	200	dynamic	48	1/100	10	7.0 max	11.0 max	510	(150)
AC	8.8	312	dynamic	50	1/50	10	4.5	27.0	690	(200)
AC	3.0	78	dynamic	35	1/18	5	0.2*	4.0	1030	(300)
AC	4.2	78	dynamic	36.2	1/24	6	4.8	4.3	820	(240)
AC	9.2	234	dynamic	60	1/75	12	0.7*	15.0	690	(200)
AC	5.3	312	dynamic	52	1/100	6	4.0	4.0	690	(200)
AC	8.9	450	dynamic	$e_b = 100$ $e_c = 50$	1/175	12	0.1*	6.0	690	(200)

Display Configuration Table

A


FIP16X1EA


FIP16X1CA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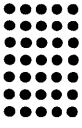
FIP16X1KA


FIP17X1AA


FIP20X1LB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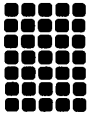
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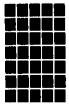
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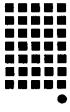
FIP40X1DA/FIP40E5X

B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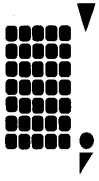
C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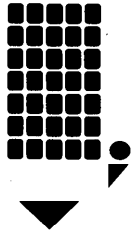
D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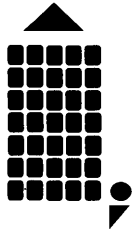
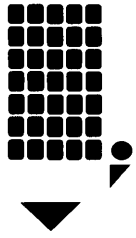
FIP16D11AX
FIP20XM1BA

E



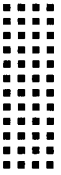

FIP10XM2AA

Display Configuration Table (cont)

F

FIP20X1AA/FIP20A5X
FIP32X1BA/FIP32B5X
FIP40X1HB
FIP32X2AA
FIP40X2CB
FIP40X2CC
FIP80X2AA/FIP160A4X
FIP42X2AA
FIP40X6AA

G



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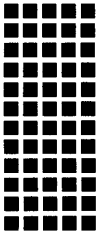
FIP32X1CA/FIP32A9X
FIP40X1FB/FIP40B9AX

H



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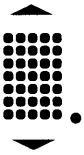
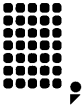
FIP80X1AA/FIP80A6X

J



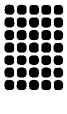
FIP20XM1AA

K



FIP12XM2AA

L

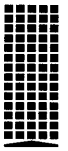


FIP16M2AA/FIP32A11X
FIP18X2AA
FIP20X2CA

M

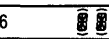
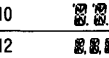
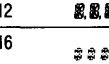
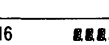
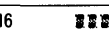
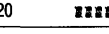
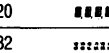
FIP40X1AA/FIP40A5X,
FIP40A5AX

N



FIP40X1GA/FIP40C9X

Data Terminal and Others (Alpha-Numeric Type)

Type No. (Note 1)	No. of Digits	Character Format, Symbol	Outline Dimensions (in millimeters)						
			Character		Panel			Lead	
			Height	Width	Height	Length	Thickness	Pitch	Length
FIP6A8R	6		8.15	4.4	28.0 ±1.0	78.0 ±1.0	7.5 ±0.7	2.54	20.0
FIP8A5R FIP8A5AR	8		5.0	3.0	24.5 $^{+0.5}_{-0.3}$	65.5 max	7.3 max	2.54	14.0 7.0
FIP8A6R	8		5.5	3.0	20.0 ±1.0	70.0. ±1.0	6.5 $^{+0.5}_{-1.0}$	2.54	9.2
FIP9A5AR	9		5.0	3.0	23.0 $^{+0.5}_{-0.3}$	71.5 max	7.5 max	2.54	7.0
FIP10A6R	10		6.0	3.0	22.8 ±1.0	75.2 ±0.7	7.2 max	2.54	24.0
FIP12A11R	12		10.7	6.35	31.0 ±1.0	160.0 ±1.5	10.0 max	2.54	14.0
FIP16A5R FIP16A5CR	16		5.0	3.0	20.0 ±1.0	110.0 ±1.5	8.0 max	2.54	10.0
FIP16A11R	16		10.7	6.35	31.0 ±1.0	200.0 ±1.5	8.0 ±0.7	2.54	7.4
FIP16B13R	16		12.5	7.0	33.0 ±1.0	205.0 ±1.0	10.0 max	5.08	10.0
FIP20B6R	20		6.0	3.0	22.8 ±1.0	134.0 ±1.0	9.2 max	2.54	14.0
FIP20B9AR	20		9.0	5.0	33.0 ±1.0	205.0 ±1.0	9.6 max	2.54	14.0
FIP32A6R	32		6.0	3.0	30.0 ±1.0	202.0 ±1.5	9.2 max	2.54	14.0
FIP32B6R	32		6.0	3.5	41.0 $^{+0.8}_{-0.3}$	208.0 $^{+0.8}_{-0.3}$	10.2 max	2.54	14.0
FIP32D6R	32		6.0	3.2	41.0 $^{+0.8}_{-0.3}$	208.0 $^{+0.8}_{-0.3}$	10.2 max	2.54	14.0
80B5R	80 40x2 line	14 segment, CURSOR, COMMA, 2 line	5.0	3.0	39.0 ±1.0	250 ±1.0	9.7 ±0.7	2.54	10.0

Notes:

(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

Recommended Electrical Ratings										
Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper.	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (—)	E_k (V_{dc})	I_b/dig. (mA) *i_b/1 seg	i_c/dig. (mA)	L (cd/m^2)	L (ft.L)
AC	2.4	125	dynamic	26	1/20	4.0	4.5	9.8	620	(180)
AC	3.0	22	dynamic	24	1/20	3.0	2.5	2.5	690	(200)
AC	2.3	78	dynamic	30	1/20	3.5	0.3*	6.0	1370	(400)
AC	3.4	22	dynamic	24	1/12	3.5	3.0	3.0	690	(200)
AC	3.9	16.5	dynamic	26	1/16	5.0	2.5	2.5	860	(250)
AC	5.9	104	dynamic	28	1/20	6.0	1.5*	8.5	1200	(350)
AC	5.5 4.8	16.5 40.0	dynamic	24	1/20	6.0	2.5 3.0	3.0	690 1230	200 (360)
AC	8.0	104	dynamic	28	1/20	7.0	1.0*	8.5	1200	(350)
AC	7.2	75	dynamic	47	1/20	15.0	8.0	9.0	1030	(300)
AC	5.8	37	dynamic	32	1/24	7.0	3.5	3.5	1030	(300)
AC	7.2	130	dynamic	35	1/24	8.5	9.0	9.0	690	(200)
AC	7.5	50	dynamic	38	1/40	10.0	5.0	5.0	860	(250)
AC	6.8	80	dynamic	45	1/40	7.0	5.0	5.0	890	(260)
AC	8.4	78	dynamic	45	1/40	8.0	7.0	7.0	890	(260)
AC	9.5	162	dynamic	40	1/48	8.5	5.0	12.0	690	(200)

Automotive and Others

Type No. (Note 1)	No. of Digits	Character Format, Symbol	Outline Dimensions (in millimeters)						
			Character		Panel			Lead	
			Height	Width	Height	Length	Thickness	Pitch	Length
FIP4C5	4	18:8.8	5.0	2.4	14.5 ±1.0	41.0 ±1.0	$6.0^{+0.5}_{-0.7}$	2.0	6.0
FIP4B6S	4	38:8.8	6.0	3.0	18.5 ±1.0	44.0 ±1.0	6.5 max	2.0	8.7
FIP4F6S	4	38:88	6.0	3.0	18.5 ±1.0	44.0 ±1.0	6.5 max	2.0	5.21
LD8164/FIP4A8S	4	88:88	7.6	4.0	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP4B8	4	88:88	7.6	4.0	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	10.5
FIP4B8AS	4	88:88	7.6	4.3	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP4E8S	4	18:88	7.6	4.0	20.0 ±1.0	48.0 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP4E8BS	4	18:88	7.6	4.0	20.0 ±1.0	48.0 ±1.0	6.1 ±0.5	2.54	8.2
FIP4Y8S	4	18:88	7.6	4.0	20.0 ±1.0	48.0 ±1.0	6.5 ±0.7	2.54	8.7
FIP4S8S	4	H8:88 (Note 2)	7.6	4.0	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.7}_{-1.0}$	2.54	8.2
FIP4Q8S	4	18:88 (Note 2)	8.0	4.4	20.0 ±1.0	48.0 ±1.0	6.5 ±0.7	2.54	8.2
FIP4E13S	4	88:88	12.6	6.6	29.0 max	79.0 max	7.5 ±1.0	2.0	10.0
FIP5C8S	5	AM PM 88:88.	7.6	3.6	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP6F6	6	AM FM 18:8.8 ME ST	6.0	2.7	17.0 ±1.0	62.5 ±1.0	6.5 max	2.54	8.0
FIP6F8	6	88:88.8.8.	7.6	4.0	22.8 ±1.0	75.2 ±1.0	7.7 ±1.0	2.54	10.5

Notes:

(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

(2) White back

Recommended Electrical Ratings										
Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper.	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (—)	E_k (V_{dc})	I_b/dig. (mA) *i_b/1 seg	I_c/dig. (mA)	L (cd/m^2)	L (ft.L)
AC	1.2	52	dynamic	22	1/6	2	1.2	1.5	1710	(500)
DC	1.6	57	static	12*	—	—	0.7	4.0	2060	(600)
DC	1.3	90	static	10.5*	—	1	0.9	7.0	2740	(800)
DC	1.7	78	static	12*	—	—	0.8	6.0	1370	(400)
DC	1.7	78	dynamic	24	1/7.5	1	3.2	4.5	1440	(420)
AC	1.7	78	static	18*	—	—	1.5	8.5	2570	(750)
DC	1.4	78	static	12*	—	—	0.8	5.0	1370	(400)
DC	1.4	78	static	12*	—	—	0.8	5.0	2060	(600)
DC	1.5	110	static	12*	—	—	1.4	8.0	2740	(800)
DC	1.7	104	static	12*	—	—	1.4	7.5	2740	(800)
DC	1.5	110	static	12*	—	—	1.9	8.0	2740	(800)
AC	2.3	108	static	12*	—	—	1.0	13.0	1030	(300)
DC	1.7	78	static	12*	—	—	1.1	6.0	1370	(400)
DC	2.3	85	dynamic	21	1/7.5	3	1.6	2.0	1540	(450)
DC	2.3	78	dynamic	24	1/7.5	3	2.6	3.6	1710	(500)

Audio, Analog Instrument, and Others

Type No. (Note 1)	No. of Digits	Character Format, Symbol	Outline Dimensions (in millimeters)						
			Character		Panel			Lead	
			Height	Width	Height	Length	Thickness	Pitch	Length
FIP2A13	2	·88	12.5	6.6	28.0 $^{\pm1.0}_{-0.5}$	50.0 ±1.0	7.5 ±1.0	2.54	10.0
FIP2A15S	2	88	15.0	8.0	33.0 ±1.0	55.0 ±1.0	8.0 $^{+1.5}_{-0.5}$	2.54	10.0
FIP4H5	4	8888	5.0	2.5	14.5 ±1.0	41.0 ±1.0	6.5 ±0.7	2.54	8.0
FIP6A8B	6	18:8.8	7.62	3.8	22.8 ±1.0	75.2 ±1.0	7.7 ±1.0	2.54	10.0
FIP6A8S	6	188.8	8.0	4.8	28.0 ±1.0	78.0 ±1.0	7.5 ±1.0	2.0	7.5
FIP7A8S FIP7A8AS	7	188.88	8.0	4.8	28.0 ±1.0	78.0 ±1.0	7.5 ±1.0	2.0	7.5 3.5
FIP7B8S FIP7B8AS	7	188.88	8.0	4.8	28.0 ±1.0	78.0 ±1.0	7.5 ±1.0	2.0	7.5 3.5
FIP7D8 FIP7D8A FIP7D8F	7	188.88	8.0	4.6	28.0 ±1.0	78.0 ±1.0	7.5 ±1.0	2.54	7.5 2.7 3.2
FIP7E8S	7	188.88 (Note 2)	8.0	4.5	24.5 ±1.0	85.0 ±1.0	7.5 ±0.7	2.0	7.7
FIP7F8S	7	188.88 (Note 2)	8.0	4.5	24.5 ±1.0	85.0 ±1.0	7.5 ±0.7	2.0	7.7
FIP7G8 FIP7G8A FIP7G8D	7	188.88	8.0	4.6	28.0 ±1.0	78.0 ±1.0	7.5 ±1.0	2.54	7.5 3.2 3.2
FIP7P8 Series	7	188.88	8.0	4.6	24.5 ±1.0	76.0 ±1.0	6.1 ±0.7	2.54	15.0 to 3.2
FIP7Q8 Series	7	188.88	8.0	4.6	24.5 ±1.0	76.0 ±1.0	6.1 ±0.7	2.54	15.0 to 3.2
FIP7A13 FIP7A13A	7	88:8.8.8	12.5	6.0	28.5 ±1.0	102.0 $^{+1.0}_{-0.5}$	7.5 $^{+1.0}_{-0.7}$	2.54	10.0 5.2
FIP7C13	7	888.88	12.5	6.0	28.0 ±1.0	102.0 ±1.0	8.0 ±0.7	2.54	10.2
FIP9B6 FIP9B6A	9	8.8.8.8.8.8.8.8.8	5.5	2.65	20	70	6.5	2.54	3.5 9.0
FIP9LM6	9	88888	5	2.5	24.5	76	6.1	2.54	7.5
FIP9BM12	9	88888	7	3	28	98	7.5	2.54	13.7
FIP10AW19Y	10		18.5	70.0	33.0 ±1.0	98.0 ±1.0	8.0 ±0.7	2.54	9.5
FIP12AW7YS	12		7.0	71.05	20.0 ±1.0	98.0 ±1.0	7.5 ±0.7	2.54	7.5
FIP24A15YS	24		15.0	71.7	33.0 ±1.0	98.0 ±1.0	8.5 max	2.54	7.0
FIP24AW16YS	24		16.0	73.7	33.0 ±1.0	98.0 ±1.0	8.3 ±0.7	2.54	8.0
FIP24BW16YS	24	(Note 2)	16.0	73.7	33.0 ±1.0	98.0 ±1.0	8.3 ±0.7	2.54	8.0
FIP48AW14YS	48		14.0	71.3	28.0 ±1.0	102.0 ±1.0	8.0 ±0.7	2.54	13.5
FIP60B30T	60		35.0	50.0	55.0 ±1.0	91.0 ±1.0	12.0 max	2.0	4.5
FIP101B8AY	101		7.6	127.5	24.5 ±1.0	158.8 ±1.5	10.0 max	5.08	12.5

Notes:

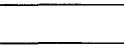
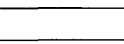
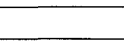
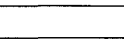
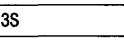
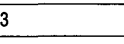
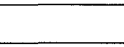
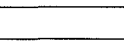
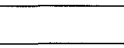
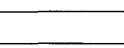
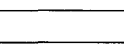
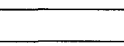
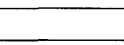
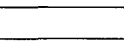
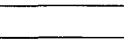
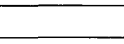
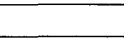
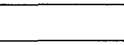
(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

(2) Green/amber

Recommended Electrical Ratings

Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (—)	E_k (V_{dc})	I_b/dig. (mA) *I_b/1 seg	i_c/dig. (mA)	L (cd/m²)	L (ft.L)
AC	1.7	58	dynamic	24	1/4	3	2.0	4.5	860	(250)
AC	1.5	75	static	18*	—	1	1.5	4.0	750	(220)
DC	1.5	40	dynamic	22	1/4	2	0.5	1.0	1030	(300)
AC	2.6	53	dynamic	24	1/7.5	3.3	3.2	4.5	690	(200)
AC	2.3	75	static	15*	—	—	0.4	6.0	860	(250)
AC	2.3	75	static	15*	—	—	0.4	6.0	860	(250)
AC	2.3	75	static	26*	—	—	0.4	6.0	860	(250)
AC	2.3	75	dynamic	26	1/7	4	1.8	3.0	690	(200)
AC	3.0	78	static	15*	—	—	0.7	10.0	2400/120	(700/35)
AC	3.0	78	static	15*	—	—	0.7	10.0	2400/120	(700/35)
AC	2.6	78	dynamic	24	1/9	3.5	1.5	2.5	690	(200)
AC	2.3	106	dynamic	26	1/7	4	2.5	4.5	1370	(400)
AC	2.3	106	dynamic	24	1/9	4	2.5	4.5	890	(260)
AC	3.2	100	dynamic	26	1/8	4	2.5	5.0	690	(200)
AC	3.4	104	dynamic	25	1/10	5	4.0	4.0	690	(200)
AC	4.4	14	dynamic	22	1/12.5	5	1.1	1.8	580	(170)
AC	2.8	106	dynamic	26	1/10	4	1.3	2.5	960	(280)
AC	3.6	135	dynamic	26.5	1/10	5.5	3.0	5.5	690	(200)
AC	3.2	130	dynamic	19	1/12	5	0.6*	5.0	510	(150)
AC	3.3	52	static	15*	—	1	0.4*	9.0	1030	(300)
AC	3.0	100	static	16*	—	1	0.35*	13.0	620	(180)
AC	3.2	100	static	16*	—	1	0.35*	13.0	620	(180)
AC	3.2	100	static	19*	—	1	0.45*	17.0	1030/70	(300/20)
AC	3.7	136	static	14*	—	—	0.75*	16.0	1370	(400)
AC	2.7	196	dynamic	$e_b = 30$ $e_c = 15$	1/3	3	0.9*	10.0	690	(200)
AC	5.4	78	dynamic	24	1/3	6	0.42*	4.2	1370	(400)

Digital Clock, Timer, Measuring Meter, and Others

Type No. (Note 1)	No. of Digits	Character Format, Symbol	Outline Dimensions (in millimeters)						
			Character		Panel			Lead	
			Height	Width	Height	Length	Thickness	Pitch	Length
FIP4A6	4		5.5	2.7	20.0 ±1.0	48.0 ±1.0	6.5 ±0.7	2.54	12.5
FIP4B8B	4		7.6	4.0	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	10.5
FIP4F8S	4		7.6	3.6	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP4B9	4		8.5	5.0	28.5 ±1.0	78.2 ±1.0	7.5 ±0.7	2.54	20.0
FIP4C9	4		8.5	5.0	28.0 ±1.0	78.0 ±1.0	7.5 ±0.7	2.54	16.0
FIP4C9B	4		8.5	5.0	28.5 ±1.0	78.2 ±1.0	7.5 ±0.7	2.54	20.0
LD8213/FIP4A13S	4		12.6	6.6	29.0 max	79.0 max	7.5 ±1.0	2.0	10.0
LD8241/FIP4B13	4		12.6	6.6	28.0 ±1.0	78.0 ±1.0	7.5 ±1.0	2.54	10.0
FIP4C13A FIP4C13C	4		12.5	7.0	28.0 ±1.0	78.0 ±1.0	8.5 max	2.54	9.7 20.5
FIP4F13S	4		12.5	6.8	28.0 ±1.0	78.0 ±1.0	7.5 ±0.7	2.0	8.2
FIP4A15A	4		15.0	8.4	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	6.2
FIP4B15S	4		15.0	8.4	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	10.5
FIP4C15	4		15.0	8.4	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	10.5
FIP5A8B	5		7.6	3.6	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	10.5
FIP5D8S	5		7.6	3.6	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP5D8	5		7.6	3.6	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	10.8
FIP5F8S	5		7.6	3.6	24.5 ±1.0	55.4 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	8.7
FIP5B13S	5		12.6	6.0	28.5 ±1.0	78.2 ±1.0	7.5 ±1.0	2.0	10.0
FIP5D13A	5		12.5	6.6	$28.0^{+1.5}_{-0.8}$	$78.0^{+1.2}_{-0.8}$	7.5 ±1.0	2.54	9.7
FIP5H13S	5		12.5	6.8	28.0 ±1.0	78.0 ±1.0	7.5 ±0.7	2.0	8.2
FIP5B15	5		15.0	8.0	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	5.2
FIP5D15S	5		15.0	8.4	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	10.5
FIP5D15AS	5		15.0	8.4	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	10.5
FIP5E15S	5		15.0	8.4	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	8.25
FIP5H15	5		15.0	8.0	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	4.0	10.5
FIP5K15S	5		15.0	8.0	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	10.5
FIP6F13	6		12.5	6.8	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	2.54	5.2
FIP6L13	6		12.5	6.8	33.0 ±1.0	98.0 ±1.0	$7.8^{+1.0}_{-0.8}$	2.54	10.0
FIP6C15 FIP6C15A	6	 (Note 2)	15.0	8.0	33.0 ±1.0	110.0 ±1.0	7.8 ±0.7	4.0	10.5
FIP6D15A FIP6D15B	6		15.0	7.5	33.0 ±1.0	98.0 ±1.0	8.3 ±0.7	2.54	15.0 6.5
FIP7B25	7		25.4	12.0	48.0 ±1.0	164.0 ±1.0	10.5 ±1.0	4.0	10.5
FIP9D7	9		6.5	3.4	20.0 ±1.0	86.0 ±1.0	6.1 ±0.7	2.54	6.5

Notes:

(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

(2) Gray back

Recommended Electrical Ratings										
Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper.	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (—)	E_k (V_{dc})	I_b/dig. (mA) *i_b/1 seg	I_c/dig. (mA)	L (cd/m^2)	L (ft.L)
DC	1.5	52	dynamic	19	1/4	1	1.0	1.2	1030	(300)
AC	1.7	78	dynamic	24	1/8	5	3.2	4.5	1370	(400)
DC	1.7	78	static	12*	—	—	1.1	6.0	1370	(400)
AC	2.4	75	dynamic	26	1/8	4	2.6	5.0	620	(180)
AC	2.3	75	dynamic	24	1/6	4	3.0	4.5	620	(180)
AC	2.4	75	dynamic	24	1/8	3.5	2.6	4.9	620	(180)
AC	2.3	75	static	15*	—	—	1.0	7.0	690	(200)
AC	2.3	75	dynamic	30	1/5	6	4.5	6.6	860	(250)
AC	2.34 2.4	100	dynamic	26	1/6	5	3.0	4.5	690	(200)
AC	2.4	75	static	15*	—	2	1.3	10.0	690	(200)
AC	3.0	75	dynamic	30	1/5	4	4.0	7.0	690	(200)
AC	3.0	75	static	18*	—	1.5	1.5	10.0	750	(220)
AC	3.0	75	dynamic	25	1/7	4	5.7	7.0	620	(180)
DC	1.7	78	dynamic	24	1/5.33	2.5	3.0	4.0	2060	(600)
DC	1.7	78	static	12*	—	—	0.8	6.0	1370	(400)
AC	1.7	78	dynamic	30	1/12	5	3.2	4.0	1370	(400)
DC	1.7	78	static	12*	—	—	1.1	6.0	1370	(400)
AC	3.0	58	static	24*	—	—	1.2	12.0	860	(250)
AC	2.3	75	dynamic	26	1/6	4	3.0	4.0	620	(180)
AC	2.4	75	static	15*	—	2	1.3	10.0	690	(200)
AC	3.3	100	dynamic	38	1/18	4	8.0	15.0	620	(180)
AC	3.0	75	static	18*	—	1.5	1.5	10.0	750	(220)
AC	3.0	75	static	18*	—	1.5	1.5	10.0	750	(220)
AC	3.0	75	static	18*	—	1.5	1.5	15.0	750	(220)
AC	3.2	150	dynamic	30	1/7.5	5	20.0	20.0	2400	(700)
AC	3.0	75	static	18*	—	1.5	1.5	10.0	750	(220)
AC	3.2	100	dynamic	42	1/21	4	9.5	11.0	1230	(360)
AC	3.0	75	dynamic	26	1/7.5	6	3.8	4.2	690	(200)
AC	3.7	150	dynamic	30	1/7.5	5	10.0	13.0	2400	(700)
AC	3.3	100	dynamic	35	1/16	5	9.0	11.0	1030	(300)
AC	5.5	125	dynamic	34.5	1/7.5	8	17.5	14.0	690	(200)
AC	4.4	23	dynamic	22	1/12.5	5	2.9	2.9	580	(170)

ECR and Others

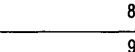
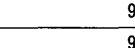
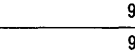
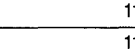
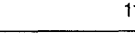
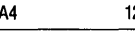
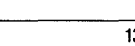
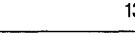
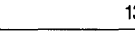
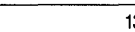
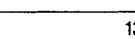
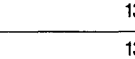
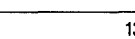
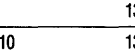
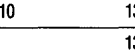
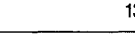
Type No. (Note 1)	No. of Digits	Character Format, Symbol	Outline Dimensions (in millimeters)						
			Character		Panel			Lead	
			Height	Width	Height	Length	Thickness	Pitch	Length
FIP6C13	6		12.5	6.8	33.0 ±1.0	98.0 ±1.0	7.8 ±0.7	4.0	10.5
FIP6A13	6		13.0	6.5	39.0 ±1.0	108.0 $^{+2.0}_{-0.5}$	10.0 max	2.54	10.0
FIP7B13	7		13.0	6.0	33.0 ±1.0	98.0 ±1.0	8.0 ±0.7	2.54	7.4
FIP8B11	8		10.5	5.0	33.0 ±1.0	98.0 ±1.0	7.8 $^{+1.2}_{-0.7}$	2.54	5.2
LD8217/FIP8A11	8		11.0	5.3	31.0 ±1.0	112.0 ±1.5	7.8 ±1.0	5.08	10.0
FIP9J5	9		5.0	2.4	20.0 ±1.0	65.8 ±1.0	6.5 max	2.54	10.0
FIP9K5A	9		5.0	2.4	21.0 max	66.0 max	6.5 max	2.54	14.0
FIP9B8 FIP9B8B	9		7.6	4.0	24.5 ±1.0	100.0 ±1.0	8.5 max	2.54	16.5 12.5
FIP9F8	9		7.6	4.0	26.0 ±1.0	93.0 $^{+1.5}_{-0.5}$	7.8 ±0.7	2.54	35.0
FIP9C10	9		9.5	4.0	38.0 $^{+0.8}_{-0.3}$	100.0 $^{+0.8}_{-0.3}$	7.8 ±0.7	2.54	14.0
FIP9B10	9		10.0	4.8	31.0 ±1.0	112.0 ±1.5	7.8 ±1.0	2.54	11.0
LD8185/FIP9A12 FIP9A12A	9		12.4	5.2	31.0 ±1.0	127.0 ±1.5	7.8 ±1.0	5.08	10.5 3.7
FIP9A13A	9		12.5	6.8	33.0 ±1.0	135.0 ±1.0	7.5 $^{+1.0}_{-0.5}$	4.0	10.0
FIP9C13	9		12.5	6.2	39.0 ±1.0	125.0 ±1.5	9.0 max	2.54	14.0
LD8221/FIP10B13 FIP10B13A	10		13.0	6.5	39.0 ±1.0	160.0 $^{+2.0}_{-0.5}$	10.0 max	5.08	10.0 5.0
FIP10D13	10		13.0	6.5	40.0 ±0.7	160.0 ±0.7	10.0 max	2.54	14.0
FIP10A20	10		20.0	10.0	48.0 ±1.0	196.0 ±1.5	14.0 max	4.0	10.0
FIP11F10	11		9.6	4.2	24.5 ±1.0	113.0 ±1.0	7.5 ±0.7	2.54	16.0
FIP11A13	11		12.5	6.1	33.0 ±1.0	147.0 ±1.0	8.5 max	4.0	10.0
FIP11B13	11		13.0	6.0	36.0 ±1.0	147.0 ±1.0	8.0 ±0.7	2.54	7.4
FIP11A15	11		15.0	8.0	39.0 ±1.0	185.0 ±1.0	10.0 ±1.5	4.0	15.0
FIP12A13	12		13.0	6.0	40.0 $^{+0.8}_{-0.3}$	160.0 $^{+0.8}_{-0.3}$	10.0 max	2.54	14.0
FIP13K10	13		9.5	4.3	39.0 ±1.0	138.0 $^{+2.0}_{-0.5}$	12.5 max	2.54	36.0
FIP13B13	13		13.0	6.5	39.0 ±1.0	166.0 ±1.5	10.0 max	25.4	5.2

Note:

(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

Recommended Electrical Ratings										
Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper.	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (–)	E_k (V_{dc})	I_b/dig. (mA) *I_b/1 seg	i_c/dig. (mA)	L (cd/m^2)	L (ft.L)
AC	3.0	100	dynamic	26	1/7	4	2.7	4.5	690	(200)
AC	3.2	120	dynamic	35	1/16	7	5.0	8.0	690	(200)
AC	3.3	104	dynamic	35	1/19	4	5.5	6.5	860	(250)
AC	3.0	100	dynamic	45	1/29	8	6.0	8.0	620	(180)
AC	3.5	78	dynamic	42	1/16.5	5	5.0	8.0	550	(160)
AC	2.4	38	dynamic	32	1/24	5	1.6	2.2	1030	(300)
AC	3.0	23	dynamic	24	1/16	3	1.1	2.0	690	(200)
AC	3.2	75	dynamic	25	1/18 1/14	5	2.3	4.0	620 1030	(180) (300)
AC	3.2	75	dynamic	25	1/14	5	3.5	4.5	1030	(300)
AC	3.8	58	dynamic	33	1/30	7	6.0	7.0	750	(220)
AC	3.5	75	dynamic	30	1/16	6	3.2	4.5	580	(170)
AC	4.6	54	dynamic	45	1/8	6	6.0	8.0	550 1230	(160) (360)
AC	4.6	75	dynamic	45	1/12.5	10	3.6	7.0	690	(200)
AC	3.9	140	dynamic	29	1/16	5	7.5	7.5	690	(200)
AC	5.0	120	dynamic	35	1/16	7	5.0	8.0	690	(200)
AC	5.0	120	dynamic	35	1/16	4.5	5.0	8.0	1200	(350)
AC	6.0	180	dynamic	43	1/16	9	12.0	16.0	860	(250)
AC	4.8	78	dynamic	25	1/15	9.5	4.0	4.0	690	(200)
AC	4.8	120	dynamic	35	1/16	7	5.0	7.0	690	(200)
AC	5.5	78	dynamic	35	1/19	7	5.5	6.5	860	(250)
AC	6.3	125	dynamic	45	1/29	8	11.5	15.5	620	(180)
AC	5.9	106	dynamic	28	1/16	6	6.5	8.0	1200	(350)
AC	5.5	55	dynamic	30	1/16	5.5	6.0	6.0	1200	(350)
AC	5.2	120	dynamic	42	1/16	7	6.0	12.0	1200	(350)

Calculator and Others

Type No. (Note 1)	No. of Digits	Character Format, Symbol	Outline Dimensions (in millimeters) Character Height	Character Width	Panel Height	Panel Length	Panel Thickness	Lead Pitch	Lead Length
LD8225/FIP8A5	8		4.5	2.3	17.0 ±1.0	58.0 ±1.0	6.5 max	2.54	6.2
LD8228/FIP8B5	8		5.0	2.0	19.0 ±1.0	$55.3^{+0.8}_{-1.0}$	7.2 max	2.54	7.0
FIP9D5	9		4.5	2.3	17.0 ±1.0	62.5 ±1.0	6.5 max	2.54	6.2
LD8191/FIP9A5	9		5.0	2.4	20.0 ±1.0	65.8 ±1.0	6.5 max	2.54	10.0
LD8231/FIP9C5	9		5.0	2.4	21.0 max	66.0 max	6.5 max	2.54	15.0
FIP11A6A	11		5.5	2.45	22.8 ±1.0	75.2 ±0.7	7.2 max	2.54	25.0
FIP11D6A	11		6.01	2.4	20.0 ±1.0	76.0 ±1.0	6.1 ±0.5	2.54	16
FIP11F6	11		6.0	2.4	22.8 ±1.0	75.2 ±1.0	7.5 max	2.54	21.5
FIP11B8A	11		8.0	3.6	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	9.5 max	2.54	14.0
FIP11C8A/ FIP11C8B	11		8.0	3.6	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	9.5 max	2.54	14.0 36.0
FIP11B10A	11		9.5	4.0	39.0 ±1.0	$138.0^{+2.0}_{-0.5}$	12.5 max	2.54	14.0
LD8197A/FIP12A4	12		4.2	2.08	17.0 ±1.0	70.0 ±1.0	6.5 max	2.54	5.8
FIP12A5A/ FIP12A5B	12		5.2	2.4	20.0 ±1.0	81.0 ±1.0	8.0 max	2.54	9.5 11.0
FIP13E5A	13		5.2	2.4	20.0 ±1.0	86.5 ±1.5	7.5 max	2.54	35.0
FIP13F5	13		5.3	2.4	$20.0^{+1.2}_{-0.5}$	$86.0^{+1.5}_{-0.5}$	7.5 max	2.54	34.0
FIP13A7B	13		6.5	3.0	24.5 ±1.0	113.0 ±1.5	8.5 max	2.54	24.0
FIP13C7	13		7.0	2.8	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	9.5 max	2.54	36.0
FIP13F7	13		6.5	2.9	$25.0^{+0.5}_{-0.3}$	94.5 max	9.5 max	2.54	34.0
FIP13B8	13		8.0	3.3	$25.5^{+1.5}_{-0.5}$	$112.0^{+1.5}_{-1.0}$	9.5 max	2.54	34.0
FIP13C8/ FIP13C8A	13		8.0	3.3	$25.5^{+1.5}_{-1.0}$	$112.0^{+1.5}_{-1.0}$	7.6 ±1.0	2.54	36.0 14.0
FIP13E8	13		8.0	3.3	$25.0^{+1.0}_{-0.3}$	$112.0^{+1.5}_{-0.5}$	9.5 max	2.54	34.0
FIP13H8	13	 (Note 2)	7.6	3.55	24.5 ±1.0	114.4 ±1.0	6.5 ±1.0	2.54	15.5
LD8214/FIP13A10	13		9.5	4.3	31.0 ±1.0	138.0 ±1.0	7.8 ±1.0	2.54	11.0
FIP13C10C	13		9.5	4.2	31.0 ±1.0	138.0 ±1.0	7.8 ±0.7	2.54	24.0
FIP13D10A	13		9.5	4.0	39.0 ±1.0	$138.0^{+2.0}_{-0.5}$	9.0 ±1.0	2.54	36.0
FIP13D10B	13		9.5	4.0	39.0 ±1.0	$138.0^{+2.0}_{-0.5}$	9.0 ±1.0	2.54	36.0
FIP13H10	13		9.5	4.2	31.0 ±1.0	138.0 ±1.0	7.8 ±1.0	2.54	24.0
LD8232/FIP14A5	14		5.2	2.4	20.0 ±1.0	$90.5^{+1.5}_{-1.0}$	$7.0^{+0.5}_{-0.7}$	2.54	10.0
FIP15B7	15		6.5	2.9	$25.0^{+1.0}_{-1.0}$	$112.0^{+1.5}_{-0.5}$	9.5 max	2.54	34.0
FIP17A5	17		4.5	1.9	20.0 ±1.0	92.0 ±1.0	$6.5^{+0.5}_{-1.0}$	2.54	16.0
LD8230/FIP17A10	17		9.5	4.0	30.0 ±1.0	164.0 ±2.0	11.0 max	2.54	10.0

Notes:

(1) These characteristics are given when the panels are turned on at the recommended electrical ratings and in case of AC filament mode when e_b or e_c is also supplied from the center tap of the filament transformer.

(2) Green/amber

Recommended Electrical Ratings										
Mode of Fil.	E_f (V_{rms})	I_f (mA_{rms})	Mode of Oper.	$e_b = e_c$ (V_{p-p}) *$E_b = E_c$ (V_{dc})	Duty (—)	E_k (V_{dc})	I_b/dig. (mA) *i_b/1 seg	i_c/dig. (mA)	L (cd/m^2)	L (ft.L)
AC	2.8	12	dynamic	22	1/12	3	0.6	0.8	580	(170)
AC	3.0	12	dynamic	24	1/12	3	0.7	0.9	690	(200)
AC	3.2	16	dynamic	22	1/12	3	0.6	0.9	620	(180)
AC	3.4	12	dynamic	24	1/12	4	0.8	1.3	580	(170)
AC	3.3	13	dynamic	24	1/12	3	0.8	1.2	580	(170)
AC	3.9	16.5	dynamic	24	1/16	4	1.2	1.4	690	(200)
AC	4.0	18	dynamic	20	1/15	5	1.3	1.8	690	(200)
AC	3.5	22	dynamic	24	1/12	4	1.8	1.8	690	(200)
AC	4.5	22	dynamic	26	1/12	4.5	2.0	2.5	750	(220)
AC	4.5	22	dynamic	26	1/14	4	2.5	2.5	690 860	(200) (250)
AC	5.5	55	dynamic	30	1/16	5.5	2.8	3.6	690	(200)
AC	3.7	16	dynamic	24	1/14	4	0.6	0.9	690	(200)
AC	4.5	16	dynamic	22	1/14	4	0.7	1.5	690	(200)
AC	4.0	23	dynamic	24	1/14	4	1.0	2.0	690	(200)
AC	4.2	22	dynamic	24	1/16	4.5	1.5	2.0	860	(250)
AC	5.4	22	dynamic	26	1/16	6	2.0	3.0	580	(170)
AC	4.5	22	dynamic	26	1/14	4	2.0	2.5	860	(250)
AC	4.2	58	dynamic	18	1/16	3.5	2.1	2.0	860	(250)
AC	4.2	55	dynamic	26	1/16	4	3.0	3.0	690	(200)
AC	4.2	55	dynamic	26	1/16	4	3.0	3.0	690	(200)
AC	4.2	55	dynamic	26	1/16	3	3.0	3.0	690	(200)
AC	6.1	23	dynamic	21.5	1/17.5	6.5	3.5	3.5	580/60	(170/17
AC	5.5	55	dynamic	30	1/16	5.5	2.8	3.8	580	(170)
AC	5.5	55	dynamic	30	1/16	5.5	3.0	4.0	860	(250)
AC	5.5	55	dynamic	26	1/16	5	4.0	4.0	690	(200)
AC	5.5	55	dynamic	26	1/16	5	4.0	4.0	690	(200)
AC	5.5	55	dynamic	30	1/16	5.5	3.0	4.0	860	(250)
AC	3.8	38	dynamic	24	1/17	4	0.7	1.5	580	(170)
AC	4.7	37	dynamic	26	1/18	5	2.0	2.5	690	(200)
AC	4.5	22.4	dynamic	22	1/20	7	1.3	1.8	690	(200)
AC	6.0	81	dynamic	38	1/23	6	2.8	5.6	580	(170)

Dot Type Fluorescent Indicator Modules

Mechanical Characteristics

Device	No of Character	Character Format	No of Display Dots Row x Column	Character Height x Width (mm)	Character Pitch Row x Column (mm)	Dot Pitch Vertical x Horizontal (mm)	Dot Size W x H (mm)	Outline Dimensions H x W x D (mm)	Weight (g)
Character Type Modules									
FM20X1AA-D	20 (20 char., 1 line)	5 x 7 dot, with cursor	—	5.05 x 3.55	— x 5.2	0.75 x 0.75	0.55 x 0.55	70 x 180 x 20 max	160 typ
FM20X1DB-AC	20 (20 char., 1 line)	5 x 7 dot	—	9.0 x 6.3	— x 8.3	1.35 x 1.35	ϕ0.9	73 x 240 x 20 max	250 typ
FM20X2AA-DA	40 (20 char., 2 line)	5 x 7 dot	—	5.05 x 3.55	12.62 x 4.75	0.75 x 0.75	0.55 x 0.55	55 x 146 x 37 max	200 typ
FM40X1AA-B	40 (40 char., 1 line)	5 x 7 dot, with cursor	—	5.05 x 3.55	— x 4.75	0.75 x 0.75	0.55 x 0.55	70 x 250 x 20 max	250 typ
FM40X1FB-B	40 (40 char., 1 line)	5 x 12 dot	—	8.80 x 3.55	— x 5.2	0.75 x 0.75	0.55 x 0.55	76.2 x 320 x 24 max	300 typ
FM40X2CB-AA	80 (40 char., 2 line)	5 x 7 dot, with cursor	—	5.35 x 3.55	11.94 x 4.75	0.8 x 0.75	0.55 x 0.55	76 x 294 x 37 max	360 typ
FM40X6AA-A	240 (40 char., 6 line)	5 x 7 dot, with cursor	—	5.0 x 3.5	8.0 x 4.75	0.75 x 0.75	0.5 x 0.5	110 x 264 x 45 max	880 typ
FM80X2AA-A	160 (80 char., 2 line)	5 x 7 dot, with cursor	—	3.5 x 2.05	5.25 x 3.2	0.55 x 0.45	0.25 x 0.25	66 x 388 x 43 max	520 typ
Graphic Type Module									
FM180GX48BA-A	—	—	48 x 180 (total dots 8640)	—	—	0.6	0.4	90 x 200 x 45 max	400 typ

General Characteristics

Device	Brightness BL cd/m^2 (ft•L)	Color (without filter)	Temperature Range Operation T_{OP} °C	Temperature Range Storage T_{STG} °C	Vibration (10-55 Hz) G	Shock G	Relative Humidity Operation RH_{OP} %	Relative Humidity Storage RH_{STG} %	Mating Connector Power	Mating Connector Signal
Character Type Modules										
FM20X1AA-D	1030 typ (300)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-4
FM20X1DB-AC	1030 typ (300)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-4
FM20X2AA-DA	856 typ (250)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-4
FM40X1AA-B	685 typ (200)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-4
FM40X1FB-B	685 typ (200)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-5
FM40X2CB-AA	685 typ (200)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-5
FM40X6AA-A	685 typ (200)	Blue-green	–5 to 60	–20 to 70	2	25	0 to 85	0 to 95	(Note 1)	172083-5
FM80X2AA-A	514 typ (150)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-5
Graphic Type Modules										
FM180GX48BA-A	685 typ (200)	Blue-green	–5 to 60	–20 to 70	2	40	0 to 85	0 to 95	(Note 1)	172083-4

Note:

(1) Housing 171822-2, pin 170204-2

Dot Type Fluorescent Indicator Modules (cont)

Electrical Characteristics

	Display					
	Voltage			Current		
Device	Min	Typ	Max	Min	Typ	Max
Character Type Modules						
FM20X1AA-D	4.75	5.0	5.25	—	0.6	0.8
FM20X1DB-AC	4.75	5.0	5.25	—	0.8	1.0
FM20X2AA-DA	4.75	5.0	5.25	—	1.0	1.2
FM40X1AA-B (Note 1)	4.75	5.0	5.25	—	1.0	1.2
FM40X1FB-B	4.75	5.0	5.25	—	1.0	1.5
FM40X2CB-AA	4.75	5.0	5.25	—	1.3	1.5
FM40X6AA-A	4.75	5.0	5.25	—	2.5	3.5
FM80X2AA-A	4.75	5.0	5.25	—	1.3	1.5
Graphic Type Modules						
FM180GX48BA-A	4.75	5.0	5.25	—	1.2	1.8

Note:

(1) Power polarity is different from other modules.

Display Functions

Device	Data	Data Write	Command Write	Data Read	Reset	Display Blanking	Test Mode	Refresh Memory
Character Type Modules								
FM20X1AA-D	CPU data bus compatible, TTL level	•	•	•	—	—	•	—
FM20X1DB-AC	CPU data bus compatible, TTL level	•	•	•	—	—	•	—
FM20X2AA-DA	CPU data bus compatible, TTL level	•	•	•	—	—	•	—
FM40X1AA-B	CPU data bus compatible, TTL level	•	•	•	—	—	•	—
FM40X1FB-B	CPU data bus compatible, four kinds of serial input, TTL level	•	•	•	•	•	•	—
FM40X2CB-AA	CPU data bus compatible, TTL level	•	•	•	—	—	•	—
FM40X6AA-A	CPU data bus compatible, serial input 1200 baud, TTL level	•	•	•	•	•	•	—
FM80X2AA-A	CPU data bus compatible, serial input 1200 baud, TTL level	•	•	•	•	•	•	—
Graphic Type Modules								
FM180GX48BA-A	8-bit parallel, TTL level	•	—	—	—	•	—	with one frame memory (RAM)

Chip-in-Glass FIP Modules

Mechanical Characteristics

Device	No of Character	Character Format	Character Height x Width (mm)	Character Pitch Row x Column (mm)	Dot Pitch Vertical x Horizontal (mm)	Dot Size W x H (mm)	Outline Dimensions H x W x D (mm)	Weight (g)
Character Type Modules								
FC20X1JA-AA/AB (Note 1)	20 (20 char., 1 line)	5 x 7 dot with cursor	5.05 x 3.55	– x 5.2	0.75 x 0.75	0.55 x 0.55	29 x 153 x 24	80 typ
FC20X1NA-AA/AB	20 (20 char., 1 line)	5 x 7 dot	9.0 x 6.3	– x 8.3	1.35 x 1.35	ϕ0.9	30 x 259 x 24	120 typ
FC20X2FA-AA/AB	40 (20 char., 2 line)	5 x 7 dot	5.05 x 3.55	12.62 x 4.75	0.75 x 0.75	0.55 x 0.55	34 x 194 x 24	100 typ
FC40X1KA-AA/AB	40 (40 char., 1 line)	5 x 7 dot with cursor	5.05 x 3.55	– x 4.75	0.75 x 0.75	0.55 x 0.55	29 x 280 x 29	150 typ
FC40X2DA-AA/AB	80 (40 char., 2 line)	5 x 7 dot with cursor	5.35 x 3.55	11.94 x 4.75	0.8 x 0.75	0.55 x 0.55	40 x 270 x 28	240 typ

General Characteristics

			Temperature Range		Vibration (10-55 Hz)		Relative Humidity		Mating Connector	
Device	Brightness BL cd/m^2 (ft•L)	Color (without filter)	Operation T_{OP} °C	Storage T_{STG} °C	Displacement (mm)	Shock (G)	Operation RH_{OP} %	Storage RH_{STG} %	Power	Signal (Note 3)
Character Type Modules										
FC20X1JA-AA/AB	(150)	Green	–5 to 60	–20 to +70	.5	40	0 to 85	0 to 95	(Note 2)	HIF3BA-26D-2.54R
FC20X1NA-AA/AB	(150)	Green	–5 to 60	–20 to +70	.5	40	0 to 85	0 to 95	(Note 2)	HIF3BA-26D-2.54R
FC20X2FA-AA/AB	(150)	Green	–5 to 60	–20 to +70	.5	40	0 to 85	0 to 95	(Note 2)	HIF3BA-26A-2.54R
FC40X1KA-AA/AB	(150)	Green	–5 to 60	–20 to +70	.5	40	0 to 85	0 to 95	(Note 2)	HIF3BA-26D-2.54R
FC40X2DA-AA/AB	(150)	Green	–5 to 60	–20 to +70	.5	40	0 to 85	0 to 95	(Note 2)	HIF3BA-34D-2.54R

Notes:

(1) AA ending is for English and Japanese characters. AB ending is for English and European characters.

(2) Housing AMP 171822-2, Pin AMP 170204-2

(3) Signal connectors: contact Hirose U.S.A.

Chip-in-Glass FIP Modules (cont)

Electrical Characteristics

	Display					
	Voltage			Current		
Device	Min	Typ	Max	Min	Typ	Max
Character Type Modules						
FC20X1JA-AA/AB	4.75	5.0	5.25	—	0.3	0.4
FC20X1NA-AA/AB	4.75	5.0	5.25	—	0.4	0.5
FC20X2FA-AA/AB	4.75	5.0	5.25	—	0.3	0.4
FC40X1KA-AA/AB	4.75	5.0	5.25	—	0.4	0.6
FC40X2DA-AA/AB	4.75	5.0	5.25	—	0.8	1.0

Display Functions

Device	Data Write	Command Write	Data Read	Reset	Display Blanking	Test Mode	Status Read
Character Type Modules							
FC20X1JA-AA/AB	•	•	•	•	—	•	•
FC20X1NA-AA/AB	•	•	•	•	—	•	•
FC20X2FA-AA/AB	•	•	•	•	—	•	•
FC40X1KA-AA/AB	•	•	•	•	—	•	•
FC40X2DA-AA/AB	•	•	•	•	•	•	—

NEC

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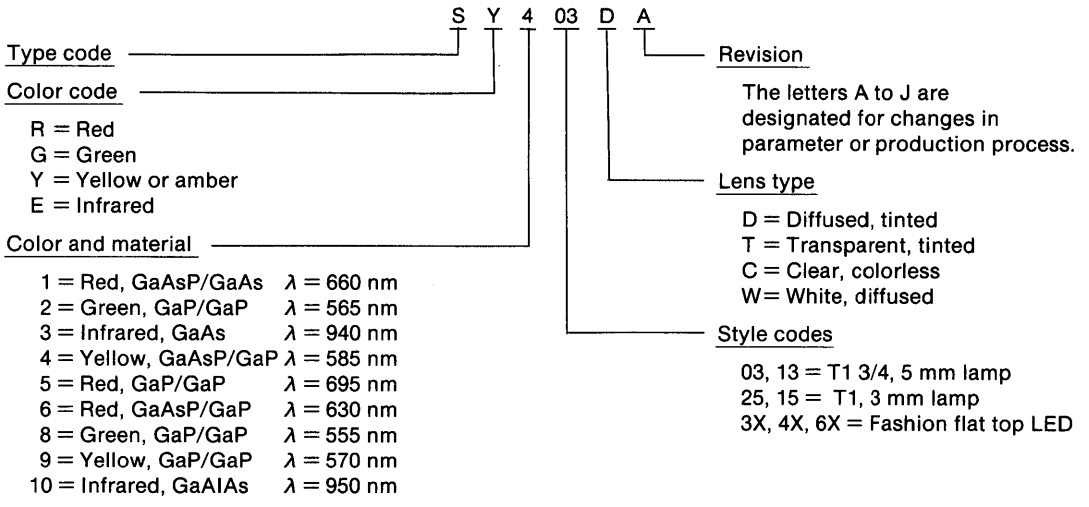
Section 9 — Optoelectronic Devices **Page**

Part Numbering System



Optoelectronics Cross Reference

Photo Couplers

General Electric	NEC	Notes
CYN17 I	PS2031	2, 3
CNY17 II	PS2031	2, 3
CNY17 III	PS2031	2, 3
CNY IV	PS2031	2, 3
CNY30	PS3001 (1)	1
CNY31	PS2022	3
CNY32	PS2021	3
CNY34	PS3002 (1)	1
CNY47	PS2010	1
CNY47A	PS2010L/K	1
CNY48	PS2022	1
CNY51	PS2021K	2, 3
C2Y80	PS2021K, L	2, 3
GEPS2001	PS2010K, L	2, 3
GFH600 I	PS2031L	2, 3
GFH600 II	PS2031L	2, 3
GFH600 III	PS2031K	2, 3
GFH601 I	PS2031M	2, 3
GFH601 II	PS2031L, M	2, 3
GFH601 III	PS2031L, K	2, 3
GFH601 IV	PS2031K	2, 3
H11A1	PS2021	1
H11A2	PS2010	1
H11A3	PS2010	1
H11A4	PS2021	1
H11A5	PS2010	1
H11A520	PS2021L	2, 3
H11A550	PS2021L	2, 3
H11A5100	PS2021L	2, 3
H11B1	PS2022	1
H11B2	PS2022	1
H11B255	PS2022	4
H11BX522	PS2022	4
H11C1	PS3001 (1)	1
H11C2	PS3001 (1)	1
H11C3	PS3001 (1)	1
H11C4	PS3002 (1)	1
H11C5	PS3002 (1)	1
H11C6	PS3002 (1)	1
H11D1	PS2031	1
H11D2	PS2031	1
H11D3	PS2031	1
H11D4	PS2031	1
H15A1	PS2021	3
H15A2	PS2021	3
H15B1	PS2022	3
H15B2	PS2022	3
MCA230	PS2022	3
MCA231	PS2022	3
MCS2	PS3001 (1)	2, 3
MCS2400	PS3002 (1)	2, 3
MCS21	PS3001 (1)	2, 3
MCT2E	PS2021	2, 3
MCT26	PS2021	2, 3
MCT210	PS2021	2, 3

General Electric	NEC	Notes
4N25	PS2010	3
4N25A	PS2021	1
4N26	PS2021	1
4N27	PS2021	1
4N28	PS2021	1
4N29	PS2022	2, 3
4N29A	PS2022	2, 3
4N30	PS2022	2, 3
4N31	PS2022	2, 3
4N32	PS2022	2, 3
4N33	PS2022	2, 3
4N35	PS2021	1
4N36	PS2010K	1
4N37	PS2010K	2
4N38	PS2011	2, 3
4N38A	PS2031	2, 3
4N39	PS3001 (1)	1
4N40	PS3002 (1)	1

General Instrument	NEC	Notes
CNX35	PS2021	2, 3
CNX36	PS2021	2, 3
H11B3	PS2022	2, 3
H11D1	PS2031	2, 3
H11D2	PS2031	2, 3
H11D3	PS2031	2, 3
H11D4	PS2031	2, 3
MCA230	PS2022	3
MCA231	PS2022	3
MCA255	PS2022	2
MCA2230	PS2022	2, 3
MCA2231	PS2022	2, 3
MCA8	PS4001	
MCA81	PS4001	
MCS2	PS3001 (1)	1
MCS21	PS3001 (1)	1
MCS2401	PS3002 (1)	1
MCT2	PS2010	1
MCT2E	PS2021	1
MCT26	PS2010	1
MCT210	PS2021K	2
MCT271	PS2021M	2
MCT272	PS2021L	2
MCT273	PS2021L	1
MCT275	PS2021	2, 3
MCT276	PS2021	2, 3
MCT2200	PS2021	2, 3
MCT2201	PS2021	2, 3
MCT2202	PS2021	
MCT4	PS1001	4
MCT4R	PS1001	4
MCT6	PS2401A-1	1
MCT66	PS2401A-2	4
MCT8	PS4014	
MCT81	PS4014	

Hewlett-Packard	NEC	Notes
6N135	PS2006B	2, 3
6N136	PS2006B	2, 3
6N137	PS2007B	1
HCPL-2502	PS2006B	2
HCPL-2601	PS2007B	4
SL5505	PS2006B	

JEDEC	NEC	Notes
4N25	PS2010	2, 3
4N25A	PS2021	1
4N26	PS2021	1
4N27	PS2021	1
4N28	PS2021	1
4N29	PS2022	2, 3
4N29A	PS2022	2, 3
4N30	PS2022	2, 3
4N31	PS2022	2, 3
4N32	PS2022	2, 3
4N33	PS2022	2, 3
4N35	PS2021K	2, 3
4N36	PS2010	1
4N37	PS2010	1
4N38	PS3001 (1)	1
4N39	PS3001 (1)	1
4N40	PS3002 (1)	1

Siemens	NEC	Notes
CNY18-2	PS1001	4
CNY18-3	PS1001	4
CNY18-4	PS1001	4
CNY18-5	PS1001	4
IL-1	PS2010	1
IL-1B	PS2021	2, 3
IL-5	PS2021	2, 3
IL-12	PS2010	2
IL-16	PS2010	2
IL-30	PS2022	2, 3
IL-74	PS2021	2, 3
IL-100	PS2007B	4
IL-101	PS2007B	4
IL-400	PS3002(1)	2, 3
ILA-30	PS2022	1
ILA-55	PS2022	2, 3
ILCA2-30	PS2022	1
ILCA2-55	PS2022	2, 3
ILCT-6	PS2401A-2	4
ILD-74	PS2401A-2	4
ILQ-74	PS2401A-4	4
SFH600	PS2031	2, 3
SFH600-1	PS2031	2, 3
SFH600-2	PS2031	2, 3
SFH600-3	PS2031	2, 3
SFH601-1	PS2031	2, 3
SFH601-2	PS2031	2, 3
SFH601-3	PS2031	2, 3

Notes:

(1) Direct replacement

(2) Equivalent (minor electrical difference)

(3) Equivalent (minor mechanical difference)

(4) Different (significant difference, electrical or mechanical)

Photo Couplers [cont]

Siemens	NEC	Notes
SFH601-4	PS2031	2, 3
SFH609-1	PS2031	2, 3
SFH609-2	PS2031	2, 3
SFH609-3	PS2031	2, 3
SFH610-2	PS2401A-1	4
SFH610-3	PS2401A-1	4
SFH610-4	PS2401A-1	4
SFH611-2	PS2401A-1	4
SFH611-3	PS2401A-1	4
SFH611-4	PS2401A-1	4

Spectronics	NEC	Notes
SCD11B1	PS2022	3
SCD11B2	PS2022	3
SCD11B3	PS2022	3
SPX-103	PS2021L, K	2, 3
SPX-2	PS2021	3
SPX-2E	PS2021	3
SPX-26	PS2021	3
SPX-33	PS2021	3
SPX-35	PS2021	3
SPX-4	PS2021	3
SPX-5	PS2021	3
SPX-53	PS2021	3
SPX-6	PS2021	2, 3

Texas Instruments	NEC	Notes
TIL102	PS1001	4
TIL103	PS1001	4
TIL111	PS2010	1
TIL112	PS2022	2
TIL113	PS2022	2
TIL114	PS2021	1
TIL115	PS2021	2
TIL116	PS2021	1
TIL117	PS2021	1
TIL118	PS2021	1
TIL119	PS2022	2

TRW	NEC	Notes
OP12100	PS2021K	2, 3
OP12150	PS2010	2, 3
OP12250	PS2021	2, 3
OP12151	PS2010	2, 3
OP12152	PS2010	2, 3
OP12252	PS2021	2, 3
OP12153	PS2010	2, 3
OP12253	PS2021	2, 3
OP13150	PS2004B	2, 3
OP13250	PS2004B	2, 3
OP13151	PS2004B	2, 3
OP13251	PS2004B	2, 3

Sensors and IR Emitters

General Instruments	NEC	Notes
MEK730	SE303A	2, 3
MEK760	SE303A	2, 3
MTS360	PH108	2, 3
MTS460	PH108	2, 3
MTS361	PH108	2, 3
MTS461	PH108	2, 3
ME60	SE302A	2, 3
ME61	SE302A	2, 3
ME7161	SE302A	2, 3

Motorola	NEC	Notes
MLED60	SE302A	2, 3
MLED90	SE302A	2, 3

OKI	NEC	Notes
OLD122	SE301A	2, 3
OLD124	SE301A	2, 3

Sharp	NEC	Notes
GL503	SE301A	2, 3
GL504	SE301A	2, 3
GL50G	SE301A	2, 3
GLE503	SE301A	2, 3
GLE503F	SE301A	2, 3

Siemens	NEC	Notes
IRL-60	SE302A	2, 3
IRL-61	SE302A	2, 3
IRL-80	SE308	2, 3
IRL-81	SE308	4
LD-271	SE303A	2, 3
LD-274	SE307	2, 3
SFH-400	SE301A	2, 3
SFH-401	SE301A	2, 3

Telefunken	NEC	Notes
CQY32	SE301A	2, 3
CQY34	SE301A	2, 3
CQY35	SE301A	2, 3
CQY37	SE302A	2, 3

Texas Instruments	NEC	Notes
TIL38	SE313	2, 3
TIL39	SE307	2, 3
TIL40	PH302/PH302C	2, 3
TIL411	PH104	2, 3
TIL412	PH103	2, 3
TIL413	PH309	2, 3
TIL415	PH108	2, 3
TIL416	PH103	2, 3

Toshiba	NEC	Notes
TLN101	SE301A	2, 3
TLN103	SE301A	2, 3

TRW	NEC	Notes
OP135	SE301A	2, 3
OP135W	SE301A	2, 3
OP136	SE301A	2, 3
OP136W	SE301A	2, 3
OP140	SE308	2, 3
OP168F	SE308	2, 3
OP169	SE310	2, 3
OP240	SE312	2, 3
OP260	SE1003	2, 3
OP500	PH105	2, 3
OP501	PH108	2, 3
OP508	PH108	2, 3
OP509	PH110	2, 3
OP530	PH103	2, 3
OP538	PH108	2, 3
OP550	PH112	2, 3
OP556	PH108	2, 3

Visible LEDs

Dialight	NEC	Notes
521-9165	SR503D	1
521-9166	SR503C	1
521-9179	SR503D	1
521-9186	SR106D	1
521-9189	SR503D	1
521-9190	SR503W	1
521-9195	SR515D	2, 3
521-9200	SR503D	2, 3
521-9202	SG203TA	2, 3
521-9203	SG203DA	2, 3
521-9204	SY403TA	2, 3
521-9205	SY403DA	2, 3
521-9206	SG215D	2, 3
521-9207	SY415D	2, 3
521-9217	SR503D	2, 3
521-9185	SR106C	2, 3

General Instrument	NEC	Notes
MV50	SR106D	2, 3
MV52	SR206D	2, 3
MV53	SY406D	2, 3
MV54	SR106D	2, 3
MV55	SY406D	2, 3
MV5020	SR503C	2, 3
MV5021	SR503W	2, 3
MV5023	SR503D	2, 3
MV5024	SR503D	2, 3
MV5025	SR503D	2, 3
MV5026	SR503D	2, 3

Notes:

(1) Direct replacement

(2) Equivalent (minor electrical difference)

(3) Equivalent (minor mechanical difference)

(4) Different (significant difference, electrical or mechanical)

Visible LEDs [cont]

General Instrument	NEC	Notes
MV5050	SR503C	2, 3
MV5051	SR503W	2, 3
MV5053	SR503D	2, 3
MV5054-1	SR503D	2, 3
MV5054-2	SR503D	2, 3
MV5054-3	SR503D	2, 3
MV5055	SR503D	2, 3
MV5056	SR503D	2, 3
MV5074B/C	SR515D	2, 3
MV5075B/C	SR515D	2, 3
MV5152	SY403TA	2, 3
MV5153	SY403DA	2, 3
MV5154	SY403DA	2, 3
MV5252	SG203TA	2, 3
MV5253	SG203DA	2, 3
MV5254	SG203DA	2, 3
MV5352	SY403TA	2, 3
MV5353	SY403DA	2, 3
MV5354	SY403DA	2, 3
MV5752	SR603D	2, 3
MV5753	SR603D	2, 3
MV5274B/C	SG215D	2, 3
MV5374B/C	SY415D	2, 3
MV5774B/C	SR603D	2, 3

Hewlett-Packard	NEC	Notes
HLMP-0202	SR503D	2, 3
HLMP-0220	SR503C	2, 3
HLMP-0240	SR503W	2, 3
HLMP-0242	SR503W	2, 3
HLMP-1000	SR515D	2, 3
HLMP-1002	SR515D	2, 3
HLMP-1071	SR515C	2, 3
HLMP-1080	SR515W	2, 3
HLMP-1301	SR615D	2, 3
HLMP-1350	SR525D	2, 3
HLMP-1401	SY415D	2, 3
HLMP-1450	SY425D	2, 3
HLMP-1501	SG215D	2, 3
HLMP-1550	SG225D	2, 3
HLMP-1700	SR525D	2, 3
HLMP-1719	SY425D	2, 3
HLMP-3000	SR603D	2, 3
HLMP-3001	SR603D	2, 3
HLMP-3002	SR603D	2, 3
HLMP-3003	SR603D	2, 3
HLMP-3300	SR603D	2, 3
HLMP-3301	SR603D	2, 3
HLMP-3315	SR603C	2, 3
HLMP-3316	SR603C	2, 3
HLMP-3400	SY403DA	2, 3
HLMP-3401	SY403DA	2, 3
HLMP-3415	SY403TA	2, 3
HLMP-3416	SY403TA	2, 3

Hewlett-Packard	NEC	Notes
HLMP-3500	SG203DA	2, 3
HLMP-3501	SG203DA	2, 3
HLMP-3517	SG203TA	2, 3
HLMP-3519	SG203TA	2, 3
HLMP-4610	SR613D	2, 3
HLMP-4700	SR603DB	2, 3
HLMP-4719	SR603DB	2, 3
HLMP-6400	SY406D	2, 3
HLMP-6500	SG206D	2, 3
HLMP-7000	SR106D	2, 3
HLMP-7019	SY406D	2, 3

OKI	NEC	Notes
OLD415	SR515C	2, 3
OLD415T	SR515C	2, 3
OLD416	SR106C	2, 3
OLD416LD	SR106D	2, 3
OLD416LT	SR106C	2, 3
OLD4101D	SR503D	2, 3
OLD41011	SR503C	2, 3
OLD315D	SG215D	2, 3
OLD316LC	SG206T	2, 3
OLD3101C	SG203TA	2, 3
OLD2101D	SG203DA	2, 3
OLD715D	SY415D	2, 3
OLD716LC	SY406T	2, 3
OLD7101C	SY403TA	2, 3
OLD7101D	SY403DA	2, 3

Panasonic	NEC	Notes
LN21RPHL	SR503D	2, 3
LN21RPH	SR513D	2, 3
LN21WPH	SR513W	2, 3
LN21CPH	SR513C	2, 3
LN31GPH	SG213DA	2, 3
LN31GCPH	SG213TA	2, 3
LN41YPH	SY413D	2, 3
LN41YCPH	SY413T	2, 3
LN28RP	SR525D	2, 3
LN38GP	SG225D	2, 3
LN48YP	SY425D	2, 3
LN222RP	SR539D	2, 3
LN322GP	SG239D	2, 3
LN422YP	SY439D	2, 3
LN230RPP	SR539D	2, 3
LN330GPP	SG239D	2, 3
LN430YPP	SY439D	2, 3
LN25RP	SR607D	2, 3
LN35GP	SG207D	2, 3
LN45YP	SY407D	2, 3
LN247RP	SR106D	2, 3
LN247CP	SR506C	2, 3
LN347GP	SG206D	2, 3
LN447YP	SY406D	2, 3

Sharp	NEC	Notes
GL-3PR1	SR515D	2, 3
GL-3PR2	SR515D	2, 3
GL-5PR1	SR503D	2, 3
GL-5PR2	SR503D	2, 3
GL-30PR3	SR515W	2, 3
GL-30PR8	SR515C	2, 3
GL-31AR	SR515D	2, 3
GL-31AR8	SR515C	2, 3
GL-32AR	SR515D	2, 3
GL-30PG	SG203DA	2, 3
GL-32PG	SR215D	2, 3
GL-52PG	SR203DA	2, 3
GL-52AY	SY403DA	2, 3

Siemens	NEC	Notes
GL56	SG203D	2, 3
LDG1201	SG203DA	2, 3
LDG1231	SG203DB	2, 3
LDG1251	SG813DB	2, 3
LDG3571	SG215D	2, 3
LDG3900	SG240D	2, 3
LDG5171	SG813D	2, 3
LDG5172	SG203DA	2, 3
LDG5591	SG213T	2, 3
LDR3501	SR515D	2, 3
LDR3600	SR540D	2, 3
LDR3700	SR540D	2, 3
LDR5000	SR503D	2, 3
LDR5001	SR503D	2, 3
LDR5020	SR503D	2, 3
LDR5091	SR503C	2, 3
LDR5092	SR503C	2, 3
LDR5093	SR503C	2, 3
LDR5101	SR603D	2, 3
LDR5102	SR603D	2, 3
LDR5103	SR513D	2, 3
LDR5121	SR603D	2, 3
LDR5122	SR503D	2, 3
LDR5600	SR531D	2, 3
LDR5700	SR531D	2, 3
LDY3561	SY415D	2, 3
LDY3800	SY440D	2, 3
LDY5060	SY440D	2, 3
LDY5161	SY403DA	2, 3
LDY5162	SY403DA	2, 3
LDY5163	SY403DA	2, 3
LDY5391	SY403TA	2, 3
LDY5392	SY403TA	2, 3
LDY5393	SY403TA	2, 3
LDY5600	SY413D	2, 3
RL50	SR106C	2, 3
RL50-01	SR106D	2, 3
RL54	SR106D	2, 3
RL55	SR106D	2, 3
YL56	SY406D	2, 3

Notes:

(1) Direct replacement

(2) Equivalent (minor electrical difference)

(3) Equivalent (minor mechanical difference)

(4) Different (significant difference, electrical or mechanical)

Visible LEDs [cont]

Stanley	NEC	Notes
GD-2-301C	SR106C	1
GD-2-301G	SR206T	1
GD-4-204RD	SR503D	2, 3
GD-4-204CD	SR503W	2, 3
GD-4-204GD	SG203DA	2, 3
GD-4-204YD	SY403DA	2, 3
GD-4-205RD	SR503D	2, 3
GD-4-205CD	SR503W	2, 3
GD-4-205GD	SG203DA	2, 3
GD-4-205YD	SY403DA	2, 3
GD-4-505RD	SR515D	2, 3
GD-4-505CD	SR515W	2, 3
GD-4-505GD	SG215D	2, 3
GD-4-505YD	SY415D	2, 3
SG2-04B	SR515D	2, 3
SG2-05B	SG215D	2, 3
SG2-06B	SY415D	2, 3

Telefunken	NEC	Notes
CQX10	SR503D	1
CQX40L	SR503D	2, 3
CQX40/5VL	SR503D	2, 3
CQX40/12VL	SR503D	2, 3
CQX41	SR106D	1
CQY85	SR515D	2, 3
V136PL	SR503C	2, 3
V137PL	SR503W	2, 3
V138P	SR106C	2, 3
V169	SR503D	2, 3
CQX11	SG203DA	2, 3
CQY73	SG206D	2, 3
CQY86	SG215D	2, 3
V179P	SG215D	2, 3
CQX12	SY403DA	2, 3
CQY74L	SY403DA	2, 3
V170P	SY403DA	2, 3
CQ75	SY406D	2, 3
CQY87	SY415D	2, 3
V180P	SY415D	2, 3

Toshiba	NEC	Notes
TLR102	SR515D	2, 3
TLR104	SR503D	2, 3
TLR106	SR503W	2, 3
TLR108	SR515C	2, 3
TLR109	SR515W	2, 3
TLR110	SR503C	2, 3
TLR113	SR503C	2, 3
TLR114	SR503D	2, 3
TLR120	SR503C	2, 3
TLG102	SG215D	2, 3
TLG103	SG203TA	2, 3

Notes:

(1) Direct replacement

(2) Equivalent (minor electrical difference)

(3) Equivalent (minor mechanical difference)

(4) Different (significant difference, electrical or mechanical)

Red — Light Emitting Diodes

Part Number	P_D (mW) (Max)	I_F (mA) (Max)	Typical V_F (V)	Typical I_R (μA)	Typical I_V (mcd)	Typical 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
SR506D/C	60	30	2.0	0.01	1/2	695
SR513D/C/W	60	30	2.0	0.01	5/10/5	695
SR515D/C/W	60	30	2.0	0.01	3.5/10/3.5	695
SR525D	60	30	2.0	0.01	1.0	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
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
SR625D	100	40	2.0	0.01	3.0	630
SR632D	100	40	2.0	0.01	1.2	630
SR641D	100	40	2.1	0.01	3	630
SR661D	100	40	2.0	0.01	1.0	630

Notes:

(1) V_F measured at $I_F = 10$ mA, except SR106, $I_F = 20$ mA

(2) I_R measured at $V_R = 4.5$ V, except SR106, $V_R = 3$ V

(3) I_V measured at $I_F = 10$ mA, except SR106, $I_F = 20$ mA

(4) Wavelength measured at $I_F = 10$ mA

Green — Light Emitting Diodes

Part Number	P_D (mW) (Max)	I_F (mA) (Max)	Typical V_F (V)	Typical I_R (μA)	Typical I_V (mcd)	Typical Wavelength (nm)
SG203TA/DA	100	40	2.0	0.01	13/8	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
SG225D	100	40	2.0	0.01	5	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
SG241D	100	40	2.1	0.01	4.5	565
SG261D	100	40	2.0	0.01	1.5	565
SG813D/T	100	40	2.0	0.01	5/9	555
SG815D/T	100	40	2.0	0.01	2.2/5	555
SG825D	100	40	2.0	0.01	1.0	555

Notes:

(1) V_F measured at $I_F = 10$ mA

(2) I_R measured at $V_R = 4.5$ V

(3) I_V measured at $I_F = 10$ mA

(4) Wavelength measured at $I_F = 10$ mA

Amber/Yellow — Light Emitting Diodes

Part Number	P_D (mW) (Max)	I_F (mA) (Max)	Typical V_F (V)	Typical I_R (μA)	Typical I_V (mcd)	Wavelength (nm)
SY403DA/TA	100	40	2.0	0.01	10/30	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
SY425D	100	40	2.0	0.01	5	590
SY431D	100	40	2.0	0.01	1.0	500
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
SY441D	100	40	2.1	0.01	5.5	590
SY461D	100	40	2.0	0.01	1.5	590
SY913D/T	100	40	2.0	0.01	30/80	570
SY915D/T	100	40	2.0	0.01	15/30	570
SY925D/T	100	40	2.0	0.01	6	570
SY941D	100	40	2.1	0.01	8.5	570

Notes:

(1) V_F measured at $I_F = 10$ mA

(2) I_R measured at $V_R = 4.5$ V

(3) I_V measured at $I_F = 10$ mA

(4) Wavelength measured at $I_F = 10$ mA

Infrared — Light Emitting Diodes

Part Number	P_D (mW) (Max)	I_F (mA) (Max)	Typical V_F (V)	Typical I_R (μA)	Typical P_O (mW)	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
SE310	100	50	1.1/50	0.01	11	940
SE312	100	50	1.1/50	0.01	11	940
SE313	150	100	1.27/50	2.1	25	940
SE1003	150	50	1.25/50	0.01	20	950

Notes:

(1) I_R tested at $V_R = 3$ V

(2) P_O tested at $I_F = 30$ mA

(3) Wavelength tested at $I_F = 30$ mA

(4) $T_A = 25°C$ for all data

Photo Couplers

Part Number	I_F (mA) (Max)	I_C (mA) (Max)	V_{ISO} (VAC) (Max)	V_F/I_F (V/mA) (Max)	I_{CEO} (nA) (Max)	CTR/I_F (%/mA) (Min)	V_{CE}(sat) ($I_C = 2$ mA) (Max)	BV_{CEO} (V) (Min)
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 (Note 1)	1.9/5	400	100/5	1.2	
PS2004B	50	200	2000	1.4/20	400	1300/5	1.2	
PS2005B	150	50	2000	2.0/10	200	10/100	0.3	
PS2006B	25	8	3000 (Note 1)	1.7/16	n/a	15/16	n/a	
PS2007B	10	50	3000 (Note 1)	1.7/10	TTL	600/5	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
PS2101	50	30	2000	1.4/10	100	200/5	0.3	
PS2041	25	n/a	2500	2.2/16	n/a	22/16	n/a	
PS2042	25	n/a	2500	2.2/16	n/a	22/16	n/a	
PS2043	25	n/a	2500	2.2/16	n/a	22/16	n/a	
PS2044	25	n/a	2500	2.2/16	n/a	22/16	n/a	
PS2501	80	80	5000	1.1/10	100	150/5	0.1	
PS2502	80	200	5000	1.1/10	400	2000/1	0.1	
PS2505	80	80	5000	1.1/10	100	150/5	0.1	
PS2506	80	200	5000	1.1/10	400	2000/1	1.0	

Notes:

(1) In DC volts; all others in AC volts

(2) I_{CEO} measured at $V_{CE} = 10$ V and $I_F = 0$

Photo Couplers — SCR Type

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

Notes:

(1) I_{DRM} with $R_{GK} = 27\ k\Omega$ and $T_A = 100°C$

(2) V_{TM} with $I_T = 300$ mA

(3) I_{FT} with $V_D = 6$ V and $R_{GK} = 27\ \Omega$

Photo Transistors

Part Number	P_C (mW) (Max)	I_C (mA) (Max)	V_{CEO} (V) (Max)	I_{CEO} (nA)	V_{CE} (sat) (V)	I_L (mA) (Min)
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
PH105	150	50	30	200	0.3	2
PH106	100	40	30	100	0.3	0.060
PH108	100	40	30	100	0.3 (Note 4)	0.3 (Note 5)
PH110	100	40	30	100	0.3	400 μA
PH112	100	40	30	100	0.3	400 μA

Notes:

(1) I_{CEO} tested at $V_{CE} = 10$ V and L = 0

(2) $V_{CE\ (sat)}$ tested at L = 1000 lx

(3) I_L tested at $V_{CE} = 2$ V and 100 lx

(4) IC = 0.5 mA, H = 5.0 mW/cm^2

(5) $V_{CE} = 5$ V, H = 5.0 mW/cm^2

Photo Interrupters

Part Number	I_F (mA) (Max)	V_{CEO} (V) (Max)	I_C (mA) (V)	V_F (mA)	I_{CEO} (nA)	V_{CE}(sat) (V)	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	100	0.3	20
PS4014	50	30	40	1.1	100	0.3	0.5
PS4501	50	30	40	1.1	100	0.3	n/a
PS4502	50	30	40	1.1	100	1.2	n/a
PS6001A	50	30	40	1.4	n/a	0.3	n/a

Notes:

(1) V_F tested at $I_F = 20$ mA, except PS6001A $I_F = 30$ mA

(2) I_{CEO} tested at $V_{CE} = 10$ V and $I_F = 0$

(3) $V_{CE\ (sat)}$ tested at $I_F = 10$ mA and $I_C = 0.5$ mA

(4) CTR tested at $I_F = 10$ mA and $V_{CE} = 2$ V

(5) PS4008/PS6001A $V_{CE(sat)}$ tested at $I_F = 10$ mA and $I_C = 50\ \mu$A

(6) The PS6001A is a photo reflective sensor

Photo Diodes

Part Number	V_R (V) (Max)	P_C (mW)	I_F (mA)	Sensitivity (nA)/lx	I_D (pA) (Max)	t_r (ns)
PH302	32	150	n/a	50 (Note 4)	30	50
PH302B/C	32	150	n/a	32	30	50
PH309	20	150	n/a	50	30	30
PH310	32	150	n/a	32	30	30
PH314	20	20	10	0.52A/W	4	1

Notes:

(1) t_r tested at $R_L = 1\ k\Omega$

(2) I_D tested at $V_R = 10$ V

(3) Wavelength of maximum sensitivity is 940 nm

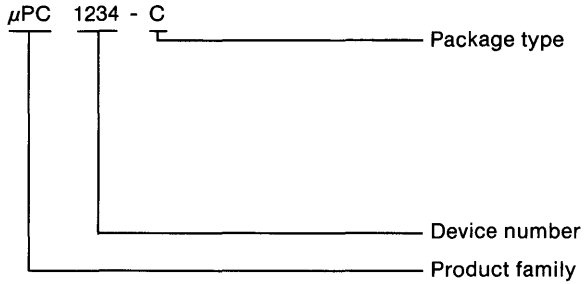
(4) Measured in nA

NEC

INDUSTRIAL LINEAR PRODUCTS 10

Section 10 — Industrial Linear Products **Page**

Part Numbering System



B	=	Ceramic flatpack
C	=	Plastic molded DIP
D	=	Ceramic DIP/CERDIP
G2	=	Plastic miniflat
H	=	TO-220
HA	=	Plastic SIP
J	=	TO-92

μPC	=	Bipolar linear circuits
μPD	=	MOS circuits

Linear Cross Reference

AMD	NEC
AM 6012	μPC6012
DAC 08	μPC624

Fairchild	NEC
UA 1458	μPC1458*
UA 301A	μPC301A
UA 305	μPC305*
UA 311	μPC311*
UA 324	μPC324*
UA 339	μPC339*
LM 358	μPC358*
UA 393	μPC393*
UA 398	μPC398
UA 4558	μPC4558*
UA 494	μPC494*
UA 555	μPC1555*
UA 733	μPC1663
UA 741	μPC741*
UA 78XX	μPC78XX
UA 78LXX	μPC78LXX
UA 78MXX	μPC78MXX
UA 79XX	μPC79XX
UA 79LXX	μPC79LXX
UA 79MXX	μPC79MXX

Intersil	NEC
ICM 7555	μPD5555*
ICM 7556	μPD5556*

Motorola	NEC
DAC 08	μPC624
TL 071	μPC4071*
TL 072	μPC4072*
TL 074	μPC4074*
TL 081	μPC4081*
TL 082	μPC4082*
TL 084	μPC4084
MC 1403	μPC1060
MC 1408-8	μPC624
MC 1455	μPC1555*
MC 1458	μPC1458*
UA 301A	μPC301A
LM 305	μPC305*
LM 311	μPC311*
LM 317	μPC317
LM 324	μPC324*
LM 339	μPC339*
MC 3403	μPC3403*
MC 34072	μPC842
MC 34074	μPC844
LM 358	μPC358*
MC 4558	μPC4558*
MC 4741	μPC4741*
LM 741	μPC741*
MC 78XX	μPC78XX
MC 78LXX	μPC78LXX
MC 78MXX	μPC78MXX
MC 79XX	μPC79XX

National	NEC
DAC 08	μPC624
LM 1458	μPC1458*
LM 301A	μPC301A
LM 305	μPC305*
LM 311	μPC311*
LM 317	μPC317
LM 319	μPC319*
LM 320TX	μPC79XX
LM 324	μPC324
LM 336-2.5	μPC1093J*
LM 337	μPC337
LM 339	μPC339*
LM 340T	μPC78XX
LF 351	μPC811*
LM 353	μPC812*
LF 356	μPC356
LM 358	μPC358*
LM 359	μPC4359*
LM 385-2.5	μPC1093J*
LM 393	μPC393*
LM 398	μPC398
LF 411	μPC811*
LF 412	μPC812*
LM 4250	μPC4250*
LM 555	μPC1555*
LM 741	μPC741*
LM 78XX	μPC78XX
LM 78LXX	μPC78LXX
LM 78MXX	μPC78MXX
LM 79XX	μPC79XX
LM 79LXX	μPC79LXX
LM 79MXX	μPC79MXX

PMI	NEC
DAC 01C	μPC603
DAC 02	μPC610
DAC 08	μPC624

RCA	NEC
CA 081	μPC4081*
CA 082	μPC4082*
CA 084	μPC4084
CA 1458	μPC1458*
CA 301A	μPC301A
CA 311	μPC311*
CA 324	μPC324*
CA 339	μPC339*
CA 358	μPC358*
CA 393	μPC393*
CA 555	μPC1555*
CA 741	μPC741*

SGS	NEC
MC 1458	μPC1458*
L 2605	μPC2605
L 2610	μPC2610
LS 301A	μPC301A
LM 317	μPC317

SGS	NEC
LM 324	μPC324*
LM 339	μPC339*
LM 358	μPC358*
LM 393	μPC393*
LS 4558	μPC4558*
NE 555	μPC1555*
LM 741	μPC741*
L 78XX	μPC78XX
L 78MXX	μPC78MXX
L 79XX	μPC79XX

Signetics	NEC
AM 6012	μPC6012
DAC 08	μPC624
MC 1408-8	μPC624
MC 1458	μPC1458*
LM 311	μPC311*
LM 319	μPC319*
LM 324	μPC324*
LM 339	μPC339*
MC 3403	μPC3403*
LM 393	μPC393*
LF 398	μPC398
NE 4558	μPC4558*
NE 555	μPC1555*
NE 5532	μPC4570*
UA 741	μPC741*

Texas Inst.	NEC
TL 061	μPC4061*
TL 062	μPC4062*
TL 064	μPC4064*
TL 071	μPC4071*
TL 072	μPC4072*
TL 074	μPC4074*
TL 081	μPC4081*
TL 082	μPC4082*
TL 084	μPC4084
TL 431	μPC1093
MC 1458	μPC1458*
LM 301A	μPC301A
LM 311	μPC311*
LM 319	μPC319*
LM 324	μPC324*
LM 339	μPC339*
LM 358	μPC358*
LM 393	μPC393*
TL 431	μPC1093J*
RC 4558	μPC4558*
RC 4559	μPC4559*
TL 494	μPC494*
NE 555	μPC1555*
UA 741	μPC741*
UA 78XX	μPC78XX
UA 78LXX	μPC78LXX
UA 78MXX	μPC78MXX
UA 79XX	μPC79XX
UA 79LXX	μPC79LXX
UA 79MXX	μPC79MXX

Note:

*Available in Surface Mount Package.

Operational Amplifiers

Temperature range: C Package (plastic molded DIP) −40 to +85°C
G2 Package (plastic molded SO) −40 to +85°C

* Unless otherwise specified, V± = ±15 V, T_A = 25°C

Part No.	Package	Generic	V± (V) (Note 1)	I_{CC} (mA) Max	V_{IO} (mV) Max	I_{IO} (nA) Max	I_b (nA) Max	A_{VOL} (dB) Min	e_n (Note 2) (nV/$\sqrt{Hz}$) 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	C/8 G2/8	LF411	5-16	3.5	2.5	0.05	0.2	88	20	4	15
μPC813	C/8 G2/8	LF412	5-16	3.5	2.5	0.05	0.2	88	20	8	25
μPC4061	C/8 G2/8	TL061	2-16	0.25	10	0.1	0.2	69	30	1	3
μPC4061B	C/8 G2/8	TL061B	2-16	0.25	3	0.1	0.2	69	30	1	3
μPC4071	C/8 G2/8	TL071	5-16	2.7	10	0.1	0.2	88	18	3	13
μPC4071B	C/8 G2/8	TL071B	5-16	2.7	3	0.1	0.2	88	18	3	13
μPC4081	C/8 G2/8	TL081	5-16	2.8	15	0.2	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 Ω).

Operational Amplifiers (cont)

Temperature range: C Package (plastic molded DIP) −40 to +85°C
G2 Package (plastic molded SO) −40 to +85°C
HA Package (single in line)

* Unless otherwise specified, V± = ±15 V, T_A = 25°C

Part No.	Package	Generic	V± (V) (Note 1)	I_{CC} (mA) Max	V_{IO} (mV) Max	I_{IO} (nA) Max	I_B (nA) Max	A_{VOL} (dB) Min	e_n (Note 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± = +5 V											
μPC812	C/8, G2/8	Orig	5-16	6.8	3.0	0.05	0.2	88	20	4	15
μPC814	C/8	Orig	5-16	6.8	3.0	0.05	0.2	88	20	8	25
μPC842	C/8, G2/8	MC34072	3-36 (Single supply)	5.5	4.5	75	500	86	N/A	3.5	8.5
μPC1458	C/8 G2/8	MC1458	7-16	5.6	6	200	500	88	25	0.6	0.5
μPC4062	C/8	TL062	2-16	0.50	10	0.1	0.2	69	30	1	3
μPC4062B	G2/8	TL062B	2-16	0.50	3.0	0.1	0.2	69	30	1	3
μPC4072	C/8	TL072	5-16	5.0	10	0.1	0.2	88	18	3	13
μPC4072B	G2/8 HA/9	TL072B	5-16	5.0	3.0	0.1	0.2	69	17	3	13
μPC4082	C/8 G2/8	TL082	5-16	5.6	15	0.2	0.4	88	25	3	13
μPC4359	C/14	LM339	5-22	22	—	—	1500	70	—	15	60
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	C/8 G2/8 HA/9	Orig	4-16	8.0	5.0	200	1000	90	4.5	15 (GBW at 10 kHz)	7
μPC4572	C/8 G2/8 HA/9	Orig	4-15 (Single supply)	7.0	5.0	100	400	80	4.5	16	6

Notes:

(1) Recommended supply voltage range.

(2) Input equivalent noise density at 1 kHz (R_S = 100 Ω).

Operational Amplifiers (cont)

Temperature range: C Package (plastic molded DIP) −40 to +85°C
G2 Package (plastic molded SO) −40 to +85°C

* Unless otherwise specified, V± = ±15 V, T_A = 25°C

Part No.	Package	Generic	V± (V) (Note 1)	I_{CC} (mA) Max	V_{IO} (mV) Max	I_{IO} (nA) Max	I_b (nA) Max	A_{VOL} (dB) Min	e_n (Note 2) (nV/$\sqrt{Hz}$) 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± = +5 V											
μPC844	C/G2	MC34074	3-36 (Single supply)	—	5.0	75	500	70	—	3.5	8.5
μPC3403	C/14 G2/14	MC3403	3-32 (Single supply)	7.0	7.0	50	250	88	32	1	0.6
*Specified at V± = +5 V											
μPC4064	C/14	TL064	2-16	1.0	10	0.1	0.2	69	30	1	3
μPC4064B	C/14 G2/14	TL064B	2-16	1.0	3.0	0.1	0.2	69	30	1	3
μPC4074	C/14	TL074	5-16	10	10	0.1	0.2	88	18	3	13
μPC4074B	G2/14	TL074B	5-16	10	3.0	0.1	0.2	88	18	3	13
μPC4084	C/14	TL084	5-16	10	15	0.2	0.4	88	25	3	13
μPC4574	C/14 G2/14	Orig	±15	12	5.0	200	1000	90	5	7	6
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 Ω).

Comparators

Temperature range: C Package (plastic molded DIP) −40 to +85 °C
G2 Package (plastic molded SO) −40 to +85 °C

* Unless otherwise specified, V± = ±15 V, T_A = 25 °C

Part No.	Package	Generic	V± (V) (Note 1)	I_{CC} (mA) Max	V_{IO} (mV) Max	I_{IO} (nA) Max	I_b (nA) Max	A_{VOL} (dB) Typ	I_{SINK} (mA) Typ (Note 2)	Response Time (Note 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 to 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

Part No.	Generic	Operating Temperature Range (°C)	V_{OUT} (V)	V_{IN} (V) Min	V_{IN} (V) Max	I_O Max (A)	P_T Max (W)	Package
μPC305C/G2	LM305	0 to +70	4.5 to 30	8.0	40	0.05	0.35	8-pin DIP
μPC317H	LM317	− 20 to +80	+1.3 to +30	4.3	40	1.5	20	TO-220
μPC337H	LM337	− 20 to +80	+1.3 to +30	4.3	40	1.5	20	TO-220
μPC2600H	L2605 L2610	− 30 to +85	5, 10	12	28	0.5	20	TO-220
μPC78L05J	78L05	− 20 to +150 (1)	5 (2)	7	30	0.1	0.8	TO-92
μPC78L08J	78L08	− 20 to +150 (1)	8 (2)	10.5	30	0.1	0.8	TO-92
μPC78L12J	78L12	− 20 to +150 (1)	12 (2)	14.5	35	0.1	0.8	TO-92
μPC78L15J	78L15	− 20 to +150 (1)	15 (2)	17.5	35	0.1	0.8	TO-92
μPC78M05H	78M05	− 20 to +80	5 (2)	7	35	0.5	20	TO-220
μPC78M08H	78M08	− 20 to +80	8 (2)	10.5	35	0.5	20	TO-220
μPC78M10H	78M10	− 20 to +80	10 (2)	12.5	35	0.5	20	TO-220
μPC78M12H	78M12	− 20 to +80	12 (2)	14.5	35	0.5	20	TO-220
μPC78M15H	78M15	− 20 to +80	15 (2)	17.5	35	0.5	20	TO-220
μPC78M18H	78M18	− 20 to +80	18 (2)	21	35	0.5	20	TO-220
μPC78M24H	78M24	− 20 to +80	24 (2)	27	40	0.5	20	TO-220
μPC7805H	7805	− 20 to +80	5 (2)	7	35	1.0	20	TO-220
μPC7808H	7808	− 20 to +80	8 (2)	10.5	35	1.0	20	TO-220
μPC7812H	7812	− 20 to +80	12 (2)	14.5	35	1.0	20	TO-220
μPC7815H	7815	− 20 to +80	15 (2)	17.5	35	1.0	20	TO-220
μPC7818H	7818	− 20 to +80	18 (2)	21	35	1.0	20	TO-220
μPC7824H	7824	− 20 to +80	24 (2)	27	40	1.0	20	TO-220
μPC79L05J	79L05	− 20 to +125 (1)	−5 (2)	−7	−20	0.07	0.7	TO-92
μPC79L08J	79L08	− 20 to +125 (1)	−8 (2)	−10.5	−23	0.07	0.7	TO-92
μPC79L12J	79L12	− 20 to +125 (1)	−12 (2)	−14.5	−27	0.07	0.7	TO-92
μPC79L15J	79L15	− 20 to +125 (1)	−15 (2)	−17.5	−30	0.07	0.7	TO-92
μPC79M05H	79M05	− 20 to +150 (1)	−5 (2)	−7	−25	0.35	20	TO-220
μPC79M08H	79M08	− 20 to +150 (1)	−8 (2)	−10.5	−25	0.35	20	TO-220
μPC79M12H	79M12	− 20 to +150 (1)	−12 (2)	−14.5	−30	0.35	20	TO-220
μPC79M15H	79M15	− 20 to +150 (1)	−15 (2)	−17.5	−30	0.35	20	TO-220
μPC79M24H	79M24	− 20 to +150 (1)	−24 (2)	−27	−38	0.35	20	TO-220
μPC7905H	7905	− 20 to +80	−5 (2)	−7	−35	1.0	20	TO-220
μPC7908H	7908	− 20 to +80	−8 (2)	−10.5	−35	1.0	20	TO-220
μPC7912H	7912	− 20 to +80	−12 (2)	−14.5	−35	1.0	20	TO-220
μPC7915H	7915	− 20 to +80	−15 (2)	−17.5	−35	1.0	20	TO-220
μPC7918H	7918	− 20 to +80	−18 (2)	−21	−35	1.0	20	TO-220
μPC7924H	7924	− 20 to +80	−24 (2)	−27	−40	1.0	20	TO-220
μPC1093J	TL431CP	− 20 to +85	2.5 −36 V	V_{ref}	37	0.1	.22	TO-92
μPC1093G2	TL431CD	− 20 to +85	2.5 −36 V	V_{ref}	37	0.1	.10	8-pin miniflat

Notes:

(1) Junction temperature (2) Output voltage accuracy ±5%

Digital to Analog Converters

Part No.	Generic	Resolution	Non-Linearity	Conversion Speed	Supply Voltage	Features	Package
μPC603D	OP-01	6-bit	0.4%	3 μs	±15	Onboard V_{REF} —Output buffer	14-pin ceramic DIP
μPC610D	OP-02	10-bit	0.2%	6 μs	±15	Onboard V_{REF} —Output buffer	18-pin ceramic DIP
μPC624C	DAC-08	8-bit	0.19%	150 ns	±15	Current output	16-pin plastic DIP
μPC6012C	AM-6012	12-bit	0.05%	400 ns	±15	Current output	20-pin plastic DIP
μPD6900C	Orig	8-bit	1/2 LSB	20 x 10^6 samples/sec	+5	Current output	22-pin plastic DIP
μPD7011C	Orig	8-bit	0.4%	3 μs	+5	Current output	18-pin plastic DIP

Analog to Digital Converters

Part No.	Generic	Resolution	Non-Linearity	Conversion Speed	Supply Voltage	Output	Package
μPC650D	Orig	12-bit	0.05%	45 μs	+5 −15	Parallel	28-pin ceramic DIP
μPD6950C/G	Orig	8-bit	±1 1/2 LSB	15 x 10^6 samples/sec	+5	Parallel	24-pin plastic DIP/SO
μPD7001C	Orig	8-bit	0.8%	140 μs	+5	Serial	16-pin plastic DIP
μPD7002C	Orig	10-bit	0.2%	15 ms	+5	Three state	28-pin plastic DIP
μPD7002C-1	Orig	10-bit	0.1%	15 ms	+5	Three state	28-pin plastic DIP
μPD7003C	Orig	8-bit	0.49%	4 μs	+5	Three state	24-pin plastic DIP
μPD7004C	Orig	10-bit	0.15%	104 μs	+5	Serial/ parallel	28-pin plastic DIP

Functional Blocks

Part No.	Generic	Description (Note 1)	Package
μPC398C	LF398N	Monolithic sample and hold circuit	8-pin plastic DIP
μPC494C (Note 2)	TL494	Switching regulator (SMPS) controller	8-pin plastic DIP
μPC494G	TL494	Switching regulator (SMPS) controller	16-pin plastic SO
μPC751B	SSI104	Quad read/write amp for hard disk media	24-pin ceramic flatpack
μPC754D	Orig	Magnetic servo head preamp	8-pin ceramic DIP
μPC1042C	Orig	Switching regulator (SMPS) controller	16-pin plastic DIP
μPC1060C	MC-1403	2.5 V precision voltage reference, for use with D/A and A/D converters	8-pin plastic DIP
μPC1555C/G2	NE-555	Precision timer (NE-555 direct replacement)	8-pin plastic DIP/SO
μPC1571C	—	Dual gain control circuit	16-pin plastic DIP
μPC1663C	—	Ultra-wideband differential amplifier	8-pin plastic DIP
μPC1664C	—	Ultra-wideband differential amplifier	14-pin plastic DIP
μPC3423C	MC-3423	Overvoltage "crowbar" sensing circuit	8-pin plastic DIP
μPD5555C/G2	ICL5555/TLC555	CMOS 555 timer	8-pin plastic DIP/SO
μPD5556C/G2	ICL5556/TLC556	CMOS 556 dual timer	14-pin plastic DIP/SO

Notes:

(1) Contact manufacturer for specifications.

(2) For automotive temperature range.

Charge Coupled Devices (CCD Image Sensors)

Part No.	Description	Package
μPD791D	4096 pixel line array	24-pin ceramic DIP
μPD795D	1024 pixel line array	20-pin ceramic DIP
μPD799D	2048 pixel line array	24-pin ceramic DIP
μPD3520D	427 x 492 pixel area array (color)	20-pin ceramic shrink DIP
μPD3570D	2592 pixel line array	20-pin ceramic shrink DIP

NEC

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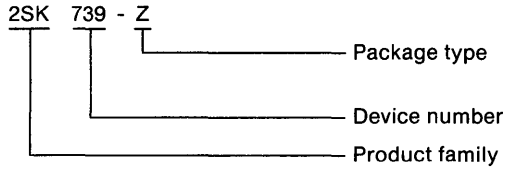
Part Numbering System



	H	= SIP
	Z	= Surface mountable MP-3
1S, 1SS, 1SV	=	Tuner/Mixer Diode
2SA, 2SB	=	PNP transistor
2SC, 2SD	=	NPN transistor
2SK, V	=	N-Channel power MOS or JFET
2SJ	=	P-Channel power MOS or JFET
3SK	=	Dual-Gate JFET
RD	=	Zerner Diode
UPA	=	Power MOS or transistor Array

Note:

(1) Not all products are listed. Contact discrete product marketing for further information.

Power MOSFET Cross Reference

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2N6656	35	1.800	2.000	TO-3		0	0.000	0.000		
2N6657	60	3.000	2.000	TO-3		0	0.000	0.000		
2N6658	90	4.000	1.900	TO-3		0	0.000	0.000		
2N6659	35	1.800	1.400	TO-39		0	0.000	0.000		
2N6660	60	3.000	1.100	TO-39		0	0.000	0.000		
2N6661	90	4.000	0.900	TO-39		0	0.000	0.000		
2N6755	60	0.250	12.000	TO-3		0	0.000	0.000		
2N6756	100	0.180	14.000	TO-3		0	0.000	0.000		
2N6757	150	0.600	8.000	TO-3		0	0.000	0.000		
2N6758	200	0.400	9.000	TO-3		0	0.000	0.000		
2N6759	350	1.500	4.500	TO-3		0	0.000	0.000		
2N6760	400	1.000	5.500	TO-3		0	0.000	0.000		
2N6761	450	2.000	4.000	TO-3		0	0.000	0.000		
2N6762	500	1.500	4.500	TO-3		0	0.000	0.000		
2N6763	60	0.080	31.000	TO-3		0	0.000	0.000		
2N6764	100	0.055	38.000	TO-3		0	0.000	0.000		
2N6765	150	0.120	25.000	TO-3		0	0.000	0.000		
2N6766	200	0.085	30.000	TO-3		0	0.000	0.000		
2N6767	350	0.400	12.000	TO-3		0	0.000	0.000		
2N6768	400	0.300	14.000	TO-3		0	0.000	0.000		
2N6769	450	0.500	11.000	TO-3		0	0.000	0.000		
2N6770	500	0.400	12.000	TO-3		0	0.000	0.000		
2N6781	60	0.600	3.500	TO-39		0	0.000	0.000		
2N6782	100	0.600	3.500	TO-39		0	0.000	0.000		
2N6783	150	1.500	2.250	TO-39		0	0.000	0.000		
2N6784	200	1.500	2.250	TO-39		0	0.000	0.000		
2N6785	350	3.600	1.250	TO-39		0	0.000	0.000		
2N6786	400	3.600	1.250	TO-39		0	0.000	0.000		
2N6787	60	0.300	6.000	TO-39		0	0.000	0.000		
2N6788	100	0.300	6.000	TO-39		0	0.000	0.000		
2N6789	150	0.800	3.500	TO-39		0	0.000	0.000		
2N6790	200	0.800	3.500	TO-39		0	0.000	0.000		
2N6791	350	1.800	2.000	TO-39		0	0.000	0.000		
2N6792	400	1.800	2.000	TO-39		0	0.000	0.000		
2N6793	450	3.000	1.500	TO-39		0	0.000	0.000		
2N6794	500	3.000	1.500	TO-39		0	0.000	0.000		

Notes:

These notes apply to all of the following tables.

(1) Check data sheet for package differences (isolated package).

(2) Four devices per package, check Power MOSFET Array family (μPA1500 Series).

(3) N-and P-channel devices in same package.

(4) 4-pin DIP package, check MP-3 family.

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2N6795	60	0.180	8.000	TO-39		0	0.000	0.000		
2N6796	100	0.180	8.000	TO-39		0	0.000	0.000		
2N6797	150	0.400	5.500	TO-39		0	0.000	0.000		
2N6798	200	0.400	5.500	TO-39		0	0.000	0.000		
2N6799	350	1.000	3.000	TO-39		0	0.000	0.000		
2N6800	400	1.000	3.000	TO-39		0	0.000	0.000		
2N6801	450	1.500	3.500	TO-39		0	0.000	0.000		
2N6802	500	1.500	3.500	TO-39		0	0.000	0.000		
2SJ101	−40	0.400	−5.000	TO-220AB	2SJ136	−60	0.300	−12.000	TO-220	
2SJ102	−60	0.200	−10.000	TO-220AB	2SJ140	−60	0.250	−19.000	TO-220	
2SJ112	−100	0.350	−10.000	TO-3		0	0.000	0.000		
2SJ113	−100	0.350	−10.000	TO-3P		0	0.000	0.000		
2SJ114	−200	0.800	−8.000	TO-3P		0	0.000	0.000		
2SJ115	−160	0.700	−8.000	TO-3P		0	0.000	0.000		
2SJ116	−400	2.250	−8.000	TO-3		0	0.000	0.000		
2SJ117	−400	7.000	−3.000	TO-220AB		0	0.000	0.000		
2SJ118	−140	0.500	−8.000	TO-3P		0	0.000	0.000		
2SJ119	−160	0.500	−8.000	TO-3P		0	0.000	0.000		
2SJ120L	−40	1.500	−2.000	MP-3	2SJ133	−60	0.800	−2.000	MP-3	
2SJ120S	−40	1.500	−2.000	MP-3S	2SJ133-Z	−60	0.800	−2.000	MP-3S	
2SJ122	−60	0.200	−10.000	TO-220AB		0	0.000	0.000		
2SJ123	−70	0.200	−10.000	TO-220AB	2SJ142	−100	0.200	−13.000	MP-45	1
2SJ124	−60	0.000	−10.000	TO-220AB	2SJ137	−60	0.300	−10.000	MP-45	1
2SJ127	−120	0.250	−10.000	TO-220AB		0	0.000	0.000		
2SJ128	−100	1.000	−2.000	MP-3	2SJ128	−100	1.000	−2.000	MP-3	
2SJ128-Z	−100	1.000	−2.000	MP-3	2SJ128-Z	−100	1.000	−2.000	MP-3	
2SJ132	−30	0.400	−2.000	MP-3	2SJ132	−30	0.400	−2.000	MP-3	
2SJ132-Z	−30	0.400	−2.000	MP-3S	2SJ132-Z	−30	0.400	−2.000	MP-3S	
2SJ133	−60	0.800	−2.000	MP-3	2SJ133	−60	0.800	−2.000	MP-3	
2SJ133-Z	−60	0.800	−2.000	MP-3	2SJ133-Z	−60	0.800	−2.000	MP-3	
2SJ134	−100	0.600	−6.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
2SJ135	−100	0.600	−5.000	MP-45	2SJ135	−100	0.600	−5.000	MP-45	1
2SJ136	−60	0.300	−12.000	TO-220	2SJ136	−60	0.300	−12.000	TO-220	
2SJ137	−60	0.300	−10.000	MP-45	2SJ137	−60	0.300	−10.000	MP-45	1
2SJ138	−100	0.300	−12.000	TO-220	2SJ138	−100	0.300	−12.000	TO-220	
2SJ139	−100	0.300	−10.000	MP-45	2SJ139	−100	0.300	−10.000	MP-45	1
2SJ140	−60	0.250	−19.000	TO-220	2SJ140	−60	0.250	−19.000	TO-220	
2SJ141	−60	0.250	−15.000	MP-45	2SJ141	−60	0.250	−15.000	MP-45	
2SJ142	−100	0.200	−13.000	MP-45	2SJ142	−100	0.200	−13.000	MP-45	
2SJ143	−60	0.150	−24.000	MP-45	2SJ143	−60	0.150	−24.000	MP-45	
2SJ47	−100	1.710	−7.000	TO-3		0	0.000	0.000		
2SJ48	−120	1.700	−7.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2SJ49	−140	1.700	−7.000	TO-3		0	0.000	0 000		
2SJ50	−160	1.700	−7.000	TO-3		0	0.000	0.000		
2SJ54	−210	1.000	0.000	TO-220		0	0.000	0.000		
2SJ55	−180	1.700	−8.000	TO-3		0	0.000	0.000		
2SJ56	−200	1.700	−8.000	TO-3		0	0.000	0.000		
2SJ56(H)	−200	1.700	−8.000	TO-3		0	0.000	0.000		
2SJ76	−140	0.000	−.500	TO-220AB		0	0.000	0.000		
2SJ77(K)	−160	0.000	−.500	TO-220AB		0	0.000	0.000		
2SJ78	−180	0.000	−.500	TO-220AB		0	0.000	0.000		
2SJ79	−200	0.000	−.500	TO-220AB		0	0.000	0.000		
2SJ79(K)	−200	0.000	−.500	TO-220AB		0	0.000	0.000		
2SK132	100	1.710	7.000	TO-3		0	0.000	0.000		
2SK133	120	1.700	7.000	TO-3		0	0.000	0.000		
2SK134	140	1.700	7.000	TO-3		0	0.000	0.000		
2SK135	160	1.700	7.000	TO-3		0	0.000	0.000		
2SK173	210	1.000	0.000	TO-220	V3088	250	0.670	5.000	TO-220	
2SK175	180	1.700	8.000	TO-3		0	0.000	0.000		
2SK176	200	1.700	8.000	TO-3		0	0.000	0.000		
2SK176(H)	200	1.700	8.000	TO-3		0	0.000	0.000		
2SK196(H)	160	15.000	0.500	TO-39		0	0.000	0.000		
2SK213	140	0.000	0.500	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK214	160	0.000	0.500	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK214(K)	160	0.000	0.500	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK215	180	0.000	0.500	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK216	200	0.000	0.500	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK216(K)	200	0.000	0.500	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK220	160	1.500	8.000	TO-3		0	0.000	0.000		
2SK220(H)	160	1.500	8.000	TO-3		0	0.000	0.000		
2SK221	200	1.500	8.000	TO-3		0	0.000	0.000		
2SK221(H)	200	1.500	8.000	TO-3		0	0.000	0.000		
2SK258(H)	250	1.100	8.000	TO-3		0	0.000	0.000		
2SK259	350	3.000	5.000	TO-3		0	0.000	0.000		
2SK259(H)	350	3.000	5.000	TO-3		0	0.000	0.000		
2SK260	400	3.000	5.000	TO-3		0	0.000	0.000		
2SK260(H)	400	3.000	5.000	TO-3		0	0.000	0.000		
2SK277	350	1.500	7.000	TO-3		0	0.000	0.000		
2SK278	400	1.500	7.000	TO-3		0	0.000	0.000		
2SK293	300	1.300	7.000	TO-3		0	0.000	0.000		
2SK294	80	0.560	5.000	TO-220AB	2SK702	100	0.450	5.000	TO-220	
2SK295	100	0.560	5.000	TO-220AB	2SK702	100	0.450	5.000	TO-220	
2SK296	300	4.000	1.000	TO-220AB		0	0.000	0.000		
2SK298	400	2.250	8.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2SK299	450	1.750	8.000	TO-3		0	0.000	0.000		
2SK308	120	0.300	10.000	TO-3		0	0.000	0.000		
2SK310	400	7.000	3.000	TO-220AB	2SK854	450	1.400	5.000	TO-220	
2SK311	450	4.000	3.000	TO-220AB	2SK854	450	1.400	5.000	TO-220	
2SK312	400	0.900	12.000	TO-3		0	0.000	0.000		
2SK313	450	0.900	12.000	TO-3		0	0.000	0.000		
2SK317	180	1.250	8.000	RFPAK		0	0.000	0.000		
2SK318	180	2.500	4.000	RFPAK		0	0.000	0.000		
2SK320	450	1.830	5.000	TO-220AB	2SK854	450	1.400	5.000	TO-220	
2SK324	400	0.450	10.000	TO-3		0	0.000	0.000		
2SK325	450	0.500	10.000	TO-3		0	0.000	0.000		
2SK338	400	1.500	5.000	TO-220	2SK338	400	1.500	5.000	TO-220	
2SK339	100	0.500	5.000	TO-220	2SK339	100	0.500	5.000	TO-220	
2SK345	40	0.400	5.000	TO-220AB	2SK704	60	0.250	5.000	TO-220	
2SK346	60	0.400	5.000	TO-220AB	2SK704	60	0.250	5.000	TO-220	
2SK349	400	0.900	10.000	TO-3P	2SK735	450	0.800	10.000	MP-88	1
2SK350	450	0.900	10.000	TO-3P	2SK735	450	0.800	10.000	MP-88	1
2SK351	800	3.000	5.000	TO-3		0	0.000	0.000		
2SK355	150	0.120	12.000	TO-3		0	0.000	0.000		
2SK356	250	0.200	12.000	TO-3		0	0.000	0.000		
2SK357	150	0.550	5.000	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK358	250	0.700	5.000	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK375L	300	4.000	1.000	MP-3		0	0.000	0.000		
2SK375S	300	4.000	1.000	MP-3S		0	0.000	0.000		
2SK379	400	1.500	8.000	TO-3		0	0.000	0.000		
2SK380	450	1.500	8.000	TO-3		0	0.000	0.000		
2SK382	500	4.000	2.000	TO-220AB	2SK855	500	1.500	5.000	TO-220	
2SK383	100	0.180	10.000	TO-220AB	2SK810	100	0.180	15.000	TO-220	
2SK384L	500	50.000	0.300	MP-3	V3080B	500	4.100	1.500	MP-3	
2SK384S	500	50.000	0.300	MP-3S	V3080B	500	4.100	1.500	MP-3S	
2SK385	400	0.450	10.000	TO-3P(L)	2SK827	450	0.380	18.000	MP-88	1
2SK386	450	0.500	10.000	TO-3P(L)	2SK825	450	0.500	15.000	MP-88	1
2SK387	150	0.120	12.000	TO-3P(L)		0	0.000	0.000		
2SK388	250	0.200	12.000	TO-3P(L)	2SK707	250	0.150	25.000	MP-88	1
2SK398	100	0.350	10.000	TO-3		0	0.000	0.000		
2SK399	100	0.350	10.000	TO-3P		0	0.000	0.000		
2SK400	200	0.800	8.000	TO-3P	V3087	250	0.450	8.000	MP-88	1
2SK401	250	0.400	10.000	TO-3		0	0.000	0.000		
2SK402	400	1.750	8.000	TO-3P	2SK873	450	1.100	8.000	MP-88	1
2SK403	450	1.750	8.000	TO-3P	2SK873	450	1.100	8.000	MP-88	1
2SK405	160	0.500	8.000	TO-3P	V3087	250	0.450	8.000	MP-88	1
2SK408	180	9.000	2.000	TO-220AB		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2SK409	180	9.000	2.000	TO-220AB		0	0.000	0.000		
2SK410	180	1.500	8.000	RFPAK		0	0.000	0.000		
2SK412	250	0.400	10.000	TO-3P	V3086	250	0.370	10.000	MP-88	1
2SK413	140	0.500	8.000	TO-3P	V3087	250	0.450	8.000	MP-88	1
2SK414	160	0.500	8.000	TO-3P	V3087	250	0.450	8.000	MP-88	1
2SK415	800	6.000	3.000	TO-3P	V3075	900	4.500	4.000	MP-88	1
2SK416L	40	1.500	2.000	MP-3	2SK739	60	0.250	2.000	MP-3	
2SK416S	40	1.500	2.000	MP-3S	2SK739-Z	60	0.250	2.000	MP-3S	
2SK417	60	0.100	10.000	TO-220BS	2SK659	60	0.075	12.000	MP-45	1
2SK418	400	2.200	2.000	TO-220BS	2SK854	450	1.400	5.000	TO-220	
2SK419	450	2.600	2.000	TO-220BS	2SK854	450	1.400	5.000	TO-220	
2SK420	400	1.000	5.000	TO-220BS	2SK735	450	0.800	10.000	TO-220	
2SK421	450	1.100	5.000	TO-220BS	2SK873	450	1.100	8.000	TO-220	
2SK422	60	1.400	0.700	TO-92M		0	0.000	0.000		
2SK423	100	2.400	0.500	TO-92M		0	0.000	0.000		
2SK428	60	0.200	10.000	TO-220AB	2SK659	60	0.075	12.000	TO-220	
2SK429L	100	0.700	3.000	MP-3	2SK612	100	0.450	2.000	MP-3	
2SK429S	100	0.700	3.000	MP-3S	2SK612-Z	100	0.450	2.000	MP-3S	
2SK430L	150	1.000	3.000	MP-3		0	0.000	0.000		
2SK430S	150	1.000	3.000	MP-3S		0	0.000	0.000		
2SK440	200	0.500	6.000	TO-220AB		0	0.000	0.000		
2SK442	70	0.200	10.000	TO-220AB	2SK810	100	0.180	15.000	TO-220	
2SK446	20	0.400	2.000	MP-3	2SK446	20	0.400	2.000	MP-3	
2SK446-Z	20	0.400	2.000	MP-3S	2SK446-Z	20	0.400	2.000	MP-3S	
2SK447	250	0.180	15.000	TO-3P(L)	2SK707	250	0.150	25.000	MP-88	1
2SK459	200	0.500	10.000	TO-220	2SK459	200	0.500	10.000	TO-220	
2SK462	60	0.500	2.000	MP-3	2SK462	60	0.500	2.000	MP-3	
2SK462-Z	60	0.500	2.000	MP-3S	2SK462-Z	60	0.500	2.000	MP-3S	
2SK463	60	0.300	5.000	TO-220	2SK463	60	0.300	5.000	TO-220	
2SK464	60	0.200	10.000	TO-220	2SK464	60	0.200	10.000	TO-220	
2SK468	100	1.000	2.000	MP-3	2SK468	100	1.000	2.000	MP-3	
2SK468-Z	100	1.000	2.000	MP-3S	2SK468-Z	100	1.000	2.000	MP-3S	
2SK470	100	0.300	10.000	TO-220	2SK470	100	0.300	10.000	TO-220	
2SK479	250	0.400	15.000	MP-80	2SK479	250	0.400	15.000	MP-80	
2SK482	450	2.000	5.000	TO-220	2SK482	450	2.000	5.000	TO-220	
2SK484	450	1.000	8.000	MP-80	2SK484	450	1.000	8.000	MP-80	
2SK490	400	0.800	10.000	MP-80	2SK490	400	0.800	10.000	MP-80	
2SK495	60	0.200	5.000	TO-220	2SK659	60	0.075	12.000	TO-220	
2SK496	60	0.200	5.000	Full Pack		0	0.000	0.000		
2SK497	50	0.180	5.000	TO-220	2SK659	60	0.075	12.000	TO-220	
2SK498	50	0.180	5.000	N Pack		0	0.000	0.000		
2SK499	50	0.180	5.000	Full Pack		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2SK500	60	0.080	10.000	TO-3P(NC)		0	0.000	0.000		
2SK501	400	0.800	8.000	TO-3P(NC)	2SK735	450	0.800	10.000	MP-88	1
2SK502	400	2.500	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
2SK503	400	2.500	3.000	Full Pack		0	0.000	0.000		
2SK511	250	50.000	0.300	TO-126		0	0.000	0.000		
2SK512	500	0.650	12.000	TO-3		0	0.000	0.000		
2SK513	800	6.000	3.000	TO-220AB		0	0.000	0.000		
2SK532	60	0.060	12.000	TO-220BS	2SK817	60	0.055	26.000	MP-45	1
2SK534	800	4.000	5.000	TO-3P	2SK833	900	4.000	5.000	MP-88	1
2SK535L	400	6.000	1.500	MP-3	V3080A	450	3.800	1.500	MP-3	
2SK535S	400	6.000	1.500	MP-3S	V3080A	450	3.800	1.500	MP-3S	
2SK537	900	7.000	1.000	TO-220BS	2SK786	900	7.000	3.000	TO-220	
2SK538	900	3.700	3.000	TO-3P	V3076	900	2.000	6.000	MP-88	1
2SK539	900	1.900	5.000	TO-3PL	2SK787	900	1.600	8.000	MP-88	1
2SK542	150	1.500	2.000	TO-220	2SK542	150	1.500	2.000	TO-220	
2SK549	60	0.150	10.000	TO-220AB	2SK659	60	0.075	12.000	TO-220	
2SK551	120	0.250	10.000	TO-220AB	V3088	250	0.670	5.000	TO-220	
2SK552	450	1.400	5.000	TO-220AB	2SK854	450	1.000	0.000	TO-220	
2SK553	500	1.500	5.000	TO-220AB	2SK855	500	1.100	0.000	TO-220	
2SK554	450	0.850	7.000	TO-220AB		0	0.000	0.000		
2SK555	500	1.000	7.000	TO-220AB		0	0.000	0.000		
2SK556	450	0.550	12.000	TO-3P	2SK825	450	0.500	15.000	MP-88	1
2SK557	500	0.600	12.000	TO-3P	2SK829	500	0.600	15.000	MP-88	1
2SK559	450	0.360	15.000	TO-3P	2SK784	450	0.350	20.000	MP-88	1
2SK560	500	0.400	15.000	TO-3P	2SK785	500	0.400	18.000	MP-88	1
2SK561	100	0.070	30.000	TO-3		0	0.000	0.000		
2SK579L	450	5.500	1.500	MP-3	V3080A	450	3.800	1.500	MP-3	
2SK579S	450	5.500	1.500	MP-3S	V3080A	450	3.800	1.500	MP-3S	
2SK580L	500	6.000	1.500	MP-3	V3080B	500	4.100	1.500	MP-3	
2SK580S	500	6.000	1.500	MP-3S	V3080B	500	4.100	1.500	MP-3S	
2SK591	60	0.055	15.000	MP-45	2SK591	60	0.055	15.000	MP-45	
2SK600	60	0.055	25.000	TO-220AB	2SK817	60	0.055	26.000	MP-45	1
2SK611	100	5.000	1.000	MP-3	2SK611	100	5.000	1.000	MP-3	
2SK611-Z	100	5.000	1.000	MP-3S	2SK611-Z	100	5.000	1.000	MP-3S	
2SK612	100	0.450	2.000	MP-3	2SK612	100	0.450	2.000	MP-3	
2SK612-Z	100	0.450	2.000	MP-3S	2SK612-Z	100	0.450	2.000	MP-3S	
2SK654	100	3.000	1.000	MP-3	2SK654	100	3.000	1.000	MP-3	
2SK654-Z	100	3.000	1.000	MP-3S	2SK654-Z	100	3.000	1.000	MP-3S	
2SK659	60	0.075	12.000	MP-45	2SK659	60	0.075	12.000	MP-45	
2SK679	30	1.000	0.500	TO-92	2SK679	30	1.000	0.500	TO-92	
2SK680	30	1.000	1.000	SOT-89	2SK680	30	1.000	1.000	SOT-89	
2SK681	30	1.000	1.000	SP-8	2SK681	30	1.000	1.000	SP-8	

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2SK698	450	0.650	10.000	MP-80	2SK698	450	.650	10.000	MP-80	
2SK699	100	1.200	2.000	TO-126	2SK699	100	1.200	2.000	TO-126	
2SK700	80	0.800	2.000	TO-126	2SK700	80	0.800	2.000	TO-126	
2SK701	60	0.600	2.000	TO-126	2SK701	60	0.600	2.000	TO-126	
2SK702	100	0.450	5.000	TO-220	2SK702	100	0.450	5.000	TO-220	
2SK703	100	0.450	5.000	MP-45	2SK703	100	0.450	5.000	MP-45	
2SK704	60	0.250	5.000	TO-220	2SK704	60	0.250	5.000	TO-220	
2SK705	60	0.250	5.000	MP-45	2SK705	60	0.250	5.000	MP-45	
2SK707	250	0.150	25.000	MP-80	2SK707	250	0.150	25.000	MP-80	
2SK719	900	4.000	5.000	MP-80	2SK719	900	4.000	5.000	MP-80	
2SK720A	250	0.230	20.000	MP-80	2SK720A	250	0.230	20.000	MP-80	
2SK735	450	0.800	10.000	MP-88	2SK735	450	0.800	10.000	MP-88	
2SK736	100	0.080	15.000	MP-45	2SK736	100	0.080	15.000	MP-45	
2SK737	100	0.150	12.000	MP-45	2SK737	100	0.150	12.000	MP-45	
2SK738	30	0.170	2.000	MP-3	2SK738	30	0.170	2.000	MP-3	
2SK738-Z	30	0.170	2.000	MP-3S	2SK738-Z	30	0.170	2.000	MP-3S	
2SK739	60	0.250	2.000	MP-3	2SK739	60	0.250	2.000	MP-3	
2SK739-Z	60	0.250	2.000	MP-3S	2SK739-Z	60	0.250	2.000	MP-3S	
2SK773	500	0.600	12.000	MP-80	2SK773	500	0.600	12.000	MP-80	
2SK774	500	0.450	18.000	MP-80	2SK774	500	0.450	18.000	MP-80	
2SK784	450	0.350	20.000	MP-85	2SK784	450	0.350	20.000	MP-85	
2SK785	500	0.400	20.000	MP-85	2SK785	500	0.400	20.000	MP-85	
2SK786	900	7.000	3.000	MP-25	2SK786	900	7.000	3.000	MP-25	
2SK787	900	1.600	8.000	MP-88	2SK787	900	1.600	8.000	MP-88	
2SK797	60	0.018	40.000	MP-88	2SK797	60	0.018	40.000	MP-88	
2SK798	100	0.031	40.000	MP-88	2SK798	100	0.031	40.000	MP-88	
2SK799	450	0.500	12.000	MP-80	2SK799	450	0.500	12.000	MP-80	
2SK800	450	0.380	18.000	MP-80	2SK800	450	0.380	18.000	MP-80	
2SK801	30	0.350	2.000	MP-3	2SK801	30	0.350	2.000	MP-3	
2SK802	30	0.350	2.000	TO-126	2SK802	30	0.350	2.000	TO-126	
2SK810	100	0.180	15.000	TO-220	2SK810	100	0.180	15.000	TO-220	
2SK811	100	0.180	12.000	MP-45	2SK811	100	0.180	12.000	MP-45	
2SK812	60	0.085	27.000	TO-220	2SK812	60	0.085	27.000	TO-220	
2SK813	60	0.085	21.000	MP-45	2SK813	60	0.085	21.000	MP-45	
2SK815	100	0.085	21.000	MP-45	2SK815	100	0.085	21.000	MP-45	
2SK817	60	0.055	26.000	MP-45	2SK817	60	0.055	26.000	MP-45	
2SK819	500	1.000	10.000	MP-88	2SK819	500	1.000	10.000	MP-88	
2SK821	250	0.230	20.000	MP-88	2SK821	250	0.230	20.000	MP-88	
2SK823	250	0.150	22.000	MP-88	2SK823	250	0.150	22.000	MP-88	
2SK825	450	0.500	15.000	MP-88	2SK825	450	0.500	15.000	MP-88	
2SK827	450	0.380	18.000	MP-88	2SK827	450	0.380	18.000	MP-88	
2SK829	500	0.600	15.000	MP-88	2SK829	500	0.600	15.000	MP-88	

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
2SK831	500	0.450	18.000	MP-88	2SK831	500	0.450	18.000	MP-88	
2SK833	900	4.000	5.000	MP-88	2SK833	900	4.000	5.000	MP-88	
2SK854	450	1.400	5.000	TO-220	2SK854	450	1.400	5.000	TO-220	
2SK855	500	1.500	5.000	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ10	50	0.080	20.000	TO-220	2SK659	60	0.075	12.000	MP-45	1
BUZ10A	50	0.100	12.000	TO-220	2SK659	60	0.075	12.000	MP-45	1
BUZ11	50	0.040	30.000	TO-220		0	0.000	0.000		
BUZ11A	50	0.060	25.000	TO-220	2SK817	60	0.055	26.000	MP-45	1
BUZ11S2	50	0.040	30.000	TO-220		0	0.000	0.000		
BUZ14	50	0.040	39.000	TO-3		0	0.000	0.000		
BUZ15	50	0.030	45.000	TO-3		0	0.000	0.000		
BUZ17	50	0.040	32.000	TO-238		0	0.000	0.000		
BUZ171	−50	0.400	−7.000	TO-220	2SJ136	−60	0.300	−12.000	TO-220	
BUZ172	−100	0.800	−5.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
BUZ173	−200	2.000	−3.000	TO-220		0	0.000	0.000		
BUZ18	50	0.030	37.000	TO-238		0	0.000	0.000		
BUZ20	100	0.200	12.000	TO-220	2SK810	100	0.180	15.000	MP-45	1
BUZ201	400	0.400	12.500	TO-3		0	0.000	0.000		
BUZ202	400	0.500	11.500	TO-3		0	0.000	0.000		
BUZ205	400	1.000	6.000	TO-220		0	0.000	0.000		
BUZ206	400	1.500	5.000	TO-220	2SK854	450	1.400	5.000	TO-220	
BUZ21	100	0.100	19.000	TO-220	2SK736	100	0.080	15.000	MP-45	1
BUZ210	500	0.600	10.500	TO-3		0	0.000	0.000		
BUZ211	500	0.800	9.000	TO-3		0	0.000	0.000		
BUZ213	500	0.600	8.500	TO-238		0	0.000	0.000		
BUZ214	500	0.800	7.000	TO-238		0	0.000	0.000		
BUZ215	500	1.500	5.000	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ216	500	2.000	4.400	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ220	800	1.500	6.500	TO-3		0	0.000	0.000		
BUZ221	800	2.000	5.500	TO-3		0	0.000	0.000		
BUZ23	100	0.200	10.000	TO-3		0	0.000	0.000		
BUZ230	1000	2.000	5.500	TO-3		0	0.000	0.000		
BUZ231	1000	2.600	4.900	TO-3		0	0.000	0.000		
BUZ24	100	0.060	32.000	TO-3		0	0.000	0.000		
BUZ25	100	0.100	19.000	TO-3		0	0.000	0.000		
BUZ27	100	0.060	26.000	TO-238		0	0.000	0.000		
BUZ28	100	0.100	18.000	TO-238		0	0.000	0.000		
BUZ30	200	0.500	7.000	TO-220		0	0.000	0.000		
BUZ307	800	3.000	3.000	TO-218	V3076	900	2.000	6.000	MP-88	1
BUZ308	800	4.000	2.600	TO-218	2SK833	900	4.000	5.000	MP-88	1
BUZ31	200	0.200	12.500	TO-220		0	0.000	0.000		
BUZ310	1000	5.000	2.500	TO-218		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
BUZ311	1000	6.000	2.300	TO-218		0	0.000	0.000		
BUZ32	200	0.400	9.500	TO-220		0	0.000	0.000		
BUZ326	400	0.500	10.500	TO-218	2SK825	450	0.500	15.000	MP-88	1
BUZ33	200	0.500	7.200	TO-3		0	0.000	0.000		
BUZ330	500	0.600	9.500	TO-218	2SK829	500	0.600	15.000	MP-88	1
BUZ331	500	0.800	8.000	TO-218	2SK876	500	0.700	12.000	MP-88	1
BUZ34	200	0.200	14.000	TO-3		0	0.000	0.000		
BUZ347	50	0.030	40.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
BUZ348	50	0.040	39.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
BUZ349	100	0.060	32.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
BUZ35	200	0.400	9.900	TO-3		0	0.000	0.000		
BUZ350	200	0.120	22.000	TO-218		0	0.000	0.000		
BUZ351	400	0.400	11.500	TO-218	2SK827	450	0.380	18.000	MP-88	1
BUZ353	500	0.600	9.500	TO-218	2SK829	500	0.600	15.000	MP-88	1
BUZ354	500	0.800	8.000	TO-218	2SK876	500	0.700	12.000	MP-88	1
BUZ355	800	1.500	6.000	TO-218		0	0.000	0.000		
BUZ356	800	2.000	5.000	TO-218	V3076	900	2.000	6.000	MP-88	1
BUZ357	1000	2.000	5.000	TO-218		0	0.000	0.000		
BUZ358	1000	2.600	4.500	TO-218		0	0.000	0.000		
BUZ36	200	0.120	22.000	TO-3		0	0.000	0.000		
BUZ360	800	3.000	3.600	TO-218	V3076	900	2.000	6.000	MP-88	1
BUZ361	800	4.500	2.900	TO-218	2SK833	900	4.000	5.000	MP-88	1
BUZ37	200	0.200	13.000	TO-238		0	0.000	0.000		
BUZ38	200	0.120	18.000	TO-238		0	0.000	0.000		
BUZ380	1000	2.000	5.500	TO-218		0	0.000	0.000		
BUZ381	1000	2.600	4.900	TO-218		0	0.000	0.000		
BUZ382	400	0.400	12.500	TO-218	2SK827	450	0.380	18.000	MP-88	1
BUZ383	400	0.500	11.500	TO-218	2SK825	450	0.500	15.000	MP-88	1
BUZ384	500	0.600	10.500	TO-218	2SK829	500	0.600	15.000	MP-88	1
BUZ385	500	0.800	9.000	TO-218	2SK876	500	0.700	12.000	MP-88	1
BUZ40	500	3.000	2.500	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ41	500	0.900	5.500	TO-220		0	0.000	0.000		
BUZ41A	500	1.500	4.500	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ42	500	2.000	4.000	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ43	500	3.000	2.800	TO-3		0	0.000	0.000		
BUZ44	500	0.900	5.600	TO-3		0	0.000	0.000		
BUZ44A	500	1.500	4.800	TO-3		0	0.000	0.000		
BUZ45	500	0.600	9.600	TO-3		0	0.000	0.000		
BUZ45A	500	0.800	8.300	TO-3		0	0.000	0.000		
BUZ45B	500	0.500	10.000	TO-3		0	0.000	0.000		
BUZ45C	450	0.400	10.000	TO-3		0	0.000	0.000		
BUZ46	500	1.800	4.200	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
BUZ47	500	0.900	4.500	TO-238		0	0.000	0.000		
BUZ47A	500	2.000	3.900	TO-238		0	0.000	0.000		
BUZ48	500	0.600	7.800	TO-238		0	0.000	0.000		
BUZ48A	500	0.800	6.800	TO-238		0	0.000	0.000		
BUZ48C	450	0.400	8.500	TO-238		0	0.000	0.000		
BUZ50	1000	3.000	3.000	TO-220		0	0.000	0.000		
BUZ50A	1000	5.000	2.500	TO-220		0	0.000	0.000		
BUZ50B	1000	8.000	2.000	TO-220		0	0.000	0.000		
BUZ50C	1000	6.000	2.300	TO-220		0	0.000	0.000		
BUZ53	1000	3.000	3.000	TO-3		0	0.000	0.000		
BUZ53A	1000	5.000	2.600	TO-3		0	0.000	0.000		
BUZ53B	1000	7.000	2.000	TO-3		0	0.000	0.000		
BUZ53C	1000	6.000	2.300	TO-3		0	0.000	0.000		
BUZ54	1000	2.000	5.100	TO-3		0	0.000	0.000		
BUZ54A	1000	2.600	4.500	TO-3		0	0.000	0.000		
BUZ57	1000	3.000	2.500	TO-238		0	0.000	0.000		
BUZ57A	1000	4.000	2.100	TO-238		0	0.000	0.000		
BUZ58	1000	2.000	4.200	TO-238		0	0.000	0.000		
BUZ58A	1000	2.600	3.600	TO-238		0	0.000	0.000		
BUZ60	400	1.000	5.500	TO-220	2SK735	450	0.800	5.000	TO-220	
BUZ60B	400	1.500	4.500	TO-220	2SK854	450	1.400	5.000	TO-220	
BUZ63	400	1.000	5.900	TO-3		0	0.000	0.000		
BUZ63B	400	1.200	4.500	TO-3		0	0.000	0.000		
BUZ64	400	4.000	11.500	TO-3		0	0.000	0.000		
BUZ67	400	0.400	9.600	TO-238		0	0.000	0.000		
BUZ71	50	0.100	14.000	TO-220	2SK659	60	0.075	12.000	MP-45	1
BUZ71A	50	0.120	13.000	TO-220	2SK659	60	0.075	12.000	MP-45	1
BUZ71L	50	0.100	14.000	TO-220	2SK812	60	0.085	27.000	TO-220	
BUZ72	100	0.200	10.000	TO-220	2SK810	100	0.180	15.000	TO-220	
BUZ72A	100	0.250	9.000	TO-220	2SK810	100	0.180	15.000	TO-220	
BUZ73	200	0.400	7.000	TO-220		0	0.000	0.000		
BUZ73A	200	0.600	5.800	TO-220		0	0.000	0.000		
BUZ74	500	3.000	2.400	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ74A	500	4.000	2.000	TO-220	2SK855	500	1.500	5.000	TO-220	
BUZ76	400	1.800	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
BUZ76A	400	2.500	2.600	TO-220	2SK854	450	1.400	5.000	TO-220	
BUZ78	800	8.000	1.500	TO-220	2SK786	900	7.000	3.000	TO-220	
BUZ80	800	4.000	2.600	TO-220		0	0.000	0.000		
BUZ80A	800	3.000	3.000	TO-220		0	0.000	0.000		
BUZ83	800	4.000	2.900	TO-3		0	0.000	0.000		
BUZ83A	800	3.000	3.400	TO-3		0	0.000	0.000		
BUZ84	800	2.000	5.300	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
BUZ84A	800	1.500	6.000	TO-3		0	0.000	0.000		
BUZ88	800	2.000	4.300	TO-238		0	0.000	0.000		
BUZ88A	800	1.500	5.000	TO-238		0	0.000	0.000		
BUZ90	600	2.000	4.000	TO-220		0	0.000	0.000		
BUZ90A	600	2.500	3.500	TO-220		0	0.000	0.000		
BUZ94	600	0.900	7.800	TO-3		0	0.000	0.000		
D84CK1	50	0.300	8.000	TO-220	2SK704	60	0.250	5.000	TO-220	
D84CK2	60	0.300	8.000	TO-220	2SK704	60	0.250	5.000	TO-220	
D84CL1	80	0.300	8.000	TO-220	2SK810	100	0.180	15.000	TO-220	
D84CL2	100	0.300	8.000	TO-220	2SK810	100	0.180	15.000	TO-220	
D84CM1	120	0.800	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
D84CM2	150	0.800	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
D84CN1	180	0.800	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
D84CN2	200	0.800	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
D84CR1	450	3.000	2.500	TO-220	2SK854	450	1.400	5.000	TO-220	
D84CR2	500	3.000	2.500	TO-220	2SK855	500	1.500	5.000	TO-220	
D84DK1	50	0.180	14.000	TO-220	2SK812	60	0.085	27.000	TO-220	
D84DK2	60	0.180	14.000	TO-220	2SK812	60	0.085	27.000	TO-220	
D84DL1	80	0.180	14.000	TO-220	2SK810	100	0.180	15.000	TO-220	
D84DL2	100	0.180	14.000	TO-220	2SK810	100	0.180	15.000	TO-220	
D84DM1	120	0.400	9.000	TO-220		0	0.000	0.000		
D84DM2	150	0.400	9.000	TO-220		0	0.000	0.000		
D84DN1	180	0.400	9.000	TO-220		0	0.000	0.000		
D84DN2	200	0.400	9.000	TO-220		0	0.000	0.000		
D84DR1	450	1.500	4.500	TO-220	2SK854	450	1.400	5.000	TO-220	
D84DR2	500	1.500	4.500	TO-220	2SK855	500	1.500	5.000	TO-220	
D84EK1	50	0.085	27.000	TO-220	2SK812	60	0.085	27.000	TO-220	
D84EK2	60	0.085	27.000	TO-220	2SK812	60	0.085	27.000	TO-220	
D84EL1	80	0.085	27.000	TO-220	2SK815	100	0.085	21.000	MP-45	1
D84EL2	100	0.085	27.000	TO-220	2SK815	100	0.085	21.000	MP-45	1
D84EM1	120	0.180	18.000	TO-220		0	0.000	0.000		
D84EM2	150	0.180	18.000	TO-220		0	0.000	0.000		
D84EN1	180	0.180	18.000	TO-220		0	0.000	0.000		
D84EN2	200	0.180	18.000	TO-220		0	0.000	0.000		
D84ER1	450	0.850	8.000	TO-220		0	0.000	0.000		
D84ER2	500	0.850	8.000	TO-220		0	0.000	0.000		
D88FK1	50	0.055	40.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
D88FK2	60	0.055	40.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
D88FL1	80	0.055	40.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
D88FL2	100	0.055	40.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
D88FM1	120	0.085	30.000	TO-218		0	0.000	0.000		
D88FM2	150	0.085	30.000	TO-218		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
D88FN1	180	0.085	30.000	TO-218		0	0.000	0.000		
D88FN2	200	0.085	30.000	TO-218		0	0.000	0.000		
D88FQ1	350	0.300	15.000	TO-218		0	0.000	0.000		
D88FQ2	400	0.300	15.000	TO-218		0	0.000	0.000		
D88FR1	450	0.400	13.000	TO-218	2SK784	450	0.350	20.000	MP-88	1
D88FR2	500	0.400	13.000	TO-218	2SK785	500	0.400	20.000	MP-88	1
HPWR-6501	450	0.850	6.000	TO-3		0	0.000	0.000		
HPWR-6502	400	0.740	6.000	TO-3		0	0.000	0.000		
HPWR-6503	450	1.000	5.000	TO-3		0	0.000	0.000		
HPWR-6504	400	1.000	5.000	TO-3		0	0.000	0.000		
IRF120	100	0.300	8.000	TO-3		0	0.000	0.000		
IRF121	60	0.300	8.000	TO-3		0	0.000	0.000		
IRF122	100	0.400	7.000	TO-3		0	0.000	0.000		
IRF123	60	0.400	7.000	TO-3		0	0.000	0.000		
IRF130	100	0.180	14.000	TO-3		0	0.000	0.000		
IRF131	60	0.180	14.000	TO-3		0	0.000	0.000		
IRF132	100	0.250	12.000	TO-3		0	0.000	0.000		
IRF133	60	0.250	12.000	TO-3		0	0.000	0.000		
IRF140	100	0.085	27.000	TO-3		0	0.000	0.000		
IRF141	60	0.085	27.000	TO-3		0	0.000	0.000		
IRF142	100	0.110	24.000	TO-3		0	0.000	0.000		
IRF143	60	0.110	24.000	TO-3		0	0.000	0.000		
IRF150	100	0.055	40.000	TO-3		0	0.000	0.000		
IRF151	60	0.055	40.000	TO-3		0	0.000	0.000		
IRF152	100	0.080	33.000	TO-3		0	0.000	0.000		
IRF153	60	0.080	33.000	TO-3		0	0.000	0.000		
IRF220	200	0.800	5.000	TO-3		0	0.000	0.000		
IRF221	150	0.800	5.000	TO-3		0	0.000	0.000		
IRF222	200	1.200	4.000	TO-3		0	0.000	0.000		
IRF223	150	1.200	4.000	TO-3		0	0.000	0.000		
IRF230	200	0.400	9.000	TO-3		0	0.000	0.000		
IRF231	150	0.400	9.000	TO-3		0	0.000	0.000		
IRF232	200	0.600	8.000	TO-3		0	0.000	0.000		
IRF233	150	0.600	8.000	TO-3		0	0.000	0.000		
IRF240	200	0.180	18.000	TO-3		0	0.000	0.000		
IRF241	150	0.180	18.000	TO-3		0	0.000	0.000		
IRF242	200	0.220	16.000	TO-3		0	0.000	0.000		
IRF243	150	0.220	16.000	TO-3		0	0.000	0.000		
IRF250	200	0.085	30.000	TO-3		0	0.000	0.000		
IRF251	150	0.085	30.000	TO-3		0	0.000	0.000		
IRF252	200	0.120	25.000	TO-3		0	0.000	0.000		
IRF253	150	0.120	25.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IRF320	400	1.800	3.000	TO-3		0	0.000	0.000		
IRF321	350	1.800	3.000	TO-3		0	0.000	0.000		
IRF322	400	2.500	2.500	TO-3		0	0.000	0.000		
IRF323	350	2.500	2.500	TO-3		0	0.000	0.000		
IRF330	400	1.000	5.500	TO-3		0	0.000	0.000		
IRF331	350	1.000	5.500	TO-3		0	0.000	0.000		
IRF332	400	1.500	4.500	TO-3		0	0.000	0.000		
IRF333	350	1.500	4.500	TO-3		0	0.000	0.000		
IRF340	400	0.550	10.000	TO-3		0	0.000	0.000		
IRF341	350	0.550	10.000	TO-3		0	0.000	0.000		
IRF342	400	0.800	8.000	TO-3		0	0.000	0.000		
IRF343	350	0.800	8.000	TO-3		0	0.000	0.000		
IRF350	400	0.300	15.000	TO-3		0	0.000	0.000		
IRF351	350	0.300	15.000	TO-3		0	0.000	0.000		
IRF352	400	0.400	13.000	TO-3		0	0.000	0.000		
IRF353	350	0.400	13.000	TO-3		0	0.000	0.000		
IRF420	500	3.000	2.500	TO-3		0	0.000	0.000		
IRF421	450	3.000	2.500	TO-3		0	0.000	0.000		
IRF422	500	4.000	2.000	TO-3		0	0.000	0.000		
IRF423	450	4.000	2.000	TO-3		0	0.000	0.000		
IRF430	500	1.500	4.500	TO-3		0	0.000	0.000		
IRF431	450	1.500	4.500	TO-3		0	0.000	0.000		
IRF432	500	2.000	4.000	TO-3		0	0.000	0.000		
IRF433	450	2.000	4.000	TO-3		0	0.000	0.000		
IRF440	500	0.850	8.000	TO-3		0	0.000	0.000		
IRF441	450	0.850	8.000	TO-3		0	0.000	0.000		
IRF442	500	1.100	7.000	TO-3		0	0.000	0.000		
IRF443	450	1.100	7.000	TO-3		0	0.000	0.000		
IRF450	500	0.400	13.000	TO-3		0	0.000	0.000		
IRF451	450	0.400	13.000	TO-3		0	0.000	0.000		
IRF452	500	0.500	12.000	TO-3		0	0.000	0.000		
IRF453	450	0.500	12.000	TO-3		0	0.000	0.000		
IRF510	100	0.600	4.000	TO-220	2SK702	100	0.450	5.000	TO-220	
IRF511	60	0.600	4.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IRF512	100	0.800	3.500	TO-220	2SK702	100	0.450	5.000	TO-220	
IRF513	60	0.800	3.500	TO-220	2SK704	60	0.250	5.000	TO-220	
IRF520	100	0.300	8.000	TO-220	2SK810	100	0.180	15.000	TO-220	
IRF521	60	0.300	8.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IRF522	100	0.400	7.000	TO-220	2SK810	100	0.180	15.000	TO-220	
IRF523	60	0.400	7.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IRF530	100	0.180	14.000	TO-220	2SK810	100	0.180	15.000	TO-220	
IRF531	60	0.180	14.000	TO-220	2SK812	60	0.085	27.000	TO-220	

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IRF532	100	0.250	12.000	TO-220	2SK810	100	0.180	15.000	TO-220	
IRF533	60	0.250	12.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IRF540	100	0.085	27.000	TO-220	2SK815	100	0.085	21.000	MP-45	1
IRF541	60	0.085	27.000	TO-220	2SK812	60	0.085	27.000	TO-220	
IRF542	100	0.110	24.000	TO-220	2SK815	100	0.085	21.000	MP-45	1
IRF543	60	0.110	24.000	TO-220	2SK812	60	0.085	27.000	TO-220	
IRF610	200	1.500	2.500	TO-220	V3088	250	0.670	5.000	TO-220	
IRF611	150	1.500	2.500	TO-220	V3088	250	0.670	5.000	TO-220	
IRF612	200	2.400	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
IRF613	150	2.400	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
IRF620	200	0.800	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
IRF621	150	0.800	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
IRF622	200	1.200	4.000	TO-220	V3088	250	0.670	5.000	TO-220	
IRF623	150	1.200	4.000	TO-220	V3088	250	0.670	5.000	TO-220	
IRF630	200	0.400	9.000	TO-220	V3086	250	0.370	10.000	MP-88	1
IRF631	150	0.400	9.000	TO-220	V3086	250	0.370	10.000	MP-88	1
IRF632	200	0.600	8.000	TO-220	V3087	250	0.450	8.000	MP-88	1
IRF633	150	0.600	8.000	TO-220	V3087	250	0.450	8.000	MP-88	1
IRF640	200	0.180	18.000	TO-220	2SK707	250	0.150	25.000	MP-80	1
IRF641	150	0.180	18.000	TO-220	2SK707	250	0.150	25.000	MP-80	1
IRF642	200	0.220	16.000	TO-220	2SK707	250	0.150	25.000	MP-80	1
IRF643	150	0.220	16.000	TO-220	2SK707	250	0.150	25.000	MP-80	1
IRF710	400	3.600	1.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF711	350	3.600	1.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF712	400	5.000	1.300	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF713	350	5.000	1.300	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF720	400	1.800	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF721	350	1.800	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF722	400	2.500	2.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF723	350	2.500	2.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF730	400	1.000	5.500	TO-220		0	0.000	0.000		
IRF731	350	1.000	5.500	TO-220		0	0.000	0.000		
IRF732	400	1.500	4.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF733	350	1.500	4.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF740	400	0.550	10.000	TO-220		0	0.000	0.000		
IRF741	350	0.550	10.000	TO-220		0	0.000	0.000		
IRF742	400	0.800	8.000	TO-220		0	0.000	0.000		
IRF743	350	0.800	8.000	TO-220		0	0.000	0.000		
IRF820	500	3.000	2.500	TO-220	2SK855	500	1.500	5.000	TO-220	
IRF821	450	3.000	2.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF822	500	4.000	2.000	TO-220	2SK855	500	1.500	5.000	TO-220	
IRF823	450	4.000	2.000	TO-220	2SK854	450	1.400	5.000	TO-220	

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IRF830	500	1.500	4.500	TO-220	2SK855	500	1.500	5.000	TO-220	
IRF831	450	1.500	4.500	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF832	500	2.000	4.000	TO-220	2SK855	500	1.500	5.000	TO-220	
IRF833	450	2.000	4.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IRF840	500	0.850	8.000	TO-220		0	0.000	0.000		
IRF841	450	0.850	8.000	TO-220		0	0.000	0.000		
IRF842	500	1.100	7.000	TO-220		0	0.000	0.000		
IRF843	450	1.100	7.000	TO-220		0	0.000	0.000		
IRF9120	−100	0.600	−1.000	TO-3		0	0.000	0.000		
IRF9121	−60	0.600	−1.000	TO-3		0	0.000	0.000		
IRF9122	−100	0.800	0.000	TO-3		0	0.000	0.000		
IRF9123	−60	0.800	0.000	TO-3		0	0.000	0.000		
IRF9130	−100	0.300	−12.000	TO-3		0	0.000	0.000		
IRF9131	−60	0.300	−12.000	TO-3		0	0.000	0.000		
IRF9132	−100	0.400	−10.000	TO-3		0	0.000	0.000		
IRF9133	−60	0.400	−10.000	TO-3		0	0.000	0.000		
IRF9140	−100	0.200	0.000	TO-3		0	0.000	0.000		
IRF9141	−60	0.200	0.000	TO-3		0	0.000	0.000		
IRF9142	−100	0.300	0.000	TO-3		0	0.000	0.000		
IRF9143	−60	0.300	0.000	TO-3		0	0.000	0.000		
IRF9230	−200	0.800	−6.500	TO-3		0	0.000	0.000		
IRF9231	−150	0.800	−6.500	TO-3		0	0.000	0.000		
IRF9232	−200	1.200	−5.500	TO-3		0	0.000	0.000		
IRF9233	−150	1.200	−5.500	TO-3		0	0.000	0.000		
IRF9510	−100	1.200	−3.000	TO-220	2SJ135	−100	0.600	−5.000	TO-220	
IRF9511	−60	1.200	−3.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
IRF9512	−100	1.600	−2.500	TO-220	2SJ135	−100	0.600	−5.000	TO-220	
IRF9513	−60	1.600	−2.500	TO-220	V2994A	−60	0.450	−6.000	TO-220	
IRF9520	−100	0.600	−6.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
IRF9521	−60	0.600	−6.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
IRF9522	−100	0.800	−5.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
IRF9523	−60	0.800	−5.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
IRF9530	−100	0.300	−12.000	TO-220	2SJ138	−100	0.300	−12.000	TO-220	
IRF9531	−60	0.300	−12.000	TO-220	2SJ136	−60	0.300	−12.000	TO-220	
IRF9532	−100	0.400	−10.000	TO-220	2SJ138	−100	0.300	−12.000	TO-220	
IRF9533	−60	0.400	−10.000	TO-220	2SJ136	−60	0.300	−12.000	TO-220	
IRF9540	−100	0.200	−19.000	TO-220	2SJ142	−100	0.200	−13.000	MP-45	1
IRF9541	−60	0.200	−19.000	TO-220	2SJ143	−60	0.150	−24.000	MP-45	1
IRF9542	−100	0.300	−15.000	TO-220	2SJ138	−100	0.300	−12.000	TO-220	
IRF9543	−60	0.300	−15.000	TO-220	2SJ136	−60	0.300	−12.000	TO-220	
IRF9610	−200	3.000	−1.750	TO-220		0	0.000	0.000		
IRF9611	−150	3.000	−1.750	TO-220		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IRF9612	−200	4.500	−1.500	TO-220		0	0.000	0.000		
IRF9613	−150	4.500	−1.500	TO-220		0	0.000	0.000		
IRF9620	−200	1.500	−3.500	TO-220		0	0.000	0.000		
IRF9621	−150	1.500	−3.500	TO-220		0	0.000	0.000		
IRF9622	−200	2.400	−3.000	TO-220		0	0.000	0.000		
IRF9623	−150	2.400	−3.000	TO-220		0	0.000	0.000		
IRF9630	−200	0.800	−6.500	TO-220		0	0.000	0.000		
IRF9631	−150	0.800	−6.500	TO-220		0	0.000	0.000		
IRF9632	−200	1.200	−5.500	TO-220		0	0.000	0.000		
IRF9633	−150	1.200	−5.500	TO-220		0	0.000	0.000		
IRF9640	−200	0.500	−11.000	TO-220		0	0.000	0.000		
IRF9641	−150	0.500	−11.000	TO-220		0	0.000	0.000		
IRF9642	−200	0.700	−9.000	TO-220		0	0.000	0.000		
IRF9643	−150	0.700	−9.000	TO-220		0	0.000	0.000		
IRFD110	100	0.600	1.000	4-Pin DIP		0	0.000	0.000		4
IRFD113	60	0.800	0.800	4-Pin DIP		0	0.000	0.000		4
IRFD120	100	0.300	1.300	4-Pin DIP		0	0.000	0.000		4
IRFD123	60	0.400	1.100	4-Pin DIP		0	0.000	0.000		4
IRFD1Z0	100	2.400	0.500	4-Pin DIP		0	0.000	0.000		4
IRFD1Z3	60	3.200	0.400	4-Pin DIP		0	0.000	0.000		4
IRFD210	200	1.500	0.600	4-Pin DIP		0	0.000	0.000		4
IRFD213	150	2.400	0.450	4-Pin DIP		0	0.000	0.000		4
IRFD220	200	0.800	0.800	4-Pin DIP		0	0.000	0.000		4
IRFD223	150	1.200	0.700	4-Pin DIP		0	0.000	0.000		4
IRFD9110	−100	1.200	−0.700	4-Pin DIP		0	0.000	0.000		4
IRFD9113	−60	1.600	−0.600	4-Pin DIP		0	0.000	0.000		4
IRFD9123	−60	0.800	−0.800	4-Pin DIP		0	0.000	0.000		4
IRFD9210	−200	3.000	−0.400	4-Pin DIP		0	0.000	0.000		4
IRFD9213	−150	4.500	−0.300	4-Pin DIP		0	0.000	0.000		4
IRFD9220	−200	1.500	−0.600	4-Pin DIP		0	0.000	0.000		4
IRFD9223	−150	2.400	−0.450	4-Pin DIP		0	0.000	0.000		4
IRFF110	100	0.600	3.500	TO-39		0	0.000	0.000		
IRFF111	60	0.600	3.500	TO-39		0	0.000	0.000		
IRFF112	100	0.800	3.000	TO-39		0	0.000	0.000		
IRFF113	60	0.800	3.000	TO-39		0	0.000	0.000		
IRFF120	100	0.300	6.000	TO-39		0	0.000	0.000		
IRFF121	60	0.300	6.000	TO-39		0	0.000	0.000		
IRFF122	100	0.400	5.000	TO-39		0	0.000	0.000		
IRFF123	60	0.400	5.000	TO-39		0	0.000	0.000		
IRFF130	100	0.180	8.000	TO-39		0	0.000	0.000		
IRFF131	60	0.180	8.000	TO-39		0	0.000	0.000		
IRFF132	100	0.250	7.000	TO-39		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IRFF133	60	0.250	7.000	TO-39		0	0.000	0.000		
IRFF9210	−200	3.000	−1.600	TO-39		0	0.000	0.000		
IRFF9211	−150	3.000	−1.600	TO-39		0	0.000	0.000		
IRFF9212	−200	1.500	−1.300	TO-39		0	0.000	0.000		
IRFF9213	−150	1.500	−1.300	TO-39		0	0.000	0.000		
IRFF9220	−200	1.500	−2.500	TO-39		0	0.000	0.000		
IRFF9221	−150	1.500	−2.500	TO-39		0	0.000	0.000		
IRFF9222	−200	2.400	−2.000	TO-39		0	0.000	0.000		
IRFF9223	−150	2.400	−2.000	TO-39		0	0.000	0.000		
IRFF9230	−200	0.800	−4.000	TO-39		0	0.000	0.000		
IRFF9231	−150	0.800	−4.000	TO-39		0	0.000	0.000		
IRFF9232	−200	1.200	−3.500	TO-39		0	0.000	0.000		
IRFF9233	−150	1.200	−3.500	TO-39		0	0.000	0.000		
IRFG110	100	0.800	1.000	14-Pin DIP		0	0.000	0.000		2
IRFG1Z0	100	2.600	0.500	14-Pin DIP		0	0.000	0.000		2
IRFG5110-N	100	0.800	1.000	14-Pin DIP		0	0.000	0.000		2
IRFG5110-P	−100	0.800	−1.000	14-Pin DIP		0	0.000	0.000		2
IRFG6110-N	100	0.800	0.950	14-Pin DIP		0	0.000	0.000		2
IRFG6110-P	−100	0.800	−0.750	14-Pin DIP		0	0.000	0.000		2
IRFG9110	−100	1.200	−0.700	14-Pin DIP		0	0.000	0.000		2
IRFH150	100	0.060	30.000	TO-61		0	0.000	0.000		
IRFH250	200	0.090	30.000	TO-61		0	0.000	0.000		
IRFH350	400	0.300	15.000	TO-61		0	0.000	0.000		
IRFH450	500	0.400	13.000	TO-61		0	0.000	0.000		
IRFH9140	−100	0.200	0.000	TO-61		0	0.000	0.000		
IRFH9240	−200	0.500	0.000	TO-61		0	0.000	0.000		
IRFJ130	100	0.180	10.000	TO-66		0	0.000	0.000		
IRFJ140	100	0.085	15.000	TO-66		0	0.000	0.000		
IRFJ230	200	0.400	8.000	TO-66		0	0.000	0.000		
IRFJ240	200	0.180	13.000	TO-66		0	0.000	0.000		
IRFJ330	400	1.000	4.500	TO-66		0	0.000	0.000		
IRFJ340	400	0.550	7.500	TO-66		0	0.000	0.000		
IRFJ430	500	1.500	3.800	TO-66		0	0.000	0.000		
IRFJ440	500	0.850	6.000	TO-66		0	0.000	0.000		
IRFJ9130	−100	0.300	0.000	TO-66		0	0.000	0.000		
IRFJ9140	−100	0.200	0.000	TO-66		0	0.000	0.000		
IRFJ9230	−200	0.800	0.000	TO-66		0	0.000	0.000		
IRFJ9240	−200	0.500	0.000	TO-66		0	0.000	0.000		
IRFK2D150	100	0.000	72.000	Module		0	0.000	0.000		
IRFK2D151	60	0.000	72.000	Module		0	0.000	0.000		
IRFK2D250	200	0.000	54.000	Module		0	0.000	0.000		
IRFK2D251	150	0.000	54.000	Module		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IRFK2D350	400	0.000	25.000	Module		0	0.000	0.000		
IRFK2D351	350	0.000	25.000	Module		0	0.000	0.000		
IRFK2D450	500	0.000	22.000	Module		0	0.000	0.000		
IRFK2D451	450	0.000	22.000	Module		0	0.000	0.000		
IRFK4H150	100	0.000	145.000	Module		0	0.000	0.000		
IRFK4H151	60	0.000	145.000	Module		0	0.000	0.000		
IRFK4H250	200	0.000	108.000	Module		0	0.000	0.000		
IRFK4H251	150	0.000	108.000	Module		0	0.000	0.000		
IRFK4H350	400	0.000	50.000	Module		0	0.000	0.000		
IRFK4H351	350	0.000	50.000	Module		0	0.000	0.000		
IRFK4H450	500	0.000	44.000	Module		0	0.000	0.000		
IRFK4H451	450	0.000	44.000	Module		0	0.000	0.000		
IRFP140	100	0.085	29.000	TO-3P	2SK798	100	0.031	40.000	MP-88	1
IRFP143	60	0.110	26.000	TO-3P	2SK797	60	0.018	40.000	MP-88	1
IRFP150	100	0.055	41.000	TO-3P	2SK798	100	0.031	40.000	MP-88	1
IRFP153	60	0.080	34.000	TO-3P	2SK797	60	0.018	40.000	MP-88	1
IRFP240	200	0.180	19.000	TO-3P	2SK707	250	0.150	25.000	MP-80	1
IRFP243	150	0.220	17.000	TO-3P	2SK707	250	0.150	25.000	MP-80	1
IRFP250	200	0.085	31.000	TO-3P		0	0.000	0.000		
IRFP253	150	0.120	26.000	TO-3P		0	0.000	0.000		
IRFP340	400	0.550	9.200	TO-3P	2SK825	450	0.500	15.000	MP-88	1
IRFP343	350	0.800	7.700	TO-3P	2SK735	450	0.800	10.000	MP-88	1
IRFP350	400	0.300	16.000	TO-3P		0	0.000	0.000		
IRFP353	350	0.400	14.000	TO-3P	2SK784	450	0.350	20.000	MP-88	1
IRFP440	500	0.850	8.100	TO-3P	2SK876	500	0.700	12.000	MP-88	1
IRFP443	450	1.100	7.100	TO-3P	2SK873	450	1.100	8.000	MP-88	1
IRFP450	500	0.400	14.000	TO-3P	2SK785	500	0.400	20.000	MP-88	1
IRFP453	450	0.500	12.000	TO-3P	2SK825	450	0.500	15.000	MP-88	1
IRFS1Z0	100	2.400	0.900	SOT-89		0	0.000	0.000		
IRFS1Z3	60	3.200	0.750	SOT-89		0	0.000	0.000		
IRFT001	60	0.000	3.800	SIP Array		0	0.000	0.000		
IRFT002	50	0.000	7.500	SIP Array		0	0.000	0.000		
IRFT003	50	0.000	7.500	SIP Array		0	0.000	0.000		
IRFT004	50	0.000	3.500	SIP Array		0	0.000	0.000		
IRFZ10	50	0.200	7.500	TO-220	2SK812	60	0.085	27.000	TO-220	
IRFZ12	50	0.250	6.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IRFZ20	50	0.100	15.000	TO-220	2SK812	60	0.085	27.000	TO-220	
IRFZ22	50	0.120	14.000	TO-220	2SK812	60	0.085	27.000	TO-220	
IRFZ30	50	0.050	30.000	TO-220		0	0.000	0.000		
IRFZ32	50	0.070	25.000	TO-220	2SK817	60	0.055	26.000	MP-45	1
IRFZ40	50	0.028	51.000	TO-220		0	0.000	0.000		
IRFZ42	50	0.035	46.000	TO-220		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IVN5000AND	40	2.500	0.000	TO-237		0	0.000	0.000		
IVN5000ANE	60	2.500	0.000	TO-237		0	0.000	0.000		
IVN5000ANF	80	2.500	0.000	TO-237		0	0.000	0.000		
IVN5000ANH	100	2.500	0.000	TO-237		0	0.000	0.000		
IVN5000SND	40	2.500	0.000	TO-52		0	0.000	0.000		
IVN5000SNE	60	2.500	0.000	TO-52		0	0.000	0.000		
IVN5000SNF	80	2.500	0.000	TO-52		0	0.000	0.000		
IVN5000SNH	100	2.500	0.000	TO-52		0	0.000	0.000		
IVN5000TND	40	2.500	0.000	TO-39		0	0.000	0.000		
IVN5000TNE	60	2.500	0.000	TO-39		0	0.000	0.000		
IVN5000TNF	80	2.500	0.000	TO-39		0	0.000	0.000		
IVN5000TNH	100	2.500	0.000	TO-39		0	0.000	0.000		
IVN5001AND	40	2.500	0.000	TO-237		0	0.000	0.000		
IVN5001ANE	60	2.500	0.000	TO-237		0	0.000	0.000		
IVN5001ANF	80	2.500	0.000	TO-237		0	0.000	0.000		
IVN5001ANH	100	2.500	0.000	TO-237		0	0.000	0.000		
IVN5001SND	40	2.500	0.000	TO-52		0	0.000	0.000		
IVN5001SNE	60	2.500	0.000	TO-52		0	0.000	0.000		
IVN5001SNF	80	2.500	0.000	TO-52		0	0.000	0.000		
IVN5001SNH	100	2.500	0.000	TO-52		0	0.000	0.000		
IVN5001TND	40	2.500	0.000	TO-39		0	0.000	0.000		
IVN5001TNE	60	2.500	0.000	TO-39		0	0.000	0.000		
IVN5001TNF	80	2.500	0.000	TO-39		0	0.000	0.000		
IVN5001TNH	100	2.500	0.000	TO-39		0	0.000	0.000		
IVN5200HND	40	0.500	0.000	TO-66		0	0.000	0.000		
IVN5200HNE	60	0.500	0.000	TO-66		0	0.000	0.000		
IVN5200HNF	80	0.500	0.000	TO-66		0	0.000	0.000		
IVN5200HNH	100	0.500	0.000	TO-66		0	0.000	0.000		
IVN5200KND	40	0.500	0.000	TO-3		0	0.000	0.000		
IVN5200KNE	60	0.500	0.000	TO-3		0	0.000	0.000		
IVN5200KNF	80	0.500	0.000	TO-3		0	0.000	0.000		
IVN5200KNH	100	0.500	0.000	TO-3		0	0.000	0.000		
IVN5200TND	40	0.500	0.000	TO-39		0	0.000	0.000		
IVN5200TNE	60	0.500	0.000	TO-39		0	0.000	0.000		
IVN5200TNF	80	0.500	0.000	TO-39		0	0.000	0.000		
IVN5200TNH	100	0.500	0.000	TO-39		0	0.000	0.000		
IVN5201CND	40	0.500	0.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IVN5201CNE	60	0.500	0.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IVN5201CNF	80	0.500	0.000	TO-220	2SK702	100	0.450	5.000	TO-220	
IVN5201CNH	100	0.500	0.000	TO-220	2SK702	100	0.450	5.000	TO-220	
IVN5201HND	40	0.500	0.000	TO-66		0	0.000	0.000		
IVN5201HNE	60	0.500	0.000	TO-66		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IVN5201HNF	80	0.500	0.000	TO-66		0	0.000	0.000		
IVN5201HNH	100	0.500	0.000	TO-66		0	0.000	0.000		
IVN5201KND	40	0.500	0.000	TO-3		0	0.000	0.000		
IVN5201KNE	60	0.500	0.000	TO-3		0	0.000	0.000		
IVN5201KNF	80	0.500	0.000	TO-3		0	0.000	0.000		
IVN5201KNH	100	0.500	0.000	TO-39		0	0.000	0.000		
IVN5201TND	40	0.500	0.000	TO-39		0	0.000	0.000		
IVN5201TNE	60	0.500	0.000	TO-39		0	0.000	0.000		
IVN5201TNF	80	0.500	0.000	TO-39		0	0.000	0.000		
IVN5201TNH	100	0.500	0.000	TO-39		0	0.000	0.000		
IVN6000CNS	400	3.500	0.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IVN6000CNT	450	3.500	0.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IVN6000CNU	500	4.000	0.000	TO-220	2SK855	500	1.500	5.000	TO-220	
IVN6000KNR	350	3.000	0.000	TO-3		0	0.000	0.000		
IVN6000KNS	400	3.000	0.000	TO-3		0	0.000	0.000		
IVN6000KNT	450	3.000	0.000	TO-3		0	0.000	0.000		
IVN6000KNU	500	4.000	0.000	TO-3		0	0.000	0.000		
IVN6100TNS	400	15.000	0.000	TO-39		0	0.000	0.000		
IVN6100TNT	450	15.000	0.000	TO-39		0	0.000	0.000		
IVN6100TNU	500	15.000	0.000	TO-39		0	0.000	0.000		
IVN6200CND	40	0.350	0.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IVN6200CNE	60	0.250	0.000	TO-220	2SK704	60	0.250	5.000	TO-220	
IVN6200CNF	80	0.250	0.000	TO-220	2SK810	100	0.180	15.000	TO-220	
IVN6200CNH	100	0.250	0.000	TO-220	2SK810	100	0.180	15.000	TO-220	
IVN6200CNM	200	0.500	0.000	TO-220		0	0.000	0.000		
IVN6200CNP	250	0.500	0.000	TO-220		0	0.000	0.000		
IVN6200CNR	395	2.500	0.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IVN6200CNS	400	1.500	0.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IVN6200CNT	450	1.500	0.000	TO-220	2SK854	450	1.400	5.000	TO-220	
IVN6200CNU	500	2.000	0.000	TO-220	2SK855	500	1.500	5.000	TO-220	
IVN6200KND	40	0.250	0.000	TO-3		0	0.000	0.000		
IVN6200KNE	60	0.250	0.000	TO-3		0	0.000	0.000		
IVN6200KNF	80	0.250	0.000	TO-3		0	0.000	0.000		
IVN6200KNH	100	0.250	0.000	TO-3		0	0.000	0.000		
IVN6200KNM	200	0.500	0.000	TO-3		0	0.000	0.000		
IVN6200KNP	250	0.500	0.000	TO-3		0	0.000	0.000		
IVN6200KNS	400	1.500	0.000	TO-3		0	0.000	0.000		
IVN6200KNT	450	1.500	0.000	TO-3		0	0.000	0.000		
IVN6200KNU	500	2.000	0.000	TO-3		0	0.000	0.000		
IVN6300ANE	60	7.500	0.000	TO-237		0	0.000	0.000		
IVN6300ANF	80	7.500	0.000	TO-237		0	0.000	0.000		
IVN6300ANH	100	7.500	0.000	TO-237		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
IVN6300ANM	200	25.000	0.000	TO-237		0	0.000	0.000		
IVN6300ANP	250	25.000	0.000	TO-237		0	0.000	0.000		
IVN6300ANS	400	75.000	0.000	TO-237		0	0.000	0.000		
IVN6300ANT	450	75.000	0.000	TO-237		0	0.000	0.000		
IVN6300ANU	500	75.000	0.000	TO-237		0	0.000	0.000		
IVN6300SNE	60	7.500	0.000	TO-52		0	0.000	0.000		
IVN6300SNF	80	7.500	0.000	TO-52		0	0.000	0.000		
IVN6300SNH	100	7.500	0.000	TO-52		0	0.000	0.000		
IVN6300SNM	200	25.000	0.000	TO-52		0	0.000	0.000		
IVN6300SNP	250	25.000	0.000	TO-52		0	0.000	0.000		
IVN6300SNS	400	75.000	0.000	TO-52		0	0.000	0.000		
IVN6300SNT	450	75.000	0.000	TO-52		0	0.000	0.000		
IVN6300SNU	500	75.000	0.000	TO-52		0	0.000	0.000		
MTA4N18	180	1.200	4.000	TO-225		0	0.000	0.000		
MTA4N20	200	1.200	4.000	TO-225		0	0.000	0.000		
MTA5N12	120	0.900	5.000	TO-225		0	0.000	0.000		
MTA5N15	150	0.900	5.000	TO-225		0	0.000	0.000		
MTA6N08	80	0.600	6.000	TO-225		0	0.000	0.000		
MTA6N10	100	0.600	6.000	TO-225		0	0.000	0.000		
MTA7N05	50	0.400	7.000	TO-225		0	0.000	0.000		
MTA7N06	60	0.400	7.000	TO-225		0	0.000	0.000		
MTE100N05	50	0.018	100.000	Module		0	0.000	0.000		
MTE100N06	60	0.018	100.000	Module		0	0.000	0.000		
MTE120N18	180	0.024	120.000	Module		0	0.000	0.000		
MTE120N20	200	0.024	120.000	Module		0	0.000	0.000		
MTE130N12	120	0.020	130.000	Module		0	0.000	0.000		
MTE130N15	150	0.020	130.000	Module		0	0.000	0.000		
MTE150N08	80	0.012	150.000	Module		0	0.000	0.000		
MTE150N10	100	0.012	150.000	Module		0	0.000	0.000		
MTE200N05	50	0.009	200.000	Module		0	0.000	0.000		
MTE200N06	60	0.009	200.000	Module		0	0.000	0.000		
MTE60N18	180	0.048	60.000	Module		0	0.000	0.000		
MTE60N20	200	0.048	60.000	Module		0	0.000	0.000		
MTE65N12	120	0.038	65.000	Module		0	0.000	0.000		
MTE65N15	150	0.038	65.000	Module		0	0.000	0.000		
MTE75N08	80	0.028	75.000	Module		0	0.000	0.000		
MTE75N10	100	0.028	75.000	Module		0	0.000	0.000		
MTH15N18	180	0.160	15.000	TO-218	2SK707	250	0.150	25.000	MP-80	1
MTH15N20	200	0.160	15.000	TO-218	2SK707	250	0.150	25.000	MP-80	1
MTH20N12	120	0.120	20.000	TO-218		0	0.000	0.000		
MTH20N15	150	0.120	20.000	TO-218		0	0.000	0.000		
MTH25N08	80	0.075	25.000	TO-218	2SK798	100	0.031	40.000	MP-88	1

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
MTH25N10	100	0.075	25.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
MTH35N05	50	0.055	35.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
MTH35N06	60	0.055	35.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
MTH6N55	550	1.200	6.000	TO-218		0	0.000	0.000		
MTH6N60	600	1.200	6.000	TO-218		0	0.000	0.000		
MTH7N45	450	0.800	7.000	TO-218	2SK735	450	0.800	10.000	MP-88	1
MTH7N50	500	0.800	7.000	TO-218	2SK876	500	0.700	12.000	MP-88	1
MTH8N35	350	0.550	8.000	TO-218	2SK825	450	0.500	15.000	MP-88	1
MTH8N40	400	0.550	8.000	TO-218	2SK825	450	0.500	15.000	MP-88	1
MTM10N08	80	0.330	10.000	TO-3		0	0.000	0.000		
MTM10N10	100	0.330	10.000	TO-3		0	0.000	0.000		
MTM10N12	120	0.300	10.000	TO-3		0	0.000	0.000		
MTM10N15	150	0.300	10.000	TO-3		0	0.000	0.000		
MTM12N05	50	0.200	12.000	TO-3		0	0.000	0.000		
MTM12N06	60	0.200	12.000	TO-3		0	0.000	0.000		
MTM12N08	80	0.250	12.000	TO-3		0	0.000	0.000		
MTM12N10	100	0.250	12.000	TO-3		0	0.000	0.000		
MTM15N05	50	0.160	15.000	TO-3		0	0.000	0.000		
MTM15N06	60	0.160	15.000	TO-3		0	0.000	0.000		
MTM15N35	350	0.400	15.000	TO-3		0	0.000	0.000		
MTM15N40	400	0.400	15.000	TO-3		0	0.000	0.000		
MTM15N45	450	0.500	15.000	TO-3		0	0.000	0.000		
MTM15N50	500	0.500	15.000	TO-3		0	0.000	0.000		
MTM1N100	1000	10.000	1.000	TO-3		0	0.000	0.000		
MTM1N95	950	10.000	1.000	TO-3		0	0.000	0.000		
MTM2N45	450	4.000	2.000	TO-3		0	0.000	0.000		
MTM2N50	500	4.000	2.000	TO-3		0	0.000	0.000		
MTM2N85	850	8.000	2.000	TO-3		0	0.000	0.000		
MTM2N90	900	8.000	2.000	TO-3		0	0.000	0.000		
MTM2P45	−450	6.000	−2.000	TO-3		0	0.000	0.000		
MTM2P50	−500	6.000	−2.000	TO-3		0	0.000	0.000		
MTM3N35	350	3.300	3.000	TO-3		0	0.000	0.000		
MTM3N40	400	3.300	3.000	TO-3		0	0.000	0.000		
MTM3N55	550	2.500	3.000	TO-3		0	0.000	0.000		
MTM3N60	600	2.500	3.000	TO-3		0	0.000	0.000		
MTM4N45	450	2.000	4.000	TO-3		0	0.000	0.000		
MTM4N50	500	2.000	4.000	TO-3		0	0.000	0.000		
MTM5N35	350	1.500	5.000	TO-3		0	0.000	0.000		
MTM5N40	400	1.500	5.000	TO-3		0	0.000	0.000		
MTM6N55	550	1.500	6.000	TO-3		0	0.000	0.000		
MTM6N60	600	1.500	6.000	TO-3		0	0.000	0.000		
MTM7N45	450	1.200	7.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
MTM7N50	500	1.200	7.000	TO-3		0	0.000	0.000		
MTM814	80	0.400	0.000	TO-3		0	0.000	0.000		
MTM815	100	0.400	0.000	TO-3		0	0.000	0.000		
MTM8N12	120	0.500	8.000	TO-3		0	0.000	0.000		
MTM8N15	150	0.500	8.000	TO-3		0	0.000	0.000		
MTM8N18	180	0.400	8.000	TO-3		0	0.000	0.000		
MTM8N20	200	0.400	8.000	TO-3		0	0.000	0.000		
MTM8N35	350	0.800	8.000	TO-3		0	0.000	0.000		
MTM8N40	400	0.800	8.000	TO-3		0	0.000	0.000		
MTP10N05	50	0.280	10.000	TO-220	2SK704	60	0.250	5.000	TO-220	
MTP10N06	60	0.280	10.000	TO-220	2SK704	60	0.250	5.000	TO-220	
MTP10N08	80	0.330	10.000	TO-220	2SK470	100	0.300	10.000	TO-220	
MTP10N10	100	0.330	10.000	TO-220	2SK470	100	0.300	10.000	TO-220	
MTP10N12	120	0.300	10.000	TO-220		0	0.000	0.000		
MTP10N15	150	0.300	10.000	TO-220		0	0.000	0.000		
MTP10N25	250	0.450	10.000	TO-220		0	0.000	0.000		
MTP12N05	50	0.200	12.000	TO-220	2SK812	60	0.085	21.000	TO-220	
MTP12N06	60	0.200	12.000	TO-220	2SK812	60	0.085	21.000	TO-220	
MTP12N08	80	0.180	12.000	TO-220	2SK810	100	0.180	15.000	TO-220	
MTP12N10	100	0.180	12.000	TO-220	2SK810	100	0.180	15.000	TO-220	
MTP12N18	180	0.350	12.000	TO-220		0	0.000	0.000		
MTP12N20	200	0.350	12.000	TO-220		0	0.000	0.000		
MTP15N05	50	0.160	15.000	TO-220		0	0.000	0.000		
MTP15N06	60	0.160	15.000	TO-220		0	0.000	0.000		
MTP15N12	120	0.250	15.000	TO-220		0	0.000	0.000		
MTP15N15	150	0.250	15.000	TO-220		0	0.000	0.000		
MTP1N100	1000	10.000	1.000	TO-220		0	0.000	0.000		
MTP1N45	450	8.000	1.000	TO-220	2SK854	450	1.400	5.000	TO-220	
MTP1N50	500	8.000	1.000	TO-220	2SK855	500	1.500	5.000	TO-220	
MTP1N55	550	12.000	1.000	TO-220	2SK786	900	7.000	3.000	TO-220	
MTP1N60	600	12.000	1.000	TO-220	2SK786	900	7.000	3.000	TO-220	
MTP1N95	950	10.000	1.000	TO-220		0	0.000	0.000		
MTP20N08	80	0.150	20.000	TO-220	2SK737	100	0.150	12.000	MP-45	1
MTP20N10	100	0.150	20.000	TO-220	2SK737	100	0.150	12.000	MP-45	1
MTP25N05	50	0.080	25.000	TO-220	2SK659	60	0.075	12.000	MP-45	1
MTP25N06	60	0.080	25.000	TO-220	2SK659	60	0.075	12.000	MP-45	1
MTP2N18	180	1.800	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP2N20	200	1.800	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP2N35	350	5.000	2.000	TO-220	2SK854	450	1.400	5.000	TO-220	
MTP2N40	400	5.000	2.000	TO-220	2SK854	450	1.400	5.000	TO-220	
MTP2N45	450	4.000	2.000	TO-220	2SK854	450	1.400	5.000	TO-220	
MTP2N50	500	4.000	2.000	TO-220	2SK855	500	1.500	5.000	TO-220	

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
MTP2N85	850	8.000	2.000	TO-220	2SK786	900	7.000	3.000	TO-220	
MTP2N90	900	8.000	2.000	TO-220	2SK786	900	7.000	3.000	TO-220	
MTP2P45	−450	6.000	−2.000	TO-220		0	0.000	0.000		
MTP2P50	−500	6.000	−2.000	TO-220		0	0.000	0.000		
MTP3N12	120	1.300	3.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP3N15	150	1.300	3.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP3N35	350	3.300	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
MTP3N40	400	3.300	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
MTP3N55	550	2.500	3.000	TO-220		0	0.000	0.000		
MTP3N60	600	2.500	3.000	TO-220		0	0.000	0.000		
MTP3N75	750	7.000	3.000	TO-220	2SK786	900	7.000	3.000	TO-220	
MTP3N80	800	7.000	3.000	TO-220	2SK786	900	7.000	3.000	TO-220	
MTP4N08	80	0.800	4.000	TO-220	2SK702	100	0.450	5.000	TO-220	
MTP4N10	100	0.800	4.000	TO-220	2SK702	100	0.450	5.000	TO-220	
MTP4N45	450	1.500	4.000	TO-220	2SK854	450	1.400	5.000	TO-220	
MTP4N50	500	1.500	4.000	TO-220	2SK855	500	1.500	5.000	TO-220	
MTP5N05	50	0.600	5.000	TO-220	2SK704	60	0.250	5.000	TO-220	
MTP5N06	60	0.600	5.000	TO-220	2SK704	60	0.250	5.000	TO-220	
MTP5N18	180	1.000	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP5N20	200	1.000	5.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP5N35	350	1.000	5.000	TO-220		0	0.000	0.000		
MTP5N40	400	1.000	5.000	TO-220		0	0.000	0.000		
MTP7N12	120	0.700	7.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP7N15	150	0.700	7.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP7N18	180	0.700	7.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP7N20	200	0.700	7.000	TO-220	V3088	250	0.670	5.000	TO-220	
MTP8N08	80	0.500	8.000	TO-220	2SK702	100	0.450	5.000	TO-220	
MTP8N10	100	0.500	8.000	TO-220	2SK702	100	0.450	5.000	TO-220	
MTP8N12	120	0.500	8.000	TO-220		0	0.000	0.000		
MTP8N15	150	0.500	8.000	TO-220		0	0.000	0.000		
MTP8N18	180	0.400	8.000	TO-220		0	0.000	0.000		
MTP8N20	200	0.400	8.000	TO-220		0	0.000	0.000		
MTP8P08	−80	0.400	−8.000	TO-220	2SJ138	−100	0.300	−12.000	TO-220	
MTP8P10	−100	0.400	−8.000	TO-220	2SJ138	−100	0.300	−12.000	TO-220	
PM1210B	120	0.000	10.000	Module		0	0.000	0.000		
PM1220B	120	0.000	20.000	Module		0	0.000	0.000		
PM4550C	450	0.000	50.000	Module		0	0.000	0.000		
RCA9192A	100	0.300	0.000	TO-3		0	0.000	0.000		
RCA9192B	150	0.300	0.000	TO-3		0	0.000	0.000		
RCA9195A	100	0.150	0.000	TO-3		0	0.000	0.000		
RCA9195B	150	0.150	0.000	TO-3		0	0.000	0.000		
RCA9196A	100	2.500	0.000	TO-39		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
RCA9196B	150	2.500	0.000	TO-39		0	0.000	0.000		
RCA9212A	100	0.300	0.000	TO-220	2SK811	100	0.180	12.000	MP-45	1
RCA9212B	150	0.300	0.000	TO-220		0	0.000	0.000		
RCA9213A	100	2.500	0.000	TO-220	2SK702	100	0.450	5.000	TO-220	
RCA9213B	150	2.500	0.000	TO-220	V3088	250	0.670	5.000	TO-220	
RCA9230A	100	0.150	0.000	TO-220	2SK737	100	0.150	12.000	MP-45	1
RCA9230B	150	0.150	0.000	TO-220		0	0.000	0.000		
RFP10N12L	120	0.300	10.000	TO-220		0	0.000	0.000		
RFP10N15L	150	0.300	10.000	TO-220		0	0.000	0.000		
RFP12N08L	80	0.200	12.000	TO-220	2SK810	100	0.180	15.000	TO-220	
RFP12N10L	100	0.200	12.000	TO-220	2SK810	100	0.180	15.000	TO-220	
RFP15N05L	50	0.150	15.000	TO-220		0	0.000	0.000		
RFP15N06L	60	0.150	15.000	TO-220		0	0.000	0.000		
RFP2N08L	80	1.250	2.000	TO-220	2SK702	100	0.450	5.000	TO-220	
RFP2N10L	100	1.250	2.000	TO-220	2SK702	100	0.450	5.000	TO-220	
RFP2N12L	120	2.000	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
RFP2N15L	150	2.000	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
RFP2N18L	180	3.500	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
RFP2N20L	200	3.500	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
RFP4N05L	50	0.800	4.000	TO-220	2SK704	60	0.250	5.000	TO-220	
RFP4N06L	60	0.800	4.000	TO-220	2SK704	60	0.250	5.000	TO-220	
RFP8N18L	180	0.600	8.000	TO-220		0	0.000	0.000		
RFP8N20L	200	0.600	8.000	TO-220		0	0.000	0.000		
SGSP101	100	1.400	1.500	TO-39		0	0.000	0.000		
SGSP102	100	1.400	1.500	TO-39		0	0.000	0.000		
SGSP151	100	0.600	5.000	TO-39		0	0.000	0.000		
SGSP154	450	6.000	1.500	TO-39		0	0.000	0.000		
SGSP155	400	5.000	1.500	TO-39		0	0.000	0.000		
SGSP201	100	1.400	1.500	SOT-82		0	0.000	0.000		
SGSP211	100	0.300	7.000	SOT-82		0	0.000	0.000		
SGSP212	80	0.300	7.000	SOT-82		0	0.000	0.000		
SGSP216	250	1.200	6.000	SOT-82		0	0.000	0.000		
SGSP217	200	0.750	6.000	SOT-82		0	0.000	0.000		
SGSP218	550	4.500	2.000	SOT-82		0	0.000	0.000		
SGSP219	500	3.800	2.000	SOT-82		0	0.000	0.000		
SGSP221	60	0.130	10.000	SOT-82		0	0.000	0.000		
SGSP222	50	0.130	10.000	SOT-82		0	0.000	0.000		
SGSP230	450	3.000	3.000	SOT-82		0	0.000	0.000		
SGSP231	400	2.500	3.000	SOT-82		0	0.000	0.000		
SGSP232	350	2.500	3.000	SOT-82		0	0.000	0.000		
SGSP238	550	11.000	1.200	SOT-82		0	0.000	0.000		
SGSP239	500	8.500	1.200	SOT-82		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
SGSP240	450	20.000	0.600	SOT-82		0	0.000	0.000		
SGSP241	400	20.000	0.600	SOT-82		0	0.000	0.000		
SGSP242	350	20.000	0.600	SOT-82		0	0.000	0.000		
SGSP248	550	40.000	0.500	SOT-82		0	0.000	0.000		
SGSP249	500	40.000	0.500	SOT-82		0	0.000	0.000		
SGSP251	100	0.450	5.000	SOT-82		0	0.000	0.000		
SGSP252	80	0.450	5.000	SOT-82		0	0.000	0.000		
SGSP254	450	6.500	1.500	SOT-82		0	0.000	0.000		
SGSP255	400	5.000	1.500	SOT-82		0	0.000	0.000		
SGSP256	350	5.000	1.500	SOT-82		0	0.000	0.000		
SGSP257	60	0.300	7.000	SOT-82		0	0.000	0.000		
SGSP258	50	0.300	7.000	SOT-82		0	0.000	0.000		
SGSP301	100	1.400	1.500	TO-220	2SK702	100	0.450	5.000	TO-220	
SGSP302	80	1.400	1.500	TO-220	2SK702	100	0.450	5.000	TO-220	
SGSP311	100	0.300	7.000	TO-220	2SK810	100	0.180	15.000	TO-220	
SGSP312	80	3.500	7.000	TO-220	2SK702	100	0.450	5.000	TO-220	
SGSP316	250	1.200	6.000	TO-220	V3088	250	0.670	5.000	TO-220	
SGSP317	200	0.750	6.000	TO-220	V3088	250	0.670	5.000	TO-220	
SGSP318	550	4.500	2.000	TO-220		0	0.000	0.000		
SGSP319	500	3.800	2.000	TO-220	2SK855	500	1.500	5.000	TO-220	
SGSP321	60	0.130	10.000	TO-220	2SK812	60	0.085	21.000	TO-220	
SGSP322	50	0.130	10.000	TO-220	2SK812	60	0.085	21.000	TO-220	
SGSP330	450	3.000	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
SGSP331	400	2.500	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
SGSP332	350	2.500	3.000	TO-220	2SK854	450	1.400	5.000	TO-220	
SGSP338	550	11.000	1.200	TO-220		0	0.000	0.000		
SGSP339	500	8.500	1.200	TO-220	2SK855	500	1.500	5.000	TO-220	
SGSP340	450	20.000	0.600	TO-220		0	0.000	0.000		
SGSP341	400	20.000	0.600	TO-220		0	0.000	0.000		
SGSP342	350	20.000	0.600	TO-220		0	0.000	0.000		
SGSP348	550	40.000	0.500	TO-220		0	0.000	0.000		
SGSP349	500	40.000	0.500	TO-220		0	0.000	0.000		
SGSP351	100	0.450	5.000	TO-220	2SK702	100	0.450	5.000	TO-220	
SGSP352	80	0.450	5.000	TO-220	2SK702	100	0.450	5.000	TO-220	
SGSP354	450	6.500	1.500	TO-220	2SK854	450	1.400	5.000	TO-220	
SGSP355	400	5.000	1.500	TO-220	2SK854	450	1.400	5.000	TO-220	
SGSP356	350	5.000	1.500	TO-220	2SK854	450	1.400	5.000	TO-220	
SGSP357	60	0.300	7.000	TO-220	2SK704	60	0.250	5.000	TO-220	
SGSP358	250	0.300	7.000	TO-220		0	0.000	0.000		
SGSP361	100	0.150	16.000	TO-220	2SK737	100	0.150	12.000	MP-45	1
SGSP362	80	0.150	16.000	TO-220	2SK737	100	0.150	12.000	MP-45	1
SGSP363	50	0.450	10.000	TO-220	2SK704	60	0.250	5.000	TO-220	

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
SGSP364	450	1.500	6.000	TO-220	2SK854	450	1.400	5.000	TO-220	
SGSP365	400	1.200	6.000	TO-220		0	0.000	0.000		
SGSP366	350	1.200	6.000	TO-220		0	0.000	0.000		
SGSP367	200	0.600	10.000	TO-220		0	0.000	0.000		
SGSP368	550	2.500	5.000	TO-220		0	0.000	0.000		
SGSP369	500	1.900	5.000	TO-220	2SK855	500	1.500	5.000	TO-220	
SGSP381	60	0.060	24.000	TO-220	2SK817	60	0.055	26.000	MP-45	1
SGSP382	50	0.060	24.000	TO-220	2SK817	60	0.055	26.000	MP-45	1
SGSP421	60	0.130	10.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
SGSP422	50	0.130	10.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
SGSP461	100	0.150	16.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
SGSP462	80	0.100	16.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
SGSP463	250	0.450	10.000	TO-218	V3087	250	0.450	8.000	MP-88	1
SGSP464	450	1.500	6.000	TO-218	2SK873	450	1.100	8.000	MP-88	1
SGSP465	400	1.000	6.000	TO-218	2SK735	450	0.800	10.000	MP-88	1
SGSP466	350	1.000	6.000	TO-218	2SK735	450	0.800	10.000	MP-88	1
SGSP467	200	0.330	10.000	TO-218	V3085	250	0.250	15.000	MP-88	1
SGSP468	550	2.500	5.000	TO-218		0	0.000	0.000		
SGSP469	500	1.500	5.000	TO-218	2SK874	500	1.200	8.000	MP-88	1
SGSP471	100	0.070	30.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
SGSP472	80	0.070	30.000	TO-218	2SK798	100	0.031	40.000	MP-88	1
SGSP473	250	0.220	20.000	TO-218	2SK707	250	0.150	25.000	MP-80	1
SGSP474	450	0.700	12.000	TO-218	2SK875	450	0.600	12.000	MP-88	1
SGSP475	400	0.550	12.000	TO-218	2SK825	450	0.500	15.000	MP-88	1
SGSP476	350	0.550	12.000	TO-218	2SK825	450	0.500	15.000	MP-88	1
SGSP477	200	0.170	20.000	TO-218	2SK707	250	0.150	25.000	MP-80	1
SGSP478	550	1.000	10.000	TO-218		0	0.000	0.000		
SGSP479	500	0.700	10.000	TO-218	2SK876	500	0.700	12.000	MP-88	1
SGSP481	60	0.060	24.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
SGSP482	50	0.060	24.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
SGSP491	60	0.050	40.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
SGSP492	50	0.033	40.000	TO-218	2SK797	60	0.018	40.000	MP-88	1
TN0102N2	20	1.500	3.500	TO-39		0	0.000	0.000		
TN0102N3	20	1.500	3.500	TO-92		0	0.000	0.000		
TN0104N2	40	1.500	3.500	TO-39		0	0.000	0.000		
TN0104N3	40	1.500	3.500	TO-92		0	0.000	0.000		
TN0106N2	60	3.000	2.000	TO-39		0	0.000	0.000		
TN0106N3	60	3.000	2.000	TO-92		0	0.000	0.000		
TN0110N2	100	3.000	2.000	TO-39		0	0.000	0.000		
TN0110N3	100	3.000	2.000	TO-92		0	0.000	0.000		
TN0202N2	20	1.000	5.000	TO-39		0	0.000	0.000		
TN0202N3	20	1.000	5.000	TO-92		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
TN0204N2	40	1.000	5.000	TO-39		0	0.000	0.000		
TN0204N3	40	1.000	5.000	TO-92		0	0.000	0.000		
TN0520N2	200	10.000	0.300	TO-39		0	0.000	0.000		
TN0520N3	200	10.000	0.300	TO-92		0	0.000	0.000		
TN0524N2	240	10.000	0.300	TO-39		0	0.000	0.000		
TN0524N3	240	10.000	0.300	TO-92		0	0.000	0.000		
TN0602N2	20	0.750	5.000	TO-39		0	0.000	0.000		
TN0602N3	20	0.750	5.000	TO-92		0	0.000	0.000		
TN0604N2	40	0.750	5.000	TO-39		0	0.000	0.000		
TN0604N3	40	0.750	5.000	TO-92		0	0.000	0.000		
TN0620N2	200	6.000	1.000	TO-39		0	0.000	0.000		
TN0620N3	200	6.000	1.000	TO-92		0	0.000	0.000		
TN0620N5	200	6.000	1.000	TO-220	V3088	250	0.670	5.000	TO-220	
TN0624N2	240	6.000	1.000	TO-39		0	0.000	0.000		
TN0624N3	240	6.000	1.000	TO-92		0	0.000	0.000		
TN0624N5	240	6.000	1.000	TO-220	V3088	250	0.670	5.000	TO-220	
TP0102N2	−20	4.000	−.850	TO-39		0	0.000	0.000		
TP0102N3	−20	4.000	−.850	TO-92		0	0.000	0.000		
TP0104N2	−40	4.000	−.850	TO-39		0	0.000	0.000		
TP0104N3	−40	4.000	−.850	TO-92		0	0.000	0.000		
TP0202N2	−20	2.000	−3.500	TO-39		0	0.000	0.000		
TP0202N3	−20	2.000	−3.500	TO-92		0	0.000	0.000		
TP0204N2	−40	2.000	−3.500	TO-39		0	0.000	0.000		
TP0204N3	−40	2.000	−3.500	TO-92		0	0.000	0.000		
TP0602N2	−20	1.500	−3.500	TO-39		0	0.000	0.000		
TP0602N3	−20	1.500	−3.500	TO-92		0	0.000	0.000		
TP0604N2	−40	1.500	−3.500	TO-39		0	0.000	0.000		
TP0604N3	−40	1.500	−3.500	TO-92		0	0.000	0.000		
TP0606N2	−60	3.500	−2.000	TO-39		0	0.000	0.000		
TP0606N3	−60	3.500	−2.000	TO-92		0	0.000	0.000		
TP0606N5	−60	3.500	−2.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
TP0606N6	−60	3.500	−2.000	14-Pin DIP		0	0.000	0.000		2
TP0606N7	−60	3.500	−2.000	14-Pin DIP		0	0.000	0.000		2
TP0610N2	−100	3.500	−2.000	TO-39		0	0.000	0.000		
TP0610N3	−100	3.500	−2.000	TO-92		0	0.000	0.000		
TP0610N5	−100	3.500	−2.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
TP0616N2	−160	12.000	−.750	TO-39		0	0.000	0.000		
TP0616N3	−160	12.000	−.750	TO-92		0	0.000	0.000		
TP0616N5	−160	12.000	−.750	TO-220		0	0.000	0.000		
TP0620N2	−200	12.000	−.750	TO-39		0	0.000	0.000		
TP0620N3	−200	12.000	−.750	TO-92		0	0.000	0.000		
TP0620N5	−200	12.000	−.750	TO-220		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VN0104N1	40	4.000	2.000	TO-3		0	0.000	0.000		
VN0104N2	40	4.000	0.800	TO-39		0	0.000	0.000		
VN0104N3	40	4.000	0.500	TO-92		0	0.000	0.000		
VN0104N4	40	4.000	0.500	TO-202		0	0.000	0.000		
VN0104N5	40	4.000	1.500	TO-220		0	0.000	0.000		
VN0104N6	40	4.000	0.700	14-Pin DIP		0	0.000	0.000		2
VN0104N7	40	3.000	0.700	14-Pin DIP		0	0.000	0.000		2
VN0106N1	60	4.000	2.000	TO-3		0	0.000	0.000		
VN0106N2	60	4.000	0.800	TO-39		0	0.000	0.000		
VN0106N3	60	4.000	0.500	TO-92		0	0.000	0.000		
VN0106N4	60	4.000	0.500	TO-202		0	0.000	0.000		
VN0106N5	60	4.000	1.500	TO-220		0	0.000	0.000		
VN0106N6	60	4.000	0.700	14-Pin DIP		0	0.000	0.000		2
VN0106N7	60	3.000	0.700	14-Pin DIP		0	0.000	0.000		2
VN0108N1	80	4.000	2.000	TO-3		0	0.000	0.000		
VN0108N2	80	4.000	0.800	TO-39		0	0.000	0.000		
VN0108N3	80	4.000	0.500	TO-92		0	0.000	0.000		
VN0108N4	80	4.000	0.500	TO-202		0	0.000	0.000		
VN0108N5	80	4.000	1.500	TO-220		0	0.000	0.000		
VN0108N6	80	4.000	0.700	14-Pin DIP		0	0.000	0.000		2
VN0109N1	90	4.000	2.000	TO-3		0	0.000	0.000		
VN0109N2	90	4.000	0.800	TO-39		0	0.000	0.000		
VN0109N3	90	4.000	0.500	TO-92		0	0.000	0.000		
VN0109N4	90	4.000	0.500	TO-202		0	0.000	0.000		
VN0109N5	90	4.000	1.500	TO-220		0	0.000	0.000		
VN0109N6	90	4.000	0.700	14-Pin DIP		0	0.000	0.000		2
VN0116N2	160	10.000	0.400	TO-39		0	0.000	0.000		
VN0116N3	160	10.000	0.400	TO-92		0	0.000	0.000		
VN0116N5	160	10.000	0.400	TO-220		0	0.000	0.000		
VN0120N2	200	10.000	0.400	TO-39		0	0.000	0.000		
VN0120N3	200	10.000	0.400	TO-92		0	0.000	0.000		
VN0120N5	200	10.000	0.400	TO-220		0	0.000	0.000		
VN0204N1	40	2.000	3.000	TO-3		0	0.000	0.000		
VN0204N2	40	2.000	1.500	TO-39		0	0.000	0.000		
VN0204N5	40	2.000	3.000	TO-220	2SK704	60	0.250	5.000	TO-220	
VN0204N6	40	2.000	1.000	14-Pin DIP		0	0.000	0.000		2
VN0204N7	40	2.000	1.000	14-Pin DIP		0	0.000	0.000		2
VN0206N1	60	2.000	3.000	TO-3		0	0.000	0.000		
VN0206N2	60	2.000	1.500	TO-39		0	0.000	0.000		
VN0206N3	60	2.000	0.800	TO-92		0	0.000	0.000		
VN0206N5	60	2.000	3.000	TO-220	2SK704	60	0.250	5.000	TO-220	
VN0206N6	60	2.000	1.000	14-Pin DIP		0	0.000	0.000		2

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VN0206N7	60	2.000	1.000	14-Pin DIP		0	0.000	0.000		2
VN0208N1	80	2.000	3.000	TO-3		0	0.000	0.000		
VN0208N2	80	2.000	1.500	TO-39		0	0.000	0.000		
VN0208N5	80	2.000	3.000	TO-220	2SK702	100	0.450	5.000	TO-220	
VN0208N6	80	2.000	1.000	14-Pin DIP		0	0.000	0.000		2
VN0209N1	90	2.000	3.000	TO-3		0	0.000	0.000		
VN0209N2	90	2.000	1.500	TO-39		0	0.000	0.000		
VN0209N5	90	2.000	3.000	TO-220	2SK702	100	0.450	5.000	TO-220	
VN0209N6	90	2.000	1.000	14-Pin DIP		0	0.000	0.000		2
VN0210N2	100	2.000	1.500	TO-39		0	0.000	0.000		
VN0210N3	100	2.000	0.800	TO-92		0	0.000	0.000		
VN0210N5	100	2.000	1.000	TO-220	2SK702	100	0.450	5.000	TO-220	
VN0216N2	160	6.000	1.000	TO-39		0	0.000	0.000		
VN0216N3	160	6.000	1.000	TO-92		0	0.000	0.000		
VN0216N5	160	6.000	1.000	TO-220	V3088	250	0.670	5.000	TO-220	
VN0220N2	200	6.000	1.000	TO-39		0	0.000	0.000		
VN0220N3	200	6.000	1.000	TO-92		0	0.000	0.000		
VN0220N5	200	6.000	1.000	TO-220	V3088	250	0.670	5.000	TO-220	
VN0300D	30	1.200	2.500	TO-220AB	2SK704	60	0.250	5.000	TO-220	
VN0300M	30	1.200	0.700	TO-237		0	0.000	0.000		
VN0330N1	300	2.500	3.500	TO-3		0	0.000	0.000		
VN0330N2	300	2.500	1.000	TO-39		0	0.000	0.000		
VN0330N5	300	2.500	2.100	TO-220	2SK854	450	1.400	5.000	TO-220	
VN0335A1	350	1.000	0.000	TO-3		0	0.000	0.000		
VN0335N1	350	2.500	3.500	TO-3		0	0.000	0.000		
VN0335N2	350	2.500	1.000	TO-39		0	0.000	0.000		
VN0335N5	350	2.500	2.100	TO-220	2SK854	450	1.400	5.000	TO-220	
VN0340A1	400	1.000	0.000	TO-3		0	0.000	0.000		
VN0340N1	400	2.500	3.500	TO-3		0	0.000	0.000		
VN0340N2	400	2.500	1.000	TO-39		0	0.000	0.000		
VN0340N5	400	2.500	2.100	TO-220	2SK854	450	1.400	5.000	TO-220	
VN0345A1	450	1.000	0.000	TO-3		0	0.000	0.000		
VN0345N1	450	4.000	2.500	TO-3		0	0.000	0.000		
VN0345N2	450	4.000	0.350	TO-39		0	0.000	0.000		
VN0345N5	450	4.000	1.500	TO-220	2SK854	450	1.400	5.000	TO-220	
VN0350A1	500	1.000	0.000	TO-3		0	0.000	0.000		
VN0350N2	500	4.000	2.500	TO-3		0	0.000	0.000		
VN0350N3	500	4.000	0.350	TO-39		0	0.000	0.000		
VN0350N5	500	4.000	1.500	TO-220	2SK855	500	1.500	5.000	TO-220	
VN0355N1	550	6.000	1.500	TO-3		0	0.000	0.000		
VN0355N5	550	6.000	1.500	TO-220		0	0.000	0.000		
VN0360N1	600	6.000	1.500	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VN0360N5	600	6.000	1.500	TO-220		0	0.000	0.000		
VN0400A	40	0.120	18.000	TO-3		0	0.000	0.000		
VN0400D	40	0.120	18.000	TO-220AB	2SK659	60	0.075	12.000	MP-45	1
VN0401A	40	0.150	16.000	TO-3		0	0.000	0.000		
VN0401D	40	0.150	16.000	TO-220AB	2SK659	60	0.075	12.000	MP-45	1
VN0430N1	300	0.800	0.000	TO-3		0	0.000	0.000		
VN0435N1	350	0.800	0.000	TO-3		0	0.000	0.000		
VN0440N1	400	0.800	0.000	TO-3		0	0.000	0.000		
VN0445N1	450	0.800	0.000	TO-3		0	0.000	0.000		
VN0535N2	350	35.000	0.250	TO-39		0	0.000	0.000		
VN0535N3	350	35.000	0.250	TO-92		0	0.000	0.000		
VN0540N2	400	35.000	0.250	TO-39		0	0.000	0.000		
VN0540N3	400	35.000	0.250	TO-92		0	0.000	0.000		
VN0545N2	450	60.000	0.150	TO-39		0	0.000	0.000		
VN0545N3	450	60.000	0.150	TO-92		0	0.000	0.000		
VN0550N2	500	60.000	0.150	TO-39		0	0.000	0.000		
VN0550N3	500	60.000	0.150	TO-92		0	0.000	0.000		
VN0600A	60	0.120	18.000	TO-3		0	0.000	0.000		
VN0600D	60	0.120	18.000	TO-220AB	2SK659	60	0.075	12.000	MP-45	1
VN0601A	60	0.150	16.000	TO-3		0	0.000	0.000		
VN0601D	60	0.150	16.000	TO-220AB	2SK659	60	0.075	12.000	MP-45	1
VN0606M	60	3.000	0.400	TO-237		0	0.000	0.000		
VN0610L	60	5.000	0.200	TO-92		0	0.000	0.000		
VN0635N2	350	8.000	1.500	TO-39		0	0.000	0.000		
VN0635N3	350	8.000	1.500	TO-92		0	0.000	0.000		
VN0635N5	350	8.000	1.500	TO-220		0	0.000	0.000		
VN0640N2	400	8.000	1.500	TO-39		0	0.000	0.000		
VN0640N3	400	8.000	1.500	TO-92		0	0.000	0.000		
VN0640N5	400	8.000	1.500	TO-220		0	0.000	0.000		
VN0645N2	450	15.000	0.800	TO-39		0	0.000	0.000		
VN0645N3	450	15.000	0.800	TO-92		0	0.000	0.000		
VN0645N5	450	15.000	0.800	TO-220		0	0.000	0.000		
VN0650N2	500	15.000	0.800	TO-39		0	0.000	0.000		
VN0650N3	500	15.000	0.800	TO-92		0	0.000	0.000		
VN0650N5	500	15.000	0.800	TO-220		0	0.000	0.000		
VN0655N2	550	20.000	0.500	TO-39		0	0.000	0.000		
VN0655N3	550	20.000	0.500	TO-92		0	0.000	0.000		
VN0655N5	550	20.000	0.500	TO-220		0	0.000	0.000		
VN0660N2	600	20.000	0.500	TO-39		0	0.000	0.000		
VN0660N3	600	20.000	0.500	TO-92		0	0.000	0.000		
VN0660N5	600	20.000	0.500	TO-220		0	0.000	0.000		
VN0800A	80	0.180	14.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VN0800D	80	0.180	14.000	TO-220AB	2SK810	100	0.180	15.000	TO-220	
VN0801A	80	0.250	12.000	TO-3		0	0.000	0.000		
VN0801D	80	0.250	12.000	TO-220AB	2SK810	100	0.180	15.000	TO-220	
VN0808M	80	4.000	0.350	TO-237		0	0.000	0.000		
VN1000A	100	0.180	14.000	TO-3		0	0.000	0.000		
VN1000D	100	0.180	14.000	TO-220AB	2SK810	100	0.180	15.000	TO-220	
VN1001A	100	0.250	12.000	TO-3		0	0.000	0.000		
VN1001D	100	0.250	12.000	TO-220AB	2SK810	100	0.180	15.000	TO-220	
VN10KE	60	5.000	0.200	TO-52		0	0.000	0.000		
VN10KM	60	5.000	0.300	TO-237		0	0.000	0.000		
VN10KN3	60	5.000	0.500	TO-92		0	0.000	0.000		
VN10KN9	60	5.000	0.500	TO-52		0	0.000	0.000		
VN10LE	60	5.000	0.200	TO-52		0	0.000	0.000		
VN10LM	60	5.000	0.300	TO-237		0	0.000	0.000		
VN1106N1	60	0.700	8.000	TO-3		0	0.000	0.000		
VN1106N2	60	0.700	8.000	TO-39		0	0.000	0.000		
VN1106N5	60	0.700	8.000	TO-220	2SK704	60	0.250	5.000	TO-220	
VN1110N1	100	0.700	8.000	TO-3		0	0.000	0.000		
VN1110N2	100	0.700	8.000	TO-39		0	0.000	0.000		
VN1110N5	100	0.700	8.000	TO-220	2SK702	100	0.450	5.000	TO-220	
VN1116N1	160	3.000	2.000	TO-3		0	0.000	0.000		
VN1116N2	160	3.000	2.000	TO-39		0	0.000	0.000		
VN1116N5	160	3.000	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
VN1120N1	200	3.000	2.000	TO-3		0	0.000	0.000		
VN1120N2	200	3.000	2.000	TO-39		0	0.000	0.000		
VN1120N5	200	3.000	2.000	TO-220	V3088	250	0.670	5.000	TO-220	
VN1200A	120	0.180	14.000	TO-3		0	0.000	0.000		
VN1200D	120	0.180	14.000	TO-220AB	2SK720A	0	0.000	0.000		
VN1201A	120	0.250	12.000	TO-3		0	0.000	0.000		
VN1201D	120	0.250	12.000	TO-220AB	V3085	0	0.000	0.000		
VN1204N1	40	0.400	0.000	TO-3		0	0.000	0.000		
VN1204N2	40	0.400	0.000	TO-39		0	0.000	0.000		
VN1204N5	40	0.400	0.000	TO-220	2SK704	60	0.250	5.000	TO-220	
VN1206B	120	6.000	0.800	TO-39		0	0.000	0.000		
VN1206D	120	6.000	1.400	TO-220AB		0	0.000	0.000		
VN1206L	120	6.000	0.210	TO-92		0	0.000	0.000		
VN1206M	120	6.000	0.300	TO-237		0	0.000	0.000		
VN1206N1	60	0.400	0.000	TO-3		0	0.000	0.000		
VN1206N2	60	0.400	0.000	TO-39		0	0.000	0.000		
VN1206N5	60	0.400	0.000	TO-220	2SK704	60	0.250	5.000	TO-220	
VN1208N1	80	0.400	0.000	TO-3		0	0.000	0.000		
VN1208N2	80	0.400	0.000	TO-39		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VN1208N5	80	0.400	0.000	TO-220	2SK810	100	0.180	15.000	TO-220	
VN1209N1	90	0.400	0.000	TO-3		0	0.000	0.000		
VN1209N2	90	0.400	0.000	TO-39		0	0.000	0.000		
VN1209N5	90	0.400	0.000	TO-220	2SK810	100	0.180	15.000	TO-220	
VN1210L	120	10.000	0.160	TO-92		0	0.000	0.000		
VN1210M	120	10.000	0.250	TO-237		0	0.000	0.000		
VN1304N2	40	10.000	0.000	TO-39		0	0.000	0.000		
VN1304N3	40	10.000	0.000	TO-92		0	0.000	0.000		
VN1304N6	40	10.000	0.000	14-Pin DIP		0	0.000	0.000		2
VN1304N7	40	8.000	0.500	14-Pin DIP		0	0.000	0.000		2
VN1306N2	60	10.000	0.000	TO-39		0	0.000	0.000		
VN1306N3	60	10.000	0.000	TO-92		0	0.000	0.000		
VN1306N6	60	10.000	0.000	14-Pin DIP		0	0.000	0.000		2
VN1306N7	60	8.000	0.500	14-Pin DIP		0	0.000	0.000		2
VN1308N2	80	10.000	0.000	TO-39		0	0.000	0.000		
VN1308N3	80	10.000	0.000	TO-92		0	0.000	0.000		
VN1308N6	80	10.000	0.000	14-Pin DIP		0	0.000	0.000		2
VN1309N2	90	10.000	0.000	TO-39		0	0.000	0.000		
VN1309N3	90	10.000	0.000	TO-92		0	0.000	0.000		
VN1309N6	90	10.000	0.000	14-Pin DIP		0	0.000	0.000		2
VN1310N2	100	8.000	0.500	TO-39		0	0.000	0.000		
VN1310N3	100	8.000	0.500	TO-92		0	0.000	0.000		
VN1316N2	160	40.000	0.250	TO-39		0	0.000	0.000		
VN1316N3	160	40.000	0.250	TO-92		0	0.000	0.000		
VN1320N2	200	40.000	0.250	TO-39		0	0.000	0.000		
VN1320N3	200	40.000	0.250	TO-92		0	0.000	0.000		
VN1706B	170	6.000	0.800	TO-39		0	0.000	0.000		
VN1706D	170	6.000	1.400	TO-220AB		0	0.000	0.000		
VN1706L	170	6.000	0.210	TO-92		0	0.000	0.000		
VN1706M	170	6.000	0.300	TO-237		0	0.000	0.000		
VN1710L	170	10.000	0.160	TO-92		0	0.000	0.000		
VN1710M	170	10.000	0.250	TO-237		0	0.000	0.000		
VN2222KM	60	7.500	0.250	TO-237		0	0.000	0.000		
VN2222L	60	7.500	0.150	TO-92		0	0.000	0.000		
VN2222LM	60	7.500	0.250	TO-237		0	0.000	0.000		
VN2406B	240	6.000	0.800	TO-39		0	0.000	0.000		
VN2406D	240	6.000	1.400	TO-220AB		0	0.000	0.000		
VN2406L	240	6.000	0.210	TO-92		0	0.000	0.000		
VN2406M	240	6.000	0.300	TO-237		0	0.000	0.000		
VN2410L	240	10.000	0.160	TO-92		0	0.000	0.000		
VN2410M	240	10.000	0.250	TO-237		0	0.000	0.000		
VN3500A	350	1.000	6.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VN3500D	350	1.000	6.000	TO-220AB		0	0.000	0.000		
VN3501A	350	1.500	5.000	TO-3		0	0.000	0.000		
VN3501D	350	1.500	5.000	TO-220AB	2SK854	450	1.400	5.000	TO-220	
VN35AA	35	2.500	2.000	TO-3		0	0.000	0.000		
VN35AB	35	2.500	1.200	TO-39		0	0.000	0.000		
VN4000A	400	1.000	6.000	TO-3		0	0.000	0.000		
VN4000D	400	1.000	6.000	TO-220AB		0	0.000	0.000		
VN4001A	400	1.500	5.000	TO-3		0	0.000	0.000		
VN4001D	400	1.500	5.000	TO-220AB	2SK854	450	1.400	5.000	TO-220	
VN40AD	40	5.000	1.500	TO-220AB		0	0.000	0.000		
VN40AF	40	5.000	1.300	TO-202AA		0	0.000	0.000		
VN4501A	450	1.500	4.500	TO-3		0	0.000	0.000		
VN4501D	450	1.500	4.500	TO-220AB	2SK854	450	1.400	5.000	TO-220	
VN4502A	450	2.000	4.000	TO-3		0	0.000	0.000		
VN4502D	450	2.000	4.000	TO-220AB	2SK854	450	1.400	5.000	TO-220	
VN46AD	40	3.000	1.900	TO-220AB		0	0.000	0.000		
VN46AF	40	3.000	1.600	TO-202AA		0	0.000	0.000		
VN5001A	500	1.500	4.500	TO-3		0	0.000	0.000		
VN5001D	500	1.500	4.500	TO-220AB	2SK855	500	1.500	5.000	TO-220	
VN5002A	500	2.000	4.000	TO-3		0	0.000	0.000		
VN5002D	500	2.000	4.000	TO-220AB	2SK855	500	1.500	5.000	TO-220	
VN64GA	60	0.400	10.000	TO-3		0	0.000	0.000		
VN66AD	60	3.000	1.900	TO-220AB		0	0.000	0.000		
VN66AF	60	3.000	1.700	TO-202AA		0	0.000	0.000		
VN67AA	60	3.500	2.000	TO-3		0	0.000	0.000		
VN67AB	60	3.500	1.000	TO-39		0	0.000	0.000		
VN67AD	60	3.500	1.800	TO-220AB		0	0.000	0.000		
VN67AF	60	3.500	1.600	TO-202AA		0	0.000	0.000		
VN80AF	80	5.000	1.300	TO-202AA		0	0.000	0.000		
VN88AD	80	4.000	1.700	TO-220AB		0	0.000	0.000		
VN88AF	80	4.000	1.500	TO-202AA		0	0.000	0.000		
VN89AD	80	4.500	1.600	TO-220AB		0	0.000	0.000		
VN89AF	80	4.500	1.400	TO-202AA		0	0.000	0.000		
VN90AA	90	5.000	1.700	TO-3		0	0.000	0.000		
VN90AB	90	5.000	0.800	TO-39		0	0.000	0.000		
VN99AA	90	4.500	1.800	TO-3		0	0.000	0.000		
VN99AB	90	4.500	0.900	TO-39		0	0.000	0.000		
VNL001A	350	1.000	8.000	TO-3		0	0.000	0.000		
VNM001A	400	1.000	8.000	TO-3		0	0.000	0.000		
VNN002A	450	1.500	6.500	TO-3		0	0.000	0.000		
VNP002A	500	1.500	6.500	TO-3		0	0.000	0.000		
VP0104N1	−40	8.000	0.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VP0104N2	−40	8.000	0.000	TO-39		0	0.000	0.000		
VP0104N3	−40	8.000	0.000	TO-92		0	0.000	0.000		
VP0104N5	−40	8.000	0.000	TO-220		0	0.000	0.000		
VP0104N6	−40	8.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0104N7	−40	8.000	−.500	14-Pin DIP		0	0.000	0.000		2
VP0104N9	−40	8.000	−.500	TO-52		0	0.000	0.000		
VP0106N1	−60	8.000	0.000	TO-3		0	0.000	0.000		
VP0106N2	−60	8.000	0.000	TO-39		0	0.000	0.000		
VP0106N3	−60	8.000	0.000	TO-92		0	0.000	0.000		
VP0106N5	−60	8.000	0.000	TO-220		0	0.000	0.000		
VP0106N6	−60	8.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0106N7	−60	8.000	−.500	14-Pin DIP		0	0.000	0.000		2
VP0106N9	−60	8.000	−.500	TO-52		0	0.000	0.000		
VP0108N1	−80	8.000	0.000	TO-3		0	0.000	0.000		
VP0108N2	−80	8.000	0.000	TO-39		0	0.000	0.000		
VP0108N3	−80	8.000	0.000	TO-92		0	0.000	0.000		
VP0108N5	−80	8.000	0.000	TO-220		0	0.000	0.000		
VP0108N6	−80	8.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0109N1	−90	8.000	0.000	TO-3		0	0.000	0.000		
VP0109N2	−90	8.000	0.000	TO-39		0	0.000	0.000		
VP0109N3	−90	8.000	0.000	TO-92		0	0.000	0.000		
VP0109N5	−90	8.000	0.000	TO-220		0	0.000	0.000		
VP0109N6	−90	8.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0109N9	−90	8.000	−.500	TO-52		0	0.000	0.000		
VP0116N2	−160	25.000	−.250	TO-39		0	0.000	0.000		
VP0116N3	−160	25.000	−.250	TO-92		0	0.000	0.000		
VP0116N5	−160	25.000	−.250	TO-220		0	0.000	0.000		
VP0120N2	−200	25.000	−.250	TO-39		0	0.000	0.000		
VP0120N3	−200	25.000	−.250	TO-92		0	0.000	0.000		
VP0120N5	−200	25.000	−.250	TO-220		0	0.000	0.000		
VP0204N1	−40	4.000	0.000	TO-3		0	0.000	0.000		
VP0204N2	−40	4.000	0.000	TO-39		0	0.000	0.000		
VP0204N5	−40	4.000	0.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
VP0204N6	−40	4.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0204N7	−40	4.000	−1.000	14-Pin DIP		0	0.000	0.000		2
VP0206N1	−60	4.000	0.000	TO-3		0	0.000	0.000		
VP0206N2	−60	4.000	0.000	TO-39		0	0.000	0.000		
VP0206N5	−60	4.000	0.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
VP0206N6	−60	4.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0206N7	−60	4.000	−1.000	14-Pin DIP		0	0.000	0.000		2
VP0208N1	−80	4.000	0.000	TO-3		0	0.000	0.000		
VP0208N2	−80	4.000	0.000	TO-39		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VP0208N5	−80	4.000	0.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
VP0208N6	−80	4.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0209N1	−90	4.000	0.000	TO-3		0	0.000	0.000		
VP0209N2	−90	4.000	0.000	TO-39		0	0.000	0.000		
VP0209N5	−90	4.000	0.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
VP0209N6	−90	4.000	0.000	14-Pin DIP		0	0.000	0.000		2
VP0216N2	−160	16.000	−.800	TO-39		0	0.000	0.000		
VP0216N3	−160	16.000	−.800	TO-92		0	0.000	0.000		
VP0216N5	−160	16.000	−.800	TO-220		0	0.000	0.000		
VP0220N2	−200	16.000	−.800	TO-39		0	0.000	0.000		
VP0220N3	−200	16.000	−.800	TO-92		0	0.000	0.000		
VP0220N5	−200	16.000	−.800	TO-220		0	0.000	0.000		
VP0300B	−30	2.500	−1.300	TO-39		0	0.000	0.000		
VP0300L	−30	2.500	−.300	TO-92		0	0.000	0.000		
VP0300M	−30	2.500	−.480	TO-237		0	0.000	0.000		
VP0335N1	−350	6.000	−1.500	TO-3		0	0.000	0.000		
VP0335N2	−350	6.000	−1.500	TO-39		0	0.000	0.000		
VP0335N5	−350	6.000	−1.500	TO-220		0	0.000	0.000		
VP0340N1	−400	6.000	−1.500	TO-3		0	0.000	0.000		
VP0340N2	−400	6.000	−1.500	TO-39		0	0.000	0.000		
VP0340N5	−400	6.000	−1.500	TO-220		0	0.000	0.000		
VP0345N1	−450	7.500	−1.000	TO-3		0	0.000	0.000		
VP0345N2	−450	7.500	−1.000	TO-39		0	0.000	0.000		
VP0345N5	−450	7.500	−1.000	TO-220		0	0.000	0.000		
VP0350N1	−500	7.500	−1.000	TO-3		0	0.000	0.000		
VP0350N2	−500	7.500	−1.000	TO-39		0	0.000	0.000		
VP0350N5	−500	7.500	−1.000	TO-220		0	0.000	0.000		
VP0535N2	−350	75.000	−.200	TO-39		0	0.000	0.000		
VP0535N3	−350	75.000	−.200	TO-92		0	0.000	0.000		
VP0540N2	−400	75.000	−.200	TO-39		0	0.000	0.000		
VP0540N3	−400	75.000	−.200	TO-92		0	0.000	0.000		
VP0545N2	450	125.000	−.100	TO-39		0	0.000	0.000		
VP0545N3	−450	125.000	−.100	TO-92		0	0.000	0.000		
VP0550N2	−500	125.000	−.100	TO-39		0	0.000	0.000		
VP0550N3	−500	125.000	−.100	TO-92		0	0.000	0.000		
VP0635N2	−350	15.000	−.400	TO-39		0	0.000	0.000		
VP0635N3	−350	15.000	−.400	TO-92		0	0.000	0.000		
VP0635N5	−350	15.000	−.400	TO-220		0	0.000	0.000		
VP0640N2	−400	15.000	−.400	TO-39		0	0.000	0.000		
VP0640N3	−400	15.000	−.400	TO-92		0	0.000	0.000		
VP0640N5	−400	15.000	−.400	TO-220		0	0.000	0.000		
VP0645N2	−450	20.000	−.200	TO-39		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VP0645N3	−450	20.000	−.200	TO-92		0	0.000	0.000		
VP0645N5	−450	20.000	−.200	TO-220		0	0.000	0.000		
VP0650N2	−500	20.000	−.200	TO-39		0	0.000	0.000		
VP0650N3	−500	20.000	−.200	TO-92		0	0.000	0.000		
VP0650N5	−500	20.000	−.200	TO-220		0	0.000	0.000		
VP0808B	−80	5.000	−.900	TO-39		0	0.000	0.000		
VP0808L	−80	5.000	−.230	TO-92		0	0.000	0.000		
VP0808M	−80	5.000	−.370	TO-237		0	0.000	0.000		
VP1008B	−100	5.000	−.900	TO-39		0	0.000	0.000		
VP1008L	−100	5.000	−.230	TO-92		0	0.000	0.000		
VP1008M	−100	5.000	−.370	TO-237		0	0.000	0.000		
VP1106N1	−60	2.000	−5.000	TO-3		0	0.000	0.000		
VP1106N2	−60	2.000	−5.000	TO-39		0	0.000	0.000		
VP1106N5	−60	2.000	−5.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
VP1110N1	−100	2.000	−5.000	TO-3		0	0.000	0.000		
VP1110N2	−100	2.000	−5.000	TO-39		0	0.000	0.000		
VP1110N5	−100	2.000	−5.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
VP1116N1	−160	5.000	−1.500	TO-3		0	0.000	0.000		
VP1116N2	−160	5.000	−1.500	TO-39		0	0.000	0.000		
VP1116N5	−160	5.000	−1.500	TO-220		0	0.000	0.000		
VP1120N1	−200	5.000	−1.500	TO-3		0	0.000	0.000		
VP1120N2	−200	5.000	−1.500	TO-39		0	0.000	0.000		
VP1120N5	−200	5.000	−1.500	TO-220		0	0.000	0.000		
VP1204N1	−40	0.800	0.000	TO-3		0	0.000	0.000		
VP1204N2	−40	0.800	0.000	TO-39		0	0.000	0.000		
VP1204N5	−40	0.800	0.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
VP1206N1	−60	0.800	0.000	TO-3		0	0.000	0.000		
VP1206N2	−60	0.800	0.000	TO-39		0	0.000	0.000		
VP1206N5	−60	0.800	0.000	TO-220	V2994A	−60	0.450	−6.000	TO-220	
VP1208N1	−80	0.800	0.000	TO-3		0	0.000	0.000		
VP1208N2	−80	0.800	0.000	TO-39		0	0.000	0.000		
VP1208N5	−80	0.800	0.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
VP1209N1	−90	0.800	0.000	TO-3		0	0.000	0.000		
VP1209N2	−90	0.800	0.000	TO-39		0	0.000	0.000		
VP1209N5	−90	0.800	0.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
VP1210N1	−100	0.800	−6.000	TO-3		0	0.000	0.000		
VP1210N2	−100	0.800	−6.000	TO-39		0	0.000	0.000		
VP1210N5	−100	0.800	−6.000	TO-220	2SJ134	−100	0.600	−6.000	TO-220	
VP1216N1	−160	2.500	−4.000	TO-3		0	0.000	0.000		
VP1216N2	−160	2.500	−4.000	TO-39		0	0.000	0.000		
VP1216N5	−160	2.500	−4.000	TO-220		0	0.000	0.000		
VP1220N1	−200	2.500	−4.000	TO-3		0	0.000	0.000		

Power MOSFET Cross Reference [cont]

Ind. Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	NEC Part No.	BV_{DSS} (V)	$R_{DS(ON)}$ (Ω)	I_D (A)	Pkg.	Notes
VP1220N2	−200	2.500	−4.000	TO-39		0	0.000	0.000		
VP1220N5	−200	2.500	−4.000	TO-220		0	0.000	0.000		
VP1304N2	−40	25.000	−.250	TO-39		0	0.000	0.000		
VP1304N3	−40	25.000	−.250	TO-92		0	0.000	0.000		
VP1304N6	−40	25.000	−.250	14-Pin DIP		0	0.000	0.000		2
VP1304N7	−40	25.000	−.250	14-Pin DIP		0	0.000	0.000		2
VP1306N2	−60	25.000	−.250	TO-39		0	0.000	0.000		
VP1306N3	−60	25.000	−.250	TO-92		0	0.000	0.000		
VP1306N6	−60	25.000	−.250	14-Pin DIP		0	0.000	0.000		2
VP1306N7	−60	25.000	−.250	14-Pin DIP		0	0.000	0.000		2
VP1310N2	−100	25.000	−.250	TO-39		0	0.000	0.000		
VP1310N3	−100	25.000	−.250	TO-92		0	0.000	0.000		
VP1316N2	−160	100.000	−.100	TO-39		0	0.000	0.000		
VP1316N3	−160	100.000	−.100	TO-92		0	0.000	0.000		
VP1320N2	−200	100.000	−.100	TO-39		0	0.000	0.000		
VP1320N3	−200	100.000	−.100	TO-92		0	0.000	0.000		
VQ1000J	60	5.500	0.225	14-Pin DIP		0	0.000	0.000		2
VQ1000P	60	5.500	0.225	14-Pin DIP		0	0.000	0.000		2
VQ1001J	30	1.000	0.850	14-Pin DIP		0	0.000	0.000		2
VQ1001P	30	1.000	0.850	14-Pin DIP		0	0.000	0.000		2
VQ1004J	60	3.500	0.460	14-Pin DIP		0	0.000	0.000		2
VQ1004P	60	3.500	0.460	14-Pin DIP		0	0.000	0.000		2
VQ1006J	90	4.500	0.400	14-Pin DIP		0	0.000	0.000		2
VQ1006P	90	4.500	0.400	14-Pin DIP		0	0.000	0.000		2
VQ2001J	−30	2.000	0.600	14-Pin DIP		0	0.000	0.000		2
VQ2001P	−30	2.000	0.600	14-Pin DIP		0	0.000	0.000		2
VQ2004J	−60	5.000	0.410	14-Pin DIP		0	0.000	0.000		2
VQ2004P	−60	5.000	0.410	14-Pin DIP		0	0.000	0.000		2
VQ2006J	−90	5.000	0.410	14-Pin DIP		0	0.000	0.000		2
VQ2006P	−90	5.000	0.410	14-Pin DIP		0	0.000	0.000		2
VQ3001J	−30	3.000	1.500	14-Pin DIP		0	0.000	0.000		2, 3
VQ3001P	−30	3.000	1.500	14-Pin DIP		0	0.000	0.000		2, 3
VQ7254J	−20	3.000	1.500	14-Pin DIP		0	0.000	0.000		2, 3
VQ7254P	−20	3.000	1.500	14-Pin DIP		0	0.000	0.000		2, 3

N-Channel Power MOSFET

N-Channel Power MOSFET 30 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
0.5	2SK679	1.0	TO-92
1.0	2SK680	1.0	SOT-89
	2SK681	1.0	SP-8
2.0	2SK738	0.17	MP-3
	2SK801	0.35	MP-3
	2SK802	0.35	MP-5

N-Channel Power MOSFET 60 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
2.0	2SK739	0.25	MP-3
	2SK701	0.6	MP-5
5.0	2SK704	0.25	TO-220
	2SK705	0.25	MP-45
12.0	2SK659	0.075	MP-45
21.0	2SK813	0.085	MP-45
26.0	2SK817	0.055	MP-45
27.0	2SK812	0.085	TO-220
40.0	2SK797	0.018	MP-88

N-Channel Power MOSFET 80 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
2.0	2SK700	0.8	TO-126

N-Channel Power MOSFET 100 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
1.0	2SK611	5.0	MP-3
	2SK654	3.0	MP-3
2.0	2SK612	0.45	MP-3
	2SK699	1.2	MP-5
5.0	2SK702	0.45	TO-220
	2SK703	0.45	MP-45
12.0	2SK737	0.15	MP-45
	2SK811	0.18	MP-45
15.0	2SK810	0.18	TO-220
	2SK736	0.08	MP-45
21.0	2SK815	0.085	MP-45
40.0	2SK798	0.031	MP-88

N-Channel Power MOSFET 250 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
5.0	V3088	0.67	TO-220
8.0	V3087	0.45	MP-88
10.0	V3086	0.37	MP-88
15.0	V3085	0.25	MP-88
20.0	2SK720A	0.23	MP-85
	2SK821	0.23	MP-88
25.0	2SK707	0.15	MP-80

N-Channel Power MOSFET 450 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
1.5	V3080A	3.8	MP-3
5.0	2SK854	1.4	TO-220
8.0	2SK873	1.1	MP-88
10.0	2SK735	0.8	MP-88
12.0	2SK799	0.5	MP-80
	2SK875	0.6	MP-88
15.0	2SK825	0.5	MP-88
18.0	2SK800	0.38	MP-80
	2SK827	0.38	MP-88
20.0	2SK784	0.35	MP-88

N-Channel Power MOSFET 500 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
1.5	V3080B	4.1	MP-3
5.0	2SK855	1.5	TO-220
8.0	2SK874	1.2	MP-88
10.0	2SK819	1.0	MP-88
12.0	2SK773	0.6	MP-80
	2SK876	0.7	MP-88
15.0	2SK829	0.6	MP-88
18.0	2SK774	0.45	MP-80
	2SK831	0.45	MP-88
20.0	2SK785	0.4	MP-88

N-Channel Power MOSFET 900 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
3.0	2SK786	7.0	TO-220
4.0	V3075	4.5	MP-88
5.0	2SK719	4.0	MP-80
	2SK833	4.0	MP-88
6.0	V3076	2.0	MP-88
8.0	2SK787	1.6	MP-88

P-Channel Power MOSFET

P-Channel Power MOSFET −30 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
−2.0	2SJ132	0.4	MP-3

P-Channel Power MOSFET −60 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
−2.0	2SJ133	0.8	MP-3
−6.0	V2994A	0.45	TO-220
	V2994B	0.45	MP-45
−10.0	2SJ137	0.3	MP-45
−12.0	2SJ136	0.3	TO-220
−15.0	2SJ141	0.25	MP-45
−19.0	2SJ140	0.25	TO-220
−24.0	2SJ143	0.15	MP-45

P-Channel Power MOSFET −100 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package
−2.0	2SJ128	1.0	MP-3
−5.0	2SJ135	0.6	MP-45
−6.0	2SJ134	0.6	TO-220
−10.0	2SJ139	0.3	MP-45
−12.0	2SJ138	0.3	TO-220
−13.0	2SJ142	0.2	MP-45

Power MOSFET Quad Arrays

Power MOSFET Quad Arrays 30 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package	Type
2.0	μPA1520H	0.17	SIP (H)	N-Ch
	μPA1570H	0.35	SIP (H)	N-Ch

Power MOSFET Quad Arrays 60 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package	Type
2.0	μPA1522	0.25	SIP	N-Ch
	μPA1572	0.6	SIP	N-Ch
−2.0	μPA1523	0.8	SIP	P-Ch
3.0	μPA1552	0.3	SIP	N-Ch

Power MOSFET Quad Arrays 80 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package	Type
2.0	μPA1524	0.8	SIP	N-Ch

Power MOSFET Quad Arrays 100 V

I_D (A)	Part Number	$R_{DS(ON)}$ (Ω)	Package	Type
2.0	μPA1526	0.4	SIP	N-Ch
	μPA1576	1.2	SIP	N-Ch
−2.0	μPA1527	1.0	SIP	P-Ch
5.0	μPA1556	0.45	SIP	N-Ch

NEC

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Section 12 — Consumer ICs **Page**

Consumer ICs Cross Reference

Fujitsu	NEC
MB3202	μPC1028H

Hitachi	NEC
HA1124	μPC1382C
HA1199	μPC1216V2
HA1366W	μPC1241H
HA1377A	μPC1185H2
HA1388A	μPC1230H2
HA1392	μPC1277H
HA1398	μPC1185H2
HA11219	μPC1176C
HA11227*	μPC1197C
HA11251F	μPC1356C2
HA11412A	μPC1352C
HA12413	μPC1222C
HD43019A	μPD6122G-001
HD43109	μPD6121G-002
HD44042	μPC1373HA
HZT33	μPC574J
TBA810	μPC1213C
TDA2002*	μPC2002H/V

ITT	NEC
SA5010	μPD6121G-002
ZKT33	μPC574J

Matsushita	NEC
AN101*	μPC1176C
AN115	μPC1026C
AN5010	μPC1361C
AN5010	μPC1363C
AN5020	μPC1373H2
AN5111	μPC1356C2
AN5215	μPC1391H
AN5310*	μPC1352C
AN5350	μPC1397C
AN5352	μPC1397C
AN5512	μPC1378H
AN6130	μPC1176C
AN7110	μPC1212C
AN7120	μPC1213C
AN7140	μPC1241H
AN7145	μPC1277H
AN7156	μPC1185H2
AN7166	μPC1185H2
AN7222	μPC1222C
AN7310*	μPC1032H
AN7410	μPC1197C
AN7414	μPC1227V
AN7417	μPC1227V
AN7510	μPC1216V2
MN6024	μPD6120C-101
MN6027	μPD6121G-002

Mitsubishi	NEC
M5152L*	μPC1032H
M5185P	μPC1356C2
M50110P	μPD6120C-101
M50115P	μPD6121G-002
M51103L	μPC1241H
M51515L	μPC1185H2
M51517L	μPC1185H2

Motorola	NEC
MHW1134	MC5813
MHW1184	MC5818
MHW1224	MC5822
MHW1244	MC5824
MHW3171	MC5381
MHW3172	MC5382
MHW3342	MC5383
MHW5120	MC5120
MHW5121	MC5121
MHW5171	MC5264
MHW5172	MC5265
MHW5181	MC5384
MHW5182	MC5385
MHW5222	MC5814
MHW5222	MC5815
MHW5342	MC5386
MHW6181	MC5387
MHW6181	MC5819
MHW6182	MC5388
MHW6182	MC5820
MHW6222	MC5816
MHW6222	MC5817
MHW6342	MC5389
MHW6342	MC5821

PHI	NEC
PHA3317-1	MC5381
PHA3317-2	MC5382
PHA3334-2	MC5383
PHA4517-1	MC5264
PHA4517-2	MC5265
PHA4518-1	MC5384
PHA4518-2	MC5385
PHA4534	MC5386
PHA5018-1	MC5387
PHA5018-2	MC5388
PHA5034	MC5389

Philips	NEC
BGY54	MC5381
BGY55	MC5382
BGY58A	MC5383
BGY61	MC5813
BGY65	MC5818
BGY67	MC5822
BGY67A	MC5824
BGY78	MC5386
BGY84	MC5264
BGY84A	MC5384
BGY85	MC5265
BGY85A	MC5385
SAB3209	μPD6121G-002
TDA1001*	μPC1176C
TDA3560	μPC1397C
TDA3570*	μPD1352C

Rohm	NEC
BA328*	μPC1032H
BA403*	μPC1028H
BA527	μPC1212C
BA534	μPC1213C
BA535	μPC1185H2
BA536	μPC1277H
BA542	μPC1185H2
BA1330	μPC1197C
BA1350	μPC1227V
BA3203	μPC1216V
BA4210	μPC1222C

Sanyo	NEC
L5630*	μPC574J
LA1130	μPC1216V2
LA1150*	μPC1028H
LA1210	μPC1222C
LA1357N*	μPC1356C2
LA2100*	μPC1176C
LA2101	μPC1176C
LA2110	μPC1176C
LA3161*	μPC1032H
LA3200	μPC1158HA2
LA3360	μPC1197C
LA3370	μPC1227V
LA4110	μPC1212C
LA4112	μPC1213C
LA4125	μPC1277H
LA7600	μPC1352C
LA7700	μPC1382C

SGS	NEC
TDA1170	μPC1378H
TDA2002*	μPC2002V
TDA2005*	μPC2005V
TDA2006*	μPC1238H/V

Toshiba	NEC
TA7130P*	μPC1028H
TA7137P	μPC1158HA2
TA7207P	μPC1212C
TA7208P	μPC1213C
TA7215P	μPC1227H
TA7227P	μPC1185H2
TA7240P	μPC1185H2
TA7240P	μPC1230H2
TA7604P*	μPC1197C
TA7606P	μPC1356C2
TA7608CP	μPC1352C
TA7614	μPC1222C
TA7616P	μPC1216V
TA7628P	μPC1350C
TA7632P	μPC1382C
TC9132P	μPD6121G-002

TRW	NEC
CA3100	MC5381
CA3200	MC5382
CA4411	MC5813
CA4418	MC5818
CA4422	MC5822
CA4424	MC5824
CA5101	MC5384
CA5170	MC5264
CA5201	MC5385
CA5270	MC5265
CA5300	MC5814
CA5301	MC5815
CA5600	MC5386
CA6101	MC5819
CA6201	MC5820

*These devices are pin compatible with NEC devices; all others are functional equivalents.

Audio ICs

Low Noise Amplifiers

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1217G	Micro cassette	Recording/playback amplifier	1.8 to 6	T_a = 25°C, V_{CC} = 3 V, f = 1 kHz, R_L = 10 kΩ			20-pin flatpack
				Playback amplifier			
				I_{CC}	6.5 to 10.5 mA	V_i = 0	
				A_{vo}	72 dB		
				V_{om}	0.5 to 0.8 V	THD = 1%	
				THD	0.065 to 0.7%	V_O = 0.3 V	
				R_i	36 kΩ		
				V_{nin}	1.0 to 1.6 μV	R_G = 2.2 kΩ 10 Hz to 10 kHz BPF	
				Microphone amplifier			
				I_{CC}	8.5 to 13.5 mA	V_i = 0	
				A_{vo}	52 dB		
				V_{om}	0.4 to 0.7 V	THD = 1%	
				THD	0.3 to 0.7%	V_O = 0.3 V	
				R_i	36 kΩ		
				V_{nin}	1.0 to 1.6 μV	R_G = 2.2 kΩ 10 Hz to 10 kHz BPF	
				Recording amplifier			
				A_{vo}	70 dB		
				V_{om}	0.5 to 0.9 V	THD = 1%	
				THD	0.2 to 0.7%	V_O = 0.3 V	
				ALC circuits: ALC1	2.6 to 9 dB	V_i = −70 to −40 dBm	
				ALC2	45 to 64 dB	THD 3%	
μPC1281G	Headphone, tape recorder	2 channel recording and playback amplifier with switch	V_{CC} = 1.8 to 6	T_a = 25°C, V_{CC} = 3 V, f = 1 kHz			24-pin flatpack
				Overall			
				I_{CC}	5 to 9 to 14 mA	V_i = 0	
				V_O rec	330 to 400 to 470 mV	$V_{i\ mic}$ = −50 dBV	
				THD rec	0.7 to 1.5%	$V_{i\ mic}$ = −50 dBV	
				V_{cc} min	1.8 to 2.1 V	$V_{i\ mic}$ = −50 dBV Non clip	
				P/B amplifier			
				V_{om}	0.5 to 0.7 V	THD = 1%	
				V_{nin}	1.3 to 2 μV	R_G = 2.2 kΩ 15 Hz to 30 kHz BPF	
				THD	0.1 to 0.6%	V_O = 0.3 V	
				Z_{in}	35 to 50 kΩ		
				MIC amplifier			
				V_{om}	0.5 to 0.7 V	THD = 1%	
				V_{nin}	2 to 3 μV	R_G = 2.2 kΩ 15 Hz to 30 kHz BPF	
				THD	0.1 to 0.6%	V_O = 0.3 V	

Audio ICs (cont)

Low Noise Amplifiers [cont]

Part Number	Use	Description	Supply Voltage [V]	Electrical Characteristics			Package Information
μPC1281G	Headphone, tape recorder	2 channel recording and playback amplifier with switch	V_{CC} = 1.8 to 6	T_a = 25°C, V_{CC} = 3 V, f = 1 kHz			24-pin flatpack
				Line amplifier			
				A_v	37 to 39 to 41 dB	V_O = 0.3 V	
				V_{om}	0.5 to 0.8 V	THD = 1%	
μPC566HA3	Car stereo set, cassette tape recorder, home stereo	Pre-amplifier with high input impedance, emitter-follower output	5 to 13	T_a = 25°C, V_{CC} = 8 V, f = 1 kHz, R_L = 22 kΩ			7-pin SIP
				I_{CC}	1.2 to 1.5 to 1.9 mA		
				A_{vo}	67 to 72.5 dB	R_{NF} = 22 kΩ	
				A_v	41.5 to 46.5 dB	R_{NF} = 22 kΩ	
				V_{OM}	1.2 to 1.75 V	NAB, R_G = 22 kΩ	
				V_{nin}	1.2 to 2.0 μV		
μPC1032HA	Car stereo set, cassette tape recorder, stereo	Direct coupled 2 channel amplifier, emitter follower output	8 to 17	T_a = 25°C, V_{CC} = 13.2 V, f = 1 kHz, R_L = 10 kΩ			8-pin SIP
				I_{CC}	7 to 11 mA		
				A_{vo}	70 to 81 dB		
				A_v	33.5 to 35 to 35.5 dB	R_{NF} = 1.8 kΩ	
				V_{OM}	1.1 to 1.7 V	NAB = 35 dB	
				THD	0.1 to 0.3%	NAB, V_O = 0.3 V	
				V_{nin}	1.4 to 2.0 μV	NAB, R_G = 2.2 kΩ	
				R_i	50 to 100 kΩ		
μPC1228HA	Car stereo set, cassette tape recorder, home stereo set	Direct coupled 2 channel amplifier, S.E.P.P. output	6 to 16	T_a = 25°C, V_{CC} = 10 V, f = 1 kHz, R_L = 10 kΩ			8-pin SIP
				I_{CC}	2.5 to 3.3 to 4.88 mA		
				A_{vo}	90 to 100 dB		
				A_v	40 dB		
				V_{OM}	1.0 to 2.0 V	NAB, THD = 1%	
				THD	0.02 to 0.3%	NAB, V_O = 0.3 V	
				V_{nin}	1.1 to 1.7 μV	NAB, R_G = 2.2 kΩ	
				R_i	50 to 100 kΩ		
μPC1313HA	Stereo cassette tape recorder	2 channel pre-amplifier with ALC	4 to 15	T_a = 25°C, V_{CC} = 8 V, f = 1 kHz, NAB, R_L = 10 kΩ			9-pin SIP
				I_{CC}	2.5 to 4 to 6 mA		
				A_{vo}	80 to 90 dB	V_O = 0.3 V	
				A_v	46 dB	V_O = 0.3 V	
				V_{OM}	1.2 to 1.8 V	THD = 1%	
				THD	0.05 to 0.3%	V_O = 0.3 V	
				V_{nin}	1.3 to 4.0 μV	R_G = 2.2 kΩ	
				R_i	25 to 45 kΩ		
				CT	−50 to −65 dB	V_O = 1 V, other channel, R_G = 2.2 kΩ	
				THD	0.2 to 1.0%	V_i = −50 dBV	
				ALC ΔALC	0 to 2.5 dB	V_i = −50 dBV	
				ALC	40 to 50 dB	from V_i = −70 dBV to THD = 10%	

Audio ICs (cont)

Low Noise Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1350C	Cassette tape recorder	Direct coupled 2-stage amplifier, ALC stage, audio power stage	3.5 to 10	T_a = 25°C, V_{CC} = 6 V, f = 1 kHz, NAB, R_L = 10 kΩ (pre), R_L = 8 Ω (P_O)			14-pin DIP with TAB
				Overall			
				I_{CC}	10 to 20 to 33 mA		
				P_O	400 to 450 mW	THD = 10%	
				THD	0.8 to 2.0%	P_O = 50 mW	
				ALC range	60 dB	THD = 3%	
				Pre amp stage			
				A_{vo}	55 to 65 dB		
				A_v	3.08 dB		
				V_{OM}	0.6 V	THD = 1%	
				R_i	20 kΩ		
				Power amp stage			
				A_{vo}	70 to 81 dB	P_O = 50 mW	
				A_v	46.8 dB	P_O = 50 mW	
				R_i	20 to 28 kΩ		

Audio Power Amplifiers

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC575C2	Cassette tape recorder, car stereo, car radio, stereo, record player	Power amplifier	9 to 17	T_a = 25°C, V_{CC} = 13.2 V, f = 1 kHz, R_L = 8 Ω			8-pin DIP
				I_{CC}	8 to 12 to 16 mA		
				P_O	1.5 to 2.0 W	THD = 10%	
				A_v	51 to 56 dB	P_O = 0.5 W	
				THD	0.5 to 1.5%	P_O = 0.5 W	
				NL	0.4 to 0.08 mV	R_G = 0 Ω	
μPC1188H	Stereo, tape recorder, radio receiver, (P_O = 20 W at 8 Ω)	Power amplifier with built-in short protection circuit	±17 to ±23	T_a = 25°C, V_{CC} = ±22 V, f = 1 kHz, R_L = 8 Ω, A_v = 40 dB			10-pin SIP
				I_{CC}	30 to 60 to 120 mA		
				P_O	16 to 18 W	THD = 0.5%, P_o = 3 W	
				A_{vo}	65 to 75 dB		
				THD	0.1 to 0.3%	P_o = 10 W	
				NVV	0.4 to 1.0 mV	R_G = 2.2 kΩ	
				V_{OFF}	−100 to 0 to 100 mV		
μPC1238V	Stereo, tape recorder, recorder player, (P_O = 10 W at 8 Ω)	Power amplifier	±6 to ±16	T_a = 25°C, V_{CC} = ±13 V, f = 1 kHz, R_L = 8 Ω, A_v = 35 dB			5-pin V-DIP
				I_{CC}	30 to 60 to 130 mA		
				P_O	7 to 8.4 W	THD = 1%	
				A_{vo}	83 dB	P_O = 0.1 W	
				THD	0.2 to 1.0%	P_O = 0.1 to 7 W	

Audio ICs (cont)

Audio Power Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1238V (cont)	Stereo, tape recorder, recorder player, (P_O = 10 W at 8 Ω)	Power amplifier	±6 to ±16	T_a = 25°C, V_{CC} = ±13 V, f = 1 kHz, R_L = 8 Ω, A_V = 35 dB			5-pin V-DIP
				NV	3 to 10 μV	R_G = 2.2 kΩ	
				R_i	20 kΩ		
				SVR	45 to 51 dB	R_G = 2.2 kΩ, f = 100 Hz ripple input 300 mV_{pp}	
μPC1212C	Tape recorder, radio receiver (P_O = 1 W at 4 Ω)	Power amplifier	V_{CC} = 3.5 to 9	T_a = 25°C, V_{CC} = 6 V, f = 1 kHz, R_L = 4 Ω			8-pin DIP with TAB
				I_{CC}	8 to 15 to 25 mA	V_i = 0	
				A_{vo}	55 to 65 dB	P_O = 0.25 W	
				A_V	41 to 45 to 48 dB	P_O = 0.25 W	
				P_O	0.7 to 1 W	THD = 10%	
				THD	0.4 to 1.5%	P_O = 0.25 W	
				NL	0.2 to 0.8 mV	R_G = 0	
				R_i	10 to 20 kΩ		
				SVR	40 to 55 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.3 V	
μPC1213C	Radio receiver, tape recorder (P_O = 2.4 W at 4 Ω)	Power amplifier	V_{CC} = 4.5 to 11	T_a = 25°C, V_{CC} = 9 V, f = 1 kHz, R_L = 4 Ω			8-pin DIP with TAB
				I_{CC}	8 to 15 to 25 mA	V_i = 0	
				A_{vo}	55 to 65 dB	P_O = 0.25 W	
				A_V	41 to 45 to 48 dB	P_O = 0.25 W	
				P_O	1.8 to 2.4 W	THD = 10%	
				THD	0.4 to 1.5%	P_O = 0.25 W	
				NL	0.2 to 0.8 mV	R_G = 0	
				R_i	10 to 20 kΩ		
				SVR	40 to 55 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.3 V	
μPC1277H	Radio receiver, tape recorder (P_O = 4.2 Wx2 at 4 Ω)	2 channel power amplifier	V_{CC} = 5 to 16	T_a = 25°C, V_{CC} = 12 V, f = 1 kHz, R_L = 4 Ω			12-pin SIP
				I_{CC}	20 to 45 to 90 mA	V_i = 0	
				A_V	42 to 45 to 48 dB	P_O = 1 W	
				P_O	1.8 to 2.2 dB	THD = 10%, 9 V/4 Ω	
					2.5 to 3 dB	THD = 10%, 9 V/3 Ω	
					3.2 to 4.2 W	THD = 10%, 12 V/4 Ω	
					4 to 5 W	THD = 10%, 12 V/3 Ω	
				THD	0.2 to 1%	P_O = 1 W	
				NL	0.6 to 2 mV	R_G = 10 kΩ	
				CT	45 to 55 dB	P_O = 1 W, other R_G = 10 kΩ	

Audio ICs (cont)

Audio Power Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1277H (cont)	Radio receiver, tape recorder (P_O = 4.2 Wx2 at 4 Ω)	2 channel power amplifier	V_{CC} = 5 to 16	T_a = 25°C, V_{CC} = 12 V, f = 1 kHz, R_L = 4 Ω			12-pin SIP
				Ch. B	−2 to 0 to 2 dB	P_O = 1 W	
				R_i	30 to 50 kΩ		
				SVR	40 to 50 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.3 V	
μPC1278H	Radio receiver, tape recorder	2 channel power amplifier	V_{CC} = 5 to 16	T_a = 25°C, V_{CC} = 9 V, f = 1 kHz, R_L = 4 Ω			12-pin SIP
				I_{CC}	43 to 80 mA	V_i = 0	
				A_V	42 to 45 to 48 dB	P_O = 1 W	
				P_O	1.8 to 2.5 W	THD = 10%	
				THD	0.2 to 1%	P_O = 1 W	
				NL	0.6 to 1.5 mV	R_G = 10 kΩ	
				R_i	50 kΩ		
				SVR	40 to 50 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.3 V	
μPC1263C2	Radio receiver, tape recorder	2 channel power amplifier	V_{CC} = 3 to 16	T_a = 25°C, V_{CC} = 9 V, f = 1 kHz, R_L = 8 Ω			14-pin DIP with TAB
				I_{CC}	10 mA	V_i = 0	
				A_V	44 dB	P_O = 0.25 W, R_{NF} = 33 Ω	
				P_O	0.9 to 1.2 W	THD = 10%	
				THD	0.8%	P_O = 0.5 W	
				NL	0.6 mV	R_G = 10 kΩ	
				R_i	5 MΩ		
				SVR	50 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.3 V	
μPC1260G	Head phone, tape recorder, radio receiver	2 channel power amplifier with mute and dual/BTL switch	V_{CC} = 1.8 to 5	T_a = 25°C, V_{CC} = 3 V, f = 1 kHz, R_L = 32 Ω (dual), R_L = 8 Ω (BTL)			20-pin flatpack
				I_{CC}	8 to 15 mA	V_i = 0	
				A_V	39 to 42 to 45 dB	P_O = 10 mW	
				P_{O1}	30 to 40 mW	THD = 10%	
				P_{O2}	0.35 to 0.43 W	THD = 10%, BTL	
				THD	0.6 to 1.5%	P_O = 10 mW	
				NL	0.3 to 0.8 mV	R_G = 0, 20 Hz to 15 kHz BPF	
				R_i	30 to 50 kΩ		

Audio ICs (cont)

Audio Power Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1185H2	Car stereo set, car radio receiver (P_O = 8.5 W at 2 Ω)	2 channel power amplifier	9.5 to 18	T_a = 25°C, V_{CC} = 13.2 V, f = 1 kHz, R_L = 4 Ω			12-pin SIP
				I_{CC}	30 to 80 to 180 mA	V_i = 0	
				P_O	7.0 W	THD = 10%, V_{CC} = 14.4 V	
					5.0 to 5.8 W	THD = 10%	
					8.5 W	THD = 10%, R_L = 2 Ω	
				THD	0.3 to 1.0%	P_O = 0.5 W	
				THD	0.4%	P_O = 2 W, R_L = 2 Ω	
				A_V	51 to 54 to 58 dB	P_O = 0.5 W	
				Ch. B	−1.5 to 0 to 1.5 dB	P_O = 0.5 W	
				NL	1.4 to 4.0 mV	R_G = 10 kΩ	
μPC1230H2	Car stereo set, car radio receiver (P_O = 25 W at 4 Ω)	BTL-OCL power amplifier	9 to 16	T_a = 25°C, V_{CC} = 13.2 V, f = 1 kHz, R_L = 4 Ω			12-pin SIP
				I_{CC}	35 to 90 to 180 mA	V_i = 0	
				V_{offset}	−150 to 0 to 150 mV	V_i = 0	
				P_O	25 W	THD = 10%, V_{CC} = 14.4 V	
					16 to 20 W	THD = 10%	
				THD	0.15 to 1.0%	P_O = 2 W	
				A_V	53 to 55 to 56 dB	P_O = 2 W	
				NL	0.65 mV	R_G = 0 Ω	
				R_i	45 kΩ		
				SVR	34 to 45 dB	R_G = 0 Ω, f(ripple) = 100 Hz, V(ripple) = 0.5 V	
μPC1241H μPC1242H	Car stereo set, car radio receiver (P_O = 9.2 W at 2 Ω)	Power amplifier	9.5 to 16	T_a = 25°C, V_{CC} = 13.2 V, f = 1 kHz, R_L = 4 Ω			8-pin SIP
				I_{CC}	25 to 45 to 80 mA	V_i = 0	
				P_O	5.0 to 5.8 W	THD = 10%	
					7 W	THD = 10%, V_{CC} = 14.4 V	
					9.2 W	THD = 10%, R_L = 2 Ω	
					11 W	THD = 10%, V_{CC} = 14.4 V, R_L = 2 Ω	
				THD	0.1 to 1%	P_O = 0.5 W	
				THD	0.4%	P_O = 1 W, R_L = 2 Ω	
				A_V	49 to 51.5 to 53 dB	P_O = 0.5 W	
				NL	1.4 to 4 mV	R_G = 10 kΩ	

Audio ICs (cont)

Audio Power Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics				Package Information
μPC1288V	Radio receiver, stereo set (P_O = 20 W at 8 Ω)	DUAL/BTL power amplifier	6 to 20	T_a = 25°C, V_{CC} = 15 V, f = 1 kHz, R_L = 4 Ω DUAL				14-pin V-DIP
				I_{CC}	23 to 36 mA			
				A_V	46 to 48 to 50 dB	P_O = 4 W		
				P_O	6 to 7 W	THD = 10%		
					20 W	BTL, THD = 10%		
				THD	0.2 to 1%	P_O = 1 W		
				NL	0.25 to 0.6 mV	R_G = 0, DIN AUDIO		
				SVR	45 to 55 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.3 V		
				R_i	20 to 30 kΩ			
μPC2002V	Car stereo set, car radio receiver (P_O = 9.0 W at 2 Ω)	Power amplifier	8 to 18	T_a = 25°C, f = 1 kHz				5-pin V-DIP V-type H-type
					V_{CC} = 14.4 V	V_{CC} = 13.2 V		
				I_{CC}	35 to 55 to 85	54 mA	V_i = 0	
				P_O	5.4 W	4.5 W	THD = 10%, R_L = 4 Ω	
					9.0 W	7.5 W	THD = 10%, R_L = 2 Ω	
				THD	0.05 to 1.0%	0.05%	P_O = 0.5 W, R_L = 4 Ω	
					0.06 to 1.0%	0.06%	P_O = 1 W, R_L = 2 Ω	
				A_{VO}	80 dB	78 dB	R_L = 4 Ω	
				A_V	39.5 to 40 to 40.5 dB	40 dB	R_L = 4 Ω, P_O = 0.5 W	
				NL	0.6 to 3.0 mV	0.6 mV	R_G = 10 kΩ	
				R_i	70 to 150 kΩ	150 kΩ		
				SVR	30 to 39 dB	39 dB	R_L = 4 Ω, R_G = 10 kΩ, f(ripple) = 100 Hz, V(ripple) = 0.5 V	
μPC1218H	Tape recorder, radio receiver (P_O = 0.25 W at 8 Ω)	BTL power amplifier	1.8 to 5.0	T_a = 25°C, V_{CC} = 3 V, f = 1 kHz, R_L = 8 Ω, A_V = 45 dB				8-pin SIP
				I_{CC}	10 to 23 to 36 mA			
				A_{VO}	65 to 75 dB	P_O = 50 mV		
				A_V	45 dB	P_O = 50 mV		
				P_O	200 to 250 mW	THD = 10%		
				THD	1.3 to 3%	P_O = 50 mV		
				R_i	10 to 17 kΩ			
				NL	0.2 to 0.8 mV	R_G = 2.2 kΩ		

Audio ICs (cont)

Audio Power Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1274V	Car stereo set, car radio receiver (P_O = 20 W at 4 Ω)	BTL-OCL power amplifier	9 to 16	T_a = 25°C, V_{CC} = 13.2 V, f = 1 kHz, R_L = 4 Ω			14-pin V-DIP
				I_{CC}	35 to 90 to 180 mA	V_i = 0	
				V_{offset}	−150 to 0 to +150 mV	V_i = 0	
				A_v	53 to 54 to 56 dB	P_O = 2 W	
				P_O	16 to 20 W	THD = 10%	
				THD	0.15 to 1.0%	P_O = 2 W	
				V_n	1.2 to 4 mV	R_G = 10 kΩ	
				SVR	34 to 45 dB	R_G = 0 Ω, f(ripple) = 100 Hz, V(ripple) = 0.5 V	
				R_{in}	45 kΩ		
μPC1280V	Car stereo set, car radio receiver (P_O = 2 W at 4 Ω)	BTL-OCL power amplifier with muting circuit	9 to 16	T_a = 25°C, V_{CC} = 13.2 V, f = 1 kHz, R_L = 4 Ω			14-pin V-DIP
				I_{CC}	35 to 90 to 180 mA	V_i = 0	
				V_{offset}	−150 to 0 to 150 mV	V_i = 0	
				A_v	51 to 52 to 54 dB	P_O = 1 W	
				P_O	16 to 20 W	THD = 10%	
				THD	0.2 to 1.0%	P_O = 1W	
				V_n	0.9 to 2 mV	R_G = 10 kΩ	
				SVR	34 to 45 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.5 V	
				R_{in}	50 kΩ		
				ATTmute	40 to 50 dB	V_M = 5 V, R_M = 33 kΩ	
μPC2005V	Car stereo set, car radio receiver (P_O = 20 W at 4 Ω)	DUAL/BTL power amplifier	8 to 16	T_a = 25°C, V_{CC} = 14.4 V, f = 1 kHz, R_L = 4 Ω			11-pin V-DIP
					DUAL	BTL	
				I_{cc}	75 mA	75 mA	
				P_O	6 W	20 W	
				THD1	0.2%	0.2%	P_O = 1 W
				V_{nin}	1.5 μV	3 μV	R_G = 10 kΩ
				SVR	45 dB	55 dB	R_G = 0, f(ripple) = 100 Hz, V(ripple) = 0.5 V

Audio ICs (cont)

High Power Amplifiers

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1225H	Stereo set receiver	Power amplifier driver for 30 to 50 W	±25 to ±36	T_a = 25°C, V_{CC} = ±36 V, A_v = 40 dB			12-pin SIP
				I_{CC}	20 to 40 mA		
				V_{OFF}	−100 to 5 to 100 mW		
				V_{OM}	20 to 23 V	THD = 0.05%	
				A_{vo}	80 to 95 dB	V_O = 1.5 V	
				SVR	55 to 70 dB	R_G = 2 kΩ, f = 100 Hz	
μPC1270H	Stereo set receiver	Power amplifier driver for 30 to 50 W	±18 to ±36	T_a = 25°C, V_{CC} = ±36 V, A_v = 30 dB, f = kHz			12-pin SIP
				I_{CC}	20 to 40 mA		
				V_{OFF}	−100 to 5 to 100 mV		
				V_{OM}	20 to 23 V	THD = 0.05%	
				A_{vo}	80 to 95 dB	V_O = 1.5 V	
				SVR	55 to 70 dB	R_G = 2 kΩ, f = 100 Hz	
μPC1298V	Stereo set receiver	Power amplifier driver for 50 to 80 W	±36 to ±46	T_a = 25°C, V_{CC} = ±46 V, A_v = 30 dB, f = kHz			14-pin V-DIP
				I_{CC}	20 to 40 mA		
				V_{OFF}	−50 to 5 to 50 mV		
				V_{OM}	25 to 28 V	THD = 0.05%	
				A_{vo}	80 to 95 dB	V_O = 1.5 V	
				SVR	55 to 70 dB	R_G = 2 kΩ, f = 100 Hz	
μPC1237H	Stereo set receiver	Power amplifier protector	25 to 60	T_a = 25°C, V_{CC} = ±45 V			7-pin SIP
				V_{th}+	0.54 to 0.62 to 0.7 V	No. 6 pin on	
				V_{th}−	−0.12 to −0.17 to −0.23 V	No. 6 pin on	
				I_{Gmax}	80 mA	For relay	

Tape Recorders

Part Number	Use	Description	Electrical Characteristics			Package Information
μPC1210C	Cassette tape recorder	Dolby-B™ type noise reduction (Note 1)	T_a = 25°C, V_{CC} = 12 V, dolby level = 580 mV			16-pin DIP
			I_{CC}	7 to 13.5 to 20 mA		
			A_v	15.5 to 17.0 dB	Encode	
			V_{om}	12 to 16 dB	THD = 0.5%, R_L = 2 kΩ	
			THD	0.05 to 0.2%	0 dB, R_L = 2 kΩ	
				0.05 to 0.3%	10 dB, R_L = 2 kΩ	
			S/N	63 to 67 dB	R_G = 10 kΩ, encode	
			R_i	100 kΩ		

Dolby is a trademark of Dolby Laboratories Licensing Corporation.

Audio ICs (cont)

Tape Recorders [cont]

Part Number	Use	Description	Electrical Characteristics			Package Information
μPC1284G	Car stereo set	2 channel Dolby-B type noise reduction	T_a = 25°C, V_{CC} = 8 V, dolby level = 450 mV			20-pin flatpack
			I_{CC}	20 to 29 mA		
			A_V	25 to 26.5 to 28 dB	NR off, V_o = 0 dB	
			V_{om}	12 to 13 dB	THD = 0.5%, V_{CC} = 7.5 V	
			THD	0.05 to 0.2%	V_O = 0 dB	
				0.1 to 0.3%	V_O = +10 dB	
			S/N	65 to 70 dB	R_G = 10 kΩ (CCIR/ARM)	
			SVR	34 dB	f(ripple) = 100 Hz, R_G = 10 kΩ, NR off	
			R_i	50 to 65 kΩ		
			CT	50 to 53 dB	V_O = 0 dB, other channel, R_G = 10 kΩ	
μPC1290C	Stereo cassette tape recorder	2 channel head SW	T_a = 25°C, V_{CC} = 9 V			14-pin DIP
			I_{CC1}	2 mA	SW off	
			I_{CC2}	15 mA	SW on	
			R_R	5 to 10 Ω	I_R = ±1 mA	
			R_P	10 to 20 Ω	I_P = ±1 mA	
			V_{inp}	100 V_{pp}	f = 100 kHz	
μPC1297CA	Stereo cassette tape recorder	2 channel Dolby HX PRO™ circuit	T_a = 25°C, V_{CC} = 15 V			18-pin S-DIP
			I_{CC}	7 mA		
			I_{BIAS}	12 to 16 to 20 mA		
			V_{ST}	4.1 to 4.4 to 4.7 V		

HX PRO is a trademark of Dolby Laboratories Licensing Corporation.

AM Tuners

Part Number	Use	Description	Supply Voltage [V]	Electrical Characteristics			Package Information
μPC1215V	Car radio receiver, car stereo set	Mixer, oscillator, IF amplifier, detector, AGC amplifier, OSC buffer amp, and on channel det	8 to 15	T_a = 25°C, V_{CC} = 10 V, f = 1 MHz, f_{mod} = 400 Hz, m = 30%			19-pin V-DIP
				I_{CC}	10 to 14 to 21 mA	V_i = 0	
				MS	14 to 21 to 28 dBμV	V_o = 30 mV	
				S/N	8 to 13 dB	V_i = 21 dBμV	
				V_O	70 to 100 to 130 mV	V_i = 74 dBμV	
				THD	0.5 to 1.0%	V_i = 120 dBμV	
				$V_{19\text{-}L}$	0.5 V	V_i = 0 dBμV, R_L = 18 kΩ	
				$V_{19\text{-}H}$	8 V	V_i = 74 dBμV, R_L = 18 kΩ	

Audio ICs (cont)

AM Tuners [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1216V2	Car radio receiver, car stereo set	RF amplifier, mixer, oscillator, IF amplifier, detector and AGC amplifier	9 to 16	T_a = 25°C, V_{CC} = 13 V, f = 1 MHz, f_{mod} = 400 Hz, m = 30%			19-pin V-DIP
				I_{CC}	10.5 to 15 to 19.5 mA	V_i = 0	
				MS	13 to 20 dBμV	V_O = 40 mV	
				S/N	15 to 20 dB	V_i = 23 dBμV	
				V_O	110 mV	V_i = 74 dBμV	
				THD	0.4 to 3%	V_i = 126 dBμV	
μPC1248V	Car radio receiver, car stereo set	RF amplifier, mixer, oscillator, IF amplifier, detector, AGC amplifier, OSC buffer amp and on channel det	7 to 16	T_a = 25°C, V_{CC} = 8 V, f = 1 MHz, f_{mod} = 400 Hz, m = 30%			19-pin V-DIP
				I_{CC}	10 to 16 to 22 mA	V_i = 0	
				MS	10 to 17 to 24 dBμV	V_O = 25 mV	
				S/N1	16 to 20 dB	V_i = 26 dBμV	
				S/N2	47 to 52 dB	V_i = 74 dBμV	
				THD	0.8 to 2.0%	V_i = 125 dBμV	
				$V_{19\text{-}L}$	0.5 V	V_i = 0 dBμV, R_L = 22 kΩ	
				$V_{19\text{-}H}$	7 V	V_i = 74 dBμV, R_L = 22 kΩ	
μPC1296G	Car radio receiver, car stereo set	RF amplifier, mixer oscillator, osc. buffer amp, IF amplifier, detector, AGC circuit, single meter circuit, AGC clear circuit, LO/DX switch	9 to 16	T_a = 25°C, V_{CC} = 13 V, f = 1 MHz, f_{mod} = 400 Hz, m = 30%, R_L = 10 kΩ			24-pin miniflat
				I_{CC}	16 to 22 to 30 mA	V_i = 0 dBμV	
				MS	10 to 16 to 22 dBμV	V_O = 40 mV	
				S/N1	15 to 19 dB	V_i = 24 dBμV	
				S/N2	47 to 52 dB	V_i = 74 dBμV	
				V_{OAF}	110 to 150 to 180 mV	V_i = 74 dBμV	
				THD1	0.4 to 1.0%	V_i = 74 dBμV	
				THD2	0.6 to 3.0%	V_i = 126 dBμV	
				SS1	17 to 23 to 29 dBμV	V_{24} = 5 V, SD_{out} = 0.5 V_{pp}	
				SS2	42 to 48 to 54 dBμV	V_{24} = 1.6 V, SD_{out} = 0.5 V_{pp}	
				V_{S1}	0.1 to 0.5 V	V_i = 0 dBμV	
				V_{S2}	1.4 to 2.0 to 2.6 V	V_i = 40 dBμV	
				V_{S3}	4.2 to 5.2 to 6.2 V	V_i = 74 dBμV	

RF IF Amplifiers

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC577H	IF amplifier	Differential direct-coupled 3-stage amplifier	7 to 13	T_a = 25°C, V_{CC} = 10 V, R_L = 1 kΩ			7-pin SIP
				I_{CC}	8 to 12.5 to 17 mA		
				I_{OUT}	0.9 to 1.6 to 2.3 mA		
				A_v	60 to 66 to 72 dB	f = 10.7 MHz	
				A_i	4.4 to 5.1 to 5.8 V		

Audio ICs (cont)

RF IF Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1018C	Portable FM/AM radio receiver, cassette-recorder, stereo set	AM block: RF amplifier, mixer, oscillator, AGC circuit. FM block: 2-stage IF amplifier and 3-stage direct coupled differential amplifier	2.5 to 6.0	T_a = 25°C, V_{CC} = 4 V			16-pin DIP
				I_{CC} (AM)	4.5 to 8.0 to 11.5 mA	AM	
				A_V (MIX)	7.5 to 11.5 to 15.5 dB	AM-MIX	
				A_V (IF)	44 to 50 to 56 dB	AM-IF	
				I_{CC} (FM)	5 to 9 to 13 mA	FM	
				A_V (F1)	38 to 42 to 46 dB	FM-IF1	
				A_V (F2)	27 to 33 to 39 dB	FM-IF2	
μPC1222C	Portable FM/AM radio receiver, cassette tape recorder, stereo set	AM tuner, AM/FM IF amplifier, AM/FM detector	V_{CC} = 2 to 6	T_a = 25°C, V_{CC} = 4 V, $f_{(mod)}$ = 400 Hz			16-pin DIP
					AM; f = 1 MHz, mod = 30% FM; f = 10.7 MHz, f(div) = 22.5 kHz		
				FM stage			
				I_{CC}	6.5 to 10 to 15 mA	V_i = 0	
				V_O	35 to 50 to 70 mV	V_i = 80 dBμV	
				V_i	33 to 39 to 45 dBμV	Limiting sensitivity	
				S/N	50 to 60 dB	V_i = 80 dBμV	
				THD	to 0.2 to 0.8%	V_i = 80 dBμV	
				AMR	25 to 35 dB	V_i = 80 dBμV, m = 30%	
				V_i	1.5 to 5 dB	V_{CC} = 4 to 2 V, V_O = 5 mV	
				AM stage			
				I_{CC}	6 to 12 to 18 mA	V_i = 0	
				V_i	28 to 35 to 42 dBμV	V_O = 10 mV	
				V_O	25 to 34 to 50 mV	V_i = 100 dBμV	
				S/N	45 to 51 dB	V_i = 100 dBμV	
				V_{osc}	150 mV	f_{osc} = 1,455 kHz	
				THD	0.5 to 2%	V_i = 100 dBμV	
				V_i	5 to 10 dB	V_{CC} = 4 to 2 V, V_O = 10 mV	
μPC1262G	Portable FM/AM radio receiver, cassette tape recorder	AM tuner, AM/FM IF amplifier, AM/FM detector	1.8 to 5	T_a = 25°C, V_{CC} = 3 V			20-pin flatpack
				FM stage: f = 10.7 MHz, Δf = 22.5 kHz Dev			
				I_{CC}	7.8 to 12 to 17 mA	V_i = 0	
				V_O	34 to 48 to 67 mV	V_i = 80 dBμV	
				$V_{i\ (lim)}$	33 to 39 to 45 dBμV		
				S/N	53 to 63 dB	V_i = 80 dBμV	
				THD	0.2 to 0.8%	V_i = 80 dBμV	
				AMR	30 to 35 dB	V_i = 80 dBμV	

Audio ICs (cont)

RF IF Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1262G (cont)	Portable FM/AM radio receiver, cassette tape	AM tuner, AM/FM IF amplifier, AM/FM detector	1.8 to 5	T_a = 25°C, V_{CC} = 3 V			20-pin flatpack
				AM Stage: f = 1 MHz, mod = 30%, f_{mod} = 400 Hz			
				I_{CC}	8 to 13 to 18 mA	V_i = 0	
				MS	28 to 35 to 42 dBμV	V_O = 10 mV	
				V_O	28 to 38 to 55 mV	V_i = 100 dBμV	
				S/N	44 to 50 dB	V_i = 100 dBμV	
				THD	0.5 to 2.0%	V_i = 100 dBμV	
μPC1028H μPC1028HA	Car stereo set, car radio receiver, home stereo	Direct-coupled 3-stage IF amplifier and detector	8 to 15	T_a = 25°C, f = 10.7 MHz, f_{mod} = 400 Hz, Δf = ±22.5 kHz Dev, V_{CC} = 10 V			7-pin SIP
				I_{CC}	8 to 12 to 16 mA	V_i = 0	
				A_V	67 dB		
				$V_{i\ (lim)}$	41 to 48 to 55 dB	V_O = −3 dB	
				AMR	25 to 40 dB	V_i = 80 dBμV, AM = 30%	
				V_{ODET}	110 to 165 to 210 mV	V_i = 80 dBμV	
				THD	0.1 to 0.5%	V_i = 80 dBμV	
				S/N	65 dB	V_i = 80 dBμV	
μPC1163H	IF amplifier	Differential 1-stage amplifier	10 to 15	T_a = 25°C, V_{CC} = 12 V, R_L = 1 kΩ			7-pin SIP
				I_{CC}	3.6 mA		
				I_{out}	2.1 mA		
				A_V	30 dB	f = 10.7 MHz	
μPC1211V	Car stereo set, car radio receiver, home stereo set	Direct coupled 3-stage IF amplifier, PLL detector, muting circuit, AGC circuit, AFC circuit, tuning meter circuit and station detector	7.5 to 12	T_a = 25°C, V_{CC} = 9 V, f = 10.7 MHz, f_{mod} = 400 Hz, Δf = ±75 kHz Dev			19-pin V-DIP
				I_{CC}	15 to 23 to 31 mA	V_i = 30 dBμV	
				$V_{i\ (mute)}$	31 to 41 to 51 dBμV	V_O = −3 dB	
				ATT (mute)	20 to 40 to 60 dB	V_i = $V_{i(mute)}$ −10 dBμV	
				V_O	180 to 250 to 350 mV	AM = 30%	
				AMR	45 to 55 dB	V_i = 100 dBμV	
				THD	0.1 to 0.5%	V_i = 100 dBμV	
				S/N1	52 dB	V_i = 30 dBμV	
				S/N2	70 to 82 dB	V_i = 100 dBμV	
				V_{AFC}	5.25 V	V_i = 0 dBμV	

Audio ICs (cont)

RF IF Amplifiers [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1245V	Car stereo set, car radio receiver, home stereo set	Direct coupled 3-stage IF amplifier, peak detector, muting circuit, AGC circuit, AFC circuit, tuning meter circuit and station detector	7 to 15	$T_a = 25°C$, $V_{CC} = 10$ V, f = 10.7 MHz, $f_{mod} = 400$ Hz, $\Delta f = \pm 22.5$ kHz Dev			19-pin V-DIP
				I_{CC}	12 to 18 to 25 mA	$V_i = 0$	
				V_i(lim)1	38 to 44 to 50 dBμV	$V_O = -3$ dB, mute off	
				V_i(lim)2	42 to 50 to 58 dBμV	$V_O = -3$ dB, mute on	
				V_O	85 to 130 to 175 mV	$V_i = 80$ dBμV	
				AMR	30 to 42 dB	$V_i = 80$ dBμV	
				THD	0.1 to 0.5%	$V_i = 80$ dBμV	
				S/N	60 to 67 dB	$V_i = 80$ dBμV	
				V_{AFC}	4.6 to 5.2 to 5.8 V	$V_i = 80$ dBμV	
μPC1265G	Car stereo set, car radio receiver	Differential 5-stage IF amplifier, peak detector, muting circuit, AGC circuit, AFC circuit, tuning meter circuit and station detector	7.5 to 10	$T_a = 25°C$, $V_{CC} = 8.5$ V, f = 83 MHz, $f_{mod} = 400$ Hz, $\Delta f = \pm 22.5$ kHz Dev			28-pin flatpack
				I_{CC}	31 to 42 mA	$V_i = 0$	
				$V_{i(lim)}$	33 to 43 to 53 dBμV	$V_O = V_{OAF} - 3$ dB	
				V_O	90 to 140 to 185 mV	$V_i = 100$ dBμV	
				AMR	28 to 40 dB	$V_i = 100$ dBμV	
				THD	0.2 to 1.2%	$V_i = 100$ dBμV	
				S/N1	25 to 30 dB	$V_i = 45$ dBμV	
				S/N2	58 to 65 dB	$V_i = 100$ dBμV	

FM Multiplex Stereo Demodulators

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC587C2	Car stereo set, home stereo, FM tuner	Stereo demodulator, PLL system: VCO, phase detector, divider, DC amplifier. Stereo indicator driver	7 to 15	$T_a = 25°C$, $V_{CC} = 10$ V, f = 1 kHz, $V_i = 300$ mV			14-pin DIP
				I_{CC}	7 to 13 to 18 mA		
				Sep	35 to 45 dB	f = 1 kHz	
					−9 to −6 dB		
				Ch. B	−1.5 to 0 to 1.5 dB		
				THD	0.07 to 0.5%	Monaural	
				Lamp-on	12 to 16 to 20 mV	Pilot level	
				R_i	50 kΩ		
				CR	±1.5 to ±3%		

Audio ICs (cont)

FM Multiplex Stereo Demodulators [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1026C	Car stereo set, home stereo, FM tuner	Stereo demodulator, PLL system: VCO, phase detector, divider, DC amplifier. Stereo indicator driver	7 to 16	T_a = 25°C, V_{CC} = 10 V, f = 1 kHz, V_i = 150 mV			14-pin DIP
				I_{CC}	7 to 13 to 18 mA		
				Sep	35 to 45 dB	f = 1 kHz	
				A_V	−4.5 to 1.5 to 2 dB		
				Ch. B	−1.5 to 0 to 1.5 dB		
				THD	0.15 to 0.5%		
				Lamp-on	5 to 8 to 11 mV	Pilot level	
				R_i	50 kΩ		
				CR	±1.5 to ±3%		
μPC1161C3	Home stereo set, FM tuner	Stereo demodulator, PLL system: VCO, phase detector, divider, DC amplifier. Stereo/monaural switch, stereo indicator driver, post amplifier	9 to 15	T_a = 25°C, V_{CC} = 12 V, f = 1 kHz, V_i = 300 mV			16-pin DIP
				I_{CC}	12 to 20 to 30 mA		
				Sep	45 to 55 dB	f = 1 kHz	
				A_V	9 to 13 to 17 dB		
				Ch. B	±1.5 to 0 to +1.5 dB		
				THD	0.01 to 0.1%		
				Lamp-on	6 to 12 to 20 mV		
				S/N	76 to 82 dB		
				CR	±1.5 to ±3%		
μPC1197C	Portable radio receiver	Stereo demodulator, PLL system: VCO, phase detector, divider, DC amplifier. Stereo/monaural switch, stereo indicator driver	4 to 16	T_a = 25°C, V_{CC} = 9 V, V_i = 200 mV, L = 45%, R = 45%, pilot = 10%			16-pin DIP
				I_{CC}	7 to 12 to 16 mA	V_i = 0	
				Sep	40 to 55 dB	f = 1 kHz	
				THD	0.3 to 0.5%	V_i = 200 mV, monaural	
					0.2 to 0.5%	V_i = 200 mV, stereo	
				V_O	120 to 170 to 240 mV	V_i = 200 mV, monaural	
				Ch. B	−2 to 0 to 2 dB	V_i = 200 mV, monaural	
				Lamp-on	4 to 8 to 12 mV	V_i = pilot	
				Hys	4 dB	V_i = pilot 4	
				CR	±1.5 to ±4%	V_i (pilot) = 20 mV	
				V_i (max)	500 mV	THD = 2%	
				S/N	86 dB	V_i = 200 mV	

Audio ICs (cont)

FM Multiplex Stereo Demodulators [cont]

Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics			Package Information
μPC1227V	Car stereo set, home stereo, FM tuner	Stereo demodulator, PLL system: VCO, phase detector, divider, DC amplifier. Stereo/monaural switch, stereo indicator driver	6 to 14	T_a = 25°C, V_{CC} = 8 V, f = 1 kHz, V_i = 300 mV			19-pin V-DIP
				I_{CC}	12 to 20 to 28 mA		
				Sep	40 to 55 dB	f = 1 kHz	
				A_V	−3.5 to −0.6 to 2.5 dB		
				Ch. B	−2.0 to 0 to 2.0 dB		
				THD	0.05 to 0.3%		
				Lamp-on	4 to 8 to 12 mV	Pilot level	
				R_i	50 kΩ		
				CR	±2 to ±4%		
				S/N	70 to 80 dB		
μPC1223C	Home stereo set, FM tuner	Stereo demodulator, PLL system: VCO, phase detector, divider, DC amplifier. stereo indicator driver, stereo/monaural switch, pilot signal cancel	9 to 15	T_a = 25°C, V_{CC} = 13 V, V_{in} = 400 mV			22-pin DIP
				I_{CC}	15 to 23 to 36 mA		
				Sep	50 to 63 dB	f = 1 kHz	
				A_V	6.5 to 9 to 11.5 dB		
				Ch. B	−0.8 to 0 to 0.8 dB		
				THD	0.006 to 0.02%	Monaural	
				Lamp-on	7 to 13 to 20 mV		
				S/N	90 to 97 dB		
				CR	±1.5 to ±3%		
				19 kHz Rej	72 to 82 dB	Sine wave	
μPC1235C	Home stereo set, FM tuner	Stereo demodulator, PLL system: VCO, phase detector, divider, DC amplifier, Stereo indication driver, stereo/ monaural switch	9 to 15	T_a = 25°C, V_{CC} = 12 V, V_{in} = 300 mV			16-pin DIP
				I_{CC}	12 to 20 to 30 mA		
				Sep	45 to 55 dB	f = 1 kHz	
				A_V	8 to 12 to 16 dB		
				Ch. B	−1.5 to 0 to 1.5 dB		
				THD	0.02 to 0.08%	Monaural	
				Lamp-on	6 to 12 to 20 mV		
				S/N	81 to 89 dB		
				CR	±1.5 to ±3%		

TV ICs

Application	Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics		Package Information
Channel selector	μPC574J	Voltage stabilizer	33 V voltage stabilizer	—	Stabilized voltage	33 V ±2 V	2-pin TO-92
					Temperature drift	±1 mV/°C	
	μPC1362C	12 channel select	LED, neon indicate, initial channel settable	12	Supply current	I_{CC} = 5 mA	20-pin DIP
					Output saturation voltage	I_K = 5 mA, V_{sat} = 40 mV typ	
	μPC1363CA	16 channel select	LED, neon indicate, initial channel settable	12	Supply current	I_{CC} = 15 mA	S-DIP
					Output saturation voltage	I_K = 15 mA, V_{sat} = 40 mV typ	
DTS interface	μPC1484CA μPC1485CA	DTS interface for VCR	33 V voltage stabilizer, 4 band decoder and driver, error amp, H.OSC and H.SYNC detector	8.1 to 13.2	Supply current	11 mA typ	S-DIP
					Zener stabilized voltage	33 V ± 2 V	
					Band output saturation voltage	0.3 V typ	
	μPC1486C μPC1487C	DTS interface for TV	33 V voltage stabilizer, 4 band decoder and driver, error amp, H.SYNC detector	8.1 to 13.2	Supply current	6 mA typ	16-pin DIP
					Zener stabilized voltage	33 V ±2 V	
					Band output saturation voltage	0.3 V typ	
PIF	μPC1366C2	PIF process for B/W TV	IF amp, IF AGC, RF AGC, picture detector	9 to 15	Input sensitivity	30 dBμ typ	14-pin DIP
					Picture output voltage	1.5 V_{pp} typ	
					Maximum input voltage	100 dBμ min	
					Picture detector band width	5.5 MHz min	
	μPC1356C2	PIF process for color TV	IF amp IF AFT detector, IF AGC, RF AGC, picture detector	10 to 15	Input sensitivity	30 dBμ typ	22-pin DIP
					Maximum input voltage	100 dBμ typ	
					Signal to noise ratio	55 dB typ	
					AFT band width	1.5 MHz typ	
SIF	μPC1353C	Sound detector and power amp	SIF amp, peak differential detector, DC attenuator, power amp	9 to 15	Input sensitivity	46 dBμ typ	14-pin DIP
					AM rejection	−50 dB typ	
					DC control maximum attenuation	−80 dB typ	
					Output power (V_{CC} = 12 V)	1.2 W typ	
					Overall THD (P_O = 0.5 W)	1.5% typ	
	μPC1391HA	Sound detector for multi-sound TV	SIF amp, quadrature detector	9 to 15	Input sensitivity	46 dBμ typ	8-pin SIP
					Detector output voltage	200 mVrms typ	
					Output THD	0.2% typ	
					AM rejection	−55 dB typ	

TV ICs (cont)

Application	Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics		Package Information
SIF (cont)	μPC1382C	Sound detector and DC attenuator	SIF amp., quadrature detector, DC attenuator (soft curve), SRPP output driver	9 to 15	Input sensitivity	46 dBμ typ	14-pin DIP
					Detector output voltage	600 mVrms typ	
					Output THD	0.2% typ	
					AM rejection	−55 dB typ	
					DC control maximum attenuation	−75 dB typ	
					DC attenuator control voltage	0 to 5 V	
	μPC1406HA	DC attenuator	DC attenuator x 2 regulator	8 to 15	Circuit current	10.5 mA typ	9-pin SIP
					Channel separation	64 dB typ	
					THD	0.5% typ	
Luminance Chrominance Interface	μPC1352C	NTSC system, luminance, chrominance	Automatic color killer, automatic control of color and tint	12 V typ 12 V ±20%	Luminance input level 1 V_{pp} Chrominance input level	DC restored 75%	28-pin DIP
	μPC1372C				150 mV_{pp} (burst) RGB output level 3 V_{pp}	DC restored 100%	28-pin DIP
	μPC1365C3	PAL system, (NTSC system), luminance, chrominance	Dual (tripple) system, PAL (NTSC)/SECAM, automatic system SW of PAL/SECAM, IH delay line using commonly	12 V typ 12 V ±20%	Luminance input level 1 V_{pp} Chrominance input level	DC restored 100% R/B = 0.56 Changing black level by contrast 0 mV	28-pin DIP
	μPC1384C				100 mV_{pp} (burst) RGB output level 3 V_{pp}	DC restored 75% R/B = 0.78 Changing black level by contrast 400 mV	28-pin DIP
	μPC1364C2	SECAM system, chrominance			Chrominance input level	200 mV_{pp} (burst)	28-pin DIP
					RGB output level	3 V_{pp}	
					Crosstalk level	43 dB	
	μPC1397C	RGB interface, TEL text, video test system	Analog input system, white peak level clipper	12 V typ 12 V ±10%	Analog (digital) input level 1 V_{pp}/75 Ω terminated		22-pin DIP
	μPC1417CA		Analog and digital input system		Analog input level	1 V_{pp}/75 Ω terminated	28-pin S-DIP
					Digital input level	TTL level	
MPX	μPC1480CA	US multisound, decoder	Pre-amp, stereo-decoder, SAP-detector, stereo-matrix	8 to 13.2 V	L+R, L−R, SAP output level	430 mVrms typ	30-pin S-DIP
					L, R matrix output level	500 mVrms typ	
					Standard input level (100% modulation)	30 mVrms (pilot)	
	μPC1481CA	US multisound, dbx™ NR decoder	50P-amps, 2 VCAs, 2 RMSs, regulator	8 to 15 V	Standard input level (no gain)	10 mVrms, 300 Hz	28-pin S-DIP
					Noise level	−96 dBV typ	
					Distortion	0.1% typ	

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TV ICs (cont)

Application	Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics		Package Information
Deflection	μPC1031H2	Vertical deflection for B/W TV and small size color TV	Vertical oscillator, sawtooth shaper, vertical output	12 V typ	Circuit current	30 mA typ	10-pin SIP
					Vertical oscillation frequency	50/60 Hz typ	
					Free-running frequency	60 Hz typ	
	μPC1379C	B/W TV and small size color TV	Vertical and horizontal deflection circuit	12 V typ	Power supply current for vertical part	85 mA typ	16-pin DIP
					Power supply current for horizontal part	12 mA typ	
					Vertical free-running frequency	50 Hz typ	
	μPC1377C	Synchronization signal processor of color TV	Hand V synch. separator vertical and horizontal deflection circuit	12 V typ	Power supply current for horizontal part	14 mA typ	22-pin shrink DIP
					Power supply current for vertical part	15 mA typ	
					Vertical free-running frequency	50 Hz typ	
	μPC1378H	Vertical output of color TV	Vertical output, voltage booster	24 V typ	Deflection current	1.2 A typ	7-pin SIP
					Middle voltage of deflection output	11.5 V typ	
Regulator	μPC1394C/G	Switching regulator control	Error amplifier, comparator, current limiter	6.6 V (shunt reg)	Supply voltage	6.6 V typ	14-pin DIP/ miniflat
					Output drain current	−5.0 mA typ	
					Synchronizing oscillation frequency	15.75 kHz typ	
PIF and SIF	μPC1414CA	PIF and SIF for B/W TV	PIF amp, AGC picture detector, SIF amp., DC ATT, quadrature detector	8 to 13 V	Circuit current	45 mA typ	30-pin shrink DIP
					Input sensitivity (PIF)	30 dBμ typ	
					Input sensitivity (SIF)	46 dBμ typ	
	μPC1411CA	PIF and SIF for color TV	PIF amp, AGC, picture detector, SIF amp, DC quadrature detector	8 to 13 V	Circuit current	30 mA typ	30-pin shrink DIP
					Input sensitivity (PIF)	30 dBμ typ	
					Input sensitivity (SIF)	46 dBμ typ	
Luminance, Chrominance and Deflection	μPC1401CA μPC1402CA μPC1409CA	NTSC system, luminance, chrominance, deflection	Automatic color killer, automatic control of color and tint, automatic control of V-hold and H-hold	12 V typ 12 V ±1 V	Video input signal level	1 V_{pp}	42-pin shrink DIP
					Chrominance input signal level	200 mV_{pp}	
					Chroma demodulation output ratio	R-Y/B-Y 0.75 typ, G-Y/B-Y 0.25 typ	
					Chroma demodulation angle	LR-Y 98° typ, LG-Y 240° typ	
	μPC1420CA μPC1421CA	PAL/NTSC system, luminance, chrominance, deflection			Video input signal level	1 V_{pp}	16-pin shrink DIP
					Chrominance input signal level	200 mV_{pp}	
					Chroma demodulator output ratio	R-Y/B-Y 0.6 typ, G-Y/B-Y 0.37 typ	
					Chroma demodulation angle	LR-Y 90° typ, LG-Y 233° typ	

VTR ICs

Application	Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics		Package Information
Video	μPC1521HA	Video signal playback pre-amp	2 channel pre-amps, head switch, output buffer	5 V typ 4.5 to 5.5 V	Voltage gain	55.5 dB typ	9-pin SIP
					Frequency response	10 MHz min	
					Equivalent input noise voltage	1.5 μVrms typ	
	μPC1522HA	Video signal recording amp	Chroma/luminance mixer, rec amp, head driver	9 V typ 8 to 10 V	Recording current	15 mApp/ch typ	9-pin SIP
					2nd harmonic distortion	−45 dB typ	
					Cross modulation distortion	−50 dB typ	
	μPC1524C	Video signal processor (I)	Video amp (AGC), EE amp (squelch SW), FM limit/demo d. deemph, N.C., C/L mixer	9 V typ 8 to 10 V	FM demodulator sensitivity	0.26 V/MHz typ	28-pin DIP
					FM demodulator linearity	0% typ	
					P.B. chroma gain	16.5 dB typ	
	μPC1534C	Video signal processor (II)	Pre-amp., RF AGC, DOC main/dynamic pre-emph, W/D clip, FM mod, rec amp	9 V typ 8 to 10 V	Pre amp gain	61.8 dB typ	28-pin DIP
					AGC amp gain	26.5 dB typ	
					Rec amp gain	20.5 dB typ	
	μPC1536C	Color signal processor	Rec/PB main conv, sub conv, killer amp, ACC, 160 f_H VCO, 3.58 MHz VCO, 4-phase sifter	9 V typ 8 to 10 V	Supply current	70 mA typ	28-pin DIP
					ACC control range	15 to 450 mV_{pp} typ	
					Burst emphasis gain	6 dB typ	
	μPC1517CA	Compensation skew response	Video AM modulator/demo, 1/2 H DL drive, clamp, $2f_H$ VCO with AFC	5 V typ 4.7 to 5.3 V	Supply current	15 mA/34 mA	22-pin shrink DIP
					Video output voltage	2.0 V_{pp} typ	
Audio	μPC1513HA	Audio head SW	Audio head switches	9 V typ 4.5 to 14.4 V	Supply current	2 mA max	7-pin SIP
					High voltage head SW	130 V_{pp} max	
					Low operating resistor	5 Ω max	
	μPC1533HA	Audio head & bias OSC SW	Audio head switches, bias oscillator switch	9 V typ 4.5 to 14.4 V	High voltage head SW	130 V_{pp} max	9-pin SIP
					Low operating resistor	5 Ω max	
					OSC driving current (sink)	3 mA min	
	μPC1514CA	Audio signal processor	Line amp with AGC P.B. rec equalizer, mute amps	9 V typ 5 to 12 V	Equivalent input noise voltage	−127 dBV typ	18-pin shrink DIP
					Attaching time	5 ms typ	
					Output power (R_L = 100 Ω)	57 mW typ	
	μPC1520CA	Audio signal processor & equalizer SWs	Line amp. with AGC P.B. rec. equalizer, mute amps. equalizer SWs	9 V typ 5 to 11 V	Low operating resistor (equalizer SW)	13 Ω typ	22-pin shrink DIP
					Equivalent input noise voltage	−127 dB typ	
					Output power (R_L = 100 Ω)	57 mW typ	
FM audio	μPC1522HA	FM audio signal recording amp	L/R channels mixer, rec amp, head driver	9 V typ 8 to 10 V	Recording current	15 mA_{pp}/ch typ	8-pin SIP
					2nd harmonic distortion	−45 dB typ	
					3rd harmonic distortion	−50 dB typ	

VTR ICs (cont)

Application	Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics		Package Information
FM audio (cont)	μPC1531HA	FM audio signal playback pre-amp	L channel pre-amp R channel pre-amp	5 V typ 4.5 to 5.5 V	Voltage gain	56 dB typ	9-pin SIP
					Frequency response	10 MHz min	
					Equivalent input noise voltage	1.5 μVrms typ	
	μPC1540CA	FM audio signal processor	Line amp (AGC), clip FM mod/demo, pre-amp limit, DOC, PB amp	5 V typ 4.8 to 5.5 V	Dynamic range	95 dB max	30-pin shrink DIP
					S/N ratio	90 dB max	
					Voltage gain (pre-amp/limiter)	(30 dB/70 dB)	
Servo	μPC1504C	Cylinder servo	PG/FG high sens amp, schmitt, mono multi x 4 TPZ waveformer, CTLOSC	9 V typ to 12 V	Supply current	12 mA	22-pin DIP
					FG frequency	240 Hz	
					PG/FG input	±30/±40 mV	
	μPC1505C	Capstan servo (NTSC 2H/4H/6H)	High gain CTL amp, capstan phase control, capstan speed control, FG/CTL signal dividing ratio control	9 V typ to 12 V	Supply current	12 mA typ	22-pin DIP
					FG frequency	1440/720/480 Hz	
					CTL amp gain	70 dB typ	
	μPC1525C	Capstan servo (NTSC 2H/4H, PAL3H)		9 V typ to 12 V	Supply current	12 mA typ	22-pin DIP
					FG frequency	720/360/240 Hz	
					CTL amp gain	70 dB typ	
	μPC1526C	Capstan servo (PAL 3H/6H)		9 V typ to 12 V	Supply current	12 mA typ	22-pin DIP
					FG frequency	1200/600 Hz typ	
					CTL amp gain	70 dB typ	
	μPC1515CA	Compensating capstan gain (NTSC)	Cylinder error amp, capstan error amp with with gain control	5 V typ 4.0 to 6.0 V	Supply current	3.8 mA typ	14-pin shrink DIP
					Capstan gain switching modes	27 modes	
					Variable total gain	More than 0 dB	
	μPC1516CA	Compensating capstan gain (PAL)		5 V typ 4.0 to 6.0 V	Supply current	3.8 mA typ	14-pin shrink DIP
					Capstan gain switching modes	27 modes	
					Variable total gain	More than 0 dB	
	μPC1503C	Index for playback/recording	Write amp/driver, read amp, schmitt/delay ckt, output buffer	V_{CC} 5 V typ V_B 9 V typ V_{CC} 4.5 to 14.4 V V_B 10 to 24 V	Supply current	4 mA typ	16-pin DIP with TAB
					Voltage gain (read amp)	72 dB typ	
					Maximum output voltage (write amp)	16 V_{pp} typ	
	μPD6110CA	Fine slow control	Capstan control, video head amp control, building vertical sync	5 V typ 4.5 to 5.5 V	Supply current	2 mA typ	42-pin shrink DIP
					CTL input level	0.3 V_{pp} min	
					CLK frequency	3.58/4.43 MHz	

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VTR ICs (cont)

Application	Part Number	Use	Description	Supply Voltage (V)	Electrical Characteristics		Package Information
Servo (cont)	μPC6111G	One-chip servo control	Cylinder/capstan control, compensating gain/fine slow-controls	5 V typ 4.5 to 6.3 V	Supply current	20 mA min	64-pin flatpack
					PG/FG input level	30 to 100 mV_{pp} typ	
					CLK frequency	3.58/4.43 MHz	
	μPC1246C/G	3 phase motor drive	Inputs comparator x 3, rotary direction SW, output driver x 3	12 V typ 9 to 15 V	Supply current	4.5 mA typ	16-pin DIP/ miniflat
					Input/output phase error	±5 deg max	
					Maximum output drive current	more than −50 mA, +37 mA	
RF modulator	μPC1527C	VHF RF modulator	Video clamp, white clip AM modulator, sound FM modulator, carrier OSC with SAW, channel select SW	5 V typ	Supply current	20 mA typ	16-pin DIP
					Differential gain (mod = 80%)	8% max	
					S/N ratio	50 dB min	

TV/VTR/Audio System Optional Devices

Application	Part Number	Description	Supply Voltage (V)	Electrical Characteristics		Package Information
On screen display	μPD6104C/G	12 alphanumeric characters (6x2), character set for 16 characters	5 V ±10%	Oscillation frequency	5.2 MHz max	16-pin DIP (μPD6104C) 16-pin miniflat (μPD6014G)
				Supply current	15 mA max	
	μPD6105C/G	70 alphanumeric characters (14x5), character set for 64 characters		Oscillation frequency	5.5 MHz max	22-pin DIP (μPD6105C) 24-pin miniflat (μPD6015G)
				Supply current	10 mA max	
	μPD6142C/G	288 alphanumeric characters (24x12), character set for 64 characters		Oscillation frequency	7.0 MHz max	16-pin DIP (μPD6142C) 16-pin miniflat (μPD6142G)
				Supply current	10 mA max	
IR remote control pre-amplifier	μPC1373HA	Active "low"	6 to 14.4 V	Supply current	3.5 mA max	8-pin SIP
	μPC1473HA	Active "low"	5 V ±10%	Supply current	3.5 mA max	8-pin SIP
	μPC1474HA	Active "low", immune to light interference	5 V ±10%	Supply current	3.5 mA max	9-pin SIP
	μPC1475HA	Active "high", immune to light interference	5 V ±10%	Supply current	3.5 mA max	9-pin SIP
	μPC1490HA	Active "low", on-chip band-pass filter	5 V ±10% (R_S = 0 Ω)	Supply current	2.5 mA max	8-pin SIP
				Supply voltage	11.0 to 13.0 V (R_S = 1.5 kΩ)	
	μPC1491HA	Active "high", on-chip band-pass filter	5 V ±10% (R_S = 0 Ω)	Supply current	2.8 mA max	8-pin SIP
				Supply voltage	11.0 to 13.0 V (R_S = 1.5 kΩ)	
IR remote control transmitter	μPD6120C	μPD1913C modification, 16-bit customer code, 20 keys	2.0 to 3.3 V	Oscillation frequency	400 to 500 kHz	16-pin DIP
				Supply current 1 (run)	1.0 mA max	
				Supply current 2 (standby)	1 μA max	
	μPD6121G	μPD1943C modification, 16-bit customer code, 32 keys				20-pin miniflat
	μPD6122G	μPD6102G modification, 16-bit customer code, 64 keys				24-pin miniflat
	μPD6125G/CA	Programmable remote control IC, ROM 1K steps (10 bit), RAM 32 words, I/O 12, input 4	2.0 to 6.0 V	Oscillation frequency	400 to 500 kHz	24-pin miniflat (μPD6125G) 24-pin shrink DIP (μPD6125CA)
				Supply current (run)	1.0 mA max	
				Supply current (OSC stop)	1 μA max	
	μPD6126G	Programmable remote control IC, ROM 1K steps (10 bit), RAM 32 words, I/O 15, input 4				28-pin miniflat
Real-time clock	μPD4990AC	μPD1990AC modification, sec, min, hour, week, month, year counter, automatic leap year counter	2.0 to 5.5 V	Oscillation frequency	32.768 kHz	14-pin DIP
				Supply current (V_{DD} = 5.5 V, no load)	100 μA max	
				Supply current (V_{DD} = 3.6 V, no load)	20 μA max	

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Digital Tuning Systems: μPD1700 Series

Type No.	μPD1701	μPD1703	μPD1704	μPD1705	μPD1706	μPD1707	μPD1708
Main use	Radio, tuner	Radio, tuner	Radio, tuner	TV, CATV	Portable radio, radio cassette	Hi-Fi tuner, TV, CATV	Car radio tunder
Package	28-pin DIP (400 mil)	28-pin DIP (400 mil)	42-pin DIP (600 mil)	42-pin DIP (600 mil)	64-pin flatpack	52-pin flatpack	52-pin flatpack
Supply voltage	5 V ±10%	5 V ±10%	5 V ±10%	5 V ±10%	3 V ±10%	5 V ±10%	5 V ±10%
Supply current (CPU)	500 μA typ	500 μA typ	600 μA typ	600 μA typ	85 μA typ	500 μA typ	400 μA typ
ROM	760 steps x 16 bits	760 steps x 16 bits	1016 steps x 16 bits	1016 steps x 16 bits	1148 steps x 16 bits	2040 steps x 16 bits	1528 steps x 16 bits
RAM	64 words x 4 bits	64 words x 4 bits	128 words x 4 bits	64 words x 4 bits	80 words x 4 bits	128 words x 4 bits	96 words x 4 bits
No. of commands	55	55	78	77	71	85	77
Display	LED (FIP)	FIP (LED)	FIP (LED)	FIP (LED)	LCD (1/3 duty)	FIP (LED)	LCD (1/2 duty)
Segment	7 (CMOS)	7 (P-ch open drain)	7 (P-ch open drain)	7 (P-ch open drain)	LCD driver incorporated Segment: 20 Common: 3	7 (P-ch open drain)	LCD driver incorporated Segment: 23 Common: 2
Digit	6	6	7	6		6	
Input port	5 (SD, K_0 to K_3)	5 (SD, K_0 to K_3)	5 (SD, K_0 to K_3)	4 (K_0 to K_3)	5 (SD, K_0 to K_3)	4 (K_0 to K_3)	4 (K_0 to K_3)
Output port	0	0	0	0	16	11	8
I/O port	0	0	11	12	4	4 (Serial I/O incorporated)	4
VDP (D/A converter)	0	0	1	3	0	1	0
A/D converter	0	0	0	0	0	3	0
Crystal oscillator	4.5 MHz	4.5 MHz	4.5 MHz	4.5 MHz	150 MHz	4.5 MHz	4.5 MHz
PLL reference frequency	1, 5, 9, 10, 25 kHz	1, 5, 9, 10, 25 kHz	1, 5, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 25 kHz	1, 3, 5, 6.25, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz
Application prescaler	μPB553AC (130 MHz), μPB562AC (1 GHz)	μPB553AC (130 MHz), μPB562AC (1 GHz)	μPB553AC (130 MHz), μPB562AC (1 GHz)	μPB553AC (130 MHz), μPB562AC (1 GHz)	μPB566A (130 MHz)	μPB553AC (130 MHz), μPB562AC (1 GHz)	Incorporated (50 MHz)
Support tool							
EVA-KIT	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700
SE board	SE-1701	SE-1701	SE-1704	SE-1705	SE-1706	SE-1700	SE-1700
Option board	—	—	—	—	—	EV-1707	EV1708
Assembler	Cross-assembler CP/M-80™ MP/M-86™						

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Digital Tuning Systems: μPD1700 Series (cont)

Type No.	μPD1709	μPD1710	μPD1711	μPD1712	μPD1713	μPD1714	μPD1715
Main use	TV, CATV	Car radio	Radio, TV, CATV	Tuner, TV, CATV	Car radio, tuner	Hi-Fi tuner, car radio	Portable radio, radio cassette
Package	28-pin shrink DIP	52-pin flatpack	42-pin shrink DIP	42-pin shrink DIP	52-pin flatpack	64-pin flatpack	54-pin flatpack
Supply voltage	5 V ±10%	5 V ±10%	5 V ±10%	5 V ±10%	5 V ±10%	5 V ±10%	2.2 to 3.5 V
Supply current (CPU)	600 μA typ	600 μA typ	500 μA typ	500 μA typ	400 μA typ	500 μA typ	30 μA typ
ROM	1526 steps x 16 bits	1016 steps x 16 bits	1016 steps x 16 bits	2040 steps x 16 bits	1528 steps x 16 bits	2040 steps x 16 bits	1528 steps x 16 bits
RAM	64 words x 4 bits	128 words x 4 bits	128 words x 4 bits	128 words x 4 bits	96 words x 4 bits	128 words x 4 bits	96 words x 4 bits
No. of commands	82	78	84	84	79	94	76
Display	LED	LED (FIP)	FIP (LED)	FIP (LED)	LCD (1/2 duty)	LCD (1/2 duty)	LCD (1/3 duty)
Segment	7 (LED driver incorporated)	7 (CMOS output)	7 (P-ch open drain)	7 (P-ch open drain)	LCD driver incorporated	LCD driver incorporated	LCD driver incorporated
Digit	2	7	6	6	Segment: 21 Common: 2	Segment: 28 Common: 2	Segment: 16 Common: 3
Input port	0	5 (SD, K_0 to K_3)	4 (K_0 to K_3)	4 (K_0 to K_3)	4 (K_0 to K_3) +2	4 (K_0 to K_3)	4 (K_0 to K_3)
Output port	2	0	8	8	7	12	9
I/O port	6 (Serial I/O incorporated)	11	4 (Serial I/O incorporated)	4 (Serial I/O incorporated)	4	8 (Serial I/O incorporated)	4
VDP (D/A converter)	1	1	1	1	0	1	1
A/D converter	1	0	1	1	0	1	0
Crystal oscillator	4.5 MHz	4.5 MHz	4.5 MHz	4.5 MHz	4.5 MHz	4.5 MHz	7.5 MHz
PLL reference frequency	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 7, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 3, 5, 6.25, 12.5, 25 kHz
Application prescaler	μPB553AC (130 MHz), μPB562AC (1 GHz)	μPB553AC (130 MHz), μPB562AC (1 GHz)	μPB553AC (130 MHz), μPB562AC (1 GHz)	μPB553AC (130 MHz), μPB562AC (1 GHz)	Incorporated (150 MHz)	Incorporated (150 MHz)	Incorporated (130 MHz)
Support tool							
EVA-KIT	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700
SE board	SE-1700	SE-1704	SE-1700	SE-1700	SE-1700	SE-1700	SE-1700
Option board	EV-1709	—	EV-1707	EV-1707	EV1713	EV-1714	EV-1715
Assembler	Cross-assembler CP/M-80 MP/M-86						

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Digital Tuning Systems: μPD1700 Series (cont)

Type No.	μPD1716	μPD1717*	μPD1719*	μPD1720	μPD1730
Main use	VTR, TV, car radio, Hi-fi tuner	TV, CATV	Hi-fi tuner, car radio	Car radio (AM only)	TV, VTR
Package	28-pin shrink DIP	40-pin shrink DIP	64-pin flatpack	52-pin flatpack	30-pin shrink DIP
Supply voltage	5 V ± 10%	5 V ± 10%	5 V ± 10%	5 V ± 10%	5 V ± 10%
Supply current (CPU)	500 μA typ.	500 μA typ.	500 μA typ.	400 μA typ.	500 μA typ.
ROM	1016 steps x 16 bits	2040 steps x 16 bits	2040 steps x 16 bits	1016 steps x 16 bits	1008 steps x 16 bits
RAM	64 words x 4 bits	64 words x 4 bits EEP ROM 64 x 8	256 words x 4 bits	64 words x 4 bits	48 words x 4 bits
Number of commands	82	87	94	78	67
Display	—	LED	LCD (1/3 duty)	LCD (1/3 duty)	LED
Segment	—	7	LCD driver incorporated Segment: 28 Common: 2	LCD driver incorporated Segment: 21 Common: 2	7 (LED driver incorporated)
Digit	—	3			2
Input port	0	0	4 (K_0 to K_3)	4 (K_0 to K_3)	0
Output port	5	4	12	7	8
I/O port	8	8	8 (Serial I/O incorporated)	4	5
VDP (D/A converter)	0	1	1	0	1
A/D converter	1	1	1	0	1
Crystal oscillator	4.5 MHz	4.5 MHz	4.5 MHz	4.5 MHz	4.5 MHz (Ceramic oscillator)
PLL reference frequency	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	1, 5, 6.25, 9, 10, 12.5, 25 kHz	Voltage synthesizer (13 bits D/A incorporated)
Application prescaler	Incorporated (150 MHz), μPB567HA (1 GHz)	Incorporated (150 MHz), μPB567HA (1 GHz)	Incorporated	—	—
Support tool					
EVA-KIT	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700	EVA-KIT 1700
SE board	SE-1700	SE-1700	SE-1700	SE-1700	SE-1700
Option board	EV-1709	EV-1717	EV-1714	EV-1713	EV-1730
Assembler	Cross-assembler under CP/M-80 and MP/M-86				

* Under development

NEC

TELECOM AND DATACOM FIBER OPTICS

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Section 13 — Telecom and Datacom Fiber Optics **Page**

Emitters and Detectors

Laser Diodes [LD]

Device	Description	Wavelength (nm) (Typ)	Output Power (mW) (Typ)	Threshold Current (mA) (Typ)	Rise Time/ Fall Time (ns) (Typ)	Operating Temperature
NDL5003	InGaAsP laser diode	1300	8.0	20	0.5/0.7	−40 to +70°C
NDL5004	InGaAsP laser diode	1300	8.0	20	0.5/0.7	−40 to +70°C
NDL5004P	InGaAsP laser module with multimode fiber pigtail	1300	2.5	20	0.5/0.7	−20 to +65°C
NDL5005P	InGaAsP laser diode with multimode fiber pigtail	1300	3.0	20	0.5/0.7	−20 to +65°C
NDL5007P	InGaAsP laser diode with multimode fiber pigtail	1300	3.0	20	0.5/0.7	−20 to +65°C
NDL5008	InGaAsP laser diode	1200	7.0	25	0.5/0.7	−20 to +60°C
NDL5009	InGaAsP laser diode	1310	8.0	20	0.2/0.3	−10 to +70°C
NDL5009C	InGaAsP laser diode surface mount	1310	8.0	20	0.2/0.3	−10 to +70°C
NDL5030P	InGaAsP laser diode with single mode fiber pigtail	1310	2.0	20	0.2/0.3	−20 to +70°C
NDL5031P	InGaAsP laser diode with single mode fiber pigtail	1310	2.0	20	0.3/0.4	−20 to +70°C
NDL5034P	InGaAsP laser diode with single mode fiber pigtail	1310	2.0	20	0.5/0.7	−20 to +70°C
NDL5035P	InGaAsP laser diode with single mode fiber pigtail	1300	0.7	20	0.5/0.7	0 to +60°C
NDL5036P	InGaAsP laser diode with single mode fiber pigtail	1300	0.2	20	0.5/0.7	0 to +60°C
NDL5050A	InGaAsP laser diode	1550	5.0	40	0.5/0.7	−40 to +70°C
NDL5600	InGaAsP DFB laser diode	1310	8.0	25	0.2/0.2	−20 to +60°C
NDL5600C	InGaAsP DFB laser diode surface mount	1310	8.0	25	0.2/0.2	0 to +60°C
NDL5650	InGaAsP DFB laser diode	1550	5.0	30	0.2/0.2	−20 to +60°C
NDL5650C	InGaAsP DFB laser diode surface mount	1550	5.0	30	0.2/0.2	0 to +60°C
OD8325	AlGaAs laser diode with multimode fiber pigtail	800-890	1.3	20	0.5/0.5	−10 to +60°C

Emitters and Detectors

Light Emitting Diodes [LED]

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
NDL4105A	AlGaAs LED	850	3.5 mW	10.0/10.0	50
NDL4105B	AlGaAs LED with ball lens	850	55 μW	10.0/10.0	50
NDL4105-78	AlGaAs LED	780	3.5 mW	10.0/10.0	50
NDL4105-88	AlGaAs LED	880	3.5 mW	10.0/10.0	50
NDL4201A	AlGaAs LED	850	1.0 mW	10.0/10.0	50
NDL4201B	AlGaAs LED with ball lens	850	15 μW	10.0/10.0	50
NDL5300	InGaAsP LED	1300	0.6 mW	12.0/12.0	140
NDL5300P	InGaAsP LED with multimode fiber pigtail	1300	30 μW	12.0/12.0	140
NDL5302	InGaAsP LED	1300	0.7 mW	3.0/4.0	150
NDL5302P	InGaAsP LED with multimode fiber pigtail	1300	25 μW	3.0/4.0	150
NDL5303P	InGaAsP LED with multimode fiber pigtail	1300	25 μW	2.0/3.0	150
NDL5310	InGaAsP LED	1300	1.5 mW	4.0/8.0	130
NDL5312	InGaAsP LED	1300	1.0 mW	1.0/2.0	150
OD8358	InGaAsP LED	850	80 μW	15.0/15.0	50
OD8363	InGaAsP LED	1300	25 μW	12.0/12.0	140
OD8364	AlGaAs LED — plastic	865	30 μW	15.0/15.0	50
OD8365	AlGaAs LED with multimode fiber pigtail	780, 850, 880	100 μW	15.0/15.0	50
OD8366	InGaAsP LED with multimode fiber pigtail	1300	25 μW	12.0/12.0	140
OD8367	InGaAsP LED	1300	20 μW	3.0/3.0	130
OD8368	InGaAsP LED with multimode fiber pigtail	1300	20 μW	3.0/3.0	130

Avalanche Photo Diodes [APD]

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 multimode 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 multimode 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 single mode fiber pigtail	1300	75	0.5/0.5	200
NDL5500	InGaAs avalanche photo diode	1300/1550	80/70	0.3/0.3	100
OD8406	Silicon APD	850	75	1.5/1.5	1.0
OD8409	Germanium APD	1300	75	0.5/0.5	500
OD8412	Germanium APD with multimode fiber pigtail	850	75	1.5/1.5	1.0
OD8413	Germanium APD with multimode fiber pigtail	1300	75	0.5/0.5	500

PIN Photo Diodes [PIN]

Device	Description	Wavelength (nm)	Quantum Efficiency (%) (Typ)	Rise Time/ Fall Time (ns) (Typ)	Dark Current (nA) (Max)
NDL2102	Silicon PIN photo diode	600-1100	70	1.0/1.0	1.0
NDL2104	Silicon PIN photo diode	600-1100	70	4.0/4.0	1.0
NDL2208	Silicon PIN photo diode	600-1100	85	10.0/10.0	1.0
NDL5200	Germanium PIN photo diode	1000-1600	75	1.5/1.5	1.0 μA
NDL5405	InGaAs PIN photo diode	1000-1600	80	0.3/0.3	10
OD8454	Silicon PIN	600-1100	65	1.5/1.5	1.0
OD8456	Silicon PIN — plastic	600-1100	85	10.0/10.0	1.0
OD8457	Silicon PIN with multimode fiber pigtail	600-1100	65	1.5/1.5	1.0
OD8461	InGaAs PIN	1000-1600	75	0.5/0.5	5
OD8462	InGaAs PIN with multimode fiber pigtail	1000-1600	75	0.5/0.5	5

Fiber Optic Data Links

Device	Description
ODN0101R	Receiver, DC to 1MB/s, TTL
ODN0101T-D	Transmitter, DC to 1MB/s, TTL, 50/125 μm
ODN0101T-J	Transmitter, DC to 1MB/s, TTL, 80/125 μm
ODN0201	Transceiver, DC to 2MB/s, TTL, for T1
ODN02B1-XXX	Transceiver, DC to 20kB/s, RS-232C
ODN0301R	Receiver, DC to 3MB/s, TTL
ODN0301T-FT	Transmitter, DC to 3MB/s, TTL, 200/250 μm
ODN0301T-J	Transmitter, DC to 3MB/s, TTL, 80/125 μm
ODN1311R	Receiver, 10 to 130MB/s, ECL, for FDDI
ODN2011R	Receiver, 50 to 200MB/s, ECL
ODN2011T	Transmitter, DC to 200MB/s, ECL, 1300 nm
ODN2012R	Receiver, 40 to 200MB/s, ECL
ODN2012T	Transmitter, DC to 200MB/s, ECL, for FDDI
ODN3501R	Receiver, DC to 35MB/s, TTL
ODN3501T	Transmitter, DC to 35MB/s, TTL, 850 nm

Connectors

Cable Assemblies

Device	Description
OD9370B3B05Y	Patchcord, FC, MM, 5 m
OD9370B3B05Y-M	Patchcord, FC, MM, 5 m, master
OD9370PCB3B05Y	Patchcord, FC, MM, 5 m, PC
OD9370PCB3B05Y-M	Patchcord, FC, MM, 5 m, PC, master
OD9371B3B05Y	Patchcord, FC, SM, 5 m
OD9371B3B05Y-M	Patchcord, FC, SM, 5 m, master
OD9371PCB3B05Y	Patchcord, FC, SM, 5 m, PC
OD9371PCB3B05Y-M	Patchcord, FC, SM, 5 m, PC, master
OD9373B3B05Y	Patchcord, D3, MM, 5 m
OD9373B3B05Y-M	Patchcord, D3, MM, 5 m, master
OD9373PCB3B05Y	Patchcord, D3, MM, 5 m, PC
OD9373PCB3B05Y-M	Patchcord, D3, MM, 5 m, PC, master
OD9374B3B05Y	Patchcord, D3, SM, 5 m
OD9374B3B05Y-M	Patchcord, D3, SM, 5 m, master
OD9374PCB3B05Y	Patchcord, D3, SM, 5 m, PC
OD9374PCB3B05Y-M	Patchcord, D3, SM, 5 m, PC, master
OD9438B1B3B05Y	Patchcord, DX, MM, 5 m, plastic
OD9470B3B05Y	Patchcord, D4, MM, 5 m
OD9470B3B05Y-M	Patchcord, D4, MM, 5 m, master
OD9470PCB3B05Y	Patchcord, D4, MM, 5 m, PC
OD9470PCB3B05Y-M	Patchcord, D4, MM, 5 m, PC, master
OD9474B3B05Y	Patchcord, D4, SM, 5 m
OD9474B3B05Y-M	Patchcord, D4, SM, 5 m, master
OD9474PCB3B05Y	Patchcord, D4, SM, 5 m, PC
OD9474PCB3B05Y-M	Patchcord, D4, SM, 5 m, PC, master
OD9476B3B05Y	Patchcord, D4, MM, 5 m, plastic
OD9478B3B05Y	Patchcord, SX, MM, 5 m, plastic
ODS03505Y	Patchcord, FC/D4, SM, 5 m
ODS035PC05Y	Patchcord, FC/D4, SM, 5 m, PC
ODS05505Y	Patchcord, D3/D4, SM, 5 m
ODS055PC05Y	Patchcord, D3/D4, SM, 5 m, PC
ODS05605Y	Patchcord, D3/D4, MM, 5 m
ODS056PC05Y	Patchcord, D3/D4, MM, 5 m, PC
ODS07005Y	Patchcord, FC/D4, MM, 5 m
ODS070PC05Y	Patchcord, FC/D4, MM, 5 m, PC
ODS10905Y	Patchcord, 5 m, for Neolink ODN0201
ODS12105Y	Patchcord, SX/D4, MM, 5 m
ODS148B105Y	Patchcord, SX/DX, MM, 5 m, plastic

Fiber Optic Connector Parts

Device	Description
OD9311BF	Ferrule, FC, MM, 125 μm (needs OD9321)
OD9312BE	Ferrule, D3, SM, 125 μm
OD9313BF	Ferrule, D3, MM, 125 μm
OD9313GG	Ferrule, D3, MM, 140 μm
OD9313HH	Ferrule, D3, MM, 250 μm
OD9314BE	Ferrule, FC, SM, 125 μm (needs OD9321)
OD9321	Housing, FC, MM or SM
OD9384	Through adapter, D3 or FC, MM or SM
OD9390	Receptacle, D3 or FC, MM
OD9411BF	Ferrule, D4, MM, 125 μm (needs OD9420)
OD9411GG	Ferrule, D4, MM, 140 μm (needs OD9420)
OD9411HH	Ferrule, D4, MM, 250 μm (needs OD9420)
OD9414BE	Ferrule, D4, SM, 125 μm (needs OD9424)
OD9416B	Ferrule, D4, MM, 125 μm, plastic
OD9416G	Ferrule, D4, MM, 140 μm, plastic
OD9416H	Ferrule, D4, MM, 250 μm, plastic
OD9418B	Ferrule, SX, MM, 125 μm, plastic
OD9418G	Ferrule, SX, MM, 140 μm, plastic
OD9418H	Ferrule, SX, MM, 250 μm, plastic
OD9420	Housing, D4, MM
OD9421	Housing, D4, MM, bulkhead mount
OD9424	Housing, D4, SM

Connectors

Fiber Optic Connector Parts [cont]

Device	Description
OD9428B1	Ferrule, DX, MM, 125 μm, plastic
OD9428G1	Ferrule, DX, MM, 140 μm, plastic
OD9428H1	Ferrule, DX, MM, 250 μm, plastic
OD9430	Housing, auto plug, D4, MM or SM
OD9431	Housing, auto socket, D4, MM
OD9432	Housing, auto socket, D4, SM
OD9440-12	MLTPLG housing, D4, MM, RND, 12-channel
OD9440-4	MLTPLG housing, D4, MM, RND, 4-channel
OD9441-12	MLTSKT housing, D4, MM, RND, 12-channel
OD9441-4	MLTSKT housing, D4, MM, RND, 4-channel
OD9450-12	MLTPLG housing, D4, MM, SQR, 12-channel
OD9450-4	MLTPLG housing, D4, MM, SQR, 4-channel
OD9451-12	MLTSKT housing, D4, MM, SQR, 12-channel
OD9451-4	MLTSKT housing, D4, MM, SQR, 4-channel
OD9480	Through adapter, D4, MM
OD9481	Through adapter, FC female/D4 male
OD9482	Through adapter, FC male/D4 female
OD9483M	Through adapter, FC male/D4 male
OD9483S	Through adapter, FC male/D4 male, SM
OD9484	Through adapter, D4, SM
OD9485	Through adapter, D4, MM, plastic
OD9486	Through adapter, DX, MM, plastic
OD9487	Through adapter, SX/DX, MM, plastic
OD9488	Through adapter, SX, MM, plastic
OD9489D	Through adapter, D4, MM, hermetic
OD9490	Receptacle, D4, MM (for 11 mm OD max)
OD9490L	Receptacle, D4, MM (for 12.5 mm OD max)
OD9495	Receptacle, D4, MM, plastic
OD9498	Receptacle, SX, MM, plastic
ODS001	Through adapter, D4/SMA, MM

Connector Assembly Equipment, Tools, Polish Film

Device	Description
OD9500A	Termination kit, D4, MM, 150 μm
OD9500B	Termination kit, D4, MM, 125 μm
OD9506B	Termination kit, D4, MM, 125 μm, plastic
OD9506G	Termination kit, D4, MM, 140 μm, plastic
OD9506H	Termination kit, D4, MM, 250 μm, plastic
OD9508B	Termination kit, SX/DX, MM, 125 μm
OD9508G	Termination kit, SX/DX, MM, 140 μm
OD9508H	Termination kit, SX/DX, MM, 250 μm
OD9610CBB	Polish machine, for D3
OD9610DBB	Polish machine, for D4, SX, DX
OD9610FBB	Polish machine, for FC
OD9620	Epoxy curing oven, for FC, D3, D4, SX, DX
OD9640	Hand polish kit, for FC, D3, D4, SX, DX
OD9641A	Machine polish kit, for D3, D4, SX, DX
OD9641B	Machine polish kit, for FC
OD9641E	Machine polish kit, for D3PC, D4PC
ODS044	Collet chuck, 2.5 mm, for FC, D3
ODS045	Hand polish tool, for DX
ODS046	Assembly jig, for plastic D4, SX ferrule
ODS047	Epoxy, for FC, D3, D4 Kevlar bonding
ODS048	Crimp tool, for plastic D4, SX
ODS050	Ferrule selector, for FC, D3, D4
ODS058	Crimp tool, for DX (DIB cable only)
ODS059	Polish machine adapter, for DX
ODS060	Assembly jig, for SX housing
ODS061	Assembly jig, for OD9430
ODS063	Assembly jig, for D4 housing
ODS064	Assembly jig, for D4 ferrule
ODS066	Collet chuck, 2.0 mm, for D4, SX
ODS067	Hand polish tool, for D4, SX
ODS068	Hand polish tool, for D3
ODS069	Assembly jig, for plastic D4 housing
ODS071	Assembly jig, for OD9495, OD9498
ODS074	Epoxy, for FC, D3, D4, SX, DX fiber bonding
ODS088	Polish machine disk, for FC, D3, D4, SX
ODS101	Assembly jig, for D3 housing
ODS102	Assembly jig, for D3 ferrule
ODS103	Buff polish powder, for D3PC, D4PC
ODS110	Hand polish film, for D3, D4, SX, DX
ODS111	Hand polish buff film, for D3, D4
ODS112	Buff polish powder, for D3, D4
ODS113	Machine polish film, for FC
ODS114	Machine polish film, for D3, D4, SX, DX
ODS115	Machine polish buff film, for FC, D3, D4

Passive Devices

Optical Isolators

Device	Description	Center Wavelength (nm)	Isolation (dB) (Typ)	Insertion Loss (dB) (Typ)
OD8312	Optical isolator	850	>25	<1.5
OD8313B	Optical isolator	1300	>20	<1.5
OD8313C	Optical isolator	1550	>20	<1.5

Attenuators

Device	Description	Center Wavelength (nm)	Attenuation (dB) (Typ)	Insertion Loss (dB) (Typ)
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
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)	Insertion Loss (dB) (Typ)	Splitting Ratio
OD8601	Optical directional coupler 3 port	850, 1300	15 at1:1 20 at 10:1	<2	1:1 10:1
OD8602	Optical directional coupler 4 port	850, 1300	15 at 1:1 20 at 10:1 30 at 100:1	<2	1:1 10:1 100:1
OD8606	Optical directional coupler with fiber pigtails, 3 port	850, 1300	>35	<1.5	1:1 10:1
OD8607	Optical directional coupler with single mode fiber pigtails, 3 port	1300	43	1.5	1:1 10:1

Line Monitor/Band Pass Filter

Device	Description	Center Wavelength (nm)	Insertion Loss (dB) (Typ)	Splitting Ratio
OD8650	Line monitor	850	<5	1:1 10:1 100:1
OD8670	Optical band pass filter	(Note 1)	<3.5	

Note:

(1) Contact manufacturer

Passive Devices (cont)

Wavelength Division Multiplexers

Device	Description	Specifications
OD8674	Wavelength division multiplexers with multimode fiber pigtails	(Note 1)
OD8677	Wavelength division multiplexers	
OD8678	Wavelength division multiplexers with multimode fiber pigtails	
ODS169	Wavelength division multiplexers with single mode fiber pigtails	

Note:

(1) Contact manufacturer

Switches

Device	Description	Center Wavelength (nm)	Repeatability (Typ)	Rise/Fall Time (Typ)	Insertion Loss (dB) (Typ)
OD8752	1x2 optical switch	850, 1300	0.03	2	1.2
OD8754	1x2 optical switch	850, 1300	0.03	2	1.4
OD8756	1x2 optical switch with multimode fiber pigtail	850, 1300	0.03	3	0.8
OD8764	2x2 optical switch	850, 1300	0.04	4	1.6
OD8766	2x2 optical switch	—	—	—	—
OD8767	2x2 optical switch with multimode fiber pigtail	850, 1300	0.05	7	1.0

Acousto-Optic Modulators

Device	Description	Wavelength (nm)	Active Aperature (mm)	Center Carrier Frequency (MHz)	Rise Time (Typ)	DC Contrast Ratio
OD8802	Driver for acousto-optic modulator			(Note 1)		
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

Note:

(1) Contact manufacturer

NEC

OFFICE AUTOMATION BEAM LASERS 14

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HeNe Laser Tubes

Part No.	Wavelength (nm)	Polarization	Power (mW)	Beam Diameter (mm)	Beam Divergence (mrad)	Applicable Power Supply
GLT172B	632.8	Random	0.5	0.66	1.22	GLS5230, GLS5245
GLT2390	632.8	Random	0.5	0.34	2.4	GLS9900
GLT179	632.8	Random	0.5	0.52	1.54	GLS5230
GLT172	632.8	Random	0.8	0.66	1.22	GLS5230, GLS5245
GLT2310	632.8	Random	1.0	0.65	1.23	GLS5246
GLT2320	632.8	Random	2.0	0.65	1.23	GLS5246
GLT2150	632.8	Random	5.0	0.83	0.96	GLS5270, GLS5290
GLT2330	632.8	Linear	1.0	0.65	1.23	GLS5246
GLT2340	632.8	Linear	1.5	0.65	1.23	GLS5246
GLT2080	632.8	Linear	2.0	0.75	1.08	—
GLT2140	632.8	Linear	5.0	0.83	0.96	GLS5270, GLS5290
GLT2180	632.8	Multimode	5.0	1.2	6.0	GLS5230, GLS5246
GLT2350	632.8	Multimode	7.0	0.9	4.0	GLS5270, GLS5290

HeNe Laser Integrated Heads

Part No.	Wavelength (nm)	Polarization	Power (mW)	Beam Diameter (mm)	Beam Divergence (mrad)	Applicable Power Supply
GLG5091	632.8	Random	0.5	0.66	1.22	Self-contained
GLG5031	632.8	Random	1.0	0.65	1.23	Self-contained
GLG5041	632.8	Random	2.0	0.65	1.23	Self-contained
GLG5071	632.8	Linear	1.0	0.65	1.23	Self-contained
GLG5081	632.8	Linear	1.5	0.65	1.23	Self-contained

HeNe Cylindrical Heads

Part No.	Wavelength (nm)	Polarization	Power (mW)	Beam Diameter (mm)	Beam Divergence (mrad)	Applicable Power Supply
GLG5230	632.8	Random	1.0	0.65	1.23	GLS5246A, GLS5371
GLG5240	632.8	Random	2.0	0.65	1.23	GLS5246A, GLS5371
GLG5260	632.8	Random	5.0	0.83	0.96	GLS5271, GLS5292, GLS5361
GLG5400	632.8	Random	10.0	0.7	1.2	GLS5400, GLS5411
GLG5370	632.8	Linear	1.0	0.65	1.23	GLS5246A, GLS5371
GLG5380	632.8	Linear	1.5	0.65	1.23	GLS5246A, GLS5371
GLG5360	632.8	Linear	5.0	0.83	0.96	GLS5271, GLS5292, CLS5361
GLG5270	632.8	Multimode	7.0	0.9	4.0	GLS5271, GLS5292, GLS5361

HeNe High Power Systems

Part No.	Wavelength (nm)	Polarization	Power (mW)	Beam Diameter (mm)	Beam Divergence (mrad)	Applicable Power Supply
GLG5600	632.8	Linear	15.0	1.1	0.73	GLS5601
GLG5601	632.8	Linear	15.0	1.1	0.73	GLS5601
GLG5730	632.8	Linear	25.0	1.2	0.7	GLS5721, GLS5731
GLG5731	632.8	Linear	25.0	1.2	0.7	GLS5721, GLS5731
GLG5800	632.8	Linear	50.0	1.7	0.47	GLS5801
GLG5610	1.15 μm	Linear	5.0	1.5	1.0	GLS5601
GLG5611	1.15 μm	Linear	5.0	1.5	1.0	GLS5601
GLG5732	1.15 μm	Linear	7.0	1.7	1.0	GLS5721, GLS5731
GLG5733	1.15 μm	Linear	7.0	1.7	1.0	GLS5721, GLS5731
GLG5810	1.15 μm	Linear	15.0	2.3	0.6	GLS5801
GLG5820	1.53 μm	Linear	1.5	2.7	0.8	GLS5801

Air Cooled Argon Lasers

Part No.	Wavelength	Polarization	Power (mW)	Beam Diameter (mm)	Beam Divergence (mrad)	Applicable Power Supply
GLG3020	488 nm	Linear	15.0	0.65	1.0	GLS3020 (AC 95-110 V input) GLS3021 (AC 110-127 V input)
GLG3021	488 nm	Linear	5.0	0.65	1.0	
GLG3025	514.5 nm	Linear	5.0	0.65	1.0	
GLG3026	Multiline	Random	15.0	0.65	1.0	
GLG3027	Multiline	Linear	15.0	0.65	1.0	

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TELECOMMUNICATION ICs 15

Section 15 — Telecommunication ICs **Page**

CMOS Combos

Part No.	Description	Companding Law	Sync/Async Operation	Signaling	Loopback Capability	Package
μPD9513AD (Direct replacement for Intel 29C13/2913)	1 master clock; 1.536 or 1.544 or 2.048	A or μ law	Sync only	No	None	20-pin CERDIP
μPD9514AD (Direct replacement for Intel 29C14/2914)	Separate transmit/ receive clock	A or μ law	Both	Yes	Yes	24-pin CERDIP
μPD9516AD (Direct replacement for Intel 29C16/2916)	2.048 master clock	μ law	Sync only	No	None	16-pin CERDIP
μPD9517AD (Direct replacement for Intel 29C17/2917)	2.048 master clock	A law	Sync only	No	None	16-pin CERDIP
μPD9601AD (Compatible replacement for Hitachi 44233C/44237C)	On-chip PLL	A law	Both	No	Yes	16-pin CERDIP
μPD9602AD (Compatible replacement for Hitachi 44234C/44238C)	On-chip PLL	μ law	Both	No	Yes	16-pin CERDIP
μPD9604AD	Digital gain set capability (Note 1)	μ law	Both	No	Yes	16-pin CERDIP
μPD9605AD	Digital gain set capability (Note 1)	A law	Both	No	Yes	16-pin CERDIP
μPD9621L	PLCC version of μPD9601AD	A law	Both	No	Yes	18-pin PLCC
μPD9622L	PLCC version of μPD9602AD	μ law	Both	No	Yes	18-pin PLCC
μPD9624L	PLCC version of μPD9604AD	μ law	Both	No	Yes	18-pin PLCC
μPD9625L	PLCC version of μPD9605AD	A law	Both	No	Yes	18-pin PLCC

Notes:

(1) From 0 to 15 dB in 0.5 dB steps

(2) Contact manufacturer for specifications

SLICS

Part No.	Description	Key Features	Package
μPC7059K	−48 V SLIC; constant resistance feed	Battery feed, supervision, 2 wire to 4 wire conversion	28-pin LCC
μPC7062K	−24 V SLIC for key telephone	Battery feed, supervision, 2 wire to 4 wire conversion	28-pin LCC
μPC7069K	−48 V SLIC; constant current feed	Battery feed, supervision, 2 wire to 4 wire conversion	28-pin LCC
μPC7051L	PLCC version of μPC7059K	Battery feed, supervision, 2 wire to 4 wire conversion	32-pin PLCC
μPC7063L	PLCC version of μPC7062K	Battery feed, supervision, 2 wire to 4 wire conversion	32-pin PLCC
μPC7061L	PLCC version of μPC7069K	Battery feed, supervision, 2 wire to 4 wire conversion	32-pin PLCC

Note:

(1) Contact manufacturer for specifications

POTS

Part No.	Description	Key Features	Package
μPD784G	Single chip telephone	DTMF generator, speaker, side tone protection	64-pin plastic flatpack
μPD9702AG	Repertory tone/pulse dialer	Switchable tone/pulse, one touch dialing, abbreviated dialing, 32-digit redial	28-pin miniflat
μPD9705GU	Repertory tone/pulse dialer	Switchable tone/pulse, one touch dialing, abbreviated dialing, 32-digit redial, loud speaker hearing mode function	28-pin miniflat
μPC9705C	Repertory tone/pulse dialer	Switchable tone/pulse, one touch dialing, abbreviated dialing, 32-digit redial, loud speaker hearing mode function	28-pin shrink DIP

Note:

(1) Contact manufacturer for specifications

Crosspoint Switches

Part No.	Description	Key Features	Package
μPD22100C	4 x 4 analog crosspoint switch	16 crosspoint switches with control memory	16-pin DIP
μPD22148CA	4 x 8 analog crosspoint switch	32 crosspoint switches with control memory	24-pin DIP

Note:

(1) Contact manufacturer for specifications

Notes:

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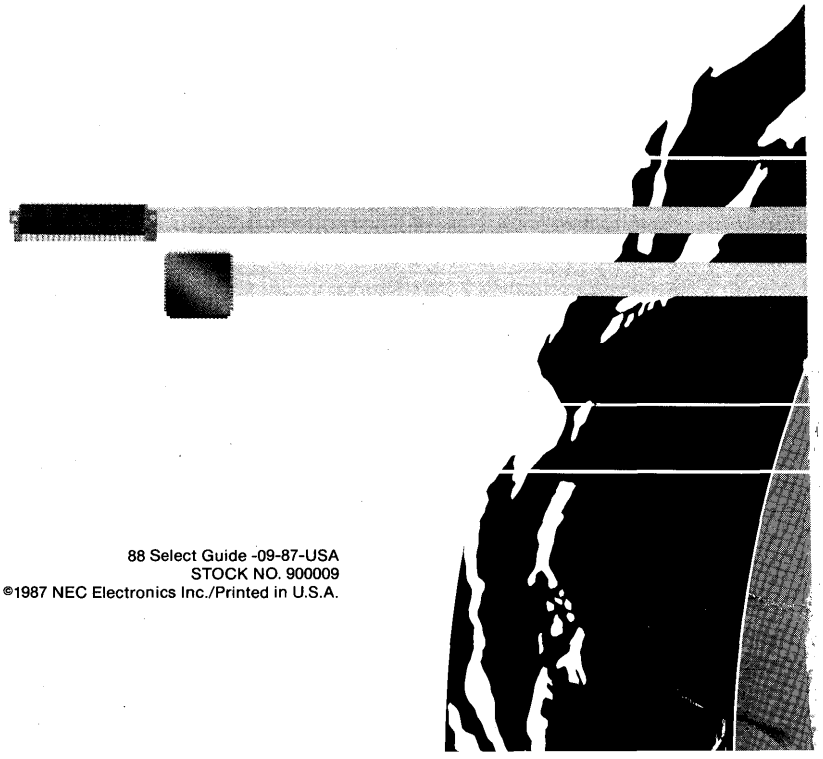

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