Panasonic

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2006 ver.2

Discrete Semiconductors
Selection Guide

Request for your special attention and precautions in using the technical information and semiconductors described in this book

(1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.

(2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products, and no license is granted under any intellectual property right or other right owned by our company or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.

(3) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).
Consult our sales staff in advance for information on the following applications:
- Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
- Any applications other than the standard applications intended.

(4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.

(5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
 Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

(6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

(7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of Matsushita Electric Industrial Co., Ltd.

 If you have any inquiries or questions about this book or our semiconductor products, please contact one of our sales offices listed on the back or Semiconductor Company's Department.

Homepage Introduction

We offer a variety of product information via the Internet.

http://panasonic.co.jp/semicon/e-index.html

(As of February 27, 2006)

News Release

- The latest press releases and back numbers

What's New

- Preliminary product information

Technology

- On-line presentation of the most updated semiconductor products and technologies

New Products

- Product information Preliminary datasheet

Document

- A variety of product catalogs
  * Customers are able to download the datasheet in Adobe PDF format.

Datasheet

- A variety of product information for the initial stage of design process.
  * Customers are able to download the datasheet in Adobe PDF format.

Microcomputer

- Full support for C language development environments
  * Development support Q&A
  * Contacts for each product type

Package Technology

- List of Package
- Package mounting methods
- Precautions when using semiconductor products

How to Read This Document

Structure of this document

This document consists of the part number list, application block diagrams, recommended types by classification, package outlines, discontinued types, maintenance types, and planned maintenance types. Types are classified according to the ECALS glossary.

ECALS is the general term for all standardization activities, including the distribution of composite components technology information (offering of and searching for information via the internet) about electronic equipment, semiconductors, electronic components, etc. as well as support administration such as the ECALS glossary, etc.

Part numbers

The part numbers used in this document are part numbers for catalog use, and are partially abbreviated Matsushita global codes (Matsushita unified part numbers). Conventional part numbers (C Part No.) are part numbers used prior to the operation of the Matsushita global code in 2000, and are listed only for those part numbers which are drastically different from the Matsushita global code. They may also be listed in parentheses together with the part number.

Package outlines (package)

Recommended products listed in this document are lead-free packages. However, unsupported types are also included in "Discontinued, Maintenance and Planned Maintenance Types".

Discontinued types, maintenance types, and planned maintenance types

Discontinued types	:	Sales of these types have ended and are no longer handled. Please accept this situation.
Maintenance types	:	Discontinuation of sales of these types is desired, and new sales of such types are not possible. Further, existing customers with new applications should switch to replacement types instead.
Planned maintenance types	:	Types that are currently being sold but which are scheduled to be shifted to maintenance types. Please refrain from using these types for new applications.

Symbols used for recommended types

○: Under planning
▲: Under development
△: Microcomputers, application-specific standard-product ICs: Undergoing ES evaluation; Discrete components, opto electronic devices: Tentative standard
★: Newly listed in this document

Catalog List

Our company's lineup of catalogs is listed below. Please select the catalog according to your purpose.

Common Catalog

- Semiconductor Selection Guide
- Semiconductor Package
- Lead-free Package

Product Catalog

Multimedia Processor

- Panasonic Integrated Platform for Digital Consumer Electronics

Microcomputers

- Microcomputer Family AM Series
- Microcomputer AM Series Selection Guide

Image Pickup Devices

- CCD Image Sensor

Application-Specific Standard-Product ICs

- 3D Sound Reproduction Technology Solutions
- System LSI Guide for IC Cards and Tags

Sensors

- Hall-ICs Series

General Purpose Discrete

- Discrete Semiconductors Selection Guide
- Variable Capacitance Diodes Family
- Zener Diodes Series
- Schottky Barrier Diodes Family

Opto Electronic Devices

- Hologram Unit / Laser for Optical Disk
- Opto-Electronic Device

* If you would like a printed catalog, please request one at the following email address. Catalog PDFs are available on our company's homepage.

E-mail: semi-catalog@semicon-support.jp.panasonic.com

Note: The above catalog lineup is subject to change without notice. Please check for the latest status on our company's homepage.

Precaution on Lead-free products (RoHS compliant) Marking and Labeling

To support lead solder control, the products supplied by our company will be marked as lead-free products (conforming to RoHS) with C3 labels on each package unit.

In the lead-free label, the "Pb" letter is marked with "×" symbol.

Label Sample

Please pay attention to the relevant marking and manage properly not to mix the lead-containing products and the lead-free products. Note that C3 labels are attached to outer boxes, inner boxes, reels, etc.; please check packaging before opening.

If you have any inquiries and questions about this matter, please contact one of our sales representatives.

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Part Number List

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SSSMini 6P: SSSMini6-F1
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SSMini 4P: SSMini4-F1
SSMini 5P: SSMini5-F1
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SMini 6P: SMini6-F1/SMini6-G1
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HNMP 2P: HNMiniP2-J1
SNMP 2P: SNMiniP2
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TO92L: TO-92L-A1
TO92NL: TO-92NL-A1
NS: NS-A1/NS-B1
U: U-G2/U-A1
N: N-G1/N-A1
I: I-G1/I-A1
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TO220C: TO-220C-G1
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△: Tentative

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MAZ2082	MA2082	DO41	K9
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MAZ7100	MA7100	DO41	K9
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XN04322	XN4322	Mini 6P	H21
XN04381	XN4381	Mini 6P	H21
XN04401	XN4401	Mini 6P	H6
XN04402	XN4402	Mini 6P	H6
XN04404	XN4404	Mini 6P	H6
XN04482	XN4482	Mini 6P	H6
XN04501	XN4501	Mini 6P	H6
XN04502	XN4502	Mini 6P	H6
XN04504	XN4504	Mini 6P	H6
XN04505	XN4505	Mini 6P	H6
XN04506	XN4506	Mini 6P	H6
XN04509	XN4509	Mini 6P	H6
XN04556	XN4556	Mini 6P	H6
XN04601	XN4601	Mini 6P	H7
XN04602		Mini 6P	H7
XN04604	XN4604	Mini 6P	H7
XN04608	XN4608	Mini 6P	H7
XN04609	XN4609	Mini 6P	H7
XN04A88		Mini 6P	H21
XN05501	XN5501	Mini 6P	H7
XN05531	XN5531	Mini 6P	H7
XN05553	XN5553	Mini 6P	H7
XN05601	XN5601	Mini 6P	H7
XN06113	XN6113	Mini 6P	H19
XN06211	XN6211	Mini 6P	H19
XN06213	XN6213	Mini 6P	H19
XN06214	XN6214	Mini 6P	H19
XN06215	XN6215	Mini 6P	H19
XN06216	XN6216	Mini 6P	H19
XN06401	XN6401	Mini 6P	H7
XN06435	XN6435	Mini 6P	H7
XN06501	XN6501	Mini 6P	H7
XN06534	XN6534	Mini 6P	H7
XN06537	XN6537	Mini 6P	H7
XN06543	XN6543	Mini 6P	H7
XN09D57		Mini 6P	J2
XN09D58		Mini 6P	J2
XN09D61		Mini 6P	J2
XN0A311	XN1A311	Mini 5P	H18
XN0A312	XN1A312	Mini 5P	H18
XN0A554	XN6A554	Mini 6P	H7
XN0B301	XN1B301	Mini 5P	H6
XN0C301	XN1C301	Mini 5P	H6
XN0F256		Mini 6P	H21
XN0F261		Mini 6P	H21
XN0F262		Mini 6P	H21
XN0F263		Mini 6P	H21
XN0NE92		Mini 5P	J2
XP01110	XP1110	SMini 5P	H18
XP01111	XP1111	SMini 5P	H18
XP01113	XP1113	SMini 5P	H18
XP01114	XP1114	SMini 5P	H18
XP01115	XP1115	SMini 5P	H18
XP01116	XP1116	SMini 5P	H18
XP01117	XP1117	SMini 5P	H18
XP01118	XP1118	SMini 5P	H18
XP01119	XP1119	SMini 5P	H18
XP0111F	XP111F	SMini 5P	H18
XP0111H	XP111H	SMini 5P	H18
XP0111M		SMini 5P	H20
XP01210	XP1210	SMini 5P	H18
XP01211	XP1211	SMini 5P	H18
XP01212	XP1212	SMini 5P	H18
XP01213	XP1213	SMini 5P	H18
XP01214	XP1214	SMini 5P	H18
XP01215	XP1215	SMini 5P	H18
XP01216	XP1216	SMini 5P	H18
XP01217	XP1217	SMini 5P	H18
XP0121E		SMini 5P	H18
XP0121L		SMini 5P	H20
XP0121M		SMini 5P	H20
XP0121N		SMini 5P	H20
XP01401	XP1401	SMini 5P	H6
XP01501	XP1501	SMini 5P	H6
XP01504	XP1504	SMini 5P	H6
XP01531		SMini 5P	H6
XP01554	XP1554	SMini 5P	H6
XP01601	XP1601	SMini 5P	H6
XP01878		SMini 5P	H23
XP02210	XP2210	SMini 5P	H18
XP02211	XP2211	SMini 5P	H18
XP02215	XP2215	SMini 5P	H18
XP02401	XP2401	SMini 5P	H6
XP02501	XP2501	SMini 5P	H6
XP03311		SMini 5P	H18
XP03312		SMini 5P	H18

★: Newly listed in this document △: Tentative

Part Number List (Alphabetical order)

	Part No.	C Part No.	Package	Page
	XP03316		SMini 5P	H18
	XP03383		SMini 5P	H20
	XP03389		SMini 5P	H20
	XP03390		SMini 5P	H20
	XP03391		SMini 5P	H20
	XP04111	XP4111	SMini 6P	H19
	XP04112	XP4112	SMini 6P	H19
	XP04113	XP4113	SMini 6P	H19
	XP04114	XP4114	SMini 6P	H19
	XP04115	XP4115	SMini 6P	H19
	XP04116	XP4116	SMini 6P	H19
	XP04117	XP4117	SMini 6P	H19
	XP0411M	XP411M	SMini 6P	H21
	XP04210	XP4210	SMini 6P	H19
	XP04211	XP4211	SMini 6P	H19
	XP04212	XP4212	SMini 6P	H19
	XP04213	XP4213	SMini 6P	H19
	XP04214	XP4214	SMini 6P	H19
	XP04215	XP4215	SMini 6P	H19
	XP04216	XP4216	SMini 6P	H19
	XP04217		SMini 6P	H19
	XP0421M		SMini 6P	H21
	XP04286		SMini 6P	H21
	XP04311	XP4311	SMini 6P	H19
	XP04312	XP4312	SMini 6P	H19
	XP04313	XP4313	SMini 6P	H19
	XP04314	XP4314	SMini 6P	H19
	XP04315	XP4315	SMini 6P	H19
	XP04316	XP4316	SMini 6P	H19
	XP0431M		SMini 6P	H21
	XP0431N		SMini 6P	H21
	XP04387		SMini 6P	H21
	XP04401	XP4401	SMini 6P	H6
	XP04501	XP4501	SMini 6P	H6
	XP04506	XP4506	SMini 6P	H6
	XP04601	XP4601	SMini 6P	H7
	XP04654	XP4654	SMini 6P	H7
	XP04878		SMini 6P	H23
	XP0497A		SMini6P	H23
	XP05501	XP5501	SMini 6P	H7
	XP05531		SMini 6P	H7
	XP05534		SMini 6P	H7
	XP05553		SMini 6P	H7
	XP05554		SMini 6P	H7
	XP05601	XP5601	SMini 6P	H7
	XP06111	XP6111	SMini 6P	H19
	XP06112	XP6112	SMini 6P	H19
	XP06113	XP6113	SMini 6P	H19
	XP06114	XP6114	SMini 6P	H19
	XP06115	XP6115	SMini 6P	H19
	XP06116	XP6116	SMini 6P	H19
	XP06210	XP6210	SMini 6P	H19
	XP06211	XP6211	SMini 6P	H19
	XP06212	XP6212	SMini 6P	H19
	XP06213	XP6213	SMini 6P	H19
	XP06214	XP6214	SMini 6P	H19
	XP06215	XP6215	SMini 6P	H19
	XP06216	XP6216	SMini 6P	H19
	XP06401	XP6401	SMini 6P	H7
	XP06435	XP6435	SMini 6P	H7
	XP06501	XP6501	SMini 6P	H7
	XP06534	XP6534	SMini 6P	H7
	XP06543		SMini 6P	H7
	XP0B301	XP1B301	SMini 5P	H6
	XP0C301	XP1C301	SMini 5P	H6
	XP0NG8A		SMini 6P	J2

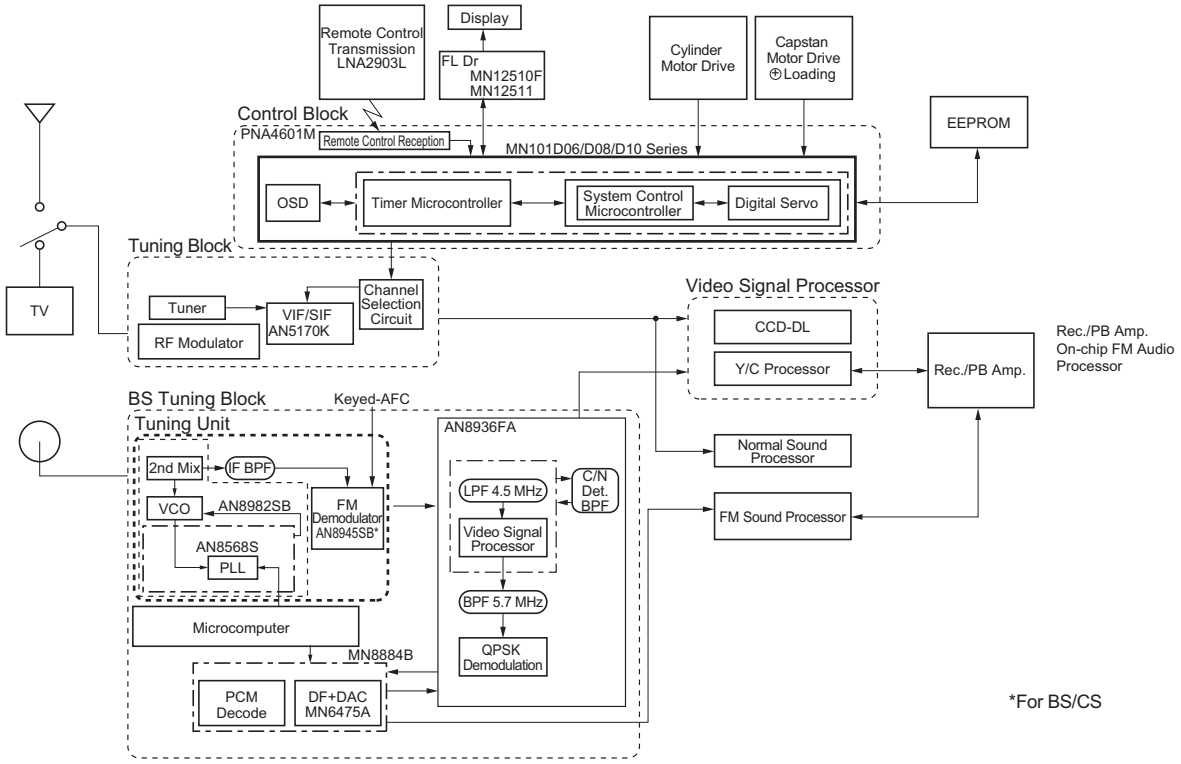
★: Newly listed in this document △: Tentative

Application Block Diagrams

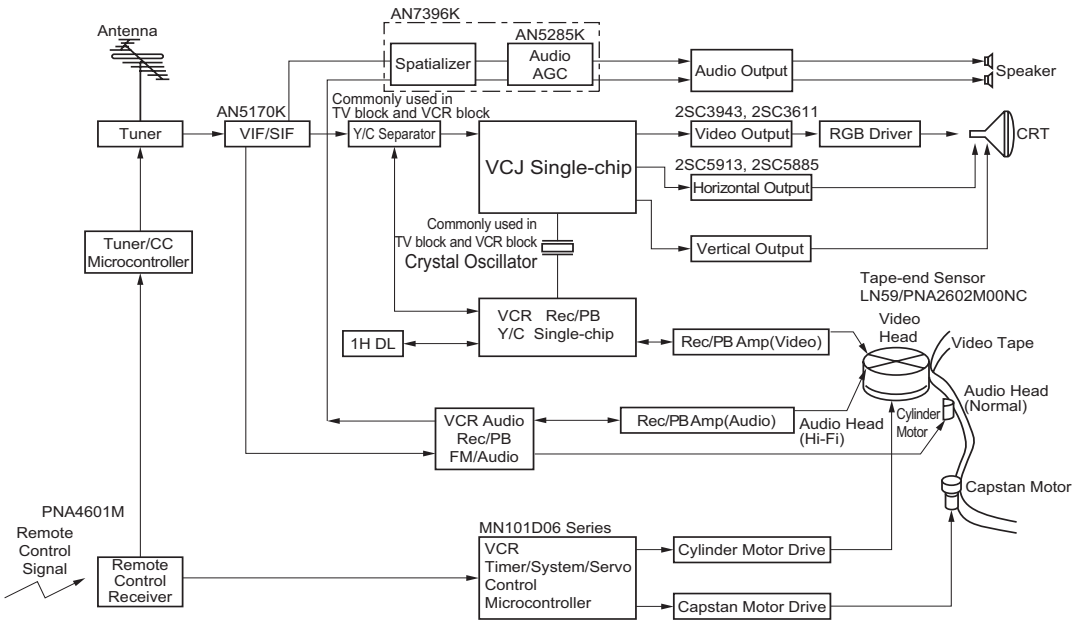
Application Block Diagrams

Video Applications

(1) VCR System



(2) TV-VCR Combination

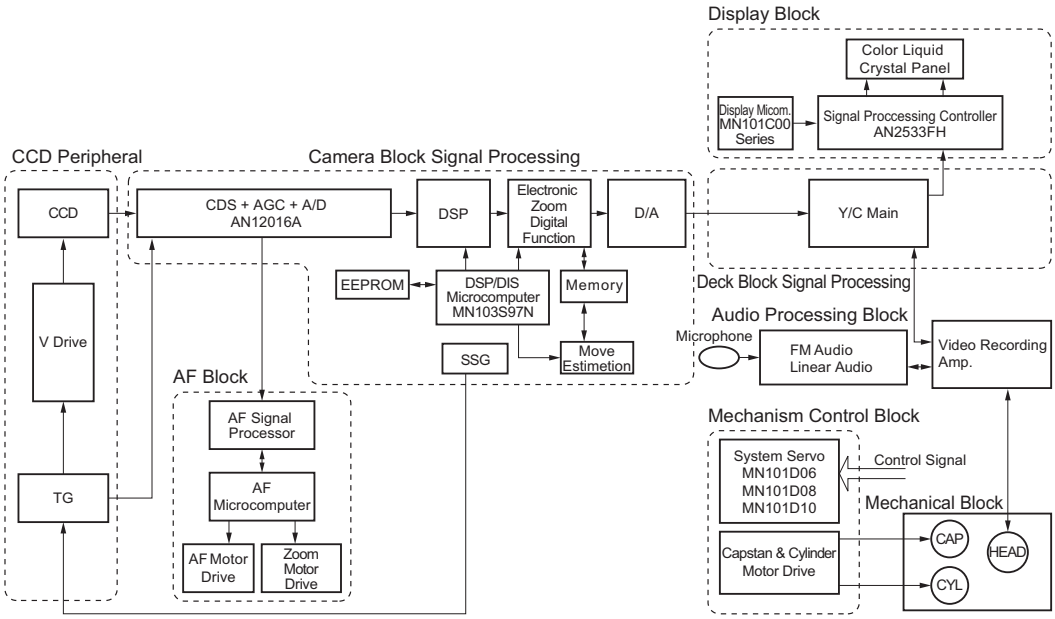


Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB0709A (2SB709A), 2SD0601A (2SD601A), UNR2000 (UN2000) Series
Diode: MA2J111 (MA111), MA3X152D (MA152WA), MAZ8000 (MA8000) Series
Photo Couplers: CNC1S101 (ON3131) (For Japan and U.S.A.), CNC1S171 (ON3171) (For Europe)

Note) The part numbers in parentheses show the conventional ones.

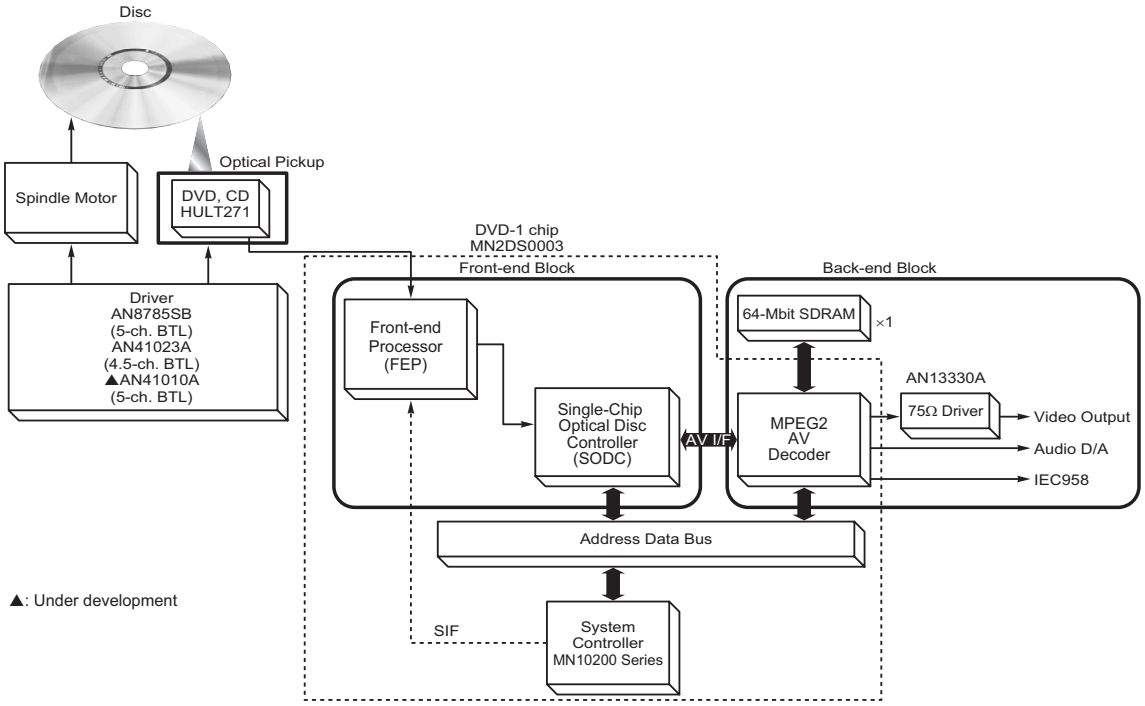
Video Applications

(3) Video Camera System



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1462J, 2SD2216J, UNR9000J(UN9000J) Series, XP Series
Diode: MA2∗111, MA2SD・MA27D・MA22D・MA24D・MA2YD・MAZD・MAZW・MAZM Series, MAYS, MALS068X
Protector Elements: UNHZ Series

(4) DVD Player



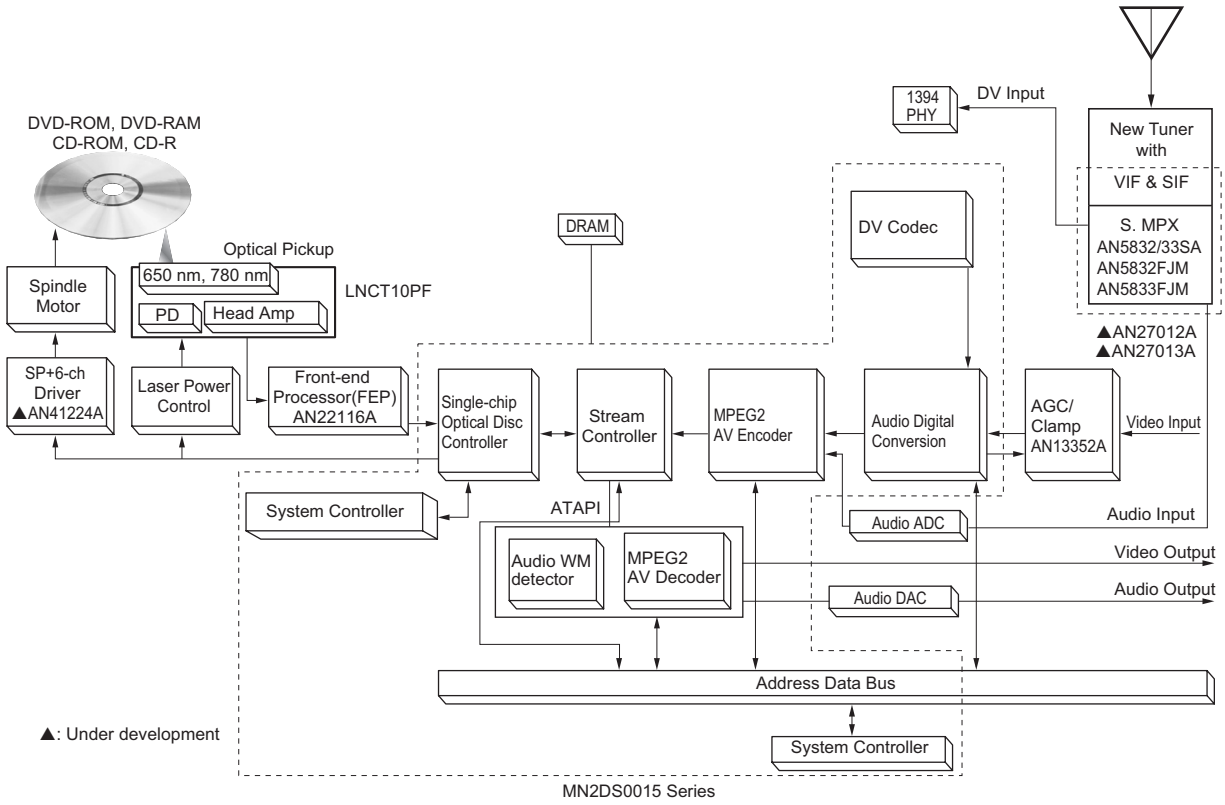
Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1218A/2SD1819A, UNR5000(UN5000) Series
Diode: MA2J111(MA111), MA2J728(MA728), MAZ8000(MA8000) Series, MA24D Series
Protector Elements: UNHS/UNHZ Series

Note) The part numbers in parentheses show the conventional ones.

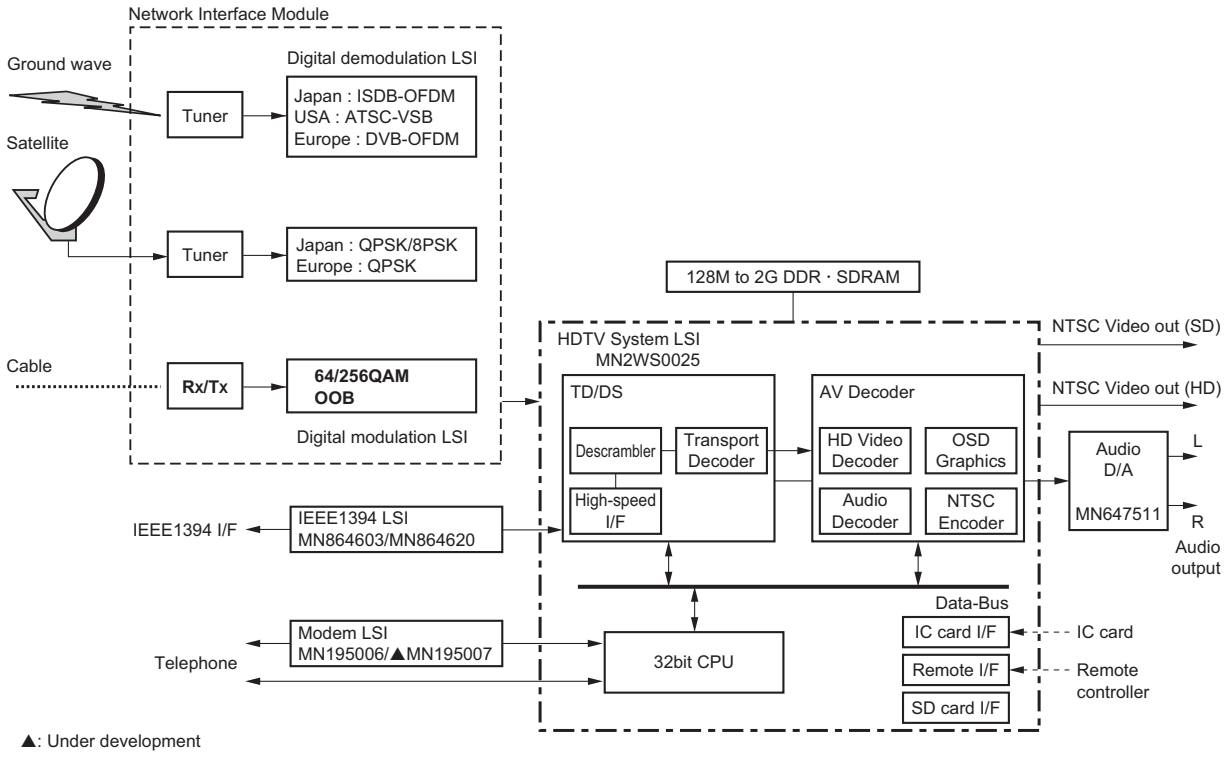
Application Block Diagrams

Video Applications

(5) DVD Recoder

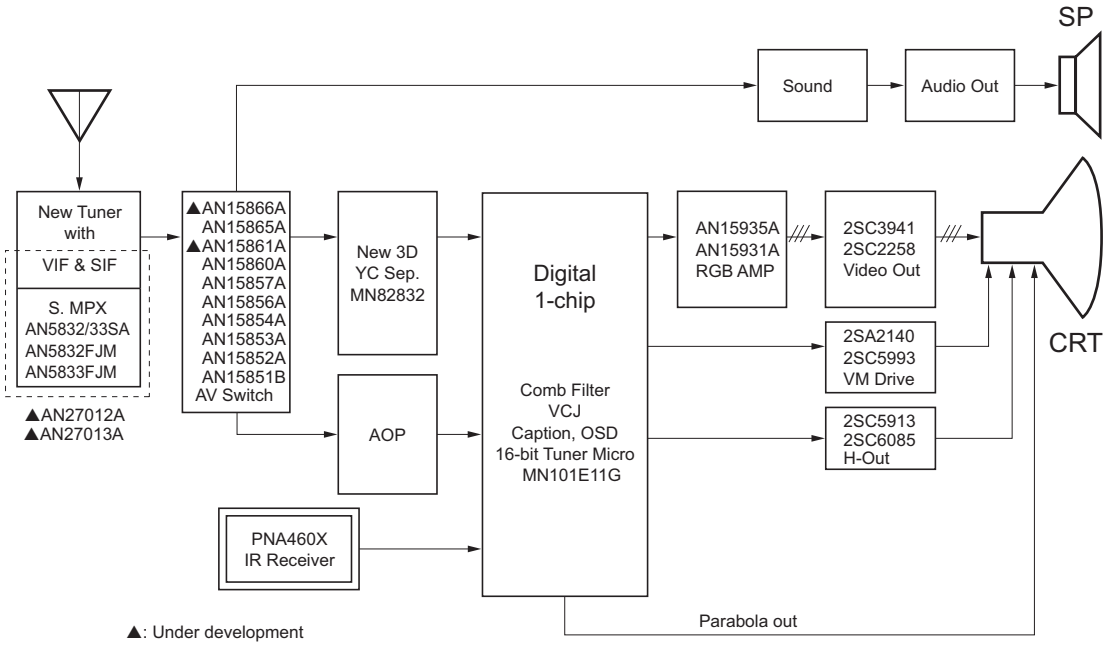


(6) Digital TV Solution



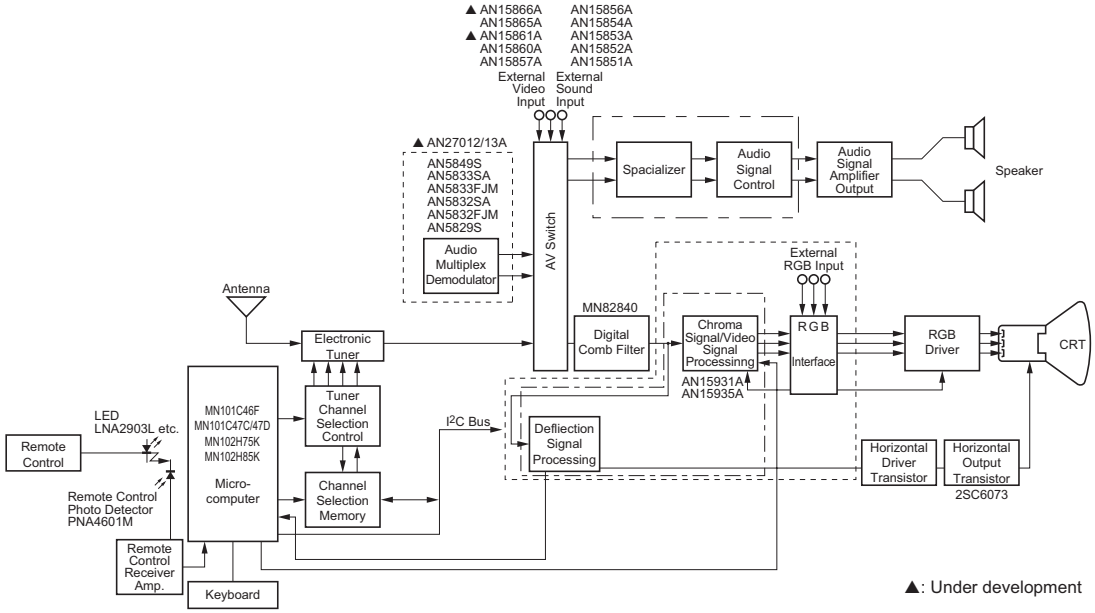
Video Applications

(7) Color TV (NTSC) – (1)



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB0709A (2SB709A), 2SD0601A (2SD601A), UNR2000 (UN2000) Series
Diode: MA2J111 (MA111), MA2J729 (MA729), MA3X152D (MA152WA), MA3X152E (MA152WK), MAZ8000 (MA8000) Series, MA22D Series, MA24D Series
Photo Couplers: CNC1S101 (ON3131) (For Japan and U.S.A.), CNC1S171 (ON3171) (For Europe)

(8) Color TV (NTSC) – (2)



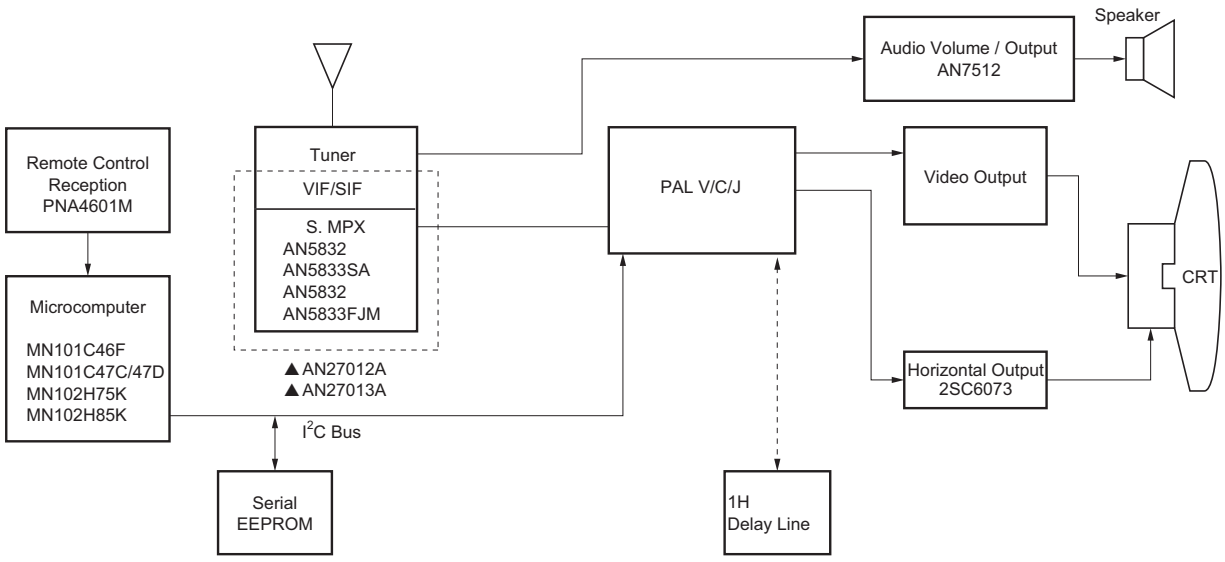
Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB0709A (2SB709A), 2SD0601A (2SD601A), 2SD1328, 2SB0970 (2SB970), UNR2000 (UN2000) Series
Diode: MA2J111 (MA111), MA2J728 (MA728), MA2J729 (MA729), MA3X152D (MA152WA), MA3X152E (MA152WK), MAZ8000 (MA8000) Series, MA22D Series, MA24D Series
Photo Couplers: CNC1S101 (ON3131) (For Japan and U.S.A.), CNC1S171 (ON3171) (For Europe)
Protector Elements: UNHS/UNHZ Series

Note) The part numbers in parentheses show the conventional ones.

Application Block Diagrams

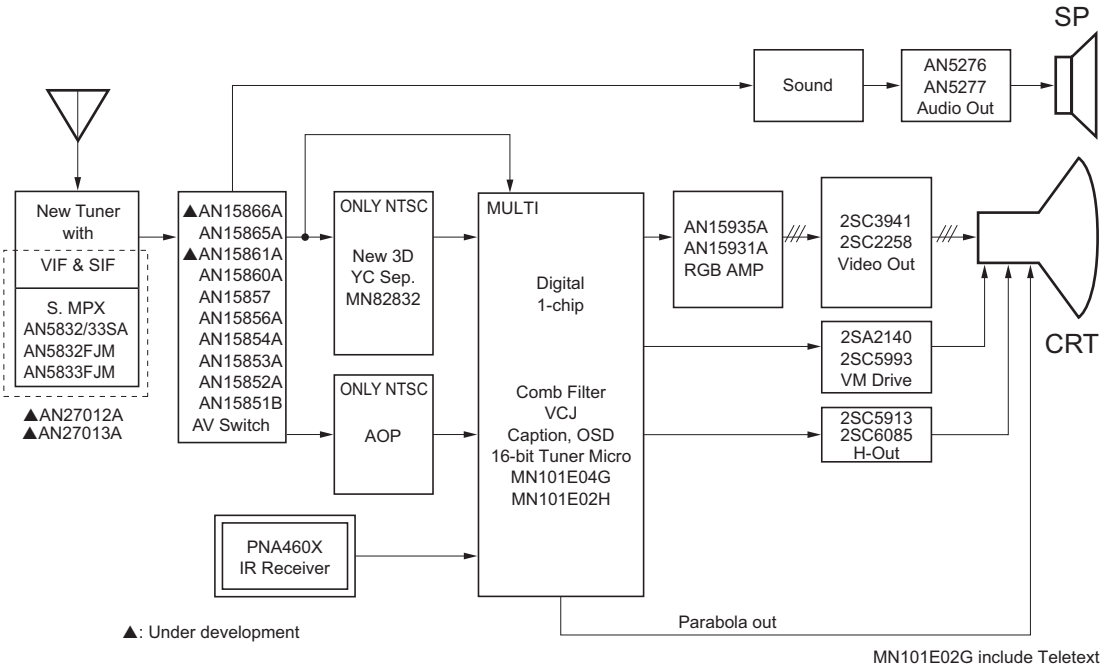
Video Applications

(9) Color TV (PAL/NTSC/SECAM) – (1)



▲: Under development

(10) Color TV (PAL/NTSC/SECAM) – (2)



▲: Under development

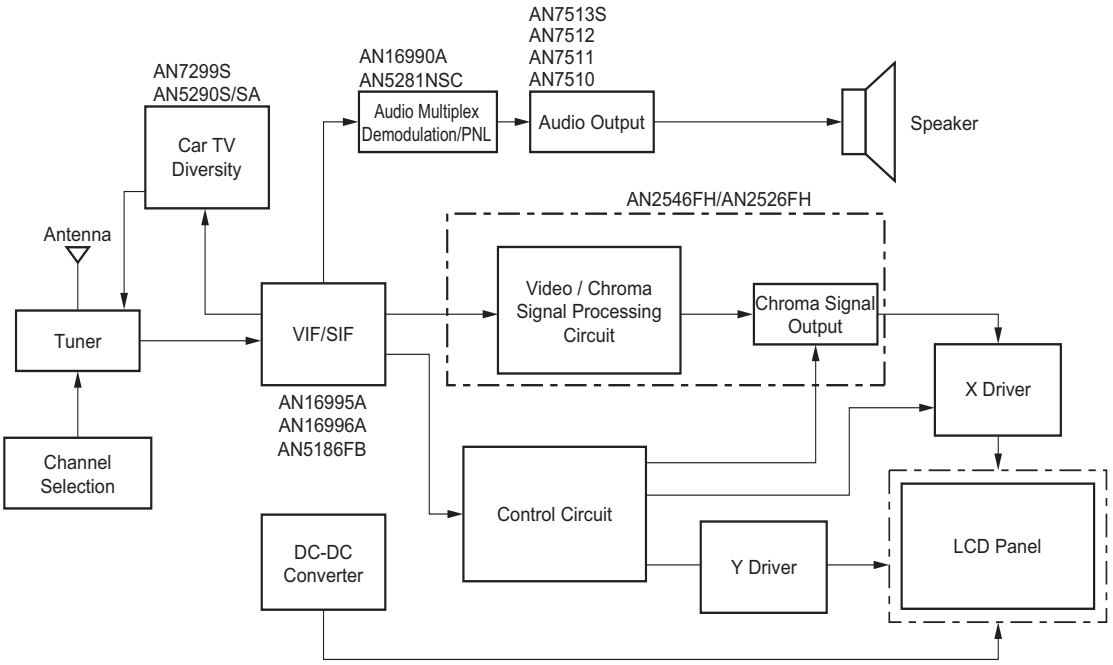
MN101E02G include Teletext

Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB0709A (2SB709A), 2SD0601A (2SD601A), UNR2000 (UN2000) Series
Diode: MA2J111 (MA111), MA2J729 (MA729), MA3X152D (MA152WA), MA3X152E (MA152WK), MAZ8000 (MA8000) Series
MA22D Series, MA24D Series, MA24D Series
Photo Couplers: CNC1S101 (ON3131) (For Japan and U.S.A.), CNC1S171 (ON3171) (For Europe)

Note) The part numbers in parentheses show the conventional ones.

Video Applications

(11) Liquid Crystal Display TV



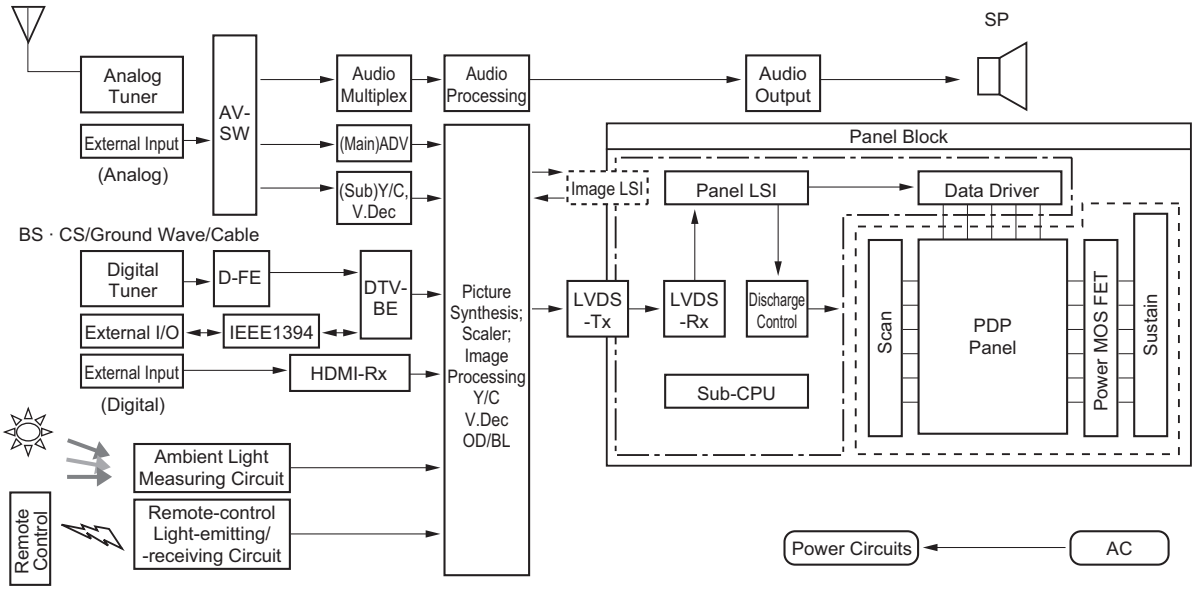
Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1218A/2SD1819A, UNR5000 (UN5000) Series, XP Series
Diode: MA2J111 (MA111), MA2J729 (MA729), MA2YD15, MA2ZD02, MAZ8000 (MA8000) Series, MA22D Series, MA2SD Series, MA24D Series
Protector Elements: UNHS/UNHZ Series

Note) The part numbers in parentheses show the conventional ones.

Application Block Diagrams

Video Applications

(12) PDP-TV

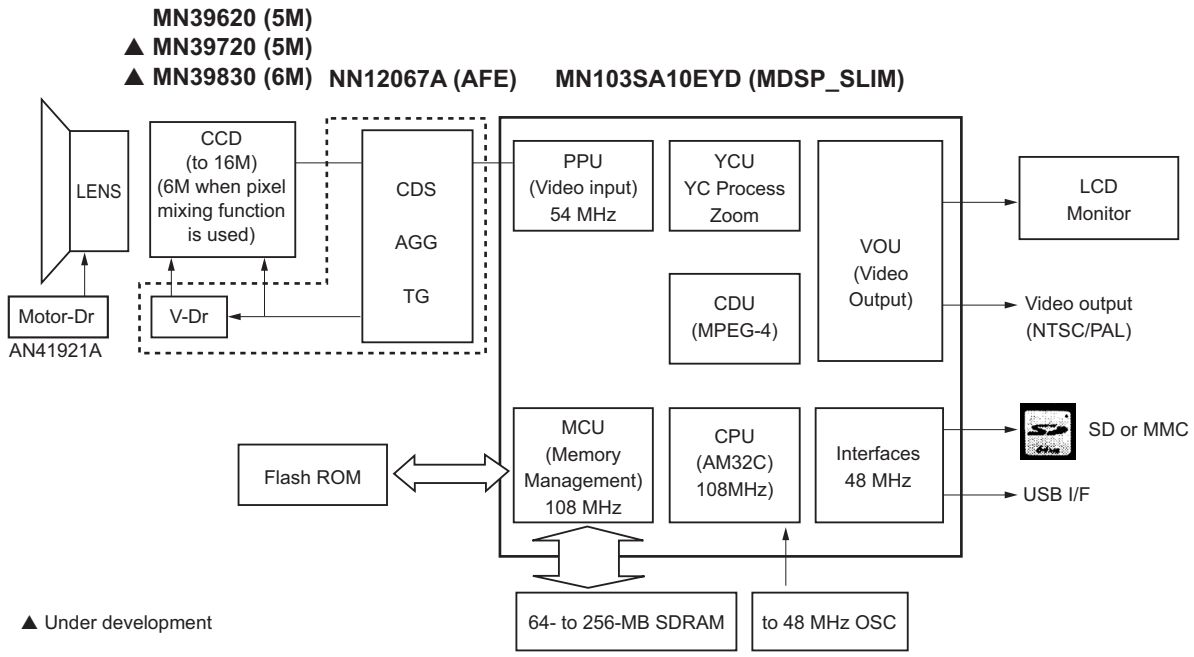


Category	Function/ Component Classification	Discrete Item Examples
Sustain	Power MOS FETs	2SK3995 to 2SK4000
	IGBT	2PG001, 2PG002, 2PG003
Ambient Light Measuring Circuit	Luminance Sensor	PNA4603H
Remote-control Light-emitting/-receiving Circuit	Transmitting Infrared Light Emitting LED	LNA2903L
	Light-receiving Photo IC	PNA46**M
General Circuits	Small signal Transistors	2SA1309A, 2SC3311A, UNR4000 Series, etc.
	Small signal Transistors Diodes	MA2J111, MA2J7**, MA3X15* Series, etc.
	Surge Protection	MAZ3000/MAZ8000 Series, MAZYS0750Z, etc.
Power Circuits	Power MOS FETs	2SK3043 to 2SK3048, 2SK3636
	Power Transistors	2SC5927, 2SC5809, 2SD1263
	FRD	MA3D649, MA3D650
	ZND	MAZ3000/MAZ8000 Series
	SBD	MA22D**, MA3X*** Series, MA24D** Series
	Output Error Feedback	CNC1S171 (Photo Couplers)

Application Block Diagrams

Video Applications

(13) Digital Still Camera System



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1462J, 2SD2216J, 2SA2078, 2SC5846
Diode: MA21D・MA22D・MA27D・MA2SD・MA4ZD ・MA24D Series, MAZD・MAZW・MAZM Series, MAYS, MALS068X, MA2YF80
Photo Couplers: CNC1S101, CNC1S171, CNA1312K

	CCD	Vdriver	Timing Gen.	CDS/AGC ADC	DSP	DC-DC	Audio
5.0M	MN39620 ▲MN39720	NN12067A			MN103SA10EYD	AN30211	AN12909A
6.0M	▲MN39830	TG + CDS/AGC/ADC + Vdr (12 bit)			Pixel Free built-in 32-bit CPU JPEG/MPEG4	Sync.rectif Min.1.51 V supply	QFN28 pin Microphone Amp. ALC, LPF

▲: Under Development

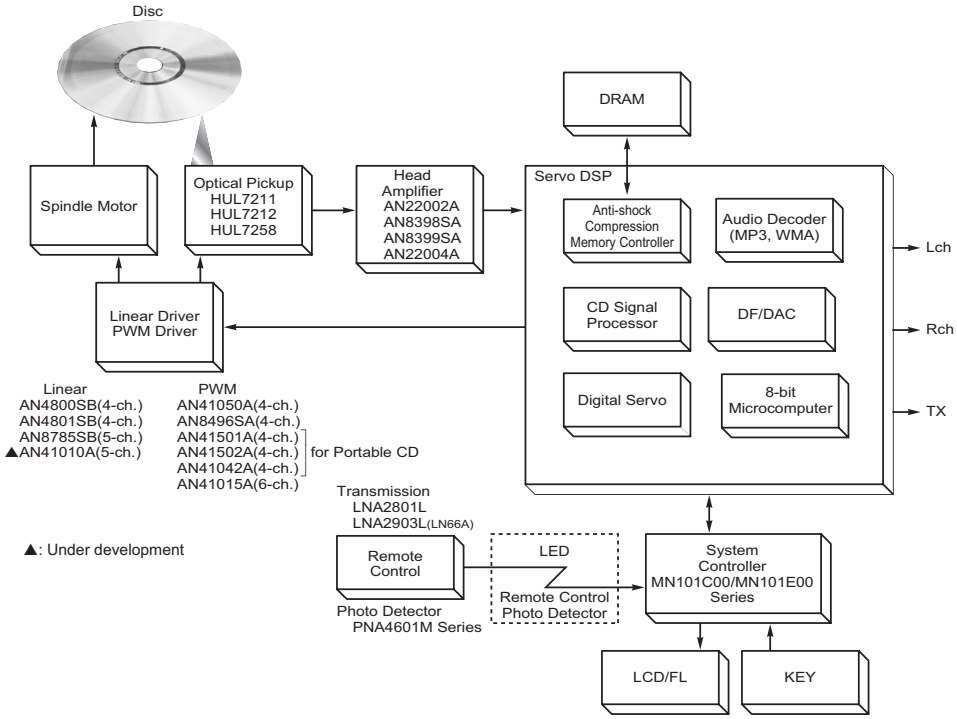
Transistors

Application/ Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)		Package (EIAJ, JEDEC)									
					ML3-N2		SSSMini3-F1		SSMini6-F1		SSMini3-F1		SMini3-G1	
	V_{CEO} (V)	I_C (mA)	h_{FE}	f_T (MHz)	(SC-101, SOT-883)	P_C (mW)	(SOT-723)	P_C (mW)	(SOT-666)	P_T (mW)	(SC-89, SOT-490)	P_C (mW)	(SC-70, SOT-323)	P_C (mW)
High-frquency Amplifiers	–20	–30	70 to 220	300	2SA2163	100	2SA2164	100			2SA1790J	125	2SA1532	150
	20	15	65 to 260	650					UP04534	125	2SC4627J	125	2SC3931	150
	20	50	25 to 250	1 300			2SC5946	100					2SC3932	150
	10	50	75 to 400	1 900			2SC5939	100			2SC4809J	125	2SC3935	150
	10	65	50 to 300	8 500							2SC5295J	125	2SC4805	150
High-frquency Amplifiers + General-use low freq. amplifier	20/50	15/100	65 to 260 160 to 460	650/15					UP04598	125				
	20/50	50/100	25 to 250 160 to 460	1 300/150					UP04599	125				
High-frquency Amplifiers + CCD load device	20	15	65 to 160	640					UP05C8B	125				
	V_{max} 40 V	I_{max} 10 mA	I_P 3.5 to 5.5 mA	Z_O 0.05 MΩ										

Application Block Diagrams

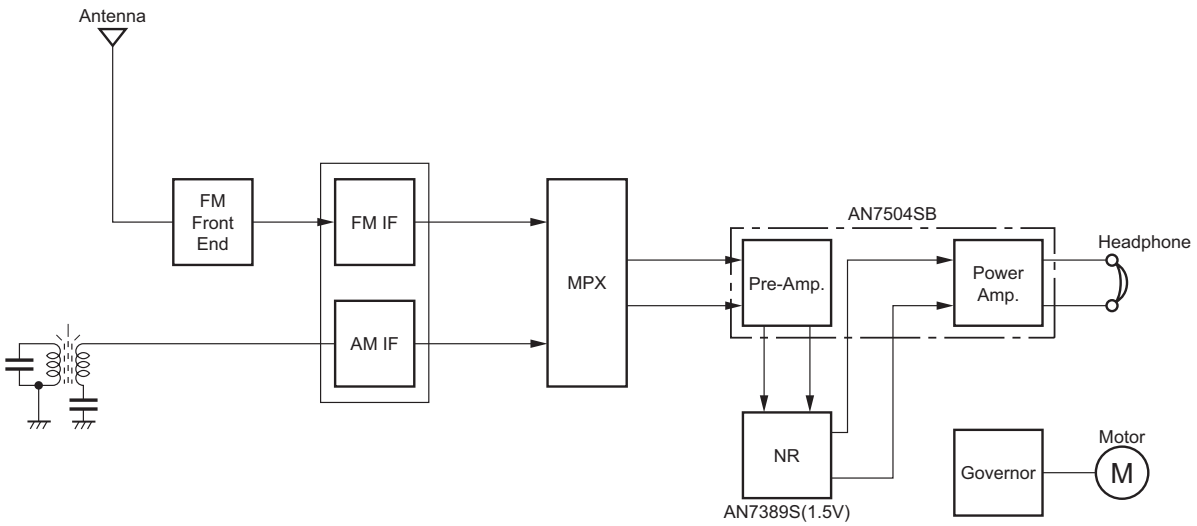
Audio Applications

(1) CD Player



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1218A, 2SD1819A, UNR5000 (UN5000) Series
Diode: MA2J111 (MA111), MAZ8000 (MA8000) Series

(2) Headphone Stereo/Microcassette/Radio (Headphone Stereo)

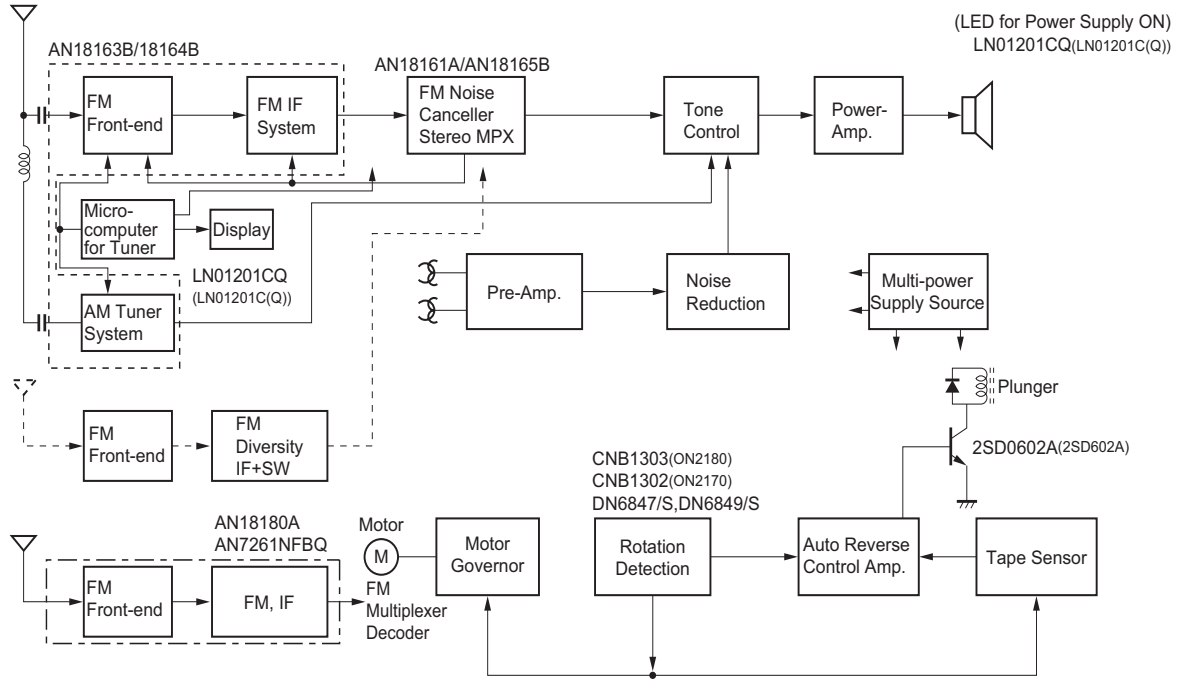


Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1462, 2SD2216, UNR9000 (UN9000) Series, etc.
Diodes: MA2J111 (MA111), MA2J729 (MA729), MA3X720 (MA720), etc.

Note) The part numbers in parentheses show the conventional ones.

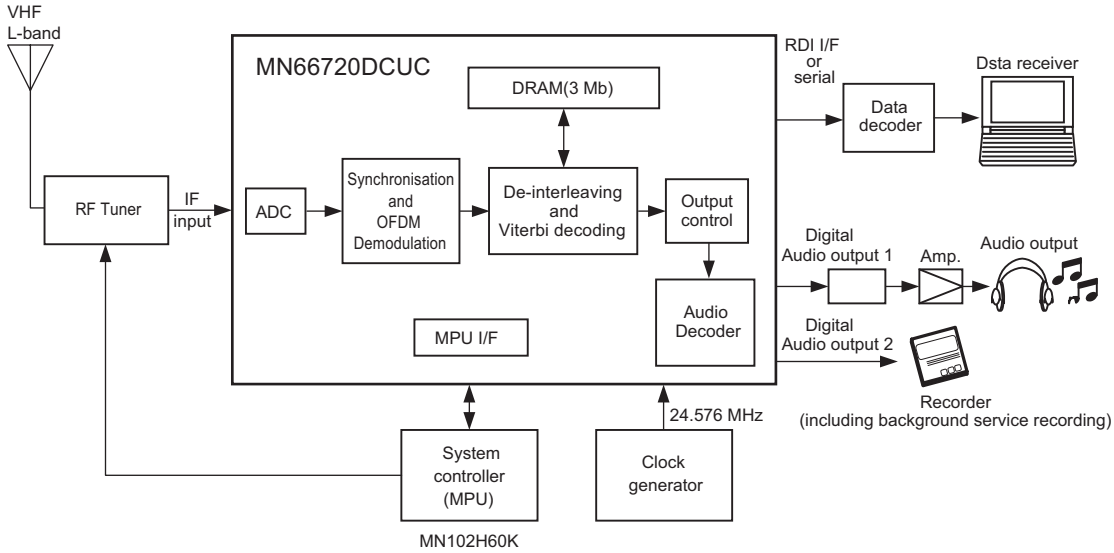
Audio Applications

(3) Car Radio/Car Stereo/FM Multiplexer



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1218A, 2SD1819A, UNR5000 (UN5000) Series
Diode: MA2J729 (MA729), MA2YD15, MA3J142D (MA142WA), MA3J142E (MA142WK), MAZ8000 (MA8000) Series

(4) DAB Receiver

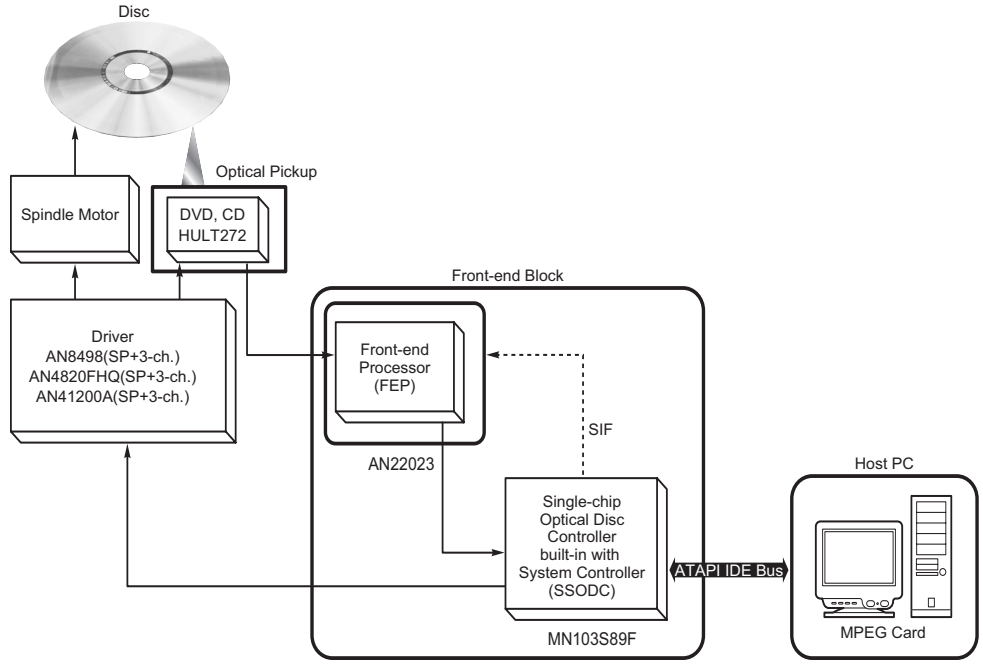


Note) The part numbers in parentheses show the conventional ones.

Application Block Diagrams

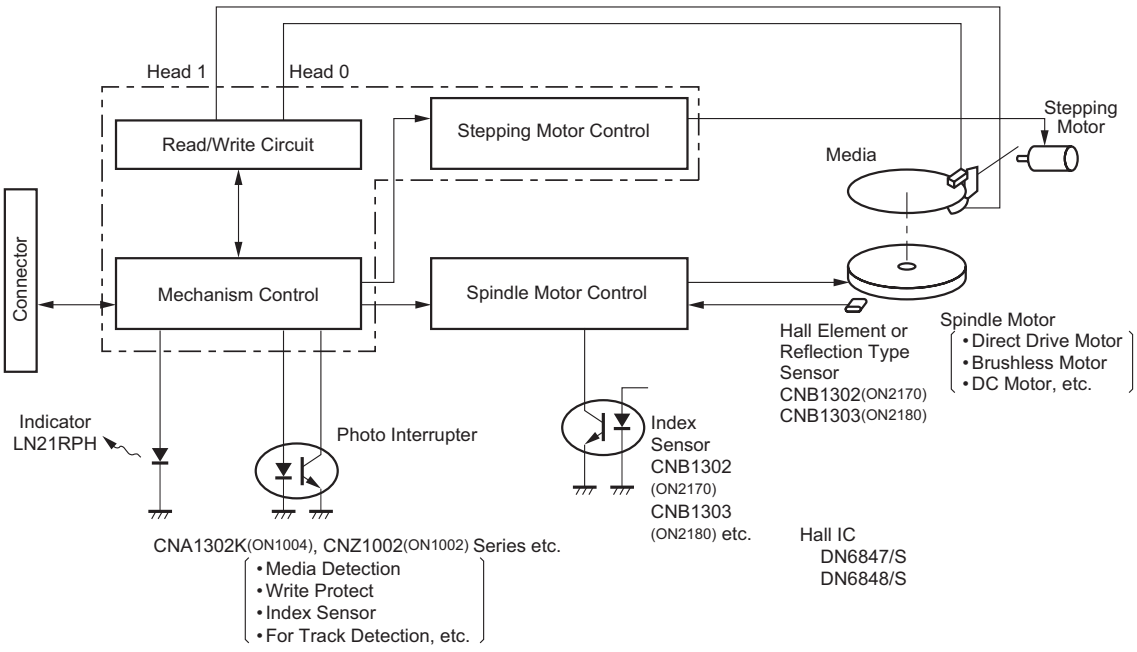
Information Applications

(1) DVD-ROM Drive (V8)



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1218A, 2SD1819A, UNR5000 (UN5000) Series
Diode: MA2J111 (MA111), MAZ8000 (MA8000) Series
Protector Elements: UNHZ Series

(2) Floppy Disc Drive

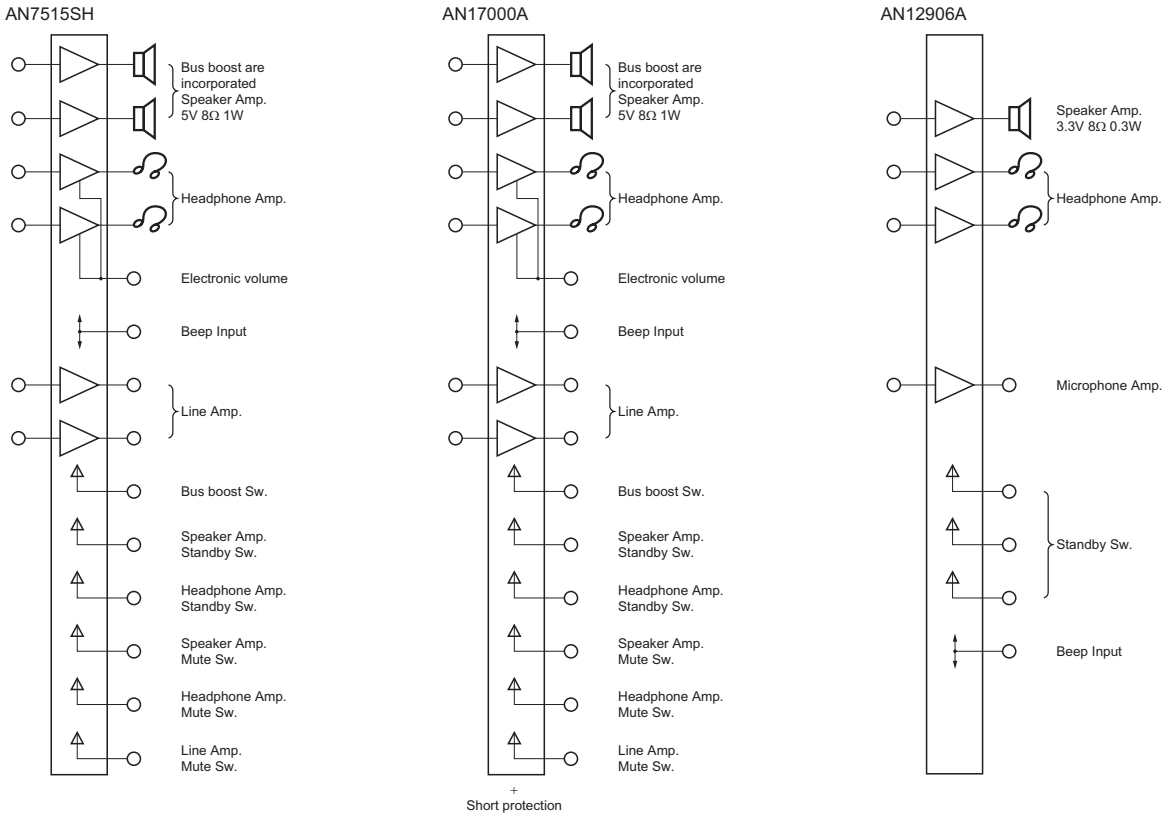


Note) The part numbers in parentheses show the conventional ones.

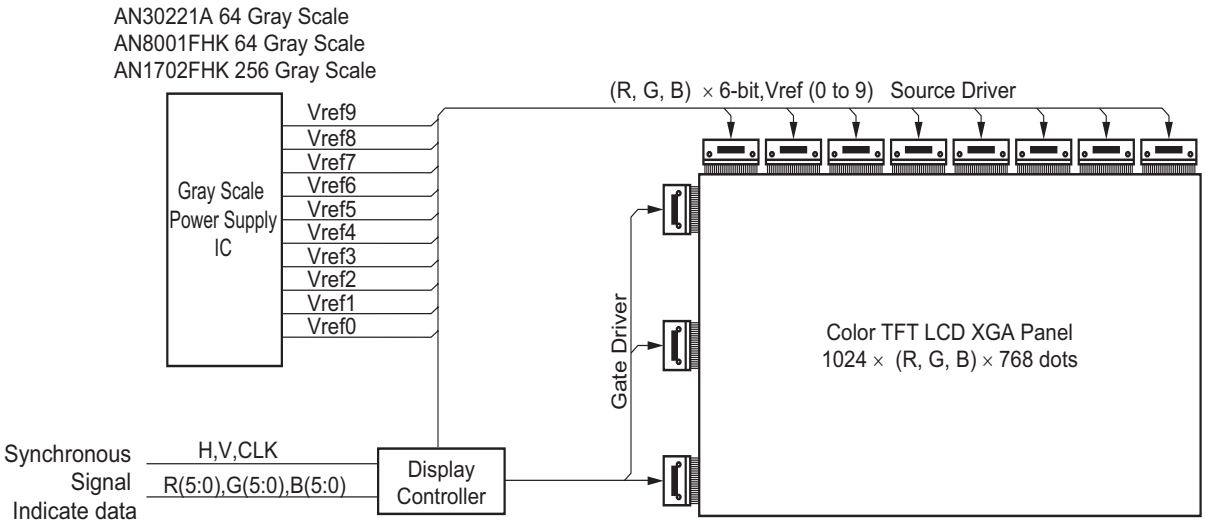
B

Information Applications

(3) Voice Signal Devices for Notebook PCs, MP3 players, and DSCs



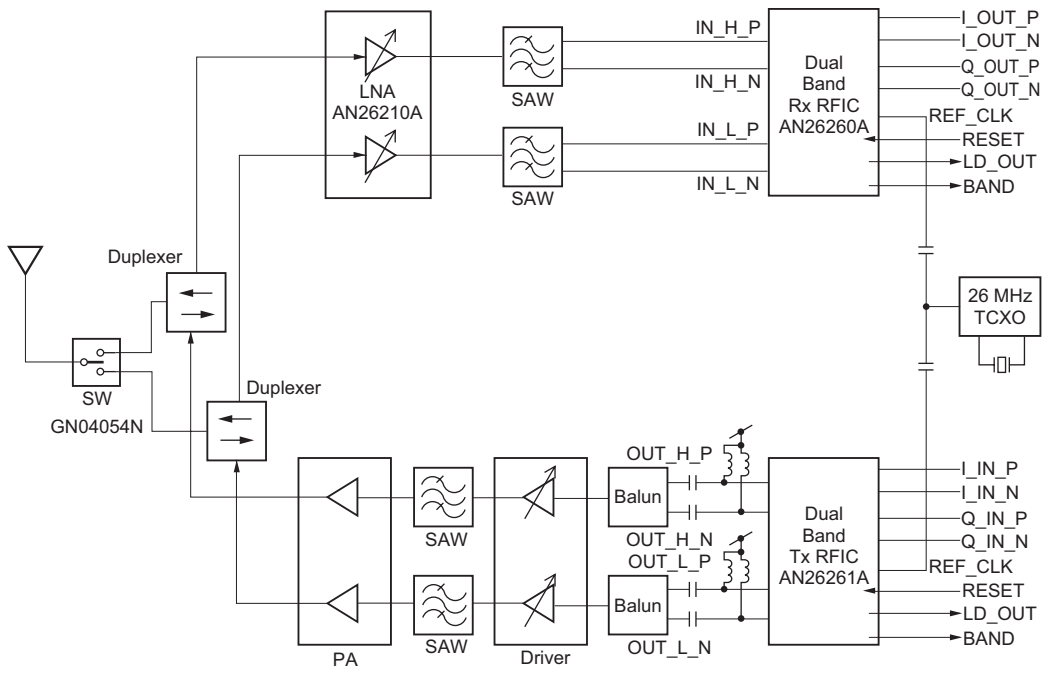
(4) Full-Color TFT-LCD System



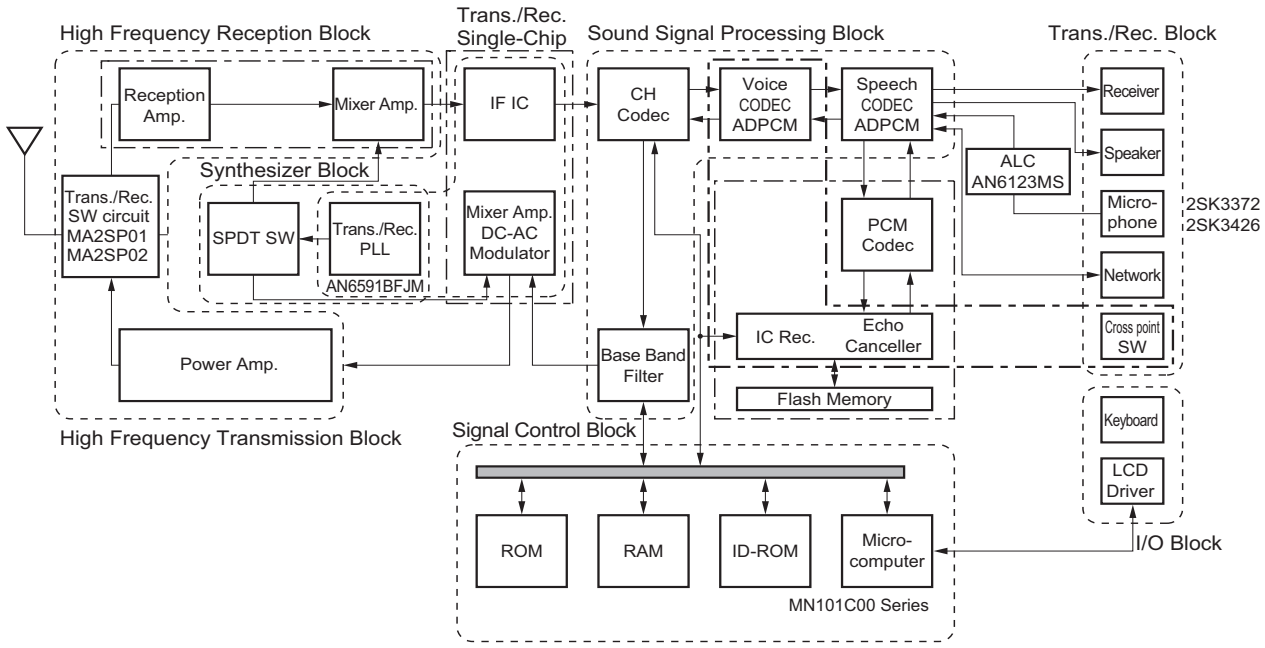
Application Block Diagrams

Communication Applications

(1) WCDMA Cellular Phone (0.8 GHz/2.1 GHz for domestic FOMA use)



(2) Digital Cordless Phone (Base set)

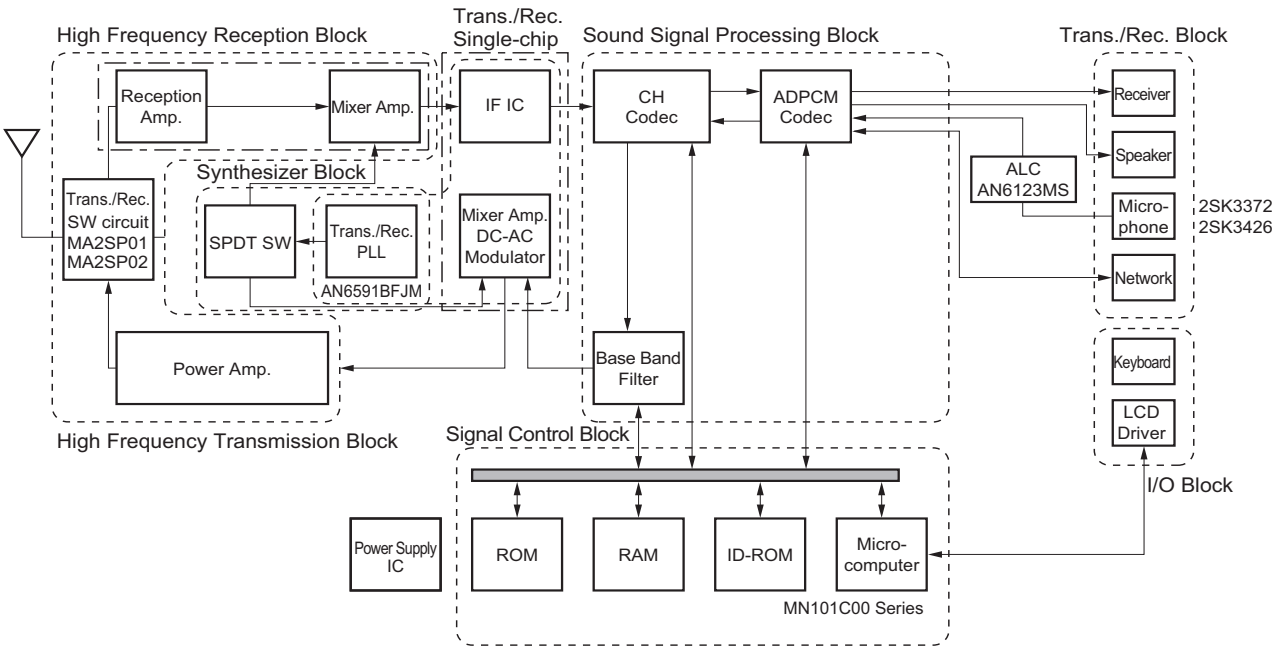


Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1462J, 2SD2216J, XP Series, UNR9000J(UN9000J) Series
Switching/Zener diode: MA2S111, MA2SD19, MAZS Series, MA21D, MA22D Series

Note) The part numbers in parentheses show the conventional ones.

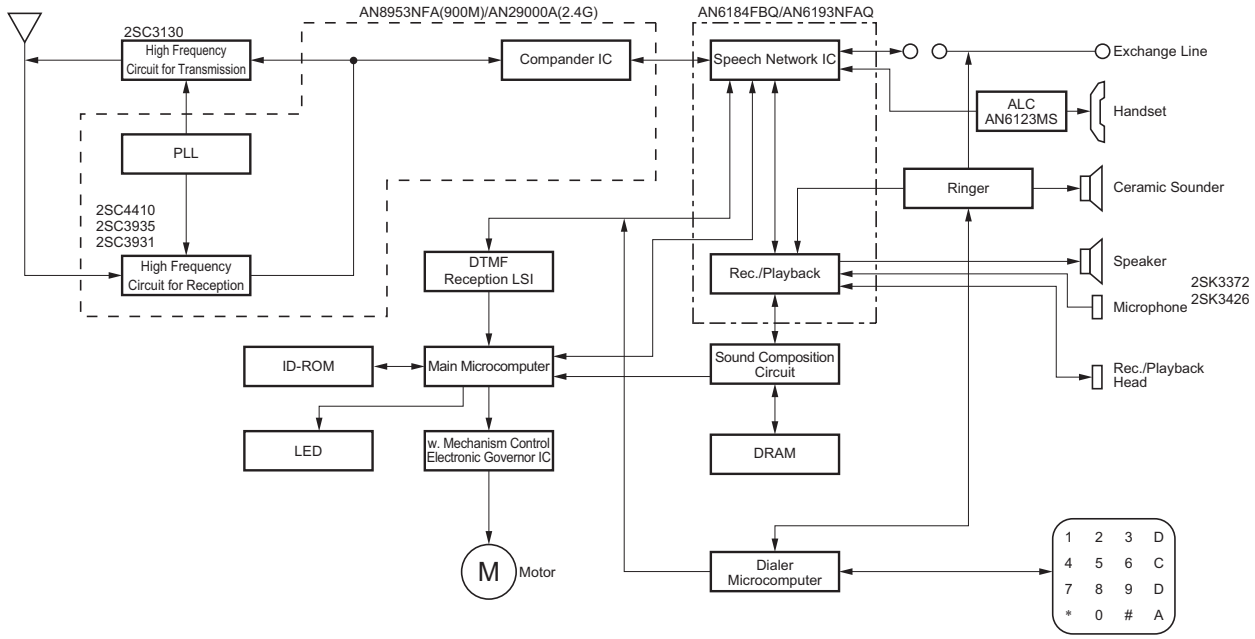
Communication Applications

(3) Digital Cordless Phone (Hand set)



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1462, 2SD2216, UNR9000J(UN9000J) Series
Diode: MA2J111, MAZS Series, MA21D, MA22D Series

(4) Cordless telephone with answering machine (base)



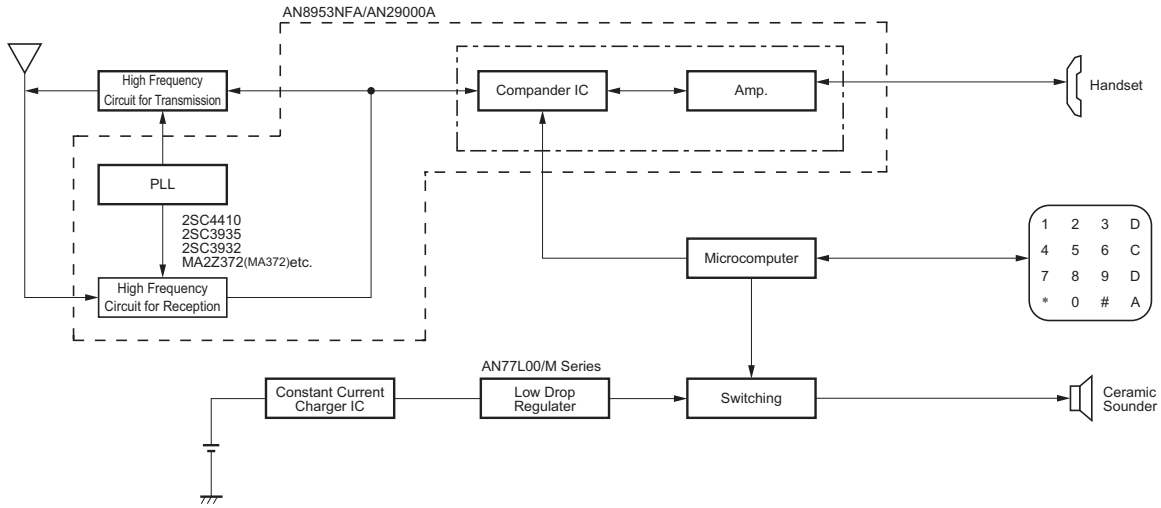
Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1462J, 2SD2216J, XP Series, UNR9000J Series
Diode: MA2S111, MA2SD19, MAZS Series, MA21D, MA22D Series

Note) The part numbers in parentheses show the conventional ones.

Application Block Diagrams

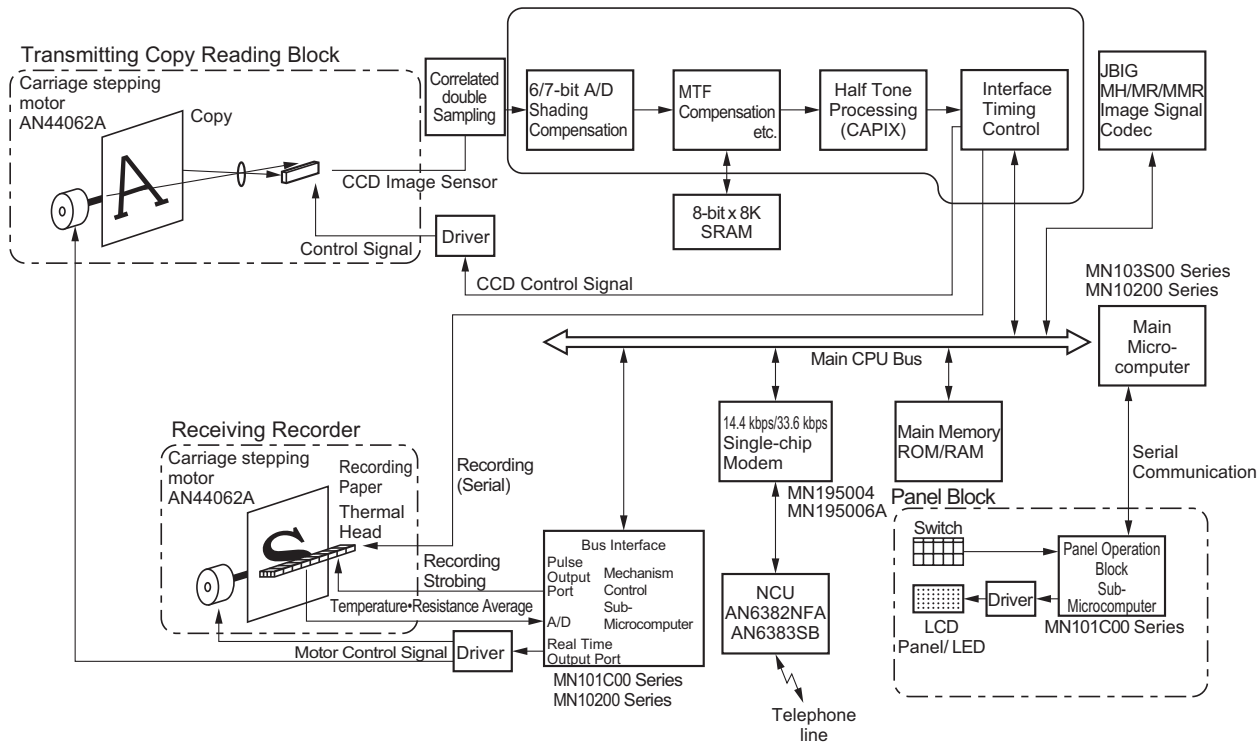
Communication Applications

(5) Cordless telephone with ansering machine (handset)



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.
Transistor: 2SB1462J, 2SD2216J, XP Series
Diode: MA2S111, MA2S728, MAZS Series, MA21D, MA22D Series

(6) Fax

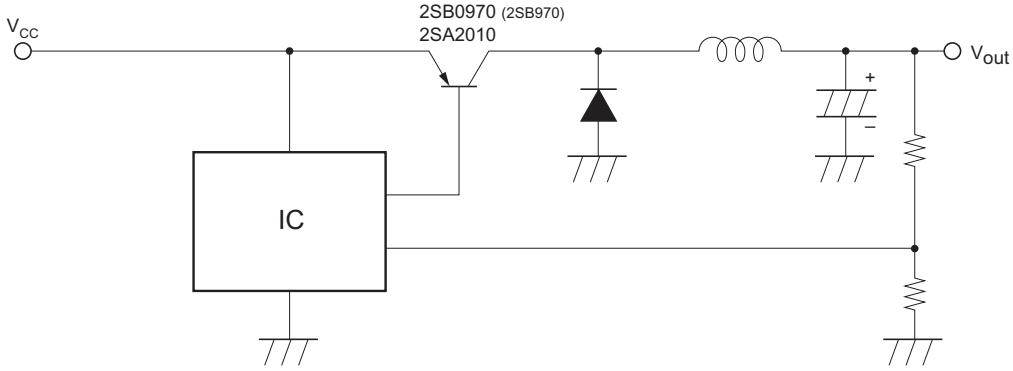


Note) The part numbers in parentheses show the conventional ones.

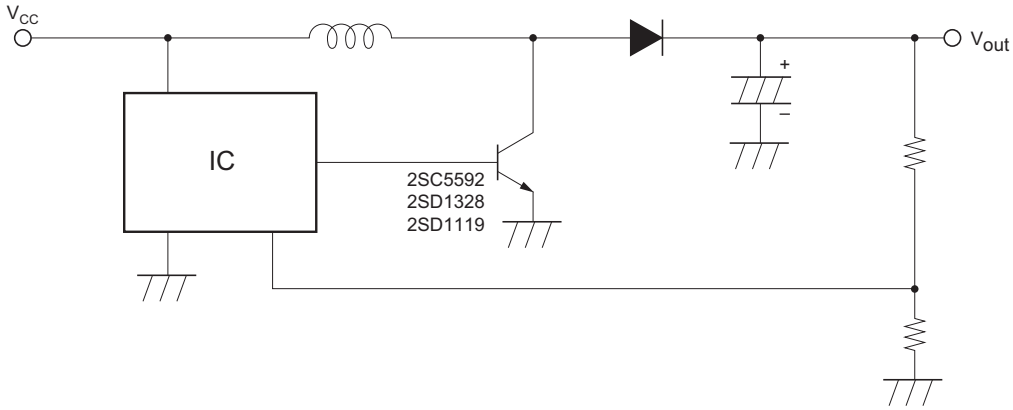
Industrial and Home Applications

(1) For Switching Power Supply DC-DC Converter

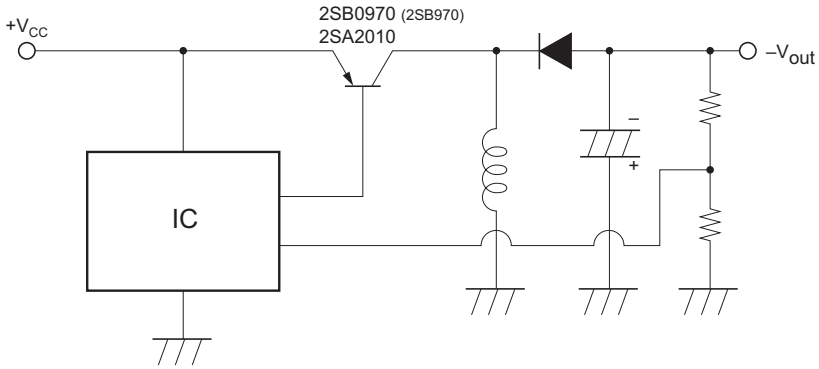
Step down



Step Up



Inversion

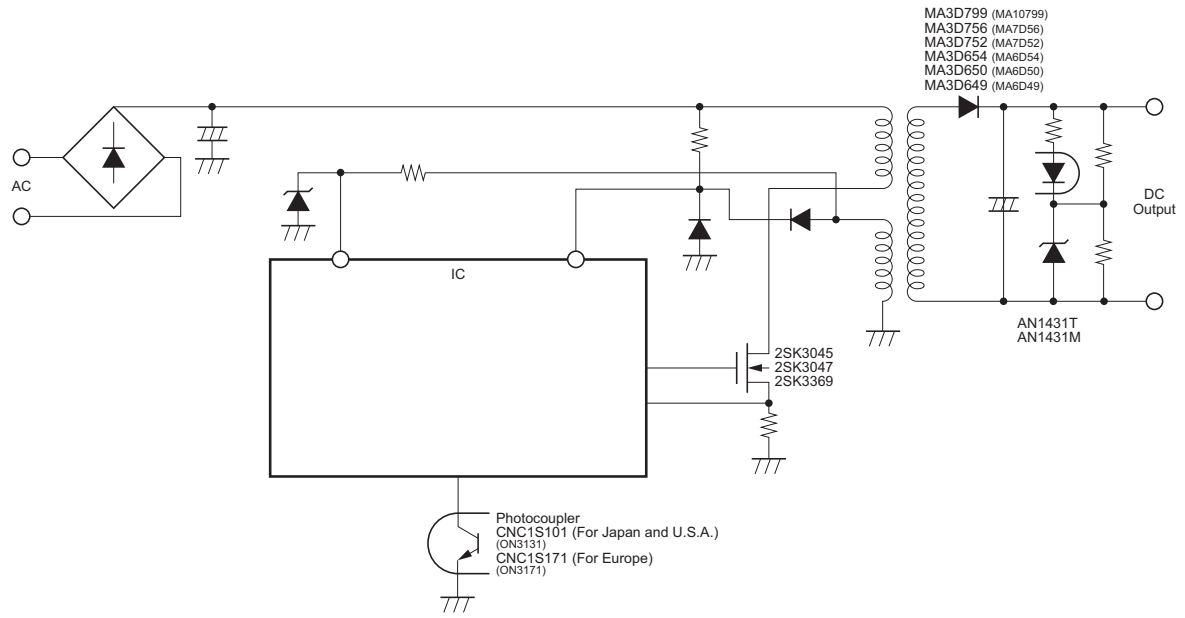


Note) The part numbers in parentheses show the conventional ones.

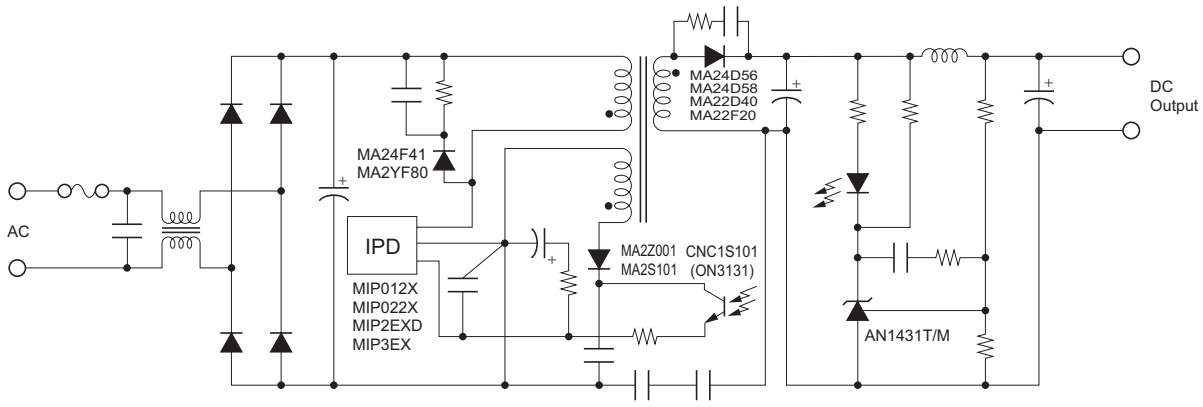
Application Block Diagrams

Industrial and Home Applications

(2) Switching Power Supply (Oscillation of RCC)



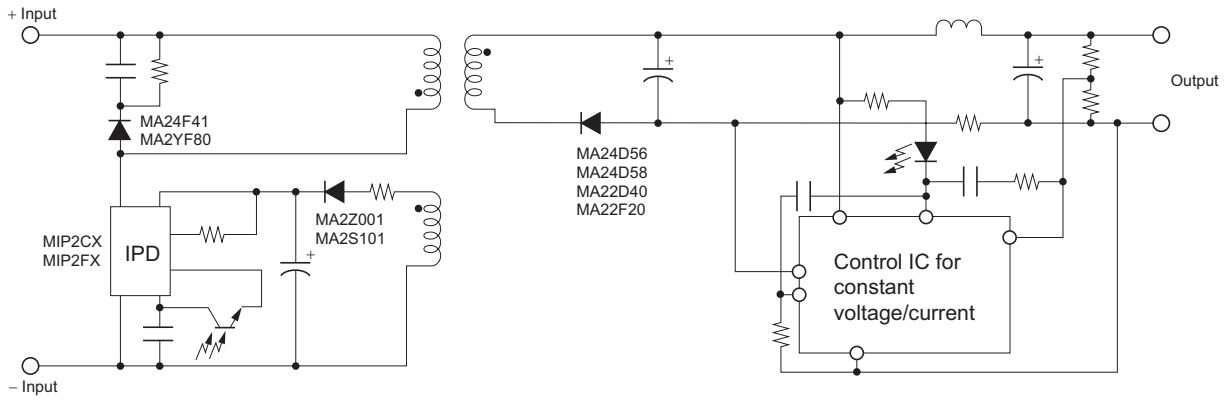
(3) Switching Power Supply (Flyback system)



Note) The part numbers in parentheses show the conventional ones.

Industrial and Home Applications

(4) Switching Power Supply (For chargers)



Transistors

Small Signal Bipolar Transistors

General-use Low-Frequency Amplifiers and Others

Application/ Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)							
	V_{CEO} (V)	I_C (mA)	$V_{CE(sat)}$ (V) ●NV (mV)	Condition I_C (mA)	h_{FE}	Condition I_C (mA)	ML3-N2 (SC-101, SOT-883)	P_C (mW)	SSSMini3-F1 (SOT-723)	P_C (mW)	SSMini3-F1 (SC-89, SOT-490)	P_C (mW)	SMini3-G1 (SC-70, SOT-323)	P_C (mW)
General-use low freq. amplifier	50	100	< 0.5 < 0.3	100	160 to 460	2					(2SB1462J 2SD2216J	125 125	(2SB1218A 2SD1819A	150 150
			< 0.5 < 0.3		180 to 390		(2SA2079 2SC5848	100 100	(2SA2078 2SC5846	100 100	(2SA2174J 2SC6054J	125 125	(2SA2122 2SC5950	150 150
	25	500	< 0.6	300	85 to 340	150							(2SB1219 2SD1820	150 150
	50												(2SB1219A 2SD1820A	150 150
High-h_{FE} (High V_{EBO})	40	50	< 0.2	10	600 to 2 000	2					2SD2345J	125	2SD1823	150
	100	20			400 to 1 200				2SD2621	100	2SD2620J	125	2SD1824	150
Low freq. low noise amplifier	120	20	●130	1	180 to 700	2					2SB1722J (V_{CEO} 100V)	125	2SA2009	150
	150	50	●150		130 to 330	10					(2SB1463J 2SD2240J	125 125	(2SB1220 2SD1821	150 150
	185												2SD1821A	150
	35				180 to 700	2							2SC3929	150
	55												2SC3929A	150
Low $V_{CE(sat)}$	10	500	< 0.3	400	130 to 350	500							2SB1679	150
	12		< 0.25	200	270 to 680	10			(2SA2162 2SC6036	100 100	(2SA2161J 2SC6037J	125 125		
	20		< 0.4	500	200 to 800	500							2SD2623	150
		300	< 0.1	30	550 to 2 500	4							2SD1979	150
		1 A	< 0.1	200	160 to 560	100							(2SA2028 2SC5654	150 150

(: Complementary pair

General-use Low-Frequency Amplifiers and Others (continued)

Application/ Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)							
	V_{CEO} (V)	I_C (mA)	$V_{CE(sat)}$ (V) ●NV (mV) ▲f_T (MHz)	Condition I_C *I_E (mA)	h_{FE}	Condition I_C (mA)	Mini3-G1 (SC-59A, SOT-346)	P_C (mW)	NS-A1 (SC-72) NS-B1	P_C (mW)	TO-92-A1 TO-92-B1	P_C (mW)	MT-1-A1	P_C (mW)
General-use low freq. amplifier	50	100	< 0.3	100	160 to 460	2	(2SB0709A	200	(2SA1309A	300			(2SB1320A	400
							2SD0601A	200	2SC3311A	300			2SD1991A	400
					180 to 390		(2SA2077	200						
							2SC5845	200						
	25	500	< 0.6	300	85 to 340	150	2SB0710	200						
	50						(2SB0710A	200	(2SB1030A	300	(2SA0720	625	(2SB1321A	600
							2SD0602A	200	2SD1423A	300	2SC1318	625	2SD1992A	600
		200	< 0.3	100	85 to 500	2	2SB1734	200						
							2SD2706	200						
	70	500	< 0.6	300	85 to 340	150					(2SA0720A	625		
											2SC1318A	625		
	25	1 A	< 0.4	500		500					(2SB0621	750		
											2SD0592	750		
	50										(2SB0621A	750		
											2SD0592A	750		
	25	100	< 0.5	100	210 to 460	2					2SB0774	400		
	20	500	< 0.3		160 to 560	100	2SB1693	200						
High-h_{FE}	40	50	< 0.2	10	400 to 2 000	2	2SD1030	200					2SD1995	400
	50	700	< 0.4	500	400 to 1 000	150					2SC2925	750		
	100	20	< 0.2	10	400 to 1 200	2	2SD1149	200						
Darlington	25	500	< 2.5	500	4k to 20k	500	2SD1478	200						
	50						2SD1478A	200						
Low freq. low noise amplifier	150	50	●150	1	130 to 450	10	2SB0792	200			(2SA1123	750		
											2SC2631	750		
	185				130 to 330	10	(2SB0792A	200						
							2SD0814A	200						
	35				180 to 700	2	(2SA1034	200	(2SA1310	300	(2SA1127	400	2SD1993	400
							2SA1035	200	2SC3312	300	2SC2634	400		
							2SC2405	200						
							2SC2406	200						
Low $V_{CE(sat)}$	10	500	< 0.3	400	130 to 350	500	2SB0970	200						
	20		< 0.4	500	200 to 800	500	2SD1328	200	2SD1450	300	2SD1302	600	2SD1996	600
					90 to 220	500	2SB0779	200						
		300	< 0.1	30	500 to 2 500	4	2SD1938F	600[1)]						
	15	2 A	< 0.28	1.5 A	200 to 800	100	2SC5725	600[1)]						
		2.5 A	< 0.32	2.5 A	200 to 560	100	2SA2010	600[1)]						
					400 to 1 000	100	2SC5592	600[1)]						
	80	1.5 A	< 0.15	500	160 to 560	100	2SA2046	400[1)]						
			< 0.5	1 A	200 ≤	100	2SC5813	600[1)]						
		1 A	< 0.3		80 to 250	1 A	2SD2714	300[1)]						
	20	5 A	< 1.0	3 A	230 to 600	500			2SD2321	400	2SB0976	750		
											2SD0965	750		
	10		< 0.5		300 to 800	500					2SD2504	750		
TV Chroma output	200	70	▲80	∗10	60 to 220	5	2SC5863	200			(2SA1018	750		
											2SC1473	750		
	300		▲50		30 to 150	5	2SA2084	200			2SA1767	750		
	400		▲30		60 to 220	5					2SC1473A	750		

(: Complementary pair

Mini3-G1 1): Measured on a ceramic substrate (15 × 15 × 0.6 mm)

H

Small Signal Bipolar Transistors

High-speed Switch · VCO and High Freq.

Application/ Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)	Package (EIAJ, JEDEC)							
	V_{CEO} V_{CES}[1)] (V)	I_C (mA)	t_S (ns)	ML3-N2 (SC-101, SOT-883)	P_C (mW)	SSMini3-F1 (SC-89, SOT-490)	P_C (mW)	SMini3-G1 (SC-70, SOT-323)	P_C (mW)	Mini3-G1 (SC-59A, SOT-346)	P_C (mW)
High speed switch • VCO and high freq. type	15	50	19	2SA2082	100	2SA1806J	125	2SA1739	150	2SA1738	200
	40[1)]	100	10			2SC4691J	125	2SC3938	150	2SC3757	200
	8	80	—			2SC5379J	125				

High-frequency Amplifiers and Others

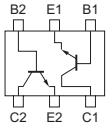
Function		Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)		Package (EIAJ, JEDEC)									
		V_{CEO} (V)	I_C (mA)	f_T (Hz)	Condition I_E*I_C (mA)	ML3-N2 (SC-101, SOT-883)	P_C (mW)	SSSMini3-F1 (SOT-723)	P_C (mW)	SSMini3-F1 (SC-89, SOT-490)	P_C (mW)	SMini3-G1 (SC-70, SOT-323)	P_C (mW)	Mini3-G1 (SC-59A, SOT-346)	P_C (mW)
AM • FM	Mix. OSC. Amp.	20	30	230 M	1					2SC4655J	125	2SC3936	150	2SC2778	200
	Amp.			300 M		2SA2163	100	2SA2164	100	(2SA1790J 2SC4626J	125 125	(2SA1532 2SC3930	150 150	(2SA1022 2SC2295	200 200
RF Amp.		50	50	250 M	2					(2SA1791J 2SC4656J	125 125	(2SA1748 2SC4562	150 150		
Video IF FM RF Amp.		20	15	650 M	1					2SC4627J	125	2SC3931	150	2SC2404	150
		8	50	1.1 G	∗15							2SC5632	150		
VHF	OSC. Amp.	20	50	1.3 G	15			2SC5946	100			2SC3932	150	2SC2480	150
UHF	OSC.	10	50	1.9 G	5	2SC6050	100	2SC5939	100	2SC4809J	125	2SC3935	150	2SC3130	150
1V RF Amp.		7	10	4.0 G	∗1	2SC5829	50					2SC4410	50	2SC3707	50
Wide Band Amp. SHF IF Amp.		12	30	4.5 G	∗10							2SC3934	150		
		10	80	6.0 G	∗20							2SC3937	150	2SC3704	200
					∗15			2SC6045	100	2SC4808J	125	2SC4835	150	2SC3829	200
					∗20									2SC5556	300
			65	8.5 G	∗15					2SC5295J	125	2SC4805	150		

(: Complementary pair

SiGe HBT

Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)	
	V_{CEO} (V)	I_C (mA)	h_{FE}	f_T (GHz)	Cob (pF)	$\|S21e\|^2$ (dB)	NF (dB)	ML3-N2 (SC-101, SOT-883) P_C = 100 mW	SSSMini3-F1 (SOT-723) P_C = 100 mW
High-frquency Amplifiers	6	30	100 to 220	19	0.3	11.0	1.4	MSG43001	MSG33001
		60			0.4	10.5		MSG43002	MSG33002
		100			0.5	10.0		MSG43003	MSG33003
				17	0.6	9.0		MSG43004	MSG33004
				16	0.8	8.0	1.6	MSG430C4	MSG330C4
				14	1.0	6.0		MSG430D4	MSG330D4

SiGe HBT (Combined Products)

Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)					Package	Basic Type		Equivalent Circuit
	V_{CEO} (V)	I_C (mA)	h_{FE}	f_T (GHz)	Cob (pF)	$\|S21e\|^2$ (dB)	NF (dB)	SSSMini6-F1 P_T = 125 mW	OSC	Buffer	
High-frquency Amplifiers	6	30	100 to 220	19	0.3	11.0	1.4	MSG36E11	MSG33001	MSG33001	
		100			0.5	10.0		MSG36E33	MSG33003	MSG33003	
		100/30			0.5/0.3	10.0/11.0		MSG36E31	MSG33003	MSG33001	
				17/19	0.6/0.3	9.0/11.0		MSG36E41	MSG33004	MSG33001	
		100/60		16/19	0.8/0.4	8.0/10.5	1.6/1.4	MSG36C42	MSG330C4	MSG33002	
				14/19	1.0/0.4	6.0/10.5	1.6/1.4	MSG36D42	MSG330D4	MSG33002	

H

Small Signal Bipolar Transistors

Composite Bipolar Transistors

(NP: SSSMini6-F1 Package, UP: SSMini6-F1 Package, XN: Mini5-G1·Mini6-G1 Packages,
XP: SMini5-G1·SMini6-G1 Packages)

Application	Absolute Maximum Ratings (T_a = 25°C)		Main Characteristics (T_a = 25°C)	SMini5-G1 (SC-88A,SOT-353) Mini5-G1 (SC-74A)							Mini6-G1 (SC-74,SOT-457) SMini6-G1 (SC-88,SOT-363) SSMini6-F1 (SOT-666) SSSMini6-F1	
				XN	XN	XN	XN	XN	XN	XN	XN	XN
	V_{CEO} (V)	I_C (mA)	h_{FE}	XP	XP	XP	XP	XP	XP	XP	XP•UP•NP	XP•UP•NP
				PNP × 2	NPN × 2	PNP + NPN	PNP + NPN	PNP + NPN	PNP × 2	NPN × 2	PNP × 2	NPN × 2
General-use	±50	±100	160 to 460	XN01401 XP01401	XN01501 XP01501	XN01601 XP01601	XN0B301 XP0B301	XN0C301 XP0C301	XN02401 XP02401	XN02501 XP02501	XN04401 XP04401 UP04401 NP04401	XN04501 XP04501 UP04501 NP04501
		±500	85 to 340			XN01602					XN04402	XN04502
	–50	–100/ –500	160 to 460/ 85 to 340								XN04482	
Low $V_{CE(sat)}$	–10/20	–500/ 500	100 to 350/ 200 to 800								XN04404	XN04504
	20	300	500 to 2 500		XN01504 XP01504							XN04506 XP04506
		500	200 to 800		XN01558							
General-use + Low $V_{CE(sat)}$	–10/50	–500/ 100	100 to 350/ 160 to 400									
	–50/20	–100/ 500	160 to 460/ 200 to 800									
	50/20	100/500										XN04505
High frequency	10	50	75 to 400		XN01531 XP01531							
	12	30	40 ≤									
	20		50 to 220									
		15	40 to 260									UP04534
	10	65	50 to 300									
	50	50	200 to 500		XN01509							XN04509
	7	10	10 to 200									
	15	50	50 to 150									
High freq. + General-use	20/50	15/100	65 to 260/ 160 to 460									UP04598
		50/100	25 to 250/ 160 to 460									UP04599
High-h_{FE}	100	20	400 to 2 000									XN04556
High-speed switching	–15/40	–50/100	50 to 150/ 60 to 320		XP01554							

Mini5/6-G1: P_T = 300 mW, SMini 5/6-G1: P_T = 150 mW, SSMini6-F1: P_T = 125 mW, SSSMini6-F1: P_T = 125 mW

Mini6-G1 (SC-74,SOT-457) SMini6-G1 (SC-88,SOT-363) SSMini6-F1 (SOT-666) SSSMini6-F1								Basic Type		Remarks
XN	XN	XN			XN	XN	XN			
XP•UP•NP	XP	XP	NP	NP	XP	XP				
PNP + NPN	NPN × 2	PNP + NPN	PNP × 2	NPN × 2	PNP × 2	NPN × 2	NPN × 2	PNP	NPN	
XN04601 XP04601 UP04601 NP04601	XN05501 XP05501	XN05601 XP05601		NP0A501	XN06401 XP06401	XN06501 XP06501		2SB0709A	2SD0601A	
XN04602								2SB0710A	2SD0602A	
								2SB0709A/ 2SB0710A	—	
XN04604								2SB0970	2SD1328	$V_{CE(sat)}$ = – 0.16/0.13 V
								—	2SD1938(F)	$V_{CE(sat)}$ = max 0.1 V
								—	2SD2623	$V_{CE(sat)}$ = 0.4 V
XN04608								2SB0970	2SD0601A	$V_{CE(sat)}$ = – 0.16/0.3 V
XN04609								2SB0709A	2SD1328	$V_{CE(sat)}$ = – 0.3/– 0.13 V
								—	2SD2216J 2SD1328	$V_{CE(sat)}$ = 0.3/0.13 V
	XN05531 XP05531							—	2SC3130	f_T = 1 900 MHz
						XN06537		—	2SC3934	f_T = 4 500 MHz
					XN06435 XP06435			2SA1022	—	f_T = 150 MHz
	XP05534					XN06534 XP06534		—	2SC2404	f_T = 650 MHz
						XN06543 XP06543		—	2SC3904	f_T = 8 500 MHz
								—	2SC4562	f_T = 250 MHz
				NP0A547				—	2SC5829	f_T = 4 000 MHz
			NP0A456					2SA2082	—	f_T = 1 500 MHz
								—	2SC2404 2SD2216J	
								—	2SC3932 2SD2216J	
	XN05553 XP05553							—	2SD1149	
XP04654	XP05554						XN0A554	2SA1738	2SC3757	t_{on} = 17 ns, t_{off} = 17 ns

H

Bipolar Power Transistors

General-use Low-Frequency Amplifiers and Others

Application/ Function	Absolute Maximum Ratings (T_C = 25°C)		Electrical Characteristics (T_C = 25°C)					Package (EIAJ, JEDEC)					
	V_{CEO} (V)	I_C (A)	$V_{CE(sat)}$ typ. (V)	Condition I_C (A)	Condition I_B (mA)	h_{FE} ●f_T (MHz)	Condition I_C ∗I_E (A)	U-G2 (SC-63)	P_C (W)	TO-126B-A1	P_C (W)	MT-3-A1	P_C (W)
General-use low freq. amplifier	35	1	< 0.5	0.5	50	85 to 340	0.5			(2SA0885 2SC1846	1.2 1.2	2SD2133	1.5
	40	1.5	0.4	– 1.5 2	– 150 200	50 to 220	1	(2SB0968 2SD1295	20 20	(2SA0886 2SC1847	1.2 1.2		
	50	2	< 1.0	1.5	150	50 to 220				(2SA1096 2SC2497	1.2 1.2		
	60									(2SA1096A 2SC2497A	1.2 1.2		
	50		< 0.3	1.0	50	120 to 340	0.2	2SB1574	10			(2SB1435 2SD2178	1.5 1.5
	60	3	< 1.2	3.0	375	40 to 250	1					(2SB1416 2SD2136	1.5 1.5
	100	0.5	0.2	0.5	50	65 to 330	0.15			(2SA0794 2SC1567	1.2 1.2		
	120									(2SA0794A 2SC1567A	1.2 1.2		
Audio drive	150	1	0.5	0.5	50	90 to 330	0.15					(2SB1414 2SD2134	1.5 1.5
Low $V_{CE(sat)}$	18	1	0.3	1.0	50	90 to 360	0.5			2SC1568	1.2		
	20	3		2.6	40	—	—					2SB1593	1.5
Darlington	50	1	< 1.8	1.0	1	4k to 40k	1			2SD0946A	1.2	2SD2220 (V_{CEO} = 80 V)	1.5
	80									2SD0946B	1.2		
	100	2	< 1.5	1.0	1		1			2SD1640	1.2	2SD2479	1.5
High breakdown voltage	400	0.1	< 2.5	0.05	5	Min. 30	0.03			2SB1011	1.2		
Display	V_{CBO} 110	0.15	< 0.5	0.15	15	●350	∗0.11			2SC3611	1.2		
TV Chroma input	250	0.1	< 1.2	0.05	5	●100	∗0.01			2SC2258	1.2		
TV Chroma input	300		< 1.5	0.03	3	●140	∗0.02			2SC3063	1.2		
TV Hori-zontal drive	300	0.2	< 1.0	0.05	5	●50	∗0.01			2SC4212	1.2		
High-h_{FE}	60	3	< 1.0	2.0	50	0.5k to 2.5k	0.5					2SD2573	1.5
		2						2SD2453	10				

(: Complementary pair P_C: T_C = 25°C

General-use Low-Frequency Amplifiers and Others (continued)

Application/ Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)							
	V_{CEO} (V)	I_C (A)	$V_{CE(sat)}$ (V) ●NV (mV)	Condition I_C (mA)	h_{FE}	Condition I_C (mA)	MiniP3-F1 (SC-62, SOT-89)	P_C (W)	MT-2-A1	P_C (W)	TO-92NL	P_C (W)	TO-92L-A1 (SC-51)	P_C (W)
General-use low freq. amplifier	25	0.5	< 0.6	300	85 to 340	150					2SC4208	1.0		
	50		< 0.6	300							2SC4208A	1.0		
	80		< 0.4	300	130 to 330		(2SB0767 2SD0875	1.0 1.0			(2SA1533 2SC3939	1.0 1.0	(2SA0777 2SC1509	1.0 1.0
	25	1.0	< 0.4	500	85 to 340	500	(2SB0766 2SD0874	1.0 1.0			2SC3940	1.0	2SA0683	1.0
	50		< 0.4	500			(2SB0766A 2SD0874A	1.0 1.0	(2SB1322A 2SD1994A	1.0 1.0	2SC3940A	1.0	(2SA0684 2SC1384	1.0 1.0
	40	1.5	< 1.0	1.5 A	80 to 220	1 A	(2SB1599 2SD2457	1.0 1.0						
	60	2.0	< 0.5	2 A	80 to 250	1 A	2SB1699	1.0						
	50		< 0.3	1 A	120 to 340	200	(2SB1440 2SD2185	1.0 1.0						
			< 0.3	1 A					(2SB1434 2SD2177	1.0 1.0				
	60		< 0.3	1 A					2SD2177A	1.0				
	50	5.0	< 0.3	2 A		500			(2SB1446 2SD2179	1.0 1.0				
	80	1.0	< 0.3	500		100	(2SA1890 2SC5026	1.0 1.0	(2SA1674 2SC4391	1.0 1.0				
	100	2.0	< 0.3	1 A		200			2SB1438	1.0				
	150	1.0	< 0.3	500		100	2SD2459	1.0	2SD2184	1.0				
High-h_{FE}	20	0.7	< 0.4	500	1k to 2.5k	150			2SD2259	1.0				
Darlington	80	1.0	< 1.8	1 A	4k to 40k	1 A	2SD1511	1.0						
	50	0.5	< 2.5	500	4k to 20k	500			2SD2598	1.0				
		1.0	< 1.8	1 A	4k to 40k	1 A			2SD2258	1.0				
	100	2.0	< 1.5	1 A					2SD2067	1.0				

(: Complementary pair

MiniP3-F1 PC value: When connected to a PC board with a collector pad area of 1.0 cm^2 or more and a thickness of 1.7 mm

P_C for all products except MiniP3-F1: T_C = 25°C

H

Bipolar Power Transistors

Low $V_{CE(sat)}$ and Others

Application/ Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)							
	V_{CEO} (V)	I_C (A)	$V_{CE(sat)}$ (V) ●NV (mV) ▲f_T (MHz)	Condition I_C *I_E (mA)	h_{FE}	Condition I_C (mA)	MiniP3-F1 (SC-62, SOT-89)	P_C (W)	MT-2-A1	P_C (W)	TO-92NL-A1	P_C (W)	TO-92L-A1 (SC-51)	P_C (W)
Low $V_{CE(sat)}$	20	0.5	< 0.4	500	200 to 800	500	2SD2210	1.0						
	10	1.0	< 0.15	500	200 to 800	100			2SD2358	1.0				
	18	1.0	< 0.5	1.0 A	130 to 280	500	(2SB0956 2SD1280	1.0 1.0						
	25	3.0	< 0.22	1.4 A	130 to 450	1.4 A					2SB1592	1.0		
	20	5.0	< 1.0	3.0 A	120 to 315	2 A	2SB1073 2SD1119	1.0 1.0	2SB1398 2SD2249	1.0 1.0	2SB1288	1.0	2SB0873	1.0
	80	3.0	< 0.4	2.0 A	80 to 250	1 A	2SD2715	1.0						
High breakdown voltage	100	0.5	< 0.6	500	130 to 330	150	2SB0789	1.0						
	120	0.5	< 0.6	500	130 to 330	150	2SB0789A 2SD0968A	1.0 1.0						
	120	0.5	< 1.0	300	90 to 330	150			2SD2225	1.0	2SB1297	1.0		
	400	0.1	< 1.5	50	30 ≤	30	2SD2413	1.0						
	400	0.5	< 1.5	250	30 ≤	30			2SD2565	1.0				
Display	45	0.05	▲500	∗10	20 to 100	10			2SC4502	1.02				
	50	0.15	▲350	∗100	20 ≤	100							2SC3526H	1.0
TV Chroma output	200	0.07	▲80	∗10	30 to 220	5					2SB1221	1.0	2SA0879	1.0
	200	0.07	▲80	∗10	30 to 220	5							2SC1573	1.0
	300	0.07	▲80	∗10	30 to 220	5							2SC1573A	1.0
	400	0.07	▲80	∗10	30 to 220	5							2SC1573B	1.0
	300	0.07	▲50	∗10	▲50	5					2SA1858	1.0		
	300	0.07	▲80	∗10	▲80	5			2SC5419	1.0	2SC3941	1.0		

(: Complementary pair

MiniP3-F1 PC value: When connected to a PC board with a collector pad area of 1.0 cm^2 or more and a thickness of 1.7 mm

P_C for all products except MiniP3-F1: T_C = 25°C

For Power Amplification

Application/ Function	Absolute Maximum Ratings (T_C = 25°C)		Electrical Characteristics (T_C = 25°C)			Package (EIAJ, JEDEC)											
				Condition		TO-220F-A1 (SC-67)				TO-220D-A1 (SC-91)				N-A1 N-G1			
	V_{CEO} (V)	I_C (A)	$V_{CE(sat)}$ typ. (V)	I_C (A)	I_B (mA)	PNP	P_C (W)	NPN	P_C (W)	PNP	P_C (W)	NPN	P_C (W)	PNP	P_C (W)	NPN	P_C (W)
General-use	60	4	< 1.5	4	400			2SD2000	35								
						2SB0942	40	2SD1267	40					2SB0930	40	2SD1253	40
	80					2SB0942A	40	2SD1267A	40					2SB0930A	40	2SD1253A	40
	60	3	< 0.8	3	375					2SB1724	30	2SD2693	25				
	80									2SB1724A	30	2SD2693A	25				
	60	8	< 1.2	5	250							2SC5505	20				
	80	10	< 0.5	6	300			2SD2151	30								
	100	5	< 2	3				2SD1499	40								
	150	2	< 1	0.5	50					2SA2118	25	2SC5935	25	2SB0928	30	2SD1250	30
	180													2SB0928A	30	2SD1250A	30
	250	0.75	< 1	1	200			2SD1263	35							2SD1249	35
	300							2SD1263A	35							2SD1249A	35
Low $V_{CE(sat)}$	20	10	0.4	10	330	2SB0948	40							2SB0936	40		
	40					2SB0948A	40							2SB0936A	40		
	50		< 0.5	5	250					2SA2064	25	2SC5779	25				
	60	3		3	375					2SA2057	20	2SC5739	20				
	80		0.3	2	100			2SD1268	30					2SB0931	30		
		4	0.25	3	150	2SB0944	35	2SD1269	35								
		5	0.3	1	125	2SB0945	40	2SD1270	40					2SB0933	40		
		7	0.25	5	250	2SB0946	40	2SD1271	40					2SB0934	40	2SD1257	40
	100							2SD1271A	40							2SD1257A	40
	180	1.5	< 0.5	1	100					2SA2140	20	2SC5993	20				
High-h_{FE}	60	6	< 1	5	100			2SD1474	40							2SD1719	40
		3		2	50	2SB1299	40					2SD2375	25			2SD1259	40
		5	< 0.3	4	100							2SD2528	40				
	150	1	< 1	0.5	20			2SD1272	40							2SD1258	40
Darlington	60	2	< 2.5	2	8			2SD1275	35					2SB0937	35	2SD1260	35
	80							2SD1275A	35					2SB0937A	35	2SD1260A	35
	60	4	< 2	3	12					2SB1623	30	2SD2420	30	2SB0938	40	2SD1261	40
	80									2SB1623A	30	2SD2420A	30	2SB0938A	40	2SD1261A	40
	60	8	< 1.5	4	8	2SB0951	45	2SD1277	45					2SB0939	45	2SD1262	45
	80					2SB0951A	45	2SD1277A	45					2SB0939A	45	2SD1262A	45
	120					2SB1193	50										
	400	6		3	60											2SD1611	40
		7	< 2	7	70			2SD1535	50								
	100	5	< 1.5	3	3			2SD1633	30								

P_C: T_C = 25°C

H

Bipolar Power Transistors

For Power Amplification (continued)

Application/ Function	Absolute Maximum Ratings (T_C = 25°C)		Electrical Characteristics (T_C = 25°C)			Package							
						I-A1 I-G1				MT-4-A1			
	V_{CEO} (V)	I_C (A)	$V_{CE(sat)}$ typ. (V)	Condition I_C (A)	Condition I_B (mA)	PNP	P_C (W)	NPN	P_C (W)	PNP	P_C (W)	NPN	P_C (W)
General-use	60	1	< 1	1	125	2SB1169	15						
	80					2SB1169A	15						
	60	3	< 1.2	3	375	2SB1172	15	2SD1742	15				
	80					2SB1172A	15	2SD1742A	15	2SB1417A	15	2SD2137A	15
	60		< 1.1							△2SB1725	—	△2SD2691	—
	80									△2SB1725A	—	△2SD2691A	—
	150	2	< 1	0.5	50			2SD1741	15				
	180							2SD1741A	15				
Low $V_{CE(sat)}$	20	10	0.4	10	330	2SB1148	15						
	40					2SB1148A	15						
	60	3	< 0.8	3	375					2SA2067	15	2SC5788	15
	80		0.3	2	100	2SB1174	15						
		4	0.25	3	150	2SB1175	15	2SD1745	15				
		5	0.3	1	125	2SB1176	15						
		7	0.25	5	250			2SD1747	15				
	100							2SD1747A	15				
	180	1.5	< 0.5	1	100								
High-h_{FE}	60	6	< 1	5	100			2SD1755	15				
		3		2	50			2SD1754	15				
	80							2SD1754A	15				
	60		< 0.7	1	20							2SC5926	15
			< 1	2	50							2SD2139	15
Darlington	60	2	< 2.5	2	8					2SB1418	15	2SD2138	15
	80									2SB1418A	15	2SD2138A	15
	60	4	< 2	3	12	2SB1179	15	2SD1749	15			2SD2242	15
	80					2SB1179A	15	2SD1749A	15			2SD2242A	15
	60	8	< 1.5	4	8	2SB1180	15	2SD1750	15				
	80					2SB1180A	15	2SD1750A	15				

△: Tentative P_C: T_C = 25°C

For Large-power Amplification

Application/ Function	Absolute Maximum Ratings (T_C = 25°C)		P_C (W) T_C = 25°C	Electrical Characteristics (T_C = 25°C)			Package (EIAJ, JEDEC)	
					Condition		TOP-3F-A1 (SC-92)	
	V_{CEO} (V)	I_C (A)		$V_{CE(sat)}$ (V)	I_C (A)	I_B (mA)	PNP	NPN
General-use	100	5	60	< 2	3	300		2SD1485
Low $V_{CE(sat)}$	80	10	70	0.2	6		2SB1154	2SD1705

For TV and CRT Monitor

Application	Absolute Maximum Ratings (T_C = 25°C)		Electrical Characteristics (T_C = 25°C)		Package (EIAJ, JEDEC)			
	V_{CBO} (V)	I_C (A)	$V_{CE(sat)}$ (V)	$t_{f\ max}$ (μs)	TO-220D-A1 (SC-91)	P_C (W)	TO-220F-A1 (SC-67)	P_C (W)
Chroma	300	0.1	< 1.5				2SC3942	10
VM circuit	–180	–1.5	< –0.5	0.1(typ)	2SA2140	25		
	180	1.5	< 0.5		2SC5993	25		

P_C: T_C = 25°C

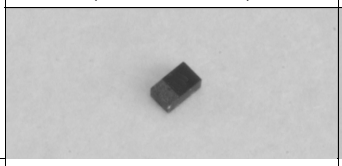
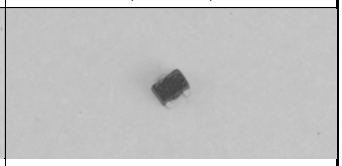
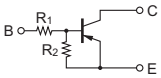
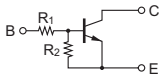
Bipolar Power Transistors

For Switching

Application	Absolute Maximum Ratings (T_C = 25°C)			Electrical Characteristics (T_C = 25°C)				Package (EIAJ, JEDEC)											
	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	$V_{CE(sat)}$ (V)	Condition I_C (A)	Condition I_B (mA)	t_f (µs)	MT-4-A1	P_C (W)	TO-220F-A1 (SC-67)	P_C (W)	TO-220D-A1 (SC-91)	P_C (W)	N-A1 N-G1	P_C (W)	I-A1 I-G1	P_C (W)	TOP-3F-A1 (SC-92)	P_C (W)
Switching	900	800	1	< 1.5	0.2	40	1	2SC4892	15	2SC4004	30			2SC3496	30	2SC3824	15	2SC4960	40
	900	900	1	< 1.5	0.2	40	1							2SC3496A	30	2SC3824A	15		
	1 000	800	3	< 0.6	0.8	160	1			2SC3743	40							2SC4359	70
	1 000	800	5	< 1.5	3	600	0.5											2SC3507	80
High-speed switching	500	400	3	< 1	1.5	300	0.3					2SC4953	30	2SC5104	30				
	500	400	3	< 1	1.5	300	0.07					△2SC5927	30						
	500	400	7	< 1	3	600	0.3			2SC4559	40								
	800	500	3	< 1	3	600	0.3					2SC5809	30						
	900	800	3	< 1.5	0.8	160	0.3			2SC3979	40							2SC4420	70
	1 000	800	3	< 1.5	0.8	160	0.3			2SC3979A	40								
	900	800	4	< 1.5	2	400	0.3											2SC3980	70

△: Tentative P_C: T_C = 25°C

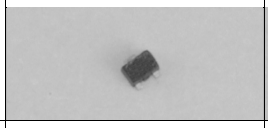
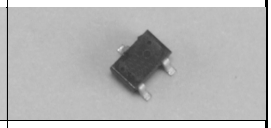
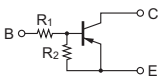
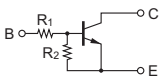
I_C = 80 mA Series

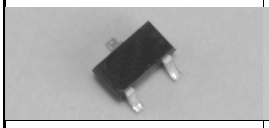
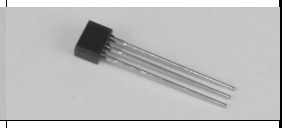
Resistor value (kΩ)		Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)	Package (EIAJ, JEDEC)			
					ML3-N2 (SC-101, SOT-883)		SSSMini3-F1 (SOT-723)	
								
R_1	R_2	V_{CEO} (V)	I_C (mA)	h_{FE}	(P_T = 100 mW)		(P_T = 100 mW)	
					PNP	NPN	PNP	NPN
47	—	–50/50	–80/80	160 to 460	UNRF1A0	UNRF2A0	UNR31A0	UNR32A0
10	10			35 ≤	UNRF1A1	UNRF2A1	UNR31A1	UNR32A1
22	22			60 ≤	UNRF1A2	UNRF2A2	UNR31A2	UNR32A2
47	47			80 ≤	UNRF1A3	UNRF2A3	UNR31A3	UNR32A3
10					UNRF1A4	UNRF2A4	UNR31A4	UNR32A4
	—			160 to 460	UNRF1A5	UNRF2A5	UNR31A5	UNR32A5
4.7	—				UNRF1A6	UNRF2A6	UNR31A6	UNR32A6
22	—				UNRF1A7	UNRF2A7	UNR31A7	UNR32A7
0.51	5.1			20 ≤	—	UNRF2A8	—	UNR32A8
1	10			30 ≤	UNRF1A9	UNRF2A9	UNR31A9	UNR32A9
100	100			80 ≤	UNRF1AA	—	UNR31AA	UNR32AA
47	22			60 ≤	—	—	UNR31AE	UNR32AE
4.7	10			30 ≤	UNRF1AF	UNRF2AF	UNR31AF	UNR32AF
2.2					UNRF1AH	—	UNR31AH	—
10	4.7			20 ≤	—	UNRF2AK	—	—
4.7					UNRF1AL	UNRF2AL	UNR31AL	UNR32AL
2.2	47			80 ≤	UNRF1AM	UNRF2AM	UNR31AM	UNR32AM
4.7				80 to 400	UNRF1AN	UNRF2AN	UNR31AN	UNR32AN
22					UNRF1AT	UNRF2AT	UNR31AT	UNR32AT
2.2	2.2			6 to 20	—	UNRF2AV	UNR31AV	UNR32AV
Equivalent circuit		(PNP Type) 			(NPN Type) 			

H

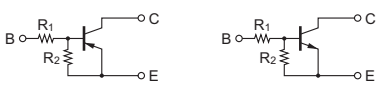
Transistor with Built-in Resistors

I_C = 100 mA Series

Resistor value (kΩ)		Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)	Package (EIAJ, JEDEC)			
					SSMini3-F1 (SC-89,SOT-490)		SMini3-G1 (SC-70,SOT-323)	
								
R_1	R_2	V_{CEO} (V)	I_C (mA)	h_{FE}	(P_T = 125 mW)		(P_T = 150 mW)	
					PNP	NPN	PNP	NPN
47	—	–50/50	–100/100	160 to 460	UNR9110J	UNR9210J	UNR5110	UNR5210
10	10			35 ≤	UNR9111J	UNR9211J	UNR5111	UNR5211
22	22			60 ≤	UNR9112J	UNR9212J	UNR5112	UNR5212
47	47			80 ≤	UNR9113J	UNR9213J	UNR5113	UNR5213
10					UNR9114J	UNR9214J	UNR5114	UNR5214
	—			160 to 460	UNR9115J	UNR9215J	UNR5115	UNR5215
4.7	—				UNR9116J	UNR9216J	UNR5116	UNR5216
22	—				UNR9117J	UNR9217J	UNR5117	UNR5217
0.51	5.1			20 ≤	UNR9118J	UNR9218J	UNR5118	UNR5218
1	10			30 ≤	UNR9119J	UNR9219J	UNR5119	UNR5219
100	100			80 ≤	UNR911AJ	UNR921AJ	—	—
	—			160 to 460	UNR911BJ	UNR921BJ	—	—
—	47			80 ≤	UNR911CJ	UNR921CJ	—	—
47	10			30 ≤	UNR911DJ	UNR921DJ	UNR511D	UNR521D
	22			60 ≤	UNR911EJ	UNR921EJ	UNR511E	UNR521E
4.7	10			30 ≤	UNR911FJ	UNR921FJ	UNR511F	UNR521F
2.2				30 ≤	UNR911HJ	—	UNR511H	—
10	4.7			20 ≤	—	UNR921KJ	—	UNR521K
4.7				20 ≤	UNR911LJ	UNR921LJ	UNR511L	UNR521L
2.2	47			80 ≤	UNR911MJ	UNR921MJ	UNR511M	UNR521M
4.7				80 to 400	UNR911NJ	UNR921NJ	UNR511N	UNR521N
22	47	–50/50	–100/100	80 to 400	UNR911TJ	UNR921TJ	UNR511T	UNR521T
2.2	2.2			6 to 20	UNR911VJ	UNR921VJ	UNR511V	UNR521V
—	100			80 ≤	—	—	—	UNR521W
4.7	22			60 to 200	—	—	UNR511Z	UNR521Z
2.2	2.2	–50/50	–500/500	40 ≤	—	—	—	—
4.7	4.7			50 ≤	—	—	—	—
10	10			60 ≤	—	—	—	—
2.2					—	—	—	—
0.27	5.0			20 ≤	—	—	—	—
3.1	4.6			50 ≤	—	—	—	—
10	47	–30	–100	80 ≤	—	—	UNR5154	—
		–50			—	—	UNR5174	UNR5274
	—	20	600	100 to 600	—	—	—	UNR5225
4.7	—				—	—	—	UNR5226
6.8	6.8			70 ≤	—	—	—	
Equivalent circuit					(PNP Type) 		(NPN Type) 	

Package (EIAJ, JEDEC)			
Mini3-G1 (SC-59A, SOT-346)		NS-A1 (SC-72) NS-B1	
			
(P_T = 200 mW)		(P_T = 300 mW)	
PNP	NPN	PNP	NPN
UNR2110	UNR2210	UNR4110	UNR4210
UNR2111	UNR2211	UNR4111	UNR4211
UNR2112	UNR2212	UNR4112	UNR4212
UNR2113	UNR2213	UNR4113	UNR4213
UNR2114	UNR2214	UNR4114	UNR4214
UNR2115	UNR2215	UNR4115	UNR4215
UNR2116	UNR2216	UNR4116	UNR4216
UNR2117	UNR2217	UNR4117	UNR4217
UNR2118	UNR2218	UNR4118	UNR4218
UNR2119	UNR2219	UNR4119	UNR4219
—	—	—	—
—	—	—	—
—	—	—	—
UNR211D	UNR221D	UNR411D	UNR421D
UNR211E	UNR221E	UNR411E	UNR421E
UNR211F	UNR221F	UNR411F	UNR421F
UNR211H	—	UNR411H	—
—	UNR221K	—	UNR421K
UNR211L	UNR221L	UNR411L	UNR421L
UNR211M	UNR221M	UNR411M	—
UNR211N	UNR221N	UNR411N	—
UNR211T	UNR221T	—	—
UNR211V	UNR221V	—	—
UNR211W	UNR221W	—	—
UNR211Z	UNR221Z	—	—
UNR2121	UNR2221	UNR4121	UNR4221
UNR2122	UNR2222	UNR4122	UNR4222
UNR2123	UNR2223	UNR4123	UNR4223
UNR2124	UNR2224	UNR4124	UNR4224
UNR212X	—	—	—
UNR212Y	—	—	—
UNR2154	—	—	—
—	—	—	—
—	UNR2225	—	—
—	UNR2226	—	—
—	UNR2227	—	—

(PNPType) (NPN Type)

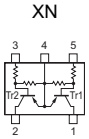
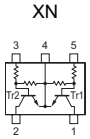
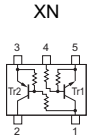
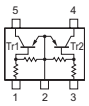
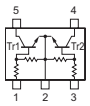
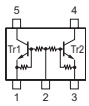
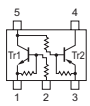


H

Transistor with Built-in Resistors

Composite Transistor with Built-in Resistors

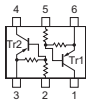
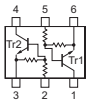
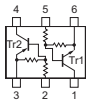
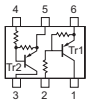
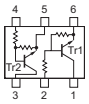
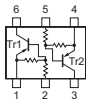
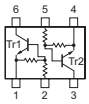
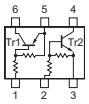
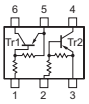
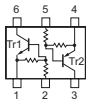
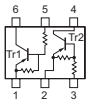
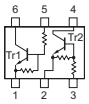
(NP: SSSMini6-F1 Package, UP: SSMini5-F2 · SSMini6-F1 Package,
XN: Mini5-G1 · Mini6-G1 Packages, XP: SMini5-G1 · SMini6-G1 Packages)

Application	Resistancce (kΩ)		Absolute Maximum Ratings (T_a = 25°C)		Main Characteristics (T_a = 25°C)	Mini5-G1 (SC-74A) SMini5-G1 (SC-88A,SOT-353) SSMini5-F2 Mini6-G1 (SC-74,SOT-457)			
						XN 	XN 		XN 
	R_1	R_2	V_{CEO} (V)	I_C (mA)	h_{FE} (min.)	XP•UP 	XP•UP 	XP 	XP•UP 
						PNP × 2	NPN × 2	NPN × 2	PNP + NPN
General-use switching	10	10	50	100 80*1	35 ≤	XN01111 XP01111	XN01211 XP01211	XP02211	XN0A311 XP03311
	22	22			60 ≤	XN01112	XN01212 XP01212 UP01212		XN0A312 XP03312 UP03312
	47	47			80 ≤	XN01113 XP01113 UP01113	XN01213 XP01213 UP01213		
	10					XN01114 XP01114	XN01214 XP01214 UP01214		
	4.7	∞			160 to 460	∗XN01115 ∗XP01115	∗XN01215 ∗XP01215	∗XP02215	
						∗XN01116 ∗XP01116	∗XN01216 ∗XP01216		∗XP03316
	22					∗XP01117	∗XP01217		
	0.51	5.1			20 ≤	XP01118			
	1	10			30 ≤	XN01119 XP01119			
	47	∞			160 to 460	∗XN01110 ∗XP01110	∗XN01210 ∗XP01210	∗XP02210	
		22			60 ≤		XN0121E XP0121E		
	4.7	10			30 ≤	XN0111F XP0111F	XN0121F		
	2.2					XN0111H XP0111H			
	4.7	47			80 ≤				
					80 to 400				

∗1: NP0XXXX series value

Note) ∗: With no resistor between Emitter and Base, R_2 (e.g., only base resistor, R_1)

Mini5/6-G1: P_T = 300 mW, SMini 5/6-G1: P_T = 150 mW, SSMini5-F2 / SSMini6-F1: P_T = 125 mW, SSSMini6-F1: P_T = 125 mW

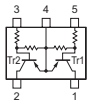
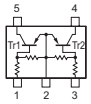
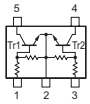
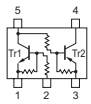
Mini6-G1 (SC-74,SOT-457) SMini6-G1 (SC-88,SOT-363) SSMini6-F1 (SOT-666)		Mini6-G1 (SC-74,SOT-457) SMini6-G1 (SC-88,SOT-363) SSMini6-F1 (SOT-666) SSSMini6-F1					Basic Type	
XN 	XN 			XN 	XN 	XN 		
XP•UP•NP 	XP•UP•NP 	NP 	NP 	XP•UP•NP 	XP•NP 	XP•NP 		
PNP × 2	NPN × 2	PNP+NPN	PNP × 2	PNP + NPN	PNP × 2	NPN × 2	PNP	NPN
XN04111 XP04111 UP04111	XN04211 XP04211 UP04211			XN04311 XP04311 UP04311	XP06111	XN06211 XP06211	UNR2111	UNR2211
NP041A1	NP042A1			NP043A1	NP061A1	NP062A1	UNR31A1	UNR32A1
XN04112 XP04112 UP04112	XN04212 XP04212 UP04212			XN04312 XP04312 UP04312	XP06112	XP06212	UNR2112	UNR2212
NP041A2	NP042A2			NP043A2	NP061A2		UNR31A2	UNR32A2
XN04113 XP04113 UP04113	XN04213 XP04213 UP04213			XP04313 UP04313	XN06113 XP06113	XN06213 XP06213	UNR2113	UNR2213
NP041A3	NP042A3	NP0G3A3		NP043A3	NP061A3	NP062A3	UNR31A3	UNR32A3
XN04114 XP04114	XN04214 XP04214 UP04214			XN04314 XP04314 UP04314	XP06114	XN06214 XP06214	UNR2114	UNR2214
NP041A4	NP042A4			NP043A4			UNR31A4	UNR32A4
∗XN04115 ∗XP04115	∗XN04215 ∗XP04215 ∗UP04215			∗XN04315 ∗XP04315 ∗UP04315	∗XP06115	∗XN06215 ∗XP06215	UNR2115	UNR2215
∗NP041A5	∗NP042A5			∗NP043A5	∗NP061A5		UNR31A5	UNR32A5
∗XN04116 ∗XP04116 ∗UP04116	∗XN04216 ∗XP04216 ∗UP04216			∗XN04316 ∗XP04316 ∗UP04316	∗XP06116	∗XN06216 ∗XP06216	UNR2116	UNR2216
∗NP041A6	∗NP042A6			∗NP043A6			UNR31A6	UNR32A6
∗XP04117	∗XP04217 ∗UP04217						UNR2117	UNR2217
∗NP041A7	∗NP042A7						UNR31A7	UNR32A7
							UNR2118	UNR2218
							UNR2119	UNR2219
	∗XN04210 ∗XP04210 ∗UP04210					∗XP06210	UNR2110	UNR2210
∗NP041A0	∗NP042A0	∗NP0G3A0				∗NP062A0	UNR31A0	UNR32A0
							UNR211E	UNR221E
			NP0G1AE				UNR31AE	—
	XN0421F						UNR211F	UNR221F
							UNR211H	—
					NP061AM	NP062AM	UNR31AM	UNR32AM
					NP061AN	NP062AN	UNR31AN	UNR32AN

H

Transistor with Built-in Resistors

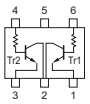
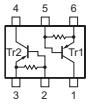
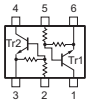
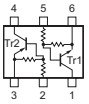
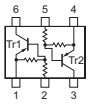
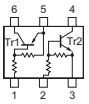
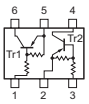
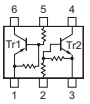
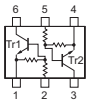
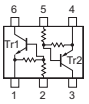
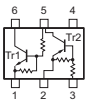
Composite Transistors (Built-in Resistors) (continued)

(NP: SSSMini6-F1 Package, UP: SSMini5-F2 · SSMini6-F1 Package,
XN: Mini5-G1 · Mini6-G1 Packages, XP: SMini5-G1 · SMini6-G1 Packages)

Application	Resistance (kΩ)		Absolute Maximum Ratings (T_a = 25°C)		Main Characteristics (T_a = 25°C)	Mini5-G1 (SC-74A) SMini5-G1 (SC-88A,SOT-353) SSMini5-F2		
						XN 		
	R_1	R_2	V_{CEO} (V)	I_C (A)	h_{FE} min.	XP 	XP•UP 	XP•UP 
						PNP × 2	NPN × 2	PNP + NPN
General-use switching	2.2	47	50	– 0.1/0.1	80 ≤	XN0111M XP0111M	XP0121M UP0121M	
	4.7						XP0121N	
		4.7		– 0.5/0.5	50 ≤			
	∞	10	15	0.5	80 to 280			
	4.7/47	4.7/47	50	– 0.5/0.1	50 ≤/80 ≤			
		10/47		– 0.1/0.1	30 ≤/80 ≤			XP03383 UP03383
	1/4.7							
	1/47							
	∞	4.7/∞	50/60		20 ≤/150 to 460			
	4.7	4.7	50	0.1	20		XP0121L	
	0.51/10	5.1/10		– 0.1/0.1	20 ≤/30 ≤			XP03389
	10/47	47/47			80 ≤			XP03390 UP03390
				– 0.08/0.08				
For muting	4.7	∞	20	0.6	100 to 600			
	3.3							
	0.27							
For digital circuits	47/47	47/47	50	0.08	80 ≤			
	47/4.7	47/4.7			80 to 400			
	22/4.7	47/4.7			80 ≤			
	47/22	47/47						
	4.7/4.7	47/∞		0.1	80 to 400/ 160 to 460			XP03391
	10/47	∞		0.08	160 to 460			
	47/0.51	47/5.1		0.1	80 ≤/20 ≤			UP03394
	10/22	10/47			35 ≤/80 to 400			UP03396
	10/10		–30/50		80 ≤/35 ≤			UP03397

Note) ∗: With no resistor between Emitter and Base, R_2 (e.g., only base resistor, R_1)

Mini5/6-G1: P_T = 300 mW, SMini 5/6-G1: P_T = 150 mW, SSMini5-F2 / SSMini6-F1: P_T = 125 mW, SSSMini 6-F1: P_T = 125 mW

Mini6-G1 (SC-74,SOT-457) SMini6-G1 (SC-88,SOT-363) SSMini6-F1 (SOT-666)		SSSMini6-F1			Mini6-G1 (SC-74,SOT-457) SMini6-G1 (SC-88,SOT-363) SSMini6-F1 (SOT-666)		SSSMini6-F1	Basic Type	
XN 	XN 				XN 	XN 			
	XP•UP 	NP 	NP 	NP 	XP•UP 	XP•UP•NP 	NP 		
NPN × 2	PNP × 2	PNP + NPN	PNP × 2	PNP + NPN	NPN × 2	PNP + NPN	PNP + NPN	PNP	NPN
	XP0411M UP0411M				XP0421M	XP0431M		UNR211M	UNR221M
					UP0421N	XP0431N UP0431N		UNR211N	UNR221N
						XN04322		UNR2122	UNR2222
	∗XN04130							—	—
						XN04381		UNR2122	UNR2213
								UNR211F	UNR2213
					XP04286			UNR2119	UNR221N
						XP04387 UP04387		UNR2119	UNR2213
						∗XN04A88		UNR211S	2SD0601A
					XN0421L			—	UNR221L
								UNR2118	UNR2211
						UP04390		UNR2114	UNR2213
						NP04390		UNR31A4	UNR32A3
∗XN0F256								—	UNR2226
∗XN0F261								—	—
∗XN0F262 ∗XN0F263								—	—
			NP0J1A3	NP0H3A3				UNR31A3	UNR32A3
		NP0G3D1						UNR31A3	UNR32AL
		NP0G3D2						UNR31AT	UNR32AL
		NP0G3D3						UNR31A3	UNR32AT
								UNR211N	UNR2216
							∗NP063D3	UNR31A0	UNR32A5
								UNR2118	UNR2213
								UNR211T	UNR2211
								UNR2154	UNR2211

H

Small Signal FETs

MOS FETs (For Small Signal)

Application/ Function	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)			Package (EIAJ, JEDEC)											
						ML3-N2		SSSMini3-F1		SSMini3-F1		SMini3-G1		Mini3-G1		MiniP3-F1	
	V_{DSS} *V_{DS} (V)	I_D (A)	$R_{DS(on)}$ typ. (Ω)	t_{on} typ. (ns)	t_{off} typ. (ns)	(SC-101, SOT-883)	P_D (mW)	(SOT-723)	P_D (mW)	(SC-89, SOT-490)	P_D (mW)	(SC-70, SOT-323)	P_D (mW)	(SC-59A, SOT-346)	P_D (mW)	(SC-62, SOT-89)	P_D (mW)
Digital/ analog switching	–30	–0.1	9.0	300	400			2SJ0674	100								
			50	100	25							2SJ0536	150				
	20	0.1	3.0	250	480			2SK3973	100								
	*20		max.50 Ω	max.1.0 µs	max.1.0 µs							2SK0665	150				
	25	1.0	0.26	8.0	30							2SK4029	150				
	30	0.1	30	150	35							2SK3064	150				
			5.0	350	350	2SK3939	100	2SK3938	100								
		1.0	0.48	12	60											2SK2211	1.0
	50	0.05	max.50 Ω	10	20							2SK0664	150				
	*50		27	2 000	2 000							2SK1374*	150	2SK1228*	150		
		0.1	6.0	200	200			2SK3547	100	2SK3546J	125	2SK3539	150	2SK4072	150		
	80	0.5	2.0	15	20											2SK0601	1.0

*: 2.5 V Drive

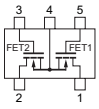
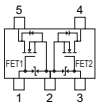
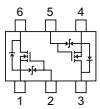
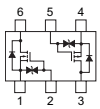
MOS FETs (For Power Management S/W)

Application/ Function	Part No.	Polarity	Absolute Maximum Ratings (T_a = 25°C)				Electrical Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)
			V_{DSS} (V)	V_{GSS} (V)	I_D (A)	P_D (mW)	$R_{DS(on)}$ (mΩ)			Ciss (pF)	
							V_{GS} = 4.0 V	V_{GS} = 2.5 V	V_{GS} = 1.8 V		
Load S/W	MTM23110	Pch	12	8	4	500	30	35	50	1 200	SMini3-G1 (SC-70,SOT-323)
	MTM23123	Pch	20	10	3	500	40	45	—	1 000	
	MTM23223	Nch	20	10	4.5	500	20	26	—	1 200	

Junction FETs

Application	Absolute Maximum Ratings (T_a = 25°C)		Electrical Characteristics (T_a = 25°C)		Package (EIAJ, JEDEC)									
	V_{DSO} *V_{GDS} (V)	I_D (mA)	NV ✱NF max. *typ. (mV)	I_{DSS} max. (mA)	SSSMini3-F1 (SOT-723)	P_D mW	SSMini3-F1 (SC-89, SOT-490)	P_D mW	SMini3-G1 (SC-70, SOT-323)	P_D mW	Mini3-G1 (SC-59A, SOT-346)	P_D mW	NS-A1 (SC-72) NS-B1	P_D mW
General-use low-frequency amplifier	*–65	20	—	6							2SK1103	150		
	*65	–20	—	–6					2SJ0364	150	2SJ0163	150	2SJ0164	300
General-use	V_{GDO} –30	20	*60	12					2SK0662	150	2SK0198	150		
	V_{GDO} –55	30	✱*2.5 dB	20			2SK2593J	125	2SK0663	150				
Capacitor microphone	20	2	0.004	0.4	2SK3372	100								
			0.01		2SK3426	100								
Infrared sensor	*–40	10	—	4.7							2SK2751	200		

Composite FETs

Application/ Function	Absolute Maximum Rating (T_a = 25°C)			Electrical Characteristics (T_a = 25°C)						Package (EIAJ, JEDEC) XN: Mini5-G1 (SC-74A) XP: SMini5-G1 (SC-88A,SOT-353) XP: SMini6-G1 (SC-88,SOT-363) UP: SSMini5-F2 UP: SSMini6-F1 (SOT-666)				Basic Type	
	V_{DSS} (V)	I_D (mA)	P_T (mW)	V_{th} (V)	$R_{DS\ (ON)}$ (Ω) V_{GS} = 4.0 V	$R_{DS\ (ON)}$ (Ω) V_{GS} = 2.5 V	$R_{DS\ (ON)}$ (Ω) V_{GS} = 1.8 V	t_{on} (ns)	t_{off} (ns)	XN 	XP•UP 	XP•UP 	XP•UP 		
										Nch × 2	Nch × 2	Nch × 2	Pch + Nch	Pch	Nch
Switching circuit	20	100	125	0.4 to 1.3	3.0	4.0	6.0	250	480			UP0487C			2SK3973
	−30/ 30	−100/ 100	150 125	typ. −1.0/1.0	9.0/5.0	13/7.0	—	300/ 350	400/ 350		UP0187B	UP0487B	XP0497A UP0497A	2SJ0674	2SK3938
	−30/ 50				15/6.0	25/8.0	—	850/ 200	850/ 200		XP01878 UP01878	XP04878 UP04878	UP04979	2SJ0672	2SK3539
	50	100	300	1.5 to 3.5	50	—	—	max. 1.0 µs	max. 1.0 µs	XN01872					2SK0665

H

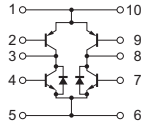
Power MOS FETs

Absolute Maximum Ratings (T_C = 25°C)			P_D (W)	Electrical Characteristics (T_C = 25°C)					Package (EIAJ, JEDEC)					
V_{DSS} (V)	V_{GSS} (V)	I_D (A)	T_C = 25°C	$R_{DS(on)}$ max. (Ω)	$\|Y_{fs}\|$ typ. (S)	$t_{d(on)}$ typ. (ns)	t_f typ. (ns)	$t_{d(off)}$ typ. (ns)	N-A1	TO-220C-G1	TO-220D-A1 (SC-91)	TOP-3F-A1 (SC-92)	TOP-3E-A1 (SC-94)	U-G2 (SC-63)
–200	±20	2	10	2	1.7	12	25	50						2SJ0582
60		5		0.135	4.0	15	170	550						2SK3022
		20	20	0.05	12	20	500	1 500						2SK3024
		30		0.04	18	10	140	350						2SK3025
80 ± 10	±15	10	30	0.23	5.5	t_{on} 500	900	1 900	2SK2339					
100	±20	15	20	0.1	11	15	35	65						2SK3268
		25	40					36		2SK3269				
150	±30	30	50	0.046	16	32	46	227		2SK3723				
200	±20	2.5	10	1.7	1.3	18	60	200						2SK3277
	±30	22	40	0.062	15	54	39	194			2SK3892			
		26	50	0.073	14	45	31	160		2SK3895				
		30		0.052	22	32	88	170		2SK3995				
		50	100	0.04	30	50	140	390					2SK3637	
				0.036		41	120	230				2SK3996		
		60		0.024	40	60	220	400					2SK3997	
230		20		0.085	14	35	36	220				2SK3628		
			50			31	47	214		2SK3731				
		25		0.082	16	47	31	157		2SK3896				
		26		0.066	20	30	86	170		2SK3998				
		30	100	0.074	16	36	35	217				2SK3559		
			50			39	45	227		2SK3560				
		50	100	0.04	34	65	145	470					2SK3652	
250		20	50	0.105	14	36	29	184		2SK3494				
		30	100	0.068	15	45	130	330				2SK3192		
		50		0.036	38	62	170	380					2SK3999	
290		20	50	0.107	18	31	82	180		2SK4000				
350	±30	20	100	0.15	12	40	95	340				2SK3193		
450		5	35	1.3	2.5	25	35	80			2SK3043			
500		2.5	30	4.0	1.5	15	30	55			2SK3045			
		7	40	1.0	5	30	60	140			2SK3046			
600		3	35	2.5	2.5	15	40	90			2SK3048			
		15	100	0.46	10	40	70	310				2SK3318		
800		2	30	7.0	1.1	15	25	60			2SK3047			
		3	35	4.0	2.4	35	160	50			2SK3636			

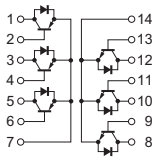
Small Signal Transistor Arrays

Application	Polarity	Absolute Maximum Ratings (T_a = 25°C)		Main Characteristics (T_a = 25°C)						Part No.	Package
		V_{CEO} (V)	I_C (A)	h_{FE}	Condition		$V_{CE(sat)}$ max. (V)	Condition			
					V_{CE} (V)	I_C (A)		I_C (A)	I_B (mA)		
Motor drive	PNP×2/NPN×2	–18/18	–1/1	90 to 360	–2/2	– 0.5/0.5	– 0.2/0.2	– 0.3/0.3	–10/10	UNA0206	SO10-G1
	PNP×3/NPN×3	–10/10	–3/3	200 to 800	–1/1		– 0.45/0.25	–2/2	–50/50	UNA0216	SO14-G1
	PNP×2/NPN×2		–1/1				– 0.3/0.3	–1/1	–30/30	UNA0217	SO10-G1
	PNP×3+NPN×3		–3/3	200 to 700			– 0.45/0.25	–2/2	–50/50	UNA0222	SO14-G1
	PNP×3+NPN×3	–13/13	–1/1	200 to 450	–2/2	– 0.1/0.1	– 0.3/0.3	– 0.5/0.5	–10/10	UNA0224	
	PNP×4/NPN×4	–10/10	– 0.5/0.5	200 to 800		– 0.2/0.2	– 0.2/0.2	– 0.2/0.2	–2/2	UNA0225	SO16-G1
	PNP×4/NPN×4		–1.5/1.5	200 to 700	–1/1	– 0.4/0.4	– 0.35/0.25	–1/1	–25/25	UNA0227	
	PNP×3+NPN×3		–3/3	200 to 800		– 0.5/0.5	– 0.45/0.45	–2/2	–50/50	UNA0235	SO14-G1

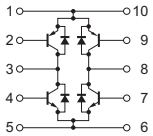
Equivalent circuit



UNA0206



UNA0216



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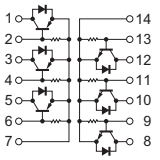
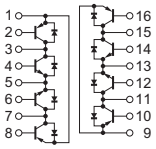
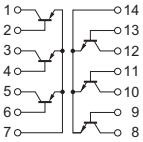


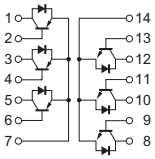
UNA0222



UNA0225/UNA0227



UNA0224



UNA0235

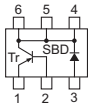
H

Multi Chip Discrete Devices

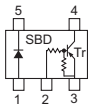
J

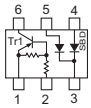
Composite Transistors

TR + SBD

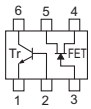
Application/ Function	Absolute Maximum (T_a = 25°C)				Electrical Characteristics (T_a = 25°C)			Package (EIAJ, JEDEC)	
								Mini6-G1 (SC-74,SOT-457)	
	TR		SBD		TR	SBD		P_T (mW)	
	V_{DSS} (V)	I_D (A)	V_R (V)	I_F (A)	$V_{CE(sat)}$ typ. (V)	V_F max. (V)	I_R max. (μA)		
DC-DC	–15	–2.5	20	1.0	– 0.27	0.45	200	600	XN09D57
	–15	–2.5	20	0.7	– 0.27	0.45	200	600	XN09D58
	–15	–1.5	20	0.7	– 0.13	0.45	200	600	XN09D61

Transistor with built-in resistors + SBD

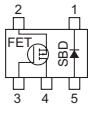
Application/ Function	Absolute Maximum (T_a = 25°C)				Electrical Characteristics (T_a = 25°C)				Package	
									SSMini5-F2	
	TR		SBD		TR		SBD		P_T (mW)	
	V_{CEO} (V)	I_C (A)	V_R (V)	I_F (A)	$V_{CE(sat)}$ max. (V)	R1/R2 (kΩ)	V_F typ. (V)	I_R typ. (μA)		
Digital circuit	–50	– 0.08	20	0.2	– 0.25	47/47	0.5	0.1	125	UP0KG8D

Application/ Function	Absolute Maximum (T_a = 25°C)				Electrical Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)	
									SMini6-G1 (SC-88,SOT-363)	
	TR		SBD		TR		SBD		P_T (mW)	
	V_{CEO} (V)	I_C (A)	V_R (V)	I_F (A)	$V_{CE(sat)}$ max. (V)	R1/R2 (kΩ)	V_F typ. (V)	I_R typ. (μA)		
Digital circuit	–50	– 0.1	80	0.1	– 0.25	4.7/4.7	1.2	0.1	150	XP0NG8A

TR + load device

Application/ Function	Absolute Maximum (T_a = 25°C)				Electrical Characteristics (T_a = 25°C)		Package (EIAJ, JEDEC)	
							SSMini6-F1 (SOT-666)	
	TR		CCD load device		TR	CCD load device	P_T (mW)	
	V_{CEO} (V)	I_C (mA)	V_{max} (V)	I_{max} (mA)	f_T typ. (MHz)	I_P (mA)		
CCD output circuit	20	15	40	10	640	3.5 to 5.5	125	UP05C8B
		50			1 000			UP05C8G

FET + SBD

Application/ Function	Absolute Maximum (T_a = 25°C)				Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)	
										Mini5-G1 (SC-74A)	
	FET		SBD		FET			SBD		P_T (mW)	
	V_{DSS} (V)	I_D (A)	V_R (V)	I_F (A)	$R_{DS(ON)}$ typ. (Ω)	t_{on} typ. (ns)	t_{off} typ. (ns)	V_F max. (V)	I_R max. (μA)		
DC-DC	–12	–1.2	20	0.7	0.35	15	10	0.45	200	600	XN0NE92

Diodes

Switching Diodes

Switching Diodes

Electrical Characteristics (T_a = 25°C)				Surface mounting package (EIAJ, JEDEC)							
V_R (V)	I_F (mA)	I_R max. (μA)	t_{rr} max. (ns)	ML2-N1	ML3-N2 (SOT-883)	USSMini2-F1	SSSMini2-F2 (SOD-723)	SSSMini3-F1 (SOT-723)	SSMini2-F1 (SC-79, SOD-523)	SSMini3-F2 (SC-81, SOT-490)	SSMini4-F1
200	100	1.0	60						MA2S101 		
			—								
	200	0.2	60								
			—								
150											
80	100	0.1	10/3								
			10					MAS3132D 		MA3S132D 	
			3		MA36132E 			MAS3132E 		MA3S132E 	
				MA26111 		MAU2111 	MA27111 		MA2S111 	MA3S132A 	MA4S111 
										MA3S132K 	
										MA3S137 	
			—							MA3S133 	

Surface mounting package (EIAJ, JEDEC)								Glass Package (EIAJ, JEDEC)	
SMini2-F1 (SC-90A)	SMini3-F1 (SC-85, SOT-523)	SMini4-F1	SMini5-F1	SMini6-F1	Mini3-G1 (SC-59A, SOT-346)	Mini4-G1 (SC-61)	Mini6-G1 (SC-74,SOT-457) Mini6-G2● (SC-74,SOT-457)	DO-34-A1	DO-35-A1 (SC-40)
MA2Z001 	MA3X100 				MA3X199 				
					MA3X158 	MA4X174 			
								MA2C188 	
MA2J115 							MA6X129 	MA2C185 	
MA2J114 									
						MA4X193 	MA6X126 		
	MA3J142D 		MA5J002D 		MA3X152D 		MA6X122● 		
	MA3J142A 						MA6X127● 		
	MA3J142E 		MA5J002E 		MA3X152E 		MA6X123● 		
							MA6X124● 		
							MA6X128● 		
MA2J111 		MA4Z159 		MA6Z121 	MA3X152A 	MA4X159A 	MA6X121 		
	MA3J142K 				MA3X152K 	MA4X160A 			
	MA3J147 				MA3X157A 				
	MA3J143A 				MA3X153A 				

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Switching Diodes

Switching Diodes (continued)

Electrical Characteristics (T_a = 25°C)				Surface mounting package (EIAJ, JEDEC)						
V_R (V)	I_F (mA)	I_R max. (μA)	t_{rr} max. (ns)	SSSMini2-F2 (SOD-723)	SSSMini3-F1 (SOT-723)	SSMini2-F1 (SC-79, SOD-523)	SSMini3-F2 (SC-81, SOT-490)	SSMini4-F1	SMini2-F1 (SC-90A)	SMini3-F1 (SC-85, SOT-523)
80	200	0.05	10						MA2J113 	
			20							
75	100	0.025	4							
50										
		0.01	0.2 ms							
40		0.1	3							
			—							MA3J143 
35		0.025	10							
40	200	0.05							MA2J112 	
			20							
35	100	0.005	0.2 ms							
40		0.01	100						MA2J116 	

Surface mounting package (EIAJ, JEDEC)						Glass Package (EIAJ, JEDEC)	
SMini4-F1	SMini5-F1	SMini6-F1	Mini3-G1 (SC-59A, SOT-346)	Mini4-G1 (SC-61)	Mini6-G1 (SC-74,SOT-457)	DO-34-A1	DO-35-A1 (SC-40)
						MA2C179 	MA2B171 
						MA2C167 	MA2B162 
						MA2C166 	
						MA2C196 	
				MA4X160 			
			MA3X153 		MA6X125 		
						MA2C165 	MA2B150 
						MA2C178 	
						MA2C195 	
			MA3X198 	MA4X194 			

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Variable Capacitance Diodes

Variable Capacitance Diodes

Application	Electrical Characteristics (T_a = 25°C)						Package (EIAJ, JEDEC)				
	V_R (V)	C_{D1} (pF)	V_R (V)	C_{D2} (pF)	V_R (V)	r_D (Ω)	ML3-N2 (SOT-883)	SSSMini2-F1 (SOD-723)	SSMini2-F2 (SC-79, SOD-523)	Mini4-G1 (SC-61)	DO-34-A2
UHF/VHF Tuning	32	14.220 to 15.473	2	2.132 to 2.321	25	< 0.45			MA2S372		
CATV Tuning	34	44.000 to 50.790	2	2.60 to 3.03	25	< 0.9			MA2S374		
		29.00 to 34.30		2.53 to 2.92		< 0.54			MA2S357		
UHF/VHF AFC	32	10.5 to 16.0	2	3.3 to 5.7	10	< 1.2					MA2C840
FM.AM AFC	15	10.0 to 16.0	10	—	—	—				MA4X348	
VCO	12	14.0 to 16.0	2	5.5 to 6.5	10	< 0.22		MA27331	MA2S331		
		2.80 to 3.40		1.1 to 1.5		< 0.60			MA2S377		
	6	14.00 to 16.00	1	6.8 to 8.9	3	< 0.30	MA26376	MA27376	MA2S376		
	30	24.8 to 29.8		6.0 to 8.3	4	< 1.0	MA26304		MA2S304		
	6	15.0 to 17.0		5.0 to 7.0	3		MA26V01	MA27V01	MA2SV01		
		18.0 to 20.0		6.9 to 9.4	4	< 0.3	MA26V02	MA27V02	MA2SV02		
		5.20 to 5.80		2.10 to 2.58			MA26V03	MA27V03	MA2SV03		
		10.0 to 11.1		5.8 to 6.4	3	< 0.35	MA26V04	MA27V04	MA2SV04		
		18.5 to 20.5		3.6 to 4.1	4	< 0.65	MA26V05	MA27V05	MA2SV05		
		2.88 to 3.12		1.49 to 1.62	3	< 0.35	MA26V07	MA27V07	MA2SV07		
		14.9 to 16.4		8.4 to 9.2			MA26V09	MA27V09	MA2SV09		
	8	2.77 to 3.01		1.23 to 1.34	4		MA26V11	MA27V11			
		3.60 to 3.90		1.97 to 2.14			MA26V12	MA27V12			
	12	11.12 to 12.29		5.25 to 5.81	3	< 0.4	MA26V13	MA27V13			
	6	4.99 to 5.41		2.33 to 2.53	4		MA26V14	MA27V14			
		7.30 to 7.91	0.5	2.98 to 3.23	2.5	< 0.45	MA26V15	MA27V15	MA2SV15		
		17.45 to 18.95	1	7.73 to 8.37	3	< 0.3	MA26V16	MA27V16			
		2.86 to 3.10		1.17 to 1.27	4	< 0.35	MA26V17	MA27V17			
		2.78 to 3.00		1.31 to 1.41	3	< 0.3		MA27V18			
		2.30 to 2.50		1.18 to 1.28		< 0.35	MA26V19	MA27V19			
		18.0 to 19.5		9.20 to 9.90			MA26V20	MA27V20			
		17.67 to 19.13		7.02 to 7.60	4	< 0.3	MA26V22	MA27V22			
		2.28 to 2.46		1.00 to 1.10		< 0.35		MA27V23			

Band Switch Diodes

Part No.	V_R (V)	I_F max. (mA)	C_D typ. (pF)	r_f typ. (Ω)	V_R (V)	Package (EIAJ, JEDEC)
MA26077	35	100	0.9	0.65	6	ML3-N2 (SOT-883)
MA2S077						SSMini2-F2 (SC-79,SOD-523)
MA27077						SSSMini2-F1 (SOD-723)
MA2C856	30		1.3/1	0.55	15/6	DO-34-A2
MA2C858						
MA2C859	35		0.8	0.4	6	
MA4X862			1			Mini4-G1 (SC-61)

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Varister Diodes (For Temperature Compensation)

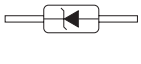
Part No.	V_R (V)	I_{FM} (mA)	V_F (V)	$\Delta V_F/\Delta T$ typ. (mV/°C)	Package (EIAJ, JEDEC)
MA2C029	6	150	0.56 to 0.64	2	DO-34-A2
MA2C029W		100	1.18 to 1.36	4.6	
MA2C029T		70	1.76 to 2.04	6.5	
MA2C029Q		50	2.20 to 2.54	8.8	
MA3X028		150	0.56 to 0.64	2	Mini3-G1 (SC-59A, SOT-346)
MA3X028W		100	1.18 to 1.36	4.6	
MA3X028T		70	1.76 to 1.92	6.5	
MA2Z030		150	0.56 to 2.04	2	SMini2-F1 (SC-90A)
MA2Z030W		100	1.18 to 1.36	4.6	

Triggers

Package	P_{DAV}	I_P	T_{opr}	V_{BO}			I_{BO}		
DO-35-A2	(mW)	(A)	(°C)	I (μA)	min. (V)	max. (V)	V (V)	typ. (μA)	max. (μA)
MA2B001	150	2[1)]	100	I_{BO}	28	36	V_{BO}	10	100

1) T_a = 25°C, t < 10 μs, f = 60 Hz

Zener Diodes Series

Type (Application)	General-Purpose			
Zener Voltage V_Z (V)	MAZ2000✖ DO-41-A1 (SC-47) P_D = 1 W	MAZ3000✖ Mini3-G1 (SC-59A, SOT-346) P_D = 200 mW	MAZ4000✖ DO-34-A2 P_D = 370 mW	MAZ7000✖ DO-41-A2 P_D = 800 mW
Equivalent Circuit				
1.88 to 2.24			MAZ4020	
2.08 to 2.45			MAZ4022	
2.28 to 2.70		MAZ3024	MAZ4024	
2.50 to 2.90		MAZ3027	MAZ4027	
2.80 to 3.20		MAZ3030	MAZ4030	
3.10 to 3.50		MAZ3033	MAZ4033	
3.40 to 3.80		MAZ3036	MAZ4036	
3.70 to 4.10		MAZ3039	MAZ4039	
4.00 to 4.60		MAZ3043	MAZ4043	
4.40 to 5.00		MAZ3047	MAZ4047	
4.80 to 5.40	MAZ2051	MAZ3051	MAZ4051	MAZ7051
5.30 to 6.00	MAZ2056	MAZ3056	MAZ4056	MAZ7056
5.80 to 6.60	MAZ2062	MAZ3062	MAZ4062	MAZ7062
6.40 to 7.20	MAZ2068	MAZ3068	MAZ4068	MAZ7068
7.00 to 7.90	MAZ2075	MAZ3075	MAZ4075	MAZ7075
7.70 to 8.70	MAZ2082	MAZ3082	MAZ4082	MAZ7082
8.50 to 9.60	MAZ2091	MAZ3091	MAZ4091	MAZ7091
9.40 to 10.60	MAZ2100	MAZ3100	MAZ4100	MAZ7100
10.40 to 11.60	MAZ2110	MAZ3110	MAZ4110	MAZ7110
11.40 to 12.70	MAZ2120	MAZ3120	MAZ4120	MAZ7120
12.40 to 14.10	MAZ2130	MAZ3130	MAZ4130	MAZ7130
13.65 to 14.35		MAZ3140	MAZ4140	
13.90 to 15.60	MAZ2150	MAZ3150	MAZ4150	MAZ7150
15.30 to 17.10	MAZ2160	MAZ3160	MAZ4160	MAZ7160
16.90 to 19.10	MAZ2180	MAZ3180	MAZ4180	MAZ7180
18.80 to 21.20	MAZ2200	MAZ3200	MAZ4200	MAZ7200
20.80 to 23.30	MAZ2220	MAZ3220	MAZ4220	MAZ7220
22.50 to 25.60	MAZ2240	MAZ3240	MAZ4240	MAZ7240
25.10 to 28.90	MAZ2270	MAZ3270	MAZ4270	MAZ7270
28.00 to 32.00	MAZ2300	MAZ3300	MAZ4300	MAZ7300
31.00 to 35.00	MAZ2330	MAZ3330	MAZ4330	MAZ7330
34.00 to 38.00	MAZ2360	MAZ3360	MAZ4360	MAZ7360
37.00 to 41.00	MAZ2390		MAZ4390	MAZ7390
40.00 to 46.00	MAZ2430			MAZ7430
44.00 to 50.00	MAZ2470			MAZ7470
48.00 to 54.00	MAZ2510			MAZ7510
52.00 to 60.00	MAZ2560			MAZ7560

✖: Rank compatible

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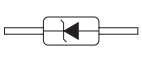
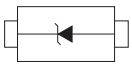
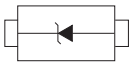
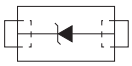
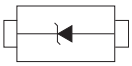
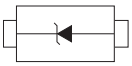
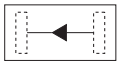
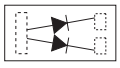
Zener Diodes

Zener Diodes Series (continued)

Type (Application)	Low Noise			Surge Absorption			
Zener Voltage V_Z (V)	MAZ4000N DO-34-A2 P_D = 400 mW	MAZ8000✖ SMini2-F1 (SC-90A) P_D = 150 mW	MAZS000✖ SSMini2-F1 (SC-79, SOD-523) P_D = 150 mW	MAZY000 NMiniP2-J1 P_D = 1 W	MAZD000 SSSMini2-F2 (SOD-723) P_D = 120 mW	MAZQ000 USSMini2-F1 P_D = 100 mW	MAZA000 ML2-N1 P_T = 100 mW
Equivalent Circuit							
1.88 to 2.24							
2.08 to 2.45							
2.28 to 2.70		MAZ8024	MAZS024				
2.50 to 2.90		MAZ8027	MAZS027				
2.80 to 3.20		MAZ8030	MAZS030				
3.10 to 3.50		MAZ8033	MAZS033				
3.40 to 3.80		MAZ8036	MAZS036				
3.70 to 4.10		MAZ8039	MAZS039				
4.00 to 4.60		MAZ8043	MAZS043				
4.40 to 5.00	MAZ4047N	MAZ8047	MAZS047	MAZY047			
4.80 to 5.40	MAZ4051N	MAZ8051	MAZS051	MAZY051	MAZD051		MAZA051
5.30 to 6.00	MAZ4056N	MAZ8056	MAZS056	MAZY056	MAZD056		MAZA056
5.80 to 6.60	MAZ4062N	MAZ8062	MAZS062	MAZY062	MAZD062	△ MAZQ062	
6.40 to 7.20	MAZ4068N	MAZ8068	MAZS068	MAZY068	MAZD068	△ MAZQ068	MAZA068
7.00 to 7.90	MAZ4075N	MAZ8075	MAZS075	MAZY075	MAZD075		
7.70 to 8.70	MAZ4082N	MAZ8082	MAZS082	MAZY082	MAZD082		MAZA082
8.50 to 9.60	MAZ4091N	MAZ8091	MAZS091	MAZY091	MAZD091		
9.40 to 10.60	MAZ4100N	MAZ8100	MAZS100	MAZY100	MAZD100		
10.40 to 11.60	MAZ4110N	MAZ8110	MAZS110	MAZY110	MAZD110		
11.40 to 12.70	MAZ4120N	MAZ8120	MAZS120	MAZY120	MAZD120		
12.40 to 14.10	MAZ4130N	MAZ8130	MAZS130	MAZY130			
13.65 to 14.35		MAZ8140					
13.90 to 15.60	MAZ4150N	MAZ8150	MAZS150	MAZY150			
15.30 to 17.10	MAZ4160N	MAZ8160	MAZS160	MAZY160	MAZD160		
16.90 to 19.10	MAZ4180N	MAZ8180	MAZS180	MAZY180	MAZD180		
18.80 to 21.20	MAZ4200N	MAZ8200	MAZS200	MAZY200	MAZD200		
20.80 to 23.30	MAZ4220N	MAZ8220	MAZS220	MAZY220	MAZD220		
22.50 to 25.60	MAZ4240N	MAZ8240	MAZS240	MAZY240	MAZD240		
25.10 to 28.90	MAZ4270N	MAZ8270	MAZS270	MAZY270	MAZD270		
28.00 to 32.00	MAZ4300N	MAZ8300	MAZS300	MAZY300	MAZD300		
31.00 to 35.00	MAZ4330N	MAZ8330	MAZS330	MAZY330			
34.00 to 38.00	MAZ4360N	MAZ8360	MAZS360	MAZY360	MAZD360		
37.00 to 41.00	MAZ4390N	MAZ8390	MAZS390	MAZY390			
40.00 to 46.00				MAZY430			
44.00 to 50.00				MAZY470			
48.00 to 54.00				MAZY510			
52.00 to 60.00							

✖: Rank compatible △: Tentative

Zener Diodes Series (continued)

Type (Application)	Surge Absorption						
Zener Voltage V_Z (V)	MAZ9000H Mini3-G1 (SC-59A, SOT-346) P_D = 200 mW	MAZL000H Mini5-G1 (SC-74A) P_D = 200 mW	MAZZ000H SMini5-F1 P_D = 200 mW	MAZT000H SSMini3-F2 (SC-81, SOT-490) P_D = 150 mW	MAZM000H SSMini5-F1 P_D = 150 mW	MAZW000H SSSMini3-F1 (SOT-723) P_D = 150 mW	MAZP000H ML3-N2 (SOT-883) P_T = 200 mW
Equivalent Circuit							
4.80 to 5.40							
5.30 to 6.00							
5.80 to 6.60	MAZ9062H		MAZZ062H	MAZT062H	MAZM062H	MAZW062H	
6.40 to 7.20	MAZ9068H	MAZL068H	MAZZ068H	MAZT068H	MAZM068H	MAZW068H	MAZP068H
7.00 to 7.90							
7.70 to 8.70		MAZL082H	MAZZ082H	MAZT082H	MAZM082H	MAZW082H	MAZP082H
8.50 to 9.60							
9.40 to 10.60			MAZZ100H	MAZT100H	MAZM100H	MAZW100H	
10.40 to 11.60							
11.40 to 12.70	MAZ9120H	MAZL120H	MAZZ120H	MAZT120H	MAZM120H	MAZW120H	

K

Zener Diodes

Low C_t Series

Zener Voltage V_Z (V)	Part No.	C_t (pF)	Equivalent Circuit	Package (EIAJ, JEDEC)
5.4 to 6.5	MAZC062D	8		Mini3-G1 (SC-59A, SOT-346)
	MAZE062D			SMini3-F1 (SC-85,SOT-523)
5.9 to 6.5	MAYK062D			Mini5-G1 (SC-74A)

Surge Protective Diode

Breakdown Voltage V_{BR} (V)	Part No.	C_t (pF)	V_{ESD} (kV)	Equivalent Circuit	Package (EIAJ, JEDEC)
7.5	MAYS0750Z	1.5	±12		SSMini2-F1 (SC-79,SOD-523)

Bidirectional Zener Diode

Zener Voltage V_Z (V)	Part No.	C_t (pF)	V_{ESD} (kV)	Equivalent Circuit	Package (EIAJ, JEDEC)
6.5 to 7.5	MALS068X	15	±15		SSMini2-F1 (SC-79,SOD-523)

High ESD (30 kV) Protection Device

Breakdown Voltage V_{BR} (V)	Part No	V_{ESD} (kV)	Equivalent Circuit	Package (EIAJ, JEDEC)
5.8 to 6.6	MALS062	±30		SSMini2-F1 (SC-79,SOD-523)
6.4 to 7.2	MALS068			
5.8 to 6.6	MALT062H			SSMini3-F2 (SC-81,SOT-490)
	MALM062H			SSMini5-F1

For Small Signal

Application	Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)									
	I_F (mA)	V_R (V)	V_F max. (V)	I_F (mA)	I_R max. (μA)	ML2-N1	USSMini2-F1	SSSMini2-F2 (SOD-723)	SSSMini3-F1 (SOT-723)	SSMini2-F1 (SC-79, SOD-523)	SSMini3-F2 (SC-81, SOT-490)	SSMini4-F1	SMini2-F1 (SC-90A)	SMini3-F1 (SC-85, SOT-523)	SMini4-F1
For high frequency wave detection	35	20	0.41	1	0.2					MA2SE01	MA3SE01				
			0.40					MA27E02			MA3SE02				
For switching mode wave detection	30	30	0.30	1	30						MA3S795		MA2J732	MA3J745	
											MA3S795D			MA3J745D	
														MA3J745E	
					50				MAS3795E		MA3S795E				
											MA3SD22F				
			0.35		0.5							MA4SD01			
			0.40		0.3	MA26728	MAU2728	MA27728		MA2S728	MA3S781		MA2J728	MA3J741	
											MA3S781F				
					1						MA3S781D			MA3J741D	MA4Z713
											MA3S781E			MA3J741E	
														MA3J742	
	100	20		100	20								MA2ZD14		MA4ZD14
			0.58		0.3			MA27D27							
		30	0.42		120		MAU2D29	MA27D29		MA2SD29	MA3SD29F				

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Schottky Barrier Diodes

For Small Signal (continued)

Application	Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)									
	I_F (mA)	V_R (V)	V_F max. (V)	I_F (mA)	I_R max. (μA)	ML2-N1	USSMini2-F1	SSSMini2-F2 (SOD-723)	SSSMini3-F1 (SOT-723)	SSMini2-F1 (SC-79, SOD-523)	SSMini3-F2 (SC-81, SOT-490)	SSMini4-F1	SMini2-F1 (SC-90A)	SMini3-F1 (SC-85, SOT-523)	SMini4-F1
For switching mode wave detection	100	30	0.55	100	15			MA27784		MA2S784			MA2Z784	MA3Z792	
														MA3Z792D	
														MA3Z792E	
														MA3Z793	
			0.58		2		MAU2D30	MA27D30		MA2SD30					
For rectification		45	0.60		5						MA3SD05F	MA4SD05X			MA4ZD03
		50	0.55		30								MA2Z785		
	200	15	0.39	200	50					MA2SD25					
		20	0.47		15					MA2SD19					
					20					MA2SD10		MA4SD10			
			0.55		2								MA2J704		
			0.58		1					MA2SD24					
		30	0.47		200					MA2SD31					
			0.55		50								MA2J729	MA3J744	
			0.56		5					MA2SD32					
		50	0.55		200								MA2J727		

For Small Signal (continued)

Application	Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)									
	I_F (mA)	V_R (V)	V_F max. (V)	I_F (mA)	I_R max. (μA)	ML2-N1	USSMini2-F1	SSSMini2-F2 (SOD-723)	SSSMini3-F1 (SOT-723)	SSMini2-F1 (SC-79, SOD-523)	SSMini3-F2 (SC-81, SOT-490)	SSMini4-F1	SMini2-F1 (SC-90A) SMini2-F2●	SMini3-F1 (SC-85, SOT-523)	SMini4-F1
For rectification	300	20	0.40	300	30								MA2Z748		
	500		0.42	500	200								MA2ZD18		
			0.55		10								MA2ZD02	MA3J702	
		40			100								MA2Z720	MA3J700	
	700	20	0.45	700	200									MA3ZD12	
	1 000	30	0.42	1 000	100								MA21D38●		
			0.38		1 200								MA21D34●		
			0.49		40								△MA21D35●		

△: Tentative

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Schottky Barrier Diodes

For Small Signal (continued)

Application	Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)								
	I_F (mA)	V_R (V)	V_F max. (V)	I_F (mA)	I_R max. (μA)	SMini6-F1	Mini2-F1	Mini3-G1 (SC-59A, SOT-346)	Mini4-G1 (SC-61)	Mini6-G1 (SC-74, SOT-457)	HNMiniP2-J1	NMiniP2-J1	DO-34-A1
For switching mode wave detection	30	15	0.40	1	0.2			MA3X704					
					0.1								MA2C700
		30			0.15								MA2C700A
					0.3			MA3X704A					
					1	MA6Z718		MA3X704D	MA4X713	MA6X718			
								MA3X704E	MA4X714				
								MA3X716					
			0.30		30			MA3X715					
								MA3X717					
								MA3X717D					
								MA3X717E					
	100		0.55	100	15	MA6J784		MA3X786					
								MA3X786D					
								MA3X786E					
								MA3X791					
		50			30			MA3X787	MA4X796				

For Small Signal (continued)

Application	Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)							
	I_F (mA)	V_R (V)	V_F max. (V)	I_F (mA)	I_R max. (μA)	SMini6-F1	Mini2-F1	Mini3-G1 (SC-59A, SOT-346)	Mini4-G1 (SC-61)	Mini6-G1 (SC-74, SOT-457)	HNMiniP2-J1	NMiniP2-J1	DO-34-A1 DO-34-A2●
For rectification	200	30	0.55	200	50			MA3X721	MA4X724				MA2C723
								MA3X721D	MA4X726				
								MA3X721E					
								MA3X740					
		50			200			MA3X727	MA4X746				
		60	0.65		50			MA3X788					
	300	100	0.57	300	200		MA22D17						
			0.58				MA2YD17						
	500	20	0.50	500	30			MA3X748					
			0.55		10			MA3X703					
		30			50		MA2YD33						
		40			100			MA3X720					MA2C719●
		60	0.65					MA3X789					
	700	30	0.55	700	80			MA3X701					
		90	0.80		1 000							MA2Q739	
	800	60	0.56	800	100		MA22D26						
			0.58				MA2YD26						

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Schottky Barrier Diodes

For Small Signal (continued)

Application	Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)							
	I_F (mA)	V_R (V)	V_F max. (V)	I_F (mA)	I_R max. (μA)	SMini6-F1	Mini2-F1	Mini3-G1 (SC-59A, SOT-346)	Mini4-G1 (SC-61)	Mini6-G1 (SC-74, SOT-457)	HNMiniP2-J1	NMiniP2-J1	TMiniP2-F1
For rectivication	1 000	15	0.38	1 000	1 500		MA22D21						
			0.40				MA2YD21	MA3XD21					
		20	0.45		200			MA3XD11					
			0.43		100		MA22D15						
			0.45				MA2YD15	MA3XD15					
		25	0.53		40		MA22D23						
			0.55				MA2YD23						
		30	0.50		1 000						MA2H735	MA2Q735	
		40	0.55		2 000						MA2H736	MA2Q736	
		60	0.58		30		△MA22D40						
	1 500	30	0.37		3 000							MA2Q705	
			0.42	1 500	200		△MA22D36						
			0.46		100		MA22D28						
			0.49				MA2YD28						
			0.50		1 000							MA2Q737	
		40	0.55	2 000	2 000							MA2Q738	
		60		1 500	1 000							MA2QD01	

△: Tentative

For Small Signal (continued)

Application	Electrical Characteristics (T_a = 25°C)					Package (EIAJ, JEDEC)							
	I_F (mA)	V_R (V)	V_F max. (V)	I_F (mA)	I_R max. (μA)	SMini6-F1	Mini2-F1	Mini3-G1 (SC-59A, SOT-346)	Mini4-G1 (SC-61)	Mini6-G1 (SC-74, SOT-457)	HNMiniP2-J1	NMiniP2-J1	TMiniP2-F1
For rectivication	1 570	40	0.57	1 500	100		MA22D39						
	2 000	40	0.48	2 000	200								MA24D60
			0.42		1 000								△MA24D61
			0.51		50								△MA24D62
		30	0.37		1 500								△MA24D64
	3 000	40	0.51	3 000	200								MA24D50
			0.42		2 000								△MA24D51
			0.53		50								△MA24D52
		30	0.37		2 000								△MA24D54
		60	0.53		800								△MA24D56
			0.58		200								△MA24D58
	5 000	40	0.52	5 000	300								△MA24D70
		30	0.37		5 000								△MA24D74

△: Tentative

For Power

Category	Part No.	Main Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)
		V_R (V)	$I_{F(AV)}$ (A)	V_F max. (V)	I_R (mA)	
Cathode-common type	MA3D749	40	5	0.55	1	TO-220D-A1 (SC-91)
	MA3D749A	45				
	MA3D750	40	10		3	
	MA3D750A	45				
	MA3D752	40	20		5	
	MA3D752A	45				
	MA3G751	40				TOP-3F-A1 (SC-92)
	MA3G751A	45				
	MA3D755	60	5	0.58	1	TO-220D-A1 (SC-91)
	MA3D756		10		3	
	MA3D760	90	5	0.85	1	
	MA3D761		10		3	
	MA3U749	40	5	0.55	1	U-G2 (SC-63)
	MA3D798	30	20	0.47	5	TO-220D-A1 (SC-91)
	MA3D799		10		3	

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Low-loss Diodes

Fast Recovery Diodes (FRD)

For Small Signal

Part No.	Main Characteristics (T_a = 25°C)				Equivalent Circuit	Package
	V_{RRM} (V)	$I_{F(AV)}$ (A)	V_F max. (V)	t_{rr} max. (ns)		
MA2YF80	800	0.2	2.5	45		Mini2-F1
△ MA22F20	200	1	0.98	35		
△ MA24F41	400	1	1.3	50		TMiniP2-F1

△: Tentative

For Power

Category	Part No.	Main Characteristics (T_a = 25°C)				Package (EIAJ, JEDEC)
		V_{RRM} (V)	$I_{F(AV)}$ (A)	V_F max. (V)	t_{rr} max. (ns)	
Cathode-common type	MA3U649	200	5	0.98	30	U-G2 (SC-63)
	MA3D649					TO-220D-A1 (SC-91)
	MA3D650		10			
	MA3D652		20		50	
	MA3D653	300	5			
	MA3D654		10			
	MA3G655		20	1.0	100	TOP-3F-A1 (SC-92)
Single-chip type	MA3D690	200	5	0.98	45	TO-220D-B1*
	MA3D691		10	1.0	100	

*: 2-pin Type

PIN Diodes

Part No.	V_R (V)	I_F (mA)	C_D max. (pF)	V_R (V)	r_{f1} typ. (kΩ)	I_F (μA)	r_{f2} max. (Ω)	I_F (mA)	Package (EIAJ, JEDEC)
MA2JP02	60	100	0.5	1	—	—	2.0	10	SMini2-F1 (SC-90A)
MA3JP02F		100 (60)							SMini3-F1 (SC-85,SOT-523) 2 elements contained
MA2SP01		100	0.8				1.0		SSMini2-F1 (SC-79,SOD-523)
MA2SP02			0.5				2.0		
MA2SP05		50	2.4	0	0.45	200	5.5		
MA2SP06		100	0.55	1	—	—	1.0		
MA27P01			0.8						SSSMini2-F2 (SOD-723)
MA27P02			0.5				2.0		
MA27P06			0.55				1.0		
MA27P07			0.35				1.5		
MA27P11		50	0.8	0					
MA27P12		100	typ 0.27	1			typ 0.8		SSSMini2-F2 (SOD-723)
MA26P01			0.8				1.0		ML2-N1
MA26P02			0.5				2.0		
MA26P07			0.35				1.5		

K

Fuses (Circuit Protector Elements)

L

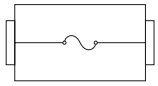
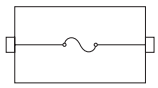
IC Links

Circuit Protector Elements

<Through-hole Package Type>

Part No.	Rated Current (A)	Internal Resistance (typ.) (mΩ)	Rated Voltage (V)	Operating Ambient Temperature (°C)	Storage Temperature (°C)	Package
UNH0003	0.6	83	50	–55 to +125	–55 to +125	TO-92-C1
UNH0005	2.5	28				
UNH0006	1.5	39				
UNH0009	2.0	28				
UNH0011	2.7	19.5				

<Surface-mount Package Type>

Part No.	Rated Current (A)	Shut-off Current (typ.) (A) ± 20%	Internal Resistance (typ.) (mΩ)	Rated Voltage (V)	Operating Ambient Temperature (°C)	Storage Temperature (°C)	Package (EIAJ, JEDEC)	Equivalent Circuit
UNHS200	0.5	1.0	130	50	–55 to +125	–55 to +125	SNMiniP2	
UNHS201	0.7	1.4	95					
UNHS202	1.0	2.0	58					
UNHS203	1.2	2.4	45					
UNHS204	1.5	3.0	38					
UNHS205	1.8	3.6	30					
UNHS206	2.3	4.6	22					
UNHZ201	0.7	1.4	93				SMini2-F1 (SC-90A)	
UNHZ202	1.0	2.0	59					
UNHZ203	1.2	2.4	46					
UNHZ204	1.5	3.0	35					

(Cautions)

- Applying continuously a current exceeding the rated current causes heating of the package and can be dangerous.
- Please use these elements to circuits in the secondary side only.
- Since these elements do not correspond to current fuses, etc., according to legal regulations, avoid using symbols for these elements in circuit diagrams, that may cause confusion with tubular fuses, etc.

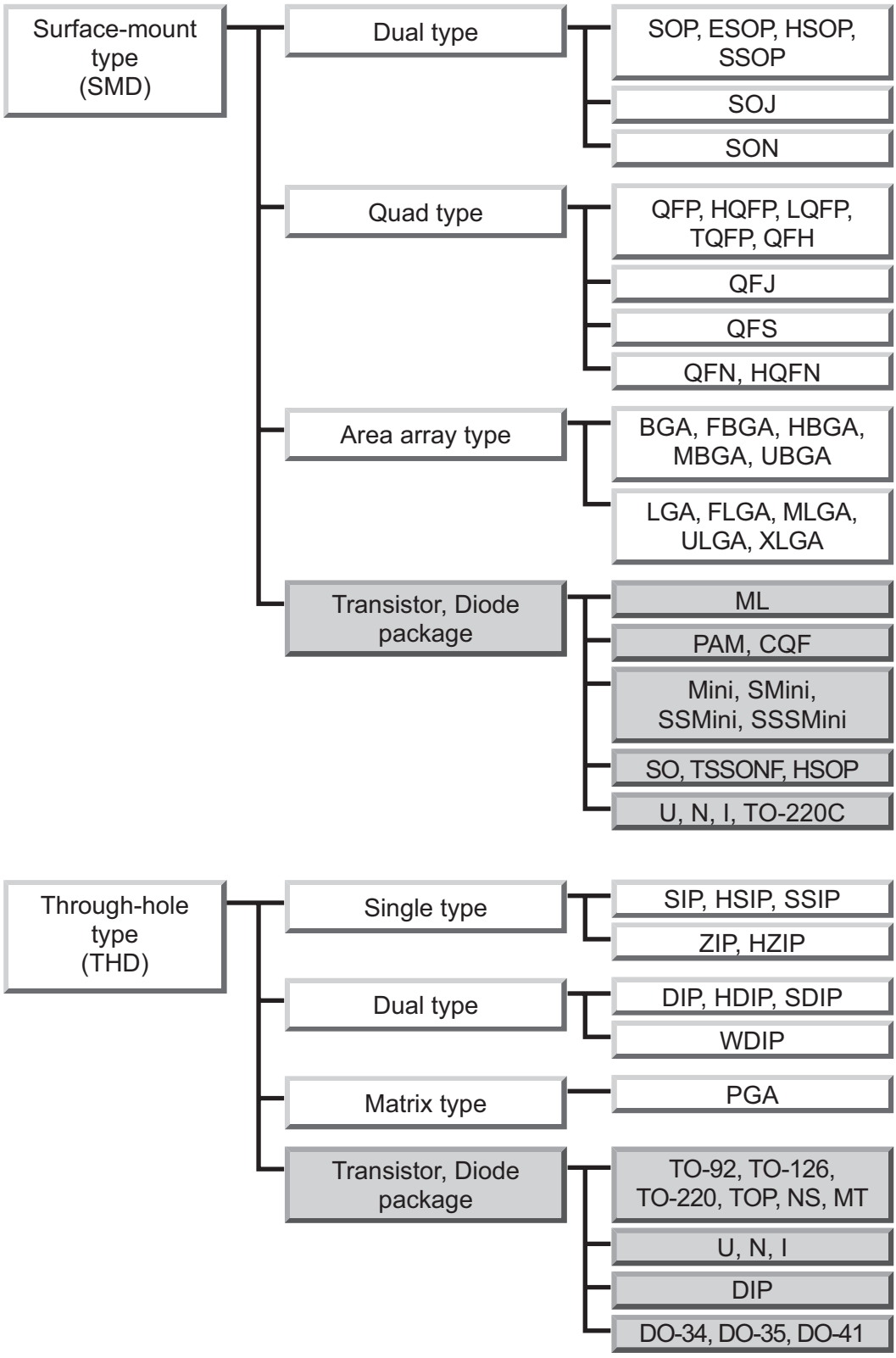
Package Information

M

Package Explanation

Package classification

Packages are classified as shown below according to the package shape and the method for mounting the package on the printed-circuit board.



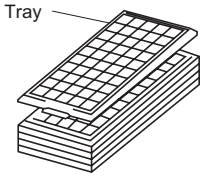
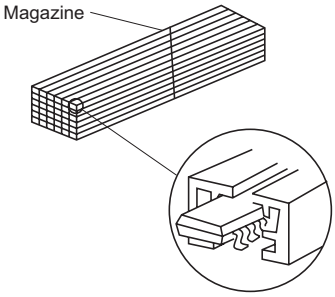
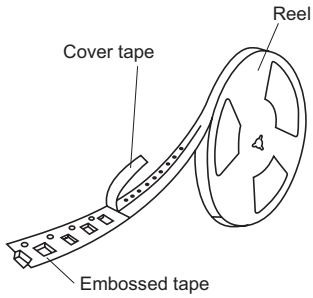
Shipment/Packaging

M

Shipment/Packaging

Packaging forms

The storage cases and packaging used for our company's semiconductor devices use materials and structures which are able to withstand the worst environmental stress during storage and shipment to maintain the initial product quality and reliability. Because of this, sufficient consideration should be given when products are taken out of our company's specified packaging and transferred to other packaging for storage or shipment.

<table>
<tr><th></th><th></th><th>Tray appearance</th><th>Magazine appearance</th><th>Embossed tape appearance</th></tr>
<tr><td>Storage cases</td><td></td><td> 
</td><td> 
</td><td> 
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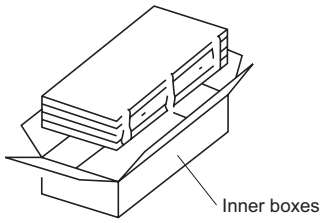
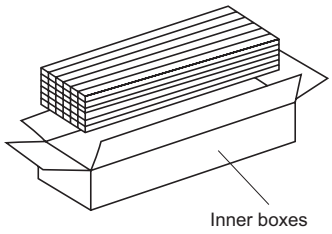
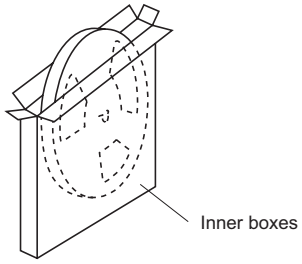
<tr><td rowspan="2">Inner boxes</td><td>Normal packaging</td><td> 
</td><td> 
</td><td> 
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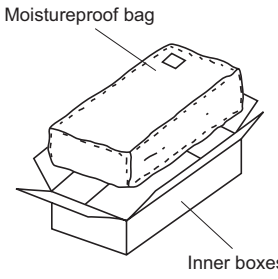
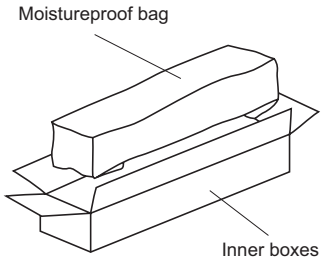
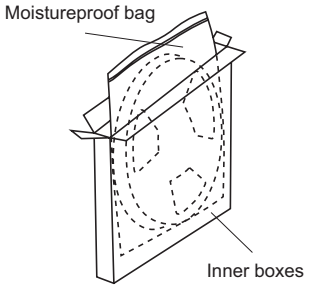
<tr><td>Moistureproof packaging</td><td> 
</td><td> 
</td><td> 
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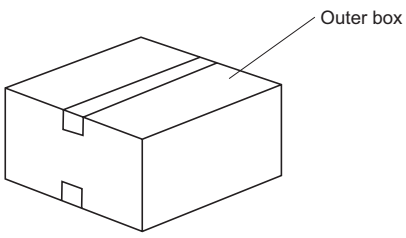
<tr><td>Outer box</td><td colspan="3"> 
</td></tr>
</table>

As part of our company's efforts toward reducing waste, we are working on cartonless (no inner boxes) packaging.

Determining packaging style from part number

Diodes

M A ❑ ❑ ❑ ❑ ❑ ❑ ❑ ■ ❑ ❑

(1) (2) (3) (4)

(1) : Terminal count (when character is a number)
(2) : Package type
(3) : Rank
(4) : Packaging style
- A: Radial TA type/Leadless (Roll of 10 000)
- E: Axial TA5 type
- F: Axial TA type
- K: Embossed TX type (half pitch)
- L: Embossed TX type

Transistors

2 S ❑ ❑ ❑ ❑ ❑ ❑ ❑ ■ ❑ ❑
3 S ❑ ❑ ❑ ❑ ❑ ❑ ❑ ■ ❑ ❑

(1) (2)

(1) : Rank
(2) : Packaging style
- A: Radial TA type/Leadless (Roll of 10 000)
- L: Embossed TX type
- Y: Surface mounting product (U-shaped/I-shaped/N-shaped)

M

Shipment/Packaging

Discrete Devices

Embossed taping

Package name	Terminal count	Package code	Tape pitch	Tape width	Maximum quantity of storage/tray
	2	ML2-N1	2 mm	8 mm	10 000
	3	ML3-N2			
	2	USSMini2-F1			
		SSSMini2-F1			
	3	SSSMini3-F1			
	6	SSSMini6-F1			
	2	SSMini2-F1	4 mm		3 000
		SSMini2-F2			
	3	SSMini3-F1			
		SSMini3-F2			
	4	SSMini4-F1			
	5	SSMini5-F1			
		SSMini5-F2	2 mm		8 000
	6	SSMini6-F1			
	2	SMini2-F1	4 mm		3 000
		SMini2-F2			
	3	SMini3-F1			
		SMini3-G1			
	4	SMini4-F1			
	5	SMini5-F1			
		SMini5-G1			
	6	SMini6-F1			
		SMini6-G1			
	2	Mini2-F1			
	3	Mini3-G1			
	4	Mini4-G1			
	5	Mini5-G1			
	6	Mini6-G1			
		Mini6-G2			
	3	MiniP3-F1	8 mm	12 mm	1 000
	2	TMiniP2-F1	4 mm		3 000
		NMiniP2-J1			1 500
		HNMiniP2-J1			
	10	SO10-A/D-G1	12 mm	16 mm	2 500
	14	SO14-G1			
	16	SO16-G1			
	3	U-G1	8 mm	12 mm	3 000
		N-G1	12 mm	24 mm	1 000
		I-G1			
		TO-220C-G1			

Package Mounting Methods

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Package Mounting Methods

Package mounting methods can be broadly classified into two methods. One is the flow solder mounting method, and the other is the reflow solder mounting method. In this section, the reflow soldering mounting method for mounting surface mount type packages will be explained.

Selection of mounting materials

1. Printed circuit board design

Desirable conditions for printed circuit boards

Since surface mounting is high density and the semiconductor device bodies as well as the printed circuit board will be directly subjected to high stress during the processes, printed circuit boards which will minimize the load transferred from the printed circuit board to the semiconductor device bodies as much as possible should be selected.
Printed circuit boards with higher performance than in the past for characteristics such as heat resistance, moisture resistance, dimensional change ratio, warpage, dimensional accuracy, etc. are desired.

Warpage and heat for surface mounting

Among the various conditions mentioned in the previous paragraph, let's consider the problems of warpage and heat. In conventional mounting, the heat of soldering is blocked by the printed circuit board, so that the semiconductor device body on the opposite side is not greatly affected. But in surface mounting, the semiconductor device body is subjected to high temperatures, and directly receives heat stress. In addition, since the semiconductor device body is adhered directly to the printed circuit board, warpage or shrinkage due to the soldering becomes stress applied directly to the semiconductor device body or poles. (Figure 1)

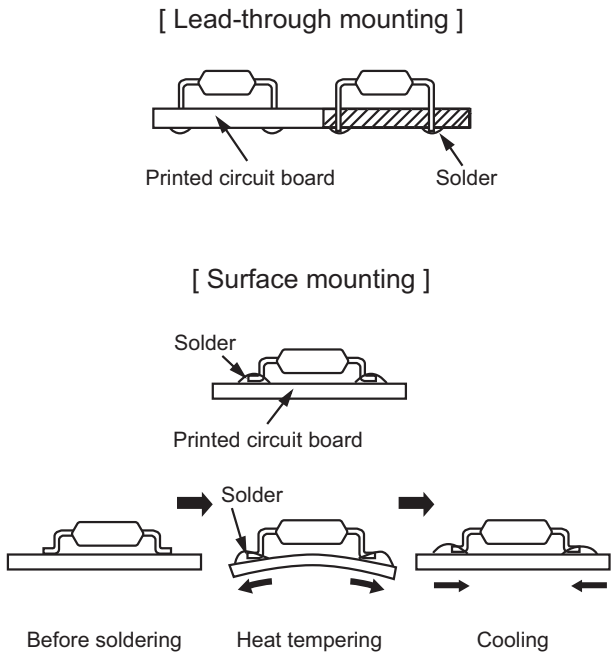


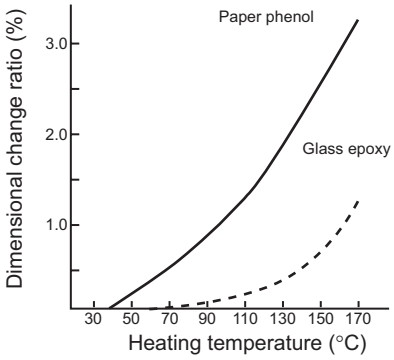
Figure 1 Warpage and heat during surface mounting

Printed circuit board selection

The important point for surface mounting is to greatly minimize the stress due to this heat and warpage. In order to do so, printed circuit board material which has the minimum possible dimension change ratio or warpage due to external stress is desirable. Figure 6.2 shows comparison data for glass epoxy material and paper phenol material commonly used in consumer products.

Although it would be ideal to use 1.6 mm-thick glass epoxy material, its high cost cannot be avoided, and actually paper phenol material is widely used. In this case, consideration must be given to greatly minimizing the heat stress and reducing printed circuit board warpage during the mounting processes.

Relationship between heating temperature and dimensional change



Relationship between external stress and warpage

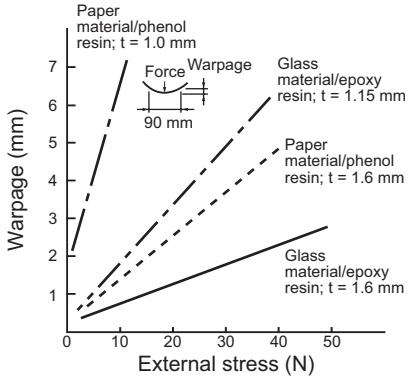


Figure 2 Dimensional change ratio and warpage for printed circuit board materials

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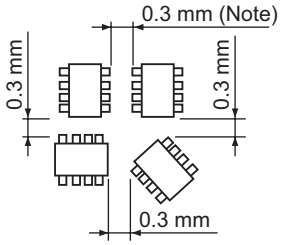
Package Mounting Methods

Mounting density and package spacing

Since the main purpose for surface mounting is to achieve high-density mounting, fine patterns are also desired in designing the printed circuit board. However, if the package spacing is too tight, incidences of solder bridging will of course increase. Considering the three factors of the positioning accuracy of the mounting equipment, dimensional variations in the printed circuit boards, and the external dimensions of the packages, using a minimum spacing dimension of at least 0.3 mm is safer. (Figure 3)



Note: Land dimension spacing is greater than 0.3 mm

Figure 3 Minimum spacing dimensions between packages

Solder resist region

One point in soldering semiconductor devices is that the amount of solder on both sides be uniform. If there is excessive solder on one side, there will be differences in the hardening time, resulting in stress toward the side with more solder. It is necessary to use solder resist to separate the solder and keep the solder amounts on uniform when attaching semiconductor devices or when semiconductor devices and lead-equipped components use the same land.

Layout of semiconductor devices

Faults may occur due to how the semiconductor devices are laid out. In SOP type flow soldering, in order to avoid insufficient solder wetting, it is better to arrange the leads so that they are parallel to the solder flow (Figure 4). When laying out semiconductor devices near easily bent sections of the printed circuit boards or separation grooves, the devices should be laid out so that the received stress is uniform for both poles; in other words, the effects of stress are reduced when the component poles are arranged perpendicular to the separation grooves or bending line.

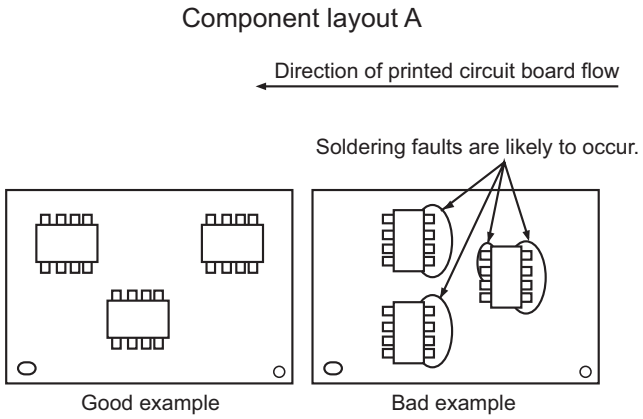


Figure 4 Semiconductor device layout

2. Selection of solder material

During selection, the following points should be considered.

Desired performance before reflow

1) Has suitable viscosity for application
2) Maintains the applied shape
3) Good adhesive power to semiconductor devices or their leads
4) Minimal change in adhesive characteristics over time

Desired performance during/after reflow

1) Good soldering characteristics
2) Low incidence of solder balls
3) Composition which inhibits increases in temperature

Cleaning characteristics

The flux in the solder should be a non-halogen flux which will enable cleaning of remaining flux without leaving remnants and which will also not adversely affect reliability if some remnants do remain.

Environmental factors

Previously, virtually all solder was Sn-Pb solder, but since Pb is a hazardous hazardous substance, its use is scheduled to be restricted. (2006, RoHS restrictions)

For lead-free solder (solder which contains no Pb), currently the following compositions are used.

Examples of lead-free solder:

Reflow system: Sn-Ag-Cu type, Sn-Ag-Bi-In type, Sn-Zn type, etc.

Flow system: Sn-Cu type, Sn-Ag-Cu type, etc.

(For reference) Semiconductor terminals:Pd plated, Sn-Bi plated, Sn-Ag-Bi dipped, etc.

When selecting lead-free solder, care should be taken to prevent the peak reflow temperature from becoming high. Care must be taken since the ratio of crack occurrence in the semiconductor device packages will increase if the peak temperature increases.

3. Selection of adhesive

Adhesives can be broadly classified as UV-hardening acryl polyester materials and heat-hardening epoxy materials, and there are various combined UV-/heat-hardening types. It is necessary to select the adhesive according to production performance, such as the application method, viscosity, hardening temperature/time, pot life, etc., but generally, the following points should be considered:

1) Quick hardening at as low a temperature as possible
2) No adverse effects on electronic components already mounted on the reverse side
3) High viscosity with superior heat resistance after hardening for the soldering process
4) Long pot life and easily stored
5) No stringiness during printing and little sagging after printing
6) Since some will remain even after soldering, no corrosiveness

4. Selection of cleaning agents

After soldering, washing off of flux is recommended. If flux remains, halogen ions in the flux may cause corrosion of metal.

Due to environmental problems such as global warming due to the destruction of the ozone layer, the use of flon 113, 1-1-1 trichloroethane, etc. is restricted, and there are shifts to the following cleaning agents:

1) Alcohol-based cleaning agents
   Ethanol, methanol, isopropyl alcohol (IPA), high-grade alcohol-based cleaning agents
2) HCFC substitute flon-based agents
   AK-225AES (Asahi Glass) etc. Since the use of HCFC substitutes will become prohibited in the future, sufficient consideration must be given.
3) No cleaning through the use of non-halogen flux
   When using no-wash flux, since it contains virtually no halogens which may cause corrosion, there is virtually no risk of residue causing fatal flaws in devices. However, residue may cause leakage between pins, resulting in device operation malfunction or damage.
   In addition, since there are also products which contain much non-ionic halogenated materials, caution is necessary. Be sure to perform evaluation of the reliability characteristics of each mounting method, and verify whether or not washing can be performed.

5. Processes prior to mounting

Lead shaping/cutting process

Before mounting semiconductor devices on the printed circuit board, the external leads must be bent, shaped, and/or cut. During this process, if stress is applied to the device body, damage such as leads breaking off or disconnection of internal wiring may occur, which reduces reliability. In particular, there may be large effects on the seal characteristics of the border between the external leads and the package for hermetically sealed types or on the moisture resistance for plastic sealed types. Although no problems may occur at that point, the service life may be reduced. Therefore, care should be given to the following points during lead processing:

1) When bending external leads, fix the base of the lead in place before bending the lead so that no stress is applied to the device body. (Figure 5)
2) When performing mass-forming using molds, consider using systems such as a lead holding device so that no stress will be applied to the entire component. (Figure 6)
3) When bending leads for glass-sealed types, either make the bend at a minimum of distance (a) from the glass body side or use a clamp to hold the lead firmly. (Figure 7)
4) Bend the leads at a distance of at least 2.5 mm from the base of the lead. Also, keep the bend angle to within 90°C and make the bend radius at least 0.75 mm. In addition, do not bend the leads toward their thicker side. (Figure 8)
5) The pulling stress along the axis of the lead wires and the bending strength are specified according to the lead diameter or cross-sectional area. Do not apply loads which exceed these specified values.
6) Depending on the shape of the forming jig, the jig may cause damage to the plating surface on lead wires, reducing reliability. Be careful when using such jigs.

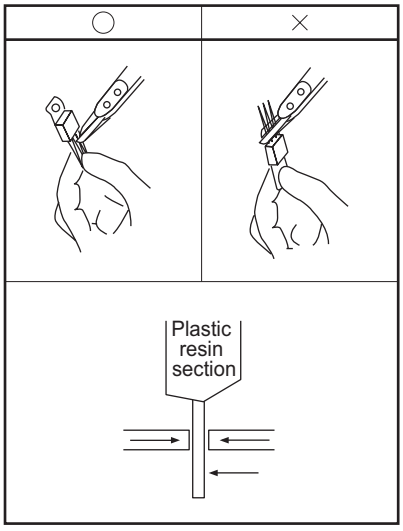


Figure 5 Bending external leads

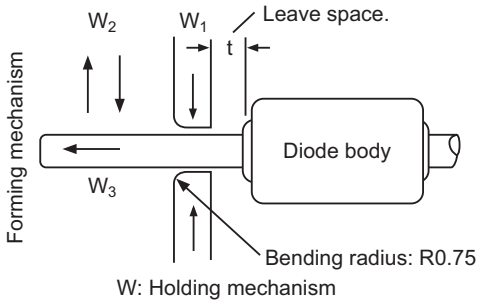


Figure 6 Bending using a mold

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Package Mounting Methods

Lead diameter	Applicable models	(a) dimension
Less than ϕ0.5 mm	DO-34 models or similar models (i. e., MA2C165, etc.)	2 mm or greater
ϕ0.5 mm or greater	DO-34 models (i. e., MA2C165, etc.)	3 mm

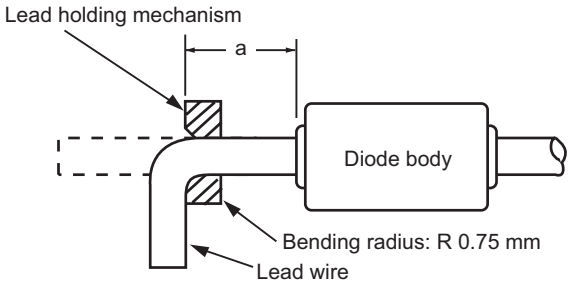


Figure 7 Lead wire bending position

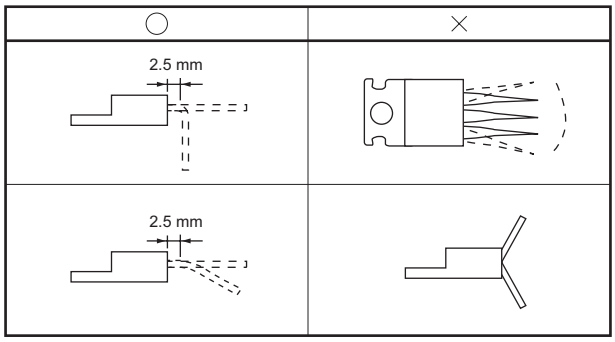


Figure 8 External lead bending positions

Points requiring care for moistureproof packaged products

1) Do not open moistureproof packages until just before mounting. After opening, use the enclosed products as soon as possible.
2) Keep the temperature and humidity of the storage location before the package is opened to within the range of Ta = 5°C to 30°C and 30%RH to 70%RH (For CCD image sensors, Ta = 0°C to 30°C.) The storage period in the moistureproof package is 1 year from the date of shipment from our company.
3) After opening the moistureproof package, in order to prevent condensation, moisture absorption by package, and oxidation of leads, store the products at Ta = 5°C to 30°C and 30%RH to 70%RH. (For CCD image sensors, Ta = 0°C to 30°C. For Hologram Units, Ta = 5°C to 35°C and 45%RH to 75%RH.)
4) Some packages have a limited storage period after opening the moistureproof package. For information on the storage period, refer to the product specifications.
5) After opening the moistureproof package, if the specified storage has been exceeded or if the indicator of the dehumidifying agent at the time of opening the package has changed to pink, perform baking before mounting. Baking conditions vary according to the type of package and packaging condition. For details, consult our company's sales division.
6) Taping materials and stick materials are not heat-resistant. Therefore, perform mounting within the specified time, or, if it is forecast in advance that the specified time will be exceeded, store the products in a dry box or in a packaging environment equivalent to the moistureproof package (Temperature: Room temperature; Relative humidity: 30% or less.) or lower.
7) To prevent oxidation of the leads, perform baking only once.

6. Mounting process

Mount

Since the thickness of surface mount packages is thin and they are very susceptible to force from above or below, do not press against them excessively with the suction nozzle (chuck). If the lower dead point for the suction nozzle is set incorrectly, it may result in problems such as deformation of the leads or cracking of the chip. Even for packages of similar thickness and height, they may be slightly different depending on the semiconductor manufacturer, etc. Perform settings while checking the product specifications.

Applying solder to printed circuit board (for reflow soldering)

1) Cream solder and application method

Methods for applying cream solder include screen printing, using dispensers, or using a metal mask. However, along with the increasing complexity of solder application, the use of a metal mask has become more and more common. Also, when selecting cream solder, select the appropriate one according to the application method and circuit wiring density (Table 1)

Table 1 Comparison of classifications of cream solder according to granularity and characteristics

Supply method		Solder granularity (mesh)	Solder powder shape	Flux inclusion amount (wt %)	Viscosity of cream solder (Pa·s)	Application
Screen	80 to 120, mesh	250 to 325	Spherical, deformed	10 to 15	250 to 450	General circuits
	150 to 200, mesh	325 to 400				
	200, mesh	325 to 400	Spherical			Miniature circuits
Dispenser		325 to 400	Spherical	12 to 18	100 to 200	Miniature circuits
		250 to 400	Spherical, deformed			General circuits
Metal mask	Board thickness: 1 mm or less	200 to 325	Spherical, deformed	8 to 13	300 to 500	General circuits
	Board thickness: 1 mm or greater	150 to 325	Deformed		400 to 600	Chip product attachment

2) Points to be careful of when using cream solder

(a) Perform suitable preheating (about 150°C for 2 minutes)

(b) Manage the land dimensions, solder resist printing accuracy, etc. (to make sure that the amount of solder used to fix the terminals in place is uniform; non-uniform solder quantities may cause the position to be shifted slightly.)

(c) Maintain the proper printing thickness for cream solder (normally, 150 μm to 300 μm)

(d) Do not apply vibrations to the printed circuit board after mounting the semiconductor devices.

(e) Complete the reflow process within 5 to 7 hours (to prevent deterioration of the cream solder.) after applying solder

Package Mounting Methods

Soldering

1) Soldering method

Soldering of semiconductor devices can be broadly classified as flow soldering and reflow soldering. In addition, reflow soldering can be further classified into full-body heating or partial heating.

Flow soldering solders together with lead-equipped components in a single process, and is suitable for mass production.

Reflow soldering enables high-accuracy soldering through the use of cream solder, but care must be taken with the infrared radiation system for temperature control. In addition, to overcome the faults of the infrared radiation system, systems combining the infrared radiation system and hot air flow are becoming popular.

Using a laser beam or light beam causes little thermal stress and enables precise soldering, making it suitable for multi-pin LSI mounting. (Table 2)

Table 2 Soldering methods for semiconductor devices

Method	Heat source	Features	Evaluation			
			Productivity	Soldering accuracy	Temperature accuracy	Thermal stress
Flow	Wave solder	Enables soldering with lead-equipped components in a single process	○	×	○	×
Full-body heating reflow	Infrared radiation	Heating of entire body with beam radiation	○	○	×	△
	Infrared radiation and hot air flow	Temperature control is relatively easier.	○	○	○	△
	VPS	Uniform steam heating to 215°C	○	○	○	○
	Hotplate	Heat conductance reduces stress.	△	○	△	○
Partial heating reflow	Laser/light beam	High-accuracy spot heating	×	○	○	○

2) Soldering temperature profile

Since surface mounting applies drastic temperature variations directly to the bodies of semiconductor devices, sufficient care must be taken with temperature control, especially for solder.

In flow soldering, a maximum temperature of 260°C for 3 to 5 seconds is common. The soldering time for the double-wave method is the sum of the two waves.

In reflow soldering, in general preheating is performed using far infrared radiation and the actual heating is performed using near infrared radiation. Care must be taken with infrared radiation, since the temperature depends on the color, material, size, etc. of the semiconductor device and printed circuit board and there will be differences between the surface and internal temperatures. In addition, it is necessary to set individual optimum temperatures, depending on the mounting conditions. Examples of soldering temperature profiles are shown in Figure 9. Also, please check with the sales division of our company as to whether or not the semiconductor device you are investigating is compatible with Pb-free solder.

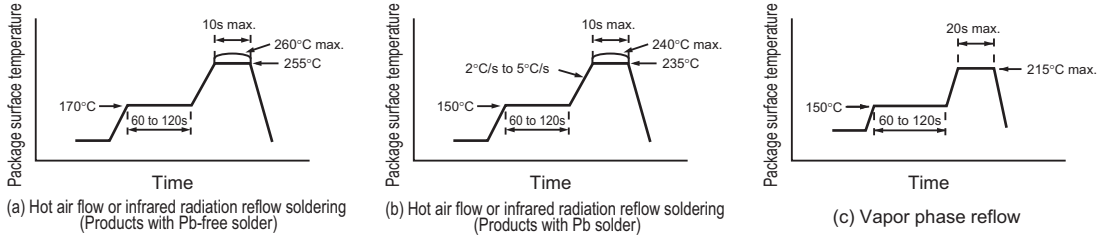


Figure 9 Examples of soldering conditions

3) Common recommended conditions for soldering

Recommended conditions for soldering of semiconductor devices vary according to each semiconductor device. Among these, on the setting side, setting the temperature conditions is difficult. Our company worked on this topic and enabled all semiconductor devices to be soldered under virtually the same conditions (although these conditions vary according to the soldering method), and submitted these recommended conditions to the industry. These common recommended conditions for soldering are listed in Table 3.

In addition, when using a soldering iron to solder leads, it should be performed at temperatures of 350×C and within 3 seconds.

Table 3 Recommended soldering conditions

Soldering method		Flow soldering	Hot air flow or infrared radiation reflow		Vapor phase reflow	Comments
			Products with Pb-free solder	Products with Pb solder		
Recommended soldering conditions	Temperature (°C)	260 max.	260 max.	240 max.	215 max.	Temperature slope during reflow by hot air flow or infrared radiation is 2 to 5°C/s
	Time (s)	3 to 5	5 to 10	5 to 10	10 to 20	
Preheating before soldering	Temperature (°C)		170	150	150	Flow soldering without preheating is also possible.
	Time (s)		60 to 120	60 to 120	60 to 120	

Multiple cycle reflow

There are some products for which multiple cycle reflow cannot be recommended. Since it is different for each product, when using the product, check the receiving specifications or consult our company's sales division.

Cleaning

1) Since flux remaining on printed circuit boards on which semiconductor devices have been installed is not desirable in terms of moisture resistance and corrosion resistance, it is recommended that cleaning be performed.
2) When performing cleaning using ultrasound, if the output is set too high, the strength of external electrodes may be reduced or problems due to resonance may occur. Be careful so that these do not occur.
3) Worrying about cleaning is not necessary for rosin flux in which the amount of chlorine is low.
4) Flon-based agents or chlorine-based agents cannot be recommended from an environmental aspect.

Table 4 Example of ultrasound cleaning conditions

Frequency: 28 to 29 kHz (no resonance with devices)
Ultrasound output: 15 W/l
Vibration source shall not directly touch the devices or the printed circuit board.
Time: 30s or less

5) The petroleum solvent may cause degradation of adhesive between hologram lens and package.
Therefore, the use of these solvents should be avoided.
In addition, ultrasonic cleaning should be avoided because this hologram is a hollow device, and also please pay attention to brushing the surface of hologram lens not to damage the surface.

7. Points requiring care for special packages

Points requiring care for power devices

Power loss at the connections during operation of the device is always accompanied by an increase in temperature. Since it is necessary that the connection temperature be below the rated maximum temperature during use, how much of a margin to provide for use is an important point in designing system reliability.

Particularly for power devices, since the cases in which they are used at temperatures close to the rated temperatures due to large power losses, suitable heat sink designs are important. In order to reduce the increase in heat, heat sinks are attached. At this time, since the dimensional accuracy of the attached parts and the attachment method have a great influence on thermal characteristics and mechanical stress, which can cause malfunctions or reduced service life, sufficient care must be taken regarding the following points:

1) Thermal grease

Since the use of thermal greases when attaching the heat sink to the power transistor can reduce the contact thermal resistance to the levels of $R_{th\ (j\text{-}c)}$ shown in Table 5, it is often used. For metal-sealed devices, this was not a problem but for plastic-sealed power transistors, it is necessary to use care when selecting the thermal grease to use.

Table 5 Examples of contact thermal resistance and insulation plate thermal resistance

Shape	Presence/absence of insulation plate	$R_{th(c\text{-}f)}$ (°C/W)			
		Grease applied		Grease not applied	
TO-126	No insulation plate	0.5	—	1.0	—
	Mica (100 μm)	—	3.0	—	6.0
TO-220 (SC-46)	No insulation plate	0.4	—	1.7	—
	Mica (100 μm)	—	2.3	—	5.0
TO-220 Full pack	No insulation plate	—	2.3	—	4.5
TOP-3 Full pack	No insulation plate	—	0.6	—	1.5

If a highly oil-separated grease is used, the stress of the power cycle, etc. may result in faults such as partially disconnected wires after a relatively short time. The reason for this is that the silicon oil which forms the base oil of thermal grease separates out and penetrates into the inside of the transistor through gaps between the plastic resin and the fins or lead frame, and swells the junction coating resin (JCR), increasing the stress on the connection base of the Al or Au electrode lead wires and causing them to be disconnected.

Because of this, it is necessary to select a thermal grease which has low oil separation and which is based on silicon oil which does not swell JCR easily. For example, G-746 (Shin-Etsu Chemical Co., Ltd.) and YG-6260 (Toshiba Silicone Co., Ltd.) are recommended.

2) Mounting heat sink of package

When attaching the heat sink of power packages to the chassis, etc., attention should be paid to the tightening torque of the attaching bolts and to the flatness of the attachment surface.

Do not bend, cut deform, or bend the mounting pins of the heat sink. Also, avoid applying solder directly to the heat sink.

When attaching the heat sink, since if the mounting brackets or positioning tabs (projections) are in contact with the plastic areas of the product, cracks may occur and mechanical stress may be applied internally, resulting in element breakage or disconnection faults, care must be taken with the attachment methods.

Regarding the hole diameter of the attachment surface, it should be determined taking into consideration the screw head diameter and the overlapping of insulation tubes, insulation plates, etc.

[Tightening torque]

If the tightening torque is too low, the heat resistance will be high, and the heat emission effectiveness will be poor. On the other hand, if the torque is too high, it may cause warpage of elements or apply stress to the semiconductor chips inside the package, causing element breakage or disconnection.

Since the recommended tightening torque, mounting hardware etc. are different for each package, refer to the product specifications or contact our company's sales division.

Further, when tightening at two or more points, be careful to tighten all points equally so that no warpage is applied to the elements.

[Flatness]

The purpose of attaching power transistors to the chassis, etc. is to enable the efficient transfer of the heat generated by the elements to the heat sink. In order to achieve this, the attachment surface of the transistor must be sufficiently smooth. If the surface roughness is high, or if there are burrs or metal chips, dirt, or other foreign materials stuck to the surface, not only will the heat sink be damaged, but the elements may also be damaged. Therefore, be sure to keep the surface flatness to 0.05 mm or less and the surface twist to 20 μm or less.

When the mounting plate such as a chassis is a pressed plate, be sure that there is no press burrs or bending, and be sure to smooth the surface of the screw holes. In addition, since if gaps occur between the product and the attachment surface, heat emission efficiency may be poor, when attaching the heat sink, be sure to check that the mounting plate or the product are not deformed.

3) Attaching to the printed circuit board

Do not attach heat sinks to the elements after soldering lead wires to the printed circuit board. Attaching heat sinks to the elements after soldering the leads to the printed circuit board will cause excessive stress due to variations in the lead wire length, heat sink, printed circuit board, etc. to be concentrated in the lead wires, causing damage to the lead wires such as pulling them out, disconnecting them, etc.

Processes should be carried out in the following order:

Attachment of heat sink to power transistor → Attachment of heat sink to printed circuit board → Soldering of power transistor to printed circuit board.

Points requiring care for LGA (C-CSP/L-CSP) and BGA

1) Rules for printed circuit board design

Recommended rules for printed circuit board design applicable to LGA (Land Grid Array) (C-CSP: Ceramic Chip Size Package; L-CSP: Leadframe CSP) and BGA (Ball Grid Array) are shown in Figure 10.

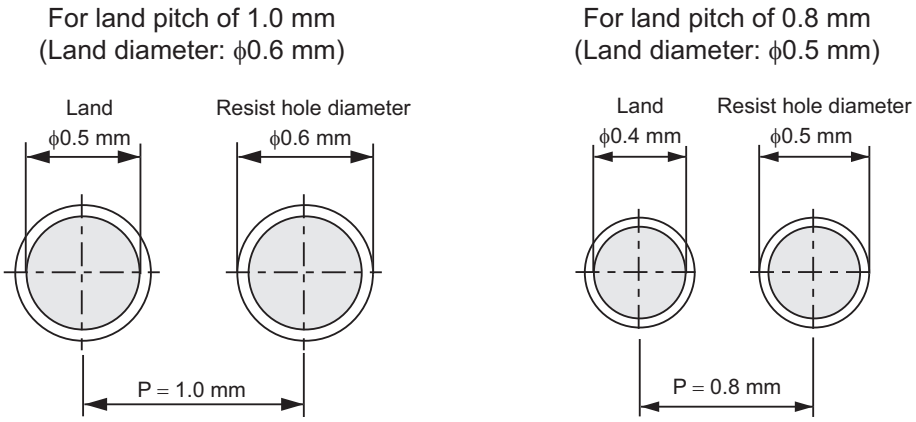


Figure 10 Printed circuit board design rules

2) Metal masks

The following specifications are recommended for metal masks. (Figure 11)

(a) Manufacturing method: Full additive

(b) Metal thickness A: 0.12 mm to 0.15 mm

(c) Opening diameter B: ϕ0.6 mm to 1.0 mm pitch (CSP land diameter: ϕ0.6 mm)
ϕ0.5 mm to 0.8 mm pitch (CSP land diameter: ϕ0.5 mm)

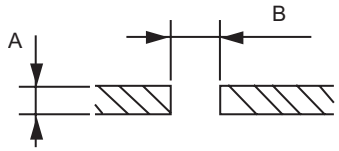


Figure 11 Metal mask specifications

3) Cream solder

The following points should be considered when selecting the solder paste:

(a) Composition

There are no particular specifications. Currently, Sn-Pb eutectic compositions can be used without problems, but since the use of Pb is becoming more restricted, sufficient consideration should be given to this point during selection.

(b) Grain size

Printing characteristics are good for grain sizes of 20 μm to 50 μm

(c) Viscosity

There are no particular specifications, but focus should be placed on characteristics such as sagging after printing, the capability to print repeatedly, etc.

(d) Other

Be careful of the creation of solder balls after reflow.

4) Reflow

For reflow soldering, it is necessary to set the individual optimum temperature conditions according to the mounting conditions. At our company, we recommend mounting by hot air flow reflow, but infrared radiation systems can also be used without problems. The recommended temperature profile is shown in Figure 12. For details, refer to the product specifications.

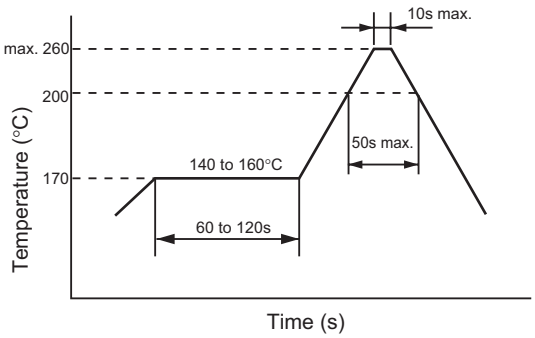


Figure 12 Reflow temperature profile

5) Storage

Environments containing high humidity, dust, or harmful gases (hydrochlorides, sulfuric acid gases, hydrosulfides) may cause deterioration of the soldering characteristics of the external electrodes. Avoid storage in areas subject to high temperatures and humidity.

M

Precautions when Using Semiconductor Products

M

Precautions when Using Semiconductor Products

Please avoid impacts such as drops to the floor when the product is handled

The radical material might crack and be lacked.

Further, be careful that strong mechanical stress is not applied to the package. For thin packages, since the mold is thin, if strong stress is applied the package or elements may be damaged.

In addition, since electrostatic discharge damage, deterioration of solderability, corrosion between electrode wiring, etc. may occur if products are touched with bare hands, be sure to be sufficiently careful when handling products.

Read the following items and handle the products with caution.

Static electricity may cause incidence of break down, dysfunction, or malfunction to the product.

Rough handling such as scratching, cracking, or breaking the product may lead to dysfunction and malfunction.

Handling the product with your bare hands or saliva or perspiration from human body may result malfunction of the outer electrodes and wires.

Environments containing high humidity, dust, or harmful gases (hydrogen chloride, sulfurous acid gas, or hydrogen sulfide) may cause deterioration of the soldering characteristics of the external electrodes.

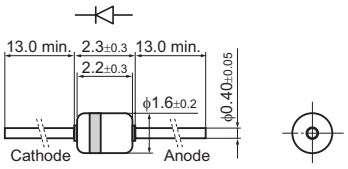
Package Outlines

N

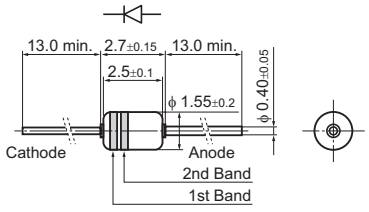
Package Outlines

( ): Reference Value Unit: mm

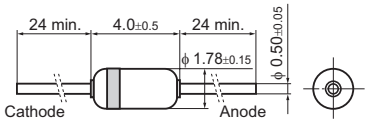
DO-34-A1



DO-34-A2

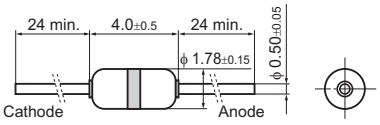


DO-35-A1

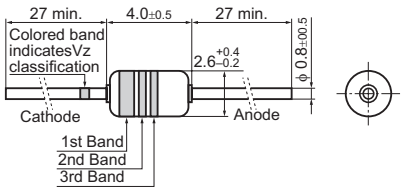


JEITA: SC-40

DO-35-A2(DO-35・Trigger)

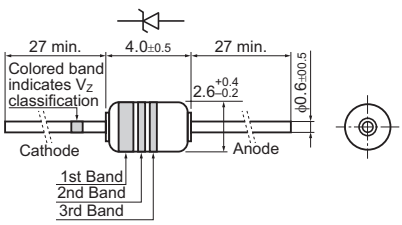


DO-41-A1



JEITA: SC-47

DO-41-A2

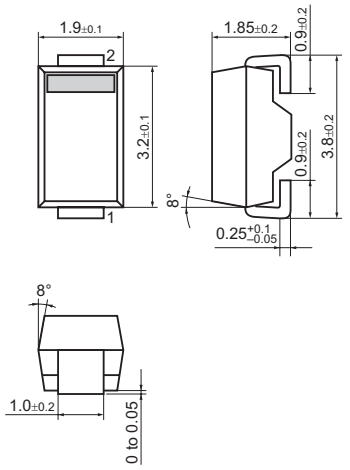


N

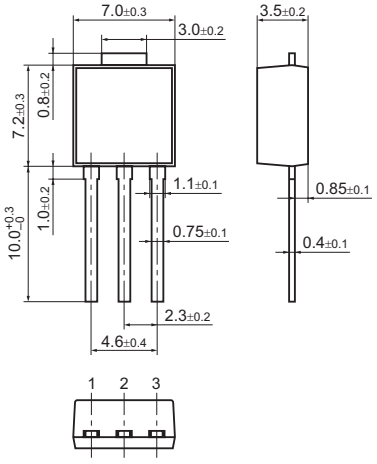
Package Outlines

( ): Reference Value Unit: mm

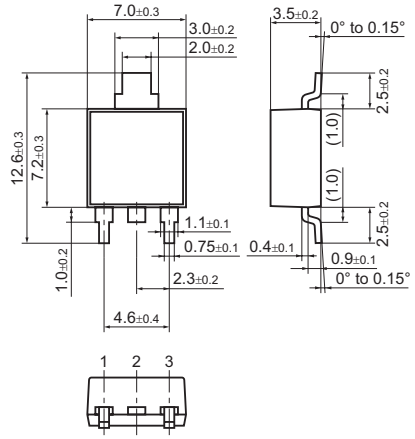
HNMiniP2-J1
(Half New Mini-Power Type · 2-pin)



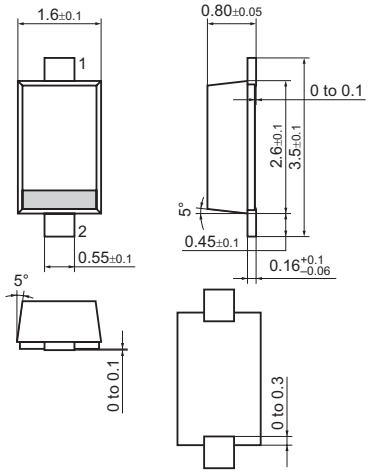
I-A1(I Type)



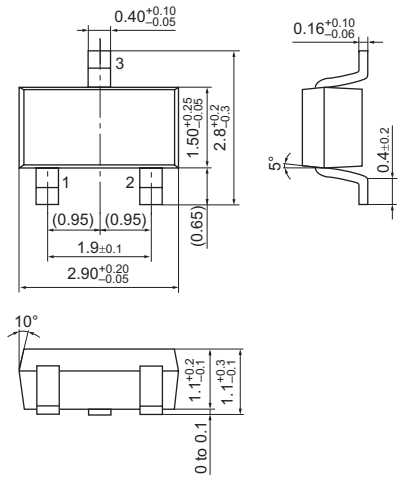
I-G1(I Type)



Mini2-F1(Mini Type・2-pin)

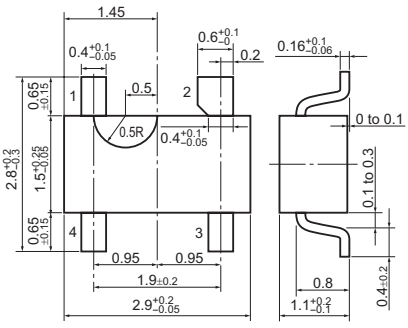


Mini3-G1(Mini Type・3-pin)



JEITA: SC-59A, JEDEC: SOT-346

Mini4-G1(Mini Type・4-pin)

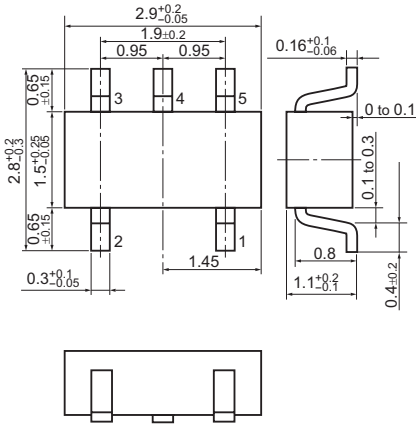


JEITA: SC-61

Package Outlines

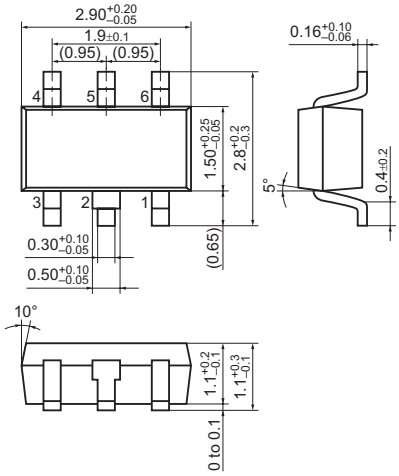
( ): Reference Value Unit: mm

Mini5-G1(Mini Type・5-pin)



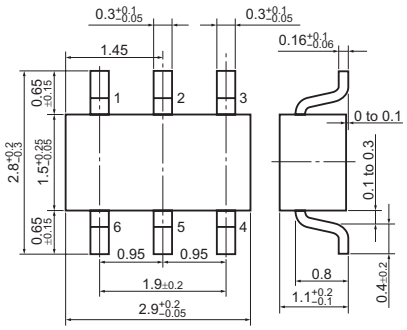
JEITA: SC-74A

Mini6-G1(Mini Type・6-pin)



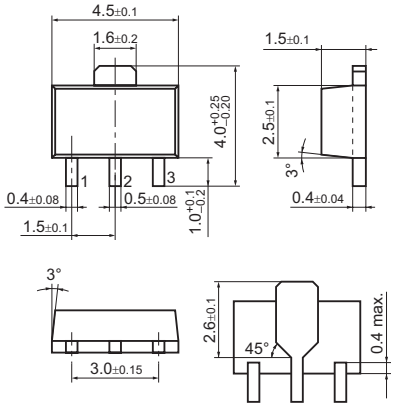
JEITA: SC-74, JEDEC: SOT-457

Mini6-G2(Mini Type・6-pin)

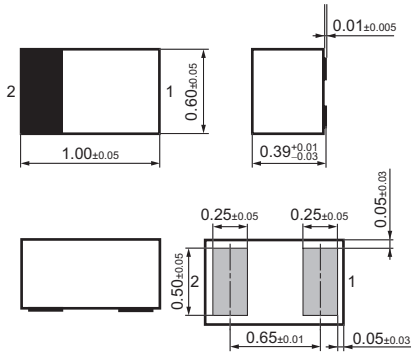


JEITA: SC-74, JEDEC: SOT-457

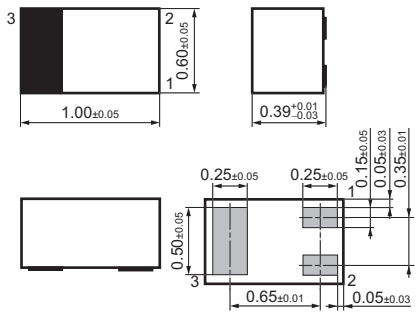
MiniP3-F1(Mini-Power Type・3-pin)



ML2-N1



ML3-N2(Mold Lead-less・3-pin)



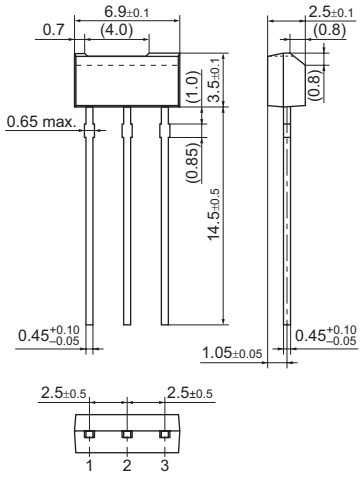
JEDEC: SOT-883

N

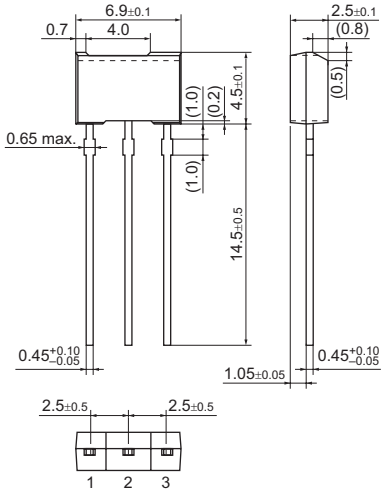
Package Outlines

( ): Reference Value Unit: mm

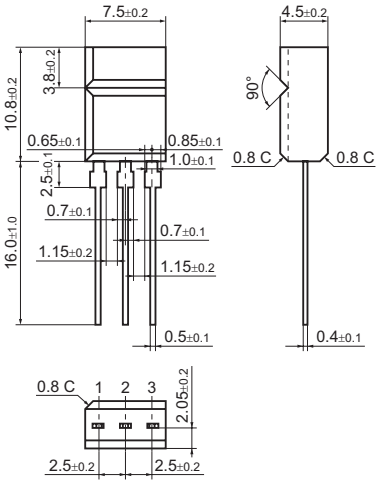
MT-1-A1(MT1 Type)



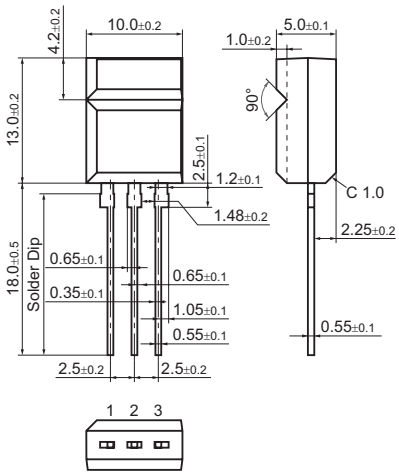
MT-2-A1(MT2 Type)



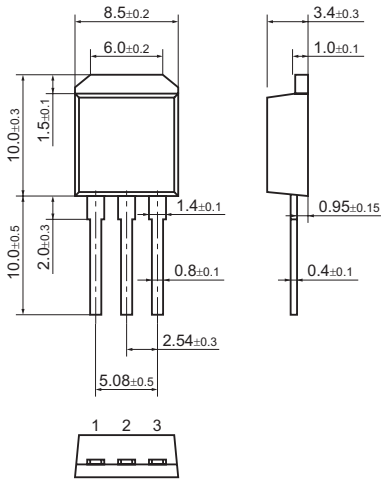
MT-3-A1(MT3 Type)



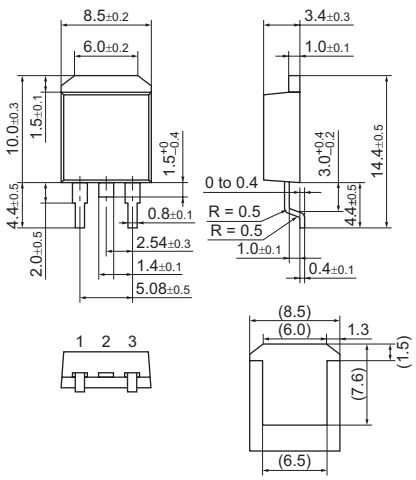
MT-4-A1(MT4 Type)



N-A1(N Type)



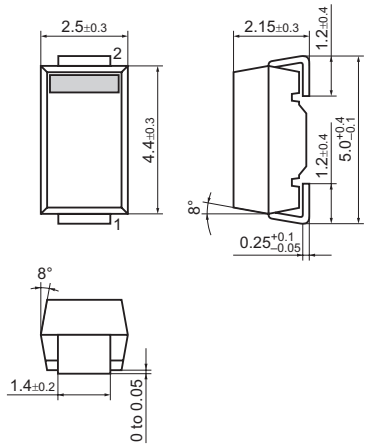
N-G1(N Type)



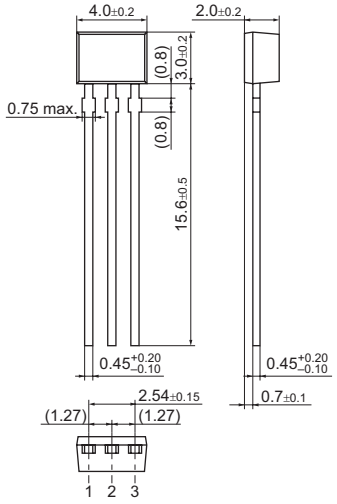
Package Outlines

( ): Reference Value Unit: mm

NMiniP2-J1
(New Mini-Power Type · 2-pin)

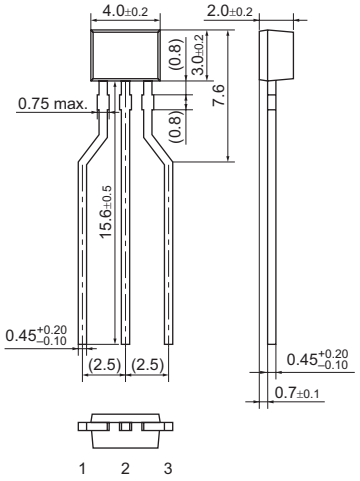


NS-A1(New S Type)

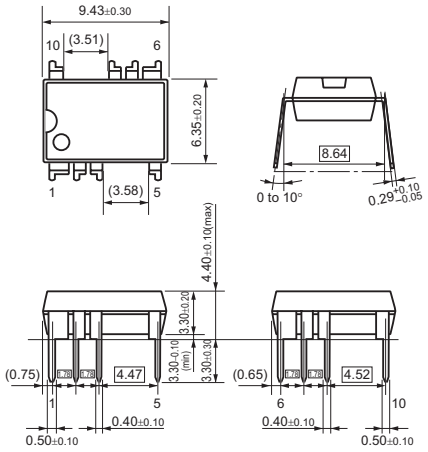


JEITA: SC-72

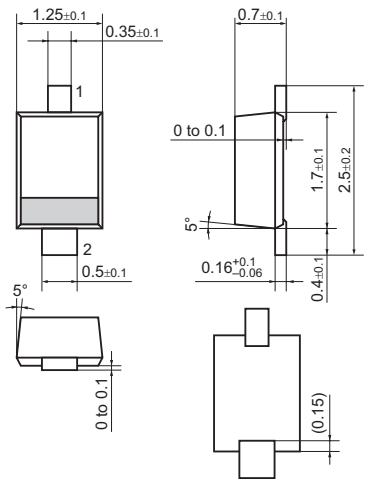
NS-B1



SDIP10-A1(CF)

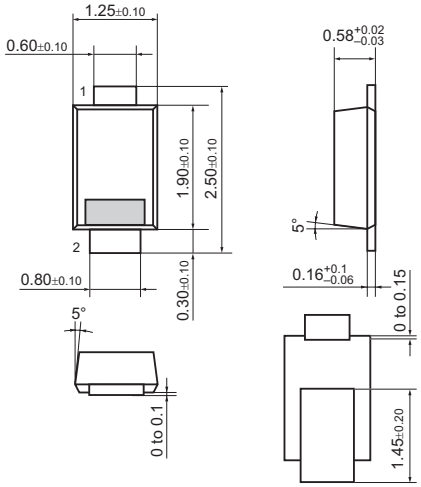


SMini2-F1(S-Mini Type・2-pin)



JEITA: SC-90A

SMini2-F2 (S-Mini Type・2-pin)

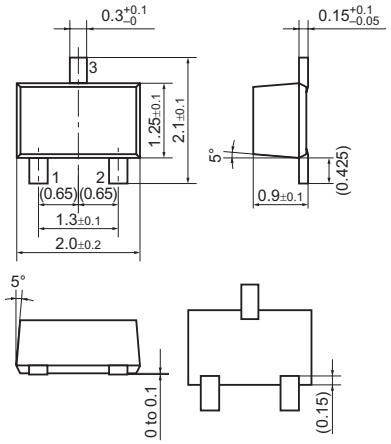


N

Package Outlines

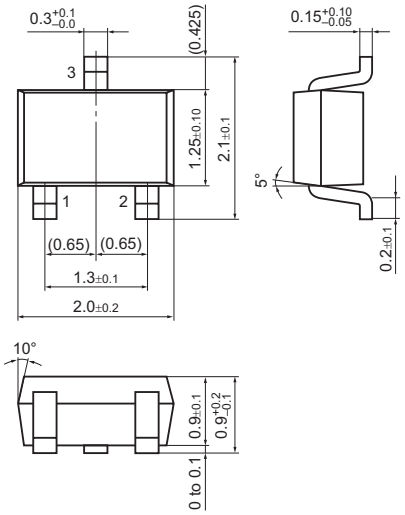
( ): Reference Value Unit: mm

SMini3-F1(S-Mini Type・3-pin)



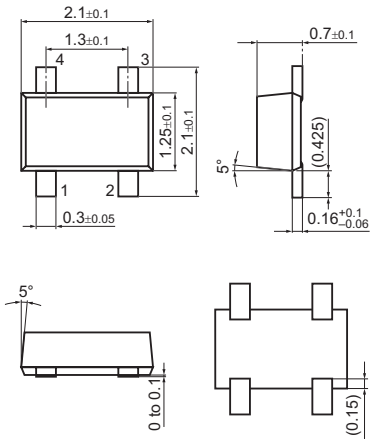
JEITA: SC-85, JEDEC: SOT-523

SMini3-G1(S-Mini Type・3-pin)

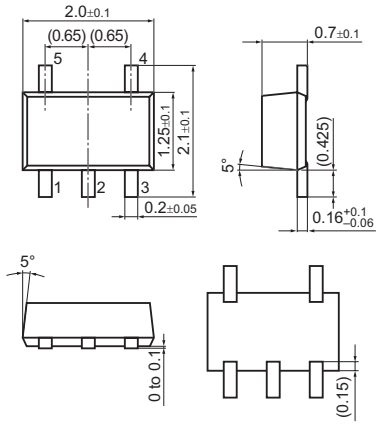


JEITA: SC-70, JEDEC: SOT-323

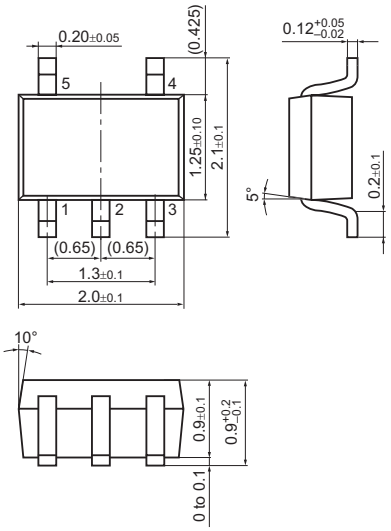
SMini4-F1(S-Mini Type・4-pin)



SMini5-F1(S-Mini Type・5-pin)

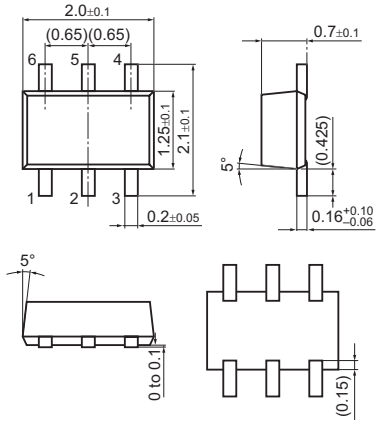


SMini5-G1(S-Mini Type・5-pin)



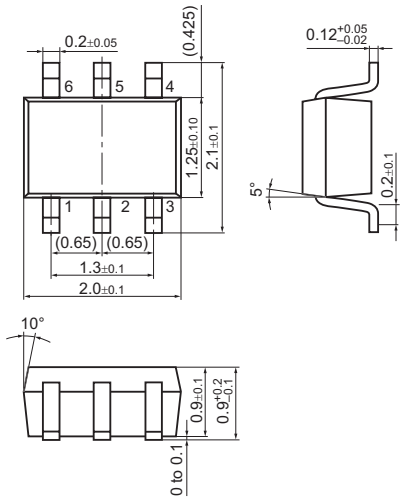
JEITA: SC-88A, JEDEC: SOT-353

SMini6-F1(S-Mini Type・6-pin)



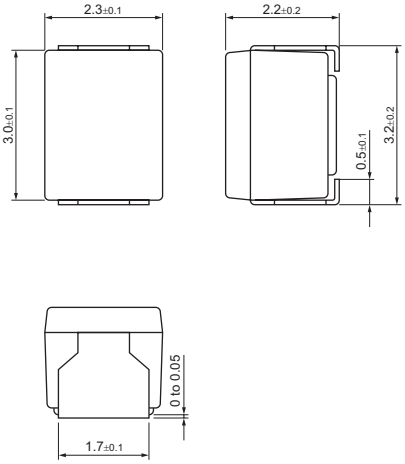
( ): Reference Value Unit: mm

SMini6-G1(S-Mini Type・6-pin)

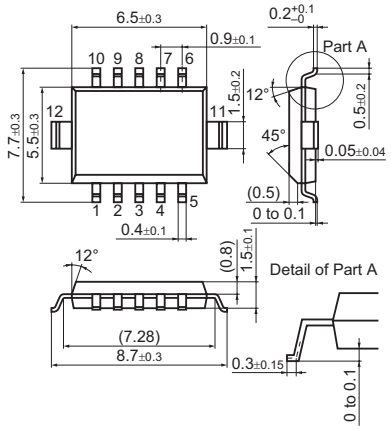


JEITA: SC-88, JEDEC: SOT-363

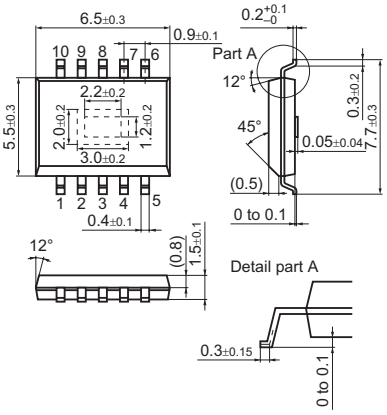
SNMiniP2
(Small New Mini-Power Type · 2-pin)



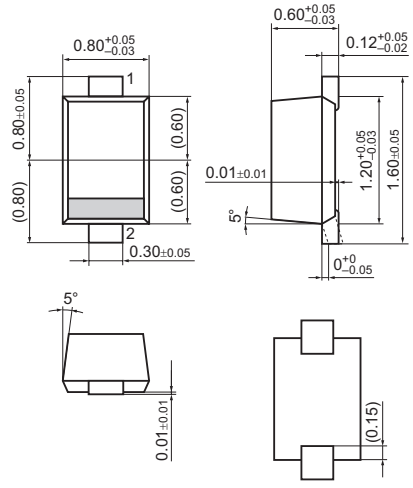
SO10-A-G1



SO10-D-G1

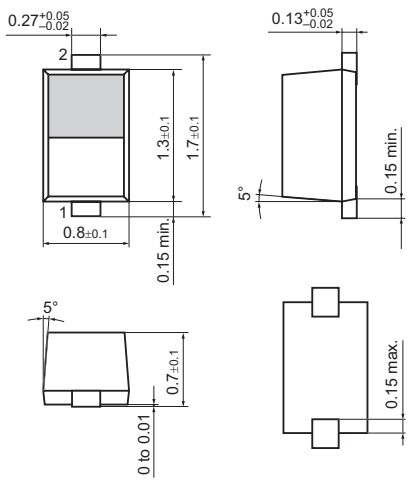


SSMini2-F1(SS-Mini Type・2-pin)



JEITA: SC-79, JEDEC: SOD-523

SSMini2-F2(SS-Mini Type・2-pin)



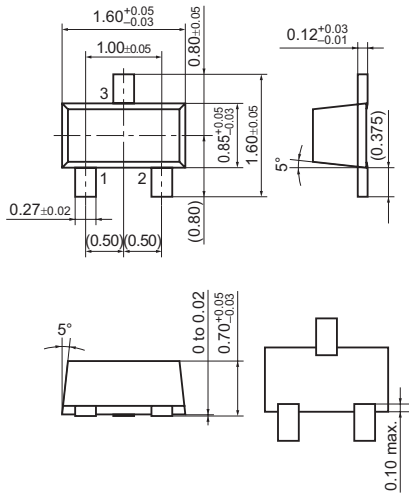
JEITA: SC-79, JEDEC: SOD-523

N

Package Outlines

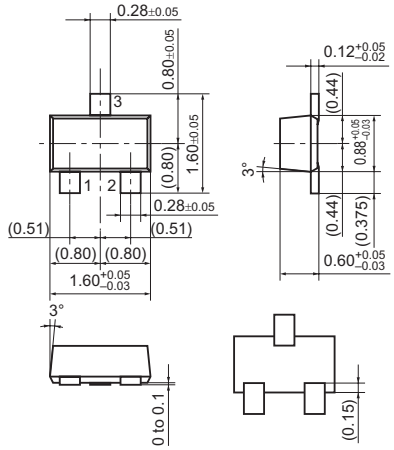
( ): Reference Value Unit: mm

SSMini3-F1(SS-Mini Type・3-pin)



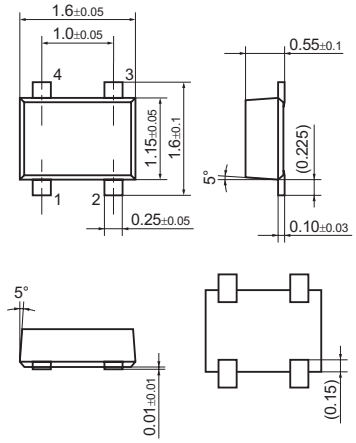
JEITA: SC-89, JEDEC: SOT-490

SSMini3-F2(SS-Mini Type・3-pin)

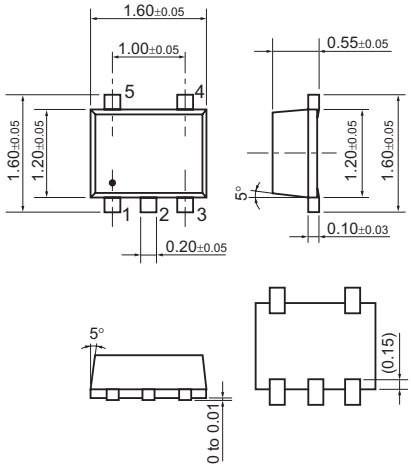


JEITA: SC-81, JEDEC: SOT-490

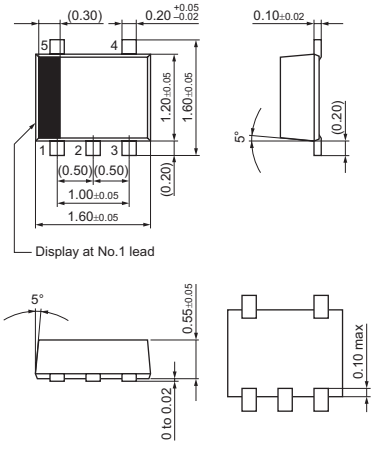
SSMini4-F1(SS-Mini Type・4-pin)



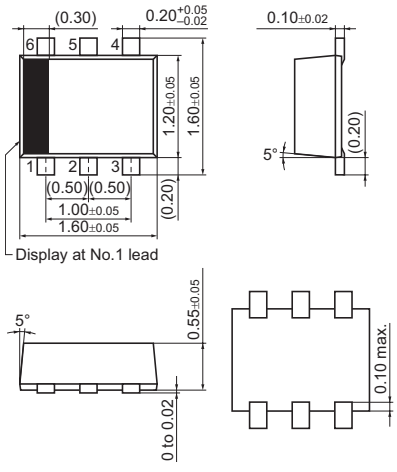
SSMini5-F1(SS-Mini Type・5-pin)



SSMini5-F2(SS-Mini Type・5-pin)



SSMini6-F1(SS-Mini Type・6-pin)

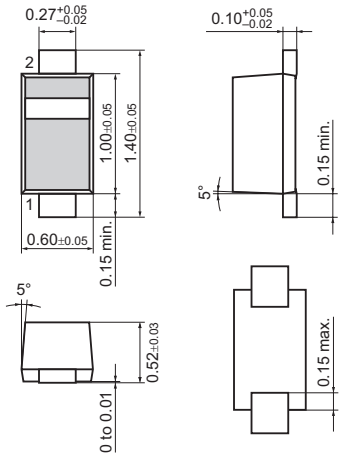


JEDEC: SOT-666

Package Outlines

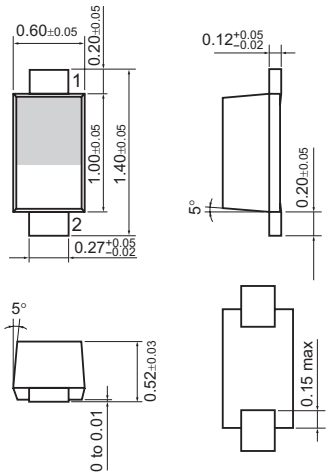
( ): Reference Value Unit: mm

SSSMini2-F1(SSS-Mini Type・2-pin)



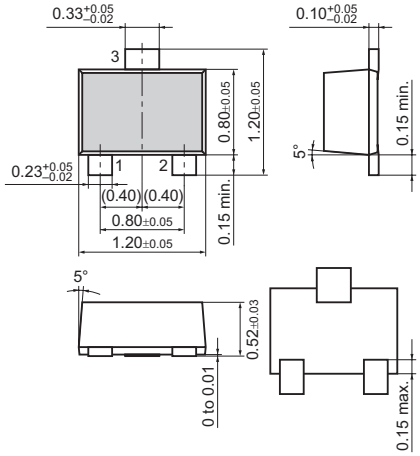
JEDEC: SOD-723

SSSMini2-F2(SSS-Mini Type・2-pin)



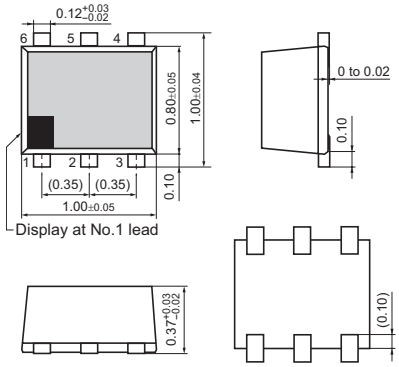
JEDEC: SOD-723

SSSMini3-F1(SSS-Mini Type・3-pin)

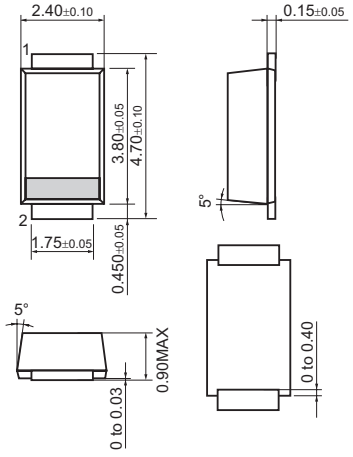


JEDEC: SOT-723

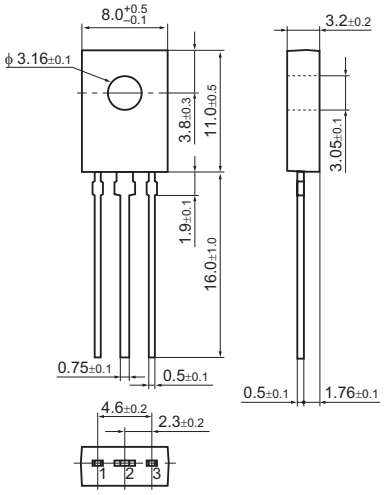
SSSMini6-F1(SSS-Mini Type・6-pin)



TMiniP2-F1



TO-126B-A1

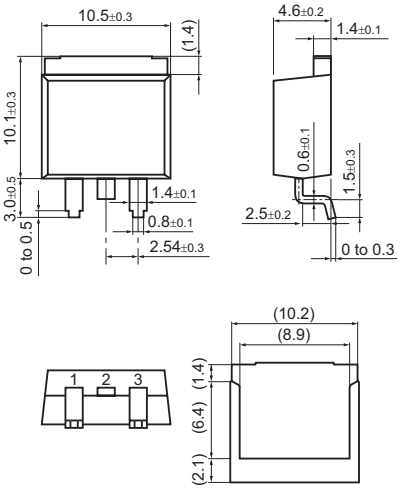


N

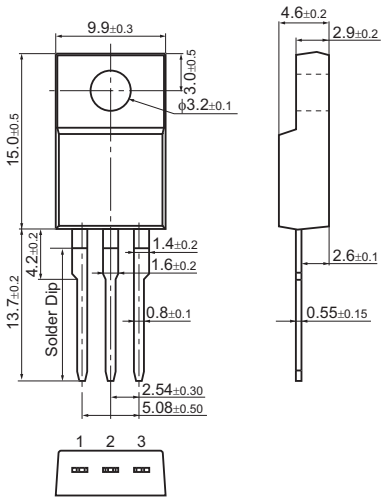
Package Outlines

( ): Reference Value Unit: mm

TO-220C-G1

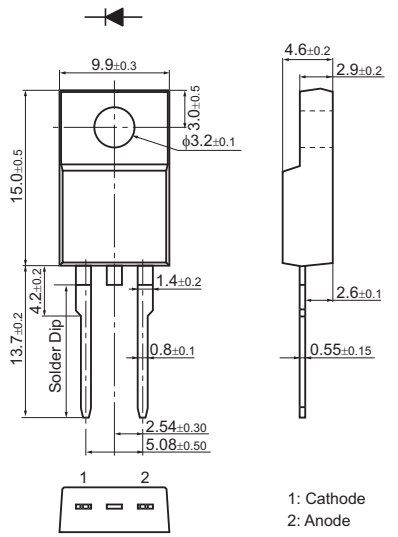


TO-220D-A1

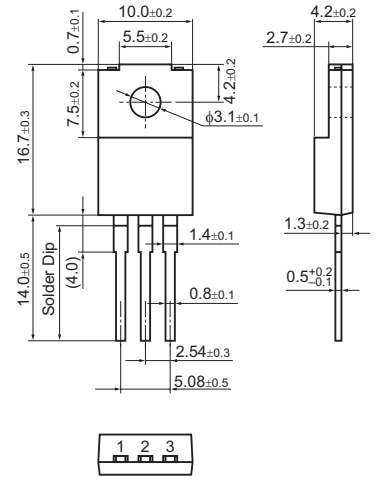


JEITA: SC-91

TO-220D-B1

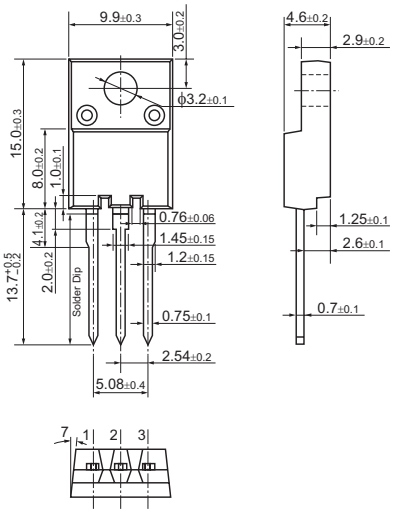


TO-220F-A1

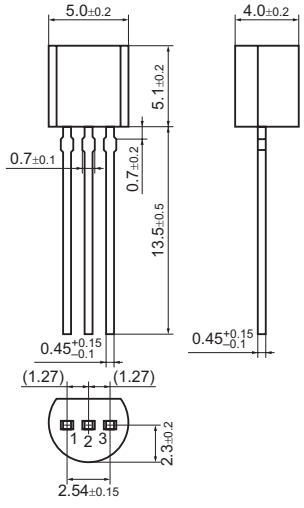


JEITA: SC-67

TO-220H

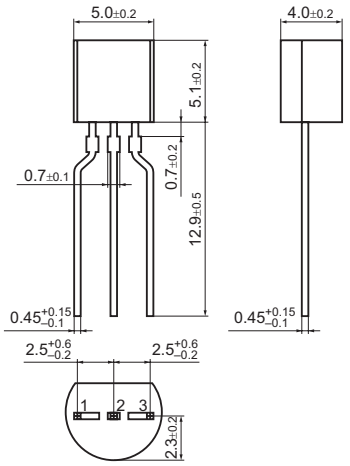


TO-92-A1

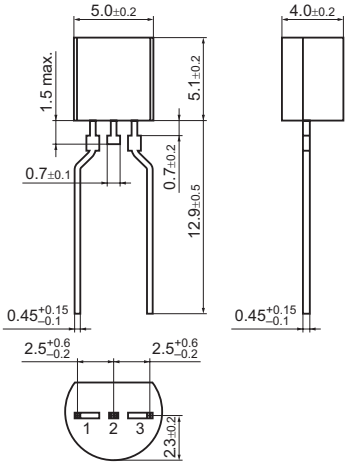


( ): Reference Value Unit: mm

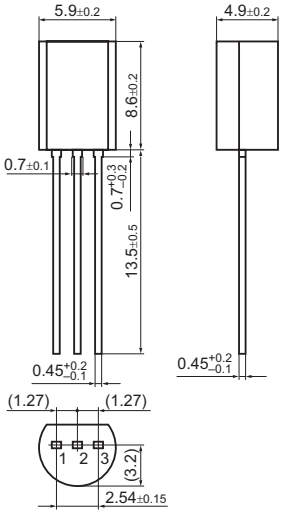
TO-92-B1



TO-92-C1

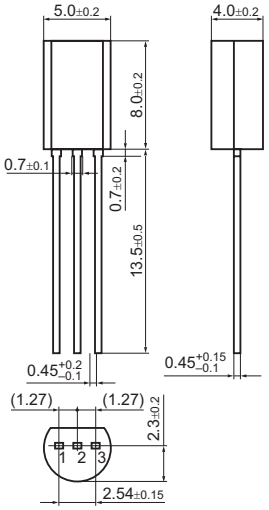


TO-92L-A1

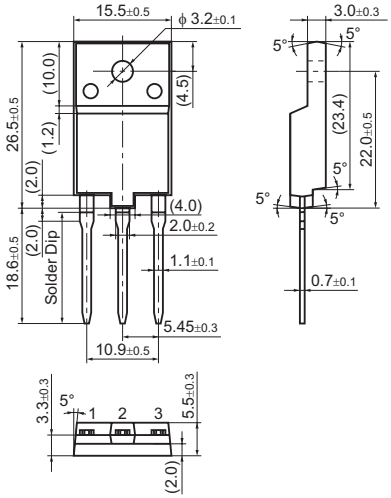


JEITA: SC-51

TO-92NL-A1

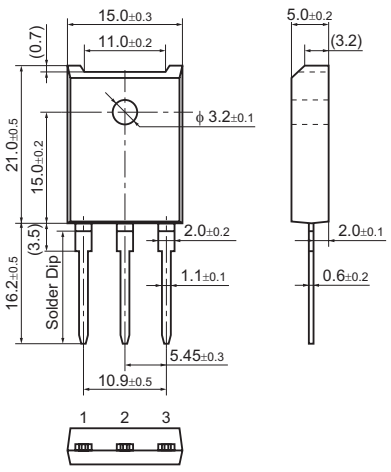


TOP-3E-A1



JEITA: SC-94

TOP-3F-A1



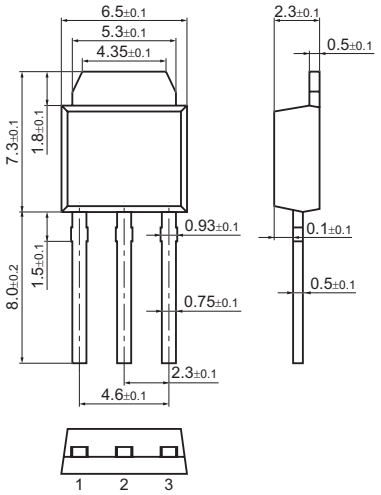
JEITA: SC-92

N

Package Outlines

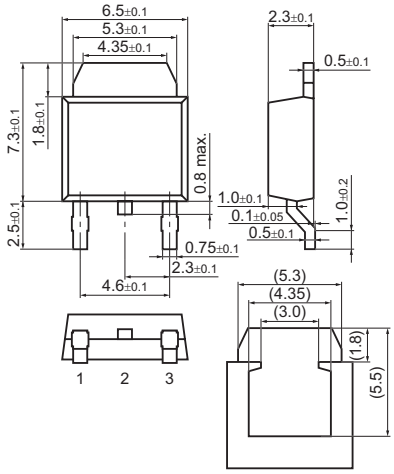
( ): Reference Value Unit: mm

U-A1(U Type)



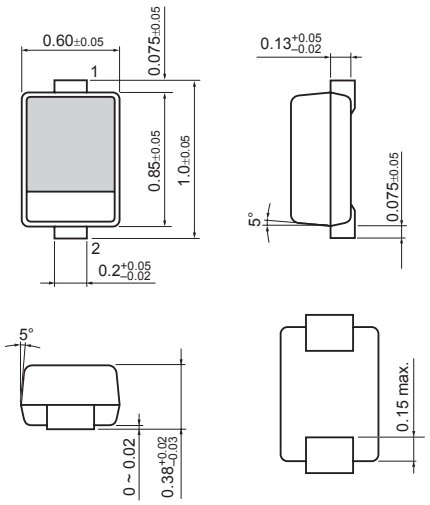
JEITA: SC-64

U-G2(U Type)



JEITA: SC-63

USSMini2-F1



Reference Dimension of Soldering pad

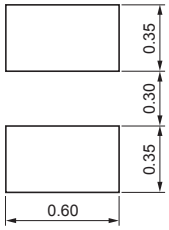
R

Reference Dimension of Soldering pad

Unit: mm

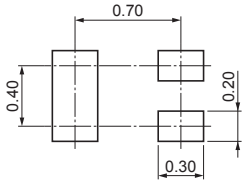
Mold Lead-less・2-pin
ML2-N1

[Diodes]



Mold Lead-less・3-pin
ML3-N2

[Transistors, Variable Capacitance Diodes]

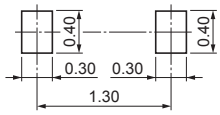


USS Mini Type・2-pin
USSMini2-F1

[Diodes]

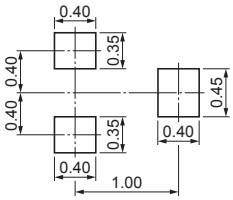
SSS Mini Type・2-pin
SSSMini2-F1
SSSMini2-F2

[Variable Capacitance Diodes, Diodes]



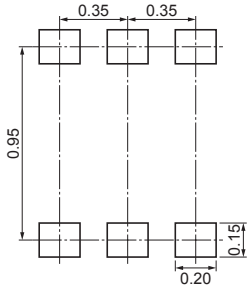
SSS Mini Type・3-pin
SSSMini3-F1

[Transistors, Diodes]



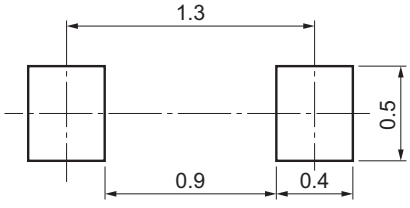
SSS Mini Type・6-pin
SSSMini6-F1

[Transistors]



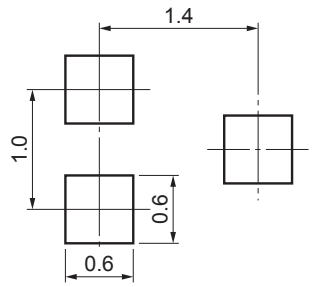
SS Mini Type・2-pin
SSMini2-F1
SSMini2-F2

[Variable Capacitance Diodes, Diodes]



SS Mini Type・3-pin
SSMini3-F1
SSMini3-F2

[Transistors, Diodes]

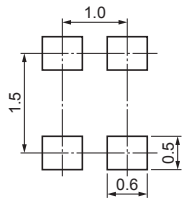


Reference Dimension of Soldering pad

Unit: mm

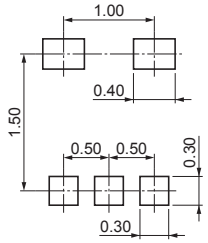
SS Mini Type • 4-pin
SSMini4-F1

[Diodes]



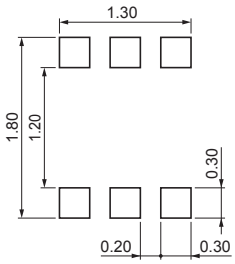
SS Mini Type • 5-pin
SSMini5-F1
SSMini5-F2

[Transistors, Diodes]



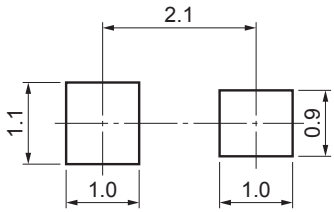
SS Mini Type • 6-pin
SSMini6-F1

[Transistors]



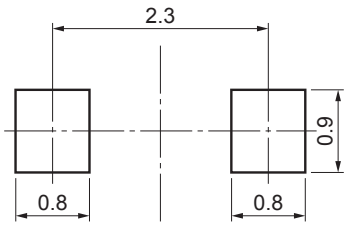
S Mini Type • 2-pin
SMini2-F1
SMini2-F2

[Diodes]



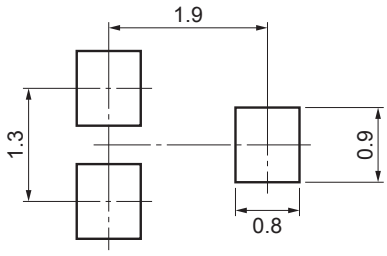
S Mini Type • 2-pin
SMini2-G1

[Variable Capacitance Diodes]



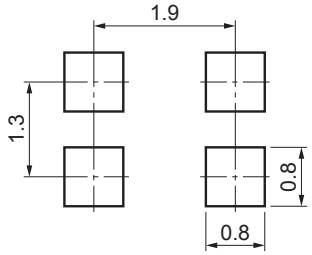
S Mini Type • 3-pin
SMini3-F1
SMini3-G1

[Transistors, Variable Capacitance Diodes, Diodes]



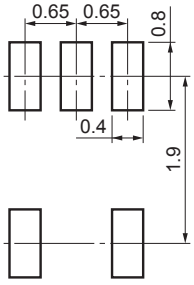
S Mini Type • 4-pin
SMini4-F1
SMini4-G1

[Transistors, Diodes]



S Mini Type • 5-pin
SMini5-F1
SMini5-G1

[Transistors, Diodes]

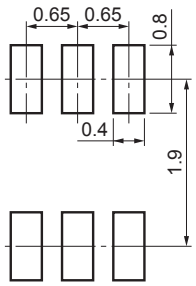


R

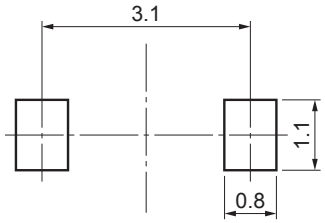
Reference Dimension of Soldering pad

Unit: mm

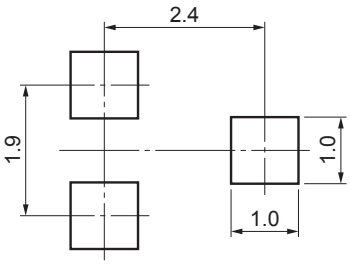
S Mini Type・6-pin
SMini6-F1
SMini6-G1
[Transistors, Diodes, GaAs MMIC]



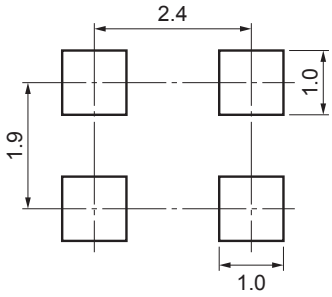
Mini Type・2-pin
Mini2-F1
Mini2-G1
[Diodes]



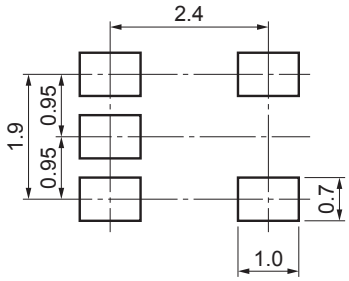
Mini Type・3-pin
Mini3-G1
[Transistors, Diodes]



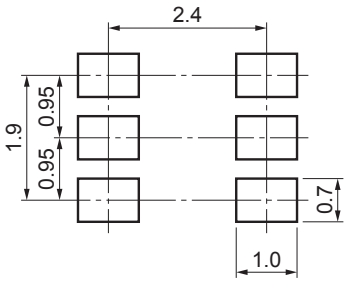
Mini Type・4-pin
Mini4-G1
[Diodes]



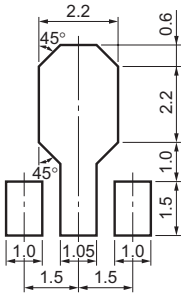
Mini Type・5-pin
Mini5-G1
[Transistors, FETs]



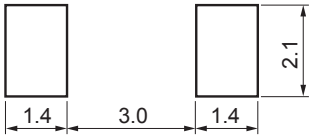
Mini Type・6-pin
Mini6-G1
Mini6-G2
[Transistors, Diodes]



Mini-Power Type・3-pin
MiniP3-F1
[Transistors]



T Mini-Power Type・2-pin
TMiniP2-F1
[Diodes]

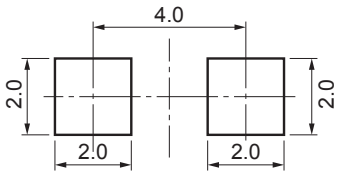


Reference Dimension of Soldering pad

Unit: mm

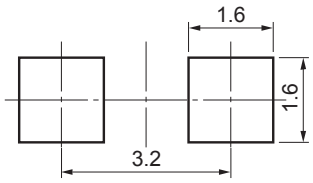
New Mini-Power Type • 2-pin
NMiniP2-J1

[Diodes]



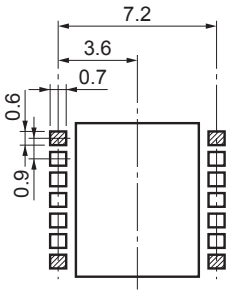
Half New Mini-Power Type • 2-pin
HNMiniP2-J1

[Diodes]



SO10-A/D
SO14-G1

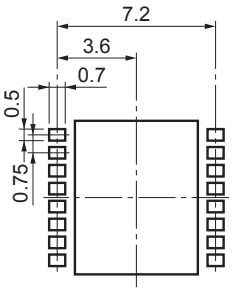
[Transistor Arrays]



Except for areas in ▨ for SO-10

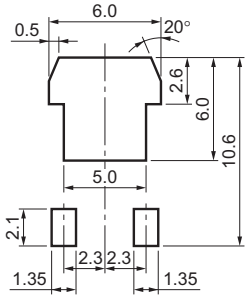
SO16-G1

[Transistor Arrays]



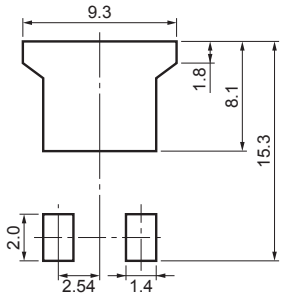
U-G1

[Transistors]



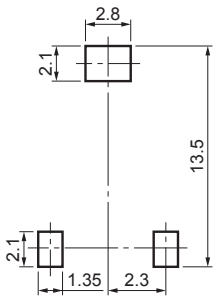
N-G1

[Transistors]



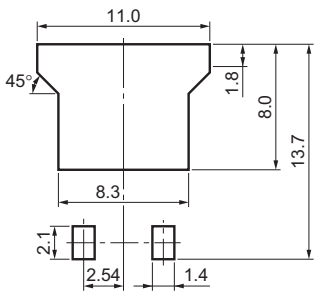
I-G1

[Transistors]



TO-220C-G1

[Transistor Arrays, Diodes]



R

Discontinued, Maintenance and Planned Maintenance Types

<Changes in the Product Naming System>

Some maintenance types using Matsushita global codes have been changed. Please order using the Matsushita global codes. If you have any questions, please contact our sales division for your area (listed on the back cover).

<Discontinued Types>

Please note that these parts have been discontinued, and no further handling can be performed.

<Maintenance Types>

Sales of these parts have been discontinued. Because of this, new sales of such products are not possible. Further, existing customers who require new sets should use replacement products instead.

<Planned Maintenance Types>

These parts are scheduled to become maintenance types. Please refrain from new applications of such products.

Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page
1N4148	D	—	—
1N4148S	D	—	—
2SA0564	D	2SA1309A	H3
2SA0564A	D	2SA1309A	H3
2SA0699	D	—	—
2SA0699A	D	—	—
2SA0719	S	—	—
2SA0748	D	—	—
2SA0838	S	—	—
2SA0887	D	—	—
2SA0900	S	—	—
2SA0913	D	—	—
2SA0914	M	—	—
2SA0921	S	—	—
2SA0921A	D	—	—
2SA0963	M	—	—
2SA100	D	—	—
2SA101	D	—	—
2SA102	D	—	—
2SA103	D	—	—
2SA104	D	—	—
2SA1060	D	—	—
2SA1061	D	—	—
2SA1062	D	—	—
2SA1063	D	—	—
2SA1064	D	—	—
2SA1065	D	—	—
2SA1092	D	—	—
2SA1110	M	—	—
2SA1111	D	—	—
2SA1112	D	—	—
2SA1124	S	—	—
2SA1124A	M	—	—
2SA1125	M	—	—
2SA1128	S	—	—
2SA1133	D	—	—
2SA1133A	D	—	—
2SA1185	D	—	—
2SA1254	M	—	—
2SA1309	D	2SA1309A	H3
2SA1309AI	D	2SA1309A	H3
2SA1323	S	—	—
2SA1375	M	—	—
2SA1487	D	—	—
2SA1495	D	—	—
2SA1498	M	—	—
2SA1499	D	—	—
2SA1500	D	—	—
2SA1501	D	—	—
2SA1512	S	—	—
2SA1531	S	—	—
2SA1531A	S	—	—
2SA1534	S	—	—
2SA1534A	S	—	—
2SA1535	S	—	—
2SA1535A	S	—	—
2SA1550	M	—	—
2SA1605	D	—	—
2SA1614	D	—	—
2SA1619	S	—	—
2SA1619A	S	—	—
2SA1698	D	2SA1767	H3
2SA1737	D	—	—
2SA1747	M	2SB0709A	H3
2SA1762	M	—	—
2SA1790	D	2SA1790J	H4
2SA1791	D	2SA1791J	H4
2SA1806	D	2SA1806J	H4
2SA1816	S	—	—
2SA1817	D	—	—
2SA1868	M	—	—
2SA1888	D	—	—
2SA1949	S	—	—
2SA1950	D	—	—
2SA1951	M	—	—
2SA1961	D	—	—
2SA1966	D	—	—
2SA1982	S	—	—
2SA2004	D	—	—
2SA2008	D	—	—
2SA2021	S	—	—
2SA2076	S	—	—
2SA341	D	—	—
2SA342	D	—	—
2SA546	D	—	—
2SA546A	D	—	—
2SA547	D	—	—
2SA547A	D	—	—
2SA550	D	—	—
2SA550A	D	—	—
2SA637	D	—	—
2SA666	D	—	—
2SA666A	D	—	—
2SA685	D	—	—
2SA699B	D	—	—
2SA721	D	—	—
2SA722	D	—	—
2SA730	D	—	—
2SA731	D	—	—
2SA731A	D	—	—
2SA749	D	—	—
2SA749A	D	—	—
2SA751	D	—	—
2SA752	D	—	—
2SA766	D	—	—
2SA774	D	—	—
2SA774A	D	—	—
2SA795	D	—	—
2SA837	D	—	—
2SA843	D	—	—
2SA880	D	—	—
2SA882	D	—	—
2SA912	D	—	—
2SA972	D	—	—
2SA973	D	—	—
2SA977	D	—	—
2SB0512	D	—	—
2SB0512A	D	—	—
2SB0513	D	—	—
2SB0513A	D	—	—
2SB0641	M	—	—
2SB0642	M	—	—
2SB0643	M	—	—
2SB0644	M	—	—
2SB0709	D	2SB0709A	H3
2SB0726	S	—	—
2SB0745	M	—	—
2SB0745A	M	—	—
2SB0747	D	—	—
2SB0750	D	—	—
2SB0750A	D	—	—
2SB0751	D	—	—
2SB0751A	D	—	—
2SB0760	D	—	—
2SB0760A	D	—	—
2SB0760B	D	—	—
2SB0761	D	—	—
2SB0761A	D	—	—
2SB0762	D	2SB0942	H11
2SB0762A	D	2SB0942A	H11
2SB0788	M	—	—
2SB0790	M	—	—
2SB0793	D	—	—
2SB0793A	D	—	—
2SB0814	D	—	—
2SB0819	M	—	—
2SB0835	M	2SB0956	H10
2SB0867	D	—	—
2SB0868	D	2SB0944	H11
2SB0869	D	2SB0945	H11
2SB0869A	D	—	—
2SB0871	D	2SB0948	H11
2SB0871A	D	2SB0948A	H11
2SB0872	D	2SB0951	H11
2SB0872A	D	2SB0951A	H11
2SB0872B	D	—	—
2SB0873A	M	—	—
2SB0894	D	2SB0774	H3
2SB0902	D	—	—
2SB0925	D	—	—
2SB0925A	D	—	—
2SB0929	S	—	—
2SB0929A	S	—	—
2SB0932	M	—	—
2SB0935	D	—	—
2SB0935A	D	—	—
2SB0940	S	—	—
2SB0940A	S	—	—
2SB0940B	S	—	—
2SB0941	D	—	—
2SB0941A	M	—	—
2SB0943	S	—	—
2SB0947	D	—	—
2SB0947A	D	—	—
2SB0949	D	—	—
2SB0949A	D	—	—
2SB0950	S	—	—
2SB0950A	S	—	—
2SB0952	D	—	—
2SB0952A	D	—	—
2SB0953	D	—	—
2SB0953A	D	—	—
2SB0954	S	—	—
2SB0954A	S	—	—
2SB0967	M	—	—
2SB0976A	M	—	—
2SB0987	D	—	—
2SB1020	M	—	—
2SB1030	S	—	—
2SB1036	S	—	—
2SB1050	M	—	—
2SB1052	D	—	—
2SB1054	D	—	—
2SB1055	D	—	—
2SB1056	D	—	—
2SB1057	D	—	—
2SB1057A	M	—	—
2SB1062	M	2SB0970	H3
2SB1063	D	—	—
2SB1063A	M	—	—
2SB1069	M	—	—
2SB1070	D	—	—
2SB1070A	D	—	—
2SB1071	D	—	—
2SB1071A	D	—	—
2SB1075	D	—	—
2SB1108	D	—	—
2SB1152CHIP	M	—	—
2SB1154	D	—	—
2SB1155	D	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

Note) 1. Alternative product is, almost alike in characteristics and function, not same in all respects. Please examine the content when you use.
2. HW and TA products for MT-2, and TW taping products for surface-mounting products are set as Discontinued types.
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Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page
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2SB1160	M	—	—
2SB1161	M	—	—
2SB1162	D	—	—
2SB1163	D	—	—
2SB1170	S	—	—
2SB1171	M	—	—
2SB1171A	M	—	—
2SB1173	S	—	—
2SB1173A	S	—	—
2SB1177	S	—	—
2SB1178	S	—	—
2SB1178A	S	—	—
2SB1190	M	—	—
2SB1190A	M	—	—
2SB1191	S	—	—
2SB1191A	S	—	—
2SB1192	S	—	—
2SB1192A	S	—	—
2SB1194	S	—	—
2SB1195	S	—	—
2SB1206	M	2SB0774	H3
2SB1207	S	—	—
2SB1208	D	—	—
2SB1209	M	—	—
2SB1218	M	2SB1218A	H2
2SB1218AI	D	2SB1218A	H2
2SB1222	D	—	—
2SB1233	S	—	—
2SB1233A	S	—	—
2SB1250	D	—	—
2SB1251CHIP	M	—	—
2SB1252	M	—	—
2SB1252A	M	—	—
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2SB1255	D	—	—
2SB126	D	—	—
2SB1264	D	2SA1018	H3
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2SB126A	D	—	—
2SB127	D	—	—
2SB127A	D	—	—
2SB128	D	—	—
2SB128A	D	—	—
2SB129	D	—	—
2SB1299A	S	—	—
2SB129A	D	—	—
2SB130	D	—	—
2SB1317	D	—	—
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2SB1319	M	—	—
2SB1320	M	2SB1320A	H3
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2SB1322	M	2SB1322A	H9
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2SB1361	M	—	—
2SB1362	D	—	—
2SB1371	D	—	—
2SB1372	M	—	—
2SB1373	D	—	—
2SB1376	M	—	—
2SB1377	M	2SB1322A	H9
2SB1378	S	—	—
2SB1393	D	—	—
2SB1393A	D	—	—
2SB1413	D	—	—
2SB1415	D	—	—
2SB1417	S	—	—
2SB1419	D	—	—
2SB1421	D	—	—
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2SB1439	S	—	—
2SB1447	D	—	—
2SB1456	D	—	—
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2SB1463	D	2SB1463J	H2
2SB1464	D	—	—
2SB1469	D	—	—
2SB1470	D	—	—
2SB1473	D	—	—
2SB1488	D	—	—
2SB1489	D	—	—
2SB1490	D	—	—
2SB1492	D	—	—
2SB1493	D	—	—
2SB1498	M	—	—
2SB1499	D	—	—
2SB1499A	S	—	—
2SB1500	D	—	—
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2SB1503	D	—	—
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2SB1538	D	—	—
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2SB1540	D	—	—
2SB1541	D	—	—
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2SB1543	D	2SB1416	H8
2SB1544	D	—	—
2SB1545	D	—	—
2SB1546	D	—	—
2SB1547	D	—	—
2SB1548A	S	—	—
2SB1553	D	—	—
2SB1554	D	—	—
2SB157	D	—	—
2SB1573	D	—	—
2SB1575	S	—	—
2SB1576	M	—	—
2SB1579	D	—	—
2SB158	D	—	—
2SB1582	D	2SB0710A	H3
2SB1583	D	2SB0792A	H3
2SB1584	D	2SB0779	H3
2SB1585	D	2SB0970	H3
2SB159	D	—	—
2SB1597	S	—	—
2SB1598	D	—	—
2SB160	D	—	—
2SB1600	D	—	—
2SB1601	D	—	—
2SB1603	D	—	—
2SB1603A	D	—	—
2SB1604	D	—	—
2SB1604A	D	—	—
2SB1605	D	—	—
2SB1605A	D	—	—
2SB1606	D	—	—
2SB1607	D	—	—
2SB1610	D	—	—
2SB1611	D	—	—
2SB1612	D	—	—
2SB1613	D	—	—
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2SB1618	D	—	—
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2SB1627	D	2SB0709A	H3
2SB1629	D	—	—
2SB1630	D	—	—
2SB1631	M	—	—
2SB1632	M	—	—
2SB1633	M	—	—
2SB1638	D	—	—
2SB1638A	D	—	—
2SB1643	S	—	—
2SB1645CHIP	S	—	—
2SB1651	D	—	—
2SB1653	D	—	—
2SB1662	D	—	—
2SB1663	D	—	—
2SB1665	D	—	—
2SB1666	D	—	—
2SB1670	M	—	—
2SB1678	D	—	—
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2SB171	D	—	—
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2SB280	D	—	—
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2SB283	D	—	—
2SB284	D	—	—
2SB285	D	—	—
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2SB371	D	—	—
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P

Discontinued, Maintenance and Planned Maintenance Types

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2SB476	D	—	—
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2SB532	D	—	—
2SB533	D	—	—
2SB604	D	—	—
2SB625	D	—	—
2SB626	D	—	—
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2SB669	D	—	—
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2SB692	D	—	—
2SB695	D	—	—
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2SB713	D	—	—
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2SB759	D	—	—
2SB759A	D	—	—
2SB763	D	—	—
2SB763A	D	—	—
2SB77	D	—	—
2SB780	D	—	—
2SB807	M	2SB0792	H3
2SB812	D	—	—
2SB812A	D	—	—
2SB870	D	—	—
2SB895	D	—	—
2SB895A	D	—	—
2SB896	M	—	—
2SB896A	M	—	—
2SB977	D	—	—
2SB977B	D	—	—
2SB979CHIP	D	—	—
2SB980	D	—	—
2SB981	D	—	—
2SB982	D	—	—
2SC0828	D	—	—
2SC0828A	D	—	—
2SC0829	S	—	—
2SC0901	D	—	—
2SC1012	D	—	—
2SC1012A	D	—	—
2SC1033	D	—	—
2SC1033A	D	—	—
2SC1033AZ	D	—	—
2SC1033Z	D	—	—
2SC1047	S	—	—
2SC1073	D	—	—
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2SC1190	D	—	—
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2SC1192	D	—	—
2SC1192A	D	—	—
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2SC1226A	M	—	—
2SC1257	S	—	—
2SC127	M	—	—
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2SC1354	D	—	—
2SC1359	S	—	—
2SC1360	S	—	—
2SC1360A	S	—	—
2SC1383	S	—	—
2SC1398	D	—	—
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2SC1405	D	—	—
2SC1406	D	—	—
2SC1407	D	—	—
2SC1440	M	—	—
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2SC1478A	D	—	—
2SC1501	D	—	—
2SC1518	M	—	—
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2SC1556	D	—	—
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2SC1565A	D	—	—
2SC1566	D	—	—
2SC1620	D	—	—
2SC1667	D	—	—
2SC1683	D	—	—
2SC1683A	D	—	—
2SC1684	D	2SC3311A	H3
2SC1685	M	2SC3311A	H3
2SC1686	D	—	—
2SC1687	D	—	—
2SC1688	D	—	—
2SC1730	M	—	—
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2SC1789	D	—	—
2SC1790	D	—	—
2SC1818	D	—	—
2SC1819	D	—	—
2SC1845	M	—	—
2SC1848	D	—	—
2SC1849	M	2SC3311A	H3
2SC1851	M	2SC1318	H3
2SC1852	M	—	—
2SC1853	M	—	—
2SC1854	M	2SC3311A	H3
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2SC1885	D	—	—
2SC1905	D	—	—
2SC1913	D	—	—
2SC1929	D	—	—
2SC1953	M	—	—
2SC1973	D	—	—
2SC1974	D	—	—
2SC1975	D	—	—
2SC1976	D	—	—
2SC1977	D	—	—
2SC1978	D	—	—
2SC1980	S	—	—
2SC1989	M	—	—
2SC1990	M	—	—
2SC2034	D	—	—
2SC2076	D	—	—
2SC2077	D	—	—
2SC2085	D	—	—
2SC2113	D	—	—
2SC2152	D	—	—
2SC2153	D	—	—
2SC2188	M	—	—
2SC2192	D	—	—
2SC2206	M	—	—
2SC2209	S	—	—
2SC2257	D	—	—
2SC2263	D	—	—
2SC2264	D	—	—
2SC2291	M	—	—
2SC2292	M	—	—
2SC2294	D	—	—
2SC2360	D	—	—
2SC2361	D	—	—
2SC2377	M	—	—
2SC2414	D	—	—
2SC2415	D	—	—
2SC2416	D	—	—
2SC2447	D	—	—
2SC2454	D	—	—
2SC2455	D	—	—
2SC2464	S	—	—
2SC2482	S	—	—
2SC2483	M	—	—
2SC2484	D	—	—
2SC2485	D	—	—
2SC2486	D	—	—
2SC2487	D	—	—
2SC2488	D	—	—
2SC2489	D	—	—
2SC2519	D	—	—
2SC2556	D	—	—
2SC2556A	D	—	—
2SC2557	D	—	—
2SC2561	D	—	—
2SC2567	M	2SC2406	H3
2SC2582	D	—	—
2SC2590	S	—	—
2SC2591	D	—	—
2SC2592	D	2SD2134	H8
2SC2594	M	—	—
2SC2632	S	—	—
2SC2632A	S	—	—
2SC2633	D	—	—
2SC2636	M	—	—
2SC2637	D	—	—
2SC2645	M	—	—
2SC2646	D	—	—
2SC2647	M	—	—
2SC2653	M	—	—
2SC2653H	S	—	—
2SC2657	D	—	—
2SC2657A	D	—	—
2SC2658	D	—	—
2SC2658A	D	—	—
2SC2659	D	—	—
2SC2659A	D	—	—
2SC2660	D	—	—
2SC2671	D	—	—
2SC2671F	S	—	—
2SC2671H	S	—	—
2SC2680	D	—	—
2SC2683	D	—	—
2SC2684	D	—	—
2SC2685	D	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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Discontinued, Maintenance and Planned Maintenance Types

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2SC2739	D	—	—
2SC2740	D	—	—
2SC2803	M	—	—
2SC2831	D	—	—
2SC2831A	D	—	—
2SC2832	D	—	—
2SC2832A	D	—	—
2SC2833	M	—	—
2SC2833A	M	—	—
2SC2834	D	—	—
2SC2834A	D	—	—
2SC2841	D	—	—
2SC2843	M	—	—
2SC2844	D	—	—
2SC2845	D	—	—
2SC2846	M	—	—
2SC2847	D	—	—
2SC2848	D	—	—
2SC2849	D	—	—
2SC2851	M	—	—
2SC2852	M	—	—
2SC2860	D	—	—
2SC2866	M	2SC1473A	H3
2SC2923	D	—	—
2SC2924	M	—	—
2SC2988	D	—	—
2SC2989	D	—	—
2SC2991	D	—	—
2SC2992	D	—	—
2SC3054	D	—	—
2SC3077	D	—	—
2SC3106	D	—	—
2SC3107	D	—	—
2SC3108	D	—	—
2SC3109	D	—	—
2SC3110	D	2SC3934	H4
2SC3111	D	—	—
2SC316	D	—	—
2SC3169	D	—	—
2SC3170	D	—	—
2SC3171	M	—	—
2SC3177	S	—	—
2SC3187	S	—	—
2SC3210	D	—	—
2SC3211	D	—	—
2SC3211A	D	—	—
2SC3212	D	—	—
2SC3212A	D	—	—
2SC3250	M	—	—
2SC3251	M	—	—
2SC3276	D	—	—
2SC3285	M	—	—
2SC3287	D	—	—
2SC3288	D	—	—
2SC3289	D	—	—
2SC3290	D	—	—
2SC3291	D	—	—
2SC3311	D	2SC3311A	H3
2SC3311AI	D	2SC3311A	H3
2SC3313	S	—	—
2SC3314	S	—	—
2SC3315	S	—	—
2SC3352	M	—	—
2SC3352A	M	—	—
2SC3353	D	—	—
2SC3353A	D	—	—
2SC3354	S	—	—
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2SC3371	D	—	—
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2SC35	D	—	—
2SC3506	D	—	—
2SC3508	M	—	—
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2SC3526	D	—	—
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2SC3795	D	—	—
2SC3796	D	—	—
2SC3796A	D	—	—
2SC3797	D	—	—
2SC3797A	D	—	—
2SC3798	S	—	—
2SC3798A	S	—	—
2SC3799	S	—	—
2SC3799A	S	—	—
2SC3811	S	—	—
2SC382400G	M	—	—
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2SC3869	M	—	—
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2SC3872	D	—	—
2SC3873	D	—	—
2SC3874	D	—	—
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2SC3944A	S	—	—
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2SC3965	M	—	—
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2SC3975A	D	—	—
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2SC3977	S	—	—
2SC3977A	S	—	—
2SC3978	S	—	—
2SC3978A	S	—	—
2SC3980A	S	—	—
2SC3981	S	—	—
2SC3981A	S	—	—
2SC3982	D	—	—
2SC3982A	D	—	—
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2SC4068	D	—	—
2SC4096	D	—	—
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2SC4114	D	—	—
2SC4152	D	—	—
2SC4158	D	—	—
2SC4190	D	—	—
2SC4238	D	—	—
2SC4239	D	—	—
2SC4309	D	—	—
2SC4358	D	—	—
2SC4379	D	—	—
2SC4417	S	—	—
2SC4421	D	—	—
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2SC4528	D	—	—
2SC4533	M	2SC4953	H14
2SC4535	D	—	—
2SC4543	D	—	—
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2SC4561	M	—	—
2SC4576	D	—	—
2SC4599	S	—	—
2SC4606	M	—	—
2SC4607	S	—	—
2SC4621	D	—	—
2SC4626	D	—	—
2SC4627	S	—	—
2SC4638	D	—	—
2SC4655	D	2SC4655J	H4
2SC4656	D	2SC4656J	H4
2SC4661	D	—	—
2SC4665	M	—	—
2SC4670	D	—	—
2SC4687	D	—	—
2SC4691	D	2SC4691J	H4
2SC4714	D	—	—
2SC4715	S	—	—
2SC4716	D	—	—
2SC4717	D	—	—
2SC4755	D	—	—
2SC4767	D	—	—
2SC4768	D	—	—
2SC477	D	—	—
2SC478	D	—	—
2SC4780	D	—	—
2SC4782	D	—	—
2SC4787	S	—	—
2SC4792	D	—	—
2SC4808	D	2SC4808J	H4
2SC4809	D	2SC4809J	H4
2SC4882	D	—	—
2SC4893	M	—	—
2SC4894	D	—	—
2SC4895	M	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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P

Discontinued, Maintenance and Planned Maintenance Types

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2SC4968	D	—	—
2SC4969	D	—	—
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2SC4971	D	—	—
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2SC4973	D	—	—
2SC4974	D	—	—
2SC4975	D	—	—
2SC4985	S	—	—
2SC4986	D	—	—
2SC50	D	—	—
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2SC5017	D	—	—
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2SC5019	S	—	—
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2SC5032	D	—	—
2SC5033	D	—	—
2SC5034	D	—	—
2SC5035	D	—	—
2SC5036	D	—	—
2SC5036A	S	—	—
2SC5037	S	—	—
2SC5037A	S	—	—
2SC5038	D	—	—
2SC5063	S	—	—
2SC5077	D	—	—
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2SC5127	D	—	—
2SC5128	D	—	—
2SC5145	S	—	—
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2SC5166	D	—	—
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2SC5244	D	—	—
2SC5244A	D	—	—
2SC526	D	—	—
2SC5270	M	—	—
2SC5270A	M	—	—
2SC5278	D	—	—
2SC5281	D	—	—
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2SC5283	D	—	—
2SC5284	D	—	—
2SC5285	S	—	—
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2SC5295	D	2SC5295J	H4
2SC5309	M	—	—
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2SC5341	D	—	—
2SC5346	S	—	—
2SC5363	S	—	—
2SC5378	D	—	—
2SC5379	D	2SC5379J	H4
2SC538	D	—	—
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2SC5380A	S	—	—
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2SC5381A	D	—	—
2SC5389	M	—	—
2SC538A	D	—	—
2SC539	D	—	—
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2SC5406A	M	—	—
2SC5407	M	—	—
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2SC5410A	D	—	—
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2SC696A	D	—	—
2SC697	D	—	—
2SC697A	D	—	—
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2SC761	D	—	—
2SC762	D	—	—
2SC821	D	—	—
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2SC99	D	—	—
2SD0389	D	—	—
2SD0389A	M	—	—
2SD0591	M	2SC3311A	H3
2SD0601	D	2SD0601A	H3
2SD0602	M	—	—
2SD0636	M	—	—
2SD0637	M	—	—
2SD0638	M	—	—
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2SD0661A	M	—	—
2SD0662	M	—	—
2SD0662A	M	—	—
2SD0662B	M	—	—
2SD0750	D	—	—
2SD0762	D	—	—
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2SD0767	M	2SC3311A	H3
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2SD0772	D	—	—
2SD0772A	D	—	—
2SD0772B	D	—	—
2SD0772C	D	—	—
2SD0792	D	—	—
2SD0804	D	—	—
2SD0813	D	—	—
2SD0814	D	2SD0814A	H3
2SD0836	D	2SD1275	H11

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Discontinued, Maintenance and Planned Maintenance Types

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2SD0837B	D	—	—
2SD0850	D	—	—
2SD0856	D	—	—
2SD0856A	D	—	—
2SD0857	D	2SD1267	H11
2SD0857A	D	2SD1267A	H11
2SD0857B	D	—	—
2SD0859	D	2SD1263	H11
2SD0859A	D	—	—
2SD0860	D	—	—
2SD0860A	D	—	—
2SD0860B	D	—	—
2SD0866	D	2SD1271	H11
2SD0866A	D	2SD1271A	H11
2SD0866B	D	—	—
2SD0876	D	2SD1272	H11
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2SD0887	M	—	—
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2SD0959	D	—	—
2SD0960	M	2SD1269	H11
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2SD1457A	D	—	—
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2SD1475	M	—	—
2SD1476	M	2SD2000	H11
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2SD1707	D	—	—
2SD1712	D	—	—
2SD1713	M	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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P

Discontinued, Maintenance and Planned Maintenance Types

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2SD1727	S	—	—
2SD1728	S	—	—
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2SD1730	D	—	—
2SD1731	M	—	—
2SD1732	D	—	—
2SD1733	S	—	—
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2SD1737	S	—	—
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2SD1772A	S	—	—
2SD1773	D	—	—
2SD1774	M	—	—
2SD1774A	M	—	—
2SD1775	D	—	—
2SD1775A	S	—	—
2SD1776	D	—	—
2SD1776A	D	—	—
2SD178	D	—	—
2SD178A	D	—	—
2SD178Z	D	—	—
2SD1807	D	—	—
2SD1808	M	—	—
2SD1808A	S	—	—
2SD1819	M	2SD1819A	H2
2SD1819AI	D	2SD1819A	H2
2SD1831	M	—	—
2SD1839	D	—	—
2SD1844	M	—	—
2SD1845	M	—	—
2SD1846	D	—	—
2SD1847	D	—	—
2SD1848	M	—	—
2SD1849	D	—	—
2SD1850	D	—	—
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2SD1893	D	—	—
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2SD19	D	—	—
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2SD1938	M	—	—
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2SD1990	D	—	—
2SD1991	D	2SD1991A	H3
2SD1992	M	2SD1992A	H3
2SD1994	M	2SD1994A	H9
2SD1994B	M	—	—
2SD200	D	—	—
2SD2001	D	—	—
2SD2018	M	—	—
2SD2029	D	—	—
2SD2051	D	—	—
2SD2052	S	—	—
2SD2053	D	—	—
2SD2057	D	—	—
2SD2064	D	—	—
2SD2065	M	—	—
2SD2066	D	—	—
2SD2068	M	—	—
2SD2070	M	2SD1991A	H3
2SD2071	M	2SD1992A	H3
2SD2072	M	2SD1993	H3
2SD2073	D	2SD1995	H3
2SD2074	S	—	—
2SD2135	D	—	—
2SD2137	S	—	—
2SD2140	D	—	—
2SD2156	M	—	—
2SD2156A	S	—	—
2SD2157	M	—	—
2SD2157A	M	—	—
2SD2158	D	—	—
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2SD2173	D	—	—
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2SD2216	D	2SD2216J	H2
2SD2221	D	—	—
2SD2222	D	—	—
2SD2240	D	2SD2240J	H2
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2SD2242B	S	—	—
2SD2250	D	—	—
2SD2254	D	—	—
2SD2255	D	—	—
2SD226	D	—	—
2SD2260	D	—	—
2SD2265	M	—	—
2SD2266	D	—	—
2SD226A	D	—	—
2SD226B	D	—	—
2SD2273	D	—	—
2SD2274	D	—	—
2SD2275	D	—	—
2SD2276	D	—	—
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2SD2326	D	—	—
2SD2327	D	—	—
2SD2328	D	—	—
2SD2329	D	—	—
2SD2330	M	2SC5901	—
2SD2331	S	—	—
2SD2332	S	—	—
2SD2333	S	—	—
2SD2334	S	—	—
2SD2335	S	—	—
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2SD2340	D	—	—
2SD2341	D	—	—
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2SD2355	D	—	—
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2SD2366	D	—	—
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2SD2368	S	—	—
2SD2369	S	—	—
2SD2370	S	—	—
2SD2371	S	—	—
2SD2372	S	—	—
2SD2373	S	—	—
2SD2374	S	—	—
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2SD2375A	S	—	—
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2SD2455	D	—	—
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2SD2466A	S	—	—
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2SD2468	D	—	—
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Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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Discontinued, Maintenance and Planned Maintenance Types

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2SD2482	D	—	—
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2SD2501	D	—	—
2SD2502	D	—	—
2SD2503	D	—	—
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2SD2527	S	—	—
2SD2527A	S	—	—
2SD2529	D	2SD1979	H2
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2SD2593	D	—	—
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2SD2602	D	—	—
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2SD299	D	—	—
2SD300	D	—	—
2SD31	D	—	—
2SD312	D	—	—
2SD317	D	—	—
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2SD318A	D	—	—
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2SD367	D	—	—
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2SD458	D	—	—
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2SD570	D	—	—
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2SD649	M	—	—
2SD671	D	—	—
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2SD692	D	—	—
2SD693	D	—	—
2SD727	D	—	—
2SD728	D	—	—
2SD731	D	—	—
2SD746	D	—	—
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2SD770	M	—	—
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2SD849	D	—	—
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2SD855A	D	—	—
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2SD861A	D	—	—
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2SD954	D	—	—
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2SD969	D	—	—
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2SF229	D	—	—
2SF248	M	—	—
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2SF940	D	—	—
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2SJ0146	D	—	—
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2SK0657	M	—	—
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2SK0667	M	—	—
2SK0667A	M	—	—
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2SK0807	M	—	—
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2SK0818A	D	—	—
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2SK0870	M	—	—
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Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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P

Discontinued, Maintenance and Planned Maintenance Types

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2SK1104	S	—	—
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2SK1265	M	—	—
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2SK127A	D	—	—
2SK128	D	—	—
2SK1308	M	—	—
2SK1308A	M	—	—
2SK1330	D	—	—
2SK1331	M	—	—
2SK136	D	—	—
2SK139	M	—	—
2SK1406	D	—	—
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2SK1607	D	—	—
2SK1608	D	—	—
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2SK2129	D	—	—
2SK2130	D	—	—
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2SK2276	M	2SK3022	H24
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2SK2588	D	—	—
2SK2593	D	2SK2593J	H22
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2SK3042	M	—	—
2SK3044	M	—	—
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2SK3091	D	—	—
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2SK3167	D	—	—
2SK3168	D	—	—
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2SK3178	D	—	—
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2SK3181	S	—	—
2SK3182	D	—	—
2SK3183	D	—	—
2SK3184	D	—	—
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2SK3186	S	—	—
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2SK3188	D	—	—
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2SK3190	D	—	—
2SK3191	S	—	—
2SK3194	D	—	—
2SK3196	D	—	—
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2SK3202	S	—	—
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2SK3286	D	—	—
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2SK3316	D	—	—
2SK3317	D	—	—
2SK3329	S	—	—
2SK3333	S	—	—
2SK3336	D	—	—
2SK3383	S	—	—
2SK3392	D	—	—
2SK3400	D	—	—
2SK3406	D	—	—
2SK3425	M	—	—
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2SK3452	D	—	—
2SK3578	S	—	—
2SK3665	D	—	—
2SK3671	S	—	—
2SK379	M	—	—
2SK380	M	—	—
2SK3862	S	—	—
2SK3866	S	—	—
2SK4001	D	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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Discontinued, Maintenance and Planned Maintenance Types

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2SK496	M	—	—
2SK497	M	—	—
2SK498	M	—	—
2SK499	M	—	—
2SK50	D	—	—
2SK500	M	—	—
2SK501	M	—	—
2SK501A	M	—	—
2SK502	M	—	—
2SK502A	M	—	—
2SK503	M	—	—
2SK503A	M	—	—
2SK56	D	—	—
2SK602	M	—	—
2SK602A	M	—	—
2SK603	M	—	—
2SK603A	M	—	—
2SK604	M	—	—
2SK604A	M	—	—
2SK605	M	—	—
2SK606	D	—	—
2SK607	D	—	—
2SK608	D	—	—
2SK610	M	—	—
2SK617	M	—	—
2SK617A	M	—	—
2SK624	D	—	—
2SK626	M	—	—
2SK627	M	—	—
2SK627A	M	—	—
2SK628	M	—	—
2SK628A	M	—	—
2SK629	M	—	—
2SK629A	M	—	—
2SK630	M	—	—
2SK631	M	—	—
2SK632	M	—	—
2SK632A	M	—	—
2SK633	M	—	—
2SK633A	M	—	—
2SK634	M	—	—
2SK634A	M	—	—
2SK635	M	—	—
2SK636	M	—	—
2SK637	M	—	—
2SK638	M	—	—
2SK638A	M	—	—
2SK648	M	—	—
2SK650	D	—	—
2SK651	D	—	—
2SK652	D	—	—
2SK66	D	—	—
2SK689	D	—	—
2SK691	D	—	—
2SK697	D	—	—
2SK742	D	—	—
2SK742A	D	—	—
2SK743	D	—	—
2SK743A	D	—	—
2SK744	D	—	—
2SK744A	D	—	—
2SK745	D	—	—
2SK745A	D	—	—
2SK746	D	—	—
2SK746A	D	—	—
2SK747	D	—	—
2SK747A	D	—	—
2SK748	D	—	—
2SK748A	D	—	—
2SK749	D	—	—
2SK749A	D	—	—
2SK750	D	—	—
2SK750A	D	—	—
2SK753	D	—	—
2SK756	D	—	—
2SK764	D	—	—
2SK764A	D	—	—
2SK766	D	—	—
2SK767	D	—	—
2SK768	D	—	—
2SK803	D	—	—
2SK83	D	—	—
2SK839	S	—	—
2SK84	D	—	—
2SK840	S	—	—
2SK841	S	—	—
2SK842	S	—	—
2SK862	D	—	—
2SK863	D	—	—
2SK863A	D	—	—
2SK864	D	—	—
2SK864A	D	—	—
2SK865	D	—	—
2SK865A	D	—	—
2SK866	D	—	—
2SK866A	D	—	—
2SK867	D	—	—
2SK867A	D	—	—
2SK869	D	—	—
2SK955	M	—	—
2SM125	D	—	—
2SM151	D	—	—
2SM152	D	—	—
2SM58	D	—	—
2SM58A	D	—	—
2SM75	D	—	—
2SM79	D	—	—
3SF11	D	—	—
3SK0119	D	—	—
3SK0120	D	—	—
3SK0139	D	—	—
3SK0143	D	—	—
3SK0144	D	—	—
3SK0169	D	—	—
3SK0192	D	—	—
3SK0219	D	—	—
3SK0220	D	—	—
3SK0227	D	—	—
3SK0269	D	—	—
3SK0270	D	—	—
3SK0271	D	—	—
3SK0285	D	—	—
3SK0286	D	—	—
3SK0287	S	—	—
3SK0301	D	—	—
3SK0302	D	—	—
3SK0303	D	—	—
3SK0304	D	—	—
3SK0305	M	—	—
3SK0306	M	—	—
3SK0307	M	—	—
3SK0308	M	—	—
3SK100	D	—	—
3SK116	D	—	—
3SK117	D	—	—
3SK118	D	—	—
3SK125	D	—	—
3SK128	D	—	—
3SK129	D	—	—
3SK141	D	—	—
3SK142	D	—	—
3SK183	D	—	—
3SK193	D	—	—
3SK200	D	—	—
3SK201	D	—	—
3SK202	D	—	—
3SK24	D	—	—
3SK247	D	—	—
3SK25	D	—	—
3SK268	D	—	—
3SK280	D	—	—
3SK282	D	—	—
3SK32	D	—	—
3SK39	D	—	—
3SK49	D	—	—
3SK66	D	—	—
3SK72	D	—	—
3SK97	D	—	—
DSM361ML50NX	M	—	—
DSM42BA15D	D	—	—
DSM42BA15DN	M	—	—
DSM78BA4D	S	—	—
DSM78BA4DN	M	—	—
DSM82BA6D	S	—	—
DSM82BA6DP	M	—	—
DSM83BA15D	S	—	—
DSM87BA6D	S	—	—
DSM90BA15D	S	—	—
DSM90BA15DN	M	—	—
DSMAM00802	M	—	—
DSMG05C	D	—	—
DSMG08C	D	—	—
DSMG10C	D	—	—
DSMG12C	D	—	—
DSMG16C	D	—	—
M119BA15D0NX	M	—	—
M168FCHIP	M	—	—
M177FCHIP	M	—	—
M18G	M	—	—
M194FCHIP	M	—	—
M195FCHIP	M	—	—
M196FCHIP	M	—	—
M197FCHIP	M	—	—
M200FCHIP	M	—	—
M203FCHIP	M	—	—
M217ML03CHIP	M	—	—
M21C	D	—	—
M21CA	D	—	—
M21F	D	—	—
M23	D	—	—
M23C	D	—	—
M23CA	D	—	—
M256ML02CHIP	M	—	—
M257MM03CHIP	M	—	—
M271ML5000NX	M	—	—
M32CA	D	—	—
M47F	D	—	—
M59C	D	—	—
M91F	D	—	—
MA101	D	—	—
MA10152D	D	—	—
MA10152E	D	—	—
MA10152K	D	—	—
MA102	D	—	—
MA103	D	—	—
MA10301	D	—	—
MA104	D	—	—
MA106	D	—	—
MA10799F	D	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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P

Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page
MA11	D	—	—
MA13	D	—	—
MA132HK	D	—	—
MA142AI	D	—	—
MA142KI	D	—	—
MA142WAI	D	MA3J142D	K3
MA147I	D	MA3J147	K3
MA150D	M	—	—
MA152AI	D	—	—
MA152KI	D	—	—
MA152WAI	D	—	—
MA152WKI	D	—	—
MA17	D	—	—
MA172	D	—	—
MA18	D	—	—
MA183	D	—	—
MA184	M	MA2C185	K3
MA186	D	—	—
MA1S121	D	—	—
MA200A	S	—	—
MA200K	S	—	—
MA203	D	—	—
MA209	D	—	—
MA21	D	—	—
MA211	D	—	—
MA215	D	—	—
MA23	D	—	—
MA231	D	—	—
MA232	D	—	—
MA233	D	—	—
MA241	D	—	—
MA242	D	—	—
MA242C	D	—	—
MA242R	D	—	—
MA25	D	—	—
MA251	D	—	—
MA252	D	—	—
MA253	D	—	—
MA26	D	—	—
MA261	D	—	—
MA262	D	—	—
MA263	D	—	—
MA26T	D	—	—
MA26W	D	—	—
MA26WO	D	—	—
MA27V10	S	—	—
MA292	D	—	—
MA2B027	M	—	—
MA2B027Q	S	—	—
MA2B027T	S	—	—
MA2B027W	S	—	—
MA2B064	M	—	—
MA2B161	S	—	—
MA2B170	M	MA2C178	K5
MA2B171A	M	—	—
MA2B181	M	—	—
MA2B182	S	—	—
MA2B190	S	—	—
MA2B345	S	—	—
MA2B345E	M	—	—
MA2C167A	S	—	—
MA2C180	S	—	—
MA2C346	S	—	—
MA2C774	S	—	—
MA2C775	M	—	—
MA2C776	M	—	—
MA2D601	D	—	—
MA2D749	S	—	—
MA2D749A	S	—	—
MA2D750	S	—	—
MA2D750A	S	—	—
MA2D755	S	—	—
MA2D760	S	—	—
MA2D760A	S	—	—
MA2F689	M	—	—
MA2F690	M	—	—
MA2HD07	S	—	—
MA2HD08	S	—	—
MA2HD09	S	—	—
MA2J372	S	—	—
MA2J733	M	—	—
MA2P291	M	—	—
MA2P291A	M	—	—
MA2P701	M	—	—
MA2P701A	M	—	—
MA2QA01	M	—	—
MA2QA02	S	—	—
MA2QD02	S	—	—
MA2R064	D	—	—
MA2R221	D	MA2J111	K3
MA2R222	D	MA2J111	K3
MA2R223	D	MA2J111	K3
MA2R782	D	—	—
MA2S075	D	—	—
MA2S082	M	—	—
MA2S367	S	—	—
MA2S707	S	—	—
MA2SV08	M	MA2SV03	K6
MA2SV10	S	—	—
MA2SV24	S	—	—
MA2W077	S	—	—
MA2W304	S	—	—
MA2WV01	S	—	—
MA2WV02	S	—	—
MA2WV03	S	—	—
MA2WV04	S	—	—
MA2WV07	S	—	—
MA2WV09	S	—	—
MA2WV11	S	—	—
MA2WV12	S	—	—
MA2WV13	D	MA27V13	K6
MA2X072	D	MA2S077	K7
MA2X073	D	MA2S077	K7
MA2X321	D	—	—
MA2X3210B	S	—	—
MA2X329	S	—	—
MA2X333	S	—	—
MA2X334	D	—	—
MA2X3340B	S	—	—
MA2X3340G	D	—	—
MA2X335	S	—	—
MA2X336	D	—	—
MA2X337	D	—	—
MA2X338	S	—	—
MA2X339	S	—	—
MA2X341	S	—	—
MA2X353	D	—	—
MA2X707	D	—	—
MA2XD15	S	—	—
MA2XD17	S	—	—
MA2XV334G	D	—	—
MA2YD09	M	—	—
MA2Z077	S	—	—
MA2Z081	S	—	—
MA2Z110	M	MA2J111	K3
MA2Z304	S	—	—
MA2Z304B	D	MA2S304	K6
MA2Z331	S	—	—
MA2Z357	S	—	—
MA2Z357J	S	—	—
MA2Z360	S	—	—
MA2Z360J	S	—	—
MA2Z362	S	—	—
MA2Z363	D	—	—
MA2Z363B	D	MA2S372	K6
MA2Z363G	M	—	—
MA2Z364	D	MA2S357	K6
MA2Z365	S	—	—
MA2Z366	S	—	—
MA2Z366C	M	—	—
MA2Z367	S	—	—
MA2Z368	D	—	—
MA2Z370	M	—	—
MA2Z371	S	—	—
MA2Z372	S	—	—
MA2Z374	S	—	—
MA2Z376	S	—	—
MA2Z377	S	—	—
MA2Z378	D	—	—
MA2Z379	D	—	—
MA2Z391	S	—	—
MA2Z392	S	—	—
MA2Z393	S	—	—
MA2Z728	S	—	—
MA2Z729	S	—	—
MA2Z732	S	—	—
MA2ZV01	S	—	—
MA2ZV02	S	—	—
MA2ZV03	S	—	—
MA2ZV05	S	—	—
MA2ZV06	S	—	—
MA2ZV08	M	MA2SV03	K6
MA3000WA	S	—	—
MA301	D	—	—
MA302	D	—	—
MA303	D	—	—
MA3051T	M	—	—
MA3066	M	—	—
MA320	D	—	—
MA322	D	—	—
MA323	D	—	—
MA3230	M	—	—
MA324	D	—	—
MA3240CHIP	M	—	—
MA325	D	—	—
MA325B	D	—	—
MA325G	D	—	—
MA326	D	—	—
MA327	D	—	—
MA328	D	—	—
MA330	D	—	—
MA332	D	—	—
MA340	D	—	—
MA342	D	—	—
MA342-B	M	—	—
MA342-M	M	—	—
MA350	D	—	—
MA351	D	—	—
MA355	D	—	—
MA361	D	—	—
MA373	D	—	—
MA375	D	—	—
MA380	S	—	—
MA381	D	—	—
MA3A100	M	—	—
MA3D660	D	—	—
MA3D689	S	—	—
MA3D693	D	—	—
MA3D694	D	—	—
MA3F649	S	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page
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MA3F653	M	MA3D653	K20
MA3F654	M	—	—
MA3F670	D	—	—
MA3F693	D	—	—
MA3F694	D	—	—
MA3F749	D	—	—
MA3F749A	M	—	—
MA3F750	D	MA3D750	K19
MA3F750A	M	MA3D750A	K19
MA3F752	D	MA3D752	K19
MA3F752A	M	MA3D752A	K19
MA3F755	D	—	—
MA3F756	D	—	—
MA3F760	D	—	—
MA3F761	D	—	—
MA3F769	D	—	—
MA3G651	S	—	—
MA3G695	S	—	—
MA3G762	D	—	—
MA3J08D	S	—	—
MA3J141A	M	MA3J142A	K3
MA3J141D	M	MA3J142D	K3
MA3J141E	M	MA3J142E	K3
MA3J141K	M	MA3J142K	K3
MA3J792	S	—	—
MA3K649	S	—	—
MA3K749	S	—	—
MA3K755	S	—	—
MA3K760	S	—	—
MA3L204D	D	MA3X152D	K3
MA3L204E	D	MA3X152E	K3
MA3L205D	D	MA3X152D	K3
MA3L205E	D	MA3X152E	K3
MA3L206	D	—	—
MA3L207	S	—	—
MA3M154D	M	—	—
MA3M154E	M	—	—
MA3M155D	M	—	—
MA3M155E	M	—	—
MA3M156	M	—	—
MA3M553	M	—	—
MA3N753	M	—	—
MA3N753A	D	—	—
MA3T152A	M	MA3X152	—
MA3T152D	M	—	—
MA3T152E	M	—	—
MA3T152K	M	—	—
MA3T157	S	—	—
MA3T157A	M	—	—
MA3TD01	M	—	—
MA3U653	S	—	—
MA3U689	S	—	—
MA3U690	S	—	—
MA3U755	S	—	—
MA3U760	S	—	—
MA3UD06	S	—	—
MA3V175D	S	—	—
MA3V175E	S	—	—
MA3V176D	S	—	—
MA3V176E	S	—	—
MA3V177	S	—	—
MA3X057	S	—	—
MA3X075D	S	—	—
MA3X075E	D	—	—
MA3X151A	M	MA3X152A	K3
MA3X151D	M	MA3X152D	K3
MA3X151E	M	MA3X152E	K3
MA3X151K	M	MA3X152K	K3
MA3X157	M	MA3X157A	K3
MA3X164	S	—	—
MA3X200E	M	—	—
MA3X200F	M	—	—
MA3X551	S	—	—
MA3X555	S	—	—
MA3X557	S	—	—
MA3X558	S	—	—
MA3X730	S	—	—
MA3X781	S	—	—
MA3X997	D	—	—
MA3XD13	S	—	—
MA3XD14E	M	—	—
MA3XD17	S	—	—
MA3Z070	S	—	—
MA3Z080D	S	—	—
MA3Z080E	S	—	—
MA3Z200	D	—	—
MA3Z220	D	—	—
MA3Z240	D	—	—
MA3Z270	M	—	—
MA3Z378	M	—	—
MA3Z551	S	—	—
MA3ZT42D	S	—	—
MA4000-(LFS) Series	S	—	—
MA432	D	—	—
MA433	D	—	—
MA47	D	—	—
MA48	D	—	—
MA49	D	—	—
MA4X159	M	MA4X159A	K3
MA4X743	M	—	—
MA4X998	M	—	—
MA51A	D	—	—
MA520	D	—	—
MA521	D	—	—
MA522	D	—	—
MA53	D	—	—
MA550	D	—	—
MA552	M	—	—
MA56	D	—	—
MA5Z002E	S	—	—
MA5Z190	M	—	—
MA60	D	—	—
MA6000 Series	M	—	—
MA603	D	—	—
MA604	D	—	—
MA6047	M	—	—
MA605	D	—	—
MA6075	M	—	—
MA61	D	—	—
MA615	D	—	—
MA619	D	—	—
MA62	D	—	—
MA6200	D	MAZ8200	K10
MA622	D	—	—
MA625	D	—	—
MA627	D	—	—
MA629	D	—	—
MA630	D	—	—
MA6300	M	—	—
MA6390	M	—	—
MA643	M	—	—
MA6430	M	—	—
MA644	D	—	—
MA645	M	—	—
MA6470	M	—	—
MA651	M	—	—
MA6510	M	—	—
MA652	M	—	—
MA660	D	—	—
MA667	D	—	—
MA671	D	—	—
MA691	D	—	—
MA6X078	S	—	—
MA6X139	D	—	—
MA6X344B	M	—	—
MA6X556	S	—	—
MA6XD16	S	—	—
MA702	D	—	—
MA704CHIP	D	—	—
MA708	D	—	—
MA709	D	—	—
MA710	D	—	—
MA711	D	—	—
MA711A	D	—	—
MA733	D	—	—
MA743	S	—	—
MA74WA	M	—	—
MA74WK	M	—	—
MA768	M	—	—
MA771	M	—	—
MA772	M	—	—
MA777	M	—	—
MA780	S	—	—
MA783	S	—	—
MA78M	S	—	—
MA79	D	—	—
MA790	D	—	—
MA7D68	D	—	—
MA7D69	D	—	—
MA7U49	M	MA3U749	K19
MA7U50	S	—	—
MA7Z030	M	—	—
MA7Z033	M	—	—
MA7Z051	M	—	—
MA7Z062	M	—	—
MA7Z082	M	—	—
MA7Z091	M	—	—
MA7Z100	M	—	—
MA7Z120	M	—	—
MA7Z180	M	—	—
MA83	D	—	—
MA860	D	—	—
MA90	D	—	—
MA999	D	—	—
MAS3781	S	—	—
MAS3781E	S	—	—
MAS3784	S	—	—
MAZ1020	D	—	—
MAZ1022	M	—	—
MAZ1024	M	—	—
MAZ1027	M	—	—
MAZ1030	M	—	—
MAZ1033	M	—	—
MAZ1036	M	—	—
MAZ1039	M	—	—
MAZ1043	M	—	—
MAZ1047	M	—	—
MAZ1051	M	—	—
MAZ1056	M	—	—
MAZ1062	M	—	—
MAZ1068	M	—	—
MAZ1075	M	—	—
MAZ1082	M	—	—
MAZ1091	M	—	—
MAZ1100	M	—	—
MAZ1110	M	—	—
MAZ1120	M	—	—
MAZ1130	M	—	—
MAZ1140	M	—	—

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Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page
MAZ1150	M	—	—
MAZ1160	M	—	—
MAZ1180	M	—	—
MAZ1200	M	—	—
MAZ1220	M	—	—
MAZ1240	M	—	—
MAZ1270	M	—	—
MAZ1300	M	—	—
MAZ1330	M	—	—
MAZ1390	M	—	—
MAZ1470	M	—	—
MAZ1560	M	—	—
MAZ3047X	S	—	—
MAZ3056D	S	—	—
MAZ3062D	S	—	—
MAZ3062X	S	—	—
MAZ3068D	M	—	—
MAZ3075D	S	—	—
MAZ3075E	S	—	—
MAZ3075T	M	—	—
MAZ3075X	M	—	—
MAZ3082D	S	—	—
MAZ3091E	S	—	—
MAZ3100D	S	—	—
MAZ3100E	S	—	—
MAZ3100X	S	—	—
MAZ3120D	S	—	—
MAZ3130D	S	—	—
MAZ3180D	S	—	—
MAZ3200D	S	—	—
MAZ3200X	S	—	—
MAZ3330D	S	—	—
MAZ3390	S	—	—
MAZ4091X	M	—	—
MAZ4510	S	—	—
MAZ4560	S	—	—
MAZ5047	M	MAZY047	K10
MAZ5051	M	MAZY051	K10
MAZ5056	M	MAZY056	K10
MAZ5062	M	MAZY062	K10
MAZ5068	M	MAZY068	K10
MAZ5075	M	MAZY075	K10
MAZ5082	M	MAZY082	K10
MAZ5091	M	MAZY091	K10
MAZ5100	M	MAZY100	K10
MAZ5110	M	MAZY110	K10
MAZ5120	M	MAZY120	K10
MAZ5130	M	MAZY130	K10
MAZ5150	M	MAZY150	K10
MAZ5160	M	MAZY160	K10
MAZ5180	M	MAZY180	K10
MAZ5200	M	MAZY200	K10
MAZ5220	M	MAZY220	K10
MAZ5240	M	MAZY240	K10
MAZ6033	D	MAZ8033	K10
MAZ6039	D	MAZ8039	K10
MAZ6043	M	—	—
MAZ6051	D	MAZ8051	K10
MAZ6056	D	MAZ8056	K10
MAZ6062	D	MAZ8062	K10
MAZ6068	D	MAZ8068	K10
MAZ6082	D	MAZ8082	K10
MAZ6091	D	MAZ8091	K10
MAZ6100	D	MAZ8100	K10
MAZ6110	D	MAZ8110	K10
MAZ6120	D	MAZ8120	K10
MAZ6130	M	—	—
MAZ6150	D	MAZ8150	K10
MAZ6180	M	—	—
MAZ6220	M	—	—
MAZ6240	D	MAZ8240	K10
MAZ6270	D	MAZ8270	K10
MAZ6330	D	MAZ8330	K10
MAZ6360	D	MAZ8360	K10
MAZ70750B	M	—	—
MAZ71800B	M	—	—
MAZ72000A	M	—	—
MAZ9039D	S	—	—
MAZ9062	S	—	—
MAZ9062D	S	—	—
MAZ9075	S	—	—
MAZ9180D	S	—	—
MAZ950	D	—	—
MAZF033	S	—	—
MAZF036	S	—	—
MAZF039	M	MAZ8039	K10
MAZF043	S	—	—
MAZF047	S	—	—
MAZF051	S	—	—
MAZF056	M	—	—
MAZF062	M	—	—
MAZF068	M	—	—
MAZF075	M	—	—
MAZF082	M	—	—
MAZF091	M	—	—
MAZF100	M	—	—
MAZF110	M	—	—
MAZF120	M	MAZ8120	K10
MAZG033	M	—	—
MAZG036	M	—	—
MAZG039	M	—	—
MAZG043	M	—	—
MAZG047	M	—	—
MAZG051	M	—	—
MAZG056	M	—	—
MAZG062	M	—	—
MAZG068	M	—	—
MAZG075	M	—	—
MAZG082	M	—	—
MAZG091	M	—	—
MAZG100	M	—	—
MAZG120	M	—	—
MAZH062	S	—	—
MAZH075	S	—	—
MAZH100	S	—	—
MAZH120	S	—	—
MAZH160	S	—	—
MAZJ068H	S	—	—
MAZJ082D	S	—	—
MAZJ082H	S	—	—
MAZJ100D	S	—	—
MAZJ100E	S	—	—
MAZJ200D	S	—	—
MAZK068D	S	—	—
MAZK068H	S	—	—
MAZK075D	S	—	—
MAZK120D	S	—	—
MAZK270D	S	—	—
MAZL062D	S	—	—
MAZL068D	S	—	—
MAZL075D	S	—	—
MAZL091D	S	—	—
MAZL120D	S	—	—
MAZL160D	S	—	—
MAZL270D	S	—	—
MAZN033	M	—	—
MAZN036	M	—	—
MAZN039	M	—	—
MAZN043	M	—	—
MAZN047	M	—	—
MAZN051	M	—	—
MAZN056	M	—	—
MAZN062	M	—	—
MAZN068	M	—	—
MAZN075	M	—	—
MAZN082	M	—	—
MAZN091	M	—	—
MAZN100	M	—	—
MAZN110	M	—	—
MAZN120	M	—	—
MAZR033	S	—	—
MAZR056	S	—	—
MAZR082	S	—	—
MAZR082H	S	—	—
MAZR120	S	—	—
MAZS0470G	S	—	—
MAZT082D	S	—	—
MAZU200	M	—	—
MAZU220	M	—	—
MAZU240	M	—	—
MAZU270	M	—	—
MAZU300	M	—	—
MAZU330	M	—	—
MAZV082D	S	—	—
MAZV082DF	S	—	—
MAZX200	M	—	—
MAZX220	M	—	—
MAZX240	M	—	—
MAZX270	M	—	—
MAZX300	M	—	—
MAZX330	M	—	—
OF4325	D	—	—
PU1102	M	—	—
PU1103	M	—	—
PU1104	M	—	—
PU1105	M	—	—
PU1163	M	—	—
PU1171	M	—	—
PU1191	M	—	—
PU1502	M	—	—
PU1504	M	—	—
PU1602	M	—	—
PU1603	M	—	—
PU1604	M	—	—
PU1620	D	—	—
PU3151	M	—	—
PU3152	M	—	—
PU3153	M	—	—
PU3154	M	—	—
PU3161	M	—	—
PU3162	M	—	—
PU3163	M	—	—
PU3164	M	—	—
PU4136	M	—	—
PU4144	D	—	—
PU4147	D	—	—
PU4148	M	—	—
PU4151	M	—	—
PU4152	M	—	—
PU4153	M	—	—
PU4154	M	—	—
PU4161	M	—	—
PU4162	M	—	—
PU4163	M	—	—
PU4164	M	—	—
PU42C26	D	—	—
PU4451	M	—	—
PU4452	M	—	—
PU4453	M	—	—
PU4454	M	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page
PU4461	M	—	—
PU4462	M	—	—
PU4463	M	—	—
PU4464	M	—	—
PU61C56	D	—	—
PU8432	D	—	—
PU8456	D	—	—
PUA3110	D	—	—
PUA3111	S	—	—
PUA3112	S	—	—
PUA3113	S	—	—
PUA3114	S	—	—
PUA3116	S	—	—
PUA3117	S	—	—
PUA3118	S	—	—
PUA3119	D	—	—
PUA3120	S	—	—
PUA3121	S	—	—
PUA3122	D	—	—
PUA3123	D	—	—
PUA3124	D	—	—
PUA3127	D	—	—
PUA3131	M	—	—
PUA3132	M	—	—
PUA3133	M	—	—
PUA3134	M	—	—
PUA3135	M	—	—
PUA3136	S	—	—
PUA3137	S	—	—
PUA3138	M	—	—
PUA3141	M	—	—
PUA3142	M	—	—
PUA3143	M	—	—
PUA3144	M	—	—
PUA3145	M	—	—
PUA3146	M	—	—
PUA3147	M	—	—
PUA3148	M	—	—
PUA3171	S	—	—
PUA3173	D	—	—
PUA3210	D	—	—
PUA3211	D	—	—
PUA3212	S	—	—
PUA3213	D	—	—
PUA3214	D	—	—
PUA3215	D	—	—
PUA3216	S	—	—
PUA3219	D	—	—
PUA3220	D	—	—
PUA3226	S	—	—
PUA3228	D	—	—
PUA3273	D	—	—
PUB2301	D	—	—
PUB4110	D	—	—
PUB4110A	D	—	—
PUB4111	D	—	—
PUB4112	D	—	—
PUB4113	S	—	—
PUB4114	D	—	—
PUB4116	D	—	—
PUB4117	D	—	—
PUB4117A	D	—	—
PUB4118	D	—	—
PUB4119	D	—	—
PUB4119A	D	—	—
PUB4120	D	—	—
PUB4120A	S	—	—
PUB4120B	S	—	—
PUB4121	S	—	—
PUB4122	D	—	—
PUB4123	D	—	—
PUB4124	D	—	—
PUB4126	D	—	—
PUB4127	D	—	—
PUB4128	D	—	—
PUB4131	S	—	—
PUB4132	M	—	—
PUB4133	M	—	—
PUB4134	M	—	—
PUB4135	D	—	—
PUB4135A	D	—	—
PUB4137	S	—	—
PUB4138	M	—	—
PUB4139	S	—	—
PUB4140	S	—	—
PUB4141	M	—	—
PUB4142	M	—	—
PUB4143	M	—	—
PUB4145	D	—	—
PUB4146	D	—	—
PUB4171	S	—	—
PUB4173	S	—	—
PUB4210	D	—	—
PUB4211	D	—	—
PUB4212	D	—	—
PUB4213	D	—	—
PUB4214	D	—	—
PUB4215	S	—	—
PUB4216	S	—	—
PUB4219	D	—	—
PUB4220	D	—	—
PUB4220A	D	—	—
PUB4301	D	—	—
PUB4310	D	—	—
PUB4311	D	—	—
PUB4314	D	—	—
PUB4320	D	—	—
PUB4320A	D	—	—
PUB4325	D	—	—
PUB4410	D	—	—
PUB4410A	D	—	—
PUB4411	D	—	—
PUB4411A	D	—	—
PUB4412	S	—	—
PUB4413	S	—	—
PUB4414	D	—	—
PUB4416	S	—	—
PUB4417	D	—	—
PUB4417A	D	—	—
PUB4418	S	—	—
PUB4419	D	—	—
PUB4420	D	—	—
PUB4420A	D	—	—
PUB4421	D	—	—
PUB4422	D	—	—
PUB4423	D	—	—
PUB4424	D	—	—
PUB4431	M	—	—
PUB4432	M	—	—
PUB4433	M	—	—
PUB4434	M	—	—
PUB4435	S	—	—
PUB4436	S	—	—
PUB4437	S	—	—
PUB4438	M	—	—
PUB4439	S	—	—
PUB4440	S	—	—
PUB4441	S	—	—
PUB4442	M	—	—
PUB4443	M	—	—
PUB4444	M	—	—
PUB4445	S	—	—
PUB4446	S	—	—
PUB4447	M	—	—
PUB4448	M	—	—
PUB4471	D	—	—
PUB4473	S	—	—
PUB4510	D	—	—
PUB4511	D	—	—
PUB4512	S	—	—
PUB4513	S	—	—
PUB4514	S	—	—
PUB4515	S	—	—
PUB4516	D	—	—
PUB4519	D	—	—
PUB4520	D	—	—
PUB4573	S	—	—
PUB4701	D	—	—
PUB4702	D	—	—
PUB4732	D	—	—
PUB4756	D	—	—
PUB4757	D	—	—
PUC4401	D	—	—
PUC4701	D	—	—
PUC6301	D	—	—
PUC6302	D	—	—
PUC6303	D	—	—
PUC6304	M	—	—
SMM4R01	S	—	—
SMM4R02	S	—	—
SMP240W	D	—	—
SMP260W	D	—	—
SP0A554	S	—	—
TAIY098	S	—	—
UN0531F	S	—	—
UN0531H	S	—	—
UN0533H	S	—	—
UN0535M	S	—	—
UN0571W	S	—	—
UN0572W	S	—	—
UN101	D	—	—
UN102	D	—	—
UN207	D	—	—
UN208	D	—	—
UN209	D	—	—
UN210	D	—	—
UN2111A	M	UNR2111	H17
UN2111AI	D	UNR2111	H17
UN2111T	S	—	—
UN2112A	M	UNR2112	H17
UN2112AI	D	—	—
UN2112T	S	—	—
UN2113A	M	UNR2113	H17
UN2113AI	D	UNR2113	H17
UN2113T	S	—	—
UN2115T	S	—	—
UN2124T	S	—	—
UN2130	D	—	—
UN215	D	—	—
UN2154T	S	—	—
UN2210T	S	—	—
UN2211A	M	UNR2211	H17
UN2211AI	D	—	—
UN2211T	S	—	—
UN2212A	M	UNR2212	H17
UN2212AI	D	—	—
UN2212T	S	—	—
UN2213A	M	UNR2213	H17
UN2213AI	D	—	—
UN2213T	S	—	—

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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P

Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page
UN2214A	M	UNR2214	H17
UN2214AI	D	—	—
UN2215T	S	—	—
UN2216T	S	—	—
UN221ET	S	—	—
UN221KT	S	—	—
UN221MT	S	—	—
UN2225T	D	—	—
UN2226T	S	—	—
UN403	M	—	—
UN4068	M	—	—
UN4111AI	D	—	—
UN4112A	D	—	—
UN4112AI	D	—	—
UN4113A	D	—	—
UN4113AI	D	—	—
UN4211AI	D	—	—
UN4212A	D	—	—
UN4212AI	D	—	—
UN4213A	D	—	—
UN4213AI	D	—	—
UN4214A	D	—	—
UN4214AI	D	—	—
UN431	D	—	—
UN501	M	—	—
UN502	M	—	—
UN5101	D	—	—
UN5111AI	D	—	—
UN5201	D	—	—
UN5211AI	D	—	—
UNA0205	S	—	—
UNA0218	D	—	—
UNA0219	D	—	—
UNA0223	M	—	—
UNA0228	S	—	—
UNA0230	S	—	—
UNA0231	S	—	—
UNA0232	S	—	—
UNA0234	S	—	—
UNA0451	M	—	—
UNA0601	D	—	—
UNA0602	D	—	—
UNA0603	D	—	—
UNA0604	D	—	—
UNA0801	D	—	—
UNA401	M	—	—
UNH0002	S	—	—
UNH0004	S	—	—
UNH0012	D	—	—
UNH0013	D	—	—
UNH0104	M	—	—
UNH0106	M	—	—
UNH0108	M	—	—
UNH0110	M	—	—
UNH0115	M	—	—
UNH0120	M	—	—
UNH0127	M	—	—
UNH0507	D	—	—
UNH1104	M	—	—
UNH1106	M	—	—
UNH1108	S	—	—
UNH1110	M	—	—
UNH1115	M	—	—
UNH1120	S	—	—
UNH1127	S	—	—
UNHH200	M	UNHS200	L2
UNHH201	M	UNHS201	L2
UNHH202	M	UNHS202	L2
UNHH203	M	UNHS203	L2
UNHH204	M	UNHS204	L2
UNHH205	M	UNHS205	L2
UNHH206	M	UNHS206	L2
UNHX301	M	—	—
UNHX302	M	—	—
UNHX303	M	—	—
UNHX304	M	—	—
UNHX401	M	—	—
UNHX402	M	—	—
UNHX403	M	—	—
UNHX404	M	—	—
UNR1110	M	—	—
UNR1111	M	—	—
UNR1112	M	—	—
UNR1113	M	—	—
UNR1114	M	—	—
UNR1115	M	—	—
UNR1116	M	—	—
UNR1117	M	—	—
UNR1118	M	—	—
UNR1119	M	—	—
UNR111D	M	—	—
UNR111E	M	—	—
UNR111F	M	—	—
UNR111H	M	—	—
UNR111L	M	—	—
UNR1121	M	—	—
UNR1122	M	—	—
UNR1123	M	—	—
UNR1124	M	—	—
UNR112X	M	—	—
UNR112Y	M	—	—
UNR1210	M	—	—
UNR1211	M	—	—
UNR1212	M	—	—
UNR1213	M	—	—
UNR1214	M	—	—
UNR1215	M	—	—
UNR1216	M	—	—
UNR1217	M	—	—
UNR1218	M	—	—
UNR1219	M	—	—
UNR121D	M	—	—
UNR121E	M	—	—
UNR121F	M	—	—
UNR121K	M	—	—
UNR121L	M	—	—
UNR1221	M	—	—
UNR1222	M	—	—
UNR1223	M	—	—
UNR1224	M	—	—
UNR1231	M	—	—
UNR1231A	M	—	—
UNR2130X	D	—	—
UNR2213A	M	—	—
UNR2214A	M	—	—
UNR2226T	D	—	—
UNR2319	S	—	—
UNR3113	S	—	—
UNR311A	S	—	—
UNR311T	S	—	—
UNR3210	S	—	—
UNR3213	S	—	—
UNR3216	S	—	—
UNR321L	S	—	—
UNR321N	S	—	—
UNR4068	M	—	—
UNR4111A	S	—	—
UNR4112A	M	—	—
UNR4113A	M	—	—
UNR412X	S	—	—
UNR412Y	S	—	—
UNR4211A	S	—	—
UNR4212A	M	—	—
UNR4213A	M	—	—
UNR4214A	M	—	—
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UNR5111A	M	UNR5111	H16
UNR511P	S	—	—
UNR511S	S	—	—
UNR5201	D	—	—
UNR5211A	M	UNR5211	H16
UNR5227	S	—	—
UNR6110	S	—	—
UNR6111	S	—	—
UNR6112	S	—	—
UNR6113	S	—	—
UNR6114	S	—	—
UNR6115	S	—	—
UNR6116	S	—	—
UNR6117	S	—	—
UNR6118	S	—	—
UNR6119	S	—	—
UNR611D	S	—	—
UNR611E	S	—	—
UNR611F	S	—	—
UNR611H	S	—	—
UNR611L	S	—	—
UNR6121	S	—	—
UNR6122	S	—	—
UNR6123	S	—	—
UNR6124	S	—	—
UNR612X	S	—	—
UNR612Y	S	—	—
UNR6210	S	—	—
UNR6211	S	—	—
UNR6212	S	—	—
UNR6213	S	—	—
UNR6214	S	—	—
UNR6215	S	—	—
UNR6216	S	—	—
UNR6217	S	—	—
UNR6218	S	—	—
UNR6219	S	—	—
UNR621D	S	—	—
UNR621E	S	—	—
UNR621F	S	—	—
UNR621K	S	—	—
UNR621L	S	—	—
UNR6221	S	—	—
UNR6222	S	—	—
UNR6223	S	—	—
UNR6224	S	—	—
UNR7231	S	—	—
UNR8231	S	—	—
UNR8231A	S	—	—
UNR9110	D	UNR9110J	H16
UNR9111	D	UNR9111J	H16
UNR9112	D	UNR9112J	H16
UNR9113	D	UNR9113J	H16
UNR9114	D	UNR9114J	H16
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UNR9117	D	UNR9117J	H16
UNR9118	D	UNR9118J	H16
UNR9119	D	UNR9119J	H16
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UNR911B	S	—	—
UNR911D	D	UNR911DJ	H16
UNR911E	D	UNR911EJ	H16

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

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Discontinued, Maintenance and Planned Maintenance Types

Part No.		Alternative	Page	Part No.		Alternative	Page	Part No.		Alternative	Page
UNR911F	D	UNR911FJ	H16	UP01210	S	—	—	XN06776	S	—	—
UNR911H	D	UNR911HJ	H16	UP0121E	S	—	—	XN06777	S	—	—
UNR911L	D	UNR911LJ	H16	UP0411T	S	—	—	XN06877	S	—	—
UNR911V	D	UNR911VJ	H16	XN01101	D	—	—	XN07602	D	—	—
UNR9210	D	UNR9210J	H16	XN01117	S	—	—	XN07651	S	—	—
UNR9211	D	UNR9211J	H16	XN01118	S	—	—	XN08081	S	—	—
UNR9212	D	UNR9212J	H16	XN0111D	D	—	—	XN0D873	S	—	—
UNR9213	D	UNR9213J	H16	XN01201	D	—	—	XN0D874	S	—	—
UNR9214	D	UNR9214J	H16	XN01217	S	—	—	XN0E551	S	—	—
UNR9215	D	UNR9215J	H16	XN0121M	S	—	—	XN0U201	D	—	—
UNR9216	D	UNR9216J	H16	XN01507	S	—	—	XN0U210	D	XN01210	H18
UNR9217	D	UNR9217J	H16	XN01871	S	—	—	XN0U401	D	XN01401	H6
UNR9218	D	UNR9218J	H16	XN02210	S	—	—	XN0U604	D	XN04604	H7
UNR9219	D	UNR9219J	H16	XN02211	S	—	—	XN0U608	D	XN04608	H7
UNR921A	S	—	—	XN02212	S	—	—	XN8081	S	—	—
UNR921B	S	—	—	XN02215	S	—	—	XP01101	M	—	—
UNR921D	D	UNR921DJ	H16	XN02216	S	—	—	XP01112	S	—	—
UNR921E	D	UNR921EJ	H16	XN02531	S	—	—	XP01201	S	—	—
UNR921F	D	—	—	XN04110	S	—	—	XP04119	S	—	—
UNR921K	D	UNR921KJ	H16	XN0421N	S	—	—	XP04219	S	—	—
UNR921L	D	UNR921LJ	H16	XN04313	S	—	—	XP0438J	S	—	—
UNR921M	D	UNR921MJ	H16	XN0431L	S	—	—	XP04601T	S	—	—
UNR921N	D	—	—	XN04382	S	—	—	XP04683	S	—	—
UNR921T	D	UNR921TJ	H16	XN04390	S	—	—	XP05543	D	—	—
UNRB110	D	—	—	XN04391	S	—	—	XP05555	S	—	—
UNRB114	D	—	—	XN04407	S	—	—	XP0611FH	S	—	—
UNRB214	D	—	—	XN04503	S	—	—	XP06401T	S	—	—
UNRF2AD	S	—	—	XN04683	S	—	—	XP06501T	S	—	—
UNRF2AE	S	—	—	XN05604	S	—	—	XP06531	D	—	—
UNRL110	S	—	—	XN06111	S	—	—	XP06545	S	—	—
UNRL112	S	—	—	XN06112	S	—	—	XP08081	S	—	—
UNRL113	S	—	—	XN06114	S	—	—	XP08546	S	—	—
UNRL115	S	—	—	XN06115	S	—	—	XP0A554	S	—	—
UNRL210	S	—	—	XN06116	S	—	—	XP0D873	S	—	—
UNRL211	S	—	—	XN0611F	D	—	—	XP0D874	S	—	—
UNRL213	S	—	—	XN0611FH	S	—	—	XP0D875	S	—	—
UNRL214	S	—	—	XN06212	S	—	—	XP0E554	S	—	—
UNRL216	S	—	—	XN06506	S	—	—				
UP01110	S	—	—	XN06542	S	—	—				

Discontinued Types: D Maintenance Types: M Planned Maintenance Types: S

Note) 1. Alternative product is, almost alike in characteristics and function, not same in all respects. Please examine the content when you use.
2. HW and TA products for MT-2, and TW taping products for surface-mounting products are set as Discontinued types.
3. Lead lead-plated products and separated surface-mounting products (including magazine products) are set as Maintenance types.

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