

Panasonic
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2009 ver.2

Semiconductor Selection Guide

Microcomputers, Bipolar ICs, Discrete Semiconductors



Caution for Safety

 **DANGER**

■ This product contains Gallium Arsenide (GaAs).

GaAs powder and vapor are hazardous to human health if inhaled or ingested. Do not burn, destroy, cut, cleave off, or chemically dissolve the product. Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.

■ Do not touch or look into the laser beam directly.

The laser beam may cause injury to the eye or skin, or loss of eyesight.

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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 our sales division.

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, planned 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 Global part number. Numbers indicating ranks, packing specifications, etc. are not listed. Conventional part numbers (C Part No.) are part numbers used prior to the operation of the Global part number in 2000, and are listed only for those part numbers which are drastically different from the Global part number. 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.

Discontinued types, planned discontinued types, maintenance types, and planned maintenance types

We offer a variety of product information at the following URL:

http://panasonic.net/sc/en/common_info

Discontinued Types : These types have been discontinued and no further handling can be performed.

Planned Discontinued Types : These types are scheduled to be discontinued.

Customers who have used these types in the past are hereby notified that sales of these types have ended.

Maintenance Types : Because sales of these types are planned to be discontinued, new sales of such types are not possible. Further, existing customers with new applications should switch to replacement types.

Planned Maintenance Types : These types are scheduled to become maintenance types.

For new applications, please refrain from using these types.

Symbols used for recommended types

○ : Under planning

▲ : Under development

△ : Microcomputers, application-specific standard-product ICs: ES available types; Discrete components, opto electronic devices: Tentative standard

★ : Newly listed in this document

Homepage Introduction

We offer a variety of product information on Panasonic semiconductor products.

<http://panasonic.net/sc/en>

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

Microcomputers

- Microcomputer Family AM Series
- Microcomputer AM Series Selection Guide

Image Pickup Devices

- CCD Image Sensor

Application-Specific Standard-Product ICs

- Panasonic Integrated Platform for Digital Appliances Uniphier
- 3D Sound Reproduction Technology Solutions
- IPD for Switching Power Supply Solution Guide

Gallium Arsenide Devices

- GaAs Device for W-LAN Solution Guide

General Purpose Discrete

- Diode Series
- MOS FET Series
- Discrete Semiconductors Selection Guide

Opto Electronic Devices

- Laser / Hologram Unit for Optical Disk
- Surface Mount Chip LEDs

Solution Catalog

- IP Camera Solution (Network Camera Solution)
- Digital Television Solution
- Mobile Phone Solution

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

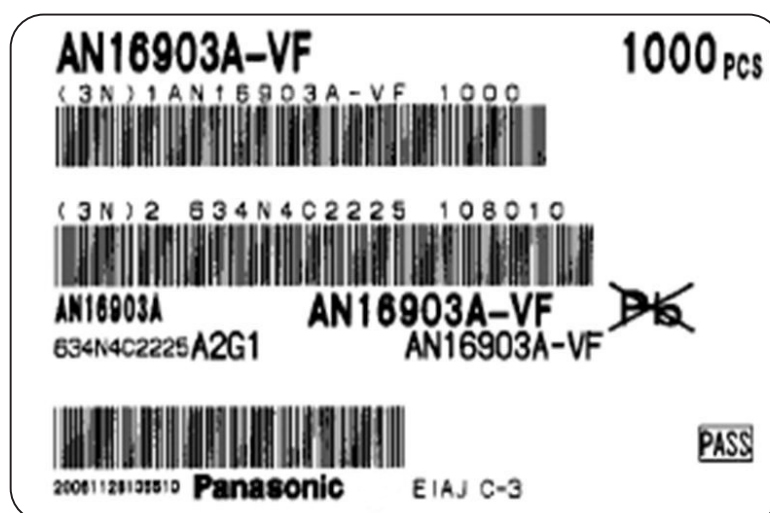
URL: <https://www.semicon.panasonic.co.jp/semi-spt/general/?lang=en&>

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

Precautions on label indication of lead-free products (RoHS compliance)

To conform to RoHS Directive restrictions, the products supplied by our company will be marked in the following two ways on C3 labels on each package unit.

1. On the lead-free label, the “Pb” letter are crossed out with × marking.
(For compliance with RoHS Directive 2002/95/EC)
2. Date of manufacture will be indicated by the first 8 digits of the 14-digit number at the bottommost left.
(For compliance with China RoHS)



Example of Label Indication

Please pay attention to the relevant marking and manage products properly to avoid mixing lead-containing products with 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 or questions about this matter, please contact one of our sales representatives.

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| | | Top View | M19 | LN289CUQ | | | M10 | LNA4801L | 3φ Plastic | | M15 |
| | | Side View | M19 | LN28RPX | | | M8 | LNA4905L | 5φ Plastic Long Lead | | M15 |
| | | Top View | M19 | LN29RPX | | | M8 | LNG092CZFF | | | M10 |
| | | Side View | M19 | LN316GPH | | | M8 | LNG0A8CYBZ | | | M10 |
| | | Top View | M19 | LN317GPH | | | M8 | LNG201RFC | | | M10 |
| | ON1021 | | M18 | LN31GCPH | | | M8 | LNG21LRKR | | | M8 |
| | ON1023 | | M18 | LN31GPH | | | M8 | LNG251RKR | | | M8 |
| | ON1120 | | M18 | LN31GPSLX | | | M8 | LNG273RKR | | | M8 |
| | ON2153 | | M18 | LN31GPX | | | M8 | LNG298CKC | | | M10 |
| | ON2179 | | M18 | LN31YCPH | | | M8 | LNG321GFG | | | M8 |
| ☼ | ON2253 | | M18 | LN320GPH | | | M8 | LNG351GKG | | | M8 |
| | ON3132 | | M19 | LN321GPX | | | M8 | LNG352GFG | | | M8 |
| | ON3133 | | M19 | LN322GPH | | | M8 | LNG373GKG | | | M8 |
| ☼ | ON3731 | | M19 | LN322GPX | | | M8 | LNG389CNJ | | | M8 |
| | | | M10 | LN324GPH | | | M8 | LNG401CF4 | | | M10 |
| | | | M10 | LN340GPX | | | M8 | LNG401YKX | | | M8 |
| | | | M10 | LN342GPH | | | M8 | LNG416YFX | | | M8 |
| | | | M10 | LN342GPX | | | M8 | LNG421YFX | | | M8 |
| | | | M11 | LN350GPH | | | M8 | LNG422YKY | | | M8 |
| ★ | | | M9 | LN352GPX | | | M8 | LNG424YFX | | | M8 |
| | | | M9 | LN360GPX | | | M8 | LNG440NKY | | | M8 |
| ★ | | | M9 | LN376GCPX | | | M8 | LNG442YKX | | | M8 |
| | | | M9 | LN376GCPXUY | | | M8 | LNG460YKX | | | M8 |
| | LN1251CALTR | LN1251CAL-(TR) | M2 | LN376GPX | | | M8 | LNG473YKX | | | M8 |
| | LN1251CTR | LN1251C-(TR) | M2 | LN382GPX | | | M8 | LNG476NKX | | | M8 |
| | LN1261CALTR | LN1261CAL-(TR) | M2 | LN38GPX | | | M8 | LNG476YKXB | | | M8 |

★: Newly listed in this document ☼: Darlington

Part Number List

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| LNG492CF4 | | | M10 | LNJ252W82RA | | | M2 | LNJ461C34RA | | | M3 |
| LNG497CK4 | | | M10 | LNJ253W82RA | | | M2 | LNJ611W8WRA | | | M3 |
| LNG498CK4 | | | M10 | LNJ301MPUJA | | | M10 | LNJ611W8WRU | | | M3 |
| LNG61LCF6 | | | M11 | LNJ302GPUJA | | | M10 | LNJ612W8CRA1 | | | M3 |
| LNG692CF6 | | | M11 | LNJ306G5TR02 | LN1371G(H)-6U(TR) | | M2 | LNJ612W8WRA | | | M3 |
| LNG801CF8 | | | M11 | LNJ306G5URA | | | M2 | LNJ616C8WRA | | | M3 |
| LNG801RKD | | | M8 | LNJ308G83RA | | | M2 | LNJ622C4CRA1 | | | M3 |
| LNG809RKD | | | M8 | LNJ308G8PRA | | | M3 | LNJ624C4CRA1 | | | M3 |
| LNG809SKSB | | | M8 | LNJ308G8TRA | | | M2 | LNJ626W8CRA | | | M3 |
| LNG816RFD | | | M8 | LNJ310C63RA | | | M2 | LNJ717W80RA | | | M5 |
| LNG897CK8 | | | M11 | LNJ310C6PRA | | | M3 | LNJ717W80RA1 | | | M5 |
| LNG901CFB | | | M11 | LNJ310M6URA | | | M2 | LNJ717W83RAS | | | M5 |
| LNG91LCFB | | | M11 | LNJ311G83RA | | | M2 | LNJ723W80RAV | | | M5 |
| LNG992CFB | | | M11 | LNJ311G8PRA | | | M3 | LNJ727W83RAA | | | M5 |
| LNJ012X8ARA1 | | | M2 | LNJ311G8TRA | | | M2 | LNJ727W83RAS | | | M5 |
| LNJ022X4ARA1 | | | M2 | LNJ311G8TRU | | | M2 | LNJ801LPDJA | | | M11 |
| LNJ024X4ARA1 | | | M2 | LNJ312G8TRA | | | M2 | LNJ801TPSJA | | | M11 |
| LNJ026X8ARA | | | M2 | LNJ312W83RA1 | | | M2 | LNJ802RPDJA | | | M11 |
| LNJ026X8BRA4 | | | M2 | LNJ314G83RA | | | M2 | LNJ802SPSJA | | | M11 |
| LNJ036X8ARA | | | M2 | LNJ314G8TRA | | | M2 | LNJ806K5SRX | | | M3 |
| ★ LNJ037X8ARA | | | M2 | LNJ316C83RA | | | M2 | LNJ806R58RX | | | M3 |
| ★ ▲ LNJ047X8ARA | | | M2 | LNJ316C83RU | | | M2 | LNJ808K87RA | | | M3 |
| LNJ052X8ARA | | | M2 | LNJ316C8PRA | | | M3 | LNJ808K8SRA | | | M3 |
| LNJ053X8BRA | | | M2 | LNJ316C8TRA | | | M2 | LNJ808R83RA | | | M3 |
| LNJ060V6BRA | | | M5 | LNJ316C8TRU | | | M2 | LNJ808R8ERA | | | M3 |
| LNJ080V6BRA | | | M5 | LNJ318C83RA | | | M2 | LNJ810C63RA | | | M3 |
| LNJ0F1C5FRA1 | | | M5 | LNJ318C83RU | | | M2 | LNJ810C67RA | | | M3 |
| LNJ0F1C5FRA2 | | | M5 | LNJ318C8PRA | | | M3 | LNJ810L6DRA | | | M3 |
| LNJ0F1C5FRA4 | | | M5 | LNJ318C8TRA | | | M2 | LNJ810L6SRA | | | M3 |
| LNJ0S2F8BRA | | | M5 | LNJ326W83RA1 | | | M2 | LNJ811K87RA | | | M3 |
| LNJ0G0V6BRA | | | M5 | LNJ336W83RA | | | M2 | LNJ811K8SRA | | | M3 |
| LNJ0Y0F9KRA4 | | | M5 | ★ LNJ337W83RA | | | M2 | LNJ811R88RA | | | M3 |
| ★ ▲ LNJ0Y0F9KRA5 | | | M5 | ★ ▲ LNJ347W83RA | | | M2 | LNJ811R8DRA | | | M3 |
| ★ ▲ LNJ0Y0F9KRA6 | | | M5 | LNJ352W83RA | | | M2 | LNJ811R8DRU | | | M3 |
| LNJ107W5ARA1 | | | M4 | LNJ353W83RA | | | M2 | LNJ812K8SRA | | | M3 |
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| LNJ115W88RA | | | M4 | LNJ3W0C83RA | | | M2 | LNJ812W83RA1 | | | M3 |
| LNJ115W89RA | | | M4 | LNJ3W0C85RA | | | M3 | LNJ812W86RA1 | | | M3 |
| LNJ115W8ARA | | | M4 | LNJ401NPYJA | | | M10 | LNJ814K87RA | | | M3 |
| LNJ115W8PRA | | | M4 | LNJ406K54RX | | | M3 | LNJ814K8SRA | | | M3 |
| LNJ115W8RRA1 | | | M4 | LNJ406K5YRX | | | M3 | LNJ814R8DRA | | | M3 |
| LNJ115W8VRA | | | M4 | LNJ408K84RA | | | M3 | LNJ814W83RA | | | M3 |
| LNJ121W84RA | | | M4 | LNJ408K8YRA | | | M3 | LNJ816C83RA | | | M3 |
| LNJ123W8RRA | | | M4 | LNJ410C64RA | | | M3 | LNJ816C87RA | | | M3 |
| LNJ201LPQJA | | | M10 | LNJ410Q6YRA | | | M3 | ★ LNJ816C88RA | | | M3 |
| LNJ206R5ARA | | | M2 | LNJ411K84RA | | | M3 | LNJ816C8DRA | | | M3 |
| LNJ208R82RA | | | M2 | LNJ411K84RU | | | M3 | LNJ816C8DRU | | | M3 |
| LNJ208R8ARA | | | M2 | LNJ411K8YRA | | | M3 | LNJ816C8SRA | | | M3 |
| LNJ210C62RA | | | M2 | LNJ411K8YRU | | | M3 | LNJ818C83RA | | | M3 |
| LNJ210C6ARA | | | M2 | LNJ412K8YRA | | | M3 | LNJ818C87RA | | | M3 |
| LNJ211R82RA | | | M2 | LNJ412W83RA1 | | | M3 | ★ LNJ818C88RA | | | M3 |
| LNJ211R8ARA | | | M2 | LNJ414K84RA | | | M3 | LNJ818C8DRA | | | M3 |
| LNJ211R8ARU | | | M2 | LNJ414K8YRA | | | M3 | LNJ818C8SRA | | | M3 |
| LNJ212R8ARA | | | M2 | LNJ416C84RA | | | M3 | LNJ818C8SRU | | | M3 |
| LNJ212W82RA1 | | | M2 | LNJ416Q8YRA | | | M3 | LNJ822C43RA1 | | | M3 |
| LNJ214R82RA | | | M2 | LNJ416Q8YRU | | | M3 | LNJ824C43RA1 | | | M3 |
| LNJ214R8ARA | | | M2 | LNJ418C84RA | | | M3 | LNJ826W83RA | | | M3 |
| LNJ216C82RA | | | M2 | LNJ418Q8YRA | | | M3 | LNJ826W86RA | | | M3 |
| LNJ216C8ARA | | | M2 | LNJ418Q8YRU | | | M3 | LNJ836W83RA | | | M3 |
| LNJ216C8ARU | | | M2 | LNJ422C46RA1 | | | M3 | LNJ836W86RA | | | M3 |
| LNJ218C82RA | | | M2 | LNJ424C46RA1 | | | M3 | ★ LNJ837W83RA | | | M3 |
| LNJ218C8ARA | | | M2 | LNJ426W83RA1 | | | M3 | ★ LNJ837W86RA | | | M3 |
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★: Newly listed in this document ▲: Under development

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| | | | LNJ8W0C83RA | M3 | | | PNA4812M | M16 | ★ | HUL7212 | |
| LNJ911W8BRA | | | M3 | PNA4813M | | | M16 | ★ | HUL7215 | | M20 |
| LNJ911W8BRU | | | M3 | PNA4K01F | | | M16 | | HULT273 | | |
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| LNJ924C4CRA1 | | | M3 | PNA4S42M | | | M16 | | LNCT12PF | | M20 |
| LNJ926W8CRA | | | M3 | PNA4S47M | | | M16 | | LNCT16PF | | M20 |
| LNJ936W8CRA | | | M3 | PNA4S54F | | | M17 | ★ | LNCT21PU | | M20 |
| LNJ937W8CRA | | | M3 | PNA4U12F | | | M17 | | | | |
| ★ LNJ947W8CRA | | | M3 | PNA4U15F | | | M17 | | | | |
| ★ ▲ LNJ952W8CRA1 | | | M3 | PNA4U17F | | | M17 | | | | |
| LNJ953W8CRA | | | M3 | PNA4U23F | | | M17 | | | | |
| ★ LNJC36X8ARA1 | | | M3 | PNA4U31F | | | M17 | | | | |
| ★ LNJC37X8ARA | | | M3 | PNZ108 | PN108 | TO-18 | M17 | | | | |
| ★ ▲ LNJC47X8ARA | | | M3 | PNZ108CL | PN108CL | TO-18 | M17 | | | | |
| LNP073024 | | | M14 | PNZ109L | PN109L | TO-18 | M17 | | | | |
| LNP075244F | | | M14 | PNZ115 | PN115 | Side View | M17 | | | | |
| LNP092014S | | | M14 | PNZ120S | PN120S | 3φ Ceramic | M17 | | | | |
| LNP093014S | | | M14 | PNZ121S | PN121S | 3φ Ceramic | M17 | | | | |
| LNP120021 | | | M14 | PNZ123S | PN123S | 3φ Ceramic | M17 | | | | |
| LNP123031 | | | M14 | PNZ147 | PN147 | Double End | M17 | | | | |
| LNP123071 | | | M14 | PNZ150 | PN150 | Side View | M17 | | | | |
| LNP125024 | | | M14 | PNZ154 | PN154 | Side View | M17 | | | | |
| LNP128081 | | | M14 | PNZ154NC | PN154NC | Side View | M17 | | | | |
| LNP129041 | | | M14 | PNZ155 | PN155 | Side View | M17 | | | | |
| LNP143024 | | | M14 | PNZ158 | PN158 | Side View | M17 | | | | |
| LNP172024 | | | M14 | PNZ202S | PN202S | 3φ Ceramic | M17 | | | | |
| LNP173014 | | | M14 | PNZ263L | PN263L | Side View | M17 | | | | |
| LNP173024 | | | M14 | PNZ313 | PN313 | Side View | M16 | | | | |
| LNP175024 | | | M14 | PNZ313B | PN313B | Side View | M16 | | | | |
| LNP178011 | | | M14 | PNZ323 | PN323 | TO-92 | M16 | | | | |
| LNP178021 | | | M14 | PNZ323B | PN323B | TO-92 | M16 | | | | |
| LNP192014 | | | M14 | PNZ327 | PN327 | TO-92 | M16 | | | | |
| LNP193024 | | | M14 | PNZ330CL | PN330CL | TO-18 | M16 | | | | |
| LNP720311 | | | M14 | PNZ330CLNC | | TO-18 | M16 | | | | |
| LNP720311W | | | M14 | PNZ334 | PN334 | 5φ Plastic | M16 | | | | |
| LNP720321 | | | M14 | PNZ335 | PN335 | Side View | M16 | | | | |
| LNP721311 | | | M14 | | | | | | | | |
| LNP729311 | | | M14 | | | | | | | | |
| LNP773224F | | | M14 | | | | | | | | |
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| LNW6B8GYFZ | | | M11 | | | | | | | | |
| LNW997CKB | | | M11 | | | | | | | | |
| LNW998CKBW | | | M11 | | | | | | | | |
| LNW9A8BYBZ | | | M11 | | | | | | | | |
| PNA1101L | | | | | M17 | | | | | | |
| PNA1401L | PN101 | 3φ Ceramic | M17 | | | | | | | | |
| PNA1401LF | | TO-18 | M17 | | | | | | | | |
| PNA1601M | PN166 | Side View | M17 | | | | | | | | |
| PNA1606L | | Side View | M17 | | | | | | | | |
| PNA1801L | PN168 | 3φ Plastic | M17 | | | | | | | | |
| PNA1803L | | 3φ Plastic | M17 | | | | | | | | |
| ⚙ PNA2W01M | PN207 | Double End | M17 | | | | | | | | |
| PNA3602L | | Side View | M16 | | | | | | | | |
| PNA3W01L | PN307 | Double End | M16 | | | | | | | | |
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| PNA4602M | | | M16 | | | | | | | | |
| PNA4612M | | | M16 | | | | | | | | |
| PNA4618M | | | M16 | | | | | | | | |
| PNA4701M | | | M16 | | | | | | | | |
| PNA4702M | | | M16 | | | | | | | | |
| PNA4801M | | | M16 | | | | | | | | |
| PNA4802M | | | M16 | | | | | | | | |
| PNA4803M | | | M16 | | | | | | | | |

★: Newly listed in this document ▲: Under development ☆: Darlington

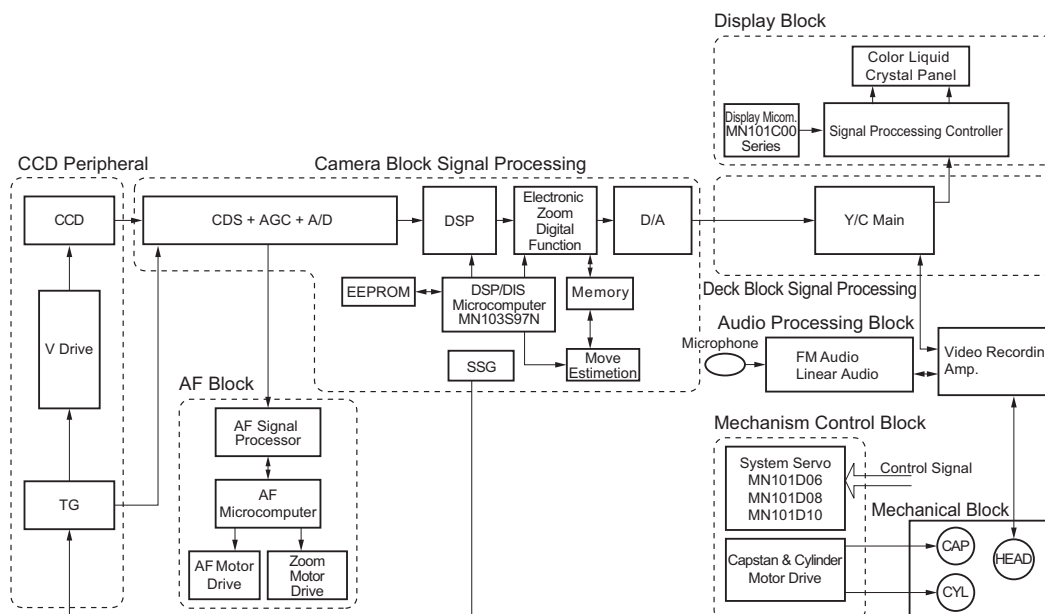
Application Block Diagrams

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Application Block Diagrams

Video Applications

(1) Video Camera System



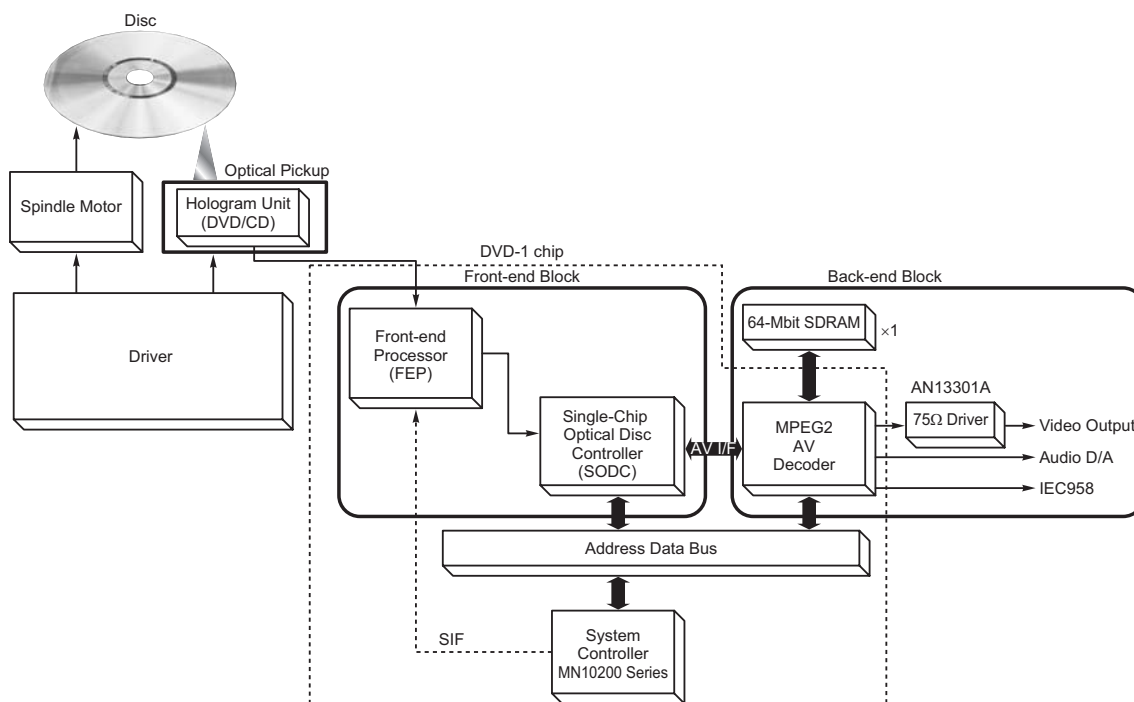
Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

Transistor: 2SB1462G, 2SD2216G, UNR9000G Series, XP Series

Diode: MA2SD • MA27D • MA22D • MA24D • MA2YD • MAZD • MAZW • MAZM Series, MAYS, MALS068XG

Protector Elements: UNHZ Series

(2) DVD Player



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

Transistor: 2SB1218G, 2SD1819G, UNR5000G Series

Diode: MA2J1110G, MA2J7280G, MAZ8000G Series, MA24D Series

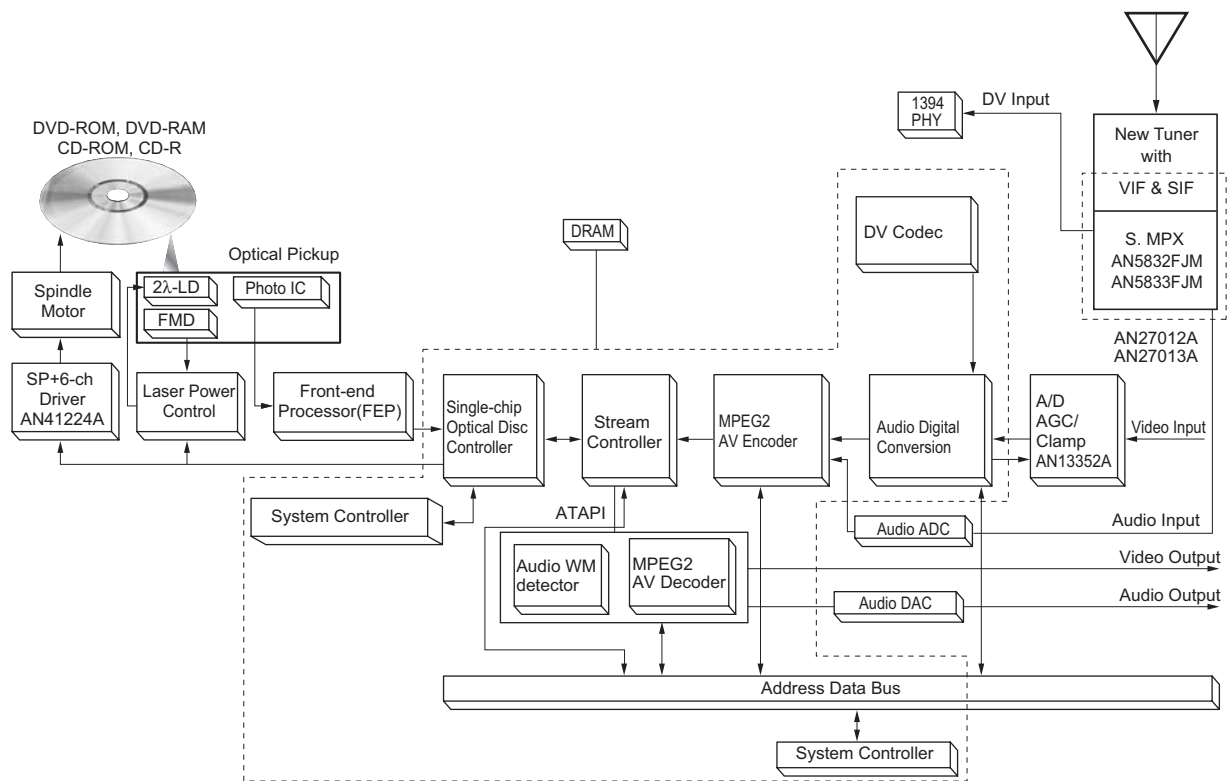
Protector Elements: UNHZ Series

Application Block Diagrams

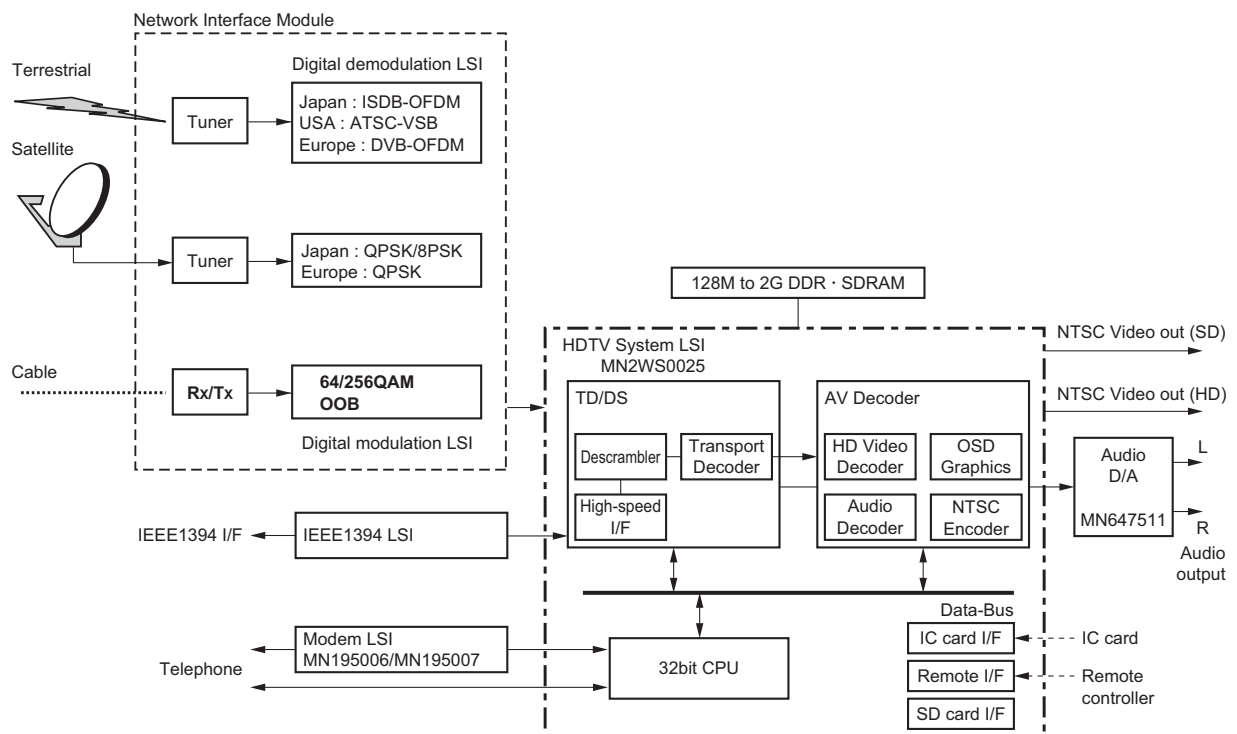
Video Applications

B

(3) DVD Recoder



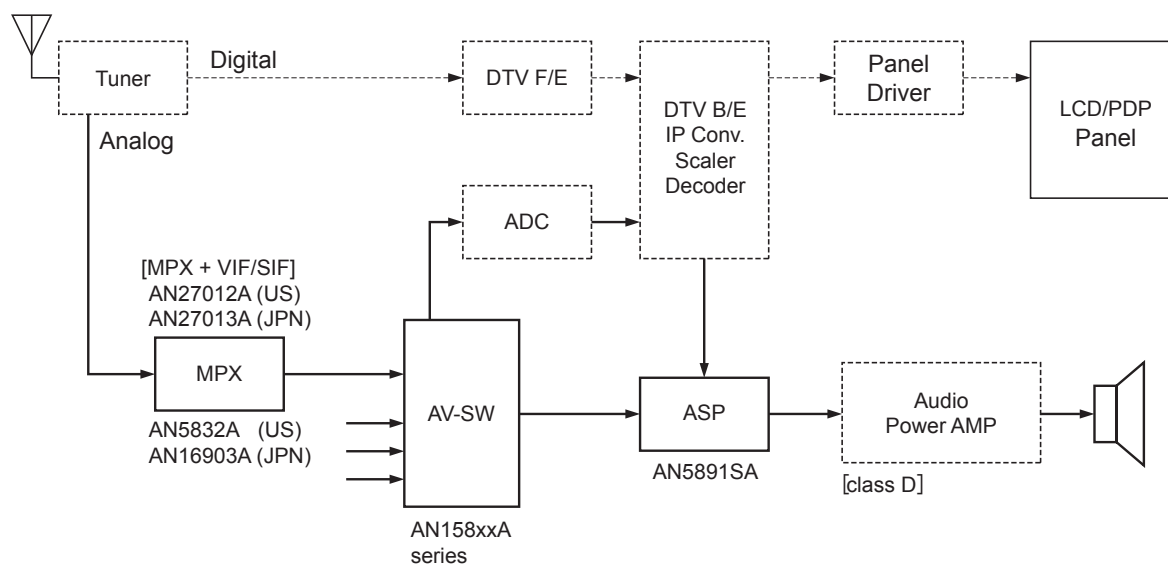
(4) Digital TV Solution



Application Block Diagrams

Video Applications

(5) PDP/LCD-TV



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

Transistor: 2SB1218G, 2SD1819G, UNR5000G Series, XP Series

Diode: MA2J1110G, MA2J7290G, MA2YD15, MA2ZD02, MAZ8000G Series, MA22DxxxG Series, MA2SD Series, MA24D Series

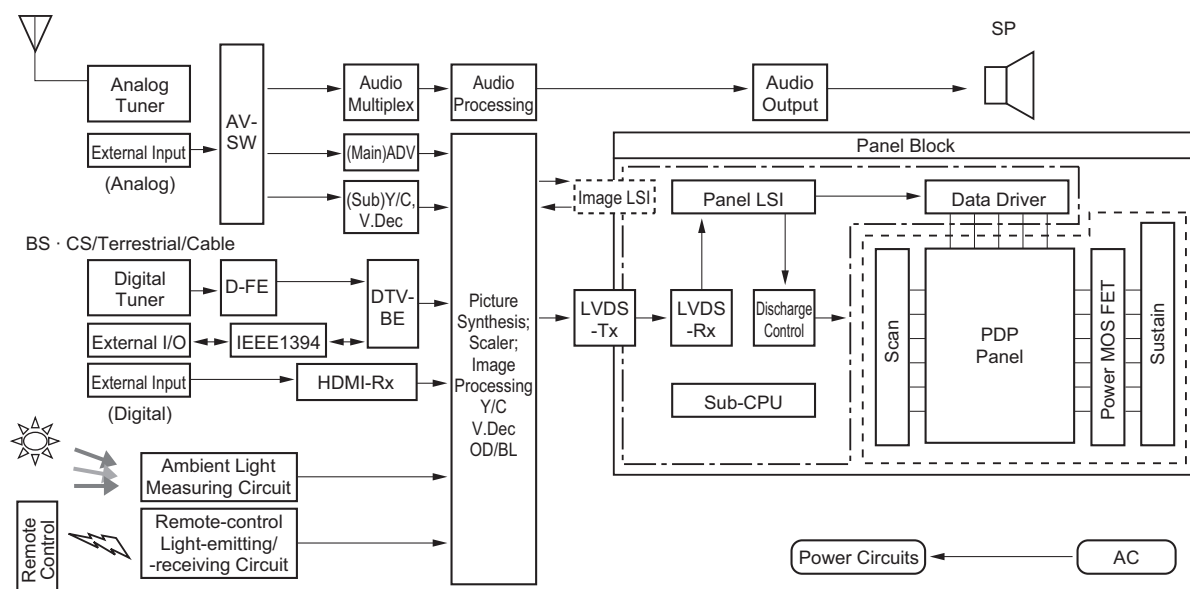
Protector Elements: UNHZ Series

Application Block Diagrams

Video Applications

B

(6) PDP-TV

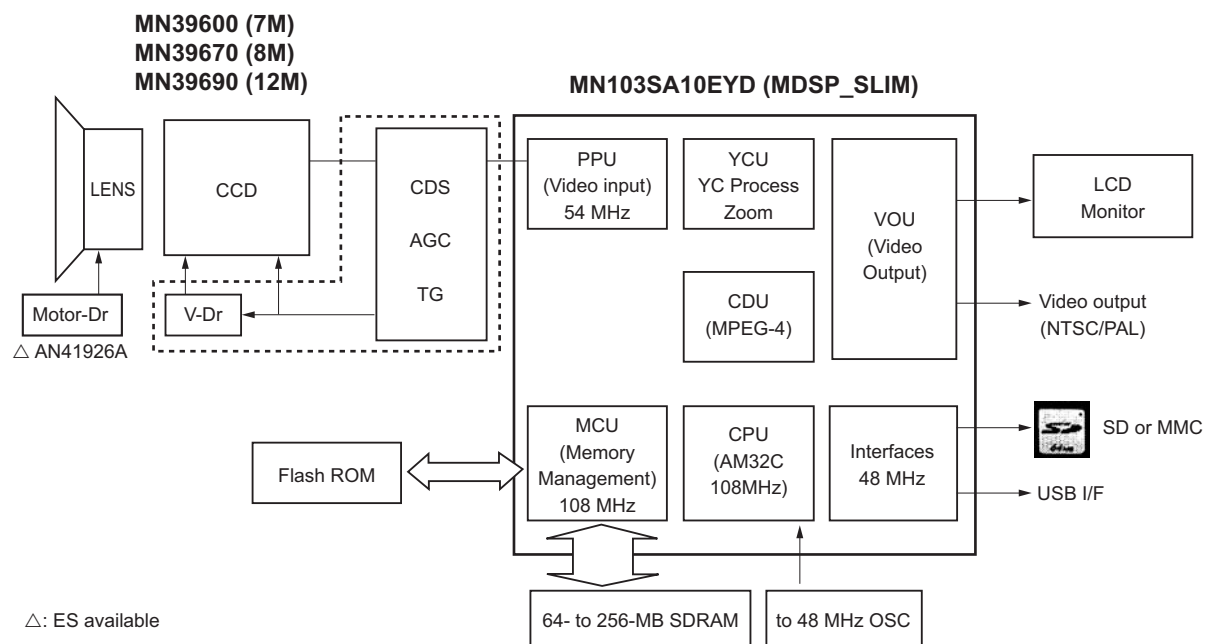


| Category | Function/ Component Classification | Discrete Item Examples |
|--|--|---|
| Sustain | Power MOS FETs | 2SK3995, 2SK4174, 2SK4208 |
| | IGBT | 2PG006, 2PG009, 2PG011 |
| Ambient Light Measuring Circuit | Luminance Sensor | PNA4603H |
| Remote-control Light-emitting/-receiving Circuit | Transmitting Infrared Light Emitting LED | LNA2903L |
| | Light-receiving Photo IC | PNA46**M |
| General Circuits | Small Signal Transistors | 2SA1309A, 2SC3311A, UNR4000 Series, etc. |
| | Small Signal Diodes | MA2J1110G, MA2J7**0G, MA3X15* Series, etc. |
| | Surge Protection | MAZ3000 Series, MAZ8000G Series, MAZYS0750Z, etc. |
| Power Circuits | Power MOS FETs | 2SK3043 to 2SK3048 |
| | Fast Recovery Diodes | MA3D649, MA3D650 |
| | Zener Diodes | MAZ3000 Series, MAZ8000G Series, |
| | Schottky Barrier Diodes | MA22D**, MA3X*** Series, MA24D** Series |
| | Output Error Feedback | CNC1S171 (Photo Couplers) |
| | IPD | MIP2FX Series, etc. |

Application Block Diagrams

Video Applications

(7) Digital Still Camera System



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

Transistor: 2SB1462G, 2SD2216G, 2SA2078G, 2SC5846G

Diode: MA21D · MA22D · MA27D · MA2SD · MA4ZD · MA24D Series, MAZD · MAZW · MAZM Series, MAYS, MALS068XG, MA2YF800G

Photo Couplers: CNC1S101, CNC1S171, CNA1312K

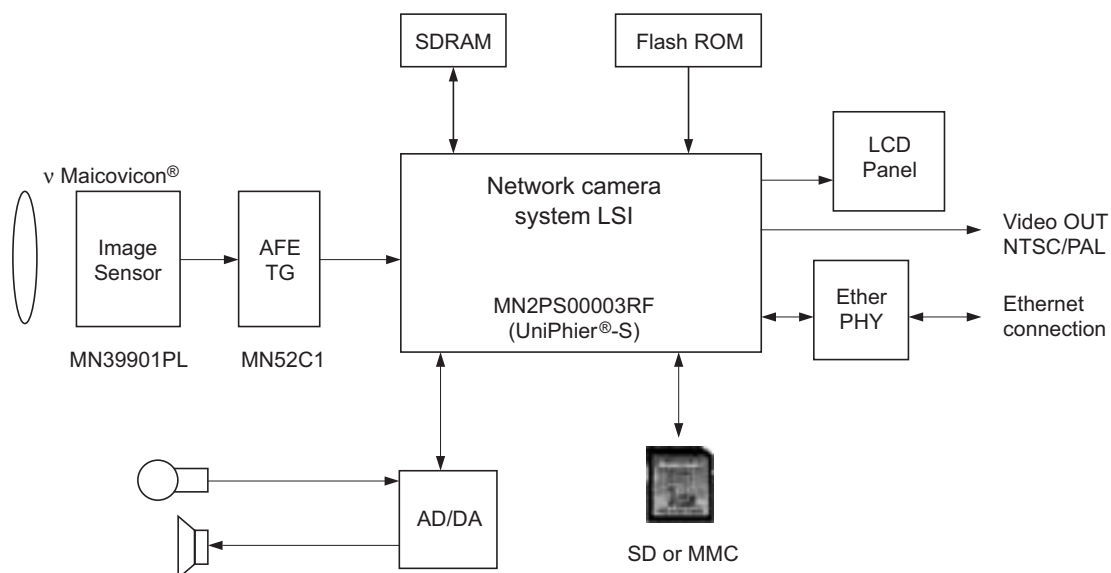
| | CCD | Vdriver | Timing Gen. | CDS/AGC ADC | DSP | DC-DC | Audio |
|-----|---------|---------|-------------|-------------|---|----------------------------------|--|
| 7M | MN39600 | — | — | — | MN103SA10EYD | AN30216A | AN12909A |
| 8M | MN39670 | | | | | | |
| 12M | MN39690 | | | | Pixel Free built-in 32-bit CPU JPEG/MPEG4 | Sync.rectif Min.1.51 V supply | QFN28 pin Microphone Amp. ALC, LPF |

Application Block Diagrams

Video Applications

B

(8) Network Camera

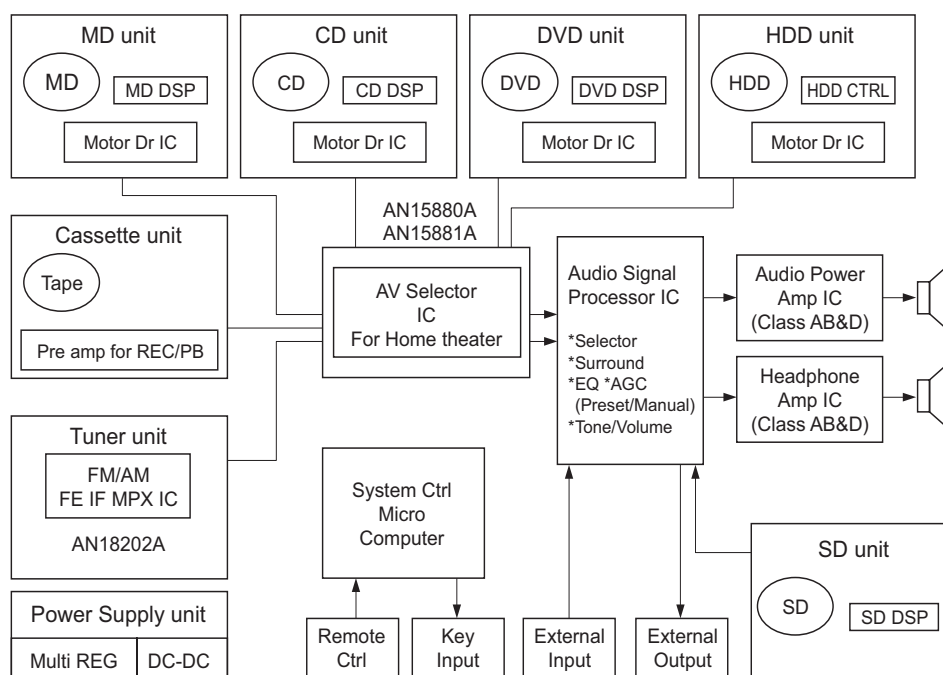


v Maicovicon® is a registered trademark of Panasonic Corp.
UniPhier® is a registered trademark of Panasonic Corp.

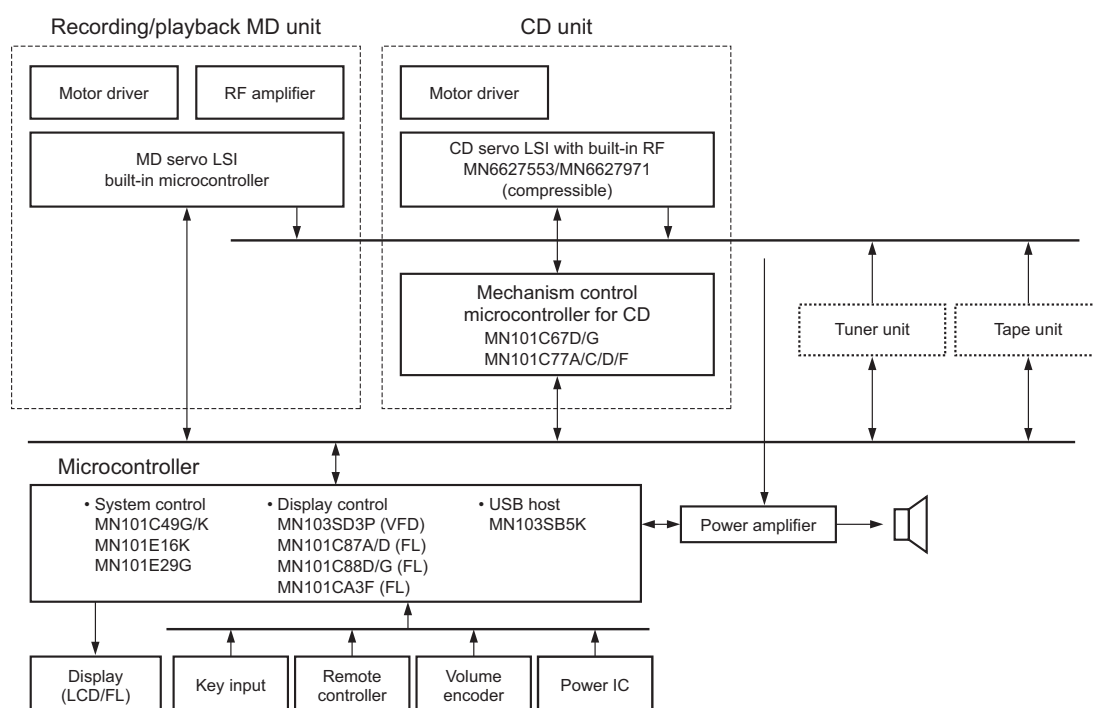
Application Block Diagrams

Audio Applications

(1) Minicomponent Stereo Set-(1)



(2) Minicomponent Stereo Set-(2)

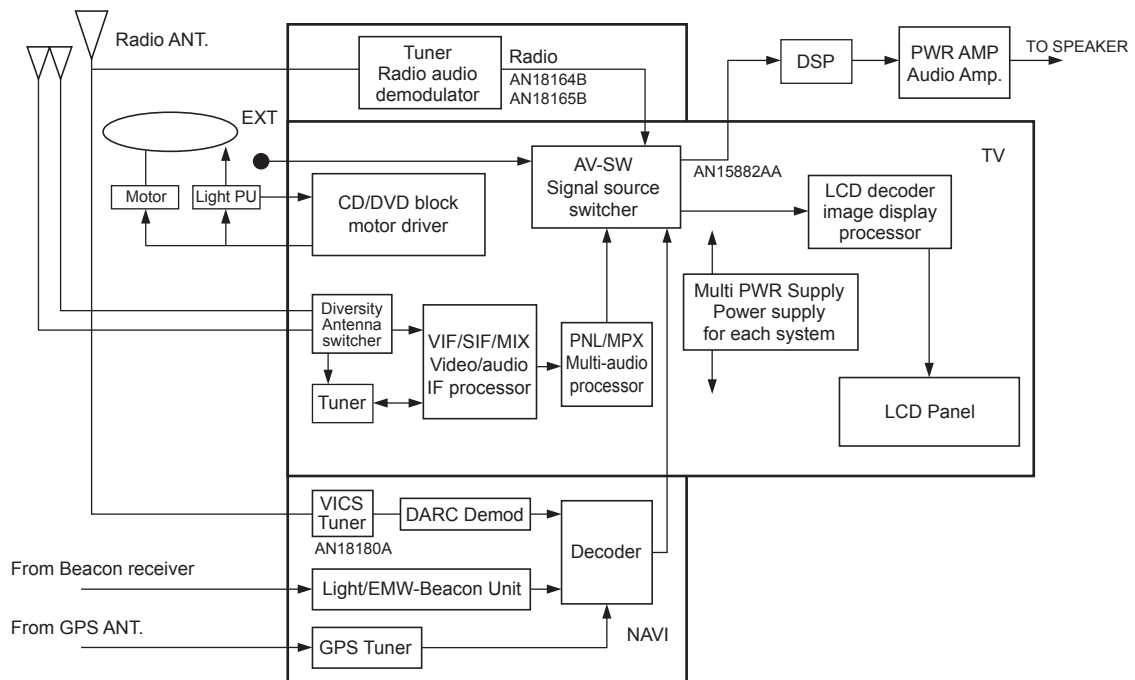


Application Block Diagrams

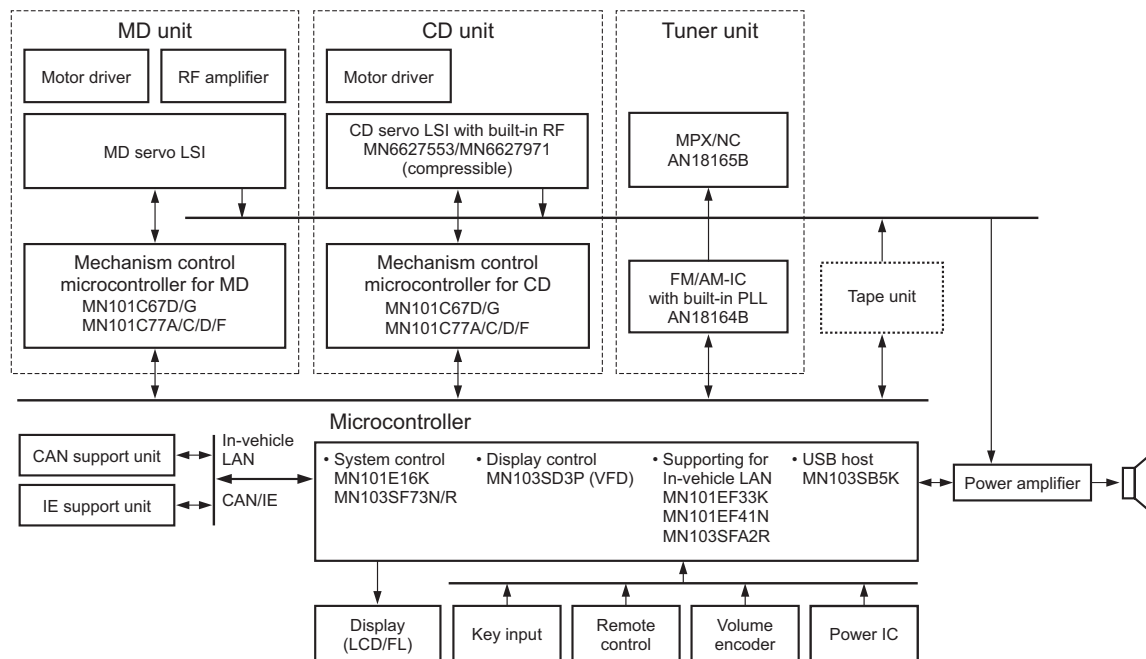
Audio Applications

B

(3) Car Audio System-(1)



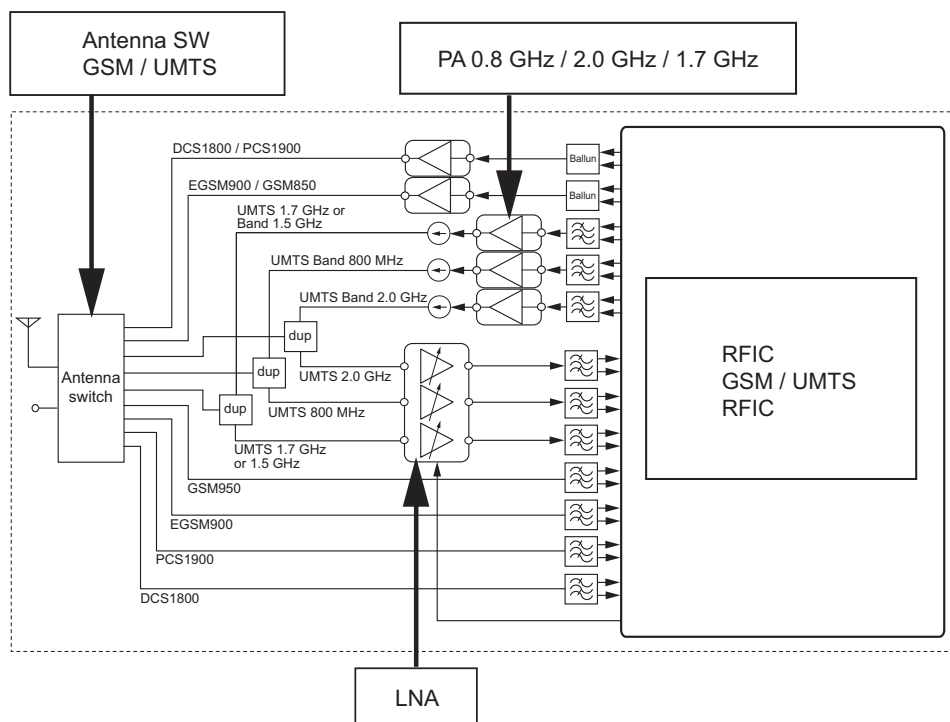
(4) Car Audio System-(2)



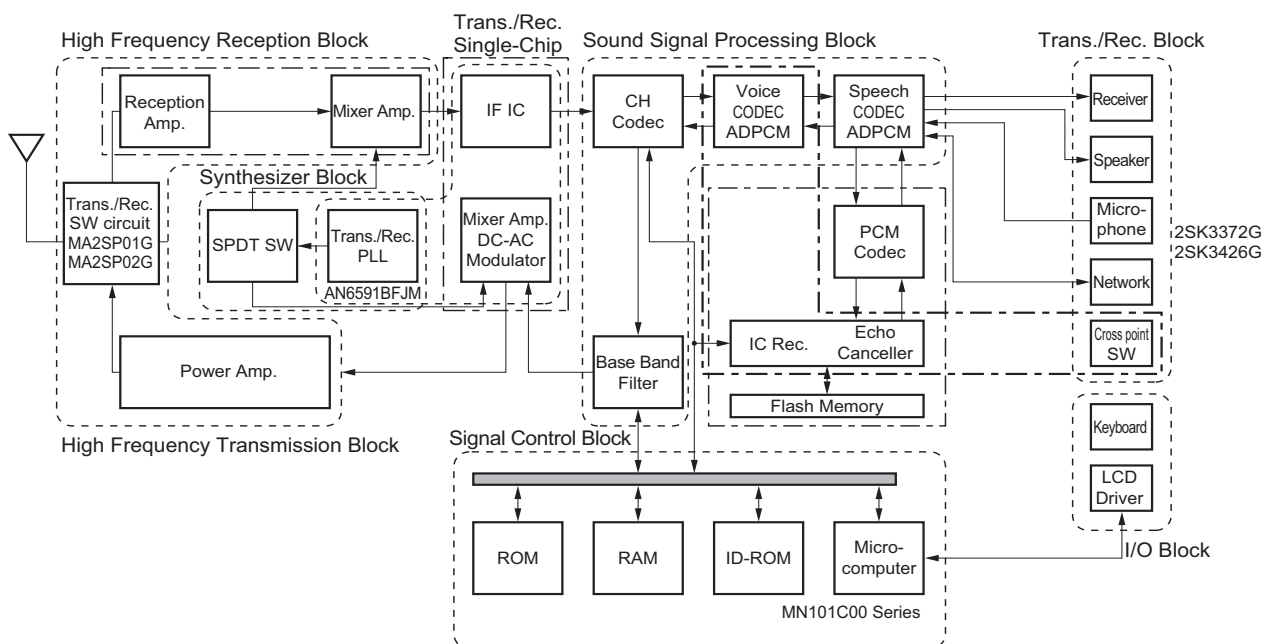
Application Block Diagrams

Communication Applications

(1) WCDMA Cellular Phone (0.8 GHz/1.7 GHz/2.0 GHz for Japanese domestic FOMA use)



(2) Digital Cordless Telephone with Answering Machine (Base unit)



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

Transistor: 2SB1462G, 2SD2216G, UNR9000G Series, XP Series

Diode: MA22DxxxG Series

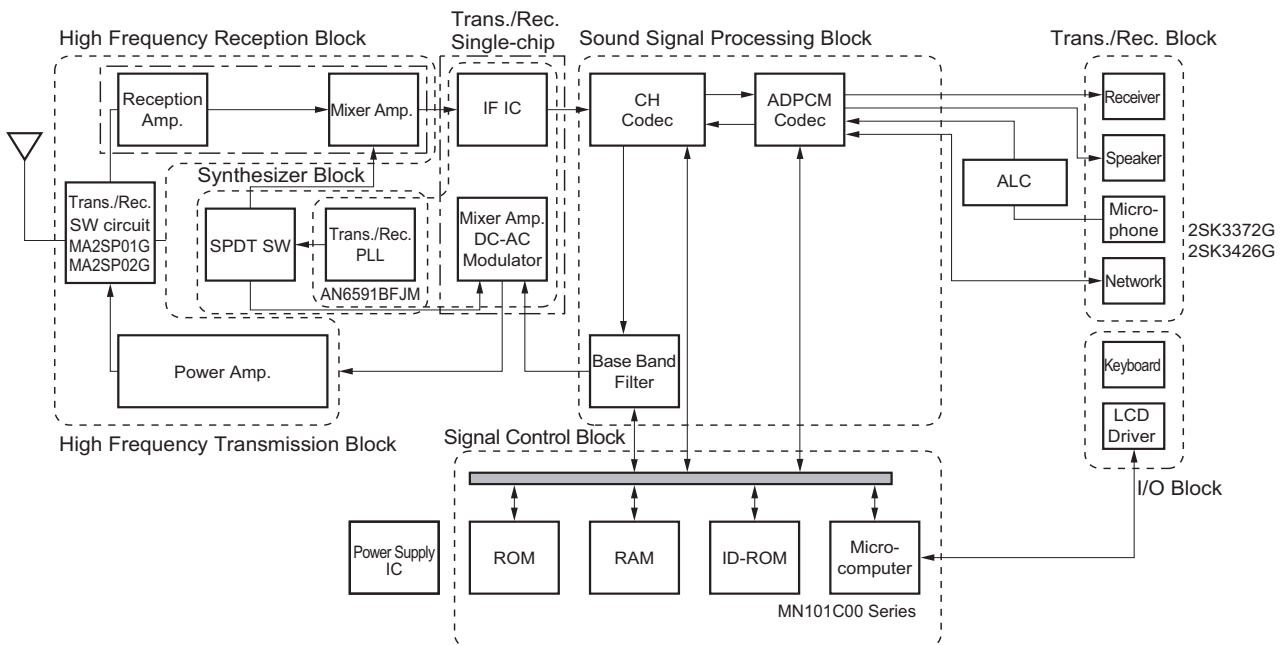
MA2S1110G, MA2SD190G, MAZSxxxG Series, MA21DxxxG Series

Application Block Diagrams

Communication Applications

B

(3) Digital Cordless Telephone (Handset)

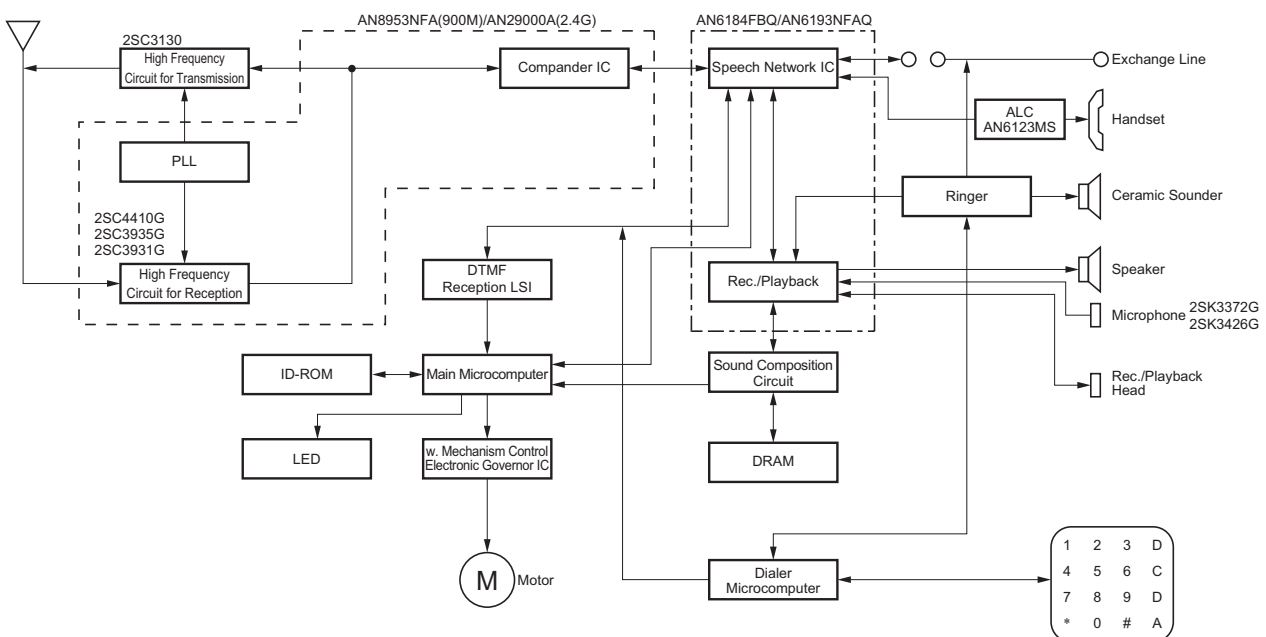


Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

Transistor: 2SB1462G, 2SD2216G, UNR9000G Series

Diode: MA22DxxxG Series, MA2J1110G, MAZSxxxG Series, MA21DxxxG Series

(4) Cordless Telephone with Answering Machine (Base unit)



Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

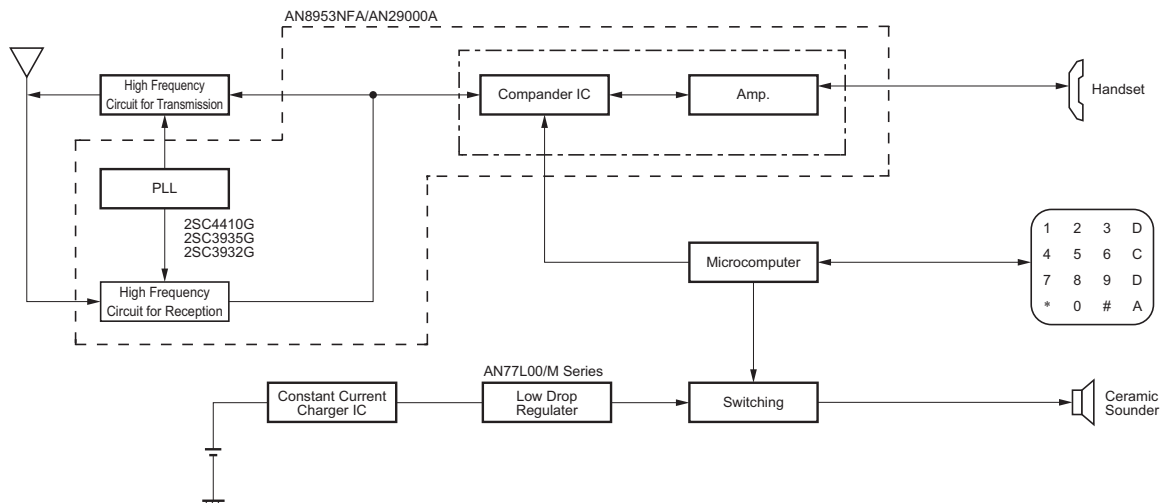
Transistor: 2SB1462G, 2SD2216G, UNR9000G Series, XP Series,

Diode: MA2S1110G, MA2SD190G, MAZSxxxG Series, MA21DxxxG, MA22DxxxG Series

Application Block Diagrams

Communication Applications

(5) Cordless Telephone with Answering Machine (Handset)

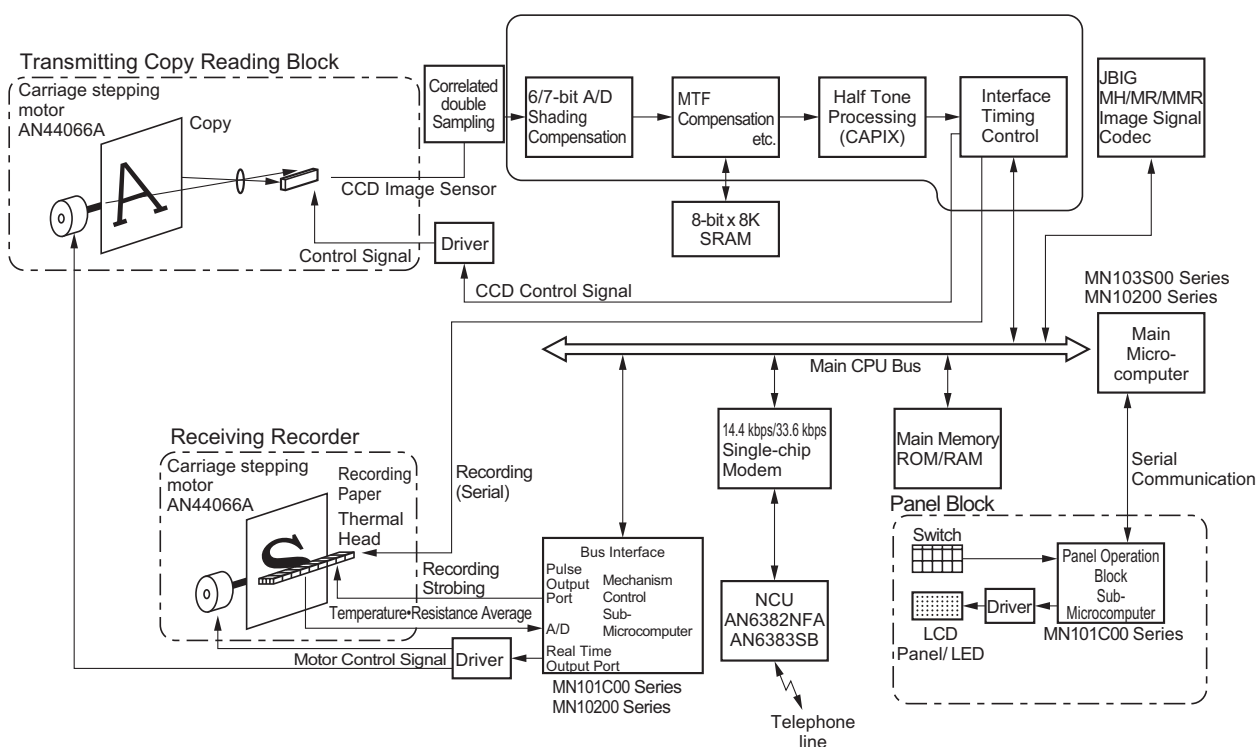


Note) The transistors and diodes listed below can be used for the peripheral circuits in this block diagram.

Transistor: 2SB1462G, 2SD2216G, XP Series

Diode: MA2S1110G, MA2S7280G, MAZSxxxG Series, MA21DxxxG Series, MA22DxxxG Series

(6) Fax

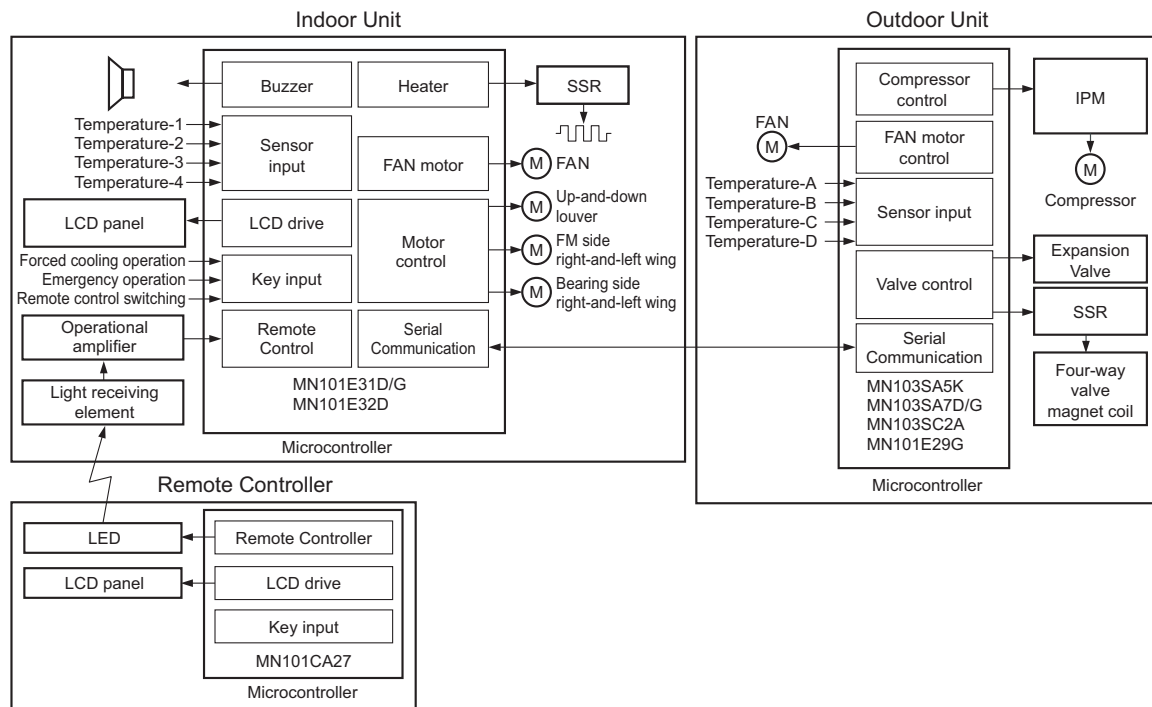


Application Block Diagrams

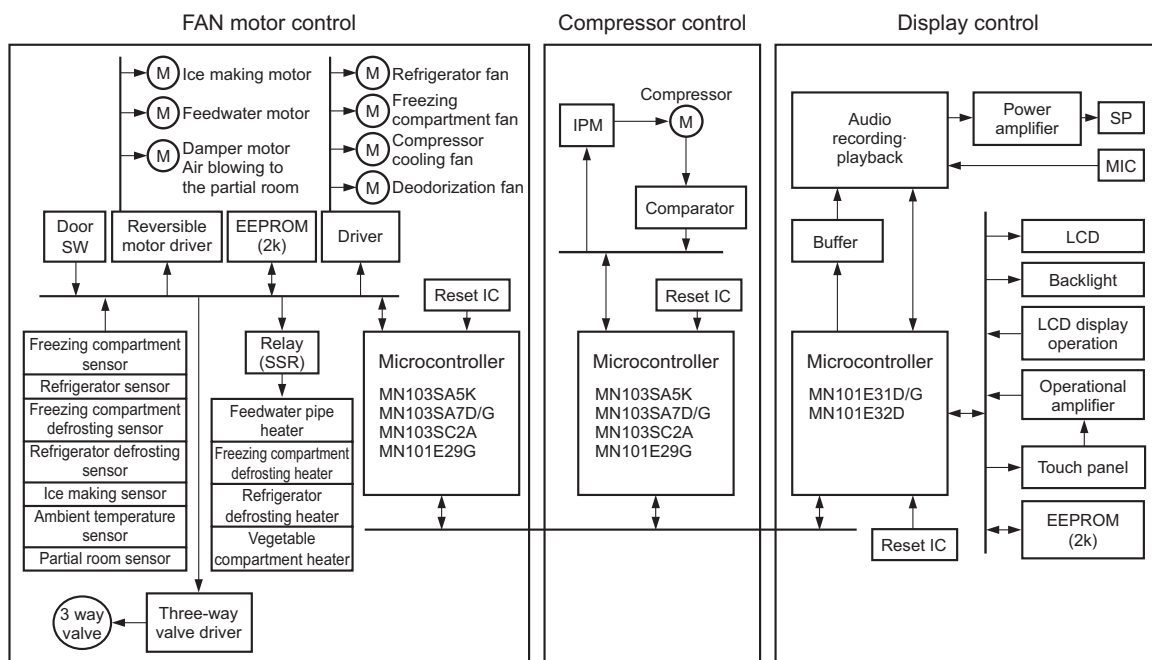
Industrial and Home Applications

B

(1) Air Conditioner



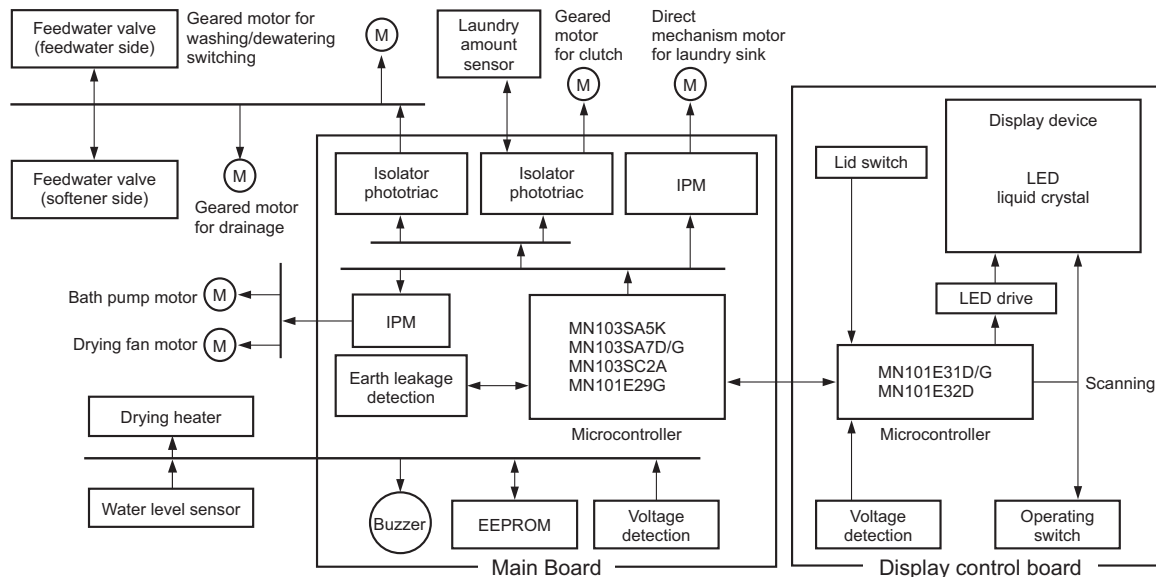
(2) Refrigerator



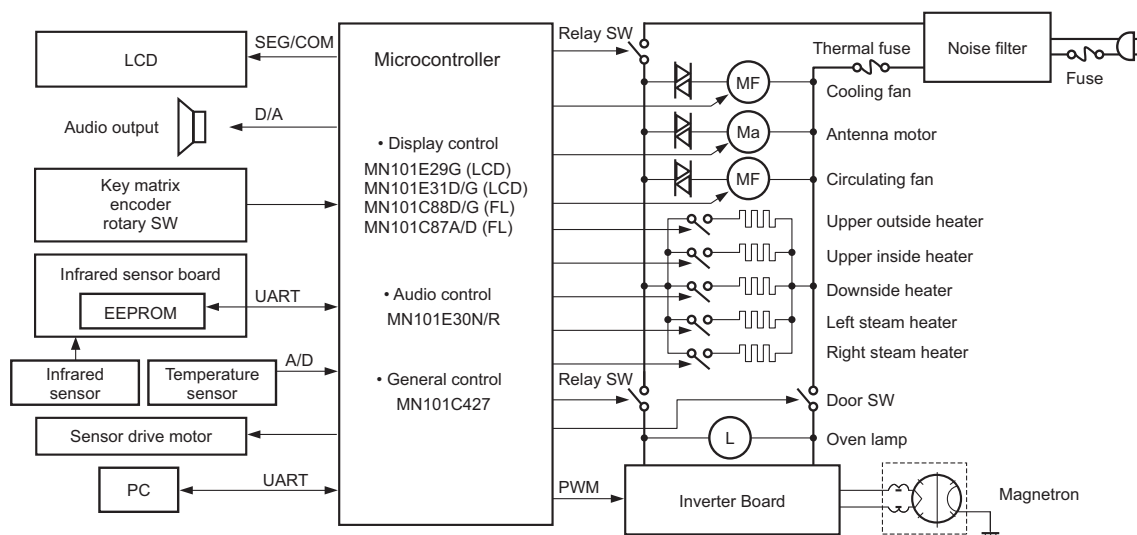
Application Block Diagrams

Industrial and Home Applications

(3) Washer/Dryer



(4) Microwave Oven



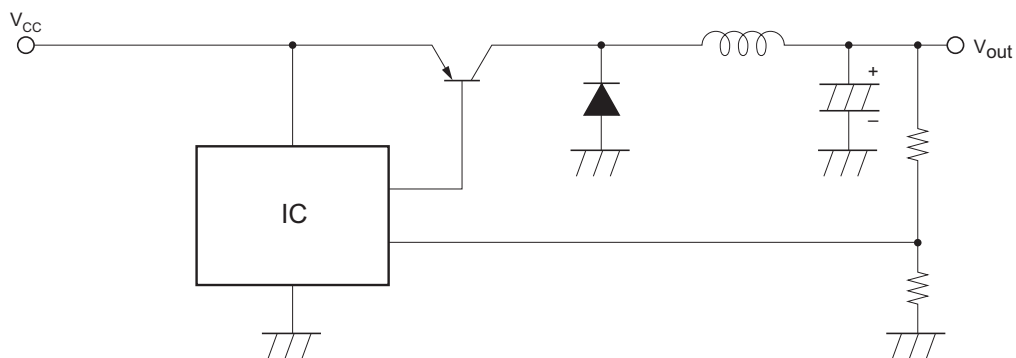
Application Block Diagrams

Industrial and Home Applications

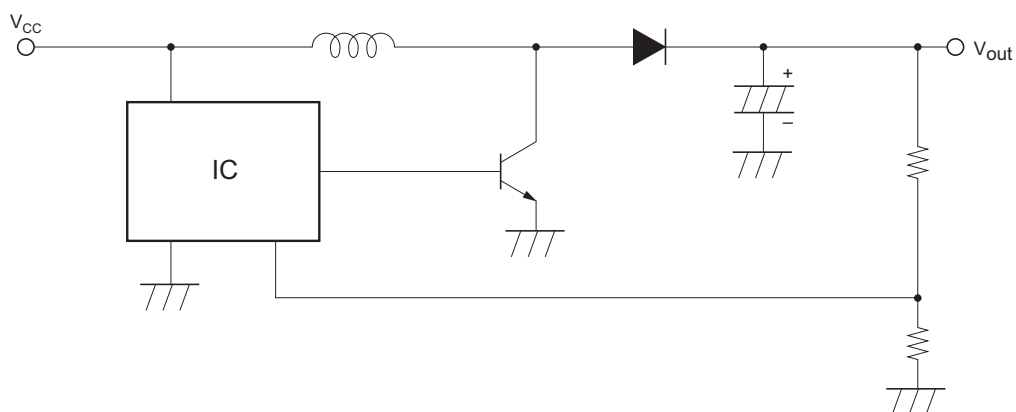
B

(5) For Switching Power Supply DC-DC Converter

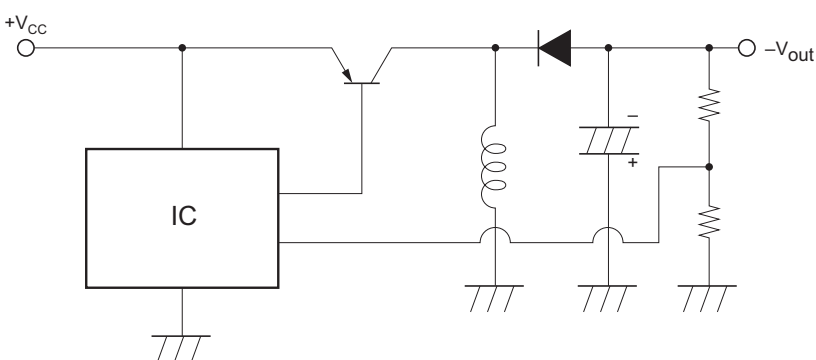
Step down



Step Up



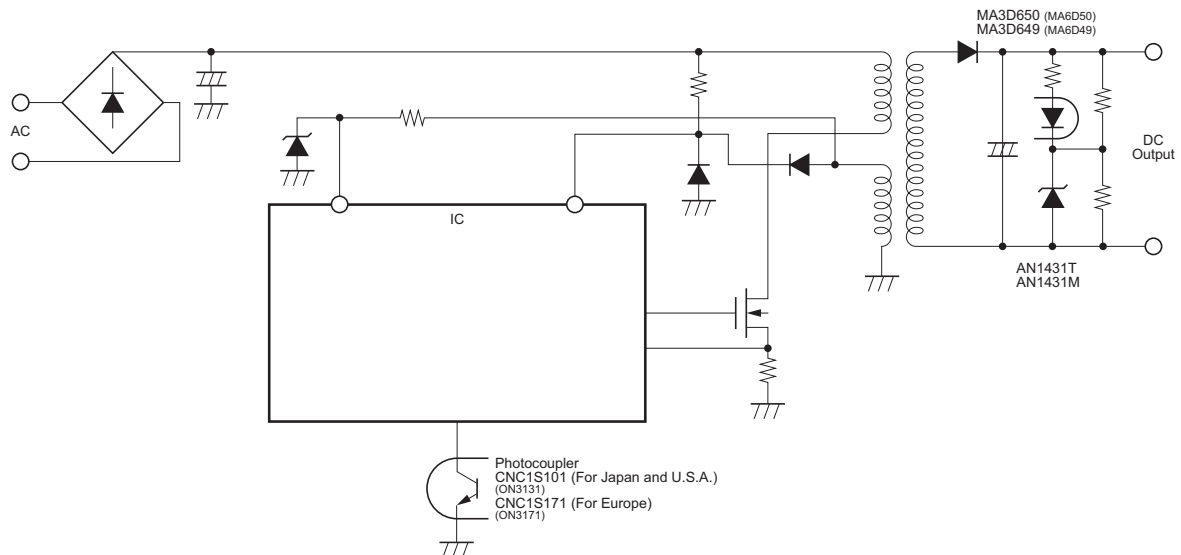
Inversion



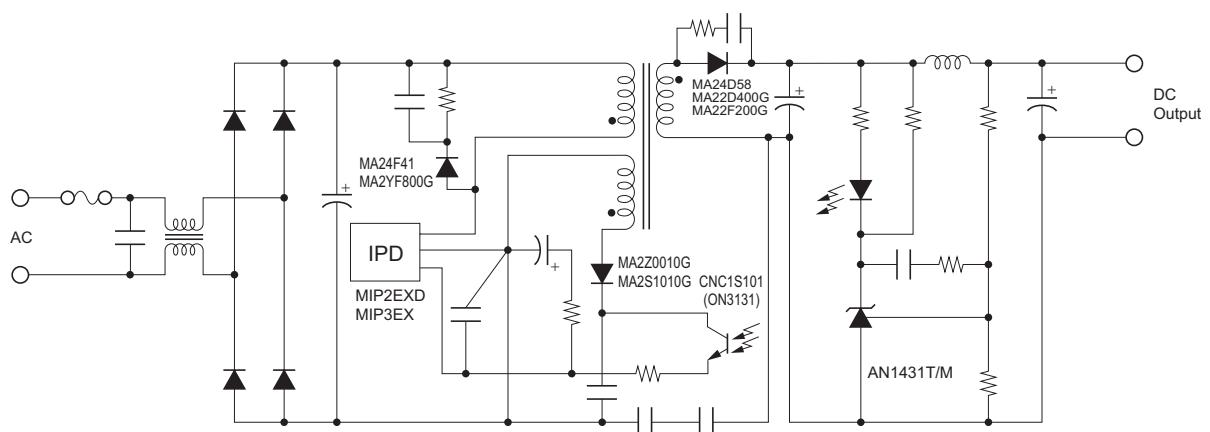
Application Block Diagrams

Industrial and Home Applications

(6) Switching Power Supply (Oscillation of RCC)



(7) Switching Power Supply (Flyback system)



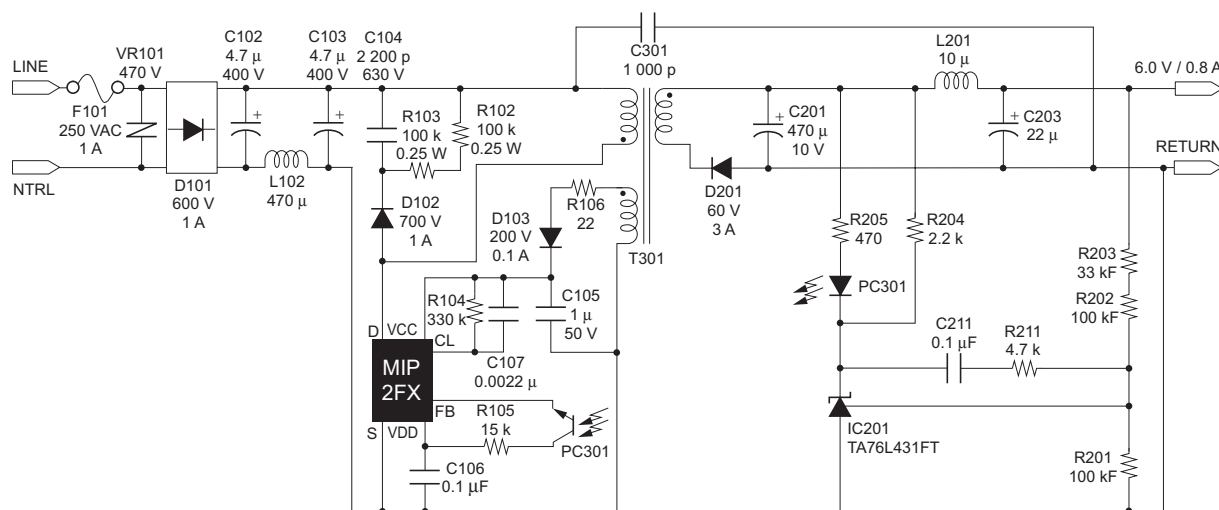
Note) The part numbers in parentheses show the conventional ones.

Application Block Diagrams

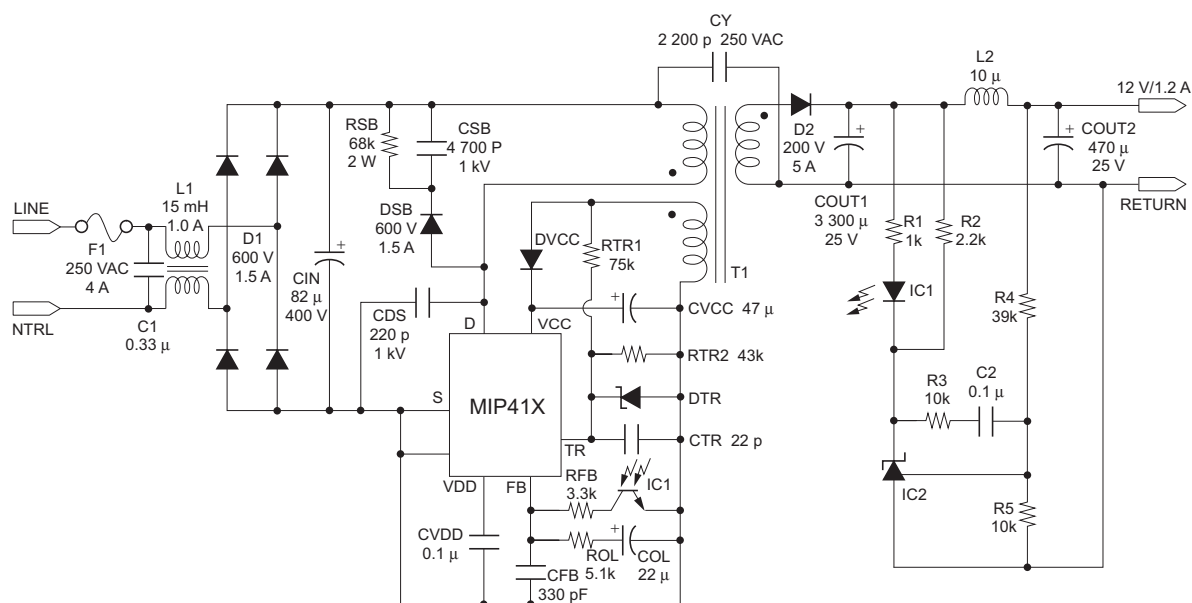
Industrial and Home Applications

B

(8) Switching Power Supply (For chargers)



(9) Switching Power Supply (Artificial Resonance Power Source)



Microcomputers

| | |
|--|----|
| Microcontrollers | C2 |
| 8-bit Single-chip Microcontrollers AM1 (MN101) Series | C2 |
| 16-bit Single-chip Microcontrollers AM2 (MN102) Series | C6 |
| 32-bit Single-chip Microcontrollers AM3 (MN103) Series | C7 |

Microcontrollers

8-bit Single-chip Microcontrollers AM1 (MN101) Series

| Category | Type | Built-in ROM Type | ROM (Bytes) | RAM (Bytes) | Minimum Instruction Execution Time/ Operating Voltage (μs/V) | Package | Number of I/O ports (Pins) [At single chip model] | Interrupt Sources | 8-bit Timer (Pins) | 16-bit Timer (Pins) | 19-bit Timer (Pins) | Serial Interfaces | | | | A/D Converter (ch) | D/A Converter (ch) | Display Control Function | |
|-------------------|------------|-------------------|-------------|--|---|--|---|-------------------|--------------------|---------------------|---------------------|-------------------|------|------------------|--------------------------------|--------------------|--------------------|--------------------------|---|
| | | | | | | | | | | | | I ² C | UART | Synchronous Type | Synchronous Type/PC Selectable | | | | |
| ADC Built-in Type | MN101C28A | M | 32K | 1.5K | 0.1/4.5 to 5.5 125/2.0 to 5.5 | LQFP080-P-1414A QFP084-P-1818E TQFP080-P-1212D | 70 | 18 | 5 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 8 | — | — |
| | MN101C28C | | 48K | 2K | | LQFP080-P-1414A | | | | | | | | | | | | | |
| | MN101C28D | | 64K | 4K | | | | | | | | | | | | | | | |
| | MN101C28F | | 96K | 10K | | | | | | | | | | | | | | | |
| | MN101CP28D | E | 64K | 2K | 0.1/4.5 to 5.5 125/2.3 to 5.5 | LQFP080-P-1414A QFP084-P-1818E TQFP080-P-1212D | 70 | 18 | 5 | 1 | 0 | 1 | 1 | 0 | 0 | 8 | — | — | |
| | MN101CP28L | | 96K | 10K | | LQFP080-P-1414A | | | | | | | | | | | | | |
| | MN101C309 | M | 24K | 1K | 0.1/4.5 to 5.5 125/2.0 to 5.5 | LQFP064-P-1414 | 54 | 17 | 5 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 8 | — | — |
| | MN101C30A | | 32K | 1.5K | | | | | | | | | | | | | | | |
| | MN101C425 | M | 8K | 0.25K | 0.1/4.5 to 5.5 0.477/2.0 to 5.5 | SDIP042-P-0600C | 36 | 11 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | — | — |
| | | | | | 0.477/2.0 to 5.5 | QFP044-P-1010F | 37 | | | | | | | | | | | | |
| | | | | | 0.1/4.5 to 5.5 125/2.0 to 5.5 | TQFP048-P-0707B | 39 | 12 | | | | | | | | | | | |
| | MN101C427 | | 16K | 0.5K | 0.1/4.5 to 5.5 0.477/2.0 to 5.5 | SDIP042-P-0600C | 36 | 11 | | | | | | | | | | | |
| | | | | | 0.477/2.0 to 5.5 | QFP044-P-1010F | 37 | | | | | | | | | | | | |
| | | | | | 0.1/4.5 to 5.5 125/2.0 to 5.5 | TQFP048-P-0707B | 39 | 12 | | | | | | | | | | | |
| | MN101CP427 | E | | | 0.1/4.5 to 5.5 0.238/2.7 to 5.5 | SDIP042-P-0600C | 36 | 11 | | | | | | | | | | | |
| | | | | | 0.1/4.5 to 5.5 0.238/2.7 to 5.5 | QFP044-P-1010F | 37 | | | | | | | | | | | | |
| | | | | | TQFP048-P-0707B | 39 | 12 | | | | | | | | | | | | |
| | MN101C457 | M | 16K | 0.5K | 0.1/4.5 to 5.5 | QFP044-P-1010F | 37 | 11 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 8 | — | — | |
| | MN101CP427 | E | | | 0.1/4.5 to 5.5 0.238/2.7 to 5.5 | | | | | | | | | | | | | | |
| | MN101C539 | M | 24K | 0.5K | 0.1/4.5 to 5.5 62.5/2.0 to 5.5 | TQFP048-P-0707B | 40 | 14 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | — | — |
| | MN101CP539 | E | | | 0.1/4.5 to 5.5 62.5/2.7 to 5.5 | | | | | | | | | | | | | | |
| | MN101C61D | M | 64K | 3K | 0.1/2.5 to 3.6 0.2/2.1 to 3.6 125/1.8 to 3.6 | TQFP080-P-1212D | 68 | 25 | 7 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 6 | — | — |
| | MN101C61G | | 128K | 12K | 0.1/2.5 to 3.0 0.2/2.2 to 3.0 125/2.2 to 3.0 | | | | | | | | | | | | | | |
| | MN101CF60G | F | | | 128K | | | | | | | | | | | | | | |
| | MN101CF61G | | | | | | | | | | | | | | | | | | |
| | MN101C62D | M | 64K | 2K | 0.1/4.5 to 5.5 0.25/2.7 to 5.5 62.5/2.0 to 5.5 | LQFP080-P-1414A | 68 | 25 | 6 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 8 | — | — |
| | MN101C62F | | 96K | 4K | 0.1/4.5 to 5.5 0.25/2.7 to 5.5 62.5/2.5 to 5.5 | | | | | | | | | | | | | | |
| | MN101CF62G | F | 128K | 10K | 0.1/4.5 to 5.5 0.25/2.7 to 5.5 62.5/2.5 to 5.5 | | | | | | | | | | | | | | |
| | MN101C67D | M | 64K | 6K | 0.1/2.5 to 3.6 0.2/2.1 to 3.6 62.5/1.8 to 3.6 | TQFP080-P-1212D | 69 | 26 | 6 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 7 | — | — |
| | MN101C67G | | 128K | 10K | 0.1/2.7 to 3.6 | | | | | | | | | | | | | | |
| | MN101CF67G | F | 64K | 4K | 0.1/2.7 to 3.6 62.5/2.7 to 3.6 | | | | | | | | | | | | | | |
| | MN101CF91D | | | | | | | | | | | | | | | | | | |
| MN101C94A | M | 32K | 1K | 0.1/4.5 to 5.5 0.238/2.7 to 5.5 0.477/2.0 to 5.5 | QFP044-P-1010F | 37 | 13 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | — | — | |
| MN101CF94D | F | 64K | 2K | 0.1/4.5 to 5.5 0.238/2.7 to 5.5 0.477/2.5 to 5.5 | | | | | | | | | | | | | | | |
| MN101CF95G | | | 128K | 6K | 0.1/2.7 to 3.6 62.5/2.7 to 3.6 | TQFP080-P-1212D | 67 | 30 | 7 | 2 | 0 | 3 | 2 | 0 | 0 | 0 | 11 | — | — |
| MN101C97A | M | 32K | 1K | 0.5/1.8 to 3.6 62.5/1.8 to 3.6 | QFP044-P-1010F TQFP048-P-0707B | 38 | 20 | 5 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 8 | — | — | |
| MN101C97D | | 64K | | | | | | | | | | | | | | | | | |
| MN101CF97D | F | | | | | | | | | | | | | | | | | | |
| MN101CA7A | M | 32K | 2K | 0.1/2.7 to 3.6 62.5/1.8 to 3.6 | TQFP048-P-0707B | 35 | 22 | 5 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 8 | — | — | |
| MN101CFA7D | F | 64K | | | TQFP048-P-0707B | | | | | | | | | | | | | | |

[Internal ROM type] M:Mask ROM, E:EPROM, F:FLASH, —:External

[Package] ○:under planning, ▲:under development, △:ES(Engineering Sample) available (All packages are lead (Pb) free.)

Microcontrollers

8-bit Single-chip Microcontrollers AM1 (MN101) Series (continued)

| Category | Type | Built-in ROM Type | ROM (Bytes) | RAM (Bytes) | Minimum Instruction Execution Time/ Operating Voltage (μsV) | Package | Number of I/O ports (Pins) [At single chip model] | Interrupt Sources | 8-bit Timer (Pins) | 16-bit Timer (Pins) | 19-bit Timer (Pins) | Serial Interfaces | | | | A/D Converter (ch) | D/A Converter (ch) | Display Control Function | | |
|-------------------|-----------------------|-------------------|-------------|---------------------------------------|--|--|---|----------------------------------|--------------------|---------------------|---------------------|-------------------|------|------------------|--------------------------------|--------------------|--------------------|--------------------------|-------------------------------------|---|
| | | | | | | | | | | | | I ² C | UART | Synchronous Type | Synchronous Type/FC Selectable | | | | | |
| ADC Built-in Type | MN101CB6A | M | 32K | 1K | 0.1/2.7 to 3.6 0.125/1.8 to 3.6 100/1.8 to 3.6 | SSOP032-P-0300B | 17 | 15 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 5 | — | — | | |
| | MN101CB6D | | 64K | 2K | | SSOP032-P-0300B ▲ | | | | | | | | | | | | | | |
| | MN101CB6G | | 124K | | | | | | | | | | | | | | | | | |
| | MN101CFB6G | F | 128K | 32K | 1K | 0.1/2.7 to 3.6 0.125/1.8 to 3.6 100/1.8 to 3.6 | SSOP032-P-0300B | 23 | 18 | 5 | 1 | 0 | 1 | 0 | 0 | 5 | — | — | | |
| | MN101CD0A | M | 64K | 2K | SSOP032-P-0300B ▲ | | | | | | | | | | | | | | | |
| | MN101CD0D | | 124K | | | | | | | | | | | | | | | | | |
| | MN101CD0G | F | 128K | MN101CFD0G | M | 256K | 12K | QFP100-P-1818B LQFP100-P-1414 | 85 | 27 | 9 | 1 | 0 | 3 | 2 | 0 | 0 | 8 | — | — |
| | MN101E16Y | 384K | 20K | QFP100-P-1818B | | | | | | | | | | | | | | | | |
| | MN101EF16K | F | 260K | 16K | QFP100-P-1818B LQFP100-P-1414 | | | | | | | | | | | | | | | |
| | MN101EF16Z | | 512K | 30K | QFP100-P-1818B | | | | | | | | | | | | | | | |
| | MN101EF34D | | 64K+4K | 4K | TQFP048-P-0707B | 39 | 28 | 6 | 3 | 0 | 2 | 1 | 0 | 0 | 12 | 8 | — | — | | |
| | MN101EF51A | 32K | 1K | QFP044-P-1010F ▲ TQFP048-P-0707B ○ | 36 | 20 | 5 | 2 | 1 | | | | | | | | | | | |
| | MN101EF52A | | | TQFP032-P-0707A UBGA036-P-0404AE ▲ | 24 | 18 | | | | | | | | | | | | | 1 | |
| | ADC-DAC Built-in Type | MN101C49G | M | 128K | 4K | 0.1/4.5 to 5.5 62.5/2.0 to 5.5 | LQFP100-P-1414 QFP100-P-1818B | 88 | | 23 | 6 | 1 | 0 | 2 | 1 | 1 | 0 | 8 | 4 | — |
| MN101C49H | | 160K | | 6K | | | | | | | | | | | | | | | | |
| MN101C49K | | | | | | | | | | | | | | | | | | | | |
| MN101CF49K | | F | 224K | 10K | 0.1/4.5 to 5.5 0.12/4.5 to 5.5 | | | | | | | | | | | | | | | |
| MN101CP49K | | E | | | 0.1/4.5 to 5.5 0.25/3.0 to 5.5 | | | | | | | | | | | | | | | |
| MN101C77A | | M | 32K | 1.5K | 0.1/2.5 to 3.6 0.2/2.1 to 3.6 62.5/1.8 to 3.6 | LQFP064-P-1414 | 53 | 22 | 5 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 7 | 2* | — | |
| MN101C77C | | | 48K | 3K | | LQFP064-P-1414 TQFP064-P-1010C | | | | | | | | | | | | | | |
| MN101C77D | | | 64K | 6K | | LQFP064-P-1414 | | | | | | | | | | | | | | |
| MN101C77F | | | 96K | | | | | | | | | | | | | | | | | |
| MN101CF77G | | F | 128K | | 0.1/2.7 to 3.6 | LQFP064-P-1414 TQFP064-P-1010C | | | | | | | | | | | | | | |
| MN101E01J | | M | 192K | 10K | 0.0625/3.0 to 3.6 62.5/3.0 to 3.6 | QFP100-P-1818B | 84 | 27 | 7 | 1 | 0 | 3 | 2 | 0 | 0 | 8 | 1 | — | | |
| MN101E01K | | | 256K | 14K | | LQFP100-P-1414 QFP100-P-1818B | | | | | | | | | | | | | | |
| MN101E01L | | | 320K | | | | | | | | | | | | | | | | 20K | |
| MN101E01M | | | 384K | 24K | | 0.0625/3.0 to 3.6 | | | | | | | | | | | | | | |
| USB Function | MN101C93K | M | 224K | 6K | 0.125/3.0 to 3.6 62.5/3.0 to 3.6 | LQFP100-P-1414 | 84 | 26 | 5 | 2 | 0 | 2 | 1 | 0 | 0 | 12 | — | SEG47 COM4 | | |
| | MN101CF93K | F | | | | | | | | | | | | | | | | | 0.167/3.0 to 3.6 62.5/3.0 to 3.6 | |
| | MN101E35A | M | 32K | 4K | 0.042/2.2 to 3.6 0.0625/3.0 to 3.6 62.5/2.2 to 3.6 | TQFP048-P-0707B | 37 | 29 | 6 | 3 | 0 | 2 | 1 | 0 | 0 | 8 | — | — | | |
| | MN101E35D | 68K | | | | | | | | | | | | | | | | | | |
| | MN101EF35A | F | 32K | | | | | | | | | | | | | | | | | |
| | MN101EF35D | 64K+4K | | | | | | | | | | | | | | | | | | |
| VTR Servo | MN101D06F | M | 96K | 3K | 0.14/4.0 to 5.5 61/2.2 to 5.5 | QFP100-P-1818B | 77 | 31 | 1 | 6 | 1 | 1 | 0 | 1 | 0 | 1 | 13 | — | — | |
| | MN101D06G | | 128K | 4K | | | | | | | | | | | | | | | | |
| | MN101D06H | | 160K | 5K | | | | | | | | | | | | | | | | |
| | MN101DF06Z | F | 224K | 6K | 0.14/4.0 to 5.5 61/2.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101D07G | M | 128K | 4K | 0.14/4.0 to 5.5 61/2.2 to 5.5 | LQFP112-P-2020 | 87 | 31 | 1 | 6 | 1 | 1 | 0 | 1 | 0 | 1 | 14 | 1 | — | |
| | MN101D07H | | 160K | 5K | | | | | | | | | | | | | | | | |
| | MN101DF07Z | F | 224K | 6K | 0.14/4.0 to 5.5 61/2.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101D08E | M | 80K | 2K | 0.14/4.0 to 5.5 61/2.5 to 5.5 | LQFP080-P-1414A | 57 | 26 | 2 | 3 | 1 | 0 | 0 | 1 | 0 | 1 | 11 | — | — | |
| MN101DF08G | F | 128K | 4K | | | | | | | | | | | | | | | | | |

[Internal ROM type] M:Mask ROM, E:EPROM, F:FLASH, —:External

[Package] ○:under planning, ▲:under development, △:ES(Engineering Sample) available (All packages are lead (Pb) free.)

[*] Serves as AD pin, as well

Microcontrollers

8-bit Single-chip Microcontrollers AM1 (MN101) Series (continued)

| Category | Type | Built-in ROM Type | ROM (Bytes) | RAM (Bytes) | Minimum Instruction Execution Time/ Operating Voltage (μs/V) | Package | Number of I/O ports (Pins) [At single chip model] | Interrupt Sources | 8-bit Timer (Pins) | 16-bit Timer (Pins) | 19-bit Timer (Pins) | Serial Interfaces | | | | A/D Converter (ch) | D/A Converter (ch) | Display Control Function | | |
|-----------------------------|------------|-------------------|-------------|-----------------|---|-----------------------------------|---|-------------------|--------------------|---------------------|---------------------|-------------------|------|------------------|--------------------------------|--------------------|--------------------|--------------------------|---------------------------|------------|
| | | | | | | | | | | | | I ² C | UART | Synchronous Type | Synchronous Type/PC Selectable | | | | | |
| VTR Servo | MN101D09E | M | 80K | 2K | 0.14/4.0 to 5.5 | QFP100-P-1818B | 57 | 26 | 2 | 3 | 1 | 0 | 0 | 1 | 0 | 1 | — | — | | |
| | MN101DF09G | F | 128K | 4K | 61/2.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101D10F | M | 96K | 2.5K | 0.14/4.0 to 5.5 | QFP100-P-1818B | 77 | 27 | 2 | 3 | 1 | 0 | 0 | 2 | 0 | 1 | — | — | | |
| | MN101D10G | | 128K | 3.5K | 61/2.5 to 5.5 | | | | | | | | | | | | | | | |
| FL Driver Built-in Type | MN101DF10G | F | 4K | 4K | | | | | | | | | | | | | | | | |
| | MN101C87A | M | 32K | 1.5K | 0.1/4.5 to 5.5 | LQFP064-P-1414 | 52 | 21 | 5 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 8 | — | SEG 8 to 16 DGT 18 to 10 | |
| | MN101C87D | | 64K | 2K | 0.25/2.7 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CF87G | F | 128K | 4K | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101C88D | M | 64K | 2K | 0.1/4.5 to 5.5 | QFP100-P-1818B | 88 | 23 | 5 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 8 | — | SEG 35 to 43 DGT 18 to 10 | |
| | MN101C88G | | | 4K | 0.25/2.7 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CF88G | F | 128K | 10K | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CA3F | M | 96K | 4K | 0.1/4.5 to 5.5 | QFP100-P-1818B | 89 | 30 | 6 | 2 | 0 | 2 | 1 | 0 | 1 | 0 | 8 | — | SEG 35 to 43 DGT 18 to 10 | |
| MN101CFA3G | F | 128K | 10K | 0.25/2.7 to 5.5 | | | | | | | | | | | | | | | | |
| LCD Driver Built-in Type | MN101C38A | M | 32K | 1.5K | 0.1/4.5 to 5.5 | LQFP100-P-1414 QFP100-P-1818B | 57 | 14 | 3 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 8 | — | SEG52 COM4 | |
| | MN101C38C | | | | 0.25/2.7 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CP38C | E | 48K | 2K | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101C39C | M | 48K | 2K | 0.1/4.5 to 5.5 | TQFP080-P-1212D | 61 | 14 | 3 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 8 | — | SEG28 COM4 | |
| | MN101CP39C | E | 48K | 2K | 125/2.0 to 5.5 | | | | | | | | | | | | | | | |
| | MN101C485 | M | 8K | 0.5K | 0.1/4.5 to 5.5 | LQFP064-P-1414 TQFP064-P-1010B | 47 | 12 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | — | SEG25 COM4 | |
| | MN101C487 | | | | 125/2.0 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CP487 | E | 16K | | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101C54A | M | 32K | 2K | 0.1/4.5 to 5.5 | LQFP080-P-1414A | 65 | 19 | 5 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 8 | — | SEG32 COM4 | |
| | MN101C54C | | | | 0.25/2.7 to 5.5 | QFP084-P-1818E | | | | | | | | | | | | | | |
| | MN101CF54D | F | 64K | | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CP54C | E | 48K | | 0.25/4.5 to 5.5 | LQFP080-P-1818E | | | | | | | | | | | | | | |
| | MN101CP54C | E | 48K | | 62.5/4.5 to 5.5 | LQFP080-P-1414A QFP084-P-1818E | | | | | | | | | | | | | | |
| | MN101C57C | M | 48K | 2K | 0.1/4.5 to 5.5 | QFP100-P-1818B | 83 | 24 | 5 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 16 | — | SEG47 COM4 |
| | MN101C57D | | | | 0.25/2.7 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CF57D | F | 64K | | 62.5/2.0 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CF57D | F | 64K | | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101C589 | M | 24K | 1.5K | 0.25/2.7 to 5.5 | LQFP064-P-1414 | 49 | 18 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | — | SEG24 COM4 | |
| | MN101C58A | | | | 62.5/2.0 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CF58D | F | 64K | 2K | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CF58D | F | 64K | 2K | 0.25/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CP58A | E | 32K | 1.5K | 62.5/2.3 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CP58A | E | 32K | 1.5K | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101C66D | M | 64K | 2K | 0.25/2.7 to 5.5 | LQFP080-P-1414A QFP084-P-1818E | 65 | 19 | 5 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 8 | — | SEG32 COM4 |
| | MN101C66G | | | 62.5/2.0 to 5.5 | LQFP080-P-1414A QFP084-P-1818E | | | | | | | | | | | | | | | |
| | MN101CF66G | F | 128K | 4K | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | |
| | MN101CF66G | F | 128K | 4K | 0.25/2.7 to 5.5 | LQFP080-P-1414A QFP084-P-1818E | | | | | | | | | | | | | | |
| | MN101CP66D | E | 64K | 2K | 62.5/2.5 to 5.5 | | | | | | | | | | | | | | | |
| MN101CP66D | E | 64K | 2K | 0.1/4.5 to 5.5 | | | | | | | | | | | | | | | | |
| MN101CP66D | E | 64K | 2K | 0.25/2.7 to 5.5 | | | | | | | | | | | | | | | | |
| MN101CP66D | E | 64K | 2K | 62.5/2.3 to 5.5 | | | | | | | | | | | | | | | | |

[Internal ROM type] M:Mask ROM, E:EPROM, F:FLASH, —:External

[Package] ○:under planning, ▲:under development, △:ES(Engineering Sample) available (All packages are lead (Pb) free.)

Microcontrollers

8-bit Single-chip Microcontrollers AM1 (MN101) Series (continued)

| Category | Type | Built-in ROM Type | ROM (Bytes) | RAM (Bytes) | Minimum Instruction Execution Time/ Operating Voltage (μs/V) | Package | Number of I/O ports (Pins) [At single chip model] | Interrupt Sources | 8-bit Timer (Pins) | 16-bit Timer (Pins) | 19-bit Timer (Pins) | Serial Interfaces | | | | A/D Converter (ch) | D/A Converter (ch) | Display Control Function | |
|--------------------------|------------|-------------------|-------------|-------------|---|--|---|-------------------|--------------------|---------------------|---------------------|-------------------|------|------------------|--------------------------------|--------------------|--------------------|--------------------------|-------------|
| | | | | | | | | | | | | I ² C | UART | Synchronous Type | Synchronous Type/FC Selectable | | | | |
| LCD Driver Built-in Type | MN101C70C | M | 48K | 2K | 0.1/3.0 to 3.6 0.235/1.8 to 3.6 62.5/1.8 to 3.6 | LQFP080-P-1414A | 66 | 20 | 6 | 2 | 0 | 1 | 1 | 0 | 0 | 16 | — | SEG32 COM4 | |
| | MN101CF70D | F | 64K | 4K | 0.25/3.0 to 3.6 0.50/2.2 to 3.6 62.5/2.2 to 3.6 | LQFP080-P-1414A ▲ | | | | | | | | | | | | | |
| | MN101C73A | M | 32K | 1.5K | 0.1/3.0 to 3.6 0.235/1.8 to 3.6 62.5/1.8 to 3.6 | LQFP064-P-1414 TQFP064-P-1010C | 55 | 24 | 5 | 2 | 0 | 2 | 1 | 0 | 0 | 12 | — | SEG32 COM4 | |
| | MN101CF73A | F | | 2K | 0.1/3.0 to 3.6 0.235/2.2 to 3.6 62.5/2.2 to 3.6 | | | | | | | | | | | | | | |
| | MN101C74F | M | 96K | 6K | 0.1/3.0 to 3.6 0.235/1.8 to 3.6 62.5/1.8 to 3.6 | LQFP100-P-1414 MLGA100-L-1010 QFP100-P-1818B | 86 | 26 | 5 | 2 | 0 | 2 | 1 | 0 | 0 | 1 | 16 | — | SEG47 COM4 |
| | MN101C74G | | 128K | | 0.1/3.0 to 3.6 0.235/2.2 to 3.6 62.5/2.2 to 3.6 | | | | | | | | | | | | | | |
| | MN101CF74G | F | | | 0.1/3.0 to 3.6 0.235/2.2 to 3.6 62.5/2.2 to 3.6 | | | | | | | | | | | | | | |
| | MN101C78A | M | 32K | 1.5K | 0.1/3.0 to 3.6 0.118/2.7 to 3.6 0.235/1.8 to 3.6 62.5/1.8 to 3.6 | TQFP048-P-0707B | 39 | 22 | 5 | 2 | 0 | 2 | 1 | 0 | 0 | 1 | 7 | — | SEG12 COM4 |
| | MN101CF78A | F | | | 0.118/3.0 to 3.6 62.5/2.2 to 3.6 | | | | | | | | | | | | | | |
| | MN101C84A | M | 32K | 1K | 0.1/4.5 to 5.5 0.25/2.7 to 5.5 62.5/2.0 to 5.5 | LQFP064-P-1414 | 52 | 18 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 8 | — | SEG32 COM4 | |
| | MN101CF84D | F | 64K | 2K | 0.1/4.5 to 5.5 0.25/2.7 to 5.5 62.5/2.5 to 5.5 | | | | | | | | | | | | | | |
| | MN101CA27 | M | 16K | 0.5K | 0.25/2.7 to 3.6 0.50/1.8 to 3.6 62.5/1.8 to 3.6 | LQFP064-P-1414 | 25 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | — | — | SEG32 COM4 | |
| | MN101CFA2D | F | 64K | 2K | 0.25/2.7 to 3.6 0.50/1.8 to 3.6 62.5/1.8 to 3.6 | | | | | | | | | | | | | | |
| | MN101E29G | M | 128K | 6K | 0.05/2.2 to 5.5 | LQFP100-P-1414 QFP100-P-1818B | 90 | 28 | 7 | 3 | 0 | 4 | 1 | 0 | 0 | 1 | 16 | 4 | SEG55 COM4 |
| | MN101EF29G | F | 128K+4K | | | | | | | | | | | | | | | | |
| | MN101E31D | M | 64K | 4K | 0.05/2.2 to 5.5 | LQFP080-P-1414A | 70 | 23 | 7 | 2 | 0 | 3 | 1 | 0 | 0 | 1 | 12 | — | SEG41 COM4 |
| | MN101E31G | | 128K | 6K | | | | | | | | | | | | | | | |
| | MN101EF31D | F | 64K+8K | 4K | 0.05/2.7 to 5.5 | LQFP080-P-1414A | 70 | 23 | 7 | 2 | 0 | 3 | 1 | 0 | 0 | 1 | 12 | — | SEG41 COM4 |
| | MN101EF31G | | 128K+4K | 6K | 0.05/2.2 to 5.5 | | | | | | | | | | | | | | |
| | MN101EF32D | M | 64K+8K | 4K | 0.05/2.7 to 5.5 | LQFP064-P-1414 | 54 | 23 | 7 | 2 | 0 | 2 | 1 | 0 | 0 | 1 | 8 | — | SEG32 COM4 |
| | MN101E46G | | 128K | | 0.1/2.2 to 3.6 0.125/1.8 to 3.6 61/1.8 to 3.6 | TQFP128-P-1414C ▲ | 67 | 21 | 5 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | — | SEG64 COM32 |
| | MN101E46N | M | 508K | | | TQFP128-P-1414C ○ | | | | | | | | | | | | | |
| | MN101E46R | | 928K | 6K | | TQFP128-P-1414A △ | | | | | | | | | | | | | |
| | MN101EF46R | F | 928K | 8K | | LQFP100-P-1414 QFP100-P-1818B | 90 | 34 | 7 | 3 | 0 | 3 | 1 | 0 | 0 | 0 | 24 | 4 | SEG55 COM4 |
| | MN101EF56G | | 128K | 6K | 0.05/2.7 to 5.5 0.1/1.8 to 5.5 | LQFP080-P-1414A TQFP080-P-1212D | 70 | | | | | | | | | | | | |
| | MN101EF57G | | | | | LQFP064-P-1414 TQFP064-P-1010C | 54 | | | | | | | | | | | | |
| | MN101EF58G | | | | | | | | | | | | | | | | | | |
| Voice control | MN101E30N | M | 508K | 8K | 0.05/2.2 to 5.5 | QFP100-P-1818B | 85 | 30 | 7 | 3 | 0 | 4 | 1 | 0 | 0 | 1 | 12 | 5 | SEG55 COM4 |
| | MN101E30R | | 928K | | | | | | | | | | | | | | | | |
| | MN101EF30R | F | 928K | 8K | 0.05/2.2 to 5.5 | QFP100-P-1818B | 85 | 30 | 7 | 3 | 0 | 4 | 1 | 0 | 0 | 1 | 12 | 5 | SEG55 COM4 |
| | MN101E59R | M | 928K | | | | | | | | | | | | | | | | |
| | MN101EF59R | F | 928K | | | | | | | | | | | | | | | | |
| In-vehicle networking | MN101EF41N | F | 512K | 30K | 0.05/3.0 to 3.6 | QFP100-P-1818B ○ | 85 | 29 | 9 | 1 | 0 | 3 | 2 | 0 | 0 | 0 | 8 | — | — |
| | MN101E49K | M | 256K | 12K | 0.05/3.0 to 3.6 30.6/2.7 to 3.6 | LQFP100-P-1414 ▲ | | | | | | | | | | | | | |
| | MN101EF49N | F | 512K | 30K | 0.05/3.0 to 3.6 30.6/2.7 to 3.6 | LQFP100-P-1414 | | | | | | | | | | | | | |
| | MN101EF63G | | 128K | 6K | 0.05/2.7 to 5.5 | TQFP064-P-1010C ▲ | 54 | 34 | 7 | 3 | 0 | 3 | 1 | 0 | 0 | 0 | 12 | — | SEG32 COM4 |

[Internal ROM type] M:Mask ROM, E:EPROM, F:FLASH, —:External

[Package] ○:under planning, ▲:under development, △:ES(Engineering Sample) available (All packages are lead (Pb) free.)

Microcontrollers

16-bit Single-chip Microcontrollers AM2 (MN102) Series

| Category | Type | Built-in ROM Type | ROM (Bytes) | RAM (Bytes) | Minimum Instruction Execution Time/ Operating Voltage (μs/V) | Package | Number of I/O ports (Pins) | Interrupt Sources | 8-bit Timer (Pins) | 16-bit Timer (Pins) | 19-bit Timer (Pins) | Serial Interfaces | | | | A/D Converter (ch) | D/A Converter (ch) |
|-----------------------|--------------|-------------------|-------------|-------------|---|------------------------------------|----------------------------|-------------------|--------------------|---------------------|---------------------|-------------------|----|--|----------------------------------|--------------------|--------------------|
| | | | | | | | | | | | | Synchronous Type | μC | Synchronous Type/UART/ I ² C Selectable | Synchronous Type/UART Selectable | | |
| ADC Built-in Type | MN102H460B | — | — | 4K | 0.05/3.0 to 3.6 0.1/2.0 to 3.6 | LQFP128-P-1818C TQFP128-P-1414B | 63 | 54 | 16 | 5 | 1 | 3 | 2 | 0 | 0 | 12 | — |
| | MN102H60G | M | 128K | 4K | 0.058/3.0 to 3.6 62.5/3.0 to 3.6 | LQFP100-P-1414 MLGA100-L-1010 | 82 | 50 | 10 | 6 | 0 | 0 | 2 | 3 | 0 | 8 | — |
| | MN102H60K | | 256K | 10K | | LQFP100-P-1414 | | | | | | | | | | | |
| | MN102HF60G | F | 128K | 4K | | LQFP100-P-1414 MLGA100-L-1010 | | | | | | | | | | | |
| | MN102HF60K | | 256K | 10K | | LQFP100-P-1414 | | | | | | | | | | | |
| | MN102L59D | M | 64K | 2K | 0.1/4.5 to 5.5 | LQFP064-P-1414 | 52 | 24 | 9 | 3 | 0 | 2 | 0 | 0 | 12 | — | |
| | MN102LF59D | F | | | | | | | | | | | | | | | |
| ADC-DAC Built-in Type | MN102H730FGT | — | — | 10K | 0.058/3.0 to 3.6 62.5/3.0 to 3.6 | TQFP128-P-1414B | 66 | 50 | 10 | 5 | 0 | 2 | 2 | 0 | 0 | 12 | 4 |
| | MN102H73G | M | 128K | | | TQFP128-P-1414A | 105 | | | | | | | | | | |
| | MN102H73K | | 256K | 12K | | TQFP128-P-1414B | | | | | | | | | | | |
| | MN102HF73G | F | 128K | 10K | | | | | | | | | | | | | |
| | MN102HF73K | | 256K | 12K | | | | | | | | | | | | | |
| | MN102H950F | — | — | 10K | 0.058/3.0 to 3.6 62.5/3.0 to 3.6 | LQFP100-P-1414 | 63 | 47 | 10 | 5 | 0 | 2 | 2 | 0 | 0 | 12 | 4 |
| USB Function | MN102H74D | M | 64K | 4K | 0.0833/3.0 to 3.6 62.5/3.0 to 3.6 | LQFP100-P-1414 | 77 | 54 | 10 | 4 | 0 | 2 | 2 | 0 | 0 | 8 | — |
| | MN102H74G | | 128K | | | | | | | | | | | | | | |
| | MN102HF74G | F | 128K | | | | | | | | | | | | | | |

[Internal ROM type] M:Mask ROM, E:EPROM, F:FLASH, —:External

[Package] ○:under planning, ▲:under development, △:ES(Engineering Sample) available (All packages are lead (Pb) free.)

Microcontrollers

32-bit Single-chip Microcontrollers AM3 (MN103) Series

| Category | Type | Built-in ROM Type | ROM (Bytes) | RAM (Bytes) | CPU Performance (MIPS/MHz) [Dhystoresz: 1] | Minimum Instruction Execution Time/ Operating Voltage (ns/V) | Package | Number of I/O ports (Pins) | | Interrupt Sources | 8-bit Timer (Pins) | 16-bit Timer (Pins) | 19-bit Timer (Pins) | Serial Interfaces | | | A/D Converter (Pins) | DMA Controller (ch) | Bus Interface | | | | | | | | | | | | | |
|-------------------------|------------|-------------------|-------------|-------------|--|--|-------------------------------|----------------------------|-----------------|-------------------|--------------------|---------------------|---------------------|---------------------------------------|----------------------------------|-----|----------------------|---------------------|---|---|-----|----|----|--------|---|---|---|--------|---|-------------|---|---|
| | | | | | | | | | | | | | | Synchronous Type/UART/ i2C Selectable | Synchronous Type/UART Selectable | i2C | | | | | | | | | | | | | | | | |
| USB HOST | MN103SFB5K | F | 256K | 8K | 38/48 | 16.7/2.7 to 3.6 | LQFP064-P-1414 | 42 | 35 | 4 | 2 | 0 | 0 | 2 | 0 | 1 | — | 4 | — | | | | | | | | | | | | | |
| | MN103SFE5P | | 624K | 32K | 48/48 | 20.83/3.0 to 3.6 | LQFP048-P2-0707A | 27 | 48 | 6 | 2 | 0 | 0 | 4 | 0 | 2 | | 5 | | Data: 16 bits | | | | | | | | | | | | |
| | MN103SG20L | — | — | | | | QFP100-P-1818B | ▲ | 44 | 59 | | | | | 5 | 0 | 3 | | | | | | | | | | | | | | | |
| | MN103SFH7J | F | 192K | 8K | 38/48 | 16.7/2.7 to 3.6 | TQFP064-P-1010C | 42 | 35 | 4 | 2 | 0 | 0 | 2 | 0 | 1 | — | 4 | — | | | | | | | | | | | | | |
| | MN103SH7J | M | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AV control applications | MN103LF06N | F | 512K | 31.5K | 38/40 | 25/2.6 to 3.6 | LQFP100-P-1414 QFP100-P-1818B | ▲ | 81 | 84 | 14 | 6 | 0 | 0 | 6 | 3 | 0 | 15-chx1 | 4 | Data : 8-bit/16-bit access | | | | | | | | | | | | |
| | MN103S57G | M | 128K | 16K | 40/40 | 25/3.0 to 3.6 | LQFP100-P-1414A | 73 | 64 | 10 | 6 | 0 | 0 | 3 | 2 | 0 | 12-chx1 | 4 | Data : 8-bit/16-bit access | | | | | | | | | | | | | |
| | MN103SF57G | F | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SF73N | F | 512K | 32K | 40/40 | 25/2.7 to 3.6 | QFP100-P-1818B | △ | 82 | 71 | 10 | 6 | 0 | 0 | 2 | 3 | 0 | 8-chx1 | 4 | Data : 8-bit/16-bit access SDRAM interface supporting | | | | | | | | | | | | |
| | MN103SF73R | | 1024K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103S97N | M | 512K | 24K | 40/40 | 16.7/2.7 to 3.6 | MBGA255-C-1111A | 195 | 106 | 16 | 12 | 0 | 0 | 7 | 0 | 1 | 25-chx1 | 4 | Data : 8-bit/16-bit/32-bit access | | | | | | | | | | | | | |
| | MN103SF66R | F | 1024K | 40K | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SB9N | M | 512K | 32K | 48/60 | 16.7/2.7 to 3.6 | TQFP128-P-1414A | 104 | 68 | 10 | 6 | 0 | 0 | 2 | 3 | 0 | 12-chx1 | 4 | Data : 8-bit/16-bit access SDRAM interface supporting | | | | | | | | | | | | | |
| | MN103SFB9R | F | 1024K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SD0Q | M | 768K | 32K | 48/60 | 16.7/2.7 to 3.6 | UBGA257-P-1111A | 195 | 116 | 8 | 12 | 0 | 0 | 11 | 0 | 2 | 32-chx1 | 6 | Data : 8-bit/16-bit access | | | | | | | | | | | | | |
| | MN103SFD0R | F | 1024K | 40K | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SD3P | M | 640K | 40K | 48/60 | 16.7/2.7 to 3.6 | LQFP100-P-1414 | 82 | 82 | 13 | 6 | 0 | 0 | 5 | 3 | 0 | 8-chx1 | 4 | Data : 8-bit/16-bit access | | | | | | | | | | | | | |
| MN103SFD3R | F | 1024K | 64K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inverter motor control | MN103SC2A | M | 32K | 4K | 48/60 | 16.7/4.5 to 5.5 | QFP044-P-1010F | 29 | 28 | 4 | 2 | 0 | 1 | 1 | 0 | 0 | 2unit 8-ch | — | — | | | | | | | | | | | | | |
| | MN103SC2D | | 64K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SFC2D | F | 256K | 40K | 70/70 | 14.3/3.0 to 5.5 | QFP100-P-1818B | 81 | 56 | 12 | 6 | 0 | 2 | 3 | 1 | 0 | 3unit 20-ch | — | — | | | | | | | | | | | | | |
| | MN103SFC6K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SE3K | M | 256K | 8K | 48/60 | 16.7/4.5 to 5.5 | QFP100-P-1818B | 81 | 56 | 12 | 6 | 0 | 2 | 3 | 0 | 0 | 3unit 20-ch | — | — | | | | | | | | | | | | | |
| | MN103SFE3K | F | | | | | QFP100-P-1818B | | | | | | | | | | | | | ▲ | | | | | | | | | | | | |
| | MN103SE4D | M | 64K | 4K | 48/60 | 16.7/4.5 to 5.5 | LQFP080-P-1414A | 61 | 56 | 12 | 6 | 0 | 2 | 3 | 0 | 0 | 3unit 16-ch | — | — | | | | | | | | | | | | | |
| | MN103SE4G | | 128K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SE4K | | 256K | 8K | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SFE4G | F | 128K | 4K | | | | | | | | | | | | | | | | LQFP128-P-1818C | 112 | 81 | 16 | 9 | 0 | 3 | 3 | 1 | 0 | 3unit 28-ch | — | — |
| | MN103SFE4K | | 8K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SFG5K | | 256K | 12K | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| In-vehicle networking | MN103LF03R | F | 1024K | 63.5K | 38/40 | 25/2.7 to 3.6 | LQFP128-P-1818C | ▲ | 109 | 84 | 14 | 6 | 0 | 0 | 6 | 3 | 0 | 15-chx1 | 4 | Data : 8-bit/16-bit access | | | | | | | | | | | | |
| | | | | | | | LQFP144-P-2020A | ▲ | 123 | | | | | | | | | 8-chx1 | | | | | | | | | | | | | | |
| | MN103LF04R | | | | | | LQFP100-P-1818B | ▲ | 81 | | | | | | | | | 81 | | | 0 | 0 | 5 | 8-chx1 | | | | | | | | |
| | | | | | | | LQFP128-P-1818C | ▲ | 104 | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | LQFP144-P-2020A | ▲ | 118 | | | | | | | | | | | | | | | | | | | | | | | |
| | MN103SFA2R | | | | | | 64K | 48/60 | 16.7/2.7 to 3.6 | | | | | | | | | LQFP100-P-1414 | | | ▲ | 82 | 84 | 13 | | | | 8-chx1 | | | | |

[Internal ROM type] M:Mask ROM, E:EPROM, F:FLASH, —:External

[Package] ○:under planning, ▲:under development, △:ES(Engineering Sample) available (All packages are lead (Pb) free.)

Image Pickup Devices

| | |
|------------------------------|----|
| CCD Area Sensors | D2 |
| CCD Area Image Sensors | D2 |
| MOS Sensor | D2 |
| MOS Image Sensor | D2 |

CCD Area Sensors

CCD Image Sensors

| Use | Diagonal Size (Optical Size) | Color or B/W | Part No. | Effective*1 Pixel Count | | Transfer System | Scanning Mode | TV System | Sensitivity (F8) typ. (mV) | Saturation Output typ.*2 (mV) | Smear typ. (dB) | Package |
|----------------------------|---------------------------------|---------------------------|-----------|----------------------------|-------|-----------------|---------------|-----------|-------------------------------|-------------------------------|-----------------|-----------------|
| | | | | H | V | | | | | | | |
| Digital Still Camera | 6.9 mm (1/2.5 type) | Primary color | MN39600PM | 3 096 | 2 238 | IT | IS | — | 190 | 580 | −77 | WSOP028-P-0450A |
| | 7.2 mm (1/2.5 type) | | MN34500PL | 3 288 | 2 472 | | | | 180 | 480 | −78 | WQFN040-C-1111 |
| | | | MN34550PA | 3 672 | 2 760 | | | | — | 150 | 430 | — |
| | 7.7 mm (1/2.35 type) | | MN39670PL | 3 360 | 2 472 | IT | | | 190 | 600 | −78 | WQFN040-C-1012 |
| | 7.8 mm (1/2.33 type) | | MN34510PL | 3 776 | 2 776 | | | | 180 | 450 | −80 | WQFN042-C-0911 |
| | | | MN34540PA | 4 112 | 3 032 | — | | | 150 | 430 | — | |
| | 9.1 mm (1/1.76 type) | | MN39850PM | 3 672 | 2 760 | IT | | | 210 | 550 | −80 | WSOP028-P-0600A |
| | 9.2 mm (1/1.72 type) | | MN39690PL | 4 032 | 3 024 | | | | 190 | 580 | −75 | WQFN040-C-1012A |
| Movie | 3.0 mm (1/6 type) | Complementary color | MN39168FD | 962 | 654 | IT | — | NTSC | — | — | — | WDIP014-P-0350A |
| | | | MN39268FD | | 774 | | | PAL | | | | |
| Monitoring camera | 4.5 mm (1/4 type) | Complementary color | MN39116KT | 512 | 491 | IT | — | NTSC | 400 | 700 | −74 | WDIP014-P-0400G |
| | | | MN39216KT | | 581 | | | PAL | 380 | | | |
| | | B/W | MN39116AT | | 491 | | | EIA | 650 | 900 | −82 | |
| | | | MN39216AT | | 581 | | | CCIR | 560 | 840 | | |
| For broadcast and business | 6.0 mm (1/3 type) | B/W (Three-plate type) | MW39461AJ | 1 056 | 583 | — | PS | HD | 190 | 490 | −96 | WDIP016-P-0400A |
| | 11.0 mm (2/3 type) | | MW39540AE | 966 | 492 | IT | — | EIA | 620 | 1 500 | −130 | WDIP020-G-0600D |
| | | | MW39640AE | 954 | 585 | | | CCIR | | | | |
| | | | | MW39781AE | 1 952 | | | 1 108 | HD | 290 | 1 600 | −125 |

[Symbol] IT: Interline Transfer system, FIT: Frame Interline Transfer system, IS: Interlace Scan, PS: Progressive Scan

*1: Effective pixel count includes the transient pixels.

*2: The color one denotes carrier saturation.

MOS Sensor

MOS Image Sensor

| Use | Diagonal Size (Optical Size) | Color or B/W | Part No. | Effective*1 Pixel Count | | Read method | Pixel Siz (μm) | Sensitivity F8(G) typ. (mV) | Saturation Output typ. (mV) | Smear | Package |
|--------------------------------------|---------------------------------|--------------|-----------|----------------------------|-----|-------------|-----------------------|--------------------------------|-----------------------------|---------------------|-----------------|
| | | | | H | V | | | | | | |
| Monitoring camera/ Network camera | 4.9 mm (1/3.6 type) | B/W | MN39901AL | 750 | 500 | PS | 5.6(H) × 5.6(V) | 660 | 900 | Smearless structure | WQFN044-C-1212A |
| | | Color | MN39901PL | | | | | 300 | | | |

[Symbol] PS: Progressive Scan

*1: Effective pixel count includes the transient pixels.

Application-Specific Standard-Product ICs

| | |
|--|-----|
| ASSP for Video | E2 |
| For VCR..... | E2 |
| For Video Camera | E2 |
| For Network Camera | E2 |
| For DSC (For Digital Still Camera) | E3 |
| For TV..... | E4 |
| Others..... | E4 |
| ASSP for Audio | E5 |
| For Compact Disc/CD-ROM Player..... | E5 |
| For DAB..... | E5 |
| For FM/AM Tuner | E5 |
| Car Radio..... | E5 |
| Home Audio Equipment..... | E5 |
| ICs for Audio Common Use..... | E5 |
| 3-D Surround | E5 |
| ASSP for Communication..... | E6 |
| For Telephone | E6 |
| For Cellular Phone, PHS Pager, GPS | E6 |
| Speaker amplifier for cellular phones | E6 |
| ASSP for Information Equipment | E7 |
| For LCD panel | E7 |
| For Contact-less ICs Card and Tag..... | E7 |
| For Equipment Control Tag (Contact Type) | E7 |
| Speaker amplifier for notebook PC..... | E7 |
| ASSP for Power Supply | E8 |
| IPD (Intelligent Power Device)..... | E8 |
| ASSP for Motor Drive | E10 |
| Applications of Motor Driver ICs | E10 |
| Motor Control Series..... | E11 |
| Storage..... | E12 |
| IP for SD Host..... | E12 |
| D/A Converter..... | E12 |
| D/A Converter | E12 |

ASSP for Video

For VCR

| Category | Part No. | Operating Voltage (V) | Functions | Package |
|-----------------------------|-----------|-----------------------|---|-----------------|
| Mechanism/ servo control | MN101D06F | 5 | On-chip OSD microcomputer servo (ROM 96KB) FLASH: MN101DF06ZAF | QFP100-P-1818B |
| | MN101D06G | | On-chip OSD microcomputer servo (ROM 128KB) | |
| | MN101D06H | | On-chip OSD microcomputer servo (ROM 160KB) FLASH: MN101DF06ZAF | LQFP112-P-2020 |
| | MN101D07H | | | |
| | MN101D08E | | On-chip OSD microcomputer servo (ROM 80KB) FLASH: MN101DF08GAF | LQFP080-P-1414A |
| | MN101D09E | | On-chip OSD microcomputer servo (ROM 80KB) FLASH: MN101DF09GAF | QFP100-P-1818B |
| | MN101D10F | | On-chip OSD microcomputer servo (ROM 96KB) | |
| | MN101D10G | | On-chip OSD microcomputer servo (ROM 128KB) | |

For Video Camera

| Category | Part No. | Operating Voltage (V) | Functions | Package |
|---|----------|---|--|-------------------|
| CCD V drive for CCD area image sensor | MN3114 | 15, 0, -7.5, 3 | Multi-power supply (On-chip SUB driver), Output (2-value × 4, 3-value × 4) | SSOP024-P-0300C |
| AFE+TG V-Dr | NN12077A | AFE/TG: 3.3 V-Dr: CCD/General Purpose | AFE for 10-bit camera + TG (for 960H CCD) + V-Dr (4-ch) Frequency 27 MHz compatible | MLGA092-L2-0808 |
| AFE/TG | AN12073A | AFE/TG: 3.3 V-Dr: CCD/General Purpose | AFE for camera + TG (for 960H CCD) SSG: External or built-in (selectable) | TQFP064-P-1010C |
| Stepping Motor (lens) | AN41902A | $V_{CC} = 2.7$ to 3.9 $V_M = 3.0$ to 5.5 | 4-channel H bridge driver (micro step), three-line bi-directional serial data communication | HQFP048-P-0707 |
| | AN41904A | $V_{CC} = 2.7$ to 3.6 $V_M = 3.0$ to 5.5 | 4-channel H bridge driver (256 micro step) Three-line bi-directional serial data communication Built-in iris control | UBGA064-P-0606ACA |

For Network Camera

| Category | Part No. | Operating Voltage (V) | Functions | Package |
|---------------------------|--------------|-----------------------|---|-----------------|
| Digital signal processing | MN2PS00003RF | 3.3, 1.2 | For camera processing, JPEG/MPEG-4/H.264, audio processing, network protocol processing UniPhier®-S | UBGA433-P-1313A |
| AFE+TG | MN52C1 | 3.3, 5 | For image pixel drive AFG+TG | TQFP080-P-1212D |
| Image Pickup Device | MN39901PL | 5 | For 1/3.6 type wide VGA v Maicovicon® | WQFN044-C-1212A |

v Maicovicon® is a registered trademark of Panasonic Corp.

UniPhier® is a registered trademark of Panasonic Corp.

ASSP for Video

For DSC (For Digital Still Camera)

| Category | Part No. | Operating Voltage (V) | Functions | Package |
|--|--------------|--|--|--------------------|
| DSC digital signal processor | MN103SA10EYD | 3.3 | For still pictures (1.3 to 10 M pixels) For high quality animation (1.3 to 6 M pixels) In accordance with JPEG/MPEG4, SD • MMC I/F | MLGA344-C-1313A |
| CCD V driver for CCD area image sensor | MN3114 | 15, 0, -7.5, 3 | Multi-power supply type (On-chip SUB driver, power input free order, 8-ch output) | SSOP024-P-0300C |
| | MN3114QFN | | | QFN028-P-0405B |
| | AN20117A | Vdr: Refer to CCD specifications. | Vertical driver including level conversion circuit (with built-in SUB driver) 3-value × 12-ch, 2-value × 11-ch (23-ch in total) (6:1 interlace drive, 9-pixel summation drive) | HQFN064-P-0808A |
| AFE/TG with built-in V-Dr | NN12082A | AFE/TG: 1.8 Vdr: Refer to CCD specifications. | AFE for CCD camera (12 bits) + TG (Full programmable type) + Vdr (23-ch) | UBGA128-P2-0707ACA |
| | NN12083A | | AFE for CCD camera (12 bits) + TG (Full programmable type) + Vdr (19-ch) | |
| Audio processing | AN12918A | 4.5 | All I/O audio processing required for DSC are built in. Microphone amplifier, ALC, LPF, EVR, line output and SP output | BGA036-P-0404AE |
| 75Ω driver | AN13206A | 3.1 | 3 V version video 75 Ω driver (clamp, filter and driver), 1-output | XLGA012-L-0303 |
| | AN13208A | | Driver for D terminal | ULGA020-L-0404 |
| DC-DC switching power supply | AN30211A | 1.51 to 7.2 | 5 V output used concurrently for 6-ch PWM control and self bias. (1-ch for selection of increasing or decreasing voltage, 1-ch decreasing voltage, 2-ch increasing voltage, 2-ch time-division control inverse/increasing voltage, and 1-ch 5 V for concurrent use for self-biasing and increasing voltage); 2-ch low-output power for synchronized rectification; control pins for each channel; built-in phase-compensation filter | HQFN064-P-0808A |
| | AN30212A | | 5 V output used concurrently for 4-ch PWM control and self bias. (1-ch for selection of increasing or decreasing voltage, 1-ch decreasing voltage, 2-ch time-division control inverse/increasing voltage, and 1-ch 5 V for concurrent use for self-bias and increasing voltage); 2-ch low-output power for synchronized rectification; control pins for each channel; built-in phase-compensation filter | QFN044-P-0606C |
| | AN30213A | 1.7 to 5.5 | 1-ch 3.3 V synchronized rectification increasing/decreasing voltage (used concurrently for self-bias) and 2-ch for time-division control inverse/increasing voltage; control pins for each channel; built-in phase compensation filter | QFN028-P-0405B |
| | AN30216A | 1.5 to 5.5 | 8-ch output, Built-in Power Tr 5 V, 3.4 V, 3 V, 1.2 V, 1.8 V, -6 V, 12 V, For LED current | HQFN044-P-0606 |
| | AN30219A | | 8-ch output, Built-in Power Tr, Built-in LED light modulation function 5 V, 3.4 V, 3 V, 1.2 V, 1.8 V, -6 V, 12 V, For LED current | |
| 7-ch driver for lens motor | AN41921A | V _{CC} 2.7 to 3.9 | 7-ch H bridge driver (driven by micro step) 3-line bi-directional serial data communication | QFN044-P-0606C |
| High side | AN34070A | 2.7 to 3.6 | Low-power-consumption load switch (built-in ground protection circuit, soft-start function) | SSMINI-5DA |

E

ASSP for Video

For TV

| Category | | Part No. | Operating Voltage (V) | Functions | Package |
|--|---------------------------|-----------|--|--|-------------------|
| Sound Multiplex Signal Processing Circuits | | AN5829S | 4.5 to 5.5 | Demodulation circuit for US TV sound multiplex system, AGC, sound input switch | SOP024-P-0375C |
| | | AN5832SA | | Demodulation circuit for US TV sound multiplex system without adjustment | SSOP032-P-0300B |
| | | AN16903A | | Demodulation circuit for Japan TV sound multiplex system without adjustment | SSOP024-P-0300E |
| | | AN5832FJM | | Demodulation circuit for US TV sound multiplex system without adjustment | QFN044-P-0606C |
| | | AN27012A | | Demodulation circuit for US TV sound multiplex system without adjustment + IF (SIF + VIF) | QFP048-P-0707A |
| | | AN27013A | | Demodulation circuit for Japan TV sound multiplex system without adjustment + IF (SIF + VIF) | |
| Sound Signal Processing | | AN5891SA | 6.0 to 10.0 | AGC, Volume/mute control, Surround | SSOP032-P-0300B |
| | | AN5891K | | | SDIP024-P-0300 |
| LSIs for Digital Broadcasting | For Terrestrial/Cable | MN88435 | V _{CC1} = 3.3 V _{CC2} = 1.2 | For US DTV VSB/64/256QAM demodulation LSI | HQFP144-P-2020 |
| | For Terrestrial/Satellite | MN884422 | | OFDM for digital terrestrial in Japan, Demodulation LSI for satellite in Japan | TQFP128-P-1414C |
| AV Switch | | AN15852A | V _{CC} : 8.5 to 9.5 V _{DD} : 4.7 to 5.3 | Video 6-input, 3-output, Audio 6-input, 3-output | QFH080-P-1420I |
| | | AN15853AA | 8.1 to 9.9 | Video 5-input, 1-output, Audio 4-input, 1-output | SSOP036-P-0450C |
| | | AN15856A | | Video 9-input, 4-output, Audio 7-input, 2-output | QFH064-P-1414H |
| | | AN15857AB | | Video 9-input, 5-output, Audio 6-input, 2-output | |
| | | AN15858A | | Video 4-input, 2-output, Audio 4-input, 2-output | SSOP036-P-0450C |
| | | AN15882AA | 7.5 to 9.5 | Video 7-input, 3-output, Audio 7-input, 3-output | QFH064-P-1414H |
| | | AN15887A | | Video 6-input, 2-output, Audio 5-input, 2-output Built-in 75Ω driver output | QFP048-P-1212C |
| Audio Switch | | AN15860A | 8.5 to 9.5 | Audio 9-input, 4-output | SSOP036-P-0450A |
| | | AN15862A | 8.1 to 9.9 | Audio 13-input, 5-output | QFP044-P-1010F |
| Video Switch | | AN15865AA | 8.5 to 9.5 | Video 10-input, 5-output | QFH080-P-1420H |
| | | AN15867A | | Video 13-input, 6-output | QFH064-P-1414H |
| | | AN15870A | | Video 10-input, 5-output Format detection × 2 (1080p/50, 1080p/60) | QFH080-P-1420H |
| | | AN15876A | | Video 19-input, 7-output, built-in 75Ω driver output Compatible with SCART, 100 MHz | QFS100-P-1414A |
| | | AN15880A | 4.8 to 5.5 | Video 8-input, 3-output, built-in 75Ω driver output | QFH064-P-1414H |
| | | AN15881A | | Video 14-input, 4-output, built-in 75Ω driver output | QFH080-P-1420I |
| | | AN15885A | 4.5 to 5.5 | Video 5-input, 2-output, built-in 75Ω driver output | SSOP032-P-0300B |
| Anti-aliased Font Engine | | MN5572 | 3.0 to 3.6 | Processing to develop the outline font data into the bitmap data of anti-aliased font data | LQFP100-P-1414 |
| LNA for DTV | | AN26017A | 2.7 to 3.0 | ISDB-T (1-seg TV) LNA Frequency: 470 to 770 MHz | SSMINI-5DA |
| | | AN26027A | 2.5 to 3.0 | | ALGA005-W-0609ANA |

Others

| Part No. | Operating Voltage (V) | Functions | Package |
|----------|-----------------------|----------------------------------|----------------|
| AN13301A | 4.8 to 5.2 | 6-ch Video Driver for D terminal | QFP048-P-1212C |
| AN13303A | | 3-ch Video Driver for D terminal | SOP016-P-0225F |

For Compact Disc/CD-ROM Player

| Category | Part No. | Operating Voltage (V) | Functions | Package |
|-------------------------|----------|---|---|-----------------|
| Head amp | AN22004A | 2.4 to 5.5 | Head amplifier for Digital servo (RW Disc play bakc, EQ built-in) | SSOP032-P-0300B |
| Driver for optical disk | AN8471SA | 4.5 to 5.5 (V _{DD}) 10.8 to 13.2 (V _M) | 3-phase full-wave direct, Low ossillation PWM drive, DMOS output Tr built-in, Short/Reverse brake, Current limiting, Reverse prevention, 1 × / 3 × FG output, Thermal protection circuit built-in | SSOP032-P-0300B |
| | AN41204A | 4.5 to 5.5 | SP + 5-ch PWM drive | HQFP048-P-0707 |
| | AN41206A | | Low ossillation PWM drive, 3 sensor, Sinusoidal PWM drive | HQFP048-P-0707A |
| | AN41250A | | Single sensor, Sinusoidal PWM drive (SP + 6-ch) | |
| | AN41251A | | | |
| | AN41224A | TYP:12V | | HSOP056-P-0300 |
| | AN41252A | 4.5 to 5.5 | Single sensor, Sinusoidal PWM drive (SP + 8-ch) | TQFP064-P-0707 |

For DAB

| Part No. | Operating Voltage (V) | Functions | | Package |
|-------------|-----------------------|----------------------------------|--|-----------------|
| MN66721 | 1.8, 3.3 | Consumer product | Base band signal processing for 4th-generation DAB | TQFP080-P-1212D |
| △ MN66721UB | | Car installation guaranteed item | | |

△: ES available

For FM/AM Tuner

Car Radio

| Part No. | Operating Voltage (V) | Functions | | | | | | Package |
|----------|-----------------------|-----------|----|----|-----|----|-----|-----------------|
| | | Front End | IF | NC | MPX | AM | PLL | |
| AN18160A | 7.2 to 8.6 | ● | ● | | | ● | ● | LQFP048-P-0707A |
| AN18163B | | ● | ● | | | ● | ● | |
| AN18164B | | ● | ● | | | ● | ● | |
| AN18161A | 7.2 to 9.0 | | | ● | ● | | | SSOP024-P-0300E |
| AN18165B | | | | ● | ● | | | |
| AN18180A | 7.2 to 8.6 | ● | ● | | | | ● | LQFP048-P-0707A |

Home Audio Equipment

| Part No. | Operating Voltage (V) | Functions | Package |
|----------|--|---|-----------------|
| AN18202A | 8.0 to 10.0 8.0 to 11.0 | AM: RF, mixer, oscillator, PLL, IF detection FM: Mixer, oscillator, PLL, IF detection, MPX | LQFP048-P-0707A |
| AN18207A | V_{CC1} : 8.0 to 10.0 V_{CC2} : 8.0 to 11.0 | AM: RF+MIX+L-OSC FM: IF+DET, FM-MPX, PLL | |
| AN18208A | | AM: RF+MIX+L-OSC FM/AM: IF+DET, FM-MPX, PLL | |

ICs for Audio Common Use

3-D Surround

| Part No. | Operating Voltage (V) | Functions | Package |
|----------|-----------------------|---|-----------------|
| MN5B02UC | 1.5/3.3 | Headphone available, 5.1-channel surround-sound processor | TQFP048-P-0707B |

ASSP for Communication

For Telephone

| Part No. | Operating Voltage (V) | Functions | Package |
|------------|-----------------------|--|-----------------|
| AN6184FBQ | 4.5 to 5.5 | Speech network with built-in cross-point SW for cordless telephone set | QFS064-P-1414C |
| AN6382NFA | | Speech network IC incorporating cross-point switch for facsimile | QFP056-P-1010B |
| AN6383SB | | | SSOP036-P-0450C |
| AN6193NFAQ | 3.2 to 3.4 | Speech network IC incorporating converter and cross-point switch | QFS080-P-1414D |
| AN8953NFA | 2.7 to 5.5 | Receiving IC for 900 M cordless telephone set receiving | QFP056-P-1010B |
| AN29000A | | Receiving IC for 2.4 G cordless telephone set receiving | |

For Cellular Phone, PHS Pager, GPS

| Part No. | Operating Voltage (V) | Functions | Package |
|------------|-----------------------|--|-------------------|
| AN29170A | 2.6 to 3.3 | Receive-send PLL single-chip for PDC 1.5 GHz | QFN044-P-0606A |
| AN6591BFJM | 2.85 to 3.1 | Receive-send PLL single-chip for PHS | QFN044-P-0606C |
| AN1201SM | 2.0 to 3.0 | For transmission power amplifier, \ominus voltage generation | SMINI-5DA |
| AN28720S | 2.3 to 3.3 | TCXO control IC | Wafer |
| AN26210A | 2.7 to 2.95 | WCDMA 800 M/2 GHz dual LNA | XLGA012-L-0303 |
| AN26218A | 2.7 to 2.87 | WCDMA 800 M/1.7 G/2 GHz triple band LNA | XLGA011-W-1216AKA |
| AN26260A | 2.7 to 3.0 | WCDMA 800 M/2 GHz receiving IC | ULGA054-W-5234 |
| AN26261A | | WCDMA 800 M/2 GHz sending IC | ULGA031-W-3525 |
| AN18401A | | Down converter IC for GPS | QFN028-P-0405B |
| AN26014A | | LNA for GPS | SSMINI-5DB |

Speaker amplifier for cellular phones

| Category | Part No. | Operating Voltage (V) | Functions | Package |
|----------------------------------|------------|-----------------------|---|-------------------|
| Speaker amplifier, dynamic | AN12975A | 2.7 to 3.3 | Speaker amplifier 2-ch (stereo), AGC (digital), I ² C control, Stand-by, Mute | ULGA020-L-0404 |
| | AN12978A | 2.7 to 4.5 | Speaker amplifier 1-ch, AGC (digital), I ² C control, Stand-by, Mute | UBGA015-W-2020 |
| | AN12979A | 2.7 to 3.3 | Speaker amplifier 2-ch (stereo), AGC (digital), I ² C control, Stand-by, Mute | ULGA020-L-0404 |
| | ▲ AN12960A | 3.0 to 4.5 | Speaker amplifier 1-ch, AGC (digital), Electronic volume, I ² C control, I ² C switch, Stand-by, Mute, Auto SP save | UBGA015-W-2020 |
| Speaker amplifier, piezoelectric | AN12959A | 7.5 to 12.5 | Speaker amplifier 2-ch (stereo), AGC (digital), I ² C control, Stand-by, Mute | UBGA021-W-2525AEA |
| | AN12969A | 3.0 to 4.5 | Speaker amplifier 2-ch (stereo), AGC (digital), I ² C control, Stand-by, Mute, Built-in DCDC (charge pump) | ULGA031-W-3030AEA |

▲: Under development

ASSP for Information Equipment

For LCD panel

| Part No. | Operating Voltage (V) | Functions | Package |
|----------|-----------------------|--|----------------|
| AN30101A | 2.35 to 3.63 | Charge pump power supply for LCD, V COM output, control function (3-ch) built-in | QFN044-P-0606A |

For Contact-less ICs Card and Tag

| Part No. | Reference standard | Frequency (MHz) | Modulation system | Memory capacity (user area) | Anti-collision | Data transfer speed (k-Bit/sec.) | Communication distance (cm) | Remarks |
|-------------------|--------------------|-----------------|----------------------------|-----------------------------|----------------|------------------------------------|-----------------------------|---|
| MN101CY727 Series | ISO14443-B | 13.56 MHz | Rec. ASK 10% Trms. Load SW | 8k-byte | ○ | Rec. 106/212/424 Trms. 106/212/424 | 10 ^{*1} | • JICSAP2.0 • Crypto co-processor |
| | CJRC ^{*2} | | | | | Rec. 212 Trms. 212 | | • CJRC ^{*2} • Crypto co-processor |

*1: Communication distance is subject to antenna size, etc.

*2: CJRC: Congress Japan Railway Cybernetics

For Equipment Control Tag (Contact Type)

| Part No. | FeRAM capacity | Features | Remarks |
|------------------|---------------------|--|---|
| MN63Y2006 Series | 2 kbit + ECC 1 kbit | Equipped with encryption function; 1-line type I/F | Equipment control using challenge & response method |

Speaker amplifier for notebook PC

| Part No. | Functions | | | | Package |
|----------|-----------------|-----------------------------|-------------|---------------------------|----------------|
| | Output (at 8 Ω) | H/P Amp. | AGC | Others | |
| AN12946A | 1.0 W × 2 ch | — | — | Mike amplifier, Regulator | HQFP048-P-0707 |
| AN12947A | 1.4 W × 2 ch | ● (Output condenserless) | ● (Analog) | | |
| AN12948A | | ● (Output condenserless) | ● (Digital) | | |
| AN12949A | | — | ● (Digital) | | |

ASSP for Power Supply

IPD (Intelligent Power Device)

| Category | Part No. | Input Voltage (V) | Output (W) (Reference value) | Characteristics | | | Package (JEITA, JEDEC) |
|--|-----------|-------------------|---------------------------------|----------------------|------------------------|------------------------|------------------------------|
| | | | | V _{DSS} (V) | I _{LIMIT} (A) | f _{OSC} (kHz) | |
| Three-terminal with low energy consumption during standby for power supplies | MIP2E1DMY | 85 to 264 | to 7 | 700 | 0.375 | 100 | TO-220-A2 |
| | MIP2E1DMS | | | | | | DIP7-A1 |
| | MIP2E1DMU | | | | | | U-G2 (SC-63) U-A1 (SC-64) |
| | MIP2E2DMY | | 5 to 10 | | 0.50 | | TO-220-A2 |
| | MIP2E2DMS | | | | | | DIP7-A1 |
| | MIP2E2DMU | | | | | | U-G2 (SC-63) U-A1 (SC-64) |
| | MIP2E3DMY | | 10 to 20 | | 1.00 | | TO-220-A2 |
| | MIP2E3DMS | | | | | | DIP7-A1 |
| | MIP2E3DMU | | | | | | U-G2 (SC-63) U-A1 (SC-64) |
| | MIP2E4DMS | | 15 to 30 | | 1.50 | | DIP7-A1 |
| | MIP2E4DMY | | | | | | TO-220-A2 |
| | MIP2E5DMY | | 20 to 40 | | 2.00 | | |
| | MIP2E7DMY | | 40 to 60 | | 3.00 | | |
| | MIP2E9DMY | | 60 to 90 | | 4.50 | | |
| | MIP3E10MS | | to 7 | | 0.375 | | DIP7-A1 |
| | MIP3E30MY | | 8 to 15 | | 0.80 | | TO-220-A2 |
| | MIP3E30MS | | | | | | DIP7-A1 |
| | MIP3E3SMY | | 10 to 20 | | 1.00 | | TO-220-A2 |
| | MIP3E3SMS | | | | | | DIP7-A1 |
| | MIP3E40MY | | 15 to 30 | | 1.35 | | TO-220-A2 |
| | MIP3E50MY | | 20 to 40 | | 1.80 | | |
| | MIP3E70MY | | 40 to 60 | | 2.70 | | |
| Multi-function power supplies with low energy consumption during standby | MIP2G40MS | 85 to 264 | to 20 | 700 | 1.0 | 100 | DIP7-A1 |
| | MIP2G40MD | | to 30 | | 1.35 | | TO-220IPD7-A2 |
| | MIP2G50MD | | to 40 | | 1.8 | | |
| | MIP2G70MD | | to 60 | | 2.7 | | |
| Artificial resonance power supply | MIP4110MS | 85 to 264 | 3 to 6 | 700 | 0.45 | — | DIP7-A1 |
| | MIP4120MS | | 5 to 9 | | 0.60 | | |
| | MIP4140MS | | 10 to 15 | | 1.00 | | |
| | MIP414SMS | | 10 to 20 | | 1.35 | | TO-220IPD7-A2 |
| | MIP4140MD | | | | | | |
| | MIP4150MD | | 15 to 25 | | 1.80 | | |
| | MIP4170MD | | 30 to 40 | | 2.70 | | |
| | MIP4180MD | | 40 to 50 | | 3.50 | | |
| | MIP4190MD | | 50 to 60 | | 4.20 | | |
| Standby power supply | MIP382 | 85 to 264 | to 8 | 700 | 0.360 | 44 | DIP7-A1 |
| | MIP384 | | to 10 | | 0.500 | | |
| | MIP289 | | to 5 | | 0.255 | | |
| | MIP290 | | to 2 | | 0.150 | | |
| | MIP291 | | to 4 | | 0.220 | | |

ASSP for Power Supply

IPD (Intelligent Power Device) (continued)

| Category | Part No. | Input Voltage (V) | Output (W) | Characteristics | | | Package |
|---------------------------|-----------|-------------------|------------|----------------------|------------------------|------------------------|---------|
| | | | | V _{DSS} (V) | I _{LIMIT} (A) | f _{OSC} (kHz) | |
| Miniature charger adapter | MIP2F10MS | 85 to 264 | to 4 | 700 | 0.25 | 100 | DIP7-A1 |
| | MIP2F20MS | | to 7 | | 0.35 | | |
| | MIP2F30MS | | to 10 | | 0.50 | | |
| | MIP2F40MS | | to 15 | | 0.70 | | |
| | MIP2F50MS | | to 20 | | 1.00 | | |

| Category | Part No. | Input Voltage (V) | Output (W) | Characteristics | | | | Package |
|---------------------|----------|-------------------|------------|----------------------|------------------------|------------------------|---------------------|---------------|
| | | | | V _{DSS} (V) | I _{Dpeak} (A) | f _{OSC} (kHz) | R _{on} (Ω) | |
| LED Lighting Driver | MIP551 | 80 to 280 | 10 | ≥ 700 | 0.5 (typ.) | 44 (typ.) | 12 (typ.) | DIP7-A1 |
| | MIP552 | | 30 | | 1.0 (typ.) | | 6 (typ.) | TO-220IPD7-A2 |

Precautions on the Sales of IPDs

- 1) The sale and/or the export of IPD products to any customer or customers located in any country other than Japan is expressly prohibited by the Agreement made and executed by and between Power Integrations, Inc. and Panasonic Corporation.
- 2) IPD products purchased from our company, or its authorized agents, hereinafter referred to as our company, shall be used only for production purposes by those parties who have duly purchased IPD products. Those who have purchased IPD products shall not use such IPD products in unmodified form for re-sale, loan, or sample shipment for evaluation purposes to any other parties.
- 3) If a party who has duly purchased IPD products subcontracts its production to any other parties, including its subsidiaries or any other third parties inside and/or out of Japan, and the IPD products are consigned to such subcontracting parties thereat, such party is obligated to monitor and control the quantity of IPD products to prevent any of the aforementioned re-sale, loan or sample shipments from taking place.
- 4) In the event that any actual or threatened breach or violation of any of the above mentioned 1, 2, or 3, has occurred or is about to occur, our company will hold all shipments of IPD products and may request the party alleged to be responsible for such occurrence for necessary.

Note) The products of MIP50□, MIP51□, and MIP7□□ are excluded from above-mentioned precautions, 1) to 3).

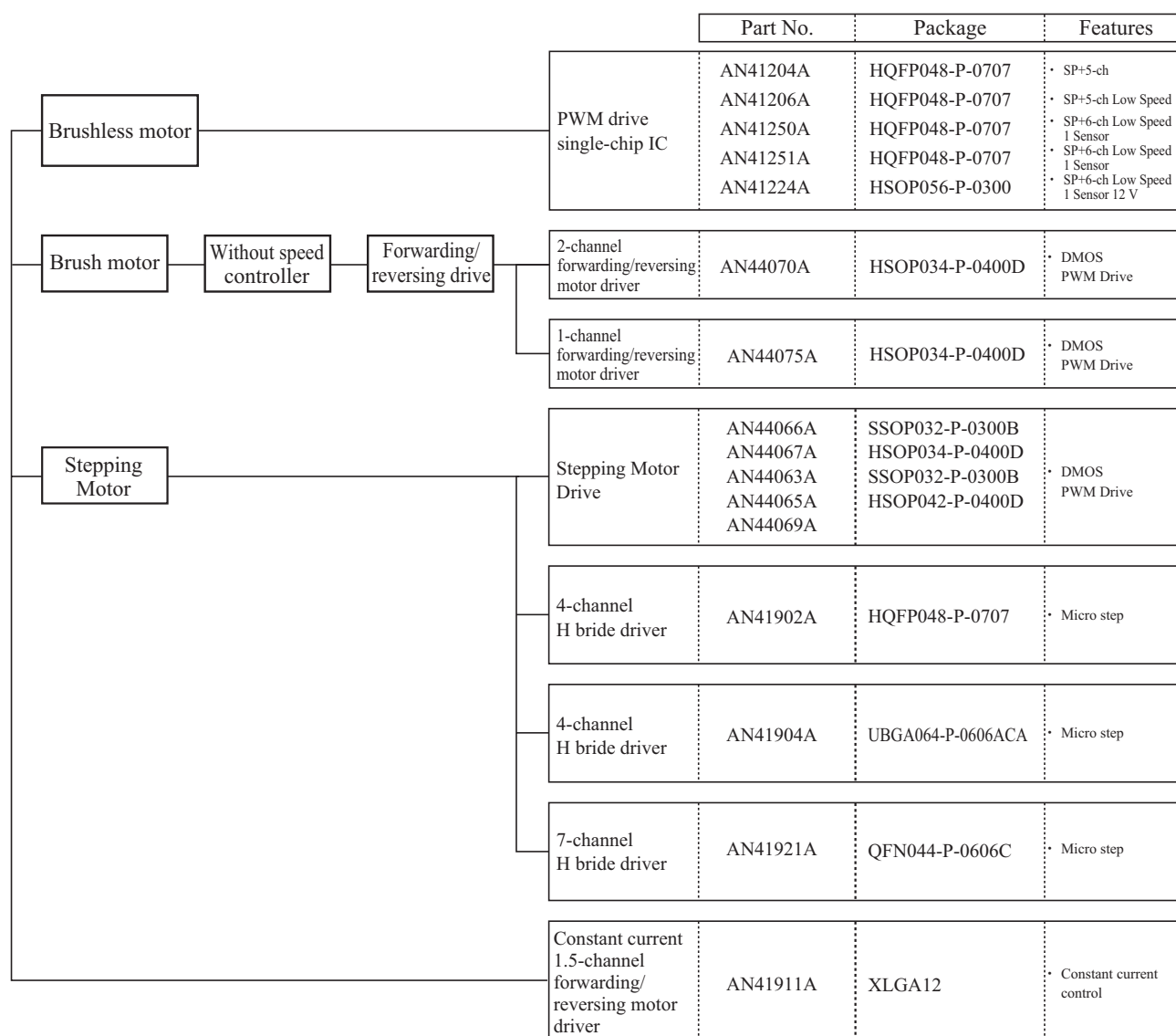
Attached table "IPD availability by customer"

| Parts No. | | | Companies/areas to which products can be sold | Companies/areas to which products cannot be sold | Application |
|---|--|--|--|--|--|
| MIP13□ MIP14□ MIP15□ MIP16□ | MIP17□ MIP18□ MIP01□□ MIP02□□ | MIP2□□□ MIP3□□□ MIP4□□□ MIP9A□□ | · Japanese companies in Japan · Japanese companies in Asia (50% or more owned) | · Companies in European and American countries · Asian companies in Asia · Other local companies | · For power supply · For DC-DC converter |
| MIP10□ MIP11□ MIP803/804/806 MIP9E□□ | MIP811/812 MIP814/815/816 MIP82□ MIP55□ | | · Japanese companies in Japan · Japanese companies in Asia (50% or more owned) · Asian companies in Asia | · Companies in European and American countries · Other local companies | · For power supply · For EL driver · For LED lighting driver |
| MIP50□ MIP51□ | MIP7□□ | | · No restrictions in terms of contract | · No restrictions in terms of contract | · For lamp driver/ car electronics accessories |

Note) If you have any inquiries about sales, contact Corporate Marketing & Sales Division of our company.

ASSP for Motor Drive

Applications of Motor Driver ICs



ASSP for Motor Drive

Motor Control Series

| Category | Part No. | Operating Voltage (V) | Peak Current | Functions | Applications | Package |
|-----------------|---|-------------------------------|---|---|--|-----------------|
| Stepping Motor | AN44063A | 16 to 34 (V _M) | 0.8 A | W 1-2 phase excitation possible, built-in thermal protection circuit, built-in PWM oscillator (two frequency selectable), two power supplies (5 V and 24 V) or single power supply (24 V) selectable, built-in temperature measurement terminal (T _j monitor) | Printers, fax machines, PPCs, cameras, ATMs, sewing machines, industrial machinery, etc. | SSOP032-P-0300B |
| | | 4.5 to 5.5 (V _{CC}) | | | | |
| | AN44066A | 10 to 34 (V _M) | | W 1-2 phase excitation possible, built-in thermal protection circuit, reducible number of parallel input pins (for 2-phase or 1-2 phase excitation), built-in PWM oscillator (two frequency selectable), single power supply (24 V) drive, built-in temperature measurement terminal (T _j monitor), built-in standby circuit | | |
| | | — | | | | |
| | AN44065A | 18 to 28 (V _M) | 1.5 A | W 1-2 phase excitation possible, built-in thermal protection circuit, built-in PWM oscillator (two frequency selectable), two power supplies (5 V and 24 V) or single power supply (24 V) selectable, built-in temperature measurement terminal (T _j monitor) | HSOP042-P-0400D | |
| | | 4.5 to 5.5 (V _{CC}) | | | | |
| | AN44069A | 16 to 34 (V _M) | | | | |
| | | 4.5 to 5.5 (V _{CC}) | | | | |
| | AN44067A | 10 to 34 (V _M) | 2.5 A | 2W 1-2 phase excitation possible, built-in thermal protection circuit, built-in PWM oscillator (three frequency selectable), single clock input compatible, built-in decay control switching function, built-in standby function, built-in ground protection function, built-in temperature measurement terminal (T _j monitor) | HSOP034-P-0300A | |
| | | — | | | | |
| AN41902A | 3.0 to 5.5 (V _M) | 250 mA | 4-channel H bride driver (micro step), three-line bi-directional serial data communication | DVC | HQFP048-P-0707 | |
| AN41921A | 2.7 to 3.9 (V _{CC}) | — | 7-channel H bride driver (micro step), three-line bi-directional serial data communication | DSC | QFN044-P-0606C | |
| AN41904A | 3.0 to 5.5 (V _M) 2.7 to 3.6 (V _{CC}) | — | 4-channel H bride driver (256 micro step), three-line bi-directional serial data communication, built-in iris control | DVC | UBGA064-P-0606ACA | |
| DC Motor Driver | AN44070A | 10 to 34 (V _M) | 2.5 A (3.5 A at t ≤ 10 ms) | 2-channel H bridge driver, built-in thermal protection circuit two power supplies (5 V and 24 V) or single power supply (24 V) selectable, built-in standby function, built-in | Printers, fax machines, PPCs, cameras, ATMs, sewing machines, industrial machinery, etc. | HSOP034-P-0300A |
| | | 3.0 to 5.5 (V _{CC}) | | | | |
| | AN44075A | 10 to 35 (V _M) | 3.0 A (3.5 A at t ≤ 10 ms) | 1-channel H bridge driver, built-in thermal protection circuit, single power supply (24 V), built-in current limiting function, built-in standby function, overcurrent protection possible, built-in temperature measurement terminal (T _j monitor) | | |
| | | — | | | | |
| Others | AN41911A | 2.6 to 5.5 (V _{CC}) | 200 mA | Constant current control 1.5-channel driver, built-in high speed brake at changeover between forwarding and reversing | Camera phone | XLGA012-L-0303 |

E

Storage

IP for SD Host

| Part No. | Operating Voltage (V) | Functions | Package |
|----------|-----------------------|---|---------|
| MVCA1Z | — | With CPRM IP, SDIO ^{Note 1), 2)} | — |
| MVCA2Z | | Without CPRM IP, SDIO ^{Note 1)} | |

Note 1) For using this IP, it is necessary to enter into the SD HALA (Host/Ancillary Product License Agreement) in advance with SD-3C-LLC which is a limited liability company in Delaware in the USA, and with the SD Card Association which is a nonprofit company in California, USA. This function is not available if you have not entered into the SD HALA.

2) For using the CPRM technology of this IP, it is necessary to enter into the 4C CPPM/CPRM License Agreement or CPRM for SD-binding License Agreement in advance with 4C Entity in Delaware, USA. This function is not available if you have not entered into the 4C CPPM/CPRM License Agreement or CPRM for SD-binding License Agreement.

D/A Converter

D/A Converter

| Part No. | Operating Voltage (V) | Functions | Package |
|----------|--|-----------------------------|----------------|
| AN8150FB | AV _{CC} 10 to 11 AV _{EE} -7.7 to -6.8 V _{DD} 4.75 to 5.25 | Octal, 13-bit D/A converter | QFP044-P-1010F |

Sensors



Magnetic field sensors..... F2

 Hall ICs F2

Magnetic field sensors

Hall ICs

| Applications | Part No. | Functions | Package |
|---------------|------------|---|-----------|
| Switch/sensor | AN48820A | Operates on Unidirectional magnetic field independent from polosity Low-power consumption, High sensitivity CMOS Hall IC open drain | MINI-3DRA |
| | ▲ AN48832B | Operates on Unidirectional magnetic field independent from polosity Low-power consumption, High sensitivity CMOS Hall IC CMOS inverter (V _{CC} = 1.65V to 3.3 V) | SMINI-5DA |
| | ▲ AN48842B | Operates on Alternating magnetic field Low-power consumption, High sensitivity CMOS Hall IC CMOS inverter (V _{CC} = 1.65V to 3.3 V) | |
| | AN48841B | Operates on Alternating magnetic field Low-power consumption, High sensitivity CMOS Hall IC CMOS inverter (V _{CC} = 2.5V to 5.25 V) | |

▲: Under development

Gallium Arsenide Devices



| | |
|-----------------------------|----|
| MMICs | G2 |
| GaAs MMICs | G2 |
| GaAs Module..... | G2 |
| GaAs Power Amp Module | G2 |

MMICs

GaAs MMICs

| Block | Part No. | Functions | RF Characteristics (typ.) | Applications | Package |
|----------------|----------|--|--|------------------------|---------|
| Antenna Switch | GN04063N | Low power DPDT-SW V _{ctl} = 0/3 V, f = 1 to 6 GHz | 1.0 GHz band • IL = 0.35 dB, ISO = 35 dB 2.5 GHz band • IL = 0.4 dB, ISO = 27 dB 6.0 GHz band • IL = 0.75 dB, ISO = 19 dB | VCO switching W-LAN | ML6-N1 |
| Power Amp | GN05019H | 24 GHz power amp V _{CC} = 3.0 V, P _{out} = 18 dBm | Gain = 28.5 dB I _{CC} = 90 mA | W-LAN (802.11 b/g) | |

GaAs Module

GaAs Power Amp Module

| Part No. | Frequency (MHz) | Modulation | Supply Voltage V _{CC} (V) | Characteristics (typ.) | | | Idle current (mA) | Applications | Package |
|----------|-----------------|---------------|------------------------------------|------------------------|--------------|-----------|-------------------|---------------------------|-----------|
| | | | | Efficiency (%) | Output (dBm) | Gain (dB) | | | |
| UN0686W | 1 920 to 1 980 | R.99 HSDPA | 3.5 | 41 43 | 26.5 | 29.5 | 30 | WCDMA 2.0 GHz | PAMP09-N1 |
| UN0683W | 824 to 849 | R.99 HSDPA | 3.5 4.0 | 46 41 | 26.5 | 28 | 40 | WCDMA 0.8 GHz | |
| UN0684W | 1 750 to 1 785 | R.99 HSDPA | 3.5 4.0 | 47 42 | 26.5 | 28 | 35 | WCDMA 1.7 GHz | |
| UN0871W | 1 920 ~ 1 980 | R.99 HSDPA | 3.5 | 41.5 43 | 26.5 | 28.5 | 28 | WCDMA 2.0 GHz/ 0.8 GHz | PAMP13-N1 |
| | 824 ~ 849 | R.99 HSDPA | 3.5 | 39.5 41 | 26.5 | 28.5 | 38 | | |
| UN0872W | 1 920 ~ 1 980 | R.99 HSDPA | 3.5 4.0 | 48 43 | 26.5 | 28.5 | 25 | | |
| | 824 ~ 849 | R.99 HSDPA | 3.5 4.0 | 47 41.5 | 26.5 | 29 | 30 | | |

Note) WCDMA modulation signal
R.99: DPCCH:DPDCH = 8:15
HSDPA:DPCCH:DPDCH:HS-DPCCH = 12:15:19.2

Transistors

| | |
|---|-----|
| Small Signal FETs | H2 |
| MOS FETs (For Small Signa) | H2 |
| MOS FETs (For Power Management) | H2 |
| Junction FETs | H4 |
| Composite MOS FETs (For Small Signal) | H4 |
| Composite MOS FETs (For Power Management) | H6 |
| MOS FET + SBD (For Power Management) | H6 |
| Small Signal Bipolar Transistors | H8 |
| Small Signal Transistors (Low-Frequency Amplifiers) | H8 |
| Small Signal Transistors (High-frequency Amplifiers) | H10 |
| SiGe HBT | H11 |
| SiGe HBT (Combined Products) | H11 |
| SiGe HBT LNA (with built-in bias circuit) | H11 |
| Composite Transistors (NPN × 2 Series) | H12 |
| Composite Transistors (PNP × 2 Series) | H13 |
| Composite Transistors (PNP + NPN Series) | H13 |
| Transistor with Built-in Resistors | H14 |
| Transistor with Built-in Resistors ($I_C = 80$ mA Series) | H14 |
| Transistor with Built-in Resistors ($I_C = 100$ mA Series) | H16 |
| Composite Transistor with Built-in Resistors (NPN × 2 Series) | H18 |
| Composite Transistor with Built-in Resistors (PNP × 2 Series) | H19 |
| Composite Transistor with Built-in Resistors (PNP + NPN Series) | H20 |
| Bipolar Power Transistors | H22 |
| Low-Frequency Amplifiers | H22 |
| For Power Amplification | H23 |
| For Switching | H23 |
| For TV and CRT Monitor | H23 |
| Power MOS FETs | H24 |
| Power MOS FETs | H24 |
| IGBT Discrete | H24 |
| IGBT | H24 |

Small Signal FETs

MOS FETs (For Small Signa)

| Application | Polarity | Absolute Maximum Ratings | | Electrical Characteristics | | | | | | | Package | |
|---------------------------------|----------|--|-----------------------|-------------------------------|-------------------------|-------------------------|---------------------------|---------------------------|---------------------------------|----------------------------------|------------------------|-----|
| | | V _{DSS} V _{DS} ^{*1} (V) | I _D (A) | R _{DS (on)} max. (Ω) | | | | | t _{on} typ. (ns) | t _{off} typ. (ns) | ML3-N2 | |
| | | | | V _{GS} = 10V | V _{GS} = 5V | V _{GS} = 4V | V _{GS} = 2.5V | V _{GS} = 1.8V | | | P _D (mW) | |
| Digital/ analog switching | Pch | −30 | −0.1 | — | — | 18 | 30 | — | 300 | 400 | | |
| | | | | | 75 | — | — | | 100 μs | 25 μs | | |
| | Nch | 20 | 0.1 | — | — | 4 | 6 | 13 | 250 | 480 | | |
| | | 20 ^{*1} | | | 50 | — | — | | max. 1.0 μs | max. 1.0 μs | | |
| | | 30 | | | | | | | 150 | 35 | | |
| | | 30 | | | — | 8 | 12 | — | 350 | 350 | 2SK3939 | 100 |
| | | 50 | 50 | — | 10 | 20 | | | | | | |
| | | 50 ^{*1} | 0.05 | — | 12 | 15 | | | 200 | 200 | | |
| | | | | | | | | | | | | |
| | | 80 | 0.5 | 4 | — | — | | | 15 | 20 | | |

MOS FETs (For Power Management)

| Application | Polarity | Absolute Maximum Ratings | | | Electrical Characteristics | | | | | | | | | Package | |
|------------------------------------|----------|--------------------------|-------------------------|-----------------------|--------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|--------------|---------------------------------|----------------------------------|-----------------------|------------|
| | | V _{DSS} (V) | V _{GSS} (V) | I _D (A) | R _{DS (on)} max. (mΩ) | | | | | | Ciss (pF) | t _{on} typ. (ns) | t _{off} typ. (ns) | WSSMini6-F1 | |
| | | | | | V _{GS} = 10V | V _{GS} = 5.0V | V _{GS} = 4.5V | V _{GS} = 4.0V | V _{GS} = 2.5V | V _{GS} = 1.8V | | | | P _D (W) | |
| Load S/W | Pch | −12 | ±8 | −4.0 | — | — | — | 42 | 55 | 75 | 1 200 | 30 | 300 | | |
| | | | | | | | 34 | — | 41 | 54 | 1 400 | 20 | 430 | | |
| | | −20 | ±10 | −3.0 | | | | | | — | 55 | 70 | — | 1 000 | 30 |
| DC-DC Converter | Pch | −20 | ±10 | −2.0 | — | — | — | 130 | 200 | — | 400 | 15 | 100 | MTM86124 | 0.54 |
| | | | | | | | | 120 | 170 | 230 | 300 | 14 | 112 | MTM86127 | 0.54 |
| | | | ±12 | −1.0 | | | | | 420 | 560 | — | 80 | 18 | 27 | △ MTM86128 |
| | Nch | 20 | ±10 | 2.2 | | | | | 105 | 150 | 300 | 280 | 12 | 50 | MTM86227 |
| Lithium battery protection circuit | Nch | 30 | ±20 | 18 | 4.2 | — | 9.8 | | | | 6 000 | 50 | 820 | | |
| | | | | 20 | 2.8 | | 8.0 | | | | 7 000 | 70 | 1 030 | | |
| Backlight inverter | Pch | −40 | ±20 | −7.0 | 25 | — | 45 | — | — | — | 2 700 | 33 | 300 | | |
| | Nch | 40 | | | 7.0 | 23 | 40 | | | | — | | 1 750 | 26 | 127 |

△: Tentative

Small Signal FETs

| Package | | | | | | | | | |
|-------------|------------------------|------------|------------------------|-----------|------------------------|----------|------------------------|-----------|------------------------|
| SSSMini3-F2 | | SSMini3-F3 | | SMini3-F2 | | Mini3-G1 | | MiniP3-F2 | |
| | P _D (mW) | | P _D (mW) | | P _D (mW) | | P _D (mW) | | P _D (mW) |
| 2SJ0674G | 100 | | | | | | | | |
| | | | | 2SJ0536G | 150 | | | | |
| 2SK3973G | 100 | | | | | | | | |
| | | | | 2SK0665G | 150 | | | | |
| | | | | 2SK3064G | 150 | | | | |
| 2SK3938G | 100 | | | | | | | | |
| | | | | 2SK0664G | 150 | | | | |
| | | | | 2SK1374G | 150 | 2SK1228 | 150 | | |
| 2SK3547G | 100 | 2SK3546G | 125 | 2SK3539G | 150 | | | | |
| | | | | | | | | 2SK0601G | 1 W |

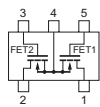
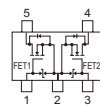
| Package | | | |
|------------|-----------------------|------------|-----------------------|
| WSMini6-F1 | | SO8-F1 | |
| | P _D (W) | | P _D (W) |
| MTM76110 | 0.7 | | |
| △ MTM76111 | 0.7 | | |
| MTM76123 | 0.7 | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | MTMF8231 | 1.0 |
| | | △ MTMF8233 | 1.0 |
| | | MTM98140 | 2.0 |
| | | MTM98240 | 2.0 |

Small Signal FETs

Junction FETs

| Application | Polarity | Absolute Maximum Ratings | | Electrical Characteristics | | | Package | | | | | |
|---------------------------------------|----------|------------------------------------|---------------------------------|----------------------------|--|--------------------------|-------------|---------------|----------------------|---------------|------------|---------------|
| | | V_{DGO} V_{GDS}^{*1} (V) | I_D I_{DSO}^{*2} (mA) | I_{DSS} max. (mA) | GV NF ^{*3} typ. (dB) | NV max. (μ A) | TSSMini3-F2 | | SSSMini3-F2 | | SSMini3-F3 | |
| | | | | | | | | P_D (mW) | | P_D (mW) | | P_D (mW) |
| Analog switch | Pch | 65 ^{*1} | −20 | −6 | — | — | | | | | | |
| Low-frequency, low-noise amplifier | Nch | 30 | 20 | 12 | — | typ. 60 mV | | | | | | |
| Low-frequency amplifier | Nch | 55 | 30 | 12 | 2.5 ^{*3} | — | | | | | | |
| | | | | 6.5 | | | | | | | 2SK2593G | 150 |
| | | −40 ^{*1} | 10 | 4.7 | — | | | | | | | |
| Capacitor microphone | Nch | 20 | 2 ^{*2} | 0.46 | −1.5 | 4 | | | 2SK3372G | 100 | | |
| | | | | 0.47 | | 10 | | | 2SK3426G 2SK3585G | 100 100 | | |
| | | | | 0.46 | 3 | 4 | 2SK3862G | 100 | | | | |
| | | | | 0.31 | −3 | 8 | 2SK3866G | 100 | | | | |
| | | | | 0.45 | 3 | 10 | 2SK4206G | 100 | | | | |
| | | | | | | 8 | 2SK3948G | 100 | | | | |
| | | | | | | 4 | 2SK4083G | 100 | | | | |

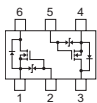
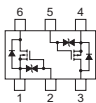
Composite MOS FETs (For Small Signal)

| Application | Absolute Maximum Rating | | Electrical Characteristics | | | | | Package | | | |
|----------------------|-------------------------|---------------|----------------------------|-------------------------|-------------------------|---------------------|---------------------|---|---------------|--|---------------|
| | | | | | | | | XN: Mini5-G2 XP: SMini5-G1 UP: SSMi5-F3 | | | |
| | V_{DSS} (V) | I_D (mA) | $R_{DS(on)}$ (Ω) | | | t_{on} (ns) | t_{off} (ns) | XN  | | XP•UP  | |
| | | | $V_{GS} = 4.0\text{ V}$ | $V_{GS} = 2.5\text{ V}$ | $V_{GS} = 1.8\text{ V}$ | | | Nch × 2 | P_T (mW) | Nch × 2 | P_T (mW) |
| Switching circuit | 20 | 100 | 3.0 | 4.0 | 6.0 | 250 | 480 | | | | |
| | 30 | | 8 | 12 | — | 350 | 350 | | | UP0187BG | 125 |
| | −30/30 | −100/100 | 18/8 | 30/12 | | 300/350 | 400/350 | | | | |
| | 50 | 100 | 12 | 15 | | 200 | 200 | | | XP01878 UP01878G | 150 125 |
| | −30/50 | −100/100 | 15/12 | 25/15 | | 850/200 | 850/200 | | | | |
| | 50 | 100 | 50 | — | | max. 1.0 μ s | max. 1.0 μ s | XN01872G | 300 | | |

Small Signal FETs

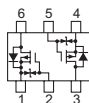
| Package | | | | | |
|-----------|------------------------|---------|------------------------|---------|------------------------|
| SMini3-F2 | Mini3-G1 | | NS-A1 NS-B1 | | |
| | | | | | |
| | P _D (mW) | | P _D (mW) | | P _D (mW) |
| 2SJ0364G | 150 | 2SJ0163 | 150 | 2SJ0164 | 300 |
| 2SK0662G | 150 | 2SK0198 | 150 | | |
| 2SK0663G | 150 | | | | |
| | | | | | |
| | | 2SK2751 | 200 | | |
| | | | | | |
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| | | | | | |
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H

| Package | | | | Basic Type | |
|---|------------------------|---|------------------------|------------|---------|
| XP: SMini6-G1 UP: SSMini6-F2 | | | | | |
| XP•UP | | XP•UP | | | |
|  | |  | | | |
| Nch × 2 | P _T (mW) | Pch + Nch | P _T (mW) | Pch | Nch |
| UP0487CG | 125 | | | — | 2SK3973 |
| UP0487BG | 125 | | | — | 2SK3938 |
| | | XP0497A UP0497AG | 150 125 | 2SJ0674 | 2SK3938 |
| XP04878 UP04878G | 150 125 | | | — | 2SK3539 |
| | | UP04979G | 125 | 2SJ0672 | 2SK3539 |
| | | | | — | 2SK0665 |

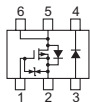
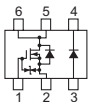
Small Signal FETs

Composite MOS FETs (For Power Management)

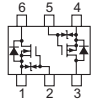
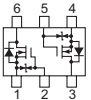
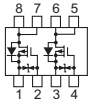
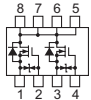
| Application | Absolute Maximum Rating | | | Electrical Characteristics | | | | | | | | Package | |
|------------------------------------|-------------------------|-------------------------|-----------------------|--------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|--------------------------|---------------------------------|----------------------------------|---|-----|
| | V _{DSS} (V) | V _{GSS} (V) | I _D (A) | R _{DS (on)} max. (mΩ) | | | | | C _{iss} (pF) | t _{on} typ. (ns) | t _{off} typ. (ns) | WSMini6-F1 | |
| | | | | V _{GS} = 5.0V | V _{GS} = 4.5V | V _{GS} = 4.0V | V _{GS} = 2.5V | V _{GS} = 1.8V | | | |  | |
| | | | | | | | | | | | | | |
| Load S/W | -12 | ±8 | -4.8 | — | — | 42 | 55 | 75 | 1 200 | 19 | 320 | | |
| | | | | 32 | | — | 40 | 60 | 1 400 | 20 | 430 | | |
| | -20 | ±10 | -4.2 | — | | 55 | 70 | — | 1 000 | 50 | 190 | | |
| DC-DC Converter | -20 | ±10 | -1.2 | — | — | 130 | 200 | 280 | 440 | 35 | 100 | MTM76420 | 0.7 |
| | -20/ 20 | ±10/ ±10 | -1.2/ 1.9 | | | 130/ 105 | 200/ 150 | — | 440/ 280 | 35/ 12 | 100/ 50 | | |
| | 20 | ±10 | 2.0 | | | 105 | 150 | 300 | 280 | 13 | 38 | | |
| Lithium battery protection circuit | 20 | ±12 | 7.0 | — | 21 | — | 33 | — | 1 450 | 1 030 | 6 000 | | |

△: Tentative

MOS FET + SBD (For Power Management)

| Application | FET Polarity | MOS FET | | | | | | | | SBD | | | | Package | | | |
|-----------------|--------------|-------------------------|-------------------------|-----------------------|----------------------------|------------------------|--------------------------|---------------------------------|----------------------------------|-------------------------|-----------------------|-------------------------------|--------------------------------|---|-----------------------|---|-----------------------|
| | | Absolute Maximum Rating | | | Electrical Characteristics | | | | | Absolute Maximum Rating | | Electrical Characteristics | | Package | | | |
| | | V _{DSS} (V) | V _{GSS} (V) | I _D (A) | R _{DS(on)} typ. | | C _{iss} (pF) | t _{on} typ. (ns) | t _{off} typ. (ns) | V _R (V) | I _F (A) | V _F max. (V) | I _R max. (μA) | WSMini6-F1 | | WSMini6-F1 | |
| | | | | | (mΩ) | V _{GS} (V) | | | | | | | |  | P _D (W) |  | P _D (W) |
| DC-DC Converter | Pch | -20 | ±10 | -2.0 | 80 100 140 | -4.0 -2.5 -1.8 | 300 | 14 | 112 | 15 | 0.7 | 0.45 | 250 | MTM86627 | 0.54 | | |
| | | | | | | | | | | 20 | 0.8 | 0.47 | 80 | MTM86627A | 0.54 | | |
| | | | ±12 | -1.0 | 300 420 | | 80 | 18 | 27 | 15 | 0.7 | 0.45 | 250 | MTM86628 | 0.54 | | |
| | Nch | 20 | ±10 | 2.2 | 80 100 | 4.0 2.5 | 280 | 13 | 38 | 20 | 0.8 | 0.47 | 80 | | | MTM86727 | 0.54 |

Small Signal FETs

| Package | | | | | | | |
|---|--------------------|---|--------------------|---|--------------------|---|--------------------|
| WSMini6-F1 | | | | WMini8-F1 | | | |
|  | |  | |  | |  | |
| Pch + Nch | P _D (W) | Nch × 2 | P _D (W) | Pch × 2 | P _D (W) | Nch × 2 | P _D (W) |
| | | | | MTM68410 | 1.0 | | |
| | | | | MTM68411 | 1.0 | | |
| | | | | △ MTM68423 | 1.0 | | |
| | | | | | | | |
| MTM76320 | 0.7 | | | | | | |
| | | MTM76520 | 0.7 | | | | |
| | | | | | | MTMC8E2A | 1.0 |



Small Signal Bipolar Transistors

Small Signal Transistors (Low-Frequency Amplifiers)

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | | | Package | | | | | | | |
|--|--------------------------|---------------------|--|---------------------|-----------------|---------------------|----------------------|---------------------|--|---------------------|--------------------------------------|---------------------|------------------------|---------------------|
| | V _{CEO} (V) | I _C (mA) | V _{CE(sat)} max. (V) NV*1 (mV) | I _C (mA) | h _{FE} | I _C (mA) | ML3-N2 | P _C (mW) | SSSMini3-F2 | P _C (mW) | SSMini3-F3 | P _C (mW) | SMini3-F2 | P _C (mW) |
| General-purpose | 50 | 100 | 0.5 0.3 | 100 | 160 to 460 | 2 | | | (2SA2021G 2SC5609G (h _{FE} : 180 to 390) | 100 100 | (2SB1462G 2SD2216G | 125 125 | (2SB1218G 2SD1819G | 150 150 |
| | | | | | 180 to 390 | | (2SA2079 2SC5848 | 100 100 | (2SA2078G 2SC5846G | 100 100 | (2SA2174G 2SC6054G | 125 125 | (2SA2122G 2SC5950G | 150 150 |
| | 500 | 0.6 | 300 | 85 to 340 | 150 | | | | | | (2SB1219G 2SD1820G | 150 150 | | |
| High-h _{FE} (High V _{EB0}) | 40 | 50 | 0.2 | 10 | 600 to 2 000 | 2 | | | | | 2SD2345G | 125 | 2SD1823G | 150 |
| | 100 | 20 | | | 400 to 1 200 | | | | 2SD2621G | 100 | 2SD2620G | 125 | 2SD1824G | 150 |
| Low freq. low noise amplifier | 120 | 20 | 130*1 | 1 | 180 to 700 | 2 | | | | | 2SB1722G (V _{CEO} 100 V) | 125 | 2SA2009G | 150 |
| | 150 | 50 | 150*1 | | 130 to 330 | 10 | | | | | (2SB1463G 2SD2240G | 125 125 | 2SB1220G | 150 |
| | 185 | | | | | | | | | | | | 2SD1821G | 150 |
| Low V _{CE(sat)} | 10 | 500 | 0.3 | 400 | 130 to 350 | 500 | | | | | | | 2SB1679G | 150 |
| | 12 | | 0.25 | 200 | 270 to 680 | 10 | | | (2SA2162G 2SC6036G | 100 100 | (2SA2161G 2SC6037G | 125 125 | | |
| | | | 0.4 | 500 | 200 to 800 | 500 | | | | | | | 2SD2623G | 150 |
| | 20 | 300 | 0.1 | 30 | 550 to 2 500 | 4 | | | | | | | 2SD1979G | 150 |
| | | 1 A | | 200 | 160 to 560 | 100 | | | | | | | (2SA2028G 2SC5654G | 150 150 |

(: Complementary pair

Small Signal Bipolar Transistors

Small Signal Transistors (Low-Frequency Amplifiers) (continued)

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | | | Package | | | |
|-------------------------------------|--------------------------|------------------------|--|--|-----------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| | V _{CEO} (V) | I _C (mA) | V _{CE(sat)} max. (V) N _V (mV)*1 f _T (MHz)*2 | I _C I _E *3 (mA) | h _{FE} | I _C (mA) | Mini3-G1 | P _C (mW) | NS-A1 NS-B1 | P _C (mW) |
| General-purpose | 50 | 100 | 0.3 | 100 | 160 to 460 | 2 | (2SB0709A 2SD0601A | 200 200 | (2SA1309A 2SC3311A | 300 300 |
| | | | | | 180 to 390 | | (2SA2077 2SC5845 | 200 200 | | |
| | | 500 | 0.6 | 300 | 85 to 340 | 150 | (2SB0710A 2SD0602A | 200 200 | (2SB1030A 2SD1423A | 300 300 |
| | | 200 | 0.3 | 100 | 85 to 500 | 2 | △2SB1734 | 200 | | |
| High-h _{FE} | 40 | 50 | 0.2 | 10 | 400 to 2 000 | 2 | 2SD1030 | 200 | | |
| | 100 | 20 | | | 400 to 1 200 | | 2SD1149 | 200 | | |
| Darlington | 50 | 500 | 2.5 | 500 | 4 000 to 20 000 | 500 | 2SD1478A | 200 | | |
| Low freq. low noise amplifier | 185 | 50 | 150*1 | 1 | 130 to 330 | 10 | (2SB0792A 2SD0814A | 200 200 | | |
| | 55 | 100 | | | 180 to 700 | 2 | | | 2SC3312 | 300 |
| Low V _{CE(sat)} | 10 | 500 | 0.3 | 400 | 130 to 350 | 500 | 2SB0970 | 200 | | |
| | | | 0.4 | 500 | 200 to 800 | | 2SD1328 | 200 | 2SD1450 | 300 |
| | 20 | 300 | 0.1 | 30 | 500 to 2 500 | 4 | 2SD1938F | 600 ¹⁾ | | |
| TV Chroma output | 300 | 70 | 50*2 | 10*3 | 30 to 150 | 5 | 2SA2084 | 200 | | |
| | | | 30*2 | | 60 to 220 | | 2SC5863 | 200 | | |

(: Complementary pair

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

△: Tentative

Small Signal Bipolar Transistors

Small Signal Transistors (High-frequency Amplifiers)

| Application | | Absolute Maximum Ratings | | Electrical Characteristics | | Package | | | | | | | | | |
|----------------------------------|--------------|--|------------------------|---|--|---------|------------------------|-------------|------------------------|------------------------|------------------------|------------------------|------------------------|----------------------|------------------------|
| | | V _{CEO} V _{CES} *1 (V) | I _C (mA) | f _T (Hz) t _s (ns)*2 | I _E , I _C *3 (mA) | ML3-N2 | | SSSMini3-F2 | | SSMini3-F3 | | SMini3-F2 | | Mini3-G1 | |
| | | | | | | | P _C (mW) | | P _C (mW) | | P _C (mW) | | P _C (mW) | | P _C (mW) |
| AM•FM Amp. | | 20 | 30 | 230 M | 1 | | | | | 2SC4655G | 125 | 2SC3936G | 150 | | |
| | | | | 300 M | | 2SA2163 | 100 | 2SA2164G | 100 | (2SA1790G 2SC4626G | 125 125 | (2SA1532G 2SC3930G | 150 150 | (2SA1022 2SC2295 | 200 200 |
| RF Amp. | | 50 | 50 | 250 M | 2 | | | | | (2SA1791G 2SC4656G | 125 125 | (2SA1748G 2SC4562G | 150 150 | | |
| Video IF FM RF Amp. | | 20 | 15 | 650 M | 1 | | | | | 2SC4627G | 125 | 2SC3931G | 150 | 2SC2404 | 150 |
| | | 8 | 50 | 1.1 G | 15 | | | | | | | 2SC5632G | 150 | | |
| VHF | OSC. Amp. | 20 | 50 | 1.3 G | 15 | | | 2SC5946G | 100 | | | 2SC3932G | 150 | 2SC2480 | 150 |
| UHF | OSC. | 10 | | 1.9 G | 5 | 2SC6050 | 100 | 2SC5939G | 100 | 2SC4809G | 125 | 2SC3935G | 150 | 2SC3130 | 150 |
| 1V RF Amp. | | 7 | 10 | 4.0 G | 1*3 | 2SC5829 | 50 | | | | | 2SC4410G | 50 | | |
| Wide Band Amp. SHF IF Amp. | | 12 | 30 | 4.5 G | 10*3 | | | | | | | 2SC3934G | 150 | | |
| | | 10 | 80 | 6.0 G | 20*3 | | | | | | | 2SC3937G | 150 | | |
| | | | | | 15*3 | | | 2SC6045G | 100 | 2SC4808G | 125 | 2SC4835G | 150 | | |
| | | | 65 | 8.5 G | | | | | | 2SC5295G | 125 | 2SC4805G | 150 | | |
| High speed switch | | 15 | 50 | 1.5 G/ 19*2 | 10 | 2SA2082 | 100 | | | 2SA1806G | 125 | 2SA1739G | 150 | 2SA1738 | 200 |
| | | 40*1 | 100 | 450 M/ 10*2 | | | | | | 2SC4691G | 125 | 2SC3938G | 150 | 2SC3757 | 200 |

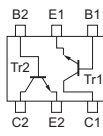
(: Complementary pair

Small Signal Bipolar Transistors

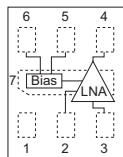
SiGe HBT

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | | | | Package |
|---------------------------|--------------------------|------------------------|----------------------------|-------------------------|-------------|----------------------------|------------|-----------------------------------|
| | V _{CEO} (V) | I _C (mA) | h _{FE} | f _T (GHz) | Cob (pF) | S21e ² (dB) | NF (dB) | ML3-N2 P _C = 100 mW |
| High-frequency Amplifiers | 6 | 30 | 100 to 220 | 19 | 0.3 | 11.0 | 1.4 | MSG43001 |
| | | 60 | | | 0.4 | 10.5 | | MSG43002 |
| | | 100 | | | 0.5 | 10.0 | | MSG43003 |
| | | | | 17 | 0.6 | 9.0 | MSG43004 | |
| | | | | 16 | 0.8 | 8.0 | 1.6 | MSG430C4 |
| | | | | 14 | 1.0 | 6.0 | | MSG430D4 |
| | | | | | | | | |

SiGe HBT (Combined Products)

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | | | | 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 | Tr1 (OSC) | Tr2 (Buffer) | |
| High-frequency Amplifiers | 6 | 30 | 100 to 220 | 19 | 0.3 | 11.0 | 1.4 | MSG36E11 | MSG33001 | |  |
| | | 100 | | | 0.5 | 10.0 | | MSG36E33 | MSG33003 | | |
| | | 100/30 | | | 0.5/0.3 | 10.0/11.0 | | MSG36E31 | MSG33003 | MSG33001 | |
| | | 100/60 | | 17/19 | 0.6/0.3 | 9.0/11.0 | 1.6/1.4 | MSG36E41 | MSG33004 | MSG33001 | |
| | | | | 16/19 | 0.8/0.4 | 8.0/10.5 | | MSG36C42 | MSG330C4 | MSG33002 | |
| | | | | 14/19 | 1.0/0.4 | 6.0/10.5 | | MSG36D42 | MSG330D4 | MSG33002 | |
| | | | | | | | | | | | |

SiGe HBT LNA (with built-in bias circuit)

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | | | | Package | Equivalent Circuit |
|--|--------------------------|-------------------------|----------------------------|-------------------------|------------------|-----------------------|----------------------|----------------------------------|---|
| | V _{CC} (V) | I _{CC} (mA) | V _{CC} (V) | I _{CC} (mA) | f (opr) (GHz) | Gp (dB) | NF (dB) | ML6-N6 P _T = 60 mW | |
| Low-noise high-frequency amplifier (LNA) | 3.8 | 18 | 2.2 to 3.6*1 | < 18*2 | 0.1 to 6*3 | 10.5 (f = 5.2 GHz) | 1.5 (f = 5.2 GHz) | MSG56BBA |  |
| | | 9 | | < 9*2 | | 11.5 (f = 5.2 GHz) | 1.6 (f = 5.2 GHz) | MSG56BBB | |














*1: Recommended voltage range

*2: Maximum value (adjustable using external resistance)

*3: Adjustable using input/output adjustment circuit

Small Signal Bipolar Transistors

Composite Transistors (NPN × 2 Series)










| Application | Absolute Maximum Ratings | | Electrical Characteristics | XN: Mini5-G2 XP: SMini5-G1 | | XN: Mini6-G3 XP: SMini6-G1 UP: SSMini6-F2 NP: SSSMini6-F1 | | | | | | Basic Type | Remarks |
|--|--------------------------|------------------------|----------------------------|---|---|---|---|---|---|---|---|---------------------|--|
| | V _{CEO} (V) | I _C (mA) | | h _{FE} | XN | XN | XN | XN | | XN | XN | NPN | |
| | | | | |  |  |  |  |  |  |  | | |
| | | | | XP | XP | XP•UP•NP | XP | XP | XP | | | | |
| | | | |  |  |  |  |  |  | | | | |
| General-use | 50 | 100 | 160 to 460 | XN01501G XP01501 | XN02501G XP02501 | XN04501G XP04501 UP04501G NP04501 | XN05501G XP05501 | | | XN06501G XP06501 △UP06501G | | 2SD0601A | |
| | | 500 | 85 to 340 | | | XN04502G | | | | | | 2SD0602A | |
| Low V _{CE(sat)} | 12 | 500 | 270 to 680 | | | UP04532G | | | | | | 2SC6037J | V _{CE(sat)} = 0.25 V max. |
| | | 20 | 300 | 500 to 2 500 | | | XN04506G XP04506 | | | | | 2SD1938(F) | V _{CE(sat)} = 0.1 V max. |
| | 500 | | 200 to 800 | | | XN04504G | | | | | | 2SD1328 | V _{CE(sat)} = 0.4 V max. |
| | | | | XN01558G | | | | | | | | 2SD2623 | |
| Low V _{CE(sat)} +General-use | 50/20 | 100/ 500 | 160 to 460/ 200 to 800 | | | XN04505G | | | | | | 2SD2216J 2SD1328 | V _{CE(sat)} = 0.5/ 0.4 V max. |
| High frequency | 10 | 50 | 75 to 400 | XN01531G XP01531 | | | XN05531G XP05531 | | | | | 2SC3130 | f _T = 1.9 GHz |
| | | 65 | 50 to 300 | | | | | | | XN06543G XP06543 | | 2SC3904 | f _T = 8.5 GHz |
| | 12 | 30 | 40 ≤ | | | | | | | XN06537G | | 2SC3934 | f _T = 4.5 GHz |
| | 20 | 15 | 40 to 260 | | | UP04534G | XP05534 | | | XN06534G XP06534 | | 2SC2404 | f _T = 650 MHz |
| High frequency +General-use | 20/50 | 15/ 100 | 65 to 260/ 160 to 460 | | | UP04598G | | | | | | 2SC2404 2SD2216J | f _T = 650/ 150 MHz |
| | | 50/ 100 | 25 to 250/ 160 to 460 | | | UP04599G | | | | | | 2SC3932 2SD2216J | f _T = 1 300/ 150 MHz |
| High-h _{FE} | 100 | 20 | 400 to 2 000 | | | XN04556G | XN05553G XP05553 | | | | | 2SD1149 | h _{FE} = 400 to 2 000 |
| High-speed switching | 40 | 100 | 60 to 320 | XP01554 | | | XP05554 | | | XN0A554G | | 2SC3757 | t _{on} = 17 ns, t _{off} = 17 ns |

Mini5P/6P: $P_T = 300 \text{ mW}$, SMini5P/6P: $P_T = 150 \text{ mW}$, SSMini6P: $P_T = 125 \text{ mW}$, SSSMini6P: $P_T = 125 \text{ mW}$

△: Tentative

Small Signal Bipolar Transistors

Composite Transistors (PNP × 2 Series)

| Function | Absolute Maximum Ratings | | Electrical Characteristics | XN: Mini5-G2 XP: SMini5-G1 | | XN: Mini6-G3 XP: SMini6-G1 UP: SSMini6-F2 NP: SSSMini6-F1 | | | Basic Type | Remarks |
|---|---|---|---|---|---|---|---------|---|------------|-----------------------------|
| | V_{CEO} (V) | I_C (mA) | h_{FE} | XN | XN | XN | | XN | PNP | |
| | | | |  |  |  | |  | | |
| XP | XP | XP•UP•NP | NP | XP | | | | | | |
|  |  |  |  |  | | | | | | |
| General-use | −50 | −100 | 160 to 460 | XN01401G XP01401 | XN02401G XP02401 | XN04401G XP04401 UP04401G NP04401 | | XN06401G XP06401 | 2SB0709A | |
| | | −500 | 85 to 340 | | | XN04402G | | | 2SB0710A | |
| Low $V_{CE(sat)}$ | −10 | −500 | 100 to 350 | | | XN04404G | | | 2SB0970 | $V_{CE(sat)} = -0.3$ V max. |
| High frequency | −20 | −30 | 50 to 220 | | | | | XN06435G XP06435 | 2SA1022 | $f_T = 150$ MHz (Min.) |
| | −15 | −50 | 50 to 150 | | | | NP0A456 | | 2SA2082 | $f_T = 1.5$ GHz |

Mini5P/6P: $P_T = 300$ mW, SMini5P/6P: $P_T = 150$ mW, SSSMini6P: $P_T = 125$ mW, SSSMini6P: $P_T = 125$ mW

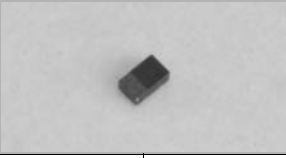
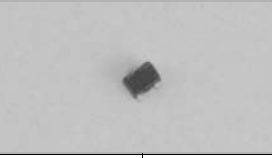

Composite Transistors (PNP + NPN Series)

| Function | Absolute Maximum Ratings | | Electrical Characteristics | XN: Mini5-G2 XP: SMini5-G1 | | | XN: Mini6-G3 XP: SMini6-G1 UP: SSSMini6-F2 NP: SSSMini6-F1 | | Basic Type | | Remarks | |
|---|--------------------------|------------------------|----------------------------|-------------------------------|---------------------|---------------------|---|---------------------|------------|----------|--|-----|
| | V _{CEO} (V) | I _C (mA) | | h _{FE} | XN | XN | XN | XN | XN | PNP | | NPN |
| | | | | | | | | | | | | |
| XP | XP | XP | XP•UP•NP | XP | | | | | | | | |
| | | | | | | | | | | | | |
| General-use | −50/ 50 | −100/ 100 | 160 to 460 | XN01601G XP01601 | XN0B301G XP0B301 | XN0C301G XP0C301 | XN04601G XP04601 UP04601G NP04601 | XN05601G XP05601 | 2SB0709A | 2SD0601A | | |
| | | −500/ 500 | 85 to 340 | XN01602G | | | XN04602G | | 2SB0710A | 2SD0602A | | |
| Low V _{CE(sat)} | −10/20 | −500/ 500 | 100 to 350/ 200 to 800 | | | | XN04604G | | 2SB0970 | 2SD1328 | V _{CE(sat)} = − 0.3/0.4 V max. | |
| Low V _{CE(sat)} +General- use | −10/50 | −500/ 100 | 100 to 350/ 160 to 400 | | | | XN04608G | | 2SB0970 | 2SD0601A | V _{CE(sat)} = − 0.3/0.4 V max. | |
| | −50/20 | −100/ 500 | 160 to 460/ 200 to 800 | | | | XN04609G | | 2SB0709A | 2SD1328 | | |
| High-speed switching | −15/ 40 | −50/100 | 50 to 150/ 60 to 320 | | | | XP04654 | | 2SA1738 | 2SC3757 | t _{on} = 12/17 ns, t _{off} = 20/17 ns | |

Mini5P/6P: $P_T = 300$ mW, SMini5P/6P: $P_T = 150$ mW, SSSMini6P: $P_T = 125$ mW, SSSMini6P: $P_T = 125$ mW

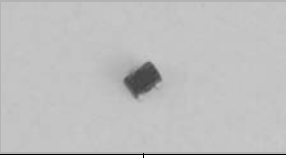
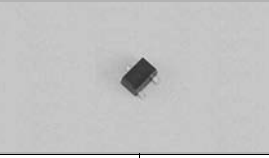

Transistor with Built-in Resistors

Transistor with Built-in Resistors ($I_C = 80$ mA Series)

| Resistor value (kΩ) | | Absolute Maximum Ratings | | Electrical Characteristics | Package | | | | |
|---------------------|----------------|--|------------------------|----------------------------|--|---------|---|----------|--|
| | | | | | ML3-N2 | | SSSMini3-F2 | | |
| | | | | |  | |  | | |
| R ₁ | R ₂ | V _{CEO} (V) | I _C (mA) | h _{FE} | PNP | NPN | PNP | NPN | |
| 0.51 | 5.1 | -50 50 | -80 80 | 20 ≤ | — | UNRF2A8 | UNR31A8G | UNR32A8G | |
| 1 | 10 | | | 30 ≤ | UNRF1A9 | UNRF2A9 | UNR31A9G | UNR32A9G | |
| 2.2 | 2.2 | | | 6 to 20 | — | UNRF2AV | UNR31AVG | UNR32AVG | |
| | 10 | | | 30 ≤ | UNRF1AH | — | UNR31AHG | — | |
| | 47 | | | 80 ≤ | UNRF1AM | UNRF2AM | UNR31AMG | UNR32AMG | |
| 4.7 | 4.7 | | | 20 ≤ | UNRF1AL | UNRF2AL | UNR31ALG | UNR32ALG | |
| | 10 | | | 30 ≤ | UNRF1AF | UNRF2AF | UNR31AFG | UNR32AFG | |
| | 47 | | | 80 to 400 | UNRF1AN | UNRF2AN | UNR31ANG | UNR32ANG | |
| | — | | | 160 to 460 | UNRF1A6 | UNRF2A6 | UNR31A6G | UNR32A6G | |
| 10 | 4.7 | | | 20 ≤ | — | UNRF2AK | — | — | |
| | 10 | | | 35 ≤ | UNRF1A1 | UNRF2A1 | UNR31A1G | UNR32A1G | |
| | 47 | | | 80 ≤ | UNRF1A4 | UNRF2A4 | UNR31A4G | UNR32A4G | |
| | — | | | 160 to 460 | UNRF1A5 | UNRF2A5 | UNR31A5G | UNR32A5G | |
| | 22 | | | 60 ≤ | UNRF1A2 | UNRF2A2 | UNR31A2G | UNR32A2G | |
| 22 | 47 | | | 80 to 400 | UNRF1AT | UNRF2AT | UNR31ATG | UNR32ATG | |
| | — | | | 160 to 460 | UNRF1A7 | UNRF2A7 | UNR31A7G | UNR32A7G | |
| | 22 | | | 60 ≤ | — | — | UNR31AEG | UNR32AEG | |
| 47 | 47 | | | 80 ≤ | UNRF1A3 | UNRF2A3 | UNR31A3G | UNR32A3G | |
| | — | | | 160 to 460 | UNRF1A0 | UNRF2A0 | UNR31A0G | UNR32A0G | |
| | 100 | | | 80 ≤ | UNRF1AA | — | UNR31AAG | UNR32AAG | |
| Equivalent circuit | | (PNP Type) | | | | | | | |
| | | (NPN Type) | | | | | | | |
| | |  | | | | | | | |



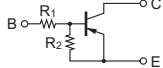
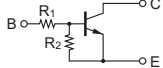
Transistor with Built-in Resistors

Transistor with Built-in Resistors ($I_C = 80$ mA Series) (continued)

| Resistor value (kΩ) | | Absolute Maximum Ratings | | Electrical Characteristics | Package | | | | | |
|---------------------|----------------|--|------------------------|----------------------------|--|----------|---|----------|----------|----------|
| | | | | | SSMini3-F3 | | SMini3-F2 | | | |
| | | | | |  | |  | | | |
| R ₁ | R ₂ | V _{CEO} (V) | I _C (mA) | h _{FE} | PNP | NPN | PNP | NPN | | |
| 0.51 | 5.1 | -50 50 | -80 80 | 20 ≤ | — | UNR92A8G | UNR51A8G | UNR52A8G | | |
| 1 | 10 | | | 30 ≤ | UNR91A9G | UNR92A9G | UNR51A9G | UNR52A9G | | |
| 2.2 | 2.2 | | | 6 to 20 | UNR91AVG | UNR92AVG | UNR51AVG | UNR52AVG | | |
| | 10 | | | 30 ≤ | UNR91AHG | — | UNR51AHG | — | | |
| | 47 | | | 80 ≤ | UNR91AMG | UNR92AMG | UNR51AMG | UNR52AMG | | |
| 4.7 | 4.7 | | | 20 ≤ | UNR91ALG | UNR92ALG | UNR51ALG | UNR52ALG | | |
| | 10 | | | 30 ≤ | UNR91AFG | UNR92AFG | UNR51AFG | UNR52AFG | | |
| | 47 | | | 80 to 400 | UNR91ANG | UNR92ANG | UNR51ANG | UNR52ANG | | |
| | — | | | 160 to 460 | UNR91A6G | UNR92A6G | UNR51A6G | UNR52A6G | | |
| 10 | 4.7 | | | 20 ≤ | — | — | — | — | | |
| | 10 | | | 35 ≤ | UNR91A1G | UNR92A1G | UNR51A1G | UNR52A1G | | |
| | 47 | | | 80 ≤ | UNR91A4G | UNR92A4G | UNR51A4G | UNR52A4G | | |
| | — | | | 160 to 460 | UNR91A5G | UNR92A5G | UNR51A5G | UNR52A5G | | |
| 22 | 22 | | | 60 ≤ | UNR91A2G | UNR92A2G | UNR51A2G | UNR52A2G | | |
| | 47 | | | 80 to 400 | UNR91ATG | UNR92ATG | UNR51ATG | UNR52ATG | | |
| | — | | | 160 to 460 | UNR91A7G | UNR92A7G | UNR51A7G | UNR52A7G | | |
| 47 | 22 | | | 60 ≤ | UNR91AEG | UNR92AEG | UNR51AEG | UNR52AEG | | |
| | 47 | | | 80 ≤ | UNR91A3G | UNR92A3G | UNR51A3G | UNR52A3G | | |
| | — | | | 160 to 460 | UNR91A0G | UNR92A0G | UNR51A0G | UNR52A0G | | |
| 100 | 100 | | | | | 80 ≤ | UNR91AAG | UNR92AAG | UNR51AAG | UNR52AAG |
| Equivalent circuit | | | | (PNP Type) | | | | | | |
| | | | | (NPN Type) | | | | | | |
| | |  | | | | | | | | |



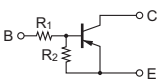
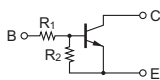
Transistor with Built-in Resistors

Transistor with Built-in Resistors ($I_C = 100$ mA Series)

| Resistor value (k Ω) | | Absolute Maximum Ratings | | Electrical Characteristics | Package | | | |
|------------------------------|-------|--|-------------|----------------------------|---|----------|---|----------|
| | | | | | SSMini3-F3 | | SMini3-F2 | |
| | | | | |  | |  | |
| R_1 | R_2 | V_{CEO} (V) | I_C (mA) | h_{FE} | PNP | NPN | PNP | NPN |
| 0.51 | 5.1 | -50 50 | -100 100 | $20 \leq$ | UNR9118G | UNR9218G | UNR5118G | UNR5218G |
| 1 | 10 | | | $30 \leq$ | UNR9119G | UNR9219G | UNR5119G | UNR5219G |
| 2.2 | 2.2 | | | 6 to 20 | UNR911VG | UNR921VG | UNR511VG | UNR521VG |
| | 10 | | | $30 \leq$ | UNR911HG | — | UNR511HG | — |
| | 47 | | | $80 \leq$ | UNR911MG | UNR921MG | UNR511MG | UNR521MG |
| 4.7 | 4.7 | | | $20 \leq$ | UNR911LG | UNR921LG | UNR511LG | UNR521LG |
| | 10 | | | $30 \leq$ | UNR911FG | UNR921FG | UNR511FG | UNR521FG |
| | 22 | | | 60 to 200 | — | — | UNR511ZG | UNR521ZG |
| | 47 | | | 80 to 400 | UNR911NG | UNR921NG | UNR511NG | UNR521NG |
| | — | | | 160 to 460 | UNR9116G | UNR9216G | UNR5116G | UNR5216G |
| 10 | 4.7 | | | $20 \leq$ | — | UNR921KG | — | UNR521KG |
| | 10 | | | $35 \leq$ | UNR9111G | UNR9211G | UNR5111G | UNR5211G |
| | 47 | | | $80 \leq$ | UNR9114G | UNR9214G | UNR5114G | UNR5214G |
| | — | | | 160 to 460 | UNR9115G | UNR9215G | UNR5115G | UNR5215G |
| 22 | 22 | | | $60 \leq$ | UNR9112G | UNR9212G | UNR5112G | UNR5212G |
| | 47 | | | 80 to 400 | UNR911TG | UNR921TG | UNR511TG | UNR521TG |
| | — | | | 160 to 460 | UNR9117G | UNR9217G | UNR5117G | UNR5217G |
| 47 | 10 | | | $30 \leq$ | UNR911DG | UNR921DG | UNR511DG | UNR521DG |
| | 22 | | | $60 \leq$ | UNR911EG | UNR921EG | UNR511EG | UNR521EG |
| | 47 | | | $80 \leq$ | UNR9113G | UNR9213G | UNR5113G | UNR5213G |
| | — | | | 160 to 460 | UNR9110G | UNR9210G | UNR5110G | UNR5210G |
| | 100 | | | $80 \leq$ | UNR911AG | UNR921AG | — | — |
| 100 | — | | | 160 to 460 | UNR911BG | UNR921BG | — | — |
| | 47 | | | $80 \leq$ | UNR911CG | UNR921CG | — | — |
| — | 100 | | | $80 \leq$ | — | — | — | UNR521WG |
| 0.27 | 5 | -30 -50 | -500 500 | $20 \leq$ | — | — | — | — |
| 2.2 | 2.2 | | | $40 \leq$ | — | — | — | — |
| | 10 | | | $60 \leq$ | — | — | — | — |
| 3.1 | 4.6 | | | $50 \leq$ | — | — | — | — |
| 4.7 | 4.7 | | | $50 \leq$ | — | — | — | — |
| 10 | 10 | | | $60 \leq$ | — | — | — | — |
| | 47 | | | $80 \leq$ | — | — | UNR5154G | — |
| 4.7 | — | | | $80 \leq$ | — | — | UNR5174G | — |
| 6.8 | 6.8 | | | 100 to 600 | — | — | — | UNR5226G |
| 10 | — | | | 6 to 20 | — | — | — | — |
| 10 | — | 20 | 600 | 100 to 600 | — | — | — | UNR5225G |
| Equivalent circuit | | (PNP Type) | | | | | | |
| | |  | | | | | | |
| | | (NPN Type) | | | | | | |
| | |  | | | | | | |

Transistor with Built-in Resistors

Transistor with Built-in Resistors ($I_C = 100$ mA Series) (continued)

| Resistor value (k Ω) | | Absolute Maximum Ratings | | Electrical Characteristics | Package | | | |
|------------------------------|-------|--|---------------|----------------------------|---|---------|---|---------|
| | | | | | Mini3-G1 | | NS-A1 NS-B1 | |
| | | | | |  | |  | |
| R_1 | R_2 | V_{CEO} (V) | I_C (mA) | h_{FE} | PNP | NPN | PNP | NPN |
| 0.51 | 5.1 | -50 50 | -100 100 | $20 \leq$ | UNR2118 | UNR2218 | UNR4118 | UNR4218 |
| 1 | 10 | | | $30 \leq$ | UNR2119 | UNR2219 | UNR4119 | UNR4219 |
| 2.2 | 2.2 | | | 6 to 20 | UNR211V | UNR221V | — | — |
| | 10 | | | $30 \leq$ | UNR211H | — | UNR411H | — |
| | 47 | | | $80 \leq$ | UNR211M | UNR221M | UNR411M | — |
| 4.7 | 4.7 | | | $20 \leq$ | UNR211L | UNR221L | UNR411L | UNR421L |
| | 10 | | | $30 \leq$ | UNR211F | UNR221F | UNR411F | UNR421F |
| | 22 | | | 60 to 200 | UNR211Z | UNR221Z | — | — |
| | 47 | | | 80 to 400 | UNR211N | UNR221N | UNR411N | — |
| | — | | | 160 to 460 | UNR2116 | UNR2216 | UNR4116 | UNR4216 |
| 10 | 4.7 | | | $20 \leq$ | — | UNR221K | — | UNR421K |
| | 10 | | | $35 \leq$ | UNR2111 | UNR2211 | UNR4111 | UNR4211 |
| | 47 | | | $80 \leq$ | UNR2114 | UNR2214 | UNR4114 | UNR4214 |
| | — | | | 160 to 460 | UNR2115 | UNR2215 | UNR4115 | UNR4215 |
| 22 | 22 | | | $60 \leq$ | UNR2112 | UNR2212 | UNR4112 | UNR4212 |
| | 47 | | | 80 to 400 | UNR211T | UNR221T | — | — |
| | — | | | 160 to 460 | UNR2117 | UNR2217 | UNR4117 | UNR4217 |
| 47 | 10 | | | $30 \leq$ | UNR211D | UNR221D | UNR411D | UNR421D |
| | 22 | | | $60 \leq$ | UNR211E | UNR221E | UNR411E | UNR421E |
| | 47 | | | $80 \leq$ | UNR2113 | UNR2213 | UNR4113 | UNR4213 |
| | — | | | 160 to 460 | UNR2110 | UNR2210 | UNR4110 | UNR4210 |
| 100 | 100 | | | $80 \leq$ | — | — | — | — |
| | — | | | 160 to 460 | — | — | — | — |
| — | 47 | | | $80 \leq$ | — | — | — | — |
| | 100 | | | $80 \leq$ | UNR211W | UNR221W | — | — |
| 0.27 | 5 | -30 -50 | -500 500 | $20 \leq$ | UNR212X | — | — | — |
| 2.2 | 2.2 | | | $40 \leq$ | UNR2121 | UNR2221 | UNR4121 | UNR4221 |
| | 10 | | | $60 \leq$ | UNR2124 | UNR2224 | UNR4124 | UNR4224 |
| 3.1 | 4.6 | | | $50 \leq$ | UNR212Y | — | — | — |
| 4.7 | 4.7 | | | $50 \leq$ | UNR2122 | UNR2222 | UNR4122 | UNR4222 |
| 10 | 10 | | | $60 \leq$ | UNR2123 | UNR2223 | UNR4123 | UNR4223 |
| | 47 | | | $80 \leq$ | UNR2154 | — | — | — |
| 4.7 | — | | | $80 \leq$ | — | — | — | — |
| 6.8 | 6.8 | | | 100 to 600 | — | UNR2226 | — | — |
| 10 | — | | | 6 to 20 | — | UNR2227 | — | — |
| | | 20 | 600 | 100 to 600 | — | UNR2225 | — | — |
| Equivalent circuit | | (PNP Type) | | | | | | |
| | |  | | | | | | |
| | | (NPN Type) | | | | | | |
| | |  | | | | | | |

Transistor with Built-in Resistors

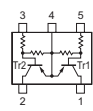
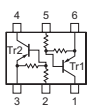
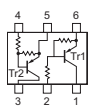
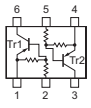
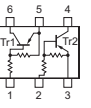
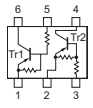
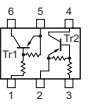
Composite Transistor with Built-in Resistors (NPN × 2 Series)

| Resistance (kΩ) | | Absolute Maximum Ratings | | Electrical Characteristics | XN: Mini5-G2 XP: SMini5-G1 UP: SSMini5-F3 | | XN: Mini6-G3 XP: SMini6-G1 UP: SSMini6-F2 NP: SSSMini6-F1 | | Basic Type |
|-----------------|----------------|--------------------------|------------------------|----------------------------|---|---------|--|---------------------|------------|
| R ₁ | R ₂ | V _{CE0} (V) | I _C (mA) | h _{FE} | XN | | XN | XN | |
| | | | | | XP•UP | XP | XP•UP•NP | XP•NP | |
| 2.2 | 47 | 50 | 100 80*1 | 80 ≤ | XP0121M UP0121MG | | XP0421M | | UNR221M |
| | | | | | | | | NP062AM*1 | UNR32AM |
| 4.7 | 4.7 | | | 20 | XP0121L | | XN0421LG | | UNR221L |
| | 10 | | | 30 ≤ | | | XN0421FG | | UNR221F |
| | 47 | | | 80 ≤ | XP0121N | | UP0421NG | | UNR221N |
| | | | | 80 to 400 | | | | NP062AN*1 | UNR32AN |
| | — | | | 160 to 460 | XN01216G XP01216 | | XN04216G XP04216 UP04216G | XN06216G XP06216 | UNR2216 |
| | | | | | | | NP042A6*1 | | UNR32A6 |
| 10 | 10 | | | 35 ≤ | XN01211G XP01211 UP01211G | XP02211 | XN04211G XP04211 UP04211G | XN06211G XP06211 | UNR2211 |
| | | | | | | | NP042A1*1 | NP062A1*1 | UNR32A1 |
| | 47 | | | 80 ≤ | XN01214G XP01214 UP01214G | | XN04214G XP04214 UP04214G | XN06214G XP06214 | UNR2214 |
| | | | | | | | NP042A4*1 | | UNR32A4 |
| | — | | | 160 to 460 | XN01215G XP01215 | XP02215 | XN04215G XP04215 UP04215G | XN06215G XP06215 | UNR2215 |
| | | | | | | | NP042A5*1 | | UNR32A5 |
| 22 | 22 | | | 60 ≤ | XN01212G XP01212 UP01212G | | XN04212G XP04212 UP04212G | XP06212 | UNR2212 |
| | | | | | | | NP042A2*1 | | UNR32A2 |
| | — | | | 160 to 460 | XP01217 | | XP04217 UP04217G | | UNR2217 |
| | | | | | | | NP042A7*1 | | UNR32A7 |
| 47 | 22 | | | 60 ≤ | XN0121EG XP0121E UP0121EG | | | | UNR221E |
| | 47 | | | 80 ≤ | XN01213G XP01213 UP01213G | | XN04213G XP04213 UP04213G | XN06213G XP06213 | UNR2213 |
| | | | | | | | NP042A3*1 | NP062A3*1 | UNR32A3 |
| | — | | | 160 to 460 | XN01210G XP01210 | XP02210 | XN04210G XP04210 UP04210G | XP06210 | UNR2210 |
| | | | | | | | NP042A0*1 | NP062A0*1 | UNR32A0 |

Mini5P/6P: P_T = 300 mW, SMini 5P/6P: P_T = 150 mW, SSMini5P/6P: P_T = 125 mW, SSSMini6P: P_T = 125 mW

Transistor with Built-in Resistors


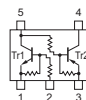
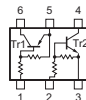
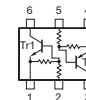
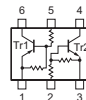
Composite Transistor with Built-in Resistors (PNP × 2 Series)

| Resistance (kΩ) | | Absolute Maximum Ratings | | Electrical Characteristics | XN: Mini5-G2 XP: SMini5-G1 UP: SSMini5-F3 | | XN: Mini6-G3 XP: SMini6-G1 UP: SSMini6-F2 NP: SSSMini6-F1 | | | Basic Type | | | |
|-----------------|----------------|--------------------------|---------------------|---------------------------------|--|---|--|--|---|------------|---------|---------|--|
| R ₁ | R ₂ | V _{CEO} (V) | I _C (mA) | h _{FE} | <div>XN </div> | <div>XN </div> | | <div>XN </div> | | | | | |
| | | | | | <div>XP•UP </div> | <div>XP•UP•NP </div> | <div>NP </div> | <div>XP•NP </div> | <div>NP </div> | | | | |
| 0.51 | 5.1 | -50 | -100 -80*1 | 20 ≤ | XP01118 | | | | | UNR2118 | | | |
| 1 | 10 | | | 30 ≤ | XN01119G XP01119 | | | | | | UNR2119 | | |
| 2.2 | 10 | | | | XN0111HG XP0111H | | | | | | UNR2111 | | |
| | 47 | | | 80 ≤ | | | | NP061AM*1 | | | UNR31AM | | |
| 4.7 | 10 | | | | XN0111MG XP0111M | XP0411M UP0411MG | | | | UNR211M | | | |
| | 30 ≤ | | | XN0111FG XP0111F UP0111FG | | | | | | | UNR211F | | |
| | 47 | | | 80 to 400 | | | | NP061AN*1 | | | UNR31AN | | |
| | — | | | 160 to 460 | XN01116G XP01116 | XN04116G XP04116 UP04116G | | XP06116 | | | UNR2116 | | |
| 10 | 10 | | | 35 ≤ | XN01111G XP01111 | XN04111G XP04111 UP04111G | | XP06111 | | | UNR2111 | | |
| | | | | | | NP041A1*1 | | NP061A1*1 | | | UNR31A1 | | |
| | 47 | | | 80 ≤ | XN01114G XP01114 | XN04114G XP04114 | | XP06114 | | | UNR2114 | | |
| | — | | | | | NP041A4*1 | | | | UNR31A4 | | | |
| | 160 to 460 | | | XN01115G XP01115 | XN04115G XP04115 | | XP06115 | | | UNR2115 | | | |
| | | | | | | NP041A5*1 | | NP061A5*1 | | | UNR31A5 | | |
| 22 | 22 | | | 60 ≤ | XN01112G XP01112 | XN04112G XP04112 UP04112G | | XP06112 | | | UNR2112 | | |
| | 47 | | | | | NP041A2*1 | | NP061A2*1 | | | UNR31A2 | | |
| | — | | | 80 to 400 | | UP0411TG | | | | | UNR211T | | |
| | | | | 160 to 460 | XP01117 | XP04117 UP04117G | | | | | | UNR2117 | |
| 47 | 22 | | | 60 ≤ | | | | NP0G1AE*1 | | | UNR31AE | | |
| | | | | | | | | | | | | | |
| | 47 | | | 80 ≤ | XN01113G XP01113 UP01113G | XN04113G XP04113 UP04113G | | XN06113G XP06113 | | | | UNR2113 | |
| | — | | | | | | NP041A3*1 | | NP061A3*1 | NP0J1A3*1 | UNR31A3 | | |
| | 160 to 460 | | | XN01110G XP01110 | | | | | | | | UNR2110 | |
| | | | | | | NP041A0*1 | | | | | | UNR31A0 | |
| — | 10 | -15 | -500 | 80 to 280 | | XN04130G | | | | | — | | |

Mini5P/6P: P_T = 300 mW, SMini 5P/6P: P_T = 150 mW, SSMini5P/6P: P_T = 125 mW, SSSMini6P: P_T = 125 mW

Transistor with Built-in Resistors



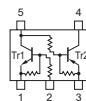
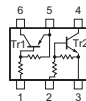
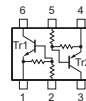
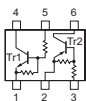
Composite Transistor with Built-in Resistors (PNP + NPN Series)

| Resistance (kΩ) | | Absolute Maximum Ratings | | Electrical Characteristics | XN: Mini5-G2 XP: SMini5-G1 UP: SSMini5-F3 | | XN: Mini6-G3 XP: SMini6-G1 UP: SSMini6-F2 NP: SSSMini6-F1 | | Basic Type | | | | |
|-----------------|----------------|--------------------------|--|----------------------------|---|--|---|--|---|---------|---------|---------|---------|
| R ₁ | R ₂ | V _{CEO} (V) | I _C (mA) | h _{FE} | XN  | XP•UP  | NP  | XP•UP•NP  | NP  | PNP | NPN | | |
| 2.2 | 47 | 50/ -50 | 500/ -500*2 100/ -100 80/ -80*1 | 80 ≤ | | | | XP0431M UP0431MG | | UNR211M | UNR221M | | |
| 4.7 | 4.7 | | | 50 ≤ | | | | XN04322G*2 | | | | UNR2122 | UNR2222 |
| | 47 | | | 80 to 400 | | | | NP043AN | | | | UNR31AN | UNR32AN |
| | — | | | 80 ≤ | | | | XP0431N UP0431NG | | | | UNR211N | UNR221N |
| | | | | 160 to 460 | XP03316 | | XN04316G XP04316 UP04316G | | | | UNR2116 | UNR2216 | |
| 10 | 10 | | | 35 ≤ | XN0A311 XP03311 UP03311G | | XN04311G XP04311 UP04311G | | | | UNR2111 | UNR2211 | |
| | | | | | | | NP043A1*1 | | | | UNR31A1 | UNR32A1 | |
| | 47 | | | 80 ≤ | | | XN04314G XP04314 UP04314G | | | | UNR2114 | UNR2214 | |
| | — | | | | | | NP043A4*1 | | | | UNR31A4 | UNR32A4 | |
| | | | | 160 to 460 | | | XN04315G XP04315 UP04315G | | | | UNR2115 | UNR2215 | |
| | | | | | | | NP0G3A5*1 | NP043A5*1 | | | | UNR31A5 | UNR32A5 |
| 22 | 22 | | | 60 ≤ | XN0A312G XP03312 UP03312G | | XN04312G XP04312 UP04312G | | | | UNR2112 | UNR2212 | |
| | 47 | | | | | | NP043A2*1 | | | | UNR31A2 | UNR32A2 | |
| | | | | 80 to 400 | | | UP0431TG | | | | UNR211T | UNR221T | |
| 47 | 47 | | | 80 ≤ | | | | XP04313 UP04313G | | | | UNR2113 | UNR2213 |
| | — | | | | | | NP0G3A3*1 | NP043A3*1 | NP0H3A3*1 | | | UNR31A3 | UNR32A3 |
| | | | | 160 to 460 | | | NP0G3A0*1 | | | | | UNR31A0 | UNR32A0 |

Mini5P/6P: P_T = 300 mW, SMini 5P/6P: P_T = 150 mW, SSMini5P/6P: P_T = 125 mW, SSSMini6P: P_T = 125 mW

Transistor with Built-in Resistors

Composite Transistor with Built-in Resistors (PNP + NPN Series) (continued)

| Resistancce (kΩ) | | | | Absolute Maximum (Tr1/Tr2) | | Electrical Characteristics (Tr1/Tr2) | XP: SMini5-G1 UP: SSMini5-F3 | XP: SMini6-G1 UP: SSMini6-F2 NP: SSSMini6-F1 XN: Mini6-G3 | | | | Basic Type | |
|------------------|----------------|----------------|----------------|-------------------------------|------------------------|--|--|---|--|---|---------|------------|---------|
| Tr1 | | Tr2 | | V _{CEO} (V) | I _C (mA) | h _{FE} | XN  | | XN  | | PNP | NPN | |
| R ₁ | R ₂ | R ₁ | R ₂ | | | | XP•UP  | NP  | XP•UP•NP  | NP  | | | |
| 4.7 | 4.7 | 1 | 10 | 50/ -50 | 100/ -100 | 80 to 400/ 30 ≤ | | | XP04286 | | UNR2119 | UNR221N | |
| | 47 | 4.7 | — | | | 80 to 400/ 160 to 460 | XP03391 | | | | UNR211N | UNR2216 | |
| 10 | 10 | 0.51 | 5.1 | 50/ -30 | 80/ -80 | 35 ≤/ 20 ≤ | XP03389 | | | | UNR2118 | UNR2211 | |
| | | 10 | 47 | | | 35 ≤/ 80 ≤ | UP03397G | | | | UNR2154 | UNR2211 | |
| | | 22 | — | | | | UP03396G | | | | UNR211T | UNR2211 | |
| | — | 47 | — | 50/ -50 | 80/ -80 | 160 to 460 | | | | NP063D3 | UNR31A0 | UNR32A5 | |
| 22 | 47 | 4.7 | 4.7 | -50/ 50 | -80/ 80 | 80 to 400/ 20 ≤ | | NP0G3D2 | | | UNR31AT | UNR32AL | |
| 0.51 | | 5.1 | 50/ -50 | 100/ -100 | 80 ≤/ 20 ≤ | UP03394G | | | | UNR2118 | UNR2213 | | |
| 1 | | 10 | | | 80 ≤/ 30 ≤ | | | XP04387 UP04387G | | UNR2119 | UNR2213 | | |
| 4.7 | | 4.7 | 50/ -50 | 100/ -100 | 80 ≤/ 20 ≤ | | NP0G3D1 | | | | UNR31A3 | UNR32AL | |
| | | | | | 80 ≤/ 50 ≤ | | | XN04381G | | | UNR2122 | UNR2213 | |
| 10 | | 47 | 50/ -50 | 100/ -100 | 80 ≤/ 30 ≤ | XP03383 UP03383G | | UP04383G | | | UNR211F | UNR2213 | |
| | | | | | 80 ≤/ 80 ≤ | XP03390 UP03390G | UP04390G | | | | UNR2114 | UNR2213 | |
| 22 | | 47 | -50/ 50 | -80/ 80 | | | | | NP0G3D3 | | | | UNR31A4 |
| | | | | | | | | | | | | UNR31A3 | UNR32AT |
| — | — | 4.7 | — | -12/ 50 | -500/ 100 | 270 to 680/ 80 to 400 | | | UP04A8MG | | 2SA2161 | UNR221N | |
| | | | | 50/ -50 | 100/ -100 | 150 to 460/ 20 ≤ | | | XN04A88G | | UNR211S | 2SD0601A | |

Mini5P/6P: P_T = 300 mW, SMini 5P/6P: P_T = 150 mW, SSMini5P/6P: P_T = 125 mW, SSSMini6P: P_T = 125 mW

Bipolar Power Transistors

Low-Frequency Amplifiers

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | | | | Package | | | | | |
|--------------------------|--------------------------|-----------------------|---|--|------------------------|--------------------|-----------------------|---------|-----------------------|------------------------|-----------------------|------------------------|-----------------------|
| | V _{CEO} (V) | I _C (A) | V _{CE(sat)} (V) f _T *1 (MHz) | I _C I _E *2 (A) | I _B (mA) | h _{FE} | I _C (A) | U-G2 | P _C (W) | MiniP3-F2 | P _C (W) | MT-2-A1 | P _C (W) |
| General-purpose | 40 | 1.5 | 1.0 | 1.5 | 150 | 80 to 220 | 1.0 | 2SB0968 | 10 | (2SB1599G 2SD2457G | 1 | | |
| | 50 | 1.0 | 0.4 | 0.5 | 50 | 85 to 340 | 0.5 | | | (2SB0766G 2SD0874G | 1 | (2SB1322A 2SD1994A | 1 |
| | | 2.0 | 0.3 | 1.0 | | 120 to 340 | 0.2 | 2SB1574 | 10 | | | | |
| | | 5.0 | | 2.0 | 100 | | 0.5 | | | (2SB1440G 2SD2185G | 1 | (2SB1434 2SD2177 | 1 |
| | | 2.0 | | 1.0 | 50 | | 0.2 | | | | | 2SD2179 | 1 |
| | 60 | 2.0 | 0.3 | 0.5 | 50 | 120 to 340 | 0.1 | | | | | 2SD2177A | 1 |
| | 80 | 0.5 | | | | | | | | (2SB0767G 2SD0875G | 1 | | |
| | | 1.0 | | | | | | | | (2SA1890G 2SC5026G | 1 | (2SA1674 2SC4391 | 1 |
| | 150 | | | | 25 | | | | | 2SD2459G | 1 | | |
| | | | | | | | | | | | | | |
| High-h _{FE} | 20 | 0.7 | 0.4 | 0.5 | 50 | 1 000 to 2 500 | 0.15 | | | | | 2SD2259 | 1 |
| | 60 | 2.0 | 1.0 | 2.0 | | 500 to 2 500 | 0.5 | 2SD2453 | 10 | | | | |
| Low V _{CE(sat)} | 10 | 1.0 | 0.15 | 0.5 | 20 | 200 to 800 | 0.1 | | | | | 2SD2358 | 1 |
| | 20 | 0.5 | 0.4 | | | | | | | 2SD2210G | 1 | | |
| | | 1.0 | 0.5 | 1.0 | 50 | 130 to 280 | 0.5 | | | (2SB0956G 2SD1280G | 1 | | |
| | | 4.0 | 1.0 | 3.0 | 100 | 120 to 315 | 2.0 | | | 2SB1073G | 1 | | |
| | 25 | 3.0 | | | | 230 to 600 | 0.5 | | | 2SD1119G | 1 | | |
| Darlington | 50 | 0.5 | 2.5 | 0.5 | 0.5 | 4 000 to 20 000 | 0.5 | | | | | 2SD2598 | 1 |
| | | 1.0 | 1.8 | 1.0 | 1 | 4 000 to 40 000 | 1.0 | | | | | 2SD2258 | 1 |
| | 80 | | | | | | | | | 2SD1511G | 1 | | |
| | 100 | 2.0 | 1.5 | | | | | | | | | 2SD2067 | 1 |
| High breakdown voltage | 120 | 0.5 | 0.6 | 0.5 | 50 | 90 to 220 | 0.15 | | | (2SB0789G 2SD0968G | 1 | | |
| | | | 1.0 | 0.3 | 30 | 90 to 330 | | | | | | 2SD2225 | 1 |
| | 400 | 0.1 | 1.5 | 0.05 | 5 | 30 ≤ | 0.03 | | | 2SD2413G | 1 | | |
| | | 0.5 | | 0.25 | 50 | | | | | | | 2SD2565 | 1 |
| TV Chroma output | 300 | 0.07 | 50*1 | 0.01*2 | — | 30 to 220 | 0.005 | | | | | 2SC5419 | 1 |

(: Complementary pair

P_C: T_C = 25°C

Bipolar Power Transistors

For Power Amplification

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | | Package | | | |
|-----------------------------|--------------------------|----------------|------------------------------|-----------------------|------------------------|------------|-----------------------|----------|-----------------------|
| | V _{CEO} | I _C | V _{CE(sat)} max. | I _C (A) | I _B (mA) | TO-220D-A1 | | | |
| | (V) | (A) | (V) | | | PNP | P _C (W) | NPN | P _C (W) |
| General-use | 80 | 3 | 1.2 | 3 | 375 | 2SB1548A | 25 | 2SD2374A | 25 |
| | 60 | | 0.8 | | | 2SB1724 | 30 | 2SD2693 | 25 |
| | 80 | | | | | 2SB1724A | 30 | 2SD2693A | 25 |
| | 180 | 2 | 1 | 0.5 | 50 | 2SA2118 | 25 | 2SC5935 | 25 |
| Low V _{CE(sat)} | 50 | 10 | 0.5 | 5 | 250 | 2SA2064 | 25 | 2SC5779 | 25 |
| | 60 | 3 | | 3 | 375 | 2SA2057 | 20 | 2SC5739 | 20 |
| | 180 | 1.5 | | 1 | 100 | 2SA2140 | 20 | 2SC5993 | 20 |
| High-h _{FE} | 60 | 3 | 1 | 2 | 50 | | | 2SD2375 | 25 |
| | | 5 | 0.3 | 4 | 100 | | | 2SD2528 | 40 |
| Darlington | 60 | 4 | 2 | 3 | 12 | 2SB1623 | 30 | 2SD2420 | 30 |
| | 80 | | | | | 2SB1623A | 30 | 2SD2420A | 30 |

P_C : $T_C = 25^\circ\text{C}$

For Switching

| Application | Absolute Maximum Ratings | | | Electrical Characteristics | | | | Package | |
|----------------------|--------------------------|------------------|--------------|------------------------------|--------------|---------------|----------------------------|------------|--------------|
| | V_{CBO} (V) | V_{CEO} (V) | I_C (A) | $V_{CE(sat)}$ max. (V) | I_C (A) | I_B (mA) | t_f (μs) | TO-220D-A1 | P_C (W) |
| High-speed switching | 500 | 400 | 3 | 1 | 1.5 | 300 | 0.3 | 2SC4953 | 30 |

P_C : $T_C = 25^\circ\text{C}$

For TV and CRT Monitor

| Application | Absolute Maximum Ratings | | Electrical Characteristics | | Package | |
|-------------|--------------------------|--------------|------------------------------|--------------------------------|------------|--------------|
| | V_{CBO} (V) | I_C (A) | $V_{CE(sat)}$ max. (V) | t_f typ (μs) | TO-220D-A1 | P_C (W) |
| VM circuit | -180 | -1.5 | -0.5 | 0.1 | 2SA2140 | 20 |
| | 180 | 1.5 | 0.5 | | 2SC5993 | 20 |

P_C : $T_C = 25^\circ\text{C}$

Power MOS FETs

Power MOS FETs

| Absolute Maximum Ratings | | | P _D (W) | Electrical Characteristics | | | | | Package | |
|--------------------------|-------------------------|-----------------------|-----------------------|------------------------------------|----------------------------------|------------------------------------|--------------------------------|-------------------------------------|------------|------------|
| V _{DSS} (V) | V _{GSS} (V) | I _D (A) | | R _{DS(on)} max. (Ω) | Y _{fs} typ. (S) | t _{d(on)} typ. (ns) | t _f typ. (ns) | t _{d(off)} typ. (ns) | TO-220C-G1 | TO-220D-A1 |
| 100 | ±20 | 25 | 50 | 0.1 | 11 | 15 | 35 | 65 | 2SK3269 | |
| 110 | ±25 | 28 | 40 | 0.052 | 21 | 30 | 90 | 150 | | 2SK4174 |
| 200 | ±30 | 30 | 50 | | 22 | 32 | 88 | 170 | 2SK3995 | |
| | | | 40 | | | | | | | 2SK4208 |

IGBT Discrete

IGBT

| Absolute Maximum Ratings | | | | Electrical Characteristics | | Package |
|--------------------------|-----------------------|------------------------|-----------------------|----------------------------------|-----------------------------|------------|
| V _{CES} (V) | I _C (A) | I _{CP} (A) | P _C (W) | V _{CE(sat)} max. (V) | t _f typ. (ns) | TO-220D-A1 |
| 430 | 40 | 230 | 40 | 2.4 | 175 | 2PG006 |
| 510 | | | | 2.5 | 185 | 2PG009 |
| 540 | | | | | | 2PG011 |

Multi Chip Discrete Devices

Composite Transistors..... J2

 MOS FET + SBD (For Power Management) J2

 TR + load device..... J2

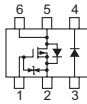
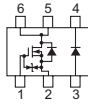
 Transistor with built-in resistors + SBD..... J2




Composite Transistors

Composite Transistors


MOS FET + SBD (For Power Management)

| Application | FET Polarity | MOS FET | | | | | | | SBD | | | | Package | | | | |
|-----------------|--------------|-------------------------|-------------------------|-----------------------|----------------------------------|------------------------|--------------------------|------------------------------|-------------------------------|-----------------------|----------------------------|----------------------------|---|-----------------------|---|-----------------------|--|
| | | Absolute Maximum Rating | | | Electrical Characteristics | | | | Absolute Maximum Rating | | Electrical Characteristics | | | | | | |
| | | V _{DSS} (V) | V _{GSS} (V) | I _D (A) | R _{DS(on)} typ. (mΩ) | V _{GS} (V) | C _{iss} (pF) | t _{on} typ. (ns) | t _{off} typ. (ns) | V _R (V) | I _F (A) | V _F max. (V) | I _R max. (μA) | WSSMini6-F1 | | WSSMini6-F1 | |
| | | | | | | | | | | | | |  | P _D (W) |  | P _D (W) | |
| DC-DC Converter | Pch | -20 | ±10 | -2.0 | 80 100 140 | -4.0 -2.5 -1.8 | 300 | 14 | 112 | 15 | 0.7 | 0.45 | 250 | MTM86627 | 0.54 | | |
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TR + load device

| Application | Absolute Maximum | | | | | Electrical Characteristics | | | Package |
|-------------------------|------------------------|-------------------------|--------------------------|---------------------------------|------------------------|----------------------------|------------|-----------------|---|
| | | | | | P _T (mW) | | | SSMini6-F2 | |
| | TR | | CCD load device | | | TR | | CCD load device |  |
| V _{CEO} (V) | I _C (mA) | V _{max} (V) | I _{max} (mA) | f _T typ. (MHz) | h _{FE} | I _P (mA) | | | |
| CCD output circuit | 20 | 15 | 40 | 10 | 125 | 640 | 65 to 160 | 3.5 to 5.5 | UP05C8BG |
| | | 1 000 | | | | 25 to 250 | UP05C8GG | | |
| | | 50 | | | | 1 300 | 100 to 250 | 3.8 to 5.2 | UP05C8GF |
| | | | | | | | | 5.0 to 7.0 | UP05C8PG |

Transistor with built-in resistors + SBD

| Application | Absolute Maximum | | | | Electrical Characteristics | | | | Package | |
|-----------------|------------------|-----------|-----------|-----------|----------------------------|--------------|----------------|-----------------|------------|---|
| | TR | | SBD | | TR | | SBD | | SSMini5-F3 | |
| | 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) | P_T (mW) |  |
| Digital circuit | -50 | -0.08 | 20 | 0.2 | -0.25 | 47/47 | 0.5 | 0.1 | 125 | UP0KG8DG |














Diodes

| | |
|--|-----|
| Switching Diodes | K2 |
| Switching Diodes | K2 |
| Band Switch Diodes | K5 |
| PIN Diodes | K5 |
| Schottky Barrier Diodes | K6 |
| For Small Signal (I_F = Less than 1 000 mA) | K6 |
| For Power | K12 |
| Rectifier Diodes | K13 |
| Fast Recovery Diodes | K13 |
| For Small Signal | K13 |
| For Power | K13 |
| Zener Diodes | K14 |
| Zener Diodes Series | K14 |
| Low C_t Series | K16 |
| Surge Protective Diode | K16 |
| Bidirectional Zener Diode | K16 |
| High ESD (30 kV) Protection Device | K16 |
| High Surge Absorption Diode | K16 |


































Switching Diodes

Switching Diodes

| Electrical Characteristics | | | | Surface mounting package | | | | | | | |
|----------------------------|---------------|-----------------------------|--------------------------|--|---|--|--|---|--|--|--|
| V_R (V) | I_F (mA) | I_R max. (μ A) | t_{rr} max. (ns) | ML2-N1 | ML3-N2 | USSMini2-F1 | SSSMini2-F3 | SSSMini3-F2 | SSMini2-F4 | SSMini3-F3 | SSMini4-F1 |
| 200 | 100 | 1.0 | 60 | | | | | | MA2S1010G  ($V_R = 250$ V) | | |
| | | | — | | | | | | | | |
| 150 | 200 | 0.2 | — | | | | | | | | |
| | | | — | | | | | | | | |
| 80 | 100 | 0.1 | 10/3 | | | | | | | | |
| | | | 10 | | | | | MAS3132DG  | | MA3S132DG  | |
| | | | | | | | | | | | |
| | | | 3 | | MA36132E  | | | MAS3132EG  | | MA3S132EG  | |
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| | | | | MA26111  | | MAU2111  | MA271110G  | | MA2S1110G  | MA3S132AG  | MA4S111  |
| | | | | | | | | | | MA3S132KG  | |
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















Switching Diodes

| Surface mounting package | | | | | | | |
|--|--|--|---|--|---|--|--|
| SMini2-F3 | SMini3-F2 | SMini4-F2 | SMini5-F1 | SMini6-F1 | Mini3-G1 | Mini4-G3 | Mini6-G3 |
| MA2Z0010G  | MA3X1000G  | | | | MA3X199  | | |
| | | | | | MA3X158  | MA4X1740G  | |
| MA2J1150G  | | | | | | | MA6X1290G  |
| MA2J1140G  | | | | | | | |
| | | | | | | MA4X1930G  | MA6X1260G  |
| | MA3J142DG  | | MA5J002D  | | MA3X152D  | | MA6X1220G  |
| | MA3J142AG  | | | | | | MA6X1270G  |
| | MA3J142EG  | | MA5J002E  | | MA3X152E  | | MA6X1230G  |
| | | | | | | | MA6X1240G  |
| | | | | | | | MA6X1280G  |
| MA2J1110G  | | MA4Z1590G  | | MA6Z121  | MA3X152A  | MA4X159AG  | MA6X1210G  |
| | MA3J142KG  | | | | MA3X152K  | MA4X160AG  | |

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Switching Diodes

Switching Diodes (continued)

| Electrical Characteristics | | | | Surface mounting package | | | | | | |
|----------------------------|---------------|-----------------------------|--------------------------|--|--|--|--|--|--|--|
| V_R (V) | I_F (mA) | I_R max. (μ A) | t_{rr} max. (ns) | SSMini3-F3 | SMini2-F3 | SMini3-F2 | SMini4-F2 | Mini3-G1 | Mini4-G3 | Mini6-G3 |
| 80 | 100 | 0.1 | 3 | MA3S1370G  | | MA3J1470G  | | MA3X157A  | | |
| | | | — | MA3S1330G  | | MA3J143AG  | | MA3X153A  | | |
| | 200 | 0.05 | 10 | | MA2J1130G  | | MA4J1130G  | | | |
| 40 | 100 | 0.1 | 3 | | | | | | MA4X1600G  | |
| | | | — | | | MA3J1430G  | | MA3X153  | | MA6X1250G  |
| | 200 | 0.05 | 10 | | MA2J1120G  | | | | | |
| | 100 | 0.01 | 100 | | MA2J1160G  | | | MA3X198  | MA4X1940G  | |

Switching Diodes

Band Switch Diodes

| Part No. | V_R (V) | I_F max. (mA) | C_D typ. (pF) | V_R (V) | r_f typ. (Ω) | Package |
|----------|--------------|-----------------------|-----------------------|--------------|-------------------------------|-------------|
| MA2S077G | 35 | 100 | 0.9 | 6 | 0.65 | SSMini2-F4 |
| MA27077G | | | | | | SSSMini2-F3 |
| MA26077 | | | | | | ML3-N2 |





























PIN Diodes

| Part No. | V _R (V) | I _F (mA) | C _t max. (pF) | V _R (V) | r _f max. (Ω) | I _F (mA) | Package | | |
|-----------|-----------------------|------------------------|--------------------------------|-----------------------|-------------------------------|------------------------|-----------------------------------|--|--|
| MA2JP020G | 60 | 100 | 0.5 | 1 | 2.0 | 10 | SMini2-F3 | | |
| MA3JP02FG | | 100 (65) | | | | | SMini3-F2 2 elements contained | | |
| MA2SP010G | | 100 | 0.8 | | 1.0 | | SSMini2-F4 | | |
| MA2SP020G | | | 0.5 | | 2.0 | | | | |
| MA2SP050G | | 50 | 2.4 | 0 | 5.5 | | | | |
| MA2SP060G | | 100 | 0.55 | 1 | 1.0 | | SSSMini2-F3 | | |
| MA27P010G | | | 0.8 | | 2.0 | | | | |
| MA27P020G | | | 0.5 | | | | | | |
| MA27P060G | | | 0.6 | | 1.2 | | | | |
| MA27P070G | | | 0.35 | | 1.5 | | | | |
| MA27P110G | | 50 | 0.8 | 0 | | | | | |
| MA27P120G | | 100 | typ 0.27 | 1 | typ 0.8 | | ML2-N1 | | |
| MA26P01 | | | 0.8 | | 1.0 | | | | |
| MA26P02 | | | 0.5 | | 2.0 | | | | |
| MA26P07 | | | 0.35 | | 1.5 | | | | |

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
























Schottky Barrier Diodes

For Small Signal (I_F = Less than 1 000 mA)

| Application | Electrical Characteristics | | | | | Package | | | | | | | | | | |
|-----------------------------------|----------------------------|------------------------|-------------------------------|------------------------|--|--|--|--|--|---|---|--|--|--|--|--|
| | V _R (V) | I _F (mA) | V _F max. (V) | I _F (mA) | I _R max. (μA) | ML2-N1 | USSMini2-F1 | SSSMini2-F3 | SSSMini3-F2 | SSMini2-F4 | SSMini3-F3 | SSMini4-F1 | SMini2-F3 | SMini3-F2 | SMini4-F2 | |
| For high frequency wave detection | 20 | 35 | 0.41 | 1 | 0.2 | | | | | MA2SE010G  | MA3SE010G  | | | | | |
| | | | 0.40 | | | | | MA27E020G  | | | MA3SE020G  | | | | | |
| For switching mode wave detection | 20 | 100 | 0.40 | 100 | 20 | | | | | | | | MA2ZD140G  | | MA4ZD140G  | |
| | | | 0.58 | | 0.3 | | | MA27D270G  | | | | | | | | |
| | 30 | 30 | 0.30 | | 30 | | | | | | MA3S7950G  | | MA2J7320G  | | | |
| | | | | | | | | | | | MA3S795DG  | | | | | |
| | | | | | | | | | | | | | | MA3J745EG  | | |
| | | | | | | | | MAS3795EG  | | MA3S795EG  | | | | | | |
| | | | 0.35 | 0.5 | | | | | | | | MA4SD01  | | | | |
| | | | | | MA26728  | MAU27280G  | MA277280G  | | MA2S7280G  | MA3S7810G  | | MA2J7280G  | MA3J7410G  | | | |
| | | | 0.40 | | 0.3 | | | | | | | MA3S781FG  | | | | |
| | | | | | | | | | | | MA3S781DG  | | | MA3J741DG  | MA4Z7130G  | |
| | | | | | | | | | | | MA3S781EG  | | | MA3J741EG  | | |
| | | | | | | | | | | | | | | MA3J7420G  | | |

Schottky Barrier Diodes












For Small Signal (I_F = Less than 1 000 mA) (continued)

| Application | Electrical Characteristics | | | | | Package | | | | | | | | | | |
|-----------------------------------|----------------------------|------------------------|---|---|---|---|---|--|---|---|---|---|---|---|---|-----------|
| | V _R (V) | I _F (mA) | V _F max. (V) | I _F max. (mA) | I _R max. (μA) | ML2-N1 | USSMini2-F1 | SSSMini2-F3 | SSSMini3-F2 | SSMini2-F4 | SSMini3-F3 | SSMini4-F1 | SSMini5-F3 | SMini2-F3 | SMini3-F2 | SMini4-F2 |
| For switching mode wave detection | 30 | 100 | 0.42 | 100 | 120 |  |  | | |  |  | |  | | | |
| | | | 0.55 | | 15 | | |  | |  | | | |  |  | |
| | | | | | | | | | | | |  | | | | |
| | | | | | | | | | | | |  | | | | |
| | | | | | | | | | | |  | | | | | |
| | 0.58 | 2 |  |  |  | |  | | | | | | | | | |
| | 45 | 0.60 | 5 | | | |  |  |  | | |  | | | | |
| 50 | 0.55 | 30 | | | | | | | |  | | | | | | |
| For rectification | 15 | 200 | 0.39 | 200 | 50 | | | | |  | | | | | | |
| | 20 | | 0.47 | | 15 | | | |  | | | | | | | |
| | | | | | 20 | | | |  | |  | | | | | |
| | | | | | 2 | | | | | |  | | | | | |
| | | | | | 1 | | |  | | | | | | | | |
| | 30 | 0.47 | 200 | | | |  | | | | | | | | | |

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



















Schottky Barrier Diodes

For Small Signal (I_F = Less than 1 000 mA) (continued)

| Application | Electrical Characteristics | | | | | Package | | | | | | | | |
|----------------------|----------------------------|------------------------|-------------------------------|------------------------|--------------------------------|---------|-------------|-------------|---|------------|------------|------------|--|--|
| | V _R (V) | I _F (mA) | V _F max. (V) | I _F (mA) | I _R max. (μA) | ML2-N1 | USSMini2-F1 | SSSMini2-F3 | SSSMini3-F2 | SSMini2-F4 | SSMini3-F3 | SSMini4-F1 | SMini2-F3 | SMini3-F2 |
| For rectification | 20 | 300 | 0.40 | 300 | 30 | | | | | | | | MA2Z7480G  | |
| | | 500 | 0.42 | | 200 | | | | | | | | MA2ZD180G  | |
| | | | 500 | 0.55 | | 10 | | | | | | | MA2ZD020G  | MA3J7020G  |
| | | 700 | 0.45 | 700 | 200 | | | | | | | | | MA3ZD120G  |
| | 30 | 200 | 0.55 | | 50 | | | | | | | | MA2J7290G  | MA3J7440G  |
| | | | 0.56 | | 5 | | | | MA2SD320G  | | | | | |
| | 40 | 500 | | 500 | 100 | | | | | | | | MA2Z7200G  | MA3J7000G  |
| | 50 | 200 | | 200 | 200 | | | | | | | | MA2J7270G  | |

Schottky Barrier Diodes



















For Small Signal (I_F = Less than 1 000 mA) (continued)

| Application | Electrical Characteristics | | | | | Package | | | | |
|---|----------------------------|---------------|----------------------|---------------|-----------------------------|---|----------|---|--|--|
| | V_R (V) | I_F (mA) | V_F max. (V) | I_F (mA) | I_R max. (μ A) | SMini6-F1 | Mini2-F2 | Mini3-G1 | Mini4-G3 | Mini6-G3 |
| For switching mode wave detection | 15 | 30 | 0.40 | 1 | 0.2 | | | MA3X704  | | |
| | | | | | 0.3 | | | MA3X704A  | | |
| | | | | | 1 | MA6Z718  | | MA3X704D  | MA4X7130G  | MA6X7180G  |
| | | | | | | | | MA3X704E  | MA4X7140G  | |
| | | | | | | | | MA3X716  | | |
| | | | 0.30 | 30 | 30 | | | MA3X715  | | |
| | | | | | | | | MA3X717  | | |
| | | | | | | | | MA3X717E  | | |
| | | | | | | MA6J786X  | | MA3X786  | | |
| | | | | | | MA6J786Y  | | MA3X786D  | | |
| | | | 0.55 | 100 | 15 | | | MA3X786E  | | |
| | | | | | | | | MA3X791  | | |
| | | | | | | | | MA3X787  | MA4X7960G  | |
| | 50 | | | | 30 | | | | | |

K

















Schottky Barrier Diodes

For Small Signal (I_F = Less than 1 000 mA) (continued)

| Application | Electrical Characteristics | | | | | Package | | | | | |
|----------------------|----------------------------|------------------------|-------------------------------|------------------------|--------------------------------|--|--|--|--|--|--|
| | V _R (V) | I _F (mA) | V _F max. (V) | I _F (mA) | I _R max. (μA) | SMini6-F1 | Mini2-F2 | Mini3-G1 | Mini4-G3 | Mini6-G3 | |
| For rectification | 20 | 500 | 0.50 | 500 | 30 | | | MA3X748  | | | |
| | | | | | 10 | | | MA3X703  | | | |
| | 30 | 200 | 0.55 | 200 | 50 | | | MA3X721  | MA4X7240G  | | |
| | | | | | | | | MA3X721D  | MA4X7260G  | | |
| | | | | | | | | MA3X721E  | | | |
| | | | | | | | | MA3X740  | | | |
| | | 500 | | 500 | | MA2YD330G  | | | | | |
| | | 700 | | 700 | 80 | | | MA3X701  | | | |
| | 40 | 500 | | 500 | 100 | | | MA3X720  | | | |
| | 50 | 200 | | 200 | 200 | | | MA3X727  | MA4X7460G  | | |
| | | | | | | | | MA3X788  | | | |
| | | 500 | 0.65 | 500 | 100 | | | MA3X789  | | | |
| | | | | | | 800 | 0.58 | 800 | | MA2YD260G  | |
| | 100 | 300 | 0.57 | 300 | 200 | | MA22D170G  | | | | |
| | | | 0.58 | | | | MA2YD170G  | | | | |

Schottky Barrier Diodes








For Small Signal ($I_F = 1\ 000\text{ mA}$ or more)

| Application | Electrical Characteristics | | | | | Package | | | | | | |
|----------------------|----------------------------|---------------|----------------------|---------------|------------------------------------|-----------|---|--|--|----------|----------|--|
| | V_R (V) | I_F (mA) | V_F max. (V) | I_F (mA) | I_R max. (μA) | SMini6-F1 | SMini2-F2* | Mini2-F1* Mini2-F2 | Mini3-G1 | Mini4-G3 | Mini6-G3 | TMiniP2-F1 |
| For rectification | 15 | | 0.40 | | 1 500 | | | MA2YD210G  | MA3XD21  | | | |
| | | | 0.45 | | 200 | | | | MA3XD11  | | | |
| | 20 | | 0.43 | | | | | MA22D150G  | | | | |
| | | | 0.45 | | 100 | | | MA2YD150G  | MA3XD15  | | | |
| | 25 | 1 000 | 0.53 | 1 000 | | | | MA22D230G  | | | | |
| | | | 0.55 | | 40 | | | MA2YD230G  | | | | |
| | | | 0.42 | | 100 | | MA21D380G*  | | | | | |
| | | | 0.38 | | 1 200 | | MA21D340G*  | | | | | |
| | | | 0.49 | | 40 | | MA21D350G*  | | | | | |
| | 30 | | | | | | MA21D382G*  | | | | | |
| | | 1 500 | 0.46 | 1 500 | 100 | | | MA22D280G  | | | | |
| | | 2 000 | 0.45 | 2 000 | 500 | | | MA22D410G  | | | | |
| | | 3 000 | 0.37 | 3 000 | 2 000 | | | | | | | MA24D54  |
| | 35 | 5 000 | 0.55 | 5 000 | 300 | | | | | | | MA24D70  |


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Schottky Barrier Diodes

For Small Signal ($I_F = 1\ 000\text{ mA}$ or more) (continued)


| Application | Electrical Characteristics | | | | | Package | | | | | | |
|----------------------|----------------------------|------------------------|-------------------------------|------------------------|--------------------------------|-----------|------------|--|----------|----------|----------|--|
| | V _R (V) | I _F (mA) | V _F max. (V) | I _F (mA) | I _R max. (μA) | SMini6-F1 | SMini2-F2* | Mini2-F1* Mini2-F2 | Mini3-G1 | Mini4-G3 | Mini6-G3 | TMiniP2-F1 |
| For rectification | 40 | 1 570 | 0.57 | 1 500 | 100 | | | MA22D390G  | | | | |
| | | 2 000 | 0.48 | | 200 | | | | | | | MA24D60  |
| | | | 0.51 | | | 50 | | | | | | MA24D62  |
| | | 3 000 | | 200 | | | | | | | | MA24D50  |
| | | | | | 0.55 | | | MA2YJ50*  | | | | |
| | | 0.42 | | | 2 000 | | | | | | | MA24D51  |
| | | 0.53 | | | 50 | | | | | | | |
| | 60 | 1 000 | 0.58 | 1 000 | 30 | | | MA22D400G  | | | | |
| | | 3 000 | | | 3 000 | 200 | | | | | | |

For Power




| Category | Part No. | Electrical Characteristics | | | | Equivalent Circuit | Package |
|------------------------|----------|----------------------------|--------------------|----------------------|---------------|---|------------|
| | | V_R (V) | $I_{F(AV)}$ (A) | V_F max. (V) | I_R (mA) | | |
| Cathode-common type | MA3DD82 | 60 | 20 | 0.72 | 0.2 |  | TO-220D-A1 |

Fast Recovery Diodes

For Small Signal

| Part No. | Electrical Characteristics | | | | Equivalent Circuit | Package |
|-----------|----------------------------|---------------------------|----------------------------|------------------------------|---|------------|
| | V _{RRM} (V) | I _{F(AV)} (A) | V _F max. (V) | t _{rr} max. (ns) | | |
| MA2JF210G | 200 | 0.3 | 1.25 | 400 (typ.) |  | SMini2-F3 |
| MA22F200G | | 1 | 0.98 | 35 | | Mini2-F2 |
| MA24F41 | 400 | | 1.3 | 45 | | TMiniP2-F1 |
| MA24F70 | 700 | | 1.7 | | | Mini2-F1 |
| MA2YF800G | 800 | 0.2 | 2.5 | | | |







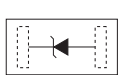
For Power

| Category | Part No. | Electrical Characteristics | | | | Equivalent Circuit | Package | |
|---------------------|----------|----------------------------|--------------------|-------------------|-----------------------|---|-------------|------------|
| | | V_{RRM} (V) | $I_{F(AV)}$ (A) | V_F max. (V) | t_{rr} max. (ns) | | | |
| Single type | MA2DF22 | 200 | 5 | 1.0 | 30 |  | TO-220D-B1* | |
| | MA2DF31 | 300 | | 1.3 | | | | |
| | MA2DF60 | 600 | | 1.7 | 25 | | | |
| | MA2DF62 | | 10 | 2.5 | | | | |
| | MA3DF30 | 300 | 20 | 1.4 | 25 |  | TO-220D-A1 | |
| | MA3DF40 | 370 | | 1.65 | 23 | | | |
| | MA3DF46 | | | 1.85 | 20 | | | |
| | MA3DF47 | | | | | | | |
| Cathode-common type | MA3U649 | 200 | 5 | 0.98 | 30 |  | U-G2 | |
| | MA3D649 | | 10 | | | | 50 | TO-220D-A1 |
| | MA3D650 | | | | | | | |
| | MA3D652 | | 20 | | | | | |

*: 2-pin Type

Zener Diodes








Zener Diodes Series

| | General-Purpose | Low Noise | | | Surge Absorption | | |
|-------------------------------|---|---|---|---|--|---|---|
| Zener Voltage V_Z (V) | MAZ3000* | MAZ8000G* | MAZS000G* | MALH000YG | MAZD000G | MAZQ000 | MAZA000 |
| | Mini3-G1 | SMini2-F3 | SSMini2-F4 | SMini4-F2 | SSSMini2-F3 | USSMini2-F1 | ML2-N1 |
| | $P_T = 200 \text{ mW}$ | $P_T = 150 \text{ mW}$ | $P_T = 150 \text{ mW}$ | $P_T = 150 \text{ mW}$ | $P_T = 120 \text{ mW}$ | $P_T = 120 \text{ mW}$ | $P_T = 100 \text{ mW}$ |
| |  |  |  |  |  |  |  |
| 2.28 to 2.60 | MAZ3024 | MAZ8024G | MAZS024G | MALH024YG | | | |
| 2.50 to 2.90 | MAZ3027 | MAZ8027G | MAZS027G | MALH027YG | | | |
| 2.80 to 3.20 | MAZ3030 | MAZ8030G | MAZS030G | MALH030YG | | | |
| 3.10 to 3.50 | MAZ3033 | MAZ8033G | MAZS033G | MALH033YG | | | |
| 3.40 to 3.80 | MAZ3036 | MAZ8036G | MAZS036G | MALH036YG | | | |
| 3.70 to 4.10 | MAZ3039 | MAZ8039G | MAZS039G | MALH039YG | | | |
| 4.00 to 4.60 | MAZ3043 | MAZ8043G | MAZS043G | MALH043YG | | | |
| 4.40 to 5.00 | MAZ3047 | MAZ8047G | MAZS047G | MALH047YG | | | |
| 4.80 to 5.40 | MAZ3051 | MAZ8051G | MAZS051G | MALH051YG | MAZD051G | | MAZA051 |
| 5.30 to 6.00 | MAZ3056 | MAZ8056G | MAZS056G | MALH056YG | MAZD056G | | MAZA056 |
| 5.80 to 6.60 | MAZ3062 | MAZ8062G | MAZS062G | MALH062YG | MAZD062G | MAZQ062 | |
| 6.40 to 7.20 | MAZ3068 | MAZ8068G | MAZS068G | MALH068YG | MAZD068G | MAZQ068 | MAZA068 |
| 7.00 to 7.90 | MAZ3075 | MAZ8075G | MAZS075G | MALH075YG | MAZD075G | | |
| 7.70 to 8.70 | MAZ3082 | MAZ8082G | MAZS082G | MALH082YG | MAZD082G | | MAZA082 |
| 8.50 to 9.60 | MAZ3091 | MAZ8091G | MAZS091G | MALH091YG | MAZD091G | | |
| 9.40 to 10.60 | MAZ3100 | MAZ8100G | MAZS100G | MALH100YG | MAZD100G | MAZQ100 | |
| 10.40 to 11.60 | MAZ3110 | MAZ8110G | MAZS110G | MALH110YG | MAZD110G | | |
| 11.40 to 12.70 | MAZ3120 | MAZ8120G | MAZS120G | MALH120YG | MAZD120G | | |
| 12.40 to 14.10 | MAZ3130 | MAZ8130G | MAZS130G | MALH130YG | | | |
| 13.65 to 14.35 | MAZ3140 | MAZ8140G | | | | | |
| 13.90 to 15.60 | MAZ3150 | MAZ8150G | MAZS150G | MALH150YG | | | |
| 15.30 to 17.10 | MAZ3160 | MAZ8160G | MAZS160G | MALH160YG | MAZD160G | | |
| 16.90 to 19.10 | MAZ3180 | MAZ8180G | MAZS180G | MALH180YG | MAZD180G | | |
| 18.80 to 21.20 | MAZ3200 | MAZ8200G | MAZS200G | MALH200YG | MAZD200G | MAZQ200 | |
| 20.80 to 23.30 | MAZ3220 | MAZ8220G | MAZS220G | MALH220YG | MAZD220G | | |
| 22.80 to 25.60 | MAZ3240 | MAZ8240G | MAZS240G | MALH240YG | MAZD240G | | |
| 25.10 to 28.90 | MAZ3270 | MAZ8270G | MAZS270G | MALH270YG | MAZD270G | | |
| 28.00 to 32.00 | MAZ3300 | MAZ8300G | MAZS300G | MALH300YG | MAZD300G | MAZQ300 | |
| 31.00 to 35.00 | MAZ3330 | MAZ8330G | MAZS330G | MALH330YG | | | |
| 34.00 to 38.00 | MAZ3360 | MAZ8360G | MAZS360G | MALH360YG | MAZD360G | | |
| 37.00 to 41.00 | | MAZ8390G | MAZS390G | MALH390YG | MAZD390G | | |

*: Rank compatible




Zener Diodes

Zener Diodes Series (continued)


| Zener Voltage V_Z (V) | Surge Absorption | | | | | | |
|-------------------------------|---|---|---|---|--|---|---|
| | MAZ9000H | MAZL000HG | MAZZ000H | MAZT000HG | MAZM000HG | MAZW000HG | MAZP000H |
| | Mini3-G1 | Mini5-G2 | SMini5-F1 | SSMini3-F3 | SSMini5-F3 | SSSMini3-F2 | ML3-N2 |
| | $P_T = 200 \text{ mW}$ | $P_T = 200 \text{ mW}$ | $P_T = 200 \text{ mW}$ | $P_T = 150 \text{ mW}$ | $P_T = 150 \text{ mW}$ | $P_T = 150 \text{ mW}$ | $P_T = 200 \text{ mW}$ |
| |  |  |  |  |  |  |  |
| 5.80 to 6.60 | MAZ9062H | | MAZZ062H | MAZT062HG | MAZM062HG | MAZW062HG | |
| 6.40 to 7.20 | MAZ9068H | MAZL068HG | MAZZ068H | MAZT068HG | MAZM068HG | MAZW068HG | MAZP068H |
| 7.00 to 7.90 | | | | | | | |
| 7.70 to 8.70 | | MAZL082HG | MAZZ082H | MAZT082HG | MAZM082HG | MAZW082HG | MAZP082H |
| 8.50 to 9.60 | | | | | | | |
| 9.40 to 10.60 | | | MAZZ100H | MAZT100HG | MAZM100HG | MAZW100HG | |
| 10.40 to 11.60 | | | | | | | |
| 11.40 to 12.70 | MAZ9120H | MAZL120HG | MAZZ120H | MAZT120HG | MAZM120HG | MAZW120HG | |

Zener Diodes


Low C_t Series

| Zener Voltage V_Z (V) | Part No. | C_t (pF) | Equivalent Circuit | Package |
|-------------------------------|-----------|---------------|---|-----------|
| 5.9 to 6.5 | MAZC062D | 8 |  | Mini3-G1 |
| | MAZE062DG | |  | SMini3-F2 |
| | MAYK062DG | |  | Mini5-G2 |




Surge Protective Diode

| Breakdown Voltage V_{BR} (V) | Part No. | C_t (pF) | ESD (kV) | Equivalent Circuit | Package |
|--------------------------------------|-----------|---------------|-------------|---|------------|
| 7.5 | MAYS075GZ | 1.5 | ± 12 |  | SSMini2-F4 |
| | MAYS075GY | 0.8 | ± 8 | | |


Bidirectional Zener Diode

| Zener Voltage V_Z (V) | Part No. | C_t (pF) | ESD (kV) | Equivalent Circuit | Package |
|-------------------------------|-----------|---------------|-------------|---|------------|
| 6.5 to 7.5 | MALS068XG | 15 | ± 15 |  | SSMini2-F4 |
| | MALD068XG | 25 | | | SSMini2-F3 |
| 14.5 to 17.5 | MALS160XG | 3.0 | | | SSMini2-F4 |
| 17.5 to 20.0 | MALS180XG | 4 | | | SSMini2-F4 |

High ESD (30 kV) Protection Device

| Breakdown Voltage V_{BR} (V) | Part No. | ESD (kV) | Equivalent Circuit | Package |
|--------------------------------------|-----------|-------------|---|------------|
| 5.8 to 6.6 | MALS062G | ± 30 |  | SSMini2-F4 |
| 6.4 to 7.2 | MALS068G | | | |
| 5.8 to 6.6 | MALT062HG | |  | SSMini3-F3 |
| | MALM062HG | |  | SSMini5-F3 |

High Surge Absorption Diode

| Breakdown Voltage V_{BR} (V) | Part No. | I_{PP} | ESD (KV) | Equivalent Circuit | Package |
|--------------------------------------|-----------|----------|----------|---|-----------|
| 20 to 30 | MANV250GE | 9 | 30 |  | SMini2-F3 |

Fuses (Circuit Protector Elements)

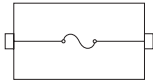
* Electrical fuses, etc. specified by laws are not applicable.

IC LinksL2

 Circuit Protector Elements.....L2



Circuit Protector Elements

| 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 | Equivalent Circuit |
|----------|----------------------|---|------------------------------------|----------------------|---------------------------------------|-----------------------------|-----------|---|
| UNHZ201 | 0.7 | 1.4 | 93 | 50 | -55 to +125 | -55 to +125 | SMini2-F1 |  |
| 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.

Opto Electronic Devices

| | |
|--|-----|
| Light Emitting Diodes | M2 |
| Surface-mount Chip LED..... | M2 |
| Mono-color Lighting | M2 |
| Bi-color Lighting | M4 |
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Light Emitting Diodes

Surface-mount Chip LED

Mono-color Lighting

| Series | Size | Package | Type | White | Red | Yellow Green | |
|--------------|------------------|--------------|-----------------|---------------|---------------|---------------|--|
| | | | | Part No. | Part No. | Part No. | |
| 1005 | 1.0 × 0.5 × 0.20 | KLTFTN2K4700 | High brightness | ▲ LNJ047X8ARA | ▲ LNJ247W82RA | ▲ LNJ347W83RA | |
| ESS II | 1.6 × 0.8 × 0.20 | KLTFTN2K3700 | High brightness | LNJ037X8ARA | LNJ237W82RA | LNJ337W83RA | |
| ESS | 1.6 × 0.8 × 0.20 | KLTFTN2K3600 | High brightness | LNJ036X8ARA | LNJ236W82RA | LNJ336W83RA | |
| UTSS | 1.6 × 0.8 × 0.35 | KLTFTN2K2600 | Standard | LNJ026X8ARA | — | LNJ326W83RA1 | |
| | | | High brightness | LNJ026X8BRA4 | — | — | |
| USS | 1.6 × 0.8 × 0.40 | KLTFTN2K1400 | Standard | — | LNJ214R8ARA | LNJ314G8TRA | |
| | | | High brightness | — | LNJ214R82RA | LNJ314G83RA | |
| Wide Angle | 1.6 × 0.8 × 0.55 | KLTLTN2KW000 | High brightness | — | — | LNJ3W0C83RA | |
| TSS | 1.6 × 0.8 × 0.55 | KLTFTN2K1200 | Standard | — | LNJ212R8ARA | LNJ312G8TRA | |
| | | | High brightness | LNJ012X8ARA1 | LNJ212W82RA1 | LNJ312W83RA1 | |
| SS | 1.6 × 0.8 × 0.80 | KLTFTN2K0800 | Standard | — | LNJ208R8ARA | LNJ308G8TRA | |
| | | | High brightness | — | LNJ208R82RA | LNJ308G83RA | |
| S-GW | 2.9 × 1.25 × 1.0 | LLTFTN2G0600 | Standard | — | — | LNJ306G5TR02 | |
| | | LLTFTN2G0610 | High brightness | — | LN1271RALTR | — | |
| S-J | 1.7 × 1.25 × 1.0 | LLTFTN2J0600 | Standard | — | LNJ206R5ARA | LNJ306G5URA | |
| | | | High brightness | — | — | — | |
| GW | 3.0 × 2.2 × 1.8 | LLTFTR2G6100 | Standard | — | LN1261CTR | LN1361CTR | |
| | | LLTFTR2G6110 | High brightness | — | LN1261CALTR | — | |
| | | LLTFTR2G6100 | | — | — | — | |
| J | 3.0 × 2.0 × 1.4 | LLDFTR2G5100 | Standard | — | LN1251CTR | LN1351CTR | |
| | | LLDFTR2G5110 | High brightness | — | LN1251CALTR | — | |
| | | LLDFTR2G5100 | | — | — | — | |
| 3216 | 3.2 × 1.6 × 1.1 | KLTFTN2K1100 | Standard | — | LNJ211R8ARA | LNJ311G8TRA | |
| | | | High brightness | — | LNJ211R82RA | LNJ311G83RA | |
| 3216 FD | 3.2 × 1.6 × 1.1 | | Standard | — | LNJ211R8ARU | LNJ311G8TRU | |
| | | | High brightness | — | — | — | |
| Microlens | 3.2 × 1.6 × 1.1 | KLTLTN2K1600 | Standard | — | LNJ216C8ARA | LNJ316C8TRA | |
| | | | High brightness | — | LNJ216C82RA | LNJ316C83RA | |
| Microlens FD | 3.2 × 1.6 × 1.1 | | Standard | — | LNJ216C8ARU | LNJ316C8TRU | |
| | | | High brightness | — | — | LNJ316C83RU | |
| Dome-Lens | 3.2 × 1.6 × 1.1 | KLTLTN2K1800 | Standard | — | LNJ218C8ARA | LNJ318C8TRA | |
| | | | High brightness | — | LNJ218C82RA | LNJ318C83RA | |
| Dome-Lens FD | 3.2 × 1.6 × 1.1 | | Standard | — | LNJ218C8ARU | — | |
| | | | High brightness | — | — | LNJ318C83RU | |
| SV-0.4 | 1.7 × 1.1 × 0.4 | KLTFSN2K5200 | High brightness | LNJ052X8ARA | LNJ252W82RA | LNJ352W83RA | |
| SV-0.5 | 1.8 × 1.1 × 0.5 | KLTFSN2K5300 | High brightness | LNJ053X8BRA | LNJ253W82RA | LNJ353W83RA | |
| SV-Case | 2.2 × 0.9 × 1.0 | LLDFSR2J1000 | Standard | — | LNJ210C6ARA | LNJ310M6URA | |
| | | | High brightness | — | LNJ210C62RA | LNJ310C63RA | |
| 2214 | 2.2 × 1.4 × 1.3 | LLDFTR4J2200 | High brightness | LNJ022X4ARA1 | LNJ222C44RA1 | — | |
| 3528 | 3.5 × 2.8 × 1.9 | LLDFTR4J2400 | High brightness | LNJ024X4ARA1 | LNJ224C44RA1 | — | |

SV: Side View FD: Face Down ▲: Under development

Light Emitting Diodes

| Amber | Pure Green | Orange | Soft Orange | Blue | other |
|---------------|--------------|----------------------------|---------------|---------------|-------------------------------|
| Part No. | Part No. | Part No. | Part No. | Part No. | Part No. |
| ▲ LNJ447W84RA | — | ▲ LNJ847W83RA | ▲ LNJ847W86RA | ▲ LNJ947W8CRA | ▲ LNJC47X8ARA (Ice Blue) |
| LNJ437W84RA | — | LNJ837W83RA | LNJ837W86RA | LNJ937W8CRA | LNJC37X8ARA (Ice Blue) |
| LNJ436W82RA | — | LNJ836W83RA | LNJ836W86RA | LNJ936W8CRA | LNJC36X8ARA1 (Ice Blue) |
| LNJ426W83RA1 | LNJ626W8CRA | LNJ826W83RA | LNJ826W86RA | LNJ926W8CRA | — |
| — | — | — | — | — | — |
| LNJ414K8YRA | — | LNJ814R8DRA | LNJ814K8SRA | — | — |
| LNJ414K84RA | — | LNJ814W83RA | LNJ814K87RA | — | — |
| — | — | LNJ8W0C83RA | — | — | LNJ3W0C85RA (Lemon Yellow) |
| LNJ412K8YRA | LNJ612W8WRA | LNJ812R8DRA | LNJ812K8SRA | LNJ912W8BRA | — |
| LNJ412W83RA1 | LNJ612W8CRA1 | LNJ812W83RA1 | LNJ812W86RA1 | LNJ912W8CRA1 | — |
| LNJ408K8YRA | LNJ308G8PRA | LNJ808R8ERA | LNJ808K8SRA | — | — |
| LNJ408K84RA | — | LNJ808R83RA | LNJ808K87RA | — | — |
| LN1471YTR | — | — | LN1871Y5TR | — | — |
| — | — | — | — | — | — |
| LNJ406K5YRX | — | — | LNJ806K5SRX | — | — |
| LNJ406K54RX | — | LNJ806R58RX | — | — | — |
| LN1461CTR | — | LN1861CTR | — | — | — |
| — | — | — | — | — | — |
| LNJ461C34RA | — | — | — | — | — |
| LN1451CTR | — | LN1851CTR | — | — | — |
| — | — | — | — | — | — |
| LNJ451C44RA | — | — | — | — | — |
| LNJ411K8YRA | LNJ311G8PRA | LNJ811R8DRA | LNJ811K8SRA | — | — |
| LNJ411K84RA | LNJ611W8WRA | LNJ811R88RA | LNJ811K87RA | LNJ911W8BRA | — |
| LNJ411K8YRU | — | LNJ811R8DRU | — | — | — |
| LNJ411K84RU | LNJ611W8WRU | — | — | LNJ911W8BRU | — |
| LNJ416Q8YRA | LNJ316C8PRA | LNJ816C8DRA | LNJ816C8SRA | — | — |
| LNJ416C84RA | LNJ616C8WRA | LNJ816C83RA LNJ816C88RA | LNJ816C87RA | LNJ916C8BRA | — |
| LNJ416Q8YRU | — | LNJ816C8DRU | — | — | — |
| — | — | — | — | — | — |
| LNJ418Q8YRA | LNJ318C8PRA | LNJ818C8DRA | LNJ818C8SRA | — | — |
| LNJ418C84RA | — | LNJ818C83RA LNJ818C88RA | LNJ818C87RA | — | — |
| LNJ418Q8YRU | — | — | LNJ818C8SRU | — | — |
| — | — | — | — | — | — |
| LNJ452W82RA | — | LNJ852W83RA | LNJ852W86RA | LNJ952W8CRA1 | — |
| LNJ453W82RA | — | LNJ853W83RA | LNJ853W86RA | LNJ953W8CRA | — |
| LNJ410Q6YRA | LNJ310C6PRA | LNJ810L6DRA | LNJ810L6SRA | — | — |
| LNJ410C64RA | — | LNJ810C63RA | LNJ810C67RA | — | — |
| LNJ422C46RA1 | LNJ622C4CRA1 | LNJ822C43RA1 | — | LNJ922C4CRA1 | — |
| LNJ424C46RA1 | LNJ624C4CRA1 | LNJ824C43RA1 | — | LNJ924C4CRA1 | — |

Light Emitting Diodes

Bi-color Lighting

| Series | Size | Package | Type | Lighting Color | Part No. |
|-------------|-------------------------------|--------------|-----------------|----------------|--------------|
| TSS-2 | $1.6 \times 1.25 \times 0.55$ | KLFTN4K1540 | Standard | Yellow Green | LNJ115W8ARA |
| | | | | Orange | |
| | | | Standard | Yellow Green | LNJ115W8PRA |
| | | | | Red | |
| | | | Standard | Yellow Green | LNJ115W88RA |
| | | | High brightness | Amber | |
| | | | Standard | Yellow Green | LNJ115W89RA |
| | | | High brightness | Soft Orange | |
| | | | High brightness | Pure Green | LNJ115W8VRA |
| | | | | Soft Orange | |
| | | | High brightness | Yellow Green | LNJ115W8RRA1 |
| | | | | Orange | |
| S-GW-2 | $1.7 \times 2.5 \times 1.0$ | LLFTN4G0740 | Standard | Yellow Green | LNJ107W5PRW |
| | | | | Red | |
| | | | Standard | Yellow Green | LNJ107W5ARA1 |
| | | | | Orange | |
| SV-2 | $2.5 \times 1.0 \times 1.0$ | KLTFN4K2340 | High brightness | Yellow Green | LNJ123W8RRA |
| | | | | Orange | |
| Dome-Lens-2 | $3.2 \times 2.5 \times 1.38$ | KLTLTN3K2130 | Standard | Yellow Green | LNJ121W84RA |
| | | | High brightness | Red | |

SV: Side View

Light Emitting Diodes

RGB Lighting

| Series | Size | Package | Type | Lighting Color | Part No. |
|--------|------------------------------|-------------|-----------------|----------------|--------------|
| TSS-3 | $1.6 \times 2.1 \times 0.55$ | KLTFN4K1720 | High brightness | Pure Green | LNJ717W80RA |
| | | | | Soft Orange | |
| | | | | Blue | |
| | | | High brightness | Pure Green | LNJ717W80RA1 |
| | | | | Soft Orange | |
| | | | | Blue | |
| | | KLTFN6K1740 | High brightness | Pure Green | LNJ717W83RAS |
| | | | | Orange | |
| | | | | Blue | |
| USS-3 | $1.6 \times 2.1 \times 0.4$ | KLTFN6K2740 | High brightness | Pure Green | LNJ727W83RAS |
| | | | | Orange | |
| | | | | Blue | |
| | | | High brightness | Pure Green | LNJ727W83RAA |
| | | | | Orange | |
| | | | | Blue | |
| SV-3 | $2.5 \times 1.1 \times 1.0$ | KLTFN4K2320 | High brightness | Pure Green | LNJ723W80RAV |
| | | | | Soft Orange | |
| | | | | Blue | |

SV: Side View

White

| Series | Size | Package | Type | Lighting Color | Part No. |
|-------------|-------------------------------|--------------|-----------------|----------------|----------------|
| Strobe | $3.4 \times 3.4 \times 1.5$ | LLTLTN4GF100 | High brightness | White | LNJ0F1C5FRA1 |
| | | | | | LNJ0F1C5FRA2 |
| | | | | | LNJ0F1C5FRA4 |
| Strobe PCB | $3.0 \times 3.0 \times 1.1$ | KLPFTR4KS200 | High brightness | White | LNJ0S2F8BRA |
| CSP | $2.04 \times 1.64 \times 0.7$ | CLPFTN2N9000 | High brightness | White | LNJ0Y0F9KRA4 |
| | | | | | ▲ LNJ0Y0F9KRA5 |
| | | | | | ▲ LNJ0Y0F9KRA6 |
| SV-Case-1.0 | $2.8 \times 1.4 \times 1.0$ | LLDFSR2J1100 | High brightness | White | LNJ0G0V6BRA |
| SV-Case-0.8 | $2.8 \times 1.2 \times 0.8$ | LLDFSR2J8000 | | | LNJ080V6BRA |
| SV-Case-0.6 | $3.8 \times 1.2 \times 0.6$ | LLDFSR2J6000 | | | LNJ060V6BRA |

SV: Side View ▲: Under development




M

Light Emitting Diodes

Appearance photo (Surface-mount Chip LED)

| | | | | | |
|---|---|---|---|---|---|
| KLTFTN2K4700 | KLTFTN2K3700 | KLTFTN2K3600 | KLTFTN2K2600 | KLTFTN2K1400 | KLTLTN2KW000 |
|  |  |  |  |  |  |
| KLTFTN2K1200 | KLTFTN2K0800 | LLTFTN2G0610 | LLTFTN2G0600 | LLTFTN2J0600 | LLTFTR2G6100 |
|  |  |  |  |  |  |
| LLTFTR2G6110 | LLDFTR2G5100 | LLDFTR2G5110 | KLTFTN2K1100 | KLTLTN2K1600 | KLTLTN2K1800 |
|  |  |  |  |  |  |
| KLTFN2K5200 | KLTFN2K5300 | LLDFSR2J1000 | LLDFTR4J2200 | LLDFTR4J2400 | KLTFTN4K1540 |
|  |  |  |  |  |  |
| LLTFTN4G0740 | LLDFTR4G6240 | KLTFN4K2340 | KLTLTN3K2130 | KLTFTN4K1720 | KLTFTN6K1740 |
|  |  |  |  |  |  |
| KLTFTN6K2740 | KLTFN4K2320 | LLLTN4GF100 | KLPFTR4KS200 | CLPFTN2N9000 | LLDFTR4GY000 |
|  |  |  |  |  |  |

Light Emitting Diodes

| LLDFSR2J1100 | LLDFSR2J8000 | LLDFSR2J6000 | | | |
|---|---|---|--|--|--|
|  |  |  | | | |

Light Emitting Diodes

Insertion-type LED lamp

| Series | Size | Package | Type | Red | Yellow Green | Amber | Orange |
|-------------|-------------------|--------------|----------|-----------|--------------|------------|------------|
| | | | | Part No. | Part No. | Part No. | Part No. |
| Round Type | φ 5.0 mm | LLXLTN2SF010 | Standard | LN21RPH | LN31GPH | LN41YPH | LN81RPH |
| | | | | LN21RCPH | LN31GCPH | LN41YCPH | LN81RCPH |
| | | LLXLTN2SK010 | | LN21RPX | LN31GPX | LNG401YKX | LNG801RKD |
| | | LLXLTN2SF010 | | LN21WPH | — | — | — |
| | | | | LN21CPH | LN31YCPH | — | — |
| | | LLXLTN2SK1L0 | | LNG21LRKR | LN31GPSLX | LN41YPSLX | LN81RPSLX |
| | | LLXLTN2SN890 | | — | LNG389CNJ | — | — |
| | φ 4.4 mm | LLXFTN2SK400 | Standard | LN240RPX | LN340GPX | LNG440NKY | LN840RPX |
| | φ 4.0 mm | LLXLTN2SK090 | Standard | LN29RPX | LN39GPX | LN49YPX | LNG809RKD |
| | | | | — | — | — | LNG809SKSB |
| | φ 3.2 mm | LLXLTN2SK760 | Standard | LN276RPX | LN376GPX | LNG476YKXB | — |
| | | | | LN276RCPX | LN376GCPX | LNG476NKX | LN876RCPX |
| | | | | — | LN376GCPXUY | — | — |
| | φ 3.0 mm | LLXLTN2SK080 | Standard | LN28RPX | LN38GPX | LN48YPX | LN88RPX |
| | φ 2.6 mm | LLXLTN2SF210 | Standard | LN221RPH | LNG321GFG | LNG421YFX | — |
| | | LLXLTN2SK210 | | LN221RPX | LN321GPX | — | — |
| | φ 2.0 mm | LLXFTN2SF220 | Standard | LN222RPH | LN322GPH | LN422YPH | — |
| | | LLXFTN2SK220 | | LN222RPX | LN322GPX | LNG422YKY | — |
| | | LLXLTN2SK820 | | LN282RPX | LN382GPX | LN482YPX | LN882RPX |
| Square Type | □5.3 mm × 1.8 mm | LLXFTN2SF170 | Standard | LN217RPH | LN317GPH | LN417YPH | — |
| | □5.0 mm × 5.0 mm | LLXFTN2SF500 | Standard | LN250RPH | LN350GPH | LN450YPH | — |
| | | LLXFTN2SK730 | | LNG273RKR | LNG373GKG | LNG473YKX | LN873RPX |
| | □5.0 mm × 2.0 mm | LLXFTN2SK420 | Standard | LN242RPX | LN342GPX | LNG442YKX | LN842RPX |
| | | LLXFTN2SF420 | | LN242RPH | LN342GPH | LN442YPH | LN842RPH |
| | □5.0 mm × 1.0 mm | LLXFTN2SF240 | Standard | LN224RPH | LN324GPH | LNG424YFX | — |
| | □4.0 mm × 4.0 mm | LLXFTN2SF520 | Standard | — | LNG352GFG | — | — |
| | | LLXFTN2SK520 | | LN252RPX | LN352GPX | LN452YPX | — |
| | □4.0 mm × 2.0 mm | LLXFTN2SK510 | Standard | LNG251RKR | LNG351GKG | LN451YPX | — |
| | □3.0 mm × 7.0 mm | LLXFTN2SF160 | Standard | LN216RPH | LN316GPH | LNG416YFX | LNG816RFD |
| | □3.0 mm × 2.0 mm | LLXFTN2SK600 | Standard | LN260RPX | LN360GPX | LNG460YKX | — |
| | | | | LN260RCPX | — | — | — |
| | □1.75 mm × 7.0 mm | LLXFTN2SF200 | Standard | LN220RPH | LN320GPH | LN420YPH | — |

Light Emitting Diodes

Insertion-type LED lamp

Bi-color Lighting

| Series | Size | Package | Type | Lighting Color | Part No. |
|-------------|------------------|--------------|--------------|----------------|-----------|
| Round Type | ϕ 5.0 mm | LLXLTN3SH012 | Standard | Red | LN11WP23 |
| | | | | Yellow Green | |
| | | | Standard | Yellow Green | LN11WP34 |
| | | | | Amber | |
| | | | Standard | Yellow Green | LN11WP38 |
| | | | | Orange | |
| | ϕ 4.4 mm | LLXFTN3SH702 | Standard | Yellow Green | LN170WP38 |
| | | | | Orange | |
| | ϕ 3.2 mm | | Standard | Yellow Green | LN086WP38 |
| | | | | Orange | |
| ϕ 3.0 mm | LLXLTN3SH382 | Standard | Yellow Green | LN138WP38 | |
| | | | Orange | | |
| Square Type | □5.0 mm × 2.0 mm | LLXFTN3SH422 | Standard | Yellow Green | LN142WP34 |
| | | | | Amber | |
| | | | Standard | Yellow Green | LN142WP38 |
| | | | | Orange | |

Light Emitting Diodes

Insertion-type LED lamp

| Series | Size | Package | Type | Red | Yellow Green | Amber |
|-----------------|------------------|--------------|-----------------|-------------|--------------|-------------|
| | | | | Part No. | Part No. | Part No. |
| Mini Bright | □2.2 mm × 3.0 mm | LLDFTR2S2010 | Standard | LN01201CQ | LN01301CQ | LN01401CQ |
| | | LLDFTR2S2011 | High brightness | LN01201CALU | — | — |
| Direct Mounting | φ 3.2 mm | LLXLTN2SP010 | Standard | LNJ201LPQJA | LNJ301MPUJA | LNJ401NPYJA |
| | φ 4.8 mm | LLXLTN2SPB40 | High brightness | — | LNJ3B4MPUJA | — |
| | □5.0 mm × 2.0 mm | LLXFTN2SP020 | Standard | — | LNJ302GPUJA | — |

Insertion-type LED lamp

| Series | Size | Package | Type | White | Red | Amber |
|------------|----------|--------------|-----------------|------------|------------|-----------|
| | | | | Part No. | Part No. | Part No. |
| Round Type | φ 5.0 mm | LLXLTN2SZ921 | High brightness | LNG092CZFZ | — | — |
| | | LLXLTN2SN891 | | — | LN289CUQ | — |
| | | LLXLTN2SF920 | | — | — | LNG492CF4 |
| | | LLXLTN2SF011 | | — | LNG201RFC | — |
| | | LLXLTN2SF010 | | — | — | LNG401CF4 |
| | | LLXLTN2SF1L0 | | — | — | — |
| | φ 3.2 mm | LLXLTN2SK761 | High brightness | — | LN276CUQX | — |
| | | | | — | LN276RCUQX | — |
| | φ 3.0 mm | LLXLTN2SK981 | High brightness | — | LNG298CKC | — |
| | | LLXLTN2SK980 | | — | — | LNG498CK4 |
| | | LLXLTN2SK970 | | — | — | LNG497CK4 |
| Oval Type | φ 4.0 mm | LLXLTN2SYB81 | High brightness | — | — | — |
| | | LLXLTN2SYA81 | | LNG0A8CYBZ | — | — |

Light Emitting Diodes





































| Orange | Soft Orange |
|-------------|-------------|
| Part No. | Part No. |
| LN01801CQ | — |
| — | — |
| LNJ801LPDJA | LNJ801TPSJA |
| LNJ8B4LPDJA | — |
| LNJ802RPDJA | LNJ802SPSJA |

| Pure Green | Orange | Blue |
|------------|-----------|------------|
| Part No. | Part No. | Part No. |
| — | — | — |
| — | — | — |
| LNG692CF6 | — | LNG992CFB |
| — | — | — |
| — | LNG801CF8 | LNG901CFB |
| LNG61LCF6 | — | LNG91LCFB |
| — | — | — |
| — | — | — |
| — | — | — |
| — | — | LNW998CKBW |
| — | LNG897CK8 | LNW997CKB |
| LNW6B8GYFZ | — | — |
| — | — | LNW9A8BYBZ |










M

Light Emitting Diodes

Appearance photo (Insertion-type LED lamp)

| | | | | | |
|---|---|---|---|---|---|
| LLXLTN2SF010 | LLXLTN2SK010 | LLXLTN2SK1L0 | LLXLTN2SN890 | LLXFTN2SK400 | LLXLTN2SK090 |
|  |  |  |  |  |  |
| LLXLTN2SK760 | LLXLTN2SK080 | LLXLTN2SF210 | LLXLTN2SK210 | LLXFTN2SF220 | LLXFTN2SK220 |
|  |  |  |  |  |  |
| LLXLTN2SK820 | LLXFTN2SF170 | LLXFTN2SF500 | LLXFTN2SK730 | LLXFTN2SK420 | LLXFTN2SF420 |
|  |  |  |  |  |  |
| LLXFTN2SF240 | LLXFTN2SF520 | LLXFTN2SK520 | LLXFTN2SK510 | LLXFTN2SF160 | LLXFTN2SK600 |
|  |  |  |  |  |  |
| LLXFTN2SF200 | LLDFTR2S2010 | LLDFTR2S2011 | LLXLTN2SP010 | LLXLTN2SPB40 | LLXFTN2SP020 |
|  |  |  |  |  |  |
| LLXLTN2SZ921 | LLXLTN2SN891 | LLXLTN2SF920 | LLXLTN2SF011 | LLXLTN2SF1L0 | LLXLTN2SK761 |
|  |  |  |  |  |  |

Light Emitting Diodes

| | | | | | |
|---|---|---|---|---|---|
| LLXLTN2SK981 | LLXLTN2SK980 | LLXLTN2SK970 | LLXLTN2SYB81 | LLXLTN2SYA81 | LLXLTN3SH012 |
|  |  |  |  |  |  |
| LLXFTN3SH702 | LLXLTN3SH382 | LLXFTN3SH422 | | | |
|  |  |  | | | |

Light Emitting Diodes

Panel Display Units

RG

| Category | Character size (mm) | Package outline (mm) | Part No. | Dot size | Structure | Brightness Red (cd/m ²) | Brightness YG (cd/m ²) | Half-power angle (°) | Type |
|----------|---------------------|----------------------|-----------|------------|-----------|-------------------------------------|------------------------------------|------------------------|---------|
| RG | □320 | 320 × 320 | LNP120021 | □18 | 16 × 16 | 1 000 | 1 500 | 120 | Outdoor |
| | □240 | 240 × 240 | LNP129041 | □13 | 16 × 16 | 1 800 | 1 000 | 120 | |
| | □160 | 160 × 160 | LNP128081 | φ7.5 OVAL | 16 × 16 | 1 500 | 1 500 | 70 | |
| | □144 | 288 × 144 | LNP178011 | φ8 | 32 × 16 | 100 | 120 | 60 | Indoor |
| | | | LNP178021 | | | 250 | 250 | | |
| | □96 | 96 × 96 | LNP125024 | 3.2 × 2.5 | 16 × 16 | 130 | 150 | 160 | |
| | | | LNP143024 | | 24 × 24 | 250 | 200 | | |
| | | 192 × 96 | LNP175024 | | 32 × 16 | 130 | 150 | | |
| | | | LNP193024 | | 48 × 24 | 250 | 200 | | |
| | □64 | 64 × 64 | LNP123031 | φ3 | 16 × 16 | 100 | 100 | 90 | |
| | | | LNP123071 | | | 400 | 300 | 80 | |
| | | 128 × 64 | LNP173014 | 1.6 × 1.25 | 32 × 16 | 150 | 150 | 160 | |
| | | | LNP173024 | 3.2 × 2.5 | | 350 | 300 | | |
| | □60 | 120 × 60 | LNP192014 | 1.6 × 1.25 | 48 × 24 | 150 | 150 | 160 | |
| | □40 | 40 | LNP172024 | 1.6 × 1.25 | 32 × 16 | 200 | 300 | 160 | |

Full Color / White

| Category | Character size (mm) | Package outline (mm) | Part No. | Dot pitch (mm) | Dot structure | Brightness White (cd/m ²) | Half-power angle (°) | Feature | Type |
|------------|---------------------|----------------------|------------|----------------|---------------|---------------------------------------|------------------------|---------------------------------------|---------|
| Full Color | □480 | 480 × 480 | LNP721311 | 30 | 16 × 16 | 5 000 | 120 | Dual side maintenance | Outdoor |
| | □320 | 320 × 320 | LNP720311 | 20 | 16 × 16 | 5 000 | 120 | Front maintenance | |
| | | | LNP720321 | | | | | Back maintenance | |
| | | | LNP720311W | 10 | 32 × 32 | | | Dual side maintenance/ Double scan | |
| | □240 | 240 × 240 | LNP729311 | 15 | 16 × 16 | 5 000 | 120 | Dual side maintenance | |
| | □96 | 192 × 96 | LNP793224 | 4 | 48 × 24 | 1 600 | 170 | Back maintenance | |
| | | | LNP775224F | 6 | 32 × 16 | | | | |
| | □64 | 128 × 64 | LNP773224F | 4 | 32 × 16 | 1 600 | 170 | Back maintenance | |
| White | □96 | 192 × 96 | LNP093014S | 4 | 48 × 24 | 1 600 | 170 | Back maintenance | Indoor |
| | | | LNP075244F | 6 | 32 × 16 | | | | |
| | □72 | 144 × 72 | LNP092014S | 3 | 48 × 24 | 1 600 | 170 | Back maintenance | |
| | □64 | 128 × 64 | LNP073024 | 4 | 32 × 16 | 1 200 | 130 | Back maintenance | |

Light Emitting Diodes

Infrared Light Emitting Diodes

| Part No. | Package | Type | I _F (mA) | P _D (mW) | P _O I _E *1 min. (mW) | V _F max. (V) | λ _p typ. (nm) | θ typ. (°) |
|----------|--------------|--------------------------|------------------------|------------------------|---|-------------------------------|--------------------------------|--------------------|
| LNA2603F | LETFSN2S0001 | Side view | 100 | 160 | 3 | 1.6 | 940 | 80 |
| LN54 | LETLSN2S0001 | | 50 | 75 | 2.5 | 1.5 | 950 | 17 |
| LN55 | LETLSN2S0002 | | | | 1.8 | | | 35 |
| LN58 | LETLSN2S0003 | | | | | | | |
| LN65 | LETLSN2S0002 | | 100 | 160 | 4.3 | 1.6 | 880 | 25 |
| LN75X | | | | 180 | 6 | 1.8 | | 40 |
| LN78 | LETLSN2S0003 | | | | | | | |
| LN152 | MEDLTN2S0001 | | TO-18 (Small) | | 160 | 5 | 1.6 | 950 |
| LN162S | CEDLTN2S0001 | 3 φ Ceramic | 50 | 75 | 1.5 | 1.5 | 80 | |
| LN175 | LETFSN2S0001 | Side view | 100 | 170 | 7 | 1.7 | 900 | 120 |
| LNA2W01L | LETLTN2S0001 | Double end | 50 | 75 | 3 | 1.5 | 950 | 18 |
| LNA4401L | MECLTN2S0001 | TO-18 | 100 | 190 | 6 | 1.9 | 860 | 6 |
| LNA4905L | LEXLTN2S0001 | 5 φ Plastic Long lead | | | 15 | 2.1 | 880 | 15 |
| LN77L | LEXLTN2S0002 | 5 φ Long lead | | | 10 | 1.9 | 860 | 20 |
| LNA4801L | LEXLTN2S0003 | 3 φ Plastic | | | 12 mW/sr. | | | 22 |
| LN66F | LEXLTN2S0004 | 5 φ Plastic | 50 | 75 | 13 mV/sr.*1 | 1.5 | 950 | 15 |
| LN66ANC | LEXLTN2S0005 | | 100 | 160 | 9 mW/sr. | 1.6 | | 20 |
| LNA2802L | LEXLTN2S0003 | 3 φ Plastic | 50 | 75 | 2.5 | 1.5 | | |
| LN69 | LEXLTN2S0006 | 3 φ Long lead | | | 3.5 mV/sr.*1 | | | |
| LNA2801L | | 3 φ Plastic | | | 6 mW/sr.*1 | | | |
| LNA2902L | LEXLTN2S0007 | 5 φ Plastic Long lead | 100 | 160 | 9 mW/sr. | 1.6 | 950 | 20 |
| LNA2903L | LEXLTN2S0004 | 5 φ Plastic | | | 10 mW/sr. | | | |
| LNA2904L | | | | | | | | |

Photo Detectors

PIN Photodiodes

| Part No. | Package | Type | Reverse Voltage V _R (V) | Dark Current I _D max. (nA) | Photo-current I _L min. (μA) | Peak Emission Wavelength λ _p typ. (nm) | Response Time t _r , t _f typ. (ns) | Half-power Angle θ typ. (°) | | | |
|------------|--------------|----------------------------------|--|--|---|--|--|--|--|--|--|
| PNZ330CL | MPDLTN2S0001 | TO-18 (Resin mold) | 30 | 10 | 7/5 | 850/900 | 2 | 70 | | | |
| PNZ330CLNC | | | | | | | | | | | |
| PNZ334 | LPTFTN2S0001 | 5 φ Plastic | | | 5 | 850 | | 45 | | | |
| PNA3602L | LPTLSN2S0001 | Side view | | | | | | | | | |
| PNZ335 | LPTFSN2S0001 | | | | | | 70 | | | | |
| PNA3W01L | LPTLTN2S0001 | Double end | | 50 | | 800 | 50 | 24 | | | |
| PNZ313 | LPTFSN2S0002 | Side view (Visible light cut) | | | 35 | 940 | | 65 | | | |
| PNZ313B | | Side view (Responds to IR88) | | | 15 | 960 | | | | | |
| PNZ327 | LPXFSN2S0001 | TO-92 | | | 4.5 | 900 | | 70 | | | |
| PNZ323 | | TO-92 (Responds to IR88) | | | 4.5 (SIR) | | | | | | |
| PNZ323B | | | | | 3.2 (SIR) | 970 | | | | | |

Photo ICs (Remote-control Receivers)

| Part No. | Package | Type | Operating Supply Voltage V_{CC} typ. (V) | Supply Current I_{CC} typ. (mA) | Reception Distance L typ. (m) | Center Frequency f_o typ. (kHz) |
|----------|--------------|------|---|--|--|--|
| PNA4601M | LPTLSN3S0001 | Lead | 5.0 | 2.4 | 10 | 36.7 |
| PNA4602M | | | | | | 38.0 |
| PNA4618M | | | | | 18 | 36.7 |
| PNA4612M | | | | | | 38.0 |
| PNA4701M | | | 10 | 36.7 | | |
| PNA4702M | | | | 38.0 | | |
| PNA4801M | LPTLSN3S0002 | | 3.3 | 0.2 | 14 | 36.7 |
| PNA4802M | | | | | | 38.0 |
| PNA4803M | | | | | | 40.0 |
| PNA4811M | | | | | 18 | 36.7 |
| PNA4812M | | | | | | 38.0 |
| PNA4813M | | | | | | 40.0 |
| PNA4S02M | KPTLTM4K0001 | SMD | 5.0 | 1.9 | 15 | 38.0 |
| PNA4S06M | KPTLTM4K0002 | | 3.3 | 0.8 | | |
| PNA4S42M | KPTLTM4K0003 | | 5.0 | 1.9 | 7 | |
| PNA4S47M | KPTLTM4K0004 | | 3.3 | 0.8 | | |

Luminance Sensor

| Part No. | Package | Type | Electrical/optical Characteristics | | | |
|----------|--------------|------|------------------------------------|---------------------------|--------------------------|---------------------|
| | | | I_{CC} typ. (mA) | V_O ($V_{CC} = 3.0$ V) | | λ_p (nm) |
| | | | | L = 10 lx (V) | L = 100 lx (μ A) | |
| PNA4K01F | KPTFTN6K0001 | SMD | 480 | 4.3 | 43 | 560 |
| PNA4K04F | KPTFTN4K0001 | | 456 | 4.1 | 41 | |
| PNA4K11F | KPTFTN4K0002 | | 480 | 4.3 | 43 | |

Photo Detectors

Photo ICs (Front monitor)

| Part No. | Package | Features/Package | Supply Voltage (Dark Condition) I_{CC} typ. (mA) | Output Voltage V_O typ. (mV)/ at 100 μ W | Output Offset Voltage V_{OFF} typ. (mV) | Response Time t_r , t_f typ. (ns) | Maximum Output Voltage V_{OM} typ. (V) |
|----------|--------------|--|---|--|---|---|---|
| PNA4S54F | KPTFTN6K0002 | For CD COMBO | 15 | −280 | 0 | 5 | −2.2 |
| PNA4U12F | KPTFTN6K0003 | For COMBO DVD, $V_{REF} = 2.5$ V | 18 | −860/−480 | | — | |
| PNA4U15F | KPTFTN6K0004 | For COMBO DVD, differential output | 26 | 280/440 | | 5 | 2.2 |
| PNA4U23F | | For COMBO DVD, differential output, $V_{REF} = 1.65$ V | | | | | |
| PNA4U17F | KPTFTN6K0005 | For COMBO DVD, differential output, | | 196/399 | | | 2.1 |
| PNA4U31F | | $V_{REF} = 1.7$ V | | 350/500 | | | |

Phototransistors

| Part No. | Package | Type | Collector-emitter Voltage (Maximum Rating) V_{CEO} (V) | Photocurrent I_L min. (mA) | L (lx) | Collector- emitter Cutoff Current I_{CEO} max. (μ A) | Half-power Angle θ typ. ($^{\circ}$) | | |
|-----------|--------------|------------------------------|--|---------------------------------------|-------------|--|---|-----|----|
| PNA1401L | MPCLTN2S0001 | TO-18 | 30 | 1.5 | 100 | 0.3 | 10 | | |
| PNA1401LF | MPCFTN2S0001 | | | 0.1 | | | 40 | | |
| PNZ108* | MPCLTN3S0001 | | 20 | 5 | 500 | 2 | 10 | | |
| PNZ108CL* | MPDLTN3S0001 | | | 3.5 | | | 80 | | |
| PNZ109L* | MPCLTN3S0001 | TO-18 (Visible light cut) | | 100 | | | 10 | | |
| PNZ115* | LPTLSN3S0001 | | | Side view | 2 | | 35 | | |
| PNZ120S | CPDLTN2S0001 | 3 ϕ Ceramic | 30 | 3 μ A | 2 | 0.5 | 50 | | |
| PNZ121S | | | 0.12 | 1 000 | 0.1 | 30 | | | |
| PNZ123S | | | | | | | | | |
| PNZ147 | LPDLTN2S0001 | Double end | 20 | 3 μ A | 2 | 0.5 | 24 | | |
| PNZ150 | LPTLSN2S0002 | Side view | | 1 | 500 | 1 | 35 | | |
| PNZ154 | LPTLSN2S0003 | | | 0.2 | | 27 | | | |
| PN8154NC | LPTFSN2S0001 | | | 0.7 | 100 | 1 | 70 | | |
| PNZ155 | | | | 1 | | | 500 | 40 | |
| PNZ158 | | | | LPTLSN2S0001 | 0.003 (SIR) | H = 15 μ W/cm ² | 0.2 | 35 | |
| PNA1601M | LPTLSN2S0004 | | | 3 ϕ Plastic | 30 | 0.8 | 500 | 0.5 | 30 |
| PNA1801L | LPXLTN2S0002 | | | | 20 | 1.0 | 1 000 | 0.5 | |
| PNA1803L | | 0.2 | | | | 2 | | | |
| PNZ202S | CPDLTN2S0001 | 3 ϕ Ceramic | 0.5 | | | | 18 | | |
| PNA2W01M | LPDLTN2S0001 | Double end | 60 μ (SIR) | | | H = 3.75 μ W/cm ² | 25 | | |
| PNZ263L | LPTLSN2S0005 | Side view | 1.05 | | | 1 000 | 0.1 | 30 | |
| PNA1101L | CPDLTN2S0001 | 3 ϕ Ceramic | 1.0 | | | 500 | 0.2 | 27 | |
| PNA1606L | LPTLSN2S0003 | Side view | | | | | | | |

*: With base pin ⚡: Darlington transistor

Photo Interrupters

Transmissive Photosensors (Photo Interrupters)

| Part No. | Package | Features | Forward Current I _F (mA) | Collector-emitter Voltage V _{CEO} (V) | Collector Current I _C min. (mA) | Collector-emitter Cutoff Current I _{CEO} max. (nA) | Response Time t _r , t _f typ. (μs) | Collector-emitter Saturation Voltage V _{CE(sat)} max. (V) | | |
|----------|--------------|-----------------------------|---|--|---|--|--|---|---|--|
| CNA1301H | LSMSIN4S0001 | Small, PCB drop mounting | 50 | 35 | 0.1 | 100 | 35 | 0.4 | | |
| CNA1311K | LSMSIN4S0002 | Ultra-small type 1.0 mm gap | | | 0.05 | | 50 | | | |
| CNA1312K | LSMSIN4S0003 | Ultra-small type 2.0 mm gap | | | 0.04 | | | | | |
| CNA1303K | LSMSIN4S0004 | Small type | | | 0.1 | | 35 | | | |
| CNA1302K | LSMSIN4S0005 | | | | 0.04 | | | | | |
| CNZ1021 | LSSSIR4S0001 | Gap width 3 mm | | 30 | 0.5 | 200 | 5 | 0.5 | | |
| CNZ1023 | LSSSIR4S0002 | | | | | | | | | |
| CNA1009H | LSSSIR4S0003 | Gap width 5 mm | | | | | | | | |
| CNA1011K | LSSSIR4S0004 | High resolution, thin type | | | | | 0.3 | | 6 | |
| CNA1012K | LSSSIR4S0005 | High output | | | | | 0.7 | | | |
| CNZ1120 | LSSNIR4S0001 | Wide gap | | 20 | 1.0 | | 5 | 0.4 | | |
| CNA1006N | LSSSIR4S0006 | Horizontal sensor with hook | | 30 | 0.7 | | | | | |
| CNA1007H | LSSSIR4S0007 | Yellow slit with boss | | | 0.5 | | | | | |

Reflective Photosensors (Photo Reflectors)

| Part No. | Package | Features | Forward Current I _F (mA) | Collector-emitter Voltage V _{CEO} (V) | Collector Current I _C min. (mA) | Collector-emitter Cutoff Current I _{CEO} max. (nA) | Response Time t _r , t _f typ. (μs) | Collector-emitter Saturation Voltage V _{CE(sat)} max. (V) |
|----------|--------------|---|---|--|---|--|--|---|
| CNZ2153 | LSSLRR4S0001 | High-speed response | 50 | 30 | 0.1 | 0.2 | 6 | 0.5 |
| CNZ2253 | LSSLRR4S0001 | High sensitivity | | 20 | 3 | 0.5 | 150 | 1.5 |
| CNB1302 | LSMFRN4S0001 | Visible light cut, small, thin type | | 30 | 0.09 | 0.2 | 20 | 0.4 |
| CNB1301 | LSSLRR4S0001 | Visible light cut, small type | | | 0.8 | | | 0.5 |
| CNB1009 | LSSLRR4S0002 | High-speed response | | 20 | 0.1 | | 6 | 0.3 |
| CNZ2179 | LSSLRR4S0003 | | | | 0.18 | | 20 | 0.5 |
| CNB2301 | LSMFRN4S0001 | Visible light cut, small, thin type | | 35 | 0.46 | 1.0 | 150 | 1.5 |
| CNB1001* | LSMFRN4G0001 | | | | 0.023 | 0.1 | 30/40 | 0.4 |
| CNB1002* | LSMFRN4G0001 | | | | | | | |
| CNB2001* | LSMFRN4G0001 | Video headphone, etc. reel sensor | | | 0.52 | 1 | 120/115 | 1.2 |
| CNB1011 | LSMFRN4G0002 | Small type visible light cut SMD ultra small type, thin type | 30 | | 0.04 | 100 | 40/50 | 0.4 |
| CNB2003 | LSMFRN4S0002 | Visible light cut SMD | 50 | 0.52 | 10 | 120/115 | 1.2 | |

☼: Darlington output *: Surface-mount device

Integrated Photosensors

| Part No. | Package | Supply Voltage V_{CC} (V) | Output Voltage: Low Level V_{OL} max. (V) | Output Voltage: High Level I_{OH} max. (μ A) | Threshold Input Current I_{Fth} max. (mA) |
|----------|--------------|-----------------------------------|--|--|---|
| CNA4302A | LSMSIN5S0001 | 2.2 to 7 | 0.4 | 100 | 2 |

Photo Couplers

Optoisolators

| Part No. | Package | Features | Collector-emitter Voltage (P-Tr) V_{CEO} (V) | Isolation Voltage, Input to Output V_{ISO} min. (V_{rms}) | AC Current Transfer Ratio CTR (%) | Rise Time t_r typ. (μs) |
|----------|--------------|--|--|---|--------------------------------------|--|
| CNC1S101 | LCTXXN4Z0001 | High breakdown voltage | 80 | 5 000 | 100 to 600 | 2 |
| CNZ3132 | LCTXXN8Z0001 | High breakdown voltage (2 reams) | | | | |
| CNZ3133 | LCTXXN1Z0001 | High breakdown voltage (3 reams) | | | 50 to 600 | 4 |
| CNC1S171 | LCTXXN4Z0002 | High breakdown voltage | | | | |
| CNC7S101 | LCTXXN4Z0001 | High breakdown voltage AC input | | | 20 to 300 | 4 |
| CNZ3731 | | High breakdown voltage, High V_{CEO} , High output | 300/350 | | 1 000 to | 40 |
| CNC2S501 | | | | | | |

⊛: Darlington output

IrDA

| Part No. | Package | SIR/ FIR | Package size (mm) | Maximum reception distance min. (cm) | Interface voltage V_{IO} min. (V) | Remote control function | Operating power supply voltage V_{CC} (V) | LED drive power supply voltage V_{LEDA} (V) |
|----------|--------------|-------------|--|--|--|-------------------------------|---|--|
| CND0204A | KMTLSM7K0001 | SIR | $1.6 \times 7.2 \times 2.6$ (Side view) | 20 | V_{CC} to 0.3 | — | 2.4 to 3.3 | 2.8 to 4.5 |
| CND0224A | KMTLSM7K0002 | | | 50 | | ○ | | 2.6 to 4.2 |
| CND0212A | KMTLSM7K0003 | | | | | — | | 2.7 to 4.5 |
| CND0213A | KMTLSM7K0004 | | | 20 | 1.5 | ○ | | 2.8 to 4.5 |
| CND0215A | KMTLSM7K0005 | | $2.05 \times 8.2 \times 1.7$ (Top view) | 20 | V_{CC} to 0.3 | ○ | 2.8 to 4.5 | |
| CND0208A | KMTLT7K0001 | | | | | — | 2.4 to 3.3 | 2.6 to 4.2 |
| CND0209A | KMTLT7K0002 | | | | | ○ | | 2.8 to 4.5 |
| CND0214A | KMTLT7K0003 | | | | — | 2.7 to 4.5 | | |
| CND0216A | KMTLT7K0004 | | | | 1.5 | ○ | 2.8 to 4.5 | |
| CND0312A | KMTLSM8K0001 | FIR | $1.45 \times 6.7 \times 2.15$ (Side view) | 2.5 to 3.3 | | | 2.7 to 4.5 | |
| CND0322A | KMTLT8K0001 | | $1.65 \times 8.2 \times 1.7$ (Top view) | | | | | |

M

Application Products

Hologram Unit

| Application | Part No. | V _{CC} (V) | P _O (mW) | | λ _p (nm) | I _{op} (mA) |
|------------------------------------|----------|------------------------|------------------------|---|------------------------|-------------------------|
| CD player; Portable CD player | HUL7212 | 5 | 3.6 | | 800 | 32 |
| | HUL7215 | 3 | | | 795 | |
| DVD player; Portable DVD player | HULT273 | 5 | DVD | 6 | 667 | 20 |
| | | | CD | 8 | 785 | |
| | HULT276 | | DVD | 5 | 667 | 50 |
| | | | CD | 6 | 785 | 40 |

Laser Diodes

Laser

| Application | Part No. | P _O * max. (mW) | | λ _p typ. (nm) | I _{th} typ. (mA) | I _{op} typ. (mA) |
|--|----------|----------------------------------|-----|--------------------------------|---------------------------------|---------------------------------|
| Dual-wavelength high-output type for DVD/CD recording/ playback | LNCT12PF | DVD | 350 | 661 | 55 | 150 |
| | | CD | | 785 | | 215 |
| | LNCT16PF | DVD | 300 | 661 | | 130 |
| | | CD | 330 | 785 | | 215 |
| | LNCT21PU | DVD | 300 | 661 | 50 | 130 |
| | | CD | 400 | 785 | 55 | 215 |
| Blu-ray Disc recording | LNC415FG | 320 | | 405 | 38 | 90 |

*: P_O is the maximum pulsed output power

Package Outlines

| | |
|--|------------|
| Application-Specific Standard-Product ICs | N3 |
| Image Pickup Devices..... | N18 |
| GaAs | N20 |

Information regarding package outlines not shown in this catalog can be obtained at the following URL

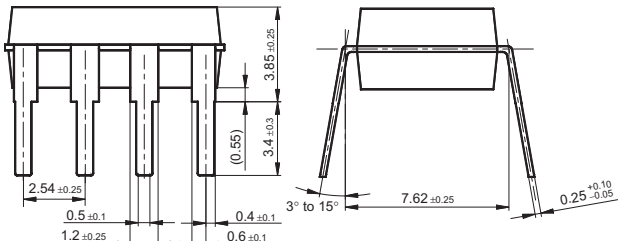
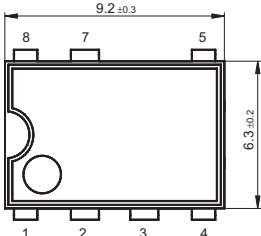
http://panasonic.net/sc/en/common_info/package

| <Package | Page> | <Package | Page> |
|--|-------|-----------------------------|-------|
| Application-Specific Standard-Product ICs | | Image Pickup Devices | |
| DIP7-A1 | N3 | WDIP014-P-0350A | N18 |
| HQFN044-P-0606 | N3 | WDIP016-P-0400A | N18 |
| HQFN064-P-0808A | N3 | WDIP020-G-0600D | N18 |
| HQFP048-P-0707 | N3 | WDIP032-G-0750C | N18 |
| HQFP048-P-0707A | N4 | WQFN040-C-1012 | N19 |
| HSOP034-P-0300A | N4 | WQFN040-C-1111 | N19 |
| HSOP042-P-0400D | N4 | WQFN042-C-0911 | N19 |
| HSOP042-P-0400F | N4 | WSOP028-P-0600A | N19 |
| HSOP056-P-0300 | N5 | | |
| LQFP048-P-0707A | N5 | GaAs | |
| LQFP064-P-1414 | N5 | ML6-N1 | N20 |
| LQFP080-P-1414A | N5 | PAMP09-N1 | N20 |
| LQFP100-P-1414 | N6 | PAMP13-N1 | N20 |
| LQFP100-P-1414A | N6 | | |
| LQFP112-P-2020 | N6 | | |
| LQFP128-P-1818C | N6 | | |
| LQFP144-P-2020A | N7 | | |
| MBGA255-C-1111A | N7 | | |
| MLGA092-L2-0808 | N7 | | |
| MLGA107-L2-0909 | N7 | | |
| MLGA344-C-1313A | N8 | | |
| QFH064-P-1414H | N8 | | |
| QFH080-P-1420H | N8 | | |
| QFN028-P-0405B | N8 | | |
| QFN044-P-0606A | N9 | | |
| QFN044-P-0606C | N9 | | |
| QFP044-P-1010F | N9 | | |
| QFP048-P-1212C | N9 | | |
| QFP056-P-1010B | N10 | | |
| QFP084-P-1818E | N10 | | |
| QFP100-P-1818B | N10 | | |
| QFS064-P-1414C | N10 | | |
| QFS080-P-1414D | N11 | | |
| SDIP042-P-0600C | N11 | | |
| S MINI-5DA | N11 | | |
| SOP016-P-0225F | N11 | | |
| SOP024-P-0375C | N12 | | |
| SS MINI-5DA | N12 | | |
| SSOP020-P-0225C | N12 | | |
| SSOP024-P-0300C | N12 | | |
| SSOP024-P-0300E | N13 | | |
| SSOP032-P-0300B | N13 | | |
| SSOP036-P-0450C | N13 | | |
| TO-220-A2 | N13 | | |
| TO-220IPD7-A2 | N14 | | |
| TQFP032-P-0707A | N14 | | |
| TQFP048-P-0707B | N14 | | |
| TQFP064-P-0707 | N14 | | |
| TQFP064-P-1010B | N15 | | |
| TQFP064-P-1010C | N15 | | |
| TQFP080-P-1212D | N15 | | |
| TQFP128-P-1414A | N15 | | |
| TQFP128-P-1414C | N16 | | |
| UBGA257-P-1111A | N16 | | |
| ULGA020-L-0404 | N16 | | |
| ULGA031-W-3525 | N16 | | |
| ULGA054-W-5234 | N17 | | |
| XLGA012-L-0303 | N17 | | |

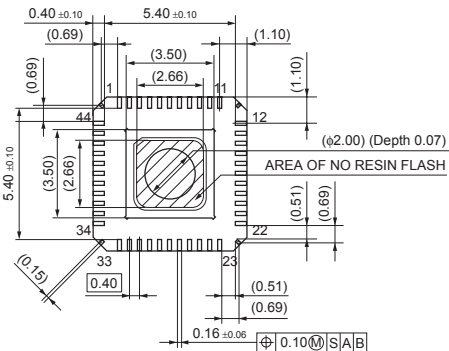
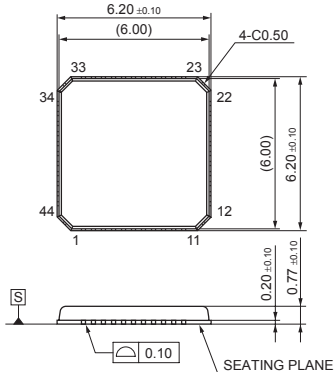
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Unit: mm

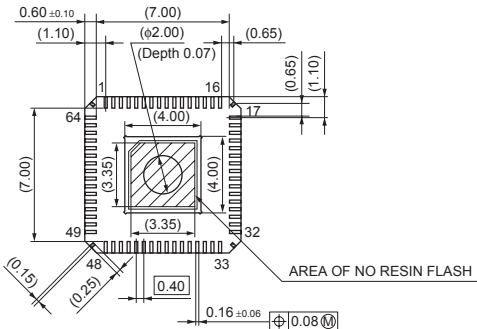
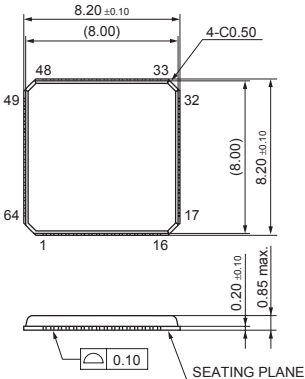
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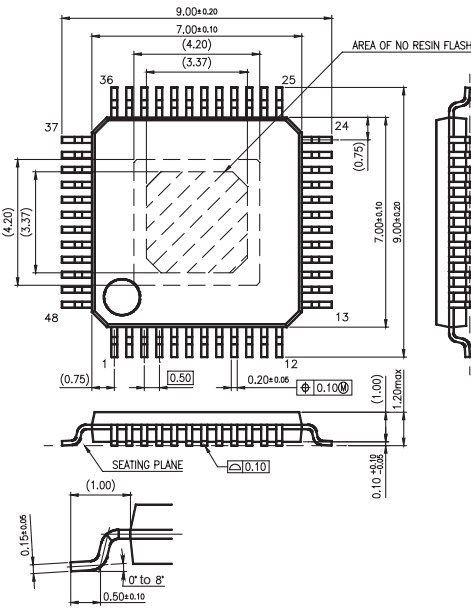
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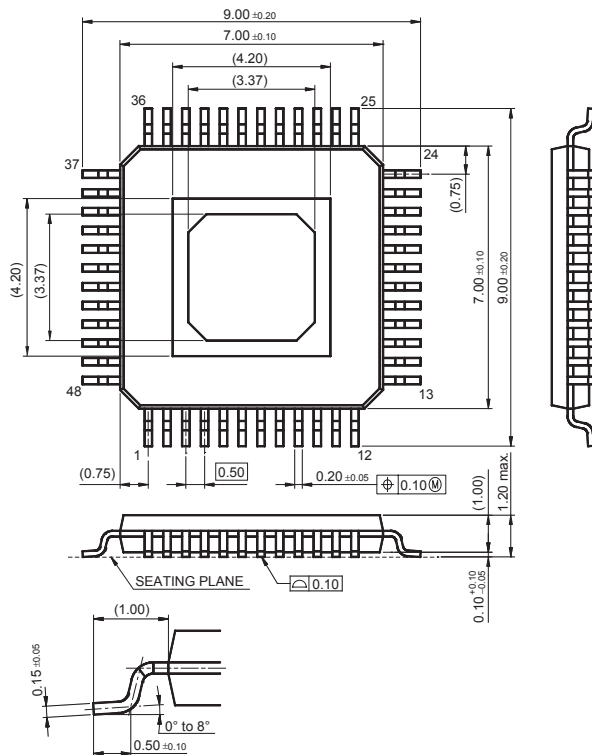
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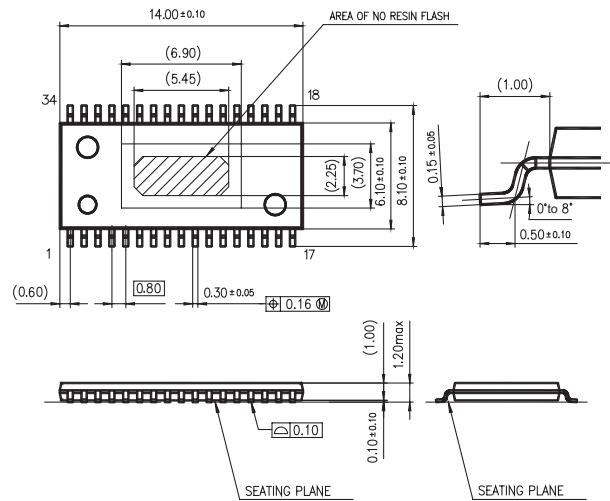
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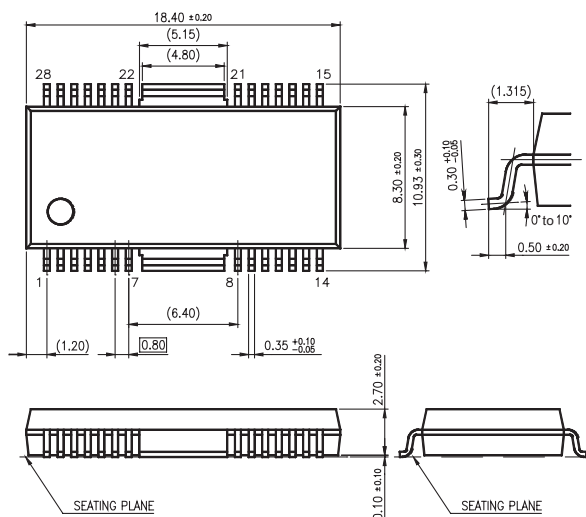
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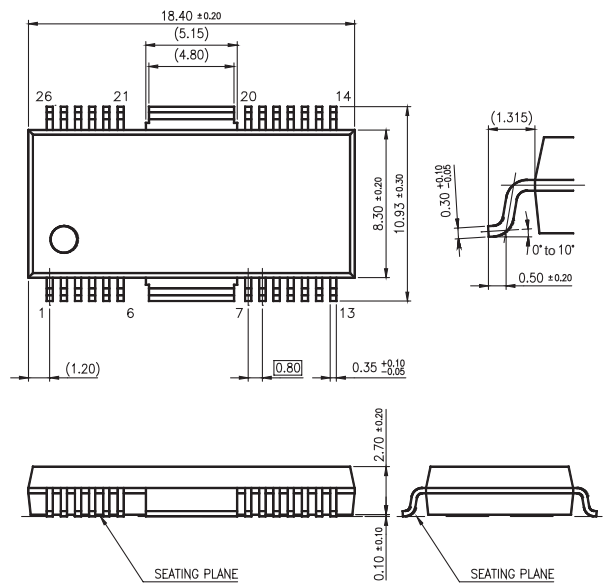
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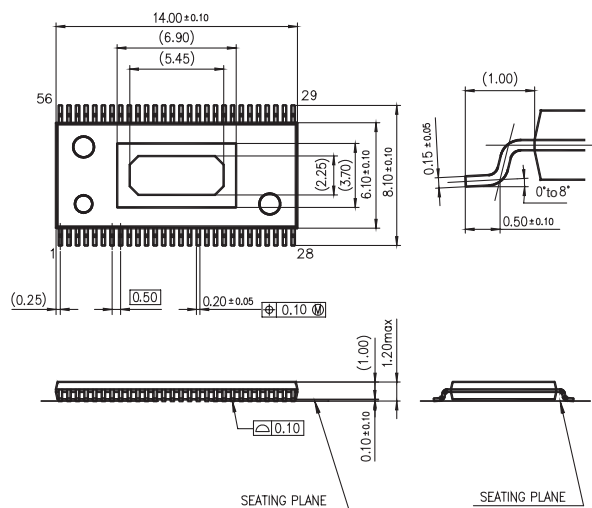
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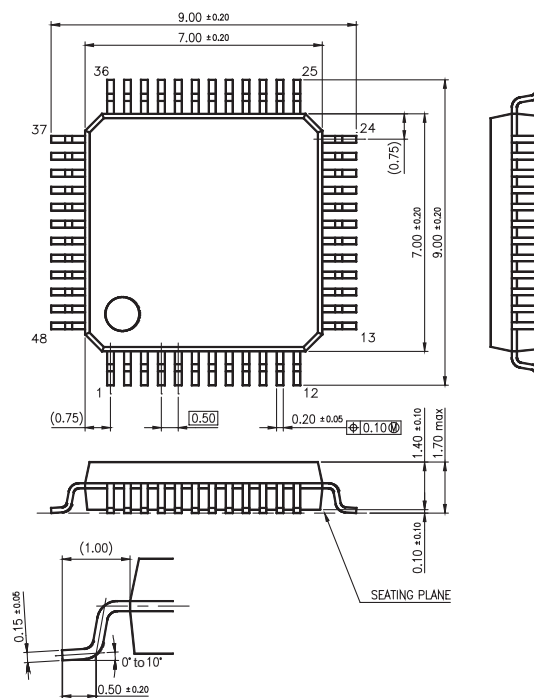
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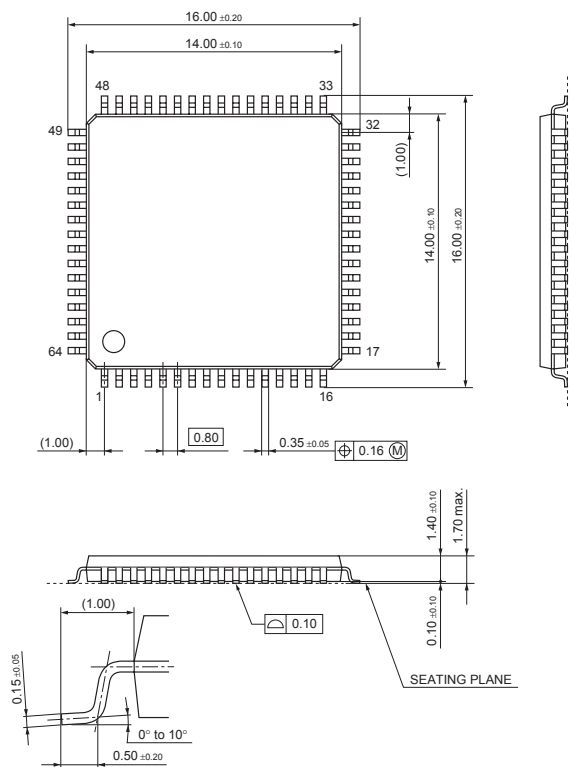
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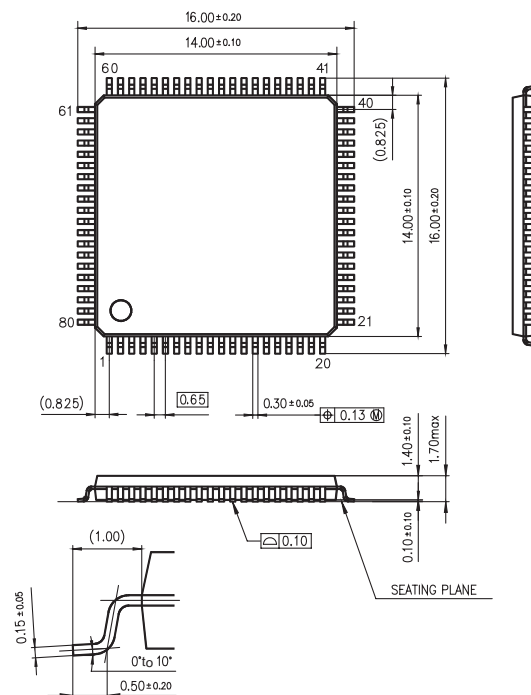
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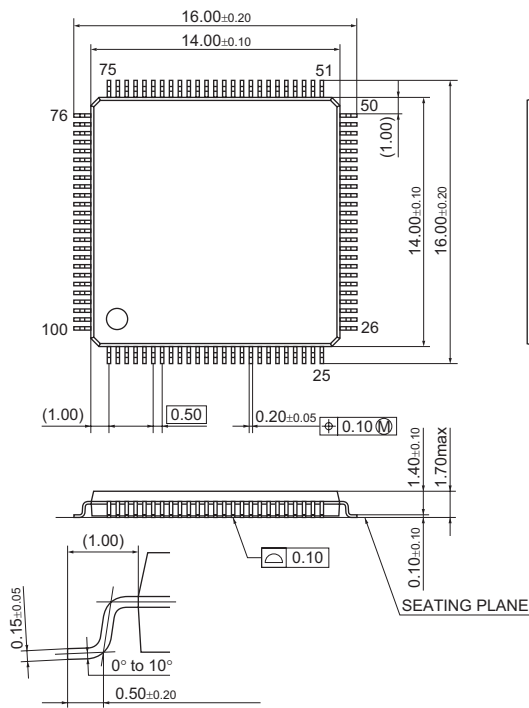


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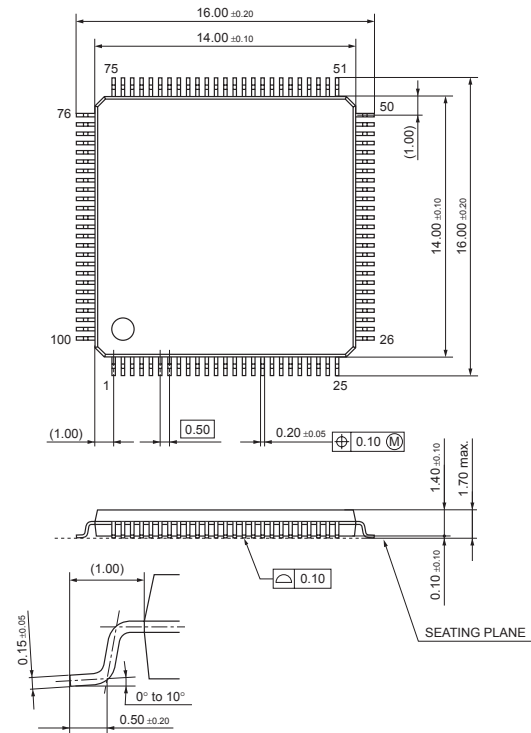
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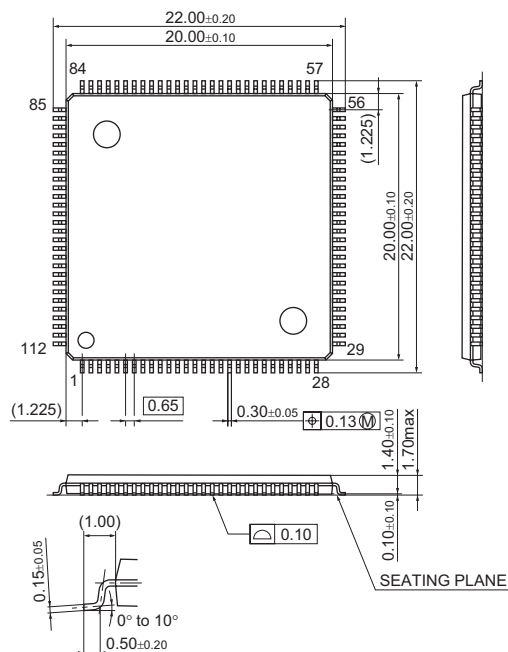
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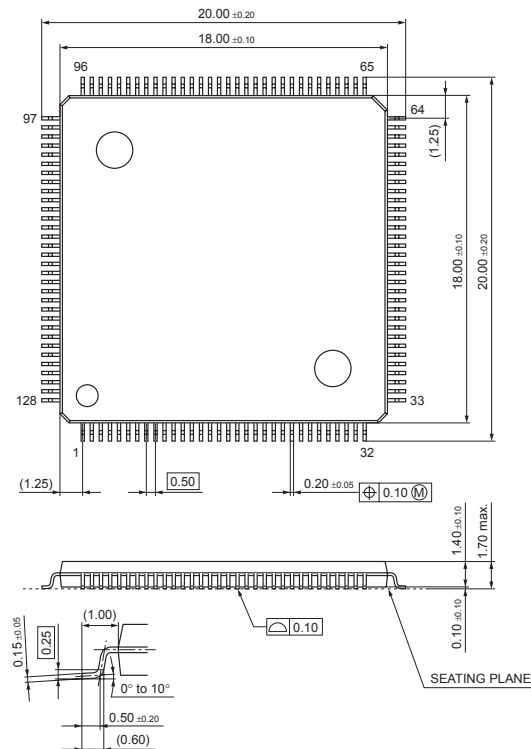
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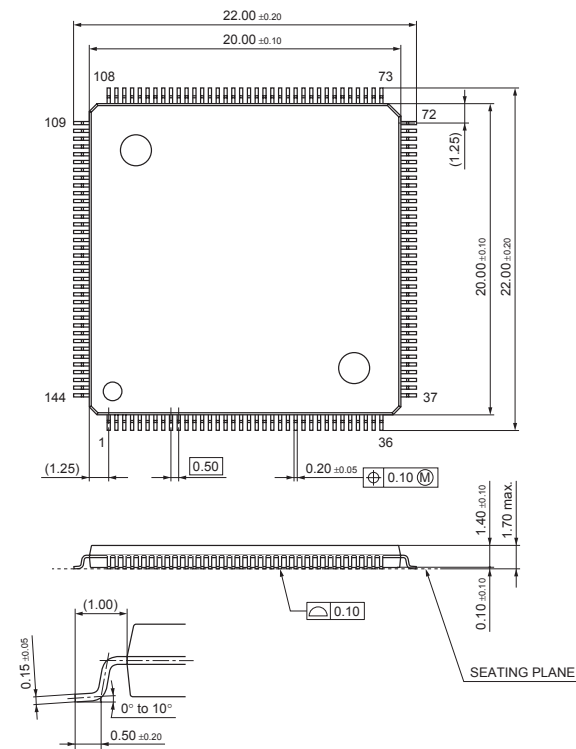
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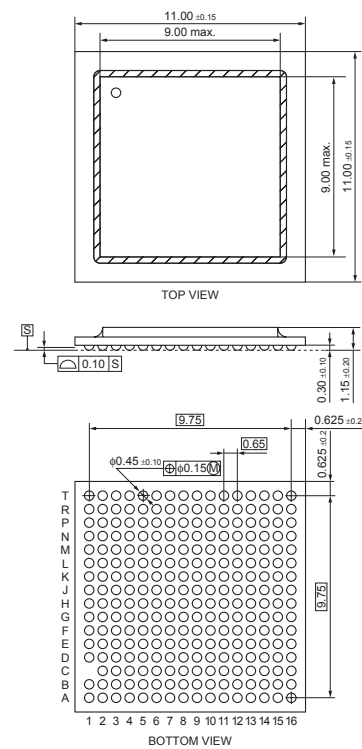
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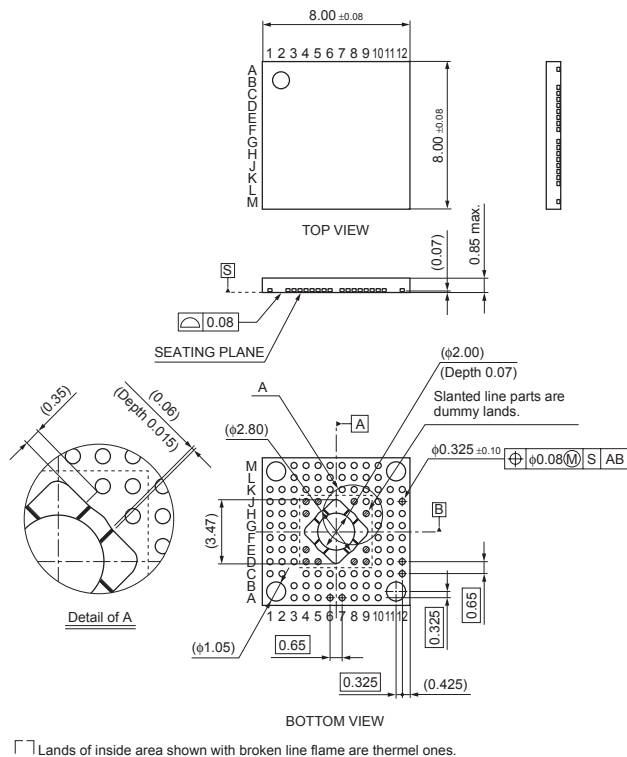
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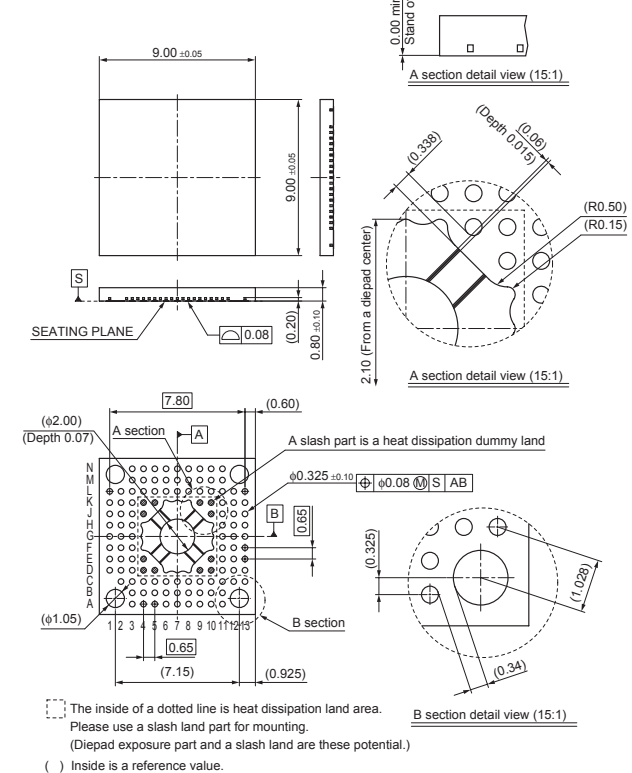
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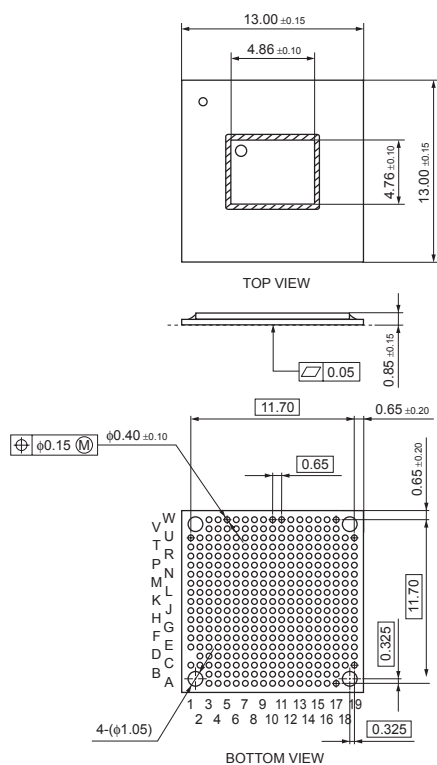
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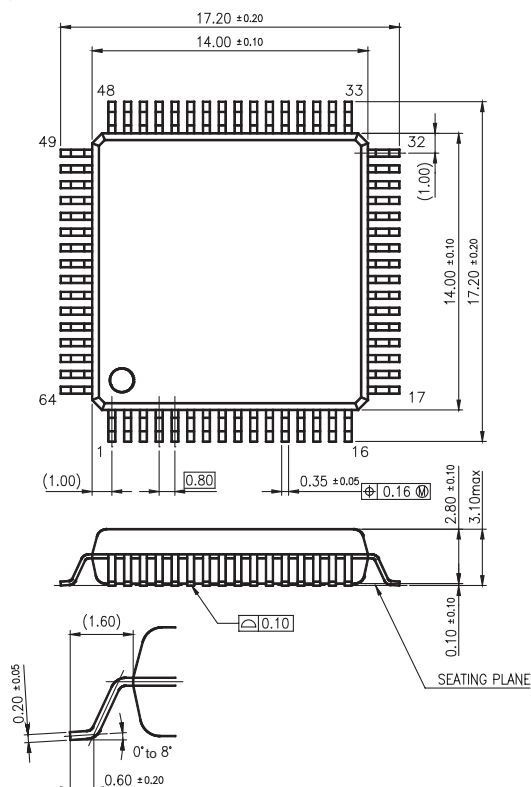
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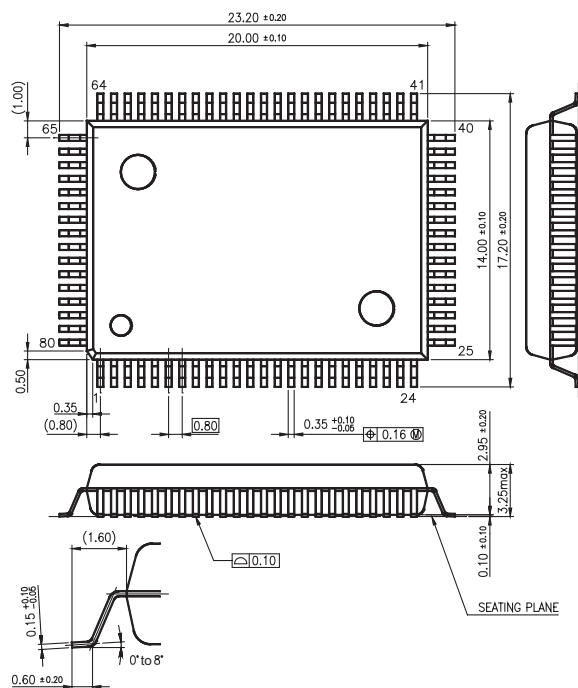
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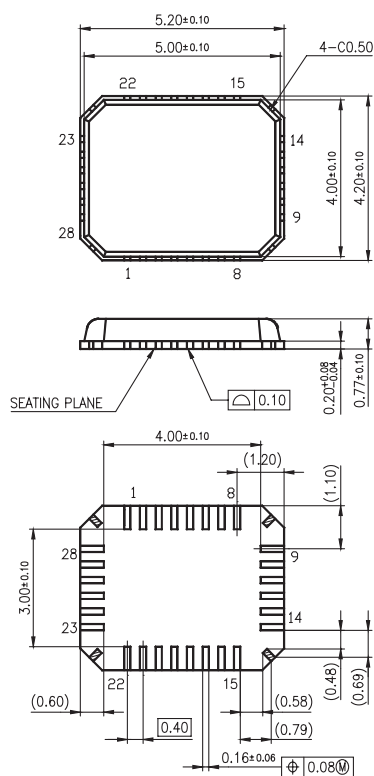
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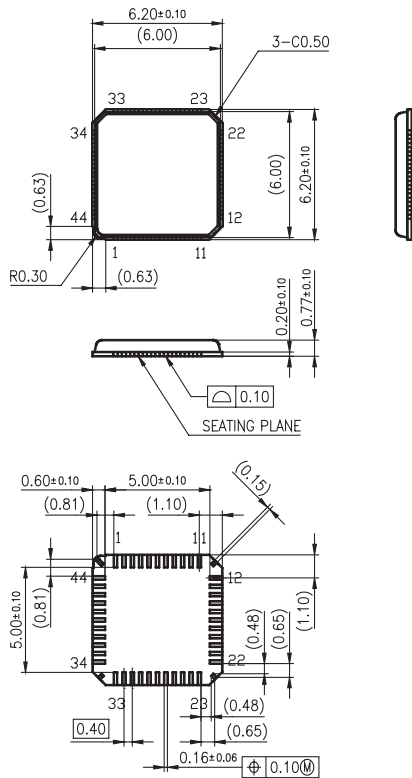
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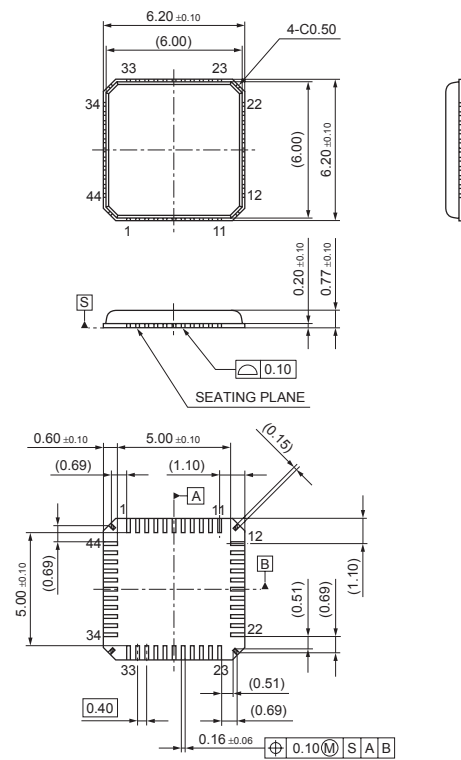
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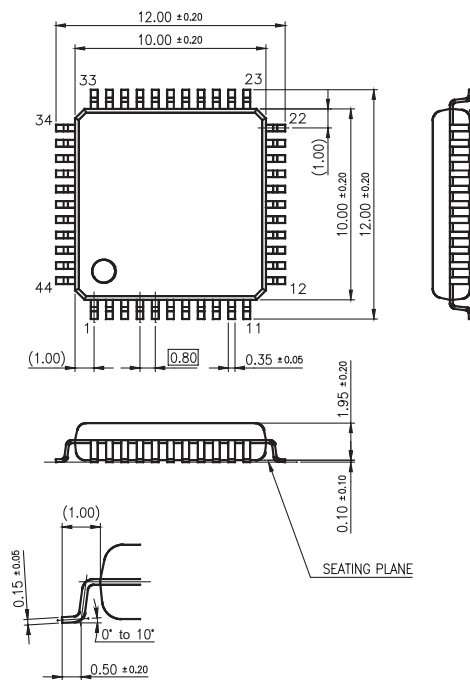
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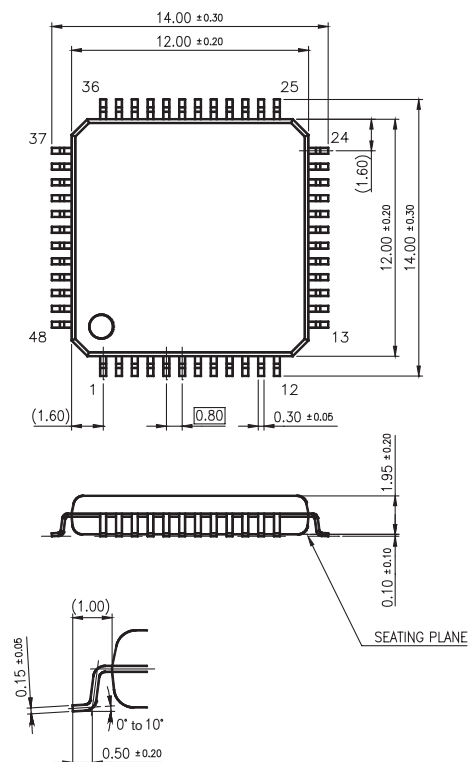
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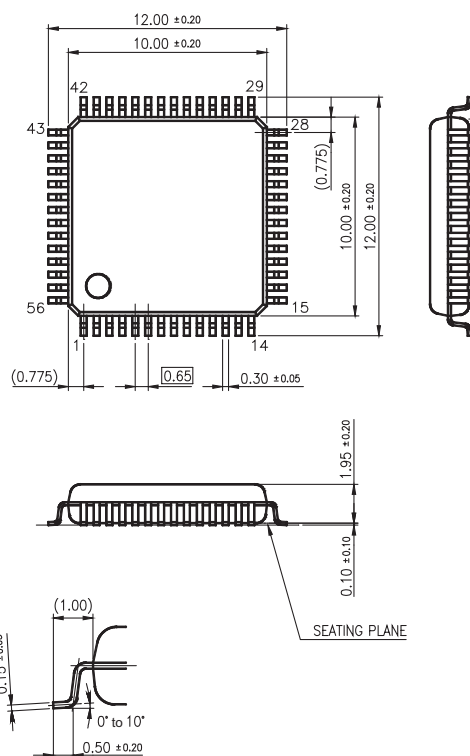


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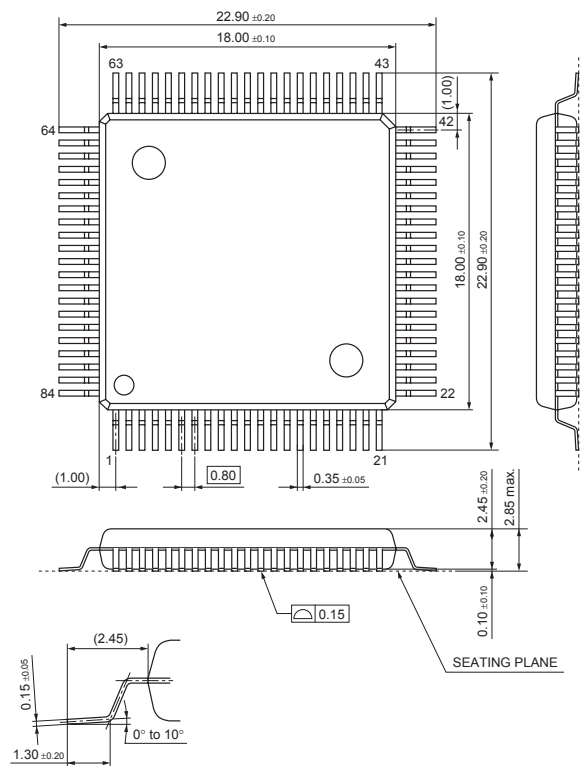
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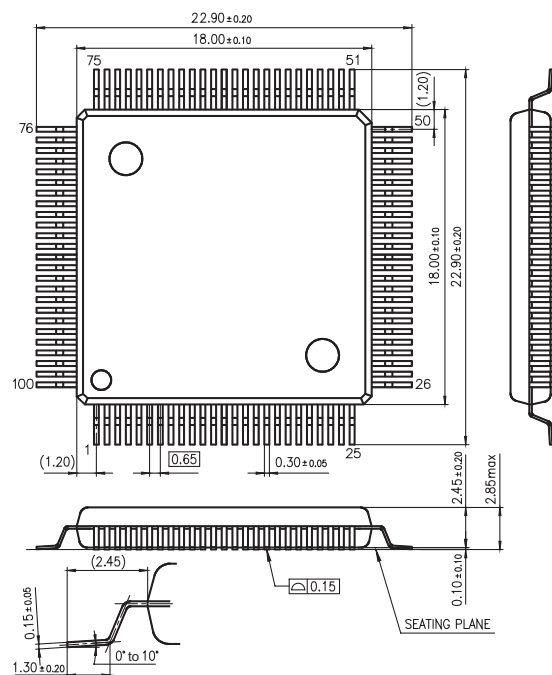
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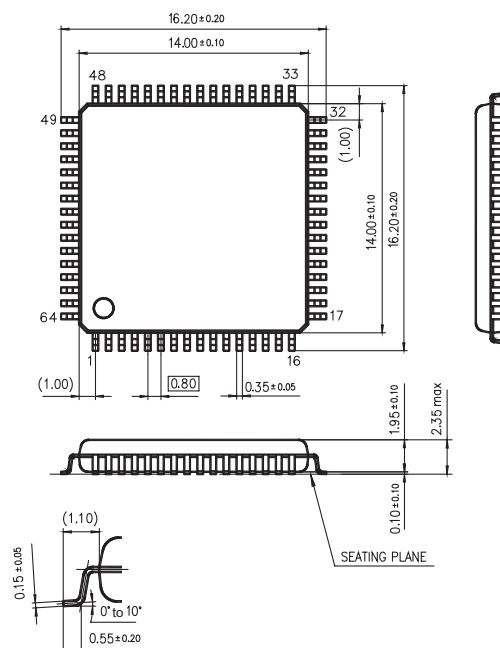
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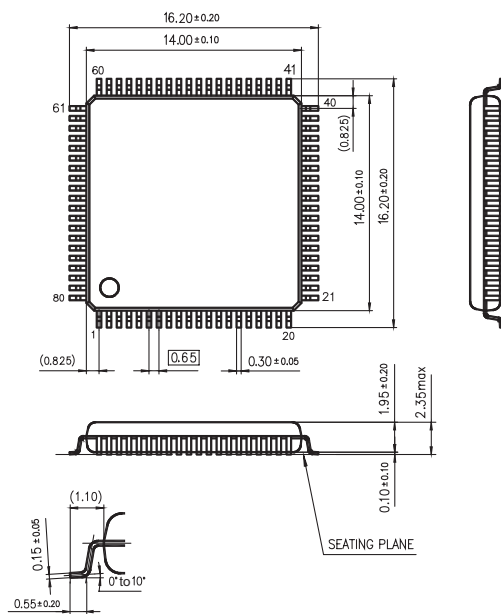
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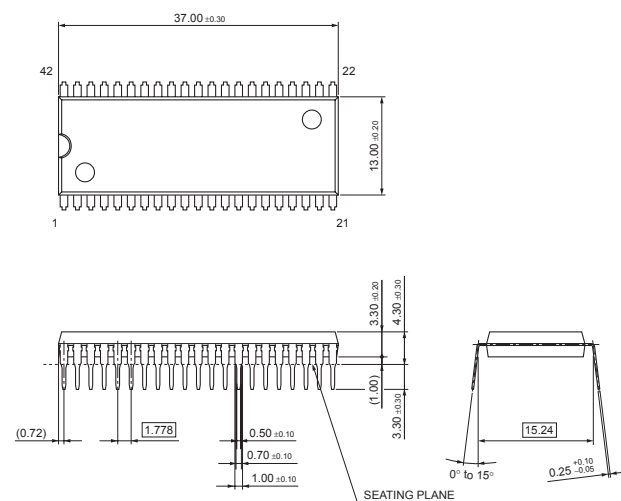
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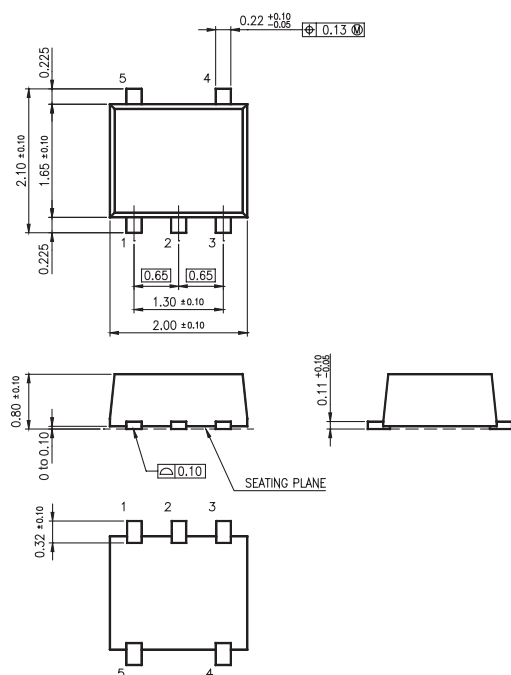
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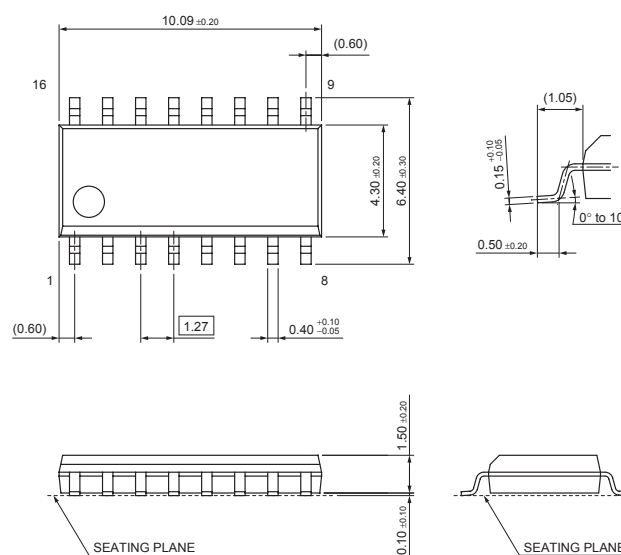
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SMINI-5DA



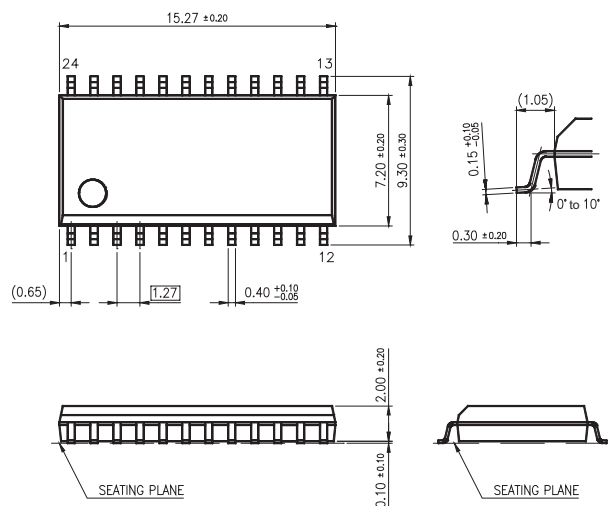
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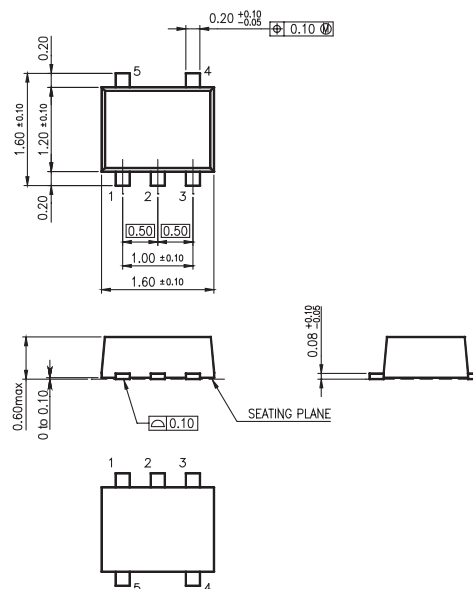
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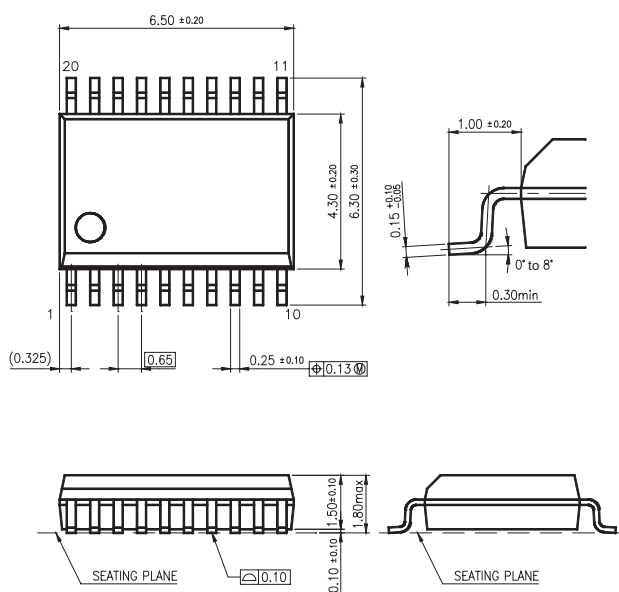
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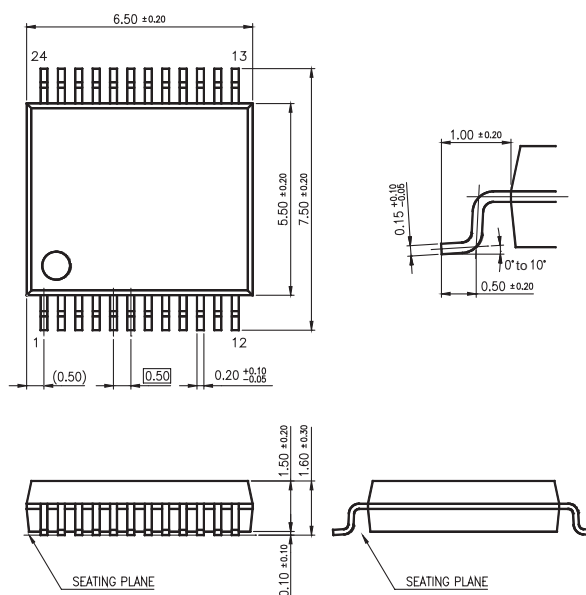
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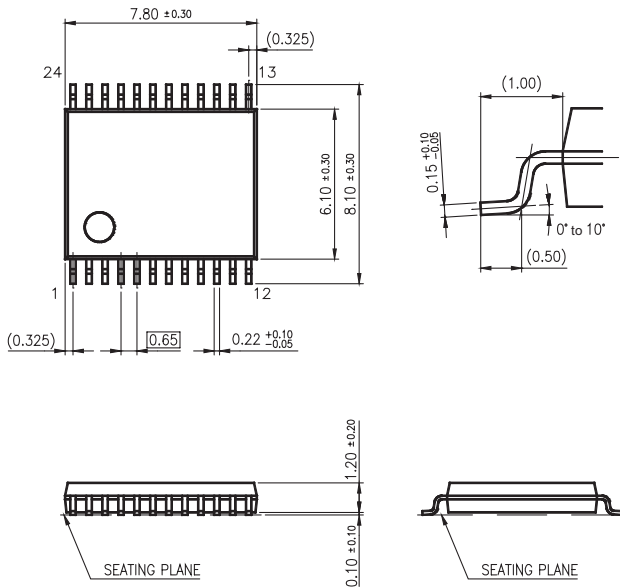
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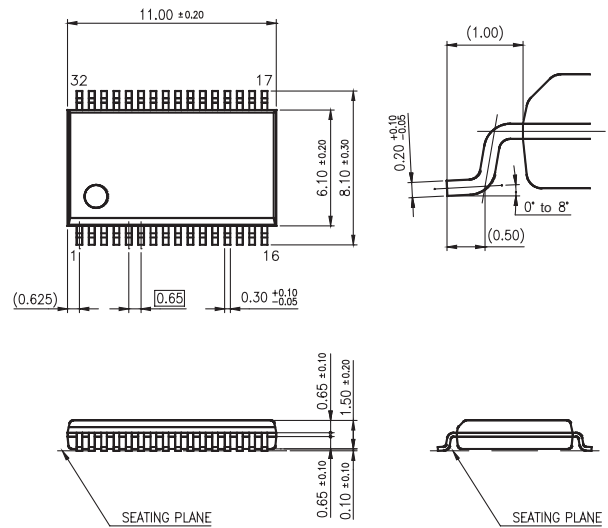
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Unit: mm

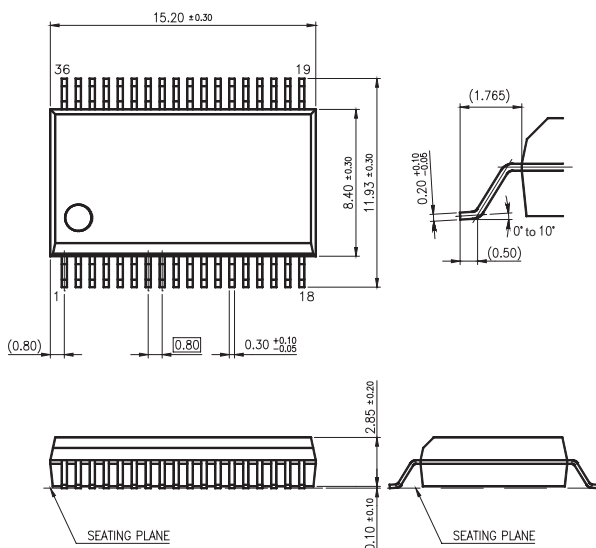
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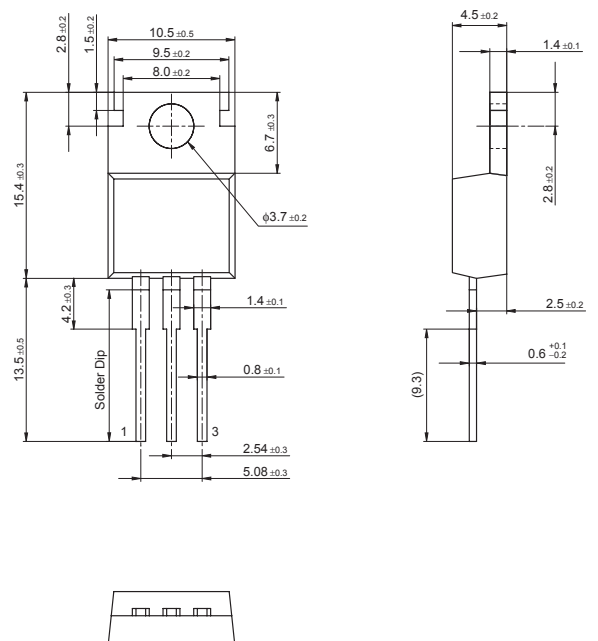
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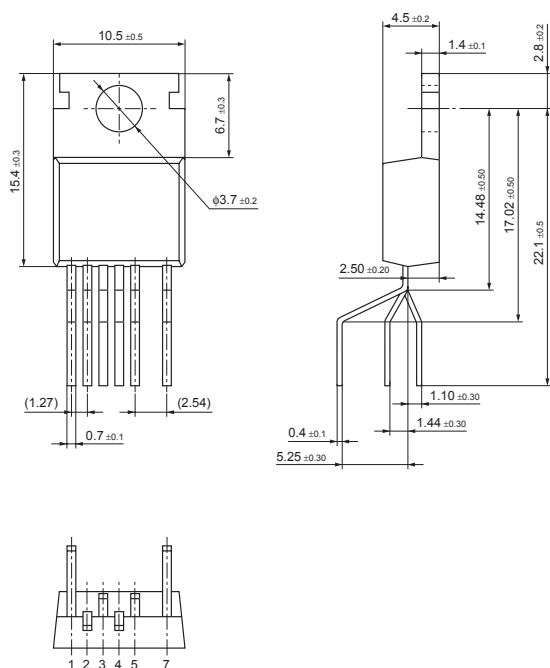
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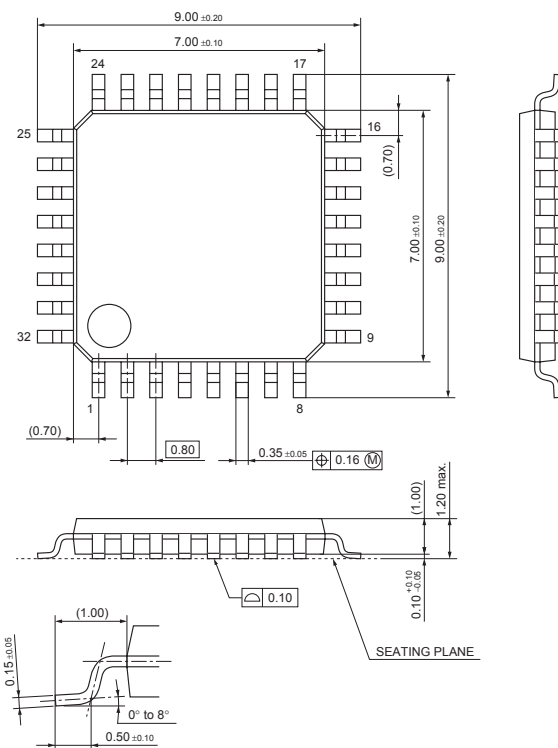
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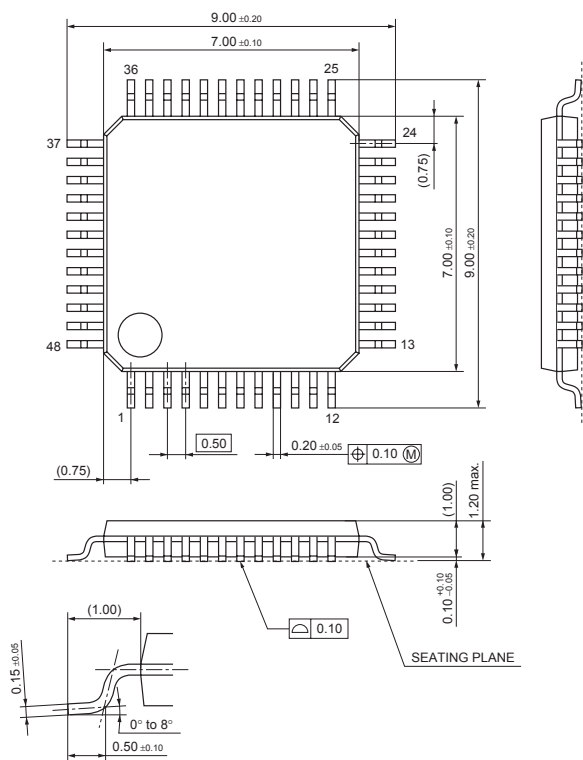
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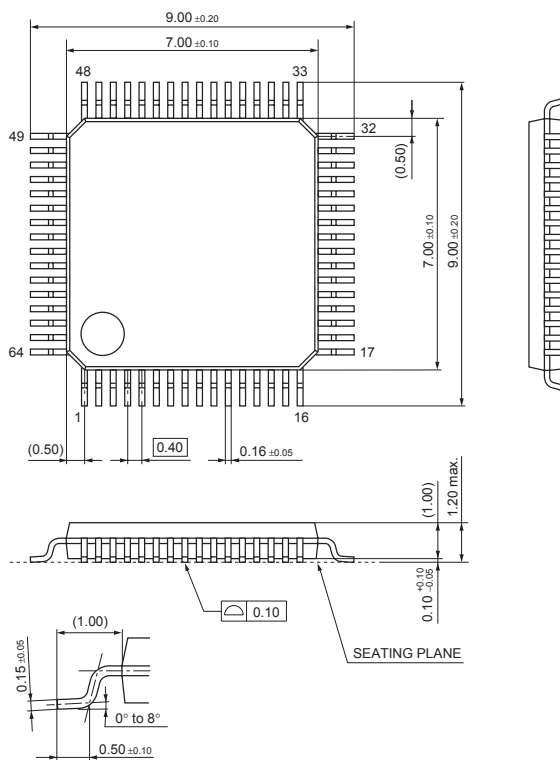
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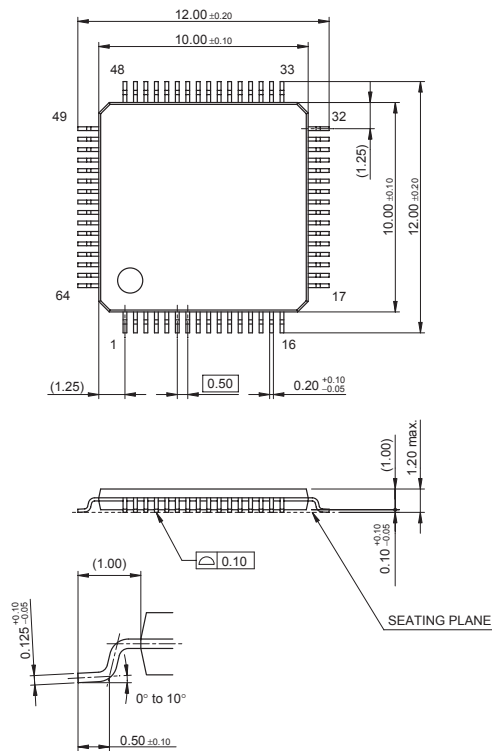
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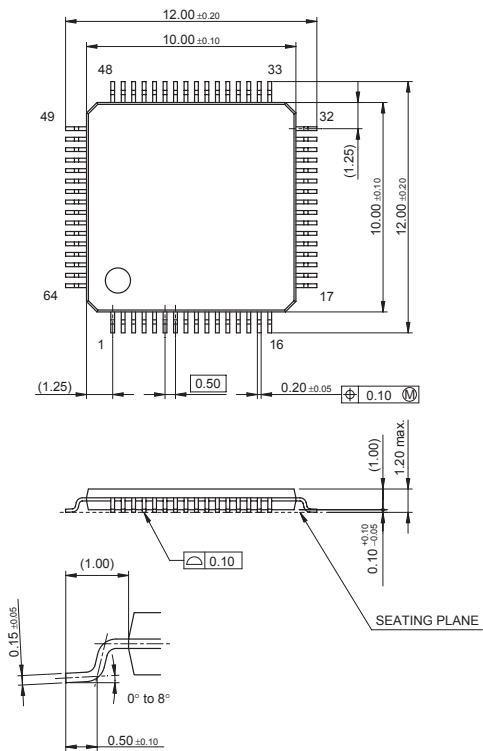
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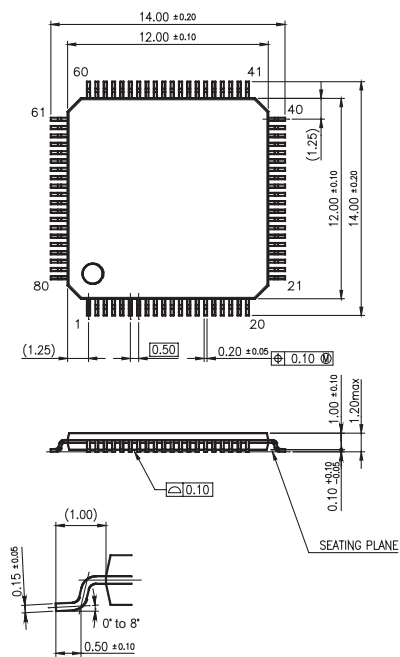
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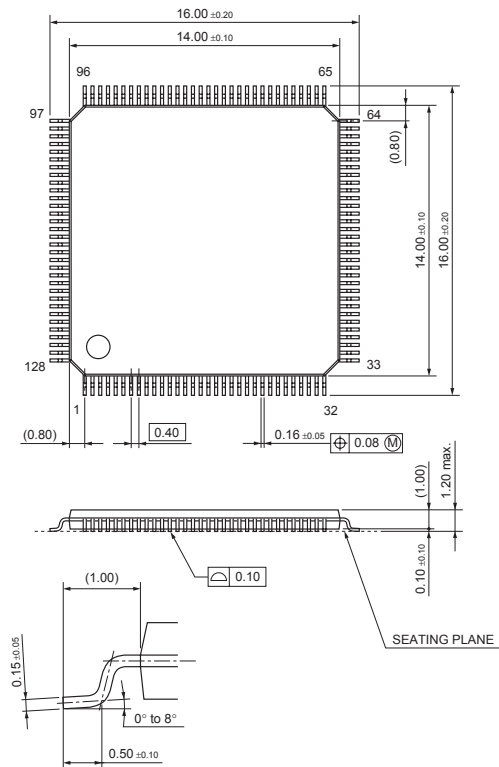
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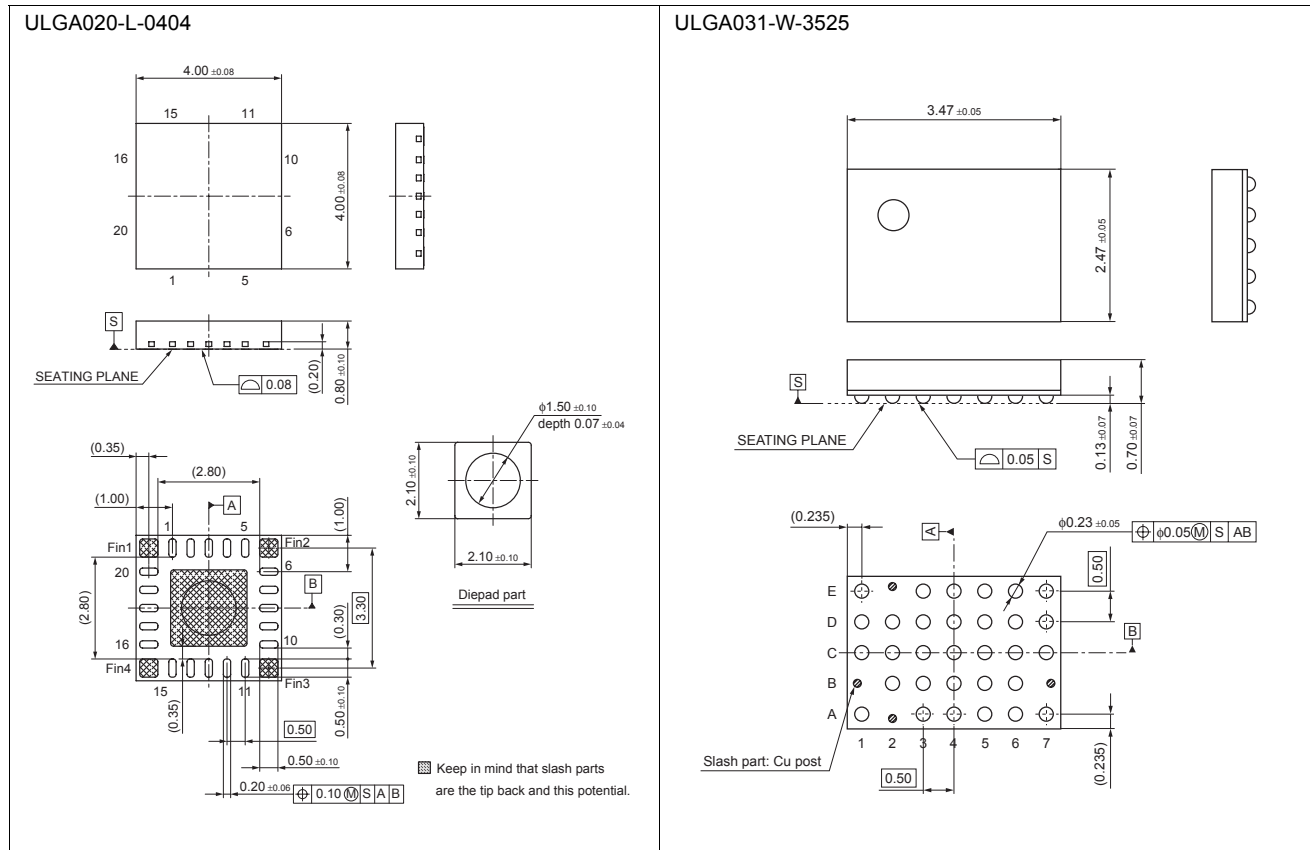
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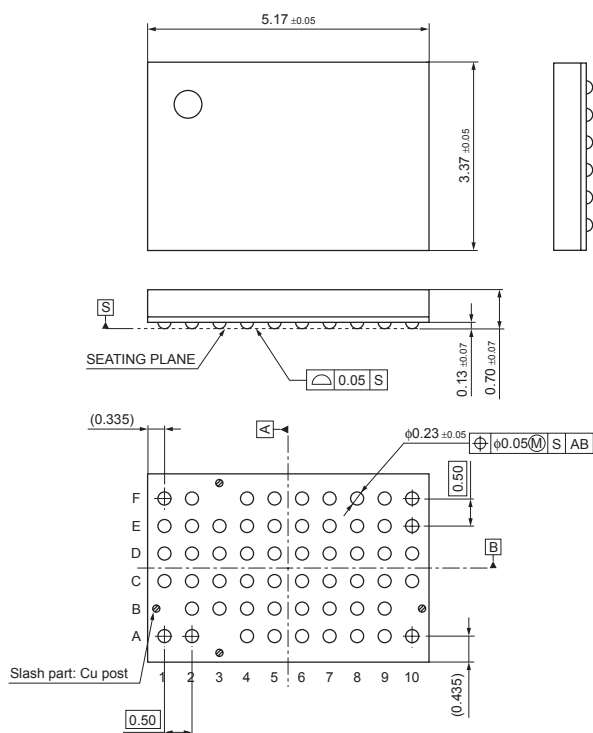
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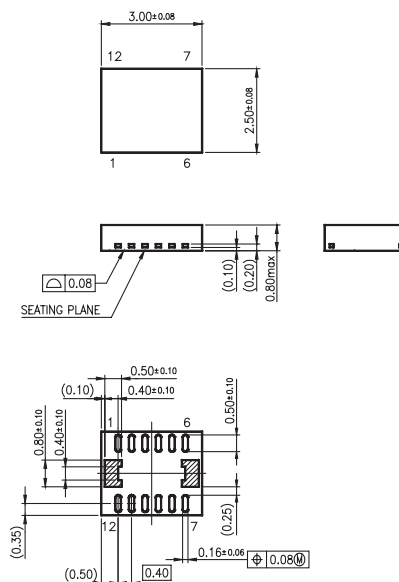
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Unit: mm

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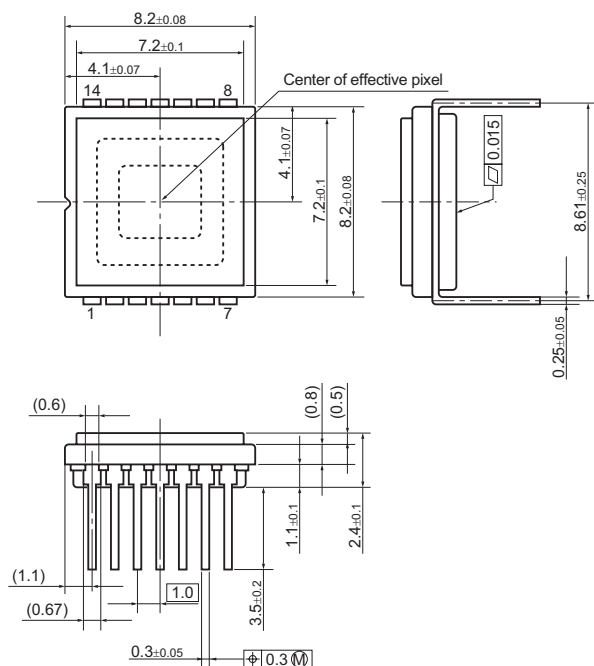


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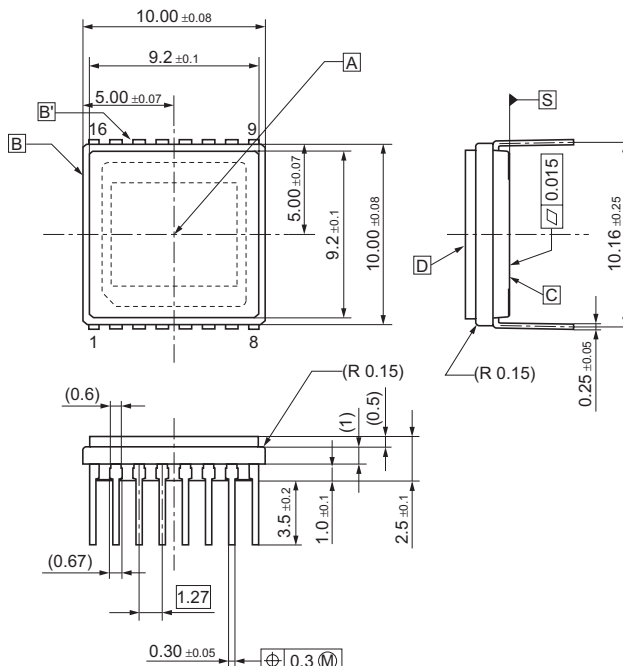
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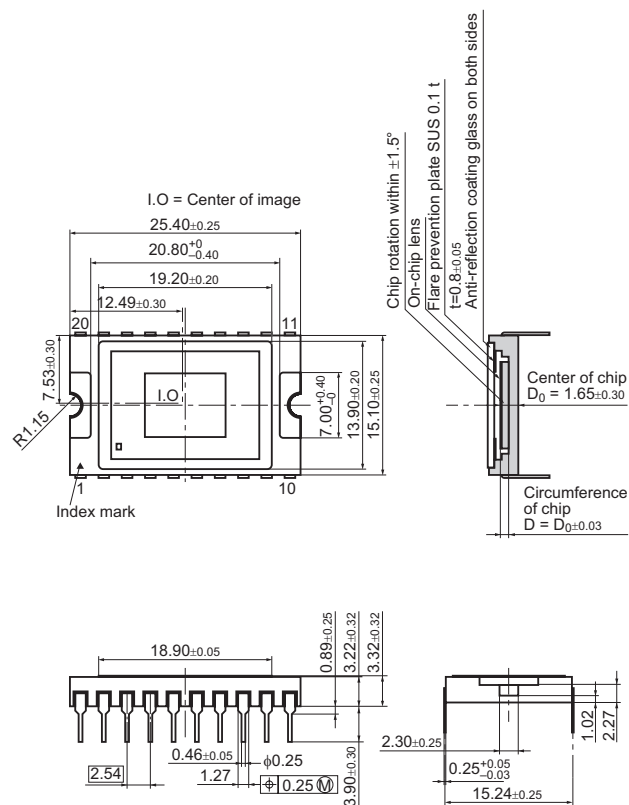
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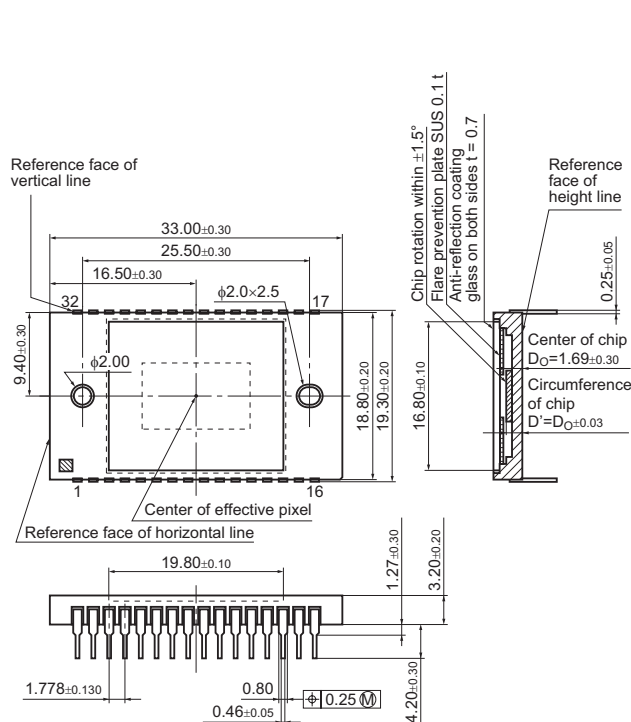
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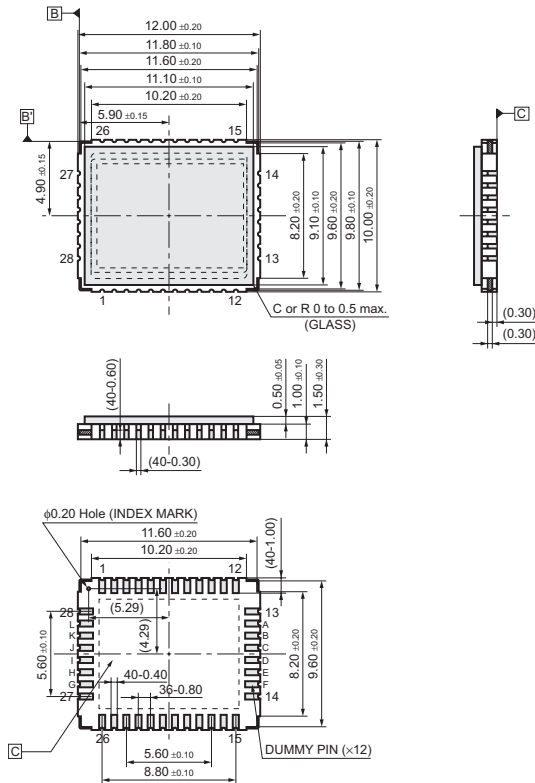
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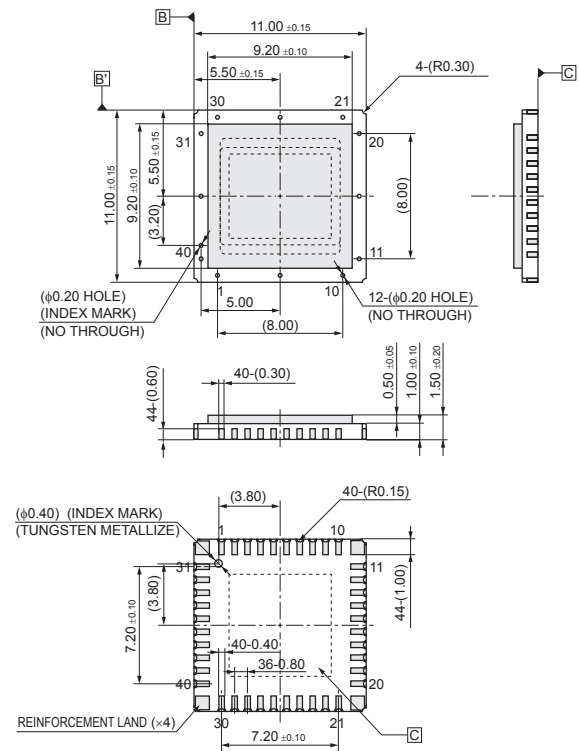
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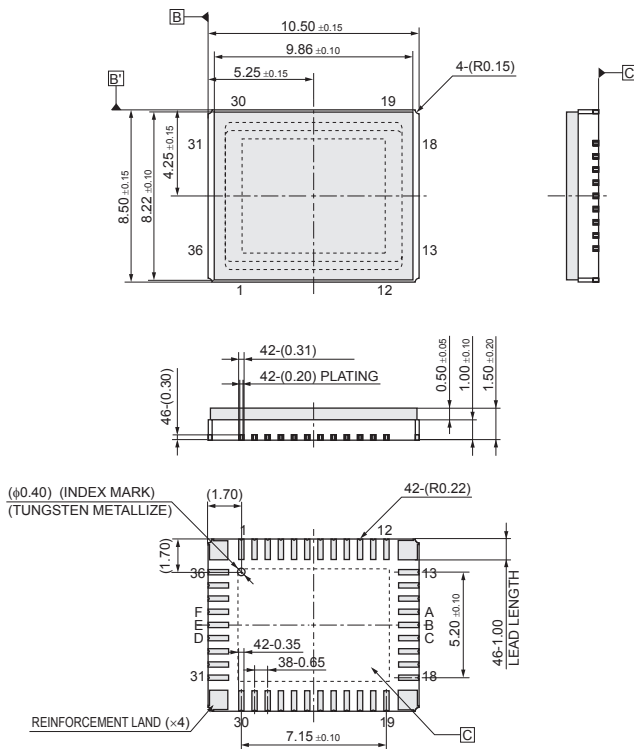
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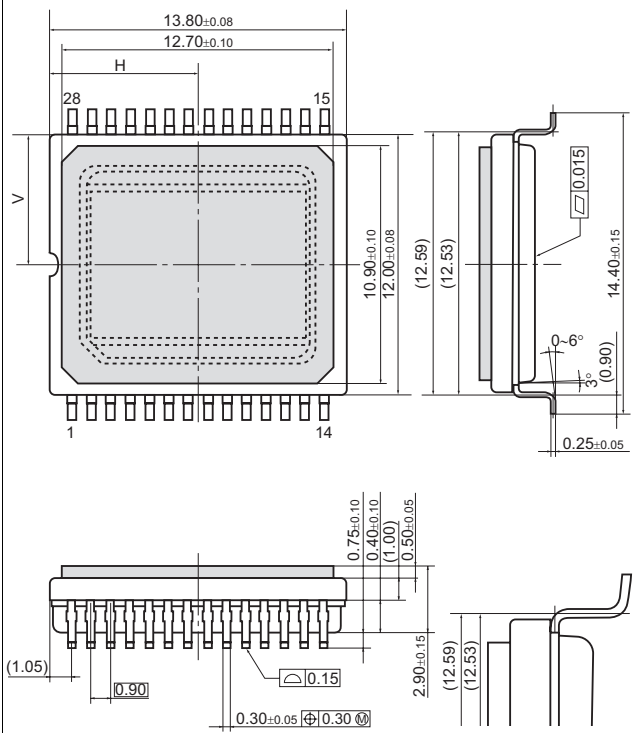
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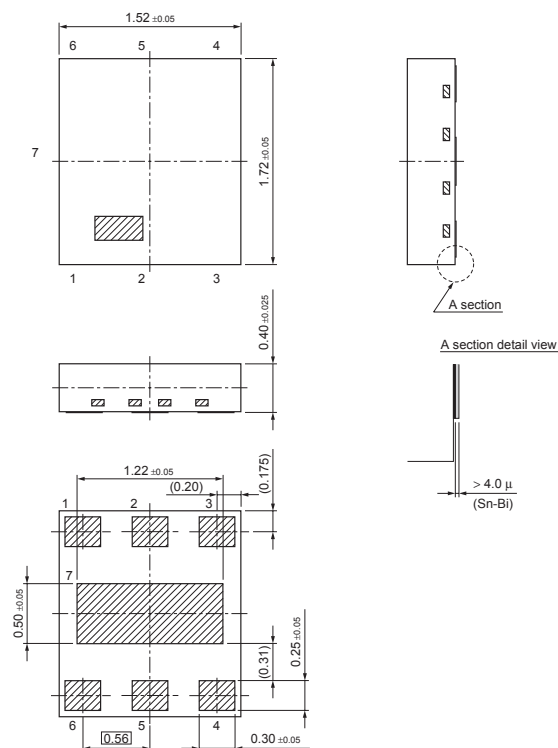
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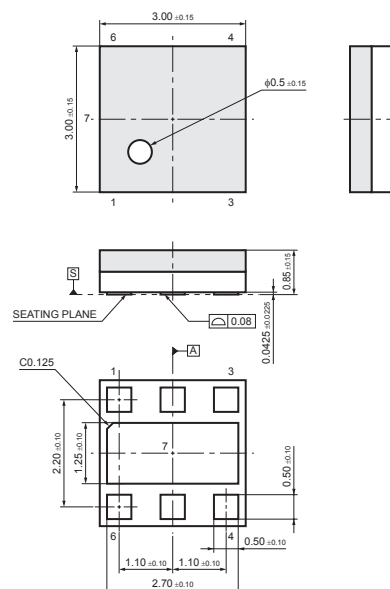
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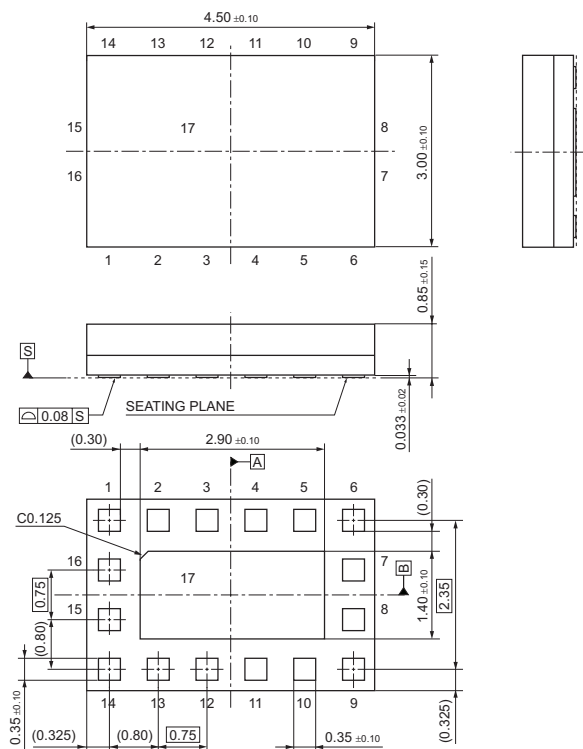
ML6-N1



PAMP09-N1



PAMP13-N1



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