

LOW NOISE, BIPOLAR INPUT DUAL AUDIO OPERATIONAL AMPLIFIER

FEATURES

- Designed for High-Quality Sound
 - Low Noise 3.5 nV/ $\sqrt{\text{Hz}}$ at 1kHz
 - Low Distortion 0.001%
 - Slew Rate 6.8V/ μs
 - Gain Bandwidth Product 19 MHz
 - Open-Loop Voltage Gain 120dB
 - Unity-Gain Stable
 - Bipolar Input
 - Supply Voltage $\pm 4\text{V}$ to $\pm 18\text{V}$
 - Operating Temperature -40°C to 125°C
 - Supply Current (All Amplifiers) 5 mA typ.
 - Package SOP8
MSOP8 (TVSP8)*
- * meet JEDEC MO-187-DA / thin type

DESCRIPTION

NJM8068 is a low noise bipolar input dual audio operational amplifier has 3.5 nV/ $\sqrt{\text{Hz}}$ at 1kHz.

The NJM8068 features Low distortion, high slew rate, wide bandwidth and high open-loop gain. In addition, unity-gain stable allows voltage-follower operation. These features make NJM8068 ideal for audio pre amplifier, microphone amplifier, line amplifier and other audio applications. NJM8068 operate over a wide temperature range of -40°C to 125°C , making this IC ideal for use in industrial measurement instruments

The NJM8068 is available in 8-pin SOP and MSOP (TVSP) packages.

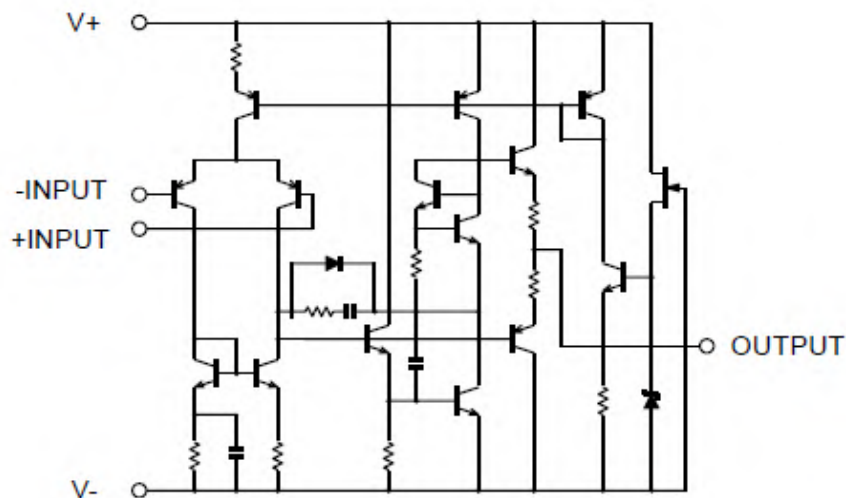
APPLICATIONS

- Professional Audio Sets
- Audio Pre / Microphone Amplifiers
- Analog / Digital Mixers
- AV Receivers
- Car Audio
- Industrial Measurement Instruments

RELATED PRODUCT

| PRODUCT NAME | FEATURES |
|--------------|--|
| NJM8080 | 5nV/ $\sqrt{\text{Hz}}$, 0.0005%, 5V/ μs , 15MHz (Low noise, low distortion audio Op-Amp) |

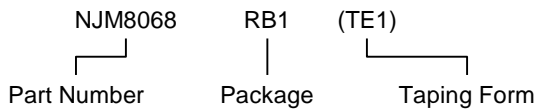
EQUIVALENT CIRCUIT



■ PIN CONFIGURATIONS

| | | |
|---------------|----------|---------------|
| PRODUCT NAME | NJM8068G | NJM8068B1 |
| Package | SOP8 | MSOP8 (TVSP8) |
| Pin Functions | | |

■ PRODUCT NAME INFORMATION



■ ORDER INFORMATION

| PRODUCT NAME | PACKAGE | RoHS | HALOGEN-FREE | TERMINAL FINISH | MARKING | WEIGHT (mg) | MOQ (pcs) |
|--------------|---------------|------|--------------|-----------------|---------|-------------|-----------|
| NJM8068G | SOP8 | Yes | Yes | Pure Sn | 8068 | 88 | 2500 |
| NJM8068RB1 | MSOP8 (TVSP8) | Yes | Yes | Sn2Bi | 8068 | 18 | 2000 |

■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATING | UNIT |
|---|-------------|----------------------------------|------|
| Supply Voltage | V^+ / V^- | ± 18 | V |
| Differential Input Voltage ⁽¹⁾ | V_{ID} | ± 36 | V |
| Input Voltage ⁽²⁾ | V_{IN} | $V^- - 0.3$ to $V^- + 36$ | V |
| Output Terminal Input Voltage | V_O | $V^- - 0.3$ to $V^+ + 0.3$ | V |
| Power Dissipation ⁽³⁾ | P_D | 2-Layer / 4-Layer ⁽⁴⁾ | |
| SOP8 | | 690 / 1000 | mW |
| MSOP8 (TVSP8) | 510 / 680 | | |
| Storage Temperature Range | T_{stg} | -65 to 150 | °C |
| Maximum Junction Temperature | T_{jmax} | 150 | °C |

■ THERMAL CHARACTERISTICS

| PACKAGE | SYMBOL | VALUE | UNIT |
|---|---------------|----------------------------------|------|
| Junction-to-Ambient Thermal Resistance | Θ_{ja} | 2-Layer / 4-Layer ⁽⁴⁾ | |
| SOP8 | | 181 / 125 | °C/W |
| MSOP8 (TVSP8) | | 245 / 184 | |
| Junction-to-Top of Package Characterization Parameter | Ψ_{jt} | 2-Layer / 4-Layer ⁽⁴⁾ | |
| SOP8 | | 49 / 43 | °C/W |
| MSOP8 (TVSP8) | | 51 / 45 | |

(1) Differential voltage is the voltage difference between +INPUT and -INPUT.

(2) Input voltage is the voltage should be allowed to apply to the input terminal independent of the magnitude of V^+ .

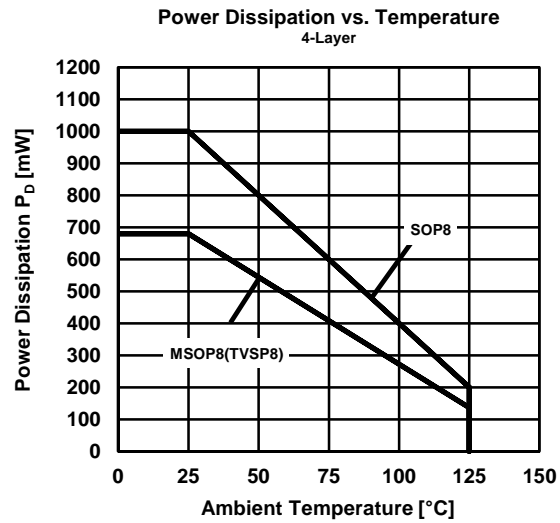
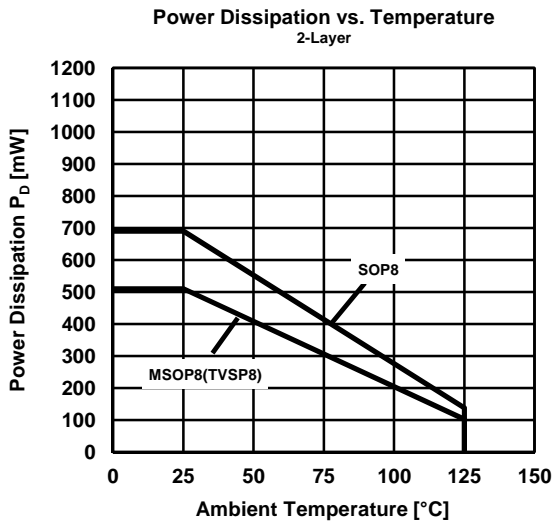
The normal operation will establish when any input is within the "Common-Mode Input Voltage Range" of electrical characteristics.

(3) Power dissipation is the power that can be consumed by the IC at $T_a = 25^\circ\text{C}$, and is the typical measured value based on JEDEC condition.

(4) 2-Layer: Mounted on glass epoxy board. (76.2x114.3x1.6 mm: based on EIA/JDEC standard, 2-layer FR-4)

4-Layer: Mounted on glass epoxy board. (76.2x114.3x1.6 mm: based on EIA/JDEC standard, 4-layer FR-4), internal Cu area: 74.2 x 74.2 mm

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



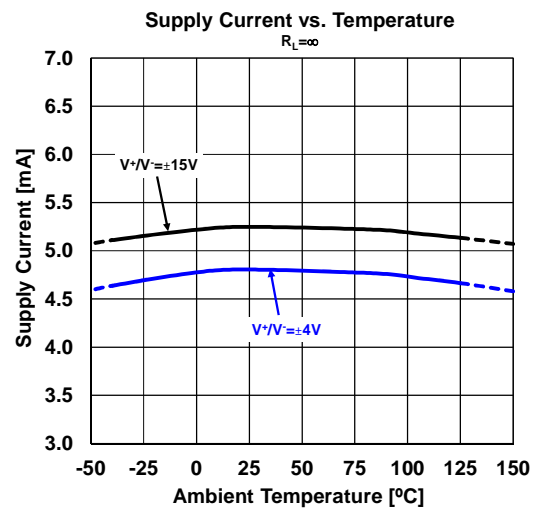
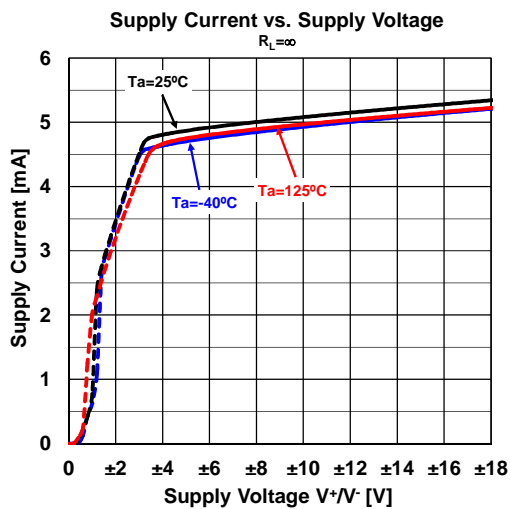
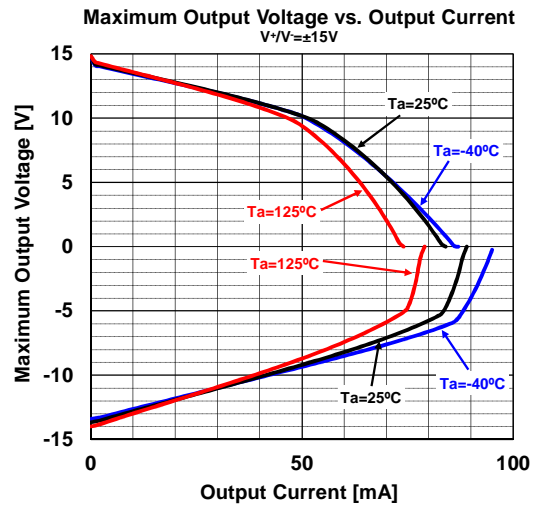
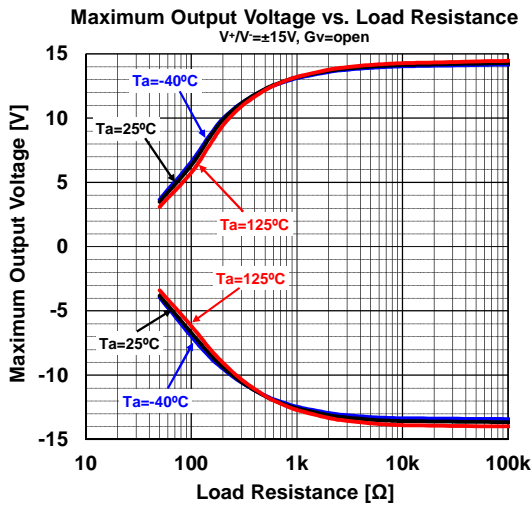
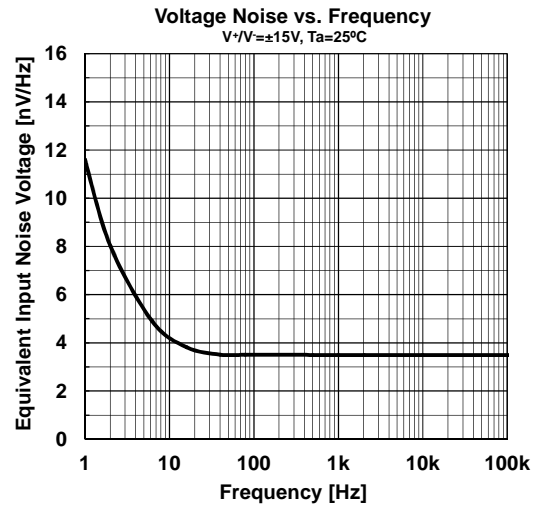
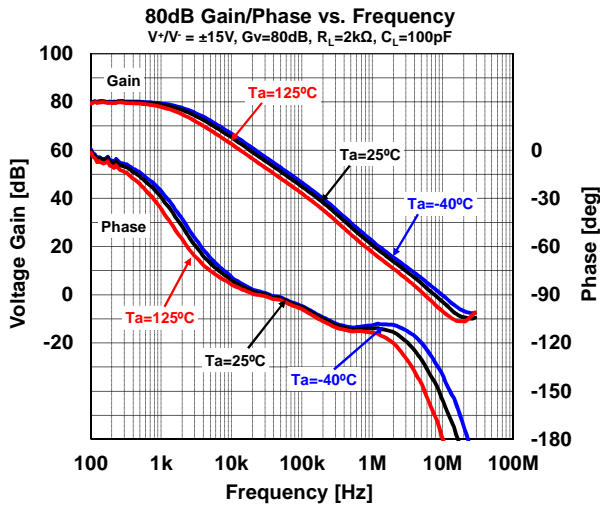
■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | CONDITIONS | VALUE | UNIT |
|-----------------------------|-----------|------------------------|---------------------|------------------|
| Supply Voltage | V^+V^- | $T_a=25^\circ\text{C}$ | ± 4 to ± 18 | V |
| Operating Temperature Range | T_{opr} | | -40 to 125 | $^\circ\text{C}$ |

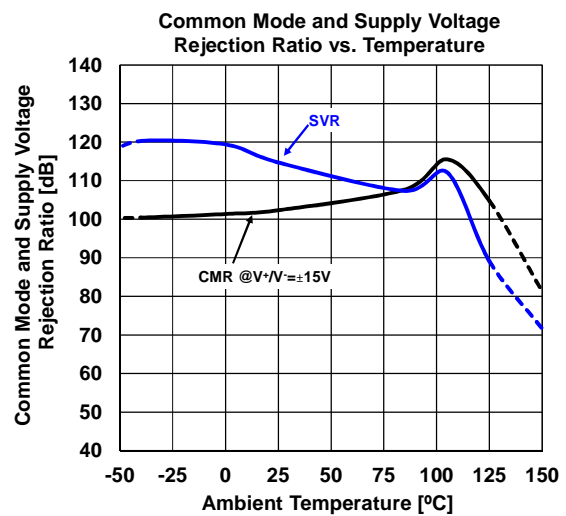
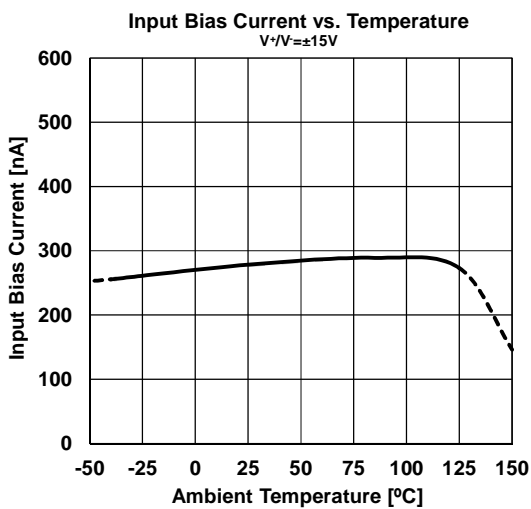
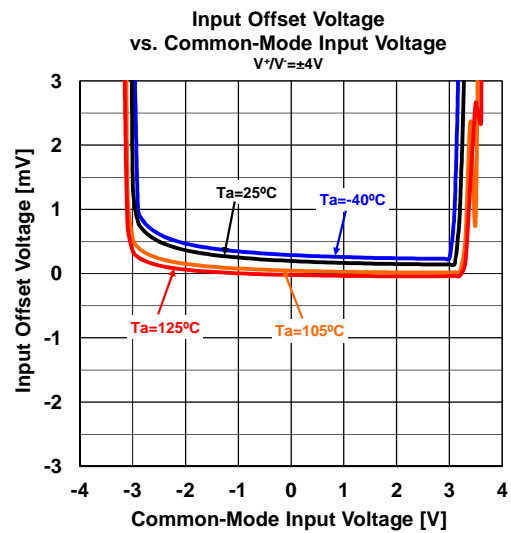
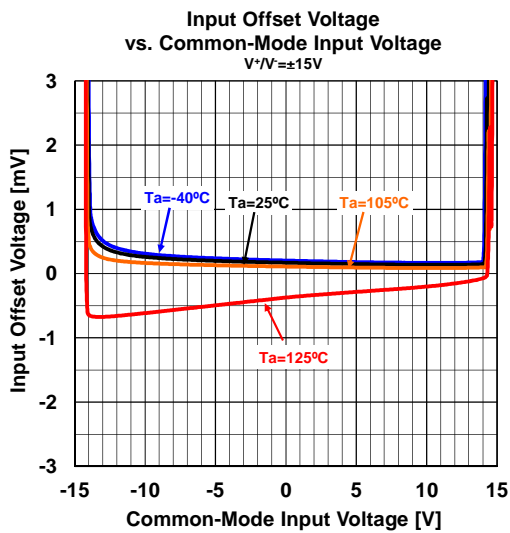
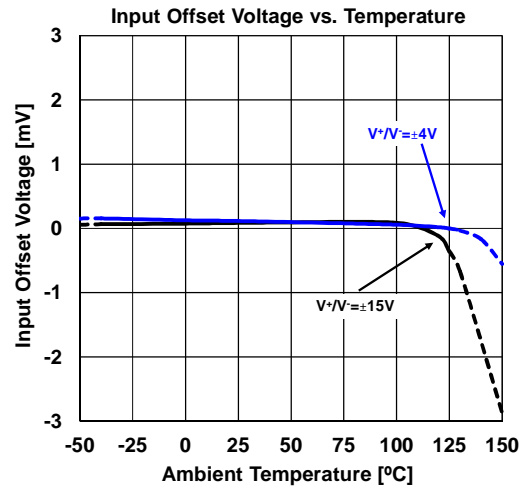
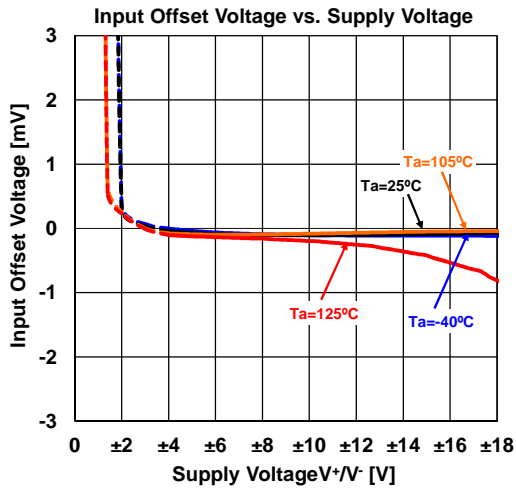
■ ELECTRICAL CHARACTERISTICS ($V^+V^-=\pm 15\text{V}$, $T_a=25^\circ\text{C}$, unless otherwise noted.)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------------------------|--------------|--|----------|------------|------|------------------|
| INPUT/OUTPUT CHARACTERISTICS | | | | | | |
| Input Offset Voltage | V_{IO} | R_s 10k Ω | - | 0.3 | 3 | mV |
| Input Bias Current | I_B | | - | 260 | 1000 | nA |
| Input Offset Current | I_{IO} | | - | 5 | 200 | nA |
| Open-Loop Voltage Gain | A_V | $R_L=2\text{k}\Omega$, $V_O=\pm 10\text{V}$ | 90 | 120 | - | dB |
| Common-Mode Rejection Ratio | CMR | | 80 | 110 | - | dB |
| Input Resistance | R_{IN} | | 50 | 300 | - | k Ω |
| Common-Mode Input Voltage Range | V_{ICM} | | ± 12 | ± 13.5 | - | V |
| Maximum Output Voltage | V_{OM} | R_L 2k Ω | ± 12 | ± 13.5 | - | V |
| POWER SUPPLY | | | | | | |
| Supply Current (All Amplifiers) | I_{SUPPLY} | | - | 5 | 8 | mA |
| Supply Voltage Rejection Ratio | SVR | | 80 | 120 | - | dB |
| AC CHARACTERISTICS | | | | | | |
| Gain Bandwidth Product | GBW | $f=100\text{kHz}$ | - | 19 | - | MHz |
| Unity Gain Frequency | f_T | $G_V=0\text{dB}$ | - | 7.5 | - | MHz |
| Slew Rate | SR | R_L 2k Ω | - | 6.8 | - | V/ μs |
| Noise, Distortion | | | | | | |
| Equivalent Input Noise Voltage | e_n | $f=1\text{kHz}$ | - | 3.5 | - | nV/ Hz |
| | | FLAT, $f=20\text{Hz}$ to 20kHz | - | 0.5 | 0.7 | μVrms |
| Total Harmonic Distortion + Noise | THD+N | | - | 0.001 | - | % |
| Channel Separation | CS | | - | 120 | - | dB |

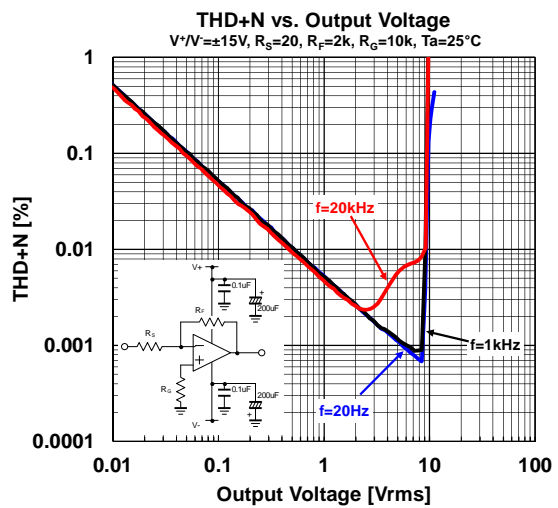
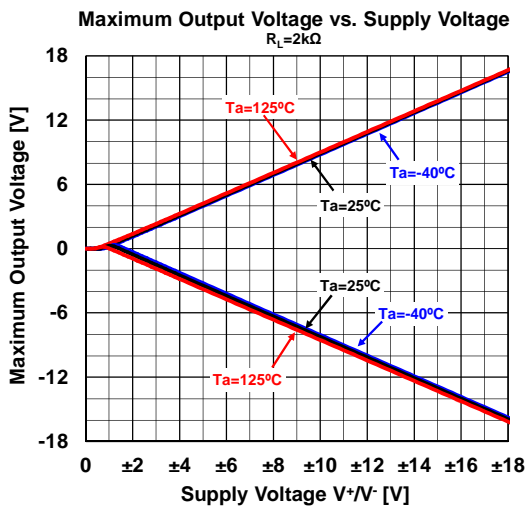
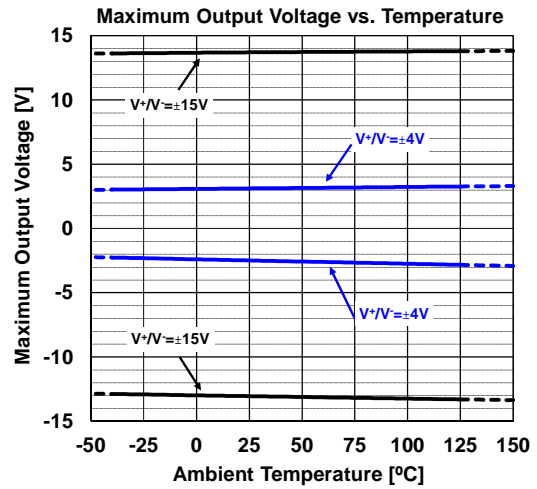
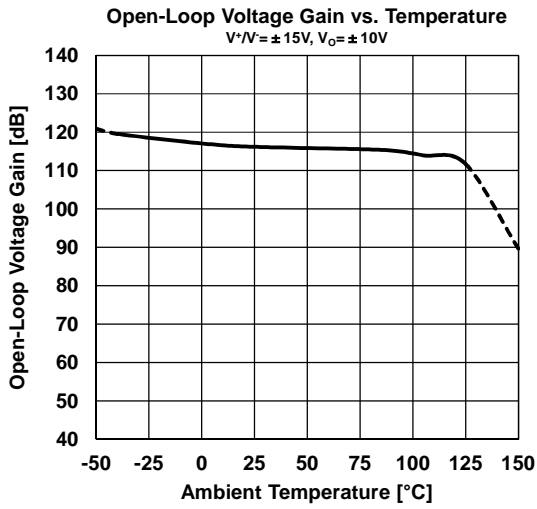
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS

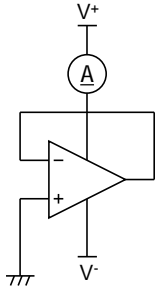


■ TYPICAL CHARACTERISTICS



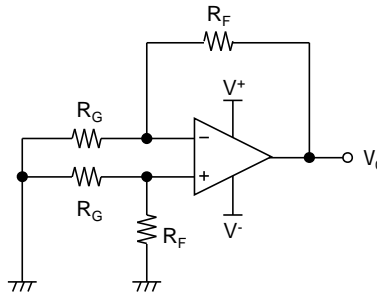
■ TEST CIRCUITS

• I_{SUPPLY}



• V_{IO}, CMR, SVR

$R_G=50\Omega, R_F=50k\Omega$



$$V_{IO} = \frac{R_G}{(R_G + R_F)} \times V_O$$

$$CMR = 20 \log \frac{\Delta V_{COM} \left(1 + \frac{R_F}{R_G}\right)}{\Delta V_O}$$

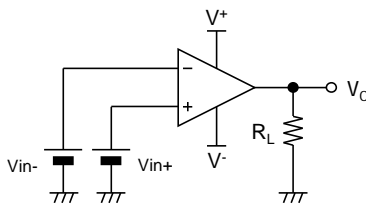
$$SVR = 20 \log \frac{\Delta V_S \left(1 + \frac{R_F}{R_G}\right)}{\Delta V_O}$$

$V_S = V^+ - V^-$

• V_{OH}, V_{OL}

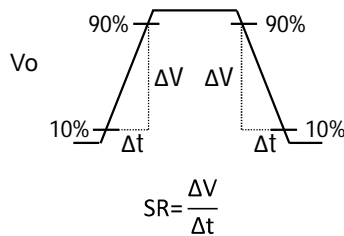
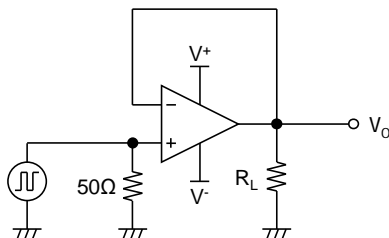
$V_{OH}: V_{in+} = 1V, V_{in-} = -1V$

$V_{OL}: V_{in+} = -1V, V_{in-} = 1V$



• SR

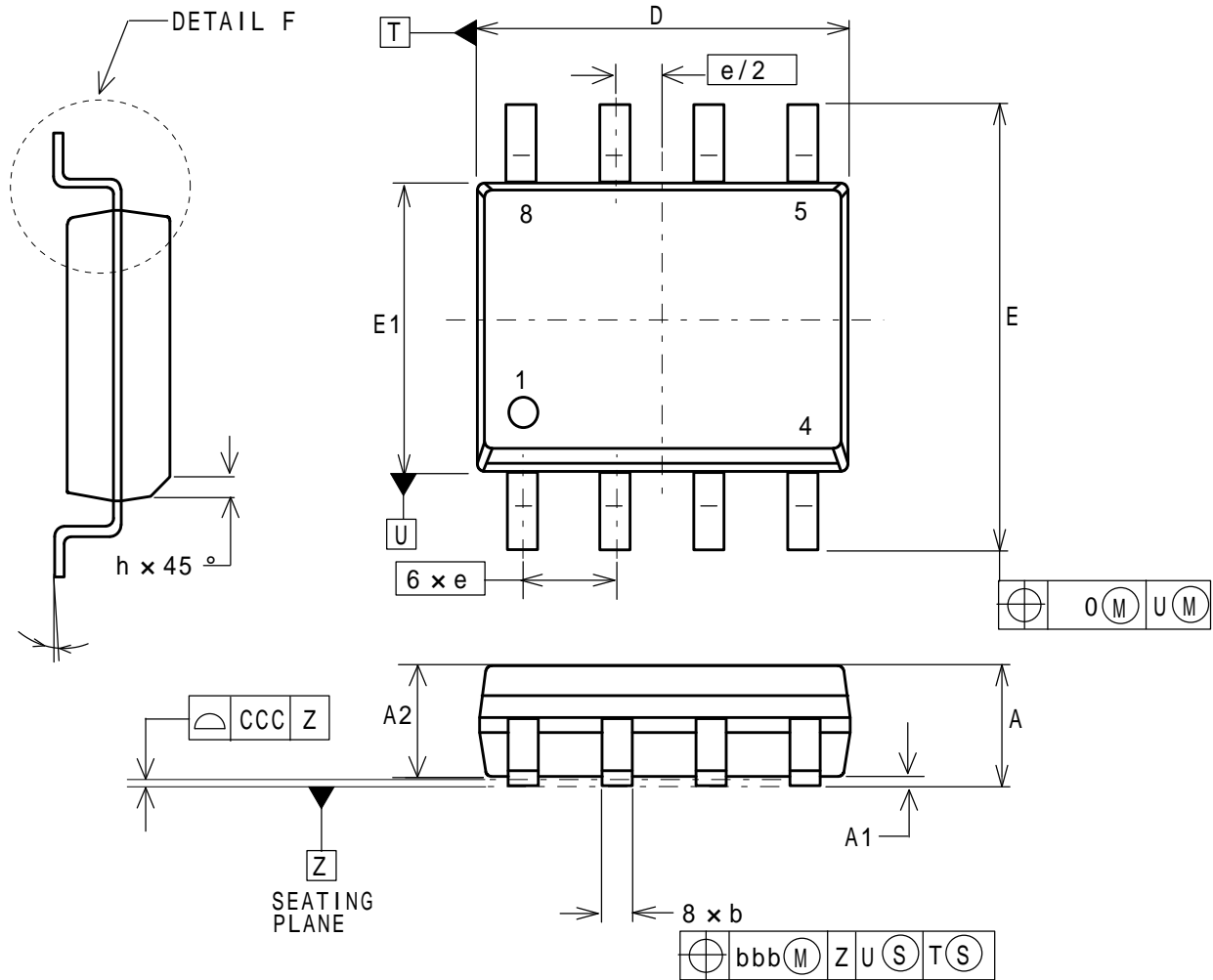
$R_L=2k\Omega$



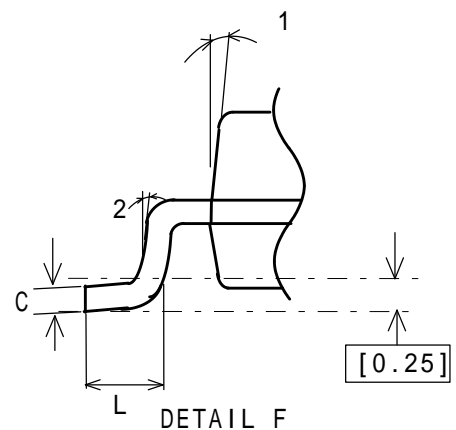
SOP8

Unit: mm

PACKAGE DIMENSIONS



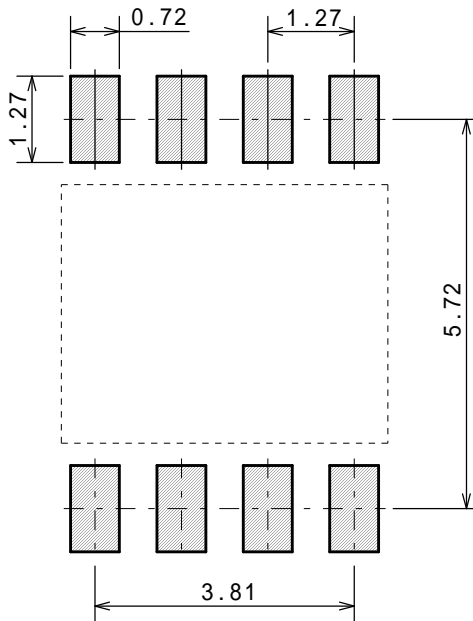
| DESCRIPTION | SYMBOL | INCH | | | MILLIMETER | | |
|------------------|--------|----------|-----|------|------------|-----|------|
| | | MIN | NCM | MAX | MIN | NCM | MAX |
| TOTAL THICKNESS | A | .053 | | .069 | 1.35 | | 1.75 |
| STAND OFF | A1 | .004 | | .010 | 0.10 | | 0.25 |
| MOLD THICKNESS | A2 | .049 | | - | 1.25 | | - |
| LEAD WIDTH | b | .014 | | .019 | 0.35 | | 0.49 |
| L/F THICKNESS | C | .007 | | .010 | 0.19 | | 0.25 |
| BODY SIZE | D | .189 | | .197 | 4.80 | | 5.00 |
| | E1 | .150 | | .157 | 3.80 | | 4.00 |
| | E | .228 | | .244 | 5.80 | | 6.20 |
| LEAD PITCH | e | .050 BSC | | | 1.27 BSC | | |
| | L | .015 | | .049 | 0.40 | | 1.25 |
| | h | .010 | | .020 | 0.25 | | 0.50 |
| | | 0° | | 7° | 0° | | 7° |
| | 1 | 5° | | 15° | 5° | | 15° |
| | 2 | 2° | 7° | 12° | 2° | 7° | 12° |
| LEAD EDGE OFFSET | 0 | | | .010 | | | 0.25 |
| LEAD OFFSET | bbb | | | .010 | | | 0.25 |
| COPLANARITY | CCC | | | .004 | | | 0.10 |



SOP8

Unit: mm

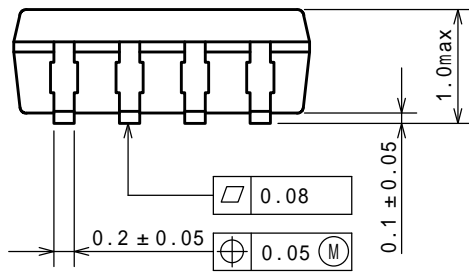
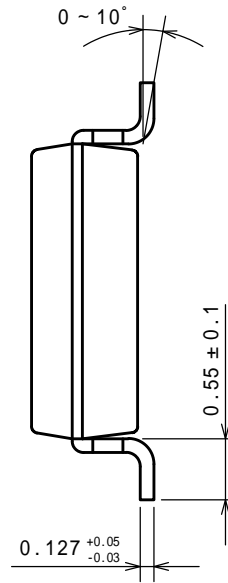
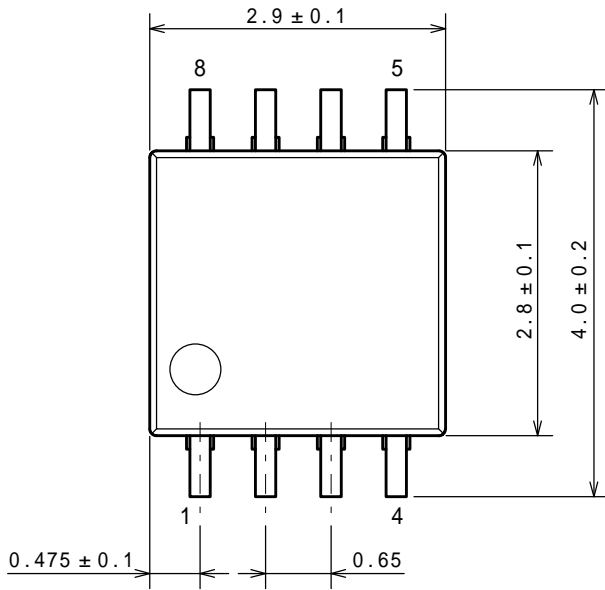
■ EXAMPLE OF SOLDER PADS DIMENSIONS



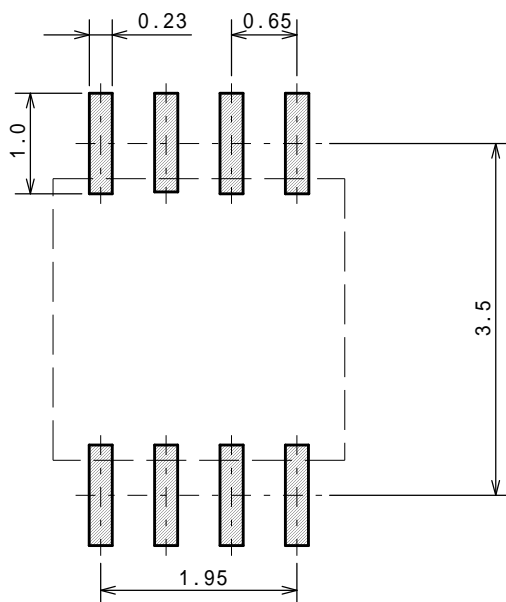
MSOP8 (TVSP8) JEDEC MO-187-DA/THIN TYPE

Unit: mm

■ PACKAGE DIMENSIONS



■ EXAMPLE OF SOLDER PADS DIMENSIONS

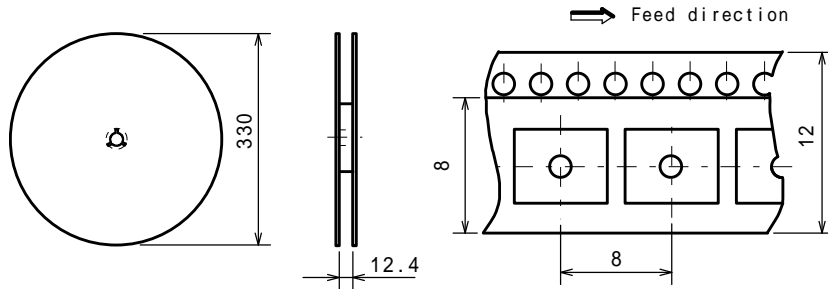


SOP8

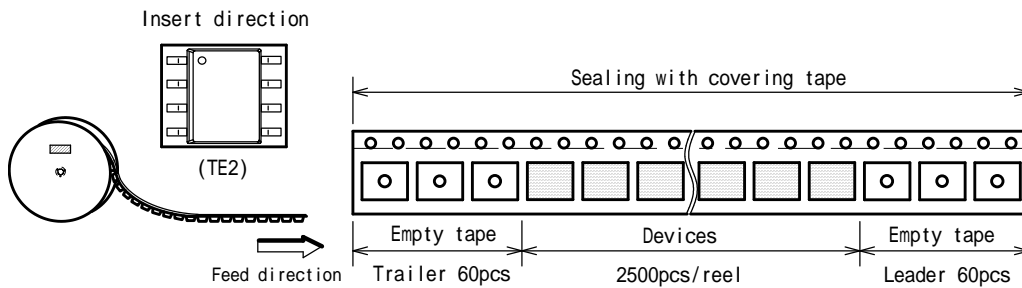
PACKING SPEC

Unit: mm

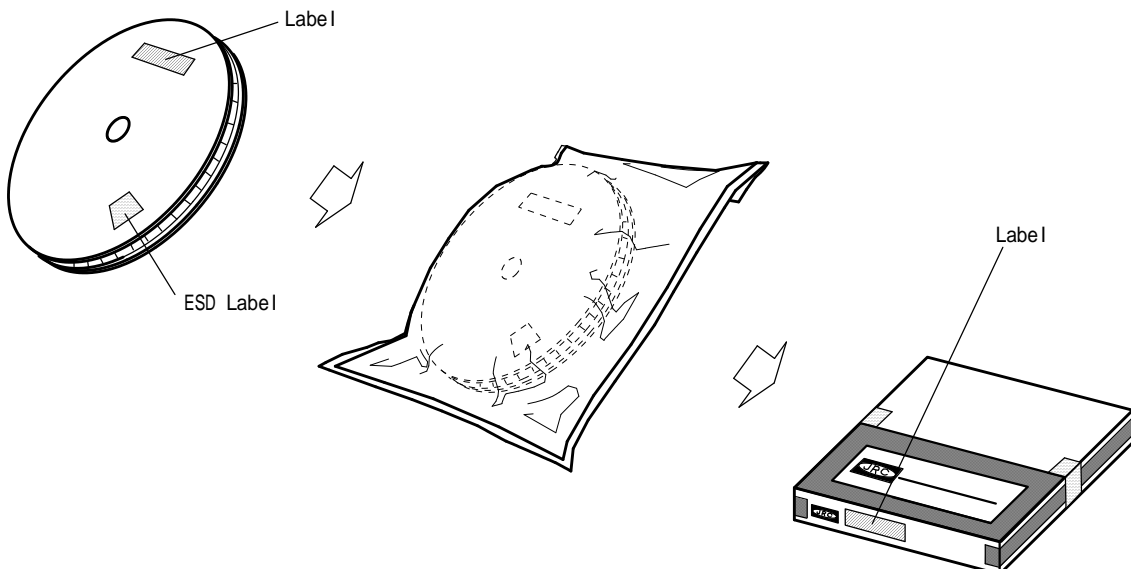
REEL DIMENSIONS / TAPING DIMENSIONS



TAPING STATE



PACKING STATE

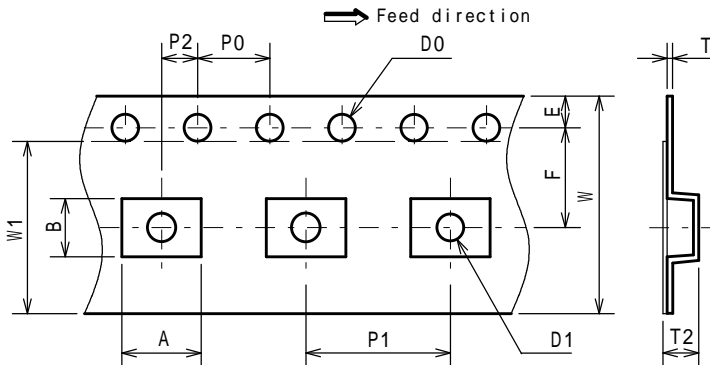


MSOP8 (TVSP8) MEET JEDEC MO-187-DA THIN TYPE

PACKING SPEC

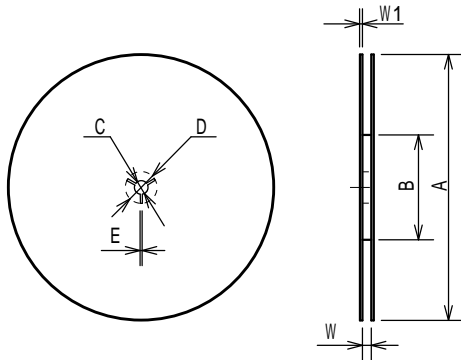
Unit: mm

TAPING DIMENSIONS



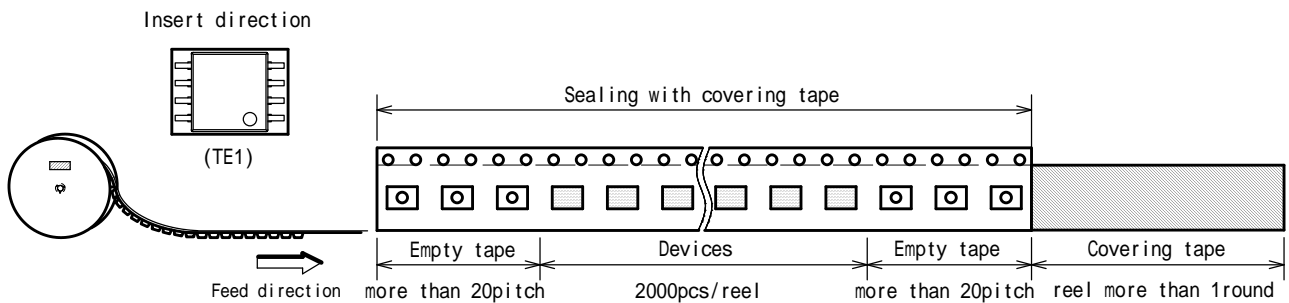
| SYMBOL | DIMENSION | REMARKS |
|--------|----------------------------------|------------------|
| A | 4.4 | BOTTOM DIMENSION |
| B | 3.2 | BOTTOM DIMENSION |
| D0 | 1.5 ^{+0.1} ₀ | |
| D1 | 1.5 ^{+0.1} ₀ | |
| E | 1.75 ± 0.1 | |
| F | 5.5 ± 0.05 | |
| P0 | 4.0 ± 0.1 | |
| P1 | 8.0 ± 0.1 | |
| P2 | 2.0 ± 0.05 | |
| T | 0.30 ± 0.05 | |
| T2 | 1.75 (MAX.) | |
| W | 12.0 ± 0.3 | |
| W1 | 9.5 | THICKNESS 0.1max |

REEL DIMENSIONS

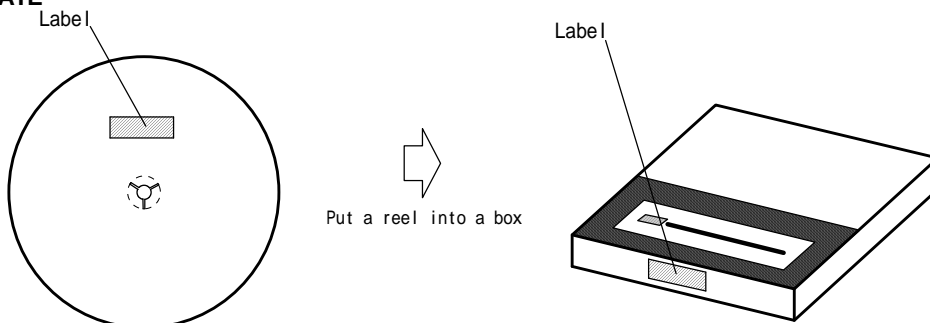


| SYMBOL | DIMENSION |
|--------|------------|
| A | 254 ± 2 |
| B | 100 ± 1 |
| C | 13 ± 0.2 |
| D | 21 ± 0.8 |
| E | 2 ± 0.5 |
| W | 13.5 ± 0.5 |
| W1 | 2.0 ± 0.2 |

TAPING STATE

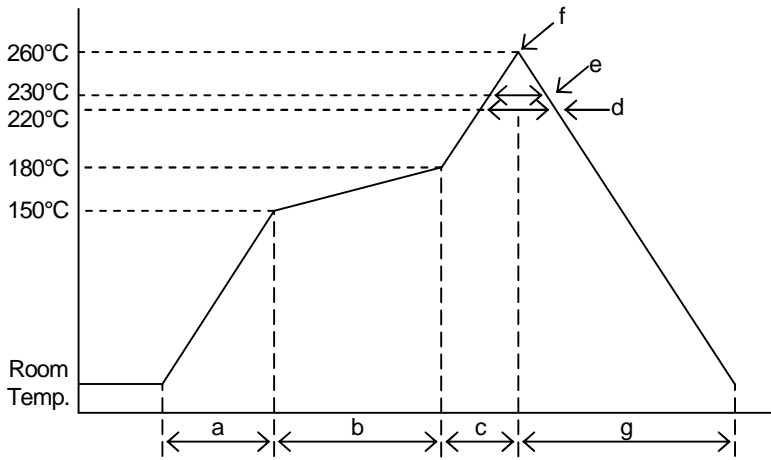


PACKING STATE



■ RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING PROFILE



| | | |
|---|--------------------------|------------------|
| a | Temperature ramping rate | 1 to 4°C/s |
| b | Pre-heating temperature | 150 to 180°C |
| | Pre-heating time | 60 to 120s |
| c | Temperature ramp rate | 1 to 4°C/s |
| d | 220°C or higher time | shorter than 60s |
| e | 230°C or higher time | shorter than 40s |
| f | Peak temperature | lower than 260°C |
| g | Temperature ramping rate | 1 to 6°C/s |

The temperature indicates at the surface of mold package.

[CAUTION]

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[BD37512FS-E2](#) [BD37543FS-E2](#) [BD3814FV-E2](#) [TPA3140D2PWPR](#) [TS2007EIJT](#) [IS31AP2005-DLS2-TR](#) [SSM2518CPZ-R7](#) [AS3410-EQFP-](#)
[500](#) [FDA4100LV](#) [MAX98306ETD+T](#) [TS4994EIJT](#) [NCP2820FCT1G](#) [NCP2823AFCT2G](#) [NCS2211MNTXG](#) [CPA2233CQ16-A1](#)
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