

## DUAL AUDIO OPERATIONAL AMPLIFIER

### FEATURES

- Supply Voltage  $\pm 2V$  to  $\pm 18V$
  - Low Input Noise Voltage  $5nV/\sqrt{\text{Hz}}$  typ. at  $f=1\text{kHz}$
  - Wide Gain Bandwidth Product  $15\text{MHz}$  typ.
  - Low Distortion  $0.0005\%$  typ.
  - Slew Rate  $5V/\mu\text{s}$  typ.
  - Bipolar Technology
  - Package Outline SOP8  
MSOP8 (TVSP8)\*
- \*meet JEDEC MO-187-DA / thin type SSOP8
- Internal ESD Protection Human Body Model (HBM)  $\pm 2000V$  typ.
  - Wide Temperature Range  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$

### APPLICATIONS

- Home Audio
- Car Audio
- Active Filters
- Servo Control Amplifiers
- Headphone Amplifiers

### DESCRIPTION

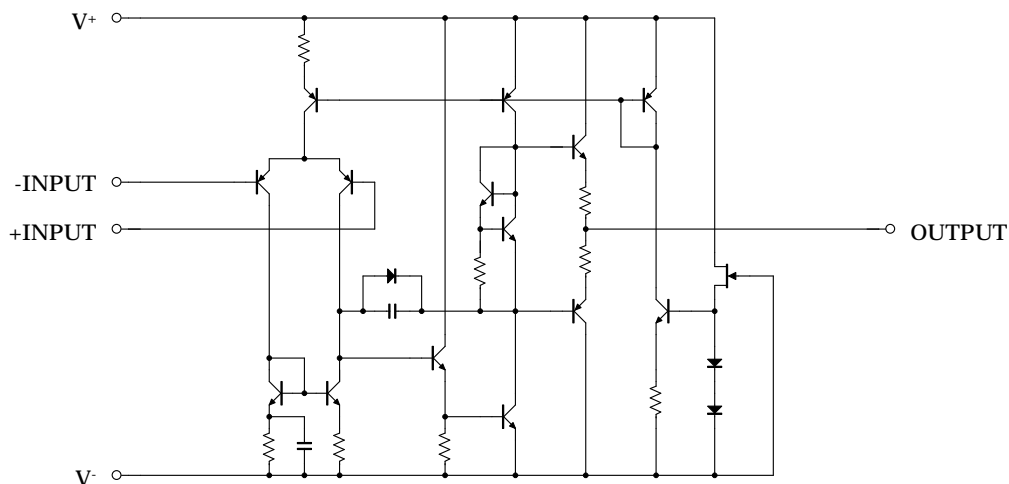
The NJM8080 is dual operational amplifier designed for audio applications. NJM8080 finely refines to every detail from Si-wafer to circuit layout, stick in a thorough improvement in sound quality. The NJM8080 features high resolution and crispy-clear high frequency sound, which can fully perform the digital sound source with loss-less.

NJM8080 features low noise, wide gain-bandwidth, low distortion and high output current, and various reliabilities and conveniences are improved. NJM8080 can widely be used as the standard audio operational amplifier.

### RELATED PRODUCT

| PRODUCT NAME | FEATURES   |
|--------------|--|
| NJM8068      | $3.5nV/\sqrt{\text{Hz}}$ , $0.001\%$ , $6.8V/\mu\text{s}$ , $19\text{MHz}$<br>(Low noise, low distortion audio Op-Amp) |

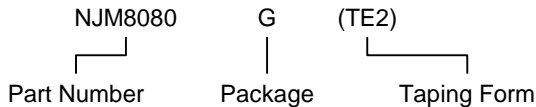
### EQUIVALENT CIRCUIT



## ■ PIN CONFIGURATIONS

| PRODUCT NAME  | NJM8080G | NJM8080RB1    | NJM8080V |
|---------------|----------|---------------|----------|
| Package       | SOP8     | MSOP8 (TVSP8) | SSOP8    |
| Pin Functions |          |               |          |

## ■ PRODUCT NAME INFORMATION



## ■ ORDER INFORMATION

| PRODUCT NAME | PACKAGE       | RoHS | HALOGEN-FREE | TERMINAL FINISH | MARKING | WEIGHT (mg) | MOQ (pcs) |
|--------------|---------------|------|--------------|-----------------|---------|-------------|-----------|
| NJM8080G     | SOP8          | Yes  | Yes          | Pure Sn         | 8080    | 88          | 2500      |
| NJM8080RB1   | MSOP8 (TVSP8) | Yes  | Yes          | Sn2Bi           | 8080    | 18          | 2000      |
| NJM8080V     | SSOP8         | Yes  | Yes          | Sn2Bi           | 8080    | 42          | 2000      |

## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                 | SYMBOL      | RATING                           | UNIT |
|---|-------------|----------------------------------|------|
| Supply Voltage                            | $V^+ / V^-$ | $\pm 18$                         | V    |
| Differential Input Voltage <sup>(1)</sup> | $V_{ID}$    | $\pm 36$                         | V    |
| Input Voltage <sup>(2)</sup>              | $V_{IN}$    | $V^- - 0.3$ to $V^+ + 36$        | V    |
| Output Terminal Input Voltage             | $V_O$       | $V^- - 0.3$ to $V^+ + 0.3$       | V    |
| Power Dissipation <sup>(3)</sup>          | $P_D$       | 2-Layer / 4-Layer <sup>(4)</sup> |      |
| SOP8                                      |             | 690 / 1000                       | mW   |
| MSOP8 (TVSP8)                             |             | 510 / 680                        |      |
| SSOP8                                     | 430 / 540   |                                  |      |
| 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                | $\Theta_{ja}$ | 2-Layer / 4-Layer <sup>(4)</sup> |      |
| SOP8  |               | 181 / 125                        | °C/W |
| MSOP8 (TVSP8)   |               | 245 / 184                        |      |
| SSOP8   | 291 / 231     |                                  |      |
| Junction-to-Top of Package Characterization Parameter | $\Psi_{jt}$   | 2-Layer / 4-Layer <sup>(4)</sup> |      |
| SOP8  |               | 49 / 43                          | °C/W |
| MSOP8 (TVSP8)   |               | 51 / 45                          |      |
| SSOP8   | 46 / 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  $V^+$ .

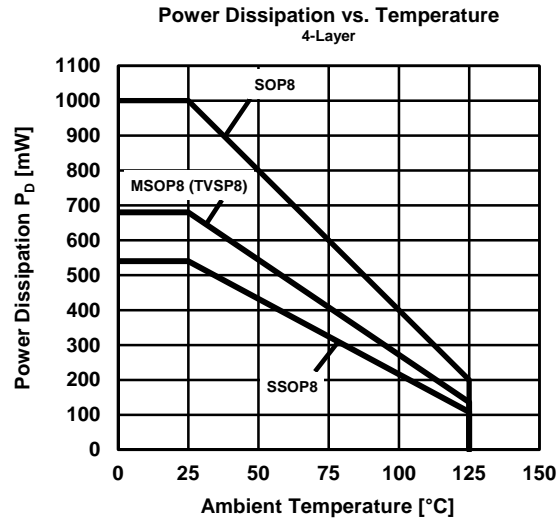
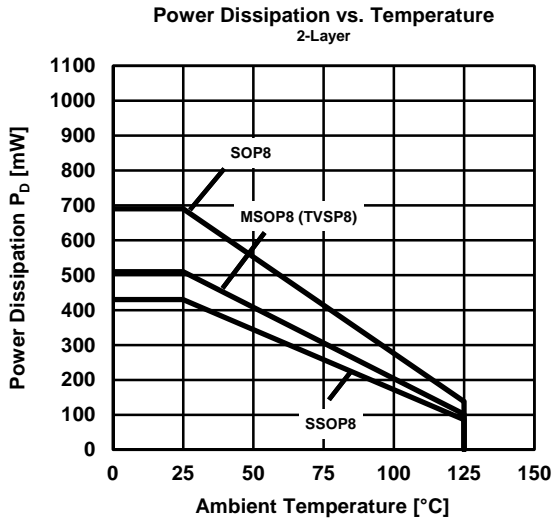
The normal operation will establish when any input is within the "Common-Mode Input Voltage Range" of electrical characteristics.

(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



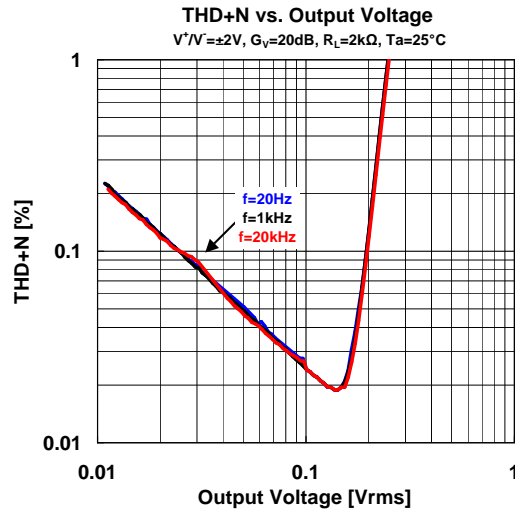
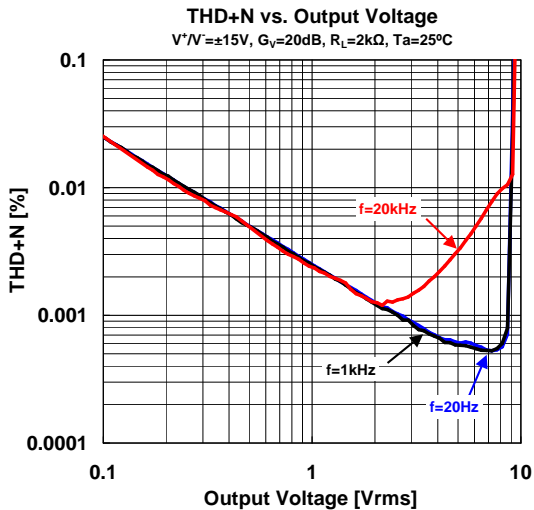
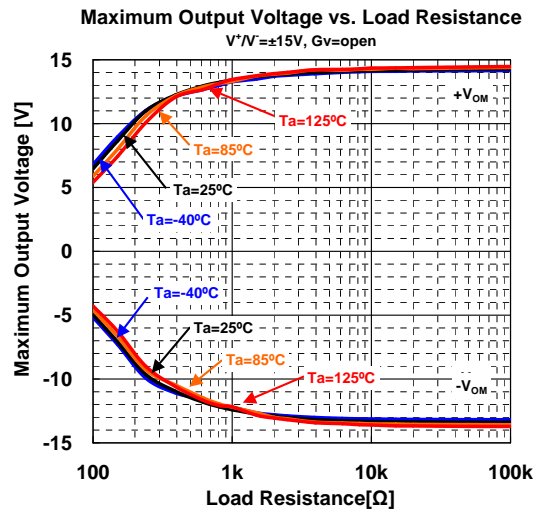
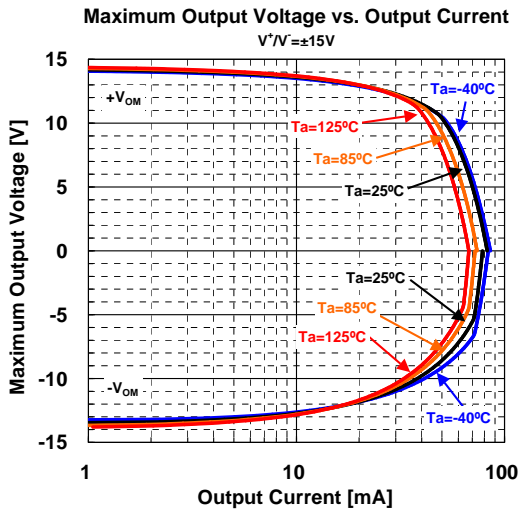
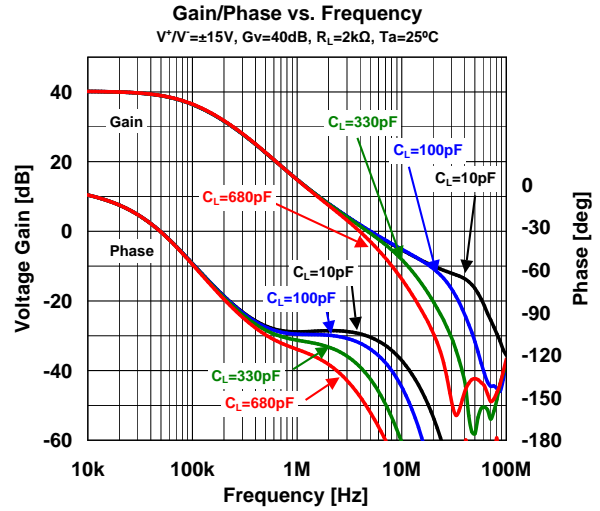
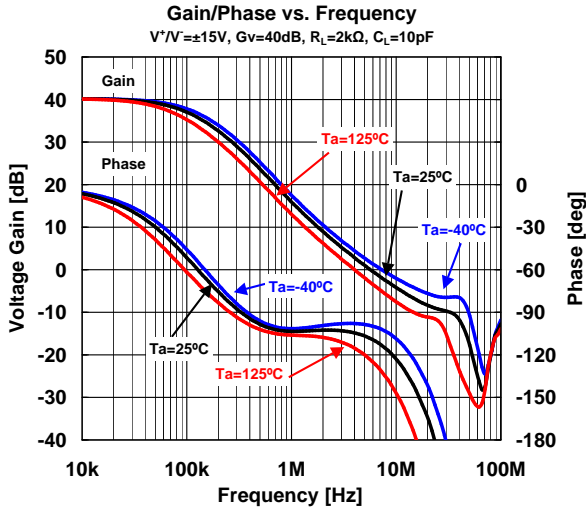
## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                   | SYMBOL    | CONDITIONS             | VALUE               | UNIT             |
|-----------------------------|-----------|------------------------|---------------------|------------------|
| Supply Voltage              | $V^+V^-$  | $T_a=25^\circ\text{C}$ | $\pm 2$ to $\pm 18$ | 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.)

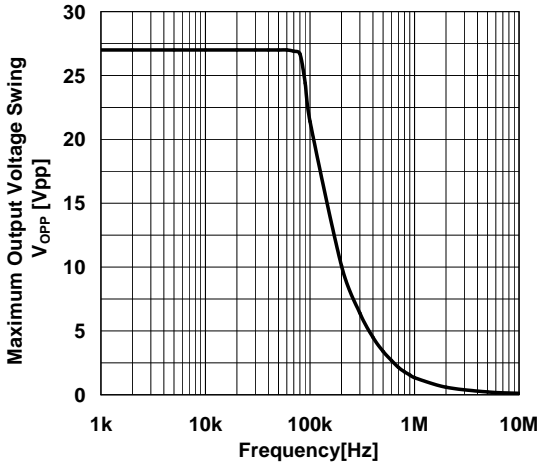
| PARAMETER                           | SYMBOL       | TEST CONDITIONS  | MIN      | TYP        | MAX | UNIT                   |
|-------------------------------------|--------------|--|----------|------------|-----|------------------------|
| <b>INPUT/OUTPUT CHARACTERISTICS</b> |              |  |          |            |     |                        |
| Input Offset Voltage                | $V_{IO}$     | $R_S \leq 10\text{k}\Omega$  | -        | 0.3        | 3   | mV                     |
| Input Bias Current                  | $I_B$        |  | -        | 100        | 500 | nA                     |
| Input Offset Current                | $I_{IO}$     |  | -        | 5          | 200 | nA                     |
| Input Resistance                    | $R_{IN}$     |  | -        | 0.5        | -   | M $\Omega$             |
| Open-Loop Voltage Gain              | $A_V$        | $R_L \geq 2\text{k}\Omega, V_O = \pm 10\text{V}$                     | 90       | 110        | -   | dB                     |
| Maximum Output Voltage              | $V_{OM}$     | $R_L \geq 2\text{k}\Omega$   | $\pm 12$ | $\pm 13.5$ | -   | V                      |
| Common-Mode Input Voltage Range     | $V_{ICM}$    |  | $\pm 12$ | $\pm 13.5$ | -   | V                      |
| Common-Mode Rejection Ratio         | CMR          | $R_S \leq 10\text{k}\Omega$  | 80       | 110        | -   | dB                     |
| <b>POWER SUPPLY</b>                 |              |  |          |            |     |                        |
| Supply Voltage Rejection Ratio      | SVR          | $R_S \leq 10\text{k}\Omega$  | 80       | 110        | -   | dB                     |
| Supply Current                      | $I_{SUPPLY}$ |  | -        | 6          | 9   | mA                     |
| <b>AC CHARACTERISTICS</b>           |              |  |          |            |     |                        |
| Slew Rate                           | SR           | $R_L \geq 2\text{k}\Omega$   | -        | 5          | -   | V/ $\mu\text{s}$       |
| Gain Bandwidth Product              | GBW          | $f=10\text{kHz}$   | -        | 15         | -   | MHz                    |
| Total Harmonic Distortion + Noise   | THD+N        | $A_V=20\text{dB}, V_O=5\text{V}, R_L=2\text{k}\Omega, f=1\text{kHz}$ | -        | 0.0005     | -   | %                      |
| Equivalent Input Noise Voltage      | $e_n$        | $f=1\text{kHz}$  | -        | 5          | -   | nV/ $\sqrt{\text{Hz}}$ |

## ■ TYPICAL CHARACTERISTICS

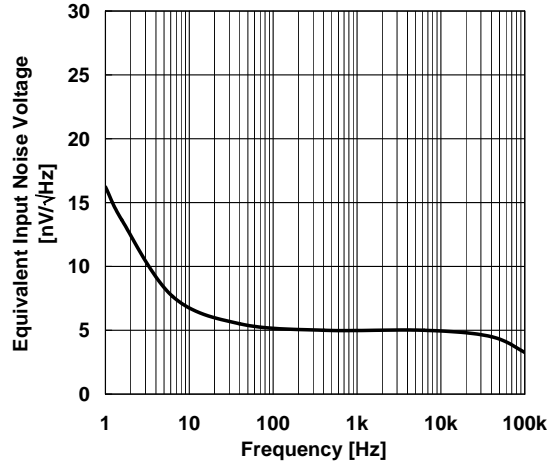


## ■ TYPICAL CHARACTERISTICS

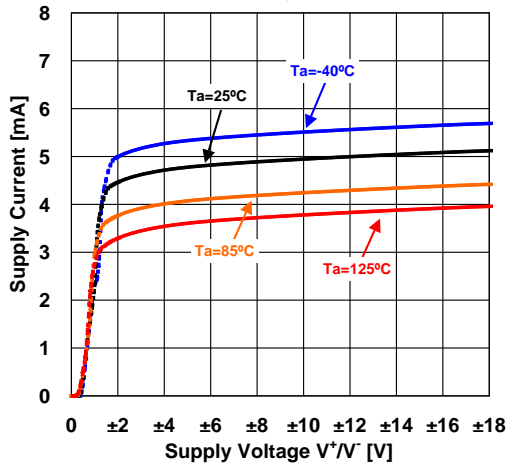
Maximum Output Voltage Swing vs. Frequency  
 $V^+V^- = \pm 15V$ ,  $R_L = 2k\Omega$ ,  $T_a = 25^\circ C$



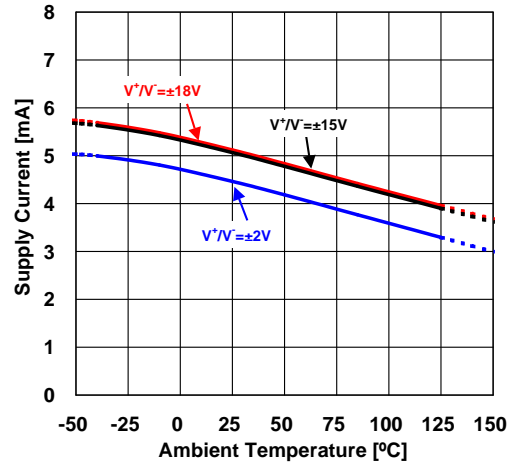
Voltage Noise vs. Frequency  
 $V^+V^- = \pm 15V$ ,  $G_v = 40dB$ ,  $R_F = 2k\Omega$ ,  $T_a = 25^\circ C$



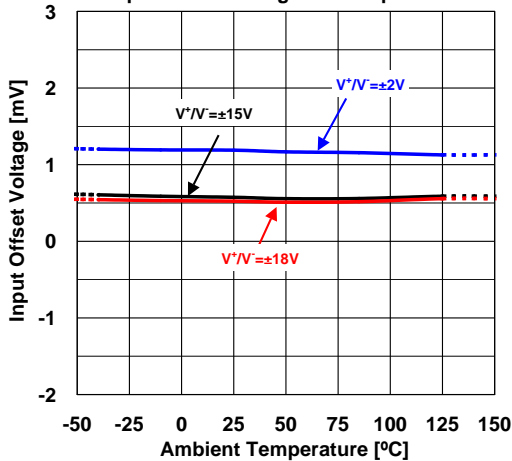
Supply Current vs. Supply Voltage  
 $R_L = open$



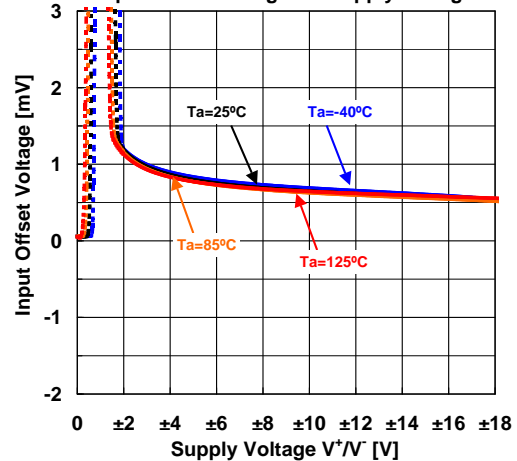
Supply Current vs. Temperature  
 $R_L = open$



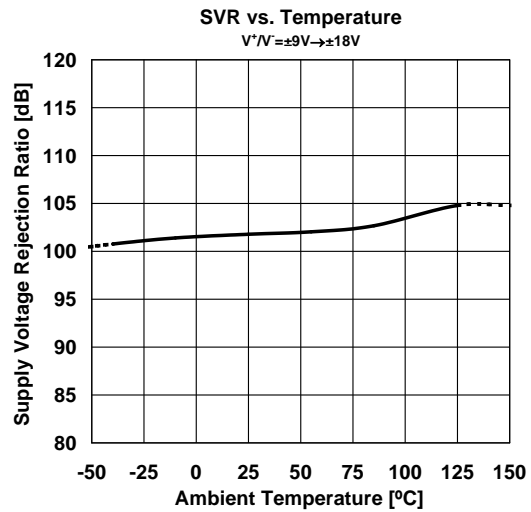
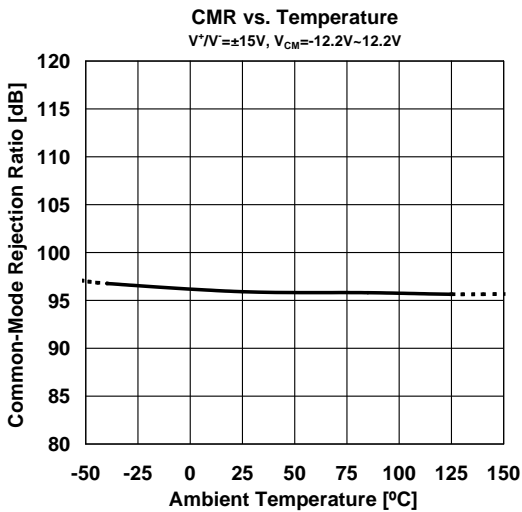
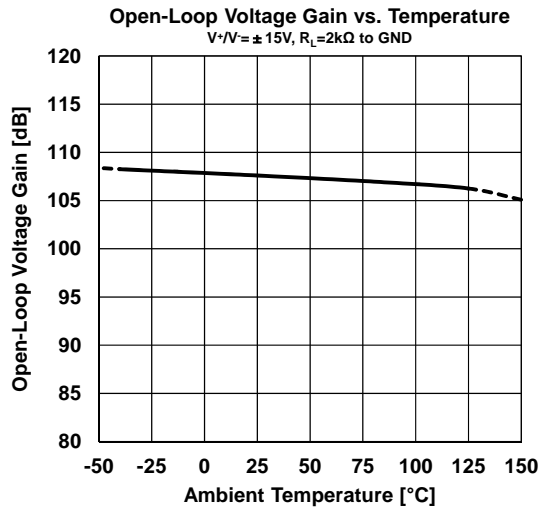
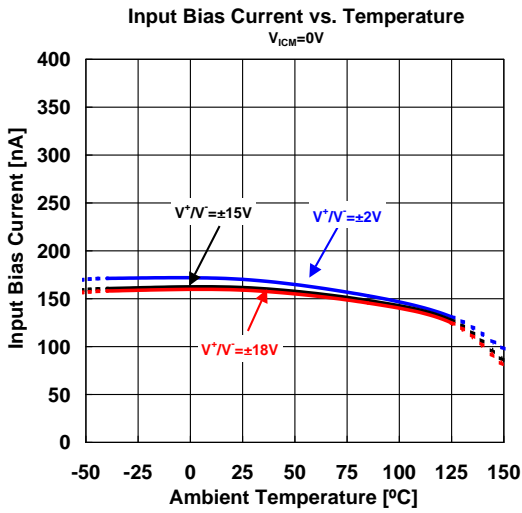
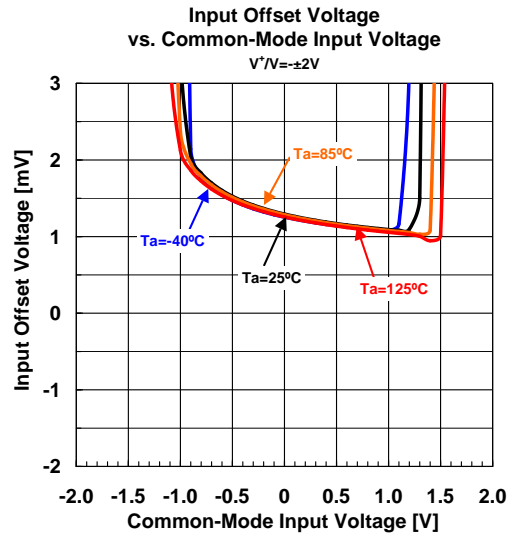
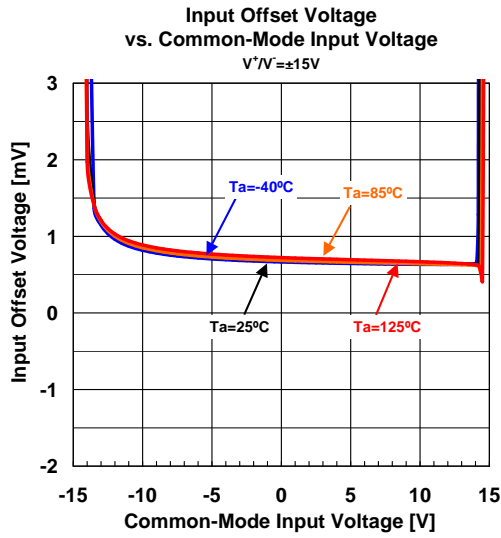
Input Offset Voltage vs. Temperature



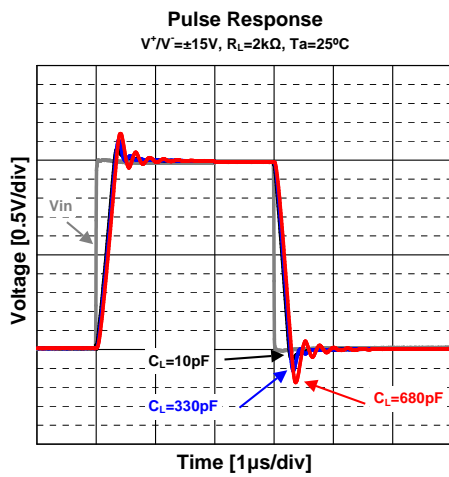
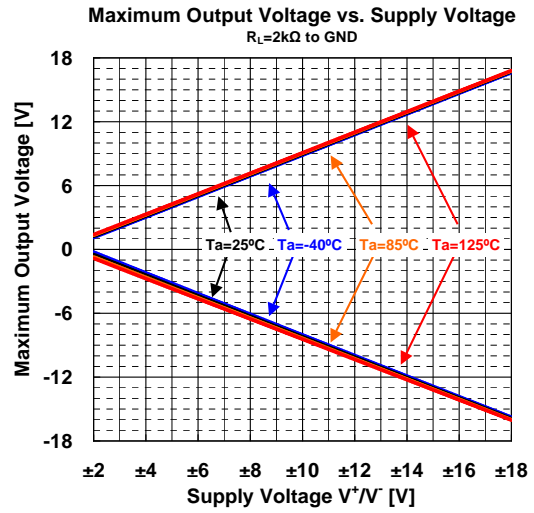
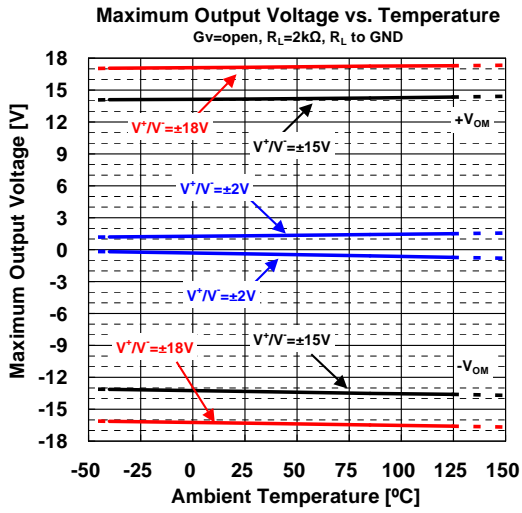
Input Offset Voltage vs. Supply Voltage



## ■ TYPICAL CHARACTERISTICS

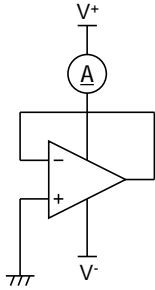


## ■ TYPICAL CHARACTERISTICS



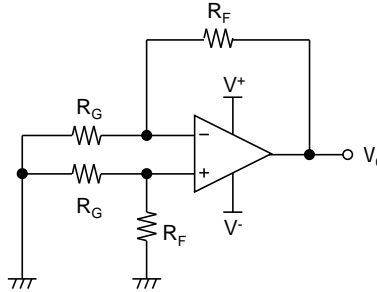
## ■ TEST CIRCUITS

- $I_{SUPPLY}$



- $V_{IO}, CMR, SVR$

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



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

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

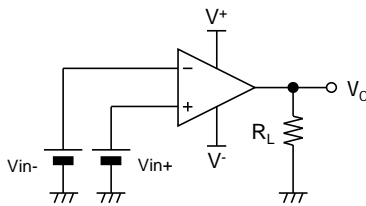
$$SVR = 20 \log \frac{\Delta V_S \left(1 + \frac{R_F}{R_G}\right)}{\Delta V_O}$$

$V_S = V^+ - V^-$

- $V_{OH}, V_{OL}$

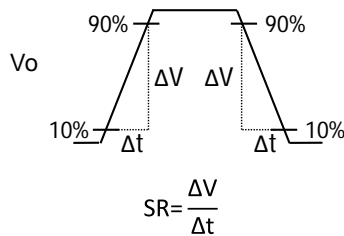
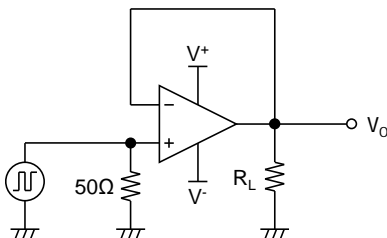
$V_{OH}: V_{in+} = 1V, V_{in-} = -1V$

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



- SR

$R_L=2k\Omega$

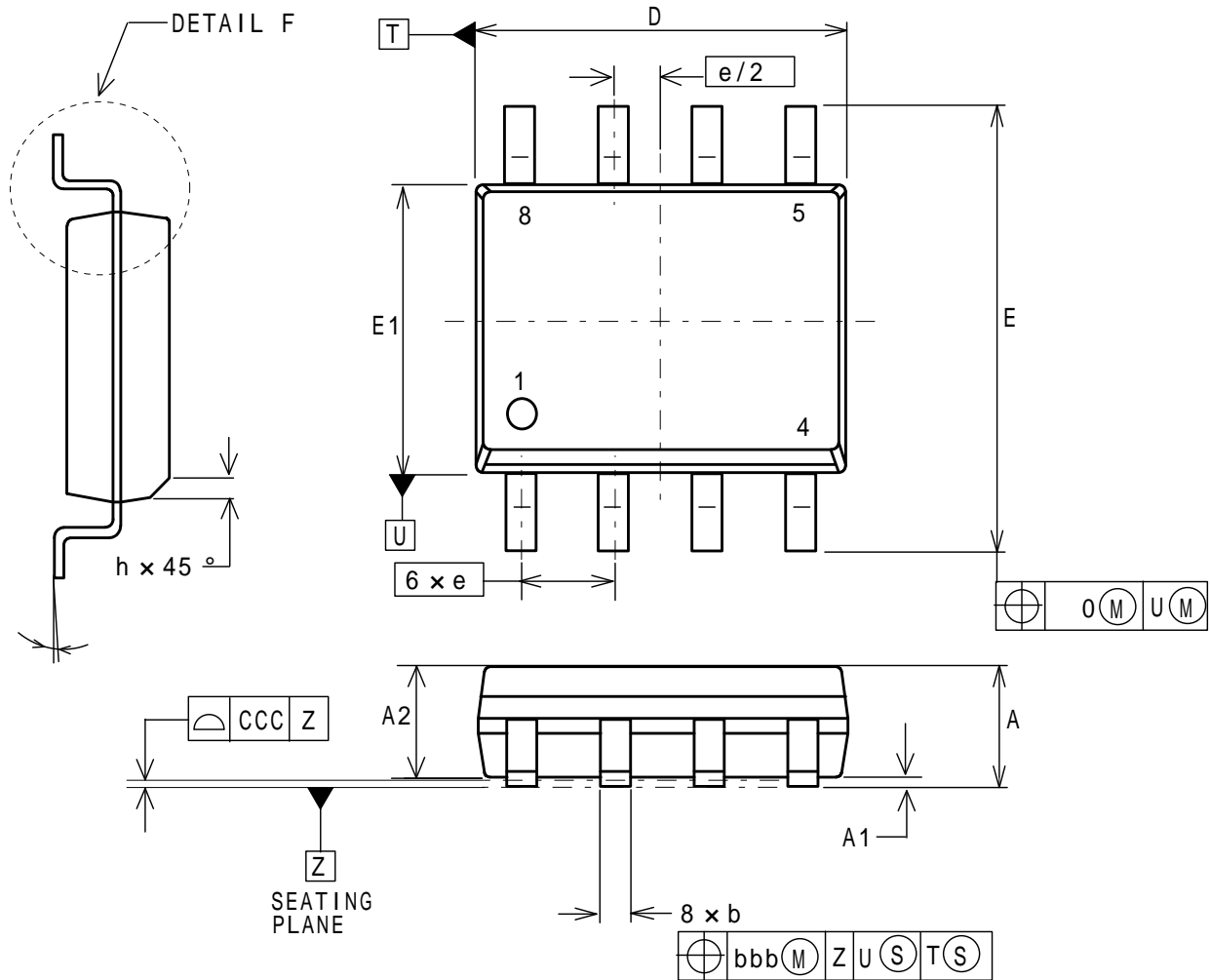




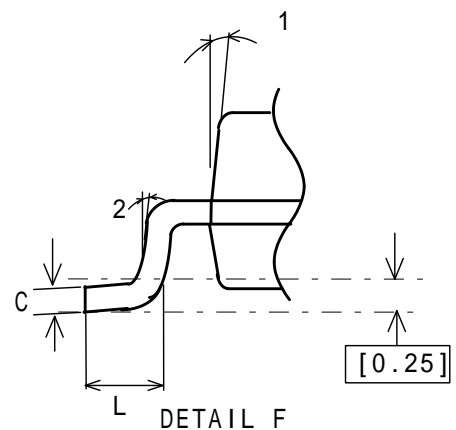
## SOP8

Unit: mm

### PACKAGE DIMENSIONS



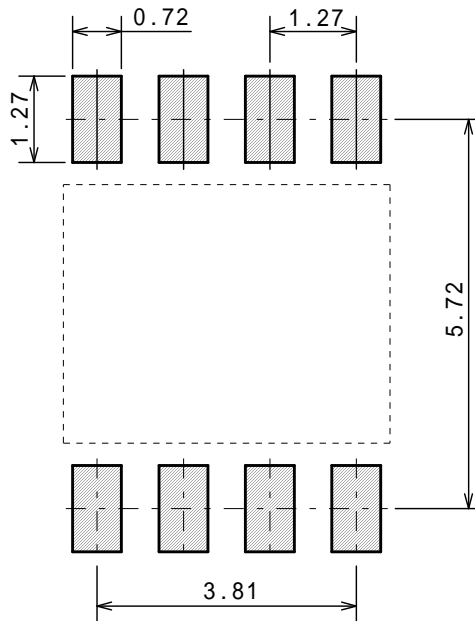
| DESCRIPTION      | SYMBOL | INCH     |     |      | MILLIMETER |     |      |
|------------------|--------|----------|-----|------|------------|-----|------|
|                  |        | MIN      | NCM | MAX  | MIN        | NCM | MAX  |
| TOTAL THICKNESS  | A      | .053     |     | .069 | 1.35       |     | 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°   | 2°         |     | 7°   |
| LEAD EDGE OFFSET | 0      |          |     | .010 |            |     | 0.25 |
| LEAD OFFSET      | bbb    |          |     | .010 |            |     | 0.25 |
| COPLANARITY      | CCC    |          |     | .004 |            |     | 0.10 |



## SOP8

Unit: mm

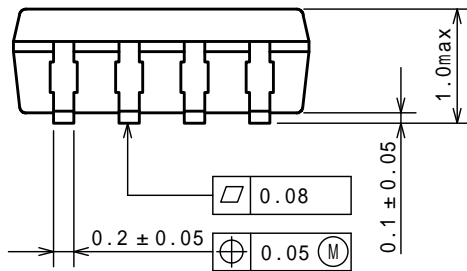
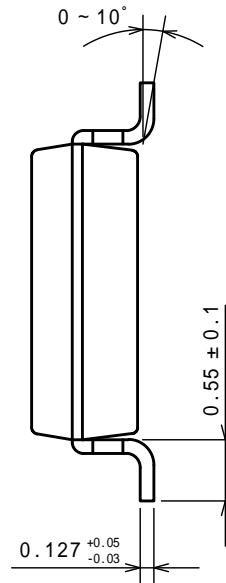
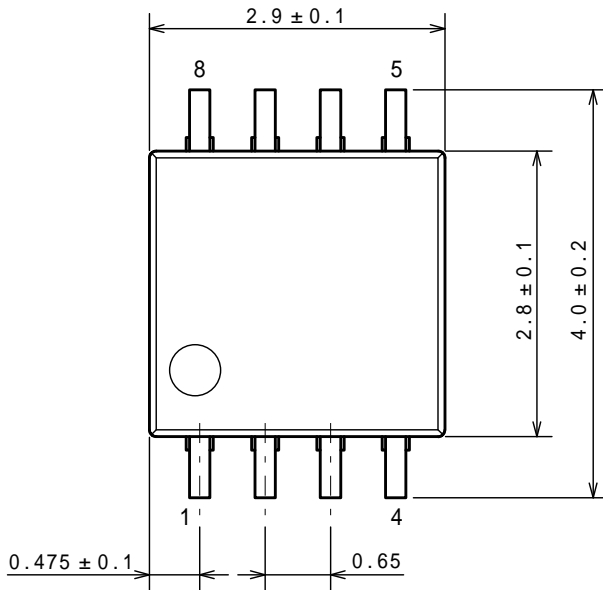
### ■ EXAMPLE OF SOLDER PADS DIMENSIONS



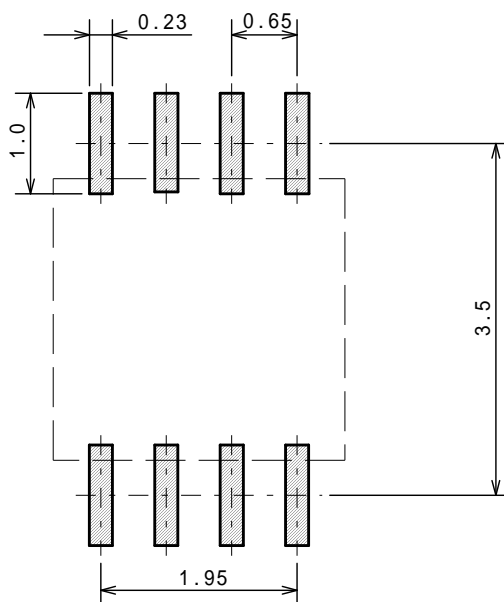
## MSOP8 (TVSP8) JEDEC MO-187-DA/THIN TYPE

Unit: mm

### ■ PACKAGE DIMENSIONS



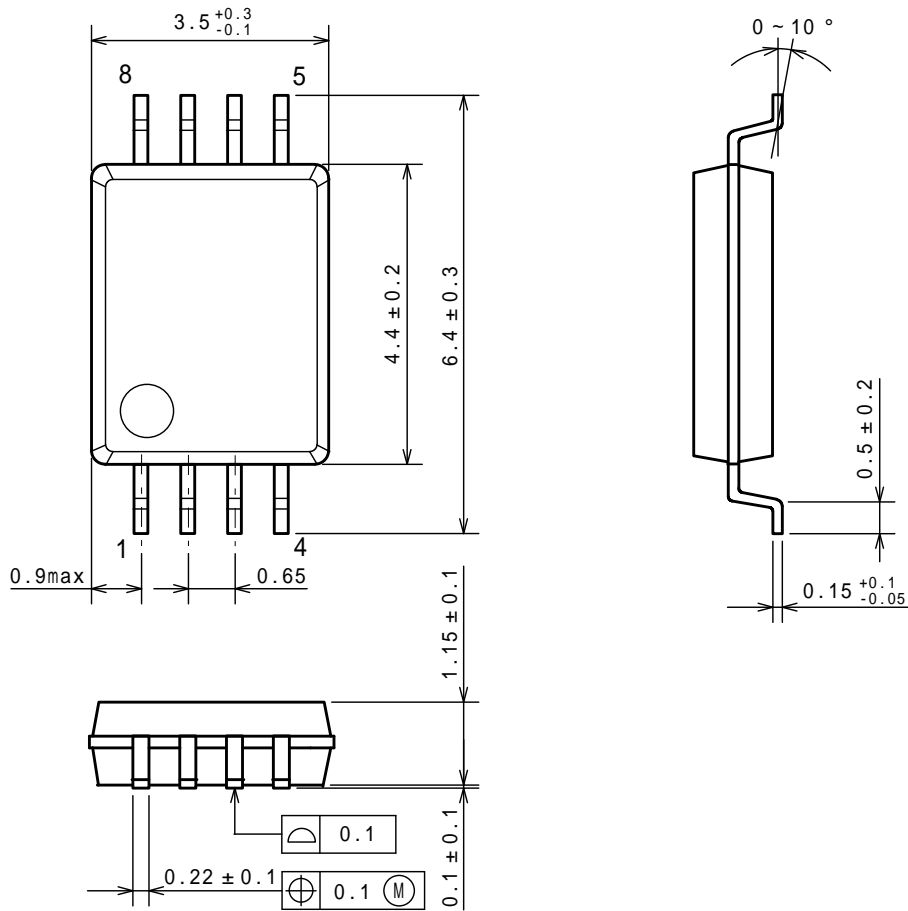
### ■ EXAMPLE OF SOLDER PADS DIMENSIONS



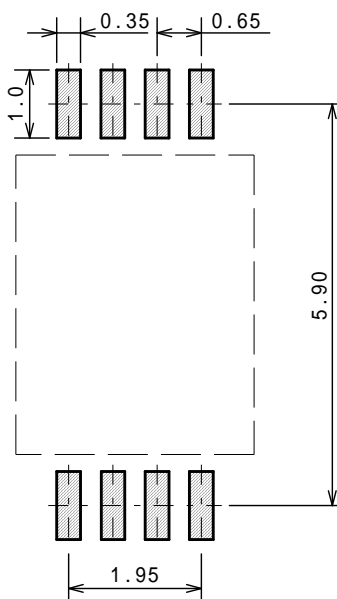
## SSOP8

Unit: mm

### ■ PACKAGE DIMENSIONS



### ■ EXAMPLE OF SOLDER PADS DIMENSIONS

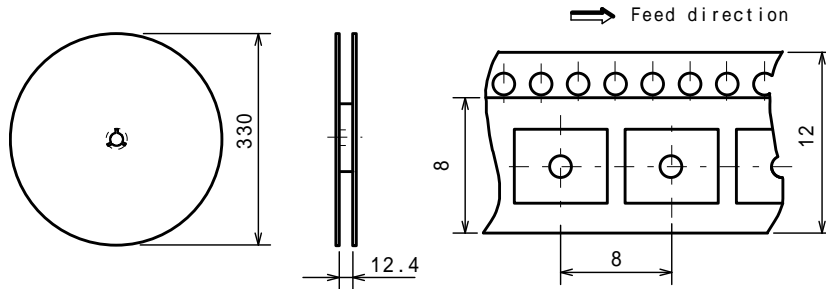


## SOP8

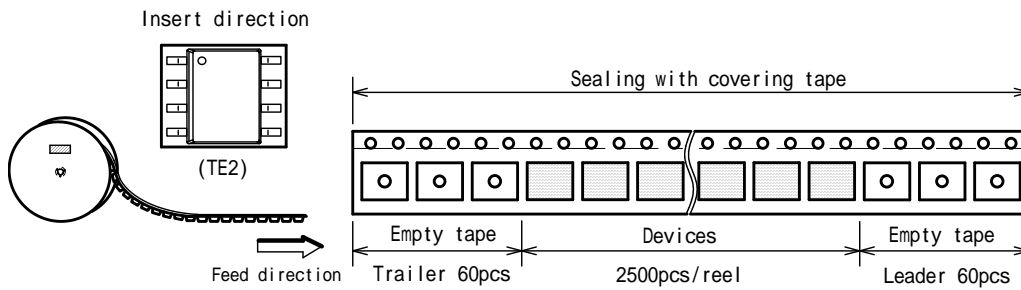
### PACKING SPEC

Unit: mm

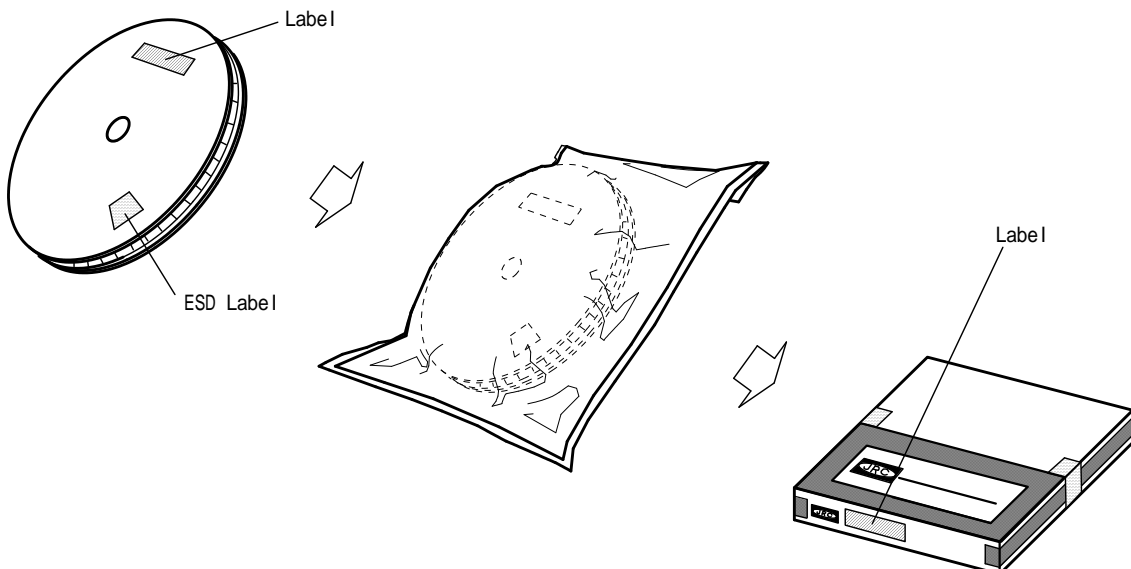
#### REEL DIMENSIONS / TAPING DIMENSIONS



#### TAPING STATE



#### PACKING STATE

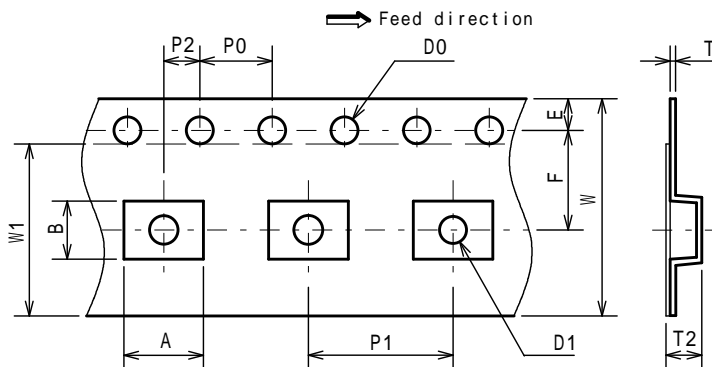


## MSOP8 (TVSP8) MEET JEDEC MO-187-DATHIN TYPE

### PACKING SPEC

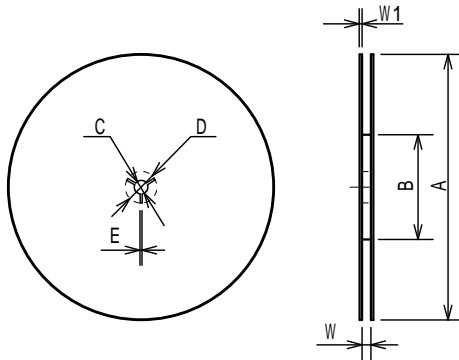
Unit: mm

#### TAPING DIMENSIONS



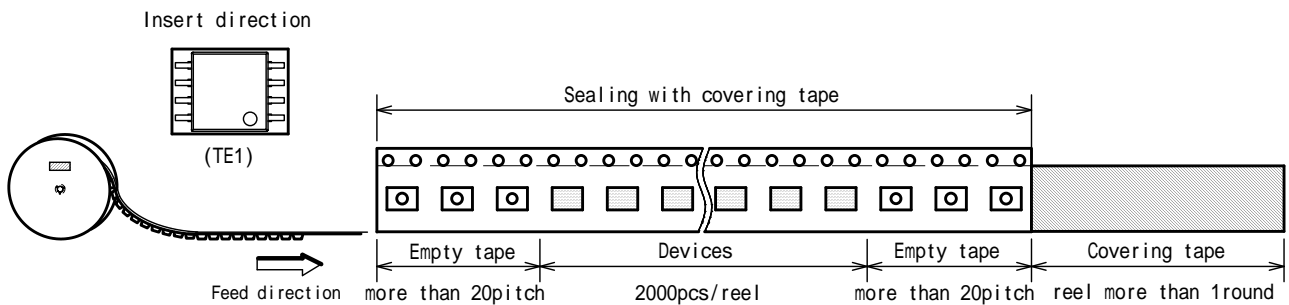
| SYMBOL | DIMENSION                        | REMARKS          |
|--------|----------------------------------|------------------|
| A      | 4.4                              | BOTTOM DIMENSION |
| B      | 3.2                              | BOTTOM DIMENSION |
| D0     | 1.5 <sup>+0.1</sup> <sub>0</sub> |                  |
| D1     | 1.5 <sup>+0.1</sup> <sub>0</sub> |                  |
| 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

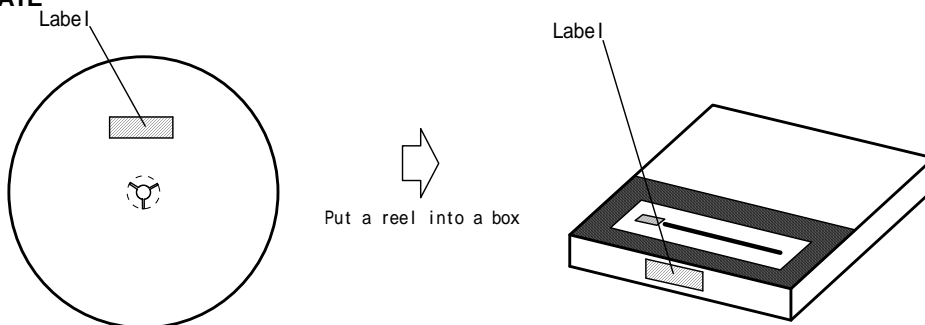


| SYMBOL | DIMENSION  |
|--------|------------|
| A      | 254 ± 2    |
| B      | 100 ± 1    |
| C      | 13 ± 0.2   |
| D      | 21 ± 0.8   |
| E      | 2 ± 0.5    |
| W      | 13.5 ± 0.5 |
| W1     | 2.0 ± 0.2  |

#### TAPING STATE



#### PACKING STATE

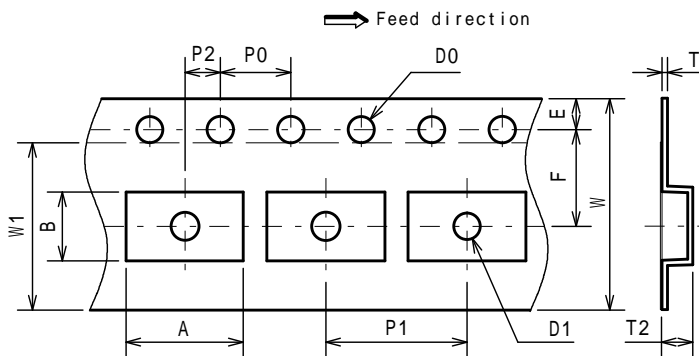


## SSOP8

### PACKING SPEC

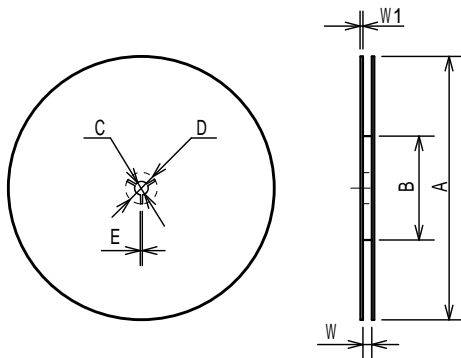
Unit: mm

#### TAPING DIMENSIONS



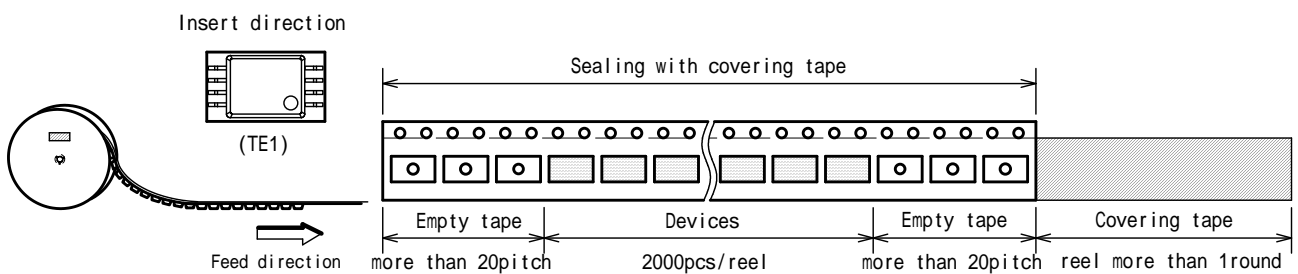
| SYMBOL | DIMENSION   | REMARKS          |
|--------|-------------|------------------|
| A      | 6.7         | BOTTOM DIMENSION |
| B      | 3.9         | BOTTOM DIMENSION |
| D0     | 1.55 ± 0.05 |                  |
| D1     | 1.55 ± 0.1  |                  |
| E      | 1.75 ± 0.1  |                  |
| F      | 5.5 ± 0.05  |                  |
| P0     | 4.0 ± 0.1   |                  |
| P1     | 8.0 ± 0.1   |                  |
| P2     | 2.0 ± 0.05  |                  |
| T      | 0.3 ± 0.05  |                  |
| T2     | 2.2         |                  |
| W      | 12.0 ± 0.3  |                  |
| W1     | 9.5         | THICKNESS 0.1max |

#### REEL DIMENSIONS

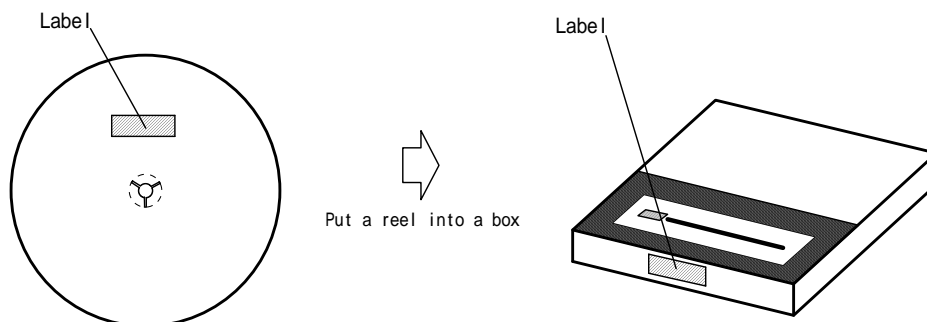


| SYMBOL | DIMENSION  |
|--------|------------|
| A      | 254 ± 2    |
| B      | 100 ± 1    |
| C      | 13 ± 0.2   |
| D      | 21 ± 0.8   |
| E      | 2 ± 0.5    |
| W      | 13.5 ± 0.5 |
| W1     | 2 ± 0.2    |

#### TAPING STATE

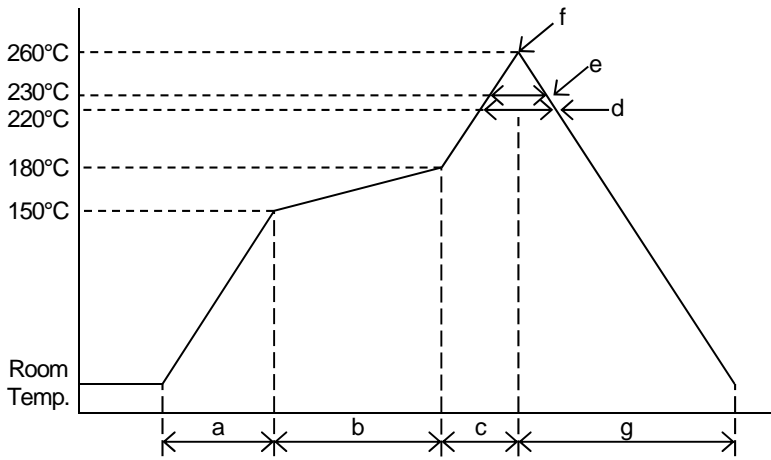


#### PACKING STATE



## ■ 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.



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