

## ADJUSTABLE PRECISION SHUNT REGULATOR

### ■FEATURES

- Operating Voltage  $V_{REF}$  to 36V
- Precision Voltage Reference  $2.495V \pm 0.8\%$   
 $2.5V \pm 0.8\%$
- Adjustable Output Voltage by external resistance
- Wide Safety Operating Boundary Area
- Bipolar Technology
- Package SOT-23-5  
SOT-89-3

### ■APPLICATION

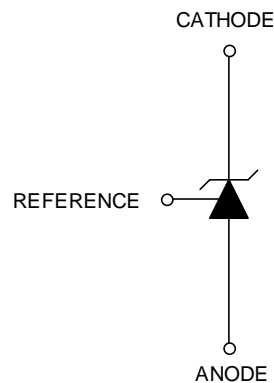
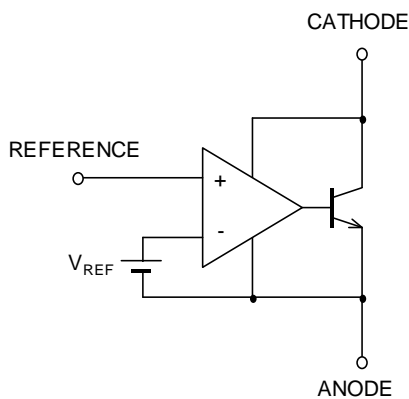
- Industrial Equipment
- Home Electrical Appliance
- Replacement from Zener Diode
- Other

### ■GENERAL DESCRIPTION

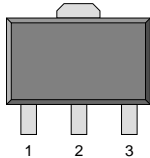
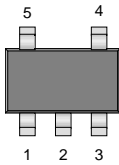
The NJM17431 is adjustable precision shunt regulator. The output voltage may be set to any value between  $V_{REF}$  (about 2.5V) and 36V by two external resistors.

The NJM17431 is improved the reference voltage accuracy ( $\pm 0.8\%$ ) and safety operating boundary area connected large capacitance. Therefore, the NJM17431 is suitable for various applications.

### ■BLOCK DIAGRAM



## ■PIN CONFIGURATION

|                |   |   |          |
|----------------|---|---|----------|
| Pin Assign     |  <p>1. REFERENCE<br/>2. ANODE<br/>3. CATHODE</p> |  <p>1. REFERENCE<br/>2. ANODE<br/>3. CATHODE<br/>4. N.C.<br/>5. N.C.</p> |          |
|                | Package   | SOT-89-3  | SOT-23-5 |
| Product Number | NJM17431Uxx   | NJM17431FxxA  |          |

## ■PRODUCT NAME INFORMATION

|             |                                       |   |  |   |                   |   |             |   |       |
|-------------|---------------------------------------|---|--|---|-------------------|---|-------------|---|-------|
| NJM17431    |                                       | - | U/F  | - | 24/25             | - | A           | - | (TE1) |
| Part Number | Package<br>U: SOT-89-3<br>F: SOT-23-5 |   | V <sub>REF</sub><br>24: 2.495V<br>25: 2.5V |   | Pin assign Option |   | Taping Form |   |       |

## ■ORDERING INFORMATION

| PRODUCT NAME | PACKAGE  | RoHS | HALOGEN-FREE | TERMINAL FINISH | MARKING              | WEIGHT (mg) | MOQ (pcs) |
|--------------|----------|------|--------------|-----------------|----------------------|-------------|-----------|
| NJM17431U24  | SOT-89-3 | Yes  | Yes          | Sn2Bi           | 181                  | 61          | 1,000     |
| NJM17431U25  | SOT-89-3 | Yes  | Yes          | Sn2Bi           | 171                  | 61          | 1,000     |
| NJM17431F24A | SOT-23-5 | Yes  | Yes          | Sn2Bi           | AK5x<br>("x" is Lot) | 15          | 3,000     |
| NJM17431F25A | SOT-23-5 | Yes  | Yes          | Sn2Bi           | AK4x<br>("x" is Lot) | 15          | 3,000     |

## ■ABSOLUTE MAXIMUM RATINGS

| PARAMETER                   | SYMBOL     | MAXIMUM RATINGS | UNIT                | REMARK            |   |
|-----------------------------|------------|-----------------|---------------------|-------------------|---|
| Cathode Voltage             | $V_{KA}$   | +37 (1)         | V                   | ANODE-CATHODE Pin |   |
| Continuous Cathode Current  | $I_K$      | - 100 to +150   | mA                  | ANODE-CATHODE Pin |   |
| Reference Input Current     | $I_{REF}$  | - 0.05 to +10   | mA                  | -                 |   |
| Power Dissipation           | $P_D$      | SOT-23-5        | 480 (2)<br>650 (3)  | mW                | - |
|                             |            | SOT-89-3        | 450 (4)<br>1300 (5) |                   |   |
| Junction Temperature        | $T_{jmax}$ | +150            | °C                  | -                 |   |
| Operating Temperature Range | $T_{opr}$  | - 40 to +125    | °C                  | -                 |   |
| Storage Temperature Range   | $T_{stg}$  | - 50 to +150    | °C                  | -                 |   |

(1) Unless specified, all voltage value are with respect to the anode pin.

(2) Mounted on glass epoxy board. (76.2×114.3×1.6mm: based on EIA/JEDEC standard, 2Layers)

(3) Mounted on glass epoxy board. (76.2×114.3×1.6mm: based on EIA/JEDEC standard, 4Layers),  
internal Cu area: 74.2×74.2mm

(4) Mounted on glass epoxy board. (76.2×114.3×1.6mm: based on EIA/JEDEC standard size, 2Layers)

(5) Mounted on glass epoxy board. (76.2×114.3×1.6mm: based on EIA/JEDEC standard, 4Layers)

(For 4Layers: Applying 74.2×74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

## ■RECOMMENDED OPERATING CONDITIONS

| PARAMETER       | SYMBOL   | RATINGS         | UNIT | REMARK            |
|-----------------|----------|-----------------|------|-------------------|
| Cathode Voltage | $V_{KA}$ | $V_{REF}$ to 36 | V    | ANODE-CATHODE Pin |
| Cathode Current | $I_K$    | 0.5 to 100      | mA   | ANODE-CATHODE Pin |

## ■ ELECTRICAL CHARACTERISTICS

(Unless other noted,  $I_K=10\text{mA}$ ,  $T_a=25^\circ\text{C}$ )

| PARAMETER   | SYMBOL                                 | TEST CONDITIONS   | MIN.        | TYP.       | MAX.         | UNIT                  |   |
|---|--|---|-------------|------------|--------------|-----------------------|---|
| Reference Voltage                                     | $V_{REF}$                              | $V_{KA}=V_{REF}$ (6)  | 2.495V ver. | 2.475      | 2.495        | 2.515                 | V |
|   |  |   | 2.5V ver.   | 2.480      | 2.500        | 2.520                 |   |
| Reference Input Voltage Change Over Temperature Range | $\Delta V_{REF}$ (dev)                 | $V_{KA}=V_{REF}$ (6)<br>$T_a=-40^\circ\text{C}$ to $+85^\circ\text{C}$                    | -           | 8          | 17           | mV                    |   |
| Reference voltage temperature coefficient             | $\Delta V_{REF}$ (ppm)                 | $V_{KA}=V_{REF}$ (6)<br>$T_a=-40^\circ\text{C}$ to $+85^\circ\text{C}$                    | -           | $\pm 30$   | -            | ppm/ $^\circ\text{C}$ |   |
| Reference Voltage Change vs. Cathode Voltage Change   | $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ | $\Delta V_{KA}=10\text{V}-V_{REF}$ (7)<br>$\Delta V_{KA}=36\text{V}-10\text{V}$           | -           | -2.0<br>-1 | -3.7<br>-2.2 | mV/V                  |   |
| Reference Input Current                               | $I_{REF}$                              | $R1=10\text{k}\Omega$ , $R2=\infty$ (7)   | -           | 1          | 2.8          | $\mu\text{A}$         |   |
| Reference Input Current Change Over Temperature Range | $\Delta I_{REF}$ (dev)                 | $R1=10\text{k}\Omega$ , $R2=\infty$ (7)<br>$T_a=-40^\circ\text{C}$ to $+85^\circ\text{C}$ | -           | 0.25       | 0.5          | $\mu\text{A}$         |   |
| Minimum Cathode Current                               | $I_{MIN}$                              | $V_{KA}=V_{REF}$ (6)  | -           | 0.25       | 0.5          | mA                    |   |
| OFF State Cathode Current                             | $I_{OFF}$                              | $V_{KA}=36\text{V}$ , $V_{REF}=0\text{V}$ (8)   | -           | 0.1        | 1.0          | $\mu\text{A}$         |   |
| Dynamic Impedance                                     | $ Z_{KA} $                             | $V_{KA}=V_{REF}$ , $I_K=1\text{mA}$ to $100\text{mA}$ ,<br>$f \leq 1\text{kHz}$ (6)       | -           | 0.2        | 0.5          | $\Omega$              |   |

The maximum value of “Dynamic Impedance”, “Reference Voltage Change” and “Reference Input Current Change” are determined based on sampling evaluation from the initial production lots, and thus not tested in the production test. Therefore, these values are for the reference design purpose only.

(6): TestCircuitFig.1

(7): Test CircuitFig.2

(8): Test Circuit Fig.3

## ■ TEST CIRCUIT

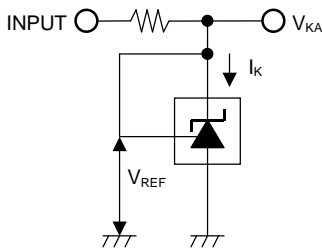


Fig.1. Test Circuit for  $V_{KA}=V_{REF}$

$$V_O = V_{KA} = V_{REF}$$

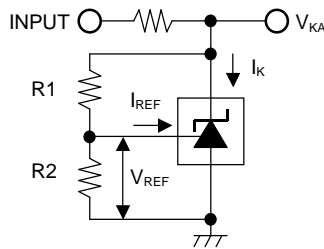


Fig.2. Test Circuit for  $V_{KA}>V_{REF}$

$$V_O = V_{KA} = V_{REF} \left( 1 + \frac{R1}{R2} \right) + I_{REF} \times R1$$

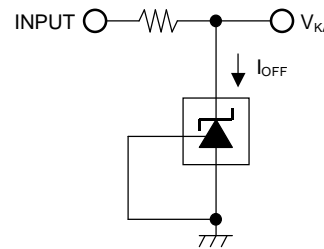


Fig.3. Test Circuit for  $I_{OFF}$

## ■ THERMAL CHARACTERISTICS

| PARAMETER   | SYMBOL        | VALUE    |                    | UNIT                        |
|---|---------------|----------|--------------------|-----------------------------|
| Junction-to-ambient thermal resistance                | $\theta_{ja}$ | SOT-23-5 | 260 (2)<br>195 (3) | $^{\circ}\text{C}/\text{W}$ |
|   |               | SOT-89-3 | 200 (4)<br>130 (5) |                             |
| Junction-to-Top of package characterization parameter | $\psi_{jt}$   | SOT-23-5 | 60 (2)<br>70 (3)   | $^{\circ}\text{C}/\text{W}$ |
|   |               | SOT-89-3 | 67 (4)<br>65 (5)   |                             |

(2) Mounted on glass epoxy board. (76.2x114.3x1.6mm: based on EIA/JEDEC standard, 2Layers)

(3) Mounted on glass epoxy board. (76.2x114.3x1.6mm: based on EIA/JEDEC standard, 4Layers),

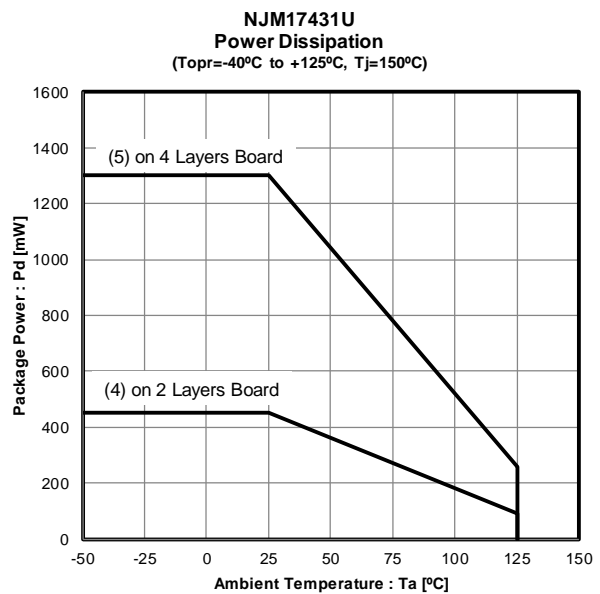
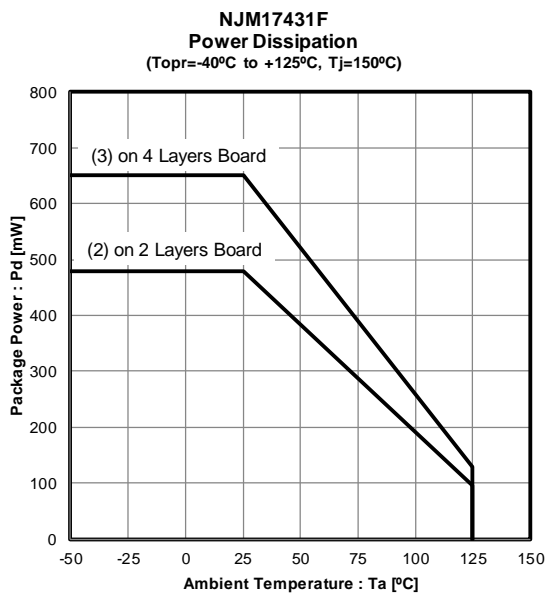
internal Cu area: 74.2x74.2mm

(4) Mounted on glass epoxy board. (76.2x114.3x1.6mm: based on EIA/JEDEC standard size, 2Layers)

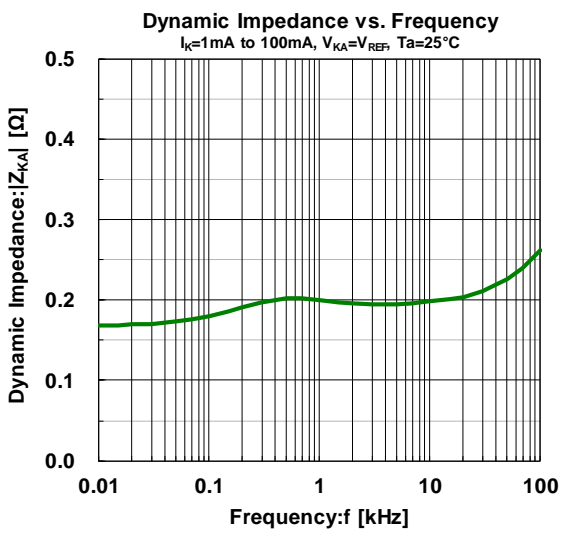
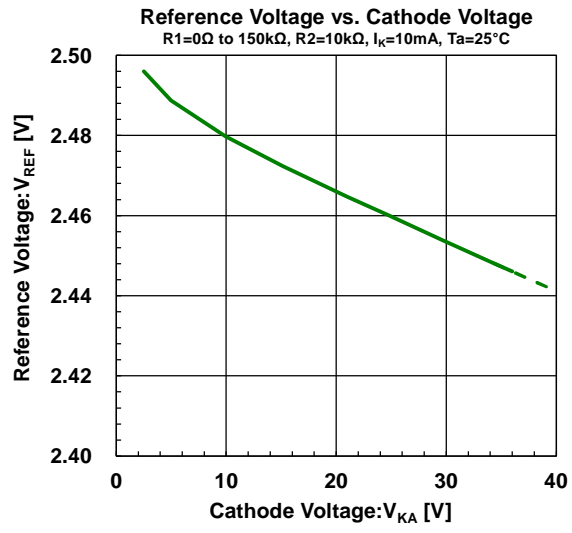
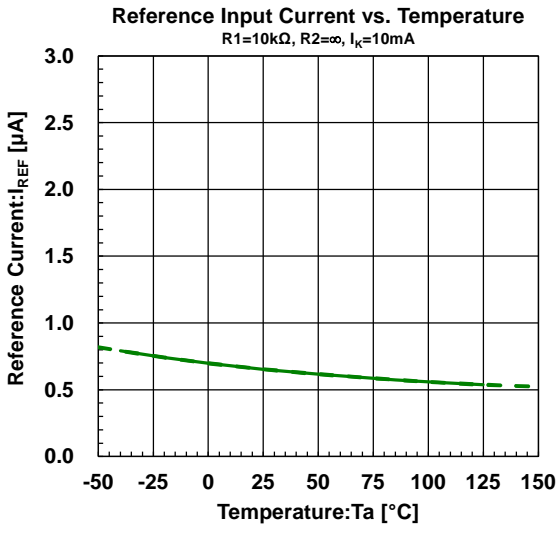
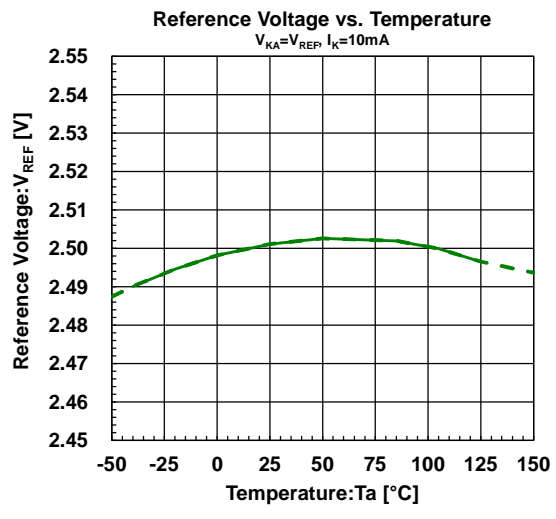
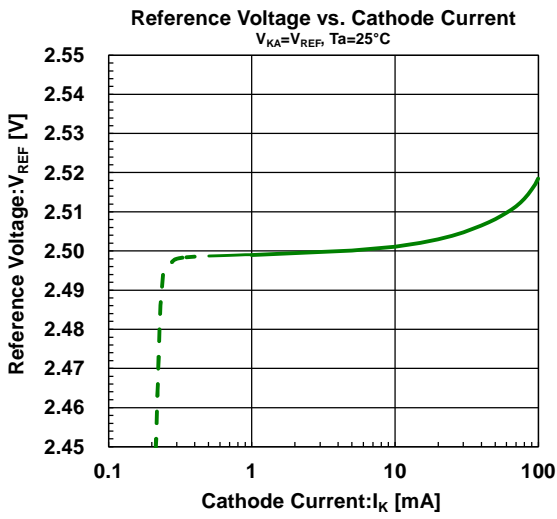
(5) Mounted on glass epoxy board. (76.2x114.3x1.6mm: based on EIA/JEDEC standard, 4Layers)

(For 4Layers: Applying 74.2x74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

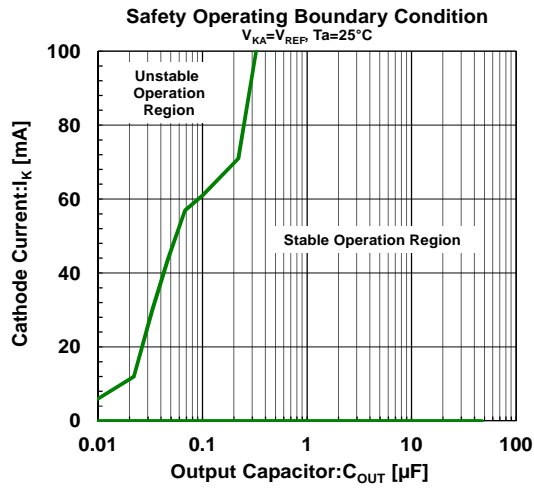
## ■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



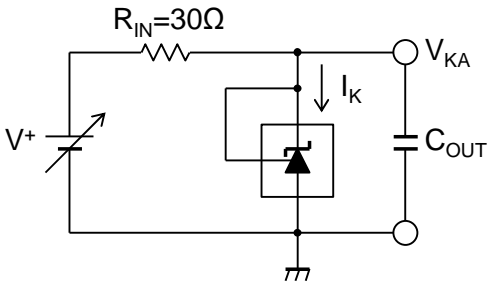
## ■ TYPICAL CHARACTERISTICS



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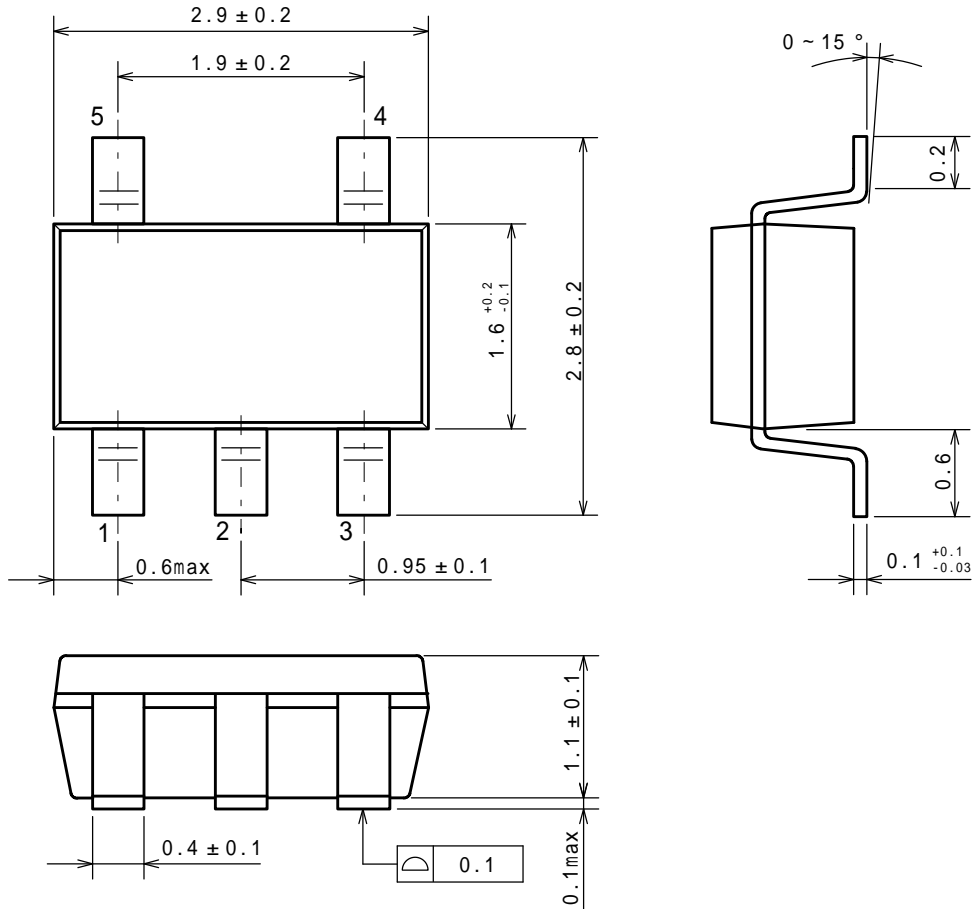


Safety Operating Boundary Condition Test Circuit

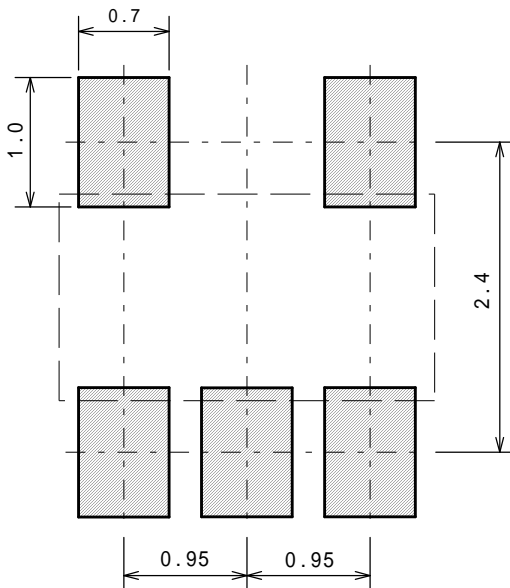


Note) Oscillation might occur while operating within the range of safety curve.  
 So that, it is necessary to make ample margins by taking considerations of fluctuation of the device.

### PACKAGE DIMENSIONS

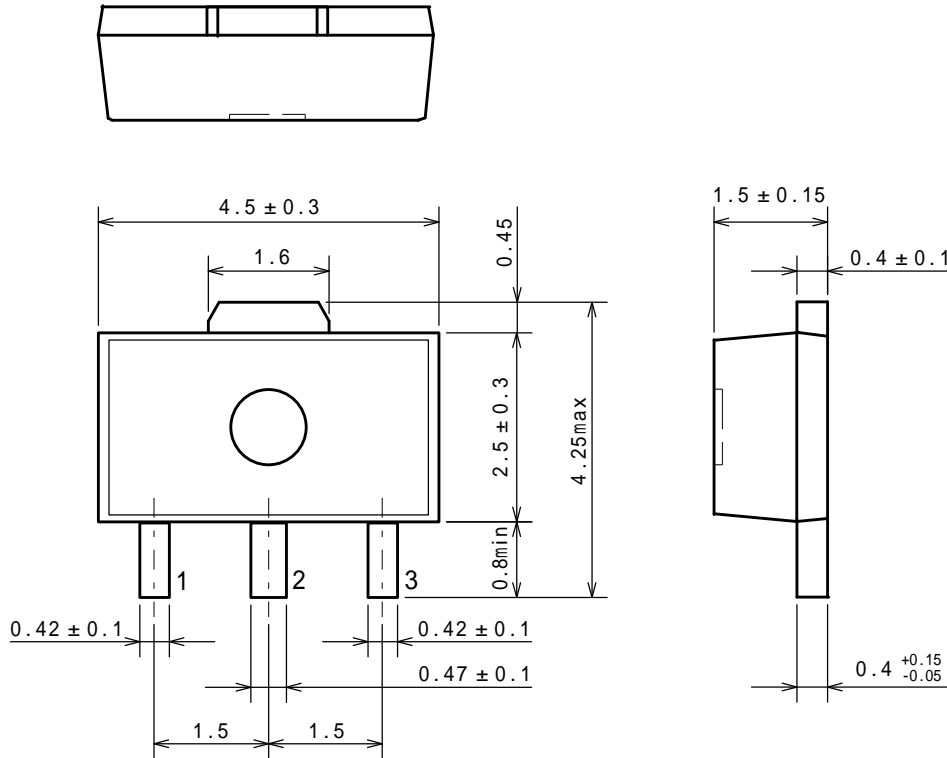


### EXAMPLE OF SOLDER PADS DIMENSIONS

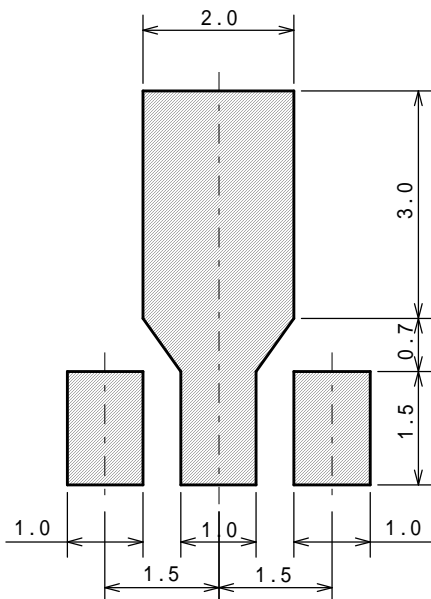




### PACKAGE DIMENSIONS

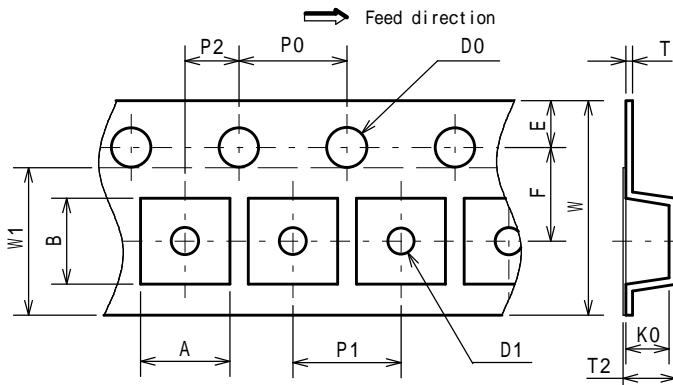


### EXAMPLE OF SOLDER PADS DIMENSIONS



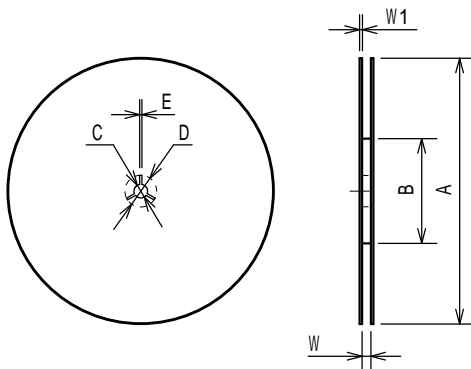
### PACKING SPEC

#### TAPING DIMENSIONS



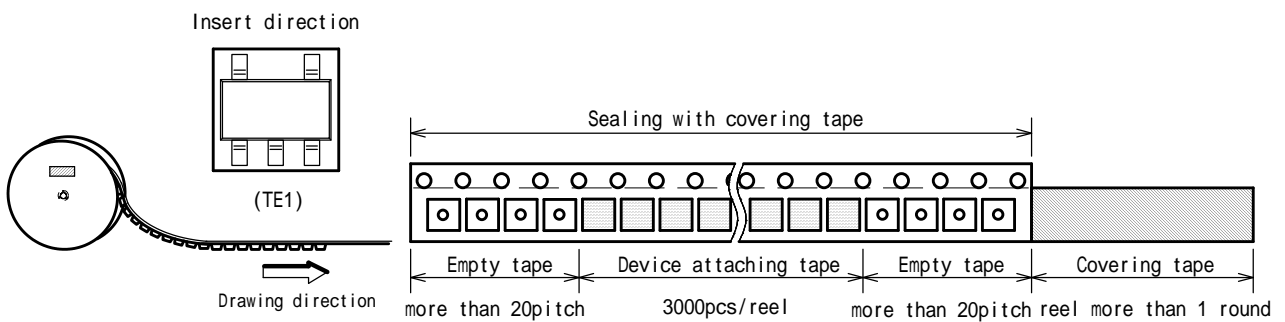
| SYMBOL | DIMENSION   | REMARKS          |
|--------|-------------|------------------|
| A      | 3.3 ± 0.1   | BOTTOM DIMENSION |
| B      | 3.2 ± 0.1   | BOTTOM DIMENSION |
| D0     | 1.55        |                  |
| D1     | 1.05        |                  |
| E      | 1.75 ± 0.1  |                  |
| F      | 3.5 ± 0.05  |                  |
| P0     | 4.0 ± 0.1   |                  |
| P1     | 4.0 ± 0.1   |                  |
| P2     | 2.0 ± 0.05  |                  |
| T      | 0.25 ± 0.05 |                  |
| T2     | 1.82        |                  |
| K0     | 1.5 ± 0.1   |                  |
| W      | 8.0 ± 0.3   |                  |
| W1     | 5.5         | THICKNESS 0.1MAX |

#### REEL DIMENSIONS

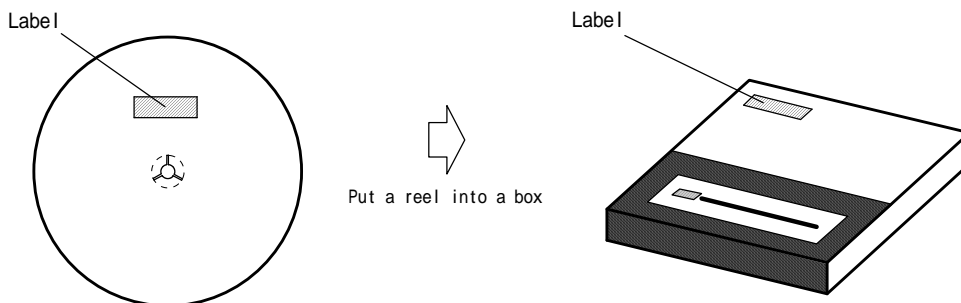


| SYMBOL | DIMENSION |
|--------|-----------|
| A      | 180 ± 1   |
| B      | 60 ± 1    |
| C      | 13 ± 0.2  |
| D      | 21 ± 0.8  |
| E      | 2 ± 0.5   |
| W      | 9 ± 0.5   |
| W1     | 1.2 ± 0.2 |

#### TAPING STATE

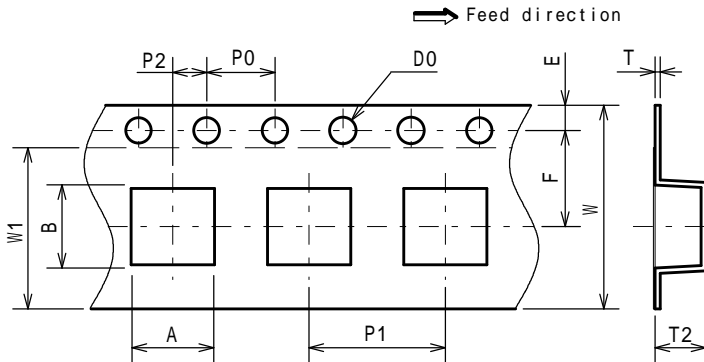


#### PACKING STATE



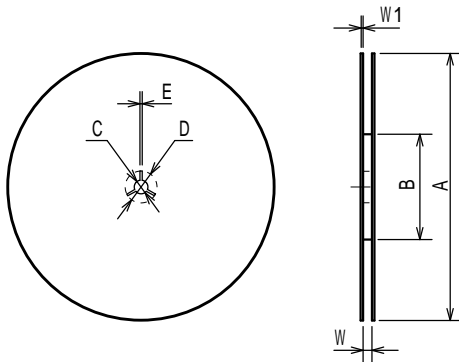
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#### TAPING DIMENSIONS



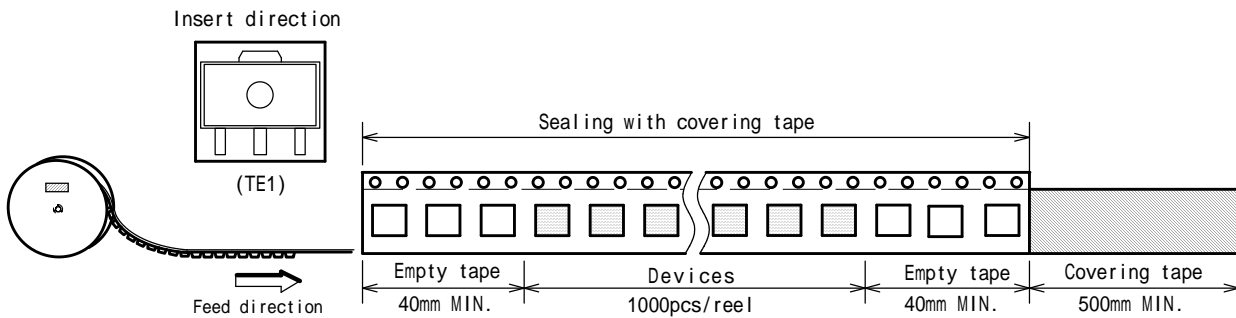
| SYMBOL | DIMENSION                        | REMARKS          |
|--------|----------------------------------|------------------|
| A      | 4.9 ± 0.1                        | BOTTOM DIMENSION |
| B      | 4.5 ± 0.1                        | BOTTOM DIMENSION |
| D0     | 1.5 <sup>+0.1</sup> <sub>0</sub> |                  |
| E      | 1.5 ± 0.1                        |                  |
| F      | 5.65 ± 0.1                       |                  |
| P0     | 4.0 ± 0.1                        |                  |
| P1     | 8.0 ± 0.1                        |                  |
| P2     | 2.0 ± 0.05                       |                  |
| T      | 0.3 ± 0.05                       |                  |
| T2     | 2.0                              |                  |
| W      | 12.0 ± 0.3                       |                  |
| W1     | 9.5                              | THICKNESS 0.1MAX |

#### REEL DIMENSIONS

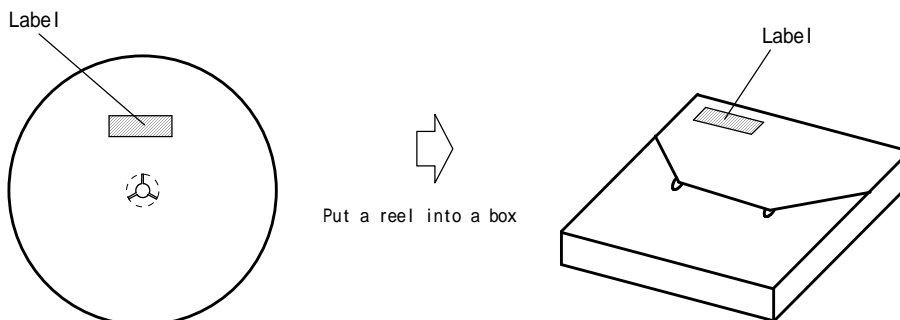


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| B      | 60 ± 1    |
| C      | 13 ± 0.2  |
| D      | 21 ± 0.8  |
| E      | 2 ± 0.5   |
| W      | 13 ± 0.5  |
| W1     | 1.2 ± 0.2 |

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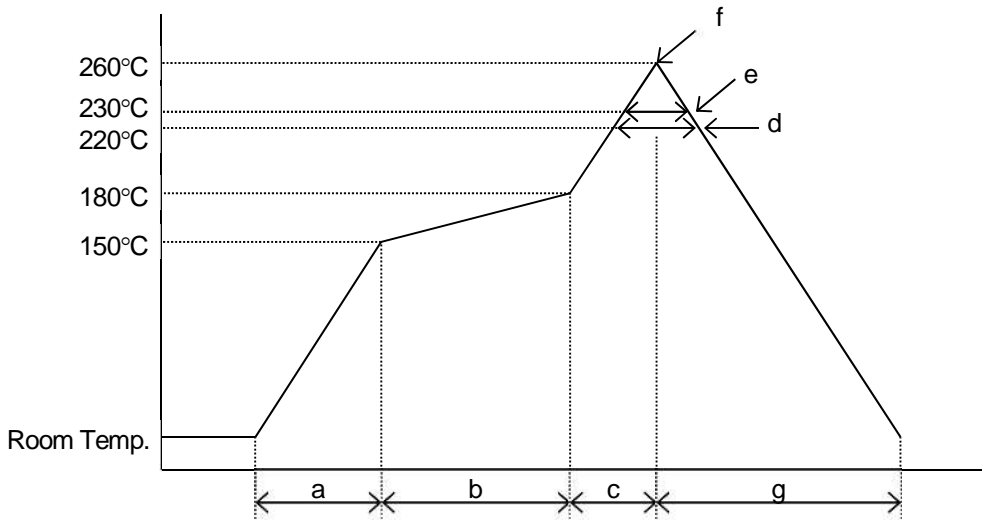
#### PACKING STATE



## RECOMMENDED MOUNTING METHOD

### INFRARED REFLOW SOLDERING METHOD

\* Recommended reflow soldering procedure



- |                             |                    |
|-----------------------------|--------------------|
| a: Temperature ramping rate | : 1 to 4°C /s      |
| b: Pre-heating temperature  | : 150 to 180°C     |
| 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.

## ■REVISION HYSTORY

| Date        | Revision | Changes            |
|-------------|----------|--------------------|
| 21.May.2020 | Ver.1.0  | New Release        |
| 16.Sep.2020 | Ver.1.1  | Added NJM17431F24A |
| 16.Sep.2021 | Ver.1.2  | Added NJM17431Uxx  |
|             |          |                    |

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  - Fire Alarms / Intruder Detectors
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