

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

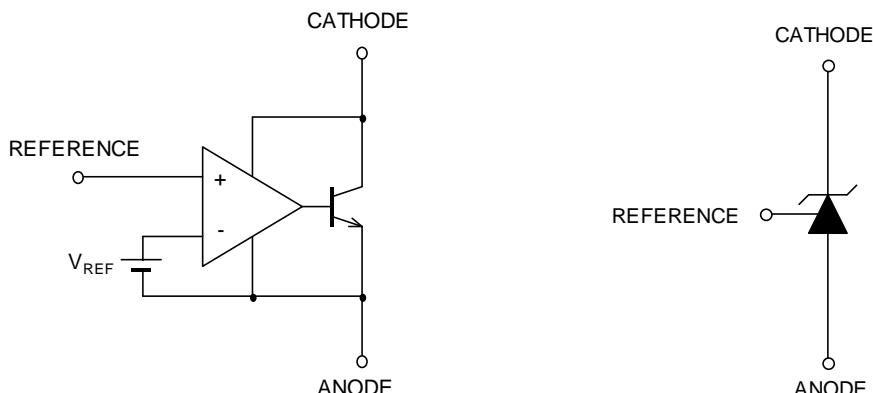
- Industrial Equipment
- Home Electrical Appliance
- Replacement from Zener Diode
- Other

■ 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		
	1. REFERENCE 2. ANODE 3. CATHODE	1. REFERENCE 2. ANODE 3. CATHODE 4. N.C. 5. N.C.
Package	SOT-89-3	SOT-23-5
Product Number	NJM17431Uxx	NJM17431FxxA

■PRODUCT NAME INFORMATION

NJM17431 - U/F - 24/25 - A - (TE1)

Part Number Package V_{REF} Pin assign Taping Form
U: SOT-89-3 F: SOT-23-5 24: 2.495V 25: 2.5V Option

■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 (“x” is Lot)	15	3,000
NJM17431F25A	SOT-23-5	Yes	Yes	Sn2Bi	AK4x (“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 Voltage	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) 650 (3)	mW	–	–
		450 (4) 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. (76.2x114.3x1.6mm: 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)

■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}	$V_{\text{KA}}=V_{\text{REF}}$ (6)	2.495V ver.	2.475	2.495	2.515
			2.5V ver.	2.480	2.500	2.520
Reference Input Voltage Change Over Temperature Range	ΔV_{REF} (dev)	$V_{\text{KA}}=V_{\text{REF}}$ (6) $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$	-	8	17	mV
Reference voltage temperature coefficient	ΔV_{REF} (ppm)	$V_{\text{KA}}=V_{\text{REF}}$ (6) $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$	-	± 30	-	$\text{ppm}/^\circ\text{C}$
Reference Voltage Change vs. Cathode Voltage Change	$\Delta V_{\text{REF}}/\Delta V_{\text{KA}}$	$\Delta V_{\text{KA}}=10\text{V}-V_{\text{REF}}$ (7) $\Delta V_{\text{KA}}=36\text{V}-10\text{V}$	-	-2.0 -1	-3.7 -2.2	mV/V
Reference Input Current	I_{REF}	$R1=10\text{k}\Omega$, $R2=\infty$ (7)	-	1	2.8	μA
Reference Input Current Change Over Temperature Range	ΔI_{REF} (dev)	$R1=10\text{k}\Omega$, $R2=\infty$ (7) $T_a = -40^\circ\text{C}$ to $+85^\circ\text{C}$	-	0.25	0.5	μA
Minimum Cathode Current	I_{MIN}	$V_{\text{KA}}=V_{\text{REF}}$ (6)	-	0.25	0.5	mA
OFF State Cathode Current	I_{OFF}	$V_{\text{KA}}=36\text{V}$, $V_{\text{REF}}=0\text{V}$ (8)	-	0.1	1.0	μA
Dynamic Impedance	IZ_{KA}	$V_{\text{KA}}=V_{\text{REF}}$, $I_k=1\text{mA}$ to 100mA , $f \leq 1\text{kHz}$ (6)	-	0.2	0.5	Ω

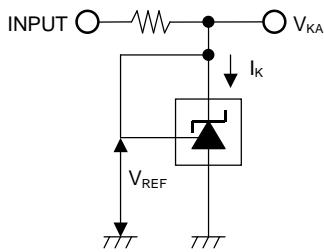
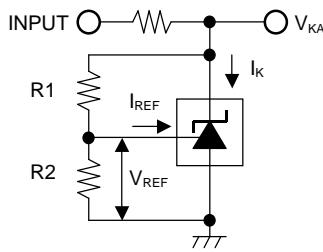
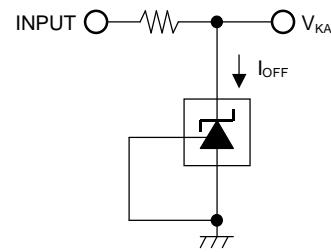
The maximum value of "Dynamic Impedance", "Reference Voltage Change" and "Reference Input Current Change" are determined based on sampling evaluation from the initial production lots, and thus not tested in the production test. Therefore, these values are for the reference design purpose only.

(6): TestCircuitFig.1

(7): Test CircuitFig.2

(8): Test Circuit Fig.3

■ TEST CIRCUIT

Fig.1. Test Circuit for $V_{\text{KA}}=V_{\text{REF}}$ Fig.2. Test Circuit for $V_{\text{KA}}>V_{\text{REF}}$ Fig.3. Test Circuit for I_{OFF}

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

$$V_O = V_{\text{KA}} = V_{\text{REF}} \left(1 + \frac{R_1}{R_2} \right) + I_{\text{REF}} \times R_1$$

■ THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	VALUE		UNIT
Junction-to-ambient thermal resistance	θ_{ja}	SOT-23-5	260 (2) 195 (3)	$^{\circ}\text{C}/\text{mW}$
		SOT-89-3	200 (4) 130 (5)	
Junction-to-Top of package characterization parameter	ψ_{jt}	SOT-23-5	60 (2) 70 (3)	$^{\circ}\text{C}/\text{mW}$
		SOT-89-3	67 (4) 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),

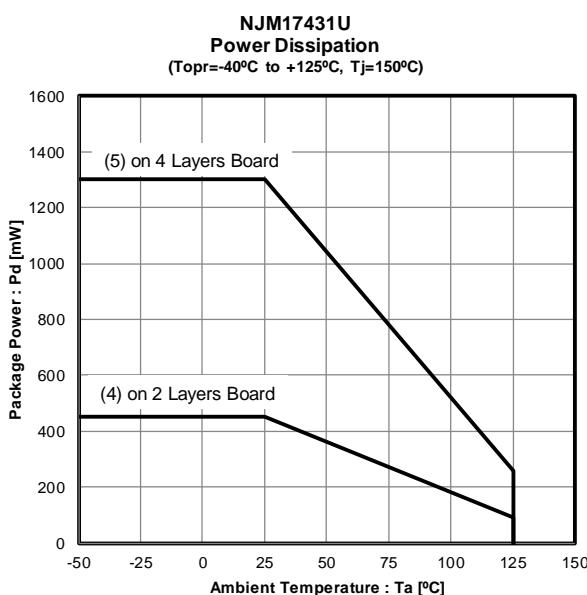
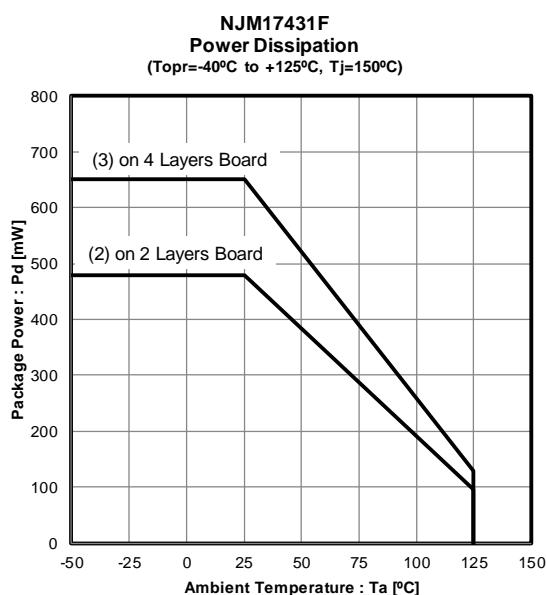
internal Cu area: 74.2x74.2mm

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

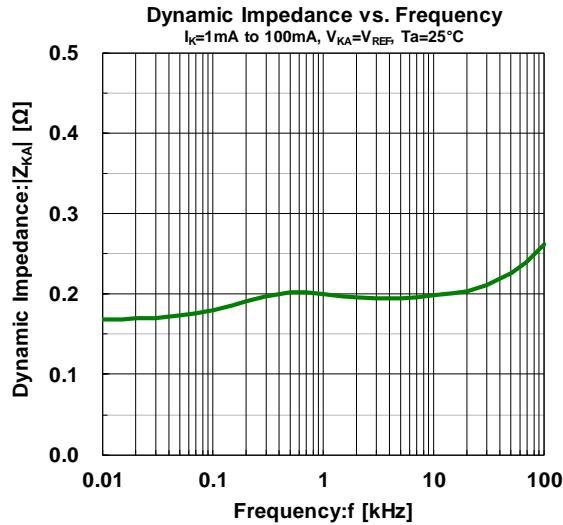
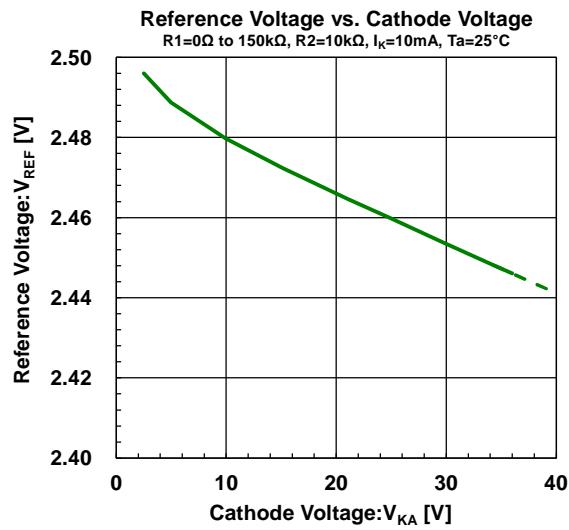
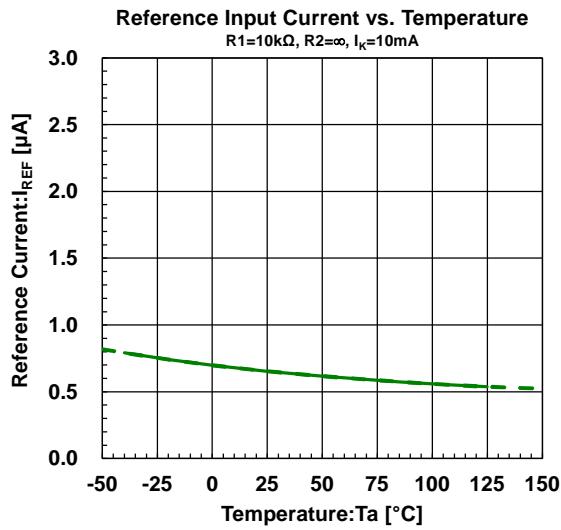
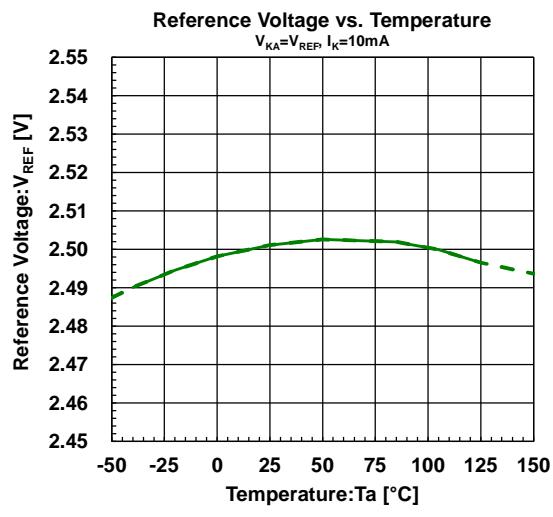
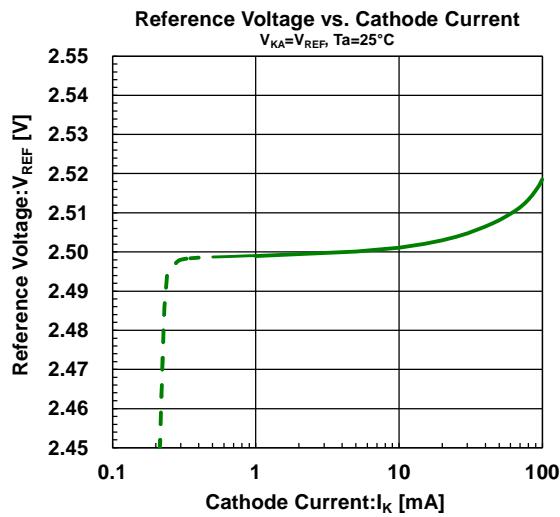
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(For 4Layers: Applying 74.2x74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

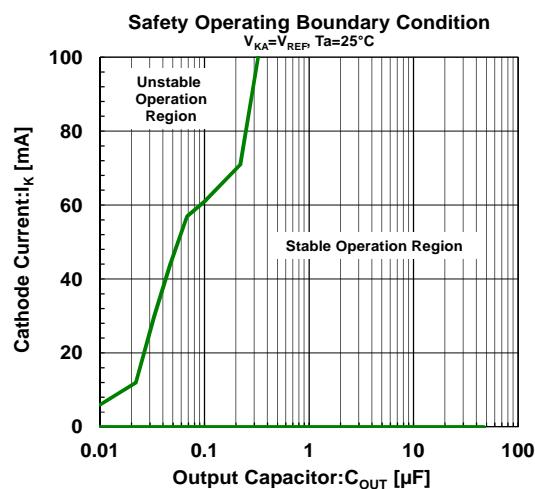
■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



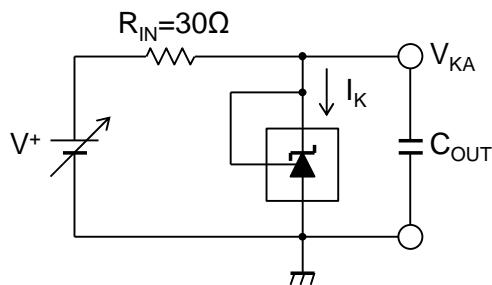
■TYPICAL CHARACTERISTICS



■TYPICAL CHARACTERISTICS



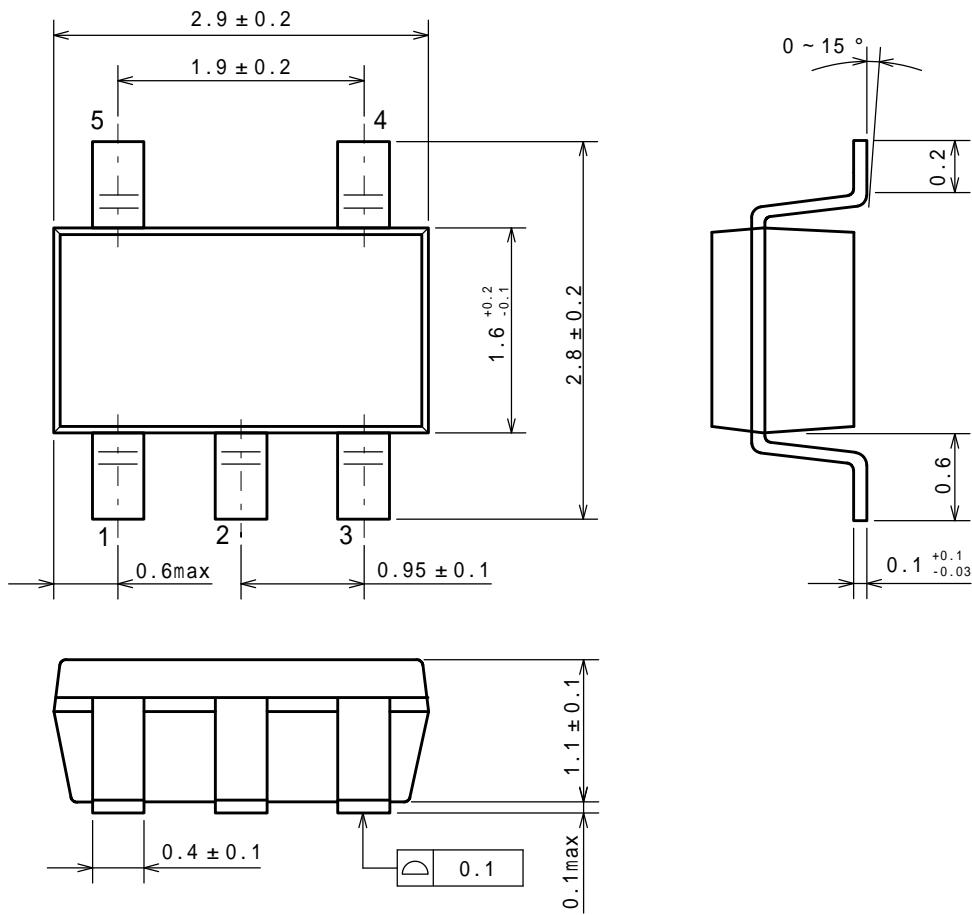
Safety Operating Boundary Condition Test Circuit



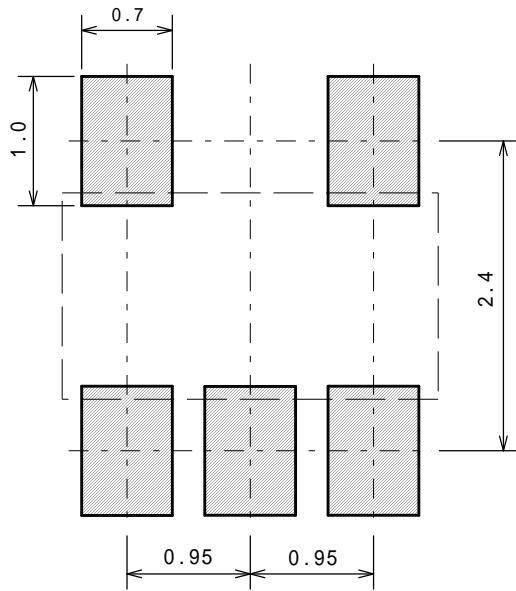
Note) Oscillation might occur while operating within the range of safety curve.

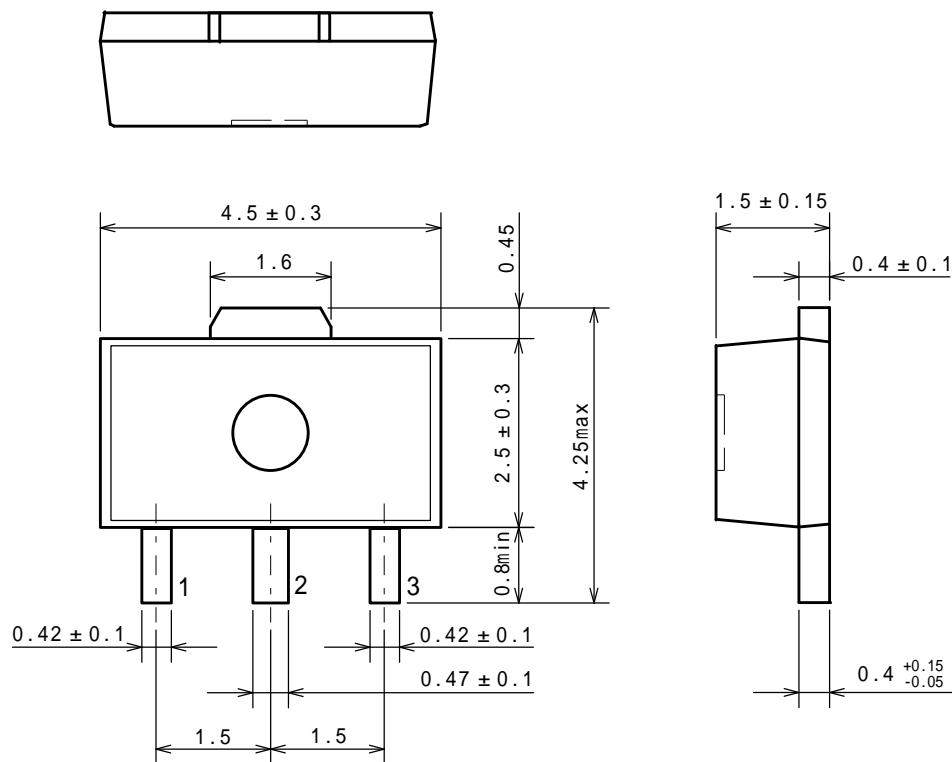
So that, it is necessary to make ample margins by taking considerations of fluctuation of the device.

PACKAGE DIMENSIONS

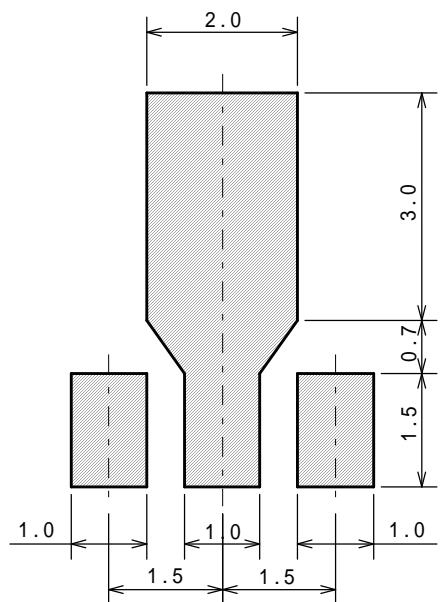


EXAMPLE OF SOLDER PADS DIMENSIONS



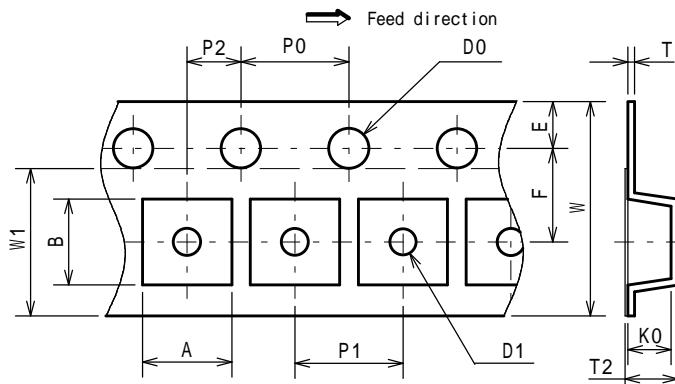


EXAMPLE OF SOLDER PADS DIMENSIONS



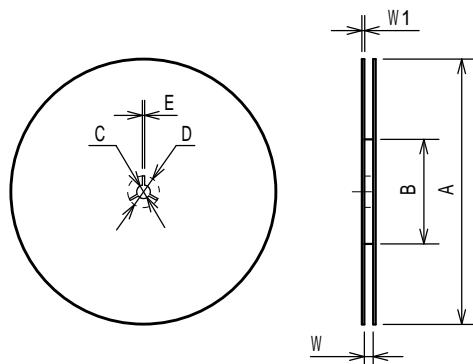
PACKING SPEC

TAPING DIMENSIONS



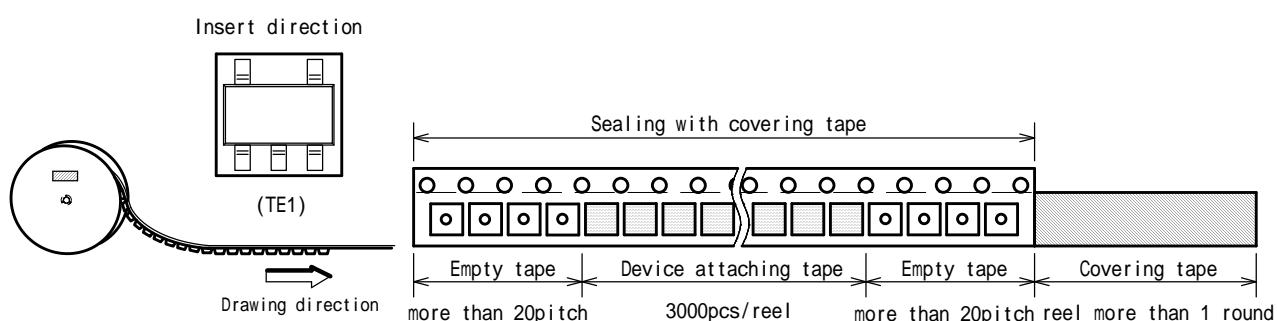
SYMBOL	DIMENSION	REMARKS
A	3.3 ± 0.1	BOTTOM DIMENSION
B	3.2 ± 0.1	BOTTOM DIMENSION
D0	1.55	
D1	1.05	
E	1.75 ± 0.1	
F	3.5 ± 0.05	
P0	4.0 ± 0.1	
P1	4.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.25 ± 0.05	
T2	1.82	
K0	1.5 ± 0.1	
W	8.0 ± 0.3	
W1	5.5	THICKNESS 0.1MAX

REEL DIMENSIONS

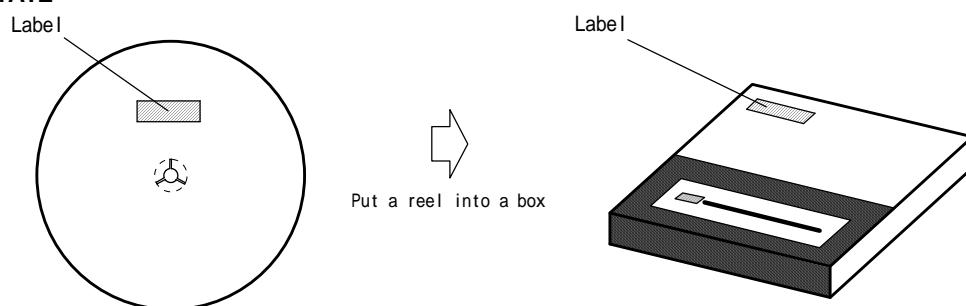


SYMBOL	DIMENSION
A	180 ± 1
B	60 ± 1
C	13 ± 0.2
D	21 ± 0.8
E	2 ± 0.5
W	9 ± 0.5
W1	1.2 ± 0.2

TAPING STATE



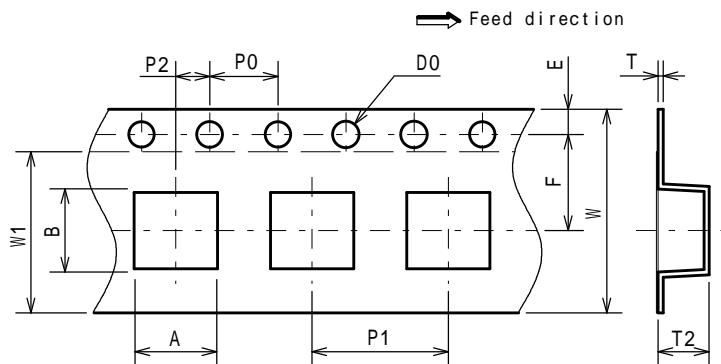
PACKING STATE



■PACKING SPEC

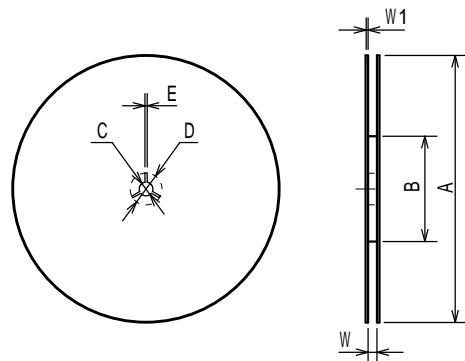
Unit: mm

TAPING DIMENSIONS



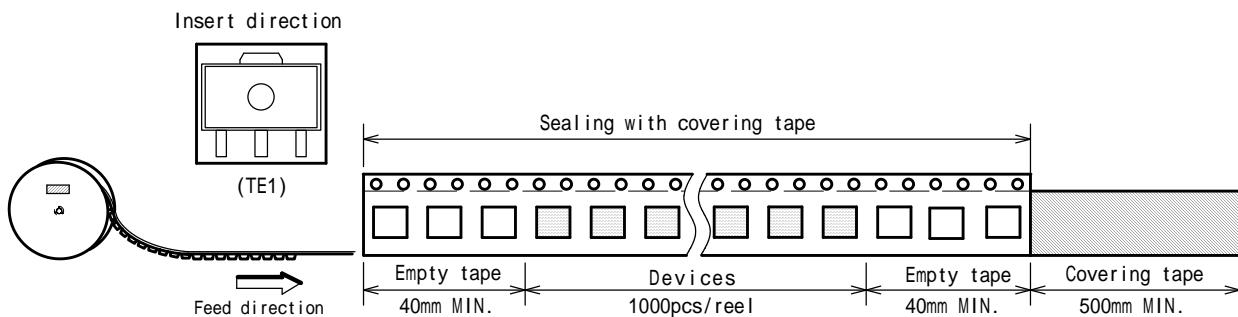
SYMBOL	DIMENSION	REMARKS
A	4.9 ± 0.1	BOTTOM DIMENSION
B	4.5 ± 0.1	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{-0}$	
E	1.5 ± 0.1	
F	5.65 ± 0.1	
P0	4.0 ± 0.1	
P1	8.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.3 ± 0.05	
T2	2.0	
W	12.0 ± 0.3	
W1	9.5	THICKNESS 0.1MAX

REEL DIMENSIONS

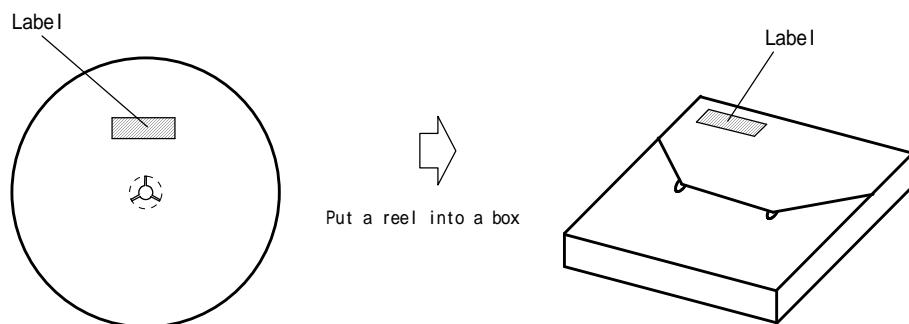


SYMBOL	DIMENSION
A	180 ± 1
B	60 ± 1
C	13 ± 0.2
D	21 ± 0.8
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W1	1.2 ± 0.2

TAPING STATE

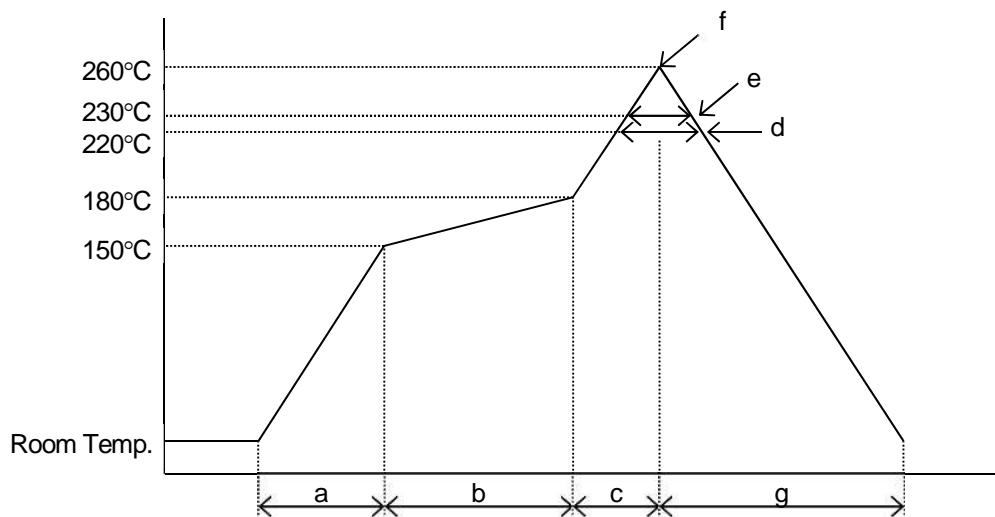


PACKING STATE



■RECOMMENDED MOUNTING METHOD**INFRARED REFLOW SOLDERING METHOD**

* Recommended reflow soldering procedure



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

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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