NJM431S/NJM432S

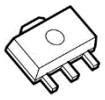
ADJUSTABLE PRECISION SHUNT REGULATOR

FEATURES

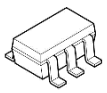
- Operating Voltage VREF to 36V
- Precision Voltage Reference 2.495±1.8%
- Adjustable Output Voltage
- Bipolar Technology
- Package Outline
  NJM431SU / NJM432SU SOT-89-3
  NJM431SF / NJM432SF SOT-23-5

GENERAL DESCRIPTION

The NJM431S/NJM432S are adjustable precision shunt regulators.
The output voltage may be set to any value between VREF (about 2.5V) and 36V by two resistors.
Compared to the conventional 431, the NJM431S/NJM432S are improved the voltage accuracy. And they have smaller package option to support a wide range of applications.
The NJM432S is the pin assignment option.

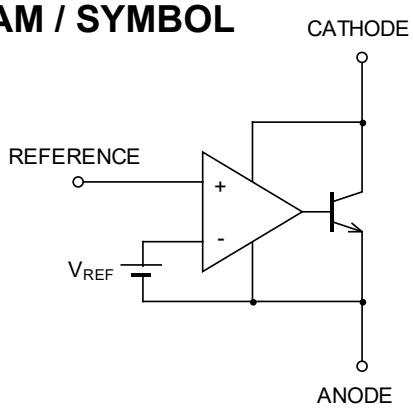


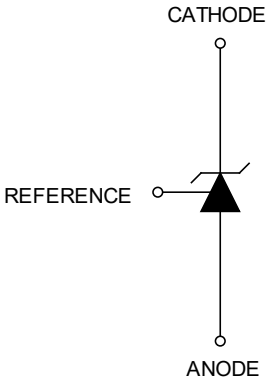
NJM431SU
NJM432SU
(SOT-89-3)



NJM431SF
NJM432SF
(SOT-23-5)

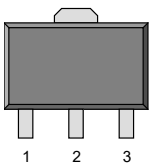
BLOCK DIAGRAM / SYMBOL





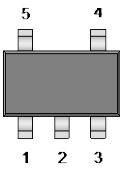
PIN CONFIGURATION

NJM431SU



1.REFERENCE
2.ANODE
3.CATHODE

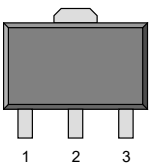
NJM431SF



1.N.C.
2.ANODE*
3.CATHODE
4.REFERENCE
5.ANODE

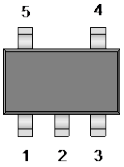
* Pin 2 is attached to Substrate and must be connected to ANODE or left open.

NJM432SU



1.CATHODE
2.ANODE
3.REFERENCE

NJM432SF



1.N.C.
2.ANODE
3.N.C.
4.CATHODE
5.REFERENCE

■ ABSOLUTE MAXIMUM RATINGS (T_a=25ºC)

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Cathode Voltage	V_{KA}	37 (*1)	V
Continuous Cathode Current	I_K	-100 to 150	mA
Reference Input Current	I_{REF}	-0.05 to 10	mA
Power Dissipation	P_D	SOT-89-3 : 625(*2) , 1300(*3)	mW
		SOT-23-5 : 480(*4) , : 650(*5)	
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: EIA/JEDEC standard size, 2Layers, Cu area 100mm^2)
(*3) Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm: 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)
(*4) Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm: EIA/JEDEC standard size, 2Layers)
(*5) Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm: EIA/JEDEC standard size, 4Layers),
internal Cu area: 74.2 × 74.2mm

■ THERMAL CHARACTERISTIC

Item	測定結果	
	SOT-89-3(*)	SOT-23-5(*)
Thermal Resistance(θja)	θja=97 ºC /W	θja=193 ºC /W
Thermal Characterization parameter(Ψjt)	Ψjt=40 ºC /W	Ψjt=58 ºC /W

(*SOT-89-3) Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm: 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)
(*SOT-23-5) Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm: EIA/JEDEC standard size, 4Layers), internal Cu area: 74.2 × 74.2mm

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Cathode Voltage	V_{KA}	V_{REF}	-	36	V
Cathode Current	I_K	0.7	-	100	mA

■ ELECTRICAL CHARACTERISTICS (I_K=10mA, T_a=25ºC)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Reference Voltage	V_{REF}	$V_{KA}=V_{REF}$ (*6)	2450	2495	2540	mV
Reference Input Voltage Change Over Temperature Range	ΔV_{REF} (dev)	$V_{KA}=V_{REF}$ (*6) T_a=-40˚C to +85˚C	-	8	17	mV
Reference Voltage Change vs. Cathode Voltage Change	$\Delta V_{REF}/\Delta V_{KA}$	(*7) ΔV_{KA}=10V-V_{REF} ΔV_{KA}=36V-10V	-	-1.4 -1	-2.7 -2	mV/V
Reference Input Current	I_{REF}	R1=10kΩ, R2=∞(*7)	-	2	4	μA
Reference Input Current Change Over Temperature Range	ΔI_{REF} (dev)	R1=10kΩ, R2=∞(*7) T_a=-40˚C to +85˚C	-	0.4	1.2	μA
Minimum Cathode Current	I_{MIN}	$V_{KA}=V_{REF}$(*6)	-	0.4	0.7	mA
OFF State Cathode Current	I_{OFF}	V_{KA}=36V, V_{REF}=0V(*8)	-	0.1	1.0	μA
Dynamic Impedance	$\lvert Z_{KA}\rvert$	$V_{KA}=V_{REF}$, I_K=1mA to 100mA, f≤1kHz(*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) Test Circuit Fig.1, (*7) Test Circuit Fig.2, (*8) Test Circuit Fig.3

■ TEST CIRCUIT

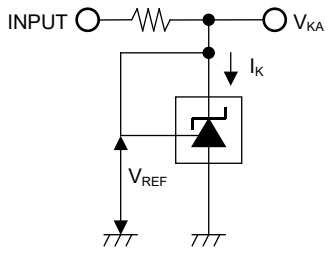


Fig.1 Test Circuit for $V_{KA}=V_{REF}$

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

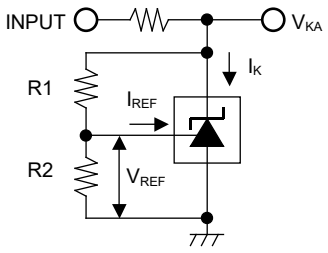


Fig. 2 Test Circuit for $V_{KA}>V_{REF}$

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

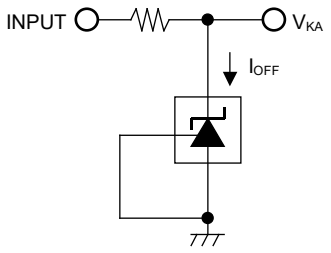
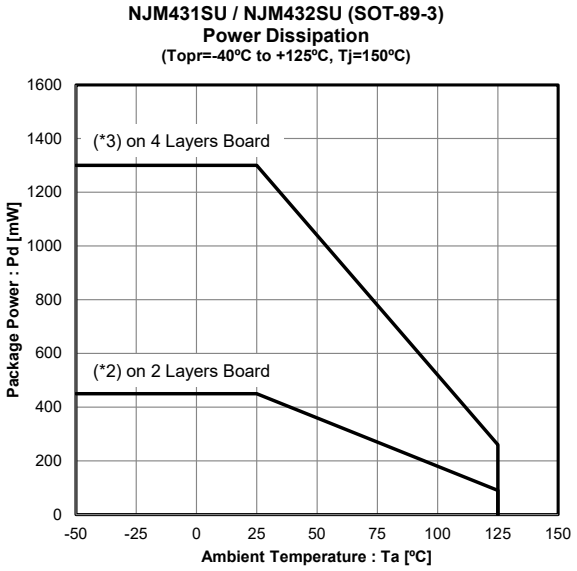
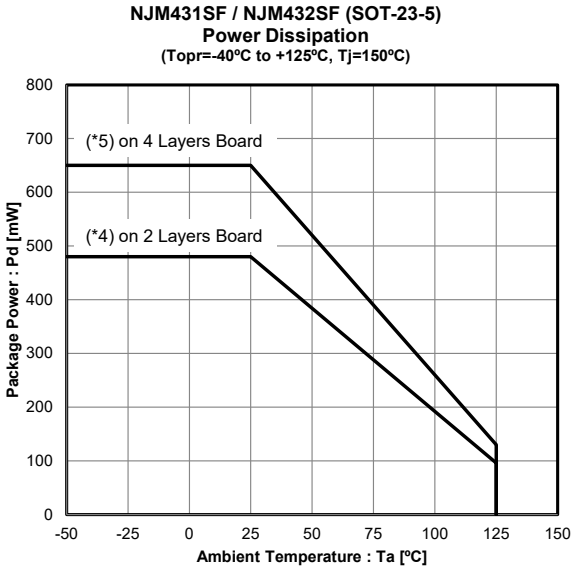


Fig.3 Test Circuit for I_{OFF}

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE





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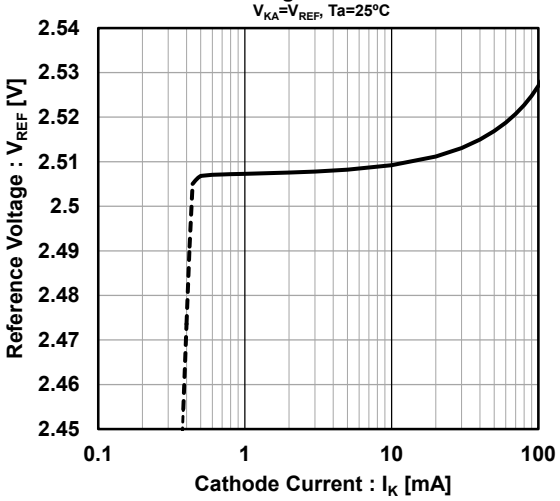
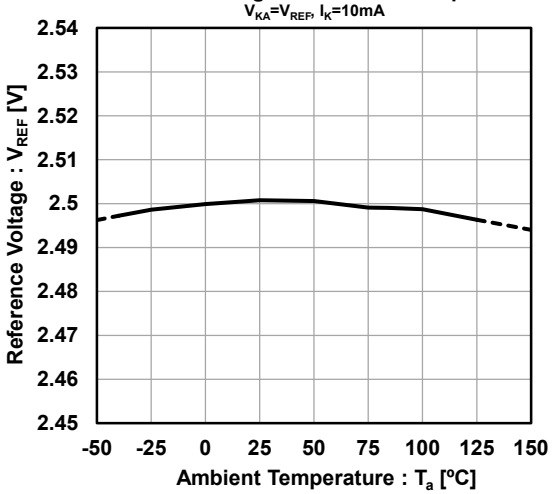
(*5) Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm: EIA/JEDEC standard size, 4Layers),
internal Cu area: 74.2 × 74.2mm

■ TYPICAL CHARACTERISTICS

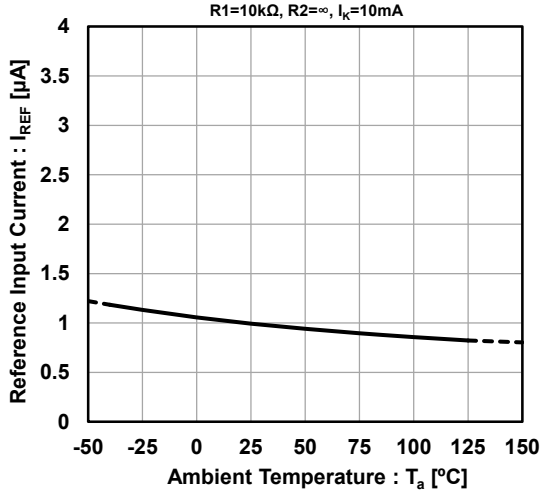
Reference Voltage vs. Cathode Current
$V_{KA}=V_{REF}$, Ta=25ºC



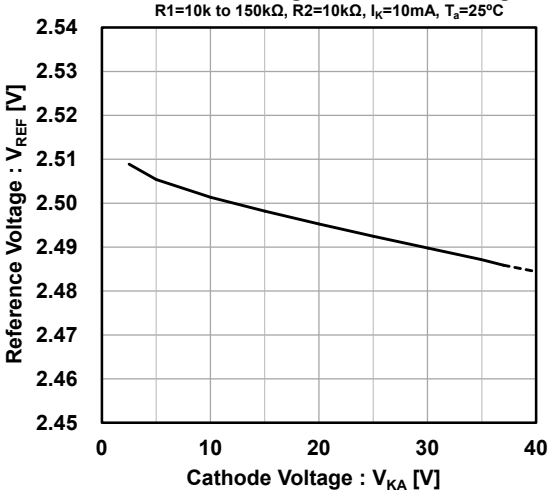
Reference Voltage vs. Ambient Temperature
$V_{KA}=V_{REF}$, I_K=10mA



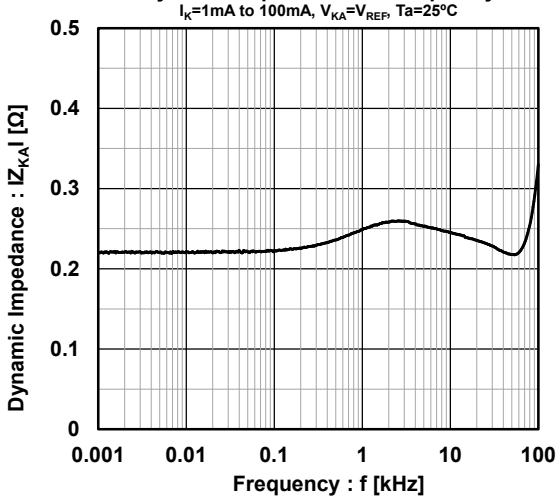
Reference Input Current vs. Ambient Temperature
R1=10kΩ, R2=∞, I_K=10mA



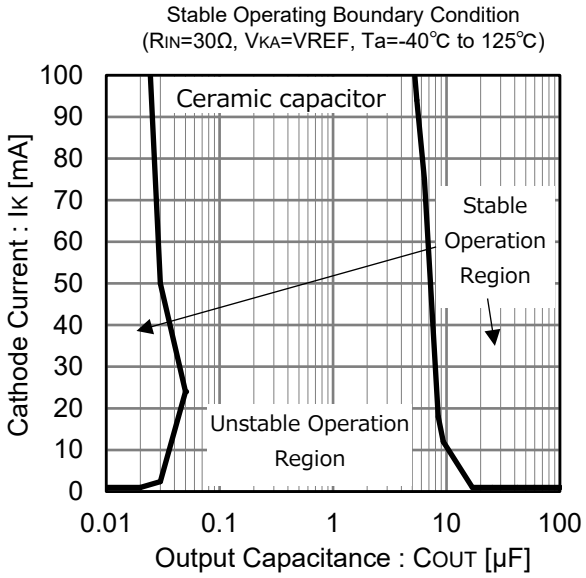
Reference Voltage vs. Cathode Voltage
R1=10k to 150kΩ, R2=10kΩ, I_K=10mA, T_a=25ºC

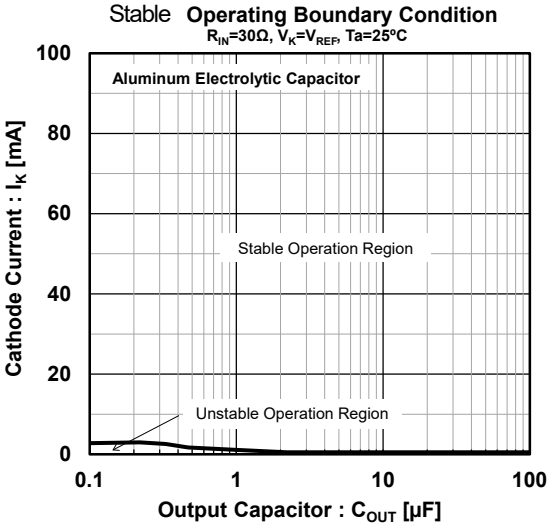


Dynamic Impedance vs. Frequency
I_K=1mA to 100mA, $V_{KA}=V_{REF}$, Ta=25ºC

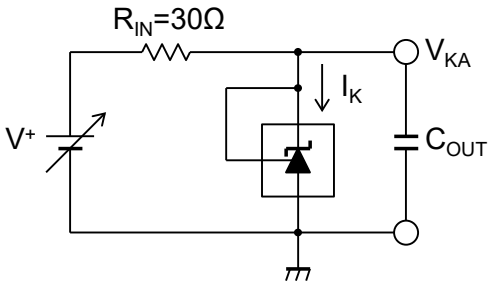


■ TYPICAL CHARACTERISTICS





Stable Operating Boundary Condition Test Circuit



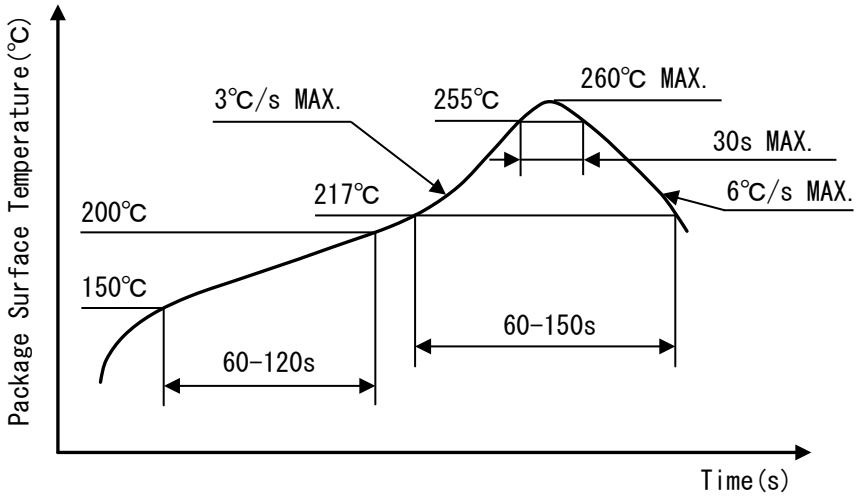
Note) Stable Operating Boundary Condition graph describes the stable operation region and unstable operation region. In the unstable operation region, the output V_{KA} may oscillate. Considering the distribution of the capacitor such as temperature or bias characteristics, choose an appropriate capacitor and mount the capacitor as close as possible to the IC.

■ **REVISION HISTORY**

Date	Revision	Changes
February 28,2023	Ver. 1.0	・P5: TYPICAL CHARACTERISTICS "Stable Operating Boundary Condition" ・P5: Note) ・P2: THERMAL CHARACTERISTIC ・Company name and design form ・Revision number (Ver.2021-05-06 → Ver.1.0) ・Added revision history

Reflow Profile

■ HEAT-RESISTANCE PROFILES



Reflow profile

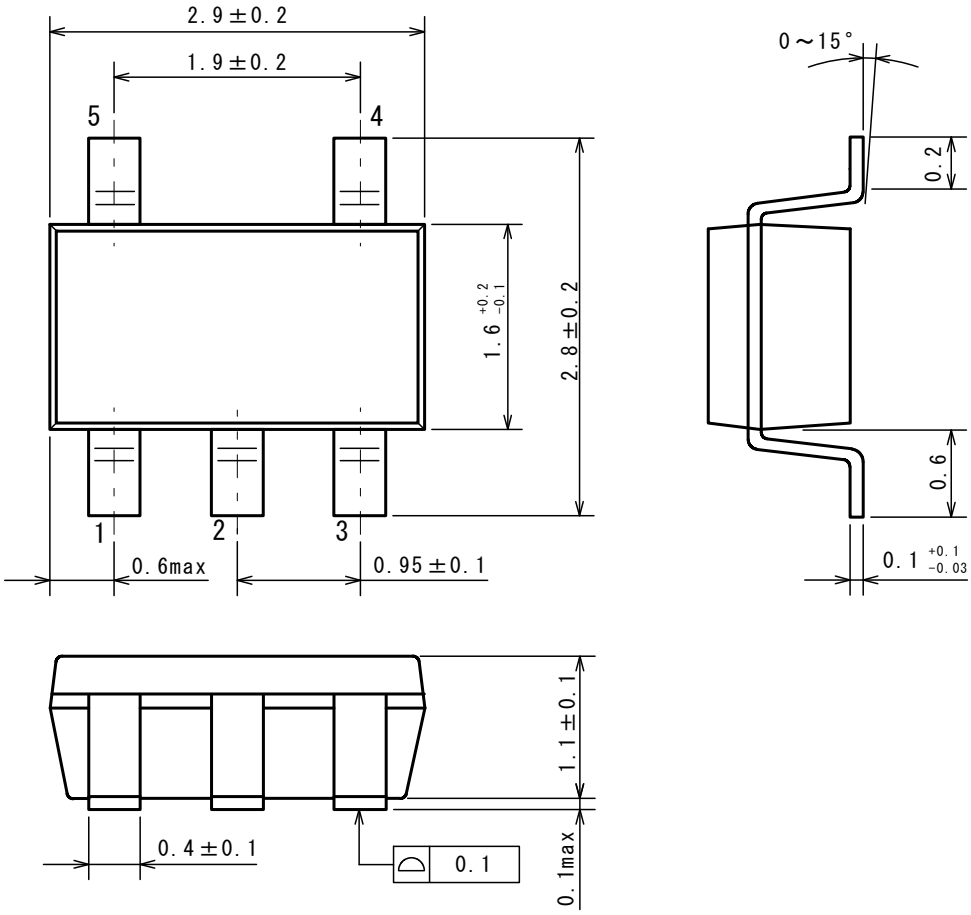
Nisshinbo Micro Devices Inc.

SOT-23-5

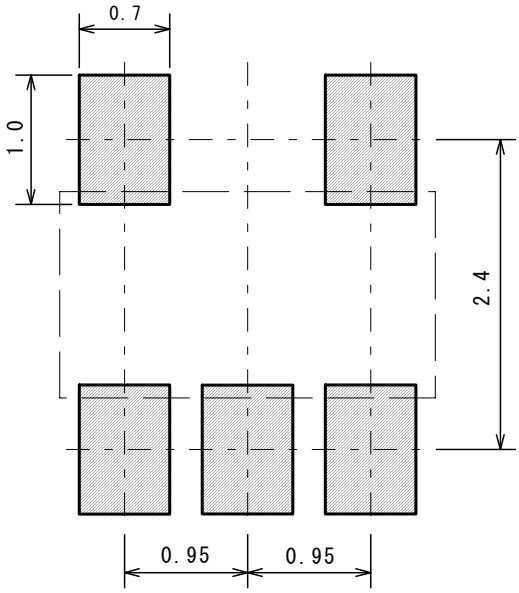
PI-SOT-23-5-E-A

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



Nisshinbo Micro Devices Inc.

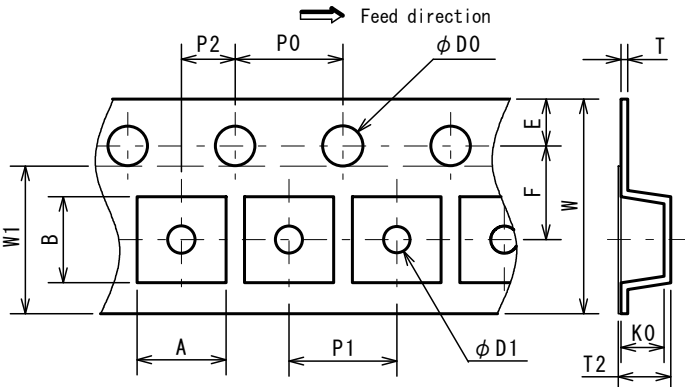
SOT-23-5

PI-SOT-23-5-E-A

■ PACKING SPEC

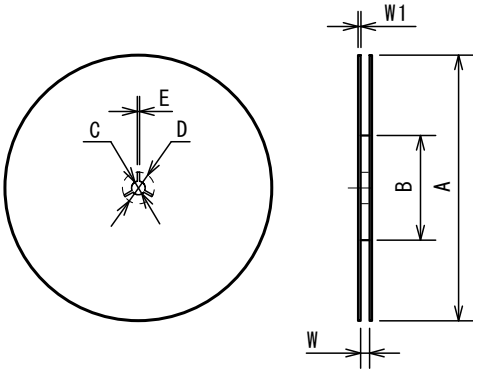
UNIT: mm

TAPING DIMENSIONS



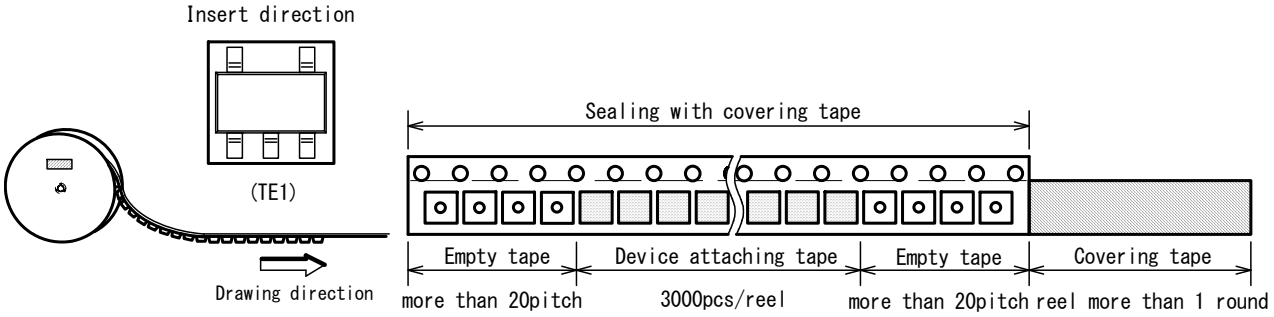
SYMBOL	DIMENSION	REMARKS
A	3.3±0.1	BOTTOM DIMENSION
B	3.2±0.1	BOTTOM DIMENSION
D0	1.55	
D1	1.05	
E	1.75±0.1	
F	3.5±0.05	
P0	4.0±0.1	
P1	4.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
T2	1.82	
K0	1.5±0.1	
W	8.0±0.3	
W1	5.5	THICKNESS 0.1MAX

REEL DIMENSIONS

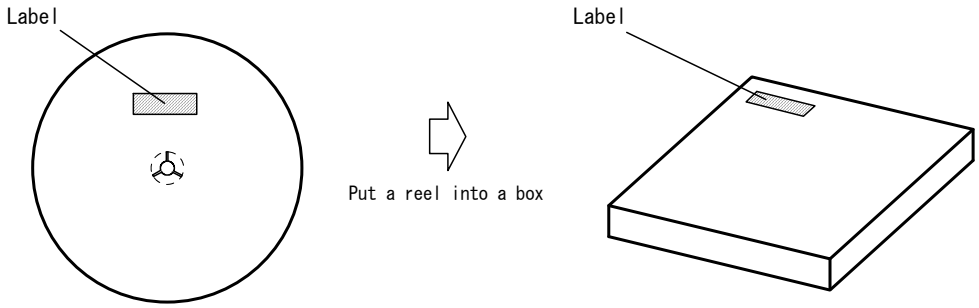


SYMBOL	DIMENSION
A	φ180±1
B	φ 60±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	9±0.5
W1	1.2±0.2

TAPING STATE



PACKING STATE



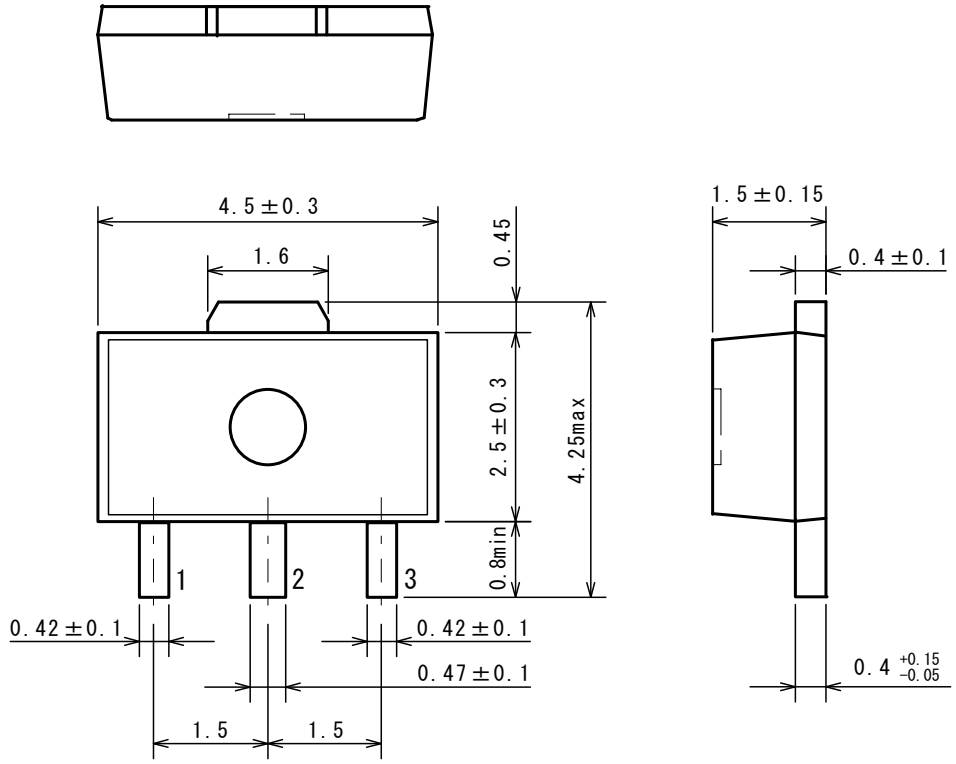
Nisshinbo Micro Devices Inc.

SOT-89-3

PI-SOT-89-3-E-A

■ PACKAGE DIMENSIONS

UNIT: mm



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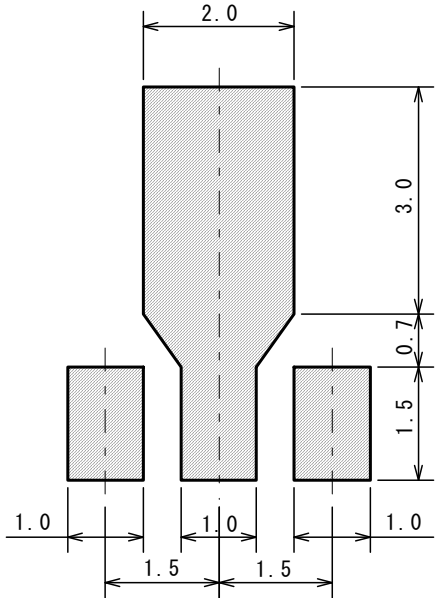


Nisshinbo Micro Devices Inc.

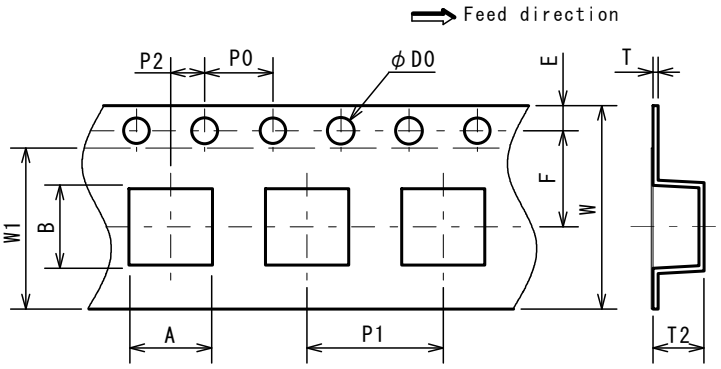
SOT-89-3

PI-SOT-89-3-E-A

■ PACKING SPEC

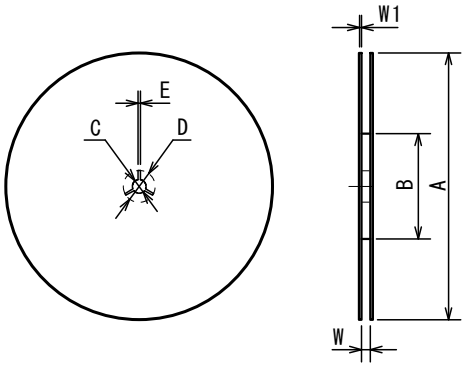
UNIT: mm

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



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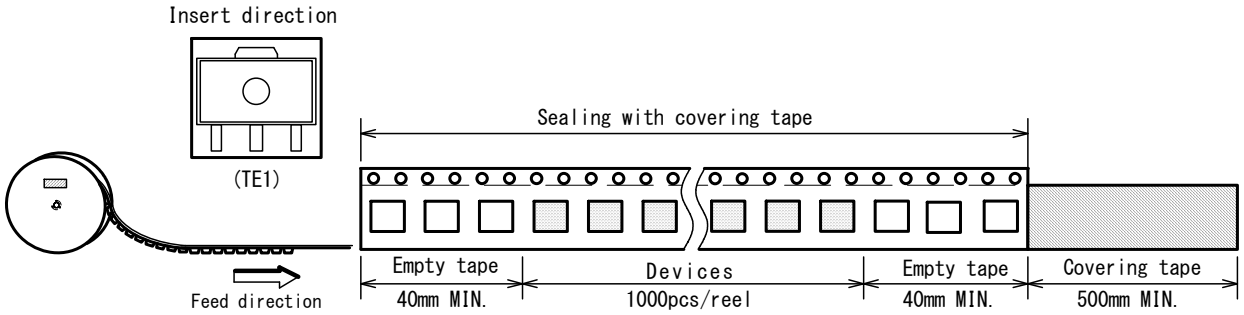
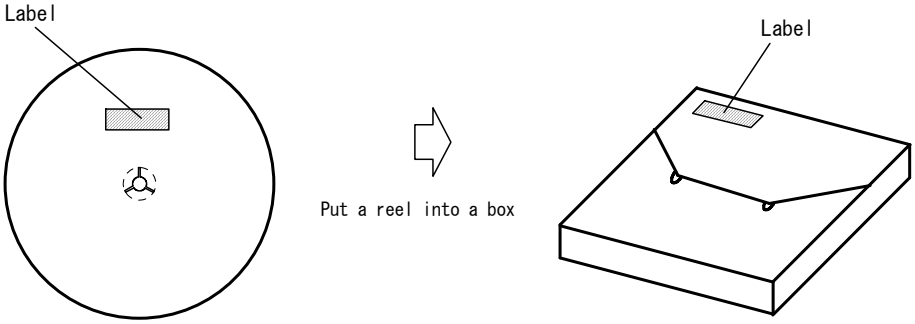
TAPING STATE



PACKING STATE



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    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

    In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. Quality Warranty
    8-1. Quality Warranty Period
    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
    8-2. Quality Warranty Remedies
    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
    8-3. Remedies after Quality Warranty Period
    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.

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Nisshinbo Micro Devices Inc.

Official website
https://www.nisshinbo-microdevices.co.jp/en/

Purchase information
https://www.nisshinbo-microdevices.co.jp/en/buy/