

Description

The TN9402 is a high accuracy, low dropout voltage, low current consumption, high PSRR three-terminal step-down regulator, Input voltage supports up to 10V, which provide large output currents even when the difference of the input-output voltage is small and has good adjustment rate, Integrated high-precision reference voltage source and output power tube over-current protection circuit and over-temperature protection.

The Enable pin EN to control the chip into standby mode, in which static current consumption is greatly reduced.

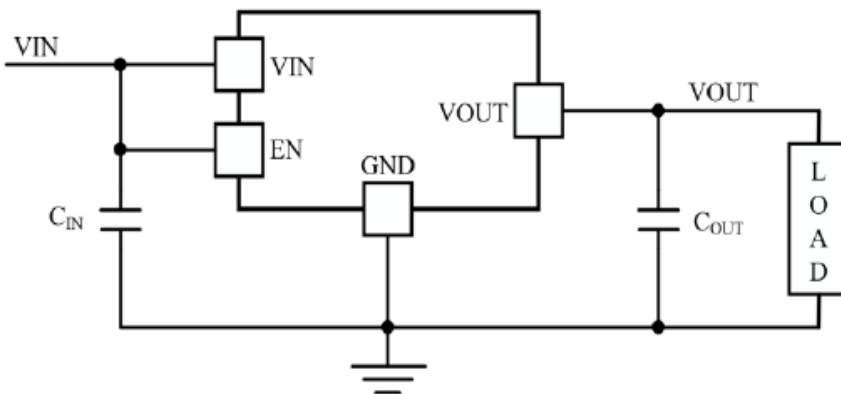
Features

- Wide Input Voltage Range: 2.3V~10V
- Maximum Output Current: 400mA
- Standard Fixed Output Voltage Options: 1.2V~5.0V(customized by every 0.1V step)
- Low Quiescent Current: 2.1 μ A(Typ.)@ VIN=6V
- PSRR=76dB@1kHz
- Low Dropout: 75mV @ IOU=50mA,VOUT=3.3V
- Low Output Voltage Accuracy: $\pm 2\%$
- EN Pin Standby Function
- Built-in Over-current , Over-temperature Protection
- Available Packages: SOT-23, SOT-89, SOT-89-5, SOT-23-3, SOT-23-5 and DFN1x1-4L

Applications

- One or Two Lithium Batteries Portable Equipments
- Two or Six Dry Batteries Power Supply Systems
- Bluetooth, RF Systems
- Consumer Electronics

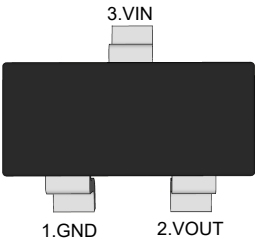
Typical Application Circuit



Note: C_{IN} recommends at least 1 μ F; In order to ensure the stability of the output voltage, C_{OUT} should choose ceramic electricity capacity at least 1 μ F, or electrolytic capacitance at least 2.2 μ F.

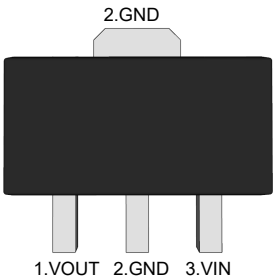
Pin Distribution

SOT-23



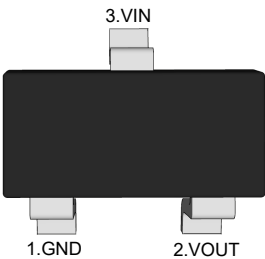
(Top View)

SOT-89



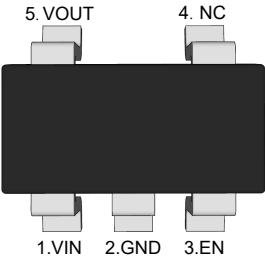
(Top View)

SOT-23-3



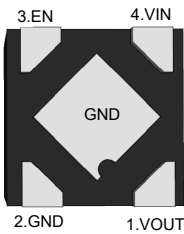
(Top View)

SOT-23-5



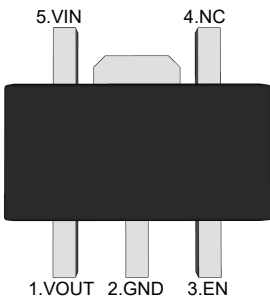
(Top View)

DFN1x1-4L



(Bottom View)

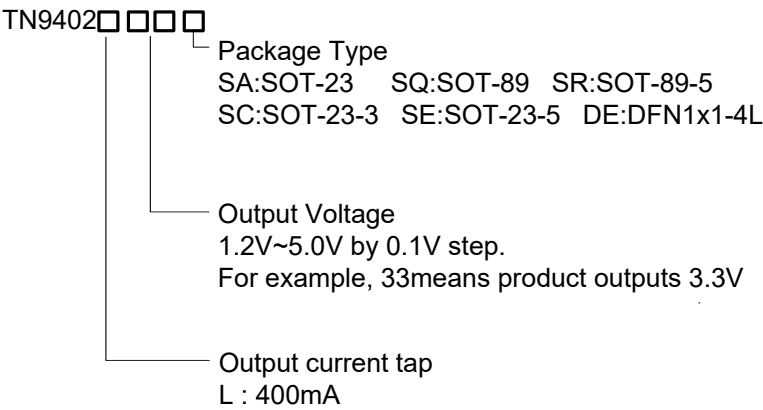
SOT-89-5



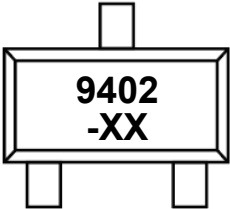
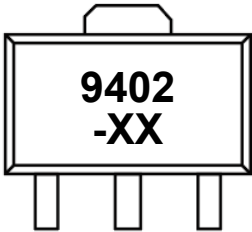
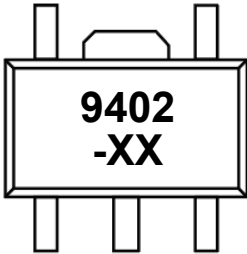
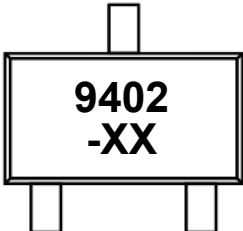
Functional Pin Description

Pin Name	Pin Function
VIN	Power Input Voltage
GND	Ground
EN	Chip Enable (Active High). Note that this pin is high impedance
NC	NO Connected
VOUT	Output Voltage

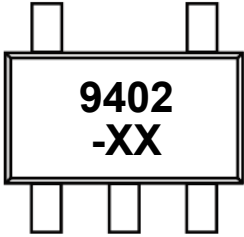
Ordering Information



Ordering Information Continue

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan ^{Note1}	MSL Level	Marking Code
TN9402LXXSA ^{Note2}	SO-T-23	7	3000	RoHS & Green	MSL1	 9402 -XX XX:Output Voltage e.g. 3.0:3.0V
TN9402LXXSQ ^{Note2}	SOT-89	7/13	1000/3000	RoHS & Green	MSL1	 9402 -XX XX:Output Voltage e.g. 3.0:3.0V
TN9402LXXSR ^{Note2}	SOT-89-5	7/13	1000/3000	RoHS & Green	MSL1	 9402 -XX XX:Output Voltage e.g. 3.0:3.0V
TN9402LXXSC ^{Note2}	SOT-23-3	7	3000	RoHS & Green	MSL3	 9402 -XX XX:Output Voltage e.g. 3.0:3.0V

Ordering Information Continue

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan ^{Note1}	MSL Level	Marking Code
TN9402LXXSE ^{Note2}	SOT-23-5	7	3000	RoHS & Green	MSL3	 9402 -XX XX:Output Voltage e.g. 3.0:3.0V
TN9402LXXDE ^{Note2}	DFN1x1-4L	7	10000	RoHS & Green	MSL1	 GXX XX:Output Voltage e.g. 3.0:3.0V

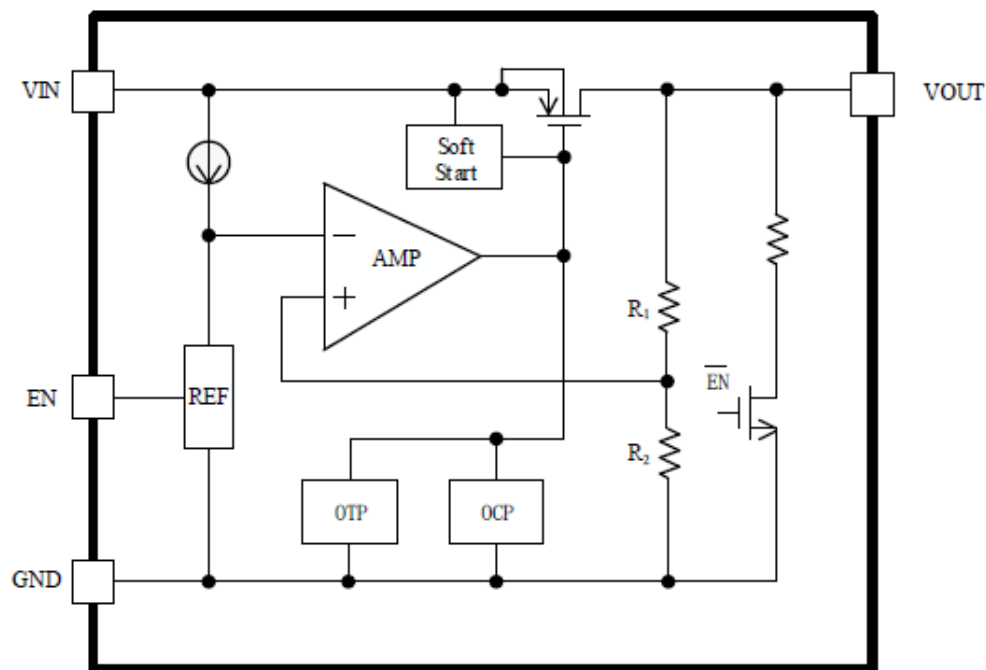
Note:

1. RoHS: TN defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials.

Green: TN defines "Green" to mean Halogen-Free and Antimony-Free.

2. XX indicates 1.2V~5.0V. For example, 33 means product outputs 3.3V.

Function Block Diagram



Absolute Maximum Ratings ^{Note3}

Ratings at 25°C ambient temperature unless otherwise specified.

Parameter		Value	Unit
Input Voltage Range		-0.3 ~ +12	V
Output Voltage Range		-0.3 ~ V _{IN} +0.3	V
Output Current		450	mA
Power Dissipation	SOT-23	320	mW
	SOT-23-3	500	mW
	SOT-89	920	mW
	SOT-89-5	920	mW
	SOT-23-5	500	mW
	DFN1x1-4L	500	mW
Thermal Resistance,Junction-to-Ambient	SOT-23	380	°C/W
	SOT-23-3	250	°C/W
	SOT-89	135	°C/W
	SOT-89-5	135	°C/W
	SOT-23-5	250	°C/W
	DFN1x1-4L	250	°C/W
Operating Ambient Temperature		-40 ~ +85	°C
Junction temperature		150	°C
Storage temperature range		-55 ~ +125	°C

Note3: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect.

Recommended Operating Conditions

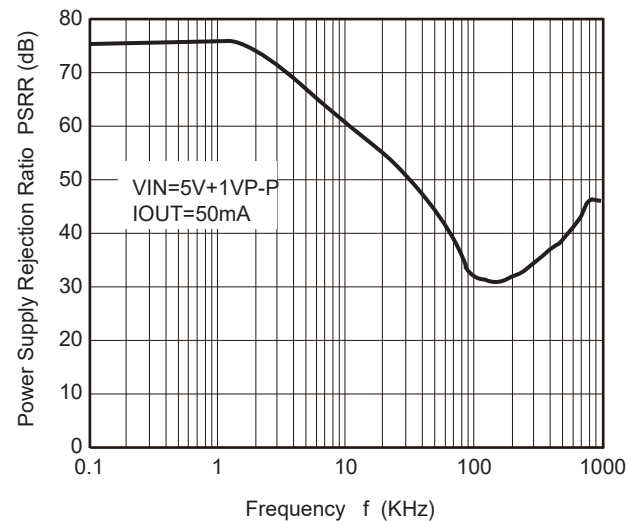
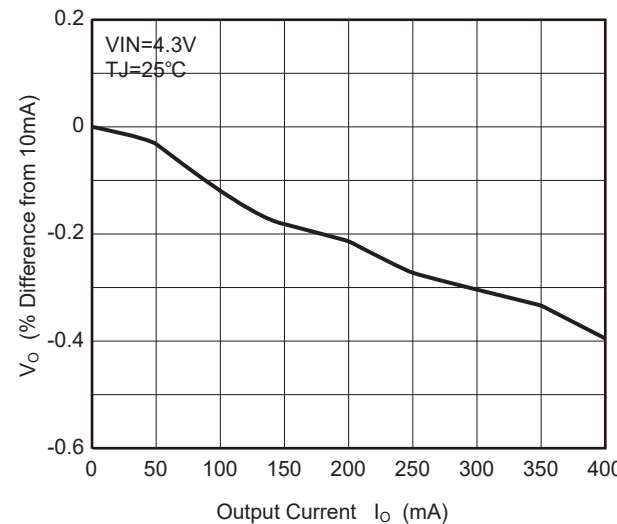
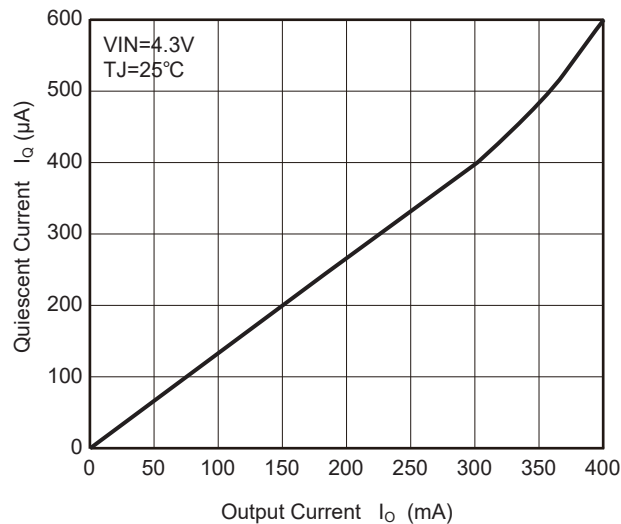
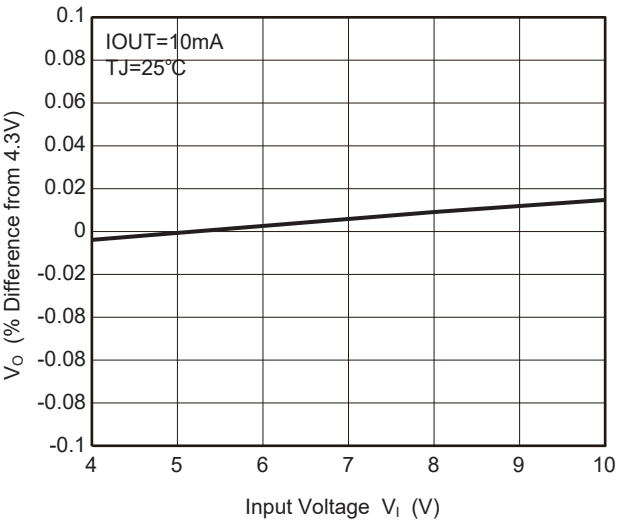
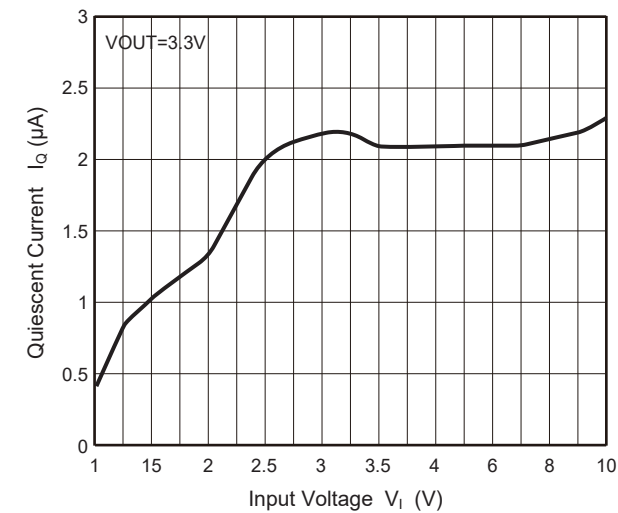
Parameter	Value	Unit
Supply Voltage	2.3~10	V
Maximum Output Current	400	mA
Operating Ambient Temperature	-40 ~ +85	°C

Electrical Characteristics(V_{IN}=V_{OUT}+1V, C_{IN}=1μF, C_{OUT}=1μF, T_A=25°C, unless otherwise noted.)

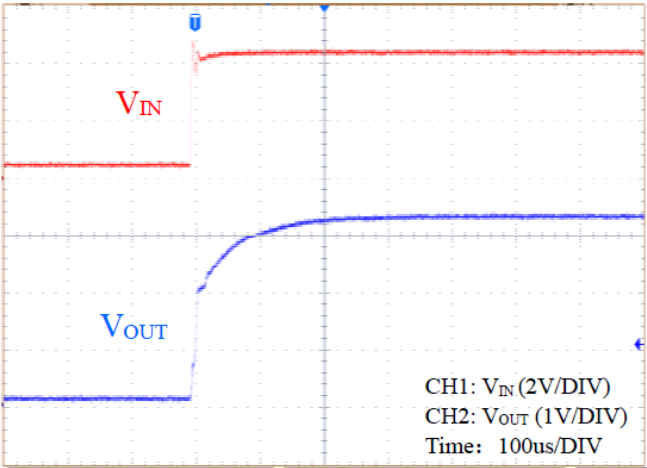
Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Voltage		V _{IN}		2.3	--	10	V
Output Voltage Accuracy		ΔV _{OUT}	I _{OUT} =1mA	-2	--	+2	%
Quiescent Current		I _Q	V _{IN} =6V, I _{OUT} =0mA	--	2.1	3	μA
			V _{IN} =10V, I _{OUT} =0mA	--	2.5	6	
Shutdown Current		I _{Shut}	V _{EN} =0V	--	--	0.1	μA
Dropout Voltage		V _{DROP}	V _{OUT} ≤2V	I _{OUT} =50mA	--	160	mV
			2<V _{OUT} ≤3V		--	120	
			3<V _{OUT} ≤5V		--	75	
Line Regulation		ΔV _{LINE}	V _{OUT} +1V≤V _{IN} ≤6V I _{OUT} =10mA	--	0.01	--	%/V
Load Regulation		ΔV _{LOAD}	1mA≤I _{OUT} ≤200mA	--	0.02	--	%/mA
Output Current		I _{OUT}		--	400	--	mA
EN Input Threshold	Logic Low	V _{IL}	V _{IN} =5V	--	--	0.4	V
	Logic High	V _{IH}	V _{IN} =5V	1.2	--	--	V
Output Noise Voltage		V _N	BW=10Hz~100KHz	--	50	--	μVrms
Power Supply Rejection Ratio		PSRR	V _{IN} =5V+1V _{P-P} (AC), I _{OUT} =50mA f=1KHz, V _{OUT} =3.3V	--	76	--	dB
Output Discharge Resistance		R _D	V _{EN} =0V, V _{OUT} =0.5V	--	500	--	Ω
Thermal Shutdown Temperature		T _{OTP}	Shutdown, Temp increasing	--	160	--	°C
Thermal Shutdown Temperature Hysteresis		T _{HYS}	Reset, Temp decreasing	--	25	--	°C

Typical Electrical Curves

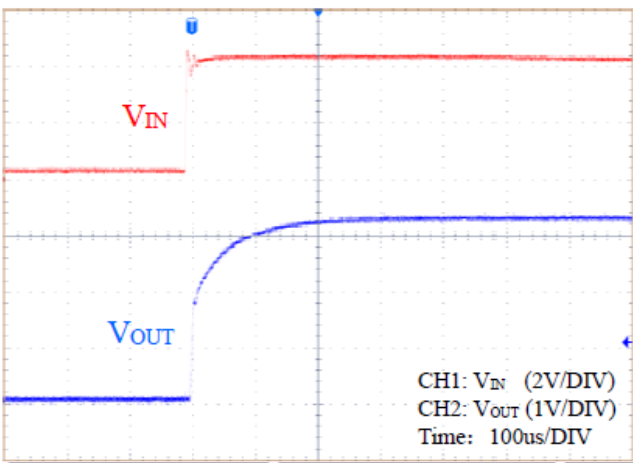
($C_{IN}=1\mu F$, $C_{OUT}=1\mu F$, $T_A=25^{\circ}C$, unless otherwise noted.)



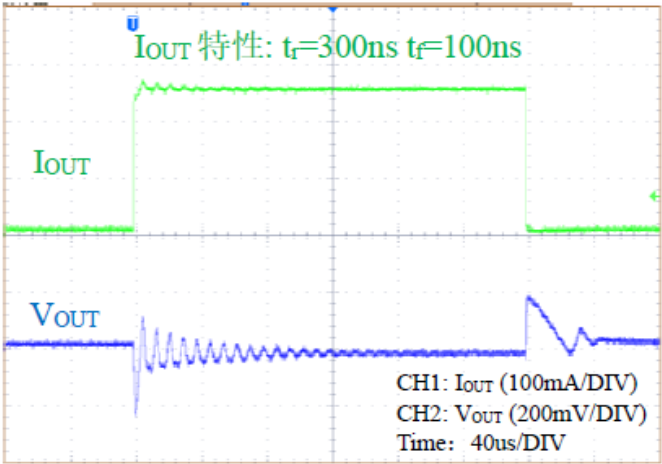
Power ON: $I_{OUT}=0mA$, $0V\sim4.3V(V_{IN})$



Power ON: $I_{OUT}=150mA$, $0V\sim4.3V(V_{IN})$



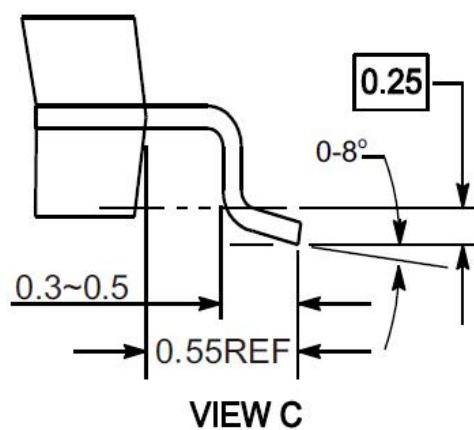
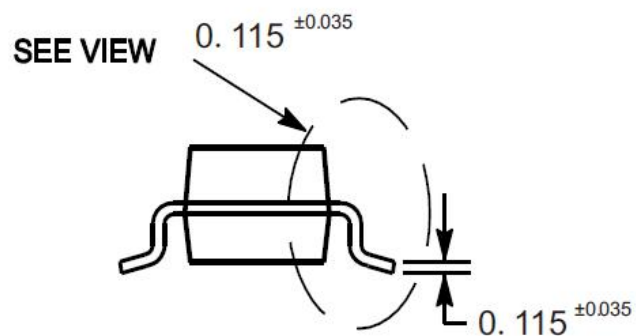
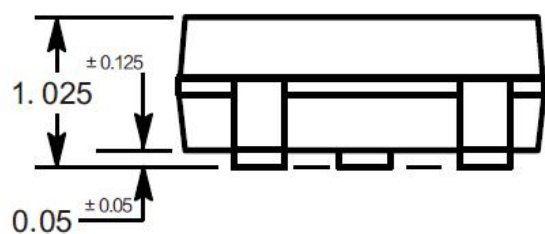
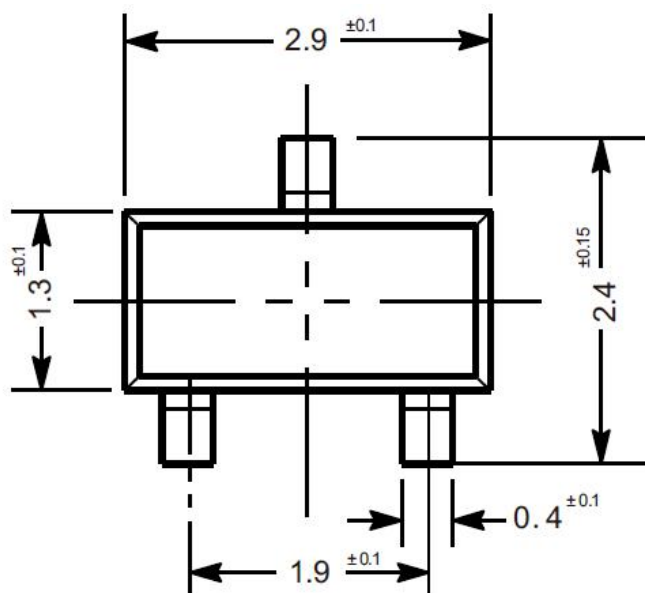
Load transient: $V_{IN}=4.3V$, $10mA\sim250mA(I_{OUT})$



Package Outline

SOT-23

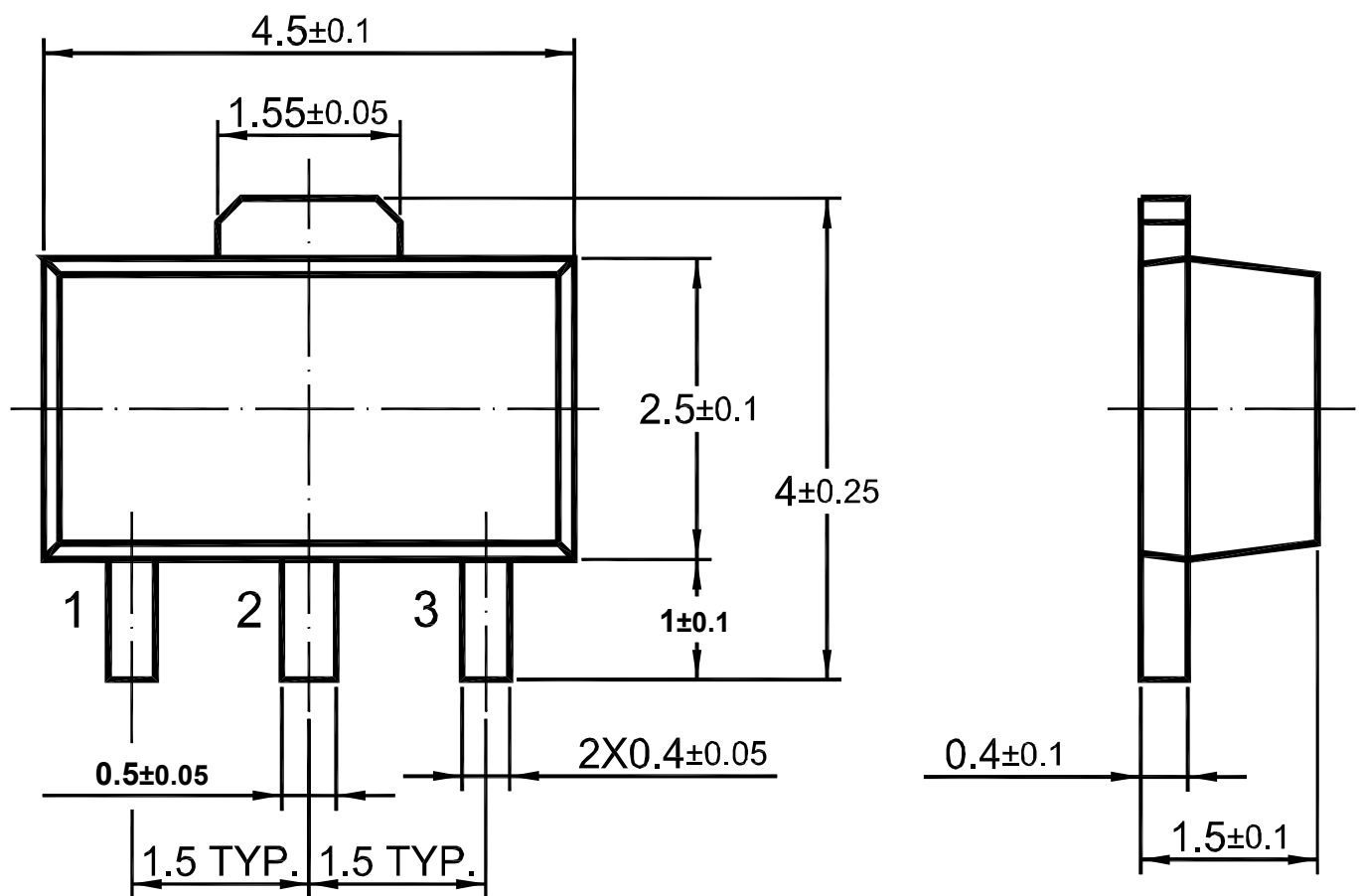
Dimensions in mm



Package Outline

SOT-89

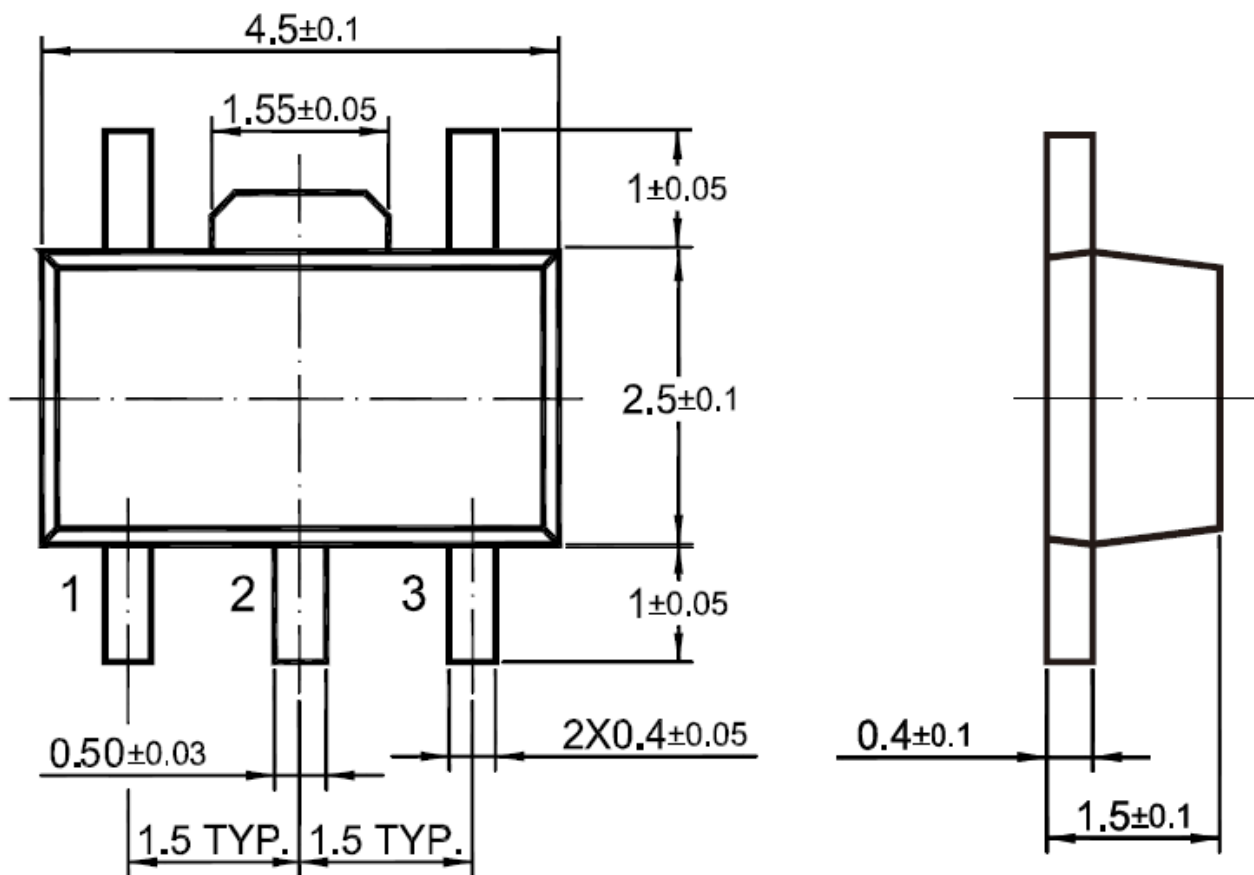
Dimensions in mm



Package Outline

SOT-89-5

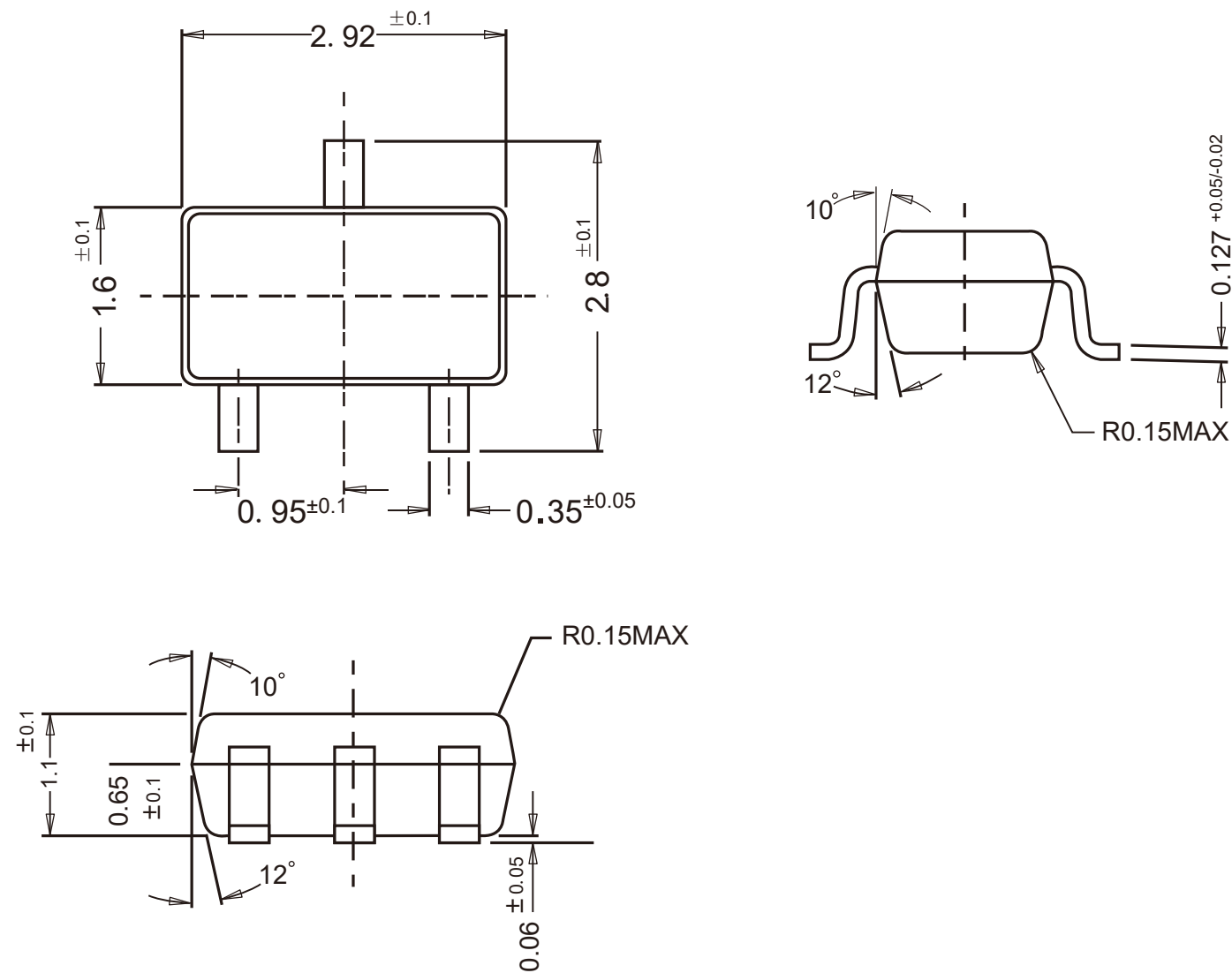
Dimensions in mm



Package Outline

SOT-23-3

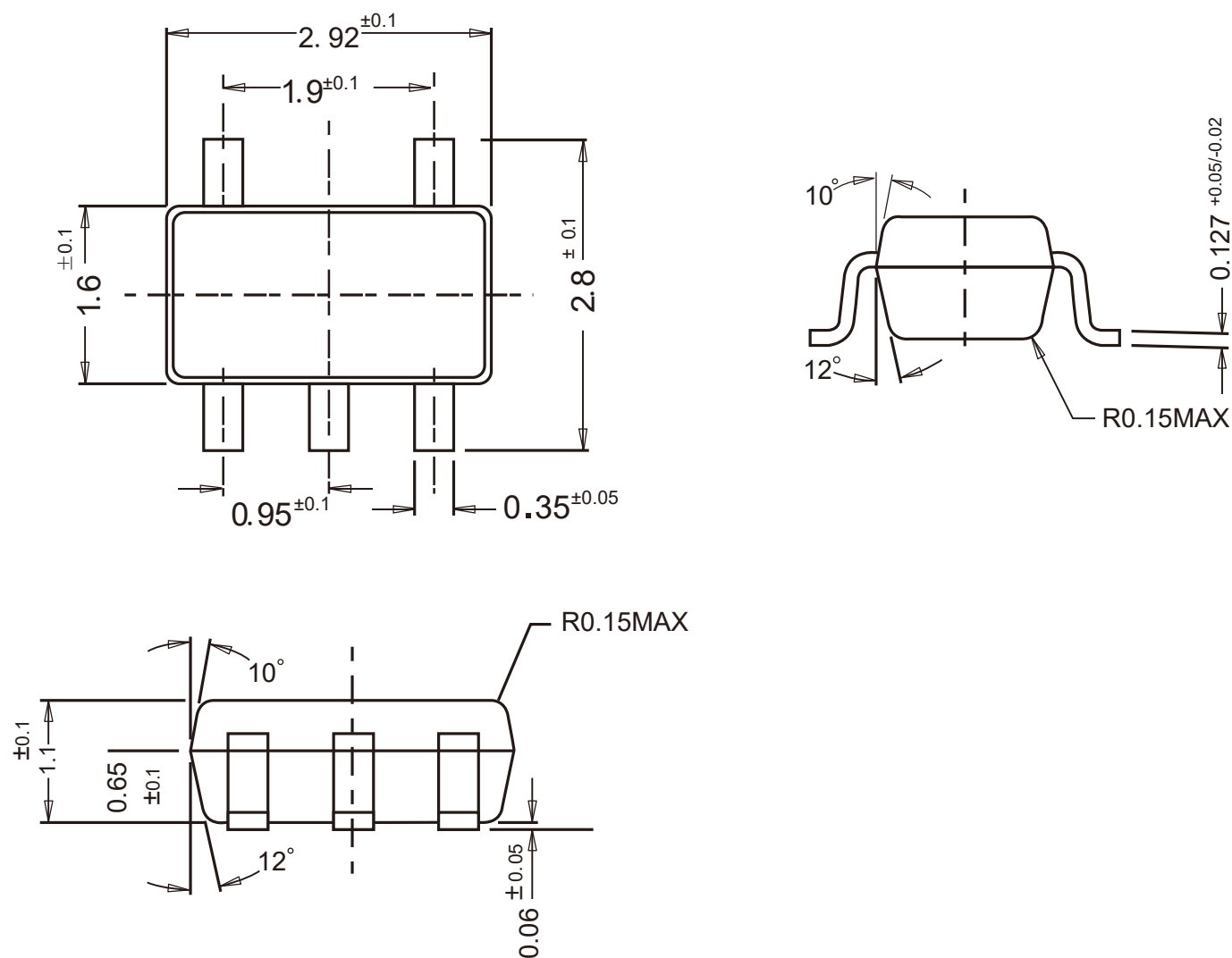
Dimensions in mm



Package Outline

SOT-23-5

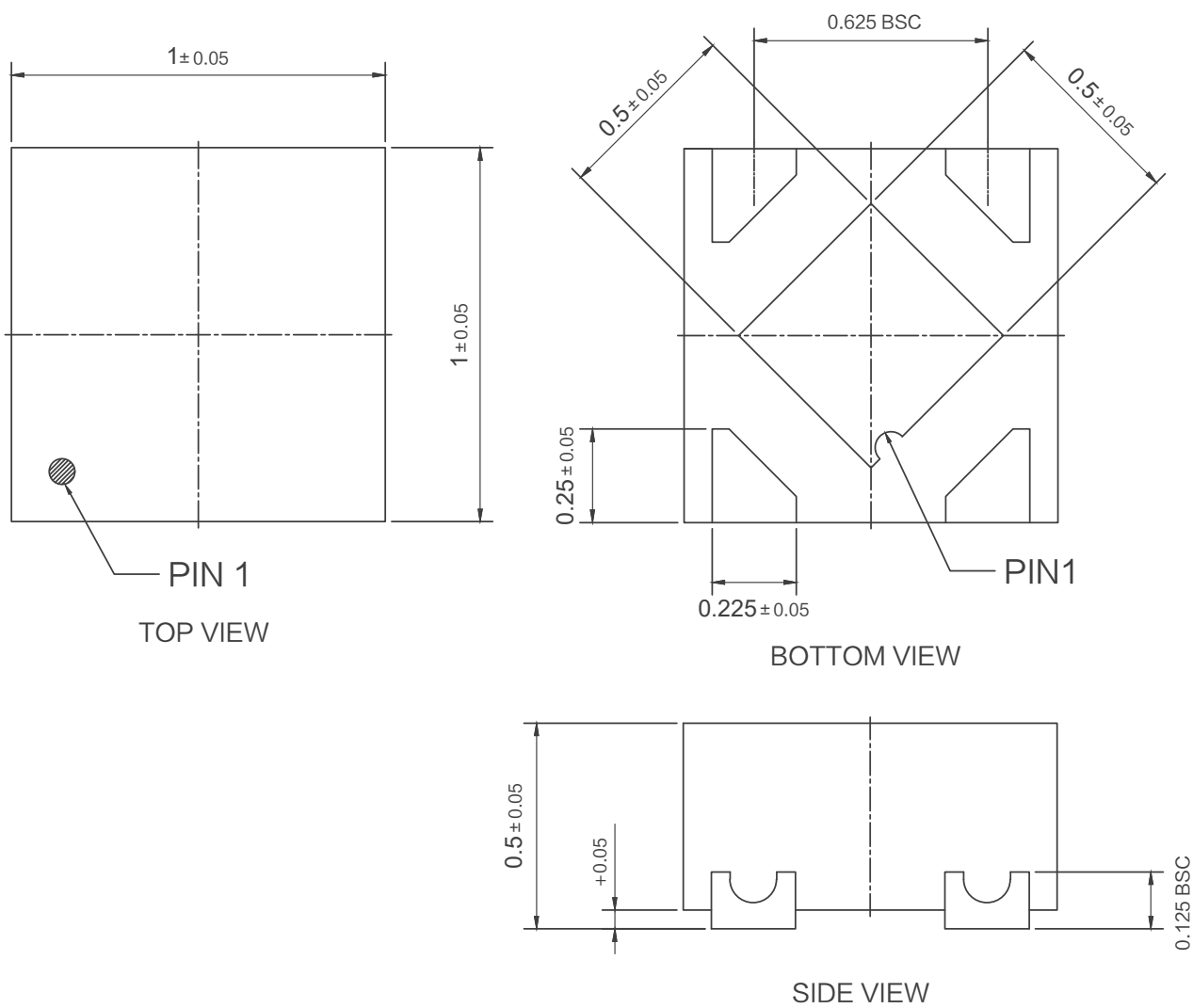
Dimensions in mm



Package Outline

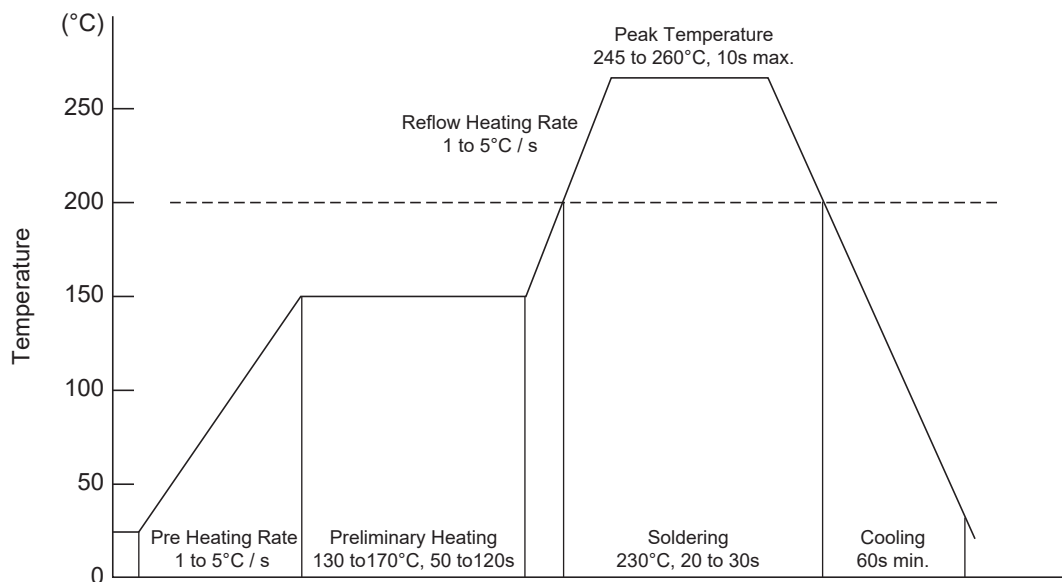
DFN1x1-4L

Dimensions in mm



Conditions of Soldering and Storage

◆ Recommended condition of reflow soldering



Recommended peak temperature is over 245°C. If peak temperature is below 245°C, you may adjust the following parameters:

- Time length of peak temperature (longer)
- Time length of soldering (longer)
- Thickness of solder paste (thicker)

◆ Conditions of hand soldering

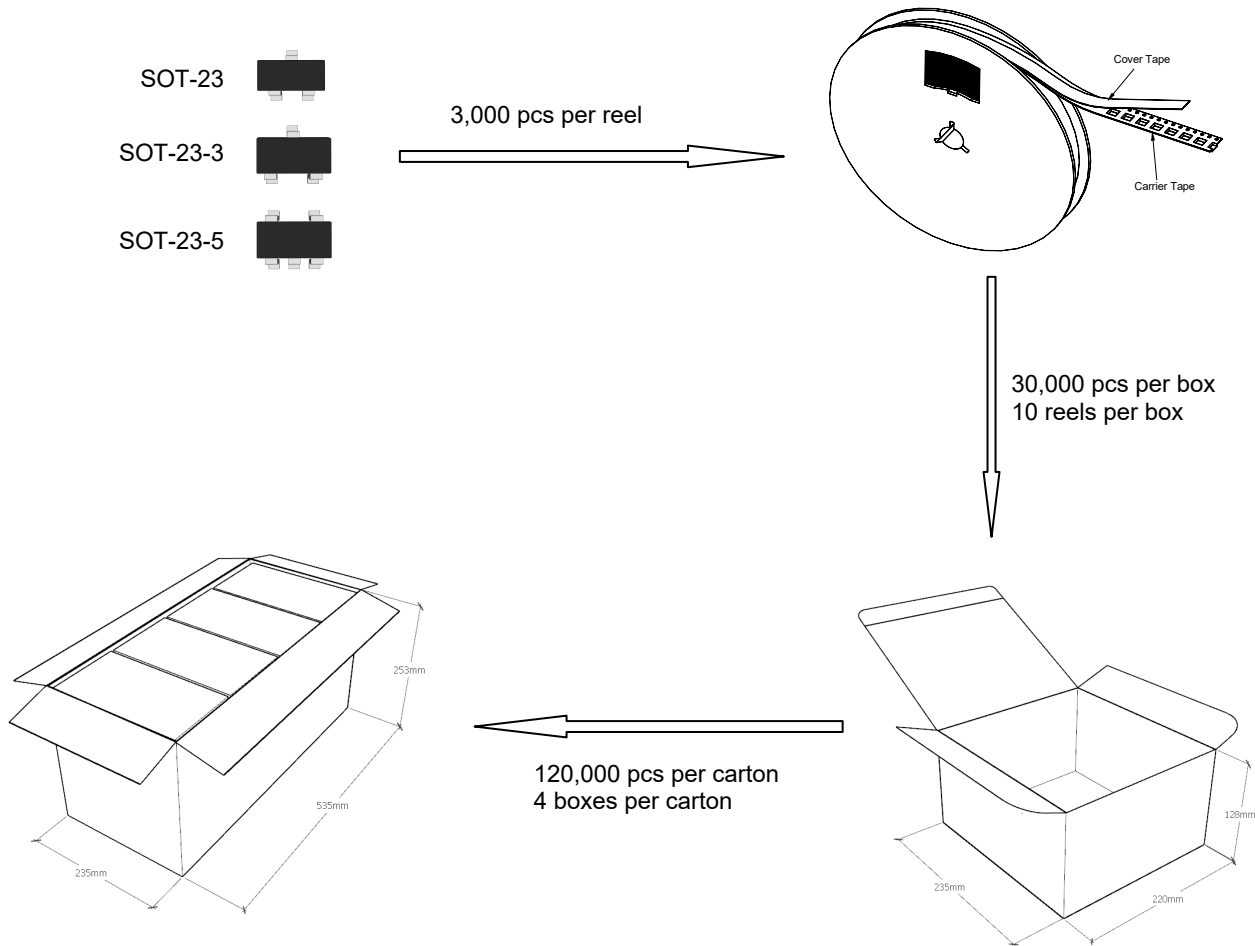
- Temperature: 300°C
- Time: 3s max.
- Times: one time

◆ Storage conditions

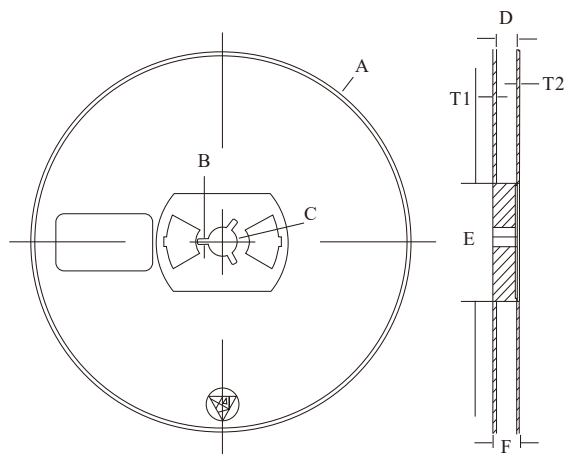
- **Temperature**
5 to 40°C
- **Humidity**
30 to 80% RH
- **Recommended period**
One year after manufacturing

Package Specifications (SOT-23/SOT-23-3/SOT-23-5/DFN2x2C-6L)

- The method of packaging



◆ Embossed reel data

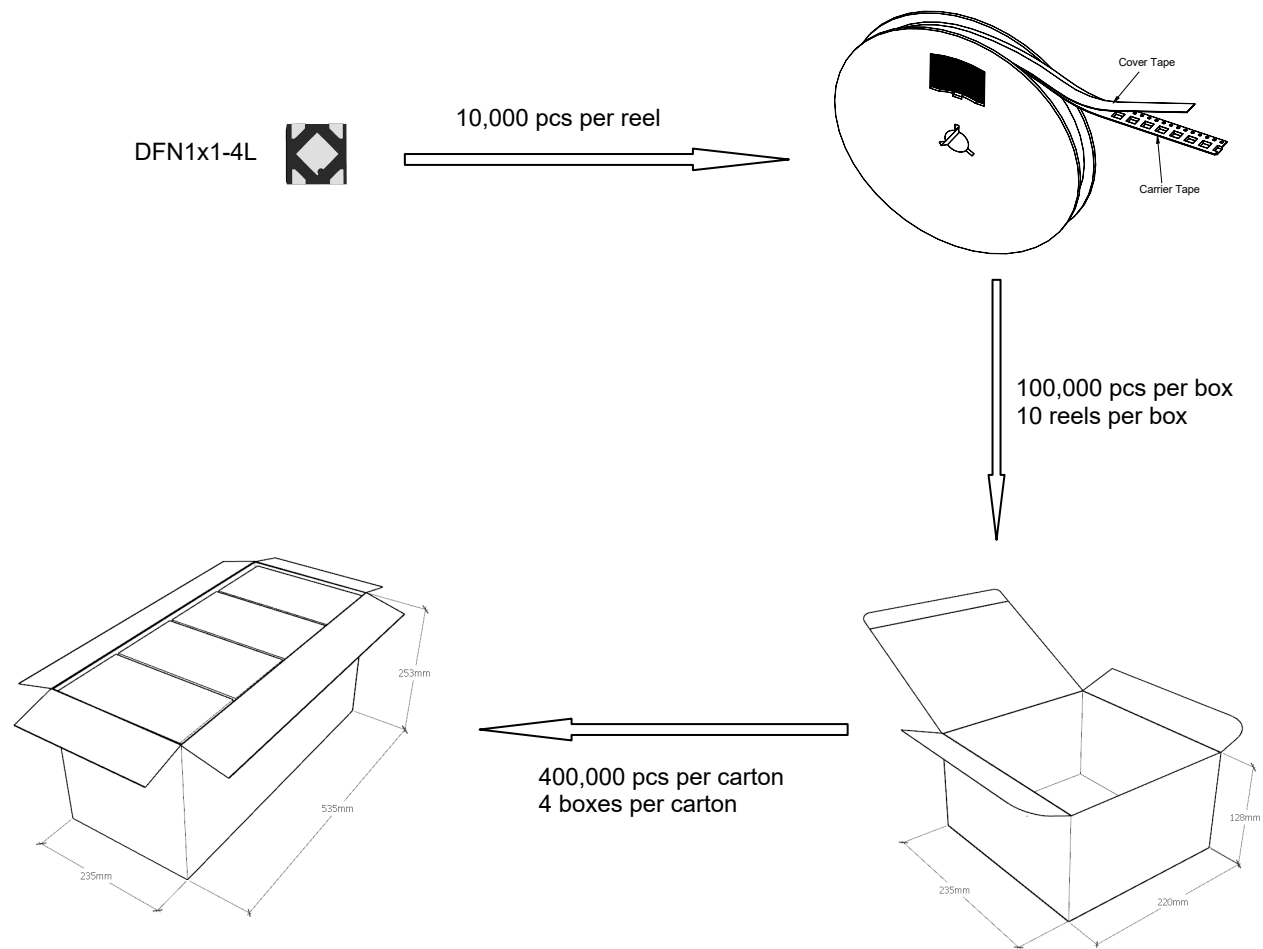


Reel (7")

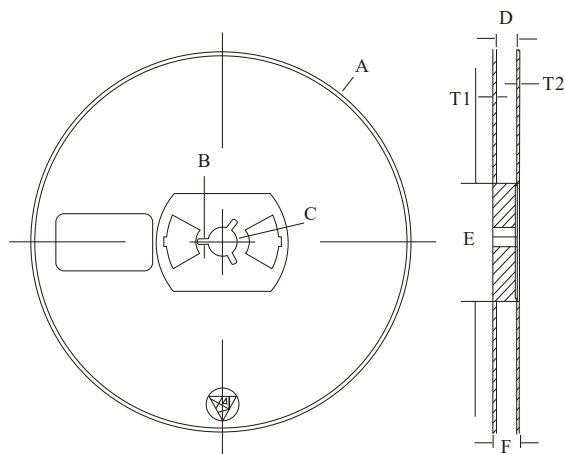
Symbol	Value (unit: mm)
A	Ø 177.8±1
B	2.7±0.2
C	Ø 13.5±0.2
E	Ø 54.5±0.2
F	12.3±0.3
D	9.6+2/-0.3
T1	1.0±0.2
T2	1.2±0.2

Package Specifications (DFN1x1-4L)

- The method of packaging



◆ Embossed reel data

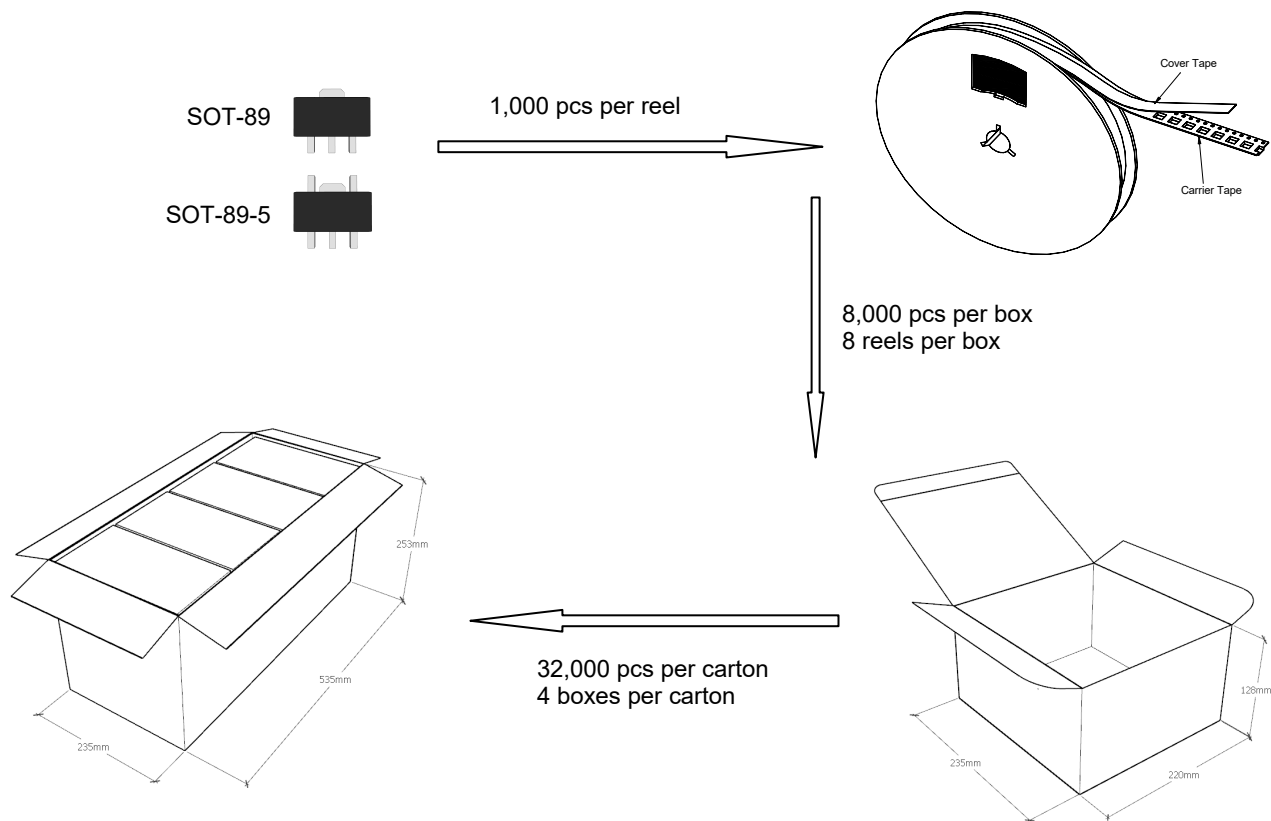


Reel (7")

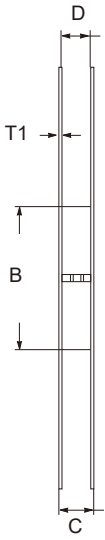
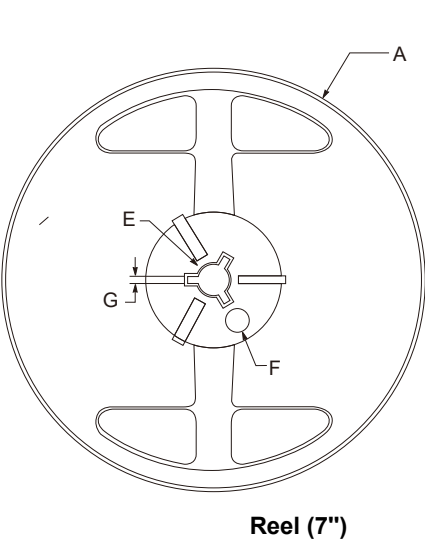
Symbol	Value (unit: mm)
A	Ø 177.8±1
B	2.7±0.2
C	Ø 13.5±0.2
E	Ø 54.5±0.2
F	12.3±0.3
D	9.6+2/-0.3
T1	1.0±0.2
T2	1.2±0.2

Package Specifications (SOT-89/SOT-89-5)

- The method of packaging (1,000PCS/Reel&7inches)



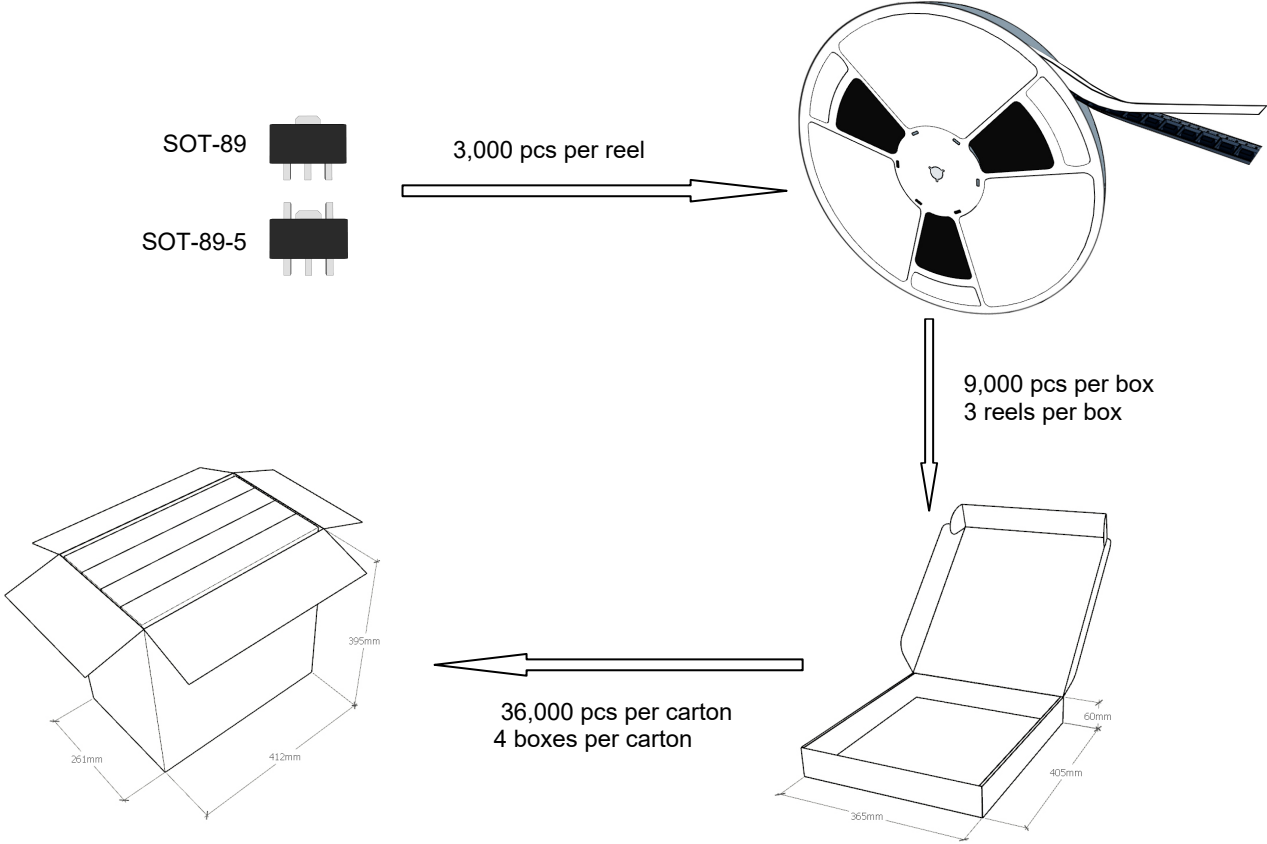
◆ Embossed reel data



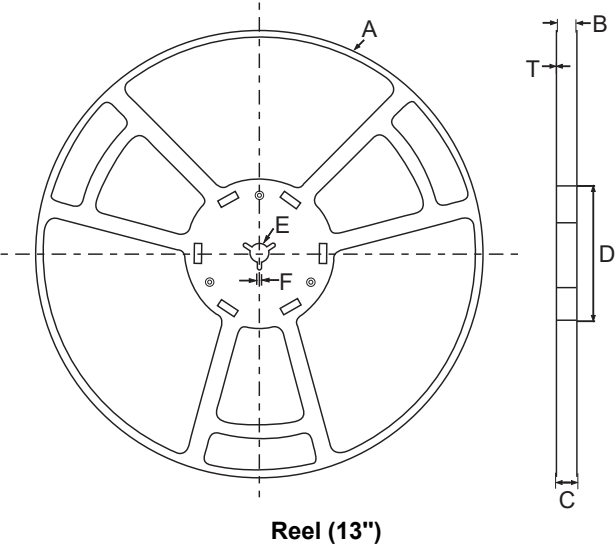
symbol	Value(unit:mm)
A	$\Phi 179\pm 1$
B	60.5 ± 0.2
C	15.3 ± 0.3
D	$12.5\sim 13.7$
E	$\Phi 13.5\pm 0.2$
F	$\Phi 10.0\pm 0.2$
G	2.7 ± 0.2
T1	1.0 ± 0.2

Package Specifications (SOT-89/SOT-89-5)

- The method of packaging (3,000PCS/Reel&13inches)



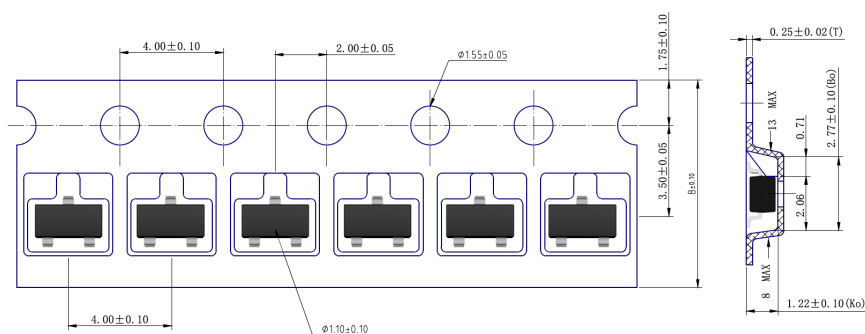
◆ Embossed reel data



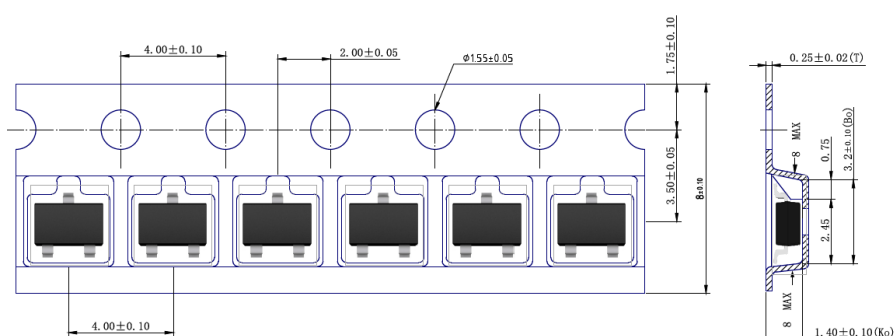
symbol	Value(unit:mm)
A	φ 330±1
B	12.7±0.5
C	16.5±0.3
D	φ 99.5±0.5
E	φ 13.6±0.3
F	2.8±0.3
T	1.9±0.2

◆ Embossed tape data

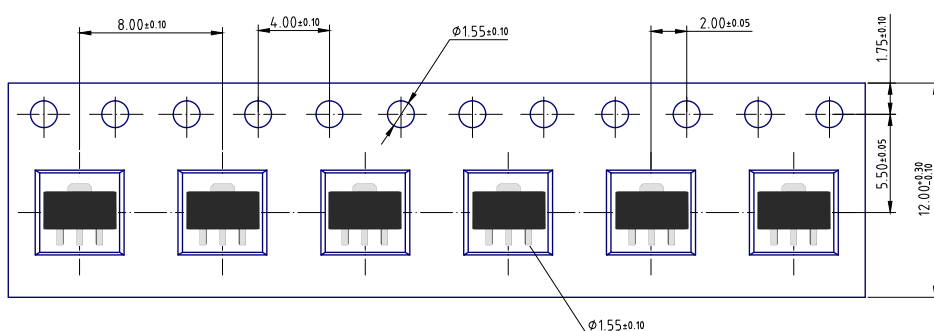
SOT-23



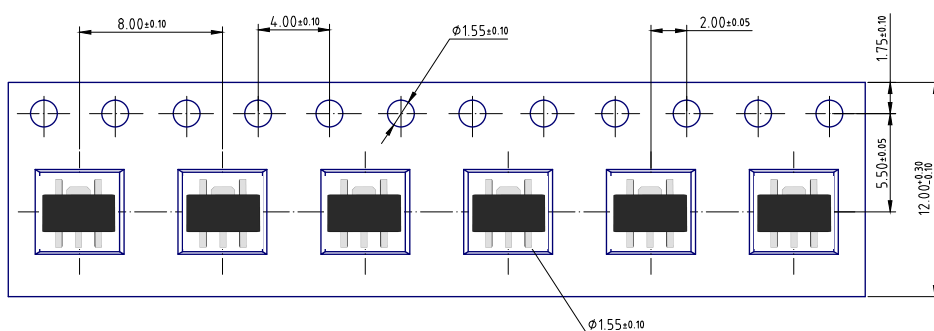
SOT-23-3



SOT-89

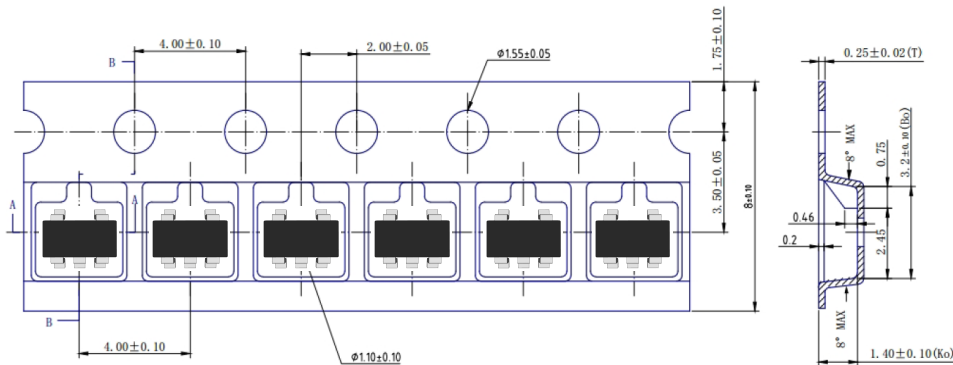


SOT-89-5

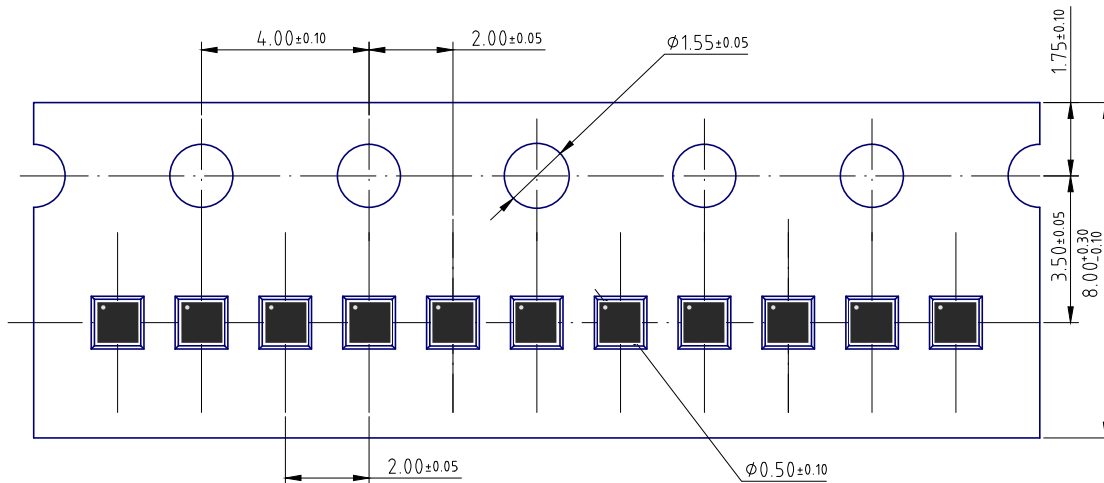


◆ Embossed tape data

SOT-23-5



DFN1x1-4L



Contact Information

TANI website: <http://www.tanisemi.com> Email: tani@tanisemi.com

For additional information, please contact your local Sales Representative.

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Product Specification Statement

The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.

The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. TANI shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and TANI assumes no responsibility for the application of the product. TANI strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, TANI cannot guarantee that the information provided in the product specification is entirely accurate and error-free. TANI shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications.

TANI reserves the right to revise or update the product specification and the products at any time without prior notice, and the user's continued use of the product specification is considered an acceptance of these revisions and updates. Prior to purchasing and using the product, users should verify the above information with TANI to ensure that the product specification is the most current, effective, and complete. If users are particularly concerned about product parameters, please consult TANI in detail or request relevant product test reports. Any data not explicitly mentioned in the product specification shall be subject to separate agreement.

Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.

The design of the product is intended to meet civilian needs and is not guaranteed for use in harsh environments or precision equipment. It is not recommended for use in systems or equipment such as medical devices, aircraft, nuclear power, and similar systems, where failures in these systems or equipment could reasonably be expected to result in personal injury. TANI shall assume no responsibility for any consequences resulting from such usage.

Users should also comply with relevant laws, regulations, policies, and standards when using the product specification. Users are responsible for the risks and liabilities arising from the use of the product specification and must ensure that it is not used for illegal purposes. Additionally, users should respect the intellectual property rights related to the product specification and refrain from infringing upon any third-party legal rights. TANI shall assume no responsibility for any disputes or controversies arising from the above-mentioned issues in any form.