Description

TN53 Series are the high input very low I_Q and 300mA maximum output current LDO with enable function that operates from 1.8V~12V, is designed specifically for portable battery-powered applications which require ultra-low quiescent current. The very-low consumption of type 2.8uA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

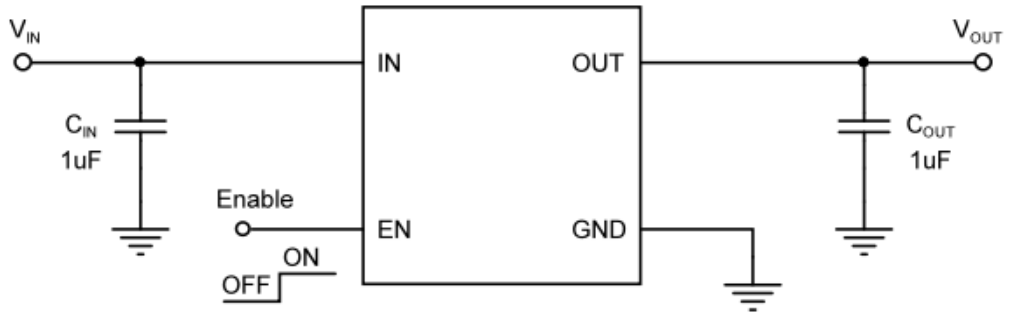
Features

- Wide Input Voltage Range: 3V~ 40V
- Maximum Output Current: 300mA
- Standard Fixed Output Voltage Options: 3.6V,5V,6V,7V,8V,12V,etc
- Low Quiescent Current: 2.8μA(Typ.)
- PSRR=50dB@1KHz
- Low Dropout : 1000mV @ 300mA(V_{OUT}=3.0V)
- Low Output Voltage Accuracy: ±1.5%(T_A=25℃)
- Excellent Load/Line Transient Response
- Available Packages: SOT-89, SOT-89-5, SOT-23-3, SOT-23-5, DFN1x1-4L,TO-252 and DFN2x2C-6L

Applications

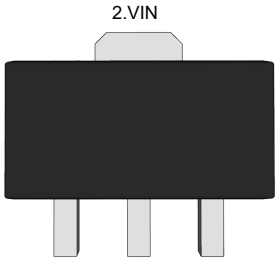
- Battery-Powered Equipment
- Smoke Detectors and Sensors
- Micro Controller Applications

Typical Application Circuit



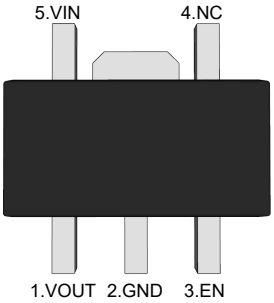
Pin Distribution

SOT-89



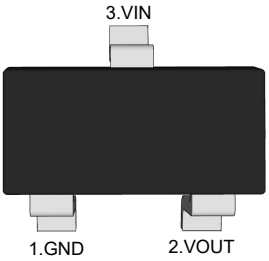
(Top View)

SOT-89-5



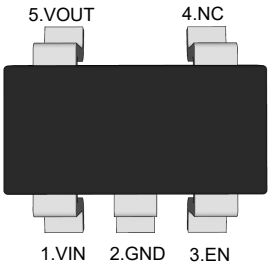
(Top View)

SOT-23-3



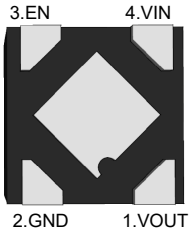
(Top View)

SOT-23-5



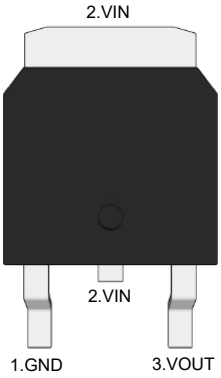
(Top View)

DFN1x1-4L



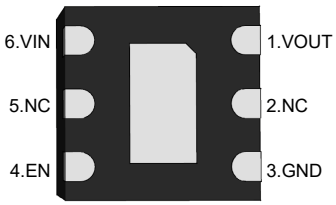
(Bottom View)

TO-252



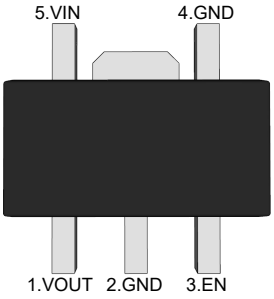
(Top View)

DFN2x2C-6L



Bottom View

SOT-89-5



(Top View)

PJ53-A Series

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

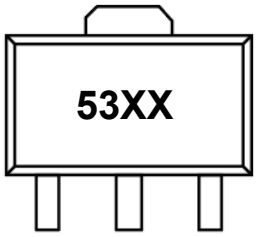
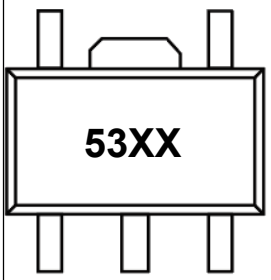
TN53□□□□□

Pin arrangement version number
□(Blank): Normal pin arrangement version
-A: A version pin arrangement

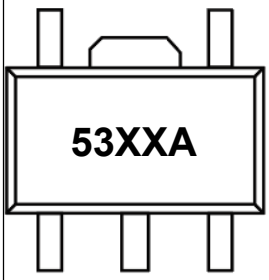
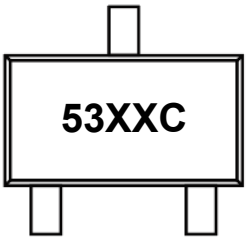
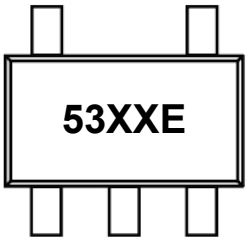
Package Type
SQ : SOT-89 SR : SOT-89-5
SC : SOT-23-3 SE : SOT-23-5
DE : DFN1x1-4L TE : TO-252 DFC : DFN2x2C-6L

Output Voltage
36 : 3.6V 50 : 5V 60 : 6V 70 : 7V
80: 8V 120: 12V

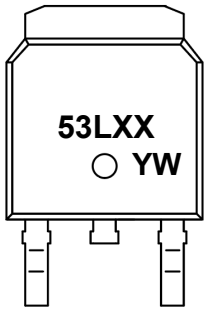
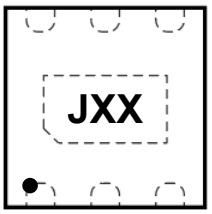
Output current tap
L : 300mA

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan Note1	MSL Level	Marking Code
TN53L36SQ	SOT-89	7/13	1000/3000	RoHS & Green	MSL1	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50SQ						
TN53L60SQ						
TN53L70SQ						
TN53L80SQ						
TN53L120SQ						
TN53L36SR	SOT-89-5	7/13	1000/3000	RoHS & Green	MSL1	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50SR						
TN53L60SR						
TN53L70SR						
TN53L80SR						
TN53L120SR						

Ordering Information

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan Note1	MSL Level	Marking Code
TN53L36SR-A	SOT-89-5	7/13	1000/3000	RoHS & Green	MSL1	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50SR-A						
TN53L60SR-A						
TN53L70SR-A						
TN53L80SR-A						
TN53L120SR-A						
TN53L36SC	SOT-23-3	7	3000	RoHS & Green	MSL3	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50SC						
TN53L60SC						
TN53L70SC						
TN53L80SC						
TN53L120SC						
TN53L36SE	SOT-23-5	7	3000	RoHS & Green	MSL3	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50SE						
TN53L60SE						
TN53L70SE						
TN53L80SE						
TN53L120SE						

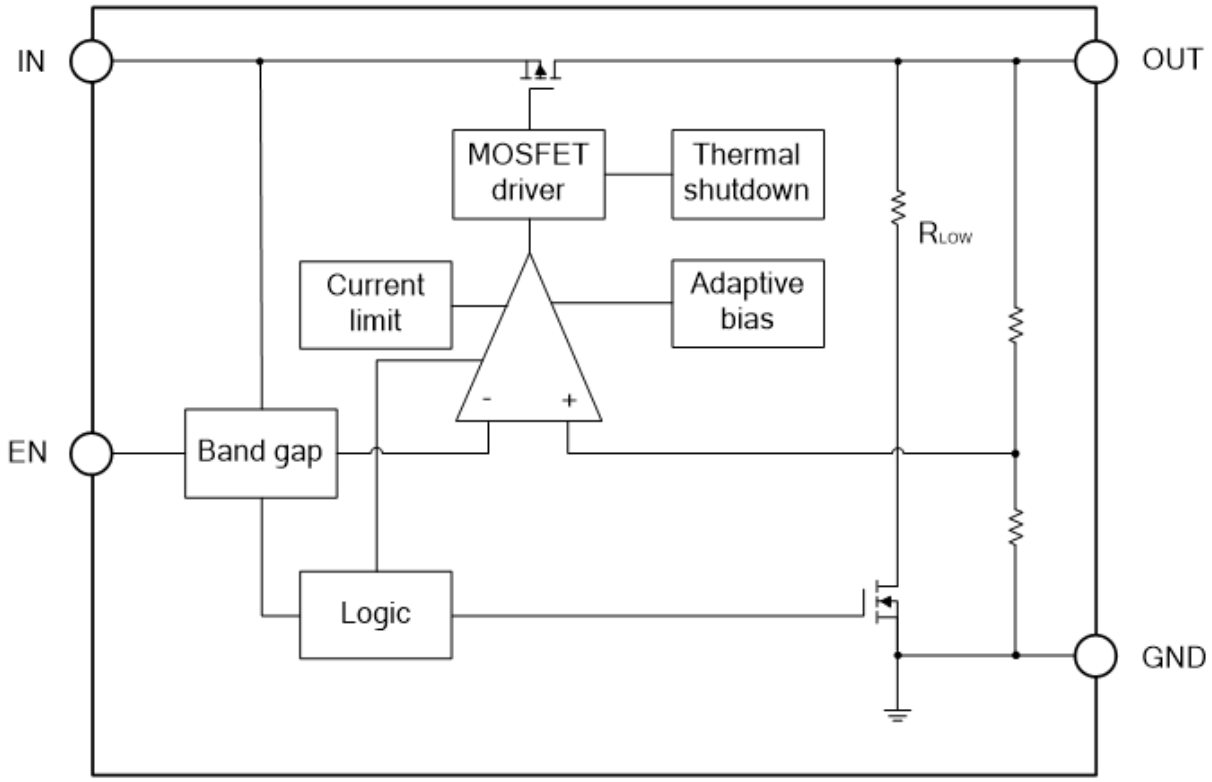
Ordering Information

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan Note1	MSL Level	Marking Code
TN53L36DE	DFN1x1-4L	7	10000	RoHS & Green	MSL1	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50DE						
TN53L60DE						
TN53L70DE						
TN53L80DE						
TN53L120DE						
TN53L36TE	TO-252	13	2500	RoHS & Green	MSL3	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50TE						
TN53L60TE						
TN53L70TE						
TN53L80TE						
TN53L120TE						
TN53L36DFC	DFN2x2C-6L	7	3000	RoHS & Green	MSL1	 XX:Output Voltage e.g. 36:3.6V, 120:12V
TN53L50DFC						
TN53L60DFC						
TN53L70DFC						
TN53L80DFC						
TN53L120DFC						

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.

Function Block Diagram



Absolute Maximum Ratings Note2

Ratings at 25℃ ambient temperature unless otherwise specified.

Parameter		Value	Unit
VIN to GND Voltage Note3		-0.3 ~ +43	V
VOUT to GND Voltage		0.8 ~ +15	V
EN to GND Voltage		-0.3 ~ +50	V
Power Dissipation Note4	SOT-89	920	mW
	SOT-89-5	920	mW
	SOT-23-3	500	mW
	SOT-23-5	500	mW
	DFN1x1-4L	500	mW
	TO-252	2500	mW
	DFN2x2C-6L	1700	mW
Thermal Resistance,Junction-to-Ambient	SOT-89	135	°C/W
	SOT-89-5	135	°C/W
	SOT-23-3	250	°C/W
	SOT-23-5	250	°C/W
	DFN1x1-4L	250	°C/W
	TO-252	50	°C/W
	DFN2x2C-6L	73	°C/W
Maximum Junction temperature		150	°C
Storage temperature range		-55 ~ +150	°C
ESD(HBM) Note5		2000	V
ESD(CDM) Note5		1500	V
Latch Up Current Maximum Rating Note5		200	mA

Note: 2. Exceed these limits to damage to the device, exposure to absolute maximum rating conditions may affect the reliability of the chip.
3. Refer to electrical eharacteristics and application information for safe operating area.
4. PCB board dimension : 40mm x 40mm (2layer) copper :1OZ
5. This device series incorporates ESD protection and is tested by the following methods:
ESD HBM tested per EIA/JESD22-A114;
ESD CDM tested per JESD22-C101;
Latch up tested per JEDEC78.

Recommended Operating Conditions

Parameter	Value	Unit
Supply Voltage	3~40	V
Maximum Output Current	300	mA
Operating Ambient Temperature	-40 ~ +85	°C

Electrical Characteristics

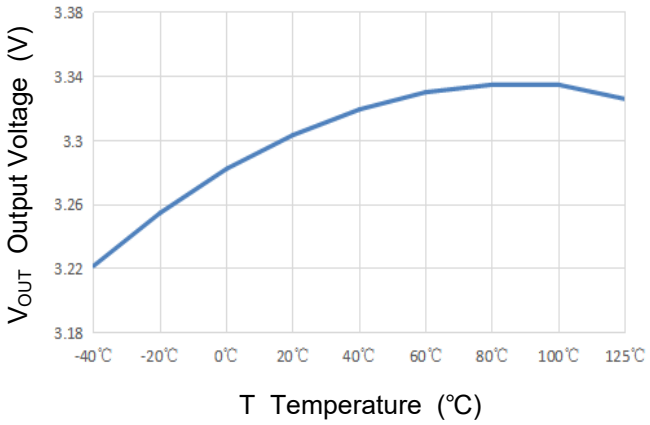
(V_{IN}=V_{OUT}+2V, I_{OUT}=10mA, C_{IN}=1μF, C_{OUT}=1μF, T_A=25℃ , unless otherwise noted.)

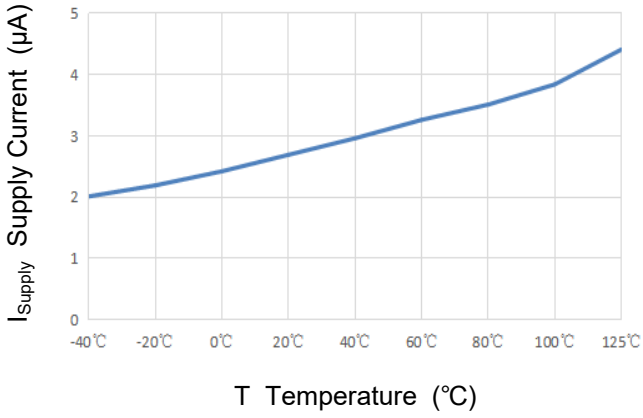
Parameter		Symbol	Test Conditions		Min.	Typ.	Max.	Unit
Input Voltage		V_{IN}			3	--	40	V
Output Voltage Accuracy		ΔV_{OUT}	T_A=25°C		-1.5	--	+1.5	%
			-40°C ≤ T_A ≤ 85°C		-2	--	+2	%
Quiescent Current		I_Q	I_{OUT}=0mA		--	2.8	6.5	μA
Shutdown Current		I_{Shut}	V_{EN} = 0V, T_A = 25°C		--	0.6	--	μA
Dropout Voltage Note		V_{DROP}	V_{OUT}=1.8V	I_{OUT}=300mA	--	950	1450	mV
			V_{OUT}=3.0V		--	1000	1500	
			V_{OUT}=5.0V		--	1050	1550	
			V_{OUT}=12.0V		--	1100	1600	
Line Regulation		ΔV_{LINE}	V_{IN}=V_{OUT}+1 to 40V, I_{OUT}=10mA		--	20	60	mV
Load Regulation		ΔV_{LOAD}	1mA≤I_{OUT}≤300mA,V_{IN}=V_{OUT}+2V		--	100	150	mV
Current Limit		I_{LIMIT}	V_{IN}=V_{OUT}+2V		--	450	--	mA
EN Pin Current		I_{EN}	V_{EN}=0~40V		--	1	--	μA
Output Noise Voltage		e_N	V_{IN} = V_{OUT}+2V, I_{OUT} = 1mA, f = 10Hz to 100KHz, V_{OUT} =3V,C_{OUT} = 1μF		--	32*V_{OUT}	--	μV_{RMS}
EN Input Threshold	Logic Low	V_{IL}	EN Input Voltage “L”		--	--	0.4	V
	Logic High	V_{IH}	EN Input Voltage “H”		1.4	--	--	V
Power Supply Rejection Ratio		PSRR	V_{IN}=V_{OUT}+2V, I_{OUT}=20mA f=1KHz		--	50	--	dB
Thermal Shutdown Temperature		T_{SHDN}	Shutdown, Temp increasing		--	165	--	°C
Thermal Shutdown Hysteresis		T_{SHDN}	Reset, Temp decreasing		--	25	--	°C

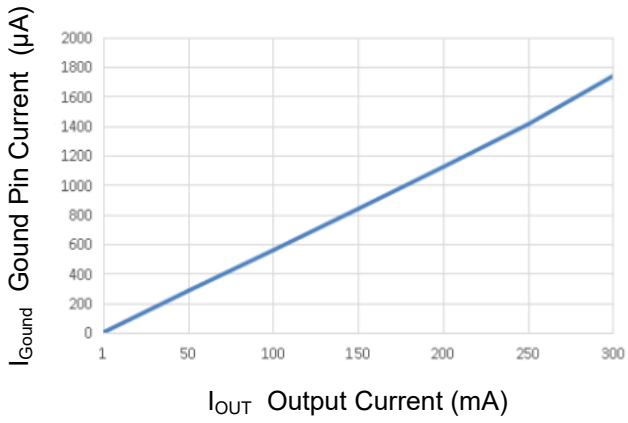
Note: V_{DROP} FT test method: test the V_{OUT} voltage at V_{OUT}+$V_{DROP(MAX)}$ with 300mA output current.

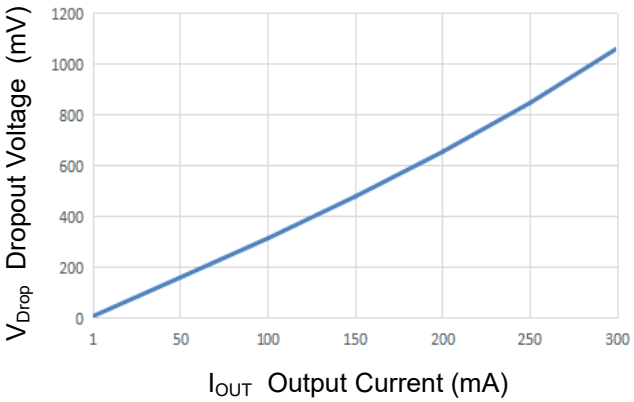
Typical Electrical Curves

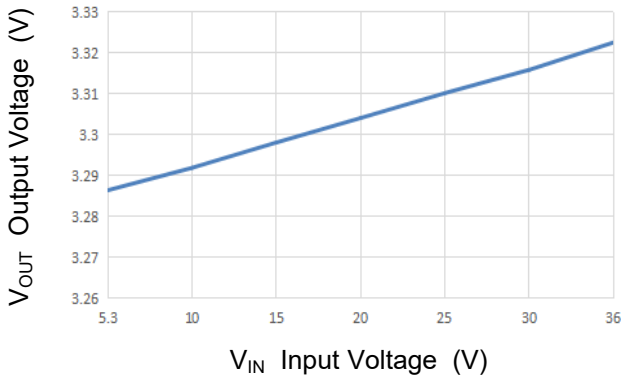
(V_{IN}=V_{OUT}+2V, I_{OUT}=10mA, C_{IN}=1μF, C_{OUT}=1μF, T_A=25℃ , unless otherwise noted.)

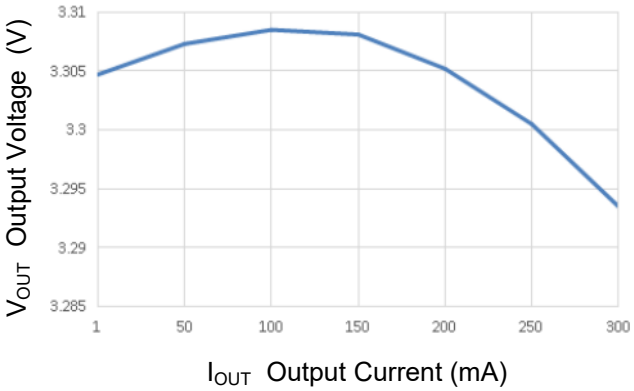


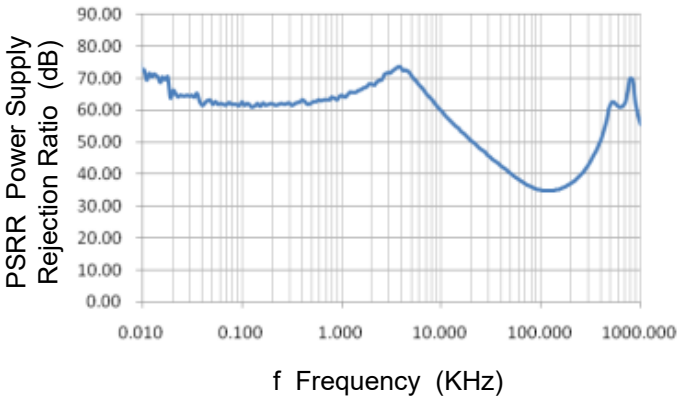


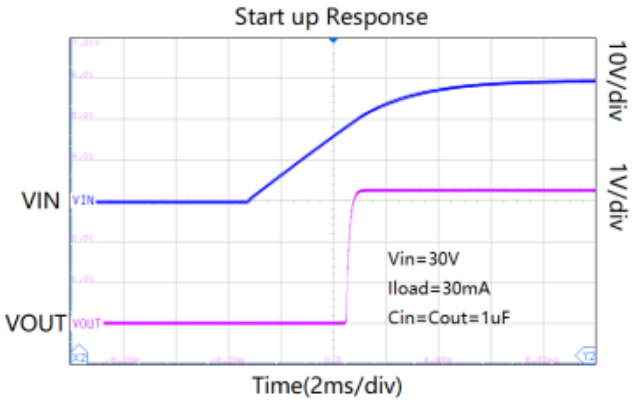


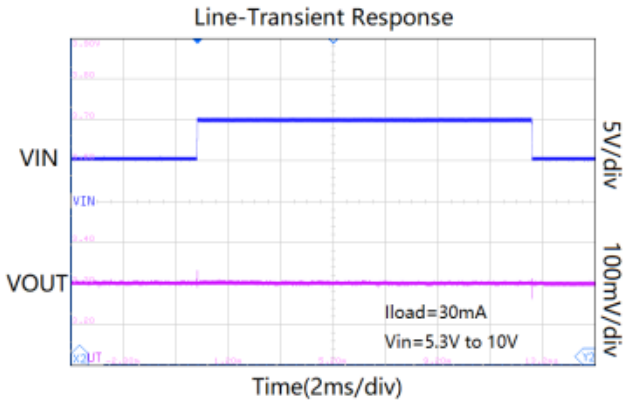


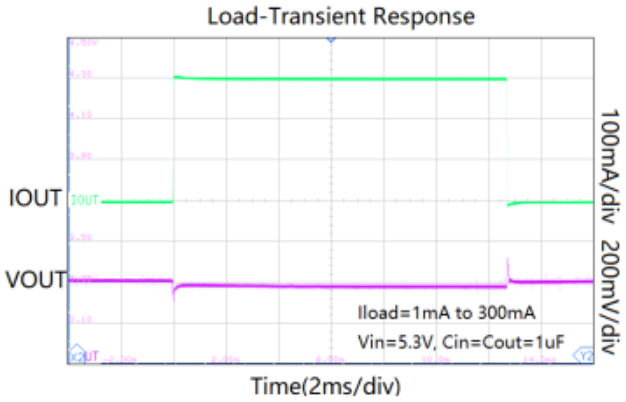












Functional Description

Input Capacitor

A 1μF~10uF ceramic capacitor is recommended to connect between IN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both IN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 10μF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to VOUT and GND pins.

Enable

The TN53 Series delivers the output power when it is set to enable state. When it works in disable state, there is no output power and the operation quiescent current is almost zero. The enable pin (EN) is active high.

Dropout Voltage

The TN53 Series uses a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (V_{DO}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. V_{DO} scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as (V_{IN} – V_{OUT}) approaches dropout operation.

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 155℃.Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 125°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the (V_{IN} – V_{OUT}) voltage and the load current. For reliable operation, limit junction temperature to 125°C maximum.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula :

$P_{D(MAX)} = (T_{J(MAX)} - T_A) / R_{\theta JA}$

Where $T_{J(MAX)}$ is the maximum operation junction temperature , T_A is the ambient temperature and the $R_{\theta JA}$ is the junction to ambient thermal resistance.

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, $R_{\theta JA}$.

The power dissipation definition in device is:

$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$

Current-Limit Protection

The TN53 Series provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

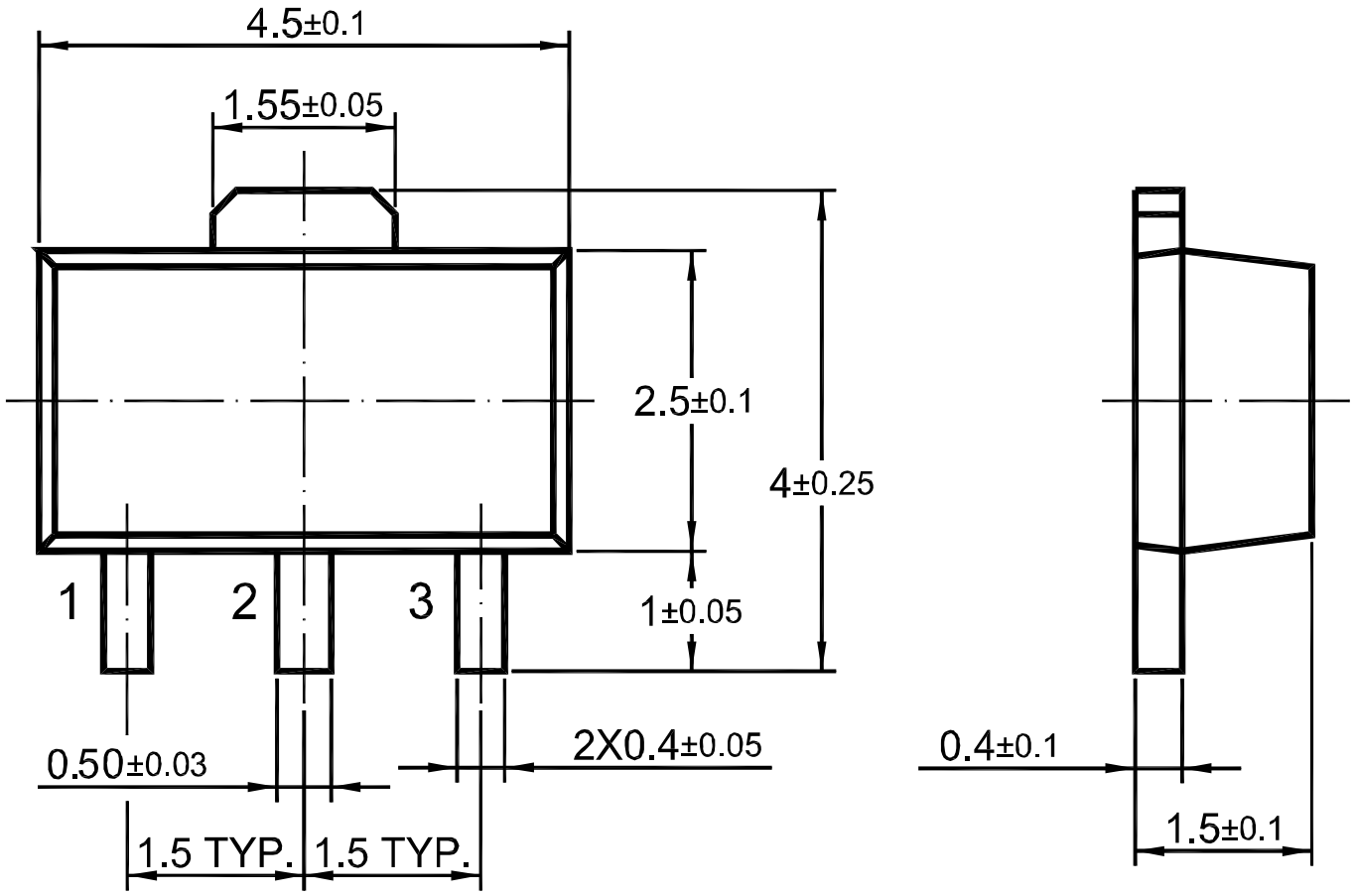
Layout Guidelines

1. Place input and output capacitors as close to the device as possible.
2. Use copper planes for device connections in order to optimize thermal performance.
3. Place thermal vias around the device to distribute heat.

Package Outline

SOT-89

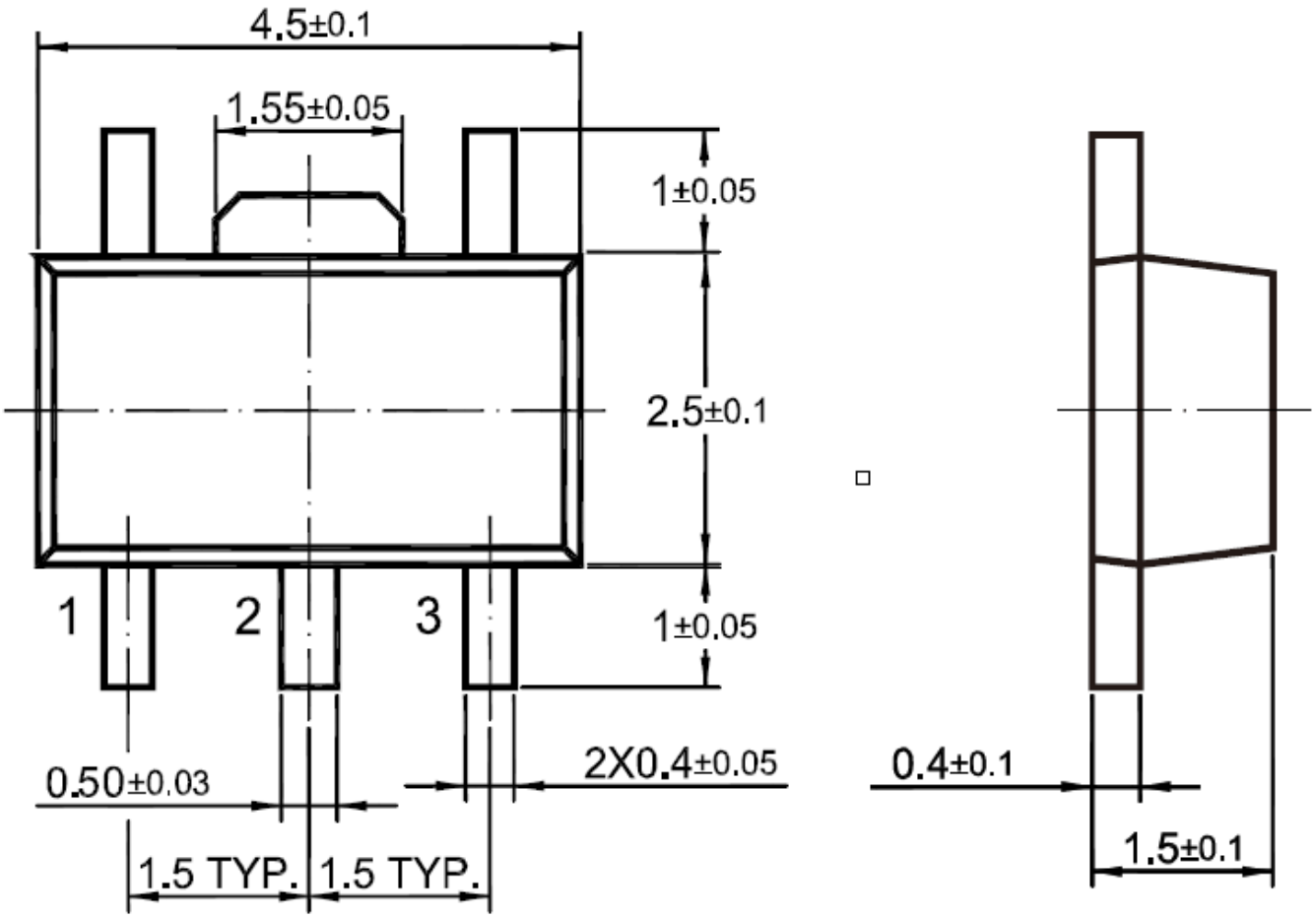
Dimensions in mm



Package Outline

SOT-89-5

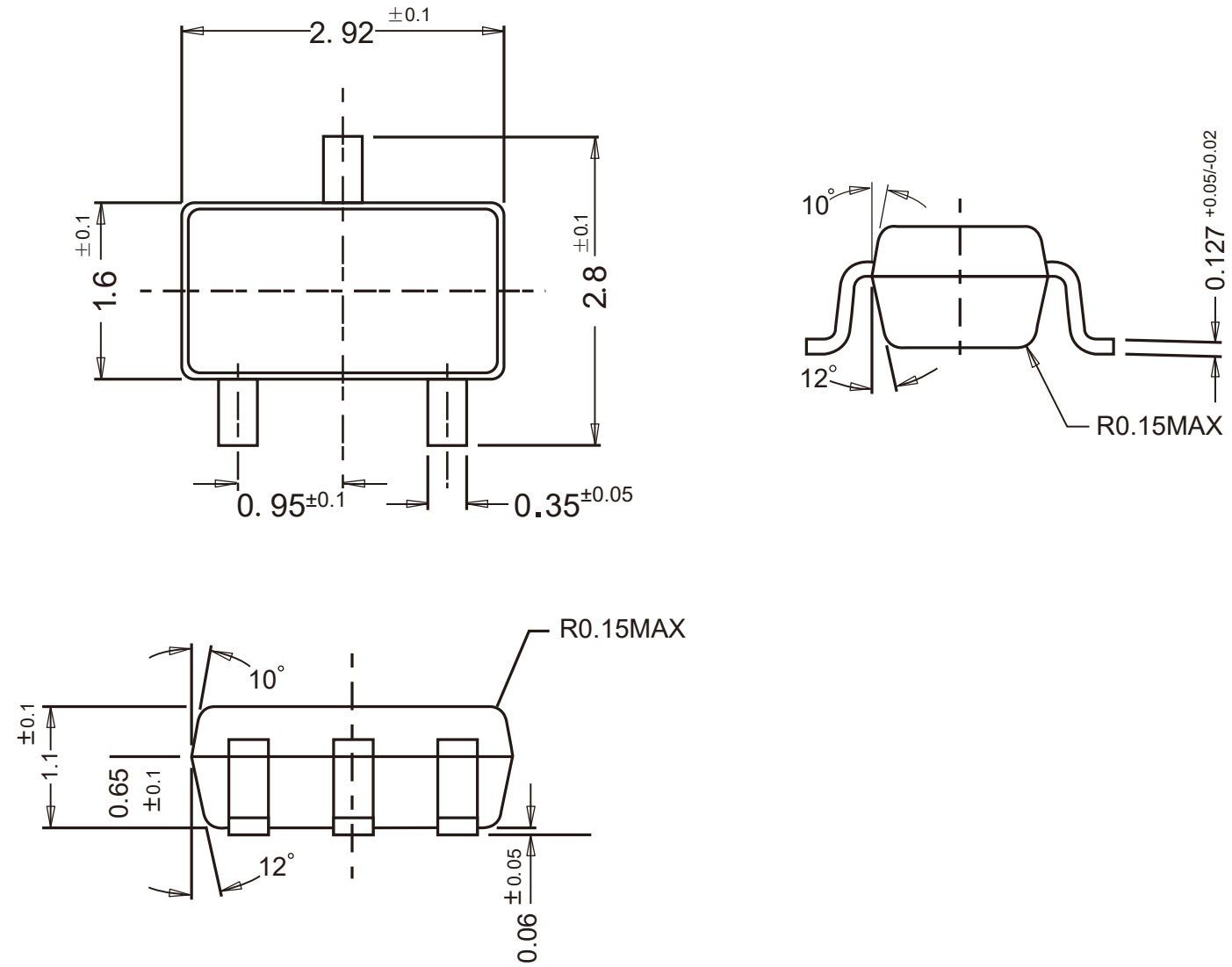
Dimensions in mm



Package Outline

SOT-23-3

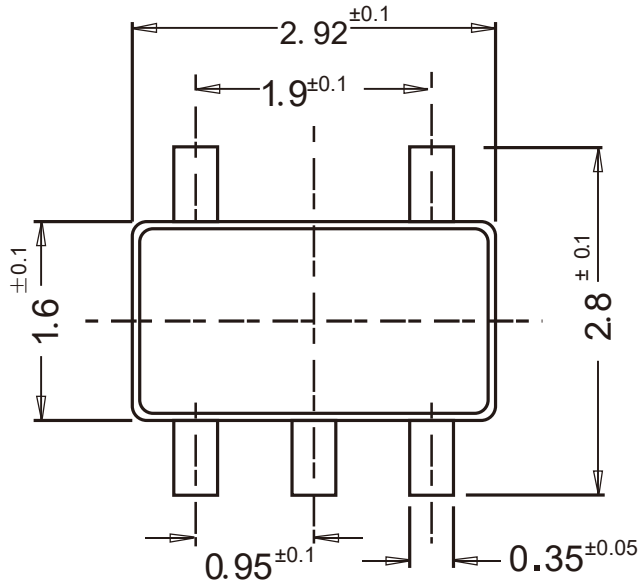
Dimensions in mm

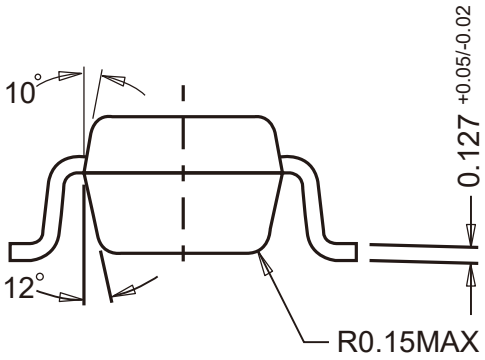


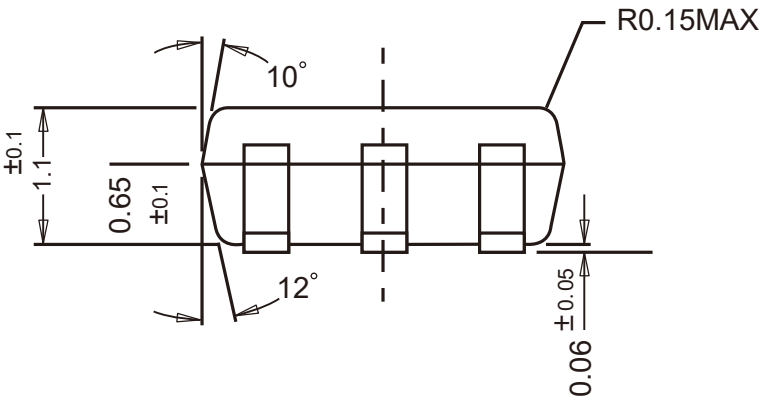
Package Outline

SOT-23-5

Dimensions in mm



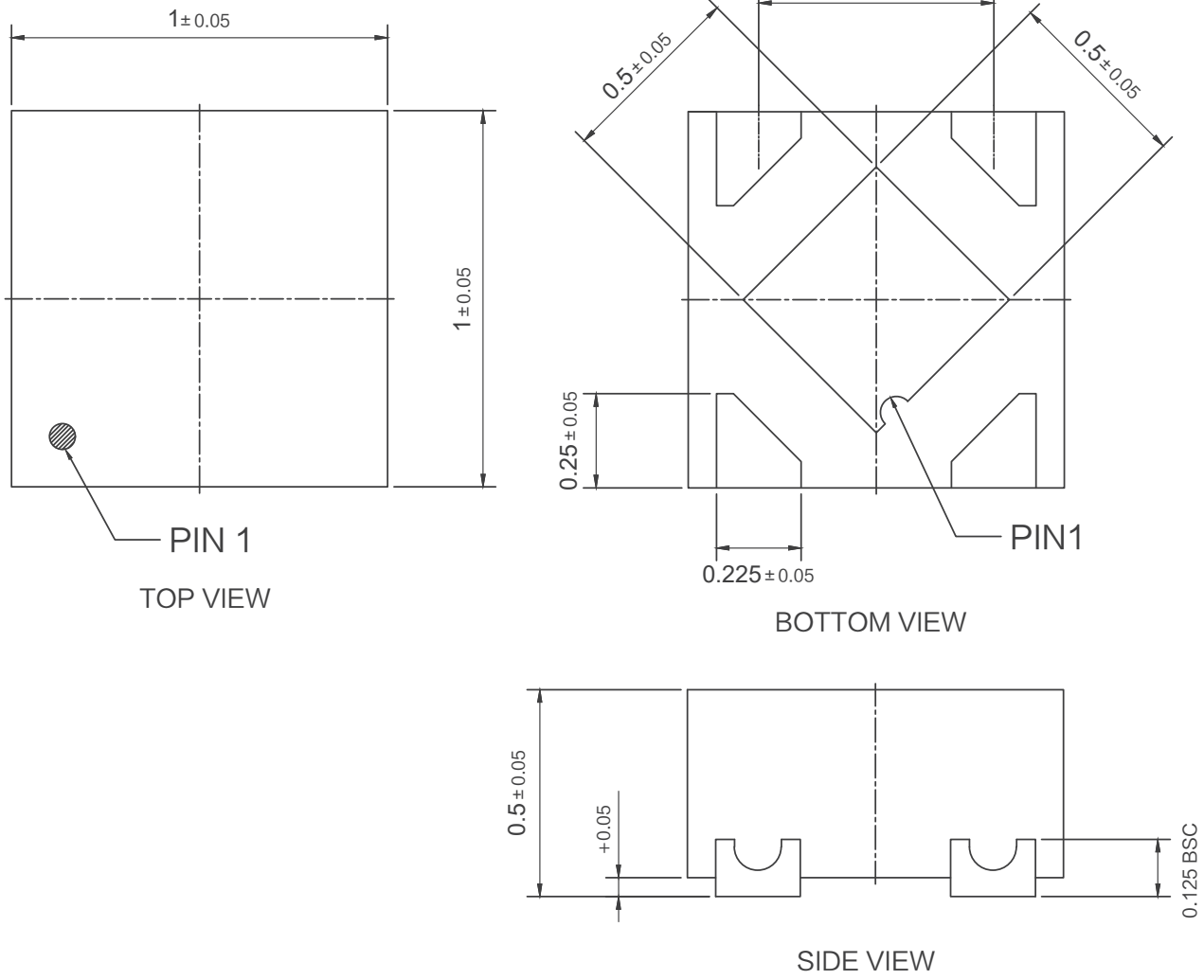




Package Outline

DFN1x1-4L

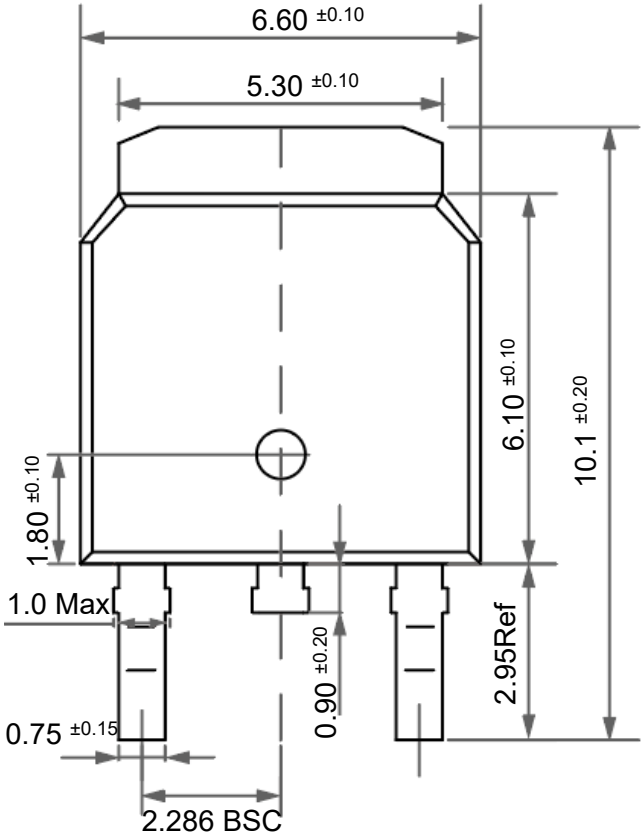
Dimensions in mm



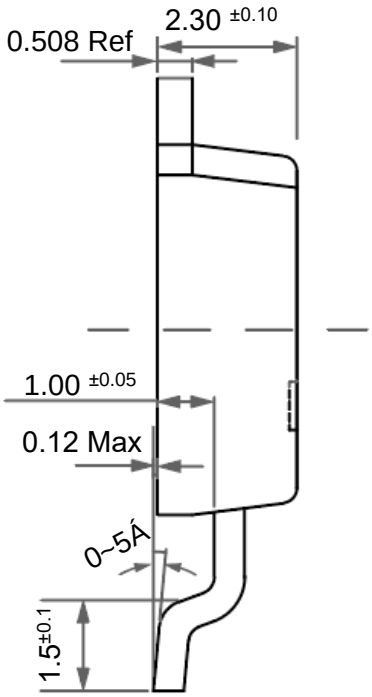
Package Outline

TO-252

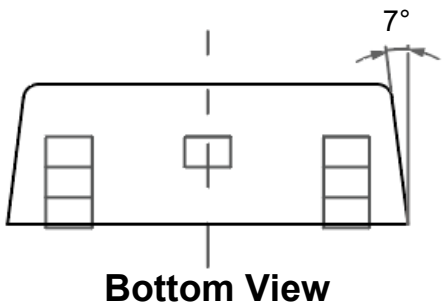
Dimensions in mm



Front View



Side View

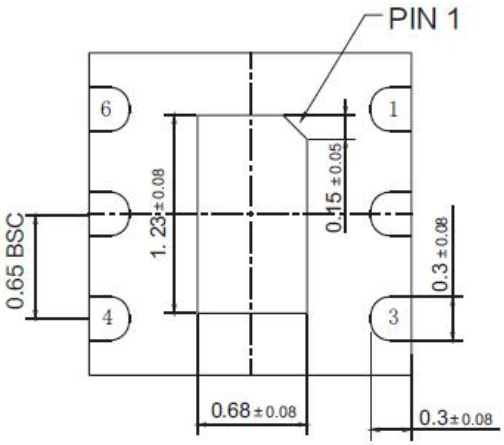


Bottom View

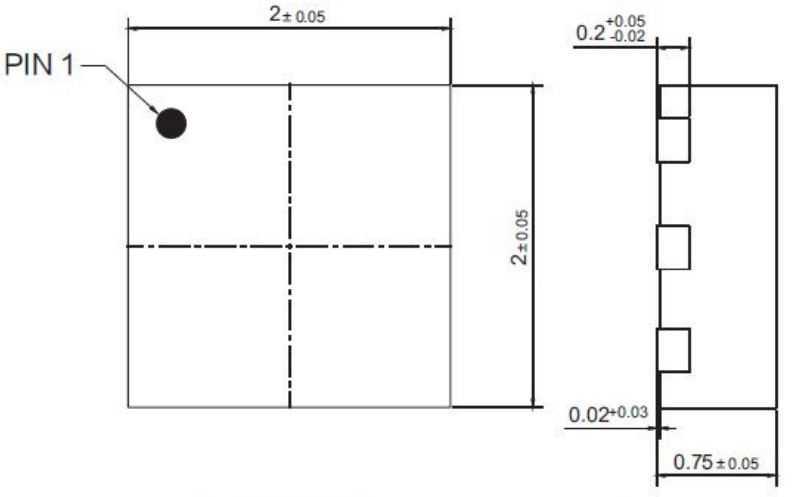
Package Outline

DFN2x2C-6L

Dimensions in mm



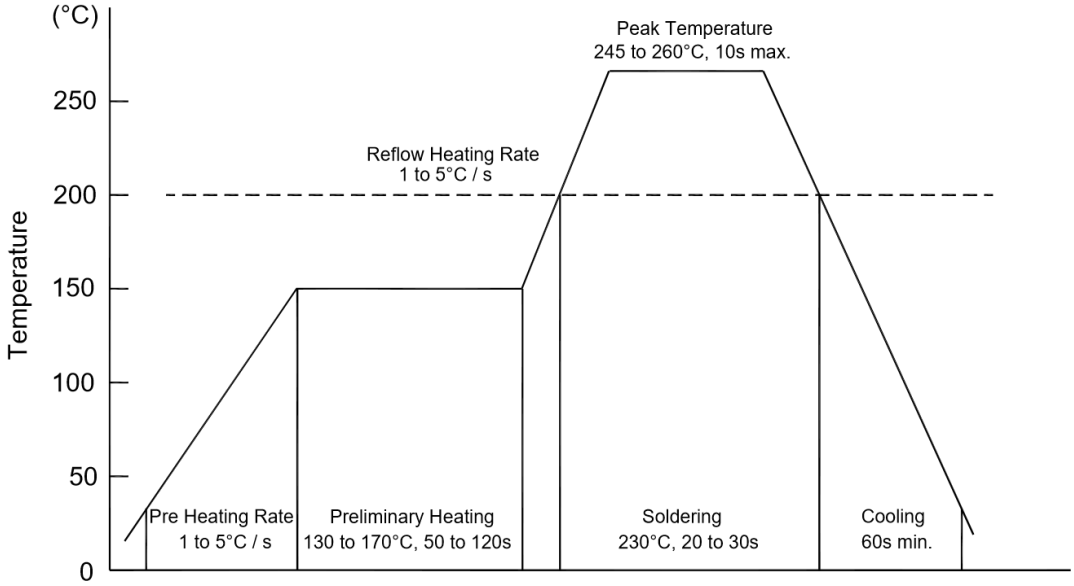
BOTTOM VIEW



TOP VIEW SIDE VIEW

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

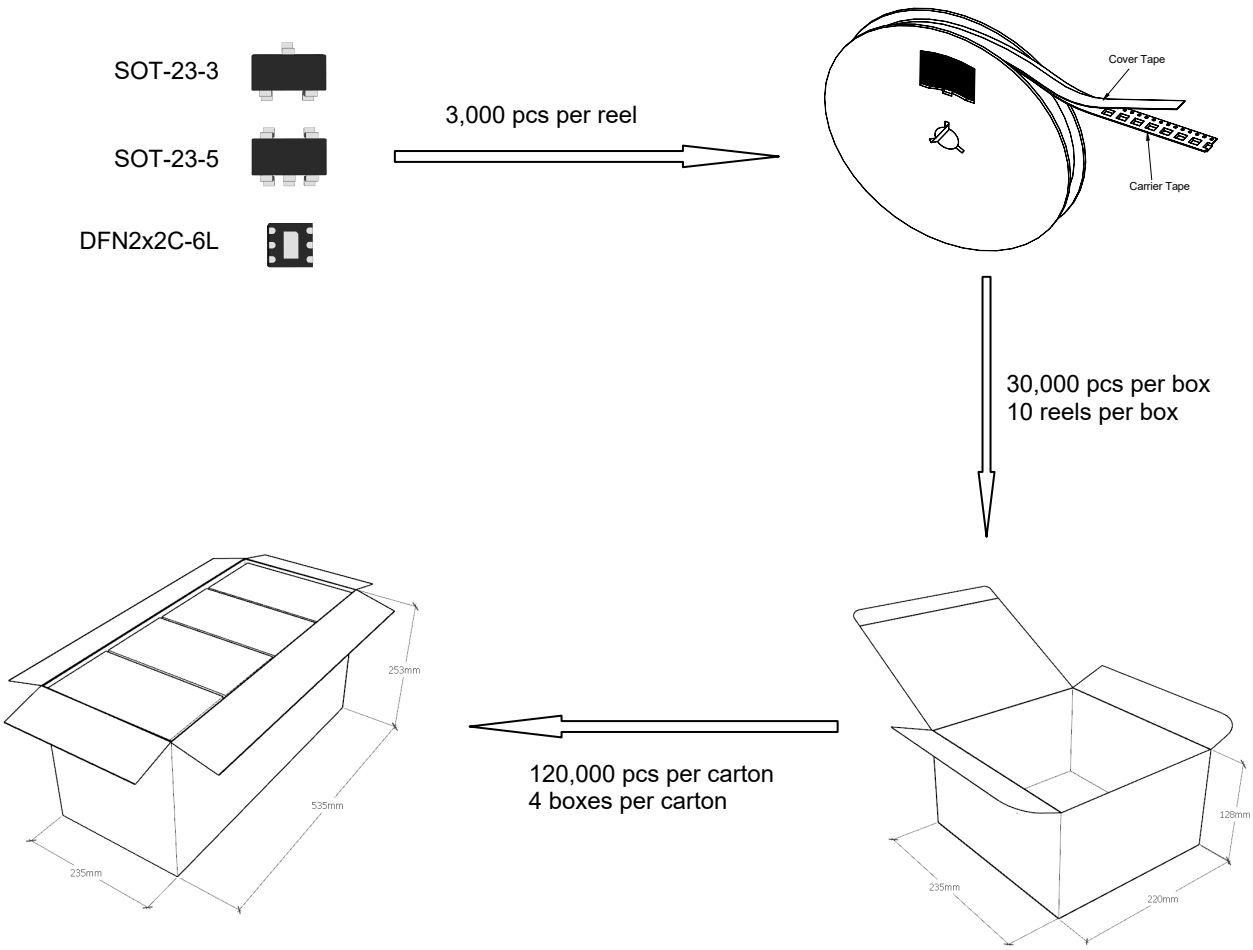
- Temperature: 300°C
- Time: 3s max.
- Times: one time

◆ Storage conditions

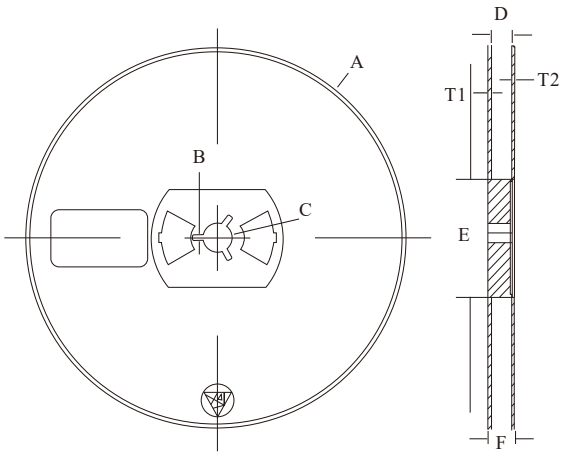
- **Temperature**
  5 to 40°C
- **Humidity**
  30 to 80% RH
- **Recommended period**
  One year after manufacturing

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

- The method of packaging



◆ **reel data**

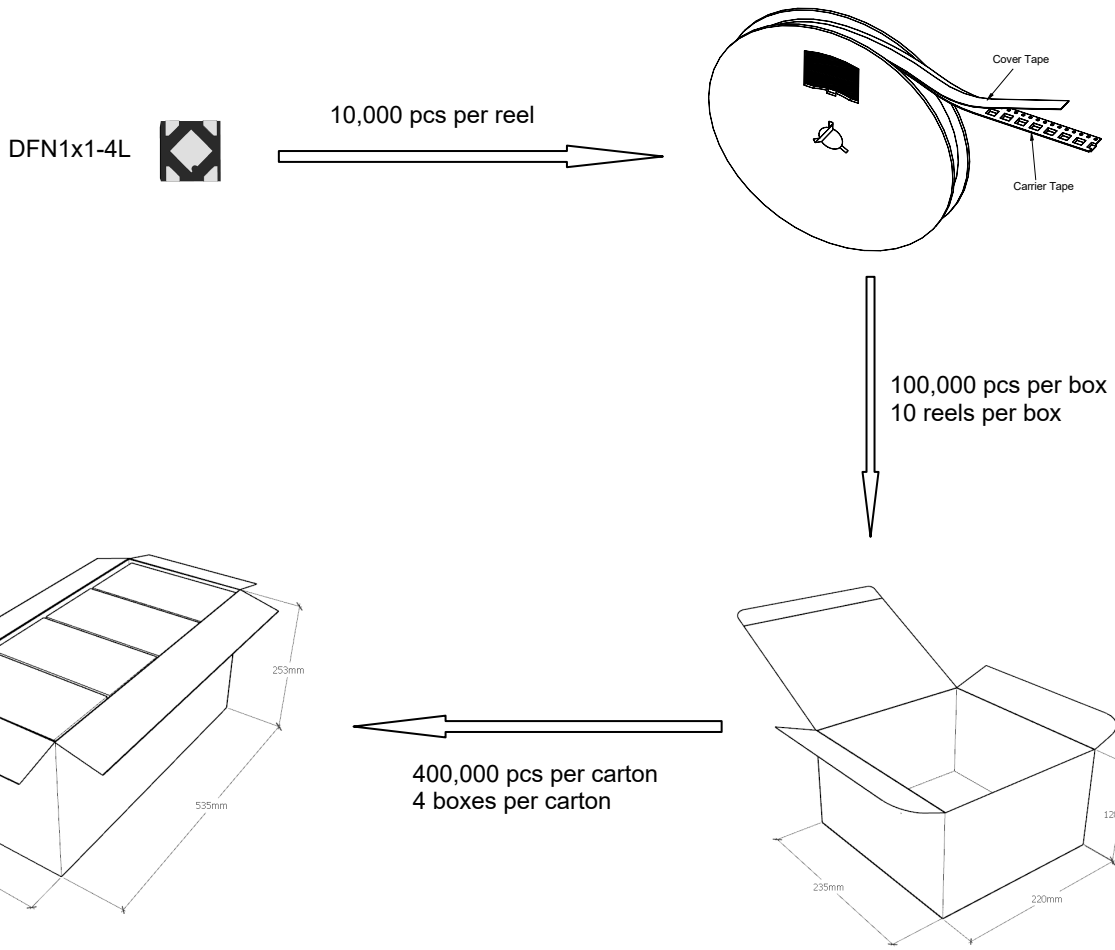


Reel (7")

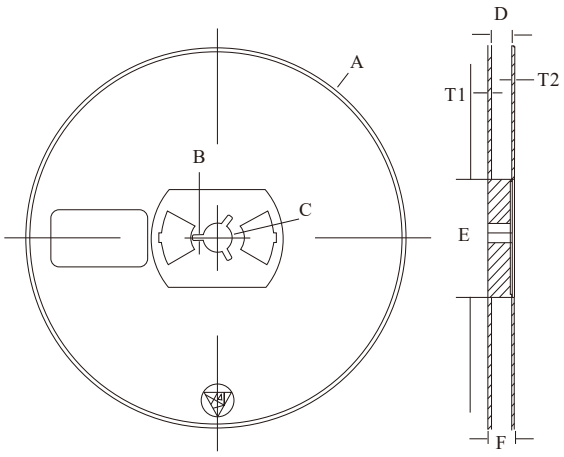
Symbol	Value (unit: mm)
A	Ø 177.8±1
B	2.7±0.2
C	Ø 13.5±0.2
E	Ø 54.5±0.2
F	12.3±0.3
D	9.6+2/-0.3
T1	1.0±0.2
T2	1.2±0.2

Package Specifications (DFN1x1-4L)

- The method of packaging



◆ Embossed reel data

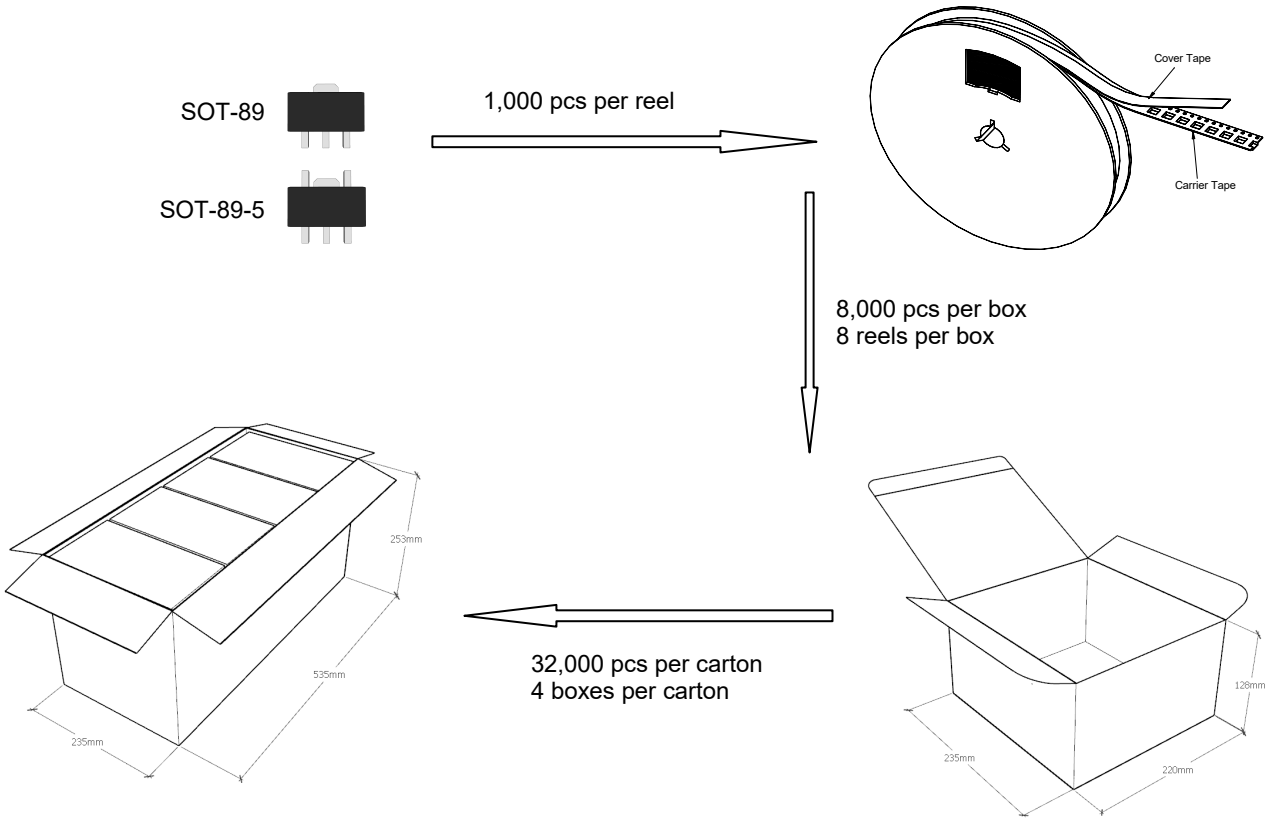


Reel (7")

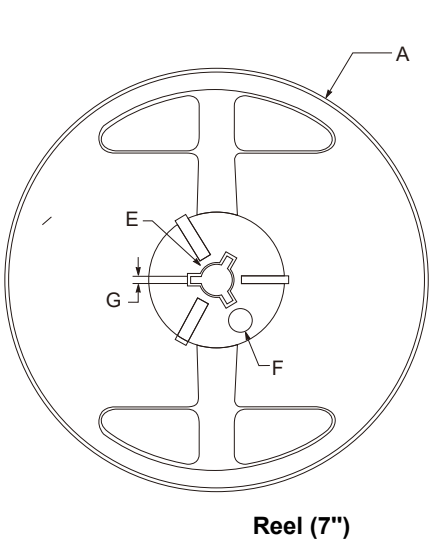
Symbol	Value (unit: mm)
A	Ø 177.8±1
B	2.7±0.2
C	Ø 13.5±0.2
E	Ø 54.5±0.2
F	12.3±0.3
D	9.6+2/-0.3
T1	1.0±0.2
T2	1.2±0.2

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

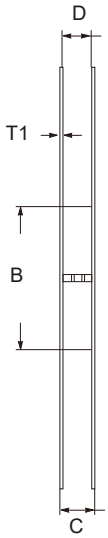
- The method of packaging (1,000PCS/Reel&7inches)



◆ **reel data**



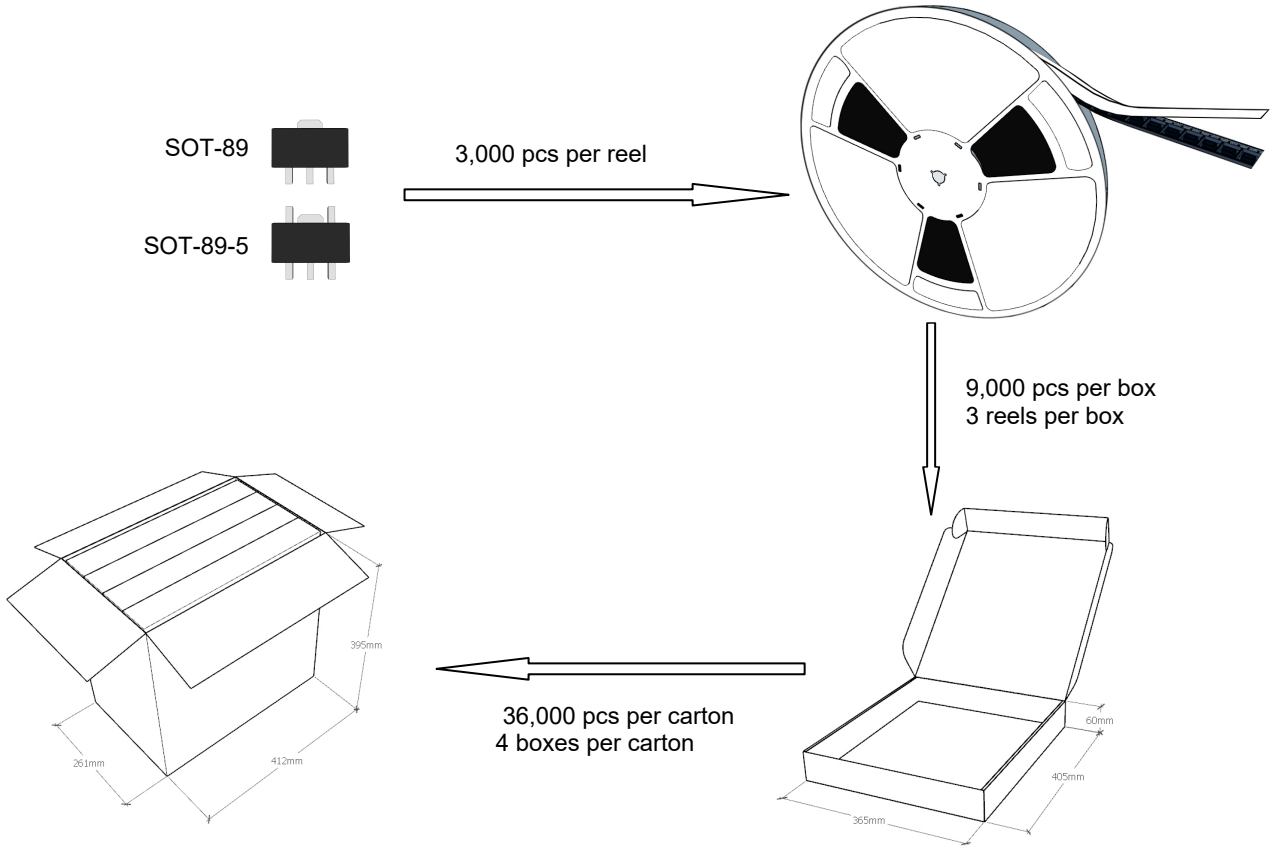
Reel (7")



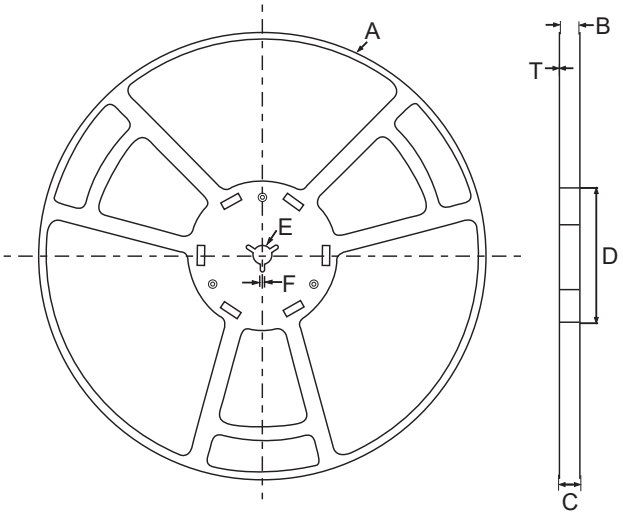
symbol	Value(unit:mm)
A	Φ179±1
B	60.5±0.2
C	15.3±0.3
D	12.5~13.7
E	Φ13.5±0.2
F	Φ10.0±0.2
G	2.7±0.2
T1	1.0±0.2

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

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



◆ **reel data**

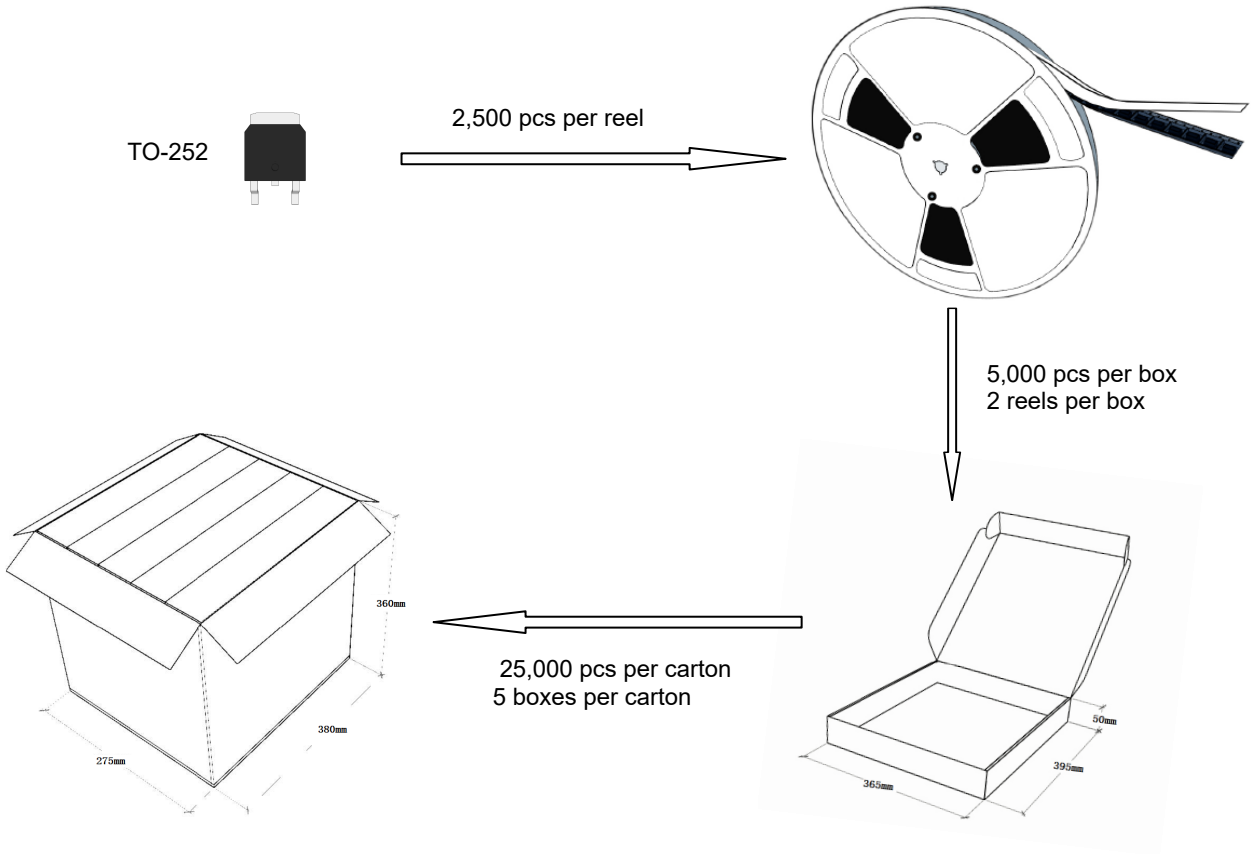


Reel (13")

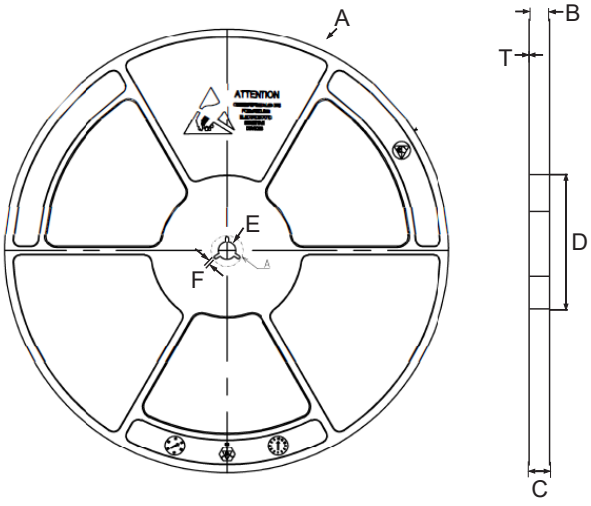
symbol	Value(unit:mm)
A	ϕ330±1
B	12.7±0.5
C	16.5±0.3
D	ϕ99.5±0.5
E	ϕ13.6±0.3
F	2.8±0.3
T	1.9±0.2

Package Specifications (TO-252)

- The method of packaging



◆ **reel data**

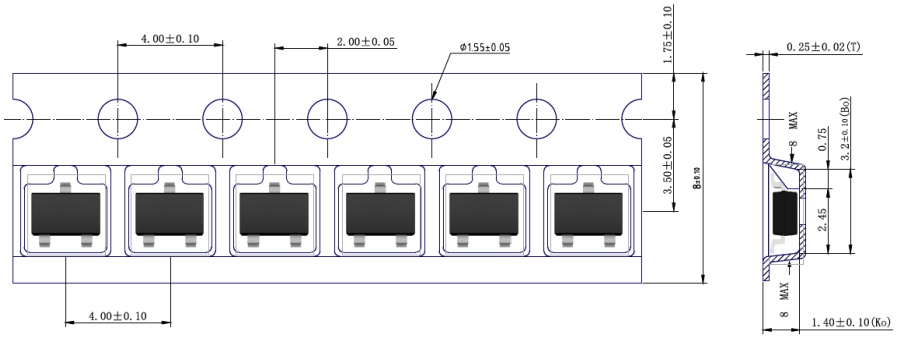


Reel (13")

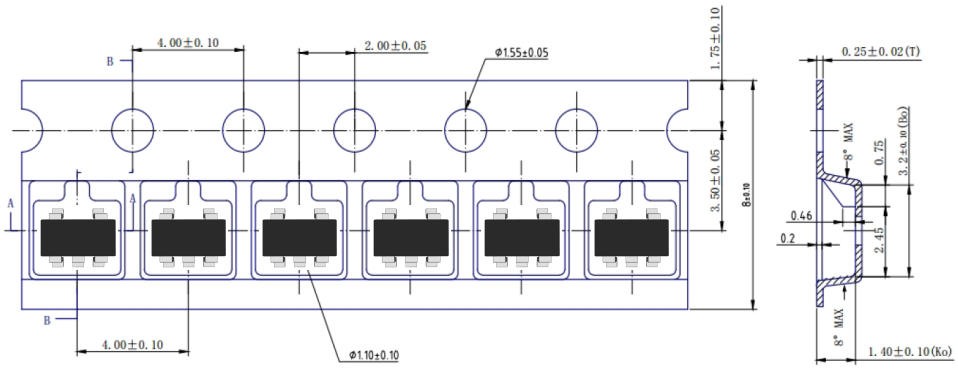
Symbol	Value(unit:mm)
A	Φ330.2±1
B	17±0.5
C	21.2±2
D	Φ100±0.5
E	Φ13.4±0.2
F	2.3±0.2
T	2.1±0.2

◆ Embossed tape data

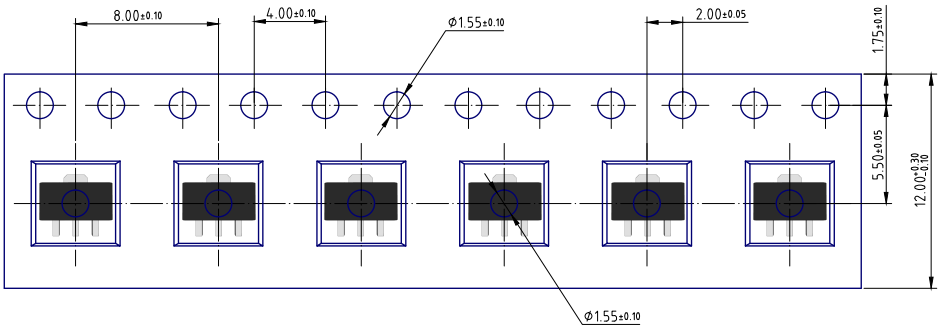
SOT-23-3



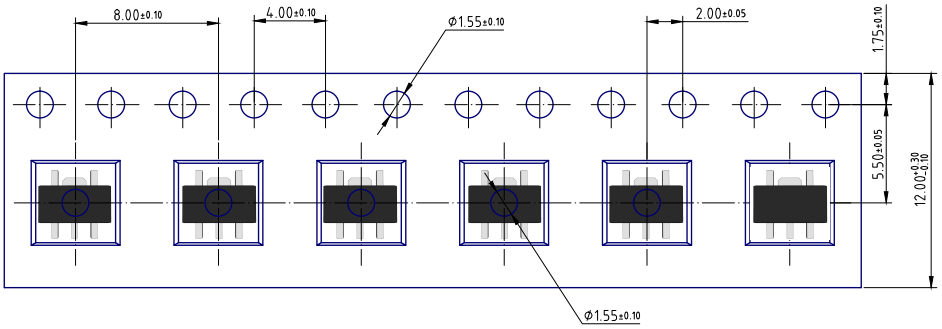
SOT-23-5



SOT-89

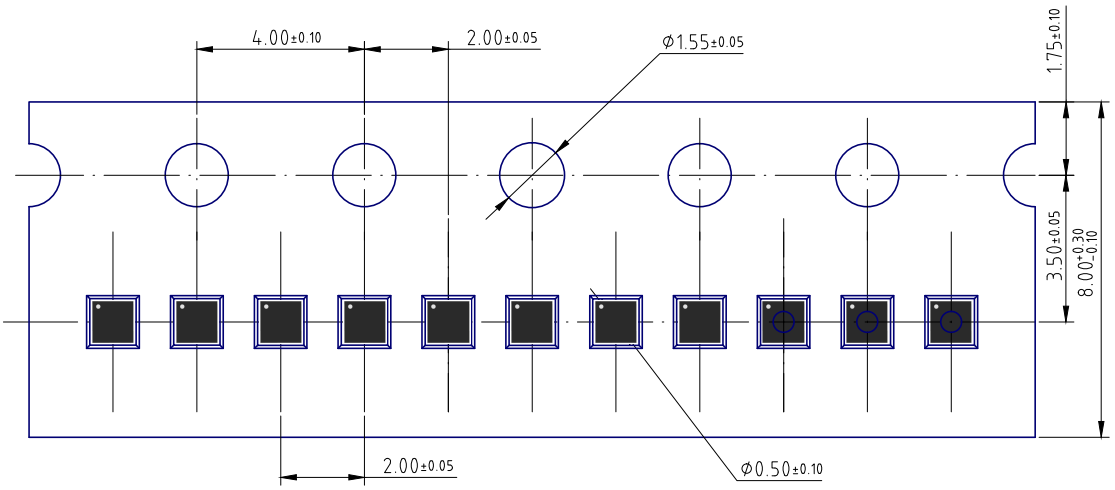


SOT-89-5

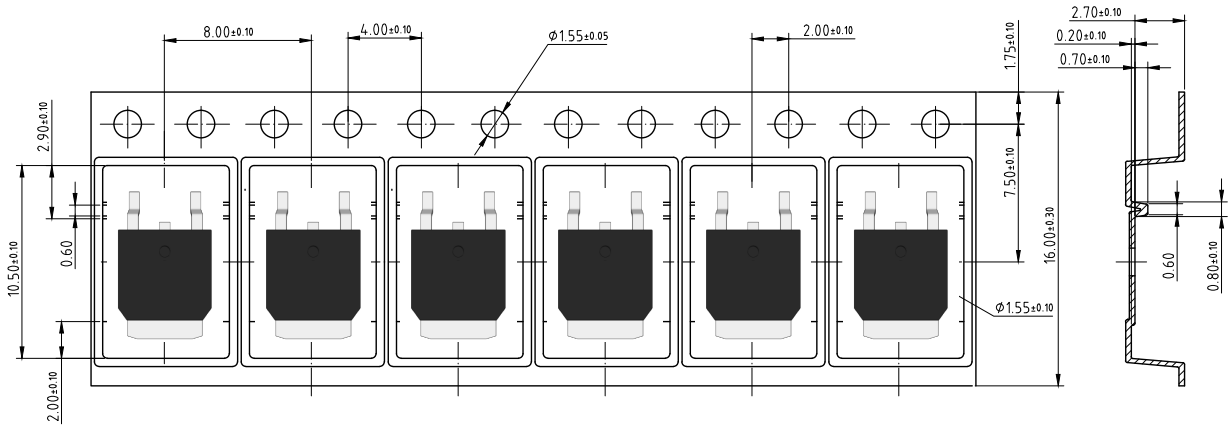


◆ **Embossed tape data**

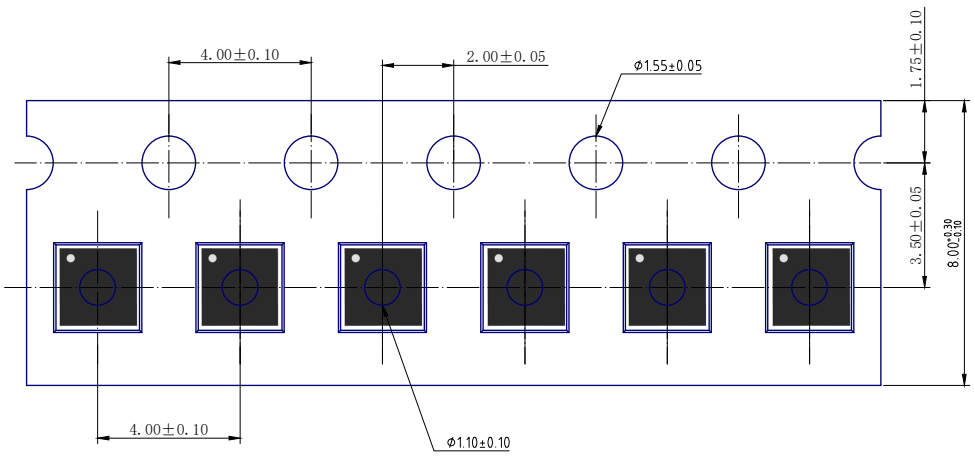
DFN1x1-4L



TO-252



DFN2x2C-6L



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.

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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.

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