

Description

The TL431K is three-terminal adjustable regulator with a guaranteed thermal stability over applicable temperature ranges. The output Voltage may be set to any value between V_{ref} (approximately 2.495V) and 36 V with two external resistors. These devices have provides a very sharp turn-on characteristic, making these device excellent replacement for zener diodes in many applications.

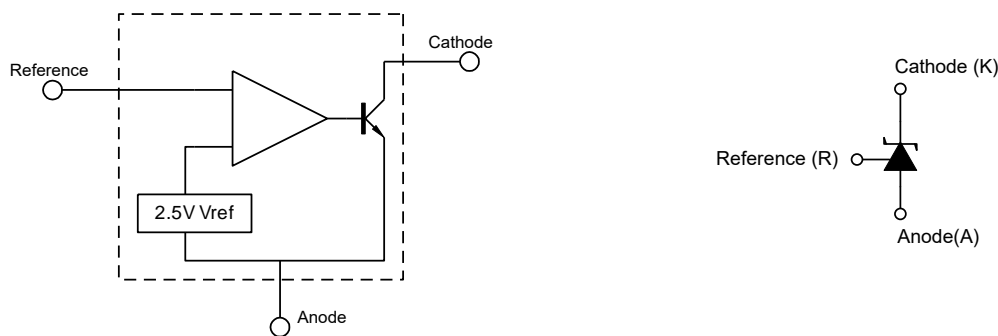
Features

- Wide programmable output voltage from 2.495V to 36V
- Sink current capability from 0.5mA to 100mA.
- Low output noise
- Wide Operating Range of -40 to 125°C

Application

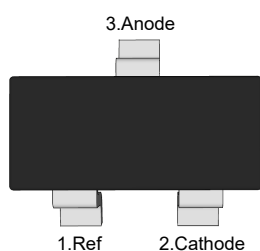
- Adjustable voltage and current references
- Voltage monitoring
- Replacement of zener diode
- Comparator with integrated reference

Functional block diagram



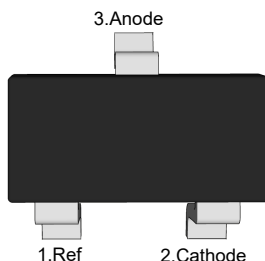
Pin Distribution

SOT-23



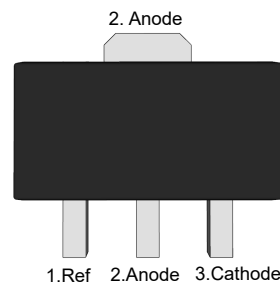
(Top View)

SOT-23-3



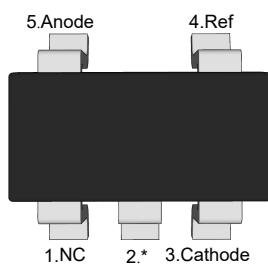
(Top View)

SOT-89



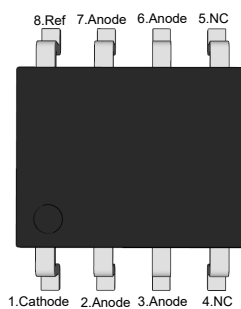
(Top View)

SOT-23-5



(Top View)

SOP-8



(Top View)

NC: No internal connection
 *: Attached to substrate and must be connected to Anode or left open



Ordering Information

TL431K□□

- └ Package Type
 - (Blank): SOT-23
 - SC: SOT-23-3
 - SQ: SOT-89
 - SE: SOT-23-5
 - PA: SOP-8

- └ V_{REF} tolerance
 - (Blank): 1%
 - A: 0.5%
 - B: 0.4%

Orderable Device	Voltage Tolerance	Package	Reel (inch)	Package Qty (PCS)	Eco Plan ^{Note}	MSL Level	Marking Code
TL431K	1%	SOT-23	7	3000	RoHS & Green	MSL1	431K
TL431KA	0.5%	SOT-23	7	3000	RoHS & Green	MSL1	431KA
TL431KB	0.4%	SOT-23	7	3000	RoHS & Green	MSL1	431KB
TL431KSC	1%	SOT-23-3	7	3000	RoHS & Green	MSL3	431KC
TL431KASC	0.5%	SOT-23-3	7	3000	RoHS & Green	MSL3	431KAC
TL431KBSC	0.4%	SOT-23-3	7	3000	RoHS & Green	MSL3	431KBC
TL431KSQ	1%	SOT-89	7 / 13	1000 / 3000	RoHS & Green	MSL1	431K
TL431KASQ	0.5%	SOT-89	7 / 13	1000 / 3000	RoHS & Green	MSL1	431KA
TL431KBSQ	0.4%	SOT-89	7 / 13	1000 / 3000	RoHS & Green	MSL1	431KB
TL431KSE	1%	SOT-23-5	7	3000	RoHS & Green	MSL3	431KE
TL431KASE	0.5%	SOT-23-5	7	3000	RoHS & Green	MSL3	431KAE
TL431KBSE	0.4%	SOT-23-5	7	3000	RoHS & Green	MSL3	431KBE
TL431KPA	1%	SOP-8	13	4000	RoHS & Green	MSL3	431KP
TL431KAPA	0.5%	SOP-8	13	4000	RoHS & Green	MSL3	431KAP
TL431KBPA	0.4%	SOP-8	13	4000	RoHS & Green	MSL3	431KBP

Note:

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

**Absolute Maximum Ratings** (Ta=25°C unless otherwise specified)

Parameter	Symbol	Value	Units
Cathode Voltage	V _{KA}	37	V
Cathode Current Range(Continuous)	I _{KA}	-100 ~ +150	mA
Reference Input Current Range	I _{REF}	-0.05 ~ +10	mA
Operating Temperature	T _{OPR}	-40 ~ +125	°C
Storage Temperature Range	T _{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

Recommended Operating Conditions

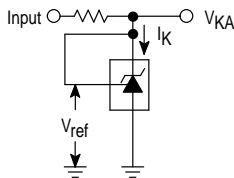
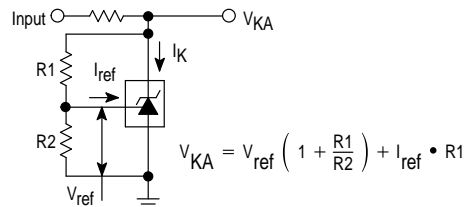
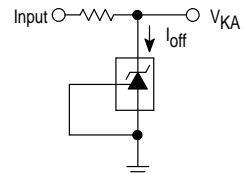
Parameter	Symbol	Min.	Max.	Units
Cathode Voltage	V _{KA}	V _{REF}	36	V
Cathode Current	I _{KA}	0.5	100	mA

Thermal Information

Parameter	Symbol	Value		Units
Junction-to-Ambient thermal resistance	R _{θJA}	SOT-23	416	°C/W
		SOT-23-3	416	°C/W
		SOT-23-5	416	°C/W
		SOT-89	156	°C/W
		SOP-8	208	°C/W

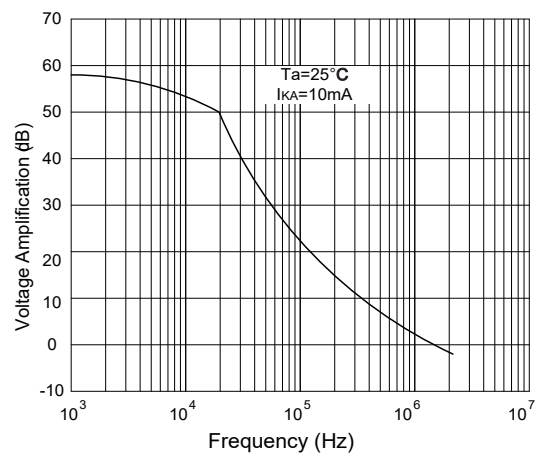
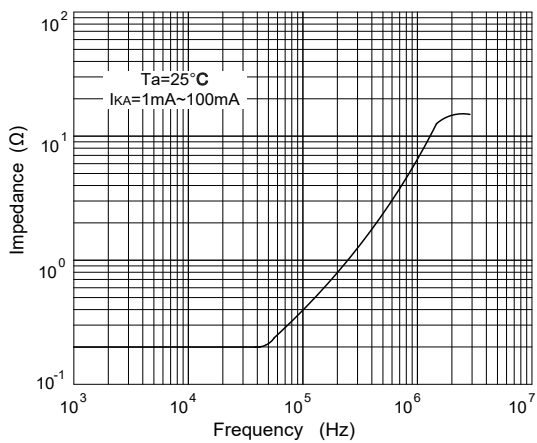
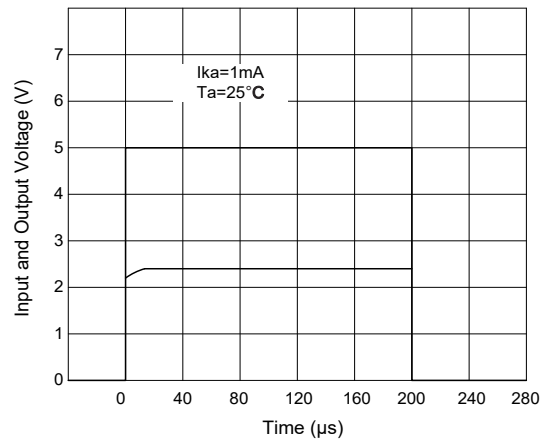
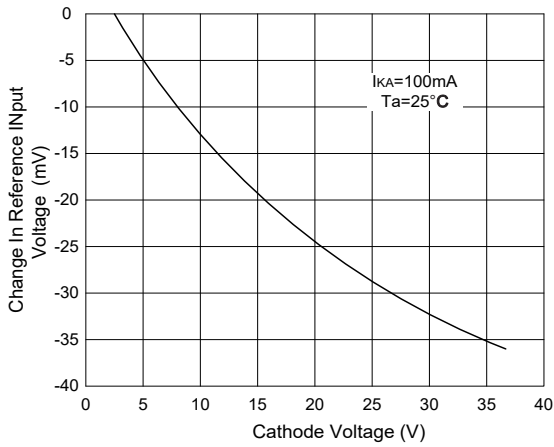
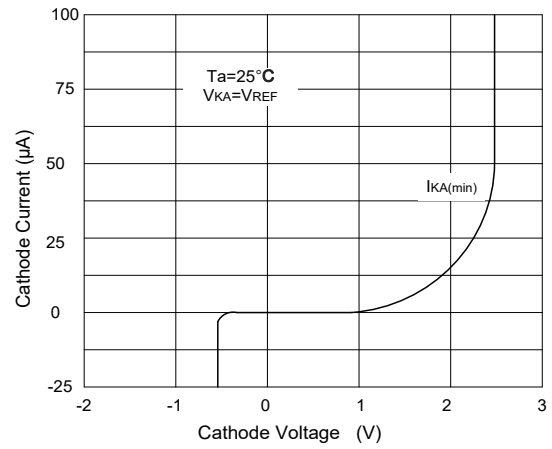
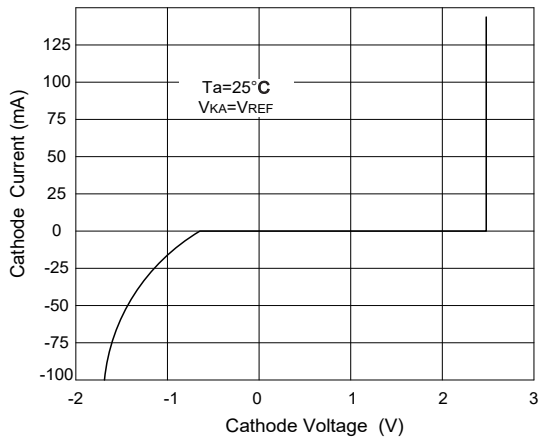
Electrical Characteristics (Ta=25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
Reference Input Voltage Fig1	V _{REF}	V _{KA} =V _{REF} , I _{KA} =10mA	1%(Accuracy)	2.470	2.495	2.520	V
			0.5%(Accuracy)	2.483	2.495	2.507	V
			0.4%(Accuracy)	2.485	2.495	2.505	V
Deviation of Reference Input Voltage Over Temperature Fig1	ΔV _{REF}	V _{KA} =V _{REF} , I _{KA} =10mA T _{MIN} ≤ T _A ≤ T _{MAX}	--	--	25	mV	
Ratio of Change in Reference Input Voltage to The Change in Cathode Voltage Fig2	$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	I _{KA} =10mA	ΔV _{KA} =10V~V _{REF}	--	-1.0	-2.7	mV/V
			ΔV _{KA} =36V~10V	--	-1.0	-2.0	
Reference Input Current Fig2	I _{REF}	I _{KA} =10mA, R1=10KΩ, R2=∞	--	1	2	μA	
Deviation of Reference Input Current Over Full Temperature Range Fig2	ΔI _{REF}	I _{KA} =10mA, R1=10KΩ, R2=∞, T _A =full Temperature	--	0.2	0.4	μA	
Minimum Cathode Current for Regulation Fig1	I _{KA(MIN)}	V _{KA} =V _{REF}	--	50	85	μA	
Off-State Cathode Current Fig3	I _{KA(OFF)}	V _{KA} =36V, V _{REF} =0	--	0.05	0.5	μA	
Dynamic Impedance	Z _{KA}	V _{KA} =V _{REF} , I _{KA} =1~100mA, f≤1.0KHz	--	--	0.5	Ω	

Figure 1. Test Circuit for V_{KA} = V_{REF}

Figure 2. Test Circuit for V_{KA} > V_{REF}

Figure 3. Test Circuit for I_{OFF}




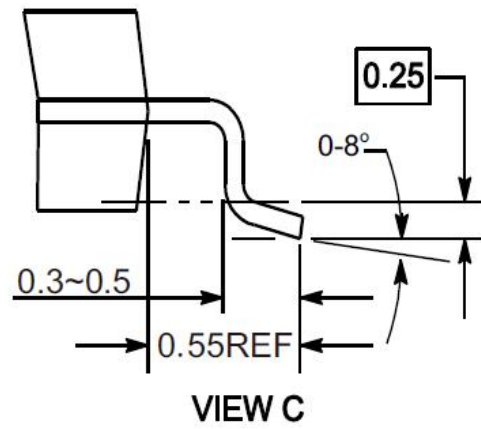
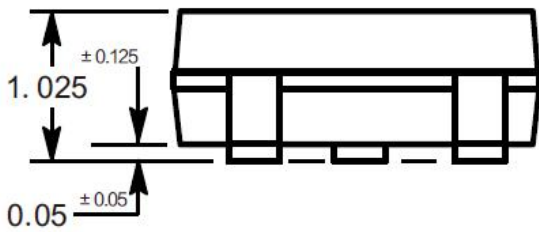
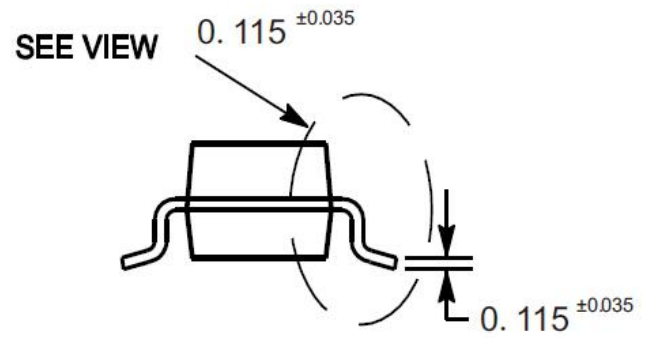
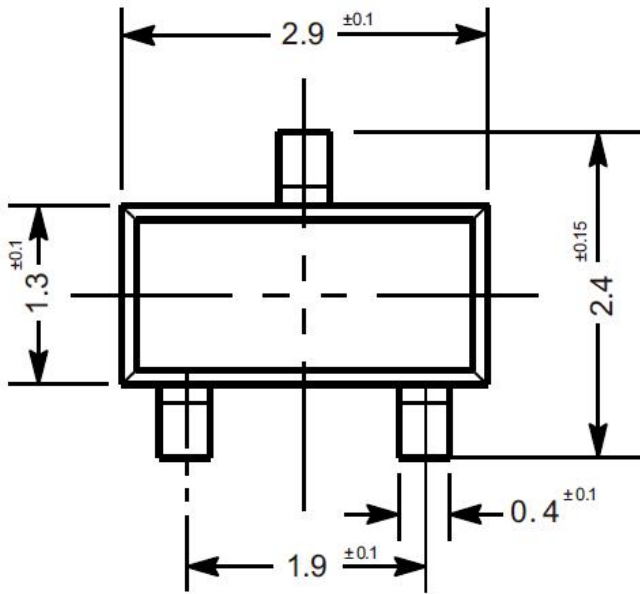
Typical Characteristic Curves



Package Outline

SOT-23

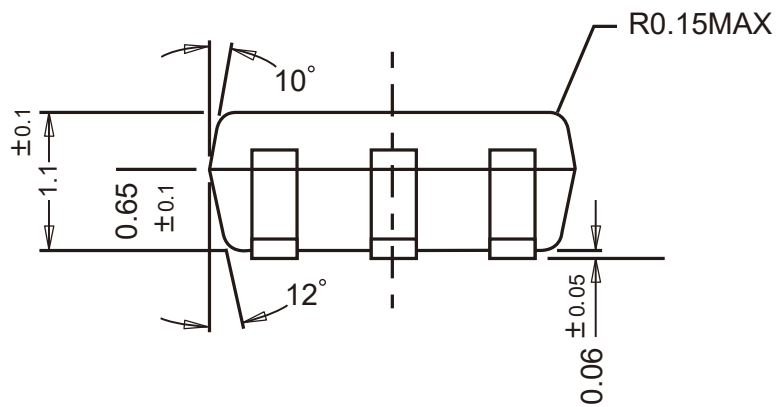
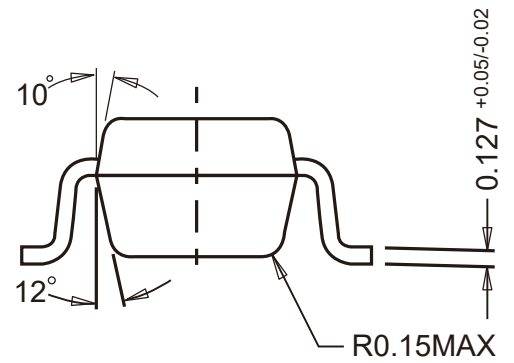
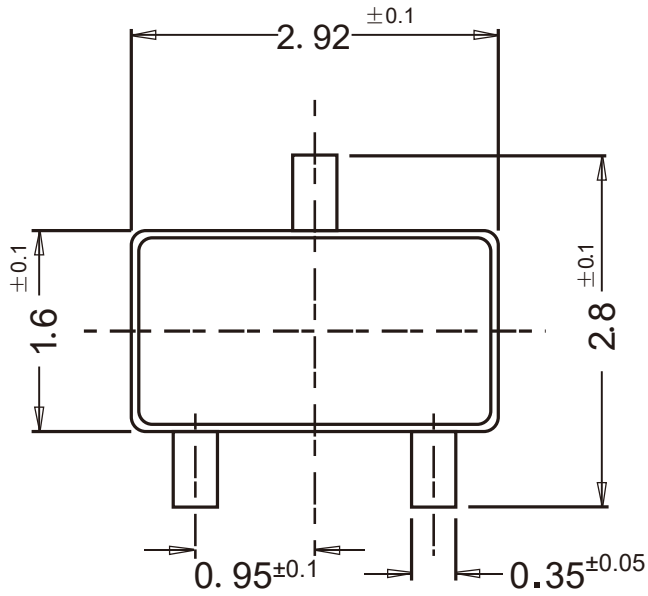
Dimensions in mm



Package Outline

SOT-23-3

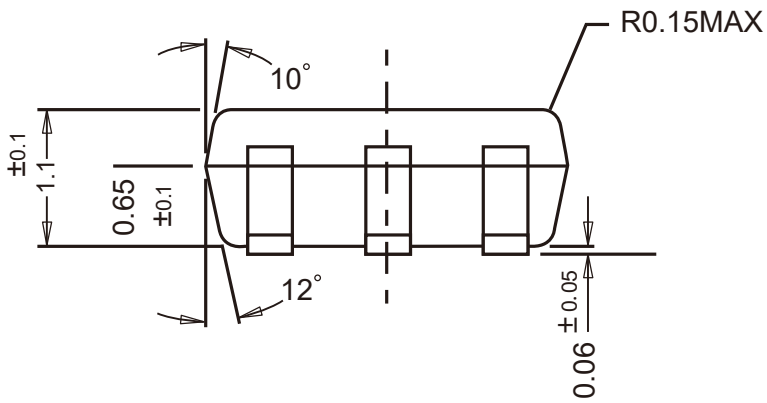
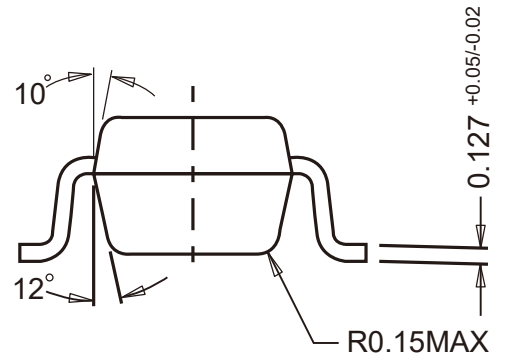
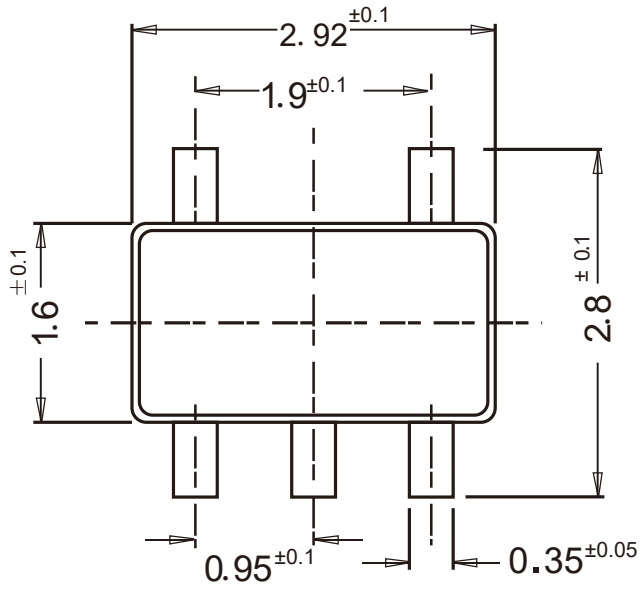
Dimensions in mm



Package Outline

SOT-23-5

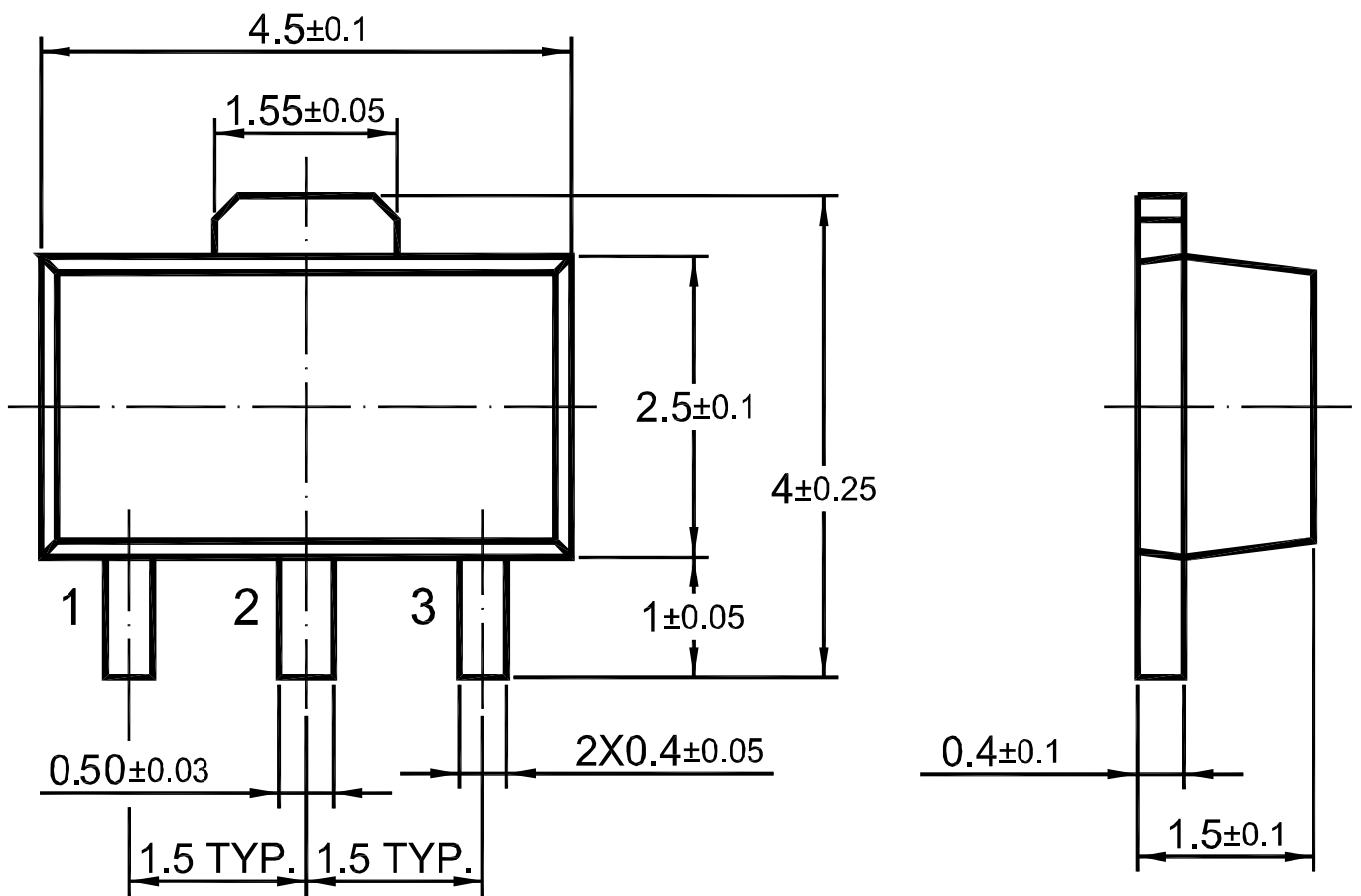
Dimensions in mm



Package Outline

SOT-89

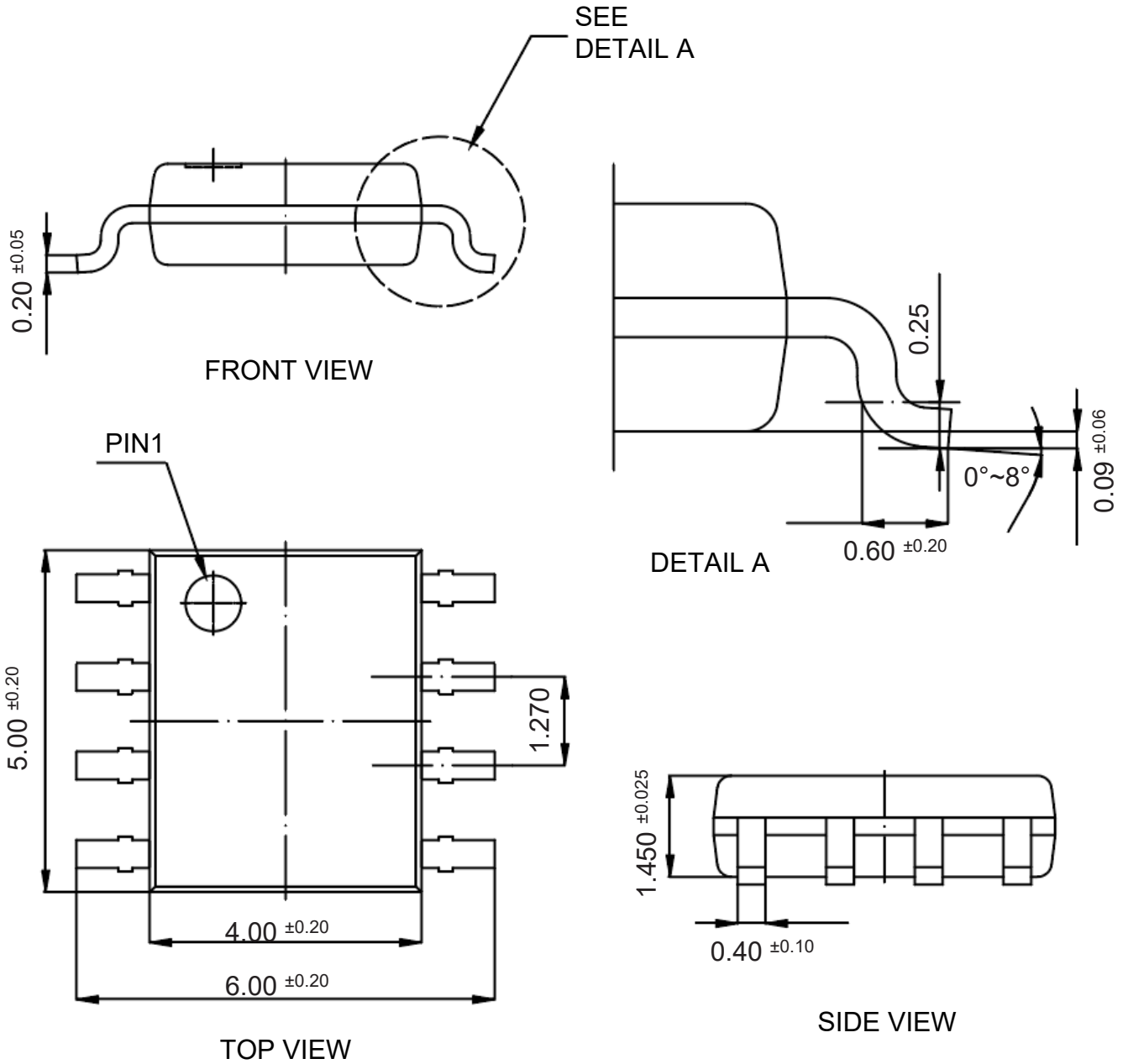
Dimensions in mm



Package Outline

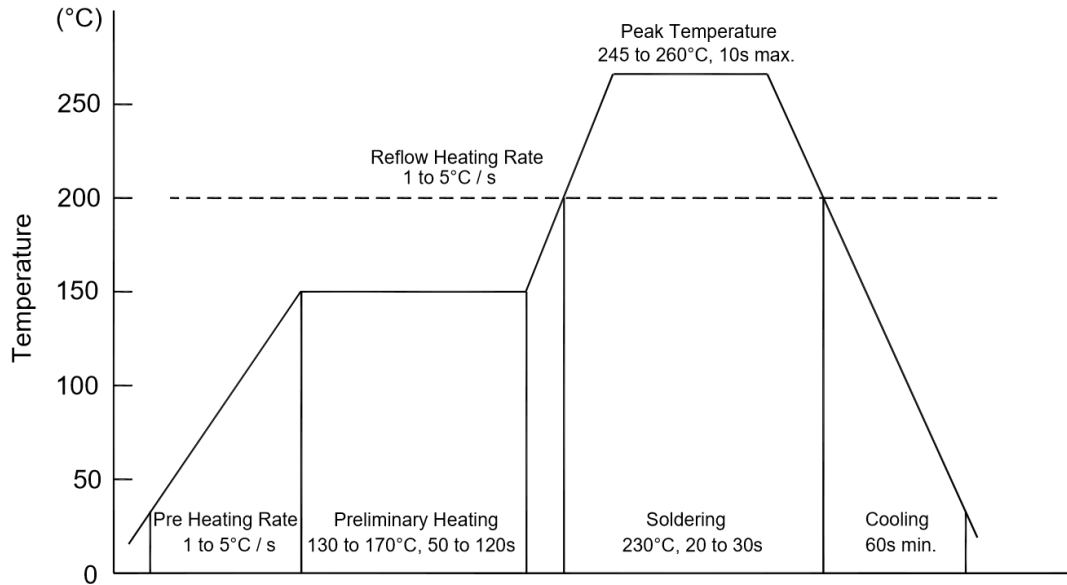
SOP-8

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

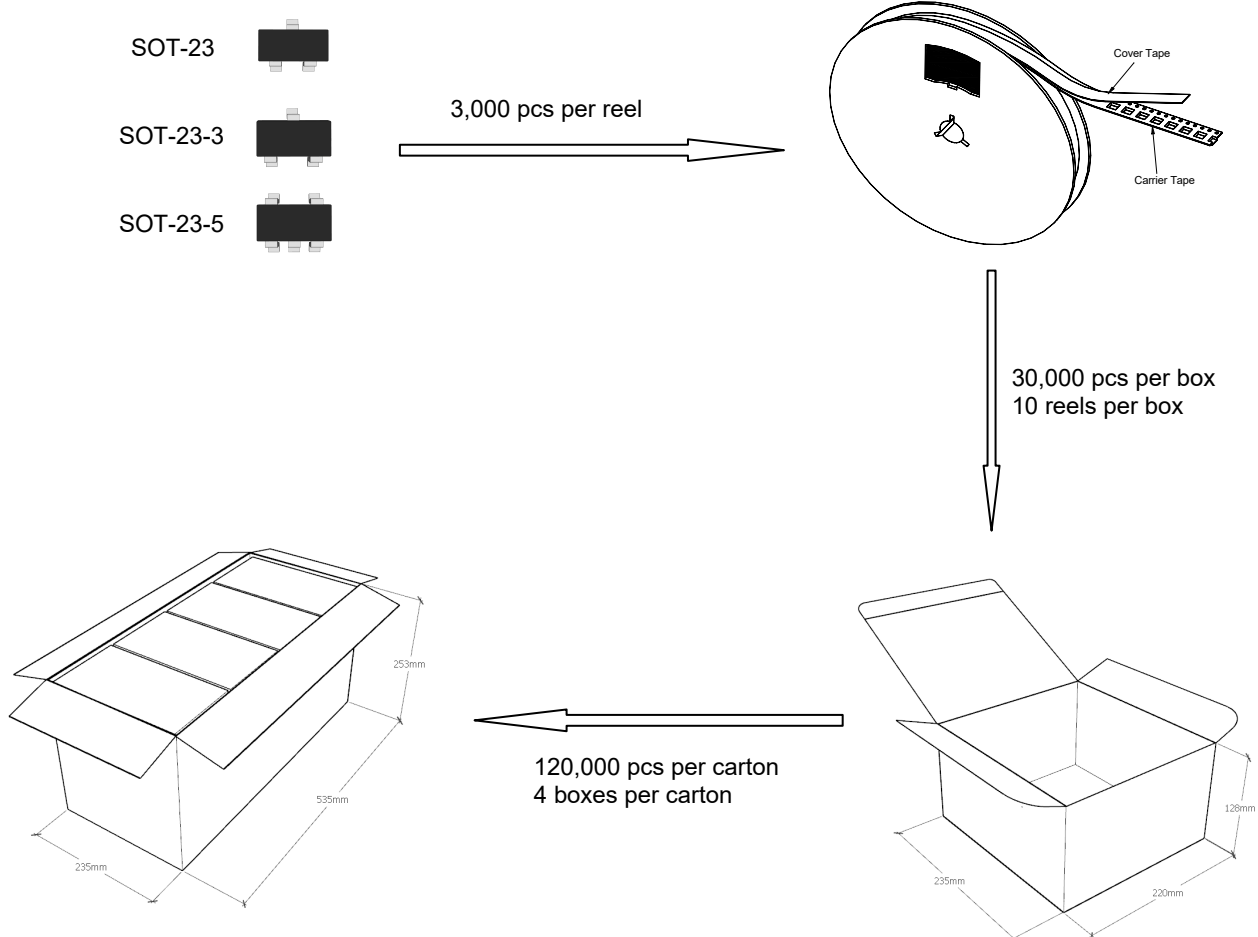
- Temperature: 300°C
- Time: 3s max.
- Times: one time

◆ Storage conditions

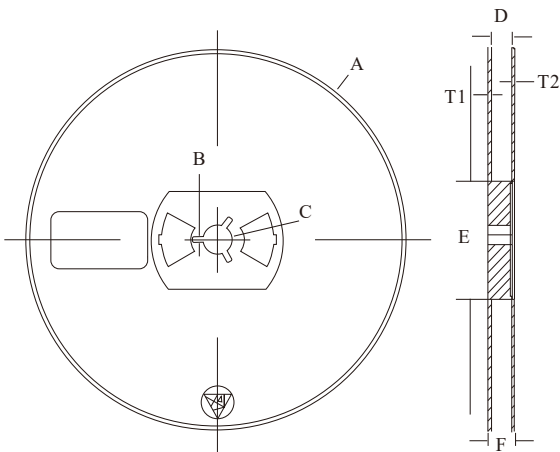
- **Temperature**
5 to 40°C
- **Humidity**
30 to 80% RH
- **Recommended period**
One year after manufacturing

Package Specifications (SOT-23/SOT-23-3/SOT-23-5)

- The method of packaging



◆ reel data

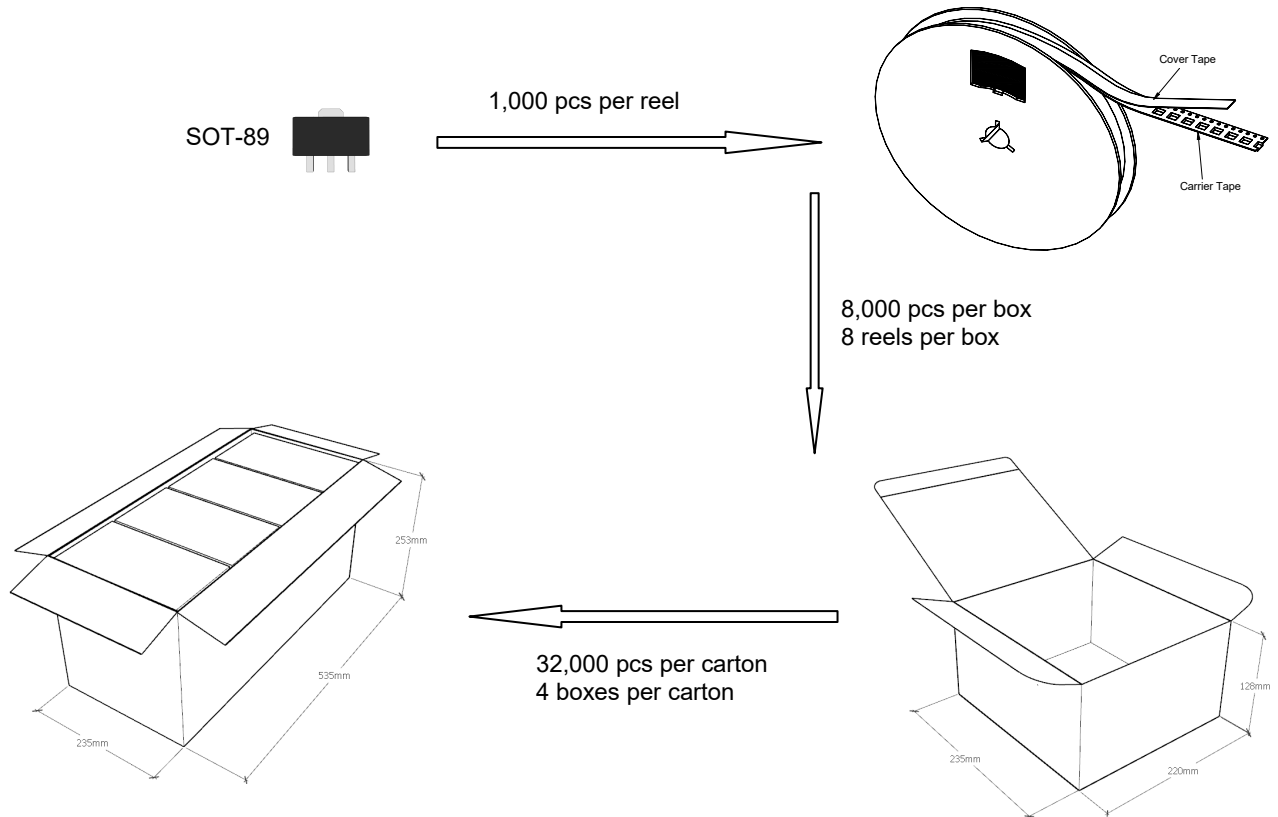


Reel (7")

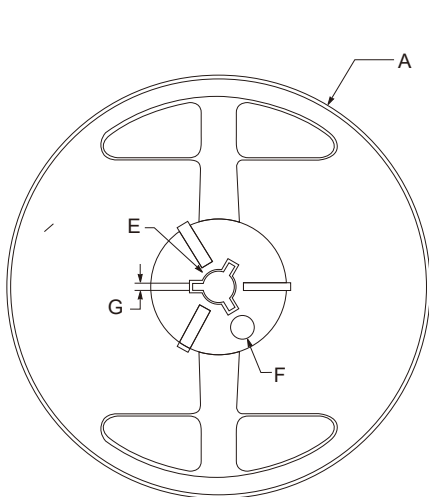
Symbol	Value (unit: mm)
A	Ø 177.8±1
B	2.7±0.2
C	Ø 13.5±0.2
E	Ø 54.5±0.2
F	12.3±0.3
D	9.6+2/-0.3
T1	1.0±0.2
T2	1.2±0.2

Package Specifications (SOT-89)

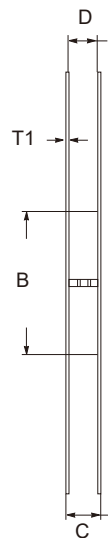
- The method of packaging (1,000PCS/Reel&7inches)



◆ reel data



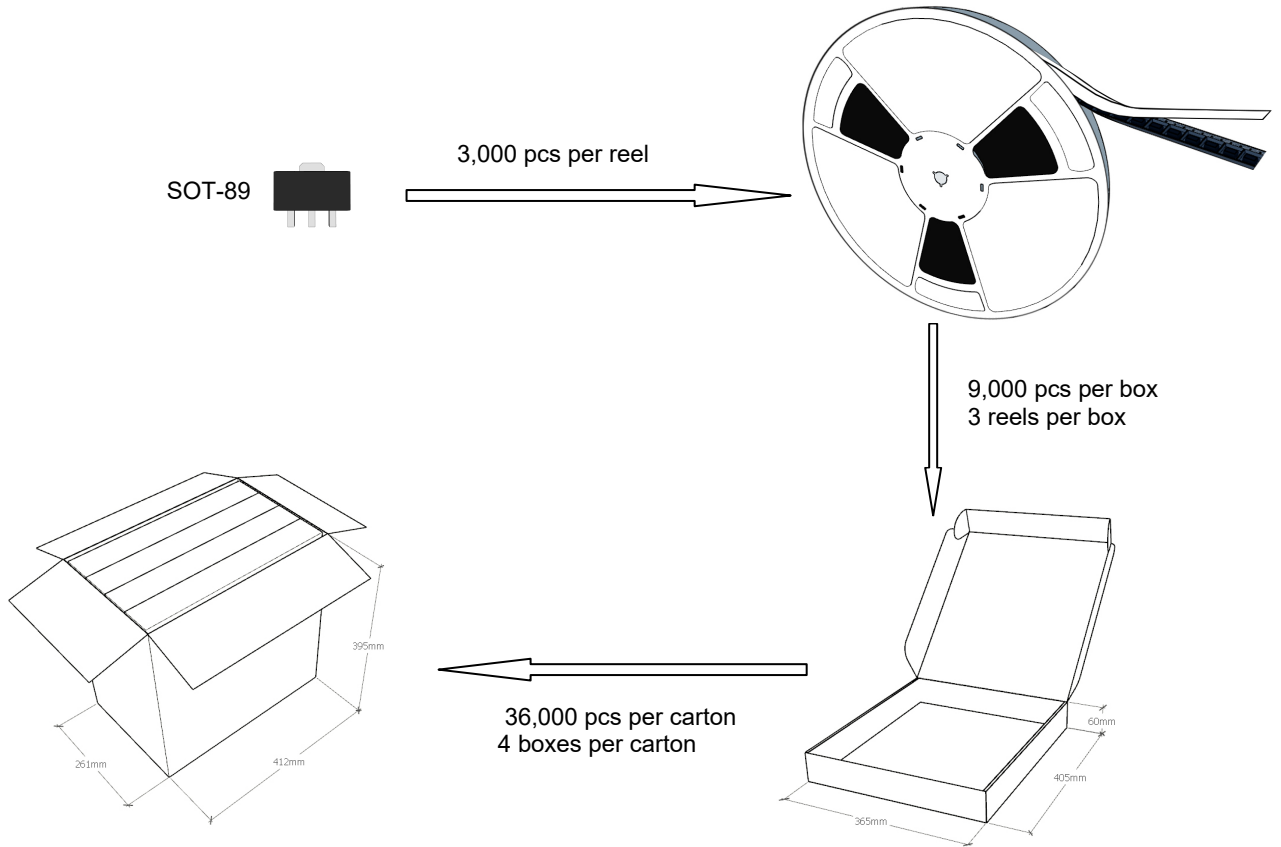
Reel (7")



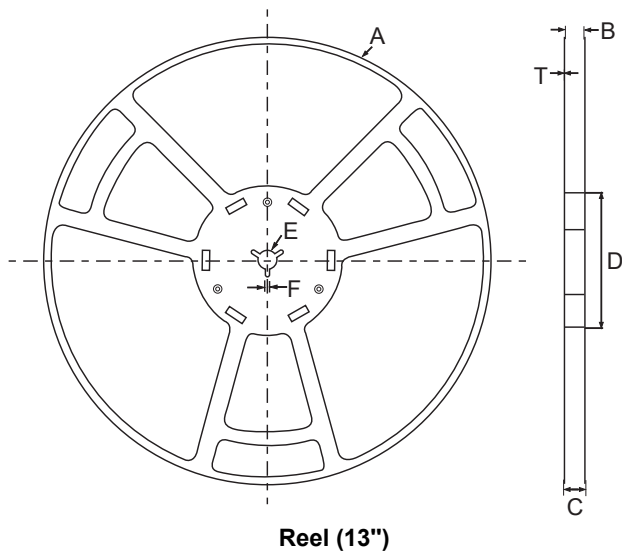
symbol	Value(unit:mm)
A	$\Phi 179 \pm 1$
B	60.5 ± 0.2
C	15.3 ± 0.3
D	12.5~13.7
E	$\Phi 13.5 \pm 0.2$
F	$\Phi 10.0 \pm 0.2$
G	2.7 ± 0.2
T1	1.0 ± 0.2

Package Specifications (SOT-89)

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



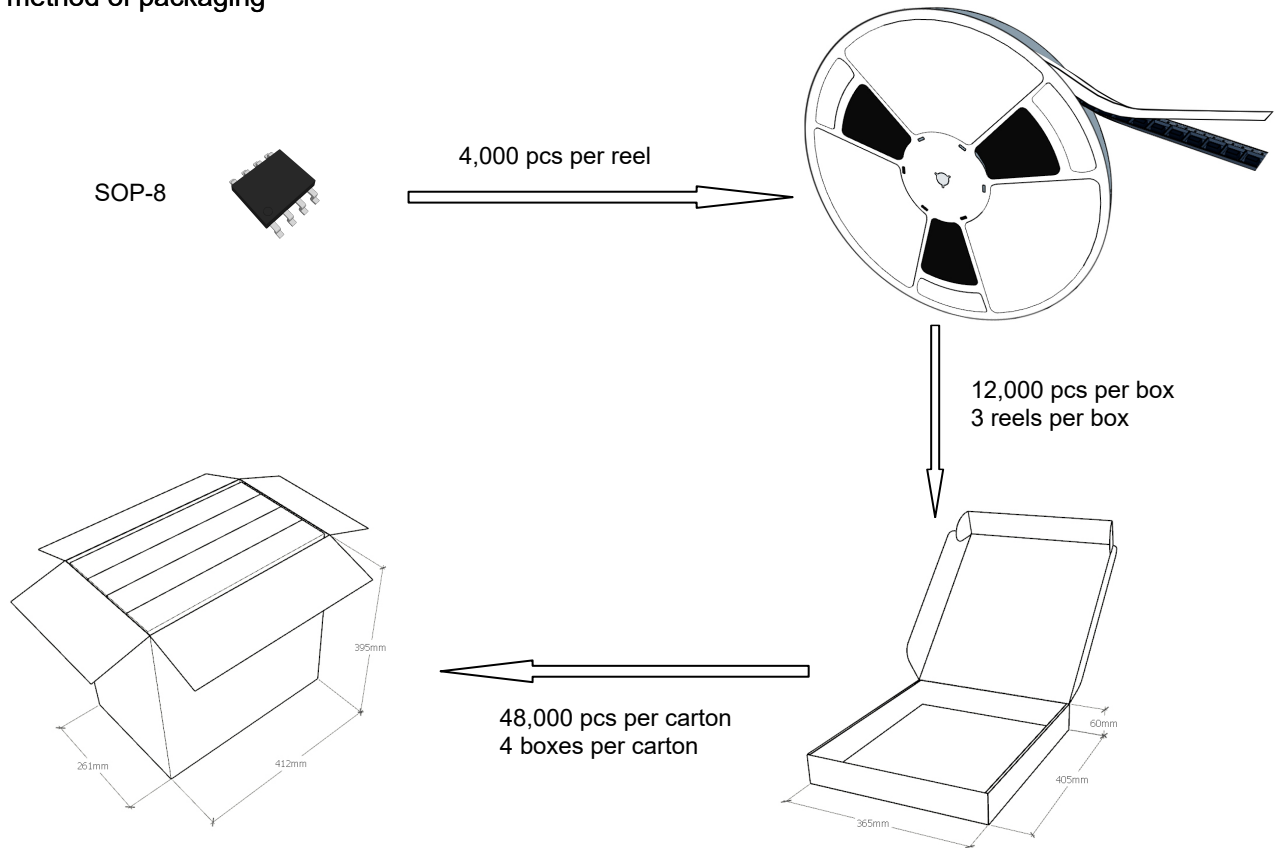
◆ reel data



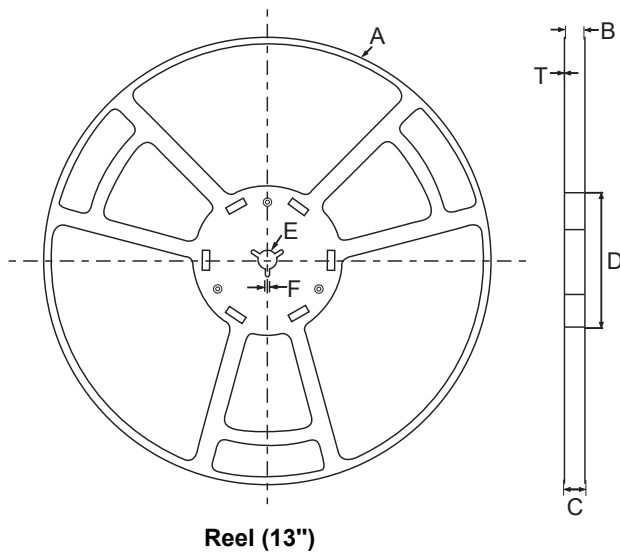
symbol	Value(unit:mm)
A	$\phi 330\pm 1$
B	12.7 ± 0.5
C	16.5 ± 0.3
D	$\phi 99.5\pm 0.5$
E	$\phi 13.6\pm 0.3$
F	2.8 ± 0.3
T	1.9 ± 0.2

Package Specifications (SOP-8)

- The method of packaging



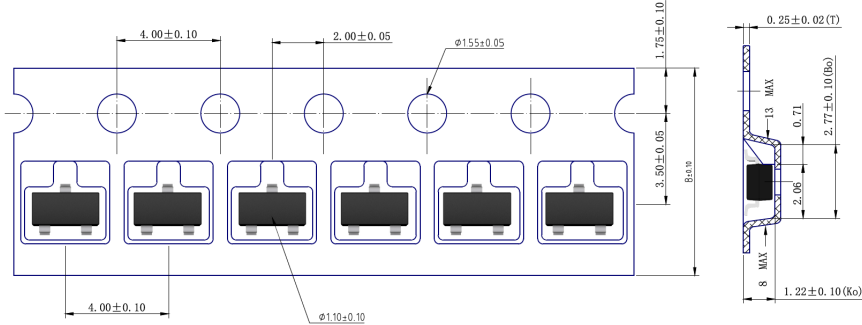
◆ Embossed tape and reel data



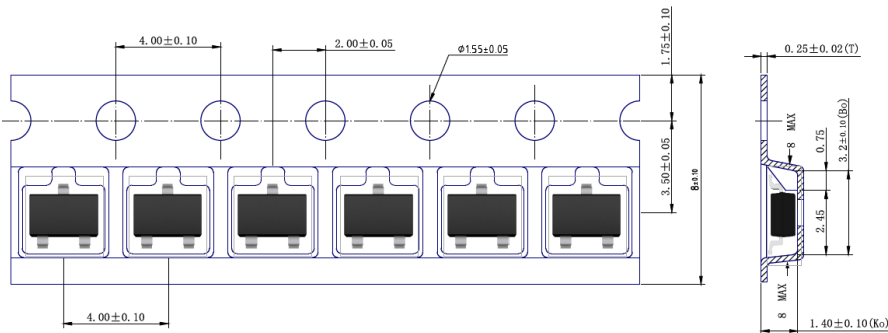
symbol	Value(unit:mm)
A	$\phi 330\pm 1$
B	12.7 ± 0.5
C	16.5 ± 0.3
D	$\phi 99.5\pm 0.5$
E	$\phi 13.6\pm 0.3$
F	2.8 ± 0.3
T	1.9 ± 0.2

◆ Embossed tape data

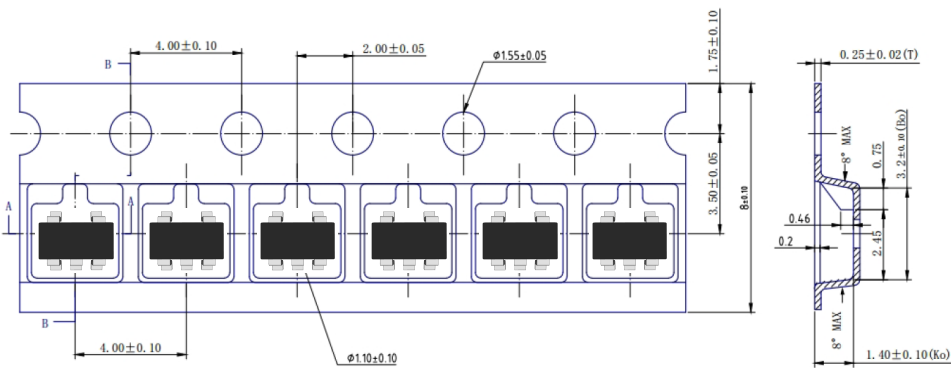
SOT-23



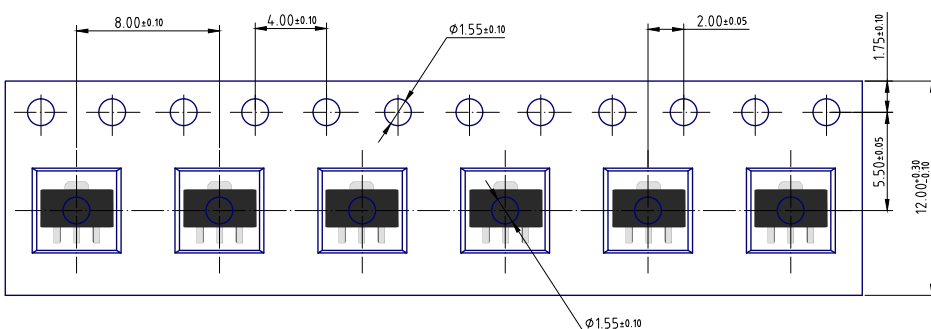
SOT-23-3



SOT-23-5



SOT-89



◆ Embossed tape data

SOP-8

