

Description

The TL431 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 devices excellent replacement for zener diodes in many applications..

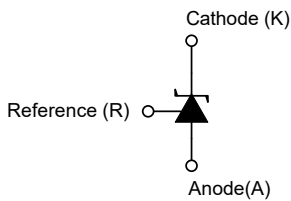
Feature

- Wide programmable output voltage from 2.495V to 36V
- Sink current capability from 1mA to 100mA.
- Low output noise
- Wide Operating Range of -40 to 125°C

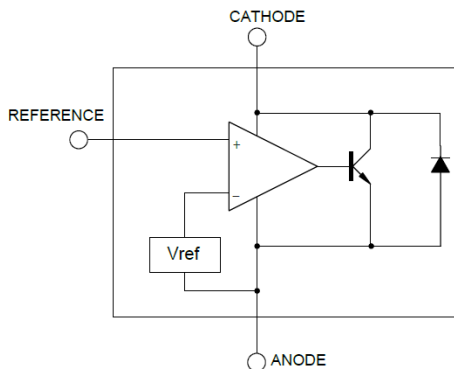
Application

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

Schematic diagram

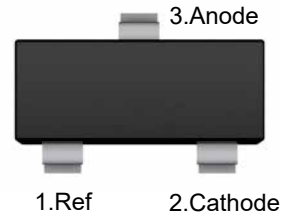


Functional block diagram

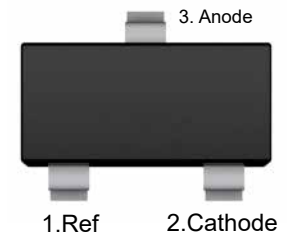


Programmable Precision Referenc

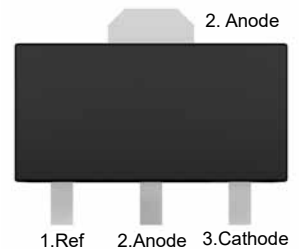
SOT-23



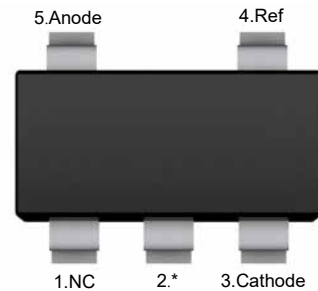
SOT-23-3



SOT-89

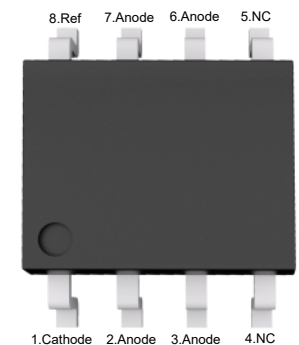


SOT-23-5



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

SOP-8



NC: No internal connection

Ordering Information

TL431-□ □

└─ 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
TL431	1%	SOT-23	7	3000	RoHS & Green	MSL1	431
TL431A	0.5%	SOT-23	7	3000	RoHS & Green	MSL1	431A
TL431B	0.4%	SOT-23	7	3000	RoHS & Green	MSL1	431B
TL431SC	1%	SOT-23-3	7	3000	RoHS & Green	MSL3	431
TL431ASC	0.5%	SOT-23-3	7	3000	RoHS & Green	MSL3	431A
TL431BSC	0.4%	SOT-23-3	7	3000	RoHS & Green	MSL3	431B
TL431SQ	1%	SOT-89	7 / 13	1000 / 3000	RoHS & Green	MSL1	TL431
TL431ASQ	0.5%	SOT-89	7 / 13	1000 / 3000	RoHS & Green	MSL1	TL431A
TL431BSQ	0.4%	SOT-89	7 / 13	1000 / 3000	RoHS & Green	MSL1	TL431B
TL431SE	1%	SOT-23-5	7	3000	RoHS & Green	MSL3	431E
TL431ASE	0.5%	SOT-23-5	7	3000	RoHS & Green	MSL3	431AE
TL431BSE	0.4%	SOT-23-5	7	3000	RoHS & Green	MSL3	431BE
TL431PA	1%	SOP-8	13	4000	RoHS & Green	MSL3	431P
TL431APA	0.5%	SOP-8	13	4000	RoHS & Green	MSL3	431AP
TL431BPA	0.4%	SOP-8	13	4000	RoHS & Green	MSL3	431BP

Note:

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.

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 Junction Temperature	T_J	150	°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}	1	100	mA
Operating Ambient Temperature Range	T_{OPR}	-40	125	°C

Thermal Information

Parameter	Symbol	Value		Units
Junction-to-Ambient thermal resistance	$R_{\theta JA}$	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	TL431(1%)	2.47	2.495	2.52	V
			TL431A(0.5%)	2.483	2.495	2.507	V
			TL431B(0.4%)	2.485	2.495	2.505	V
Deviation of Reference Input Voltage Over Temperature ^{Fig1}	ΔV _{REF}	V _{KA} =V _{REF} , I _{KA} =10mA -40°C ≤T _A ≤+85°C		--	4.5	17	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	--	-0.5	-2.0	
Reference Input Current ^{Fig2}	I _{REF}	I _{KA} =10mA, R1=10KΩ, R2=∞		--	1.5	4	μA
Deviation of Reference Input Current Over Full Temperature Range ^{Fig2}	ΔI _{REF}	I _{KA} =10mA, R1=10KΩ, R2=∞, -20°C ≤T _A ≤+85°C		--	0.4	1.2	μA
Minimum Cathode Current for Regulation ^{Fig1}	I _{KA(MIN)}	V _{KA} =V _{REF}		--	0.45	1	mA
Off-State Cathode Current ^{Fig3}	I _{KA(OFF)}	V _{KA} =36V, V _{REF} =0		--	0.05	1.0	μA
Dynamic Impedance	Z _{KA}	V _{KA} =V _{REF} , I _{KA} =1~ 100mA, f≤1.0KHz		--	0.15	0.5	Ω

Figure 1. Test Circuit for VKA = VREF

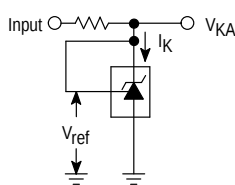


Figure 2. Test Circuit for VKA > VREF

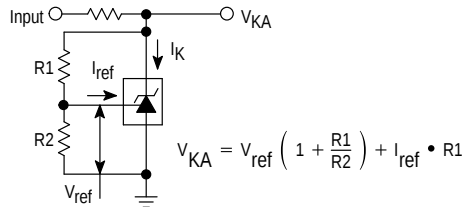
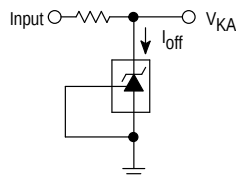
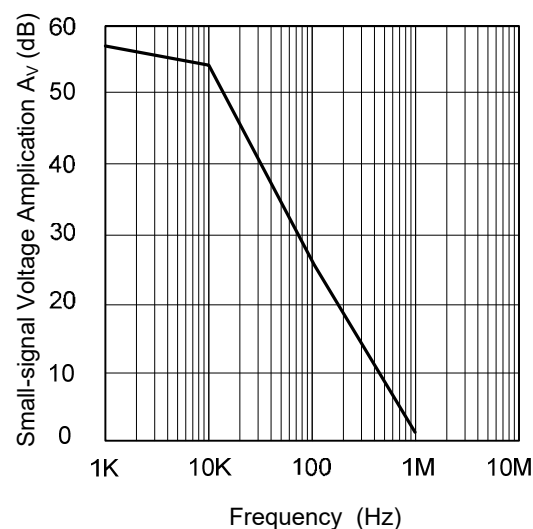
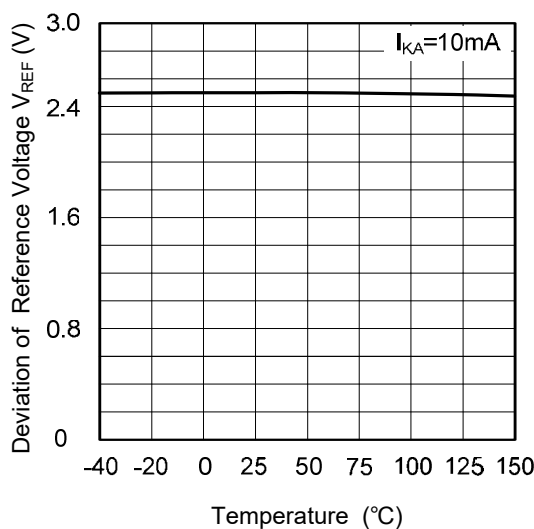
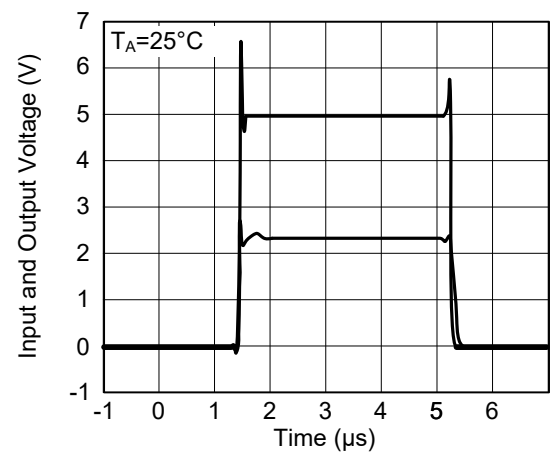
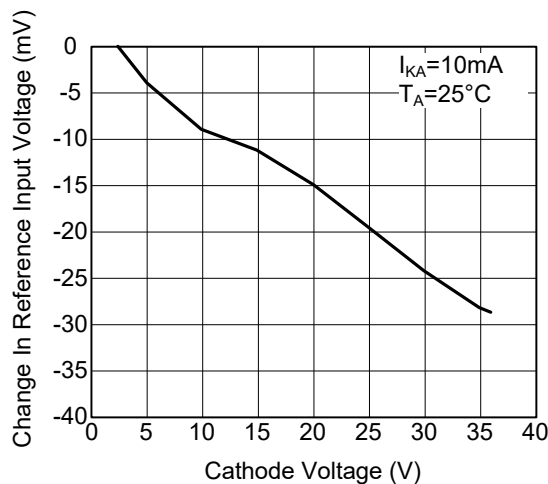
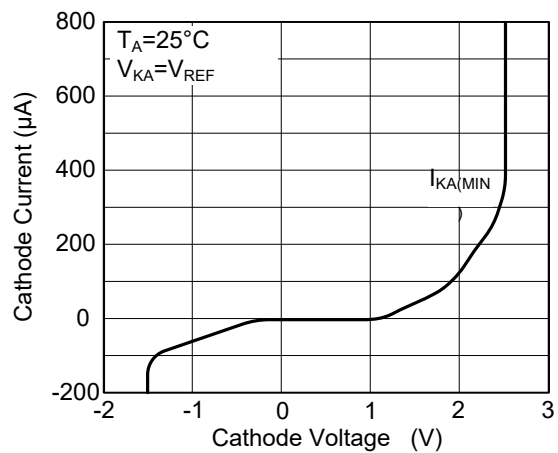
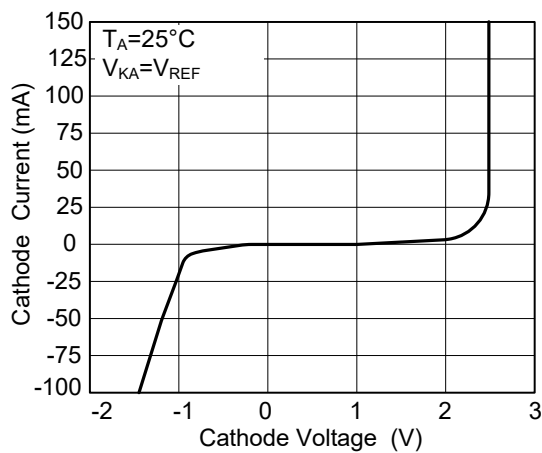


Figure 3. Test Circuit for IOFF



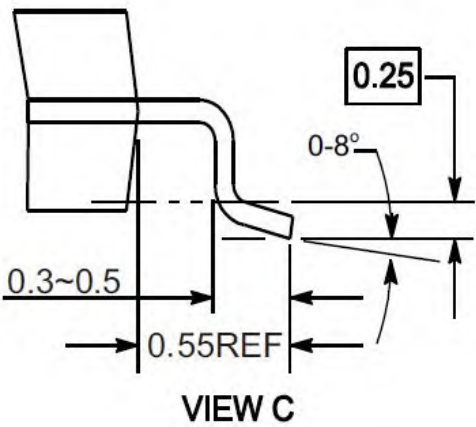
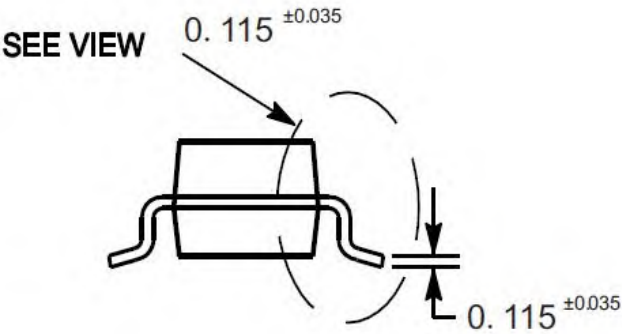
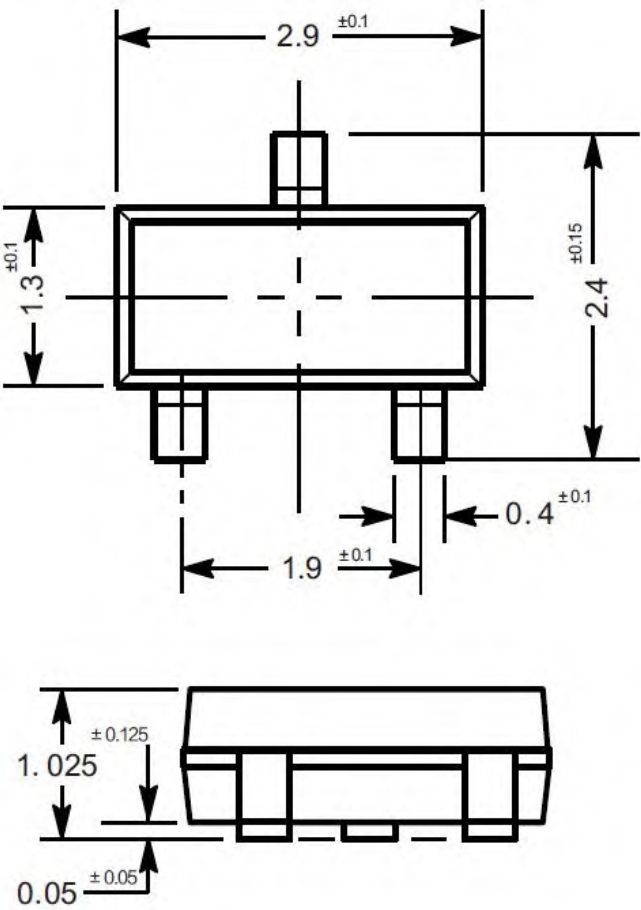
Typical Characteristic Curves



Package Outline

SOT-23

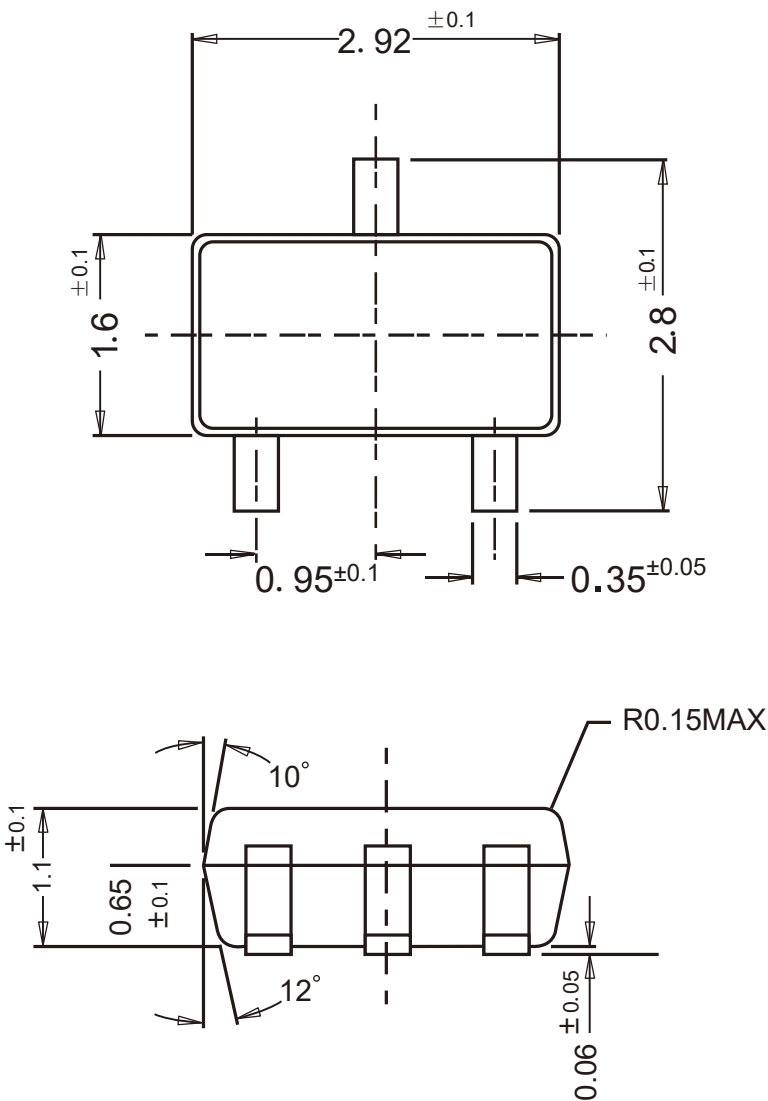
Dimensions in mm



Package Outline

SOT-23-3

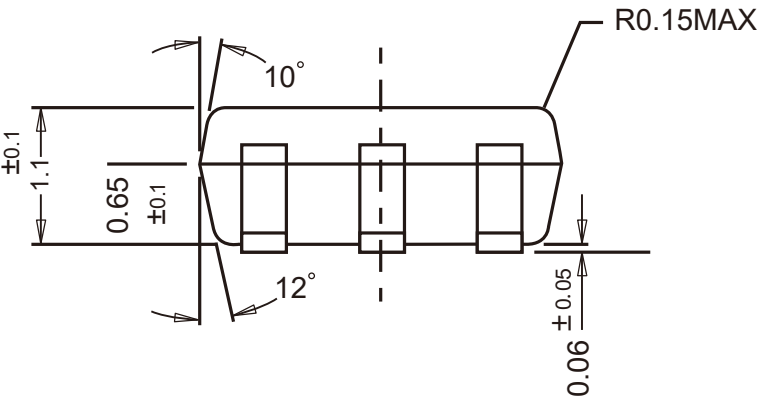
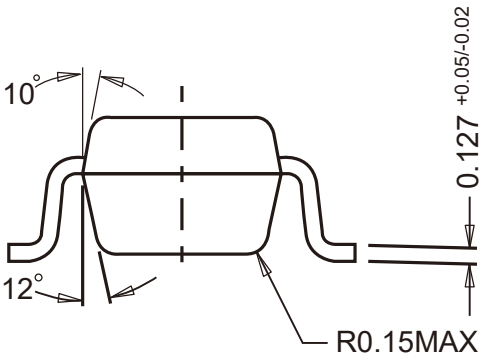
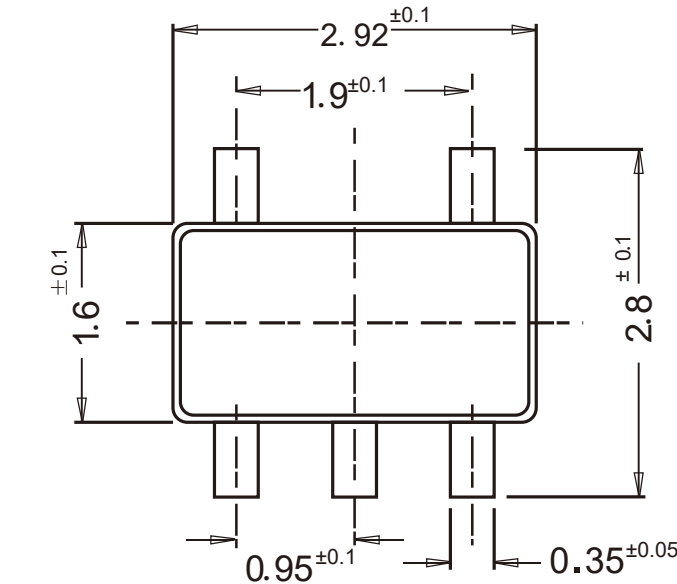
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Package Outline

SOT-23-5

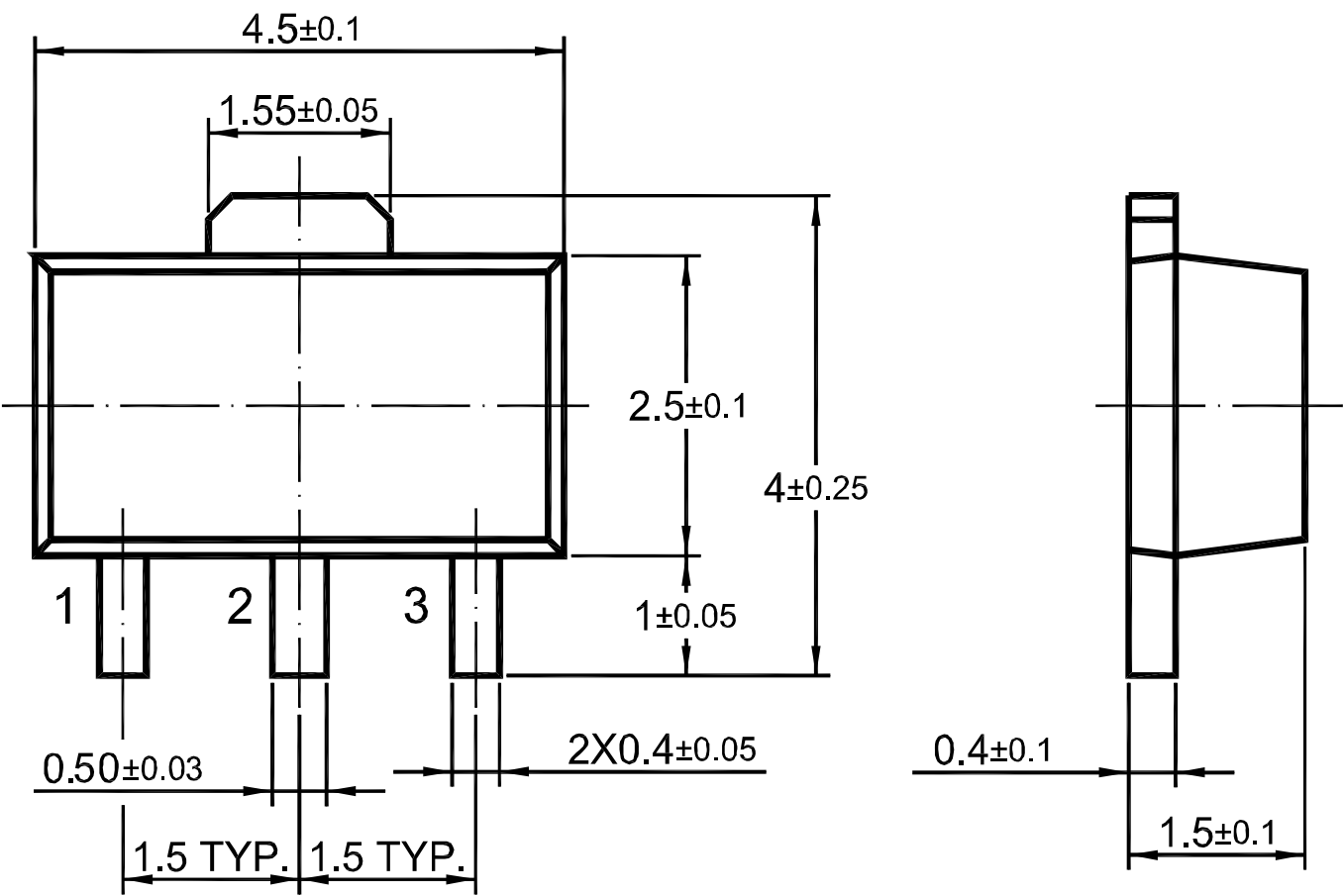
Dimensions in mm



Package Outline

SOT-89

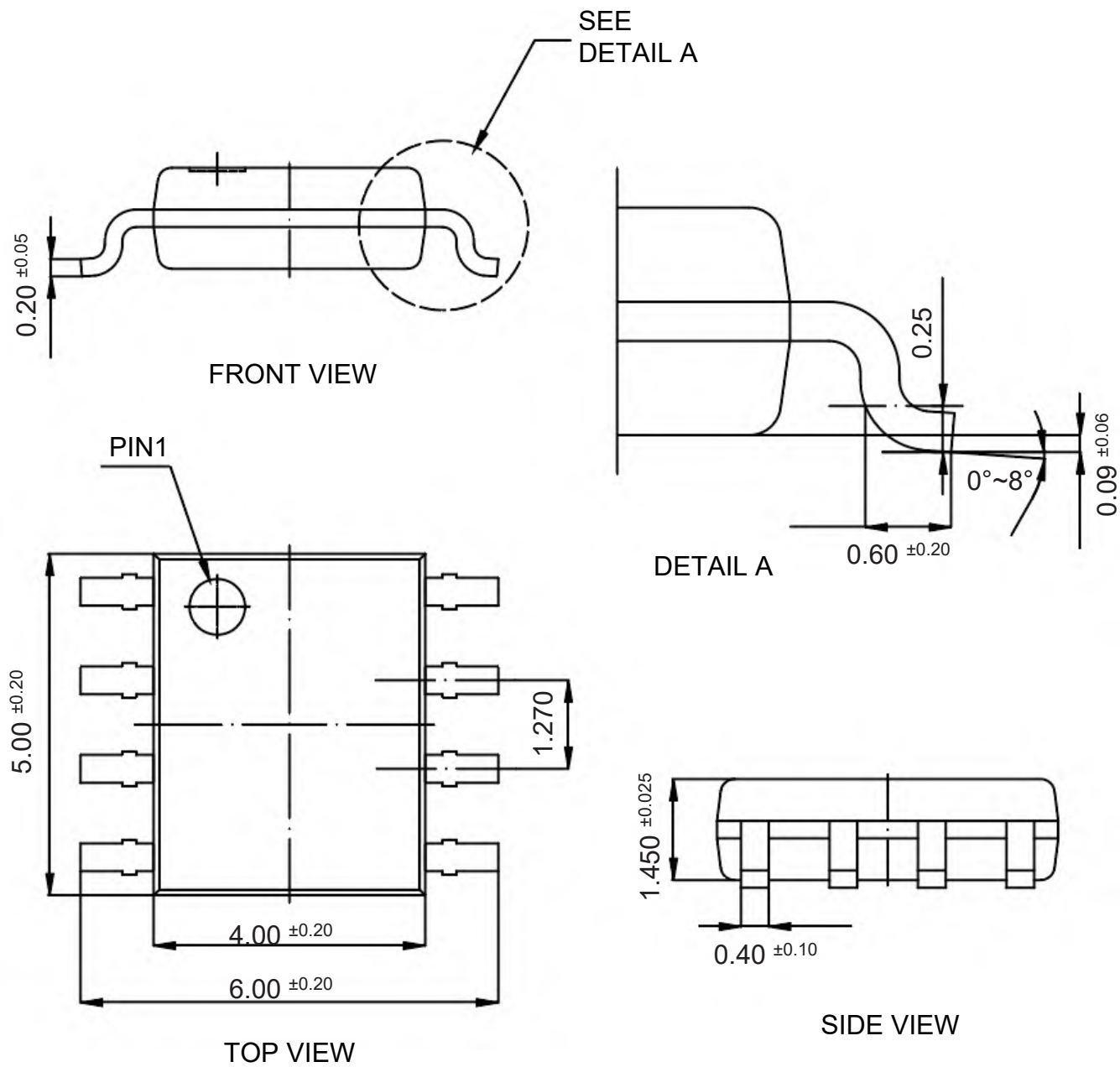
Dimensions in mm



Package Outline

SOP-8

Dimensions in mm



Contact Information

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For additional information, please contact your local Sales Representative.

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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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