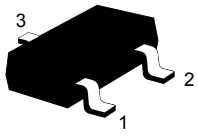
life.augmented

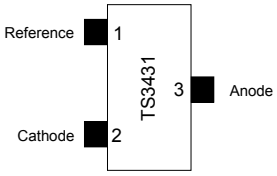
TS3431

Datasheet

1.24 V adjustable shunt voltage reference



SOT23-3L
(Plastic micropackage)



SOT23-3L
(top view)

Maturity status link
TS3431

Features

- Adjustable output voltage: 1.24 to 24 V
- Several precision levels @ 25 °C ± 2%, ± 1%, ± 0.5% and ± 0.25%
- Sink current capability: 0.4 to 100 mA
- Industrial temperature range: - 40 °C to + 105 °C
- Performance compatible with industry standard TL431

Applications

- Computers
- Instrumentation
- Battery chargers
- Switch mode power supply
- Battery operated equipment

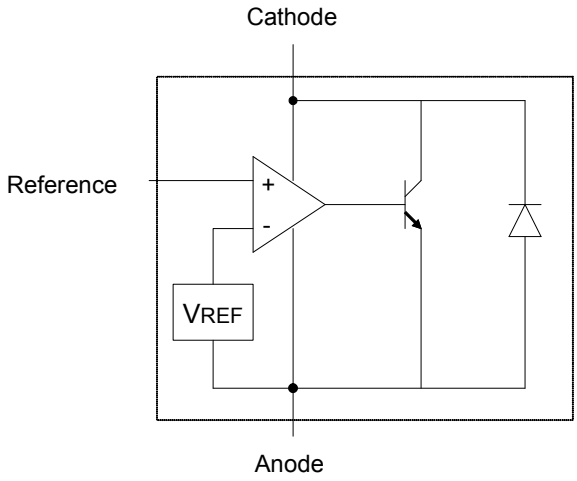
Description

The TS3431 is an adjustable shunt voltage reference with guaranteed temperature stability over the entire operating temperature range (- 40 °C to + 125 °C). The output voltage can be set to any value between 1.24 V and 24 V with an external resistor bridge.

Available in SOT23-3 surface mount package, it can be used in application designs where space saving is critical.

1 Diagram

Figure 1. **Block diagram**



2 Maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{ka}	Cathode to anode voltage	25	V
I_K	Reverse breakdown current	-100 to +150	mA
I_{REF}	Reference input current range	0.05 to +10	mA
P_d	Power dissipation SOT23-3L (1).	360	mW
T_{stg}	Storage temperature	-65 to +150	°C
ESD	Human body model (HBM)	2	kV
	Machine model (MM)	200	V
T_{LEAD}	Lead temperature (soldering, 10 seconds)	250	°C

1. *P_d is calculated with T_{amb} = 25 °C, T_j = 150 °C, R_{thjc} = 110 °C/W, R_{thja} = 340 °C/W*

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
I_K	Cathode operating current	0.5 to 100	mA
V_K	Cathode operating voltage	1.24 to 24	V
T_{oper}	Operating free air temperature range	- 40 to + 105	°C

3 Electrical characteristics

Limits are 100% production tested at 25 °C. Behavior at the temperature range limits is guaranteed through correlation and by design. T_{amb} = 25 °C (unless otherwise specified).

Table 3. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_K	Reference input voltage I_K = 10 mA, $V_{KA} = V_{ref}$	TS3431 (2%)	1.215	1.24	1.265	V
		TS3431A (1%)	1.228		1.252	
		TS3431B (0.5%)	1.234		1.246	
		TS3431C (0.25%)	1.237		1.243	
ΔV_K	Variation of reference input voltage over temperature, $V_{ka} = V_{ref}$	0°C < T < +70 °C			10	mV
		-40°C < T < +105 °C			18	
		-40°C < T < +125 °C			21	
T_C	Temperature coefficient	-40 °C < T < +125 °C			100	ppm/°C
I_{Kmin}	Minimum operating current	T = 25 °C		0.35	0.4	mA
		-40°C < T < +125 °C			0.5	
$\left\lvert\frac{\Delta Vref}{\Delta Vka}\right\rvert$	Ratio of change in reference input voltage to change in cathode to anode voltage	I_K = 10 mA V_K = 24 to 1.24 V		1.2	1.5	mV/V
		-40°C < T < +125 °C			2	
I_{REF}	Reference input current I_K = 10 mA, R1 = 10 kΩ, R2 = + ∞	T = 25 °C		0.9	1.5	µA
		-40°C < T < +125 °C			2	
ΔI_{REF}	Reference input current deviation I_K = 10 mA, R1 = 10 kΩ, R2 = + ∞	0°C < T < +70 °C		0.5	1	µA
		-40°C < T < +125 °C		0.9	1.5	
I_{OFF}	Off-state cathode current V_K = 24 V	T=25 °C		35	500	nA
		-40°C < T < +105 °C			1000	
		-40°C < T < +125 °C			2000	
R_{KA}	Reverse static impedance	I_K = 1 to 100 mA		0.2	0.4	Ω
EN	Wideband noise	I_K = 10 mA 1 kHz < f < 100 kHz		100		nV/√Hz

3.1 Performance characteristics

Figure 2. Reference voltage vs. temperature

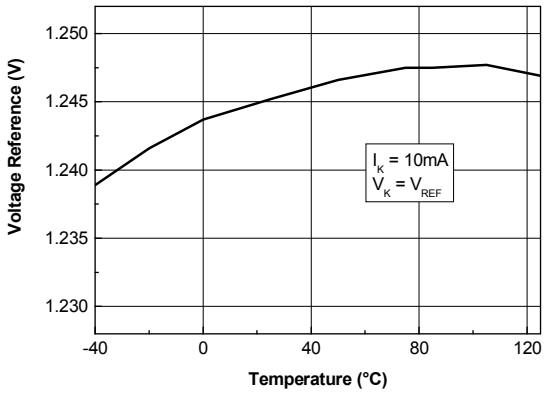


Figure 3. Test circuit for $V_K = V_{ref}$

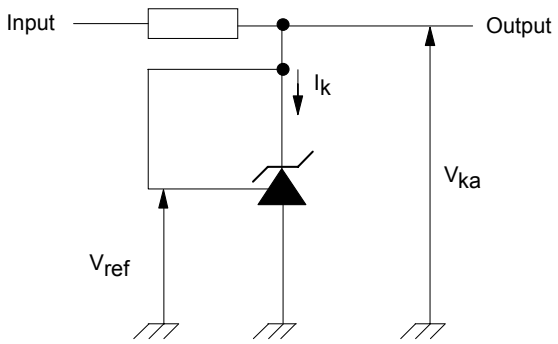


Figure 4. Cathode voltage vs. cathode current

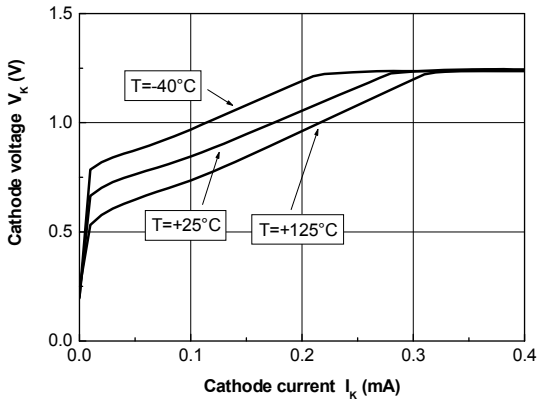


Figure 5. Minimum operating current vs. temperature

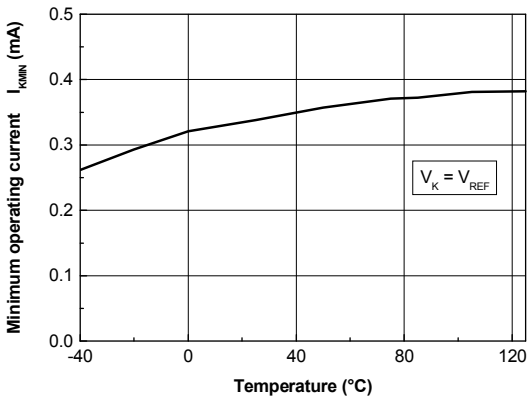


Figure 6. **Reference input current vs. temperature**

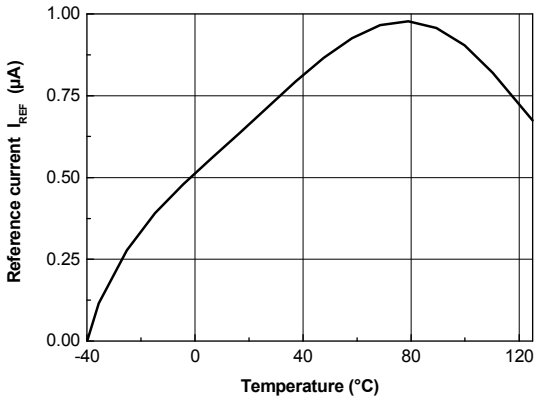


Figure 7. **Dynamic impedance vs. frequency**

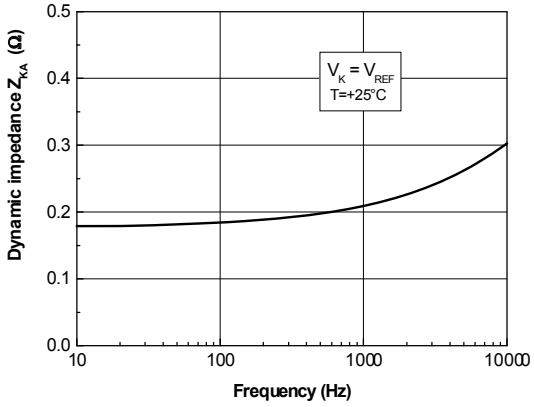


Figure 8. **Off-state current vs. temperature**

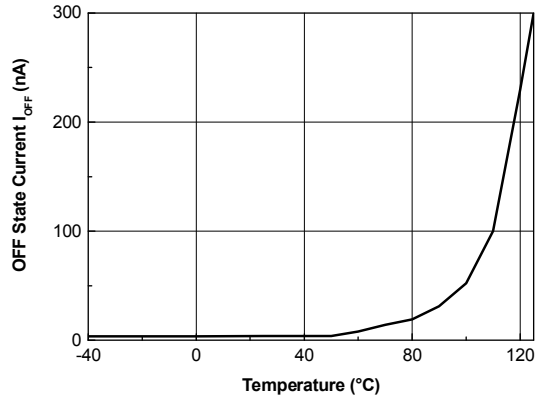


Figure 9. **Test circuit for off-state current measurement**

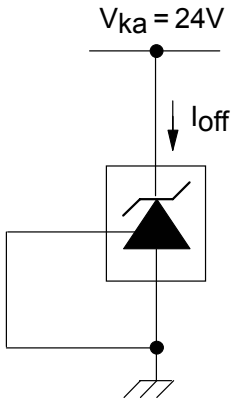


Figure 10. Ratio of change in reference input voltage to change in V_{KA} voltage vs. temperature

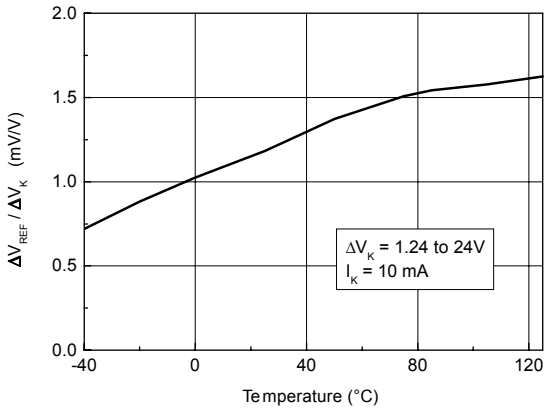


Figure 11. Test circuit for $V_K > V_{REF}$

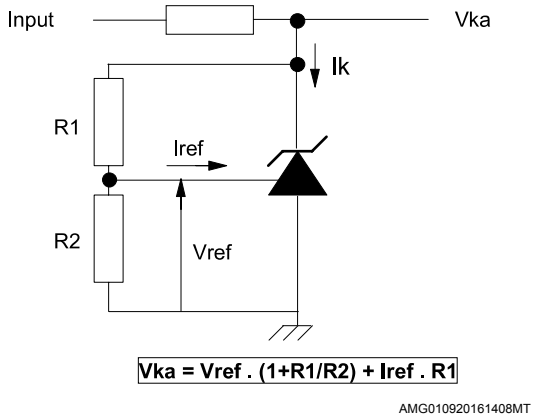


Figure 12. Pulse response at I_K = 1 mA

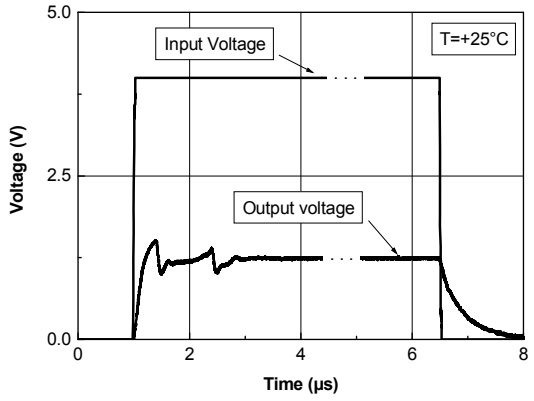


Figure 13. Test circuit for pulse response at I_K = 10 mA

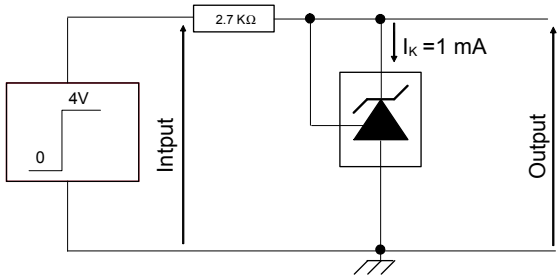


Figure 14. Pulse response at I_K = 10 mA

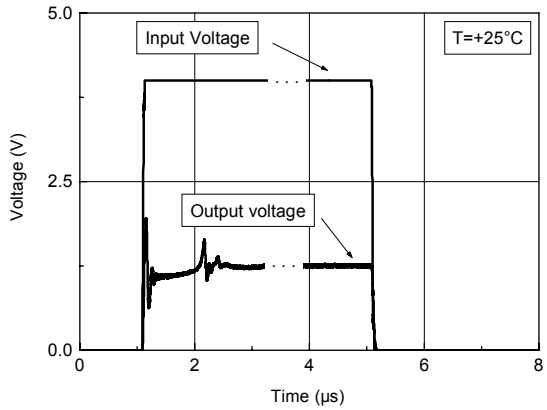


Figure 15. Test circuit for pulse response at I_K = 10 mA

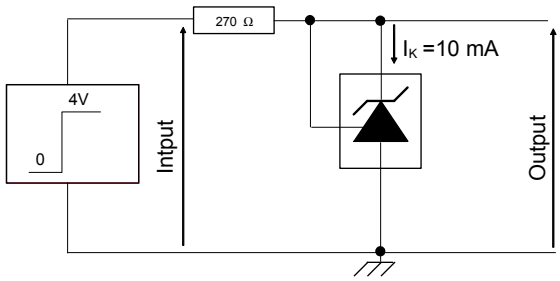


Figure 16. Phase and gain vs. frequency

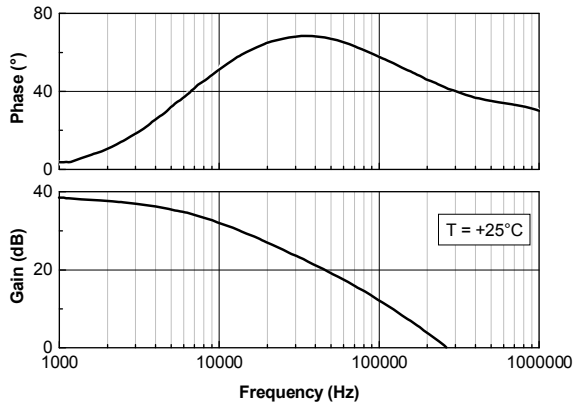


Figure 17. Equivalent input noise vs. frequency

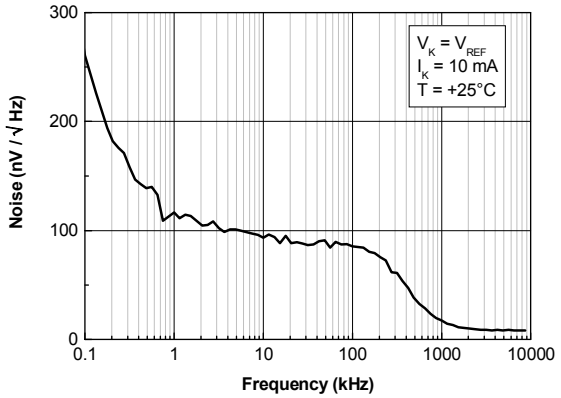
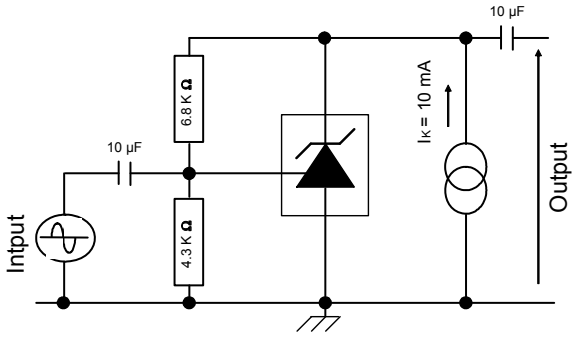


Figure 18. Test circuit for phase and gain measurement



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

4.1 SOT23-3L package information

Figure 19. **SOT23-3L package outline**

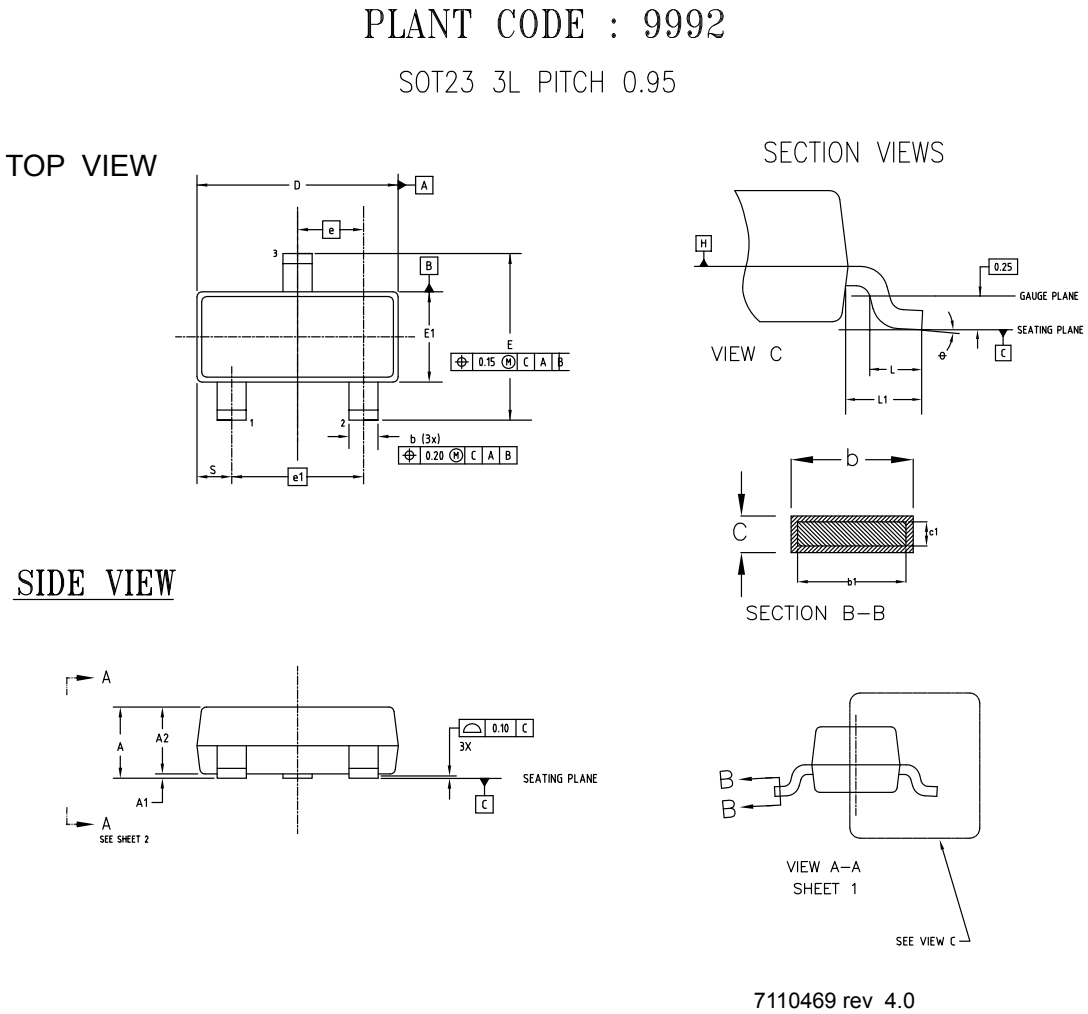


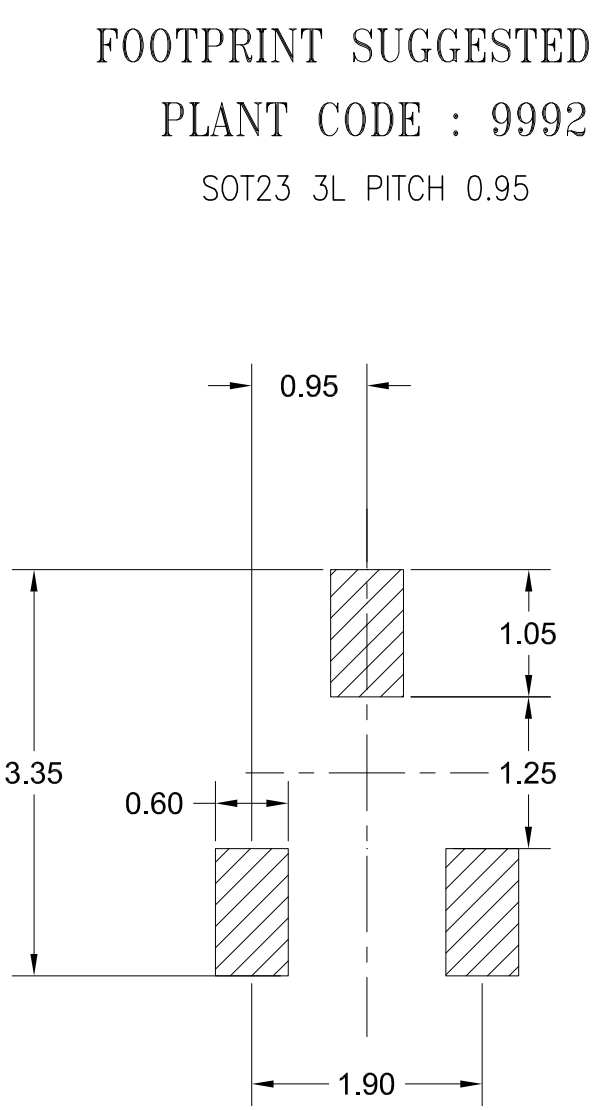
Table 4. SOT23-3L package mechanical data

Ref.	Dimensions		
	Min.	Typ.	Max.
A	0.89		1.12
A1	0.013		0.10
A2	0.88	0.95	1.02
b	0.37		0.50 (1)
b1	0.37	0.40	0.45 (1)
c	0.085		0.18 (2)
c1	0.085		0.16
D	2.80	2.90	3.04 (3)
E	2.10		3.04
E1	1.20	1.30	1.40 (3)
e		0.95BSC	
e1		1.90BSC	
*L (4)	0.28	0.38	0.48
L1		0.55REF	
R	0.05		
R1	0.05		
Θ	0°		8°
s	0.45		0.60

1. *These dimensions apply to the flat section of the lead between 0.08 mm and 0.15 mm from the lead tip.*
2. *The max. value of "c" (terminal thickness) increases to 0.19 mm when Cu base leads are electroplated with Sn or SnPb*
3. *Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.25 mm per side. Dimension E1 does not include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.25 mm per side.*
4. *All dimensions comply with JEDEC T0-236-AB unless otherwise marked with designator " * ".*

Note: Standard for thermally enhanced plastic small outline transistor. Dimension and tolerance conform to ASME Y14.5M-1994. All dimensions are in millimeters. All angles are in degrees.

Figure 20. **SOT23-3L recommended footprint**



5 Device summary

Table 5. **Order code**

Order code	Temperature range	Package	Packing	Marking
TS3431ILT	-40 to + 105 °C	SOT23-3L	Tape and reel	L280
TS3431AILT				L281
TS3431BILT				L282
TS3431CILT				L283

Revision history

Table 6. Document revision history

Date	Revision	Changes
1-Jan-2004	1	Initial release.
1-Dec-2004	2	Specific content changes as follows: – CI version added in Table 5: Order code. – Rthjc information added in Table 1: Absolute maximum ratings (AMR). – Test condition added in electrical characteristics Table 3.
26-Jun-2007	3	Removed TO-92 package information and associated order codes. Re-ordered electrical characteristics figures.
30-Aug-2012	4	Added: $V_{ka} = V_{ref}$ parameter in Table 3 on page 5.
04-Dec-2017	5	Updated the title and Section 4.1: SOT23-3L package information. Minor text changes.
27-Jun-2018	6	Updated: Figure 10. Ratio of change in reference input voltage to change in V_{KA} voltage vs. temperature and Figure 11. Test circuit for $V_K > V_{REF}$.

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