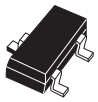
TS432

1.24 V adjustable shunt voltage reference

Features

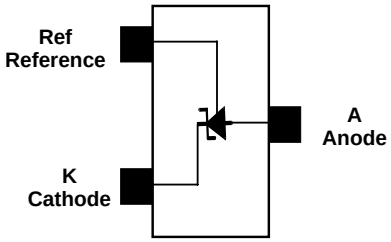
- 1.24 V typical output voltage
- Ultra low operating current: 60 µA maximum at 25° C
- High precision at 25° C:
  - +/- 1%
  - +/- 0.5%
- High stability when used with capacitive loads
- Industrial temperature range: -40° C to +85° C
- 100 ppm/°C temperature coefficient



L
SOT23-3L
(Plastic micropackage)

Pin connections
(top view)

SOT23-3



Applications

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

Description

The TS432 is an adjustable low power shunt voltage reference providing an output voltage from 1.24 V to 10 V over the industrial temperature range (-40° C to +85° C). Available in SOT23-3 surface mount package, it can be designed in applications where space saving is critical.

The low operating current is also a key advantage for power restricted designs. In addition, the TS432 is very stable and can be used in a broad range of application conditions.

1 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings (AMR)

Symbol	Parameter	Value	Unit
V_K	Cathode voltage	12	V
I_K	Cathode current	-10 to +20	mA
I_{ref}	Reference input current	-0.05 to +3	mA
P_d	Power dissipation (1) SOT23-3	340	mW
R_{thja}	Thermal resistance junction to ambient for SOT23-3	360	°C/W
T_{lead}	Lead temperature (soldering 10 seconds)	250	°C
T_{stg}	Storage temperature	-65 to +150	°C
T_j	Junction temperature	150	°C
ESD	HBM: human body model	1.5	kV
	MM: machine model	150	V

1. P_d is calculated with T_{amb} = 25° C, T_j = 150° C and R_{thja} = 360° C/W.

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
V_K	Cathode voltage	1.24 to 10	V
I_K	Cathode current	60µ to 12m	A
T_{amb}	Ambient temperature	-40 to +85	°C

2 Electrical characteristics

Table 3. T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage	I_K = 100µA, V_K=V_{REF}		1.24		V
		TS432 (1%)	1.228		1.252	
		TS432A (0.5%)	1.234		1.246	
ΔV_{ref}	Reference voltage tolerance over temperature	I_K = 100µA, V_K=V_{REF}		7	16	mV
I_{Kmin}	Minimum operating current	T_{amb} = 25°C		40	60	µA
		-40°C < T_{amb} < +85°C			65	
ΔV_{ref}	Reverse breakdown voltage change with operating current range	I_{Kmin} < I_K < 1mA		0.7	1.5	mV
		-40°C < T_{amb} < +85°C			2	
		1mA < I_K < 12mA		2	4	
		-40°C < T_{amb} < +85°C			6	
$\Delta V_{ref}/\Delta V_K$	Reference voltage change with output voltage change	I_K = 10mA, V_K=10V to V_{REF}		1.8	2.5	mV/V
		-40°C < T_{amb} < +85°C			3	
I_{ref}	Reference input current	I_K=10mA, R_1=10KΩ, R_2=+ ∞		50	100	nA
		-40°C < T_{amb} < +85°C			200	
I_{OFF}	Off-state cathode current	V_{REF}=0, V_K=10V		1	100	nA
		-40°C < T_{amb} < +85°C			150	
R_{KA}	Static impedance	ΔI_K = 100µA to 12mA		0.25	0.5	W
K_{VH}	Long term stability	I_K = 100µA, t = 1000hrs		120		ppm
E_N	Wide band noise	I_K = 100µA 100Hz < F < 10kHz		200		nV/√Hz

Note: Limits are 100% production tested at 25° C. Behavior over the temperature range is guaranteed through correlation and by design.

Figure 1. Reference voltage vs temperature

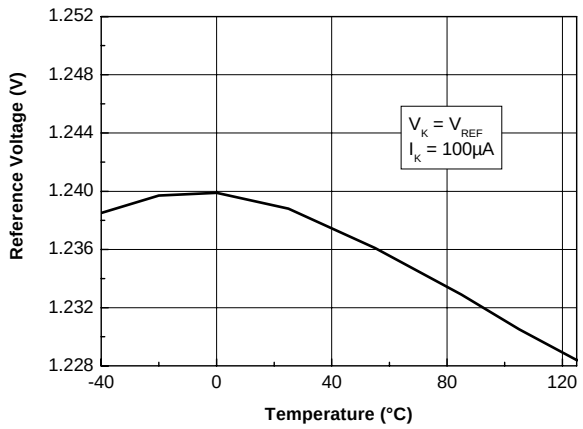


Figure 2. Test circuit for $V_K = V_{ref}$

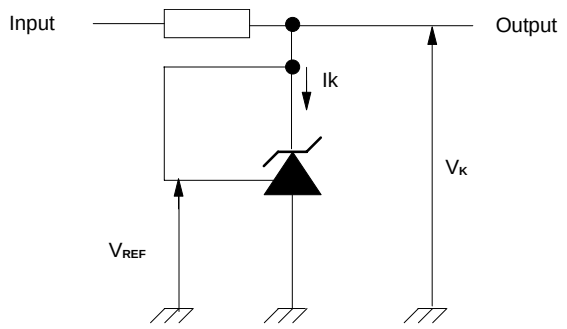


Figure 3. Cathode voltage vs cathode current

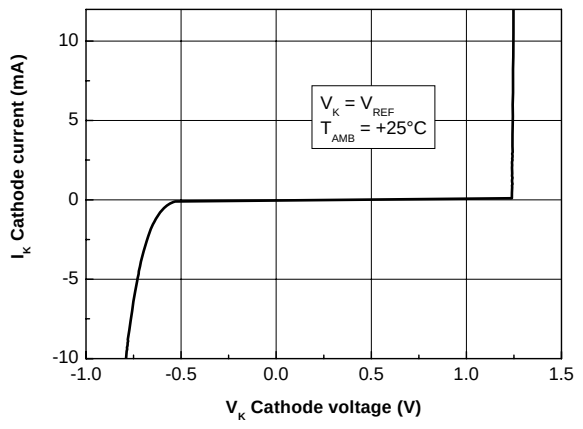


Figure 4. Cathode voltage vs cathode current

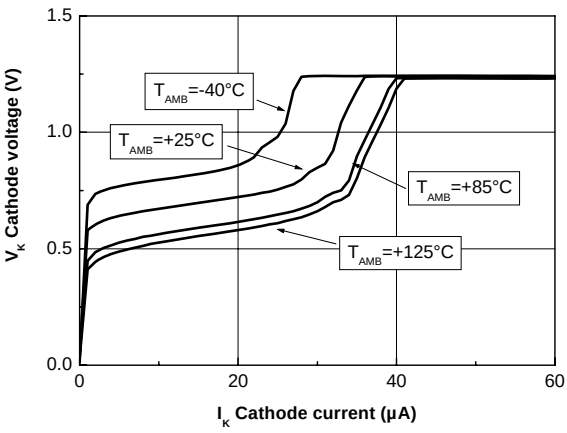


Figure 5. Reference input current vs temperature

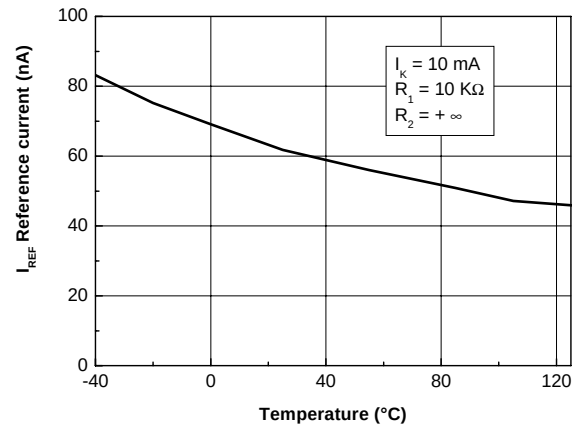


Figure 6. Static impedance vs temperature

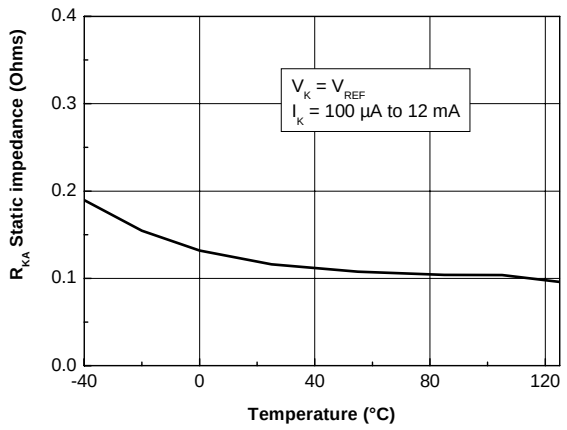


Figure 7. Off-state current vs temperature

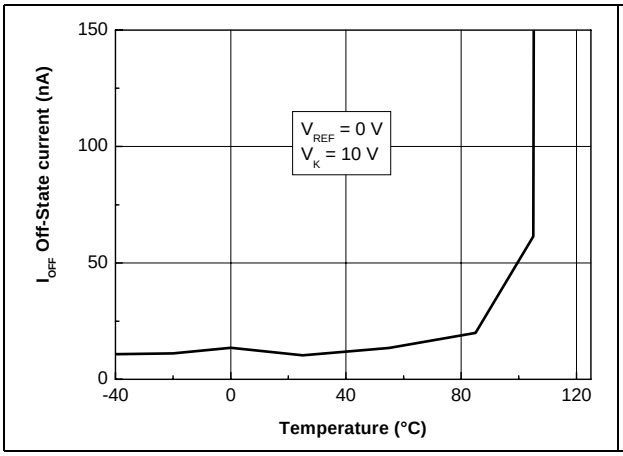


Figure 8. Test circuit for off-state current measurement

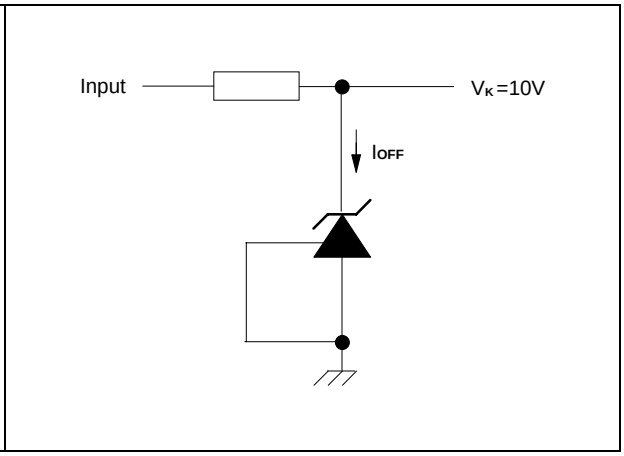


Figure 9. Ratio of change in reference input voltage to change in V_K voltage vs temperature

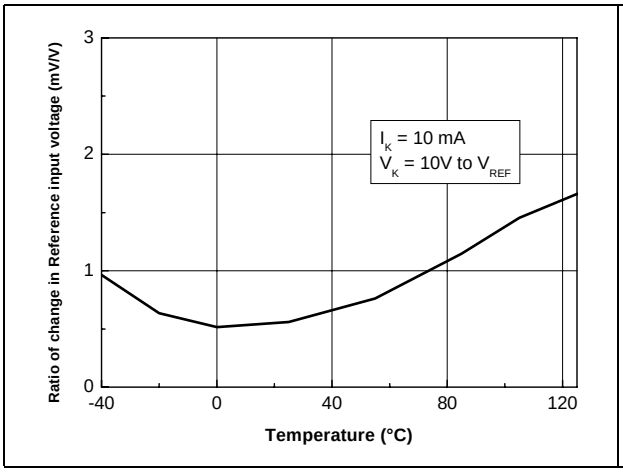


Figure 10. Test circuit for $V_{KA} > V_{REF}$

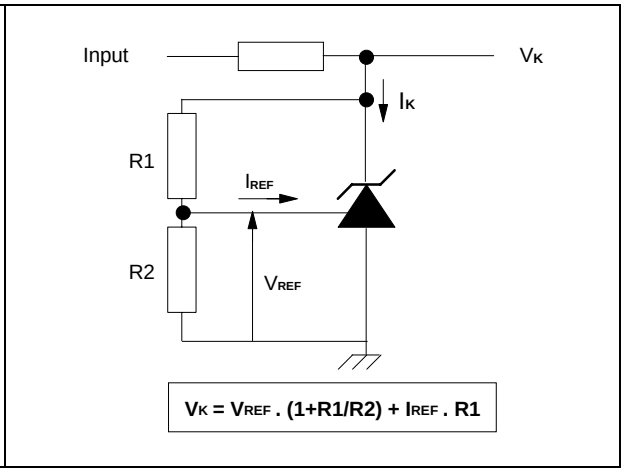


Figure 11. Phase and gain vs frequency

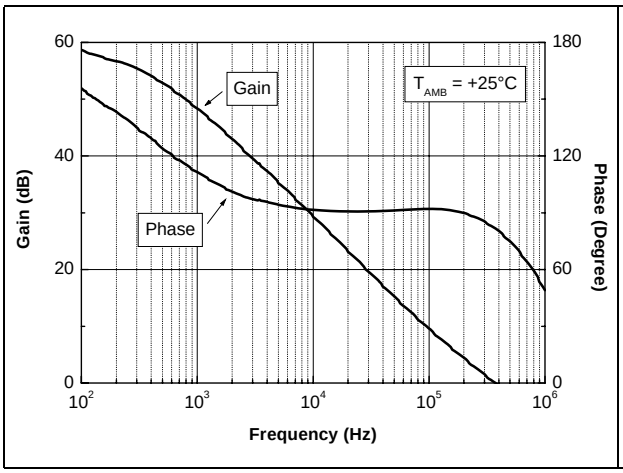


Figure 12. Test circuit for phase and gain measurement

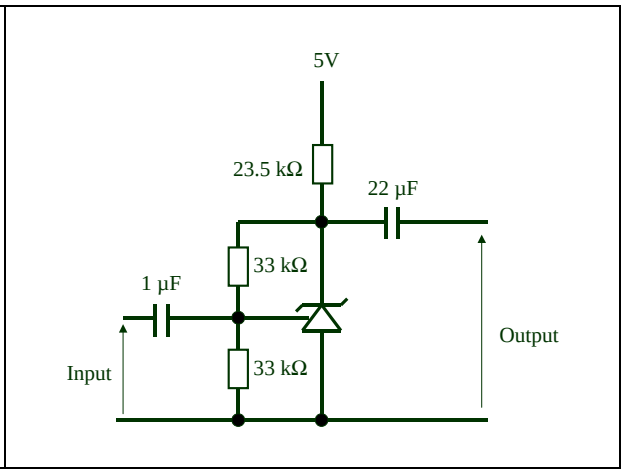


Figure 13. Test circuit for pulse response at I_K=100 µA

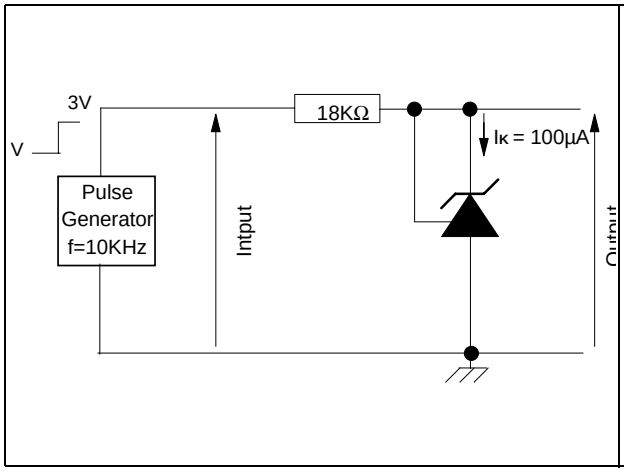


Figure 14. Test circuit for pulse response at I_K = 1 mA

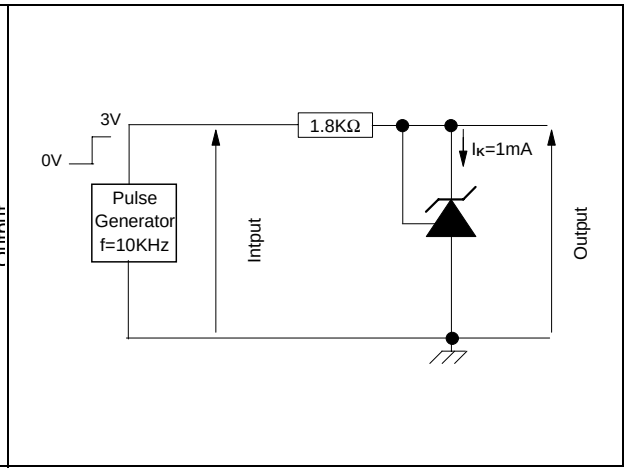


Figure 15. Pulse response at I_K = 100 µA

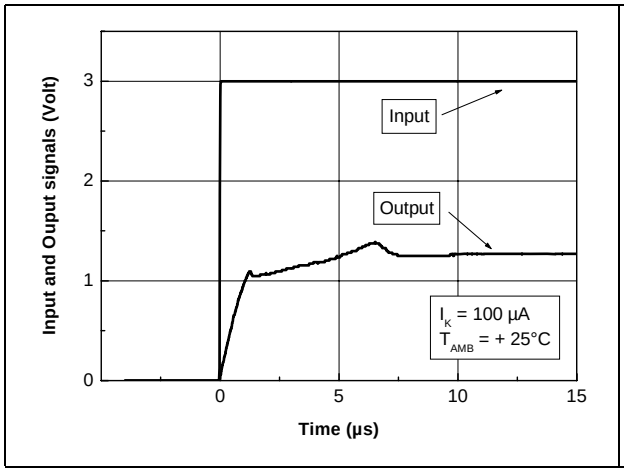


Figure 16. Pulse response at I_K = 1 mA

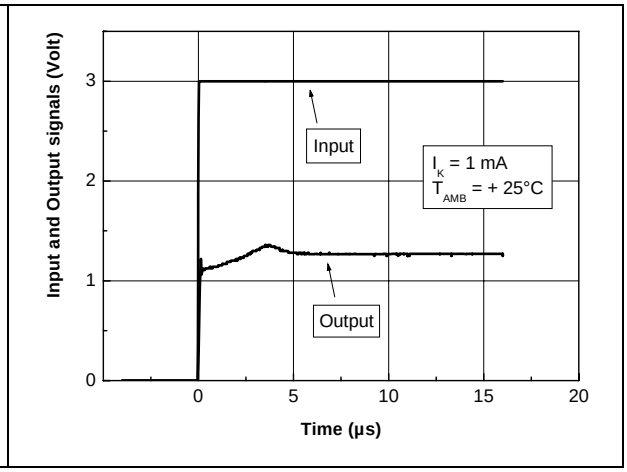


Figure 17. Pulse response at I_K = 100 µA

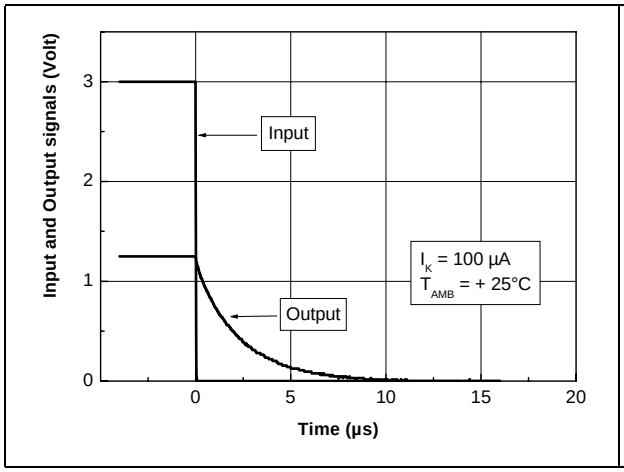


Figure 18. Pulse response at I_K = 1 mA

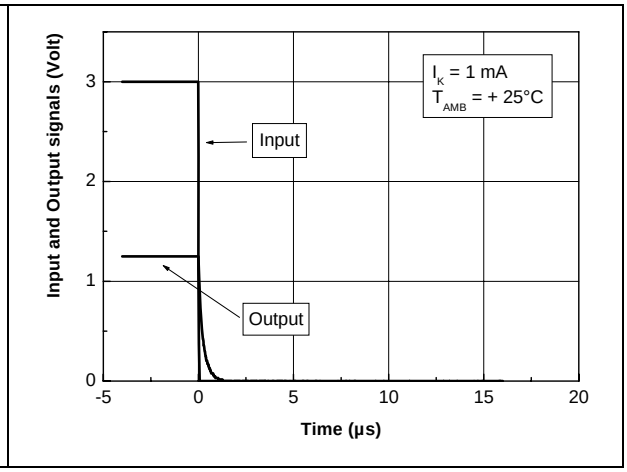


Figure 19. Equivalent input noise vs frequency

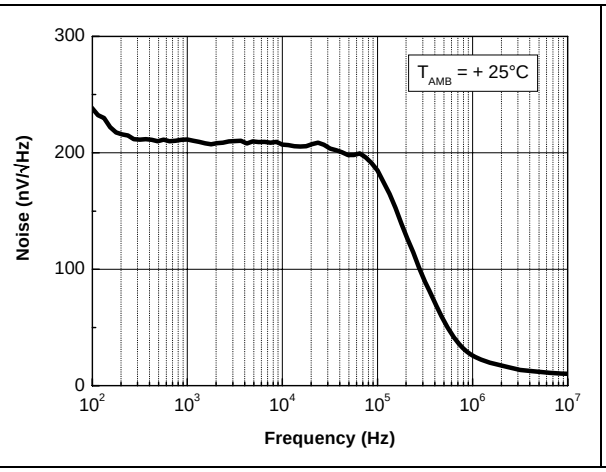
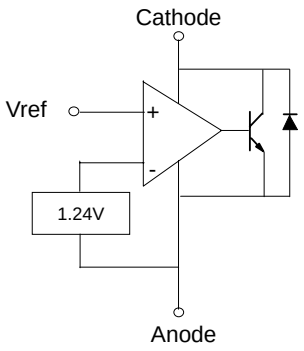


Figure 20. Block diagram



3 Package information

In order to meet environmental requirements, STMicroelectronics offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an STMicroelectronics trademark. ECOPACK specifications are available at: www.st.com.

Figure 21. SOT23-3 package mechanical drawing

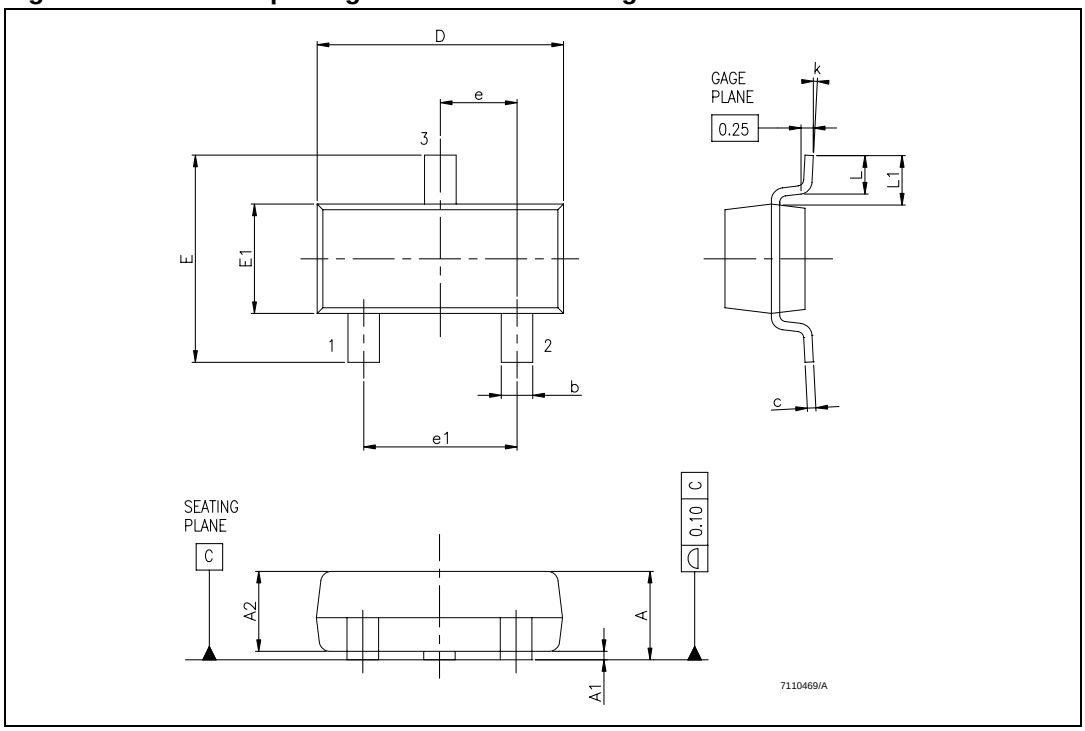


Table 4. SOT23-3 package mechanical data

Ref.	Dimensions					
	Millimeters			Mils		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.890		1.120	35.05		44.12
A1	0.010		0.100	0.39		3.94
A2	0.880	0.950	1.020	34.65	37.41	40.17
b	0.300		0.500	11.81		19.69
C	0.080		0.200	3.15		7.88
D	2.800	2.900	3.040	110.26	114.17	119.72
E	2.100		2.64	82.70		103.96
E1	1.200	1.300	1.400	47.26	51.19	55.13
e		0.950			37.41	
e1		1.900			74.82	
L	0.400		0.600	15.75		23.63
L1		0.540			21.27	
k	0°		8°	0°		8°

4 Ordering information

Table 5. Order codes

Precision	Order code	Temperature range	Package	Packing	Marking
1%	TS432ILT	-40° C to +85° C	SOT23-3	Tape & reel	L235
0.5%	TS432AILT				L236

5 Revision history

Table 6. Document revision history

Date	Revision	Changes
16-Dec-2002	1	Initial release.
7-Apr-2008	2	Corrected package mechanical data. Updated document format.

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