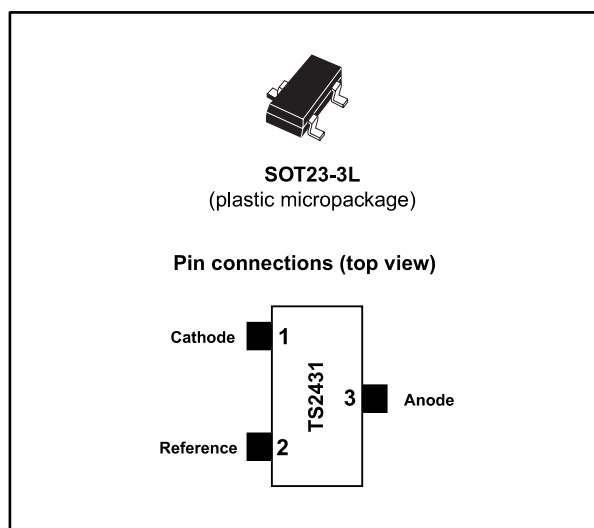


Adjustable shunt voltage reference

Datasheet - production data



- Industrial temperature range: - 40 to + 105 °C
- Performance compatible with industry-standard TL431

Applications

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

Description

The TS2431 is an adjustable shunt voltage reference with guaranteed temperature stability over the entire temperature range of operations from - 40 to + 105 °C. The output voltage may be set to any value between 2.5 and 24 V with an external resistor bridge. Available in an SOT23-3L surface mount package, the device can be implemented for those applications where space-saving is of the utmost importance.

Features

- Adjustable output voltage: 2.5 to 24 V
- Precision selection at 25 °C: $\pm 2\%$, $\pm 1\%$ and $\pm 0.5\%$
- Sink current capability: 1 to 100 mA

Table 1: Device summary

Order code	Temperature range	Package	Packing	Precision	Marking
TS2431ILT	-40 to + 105 °C	SOT23-3L	Tape and reel	2%	L285
TS2431AILT				1%	L286
TS2431BILT				0.5%	L287

Contents

1	Absolute maximum ratings and operating conditions	3
2	Electrical characteristics	4
3	Package information	9
	3.1 SOT23-3L package information	9
4	Revision history	15

1 Absolute maximum ratings and operating conditions

Table 2: 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 ⁽¹⁾ SOT23-3L	360	mW
T_{std}	Storage temperature	-65 to +150	°C
ESD	Human body model (HBM) ⁽²⁾	2	kV
	Machine model (MM) ⁽³⁾	200	V
T_{LEAD}	Lead temperature (soldering, 10 s)	260	°C

Notes:

⁽¹⁾Pd has been calculated with $T_{amb} = 25\text{ °C}$, $T_{junction} = 150\text{ °C}$, $R_{thjc} = 110\text{ °C/W}$ and $R_{thja} = 340\text{ °C/W}$ for the SOT23-3 package.

⁽²⁾Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 kΩ resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins float.

⁽³⁾Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω). This is applied for all couples of connected pin combinations while the other pins float.

Table 3: Operating conditions

Symbol	Parameter	Value	Unit
V_{KA}	Cathode to anode voltage	V_{REF} to 24	V
I_K	Cathode operating current ⁽¹⁾	1 to 100	mA
T_{oper}	Operating free air temperature range	- 40 to + 105	°C

Notes:

⁽¹⁾Maximum power dissipation must be strictly observed to avoid damaging the component.

2 Electrical characteristics

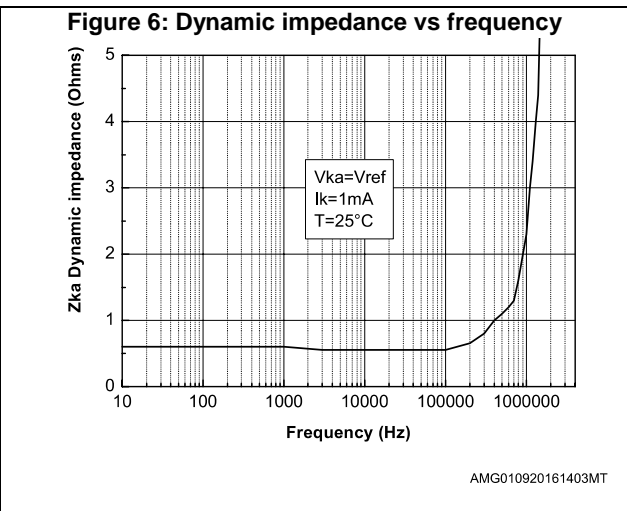
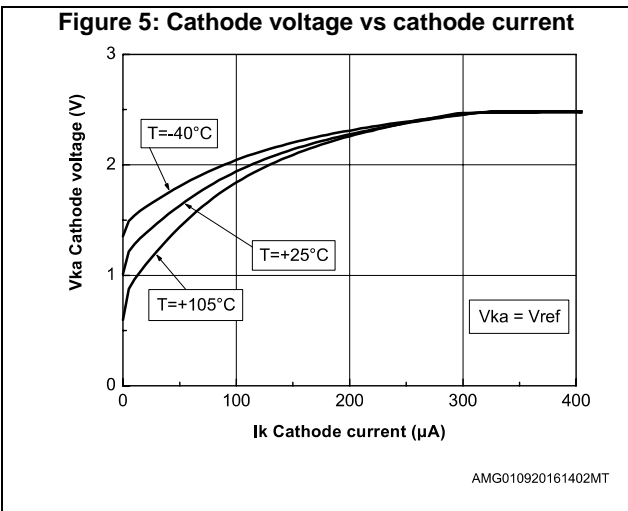
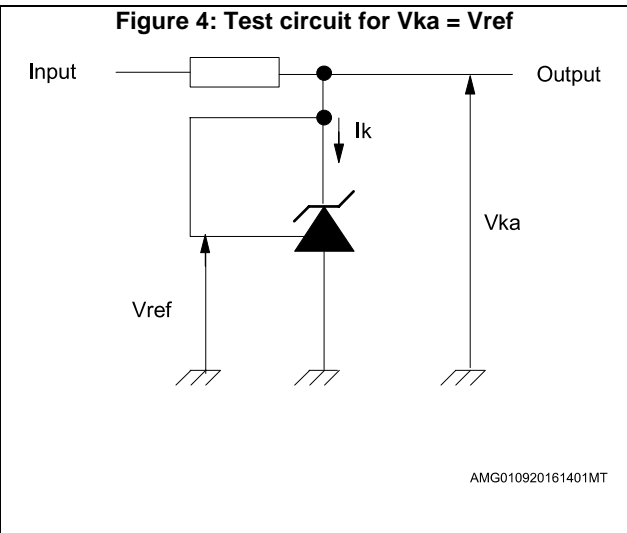
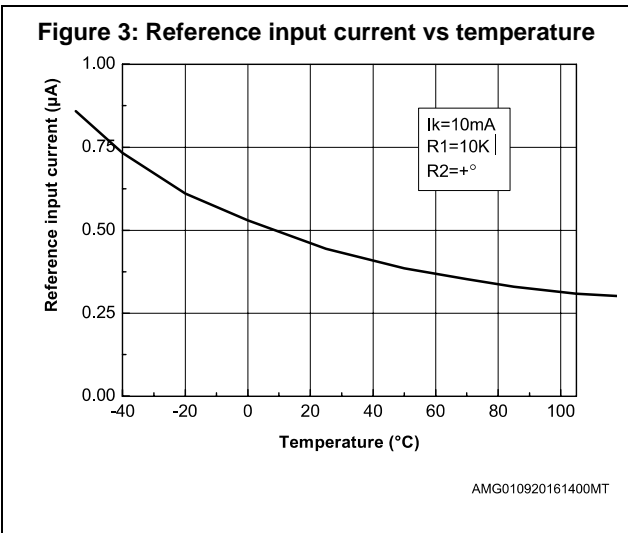
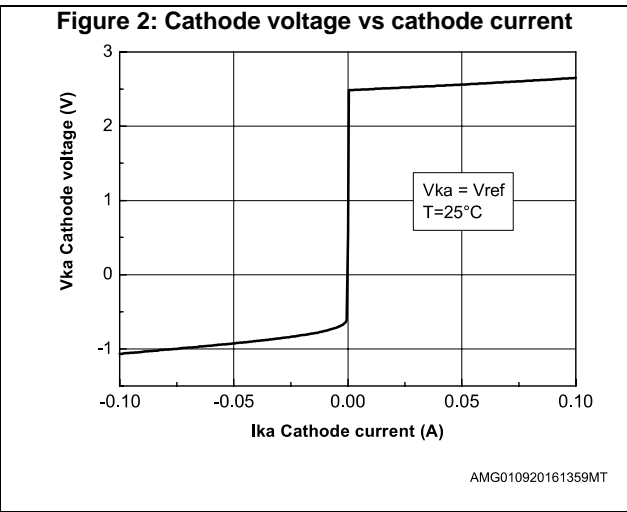
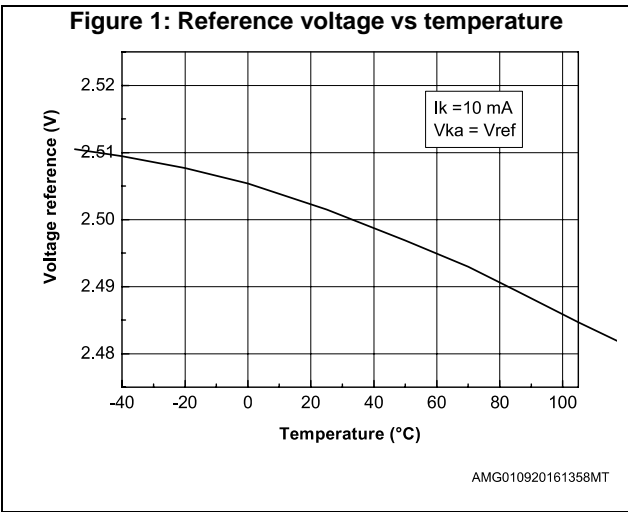
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{REF}	Reference input voltage	$V_K = V_{REF}$, $I_K = 10$ mA		2.5		V
		TS2431 (2%)	2.45		2.55	
		TS2431A (1%)	2.475		2.525	
		TS2431B (0.5%)	2.488		2.512	
		TS2431B (1%), $I_K = 1$ mA	2.475		2.525	
$ \Delta V_{REF} $	Reference input voltage deviation over temperature $V_K = V_{REF}$, $I_K = 10$ mA ⁽¹⁾⁽²⁾	$0\text{ }^\circ\text{C} < T < +70\text{ }^\circ\text{C}$		10	20	mV
		$-40\text{ }^\circ\text{C} < T < +85\text{ }^\circ\text{C}$		17	30	
		$-40\text{ }^\circ\text{C} < T < +105\text{ }^\circ\text{C}$		20	35	
T_C	Temperature coefficient ⁽²⁾	$-40\text{ }^\circ\text{C} < T < +105\text{ }^\circ\text{C}$		50	100	ppm/°C
I_{KMIN}	Minimum operating current	$T = 25\text{ }^\circ\text{C}$		0.3	0.8	mA
		$-40\text{ }^\circ\text{C} < T < +105\text{ }^\circ\text{C}$			1	
$\left \frac{\Delta V_{ref}}{\Delta V_K} \right $	Ratio of change in reference input voltage to change in cathode-to-anode voltage	$I_K = 10$ mA $V_{Ka} = 24$ to 2.5 V		0.3	2	mV/V
I_{REF}	Reference input current $I_K = 10$ mA, $R1 = 10$ k Ω , $R2 = +\infty$ ⁽³⁾	$T = 25\text{ }^\circ\text{C}$		0.5	2.5	μA
		$-40\text{ }^\circ\text{C} < T < +105\text{ }^\circ\text{C}$			3	
$ \Delta I_{REF} $	Reference input current deviation $I_K = 10$ mA, $R1 = 10$ k Ω , $R2 = +\infty$ ⁽³⁾	$-40\text{ }^\circ\text{C} < T < +105\text{ }^\circ\text{C}$		0.4	1.2	μA
I_{OFF}	Off-state cathode current	$V_K = 24$ V, $V_{REF} = \text{GND}$		10	500	nA
$ Z_{KA} $	Reverse dynamic impedance	$V_K = V_{REF}$, $\Delta I_K = 1$ to 50 mA, $f < 10$ kHz		0.5	0.75	Ω
E_N	Wide band noise	$I_K = 10$ mA 10 Hz $< f < 10$ kHz		300		nV/ $\sqrt{\text{Hz}}$

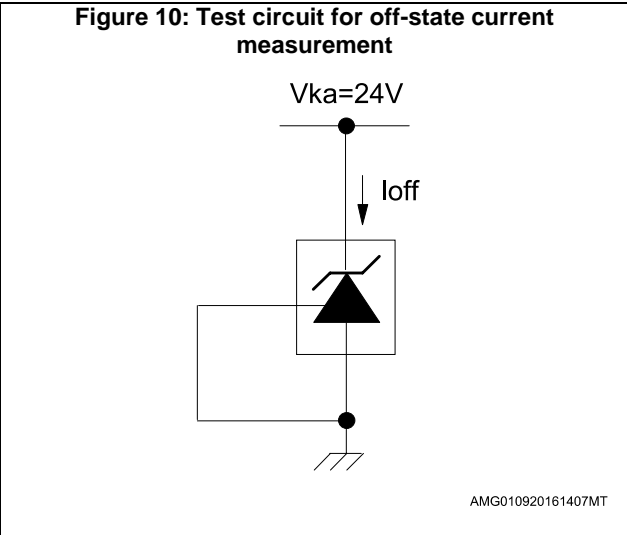
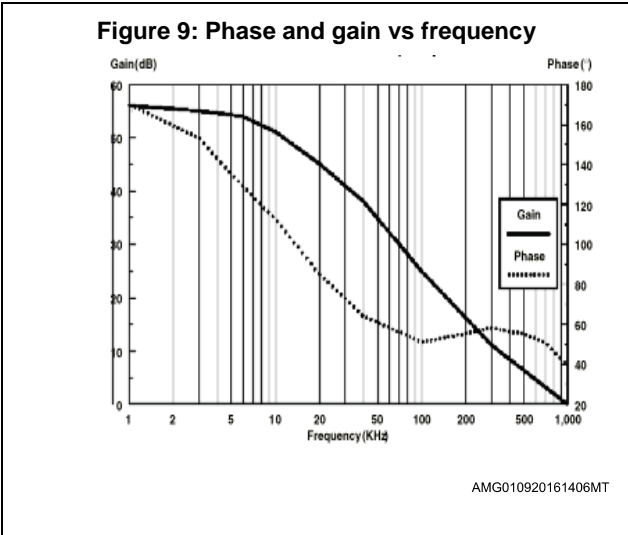
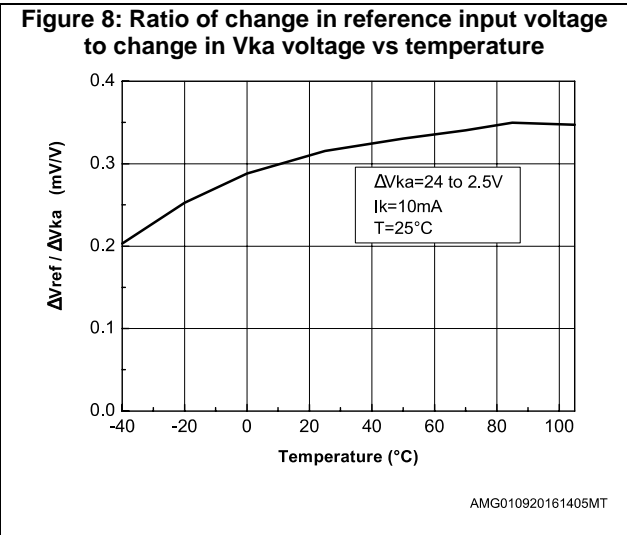
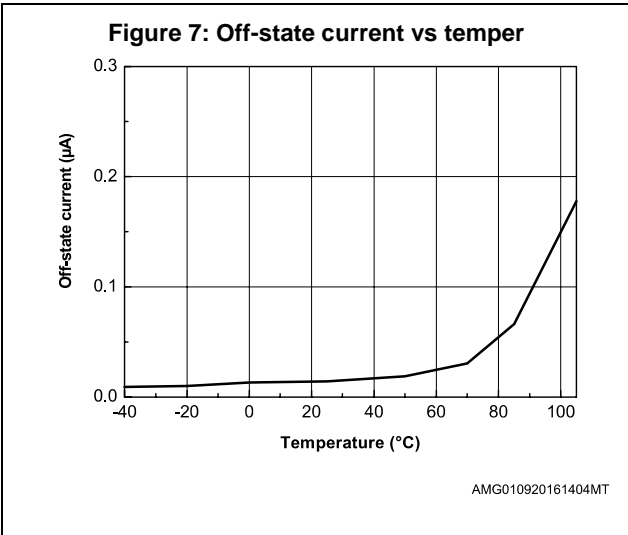
Notes:

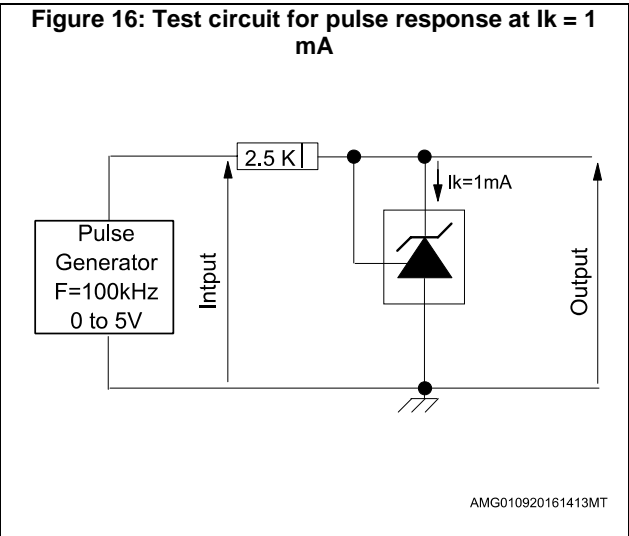
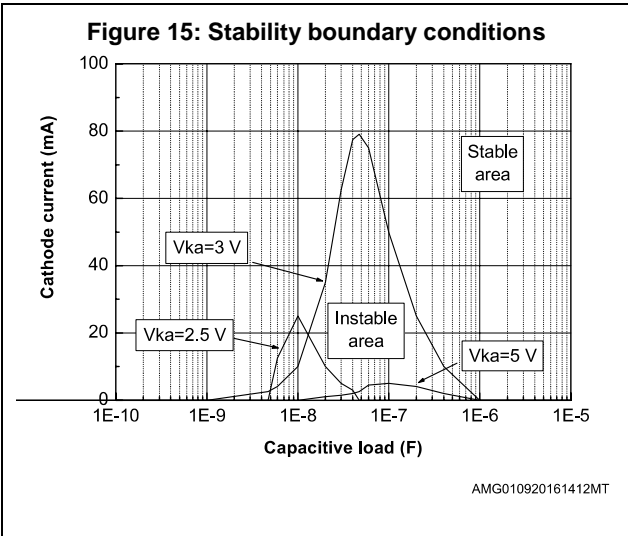
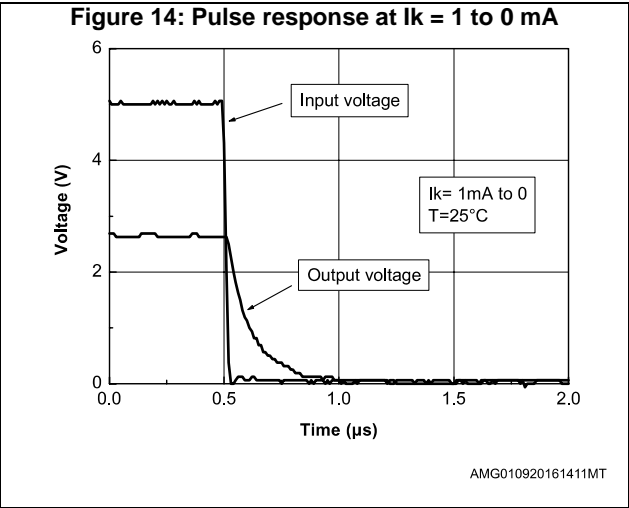
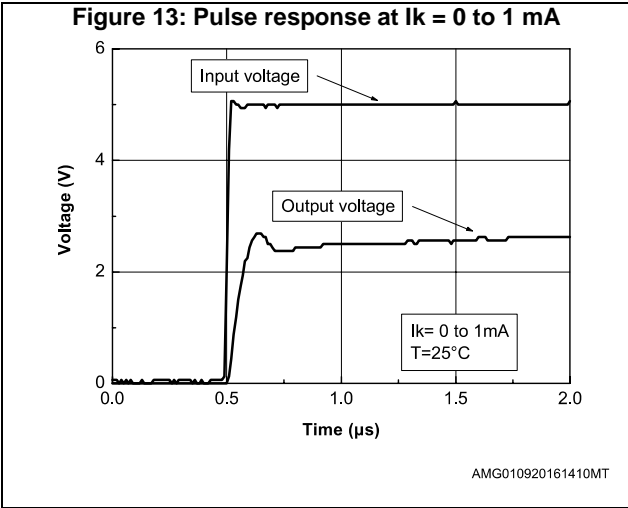
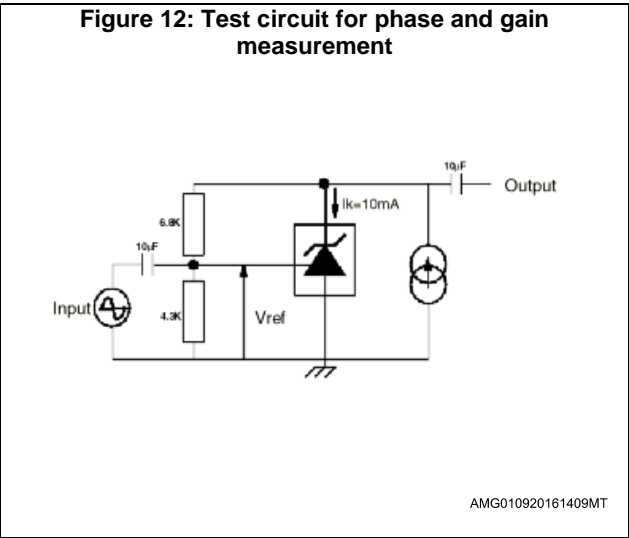
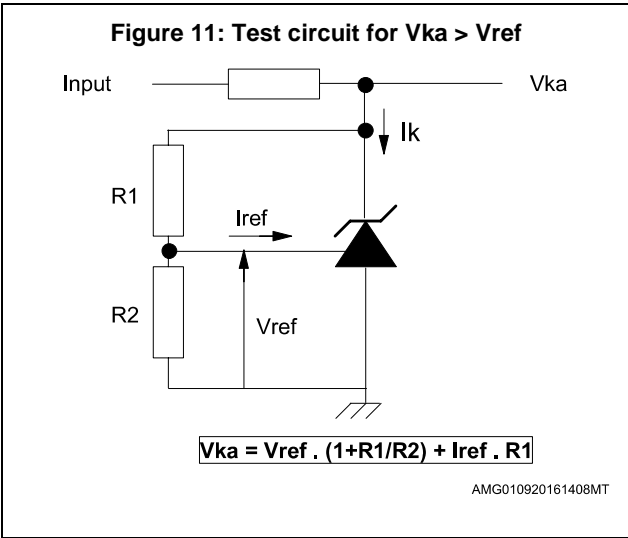
(1)Limits are 100 % production tested at 25 °C. Overtemperature limits are guaranteed through correlation and by design.

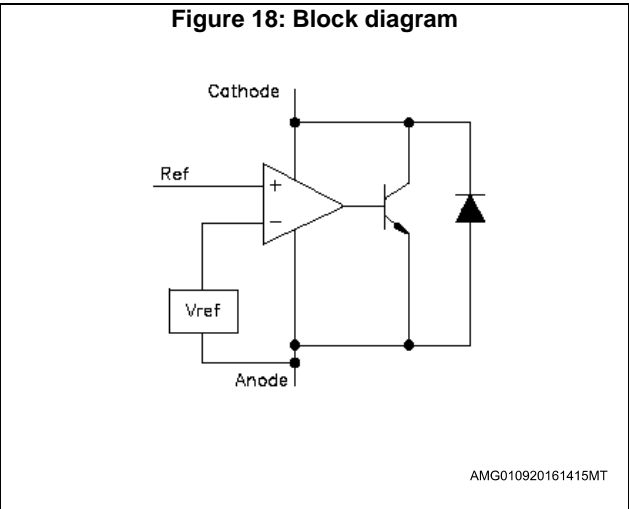
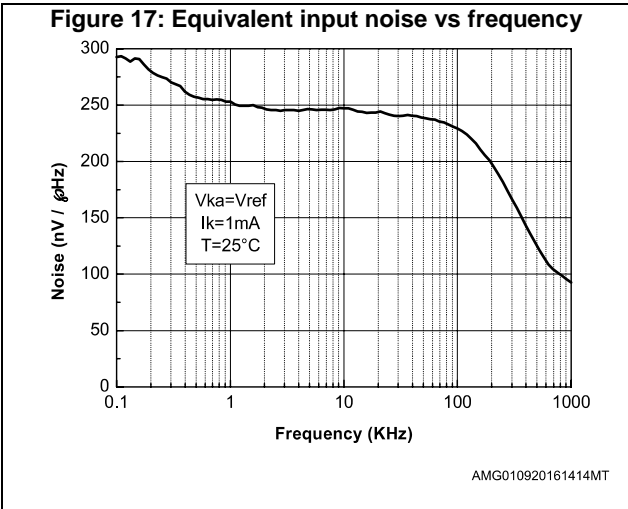
(2) $|\Delta V_{REF}|$ is defined as the difference between the maximum and minimum values of V_{REF} obtained over the full temperature range.

(3)Refer to [Figure 4: "Test circuit for \$V_{Ka} = V_{ref}\$ "](#).









3 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.

3.1 SOT23-3L package information

Figure 19: SOT23-3L (Nantong Fujitsu) package outline

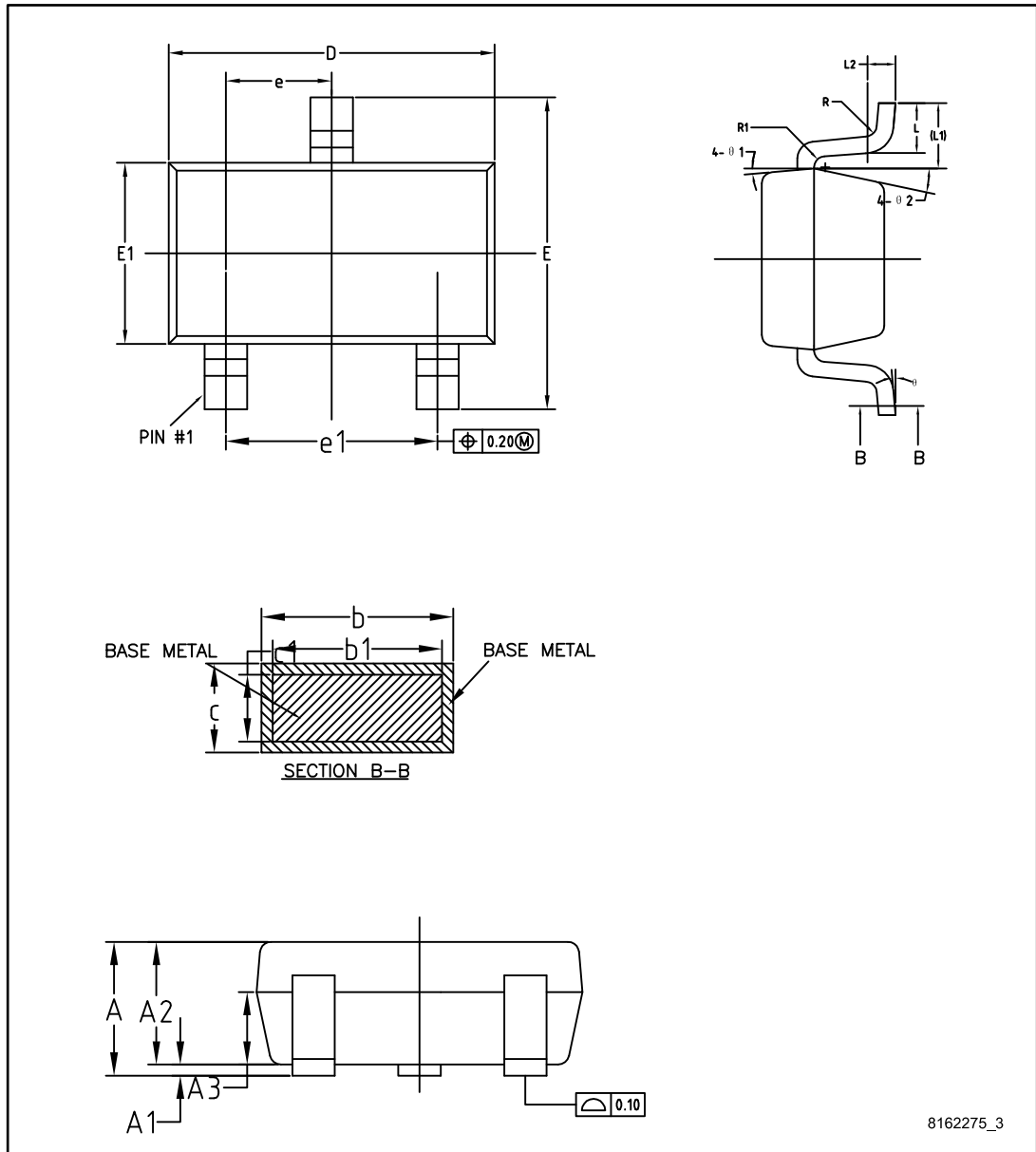


Table 4: SOT23-3L (Nantong Fujitsu) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.25
A1	0		0.15
A2	1	1.10	1.20
A3	0.60	0.65	0.70
b	0.36		0.50
b1	0.36	0.38	0.45
c	0.14		0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
L1	0.59 REF		
L2	0.25 BSC		
R	0.05		
R1	0.05		
θ	0°		8°
$\theta 1$	3°	5°	7°
$\theta 2$	6°		14°

Figure 20: SOT23-3L (Carsem) package outline

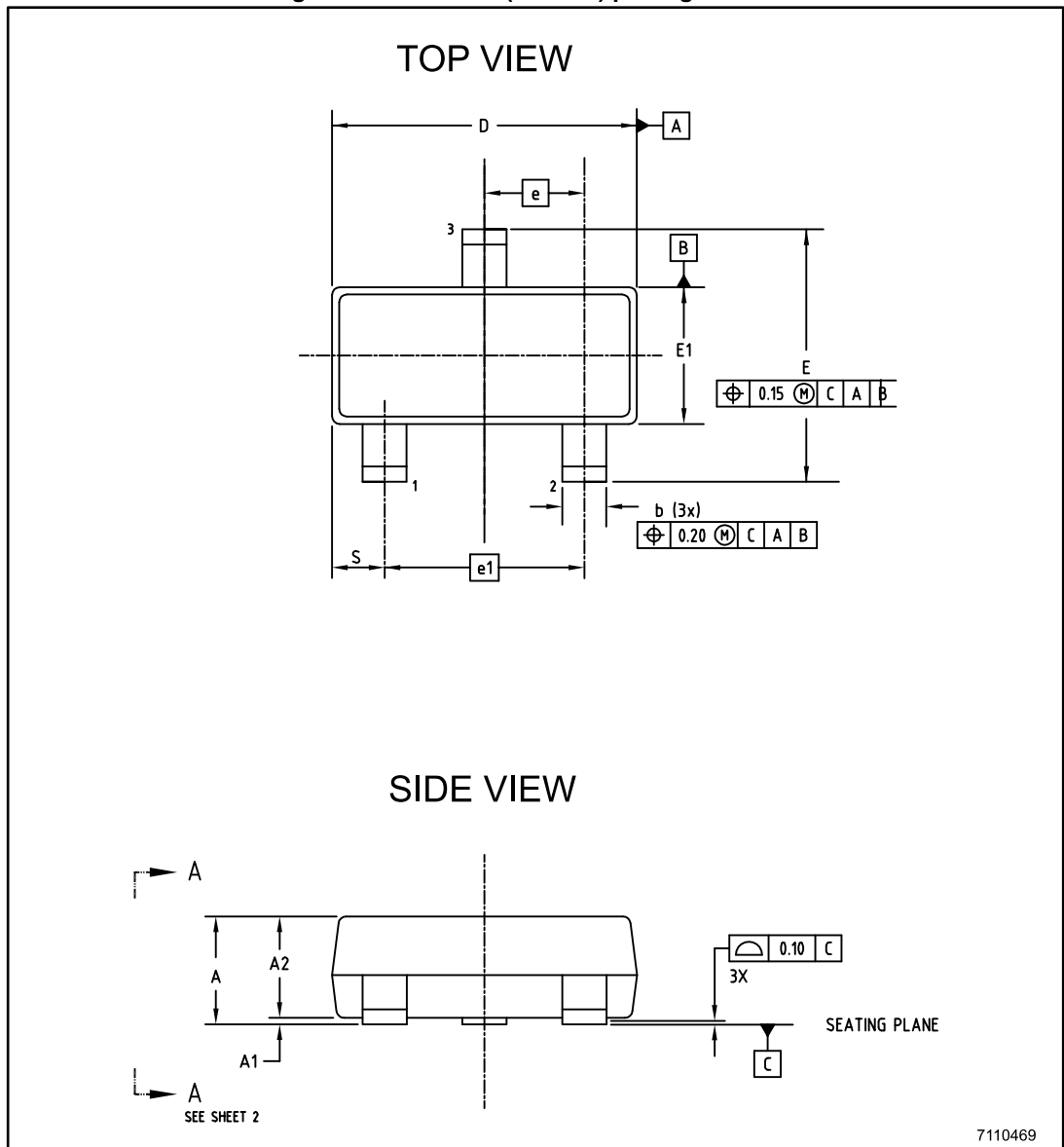
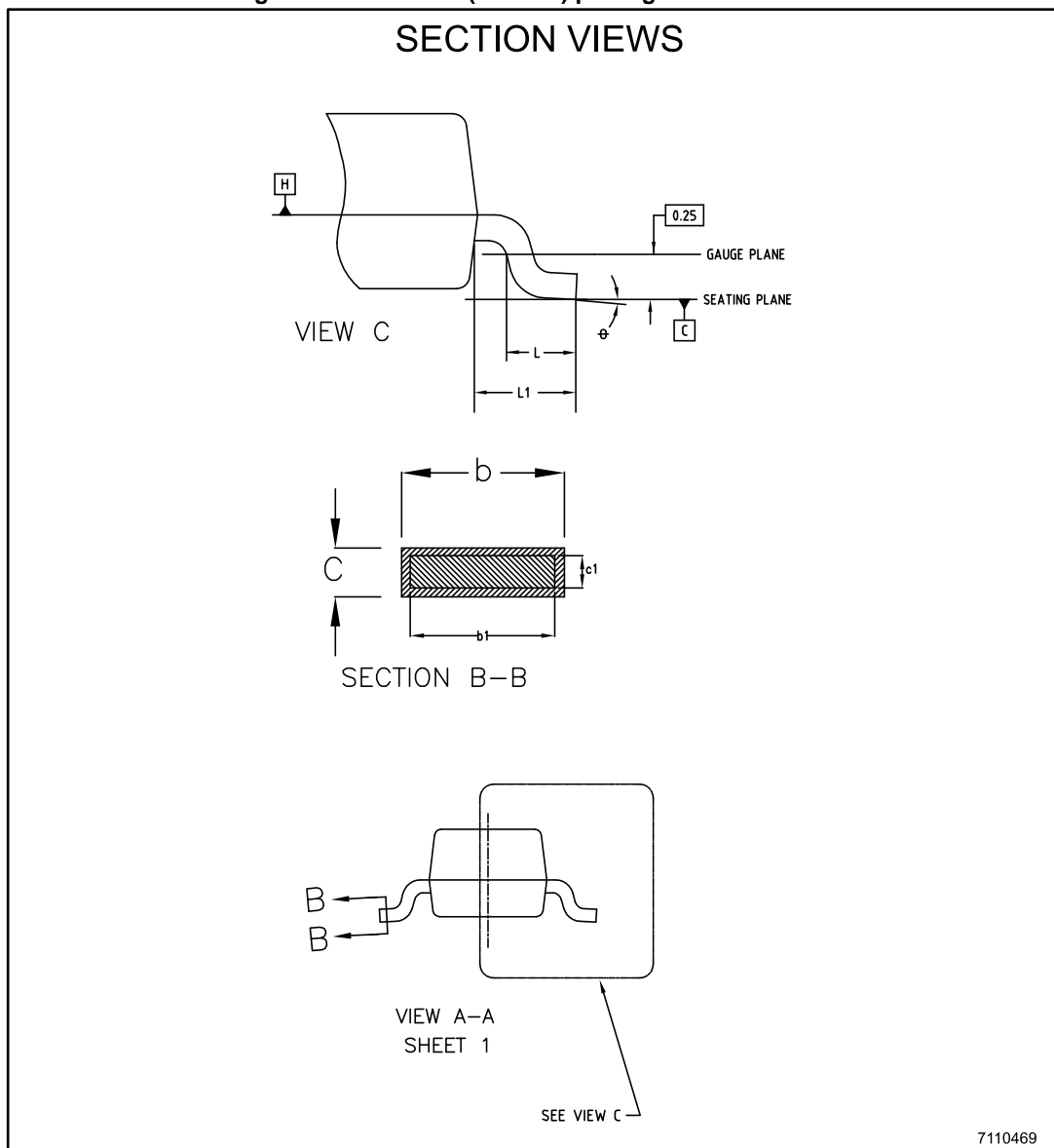


Figure 21: SOT23-3L (Carsem) package section views

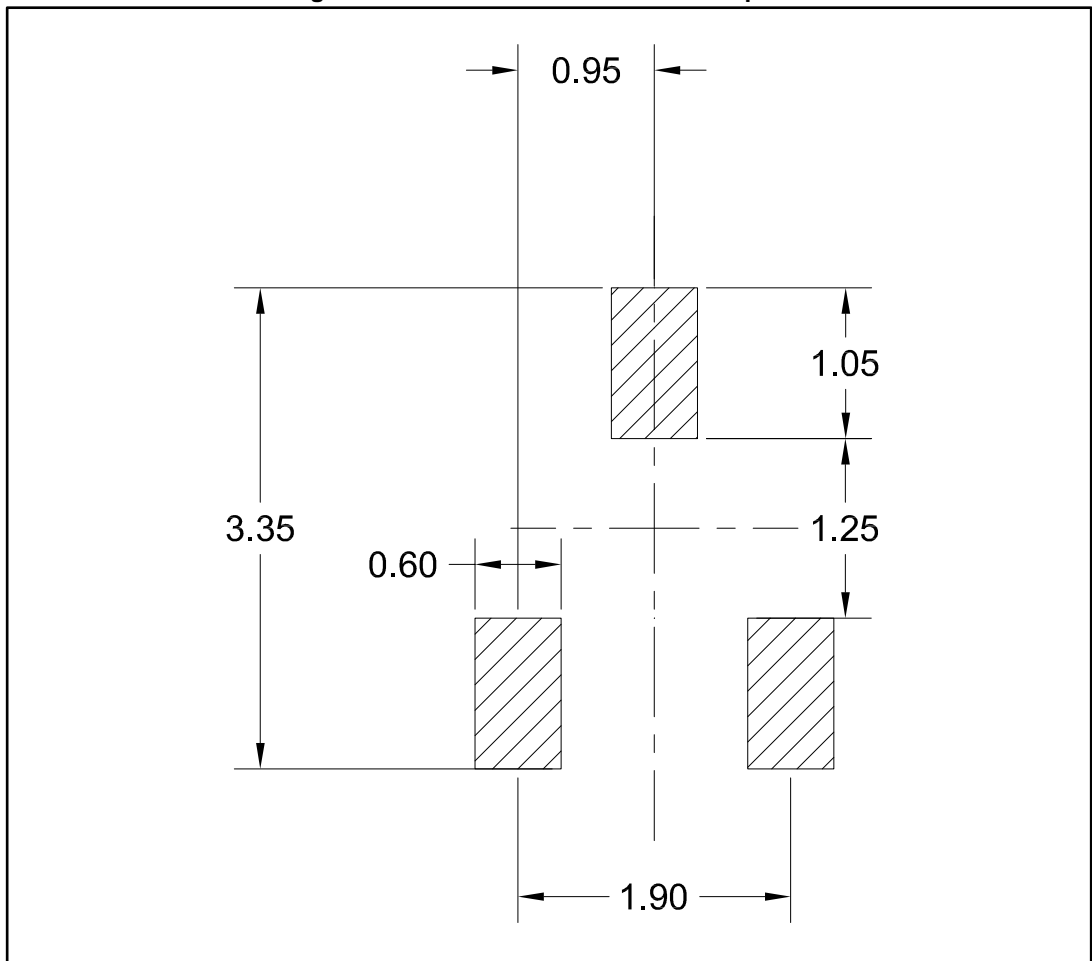


7110469

Table 5: SOT23-3L (Carsem) mechanical data

Dimensions			
Ref.	Millimeters		
	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
b1	0.37	0.40	0.45
c	0.085	-	0.18
c1	0.085	-	0.16
D	2.80	2.90	3.04
E	2.10	-	2.64
E1	1.20	1.30	1.40
e		0.95 BSC	
e1		1.90 BSC	
*L	0.28	0.38	0.48
L1		0.55 REF	
L2			
R	0.05		
R1	0.05		
θ	0°		8°
s	0.45	-	0.60

Figure 22: SOT23-3L recommended footprint



4 Revision history

Table 6: Document revision history

Date	Revision	Changes
01-Feb-2002	1	Initial release.
10-Sep-2009	2	Updated document format. Modified footnote 1 under <i>Table 2: Absolute maximum ratings on page 3</i> . Added HBM and MM notes under <i>Table 2</i> .
11-May-2012	3	Removed: automotive grade order codes <i>Table 1 on page 1</i> .
22-Nov-2012	4	Added min. and max. values test condition TS2431B (1%), $I_K = 1 \text{ mA}$ <i>Table 4 on page 4</i> .
28-Nov-2016	5	Updated Section 3: "Package information". Minor text changes.
20-Oct-2017	6	Updated the title and the description in cover page. Minor text changes.

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2017 STMicroelectronics – All rights reserved