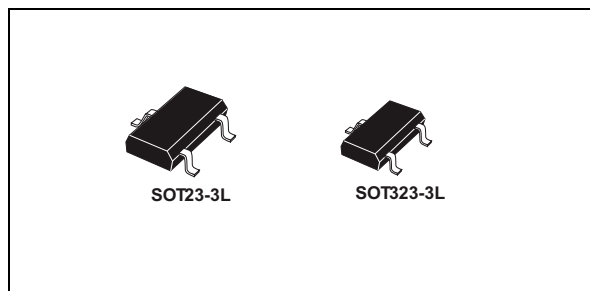


Precision micropower shunt voltage reference

Datasheet - production data



Description

The TS4061 is a low power and high accuracy shunt voltage reference providing a stable output voltage over the industrial temperature range (-40 to +85 °C), with a maximum temperature coefficient of 35 ppm/°C. It is available in 0.1% and 0.2% initial accuracy versions. The SOT323-3L and SOT23-3L packages can be designed in applications where space saving is a critical issue. The very low operating current is a key advantage for power restricted designs. The TS4061 is very stable and can be used in a broad range of application conditions.

Features

- Fixed 1.225 V, 1.25 V output voltages
- Ultra low operating current: 10 µA at 25 °C
- High precision @ 25 °C: +/-0.1% (TS4061A), +/- 0.2% (TS4061B)
- Very low LF noise: typ. 10 µV_{p-p}
- Stable when used with capacitive loads
- Industrial (-40 to +85 °C) temperature range
- 35 ppm/°C max. temperature coefficient
- Available in SOT23-3L and SOT323-3L packages

Applications

- Portable, battery-operated equipment
- Data acquisition systems
- Instrumentation

Contents

1 Pin configuration 3

2 Maximum ratings 4

3 Electrical characteristics 5

4 Typical performance characteristics 6

5 Package mechanical data 8

5.1 SOT23-3L, TS4061 8

5.2 SOT323-3L, TS4061 10

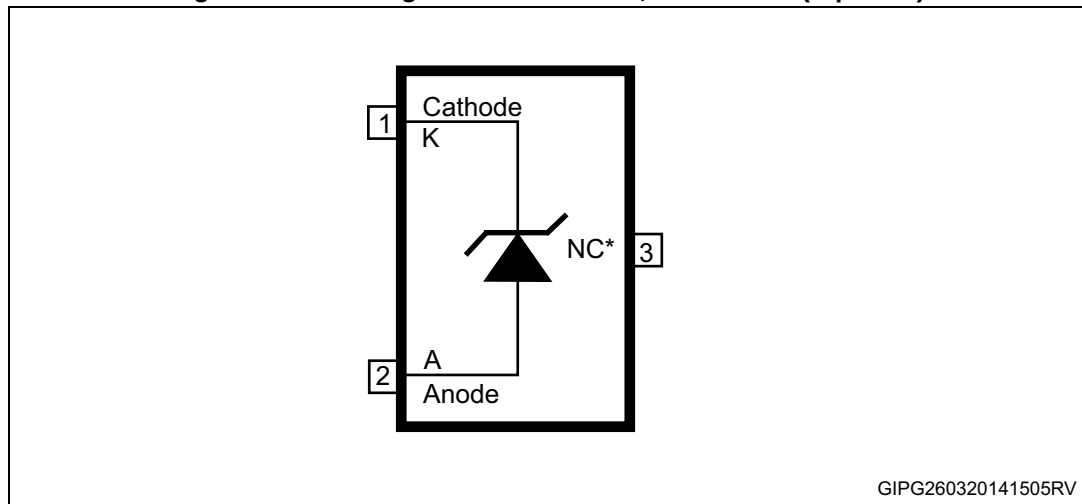
6 Ordering information 12

7 Revision history 13



1 Pin configuration

Figure 1. Pin configuration SOT23-3L, SOT323-3L (top view)



Note: The NC pin must be left unconnected or connected to anode.

2 Maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
I_k	Reverse breakdown current	20	mA
I_f	Forward current	15	mA
P_d	Power dissipation ⁽¹⁾	500	mW
T_{std}	Storage temperature	-65 to +150	°C
E_{SD}	Human body model (HBM)	2	kV
	Machine model (MM)	200	V
	Charged device model	1500	V
T_{lead}	Lead temperature (soldering) 10 sec	260	°C
T_j	Max. junction temperature	+150	°C

1. P_d has been calculated with $T_{amb} = 25\text{ °C}$ and $T_{jmax} = 150\text{ °C}$

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

Table 2. Thermal data

Symbol	Parameter	SOT323-3L	SOT23-3L	Unit
R_{thJA}	Thermal resistance junction-ambient	246	242	°C/W
R_{thJC}	Thermal resistance junction-case	171	103	°C/W

Table 3. Operating conditions

Symbol	Parameter	Value	Unit
I_{kmin}	Minimum operating current	10	μA
I_{kmax}	Maximum operating current	15	mA
T_{oper}	Operating free air temperature range	-40 to +85	°C

3 Electrical characteristics

Limits are 100% production tested at 25 °C. Limits over full temperature range are guaranteed through correlation and by design. $I_k = 10 \mu\text{A}$, $T_{\text{amb}} = 25 \text{ °C}$ (unless otherwise specified).

Table 4. Electrical characteristics for TS4061

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_k	Reverse breakdown voltage ($V_k = 1.225 \text{ V}$)	$I_k = 10 \mu\text{A}$, TS4061A	1.2237	1.225	1.2262	V
		$I_k = 10 \mu\text{A}$, TS4061B	1.2225		1.2275	
	Reverse breakdown voltage ($V_k = 1.25 \text{ V}$)	$I_k = 10 \mu\text{A}$, TS4061A	1.2487	1.25	1.2512	V
		$I_k = 10 \mu\text{A}$, TS4061B	1.2475		1.2525	
$I_{k\text{min}}$	Minimum operating current	$T_{\text{amb}} = 25 \text{ °C}$		7.5	10	μA
		$-40 \text{ °C} < T_{\text{amb}} < +85 \text{ °C}$			12	
$\Delta V_k / \Delta T$	Average temperature coefficient	$10 \mu\text{A} < I_k < 15 \text{ mA}$		20	35	ppm/°C
$\Delta V_k / \Delta I_k$	Reverse breakdown voltage change with operating current range	$I_{k\text{min}} < I_k < 1 \text{ mA}$ $-40 \text{ °C} < T_{\text{amb}} < +85 \text{ °C}$		0.2	1	mV
		$1 \text{ mA} < I_k < 15 \text{ mA}$ $-40 \text{ °C} < T_{\text{amb}} < +85 \text{ °C}$		1.7	4	
R_{ka}	Static impedance	$\Delta I_k = 10 \mu\text{A}$ to 10 mA		0.15	0.3	Ω
Hys	Thermal hysteresis ⁽¹⁾	$I_k = 10 \mu\text{A}$		120		ppm
Noise	Wideband noise	$I_k = 10 \mu\text{A}$ $10 \text{ Hz} < f < 10 \text{ kHz}$		95		μVRMS
	Low frequency noise	$I_k = 10 \mu\text{A}$ $0.1 \text{ Hz} < f < 10 \text{ Hz}$		10		$\mu\text{Vp-p}$

1. Thermal hysteresis is defined as the difference in voltage measured at +25 °C after cycling to -40 °C and the measurement at +25 °C after cycling to temperature +85 °C.

4 Typical performance characteristics

(The following plots are referred to the typical application circuit and, unless otherwise noted, at $T_A = 25\text{ }^{\circ}\text{C}$)

Figure 2. V_K change vs temperature (1.225 V version)

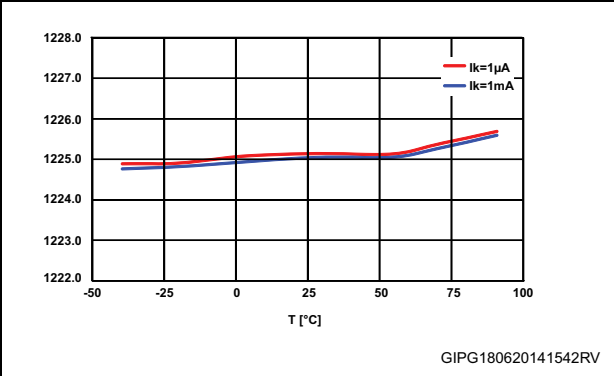


Figure 3. V_K change vs temperature (1.25 V version)

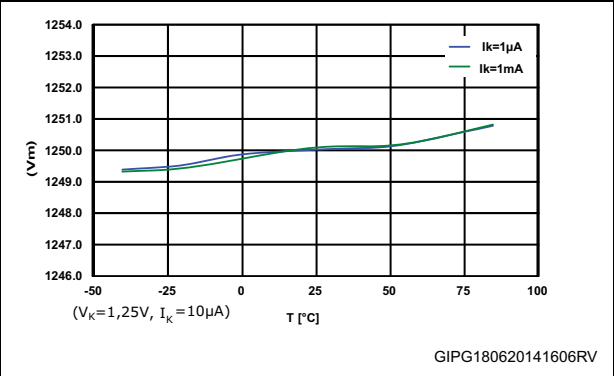


Figure 4. I_{Kmin} minimum current for regulation

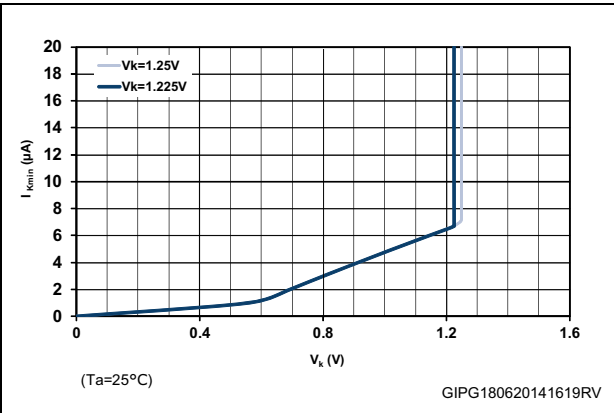


Figure 5. I_{Kmin} minimum current for regulation vs temperature

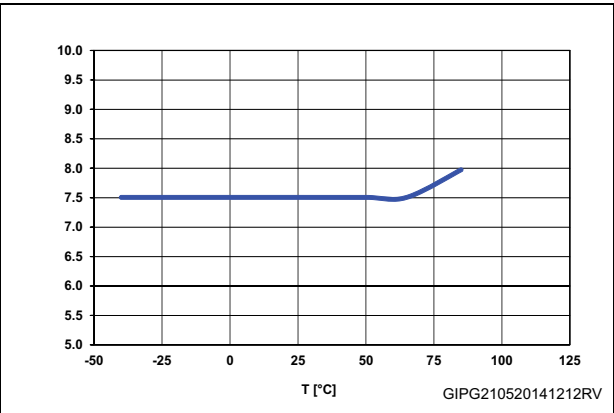


Figure 6. Output impedance vs frequency

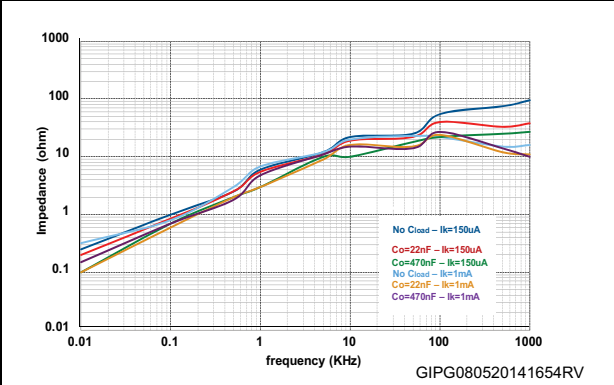


Figure 7. Forward characteristics

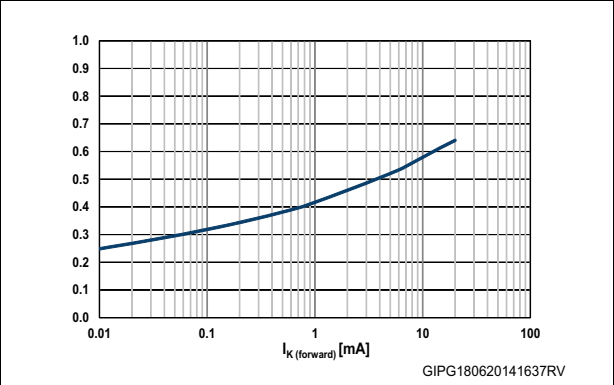


Figure 8. Start-up waveform (no C_{load})

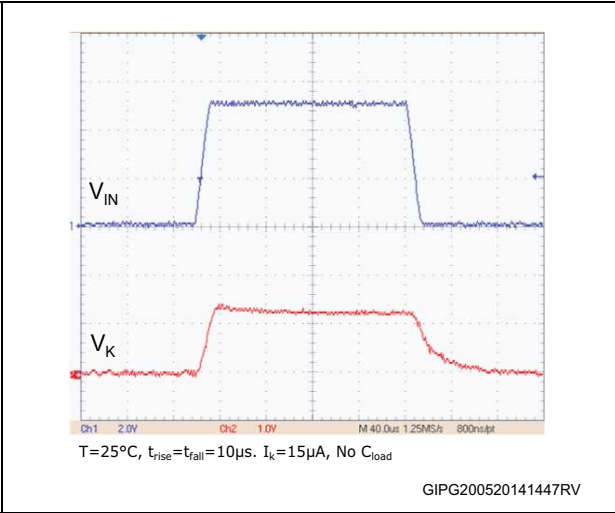


Figure 9. Start-up waveform ($C_{load} = 100\text{ nF}$)

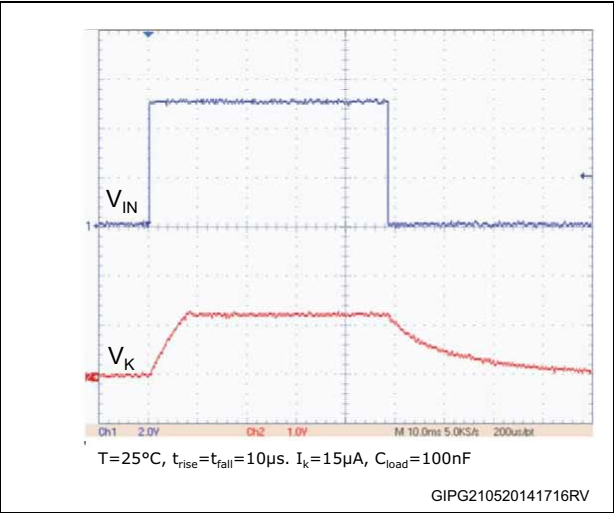
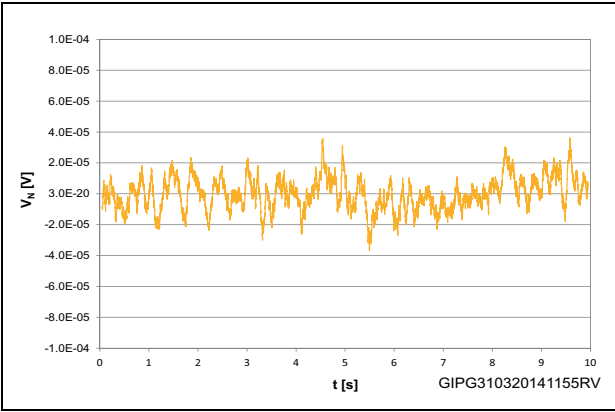


Figure 10. Low frequency noise



5 Package mechanical data

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.

5.1 SOT23-3L, TS4061

Figure 11. SOT23-3L mechanical drawings

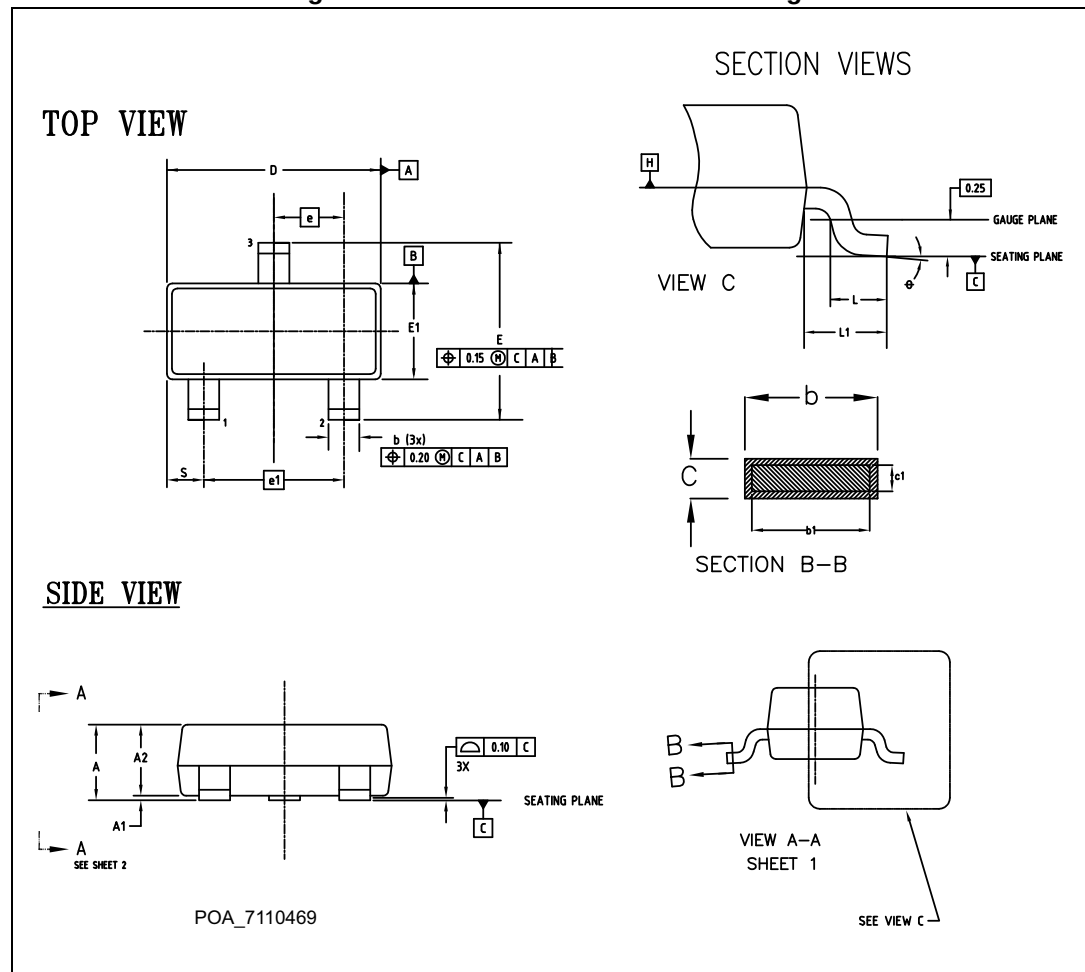
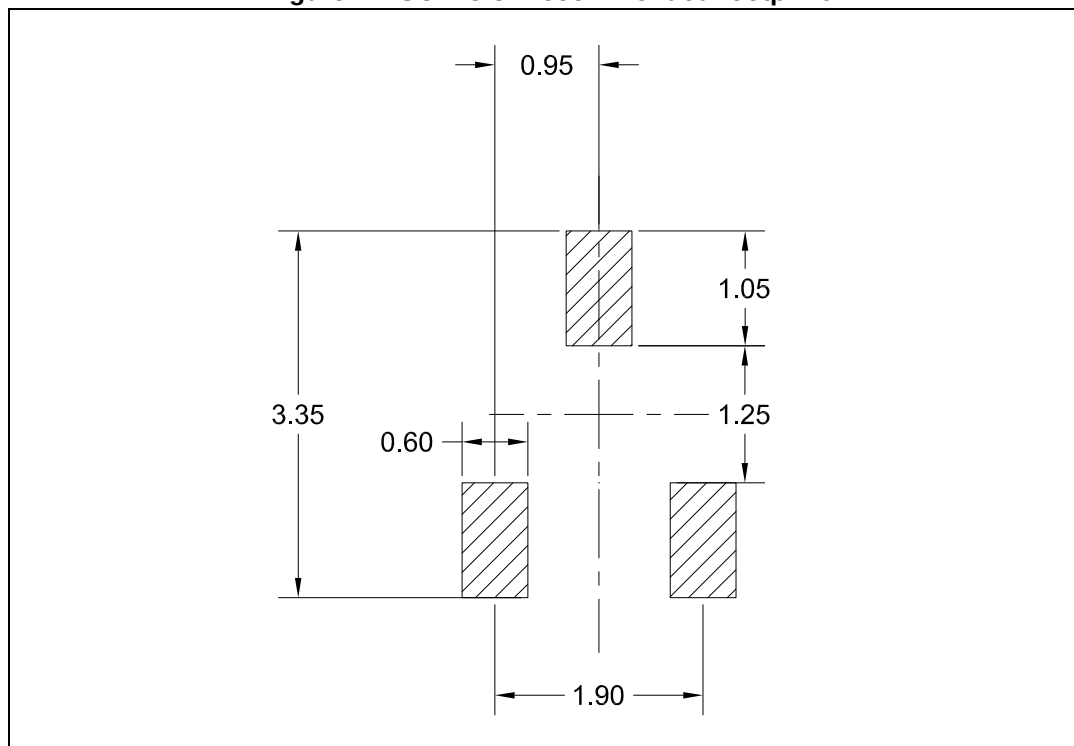


Table 5. SOT23-3L mechanical data

Dim.	mm		
	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		3.04
E	2.10		2.64
E1	1.20		1.40
e	0.95 BSC		
e1	1.90 BSC		
*L	0.28	0.38	0.48
L1	0.55		
R	0.05		
R1	0.05		
θ	0°		8°
s	0.45		0.60

Figure 12. SOT23-3L recommended footprint



5.2 SOT323-3L, TS4061

Figure 13. SOT323-3L drawings

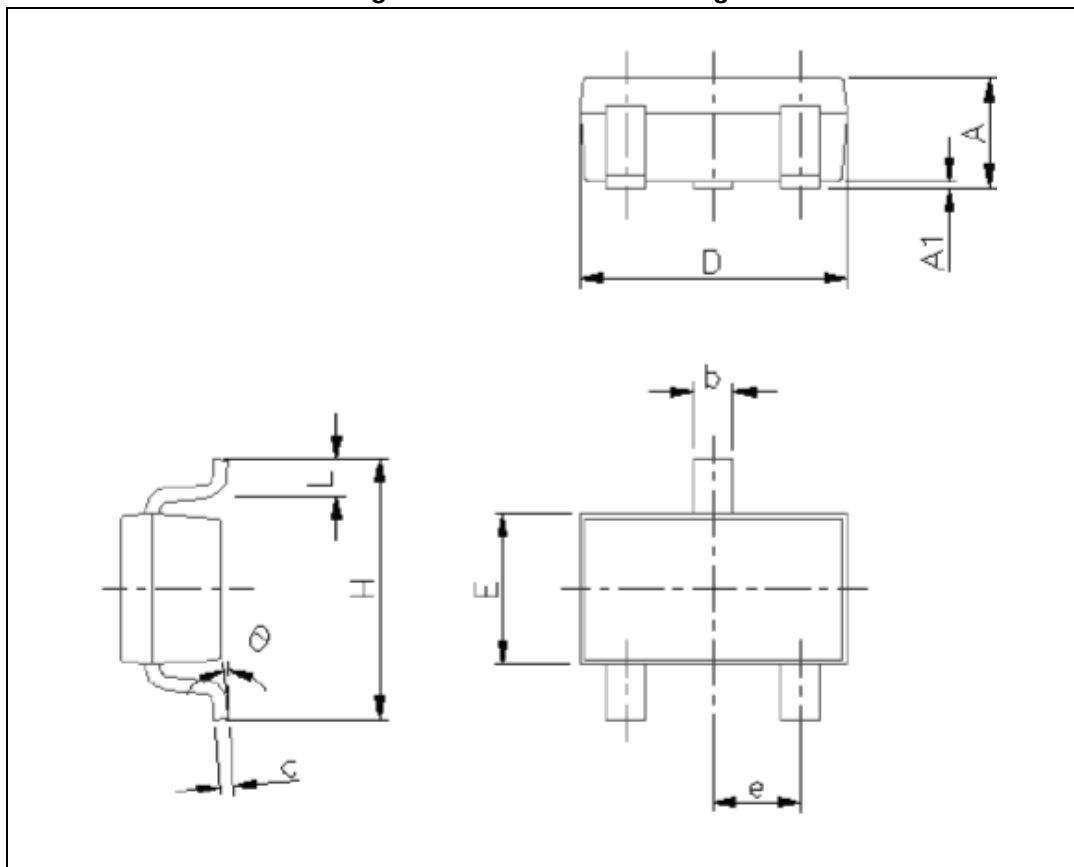
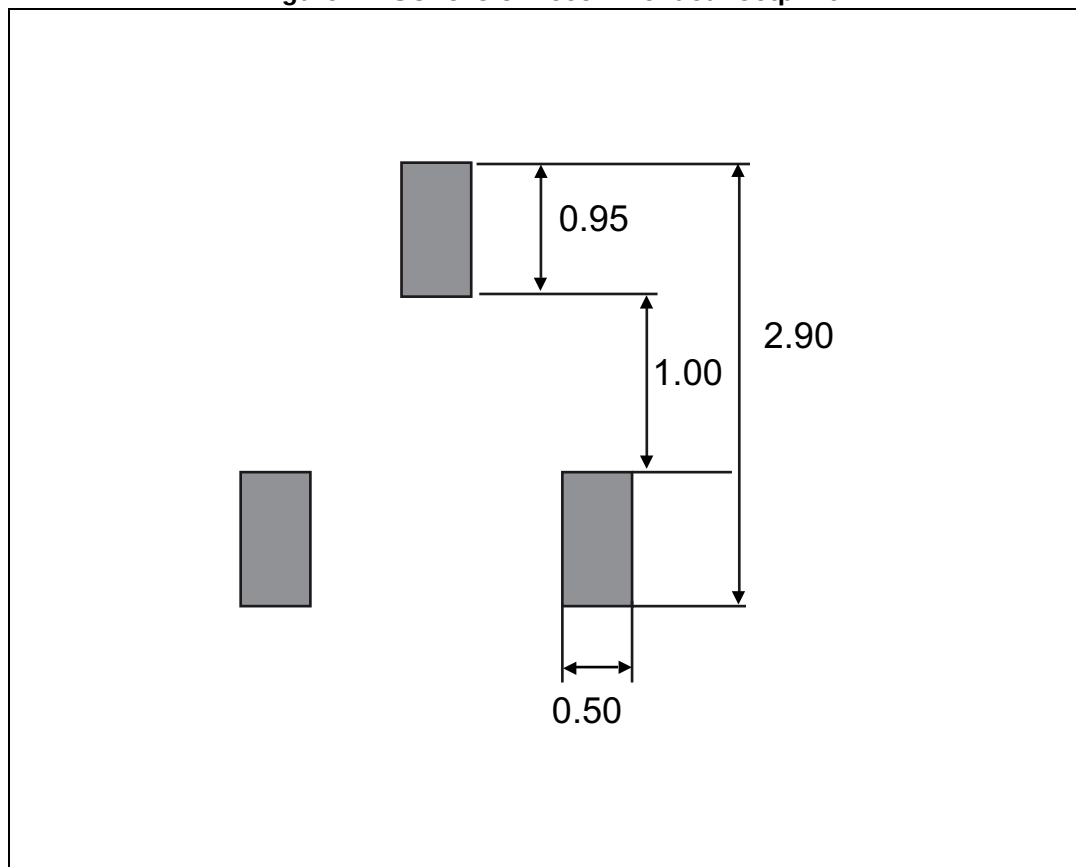


Table 6. SOT323-3L mechanical data

Dim.	mm		
	Typ.	Min.	Max.
A		0.80	1.10
A1		0.00	0.10
b		0.25	0.40
c		0.10	0.18
D		1.80	2.20
E		1.15	1.35
e	0.65	0.60	0.70
H		1.80	2.40
L		0.10	0.30

Figure 14. SOT323-3L recommended footprint



6 Ordering information

Table 7. Order codes

Order codes	Output voltage (V)	Precision (%)	Package	Temperature range (°C)
TS4061AILT-1.25	1.25	0.1	SOT23-3L	-40 to +85
TS4061AILT-1.225	1.225			
TS4061AICT-1.25	1.25	0.1	SOT323-3L	-40 to +85
TS4061AICT-1.225	1.225			
TS4061BILT-1.25	1.25	0.2	SOT23-3L	-40 to +85
TS4061BILT-1.225	1.225			
TS4061BICT-1.25	1.25	0.2	SOT323-3L	-40 to +85
TS4061BICT-1.225	1.225			

7 Revision history

Table 8. Document revision history

Date	Revision	Changes
21-Jul-2014	1	Initial release.
01-Feb-2018	2	Updated: Table 5 , Figure 11 , Figure 12 and Note: The NC pin must be left unconnected or connected to anode.

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.

© 2018 STMicroelectronics – All rights reserved