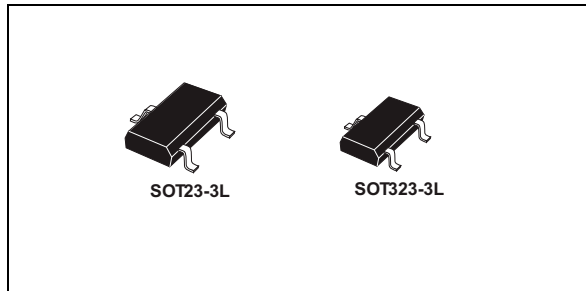


Precision micropower shunt voltage reference

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 μ A at 25 °C
- High precision @ 25 °C: +/-0.1% (TS4061A), +/- 0.2% (TS4061B)
- Very low LF noise: typ. 10 μ V_{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

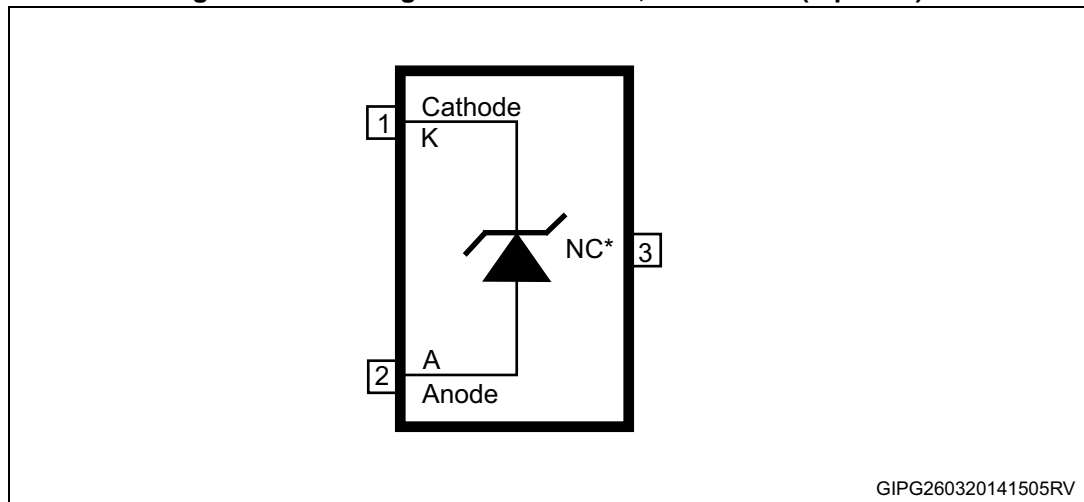
- Portable, battery-operated equipment
- Data acquisition systems
- Instrumentation

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 Hz < f < 10 kHz | | 95 | | μVRMS |
| | Low frequency noise | $I_k = 10 \mu\text{A}$ 0.1 Hz < f < 10 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)

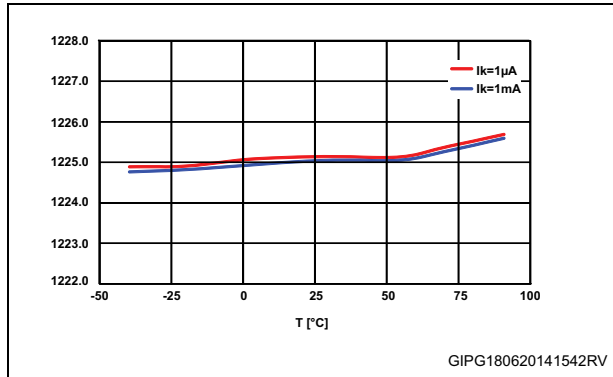


Figure 3. V_K change vs temperature (1.25 V version)

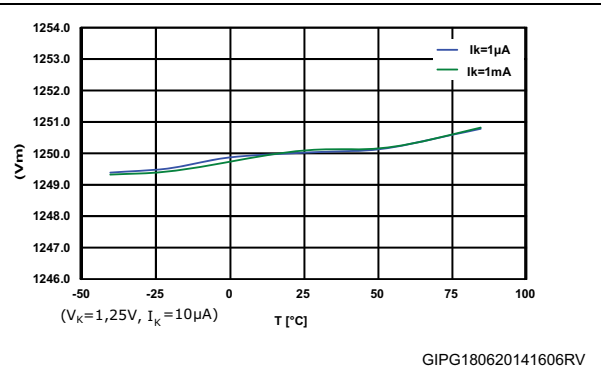


Figure 4. I_{Kmin} minimum current for regulation

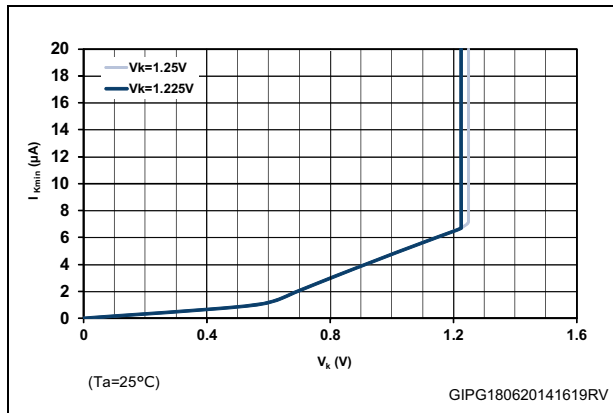


Figure 5. I_{Kmin} minimum current for regulation vs temperature

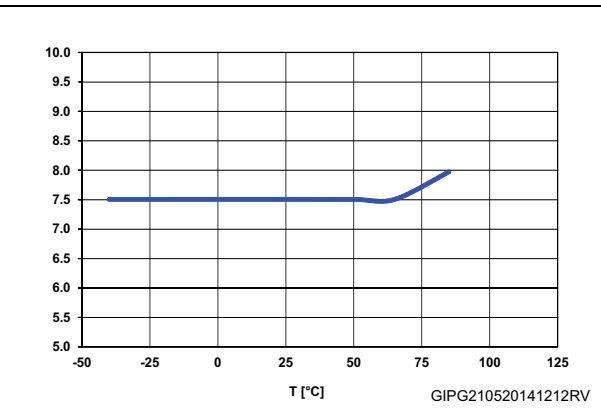


Figure 6. Output impedance vs frequency

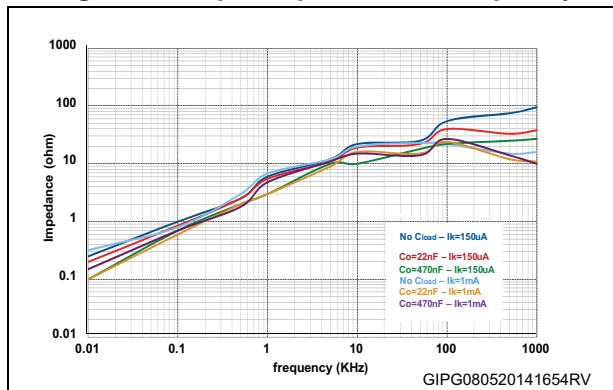


Figure 7. Forward characteristics

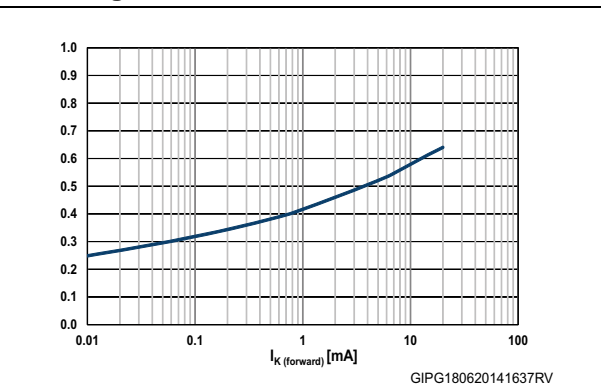


Figure 8. Start-up waveform (no C_{load})

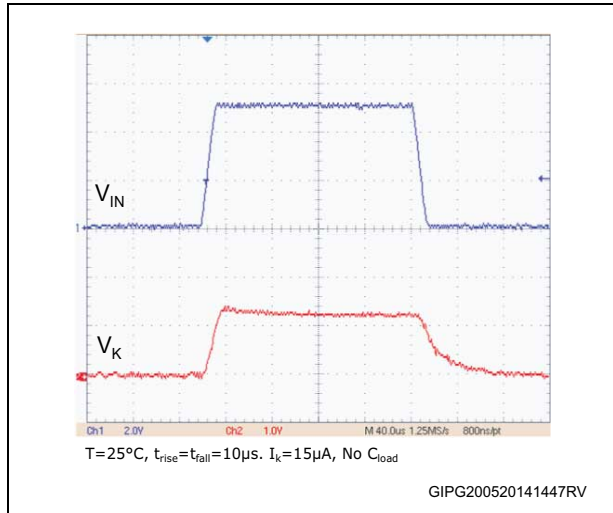


Figure 9. Start-up waveform ($C_{load} = 100 \text{ nF}$)

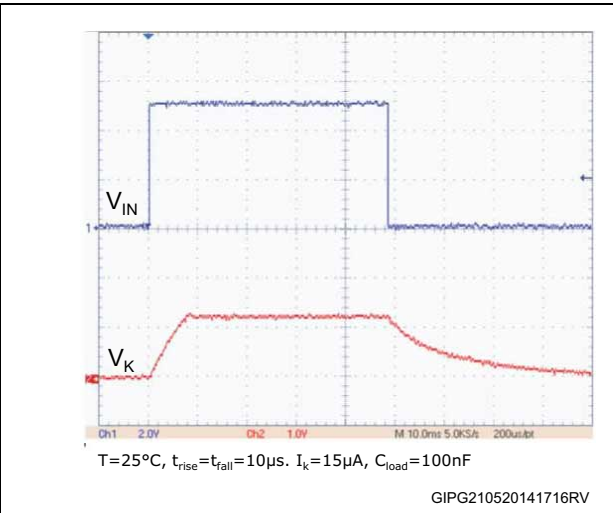
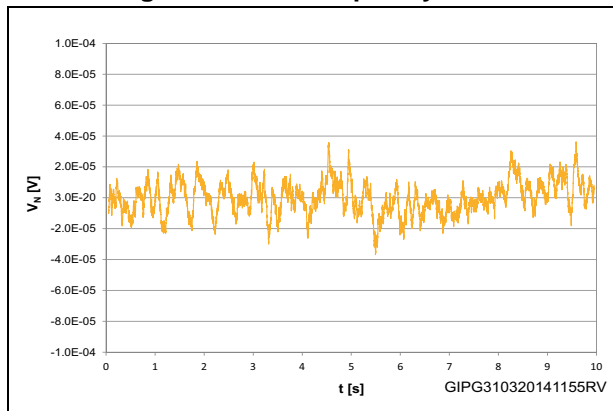


Figure 10. Low frequency noise



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

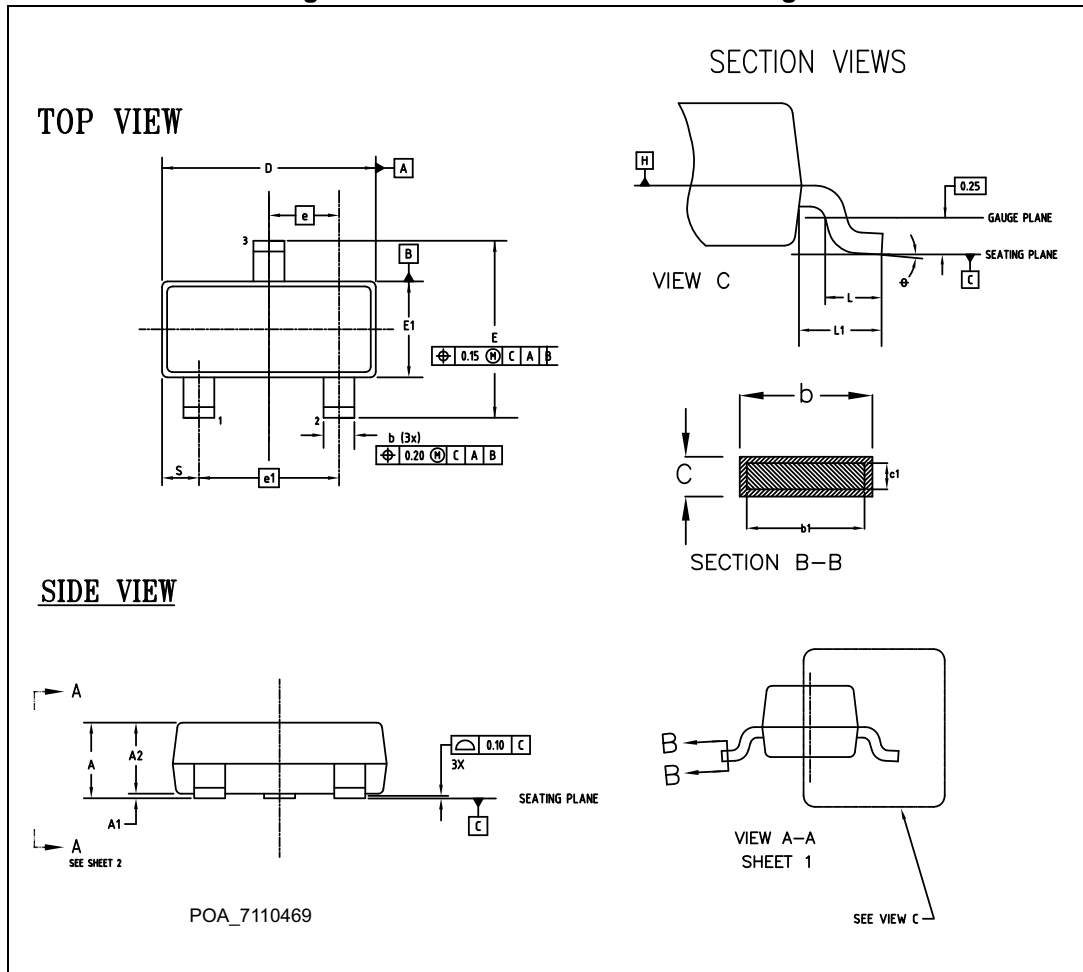
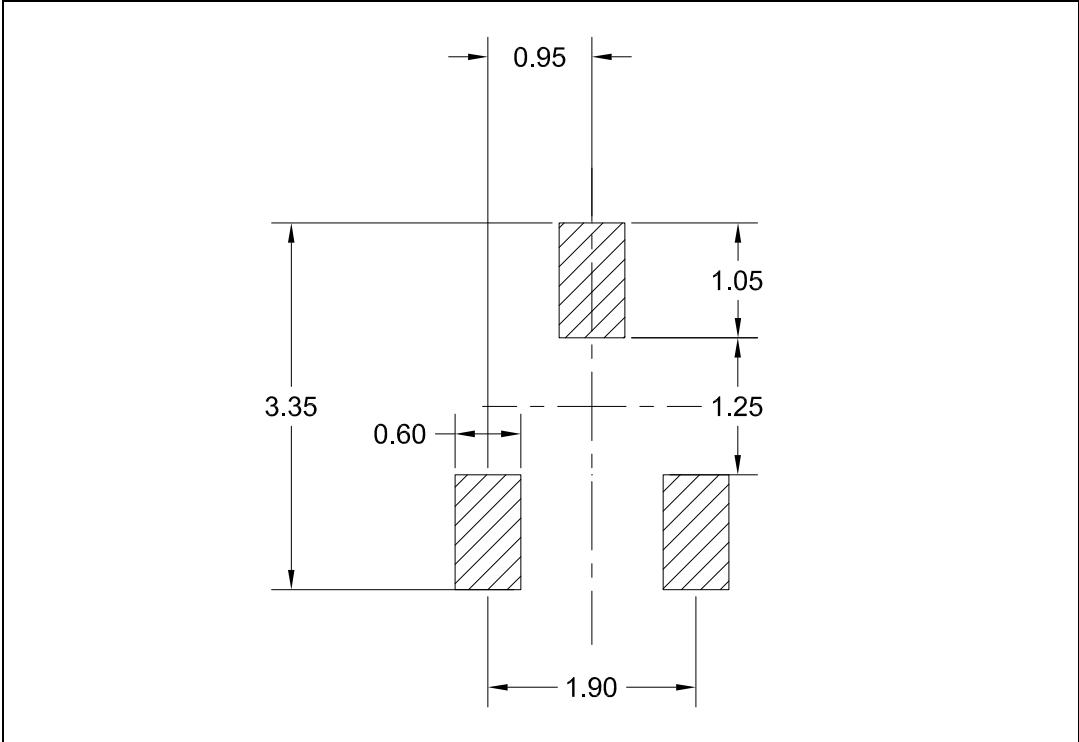


Table 5. SOT23-3L mechanical data

| 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

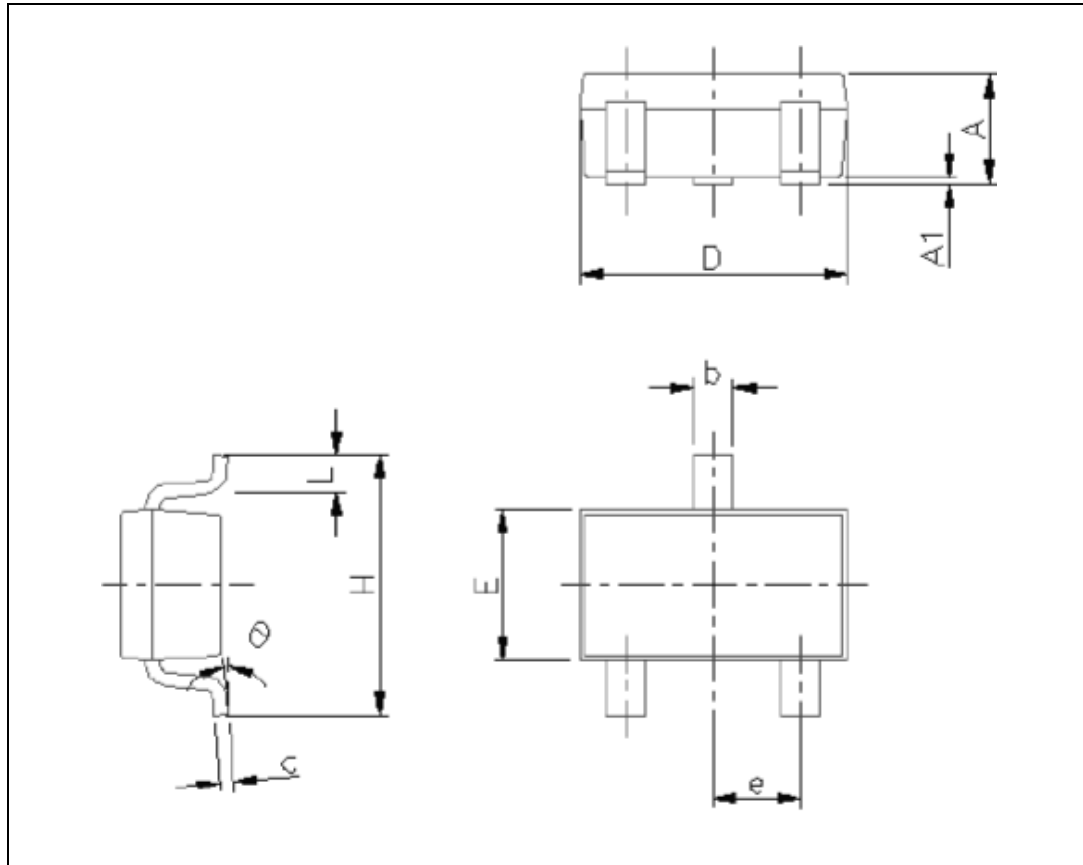
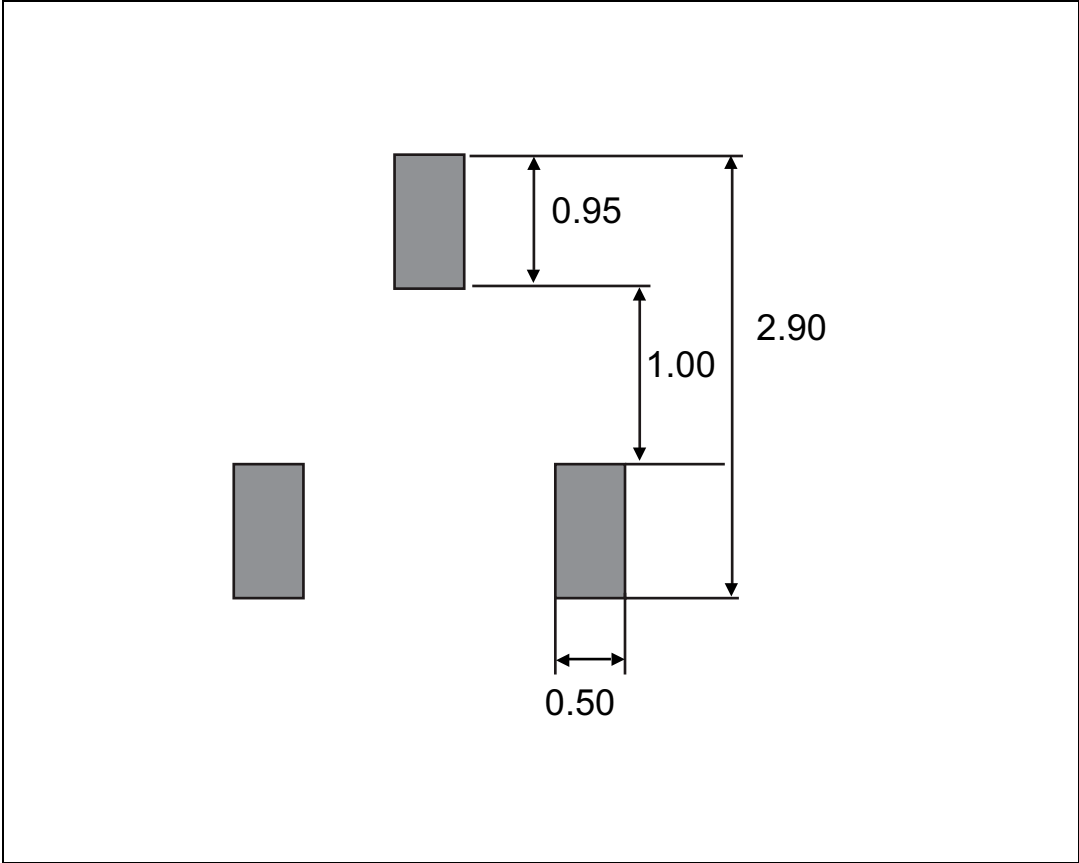


Table 6. SOT323-3L mechanical data

| 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: <i>Table 5, Figure 11, Figure 12</i> and Note: <i>The NC pin must be left unconnected or connected to anode.</i> |

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

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [Voltage References](#) category:

Click to view products by [STMicroelectronics](#) manufacturer:

Other Similar products are found below :

[REF01J/883](#) [5962-8686103XC](#) [NCV431BVDMR2G](#) [LT6654AMPS6-2.048#TRMPBF](#) [SCV431AIDMR2G](#) [LT1019AIS8-2.5](#) [SC431ILPRAG](#)
[AP432AQG-7](#) [NJM2823F-TE1](#) [TL431-A](#) [MCP1502T-18E/CHY](#) [MCP1502T-40E/CHY](#) [TL431ACZ](#) [KA431SLMF2TF](#) [KA431SMF2TF](#)
[KA431SMFTF](#) [LM4040QCEM3-3.0/NOPB](#) [LM4041C12ILPR](#) [LM4120AIM5-2.5/NOP](#) [LM431SCCMFX](#) [TS3330AQPR](#) [REF5040MDREP](#)
[REF3012AIDBZR](#) [LM285BXM3-1.2/NOPB](#) [LM385BM-2.5/NOPB](#) [LM4040AIM3-10.0](#) [LM4040BIM3-4.1](#) [LM4040CIM3-10.0](#)
[LM4040CIM3X-2.0/NOPB](#) [LM4041BSD-122GT3](#) [LM4041QDIM3-ADJ/NO](#) [LM4050QAEM3X4.1/NOPB](#) [LM4051BIM3-ADJ/NOPB](#)
[LM4051CIM3X-1.2/NOPB](#) [LM4128CMF-1.8/NOPB](#) [LM4132DMF-1.8/NOPB](#) [LM4132EMF-1.8/NOPB](#) [LM4132EMF-2.0/NOPB](#)
[LM4140CCMX-1.2/NOPB](#) [LM431CIM](#) [LM385BD-2.5R2G](#) [LM385M-2.5/NOPB](#) [LM4030AMF-4.096/NOPB](#) [LM4040D30ILPR](#)
[LM4051CIM3X-ADJ/NOPB](#) [AP432YG-13](#) [AS431ANTR-G1](#) [AS431BZTR-E1](#) [AN431AN-ATRG1](#) [AP431IBNTR-G1](#)