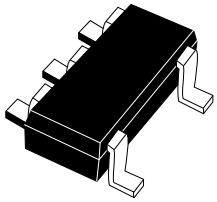
# TS4061V

Datasheet

## Precision micropower shunt voltage reference



SOT323-5L

### Features

- Fixed 2.048 V output voltage
- Ultra low operating current: 10 µA at 25 °C
- High initial accuracy: ± 0.2%
- Stable when used with capacitive loads
- Industrial (-40 to +85 °C) temperature range
- 20 ppm / °C typ., 70 ppm / °C max. temperature coefficient
- Available in SOT323-5L package

### Applications

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

### Description

The TS4061V is a low power high accuracy shunt voltage reference providing a stable output voltage over the industrial temperature range, with a maximum temperature coefficient of 70 ppm/°C.

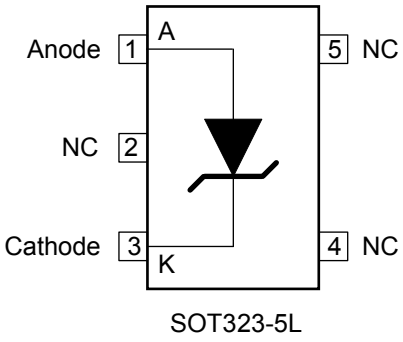
The SOT323-5L package is ideal in applications where space saving is a critical issue.

The very low operating current is a key advantage for power budgeted designs. In addition, the TS4061V is very stable and can be used in a broad range of application conditions.

| Maturity status link |
| --- |
| TS4061V |

# 1 Pin configuration

Figure 1. **Pin connections (top view)**




SOT323-5L

Table 1. **Order code**

| Part number | Cathode-to-anode voltage | Precision | Package | Temperature range |
|---|---|---|---|---|
| TS4061VIBT-205 | 2.048 V | 0.2% | SOT323-5L | -40 to +85 °C |

# 2 Maximum ratings

**Table 2. 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) SOT323-5L | 500 | mW |
| $T_{std}$ | Storage temperature | -65 to +150 | °C |
| ESD | Human body model (HBM) | 2 | kV |
| | Charged device model | 1500 | V |
| $T_{lead}$ | Lead temperature (Soldering) 10 s. | 260 | °C |
| $T_j$ | Max junction temperature | +150 | °C |

1. *$P_d$ has been calculated with $T_{amb}$ = 25 °C and $T_{jmax}$ = 150 °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 3. Thermal data**

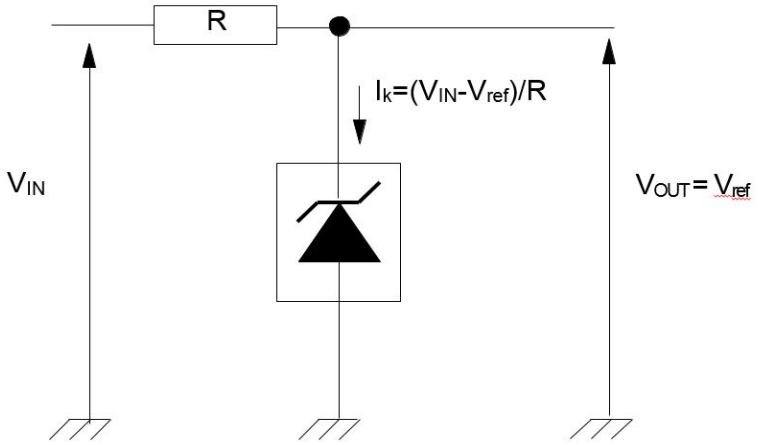
| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJA}$ | Thermal resistance junction-ambient | 250 | °C/W |
| $R_{thJC}$ | Thermal resistance junction-case | 171 | °C/W |

**Table 4. 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 Typical application circuit

Figure 2. **Application circuit**




*Note: The value of R must be chosen in order to ensure $I_K \geq I_{Kmin}$ in all the operating conditions ($V_{IN}$, load and temperature).*

# 4 Electrical characteristics

$I_k$ = 10 µA, $T_{amb}$ = 25 °C (unless otherwise specified).

**Table 5. Electrical characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_k$ | Initial accuracy TS4061VIBT-205 | $I_k$ = 10 µA | -0.2 | | +0.2 | % |
| $I_{kmin}$ | Minimum operating current | $T_{amb}$ = 25 °C | | 7.5 | 10 | µA |
| | | -40 °C < $T_{amb}$ < +85 °C | | | 12 | |
| $\Delta V_k$ / $\Delta T$ | Average temperature coefficient | 10 µA < $I_k$ < 15 mA, -40 °C < $T_{amb}$ < +85 °C | | 20 | 70 | ppm/°C |
| $\Delta V_k$ / $\Delta I_k$ | Reverse breakdown voltage change with operating current range | $I_{kmin}$ < $I_k$ < 1 mA<br>-40 °C < T amb < +85 °C | | 0.2 | 1 | mV |
| | | 1 mA < $I_k$ < 15 mA<br>-40 °C < $T_{amb}$< +85 °C | | 1.7 | 4 | |
| $R_{ka}$ | Static impedance | $I_k$ = 10 µA to 10 mA | | 0.15 | 0.3 | Ω |
| Hys | Thermal hysteresis | $I_k$ = 10 µA | | 120 | | ppm |
| Noise | Wide band noise | $I_k$ = 10 µA 10 Hz < f < 10 kHz | | 90 | | $\mu V_{RMS}$ |
| | Low frequency noise | $I_k$ = 10 µA 0.1 Hz < f < 10 Hz | | 45 | | $\mu V_{p-p}$ |

*Note: Limits are 100% production tested at 25 °C. Limits overtemperature are guaranteed through correlation and by design.*

# 5 Typical performance characteristics

The following plots are referred to the typical application circuit and, unless otherwise noted, at $T_A$ = 25 °C.

**Figure 3. Cathode voltage vs. temperature ($I_K$ = 10 µA)**

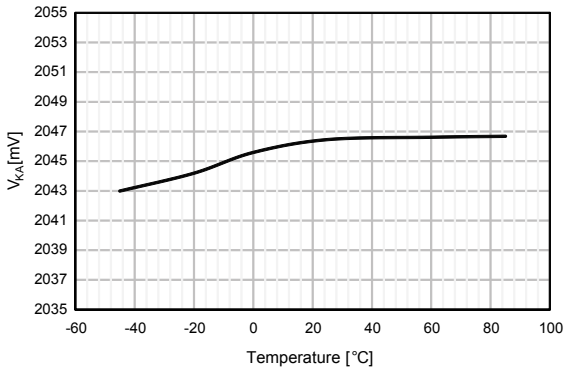



**Figure 4. Cathode voltage vs. temperature ($I_K$ = 1 mA)**

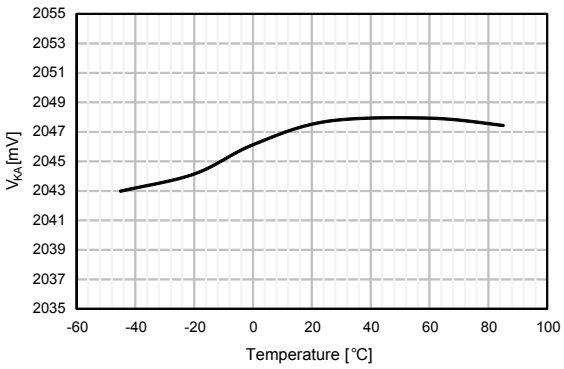



**Figure 5. Cathode voltage vs. temperature ($I_K$ = 15 mA)**

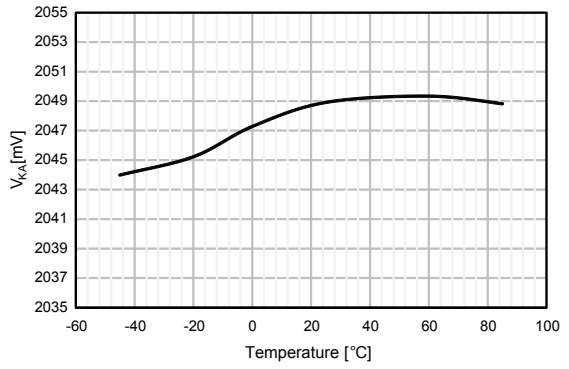



**Figure 6. Static impedance vs. temperature**

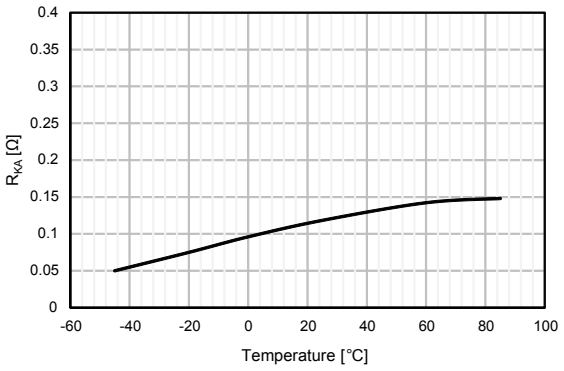



**Figure 7. $\Delta V_k$ / $\Delta I_k$ vs. temperature ($I_K$ = 8 µA to 1 mA)**

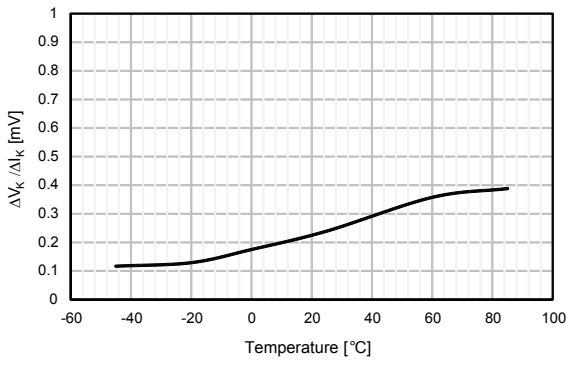



**Figure 8. $\Delta V_k$ / $\Delta I_k$ vs. temperature ($I_K$ = 1 mA to 15 mA)**

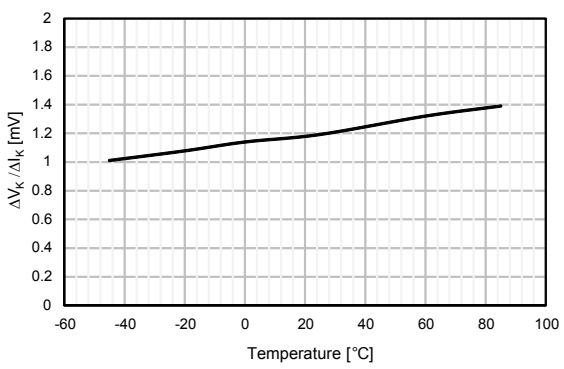


**Figure 9. Minimum operating cathode current vs. temperature**

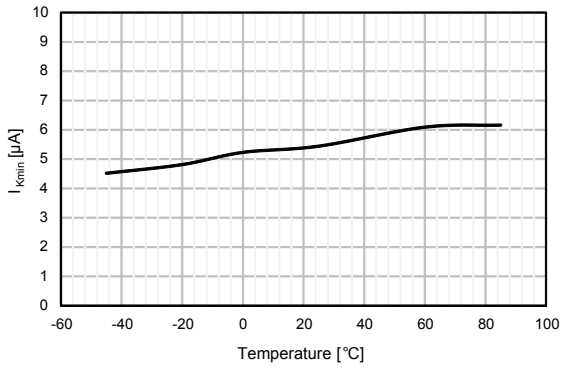



**Figure 10. Reverse characteristic**

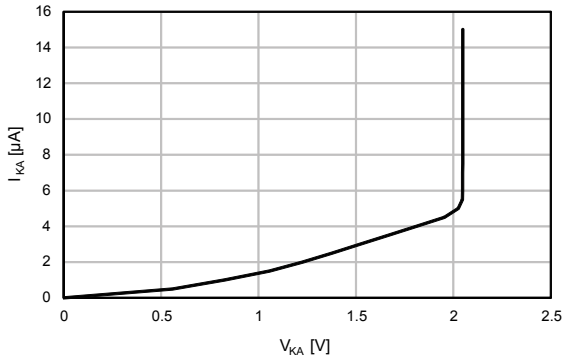



**Figure 11. Forward characteristic**

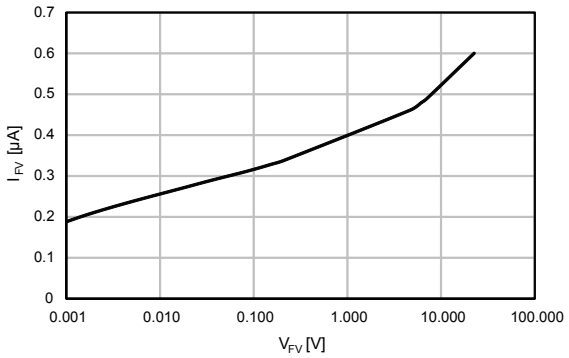



**Figure 12. Temperature coefficient**

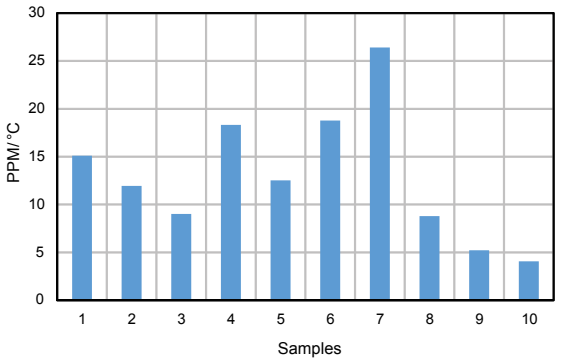



**Figure 13. Turn-on transient ($t_{rise}$ = 10 µs, no $C_{OUT}$)**

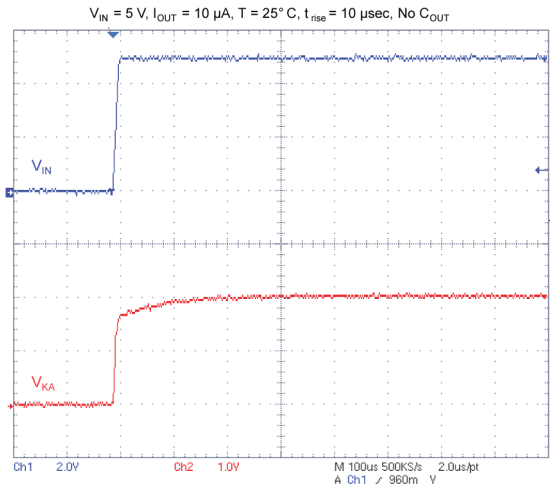



**Figure 14. Turn-on transient ($t_{rise}$ = 1.2 ms, no $C_{OUT}$)**

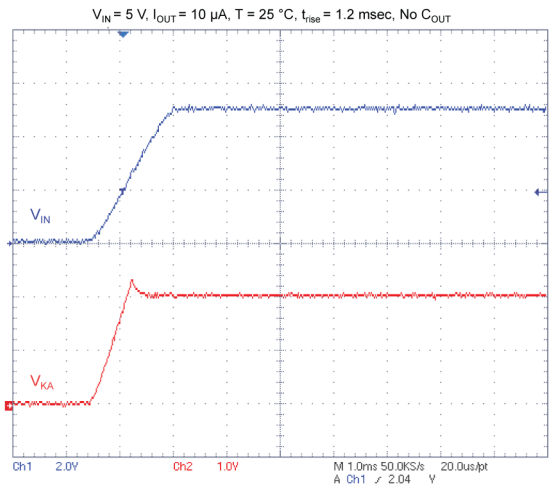


**Figure 15. Turn-on transient ($t_{rise}$ = 1.2 ms, $C_{OUT}$ = 100 nF)**

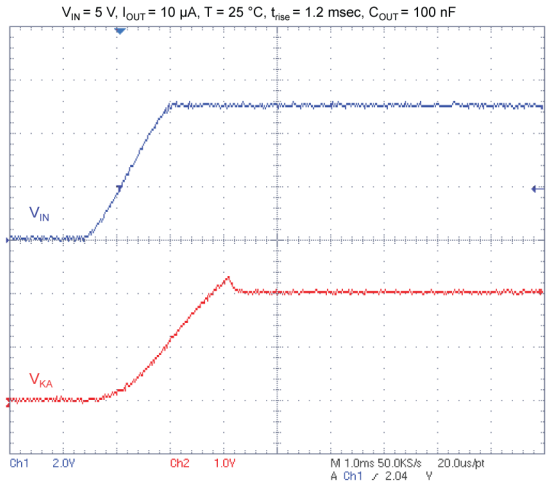
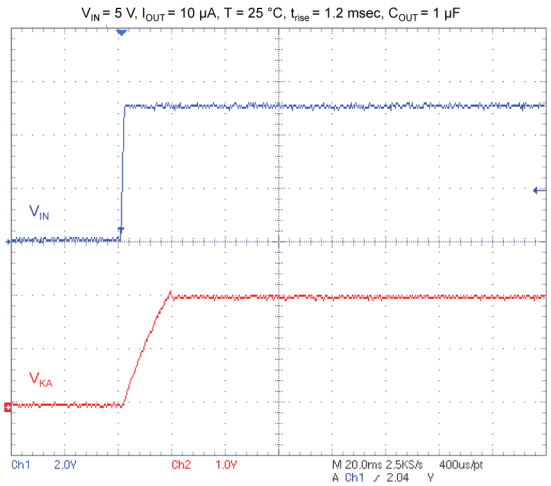



**Figure 16. Turn-on transient ($t_{rise}$ = 1.2 ms, $C_{OUT}$ = 1 µF)**



# 6 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.

## 6.1 SOT323-5L package information

**Figure 17. SOT323-5L package outline**

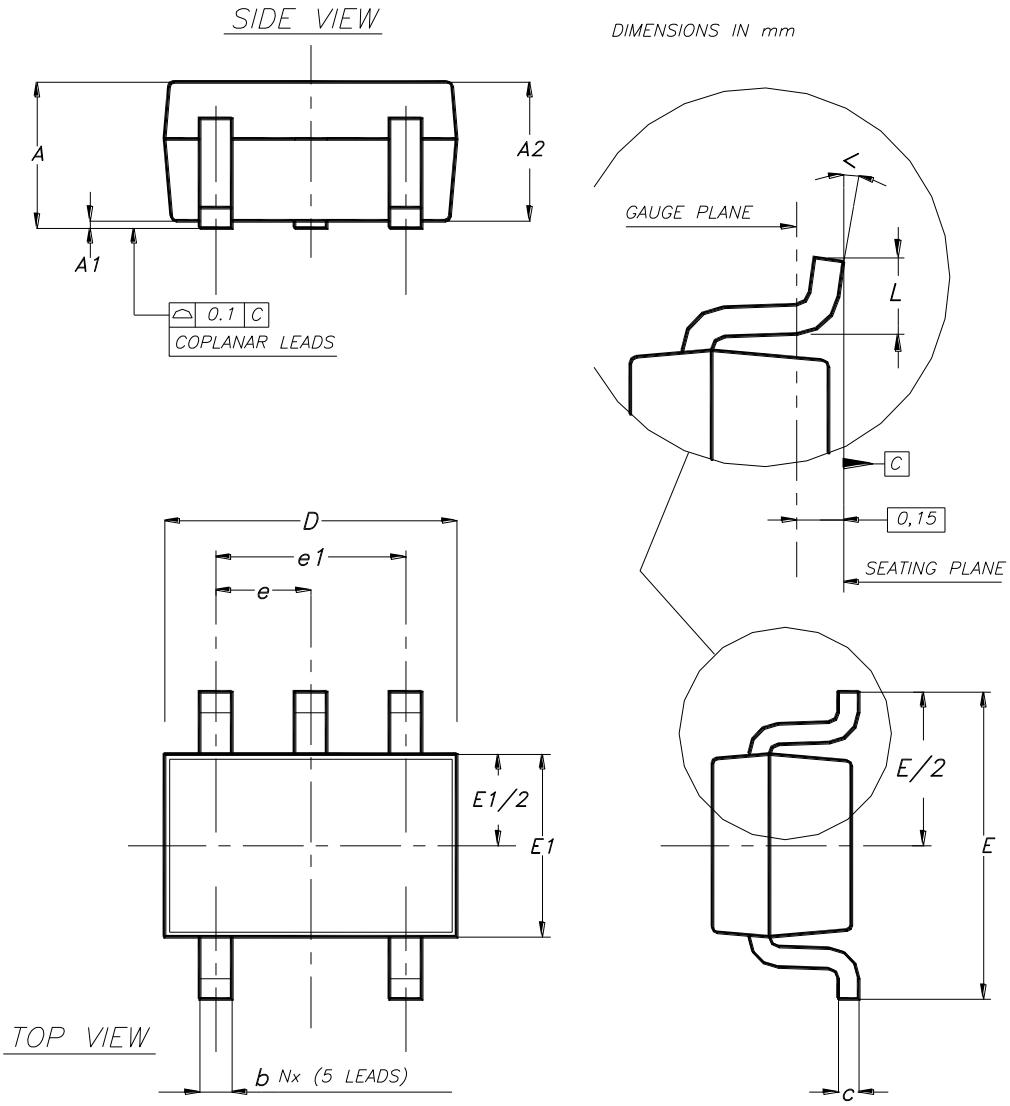


Table 6. **SOT323-5L package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 0.80 | | 1.10 |
| A1 | 0 | | 0.10 |
| A2 | 0.80 | 0.90 | 1.00 |
| b | 0.15 | | 0.30 |
| c | 0.10 | | 0.22 |
| D | 1.80 | 2.00 | 2.20 |
| E | 1.80 | 2.10 | 2.40 |
| E1 | 1.15 | 1.25 | 1.35 |
| e | | 0.65 | |
| e1 | | 1.30 | |
| L | 0.26 | 0.36 | 0.46 |
| θ | 0° | | 8° |

# Revision history

Table 7. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 07-Jun-2018 | 1 | Initial release. |

# Contents

# List of tables

# List of figures

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