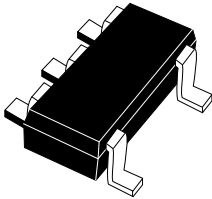


Precision micropower shunt voltage reference



SOT323-5L

Features

- Fixed 2.048 V output voltage
- Ultra low operating current: 10 μ A at 25 °C
- High initial accuracy: \pm 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)

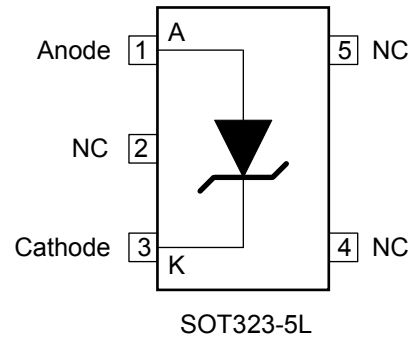


Table 1. Order code

| 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 $T_{amb} = 25\text{ °C}$ 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 3. Thermal data

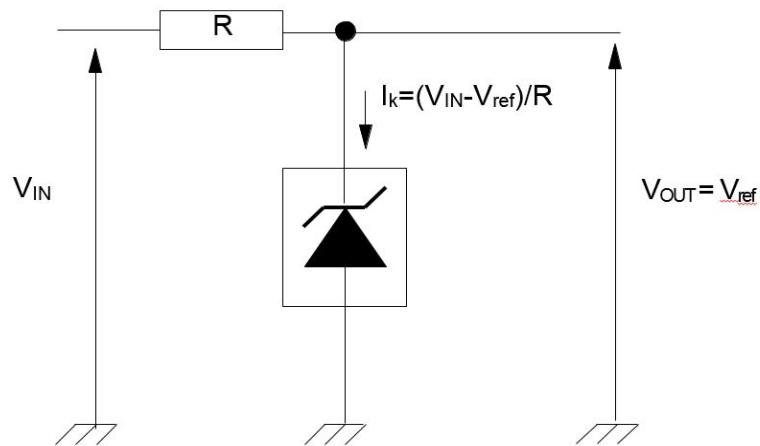
| Symbol | Parameter | Value | Unit |
|------------|-------------------------------------|-------|------|
| R_{thJA} | Thermal resistance junction-ambient | 250 | °C/W |
| R_{thJC} | Thermal resistance junction-case | 171 | °C/W |

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

$I_k = 10 \mu\text{A}$, $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ (unless otherwise specified).

Table 5. Electrical characteristics

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

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 $T_A = 25\text{ }^\circ\text{C}$.

Figure 3. Cathode voltage vs. temperature ($I_K = 10\text{ }\mu\text{A}$)

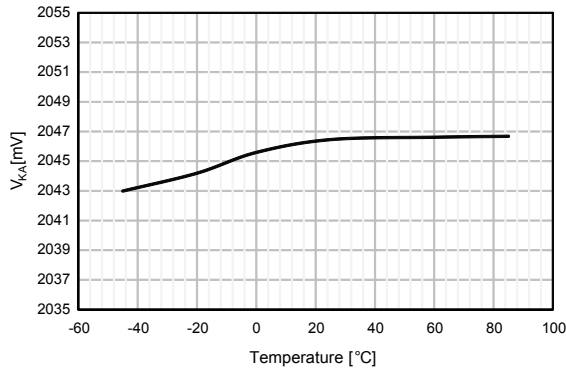


Figure 4. Cathode voltage vs. temperature ($I_K = 1\text{ mA}$)

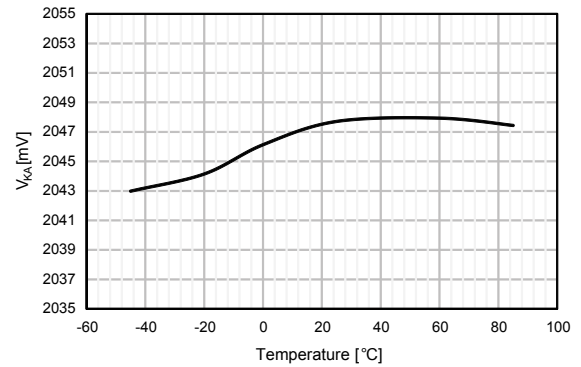


Figure 5. Cathode voltage vs. temperature ($I_K = 15\text{ mA}$)

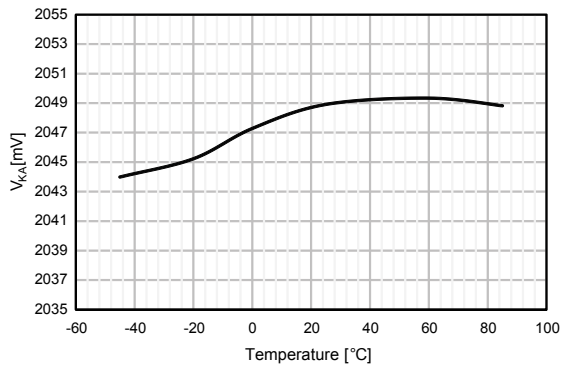


Figure 6. Static impedance vs. temperature

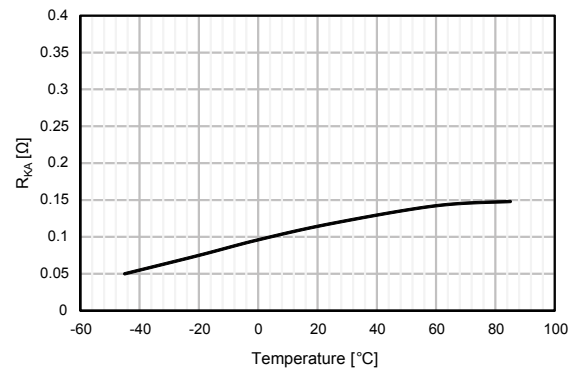


Figure 7. $\Delta V_K / \Delta I_K$ vs. temperature ($I_K = 8\text{ }\mu\text{A}$ to 1 mA)

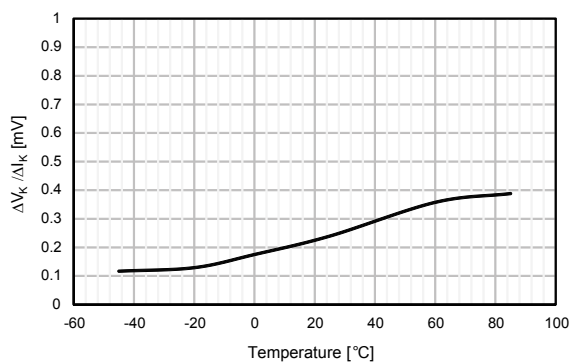


Figure 8. $\Delta V_K / \Delta I_K$ vs. temperature ($I_K = 1\text{ mA}$ to 15 mA)

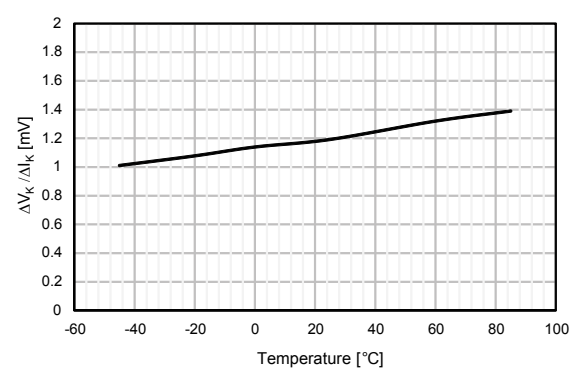


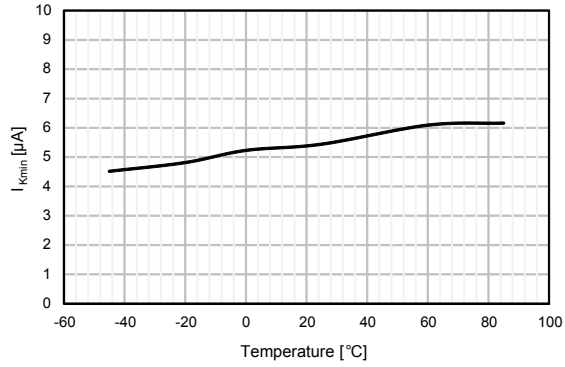
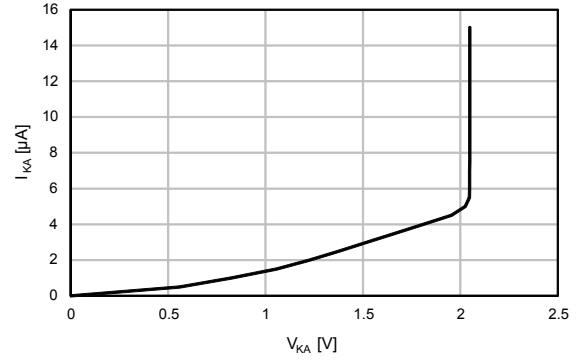
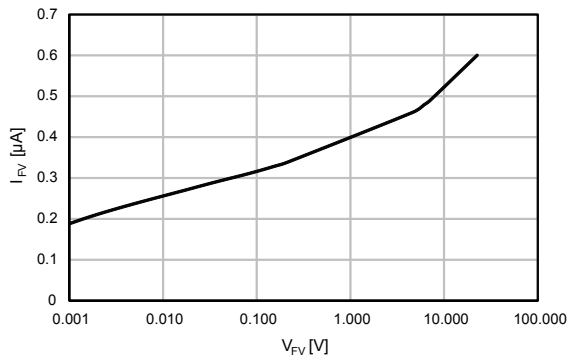
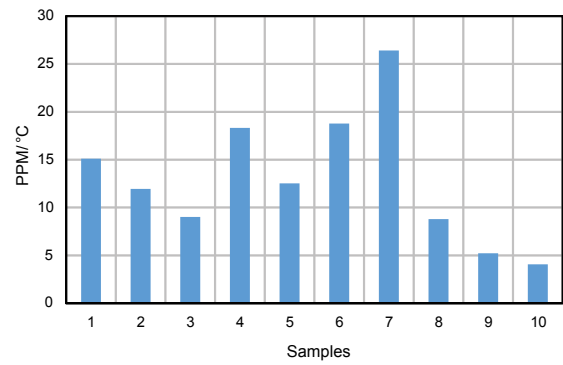
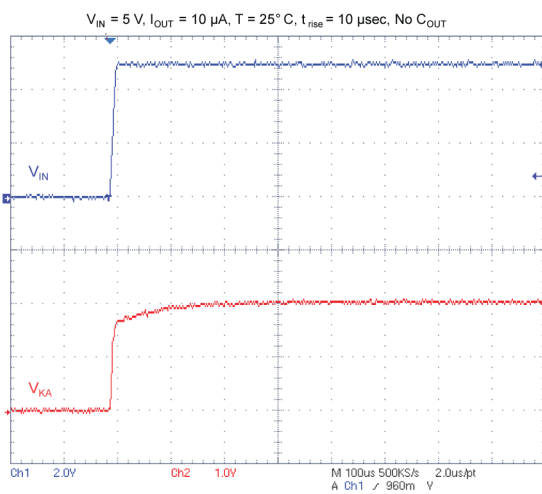
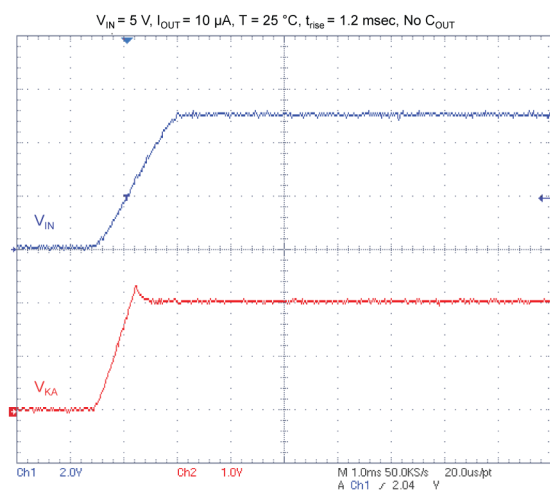
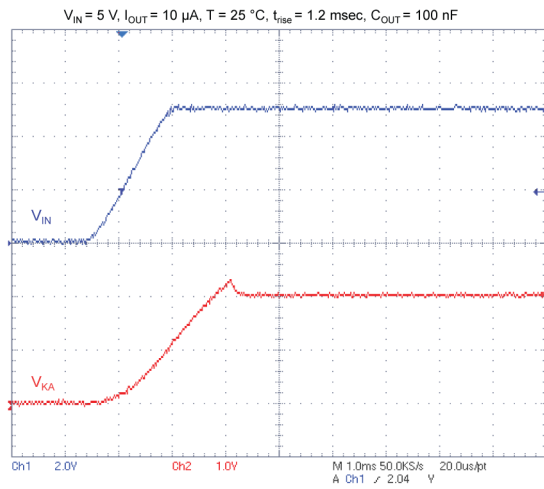
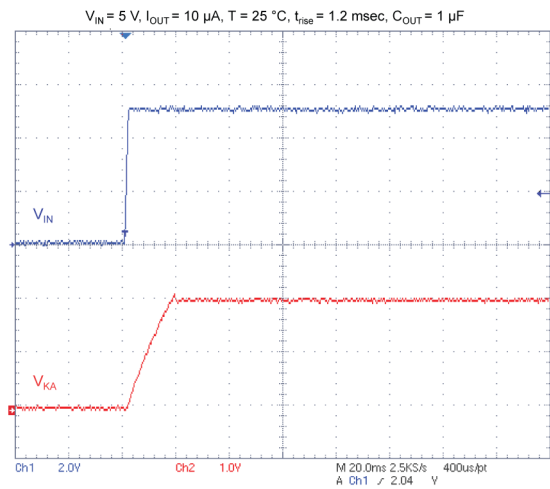
Figure 9. Minimum operating cathode current vs. temperature

Figure 10. Reverse characteristic

Figure 11. Forward characteristic

Figure 12. Temperature coefficient

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

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


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

Figure 16. Turn-on transient ($t_{rise} = 1.2\text{ ms}$, $C_{OUT} = 1\text{ }\mu\text{F}$)


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

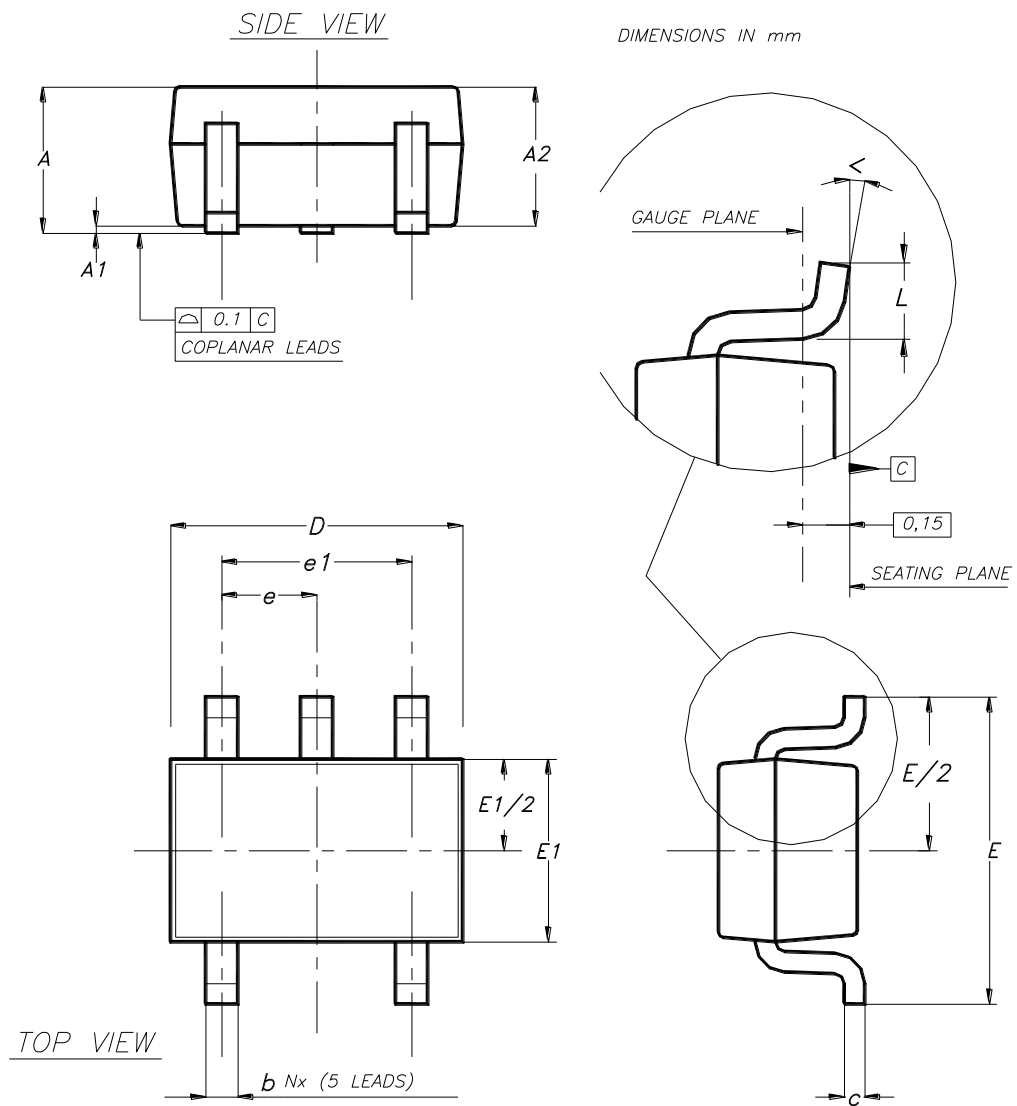


Table 6. SOT323-5L package mechanical data

| 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. |

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