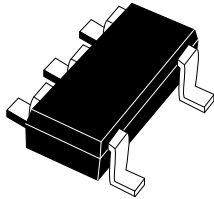


Precision micropower shunt voltage reference



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)

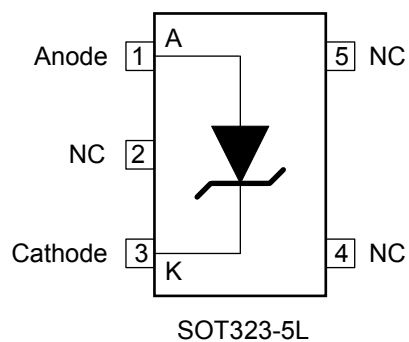


Table 1. Order code

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

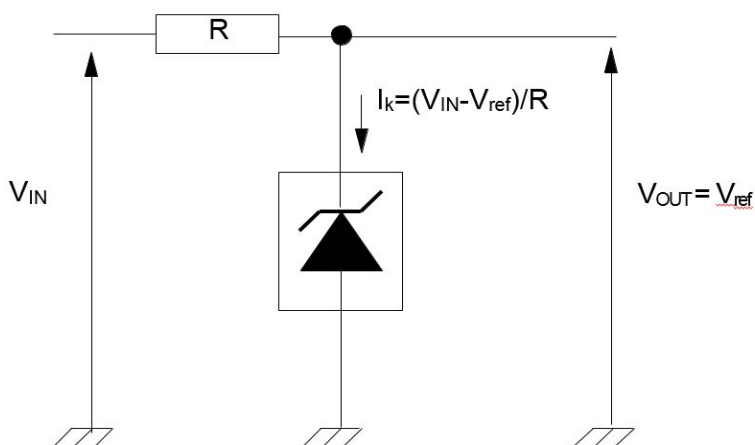
Symbol	Parameter	Value	Unit
R_{thJA}	Thermal resistance junction-ambient	250	°C/W
R_{thJC}	Thermal resistance junction-case	171	°C/W

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

$I_k = 10 \mu\text{A}$, $T_{\text{amb}} = 25^\circ\text{C}$ (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	$T_{\text{amb}} = 25^\circ\text{C}$		7.5	10	μA
		$-40^\circ\text{C} < T_{\text{amb}} < +85^\circ\text{C}$			12	
$\Delta V_k / \Delta T$	Average temperature coefficient	$10 \mu\text{A} < I_k < 15 \text{ mA}$, $-40^\circ\text{C} < T_{\text{amb}} < +85^\circ\text{C}$		20	70	ppm/ $^\circ\text{C}$
$\Delta V_k / \Delta I_k$	Reverse breakdown voltage change with operating current range	$I_{k\text{min}} < I_k < 1 \text{ mA}$ $-40^\circ\text{C} < T_{\text{amb}} < +85^\circ\text{C}$		0.2	1	mV
		$1 \text{ mA} < I_k < 15 \text{ mA}$ $-40^\circ\text{C} < T_{\text{amb}} < +85^\circ\text{C}$		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 $T_A = 25^\circ\text{C}$.

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

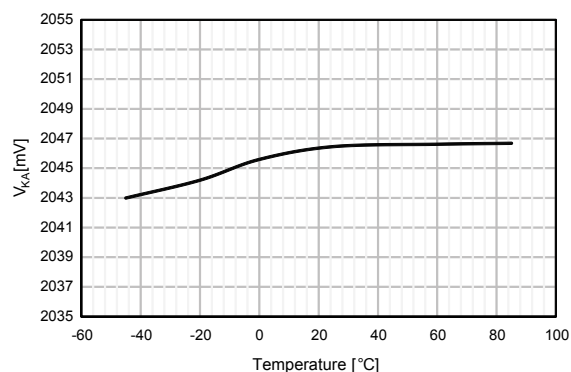


Figure 4. Cathode voltage vs. temperature ($I_K = 1\ \text{mA}$)

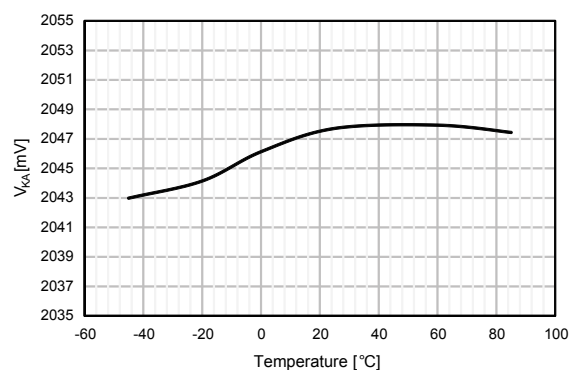


Figure 5. Cathode voltage vs. temperature ($I_K = 15\ \text{mA}$)

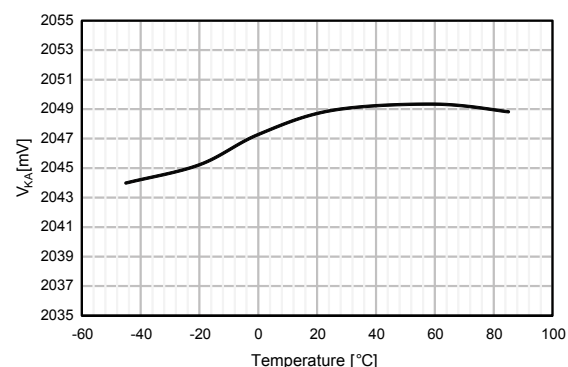


Figure 6. Static impedance vs. temperature

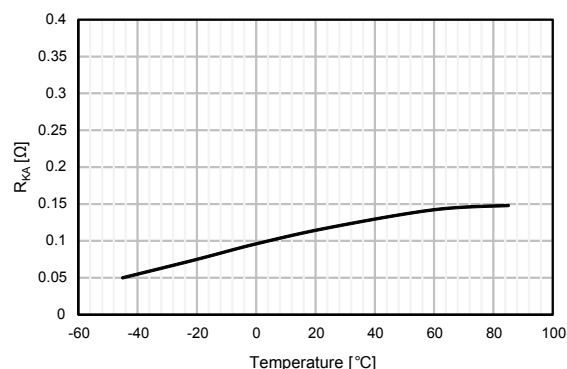


Figure 7. $\Delta V_K / \Delta I_K$ vs. temperature ($I_K = 8\ \mu\text{A}$ to $1\ \text{mA}$)

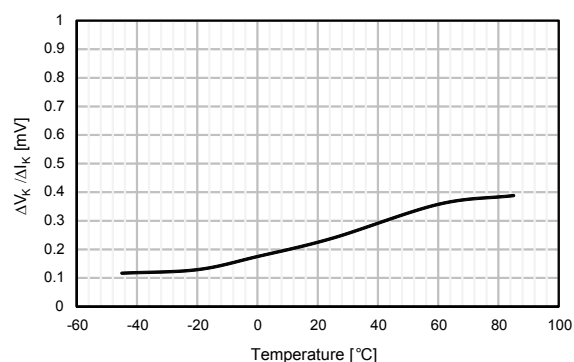


Figure 8. $\Delta V_K / \Delta I_K$ vs. temperature ($I_K = 1\ \text{mA}$ to $15\ \text{mA}$)

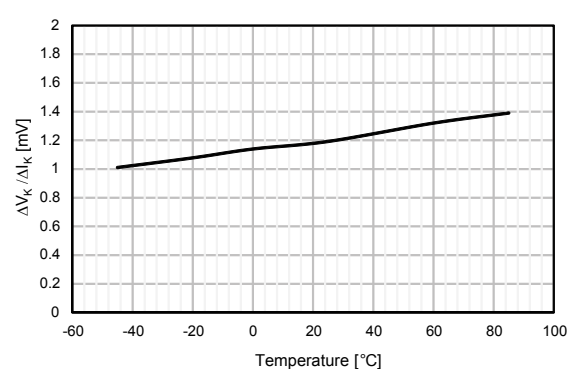


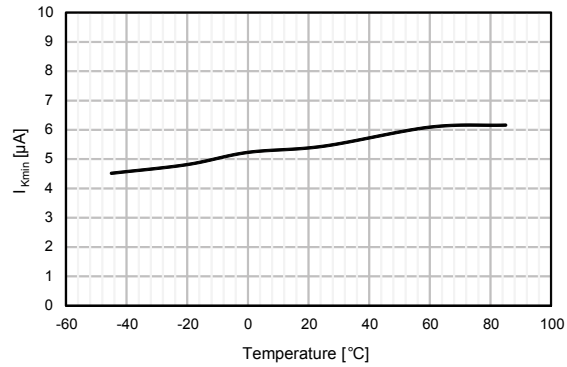
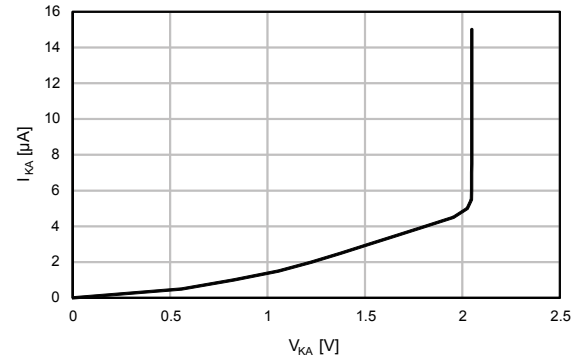
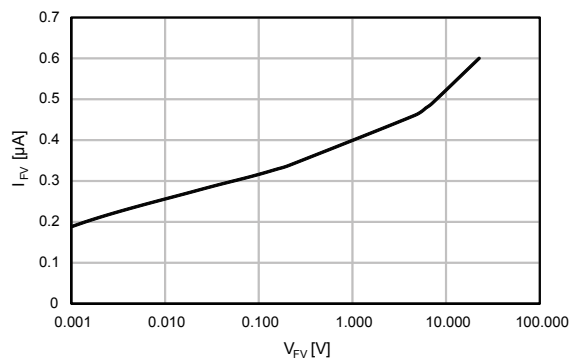
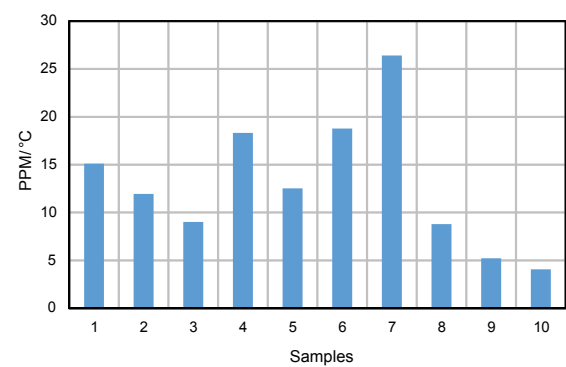
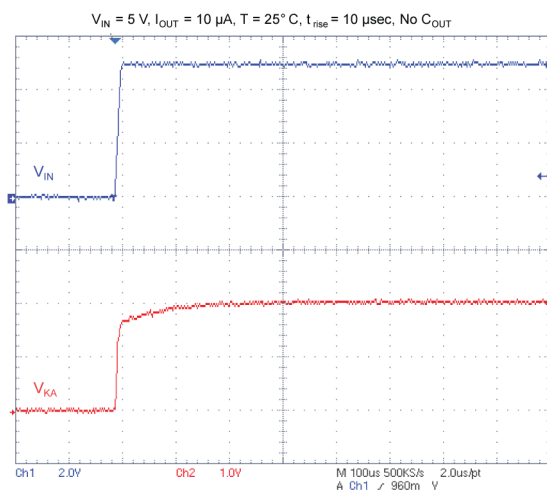
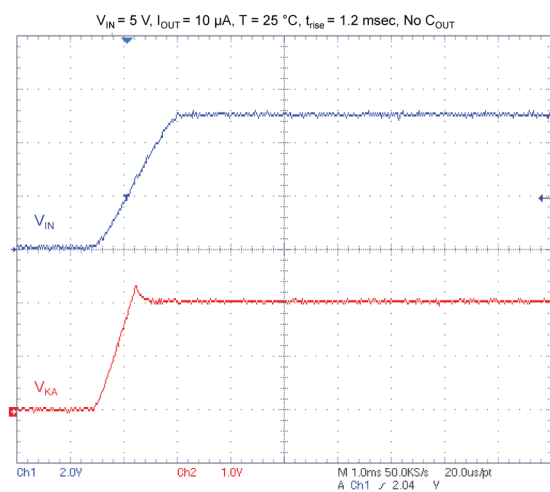
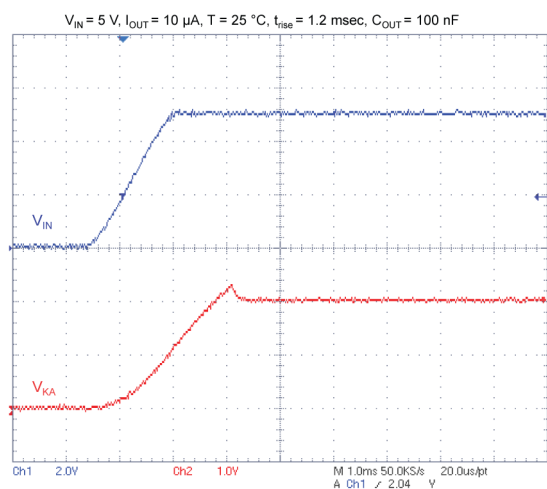
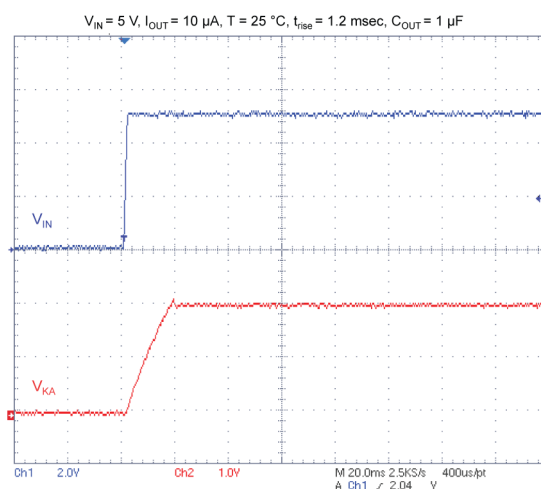
Figure 9. Minimum operating cathode current vs. temperature

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 ($t_{\text{rise}} = 1.2 \text{ ms}$, $C_{\text{OUT}} = 100 \text{ nF}$)

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


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

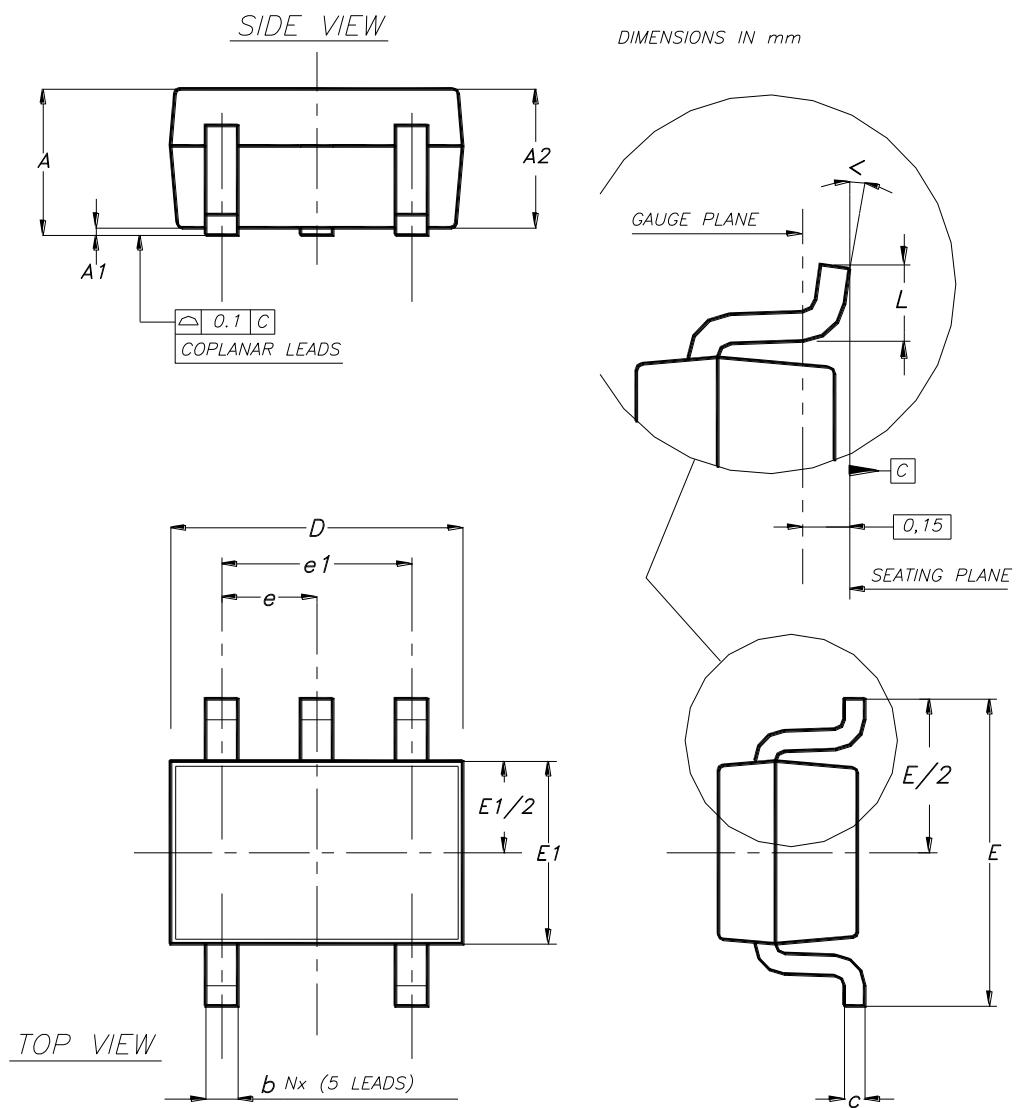


Table 6. SOT323-5L package mechanical data

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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