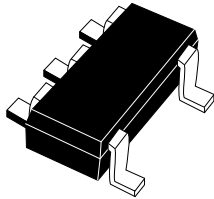


## Precision micropower shunt voltage reference



SOT323-5L

### Features

- Fixed 2.048 V output voltage
- Ultra low operating current: 10  $\mu$ 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.

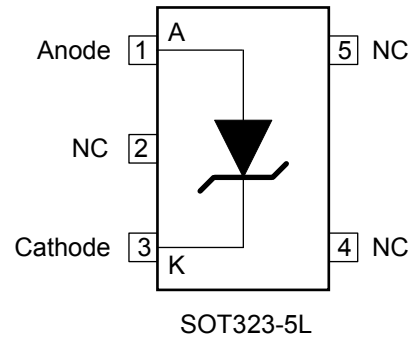
The very low operating current is a key advantage for power budgeted designs. In addition, the **TS4061V** is very stable and can be used in a broad range of application conditions.

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 <sup>(1)</sup> 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**

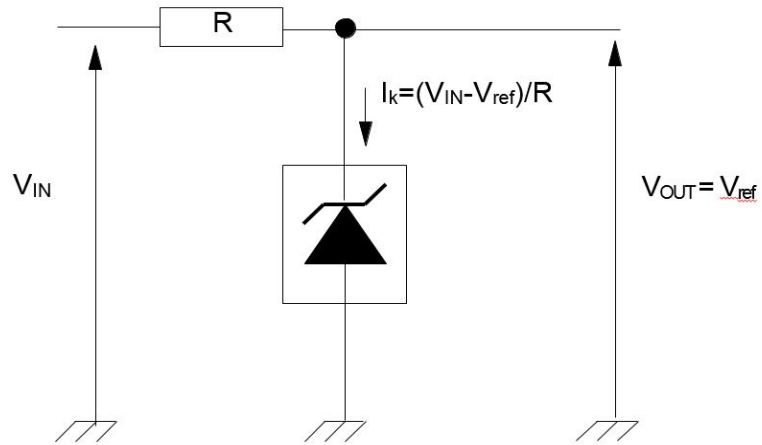
Symbol	Parameter	Value	Unit
$R_{thJA}$	Thermal resistance junction-ambient	250	°C/W
$R_{thJC}$	Thermal resistance junction-case	171	°C/W

**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**

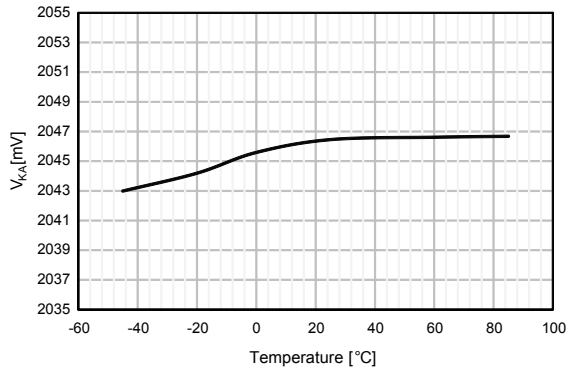
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_k$	Initial accuracy TS4061VIBT-205	$I_k = 10 \mu\text{A}$	-0.2		+0.2	%
$I_{k\text{min}}$	Minimum operating current	$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$		7.5	10	$\mu\text{A}$
		$-40 \text{ }^\circ\text{C} < T_{\text{amb}} < +85 \text{ }^\circ\text{C}$			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 $10 \text{ mA}$		0.15	0.3	$\Omega$
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		$\mu\text{V}_{\text{RMS}}$
	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.

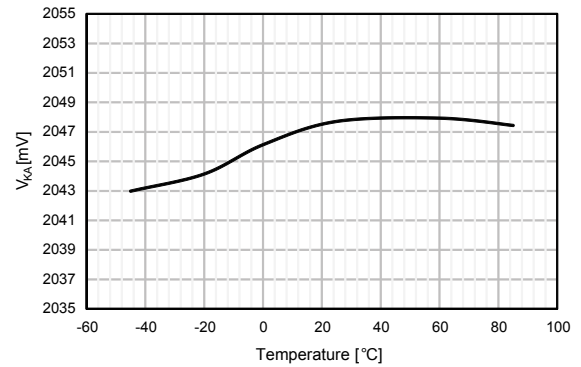
## 5 Typical performance characteristics

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

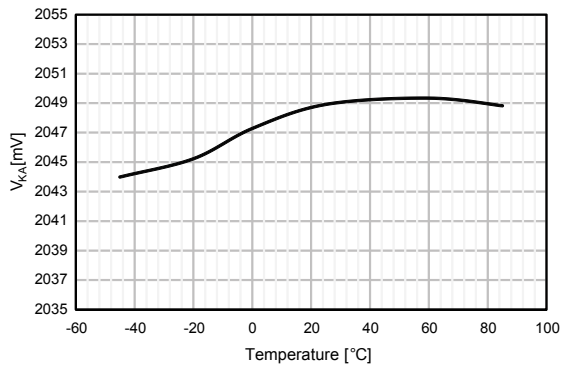
**Figure 3. Cathode voltage vs. temperature ( $I_K = 10\text{ }\mu\text{A}$ )**



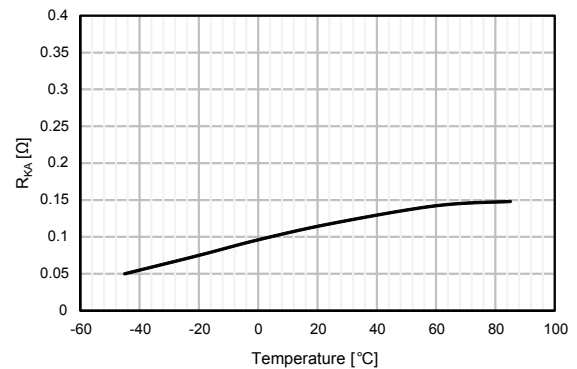
**Figure 4. Cathode voltage vs. temperature ( $I_K = 1\text{ mA}$ )**



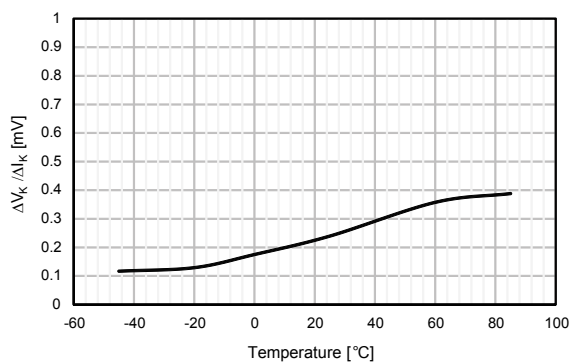
**Figure 5. Cathode voltage vs. temperature ( $I_K = 15\text{ mA}$ )**



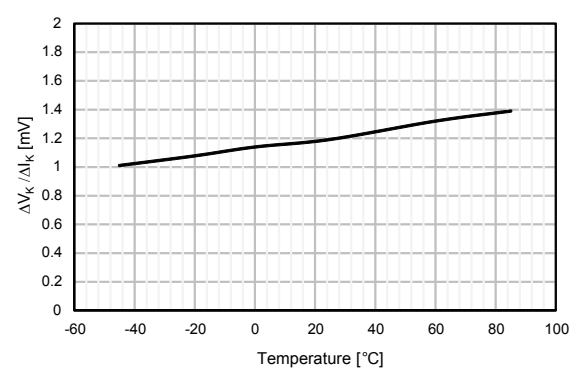
**Figure 6. Static impedance vs. temperature**

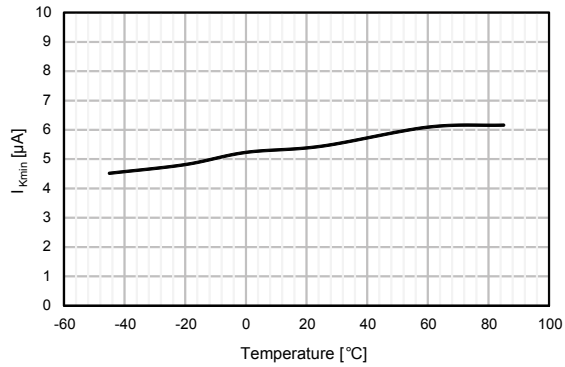
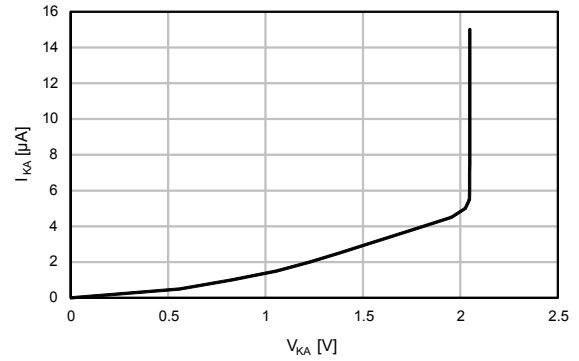
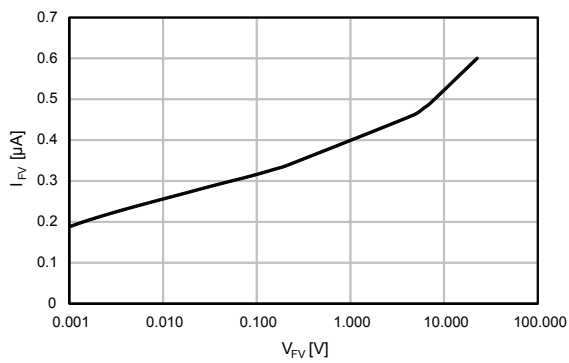
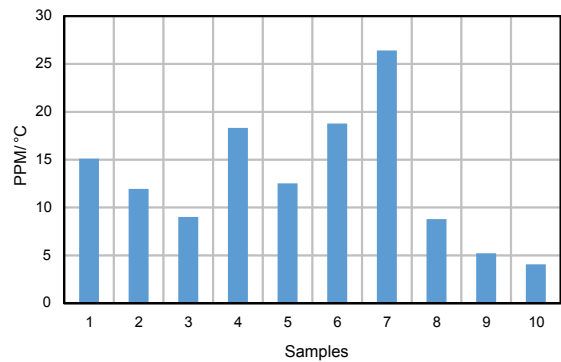
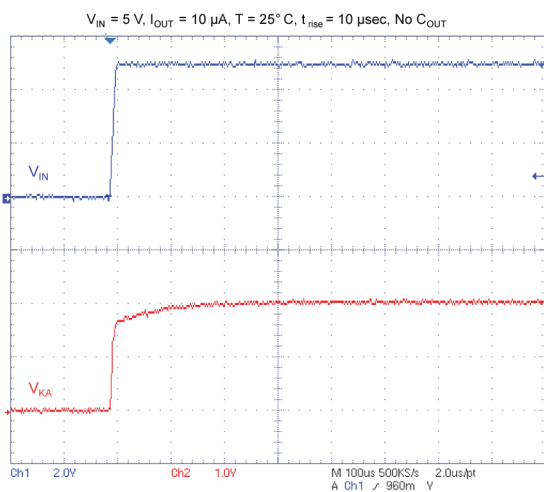
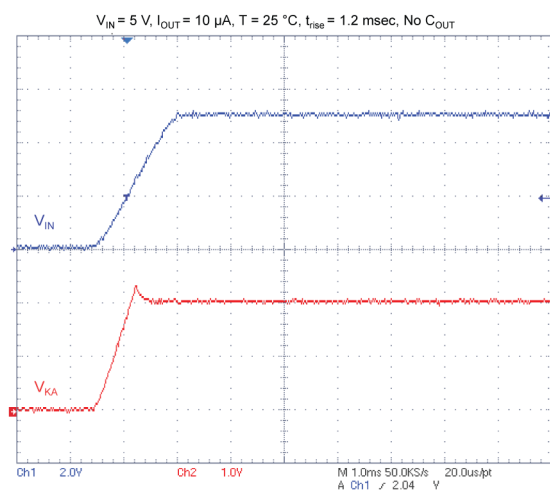


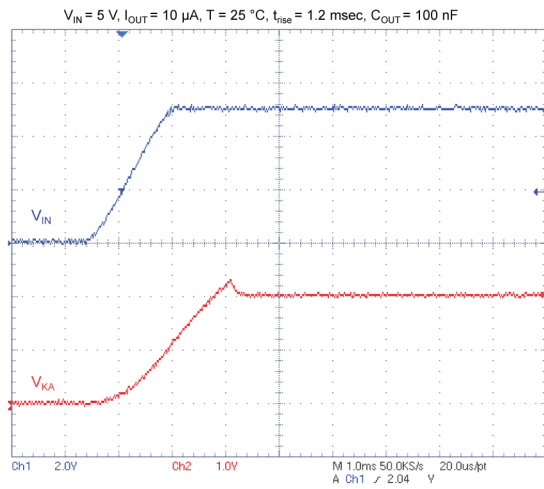
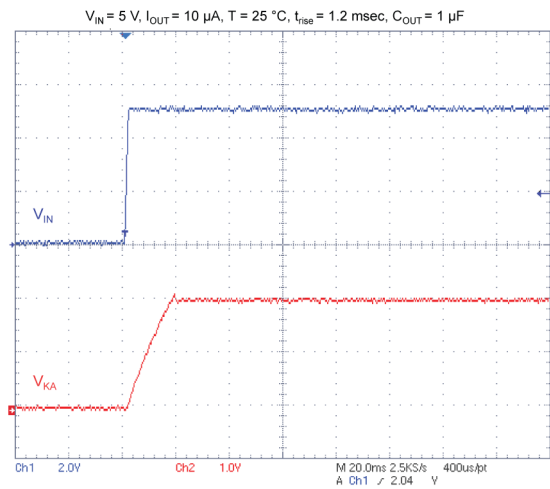
**Figure 7.  $\Delta V_K / \Delta I_K$  vs. temperature ( $I_K = 8\text{ }\mu\text{A}$  to 1 mA)**



**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](http://www.st.com). ECOPACK® is an ST trademark.

### 6.1 SOT323-5L package information

Figure 17. SOT323-5L package outline

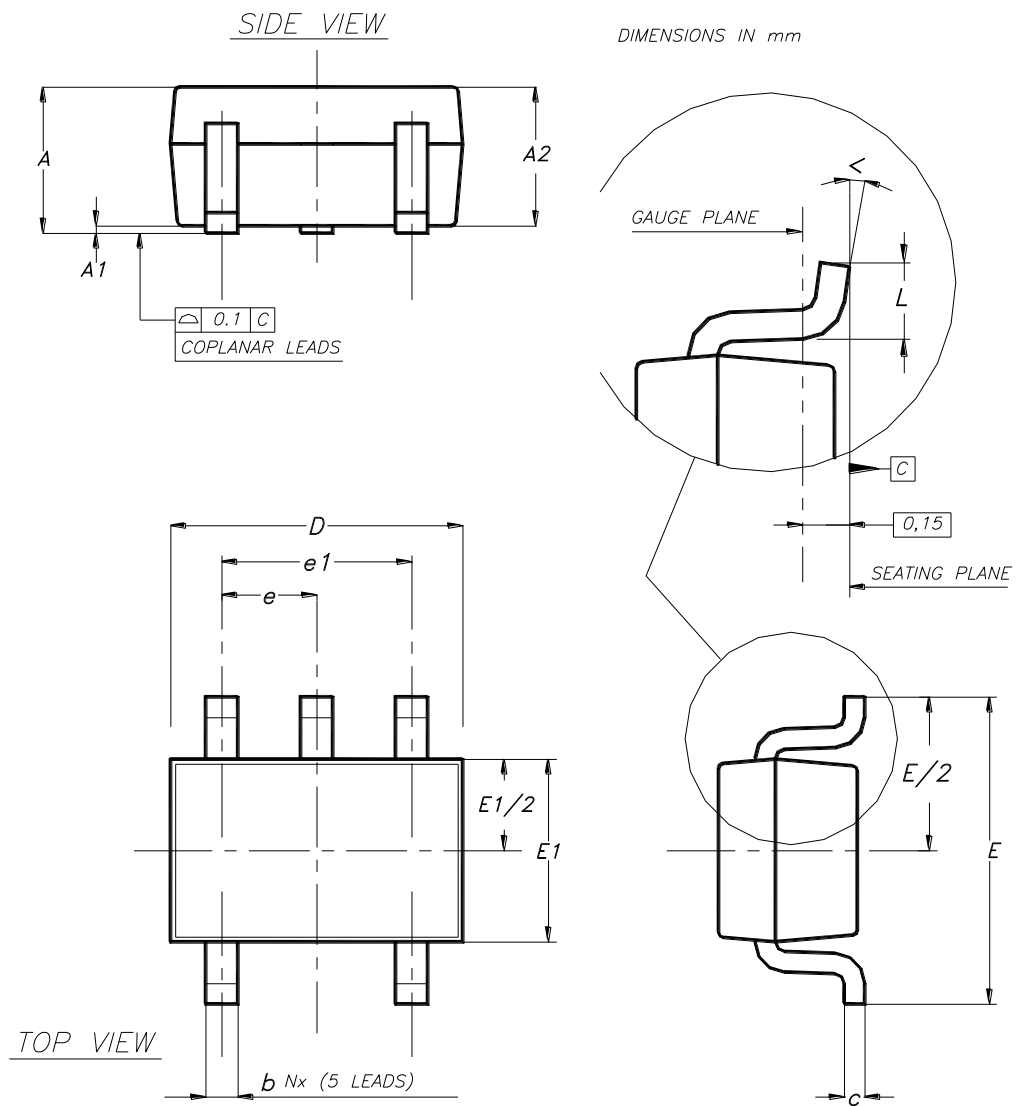


Table 6. SOT323-5L package mechanical data

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
$\theta$	0°		8°

## Revision history

**Table 7. Document revision history**

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

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