

1.225V micropower shunt voltage reference

Features

- 1.225V typical output voltage
- Ultra low operating current: 65µA maximum at 25°C
- High precision @ 25°C
 - +/- 2%
 - +/- 1%
 - +/- 0.5%
- High stability when used with capacitive loads
- Industrial temperature range: -40°C to +85°C
- 150ppm/°C maximum temperature coefficient

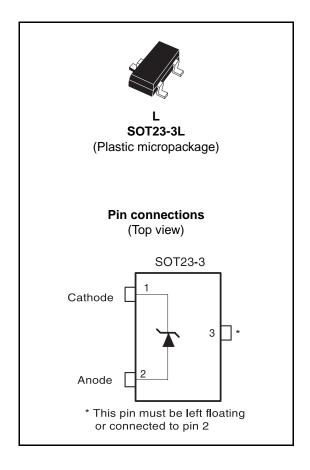
Application

- Computers
- Instrumentation
- Battery chargers
- Switch mode power supply
- Battery operated equipments

Description

The TS4041 is a low power shunt voltage reference providing a stable 1.225V output voltage over the industrial temperature range (-40°C to +85°C). Availabe in SOT23-3 surface mount package, it can be designed in applications where space saving is critical.

The low operating current is a key advantage for power restricted designs. In addition, the TS4041 is very stable and can be used in a broad range of application conditions.



1 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings (AMR)

Symbol	Parameter	Value	Unit
I _k	Reverse breakdown current	20	mA
I _f	Forward current	10	mA
P _d	Power dissipation ⁽¹⁾ SOT23-3	360	mW
T _{stg}	Storage temperature	-65 to +150	°C
ESD	Human body model (HBM) ⁽²⁾	2	kV
ESD	Machine model (MM) ⁽³⁾	200	V
T _{lead}	Lead temperature (soldering, 10 seconds)	260	°C

^{1.} P_d is calculated with T_{amb} = 25°C and T_j = 150°C and R_{thja} = 340°C/W for the SOT23-3L package.

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
I _{min}	Minimum operating current	65	μΑ
I _{max}	Maximum operating current	12	mA
T _{oper}	Operating free air temperature range	-40 to +85	°C

^{2.} Human body model: 100pF discharged through a $1.5k\Omega$ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.

^{3.} Machine model: a 200pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor $< 5\Omega$), done for all couples of pin combinations with other pins floating.

2 Electrical characteristics

Table 3. TS4041E (2% precision) $T_{amb} = 25^{\circ}C^{(1)}$ (unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V	Reverse breakdown voltage	I _k = 100μA	1.20 0	1.22 5	1.25 0	V
V _k	Reverse breakdown voltage tolerance	$I_k = 100 \mu A$ -40°C < T _{amb} < +85°C	-25 -36		+25 +36	mV
	Minimum operating current	T _{amb} = 25°C		40	65	
I _{k-min}	willing current	-40°C < T _{amb} < +85°C			70	μА
$\Delta V_{ref}/\Delta T$	Average temperature coefficient	I _k = 100μA			150	ppm/°C
$\Delta V_{k}/\Delta I_{k}$	Reverse breakdown voltage change	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.3	2 2.5	mV
Δν κ/Δικ	with operating current range	1mA < I _k < 12mA -40°C < T _{amb} < +85°C		2.5	8 10	IIIV
R _{ka}	Static impedance	$\Delta I_k = 45\mu A$ to 1mA		0.25	0.5	Ω
K _{vh}	Long term stability	$I_k = 100 \mu A, t = 1000 hrs$		120		ppm
En	Wide band noise	$I_{k} = 100 \mu A, 10 Hz < f < 10 kHz$		200		nV/√Hz

Limits are 100% production tested at 25°C. Behavior at the temperature range limits is guaranteed through correlation and by design.

Table 4. TS4041D (1% precision) $T_{amb} = 25^{\circ}C^{(1)}$ (unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V	Reverse breakdown voltage	I _k = 100μA	1.21 3	1.22 5	1.23 7	V
V _k	Reverse breakdown voltage tolerance	$I_k = 100 \mu A$ -40°C < T_{amb} < +85°C	-12 -25		+12 +25	mV
	Minimum operating current	T _{amb} = 25°C		40	65	
l _{k-min}	willing current	-40°C < T _{amb} < +85°C			70	- μΑ
$\Delta V_{ref}/\Delta T$	Average temperature coefficient	I _k = 100μA			150	ppm/°C
AV. /AI	Reverse breakdown voltage change	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.3	2 2.5	mV
$\Delta V_k/\Delta I_k$	with operating current range	1mA < I _k < 12mA -40°C < T _{amb} < +85°C		2.5	8 10	IIIV
R _{ka}	Static impedance	$\Delta I_k = 45\mu A$ to 1mA		0.25	0.5	Ω
K _{vh}	Long term stability	$I_k = 100 \mu A, t = 1000 hrs$		120		ppm
En	Wide band noise	$I_k = 100 \mu A$, $10Hz < f < 10kHz$		200		nV/√Hz

^{1.} Limits are 100% production tested at 25°C. Behavior at the temperature range limits is guaranteed through correlation and by design.

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Electrical characteristics TS4041

Table 5. TS4041C (0.5% precision) $^{(1)}$ T_{amb} = 25°C (unless otherwise specified)

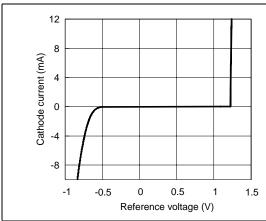
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
	Reverse breakdown voltage	I _k = 100μA	1.21 9	1.22 5	1.23 1	V
V _k	Reverse breakdown voltage tolerance	$I_k = 100\mu A$ -40°C < T_{amb} < +85°C	-6 -16		+6 +16	mV
1	Minimum operating current	T _{amb} = 25°C		40	60	
I _{k-min}	willing current	-40°C < T _{amb} < +85°C			65	μА
$\Delta V_{ref}/\Delta T$	Average temperature coefficient	I _k = 100μA			120	ppm/°C
$\Delta V_k / \Delta I_k$	Reverse breakdown voltage change	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.3	1.5 2	mV
Δν _κ /Δι _κ	with operating current range	1mA < I _k < 12mA -40°C < T _{amb} < +85°C		2.5	6 8	IIIV
R _{ka}	Static impedance	$\Delta I_k = 45\mu A$ to 1mA		0.25	0.5	Ω
K _{vh}	Long term stability	$I_{k} = 100 \mu A, t = 1000 hrs$		120		ppm
En	Wide band noise	I _k = 100μA, 10Hz < f < 10kHz		200		nV/√Hz

Limits are 100% production tested at 25°C. Behavior at the temperature range limits is guaranteed through correlation and by design.

TS4041 Electrical characteristics

Figure 1. Reference voltage versus cathode Figure 2. current

Figure 2. Reference voltage versus cathode current



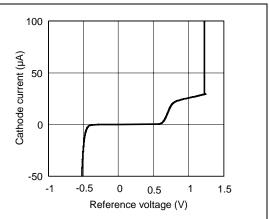
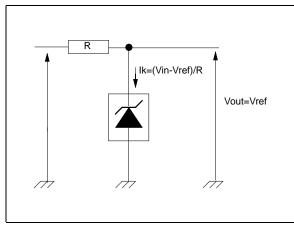


Figure 3. Test circuit

Figure 4. Reference voltage versus temperature



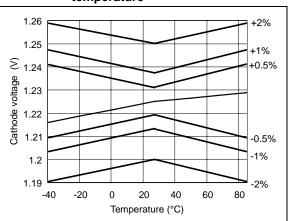
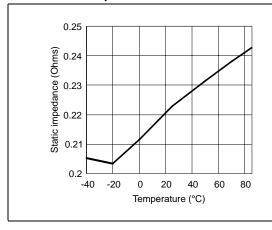
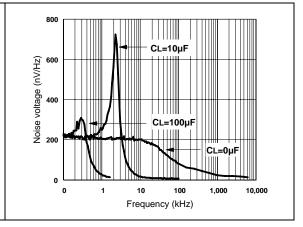


Figure 5. Static impedance versus temperature

Figure 6. Noise voltage versus frequency





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Figure 7. Pulse response for $I_k=100\mu A$

Figure 8. Test circuit for pulse response at I_k =100 μ A

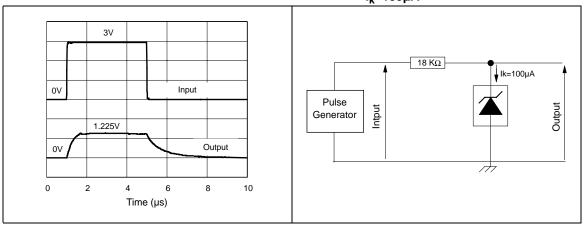
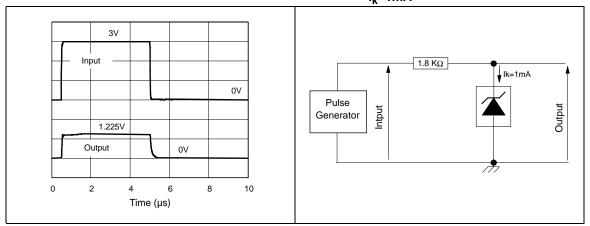


Figure 9. Pulse response for $I_k=1$ mA

Figure 10. Test circuit for pulse response at $I_k=1$ mA



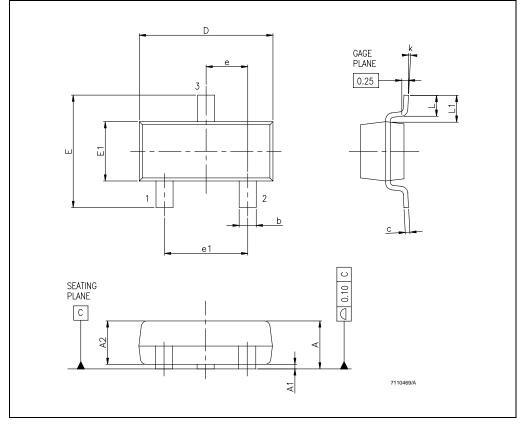
3 Package information

In order to meet environmental requirements, STMicroelectronics offers these devices in ECOPACK[®] packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an STMicroelectronics trademark. ECOPACK specifications are available at: www.st.com.

TS4041 Package information

Figure 11. SOT23-3 package mechanical data

			Dimer	nsions			
Ref.		Millimeters			Mils		
	Min.	Тур.	Max.	Min.	Тур.	Max.	
Α	0.890		1.120	35.05		44.12	
A1	0.010		0.100	0.39		3.94	
A2	0.880	0.950	1.020	34.65	37.41	40.17	
b	0.300		0.500	11.81		19.69	
С	0.080		0.200	3.15		7.88	
D	2.800	2.900	3.040	110.26	114.17	119.72	
Е	2.100		2.64	82.70		103.96	
E1	1.200	1.300	1.400	47.26	51.19	55.13	
е		0.950			37.41		
e1		1.900			74.82		
L	0.400		0.600	15.75		23.63	
L1		0.540			21.27		
k	0°		8°	0°		8°	



Ordering information TS4041

4 Ordering information

Table 6. Order codes

Part number	Precision	Temperature range	Package	Packing	Marking
TS4041EILT-1.2	2%				L233
TS4041DILT-1.2	1%	-40°C to +85°C	SOT23-3	Tape & reel	L232
TS4041CILT-1.2	0.5%				L231

5 Revision history

Table 7. Document revision history

Date	Revision	Changes
21-Mar-2002	1	Initial release.
20-Aug-2007 2		Removed TO-92 package information. Format update.

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