

TS4041

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

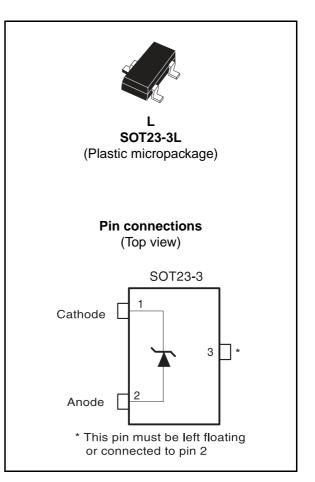
Application

- 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.



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Symbol	Parameter	Value	Unit
I _k	Reverse breakdown current	20	mA
۱ _f	Forward current	10	mA
Pd	Power dissipation ⁽¹⁾ SOT23-3	360	mW
T _{stg}	Storage temperature	-65 to +150	°C
ESD	Human body model (HBM) ⁽²⁾	2	kV
E3D	Machine model (MM) ⁽³⁾	200	V
T _{lead}	Lead temperature (soldering, 10 seconds)	260	°C

Table 1. Absolute maximum ratings (AMR)

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

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 < 5Ω), done for all couples of pin combinations with other pins floating.

Table 2.	Operating conditions
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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 Electrical characteristics

Table 3.	TS4041E (2% precision) $T_{amb} = 25^{\circ}C^{(1)}$ (unless otherwise specified)
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Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
V _k	Reverse breakdown voltage	I _k = 100μA	1.20 0	1.22 5	1.25 0	V	
	Reverse breakdown voltage tolerance	$I_k = 100\mu A$ -40°C < T _{amb} < +85°C	-25 -36		+25 +36	mV	
I _{k-min}	Minimum operating current	$T_{amb} = 25^{\circ}C$		40	65		
		-40°C < T _{amb} < +85°C			70	μA	
$\Delta V_{ref} / \Delta T$	Average temperature coefficient	I _k = 100μA			150	ppm/°C	
$\Delta V_k / \Delta I_k$	Reverse breakdown voltage change with operating current range	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.3	2 2.5		
		1mA < I _k < 12mA -40°C < T _{amb} < +85°C		2.5	8 10	mV	
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	

1. 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)
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Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
V _k	Reverse breakdown voltage	I _k = 100μA	1.21 3	1.22 5	1.23 7	V	
	Reverse breakdown voltage tolerance	I _k = 100μA -40°C < T _{amb} < +85°C	-12 -25		+12 +25	mV	
	Minimum operating current	$T_{amb} = 25^{\circ}C$		40	65	μΑ	
I _{k-min}		-40°C < T _{amb} < +85°C			70		
$\Delta V_{ref} / \Delta T$	Average temperature coefficient	I _k = 100μA			150	ppm/°C	
$\Delta V_k / \Delta I_k$	Reverse breakdown voltage change with operating current range	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.3	2 2.5	m)/	
		1mA < I _k < 12mA -40°C < T _{amb} < +85°C		2.5	8 10	mV	
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	

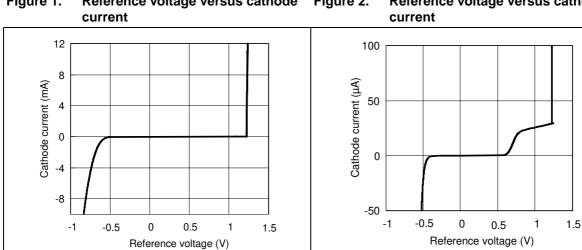
1. Limits are 100% production tested at 25°C. Behavior at the temperature range limits is guaranteed through correlation and by design.



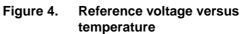
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
V _k	Reverse breakdown voltage	I _k = 100μA	1.21 9	1.22 5	1.23 1	V	
	Reverse breakdown voltage tolerance	I _k = 100μΑ -40°C < T _{amb} < +85°C	-6 -16		+6 +16	mV	
I	Minimum operating current	T _{amb} = 25°C		40	60	μA	
I _{k-min}		-40°C < T _{amb} < +85°C			65		
$\Delta V_{\text{ref}}\!/\Delta T$	Average temperature coefficient	I _k = 100μA			120	ppm/°C	
ΔV _k /ΔI _k	Reverse breakdown voltage change with operating current range	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.3	1.5 2	mV	
		1mA < I _k < 12mA -40°C < T _{amb} < +85°C		2.5	6 8	ΠV	
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	l _k = 100μA, 10Hz < f < 10kHz		200		nV/√Hz	

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

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







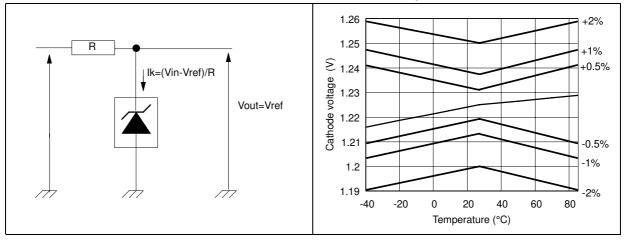
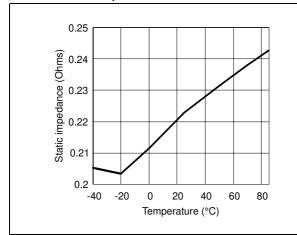


Figure 5. Static impedance versus temperature



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Figure 6. Noise voltage versus frequency

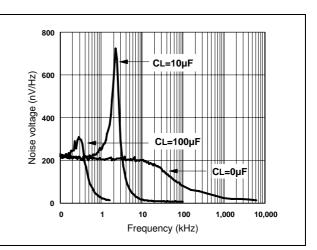
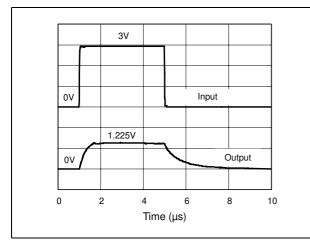


Figure 1. Reference voltage versus cathode Figure 2.



Figure 7. Pulse response for Ik=100µA





ЗV

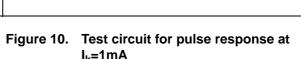
1.225V

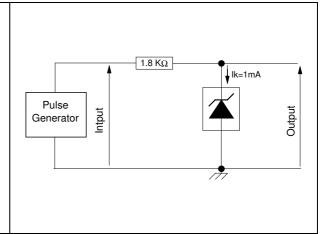
Output

2

0

Input





3 **Package information**

4

Time (µs)

0V

10

0V

8

6

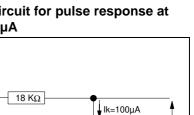
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Pulse

Generator

Intput

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



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TS4041

Output

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I_k=1mA

			Dimen	sions				
Ref.		Millimeters		Mils				
	Min. Typ.		Max.	Min.	Тур.	Max.		
А	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		
E	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°		
GAGE PLANE 0.25 0.25 0.25 0.25 0.25 0.25								
SEA PLAI C				A 0.10 C				



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

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

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