

2.5V micropower shunt voltage reference

Features

- 2.50V typical output voltage
- Ultra low current consumption: 40µA typ.
- High precision @ 25°C
 - ±2% (standard version)
 - ±1% (A grade)
- High stability when used with capacitive loads
- Industrial temperature range: -40°C to +85°C
- 100ppm/°C maximum temperature coefficient

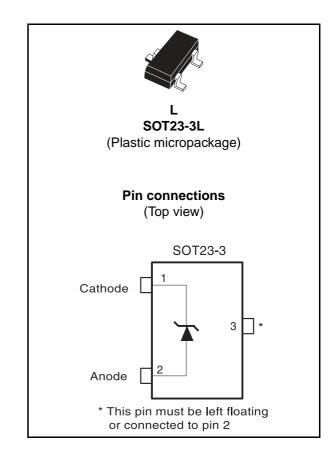
Applications

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

Description

The TS822 is a low power shunt voltage reference providing a stable 2.5V 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 TS822 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

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 R_{thja} = 340°C/W for the SOT23-3L package

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
I _{k-min}	Minimum operating current	50	μΑ
I _{k-max}	Maximum operating current	15	mA
T _{oper}	Operating free air temperature range	-40 to +85	°C

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

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.

2 Electrical characteristics

Table 3. TS822 (2% precision) $T_{amb} = 25^{\circ}C^{(1)}$ (unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
	Reverse breakdown voltage	I _k = 100μA	2.45	2.5	2.55	V	
V _k	Reverse breakdown voltage tolerance	I _k = 100μA -40°C < T _{amb} < +85°C	-50 -66		50 66	mV	
	Minimum operating current	T = 25°C		40	50	μА	
l _{k-min}	Minimum operating current	-40°C < T _{amb} < +85°C			60		
$\Delta V_{ref}/\Delta T$	Average temperature coefficient	I _k = 100μA		30	100	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		0.4	1 1.2	mV	
		1mA < I _k < 15mA -40°C < T _{amb} < +85°C		2.5	8 10	1110	
Ь	Deverse static impedance	$I_k = I_{k\text{-min}}$ to 1mA -40°C < T_{amb} < +85°C		0.4	1 1.2	Ω	
R _{ka}	Reverse static impedance	I _k = 1 to 15mA -40°C < T _{amb} < +85°C		0.2	0.6 0.7	3 22	
K_{vh}	Long term stability	$I_k = 100 \mu A, t = 1000 hrs$		120		ppm	
En	Wide band noise	$I_k = 100\mu A$, $10Hz < f < 10kHz$		35		nV/√Hz	

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

Table 4. TS822A (1% precision) $T_{amb} = 25^{\circ}C^{(1)}$ (unless otherwise specified)

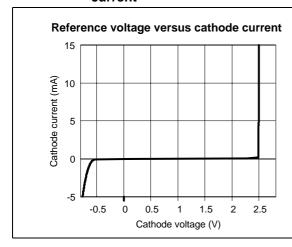
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
	Reverse breakdown voltage	I _k = 100μA	2.475	2.5	2.525	V	
V _k	Reverse breakdown voltage tolerance	I _k = 100μA -40°C < T _{amb} < +85°C	-25 -41		25 41	mV	
	Minimum operating current	T = 25°C		40	50	μΑ	
I _{k-min}	William Operating Current	-40°C < T _{amb} < +85°C			60		
$\Delta V_{ref}/\Delta T$	Average temperature coefficient	I _k = 100μA		30	100	ppm/°C	
$\Delta V_k/\Delta_{lk}$	Reverse breakdown voltage change with operating current range	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.4	1 1.2	mV	
		1mA < I _k < 15mA -40°C < T _{amb} < +85°C		2.5	8 10	1110	
R _{ka}	Reverse static impedance	$I_k = I_{k-min}$ to 1mA -40°C < T_{amb} < +85°C		0.4	1 1.2	Ω	
		I _k = 1mA to 15mA -40°C < T _{amb} < +85°C		0.2	0.6 0.7	22	
K _{vh}	Long term stability	$I_k = 100 \mu A, t = 1000 hrs$		120		ppm	
En	Wide band noise	$I_k = 100\mu A, 10Hz < f < 10kHz$		35		nV/√Hz	

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

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Electrical characteristics TS822

Figure 1. Reference voltage versus cathode Figure 2. Minimum operating current current



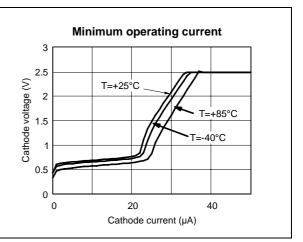
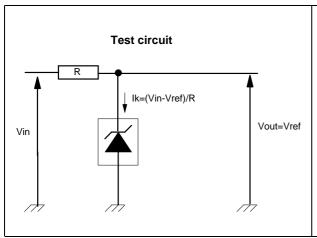


Figure 3. Test circuit

Figure 4. Reference voltage versus temperature



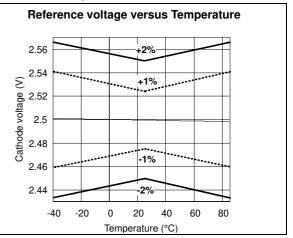
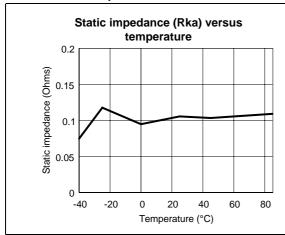
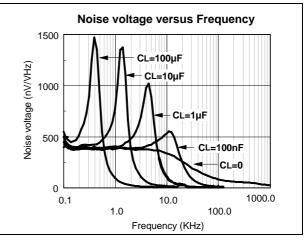


Figure 5. Static impedance (R_{ka}) versus temperature

Figure 6. Noise voltage versus frequency

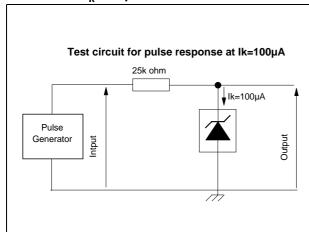




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Figure 7. Test circuit for pulse response at $I_k=100\mu A$

Figure 8. Pulse response for $I_k=100\mu$ A



Pulse response for Ik=100µA

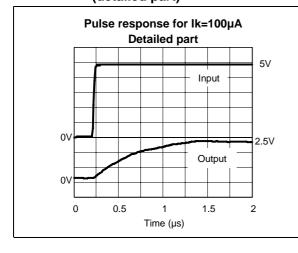
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0
2.5

0
5
10
15
20
Time (µs)

Figure 9. Pulse response for $I_k=100\mu A$ (detailed part)

Figure 10. Pulse response for I_k=100μA (detailed part)



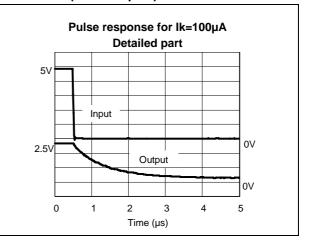
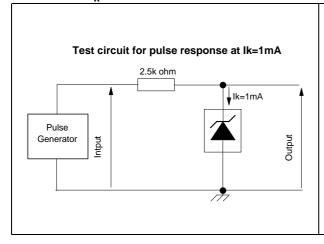
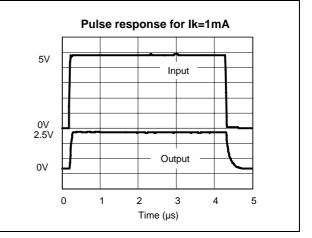


Figure 11. Test circuit for pulse response at I_k =100mA

Figure 12. Pulse response for I_k=100mA



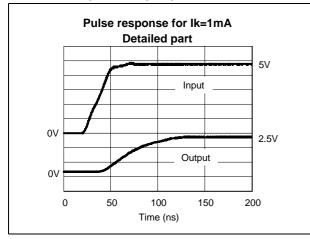


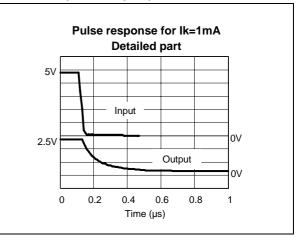
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Package information TS822

Figure 13. Pulse response for I_k=100mA (detailed part)

Figure 14. Pulse response for I_k=100mA (detailed part)





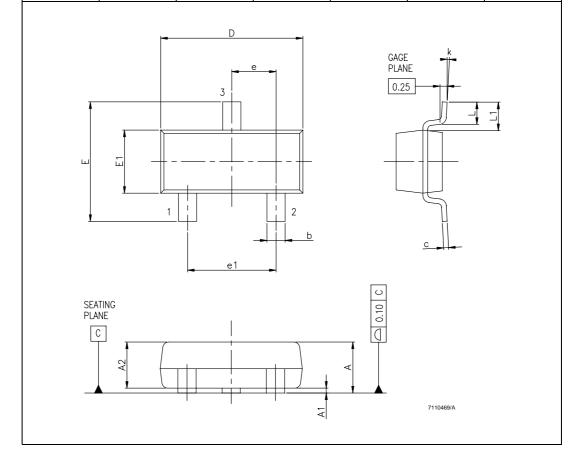
3 Package information

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.

TS822 Package information

Figure 15. SOT23-3 package mechanical data

	Dimensions							
Ref.		Millimeters			Mils			
	Min.	Тур.	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°		



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Ordering information TS822

4 Ordering information

Table 5. Order codes

Part number	Precision	Temperature range	Package	Packing	Marking
TS822ILT	2%	-40°C to +85°C	SOT23-3	Tape & reel	L223
TS822AILT	1%	-40 C to +65 C	30123-3	Tape & Teel	L222

5 Revision history

Table 6. Document revision history

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

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