

TS821

1.225V micropower shunt voltage reference

Features

- 1.225V typical output voltage
- Ultra low operating current: 45µA maximum at 25°C
- High precision @ 25°C
 - +/- 2% (standard version)
 - +/- 1% (A grade)
 - +/- 0.5% (B grade)
- High stability when used with capacitive loads
- Industrial temperature range: -40°C to +85°C
- 120ppm/°C maximum temperature coefficient

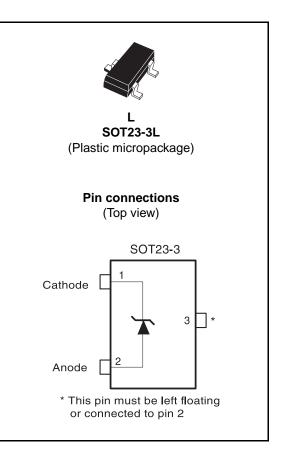
Applications

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

Description

The TS821 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 TS821 is very stable and can be used in a broad range of application conditions.



1 Absolute maximum ratings and operating conditions

Symbol	Parameter	Value	
۱ _k	Reverse breakdown current	20	mA
۱ _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
230	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.

 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	Table 2.	Operating conditions
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Symbol	Parameter	Value	Unit
I _{min}	Minimum operating current	45	μA
I _{max}	Maximum operating current	12	mA
T _{oper}	Operating free air temperature range	-40 to +85	°C

2 Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
	Reverse breakdown voltage	I _k = 100μA	1.200	1.225	1.250	V
V _k	Reverse breakdown voltage tolerance	$I_{k} = 100\mu A$ -40°C < T _{amb} < +85°C	-25 +34		+25 +34	mV
	Minimum operating current	$T_{amb} = 25^{\circ}C$		40	45	μA
I _{k-min}	immuni operating current	$-40^{\circ}\text{C} < \text{T}_{amb} < +85^{\circ}\text{C}$			50	μΛ
$\Delta V_{ref} / \Delta T$	Average temperature coefficient	I _k = 100μA			120	ppm/°C
A)/ /A1	Reverse breakdown voltage change	I _{k-min} < I _k < 1mA -40°C < T _{amb} < +85°C		0.3	0.7 1	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	
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

Table 3. TS821 (2% precision) $T_{amb} = 25^{\circ}C^{(1)}$ (unless otherwise specified)

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

Table 4.	TS821A (1% precision) T _{amb} = 25°C ⁽¹⁾ (unless otherwise specified)
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Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
	Reverse breakdown voltage	I _k = 100μA	1.213	1.225	1.237	V
V _k	Reverse breakdown voltage tolerance	$I_{k} = 100\mu A$ -40°C < T _{amb} < +85°C	-12 -22		+12 +22	mV
	Minimum operating current	$T_{amb} = 25^{\circ}C$		40	45	
I _{k-min}	Minimum operating current	$-40^{\circ}\text{C} < \text{T}_{amb} < +85^{\circ}\text{C}$			50	μA
$\Delta V_{ref} / \Delta T$	Average temperature coefficient	I _k = 100μA			120	ppm/°C
A)/ (A)	Reverse breakdown voltage change	$I_{k-min} < I_k < 1mA$ -40°C < T_{amb} < +85°C		0.3	0.7 1	mV
$\Delta V_k / \Delta I_k$	with operating current range	1mA < I _k < 12mA -40°C < T _{amb} < +85°C		2.5	5 7	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

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



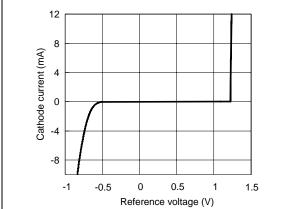
Symbol	Parameter	Parameter Test conditions		Тур.	Max.	Unit
	Reverse breakdown voltage	I _k = 100μA	1.219	1.225	1.231	V
V _k	Reverse breakdown voltage tolerance	$I_{k} = 100\mu A$ -40°C < T _{amb} < +85°C	-6 -16		+6 +16	mV
	Minimum operating current	$T_{amb} = 25^{\circ}C$		40	45	
I _{k-min}	Minimum operating current	$-40^{\circ}\text{C} < \text{T}_{amb} < +85^{\circ}\text{C}$			50	μA
$\Delta V_{ref} / \Delta T$	Average temperature coefficient	I _k = 100μA			120	ppm/°C
A)/ /A1	$ \begin{array}{ c c c c } \mbox{Reverse breakdown voltage change} & I_{k-min} < I_k < 1mA \\ -40^{\circ}C < T_{amb} < +85^{\circ}C \\ \mbox{1mA} < I_k < 12mA \\ -40^{\circ}C < T_{amb} < +85^{\circ}C \\ \end{array} $			0.3	0.7 1	mV
$\Delta V_k / \Delta I_k$				2.5	5 7	IIIV
R _{ka}	Static impedance	$\Delta I_k = 45 \mu A$ to 1mA		0.25	0.5	W
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

Table 5.TS821B (0.5% precision) $T_{amb} = 25^{\circ}C^{(1)}$ (unless otherwise specified)

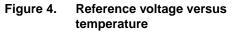
1. Limits are 100% production tested at 25°C. Behavior at the temperature range limits is guaranteed through correlation and by design.



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







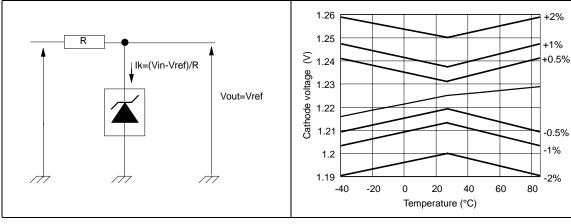
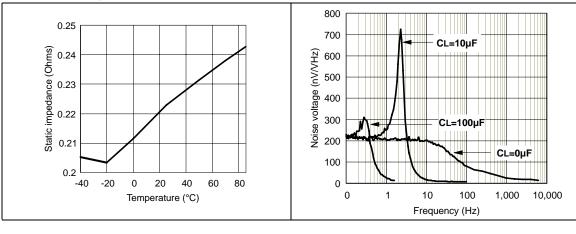


Figure 6.

Figure 5. Static impedance versus temperature





Noise voltage versus frequency

100

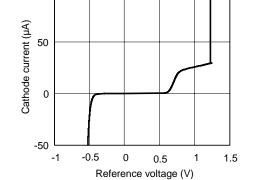
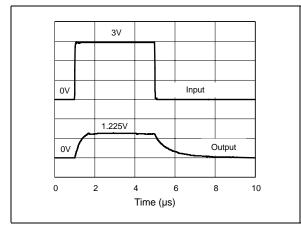
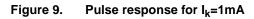


Figure 7. Pulse response for $I_k=100\mu A$





ЗV

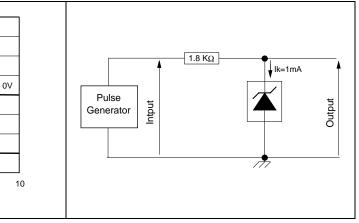
1.225V Output

Input

2

0





3 Package information

4

Time (µs)

0V

8

6

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.

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

18 KΩ

Pulse

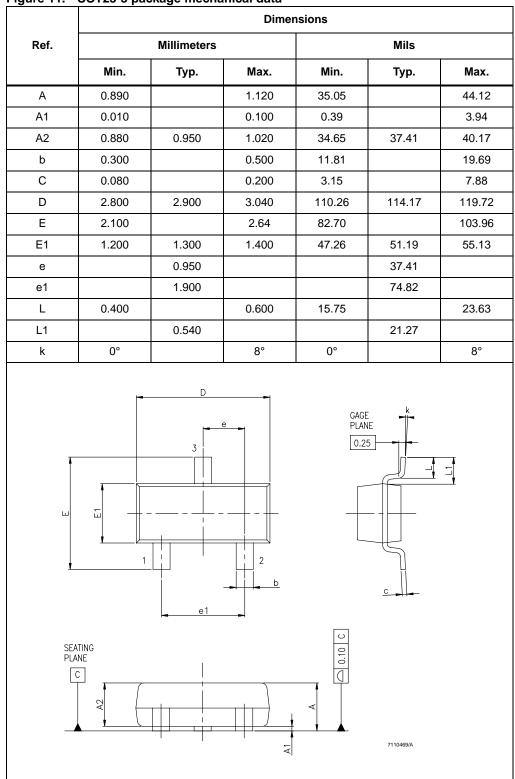
Generator

Intput

Output

lk=100µA

h







4 Ordering information

Table 6. Order codes

Part number	Precision	Temperature range	Package	Packing	Marking
TS821ILT	2%	1000			L213
TS821AILT	1%	-40°C to +85°C	SOT23-3	Tape & reel	L212
TS821BILT	0.5%				L211

5 Revision history

Table 7. Document revision history

Date	Revision	Changes
10-Nov-2005	1	Initial release.
24-Jul-2007	2	Removed information related to TO-92. Format update.

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