

HIGH THERMAL STABILITY MICROPOWER SHUNT VOLTAGE REFERENCE

- LOW Tc: 50 ppm/°C MAXIMUM
- 2.5V OUTPUT VOLTAGE
- LOW OPERATING CURRENT: 60μA max @ 25°C
- HIGH PRECISION AT 25°C: ±0.5% AND +1%
- STABLE WHEN USED WITH CAPACITIVE LOADS
- INDUSTRIAL TEMPERATURE RANGE: -40 to +85°C

DESCRIPTION

The TS824-2.5 is a low power shunt voltage reference featuring a very low temperature coefficient of 50ppm/°C as a maximum value. Providing a 2.5V output voltage, the TS824-2.5 operates over the industrial temperature range (-40 to +85°C). Ideal for battery-powered equipments where power conservation is critical, the TS824 is housed in a tiny SOT23-3 package allowing space saving.

The TS824 is typically stable with any capacitive loads within the entire temperature range. The product is thus easy to use and the design simplified.

APPLICATION

- Instrumentation,
- Data acquisition systems,
- Portable, Battery powered equipments
- Power management

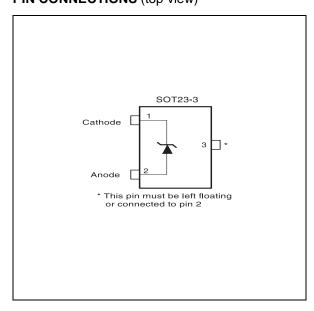
ORDER CODE

Voltage	Precision	SOT23-3	SOT23 Marking			
2.5V	±1%	TS824ILT-2.5	L252			
2.5 V	±0.5%	TS824AILT-2.5	L253			
Single temperature range: -40 to +85°C						

LT = Tiny Package (SOT23-3) - only available in Tape & Reel (LT)



PIN CONNECTIONS (top view)



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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
I _K	Reverse Breakdown Current	20	mA
I _F	Forward Current	10	mA
P _D	Power Dissipation (note1) SOT23-3	360	mW
T _{Std}	Storage Temperature	-65 to +150	°C
ESD	Human Body Model (HBM) (note2)	2	kV
	Machine Model (MM) (note 2)	200	V
T _{Lead}	Lead Temperature (soldering, 10 seconds)	260	°C

Note 1: The maximum power dissipation must be derated at high temperature. It can be calculated using T_{JMAX} (maximum junction temperature), R_{THJA} (Thermal resistance junction to ambient) and T_A (Ambient temperature). The maximum power dissipation formula at any temperature is $P_{DMAX} = (T_{JMAX} - T_A) / R_{THJA}$. R_{THJA} is 340°C/W for the SOT23-3 package.

Note 2: The Human Body Model (HBM) is defined as a 100pF capacitor discharge through a $1.5 \mathrm{k}\Omega$ resistor into each pin. The Machine Mode (MM) is defined as a 200pF capacitor discharge directly into each pins.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
I _{min}	Minimum Operating Current	60	μΑ
I _{max}	Maximum Operating Current	15	mA
T _{oper}	Operating Free Air Temperature Range	-40 to +85	°C

ELECTRICAL CHARACTERISTICS (note 3)

T_{amb} = 25°C (unless otherwise specified)

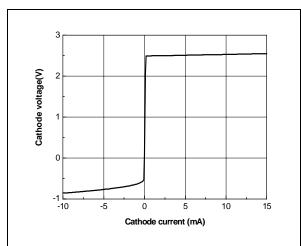
Symbol	Parameter	Test Condition	Min.	Тур.	Max.	Unit	
	Deverse Breekdown Velters	$I_K = 100 \mu A, \pm 0.5\%$	2.4875	2.500	000 2.5125 V		
	Reverse Breakdown Voltage	I _K = 100μA, ±1%	2.475 2.500 2.525		V		
V_{K}	Povorce Prockdown Voltage Teleranee	$I_{K} = 100\mu A, \pm 0.5\%$ -40°C < T_{amb} < +85°C	-12.5 -20		+12.5 +20	mV	
	Reverse Breakdown Voltage Tolerance	$I_{K} = 100 \mu A, \pm 1\%$ -40°C < T_{amb} < +85°C	-25 -33		+25 +33		
I _{KMIN}	Minimum Operating Current	$T_{amb} = 25^{\circ}C$ $-40^{\circ}C < T_{amb} < +85^{\circ}C$		50	60 65	μΑ	
$\Delta V_{K}/\Delta T$	Average Temperature Coefficient (note 5)	I _K = 100μA			50	ppm/°C	
$\Delta V_{K}/\Delta I_{K}$	Reverse Breakdown Voltage Change	I _{KMIN} < I _K < 1mA -40°C < T _{amb} < +85°C		0.4	1 1.2	mV	
	with Operating Current Range	1mA < I _K < 15mA -40°C < T _{amb} < +85°C		4.5	8 10		
R _{KA}	Static Impedance	$\Delta I_K = I_{KMIN}$ to 1mA -40°C < T_{amb} < +85°C		0.4	1 1.2		
		$\Delta I_K = 1$ mA to 15mA -40°C < T _{amb} < +85°C		0.3	0.6 0.7	Ω	
K _{VH}	Long Term Stability	$I_K = 100 \mu A, t = 1000 hrs$		120		ppm	
E _N	Wide Band Noise	I _K = 100μA 100Hz < f < 10kHz		350		nV/√Hz	

Note 3: Limits are 100% production tested at 25°C. Limits over temperature are guaranteed through correlation and by design.

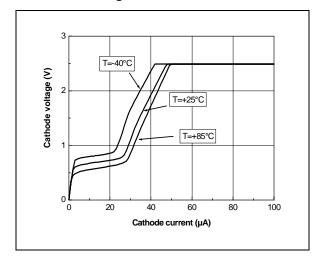
Note 4: The total tolerance within the industrial range, where the maximum ΔT versus 25°C is 65°C, is explained hereafter: \pm 1 % + (\pm 50 ppm/°C x 65°C) = \pm 1.325 %

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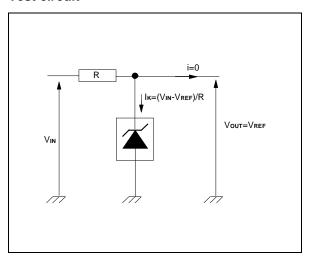
Reference voltage versus cathode current



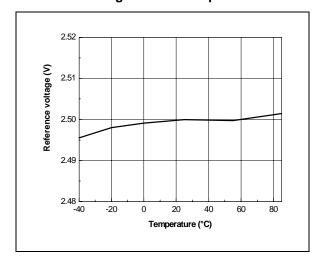
Reference voltage versus cathode current



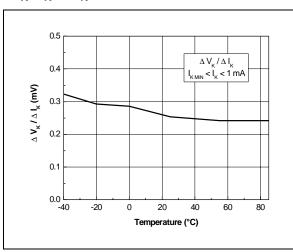
Test circuit



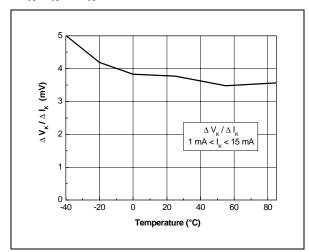
Reference voltage versus Temperature



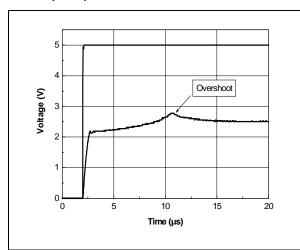
 $\Delta V_{K}/\Delta I_{K}$ for I_{K} < 1mA versus temperature



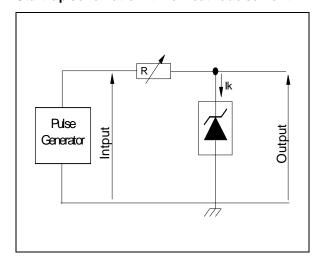
 $\Delta V_{K}/\Delta I_{K}$ for $I_{K} > 1$ mA versus temperature



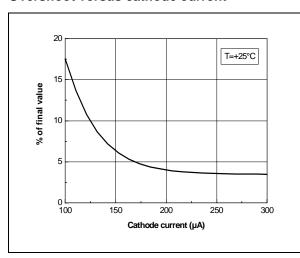
Start-up response with low cathode current



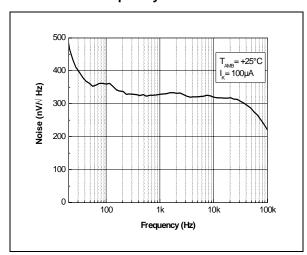
Start-up schematic with low cathode current



Overshoot versus cathode current



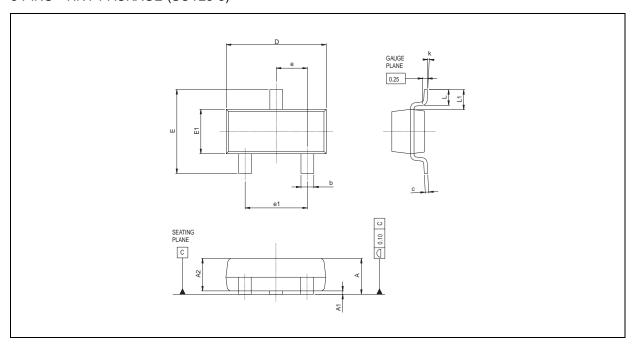
Noise versus frequency



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PACKAGE MECHANICAL DATA

3 PINS - TINY PACKAGE (SOT23-3)



Dimensions -	Millimeters			Inches			
	Min.	Тур.	Max.	Min.	Тур.	Max.	
Α	0.890		1.120	0.035		0.044	
A1	0.010		0.100	0.0004		0.004	
A2	0.880	0.950	1.020		0.037	0.040	
b	0.300		0.500	0.012		0.020	
С	0.080		0.200	0.003		0.008	
D	2.800	2.900	3.040	0.110	0.114	0.120	
E	2.100		2.640	0.083		0.104	
E1	1.200	1.300	1.400	0.047	0.051	0.055	
е		0.950			0.037		
e1		1.900			0.075		
L	0.400	0.500	0.600	0.016	0.020	0.024	
L1		0.540			0.021		
k	0°		8°				

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