1.2 V Micropower, Precision Shunt Voltage Reference

AD1580

FEATURES

Wide operating range: 50 µA to 10 mA
Initial accuracy: ±0.1% maximum
Temperature drift: ±50 ppm/°C maximum
Output impedance: 0.5 Ω maximum
Wideband noise (10 Hz to 10 kHz): 20 µV rms
Operating temperature range: −40°C to +85°C
High ESD rating
4 kV human body model
400 V machine model
Compact, surface-mount SOT-23 and SC70 packages

APPLICATIONS

Portable, battery-powered equipment
Cellular phones, notebook computers, PDAs, GPSs, and DMMs
Computer workstations
Suitable for use with a wide range of video RAMDACs
Smart industrial transmitters
PCMCIA cards
Automotive
3 V/5 V, 8-bit to 12-bit data converters

GENERAL DESCRIPTION

The AD1580[1] is a low cost, 2-terminal (shunt), precision band gap reference. It provides an accurate 1.225 V output for input currents between 50 µA and 10 mA.

The superior accuracy and stability of the AD1580 is made possible by the precise matching and thermal tracking of on-chip components. Proprietary curvature correction design techniques have been used to minimize the nonlinearities in the voltage output temperature characteristics. The AD1580 is stable with any value of capacitive load.

The low minimum operating current makes the AD1580 ideal for use in battery-powered 3 V or 5 V systems. However, the wide operating current range means that the AD1580 is extremely versatile and suitable for use in a wide variety of high current applications.

The AD1580 is available in two grades, A and B, both of which are provided in the SOT-23 and SC70 packages, the smallest surface-mount packages available. Both grades are specified over the industrial temperature range of −40°C to +85°C.

PIN CONFIGURATIONS

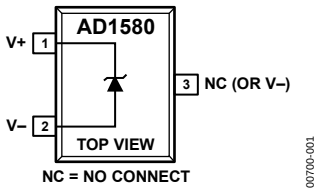

Figure 1. SOT-23

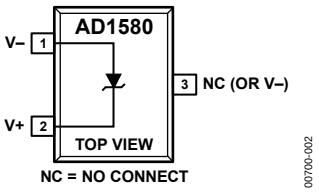

Figure 2. SC70

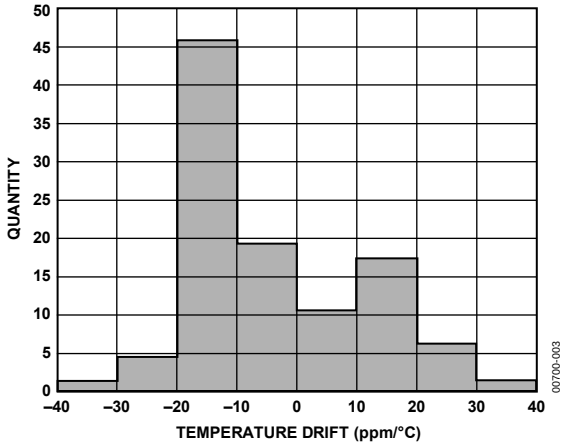

Figure 3. Reverse Voltage Temperature Drift Distribution

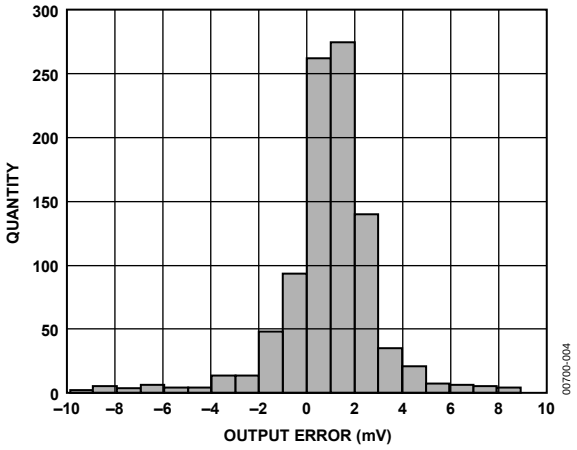

Figure 4. Reverse Voltage Error Distribution

[1] Protected by U.S. Patent No. 5,969,657; other patents pending.

SPECIFICATIONS

T_A = 25°C, I_{IN} = 100 µA, unless otherwise noted.

Table 1.

	AD1580A			AD1580B			
Model	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
REVERSE VOLTAGE OUTPUT (SOT-23)	1.215	1.225	1.235	1.224	1.225	1.226	V
REVERSE VOLTAGE OUTPUT (SC70)				1.2225	1.225	1.2275	V
REVERSE VOLTAGE TEMPERATURE DRIFT							
−40°C to +85°C			100			50	ppm/°C
MINIMUM OPERATING CURRENT, T_{MIN} to T_{MAX}			50			50	µA
REVERSE VOLTAGE CHANGE WITH REVERSE CURRENT							
50 µA < I_{IN} < 10 mA, T_{MIN} to T_{MAX}		2.5	6		2.5	6	mV
50 µA < I_{IN} < 1 mA, T_{MIN} to T_{MAX}		0.5			0.5		mV
DYNAMIC OUTPUT IMPEDANCE ($\Delta V_R/\Delta I_R$)							
I_{IN} = 1 mA ± 100 µA (f = 120 Hz)		0.4	1		0.4	0.5	Ω
OUTPUT NOISE							
RMS Noise Voltage: 10 Hz to 10 kHz		20			20		µV rms
Low Frequency Noise Voltage: 0.1 Hz to 10 Hz		5			5		µV p-p
TURN-ON SETTLING TIME TO 0.1%[1]		5			5		µs
OUTPUT VOLTAGE HYSTERESIS[2]		80			80		µV
TEMPERATURE RANGE							
Specified Performance, T_{MIN} to T_{MAX}	−40		+85	−40		+85	°C
Operating Range[3]	−55		+125	−55		+125	°C

[1] Measured with no load capacitor.
[2] Output hysteresis is defined as the change in the +25°C output voltage after a temperature excursion to +85°C and then to −40°C.
[3] The operating temperature range is defined as the temperature extremes at which the device continues to function. Parts may deviate from their specified performance.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Reverse Current	25 mA
Forward Current	20 mA
Internal Power Dissipation[1]	
SOT-23 (RT)	0.3 W
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	
AD1580/RT	−55°C to +125°C
Lead Temperature, Soldering	
Vapor Phase (60 sec)	215°C
Infrared (15 sec)	220°C
ESD Susceptibility[2]	
Human Body Model	4 kV
Machine Model	400 V

[1] Specification is for device in free air at 25°C, SOT-23 package. θ_{JA} = 300°C/W.
[2] The human body model is a 100 pF capacitor discharged through 1.5 kΩ. For the machine model, a 200 pF capacitor is discharged directly into the device.

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

OUTLINE DIMENSIONS

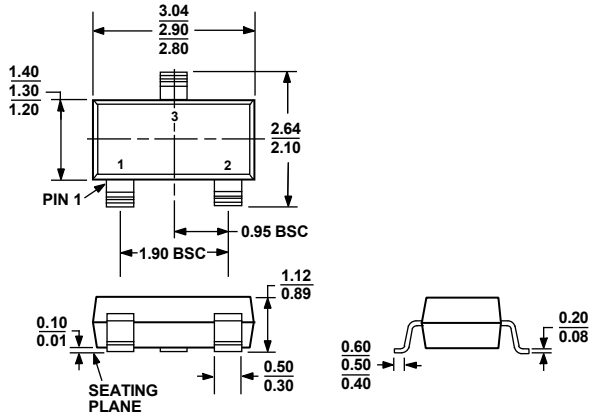

Figure 27. 3-Lead Small Outline Transistor Package [SOT-23-3] (RT-3)
Dimensions shown in millimeters

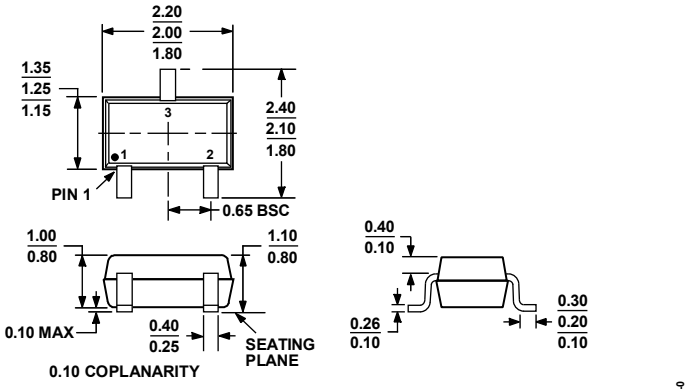

Figure 28. 3-Lead Thin Shrink Small Outline Transistor Package [SC70] (KS-3)
Dimensions shown in millimeters

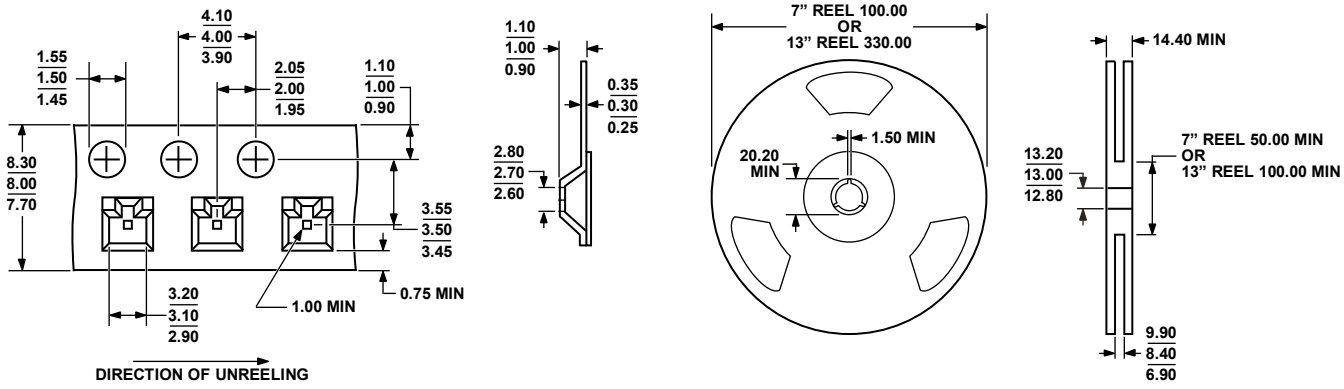

Figure 29. Tape and Reel Dimensions (RT-3 and KS-3)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Initial Output Error	Temperature Coefficient	Package Description	Package Option	Branding
AD1580ART-R2	−40°C to +85°C	10 mV	100 ppm/°C	3-Lead SOT-23-3	RT-3	0Axx
AD1580ART-REEL	−40°C to +85°C	10 mV	100 ppm/°C	3-Lead SOT-23-3	RT-3	0Axx
AD1580ART-REEL7	−40°C to +85°C	10 mV	100 ppm/°C	3-Lead SOT-23-3	RT-3	0Axx
AD1580ARTZ-REEL[1]	−40°C to +85°C	10 mV	100 ppm/°C	3-Lead SOT-23-3	RT-3	R0Y
AD1580ARTZ-REEL7[1]	−40°C to +85°C	10 mV	100 ppm/°C	3-Lead SOT-23-3	RT-3	R0Y
AD1580BRT-R2	−40°C to +85°C	1 mV	50 ppm/°C	3-Lead SOT-23-3	RT-3	0Bxx
AD1580BRT-REEL7	−40°C to +85°C	1 mV	50 ppm/°C	3-Lead SOT-23-3	RT-3	0Bxx
AD1580BRTZ-R2[1]	−40°C to +85°C	1 mV	50 ppm/°C	3-Lead SOT-23-3	RT-3	0Bxx
AD1580BRTZ-REEL7[1]	−40°C to +85°C	1 mV	50 ppm/°C	3-Lead SOT-23-3	RT-3	R2E
AD1580BKSZ-REEL[1]	−40°C to +85°C	2.5 mV	50 ppm/°C	3-Lead SC70	KS-3	R2E
AD1580BKSZ-REEL7[1]	−40°C to +85°C	2.5 mV	50 ppm/°C	3-Lead SC70	KS-3	R2E

[1] Z = RoHS Compliant Part.

PACKAGE BRANDING INFORMATION

In the SOT-23 package (RT), four marking fields identify the device generic, grade, and date of processing.
The first field is the product identifier. A 0 identifies the generic as the AD1580.
The second field indicates the device grade: A or B.
In the third field, a numeral or letter indicates a calendar year: 5 for 1995, A for 2001.
In the fourth field, letters A through Z represent a two-week window within the calendar year, starting with A for the first two weeks of January.