

## Precision 2.5-Volt Reference

### Description

The SG1503 is a monolithic integrated circuit implementing a self-contained precision voltage reference generator. It is internally trimmed for  $\pm 1\%$  accuracy and requires less than 2mA quiescent current. SG1503 can deliver greater than 10mA output current while achieving total load and line induced tolerances of less than 0.5%.

In addition to voltage accuracy, internal trimming achieves a temperature coefficient of output voltage of typically 10 ppm/ $^{\circ}\text{C}$ . As a result, these references are excellent choices for applications in critical instrumentation and D-to-A converter systems. The SG1503 is specified for operation over the full military ambient temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , while the SG2503 is designed for  $-25^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  and the SG3503 for commercial applications of  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

### Features

- Output Voltage Trimmed to  $\pm 1\%$
- Input Voltage Range of 4.5V to 40V
- Temperature Coefficient of 10ppm/ $^{\circ}\text{C}$
- Quiescent Current Typically 1.5mA
- Output Current in excess of 10mA
- Interchangeable with MC1503 and AD580

### Application

- Available to MIL-STD-883, ¶ 1.2.1
- Available to DSCC
  - Standard Microcircuit Drawing (SMD)
- Microsemi<sup>®</sup> Level "S" Processing Available

### Functional Diagram

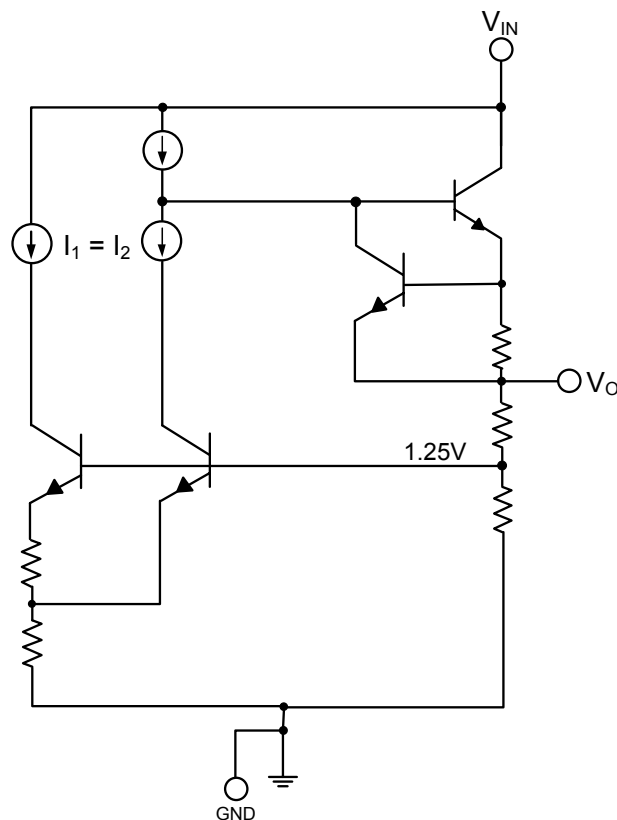
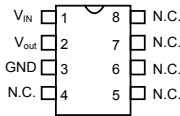
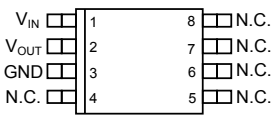
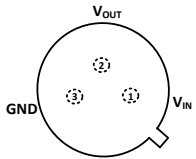


Figure 1 • Functional Block Diagram

## Connection Diagrams and Ordering Information

Ambient Temperature	Type	Package	Part Number	Packaging Type	Connection Diagram
-55°C to 125°C	Y	8-PIN ceramic DIP	SG1503Y-883B	CERDIP	
-25°C to 85°C			SG1503Y-DESC		
0°C to 70°C			SG1503Y		
			SG2503Y		
0°C to 70°C	SG3503Y				
-25°C to 85°C	M	8-PIN plastic DIP Pb-free / RoHS Transition DC: 0503*	SG2503M	PDIP	<p>Y Package: PbSn Lead Finish M Package: Pb-free / RoHS 100% Matte Tin Lead Finish</p>
0°C to 70°C			SG3503M		
-25°C to 85°C	DM	8-PIN plastic SOIC Pb-free / RoHS Transition DC: 0440*	SG2503DM	SOIC	
0°C to 70°C			SG3503DM		
-55°C to 125°C	T	3-PIN METAL CAN	SG1503T-883B	TO-39	
-25°C to 85°C			SG1503T-DESC		
0°C to 70°C			SG1503T		
			SG2503T		
0°C to 70°C	SG3503T				
<p><i>Notes:</i></p> <ol style="list-style-type: none"> <li>Contact factory for JAN and DESC product availability.</li> <li>All packages are viewed from the top.</li> </ol> <p>*RoHS compliant</p>					

## Absolute Maximum Ratings

Parameter	Value	Units
Input Voltage	40	V
Storage Temperature Range	-65 to 150	°C
<b>Operating Junction Temperature</b>		
Hermetic (T, Y Packages)	150	°C
Plastic (M, DM Packages)	150	°C
Lead Temperature (Soldering, 10 seconds)	300	°C
Pb-free / RoHS Peak Solder Reflow Temp (40s max. exp.)	260 (+0, -5)	°C
<i>Note: Exceeding these ratings could cause damage to the device.</i>		

## Thermal Data

Parameter	Value	Units
<b>T Package</b>		
Thermal Resistance-Junction to Case, $\theta_{JC}$	15	°C/W
Thermal Resistance-Junction to Ambient, $\theta_{JA}$	120	°C/W
<b>Y Package</b>		
Thermal Resistance-Junction to Case, $\theta_{JC}$	50	°C/W
Thermal Resistance-Junction to Ambient, $\theta_{JA}$	130	°C/W
<b>M Package</b>		
Thermal Resistance-Junction to Case, $\theta_{JC}$	60	°C/W
Thermal Resistance-Junction to Ambient, $\theta_{JA}$	95	°C/W
<b>DM Package</b>		
Thermal Resistance-Junction to Case, $\theta_{JC}$	55	°C/W
Thermal Resistance-Junction to Ambient, $\theta_{JA}$	165	°C/W
<i>Notes:</i>		
1. Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$ .		
2. The above numbers for $\theta_{JC}$ are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The $\theta_{JA}$ numbers are meant to be guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.		

## Recommended Operating Conditions

Parameter	Value	Units
Input Voltage	4.5 to 40	V
<b>Operating Ambient Temperature Range</b>		
SG1503	-55 to 125	°C
SG2503	-25 to 85	°C
SG3503	0 to 70	°C
<i>Note: Range over which the device is functional.</i>		

## Electrical Characteristics

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for SG1503 with  $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$ , SG2503/SG3503 with  $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ ,  $V_{IN} = 15\text{V}$ , and  $I_L = 0\text{mA}$ . Low duty cycle pulse testing techniques are used that maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Test Conditions	SG1503/2503			SG3503			Units
		Min	Typ	Max	Min	Typ	Max	
Output Voltage	$T_A = 25^{\circ}\text{C}$	2.485	2.500	2.515	2.475	2.500	2.525	V
Input Voltage		4.7		40	4.7		40	V
	$T_A = 25^{\circ}\text{C}$	4.5		40	4.5		40	V
Line Regulation	$V_{IN} = 5\text{V TO } 15\text{V}$		1	3		1	3	mV
	$V_{IN} = 15\text{V TO } 40\text{V}$		3	5		3	10	mV
Load Regulation	$\Delta I_L = 10\text{mA}$		3	5		3	10	mV
	$\Delta I_L = 10\text{mA}, V_{IN} = 30\text{V}$		4	8		4	15	mV
Temperature Regulation	(SG1503 only)		15	20				mV
	(SG2503/SG3503 only)		2.5	5		5	10	mV
Quiescent Current	$V_{IN} = 40\text{V}$		1.5	2.0		1.5	2.0	mA
Short Circuit Current	$T_A = 25^{\circ}\text{C}$	15	20	30	15	20	30	mA
Ripple Rejection	$f = 120\text{Hz}, T_A = 25^{\circ}\text{C}$		76			76		dB
Output Noise	$\text{BW} = 10\text{kHz}, T_A = 25^{\circ}\text{C}$		100			100		$\mu\text{V rms}$
Voltage Stability			250			250		$\mu\text{V}/\text{hr}$

## Characteristics Curves

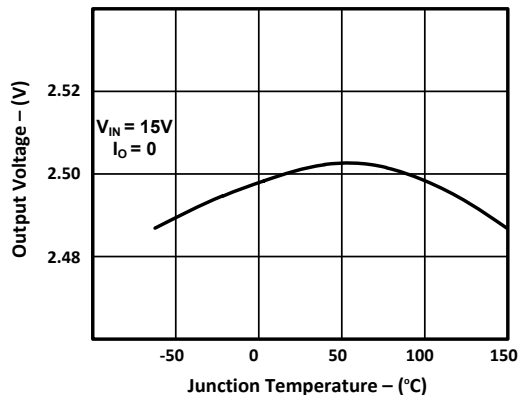


Figure 2 · Output Voltage versus Temperature

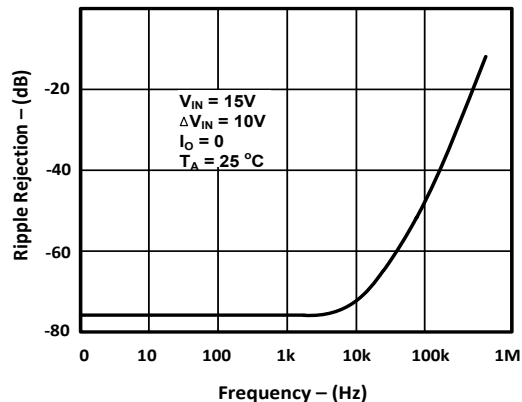
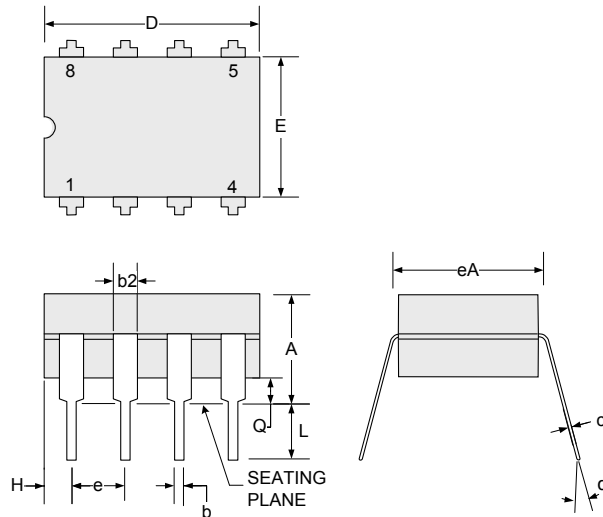


Figure 3. Ripple Rejection

# Package Outline Dimensions

Controlling dimensions are in inches; metric equivalents are shown for general information.

## Y 8-Pin Cerdip Package Dimensions



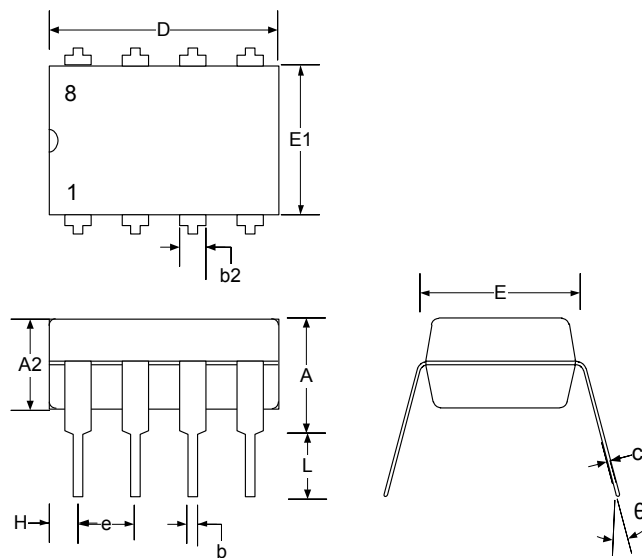
Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.32	5.08	0.170	0.200
b	0.38	0.51	0.015	0.020
b2	1.04	1.65	0.045	0.065
c	0.20	0.38	0.008	0.015
D	9.52	10.29	0.375	0.405
E	5.59	7.11	0.220	0.280
e	2.54 BSC		0.100 BSC	
eA	7.37	7.87	0.290	0.310
H	0.63	1.78	0.025	0.070
L	3.18	4.06	0.125	0.160
$\alpha$	-	15°	-	15°
Q	0.51	1.02	0.020	0.040

**Note:**

Dimensions do not include protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

Figure 4 · Y 8-Pin Cerdip Package Dimensions

## M 8-Pin PDIP Package Dimensions



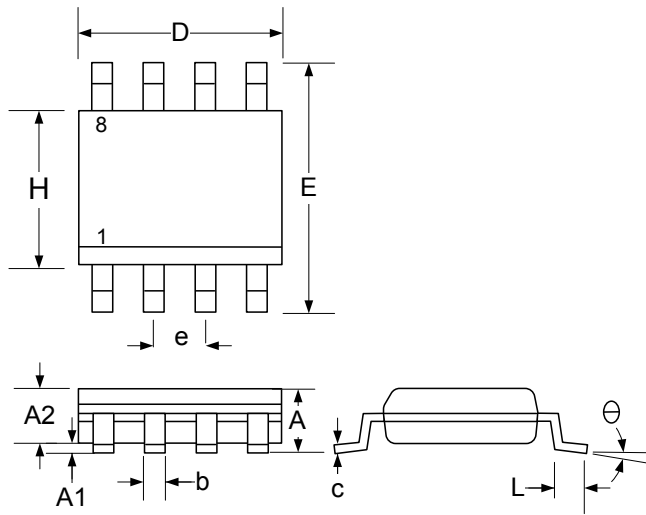
Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	5.08	-	0.200
A2	3.30 Typ.		1.30 Typ.	
b	0.38	0.51	0.145	0.020
b2	0.76	1.65	0.030	0.065
c	0.20	0.38	0.008	0.015
D	-	10.16	-	0.400
E	7.62 BSC		0.300 BSC	
e	2.54 BSC		0.100 BSC	
E1	6.10	6.86	0.240	0.270
L	3.05	-	0.120	-
$\theta$	0°	15°	0°	15°

**Note:**

Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

Figure 5 · M 8-Pin PDIP Package Dimensions

## DM 8-Pin SOIC Package Dimensions



Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.52	0.049	0.060
b	0.33	0.51	0.013	0.020
c	0.19	0.25	0.007	0.010
D	4.83	5.21	0.189	0.205
E	5.79	6.20	0.228	0.244
e	1.27 BSC		0.050 BSC	
H	3.81	4.01	0.150	0.158
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°
*LC	-	.010	-	0.004

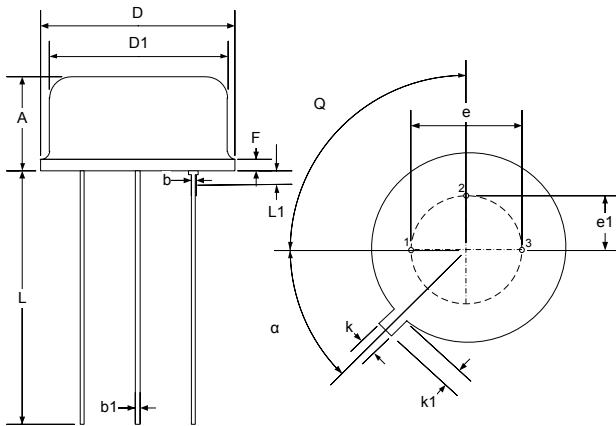
\*Lead Co-planarity

**Note:**

Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

Figure 6 · DM 8-Pin SOIC Package Dimensions

## T 3-Pin Metal Can TO-39



Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.19	4.70	0.165	0.185
b	0.41	0.48	0.016	0.019
b1	0.41	0.53	0.016	0.021
D	8.89	9.40	0.350	0.370
D1	8.13	8.51	0.320	0.335
e	5.08 BSC		0.200 BSC	
e1	2.54 TYP		0.100 TYP	
F	-	1.02	-	0.040
k	0.71	0.86	0.028	0.034
k1	0.74	1.14	0.029	0.045
L	12.70	14.48	0.500	0.570
L1	-	1.27	-	0.050
Q	90° TYP		90° TYP	
α	45° TYP		45° TYP	

**Note:**

Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm (.006") on any side. Lead dimension shall not include solder coverage.

Figure 7 · T 3-Pin Metal Can TO-39



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