

## 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

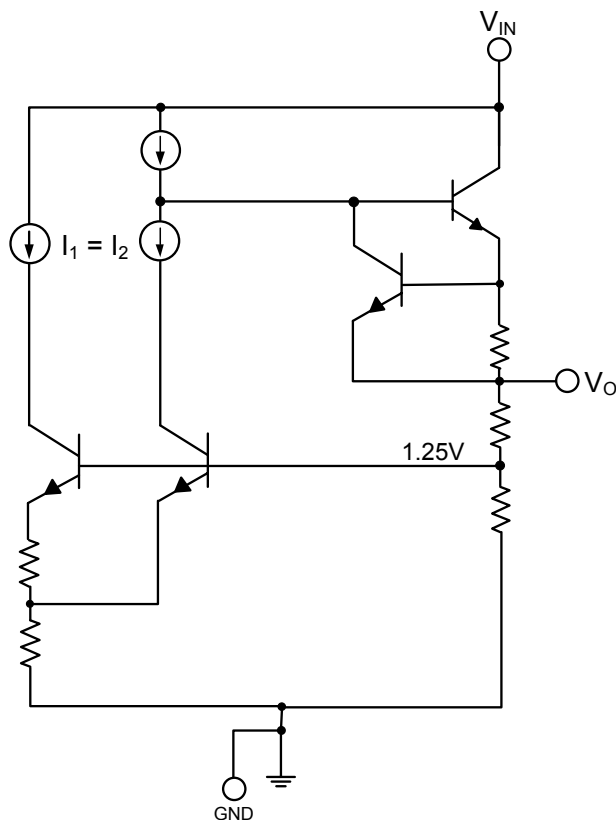
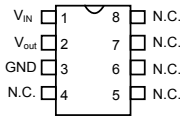
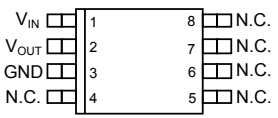
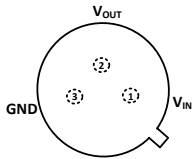


Figure 1 • Functional Block Diagram

## 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	Y Package: PbSn Lead Finish M Package: Pb-free / RoHS 100% Matte Tin Lead Finish
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

*Note: Range over which the device is functional.*

## 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

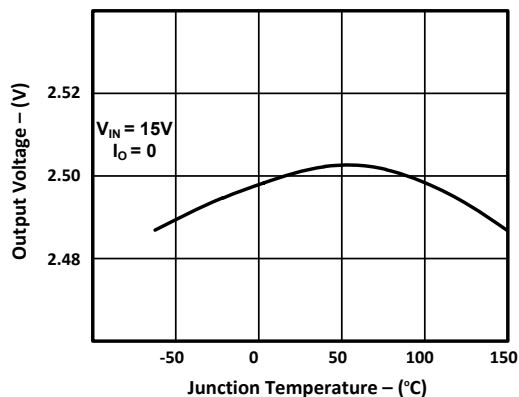


Figure 2 · Output Voltage versus Temperature

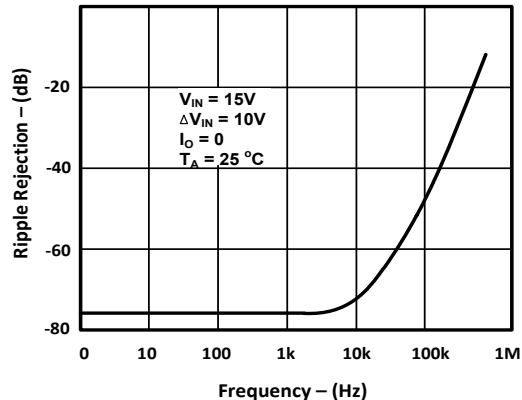
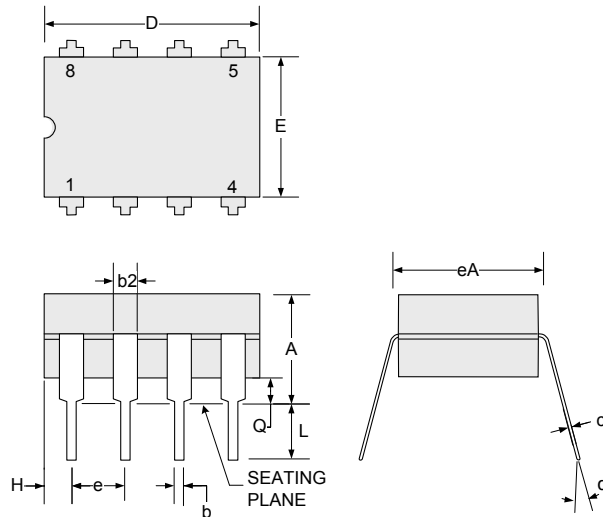


Figure 3. Ripple Rejection

# Package Outline Dimensions

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

## Y 8-Pin Cerdip Package Dimensions



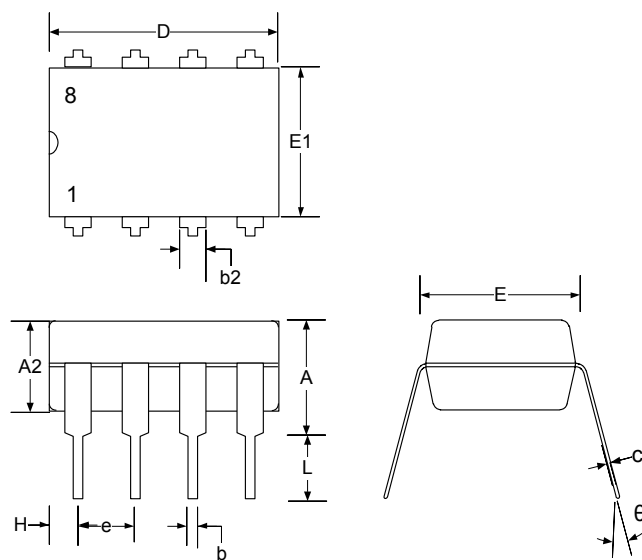
Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.32	5.08	0.170	0.200
b	0.38	0.51	0.015	0.020
b2	1.04	1.65	0.045	0.065
c	0.20	0.38	0.008	0.015
D	9.52	10.29	0.375	0.405
E	5.59	7.11	0.220	0.280
e	2.54 BSC		0.100 BSC	
eA	7.37	7.87	0.290	0.310
H	0.63	1.78	0.025	0.070
L	3.18	4.06	0.125	0.160
$\alpha$	-	15°	-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



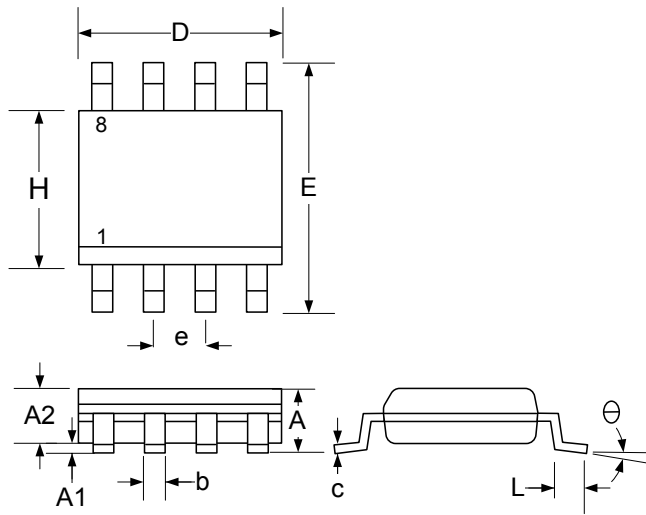
Dim	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	5.08	-	0.200
A2	3.30 Typ.		1.30 Typ.	
b	0.38	0.51	0.145	0.020
b2	0.76	1.65	0.030	0.065
c	0.20	0.38	0.008	0.015
D	-	10.16	-	0.400
E	7.62 BSC		0.300 BSC	
e	2.54 BSC		0.100 BSC	
E1	6.10	6.86	0.240	0.270
L	3.05	-	0.120	-
$\theta$	0°	15°	0°	15°

**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

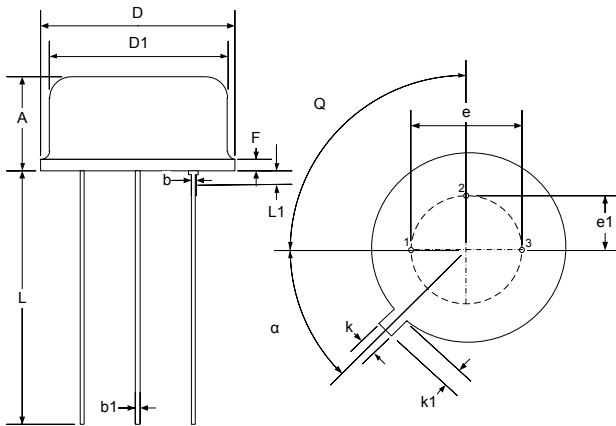
\*Lead Co-planarity

**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



**Microsemi Corporate Headquarters**  
One Enterprise, Aliso Viejo,  
CA 92656 USA

**Within the USA:** +1 (800) 713-4113  
**Outside the USA:** +1 (949) 380-6100  
**Sales:** +1 (949) 380-6136  
**Fax:** +1 (949) 215-4996

**E-mail:** [sales.support@microsemi.com](mailto:sales.support@microsemi.com)

© 2014 Microsemi Corporation. All rights reserved. Microsemi and the Microsemi logo are trademarks of Microsemi Corporation. All other trademarks and service marks are the property of their respective owners.

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for communications, defense & security, aerospace and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; security technologies and scalable anti-tamper products; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 3,400 employees globally. Learn more at [www.microsemi.com](http://www.microsemi.com).

Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.