Precision General - Purpose Regulator

Description

This monolithic integrated circuit is a versatile, general-purpose voltage regulator designed as a substantially improved replacement for the popular SG723 device. The SG1532 series regulators retain all the versatility of the SG723 but have the added benefits of operation. The SG1532 series have input voltages as low as 4.5 V and as high as 50 V, a low noise, low voltage reference temperature compensated, low threshold current limiting and protective circuits which include thermal shutdown and independent current limiting of both the reference and output voltages. A separate remote shutdown terminal is included. In the dual-in-line package an open collector output is available for low input-output differential applications.

These devices are available in a hermetic 14-pin CERDIP. The SG1532 is rated for operation over the ambient temperature range of -55°C to 125°C.

Features

- Input Voltage Range of 4.5 V to 50 V
- 2.5 V Low Noise Reference
- Independent Shutdown Terminal
- Improved Line and Load Regulation
- 80 mV Current Limit Sense Voltage
- Fully Protected Including Thermal Shutdown
- Useful Output Current to 150 mA

High Reliability Features

- Available to MIL-STD-883, ¶ 1.2.1
- Available to DSCC
  – Standard Microcircuit Drawing (SMD)
- MSC-AMS level “S” Processing Available

Block Diagram

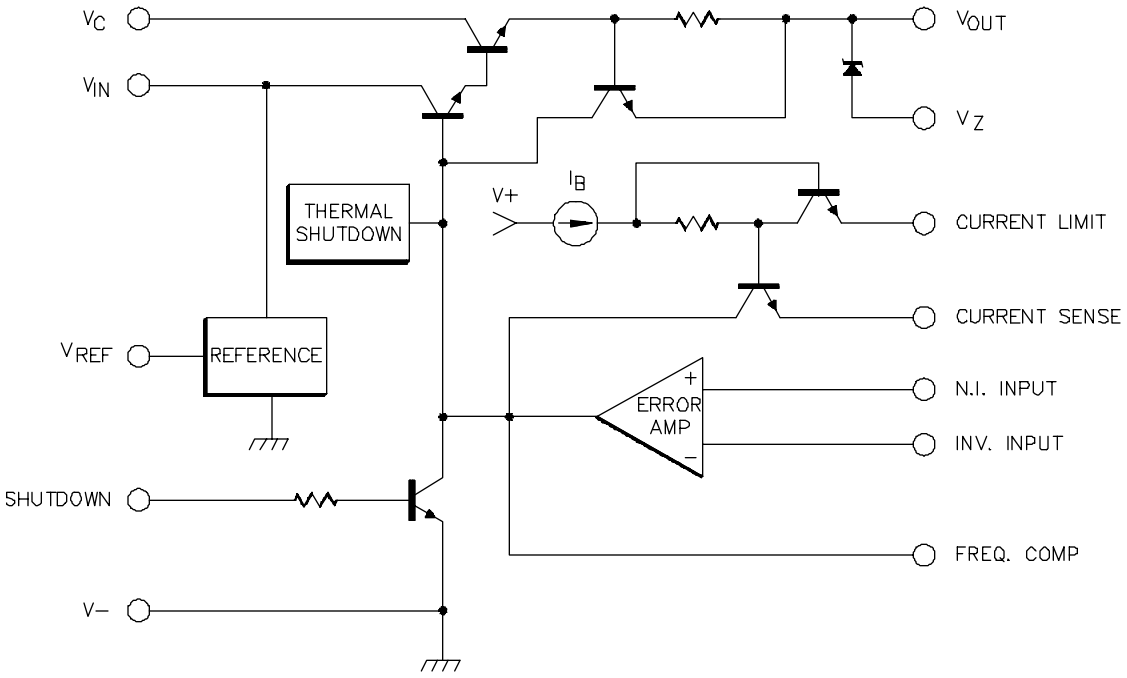


Figure 1 · Block Diagram

Absolute Maximum Ratings (Note 1)

Pulse (50 ms) Input Voltage from V_{IN} to V- ..... 50 V
Continuous Input Voltage from V_{IN} to V-..... 40 V
Input to Output Voltage Differential..... 40 V
Maximum Output Current ..... 250 mA
Current from V_Z ..... 100 mA

Note 1. Exceeding these ratings could cause damage to the device.

Current from V_{REF}..... 25 mA
Operating Junction Temperature
Storage Temperature Range ..... -65°C to 150°C
Lead Temperature (Soldering, 10s) ..... 300°C

Thermal Data

J Package:
Thermal Resistance-Junction to Case, θ_{JC} ..... 30°C/W
Thermal Resistance-Junction to Ambient, θ_{JA} ..... 80°C/W

Note A. Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
Note B. The above numbers for θ_{JC} are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The θ_{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 (Note 2)

Input Voltage Range
SG1532 ..... 5 V to 45 V
Output Current Range ..... 1 mA to 100 mA

Note 2. Range over which the device is functional.

Reference Current ..... 5 mA
Zener Current ..... 20 mA
Operating Ambient Temperature Range
SG1532 ..... -55°C to 125°C

Electrical Characteristics

(Unless otherwise specified, these specifications apply over the operating ambient temperature for SG1532 with -55°C ≤ T_A ≤ 125°C, V_{IN} = 10 V, V_{OUT} = 5 V, and I_{OUT} = 1 mA. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Test Conditions	SG1532			Units
		Min.	Typ.	Max.	
Input Voltage Range	T_A = 25°C	4.5		50	V
		4.7		50	V
Output Voltage Range		2.0		38	V
Max Output Current	R_{SC} = 0, V_{OUT} = 0, T_A = 25°C		175	250	mA
Min (V_{IN} - V_{OUT})	I_{OUT} = 100 mA, T_A = 25°C		1.7	2.0	V
Reference Voltage	T_A = 25°C	2.40	2.50	2.60	V
		2.35		2.65	V
Temperature Stability (Note 4)			0.005	0.015	%/°C
Ref Short Circuit Current	V_{REF} = 0, T_A = 25°C		15	25	mA
Line Regulation (Note 3)	8 V ≤ V_{IN} ≤ 40 V		0.005	0.01	%/V
	8 V ≤ V_{IN} ≤ 20 V, I_{OUT} = 25 mA		0.01	0.02	%/V
Load Regulation (Note 3)	1 mA ≤ I_{OUT} ≤ 25 mA		0.002	0.004	%/mA
	1 mA ≤ I_{OUT} ≤ 100 mA		0.002	0.005	%/mA
Current Limit Sense Voltage	R_{SC} = 100 Ω, V_{OUT} = 0 V	0.06	0.08	0.10	V
Shutdown Voltage Threshold		0.40	0.70	1.0	V
Shutdown Source Current	V_{OUT} = high	100	200	300	µA
Zener Voltage	I_{OUT} = 10 mA	6.0	6.4	7.2	V
Standby Current	V_{IN} = 40 V		2.5	3.5	mA
Error Amplifier Offset Voltage			2.0	10	mV
Error Amplifier Input Bias Current			4.0	15	µA

Electrical Characteristics (Continued)

Parameter	Test Conditions	SG1532			Units
		Min.	Typ.	Max.	
Open Loop Gain	T_A = 25°C	66	68		dB
Ripple Rejection	f = 120 Hz, T_A = 25°C		66		dB
Output Noise (Note 4)	10 Hz ≤ f ≤ 100 kHz, T_A = 25°C		50		μV_{RMS}
Long Term Stability (Note 4)	V_{IN} = 30 V, T_A = 125°C		0.3	1.0	%/khr
Thermal Shutdown (Note 4)			175		°C

Note 3. Applies for constant junction temperature. Temperature drift effects must be taken into account separately when the unit is operating under conditions of high dissipation.

Note 4. These parameters, although guaranteed, are not tested in production.

Characteristics Curves

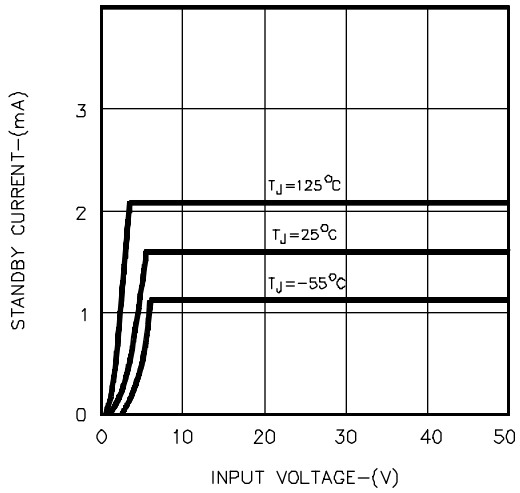


Figure 2. Standby Current

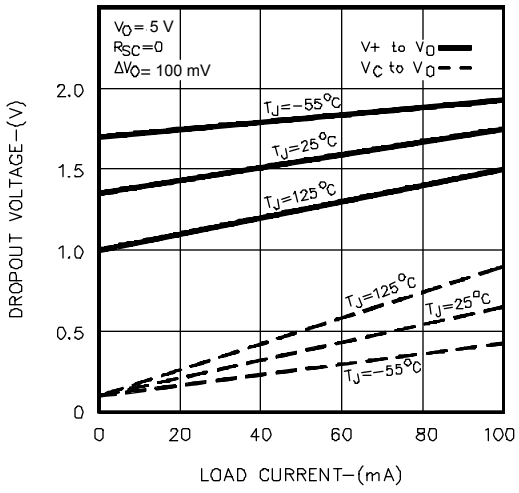


Figure 3. Minimum Input-Output Voltage

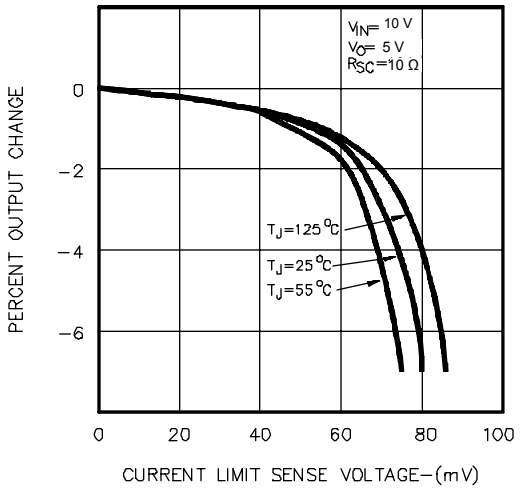


Figure 4. Current Limiting

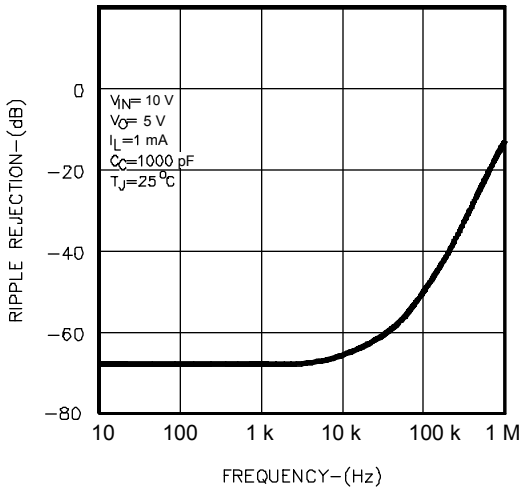


Figure 5. Ripple Rejection

Characteristics Curves (Continued)

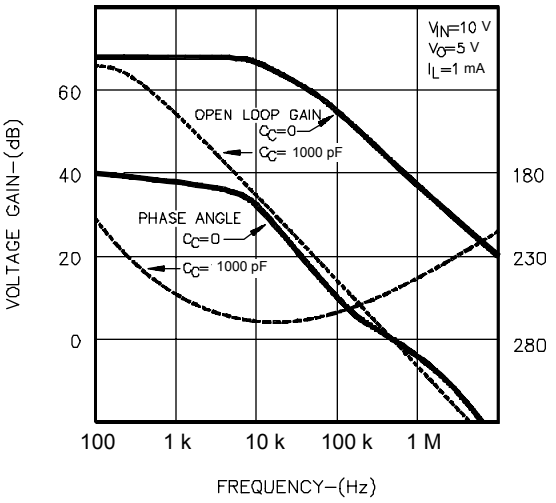


Figure 6. Frequency Response

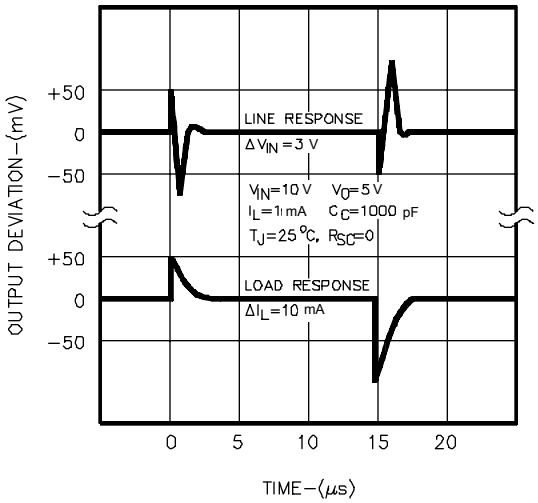


Figure 7. Transient Response

Application Information

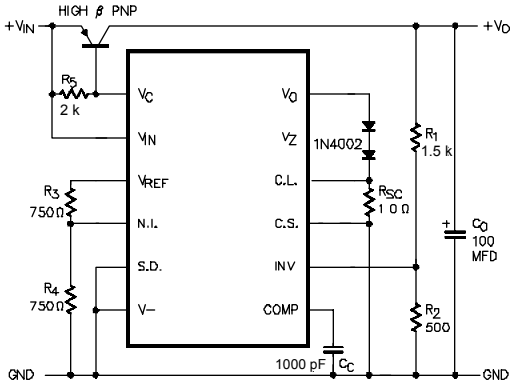


Figure 8. 90% Efficient Linear Regulator

Output Voltage = 5 V
Min (V_{IN}-V_{OUT}) at 2 A = 0.4 V
Load Reg 0-2 A = 20 mV

Max Output Current = 3 A
Line Reg 6-30 V = 10 mV

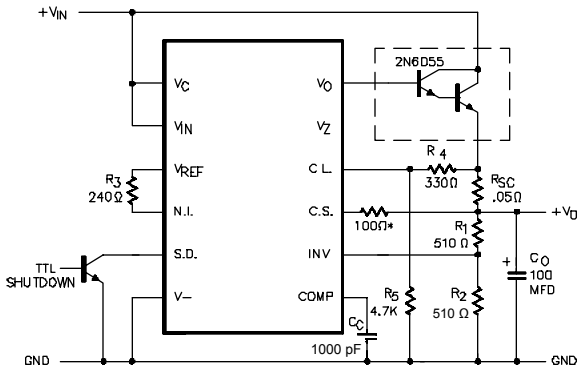


Figure 9. High Current Regulator with Foldback Current Limiting and Remote Shutdown

Output Voltage = 5 V
Max Output Current = 8 A
Min V_{IN} at No Load = 6.9 V
Min V_{IN} at 5 A = 8.2 V

Line Reg 10-30 V = 3 mV
Load Reg 0-5 A = 17 mV
Short Circuit Current = 1.8 A

Notes:

1. For output voltages above 8 V and load currents which allow PNP base current to be limited to 25 mA, the internal zener may be used, eliminating the need for the two external diodes and the divider on V_{REF} .
2. R_{SC} can be eliminated if the 200 mA current limit on V_{OUT} is adequate. Overall current limiting is dependent upon PNP Beta. For greater accuracy, load currrent may be sensed in the ground line.

Note:

* 100 Ω surge limiting resistor should be used for output voltages above 8 V.

Application Information (Continued)

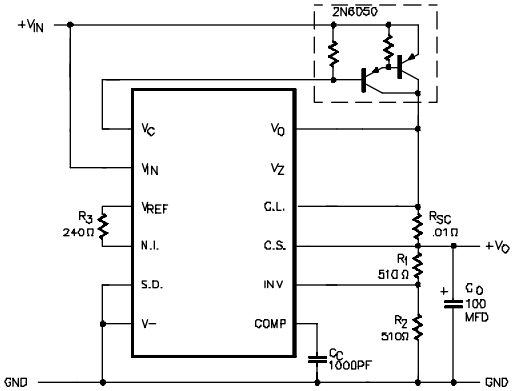


Figure 10. High Efficiency Low Voltage Regulator

Output Voltage = 5 V
Max Output Current = 9 A
Min V_{IN} at 5 A = 7.0 V

Line Reg 7-20 V = 10 mV
Load Reg 0-5 A = 25 mV
Constant Current Limiting

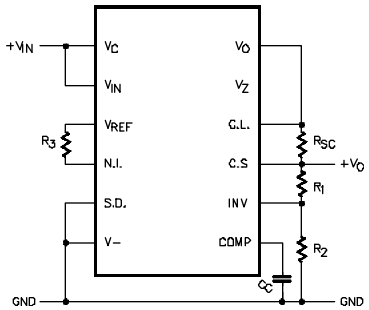


Figure 11. Basic Low Current Regulator

$V_{OUT} = V_{REF}\left(1+\frac{R_1}{R_2}\right)$

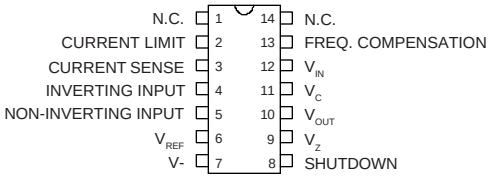
C_C = 1000 pF

$I_{OUT} \leq 100$ mA

$I_{SC} = \frac{\text{Sense Voltage}}{R_{SC}}$

$R_3 = \frac{R_1 R_2}{R_1+R_2}$

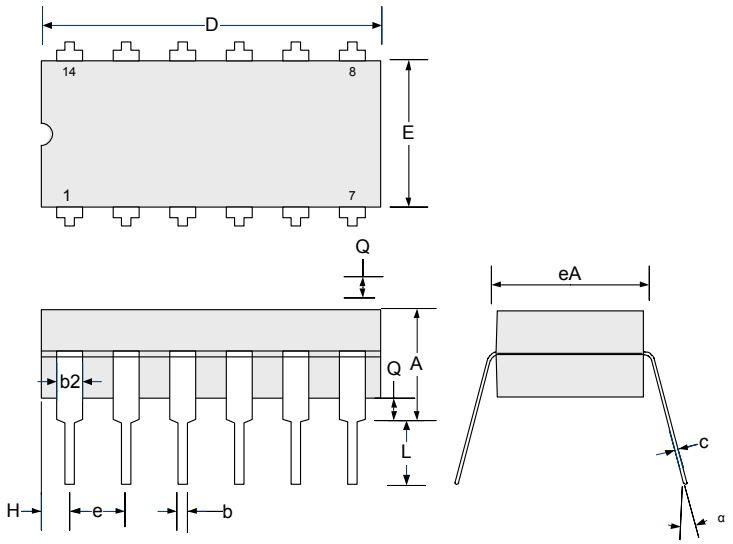
Connection Diagrams and Ordering Information (See Notes Below)

Package	Part Number	Ambient Temperature Range	Connection Diagram
14-PIN CERAMIC DIP J - PACKAGE	SG1532J-883B SG1532J-DESC SG1532J	-55°C to 125°C -55°C to 125°C -55°C to 125°C	

Note 1. Contact factory for JAN product availability.
2. All packages are viewed from the top.

Package Outline Dimensions

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



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	5.08	-	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	19.30	19.94	0.760	0.785
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	5.08	0.125	0.200
α	-	15°	-	15°
Q	0.51	1.02	0.020	0.040

Note:

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

Figure 12 · J 14-Pin Ceramic Dip Package Dimensions

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