Low-Voltage Supervisory Circuit

Description

This device was designed to provide all the operational features of the SG1543/2543/3543 devices with the added advantage of uncommitted inputs to the voltage sensing comparators. This allows monitoring of voltage levels less than 2.5 volts by dividing down the internal reference supply.

In all other respects, the SG1544 series is identical to the SG1543 series. These monolithic devices contain all the functions necessary to monitor and control the output of a sophisticated power supply system. Over-voltage sensing with provision to trigger an external SCR “crowbar” shutdown; an under-voltage circuit which can be used to monitor either the output or sample the input line voltage; and a third op-amp/comparator usable for current sensing are all included in this IC, together with an independent, accurate reference generator.

The voltage-sensing input comparators are identical and can be used with threshold levels from zero volts to V_{IN} (3V). Each has approximately 25mV of hysteresis which is offset so the switching differential threshold is zero on the non-inverting input for rising levels and zero on the inverting input for falling signals. All other operating characteristics are as described in the SG1543 data sheet and application note.

Features

- Uncommitted Comparator Inputs for Wide Input Flexibility
- Common-Mode Range from Zero to Near Supply Voltage
- Reference Voltage Trimmed to 1% Accuracy
- Over-Voltage, Under-Voltage, and Current Sensing Circuits all included
- SCR "Crowbar" Drive of 300mA
- Programmable Time Delays
- Open-Collector Outputs and Remote Activation Capability
- Total Standby Current Less Than 10mA

High Reliability Features

- Available to MIL-STD-883, ¶ 1.2.1
- MSC-AMS level “S” Processing Available

Block Diagram

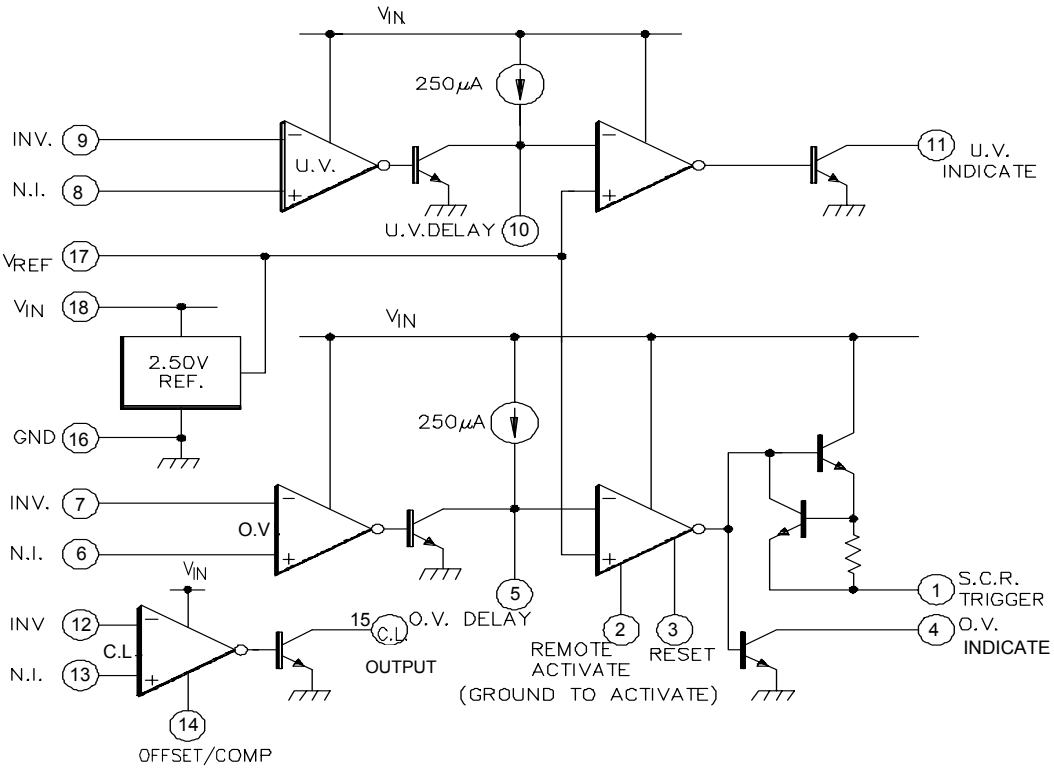


Figure 1 · Block Diagram

Absolute Maximum Ratings (Note 1)

Input Supply Voltage ($+V_{IN}$) 40V
Sense Inputs ..... $+V_{IN}$
SCR Trigger Current (Note 2) 300mA
Indicator Output Voltage 40V
Indicator Output Sink Current 50mA
Operating Junction Temperature
  Hermetic (J Package) ..... 150°C
  Plasitc (N, DW Packages) ..... 150°C
Storage Temperature Range ..... -65°C to 150°C
RoHS Peak Package Solder Reflow (40 sec. max. exp.)...260°C (+0, -5)

Note 1. Values beyond which damage may occur.
Note 2. At higher input voltages, a dissipation limiting resistor, R_G is required. See Figure 2.

Thermal Data

J Package:
  Thermal Resistance-Junction to Case, θ_{JC} ..... 25°C/W
  Thermal Resistance-Junction to Ambient, θ_{JA} ..... 70°C/W
N Package:
  Thermal Resistance-Junction to Case, θ_{JC} ..... 30°C/W
  Thermal Resistance-Junction to Ambient, θ_{JA} ..... 60°C/W
DW Package:
  Thermal Resistance-Junction to Case, θ_{JC} ..... 35°C/W
  Thermal Resistance-Junction to Ambient, θ_{JA} ..... 90°C/W

Note A. Junction Temperature Calculation: $T_J = T_A + (P_D \times J_A)$.

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 3)

Input Supply Voltage ($+V_{IN}$) ..... 4.7V to 40V
Current Limit Common Mode
Input Voltage Range ..... 0V to $+V_{IN}$-3V
Reference Load Current ..... 0 to 10mA
Indicator Output Voltage ..... 4.7V to 40V
Indicator Output Current ..... 0 to 10mA
Delay Timing Capcitor (Note 4) ..... 0 to 1µF
Operating Ambient Temperature Range
SG1544 ..... -55°C to 125°C
SG2544 ..... -25°C to 85°C
SG3544 ..... 0°C to 70°C

Note 3: Range over which the device is functional.
Note 4. Larger value capacitor may be used with peak current limiting. See Figure 2.

Electrical Characteristics

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for SG1544 with -55°C ≤ T_A ≤ 125°C, SG2544 with -25°C ≤ T_A ≤ 85°C, SG3544 with 0°C ≤ T_A ≤ 70°C, and $+V_{IN}$ = 10V. Indicator outputs have 2kΩ pull-up resistors. All electrical ratings and specifications are tested with the inverting over-voltage input and the non-inverting under-voltage input externally connected to the 2.5V reference. Low duty cycle testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Test Conditions	SG1544/SG2544			SG3544			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Supply Section								
Input Voltage Range	T_J = 25°C to T_{MAX}	4.5		40	4.5		40	V
		4.7		40	4.7		40	V
Supply Current	$+V_{IN}$ = 40V, Outputs open		7	10		7	10	mA
Reference Section								
Output Voltage	T_J = 25°C	2.48	2.50	2.52	2.45	2.50	2.55	V
		2.45		2.55	2.40		2.60	V
Line Regulation	$+V_{IN}$ = 5 to 30V		1	5		1	5	mV
Load Regulation	I_{REF} = 0 to 10mA		1	10		1	10	mV
Short Circuit Current	V_{REF} = 0V	12	25	40	12	25	40	mA
Temperature Stability			.005			.005		%/°C

Electrical Characteristics (Continued)

Parameter	Test Conditions	SG1544/SG2544			SG3544			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Comparator Section								
Input Threshold (Note 5)	T_J = 25°C	2.45	2.50	2.55	2.40	2.50	2.60	V
		2.40		2.60	2.35		2.65	V
Input Hysteresis			25			25		mV
Input Bias Current	Sense input = 0V		0.3	1.0		0.3	1.0	µA
Delay Saturation			0.2	0.5		0.2	0.5	V
Delay High Level			6	8		6	8	V
Delay Charging Current	V_D = 0V	200	250	300	200	250	300	µA
Indicate Saturation	I_L = 10mA		0.2	0.5		0.2	0.5	V
Indicate Leakage	V_{IND} = 40V		.01	1.0		0.1	1.0	µA
Propagation Delay	$V_{O.V.\ N.I.\ IN}$ = 2.7V, $V_{U.V.\ INV.\ IN}$ = 2.3V, T_J = 25°C							
	C_D = 0		400			400		ns
	C_D = 1µF		10			10		ms
SCR Trigger Section								
Peak Output Current	$+V_{IN}$ = 5V, R_G = 0, V_O = 0	100	200	400	100	200	400	mA
Peak Output Voltage	$+V_{IN}$ = 15V, I_O = 100mA	12	13		12	13		V
Output Off Voltage	$+V_{IN}$ = 40V, R_L = 1kΩ		0	0.1		0	0.1	V
Remote Activate Current	REM. ACT. pin = Gnd		0.4	0.8		0.4	0.8	mA
Remote Activate Voltage	REM. ACT pin open		2	6		2	6	V
Reset Current	RESET pin = Gnd, REM. ACT. = Gnd		0.4	0.8		0.4	0.8	mA
Reset Voltage	RESET pin open, REM. ACT. = Gnd		2	6		2	6	V
Output Current Rise Time	R_L = 50Ω, T_J = 25°C, C_D = 0		400			400		mA/µs
Prop. Delay from REM. ACT. Pin	$V_{REM.\ ACT.}$ = 0.4V		300			300		ns
Prop. Delay fom O.V. N.I. IN Pin	$V_{O.V.\ N.I.\ INPUT}$ = 2.7V		500			500		ns
Current Limit Section								
Input Voltage Range		0		V_{IN}-3V	0		V_{IN}-3V	V
Input Bias Current	OFFSET/COMP pin open, V_{CM} = 0V		0.3	1.0		0.3	1.0	µA
Input Offset Voltage	OFFSET/COMP pin open, V_{CM} = 0V		0	10		0	15	mV
	10Ω from OFFSET/COMP pin to Gnd, T_J = 25°C	80	100	120	70	100	130	mV
CMRR	$0 \le V_{CM} \le 12V$, V_{IN} = 15V	60	70		60	70		dB
AVOL	OFFSET/COMP pin open, V_{CM} = 0V	72	80		72	80		dB
Output Saturation	I_L = 10mA		0.2	0.5		0.2	0.5	V
Output Leakage	V_{IND} = 40V		.01	1.0		.01	1.0	µA
Small Signal Bandwidth	A_V = 0dB, T_J = 25°C		5			5		MHz
Propagation Delay	$V_{OVERDRIVE}$ = 100mV, T_J = 25°C		200			200		ns

Note 5. Input voltage rising on O.V. N.I. INPUT and falling on U.V. INV. INPUT.

Application Information

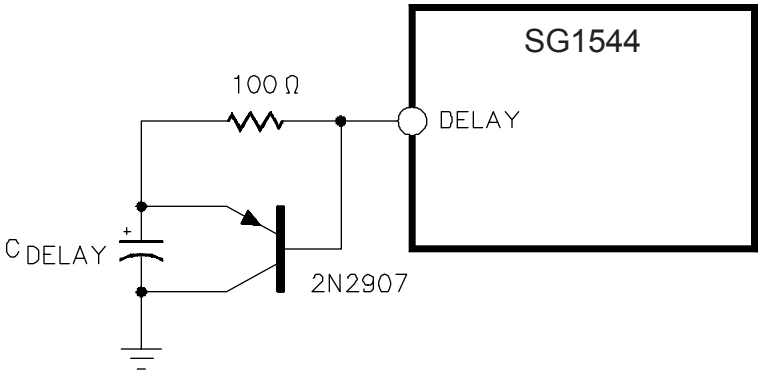
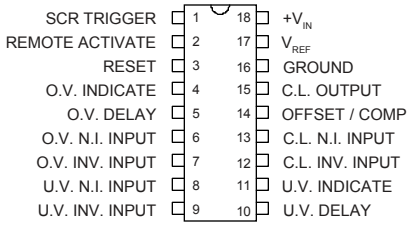
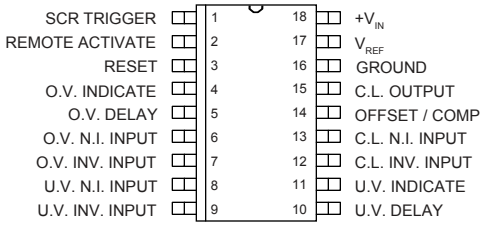


Figure 2 · Surge Limit Circuit for Large Delay Capacitors

The 100 ohm resistor (R_G) limits the peak discharge current into the SG1544 while the external PNP transistor provides a high peak-current discharge path for the delay capacitor.

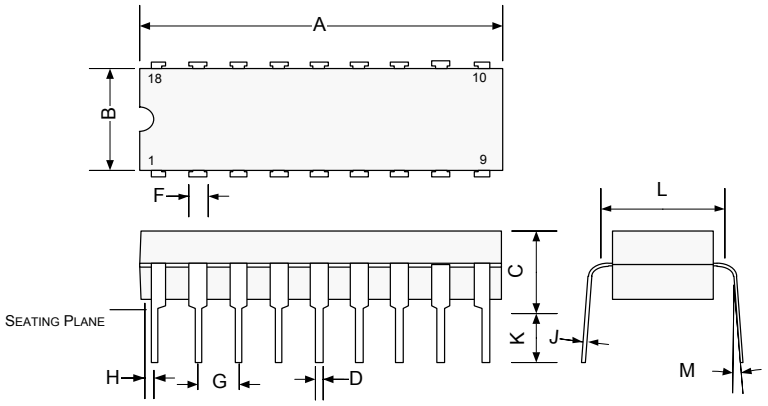
Connection Diagrams and Ordering Information (See Notes Below)

Package	Part No.	Ambient Temperature Range	Connection Diagram
18-PIN CERAMIC DIP J - PACKAGE	SG1544J-883B SG1544J-DESC SG1544J SG2544J SG3544J	-55°C to 125°C -55°C to 125°C -55°C to 125°C -25°C to 85°C 0°C to 70°C	 N Package: RoHS Compliant / Pb-free Transition DC: 0503 N Package: RoHS / Pb-free 100% Matte Tin lead Finish
18-PIN PLASTIC DIP N - PACKAGE	SG2544N SG3544N	-25°C to 85°C 0°C to 70°C	
18-PIN WIDE BODY PLASTIC SOIC DW - PACKAGE	SG2544DW SG3544DW	-25°C to 85°C 0°C to 70°C	 DW Package: RoHS Compliant / Pb-free Transition DC: 0516 DW Package: RoHS / Pb-free 100% Matte Tin lead Finish

Note 1. Contact factory for DESC product availablity.
2. All packages are viewed from the top.
3. J package uses Sn63/Pb37 hot solder lead finish, contact factory for availability of a RoHS version.

Package Outline Dimensions

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

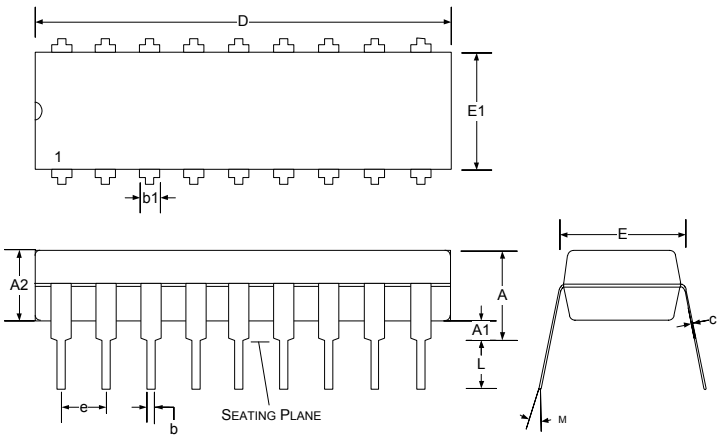


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	24.38	-	0.960
B	5.59	7.11	0.220	0.280
C	-	5.08	-	0.200
D	0.38	0.51	0.015	0.020
F	1.02	1.77	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	-	2.03	-	0.080
J	0.20	0.38	0.008	0.015
K	3.18	5.08	0.125	0.200
L	7.37	7.87	0.290	0.310
M	-	15°	-	15°

Note:

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

Figure 3 · J 18-Pin CERDIP Package Dimensions



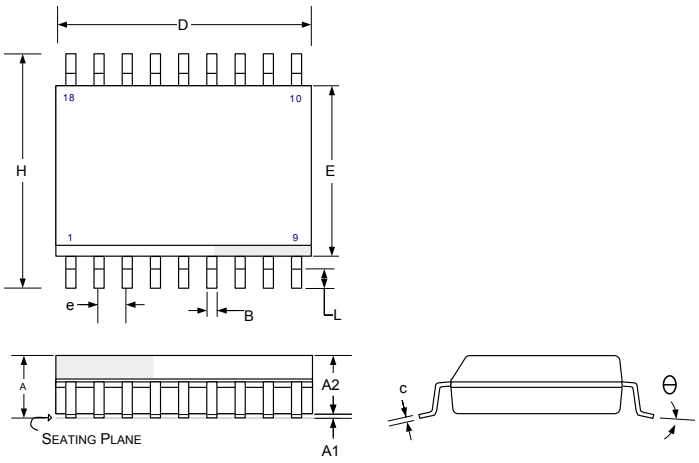
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	-	5.33	-	0.210
A1	0.38	-	0.015	-
A2	3.30 Typ		0.130 Typ	
b	0.36	0.56	0.014	0.022
b1	1.14	1.78	0.045	0.070
c	0.20	0.36	0.008	0.014
D	22.35	23.34	0.880	0.920
e	2.54 BSC		0.100 BSC	
E	7.62	8.26	0.300	0.325
E1	6.10	7.11	0.240	0.280
L	2.92	3.81	0.115	0.150
M	-	15°	-	15°

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 · N 18-Pin Plastic Dual Inline Package Dimensions

Package Outline Dimensions (continued)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.35	2.65	0.093	0.104
A1	0.10	0.30	0.004	0.012
A2	2.20	2.55	0.086	0.100
B	0.33	0.51	0.013	0.020
c	0.23	0.32	0.009	0.013
D	11.40	11.70	0.449	0.461
E	7.40	7.60	0.291	0.299
e	1.27 BSC		0.05 BSC	
H	10.00	10.65	0.394	0.419
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°
*LC	–	0.10	–	0.004

Lead co planarity

Note:

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

Figure 5 · DW 18-Pin Plastic Wide-body SOIC (SOWB) Package Dimensions

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