VOLTAGE SENSING CIRCUIT

SG1542 / SG2542 / SG3542

DESCRIPTION

This monolithic integrated circuit provides the control functions necessary to protect sensitive electronic circuitry from over-voltage transients or the effects of voltage regulator failure. It is designed for use with an external SCR "crowbar" for immediate shutdown of the power supply, but additionally provides logic level outputs for regulator turn-off and/or operator or system out-of-tolerance indication.

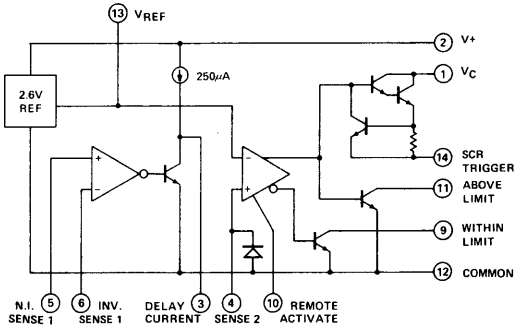
This device contains an accurate, stable 2.6 volt reference which allows the sensing threshold to be set predictably without the need for potentiometers. Uncommitted availability of both polarity inputs to the sensing comparator allows a wide flexibility of use including the ability to sense voltages less than the reference voltage. An external capacitor can be used to program an accurate time delay between fault occurrence and crowbar triggering, but this delay may be bypassed by inputing at the Sense 2 terminal or by using the remote activation capability.

For additional circuit functions, see SG1543 data sheet.

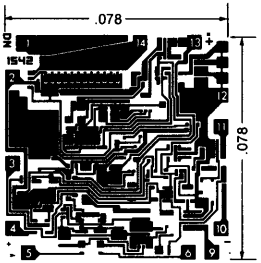
FEATURES

- **Operation from 4.5 to 40 volts**
- **Useful for either over- or under-voltage sensing**
- **Sensing threshold accurate to ±2%**
- **Built-in input hysteresis**
- **Zero to 35 volt sensing capability**
- **Programmable time delay**
- **SCR "Crowbar" drive of 200mA**
- **Remote activation capability**
- **2.6V 1% reference available**

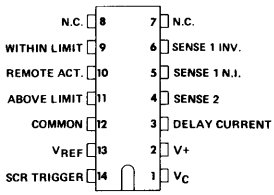
BLOCK DIAGRAM



CHIP LAYOUT



CONNECTION DIAGRAM



J, N PACKAGES (TO-116)

SG 1542

SG1542 / SG2542 / SG3542

ABSOLUTE MAXIMUM RATINGS

Input Supply Voltage, V+	40V
Collector Supply Voltage, V_C	40V
Sense Voltage (1)	V+
Sense Voltage (2)	6.5V
Remote Activation Input Voltage	7.0V
SCR Trigger Current	300mA*
Limit Indicators Output Voltage	40V
Limit Indicators Output Sink Current	50mA

Power Dissipation (Package Limitation)	1000mW
Derate above 25° C	8.0 mW/° C
Operating Temperature Range	
SG1542	−55° C to +125° C
SG2542	−25° C to +85° C
SG3542	0° C to +70° C
Storage Temperature Range	−65° C to +150° C

*At higher input voltages, a dissipation limiting resistor, R_G, is required. See graph.

ELECTRICAL CHARACTERISTICS

(Unless otherwise stated, these specifications apply for V+ = 5 to 35V and T_J = −55° C to +125° C for the SG1542, −25° C to +85° C for the SG2542, and 0° C to +70° C for the SG3542.)

PARAMETER	CONDITIONS	SG1542/2542			SG3542			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Input Voltage Range	T_J = 25°C to T_{max}	4.5	—	40	4.5	—	40	V
Input Voltage Range	T_{min} to T_{max}	4.7	—	40	4.7	—	40	V
Supply Current	V+ = 40V, Outputs open	—	5	7	—	5	10	mA
Reference Voltage	T_J = 25°C	2.58	2.60	2.62	2.55	2.60	2.65	V
Reference Voltage	Over Temp. Range	2.55	—	2.65	2.50	—	2.70	V
Line Regulation	V+ = 5 to 40V	—	1	5	—	1	5	mV
Load Regulation	I_{REF} = 0 to 10mA	—	1	10	—	1	10	mV
Short Circuit Current	V_{REF} = 0	12	15	25	12	15	25	mA
Temperature Stability		—	.005	—	—	.005	—	%/°C
Sense 1 Offset Voltage	Sense 1 (+) rising	-10	0	+10	-20	0	+20	mV
Sense 1 Offset Voltage	Sense 1 (+) falling	-35	-25	-15	-50	-25	0	mV
Sense 1 Common Mode		0	—	(V+) −3	0	—	(V+) −3	V
Sense 1 Bias Current		—	-0.3	-1.0	—	-0.3	-1.0	μA
Sense 2 Threshold		2.50	2.60	2.70	2.50	2.60	2.70	V
Sense 2 Bias Current		—	1.0	10	—	1.0	10	μA
Delay Current		200	250	300	200	250	300	μA
Remote Activation Current		—	120	180	—	120	180	μA
Remote Act. Threshold		0.8	1.0	2.0	0.8	1.0	2.0	V
Peak Output Current	V_C = 5V, R_G = 0, V_O = 0	100	200	400	100	200	400	mA
Peak Output Voltage	I_O = 100mA	V_{IN} −2	V_{IN} −1.6	—	V_{IN} −2	V_{IN} −1.6	—	V
Output Off Voltage	V+ = V_C = 40V	—	0	0.1	—	0	0.1	V
Limit Indicators V_{SAT}	I_L = -10mA	—	0.2	0.5	—	0.2	0.5	V
Limit Indicators Leakage	V_{IND} = 40V	—	.01	1.0	—	.01	1.0	μA
Propagation Delay	T_O Ind., T_J = 25°C	—	500	—	—	500	—	nS
Propagation Delay	T_O Trigger, T_J = 25°C	—	500	—	—	500	—	nS
Output Current Rise Time	R_L = 50Ω, T_J = 25°C	—	400	—	—	400	—	mA/μS

VOLTAGE SENSING CIRCUIT

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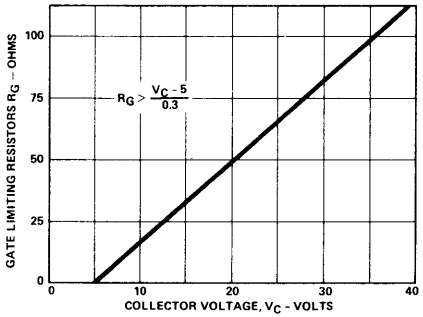
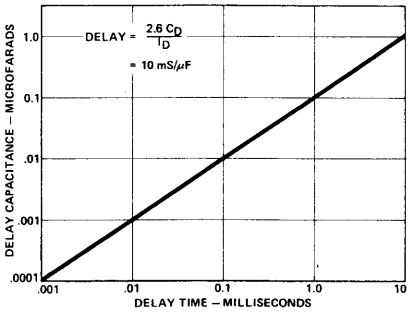
TYPICAL CHARACTERISTICS

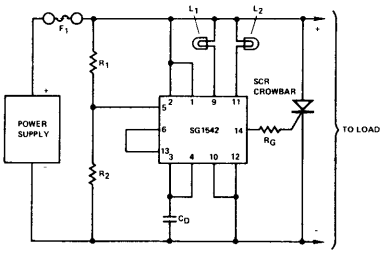
MINIMUM GATE CURRENT LIMITING RESISTANCE



ACTIVATION DELAY VS. CAPACITOR VALUE



BASIC OVER-VOLTAGE PROTECTION CIRCUIT CONFIGURATION



F_1 = Only necessary if power supply is not current limited

$V_{TRIP} = \left[\frac{2.6V\,(R_1 + R_2)}{R_2}\right]$, $R_2 \leq 100k\Omega$

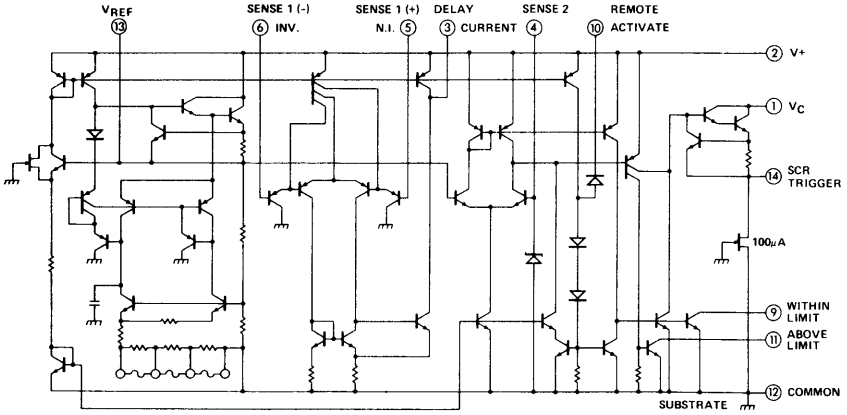
$t_D = 10^4\,C_D$

$R_G > \frac{V_C - 5}{0.3}$

L_1, L_2 = Indicator selected for max. current ≈ 10mA @ V_{TRIP}

SCR = Selected for max. peak current capability

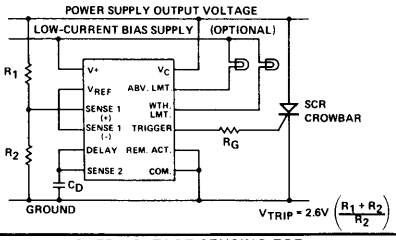
SG1542 SIMPLIFIED SCHEMATIC DIAGRAM



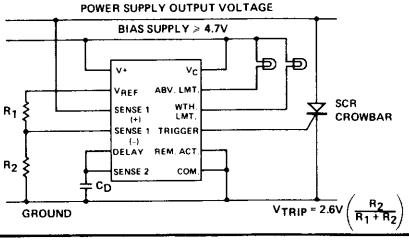
SG1542 / SG2542 / SG3542

APPLICATIONS

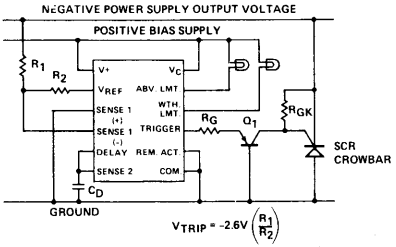
OVER-VOLTAGE SENSING FOR VOLTAGES ABOVE 2.6 VOLTS



OVER-VOLTAGE SENSING FOR VOLTAGES LESS THAN 2.6 VOLTS

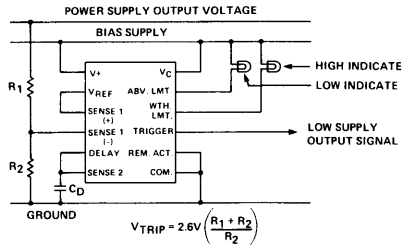


OVER-VOLTAGE SENSING FOR NEGATIVE OUTPUT VOLTAGES*

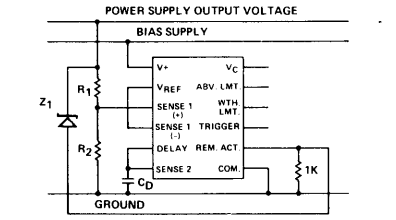


*Without a positive bias supply, the basic OVP circuit on page 3 can be used equally well with either positive or negative voltages.

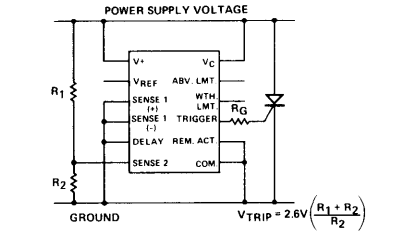
UNDER-VOLTAGE SENSING



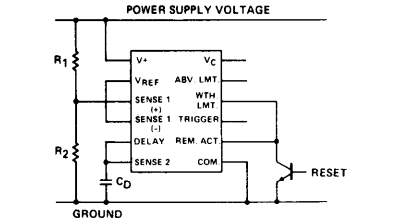
DELAYED THRESHOLD SENSE PLUS IMMEDIATE TRIP FOR HIGH OVER-VOLTAGE



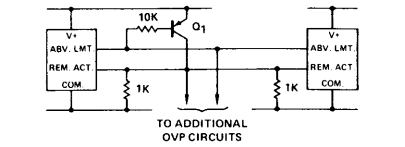
OVER-VOLTAGE SENSING WITH MINIMUM TIME DELAY



OVER-VOLTAGE LATCH WITH RESET



INTERCONNECTING MULTIPLE SG1542'S



Q1 must provide ≥ 2mA for each OVP circuit. With this arrangement, activation of any circuit will activate all. For a master-slave relationship, the WITHIN LIMIT terminal of the master may be directly connected to the REMOTE ACTIVATE terminals of all the slaves.

See Applications Notes for additional information.