

**ADJUSTABLE DUAL VOLTAGE REGULATOR**

**DESCRIPTION**

This circuit is identical to the SG1501 series of dual polarity tracking regulators except that the internal voltage setting resistors are not included and the current limit inputs have been disconnected from the pass transistors. While this circuit does require external divider resistors, maximum versatility is offered in adjusting the output voltage levels, and additional current-limit inputs ease the application of fold-back current limiting. In all other respects, this circuit performs as the SG1501.

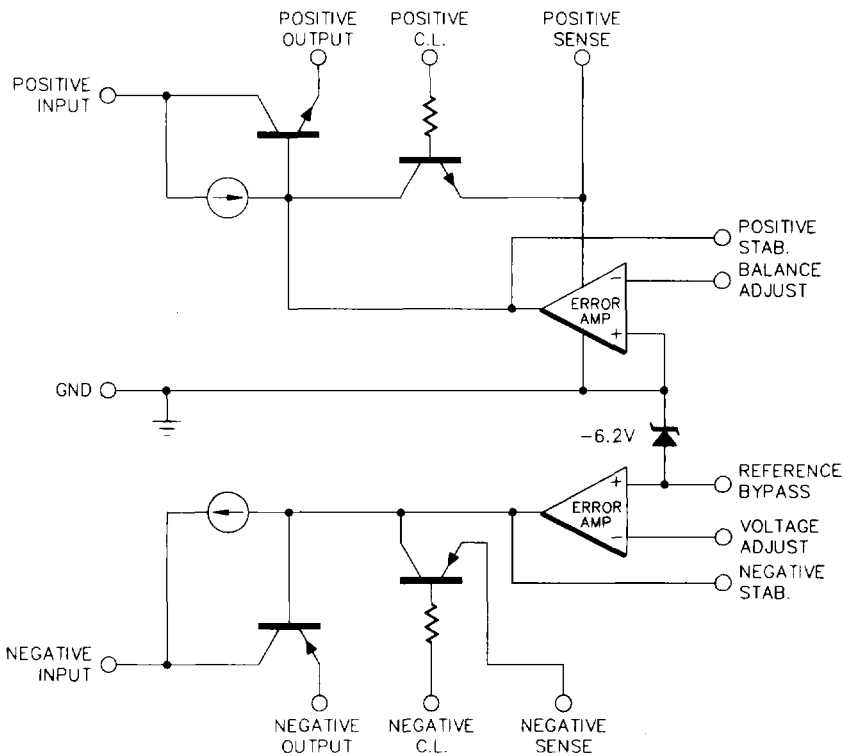
**FEATURES**

- Positive and negative output voltage independently adjustable from 10V to 28V
- Output currents to 100mA
- Line and load regulation of 0.1%
- 1% maximum temperature variation
- Standby current drain only 3mA
- Internal thermal shutdown protection

**HIGH RELIABILITY FEATURES - SG1502**

- ◆ Available to MIL-STD-883
- ◆ SG level "S" processing available

**BLOCK DIAGRAM**



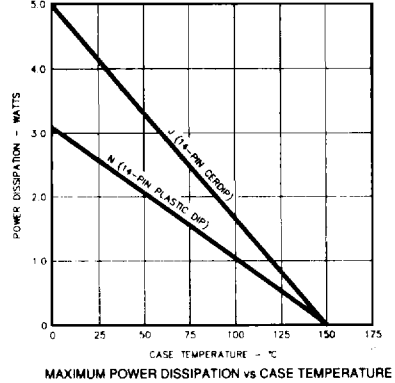
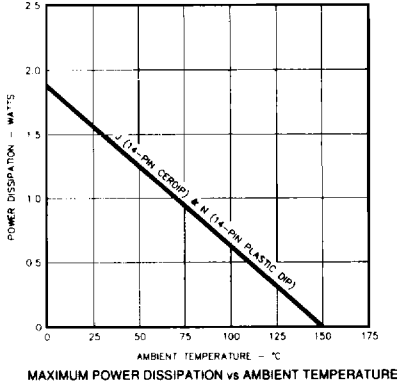
**ABSOLUTE MAXIMUM RATINGS** (Note 1)

Input Voltage from V+ to V-  
 SG1502, SG2502 ..... 60V  
 SG3502 ..... 50V  
 Maximum Load Current ..... 100mA

Operating Junction Temperature  
 Hermetic (J Package) ..... 150°C  
 Plastic (N Package) ..... 150°C  
 Storage Temperature Range ..... -65°C to 150°C  
 Lead Temperature (Soldering, 10 Seconds) ..... 300°C

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

**THERMAL DERATING CURVES**



**RECOMMENDED OPERATING CONDITIONS** (Note 2)

Input Voltage from V+ to V-  
 SG1502, SG2502 ..... 50V  
 SG3502 ..... 40V  
 Output Current ..... 0 to 50mA

Input - Output Differential (minimum) ..... 4V  
 Operating Ambient Temperature Range ( $T_A$ )  
 SG1502 ..... -55°C to 125°C  
 SG2502, SG3502 ..... 0°C to 70°C

Note 2. Range over which the device is functional.

**ELECTRICAL SPECIFICATIONS**

(Unless otherwise stated, these specifications apply for the operating ambient temperature of  $T_A = 25^\circ\text{C}$ ,  $V_{in} = \pm 20\text{V}$ ,  $V_{out} = \pm 15\text{V}$ ,  $I_L = 0$ ,  $R_{sc} = 0\Omega$ ,  $C_1 = C_2 = 0.01\mu\text{F}$ , and  $C_3 = C_4 = 1.0\mu\text{F}$ . All specifications apply to both positive and negative sides of the regulator, either singly or together. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Test Conditions	SG1502/2502			SG3502			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Voltage Range		12		30	12		25	V
Output Voltage Range		10		28	10		23	V
Input - Output Differential		2			2			V
Line Regulation	$\Delta V_{in} = 10\text{V}$ $T_A = T_{MIN}$ to $T_{MAX}$		0.02	0.1		0.02	0.1	% $V_{OUT}$
Load Regulation	$I_L = 0\text{mA}$ to $50\text{mA}$ $T_A = T_{MIN}$ to $T_{MAX}$		0.02	0.1		0.02	0.1	% $V_{OUT}$
Temperature Stability (Note 3)	$T_A = T_{MIN}$ to $T_{MAX}$		0.03	0.3		0.02	0.3	% $V_{OUT}$
Current Limit Sense Voltage	$T_A = T_{MIN}$ to $T_{MAX}$		0.3	1.0		0.3	1.0	% $V_{OUT}$
Reference Voltage		6.3		6.6	6.2		6.8	V
Ripple Rejection	$f = 120\text{Hz}$		75			75		dB
Output Noise Voltage	BW = 100Hz to 10KHz		50			50		$\mu\text{V}_{rms}$
Positive Standby Current	Divider 1 = 0.5mA (Note 4)		2	3		2	3	mA
Negative Standby Current	Divider 1 = 0.5mA (Note 4)		3	4		3	4	mA
Long Term Stability			0.1			0.1		%/K/yr

Note 3. These parameters, although guaranteed, they are not tested in production.

Note 4. "Divider 1" refers to  $R_1$ ,  $R_2$  resistor divider. (See Figure 7)

CHARACTERISTIC CURVES

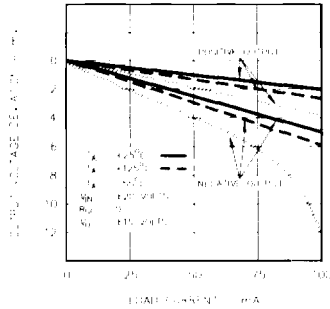


FIGURE 1. LOAD REGULATION

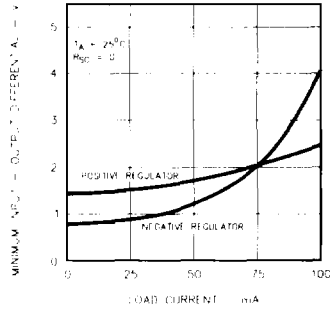


FIGURE 2. REGULATOR DROPOUT VOLTAGE

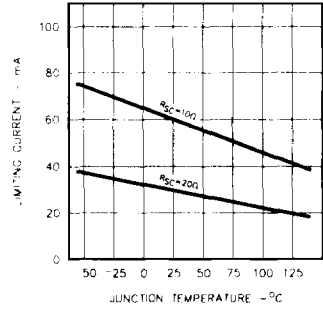


FIGURE 3. CURRENT LIMITING CHARACTERISTICS

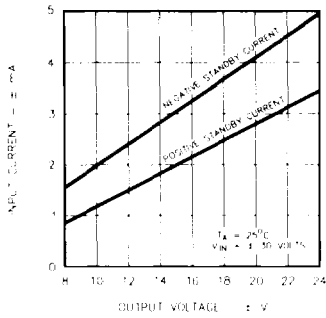


FIGURE 4. STANDBY CURRENT DRAIN

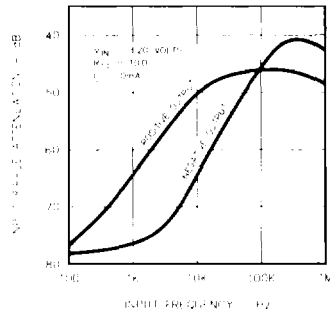


FIGURE 5. RIPPLE REJECTION

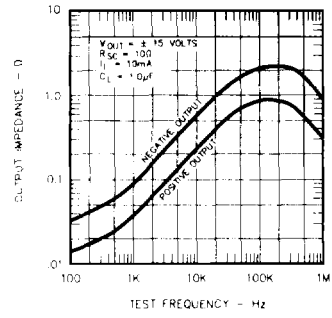


FIGURE 6. OUTPUT IMPEDANCE

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TYPICAL APPLICATIONS

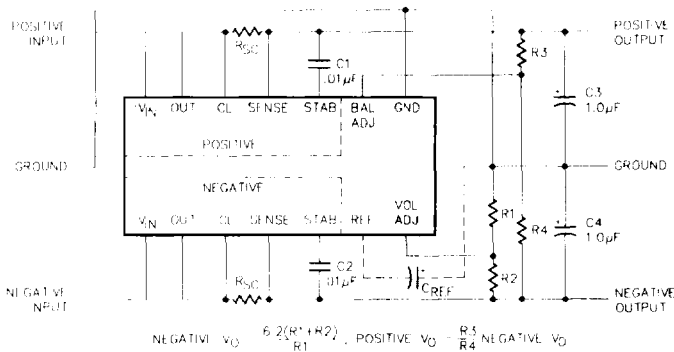


FIGURE 7. BASIC REGULATOR CIRCUIT

For best temperature performance, the parallel impedance of  $R_1$  and  $R_2$  should be 6.3K ohm while that of  $R_3$  and  $R_4$  should be 10 K. Increasing the value of  $C_1$  and  $C_2$  will reduce the frequency response while transient response may be improved by increasing  $C_3$  and  $C_4$ . For very low-noise applications, a 4.7 $\mu\text{F}$  capacitor for  $C_{REF}$  may be added.  $R_{SC}$  is selected such that a sense voltage of 0.6 volts (at  $T_J = 25^\circ\text{C}$ ) is developed at the maximum load current desired.

TYPICAL APPLICATIONS (continued)

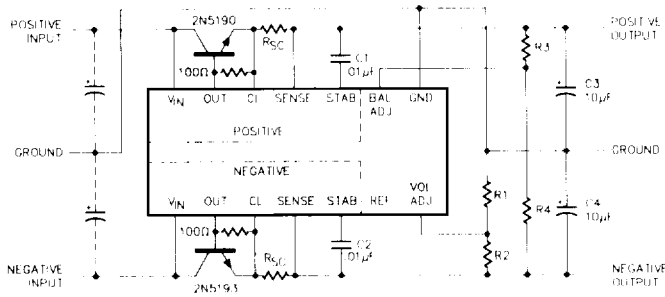


FIGURE 8 - HIGH CURRENT CONFIGURATION

Power transistors should be selected on the basis of current and voltage requirements with low-frequency devices preferred to minimize the risk of oscillation. Input capacitors (0.1µF to 1.0µF) may be required if the circuit is located remote from the power supply filter. The common-collector configuration here has the advantage of allowing the use of separate collector voltages for the pass transistors but the common-emitter configuration shown below may also be used. In fact, one configuration on the positive side and the other on the negative side will allow the use of all NPN or all PNP power transistors.

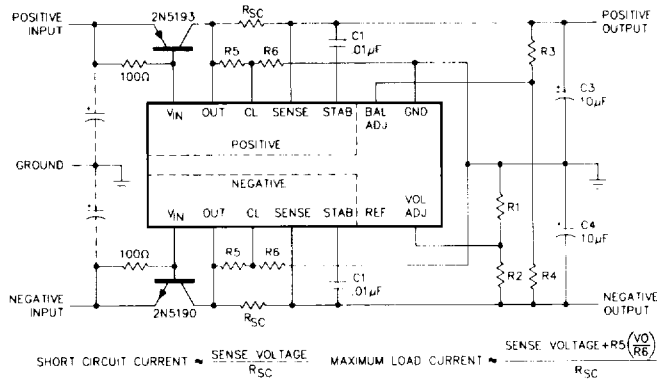


FIGURE 9 - FOLDBACK CURRENT LIMITING

The use of R5 and R6 to provide fold-back current limiting is possible with either common-emitter or common-collector configurations. The values for R5 and R6 are determined by an iterative solution of the equations shown with the trade-off being that a greater amount of fold-back requires a larger voltage drop across R<sub>SC</sub>. Note that in the common-emitter configuration, the 100Ω base - to emitter resistors must provide a path for the regulator stand-by current and should not be increased in value.

CONNECTION DIAGRAMS & ORDERING INFORMATION (See Note Below)

Package	Part No.	Ambient Temperature Range	Connection Diagram
14-PIN CERAMIC DIP J - PACKAGE	SG1502J/883B	-55°C to 125°C	GND 1 14 VOLTAGE ADJ BALANCE ADJUST 2 13 REFERENCE BYPASS POSITIVE STAB 3 12 NEGATIVE STAB POSITIVE SENSE 4 11 NEGATIVE SENSE + CURRENT LIMIT 5 10 - CURRENT LIMIT POSITIVE OUTPUT 6 9 NEGATIVE OUTPUT POSITIVE INPUT V <sub>I</sub> 7 8 NEGATIVE INPUT V <sub>I</sub>
	SG1502J	-55°C to 125°C	
	SG2502J	0°C to 70°C	
	SG3502J	0°C to 70°C	
14-PIN PLASTIC DIP N - PACKAGE	SG2502N	0°C to 70°C	
	SG3502N	0°C to 70°C	

Note 1. All packages are viewed from the top.