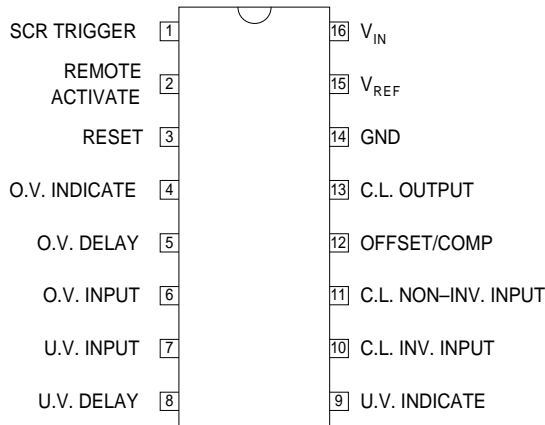


TOP VIEW



J Package – 16 Pin Ceramic DIP
 N Package – 16 Pin Plastic DIP
 D Package – 16 Pin Plastic (300) SOIC

POWER SUPPLY SUPERVISORY CIRCUIT

FEATURES

- 4.5 to 40V operation over full temperature range
- Reference voltage trimmed to 1% accuracy
- Includes over-voltage, under-voltage and current sensing
- Programmable time delays
- SCR “Crowbar” drive of 300mA
- Remote activation capability
- Optional over-voltage latch capability

Order Information

| Part Number | J-Pack 16 Pin | N-Pack 16 Pin | D-16 16 Pin | Temp. Range |
|-------------|---------------|---------------|-------------|---------------|
| IP1543 | ✓ | | | -55 to +125°C |
| IP3543 | ✓ | ✓ | ✓ | 0 to +70°C |

Note:
 To order, add the package identifier to the part number.
 eg. IP1543J
 IP3543D-16

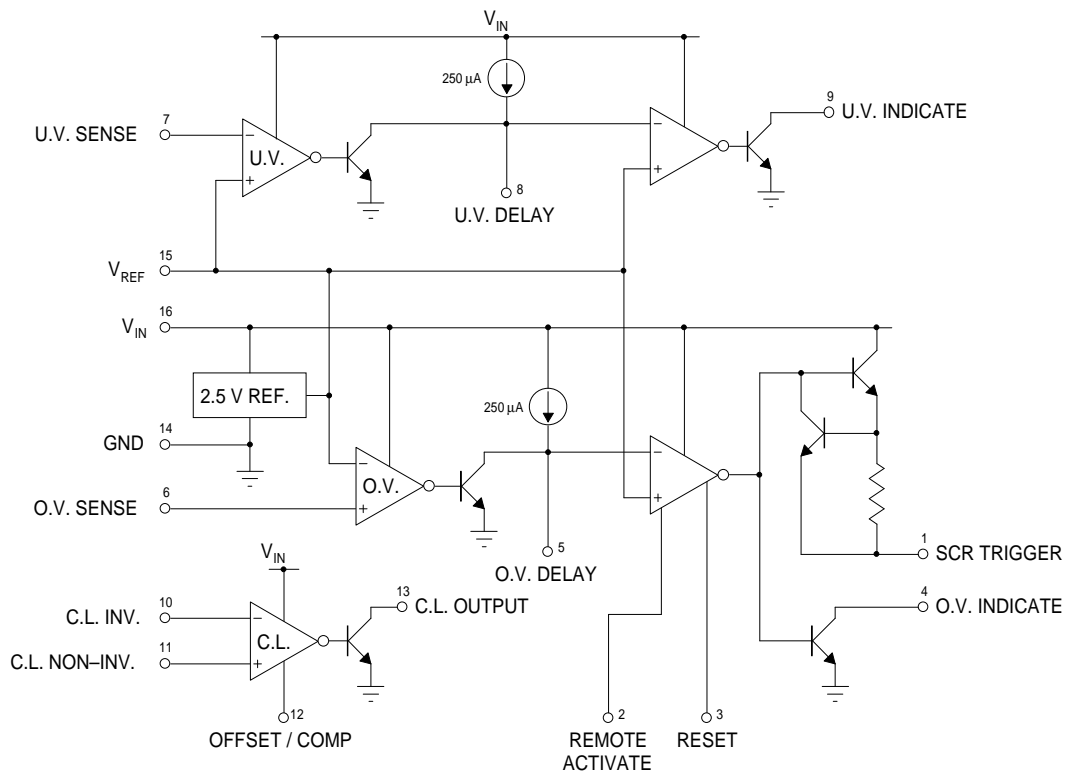
ABSOLUTE MAXIMUM RATINGS (T_{case} = 25°C unless otherwise stated)

| | | |
|------------------|--|---|
| +V _{IN} | Input Supply Voltage | 40V |
| | Sense Inputs | V _{IN} |
| | SCR Trigger Current | Internally Limited |
| | Indicator Output Voltage | +40V |
| | Indicator Output Sink Current | 50mA |
| P _D | Power Dissipation | T _A = 25°C Derate @ T _A > 50°C |
| | | 1W 10mW/°C |
| P _D | Power Dissipation | T _C = 25°C Derate @ T _C > 25°C |
| | | 2W 16mW/°C |
| T _J | Operating Junction Temperature | See Ordering Information |
| T _{STG} | Storage Temperature Range | -65 to +150°C |
| T _L | Lead Temperature (soldering, 10 seconds) | +300°C |

DESCRIPTION

The IP1543 and IP3543 power supply supervisory circuits contain all the functions necessary to monitor and control the output of a sophisticated power supply system. Included on the chip are over-voltage (O.V.) sensing with externally programmable delay used to trigger an external SCR "Crowbar", under-voltage (U.V.) sensing with externally programmable delay used to sense either the power supply output or the line input voltage, a third op-amp/comparator with provision for external compensation and/or offset programming used for either current limiting or as an additional voltage monitor, and a voltage reference trimmed to $\pm 1\%$.

BLOCK DIAGRAM



RECOMMENDED OPERATING CONDITIONS

| | | | |
|----------|-------------------------------------|--------|-------------------|
| V_{IN} | Input Supply Voltage | | +4.5 to +40V |
| | Input Voltage Range | | 0 to $V_{IN} - 3$ |
| | Reference Load Current | | 0 to 10mA |
| | Indicate Output Current | | 0 to 10mA |
| | Operating Ambient Temperature Range | IP1543 | -55 to +125°C |
| | | IP3543 | 0 to +70°C |

ELECTRICAL CHARACTERISTICS (T_J = Over Operating Temperature Range unless otherwise stated)

| Parameter | Test Conditions | IP1543 | | | IP3543 | | | Units |
|---|---|--------|------|------|--------|------|------|-----------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Input Voltage Range | | 4.5 | | 40 | 4.5 | | 40 | V |
| Supply Current | $V_{IN} = 40V$ | | 7 | 10 | | 7 | 10 | mA |
| REFERENCE SECTION | | | | | | | | |
| Output Voltage | $T_J = 25^\circ C$ | 2.48 | 2.5 | 2.52 | 2.45 | 2.5 | 2.55 | V |
| | | 2.45 | | 2.55 | 2.4 | | 2.6 | |
| Line Regulation | $V_{IN} = 4.5$ to $30V$ | | 1 | 5 | | 1 | 5 | mV |
| Load Regulation | $I_{REF} = 0$ to $10mA$ | | 1 | 10 | | 1 | 10 | |
| Short Circuit Current | $V_{REF} = 0$ | 12 | 25 | 40 | 12 | 25 | 40 | mA |
| Temperature Stability | | | 50 | | | 50 | | ppm/ $^\circ C$ |
| 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 | $V_{IN} = 40V$ | | 0 | 0.1 | | 0 | 0.1 | |
| Remote Activate Current | Pin 2 = Gnd | | -0.1 | -0.8 | | -0.1 | -0.8 | mA |
| Remote Activate Voltage | Pin 2 = Open | | 1.5 | 6 | | 1.5 | 6 | V |
| Reset Current | Pin 3 = Gnd Pin 2 = Gnd | | -0.1 | -0.8 | | -0.1 | -0.8 | mA |
| Reset Voltage | Pin 3 = Open Pin 2 = Gnd | | 1.5 | 6 | | 1.5 | 6 | V |
| Output Current Rise Time | $R_L = 50\Omega$ $T_J = 25^\circ C$ | | 400 | | | 400 | | mA/ μs |
| Prop. Delay from Pin 2 | $C_D = 0$ $V_{PIN2} = 0.4V$ $T_J = 25^\circ C$ | | 300 | | | 300 | | ns |
| Prop. Delay from Pin 6 | $V_{PIN6} = 2.7V$ $T_J = 25^\circ C$ | | 500 | | | 500 | | ns |
| COMPARATOR SECTIONS | | | | | | | | |
| Input Threshold (Input Voltage Rising on Pin 6, Falling on Pin 7) | $T_J = 25^\circ C$ | 2.45 | 2.5 | 2.55 | 2.4 | 2.5 | 2.6 | V |
| | | 2.4 | | 2.6 | 2.35 | | 2.65 | |
| Input Hysteresis | $T_J = 25^\circ C$ | | 25 | | | 25 | | mV |
| Input Bias Current | Sense Input = $0V$ | | -0.3 | -1 | | -0.3 | -1 | μA |
| Delay Saturation | | | 0.2 | 0.5 | | 0.2 | 0.5 | V |
| Delay High Level | | | 6 | 8 | | 6 | 8 | |
| Delay Charging Current | $V_D = 0$ | 200 | 250 | 300 | 200 | 250 | 300 | μA |

ELECTRICAL CHARACTERISTICS (T_J = Over Operating Temperature Range unless otherwise stated)

| Parameter | Test Conditions | IP1543 | | | IP3543 | | | Units |
|------------------------------------|---|--|------|--------------|--------|------|--------------|---------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| COMPARATOR SECTIONS (cont.) | | | | | | | | |
| Indicate Saturation | $I_L = -10\text{mA}$ | 0.2 | 0.5 | | 0.2 | 0.5 | | V |
| Indicate Leakage | $V_{IND} = 40\text{V}$ | 0.01 | 1 | | 0.01 | 1 | | μA |
| Propagation Delay | $V_{PIN6} = 2.7\text{V}$ $C_D = 0$ | $V_{PIN7} = 2.3\text{V}$ $T_J = 25^\circ\text{C}$ | | | 400 | | | ns |
| | $V_{PIN6} = 2.7\text{V}$ $C_D = 0$ | $V_{PIN7} = 2.3\text{V}$ $T_J = 25^\circ\text{C}$ | | | 10 | | | ms |
| CURRENT LIMIT SECTION | | | | | | | | |
| Input Voltage Range | | 0 | | $V_{IN} - 3$ | 0 | | $V_{IN} - 3$ | V |
| Input Bias Current | Pin 12 = Open $V_{CM} = 0$ | -0.3 | -1 | | -0.3 | -1 | | μA |
| Input Offset Voltage | Pin 12 = Open $V_{CM} = 0$ | 0 | 10 | | 0 | 15 | | mV |
| | 10k Ω from Pin 12 to Gnd | 70 | 100 | 130 | 70 | 100 | 130 | |
| CMRR | $V_{CM} = 0$ to 12V $V_{IN} = 15\text{V}$ | 60 | 70 | | 60 | 70 | | dB |
| AVOL | Pin 12 = Open $V_{CM} = 0$ | 72 | 80 | | 72 | 80 | | |
| Output Saturation | $I_L = -10\text{mA}$ | 0.2 | 0.5 | | 0.2 | 0.5 | | V |
| Output Leakage | $V_{IND} = 40\text{V}$ | 0.01 | 1 | | 0.01 | 1 | | μA |
| Small Signal Bandwidth | $A_V = 0\text{dB}$ $T_J = 25^\circ\text{C}$ | 5 | | | 5 | | | MHz |
| Propagation Delay | $V_{\text{overdrive}} = 100\text{mV}$ $T_J = 25^\circ\text{C}$ | 200 | | | 200 | | | ns |

NOTES

1. Test Conditions unless otherwise stated:

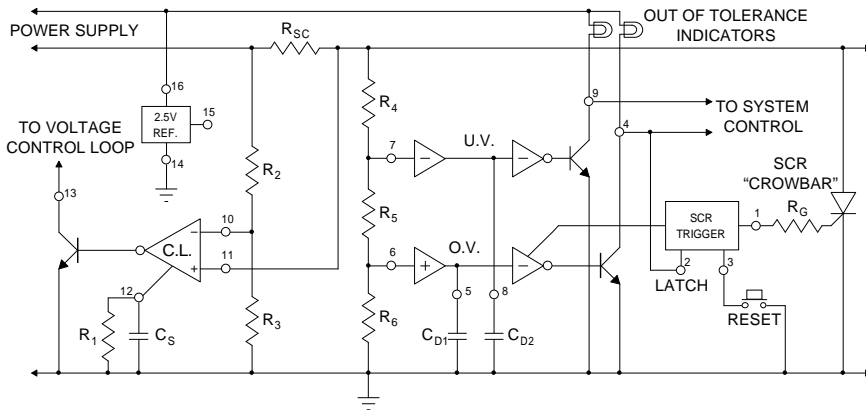
$$V_{IN} = 10\text{V}$$

$$T_J = -55 \text{ to } +125^\circ\text{C} \quad \text{for IP1543}$$

$$T_J = 0 \text{ to } +70^\circ\text{C} \quad \text{for IP3543}$$

APPLICATIONS INFORMATION

Typical Application



$$\text{Current Limit } V_{TH} \approx \frac{1000}{R_1}$$

C_S is determined by the current loop dynamics.

$$\text{Peak Current to load } I_p \approx \frac{V_{TH}}{R_{SC}} + \frac{V_O}{R_{SC}} \left(\frac{R_2}{R_2 + R_3} \right)$$

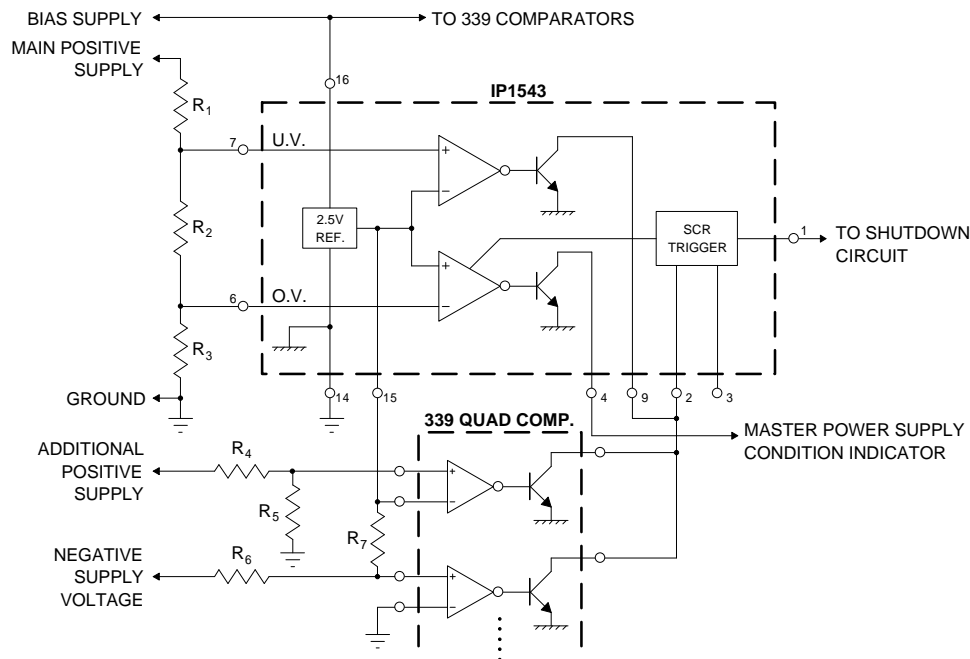
$$\text{Low Output Voltage Limit } V_{O(\text{low})} = \frac{2.5 (R_4 + R_5 + R_6)}{R_5 + R_6}$$

$$\text{High Output Voltage Limit } V_{O(\text{high})} = \frac{2.5 (R_4 + R_5 + R_6)}{R_6}$$

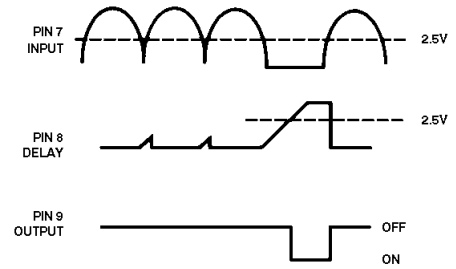
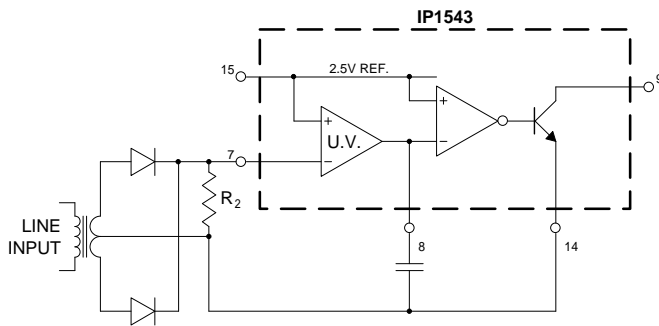
Voltage Sensing Delay $T_D = 10000 C_D$

$$\text{SCR trigger power limiting resistor } R_G > \frac{V_{IN} - 5}{0.2}$$

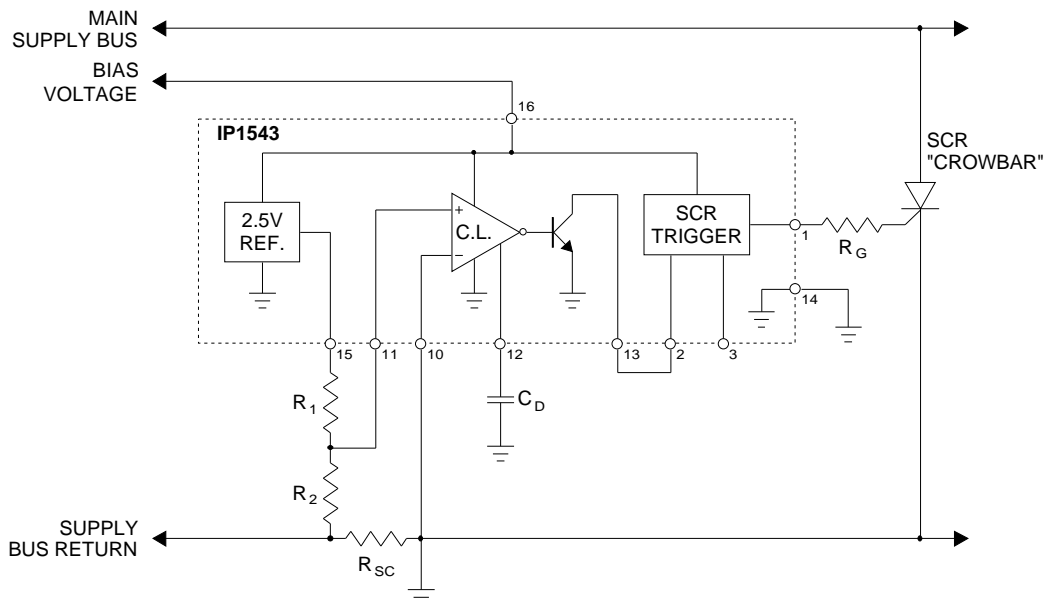
Sensing Multiple Supply Voltages



Input Line Monitor

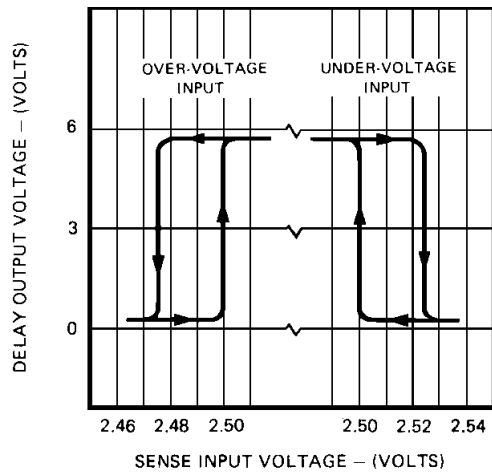


Overcurrent Shutdown

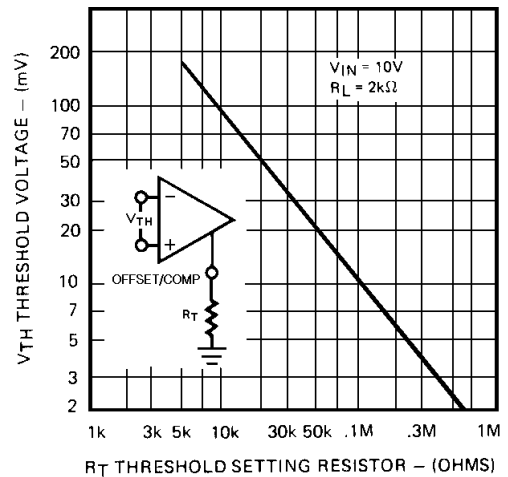


TYPICAL PERFORMANCE CHARACTERISTICS

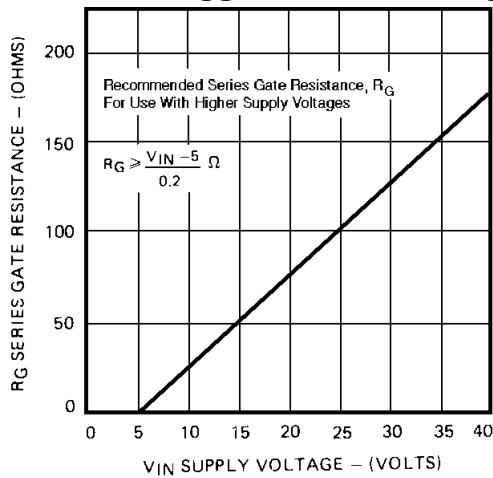
Comparator Input Hysteresis



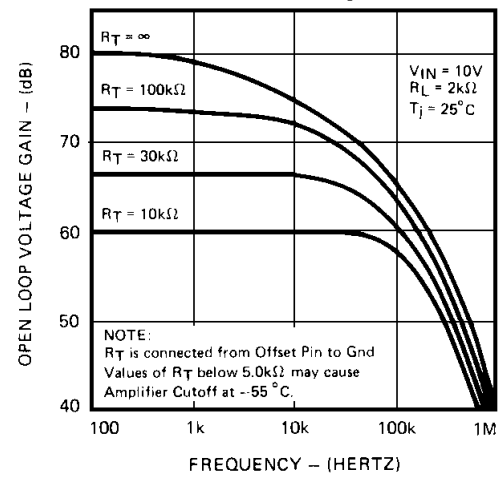
Comparator Input Hysteresis



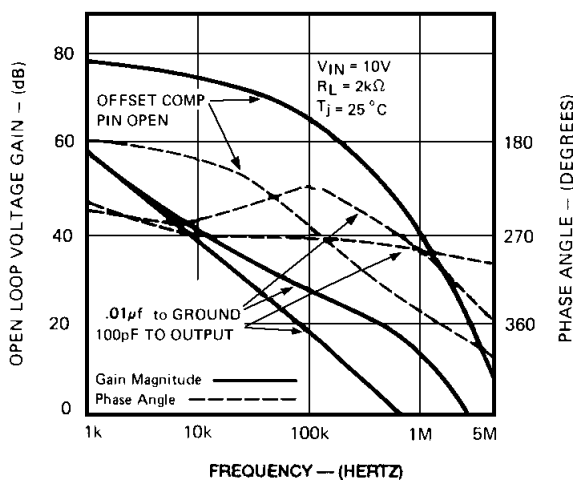
SCR Trigger Power Limiting



Current Limit Amplifier Gain



Current Limit Amplifier Frequency Response



Activation Delay vs Capacitor Value

