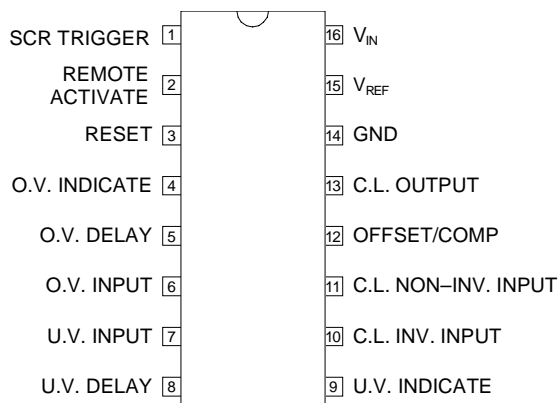


IP1543 SERIES

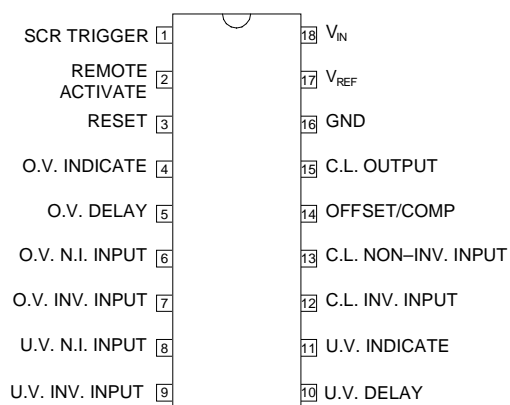


POWER SUPPLY SUPERVISORY CIRCUITS

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
- Uncommitted comparator inputs for low voltage sensing (IP1544 series only)

IP1544 SERIES



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

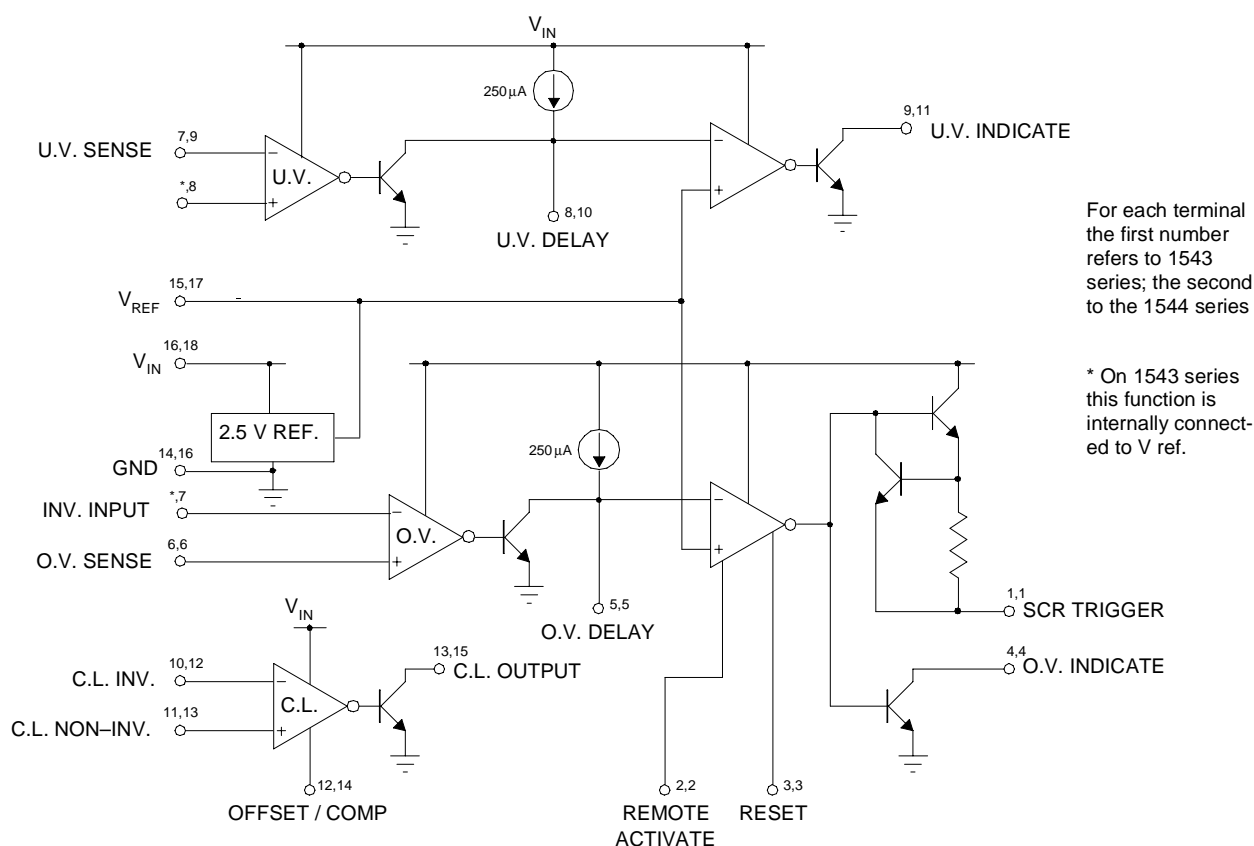
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DESCRIPTION

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 $\pm 1\%$.

The IP1544 and IP3544 circuits contain all of the features of the IP1543 series and have the added flexibility of the completely uncommitted inputs to the O.V. and U.V. sensing comparators so that voltages less than 2.5V may be monitored by dividing down the reference voltage

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	IP1544	-55 to +125°C
		IP3543	IP3544	0 to +70°C

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

Parameter	Test Conditions	IP1543 / IP1544			IP3543 / IP3544			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°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	Over Operating Range		50			50		ppm/°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 = 50Ω T _J = 25°C		400			400		mA/μs
Prop. Delay from Pin 2	C _D = 0		300			300		ns
	V _{PIN2} = 0.4V T _J = 25°C							
Prop. Delay from Pin 6	V _{PIN6} = 2.7V T _J = 25°C		500			500		ns
COMPARATOR SECTIONS								
Input Threshold (Input Voltage Rising on Pin 6, Falling on Pin 7)	T _J = 25°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°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 / IP1544			IP3543 / IP3544			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	$V_{\text{IND}} = 40\text{V}$		0.01	1		0.01	1	μA	
Propagation Delay	$V_{\text{PIN}6} = 2.7\text{V}$ $C_D = 0$	$V_{\text{PIN}7} = 2.3\text{V}$ $T_J = 25^\circ\text{C}$	400			400			ns
	$V_{\text{PIN}6} = 2.7\text{V}$ $C_D = 1\mu\text{F}$	$V_{\text{PIN}7} = 2.3\text{V}$ $T_J = 25^\circ\text{C}$	10			10			ms
CURRENT LIMIT SECTION									
Input Voltage Range			0	$V_{\text{IN}} - 3$		0	$V_{\text{IN}} - 3$		V
Input Bias Current	Pin 12 = Open	$V_{\text{CM}} = 0$	-0.3	-1		-0.3	-1		μA
Input Offset Voltage	Pin 12 = Open	$V_{\text{CM}} = 0$	0 10			0 15			mV
	10k Ω from Pin 12 to Gnd		70	100	130	70	100	130	
CMRR	$V_{\text{CM}} = 0$ to 12V	$V_{\text{IN}} = 15\text{V}$	60	70		60	70		dB
AVOL	Pin 12 = Open	$V_{\text{CM}} = 0$	72	80		72	80		
Output Saturation	$I_L = -10\text{mA}$			0.2	0.5		0.2	0.5	V
Output Leakage	$V_{\text{IND}} = 40\text{V}$			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

- Test Conditions unless otherwise stated:
V_{IN} = 10V
T_J = -55 to +125°C for IP1543 / IP1544
T_J = 0 to +70°C for IP3543 / IP3544

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
IP1544	✓			-55 to +125°C
IP3544	✓	✓	✓	0 to +70°C

Note:

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

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Typical Application


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

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

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

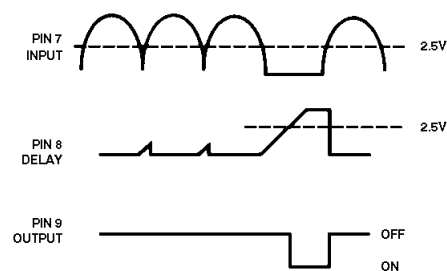
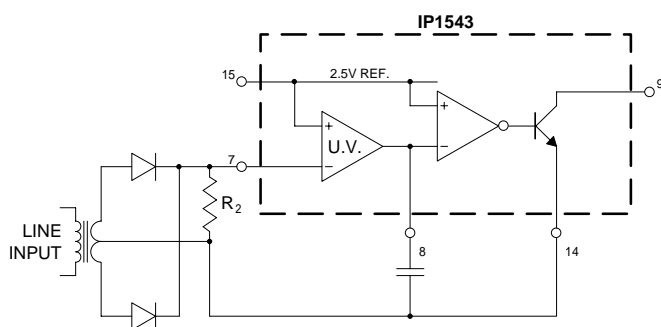
Voltage Sensing Delay $T_D = 10000 C_D$

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

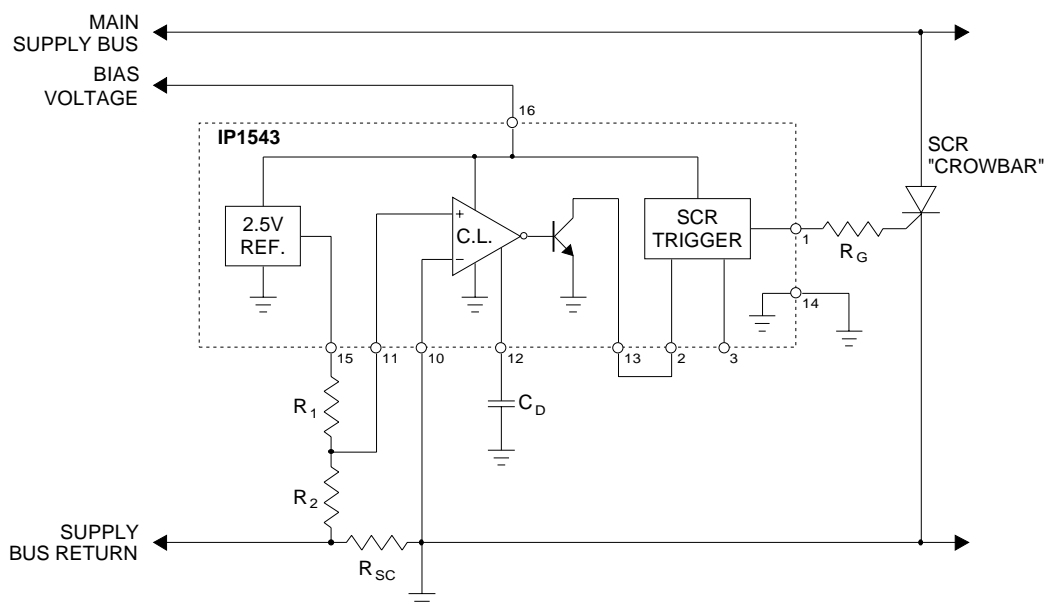
The diagram illustrates a power supply shutdown system. It features a **BIAS SUPPLY** connected to a divider of resistors R_1 , R_2 , and R_3 . The junction between R_1 and R_2 is labeled **U.V.** (Under Voltage) and is connected to pin 7 of the **IP1543**. The junction between R_2 and R_3 is labeled **O.V.** (Over Voltage) and is connected to pin 6 of the **IP1543**. A **2.5V REF.** block is connected to pin 16 of the **IP1543**. The **IP1543** contains two comparators and an **SCR TRIGGER** block. The comparators' outputs drive the gates of two transistors, which in turn drive the **SCR TRIGGER**. The **SCR TRIGGER** has an output labeled **1** connected to **TO SHUTDOWN CIRCUIT**. The **IP1543** also has pins 14 and 15 connected to ground. The **339 QUAD COMP.** (339 Quad Comparator) is shown with its first comparator's output connected to the **MASTER POWER SUPPLY CONDITION INDICATOR**. The **339 QUAD COMP.** is powered by an **ADDITIONAL POSITIVE SUPPLY** through resistor R_4 and a **NEGATIVE SUPPLY VOLTAGE** through resistor R_6 . A feedback network consisting of resistors R_5 and R_7 is connected to the input of the first comparator. The output of the first comparator is connected to the base of a transistor, which is also connected to the **MASTER POWER SUPPLY CONDITION INDICATOR**. The emitter of this transistor is connected to ground. The diagram shows multiple such stages, indicated by an ellipsis.

Semelab plc. Telephone +44(0)1455 556565. Fax +44(0)1455 552612.
E-mail: sales@semelab.co.uk Website: <http://www.semelab.co.uk>

Input Line Monitor



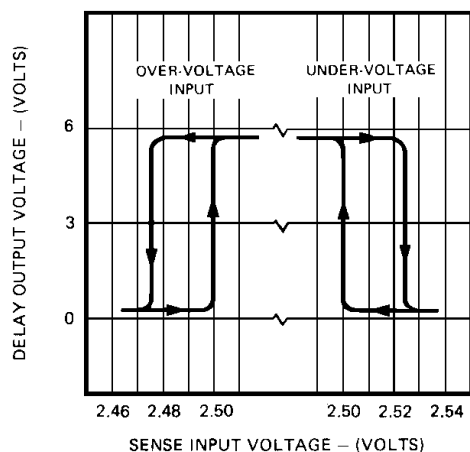
Overcurrent Shutdown



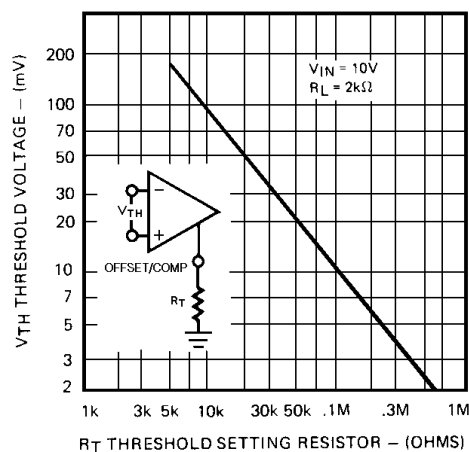
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TYPICAL PERFORMANCE CHARACTERISTICS

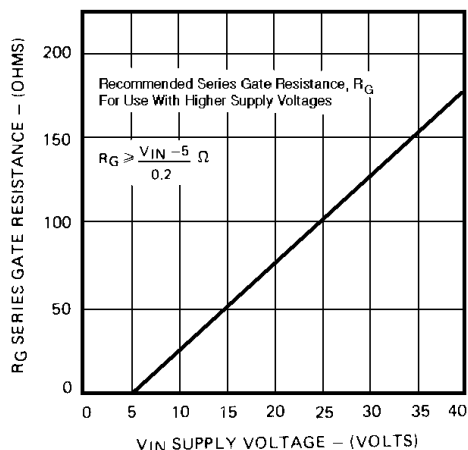
Comparator Input Hysteresis



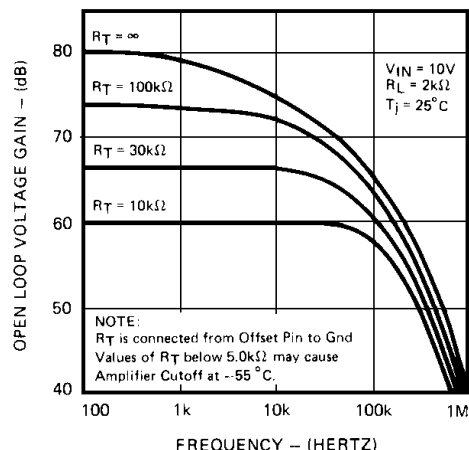
Comparator Input Hysteresis



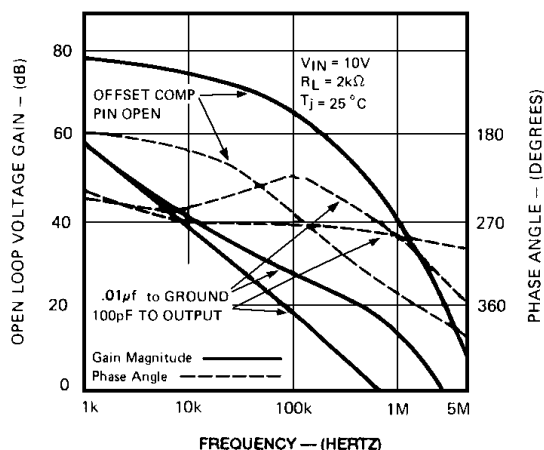
SCR Trigger Power Limiting



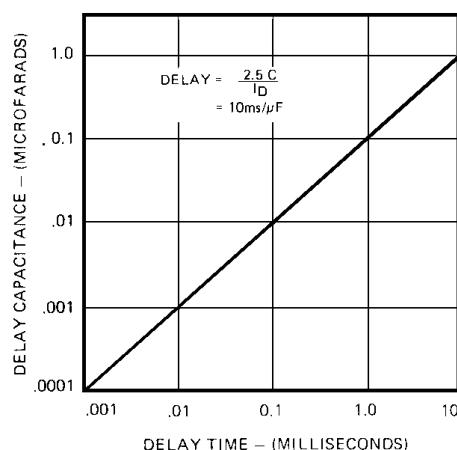
Current Limit Amplifier Gain



Current Limit Amplifier Frequency Response



Activation Delay vs Capacitor Value



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E-mail: sales@semelab.co.uk

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