

Earth Leakage Detector

Features

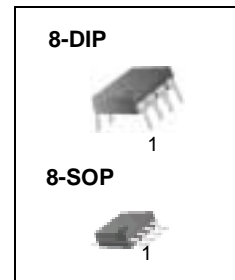
- Low Power Consumption $P_D = 5\text{mW}$, 100V/200V
- Built-in Voltage Regulator
- High Gain Differential Amplifier
- 0.4mA Output Current Pulse to Trigger SCR' S
- Low External Part Count
- DIP Package (8-DIP), High Packing Density
- High Noise Immunity, Large Surge Margin
- Super Temperature Characteristic of Input Sensitivity
- Wide Operating Temperature Range ($T_A = -25^\circ\text{C} \sim +80^\circ\text{C}$)
- Operation from 12 to 20V Input

Functions

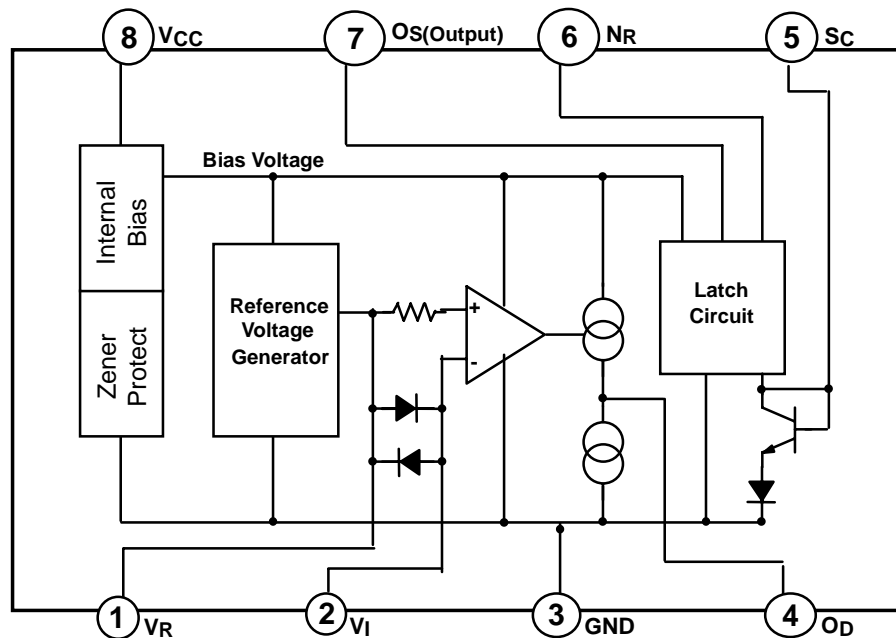
- Differential Amplifier
- Level Comparator
- Latch Circuit

Description

The HT54123 is designed for use in earth leakage circuit interrupters, for stable operation of the AC line in breakers. The input of the differential amplifier is connected to the secondary coil of ZCT(Zero Current Transformer). The amplified output of differential amplifier is integrated at external capacitor to gain adequate time delay that is specified in KSC4613. The level comparator generates high level when earth leakage current is greater than the fixed level.



Block Diagram



Absolute Maximum Ratings (TA = 25⁰⁰⁰⁰C)

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	20	V
Supply Current	ICC	8	mA
Power Dissipation	PD	300	mW
Lead Temperature (Soldering 10sec)	TLEAD	260	°C
Operating Temperature	TOPR	- 25 ~ +80	°C
Storage Temperature	TSTG	- 65 ~ +150	°C

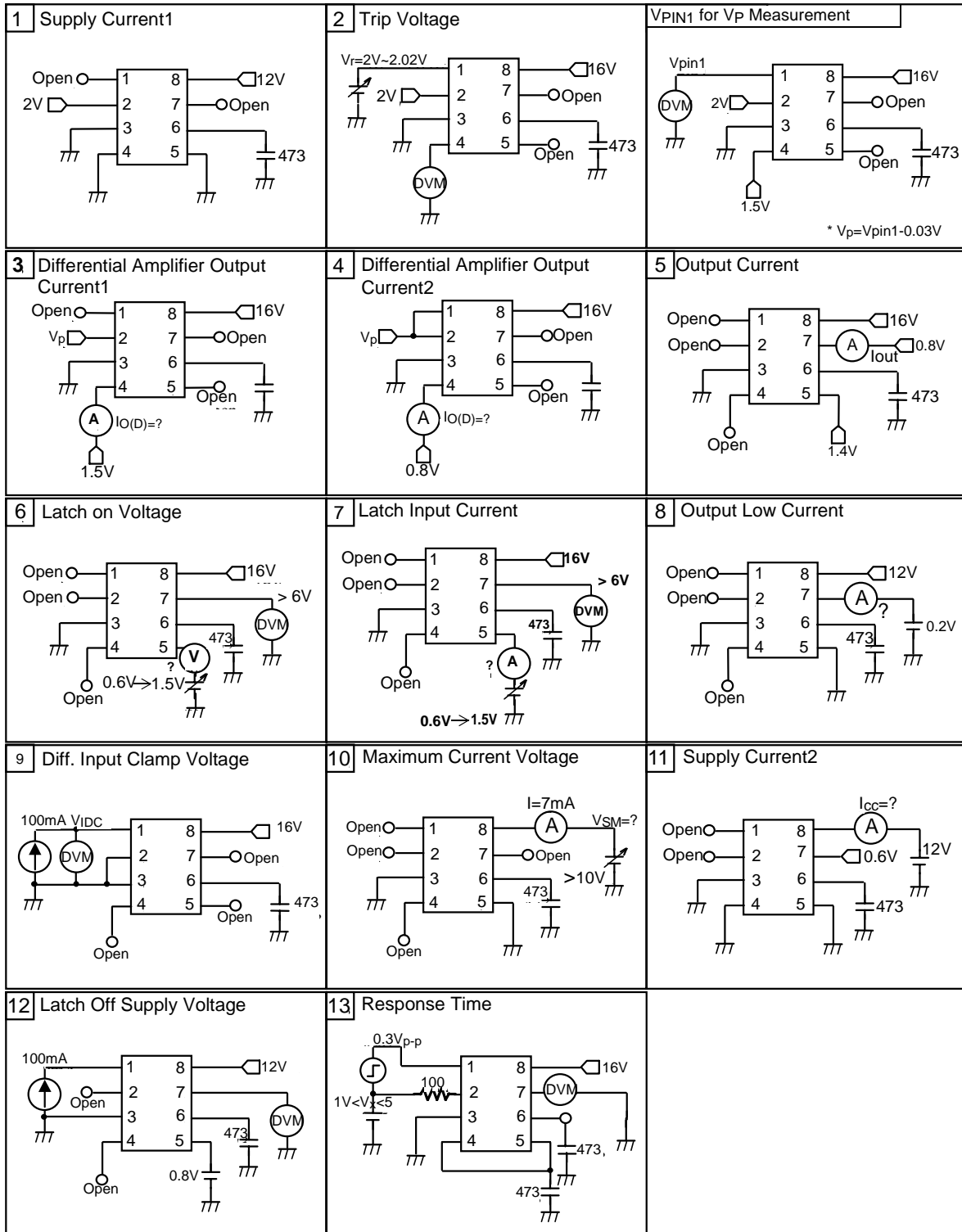
Electrical Characteristics

(TA = -25°C to 80°C)

Parameter	Symbol	Conditions	Circuit	Min.	Typ.	Max.	Unit	
Supply Current 1	ICC	VCC = 12V VR = Open VI = 2V	1	(-25°C)	-	-	580	μA
				(25°C)	300	400	530	
				(80°C)	-	-	480	
Trip Voltage	VT	VCC = 16V VR = 2V ~ 2.02V VI = 2V (Note1)	2	14	16	18	mV	
				12.5	14.2	17	mVrms	
Differential Amplifier Output Current 1	IO(D)	VCC = 16V (VR-VI = 30mV, VOD = 1.2V)	3	-12	20	-30	μA	
Differential Amplifier Output Current 2	IO(D)	VCC = 16V, VOD = 0.8V VR, VI = VP (Note2)	4	17	27	37	(rms) μA	
Output Current	IO	VSC = 1.4V (-25°C) VOS = 0.8V (25°C) VCC = 16V (25°C)	5	200	400	800	μA	
				200	400	800		
				100	300	600		
Latch on Voltage	VSCON	VCC = 16V	6	0.7	1.0	1.4	V	
Latch Input Current	ISCON	VCC = 16V	7	-13	-7	-1	μA	
Output Low Current	IOSL	VCC = 12V, VOSL = 0.2V	8	200	800	1400	μA	
Diff. Input Clamp Voltage	VIDC	VCC = 16V, IIDC = 100mA	9	0.4	1.2	2	V	
Maximum Current Voltage	VSM	ISM = 7mA	10	20	24	28	V	
Supply Current 2	IS2	VCC = 12V, VOSL = 0.6V	11	200	400	900	μA	
Latch Off Supply Voltage	VSOFF	VOS = 12V VSC = 1.8V IIDC = 100mA	12	7.0	8.0	9.0	V	
Response Time(Note1)	TON	VCC = 16V VR-VI = 0.3V, 1V < VX < 5V	13	2	3	4	mS	

Note:

1. This Parameter, although guaranteed, is not tested in Production.
2. VP=Vpin1 -0.03V at Vpin2=2.0V, Vpin4=1.5V
3. VT value can be customized according to customer needs.

Test Circuit


Typical Characteristics

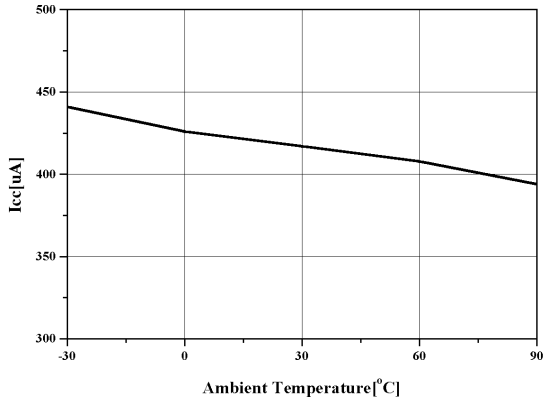


Figure 1. Supply Current

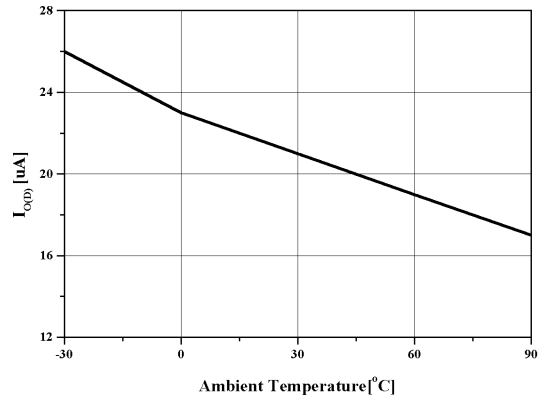


Figure 2. Differential Amp. Output Current
VR-VI=30mV, VOD=1.2V

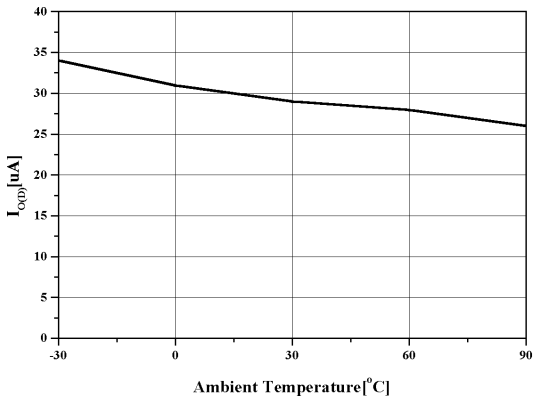


Figure 3. Differential Amp. Output Current
VR, VI=VP, VOD=0.8V

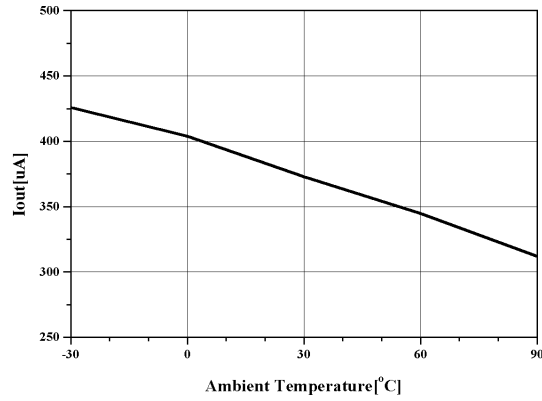


Figure 4. Output Current

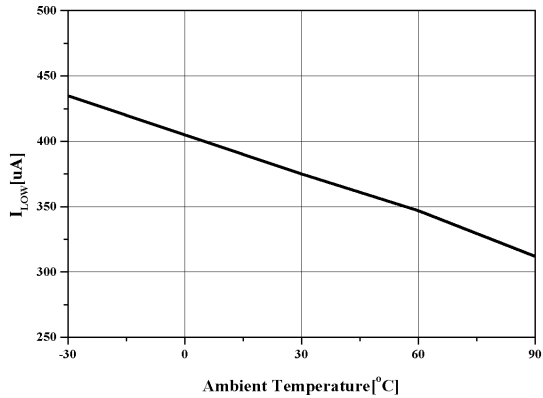


Figure 5. Output Low Current

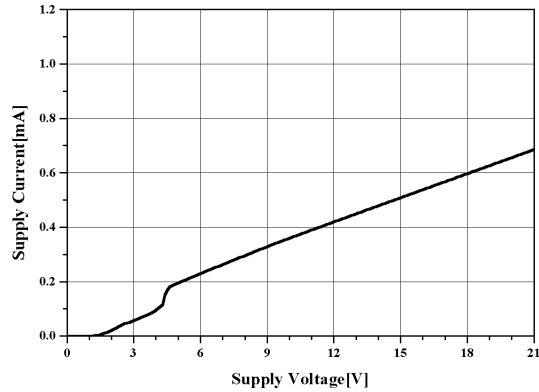


Figure 6. Vcc Voltage Vs. Supply Current 1

Typical Characteristics (Continued)

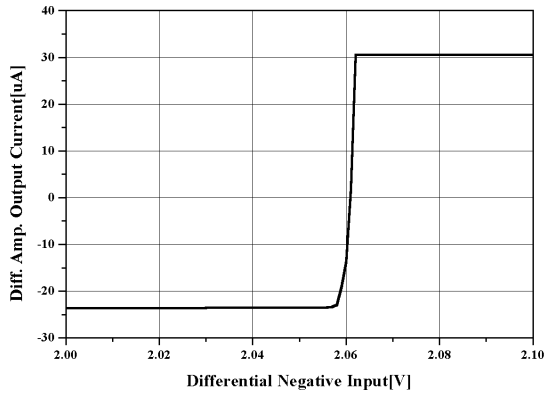


Figure 7. Differential Amp. Output Current 1

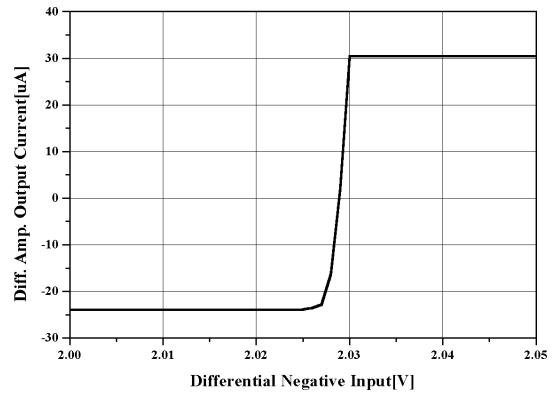


Figure 8. Differential Amp. Output

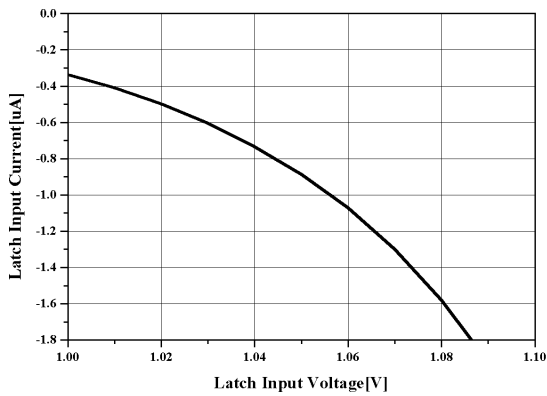


Figure 9. Latch Input Current

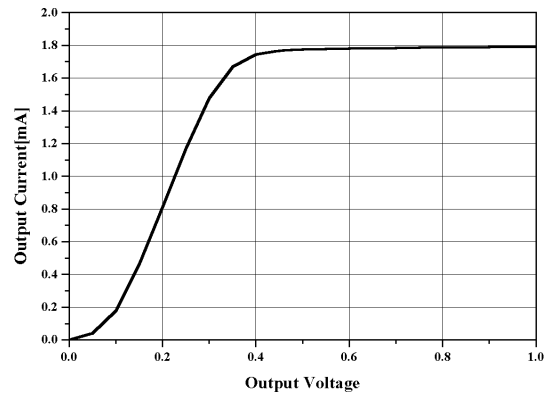


Figure 10. Output Low Current

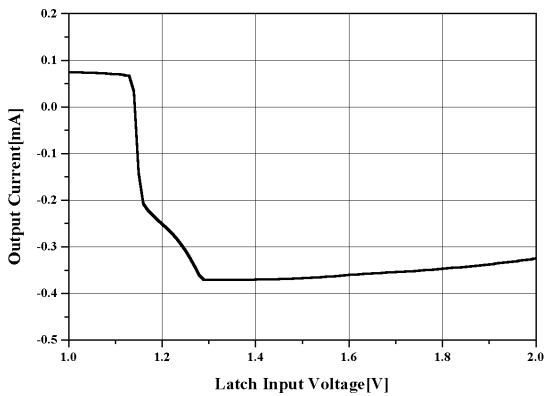


Figure 11. Output Current

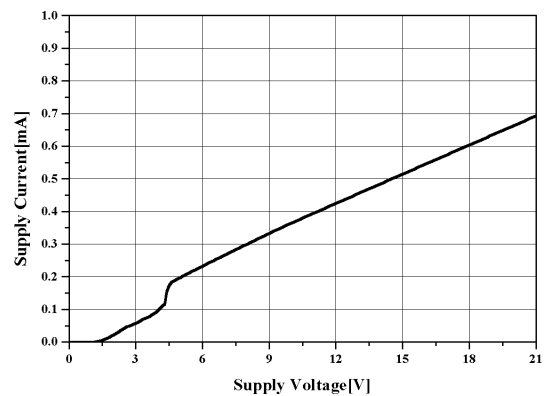


Figure 12. Vcc Voltage Vs. Supply Current 2

Typical Characteristics (Continued)

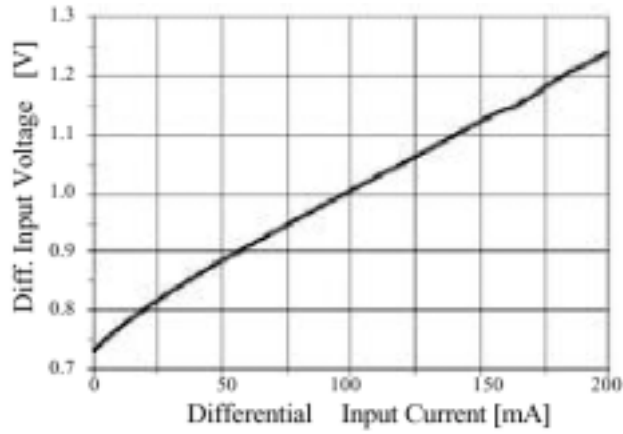


Figure 13. Differential Input Clamp Voltage

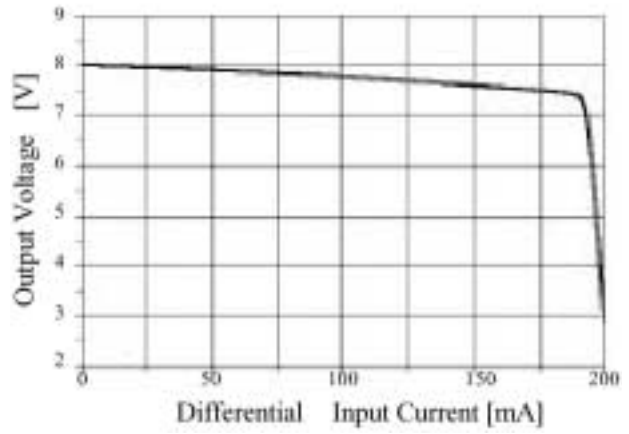


Figure 14. Latch Off Supply Voltage

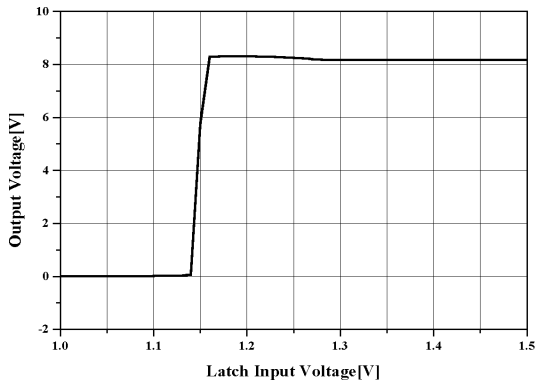


Figure 15. Latch On Input Voltage

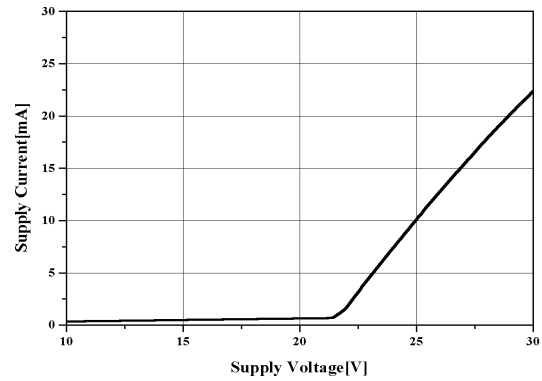


Figure 16. Maximum Supply

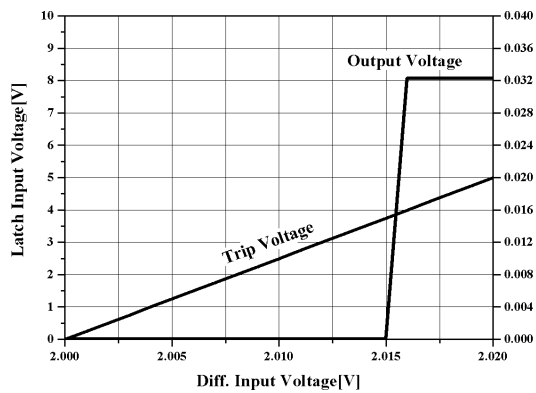


Figure 17. Trip & Output

Typical Characteristics (Continued)

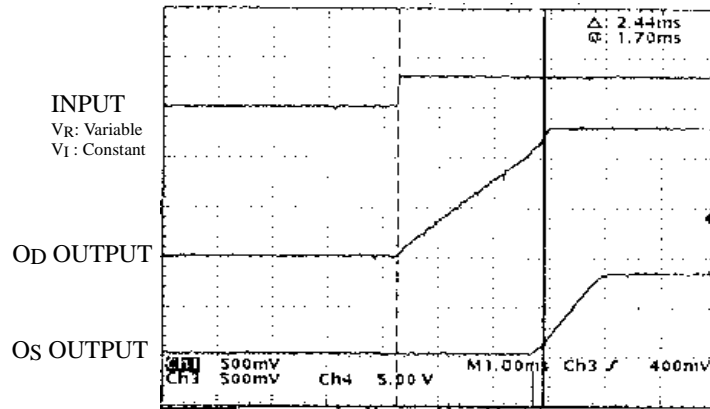


Figure 18. Output Response Time

Application Circuit

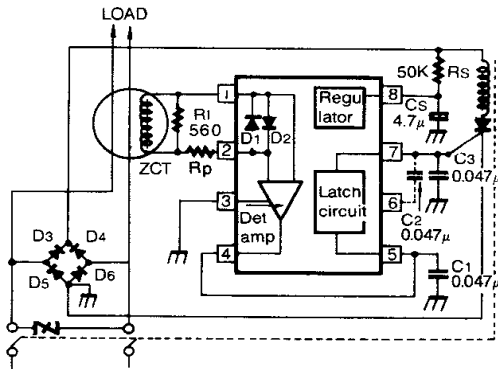


Figure 1. Full Wave Application Circuit

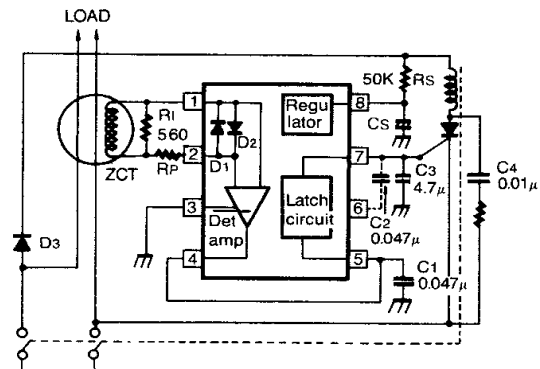


Figure 2. Half Wave Application Circuit

Application Note

(refer to full wave application circuit Fig. 1)

The Fig 1 shows the HT54123 connected in a typical leakage current detector system.

The power is applied to the VCC terminal (Pin 8) of the HT54123 directly from the power line.

The resistor R_S and capacitor C_S are chosen so that pin 8 voltage is at least 12V.

The value of C_S is recommended above $1\mu\text{F}$ at this time.

If the leakage current is at the load, it is detected by the zero current transformer (ZCT).

The output voltage signal of ZCT is amplified by the differential amplifier of the HT54123 internal circuit and appears as half cycle sine wave signal referred to input signal at the output of the amplifier.

The amplifier closed loop gain is fixed about 1000 times with internal feedback resistor to compensate for zero current transformer (ZCT) Variations.

The resistor R_L should be selected so that the breaker satisfies the required sensing current.

The protection resistor R_p is not usually used put when the high current is injected at the breaker, this resistor should be used to protect the earth leakage detector IC the HT54123.

The range of R_p is from several hundred Ω to several k Ω .

The capacitor C_1 , is for the noise canceller and standard value of C_1 is $0.047\mu\text{F}$. Also the capacitor C_2 is noise canceller capacitance but it is not usually used.

When high noise is only appeared at this system $0.047\mu\text{F}$ capacitor may be connected between pin 6 and pin 7.

The amplified signal is finally appeared to the Pin 7 with pulse signal through the internal latch circuit of the HT54123.

This signal drives the gate of the external SCR which energizes the trip coil which opens the circuit breaker.

The trip time of breaker is decided by the capacitor C_3 and the mechanism breaker.

This capacitor should be selected under $1\mu\text{F}$ for the required the trip time.

The full wave bridge supplies power to the HT54123 during both the positive and negative half cycles of the line voltage. This allows the hot and neutral lines to be interchanged.

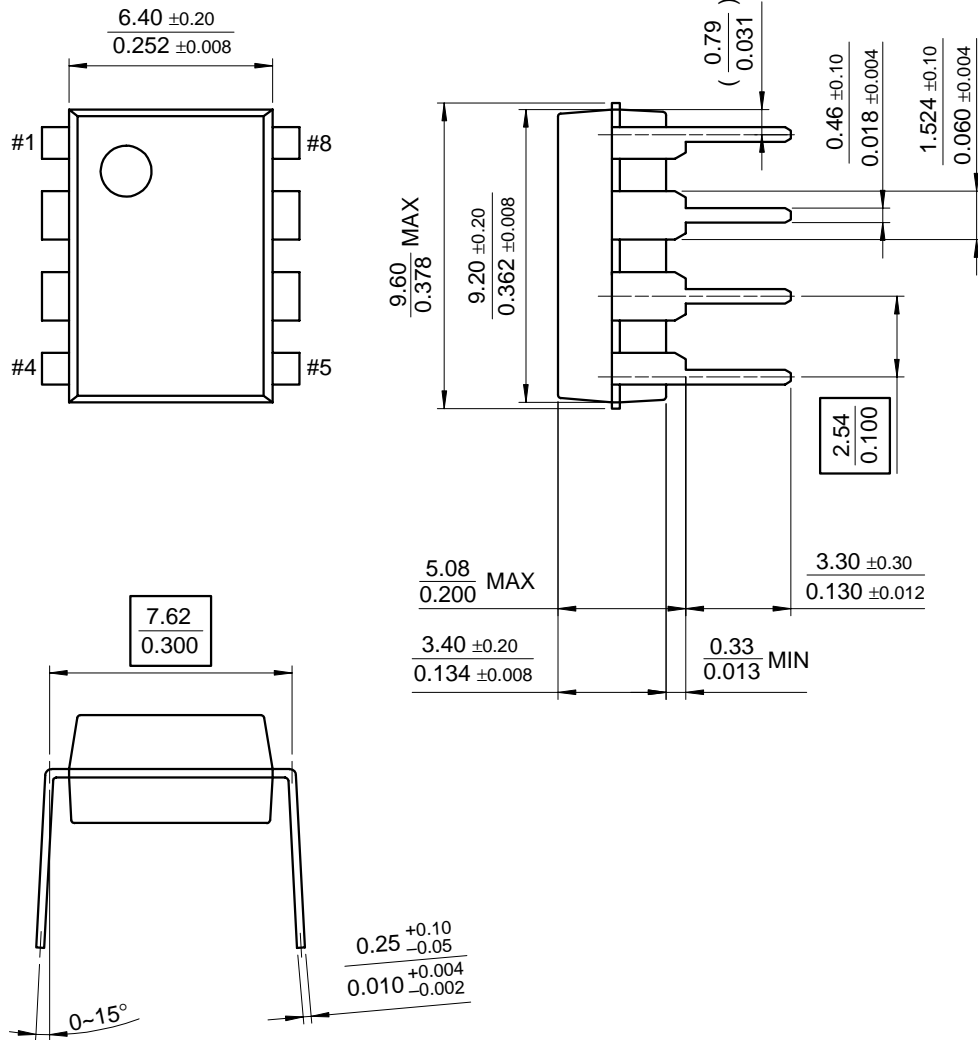
If your application want the detail information, request it on our application circuit designer of HT54123.

Mechanical Dimensions

Package

Dimensions in millimeters

8-DIP



Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

8-SOP

