

# GROUND FAULT INTERRUPTER EARTH LEAKAGE CURRENT DETECTOR

**IL54123**

## Description

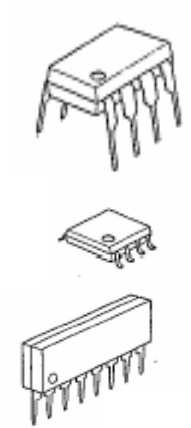
The IL54123N/D is designed for use in earth leakage circuit interrupters for operation directly off the AC Line in breakers.

It contains pre regulator, main regulator, after regulator, differential amplifier, level comparator, latch circuit. The input in the differential amp latch circuit. The input in the differential amplifier is connect to the secondary node of zero current transformer.

The level comparator generates high level when earth leakage current is greater than some level.

## Feature

- Low Power Consumption ( $P_D=5mW$ ) 100V/200V
- 100V/200V Common Built-in Voltage Regulator
- High Gain Differential Amplifier
- High Input Sensitivity ( $V_T = 6.1mV$  Typ.)
- Minimum External Parts
- Large Surge Margin
- Wide Operating Temperature Range ( $T_A = -40$  to  $85^\circ C$ )
- High Noise Immunity
- Meet U. L. 943 standards



**ORDERING INFORMATION**

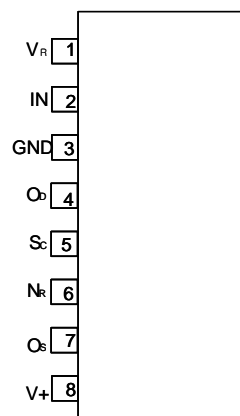
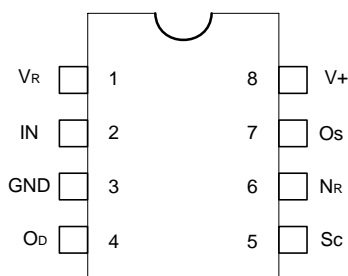
IL54123N Plastic  
 IL54123D SOIC  
 IL54123S SIP-8

$T_A = -40^\circ$  to  $85^\circ C$  for all packages.

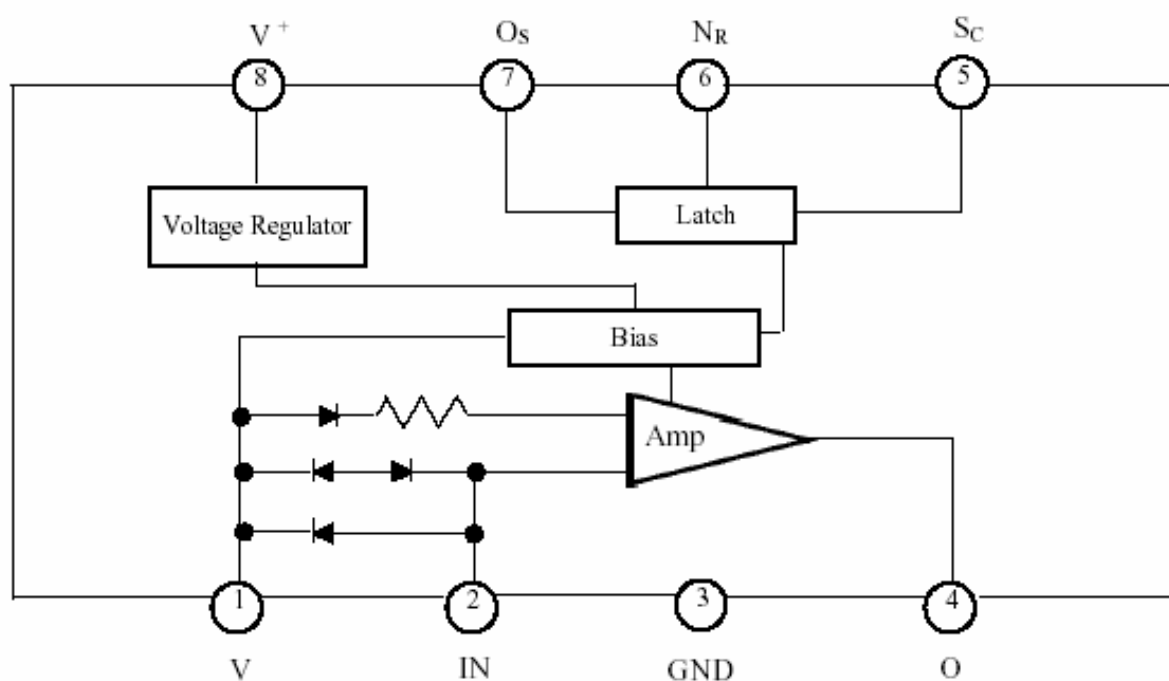
## Absolute Maximum Ratings ( $T_A=25^\circ c$ )

- |                         |                       |
|-------------------------|-----------------------|
| ▪ Supply Voltage        | 20V                   |
| ▪ Supply Current        | 8mA                   |
| ▪ Power Dissipation     | 200m W                |
| ▪ Operating Temperature | - 40 to $85^\circ C$  |
| ▪ Storage Temperature   | - 55 to $125^\circ C$ |

## Pin Configuration (Top View)



## Block Diagram



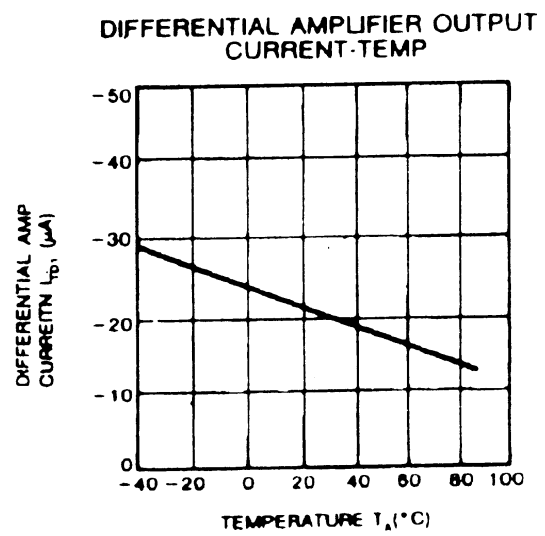
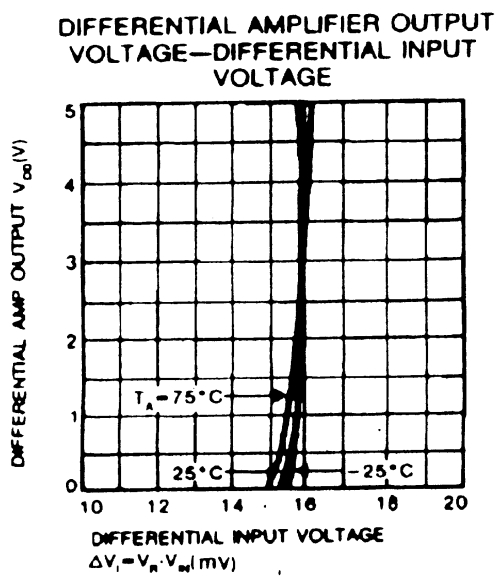
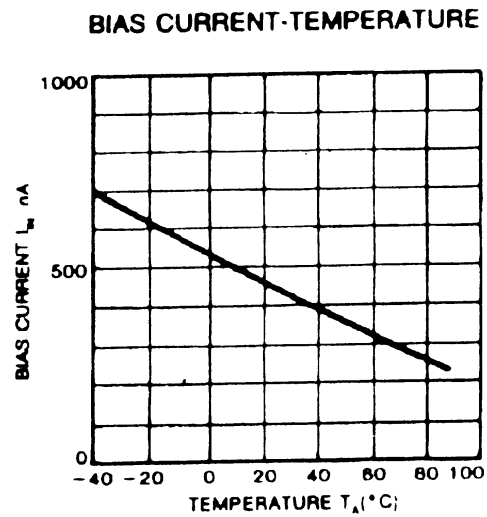
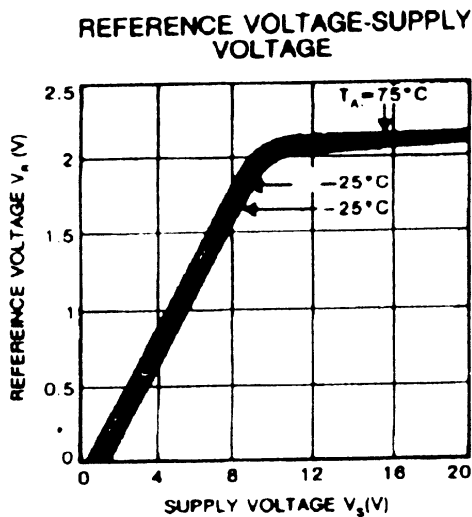
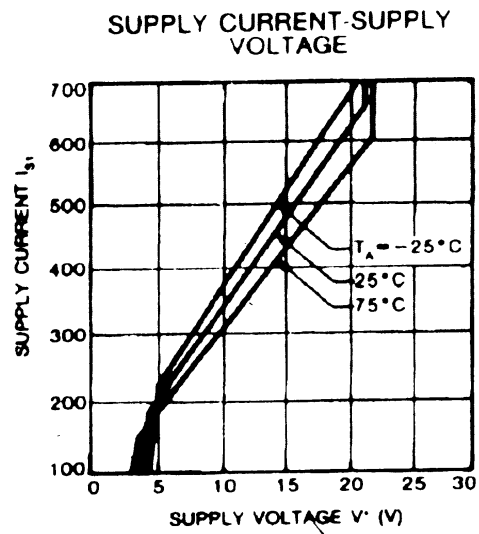
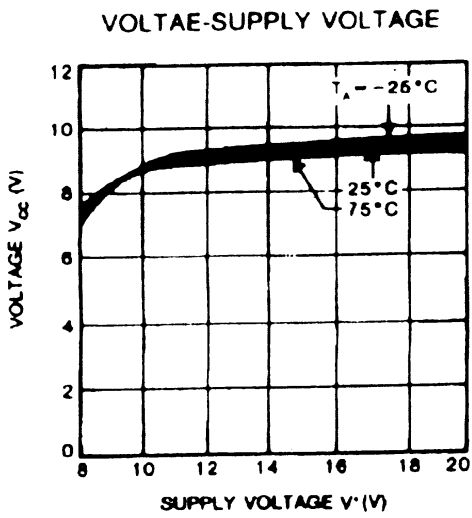
**Recommended Operating Condition:  $T_A = -30^{\circ}\text{C}$  to  $80^{\circ}\text{C}$** 

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	$V^+$	12			V
Vs-GND Capacitor	$C_{vs}$	1			$\mu\text{F}$
O <sub>s</sub> -GND Capacitor	$C_{os}$			1	$\mu\text{F}$

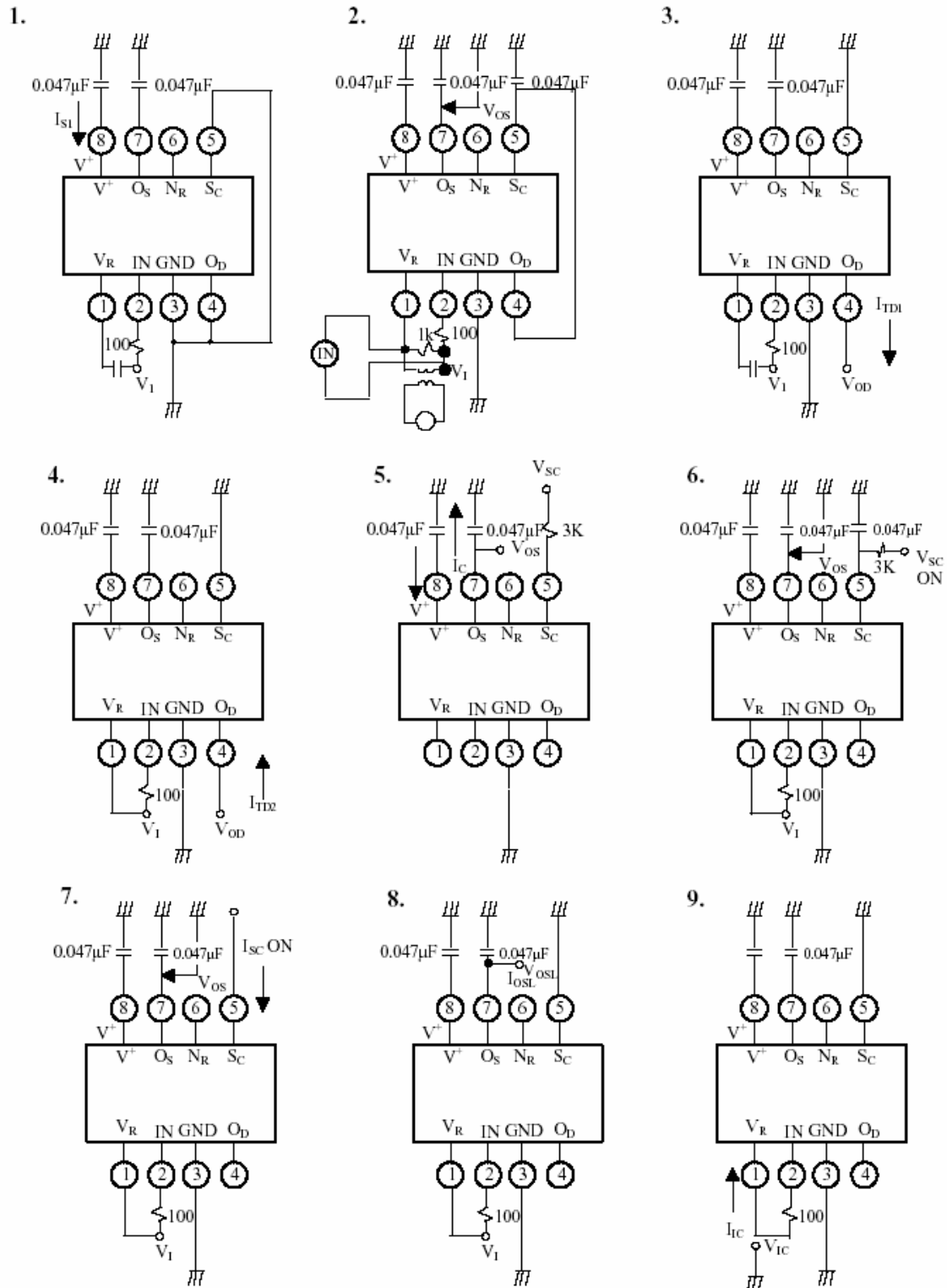
**Electrical Characteristics**

PARAMETER	SYMBOL	CONDITONS	TEMP. (°C)	MIN.	TYP.	MAX.	UNIT
Supply Current 1	$I_{S1}$	$V^+ = 12\text{V}$ , $V_R - V_I = 30\text{ mV}$	-30	-	-	580	$\mu\text{A}$
			25	-	400	530	
			85	-	-	480	
* Trip Voltage	$V_T$	$V^+ = 16\text{V}$ , $V_R - V_I = X$	-30 85	4	6.1	9	mV (rms)
Differential Amplifier Output Current 1	$I_{TD1}$	$V^+ = 16\text{V}$ , $V_R - V_I = 30\text{ mV}$ $V_{OD} = 1.2\text{ V}$	25	-12	-	-30	$\mu\text{A}$
Differential Amplifier Output current 2	$I_{TD2}$	$V^+ = 16\text{V}$ , $V_R - V_I = \text{short}$ $V_{OD} = 0.8\text{ V}$	25	17	-	37	$\mu\text{A}$
Output Current	$I_O$	$V_{sc} = 1.4\text{ V}$ $V_{os} = 0.8\text{ V}$	$I_{S1} = 580\mu\text{A}$	-30	-200	-	$\mu\text{A}$
			$I_{S1} = 530\mu\text{A}$	25	-100	-	
			$I_{S1} = 480\mu\text{A}$	85	-75	-	
S <sub>C</sub> ON Voltage	$V_{SC\ ON}$	$V^+ = 16\text{ V}$	25	0.7	-	1.4	V
S <sub>C</sub> Input Current	$I_{SC\ ON}$	$V^+ = 12\text{V}$	25	-	-	5	$\mu\text{A}$
Output "L" Current	$I_{OSL}$	$V^+ = 12\text{ V}$ , $V_{OSL} = 0.2\text{ V}$	-30	200	-	-	$\mu\text{A}$
			85				
Input Clamp Voltage	$V_{IC}$	$V^+ = 12\text{ V}$ , $I_{IC} = 20\text{ mA}$	-30	4.3	-	6.7	V
			85				
Differential Input Clamp Voltage	$V_{IDC}$	$I_{IDC} = 100\text{mA}$	-30	0.4	-	2	V
			85				
Max. Current Voltage	$V_{SM}$	$I_{SM} = 7\text{ mA}$	25	20	-	28	V
Supply Current 2	$I_{S2}$	$V_{OS} = 0.5\text{ V}$ , $V_R - V_I = X$	-30	-	-	1200	$\mu\text{A}$
			85				
Latch Circuit Off Supply Voltage	V+ OFF		25	0.5			V
Response Time	$T_{ON}$	$V^+ = 16\text{ V}$ , $V_R - V_I = 0.3\text{ V}$	25	1	-	4	ms

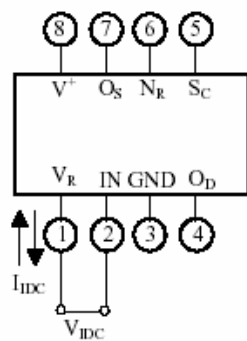
Typical Performance Curves



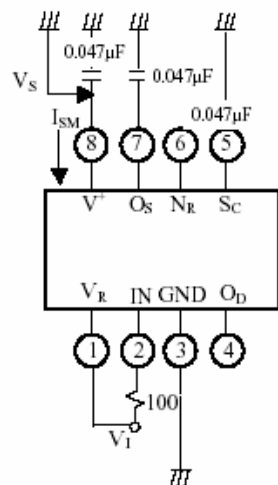
Test Circuit



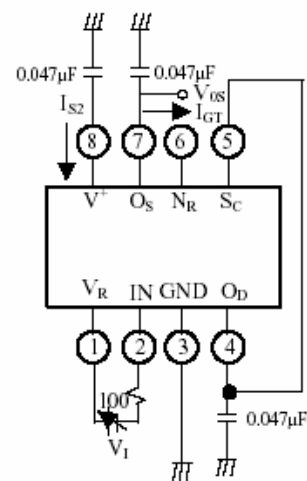
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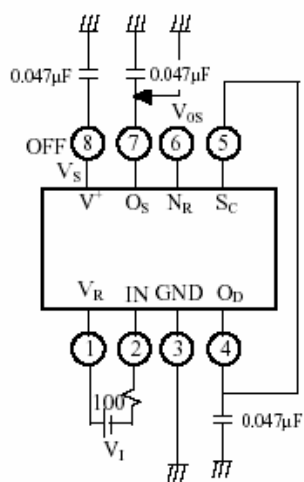
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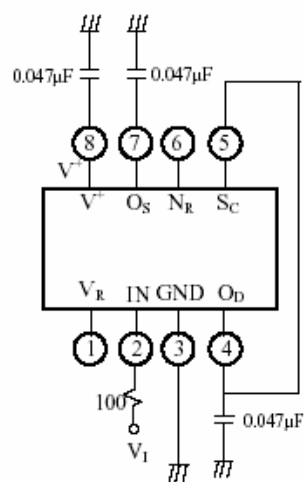
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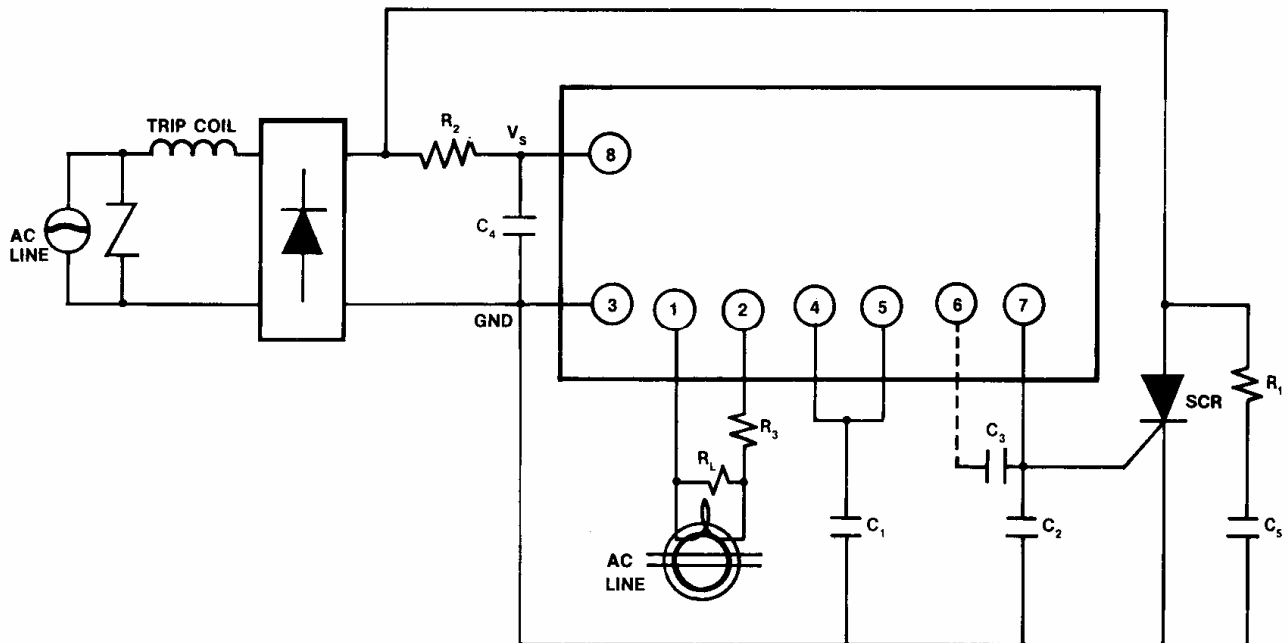
13.



14.



## Typical Application



Supply voltage circuit is connected as a previous diagram. Please decide constants  $R_1$ ,  $R_2$ ,  $C_4$ , and  $C_5$  of a filter in order to keep at least 12V in  $V_s$ , when normal supply current flows.

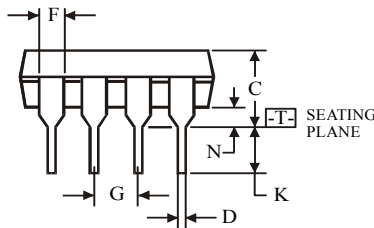
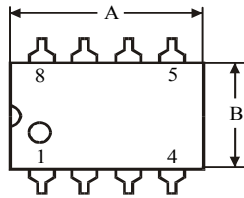
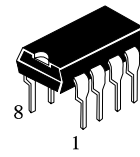
In this case, please connect  $C_4$  (more than  $1 \mu\text{F}$ ) and  $C_2$  (less than  $1 \mu\text{F}$ ). ZCT and load resistance  $R_L$  of ZCT are connected between input pin① and ②. In this case protective resistance ( $R_3=100\Omega$ ) must be insulated. Sensitivity current is regulated by  $R_L$ , and output of amplifier shows in pin④. External capacitor  $C_1$  between pin④ and GND is used for noise removal.

When large current is grounded in the primary side (AC line) of ZCT, the wave form in the secondary side of ZCT is distorted and some signals doesn't appear in the output of amplifier. So please connect a varistor or a diode (2pcs.) to ZCT in parallel.

Latch circuit is used to inspect the output level of amplifier and to supply gate current on the external SCR. When input pin becomes more than 1.1V (Typ.) latch circuit operates and supply gate current in the gate of SCR connected to the output pin⑦.

Pin⑥ can be used in the open state, but please connect capacitor (about  $0.047 \mu\text{F}$ ) between pin⑥ and ⑦. Capacitor  $C_6$  between pin① and GND is used to remove noise and is about  $0.047 \mu\text{F}$ .

**N SUFFIX PLASTIC DIP  
(MS – 001BA)**



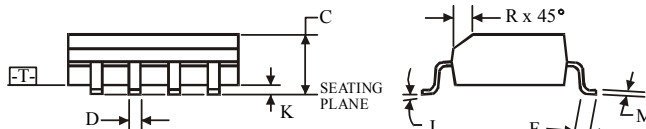
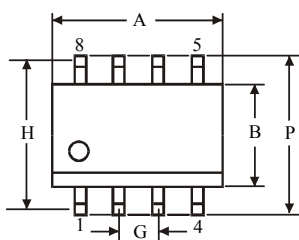
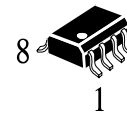
$\oplus 0.25 (0.010) \text{ (M) T}$

Dimension, mm		
Symbol	MIN	MAX
A	8.51	10.16
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

**NOTES:**

- Dimensions “A”, “B” do not include mold flash or protrusions.  
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

**D SUFFIX SOIC  
(MS - 012AA)**



$\oplus 0.25 (0.010) \text{ (M) T (C) (M)}$

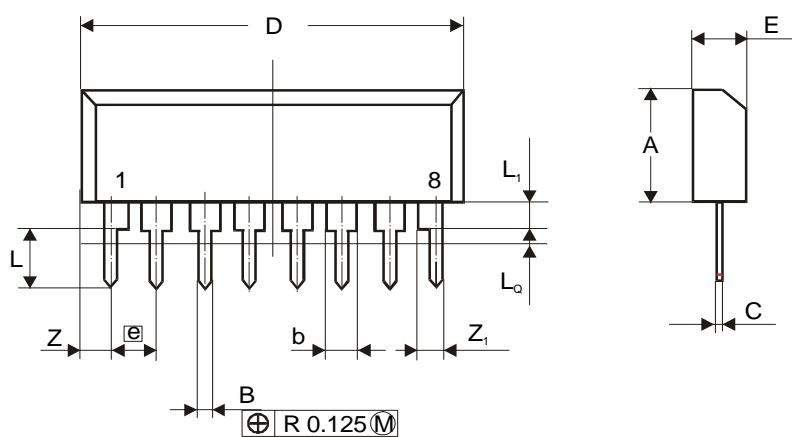
Dimension, mm		
Symbol	MIN	MAX
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

**NOTES:**

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.



### 8-Pin Plastic Single-in-Line (SIP)



Dimension	mm	
	min	max
A	6.24	6.60
B	0.40	0.54
b	1.15	1.40
C	0.23	0.35
D	19.68	20.20
E	2.675	2.925
e	2.54	
L	2.95	3.25
L1	1.61	1.97
L0		0.70
Z		1.21
Z1		1.40