

Ground Fault Interrupter Earth Leakage Current Detector

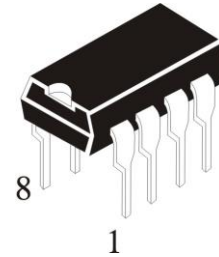
IK7104

GENERAL DESCRIPTION

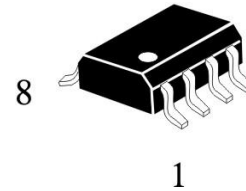
The IL7104 is designed for use in earth leakage circuit interrupters for operation directly off the AC Line in breakers.

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 connecting to the secondary node of zero current transformers.

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



DIP-8



SOIC-8

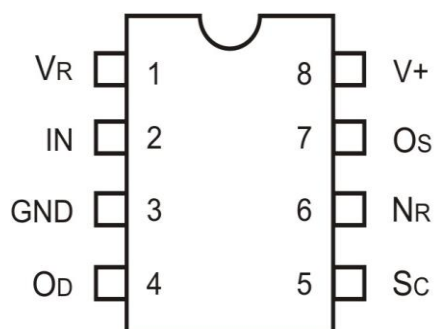
FEATURES

- ◆ Low Power Consumption ($P_D=5mW$) 100V/200V
- ◆ 100V/200V Common Built-in Voltage Regulator
- ◆ High Gain Differential Amplifier
- ◆ High Input Sensitivity
- ◆ Minimum External Parts
- ◆ Large Surge Margin
- ◆ Wide Operating Temperature Range ($T_A = -30^{\circ}C$ to $85^{\circ}C$)
- ◆ High Noise Immunity
- ◆ Meet U.L. 943 standards

ORDERING INFORMATION

Device	Operating Temperature Range	Package	Shipping
IK7104N	$T_A = -30^{\circ}$ to $85^{\circ}C$ for all packages	Plastic DIP-8	Tube
IK7104D		SOIC-8	Tube
IK7104DT		SOIC-8	Tape& Reel

PIN CONFIGURATION (Top View)



BLOCK DIAGRAMM

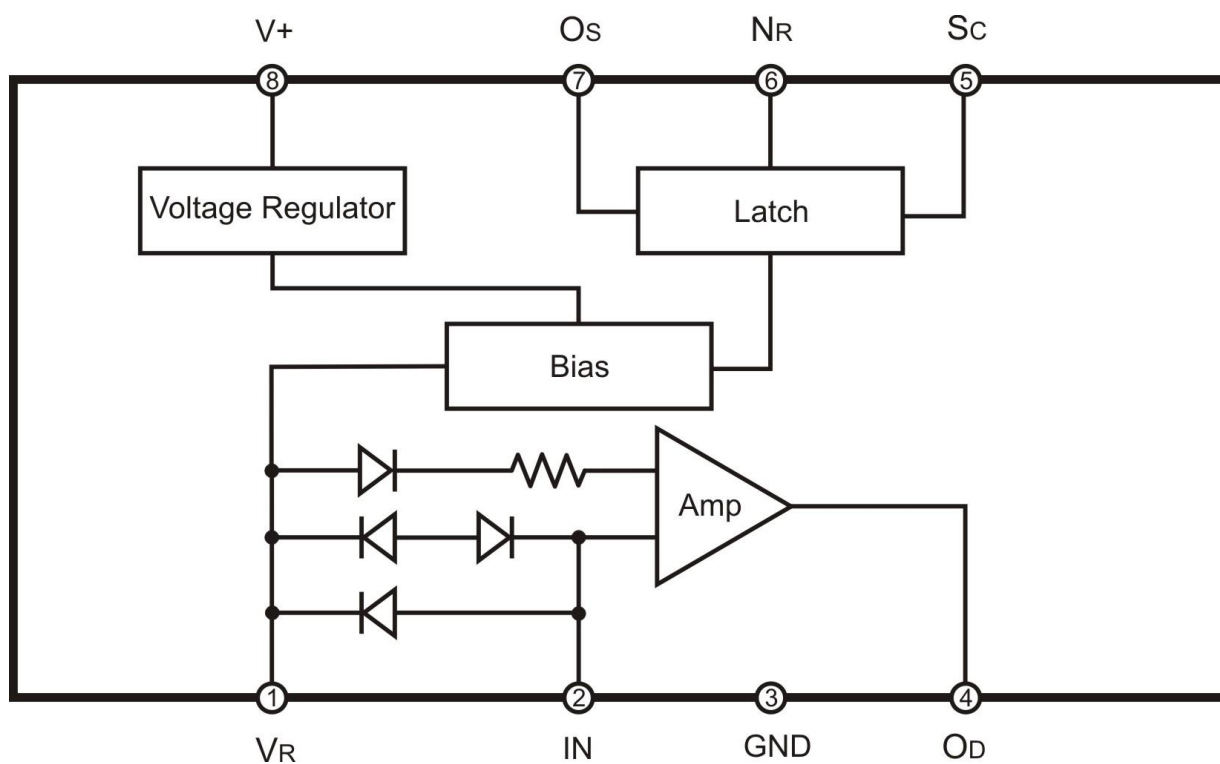


Fig. 1. Block Diagram

PIN LIST AND DESCRIPTIONS

Pin	Name	I/O	Description
1.	V _R	I	Reference input
2.	IN	I	Negative input
3.	GNG	-	Ground
4.	O _D	O	Differential amplifier output
5.	S _C	I	Latch input
6.	N _R	-	Noise rejection
7.	O _S	O	Signal output
8.	V+	I	Supply voltage

ABSOLUTE MAXIMUM RATINGS *

Symbol	Parameter	Min	Max	Unit
V+	Supply Voltage		20	V
I _S	Supply Current		8	mA
P _D	Power Dissipation		200	mW
T _A	Operating Temperature	-30	+85	°C
T _{STG}	Storage Temperature	-55	+125	°C

* Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

OPERATING RANGE (T_A=-30°C to 80°C)

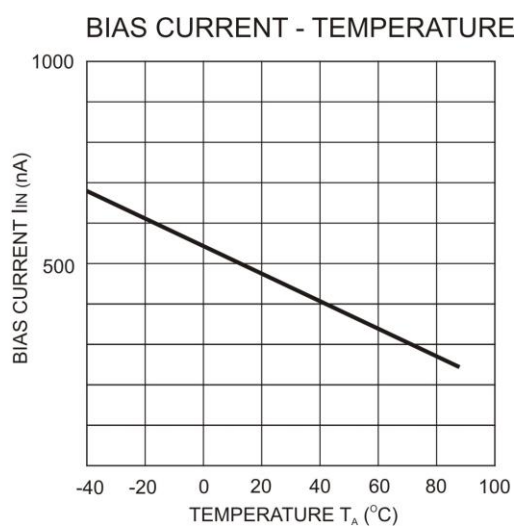
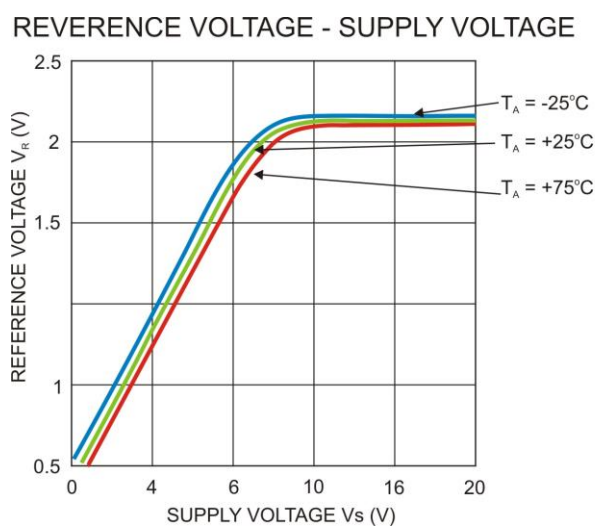
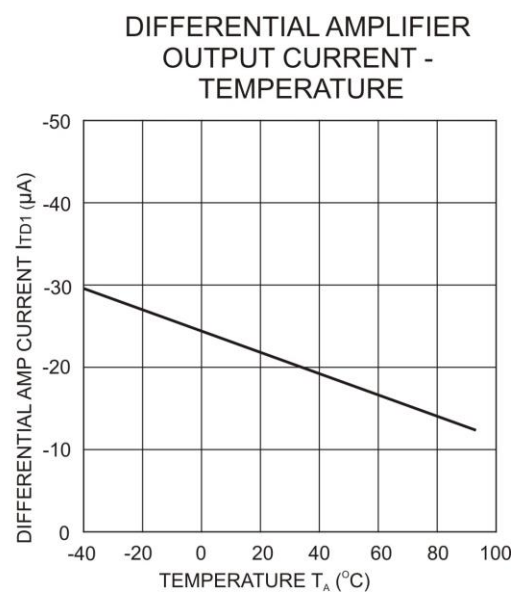
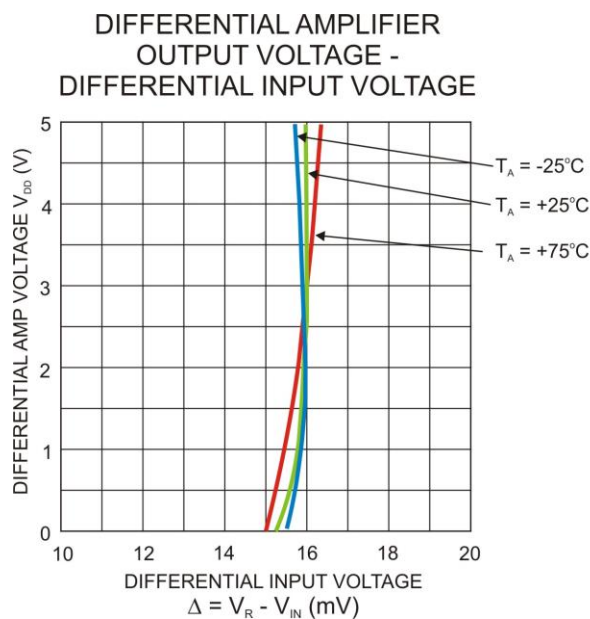
Symbol	Parameter	Min	Typ	Max	Unit
V+	Supply Voltage	12			V
C _{vs}	V _S -GND Capacitor	1			μF
C _{os}	O _S -GND Capacitor			1	μF

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Temp. °C	Min	Typ	Max	Unit	Test Circuit
Supply Current 1	I_{S1}	$V_+ = 12V,$ $V_R - V_I = 30 \text{ mV}$	-30	-	-	580	μA	1
			25	-	400	530		
			85	-	-	480		
*Trip Voltage	V_T	$V_+ = 16V,$ $V_R - V_I = X$	25	10.0	-	15.6	mV (rms)	2
			-30	9.75	-	15.75		
			85	9.75	-	15.75		
Differential Amplifier Output Current 1	I_{TD1}	$V_+ = 16 V,$ $V_R - V_I = 30 \text{ mV}$ $V_{OD} = 1.2 V$	25	-12	-	-30	μA	3
Differential Amplifier Output current 2	I_{TD2}	$V_+ = 16 V,$ $V_R - V_I = \text{short}$ $V_{OD} = 0.8 V$	25	17	-	37	μA	4
Output Current	I_O	$V_{SC}=1.4V$ $V_{OS}=0.8V$	$I_{SI} = 580\mu A$	-30	-200	-	μA	5
			$I_{SI} = 530\mu A$	25	-100	-		
			$I_{SI} = 480\mu A$	85	-75	-		
S_C ON Voltage	$V_{SC \text{ ON}}$	$V_+ = 16 V$	25	0.7	-	1.4	V	6
S_C Input Current	$I_{SC \text{ ON}}$	$V_+ = 12V$	25	-	-	5	μA	7
Output "L" Current	I_{OSL}	$V_+ = 12 V,$ $V_{OSL} = 0.2 V$	-30 85	200	-	-	μA	8
Input Clamp Voltage	V_{IC}	$V_+ = 12 V,$ $I_{IC} = 20 \text{ mA}$	-30 85	4.3	-	6.7	V	9
Differential Input Clamp Voltage	V_{IDC}	$I_{IDC} = 100\text{mA}$	-30 85	0.4	-	2	V	10
Max. Current Voltage	V_{SM}	$I_{SM} = 7 \text{ mA}$	25	20	-	28	V	11
Supply Current 2	I_{S2}	$V_{OS} = 0.5 V,$ $V_R - V_I = X$	-30 85	-	-	1200	μA	12
Latch Circuit Off Supply Voltage	V_{+OFF}		25	0.5	-	-	V	13
Response Time	T_{ON}	$V_+ = 16 V,$ $V_R - V_I = 0.3 V$	25	1	-	4	ms	14

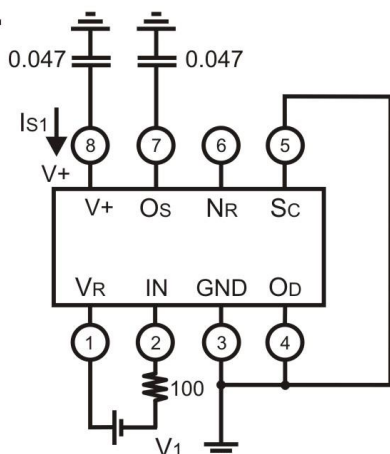
*S: 10mV ~ 13.86mV, A: 13.86mV ~ 15.6mV

TYPICAL PERFORMANCE CURVES

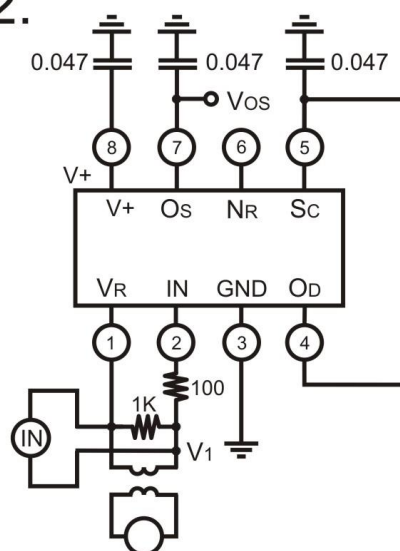


TEST CIRCUIT

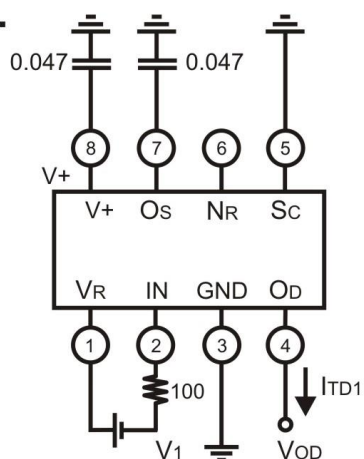
1.



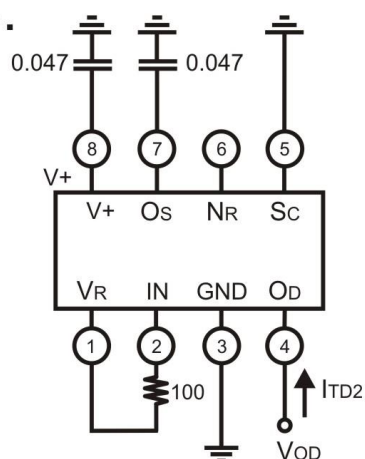
2.



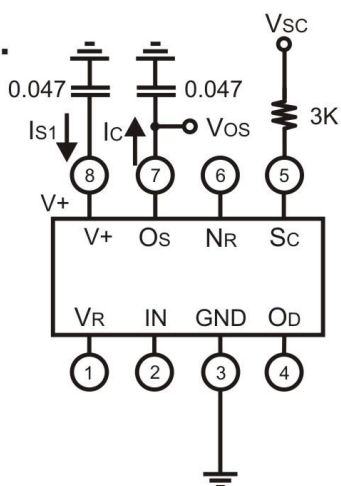
3.



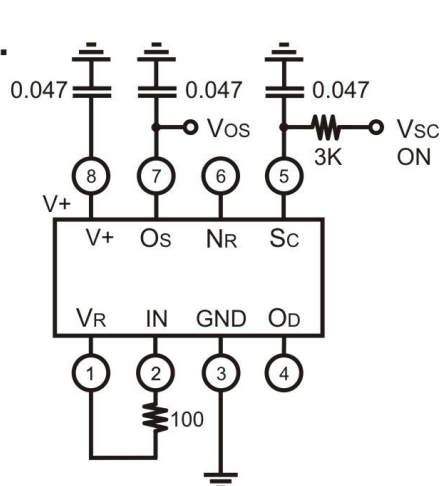
4.

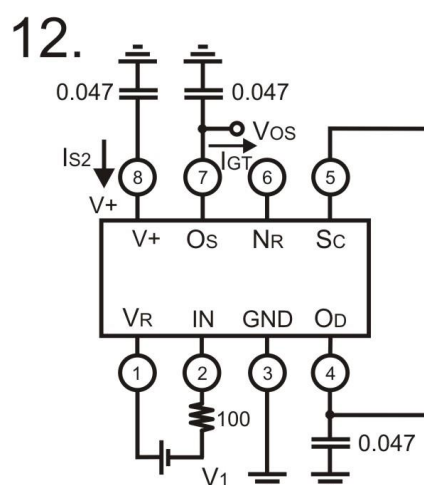
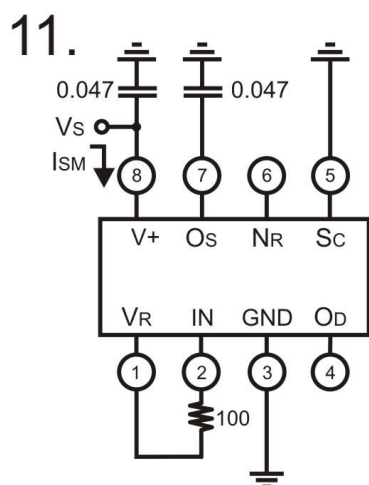
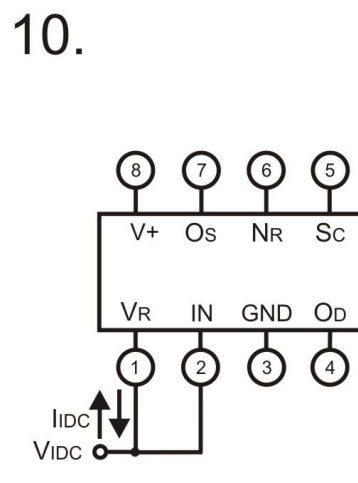
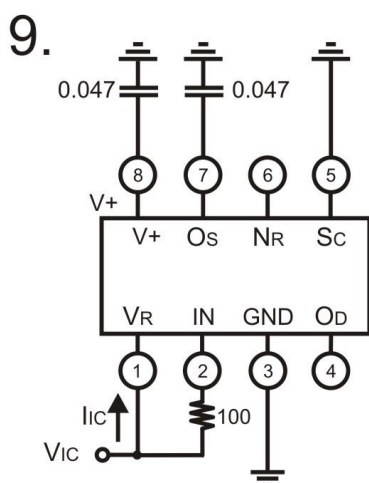
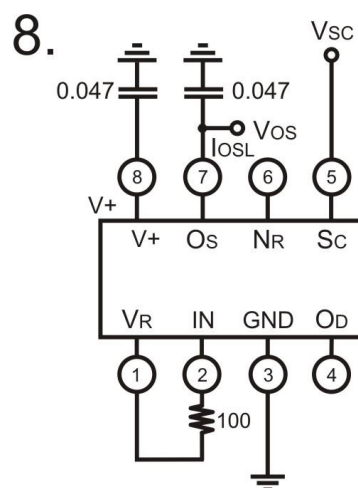
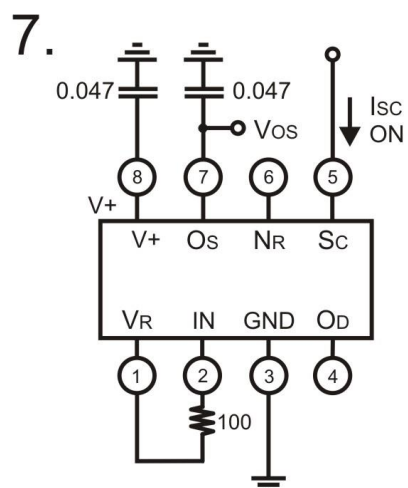


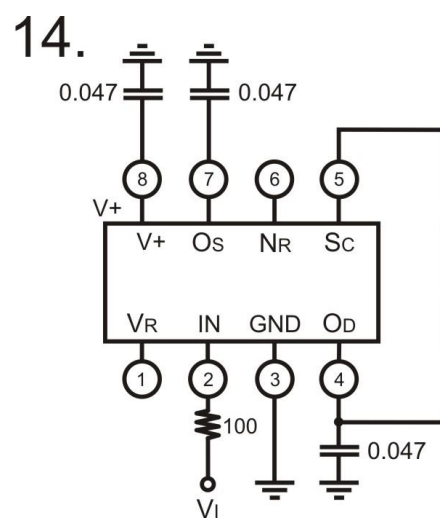
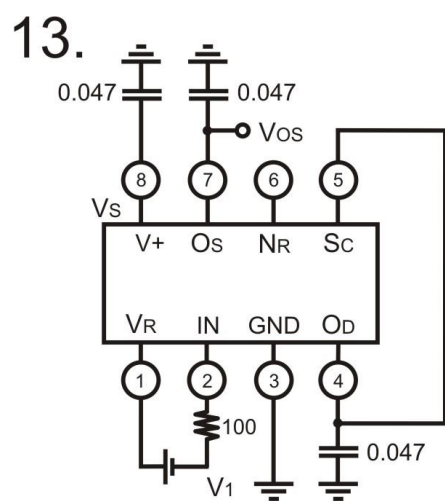
5.



6.

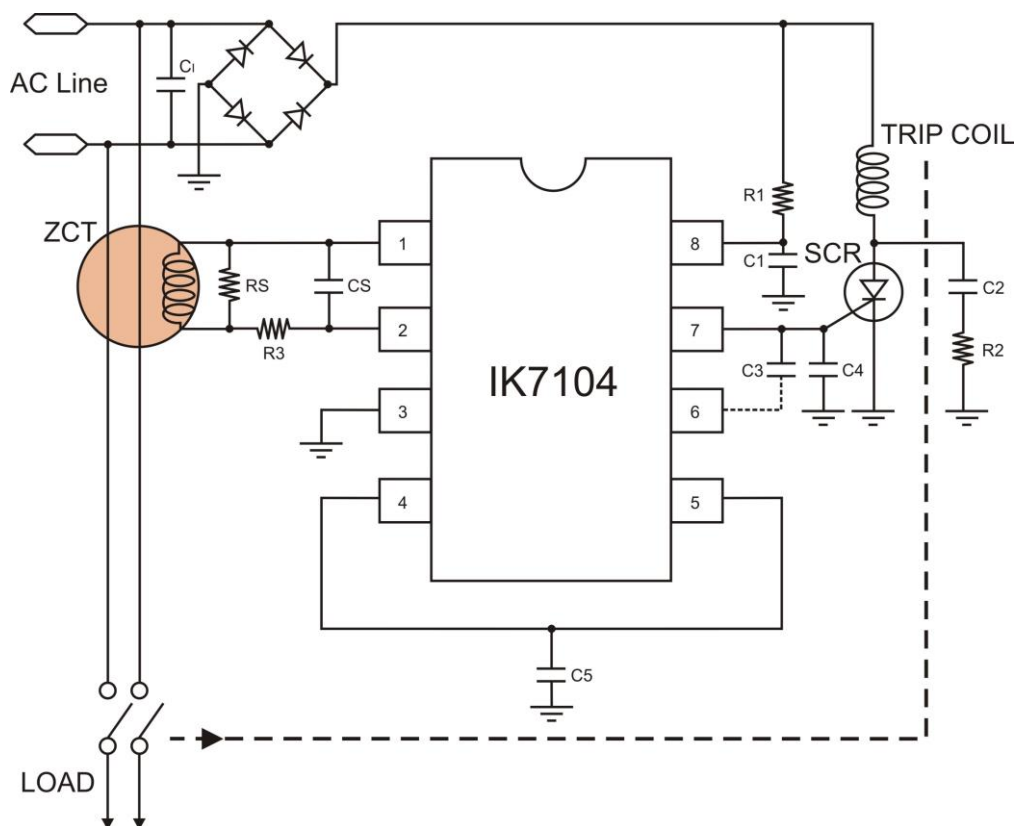




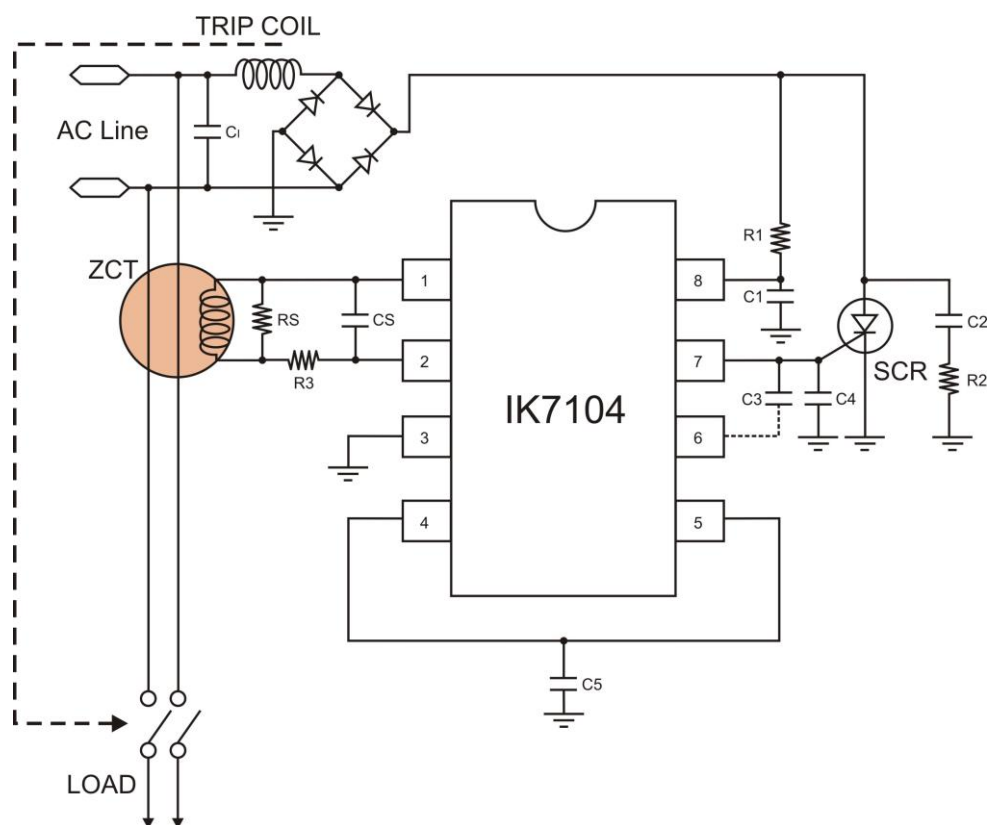


APPLICATION INFORMATION

Typical Application 1



Typical Application 2



Supply voltage circuit is connecting as a previous diagram. Please decide constants R1, R2, C1, and C2 of a filter in order to keep at least 12V in V_s , when normal supply current flows in. In this case, please connect C1 (more than $1\mu\text{F}$) and C2 (less than $1\mu\text{F}$).

ZCT and load resistance R_S of ZCT are connecting between input pin 1 and 2. In this case protective resistance ($R_3=100\Omega$) must be insulated. Sensitivity for current is regulating by R_S , and output of amplifier shows in pin4. External capacitor C5 between pin 4 and GND is using for noise removal.

When large current is grounding in the primary side (AC line) of ZCT, the wave's form in the secondary side of ZCT is distorting and some signals have not appeared in the output of amplifier. So please connect a varistor or a diode (2pcs.) to ZCT in parallel.

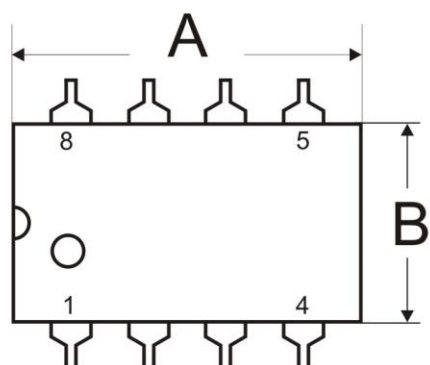
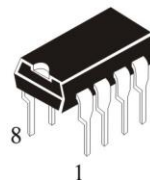
Latch circuit is using to inspect the output level of amplifier and to supply gate current on the external SCR. When input pin becomes more than 1.1 V (Typ.) latch circuit operates and supply gate current in the gate of SCR connected to the output pin 7.

Pin 6 can be used in the open state, but please connect capacitor C3 (about $0.047\mu\text{F}$) between pin 6 and 7.

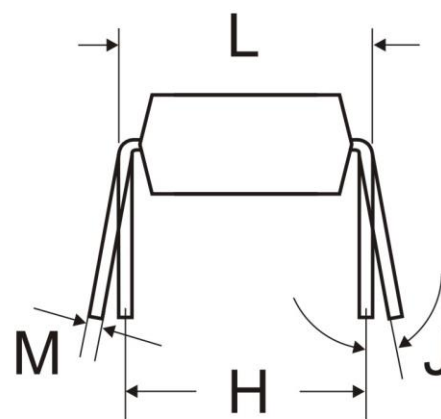
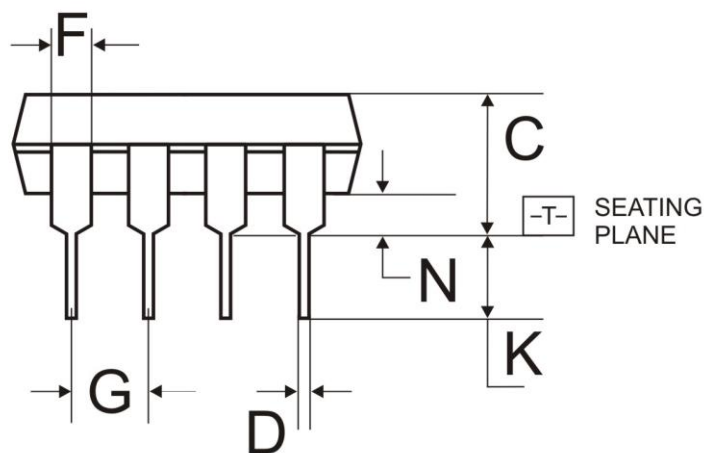
Capacitor CS between pin 1 and 2 is using to remove noise and is about $0.047\mu\text{F}$.

EMI test block diagram 1

N SUFFIX PLASTIC DIP



Symbol	Dimension, mm	
	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	

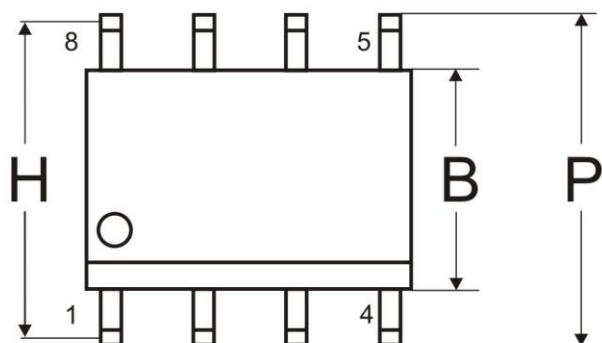
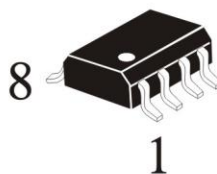


⊕ 0.25 (0.010) (M) T

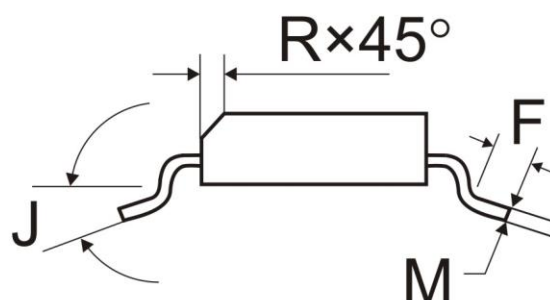
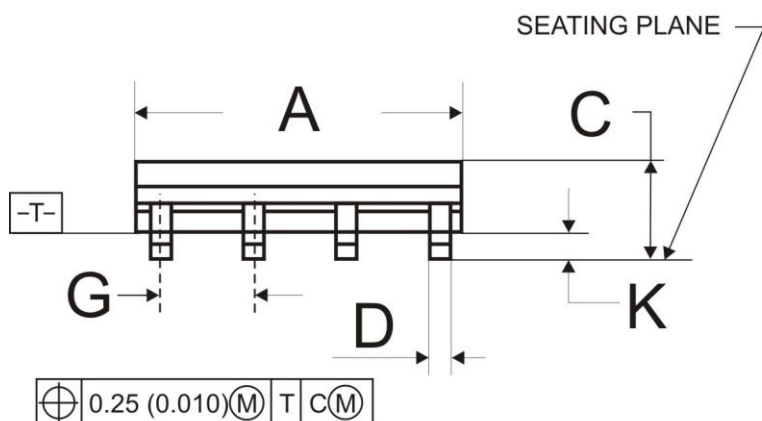
NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion - 0.25 mm (0.010) per side.

D SUFFIX SOIC



Symbol	Dimension, mm	
	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:

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