μA7390

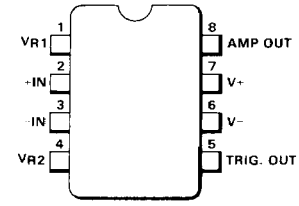
GROUND FAULT DETECTOR

FAIRCHILD LINEAR INTEGRATED CIRCUIT

GENERAL DESCRIPTION – The μA7390 is a monolithic ground fault detector circuit utilizing the Fairchild Planar* Epitaxial Process. It is designed for use in class A Ground Fault Circuit Interrupters for operation directly off the ac line in either breakers or receptacles. The μA7390 contains an operational amplifier, a threshold detector, and a driver capable of providing high energy pulses for thyristor triggering.

- **OPERATES DIRECTLY FROM AC LINE**
- **BUILT IN 24 V REGULATOR**
- **HIGH GAIN OPERATIONAL AMPLIFIER**
- **50 mA OUTPUT CURRENT PULSE TO TRIGGER SCRs**
- **LOW EXTERNAL PART COUNT**
- **MINI-DIP PACKAGE**
- **HIGH NOISE IMMUNITY**

CONNECTION DIAGRAM
8-PIN MINI-DIP
(TOP VIEW)
PACKAGE OUTLINE 9T
PACKAGE CODE T



ORDER INFORMATION

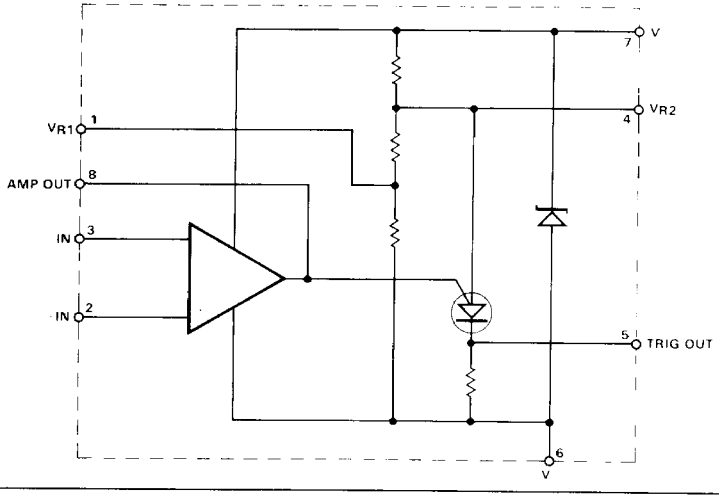
TYPE	PART NO.
μA7390	μA7390TC

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Limited by Internal Zener (Note 1)	
Supply Current (Note 2)	40 mA
Power Dissipation (Note 3)	560 mW
Storage Temperature Range	−55°C to +125°C
Operating Temperature	−40°C to +85°C
Pin Temperature soldering 10 s	260°C

NOTES:
1. Device must always have a series resistor between the supply and pin 7, which limits current to 40 mA maximum.
2. Single cycle 60 Hz surge current. Steady state current limited by Power Dissipation.
3. Power Dissipation applies to case temperature of 25°C derate at 5.6 mW/°C.

BLOCK DIAGRAM



*Planar is a patented Fairchild process.

ELECTRICAL CHARACTERISTICS: T_A = 25°C, I_S = 10 mA unless otherwise specified

CHARACTERISTICS	CONDITIONS	LIMITS			UNITS
		MIN	TYP	MAX	
POWER SUPPLY					
Zener Voltage		21	23.5	26	V
Zener Series Resistance			50	100	Ω
Ratio of V_{R1} to Zener Voltage		0.3	0.33	0.37	
Ratio of V_{R2} to Zener Voltage		0.6	0.63	0.67	
OPERATIONAL AMPLIFIER					
Input Offset Voltage	$R_S \leq 50\ \Omega$		2.0	5.0	mV
Input Offset Current			30	100	nA
Input Bias Current			150	400	nA
Large Signal Voltage Gain	R_L = 100 k	8.0	15		V/mV
Output Source Current	V_{OUT} = 7.0 V	0.35	0.5	0.65	mA
Output Sink Current	V_{OUT} = 7.0 V	2.0	3.0	4.0	mA
OUTPUT TRIGGER					
Peak Output Current	V_{OUT} Trigger = 1.5 V	50	70		mA
Output Impedance	I = 10 mA	35	50	65	Ω

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APPLICATIONS

GROUND FAULT BREAKER

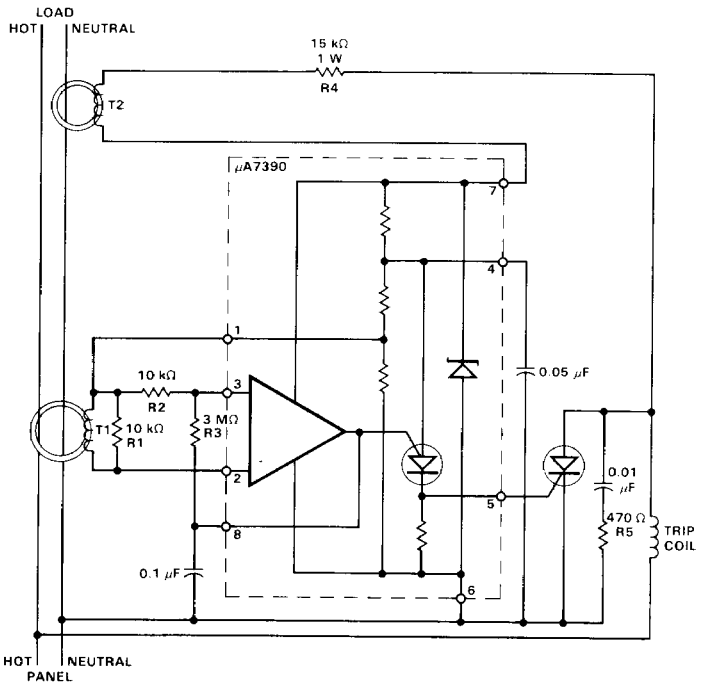


Fig. 1

APPLICATIONS (Cont'd)

FULL WAVE GFI FOR RECEPTACLE

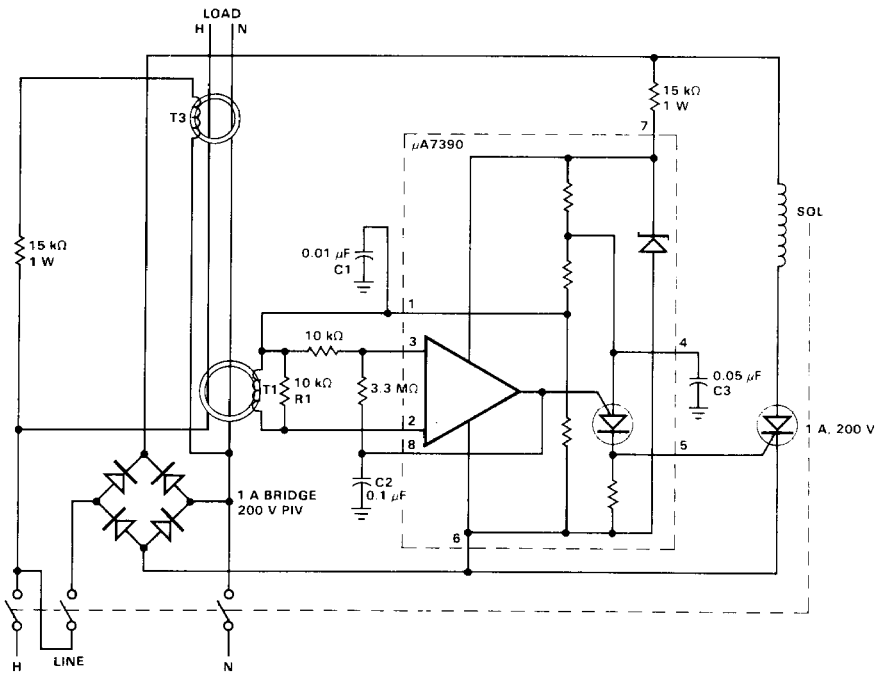


Fig. 2

Figure 1 shows the μA7390 connected in a typical Ground Fault Interrupter System. Power is applied to the V+ terminal of the μA7390 directly from the hot power line through a 15 kΩ resistor and the primary winding of transformer, T2. This limits the supply current into the μA7390 to a peak of 10 mA. The internal zener diode clamps the supply voltage to 23.5 V during the positive half-cycle and to more than minus 1 V during the negative half-cycle. The system therefore functions only on positive half-cycles of the line voltage.

Ground Fault currents (any currents in the hot line that are not returned in the neutral line) are detected by the differential current transformer, T1. The output voltage signal of T1 is amplified by the μA7390 operational amplifier and appears as a half-cycle sine wave signal referenced to V_{R2} at the output of the amplifier. The amplifier closed-loop gain is adjusted by modifying the external input and feedback resistors to compensate for transformer variations. When the peak signal amplitude equals V_{R2} + 0.6 V, the output trigger will fire and discharge the .1 μF capacitor connected to amp-out and the 0.05 μF capacitor connected to V_{R2} into the gate of the external SCR which energizes the trip coil which opens the circuit breaker. The .01 μF capacitor and the 470 Ω resistor are for transient suppression.

The transformer, T2, induces a small voltage, on the order of 10-20 mV on the neutral line with respect to ground so that a short from neutral load to ground will cause a fault current to flow in the neutral line of sufficient magnitude to cause the breaker to open as required for Class A Ground Fault Interrupter operation.

Figure 2 shows a typical full wave ground fault interrupter system. The full wave bridge supplies power to the μA7390 during both the positive and negative half-cycles of the line voltage. This allows the hot and neutral lines to be interchanged. The use of a third breaker contact allows interchanging the line and load sides of the breaker system. These two features allow the use of this system in ground fault interrupter receptacle applications.