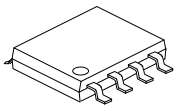
EARTH LEAKAGE DETECTOR



SOP-8

■ DESCRIPTION

The **MA2803** is designed for use in earth leakage circuit interrupters, for operation directly off the AC line in breakers. The input of the differential amplifier is connected to the secondary coil of Zero Current Transformer (ZCT). The amplified output of differential amplifier is integrated at external capacitor to gain adequate time delay. The level comparator generates a high level when earth leakage current is greater than the fixed level.

■ FEATURES

* Low Power Consumption: 5mW, 100V / 200V
* Built-in Voltage Regulator
* High-gain Differential Amplifier
* 0.4mA Output Current Pulse to Trigger SCRs
* Low External Part Count
* High Noise Immunity, Large Surge Margin
* Super Temperature Characteristic of Input Sensitivity
* Wide Operating Temperature Range: T_A = −25°C to +80°C
* Operation from 12V to 20V Input

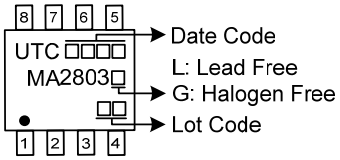
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
MA2803L-S08-R	MA2803G-S08-R	SOP-8	Tape Reel

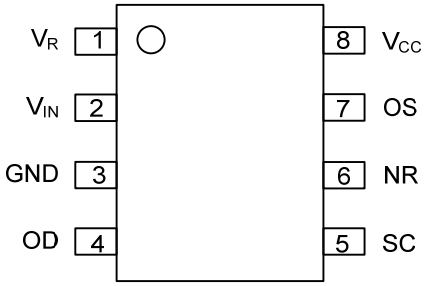
MA2803G-S08-R

(1) Packing Type	(1) R: Tape Reel
(2) Package Type	(2) S08: SOP-8
(3) Green Package	(3) G : Halogen Free and Lead Free, L: Lead Free

■ MARKING



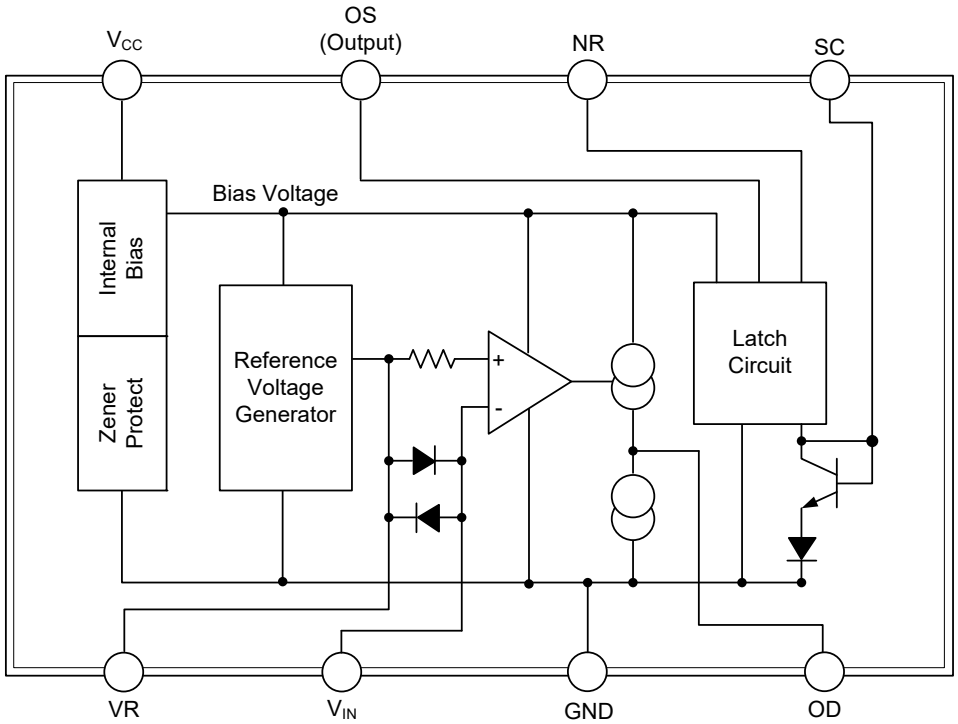
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	V_R	Non inverting input for current sensing amplifier
2	V_{IN}	Inverting Input for current sensing amplifier
3	GND	Ground
4	OD	Output of current sensing amplifier
5	SC	Input of latch circuit
6	NR	Noise absorption
7	OS	Gate drive for external SCR
8	V_{CC}	Power supply input circuitry

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{CC}	20	V
Supply Current	I_{CC}	8	mA
Power Dissipation	P_D	300	mW
Operating Temperature	T_A	-25 ~ +80	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Current (Note 2)	I_{CC}	V_{CC}=12V, V_R=OPEN V_{IN}=2V See Test Circuit Figure 1	300	400	530	μA
Trip Voltage	V_T	V_{CC}=16V, V_R=2V~2.02V V_{IN}=2V See Test Circuit Figure 2	14	16	18	mVrms
Differential Amplifier Current Current 1	$I_{O(D)}$	V_{CC}=16V, V_R-V_I=30mV V_{OD}=1.2V See Test Circuit Figure 4	-12	-18	-30	μA
Differential Amplifier Current Current 2		V_{CC}=16V, V_R=0.8V, V_R V_I Short=V_P See Test Circuit Figure 5	15	25	35	μA
Output Current	I_O	V_{SC}=1.4V, V_{OS}=0.8V, V_{CC}=16V See Test Circuit Figure 6	200	350	800	μA
Latch-On Voltage	$V_{SC(ON)}$	V_{CC}=16V See Test Circuit Figure 7	0.7	1.0	1.4	V
Latch Input Current	$I_{SC(ON)}$	V_{CC}=16V See Test Circuit Figure 8	-18	-7	-1	μA
Output Low Current	I_{OSL}	V_{CC}=12V, V_{OSL}=0.2V See Test Circuit Figure 9	100	500	1000	μA
Differential Input Clamp Voltage	V_{IDC}	V_{CC}=16V, I_{IDC}=100mA See Test Circuit Figure 10	0.4	1.2	2.0	V
Maximum Current Voltage	V_{SM}	I_{SM}=7mA See Test Circuit Figure 11	22	26	30	V
Supply Current 2	I_{S2}	V_{CC}=12V, V_{OSL}=0.6V See Test Circuit Figure 12	200	400	900	μA
Latch-Off Supply Voltage	V_{SOFF}	V_{OS}=12V, V_{SC}=1.8V I_{IDC}=100mA See Test Circuit Figure 13	7.5	9.0		V
Response Time	t_{ON}	V_{CC}=16V, V_R-V_I=0.3V, 1V < V_X < 5V See Test Circuit Figure 14	2	3	4	ms

Notes: 1. Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.
2. Guaranteed by design, not tested in production.

■ TEST CIRCUITS

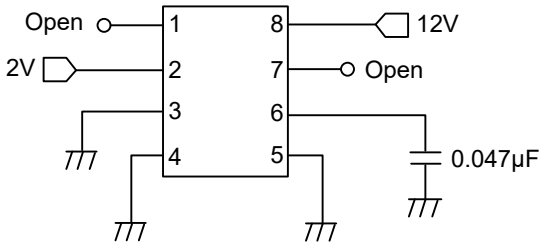


Figure 1. Supply Current 1

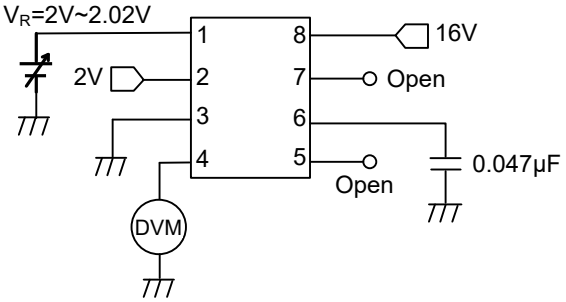


Figure 2. Trip Voltage

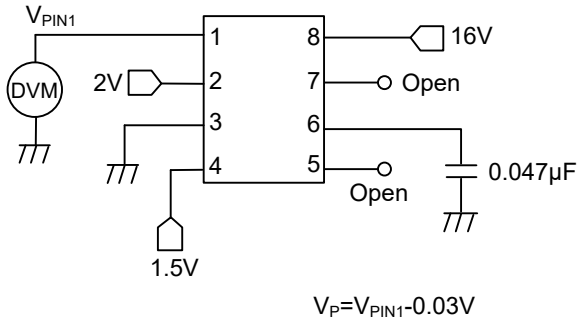


Figure 3. VPN1 for VP Measurement

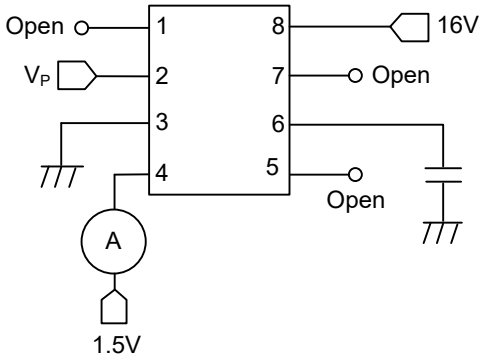


Figure 4. Differential Amplifier Output Current 1

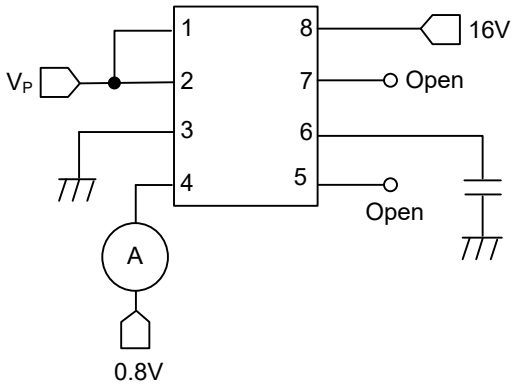


Figure 5. Differential Amplifier Output Current 2

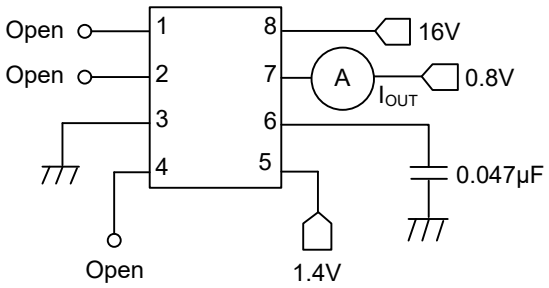


Figure 6. Output Current

■ TEST CIRCUITS

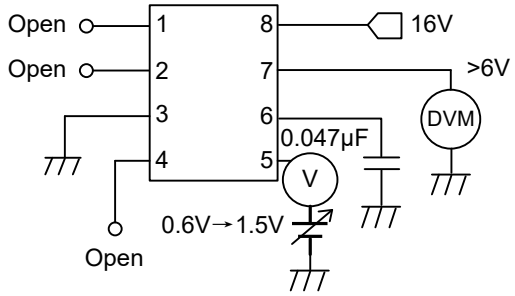


Figure 7. Latch-On Voltage

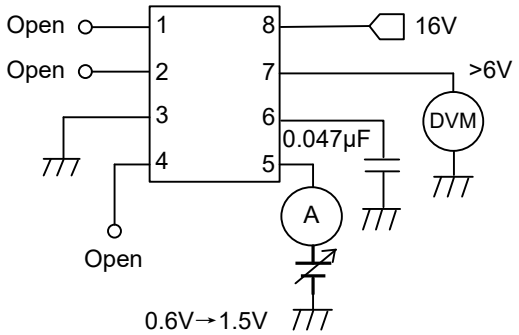


Figure 8. Latch Input Current

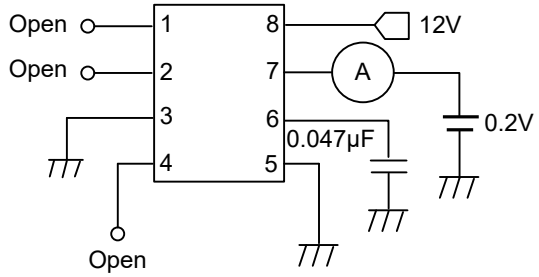


Figure 9. Output Low Current

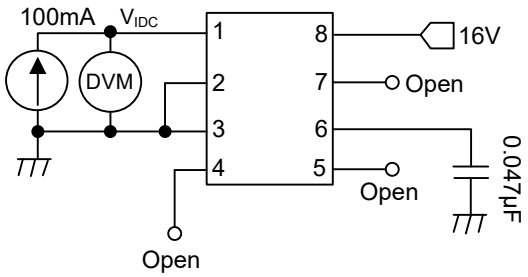


Figure 10. Differential Input Clamp Voltage

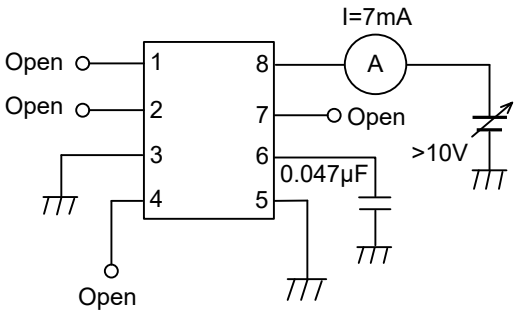


Figure 11. Maximum Current Voltage

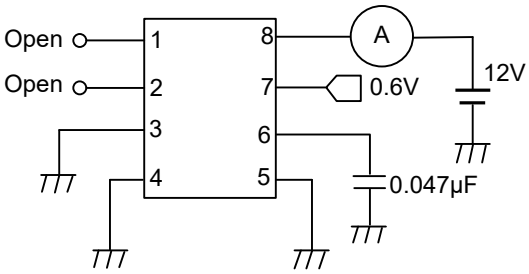


Figure 12. Supply Current 2

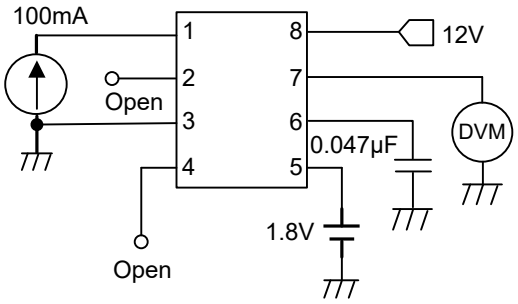


Figure 13. Latoh-Off Supply Voltage

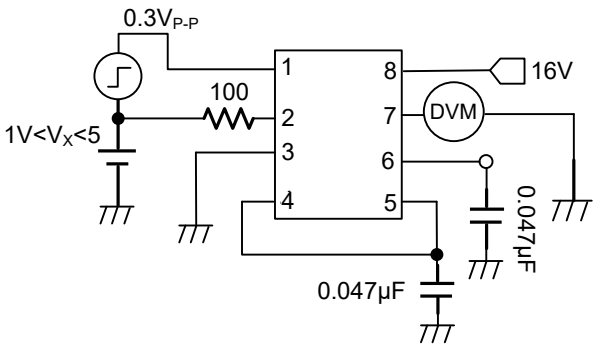


Figure 14. Response Time

■ APPLICATION INFORMATION

Figure 15 shows the **MA2803** connected in a typical leakage current detector system. The power is applied to the V_{CC} terminal (Pin 8) directly from the power line. The resistor RS and capacitor C_S are chosen so that Pin 8 voltage is at least 12 V. The value of C_S is recommended above 1 F. 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 **MA2803** internal circuit and appears as a 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 RL should be selected so that the breaker satisfies the required sensing current. The protection resistor RP is not usually used when high current is injected at the breaker; this resistor should be used to protect the earth leakage detector IC (**MA2803**). The range of RP is from several hundred to several k.

Capacitor C_1 is for the noise canceller and a standard value of C_1 is 0.047μF. Capacitor C_2 is also a noise canceller capacitance, but it is not usually used.

When high noise is present, a 0.047μF capacitor may be connected between Pins 6 and 7. The amplified signal finally appears at the Pin 7 with pulse signal through the internal latch circuit of the **MA2803**. This signal drives the gate of the external SCR, which energizes the trip coil, which opens the circuit breaker. The trip time of the breaker is determined by capacitor C3 and the mechanism breaker. This capacitor should be selected under 1μF to satisfy the required trip time. The full-wave bridge supplies power to the **MA2803** during both the positive and negative half cycles of the line voltage. This allows the hot and neutral lines to be interchanged.

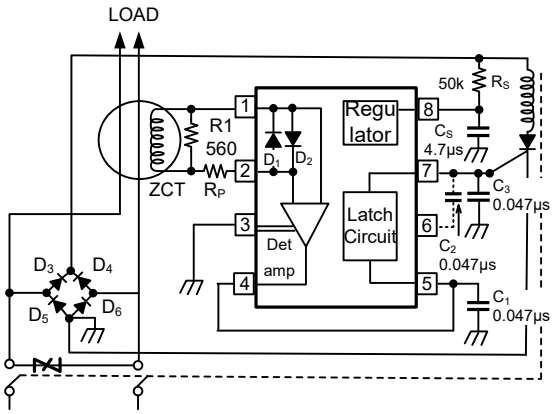


Figure 15. Full-wave Application Circuit

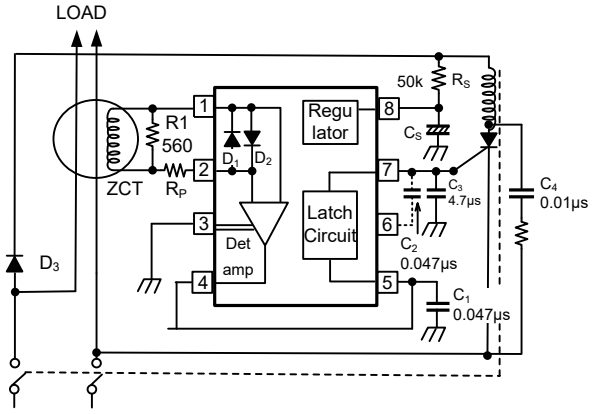


Figure 16. Half-wave Application Circuit