

LM1801 Smoke Detector

General Description

The LM1801 is designed to provide the functions of an ionization type smoke detector as specified by UL217. Though primarily designed to operate from a 9V alkaline battery, provision is made for operation at supplies up to 14V and for line operation.

Low battery threshold, alarm threshold, hysteresis and stand-by current drain are externally programmed by resistors. The LM1801 includes a power transistor capable of directly driving a typical 85 dB horn. The ionization chamber requires an external FET buffer.

A parallel alarm output is provided to enable up to 8 similar detectors to be connected in parallel. In this mode, a fault on the line cannot prevent local operation. The low battery alarm signal is confined to the local unit.

A 6V regulated output is provided for the chamber and FET supply and a second output with a different temperature coefficient is available for the alarm threshold potentiometer. This allows compensation of JFET drift.

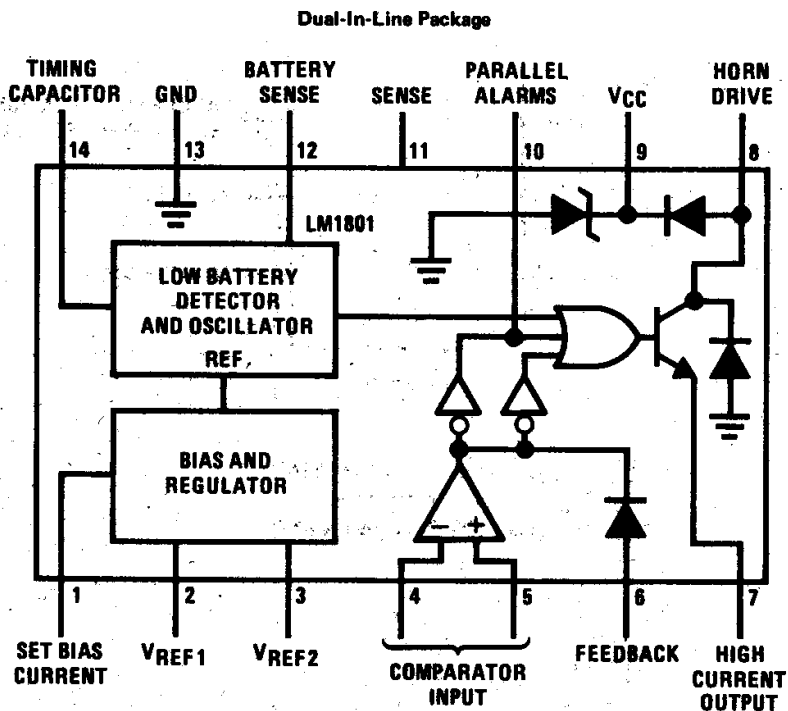
Features

- UL component recognized
- 9V to 14V operation
- Direct drive to horn
- Clamp diodes on chip
- Internal zener for line operation
- JFET and MOSFET compatible
- Parallel alarm capability
- Low stand-by current drain

Applications

- Domestic smoke detectors
- Line operated smoke detectors
- Gas detectors
- Intrusion alarms
- Battery operated detectors

Block and Connection Diagram



Order Number LM1801N
See NS Package N14A

Absolute Maximum Ratings

Supply Voltage	14V
Input Voltage	-0.3V to 14V
Input Differential Voltage	±14V
Power Dissipation (Note 1)	300 mW
Operating Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +125°C
Lead Temperature (Soldering, 10 seconds)	300°C

Electrical Characteristics (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Comparator					
Input Offset Voltage			3	15	mV
Input Bias Current			3	10	nA
Input Offset Current			0.5	3	nA
Pin 6 Output Low	I _{SINK} = 100 μA		1.5	2.0	V
Output Stage (Pin 8)					
Leakage Current			45	500	nA
Saturation Voltage	I _g = 200 mA		0.9	1.3	V
Saturation Voltage	I _g = 500 mA		1.8		V
Common Alarm Line (Pin 10)					
Drive Capabilities					
Output Voltage High	V ₄ > V ₅	6.0	6.5		V
Output Current	V ₁₀ = 0.0V	4.0	6.5		mA
Driver Requirements					
Input Voltage	V ₅ > V ₄		3.6		V
Input Current	V ₈ = 1.5V, I _g = 200 mA		0.4		mA
Regulator					
Pin 2 Reference Voltage	I ₂ = 1 μA	5.4	5.8	6.4	V
Temperature Coefficient			5		mV/°C
Pin 3 Reference Voltage	I ₂ = I ₃ = 1 μA	4.8	5.3	5.8	V
Temperature Coefficient			7		mV/°C
Battery Check Oscillator					
Threshold Voltage (Pin 12)		5.5	6.0	6.5	V
Period	V _{CC} = 7.5V, C ₁ = 10 μF	28	42	50	Sec
Beep Pulse Width	V _{CC} = 7.5V, C ₁ = 10 μF		30		ms
Supply Current (Note 3)			7	9	μA
Zener Clamp Voltage, V ₉	I _g = 1 mA	14	14.5	17	V

Note 1: For operating at elevated temperatures, the device must be derated based on a 125°C maximum junction temperature and a thermal resistance of 187°C/W junction to ambient.

Note 2: R_{SET} = 10 MΩ, V_{CC} = 9V, T_A = 25°C, (Figure 1).

Note 3: Stand-by mode. JFET is biased for I_{DS} = 1 μA.

Application Hints

The LM1801 is biased by a group of current sources which are controlled externally by a fixed resistor. In normal operation the stand-by current drain is nominally 6 times the set current at pin 1. The voltage at pin 1 is 2 diode drops below the positive supply voltage. The total stand-by current drain of the smoke detector will include, in addition to the above, the current drawn by the external circuits connected at pins 2, 3 and 12. These comprise the resistive dividers used to set the low battery threshold and alarm threshold plus the bias current in the ionization chamber and FET buffer.

The low battery threshold is set by R1 and R2 (Figure 1). Select these values so that the voltage at pin 12 is equal to the oscillator trip voltage when the battery voltage is

at the low limit at which the low battery alarm is to operate. The given values provide a warning at about 8.2V.

Hysteresis can be provided by R5, giving an added degree of noise immunity in high noise environments.

Figure 2 is a suggested PC board layout for the circuit of Figure 1.

Parallel operation of 2 or more units is easily achieved with a pair of wires connecting pin 10 of each unit and ground. In this mode, every alarm will sound should any single unit detect smoke.

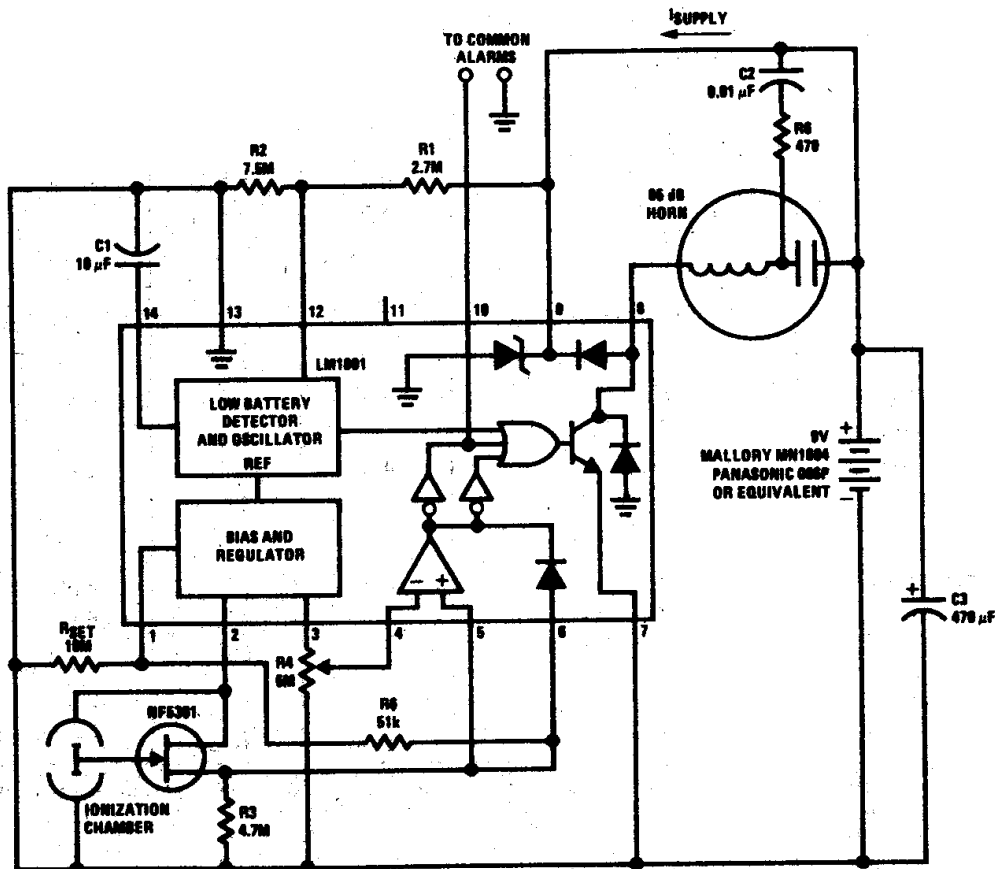


FIGURE 1. 9V Battery Operated Ionization Type Smoke Detector

Application Hints (Continued)

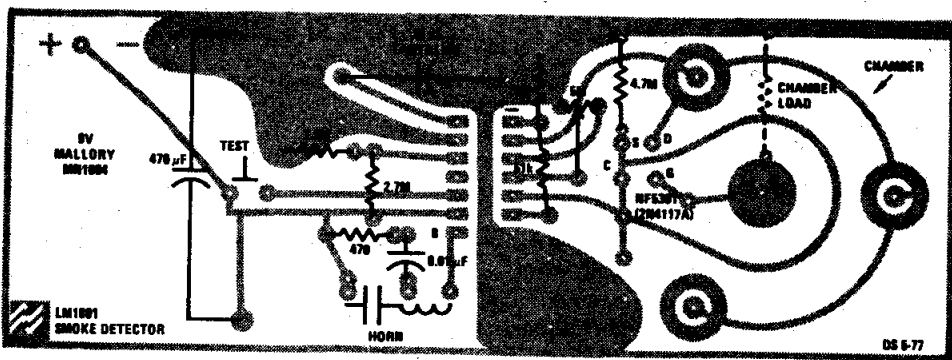


FIGURE 2. Smoke Detector PC Board Layout (Not to Scale)

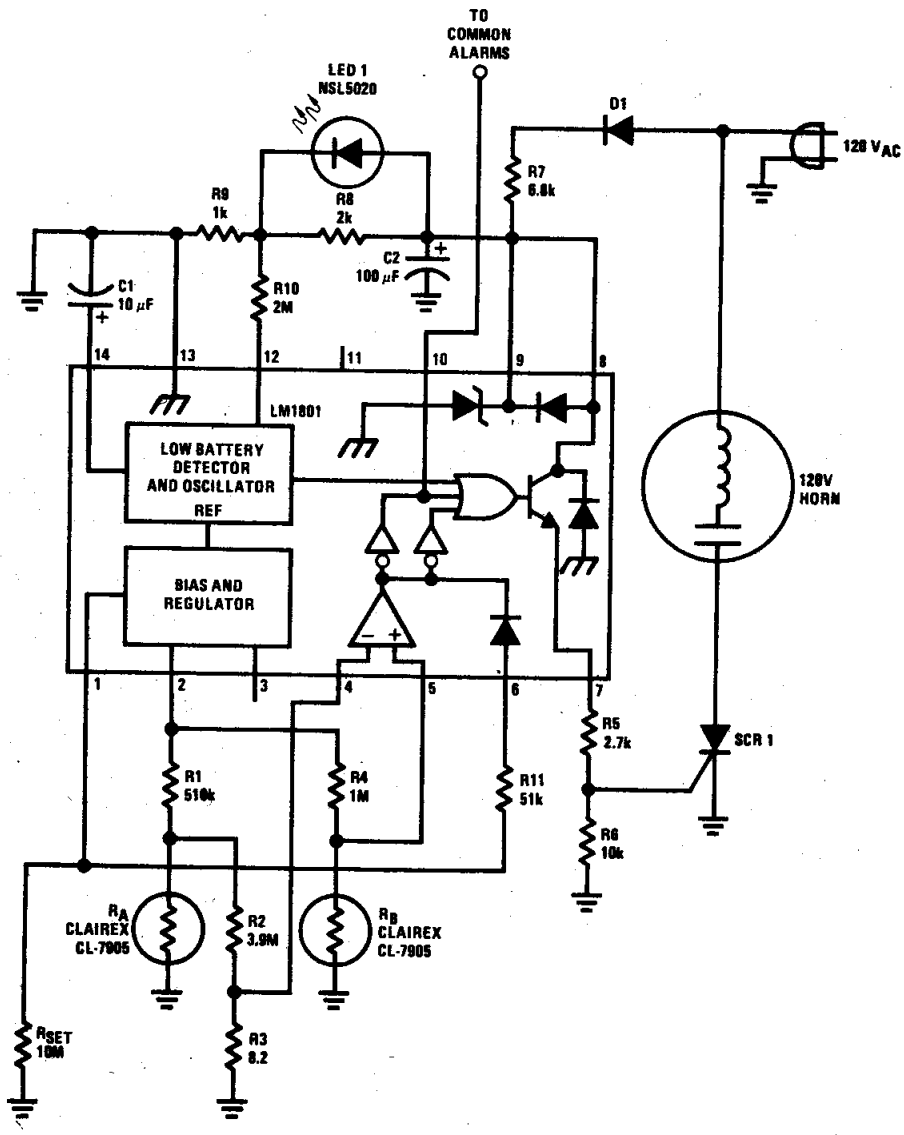


FIGURE 3. Line-Operated Photo-Electric Smoke Alarm Using Light Sensitive Resistor (Includes Detection of Open-Circuited LED)