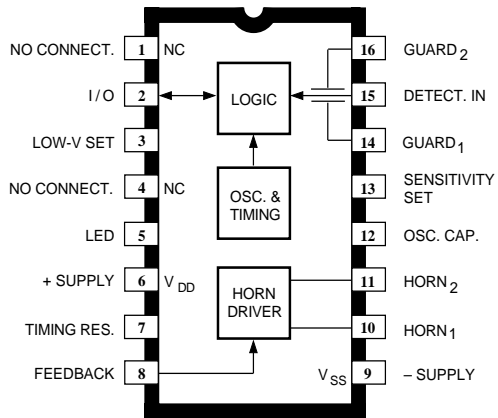


5354

SMOKE DETECTOR WITH INTERCONNECT



Rev. 02-014.1

ABSOLUTE MAXIMUM RATINGS (Voltages are referenced to V_{SS})

| | |
|--------------------------------|----------------------------|
| Supply Voltage Range, | |
| V_{DD} | -0.5 V to +15 V |
| Reverse Battery (10.5 V) | 20 s |
| Input Voltage Range, | |
| V_{IN} | -0.3 V to $V_{DD} + 0.3$ V |
| Input Current, I_{IN} | 10 mA |
| Operating Temperature Range, | |
| T_A | 0°C to +50°C |
| Storage Temperature Range, | |
| T_S | -55°C to +125°C |

CAUTION: CMOS devices have input static protection but are susceptible to damage when exposed to extremely high static electrical charges.

The A5354CA is a low-current, CMOS circuit providing all of the required features for an ionization-type smoke detector. A networking capability allows as many as 125 units to be interconnected so that if any unit senses smoke, all units will sound an alarm. In addition, special features are incorporated to facilitate alignment and test of the finished smoke detector. This device is designed to comply with Underwriters Laboratories Specification UL217.

The internal oscillator and timing circuitry keeps standby power to a minimum by powering down the device for 1.66 seconds and sensing smoke for only 10 ms. Every 24 on/off cycles, a check is made for low battery condition. By substituting other types of sensors, or a switch for the ionization detector, this very-low power device can be used in numerous other battery-operated safety/security applications.

The A5354CA is supplied in a low-cost, 16-pin dual in-line plastic package. It is rated for continuous operation over the temperature range of 0°C to +50°C. Similar devices, with an internal timer to allow for a period of reduced sensitivity ("hush"), are available as the A5348CA.

FEATURES

- Interconnect Up to 125 Detectors
- Piezoelectric Horn Driver
- Guard Outputs for Detector Input
- Pulse Testing for Low Battery
- Power-ON Reset
- Internal Reverse Battery Protection
- Built-In Hysteresis Reduces False Triggering

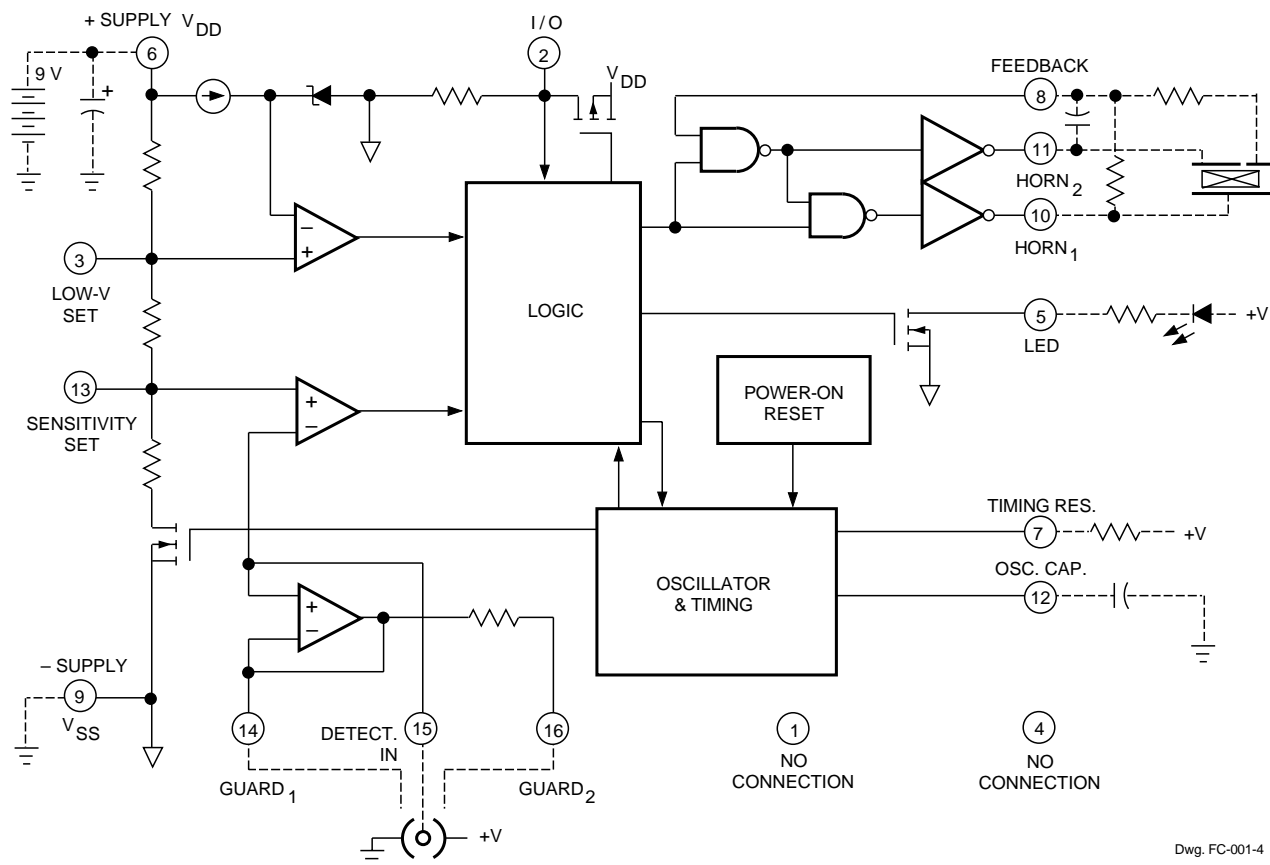
Always order by complete part number: **A5354CA**.

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SMOKE DETECTOR

with INTERCONNECT

FUNCTIONAL BLOCK DIAGRAM AND TYPICAL APPLICATION



5354

SMOKE DETECTOR

with INTERCONNECT

ELECTRICAL CHARACTERISTICS at $T_A = +25^{\circ}\text{C}$, $V_{DD} = 9.0\text{ V}$, $V_{SS} = 0\text{ V}$, $C_{12} = 0.1\text{ }\mu\text{F}$, $R_7 = 8.2\text{ M}\Omega$ (unless otherwise noted).

| Characteristic | Test Pin | Test Conditions | Limits | | | |
|----------------------------|----------|---|--------|------|----------------|------------|
| | | | Min. | Typ. | Max. | Units |
| Supply Voltage Range | 6 | Operating | 6.0 | 9.0 | 12 | V |
| Detector Input Current | 15 | 0 to 40% RH, $V_{IN} = 0$ to 9.0 V | — | — | ± 1.0 | pA |
| Input Offset Voltage | 14-15 | Active Guard | — | — | ± 100 | mV |
| | 16-15 | Active Guard | — | — | ± 100 | mV |
| | 15-13 | Detect Comparator | — | — | ± 50 | mV |
| Hysteresis | 13 | No Alarm to Alarm | 90 | 130 | 170 | mV |
| Common Mode Range | 14-15 | Guard Amplifier | 2.0 | — | $V_{DD} - 0.5$ | V |
| | 13-15 | Smoke Comparator | 0.5 | — | $V_{DD} - 2.0$ | V |
| Active Guard Impedance | 14 | to V_{SS} | — | 10 | — | k Ω |
| | 16 | to V_{SS} | — | 500 | — | k Ω |
| Oscillator Period | 12 | No Alarm | 1.34 | 1.67 | 2.00 | s |
| | | Alarm | 32 | 40 | 48 | ms |
| Oscillator Pulse Width | 12 | | 8.0 | 10 | 12 | ms |
| Low Voltage Threshold | 6 | $T_A = 0^{\circ}\text{C}$ to 50°C | 7.2 | — | 7.8 | V |
| Sensitivity Adjust Voltage | 13 | V_{13}/V_{DD} , pin 13 open circuit | 48.5 | 50 | 51.5 | % |
| Horn Output Voltage | 10-11 | $I_{OUT} = 16\text{ mA}$, $V_{DD} = 9.0\text{ V}$ | — | 0.1 | 0.5 | V |
| | | $I_{OUT} = 16\text{ mA}$, $V_{DD} = 7.2\text{ V}$ | — | — | 0.9 | V |
| | | $I_{OUT} = -16\text{ mA}$, $V_{DD} = 9.0\text{ V}$ | 8.5 | 8.8 | — | V |
| | | $I_{OUT} = -16\text{ mA}$, $V_{DD} = 7.2\text{ V}$ | 6.3 | — | — | V |
| Horn Output ON Time | 10-11 | Alarm | 120 | 160 | 208 | ms |
| | | Low Battery | 8.0 | 10 | 12 | ms |
| Horn Output OFF Time | 10-11 | Alarm | 60 | 80 | 104 | ms |
| | | Low Battery | 32 | 40 | 48 | s |
| LED Output ON Current | 5 | $V_{DD} = 7.2\text{ V}$, $V_{OUT} = 1.0\text{ V}$ | 10 | — | — | mA |
| LED Output ON Time | 5 | | 8.0 | 10 | 12 | ms |
| LED Output OFF Time | 5 | No Alarm, In Standby | 32 | 40 | 48 | s |

Continued next page . . .

NOTE 1: Negative current is defined as coming out of (sourcing) the specified device pin.

NOTE 2: Alarm (Smoke) Condition is defined as $V_{15} < V_{13}$; No Alarm (No Smoke) Condition as $V_{15} > V_{13}$.

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SMOKE DETECTOR

with INTERCONNECT

ELECTRICAL CHARACTERISTICS continued

| Characteristic | Test Pin | Test Conditions | Limits | | | |
|-------------------|----------|---|--------|------|------|---------------|
| | | | Min. | Typ. | Max. | Units |
| I/O Current | 2 | No Alarm, $V_{I/O} = V_{DD} - 2.0 \text{ V}$ | 25 | — | 60 | μA |
| | | Alarm, $V_{I/O} = V_{DD} - 2.0 \text{ V}$ | -7.5 | — | — | mA |
| I/O Alarm Voltage | 2 | External "Alarm" In | 3.0 | — | — | V |
| I/O Delay | 2 | "Alarm" Out | — | 3.0 | — | s |
| Supply Current | 6 | $V_{DD} = 9.0 \text{ V}$, No Alarm, No Loads | — | 5.0 | 9.0 | μA |
| | | $V_{DD} = 12 \text{ V}$, No Alarm, No Loads | — | — | 12 | μA |

NOTE 1: Negative current is defined as coming out of (sourcing) the specified device pin.

NOTE 2: Alarm (Smoke) Condition is defined as $V_{15} < V_{13}$; No Alarm (No Smoke) Condition as $V_{15} > V_{13}$.

CIRCUIT DESCRIPTION

The A5354CA is a low-current CMOS circuit providing all of the required features for an ionization-type smoke detector.

Oscillator. An internal oscillator operates with a period of 1.67 seconds during no-smoke conditions. Every 1.67 seconds, internal power is applied to the entire circuit and a check is made for smoke. Every 24 clock cycles (40 seconds), the LED is pulsed and a check is made for low battery by comparing V_{DD} to an internal reference. Because very-low currents are used in the device, the oscillator capacitor at pin 12 should be a low-leakage type (PTFE, polystyrene, or polypropylene).

Detector Circuitry. When smoke is detected, the resistor divider network that sets the sensitivity (smoke trip point) is altered to increase the sensitivity set voltage (pin 13) by typically 130 mV with no external connections to pins 3 or 13. This provides hysteresis and reduces false triggering. An active guard is provided on both pins adjacent to the detector input (pin 15). The voltage at pins 14 and 16 will be within 100 mV of the

input. This will keep surface leakage currents to a minimum and provide a method of measuring the input voltage without loading the ionization chamber. The active guard amplifier is not power strobed and thus provides constant protection from surface leakage currents. The detector input has internal diode protection against static damage.

Alarm Circuitry. If smoke is detected, the oscillator period changes to 40 ms and the horn is enabled. The horn output is typically 160 ms ON, 80 ms OFF. During the OFF time, smoke is again checked and will inhibit further alarm output if smoke is not sensed. During smoke conditions the low battery alarm is inhibited and the LED is driven at a 1 Hz rate.

Sensitivity Adjust. The detector sensitivity to smoke is set internally by a voltage divider connected between V_{DD} and V_{SS} . The sensitivity can be externally adjusted to the individual characteristics of the ionization chamber by connecting a resistor between pin 13 and V_{DD} , or between pin 13 and V_{SS} .

Low Battery. The low battery threshold is set internally by a voltage divider connected between V_{DD} and V_{SS} . The threshold can be increased by connecting a resistor between pin 3 and V_{DD} . The threshold can be decreased by connecting a resistor between pin 3 and V_{SS} . The battery voltage level is checked every 40 seconds during the 10 mA, 10 ms LED pulse. If an LED is not used, it should be replaced with an equivalent resistor (typically 500 Ω to 1000 Ω) such that the battery loading remains at 10 mA.

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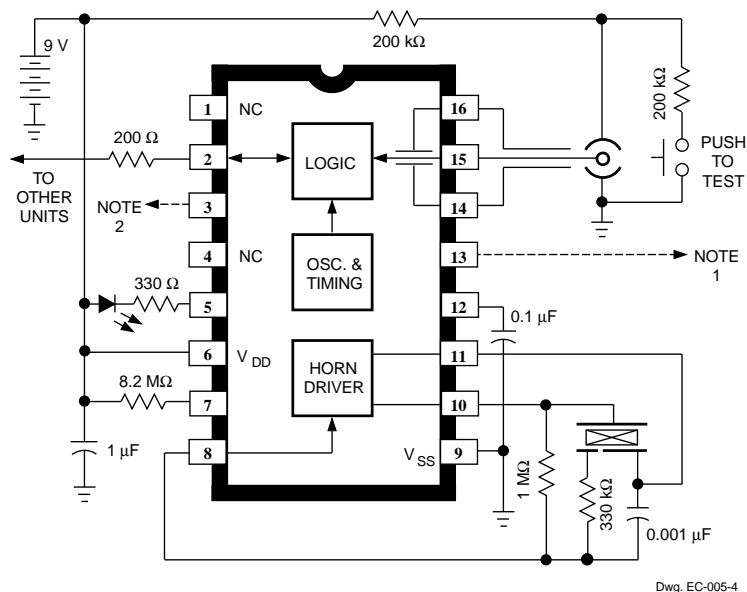
SMOKE DETECTOR

with INTERCONNECT

TYPICAL APPLICATION

I/O. A connection is provided at pin 2 to allow multiple smoke detectors to be commoned. If any single unit detects smoke (I/O is driven high), all connected units will sound their associated horns after a nominal 3 second delay. The LED is suppressed when an alarm is signaled from an interconnected unit.

Testing. On power up, all internal counters are reset. Internal test circuitry allows for low battery check by holding pins 8 and 12 low during power up, then reducing V_{DD} and monitoring HORN₁ (pin 10). All functional tests can be accelerated by driving pin 12 with a 2 kHz square wave. The 10 ms strobe period must be maintained for proper operation of the comparator circuitry.

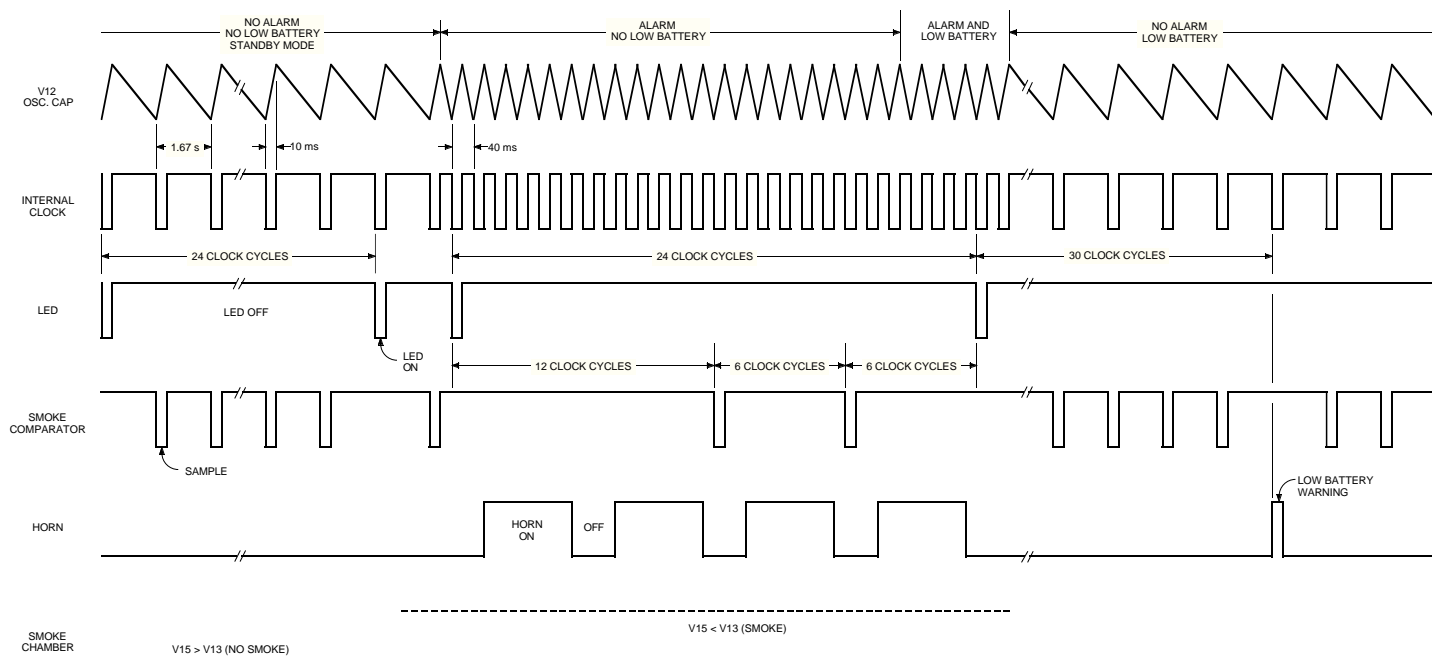


Dwg. EC-005-4

NOTE 1: An external resistor divider is used to adjust sensitivity for the particular smoke chamber.

NOTE 2: A resistor to ground or V_{DD} may be added to this pin to modify low battery voltage threshold.

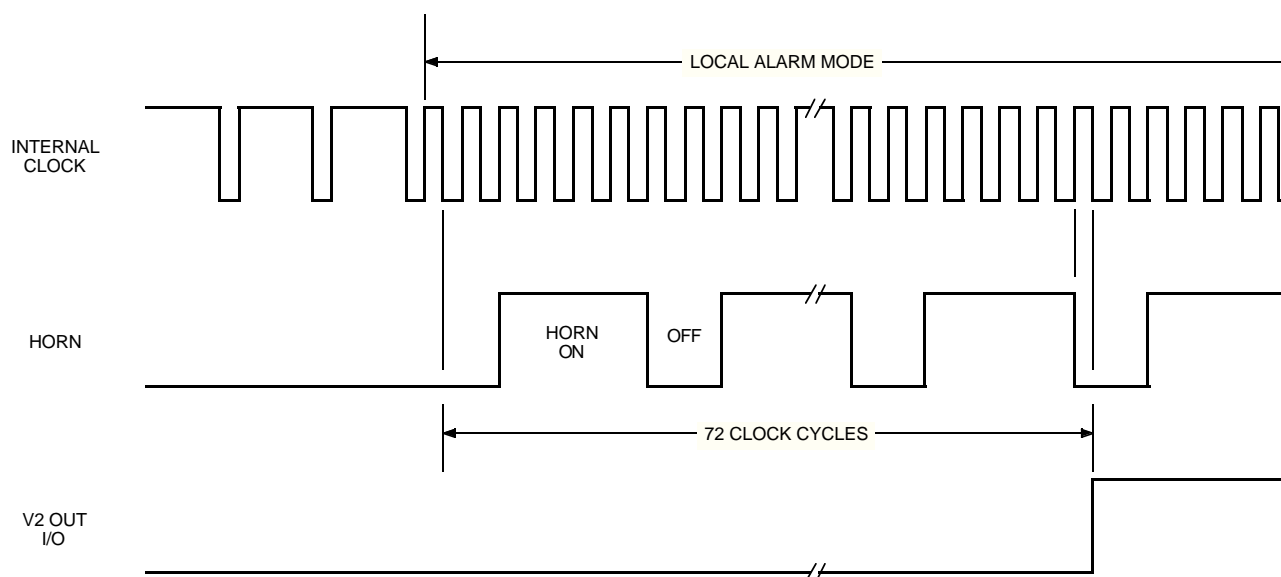
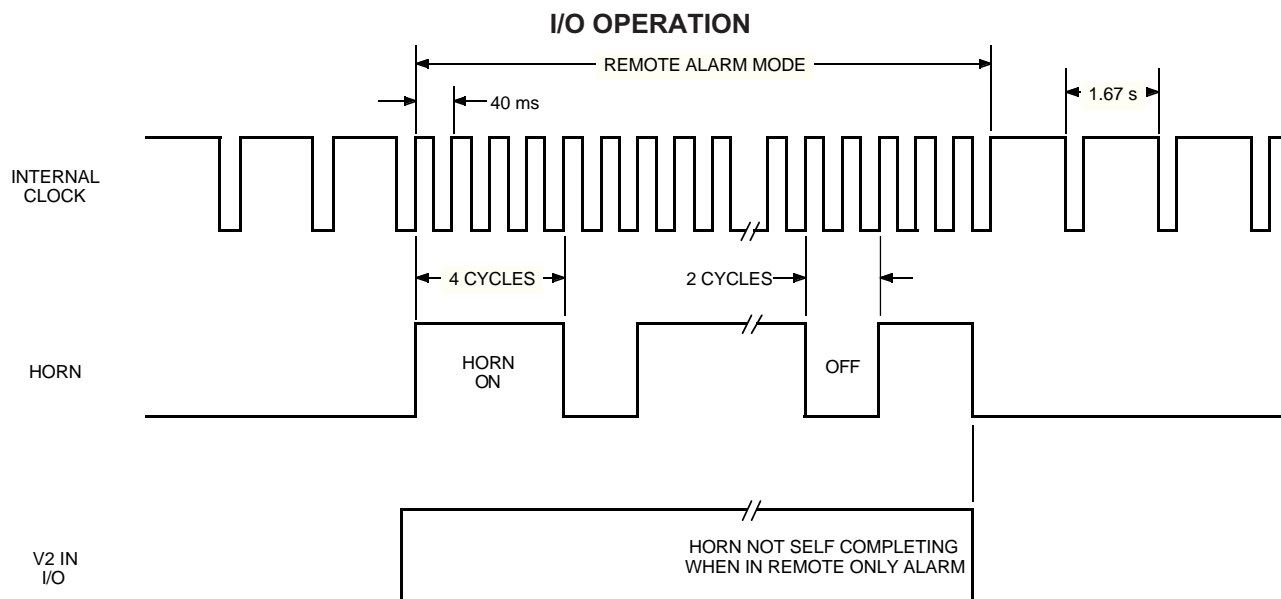
TIMING DIAGRAMS IN TYPICAL APPLICATION



5354

SMOKE DETECTOR

with INTERCONNECT



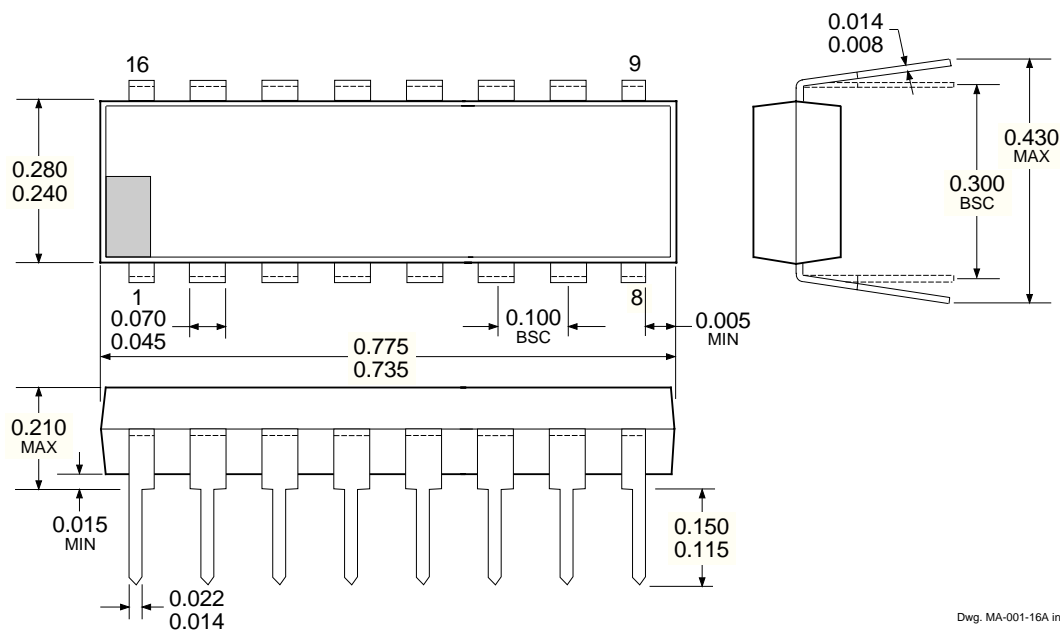
Dwg. WC-004

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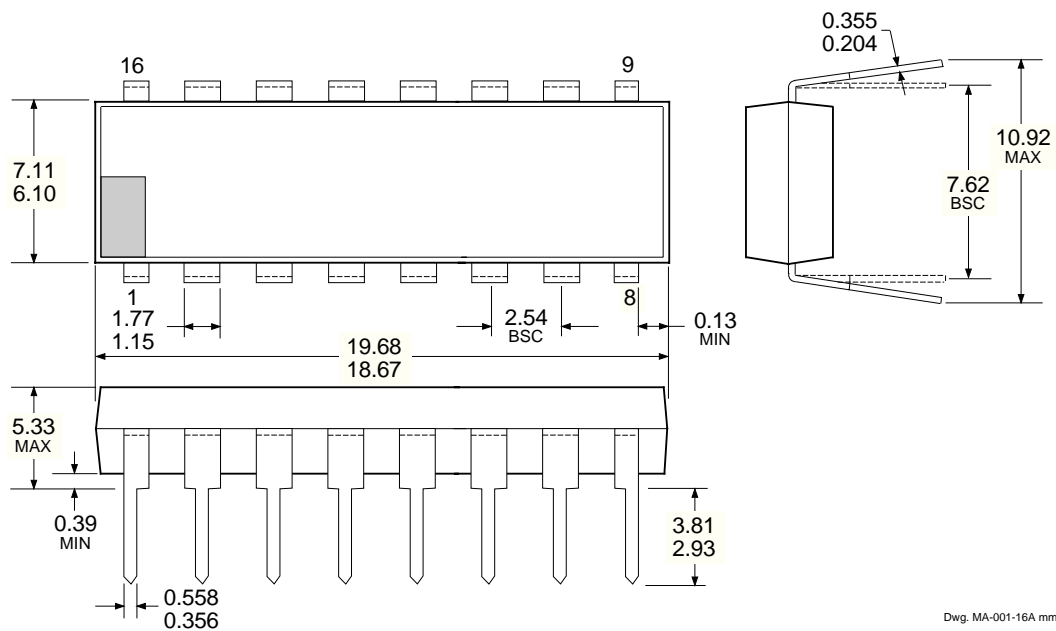
SMOKE DETECTOR

with INTERCONNECT

Dimensions in Inches (controlling dimensions)



Dimensions in Millimeters (for reference only)



- NOTES:
1. Lead thickness is measured at seating plane or below.
 2. Lead spacing tolerance is non-cumulative.
 3. Exact body and lead configuration at vendor's option within limits shown.

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SMOKE DETECTOR
with INTERCONNECT

SAFETY & SECURITY ICs
SELECTION GUIDE

| Part Number | Function |
|-------------|---|
| A3054KU/SU | Multiplexed Two-Wire Hall-Effect Sensor |
| A5347CA | Ionization-Type Smoke Detector with Interconnect and Timer |
| A5348CA | Ionization-Type Smoke Detector with Interconnect, Timer, and Reverse-Battery Protection |
| A5349CA | Ionization-Type Smoke Detector with Interconnect and Timer for AC Line Operation |
| A5354CA | Ionization-Type Smoke Detector with Interconnect and Reverse-Battery Protection |
| A5355CA | Ionization-Type Smoke Detector with Interconnect and Reverse-Battery Protection |
| A5358CA | Photoelectric-Type Smoke Detector with Interconnect and Timer |

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