

## CMOS Photoelectric Smoke Detector ASIC with Interconnect and Timer Mode

### Features:

- Internal Power On Reset
- Low Quiescent Current Consumption
- ESD Protection on all Pins
- Interconnect up to 40 Detectors
- 10 Minute Timer for Sensitivity Control
- Temporal Horn Pattern
- Internal Low Battery and Chamber Test
- Compatible with Allegro A5366
- Alternate Diagnostic Mode
- UL Recognized per File S24036

### General Description:

The RE46C145 is a low-power, CMOS photoelectric-type smoke detector IC. With minimal external components, this circuit will provide all the required features for a photoelectric-type smoke detector.

The design incorporates a gain-selectable photo amplifier for use with an infrared emitter/detector pair.

An internal oscillator strobes power to the smoke detection circuitry for 100  $\mu$ s every 10 seconds to keep standby current to a minimum. If smoke is sensed, the detection rate is increased to verify an Alarm condition. A High Gain mode is available for push button chamber testing.

In diagnostic mode, the photo amplifier output is available on pin 15 for production calibration of the photo chamber.

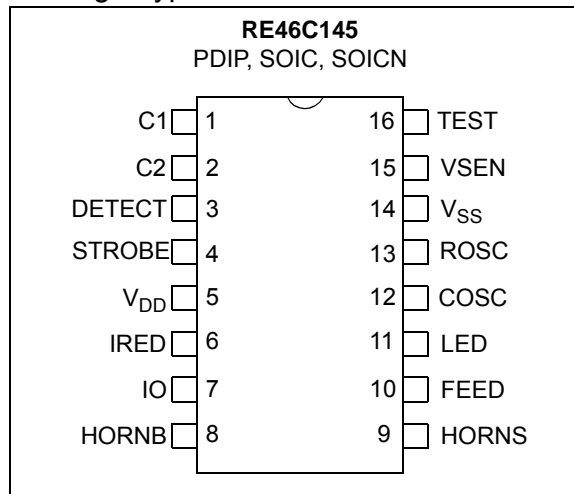
When in Standby, a check for a low battery condition and chamber integrity is performed every 43 seconds. The temporal horn pattern supports the NFPA 72 emergency evacuation signal.

An interconnect pin allows multiple detectors to be connected such that when one units alarms, all units will sound.

An internal 10 minute timer can be used for a reduced sensitivity mode.

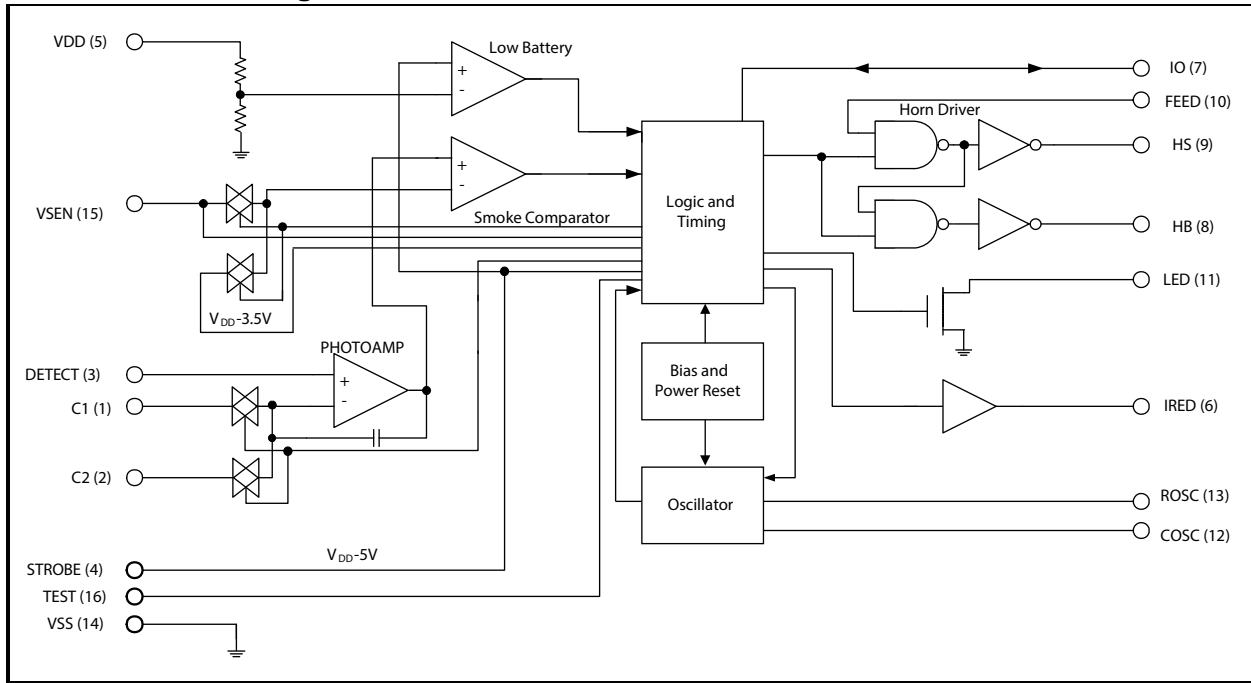
The RE46C145 is recognized by Underwriters Laboratories for use in smoke detectors that comply with specification UL217 and UL268.

### Package Types

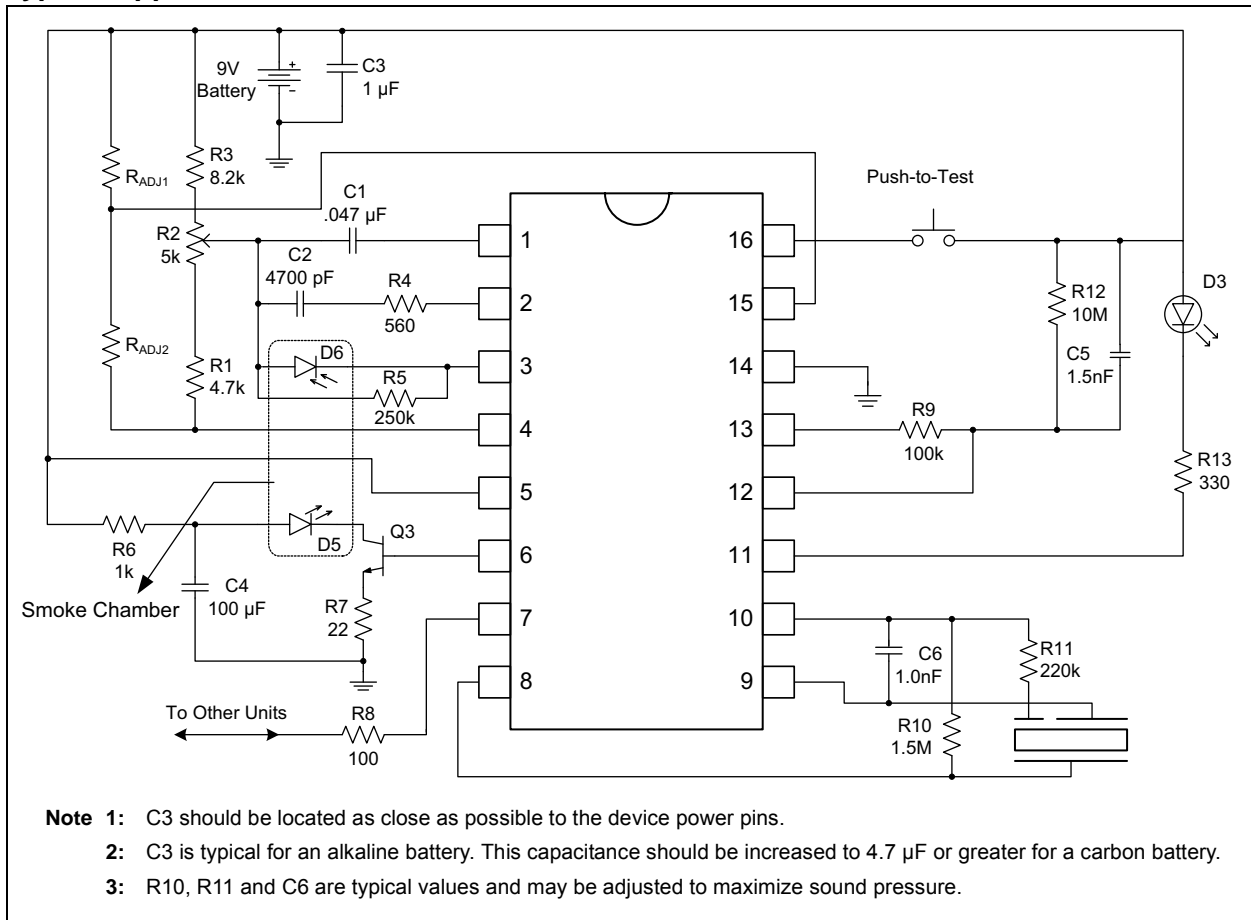


# RE46C145

## Functional Block Diagram



## Typical Application



## 1.0 ELECTRICAL CHARACTERISTICS

### 1.1 Absolute Maximum Ratings†

|  |                                    |
|--|------------------------------------|
| $V_{DD}$ .....                           | 15V                                |
| Input Voltage Range Except FEED, IO..... | $V_{IN} = -3V$ to $V_{DD} +.3V$    |
| FEED Input Voltage Range.....            | $V_{INFD} = -10$ to $+22V$         |
| IO Input Voltage Range.....              | $V_{IO1} = -.3$ to $15V$           |
| Input Current except FEED.....           | $I_{IN} = 10$ mA                   |
| Operating Temperature.....               | $T_A = -25$ to $+75^{\circ}C$      |
| Storage Temperature.....                 | $T_{STG} = -55$ to $+125^{\circ}C$ |
| Maximum Junction Temperature.....        | $T_J = +150^{\circ}C$              |

† **Notice:** Stresses above those listed under “Maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

## DC ELECTRICAL CHARACTERISTICS

**DC Electrical Characteristics:** Unless otherwise indicated, all parameters apply at  $T_A = -25^{\circ}C$  to  $+75^{\circ}C$ ,  $V_{DD} = 9V$

| Parameter          | Symbol    | Test Pin | Min | Typ | Max  | Units   | Conditions   |
|--------------------|-----------|----------|-----|-----|------|---------|--|
| Supply Voltage     | $V_{DD}$  | 5        | 6   | —   | 12   | V       | Operating  |
| Supply Current     | $I_{DD1}$ | 5        | —   | 4   | 6    | $\mu A$ | Configured as in <a href="#">Typical Application</a> , COSC = $V_{SS}$ , LED off                                   |
|                    | $I_{DD2}$ | 5        | —   | 5.5 | 8    | $\mu A$ | Configured as in <a href="#">Typical Application</a> , $V_{DD} = 12V$ , COSC = $V_{SS}$                            |
|                    | $I_{DD3}$ | 5        | —   | —   | 2    | mA      | Configured as in <a href="#">Typical Application</a> , STROBE on, IRED off, $V_{DD} = 12V$                         |
|                    | $I_{DD4}$ | 5        | —   | —   | 3    | mA      | Configured as in <a href="#">Typical Application</a> , STROBE on, IRED on, $V_{DD} = 12V$ , <a href="#">Note 1</a> |
| Input Voltage High | $V_{IH1}$ | 10       | 6.2 | —   | —    | V       | FEED   |
|                    | $V_{IH2}$ | 7        | 3.2 | —   | —    | V       | No Local Alarm, IO as Input  |
|                    | $V_{IH3}$ | 15       | 1.6 | —   | —    | V       | $V_{SEN}$  |
|                    | $V_{IH4}$ | 16       | 8.5 | —   | —    | V       | TEST   |
| Input Voltage Low  | $V_{IL1}$ | 10       | —   | —   | 2.7  | V       | FEED   |
|                    | $V_{IL2}$ | 7        | —   | —   | 1.5  | V       | No Local Alarm, IO as Input  |
|                    | $V_{IL3}$ | 15       | —   | —   | .5   | V       | $V_{SEN}$  |
|                    | $V_{IL4}$ | 16       | —   | —   | 7    | V       | TEST   |
| Input Leakage Low  | $I_{IL1}$ | 1,2,3    | —   | —   | -100 | nA      | $V_{DD} = 12V$ , COSC = $12V$ , STROBE active  |
|                    | $I_{IL2}$ | 10,12    | —   | —   | -100 | nA      | $V_{DD} = 12V$ , $V_{IN} = V_{SS}$   |
|                    | $I_{IL3}$ | 15,16    | —   | —   | -1   | $\mu A$ | $V_{DD} = 12V$ , $V_{IN} = V_{SS}$   |
|                    | $I_{LFD}$ | 10       | —   | —   | -50  | $\mu A$ | FEED = -10V  |

**Note 1:** Does not include Q3 emitter current.

**2:** Not production tested.

**3:** Typical values are for design information and are not ensured.

**4:** Limits over the specified temperature range are not production tested and are based on characterization data.

# RE46C145

## DC ELECTRICAL CHARACTERISTICS (CONTINUED)

| DC Electrical Characteristics: Unless otherwise indicated, all parameters apply at $T_A = -25^{\circ}\text{C}$ to $+75^{\circ}\text{C}$ , $V_{DD} = 9\text{V}$ |                     |          |               |            |               |                       |  |
|--|---------------------|----------|---------------|------------|---------------|-----------------------|--|
| Parameter  | Symbol              | Test Pin | Min           | Typ        | Max           | Units                 | Conditions   |
| Input Leakage High   | $I_{IH1}$           | 1,2      | —             | —          | 100           | nA                    | $V_{DD} = 12\text{V}$ , $V_{IN} = V_{DD}$ , STROBE active  |
|  | $I_{IH2}$           | 3,10,12  | —             | —          | 100           | nA                    | $V_{DD} = 12\text{V}$ , $V_{IN} = V_{DD}$  |
|  | $I_{HFD}$           | 10       | —             | —          | 50            | $\mu\text{A}$         | FEED = 22V   |
| Input Pull Down Current  | $I_{PD1}$           | 16       | .25           | —          | 10            | $\mu\text{A}$         | $V_{IN} = V_{DD}$  |
|  | $I_{PD2}$           | 15       | .1            | .25        | .5            | $\mu\text{A}$         | $V_{IN} = V_{DD}$  |
|  | $I_{PDIO1}$         | 7        | 20            | —          | 80            | $\mu\text{A}$         | $V_{IN} = V_{DD}$  |
|  | $I_{PDIO2}$         | 7        | —             | —          | 140           | $\mu\text{A}$         | $V_{IN} = 15\text{V}$ , $V_{DD} = 12$  |
| Output Leakage Current Low   | $I_{OZL1}$          | 11,13    | —             | —          | -1            | $\mu\text{A}$         | Output Off, Output = $V_{SS}$  |
| Output Leakage Current High  | $I_{OZH1}$          | 11,13    | —             | —          | 1             | $\mu\text{A}$         | Output Off, Output = $V_{DD}$  |
| Output Voltage Low   | $V_{OL1}$           | 8,9      | —             | —          | 1             | V                     | $I_{OL} = 16\text{ mA}$ , $V_{DD} = 6.5\text{V}$   |
|  | $V_{OL2}$           | 13       | —             | .5         | —             | V                     | $I_{OL} = 5\text{ mA}$ , $V_{DD} = 6.5\text{V}$  |
|  | $V_{OL3}$           | 11       | —             | —          | .6            | V                     | $I_{OL} = 10\text{ mA}$ , $V_{DD} = 6.5\text{V}$   |
| Output Voltage High  | $V_{OH1}$           | 8,9      | 5.5           | —          | —             | V                     | $I_{OL} = -16\text{ mA}$ , $V_{DD} = 6.5\text{V}$  |
| Output Current   | $I_{IOH1}$          | 7        | -4            | —          | -16           | mA                    | Alarm, $V_{IO} = V_{DD}-2\text{V}$ or $V_{IO} = 0\text{V}$                                       |
|  | $I_{IODMP}$         | 7        | 5             | —          | —             | mA                    | At Conclusion of Local Alarm or Test, $V_{IO} = 1\text{V}$                                       |
| Low Battery Alarm Voltage  | $V_{LB}$            | 5        | 6.9           | 7.2        | 7.5           | V                     |  |
| Output Voltage   | $V_{STOF}$          | 4        | $V_{DD}-1$    | —          | —             | V                     | STROBE off, $V_{DD} = 12\text{V}$ , $I_{OUT} = -1\text{ }\mu\text{A}$                            |
|  | $V_{STON}$          | 4        | $V_{DD}-5.25$ | $V_{DD}-5$ | $V_{DD}-4.75$ | V                     | STROBE on, $V_{DD} = 9\text{V}$ , $I_{OUT} = 100\text{ }\mu\text{A}$ to $500\text{ }\mu\text{A}$ |
|  | $V_{IREDOF}$        | 6        | —             | —          | .1            | V                     | IRED off, $V_{DD} = 12\text{V}$ , $I_{OUT} = 1\text{ }\mu\text{A}$                               |
|  | $V_{IREDON}$        | 6        | 2.85          | 3.1        | 3.35          | V                     | IRED on, $V_{DD} = 9\text{V}$ , $I_{OUT} = 0$ to $-6\text{ mA}$ , $T_A = +25^{\circ}\text{C}$    |
| Common Mode Voltage  | $V_{CM1}$           | 1,2,3    | .5            | —          | $V_{DD}-2$    | V                     | Local smoke, Push to Test or Chamber Test, <a href="#">Note 2</a>                                |
| Smoke Comparator Reference   | $V_{REF}$           | -        | $V_{DD}-3.7$  | —          | $V_{DD}-3.3$  | V                     | Internal Reference   |
| Temperature Coefficient  | $T_{CST}$           | 4        | —             | .01        | —             | %/ $^{\circ}\text{C}$ | $V_{DD} = 6\text{V}$ to $12\text{V}$ , STROBE Output Voltage                                     |
|  | $T_{CIRED}$         | 6        | —             | .3         | —             | %/ $^{\circ}\text{C}$ | $V_{DD} = 6\text{V}$ to $12\text{V}$ , IRED Output Voltage                                       |
| Line Regulation  | $\Delta V_{STON}$   | 4,5      | —             | -50        | —             | dB                    | Active, $V_{DD} = 6\text{V}$ to $12\text{V}$   |
|  | $\Delta V_{IREDON}$ | 6,5      | —             | -30        | —             | dB                    | Active, $V_{DD} = 6\text{V}$ to $12\text{V}$   |

**Note 1:** Does not include Q3 emitter current.

**2:** Not production tested.

**3:** Typical values are for design information and are not ensured.

**4:** Limits over the specified temperature range are not production tested and are based on characterization data.

## AC ELECTRICAL CHARACTERISTICS

**AC Electrical Characteristics:** Unless otherwise indicated, all parameters apply at  $T_A = -25^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$ ,  $V_{DD} = 9\text{V}$ ,  $V_{SS} = 0\text{V}$ , Component Values from [Typical Application](#);  $R_9 = 100\text{K}\Omega$ ,  $R_{12} = 10\text{M}\Omega$ ,  $C_5 = 1.5\text{nF}$

| Parameter                    | Symbol       | Test Pin | Min           | Typ   | Max  | Units         | Test Conditions  |
|------------------------------|--------------|----------|---------------|-------|------|---------------|--|
| Oscillator Period            | $T_{POSC}$   | 12       | 9.4           | 10.5  | 11.5 | ms            | No alarm condition   |
| LED and STROBE On Time       | $T_{ON1}$    | 11,4     | 9.4           | 10.5  | 11.5 | ms            | Operating  |
| LED Period                   | $T_{PLED1}$  | 11       | 39            | 43    | 47   | s             | Standby, no alarm  |
|                              | $T_{PLED2}$  | 11       | .45           | .5    | .55  | s             | Local alarm condition  |
|                              | $T_{PLED3}$  | 11       | 9.6           | 10.75 | 11.8 | s             | Timer mode, no local alarm   |
|                              | $T_{PLED4}$  | 11       | LED IS NOT ON |       |      | s             | Remote alarm only  |
| STROBE and IRED Pulse Period | $T_{PER1}$   | 4,6      | 9.6           | 10.75 | 11.8 | s             | Standby, no alarm  |
|                              | $T_{PER1A}$  | 4,6      | 1.8           | 2     | 2.2  | s             | Standby, after one valid smoke sample                              |
|                              | $T_{PER1B}$  | 4,6      | .9            | 1     | 1.1  | s             | Standby, after two consecutive valid smoke samples                 |
|                              | $T_{PER2}$   | 4,6      | .9            | 1     | 1.1  | s             | In Local Alarm (three consecutive valid smoke samples)             |
|                              | $T_{PER3}$   | 4,6      | 7.2           | 8     | 8.9  | s             | In Remote Alarm  |
|                              | $T_{PER4}$   | 4,6      | 300           | 336   | 370  | ms            | Push-button test   |
|                              | $T_{PER5}$   | 4,6      | 39            |       | 47   | s             | Chamber Test or Low Battery Test, no alarms                        |
| IRED On Time                 | $T_{ON2}$    | 6        | 94            | 104   | 115  | $\mu\text{s}$ | Operating  |
| Horn On Time                 | $T_{HON1}$   | 8,9      | 450           | 500   | 550  | ms            | Operating, alarm condition, <a href="#">Note 1</a>                 |
|                              | $T_{HON2}$   | 8,9      | 9.5           | 10.5  | 11.5 | ms            | Low Battery or Failed Chamber test, no alarm                       |
| Horn Off Time                | $T_{HOF1}$   | 8,9      | 450           | 500   | 550  | ms            | Operating, alarm condition, <a href="#">Note 1</a>                 |
|                              | $T_{HOF2}$   | 8,9      | 1.35          | 1.5   | 1.65 | s             | Operating, alarm condition, <a href="#">Note 1</a>                 |
|                              | $T_{HOF3}$   | 8,9      | 39            | 43    | 47   | s             | Low Battery or Failed Chamber test, no alarm                       |
| IO Charge Dump Duration      | $T_{IODMP}$  | 7        | .9            |       | 1.46 | s             | At the conclusion of the Local Alarm or Test                       |
| IO Delay                     | $T_{IODLY1}$ | 7        |               | 0     |      | s             | From start of Local Alarm to IO Active                             |
| IO Filter                    | $T_{IOFILT}$ | 7        |               |       | 600  | mSs           | IO pulse-width ensured to be filtered. IO as input, no local alarm |
| Remote Alarm Delay           | $T_{IODLY2}$ | 7        | 1.05          |       | 2.0  | s             | No local alarm, from IO Active to Horn Active                      |
| Timer Period                 | $T_{TPER}$   |          | 7             | 8.5   | 10   | Min           | No alarm condition, <a href="#">Note 2</a>                         |

**Note 1:** See timing diagram for Horn Temporal Pattern

**2:** During the Timer mode, the LED period is 10.5 seconds. The LED period will return to 43 seconds at the conclusion of the Timer mode.

**3:**  $T_{POSC}$  and  $T_{ON2}$  are 100% production tested. All other timing is ensured by functional testing.

**4:** Typical values are for design information and are not ensured.

# RE46C145

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## TEMPERATURE CHARACTERISTICS

| Electrical Specifications: Unless otherwise indicated, $V_{DD} = 9V$ , $V_{SS} = 0V$ |               |      |      |      |       |            |
|--|---------------|------|------|------|-------|------------|
| Parameters   | Sym.          | Min. | Typ. | Max. | Units | Conditions |
| <b>Temperature Ranges</b>  |               |      |      |      |       |            |
| Operating Temperature Range  | $T_A$         | -25  | —    | +75  | °C    |            |
| Storage Temperature Range  | $T_{STG}$     | -55  | —    | +125 | °C    |            |
| <b>Thermal Package Resistances</b>   |               |      |      |      |       |            |
| Thermal Resistance, 16L-PDIP   | $\theta_{JA}$ | —    | 70   | —    | °C/W  |            |
| Thermal Resistance, 16L-SOIC (150 mil.)  | $\theta_{JA}$ | —    | 86.1 | —    | °C/W  |            |
| Thermal Resistance, 16L-SOIC (300 mil.)  | $\theta_{JA}$ | —    | 80   | —    | °C/W  |            |

## 2.0 PIN DESCRIPTION

The descriptions of the pins are listed in .

**TABLE 2-1: PIN FUNCTION TABLE**

| RE46C145<br>PDIP, SOIC, SOICN | Symbol          | Function                          |
|-------------------------------|-----------------|-----------------------------------|
| 1                             | C1              | High Gain Capacitor Pin           |
| 2                             | C2              | Normal Gain Capacitor Pin         |
| 3                             | DETECT          | Photo Diode Input                 |
| 4                             | STROBE          | Strobed Detection Negative Supply |
| 5                             | V <sub>DD</sub> | Positive Power Supply             |
| 6                             | IREDD           | Infrared Emitting Diode Pin       |
| 7                             | IO              | Interconnect Pin                  |
| 8                             | HB              | Horn Brass, Inverted Output       |
| 9                             | HS              | Horn Silver Output                |
| 10                            | FEED            | Horn Feedback Pin                 |
| 11                            | LED             | LED Driver Pin                    |
| 12                            | COSC            | Oscillator Capacitor Input        |
| 13                            | ROSC            | Oscillator Resistor Drive Low     |
| 14                            | V <sub>SS</sub> | Negative Power Supply             |
| 15                            | VSEN            | HushTimer Sensitivity Pin         |
| 16                            | TEST            | Test Pin                          |

### 2.1 High/Normal Gain Capacitor Pins (C1, C2)

The capacitor connected to C1 pin sets the photo amplifier gain (high) for the push-to-test and chamber sensitivity test. The size of this capacitor will depend on the chamber background reflections.  $A = 1+(C1/10)$ , where C1 is expressed in pF. The gain should be <10000.

The capacitor connected to C2 pin sets the photo amplifier gain (normal) during standby. The value of this capacitor will depend on the smoke sensitivity required.  $A = 1+(C2/10)$ , where C2 is expressed in pF.

### 2.2 Photo Diode Input (DETECT)

This input is normally connected to the cathode of an external photo diode operated at zero bias.

### 2.3 Strobed Detection Negative Supply (STROBE)

Regulated output voltage of V<sub>DD</sub>-5 which is active during a test for smoke. This output is the negative side of the photo amplifier reference circuitry.

### 2.4 Positive Power Supply (V<sub>DD</sub>)

The V<sub>DD</sub> pin is the device's positive power supply input.

### 2.5 Infrared Emitting Diode Pin (IREDD)

Provides a regulated pulsed output voltage pre-driver for the infrared emitter. This output usually drives the base of an NPN transistor.

### 2.6 Interconnect Pin (IO)

This bidirectional pin provides the capability to interconnect many detectors in a single system. This pin has an internal pull-down device.

### 2.7 Horn Brass, Inverted Output (HB)

HB pin is connected to the metal electrode of a piezoelectric transducer.

### 2.8 Horn Silver Output Pin (HS)

HS pin is a complementary output to HB and connects to the ceramic electrode of the piezoelectric transducer.

# RE46C145

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## 2.9 Horn Feedback Pin (FEED)

Usually this pin is connected to the feedback electrode through a current limiting resistor. If not used, this pin must be connected to  $V_{DD}$  or  $V_{SS}$ .

## 2.10 LED Driver Pin (LED)

This pin is an open drain NMOS output used to drive a visible LED.

## 2.11 Oscillator Capacitor Input (COSC)

A capacitor connected to this pin, with a parallel resistor, sets the internal clock low time, which is approximately the clock period.

## 2.12 Oscillator Resistor Drive Low (ROSC)

A resistor between this pin and COSC pin sets the internal clock high time. This also sets the IRED pulse width (100 - 200  $\mu$ s).

## 2.13 Hush Timer Sensitivity Pin (VSEN)

In Timer mode, this input pin can be used to set an external smoke comparator reference.

## 2.14 TEST Pin

This input is used to invoke two test modes and the Timer mode. This input has an internal pull-down.



### 3.0 DEVICE DESCRIPTION

**Note:** All timing references are nominal. See [Electrical Characteristics](#) for limits.

#### 3.1 Standby Internal Timing

With the external components specified in the [Typical Application](#) for R12 and C5, the internal oscillator has a nominal period of 10 ms. Normally the analog circuitry is powered down to minimize standby current (typically 4  $\mu$ A at 9V). Once every 10 seconds the detection circuitry (normal gain) is powered up for 10 ms. Prior to completion of the 10 ms period, the IRED pulse is active for 100  $\mu$ s. At the conclusion of the 10 ms period, the photo amplifier is compared to an internal reference to determine the chamber status and latched. If a smoke condition is present, the period to the next detection decreases and additional checks are made. Three consecutive smoke detections will cause the device to go into alarm, and the horn circuit and interconnect will be active.

Once every 43 seconds the status of the battery voltage is checked. This status is checked and latched at the conclusion of the LED pulse. In addition, once every 43 seconds the chamber is activated and, using the high gain mode (capacitor C1), a check of the chamber is made by amplifying background reflections. If either the low battery or the photo chamber test fails, the horn will chirp for 10 ms every 43 seconds.

The oscillator period is determined by the values of R9, R12 and C5 (see [Typical Application](#)). The oscillator period is as follows:

#### EQUATION 3-1:

$$T = T_R + T_F$$

Where:

$$T_R = .6931 \times R12 \times C5$$

$$T_F = .6931 \times R9 \times C5$$

#### 3.2 Smoke Detection Circuitry

A comparator compares the photo amp output to an internal reference voltage. If the required number of consecutive smoke conditions is met, the device will go into local alarm and the horn will be active. In local alarm, the C2 gain is internally increased by approximately 10% to provide alarm hysteresis.

#### 3.3 Push-to-Test Operation

If the TEST input pin is activated ( $V_{IH}$ ), after one internal clock cycle, the smoke detection rate increases to once every 330 ms. In this mode, the high-gain capacitor C1 is selected, and background reflections are used to simulate a smoke condition. After the required consecutive detections, the device will go into a local alarm condition. When the TEST input is deactivated ( $V_{IL}$ ) and after one clock cycle, the normal gain capacitor C1 is selected. The detection rate continues at once every 330 ms until three consecutive no smoke conditions are detected. At this point, the device returns to standby timing.

#### 3.4 LED Operation

In standby, the LED is pulsed on for 10 ms every 43 seconds. In a local alarm condition or the push-to-test alarm, the LED pulse frequency is increased to once every .5 seconds. In the case of a remote alarm, the LED is not active. In the Timer mode of operation, the LED is pulsed on for 10 ms every 10 seconds.

#### 3.5 Interconnect Operation

The bidirectional I/O pin allows for interconnection of multiple detectors. In a local alarm condition, this pin is driven high immediately through a constant current source. Shorting this output to ground will not cause excessive current. The I/O is ignored as an input during a local alarm.

The I/O pin also has an NMOS discharge device that is active for 1 second after the conclusion of any type of local alarm. This device helps to quickly discharge any capacitance associated with the interconnect line.

If a remote active-high signal is detected, the device goes into remote alarm and the horn will be active. Internal protection circuitry allows for the signaling unit to have a higher supply voltage than the signaled unit, without excessive current draw.

The interconnect input has a 670 ms nominal digital filter. This allows for interconnection to other types of alarms (carbon monoxide, for example) that may have a pulsed interconnect signal.

# RE46C145

## 3.6 Low Battery Detection

In standby, an internal reference is compared to the voltage divided  $V_{DD}$  supply. A low battery status is latched at the conclusion of the LED pulse. The horn will chirp for 10 ms every 43 seconds, until the low battery condition no longer exists. The low battery test is not performed in a local or remote alarm condition.

The low battery notification does not sound in a local or remote alarm condition.

## 3.7 Chamber Fail Detection

In standby, a chamber test is also performed every 43 seconds, by switching to the high gain capacitor C1 and sensing the photo chamber background reflections. Two consecutive chamber test failures will also cause the horn to chirp for 10 ms every 43 seconds. The low battery chirp occurs just before the LED pulse (see [Figure 3-1](#)). The chamber test and chamber test failure chirp occurs approximately 21 seconds after the LED pulse. The chamber tests are not performed in a local or remote alarm condition.

The chamber fail notification does not sound in a local or remote alarm condition.

## 3.8 Timer Mode

If resistors  $R_{ADJ1}$  and  $R_{ADJ2}$  are in place and a high-to-low transition occurs on the TEST input, the device enters a 10 minute timer mode. In this mode, the smoke comparator reference is switched from the internal  $V_{DD} - 3.5V$  reference to the voltage that appears on VSEN (pin 15). This allows the sensitivity to be modified for the duration of the 9 minute timer period. The chamber test is performed in Timer mode.

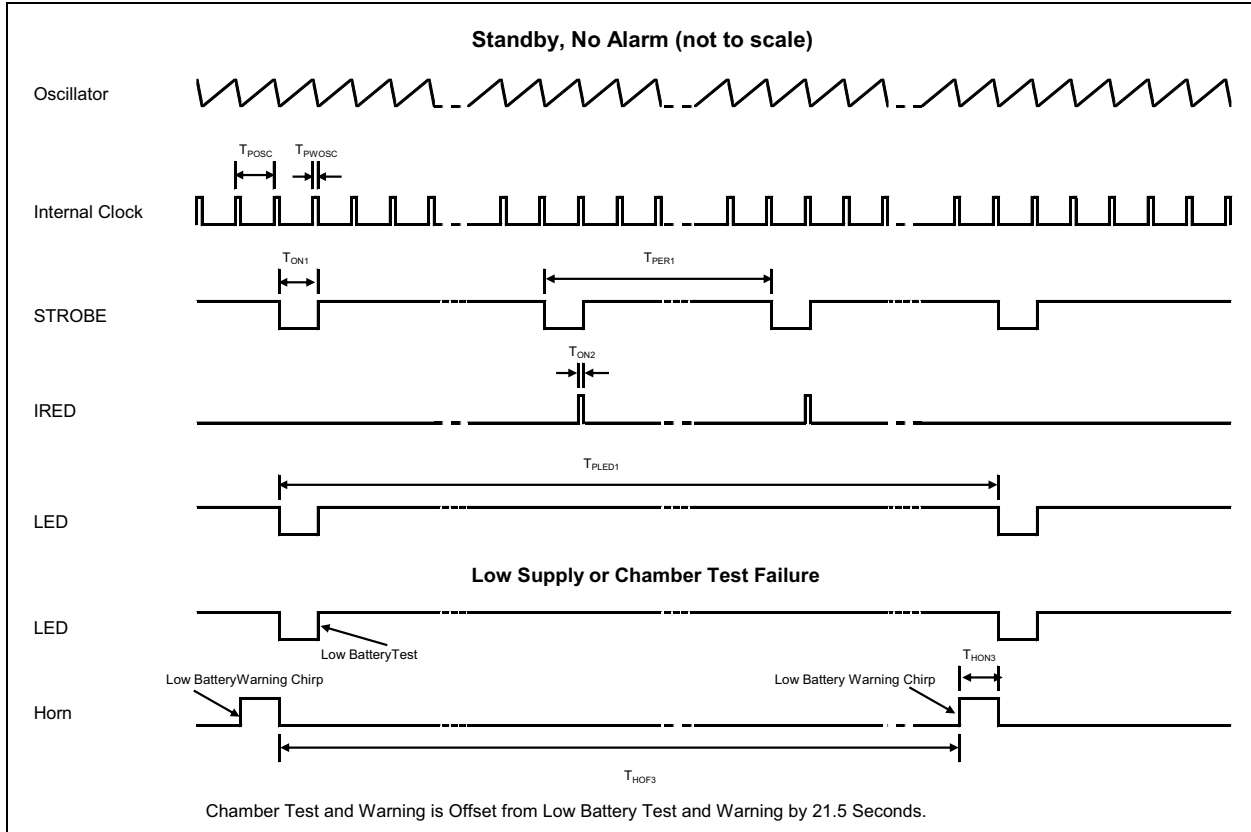
If VSEN is left unconnected or tied to  $V_{SS}$ , the Timer mode of operation is inhibited.

## 3.9 Diagnostic Mode

In addition to the normal function of the TEST input, a special diagnostic mode is available to calibrate and test of the smoke detector. Taking the TEST pin below  $V_{SS}$  and sourcing  $\sim 200 \mu A$  out of the pin for 1 clock cycle will enable the diagnostic mode. In the diagnostic mode, some of the pin functions are redefined. Refer to [Table 3-1](#) for redefined pin functions in the diagnostic mode. In addition, in this mode STROBE is always enabled, and the IRED is pulsed at the clock rate of 10 ms nominal.

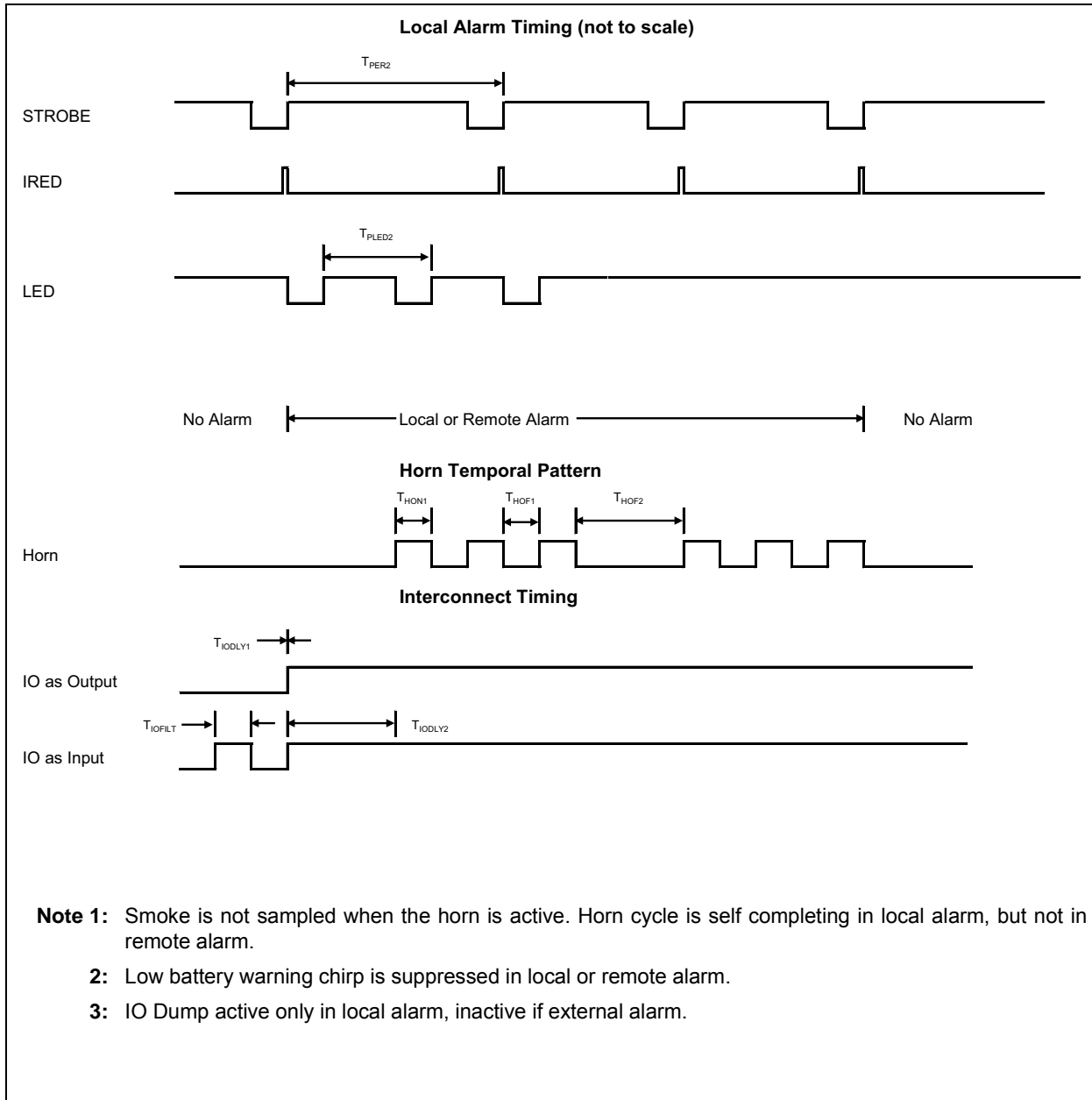
TABLE 3-1: DIAGNOSTIC MODE PIN FUNCTION

| Pin Name | Pin Number | Function  |
|----------|------------|---|
| IO       | 7          | The IO pin (7) controls the gain capacitor used for the photo amplifier. If IO is low, then normal gain is selected. If IO is high, then high gain is selected.                     |
| VSEN     | 15         | In Diagnostic mode, the output of the photo amplifier is gated to this pin and the pull-down device is disabled. .  |
| FEED     | 10         | If the IO pin (7) is low, then taking this input high will enable hysteresis, which is a nominal 10% gain increase in Normal Gain mode.   |
| COSC     | 12         | If desired, this pin can be driven by an external clock.  |
| HORNB    | 8          | This pin becomes the smoke integrator output. A high level indicates that an alarm condition has been detected.   |
| LED      | 11         | The LED pin is used as a low battery indicator. For $V_{DD}$ above the low battery threshold, the open drain NMOS is off. If $V_{DD}$ falls below the threshold, the NMOS turns on. |



**FIGURE 3-1:** RE46C145 Timing Diagram – Standby, Low Supply and Chamber Test Failure.

# RE46C145

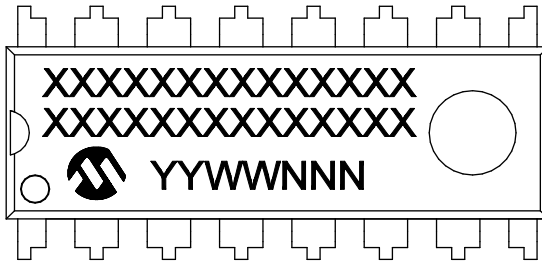


**FIGURE 3-2:** RE46C145 Timing Diagram – Local Alarm, Horn and Interconnect Timings.

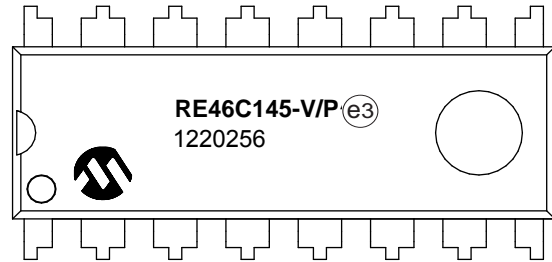
## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

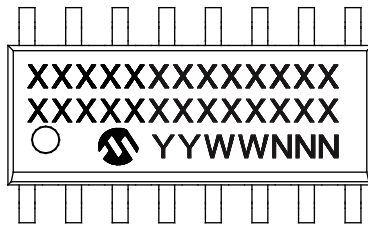
16-Lead PDIP (300 mil)



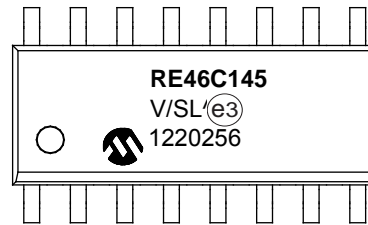
Example



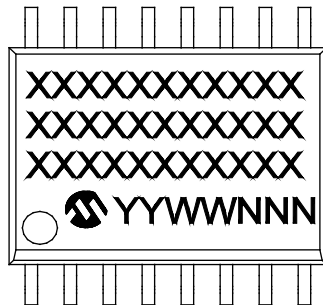
16-Lead Narrow SOIC (3.90 mm)



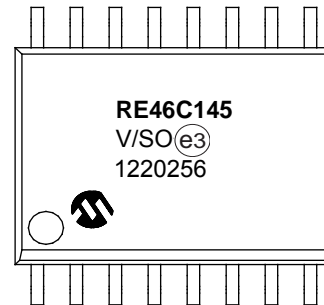
Example



16-Lead Wide SOIC (7.50 mm)



Example



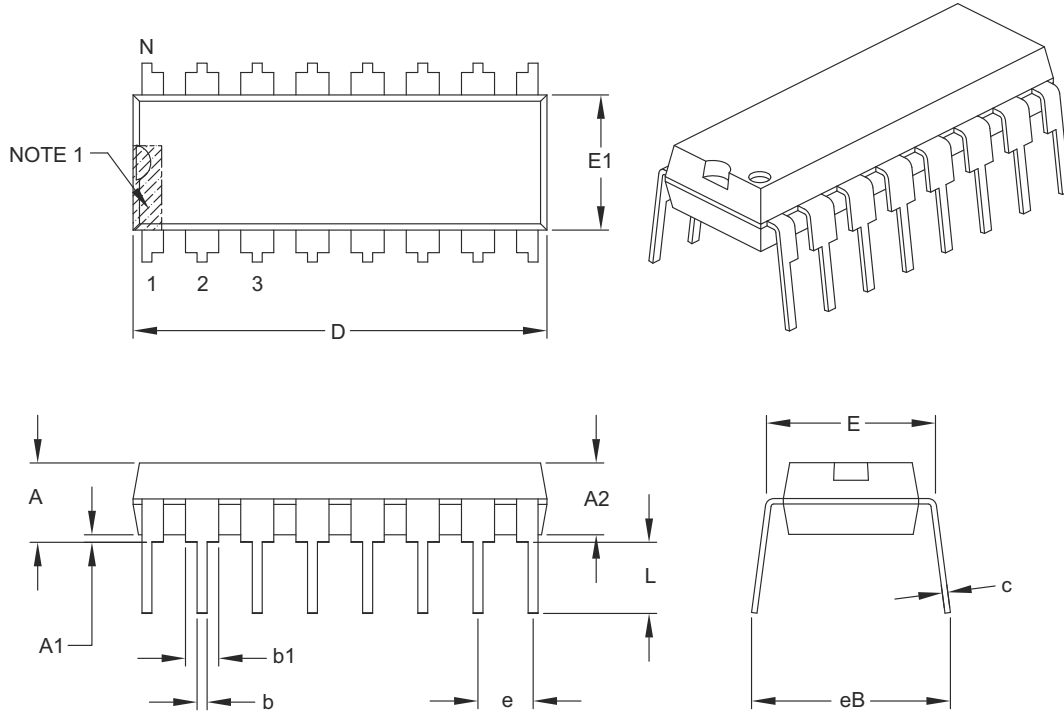
|                |        |  |
|----------------|--------|--|
| <b>Legend:</b> | XX...X | Customer-specific information  |
|                | Y      | Year code (last digit of calendar year)  |
|                | YY     | Year code (last 2 digits of calendar year)   |
|                | WW     | Week code (week of January 1 is week '01')   |
|                | NNN    | Alphanumeric traceability code   |
|                | (e3)   | Pb-free JEDEC designator for Matte Tin (Sn)  |
|                | *      | This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the outer packaging for this package. |

**Note:** In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

# RE46C145

## 16-Lead Plastic Dual In-Line (P) – 300 mil Body [PDIP]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



| Dimension Limits           | Units | INCHES   |      |      |
|----------------------------|-------|----------|------|------|
|                            |       | MIN      | NOM  | MAX  |
| Number of Pins             | N     | 16       |      |      |
| Pitch                      | e     | .100 BSC |      |      |
| Top to Seating Plane       | A     | –        | –    | .210 |
| Molded Package Thickness   | A2    | .115     | .130 | .195 |
| Base to Seating Plane      | A1    | .015     | –    | –    |
| Shoulder to Shoulder Width | E     | .290     | .310 | .325 |
| Molded Package Width       | E1    | .240     | .250 | .280 |
| Overall Length             | D     | .735     | .755 | .775 |
| Tip to Seating Plane       | L     | .115     | .130 | .150 |
| Lead Thickness             | c     | .008     | .010 | .015 |
| Upper Lead Width           | b1    | .045     | .060 | .070 |
| Lower Lead Width           | b     | .014     | .018 | .022 |
| Overall Row Spacing §      | eB    | –        | –    | .430 |

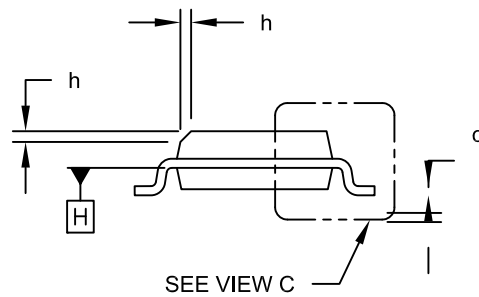
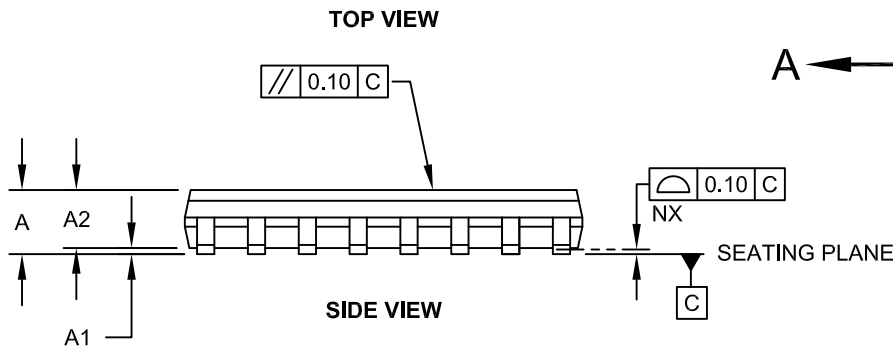
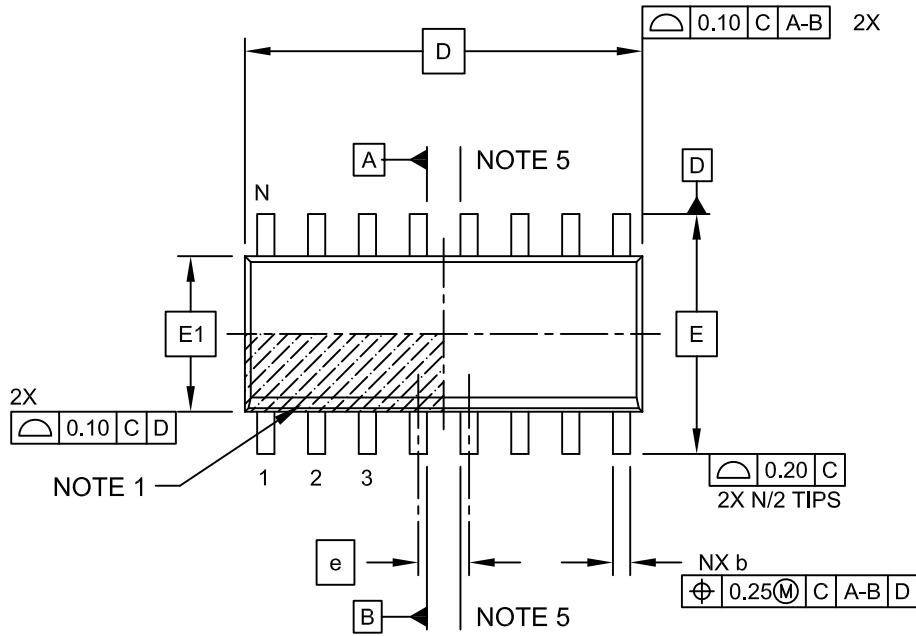
**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic.
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
- Dimensioning and tolerancing per ASME Y14.5M.  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-017B

## 16-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>

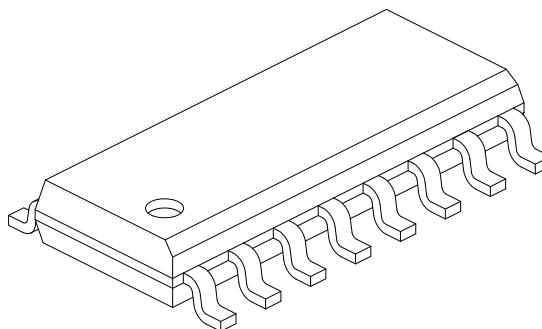
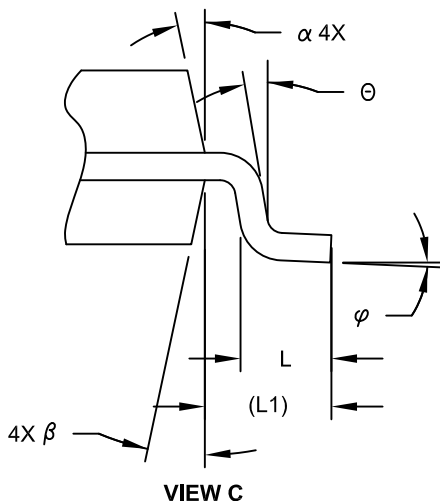


Microchip Technology Drawing No. C04-108C Sheet 1 of 2

# RE46C145

## 16-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



|                          |          | MILLIMETERS |     |      |
|--------------------------|----------|-------------|-----|------|
| Units                    |          | MIN         | NOM | MAX  |
| Dimension Limits         |          |             |     |      |
| Number of Pins           | N        | 16          |     |      |
| Pitch                    | e        | 1.27 BSC    |     |      |
| Overall Height           | A        | -           | -   | 1.75 |
| Molded Package Thickness | A2       | 1.25        | -   | -    |
| Standoff §               | A1       | 0.10        | -   | 0.25 |
| Overall Width            | E        | 6.00 BSC    |     |      |
| Molded Package Width     | E1       | 3.90 BSC    |     |      |
| Overall Length           | D        | 9.90 BSC    |     |      |
| Chamfer (Optional)       | h        | 0.25        | -   | 0.50 |
| Foot Length              | L        | 0.40        | -   | 1.27 |
| Footprint                | L1       | 1.04 REF    |     |      |
| Lead Angle               | $\theta$ | 0°          | -   | -    |
| Foot Angle               | $\phi$   | 0°          | -   | 8°   |
| Lead Thickness           | c        | 0.10        | -   | 0.25 |
| Lead Width               | b        | 0.31        | -   | 0.51 |
| Mold Draft Angle Top     | $\alpha$ | 5°          | -   | 15°  |
| Mold Draft Angle Bottom  | $\beta$  | 5°          | -   | 15°  |

**Notes:**

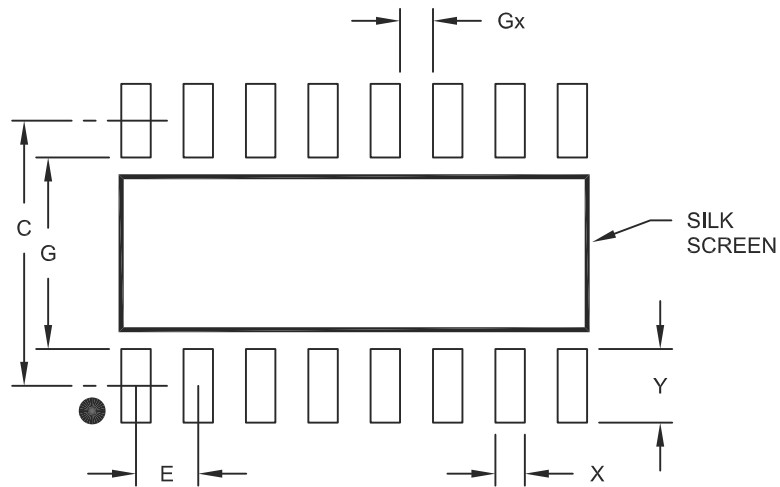
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimension D does not include mold flash, protrusions or gate burrs, which shall not exceed 0.15 mm per end. Dimension E1 does not include interlead flash or protrusion, which shall not exceed 0.25 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M
  - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
  - REF: Reference Dimension, usually without tolerance, for information purposes only.
- Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-108C Sheet 2 of 2



## 16-Lead Plastic Small Outline (SL) - Narrow, 3.90 mm Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



### RECOMMENDED LAND PATTERN

| Dimension Limits      | Units | MILLIMETERS |      |      |
|-----------------------|-------|-------------|------|------|
|                       |       | MIN         | NOM  | MAX  |
| Contact Pitch         | E     | 1.27 BSC    |      |      |
| Contact Pad Spacing   | C     |             | 5.40 |      |
| Contact Pad Width     | X     |             |      | 0.60 |
| Contact Pad Length    | Y     |             |      | 1.50 |
| Distance Between Pads | Gx    | 0.67        |      |      |
| Distance Between Pads | G     | 3.90        |      |      |

**Notes:**

1. Dimensioning and tolerancing per ASME Y14.5M

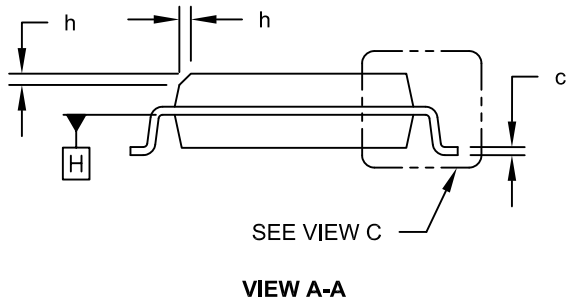
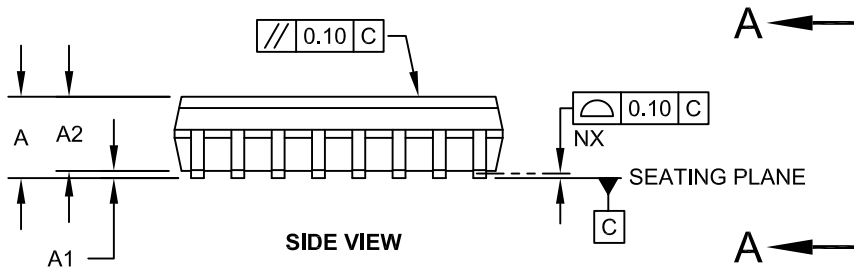
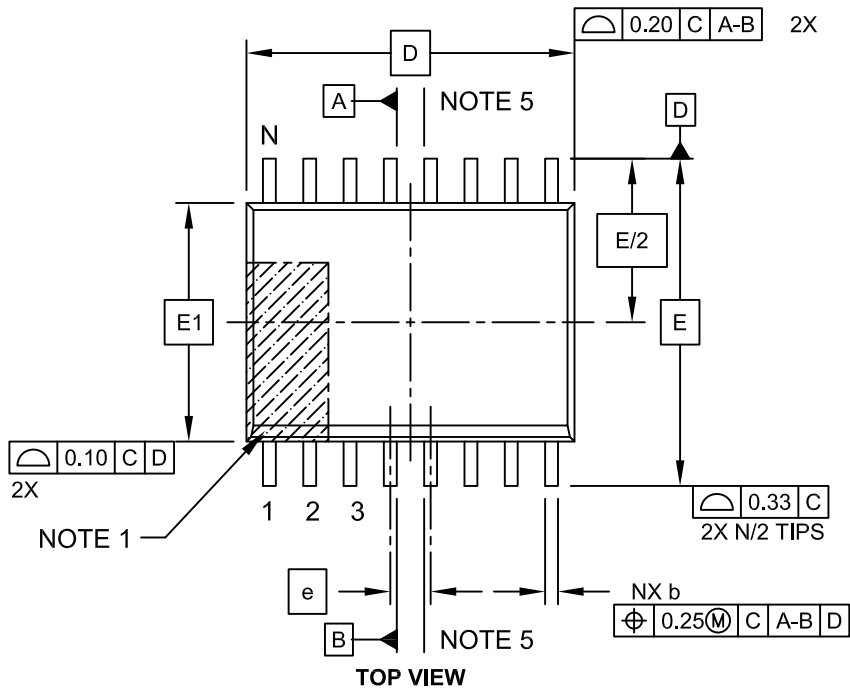
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2108A

# RE46C145

## 16-Lead Plastic Small Outline (SO) - Wide, 7.50 mm Body [SOIC]

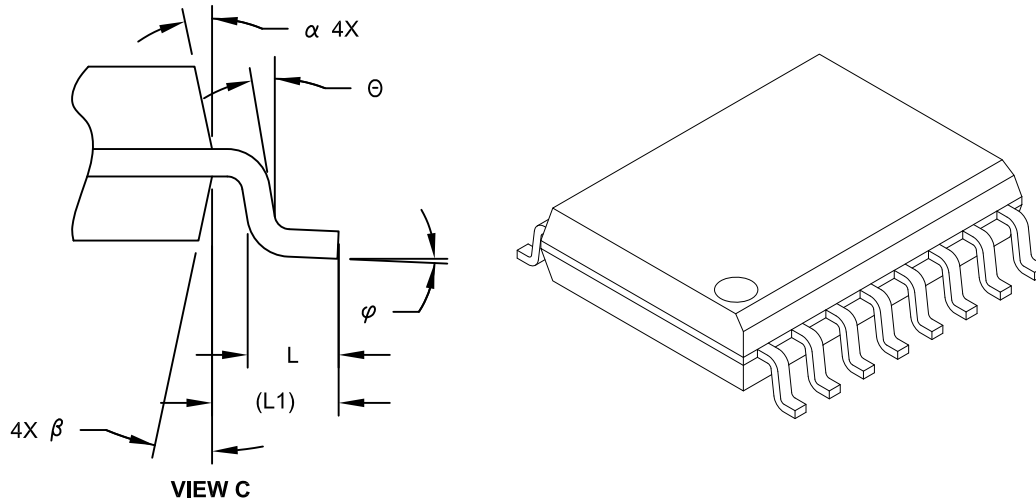
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-102C Sheet 1 of 2

## 16-Lead Plastic Small Outline (SO) - Wide, 7.50 mm Body [SOIC]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



| Dimension Limits         | Units | MILLIMETERS |     |      |
|--------------------------|-------|-------------|-----|------|
|                          |       | MIN         | NOM | MAX  |
| Number of Pins           | N     | 16          |     |      |
| Pitch                    | e     | 1.27 BSC    |     |      |
| Overall Height           | A     | -           | -   | 2.65 |
| Molded Package Thickness | A2    | 2.05        | -   | -    |
| Standoff §               | A1    | 0.10        | -   | 0.30 |
| Overall Width            | E     | 10.30 BSC   |     |      |
| Molded Package Width     | E1    | 7.50 BSC    |     |      |
| Overall Length           | D     | 10.30 BSC   |     |      |
| Chamfer (Optional)       | h     | 0.25        | -   | 0.75 |
| Foot Length              | L     | 0.40        | -   | 1.27 |
| Footprint                | L1    | 1.40 REF    |     |      |
| Lead Angle               | Θ     | 0°          | -   | -    |
| Foot Angle               | φ     | 0°          | -   | 8°   |
| Lead Thickness           | c     | 0.20        | -   | 0.33 |
| Lead Width               | b     | 0.31        | -   | 0.51 |
| Mold Draft Angle Top     | α     | 5°          | -   | 15°  |
| Mold Draft Angle Bottom  | β     | 5°          | -   | 15°  |

**Notes:**

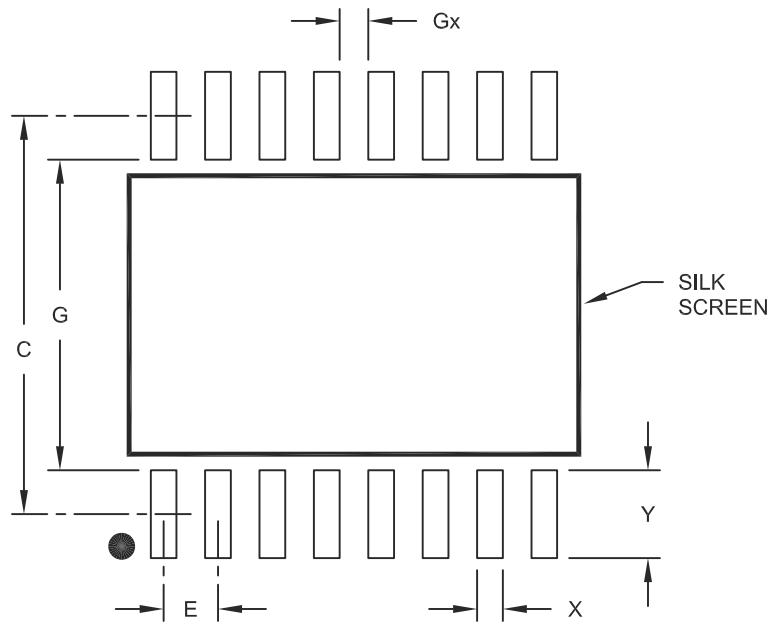
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimension D does not include mold flash, protrusions or gate burrs, which shall not exceed 0.15 mm per end. Dimension E1 does not include interlead flash or protrusion, which shall not exceed 0.25 mm per side.
- Dimensioning and tolerancing per ASME Y14.5M  
 BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
 REF: Reference Dimension, usually without tolerance, for information purposes only.
- Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-102C Sheet 2 of 2

# RE46C145

## 16-Lead Plastic Small Outline (SO) – Wide, 7.50 mm Body [SOIC] Land Pattern

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



RECOMMENDED LAND PATTERN

| Dimension Limits      | Units | MILLIMETERS |      |      |
|-----------------------|-------|-------------|------|------|
|                       |       | MIN         | NOM  | MAX  |
| Contact Pitch         | E     | 1.27 BSC    |      |      |
| Contact Pad Spacing   | C     |             | 9.30 |      |
| Contact Pad Width     | X     |             |      | 0.60 |
| Contact Pad Length    | Y     |             |      | 2.05 |
| Distance Between Pads | Gx    | 0.67        |      |      |
| Distance Between Pads | G     | 7.25        |      |      |

**Notes:**

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2102A

## APPENDIX A: REVISION HISTORY

### Revision C (August 2012)

The following is the list of modifications:

1. Re-structured the entire document.
2. Moved [Functional Block Diagram](#) and [Typical Application](#) figures to the front pages.
3. Added [Temperature Characteristics](#) table.
4. Reorganized [Section 2.0, Pin Description](#). Simplified [Table 2-1](#), added description sections.
5. Added [Section 4.0, Packaging Information](#).
6. Added [Product Identification System](#) section.

### Revision B (October 2009)

- Undocumented changes.

### Revision A (May 2009)

- Original Release of this Document.

# RE46C145

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NOTES:

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

| <u>PART NO.</u> | <u>/X</u>  | <u>XX</u>  |
|-----------------|------------|--|
| Device          | Package    | Number of Pins   |
| Device          | RE46C145:  | CMOS Photoelectric Smoke Detector ASIC                               |
|                 | RE46C145T: | CMOS Photoelectric Smoke Detector ASIC<br>(Tape and Reel, SOIC only) |
| Package         | E          | = Plastic Dual In-Line, 300 mil. Body, 16-Lead (PDIP)                |
|                 | S          | = Small Plastic Outline - Narrow, 3.90 mm Body,<br>16-Lead (SOIC)    |
|                 | SW         | = Small Plastic Outline - Wide, 7.50 mm Body,<br>16-Lead (SOIC)      |

**Examples:**

- a) RE46C145E16F: 16LD PDIP Package
- b) RE46C145S16F: 16LD SOIC Package
- c) RE46C145S16TF: 16LD SOIC Package,  
Tape and Reel
- d) RE46C145SW16F: 16LD SOIC Package
- e) RE46C145SW16TF: 16LD SOIC Package,  
Tape and Reel

# RE46C145

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NOTES:



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**Note the following details of the code protection feature on Microchip devices:**

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**France - Paris**  
Tel: 33-1-69-53-63-20  
Fax: 33-1-69-30-90-79

**Germany - Munich**  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

**Italy - Milan**  
Tel: 39-0331-742611  
Fax: 39-0331-466781

**Netherlands - Drunen**  
Tel: 31-416-690399  
Fax: 31-416-690340

**Spain - Madrid**  
Tel: 34-91-708-08-90  
Fax: 34-91-708-08-91

**UK - Wokingham**  
Tel: 44-118-921-5869  
Fax: 44-118-921-5820

11/29/11

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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