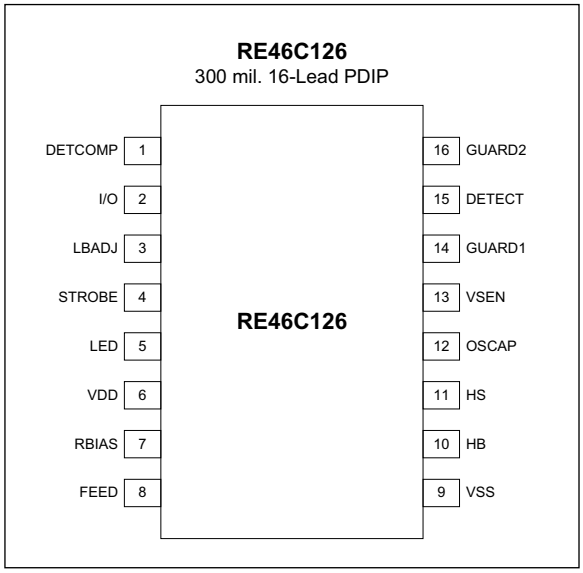
RE46C126

CMOS Ionization Smoke Detector ASIC with Interconnect

Features

- Guard Outputs for Ion Detector Input
- ±0.75 pA Detect Input Current
- Internal Reverse Battery Protection
- Internal Low Battery Detection
- Low Quiescent Current Consumption (<6.5 µA)
- Electrostatic Discharge (ESD) Protection (HBM) on all Pins
- Interconnect up to 40 Detectors
- Available in RoHS Compliant Lead-Free Packaging
- Packaging:
  - 300 mil. 16-Lead PDIP
- Compatible with NXP™ MC14468

Pin Configuration



General Description

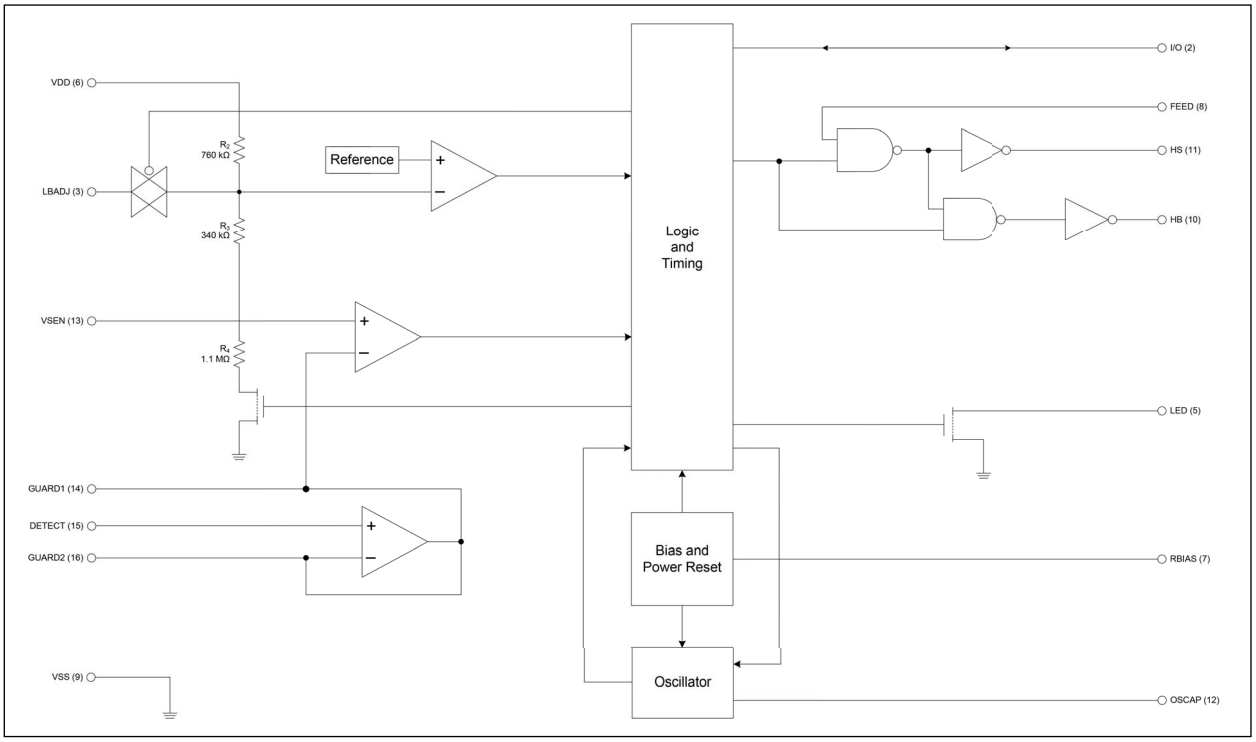
RE46C126 is a low power CMOS ionization smoke detector integrated circuit (IC). Together with a few external components, this circuit provides all the required features for an ionization type smoke detector.

An internal oscillator strobes power to the smoke detector circuitry for 10.5 ms every 1.66 seconds to keep standby current to a minimum. While in standby, RE46C126 performs a check for low battery condition every 40 seconds.

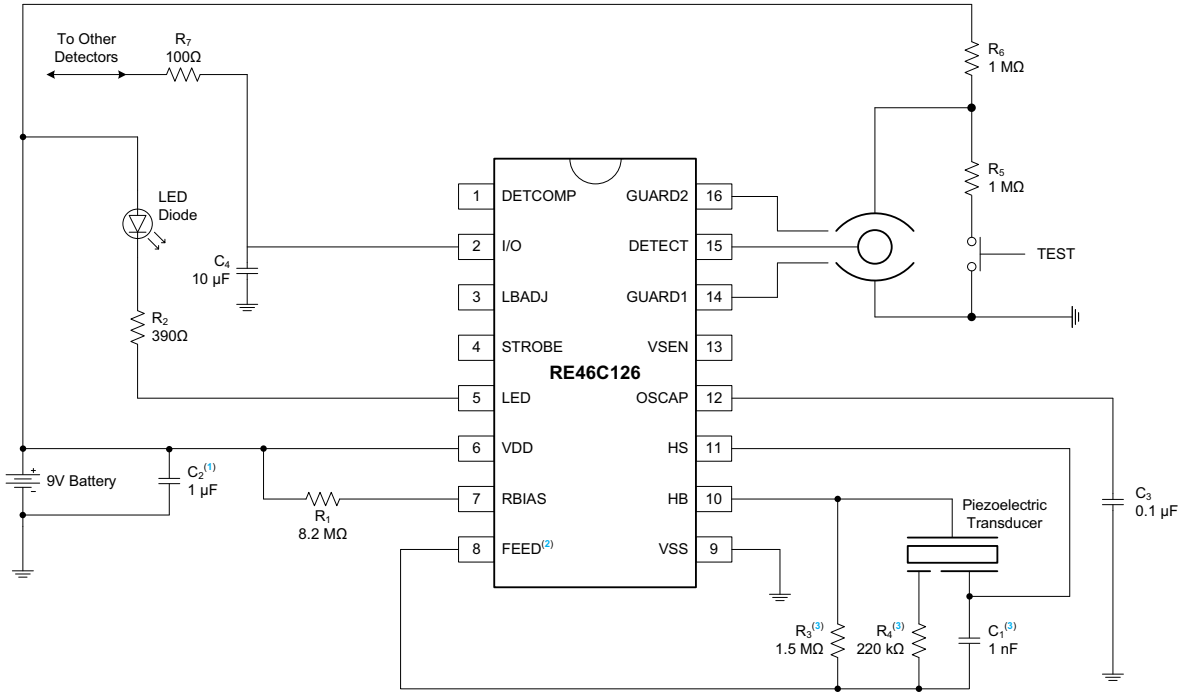
The interconnect pin (I/O) enables the connection of multiple detectors so that when one smoke detector alarms, all units sound together.

Although RE46C126 is designed for smoke detection using an ionization chamber, the device can be used in a variety of security applications.

Functional Block Diagram



Typical Application



NOTES:

1. C_2 must be placed as close as possible to the RE46C126 power pins.
2. Route the PCB trace of the FEED pin away from the RBIAS pin to avoid coupling.
3. R_3, R_4 and C_1 are typical values and can be adjusted to maximize sound pressure.

1.0 ELECTRICAL CHARACTERISTICS

1.1 Absolute Maximum Ratings†

Supply Voltage (V_{DD}) 15V
Input Voltage Range except FEED, I/O (V_{IN}) . . . . . -0.3V to V_{DD} + 0.3V
FEED Input Voltage Range (V_{INFD}) . . . . . -10V to + 22V
I/O Input Voltage Range (V_{IO1}) . . . . . -0.3V to 17V
Reverse Battery Time (t_{RB}) 5s
Input Current except FEED (I_{IN}) . . . . . 10 mA
Operating Temperature (T_A) . . . . . -10°C to +60°C
Storage Temperature (T_{STG}) . . . . . -55°C to +125°C
Maximum Junction Temperature (T_J) . . . . . +150°C

† Notices:

1: 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.

2: Although this product uses CMOS technology with static protection, proper ESD prevention procedures must be used when handling this product. Damage can occur when exposed to extremely high static electric charge.

1.2 Electrical Specifications

TABLE 1-1: DC ELECTRICAL SPECIFICATIONS

DC Electrical Characteristics: Unless otherwise specified, all parameters apply at T_A = +25°C, V_{DD} = 9V, OSCAP = 0.1 µF, R_{BIAS} = 8.2 MΩ and V_{SS} = 0V.

Parameter	Symbol	Pin	Min.	Typical	Max.	Units	Conditions
Power Supply							
Supply Voltage	V_{DD}	VDD	6	—	12	V	Operating
Supply Current	I_{DD1}	VDD	—	4.5	6.5	µA	R_{BIAS} = 8.2 MΩ, OSCAP = 0.1 µF
	I_{DD2}	VDD	—	—	9	µA	R_{BIAS} = 8.2 MΩ, OSCAP = 0.1 µF, V_{DD} = 12V
Input Voltage High	V_{IH1}	FEED	6.2	4.5	—	V	
	V_{IH2}	I/O	3	—	—	V	No Local Alarm, I/O as input
Input Voltage Low	V_{IL1}	FEED	—	4.5	2.7	V	
	V_{IL2}	I/O	—	—	1	V	No Local Alarm, I/O as input
Input Leakage Low	I_{LDET1}	DETECT	—	—	-0.75	pA	V_{DD} = 9V, DETECT = V_{SS}, 0-40% RH
	I_{LDET2}	DETECT	—	—	-1.5	pA	V_{DD} = 9V, DETECT = V_{SS}, 85% RH (Note 1)
	I_{LFD}	FEED	—	—	-50	µA	FEED = -10V

Note 1: Sample test only.
2: Production tested at room temperature with guardbanded limits.
3: Not 100% production tested.

TABLE 1-1: DC ELECTRICAL SPECIFICATIONS (CONTINUED)

DC Electrical Characteristics: Unless otherwise specified, all parameters apply at T_A = +25°C, V_{DD} = 9V, OSCAP = 0.1 µF, R_{BIAS} = 8.2 MΩ and V_{SS} = 0V.

Parameter	Symbol	Pin	Min.	Typical	Max.	Units	Conditions
Power Supply (continued)							
Input Leakage High	I_{HDET1}	DETECT	—	—	0.75	pA	V_{DD} = 9V, DETECT = V_{DD}, 0-40% RH
	I_{HDET2}	DETECT	—	—	1.5	pA	V_{DD} = 9V, DETECT = V_{DD}, 85% RH (Note 1)
	I_{HFD}	FEED	—	—	50	µA	FEED = 22V
	I_{IOL1}	I/O	25	—	100	µA	No Alarm, V_{IO} = V_{DD} – 2V
	I_{IOL2}	I/O	—	—	150	µA	No Alarm, V_{IO} = 17V
Output Off Leakage High	I_{OHZ}	STROBE, LED	—	—	1	µA	Outputs Off
Output Voltage High	V_{OH1}	HB, HS	6.3	—	—	V	I_{OH} = -16 mA, V_{DD} = 7.2V
	V_{OH2}	DETCOMP	8.5	—	—	V	I_{OH} = -30 mA
Output Voltage Low	V_{OL1}	HB, HS	—	—	0.9	V	I_{OL} = 16 mA, V_{DD} = 7.2V
	V_{OL2}	DETCOMP, STROBE	—	—	0.5	V	I_{OL} = 30 mA
	V_{OL3}	LED	—	—	3	V	I_{OL} = 10 mA, V_{DD} = 7.2V
Output Current	I_{IOH1}	I/O	-4	—	-16	mA	Alarm, V_{IO} = V_{DD} – 2V or V_{IO} = 0V
	I_{IODMP}	I/O	5	—	—	mA	At the conclusion of Local Alarm or Test, V_{IO} = 1V
Low Battery Voltage	V_{LB}	VDD	7.2	7.5	7.8	V	T_A = -10°C to +60°C, Note 2
Internal Sensitivity Set Voltage	V_{SET1}	VSEN	47	50	53	%V_{DD}	
	V_{SET2}	LBADJ	—	65.5	—	%V_{DD}	
Offset Voltage	V_{GOS1}	GUARD1, DETECT	-50	—	50	mV	Guard Amplifier
	V_{GOS2}	DETECT, GUARD2	-50	—	50	mV	Guard Amplifier
	V_{GOS3}	VSEN, DETECT	-50	—	50	mV	Smoke Comparator
Common Mode Voltage	V_{CM1}	GUARD1, DETECT	2	—	V_{DD} – 0.5	V	Guard Amplifier, Note 3
	V_{CM2}	VSEN, DETECT	0.5	—	V_{DD} – 2	V	Smoke Comparator, Note 3
Output Impedance	Z_{OUT}	GUARD1, GUARD2	—	10	—	kΩ	Guard Amplifier Outputs, Note 3
Hysteresis	V_{HYS}	VSEN	90	130	170	mV	No Alarm to Alarm Condition

Note 1: Sample test only.

2: Production tested at room temperature with guardbanded limits.

3: Not 100% production tested.

TABLE 1-2: AC ELECTRICAL SPECIFICATIONS

AC Electrical Characteristics: Unless otherwise specified, all parameters apply at T_A = +25°C, V_{DD} = 9V, OSCAP = 0.1 µF, R_{BIAS} = 8.2 MΩ and V_{SS} = 0V.
All timing except oscillator period (t_{PER}) and oscillator pulse width (t_{PW}) are guaranteed by functional tests.

Parameter	Symbol	Pin	Min.	Typical	Max.	Units	Conditions
Oscillator Time Base							
Oscillator Period	t_{PER1}	OSCAP	1.34	1.67	2	s	No Alarm Condition
	t_{PER2}	OSCAP	37.5	41.5	45.8	ms	Alarm Condition
Oscillator Pulse Width	t_{PW}	LED	9.1	10.5	12.9	ms	Operating
LED Indication							
LED On Time	t_{LON}	LED	9.1	10.5	12.9	ms	Operating
LED Off Time	t_{LOF1}	LED	32	40	48	s	Standby, No Alarm
	t_{LOF2}	LED	0.9	1	1.1	s	Alarm Condition
Horn Indication							
Horn On Time	t_{HON1}	HB, HS	141	166	190	ms	Operating, Alarm Condition, Note 1
	t_{HON2}	HB, HS	9.4	10.5	12.9	ms	Low Battery, No Alarm
Horn Off Time	t_{HOF1}	HB, HS	71	83	95	ms	Operating, Alarm Condition, Note 1
	t_{HOF3}	HB, HS	32	40	48	s	Low Battery, No Alarm
I/O Charge Dump Duration	t_{IODMP}	I/O	1.34	1.67	2	s	At the conclusion of Local Alarm or Test
I/O Delay	t_{IODLY1}	I/O	—	3	—	s	From the start of Local Alarm to I/O Active
I/O Filter	t_{IOFILT}	I/O	—	—	0.45	s	I/O pulse width guaranteed to be filtered. I/O as input, No Local Alarm
Remote Alarm Delay	t_{IODLY2}	I/O	0.45	—	2.2	s	No Local Alarm, I/O as input, from I/O active to Horn Active

Note 1: See timing diagram for 2/3 Duty Cycle Horn Pattern in Figure 3-1.

TABLE 1-3: TEMPERATURE CHARACTERISTICS

DC Electrical Characteristics: Unless otherwise specified, all parameters apply at V_{DD} = 9V and V_{SS} = 0V (typical application).

Parameter	Symbol	Min.	Typical	Max.	Units	Conditions
Temperature Ranges						
Specified Temperature Range	T_A	-10	—	+60	°C	
Operating Temperature Range	T_A	-10	—	+60	°C	
Storage Temperature Range	T_{STG}	-55	—	+125	°C	
Thermal Package Resistances						
Thermal Resistance, 16-Lead PDIP	θ_{JA}	—	70	—	°C/W	

2.0 PIN DESCRIPTION

Table 2-1 describes the pins of RE46C126.

TABLE 2-1: RE46C126 PIN FUNCTION

Pin Number	Symbol	Description
1	DETCOMP	Use this pin to check for smoke, while holding the OSCAP pin low.
2	I/O	Interconnect Pin. Use this bidirectional pin to connect many detectors in a single system. If one unit goes into alarm, the I/O pin is driven high causing all the interconnected detectors to alarm. This pin has an internal pull-down resistor.
3	LBADJ	Low Battery Adjustment. Use this pin to modify the low battery set point by connecting a resistor between the pin and V_{DD} or V_{SS}.
4	STROBE	Internal Power Strobe. Holding the OSCAP pin low, the internal power strobe activates and the DETCOMP pin can be used to check for smoke.
5	LED	LED Driver Pin. Open-drain NMOS output used to drive a visible LED.
6	VDD	This pin connects to the positive power supply.
7	RBIAS	Set the internal bias current by connecting a resistor between this pin and V_{DD}.
8	FEED	This pin connects to the feedback electrode through a current limiting resistor. When the horn is enabled, this pin drives the buffered output HS pin and the complementary output HB pin. If not used, ensure this pin connects to V_{DD} or V_{SS}.
9	VSS	This pin connects to the negative power supply.
10	HB	Horn Brass, Inverted Output. This pin connects to the metal electrode of a piezoelectric transducer.
11	HS	Horn Silver Output. This pin is a complementary output to the HB pin and connects to the ceramic electrode of the piezoelectric transducer.
12	OSCAP	Set the oscillator period (t_{PER}) by connecting a capacitor between this pin and V_{SS}.
13	VSEN	Use this pin to set an external smoke comparator reference by connecting external resistors to V_{DD} or V_{SS}.
14	GUARD1	Guard amplifier output 1. This allows for measurement of the DETECT pin without loading the ionization chamber.
15	DETECT	This pin connects to the collector electrode of the ion smoke chamber.
16	GUARD2	Guard amplifier output 2. This allows for measurement of the DETECT pin without loading the ionization chamber.

3.0 DEVICE DESCRIPTION

3.1 Introduction

RE46C126 is a low power CMOS ionization smoke detector integrated circuit (IC). Together with a few external components, this circuit provides all the required features for an ionization type smoke detector.

Note: All timing references are nominal values. Refer to Table 1-1 and Table 1-2 for limits.

3.2 Internal Timing

With external components as indicated in the Typical Application diagram, the oscillator period is nominally t_{PER1} = 1.67 seconds while in standby. The detection circuitry is powered up for 10.5 ms every 1.66 seconds and the status of the smoke comparator is latched. Additionally, every 40 seconds, the LED driver is turned on for 10.5 ms and the status of the low battery comparator is latched. The smoke comparator status is not checked during the low battery test or low battery horn warning chirp or when the horn is active due to an alarm condition.

If RE46C126 detects an alarm condition, the oscillator period increases to t_{PER2} = 41.5 ms.

Due to the low currents used in the oscillator, ensure that the OSCAP pin connects to a low leakage type capacitor. Oscillator accuracy depends mainly on the tolerance of the bias resistor connected to the RBIAS pin and the oscillator capacitor connected to the OSCAP pin.

3.3 Smoke Detection Circuitry

The smoke comparator takes the value of the ionization chamber voltage and compares it to a voltage derived from a resistor divider across V_{DD}. This divider voltage is available externally on the VSEN pin.

Use the VSEN pin to modify the internal set point for the smoke comparator by connecting external resistors to V_{DD} or V_{SS}. Nominal values for the internal resistor divider are indicated on the Functional Block Diagram. While these internal resistor values can vary up to ±20%, the resistor matching is typically less than 2% on any single device. A transmission switch on the VSEN pin isolates the pin during low battery tests to prevent the low battery set point from being affected when using external resistors to modify the smoke sensitivity set point.

To reduce surface leakage, the guard amplifier and outputs are always active and within 50 mV of the DETECT pin voltage. The guard outputs also allow for the measurement of the DETECT input without loading the ionization chamber.

3.4 Low Battery Detection

An internal reference is compared to the voltage divided V_{DD} power supply. The battery is checked under load using the LED low side driver output since a low battery status is latched at the conclusion of the 10.5 ms LED pulse. Use the LBADJ pin to modify the low battery set point by connecting a resistor between the pin and V_{DD} or V_{SS}.

Note 1: The internal resistor string is common to both LBADJ and VSEN pins. This results in some interaction between the two pins.

2: Modifying the low battery set point can affect the smoke sensitivity setting.

3.5 LED Pulse

The LED pulses on for 10.5 ms every 40 seconds while in standby. When an alarm condition is detected, the LED pulses on for 10.5 ms every second.

Note: For remote alarm conditions, the LED is always off.

3.6 Interconnect

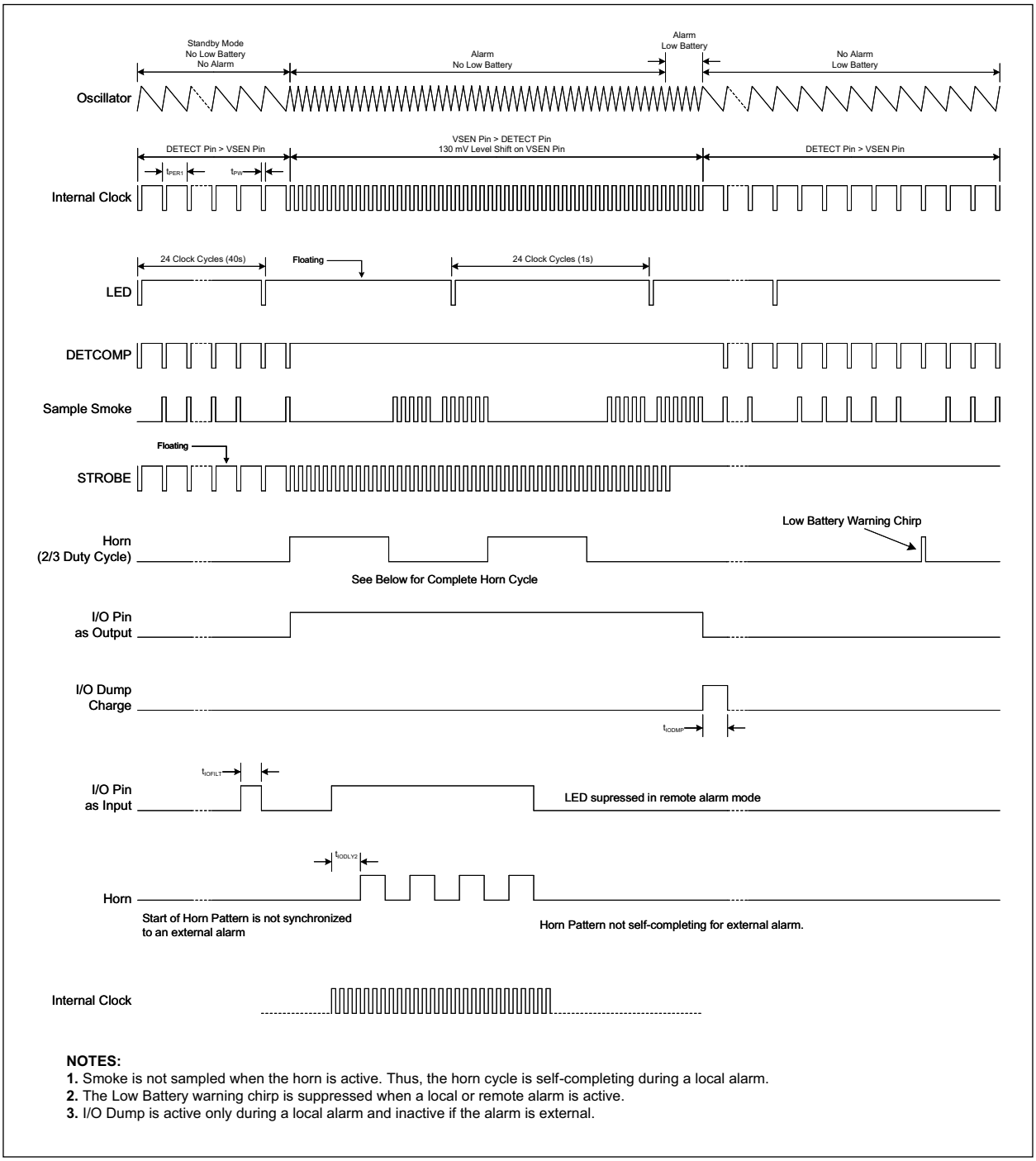
Use the I/O pin to interconnect many detectors into a single system. If one unit goes into alarm, the I/O pin is driven high. This high signal causes all the interconnected detectors to alarm. The LED flashes for 10.5 ms every second on the signaling unit, while it is inhibited on the units that are in alarm due to the I/O high signal. An internal sink device on the I/O pin helps to discharge the interconnect line. This charge dump device is active for one clock cycle (1.67 seconds) after the detector exits the alarm condition.

The interconnect input (I/O pin) has a 500 ms nominal digital filter. This allows to interconnect other types of alarm devices, such as carbon monoxide detectors, that can have a pulsed interconnect signal.

3.7 Testing

By holding the OSCAP pin low at power up, the internal power strobe becomes active and the DETCOMP pin can be used to check for smoke.

Note: Refer to timing diagram in Figure 3-1.



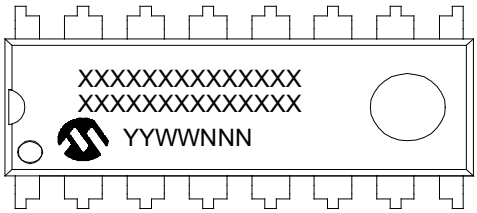
NOTES:
1. Smoke is not sampled when the horn is active. Thus, the horn cycle is self-completing during a local alarm.
2. The Low Battery warning chirp is suppressed when a local or remote alarm is active.
3. I/O Dump is active only during a local alarm and inactive if the alarm is external.

FIGURE 3-1: *RE46C126 Timing Diagram.*

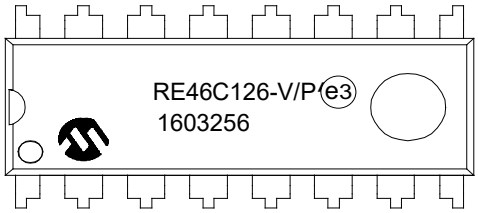
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

16-Lead PDIP (300 mil.)



Example:



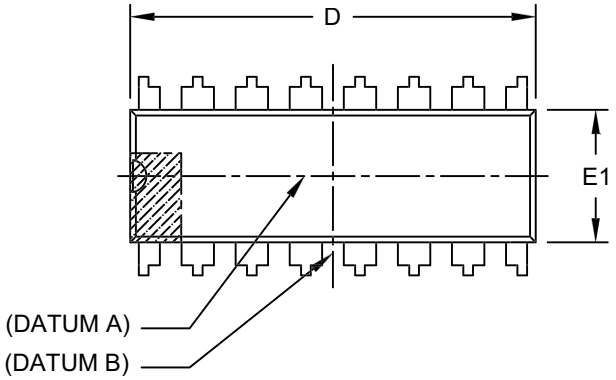
Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free 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.

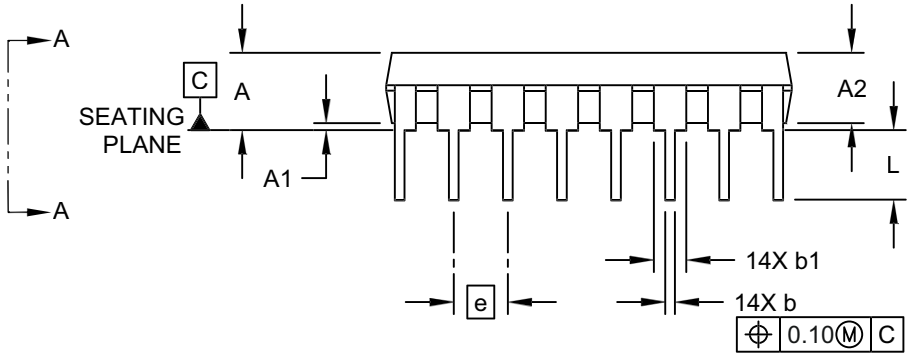
4.2 Package Drawings

16-Lead Plastic Dual In-Line (D6X) - 300 mil Body [PDIP]

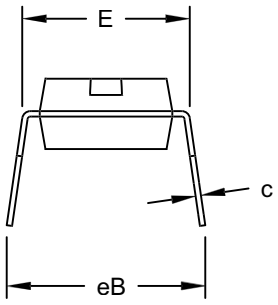
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

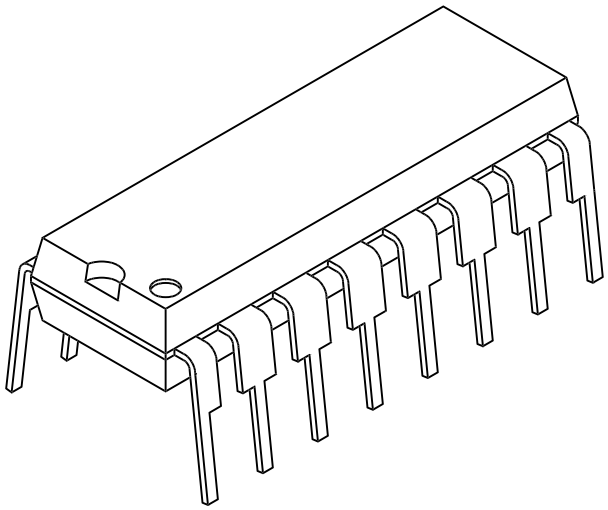


VIEW A-A

Microchip Technology Drawing C04-00017 Rev C (D6X) Sheet 1 of 2

16-Lead Plastic Dual In-Line (D6X) - 300 mil Body [PDIP]

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



Units		INCHES		
Dimension Limits		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	.750	.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:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" per side.
4. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing C04-00017 Rev C (D6X) Sheet 2 of 2

APPENDIX A: REVISION HISTORY

Revision C (June 2025)

- Removed mentions of Underwriters Laboratory Specifications UL217 and UL268.
- Updated Functional Block Diagram and Typical Application.
- Added **Section 2.0, "Pin Description"**.
- Updated Figure 3-1.
- Removed “Zener” from **Section 3.4**.
- Updated **Section 3.0, "Device Description"**.
- Added **Section 4.0, "Packaging Information"**.
- Added **Product Identification System** section.

Revision B (June 2009)

- Undocumented changes.

Revision A (May 2009)

- Initial release of this document.

PRODUCT IDENTIFICATION SYSTEM

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

PART NO.	X	XX	X
Device	Package	Number of Pins	Lead Free

Device:	RE46C126	= CMOS Ionization Smoke Detector ASIC
Package:	E	= Plastic Dual In-line (D6X), 300 mil. Body (PDIP)
Number of Pins:	16	= 16-Lead
Lead Free:	F	= Lead Free Packaging

Examples:

a) RE46C126E16F: CMOS Ionization Smoke Detector ASIC, Plastic Dual In-Line PDIP, 16-Lead, Lead Free

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