# R&E International

*A Subsidiary of Microchip Technology Inc.*

## RE46C128

***CMOS Ionization Smoke Detector ASIC with Interconnect***

*Product Specification*

## General Description

The RE46C128 is low power CMOS ionization type smoke detector IC. With few external components this circuit will provide all the required features for an ionization type smoke detector.

An internal oscillator strobes power to the smoke detection circuitry for 10.5mS every 1.66 seconds to keep standby current to a minimum. A check for a low battery condition is performed every 40 seconds when in standby. 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.

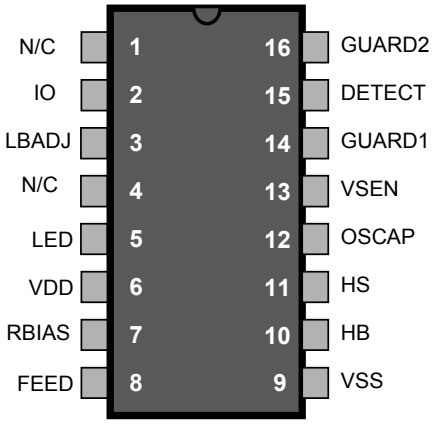
Although this device was designed for smoke detection utilizing an ionization chamber it could be used in a variety of security applications.

Utilizing low power CMOS technology the RE46C128 was designed for use in smoke detectors that comply with Underwriters Laboratory Specification UL217 and UL268.

## Features

- >1500V ESD Protection (HBM) on all Pins
- Guard Outputs for Ion Detector Input
- +/-0.75pA Detect Input Current
- Internal Reverse Battery Protection
- Low Quiescent Current Consumption (<6.5uA)
- Available in 16L PDIP or 16L N SOIC
- Internal Low Battery Detection
- Power Up Low Battery Test
- Interconnect up to 40 Detectors
- Compatible with Allegro A5364
- Available in Standard Packaging or RoHS Compliant Pb Free Packaging.

## Pin Configuration




## ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 15 | V |
| Input Voltage Range Except FEED, IO | $V_{in}$ | -.3 to $V_{dd}$ +.3 | V |
| FEED Input Voltage Range | $V_{infd}$ | -10 to +22 | V |
| IO Input Voltage Range | $V_{io1}$ | -.3 to 17 | V |
| Reverse Battery Time | $T_{RB}$ | 5 | S |
| Input Current except FEED | $I_{in}$ | 10 | mA |
| Operating Temperature | $T_A$ | -10 to 60 | °C |
| Storage Temperature | $T_{STG}$ | -55 to 125 | °C |
| Maximum Junction Temperature | $T_J$ | 150 | °C |

*Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and operation at these conditions for extended periods may affect device reliability.*

*This product utilizes CMOS technology with static protection; however proper ESD prevention procedures should be used when handling this product. Damage can occur when exposed to extremely high static electrical charge.*

**DC Electrical Characteristics at TA = 25°C, VDD=9V, OSCAP=.1uF, RBIAS=8.2MΩ, VSS=0V (unless otherwise noted)**

| Parameter | Symbol | Test Pin | Test Conditions | Limits | | | |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Units |
| Supply Voltage | $V_{DD}$ | 6 | Operating | 6 | | 12 | V |
| Supply Current | $I_{DD1}$ | 6 | RBIAS=8.2MΩ, OSCAP=.1uF | | 5 | 6.5 | uA |
| | $I_{DD2}$ | 6 | RBIAS=8.2MΩ, OSCAP=.1uF;Vdd=12V | | | 9 | uA |
| Input Voltage High | $V_{IH1}$ | 8 | | 6.2 | 4.5 | | V |
| | $V_{IH2}$ | 2 | No Local Alarm, IO as an Input | 3 | | | V |
| Input Voltage Low | $V_{IL1}$ | 8 | | | 4.5 | 2.7 | V |
| | $V_{IL2}$ | 2 | No Local Alarm, IO as an Input | | | 1 | V |
| Input Leakage Low | $IL_{DET1}$ | 15 | VDD=9V, DETECT=VSS, 0-40% RH | | | -0.75 | pA |
| | $IL_{DET2}$ | 15 | VDD=9V, DETECT=VSS, 85% RH Note 1 | | | -1.50 | pA |
| | $IL_{FD}$ | 8 | FEED=-10V | | | -50 | uA |
| Input Leakage High | $IH_{DET1}$ | 15 | VDD=9V, DETECT=VDD, 0-40% RH | | | 0.75 | pA |
| | $IH_{DET2}$ | 15 | VDD=9V, DETECT=VDD, 85% RH Note 1 | | | 1.50 | pA |
| | $IH_{FD}$ | 8 | FEED=22V | | | 50 | uA |
| | $I_{IOL2}$ | 2 | No Alarm, Vio=17V | | | 150 | uA |
| Output Off Leakage High | $I_{IOHZ}$ | 5 | Outputs Off | | | 1 | uA |
| Output High Voltage | $V_{OH1}$ | 10,11 | IOH=-16mA, VDD=7.2V | 6.3 | | | V |
| Output Low Voltage | $V_{OL1}$ | 10,11 | IOL=16mA, VDD=7.2V | | | .9 | V |
| | $V_{OL3}$ | 5 | IOL=10mA, VDD=7.2V | | | 1 | V |
| Output Current | $I_{IOL1}$ | 2 | No Alarm, Vio=Vdd-2V | 25 | | 60 | uA |
| | $I_{IOH1}$ | 2 | Alarm, Vio=Vdd-2V or Vio=0V | -4 | | -16 | mA |
| | $I_{IODMP}$ | 2 | At Conclusion of Local Alarm or Test, Vio=1V | 5 | | | mA |
| Low Battery Voltage | $V_{LB}$ | 6 | $T_A$=-10 to 60ºC, Note 3 | 7.2 | 7.5 | 7.8 | V |
| Internal Sensitivity Set Voltage | $V_{SET1}$ | 13 | | 48.5 | 50 | 51.5 | $\%V_{DD}$ |
| | $V_{SET2}$ | 3 | | | 65.5 | | $\%V_{DD}$ |

### DC Electrical Characteristics – Continued

| Parameter | Symbol | Test Pin | Test Conditions | Limits | | | |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Units |
| Offset Voltage | $VG_{OS1}$ | 14,15 | Guard Amplifier | -50 | | 50 | mV |
| | $VG_{OS2}$ | 15,16 | Guard Amplifier | -50 | | 50 | mV |
| | $VG_{OS3}$ | 13,15 | Smoke Comparator | -50 | | 50 | mV |
| Common Mode Voltage | $V_{CM1}$ | 14,15 | Guard Amplifier, Note 2 | 2 | | $V_{DD}$-.5 | V |
| | $V_{CM2}$ | 13,15 | Smoke Comparator, Note 2 | .5 | | $V_{DD}$-2 | V |
| Output Impedance | $Z_{OUT}$ | 14,16 | Guard Amplifier Outputs, Note 2 | | 10 | | kΩ |
| Hysteresis | $V_{HYS}$ | 13 | No Alarm to Alarm Condition | 90 | 130 | 170 | mV |

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

### AC Electrical Characteristics at TA = 25°C, VDD=9V, OSCAP=.1uF, RBIAS=8.2MΩ, VSS=0V (unless otherwise noted)

| Parameter | Symbol | Test Pin | Test Conditions | Limits | | | |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Units |
| Oscillator Period | $T_{PER1}$ | 12 | No Alarm Condition | 1.34 | 1.67 | 2 | S |
| | $T_{PER2}$ | 12 | Alarm Condition | 37.5 | 41.5 | 45.8 | mS |
| Oscillator Pulse Width | $T_{PW}$ | 5 | Operating | 9.4 | 10.5 | 12.9 | mS |
| LED On Time | $T_{LON}$ | 5 | Operating | 9.4 | 10.5 | 12.9 | mS |
| LED Off Time | $T_{LOF1}$ | 5 | Standby, No Alarm | 32 | 40 | 48 | S |
| | $T_{LOF2}$ | 5 | Alarm Condition | .8 | 1 | 1.2 | S |
| | $T_{LOF3}$ | 5 | Timer Mode, No Alarm | 8 | 10 | 12 | S |
| Horn On Time | $T_{HON1}$ | 10,11 | Operating, Alarm Condition, Note 4 | 450 | 500 | 550 | mS |
| | $T_{HON2}$ | 10,11 | Low Battery, No Alarm | 9.4 | 10.5 | 12.9 | mS |
| Horn Off Time | $T_{HOF1}$ | 10,11 | Operating, Alarm Condition, Note 4 | 450 | 500 | 550 | mS |
| | $T_{HOF2}$ | 10,11 | Operating, Alarm Condition, Note 4 | 1.35 | 1.5 | 1.65 | S |
| | $T_{HOF3}$ | 10,11 | Low Battery, No Alarm | 32 | 40 | 48 | S |
| IO Charge Dump Duration | $T_{IODMP}$ | 2 | At Conclusion of Local Alarm or Test | 1.34 | 1.67 | 2.0 | S |
| IO Delay | $T_{IODLY1}$ | 2 | From Start of Local Alarm to IO Active | | 3 | | S |
| IO Filter | $T_{IOFILT}$ | 2 | IO pulse width guaranteed to be filtered. IO as Input, No Local Alarm | | | 450 | mS |
| Remote Alarm Delay | $T_{IODLY2}$ | 2 | No Local Alarm, IO as input, From IO active to Horn Active | .450 | | 2.2 | S |

Note 4 – See timing diagram for horn temporal pattern.
All timing except for $T_{PER}$ and $T_{PW}$ are guaranteed by functional tests.

RE46c128 Functional Block Diagram

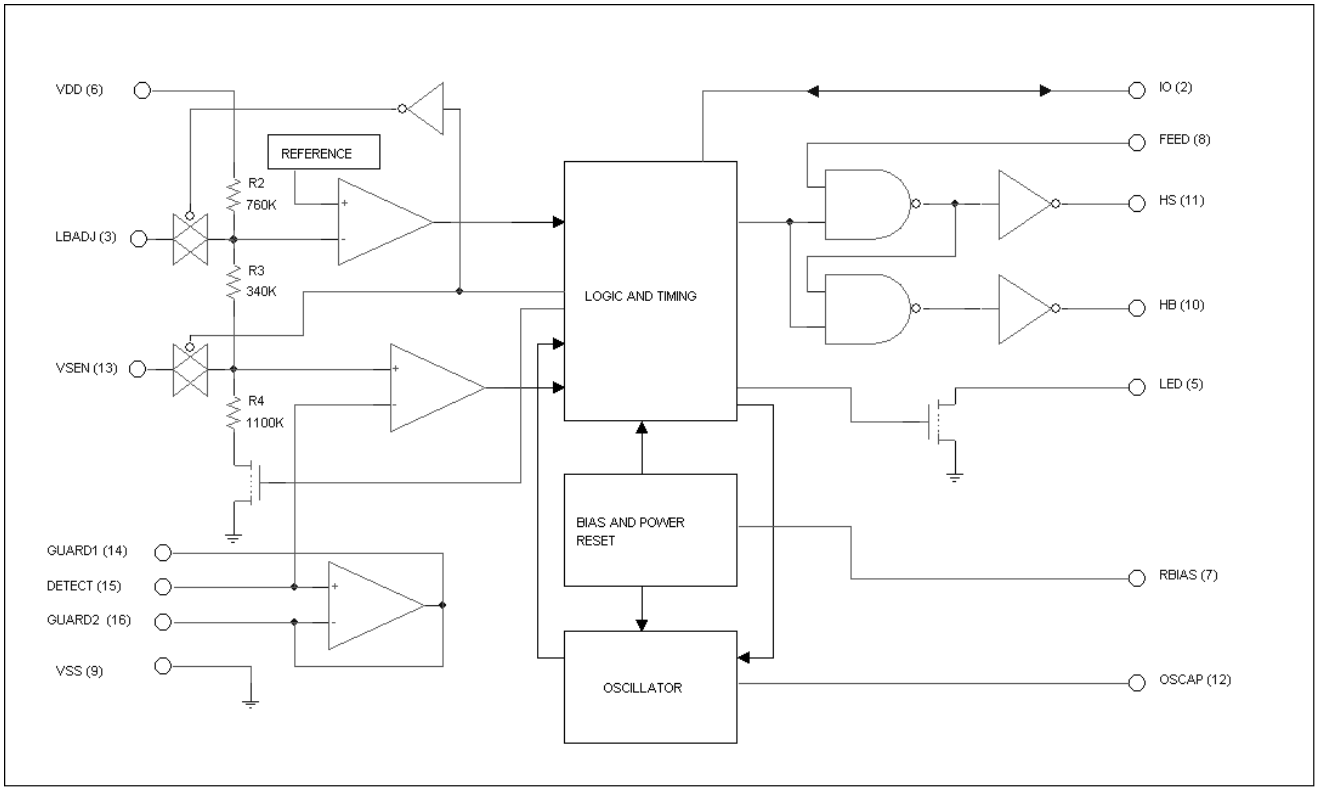



Figure 1

## DEVICE DESCRIPTION and APPLICATION NOTES

Internal Timing – With external components as indicated on the application drawing the period of the oscillator is nominally 1.67 seconds in standby. Every 1.66 seconds the detection circuitry is powered up for 10.5mS and the status of the smoke comparator is latched. In addition every 40 seconds the LED driver is turned on for 10.5mS and the status of the low battery comparator is latched. The smoke comparator status is not checked during the low battery test, during the low battery horn warning chirp, or when the horn is on due to an alarm condition.

If an alarm condition is detected the oscillator period increases to 41.5mS.

Due to the low currents used in the oscillator the capacitor on pin 12 should be a low leakage type. Oscillator accuracy will depend mainly on the tolerance of the RBIAS resistor and OSCAP capacitor.

Smoke Detection Circuit – The smoke comparator compares the ionization chamber voltage to a voltage derived from a resistor divider across VDD. This divider voltage is available externally on pin 13 (VSEN). When smoke is detected this voltage is internally increased by 130mV nominal to provide hysteresis and make the detector less sensitive to false triggering.

Pin 13 (VSEN) can be used to modify the internal set point for the smoke comparator by use of external resistors to VDD or VSS. Nominal values for the internal resistor divider are indicated on the block diagram. These internal resistor values can vary by up to ±20% but the resistor matching should be <2% on any one device. Transmission switches on VSEN and LBADJ prevent any interaction from the external adjustment resistors.

The guard amplifier and outputs are always active and will be within 50mV of the DETECT input to reduce surface leakage. The guard outputs also allow for measurement of the DETECT input without loading the ionization chamber.

Low Battery Detection - An internal reference is compared to the voltage divided VDD supply. The battery can be checked under load via the LED low side driver output since low battery status is latched at the end of the 10.5mS LED pulse. Pin 3 (LBADJ) can be used to modify the low battery set point by placing a resistor to VDD or VSS. Transmission switches on VSEN and LBADJ prevent any interaction from external adjustment resistance.

LED Pulse – The LED is pulsed on for 10.5mS every 40S in standby. In alarm the LED is pulsed on for 10.5mS every 1S.

Interconnect – Pin 2 (IO) provides the capability to common many detectors in a single system. If a single unit goes into alarm the IO pin is driven high. This high signal causes the interconnected units to alarm. The LED flashes every 1S for 10.5mS on the signaling unit and is inhibited on the units that are in alarm due to the IO signal. An internal sink device on the IO pin helps to discharge the interconnect line. This charge dump device is active for 1 clock cycle after the unit exits the alarm condition (1.67S).

The interconnect input has a 1000mS nominal digital filter. This allows for interconnection to other types of alarms (carbon monoxide for example) that may have a pulsed interconnect signal.

Testing – At power up all internal registers are reset. The low battery set point can be tested at power up by holding FEED and OSCAP low at power up. HB will change state as VDD passes through the low battery set point. By holding pin 12 (OSCAP) low the internal power strobe is active. Functional testing can be accelerated by driving pin 12 with a 4 kHz square wave however the 10.5mS strobe period must be maintained for proper operation of the analog circuitry. Please refer to the timing diagrams.

RE46c128 Typical Application

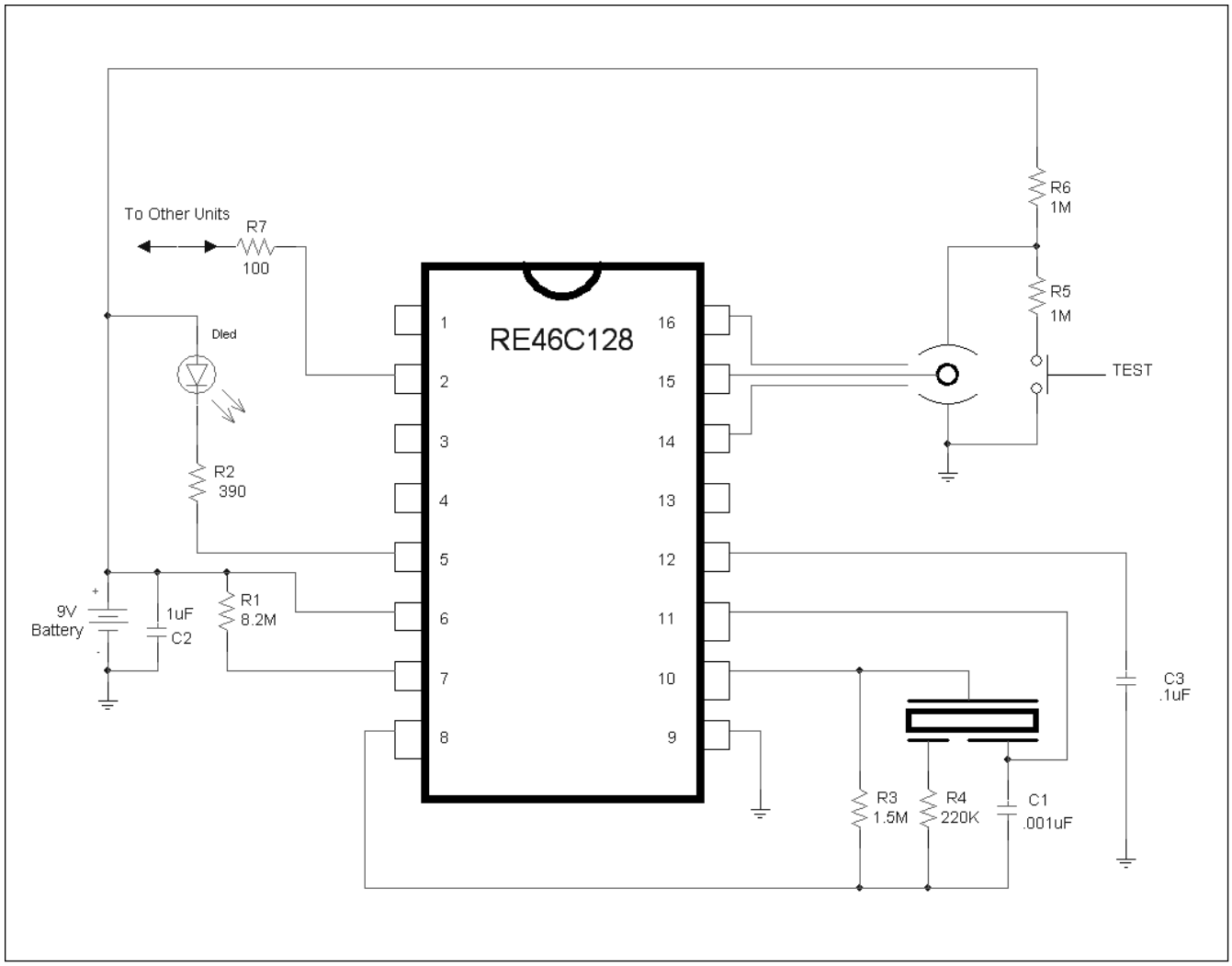
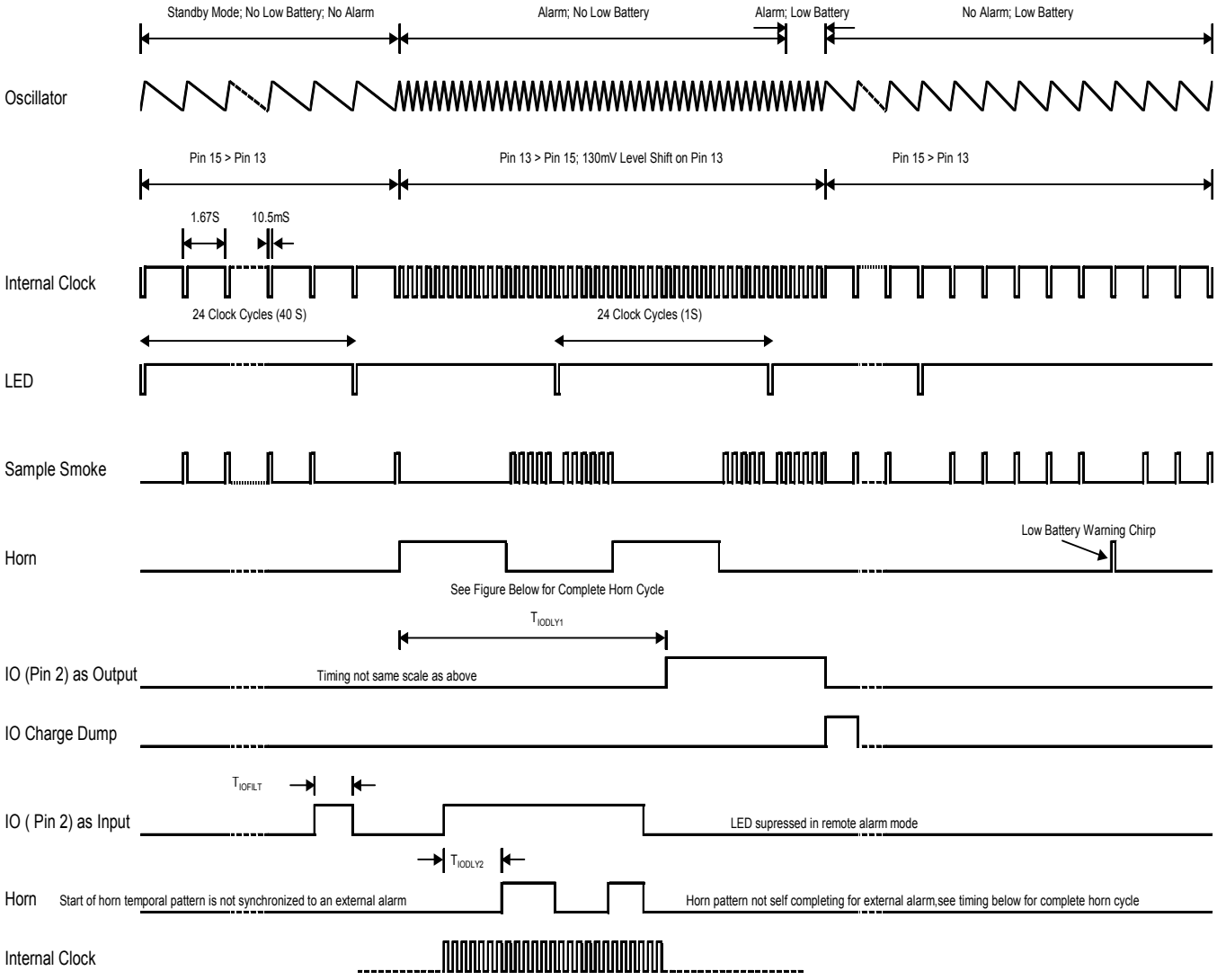



Figure 2

Notes:

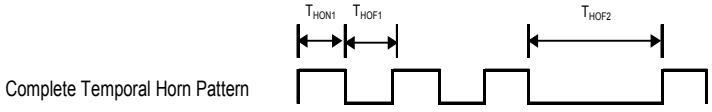
Pins 1 and 4 are not used.
External resistors on pin 13 can be used to adjust the alarm threshold.
R3, R4 and C1 are typical values and may be adjusted to maximize sound pressure.
C2 should be located as close as possible to the device power pins.
Route the pin 8 PC board trace away from pin 7 to avoid signal coupling.

## Timing Diagram




Notes:

1. Smoke is not sampled when the horn is active. Horn cycle is self completing in local alarm.
2. Low battery warning chirp is suppressed in local or remote alarm
3. IO Dump active only in local alarm, inactive if external alarm



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ISO/TS 16949:2002

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