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Freescale Semiconductor
Technical Data

Document Number: MC14600
Rev. 7.0, 6/2007

Low-Power CMOS ALARM IC with Horn Driver

14600

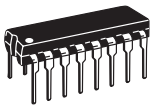
LOW-POWER CMOS ALARM IC WITH HORN DRIVER

The MC14600 Alarm IC is designed to simplify the process of interfacing an alarm level voltage condition to a piezoelectric horn and/or LED. With an extremely low average current requirement and an integrated low battery detect feature, the part is ideally suited to battery operated applications. The MC14600 is easily configured with a minimum number of external components to serve a wide range of applications and circuit configurations. Typical applications include intrusion alarms, moisture or water ingress alarms, and personal safety devices.

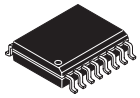
Features

- High Impedance, FET Input Comparator
- Comparator Outputs for Low Battery and Alarm Detect
- Alarm Detect Threshold Easily Established with 2 Resistors
- Integrated Oscillator and Piezoelectric Horn Driver
- Low Battery Trip Point Set Internally (Altered Externally)
- Horn “Chirp" During Low Battery Condition
- Pulsed LED Drive Output
- Reverse Battery Protection
- Input Protection Diodes on the Detect Input
- Average Supply Current: 9 μA
- Pb-Free Packaging Designated by Suffix Codes ED and EG

ORDERING INFORMATION		
Device	**Case No.**	**Package**
MC14600P	648-08	16 PDIP
MC14600DW/R2	751G-04	16 SOIC
MCZ14600EG/R2		16 SOIC (Pb-free)



P SUFFIX
ED SUFFIX (PB-FREE)
16-LEAD PLASTIC DIP
CASE 648-08



DW SUFFIX
EG SUFFIX (PB-FREE)
16-LEAD SOIC
CASE 751G-04

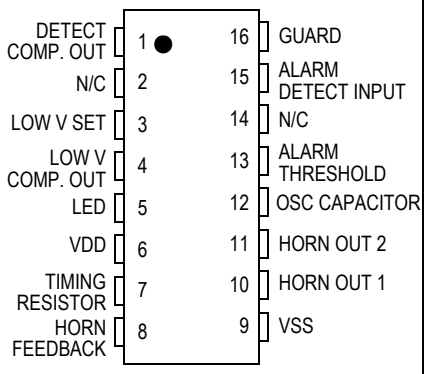


Figure 1. Pin Connections

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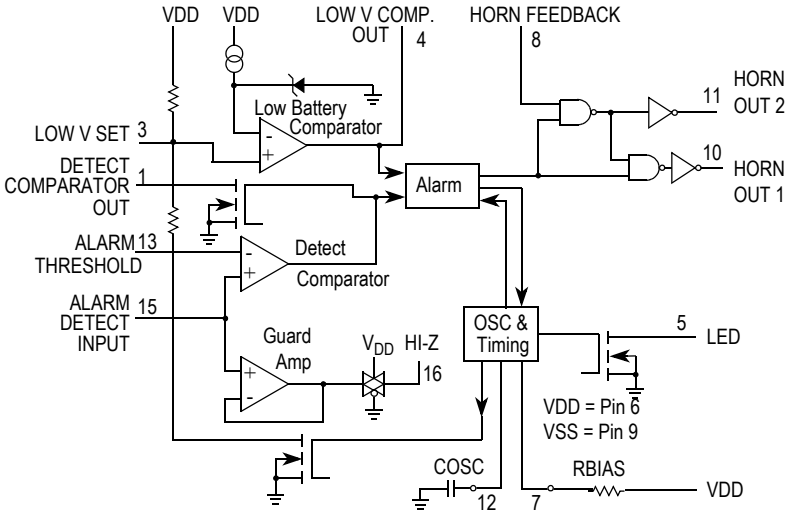


Figure 2. 14600 Block Diagram

Table 1. Maximum Ratings[1]
(Voltages referenced to V_{SS})

Rating	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	-0.5 to +15	V
Input Voltage, All Inputs Except Pin 8	V_{IN}	-0.25 to VDD +0.25	V
DC Current Drain per Input Pin Except Pin 15 = 1 mA	I	10	mA
DC Current Drain per Output Pin	I	30	mA
Operating Temperature Range	T_A	-10 to +60°C	°C
Storage Temperature Range	T_{STG}	-55 to +125	°C
Reverse Battery Time	t_{RB}	5.0	s

1. Maximum Ratings are those values beyond which damage to the device may occur.
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation, it is recommended V_{IN} and V_{OUT} be constrained to the range $V_{SS} \le (V_{IN}$ or $V_{OUT}) \le V_{DD}$.

Table 2. Recommended Operating Conditions
(Voltages referenced to V_{SS})

Parameter	Symbol	Value	Unit
Supply Voltage	V_{DD}	9.0	V
LED Load (Pin 5)	—	10	mA

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Table 3. Electrical Characteristics
(Voltages referenced to V_{CC}, T_A = 25°C)

Characteristics	Symbol	V_{DD}/V_{DC}	Min	Typ[1]	Max	Unit
Operating Voltage	V_{DD}	—	6.0	—	12	V
Output Voltage						
Piezoelectric Horn Drivers (I_{OH} = +16 mA), Pins 10, 11	V_{OH}	7.4	6.5	—	—	V
Comparators (I_{OH} = +30 μA), Pin 4		9.0	8.5	8.8	—	
Piezoelectric Horn Drivers (I_{OL} = -16 mA), Pins 10, 11		7.4	—	—	0.9	
Comparators (I_{OL} = -30 μA), Pin 4	V_{OL}	9.0	—	0.1	0.5	V
(I_{OL} = -200 μA), Pin 1		—	—	—	0.5	
Output Voltage — LED Driver, I_{OL} = 10 mA, Pin 5	V_{OL}	7.2	—	—	2.0	V
Output Impedance, Active Guard, Pin 16	HI-Z	9.0	—	—	1000	kΩ
Standby Current (R_{BIAS} = 8.2 MΩ)	I_{DD}	9.0	—	5.0	9.0	μA
		12.0	—	—	12.0	
Input Leakage Current						
Pin 1	—	9.0	—	—	±30	nA
Pin 8	I_{IN}	9.0	—	—	±0.1	μA
Pin 13	—	9.0	—	—	±30	nA
Detect Comparator Out , Pin 1						
V = 3.0 V	—	—	2.50	—	—	mA
V = 9.0 V	—	—	—	—	8.00	mA
Low Battery Threshold Voltage (Pin 3 Open), Pin 6	V_{LOW}	9.0	7.2	—	7.8	V
Offset Voltage (Measured at $V_{IN} = V_{DD}/2$)						
Active Guard	V_{OS}	9.0	—	—	±100	mV
Detect Comparator		9.0	—	—	±50	
Input Voltage Range, Pin 8	V_{IN}	—	V_{SS} -10	—	V_{DD} +10	V
Input Capacities (to V_{SS} @ 1 khz), Pin 15	C_{IN}	—	—	5.0	—	pF
Common Mode Voltage Range, Pins 13, 15	V_{CM}	—	1.5	—	V_{DD} -2	V
Breakdown Voltage, All Pins Except 15	—	—	±500	—	—	V
Human Body Models/MIL–STD–883 Method 3015, Pin 15	—	—	±400	—	—	

1. Data labelled "Typ" is not to be used for design purposes, but is intended as an indication of the IC's potential performance.

Table 4. Timing Parameters
(C_{OSC} = 0.1 μF, R_{BIAS} = 8.2 MΩ, V_{DD} = 9.0 V, T_A = 25°C, see Figure 3.)

Characteristic		Pin #	Symbol	Min	Max	Units
Oscillator Period (1 Clock Cycle = 1 Oscillator Period)	No Alarm	12	t_{CI}	1.25	2.25	s
	Alarm		—	30	52	ms
Oscillator Pulse Width (No Alarm and Alarm Condition)		3, 4, 5, 13	t_r	7.0	13	ms
LED Output Period	No Alarm	5	t_{LED}	30	52	s
	Alarm		—	.71	1.25	ms
Alarm Horn Output	Hi Time	10, 11	t_{ON}	120	208	ms
	Low Time		t_{OFF}	60	104	ms
Low Battery Horn OutpuT	Hi Time	10, 11	t_{ON}	7.0	13	ms
	Between Pulses		t_{OFF}	30	52	s

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DEVICE OPERATION

Timing

The internal oscillator of the MC14600 operates with a period of 1.65 seconds during no-alarm conditions. Each 1.65 seconds, internal power is applied to the entire IC and a check is made for an alarm input level except during LED pulse, Low Battery Alarm Chirp, or Horn Modulation (in alarm). Every 24 clock cycles a check is made for low battery by comparing V_{DD} to an internal zener voltage. Since very small currents are used in the oscillator, the oscillator capacitor should be of a low leakage type.

Detect Circuitry

If an alarm condition is detected, the oscillator period becomes 41.67 ms and the piezoelectric horn oscillator circuit is enabled. The horn output is modulated 167 ms on, 83 ms off. During the off time, alarm detect input (Pin 15) is again checked and will inhibit further horn output if no alarm condition is sensed. During alarm conditions the low battery chirp is inhibited, and the LED pulses at a 1.0 Hz rate.

An active guard is provided on a pin adjacent to the detect input (Pin 16). The voltage at this pin will be within 100 mV of the input signal. Pin 16 will allow monitoring of the input signal at pin 15 through a buffer. The active guard op amp is not power strobed and thus gives constant protection from surface leakage currents. Pin 15 (the Detect input) has internal diode protection against static damage.

Low Battery Threshold

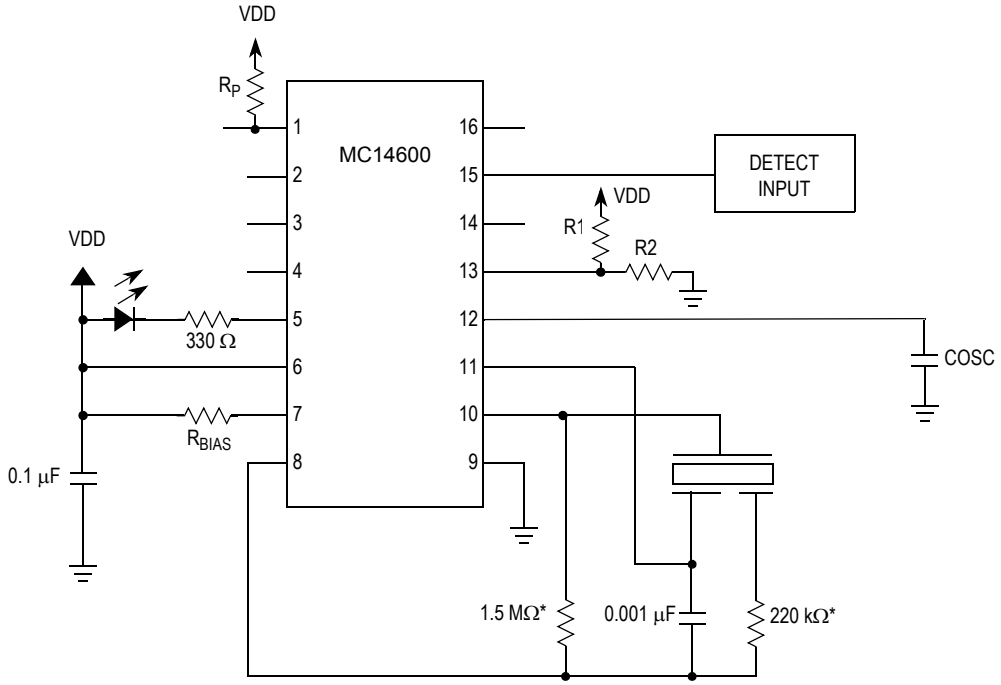
The low battery voltage level is set internally by a voltage divider connected between VDD and VSS. This voltage can be altered by external resistors connected from pin 3 to either VDD or VSS. A resistor to VDD will decrease the threshold while a resistor to GND will increase it.

Alarm Threshold (Sensitivity)

The alarm condition voltage level is set externally through Pin 13. A voltage divider can be used to set the alarm trip point. Pin 13 is connected internally to the negative input of the detect comparator.

LED Pulse

The 9-volt battery level is checked every 40 seconds during the LED pulse. The battery is loaded via a 10 mA pulse for 10 ms. If the LED is not used, it should be replaced with an equivalent resistor so that the battery loading remains at 10 mA.



*Note: Component values may change depending on the type of piezoelectric horn used.

Figure 3. Typical Application Components

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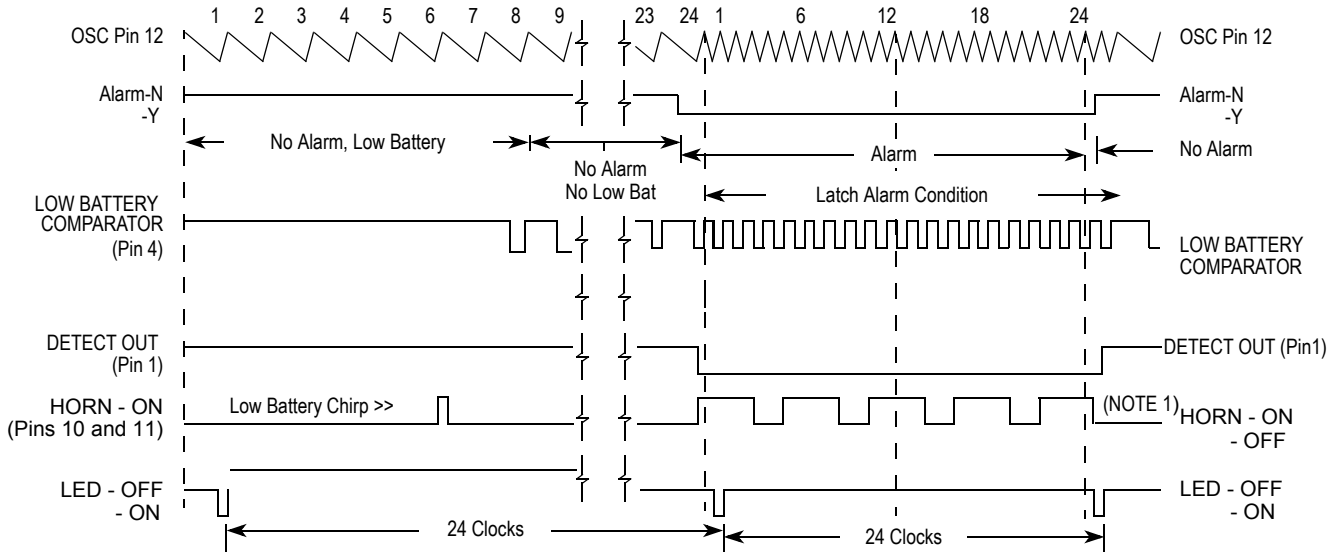


Figure 4. MC14600 Timing Diagram

NOTE:

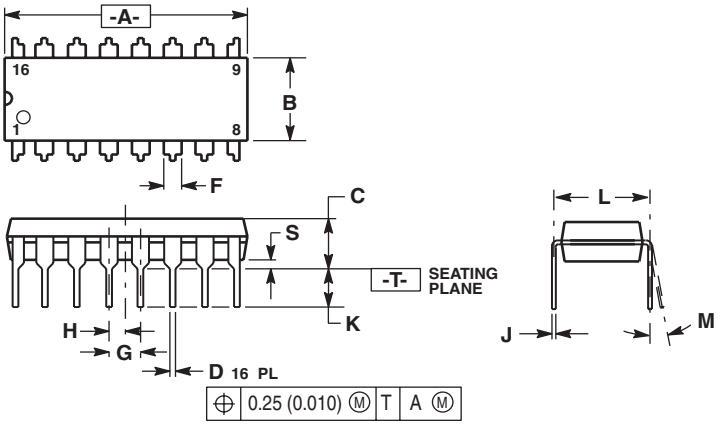
1. Horn modulation is self-completing. When going from Alarm to No Alarm, the alarm condition will terminate only when horn is off.
2. Comparators are strobed once per cycle.
3. Low Battery comparator information is latched only during LED pulse.
4. Current source required into Pin 1.
5. Alarm Condition can initiate on any clock pulse except 1 and 7.

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PACKAGING



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0	10	0	10
S	0.020	0.040	0.51	1.01

STYLE 1:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

STYLE 2:
PIN 1. COMMON DRAIN
2. COMMON DRAIN
3. COMMON DRAIN
4. COMMON DRAIN
5. COMMON DRAIN
6. COMMON DRAIN
7. COMMON DRAIN
8. COMMON DRAIN
9. GATE
10. SOURCE
11. GATE
12. SOURCE
13. GATE
14. SOURCE
15. GATE
16. SOURCE

DATE 05/18/88

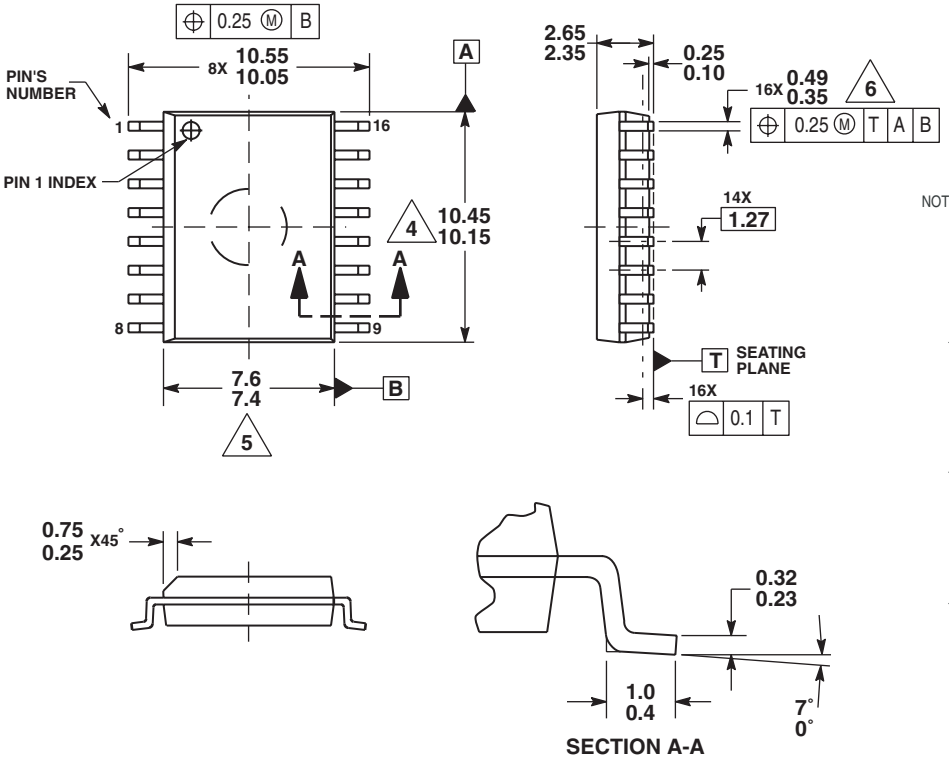
CASE 751G-04
ISSUE D
16-LEAD SOIC

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NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
3. DATUMS A AND B TO BE DETERMINED AT THE PLANE WHERE THE BOTTOM OF THE LEADS EXIT THE PLASTIC BODY.
4. THIS DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS. MOLD FLASH, PROTRUSTION OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE. THIS DIMENSION IS DETERMINED AT THE PLANE WHERE THE BOTTOM OF THE LEADS EXIT THE PLASTIC BODY.
5. THIS DIMENSION DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.25mm PER SIDE. THIS DIMENSION IS DETERMINED AT THE PLANE WHERE THE BOTTOM OF THE LEADS EXIT THE PLASTIC BODY.
6. THIS DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED 0.62mm.

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DATE 03/05/0

CASE 751G-04
ISSUE D
16-LEAD SOIC

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MC14600
Rev. 7.0
6/2007

freescale™ semiconductor

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