

## RCL Semiconductors Ltd.



### 6-Digits LCD Clock with Alarm & Snooze & Light

C1957

#### GENERAL DESCRIPTION

C1957 is a CMOS integrated circuit which is 3-function clock with alarm and snooze function. It can drive a 6-digit triplex liquid crystal display with Colon, AM/PM and Snooze, Alarm, Alarm standby icons. This chip provides a variable alarm sound with crescendo, and light on for 3 seconds as well.

#### FUNCTIONS

- 3-function clock: Hour, Minute and Second
- 60-seconds alarm auto-stop
- Alarm tone 4 steps variable with crescendo
- Alarm stop and light on 3 seconds function
- Snooze function
- Drive 6-digits LCD (1/3 duty 1/2 bias) with six icons: Colon, AM, PM, Alarm, Alarm standby, Snooze
- 12/24 hour format select
- Colon display flash or freeze available
- 2-function clock: Hour, Minute available

#### FEATURES

- Single 1.5V battery operation
- 32768 Hz quartz crystal time base
- Alarm enable / disable
- Alarm Sound Demonstration Capability
- Direct drive of piezoelectric transducer
- 8 operational switches (with pull-down resistor)
- Built-in chip oscillator, capacitor, resistor and voltage doubler.
- Single-chip CMOS construction
- Low power consumption

#### PIN DESCRIPTION

| Function           | Name             | Number | Description                                              |
|--------------------|------------------|--------|----------------------------------------------------------|
| Power Supply       | VDD, VSS         | 2      | Positive and negative supply                             |
| Voltage Doubler    | VDD2             | 3      | VDD2=3V for driving LCD                                  |
|                    | VCP, VCM         |        | Voltage doubler capacitor positive and negative          |
| Alarm Output       | BD, BD bar       | 2      | Directly drive Piezo                                     |
| LCD Drive Output   | SEG1-SEG15       | 15     | LCD segments                                             |
|                    | COM1, COM2, COM3 | 3      | LCD Backplanes                                           |
| Light Drive Output | LIGHT            | 1      | Light on 3 seconds (active at High)                      |
| Oscillator         | OSCI, OSCO       | 3      | Oscillator input and output                              |
|                    | OSCI-C           |        | Oscillator input with built-in Capacitor                 |
| Switch             | NORS             | 1      | Normal time set                                          |
|                    | ALS              | 1      | Alarm time set                                           |
|                    | SNZ              | 1      | Snooze enable/disable                                    |
|                    | ALOFF            | 1      | Alarm off                                                |
|                    | HR               | 1      | Hour digits set                                          |
|                    | MIN              | 1      | Minute digits set and Second digits Reset simultaneously |
|                    | 12/24            | 1      | 12/24-hour format select                                 |
|                    | ALSTOP/LIGHT     | 1      | Alarm stop and light turn on                             |
|                    | TRIG             | 1      | Alarm trigger output pin for switch control              |
| Test               | TEST, TP         | 2      | Test pins                                                |

#### FUNCTION DESCRIPTION

- Icon display: "Colon" icon is on in alarm time setting mode and flashing at 1Hz rate in normal time, alarm time and normal time setting mode  
"PM" icon is on from 12:00:00 PM to 11:59:59 PM and off from 12:00:00 AM to 11:59:59 AM in 12HR format. It is always off in 24HR format.  
"AM" icon is on from 12:00:00 AM to 11:59:59 AM and off from 12:00:00 PM to 11:59:59 PM in 12HR format. It is always off in 24HR format..  
"☉" icon is on in alarm time indication and off in normal time indication  
"☿" icon is on in alarm on mode and off in alarm off mode

"🔔" icon is on in snooze standby mode and flashing at 1Hz rate in snooze operation mode and it is off in alarm off mode.

2. Operation Mode: Normal Time Mode, Alarm Time Mode --- Normal Operation Mode  
Alarm Time Setting Mode, Normal Time Setting Mode --- Setting Mode

In setting mode of alarm time or normal time, Hour or Minute digits can advance +1 by HR or MIN switch is depressed once; or fast advance at 4 Hz rate after HR or MIN switch is depressed for more than 2 seconds. In normal time setting mode, second digits reset whenever MIN switch is pressed.

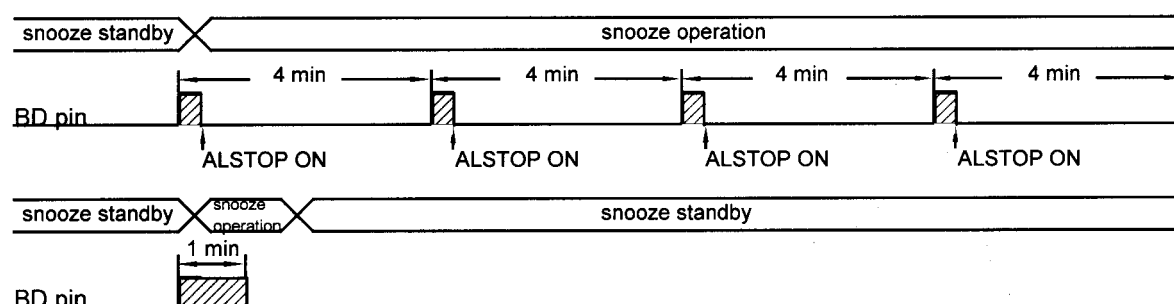
In normal time and alarm time mode, when HR or MIN is depressed, LCD shows the set-in alarm time and the icon "🔔" will also show up.

3. Mode Selection:
- |                          |                                          |
|--------------------------|------------------------------------------|
| Normal time mode         | HR and MIN are all off;                  |
| Alarm time mode          | HR or MIN is on;                         |
| Normal time setting mode | NORS is on and ALS is off;               |
| Alarm time setting mode  | NORS is off and ALS is on;               |
| Alarm off mode           | ALOFF is on and SNZ is off;              |
| Snooze standby mode      | ALOFF is off and SNZ is on.              |
| 12/24-hour mode:         | 12-hour format and 24-hour format select |

4. Alarm Function: Alarm buzzer will sound for 60 seconds when it is time of the set-in alarm time in all the alarm on mode (i.e. when icon "🔔" displaying on LCD). A momentary closure of ALSTOP/LIGHT, or changing any mode switch will stop the alarm sound. During alarm, TRIG output is high.

The 60 seconds alarm sound is a 4 steps variable alarm tone with crescendo. The detail is shown in the diagram of "Waveform of BD Pin" in the last page.

5. Snooze Function: This function can be operated in Alarm Time Mode. When it is time of the set-in alarm time, buzzer sound will output and the icon "🔔" will flash at 1 Hz rate. If ALSTOP/LIGHT is turned on while the buzzer is sounding, alarm sound will be suspended at once and buzzer sound will output 4 minutes later. If ALSTOP/LIGHT is not turned on while the buzzer is sounding, alarm sound will last 60 seconds then go to the snooze standby mode (shown in the diagram below).

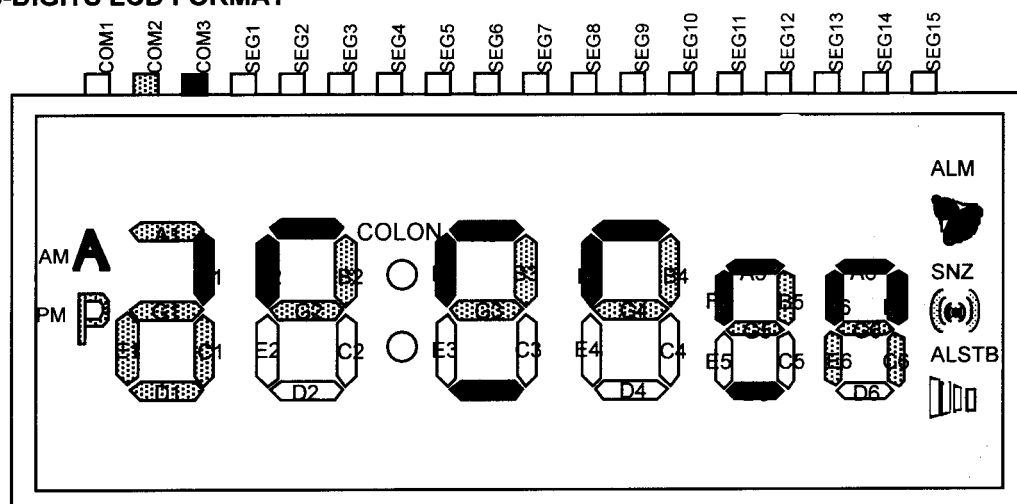


6. Light on function: Whenever ALSTOP/LIGHT is pressed, LIGHT output will go high 3 seconds to turn on the light for 3 seconds.
7. Hour-Minute-Second (3 function) and Hour-Minute (2 function) select by bonding option.
8. Power on C1957: Whenever power on the clock, C1957 is in 12HR format (default set) and LCD displays 12:00:00AM (3 function) corresponding to 0:00:00 in 24HR format; or 12:00AM (2 function) corresponding to 0:00 in 24HR format.

**ELECTRICAL CHARACTERISTICS**

(Ta = 25°C, Vss = 0V, VDD = 1.5V; unless otherwise specified)

| Parameter                  | Symbol | Min. | Typ.         | Max. | Unit | Test Condition               |
|----------------------------|--------|------|--------------|------|------|------------------------------|
| Operating voltage          | VDD1   | 1.2  | 1.5          | 1.65 | V    | —                            |
|                            | VDD2   | 2.2  | 3.0          |      | V    |                              |
| Oscillator Start Voltage   | Vosc   | 1.45 | -            | -    | V    | Within 2 sec                 |
| Supply Current             | IDD    | -    | -            | 3.5  | μA   | Without Load                 |
| Trigger Output Current     | ITP    | 0.2  | 0.25         | -    | mA   | VOH = 1.2V                   |
| Switch Activation Current  | ISW    | 0.1  | 1.0          | 3.0  | μA   | VIN = VDD                    |
| Alarm Drive Current        | IALA   | 0.2  | 0.5          | -    | mA   | Vsat = 0.5V (Both Direction) |
| Light Drive Current        | ILIGHT | 0.8  |              |      | mA   | VOH=0.8V                     |
| Oscillator Frequency       | Fosc   | -    | 32,768       | -    | Hz   | —                            |
| Oscillator Input Capacitor | CIN    | -    | 20           | -    | pF   | —                            |
| Time Stability             | Tstb   | -    | -            | 1    | ppm  | VDD = 1.35 ~ 1.65V           |
| Switch Debouncing Time     | Tdeb   | -    | 60           | -    | mSec | —                            |
| Alarm Output Frequency     | FAL    | -    | 4096x<br>8x1 | -    | Hz   | —                            |

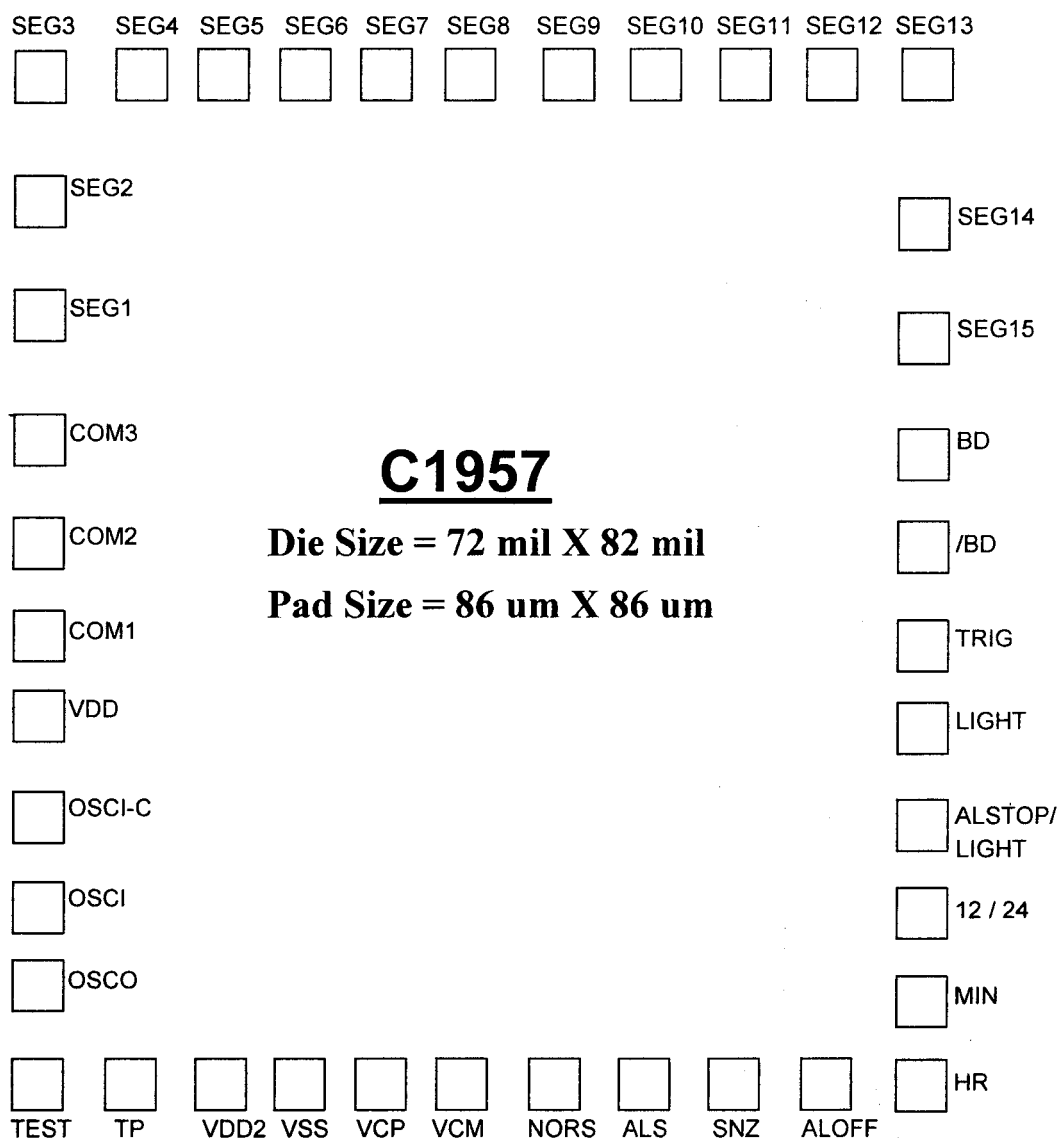
**6-DIGITS LCD FORMAT**

| PIN  | COM1 | COM2 | COM3 | SEG1 | SEG2  | SEG3 | SEG4 | SEG5 | SEG6 |
|------|------|------|------|------|-------|------|------|------|------|
| COM1 | COM1 |      |      | 4D   | COLON | 2D   | 2E   | 2C   | 3E   |
| COM2 |      | COM2 |      | PM   | 1ADEG | 1C   | 2G   | 2B   | 3G   |
| COM3 |      |      | COM3 |      | AM    | 1B   | 2F   | 2A   | 3F   |

| PIN  | SEG7 | SEG8 | SEG9 | SEG10 | SEG11 | SEG12 | SEG13 | SEG14 | SEG15 |
|------|------|------|------|-------|-------|-------|-------|-------|-------|
| COM1 | 3C   | 4E   | 4C   | 5E    | 5C    |       | 6D    |       | ALSTB |
| COM2 | 3B   | 4G   | 4B   | 5G    | 5B    | 6E    | 6G    | 6C    | SNZ   |
| COM3 | 3AD  | 4F   | 4A   | 5F    | 5AD   | 6F    | 6A    | 6B    | ALM   |

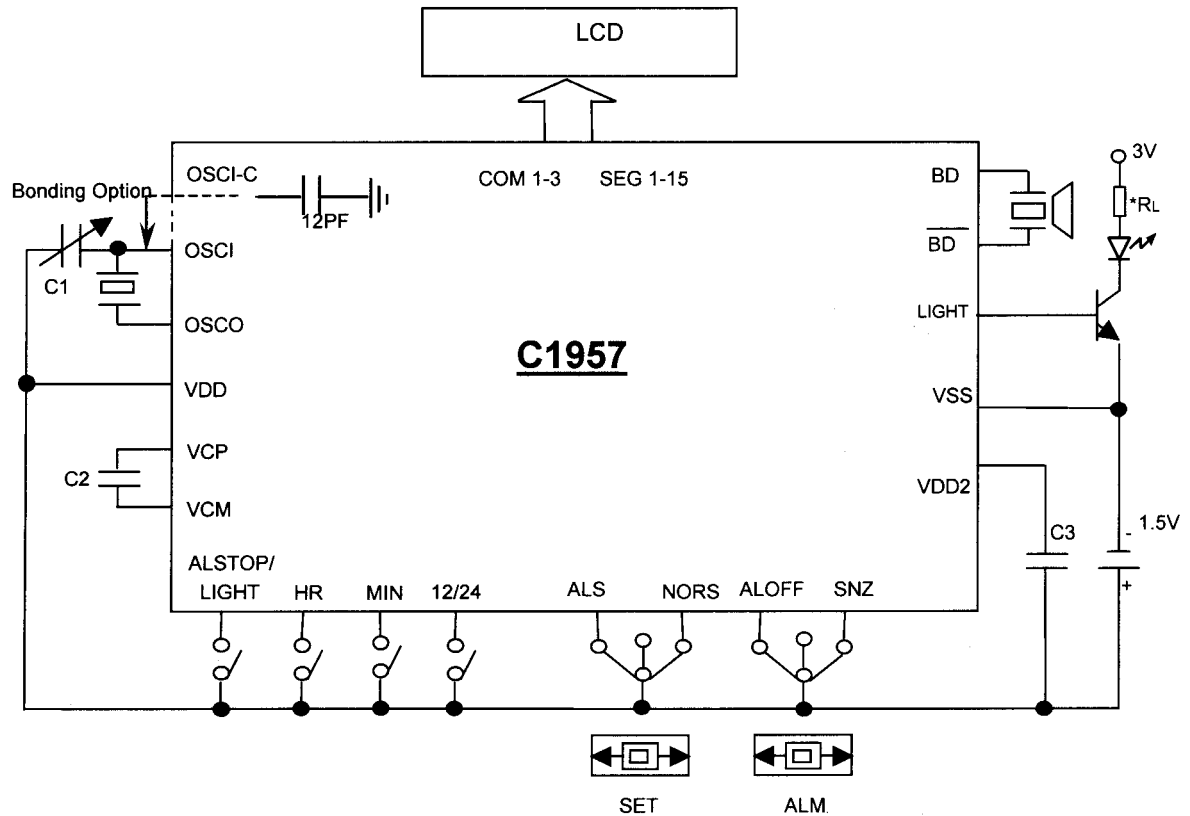
**Note:** When SEG10-SEG14 are not bonded, LCD will display 4 digits (HR : MIN without second).

## PAD DIAGRAM

**The Coordinate of Low Left Corner for Each Pad**

|                       |                             |                      |                        |
|-----------------------|-----------------------------|----------------------|------------------------|
| TEST (-817.9, -929.0) | HR (731.9, -929.0)          | SEG13(731.8, 843.0)  | SEG3 (-817.9, 842.1)   |
| TP (-658.5, -929.0)   | MIN (731.9, -787.0)         | SEG12(565.8, 843.0)  | SEG2 (-817.9, 623.7)   |
| VDD2 (-499.2, -929.0) | 12/24(731.9, -627.7)        | SEG11(411.6, 843.0)  | SEG1 (-817.9, 424.4)   |
| VSS (-358.2, -929.0)  | ALSTOP/LIGHT(731.9, -468.4) | SEG10(255.5, 843.0)  | COM3 (-817.9, 206.1)   |
| VCP (-217.2, -929.0)  | LIGHT(731.9, -298.4)        | SEG9 (105.8, 843.0)  | COM2 (-817.9, 25.1)    |
| VCM (-76.2, -929.0)   | TRIG (731.9, -156.4)        | SEG8 (-66.6, 843.0)  | COM1 (-817.9, -135.9)  |
| NORS (83.5, -929.0)   | /BD (731.9, 17.9)           | SEG7 (-212.6, 843.0) | VDD (-817.9, -276.9)   |
| ALS (243.2, -929.0)   | BD (731.9, 179.9)           | SEG6 (-356.6, 843.0) | OSCI-C(-817.9, -456.2) |
| SNZ (402.5, -929.0)   | SEG15(731.9, 381.6)         | SEG5 (-499.4, 843.0) | OSCI (-817.9, -615.5)  |
| ALOFF(561.8, -929.0)  | SEG14(731.8, 586.4)         | SEG4 (-641.3, 843.0) | OSCO (-817.9, -756.5)  |

## APPLICATION DIAGRAM



- Note :**
1. C1 = 5 - 35 pF      C2 = C3 = 0.1  $\mu$ F
  2. Substrate should be connected to VSS

## WAVEFORM OF ALARM AT BD PIN

Date : Oct 13, 99

