

Preliminary Specification

RCL Semiconductors Ltd.



Four Digits Countdown/Up Timer

C6001A

GENERAL DESCRIPTION

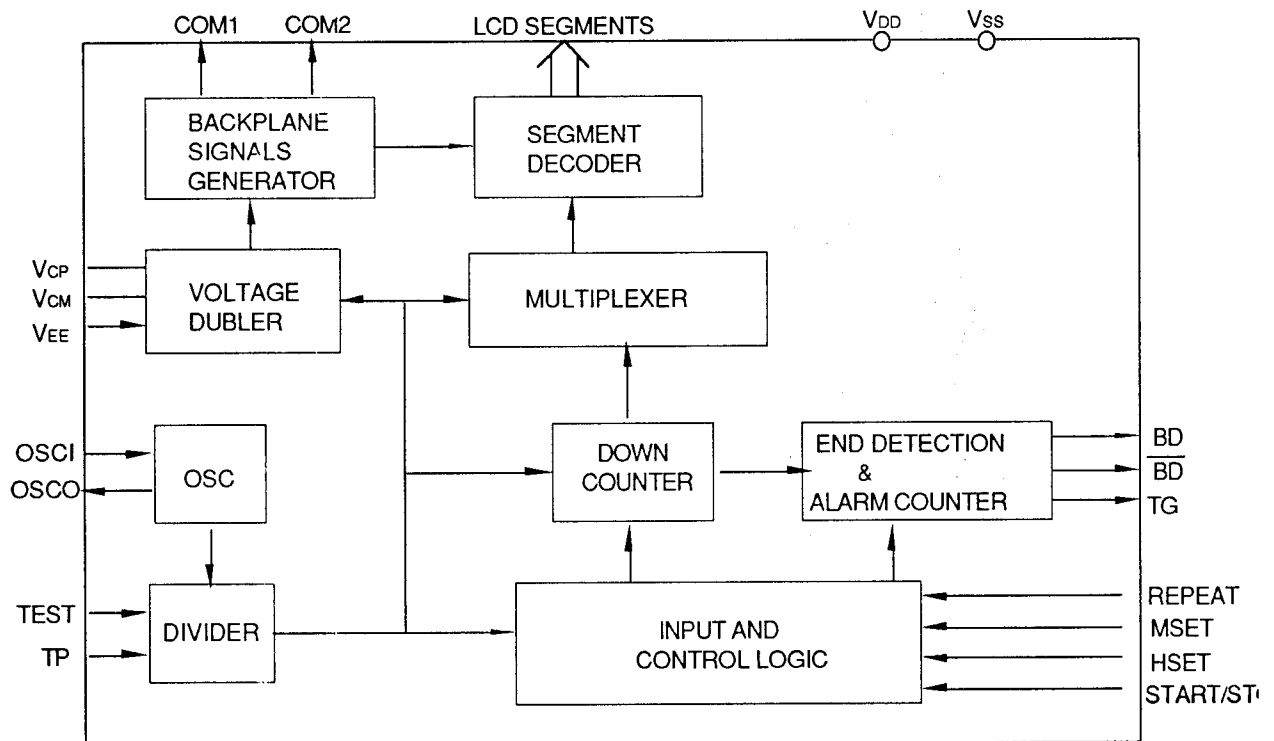
The C6001A is a four digits count-down/up timer CMOS LSI circuit. It can directly drive 4 digits LCD and alarm piezoelectric buzzer. The maximum countdown time is 24 hours and countup cycle time is 24 hours.

The C6001A is suitable for many applications, such as pillbox timer, kitchen timer, parking alarm timer, etc.

FEATURES

- Single 1.5V battery operation
- 32768 Hz quartz crystal time base
- 4 digits LCD display
- Directly drive alarm piezoelectric buzzer
- Maximum countdown time 24 hours
- Maximum countup cycle time 24 hours
- Hour and minute set independently
- Fast setting hour or minute after HSET or MSET depressed continuously for 0.5 second
- 4 digits and colon blanking on every second as timer begins to counting
- Timer reset when HSET & MSET depressed simultaneously
- Countdown timer repeat function by bonding option
- Immediately start timer after START depressed, but 2 second delay to stop timer after STOP depressed
- Special alarm trigger output for switch control or for driving another melody IC
- 5 minutes and 10 minutes pre-alarm function
- Internal voltage doubler

BLOCK DIAGRAM



PIN DESCRIPTION

HSET - Hour Setting Input

This pin is used for setting the time hour during countdown mode. The setting function will be effective only when the countdown mode has been stopped or reset. If this pin is pulled high with the pin MSET simultaneously, the timer will be reset. This pin has been internally pulled low.

MSET - Minute Setting Input

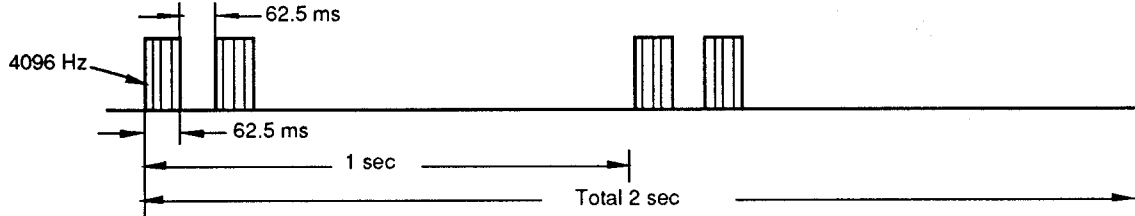
This pin is used for setting the time minute during countdown mode. The setting function will be effective only when the countdown mode has been stopped or reset. This pin with the HSET pin is used to execute the reset function. This pin has been internally pulled low.

START/STOP - Start or Stop Input

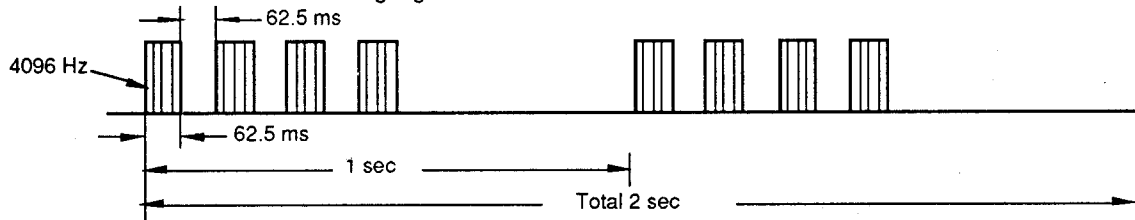
This pin acts as Start/Stop function for the Up/Down timer. After power on or reset, the timer will be in stop state. When it is triggered, the timer will be enable, and another trigger will stop the timer after this pin depressed continuously for 2 second. It has been internally pulled low.

BD, BD bar - Piezo Buzzer Driving Output

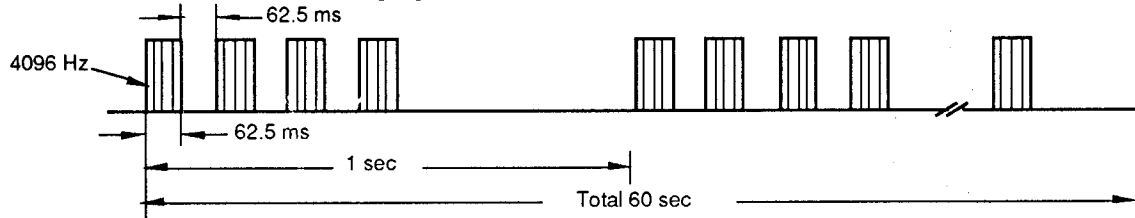
These two pins are used to drive the piezo buzzer directly. BD bar is the inverting output of BD. BD sends out the following signal 10 minutes before the countdown time reaches zero:



BD sends out the following signal 5 minutes before the countdown time reaches zero.

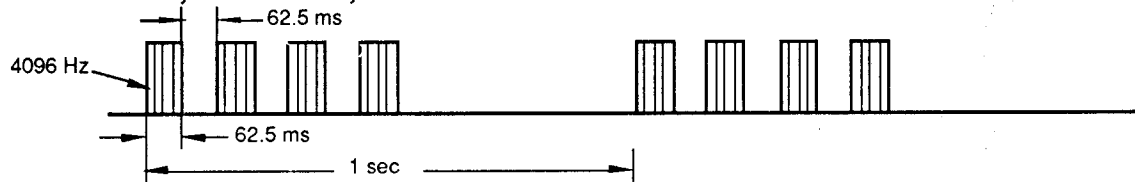


BD sends out the following signal when the countdown time reaches zero.



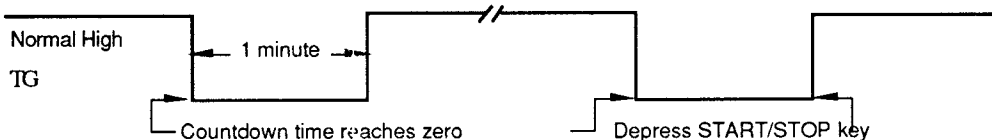
The above alarm signals will be stopped if Start/Stop is triggered during this period of time.

When HSET and MSET are depressed simultaneously, BD will send out the following signal successively until these keys are released.



TG - Trigger Output

This output pin sends out a high level signal in normal condition, including countdown, countup and standby. If countdown time reaches zero, a low level output appears in this 60 seconds alarm interval; then goes back to high level while alarm stops or START/STOP key is pressed.



REPEAT - Repeat Control Input pin

This input pin controls the repeat function. If this pin is connected to Vss, the chip won't execute the repeat function. A trigger of START/STOP pin will start the countup timer after countdown time has reached zero. If it is connected to VDD, the countdown timer will operate repeatedly by triggering START/STOP pin when the countdown timer is zero, i.e. when countdown timer has reached zero, a simulation of START/STOP makes the countdown timer start to count from the time previously set.

To execute the countup function when the REPEAT pin is high, a reset (depressing HSET and MSET simultaneously) has to be carried out first.

VDD / VSS / VEE - Power Supply Pins

VDD is positive power supply, VSS is ground and VEE is Voltage Doubler supply.

VCP / VCM - Voltage Doubler Capacitor Pins

A capacitor should be connected between these two pins.

OSCI / OSCO - Oscillator Input and Output Pins

A 32768 Hz quartz crystal oscillator is connected to these two pins to generate the system timing. Both XT and XTB have a built-in capacitance.

COM1, COM2, 1A/DEG/1C, 1B/2D, 2F/2E, 2A/2G, 2B/2C, COL/4D, 3F/3E, 3AD/3G, 3B/3C, 4F/4E, 4A/4G, 4B/4C - LCD Display Pins

These are LCD display pins. COM1 and COM2 are backplane pins and the others are segment driving pins.

TP and TEST - Test1 and Test2 Input Pins

These two test pins are used for speeding up the testing.

FUNCTIONAL DESCRIPTION**1. Countdown Timer Mode**

- a. After power on, LCD will display $\overline{00:00}$ for about one second and then return to $0:00$.
- b. Time is set by HSET and MSET pins. Time setting is only effective in this mode and the timer must be in the stop or reset state. Each depression of these pins will make the timer count advance on digit and if it is depressed more than 0.5 seconds, the timer will count one digit for every 1/4 second. The hour setting and minute setting are independent. Colon will be on but will not flash during time setting.
- c. The timer will reset to 0:00 and generate an alarm test, if HSET and MSET are depressed simultaneously. This alarm signal will be on as long as these pins are depressed.
- d. After time has been set, triggering START/STOP pin will start the timer and colon with 4 digits will begin to flash(0.5 sec on 0.5 sec off).
- e. When the timer is counting, it will be stopped by another triggering of START/STOP depressed continuously for 2 seconds. In this stop state, the colon with digits will be on but will not flash. The timer can also be set during this state. An additional trigger to START/STOP will terminate this state and start to count from the time which it displays.
- f. As countdown time remains 10 minutes and 5 minutes, BD and BD bar will send out the pre-alarm signal which is described in the Pin Description. A trigger of START/STOP or depressing HSET & MSET simultaneously during this output period, will truncate the pre-alarm output.
- g. When countdown time is reached, LCD displays 0:00 and the colon with digits will be on but will not flash. At this moment, BD and BD bar will send out a 4096 X 8 X 1 Hz signal for 60 seconds. During this alarm period, triggering START/STOP or triggering reset(MSET and HSET depressed at same time) will stop the alarm output. If the repeat function is enable, the triggering of START/STOP will restart the countdown timer from the previous setting time. If the repeat function is disable, START/STOP triggering will only stop the output.
- h. When the countdown timer reaches zero and the alarm signal ends(after 60 seconds), timer can be set. If repeat function is enable, a trigger of START/STOP will execute previous setting time after the timer reaches zero and alarm for 60 seconds. If repeat function is disable, in the above case, a triggering of START/STOP will start the countup timer.
- i. When this chip is in countdown timer mode, DCO will send out a DC high level signal and can not be stopped until the timer reaches zero or reset.

2. Countup Timer Mode

a. If repeat function is enable, countup timer will start only when the chip has been reset and powered on without a set time. If there is no repeat function, depressing START /STOP key will start the countup timer when the countdown time has reached zero and the alarm output has finished. However, the countup timer will start by triggering START/STOP after reset. One special case, if you set time to 0:00 after reset or the countdown timer reaches zero with no repeat function, a trigger of the START/STOP countup timer will start.

b. The countup timer has a cyclical count of 24 hours after being started. The counting sequences are listed below:

0:00 -> 0:01 -> 0:02 ->->23:00 -> 23:01 ->23:59



In this mode, it will always display hours and minutes . In addition, colon is always on and not flashing.

c. While the countup timer is counting, depressing the START/STOP key will stop it. Another trigger of START/STOP will start the timer continuously counting.

d. When the chip is in count up timer mode, the chip can change to count down timer mode after the countup timer is reset by depressing MSET and HSET at the same time.

ABSOLUTE MAXIMUM RATINGS(Ta = 25 °C)

Parameter	Symbol	Limits
Power supply voltage range	VDD - VSS	-0.3 V to +3.0V
Input voltage range	Vin	VSS -0.3 to VDD +0.3
Operating temperature range	TA	-20 to +60°C
Storage temperature range	Tstg	-40 to +70°C

DC ELECTRICAL CHARACTERISTICS

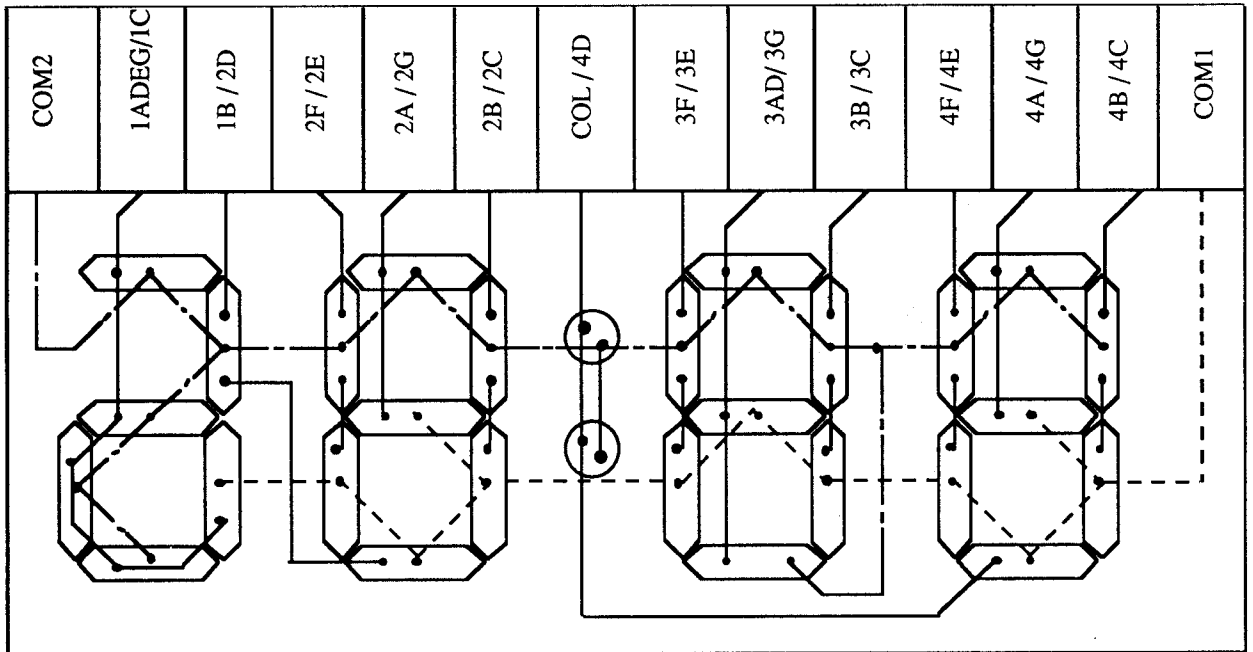
Unless otherwise specified, Ta = 25°C, VDD = 0V, VSS = -1.5V, Fosc = 32768 Hz

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Operating voltage range	VSS	-1.8	-1.5	-1.2	V	-
Voltage Doubler Supply	VEE	-3.6	-3.0	-2.4	V	-
Supply current	IDD	-	-	3	μA	**no load
Buzzer Driving Current	IBD	200			μA	VBD =1V
TRIG Driving Current	IT	200			μA	VOH =1.2V
Frequency Stability	Δf/f	-	-	1	ppm	VSS =-1.35V to -1.65V
Oscillator Built-in Capacitor	CD	-	20	-	pF	-
Alarm Output Frequency	FBD	4096x8x 1		-	Hz	-
LCD Driving Current	ILCD	0.1	-	-	μA	
Oscillator Start up Time	Tosc	-	-	2	sec	VSS = -1.2V

Note: ** refers to LCD unload, BD & BD bar & TG open. No trigger input.

MAR 21, 1996

4-DIGITS LCD FORMAT



12 LCD SEGMENT OUTPUT PADS:

- | | | |
|-----------|--------|--------|
| 1A/DEG/1C | 1B/2D | 2F/2E |
| 2A/2G | 2B/2C | COL/4D |
| 3F/3E | 3AD/3G | 3B/3C |
| 4F/4E | 4A/4G | 4B/4C |

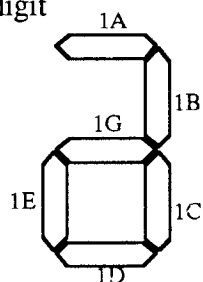
2 LCD BACKPLANES OUTPUT PADS

- COM1 COM2

LCD BIPLEX SEGMENT ARRANGEMENT

Pad NO. in IC	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	COM1	4B	4A	4F	3B	3AD	3F	COL	2B	2A	2F	1B	1A/DEG	
		4C	4G	4E	3C	3G	3E	4D	2C	2G	2E	2D	1C	COM2

The 1th digit



The 2th - 4th digits

