HT1330
3-1/2 Digit Timer + Watch

Features

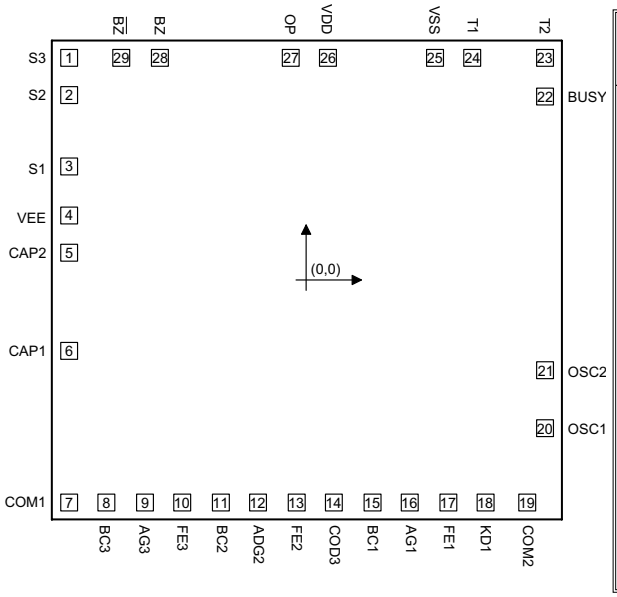
- A real time watch
- A 20-hour adjustable range setting count-down timer
- 20-minute count-up display cycle time
- 20 hours of count-up time maximum
- Auto recycle or manual reset the count-down timer by bonding option
- Hours and minutes are set independently
- Real time display in timer mode
- 5-minute/10-minute pre-alarm
- DC output and piezo output
- An internal voltage doubler
- Busy flag output high in timer counting
- 3-1/2 digit LCD display
- 32768Hz crystal oscillator
- Single 1.5V battery operation

General Description

The HT1330 is a CMOS fabricated LSI chip designed to drive a standard three and 1/2 digit biplexed LCD for a count-up/down timer in watch applications. The watch and timer are based on a 32768Hz quartz crystal oscillator. The maximum count-down time is 20 hours with an accuracy of 1 second. The maximum count-up period is 20 hours, but the LCD will normally display a maximum period of 19 minutes and 59 seconds. If the user presses switch ″S2″, the total count-up time in hours and minutes will be displayed. In the count-up/down mode, the real time can be seen by pressing switch ″S1″ and return to the count-up/down mode by releasing ″S1″.

Once the count-down is finished, the timer can either automatically recycle the preset time or manually reset the desired time depending on the selected bonding-pad option. The forecast alarm generates 4 alarm sounds at 10 minutes before set time and 8 alarm sounds at 5 minutes before set time. The HT1330 can be used as a parking timer, an alarm timer, a pill box timer, a kitchen timer, a sports timer, etc.

Pad Assignment



Pad Coordinates

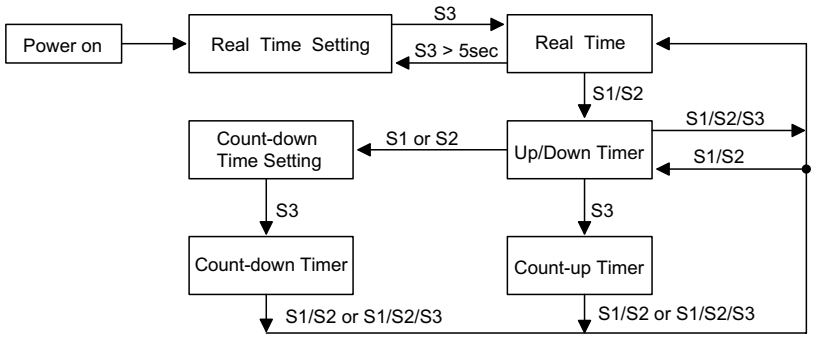
Unit: mil

Pad No.	X	Y	Pad No.	X	Y
1	–62.7	58.7	16	27.3	–58.7
2	–62.7	48.7	17	37.3	–58.7
3	–62.7	30.1	18	47.3	–58.7
4	–62.7	17.2	19	58.3	–58.7
5	–62.7	7.3	20	62.7	–38.8
6	–62.7	–18.7	21	62.7	–23.7
7	–62.7	–58.7	22	62.7	48.6
8	–52.7	–58.7	23	62.7	58.7
9	–42.7	–58.7	24	43.8	58.7
10	–32.7	–58.7	25	33.8	58.7
11	–22.7	–58.7	26	5.8	58.7
12	–12.7	–58.7	27	–4.3	58.7
13	–2.7	–58.7	28	–38.6	58.7
14	7.3	–58.7	29	–48.6	58.7
15	17.3	–58.7			

Chip size: 119 × 112 (mil)^2

* The IC substrate should be connected to VDD in the PCB layout artwork.

Operational Sequence



Note: S1 for Hour setting

S2 for Minute setting

S3 to Start/Stop the timer

S3>5 seconds into the real time setting mode

S1/S2 to reset the timer to the initial state (0:00)

S1/S2/S3 to return to the real time mode

Pad Description

Pad No.	Pad Name	I/O	Description
1	S3	I	Input to start/stop the timer
2	S2	I	Input for minute setting
3	S1	I	Input for hour setting
4	VEE	—	Negative voltage supply for LCD display
5	CAP2	O	For voltage doubling capacitor
6	CAP1	O	For voltage doubling capacitor
7	COM1	O	Common 1 drive
8	BC3	O	Segment drive
9	AG3	O	Segment drive
10	FE3	O	Segment drive
11	BC2	O	Segment drive
12	ADG2	O	Segment drive
13	FE2	O	Segment drive
14	COD3	O	Segment drive
15	BC1	O	Segment drive
16	AG1	O	Segment drive
17	FE1	O	Segment drive
18	KD1	O	Segment drive
19	COM2	O	Common 2 drive
20	OSC1	I	Oscillator input
21	OSC2	O	Oscillator output
22	BUSY	O	Timer busy flag, active high
23	T2	I/O	Chip test pin
24	T1	I/O	Fast-test control pin
25	VSS	—	Negative power supply, ground
26	VDD	—	Positive power supply
27	OP	I	Option pin for countdown recycle
28	BZ	O	Piezo drive
29	$\overline{BZ}$	O	Piezo drive

Absolute Maximum Rating

Supply Voltage.....–0.3V to 5V
Input Voltage.....V_{SS}–0.3V to V_{DD}+0.3V
Storage Temperature.....–50°C to 125°C
Operating Temperature .....–0°C to 70°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Electric Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Supply Voltage	1.5V	—	1.25	1.50	1.70	V
I_{DD}	Operating Current	1.5V	fosc=32768Hz No load	—	—	2	μA
V_{EE}	Display Voltage	1.25~1.7V	—	–1.2	–1.5	–1.7	V
I_{IN}	Switch Input Current	1.5V	$V_{IN}=V_{DD}$	5	—	65	μA
V_{STR}	Osc Starting Voltage	—	Within 3 secs	1.35	—	—	V
Δf/f	Frequency Stability	1.25~1.7V	—	—	—	10	PPM
I_{OHA}	Alarm Output Drive Current	1.5V	V_{OH}=1.35V	–480	—	—	μA
f_{OUT}	Alarm Output Frequency	1.5V	—	—	4096	—	Hz
I_{OHF}	Busy Flag Output Drive Current	1.5V	V_{OH}=1.35V	–480	—	—	μA

Functional Description

When power is turned on, all the LCD segments are illuminated to display "18:88" and the alarm sounds 2 seconds.

For fast-test, hold the "TP1" pin high and the minute digit will be increased every second.

In the count-down mode, when the time has gone past the set time and the alarm is stopped, the set time will remain at its current state or be reset to 0:00 depending on the bonding of the "OPT" pin to VDD.

In the timer mode, while the timer is counting, the actual time can be displayed by pressing "S1". Once "S1" is released, the count-down time will be shown instead.

In the count-up mode, the LCD display is normally in minutes and seconds where the maximum count-up period is 20 minutes. If "S2" is pressed, the LCD display will revert to hours and minutes and the maximum count-up time will turn out to be 20 hours.

The timer alarm will sound during the count-down process as listed below:

4 sounds are generated at 10 minutes before the set time is up.

8 sounds are generated at 5 minutes before the set time is up.

Once the set time is reached, the alarm will sound 60 seconds unless it is stopped by users (by pressing S3), in which case the preset time of the timer will remain unchanged or at 0:00 depending on the status of the option pin.

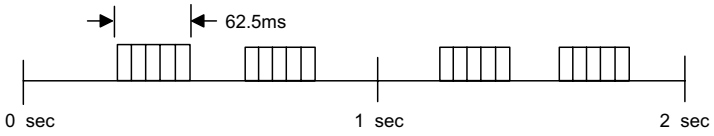
Pressing any one of the inputs (S1 or S2 or S3) will stop the alarm during the period for which the alarm is sounding.

At 0:00 in the timer mode, the alarm will sound when S1 and S2 are simultaneously depressed. This is for the alarm test only.

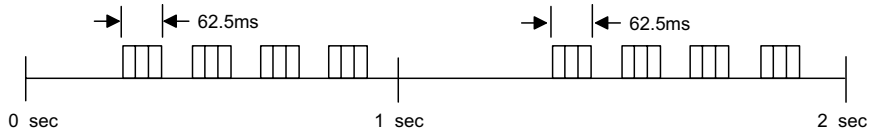
After the device is powered on, the alarm will sound two seconds and all segments on the LCD display panel be illuminated.

Output Waveform

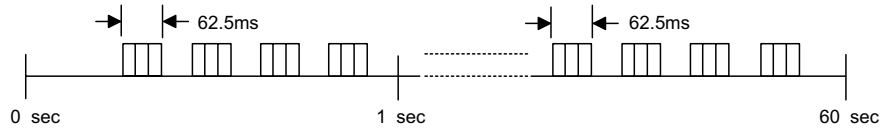
10 minutes before set time is up



5 minutes before set time is up



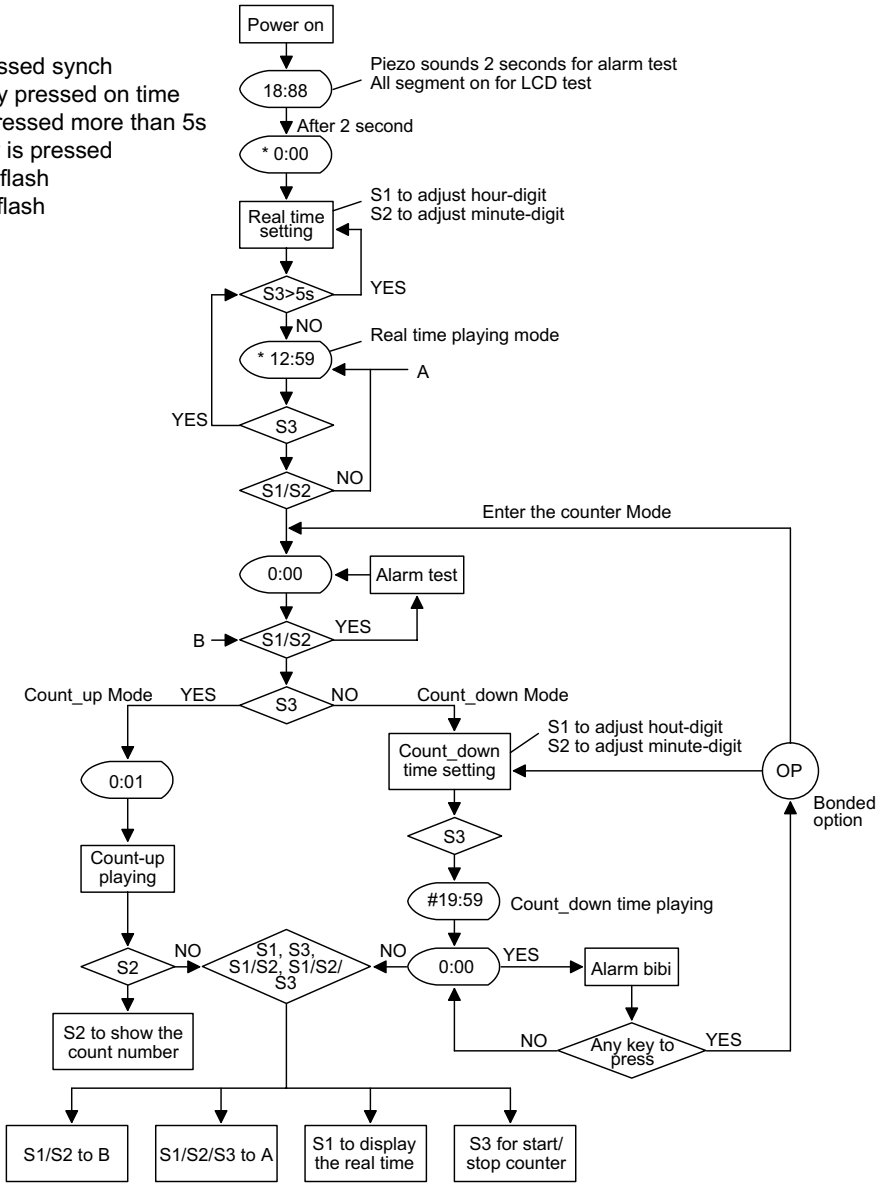
Time is up



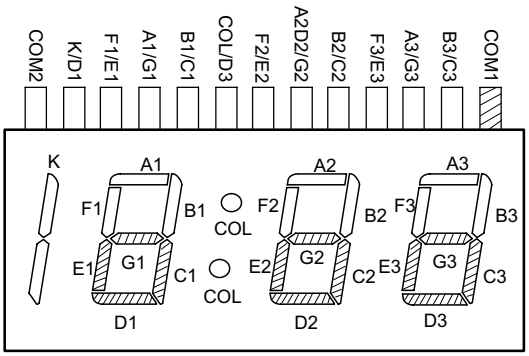
Timer busy flag output

Operational FlowChart

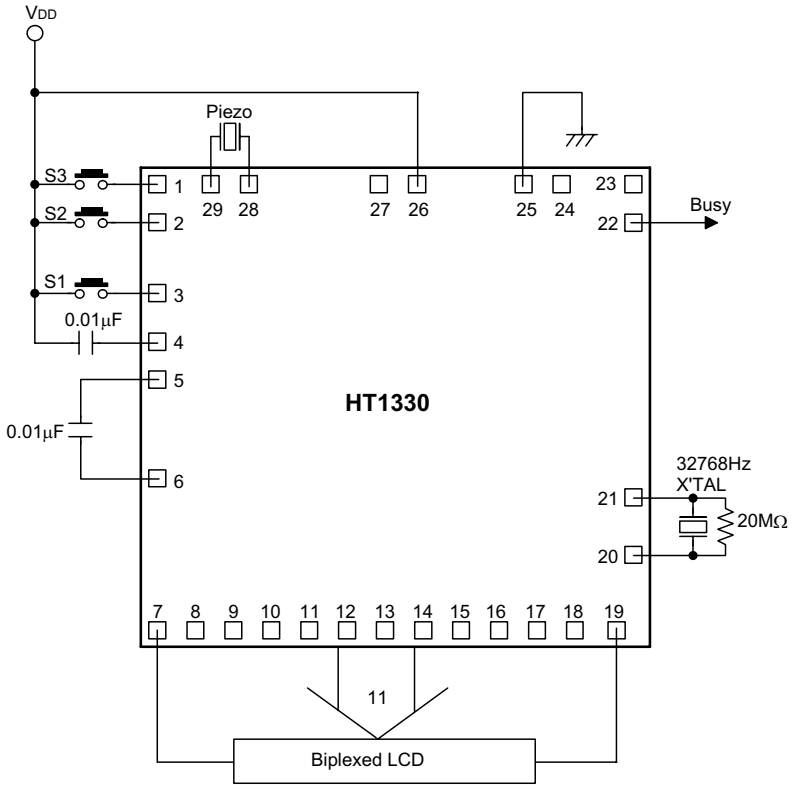
Note:
S1/S2: two key pressed synch
S1/S2/S3: three key pressed on time
S3>5s: S3 key is pressed more than 5s
S1, S2, S3: the key is pressed
#: Represents 2Hz flash
*: Represents 1Hz flash



LCD Format



Application Circuits



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