FINAL SPECIFICATION

FOR

DATE COUNTDOWN WATCH & CLOCK

HCS-T003-0

PROJECT CODE : **HCS-T003-0**
DATE : **OCTOBER 22, 1998**
PREPARED BY : **DAVID CHU**

APPROVED BY:

_____

DATE:

SPECIFICATION FOR **DATE COUNTDOWN WATCH & CLOCK**

PROJECT CODE : HCS-T003-0
MCU SELECTED : LC573202A
DATE : OCTOBER 22, 1998

I. GENERAL DESCRIPTION

A 4-bit single chip microcontroller is implemented into a timer device. It is specifically designed to show the time left from reaching a specified date. It can be used as a watch or a clock with 4 buttons and 6 buttons, respectively. The features are:

1.1 6 digits with hours, minutes, seconds; 4 digits with date (month and day); and 7 flags for showing the day of week.

1.2 Select to show days/hours/minutes/seconds or seconds countdown from the target date, 1st January 2000 by default. User can set the target date and year anytime between 1998 to 2019. A default melody will be played to alert the user when the clock reaches the target date.

1.3 Function as a watch with 4-buttons operation or as a clock with 6-buttons operation – 2 extra buttons for quick access to Countdown.

1.4 Clock with 12 / 24 hour format by key selection.

1.5 Two daily alarms available for both real time and dual time. Two melodies are played for alarm purpose in alternate days according to the day of week. Stop alarm and activate snooze function by pressing any key when the alarm melody is playing.

1.6 Dual time with day of week available.

1.7 Snooze function (twice) after the initial alarm is activated.

1.8 Real time hourly chime available.

1.9 1/100 second display resolution stop watch with lap function counting up to 99 minutes 59 seconds. Accuracy to 1/10 second.

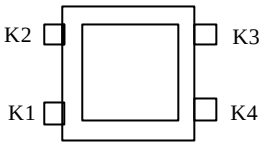
1.10 Operation Voltage: 3 volts.

1.11 32,768 Hz crystal oscillation.

1.12 Direct drive LCD 1/4 duty 1/2 bias at 3 volts.

II. KEY OPERATION DESCRIPTIONS

Watch version



2.1 K1

- In sequences of Real Time mode, Alarm 1 mode, Dual Time mode, Alarm 2 mode, Countdown by days, Stop Watch, and repeat.
- Select key when in setting mode. In Real Time setting mode, press key to select second, minute, hour, day, month, year (month and day are shown on the 2nd line of display), or day of week. In both Alarm 1 and 2 setting modes, press key to select minute or hour. In target date setting mode, press key to select day, month, or year.

2.2 K2

- Enter or exit all setting modes, with corresponding digits flashing when setting mode is entered. First setting digits will be second for time set; day for date set.

2.3 K3

- Increment digits by 1 in all setting modes. Key auto-repeat function (10 Hz) is activated when the key is held about 1 to 2 seconds.
- In Stop watch mode, press to start the lap function. Elapsed time will keep counting while the display is not updated. Press again to show the 2nd lap time when the elapsed time is stopped.
- Press to toggle alarm in alarm display modes.
- Press to increment hour in dual time setting mode if dual time is ahead of the real time. The day of week flag for dual time will be adjusted accordingly. No auto-repeat function.
- In countdown mode, press to toggle between the 2 display formats for the countdown – all seconds countdown or days/hours/minutes/seconds countdown. Default display is all second countdown.

2.4 K4

- In Stop watch mode, start or stop the stop watch.
- Press to toggle between 12 / 24 hour display format in Real Time, and Dual Time modes.
- Press to toggle hourly chime function in both Alarm 1 and 2 modes.
- Press to decrement hour in dual time setting mode if dual time is behind the real time. The day of week flag for dual time will be adjusted accordingly. No auto-repeat function.

Clock version

In addition to the above 4 keys, K1 to K4, another 2 keys are mainly used for countdown.

2.5 K5

Days and time countdown key

- Press at any time to display the countdown by days, hours, minutes, and seconds.

2.6 K6

All second countdown key

- Press at any time to display the countdown by total seconds.

2.7 Key Assignment Table

The following table summarizes the functions of the keys in different modes.

	K1	K2	K3	K4
Real Time	Mode	Set Mode	—	12/24
Setting	Select	Exit Set	Increment	12/24
Alarm 1	Mode	Set Mode	Set Alarm	Set Chime
Setting	Select	Exit Set	Increment	Set Chime
Dual Time	Mode	Set Mode	—	12/24
Setting	Select	Exit Set	Increment Hour	Decrement Hour
Alarm 2	Mode	Set Mode	Set Alarm	Set Chime
Setting	Select	Exit Set	Increment	Set Chime
Countdown	Mode	Set Mode	Display	—
Setting	Select	Exit Set	Increment	—
Stop Watch	Mode	—	Lap / Reset	Start/Stop

Note:

- Press K1, K2, K3, and K4 simultaneously to reset the device.
- Stop snooze by pressing K3 whenever snooze indicator is ON.
- Press K5 to go directly to day/hour/minute/second countdown mode.
- Press K6 to go directly to all second countdown mode.

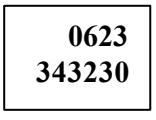
III. SPECIFIC FEATURES

3.1 Alarm Features

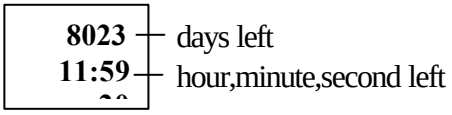
- Two melodies are available. One will be played when the alarm time is on Sunday, Tuesday, Thursday, or Saturday. Another one will be played on Monday, Wednesday, or Friday.
- Alarm enabled indicator will be ON in all modes if either or both alarm 1 and 2 are enabled. However, inside Alarm modes 1 and 2, the indicator will show individual alarm status accordingly.
- Alarm 2 is specifically designed for dual time. Alarm 2 will sound if the dual time is same as the Alarm 2 time. It is possible to have 2 daily alarms for current time if the dual time is set up such that it is same as the current time.
- If alarm is sounding, press any key to shut off the alarm melody and go into snooze period with snooze dot indicator being turned on.
- Snooze will repeat (sound the alarm again) every 16 minutes for 2 times. To disable the snooze, press K3 in any mode during snooze period. Snooze function can be re-activated if a key is pressed during the 2nd snooze sounding alarm.

3.2 Date Countdown

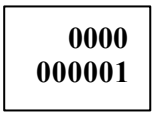
- The result of days/hours/minutes/seconds will be shown by subtracting current time from year 2000 (1st January 2000 at time 00:00:00). (By default)
- The target date (from current date up to 31st December 2019) can be set by the user. A new countdown is generated by changing the target date in setting mode (entry by Set key). If current date is the same as or after the target date, the display will show all zeros digits to indicate that countdown is not valid in this case. Countdown is not available unless the user re-enters a new target date which is after the current date.
- As current time reaches 12:00 a.m. of the target date and year (default – 1st January 2000), a default melody will be played automatically. No preset operation is required.
- Default display mode shows the total seconds left (all second countdown). Press K3 to toggle between all seconds countdown or days/hours/minutes/seconds countdown display mode.



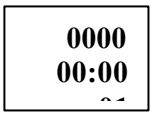
e.g. 623,343,230 seconds left
All second countdown



e.g. 8,023 days, 11 hours 59 minutes and 20 seconds left
Day/hour/minute/second countdown



e.g. 1 second left
All second countdown



e.g. 0 days, 1 second left
Day/hour/minute/second countdown

3.3 Dual Time

- Press K2 to enter setting mode.
- K3 is the + KEY for dual time hour. Press K3 to increment the hour if dual time is ahead of the real time (e.g. Hong Kong time as the dual time is ahead of London time as the real time by 8 hours). The date will be adjusted automatically according to the real time.
- K4 is the – KEY for dual time hour. Press K4 to decrement the hour if dual time is behind of the real time. The date will be adjusted automatically according to the real time.
- The default dual time upon entering Dual Time setting mode is the current time. Use K3 or K4 to adjust for different time zones.

3.4 Stop Watch

- Press K4 to start and stop the elapsed time.
- Press K3 to reset to 00:00:00 when in stop state.
- Press K3 to enter lap state when running. The display of the elapsed time is held while the elapsed time is still running. Lap indicator is ON.
- Press K3 again to release the lap. Elapsed time displays again.
- Press K4 to stop the elapsed time when in lap state. Lap indicator will still be ON.
- Press K3 to exit lap state (Lap indicator OFF) and display the stopped elapsed time. Press K3 again to reset to 00:00:00.

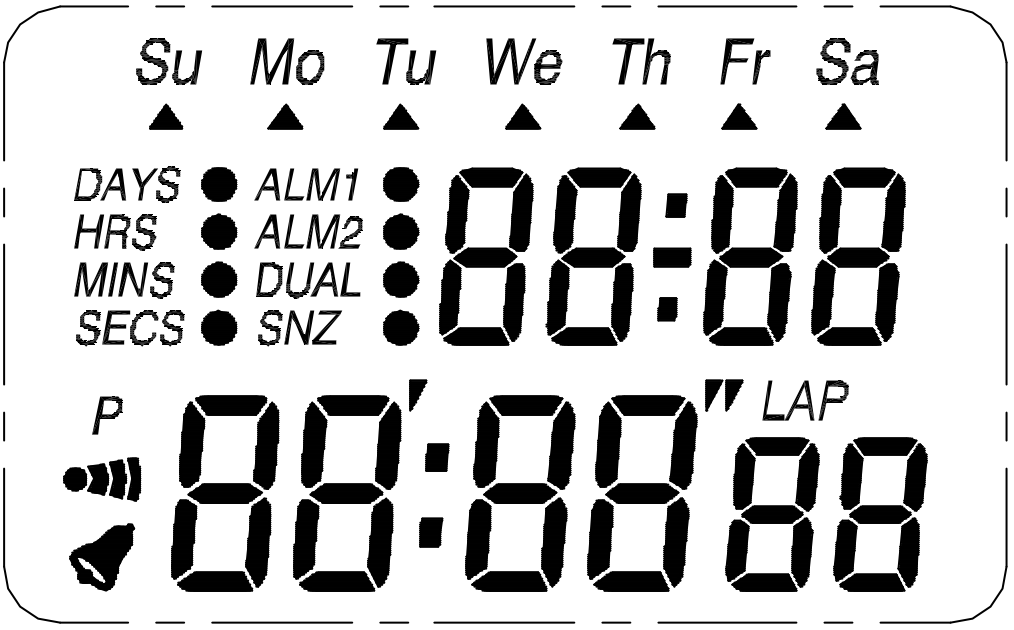
3.5 Auto Calendar

- Date available from 1st January 1998 to 31st December 2019. Leap year, the 29th, 30th, and 31st day of the month will be detected automatically by the device upon exiting from setting mode. Day of week is to be set manually by the user.

3.6 Auto Exit Setting Mode

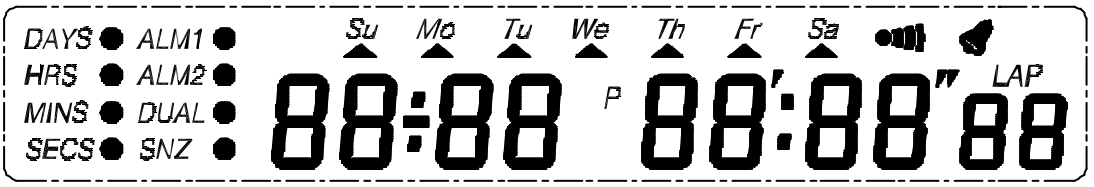
- Exit in about 1 to 2 minutes if the device is left idle in all setting modes. This feature is to avoid any accidental changes to the setting.

LCD PATTERN

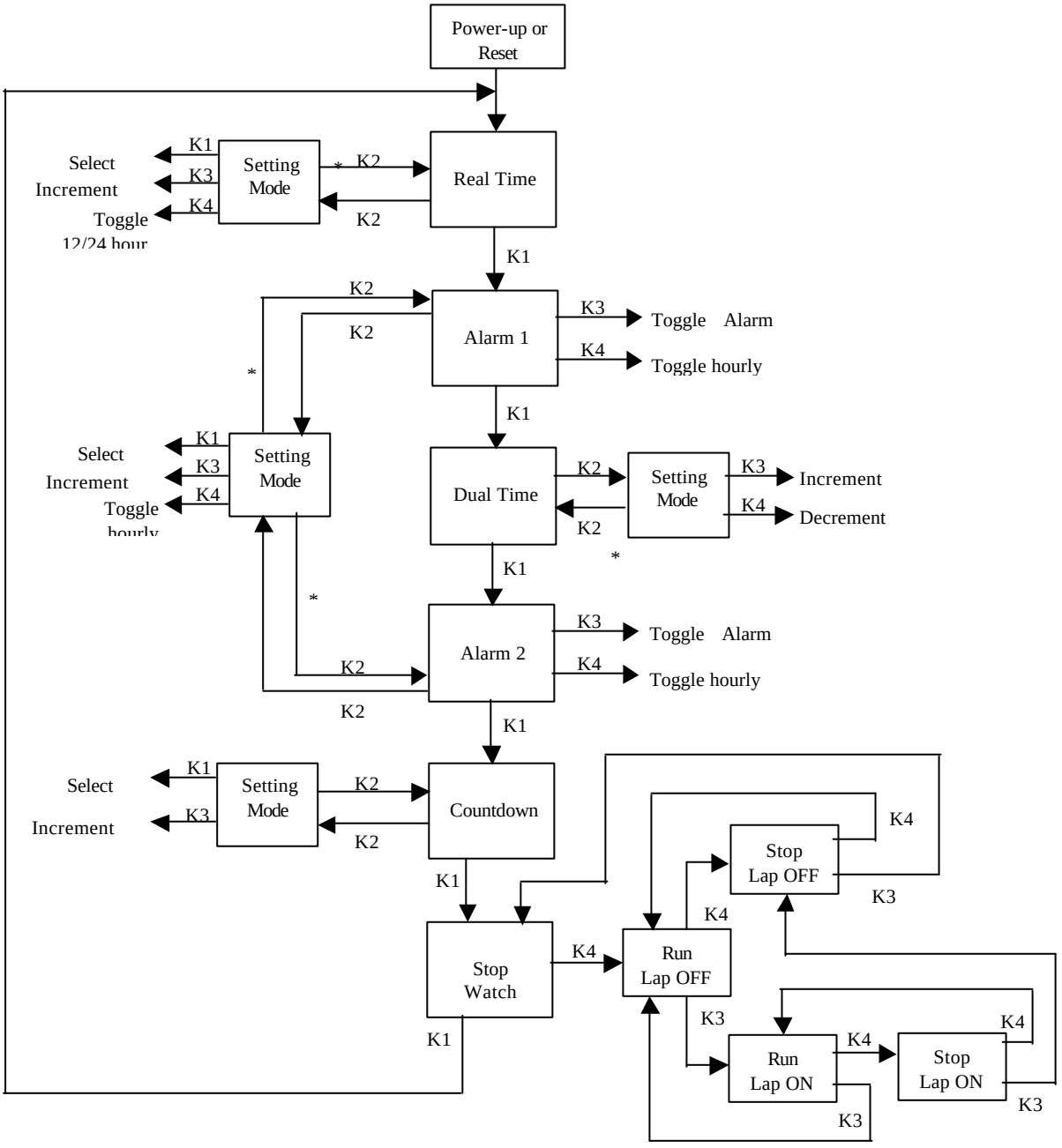


4.1 Watch Version

4.2 Clock Version



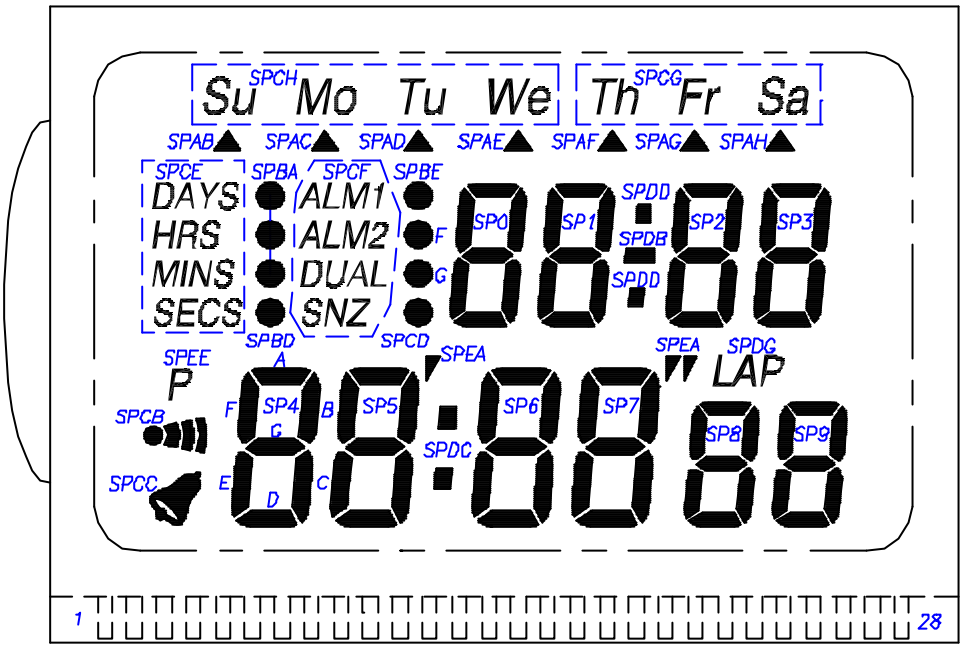
V. OPERATION FLOW DIAGRAM



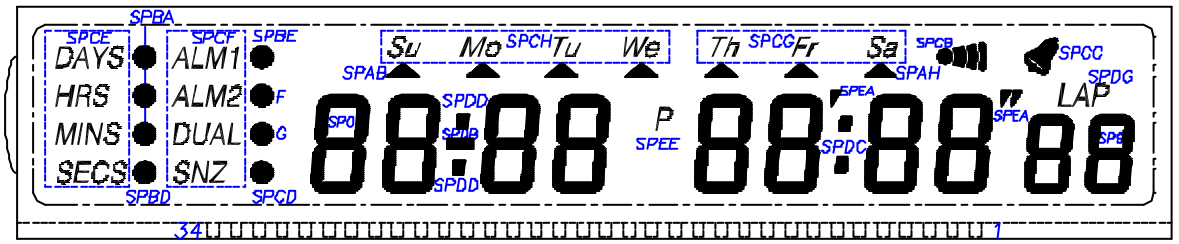
* Auto exit if keys are not pressed.

VI. LCD ASSIGNMENT

6.1 LCD Pattern with Labels (Watch Version)



6.2 LCD Pattern with Labels (Clock Version)



6.3 LCD Assignment Table (Watch Version)

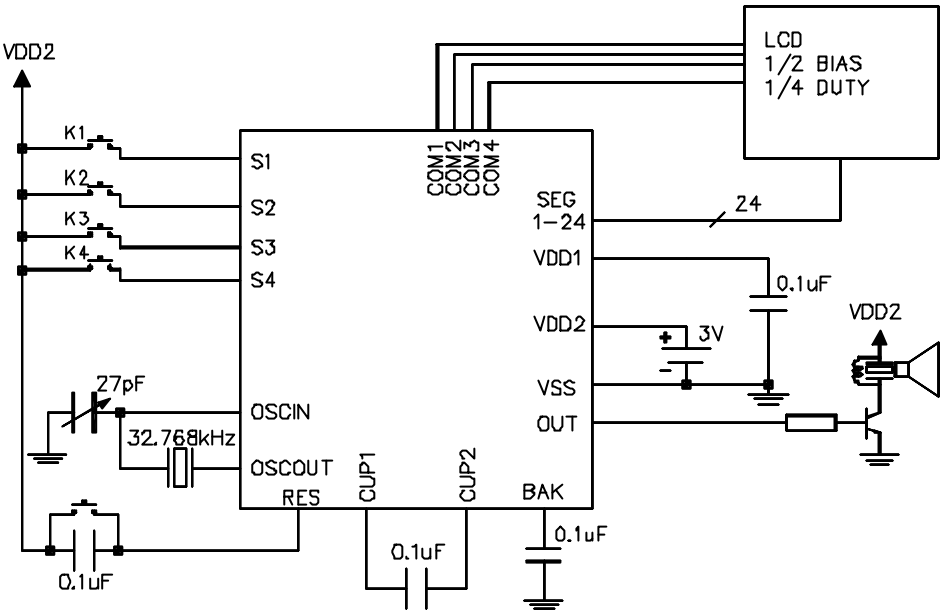
Pad No.	LSI Name	COM 1	COM 2	COM 3	COM 4
1	SEG 8	SP1F	SP1A	SP1D	SP1E
2	SEG 9	SP0F	SP0A	SP0D	SP0E
3	SEG 10	SPCH	SPAE	SPCD	SPBG
4	SEG 11	SPAD	SPAC	SPAB	SPCE
5	SEG 12	SPBF	SPBE	SPBD	SPBA
6	COM 3	—	—	COM 3	–
7	COM 4	—	—	—	COM 4
8	SEG 13	SP0G	SP0B	SPCF	SP0C
9	SEG 14	SP4G	SP4E	SPCB	SP4F
10	SEG 15	SP4C	SP4D	SP4A	SP4B
11	SEG 16	SP5G	SP5E	SPEE	SP5F
12	SEG 17	SP5C	SP5D	SP5A	SP5B
13	SEG 18	SP6G	SP6E	SPDC	SP6F
14	SEG 19	SP6C	SP6D	SP6A	SP6B
15	SEG 20	SP7G	SP7E	SPCC	SP7F
16	SEG 21	SP7C	SP7D	SP7A	SP7B
17	SEG 22	SP8G	SP8E	SPDG	SP8F
18	SEG 23	SP8C	SP8D	SP8A	SP8B
19	SEG 24	SP9G	SP9E	—	SP9F
20	COM 1	COM 1	—	—	—
21	COM 2	—	COM 2	—	—
22	SEG 1	SP9C	SP9D	SP9A	SP9B
23	SEG 2	SP3G	SP3B	SPEA	SP3C
24	SEG 3	SP3F	SP3A	SP3D	SP3E
25	SEG 4	SP2G	SP2B	SPDD	SP2C
26	SEG 5	SP2F	SP2A	SP2D	SP2E
27	SEG 6	SPAH	SPCG	SPDB	SPAG
28	SEG 7	SP1B	SPAF	SP1C	SP1G

6.4 LCD Assignment Table (Clock Version)

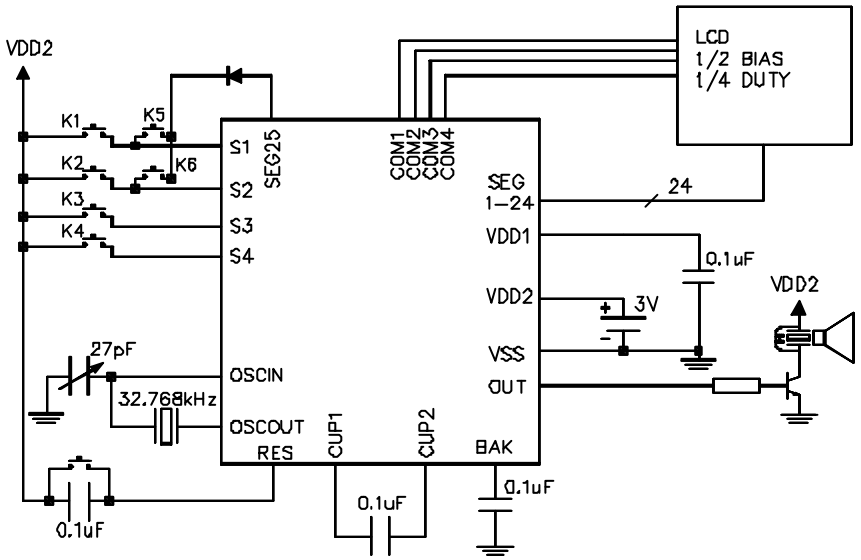
Pad No.	LSI Name	COM 1	COM 2	COM 3	COM 4
1	SEG 6	SPAH	SPCG	—	SPAG
2	SEG 14	—	—	SPCB	—
3	SEG 1	SP9C	SP9D	SP9A	SP9B
4	COM 2	—	COM 2	—	—
5	COM 1	COM 1	—	—	—
6	SEG 24	SP9G	SP9E	—	SP9F
7	SEG 23	SP8C	SP8D	SP8A	SP8B
8	SEG 22	SP8G	SP8E	SPDG	SP8F
9	SEG 21	SP7C	SP7D	SP7A	SP7B
10	SEG 20	SP7G	SP7E	SPCC	SP7F
11	SEG 19	SP6C	SP6D	SP6A	SP6B
12	SEG 18	SP6G	SP6E	SPDC	SP6F
13	SEG 17	SP5C	SP5D	SP5A	SP5B
14	SEG 16	SP5G	SP5E	SPEE	SP5F
15	SEG 15	SP4C	SP4D	SP4A	SP4B
16	SEG 14	SP4G	SP4E	—	SP4F
17	SEG 2	SP3G	SP3B	SPEA	SP3C
18	SEG 3	SP3F	SP3A	SP3D	SP3E
19	SEG 4	SP2G	SP2B	—	SP2C
20	SEG 5	SP2F	SP2A	SP2D	SP2E
21	SEG 4	—	—	SPDD	—
22	SEG 6	—	—	SPDB	—
23	SEG 7	SP1B	SPAF	SP1C	SP1G
24	SEG 8	SP1F	SP1A	SP1D	SP1E
25	SEG 13	SP0G	SP0B	—	SP0C
26	SEG 9	SP0F	SP0A	SP0D	SP0E
27	SEG 10	—	—	SPCD	SPBG
28	SEG 11	—	—	—	SPCE
29	SEG 12	SPBF	SPBE	SPBD	SPBA
30	COM 4	—	—	—	COM 4
31	COM 3	—	—	COM 3	—
32	SEG 13	—	—	SPCF	—
33	SEG 11	SPAD	SPAC	SPAB	—
34	SEG 10	SPCH	SPAE	—	—

VII. CIRCUIT DIAGRAM

7.1 Watch Version

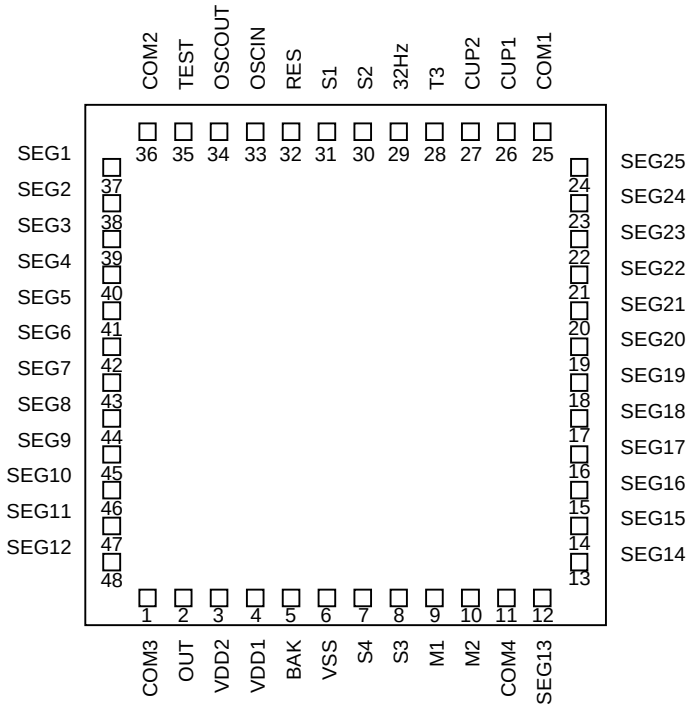


7.2 Clock Version



Pad assignment

Chip thickness : 480μm
Chip size (X × Y) : 2.54mm × 2.27mm
Pad size : 120μm × 120μm
Pad pitch : 140μm minimum



Note:
When a Lithium battery has been selected as the power supply, please note the following points.
There are two modes of use for the lithium battery: Backup mode and Normal mode (backup flag off). In backup mode, the battery potential is applied directly to the oscillation circuit, whereas in Normal mode only half the battery potential is applied.
Because of the different voltage applied to the oscillation circuit in each mode, there may be a difference in the generated oscillation frequency. When entering backup mode a corresponding error will arise. If timing accuracy is required (for clocks, etc), please bear in mind the above in the program design.

Pad name and coordinates

QFP64 PIN No.	Pad No.	Pad Name	Coordinates Xμm	Coordinates Yμm
1	1	COM3	-700	-1030
2	2	OUT	-560	-1030
3	3	VDD2	-420	-1030
4	4	VDD1	-275	-1030
5	5	BAK	-135	-1030
6	6	VSS	5	-1030
7	7	S4	145	-1030
8	8	S3	285	-1030
9	9	M1	425	-1030
10	10	M2	565	-1030
11	11	COM4	705	-1030
12	12	SEG13	845	-1030
13	13	SEG14	895	-775
14	14	SEG15	895	-635
15	15	SEG16	895	-495
16	16	SEG17	895	-355
17	17	SEG18	895	-215
18	18	SEG19	895	-75
19	19	SEG20	895	65
20	20	SEG21	895	205
21	21	SEG22	895	345
22	22	SEG23	895	485
23	23	SEG24	895	625
24	24	SEG25	895	765

QFP64 PIN No.	Pad No.	Pad Name	Coordinates Xμm	Coordinates Yμm
25	25	COM1	840	1030
26	26	CUP1	700	1030
27	27	CUP2	560	1030
28	28	T3	420	1030
29	29	32HZ	280	1030
30	30	S2	140	1030
31	31	S1	0	1030
32	32	RES	-140	1030
33	33	OSCIN	-280	1030
34	34	OSCOUT	-420	1030
35	35	TEST	-560	1030
36	36	COM2	-700	1030
37	37	SEG1	-895	765
38	38	SEG2	-895	625
39	39	SEG3	-895	485
40	40	SEG4	-895	345
41	41	SEG5	-895	205
42	42	SEG6	-895	65
43	43	SEG7	-895	-75
44	44	SEG8	-895	-215
45	45	SEG9	-895	-355
46	46	SEG10	-895	-495
47	47	SEG11	-895	-635
48	48	SEG12	-895	-775

- The pad coordinates are such that the chip center is taken as the origin and the values for (X, Y) represent the coordinates of the center point of each pad.
- Substrate must be connected to VSS or left open.

LC573202A Terminal Description

Pin Name	Pad No. Pin No.	I/O	Function description	Option
VSS	6	-	Power terminal(-)	-
VDD1	4	-	•Power terminal(+) (Ag battery version) •Voltage supply to LCD driver (Li battery & EXTV ver.) (C is connected between VDD1 and VSS.) •Voltage supply to logic unit (Ag battery version, Back up flag OFF at Li battery version.)	Battery version Ag/Li/EXTV
VDD2	3	-	•Power terminal(+) (Li battery & EXTV version) •Voltage supply to LCD driver (Ag battery version) (C is connected between VDD2 and VSS.) •Voltage supply to logic unit (EXTV version, Back up flag ON at Li battery version.)	Battery version Ag/Li/EXTV
BAK	5	-	•Power terminal(+) •For Li battery version, a capacitor must be connected across BAK and VSS to prevent logic unit from malfunctioning.	-
CUP1, 2	26, 27	-	Capacitor connecting terminals for step-up/step-down.	-
S PORT S1 to S4	31 30 8 7	I	•4-bit input port •Input for HALT release •LSI system is reset by applying VDD* to S1 to S4 simultaneously. (Mask option) 〔*Ag version : VDD1 Li/EXTV version : VDD2〕 •Programmable pull-down resistor •"L"-level hold Tr. (Mask option)	•"L"-level hold Tr. Provided/Not provided •Reset by setting S1-S4 Enable/disable
M-PORT M1, M2	9 10	I	•2-bit input port •Input for HALT release •Programmable pull-down resistor •"L"-level hold Tr.	•"L"-level hold Tr. Provided/Not provided
OUT	2	O	•Output terminal •Selectable general output or buzzer output by mask option (1) As using general output port •The output level is controlled by executing the SLGT and RLGT instructions. (2) As using buzzer output •Melody signal or 9 kinds of modulated signal is controlled by executing the SAS or TMEL instructions.* (Possible to output non-modulated signal) •Possible to output 3 octave melody signal.	•Output data Melody(Buzzer) /General output
SEG1 to SEG25	37 to 48 12 to 24	O	•LCD output terminals for segment •Possible to use output port for SEG13 to SEG25 (Pad No.12 to 24) by mask option. •SEG13 can be used as COM4 output by mask option.	•Output form segment/CMOS (SEG13-SEG25) •Output data SP=0-FH, DBUS=a/b/c/d/e/f/g/h •SEG13/COM4
COM1 to COM4	25, 36 1, 11	O	•LCD output terminals for common •COM4 can be used as normal output terminal by mask option.	•LCD duty 1/1,1/2,1/3,1/4 •COM4/LIGHT

Continue.

Pin Name	Pad No. Pin No.	I/O	Function description	Option
OSCIN	33	I	•Input for 32.768kHz crystal oscillation •Input for RC oscillation •R is connected between OSCIN and OSCOUT and C is connected between OSCIN and VSS.	•Oscillation circuit X'tal oscillation /external RC oscillation
OSCOUT	34	O	•Output for 32.768kHz crystal oscillation •Output for RC oscillation •R is connected between OSCIN and OSCOUT.	•Oscillation circuit X'tal oscillation /external RC oscillation
RES	32	I	Reset	
TEST	35	-	•Test terminal •This terminal should be left unconnected.	
T3	28	-	•Test terminal •This terminal should be left unconnected.	
32Hz	29	-	•Test terminal •This terminal should be left unconnected.	

* 9 kinds of modulated output : For 32.768kHz crystal oscillation, proportional to oscillation frequency.
Please refer to User's manual for more detail.

(Note) There are two operation modes, back-up mode (back up flag on) and normal mode (back up flag off), in Li battery specification. In normal operation mode, the internal circuit of CPU is operated on 1/2 of Li battery voltage (it can be monitored as external capacitor voltage of voltage step down circuit).
The power consumption can be saved in normal mode operation. However, the large current flown into/from the buzzer output or output port will generate a voltage drop-down and it might be a cause of abnormal CPU operation. If the microcontroller has to drive a large current, switch the CPU into the back up mode before driving the current.
CPU consumes the relatively large current in back up mode. When the Li battery voltage has recovered, you should change the CPU into the normal mode.
CPU is in the back up mode at reset.

Li battery version

1. Absolute Maximum Ratings at Ta=25±2°C, VSS=0V

Parameter	Symbol	Pin & Conditions	Ratings	Unit
Supply voltage	VDD1		-0.3 to +4.0	V
	VDD2		-0.3 to +4.0	
Input voltage	VIN1	OSCIN (Back-up flag OFF)	-0.3 to VDD1+0.3	
	VIN2	S1-S4, M1, M2, TEST, RES OSCIN (Back-up flag ON)	-0.3 to VDD2+0.3	
Output voltage	VOUT1	CUP2, OSCOUT (Back-up flag OFF)	-0.3 to VDD1+0.3	
	VOUT2	SEG1-SEG25, COM1-COM4, CUP1, OUT, OSCOUT (Back-up flag ON)	-0.3 to VDD2+0.3	
Peak output current (at each pins)	IOUT1	OUT	4	mA
	IOUT2	COM4 (As using LIGHT)	1	
	IOUT3	Output except OUT and COM4	500	μA
Total output current	IALL	The total all pins.	10	mA
Maximum power dissipation	Pdmax	QFP48	430	mW
Operating temperature range	Topr		-30 to +70	°C
Storage temperature range	Tstg		-40 to +125	

2. Recommended Operating Range at Ta=-30°C to + 70°C, VSS=0V

Parameter	Symbol	Conditions	Ratings			Unit
			min.	typ.	max.	
Operating supply voltage	VDD1		1.30		3.6	V
	VDD2		2.6		3.6	
Input high voltage	VIH	S1-S4, RES, M1, M2	VDD2-0.4		VDD2	
Input low voltage	VIL	S1-S4, RES, M1, M2	0		0.4	
Oscillation frequency range	fOPG1	•32.768kHz (crystal oscillation) •VDD2=2.6 - 3.6V •Refer to figure 1	32	32.768	33	kHz

3. Electrical Characteristics at Ta=-30°C to + 70°C, VSS=0V

Parameter	Symbol	Conditions	Ratings			Unit
			min.	typ.	max.	
Pull-down transistor	RIN1A	VDD2=2.9V, VIL=0.4V, Low level hold Tr. Fig.3 *1	150	300	1000	kΩ
	RIN1B	VDD2=2.9V, Low level pull in Tr. Fig.3 *1	100	300	1000	
	RIN2	VDD2=2.9V, TEST, RES	10		300	
Output high voltage	VOH1	VDD2=2.9V, IOH=-0.4μA *2	VDD2-0.2			V
Output low voltage	VOL1	VDD2=2.9V, IOL=0.4μA *2			0.2	
Output high voltage	VOH2	VDD2=2.9V, IOH=-4μA, COM1-4	VDD2-0.2			
Output middle voltage	VOM	VDD2=2.9V, IOH=-4μA, IOL=4μA, COM1-4	VDD2/2 -0.2		VDD2/2 +0.2	
Output low voltage	VOL2	VDD2=2.9V, IOL=4μA, COM1-4			0.2	
Output high voltage	VOH3	VDD2=2.4V, IOH=-250μA, OUT	VDD2-0.65			
Output low voltage	VOL3	VDD2=2.4V, IOL=250μA, OUT			0.65	
Output high voltage	VOH4	VDD2=2.4V, IOH=-150μA, COM4 (As using LIGHT)	VDD2-1.5			
Output low voltage	VOL4	VDD2=2.4V, IOL=150μA, COM4 (As using LIGHT)			1.5	
Output high voltage	VOH5	VDD2=2.9V, IOH=-40μA *3	VDD2-0.4			
Output low voltage	VOL5	VDD2=2.9V, IOL=40μA *3			0.4	
Step-down voltage	VDD1	VDD2=2.8V, C1=C2=0.1μF, fopg=32.768kHz, Fig.7	1.35			V
Current dissipation (In Halt mode)	IDD1	VDD2=2.9V, C1=C2=0.1μF, Fig.7, Cg=16pF, Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta≤50°C		0.8	2.0	μA
Current dissipation (In Operating mode)	IDD2	VDD2=2.9V, C1=C2=0.1μF, Fig.7, Cg=16pF, Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta≤50°C		1.5	5.0	
Oscillator start-up voltage	Vstt	Cg=16pF, Crystal osc (CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.9	2.60			V
Oscillator sustaining voltage	VHOLD	Cg=16pF, Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta=25°C, Fig.9	2.60			
Oscillator start-up time	tstt	VDD2=2.60V Cg=16pF, Crystal osc (CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.9			10	s

(Notes) •Since the circuit pattern affects the oscillation frequency, place the oscillation-related parts as close to the oscillation pins as possible with the shortest possible pattern length.
•If you use other oscillators herein, we provide no guarantee for the characteristics.

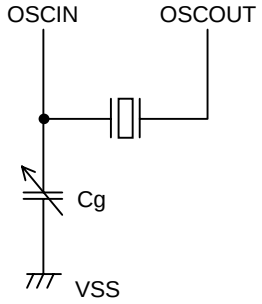


Figure1 Crystal oscillation circuit

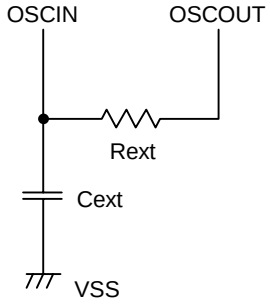


Figure 2 RC oscillation circuit

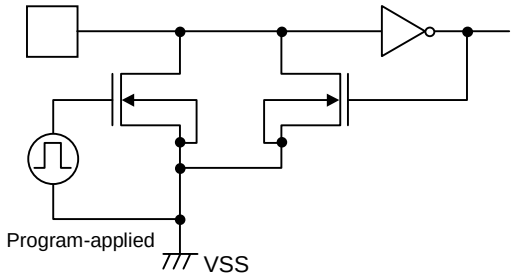


Figure3 Input configuration of S1-4, M1, M2

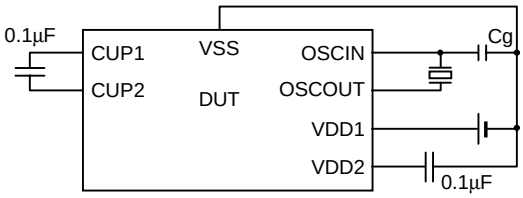


Figure 4 Current dissipation, step-up voltage measurement

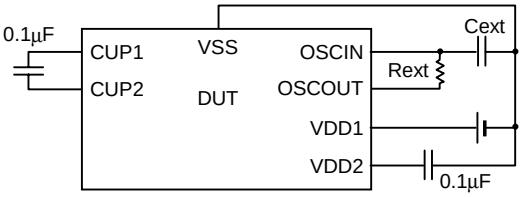


Figure5 Current dissipation, step-up voltage measurement

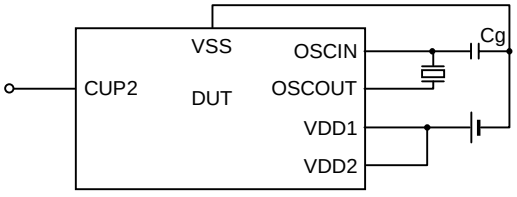


Figure 6 Oscillator start-up voltage, oscillator start-up time, oscillator sustaining voltage measurement

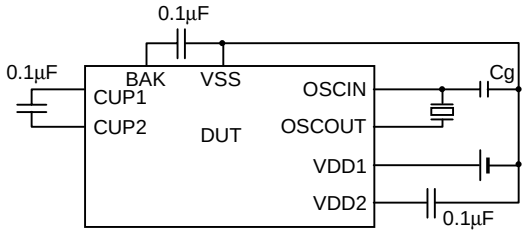


Figure7 Current dissipation, step-down voltage measurement

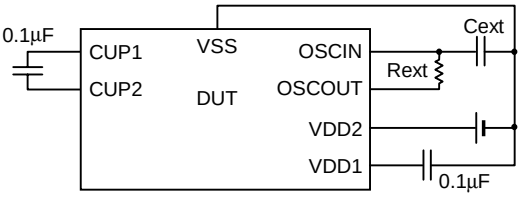


Figure 8 Current dissipation, step-down voltage measurement

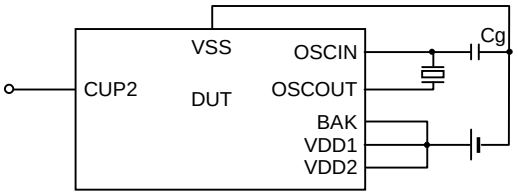


Figure9 Oscillator start-up voltage, oscillator start-up time, oscillator sustaining voltage measurement