

**LC573904**

4-Bit Microcontroller with 4K-Byte ROM, 120 × 4Bits RAM and LCD Driver

Preliminary

Overview

The LC573904 is a CMOS 4-bit microcontroller that operates on low voltage and very low power consumption. It also contains 4K-byte ROM, 128 × 4 bits RAM, LCD drivers and melody function.

Features

(1) ROM : 4096 × 8 bits

(2) RAM : 128 × 4 bits

(3) Cycle Time

Cycle Time	Oscillation source	Oscillation frequency	Power supply voltage	Power source
122μs	Crystal oscillation	32.768kHz	1.20 - 1.65V	Ag Battery
27μs	RC oscillation	150kHz		
122μs	Crystal oscillation	32.768kHz	2.50 - 3.60V	Li Battery
27μs	RC oscillation	150kHz		
122μs	Crystal oscillation	32.768kHz	2.00 - 6.00V	External voltage supply
8μs	RC oscillation	500kHz		

(4) Input / Output Terminals

- Input ports : 4 terminals (S-port : 4 terminals)

- Input / Output ports : 8 terminals (P0 port : 4 terminals, P1 port : 4 terminals)

[Notes] When using the P1 port for output, the "L" level hold Tr. of P1 should be OFF.

If P1 port becomes "H" level with "L" level hold Tr. on, it causes the through current from VDD to GND and increases the current consumption.

- Output ports : 2 terminals (Buzzer / melody output terminal : 1 terminal,
General output port : 1 terminal)

- LCD segment output ports : 32 terminals (Possible to use output port by mask option)

- LCD common output ports : 4 terminals

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(5) LCD driver

Drivable LCD panel	Number of drivable LCD segment output
1/2 bias 1/4 duty	128 segments
1/2 bias 1/3 duty	96 segments
1/2 bias 1/2 duty	64 segments
STATIC	32 segments

(Possible to use output port by mask option.)

- Built-in Step-up / Step-down circuit

(6) Melody/Buzzer

- Melody function Octave : 3 octaves
 Time of musical note : specified by program
- Buzzer output

(7) Base timer

- 15-bit base timer for timekeeping

(8) HALT release

- Five vectors
 1. 15-bit base timer (500ms overflow output)
 2. 15-bit base timer (output every 32ms)
 3. S-port
 4. P1-port
 5. 1/10 second pulse

(9) Stand-by mode

- HALT mode
The program operation will be stopped in this mode. This mode is released by system reset and 5 vectors for HALT release above-mentioned.

(10) System reset

- RES terminal
- Reset by setting S1 to S4 terminals to "H" level simultaneously.

(11) Oscillation

- Two oscillation circuits
- 32.768kHz crystal oscillation / RC oscillation

(12) Power supply

- Ag-battery : VDD1-VSS=1.20V to 1.65V, Step-up voltage (VDD2-VSS=2.4V to 3.3V)
- Li-battery : VDD2-VSS=2.50V to 3.60V, Step-down voltage (VDD1-VSS=1.25V to 1.8V)
- External voltage supply : VDD2-VSS=2.00V to 6.00V, Step-down voltage (VDD1-VSS=1.3V to 3.0V)

(13) Shipping form

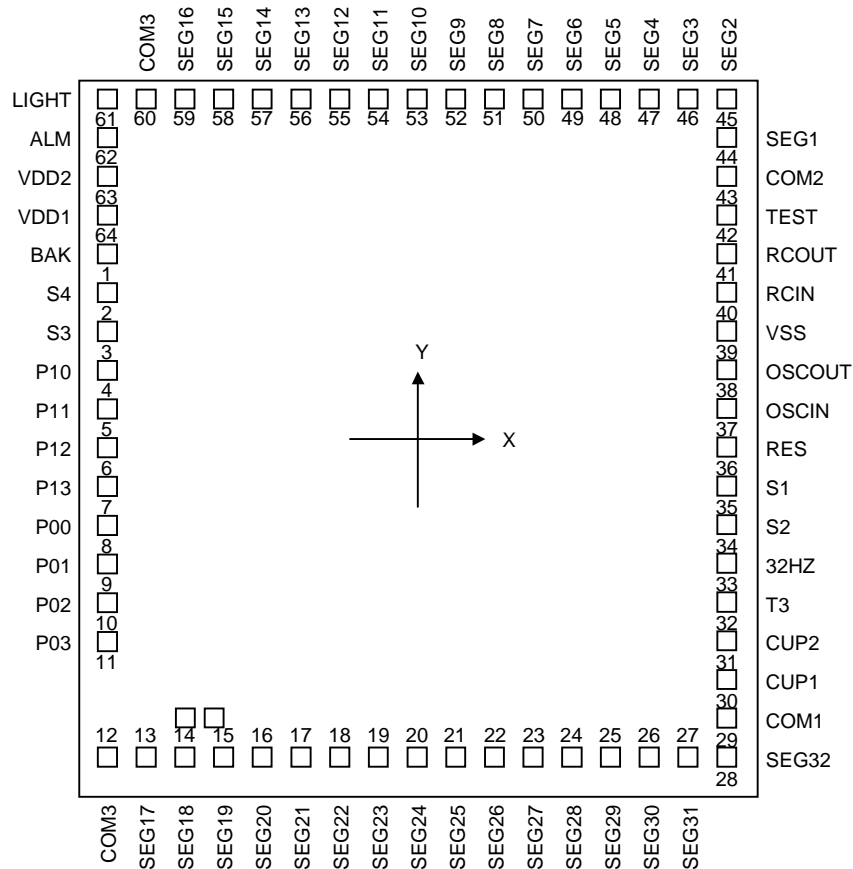
- Bare chip, QFP64

(14) The development tool

- Evaluation chip : LC5797
- Emulator : EVA520 + TB5739 + DCB-1A

Pad assignment

Chip size (X × Y) : 2.63mm × 2.89mm
 Chip thickness : 480μm
 Pad size : 116μm × 116μm



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	
			X μ m	Y μ m
5	1	BAK	-1065	645
6	2	S4	-1065	455
7	3	S3	-1065	330
8	4	P10	-1065	170
9	5	P11	-1065	5
10	6	P12	-1065	-155
11	7	P13	-1065	-315
12	8	P00	-1065	-475
13	9	P01	-1065	-635
14	10	P02	-1065	-800
15	11	P03	-1065	-960
16	12	COM4	-1080	-1205
17	13	SEG17	-940	-1205
18	14	SEG18	-790	-1205
19	15	SEG19	-650	-1205
20	16	SEG20	-525	-1205
21	17	SEG21	-400	-1205
22	18	SEG22	-275	-1205
23	19	SEG23	-150	-1205
24	20	SEG24	-25	-1205
25	21	SEG25	100	-1205
26	22	SEG26	225	-1205
27	23	SEG27	350	-1205
28	24	SEG28	475	-1205
29	25	SEG29	600	-1205
30	26	SEG30	725	-1205
31	27	SEG31	865	-1205
32	28	SEG32	1065	-1185
33	29	COM1	1065	-1035
34	30	CUP1	1065	-895
35	31	CUP2	1065	-770
36	32	T3	1065	-630

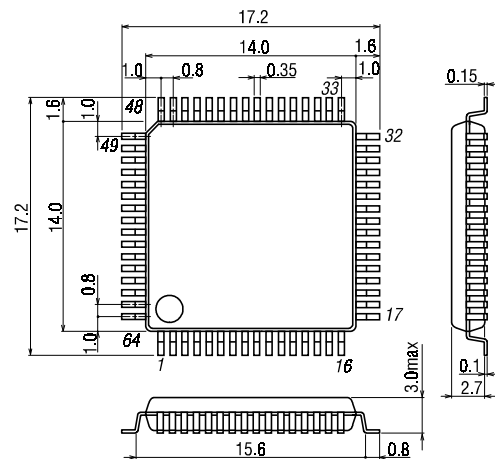
QFP64 PIN No.	Pad No.	Pad Name	Coordinates	
			X μ m	Y μ m
37	33	32HZ	1065	-505
38	34	S2	1065	-380
39	35	S1	1065	-255
40	36	RES	1065	-130
41	37	OSCIN	1065	-5
42	38	OSCOU	1065	115
43	39	VSS	1065	300
44	40	RCIN	1065	490
45	41	RCOUT	1065	615
46	42	TEST	1065	740
47	43	COM2	1065	865
48	44	SEG1	1065	1005
49	45	SEG2	1075	1205
50	46	SEG3	935	1205
51	47	SEG4	810	1205
52	48	SEG5	685	1205
53	49	SEG6	560	1205
54	50	SEG7	435	1205
55	51	SEG8	310	1205
56	52	SEG9	185	1205
57	53	SEG10	60	1205
58	54	SEG11	-65	1205
59	55	SEG12	-190	1205
60	56	SEG13	-315	1205
61	57	SEG14	-440	1205
62	58	SEG15	-565	1205
63	59	SEG16	-705	1205
64	60	COM3	-855	1205
1	61	LIGHT	-1065	1195
2	62	ALM	-1065	1070
3	63	VDD2	-1065	895
4	64	VDD1	-1065	770

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.

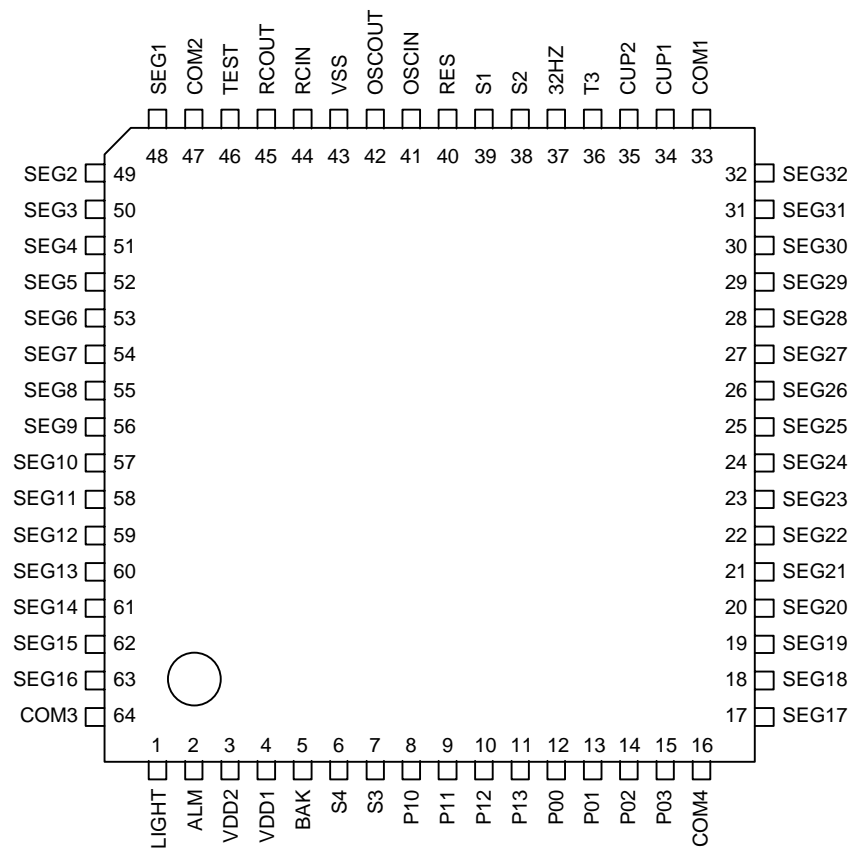
Package Dimension

(unit : mm)
3159

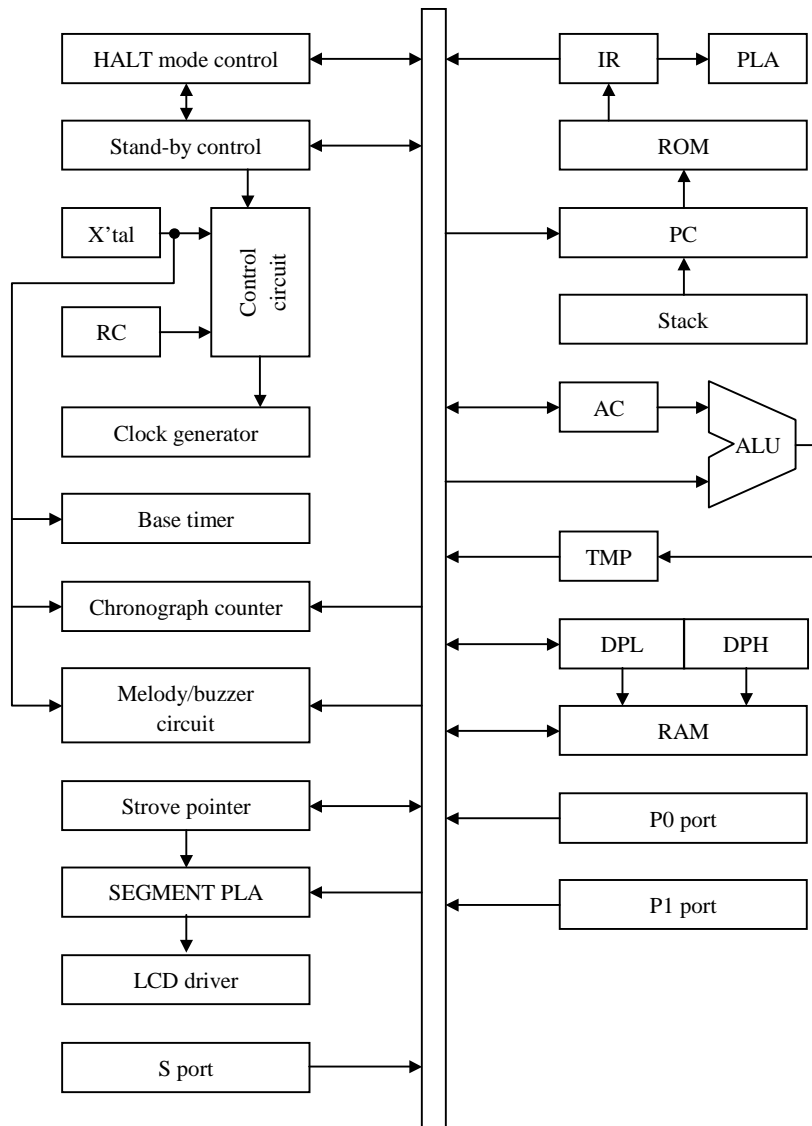


SANYO : QIP-64E

Pin Assignment QIP64E

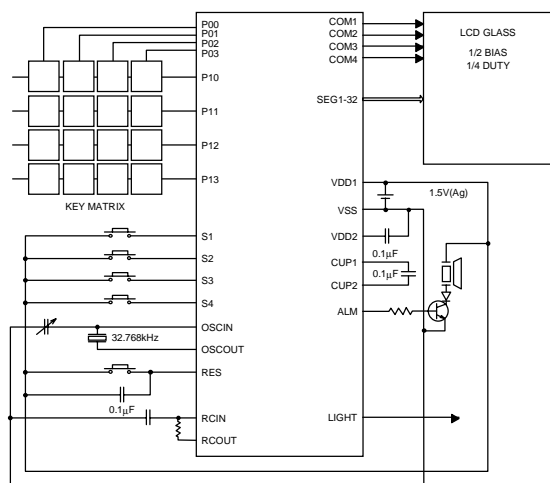


System Block Diagram



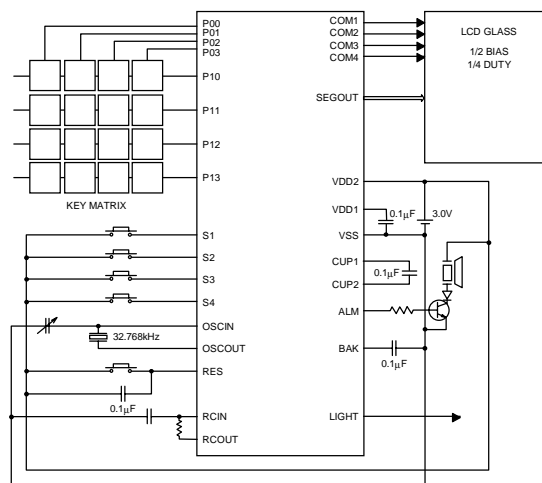
Sample Application Circuit

(1) Ag battery used application
(1/2 bias 1/4 duty)



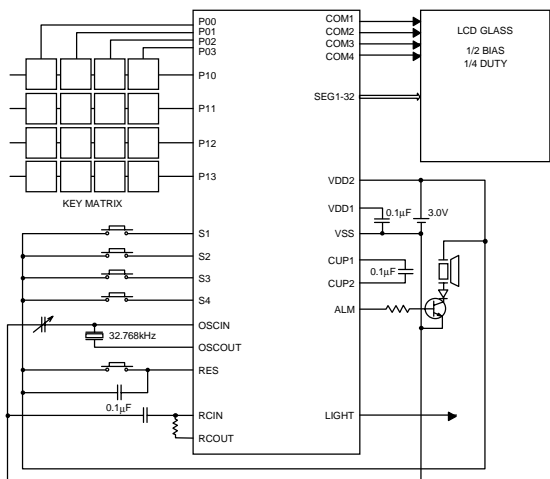
(Power supply : Ag battery version)

(2) Li battery used application
(1/2 bias 1/4 duty)



(Power supply : Li battery version)

(3) EXT-V used application
(1/2 bias 1/4 duty)



(Power supply : EXT-V version)

- Note 1) If P0, P1 port or segment output (SEG17 to SEG32) are used for key scan output port, P-ch open drain option should be used in order to prohibit signal short between output ports when two or more keys are pushed simultaneously.
- Note 2) If P1 port is used as output port, the following setting is necessary. Programmable pull-down register which is one of the internal pull-down register should be set to open mode with the SPDR instruction.

LC573904 Terminal Description

Name	Pin No.	PAD No.	I/O	Function description	Option
VSS	43	39	-	Power terminal (-)	
VDD1	9	64	-	<ul style="list-style-type: none"> •Power terminal(+) (Ag battery version) •Voltage supply to LCD driver (Li battery version, EXTV version) (C is connected between VDD1 and VSS.) •Voltage supply to logic unit (Ag battery version, when Back up flag is off in Li battery option.) 	Battery version Ag/Li/EXT-V
VDD2	3	63	-	<ul style="list-style-type: none"> •Power terminal(+) (Li battery version, EXTV version) •Voltage supply to LCD driver (Ag battery version) (C is connected between VDD2 and VSS.) •Voltage supply to logic unit (EXTV version, when Back up flag is on in Li battery option.) 	Battery version Ag/Li/EXT-V
BAK	5	1	-	<ul style="list-style-type: none"> •Power terminal(+) •Capacitor is required between BAK and VSS in order to prevent the malfunction of the logic circuit in Li battery option. 	
CUP1,2	34 35	30 31	-	Capacitor connecting terminals for step-up (or stop down)	
S port S1-S4	39 38 7 6	35 34 3 2	I	<ul style="list-style-type: none"> •4-bit input port •Input for HALT release •LSI system is reset by applying VDD to S1 to S4 simultaneously. •Programmable pull-down resistor •"L"-level hold Tr. 	"L"-level hold Tr. Provided/Not provided
P1 port P10-P13	8-11	4-7	I/O	<ul style="list-style-type: none"> •4-bit input/output port •CMOS output/P-ch open drain output •Input for HALT release •Programmable pull-down resistor •"L"-level hold Tr. •"H"-level hold Tr. 	<ul style="list-style-type: none"> •"L"-level hold Tr. •"H"-level hold Tr. •Output form CMOS /P-ch open drain
P0 port P00-P03	12-15	8-11	I/O	<ul style="list-style-type: none"> •4-bit input/output port •CMOS output/P-ch open drain output •"H"-level hold Tr. 	<ul style="list-style-type: none"> •"H"-level hold Tr. •Output form CMOS /P-ch open drain
LIGHT	1	61	O	Output port	
ALM	2	62	O	<ul style="list-style-type: none"> •Output port •Output terminal to deliver melody signal or buzzer with SAS or TMEL instruction. (Buzzer : 4kHz/2kHz/1kHz modulation signal or non modulation signal.)* (Melody signal : 3 octaves) 	
SEG1 -SEG32	48-63 17-32	44-59 13-28	O	<ul style="list-style-type: none"> •LCD output terminals for segment •Possible to use output port for SEG17 to SEG32 (Pad No.13 to 28) by mask option. 	<ul style="list-style-type: none"> •Output form segment/CMOS/P-ch open drain •Segment data SP=0 - FH DBUS=a/b/c/d/e/f /g/h

Continue.

Name	Pin No.	PAD No.	I/O	Function description	Option
COM1 -COM4	33 47 64 16	29 43 60 12	O	LCD output terminals for common	LCD duty 1/1,1/2,1/3,1/4
OSCIN	41	37	I	Input for 32.768kHz crystal oscillation	
OSCOUT	42	38	O	Output for 32.768kHz crystal oscillation	
RCIN	44	40	I	•Input for RC oscillation R is connected across RCIN and RCOUT, and C is connected across RCIN and VSS.	
RCOUT	45	41	O	•Output for RC oscillation R is connected across RCIN and RCOUT.	
RES	40	36	I	Reset	
32HZ	37	33	-	•Test terminal This terminal should be left unconnected.	
T3	36	32	-	•Test terminal This terminal should be left unconnected.	
TEST	46	42	-	•Test terminal This terminal should be left unconnected.	

* 4kHz/2kHz/1kHz : For 32.768kHz crystal oscillation, proportional to oscillation frequency.

Ag 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	VIN	S1-S4, P00-P03, P10-P13, TEST, OSCIN, RES, RCIN	-0.3 to VDD1+0.3	
Output voltage	VOUT1	CUP2, OSCOUT, ALM, LIGHT, P00-P03, P10-P13, RCOUT	-0.3 to VDD1+0.3	
	VOUT2	SEG1-SEG32, COM1-COM4, CUP1	-0.3 to VDD2+0.3	
Peak output current (at each pins)	IOUT1	ALM	4	mA
	IOUT2	LIGHT	1	
	IOUT3	Output except ALM and LIGHT	500	μA
Total output current	IALL	Total output pins.	10	mA
Maximum power dissipation	Pdmax	QFP64	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		1.65	V
	VDD2		2.4		3.3	
Input high voltage	VIH	S1-S4, RES, P00-P03, P10-P13	VDD1-0.2		VDD1	
Input low voltage	VIL	S1-S4, RES, P00-P03, P10-P13	0		0.2	
Oscillation frequency range	fOPG1	•32.768kHz (crystal oscillation) •VDD1=1.20 - 1.65V (Ta=25°C) •Refer to figure 1	32	32.768	33	kHz
	fOPG2	•RC oscillation •VDD1=1.20 - 1.65V (Ta=25°C) •Refer to figure 2	30		100	

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

Parameter	Symbol	Conditions		Ratings			Unit	
				min.	typ.	max.		
Pull-down transistor	RIN1A	VDD1=1.55V, VIL=0.2V, Low level hold Tr. Fig.3	*1	150	300	1000	kΩ	
	RIN1B	VDD1=1.55V, Low level pull in Tr. Fig.3	*1	100	300	500		
	RIN3	VDD1=1.55V, TEST, RES		10		300		
Pull-up transistor	RIN2	VDD1=1.55V, High level hold Tr. Fig.6	*5	100	400	2000		
Output high voltage	VOH1	VDD1=1.55V, IOH=-0.4μA	*2	VDD2-0.2			V	
Output low voltage	VOL1	VDD1=1.55V, IOL=0.4μA	*2			0.2		
Output high voltage	VOH2	VDD1=1.55V, IOH=-4μA, COM1-4		VDD2-0.2				
Output middle voltage	VOM	VDD1=1.55V, IOH=-4μA, IOL=4μA, COM1-4		VDD1-0.2		VDD1+0.2		
Output low voltage	VOL2	VDD1=1.55V, IOL=4μA, COM1-4				0.2		
Output high voltage	VOH3	VDD1=1.35V, IOH=-250μA, ALM, LIGHT		VDD1-0.6 5				
Output low voltage	VOL3	VDD1=1.35V, IOL=150μA, ALM, LIGHT				0.6		
Output high voltage	VOH4	VDD1=1.55V, IOH=-20μA	*3	VDD1-0.2				
Output low voltage	VOL4	VDD1=1.55V, IOL=20μA	*4			0.2		
Output high current	IOH	VDD1=1.55V, VOH=VDD1 × 0.5	*5			-100		μA
Output low current	IOL	VDD1=1.55V, VOL=VDD1 × 0.5	*6	100				
Step-up voltage	VDD2	VDD1=1.35V, C1=C2=0.1μF, fopg=32.768kHz, Fig.4		2.5		2.7		V
Current dissipation (In Halt mode)	IDD1	VDD1=1.55V, C1=C2=0.1μF, Fig.4, Cg=16pF, Crystal osc(CI≤25kΩ),	RC osc stop		1.0	4.0	μA	
	IDD2	RC osc(Rext=470 kΩ, Cext=18pF), Back-up flag OFF, Ta≤50°C	RC osc operating		5.0	15.0		
Current dissipation (In operating mode)	IDD3	VDD1=1.55V, C1=C2=0.1μF, Fig.4, Cg=16pF, Crystal osc(CI≤25kΩ),	RC osc stop		3.0	12.0		
	IDD4	RC osc(Rext=470 kΩ, Cext=18pF), Back-up flag OFF, Ta≤50°C	RC osc operating		7.0	20.0		
Oscillator start-up voltage	Vstt	Cg=16pF, Crystal osc(CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.5		1.35			V	
Oscillator sustaining voltage	VHOLD			1.30				
Oscillator start-up time	tstt	VDD1=1.35V Cg=16pF, Crystal osc(CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.5				10	s	

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, RCIN	-0.3 to VDD1+0.3	
	VIN2	S1-S4, P00-P03, P10-P13, TEST, RES	-0.3 to VDD2+0.3	
Output voltage	VOUT1	CUP2, OSCOUT, RCOUT	-0.3 to VDD1+0.3	
	VOUT2	SEGOUT, COM1-COM4, CUP1, ALM, LIGHT, P00-P03, P10-P13	-0.3 to VDD2+0.3	
Peak output current (at each pins)	IOUT1	ALM	4	mA
	IOUT2	LIGHT	1	
	IOUT3	Output except ALM1 and LIGHT	500	μA
Total output current	IALL	The total all pins.	10	mA
Maximum power dissipation	Pdmax	QFP64	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		1.25		3.60	V
	VDD2		2.5		3.6	
Input high voltage	VIH	S1-S4, RES, P00-P03, P10-P13	VDD2-0.4		VDD2	
Input low voltage	VIL	S1-S4, RES, P00-P03, P10-P13	0		0.4	
Oscillation frequency range	fOPG1	•32.768kHz (crystal oscillation) •VDD2=2.5 - 3.6V (Ta=25°C) •Refer to figure 1	32	32.768	33	kHz
	fOPG2	•RC oscillation •VDD2=2.5 - 3.6V (Ta=25°C) •Refer to figure 2	30		150	

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	60	150	300	
	RIN2	VDD2=2.9V, TEST, RES	10		300	
Pull-up transistor	RIN3	VDD2=2.9V, High level hold Tr. Fig.9 *5	200	600	2000	V
Output high voltage	VOH1	VDD2=2.9V, IOH=-0.4μA *2	VDD2-0.2			
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, ALM	VDD2-0.6 5			
Output low voltage	VOL3	VDD2=2.4V, IOL=250μA, ALM			0.65	
Output high voltage	VOH4	VDD2=2.4V, IOH=-150μA, LIGHT	VDD2-1.5			
Output low voltage	VOL4	VDD2=2.4V, IOL=150μA, 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 *4			0.4	
Output high current	IOH	VDD2=2.9V, VOH=VDD2-0.45V *5			-450	μA
Output low current	IOL	VDD2=2.9V, VOL=0.45V *6	450			
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,	RC osc stop	0.8	2.0	μA
	IDD2	Crystal osc(CI≤25kΩ), Back-up flag OFF, RC osc(Rext=470 kΩ, Cext=18pF), Ta≤50°C	RC osc operating	5	15.0	
Current dissipation (In operating mode)	IDD3	VDD2=2.9V, C1=C2=0.1μF, Fig.7, Cg=16pF,	RC osc stop	3	12.0	
	IDD4	Crystal osc(CI≤25kΩ), Back-up flag OFF, RC osc(Rext=470 kΩ, Cext=18pF), Ta≤50°C	RC osc operating	7	20.0	
Oscillator start-up voltage	Vstt	Cg=16pF, Crystal osc(CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.8	2.60			V
Oscillator sustaining voltage	VHOLD	Cg=16pF, Crystal osc(CI≤25kΩ), Back-up flag OFF, Ta=25°C, Fig.8	1.25			
Oscillator start-up time	tsst	VDD2=2.0V Cg=16pF, Crystal osc(CI≤25kΩ), Ta=25°C, Fig.8			10	s

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

Parameter	Symbol	Pin & Conditions	Ratings	Unit
Supply voltage	VDD1		-0.3 to +7.0	V
	VDD2		-0.3 to +7.0	
Input voltage	VIN	S1-S4, P00-P03, P10-P13, TEST, RES, OSCIN, RCIN	-0.3 to VDD2+0.3	
Output voltage	VOUT	SEG1-SEG32, COM1-COM4, CUP1, CUP2, OSCOUT, ALM, LIGHT, RCOUT	-0.3 to VDD2+0.3	
Peak output current (at each pins)	IOUT1	ALM	4	mA
	IOUT2	LIGHT	1	
	IOUT3	Output except ALM and LIGHT	500	μA
Total output current	IALL	The total all pins.	10	mA
Maximum power dissipation	Pdmax	QFP64	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		1.3		3.0	V
	VDD2		2.0		6.0	
Input high voltage	VIH	S1-S4, RES, P00-P03, P10-P13	VDD2-0.4		VDD2	
Input low voltage	VIL	S1-S4, RES, P00-P03, P10-P13	0		0.4	
Oscillation frequency range	fOPG1	•32.768kHz (crystal oscillation) •VDD2=2.0 - 6.0V •Refer to figure 1	32	32.768	33	kHz
	fOPG2	•RC oscillation •VDD2=2.0 - 6.0V (Ta=25°C) •Refer to figure 2	30		500	

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	60	150	300	
	RIN2	VDD2=2.9V, TEST, RES	10		300	
Pull-up transistor	RIN3	VDD2=2.9V, High level hold Tr. Fig.9 *5	200	600	2000	V
Output high voltage	VOH1	VDD2=2.9V, IOH=-0.4μA *2	VDD2-0.2			
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, ALM	VDD2-0.6 5			
Output low voltage	VOL3	VDD2=2.4V, IOL=250μA, ALM			0.65	
Output high voltage	VOH4	VDD2=2.4V, IOH=-150μA, LIGHT	VDD2-1.5			
Output low voltage	VOL4	VDD2=2.4V, IOL=150μA, 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 *4			0.4	
Output high current	IOH	VDD2=2.9V, VOH=VDD2-0.45V *5			-450	μA
Output low current	IOL	VDD2=2.9V, VOL=0.45V *6	450			
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=15pF,	RC osc stop	5.0	15.0	μA
	IDD2	Crystal osc(CI≤25kΩ), RC osc(Rext=470 kΩ, Cext=18pF), Ta≤50°C		15	50	
Current dissipation (In operating mode)	IDD3	VDD2=2.9V, C1=C2=0.1μF, Fig.7,	RC osc stop	10	40	
	IDD4	Cg=15pF, Crystal osc(CI≤25kΩ), RC osc(Rext=470 kΩ, Cext=18pF), Ta≤50°C	RC osc operating	50	200	
Oscillator start-up voltage	Vstt	Cg=15pF, Crystal osc(CI≤25kΩ), Ta=25°C, Fig.8	2.0			V
Oscillator sustaining voltage	VHOLD		2.0			
Oscillator start-up time	tsst	VDD2=2.0V Cg=15pF, Crystal osc(CI≤25kΩ), Ta=25°C, Fig.8			10	s

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

Parameter	Symbol	Conditions	Ratings			Unit	
			min.	typ.	max.		
Pull-down transistor	RIN1A	VDD2=5.0V, VIL=0.4V, Low level hold Tr. Fig.3 *1	70	200	600	kΩ	
	RIN1B	VDD2=5.0V, Low level pull in Tr. Fig.3 *1	60	150	300		
	RIN2	VDD2=5.0V, TEST, RES	10		300		
Pull-up transistor	RIN3	VDD2=5.0V, High level hold Tr. Fig.9 *5	100	400	1000		
Output high voltage	VOH1	VDD2=5.0V, IOH=-0.4μA *2	VDD2-0.2			V	
Output low voltage	VOL1	VDD2=5.0V, IOL=0.4μA *2			0.2		
Output high voltage	VOH2	VDD2=5.0V, IOH=-4μA, COM1-4	VDD2-0.2				
Output middle voltage	VOM	VDD2=5.0V, IOH=-4μA, IOL=4μA, COM1-4	VDD2/2 -0.2		VDD2/2 +0.2		
Output low voltage	VOL2	VDD2=5.0V, IOL=4μA, COM1-4			0.2		
Output high voltage	VOH3	VDD2=5.0V, IOH=-2.0mA, ALM	VDD2-1.0				
Output low voltage	VOL3	VDD2=5.0V, IOL=2.0mA, ALM			1.0		
Output high voltage	VOH4	VDD2=5.0V, IOH=-250μA, LIGHT	VDD2-1.5				
Output low voltage	VOL4	VDD2=5.0V, IOL=250μA, LIGHT			1.5		
Output high voltage	VOH5	VDD2=5.0V, IOH=-80μA *3	VDD2-0.8				
Output low voltage	VOL5	VDD2=5.0V, IOL=80μA *4			0.8		
Output high current	IOH	VDD2=5.0V, VOH=VDD2-0.75V *5			-750		μA
Output low current	IOL	VDD2=5.0V, VOL=0.75V *6	750				
Step-down voltage	VDD1	VDD2=5.0V, C1=C2=0.1μF, fopg=32.768kHz, Fig.7	2.4				V
Current dissipation (In Halt mode)	IDD1	VDD2=5.0V, C1=C2=0.1μF, Fig.7, Cg=15pF, Crystal osc(CI≤25kΩ), RC osc(Rext=470kΩ, Cext=18pF), Ta≤50°C	RC osc stop	To be determined		μA	
	IDD2		RC osc operating	To be determined			
Current dissipation (In operating mode)	IDD3	VDD2=5.0V, C1=C2=0.1μF, Fig.7, Cg=15pF, Crystal osc(CI≤25kΩ), RC osc(Rext=470kΩ, Cext=18pF), Ta≤50°C	RC osc stop	To be determined			
	IDD4		RC osc operating	To be determined			
Oscillator start-up voltage	Vstt	Cg=15pF, Crystal osc(CI≤25kΩ), Ta=25°C, Fig.8	2.0			V	
Oscillator sustaining voltage	VHOLD		2.0				
Oscillator start-up time	tsst	VDD2=2.0V, Cg=15pF, Crystal osc(CI≤25kΩ), Ta=25°C, Fig.8			10	s	

*1 : S1, S2, S3, S4, P10 to P13

*2 : Applied to SEG1 to SEG16 and LCD driver option terminals in SEG17 to SEG32.

*3 : Applied to the CMOS or P-ch open drain terminals in SEG17 to SEG32.

*4 : Applied to the CMOS terminals in SEG17 to SEG32.

*5 : P00 to P03, P10 to P13

*6 : Applied to the CMOS terminals in P00 to P03, P10 to P13.

Crystal oscillation guaranteed constant

A kind of oscillation	Producer	Oscillator	Cg
32.768kHz Crystal oscillation	CITIZEN	CFS-308	16pF (Ag, Li battery version) 15pF (EXT-V version)
	SII	DT-VT-200	15pF

*Cg must be used J rank ($\pm 5\%$) and CH characteristics.

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

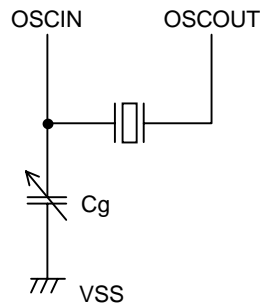


Figure1 Crystal oscillation circuit

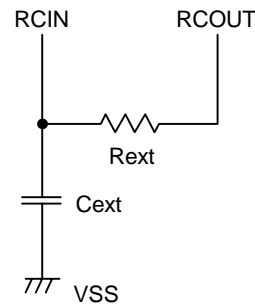


Figure 2 RC oscillation circuit

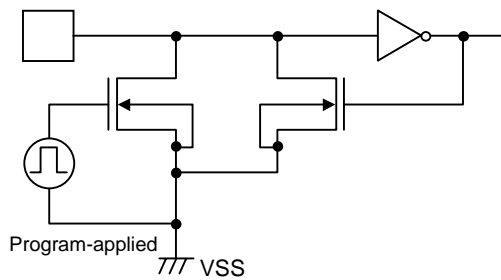


Figure3 Input configuration of S1-4, P10-13

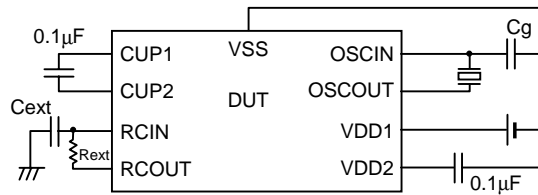


Figure 4 Current dissipation, step-up voltage measurement

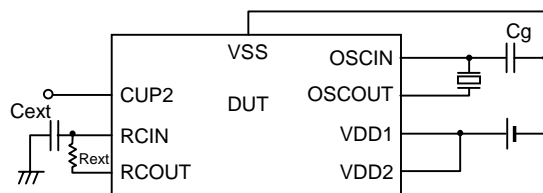


Figure5 Oscillator start-up voltage, oscillator start-up time, oscillator sustaining voltage measurement

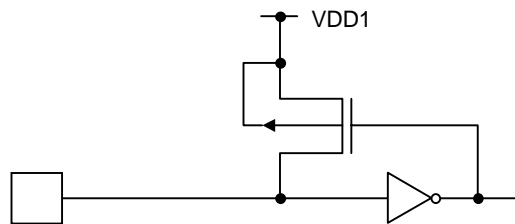


Figure 6 Input configuration of P00-03, P10-13

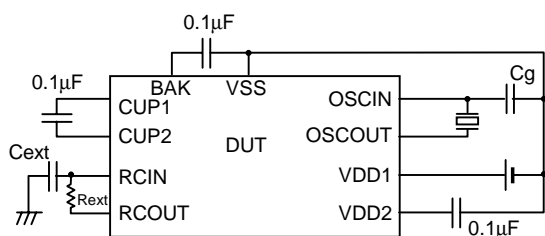


Figure7 Current dissipation, step-down voltage measurement

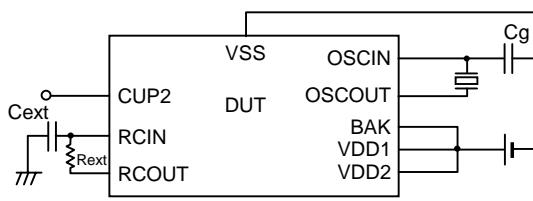


Figure 8 Oscillator start-up voltage, oscillator start-up time, oscillator sustaining voltage measurement

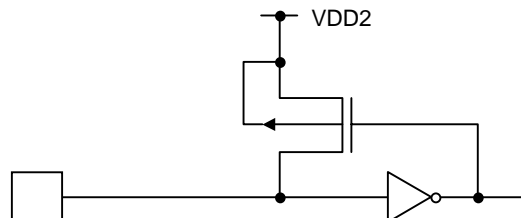


Figure9 Input configuration P00-03, P10-13

[Note]

The specifications above are for a die mounted in a QFP64 type package. The specifications for a die is almost same as ones for a QFP type package basically. However, the operational characteristics may vary depending on the user's assembling method. Therefore, the operating temperature range for a die is specified only in $T_a=25^{\circ}\text{C}\pm 2^{\circ}\text{C}$.

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