



LC5739

4-Bit Microcontroller with LCD Driver

Preliminary

Overview

The LC5739 is a CMOS 4-bit microcontroller that operates on low voltage and very low power consumption. It also contains 4K-byte ROM, 128-byte 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	1.30 - 1.65V	Ag Battery
	RC oscillation			
122μs	Crystal oscillation	32.768kHz	2.60 - 3.60V	Li Battery
122μs	Crystal oscillation	32.768kHz	2.60 - 3.60V	External voltage supply
	RC oscillation			

(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)
- 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

- 32.768kHz crystal oscillation
- RC oscillation

(12) Power supply

- Ag-battery : VDD1-VSS=1.30V to 1.65V, Step-up voltage (VDD2-VSS=2.4V to 3.3V)
- Li-battery : VDD2-VSS=2.60V to 3.60V, Step-down voltage (VDD1-VSS=1.3V to 1.8V)
- External voltage supply : VDD2-VSS=2.00V to 3.60V, Step-down voltage (VDD1-VSS=1.3V to 1.8V)

(13) Shipping form

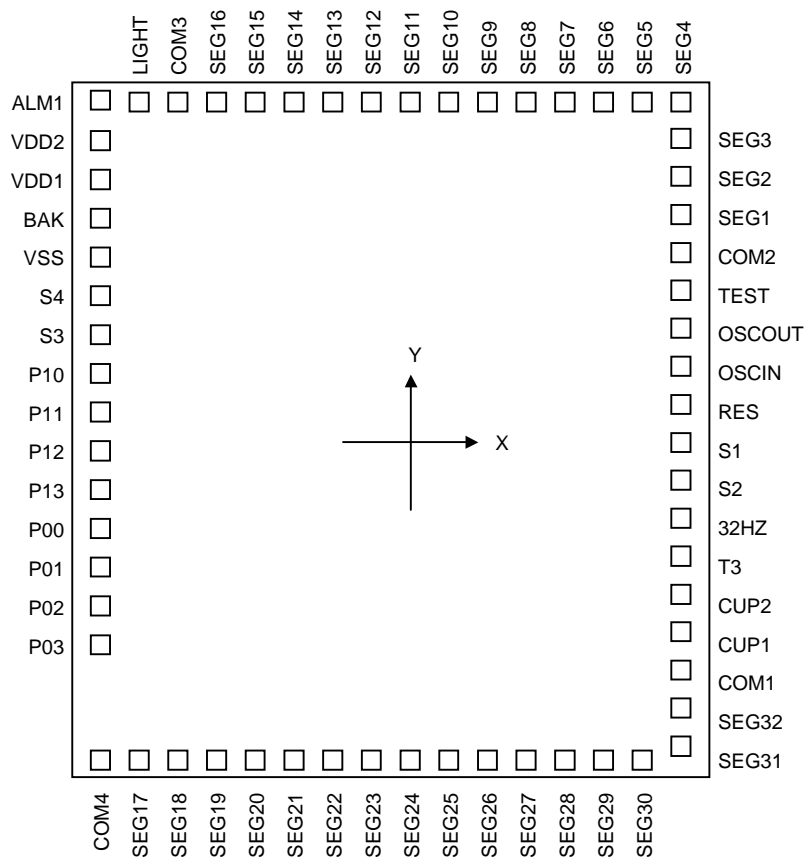
- Bare chip, QFP64

(14) The development tool

- Evaluation chip : LC5797
- Emulator : EVA510 + 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
3	1	BAK	-1065	755
4	2	VSS	-1065	615
5	3	S4	-1065	475
6	4	S3	-1065	335
7	5	P10	-1065	175
8	6	P11	-1065	15
9	7	P12	-1065	-145
10	8	P13	-1065	-305
11	9	P00	-1065	-470
12	10	P01	-1065	-630
13	11	P02	-1065	-790
14	12	P03	-1065	-950
15	13	COM4	-1105	-1205
17	14	SEG17	-965	-1205
18	15	SEG18	-825	-1205
19	16	SEG19	-685	-1205
20	17	SEG20	-545	-1205
21	18	SEG21	-405	-1205
22	19	SEG22	-265	-1205
23	20	SEG23	-125	-1205
24	21	SEG24	15	-1205
25	22	SEG25	155	-1205
26	23	SEG26	295	-1205
27	24	SEG27	435	-1205
28	25	SEG28	575	-1205
29	26	SEG29	715	-1205
30	27	SEG30	855	-1205
31	28	SEG31	1065	-1245
33	29	SEG32	1065	-1105
34	30	COM1	1065	-965
35	31	CUP1	1065	-825
36	32	CUP2	1065	-685
37	33	T3	1065	-545

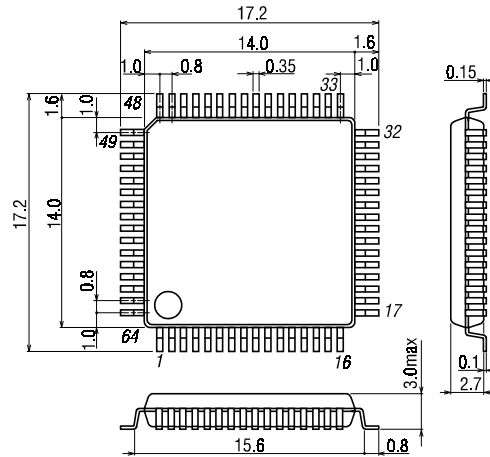
QFP64 PIN No.	Pad No.	Pad Name	Coordinates	
			X μ m	Y μ m
38	34	32HZ	1065	-405
39	35	S2	1065	-265
40	36	S1	1065	-125
41	37	RES	1065	15
42	38	OSCIN	1065	155
43	39	OSCOU	1065	295
44	40	TEST	1065	435
45	41	COM2	1065	575
46	42	SEG1	1065	715
47	43	SEG2	1065	855
48	44	SEG3	1065	995
49	45	SEG4	1105	1205
50	46	SEG5	965	1205
51	47	SEG6	825	1205
52	48	SEG7	685	1205
53	49	SEG8	545	1205
54	50	SEG9	405	1205
55	51	SEG10	265	1205
56	52	SEG11	125	1205
57	53	SEG12	-15	1205
58	54	SEG13	-155	1205
59	55	SEG14	-295	1205
60	56	SEG15	-435	1205
61	57	SEG16	-575	1205
62	58	COM3	-715	1205
63	59	LIGHT	-855	1205
64	60	ALM	-1065	1245
1	61	VDD2	-1065	1035
2	62	VDD1	-1065	895

- 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

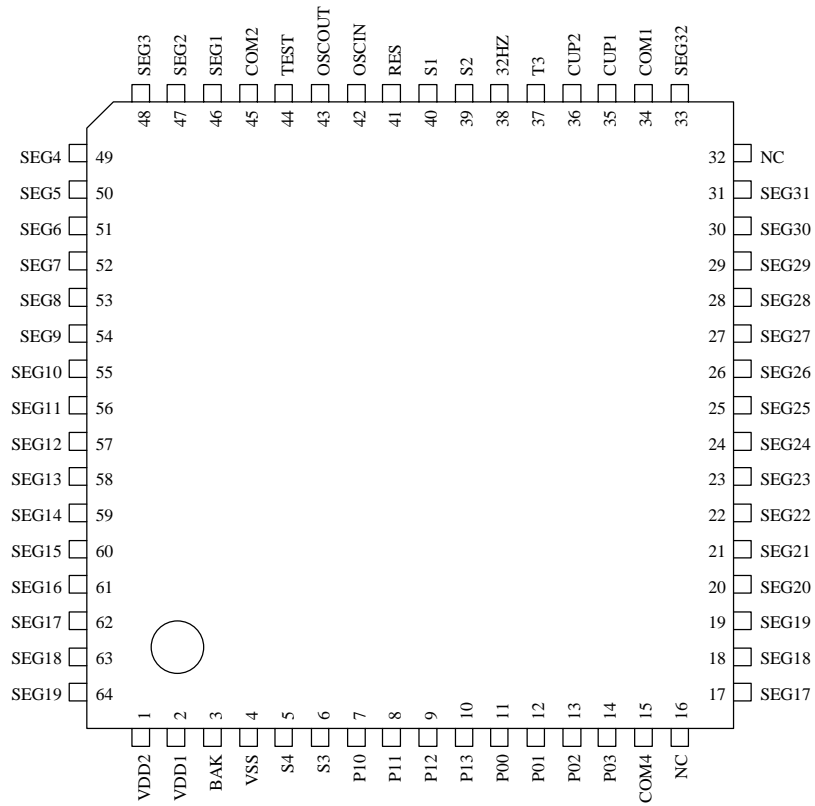
(unit : mm)

3159

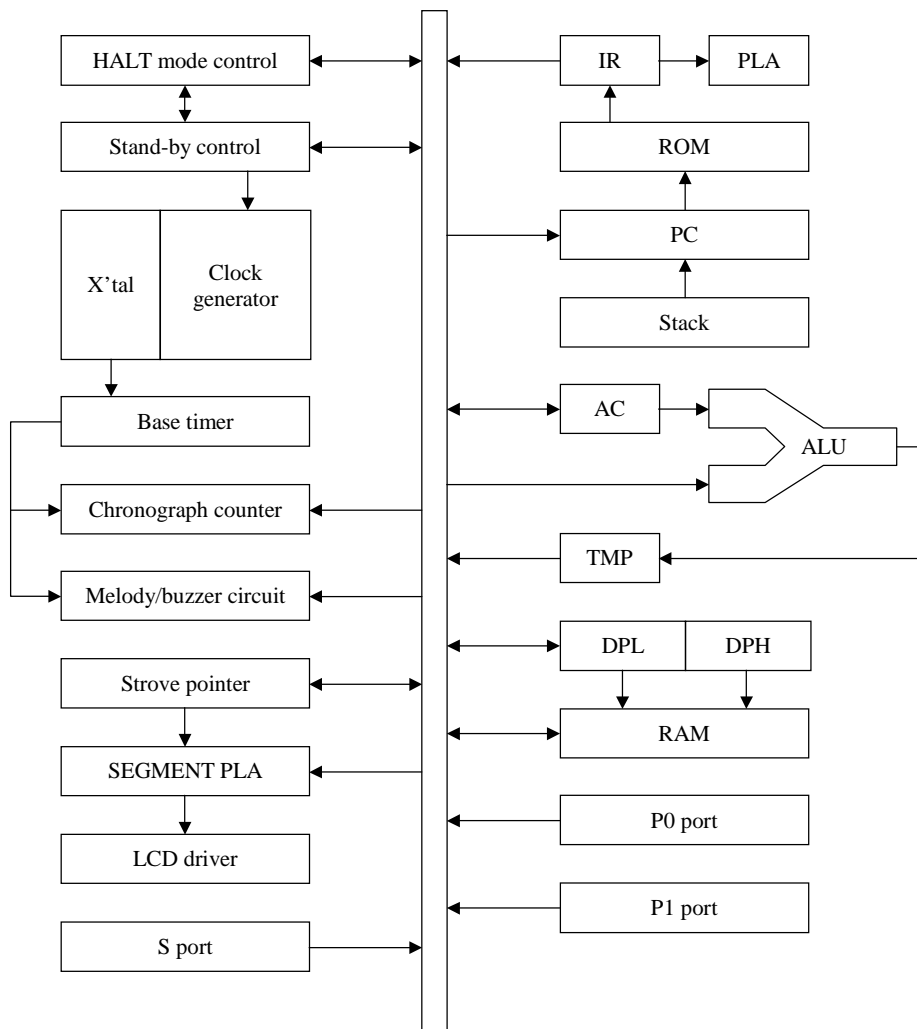


SANYO : QIP-64E

Pin Assignment

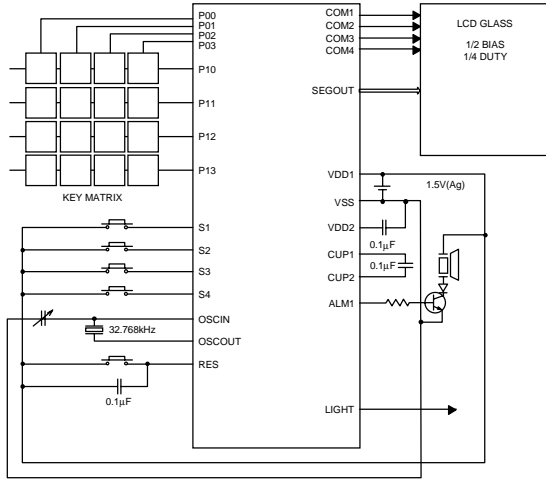


System Block Diagram



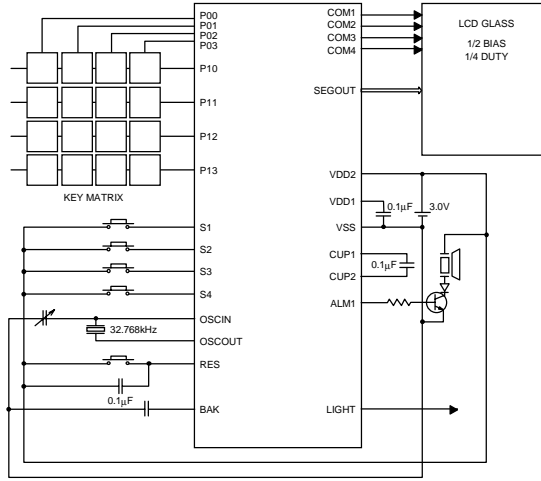
Sample Application Circuit

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



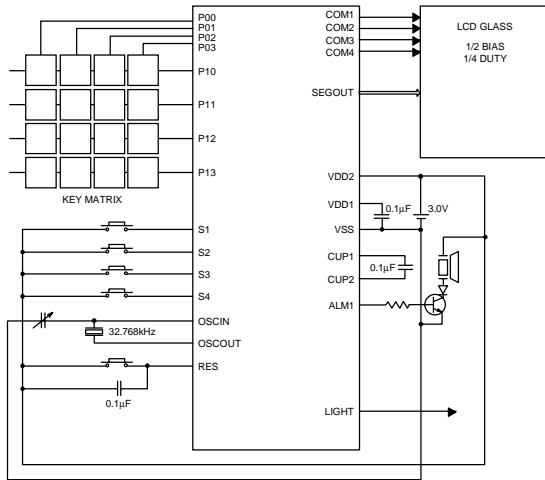
Crystal Oscillation
(Power supply : Ag battery version)

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



Crystal Oscillation
(Power supply : Li battery version)

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



Crystal Oscillation
(Power supply : EXT-V version)

(Note) If P0 or P1 port are used for key scan output port, diodes or resistors must be added to prohibit signal short between output ports when two or more keys are pushed simultaneously.

LC5739 Terminal Description

Pin Name	No.	I/O	Function description	Option
VSS	2	-	Power terminal (-)	
VDD1	62	-	<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, Back up flag off at Li battery version.) 	Battery version Ag/Li/EXTV
VDD2	61	-	<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, Back up flag is ON at Li battery version.) 	Battery version Ag/Li/EXTV
BAK	1	-	<ul style="list-style-type: none"> •Power terminal(+) •For Li battery version, a capacitor must be connected across BAK and VSS to prevent logic unit from malfunctioning. 	
CUP1,2	31, 32	-	Capacitor connecting terminals for step-up (doubler/tripler)	
S port S1 - S4	36 35 4 3	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 (Mask option). •Programmable pull-down resistor •"L"-level hold Tr. 	<ul style="list-style-type: none"> •LSI reset by S1-S4 Enable/Disable •"L"-level hold Tr. Provided/Not provided
P1 port P10 - P13	5 6 7 8	I/O	<ul style="list-style-type: none"> •4-bit input/output port •CMOS 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. Provided/Not provided •"H"-level hold Tr. Provided/Not provided
P0 port P00 - P03	9 10 11 12	I/O	<ul style="list-style-type: none"> •4-bit input/output port •CMOS output •"H"-level hold Tr. 	"H"-level hold Tr. Provided/Not provided
LIGHT	59	O	Output port	
ALM1	60	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	42-57 14-29	O	LCD output terminals for segment	<ul style="list-style-type: none"> •Output form segment/CMOS •Segment data SP=0 - FH DBUS=a/b/c/d/e/f/g/h
COM1 - COM4	30 41 58 13	O	LCD output terminals for common	LCD duty 1/1,1/2,1/3,1/4

Continue.

Pin Name	No.	I/O	Function description	Option
OSCIN	38	I	<ul style="list-style-type: none"> •Input for 32.768kHz crystal oscillation •Input for RC oscillation R is connected across OSCIN and OSCOUT, and C is connected across OSCIN and VSS.	Oscillation version crystal/RC oscillation
OSCOUT	39	O	<ul style="list-style-type: none"> •Output for 32.768kHz crystal oscillation •Output for RC oscillation R is connected across OSCIN and OSCOUT.	
RES	37	I	Reset	
32HZ	34	-	<ul style="list-style-type: none"> •Test terminal This terminal should be left unconnected.	
T3	33	-	<ul style="list-style-type: none"> •Test terminal This terminal should be left unconnected.	
TEST	40	-	<ul style="list-style-type: none"> •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, 32HZ, TEST, OSCIN, RES	-0.3 to VDD1+0.3	
Output voltage	VOUT1	32HZ, CUP2, OSCOUT, ALM1, LIGHT, P00-P03	-0.3 to VDD1+0.3	
	VOUT2	SEGOUT, COM1, COM2, COM3, COM4, CUP1, P00-P03, P10, P13	-0.3 to VDD2+0.3	
Peak output current (at each pins)	IOUT1	ALM1	4	mA
	IOUT2	LIGHT	1	
	IOUT3	Output except ALM1 and LIGHT	500	µA
Total output current	IALL	Total output pins.	10	mA
Operating temperature range	Topg		-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=1.30 - 1.65V •Refer to figure 1	32	32.768	33	kHz
	fOPG2	•RC oscillation •VDD1=1.30 - 1.65V •Rext=470kΩ •Cext=30pF •Refer to figure 2	30	32.768	40	

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	RIN2A	VDD1=1.55V, High level hold Tr. Fig.7 *4	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, ALM1, LIGHT	VDD1-0.65				
Output low voltage	VOL3	VDD1=1.35V, IOL=150μA, ALM1, LIGHT			0.65		
Output high voltage	VOH4	VDD1=1.55V, IOH=-20μA *3	VDD1-0.2				
Output low voltage	VOL4	VDD1=1.55V, IOL=20μA *3			0.2		
Output high current	IOH	VDD1=1.55V, VOH=VDD1 × 0.5 *4			-100		μA
Output low current	IOL	VDD1=1.55V, VOL=VDD1 × 0.5 *4	100				
Step-up voltage	VDD2	VDD1=1.35V, C1=C2=0.1μF, f _{opg} =32.768kHz, Fig.4	2.5		3.3		V
Current dissipation (In Halt mode)	IDD1	VDD1=1.55V, C1=C2=0.1μF, Fig.4, Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta≤50°C		1.0	4.0		μA
	IDD2	VDD1=1.55V, C1=C2=0.1μF, Fig.5, RC osc (Rext=470kΩ, Cext=30pF), Back-up flag OFF, Ta≤50°C		5.0	15.0		
Current dissipation (In Operating mode)	IDD3	VDD1=1.55V, C1=C2=0.1μF, Fig.4, Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta≤50°C		3.0	12.0	μA	
	IDD4	VDD1=1.55V, C1=C2=0.1μF, Fig.5, RC osc (Rext=470kΩ, Cext=30pF), Back-up flag OFF, Ta≤50°C		7.0	20.0		
Oscillator start-up voltage	V _{stt}	Crystal osc (CI≤25kΩ), Back-up flag ON, Ta≤25°C, Fig.6	1.35			V	
Oscillator sustaining voltage	V _{HOLD}	Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta≤25°C, Fig.6	1.30				
Oscillator start-up time	t _{stt}	VDD1=1.35V Crystal osc (CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.6			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	32HZ, OSCIN	-0.3 to VDD1+0.3	
	VIN2	S1-S4, P00-P03, P10-P13, TEST, RES	-0.3 to VDD2+0.3	
Output voltage	VOUT1	32HZ, CUP2, OSCOUT	-0.3 to VDD1+0.3	
	VOUT2	SEGOUT, COM1-COM4, CUP1, ALM1, LIGHT, P00-P03, P10-P13	-0.3 to VDD2+0.3	
Peak output current (at each pins)	IOUT1	ALM1	4	mA
	IOUT2	LIGHT	1	
	IOUT3	Output except ALM1 and LIGHT	500	µA
Total output current	IALL	The total all pins.	10	mA
Operating temperature range	Topg		-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, 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=2.6 - 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	60	150	300		
	RIN2	VDD2=2.9V, TEST, RES	10		300		
Pull-up transistor	RIN3A	VDD2=2.9V, High level hold Tr. Fig.11 *1	200	600	2000		
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, ALM1	VDD2-0.65				
Output low voltage	VOL3	VDD2=2.4V, IOL=250μA, ALM1			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 *3			0.4		
Output high current	IOH	VDD2=2.9V, VOH=VDD2-0.4V *4			-450		μA
Output low current	IOL	VDD2=2.9V, VOL=0.4V *4	450				
Step-down voltage	VDD1	VDD2=2.8V, C1=C2=0.1μF, fopg=32.768kHz, Fig.8	1.35				V
Current dissipation (In Halt mode)	IDD1	VDD2=2.9V, C1=C2=0.1μF, Fig.8, 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.8, Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta≤50°C		1.5	5.0		
Oscillator start-up voltage	Vstt	Crystal osc (CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.10	2.70			V	
Oscillator sustaining voltage	VHOLD	Crystal osc (CI≤25kΩ), Back-up flag OFF, Ta=25°C, Fig.10	1.3				
Oscillator start-up time	tsst	VDD2=2.70V Crystal osc (CI≤25kΩ), Back-up flag ON, Ta=25°C, Fig.10			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, 32HZ, OSCIN	-0.3 to VDD2+0.3	
Output voltage	VOUT	SEGOUT, COM1-COM4, 32HZ, CUP1, CUP2, OSCOUT, ALM1, LIGHT	-0.3 to VDD2+0.3	
Peak output current (at each pins)	IOUT1	ALM1	4	mA
	IOUT2	LIGHT	1	
	IOUT3	Output except ALM1 and LIGHT	500	µA
Total output current	IALL	The total all pins.	10	mA
Operating temperature range	Topg		-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		6.0	V
	VDD2		2.6		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=2.6 - 6.0V •Refer to figure 1	32	32.768	33	kHz
	fOPG2	•RC oscillation •VDD2=2.6 - 6.0V •Rext=470kΩ •Cext=30pF •Refer to figure 2	30	32.768	40	

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	RIN3A	VDD2=2.9V, High level hold Tr. Fig.1 *4	200	600	2000		
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, ALM1	VDD2-0.65				
Output low voltage	VOL3	VDD2=2.4V, IOL=250μA, ALM1			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 *3			0.4		
Output high current	IOH	VDD2=2.9V, VOH=VDD2-0.45V *4			-450		μA
Output low current	IOL	VDD2=2.9V, VOL=0.45V *4	450				
Step-down voltage	VDD1	VDD2=2.8V, C1=C2=0.1μF, f _{opg} =32.768kHz, Fig.8	1.35				V
Current dissipation (In Halt mode)	IDD1	VDD2=2.9V, C1=C2=0.1μF, Fig.8, Crystal osc (CI≤25kΩ), Ta≤50°C		3.0	15.0		μA
	IDD2	VDD2=2.9V, C1=C2=0.1μF, Fig.9, RC osc (R _{ext} =470kΩ, C _{ext} =30pF), Ta≤50°C		40	150		
Current dissipation	IDD3	VDD2=2.9V, C1=C2=0.1μF, Fig.8, Crystal osc (CI≤25kΩ), Ta≤50°C		7.0	30.0		
	IDD4	VDD2=2.9V, C1=C2=0.1μF, Fig.9, RC osc (R _{ext} =470kΩ, C _{ext} =30pF), Ta≤50°C		50	180		
Oscillator start-up voltage	V _{stt}	Crystal osc (CI≤25kΩ), Ta=25°C, Fig.10	2.3			V	
Oscillator sustaining voltage	V _{HOLD}	Crystal osc (CI≤25kΩ), Ta=25°C, Fig.10	2.0				
Oscillator start-up time	t _{stt}	VDD2=2.3V Crystal osc (CI≤25kΩ), Ta=25°C, Fig.10			10	s	

LC5739

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	100	150		
	RIN2	VDD2=5.0V, TEST, RES	10		300		
Pull-up transistor	RIN3A	VDD2=5.0V, High level hold Tr. Fig.1 *4	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, ALM1	VDD2-1.0				
Output low voltage	VOL3	VDD2=5.0V, IOL=2.0mA, ALM1			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 *3			0.8		
Output high current	IOH	VDD2=5.0V, VOH=VDD2-0.75V *4			-750		μA
Output low current	IOL	VDD2=5.0V, VOL=0.75V *4	750				
Step-down voltage	VDD1	VDD2=5.0V, C1=C2=0.1μF, fopg=32.768kHz, Fig.8	2.4				V
Current dissipation (In Halt mode)	IDD1	VDD2=5.0V, C1=C2=0.1μF, Fig.8, Crystal osc (CI≤25kΩ), Ta≤50°C		8.0	20.0		μA
	IDD2	VDD2=5.0V, C1=C2=0.1μF, Fig.9, RC osc (Rext=470kΩ, Cext=30pF), Ta≤50°C		230	500		
Current dissipation (In Operating mode)	IDD3	VDD2=5.0V, C1=C2=0.1μF, Fig.8, Crystal osc (CI≤25kΩ), Ta≤50°C		30	50	μA	
	IDD4	VDD2=5.0V, C1=C2=0.1μF, Fig.9, RC osc (Rext=470kΩ, Cext=30pF), Ta≤50°C		250	500		
Oscillator start-up voltage	Vstt	Crystal osc (CIv25kΩ), Ta=25°C, Fig.10	2.3			V	
Oscillator sustaining voltage	VHOLD	Crystal osc (CI≤25kΩ), Ta=25°C, Fig.10	2.0				
Oscillator start-up time	tsst	VDD2=2.3V Crystal osc (CI≤25kΩ), Ta=25°C, Fig.10			10	s	

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

*2 : SEG1 to SEG16 and LCD output pins out of SEG17 to SEG32.

*3 : OUTPUT PORT pins out of SEG17 to SEG32.

*4 : P00 to P03, P10 to P13

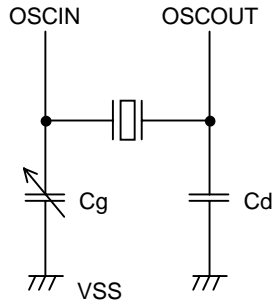


Figure1 Crystal oscillation circuit

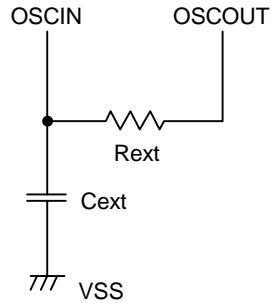


Figure 2 RC oscillation circuit

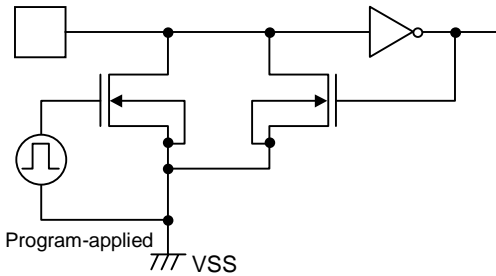


Figure3 Input configuration of S1-4, P10-13

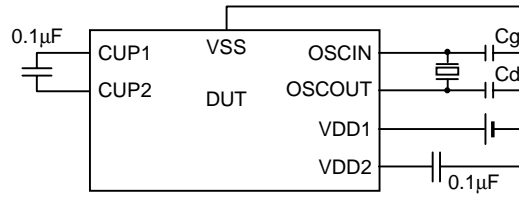


Figure 4 Current dissipation, step-up voltage measurement

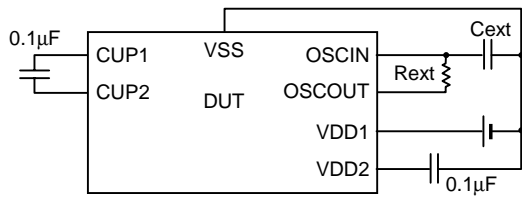


Figure5 Current dissipation, step-down voltage measurement

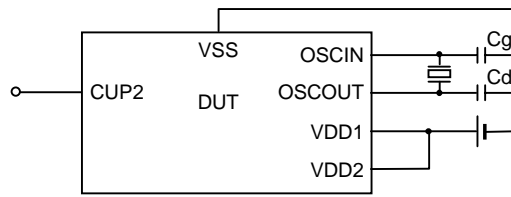


Figure 6 Oscillator start-up voltage, oscillator start-up time, oscillator sustaining voltage measurement

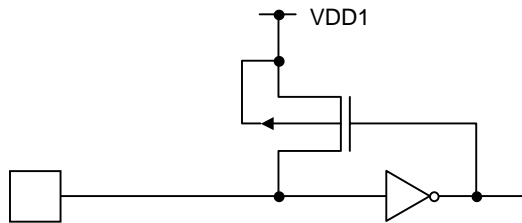


Figure7 Input configuration of P00-03, P10-13

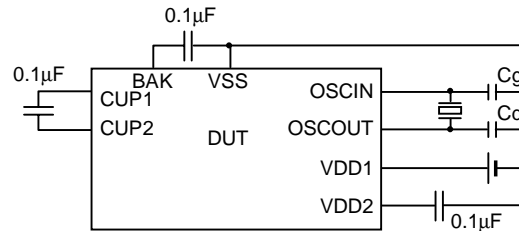


Figure 8 Current dissipation, step-down voltage measurement

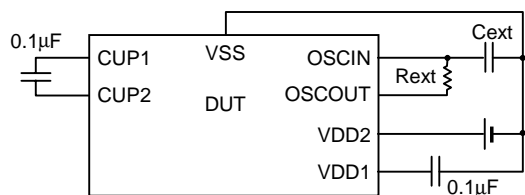


Figure9 Current dissipation, step-down voltage measurement

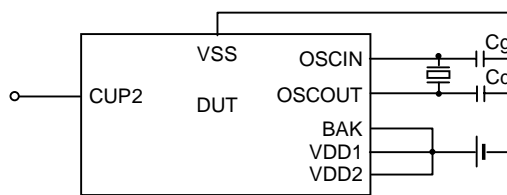


Figure 10 Oscillator start-up voltage, oscillator start-up time, oscillator sustaining voltage measurement

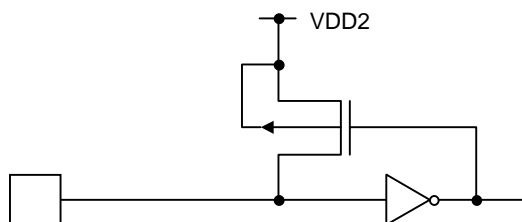


Figure11 Input configuration P00-03, P10-13

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