Ordering number : EN3379A

CMOS LSI

SANYO No.3379A

LC5732N

4-Bit Microcomputer with LCD Driver

Overview

The LC5732N is a CMOS 4-bit microcomputer that operate on low voltage, very low current and contain LCD drivers. They also contain a 4-bit parallel processing ALU, a program memory ROM, many LCD segment outputs, a prescaler, an oscillator.

The LC5732N is especially suited for use in high-grade timepieces, time controllers, electronic calculators, LCD games with timepiece.

Hardware Features

- Supply voltage :
  1.5V or 3.0V typ. (mask option-selectable)
- Very low current dissipation :
  3.0μA typ. (Ag battery version, 32kHz crystal oscillation, during timekeeping operation)
  1.5μA typ. (Li battery version, 32kHz crystal oscillation, during timekeeping operation)
- Crystal oscillator for timekeeping (32.768kHz crystal connected externally) or CR oscillator (CR connected externally)
- Many output pins for LCD panel drive (27 pins)

Drivable LCD panel		Number of drivable LCD segments
1/2 bias	1/3 duty	81 segments
1/2 bias	1/2 duty	54 segments
Static		27 segments

- On-chip melody function : 3 octaves (The melody length is software-controlled. One musical note requires one byte.)
- Input/output pins
  Input pins : 8 pins
  Control output pins : 3 pins (Output dedicated to alarm : 2 pins, general-purpose output : 1 pin)
- Possible to use LCD panel drive output pins as output-only ports (mask option-selectable)
- ROM : 2048×8 bits
- RAM : 48×4 bits
- Cycle time : 122μsec. for 32.768kHz crystal
- On-chip step-up circuit/step-down circuit
- Shipping style : Chip

Software Features

- Powerful instruction set : 92 instructions
- Table read instruction
- 1-level subroutine nesting
- On-chip 15-bit divider for timekeeping (delivers an overflow signal every 32ms or 64ms/100ms/500ms when a 32.768kHz crystal is used.)
- HALT function

Application Development Support System

- Evaluation chip (LC5797) is available for application development and the dedicated equipment is available as the application development tools.
- Tools for developing the LC5732N application programs

① · MS-DOS machine
  · Cross Assembler : LC5732.EXE
  · Mask Option selections program : SU5732.EXE

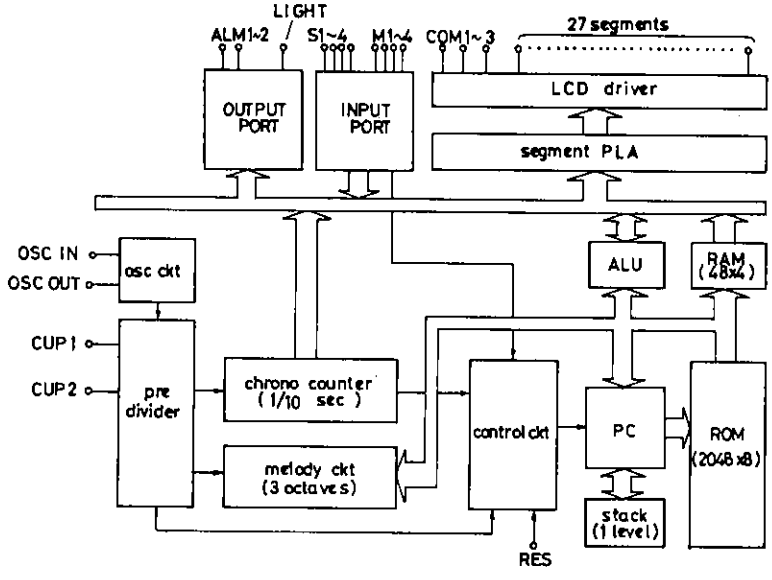
② · SDS-410 system
  · Cross-Assembler : LC5732.COM
  · Mask Option selections program : SU5732.COM

- EVA-510 + TB-5734 + DCB-1 (Rev 2.0V or greater) + Application evaluation board + LC5797
  By connecting to the SDS-410 or MS-DOS machine, application development program data correction and debugging may be done.
- TB-5734 + DCB-1 (Rev 2.0V or greater) + Application evaluation board + LC5797
  By using the EPROM (2732) with application development program data written in, mounting evaluation may be done.

Note 1
- The application evaluation board is constructed by the user.
- LEDs or LCDs may be used for display.
- The EVA-510 is a modified version of the EVA-410 whose monitor ROM is replaced by the SCR-5734.

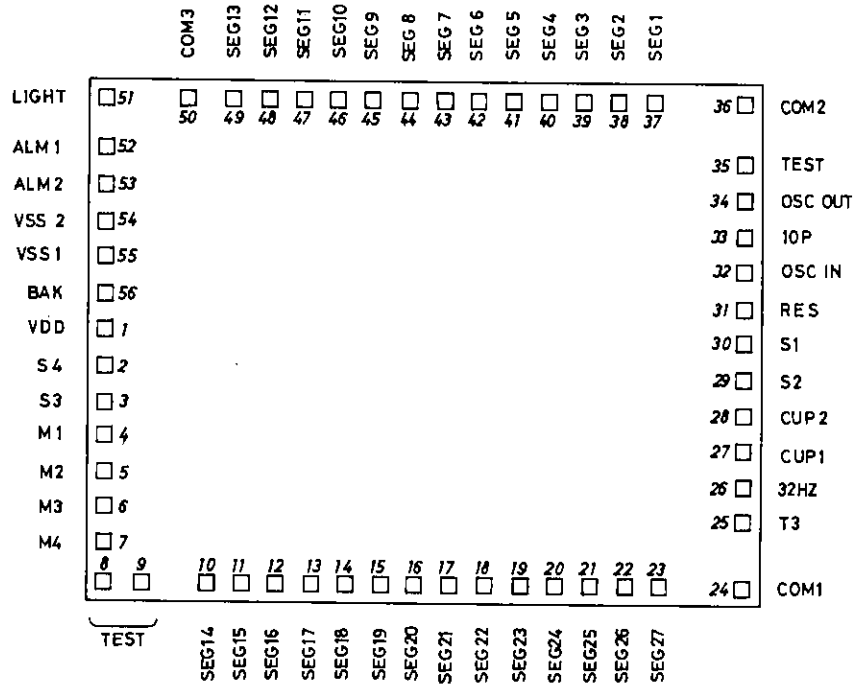
Note 2
- Since the evaluation chip LC5797 and the LC5732N differ in RAM capacity, check the ROM capacity when developing or debugging programs.
  LC5732N : 48×4 bits
  LC5797 : 256×4 bits
- If the DPH value on a program is other than 0, 1, 2, the LC5732N will malfunction in actual applications.
- When developing programs, take care of the DPH value. The usable DPH values are "0", "1", "2" only.
- We will be free from any blame even if you use DPH = other than 0 to 2 to develop programs.
- User's Manual : "LC5732/32H, 5733/33H, 5734/34H User's Manual"
  Refer to the LC5732 section of this User's Manual.
- Development Tool Manual : "LC5730 Series Development Tool Manual"
  Refer to the LC5732 section of this Development Tool Manual.

Equivalent Circuit Block Diagram



Pad Assignment of LSI Chip

Chip size : 3.72mm×3.11mm
Chip thickness : 480μm
Pad size : 120μm×120μm



(Note) SEG14 to SEG27 can be used for output ports. (mask option-selectable)

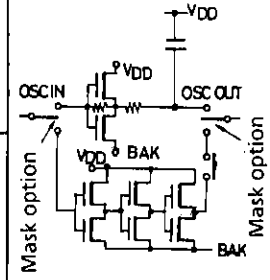
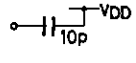
Pad Name and Coordinates

Pad No	Pin Name	X (μm)	Y (μm)
1	VDD	−1665	90
2	S 4	−1665	−90
3	S 3	−1665	−295
4	M 1	−1665	−500
5	M 2	−1665	−700
6	M 3	−1665	−905
7	M 4	−1665	−1110
8	TEST	−1665	−1360
9	TEST	−1340	−1360
10	SEG14	−1100	−1360
11	SEG15	−920	−1360
12	SEG16	−740	−1360
13	SEG17	−560	−1360
14	SEG18	−380	−1360
15	SEG19	−200	−1360
16	SEG20	−20	−1360
17	SEG21	160	−1360
18	SEG22	340	−1360
19	SEG23	520	−1360
20	SEG24	700	−1360
21	SEG25	880	−1360
22	SEG26	1060	−1360
23	SEG27	1240	−1360
24	COM 1	1665	−1360
25	T 3	1665	−1075
26	32Hz	1665	−875
27	CUP 1	1665	−670
28	CUP 2	1665	−465

Pad No	Pin Name	X (μm)	Y (μm)
29	S 2	1665	−260
30	S 1	1665	−55
31	RES	1665	150
32	OSCIN	1665	410
33	10P	1665	635
34	OSCOUT	1665	840
35	TEST	1665	1045
36	COM 2	1665	1360
37	SEG 1	1150	1360
38	SEG 2	970	1360
39	SEG 3	790	1360
40	SEG 4	610	1360
41	SEG 5	430	1360
42	SEG 6	250	1360
43	SEG 7	70	1360
44	SEG 8	−110	1360
45	SEG 9	−290	1360
46	SEG10	−470	1360
47	SEG11	−650	1360
48	SEG12	−830	1360
49	SEG13	−1010	1360
50	COM 3	−1190	1360
51	LIGHT	−1665	1360
52	ALM 1	−1665	990
53	ALM 2	−1665	810
54	Vss 2	−1665	630
55	Vss 1	−1665	450
56	BAK	−1665	270

· 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.

Pin Description

Pad No.	Pin Name	Input/ Output	Circuit Configuration	Function
32	OSCIN	Input		Crystal OSC mode 32.768kHz crystal is connected across OSCIN and OSCOUT for oscillation. Used as reference clock for timepiece and system clock. CR OSC mode R and C are connected across OSCIN and OSCOUT for oscillation. Used as system clock.
34	OSCOUT	Output		
33	10P			Connected to OSCOUT and used as OSC phase compensation capacitor.

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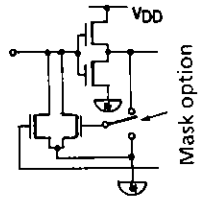
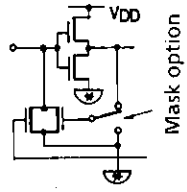
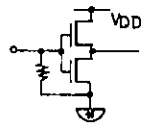
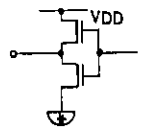
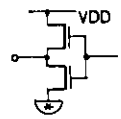
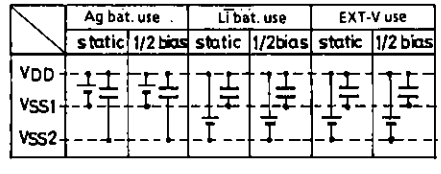
Pad No.	Pin Name	Input/ Output	Circuit Configuration	Function
30 29 3 2	S1 S2 S3 S4	Input		Input-only port. LSI system is reset by applying V_{DD} to S1 to S4 simultaneously. Note (Operating from Li battery, the RES pin must be used in both.)
4 5 6 7	M1 M2 M3 M4	Input		Input pins for placing data in LSI.
31	RES	Input		Input pin for resetting LSI system.
56	BAK			(−) power supply pin for logic unit inside the LSI. For Li battery version, a capacitor must be connected across BAK and V_{DD} to prevent logic unit from malfunctioning.
51	LIGHT	Output		Output-only pin Suited for driving transistor for light.
52 53	ALM1 ALM2	Output		Output-only pin Used to deliver *4kHz, 2kHz, 1kHz modulation signal with instruction. Also used to deliver non-modulation signal. Used to deliver melody signal of 3 octaves with instruction.
1	V_{DD}			(+) power supply pin.
54 55	V_{SS2} V_{SS1}			(−) power supply pin. Ag battery version, Li battery version, EXT-V version : mask option selectable. Also used as power supply for LCD drive. The following Table shows how to connect external parts in each case. 
27 28	CUP1 CUP2			Pins for connecting voltage step-up (step-down) capacitor.

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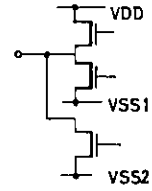
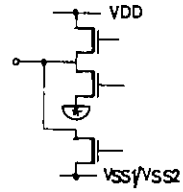
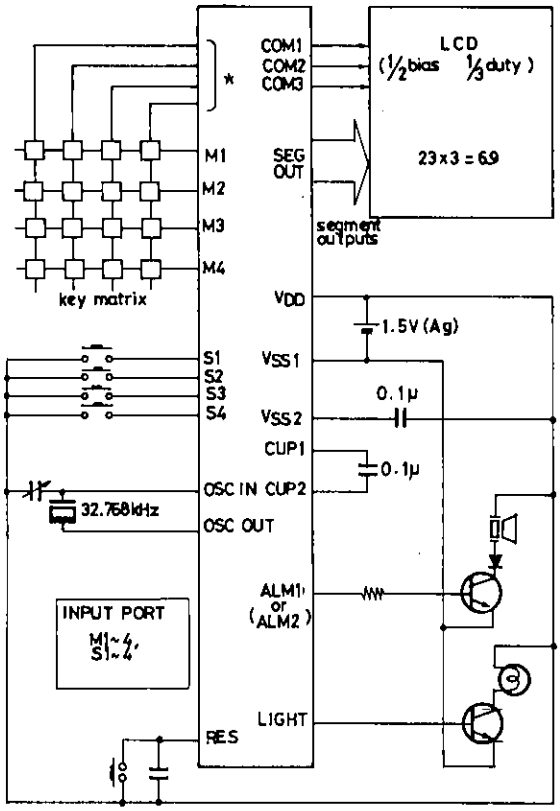
<table>
<tr><th>Pad No.</th><th>Pin Name</th><th>Input/ Output</th><th>Circuit Configuration</th><th>Function</th></tr>
<tr><td>24
36
50</td><td>COM1
COM2
COM3</td><td>Output</td><td> 
</td><td>Output pins for LCD panel common plate.
The following pin is used in each case.
<table>
<tr><th></th><th>Static</th><th>1/2 duty</th><th>1/3 duty</th></tr>
<tr><td>COM1</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>COM2</td><td>-</td><td>○</td><td>○</td></tr>
<tr><td>COM3</td><td>-</td><td>-</td><td>○</td></tr>
<tr><td>Alternating frequency</td><td>64Hz</td><td>32Hz</td><td>43Hz</td></tr>
</table>
(Alternating frequency is for 32.768kHz crystal OSC application.)</td></tr>
<tr><td>10
to
23

37
to
49</td><td>Segment driver</td><td>Output</td><td> 
</td><td>Output pins for LCD panel segments.
Mask option permits Seg 14 to Seg 27 (pad No.10 to 23) to be used as output ports.</td></tr>
<tr><td>26
25
35
8
9</td><td>32Hz
T3
TEST</td><td>Test</td><td></td><td>Test pins (not used by user)</td></tr>
</table>

(Note) For Ag battery power supply, ⏚ is connected to V_{SS1}; for Li battery/EXT-V power supply, connected to V_{SS2}.
* 4kHz, 2kHz, 1kHz : For 32.768kHz crystal OSC application, proportional to OSC frequency.

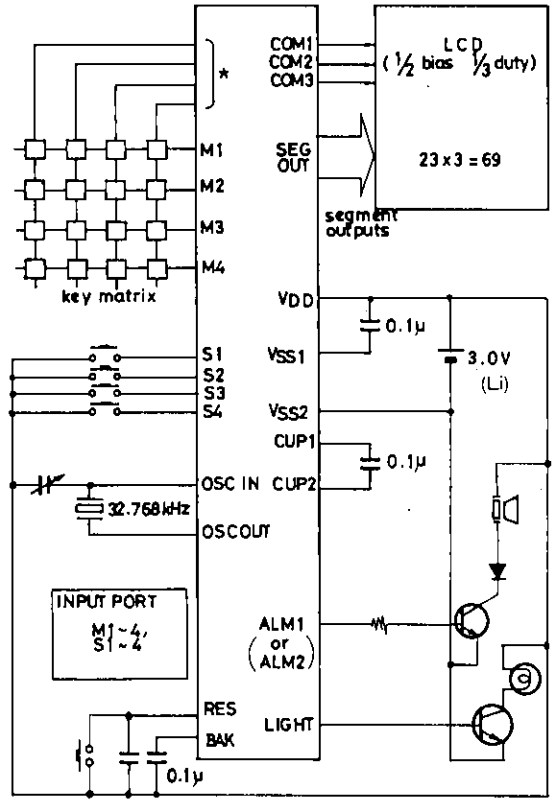
Sample Application Circuits

(1) Ag Battery used application
(1/2 bias 1/3 duty) *: 4 segment outputs are used for output ports.



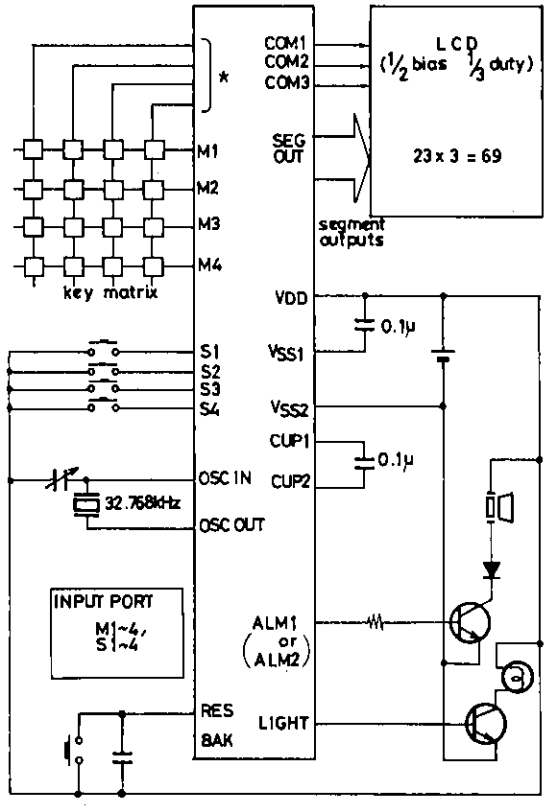
Crystal OSC (Power supply : Ag battery version)

(2) Li Battery used application
(1/2 bias 1/3 duty) *: 4 segment outputs are used for output ports.



Crystal OSC (Power supply : Li battery version)

(3) EXT-V used application
(1/2 bias 1/3 duty) *: 4 segment outputs are used for output ports.



Crystal OSC (Power supply : EXT-V version)

Unit (capacitance: F)

● **Ag Battery Version**

Absolute Maximum Ratings at Ta = 25 ± 2°C, V_{DD} = 0V

				unit
Maximum Supply Voltage	V_{SS1}		−4.0 to +0.3	V
	V_{SS2}		−4.0 to +0.3	V
Maximum Input Voltage	V_{IN}	S1-4,M1-4,TEST,OSCIN,RES	V_{SS1} −0.3 to +0.3	V
Maximum Output Voltage	V_{OUT1}	CUP2,OSCOUT,ALM1,ALM2,LIGHT	V_{SS1} −0.3 to +0.3	V
	V_{OUT2}	SEGOUT,COM1,COM2,COM3,CUP1	V_{SS2} −0.3 to +0.3	V
Operating Temperature	Topr		−10 to +65	°C
Storage Temperature	Tstg		−30 to +125	°C

Allowable Operating Conditions at Ta = 25 ± 2°C, V_{DD} = 0V

			min	typ	max	unit
Supply Voltage	V_{SS1}		−1.65		−1.30	V
	V_{SS2}		−3.3		−2.4	V
Input 'H'-Level Voltage	V_{IH}	S1-4,M1-4,RES	−0.2		0	V
Input 'L'-Level Voltage	V_{IL}	S1-4,M1-4,RES	V_{SS1}		V_{SS1} +0.2	V
Operating Frequency	f_{opg1}	Ta = −10 to +65°C,crystal OSC (recommended OSC circuit Fig.7)	32		33	kHz
	f_{opg2}	Ta = −10 to +65°C,CR OSC (recommended OSC circuit Fig.8) (Recommended external CR constant : Cext = 33pF,Rext = 510kΩ)		32.768		kHz

Electrical Characteristics at Ta = 25 ± 2°C, V_{DD} = 0V

			min	typ	max	unit
Input Resistance	R_{IN1A}	V_{SS1} = −1.55V, V_{IL} = V_{SS1} + 0.2V, 'L' level hold tr., ※1,Fig.1	200		2000	kΩ
	R_{IN1B}	V_{SS1} = −1.55V, 'L' level pull-in tr., ※1,Fig.1	200		2000	kΩ
	R_{IN2}	V_{SS1} = −1.55V,TEST,RES	10		300	kΩ
Output 'H'-Level Voltage	V_{OH1}	V_{SS1} = −1.55V, I_{OH} = −0.4μA, ※2	−0.2			V
Output 'L'-Level Voltage	V_{OL1}	V_{SS1} = −1.55V, I_{OL} = 0.4μA, ※2			V_{SS2} +0.2	V
Output 'H'-Level Voltage	V_{OH2}	V_{SS1} = −1.55V, I_{OH} = −4μA, COM1,COM2,COM3	−0.2			V
Output 'M'-Level Voltage	V_{OM}	V_{SS1} = −1.55V, I_{OH} = −4μA, I_{OL} = 4μA,COM1,COM2,COM3	V_{SS1} −0.2		V_{SS1} +0.2	V
Output 'L'-Level Voltage	V_{OL2}	V_{SS1} = −1.55V, I_{OL} = 4μA, COM1,COM2,COM3			V_{SS2} +0.2	V
Output 'H'-Level Voltage	V_{OH3}	V_{SS1} = −1.35V, I_{OH} = −250μA, ALM1,ALM2,LIGHT	−0.65			V
Output 'L'-Level Voltage	V_{OL3}	V_{SS1} = −1.35V, I_{OL} = 150μA, ALM1,ALM2,LIGHT			V_{SS1} +0.65	V
Output 'H'-Level Voltage	V_{OH4}	V_{SS1} = −1.55V, I_{OH} = −20μA, ※3	−0.2			V
Output 'L'-Level Voltage	V_{OL4}	V_{SS1} = −1.55V, I_{OL} = 20μA, ※3			V_{SS1} +0.2	V
Output Voltage	V_{SS2}	V_{SS1} = −1.35V, C1 = C2 = 0.1μF, f_{opg} = 32.768kHz,Fig.2	−3.3		−2.5	V
Current Dissipation	I_{DD1}	[V_{SS1} = −1.55V,C1 = C2 = 0.1μF,Cg = 20pF, crystal OSC (CI ≦ 25kΩ), Fig.2,backup flag OFF] HALT mode		2.0		μA
	I_{DD2}	[V_{SS1} = −1.55V,C1 = C2 = 0.1μF,Cg = 20pF, crystal OSC (CI ≦ 25kΩ), Fig.2,backup flag OFF] ROM continue mode		5.0		μA
Oscillation Start Voltage	Vstt	Cg = 20pF,crystal OSC (CI ≦ 25kΩ), Fig.3	−1.35			V
Oscillation Hold Voltage	V_{HOLD}	Cg = 20pF,crystal OSC (CI ≦ 25kΩ), Fig.3			−1.30	V
Oscillation Start Time	t_{stt}	[V_{SS1} = −1.35V,Cg = 20pF, crystal OSC (CI ≦ 25kΩ),Fig.3			10	s
Oscillation Compensation Capacitance	10P	External pin	8	10	12	pF

● **Li Battery Version**

Absolute Maximum Ratings at Ta = 25 ± 2°C, V_{DD} = 0V

				unit
Maximum Supply Voltage	V_{SS1}		−4.0 to +0.3	V
	V_{SS2}		−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	OSCIN	V_{SS1} −0.3 to +0.3	V
	V_{IN2}	S1-4,M1-4,TEST,RES	V_{SS2} −0.3 to +0.3	V
Maximum Output Voltage	V_{OUT1}	CUP2,OSCOUT	V_{SS1} −0.3 to +0.3	V
	V_{OUT2}	SEGOUT,COM1,COM2,COM3,CUP1, LIGHT,ALM1,ALM2	V_{SS2} −0.3 to +0.3	V
Operating Temperature	Topr		−10 to +65	°C
Storage Temperature	Tstg		−30 to +125	°C

Allowable Operating Conditions at Ta = 25 ± 2°C, V_{DD} = 0V

			min	typ	max	unit
Supply Voltage	V_{SS1}		−3.6		−1.3	V
	V_{SS2}		−3.6		−2.0	V
Input 'H'-Level Voltage	V_{IH}	S1-4,M1-4,RES	−0.4		0	V
Input 'L'-Level Voltage	V_{IL}	S1-4,M1-4,RES	V_{SS2}		V_{SS2} + 0.4	V
Operating Frequency	f_{opg1}	Ta = −10 to +65°C,crystal OSC (recommended OSC circuit Fig.7)	32		33	kHz

Electrical Characteristics at Ta = 25 ± 2°C, V_{DD} = 0V

			min	typ	max	unit
Input Resistance	R_{IN1A}	V_{SS2} = −2.9V, V_{IL} = V_{SS2} + 0.4V, 'L' level hold tr.,※1,Fig.4	200		2000	kΩ
	R_{IN1B}	V_{SS2} = −2.9V, 'L' level pull-in tr.,※1,Fig.4	100		2000	kΩ
	R_{IN2}	V_{SS2} = −2.9V,TEST,RES	10		300	kΩ
Output 'H'-Level Voltage	V_{OH1}	V_{SS2} = −2.9V, I_{OH} = −0.4μA,※2	−0.2			V
Output 'L'-Level Voltage	V_{OL1}	V_{SS2} = −2.9V, I_{OL} = 0.4μA,※2			V_{SS2} + 0.2	V
Output 'H'-Level Voltage	V_{OH2}	[V_{SS2} = −2.9V, I_{OH} = −4μA, COM1,COM2,COM3	−0.2			V
Output 'M'-Level Voltage	V_{OM}	[V_{SS2} = −2.9V, I_{OH} = −4μA, I_{OL} = 4μA,COM1,COM2,COM3	V_{SS2}/2 − 0.2		V_{SS2}/2 + 0.2	V
Output 'L'-Level Voltage	V_{OL2}	[V_{SS2} = −2.9V, I_{OL} = 4μA, COM1,COM2,COM3			V_{SS2} + 0.2	V
Output 'H'-Level Voltage	V_{OH3}	[V_{SS2} = −2.4V, I_{OH} = −250μA, ALM1,ALM2	−0.65			V
Output 'L'-Level Voltage	V_{OL3}	[V_{SS2} = −2.4V, I_{OL} = 250μA, ALM1,ALM2			V_{SS2} + 0.65	V
Output 'H'-Level Voltage	V_{OH4}	V_{SS2} = −2.4V, I_{OH} = −150μA,LIGHT	−1.5			V
Output 'L'-Level Voltage	V_{OL4}	V_{SS2} = −2.4V, I_{OL} = 150μA,LIGHT			V_{SS2} + 1.5	V
Output 'H'-Level Voltage	V_{OH5}	V_{SS2} = −2.9V, I_{OH} = −40μA,※3	−0.4			V
Output 'L'-Level Voltage	V_{OL5}	V_{SS2} = −2.9V, I_{OL} = 40μA,※3			V_{SS2} + 0.4	V
Output Voltage (halver)	V_{SS1}	V_{SS2} = −2.8V, C1 = C2 = 0.1μF, f_{opg} = 32.768kHz,Fig.5			−1.35	V
Current Dissipation	I_{DD1}	[V_{SS2} = −2.9V,C1 = C2 = 0.1μF,crystal OSC (CI≦25kΩ),Cg = 20pF, Fig.5,backup flag OFF — HALT mode		0.8		μA
	I_{DD2}	ROM continue mode		2.0		μA
Oscillation Start Voltage	Vstt	Cg = 20pF,crystal OSC (CI≦25kΩ), Fig.6	−1.35			V
Oscillation Hold Voltage	V_{HOLD}	Cg = 20pF,crystal OSC (CI≦25kΩ), Fig.6			−1.3	V
Oscillation Start Time	t_{stt}	V_{SS2} = −1.35V,Cg = 20pF, crystal OSC (CI≦25kΩ),Fig.6			10	s
Oscillation Compensation Capacitance	10P	External pin	8	10	12	pF

● EXT-V Version

Absolute Maximum Ratings at Ta = 25 ± 2°C, V_{DD} = 0V

				unit
Maximum Supply Voltage	V_{SS1}		−4.0 to +0.3	V
	V_{SS2}		−4.0 to +0.3	V
Maximum Input Voltage	V_{IN}	OSCIN, S1-4,M1-4,TEST,RES	V_{SS2} −0.3 to +0.3	V
Maximum Output Voltage	V_{OUT}	CUP2,OSCOUT, SEGOUT,COM1,COM2,COM3,CUP1, LIGHT,ALM1,ALM2	V_{SS2} −0.3 to +0.3	V
Operating Temperature	Topr		−30 to +70	°C
Storage Temperature	Tstg		−40 to +125	°C

Allowable Operating Conditions at Ta = 25 ± 2°C, V_{DD} = 0V

			min	typ	max	unit
Supply Voltage	V_{SS1}		−3.6		−1.3	V
	V_{SS2}		−3.6		−2.0	V
Input 'H'-Level Voltage	V_{IH}	S1-4,M1-4,RES	−0.4		0	V
Input 'L'-Level Voltage	V_{IL}	S1-4,M1-4,RES	V_{SS2}		V_{SS2} + 0.4	V
Operating Frequency	f_{opg1}	Ta = −30 to +70°C,crystal OSC (recommended OSC circuit Fig.7)	32		33	kHz
	f_{opg2}	Ta = −30 to +70°C,CR OSC (recommended OSC circuit Fig.8) (Recommended external CR constant : C = 27pF,R = 680kΩ)		32.768		kHz

Electrical Characteristics at Ta = 25 ± 2°C, V_{DD} = 0V

			min	typ	max	unit
Input Resistance	R_{IN1A}	V_{SS2} = −2.9V, V_{IL} = V_{SS2} + 0.4V, 'L' level hold tr.,※1,Fig.4	200		2000	kΩ
	R_{IN1B}	V_{SS2} = −2.9V, 'L' level pull-in tr.,※1,Fig.4	100		2000	kΩ
	R_{IN2}	V_{SS2} = −2.9V,TEST,RES	10		300	kΩ
Output 'H'-Level Voltage	V_{OH1}	V_{SS2} = −2.9V, I_{OH} = −0.4μA,※2	−0.2			V
Output 'L'-Level Voltage	V_{OL1}	V_{SS2} = −2.9V, I_{OL} = 0.4μA,※2			V_{SS2} + 0.2	V
Output 'H'-Level Voltage	V_{OH2}	V_{SS2} = −2.9V, I_{OH} = −4μA, COM1,COM2,COM3	−0.2			V
Output 'M'-Level Voltage	V_{OM}	V_{SS2} = −2.9V, I_{OH} = −4μA, I_{OL} = 4μA,COM1,COM2,COM3	V_{SS2}/2 − 0.2		V_{SS2}/2 + 0.2	V
Output 'L'-Level Voltage	V_{OL2}	V_{SS2} = −2.9V, I_{OL} = 4μA, COM1,COM2,COM3			V_{SS2} + 0.2	V
Output 'H'-Level Voltage	V_{OH3}	V_{SS2} = −2.4V, I_{OH} = −250μA, ALM1,ALM2	−0.65			V
Output 'L'-Level Voltage	V_{OL3}	V_{SS2} = −2.4V, I_{OL} = 250μA, ALM1,ALM2			V_{SS2} + 0.65	V
Output 'H'-Level Voltage	V_{OH4}	V_{SS2} = −2.4V, I_{OH} = −150μA,LIGHT	−1.5			V
Output 'L'-Level Voltage	V_{OL4}	V_{SS2} = −2.4V, I_{OL} = 150μA,LIGHT			V_{SS2} + 1.5	V
Output 'H'-Level Voltage	V_{OH5}	V_{SS2} = −2.9V, I_{OH} = −40μA,※3	−0.4			V
Output 'L'-Level Voltage	V_{OL5}	V_{SS2} = −2.9V, I_{OL} = 40μA,※3			V_{SS2} + 0.4	V
Output Voltage (halver)	V_{SS1}	V_{SS2} = −2.8V, C1 = C2 = 0.1μF, f_{opg} = 32.768kHz,Fig.5			−1.35	V
Current Dissipation	I_{DD1}	[V_{SS2} = −2.9V,C1 = C2 = 0.1μF,crystal OSC (CI ≦ 25kΩ), Cg = 20pF,Fig.5] HALT mode		5.0		μA
	I_{DD2}	[V_{SS2} = −2.9V,C1 = C2 = 0.1μF,crystal OSC (CI ≦ 25kΩ), Cg = 20pF,Fig.5] ROM continue mode		12.5		μA
Oscillation Start Voltage	Vstt	Cg = 20pF,crystal OSC (CI ≦ 25kΩ), Fig.6	−2.2			V
Oscillation Hold Voltage	V_{HOLD}	Cg = 20pF,crystal OSC (CI ≦ 25kΩ), Fig.6			−2.0	V

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			min	typ	max	unit
Oscillation Start Time	t_{stt}	$V_{SS2}=-2.2V$,Cg=20pF, crystal OSC (CI≦25kΩ),Fig.6			10	sec
Oscillation Compensation Capacitance	10P	External pin	8	10	12	pF

※1 S1, S2, S3, S4 ; M1, M2, M3, M4
※2 LCD driver output pins out of SEGOUT14 to 27, SEGOUT1 to 13
※3 Output pins (used as output port) of SEGOUT14 to 27

Table 1 Constants Guaranteed for Crystal OSC

Oscillator Type	Supplier	Oscillator	Power Supply	Cg
32.768kHz crystal oscillation	Daiwa Shinku	DT-38, 32.768kHz (CL=12.5pF)	Ag/Li EXT-V	15pF
	Kyocera	KF-38G, 32.768kHz (CL=13pF)	Ag/Li	20pF
			EXT-V	18pF

Cg tolerance : ±5%

(Note) 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 oscillators other than shown above are used, the characteristics cannot be guaranteed.

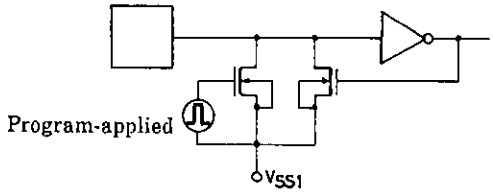

Fig.1 Input configuration of S1-4, M1-4

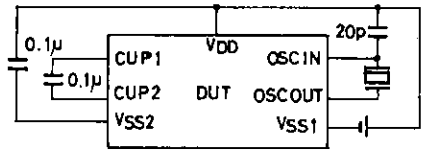

Fig.2 Current dissipation, output voltage test circuit

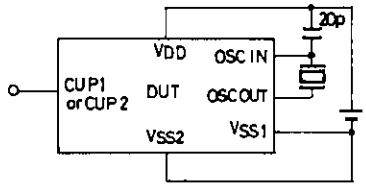

Fig.3 Oscillation start voltage, oscillation start time, frequency stability, oscillation hold voltage test circuit

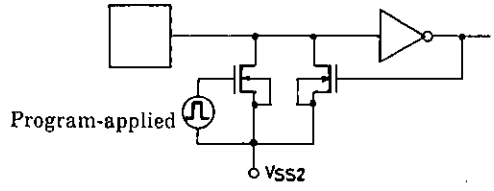

Fig.4 Input configuration of S1-4, M1-4

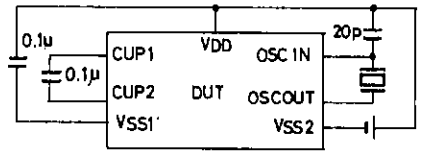

Fig.5 Current dissipation, output voltage test circuit

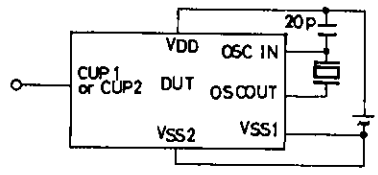

Fig.6 Oscillation start voltage, oscillation start time, frequency stability, oscillation hold voltage test circuit

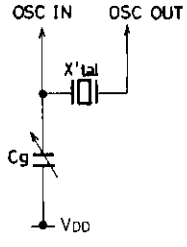

Fig.7 Recommended crystal oscillation circuit

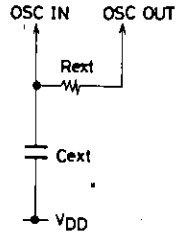

Fig.8 Recommended CR oscillation circuit

Unit (capacitance: F)

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