SANYO No.1318F

LC5850

C MOS LSI
SINGLE-CHIP 4-BIT MICROCOMPUTER
WITH LCD DRIVER

The LC5850 is a C-MOS 4-bit microcomputer that operates on low voltage, very small current and contains LCD drivers. It contains a 4-bit parallel processing ALU, program memory ROM, data memory RAM, many LCD segment outputs, many I/O ports, a prescaler, and a 32.768kHz crystal oscillator.
It is ideally suited for use in watch/clock, desk-top calculator, camera, speech synthesis LSI controller, equipment controller applications.

(1) Hardware features

- Supply voltage: 1.5V or 3.0V (typ.) (mask option)
- Very small current dissipation:

Power supply	Current at HALT mode (typ) (μA)	Current at simple time-keeping operation mode (typ) (μA)	Cycle time (μs)
1.5V (Ag battery version)	1.8	3.0	244
3V (Li battery version)	0.6	1.5	244
EXT-V version*	2.8	8	122

* EXT-V version
To operate the microcomputer at a faster speed (122μsec), the control logic is connected to 3V supply by mask option. (For the other two versions, connected to 1.5V supply.)

- Built-in crystal oscillator for watch/clock (32.768kHz crystal connected externally)
- Many output pins for LCD panel drive (25 pins)

Drivable LCD panel	Number of drivable LCD segments
1/3 bias 1/3 duty	75 segments
1/2 bias 1/3 duty	75 segments
1/2 bias 1/2 duty	50 segments
Static	25 segments

- Many input/output pins
  Ports for input only: 2 ports/8 pins
  Input/output common ports: 2 ports/8 pins
  Port for output only: 1 port/4 pins
  Control output pins: 2 pins
- Possible to use LCD panel drive output pins as ports for output only (mask option)
- With initial reset pin (Port S3 for input only is used by mask option.)
- ROM: 1024 x 15 bits
- RAM: 64 x 4 bits
- Cycle time: 244μsec. (or 122μsec./mask option, selectable for EXT-V version only)
- Built-in step-up circuit, step-down circuit
- Shipping style: QIP64 (or chip)
  (For chip specifications, consult us.)

SANYO Electric Co.,Ltd. Semiconductor Overseas Marketing Div.
Natsume Bldg., 18-6, 2-chome, Yushima, Bunkyo-ku, TOKYO 113 JAPAN

(2) Software features

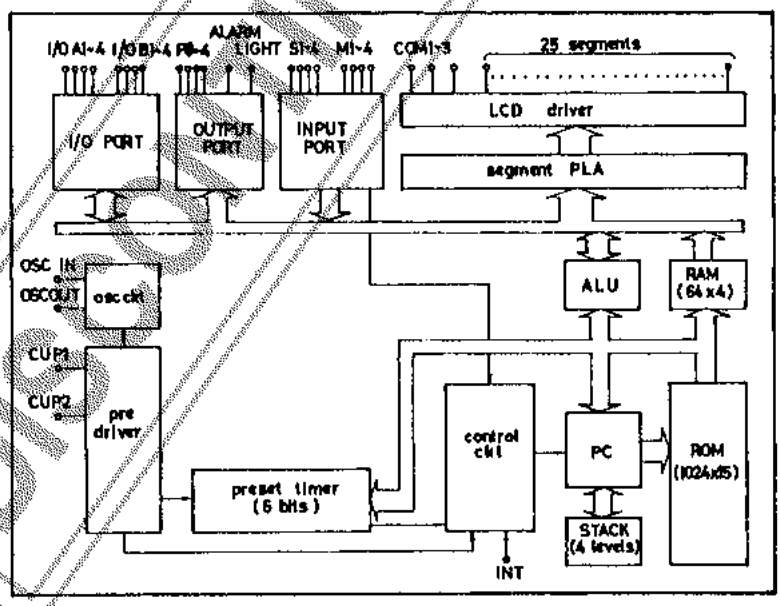
- Powerful instruction set: 78 instructions
- 4-level subroutine nesting (common with interrupt)
- External interrupt function
- 15-bit divider for watch/clock
- Built-in 6-bit programmable timer
- HALT function
- Direct addressing type
- Single stepping of all instructions

(3) Application development tools

For performing application development, the evaluation chip (LC5898F/G) and the dedicated application development tools are prepared. For development at cycle time 244μsec, use the LC5898F. For development at cycle time 122μsec, use the LC5898G.

- SDS410 system
  Application development program of microcomputer can be made in assembly language (edit, asemble).
- EVA510 + TB51 + display board + LC5898
  By connecting to the SDS410, application development program can be corrected and debugged. The EVA510 is a control ROM-replaced version of the EVA410.
- TB51 + display board + LC5898
  By using the EPROM (2732) with application development program data written in, mounting evaluation can be performed.

Equivalent Circuit Block Diagram

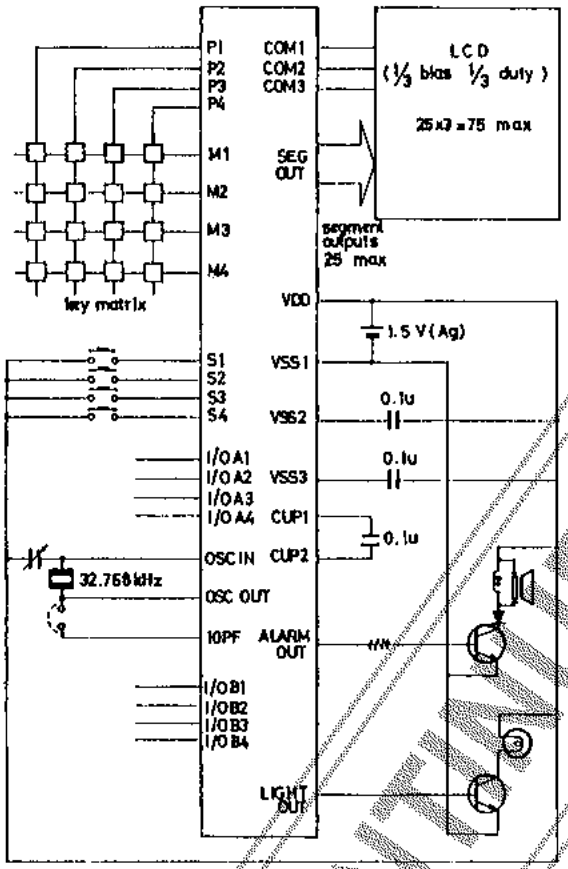


Application Areas

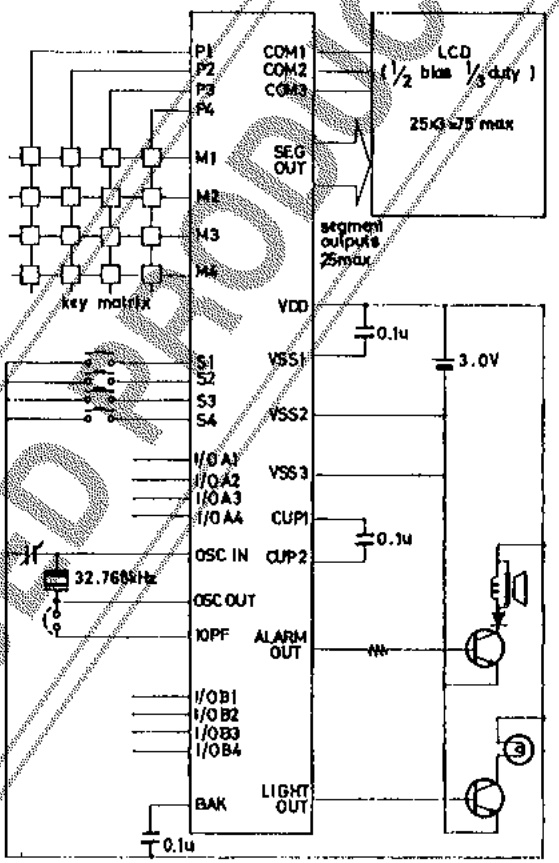
1) Watch/clock with calculator
2) Controller of speech synthesis LSI
3) Controller of camera
4) Mechanical controller of VTR, radio-cassette recorder, tape deck, etc.
5) Controller of telephone dialer, etc.

Sample Application Circuits

(1) Typcal application circuit using Ag battery (1/3 bias 1/3 duty)

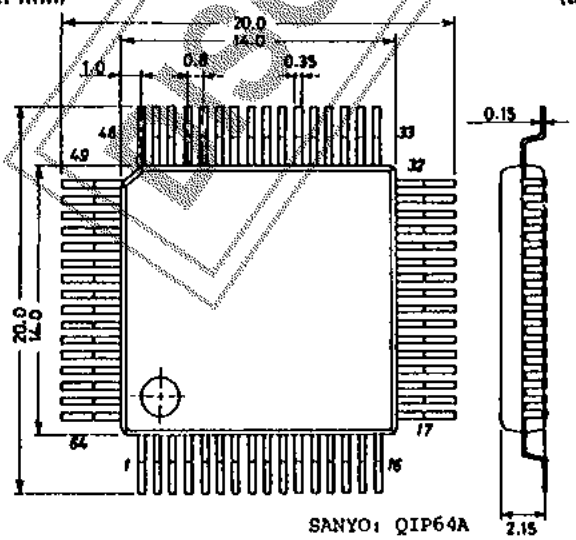


(2) Typical application circuit using Li battery (1/2 bias 1/3 duty)



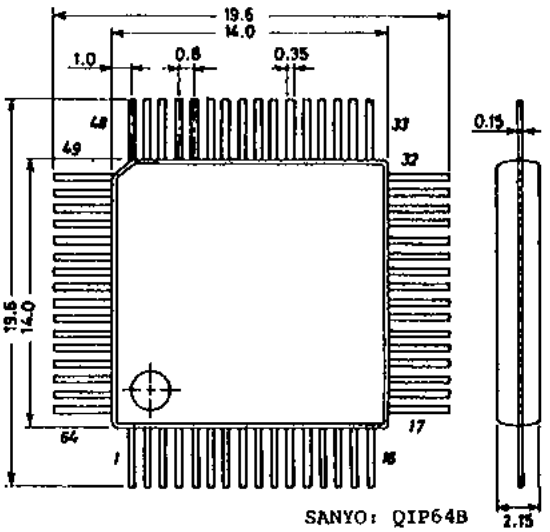
INPUT/OUTPUT PORT	I/OA1～4, I/OB1～4
INPUT PORT	S1～4 , M1～4
OUTPUT PORT	P1～4

Case Outline 3057-Q64A1C
(unit: mm)



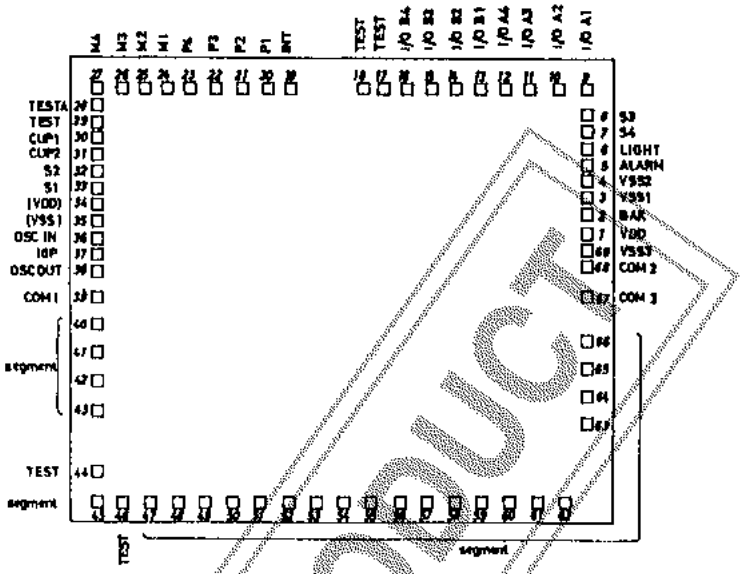
Case Outline 3026B-Q64B1C
(unit: mm)

(Note) The A or B type shown below is selectable.



Pad Assignment of LSI Chip

CHIP SIZE	5.72mm x 4.76mm
CHIP THICKNESS	480μm
PAD SIZE	120μm x 120μm



Pad Name and Coordinates

Pin assignment of QIP64

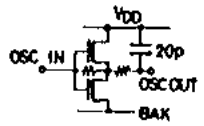
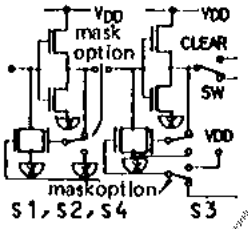
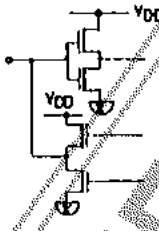
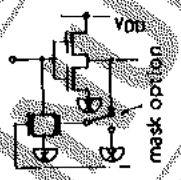
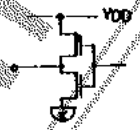
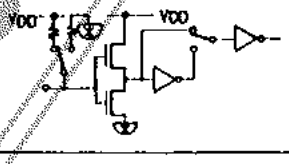
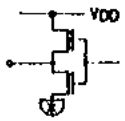
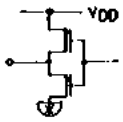
	Pad No.	Pin name	X (μm)	Y (μm)
40	1	VDD	2707	669
41	2	BAK	〃	878
42	3	VSS1	〃	1058
43	4	VSS2	〃	1238
44	5	ALARM OUT	〃	1418
45	6	LIGHT OUT	〃	1589
46	7	S4	〃	1778
47	8	S3	〃	1958
48	9	I/O A1	〃	2228
49	10	I/O A2	2385	〃
50	11	I/O A3	2070	〃
51	12	I/O A4	1800	〃
52	13	I/O B1	1530	〃
53	14	I/O B2	1260	〃
54	15	I/O B3	990	〃
55	16	I/O B4	720	〃
-	17	TEST	450	〃
-	18	TEST	239	〃
57	19	INT	-558	〃
58	20	P1	-810	〃
59	21	P2	-1098	〃
60	22	P3	-1386	〃
61	23	P4	-1674	〃
62	24	M1	-1926	〃
63	25	M2	-2178	〃
64	26	M3	-2430	〃
1	27	M4	-2707	〃
2	28	TEST A	〃	2048
3	29	TEST	〃	1868
4	30	CUP1	〃	1688
5	31	CUP2	〃	1508
6	32	S2	〃	1328
7	33	S1	〃	1148
-	34	(VDD)	〃	968
-	35	(VSS)	〃	788

Pin assignment of QIP64

	Pad No.	Pin name	X (μm)	Y (μm)
8	36	OSC IN	-2707	608
-	37	10PF	〃	428
9	38	OSC OUT	〃	248
10	39	COMMON1	〃	-36
11	40	segment	〃	-324
12	41	〃	〃	-630
13	42	〃	〃	-936
14	43	〃	〃	-1242
-	44	TEST	〃	-1899
15	45	segment	〃	-2228
-	46	TEST	-2446	-2232
16	47	segment	-2140	-2228
17	48	〃	-1834	〃
18	49	〃	-1528	〃
19	50	〃	-1222	〃
20	51	〃	-916	〃
21	52	〃	-610	〃
22	53	〃	-304	〃
23	54	〃	2	〃
25	55	〃	308	〃
26	56	〃	614	〃
27	57	〃	920	〃
28	58	〃	1226	〃
29	59	〃	1532	〃
30	60	〃	1838	〃
31	61	〃	2144	〃
32	62	〃	2450	〃
33	63	〃	2707	-1382
34	64	〃	〃	-1087
35	65	〃	〃	-792
36	66	〃	〃	-496
37	67	COMMON3	〃	-15
38	68	COMMON2	〃	309
39	69	VSS3	〃	489

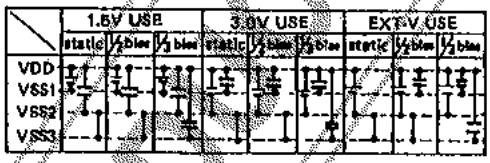
- Pins 24, 56 QIP package: SUB (open)
- The above pad coordinates are such that the chip center is taken as the origin and the values of (X,Y) represent the coordinates of the center of each pad.
- When mounting the QIP64 package version on the board, do not dip it in solder.

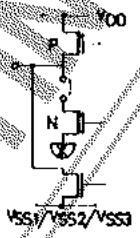
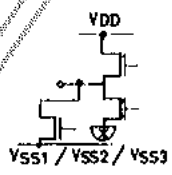
Pin Description

QIP Pin	Pad No.	Pin Name	Input/ Output	Circuit Configuration	Function
8	36	OSC IN	Input		32.768kHz crystal is connected across OSCIN and OSCOUT for oscillation. Used as system clock and reference clock for watch/clock. 20pF capacitor is connected across OSCOUT and V_{DD}.
9	38	OSC OUT	Output		
—	37	10P	—		Connected to OSCOUT and used as oscillation phase compensation capacitor.
7	33	S1	Input		Port for input only. With 32ms chattering eliminator. S3 is used for switch input/LSI system reset input (PLA mask option). If S3 is used for switch input, LSI system is reset by applying V_{DD} to S1 to S4 simultaneously.
6	32	S2			
47	8	S3(CLEAR/ SWITCH)			
46	7	S4			
48	9	I/O A1	Input/ Output		Input/output pins for selecting the following 2 operations with instruction. (1) Input pin for fetching data into RAM. (2) Output pin for outputting data from RAM.
49	10	I/O A2			
50	11	I/O A3			
51	12	I/O A4			
52	13	I/O B1			
53	14	I/O B2			
54	15	I/O B3			
55	16	I/O B4			
62	24	M1	Input		Port for input only. Input pin for fetching data into RAM.
63	25	M2			
64	26	M3			
1	27	M4			
58	20	P1	Output		Port for output only.
59	21	P2			
60	22	P3			
61	23	P4			
57	19	INT	Input		External interrupt request control input pin.
41	2	BAK			(—) power supply pin for logic unit inside LSI. When using 3.0V (Li battery version) supply, a capacitor must be connected across BAK and V_{DD}. (to prevent logic unit from malfunctioning.)
45	6	LIGHT	Output		Pin for output only. Suited for outputting signal to drive transistor for light.
44	5	ALARM	Output		Pin for output only. Used to output 4kHz and 2kHz or 4kHz and 1kHz modulation signal with instruction. Also used to output non-modulation signal.

Continued on next page.

Continued from preceding page.

<table>
<tr><th>QIP Pin</th><th>Pad No.</th><th>Pin Name</th><th>Input/ Output</th><th>Circuit Configuration</th><th>Function</th></tr>
<tr><td>40</td><td>1</td><td>VDD</td><td></td><td></td><td>(+) Power supply pin.</td></tr>
<tr><td>39
43
42</td><td>69
4
3</td><td>VSS3
VSS2
VSS1</td><td></td><td></td><td>(–) power supply pin.
• 1.5V/3.0V selectable with mask option.
For 1.5V use (Ag battery version), apply (–) side to V_{SS1}.
For 3.0V use (Li battery version), apply (–) side to V_{SS2}.
• Also used as power supply for LCD drive.
 

The above Table shows how to connect external parts in each case.</td></tr>
<tr><td>4
5</td><td>30
31</td><td>CUP1
CUP2</td><td></td><td></td><td>Pins for connecting voltage step-up (step-down) capacitor.</td></tr>
<tr><td>10
38
37</td><td>39
68
67</td><td>COM1
COM2
COM3</td><td>Output</td><td> 
</td><td>Output pins for LCD panel common electrode.
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>32Hz*</td><td>32Hz*</td><td>43Hz*</td></tr></table>* Possible to make frequency 2 or 4-fold by using PLA.</td></tr>
<tr><td>34
35
36</td><td>64
65
66</td><td>segment
driver</td><td>Output</td><td> 
</td><td>Output pins for LCD panel segments.
• Also used as output ports with mask option.
• When LSI system is in reset mode, 32Hz, 64Hz, or 128Hz static light-up signal is output at COM1 to COM3 and each LCD segment output and all LCD panel segments light up.
• Segment PLA system is adopted to support any type of LCD layout.</td></tr>
<tr><td>11
~
33</td><td>40
~
43
~
45
47
~
63</td><td>segment
driver</td><td>Output</td><td> 
</td><td>Output pins for LCD panel segments.
• Also used as output ports with mask option.</td></tr>
<tr><td>–
–
2
3
–
–</td><td>17
18
28
29
44
46</td><td>TEST
TEST
TEST A
TEST
TEST
TEST</td><td></td><td></td><td>Test pins (not used by user).</td></tr>
<tr><td>–
–</td><td>35
34</td><td>(VSS)
(VDD)</td><td></td><td></td><td>Backup power supply pin.
Normally, not used.</td></tr>
</table>

NOTE) Ag Battery : ⏚ = V_{SS1}
Li Battery, EXT-V : ⏚ = V_{SS2}

Operation from Ag Battery [Static]

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}	V_{SS2}=V_{SS3}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	S1–4, M1–4, I/OA1–4, I/OB1–4, 10P, OSCIN, INT, TESTA (I/OA1–4, I/OB1–4: Input mode)	V_{SS1}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT, ALARM, LIGHT, I/OA1–4, I/OB1–4, P1–4 (I/OA1–4, I/OB1–4: Output mode)	V_{SS1}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, CUP1	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 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}	V_{SS2}=V_{SS3}	−3.3		−2.4	V
"H"-Level Input Voltage	V_{IH}	S1–4, M1–4, I/OA1–4, I/OB1–4, INT, (I/OA1–4, I/OB1–4: Input mode)	−0.2		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS1}		V_{SS1}+0.2	V
Operating Frequency	fopg	Ta=−20 to +65°C	32		33	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.	10		200	kΩ
	R_{IN1B}	V_{SS1}=−1.55V, "L"-level pull-in tr., *1, Fig. 1	200		2000	kΩ
	R_{IN2A}	V_{SS1}=−1.55V, V_{IL}=V_{SS1}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS1}=−1.55V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS1}=−1.55V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"L"-Level Output Voltage	V_{OL1}	V_{SS1}=−1.55V, I_{OL}=0.4μA, SEGOUT			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS1}=−1.55V, I_{OH}=−4μA, COM1	−0.2			V
"L"-Level Output Voltage	V_{OL2}	V_{SS1}=−1.55V, I_{OL}=4μA, COM1			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS1}=−1.35V, I_{OH}=−250μA, ALM, LIGHT	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS1}=−1.35V, I_{OL}=250μA, ALM, LIGHT			V_{SS1}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS1}=−1.55V, I_{OH}=−20μA, P1–4, I/OA1–4, I/OB1–4 (I/OA1–4, I/OB1–4: Output mode)	−0.2			V
"L"-Level Output Voltage	V_{OL4}	V_{SS1}=−1.55V, I_{OL}=20μA, P1–4, I/OA1–4, I/OB1–4 (I/OA1–4, I/OB1–4: Output mode)			V_{SS1}+0.2	V
Output Voltage (doubler)	V_{SS2}	V_{SS1}=−1.35V, C1=C2=0.1μF, fopg=32.768kHz, Fig. 2			−2.5	V
Current Dissipation	I_{DD}	V_{SS1}=−1.55V, standard watch/clock operation C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, Fig. 2		2.0		μA
Oscillation Start Voltage	$\|V_{stt}\|$	Co=Cg=20pF, Cl=25kΩ, Fig. 3			1.35	V
Oscillation Hold Voltage	$\|V_{HOLD}\|$	Co=Cg=20pF, Cl=25kΩ, Fig. 2	1.30		1.65	V
Oscillation Start Time	t_{stt}	Co=Cg=20pF, Cl=25kΩ, V_{SS1}=−1.35V, Fig. 3			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from Li Battery [Static]

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

				unit
Maximum Supply Voltage	V_{SS1}	V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
	V_{SS2}	V_{SS2}=V_{SS3}, V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN, TESTI/O	V_{BAK}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TESTI/O, CUP2, OSCOUT	V_{BAK}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, CUP1, ALARM, LIGHT, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 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_{BAK}		−3.6		−1.3	V
	V_{SS2}	V_{SS2}=V_{SS3}	−3.6		−2.0	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	−0.4		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		V_{SS2}+0.4	V
Operating Frequency	fopg	Ta=−20 to +65°C	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	10		200	kΩ
	R_{IN1B}	V_{SS2}=−2.9V, "L"-level pull-in tr., *1, Fig. 4	200		2000	kΩ
	R_{IN2A}	V_{SS2}=−2.9V, V_{IL}=V_{SS2}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS2}=−2.9V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS2}=−2.9V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"L"-Level Output Voltage	V_{OL1}	V_{SS2}=−2.9V, I_{OL}=0.4μA, SEGOUT			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS2}=−2.9V, I_{OH}=−4μA, COM1	−0.2			V
"L"-Level Output Voltage	V_{OL2}	V_{SS2}=−2.9V, I_{OL}=4μA, COM1			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS2}=−2.4V, I_{OH}=−250μA, ALM	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS2}=−2.4V, I_{OL}=250μA, ALM			V_{SS2}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS2}=−2.9V, I_{OH}=−40μA, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)	−0.4			V
"L"-Level Output Voltage	V_{OL4}	V_{SS2}=−2.9V, I_{OH}=40μA I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)			V_{SS2}+0.4	V
"H"-Level Output Voltage	V_{OH5}	V_{SS2}=−2.4V, I_{OH}=−150μA, LIGHT	−1.5			V
"L"-Level Output Voltage	V_{OL5}	V_{SS2}=−2.4V, I_{OL}=150μA, LIGHT			V_{SS2}+1.5	V
Output Voltage (halver)	V_{SS1}	V_{SS2}=−2.9V, C1=C2=0.1μF, fopg=32.768kHz, Fig. 5			−1.35	V
Current Dissipation	I_{IDD}	V_{SS2}=−2.9V, standard watch/clock operation, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, Fig. 5		1.0		μA
Oscillation Start Voltage	$\|V_{stt}\|$	V_{SS1}=V_{SS2}, Co=Cg=20pF, Cl=25kΩ, Fig. 6			1.35	V
Oscillation Hold Voltage	$\|V_{HOLD}\|$	V_{SS1}=V_{SS2}/2, Co=Cg=20pF, Cl=25kΩ, Fig. 5	2.0		3.6	V
Oscillation Start Time	t_{stt}	V_{SS1}=V_{SS2}=−2.9V, Co=Cg=20pF, Cl=25kΩ, Fig. 6			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from EXT-V [Static]

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

				unit
Maximum Supply Voltage	V_{SS2}	V_{SS2}=V_{SS3}=V_{SS1}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN	V_{SS2}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST CUP2, OSCOUT	V_{SS2}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, CUP1, ALARM, LIGHT, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 to +70	°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_{SS2}	V_{SS1}=V_{SS2}=V_{SS3}	−3.6		−2.0	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	0.3V_{SS2}		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		0.7V_{SS2}	V
Operating Frequency	fopg1	Ta=−20 to +70°C, V_{SS2}=−2.0 to −3.6V	32		33	kHz
	fopg2	Ta=−20 to +70°C, V_{SS2}=−2.3 to −3.6V	32		66	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. 13	10		200	kΩ
	R_{IN1B}	V_{SS2}=−2.9V, "L"-level pull-in tr., *1, Fig. 13	200		2000	kΩ
	R_{IN2A}	V_{SS2}=−2.9V, V_{IL}=V_{SS2}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS2}=−2.9V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	$V_{OH(1)}$	V_{SS2}=−2.4V, I_{OH}=−0.4mA, ALM, LIGHT	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(1)}$	V_{SS2}=−2.4V, I_{OL}=0.4mA, ALM, LIGHT	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(2)}$	V_{SS2}=−2.4V, I_{OH}=−0.1mA, I/O ports, port P	−1	−0.3		V
"H"-Level Output Voltage	$V_{OH(3)}$	V_{SS2}=−2.4V, I_{OH}=−50μA, I/O ports, port P	−0.6	−0.2		V
"L"-Level Output Voltage	$V_{OL(3)}$	V_{SS2}=−2.4V, I_{OL}=0.1mA, I/O ports, portP	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(4)}$	V_{SS2}=−2.4V, I_{OH}=−10μA; Segment (Output port mode) Pad Nos. 64 to 66, QIP64 pin Nos. 34 to 36	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$	V_{SS2}=−2.4V, I_{OL}=50μA; Segment (Output port mode) Pad Nos. 64 to 66, QIP64 pin Nos. 34 to 36	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(5)}$	V_{SS2}=−2.4V, I_{OH}=−5μA; Segment (Output port mode) Pad Nos. 40 to 43, 45, 47 to 63, QIP64 pin Nos. 11 to 13	−1	+0.3		V
"L"-Level Output Voltage	$V_{OL(5)}$	V_{SS2}=−2.4V, I_{OL}=20μA; Segment (Output port mode) Pad Nos. 40 to 43, 45, 47 to 63, QIP64 pin Nos. 11 to 13	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(6)}$	V_{SS2}=−2.4V, I_{OH}=−0.4μA; Each segment	−0.2			V
"L"-Level Output Voltage	$V_{OL(6)}$	V_{SS2}=−2.4V, I_{OL}=0.4μA; Each segment			V_{SS2}+0.2	V
"H"-Level Output Voltage	$V_{OH(7)}$	V_{SS2}=−2.4V, I_{OH}=−4μA, COM1	−0.2			V
"L"-Level Output Voltage	$V_{OL(7)}$	V_{SS2}=−2.4V, I_{OL}=4μA, COM1			V_{SS2}+0.2	V
Output Voltage	V_{SS1}	V_{SS2}=−2.9V, C1=C2=0.1μF, fopg=32.768kHz			−1.35	V
Current Dissipation	I_{IDD}I	V_{SS2}=−2.9V, HALT mode, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 5			5	μA
Oscillation Start Voltage	IV_{stt}I	Same as above Fig. 6			2.2	V
Oscillation Hold Voltage	IV_{HOLD}I	Same as above Fig. 6	2.0		3.6	V
Oscillation Start Time	t_{stt}	V_{SS2}=−2.9V, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 6			10	sec
Oscillation Correction Capacitance	10P	V_{SS2}=−2.9V, External pin	8	10	12	pF
	20P	V_{SS2}=−2.9V, OSCOUT	16	20	24	pF

Operation from Ag Battery [1/2 Bias, 1/2 Duty]

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}	V_{SS2}=V_{SS3}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	S1−4, M1−4, I/OA1−4, I/OB1−4, 10P, OSCIN, INT, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS1}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT, ALARM, LIGHT, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS1}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, COM2, CUP1	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 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}	V_{SS2}=V_{SS3}	−3.3		−2.4	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	−0.2		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS1}		V_{SS1}+0.2	V
Operating Frequency	fopg	Ta=−20 to +65°C	32		33	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	10		200	kΩ
	R_{IN1B}	V_{SS1}=−1.55V, "L"-level pull-in tr., *1, Fig. 1	200		2000	kΩ
	R_{IN2A}	V_{SS1}=−1.55V, V_{IL}=V_{SS1}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS1}=−1.55V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS1}=−1.55V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"L"-Level Output Voltage	V_{OL1}	V_{SS1}=−1.55V, I_{OL}=0.4μA, SEGOUT			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS1}=−1.55V, I_{OH}=−4μA, COM1, COM2	−0.2			V
"M"-Level Output Voltage	V_{OM}	V_{SS1}=−1.55V, I_{OH}=−4μA, I_{OL}=4μA, COM1, COM2	V_{SS1}−0.2		V_{SS1}+0.2	V
"L"-Level Output Voltage	V_{OL2}	V_{SS1}=−1.55V, I_{OL}=4μA, COM1, COM2			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS1}=−1.35V, I_{OH}=−250μA, ALM, LIGHT	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS1}=−1.35V, I_{OL}=250μA, ALM, LIGHT			V_{SS1}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS1}=−1.55V, I_{OH}=−20μA, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	−0.2			V
"L"-Level Output Voltage	V_{OL4}	V_{SS1}=−1.55V, I_{OL}=20μA, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)			V_{SS1}+0.2	V
Output Voltage (doubler)	V_{SS2}	V_{SS1}=−1.35V, C1=C2=0.1μF, fopg=32.768kHz, Fig. 2			−2.6	V
Current Dissipation	I_{DD}	V_{SS1}=−1.55V, standard watch/clock operation C1=C2=0.1μF, Co=Cg=20pF, CI=25kΩ, Fig. 2		2.0		μA
Oscillation Start Voltage	$\|V_{stt}\|$	Co=Cg=20pF, CI=25kΩ, Fig. 3			1.35	V
Oscillation Hold Voltage	$\|V_{HOLD}\|$	Co=Cg=20pF, CI=25kΩ, Fig. 2	1.30		1.65	V
Oscillation Start Time	t_{stt}	Co=Cg=20pF, CI=25kΩ, V_{SS1}=−1.35V, Fig. 3			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from Li Battery [1/2 Bias, 1/2 Duty]

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

				unit
Maximum Supply Voltage	V_{SS1}	V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
	V_{SS2}	V_{SS2}=V_{SS3}, V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN	V_{BAK}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT	V_{BAK}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, COM2, CUP1, ALARM, LIGHT, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 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_{BAK}		−3.6		−1.3	V
	V_{SS2}	V_{SS2}=V_{SS3}	−3.6		−2.0	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	−0.4		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		V_{SS2}+0.4	V
Operating Frequency	fopg	Ta=−20 to +65°C	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	10		200	kΩ
	R_{IN1B}	V_{SS2}=−2.9V, "L"-level pull-in tr., *1, Fig. 4	200		2000	kΩ
	R_{IN2A}	V_{SS2}=−2.9V, V_{IL}=V_{SS2}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS2}=−2.9V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS2}=−2.9V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"L"-Level Output Voltage	V_{OL1}	V_{SS2}=−2.9V, I_{OL}=0.4μA, SEGOUT			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS2}=−2.9V, I_{OH}=−4μA, COM1, COM2	−0.2			V
"M"-Level Output Voltage	V_{OM}	V_{SS2}=−2.9V, I_{OH}=−4μA, I_{OL}=4μA, COM1, COM2	V_{SS2}/2−0.2		V_{SS2}/2+0.2	V
"L"-Level Output Voltage	V_{OL2}	V_{SS2}=−2.9V, I_{OL}=4μA, COM1, COM2			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS2}=−2.4V, I_{OH}=−250μA, ALM	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS2}=−2.4V, I_{OL}=250μA, ALM			V_{SS2}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS2}=−2.9V, I_{OH}=−40μA, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)	−0.4			V
"L"-Level Output Voltage	V_{OL4}	V_{SS2}=−2.9V, I_{OH}=40μA, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)			V_{SS2}+0.4	V
"H"-Level Output Voltage	V_{OH5}	V_{SS2}=−2.9V, I_{OH}=−150μA, LIGHT	−1.5			V
"L"-Level Output Voltage	V_{OL5}	V_{SS2}=−2.9V, I_{OL}=150μA, LIGHT			V_{SS2}+1.5	V
Output Voltage (halver)	V_{SS1}	V_{SS2}=−2.9V, C1=C2=0.1μF, fopg=32.768kHz, Fig. 5			−1.35	V
Current Dissipation	I_{DD}I	V_{SS2}=−2.9V, standard watch/clock operation C1=C2=0.1μF, Co=Cg=20pF, CI=25kΩ, Fig. 5		1.0		μA
Oscillation Start Voltage	V_{stt}I	V_{SS1}=V_{SS2}, Co=Cg=20pF, CI=25kΩ, Fig. 6			1.35	V
Oscillation Hold Voltage	V_{HOLD}I	V_{SS1}=V_{SS2}/2, Co=Cg=20pF, CI=25kΩ, Fig. 5	2.6		3.6	V
Oscillation Start Time	t_{stt}	V_{SS1}=V_{SS2}=−2.9V, Co=Cg=20pF, CI=25kΩ, Fig. 6			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from EXT-V [1/2 Bias, 1/2 Duty]

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}	V_{SS2}=V_{SS3}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN	V_{SS2}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT	V_{SS2}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, COM2, CUP1, ALARM, LIGHT, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 to +70	°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}	V_{SS2}=V_{SS3}	−3.6		−2.0	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	0.3V_{SS2}		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		0.7V_{SS2}	V
Operating Frequency	fopg1	Ta=−20 to +70°C, V_{SS2}=−2.0 to −3.6V	32		33	kHz
	fopg2	Ta=−20 to +70°C, V_{SS2}=−2.3 to −3.6V	32		66	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}+0.4, "L"-level hold tr., *1, Fig. 4	10		200	kΩ
	R_{IN1B}	V_{SS2}=−2.9V, "L"-level pull-in tr., *1, Fig. 4	200		2000	kΩ
	R_{IN2A}	V_{SS2}=−2.9V, V_{IL}=V_{SS2}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS2}=−2.9V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	$V_{OH(1)}$	V_{SS2}=−2.4V, I_{OH}=−0.4mA, ALM, LIGHT	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(1)}$	V_{SS2}=−2.4V, I_{OL}=0.4mA, ALM, LIGHT	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(2)}$	V_{SS2}=−2.4V, I_{OH}=−0.1mA, I/O ports, port P	−1	−0.3		V
"H"-Level Output Voltage	$V_{OH(3)}$	V_{SS2}=−2.4V, I_{OH}=−50μA, I/O ports, port P	−0.6	−0.2		V
"L"-Level Output Voltage	$V_{OL(3)}$	V_{SS2}=−2.4V, I_{OL}=0.1mA, I/O ports, port P,	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(4)}$	V_{SS2}=−2.4V, I_{OH}=−10μA, Segment (Output port mode) Pad Nos. 64 to 66, QIP64 pin Nos. 34 to 36	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$	V_{SS2}=−2.4V, I_{OL}=50μA, Segment (Output port mode) Pad Nos. 64 to 66, QIP64 pin Nos. 34 to 36	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(5)}$	V_{SS2}=−2.4V, I_{OH}=−5μA, Segment (Output port mode) Pad Nos. 40 to 43, 46, 47 to 63, QIP64 pin Nos. 11 to 13	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(5)}$	V_{SS2}=−2.4V, I_{OL}=20μA, Segment (Output port mode) Pad Nos. 40 to 43, 46, 47 to 63, QIP64 pin Nos. 11 to 13	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(6)}$	V_{SS2}=−2.4V, I_{OH}=−0.4μA, Each segment	−0.2			V
"L"-Level Output Voltage	$V_{OL(6)}$	V_{SS2}=−2.4V, I_{OL}=0.4μA, Each segment			V_{SS2}+0.2	V
"H"-Level Output Voltage	$V_{OH(7)}$	V_{SS2}=−2.4V, I_{OH}=−4μA, COM 1−2	−0.2			V
"M"-Level Output Voltage	V_{OM}	V_{SS2}=−2.4V, I_{OH}=−4μA, I_{OL}=4μA, COM 1−2	V_{SS2}/2−0.2		V_{SS2}/2+0.2	V
"L"-Level Output Voltage	$V_{OL(7)}$	V_{SS2}=−2.4V, I_{OL}=4μA, COM 1−2			V_{SS2}+0.2	V
Output Voltage	V_{SS1}	V_{SS2}=−2.9V, C1=C2=0.1μF, fopg=32.768kHz			−1.35	V
Current Dissipation	I_{DD}	V_{SS2}=−2.9V, HALT mode, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 5			5	μA
Oscillation Start Voltage	V_{stt}	Same as above Fig. 6			2.2	V
Oscillation Hold Voltage	V_{HOLD}	Same as above Fig. 6	2.0		3.6	V
Oscillation Start Time	t_{stt}	V_{SS2}=−2.9V, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 6			10	sec
Oscillation Correction Capacitance	10P	V_{SS2}=−2.9V, External pin	8	10	12	pF
	20P	V_{SS2}=−2.9V, OSCOUT	16	20	24	pF

Operation from Ag Battery [1/2 Bias, 1/3 Duty]

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}	V_{SS2}=V_{SS3}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	S1−4, M1−4, I/OA1−4, I/OB1−4, 10P, OSCIN, INT, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS1}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT, ALARM, LIGHT, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)	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	Topg		−20 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}	V_{SS2}=V_{SS3}	−3.3		−2.4	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	−0.2		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS1}		V_{SS1}+0.2	V
Operating Frequency	fopg	Ta=−20 to +65°C	32		33	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	10		200	kΩ
	R_{IN1B}	V_{SS1}=−1.55V, "L"-level pull-in tr., *1, Fig. 1	200		2000	kΩ
	R_{IN2A}	V_{SS1}=−1.55V, V_{IL}=V_{SS1}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS1}=−1.55V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS1}=−1.55V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"L"-Level Output Voltage	V_{OL1}	V_{SS1}=−1.55V, I_{OL}=0.4μA, SEGOUT			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS1}=−1.55V, I_{OH}=−4μA, COM1, COM2, COM3	−0.2			V
"M"-Level Output 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
"L"-Level Output Voltage	V_{OL2}	V_{SS1}=−1.55V, I_{OL}=4μA, COM1, COM2, COM3			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS1}=−1.35V, I_{OH}=−250μA, ALM, LIGHT	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS1}=−1.35V, I_{OL}=250μA, ALM, LIGHT			V_{SS1}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS1}=−1.55V, I_{OH}=−20μA, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	−0.2			V
"L"-Level Output Voltage	V_{OL4}	V_{SS1}=−1.55V, I_{OL}=20μA, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)			V_{SS1}+0.2	V
Output Voltage (doubler)	V_{SS2}	V_{SS1}=−1.35V, C1=C2=0.1μF, fopg=32.768kHz, Fig. 2			−2.5	V
Current Dissipation	I_{DD}	V_{SS1}=−1.55V, standard watch/clock operation, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, Fig. 2		2.0		μA
Oscillation Start Voltage	$\|V_{stt}\|$	Co=Cg=20pF, Cl=25kΩ, Fig. 3			1.35	V
Oscillation Hold Voltage	$\|V_{HOLD}\|$	Co=Cg=20pF, Cl=25kΩ, Fig. 2	1.30		1.65	V
Oscillation Start Time	t_{stt}	Co=Cg=20pF, Cl=25kΩ, V_{SS1}=−1.35V, Fig. 3			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from Li Battery [1/2 Bias, 1/3 Duty]

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

				unit
Maximum Supply Voltage	V_{SS1}	V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
	V_{SS2}	V_{SS2}=V_{SS3}, V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN, TESTI/O	V_{BAK}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT	V_{BAK}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, COM2, COM3, CUP1, ALARM, LIGHT, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 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_{BAK}		−3.6		−1.3	V
	V_{SS2}	V_{SS2}=V_{SS3}	−3.6		−2.0	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	−0.4		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		V_{SS2}+0.4	V
Operating Frequency	fopg	Ta=−20 to +65°C	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	10		200	kΩ
	R_{IN1B}	V_{SS2}=−2.9V, "L"-level pull-in tr., *1, Fig. 4	200		2000	kΩ
	R_{IN2A}	V_{SS2}=−2.9V, V_{IL}=V_{SS2}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS2}=−2.9V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS2}=−2.9V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"L"-Level Output Voltage	V_{OL1}	V_{SS2}=−2.9V, I_{OL}=0.4μA, SEGOUT			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS2}=−2.9V, I_{OH}=−4μA, COM1, COM2, COM3	−0.2			V
"M"-Level Output 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
"L"-Level Output Voltage	V_{OL2}	V_{SS2}=−2.9V, I_{OL}=4μA, COM1, COM2, COM3			V_{SS2}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS2}=−2.4V, I_{OH}=−250μA, ALM	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS2}=−2.4V, I_{OL}=250μA, ALM			V_{SS2}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS2}=−2.9V, I_{OH}=−40μA, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)	−0.4			V
"L"-Level Output Voltage	V_{OL4}	V_{SS2}=−2.9V, I_{OH}=40μA, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)			V_{SS2}+0.4	V
"H"-Level Output Voltage	V_{OH5}	V_{SS2}=−2.9V, I_{OH}=−150μA, LIGHT	−1.5			V
"L"-Level Output Voltage	V_{OL5}	V_{SS2}=−2.9V, I_{OL}=150μA, LIGHT			V_{SS2}+1.5	V
Output Voltage (halver)	V_{SS1}	V_{SS2}=−2.9V, C1=C2=0.1μF, fopg=32.768kHz, Fig. 5			−1.35	V
Current Dissipation	I_{DD}	V_{SS2}=−2.9V, standard watch/clock operation C1=C2=0.1μF, Co=Cg=20pF, CI=25kΩ, Fig. 5		1.0		μA
Oscillation Start Voltage	V_{stt}	V_{SS1}=V_{SS2}, Co=Cg=20pF, CI=25kΩ, Fig. 6			1.35	V
Oscillation Hold Voltage	V_{HOLD}	V_{SS1}=V_{SS2}/2, Co=Cg=20pF, CI=25kΩ, Fig. 5	2.6		3.6	V
Oscillation Start Time	t_{stt}	V_{SS1}=V_{SS2}=−2.9V, Co=Cg=20pF, CI=25kΩ, Fig. 6			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from EXT-V [1/2 Bias, 1/3 Duty]

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}	V_{SS2}=V_{SS3}	−4.0 to +0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN	V_{SS2}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT	V_{SS2}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, COM2, COM3, CUP1, ALARM, LIGHT, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
Operating Temperature	Topg		−20 to +70	°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}	V_{SS2}=V_{SS3}	−3.6		−2.0	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	0.3V_{SS2}		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		0.7V_{SS2}	V
Operating Frequency	fopg1	Ta=−20 to +70°C, V_{SS2}=−2.0 to −3.6V	32		33	kHz
	fopg2	Ta=−20 to +70°C, V_{SS2}=−2.3 to −3.6V	32		66	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}+0.4, "L"-level hold tr., *1, Fig. 4	10		200	kΩ
	R_{IN1B}	V_{SS2}=−2.9V, "L"-level pull-in tr., *1, Fig. 4	200		2000	kΩ
	R_{IN2A}	V_{SS2}=−2.9V, V_{IL}=V_{SS2}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS2}=−2.9V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	$V_{OH(1)}$	V_{SS2}=−2.4V, I_{OH}=−0.4mA, ALM, LIGHT	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(1)}$	V_{SS2}=−2.4V, I_{OL}=0.4mA, ALM, LIGHT	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(2)}$	V_{SS2}=−2.4V, I_{OH}=−0.1mA, I/O ports, port P	−1	−0.3		V
"H"-Level Output Voltage	$V_{OH(3)}$	V_{SS2}=−2.4V, I_{OH}=−50μA, I/O ports, port P	−0.6	−0.2		V
"L"-Level Output Voltage	$V_{OL(3)}$	V_{SS2}=−2.4V, I_{OL}=0.1mA, I/O ports, port P,	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(4)}$	V_{SS2}=−2.4V, I_{OH}=−10μA, Segment (Output port mode) Pad Nos. 64 to 66	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$	V_{SS2}=−2.4V, I_{OL}=50μA, QIP64 pin Nos. 34 to 36	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(5)}$	V_{SS2}=−2.4V, I_{OH}=−5μA, Segment (Output port mode) Pad Nos. 40 to 43	V_{SS2}+0.2			V
"L"-Level Output Voltage	$V_{OL(5)}$	V_{SS2}=−2.4V, I_{OL}=20μA, 45, 47 to 63 QIP64 pin Nos. 11 to 33	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(6)}$	V_{SS2}=−2.4V, I_{OH}=−0.4μA, Each segment	−0.2			V
"L"-Level Output Voltage	$V_{OL(6)}$	V_{SS2}=−2.4V, I_{OL}=0.4μA	−0.2		V_{SS2}+0.2	V
"H"-Level Output Voltage	$V_{OH(7)}$	V_{SS2}=−2.4V, I_{OH}=−4μA, COM 1−3	−0.2			V
"M"-Level Output Voltage	V_{OM}	V_{SS2}=−2.4V, I_{OH}=−4μA, I_{OL}=4μA, COM 1−3	V_{SS2}/2−0.2		V_{SS2}/2+0.2	V
"H"-Level Output Voltage	$V_{OL(7)}$	V_{SS2}=−2.4V, I_{OL}=4μA, COM 1−3			V_{SS2}+0.2	V
Output Voltage	V_{SS1}	V_{SS2}=−2.9V, C1=C2=0.1μF, fopg=32.768kHz			−1.35	V
Current Dissipation	I_{IDD}I	V_{SS2}=−2.9V, HALT mode, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 5			5	μA
Oscillation Start Voltage	$IV_{stt}I$	Same as above Fig. 6			2.2	V
Oscillation Hold Voltage	$IV_{HOLD}I$	Same as above Fig. 6	2.0		3.6	V
Oscillation Start Time	t_{stt}	V_{SS2}=−2.9V, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 6			10	sec
Oscillation Correction Capacitance	10P	V_{SS2}=−2.9V, External pin	8	10	12	pF
	20P	V_{SS2}=−2.9V, OSCOUT	16	20	24	pF

Operation from 1.5V Ag Battery [1/3 Bias, 1/3 Duty]

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
	V_{SS3}		−5.5 to +0.3	V
Maximum Input Voltage	V_{IN1}	S1−4, M1−4, I/OA1−4, I/OB1−4, 10P, OSCIN, INT, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS1}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, CUP2, OSCOUT, ALARM, LIGHT, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)	V_{SS1}−0.3 to 0.3	V
	V_{OUT2}	SEGOUT, COM1, COM2, COM3, CUP1	V_{SS3}−0.3 to 0.3	V
Operating Temperature	Topg		−20 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
	V_{SS3}		−4.95		−3.7	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	−0.2		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS1}		V_{SS1}+0.2	V
Operating Frequency	fopg	Ta=−20 to +65°C	32		33	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	10		200	kΩ
	R_{IN1B}	V_{SS1}=−1.55V, "L"-level pull-in tr., *1, Fig. 1	200		2000	kΩ
	R_{IN2A}	V_{SS1}=−1.55V, V_{IL}=V_{SS1}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS1}=−1.55V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS1}=−1.55V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"M1"-Level Output Voltage	$V_{OM1\text{-}1}$	V_{SS1}=−1.55V, I_{OH}=−0.4μA, I_{OL}=0.4μA, SEGOUT	V_{SS1}−0.2		V_{SS1}+0.2	V
"M2"-Level Output Voltage	$V_{OM2\text{-}1}$	" "	V_{SS2}−0.2		V_{SS2}+0.2	V
"L"-Level Output Voltage	V_{OL1}	V_{SS1}=−1.55V, I_{OL}=0.4μA, SEGOUT			V_{SS3}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS1}=−1.55V, I_{OH}=−4μA, COM1, COM2, COM3	−0.2			V
"M1"-Level Output Voltage	$V_{OM1\text{-}2}$	V_{SS1}=−1.55V, I_{OL}=4μA, I_{OH}=−4μA, COM1, COM2, COM3	V_{SS1}−0.2		V_{SS1}+0.2	V
"M2"-Level Output Voltage	$V_{OM2\text{-}2}$	" "	V_{SS2}−0.2		V_{SS2}+0.2	V
"L"-Level Output Voltage	V_{OL2}	V_{SS1}=−1.55V, I_{OL}=4μA, COM1, COM2, COM3			V_{SS3}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS1}=−1.35V, I_{OH}=−250μA, ALM, LIGHT	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS1}=−1.35V, I_{OL}=250μA, ALM, LIGHT			V_{SS1}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS1}=−1.55V, I_{OH}=−20μA, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)	−0.2			V
"L"-Level Output Voltage	V_{OL4}	V_{SS1}=−1.55V, I_{OL}=20μA, P1−4, I/OA1−4, I/OB1−4 (I/OA1−4, I/OB1−4: Output mode)			V_{SS1}+0.2	V
Output Voltage (doubler)	V_{SS2}	V_{SS1}=−1.35V, C1=C2=0.1μF, fopg=32.768kHz, Fig. 8			−2.5	V
(tripler)	V_{SS3}	" "			−3.75	V
Current Dissipation	$I_{IDD}I$	V_{SS1}=−1.55V, standard watch/clock operation, C1 to C3=0.1μF, Co=Cg=20pF, Cl=25kΩ, Fig. 8		3.5		μA
Oscillation Start Voltage	$IV_{stt}I$	Co=Cg=20pF, Cl=25kΩ, Fig. 9			1.35	V
Oscillation Hold Voltage	$IV_{HOLD}I$	Co=Cg=20pF, Cl=25kΩ, Fig. 8	−1.30		1.65	V
Oscillation Start Time	t_{stt}	Co=Cg=20pF, Cl=25kΩ, V_{SS1}=−1.35V, Fig. 9			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from Li Battery [1/3 Bias, 1/3 Duty]

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

				unit
Maximum Supply Voltage	V_{SS1}	V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
	V_{SS2}	V_{BAK}=V_{SS1} or V_{SS2}	−4.0 to +0.3	V
	V_{SS3}	V_{BAK}=V_{SS1} or V_{SS2}	−5.5 to 0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN	V_{BAK}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, OSCOUT	V_{BAK}−0.3 to 0.3	V
	V_{OUT2}	ALARM, LIGHT, P1−4, I/OA1−4, I/OB1−4, CUP2 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
	V_{OUT3}	SEGOUT, COM1, COM2, COM3, CUP1	V_{SS3}−0.3 to 0.3	V
Operating Temperature	Topg		−20 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_{BAK}		−3.6		−1.3	V
	V_{SS2}	V_{SS2}=V_{SS3}	−3.6		−2.0	V
	V_{SS3}	V_{SS3}≈V_{SS2}+V_{SS1}	−5.0		−3.9	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	−0.4		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		V_{SS2}+0.4	V
Operating Frequency	fopg	Ta=−20 to +65°C	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. 10	10		200	kΩ
	R_{IN1B}	V_{SS2}=−2.9V, "L"-level pull-in tr., *1, Fig. 10	200		2000	kΩ
	R_{IN2A}	V_{SS2}=−2.9V, V_{IL}=V_{SS2}, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	V_{SS2}=−2.9V, V_{IH}=V_{DD}, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V_{OH1}	V_{SS2}=−2.9V, I_{OH}=−0.4μA, SEGOUT	−0.2			V
"M1"-Level Output Voltage	V_{OM1-1}	V_{SS2}=−2.9V, I_{OH}=−0.4μA, I_{OL}=0.4μA, SEGOUT	V_{SS2}/2−0.2		V_{SS}/2+0.2	V
"M2"-Level Output Voltage	V_{OM2-1}	" "	V_{SS2}−0.2		V_{SS2}+0.2	V
"L"-Level Output Voltage	V_{OL1}	V_{SS2}=−2.9V, I_{OL}=0.4μA, SEGOUT			V_{SS3}+0.2	V
"H"-Level Output Voltage	V_{OH2}	V_{SS2}=−2.9V, I_{OH}=−4μA, COM1,COM2,COM3	−0.2			V
"M1"-Level Output Voltage	V_{OM1-2}	V_{SS2}=−2.9V, I_{OH}=−4μA, I_{OL}=4μA, COM1, COM2, COM3	V_{SS2}/2+0.2		V_{SS}/2+0.2	V
"M2"-Level Output Voltage	V_{OM2-2}	" "	V_{SS2}−0.2		V_{SS2}+0.2	V
"L"-Level Output Voltage	V_{OL2}	V_{SS2}=−2.9V, I_{OL}=4μA, COM1,COM2,COM3			V_{SS3}+0.2	V
"H"-Level Output Voltage	V_{OH3}	V_{SS2}=−2.4V, I_{OH}=−250μA, ALM	−0.65			V
"L"-Level Output Voltage	V_{OL3}	V_{SS2}=−2.4V, I_{OL}=250μA, ALM			V_{SS2}+0.65	V
"H"-Level Output Voltage	V_{OH4}	V_{SS2}=−2.9V, I_{OH}=−40μA, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)	−0.4			V
"L"-Level Output Voltage	V_{OL4}	V_{SS2}=−2.9V, I_{OH}=40μA, I/OA1−4, I/OB1−4, P1−4 (I/OA1−4, I/OB1−4: Output mode)			V_{SS2}+0.4	V
"H"-Level Output Voltage	V_{OH5}	V_{SS2}=−2.9V, I_{OH}=−150μA, LIGHT	−1.5			V
"L"-Level Output Voltage	V_{OL5}	V_{SS2}=−2.9V, I_{OL}=150μA, LIGHT			V_{SS2}+1.5	V
Output Voltage (halver)	V_{SS1}	V_{SS2}=−2.9V, C1 to C4=0.1μF, fopg=32.768kHz, Fig. 1			−1.35	V
(tripler)	V_{SS3}				−4.1	V
Current Dissipation	I_{DD}I	V_{SS2}=−2.9V, standard watch/clock operation C1 to C4=0.1μF, Co=Cg=20pF, CI=25kΩ, Fig. 11		2.0		μA
Oscillation Start Voltage	V_{stt}I	V_{SS1}=V_{SS2}, Co=Cg=20pF, CI=25kΩ, Fig. 12			1.35	V

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			min	typ	max	unit
Oscillation Hold Voltage	V_{HOLD}	$V_{SS1}=V_{SS2}/2$, Co=Cg=20pF, Cl=25kΩ, Fig. 11	2.6		3.6	V
Oscillation Start Time	t_{stt}	$V_{SS1}=V_{SS2}=-2.9$V, Co=Cg=20pF, Cl=25kΩ, Fig. 12			10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	12	pF
	20P	OSCOUT	16	20	24	pF

Operation from EXT-V [1/3 Bias, 1/3 Duty]

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
	V_{SS3}		−5.5 to 0.3	V
Maximum Input Voltage	V_{IN1}	10P, OSCIN	V_{SS2}−0.3 to 0.3	V
	V_{IN2}	S1−4, M1−4, INT, I/OA1−4, I/OB1−4, TESTA (I/OA1−4, I/OB1−4: Input mode)	V_{SS2}−0.3 to 0.3	V
Maximum Output Voltage	V_{OUT1}	TEST, OSCOUT	V_{SS2}−0.3 to 0.3	V
	V_{OUT2}	ALARM, LIGHT, P1−4 I/OA1−4, I/OB1−4, CUP2 (I/OA1−4, I/OB1−4: Output mode)	V_{SS2}−0.3 to 0.3	V
	V_{OUT3}	SEGOUT, COM1, COM2, COM3, CUP1	V_{SS3}−0.3 to 0.3	V
Operating Temperature	Topg		−20 to +70	°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
	V_{SS3}	$V_{SS3}\approx V_{SS2}+V_{SS1}$	−5.0		−3.9	V
"H"-Level Input Voltage	V_{IH}	S1−4, M1−4, I/OA1−4, I/OB1−4, INT (I/OA1−4, I/OB1−4: Input mode)	0.3V_{SS2}		0	V
"L"-Level Input Voltage	V_{IL}	" "	V_{SS2}		0.7V_{SS2}	V
Operating Frequency	fopg1	Ta=−20 to +70°C, V_{SS2}=−2.0 to −3.6V	32		33	kHz
	fopg2	Ta=−20 to +70°C, V_{SS2}=−2.3 to −3.6V	32		66	kHz

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

			min	typ	max	unit
Input Resistance	R_{IN1A}	$V_{SS2}=-2.9$V, $V_{IL}=V_{SS2}+0.4$, "L"-level hold tr., *1, Fig. 10	10		200	kΩ
	R_{IN1B}	$V_{SS2}=-2.9$V, "L"-level pull-in tr., *1, Fig. 10	200		2000	kΩ
	R_{IN2A}	$V_{SS2}=-2.9$V, $V_{IL}=V_{SS2}$, INT pull-up resistance	200		2000	kΩ
	R_{IN2B}	$V_{SS2}=-2.9$V, $V_{IH}=V_{DD}$, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	$V_{OH(1)}$	$V_{SS2}=-2.4$V, $I_{OH}=-0.4$mA, ALM, LIGHT	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(1)}$	$V_{SS2}=-2.4$V, $I_{OL}=0.4$mA, ALM, LIGHT	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(2)}$	$V_{SS2}=-2.4$V, $I_{OH}=-0.1$mA, I/O ports, port P	−1	−0.3		V
"H"-Level Output Voltage	$V_{OH(3)}$	$V_{SS2}=-2.4$V, $I_{OH}=-50\mu$A, I/O ports, port P	−0.6	−0.2		V
"L"-Level Output Voltage	$V_{OL(3)}$	$V_{SS2}=-2.4$V, $I_{OL}=0.1$mA, I/O ports, port P,	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(4)}$	$V_{SS2}=-2.4$V, $I_{OH}=-10\mu$A, Segment (Output port) mode, Pad Nos. 64 to 66, QIP64 pin Nos. 34 to 36	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$	$V_{SS2}=-2.4$V, $I_{OL}=50\mu$A, Segment (Output port) mode, Pad Nos. 64 to 66, QIP64 pin Nos. 34 to 36	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(5)}$	$V_{SS2}=-2.4$V, $I_{OH}=-5\mu$A, Segment (Output port) mode, Pad Nos. 40 to 43, 45, 47 to 63, QIP64 pin Nos. 11 to 33	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(5)}$	$V_{SS2}=-2.4$V, $I_{OL}=20\mu$A, Segment (Output port) mode, Pad Nos. 40 to 43, 45, 47 to 63, QIP64 pin Nos. 11 to 33	V_{SS2}+0.3		V_{SS2}+1	V
"H"-Level Output Voltage	$V_{OH(6)}$	$V_{SS2}=-2.4$V, $I_{OH}=-0.4\mu$A, Each segment	−0.2			V
"M"-Level Output Voltage	V_{OM1-1}	$V_{SS2}=-2.4$V, $I_{OH}=-0.4\mu$A	$V_{SS2}/2-0.2$		$V_{SS2}/2+0.2$	V
	V_{OM1-2}	$I_{OL}=0.4\mu$A	$V_{SS2}-0.2$		$V_{SS2}+0.2$	V
"L"-Level Output Voltage	$V_{OL(6)}$	$V_{SS2}=-2.4$V, $I_{OL}=0.4\mu$A			$V_{SS3}+0.2$	V

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"H"-Level Output Voltage	$V_{OH(7)}$	V_{SS2}=−2.4V, I_{OH}=−4μA	COM 1–3	−0.2		V
"M"-Level Output Voltage	V_{OM2-1}	V_{SS2}=−2.4V, I_{OH}=−4μA	COM 1–3	V_{SS2}/2−0.2	V_{SS2}/2+0.2	V
	V_{OM2-2}	I_{OL}=4μA	COM 1–3	V_{SS2}−0.2	V_{SS2}+0.2	V
"L"-Level Output Voltage	$V_{OL(7)}$	V_{SS2}=−2.4V, I_{OL}=4μA			V_{SS3}+0.2	V
Output Voltage	V_{SS1}	V_{SS2}=−2.9V, C1=C2=0.1μF, fopg=32.768kHz			−1.35	V
	V_{SS3}				−4.1	V
Current Dissipation	$\|I_{DD}\|$	V_{SS2}=−2.9V, HALT mode, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 5			5	μA
Oscillation Start Voltage	$\|V_{stt}\|$	Same as above	Fig. 6		2.2	V
Oscillation Hold Voltage	$\|V_{HOLD}\|$	Same as above	Fig. 6	2.0	3.6	V
Oscillation Start Time	t_{stt}	V_{SS2}=−2.9V, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, fopg=32.768kHz, Fig. 6			10	sec
Oscillation Correction Capacitance	10P	V_{SS2}=−2.9V, External pin		8	10	12	pF
	20P	V_{SS2}=−2.9V, OSCOUT		16	20	24	pF

*1 S1·S2·S3·S4·M1·M2·M3·M4

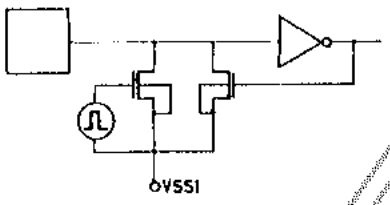

Fig. 1 Input configuration of S1-4, M1-4

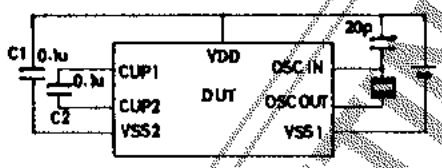

Fig. 2 Current dissipation, oscillation hold voltage test circuit

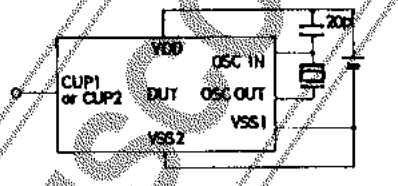

Fig. 3 Oscillation start voltage, oscillation start time, frequency stability test circuit

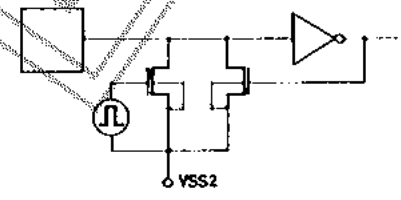

Fig. 4 Input configuration of S1-4, M1-4

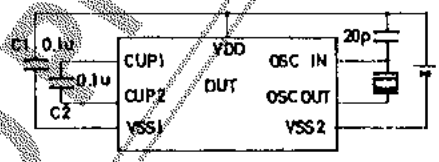

Fig. 5 Current dissipation, oscillation hold voltage test circuit

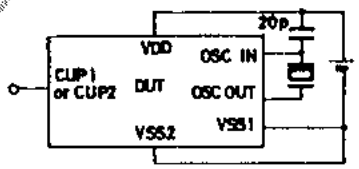

Fig. 6 Oscillation start voltage, oscillation start time, frequency stability test circuit

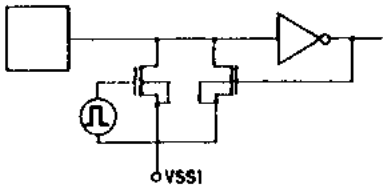

Fig. 7 Input configuration of S1-4, M1-4

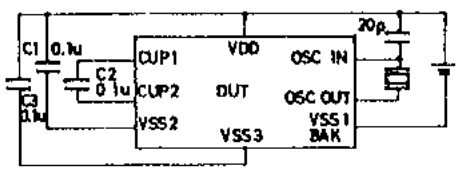

Fig. 8 Current dissipation, oscillation hold voltage test circuit

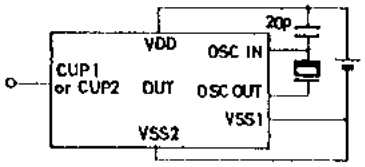

Fig. 9 Oscillation start voltage, oscillation start time, frequency stability test circuit

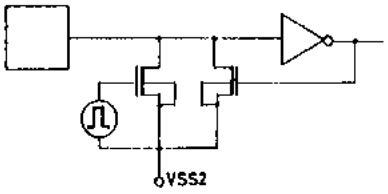

Fig. 10 Input configuration of S1-4, M1-4

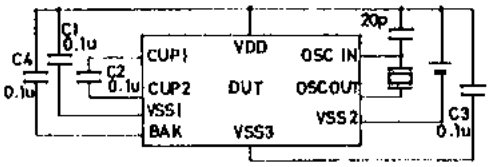

Fig. 11 Current dissipation, oscillation hold voltage test circuit

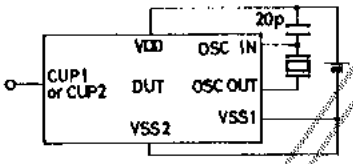

Fig. 12 Oscillation start voltage, oscillation start time, frequency stability test circuit

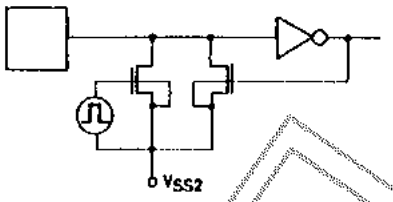

Fig. 13 Input configuration of S1-4, M1-4

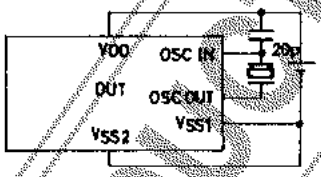

Fig. 14 Current dissipation, oscillation hold voltage test circuit

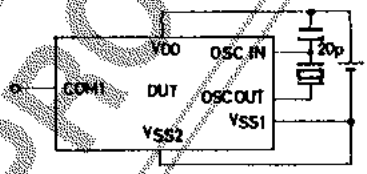

Fig. 15 Oscillation start voltage, oscillation start time, frequency stability test circuit