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.)

(2) Software features

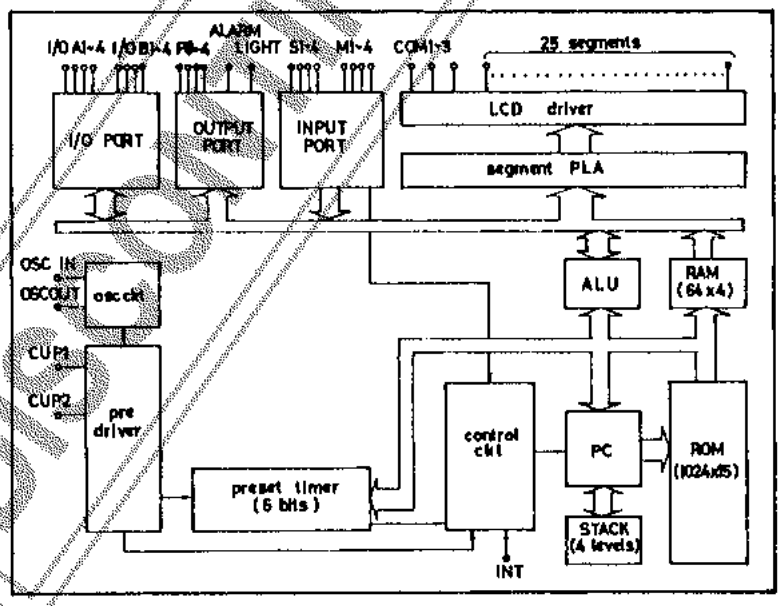
- Powerful instruction set: 78 instructions
- 4-level subroutine nesting (common with interrupt)
- External interrupt function
- 15-bit divider for watch/clock
- Built-in 6-bit programmable timer
- HALT function
- Direct addressing type
- Single stepping of all instructions

(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

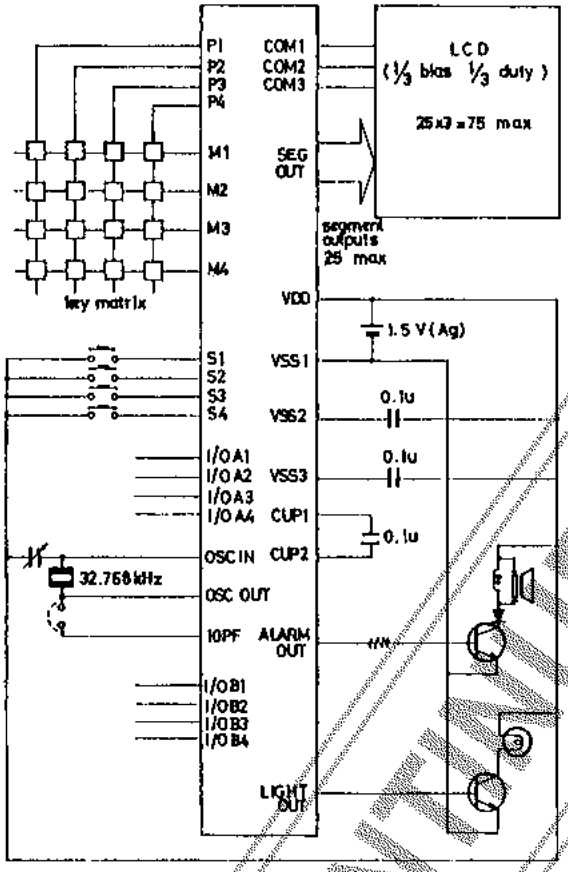


Application Areas

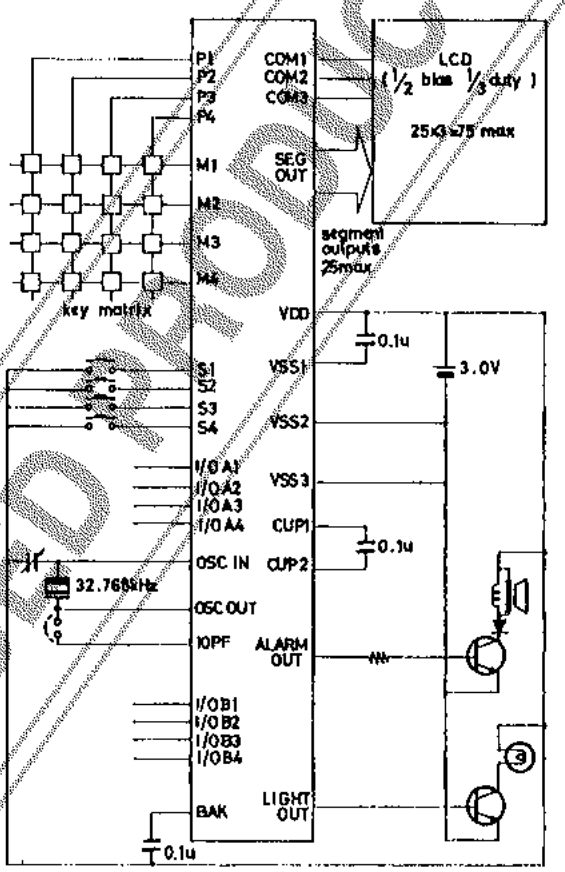
1) Watch/clock with calculator
2) Controller of speech synthesis LSI
3) Controller of camera
4) Mechanical controller of VTR, radio-cassette recorder, tape deck, etc.
5) Controller of telephone dialer, etc.

Sample Application Circuits

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

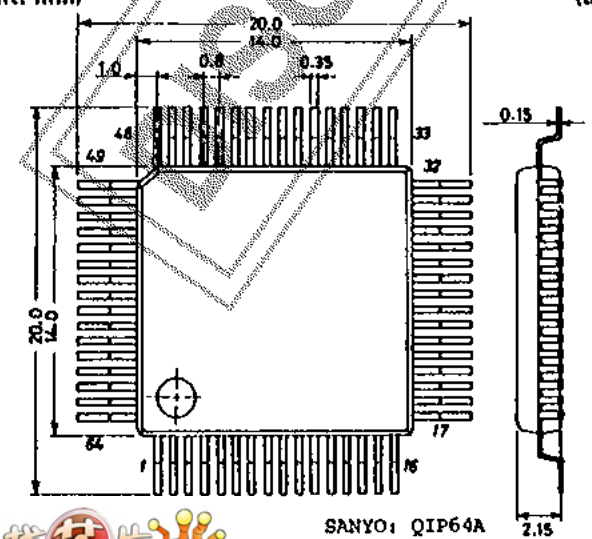


(2) Typical application circuit using Li battery (1/2 bias 1/3 duty)



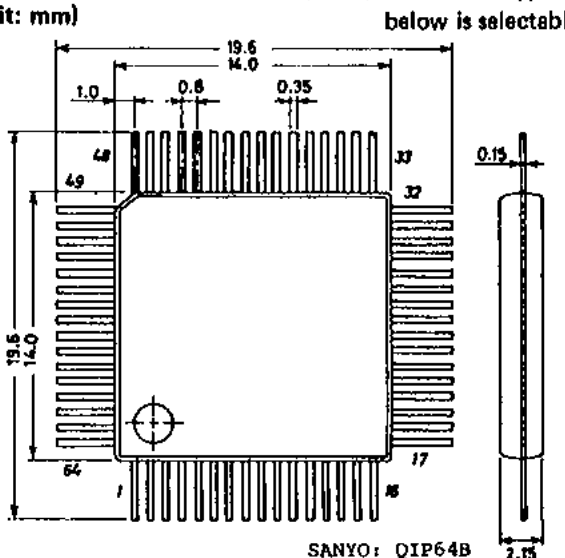
INPUT/OUTPUT PORT	I/OA1~4, I/OB1~4
INPUT PORT	S1~4, M1~4
OUTPUT PORT	P1~4

Case Outline 3057-Q64A1C
(unit: mm)



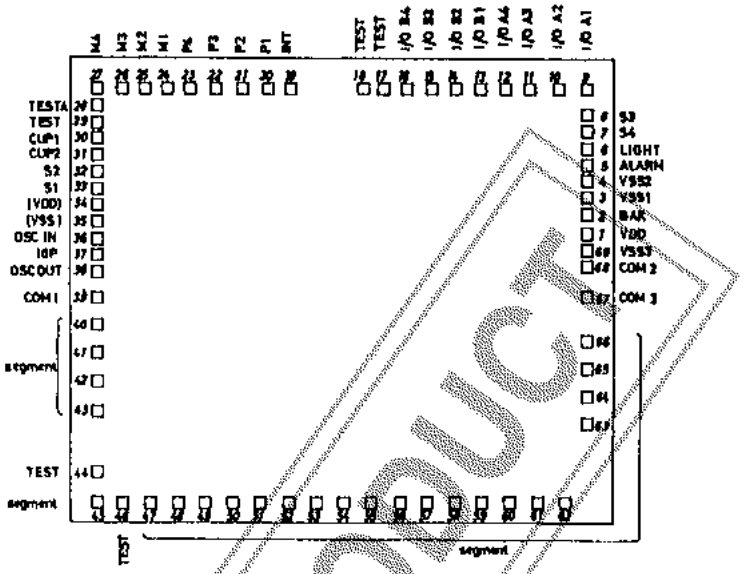
Case Outline 3026B-Q64B1C
(unit: mm)

(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



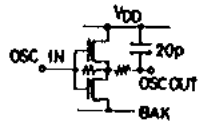
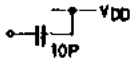
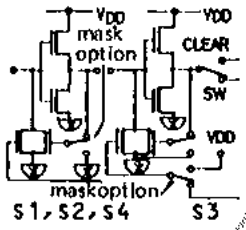
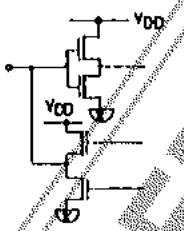
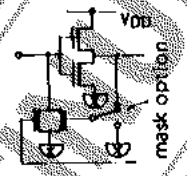
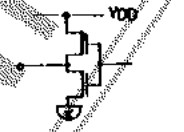
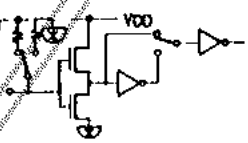
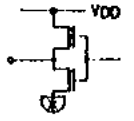
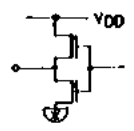
Pad Name and Coordinates

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	IOPF	〃	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) t the coordinates of the center of each pad.
  ounting 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 6 47 46	33 32 8 7	S1 S2 S3(CLEAR/ SWITCH) S4	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.
48 49 50 51 52 53 54 55	9 10 11 12 13 14 15 16	I/O A1 I/O A2 I/O A3 I/O A4 I/O B1 I/O B2 I/O B3 I/O B4	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.
62 63 64 1	24 25 26 27	M1 M2 M3 M4	Input		Port for input only. Input pin for fetching data into RAM.
58 59 60 61	20 21 22 23	P1 P2 P3 P4	Output		Port for output only.
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.

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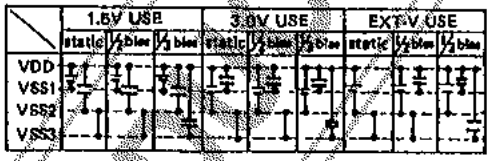
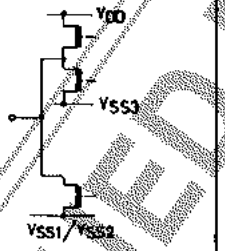
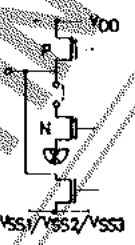
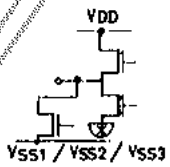
QIP Pin	Pad No.	Pin Name	Input/ Output	Circuit Configuration	Function
40	1	VDD			(+) Power supply pin.
39 43 42	69 4 3	VSS3 VSS2 VSS1			(–) power supply pin. • 1.5V/3.0V selectable with mask option. For 1.5V use (Ag battery version), apply (–) side to V_{SS1}. For 3.0V use (Li battery version), apply (–) side to V_{SS2}. • Also used as power supply for LCD drive.  The above Table shows how to connect external parts in each case.
4 5	30 31	CUP1 CUP2			Pins for connecting voltage step-up (step-down) capacitor.
10 38 37	39 68 67	COM1 COM2 COM3	Output	 	Output pins for LCD panel common electrode. The following pin is used in each case. Static: COM1 ○; COM2 –; COM3 –; Alternating frequency 32Hz* 1/2 duty: COM1 ○; COM2 ○; COM3 –; Alternating frequency 32Hz* 1/3 duty: COM1 ○; COM2 ○; COM3 ○; Alternating frequency 43Hz* * Possible to make frequency 2 or 4-fold by using PLA.
34 35 36	64 65 66	segment driver	Output	 	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.
11 ~ 33	40 ~ 43 45 47 ~ 63	segment driver	Output	 	Output pins for LCD panel segments. • Also used as output ports with mask option.
– – 2 3 – –	17 18 28 29 44 46	TEST TEST TEST A TEST TEST TEST			Test pins (not used by user).
– –	35 34	(VSS) (VDD)			Backup power supply pin. Normally, not used.

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_{DD1}	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 [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	$I_{IDD}I$	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_{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, 1/2 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_{IDD}	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	IV_{stt}I	V_{SS1}=V_{SS2}, Co=Cg=20pF, CI=25kΩ, Fig. 6			1.35	V
Oscillation Hold Voltage	IV_{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, 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, 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	$I_{IDD}I$	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	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}I	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	IV_{stt}I	Co=Cg=20pF, CI=25kΩ, Fig. 3			1.35	V
Oscillation Hold Voltage	IV_{HOLD}I	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, 1/3 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	$I_{IDD}I$	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	$IV_{stt}I$	V_{SS1}=V_{SS2}, Co=Cg=20pF, CI=25kΩ, Fig. 6			1.35	V
Oscillation Hold Voltage	$IV_{HOLD}I$	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, 1/3 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	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_{OM1-1}	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_{OM2-1}	" "	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_{OM1-2}	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_{OM2-2}	" "	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_{DD}	V_{SS1}=−1.55V, standard watch/clock operation, C1 to C3=0.1μF, Co=Cg=20pF, CI=25kΩ, Fig. 8		3.5		μA
Oscillation Start Voltage	V_{stt}	Co=Cg=20pF, CI=25kΩ, Fig. 9			1.35	V
Oscillation Hold Voltage	V_{HOLD}	Co=Cg=20pF, CI=25kΩ, Fig. 8	−1.30		1.65	V
Oscillation Start Time	t_{stt}	Co=Cg=20pF, CI=25kΩ, V_{SS1}=−1.35V, Fig. 9			10	sec
	10P	External pin	8	10	12	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}	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}	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	$IV_{HOLD}I$	$V_{SS1}=V_{SS2}/2$, Co=Cg=20pF, Cl=25kΩ, Fig. 11	2.6		3.6	V
Oscillation Start Time	t_{stt}	$V_{SS1}=V_{SS2}=-2.9V$, 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}	$V_{SS2}=-2.9V$, $V_{IL}=V_{SS2}+0.4$, "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	$V_{OH(1)}$	$V_{SS2}=-2.4V$, $I_{OH}=-0.4mA$, 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	$V_{OH(3)}$	$V_{SS2}=-2.4V$, $I_{OH}=-50\mu A$, 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	$V_{OH(4)}$	$V_{SS2}=-2.4V$, $I_{OH}=-10\mu A$, Segment (Output port mode) Pad Nos. 64 to 66, QIP64 pin Nos. 34 to 36	−1	−0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$	$V_{SS2}=-2.4V$, $I_{OL}=50\mu A$, 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	$V_{OH(5)}$	$V_{SS2}=-2.4V$, $I_{OH}=-5\mu A$, 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	$V_{OL(5)}$	$V_{SS2}=-2.4V$, $I_{OL}=20\mu A$, 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	$V_{OH(6)}$	$V_{SS2}=-2.4V$, $I_{OH}=-0.4\mu A$, Each segment	−0.2			V
"M"-Level Output Voltage	V_{OM1-1}	$V_{SS2}=-2.4V$, $I_{OH}=-0.4\mu A$	$V_{SS2}/2-0.2$		$V_{SS2}/2+0.2$	V
	V_{OM1-2}	$I_{OL}=0.4\mu A$	$V_{SS2}-0.2$		$V_{SS2}+0.2$	V
age	$V_{OL(6)}$	$V_{SS2}=-2.4V$,			$V_{SS3}+0.2$	V

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"H"-Level Output Voltage	$V_{OH(7)}$	V_{SS2}=−2.4V, I_{OH}=−4μA		−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		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, CI=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, CI=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

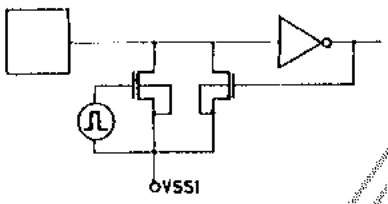

Fig. 1 Input configuration of S1-4, M1-4

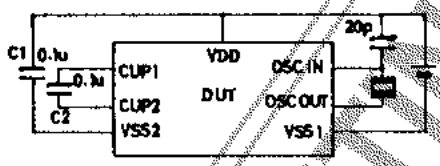

Fig. 2 Current dissipation, oscillation hold voltage test circuit

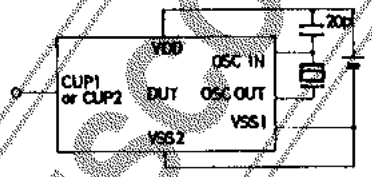

Fig. 3 Oscillation start voltage, oscillation start time, frequency stability test circuit

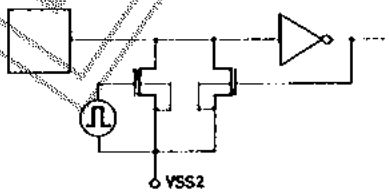

Fig. 4 Input configuration of S1-4, M1-4

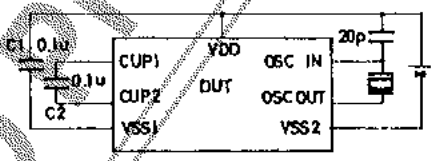

Fig. 5 Current dissipation, oscillation hold voltage test circuit

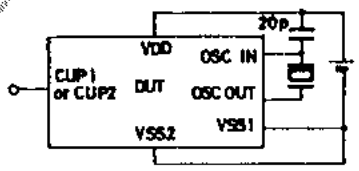

Fig. 6 Oscillation start voltage, oscillation start time, frequency stability test circuit

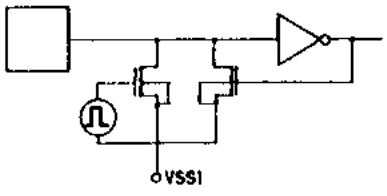

Fig. 7 Input configuration of S1-4, M1-4

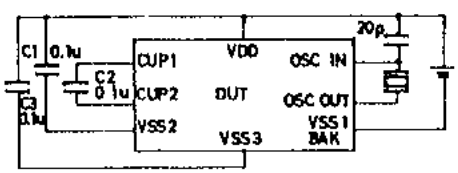

Fig. 8 Current dissipation, oscillation hold voltage test circuit

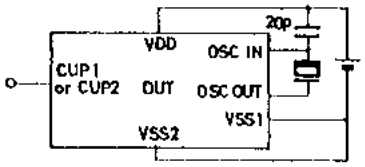

Fig. 9 Oscillation start voltage, oscillation start time, frequency stability test circuit

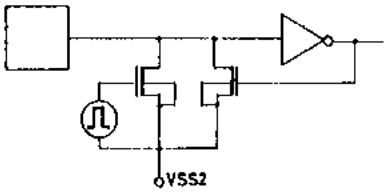

Fig. 10 Input configuration of S1-4, M1-4

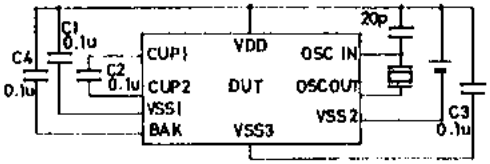

Fig. 11 Current dissipation, oscillation hold voltage test circuit

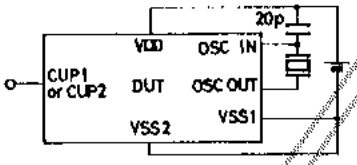

Fig. 12 Oscillation start voltage, oscillation start time, frequency stability test circuit

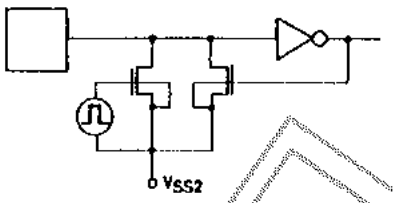

Fig. 13 Input configuration of S1-4, M1-4

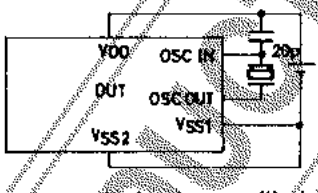

Fig. 14 Current dissipation, oscillation hold voltage test circuit

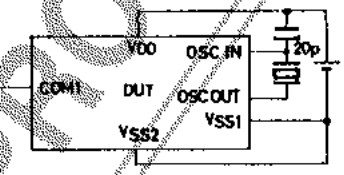

Fig. 15 Oscillation start voltage, oscillation start time, frequency stability test circuit