

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) (μ A)	Current at simple time-keeping operation mode (typ) (μ A)	Cycle time (μ s)
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 (122 μ sec), 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: 244 μ sec. (or 122 μ sec./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.)

Specifications and information herein are subject to change without notice.

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(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 244 μ sec, use the LC5898F. For development at cycle time 122 μ sec, use the LC5898G.

- SDS410 system

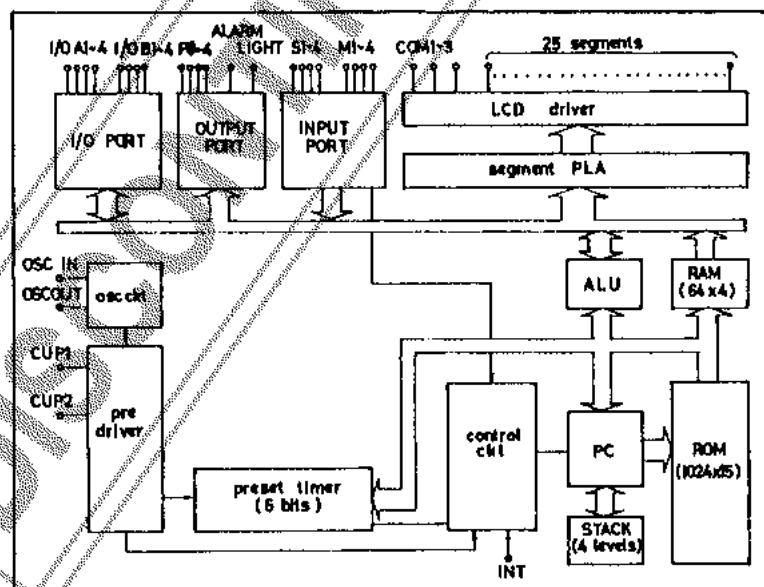
Application development program of microcomputer can be made in assembly language (edit, assemble).

- 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.

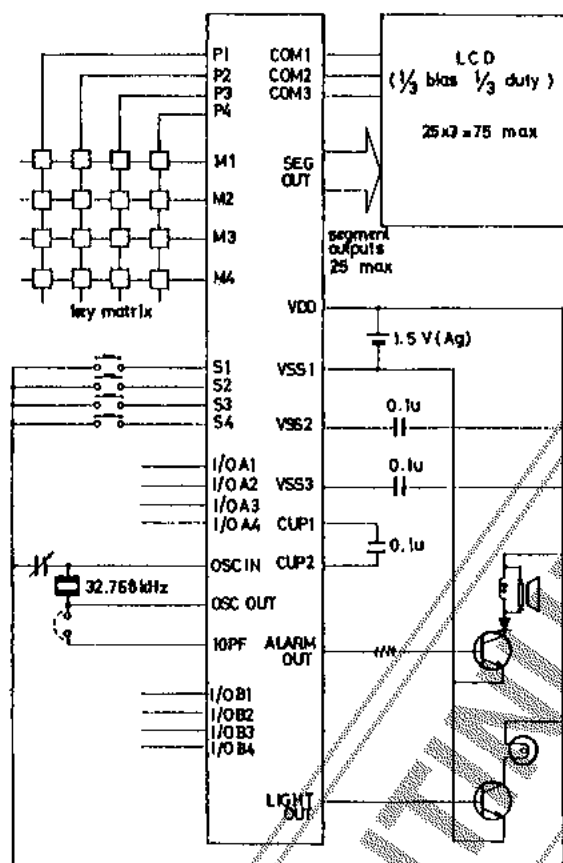
Equivalent Circuit Block Diagram

Application Areas

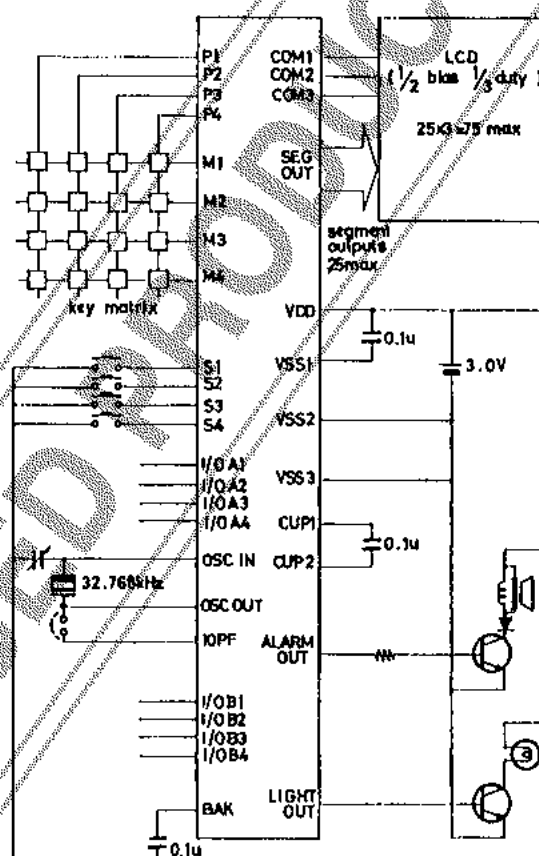
- 1) Watch/clock with calculator
- 2) Controller of speech synthesis LSI
- 3) Controller of camera
- 4) Mechanical controller of VTR, radio-cassette recorder, tape deck, etc.
- 5) Controller of telephone dialer, etc.

Sample Application Circuits

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

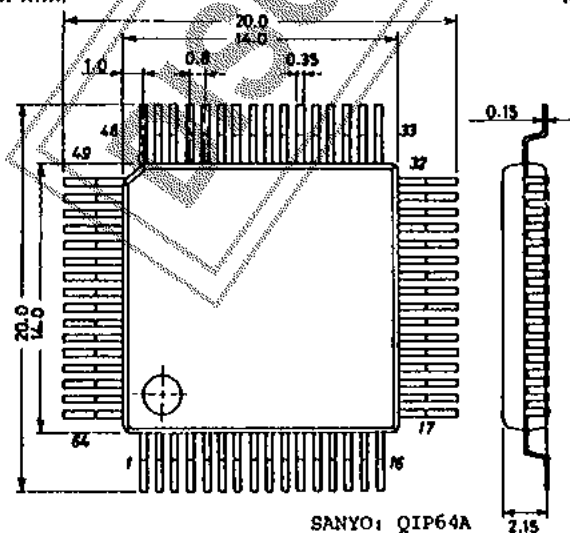


(2) Typical application circuit using Li battery (1/2 bias 1/3 duty)

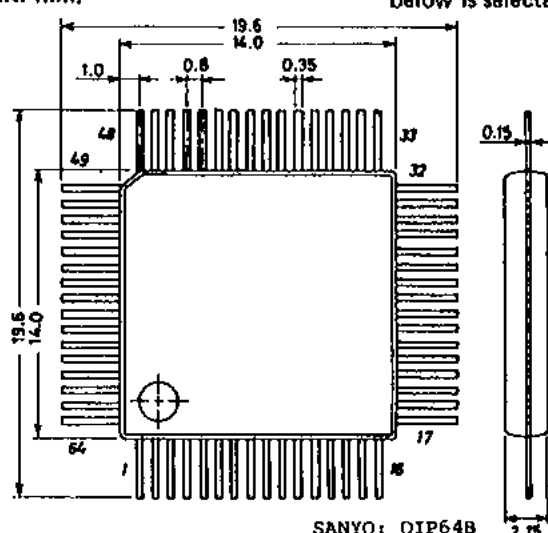


INPUT/OUTPUT PORT I/O A1~4, I/O B1~4
INPUT PORT S1~4, M1~4
OUTPUT PORT P1~4

Case Outline 3057-Q64A1C
(unit: mm)



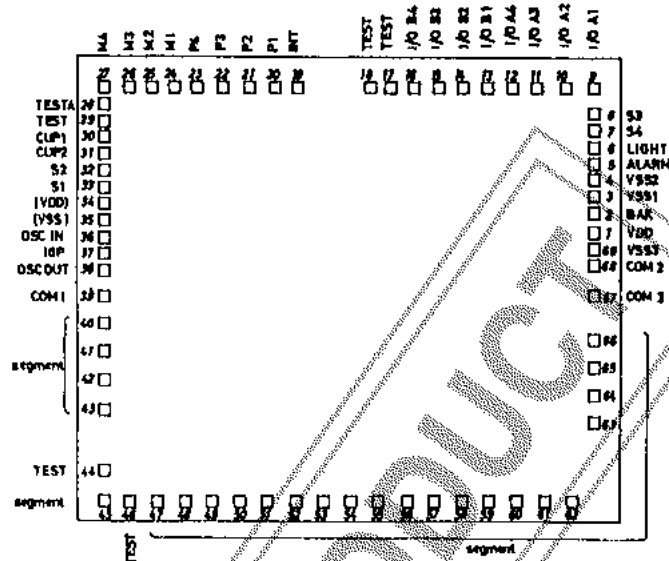
Case Outline 3026B-Q64B1C
(unit: mm)



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

Pad Assignment of LSI Chip

CHIP SIZE 5.72mm x 4.76mm
 CHIP THICKNESS 480 μ m
 PAD SIZE 120 μ m x 120 μ m

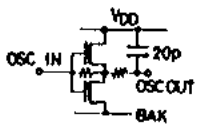
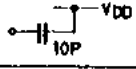
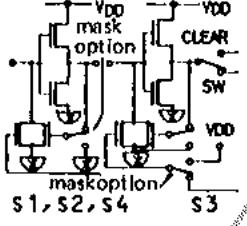
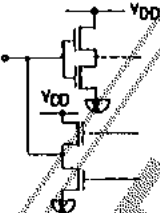
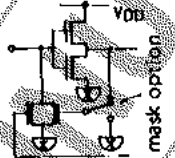
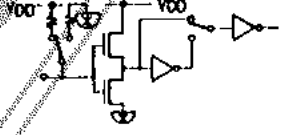
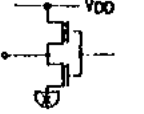
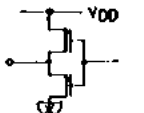


Pad Name and Coordinates

Pin assignment of QIP64					Pin assignment of QIP64				
Pad No.	Pin name	X (μ m)	Y (μ m)		Pad No.	Pin name	X (μ m)	Y (μ m)	
40	1 VDD	2707	669		8	36 OSC IN	-2707	608	
41	2 BAK	"	878		-	37 10PF	"	428	
42	3 VSS1	"	1058		9	38 OSC OUT	"	248	
43	4 VSS2	"	1238		10	39 COMMON1	"	-36	
44	5 ALARM OUT	"	1418		11	40 segment	"	-324	
45	6 LIGHT OUT	"	1589		12	41 "	"	-630	
46	7 S4	"	1778		13	42 "	"	-936	
47	8 S3	"	1958		14	43 "	"	-1242	
48	9 I/O A1	"	2228		-	44 TEST	"	-1899	
49	10 I/O A2	2385	"		15	45 segment	"	-2228	
50	11 I/O A3	2070	"		-	46 TEST	-2446	-2232	
51	12 I/O A4	1800	"		16	47 segment	-2140	-2228	
52	13 I/O B1	1530	"		17	48 "	-1834	"	
53	14 I/O B2	1260	"		18	49 "	-1528	"	
54	15 I/O B3	990	"		19	50 "	-1222	"	
55	16 I/O B4	720	"		20	51 "	-916	"	
-	17 TEST	450	"		21	52 "	-610	"	
-	18 TEST	239	"		22	53 "	-304	"	
57	19 INT	-558	"		23	54 "	2	"	
58	20 P1	-810	"		25	55 "	308	"	
59	21 P2	-1098	"		26	56 "	614	"	
60	22 P3	-1386	"		27	57 "	920	"	
61	23 P4	-1674	"		28	58 "	1226	"	
62	24 M1	-1926	"		29	59 "	1532	"	
63	25 M2	-2178	"		30	60 "	1838	"	
64	26 M3	-2430	"		31	61 "	2144	"	
1	27 M4	-2707	"		32	62 "	2450	"	
2	28 TEST A	"	2048		33	63 "	2707	-1382	
3	29 TEST	"	1868		34	64 "	"	-1087	
4	30 CUP1	"	1688		35	65 "	"	-792	
5	31 CUP2	"	1508		36	66 "	"	-496	
6	32 S2	"	1328		37	67 COMMON3	"	-15	
7	33 S1	"	1148		38	68 COMMON2	"	309	
-	34 (VDD)	"	968		39	69 VSS3	"	489	
-	35 (VSS)	"	788						

- 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 VDD.
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 VDD 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.
67	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 VDD. (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.

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QIP Pin	Pad No.	Pin Name	Input/Output	Circuit Configuration	Function																																																												
40	1	VDD			(+) Power supply pin.																																																												
39 43 42	68 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 VSS1. For 3.0V use (LI battery version), apply (-) side to VSS2. • Also used as power supply for LCD drive.																																																												
					<table><tr><th></th><th colspan="3">1.5V USE</th><th colspan="3">3.0V USE</th><th colspan="3">EXT-V USE</th></tr><tr><th></th><th>static</th><th>1/2 blue</th><th>1/3 blue</th><th>static</th><th>1/2 blue</th><th>1/3 blue</th><th>static</th><th>1/2 blue</th><th>1/3 blue</th></tr><tr><td>VDD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>VSS1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>VSS2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>VSS3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> The above Table shows how to connect external parts in each case.		1.5V USE			3.0V USE			EXT-V USE				static	1/2 blue	1/3 blue	static	1/2 blue	1/3 blue	static	1/2 blue	1/3 blue	VDD										VSS1										VSS2										VSS3									
	1.5V USE			3.0V USE			EXT-V USE																																																										
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VSS2																																																																	
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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.																																																												
					<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.		Static	1/2 duty	1/3 duty	COM1	○	○	○	COM2	—	○	○	COM3	—	—	○	Alternating frequency	32Hz*	32Hz*	43Hz*																																								
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COM3	—	—	○																																																														
Alternating frequency	32Hz*	32Hz*	43Hz*																																																														
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 : Φ = VSS1
 LI Battery, EXT-V : Φ = VSS2

Operation from Ag Battery [Static]

Absolute Maximum Ratings at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			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	T_{opg}	-20 to +65	$^\circ\text{C}$
Storage Temperature	T_{stg}	-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		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	f_{opg}	$T_a=-20$ to $+65^\circ\text{C}$	32	33	kHz

Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Input Resistance	R_{IN1A}	$V_{SS1}=-1.55\text{V}$, $V_{IL}=V_{SS1}+0.2\text{V}$, "L"-level hold tr., *1, Fig. 1	10	200	k Ω
	R_{IN1B}	$V_{SS1}=-1.55\text{V}$, "L"-level pull-in tr., *1, Fig. 1	200	2000	k Ω
	R_{IN2A}	$V_{SS1}=-1.55\text{V}$, $V_{IL}=V_{SS1}$, INT pull-up resistance	200	2000	k Ω
	R_{IN2B}	$V_{SS1}=-1.55\text{V}$, $V_{IH}=V_{DD}$, INT pull-down resistance	200	2000	k Ω
"H"-Level Output Voltage	V_{OH1}	$V_{SS1}=-1.55\text{V}$, $I_{OH}=-0.4\mu\text{A}$, SEGOUT	-0.2		V
"L"-Level Output Voltage	V_{OL1}	$V_{SS1}=-1.55\text{V}$, $I_{OL}=0.4\mu\text{A}$, SEGOUT		$V_{SS2}+0.2$	V
"H"-Level Output Voltage	V_{OH2}	$V_{SS1}=-1.55\text{V}$, $I_{OH}=-4\mu\text{A}$, COM1	-0.2		V
"L"-Level Output Voltage	V_{OL2}	$V_{SS1}=-1.55\text{V}$, $I_{OL}=4\mu\text{A}$, COM1		$V_{SS2}+0.2$	V
"H"-Level Output Voltage	V_{OH3}	$V_{SS1}=-1.35\text{V}$, $I_{OH}=-250\mu\text{A}$, ALM, LIGHT	-0.65		V
"L"-Level Output Voltage	V_{OL3}	$V_{SS1}=-1.35\text{V}$, $I_{OL}=250\mu\text{A}$, ALM, LIGHT		$V_{SS1}+0.65$	V
"H"-Level Output Voltage	V_{OH4}	$V_{SS1}=-1.55\text{V}$, $I_{OH}=-20\mu\text{A}$, 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}	$V_{SS1}=-1.55\text{V}$, $I_{OL}=20\mu\text{A}$, 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}	$V_{SS1}=-1.35\text{V}$, $C_1=C_2=0.1\mu\text{F}$, $f_{opg}=32.768\text{kHz}$, Fig. 2		-2.5	V
Current Dissipation	I_{DDI}	$V_{SS1}=-1.55\text{V}$, standard watch/clock operation $C_1=C_2=0.1\mu\text{F}$, $C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 2	2.0		μA
Oscillation Start Voltage	$ V_{stt} $	$C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 3		1.35	V
Oscillation Hold Voltage	$ V_{HOLD} $	$C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 2	1.30	1.65	V
Oscillation Start Time	t_{stt}	$C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, $V_{SS1}=-1.35\text{V}$, Fig. 3		10	sec
Oscillation Correction	10P	External pin	8	10	pF
Capacitance	20P	OSCOUT	16	20	pF

Operation from Li Battery [Static]

Absolute Maximum Ratings at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

				unit
Maximum Supply Voltage	VSS1	$V_{BAK}=V_{SS1}$ or V_{SS2}	-4.0 to +0.3	V
	VSS2	$V_{SS2}=V_{SS3}$, $V_{BAK}=V_{SS1}$ or V_{SS2}	-4.0 to +0.3	V
Maximum Input Voltage	VIN1	10P, OSCIN, TESTI/O	$V_{BAK}-0.3$ to 0.3	V
	VIN2	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	VOUT1	TESTI/O, CUP2, OSCOUT	$V_{BAK}-0.3$ to 0.3	V
	VOUT2	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	$^\circ\text{C}$
Storage Temperature	Tstg		-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Supply Voltage	VBAK		-3.6		-1.3	V
	VSS2	$V_{SS2}=V_{SS3}$	-3.6		-2.0	V
"H"-Level Input Voltage	VIH	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	VIL	"		V_{SS2}	$V_{SS2}+0.4$	V
Operating Frequency	fopg	$T_a=-20$ to $+65^\circ\text{C}$	32		33	kHz

Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Input Resistance	RIN1A	$V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}+0.4\text{V}$, "L"-level hold tr., *1, Fig. 4	10		200	k Ω
	RIN1B	$V_{SS2}=-2.9\text{V}$, "L"-level pull-in tr., *1, Fig. 4	200		2000	k Ω
	RIN2A	$V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}$, INT pull-up resistance	200		2000	k Ω
	RIN2B	$V_{SS2}=-2.9\text{V}$, $V_{IH}=V_{DD}$, INT pull-down resistance	200		2000	k Ω
"H"-Level Output Voltage	VOH1	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-0.4\mu\text{A}$, SEGOUT	-0.2			V
"L"-Level Output Voltage	VOL1	$V_{SS2}=-2.9\text{V}$, $I_{OL}=0.4\mu\text{A}$, SEGOUT		$V_{SS2}+0.2$		V
"H"-Level Output Voltage	VOH2	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-4\mu\text{A}$, COM1	-0.2			V
"L"-Level Output Voltage	VOL2	$V_{SS2}=-2.9\text{V}$, $I_{OL}=4\mu\text{A}$, COM1		$V_{SS2}+0.2$		V
"H"-Level Output Voltage	VOH3	$V_{SS2}=-2.4\text{V}$, $I_{OH}=-250\mu\text{A}$, ALM	-0.65			V
"L"-Level Output Voltage	VOL3	$V_{SS2}=-2.4\text{V}$, $I_{OL}=250\mu\text{A}$, ALM		$V_{SS2}+0.65$		V
"H"-Level Output Voltage	VOH4	$V_{SS2}=-2.9\text{V}$, $I_{OH}=40\mu\text{A}$, I/OA1-4, I/OB1-4, P1-4 (I/OA1-4, I/OB1-4: Output mode)	-0.4			V
"L"-Level Output Voltage	VOL4	$V_{SS2}=-2.9\text{V}$, $I_{OH}=40\mu\text{A}$, 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	VOH5	$V_{SS2}=-2.4\text{V}$, $I_{OH}=-150\mu\text{A}$, LIGHT	-1.5			V
"L"-Level Output Voltage	VOL5	$V_{SS2}=-2.4\text{V}$, $I_{OL}=150\mu\text{A}$, LIGHT		$V_{SS2}+1.5$		V
Output Voltage (halver)	VSS1	$V_{SS2}=-2.9\text{V}$, $C1=C2=0.1\mu\text{F}$, fopg=32.768kHz, Fig. 5			-1.35	V
Current Dissipation	I DD	$V_{SS2}=-2.9\text{V}$, standard watch/clock operation, $C1=C2=0.1\mu\text{F}$, $C_o=C_g=20\text{pF}$, $C_l=25\text{k}\Omega$, Fig. 5		1.0		μA
Oscillation Start Voltage	V _{stt}	$V_{SS1}=V_{SS2}$, $C_o=C_g=20\text{pF}$, $C_l=25\text{k}\Omega$, Fig. 6			1.35	V
Oscillation Hold Voltage	V _{hold}	$V_{SS1}=V_{SS2}/2$, $C_o=C_g=20\text{pF}$, $C_l=25\text{k}\Omega$, Fig. 5	2.0		3.6	V
Oscillation Start Time	t _{stt}	$V_{SS1}=V_{SS2}=-2.9\text{V}$, $C_o=C_g=20\text{pF}$, $C_l=25\text{k}\Omega$, Fig. 6			10	sec
Oscillation Correction	10P	External pin	8	10	12	pF
Capacitance	20P	OSCOUT	16	20	24	pF

Operation from EXT-V [Static]

Absolute Maximum Ratings at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

				unit
Maximum Supply Voltage	VSS2	VSS2=VSS3=VSS1	-4.0 to +0.3	V
Maximum Input Voltage	VIN1	10P, OSCIN	VSS2-0.3 to 0.3	V
	VIN2	S1-4, M1-4, INT, I/OA1-4, I/OB1-4, TESTA (I/OA1-4, I/OB1-4: Input mode)	VSS2-0.3 to 0.3	V
Maximum Output Voltage	VOUT1	TEST CUP2, OSCOUT	VSS2-0.3 to 0.3	V
	VOUT2	SEGOUT, COM1, CUP1, ALARM, LIGHT, P1-4, I/OA1-4, I/OB1-4 (I/OA1-4, I/OB1-4: Output mode)	VSS2-0.3 to 0.3	V
Operating Temperature	T _{opg}		-20 to +70	°C
Storage Temperature	T _{stg}		-30 to +125	°C

Allowable Operating Conditions at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Supply Voltage	VSS2	VSS1=VSS2=VSS3	-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	f _{opg1}	T _a =-20 to +70°C, V _{SS2} =-2.0 to -3.6V	32		33	kHz
	f _{opg2}	T _a =-20 to +70°C, V _{SS2} =-2.3 to -3.6V	32		66	kHz

Electrical Characteristics at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

			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, 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	-1	+0.3		V
"L"-Level Output Voltage	V _{OL} (5)	V _{SS2} =-2.4V, I _{OL} =20μA, 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		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, f _{opg} =32.768kHz			-1.35	V
Current Dissipation	I _{DDI}	V _{SS2} =-2.9V, HALT mode, C1=C2=0.1μF, Co=Cg=20pF, Cl=25kΩ, f _{opg} =32.768kHz, Fig. 5			5	μA
Oscillation Start Voltage	I _{VsttI}	Same as above, Fig. 6			2.2	V
Oscillation Hold Voltage	I _{VHOLDI}	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, f _{opg} =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 $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			unit
Maximum Supply Voltage	V_{SS1}	-4.0 to +0.3	V
	V_{SS2}	$V_{SS2}=V_{SS3}$	-4.0 to +0.3
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
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_{OUT2}	SEGOUT, COM1, COM2, CUP1	$V_{SS2}-0.3$ to 0.3
Operating Temperature	T_{opg}	-20 to +65	$^\circ\text{C}$
Storage Temperature	T_{stg}	-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		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	f_{opg}	$T_a=-20$ to +65 $^\circ\text{C}$	32	33	kHz

Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Input Resistance	R_{IN1A}	$V_{SS1}=-1.55\text{V}$, $V_{IL}=V_{SS1}+0.2\text{V}$, "L"-level hold tr., *1, Fig. 1	10	200	k Ω
	R_{IN1B}	$V_{SS1}=-1.55\text{V}$, "L"-level pull-in tr., *1, Fig. 1	200	2000	k Ω
	R_{IN2A}	$V_{SS1}=-1.55\text{V}$, $V_{IH}=V_{SS1}$, INT pull-up resistance	200	2000	k Ω
	R_{IN2B}	$V_{SS1}=-1.55\text{V}$, $V_{IH}=V_{DD}$, INT pull-down resistance	200	2000	k Ω
"H"-Level Output Voltage	V_{OH1}	$V_{SS1}=-1.55\text{V}$, $I_{OH}=-0.4\mu\text{A}$, SEGOUT	-0.2		V
"L"-Level Output Voltage	V_{OL1}	$V_{SS1}=-1.55\text{V}$, $I_{OL}=0.4\mu\text{A}$, SEGOUT		$V_{SS2}+0.2$	V
"H"-Level Output Voltage	V_{OH2}	$V_{SS1}=-1.55\text{V}$, $I_{OH}=-4\mu\text{A}$, COM1, COM2	-0.2		V
"M"-Level Output Voltage	V_{OM}	$V_{SS1}=-1.55\text{V}$, $I_{OH}=-4\mu\text{A}$, $I_{OL}=4\mu\text{A}$, COM1, COM2	$V_{SS1}-0.2$	$V_{SS1}+0.2$	V
"L"-Level Output Voltage	V_{OL2}	$V_{SS1}=-1.55\text{V}$, $I_{OL}=4\mu\text{A}$, COM1, COM2		$V_{SS2}+0.2$	V
"H"-Level Output Voltage	V_{OH3}	$V_{SS1}=-1.35\text{V}$, $I_{OH}=-250\mu\text{A}$, ALM, LIGHT	-0.65		V
"L"-Level Output Voltage	V_{OL3}	$V_{SS1}=-1.35\text{V}$, $I_{OL}=250\mu\text{A}$, ALM, LIGHT		$V_{SS1}+0.65$	V
"H"-Level Output Voltage	V_{OH4}	$V_{SS1}=-1.55\text{V}$, $I_{OH}=-20\mu\text{A}$, 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}	$V_{SS1}=-1.55\text{V}$, $I_{OL}=20\mu\text{A}$, 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}	$V_{SS1}=-1.35\text{V}$, $C1=C2=0.1\mu\text{F}$, $f_{opg}=32.768\text{kHz}$, Fig. 2		-2.5	V
Current Dissipation	I_{DD1}	$V_{SS1}=-1.55\text{V}$, standard watch/clock operation $C1=C2=0.1\mu\text{F}$, $C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 2	2.0		μA
Oscillation Start Voltage	$I_{V_{stt1}}$	$C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 3		1.35	V
Oscillation Hold Voltage	$I_{V_{HOLD1}}$	$C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 2	1.30	1.65	V
Oscillation Start Time	t_{stt}	$C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, $V_{SS1}=-1.35\text{V}$, Fig. 3		10	sec
Oscillation Correction	10P	External pin	8	10	pF
Capacitance	20P	OSCOUT	16	20	pF

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

Absolute Maximum Ratings at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

			unit
Maximum Supply Voltage	VSS1	$V_{BAK}=V_{SS1}$ or V_{SS2}	-4.0 to +0.3 V
	VSS2	$V_{SS2}=V_{SS3}$, $V_{BAK}=V_{SS1}$ or V_{SS2}	-4.0 to +0.3 V
Maximum Input Voltage	VIN1	10P, OSCIN	$V_{BAK}-0.3$ to 0.3 V
	VIN2	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	VOUT1	TEST, CUP2, OSCOUT	$V_{BAK}-0.3$ to 0.3 V
	VOUT2	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	T _{opg}		-20 to +65 °C
Storage Temperature	T _{stg}		-30 to +125 °C

Allowable Operating Conditions at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Supply Voltage	VBAK	-3.6		-1.3	V
	VSS2	$V_{SS2}=V_{SS3}$		-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
Operating Frequency	f _{opg}	$T_a=-20$ to +65 °C	32	33	kHz

Electrical Characteristics at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Input Resistance	R _{IN1A}	$V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}+0.4\text{V}$, "L"-level hold tr., *1, Fig. 4	10		200	kΩ
	R _{IN1B}	$V_{SS2}=-2.9\text{V}$, "L"-level pull-in tr., *1, Fig. 4	200		2000	kΩ
	R _{IN2A}	$V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}$, INT pull-up resistance	200		2000	kΩ
	R _{IN2B}	$V_{SS2}=-2.9\text{V}$, $V_{IH}=V_{DD}$, INT pull-down resistance	200		2000	kΩ
"H"-Level Output Voltage	V _{OH1}	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-0.4\mu\text{A}$, SEGOUT	-0.2			V
"L"-Level Output Voltage	V _{OL1}	$V_{SS2}=-2.9\text{V}$, $I_{OL}=0.4\mu\text{A}$, SEGOUT		$V_{SS2}+0.2$		V
"H"-Level Output Voltage	V _{OH2}	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-4\mu\text{A}$, COM1, COM2	-0.2			V
"M"-Level Output Voltage	V _{OM}	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-4\mu\text{A}$, $I_{OL}=4\mu\text{A}$, COM1, COM2	$V_{SS2}/2-0.2$	$V_{SS2}/2+0.2$		V
"L"-Level Output Voltage	V _{OL2}	$V_{SS2}=-2.9\text{V}$, $I_{OL}=4\mu\text{A}$, COM1, COM2		$V_{SS2}+0.2$		V
"H"-Level Output Voltage	V _{OH3}	$V_{SS2}=-2.4\text{V}$, $I_{OH}=-250\mu\text{A}$, ALM	-0.65			V
"L"-Level Output Voltage	V _{OL3}	$V_{SS2}=-2.4\text{V}$, $I_{OL}=250\mu\text{A}$, ALM		$V_{SS2}+0.65$		V
"H"-Level Output Voltage	V _{OH4}	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-40\mu\text{A}$, 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}	$V_{SS2}=-2.9\text{V}$, $I_{OH}=40\mu\text{A}$, 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}	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-150\mu\text{A}$, LIGHT	-1.5			V
"L"-Level Output Voltage	V _{OL5}	$V_{SS2}=-2.9\text{V}$, $I_{OL}=150\mu\text{A}$, LIGHT		$V_{SS2}+1.5$		V
Output Voltage (halver)	VSS1	$V_{SS2}=-2.9\text{V}$, $C1=C2=0.1\mu\text{F}$, f _{opg} =32.768kHz, Fig. 5			-1.35	V
Current Dissipation	I _{DDI}	$V_{SS2}=-2.9\text{V}$, standard watch/clock operation $C1=C2=0.1\mu\text{F}$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 5		1.0		μA
Oscillation Start Voltage	V _{stt}	$V_{SS1}=V_{SS2}$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 6			1.35	V
Oscillation Hold Voltage	V _{HOLD}	$V_{SS1}=V_{SS2}/2$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 5	2.6		3.6	V
Oscillation Start Time	t _{stt}	$V_{SS1}=V_{SS2}=-2.9\text{V}$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 6			10	sec
Oscillation Correction	10P	External pin	8	10	12	pF
Capacitance	20P	OSCOUT	16	20	24	pF

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

Absolute Maximum Ratings at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			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	T_{opg}	-20 to +70	$^\circ\text{C}$
Storage Temperature	T_{stg}	-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		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 $T_a=-20$ to $+70^\circ\text{C}$, $V_{SS2}=-2.0$ to -3.6V	32		33	kHz
	fopg2 $T_a=-20$ to $+70^\circ\text{C}$, $V_{SS2}=-2.3$ to -3.6V	32		66	kHz

Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Input Resistance	R_{IN1A} $V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}+0.4$, "L"-level hold tr., *1, Fig. 4	10		200	k Ω
	R_{IN1B} $V_{SS2}=-2.9\text{V}$, "L"-level pull-in tr., *1, Fig. 4	200		2000	k Ω
	R_{IN2A} $V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}$, INT pull-up resistance	200		2000	k Ω
	R_{IN2B} $V_{SS2}=-2.9\text{V}$, $V_{IH}=V_{DD}$, INT pull-down resistance	200		2000	k Ω
"H"-Level Output Voltage	$V_{OH(1)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-0.4\text{mA}$, ALM, LIGHT	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(1)}$ $V_{SS2}=-2.4\text{V}$, $I_{OL}=0.4\text{mA}$, ALM, LIGHT		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(2)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-0.1\text{mA}$, I/O ports, port P	-1	-0.3		V
"H"-Level Output Voltage	$V_{OH(3)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-50\mu\text{A}$, I/O ports, port P	-0.6	-0.2		V
"L"-Level Output Voltage	$V_{OL(3)}$ $V_{SS2}=-2.4\text{V}$, $I_{OL}=0.1\text{mA}$, I/O ports, port P		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(4)}$ $V_{SS2}=-2.4\text{V}$, Segment (Output port) mode Pad Nos. 64 to 66	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$ $V_{SS2}=-2.4\text{V}$, QIP64 pin Nos. 34 to 36		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(5)}$ $V_{SS2}=-2.4\text{V}$, Segment (Output port) mode Pad Nos. 40 to 43	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(5)}$ $V_{SS2}=-2.4\text{V}$, 45, 47 to 63		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(6)}$ $V_{SS2}=-2.4\text{V}$, QIP64 pin Nos. 11 to 13	-0.2			V
"L"-Level Output Voltage	$V_{OL(6)}$ $V_{SS2}=-2.4\text{V}$, Each segment			$V_{SS2}+0.2$	V
"H"-Level Output Voltage	$V_{OH(7)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-4\mu\text{A}$, COM 1-2	-0.2			V
"M"-Level Output Voltage	V_{OM} $V_{SS2}=-2.4\text{V}$, $I_{OH}=-4\mu\text{A}$, $V_{SS2}/2-0.2$		$V_{SS2}/2+0.2$		V
"L"-Level Output Voltage	$V_{OL(7)}$ $V_{SS2}=-2.4\text{V}$, $I_{OL}=4\mu\text{A}$, COM 1-2		$V_{SS2}+0.2$		V
Output Voltage	V_{SS1} $V_{SS2}=-2.9\text{V}$, $C_1=C_2=0.1\mu\text{F}$, fopg=32.768kHz			-1.35	V
Current Dissipation	I_{DDI} $V_{SS2}=-2.9\text{V}$, HALT mode, $C_1=C_2=0.1\mu\text{F}$, $C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, fopg=32.768kHz, Fig. 5			5	μA
Oscillation Start Voltage	IV_{sttI} Same as above Fig. 6			2.2	V
Oscillation Hold Voltage	IV_{HOLDI} Same as above Fig. 6	2.0		3.6	V
Oscillation Start Time	t_{stt} $V_{SS2}=-2.9\text{V}$, $C_1=C_2=0.1\mu\text{F}$, $C_o=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, fopg=32.768kHz, Fig. 6			10	sec
Oscillation Correction	10P $V_{SS2}=-2.9\text{V}$, External pin	8	10	12	pF
Capacitance	20P $V_{SS2}=-2.9\text{V}$, OSCOUT	16	20	24	pF

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

Absolute Maximum Ratings at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			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	T_{opg}	-20 to +65	$^\circ\text{C}$
Storage Temperature	T_{stg}	-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		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
Operating Frequency	fopg	$T_a=-20$ to +65 $^\circ\text{C}$	32	33	kHz

Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Input Resistance	R_{IN1A}	$V_{SS1}=-1.55\text{V}, V_{IL}=V_{SS1}+0.2\text{V},$ "L"-level hold tr., *1, Fig. 1	10	200	k Ω
	R_{IN1B}	$V_{SS1}=-1.55\text{V},$ "L" level pull-in tr., *1, Fig. 1	200	2000	k Ω
	R_{IN2A}	$V_{SS1}=-1.55\text{V}, V_{IL}=V_{SS1}, INT$ pull-up resistance	200	2000	k Ω
	R_{IN2B}	$V_{SS1}=-1.55\text{V}, V_{IH}=V_{DD}, INT$ pull-down resistance	200	2000	k Ω
"H"-Level Output Voltage	V_{OH1}	$V_{SS1}=-1.55\text{V}, I_{OH}=-0.4\mu\text{A}, SEGOUT$	-0.2		V
"L"-Level Output Voltage	V_{OL1}	$V_{SS1}=-1.55\text{V}, I_{OL}=0.4\mu\text{A}, SEGOUT$		$V_{SS2}+0.2$	V
"H"-Level Output Voltage	V_{OH2}	$V_{SS1}=-1.55\text{V}, I_{OH}=-4\mu\text{A},$ COM1, COM2, COM3	-0.2		V
"M"-Level Output Voltage	V_{OM}	$V_{SS1}=-1.55\text{V}, I_{OH}=-4\mu\text{A}, I_{OL}=4\mu\text{A},$ COM1, COM2, COM3	$V_{SS1}-0.2$	$V_{SS1}+0.2$	V
"L"-Level Output Voltage	V_{OL2}	$V_{SS1}=-1.55\text{V}, I_{OL}=4\mu\text{A}, COM1, COM2, COM3$		$V_{SS2}+0.2$	V
"H"-Level Output Voltage	V_{OH3}	$V_{SS1}=-1.35\text{V}, I_{OH}=-250\mu\text{A}, ALM, LIGHT$	-0.65		V
"L"-Level Output Voltage	V_{OL3}	$V_{SS1}=-1.35\text{V}, I_{OL}=250\mu\text{A}, ALM, LIGHT$		$V_{SS1}+0.65$	V
"H"-Level Output Voltage	V_{OH4}	$V_{SS1}=-1.55\text{V}, I_{OH}=-20\mu\text{A},$ 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}	$V_{SS1}=-1.55\text{V}, I_{OL}=20\mu\text{A},$ 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}	$V_{SS1}=-1.35\text{V}, C1=C2=0.1\mu\text{F},$ fopg=32.768kHz, Fig. 2		-2.5	V
Current Dissipation	I_{DD1}	$V_{SS1}=-1.55\text{V},$ standard watch/clock operation, $C1=C2=0.1\mu\text{F}, Co=Cg=20\text{pF}, Cl=25\text{k}\Omega,$ Fig. 2	2.0		μA
Oscillation Start Voltage	IV_{stt1}	$Co=Cg=20\text{pF}, Cl=25\text{k}\Omega,$ Fig. 3		1.35	V
Oscillation Hold Voltage	IV_{HOLD1}	$Co=Cg=20\text{pF}, Cl=25\text{k}\Omega,$ Fig. 2	1.30	1.65	V
Oscillation Start Time	t_{stt}	$Co=Cg=20\text{pF}, Cl=25\text{k}\Omega, V_{SS1}=-1.35\text{V},$ Fig. 3		10	sec
Oscillation Correction Capacitance	10P	External pin	8	10	pF
	20P	OSCOUT	16	20	pF

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

Absolute Maximum Ratings at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

				unit
Maximum Supply Voltage	VSS1	$V_{BAK}=V_{SS1}$ or V_{SS2}	-4.0 to +0.3	V
	VSS2	$V_{SS2}=V_{SS3}$, $V_{BAK}=V_{SS1}$ or V_{SS2}	-4.0 to +0.3	V
Maximum Input Voltage	VIN1	10P, OSCIN, TEST1/O	$V_{BAK}-0.3$ to 0.3	V
	VIN2	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	VOUT1	TEST, CUP2, OSCOUT	$V_{BAK}-0.3$ to 0.3	V
	VOUT2	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	$^\circ\text{C}$
Storage Temperature	Tstg		-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Supply Voltage	VBAK		-3.6		-1.3	V
	VSS2	$V_{SS2}=V_{SS3}$	-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	$T_a=-20$ to $+65^\circ\text{C}$	32		33	kHz

Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Input Resistance	RIN1A	$V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}+0.4\text{V}$, "L"-level hold tr., *1, Fig. 4	10		200	k Ω
	RIN1B	$V_{SS2}=-2.9\text{V}$, "L"-level pull-in tr., *1, Fig. 4	200		2000	k Ω
	RIN2A	$V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}$, INT pull-up resistance	200		2000	k Ω
	RIN2B	$V_{SS2}=-2.9\text{V}$, $V_{IH}=V_{DD}$, INT pull-down resistance	200		2000	k Ω
"H"-Level Output Voltage	VOH1	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-0.4\mu\text{A}$, SEGOUT	-0.2			V
"L"-Level Output Voltage	VOL1	$V_{SS2}=-2.9\text{V}$, $I_{OL}=0.4\mu\text{A}$, SEGOUT		$V_{SS2}+0.2$		V
"H"-Level Output Voltage	VOH2	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-4\mu\text{A}$, COM1, COM2, COM3	-0.2			V
"M"-Level Output Voltage	VOM	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-4\mu\text{A}$, $V_{SS2}/2-0.2$		$V_{SS2}/2+0.2$		V
"L"-Level Output Voltage	VOL2	$V_{SS2}=-2.9\text{V}$, $I_{OL}=4\mu\text{A}$, COM1, COM2, COM3		$V_{SS2}+0.2$		V
"H"-Level Output Voltage	VOH3	$V_{SS2}=-2.4\text{V}$, $I_{OH}=-250\mu\text{A}$, ALM	-0.65			V
"L"-Level Output Voltage	VOL3	$V_{SS2}=-2.4\text{V}$, $I_{OL}=250\mu\text{A}$, ALM		$V_{SS2}+0.65$		V
"H"-Level Output Voltage	VOH4	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-40\mu\text{A}$, I/OA1-4, I/OB1-4, P1-4 (I/OA1-4, I/OB1-4: Output mode)	-0.4			V
"L"-Level Output Voltage	VOL4	$V_{SS2}=-2.9\text{V}$, $I_{OH}=40\mu\text{A}$, 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	VOH5	$V_{SS2}=-2.9\text{V}$, $I_{OH}=-150\mu\text{A}$, LIGHT	-1.5			V
"L"-Level Output Voltage	VOL5	$V_{SS2}=-2.9\text{V}$, $I_{OL}=150\mu\text{A}$, LIGHT		$V_{SS2}+1.5$		V
Output Voltage (halver)	VSS1	$V_{SS2}=-2.9\text{V}$, $C1=C2=0.1\mu\text{F}$, fopg=32.768kHz, Fig. 5		-1.35		V
Current Dissipation	I _{DDI}	$V_{SS2}=-2.9\text{V}$, standard watch/clock operation $C1=C2=0.1\mu\text{F}$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 5		1.0		μA
Oscillation Start Voltage	IV _{sttI}	$V_{SS1}=V_{SS2}$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 6			1.35	V
Oscillation Hold Voltage	IV _{HOLDI}	$V_{SS1}=V_{SS2}/2$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 5	2.6		3.6	V
Oscillation Start Time	t _{stt}	$V_{SS1}=V_{SS2}=-2.9\text{V}$, $C_0=C_g=20\text{pF}$, $C_I=25\text{k}\Omega$, Fig. 6			10	sec
Oscillation Correction	10P	External pin	8	10	12	pF
Capacitance	20P	OSCOUT	16	20	24	pF

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

Absolute Maximum Ratings at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

			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	T_{opg}	-20 to +70	$^\circ\text{C}$
Storage Temperature	T_{stg}	-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		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)	0.3 V_{SS2}		0	V
"L"-Level Input Voltage	V_{IL} "	V_{SS2}	0.7 V_{SS2}		V
Operating Frequency	fopg1 $T_a=-20$ to $+70^\circ\text{C}$, $V_{SS2}=-2.0$ to -3.6V	32		33	kHz
	fopg2 $T_a=-20$ to $+70^\circ\text{C}$, $V_{SS2}=-2.3$ to -3.6V	32		66	kHz

Electrical Characteristics at $T_a=25\pm 2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Input Resistance	R_{IN1A} $V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}+0.4$, "L"-level hold tr., *1, Fig. 4	10		200	k Ω
	R_{IN1B} $V_{SS2}=-2.9\text{V}$, "L"-level pull-in tr., *1, Fig. 4	200		2000	k Ω
	R_{IN2A} $V_{SS2}=-2.9\text{V}$, $V_{IL}=V_{SS2}$, INT pull-up resistance	200		2000	k Ω
	R_{IN2B} $V_{SS2}=-2.9\text{V}$, $V_{IH}=V_{DD}$, INT pull-down resistance	200		2000	k Ω
"H"-Level Output Voltage	$V_{OH(1)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-0.4\text{mA}$, ALM, LIGHT	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(1)}$ $V_{SS2}=-2.4\text{V}$, $I_{OL}=0.4\text{mA}$, ALM, LIGHT		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(2)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-0.1\text{mA}$, I/O ports, port P	-1	-0.3		V
"H"-Level Output Voltage	$V_{OH(3)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-50\mu\text{A}$, I/O ports, port P	-0.6	-0.2		V
"L"-Level Output Voltage	$V_{OL(3)}$ $V_{SS2}=-2.4\text{V}$, $I_{OL}=0.1\text{mA}$, I/O ports, port P		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(4)}$ $V_{SS2}=-2.4\text{V}$, Segment (Output port) mode } Pad Nos. 64 to 66 } $I_{OH}=-10\mu\text{A}$	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$ $V_{SS2}=-2.4\text{V}$, Segment (Output port) mode } QIP64 pin Nos. } $I_{OL}=50\mu\text{A}$		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(5)}$ $V_{SS2}=-2.4\text{V}$, Segment (Output port) mode } Pad Nos. 40 to 43 } $I_{OH}=-5\mu\text{A}$		$V_{SS2}+0.2$		V
"L"-Level Output Voltage	$V_{OL(5)}$ $V_{SS2}=-2.4\text{V}$, Segment (Output port) mode } 45, 47 to 63 } $I_{OL}=20\mu\text{A}$		$V_{SS2}+0.3$	$V_{SS2}+1$	V
"H"-Level Output Voltage	$V_{OH(6)}$ $V_{SS2}=-2.4\text{V}$, Each segment } $I_{OH}=-0.4\mu\text{A}$	-0.2			V
"L"-Level Output Voltage	$V_{OL(6)}$ $V_{SS2}=-2.4\text{V}$, Each segment } $I_{OL}=0.4\mu\text{A}$	-0.2	$V_{SS2}+0.2$		V
"H"-Level Output Voltage	$V_{OH(7)}$ $V_{SS2}=-2.4\text{V}$, $I_{OH}=-4\mu\text{A}$, COM 1-3	-0.2			V
"M"-Level Output Voltage	V_{OM} $V_{SS2}=-2.4\text{V}$, $I_{OH}=-4\mu\text{A}$, $V_{SS2}/2-0.2$ $I_{OL}=4\mu\text{A}$, COM 1-3		$V_{SS2}/2+0.2$		V
"H"-Level Output Voltage	$V_{OL(7)}$ $V_{SS2}=-2.4\text{V}$, $I_{OL}=4\mu\text{A}$, COM 1-3		$V_{SS2}+0.2$		V
Output Voltage	V_{SS1} $V_{SS2}=-2.9\text{V}$, $C_1=C_2=0.1\mu\text{F}$, fopg=32.768kHz			-1.35	V
Current Dissipation	I_{DDI} $V_{SS2}=-2.9\text{V}$, HALT mode, $C_1=C_2=0.1\mu\text{F}$, $C_o=C_g=20\text{pF}$, $C_l=25\text{k}\Omega$, fopg=32.768kHz, Fig. 5			5	μA
Oscillation Start Voltage	I_{Vstt} Same as above Fig. 6			2.2	V
Oscillation Hold Voltage	I_{Vhold} Same as above Fig. 6	2.0		3.6	V
Oscillation Start Time	t_{stt} $V_{SS2}=-2.9\text{V}$, $C_1=C_2=0.1\mu\text{F}$, $C_o=C_g=20\text{pF}$, $C_l=25\text{k}\Omega$, fopg=32.768kHz, Fig. 6			10	sec
Oscillation Correction Capacitance	10P $V_{SS2}=-2.9\text{V}$, External pin	8	10	12	pF
	20P $V_{SS2}=-2.9\text{V}$, OSCOUT	16	20	24	pF

Operation from 1.5V Ag Battery (1/3 Bias, 1/3 Duty)

Absolute Maximum Ratings at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

			unit
Maximum Supply Voltage	VSS1	-4.0 to +0.3	V
	VSS2	-4.0 to +0.3	V
	VSS3	-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
	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
Maximum Output Voltage	V _{OUT2}	SEGOUT, COM1, COM2, COM3, CUP1	$V_{SS3}-0.3$ to 0.3 V
	Topg		-20 to +65 °C
Operating Temperature	Tstg		-30 to +125 °C
Storage Temperature			

Allowable Operating Conditions at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Supply Voltage	VSS1	-1.65		-1.30	V
	VSS2	-3.3		-2.4	V
	VSS3	-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	f _{opg}	$T_a=-20$ to $+65^\circ\text{C}$	32	33	kHz

Electrical Characteristics at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

		min	typ	max	unit
Input Resistance	R _{IN1A}	$V_{SS1}=-1.55\text{V}$, V _{IL} = $V_{SS1}+0.2\text{V}$, "L"-level hold tr., *1, Fig. 1	10	200	k Ω
	R _{IN1B}	$V_{SS1}=-1.55\text{V}$, "L"-level pull-in tr., *1, Fig. 1	200	2000	k Ω
	R _{IN2A}	$V_{SS1}=-1.55\text{V}$, V _{IL} = V_{SS1} , INT pull-up resistance	200	2000	k Ω
	R _{IN2B}	$V_{SS1}=-1.55\text{V}$, V _{IH} = V_{DD} , INT pull-down resistance	200	2000	k Ω
"H"-Level Output Voltage	V _{OH1}	$V_{SS1}=-1.55\text{V}$, I _{OH} =-0.4 μA , SEGOUT	-0.2		V
"M1"-Level Output Voltage	V _{OM1-1}	$V_{SS1}=-1.55\text{V}$, I _{OH} =-0.4 μA , I _{OL} =0.4 μA , 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}	$V_{SS1}=-1.55\text{V}$, I _{OL} =0.4 μA , SEGOUT		$V_{SS3}+0.2$	V
"H"-Level Output Voltage	V _{OH2}	$V_{SS1}=-1.55\text{V}$, I _{OH} =-4 μA , COM1, COM2, COM3	-0.2		V
"M1"-Level Output Voltage	V _{OM1-2}	$V_{SS1}=-1.55\text{V}$, I _{OL} =4 μA , I _{OH} =-4 μA , 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}	$V_{SS1}=-1.55\text{V}$, I _{OL} =4 μA , COM1, COM2, COM3		$V_{SS3}+0.2$	V
"H"-Level Output Voltage	V _{OH3}	$V_{SS1}=-1.35\text{V}$, I _{OH} =-250 μA , ALM, LIGHT	-0.65		V
"L"-Level Output Voltage	V _{OL3}	$V_{SS1}=-1.35\text{V}$, I _{OL} =250 μA , ALM, LIGHT		$V_{SS1}+0.65$	V
"H"-Level Output Voltage	V _{OH4}	$V_{SS1}=-1.55\text{V}$, I _{OH} =-20 μA , 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}	$V_{SS1}=-1.55\text{V}$, I _{OL} =20 μA , P1-4, I/OA1-4, I/OB1-4 (I/OA1-4, I/OB1-4: Output mode)		$V_{SS1}+0.2$	V
Output Voltage (doubler) (trippler)	VSS2	$V_{SS1}=-1.35\text{V}$, C1=C2=0.1 μF , f _{opg} =32.768kHz, Fig. 8		-2.5	V
	VSS3	" "		-3.75	V
Current Dissipation	I _{DDI}	$V_{SS1}=-1.55\text{V}$, standard watch/clock operation, C1 to C3=0.1 μF , Co=Cg=20pF, Cl=25k Ω , Fig. 8	3.5		μA
Oscillation Start Voltage	I _{Vstt}	Co=Cg=20pF, Cl=25k Ω , Fig. 9		1.35	V
Oscillation Hold Voltage	I _{VHOLD}	Co=Cg=20pF, Cl=25k Ω , Fig. 8	-1.30	1.65	V
Oscillation Start Time	t _{stt}	Co=Cg=20pF, Cl=25k Ω , $V_{SS1}=-1.35\text{V}$, Fig. 9		10	sec
Oscillation Correction	10P	External pin	8	10	pF
Capacitance	20P	OSCOUT	16	20	pF

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

Absolute Maximum Ratings at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

				unit
Maximum Supply Voltage	VSS1	VBAK=VSS1 or VSS2	-4.0 to +0.3	V
	VSS2	VBAK=VSS1 or VSS2	-4.0 to +0.3	V
	VSS3	VBAK=VSS1 or VSS2	-5.5 to 0.3	V
Maximum Input Voltage	VIN1	10P, OSCIN	VBAK-0.3 to 0.3	V
	VIN2	S1-4, M1-4, INT, I/OA1-4, I/OB1-4, TESTA (I/OA1-4, I/OB1-4: Input mode)	VSS2-0.3 to 0.3	V
Maximum Output Voltage	VOUT1	TEST, OSCOUT	VBAK-0.3 to 0.3	V
	VOUT2	ALARM, LIGHT, P1-4, I/OA1-4, I/OB1-4, CUP2 (I/OA1-4, I/OB1-4: Output mode)	VSS2-0.3 to 0.3	V
	VOUT3	SEGOUT, COM1, COM2, COM3, CUP1	VSS3-0.3 to 0.3	V
Operating Temperature	Topg		-20 to +65	$^\circ\text{C}$
Storage Temperature	Tstg		-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Supply Voltage	VBAK		-3.6		-1.3	V
	VSS2	VSS2=VSS3	-3.6		-2.0	V
	VSS3	VSS3 $\approx$ VSS2+VSS1	-5.0		-3.9	V
"H"-Level Input Voltage	VIH	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	VIL	" "		VSS2	VSS2+0.4	V
Operating Frequency	fopg	$T_a=-20$ to $+65^\circ\text{C}$	32		33	kHz

Electrical Characteristics at $T_a=25\pm2^\circ\text{C}$, $V_{DD}=0\text{V}$

			min	typ	max	unit
Input Resistance	RIN1A	VSS2=-2.9V, VIL=VSS2+0.4V, "L" level hold tr., *1, Fig. 10	10		200	k Ω
	RIN1B	VSS2=-2.9V, "L" level pull-in tr., *1, Fig. 10	200		2000	k Ω
	RIN2A	VSS2=-2.9V, VIL=VSS2, INT pull-up resistance	200		2000	k Ω
	RIN2B	VSS2=-2.9V, VIH=VDD, INT pull-down resistance	200		2000	k Ω
"H"-Level Output Voltage	VOH1	VSS2=-2.9V, IOH=-0.4 μA , SEGOUT	-0.2			V
"M1"-Level Output Voltage	VOM1-1	VSS2=-2.9V, IOH=-0.4 μA , IOL=0.4 μA , SEGOUT	VSS2/2-0.2		VSS/2+0.2	V
"M2"-Level Output Voltage	VOM2-1	" "	VSS2-0.2		VSS2+0.2	V
"L"-Level Output Voltage	VOL1	VSS2=-2.9V, IOL=0.4 μA , SEGOUT			VSS3+0.2	V
"H"-Level Output Voltage	VOH2	VSS2=-2.9V, IOH=-4 μA , COM1, COM2, COM3	-0.2			V
"M1"-Level Output Voltage	VOM1-2	VSS2=-2.9V, IOH=-4 μA , IOL=4 μA , COM1, COM2, COM3	VSS2/2+0.2		VSS/2+0.2	V
"M2"-Level Output Voltage	VOM2-2	" "	VSS2-0.2		VSS2+0.2	V
"L"-Level Output Voltage	VOL2	VSS2=-2.9V, IOL=4 μA , COM1, COM2, COM3			VSS3+0.2	V
"H"-Level Output Voltage	VOH3	VSS2=-2.4V, IOH=-250 μA , ALM	-0.65			V
"L"-Level Output Voltage	VOL3	VSS2=-2.4V, IOL=250 μA , ALM			VSS2+0.65	V
"H"-Level Output Voltage	VOH4	VSS2=-2.9V, IOH=-40 μA , I/OA1-4, I/OB1-4, P1-4 (I/OA1-4, I/OB1-4: Output mode)	-0.4			V
"L"-Level Output Voltage	VOL4	VSS2=-2.9V, IOH=40 μA , I/OA1-4, I/OB1-4, P1-4 (I/OA1-4, I/OB1-4: Output mode)			VSS2+0.4	V
"H"-Level Output Voltage	VOH5	VSS2=-2.9V, IOH=-150 μA , LIGHT	-1.5			V
"L"-Level Output Voltage	VOL5	VSS2=-2.9V, IOL=150 μA , LIGHT			VSS2+1.5	V
Output Voltage (halver)	VSS1	VSS2=-2.9V, C1 to C4=0.1 μF , fopg=32.768kHz, Fig. 1			-1.35	V
(tripler)	VSS3				-4.1	V
Current Dissipation	IDD1	VSS2=-2.9V, standard watch/clock operation C1 to C4=0.1 μF , Co=Cg=20pF, Cl=25k Ω , Fig. 11		2.0		μA
Oscillation Start Voltage	IVst1	VSS1=VSS2, Co=Cg=20pF, Cl=25k Ω , Fig. 12			1.35	V

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			min	typ	max	unit
Oscillation Hold Voltage	$I_{V_{HOLD}} V_{SS1} = V_{SS2}/2, C_o = C_g = 20pF, C_l = 25k\Omega, \text{Fig. 11}$		2.6		3.6	V
Oscillation Start Time	$t_{stt} \quad V_{SS1} = V_{SS2} = -2.9V, C_o = C_g = 20pF, C_l = 25k\Omega, \text{Fig. 12}$				10	sec
Oscillation Correction	10P External pin		8	10	12	pF
Capacitance	20P OSCOUT		16	20	24	pF

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

Absolute Maximum Ratings at $T_a = 25 \pm 2^\circ\text{C}, V_{DD} = 0V$

				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	T_{opg}		-20 to +70	$^\circ\text{C}$
Storage Temperature	T_{stg}		-30 to +125	$^\circ\text{C}$

Allowable Operating Conditions at $T_a = 25 \pm 2^\circ\text{C}, V_{DD} = 0V$

			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	$T_a = -20$ to $+70^\circ\text{C}, V_{SS2} = -2.0$ to $-3.6V$	32		33	kHz
	fopg2	$T_a = -20$ to $+70^\circ\text{C}, V_{SS2} = -2.3$ to $-3.6V$	32		66	kHz

Electrical Characteristics at $T_a = 25 \pm 2^\circ\text{C}, V_{DD} = 0V$

			min	typ	max	unit
Input Resistance	R_{IN1A}	$V_{SS2} = -2.9V, V_{IL} = V_{SS2} + 0.4,$ "I"-level hold tr., *1, Fig. 10	10		200	k Ω
	R_{IN1B}	$V_{SS2} = -2.9V, "L"-level pull-in tr., *1, Fig. 10$	200		2000	k Ω
	R_{IN2A}	$V_{SS2} = -2.9V, V_{IL} = V_{SS2}, \text{INT}$ pull-up resistance	200		2000	k Ω
	R_{IN2B}	$V_{SS2} = -2.9V, V_{IH} = V_{DD}, \text{INT}$ pull-down resistance	200		2000	k Ω
"H"-Level Output Voltage	$V_{OH(1)}$	$V_{SS2} = -2.4V, I_{OH} = -0.4mA, \text{ALM, LIGHT}$	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(1)}$	$V_{SS2} = -2.4V, I_{OL} = 0.4mA, \text{ALM, LIGHT}$		$V_{SS2} + 0.3$	$V_{SS2} + 1$	V
"H"-Level Output Voltage	$V_{OH(2)}$	$V_{SS2} = -2.4V, I_{OH} = -0.1mA, \text{I/O ports, port P}$	-1	-0.3		V
"H"-Level Output Voltage	$V_{OH(3)}$	$V_{SS2} = -2.4V, I_{OH} = -50\mu A, \text{I/O ports, port P}$	-0.6	-0.2		V
"L"-Level Output Voltage	$V_{OL(3)}$	$V_{SS2} = -2.4V, I_{OL} = 0.1mA, \text{I/O ports, port P}$		$V_{SS2} + 0.3$	$V_{SS2} + 1$	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	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(4)}$	$V_{SS2} = -2.4V, I_{OL} = 50\mu A$ 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	-1	-0.3		V
"L"-Level Output Voltage	$V_{OL(5)}$	$V_{SS2} = -2.4V, I_{OL} = 20\mu A$ 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
"L"-Level Output Voltage	$V_{OL(6)}$	$V_{SS2} = -2.4V, I_{OL} = 0.4\mu A$		$V_{SS3} + 0.2$		V

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

*1 S1-S2-S3-S4-M1-M2-M3-M4

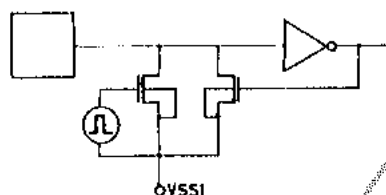


Fig. 1 Input configuration of S1-4, M1-4

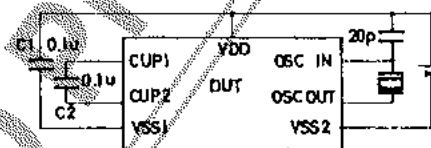


Fig. 5 Current dissipation, oscillation hold voltage test circuit

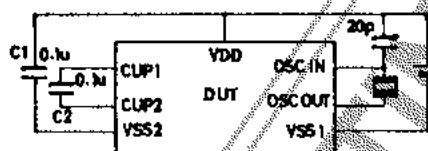


Fig. 2 Current dissipation, oscillation hold voltage test circuit

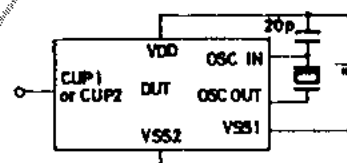


Fig. 6 Oscillation start voltage, oscillation start time, frequency stability test circuit

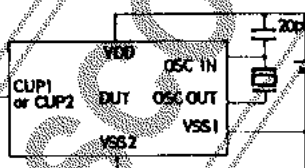


Fig. 3 Oscillation start voltage, oscillation start time, frequency stability test circuit

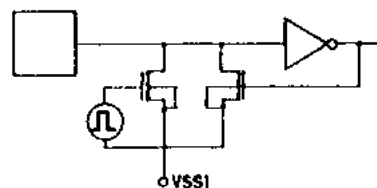


Fig. 7 Input configuration of S1-4, M1-4

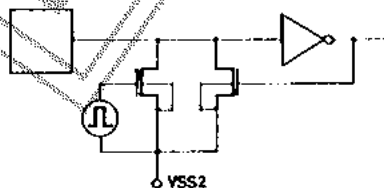


Fig. 4 Input configuration of S1-4, M1-4

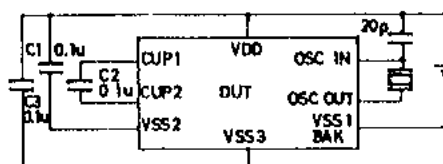


Fig. 8 Current dissipation, oscillation hold voltage test circuit

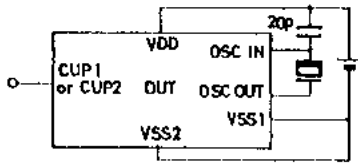


Fig. 9 Oscillation start voltage, oscillation start time, frequency stability test circuit

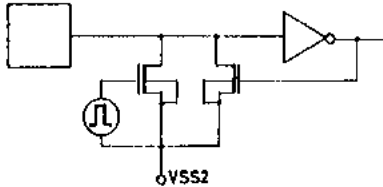


Fig. 10 Input configuration of S1-4, M1-4

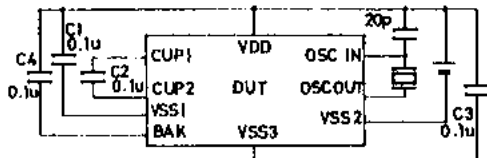


Fig. 11 Current dissipation, oscillation hold voltage test circuit

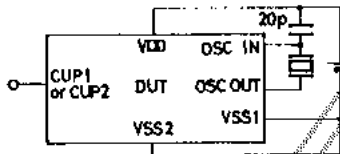


Fig. 12 Oscillation start voltage, oscillation start time, frequency stability test circuit

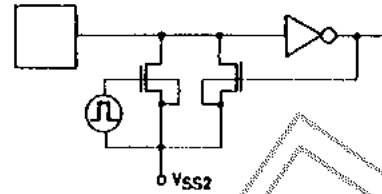


Fig. 13 Input configuration of S1-4, M1-4

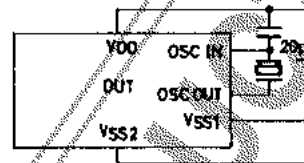


Fig. 14 Current dissipation, oscillation hold voltage test circuit

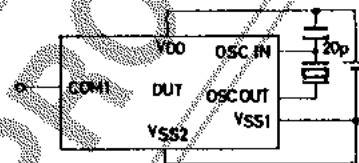


Fig. 15 Oscillation start voltage, oscillation start time, frequency stability test circuit

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