

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# MOS DIGITAL INTEGRATED CIRCUIT

## $\mu$ PD6653P3

### 8 DIGIT MULTIPLEXED LCD ALARM CHRONO QUARTZ WATCH WITH CALCULATOR CMOS LSI

\* This LSI is supplied in chip form only.

The  $\mu$ PD6653P3 is a CMOS LSI for multifunctional electronic wrist watches with calculator operated on the oscillation source of 32.768 kHz.

The functions of "basic time", "8-digit calculator", "daily/weekly alarm" and "chronograph" are provided.

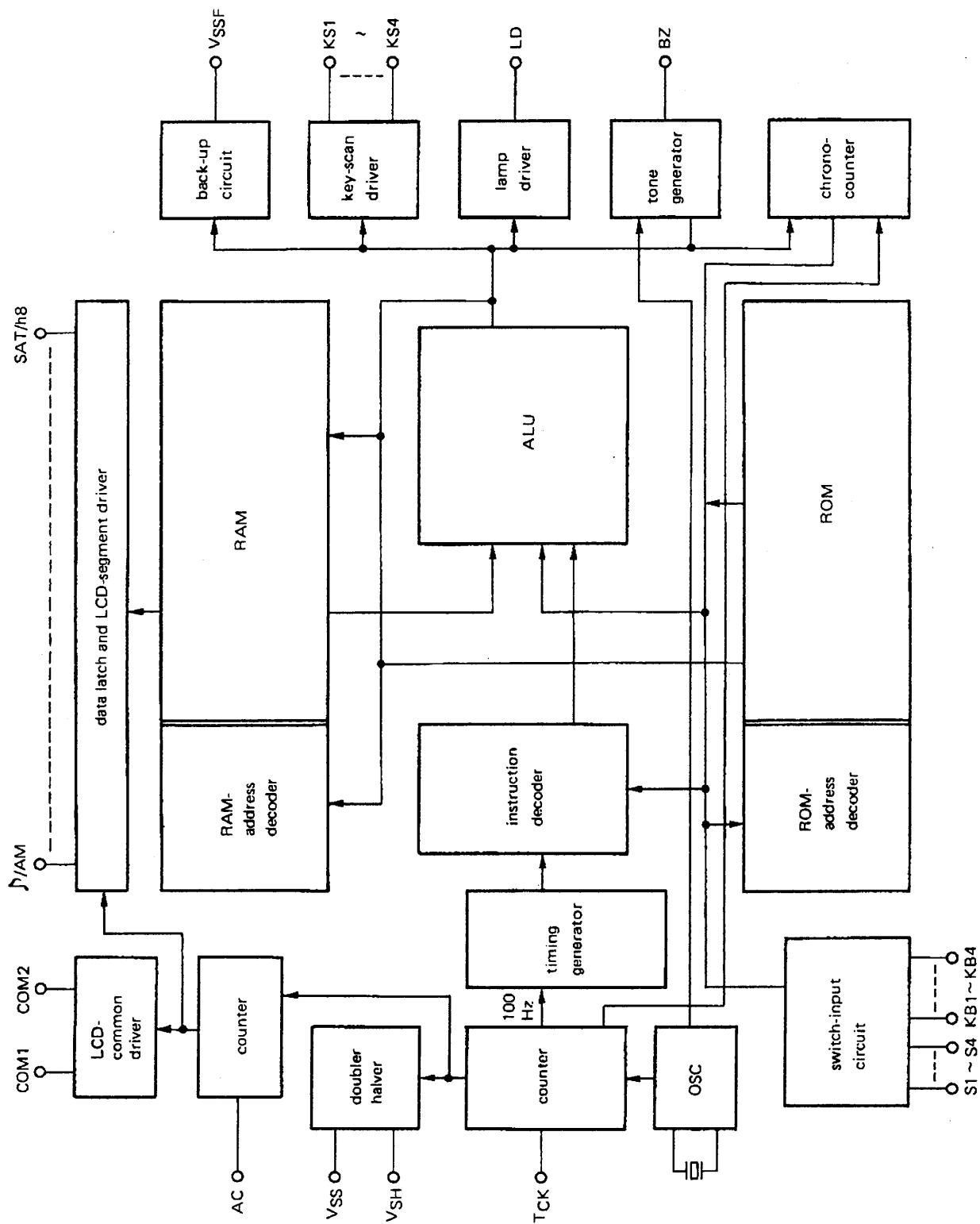
#### FEATURES

- Single chip CMOS LSI for a calculator watch.
- Calculation can be made at any time without clearing other functions (basic time, alarm and chronograph).
- 8-digit + 11-marks + 7-flags multiplexed LCD (1/2 duty, 1/2 bias)
- On chip crystal oscillator with RC network.
- Lithium (3.0 V) or silver oxide (1.5 V) battery operation is selected by bonding.

#### Outline of Functions

- (1) Basic time : "hour", "minute", "second", "day of week", "date", "month", "year".  
(Year is displayed during time setting mode only).  
Either 12 or 24 hour display format can be selected.  
Fully automatic calendar (day of week is set automatically)
- (2) Daily/weekly alarm: Daily alarm — "hour", "minute"  
Weekly alarm — "day of week", "hour", "minute"  
Plural days of week can be set in the weekly alarm mode.
- (3) Chronograph : "minute", "second", "1/100 second" (less than an hour)  
"hour", "minute", "second" (more than an hour, max. 24-hour)  
Lap time
- (4) Calculator : 8-digit addition, subtraction, multiplication and division, constant calculation, memory calculation, event counter, overflow check and rough estimate calculation function.
- (5) Chime : at every hour

## 2



# ABSOLUTE MAXIMUM RATING (T<sub>a</sub>=25 °C)

Power supply voltage 1	V <sub>SS</sub> -V <sub>DD</sub>	-5.0 to 0.3	V
Power supply voltage 2	V <sub>SH</sub> -V <sub>DD</sub>	-5.0 to 0.3	V
Input voltage 1	V <sub>I1</sub>	V <sub>SS</sub> -0.3 to 0.3	V
Input voltage 2	V <sub>I2</sub>	V <sub>SH</sub> -0.3 to 0.3	V
Output voltage 1	V <sub>O1</sub>	V <sub>SS</sub> -0.3 to 0.3	V
Output voltage 2	V <sub>O2</sub>	V <sub>SH</sub> -0.3 to 0.3	V
Operation temperature	T <sub>opt</sub>	-10 to +60	°C
Storage temperature	T <sub>stg</sub>	-40 to +125	°C

# RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Operating Voltage 1	V <sub>SS</sub> -V <sub>DD</sub>	-1.3	-1.55	-1.7	V
Operating Voltage 2	V <sub>SH</sub> -V <sub>DD</sub>	-2.2	-3.1	-3.4	V

# ELECTRICAL CHARACTERISTICS (with Silver oxide battery)

(T<sub>a</sub>=25 °C, V<sub>DD</sub>=0 V, V<sub>SS</sub>=-1.55 V, V<sub>SH</sub>=-3.1 V, f<sub>o</sub>=32.768 kHz, C<sub>I</sub>=30 kΩ, C<sub>G</sub>=33 pF, C<sub>D</sub> is integrated within)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Operating Voltage Range	V <sub>SS</sub>	-1.3		-1.8	V	Functional Operation
	V <sub>SH</sub>	-2.0		-3.6	V	
Average Current Consumption	I <sub>DD</sub>		1.6	2.3	μA	After AC, No load, Chrono. stop
Oscillation Start Voltage	V <sub>STA</sub>	-1.4			V	t <sub>STA</sub> ≤10 s
Frequency Stability	Δf/ΔV			3	ppm	V <sub>SS</sub> =-1.45 to -1.55 V, C <sub>G</sub> =20 pF
Frequency Adjustment Range	Δf/ΔC <sub>G</sub>	50			ppm	C <sub>G</sub> =5 to 33 pF
S <sub>1</sub> to S <sub>4</sub> KB <sub>1</sub> to KB <sub>4</sub> Input Current	I <sub>IH1</sub>	3	10	30	μA	V <sub>I</sub> =0 V
	I <sub>IL1</sub>			-0.2	μA	V <sub>I</sub> =-1.55 V
AC, T <sub>1</sub> , T <sub>CK</sub> Input Current	I <sub>IH2</sub>	50	150	400	μA	V <sub>I</sub> =0 V
	I <sub>IL2</sub>			-0.2	μA	V <sub>I</sub> =-1.55 V
Common Output Current	I <sub>OH1</sub>	-3	-30		μA	V <sub>O</sub> =-0.2 V
	I <sub>OM1</sub>	3	30		μA	V <sub>O</sub> =-1.35 V
	I <sub>OL1</sub>	3	30		μA	V <sub>O</sub> =-2.9 V
Segment Output Current	I <sub>OH2</sub>	-0.5	-5		μA	V <sub>O</sub> =-0.2 V
	I <sub>OL2</sub>	0.5	5		μA	V <sub>O</sub> =-2.9 V
Lamp Output Current	I <sub>OH3</sub>	-50	-300	-400	μA	V <sub>SS</sub> =-1.3 V, V <sub>O</sub> =-0.6 V
	I <sub>OH4</sub>	-3	-30	-40	μA	Pre-heat, V <sub>SS</sub> =-1.3 V, V <sub>O</sub> =-0.6 V
Buzzer Output Current	I <sub>OH5</sub>	-50	-250	-400	μA	V <sub>SS</sub> =-1.3 V, V <sub>O</sub> =-0.6 V
KS <sub>1</sub> to KS <sub>4</sub> Output Current	I <sub>OH6</sub>	-300			μA	V <sub>O</sub> =-0.3 V
	I <sub>OL6</sub>	2	10	20	μA	V <sub>O</sub> =-0.3 V
Doubler Voltage	V <sub>SHD</sub>	-2.8	-3.0		V	R <sub>L</sub> =3 MΩ, C <sub>1</sub> =C <sub>2</sub> =0.1 μF
Integrated Capacitance	C <sub>D</sub>		20		pF	f=10 kHz, V <sub>p-p</sub> =0.1 V

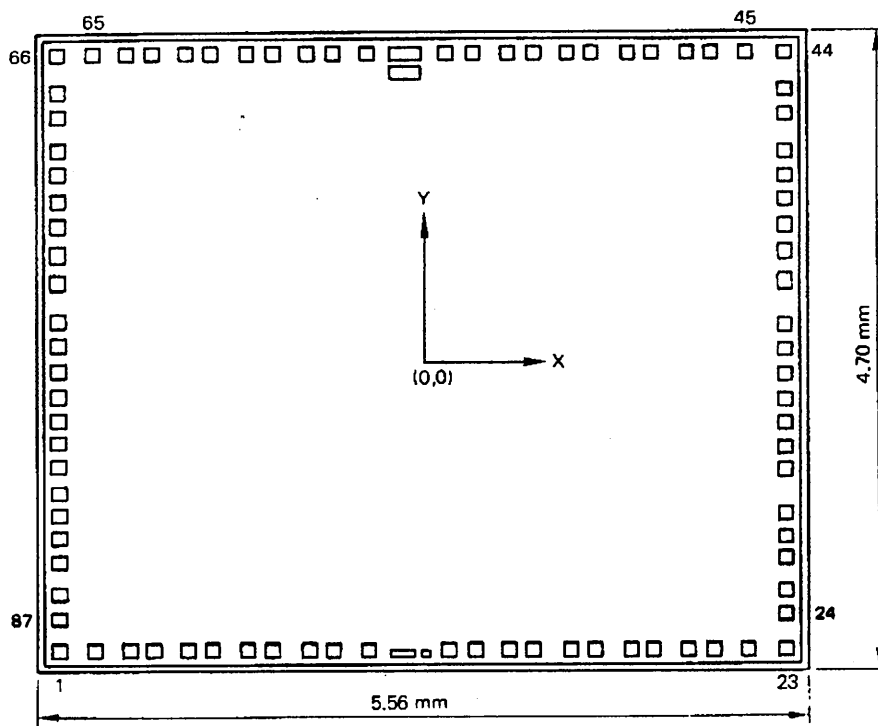
# **ELECTRICAL CHARACTERISTICS (with a lithium battery)**

( $T_a=25\text{ }^{\circ}\text{C}$ ,  $V_{DD}=0\text{ V}$ ,  $V_{SS}=-1.55\text{ V}$ ,  $V_{SH}=-3.1\text{ V}$ ,  $f_o=32.768\text{ kHz}$ ,  $C_I=30\text{ k}\Omega$ ,  $C_G=33\text{ pF}$ ,  $C_D$  is integrated within)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Operating Voltage Range	$V_{SS}$	-1.3		-1.8	V	Functional Operation
	$V_{SH}$	-2.6*		-3.6	V	
Average Current Consumption	$I_{DD}$		0.8	1.2	$\mu\text{A}$	After AC, No load, Chrono. stop
Oscillation Start Voltage	$V_{STA}$	-2.8			V	$t_{STA}\leq 10\text{ s}$
Frequency Stability	$\partial f/\partial V$			3	ppm	$V_{SS}=-1.45\text{ to }-1.55\text{ V}$ , $C_G=20\text{ pF}$
Frequency Adjustment Range	$\partial f/\partial C_G$	50			ppm	$C_G=5\text{ to }33\text{ pF}$
$S_1$ to $S_4$ KB <sub>1</sub> to KB <sub>4</sub> Input Current	$I_{IH1}$	6	20	60	$\mu\text{A}$	$V_I=0\text{ V}$
	$I_{IL1}$			-0.2	$\mu\text{A}$	$V_I=-3.1\text{ V}$
AC, $T_1$ , $T_{CK}$ Input Current	$I_{IH2}$	100	300	800	$\mu\text{A}$	$V_I=0\text{ V}$
	$I_{IL2}$			-0.2	$\mu\text{A}$	$V_I=-3.1\text{ V}$
Common Output Current	$I_{OH1}$	-3	-30		$\mu\text{A}$	$V_O=-0.2\text{ V}$
	$I_{OM1}$	3	30		$\mu\text{A}$	$V_O=-1.35\text{ V}$
	$I_{OL1}$	3	30		$\mu\text{A}$	$V_O=-2.9\text{ V}$
Segment Output Current	$I_{OH2}$	-0.5	-5		$\mu\text{A}$	$V_O=-0.2\text{ V}$
	$I_{OL2}$	0.5	5		$\mu\text{A}$	$V_O=-2.9\text{ V}$
Lamp Output Current	$I_{OH3}$	-50	-300	-400	$\mu\text{A}$	$V_{SH}=-2.6\text{ V}$ , $V_O=-0.6\text{ V}$
	$I_{OH4}$	-3	-30	-40	$\mu\text{A}$	Pre-heat, $V_{SH}=-2.8\text{ V}$ , $V_O=-0.6\text{ V}$
Buzzer Output Current	$I_{OH5}$	-50	-250	-400	$\mu\text{A}$	$V_{SH}=-2.6\text{ V}$ , $V_O=-0.6\text{ V}$
$KS_1$ to $KS_4$ Output Current	$I_{OH6}$	-550			$\mu\text{A}$	$V_O=-0.6\text{ V}$
	$I_{OL6}$	12	60	100	$\mu\text{A}$	$V_O=-0.6\text{ V}$
Halver Voltage	$V_{HLV}$	-1.4			V	$R_L=30\text{ M}\Omega$ , $C_1=C_2=0.1\text{ }\mu\text{F}$
Integrated Capacitance	$C_D$		20		pF	$V=10\text{ kHz}$ , $V_{p-p}=0.1\text{ V}$

\* Instantaneous minimum voltage by the lamp and buzzer driving can be permitted to  $-2.0\text{ V}$ .

# COORDINATES OF PAD

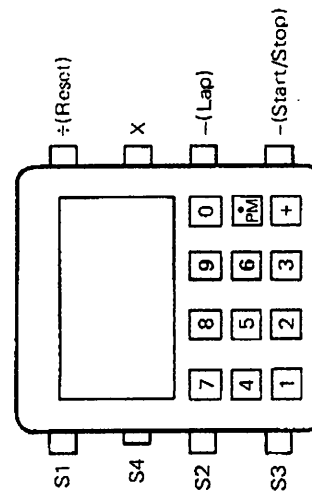
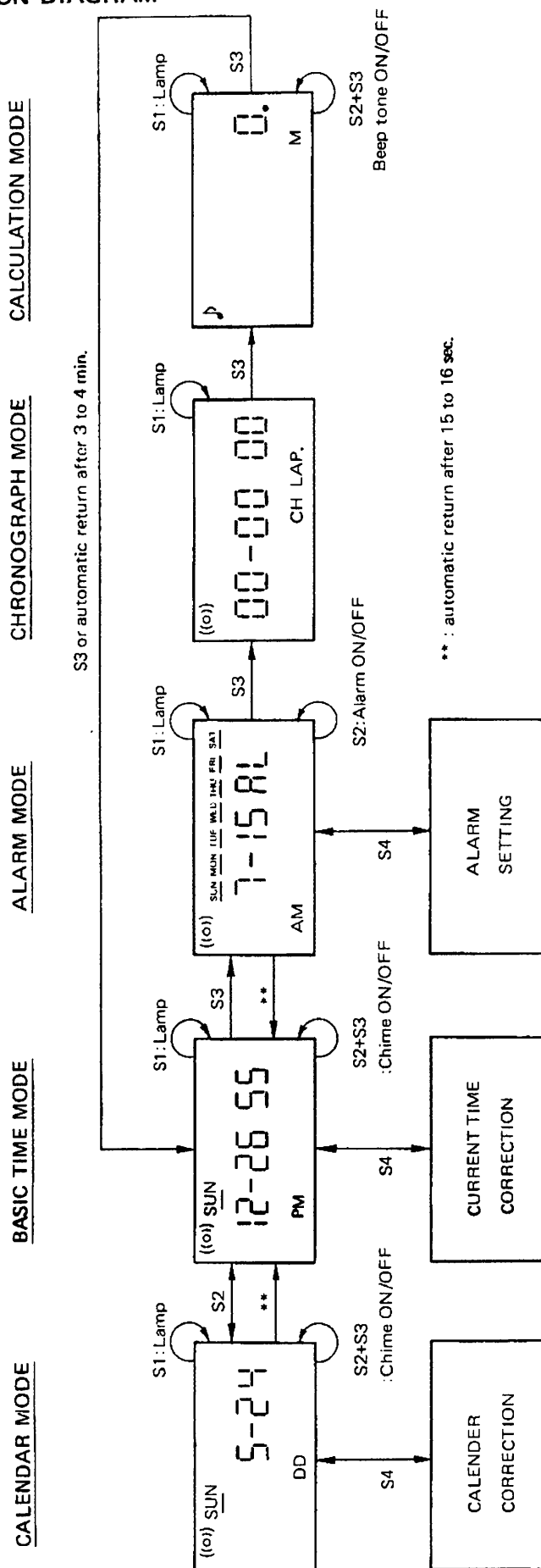


The origin of coordinate is the center of chip.

PAD NO.	TERMINOLOGY	COORDINATES		PAD NO.	TERMINOLOGY	COORDINATES		PAD NO.	TERMINOLOGY	COORDINATES	
		X	Y			X	Y			X	Y
1	NC	-2 662	-2 233	30	VSS	2 662	-624	59	g6/d6	-1 064	2 233
2	NC	-2 374		31	VSH		-442	60	b6/c6	-1 246	
3	NC	-2 119		32	BZ		-260	61	a6/E	-1 500	
4	NC	-1 937		33	VDD		-77	62	f7/e7	-1 683	
5	NC	-1 683		34	TCK		105	63	g7/d7	-1 937	
6	NC	-1 500		35	T1		287	64	b7/c7	-2 119	
7	SAT/h8	-1 246		36	S3		579	65	a7/-	-2 374	
8	FRI/h7	-1 064		37	KS1		761	66	f8/e8	-2 662	
9	THU/h6	-810		38	KS2		944	67	g8/d8		1 937
10	WED/h5	-627		39	KS3		1 126	68	b8/c8		1 755
11	TUE/h4	-373		40	KS4		1 308	69	a8/M		1 500
12	MON/h3	191		41	COM2		1 490	70	KB4		1 318
13	SUN/h2	373		42	f2/e2		1 755	71	KB3		1 136
14	h1/d1	627		43	g2/d2		1 973	72	KB2		954
15	b1/c1	810		44	b2/c2		2 233	73	KB1		772
16	a1/g1	1 064		45	a2/SET	2 374		74	S2		590
17	f1/e1	1 246		46	f3/e3	2 119		75	VSSF		321
18	((o))/PM	1 500		47	g3/d3	1 937		76	DC		139
19	Δ/AM	1 683		48	b3/c3	1 683		77	CIN		-43
20	NC	1 937		49	a3/DD	1 500		78	BKC		-225
21	NC	2 119		50	f4/e4	1 246		79	VSH		-407
22	NC	2 374		51	g4/d4	1 064		80	VSS		-590
23	NC	2 662		52	b4/c4	810		81	X OUT		-772
24	NC		-1 937	53	a4/CH	627		82	X IN		-954
25	NC		-1 755	54	f5/e5	373		83	AC		-1 136
26	COM1		-1 490	55	g5/d5	191		84	S1		-1 318
27	S4		-1 308	56	b5/c5	-373		85	NC		-1 500
28	LD		-1 126	57	a5/LAP	-627		86	NC		-1 755
29	VS8		-803	58	f6/e6	-810		87	NC		-1 937

(UNIT: μm)

## OPERATION DIAGRAM



- NOTE
1. Chime ON/OFF can be set by simultaneously depressing buttons  $\textcircled{S2}$  and  $\textcircled{S3}$  sequentially in the basic time and calendar mode.
  2. Beep tone ON/OFF can be set by simultaneously depressing buttons  $\textcircled{S2}$  and  $\textcircled{S3}$  sequentially in the calculation mode.
  3. Alarm sound can be monitored by continued depression of button  $\textcircled{S2}$  for a few seconds in the alarm mode.



## DESCRIPTION OF FUNCTION

### (1) BASIC TIME FUNCTION

- Day of week, hour, minute and second are displayed.
- A day of the week is displayed with a flag.
- If button (S1) is depressed (terminate to VDD; hereinafter omitted), lamp is on as long as it is depressed.
- By depressing buttons (S2) and (S3) simultaneously, chime ON/OFF can be set.  
Chime ON/OFF can be discerned by the mark "♪".  
When the chime mark "♪" is displayed, the time signal will ring hourly, while no time signal will ring when it is off.  
Chime ON/OFF repeats ON→OFF every time when buttons (S2) and (S3) are depressed simultaneously.
- When alarm is ON, the alarm set mark "⌚" is displayed.

### < BASIC TIME SETTING >

- Set time desired to be set (hour, minute) with the numerical keys and depressed button (S4) in tune with radio chime, by which accurate time setting can be done. In this case, "second" starts from 00 second.

Example : Setting to 5:24 p.m. (in case of setting under 12-hour system)

	Example of operation	Display
1	Set to basic time display	SUN PM 1 2 - 26 55
2	Depresse button (S4) (enter into time setting mode)	PM 1 2 - 26 50 SET
3	Time entry [5] [2] [4] (Second is set automatically to 00)	AM 0 5 - 24 00 SET
4	Designation of p.m. (a.m. "AM" and p.m. "PM" are set alternately at each time of depression.)	PM 0 5 - 24 00 SET
5	Depress (S4) (in tune with radio chime)	SUN PM 5 - 24 01

⌚ : "SET" flash at 2 Hz with 50 % duty.

### ★ TIME ENTRY

- Setting can be done under 12-hour system or 24-hour system.
- For hour system switchover, on basic time display, depress button (S4) for changeover to time setting mode and, in this mode, depress button (S2) by which hour system is switched over at each time of depression.

	Example of operation	Display
1	Depress (S2) (resulting in 24-hour display)	1 7 - 24 24 SET
2	Depress (S2) (resulting in 12-hour display)	PM 5 - 24 25 SET

- For setting under 24-hour system, set hour system to 24-hour system and then set time. Be sure to enter numbers in two digits by adding 0, as required.

Example : Seven past nineteen-**[1][9][0][7]**

- In case **[PM]** key is depressed after inputting time under 24-hour system, if the time entered is within the time range of 12-hour system, the afternoon mark "PM" is displayed and the time is set under 12-hour system, whereas it is indicated under 24-hour system if reset to basic time display.
- If mistaken keys are depressed, depress button **(S3)** to return display to 0 display and then enter correct numbers anew.
- In case time outside the setting range is set, it results in set error and the display mark "E" is displayed.
- If set error has arisen, return display to 0 by depressing button **(S3)** and enter correct numbers or, as it is, enter hour and minute correctly with the numerical keys. Then set error is cleared and error display mark "E" goes out.

Example of set error

	Example of operation	Display
1	Entry of hour and minute <b>[1][7][2][4]</b>	1 7 - 24 00 SET
2	Entry of <b>[8]</b> subsequently	7 2 - 48 00 SET
3	Depress <b>(S4)</b> (Set error)	7 2 - 48 00 SET E

- Correction of less than 30 seconds can be made by depressing button **(S4)** on basic time display to switch-over time setting mode and, in this condition, depressing button **(S4)**. In case the number of seconds is 00 sec. to 29 sec., second become 00 and minute remains the same. In case the number of seconds is 30 sec. to 59 sec., second becomes 00 and one minute is added.
- When button **(S3)** is depressed during time setting mode and display is reset to 0, if button **(S2)** is depressed, all segments go on during the time it is depressed.
- If button **(S3)** is depressed in time setting mode to set display to 0 and button **(S4)** is depressed subsequently, time before entering the setting mode is restored. In this case, the current time is counted continuously even during time setting mode.

## (2) CALENDAR FUNCTION


- If button **(S2)** is depressed on basic time display mode, calendar mode is selected and calendar is displayed. At this time the calendar display mark "DD" is displayed.
- Month, date, day of week are displayed.
- A day of week is displayed by a flag.
- If button **(S1)** is depressed lamp is on as long as it is depressed.
- If buttons **(S2)** and **(S3)** are depressed simultaneously, chime ON/OFF can be set.
- When alarm is ON, the alarm set mark "⌚" is displayed.
- If no operation is performed after display of calendar, the mode returns automatically to the basic time mode after 15 to 16 sec..

## < CALENDAR SETTING >

Set year, month and date with the numerical keys and depress button (S4). The day of the week is set automatically.

Example : Setting to May 24th, 1981.

	Example of operation	Display
1	Set to calendar display	<div> <div>(10)</div> <div>DD</div> <div>5 - 2 3</div> <div>SET</div> </div>
2	Depress (S4) (resulting in setting mode)	<div> <div>8 1 - 5 - 2 3</div> <div>SAT</div> <div>DD</div> </div>
3	Enter year, month and date [8] [1] [0] [5] [2] [4]	<div> <div>8 1 - 0 5 - 2 4</div> <div>SAT</div> <div>DD</div> </div>
4	Depress (S4)	<div> <div>((10)) SUN</div> <div>DD</div> <div>5 - 2 4</div> </div>

 : "SET" flashing at 2 Hz, 50 % duty

## ★ CALENDAR ENTRY

- March 1st, 1980 to December 31th, 1999 A.D. can be set.
- With regard to year, be sure to enter the last two digits of the year A.D.
- In case month or date comprises one digit, be sure to enter numbers in two digits by adding 0.

Example : May 24th, 1981 - - - - - [8] [1] [0] [5] [2] [4]

- Since the number of date of a month, leap year and day of week are discriminated automatically, a day of the week is set automatically if year, month and date are entered.
- If mistaken keys are depressed, depress button (S3) to return display to 0 and then enter correct numbers anew.
- If calendar outside the setting range is set or a day not in the calendar is set, it results in set error and the error display mark "E" is displayed.
- If set error has arisen, depress button (S3) to return display to 0 and then enter numbers correctly or, as it is, enter year, month and date correctly with the numerical keys and set error will be cleared and the error display mark 'E' goes out.
- If button (S3) is depressed in the setting mode to set display to 0 and button (S4) depressed subsequently, the calendar before entering the setting mode is restored.

## (3) ALARM TIME FUNCTION

- If button (S3) is depressed on the basic time display, alarm mode is selected and the alarm time hour, minute, day of week is displayed.  
In this case, the alarm display mark "AL" is displayed alphanumerically.
- Available as daily alarm or weekly alarm.
- When daily alarm is set, all day of week flags are displayed.
- When weekly alarm is set, the flags on the day of the week to which alarm is set are displayed.
- If button (S1) is depressed, lamp is on as long as it is depressed.
- At each time button (S2) is depressed, alarm ON/OFF is set alternately.
- When alarm is ON, the alarm set mark "((10))" is displayed.
- Trial alarm (alarm monitor) is possible by depressing button (S2) for a few seconds continuously.
- If no operation is performed after display of alarm time in the alarm mode, the basic time mode is restored automatically after 15 to 16 seconds to display the basic time.

- The 12-hour system and 24-hour system of alarm time are displayed, linked with 12-hour and 24-hour systems of basic time display.

#### < ALARM TIME SETTING >

- For setting, either of 12-hour and 24-hour systems can be applied, (Refer to par. "basic time")  
There are two ways of setting, that is, daily alarm setting and weekly alarm setting.

Example 1 : Daily alarm setting (setting to 7:15 a.m.)

	Example of operation	Display							
		((oi))	SUN	MON	TUE	WED	THU	FRI	SAT
1	Set to alarm display	7	-	3	0			A	L
		PM							
2	Depress button (S4) (resulting in setting mode)	7	-	3	0			A	L
		PM	SET						
3	Enter time [7][1][5]	0	7	-	1	5		A	L
		AM	SET						
4	Depress set button (S4)	((oi))	7	-	1	5		A	L
		AM							

Example 2 : Weekly alarm setting (setting to 8:30 p.m. on WED., THU., FRI. and SAT.)

	Example of operation	Display							
		((oi))	SUN	MON	TUE	WED	THU	FRI	SAT
1	Set to alarm display	7	-	1	5			A	L
		AM							
2	Depress button (S4) (resulting in setting mode)	7	-	1	5			A	L
		AM	SET						
3	While depressing button (S2), depress keys [0], [1], [2] to clear Sun., Mon. and Tue.	7	-	1	5	WED	THU	FRI	SAT
		AM	SET						
4	Enter time [8][3][0]	0	8	-	3	0		A	L
		AM	SET						
5	Designation of p.m. [PM] (At each time of depression AM and PM are set alter- nately).	0	8	-	3	0		A	L
		PM	SET						
6	Depress set button (S4).	8	-	3	0			A	L
		PM							

- Even in the condition of alarm OFF (alarm set mark "((oi))" is off), if alarm time or day of week is set newly, automatic setting to alarm ON takes place and the alarm set mark "((oi))" is displayed.
- For setting of days of the week in alarm setting, set days of the week by depressing keys [0] - [6] corresponding to the day of the week while depressing button (S2).

- Correspondence of keys to day of week

0 ..... Sunday alarm ON/OFF

1 ..... Monday alarm ON/OFF

2 ..... Tuesday alarm ON/OFF

3 ..... Wednesday alarm ON/OFF

4 ..... Thursday alarm ON/OFF

5 ..... Friday alarm ON/OFF

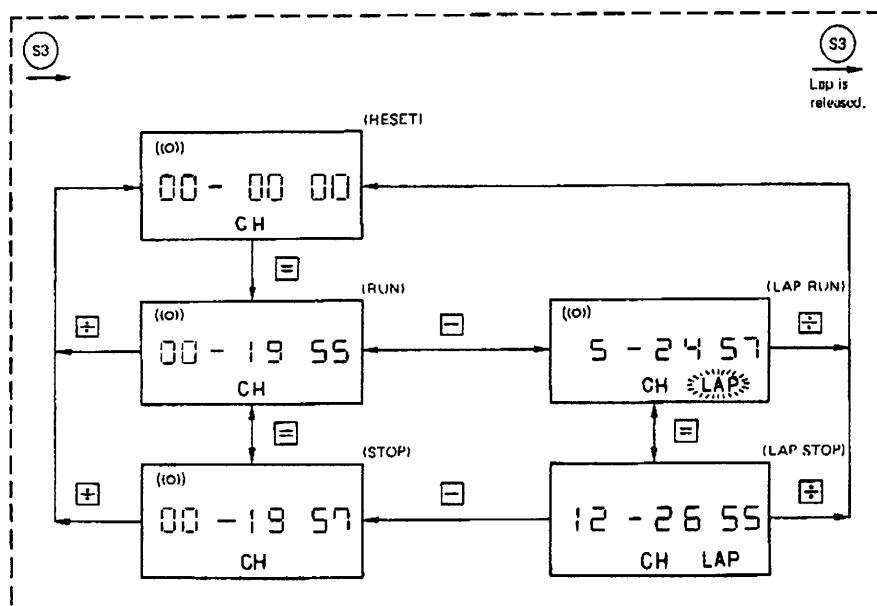
6 ..... Saturday alarm ON/OFF

- If button (S2) is depressed during setting mode, all day of week flags flash at 2 Hz 50 % duty. At this time all days of week are set.
  - If an alarm time outside the setting range is set, set error arises and the error display mark 'E' is displayed.
  - When set error has arisen, depress button (S3) to reset display to 0 and enter numbers correctly anew or, as it is, enter the alarm time correctly with the numerical keys; set error is cleared thereby and the error display mark "E" goes out.
  - If button (S3) is depressed in the setting mode to set display to 0 and button (S4) is depressed subsequently, time before entering the setting mode is restored.
- However, in the case of correction made of day of week in weekly alarm, day of week setting is effective.

#### (4) CHRONOGRAPH FUNCTION

- If button (S3) is depressed on alarm time display, the chronograph mode is selected. At this time the chronograph display mark "CH" is displayed.
  - If the measuring time is less than an hour, 00 min. 00 sec. 00 to 59 min. 59 sec. 99 are displayed and if over an hour, 1 hr. 00 min. 00 sec. to 23 hr. 59 min. 59 sec. are displayed.
- The time counter is reset in 24 hours and time counting is resumed from 0 hr. 00 min. 00 sec. 00.
- If the key [=] is depressed in the status "RESET" and "STOP", the status "RUN" is brought about and time counting start, whereas if depressed in the status "RUN", the status "STOP" is brought about.
  - If the key [LAP] is depressed in the status "RUN", the status "LAP RUN" is brought about and lap time displayed. If depressed in the status "LAP RUN" or "LAP STOP", lap is released, leading to the status "RUN" or "STOP", respectively.
  - In the status "RUN", the chronograph display "CH" flashes at 2 Hz 50 % duty.
  - Depression of the key [÷] effects resetting from any status.
  - Depression of the button (S3) causes a shift to the calculation mode and lap is cleared.
  - In the chronograph mode, a beep tone will sound at each time when the key [=], [LAP] or [÷] is depressed.

#### Chronograph sequence



## (5) CALCULATION FUNCTION

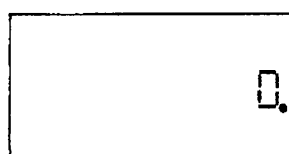
- If button (S3) is depressed in the chronograph mode, the calculation mode is selected and 0 is displayed in "all clear" status.

- Calculations : 8-digit, addition, subtraction, multiplication and division, memory calculation, constant calculation, even counter, overflow check function and automatic reset function

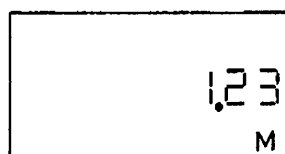
- Effective keys and their function

	: Numerical keys
	: Decimal point key
	: Memory of arithmetic instruction for addition, subtraction, multiplication and division. Memory of arithmetic instruction after execution of operation in case arithmetic instruction had been stored. Push change possible among 4-function keys. In multiplication, multiplicand is constant and operands are constants in others.
	: Execution of stored arithmetic instruction and execution of constant calculation.
	: Addition and subtraction of display content to and from memory. Execution of operation in case arithmetic instruction for multiplication or division has been stored, and addition or subtraction of result to or from memory.
	: Recall of memory content
	: Clearing of memory content
	: Lamp is on as long as this is depressed.
	: By simultaneous ON, a beep tone ON/OFF in calculation mode is possible.
	: "Clear entry" operation at time of registration. "Clear" operation in other statuses and overflow error. After calculation, if this button is depressed when 0 is displayed, the basic time mode is selected.

- Display format

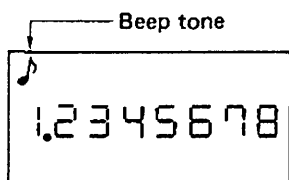


Display after clearing



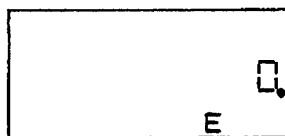
1.23 (Memory)

Memory



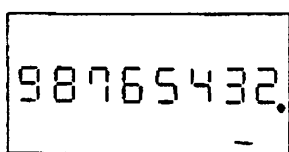
1.2345678

Beep tone



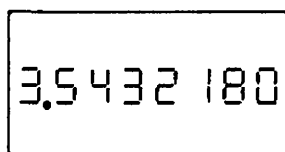
Complete error  
(÷ 0 or memory overflow)

Error



-9876532

Negative number



Rough estimate display of overflow  
(3.5432180 x 10<sup>8</sup>)

○ Four functions

Exercise	Example of operation	Display
$13.5 + 68 - 88 = -6.5$	$\textcircled{S3} 13.5 \text{ [ + ] } 68 \text{ [ - ] } 88 \text{ [ = ]}$	<u>65</u>
$75 \times 11 \div 40 = 20.625$	$\textcircled{S3} 75 \text{ [ x ] } 11 \text{ [ ÷ ] } 40 \text{ [ = ]}$	20.625

In the calculation mode, button  $\textcircled{S3}$  functions as a clear switch.

○ Memory calculation

In the calculation mode, button  $\textcircled{S2}$  functions as a function switch for memory calculation.

(If  $\textcircled{S2}$  is depressed once, "M" mark flashes, indicating that memory function is effective. If, at this time,

$\textcircled{S2}$  is depressed once more, flashing of "M" mark ceases and memory function is cleared).

$\textcircled{S2}$  [ + ] : Memory-plus (Addition to memory)

$\textcircled{S2}$  [ - ] : Memory-minus (Subtraction from memory)

$\textcircled{S2}$  [ = ] : Memory-recall (Call of memory to display)

$\textcircled{S2}$   $\textcircled{S3}$  : Memory-clear (Setting memory to 0)

As above, if one depress [ + ], [ - ], [ = ],  $\textcircled{S3}$  after depressing  $\textcircled{S2}$  (at time when "M" mark is flashing), memory calculation can be performed.

Example of operation	Display	Memory content	Explanation
$\textcircled{S2} \textcircled{S3} \textcircled{S3}$	0.	0.	Memory and display are cleared.
15 $\textcircled{S2}$ [ + ]	15. M	15.	15 is added to memory.
13.6 $\textcircled{S2}$ [ - ]	13.6 M	1.4	13.6 is subtracted from memory.
$\textcircled{S2}$ [ = ]	1.4 M	1.4	Memory call
$\textcircled{S2} \textcircled{S3}$	1.4	0.	Memory clear

On "M" mark:

"M" mark ON : Memory content other than 0

"M" mark OFF : Memory content 0

"M" mark flash : Memory function effective.

- Constant calculation  
Constant are set automatically.

Exercise	Example of operation	Display
$8 + 13 = 21$ $18 + 13 = 31$	$(S3) 8 + 13 =$ $18 =$	$21.$ $31.$
$79 - 11 = 68$ $47 - 11 = 36$	$(S3) 79 - 11 =$ $47 =$	$68.$ $36.$
$62 \times 3.9 = 241.8$ $62 \times 4.8 = 297.6$	$(S3) 62 \times 3.9 =$ $\times 4.8 =$	$241.8$ $297.6$
$60 \div 9.6 = 6.25$ $1.92 \div 9.6 = 0.2$	$(S3) 60 \div 9.6 =$ $1.92 =$	$6.25$ $0.2$

In addition, subtraction and division, operands are set as constants and in multiplication, multiplicand is set as constant.

Counting can be performed in utilizing constant calculation.

- Application as up-counter

	Example of operation	Display	Explanation
Initial set point →	$(S3) 0 + 1 =$	1.	$0 + 1 = 1$
	$=$	2.	$1 + 1 = 2$
	$=$	3.	$2 + 1 = 3$
	$=$	4.	$3 + 1 = 4$
	$\vdots$	$\vdots$	



\*\*\*\*\*。要求二。Application as Down-counter : PROOF

\*\*\*\*\*

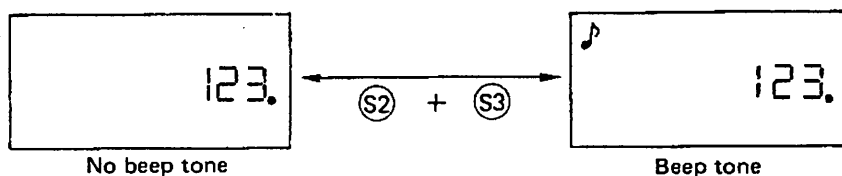
処理日 束 件数

950516

2

Example of operation	Display	Explanation
(S3) 100	100	Initial set point 100
$\boxed{-} 1 \boxed{=}$	99	$100 - 1 = 99$
$\boxed{=}$	98	$99 - 1 = 98$
$\boxed{=}$	97	$98 - 1 = 97$
$\boxed{=}$	96	$97 - 1 = 96$
⋮	⋮	
⋮	⋮	
⋮	⋮	

- Beep tone ON/OFF



- A beep tone ON/OFF changeover can be made by simultaneous depression of (S2) and (S3). (Depress (S2) first).
- If (S2) is depressed first and then (S3) is depressed, the function of (S2) as a memory function switch is cleared at the time when (S3) is depressed.
- The mark "♪" in the calculation mode is a beep tone ON mark, is not a chime ON mark. In the calculation mode, the alarm mark "⌚" is also not displayed, but if alarm and chime have been set, both alarm and chime sound.

#### (6) INITIAL STATUS AFTER ALL CLEAR

- Display mode Basic time
- Basic time Jan. 1st, 1981 A.D. 12:00 a.m. 12 hour system
- Alarm 12:00 a.m. alarm OFF, daily alarm
- Chronograph Reset
- Calculator Memory content 0, beep tone OFF
- Chime OFF

MINCS-3

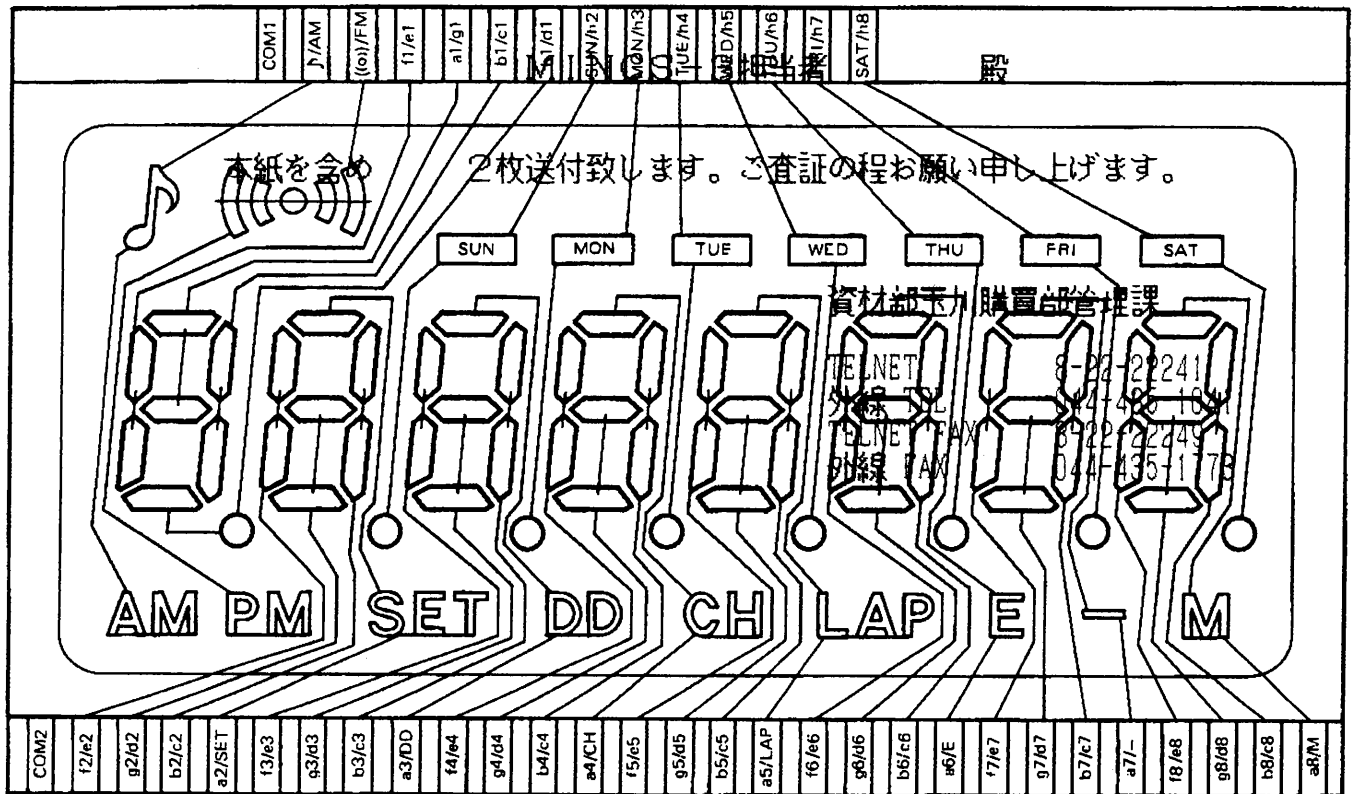
FAX送付票

95年05月16日

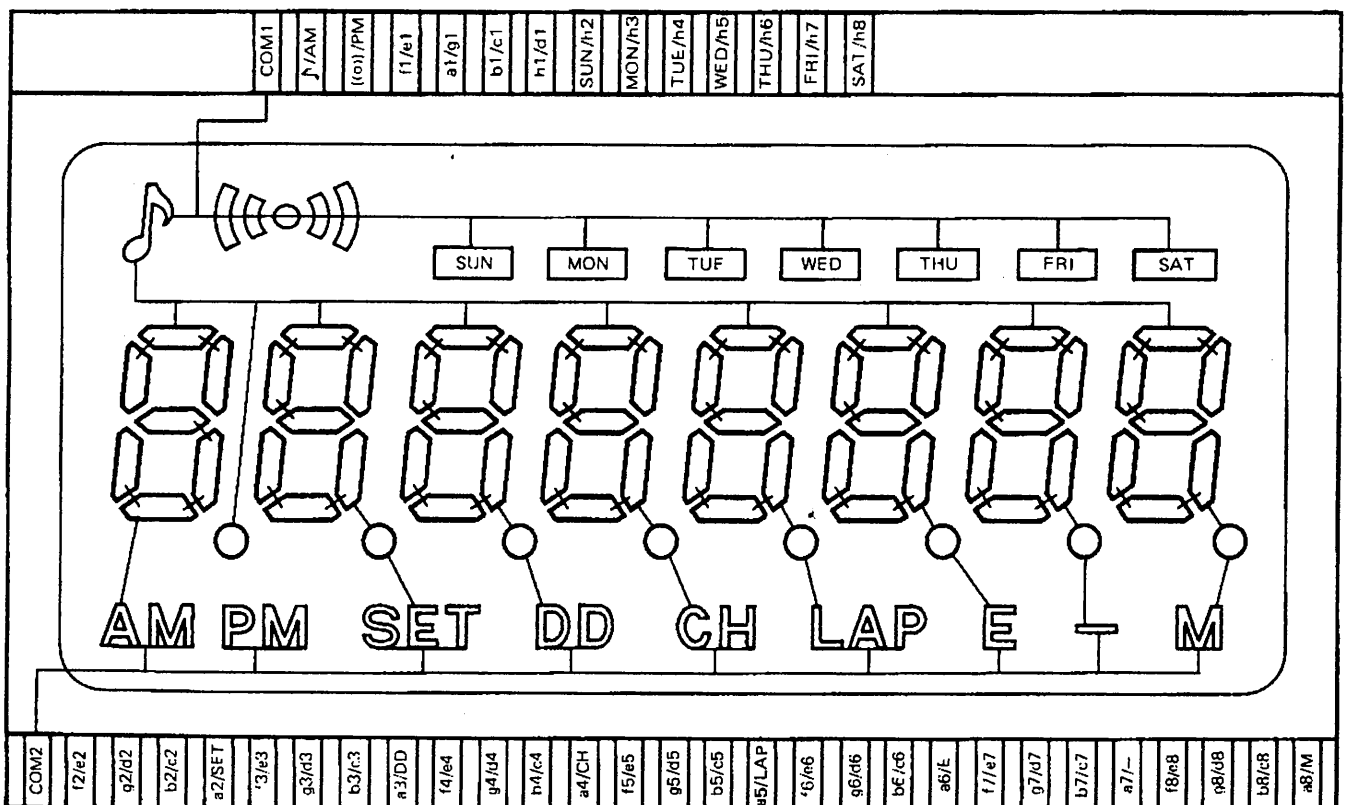
## LIQUID CRYSTAL PATTERN

マイクロコンピュータ技術部

Segment



Common



MINCS-3

FAX送付票

95年05月17日

# DISPLAY FORMATS

超高周波・光デバイス技術部

0 1 2 3 4 5 6 7 8 9 MINCS-3 担当者 殿

本紙を含め 2枚送付致します。ご査証の程お願い申し上げます。

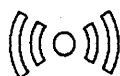


Chime ON mark (time mode)

Beep tone ON mark (calculation mode)

CH

Chronograph mode mark



Alarm set mark

LAP

Chronograph lap mark

AM

AM mark

TELNET

8-22-22241

外線 TEL

044-435-1041

TELNET FAX

Error mark

外線 FAX

044-435-1773

PM

PM mark

=

Minus mark

SET

Setting mode mark

M

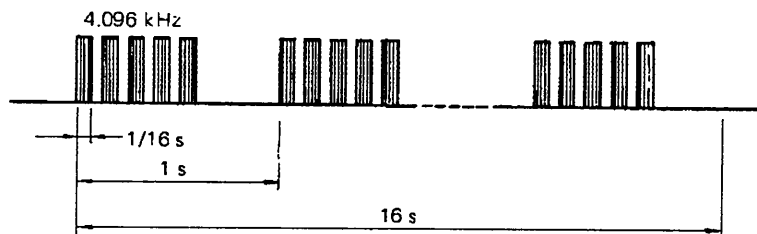
Memory mark

DD

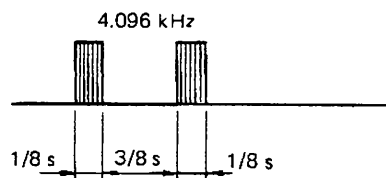
Calendar (Day Date) mode mark

## BUZZER SIGNAL OUTPUT

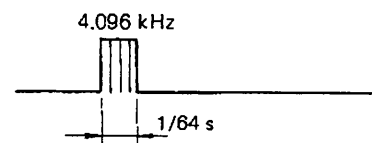
Alarm



Chime



Beep tone



\*\*\*DESCRIPTION OF PAD : PROOF

\*\*\*\*\*

処理日 東 件数

950517  
○ X IN ..... oscillator stage inverter input  
○ X OUT ..... oscillator stage inverter output

(2) Power Supply Circuit, Voltage Doubler and Halver Pad

Power supply backup circuit is provided for the use of lithium battery. For exchange of lithium battery and silver oxide battery, change connections following the table below.

battery Pad	silver oxide battery	lithium battery
VDD	battery (+) common line	battery (+) common line
VSS	battery (–) line	C to VDD
VSH	C to VDD	battery (–) line
VSB	VSS	VSH
BKC	VDD	VSH
VSSF	C to VDD	
CIN	C to DC	
DC	C to CIN	

C : capacitor of 0.068–0.33  $\mu$ F

(3) Input Pad

All input pads are pulled down to V<sub>SB</sub> by internal resistors.

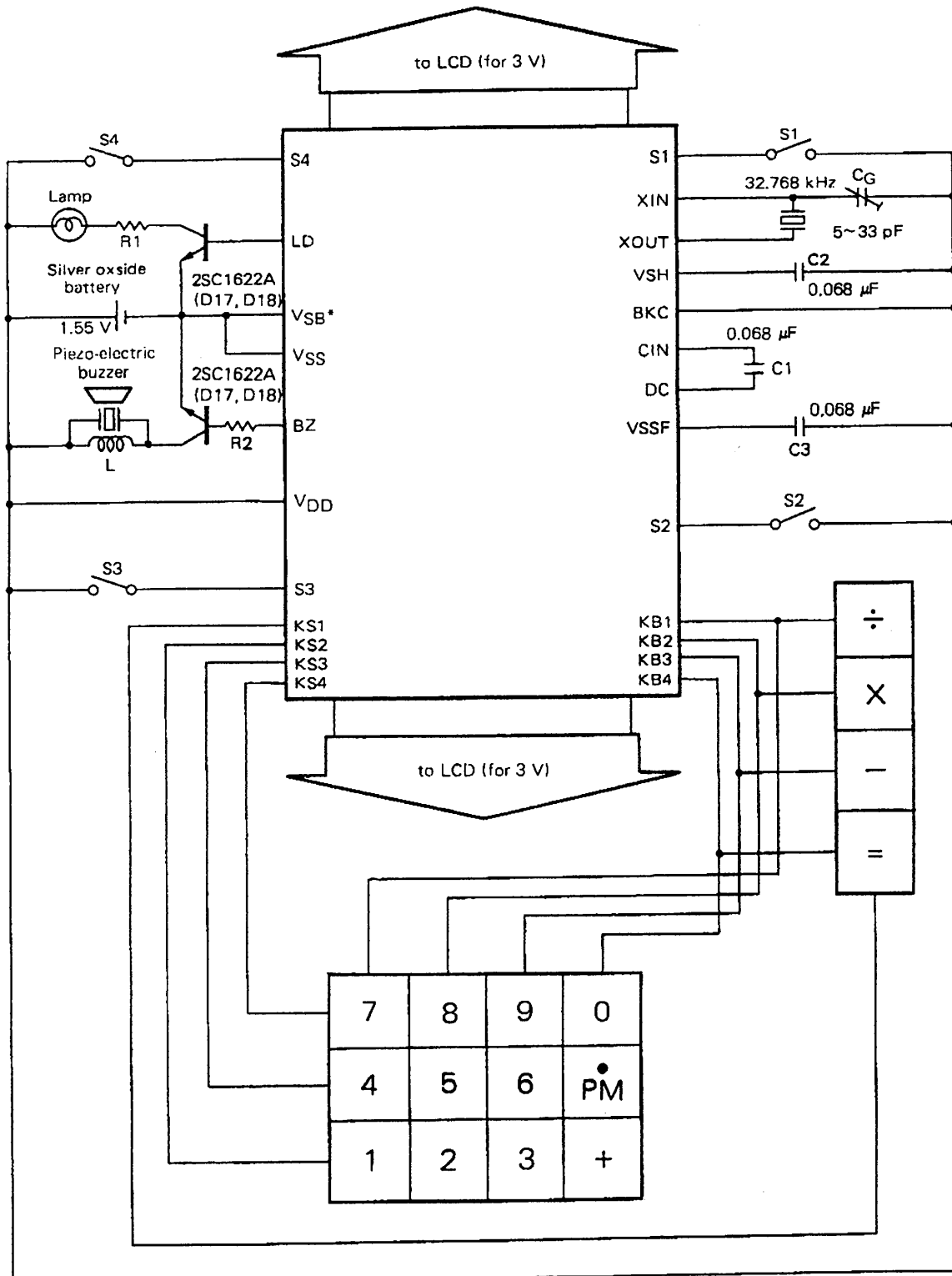
- S1–S4 ..... switch inputs.
- TCK ..... test clock input, to be kept open normally.
- T1 ..... test input, to be kept open normally.
- KB1–KB4 ..... key return inputs.
- AC ..... all clear input.

(4) Output Pad

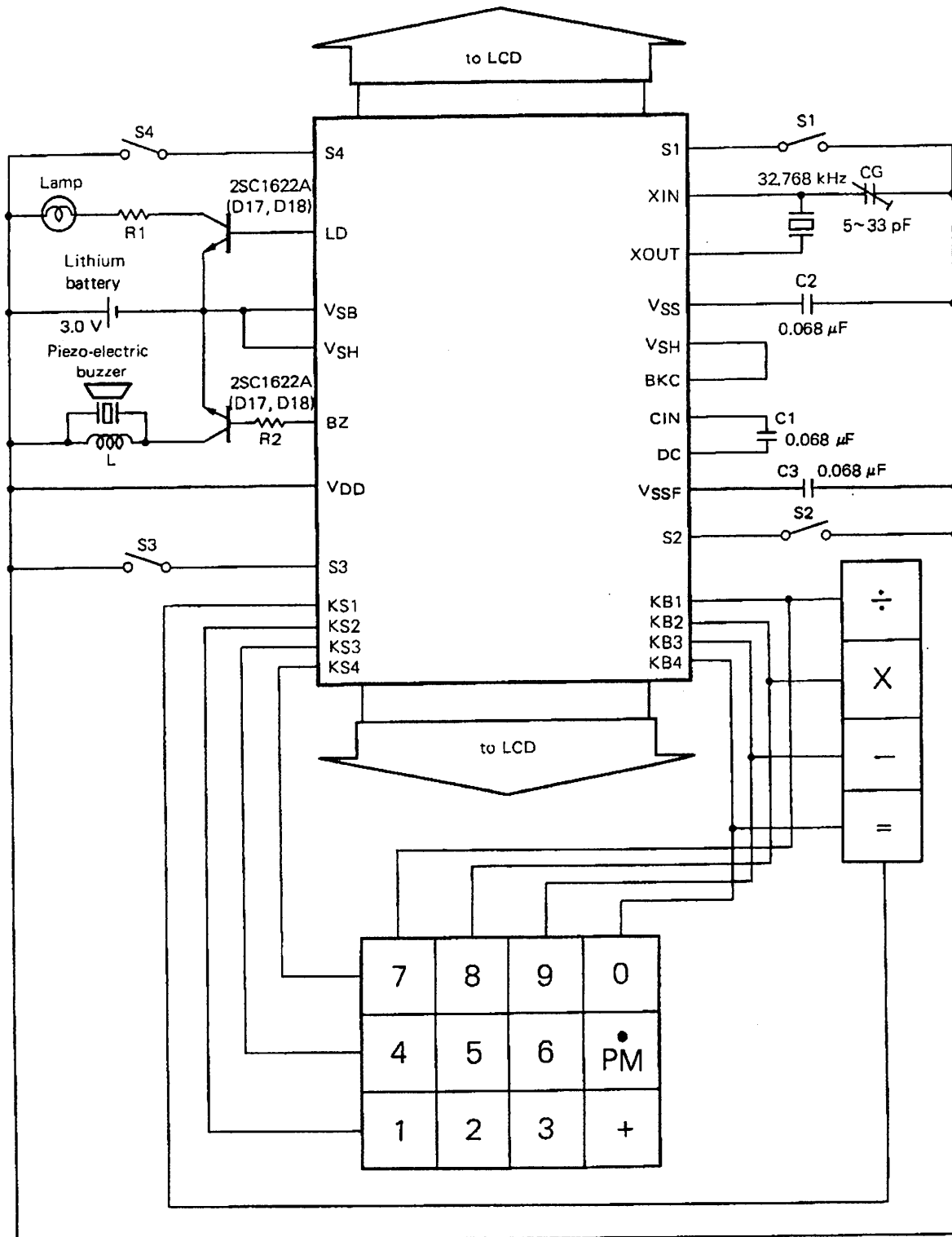
- LD ..... lamp output
- BZ ..... buzzer outout
- KS1–KS4 ..... key scan outputs.
- COM1, COM2 .... LCD common outputs
- J/AM–SAT/h8 ... LCD segment outputs

## APPLICATIONS

Example of application (silver oxide battery use)



Example of application (lithium battery use)



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