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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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MOS INTEGRATED CIRCUIT
μPD17012GF-071

**4-BIT SINGLE-CHIP MICROCONTROLLER WITH ON-CHIP
 PRESCALER, PLL FREQUENCY SYNTHESIZER, LCD CONTROLLER/
 DRIVER, AND FREQUENCY COUNTER FOR FM, AM (MW, LW),
 AND SW RADIO UNITS FOR PERSONAL STEREO SET**

The μPD17012-071 is a 4-bit CMOS microcomputer with a PLL frequency synthesizer, which performs digital tuning to receive worldwide FM, AM (MW, LW), and SW bands.

The on-chip PLL frequency synthesizer, controller, prescaler, LCD controller/driver, and frequency counter constitute a one-chip high-performance FM, AM, SW tuner with a clock function for personal stereo systems.

FEATURES

- Reception of worldwide FM, AM, and SW bands
- Versatile station selection functions, including manual tuning, automatic tuning, and preset memory (direct, scan)
- Independent preset memory for twenty FM, ten AM, and ten SW stations
- A last-channel memory for each of FM, AM, and SW bands
- Outputs MONO control signal and displays "MONO" in monoral mode.
- Displays "ST" in stereo mode.
- Auto-preset memory function
- Outputs LOUD control signal and displays "LOUD" in loudness mode.
- 12- or 24-hour clock function
- Everyday timer function (Automatically turned off in 60 when setting ON time only.)
- Once timer function (Automatically turned off in 60 minutes when setting On time only.)
- Sleep timer function (Automatically turned off in 60 minutes. Settable in 10-minute steps.)
- Single power supply of 5 V ±10 %
- On-chip prescaler (150 MHz max. $V_{IN} = 0.3 V_{P-P}$), frequency counter, LCD controller/driver (1/3 duty, 1/2 bias drive, frame frequency of 167 Hz)
- Remotely controllable reception (with μPD6121G-002 or μPD6122G-002 used as remote controller IC)
- Electronic sound control (volume, balance, bass, treble, and loudness) can be connected (supports the I²C bus).

Ordering Information

Part number	Package	Quality Grade
μPD17012GF-071-3BE	64-pin plastic QFP (14 × 20 mm)	Standard

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

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MAJOR FUNCTIONS

◦ **RECEIVING FREQUENCIES, CHANNEL SPACINGS, REFERENCE FREQUENCIES AND INTERMEDIATE FREQUENCIES**

Area	Band		Receiving frequency	Channel spacing	Reference frequency	Intermediate frequency
Eastern Europe	FM		87.5 – 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	AM	MW	522 – 1620 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
		LW	144 – 290 kHz	1 kHz	1 kHz	450 kHz/10.71 MHz
Western Europe	FM		87.5 – 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	AM	MW	522 – 1620 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
		LW	144 – 290 kHz	1 kHz	1 kHz	450 kHz/10.71 MHz
China	FM		87.0 – 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	AM	MW	522 – 1611 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
Australia, Middle and Near East	FM		87.5 – 108.0 MHz	100 kHz	25 kHz	10.7 MHz
	AM	MW	531 – 1602 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
America 1 (Central and South America)	FM		87.5 – 108.0 MHz	100 kHz	25 kHz	10.7 MHz
	AM	MW	530 – 1710 kHz	10 kHz	10 kHz	450 kHz/10.71 MHz
America 2	FM		87.5 – 107.9 MHz	200 kHz	25 kHz	10.7 MHz
	AM	MW	530 – 1620 kHz	10 kHz	10 kHz	450 kHz/10.71 MHz
America 3 (USA)	FM		87.5 – 107.0 MHz	200 kHz	25 kHz	10.7 MHz
	AM	MW	530 – 1710 kHz	10 kHz	10 kHz	450 kHz/10.71 MHz
Japan	FM		76.0 – 90.0 MHz	100 kHz	25 kHz	– 10.7 MHz
	AM	MW	522 – 1629 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
All areas above except Eastern Europe and China	SW	1	3.2 – 7.3 MHz	5 kHz	5 kHz	450 kHz/10.71 MHz
		2	9.5 – 17.9 MHz	5 kHz	5 kHz	450 kHz/10.71 MHz
China	SW	1	2.28 – 6.23 MHz	5 kHz	5 kHz	450 kHz/10.71 MHz
		2	7.1 – 21.85 MHz	5 kHz	5 kHz	450 kHz/10.71 MHz

● RADIO FUNCTIONS

(1) Manual tuning

Type	Operation
Manual UP/DOWN	Moves up and down the frequency in channel space units.

(2) Auto-tuning

Type	Operation
Seek UP/DOWN	Seeks a radio station in UP or DOWN direction, and holds the frequency for the sought station. In seeking, the channel spacing for LW is the same as that for MW.

(3) Preset tuning

Type	Operation										
Direct	<p>Receives a frequency written in each preset memory.</p> <p style="text-align: center;">Presettable stations by band (MAX.)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Band Area</th> <th style="text-align: center;">FM</th> <th style="text-align: center;">AM (MW, LW)</th> <th style="text-align: center;">SW (SW1, SW2)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Eastern Europe</td> <td rowspan="2" style="text-align: center;">20</td> <td rowspan="2" style="text-align: center;">10</td> <td style="text-align: center;">-</td> </tr> <tr> <td style="text-align: center;">Others</td> <td style="text-align: center;">10</td> </tr> </tbody> </table>	Band Area	FM	AM (MW, LW)	SW (SW1, SW2)	Eastern Europe	20	10	-	Others	10
Band Area	FM	AM (MW, LW)	SW (SW1, SW2)								
Eastern Europe	20	10	-								
Others			10								
Preset memory UP/DOWN	Moves up or down the preset memory by one station. (Specifiable with remote controller keys only.)										
Preset memory scan	Receives frequencies written in the preset memory for the currently received band (FM/AM/SW) for five seconds each.										
Auto-store memory	Seeks station frequencies in the currently received band (FM/AM/SW), and automatically writes them in the preset memory.										

(4) MONO (monaural) control output and display of "MONO"

(5) Display of "ST" by \overline{ST} (stereo) input

- **TAPE FUNCTION**

- (1) Tape mode control output, and display of "TAPE"
- (2) Remote control decoder output (8 keys)

- **CD FUNCTION**

- (1) CD mode control output and display of "CD"
- (2) Remote control decoder output (16 keys)

- **AUX FUNCTION**

- (1) AUX mode control output and display of "AUX"

- **CLOCK FUNCTION**

- (1) Selection of 12-hour (with "AM" or "PM" indication)/24-hour display
- (2) Selection of flashing of ":" (colon)
- (3) Display of unadjusted clock

When V_{DD} is supplied for the first time, or when the CE pin goes from low to high, the clock indication blinks (at 1 Hz in 1/2 duty cycle) to show that the clock is to be adjusted.

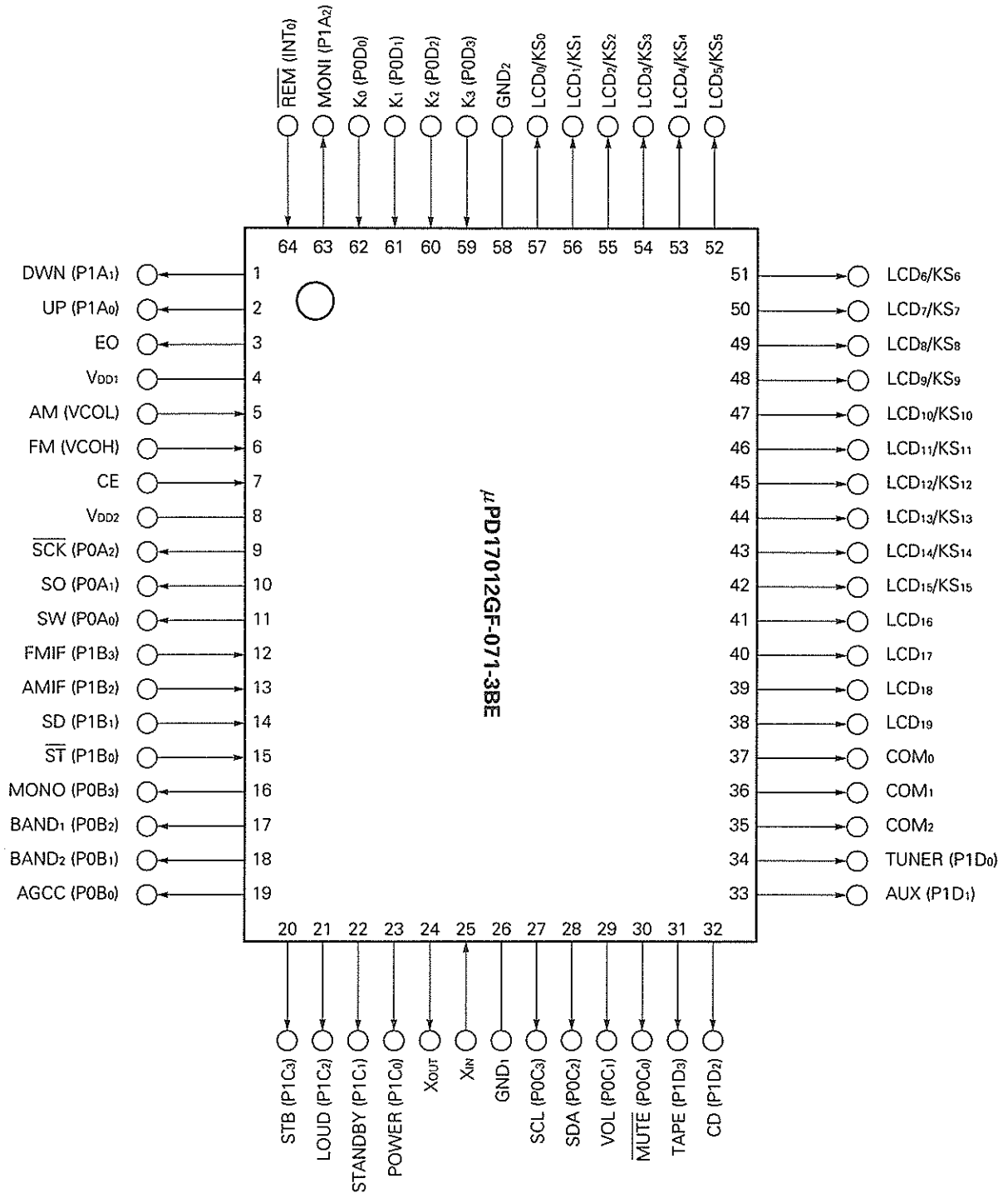
- **TIMER FUNCTION**

- (1) Everyday timer
Once On time and OFF time are set, the specified sound source will be turned on and off every day.
- (2) Once timer
If ON time and OFF time are set, the specified sound source will be turned on and off only once.
- (3) Sleep timer
The sound source will be automatically turned off 60 to 10 minutes after the timer is started (Settable in ten-minute steps).

- **MISCELLANEOUS FUNCTIONS**

- (1) LOUD (loudness) control output and display of "LOUD"
- (2) Display switching between clock and frequency modes, and preferential clock display
- (3) Remote control reception
 μ PD6122G-002 or μ PD6121G-002 should be used as remote controller transmitter IC.
 μ PC2800HA or equivalents should be used as remote controller preamplifier IC.
- (4) Mute control output
- (5) Volume PWM output
- (6) Electronic sound control outputs (volume, balance, bass, treble, and loudness)
- (7) Tape monitoring function and control output

PIN CONFIGURATION (Top View)



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1. PIN FUNCTIONS

Pin No.	Symbol	Pin name	Description	Buffer type								
1	DWN ^{Note}	Volume DOWN	Pin which outputs the status of VOL DWN key. While the VOL DWN is pressed, this pin outputs high level signal. This does not occur if the key is disabled.	CMOS push-pull output								
2	UP ^{Note}	Volume UP	Pin which outputs the status of VOL UP key. While the VOL UP is pressed, this pin outputs high level signal. This does not occur if the key is disabled.	CMOS push-pull output								
3	EO	Error OUT	Pin which outputs an error in PLL (Phase Locked Loop). It compares the input frequency on the AM pin (pin 5) or FM pin (pin 6) with the frequency setting, and outputs the result. <ul style="list-style-type: none"> ○ Input frequency > Frequency setting: High level ○ Input frequency < Frequency setting: Low level ○ Input frequency = Frequency setting: Floating Connect this pin to the varactor diode through an external LPF (Low Pass Filter).	CMOS 3-state output								
4 8	V _{DD1} V _{DD2}	Power input	Power-supply pins for the device. They supply 5 V ±10 % when the device is operating (in radio, tape, CD, or AUX mode). The data can be preserved even if the voltage is reduced to 2.3 V when the CE pin (pin 7) goes low. If the voltage applied to this pin is increased from 0 V to 4.5 V, the device is initialized. At this time, it should take less than 500 ms to increase the voltage from 0 V to 4.5 V. Be sure to connect V _{DD1} and V _{DD2} pins to the same potential line.	-								
5	AM	AM local oscillator input	Pin which inputs the local oscillator output (VCO output) in the AM (MW, LW), and SW (SW1, SW2). If the intermediate frequency is set to 10.71 MHz in China area, connect the input from SW2 to the FM pin (pin 6). If neither AM nor SW band is received, it is internally pulled down. Either of the following signals can be input to this pin: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Band</th> <th>Frequency range</th> <th>Minimum amplitude</th> </tr> </thead> <tbody> <tr> <td>SW2</td> <td>5 – 30 MHz</td> <td rowspan="2">0.3 V_{P-P}MIN.</td> </tr> <tr> <td>Others</td> <td>0.5 – 20 MHz</td> </tr> </tbody> </table> Because an AC amplifier is incorporated, cut off the DC component using a capacitor.	Band	Frequency range	Minimum amplitude	SW2	5 – 30 MHz	0.3 V _{P-P} MIN.	Others	0.5 – 20 MHz	Input
Band	Frequency range	Minimum amplitude										
SW2	5 – 30 MHz	0.3 V _{P-P} MIN.										
Others	0.5 – 20 MHz											

Note This pin floats when the level on the CE pin (pin 7) is low. If necessary, connect a pull-up/pull-down resistor.

Pin No.	Symbol	Pin name	Description	Buffer type				
6	FM	FM local oscillator input	<p>Pin which inputs the local oscillator output (VCO output) in the FM band. If the FM band is not received, it is internally pulled down. Either of the following signals can be input to this pin:</p> <table border="1"> <thead> <tr> <th>Frequency range</th> <th>Minimum amplitude</th> </tr> </thead> <tbody> <tr> <td>9 – 150 MHz</td> <td>0.3 V_{P-P}MIN.</td> </tr> </tbody> </table> <p>Because an AC amplifier is incorporated, cut off the DC component using a capacitor.</p>	Frequency range	Minimum amplitude	9 – 150 MHz	0.3 V _{P-P} MIN.	Input
Frequency range	Minimum amplitude							
9 – 150 MHz	0.3 V _{P-P} MIN.							
7	CE	Chip enable	<p>Pin that inputs select signal for the device.</p> <ul style="list-style-type: none"> ○ High level: Normal operation ○ Low level: All operations are stopped (with data preserved). <p>High or low level of less than 144.4-200 μs is not acknowledged.</p>	Input				
9	$\overline{\text{SCK}}$	Shift clock output	<p>Pin which outputs shift clock to the serial interface connected to the expansion port. Connect a pull-up resistor. Otherwise, shift clock would not be normally output.</p>	CMOS push-pull output				
10	SO ^{Note}	Serial data output	<p>Pin which outputs data to the serial interface connected to the expansion port.</p>	CMOS push-pull output				
11	SW ^{Note}	SW band switching signal output	<p>Pin which outputs SW1/SW2 switching signal.</p> <ul style="list-style-type: none"> ○ Low level: SW1 band ○ High level: SW2 band 	CMOS push-pull output				

Note This pin floats when the level on the CE pin (pin 7) is low. If necessary, connect a pull-up/pull-down resistor.

Pin No.	Symbol	Pin name	Description	Buffer type										
12	FMIF	FM intermediate frequency input	<p>Pin which inputs FM band intermediate frequency (IF). It is used to detect a radio station during seeking in FM band. It is used when ENFMIF on the initial setup diode is shorted. Seeking is terminated if this pin and SD pin (pin 14) judge that a station exists. The input frequency range and input conditions used as criteria for judgement are as follows:</p> <table border="1"> <thead> <tr> <th>Area \ Item</th> <th>Input frequency range ①</th> <th>Input frequency range ②</th> </tr> </thead> <tbody> <tr> <td>All areas</td> <td>10.7 MHz ±20 kHz</td> <td>10.7 MHz ±10 kHz</td> </tr> </tbody> </table> <p>It is judged that a radio station exists if input conditions 1 and 2 are satisfied. Condition 1: A frequency in the input frequency range ① is entered within 20 ms after locking of PLL (Phase Locked Loop). Condition 2: A frequency in the input frequency range ② is entered within 40 ms after condition 1 above is established. The frequencies that can be entered are as follows:</p> <table border="1"> <thead> <tr> <th>Frequency range</th> <th>Minimum amplitude</th> </tr> </thead> <tbody> <tr> <td>5 - 15 MHz</td> <td>0.3 V_{P-P}MIN.</td> </tr> </tbody> </table> <p>Because an AC amplifier is incorporated, cut off the DC component using a capacitor.</p>	Area \ Item	Input frequency range ①	Input frequency range ②	All areas	10.7 MHz ±20 kHz	10.7 MHz ±10 kHz	Frequency range	Minimum amplitude	5 - 15 MHz	0.3 V _{P-P} MIN.	Input
Area \ Item	Input frequency range ①	Input frequency range ②												
All areas	10.7 MHz ±20 kHz	10.7 MHz ±10 kHz												
Frequency range	Minimum amplitude													
5 - 15 MHz	0.3 V _{P-P} MIN.													

Pin No.	Symbol	Pin name	Description	Buffer type																					
13	AMIF	AM intermediate frequency input	<p>Pin which inputs AM (MW, LW) or SW (SW1, SW2) band intermediate frequency (IF). It is used to detect a radio station during seeking in AM or SW band. It is used when DISAMIF of the initial setup diode is opened. Seeking is terminated if this pin and SD pin (pin 14) judge that a station exists. The input frequency range and input conditions used as criteria for judgement are as follows:</p> <table border="1"> <thead> <tr> <th>Area</th> <th colspan="2">Band</th> <th>Input frequency range ① [kHz]</th> <th>Input frequency range ② [kHz]</th> </tr> </thead> <tbody> <tr> <td rowspan="3">All areas</td> <td rowspan="2">AM</td> <td>MW</td> <td>450 ± 5</td> <td>450 ± 2</td> </tr> <tr> <td>LW</td> <td>450 ± 5</td> <td>450 ± 0.5</td> </tr> <tr> <td>SW</td> <td>SW1, SW2</td> <td>450 ± 5</td> <td>450 ± 2</td> </tr> </tbody> </table> <p>It is judged that a radio station exists if the input conditions 1 and 2 are satisfied. Condition 1: A frequency in the input frequency range ① is entered within 20 ms after locking of PLL (Phase Locked Loop). Condition 2: A frequency in the input frequency range ② is entered within 40 ms after condition 1 above is established. The frequencies that can be entered are as follows:</p> <table border="1"> <thead> <tr> <th>Frequency range</th> <th>Minimum amplitude</th> </tr> </thead> <tbody> <tr> <td>0.3 – 1 MHz</td> <td>0.3 V_{P-P}MIN.</td> </tr> </tbody> </table> <p>Because an AC amplifier is incorporated, cut off the DC component using a capacitor.</p>	Area	Band		Input frequency range ① [kHz]	Input frequency range ② [kHz]	All areas	AM	MW	450 ± 5	450 ± 2	LW	450 ± 5	450 ± 0.5	SW	SW1, SW2	450 ± 5	450 ± 2	Frequency range	Minimum amplitude	0.3 – 1 MHz	0.3 V _{P-P} MIN.	Input
Area	Band		Input frequency range ① [kHz]	Input frequency range ② [kHz]																					
All areas	AM	MW	450 ± 5	450 ± 2																					
		LW	450 ± 5	450 ± 0.5																					
	SW	SW1, SW2	450 ± 5	450 ± 2																					
Frequency range	Minimum amplitude																								
0.3 – 1 MHz	0.3 V _{P-P} MIN.																								
14	SD	SD input	<p>Pin which inputs SD (Station Detector). It is used to detect a radio station during seeking. Seeking is terminated if this pin judges that a radio station exists. However if the FMIF pin (pin 12) or AMIF pin (pin 13) is used, seeking is terminated if this pin and FMIF or AMIF pin judge that a radio station exists. For judgement, the following reference voltage is used:</p> <table border="1"> <thead> <tr> <th rowspan="2">Band</th> <th rowspan="2">Input reference voltage [V]</th> <th>When V_{DD} = 5</th> </tr> </thead> <tbody> <tr> <td>All</td> <td>$\frac{28.5}{64} \times V_{DD}$ or higher</td> <td>2.227 V</td> </tr> </tbody> </table> <p>Waiting for chattering: It is judged that a radio station exists if the input voltage is found to be as two or more times as higher than input reference voltage when input voltage is observed three times at intervals of 20 – 22 ms.</p>	Band	Input reference voltage [V]	When V _{DD} = 5	All	$\frac{28.5}{64} \times V_{DD}$ or higher	2.227 V	Input															
Band	Input reference voltage [V]	When V _{DD} = 5																							
		All	$\frac{28.5}{64} \times V_{DD}$ or higher	2.227 V																					

Pin No.	Symbol	Pin name	Description	Buffer type																						
15	\overline{ST}	Stereo input	<p>Input pin used to display "ST" (stereo). Used in radio mode. The relations between this pin and the MONO pin (pin 16) are as follows:</p> <table border="1"> <thead> <tr> <th rowspan="2">\overline{ST} pin</th> <th rowspan="2">MONO pin</th> <th colspan="2">LCD display</th> </tr> <tr> <th>"ST"</th> <th>"MONO"</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>On</td> <td>Off</td> </tr> <tr> <td>0</td> <td>1</td> <td>Off</td> <td>On</td> </tr> <tr> <td>1</td> <td>0</td> <td>Off</td> <td>Off</td> </tr> <tr> <td>1</td> <td>1</td> <td>Off</td> <td>On</td> </tr> </tbody> </table> <p>(0: Low level, 1: High level) Display of "ST" is turned off during seeking. Waiting for chattering: It is judged that a change is made if the level remains the same when the input is observed twice at intervals of 100 – 200 ms.</p>	\overline{ST} pin	MONO pin	LCD display		"ST"	"MONO"	0	0	On	Off	0	1	Off	On	1	0	Off	Off	1	1	Off	On	Input
\overline{ST} pin	MONO pin	LCD display																								
		"ST"	"MONO"																							
0	0	On	Off																							
0	1	Off	On																							
1	0	Off	Off																							
1	1	Off	On																							
16	MONO ^{Note}	MONO (monaural)	<p>A pin which outputs MONO (monaural) control signal. Used in radio mode. The output is inverted each time the MONO key is hit. For display, see the descriptions of the \overline{ST} pin (pin 15).</p>	CMOS push-pull output																						
17 18	BAND ₁ ^{Note} BAND ₂ ^{Note}	Band switching signal output	<p>Pin which outputs band switching signal. Used in radio mode. The following outputs are given in each band:</p> <table border="1"> <thead> <tr> <th>Band \ Pin</th> <th>BAND₁</th> <th>BAND₂</th> </tr> </thead> <tbody> <tr> <td>FM</td> <td>0</td> <td>0</td> </tr> <tr> <td>MW</td> <td>0</td> <td>1</td> </tr> <tr> <td>LW</td> <td>1</td> <td>1</td> </tr> <tr> <td>SW</td> <td>1</td> <td>0</td> </tr> </tbody> </table> <p>(0: low level, 1: High level) In SW band, the SW pin (pin 11) is switched depending on the receiving frequency.</p>	Band \ Pin	BAND ₁	BAND ₂	FM	0	0	MW	0	1	LW	1	1	SW	1	0	CMOS push-pull output							
Band \ Pin	BAND ₁	BAND ₂																								
FM	0	0																								
MW	0	1																								
LW	1	1																								
SW	1	0																								

Note This pin floats if the level on the CE pin (pin 7) is low. If necessary, connect a pull-up/pull-down resistor.

Pin No.	Symbol	Pin name	Description	Buffer type
19	AGCC ^{Note}	AGC cut output	<p>Pin which outputs AGC (Auto Gain Control) cut signal. During auto-tuning, AGCC is output in the following manner:</p> <p>① : Waiting for key-on chattering ② : Pre-muting ③ : Post-pull output</p>	CMOS push-pull output
20	STB	Strobe output	Pin which outputs strobe to the serial interface connected to the expansion port.	CMOS push-pull output
21	LOUD	Loudness outputs	<p>Pins which output loudness control signal. The output is inverted each time the LOUD key is hit.</p> <ul style="list-style-type: none"> ○ High level: "LOUD" ON ○ Low level: "LOUD" OFF 	CMOS push-pull output
22	STANDBY	Standby output	<p>Pin which outputs timer standby status control signal. The output is inverted each time the STANDBY key is hit.</p> <ul style="list-style-type: none"> ○ High level: Standby ON ○ Low level: Standby OFF 	CMOS push-pull output
23	POWER	Power output	<p>Pin which outputs the power status of the set. The output is inverted each time the POWER key is hit.</p> <ul style="list-style-type: none"> ○ High level: Power ON ○ Low level: Power OFF 	CMOS push-pull output
24	X _{OUT}	Crystal oscillator	<p>Pin to which a crystal resonator is connected. Connect the 4.5-MHz crystal resonator. The precision of the clock is affected only by the oscillation frequency from the crystal oscillator. Adjust the oscillation frequency while observing the LCD drive waveform or PLL local oscillation frequency.</p>	-
25	X _{IN}			Input
26 58	GND ₁ GND ₂	Grounding	<p>Grounding pin for the device. Be sure to connect the GND₁ and GND₂ pins to the same potential.</p>	-
27	SCL	I ² C clock output	<p>A clock output to the serial interface for electronic sound control. Because the output is of N-ch open drain type, connect a pull-up resistor.</p>	N-ch open drain output

Note This pin floats when the level on the CE pin (pin 7) is low. If necessary, connect a pull-up/pull-down resistor.

Pin No.	Symbol	Pin name	Description	Buffer type																									
28	SDA	I ² C data output	A data output to the serial interface for electronic sound control. Connect a pull-up resistor because the output uses N-ch open drain configuration.	N-ch open drain output																									
29	VOL	PWM output	Pin which outputs control signal for VOL IC (μPC1406). The duty of 4.4 kHz pulse can be set in 64 steps by hitting the VOL UP or VOL DWN key. Connect a pull-up resistor because the output uses N-ch open drain configuration. If VOL on the initial setup diode is short-circuited, nothing should be connected to this pin. In that case, be sure that the pin is open.	N-ch open drain output																									
30	MUTE	Mute output	Pin that outputs mute control. It outputs low-level in any of the following cases: <ul style="list-style-type: none"> ○ Power on/off ○ Band switching ○ Manual tuning ○ Auto-tuning ○ Calling of preset memory ○ Mode switching ○ Power OFF Because the output uses N-ch open drain configuration, connect a pull-up resistor.	N-ch open drain output																									
31 34	TAPE ^{Note} CD ^{Note} AUX ^{Note} TUNER ^{Note}	Mode signal output	Pins which output mode switching signals. The output in each mode is as follows: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th style="text-align: center;">Pin Mode</th> <th style="text-align: center;">TAPE</th> <th style="text-align: center;">CD</th> <th style="text-align: center;">AUX</th> <th style="text-align: center;">TUNER</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Tape</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">CD</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">AUX</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">Radio</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> </tbody> </table> (0: Low level, 1: High level)	Pin Mode	TAPE	CD	AUX	TUNER	Tape	1	0	0	0	CD	0	1	0	0	AUX	0	0	1	0	Radio	0	0	0	1	CMOS push-pull output
Pin Mode	TAPE	CD	AUX	TUNER																									
Tape	1	0	0	0																									
CD	0	1	0	0																									
AUX	0	0	1	0																									
Radio	0	0	0	1																									
35 37	COM ₂ COM ₀	LCD common signal output	Pins which output LCD panel common signal. The matrix for LCD ₁₉ - LCD ₀ /KS ₀ (pins 38-57) allows 60-dot display on the 60-dot LCD panel.	CMOS push-pull output																									

Note This pin floats when the level on the CE pin (pin 7) is low. If necessary, connect a pull-up/pull-down resistor.

Pin No.	Symbol	Pin name	Description	Buffer type
38 41 42 57	LCD ₁₉ LCD ₁₆ LCD ₁₅ /KS ₁₅ LCD ₀ /KS ₀	LCD segment output and key source output	Pins 38 – 57 output LCD Panel segment signal. Pins 42 – 57 output key source signal for the key matrix. The matrix for COM ₀ – COM ₂ pins (pins 37 – 35) allows 60-dot display on the LCD panel. Because LCD ₁₅ /KS ₁₅ – LCD ₀ /KS ₀ (pins 42 – 57) are used in common by key source signal and LCD segment signal, diodes for prevention of reverse current flow should be connected to pins that are used for key source signal.	CMOS push-pull output
59 62	K ₃ K ₀	Key return signal input	Pins which input key return signals for key matrix. These pins have on-chip pull-down resistors.	Input
63	MONI ^{Note}	Tape monitor signal output	Pin which outputs tape monitor signal The output is inverted each time the TAPE MONI key is hit after power-on. ○ High level: Tape monitor ON ○ Low level: Tape monitor OFF	CMOS push-pull output
64	$\overline{\text{REM}}$	Remote control input	Infrared ray remote control pin. The remote controller amplifier (μ PC2800HA) output is connected to it. The μ PD6121G-002 or μ PD6122G-002 is used as remote control transmitter IC.	Input




Note This pin floats when the level on the CE pin (pin 7) is low. If necessary, connect a pull-up/pull-down resistor.

2. KEY MATRIX

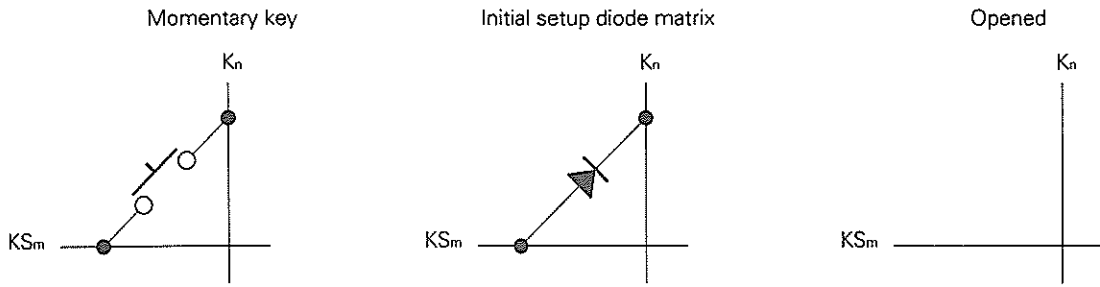
2.1 KEY MATRIX LAYOUT

Input pin Output pin	K ₃ (50)	K ₂ (60)	K ₁ (61)	K ₀ (62)
KS ₁₅ (42)	M1	M2	M3	M4
KS ₁₄ (43)	M5	M6	M7	M8
KS ₁₃ (44)	M9	M10	+10	PSCAN AMEMO
KS ₁₂ (45)	ME	DWN	UP	AUTO
KS ₁₁ (46)	TAPE MONI	LOUD	MONO	DISP
KS ₁₀ (47)	TAPE	CD	AUX	TUNER
KS ₉ (48)	STANDBY	EVERYDAY	ONCE	SLEEP
KS ₈ (40)	MUTE	VOL DWN	VOL UP	POWER
KS ₇ (50)	FM	AM	SW	SEL
KS ₆ (51)	-	-	-	-
KS ₅ (52)	-	-	-	-
KS ₄ (53)	-	-	-	-
KS ₃ (54)	P10/8	CLKDISP	FLASH	DISAMEMO
KS ₂ (55)	ENFMIF	DISAMIF	AMIF	PRI0
KS ₁ (56)	AUTO500	AUTOSTP	DISLW	DISSW2
KS ₀ (57)	AREA3	AREA2	AREA1	VOL

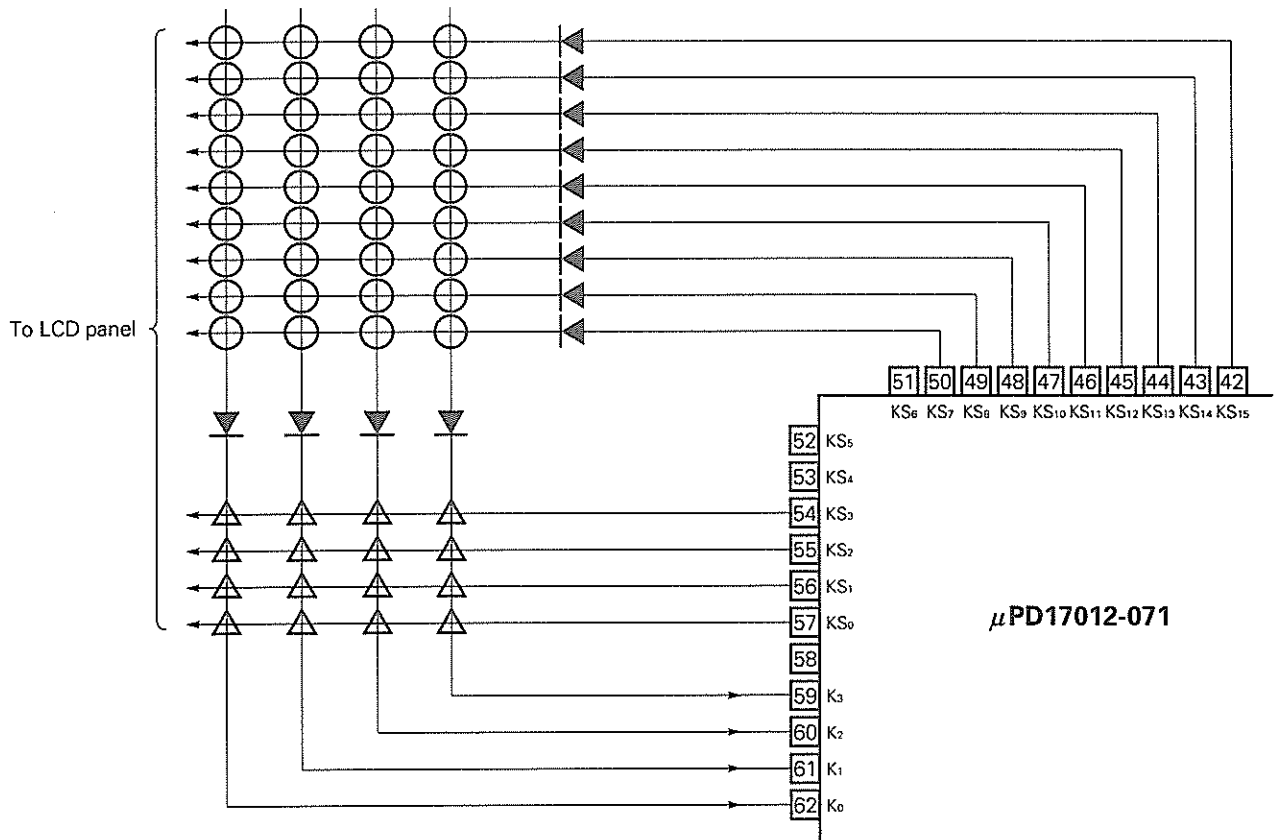
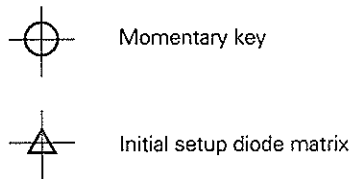
Figures in parentheses "()" are pin numbers.

-  Momentary key
-  Initial setup diode matrix
-  Opened

2.2 SWITCH CONNECTION



2.3 KEY MATRIX CONNECTION



2.4 KEY MATRIX DESCRIPTION

2.4.1 Initial Setup Diode Matrix

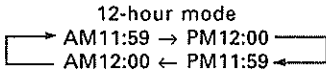
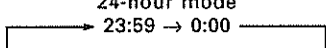
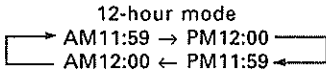
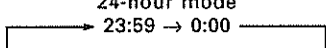
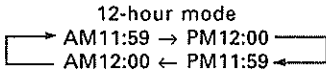
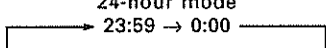
The initial setup diode matrix determines the functions of the μ PD17012-071. Be sure to perform the initial settings using this matrix. The settings are loaded when V_{DD} is switched on (power-on resetting), or when the level on the CE pin (pin 7) goes from low to high (CE reset). The settings are not loaded at the other times.

- (1) **Switches that set the receiving area**
AREA1, AREA2, AREA3
- (2) **Switch that sets the number of preset memory areas**
P10/P8
- (3) **Switches that set the receiving band**
DISLW, DISSW2
- (4) **Switch that sets the seek stopping condition**
AUTOSTP
- (5) **Switch that selects tuning mode**
AUTO500
- (6) **Switch that sets preferential display of clock**
PRIO
- (7) **Switch that sets the intermediate frequency in AM band**
AMIF
- (8) **Switches that select the frequency counter**
ENFMIF, DISAMIF
- (9) **Switch that selects the auto-memory**
DISAMEMO
- (10) **Switches that select the clock function**
CLKDISP, FLASH
- (11) **Switch that selects control of volume**
VOL

To perform these settings, short-circuit or open the matrix using diodes. The functions of the initial setup diode matrix are described below.

Symbol	Description																																				
<p>AREA1 AREA2 AREA3</p>	<p>Switches which set an area for reception. Setting is performed in the following manner:</p> <table border="1" data-bbox="571 310 1334 704"> <thead> <tr> <th>AREA3</th> <th>AREA2</th> <th>AREA1</th> <th>Area</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Western Europe</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Australia, Middle and Near East</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>America 1</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>America 2</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>America 3</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Japan</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Eastern Europe</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>China</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p> <p>For the receiving frequency in each area, see "Major Functions". If Eastern Europe is selected, do not use the <input type="checkbox"/> SW key.</p>	AREA3	AREA2	AREA1	Area	0	0	0	Western Europe	0	0	1	Australia, Middle and Near East	0	1	1	America 1	1	0	0	America 2	1	1	0	America 3	0	1	0	Japan	1	0	1	Eastern Europe	1	1	1	China
AREA3	AREA2	AREA1	Area																																		
0	0	0	Western Europe																																		
0	0	1	Australia, Middle and Near East																																		
0	1	1	America 1																																		
1	0	0	America 2																																		
1	1	0	America 3																																		
0	1	0	Japan																																		
1	0	1	Eastern Europe																																		
1	1	1	China																																		
<p>P10/P8</p>	<p>Switch that sets the number of preset memory channels. It is set in the following manner:</p> <table border="1" data-bbox="699 923 1206 1055"> <thead> <tr> <th>P10/P8</th> <th>Number of preset memory channels</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>10</td> </tr> <tr> <td>1</td> <td>8</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	P10/P8	Number of preset memory channels	0	10	1	8																														
P10/P8	Number of preset memory channels																																				
0	10																																				
1	8																																				
<p>DISLW</p>	<p>Switch that sets the receiving band. It is ignored in areas other than Eastern Europe and Western Europe.</p> <table border="1" data-bbox="699 1178 1206 1310"> <thead> <tr> <th>DISLW</th> <th>Receiving band</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>MW, LW</td> </tr> <tr> <td>1</td> <td>MW</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	DISLW	Receiving band	0	MW, LW	1	MW																														
DISLW	Receiving band																																				
0	MW, LW																																				
1	MW																																				
<p>DISSW2</p>	<p>Switch that sets the receiving band. It is ignored in Eastern Europe. It is set in the following manner:</p> <table border="1" data-bbox="699 1434 1206 1566"> <thead> <tr> <th>DISSW2</th> <th>Receiving band</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>SW1, SW2</td> </tr> <tr> <td>1</td> <td>SW1</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	DISSW2	Receiving band	0	SW1, SW2	1	SW1																														
DISSW2	Receiving band																																				
0	SW1, SW2																																				
1	SW1																																				
<p>AUTOSTP</p>	<p>Switch that sets seek stopping condition: It is set in the following manner:</p> <table border="1" data-bbox="480 1700 1433 1891"> <thead> <tr> <th>AUTOSTP</th> <th>Stopping condition</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Seek is stopped if a radio station is detected. At that time, the <input type="checkbox"/> UP / <input type="checkbox"/> DWN keys are ignored even if they are pressed.</td> </tr> <tr> <td>1</td> <td>Seeking is stopped if a radio station is detected when the <input type="checkbox"/> UP / <input type="checkbox"/> DWN key is not pressed.</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	AUTOSTP	Stopping condition	0	Seek is stopped if a radio station is detected. At that time, the <input type="checkbox"/> UP / <input type="checkbox"/> DWN keys are ignored even if they are pressed.	1	Seeking is stopped if a radio station is detected when the <input type="checkbox"/> UP / <input type="checkbox"/> DWN key is not pressed.																														
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1	Seeking is stopped if a radio station is detected when the <input type="checkbox"/> UP / <input type="checkbox"/> DWN key is not pressed.																																				

Symbol	Description																	
<p>AUTO500</p>	<p>Switch that sets the function when the frequency is adjusted using the UP and DWN keys. It is set in the following manner:</p> <table border="1" data-bbox="379 308 1332 606"> <thead> <tr> <th data-bbox="379 308 507 404">AUTO500</th> <th data-bbox="507 308 917 404"> <table border="1"> <tr> <td data-bbox="523 329 683 361">UP</td> <td data-bbox="726 329 885 361">DWN</td> </tr> </table> Key pressing </th> <th data-bbox="917 308 1332 404">Operation</th> </tr> </thead> <tbody> <tr> <td data-bbox="379 404 507 510">0</td> <td data-bbox="507 404 917 446">less than 0.5 sec.</td> <td data-bbox="917 404 1332 446">1-channel UP/DOWN</td> </tr> <tr> <td data-bbox="379 446 507 510"></td> <td data-bbox="507 446 917 510">0.5 sec. or more</td> <td data-bbox="917 446 1332 510">Continuous UP/DOWN 1-channel UP/DOWN per 50 ms</td> </tr> <tr> <td data-bbox="379 510 507 606">1</td> <td data-bbox="507 510 917 553">less than 0.5 sec.</td> <td data-bbox="917 510 1332 553">1-channel UP/DOWN</td> </tr> <tr> <td data-bbox="379 553 507 606"></td> <td data-bbox="507 553 917 606">0.5 sec. or more</td> <td data-bbox="917 553 1332 606">Seek UP/DOWN</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p> <p>If AUTO500 is shorted, do not use the AUTO key. If AUTO500 is opened, switching between continuous UP/DOWN and seek UP/DOWN can be done by switching manual mode and auto-mode (using the AUTO key).</p>	AUTO500	<table border="1"> <tr> <td data-bbox="523 329 683 361">UP</td> <td data-bbox="726 329 885 361">DWN</td> </tr> </table> Key pressing	UP	DWN	Operation	0	less than 0.5 sec.	1-channel UP/DOWN		0.5 sec. or more	Continuous UP/DOWN 1-channel UP/DOWN per 50 ms	1	less than 0.5 sec.	1-channel UP/DOWN		0.5 sec. or more	Seek UP/DOWN
AUTO500	<table border="1"> <tr> <td data-bbox="523 329 683 361">UP</td> <td data-bbox="726 329 885 361">DWN</td> </tr> </table> Key pressing	UP	DWN	Operation														
UP	DWN																	
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	0.5 sec. or more	Continuous UP/DOWN 1-channel UP/DOWN per 50 ms																
1	less than 0.5 sec.	1-channel UP/DOWN																
	0.5 sec. or more	Seek UP/DOWN																
<p>PRIO</p>	<p>Switch that sets the preferential display for the clock. Preferential display means that preferential item is displayed if nothing is done after switching of display. It is set in the following manner:</p> <table border="1" data-bbox="379 915 1332 1202"> <thead> <tr> <th data-bbox="379 915 507 1000">PRIO</th> <th data-bbox="507 915 635 1000">Preferential display</th> <th data-bbox="635 915 1332 1000">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="379 1000 507 1106">0</td> <td data-bbox="507 1000 635 1106">OFF</td> <td data-bbox="635 1000 1332 1106">The frequency is displayed if the DISP key or station selection/band TUNER key is pressed when the clock is displayed.</td> </tr> <tr> <td data-bbox="379 1106 507 1202">1</td> <td data-bbox="507 1106 635 1202">ON</td> <td data-bbox="635 1106 1332 1202">If the DISP key, or station selection/band/ TUNER key is pressed when the clock is displayed, the frequency is displayed first, and then the clock is displayed in five seconds.</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p> <p>When the clock is displayed during radio reception, the display of the receiving band, "ST", "MONO", and "LOUD" is on.</p>	PRIO	Preferential display	Description	0	OFF	The frequency is displayed if the DISP key or station selection/band TUNER key is pressed when the clock is displayed.	1	ON	If the DISP key, or station selection/band/ TUNER key is pressed when the clock is displayed, the frequency is displayed first, and then the clock is displayed in five seconds.								
PRIO	Preferential display	Description																
0	OFF	The frequency is displayed if the DISP key or station selection/band TUNER key is pressed when the clock is displayed.																
1	ON	If the DISP key, or station selection/band/ TUNER key is pressed when the clock is displayed, the frequency is displayed first, and then the clock is displayed in five seconds.																
<p>AMIF</p>	<p>Switch that sets the intermediate frequency in AM band. It is set in the following manner:</p> <table border="1" data-bbox="606 1393 1109 1532"> <thead> <tr> <th data-bbox="606 1393 734 1447">AMIF</th> <th data-bbox="734 1393 1109 1447">Intermediate frequency</th> </tr> </thead> <tbody> <tr> <td data-bbox="606 1447 734 1489">0</td> <td data-bbox="734 1447 1109 1489">450 kHz</td> </tr> <tr> <td data-bbox="606 1489 734 1532">1</td> <td data-bbox="734 1489 1109 1532">10.71 MHz</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p> <p>If AMIF is shorted, the intermediate frequency must be converted into 450 kHz before supplying it to AMIF (pin 13).</p>	AMIF	Intermediate frequency	0	450 kHz	1	10.71 MHz											
AMIF	Intermediate frequency																	
0	450 kHz																	
1	10.71 MHz																	

Symbol	Description																										
ENFMIF, DISAMIF	<p>Switches that set use of the frequency counter. They are set in the following manner:</p> <table border="1" data-bbox="475 314 1426 704"> <thead> <tr> <th>ENFMIF</th> <th>DISAMIF</th> <th>Band</th> <th>Detection of radio station</th> </tr> </thead> <tbody> <tr> <td rowspan="2">1</td> <td rowspan="2">0</td> <td>FM</td> <td rowspan="2">Frequency counter and SD method</td> </tr> <tr> <td>MW, LW, SW</td> </tr> <tr> <td rowspan="2">1</td> <td rowspan="2">1</td> <td>FM</td> <td>Frequency counter and SD method</td> </tr> <tr> <td>MW, LW, SW</td> <td>SD method</td> </tr> <tr> <td rowspan="2">0</td> <td rowspan="2">0</td> <td>FM</td> <td>SD method</td> </tr> <tr> <td>MW, LW, SW</td> <td>Frequency counter and SD method</td> </tr> <tr> <td rowspan="2">0</td> <td rowspan="2">1</td> <td>FM</td> <td rowspan="2">SD method</td> </tr> <tr> <td>MW, LW, SW</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	ENFMIF	DISAMIF	Band	Detection of radio station	1	0	FM	Frequency counter and SD method	MW, LW, SW	1	1	FM	Frequency counter and SD method	MW, LW, SW	SD method	0	0	FM	SD method	MW, LW, SW	Frequency counter and SD method	0	1	FM	SD method	MW, LW, SW
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DISAMEMO	<p>Switch that sets the function of PSCAN AMEMO key. It is set in the following manner:</p> <table border="1" data-bbox="571 842 1331 1098"> <thead> <tr> <th>DISAMEMO</th> <th>PSCAN AMEMO Key pressing time</th> <th>Operation</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0</td> <td>Less than 3 sec.</td> <td>Preset memory scan</td> </tr> <tr> <td>3 sec. or more</td> <td>Auto-store memory</td> </tr> <tr> <td rowspan="2">1</td> <td>Less than 3 sec.</td> <td>Preset memory UP</td> </tr> <tr> <td>3 sec. or more</td> <td>Auto-store memory</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	DISAMEMO	PSCAN AMEMO Key pressing time	Operation	0	Less than 3 sec.	Preset memory scan	3 sec. or more	Auto-store memory	1	Less than 3 sec.	Preset memory UP	3 sec. or more	Auto-store memory													
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	3 sec. or more	Auto-store memory																									
CLKDISP	<p>Switch that sets the time mode for the clock. It is set in the following manner:</p> <table border="1" data-bbox="667 1229 1235 1459"> <thead> <tr> <th>CLKDISP</th> <th>Time mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td> 12-hour mode  </td> </tr> <tr> <td>1</td> <td> 24-hour mode  </td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	CLKDISP	Time mode	0	12-hour mode 	1	24-hour mode 																				
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1	24-hour mode 																										
FLASH	<p>Switch that sets the colon (:) display mode. It is set in the following manner:</p> <table border="1" data-bbox="667 1613 1235 1800"> <thead> <tr> <th>FLASH</th> <th>Colon (:) display mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>ON</td> </tr> <tr> <td>1</td> <td> Blinking Frequency = 1 Hz Duty ratio = 6 (ON) : 4 (OFF) </td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	FLASH	Colon (:) display mode	0	ON	1	Blinking Frequency = 1 Hz Duty ratio = 6 (ON) : 4 (OFF)																				
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Symbol	Description						
VOL	<p>Switch that selects electronic sound control. It is set in the following manner:</p> <table border="1"> <thead> <tr> <th>VOL</th> <th>Method of control</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>PWM output only</td> </tr> <tr> <td>1</td> <td>PC serial interface (with electronic sound control connected)</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted) If VOL is open-circuited, do not use the <input type="checkbox"/> SEL <input type="checkbox"/> key.</p>	VOL	Method of control	0	PWM output only	1	PC serial interface (with electronic sound control connected)
VOL	Method of control						
0	PWM output only						
1	PC serial interface (with electronic sound control connected)						

2.4.2 Momentary Keys

The following key combinations are valid:

- POWER key and any other key (If they are pressed at the same time, the POWER key input is valid.)
- ME key (for time adjustment) and UP or DWN key

If any other combination of two keys is pressed, they are invalid (nothing will happen, as if they were not pressed).

Time of waiting for chattering is 30 – 40 ms.

Symbol	Description						
<input type="checkbox"/> M1 <input type="checkbox"/> M10	<p>Keys for writing to and calling of preset memory They are valid in radio mode. FM, AM and SW bands can be independently assigned to each key.</p> <table border="1"> <thead> <tr> <th></th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Writing</td> <td>If any key <input type="checkbox"/> M1 through <input type="checkbox"/> M10 (<input type="checkbox"/> +10) is pressed when the preset memory is ready for writing, the currently received frequency is written to the preset memory channel correspondent to the key.</td> </tr> <tr> <td>Calling</td> <td>If any key <input type="checkbox"/> M1 through <input type="checkbox"/> M10 (<input type="checkbox"/> +10) is pressed when the preset memory is not ready for writing, the frequency saved in the preset memory area correspondent to the key is called. When the contents in a preset memory area is being called, pressing the key for the same preset memory area is ignored. In the clock display mode, however, this switches the mode into the frequency display mode.</td> </tr> </tbody> </table> <p>The default settings in the preset memory channels are as follows:</p> <ul style="list-style-type: none"> • M1 [M6] : Lowest frequency • M2 [M7] : (Highest frequency – Lowest frequency) × 1/3 + Lowest frequency • M3 [M8] : (Highest frequency – Lowest frequency) × 1/2 + Lowest frequency • M4 [M9] : (Highest frequency – Lowest frequency) × 2/3 + Lowest frequency • M5 [M10] : Highest frequency <ul style="list-style-type: none"> • Frequencies in the FM band are written to M1 – M5. The lowest frequency is written to the remaining memory channels. • For AM band, frequencies in LW band are written to M1 – M5, and frequencies for MW band are written to M6 – M10. • For SW band, frequencies in SW1 band are written to M1 – M5, and frequencies in SW2 band are written to M6 – M10. <p>Of the five kinds of frequencies described above, four kinds of frequencies excepting (Highest frequency – Lowest frequency) × 1/2 + Lowest frequency will be written to the preset memory channels if P10 and P8 on the initial setup diode are shorted.</p>		Description	Writing	If any key <input type="checkbox"/> M1 through <input type="checkbox"/> M10 (<input type="checkbox"/> +10) is pressed when the preset memory is ready for writing, the currently received frequency is written to the preset memory channel correspondent to the key.	Calling	If any key <input type="checkbox"/> M1 through <input type="checkbox"/> M10 (<input type="checkbox"/> +10) is pressed when the preset memory is not ready for writing, the frequency saved in the preset memory area correspondent to the key is called. When the contents in a preset memory area is being called, pressing the key for the same preset memory area is ignored. In the clock display mode, however, this switches the mode into the frequency display mode.
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Symbol	Description								
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;">+10</div>	<p>Key for writing to and calling of preset memory areas M11 – M20. It is valid for reception of FM band in radio mode.</p> <p>Each time the <div style="border: 1px solid black; padding: 2px; display: inline-block;">+10</div> key is pressed, the preset shift status and normal status are switched. If any key <div style="border: 1px solid black; padding: 2px; display: inline-block;">M1</div> – <div style="border: 1px solid black; padding: 2px; display: inline-block;">M10</div> is pressed in the preset shift status, a value will be written to any preset memory areas M11 – M20 or a station will be called from any preset memory areas M11 – M20.</p> <p>In preset shift status:</p> <ul style="list-style-type: none"> • If any key <div style="border: 1px solid black; padding: 2px; display: inline-block;">M1</div> – <div style="border: 1px solid black; padding: 2px; display: inline-block;">M10</div> is pressed, the frequency saved in the corresponding preset memory areas (M11 – M20) will be called. (A frequency will be written to preset memory if it is ready for writing.) • Display of "f –" and "CH" on the LCD panel is turned on. • If no key is pressed for more than five seconds, the preset shift status is cancelled. <p>In the preset shift status, each key functions in the following manner:</p> <table border="1" data-bbox="478 708 1431 938" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><div style="border: 1px solid black; padding: 2px; display: inline-block;">STANDBY</div></td> <td>The key performs its function, and then the preset shift status continues.</td> </tr> <tr> <td style="text-align: center;"><div style="border: 1px solid black; padding: 2px; display: inline-block;">M1</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">M10</div></td> <td>Writing to or calling from M11 – M20</td> </tr> <tr> <td style="text-align: center;"><div style="border: 1px solid black; padding: 2px; display: inline-block;">ME</div></td> <td>Preset memory becomes ready for writing.</td> </tr> </tbody> </table> <p>If any other key is pressed, the preset shift status is cancelled, and the function of the key is performed.</p>	Key	Description	<div style="border: 1px solid black; padding: 2px; display: inline-block;">STANDBY</div>	The key performs its function, and then the preset shift status continues.	<div style="border: 1px solid black; padding: 2px; display: inline-block;">M1</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">M10</div>	Writing to or calling from M11 – M20	<div style="border: 1px solid black; padding: 2px; display: inline-block;">ME</div>	Preset memory becomes ready for writing.
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<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;">PSCAN AMEMO</div>	<p>Key for preset memory up, preset memory scan, and auto store memory. It is valid in radio mode.</p> <p>Operation differs with the status of DISAMEMO on the initial setup diode. For details on the operation, see 2.4.1, "Initial setup diode matrix."</p> <p>Preset memory up, preset memory scan, and auto store memory function are described below.</p> <ul style="list-style-type: none"> ● Preset memory up: A one-area higher preset memory area is selected and called. The preset memory number and saved frequency are displayed. <ul style="list-style-type: none"> • If any preset memory area has so far been used for reception, the next preset memory area (M4 if M3 has been in use) will be used for reception. • If preset memory has not been in use, M1 is selected for reception. ● Preset memory scan: Each of the preset memory areas is automatically called for five seconds. During receiving each frequency saved in preset memory, the display of the frequency, preset memory number, and "CH" blink (1 Hz: 1/2 duty cycle). <ul style="list-style-type: none"> • If any frequency saved in preset memory has so far been received, scan starts with the frequency in the next preset memory area (M4 if M3 has been in use). • If preset memory has not been in use, scan starts with M1. 								

Symbol	Description																																	
<p>PSCAN AMEMO</p>	<p>During preset memory scan, each key works in the following manner:</p> <table border="1" data-bbox="368 272 1321 868"> <thead> <tr> <th>Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td rowspan="16">Cancels the preset memory scan status, and executes the function of the pressed key.</td> </tr> <tr><td>I</td></tr> <tr><td>M10</td></tr> <tr><td>+10</td></tr> <tr><td>ME</td></tr> <tr><td>UP</td></tr> <tr><td>DWN</td></tr> <tr><td>FM</td></tr> <tr><td>AM</td></tr> <tr><td>SW</td></tr> <tr><td>TAPE</td></tr> <tr><td>CD</td></tr> <tr><td>AUX</td></tr> <tr><td>TUNER</td></tr> </tbody> </table> <p>PSCAN AMEMO Cancels the preset memory scan status.</p> <table border="1" data-bbox="368 932 1321 1272"> <thead> <tr> <th>Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>LOUD</td> <td rowspan="10">Executes the function of the pressed key, and continues preset memory scan.</td> </tr> <tr><td>MONO</td></tr> <tr><td>VOL UP</td></tr> <tr><td>VOL DWN</td></tr> <tr><td>AUTO</td></tr> <tr><td>TAPE MONI</td></tr> <tr><td>MUTE</td></tr> <tr><td>STANDBY</td></tr> <tr><td>SEL</td></tr> </tbody> </table> <p>All the other keys (excepting the POWER key) are invalid.</p> <ul style="list-style-type: none"> Auto-store memory <p>A radio station is automatically searched, and written to preset memory. The searched frequency is displayed with "AUTO" and "CH" blinking (1 Hz: 1/2 duty).</p> <ul style="list-style-type: none"> If preset memory has been in use, auto-store starts with the preset memory areas (M3 if M3 has been in use) used for reception at that time. If preset memory has not been in use, auto-store starts with M1. <p>When saving is completed, the frequency lastly written to preset memory is received. All frequencies within the band concerned are searched. The number of stations with higher SD that can be saved in preset memory is selected, sorted in the ascending order of the frequency, and written to preset memory.</p> <p>During auto-store, each key works in the following manner:</p> <table border="1" data-bbox="379 1698 1332 1825"> <thead> <tr> <th>Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>PSCAN AMEMO</td> <td>Cancels the auto-store memory status, and executes the function of the key pressed.</td> </tr> </tbody> </table> <p>All the other keys (excepting the POWER key) are invalid.</p> 	Key	Description	M1	Cancels the preset memory scan status, and executes the function of the pressed key.	I	M10	+10	ME	UP	DWN	FM	AM	SW	TAPE	CD	AUX	TUNER	Key	Description	LOUD	Executes the function of the pressed key, and continues preset memory scan.	MONO	VOL UP	VOL DWN	AUTO	TAPE MONI	MUTE	STANDBY	SEL	Key	Description	PSCAN AMEMO	Cancels the auto-store memory status, and executes the function of the key pressed.
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Symbol	Description								
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 5px auto;">ME</div>	<p>Key for writing to preset memory and adjustment of time</p> <p>(1) Display of a frequency: Writing to preset memory (2) Display of the clock: Adjustment of time</p> <p>(1) Writing to preset memory Each time the <div style="border: 1px solid black; padding: 2px;">ME</div> key is pressed, switching between preset memory write status and normal status is performed.</p> <ul style="list-style-type: none"> • If any key <div style="border: 1px solid black; padding: 2px;">M1</div> through <div style="border: 1px solid black; padding: 2px;">M10</div> (<div style="border: 1px solid black; padding: 2px;">+10</div>) is pressed in preset memory write status, the currently received frequency is written to the preset memory area correspondent to the pressed key. • "CH" displayed on the LCD panel blinks at 1 Hz (1/2 duty cycle). (The preset number also blinks if preset memory is being used for reception.) • If no key is pressed for more than five seconds, the preset memory write status is cancelled. <p>In preset memory write status, each key works in the following manner:</p> <table border="1" data-bbox="478 804 1433 1070"> <thead> <tr> <th>Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td><div style="border: 1px solid black; padding: 2px;">STANDBY</div></td> <td>Executes the function of the pressed key, and holds the preset memory write status.</td> </tr> <tr> <td><div style="border: 1px solid black; padding: 2px;">M1</div> <div style="border: 1px solid black; padding: 2px;">M10</div></td> <td>Writes a value to any preset memory area M1 – M20.</td> </tr> <tr> <td><div style="border: 1px solid black; padding: 2px;">+10</div></td> <td>Invokes preset memory write status.</td> </tr> </tbody> </table> <p>If any other key is pressed, the preset memory write status is cancelled, and the function of the pressed key is executed.</p> <p>(2) Adjustment of time Press the <div style="border: 1px solid black; padding: 2px;">ME</div> key and <div style="border: 1px solid black; padding: 2px;">UP</div> or <div style="border: 1px solid black; padding: 2px;">DWN</div> key at the same time to adjust the hour and minute digits. For details on the adjustment, see the descriptions of the <div style="border: 1px solid black; padding: 2px;">UP</div> and <div style="border: 1px solid black; padding: 2px;">DWN</div> keys.</p>	Key	Description	<div style="border: 1px solid black; padding: 2px;">STANDBY</div>	Executes the function of the pressed key, and holds the preset memory write status.	<div style="border: 1px solid black; padding: 2px;">M1</div> <div style="border: 1px solid black; padding: 2px;">M10</div>	Writes a value to any preset memory area M1 – M20.	<div style="border: 1px solid black; padding: 2px;">+10</div>	Invokes preset memory write status.
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Symbol	Description																			
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 2px;">UP</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">DWN</div>	<p>Keys for moving frequency UP/DOWN and adjusting the time</p> <p>(1) In radio mode: Receiving frequency UP/DOWN</p> <p>(2) During display of clock (excepting time of power-off and timer setting): Time can be adjusted by pressing the ME key, and UP or DWN key.</p> <p>(1) Receiving frequency UP/DOWN Either manual or auto-UP/DOWN is performed. Operation varies with the status of AUTO500 on the initial setup diode. For details on the operation, see 2.4.1, "Initial setup diode matrix".</p> <p>(2) Adjustment of time If the clock is displayed, time can be adjusted by pressing the UP or DWN key while holding down the ME key. If the ME key is held down, these keys work in the following manner:</p> <table border="1" data-bbox="379 746 1334 985"> <thead> <tr> <th>Key</th> <th>Digits adjusted</th> <th>Hold-down time</th> <th>Operation</th> <th>Hour digits</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">DWN</td> <td rowspan="2" style="text-align: center;">Hour digits</td> <td style="text-align: center;">Less than 0.5 sec.</td> <td>A hit of this key advances time by 1 hour.</td> <td rowspan="2" style="text-align: center;">Not affected</td> </tr> <tr> <td style="text-align: center;">0.5 sec. or more</td> <td>Time increases at a rate of 1 hour per 0.2 sec.</td> </tr> <tr> <td rowspan="2" style="text-align: center;">UP</td> <td rowspan="2" style="text-align: center;">Minutes digits</td> <td style="text-align: center;">Less than 0.5 sec.</td> <td>A hit of this key advances time by 1 minutes.</td> <td rowspan="2" style="text-align: center;">Clear</td> </tr> <tr> <td style="text-align: center;">0.5 sec. or more</td> <td>Time advances at a rate of 1 minute per 0.1 second until the key is released.</td> </tr> </tbody> </table> <p>However, only the UP and DWN keys are used for time adjustment of the timer.</p>	Key	Digits adjusted	Hold-down time	Operation	Hour digits	DWN	Hour digits	Less than 0.5 sec.	A hit of this key advances time by 1 hour.	Not affected	0.5 sec. or more	Time increases at a rate of 1 hour per 0.2 sec.	UP	Minutes digits	Less than 0.5 sec.	A hit of this key advances time by 1 minutes.	Clear	0.5 sec. or more	Time advances at a rate of 1 minute per 0.1 second until the key is released.
Key	Digits adjusted	Hold-down time	Operation	Hour digits																
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<div style="border: 1px solid black; padding: 2px; width: fit-content; text-align: center;">AUTO</div>	<p>Key for switching between auto-mode and manual mode It is valid in radio mode. Each time the AUTO key is pressed, auto-mode and manual mode are selected by turns.</p> <ul style="list-style-type: none"> ● Auto-mode The UP and DWN keys are used for seek UP/DOWN. ● Manual mode The up and DWN keys are used for manual UP/DOWN. In auto-mode, the display of "AUTO" is turned on. This key is invalid when AUTO500 on the initial setup diode is shorted (Mode is always set to manual mode). 																			
<div style="border: 1px solid black; padding: 2px; width: fit-content; text-align: center;">TAPE MONI</div>	<p>Key for setting tape monitor on/off It is valid when the power is on. Each time the TAPE MONI key is pressed, tape monitor is turned on and off by turns. The output from the MONI pin (pin 63) is switched as tape monitor is turned on and off.</p>																			

Symbol	Description
LOUD	<p>Key for setting loudness on/off. It is valid when the power is on. Each time the LOUD key is pressed, loudness function is turned on and off by turns. When loudness function is enabled, the display of "LOUD" is turned on. The output from the LOUD pin (pin 21) is switched when loudness function is turned on and off. When VOL on the initial setup diode is short-circuited, the loudness function (7.5 [dB]) of the electronic sound control can be turned on and off.</p>
MONO	<p>Key for setting monaural mode on/off. It is valid in radio mode. Each time the MONO key is pressed, monaural mode is turned on and off by turns. When the monaural mode is on, the display of "MONO" is turned on. The output from the MONO pin (pin 16) is switched when the monaural mode is turned on and off.</p>
DISP	<p>Key for display switching. It is valid when the power is turned on. Each time the DISP key is pressed, the frequency/mode and clock are displayed by turns. The operation varies with the status of PRIO on the initial setup diode. For details on the operation, see 2.4.1, "Initial setup diode matrix".</p>

Symbol	Description
<p>EVERYDAY</p>	<p>Key for setting everyday timer on/off time, and setting a preset station It is valid when the power is turned on. It is invalid when time is not adjusted (the clock is not working). The everyday timer turns the source on and off, and selects the preset station every day when the preset time comes. (In standby ON status) Each time the EVERYDAY key is pressed, the status changes in the following manner:</p> <div data-bbox="379 506 1273 644" data-label="Diagram"> <pre> graph LR A[Setting of ON time] --> B[Setting of Preset station] B --> C[Setting of OFF time] C --> D[Completion of setting of timer] D --> A </pre> </div> <p>A station can be preset only in radio mode. If ON time and OFF time are set to the same hour, the timer is turned off. If setting of the timer is completed in radio mode, the frequency from the station before setting is received. If the power is turned on by the timer, the mode that existed when the power was previously turned off will ensure.</p> <ul style="list-style-type: none"> ● Setting of timer ON time If the EVERYDAY key is pressed, the display of "EVERY", "ON" and ON time blinks. When adjustment begins, the ON time ceases to blink. (For adjustment of time, see the descriptions of the UP and DWN keys.) If no key is pressed for more than 5 seconds, the timer setting is completed, and the frequency and mode are displayed. ● Setting of timer preset station If the EVERYDAY key is pressed during setting of ON time, the display of "EVERY", band, frequency, "CH", and preset number blinks. When a preset station has been set, the display of band, frequency, "CH", and preset number stops blinking. If a different band is set, it is set to M1. For setting use the band keys (FM, AM, and SW) and preset keys (M1 through M10, and +10). Once a station is set, the frequency from that station is received until the timer setting is completed. If no key is pressed for more than 5 seconds, the timer setting is completed, and the frequency and more are displayed. ● Setting of timer OFF time If the EVERYDAY key is pressed when a preset station is displayed, the display of "EVERY", "OFF", and OFF time blinks. If adjustment begins, the display of OFF time ceases to blink. If no key is pressed for more than 5 seconds, the timer setting is completed, and the frequency and mode are displayed. If setting is completed without setting (displaying) the timer OFF time, the OFF time is automatically set to 60 minutes after the ON time.

Symbol	Description
<p style="text-align: center;">ONCE</p>	<p>Key used to set once timer on/off time, and preset station. The once timer turns on and off the source, and selects a preset station only once. For setting, see the descriptions of the EVERYDAY key. (The key executes the similar function except that "EVERY" should be read as "ONCE".)</p>
<p style="text-align: center;">SLEEP</p>	<p>A key for setting of the sleep timer. It is valid when the power is on. If the SLEEP key is pressed, the display of "SLEEP" begins to blink, and the time setting for the sleep timer is displayed for five seconds. The default setting for the sleep timer is 60 minutes. If the SLEEP key is pressed when the time is displayed, the setting is reduced in ten-minute steps (e.g., from 60 to 50 minutes, or from 45 to 35 minutes). If the time is set to "0" minute, the sleep timer is cancelled, and the display of "SLEEP" is turned off. If the sleep timer OFF time is reached during setting of the timer (everyday timer or once timer), the display of "SLEEP" will be turned off, but the power will not be turned off.</p>
<p style="text-align: center;">STANDBY</p>	<p>Key for selecting of timers (everyday timer and once timer only) It is valid when the level on the CE pin (pin 7) is high. However, it is valid when time is unadjusted (the clock is not working). Each time the STANDBY key is pressed, the timers are turned on and off by turns. If the timers (everyday and once timers) are activated in standby ON status, the display of "EVERY" and "ONCE" is turned on. If standby OFF status, the timer (everyday or once timer) will not be activated even if it is set. (The sleep timer works even in standby OFF status.) The output from the STANDBY pin (pin 22) is switched according to standby on/off.</p>
<p style="text-align: center;">MUTE</p>	<p>Key for temporarily cutting off sound. It turns on and off the mute control. It is valid when the power is on. Each time the MUTE key is pressed, the mute control is turned on and off by turns. The output from the MUTE pin (pin 30) is switched as the MUTE control is turned on and off.</p>

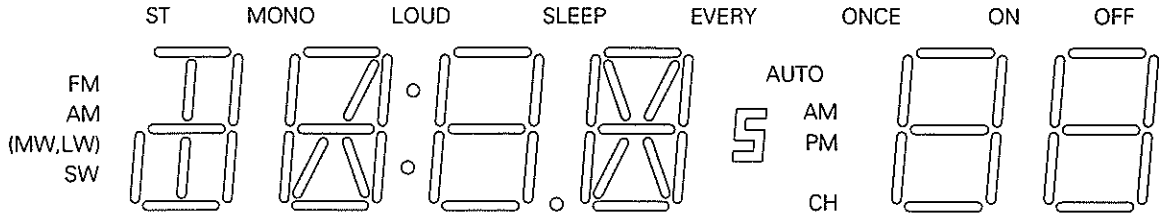
Symbol	Description																											
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">SEL</div>	<p>Key for switching between the VOL UP and VOL DWN functions. It is valid when the power is turned on. Each time the SEL key is pressed, the status changes in the following manner:</p> <div style="text-align: center; margin: 10px 0;"> <pre> graph LR A[Normal display (display of clock/ frequency/mode)] --> B[Volume display] B --> C[Balance display] C --> D[BASS display] D --> E[TREBLE display] B --- B1[Volume adjustment] C --- C1[Balance adjustment] D --- D1[BASS adjustment] E --- E1[TREBLE adjustment] </pre> </div> <p>If no key is pressed for more than two seconds when volume is displayed, the normal status (display) ensues. For adjustment of sound, see the descriptions of the VOL UP and VOL DWN keys. When the volume, balance, BASS, and TREBLE are displayed, the keys execute the following functions:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">SEL</td> <td>Changes the status.</td> </tr> <tr> <td style="text-align: center;">STANDBY</td> <td rowspan="3">Holds the status, and executes the function of the pressed key.</td> </tr> <tr> <td style="text-align: center;">VOL UP</td> </tr> <tr> <td style="text-align: center;">VOL DWN</td> </tr> </tbody> </table> <p>If any other key is pressed, normal display appears and the function of the pressed key is executed.</p>	Key	Description	SEL	Changes the status.	STANDBY	Holds the status, and executes the function of the pressed key.	VOL UP	VOL DWN																			
Key	Description																											
SEL	Changes the status.																											
STANDBY	Holds the status, and executes the function of the pressed key.																											
VOL UP																												
VOL DWN																												
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">VOL UP</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">VOL DWN</div>	<p>Keys for adjusting sound (volume, balance, BASS, and TREBLE). They are valid when the power is turned on. These keys execute the following functions:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Key pressing time</th> <th>Operation</th> </tr> </thead> <tbody> <tr> <td>Less than 0.5 sec.</td> <td>Moves up/down by one step.</td> </tr> <tr> <td>0.5 sec. or more</td> <td>Moves up/down by one step per 100 ms while the key is pressed.</td> </tr> </tbody> </table> <p>Using the SEL key, any desired item for adjustment is selected. For the switching procedure, see the descriptions of the SEL key.</p> <ul style="list-style-type: none"> ● Volume adjustment "VOL" is displayed. Using VOL on the initial setup diode, setting can be performed as follows: <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Initial setup diode VOL</th> <th rowspan="2">Output</th> <th rowspan="2">Default setting</th> <th colspan="3">Setting range</th> </tr> <tr> <th>Minimum</th> <th>Maximum</th> <th>Step</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>PWM output</td> <td>Duty ratio 38/64</td> <td>0/64</td> <td>63/64</td> <td>1/64 (in 64 steps)</td> </tr> <tr> <td>1</td> <td>Electronic source control</td> <td>-31.25 [dB]</td> <td>-78.75 [dB]</td> <td>0 [dB]</td> <td>1.25 [dB] (in 64 steps)</td> </tr> </tbody> </table> <p>(0: Opened, 1: Shorted)</p>	Key pressing time	Operation	Less than 0.5 sec.	Moves up/down by one step.	0.5 sec. or more	Moves up/down by one step per 100 ms while the key is pressed.	Initial setup diode VOL	Output	Default setting	Setting range			Minimum	Maximum	Step	0	PWM output	Duty ratio 38/64	0/64	63/64	1/64 (in 64 steps)	1	Electronic source control	-31.25 [dB]	-78.75 [dB]	0 [dB]	1.25 [dB] (in 64 steps)
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1	Electronic source control	-31.25 [dB]	-78.75 [dB]	0 [dB]	1.25 [dB] (in 64 steps)																							

Symbol	Description																																																																																	
<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: fit-content;">VOL UP</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: fit-content;">VOL DWN</div>	<p>Relations between display and volume are as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="2">Display</th> <th>VOL 0</th> <th>VOL 1</th> <th>VOL 2</th> <th>...</th> <th>VOL 62</th> <th>VOL 63</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Volume</td> <td>Duty ratio</td> <td>0/64</td> <td>1/64</td> <td>2/64</td> <td>...</td> <td>62/64</td> <td>63/64</td> </tr> <tr> <td>Attenuation [dB]</td> <td>-78.75</td> <td>-77.5</td> <td>-76.25</td> <td>...</td> <td>-1.25</td> <td>0</td> </tr> </tbody> </table> <p>● Balance adjustment "L", "C", "R" are displayed. If VOL on the initial setup diode is shorted, setting can be performed in the following manner:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Default value (for both right and left)</th> <th>Minimum (for both right and left)</th> <th>Maximum (for both right and left)</th> <th>Step</th> </tr> </thead> <tbody> <tr> <td>0 [dB]</td> <td>-∞ [dB]</td> <td>0 [dB]</td> <td>1.25 [dB] (in 63 steps)</td> </tr> </tbody> </table> <p>Caution 1. Right and left cannot be adjusted independently. 2. "-∞" indicates mute status.</p> <p>Relations between display and balance are as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="2">Display</th> <th>L31</th> <th>L30</th> <th>...</th> <th>CP</th> <th>...</th> <th>R30</th> <th>R31</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Balance [dB]</td> <td>Left</td> <td>0</td> <td>0</td> <td>...</td> <td>0</td> <td>...</td> <td>-37.5</td> <td>-∞</td> </tr> <tr> <td>Right</td> <td>-∞</td> <td>-37.5</td> <td>...</td> <td>0</td> <td>...</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <div style="text-align: center; margin: 10px 0;"> ← <div style="display: inline-block; border: 1px solid black; padding: 2px 5px;">VOL DWN</div> → <div style="display: inline-block; border: 1px solid black; padding: 2px 5px;">VOL UP</div> </div> <p>(Right attenuated) (Left attenuated)</p> <p>● BASS and TREBLE adjustment "bASS"/"TREb" are displayed. If VOL on the initial setup diode is shorted, setting can be performed in the following manner:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Default value for both BASS/TREBLE</th> <th>Minimum for both BASS/TREBLE</th> <th>Maximum for both BASS/TREBLE</th> <th>Step for both BASS/TREBLE</th> </tr> </thead> <tbody> <tr> <td>0 [dB]</td> <td>-14 [dB]</td> <td>+14 [dB]</td> <td>2 [dB] (in 15 steps)</td> </tr> </tbody> </table> <p>Relations between display and balance are as follows. (Display of "bASS"/"TREb" is omitted.)</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Display</th> <th>-7</th> <th>-6</th> <th>...</th> <th>0</th> <th>...</th> <th>6</th> <th>7</th> </tr> </thead> <tbody> <tr> <td>BASS/TREBLE [dB]</td> <td>-14</td> <td>-12</td> <td>...</td> <td>0</td> <td>...</td> <td>+12</td> <td>+14</td> </tr> </tbody> </table>	Display		VOL 0	VOL 1	VOL 2	...	VOL 62	VOL 63	Volume	Duty ratio	0/64	1/64	2/64	...	62/64	63/64	Attenuation [dB]	-78.75	-77.5	-76.25	...	-1.25	0	Default value (for both right and left)	Minimum (for both right and left)	Maximum (for both right and left)	Step	0 [dB]	-∞ [dB]	0 [dB]	1.25 [dB] (in 63 steps)	Display		L31	L30	...	CP	...	R30	R31	Balance [dB]	Left	0	0	...	0	...	-37.5	-∞	Right	-∞	-37.5	...	0	...	0	0	Default value for both BASS/TREBLE	Minimum for both BASS/TREBLE	Maximum for both BASS/TREBLE	Step for both BASS/TREBLE	0 [dB]	-14 [dB]	+14 [dB]	2 [dB] (in 15 steps)	Display	-7	-6	...	0	...	6	7	BASS/TREBLE [dB]	-14	-12	...	0	...	+12	+14
Display		VOL 0	VOL 1	VOL 2	...	VOL 62	VOL 63																																																																											
Volume	Duty ratio	0/64	1/64	2/64	...	62/64	63/64																																																																											
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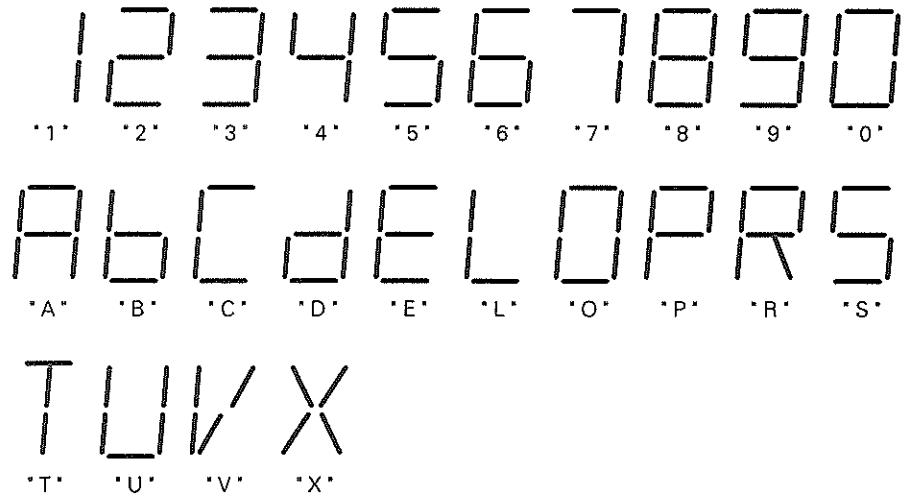
Symbol	Description
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">POWER</div>	<p>Key for setting power on/off.</p> <p>Even if the <div style="border: 1px solid black; padding: 2px;">POWER</div> key and any other key are pressed at the same time, the <div style="border: 1px solid black; padding: 2px;">POWER</div> key is valid.</p> <p>It is valid when the level on the CE pin is high.</p> <p>Each time the <div style="border: 1px solid black; padding: 2px;">POWER</div> key is pressed, the power is turned on and off by turns.</p> <p>The output from the POWER pin (pin 23) is switched as the POWER switch is pressed.</p> <ul style="list-style-type: none"> ● Power-on: <ul style="list-style-type: none"> When power is turned on, the mode which was set when the power was previously turned off is invoked. In radio mode, the frequency which was received when the power was previously turned off is received. When VDD is supplied first, the following states ensue: <ul style="list-style-type: none"> • If the time is unadjusted, the clock will not work until the time is adjusted. • In radio mode, the lowest frequency in the FM band is received. • Volume control: OFF • LOUD (loudness): OFF • MONO (Monaural): OFF • Standby: OFF • Timers (everyday, once, and sleep timers): OFF • Manual mode • Preset shift status cancelled • Preset memory write status cancelled • Tape monitor: OFF • Frequency is displayed. Display of "FM" is turned on. ● Power-off: <ul style="list-style-type: none"> Only the clock is displayed. The sleep timer is cancelled. If the once timer was used to turn on the power previously, the once timer is cancelled.
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 2px;">FM</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 2px;">AM</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">SW</div>	<p>Keys for switching bands.</p> <p>They are valid in radio mode.</p> <p>The outputs from BAND₁, BAND₂, and SW pins (pins 17, 18, and 11) vary according to the band selected.</p>
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 2px;">TAPE</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 2px;">CD</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 2px;">AUX</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">TUNER</div>	<p>Keys for switching modes.</p> <p>They are valid when the power is on.</p> <p>If the <div style="border: 1px solid black; padding: 2px;">TUNER</div> key (radio mode) is pressed, the frequency is displayed. If any other mode key is pressed, mode is displayed.</p> <p>According to the selected mode, outputs from the TAPE (pin 31), CD (pin 32), AUX (pin 33), and TUNER pins (pin 34) vary.</p>

3. DISPLAY

3.1 LCD PANEL

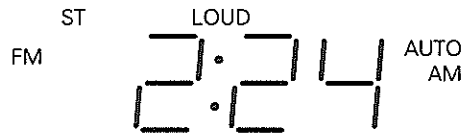


3.2 FONT



3.3 SAMPLE DISPLAY

(1) Radio mode (clock display)



(2) Radio mode (frequency display)



(3) Tape mode

LOUD SLEEP
T A P E

(4) CD mode

C d

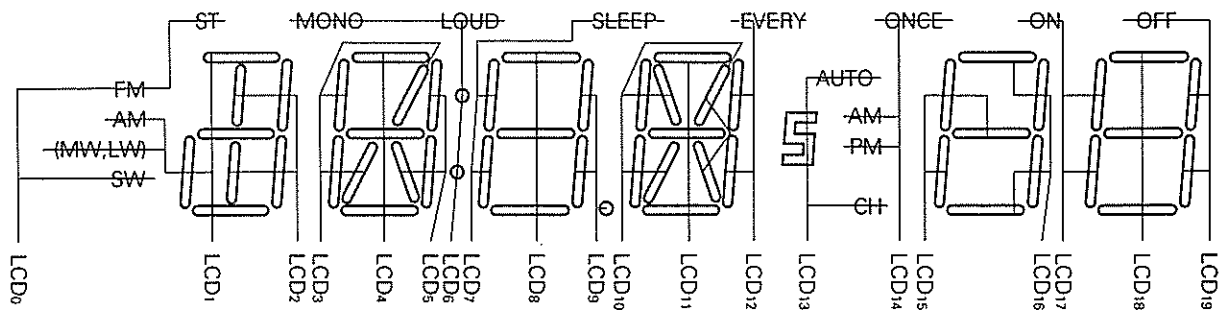
(5) AUX mode

A U X

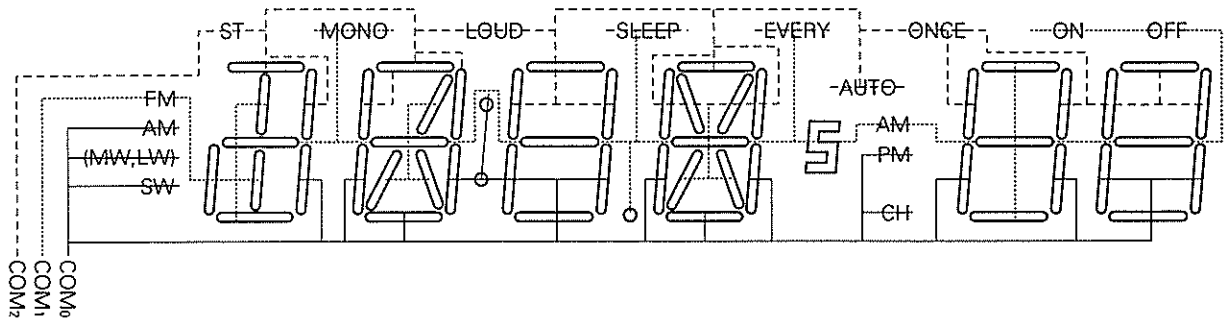
(6) Sound control

Volume display	VOL	38
Balance display (center)	C	0
Balance display (right high)	R	12
Balance display (left high)	L	6
BASS display	BAS	2
TREBLE display	TREB	-3

3.4 CONNECTION OF SEGMENT LINES



3.5 CONNECTION OF COMMON LINES



3.6 LCD ALLOCATION

① to ⑥ indicates the segment positions.

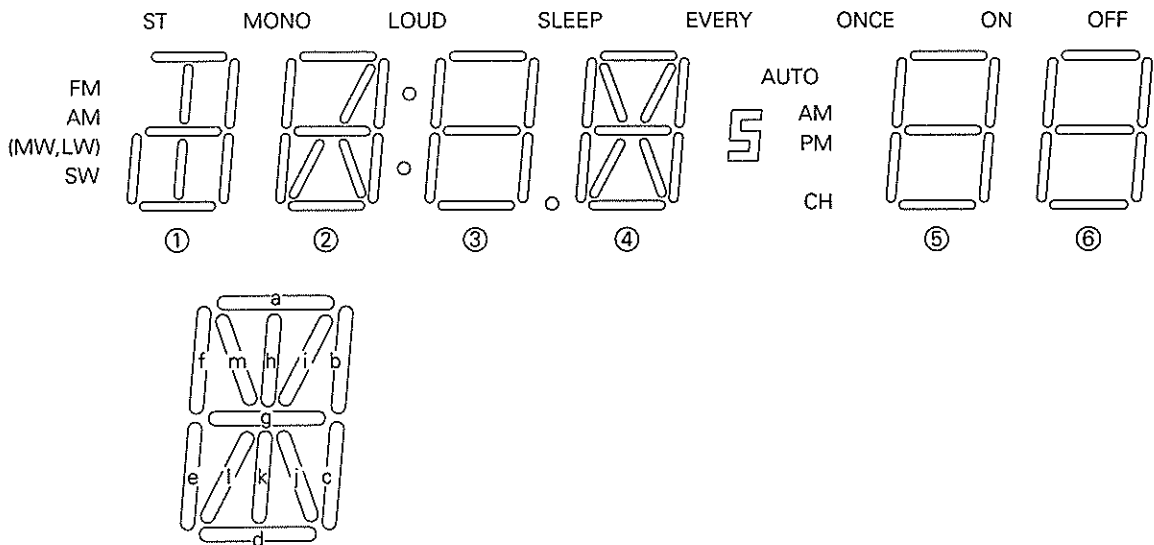
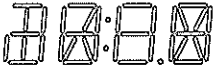



Table 3-1 Relations between Segment/common Pins and LCD Display

Common Segment	COM ₀ (37)	COM ₁ (36)	COM ₂ (35)
LCD ₀ (57)	SW	FM	ST
LCD ₁ (56)	AM (MW, LW)	①d, ①e, ①g	①a
LCD ₂ (55)	①c	①k, ①h	①b
LCD ₃ (54)	②e	②l, ②i	②f
LCD ₄ (53)	②d	②g	②a
LCD ₅ (52)	②c	②j	②b
LCD ₆ (51)	:	MONO	LOUD
LCD ₇ (50)	③d	SLEEP	③f
LCD ₈ (49)	③d	③g	③a
LCD ₉ (48)	③c		③b
LCD ₁₀ (47)	④e	④i, ④j, ④l, ④m	④f
LCD ₁₁ (46)	④d	④g	④a
LCD ₁₂ (45)	④c	EVERY	④b
LCD ₁₃ (44)	CH	5	AUTO
LCD ₁₄ (43)	PM	AM	ONCE
LCD ₁₅ (42)	⑤e	⑤g	⑤f
LCD ₁₆ (41)	⑤c	⑤a, ⑤d	⑤b
LCD ₁₇ (40)	⑥e	ON	⑥f
LCD ₁₈ (39)	⑥d	⑥g	⑥a
LCD ₁₉ (38)	⑥c	OFF	⑥b

Remark Figures in parentheses are pin numbers.

3.7 SYMBOLS DISPLAYED

Symbol	Description
FM	Turned on when a frequency in FM band is received in radio mode.
AM (MW, LW)	Turned on when a frequency in AM band is received in radio mode.
SW	Turned on when a frequency in SW band is received in radio mode.
ST	Turned on when the level on the \overline{ST} pin (pin 15) is low. However, it is not turned on when the level on the MONO pin (pin 16) is high. ST is displayed only in radio mode.
MONO	Turned on when monoral output is selected. MONO is displayed only in radio mode.
LOUD	Turned on when loudness output is selected.
SLEEP	Turned on when the sleep timer has been set. It blinks when the timer is being set.
EVERY	Turned on in standby ON status if the every timer has been set.
ONCE	Turned on in standby ON status if the once timer has been set.
ON	Blinks during setting of ON time.
OFF	Blinks during setting of OFF time.
AUTO	Turned on in auto mode.
AM/PM	Turned on in 12-hour display mode.
CH	Turned on when a preset memory number is displayed.
5	Turned on to indicate the lowest digit of a frequency in the FM (partial) or SW band. It is turned on (off) if the lowest digit is 5 (0)
	Displays frequency, clock, mode, and sound control.
	Displays preset memory number and sound control.

4. REMOTE CONTROL

The μPD6121G-002 or μPD6122G-002 is used as a remote controller transmitter IC. Unless the custom code for either of these ICs is correctly set, the μPD17012-071 cannot be remote-controlled. The custom code which operates the μPD17012-071 is 844FH. It is set by connecting a diode to the transmitter IC key matrix (See 4.5 EXAMPLE OF REMOTE CONTROL PREAMPLIFIER CIRCUIT USING μPD2800HA).

If the μPD6121G-002 is used, the **PMEMO DWN** and **PMEMO UP** keys cannot be used.


4.1 LOCATION OF REMOTE CONTROL KEYS

Fig. 4-1 Location of Remote Control Keys (when μPD6122G-002 is used)

Input pin Output pin	KI ₀	KI ₁	KI ₂	KI ₃
KI/O ₀	M1 (OPT1)	M2 (OPT2)	M3 (OPT3)	M4 (OPT4)
KI/O ₁	M5 (OPT5)	M6 (OPT6)	M7 (OPT7)	M8 (OPT8)
KI/O ₂	M9 (OPT9)	M10 (OPT10)	+10 (OPT11)	PSCAN AMEMO (OPT12)
KI/O ₃	ME (OPT13)	DWN (OPT14)	UP (OPT15)	AUTO (OPT16)
KI/O ₄	TAPE MONI	LOUD	MONO	DISP
KI/O ₅	TAPE	CD	AUX	TUNER
KI/O ₆	MUTE	VOL DWN	VOL UP	POWER
KI/O ₇	FM	AM	SW	SEL

Input pin Output pin	KI ₄	KI ₅	KI ₆	KI ₇
KI/O ₀	PMEMO DWN	PMEMO UP	-	-
KI/O ₁	-	-	-	-
KI/O ₇	-	-	-	-

 : Decoder output key in tape or CD mode

 : Decoder output key in CD mode

4.2 FUNCTIONS OF REMOTE CONTROL KEYS

The remote control keys are invalid if any key on the system is pressed.

If two keys (including the **POWER** key) are pressed at the same time, they are invalid. Therefore, time cannot be adjusted.

(1) Radio mode

Symbol	Description						
<div style="border: 1px solid black; padding: 2px; display: inline-block;">PMEMO DWN</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">PMEMO UP</div>	Keys for preset memory UP/DOWN. They are valid in radio mode. They execute the following functions: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Key pressing time</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Less than 0.5 sec.</td> <td>Move up/down preset memory by one step.</td> </tr> <tr> <td>0.5 sec. or more</td> <td>Move up/down preset memory by one step per 300 ms while being pressed.</td> </tr> </tbody> </table>	Key pressing time	Description	Less than 0.5 sec.	Move up/down preset memory by one step.	0.5 sec. or more	Move up/down preset memory by one step per 300 ms while being pressed.
Key pressing time	Description						
Less than 0.5 sec.	Move up/down preset memory by one step.						
0.5 sec. or more	Move up/down preset memory by one step per 300 ms while being pressed.						

All the other keys executes the same functions as the momentary keys for the μPD17012-071. For details on the operation, see 2.4.2, "MOMENTARY KEYS".

(2) Tape mode

Symbol	Description
<div style="border: 1px solid black; padding: 2px; display: inline-block;">M1 (OPT1)</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">M8 (OPT8)</div>	Pins for remote control key decoder outputs. If any of these keys is pressed, the output from the expansion port correspondent to the pressed key changes (See Fig. 5-3, "Expansion port pin diagram"). While the key is pressed, the level of the output is high. OPT1 → TAPE1 OPT8 → TAPE8 During setting of timers (excepting sleep timer), these keys are invalid.

All the other keys execute the same functions as the momentary keys for the μPD17012-071.

(3) CD mode

Symbol	Description
<div style="border: 1px solid black; padding: 2px; display: inline-block;">M1 (OPT1)</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">AUTO (OPT16)</div>	Pins for remote control key decoder outputs. If any of these keys is hit, the output from the expansion port correspondent to the hit key changes (See Fig. 5-3, "Expansion port pin diagram"). While the key is pressed, the level of the output is high. OPT1 → CD1 OPT16 → CD16 During setting of timers (excepting sleep timer), these keys are invalid.

All the other keys execute the same functions as the momentary keys for the μPD17012-071.

(4) AUX mode

These keys execute the same functions as the momentary keys for the μPD17012-071.

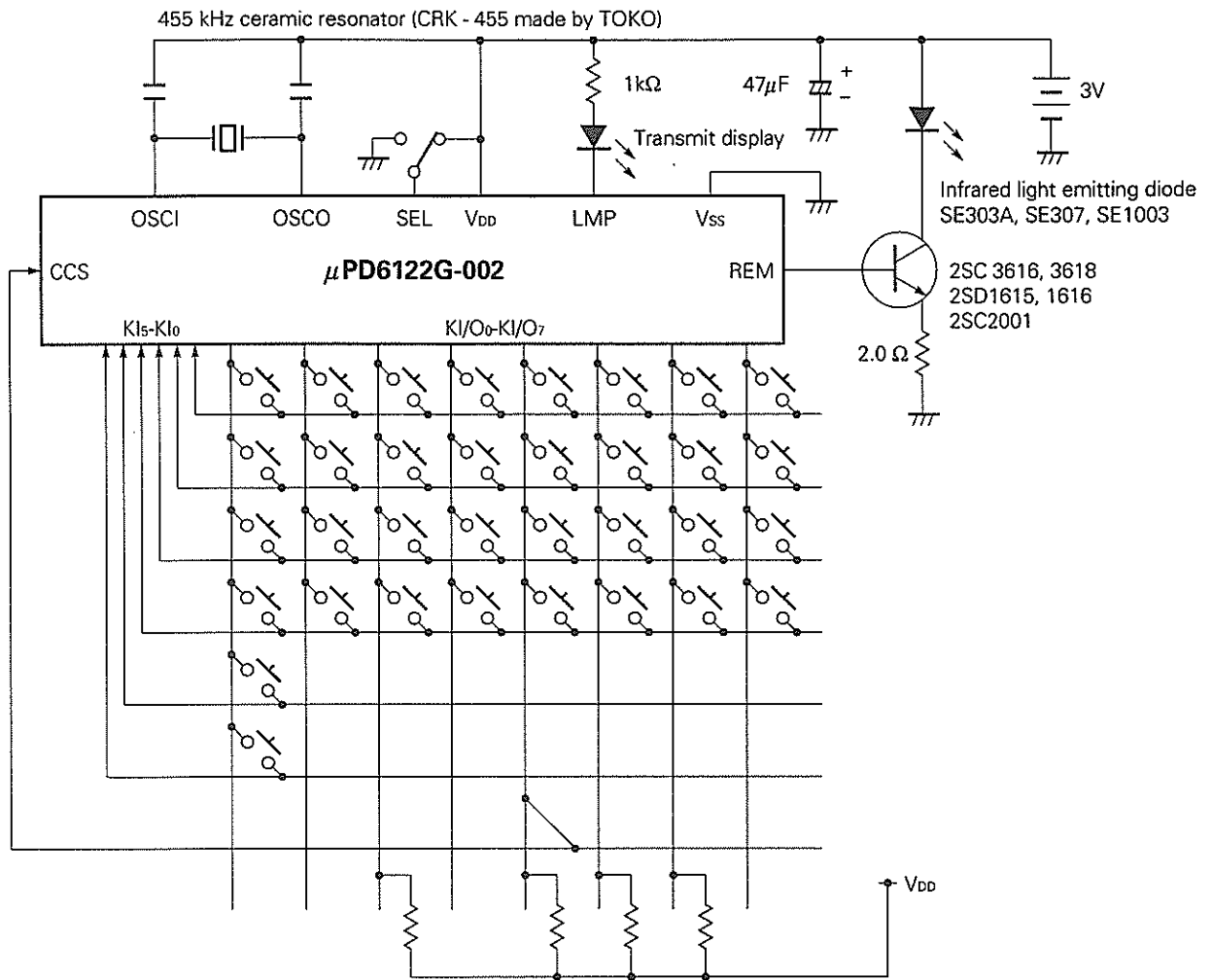
4.3 REMOTE CONTROL DATA CODE

Table 4-1 Remote Control Data Code Table

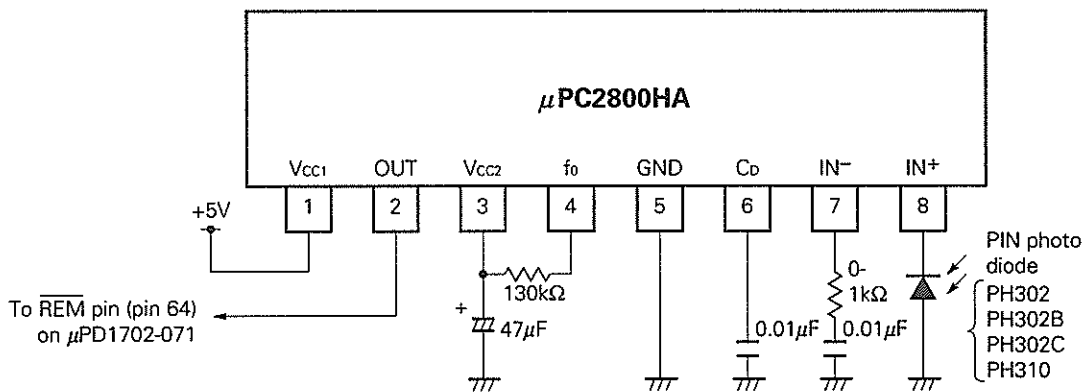
Remote control key	Data code							
	D0	D1	D2	D3	D4	D5	D6	D7
M1 (OPT1)	0	0	0	0	0	0	0	0
M2 (OPT2)	1	0	0	0	0	0	0	0
M3 (OPT3)	0	1	0	0	0	0	0	0
M4 (OPT4)	1	1	0	0	0	0	0	0
M5 (OPT5)	0	0	1	0	0	0	0	0
M6 (OPT6)	1	0	1	0	0	0	0	0
M7 (OPT7)	0	1	1	0	0	0	0	0
M8 (OPT8)	1	1	1	0	0	0	0	0
M9 (OPT9)	0	0	0	1	0	0	0	0
M10 (OPT10)	1	0	0	1	0	0	0	0
+10 (OPT11)	0	1	0	1	0	0	0	0
PSCANMEMO (OPT12)	1	1	0	1	0	0	0	0
ME (OPT13)	0	0	1	1	0	0	0	0
DWN (OPT14)	1	0	1	1	0	0	0	0
UP (OPT15)	0	1	1	1	0	0	0	0
AUTO (OPT16)	1	1	1	1	0	0	0	0
TAPE MONI	0	0	0	0	1	0	0	0

Remote control key	Data code							
	D0	D1	D2	D3	D4	D5	D6	D7
LOUD	1	0	0	0	1	0	0	0
MONO	0	1	0	0	1	0	0	0
DISP	1	1	0	0	1	0	0	0
TAPE	0	0	1	0	1	0	0	0
CD	1	0	1	0	1	0	0	0
AUX	0	1	1	0	1	0	0	0
TUNER	1	1	1	0	1	0	0	0
MUTE	0	0	0	1	1	0	0	0
VOL DWN	1	0	0	1	1	0	0	0
VOL UP	0	1	0	1	1	0	0	0
POWER	1	1	0	1	1	0	0	0
FM	0	0	1	1	1	0	0	0
AM	1	0	1	1	1	0	0	0
SW	0	1	1	1	1	0	0	0
SEL	1	1	1	1	1	0	0	0
PMEMO DWN	0	0	0	0	0	0	1	0
PMEMO UP	1	0	0	0	0	0	1	0

4.4 EXAMPLE OF REMOTE CONTROL CIRCUIT USING μPD6122G-002



4.5 EXAMPLE OF REMOTE CONTROL PREAMPLIFIER CIRCUIT USING μPC2800HA



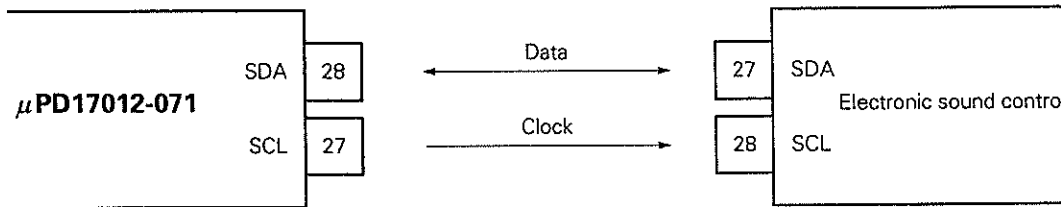
5. SERIAL DATA

5.1 ELECTRONIC SOUND CONTROL

The μPD17012-071 sends data on any desired attenuation to the electronic sound control.

Data output to the electronic sound control needs two data buses for data and clock. They are output from the SDA pin (pin 28) and SCL pin (pin 27) on the μPD17012-071.

Fig. 5-1 Pin Connection (Electronic Sound Control)

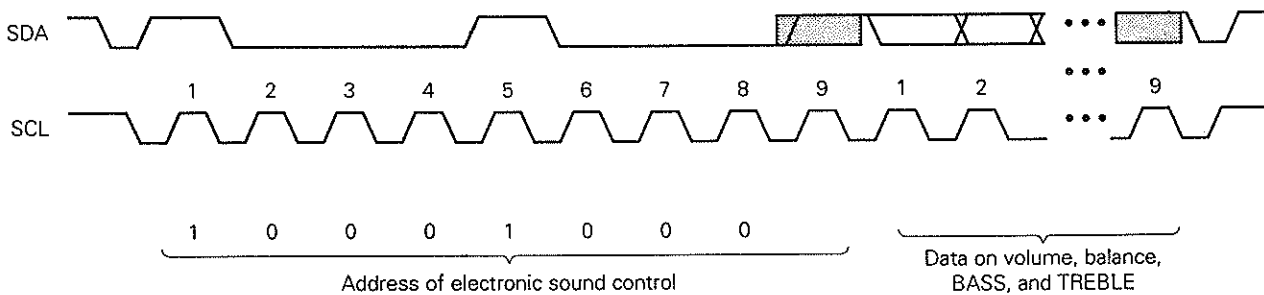


Electronic sound control data consists of nine bits (8 bits for data, and 1 bit for ACK signal).

The format for data transmission is address (9 bits) + voice data (9 bits × N), where N is the volume of data on volume, balance, etc.

The clock is an approximately 22-kHz clock.

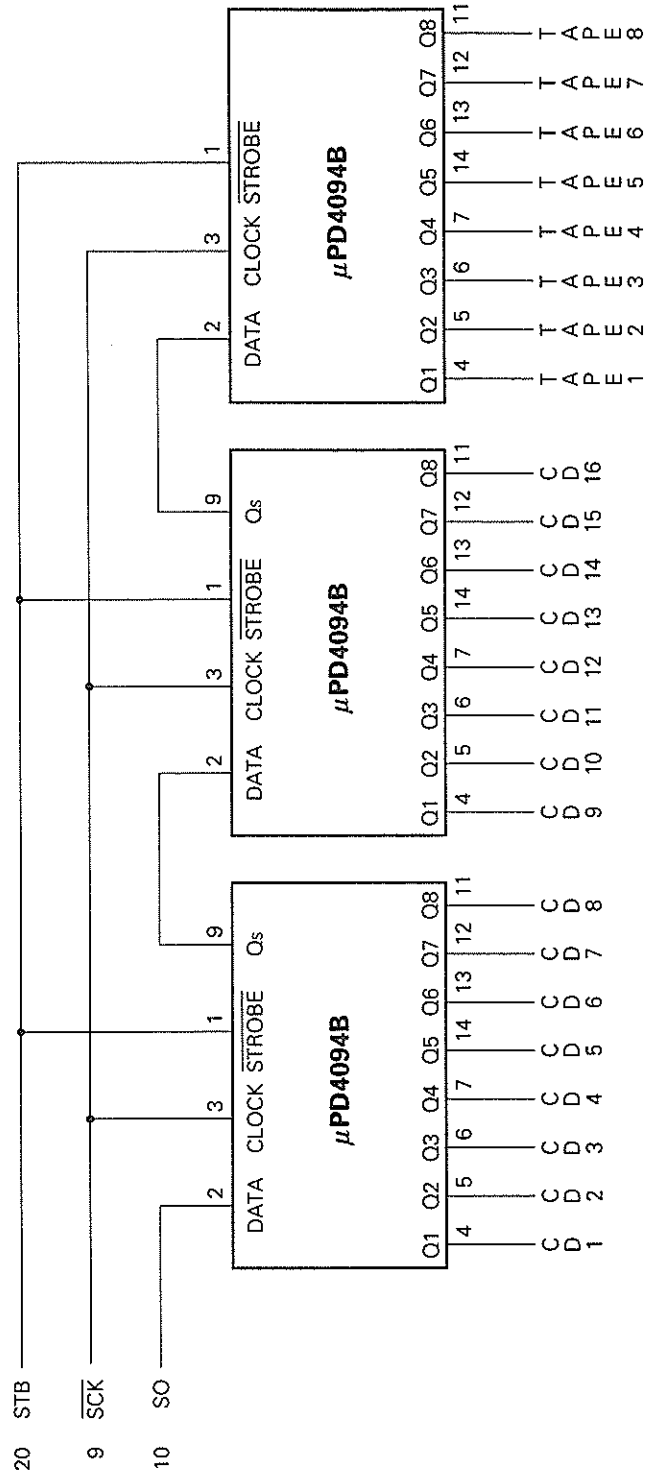
Fig. 5-2 Data Transmission Format (Electronic Sound Control)



5.2 EXPANSION PORTS

Fig. 5-3 is an expansion port pin diagram.

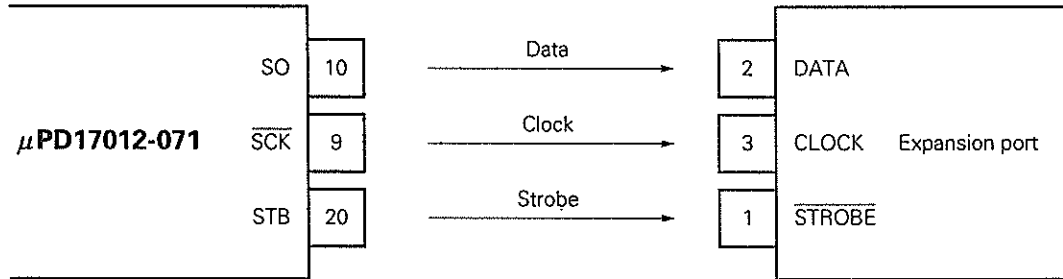
Fig. 5-3 Expansion Port Pin Diagram



The μPD17012-071 sends data to the expansion port (μPD4094B).

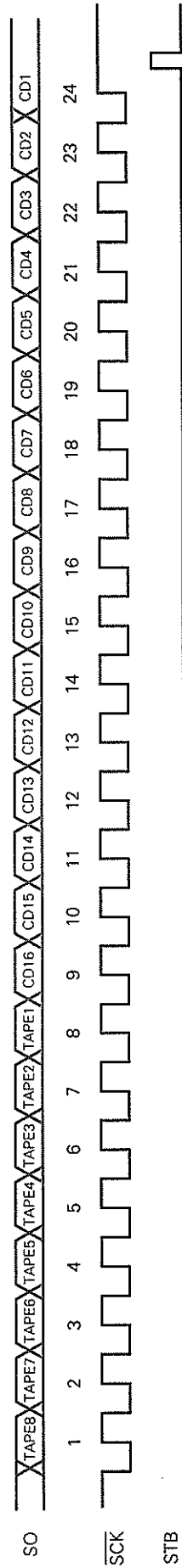
Data output to the expansion port needs three data buses for data, clock, and strobe. They are output from the SO pin (pin 10), \overline{SCK} pin (pin 9), and STB pin (pin 20).

Fig. 5-4 Pin Connection (Expansion Port)



Data for the expansion port consists of 24 bits. Change to the acquired data is synchronized with the strobe signal. The frequency of the shift clock is 450 kHz.

Fig. 5-5 Data Transmission Format (Expansion Port)



6. MUTE OUTPUT TIMING

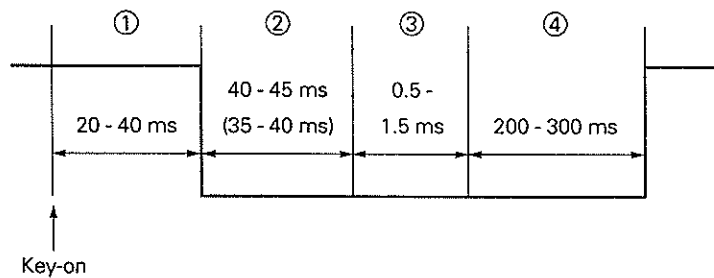
This chapter describes the mute output timing.

The timing charts in the following sections show the time requirements for each processing. The encircled numbers in the charts indicate the following parameters:

- ① Key-on chattering waiting time
- ② Pre-muting time: The figure in parentheses is the pre-muting time when the electronic sound control is selected.
- ③ Time for setting of division ratio and renewal of displayed item
- ④ Post-muting time
- ⑤ Scan time
- ⑥ PLL lock waiting time
- ⑦ Time for initial setup

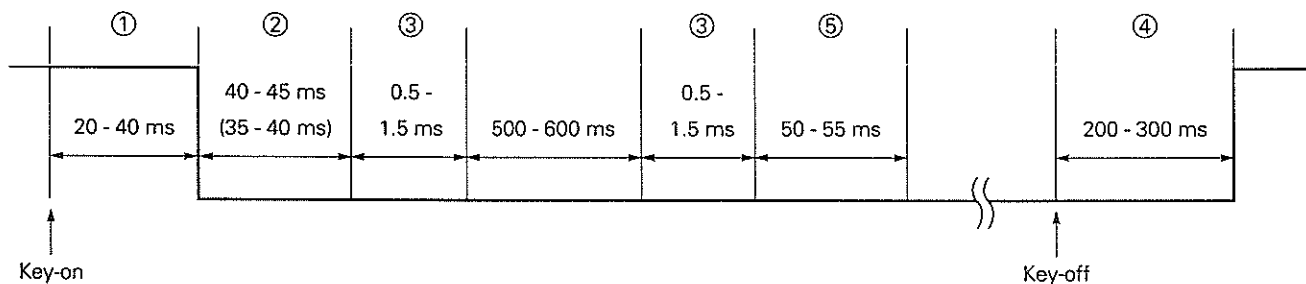
6.1 MANUAL UP/DOWN

6.1.1 1-Channel UP/DOWN



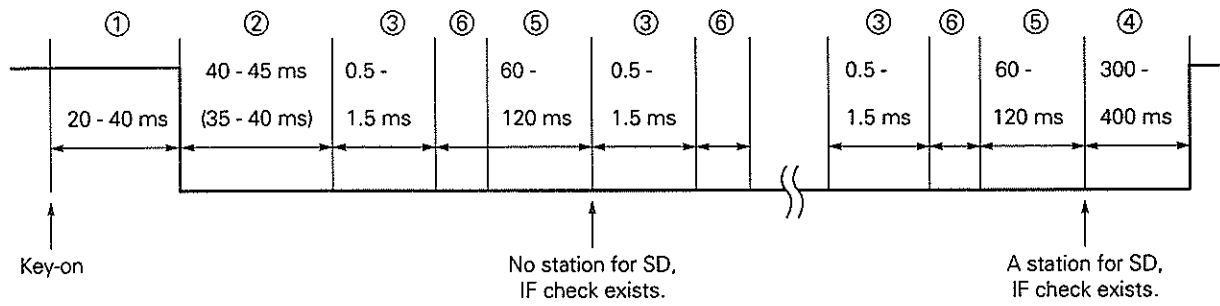
At band edges, the time ④ is 700-800 ms.

6.1.2 Continuous UP/DOWN



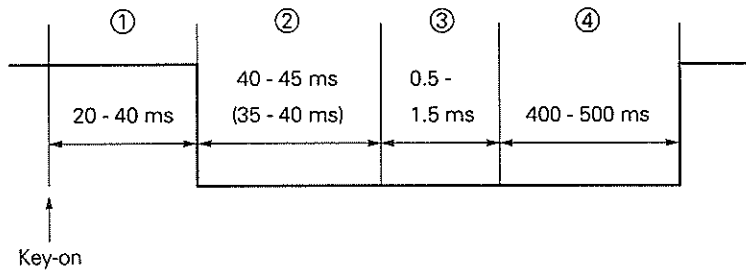
At band edges, the time ⑤ is 600-700 ms, and time ④ is 700-800 ms.

6.2 AUTO UP/DOWN

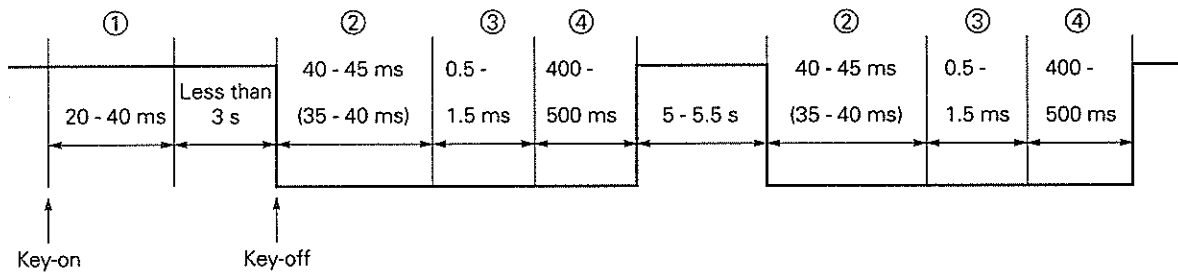


At band edges, the time ⑤ is 660-820 ms.

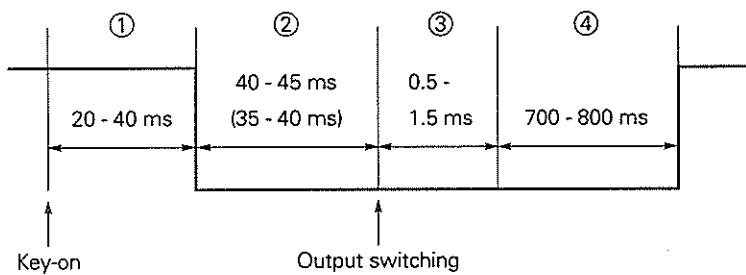
6.3 CALLING OF PRESET MEMORY



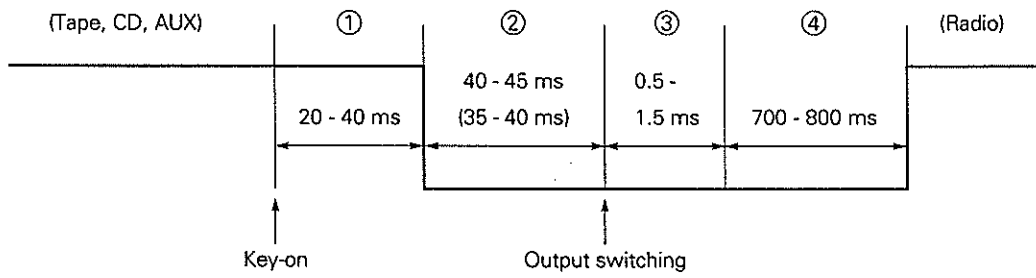
6.4 PRESET MEMORY SCANNING



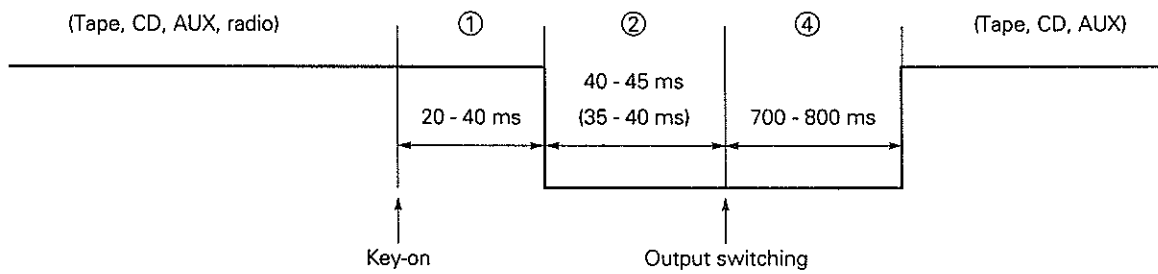
6.5 BAND SWITCHING



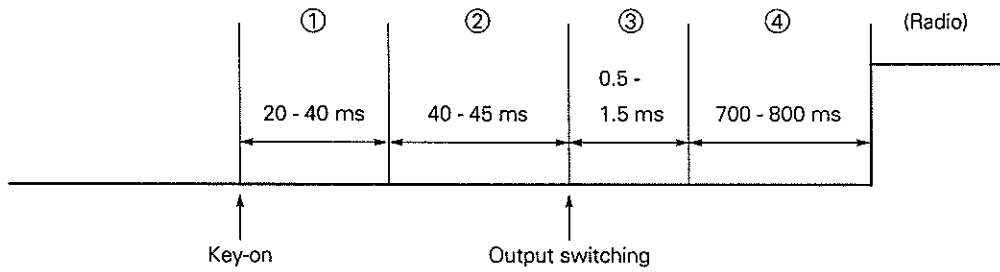
6.6 TURNING ON RADIO MODE



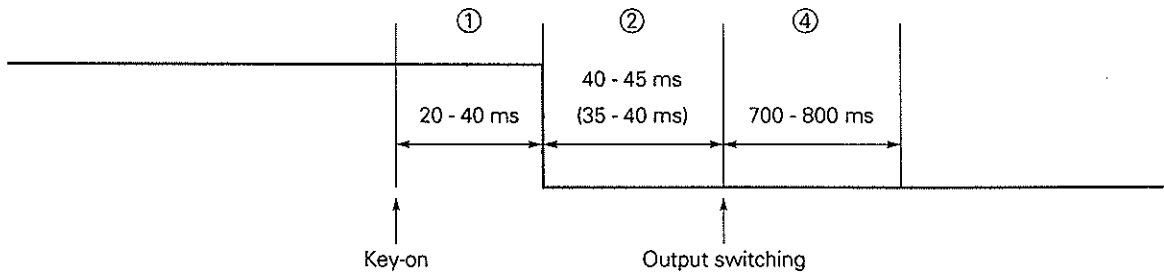
6.7 TURNING ON TAPE, CD, AUX MODE



6.8 TURNING ON POWER (RADIO MODE)

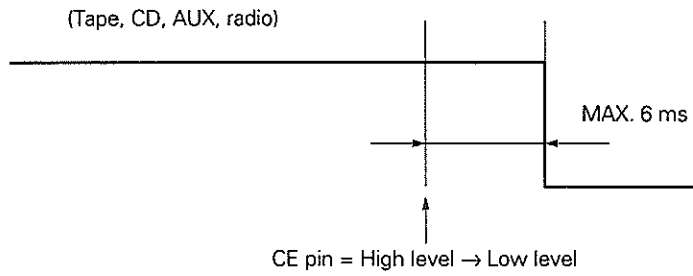


6.9 TURNING OFF POWER

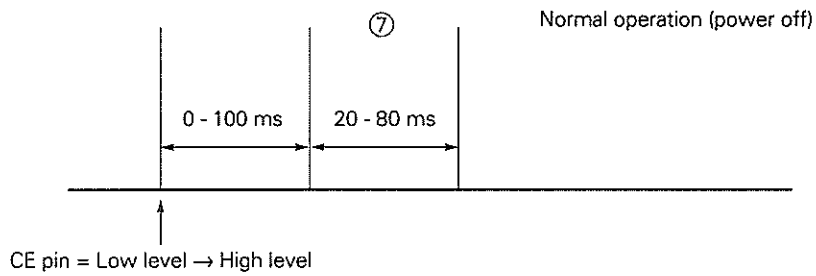


6.10 CE PIN

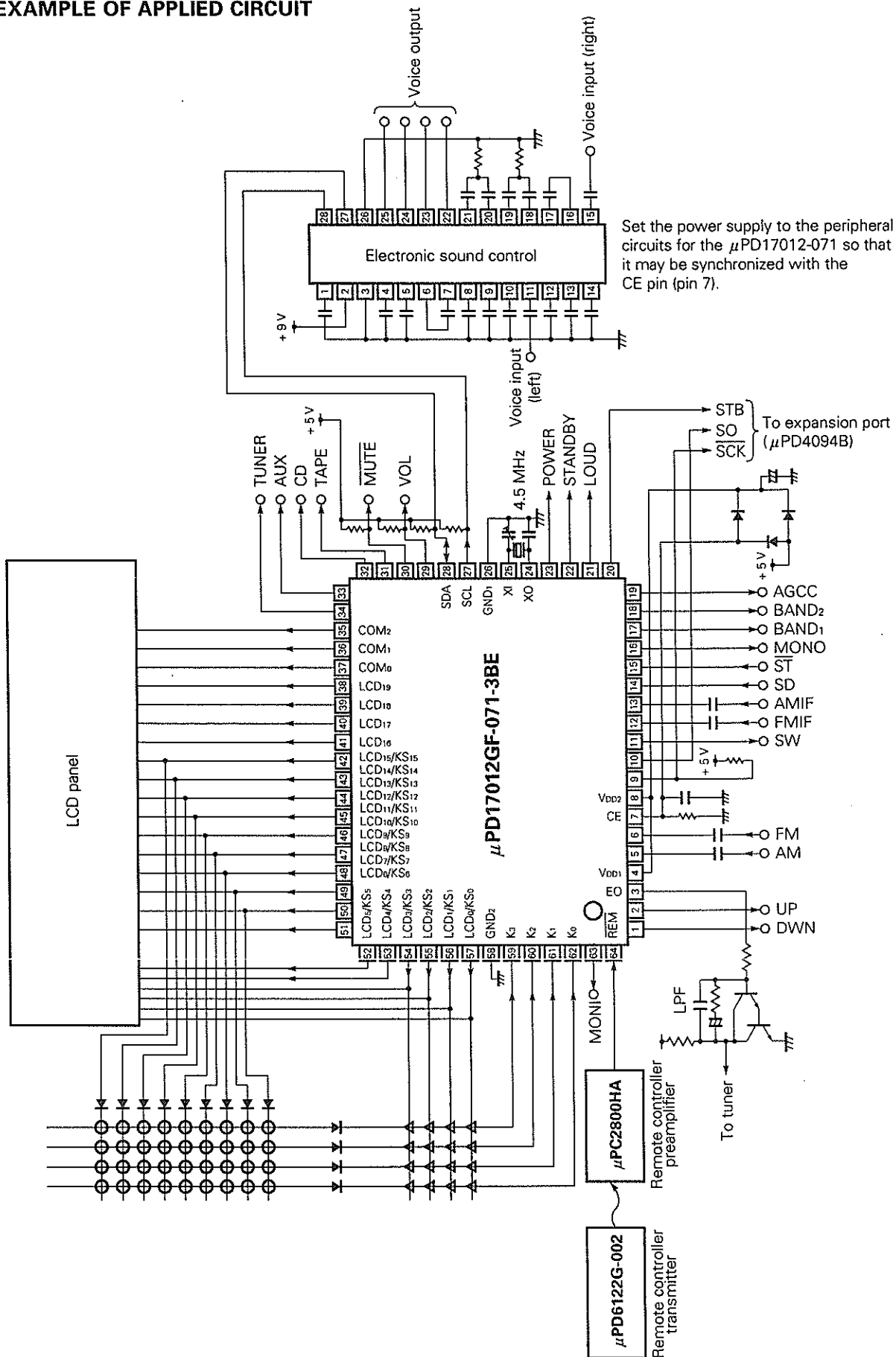
6.10.1 Change from High to Low



6.10.2 Change from Low to High



7. EXAMPLE OF APPLIED CIRCUIT



Set the power supply to the peripheral circuits for the μPD17012-071 so that it may be synchronized with the CE pin (pin 7).

8. ELECTRICAL SPECIFICATIONS (Preliminary)

ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V _{DD}		-0.3 to +6.0	V
Input voltage	V _I		-0.3 to V _{DD} +0.3	V
Output voltage	V _O	Excluding P0C0 – P0C3	-0.3 to V _{DD} +0.3	V
High level output current	I _{OH}	Per pin	-12.0	mA
		Total, all output pins	-20.0	mA
Low level output current	I _{OL}	Per pin	15.0	mA
		Total, all output pins	30.0	mA
Output breakdown voltage	V _{BDS}	P0C0 – P0C3	10.0	V
Total power dissipation	P _T		400	mW
Operating ambient temperature	T _{opt}	With all the functions turned on	-40 to +85	°C
Storage temperature	T _{stg}		-55 to +125	°C

Caution If any one of the above parameters momentarily exceeds the absolute maximum rating, the quality of the product are impaired. The absolute maximum rating is a critical value that can cause physical damage to the product. Be sure that none of the above characteristics reach the rating when using the product.

Recommended Operating Conditions (Ta = -40 to +85 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Supply voltage	V _{DD1}	With all the functions turned on	4.5	5.0	5.5	V
	V _{DD2}	With CPU operated, and PLL stopped	3.5	5.0	5.5	V
Data holding voltage	V _{DDR}	With crystal oscillator stopped	2.3		5.5	V
Output breakdown voltage	V _{BDS}	P0C0 – P0C3			9.0	V
Supply voltage rise time	t _{rise}	V _{DD} : 0 → 4.5 V			500	ms

DC CHARACTERISTIC (Ta = -40 to +85 °C, VDD = 5 V ± 10 %)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	
Supply current	I _{DD1}	CPU operated, PLL stopped, sine wave input to X _{IN} pin (f _{IN} = 4.5 MHz, V _{IN} = V _{DD})		2.0	3.0	mA	
	I _{DD2}	CPU operated, PLL stopped, sine wave input to X _{IN} pin (f _{IN} = 4.5 MHz, V _{IN} = V _{DD}) HALT instruction used		0.5	1.0	mA	
Data holding voltage	V _{DDR1}	With crystal oscillator turned on Timer FF used to detect power interruption	3.5		5.5	V	
	V _{DDR2}	With crystal oscillator turned off Timer FF used to detect power interruption	2.3		5.5	V	
	V _{DDR3}	Holding of data memory	2.0		5.5	V	
Data holding current	I _{DDR1}	With crystal oscillator stopped	V _{DD} = 5 V, T _s = 25 °C		2.0	4.0	μA
	I _{DDR2}				2.0	20.0	μA
	I _{DDR3}		V _{DD} = 2.3 V, T _s = 25 °C		1.0	2.0	μA
	I _{DDR4}		V _{DD} = 2.3 V		1.0	10.0	μA
Intermediate level output voltage	V _{OM}	COM ₀ – COM ₂ V _{DD} = 5.0 V	2.3		2.7	V	
High level input voltage	V _{IH1}	P0A ₁ , P0B ₀ – P0B ₃ , P1A ₀ – P1A ₂ , P1B ₀ – P1B ₃ , P1D ₀ – P1D ₃	0.7 V _{DD}		V _{DD}	V	
	V _{IH2}	P0A ₀ , P0A ₂ , CE, INT	0.8 V _{DD}		V _{DD}	V	
	V _{IH3}	P0D ₀ – P0D ₃	0.6 V _{DD}		V _{DD}	V	
Low level input voltage	V _{IL1}	P0A ₁ , P0B ₀ – P0B ₃ , P0D ₀ – P0D ₃ , P1A ₀ – P1A ₂ , P1B ₀ – P1B ₃ , P1D ₀ – P1D ₃	0		0.2 V _{DD}	V	
	V _{IL2}	P0A ₀ , P0A ₂ , CE, INT	0		0.2 V _{DD}	V	
High level output current	I _{OH1}	P0A ₀ – P0A ₂ , P0B ₀ – P0B ₃ , P1A ₀ – P1A ₂ , P1C ₀ – P1C ₃ , P1D ₀ – P1D ₃ V _{OH} = V _{DD} – 1 V	-1.0			mA	
	I _{OH2}	LCD ₀ – LCD ₁₀ , EO V _{OH} = V _{DD} – 1 V	-1.0			mA	
Low level output current	I _{OL1}	P0A ₀ – P0A ₂ , P0B ₀ – P0B ₃ , P1A ₀ – P1A ₂ , P1C ₀ – P1C ₃ , P1D ₀ – P1D ₃ V _{OL} = 1 V	1.0			mA	
	I _{OL2}	LCD ₀ – LCD ₁₀ , EO V _{OL} = 1 V	1.0			mA	
	I _{OL3}	P0C ₀ – P0C ₃ V _{OL} = 1 V	10			mA	
High level input current	I _{IH1}	With VCOH terminal pulled down V _{IH} = V _{DD}	0.1			mA	
	I _{IH2}	With VCOL terminal pulled down V _{IH} = V _{DD}	0.1			mA	
	I _{IH3}	With X _{IN} terminal pulled down V _{IH} = V _{DD}	0.1			mA	
	I _{IH4}	With P0D ₀ – P0D ₃ pins pulled down V _{IH} = V _{DD}	10		150	μA	
Output-off leak current	I _{L1}	P0C ₀ – P0C ₃ V _{OH} = 9 V			1.0	μA	
	I _{L2}	EO V _{OH} = V _{DD} , V _{OL} = 0 V			±1.0	μA	

AC CHARACTERISTIC (T_a = -40 to +85 °C, V_{DD} = 5 V ± 10 %)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Operating frequency	f _{IN1}	VCOL pin: MF mode Sine wave input V _{IN} = 0.3 V _{P-P}	0.58		30	MHz
	f _{IN2}	VCOL pin: HF mode Sine wave input V _{IN} = 0.3 V _{P-P}	5		40	MHz
	f _{IN3}	VCOH pin: VHF mode Sine wave input V _{IN} = 0.3 V _{P-P}	30		250	MHz
	f _{IN4}	AMIFC and FMIFC pins: AMIF count mode Sine wave input V _{IN} = 0.3 V _{P-P}	0.3		1.0	MHz
	f _{IN5}	AMIFC pin: AMIF count mode Sine wave input V _{IN} = 0.1 V _{P-P}	0.44		0.46	MHz
	f _{IN6}	FMIFC pin: FMIF count mode Sine wave input V _{IN} = 0.3 V _{P-P}	5		15	MHz
	f _{IN7}	FMIFC pin: FMIF count mode Sine wave input V _{IN} = 0.1 V _{P-P}	10.5		10.9	MHz

AC CONVERTER CHARACTERISTIC (T_a = -40 to +85 °C, V_{DD} = 5 V ± 10 %)

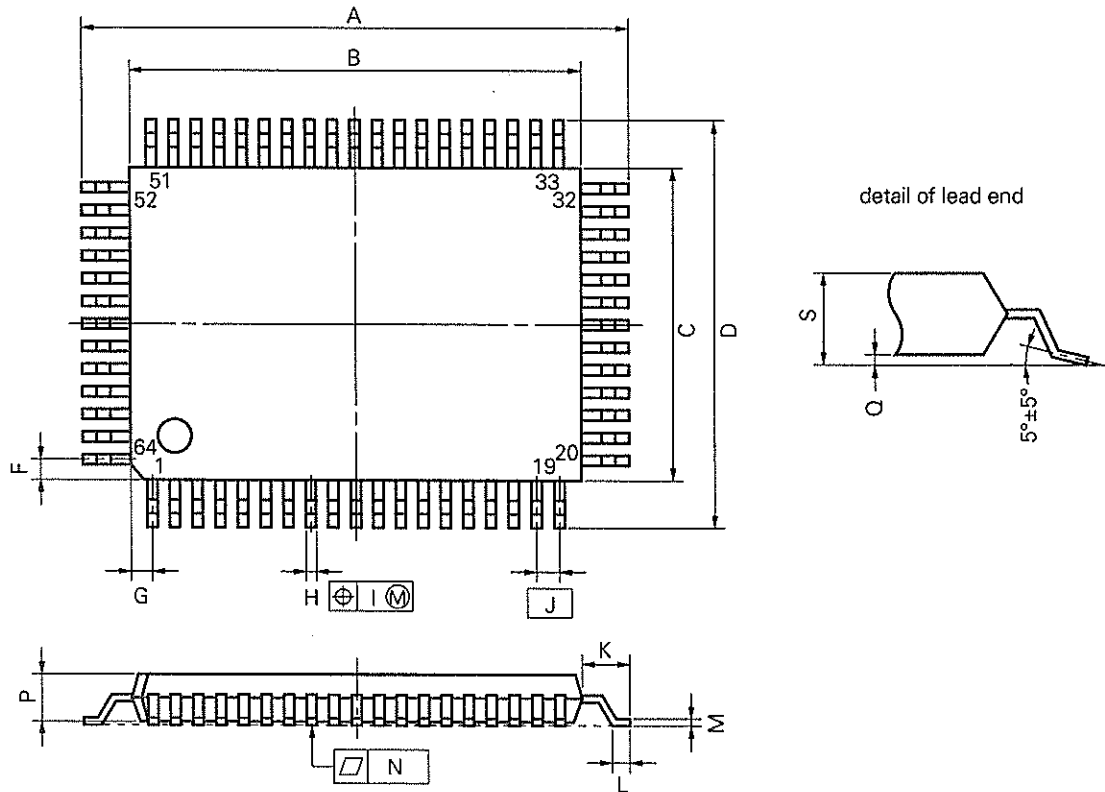
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
A/D conversion resolution					6	bit
A/D conversion quantization error		T _a = -10 to +50 °C		±1.0	±1.5	LSB

OTHER PARAMETERS (T_a = +25 °C, V_{DD} = 5.0 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Supply current	I _{DD3}	CPU and PLL operated, sine wave input to VCOH pin (f _{IN} = 130 MHz, V _{IN} = 0.3 V _{P-P})		15		mA
	I _{DD4}	CPU and PLL operated, sine wave input to VCOH pin (f _{IN} = 250 MHz, V _{IN} = 0.3 V _{P-P})		18		mA
High level output current	I _{OH3}	COM ₀ – COM ₂ V _{OH} = V _{DD} – 1 V		-300		μA
Low level output current	I _{OL4}	COM ₀ – COM ₂ V _{OL} = 1 V		300		μA
Intermediate level output current	I _{OM1}	COM ₀ – COM ₂ V _{OH} = V _{DD} – 1 V		-25		μA
	I _{OM2}	COM ₀ – COM ₂ V _{OL} = 1 V		25		μA

9. PACKAGE DRAWING

64 PIN PLASTIC QFP (14×20)



NOTE

Each lead centerline is located within 0.20 mm (0.008 inch) of its true position (T.P.) at maximum material condition.

S64GF-100-3B8,3BE-1

ITEM	MILLIMETERS	INCHES
A	23.2±0.4	0.913 ^{+0.017} _{-0.016}
B	20±0.2	0.787 ^{+0.009} _{-0.008}
C	14±0.2	0.551 ^{+0.009} _{-0.008}
D	17.2±0.4	0.677±0.016
F	1.0	0.039
G	1.0	0.039
H	0.40±0.10	0.016 ^{+0.004} _{-0.005}
I	0.20	0.008
J	1.0 (T.P.)	0.039 (T.P.)
K	1.6±0.2	0.063±0.008
L	0.8±0.2	0.031 ^{+0.009} _{-0.008}
M	0.15 ^{+0.10} _{-0.05}	0.006 ^{+0.004} _{-0.003}
N	0.12	0.005
P	2.7	0.106
Q	0.1±0.1	0.004±0.004
S	3.0 MAX.	0.119 MAX.

NOTES FOR CMOS DEVICES

① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS

Note: Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

② HANDLING OF UNUSED INPUT PINS FOR CMOS

Note: No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS device behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

③ STATUS BEFORE INITIALIZATION OF MOS DEVICES

Note: Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

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Application examples recommended by NEC Corporation

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Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.