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April 1st, 2010
Renesas Electronics Corporation

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

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PRELIMINARY DATA SHEET

RENESAS

MOS INTEGRATED CIRCUIT

μPD17012GF-011

PLL Frequency Synthesizer and Controller for Car Audio FM, MW, and LW Tuners

The μPD17012GF-011 is a CMOS LSI that was developed for FM, MW, and LW tuners employing the world-wide compatible PLL frequency synthesizer system.

It contains a PLL frequency synthesizer controller, 200 MHz pre-scaler, LCD controller/driver, and frequency counter thus enabling the compact configuration of a detachable-type car audio stereo and high-performance FM, MW, and LW tuners with clock.

FEATURES

- Receives the FM, MW, and European LW bands.
- Various tuning functions such as manual tuning, automatic tuning (seek, scan), and preset memory scanning.
- Six-button independent preset memory for presetting 18 FM stations (FM1, FM2, FM3: 6 stations each), 12 MW stations (MW1, MW2: 6 stations each), and 6 VF stations
- Last channel memory, FM: 3, MW: 2, LW: 1, VF: 1
- VF broadcast station (traffic information) automatic tuning (SK signal search) and DK standby function
- "ST" (stereo) display (MW band, ST display)
- MTL (METAL), NR (noise reduction), and AMS (Auto music search) control output and display
- Automatic preset memory function
- "CD" (compact disk) display
- "TAPE" (Cassette tape) display
- LOUD (Loudness) control output and display
- 12- or 24-hour display clock function
- External LCD controller/driver (μPD7225) connectable
- Built-in prescaler (200 MHz max. V_{in} = 0.3 V_{P-P}), frequency counter, and LCD controller/driver
- Remote control receive function (μPD6121)
- Key part or key, LCD panel detachable

ORDERING INFORMATION

Ordering Name	Package	Quality Grade
μPD17012GF-011-3BE	64-pin Plastic QFP (14 x 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.

The information in this document is subject to change without notice.

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Date Published April 1994 P
Printed in Japan

FUNCTIONS

Receiving frequency, channel space, fundamental frequency, intermediate frequency

Area	Band	Receiving frequency	Channel space	Fundamental frequency	Intermediate frequency
East Europe	FM	87.5 – 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	522 – 1620 kHz	9 kHz	9 kHz	450 kHz
	LW	144 – 290 kHz	1 kHz	1 kHz	450 kHz
West Europe	FM	87.5 – 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	522 – 1620 kHz	9 kHz	9 kHz	450 kHz
	LW	144 – 290 kHz	1 kHz	1 kHz	450 kHz
China	FM	87.5 – 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	531 – 1602 kHz	9 kHz	9 kHz	450 kHz
Australia, Middle and Near East	FM	87.5 – 108.0 MHz	100 kHz	25 kHz	10.7 MHz
	MW	531 – 1602 kHz	9 kHz	9 kHz	450 kHz
U.S.A. 1	FM	87.5 – 108.0 MHz	100 kHz	25 kHz	10.7 MHz
	MW	530 – 1620 kHz	10 kHz	10 kHz	450 kHz
U.S.A. 2	FM	87.5 – 107.9 MHz	200 kHz	25 kHz	10.7 MHz
	MW	530 – 1620 kHz	10 kHz	10 kHz	450 kHz
U.S.A. 3	FM	87.5 – 107.9 MHz	200 kHz	25 kHz	10.7 MHz
	MW	530 – 1710 kHz	10 kHz	10 kHz	450 kHz
Japan	FM	76.0 – 90.0 MHz	100 kHz	25 kHz	–10.7 MHz
	MW	522 – 1629 kHz	9 kHz	9 kHz	450 kHz

Radio functions

(1) Manual tuning

Type	Function
Manual-up Manual-down	Step feeding and fast feeding

(2) Automatic tuning

Type	Function
Seek-up Seek-down	Holds the frequency of the detected station.
Scan-up Scan-down	Receives broadcast stations 5 seconds at a time.

(3) Preset memory scan ... Receives stations with the contents of the preset memory for 5 seconds at a time.

(4) VF automatic tuning

Type	Function
SK seek-up SK seek-down	Holds the frequency of the detected traffic information broadcast station.
SK scan-up SK scan-down	Receives the traffic information broadcast station for 5 seconds at a time.

(5) Preset memory
- FM band ... FM1: 6 stations, FM2: 6 stations, FM3: 6 stations
- MW band ... MW1: 6 stations, MW2: 6 stations
- LW band ... 6 stations
- VF band ... 6 stations

(6) Last channel memory ... Independent for FM1, FM2, FM3, MW1, MW2, LW, and VF

(7) LOC (local) control output and display (Automatic local function selectable)

(8) ST (Stereo) display function ... Valid for FM and VF bands.
Can also be displayed in the MW band (Switchable)

(9) Automatic store memory

(10) DK standby, SK alarm function

Tape functions

(1) Tape running direction display ... Flickers 2.5 Hz at fast feeding.

(2) AMS (auto music search) control output and display

(3) MTL (METAL) control output and display

(4) NR (noise reduction) control output and display

(5) "TAPE" (cassette tape) display function

Clock functions

(1) 12-hour display (with "AM" and "PM" displays) and 24-hour display selectable

(2) Colon (":") flashing (1 Hz) selectable

(3) Backup enabled by low current consumption (10 μA max.) in non-clock mode

Miscellaneous

(1) LOUD (loudness) control output and display ... Common to radio, tape, and CD modes

(2) Key acknowledge (beep) output ... Output by valid momentary key-on

(3) Display switching and priority display functions

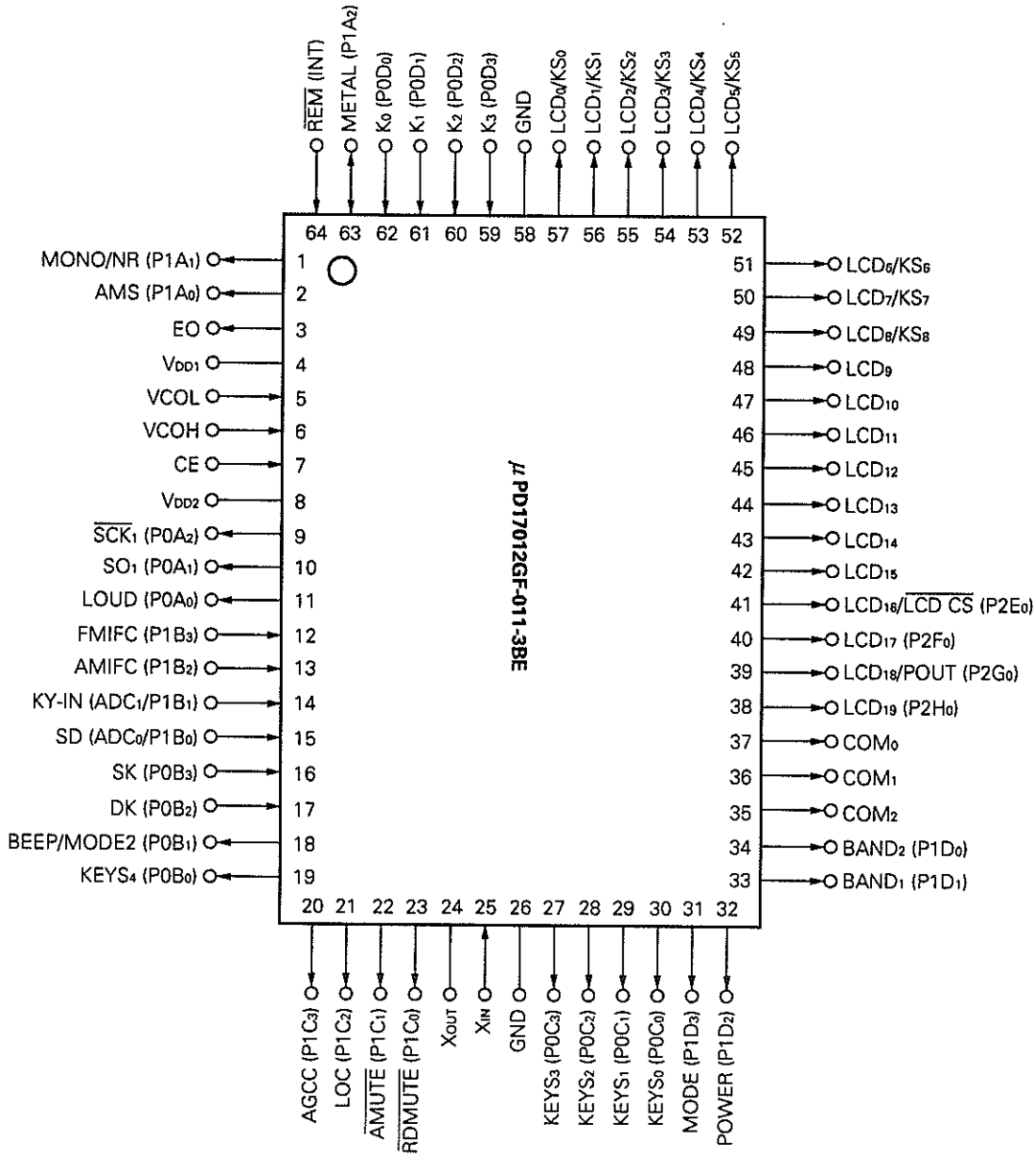
(4) "CD" (compact disk) function

(5) External CD controller/driver (μPD7225) connectable

(6) Remote control receive function (μPD6121)

(7) Key part or key and LCD panel detachable

PIN CONNECTION (TOP VIEW)



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1. PIN FUNCTIONS

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O format</th></tr>
<tr><td>1</td><td>MONO/NR</td><td>Monaural and noise reduction output</td><td>Monaural signal output pin or noise reduction signal output pin
The operations vary depending on modes as follows:

(1) Radio mode, tape radio monitor mode, CD radio monitor mode, tape DK-on mode, CD DK-on mode

In on mode
Operates as a monaural signal output pin.
The pin output level is determined depending on the selected band and whether MONO is on or off as follows:
<table><tr><th>Selected band</th><th>MONO state</th><th>Output level</th></tr><tr><td>FM</td><td>ON</td><td>High</td></tr><tr><td>VF</td><td>OFF</td><td>Low</td></tr><tr><td>LW</td><td>Don't care</td><td>Low</td></tr></table>At selection of the MW band, the pin output level is determined by the setting of initialization diode MWS as follows:
<table><tr><th>MWS</th><th>MONO state</th><th>Output level</th></tr><tr><td rowspan="2">1</td><td>ON</td><td>High</td></tr><tr><td>OFF</td><td>Low</td></tr><tr><td>0</td><td>Don't care</td><td>Low</td></tr></table>(1: Shorted by diode, 0: Open)

(2) In tape and tape DK standby modes
Operates as a noise reduction signal output pin.
The pin output level is determined depending on the NR on/off state as follows:
<table><tr><th>NR state</th><th>Output level</th></tr><tr><td>ON</td><td>High</td></tr><tr><td>OFF</td><td>Low</td></tr></table>(3) In CD, CD DK standby, and power-off modes
Outputs a low level.</td><td>CMOS push-pull output</td></tr>
<tr><td>2</td><td>AMS</td><td>AMS signal output</td><td>AMS (AUTO music search) signal output pin.
The pin output level is determined depending on the AMS on/off state as follows:
<table><tr><th>AMS state</th><th>Output level</th></tr><tr><td>ON</td><td>High</td></tr><tr><td>OFF</td><td>Low</td></tr></table>When the TPSET switch is on, the level corresponding to the AMS state is output from the pin regardless of the set mode.</td><td>CMOS push-pull output</td></tr>
</table>

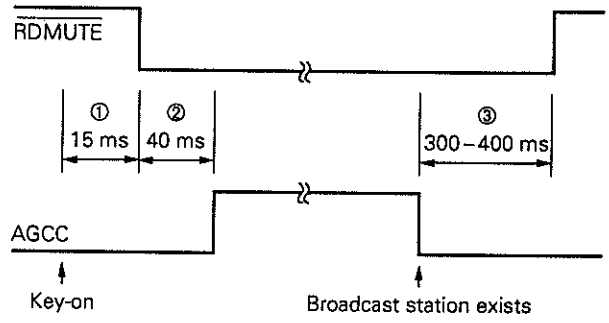
Pin No.	Symbol	Pin name	Description	I/O format
3	EO	Error out	Charge pump output pin of phase comparator that composes the PLL. If the divided oscillation frequency is higher than the fundamental, the high level is output from these pins; otherwise, the low level is output. If matching, this pin enters the floating state.	CMOS 3-state output
4 8	V_{DD1} V_{DD2}	Power pin	Device power supply pin. Supplies the 5 V ±10% voltage at device operation. The V_{DD} rise up time must be 500 ms or less (0 → 4.5 V). When the rise up time is extremely long or the voltage rises from the operating voltage or less to 3.5 V as it does not completely reduce to 0 V, the initialization diode switch state may not be normally read. (In this case, use the CE pin to normally read the initialization diode switch state.) When V_{DD} is first input, if the CE pin is set to a high level, the lowest frequency of the FM band is called.	—
5	VCOL	AM local oscillation input	Inputs the local oscillation output (VCO) of the AM (MW, LW) band. While MW and LW are received, this pin is active; otherwise, it is internally pulled down. The input frequency is 0.58 to 30 MHz (0.3 V_{P-P}). Because the AC amplifier is built in, cut the DC power using a capacitor before input.	Input
6	VCOH	FM local oscillation input	Inputs the local oscillation output (VCO) of the FM (FM, VF) band. While FM or VF band is received, this pin is active; otherwise, it is internally pulled down. The input frequency is 9 to 150 MHz (0.3 V_{P-P}). Because the AC amplifier is built in, cut the DC power using a capacitor before input.	Input
7	CE	Chip enable	Device selection signal input pin. To ordinarily operate the device (radio, tape, CD, clock display, and so on), input the high level. When not using the device, input the low level. However, the 165 μs or less high level and low level are not received. When this pin is at low level, the radio, tape, CD, and clock display states are set to off and the device is placed into the data holding state. If initialization diode NOCLK is set to 1 (Short by diode, no-clock mode), data can be held at low current consumption. (See **2.6.1 Initialization Diode Matrix.**)	Input
9	$\overline{SCK_1}$	Serial clock output	Serial clock output pin for controlling the LCD controller/driver (μPD7225). If initialization diode KLCD is set to 0 (open, internal LCD controller/driver mode), the LCD controller/driver (μPD7225) is not controlled. (See **2.6.1 Initialization Diode Matrix.**)	CMOS push-pull output
10	SO_1	Serial data output	Serial clock data output pin for controlling the LCD controller/driver (μPD7225). If initialization diode KLCD is set to 0 (open, internal LCD controller/driver mode), the LCD controller/driver (μPD7225) is not controlled. (See **2.6.1 Initialization Diode Matrix.**)	CMOS push-pull output
11	LOUD	Loudness output	Loudness control signal output pin. Outputs the high level when the loudness is on.	CMOS push-pull output

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O format</th></tr>
<tr><td>12</td><td>FMIFC</td><td>FM intermediate frequency input</td><td>FM band Intermediate Frequency (IF) input pin.
The input frequency is 5 to 15 MHz (0.3 V_{P-P}). Because the AC amplifier is built in, cut the DC power using a capacitor before input.
This pin is used to detect whether a broadcast station exists during automatic tuning when initialization diode ENFMIF is 1.
The input frequency range and input conditions for judging that a broadcast station exists are as follows:
<table><tr><th>Item / Band</th><th>Input frequency range 1</th><th>Input frequency range 2</th></tr><tr><td>FM, VF</td><td>10.7 MHz ±50 kHz</td><td>10.7 MHz ±12.5 kHz</td></tr></table>
Input frequency range 1 must be input within 20 ms after the PLL locked. When input frequency ranges 1 and 2 are satisfied, it is judged that a broadcast station exists, and the automatic tuning is stopped.</td><td>Input</td></tr>
<tr><td>13</td><td>AMIFC</td><td>AM intermediate frequency input</td><td>AM (MW, LW) band Intermediate Frequency (IF) input pin.
The input frequency is 0.3 to 1.0 MHz (0.3 V_{P-P}). Because the AC amplifier is built in, cut the DC power using a capacitor before input.
This pin is used to detect whether a broadcast station exists during automatic tuning when initialization diode ENAMIF is 1.
The input frequency range and input conditions for judging that a broadcast station exists are as follows:
<table><tr><th>Item / Band</th><th>Input frequency range 1 [kHz]</th><th>Input frequency range 2 [kHz]</th></tr><tr><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></table>
Input frequency range 1 must be input within 20 ms after the PLL locked. When input frequency ranges 1 and 2 are satisfied, it is judged that a broadcast station exists, and the automatic tuning is stopped.</td><td>Input</td></tr>
<tr><td>14</td><td>KY-IN</td><td>Key entry</td><td>Key return signal input pin for momentary key matrix</td><td>Input</td></tr>
<tr><td>15</td><td>SD</td><td>SD input</td><td>SD (Station Detector) signal input pin.
If the following voltage is applied to this pin, it is judged that SD exists:
<table><tr><th rowspan="2">Band</th><th>LOCAL
DX mode</th><th colspan="2">Voltage when SD exists</th></tr><tr><th></th><th>At V_{DD} = 5 V</th></tr><tr><td rowspan="2">FM
VF</td><td>LOCAL</td><td>$\frac{28.5}{64} \times V_{DD}$ or more</td><td>2.227</td></tr><tr><td>DX</td><td>$\frac{12.5}{64} \times V_{DD}$ or more</td><td>0.977</td></tr><tr><td rowspan="2">MW
LW</td><td>LOCAL</td><td>$\frac{15.5}{64} \times V_{DD}$ or more</td><td>1.211</td></tr><tr><td>DX</td><td>$\frac{12.5}{64} \times V_{DD}$ or more</td><td>0.977</td></tr></table>
The SD signal is used to judge that a broadcast station exists.</td><td>Input</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O format</th></tr>
<tr><td>16</td><td>SK</td><td>SK signal input</td><td>SK signal input pin for VF broadcast station.
When a broadcast station exists (this is determined by initialization diode ENFMIF) in the FM and VF bands, if the high level is input to this pin, it is judged that a traffic information broadcast station exists.
In the VF band, this pin is used as an automatic tuning stop signal. At VF-band automatic tuning, this pin is checked 400 ms after it is judged that a broadcast station exists. If the high level is input, it is judged that a traffic information broadcast station exists, and the automatic tuning is stopped.</td><td>Input</td></tr>
<tr><td>17</td><td>DK</td><td>DK signal input</td><td>DK signal input pin for VF broadcast station.
If a 2-second or more high level is input in the tape DK standby and CD DK standby modes, the traffic information is assumed to be currently received, and the tape DK on and CD DK on modes are set.</td><td>Input</td></tr>
<tr><td>18</td><td>BEEP/MODE2</td><td>Beep output or CD mode output</td><td>Operates as a beep sound output pin or CD mode output pin when the momentary key is pressed.

(1) At initialization diode ENMODE2 = 0
Outputs the square wave of 3 kHz frequency and 50% duty during approx. 40 ms when the momentary key is pressed. This duration is the same as the prefetch muting duration.
When the momentary key is pressed, if the LCD panel display and output port state varies (valid key) and the 5-second holding time in the preset memory scanning and scanning ends, the beep sounds.
The beep sound output is also used for SK alarm in the DK standby state. If this pin is not used, open it.

(2) At initialization diode ENMODE2 = 1
Operates as a CD mode output pin.
<table><tr><th>Mode</th><th>BEEP/MODE2</th></tr><tr><td>At CE = low level</td><td>0</td></tr><tr><td>CE = High level, radio, tape CD off (Power-off mode)</td><td>0</td></tr><tr><td>Radio mode</td><td>0</td></tr><tr><td>Tape mode</td><td>0</td></tr><tr><td>CD mode</td><td>1</td></tr><tr><td>• Tape DK standby mode
• Tape DK on mode
• Tape radio monitor mode</td><td>0</td></tr><tr><td>• CD DK standby mode
• CD DK on mode
• CD radio monitor mode</td><td>1</td></tr></table></td><td>CMOS push-pull output</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O format</th></tr>
<tr><td>19</td><td>KEYS4</td><td rowspan="2">Key source signal output</td><td rowspan="2">Key source output pin for momentary matrix</td><td>CMOS push-pull output</td></tr>
<tr><td>27 to 30</td><td>KEYS3 to KEYS0</td><td>N-ch open drain output</td></tr>
<tr><td>20</td><td>AGCC</td><td>AGC cut output</td><td>AGC (Auto Gain Control) cut signal output pin in radio mode.
Outputs the high level during automatic tuning as follows:
 

① : Key-on chattering waiting state
② : Prefetch muting
③ : Postfetch muting</td><td>CMOS push-pull output</td></tr>
<tr><td>21</td><td>LOC</td><td>Local signal output</td><td>Local signal output pin in radio mode.
The operation varies depending on modes as follows:

(1) Radio mode, tape radio monitor mode, CD radio monitor mode, tape DK on mode, CD DK on mode, tape DK standby mode, and CD DK standby mode
Outputs the high level in the local state only at automatic tuning.
The pin output level is determined depending on the tuning and LOCAL/DX state as follows:
<table><tr><th>Automatic tuning state</th><th>LOCAL/DX state</th><th>Output level</th></tr><tr><td rowspan="2">Under operation</td><td>LOCAL</td><td>High</td></tr><tr><td>DX</td><td>Low</td></tr><tr><td>Other than operation</td><td>Don't care</td><td>Low</td></tr></table>(2) Other modes
Outputs the low level.</td><td>CMOS push-pull output</td></tr>
<tr><td>22</td><td>$\overline{\text{AMUTE}}$</td><td>Audio muting output</td><td>Tape or CD muting signal output pin.
The operation varies depending on modes as follows:

(1) Radio mode, tape radio monitor mode, CD radio monitor mode, tape DK on mode, CD DK on mode, and power-off mode
Outputs the low level.

(2) CD mode, tape mode, CD DK standby mode, and tape DK standby mode
Outputs the high level.

For details, see 6. Muting Output Timing Chart.</td><td>CMOS push-pull output</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O format</th></tr>
<tr><td>23</td><td>$\overline{\text{RDMUTE}}$</td><td>Radio muting output</td><td>Radio muting signal output pin.
The operation varies depending on modes as follows:

(1) Radio mode, tape radio monitor mode, CD radio monitor mode, tape DK on mode, and CD DK on mode,
At radio on or off
At band switching
At receiving frequency switching
Outputs the low level.

(2) CD mode, tape mode, CD DK standby mode, and tape DK standby mode
The output method can be selected by initialization diode MUTESEL. (See 2.6.1 Initialization Diode Matrix.) When using the DK standby or radio monitor function, however, set MUTESEL to 0 and select the low level output.

For details, see 6. MUTING OUTPUT TIMING CHART.</td><td>CMOS push-pull output</td></tr>
<tr><td>24</td><td>XOUT</td><td rowspan="2">Crystal oscillator</td><td>Used to connect the crystal oscillator.</td><td>—</td></tr>
<tr><td>25</td><td>XIN</td><td>Connects the 4.5 MHz crystal oscillator.</td><td>Input</td></tr>
<tr><td>26
58</td><td>GND</td><td>Ground</td><td>Ground pin.
Pins 26 and 58 must be connected to the same electric potential.</td><td>—</td></tr>
<tr><td>31</td><td>MODE</td><td>Mode signal output</td><td>Mode switching signal output pin.
The signal is output in each mode as follows:
<table><tr><th>Mode</th><th>MODE</th></tr><tr><td>CE = low level</td><td>0</td></tr><tr><td>CE = high level in radio and tape modes
at CD = off (power- off mode)</td><td>0</td></tr><tr><td>Radio mode</td><td>1</td></tr><tr><td>Tape mode</td><td>0</td></tr><tr><td>CD mode</td><td>0</td></tr><tr><td>• Tape DK standby mode
• CD DK standby mode
• DK on mode</td><td>1</td></tr><tr><td>• Tape radio monitor mode
• CD radio monitor mode</td><td>1</td></tr></table></td><td>CMOS push-pull output</td></tr>
<tr><td>32</td><td>POWER</td><td>Power output</td><td>Inverts the output each time the POWER key is pressed.
This pin should be used to turn the power on or off.</td><td>CMOS push-pull output</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O format</th></tr>
<tr><td>33
34</td><td>BAND1
BAND2</td><td>Band switching signal output</td><td>Band switching signal output pin in radio mode.
The operation varies depending on modes as follows:

(1) Radio mode, tape radio monitor mode, and CD radio monitor mode
When the receiving band is switched by the band switching key, the signal is output in each band as follows:
<table><tr><th>Pin / Band</th><th>BAND1</th><th>BAND2</th></tr><tr><td>MW</td><td>0</td><td>0</td></tr><tr><td>LW</td><td>0</td><td>1</td></tr><tr><td>FM</td><td>1</td><td>0</td></tr><tr><td>VF</td><td>1</td><td>1</td></tr></table>(0: Low level, 1: High level)

(2) Tape DK on mode, CD DK on mode, tape DK standby mode, and CD DK standby mode
<table><tr><th>Pin / Band</th><th>BAND1</th><th>BAND2</th></tr><tr><td>VF</td><td>1</td><td>1</td></tr></table>(1: High level)

(3) Tape mode, CD mode, and power-off mode
Outputs the low level.</td><td>CMOS push-pull output</td></tr>
<tr><td>35
to
37</td><td>COM2
to
COM0</td><td>LCD common signal output</td><td>Common signal output pin to LCD panel.</td><td>CMOS 3-value output</td></tr>
<tr><td>38
40
42
to
48</td><td>LCD19
LCD17
LCD15
to
LCD9</td><td>LCD segment signal output</td><td>Segment signal output pin to LCD panel.</td><td>CMOS push-pull output</td></tr>
<tr><td>39</td><td>LCD18/POUT</td><td>LCD segment signal output/ detachable signal output</td><td>Operates as a segment signal output pin to the LCD panel or detachable status signal output pin.
The operation varies depending on the state of initialization diode KLCD as follows:

(1) KLCD = 0
Segment signal output pin to LCD panel.

(2) KLCD = 1
Outputs 1 Hz and 1/2 duty signal as a detachable signal output pin when the DTH switch is off.</td><td>CMOS push-pull output</td></tr>
</table>

Pin No.	Symbol	Pin name	Description	I/O format
41	$\overline{LCD_{16}}$ / $\overline{LCD\ CS}$	LCD segment signal output or LCD chip select signal output	Operates as a segment signal output pin to the LCD panel or chip select signal output pin. The operation varies depending on the state of initialization diode KLCD as follows: **(1) KLCD = 0** Segment signal output pin to LCD panel. **(2) KLCD = 1** Operates as a chip select signal output pin for the external LCD controller or driver (μPD7225). When the low level is output, the external CLD controller or driver is placed into the chip select state.	CMOS push-pull output
49 to 57	LCD_8/KS_8 to LCD_0/KS_0	LCD segment signal output or key source signal output	Operates as a segment signal output pin to LCD panel and key source signal output pin for key matrix. Because the LCD segment signal is shared with a key source signal for key matrix, a reverse current prevention diode is required to use this pin for a key source signal.	CMOS push-pull output
59 to 62	K_3 to K_0	Key return signal input	Key return signal input pin for key matrix. Because the LCD segment signal is shared with the LCD segment signal, do not connect the pull-down resistor to this key return signal input pin.	Input
63	METAL	Metal signal output	Metal signal output pin. The output level is determined depending on whether METAL is on or off as follows: METAL state / Output level: ON / High; OFF / Low When TPSET switch is on, this pin outputs the level corresponding to the METAL state regardless of modes.	CMOS push-pull output
64	$\overline{REM}$	Remote control input	Infrared-ray remote control signal input pin. Connects the output of the remote control preamplifier (μPC2800HA). For the remote control sender IC, use μPD6121G.	Input

Caution When using the external LCD controller/driver, μPD7225, connect the μPD7225 $C/\overline{D}$ pin to the μPD7225 V_{DD} pin.

2. KEY MATRIX CONFIGURATION

2.1 ARRANGEMENT OF INITIALIZATION DIODE, ALTERNATE SWITCH, OR TRANSISTOR SWITCH MATRIX

Input pin (Pin No.) / Output pin (Pin No.)	K_3 (59)	K_2 (60)	K_1 (61)	K_0 (62)
LCD_8/KS_8 (49)	RDSET	ST	DTH	ENMODE2
LCD_7/KS_7 (50)	FF	RL	CDSET	TPSET
LCD_6/KS_6 (51)	—	M2S	VF1	MWS
LCD_5/KS_5 (52)	AUTO500	MUTESEL	AUTOLOC	KLCD
LCD_4/KS_4 (53)	CKHLT	KAMS	KRN	KMTL
LCD_3/KS_3 (54)	NOCLK	CLK DISP	FLASH	DISAMEMO
LCD_2/KS_2 (55)	ENFMIF	ENAMIF	PRIO2	PRIO1
LCD_1/KS_1 (56)	ENFM	DISFM3	ENMW2	DISLW
LCD_0/KS_0 (57)	RDON	AREA3	AREA2	AREA1

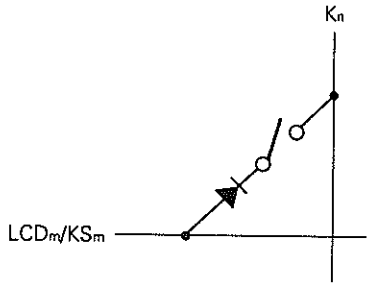
Initialization diode matrix

Alternate switch or transistor switch

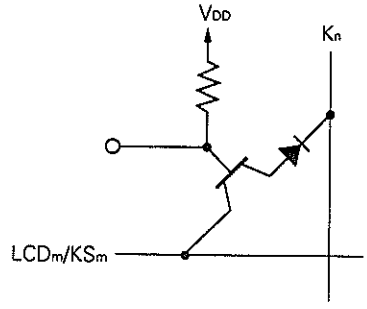
— Open

2.2 SWITCH CONNECTION

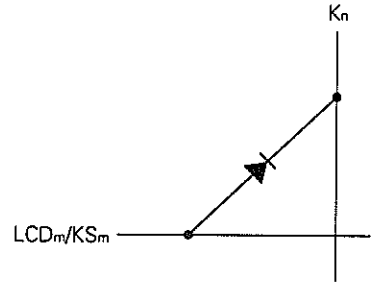
Alternate switch



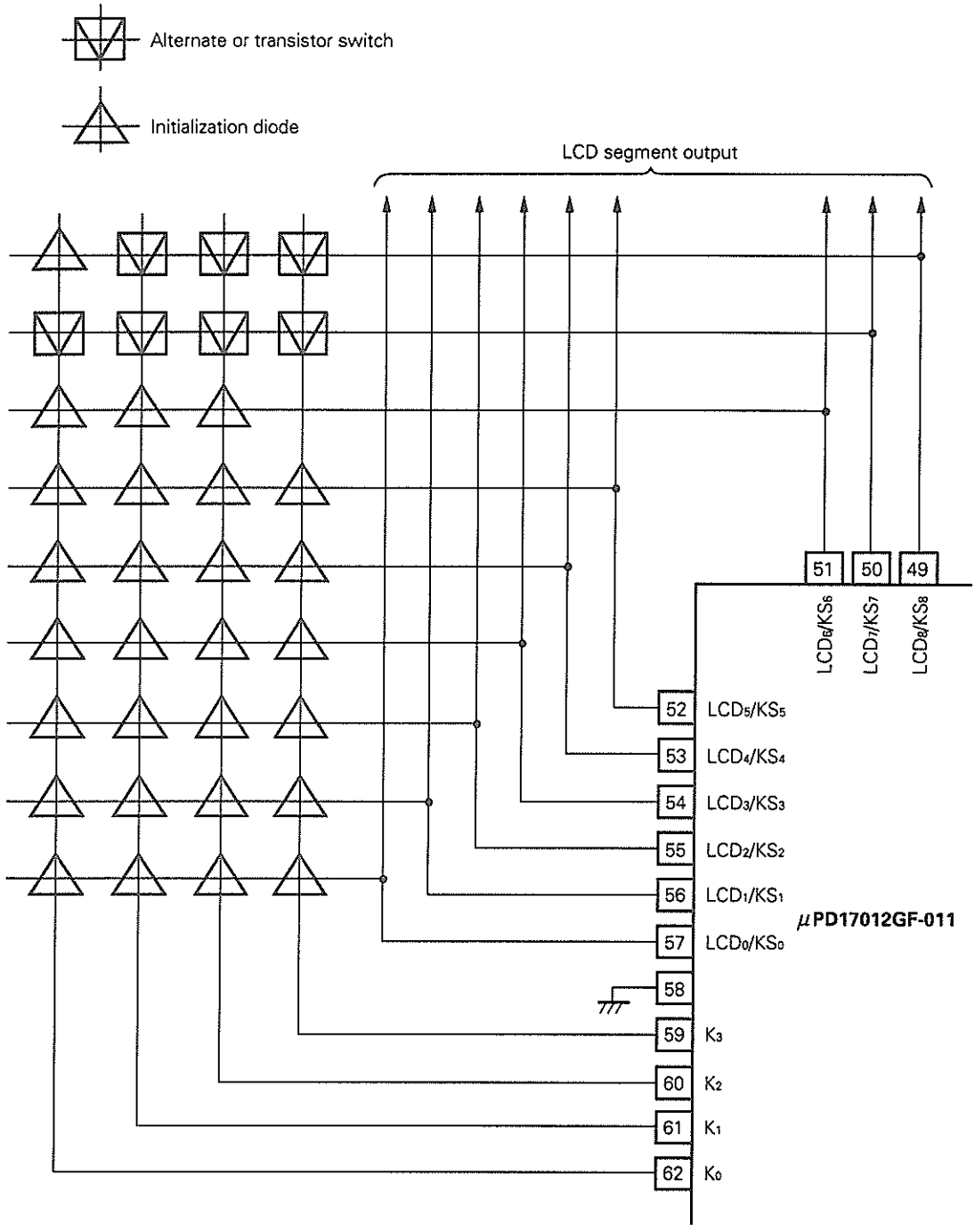
Transistor switch



Initialization diode



2.3 CONNECTION OF INITIALIZATION DIODE, ALTERNATE SWITCH, OR TRANSISTOR SWITCH MATRIX

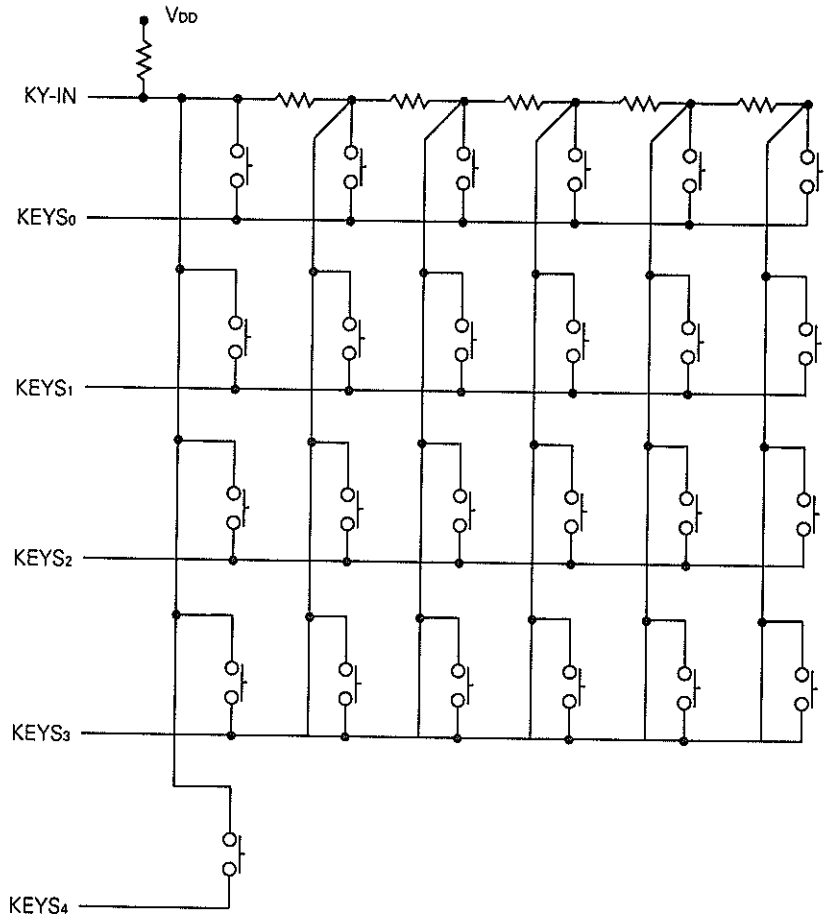


2.4 MOMENTARY KEY MATRIX ARRANGEMENT

Input voltage / Selection pin (Pin No.)	0 to 0.07 V_{DD}	to 0.16 V_{DD}	to 0.32 V_{DD}	to 0.52 V_{DD}	to 0.73 V_{DD}	to 0.87 V_{DD}
$KEYS_0$ (30)	M1 (TP1)	M2 (TP2)	M3 (TP3)	M4	M5	M6
$KEYS_1$ (29)	ME	DISP	P.SCAN	LOUD	LOC	MTL
$KEYS_2$ (28)	MAN UP	MAN DWN	SEEK UP	SCAN UP	BAND	VF
$KEYS_3$ (27)	SEEK DWN	SCAN DWN	MONO	AMS	NR	RDMONI
$KEYS_4$ (19)	POWER	—	—	—	—	—

— : Open

2.5 CONNECTION OF MOMENTARY KEY MATRIX



2.6 EXPLANATION OF KEY MATRIX

2.6.1 Initialization diode matrix

There are following 17 types of initialization diode matrix. They are read when the V_{DD} pin is first powered (power-on reset) and the CE pin changes from the lower level to the high level and ignored in the other periods.

(1) Switch for setting a receiving area
AREA1, AREA2, AREA2

(2) Switch for setting a receiving band
DISFM3, ENMW2, DISLW, ENFM

(3) Switch for setting the use of the automatic memory
DISAMEMO

(4) Switch for setting whether the frequency counter is used to detect a broadcast station
ENFMIF, ENAMIF

(5) Switch for setting the preset memory operation
M2S

(6) Switch for setting the tuning
AUTO500

(7) Switch for setting the display priority level
PRIO1, PRIO2

(8) Switch for setting whether the radio is on or off
RDON

(9) Switch for setting the clock function
NOCLK, CLKDISP, FLASH

(10) Switch for setting the tape function
KAMS, KNR, KMTL

(11) Switch for setting the muting output
MUTESEL

(12) Switch for setting the local operation
AUTOLOC

(13) Switch for setting the used LCD driver
KLCD

(14) Switch for activating/disabling the VF band automatic retune function that detects an illegal receiving state and automatically performs the seek-up operation
VF1

(15) Switch for activating/disabling the MW band stereo receiv- ing function
MWS

(16) Switch for setting the BEEP/MODE2 pin function
ENMODE2

(17) Switch for setting the standby mode without clock function
CKHLT

To set these switches, short or open the required switches on the matrix.
The following explains the functions of the initialization diode matrix.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>AREA1
AREA2
AREA3</td><td>Switch for setting a receiving area.
Set as follows:
For details on the receiving frequency in each area, see the overview of each function.
<table>
<tr><th>AREA3</th><th>AREA2</th><th>AREA1</th><th>Area</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>West Europe</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Australia and Middle and Near East</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Japan</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>U.S.A. 1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>U.S.A. 2</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>East Europe</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>U.S.A. 3</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>China</td></tr>
</table>
(1: Short by diode, 0: Open)</td></tr>
<tr><td>DISFM3
ENMW2
DISLW
ENFM</td><td>Switch for setting a receiving band.
Set by each switch as follows:
• DISFM3 ..... Setting 1 inhibits the FM3 band.
• ENMW2..... Setting 1 validates the MW2 band.
• DISLW ..... Setting 1 in West Europe and East Europe inhibits the LW band.
The DISLW switch is invalid in areas other than West Europe and East Europe.
• ENFM ..... Setting 1 sets the receiving band only to the FM band.

The receiving band is set by these switches as follows:
<table>
<tr><th>Area</th><th>ENFM</th><th>DISFM3</th><th>ENMW2</th><th>DISLW</th><th>Receiving band</th></tr>
<tr><td rowspan="8">West Europe, East Europe</td><td>1</td><td>0</td><td>—</td><td>—</td><td>FM1, FM2, FM3</td></tr>
<tr><td>1</td><td>1</td><td>—</td><td>—</td><td>FM1, FM2</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>FM1, FM2, FM3, MW1, LW</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>FM1, FM2, FM3, MW1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>—</td><td>FM1, FM2, FM3, MW1, MW2</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>FM1, FM2, MW1, LW</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>FM1, FM2, MW1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>—</td><td>FM1, FM2,MW1, MW2</td></tr>
<tr><td rowspan="8">Other areas</td><td>1</td><td>0</td><td>—</td><td>—</td><td>FM1, FM2, FM3</td></tr>
<tr><td>1</td><td>1</td><td>—</td><td>—</td><td>FM1, FM2</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>—</td><td>FM1, FM2, FM3, MW1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>—</td><td>FM1, FM2, FM3, MW1,MW2</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>—</td><td>FM1, FM2, MW1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>—</td><td>FM1, FM2,MW1, MW2</td></tr>
</table>
(1 : Short by diode, 0 : Open, — : Don't care)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>M2S</td><td>Switch for setting the preset memory writing method.
Set as follows:
<table>
<tr><th>M2S</th><th>Writing method</th></tr>
<tr><td>0</td><td>Press the [M1 (TP1)] to [M6] keys in the 5-second write enabled state obtained with the [ME] key.</td></tr>
<tr><td>1</td><td>Hold down the [M1 (TP1)] to [M6] keys for 2 seconds or more.</td></tr>
</table>
(1: Short by diode, 0: Open)

For details, see items [ME], and [M1 (TP1)] to [M6].</td></tr>
<tr><td>AUTO500</td><td>Switch for setting the [MAN UP] and [MAN DWN] key functions. With this switch, the [MAN UP] and [MAN DWN] keys can be also used as the automatic tuning (seek operation) key.
<table>
<tr><th>AUTO500</th><th>[MAN UP] and [MAN DWN] key function</th></tr>
<tr><td>0</td><td>Performs only the manual tuning.
Each time this key is pressed once, the value increases or reduces by one channel. Holding down this key for 0.5 second or more performs the fast manual feeding.</td></tr>
<tr><td>1</td><td>Performs the manual tuning and automatic tuning.
Each time this key is pressed, the value increases or reduces by one channel.
Holding down this key for 0.5 second or more performs the automatic tuning (seek operation) from the next channel.
The [SEEK UP] and [SEEK DWN] keys are valid.</td></tr>
</table>
(1 : Short by diode. 0 : Open)</td></tr>
<tr><td>AUTOLOC</td><td>Switch for setting the local function.
Set as follows:
<table>
<tr><th>AUTOLOC</th><th>Local function</th></tr>
<tr><td>0</td><td>Switches LOCAL or DX using a key. (No automatic local func- tion)
Inverts the local and DX states each time the [LOC] key is pressed.
The local output is set to the high level only in the local mode during the automatic tuning (seek, scanning, or automatic storage).</td></tr>
<tr><td>1</td><td>Performs the automatic local function.
The [LOC] key is invalid.
When the automatic tuning is set by holding down the [SEEK UP], [SEEK DWN], [SCAN UP], [SCAN DWN], or [P.SCAN] key for 2 second or more, the automatic tuning is set. The LOC indicator lamp then lights on, the local output is set to the high level, and the automatic tuning is performed. When the automatic tuning rotates once, a local channel is searched in the DX mode (LOC display-off, local output = low level).
During tuning other than the automatic tuning, the LOC indicator lamp lights off and the local output is set to the low level.
When the same key is pressed during the automatic tuning ([SEEK UP] key during seek-up operation), if the local mode is set, the channel is searched from the frequency that was set at the start of the automatic tuning in the DX mode. If the DX mode is set, the automatic tuning stops and the frequency returns to the value that was set at the beginning of the automatic tuning.
When the AUTO500 switch is set to 1 (automatic tuning by holding down the [MAN UP] or [MAN DWN] key for 0.5 second), the same operation is performed.</td></tr>
</table>
(1 : Short by diode, 0 : Open)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>PRIO1
PRIO2</td><td>
Switch for setting a priority display.
After the display was switched, the switched display returns to the specified display after 5 seconds have lapsed unless processing is performed. Only at initialization diode NOCLK = 0 (with clock), the priority display is determined depending on the state of the PRIO1 and PRIO2 switches. At NOCLK = 1 (without clock), the states of the PRIO1 and PRIO2 switches are ignored.
<table>
<tr><th>PRIO1</th><th>PRIO2</th><th>Priority display</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>None</td><td>
The display switching is performed when the DISP and station selection key (clock display) are operated.
o In radio mode
Switches the frequency display and clock display each time the DISP key is pressed.
o In tape mode
Switches the "TAPE" display and clock display each time the DISP key is pressed.
o In CD mode
Switches the "CD" display and clock display each time the DISP key is pressed.
o In tape DK standby mode and radio monitor mode
Switches the "TAPE" display, frequency display, and clock display each time the DISP key is pressed.
If the station selection key is pressed during "TAPE" display and clock display, the frequency is displayed.
When the tape DK standby mode and tape radio monitor mode are first set, the frequency is displayed.
o In CD DK standby mode and CD radio monitor mode
Switches the "CD" display, frequency display, and clock display each time the DISP key is pressed.
If the station selection key is pressed during "CD" display and clock display, the frequency is displayed.
When the CD DK standby mode and CD radio monitor mode are first set, the frequency is displayed.
o In tape DK on mode and CD DK on mode
Displays the frequency.
The DISP key is invalid.
</td></tr>
</table>
(0 : Open)
</td></tr>
</table>

Symbol	Description
PRIO1 PRIO2	

PRIO1	PRIO2	Priority display	Description
1	0	Frequency CD TAPE	If the frequency, "CD", or "TAPE" display is changed to the clock display by pressing the DISP key, the changed display returns to the original after 5 seconds unless processing is performed. o **In radio mode** Ordinarily displays the frequency. Pressing the DISP key displays the clock for 5 seconds. If the DISP key or station selection key is pressed during 5-second clock display, the clock display returns to the frequency display. o **In tape mode** Ordinarily displays "TAPE". Pressing the DISP key displays the clock for 5 seconds. If the DISP key is pressed again during 5-second clock display, the clock display returns to the "TAPE" display. o **In CD mode** Ordinarily displays "CD". Pressing the DISP key displays the clock for 5 seconds. If the DISP key is pressed again during 5-second clock display, the clock display returns to the "CD" display. o **In tape DK standby mode and tape radio monitor mode** Ordinarily displays "TAPE". Pressing the DISP key displays the frequency for 5 seconds. If the DISP key is pressed again during 5-second frequency display, the frequency display returns to the clock display. If the DISP key is pressed again during 5-second clock display, the clock display returns to the "TAPE" display. If the station selection key is pressed during "TAPE" display and clock display, the frequency is displayed for 5 seconds. o **In CD DK standby mode and CD radio monitor mode** Ordinarily displays "CD". Pressing the DISP key displays the frequency for 5 seconds. If the DISP key is pressed again during 5-second frequency display, the frequency display returns to the clock display. If the DISP key is pressed again during 5-seconds clock display, the clock display returns to the "CD" display. If the station selection key is pressed during "CD" display and clock display, the frequency is displayed for 5 seconds. o **In tape DK on mode and CD DK on mode** Displays the frequency. The DISP key is invalid.

(1 : Short by diode, 0 : Open)

Symbol	Description

PRIO1
PRIO2

PRIO1	PRIO2	Priority display	Description
0	1	Clock	Preferentially displays the clock. **o In radio mode** Ordinarily displays the clock. Pressing the DISP key displays the frequency for 5 seconds. If the DISP key is pressed again during 5-second frequency display, the frequency display returns to the clock display. **o In tape mode** Ordinarily displays the clock. Pressing the DISP key displays "TAPE" for 5 seconds. If the DISP key is pressed again during 5-second "TAPE" display, the "TAPE" display returns to the clock display. **o In CD mode** Ordinarily displays the clock. Pressing the DISP key displays the "CD" for 5 seconds. If the DISP key is pressed again during 5-second "CD" display, the "CD" display returns to the clock display. **o In tape DK standby mode and tape radio monitor mode** Ordinarily displays the clock. Pressing the DISP key displays "TAPE" for 5 seconds. If the DISP key is pressed again during 5- second "TAPE" display, the frequency is displayed. If the DISP key is pressed again during 5-second frequency display, the frequency display returns to the clock display. If the station selection key is pressed during "TAPE" display and clock display, the frequency is displayed for 5 seconds. **o In CD DK standby mode and CD radio monitor mode** Ordinarily displays the clock. Pressing the DISP key displays "CD" for 5 seconds. If the DISP key is pressed again during 5-second "CD" display, the frequency is displayed. If the DISP key is pressed again during 5-second frequency display, the frequency display returns to the clock display. If the station selection key is pressed during "CD" display and clock display, the frequency is displayed for 5 seconds. **o In tape DK on mode and CD DK on mode** Displays the frequency. The DISP key is invalid.
1	1	—	Don't set to this mode.

(1 : Short by diode, 0 : Open)

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>PRIO1
PRIO2</td><td>At NOCLK = 1 (without clock), the following is displayed regardless of the states of the PRIO1 and PRIO2 switches as follows. The DISP key is invalid.
<table>
<tr><th>Mode</th><th>Display</th></tr>
<tr><td>Radio mode</td><td>Frequency</td></tr>
<tr><td>Tape mode</td><td>TAPE</td></tr>
<tr><td>CD mode</td><td>CD</td></tr>
<tr><td>• Tape DK standby mode
• CD DK standby mode
• Tape DK on mode
• CD DK on mode
• Tape radio monitor mode
• CD radio monitor mode</td><td>Frequency</td></tr>
</table></td></tr>
<tr><td>RDON</td><td>Switch for setting method how to turn the radio on or off
Set as follows:
<table>
<tr><th>RDON</th><th>Radio on/off method</th></tr>
<tr><td>0</td><td>The radio is turned on by setting the RDSET switch to on.</td></tr>
<tr><td>1</td><td>The radio is turned off by setting the CE pin to the high level.
The RDSET switch is invalid.</td></tr>
</table>
(1: Short by diode, 0: Open)</td></tr>
<tr><td>NOCLK</td><td>Switch for setting whether the clock is specified
Set as follows:
<table>
<tr><th>NOCLK</th><th>Clock</th></tr>
<tr><td>0</td><td>Specified</td></tr>
<tr><td>1</td><td>Not specified</td></tr>
</table>
(1: Short by diode, 0: Open)

In the no-clock mode, the backup by the low power consumption (10 μA max.) is realized by setting the CE pin to the low level.</td></tr>
<tr><td>CLKDISP</td><td>Switch for setting the clock hour type
Set as follows:
<table>
<tr><th>CLKDISP</th><th>Hour type</th></tr>
<tr><td>0</td><td>12-hour type
AM12 : 00 → AM11 : 59
PM11 : 59 ← PM12 : 00</td></tr>
<tr><td>1</td><td>24-hour type
0 : 00 → 23 : 59</td></tr>
</table>
(1 : Short by diode, 0 : Open)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>FLASH</td><td>Switch for setting the clock colon (:) display
Set as follows:
<table><tr><th>FLASH</th><th>Colon (:) display</th></tr><tr><td>0</td><td>Always lights on</td></tr><tr><td>1</td><td>Flickers
• Frequency: 1 Hz
• Duty: 6 (light-on), 4 (light-off)</td></tr></table>(1: Short by diode, 0: Open)</td></tr>
<tr><td>CKHLT</td><td>Switch for setting which standby mode, STOP or HALT mode, is used at NOCLK = 1 and CE = low level
<table><tr><th>CKHLT</th><th>CE = low level</th></tr><tr><td>0</td><td>STOP mode</td></tr><tr><td>1</td><td>HALT Mode</td></tr></table>(1: Short by diode, 0: Open)</td></tr>
<tr><td>ENMODE2</td><td>Switch for setting whether the BEEP/MODE2 pin is used as the BEEP pin or CD mode switching pin
<table><tr><th>ENMODE2</th><th>Function of BEEP/MODE2 pin</th></tr><tr><td>0</td><td>BEEP pin</td></tr><tr><td>1</td><td>CD mode switching pin</td></tr></table>(1: Short by diode, 0: Open)</td></tr>
</table>

Symbol	Description
KAMS KNR KMTL	Key for sharing the tape functions (AMS, NR, and MTL) with the radio function keys The shared keys can be selected as follows:

KAMS	KNR	KMTL	Shared key		
			M1 (TP1)	M2 (TP2)	M3 (TP3)
1	1	1	AMS	NR	MTL
1	1	0	AMS	NR	—
1	0	1	AMS	MTL	—
1	0	0	AMS	—	—
0	1	1	NR	MTL	—
0	1	0	NR	—	—
0	0	1	MTL	—	—
0	0	0	—	—	—

(1: Short by diode, 0: Open)

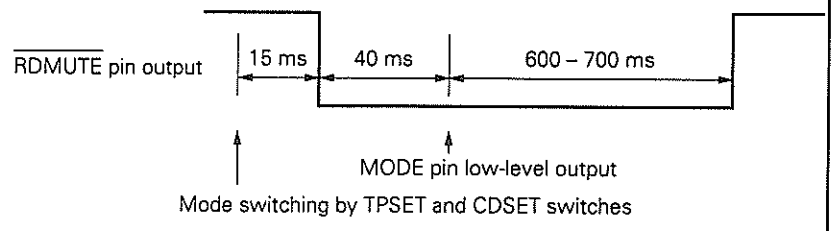
If these tape-radio functions are used, the operations of the M1 (TP1) to M6 keys in the tape DK standby mode are as follows:

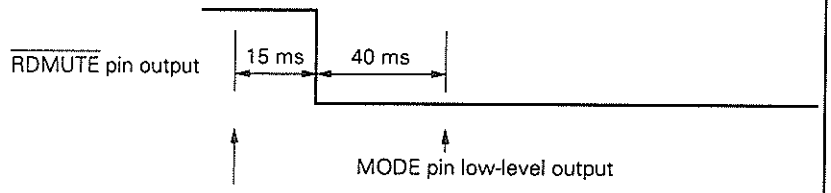
KAMS	KNR	KMTL	Description
0	0	0	The M1 (TP1) to M6 keys operate as the preset memory calling and writing keys. (Radio function)
Anyone or more is set to 1.			The M1 (TP1) to M6 keys do not operate as the radio function keys. The M1 (TP1) to M3 (TP3) keys shared with the tape functions operate as the tape function keys.

(1: Short by diode, 0: Open)

In the modes below, these keys operate as the preset memory calling and writing keys regardless of the KAMS, KNR, and KMTL states.

- Tape DK on mode
- Tape radio monitor mode
- CD DK on mode
- CD DK standby mode
- CD radio monitor mode

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>MUTESEL</td><td>
Sets the $\overline{\text{RDMUTE}}$ pin output method in the tape and CD modes.
Set as follows:
<table>
<tr><th>MUTESEL</th><th>$\overline{\text{RDMUTE}}$ pin output</th></tr>
<tr><td>1</td><td>The muting is set to off in the tape and CD modes.
 

At MUTESEL = 1, do not use the DK standby and radio monitor functions.</td></tr>
<tr><td>0</td><td>The muting remains set to on in the tape and CD modes.
 
</td></tr>
</table>
(1: Short by diode, 0: Open)
For details, see Chapter 6, "Muting Output Timing Chart."
</td></tr>
<tr><td>ENFMIF
ENAMEIF</td><td>
Switch for setting whether the frequency counter is used to detect a broadcast station
Set as follows:
<table>
<tr><th rowspan="2">ENFMIF</th><th rowspan="2">ENAMIF</th><th colspan="2">Broadcast station detection method</th></tr>
<tr><th>Band</th><th></th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">1</td><td>FM, VF</td><td>Frequency counter and SD method</td></tr>
<tr><td>MW, LW</td><td>Frequency counter and SD method</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">0</td><td>FM, VF</td><td>Frequency counter and SD method</td></tr>
<tr><td>MW, LW</td><td>SD method</td></tr>
<tr><td rowspan="2">0</td><td rowspan="2">1</td><td>FM, VF</td><td>SD method</td></tr>
<tr><td>MW, LW</td><td>Frequency counter and SD method</td></tr>
<tr><td rowspan="2">0</td><td rowspan="2">1</td><td>FM, VF</td><td>SD method</td></tr>
<tr><td>MW, LW</td><td>SD method</td></tr>
</table>
(1: Short by diode, 0: Open)
</td></tr>
<tr><td>DISAMEMO</td><td>
Switch for inhibiting the automatic storage memory
Set as follows:
<table>
<tr><th>DISAMEMO</th><th>Description</th></tr>
<tr><td>0</td><td>Enables the use of the automatic storage memory.
Pressing the P.SCAN key for more than 2 seconds starts the automatic storage memory operation.</td></tr>
<tr><td>1</td><td>Inhibits the automatic storage memory.
The P.SCAN key is valid only for the preset scan function.</td></tr>
</table>
(1: Short by diode, 0: Open)
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>KLCD</td><td>Switch for setting the used LCD controller or driver
Set as follows:
<table><tr><th>KLCD</th><th>Description</th></tr><tr><td>0</td><td>Uses the built-in LCD controller or driver.</td></tr><tr><td>1</td><td>Uses the external LCD controller or driver (μPD7225).</td></tr></table>(1: Short by diode, 0: Open)</td></tr>
<tr><td>VF1</td><td>Switch for setting or resetting the VF-band automatic retune function that detects an illegal receiving state and automatically performs the seek-up operation
Set as follows:
<table><tr><th>VF1</th><th>Description</th></tr><tr><td>1</td><td>Uses the VF-band automatic retune function.</td></tr><tr><td>0</td><td>Inhibits the VF-band automatic retune function.
When the traffic information station is not received at selection of the VF band, however, the seek-up operation is performed and the traffic information station is detected.</td></tr></table>(1: Short by diode, 0: Open)</td></tr>
<tr><td>MWS</td><td>Switch for setting or resetting the MW-band stereo receiving function
Set as follows:
<table><tr><th>MWS</th><th>Description</th></tr><tr><td>1</td><td>Uses the MW-band stereo receiving function.</td></tr><tr><td>0</td><td>Inhibits the MW-band stereo receiving function.</td></tr></table>(1: Short by diode, 0: Open)</td></tr>
</table>

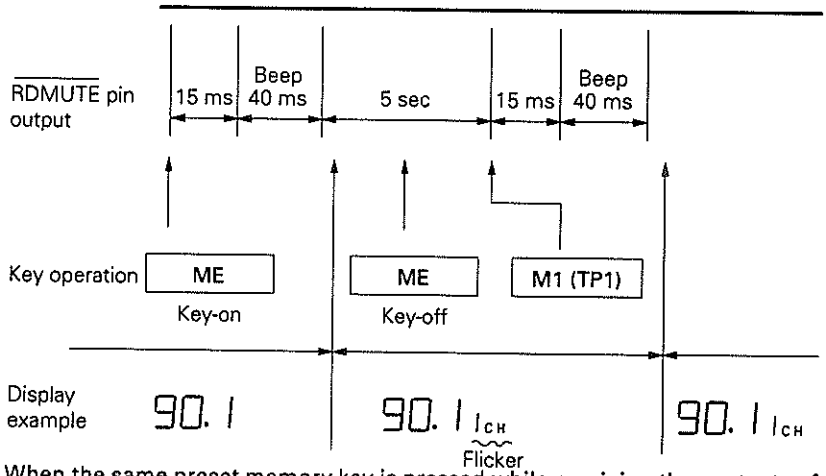
2.6.2 Alternate Switch or Transistor Switch

In the table below, switch-on indicates that the high level is input; switch-off indicates that the low level is input.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>CDSET</td><td>Switch for setting the CD mode
Valid only when the CE pin is at the high level.
Setting this switch to on places the device into the CD mode.</td></tr>
<tr><td>TPSET</td><td>Switch for setting the tape mode
Valid only when the CE pin is at the high level.
If this switch is set to on as the CDSET switch is off, the device is placed into the tape mode.</td></tr>
<tr><td>RDSET</td><td>Switch for setting the radio mode
Valid only when the CE pin is at the high level.
If this switch is set to on as the CDSET and TPSET switches are off, the device is placed into the radio mode.
This switch is valid at initialization diode RDON = 0 and invalid at RDON = 1.</td></tr>
<tr><td>FF</td><td>Fast feeding signal input switch in tape mode
The tape running indicator lamp (◀ ▶) lights depending on the state of the RL switch as follows:
<table>
<tr><th>FF</th><th>RL</th><th>Display</th></tr>
<tr><td rowspan="2">0</td><td>0</td><td>  </td></tr>
<tr><td>1</td><td>  </td></tr>
<tr><td rowspan="2">1</td><td>0</td><td>  </td></tr>
<tr><td>1</td><td>  </td></tr>
</table>
(▷: Lights off ▶: Lights on ▶: Flickers (2.5 Hz)
0 : Off 1 : On)</td></tr>
<tr><td>RL</td><td>Running direction signal input switch in tape mode
Lights on the tape running direction (◀ ▶) depending on the state of the FF switch. For details on light-on, see the explanation of the FF switch.</td></tr>
<tr><td>DTH</td><td>Detachable input switch of detachable panel
While this switch is off, the detachable switch is in the detach state.
Invalid at initialization diode KLCD = 0.</td></tr>
<tr><td>ST</td><td>Stereo signal input switch in radio mode
If this switch is set to on at the FM or VF band in the radio mode, the "ST" indicator lamp lights on.
When the stereo receiving function is specified in the MW band (initialization diode MWS = 1), if this switch is set to on, the "ST" indicator lamp lights on.
However, the "ST" indicator lamp lights off in the monaural state.</td></tr>
</table>

2.6.3 Momentary Keys

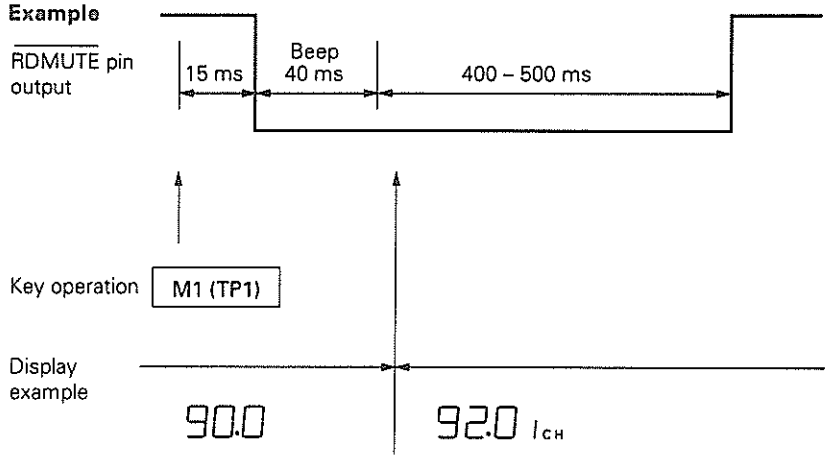
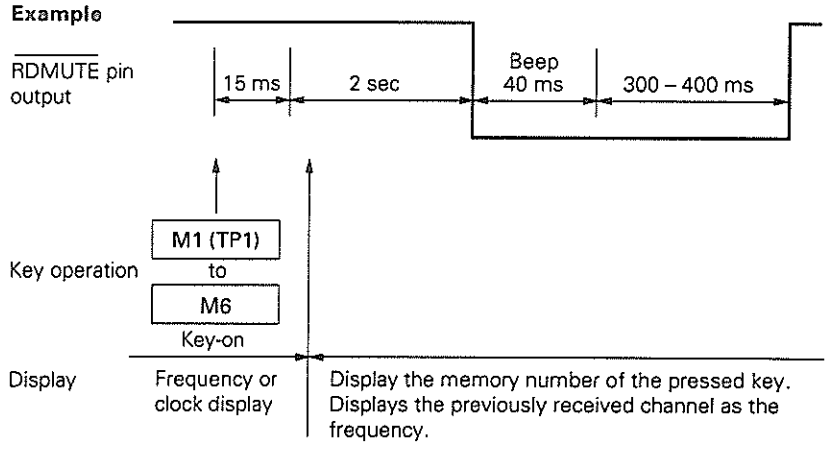
Symbol	Description
M1 (TP1) M2 (TP2) M3 (TP3) M4 M5 M6	Used for preset memory calling and writing keys in radio mode. Can also be used as a tape function key by the initialization diode (KAMS, KNR, or KMTL) in the tape mode. **(1) Radio mode, tape DK standby mode, CD DK standby mode, tape DK on mode, CD DK on mode, tape radio monitor mode, and CD radio monitor mode** Used as a key for preset memory calling and writing. The FM1, FM2, FM3, VF, MW1, MW2, and LW bands (max. 6 bands) can be independently stored for each key. Operates depending on the state of initialization diode M2S as follows:

M2S		Description
0	Write	Pressing the ME key during display of the frequency enables the preset writing for 5 seconds. If one of the M1 (TP1) to M6 keys is pressed for 5 seconds, the currently received frequency is written to the preset memory corresponding to the pressed key. Holding down the ME key disables the writing. During writing, the radio muting signal is not output. The "CH" indicator lamp and preset number (if the preset number display state is set) flicker 1 Hz and duty 1/2. **Example**  When the same preset memory key is pressed while receiving the contents of the current preset memory, the beep sound is not output. If the clock is displayed, however, the beep sound is output and the clock display is switched to the frequency display.

(0: Open)

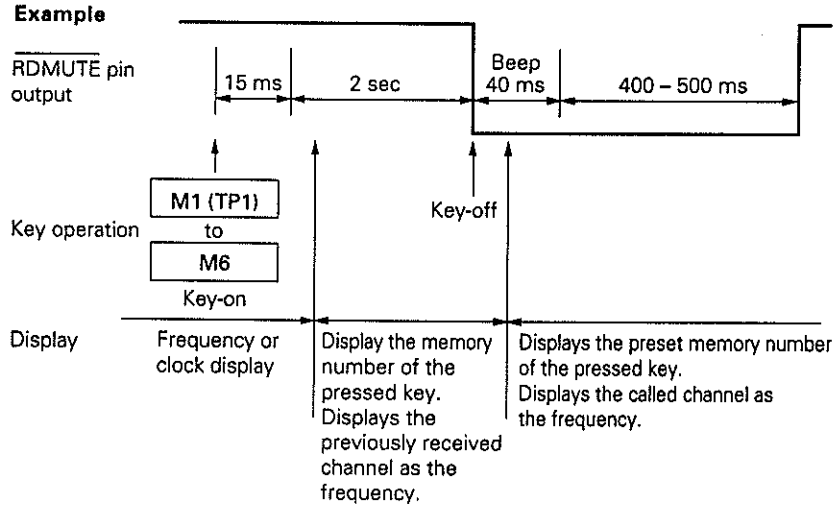
Symbol	Description

Symbol: M1 (TP1), M2 (TP2), M3 (TP3), M4, M5, M6

M2S		Description
0	Call	If the M1 (TP1) to M6 keys are pressed in other than the preset writing enabled state, the contents of the preset memory corresponding to the pressed key are called. **Example**  If the same preset memory key is pressed while receiving the contents of the current preset memory, no operation is performed. If the clock is displayed, however, the beep sound is output and the clock display is switched to the frequency display. The radio muting signal is not then output.
1	Write	Holding down the M1 (TP1) to M6 keys for 2 seconds or more writes the contents of the preset memory corresponding to the pressed key. After the writing to the preset memory is completed, the radio muting signal is output as acknowledge. **Example**  If the same preset memory key is pressed while receiving the contents of the current preset memory, no operation is performed. If the clock is displayed, however, the beep sound is output and the clock display is switched to the frequency display. The radio muting signal is not then output. If a key is pressed during seek operation, the preset memory is immediately called. The 2-second counter is then ignored.

(1: Short by diode, 0: Open)

Symbol	Description
M1 (TP1) M2 (TP2) M3 (TP3) M4 M5 M6	

M2S		Description
1	Call	If the M1 (TP1) to M6 keys are released within 2 seconds after they are pressed, the preset memory is called. **Example**  If the same preset memory key is pressed while receiving the contents of the current preset memory, no operation is performed. If the clock is displayed, however, the beep sound is output and the clock display is switched to the frequency display. The radio muting signal is not then output. If a key is pressed during seek operation, the preset memory is immediately called.

(1: Short by diode, 0: Open)

At power-on, the frequencies below are written to the M1 to M6 so that it is convenient to adjust the set value.

Area \ Memory / Band		M1	M2	M3	M4	M5	M6
East Europe, West Europe	FM1 (MHz)	87.5	87.7	92.3	96.3	105.9	87.5
	MW1 (kHz)	522	603	954	1386	522	522
	MW2 (kHz)	522	621	1098	1530	522	522
	LW (kHz)	144	155	208	256	144	144
U.S.A. 1, U.S.A. 2, U.S.A. 3	FN1 (MHz)	87.5	87.9	97.1	105.1	87.5	87.5
	MW1 (kHz)	530	620	1010	1490	530	530
Australia, Middle and Near West	FM1 (MHz)	87.5	87.9	97.1	105.1	87.5	87.5
	MW1 (kHz)	531	612	963	1395	531	531
Japan	FM1 (MHz)	76.0	76.4	85.6	76.0	76.0	76.0
	MW1 (kHz)	522	603	954	1386	522	522
China	FM1 (MHz)	87.0	87.7	92.3	87.0	87.0	87.0
	MW1 (kHz)	531	540	585	531	531	531

The lowest frequency of each area is written to the M1 to M6 of the MW2 band excluding the FM2, FM3, VF, Europe 1, and Europe 2 bands.

- **Operation in tape mode**

  Can be shared as a tape function key by initialization diode KAMS, KNR, or KMTL. For details on the keys that can be shared, see the explanation of the AMS, NR, and MTL keys.

Symbol	Description
VF	Key for selecting the VF (traffic information) band. The operation varies depending on the state of initialization diode VF1. **(1) At VF1 = 0 (without automatic retune function)** Each time the VF key is pressed, the receiving band is switched as follows: VF band ↔ FM, MW, or LW band (Receives the band that was received before the switching to the VF band.) Selecting the VF band lights on the "VF" indicator lamp. Selecting the VF band judges whether the VF broadcast station is received. If the broadcast station is received (with DS) and the SK signal is received, the VF broadcast station is placed into the receive state. When the VF broadcast station is not received while the VF band is selected, the seek-up operation is automatically performed and the VF broadcast station is detected. For details on the seek-up operation, see the explanation of SEEK UP and SEEK DWN keys. During reception of the VF band, the SD and SK signals are detected every 30 ms. If the SD or SK signal is off 256 times or more while detecting the signal 512 times, the 100 ms on and 100 ms off beep sound is output 5 times. During reception of the VF broadcast station, the operation varies depending on the state of the DK signal as follows: (a) **When the DK signal remains set to the high level for 2 seconds or more** (detected every 100 ms), the traffic information broadcasting is assumed to be received. (b) **When the DK signal remains set to the low level for 3 seconds or more** (detected every 100 ms), the traffic information broadcasting is assumed to be set to off. **(2) At VF1 = 1 (with automatic return function)** Each time the VF key is pressed, the receiving band is switched as follows: VF band ↔ FM, MW, or LW band (Receives the band that was received before the switching to the VF band.) Selecting the VF band lights on the "VF" indicator lamp. Selecting the VF band judges whether the VF broadcast station is received. When the VF broadcast station is not received while the VF band is selected, the seek-up operation is automatically performed and the VF broadcast station is detected. For details on the seek-up operation, see the explanation of SEEK UP and SEEK DWN keys. During reception of the VF band, the SD and SK signals are detected every 30 ms. If the SD or SK signal is off 256 times or more while detecting the signal 512 times, the 100 ms on and 100 ms off beep sound is output 5 times. During reception of the VF broadcast station, the operation varies depending on the state of the DK signal as follows: (a) **When the DK signal remains set to the high level for 2 seconds or more** (detected every 100 ms), the traffic information broadcasting is assumed to be received. (b) **When the DK signal remains set to the low level for 3 seconds or more** (detected every 100 ms), the traffic information broadcasting is assumed to be set to off.

Symbol	Description
P.SCAN	Preset scan and automatic memory keys. The key operation varies depending on the state of initialization diode DISAMEMO. **(1) At DISAMEMO = 0 (with automatic storage memory function)** The operation varies depending on the key operation timing. **(a) When the key is set to off within 2 seconds:** When the key is released, the preset scan operation is performed. **(b) When the key is set to on for 2 seconds or more:** After 2 seconds is lapsed, the automatic storage memory function is performed. **(2) At DISAMEMO = 1 (without automatic storage memory function)** When the key is pressed, the preset scan operation is performed. The following explains the preset scan and automatic storage memory operations. • **Preset scan operation** Automatically calls the contents of the preset memory 5 seconds at a time. If other than the preset memory is currently called, the preset memory is called from M1 5 seconds at a time. If the preset memory is being received, the preset memory is called from the next (for example, M4 if M3 is being received) 5 seconds at a time. This operation is shown below: **Example** When the FM1 band is being received, the operation is as follows: FM1 → M1 → M2 → M3 → M4 → M5 → M6 → In the MW (MW1 and MW2) and LW bands, the same operation is performed. When the next preset memory is called after 5-second holding, the beep signal is output. During 5-second holding, the preset memory number flickers 1 Hz (duty 50%). The "CH" indicator lamp does not then flicker. To stop the operation at the preset memory during 5-second holding, press the key again or press the same key as that of the currently received preset memory. The preset memory can be written (for example, M5 is written during M1 holding), but the preset scan operation ends at writing. During preset scanning, the preset memory is written as follows:

M2S	Description
0	Pressing the ME key enables the writing of the preset memory for 5 seconds. In the memory write enable state, the M1 (TP1) to M6 key operations vary depending on modes as follows: **(1) Radio mode, tape radio monitor mode, CD radio monitor mode, and CD DK standby mode** The preset memory corresponding to the pressed key is written and the preset scanning ends.

(0: Open)

Symbol	Description
P.SCAN	

M2S	Description
0	**(2) Tape DK standby mode** The operation varies depending on the state of initialization diodes KAMS, KNR, or KMTL as follows: **(a) When KAMS, KNR, or KMTL is on (the tape function is shared):** Even if the M1 (TP1) to M6 keys are pressed, the memory is not written. The preset scanning is continued. **(b) When KAMS, KNR, and KMTL are off (the tape function is not shared):** The preset memory corresponding to the pressed key is written and the preset scanning ends. If the M1 (TP1) to M6 keys are not pressed in the 5-second memory write enable state, the preset scanning restarts and the next preset memory is called. If the ME key is pressed in the 5-second memory write enabled state, the memory write enabled state is released, and the next preset memory is called 5 seconds after the key is pressed.
1	Holding down the M1 (TP1) to M6 keys for 2 seconds or more writes the currently received frequency to the preset memory corresponding to the pressed key. The preset scanning ends when the key is pressed.

(1: Short by diode, 0: Open)

During preset scanning, the operation of each key is as follows:

Key	Description
P.SCAN	Stops the scanning and receives the frequency.
SCAN UP SCAN DWN SEEK UP SEEK DWN MAN UP MAN DWN VF	Stops the scanning and performs the key operation from the currently received frequency.

Symbol	Description

P.SCAN

Key	Description
BAND	The operation varies depending on modes as follows: **(1) Radio mode, tape radio monitor mode, and CD radio monitor mode** Stops the scanning and performs the key operation from the currently received frequency. **(2) Tape DK standby mode and CD DK standby mode** Continues the scanning, but this key is invalid.
RDMONI	The operation varies depending on modes as follows: **(1) Radio mode** Continues the scanning, but this key becomes invalid. **(2) Tape DK standby mode, CD DK standby mode, tape radio monitor mode, and CD radio monitor mode** Stops the scanning and performs the key operation from the currently received frequency.
LOUD **POWER**	Continues the scanning and performs the operation of the pressed key.
LOC	The operation varies depending on the state of initialization diode AUTOLOC as follows: **(1) AUTOLOC = 0** Continues the scanning and performs the key operation. **(2) AUTOLOC = 1** Continues the scanning, but this key becomes invalid.
MONO	Continues the scanning and performs the key operation.
M1 (TP1) **M2 (TP2)** **M3 (TP3)** **M4** **M5** **M6**	The operation varies depending on the state of initialization diode M2S as follows: **(1) M2S = 0** **(a) Radio mode, tape radio monitor mode, CD radio monitor mode, and CD DK standby mode** Stops the scanning and receives the contents of the preset memory corresponding to the pressed key. **(b) Tape DK standby mode** • **When KAMS, KNR, or KMTL is on:** Continues the scanning. When the tape function is shared, this key is used as a tape function key. Keys that are not also used as a tape function key are invalid. • **When KAMS, KNR, and KMTL are off:** Stops the scanning and receives the contents of the preset memory corresponding to the pressed key.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>P.SCAN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>M1 (TP1)
M2 (TP2)
M3 (TP3)
M4
M5
M6</td><td>
(2) M2S = 1
(a) Radio mode, tape radio monitor mode, CD radio monitor mode, and CD DK standby mode
Stops the scanning.
• The operation varies depending on the key release timings as follows:
• When the key is released within 2 seconds:
Calls the preset memory corresponding to the key.
• When the key is kept pressing for 2 seconds or more:
Writes the currently received frequency to the preset memory corresponding to the pressed key.
(b) Tape DK standby mode
• When KAMS, KNR, or KMTL is on:
Continues the scanning. When the tape function is shared, this key is used as a tape function key. Keys that are not also used as a tape function key become invalid.
• When KAMS, KNR, and KMTL are off:
Stops the scanning.
The operation varies depending on the key release timings as fol- lows:
• When the key is released within 2 seconds:
Calls the preset memory corresponding to the key.
• When the key is kept pressing for 2 seconds or more:
Writes the currently received frequency to the preset memory corresponding to the pressed key.
</td></tr>
</table>

• Automatic storage memory
Automatically searches the broadcast station and writes it to the preset memory.
The method for judging whether a broadcast station exists is determined by initialization diode ENFMIF or ENAMIF.
The search of the broadcast station is performed from the currently received frequency upward.
If a broadcast station is detected, its frequency is written to the preset memory.
In the VF band, the frequency is written to the preset memory only when a VF broadcast station is detected. (A VF broadcast station is a broadcast station whose the SK signal is on.)
For details on the voltage with SD, see 1. PIN FUNCTIONS SD.
The automatic storage memory operation varies depending on the state of initialization diode AUTOLOC as follows:

(1) AUTOLOC = 0 (without automatic local function)
The operation varies depending on the LOCAL/DX state at start of the automatic storage memory operation as follows:
</td></tr>
</table>

Symbol	Description
P.SCAN	**(a) At start of automatic storage memory in DX state** The currently received frequency is searched upward. If the searched frequency rotates once, the search operation ends. When this key is pressed during search, the automatic storage memory operation ends and the frequency that was set at the start of the automatic storage memory is received. After the search frequency rotates once and the search operation ends, if even only one station is detected, the preset memory is updated and scanned from the M1. The preset memory update operation varies depending on the number of detected broadcast stations as follows: • **When six or more broadcast stations have been detected:** The six broadcast stations having the highest SD input levels are selected and written to the preset memory is ascending order from the station having the lowest frequency. • **When five or less broadcast stations have been detected:** These broadcast stations are written to the preset memory is ascending order from the station having the lowest frequency. The additional contents of the preset memory remain unchanged. **(b) At start of automatic storage memory in local state** The currently received frequency is searched in the local state upward. When the search frequency rotates once, if six or more broadcast stations are not detected, the local state is switched to the DX state and the search operation is continued. If six or more broadcast stations are detected in the local state or the search frequency rotates once in the DX state, the automatic storage memory operation ends. If this key is pressed during search operation, the automatic storage memory operation ends and the frequency that was set at the start of the automatic storage memory operation is received. After six or more broadcast stations are detected in the local state or the search frequency rotates once in the DX state, the automatic storage memory operation ends. If even only one station is detected, the preset memory is updated and scanned from the M1. The preset memory update operation varies depending on the number of detected broadcast stations as follows: • **When six or more broadcast stations have been detected in the local state:** The six broadcast stations having the highest SD input levels are selected and written to the preset memory in ascending order from the station having the lowest frequency. • **After five or less broadcast stations are detected in the local state, a broadcast station is detected in the DX state and six or more stations are detected in total:** Add the number of broadcast stations detected in the DX state to the number of broadcast stations detected in the local state, then select broadcast stations having higher SD input levels so that the total number of broadcast stations is set to 6. However, the broadcast stations detected in the local state must not be included in the number of broadcast stations selected in the DX state. The six obtained broadcast stations are written to the preset memory in ascending order from the station having the lowest frequency.

Symbol	Description
P.SCAN	• **When broadcasting stations are detected in the DX state after detecting up to five broadcasting stations in the local state, and the total number of detected broadcasting stations is less than six.** If the broadcasting stations detected in the DX state and local state are of the same frequency, the one detected in the DX state is deleted to prevent writing the same frequency to two memories. Six or fewer broadcasting stations are written to the memory in ascending order with the station with the lowest frequency being assigned to the smallest preset memory number. The contents of the remaining preset memory are not changed at that time. **(2) When AUTOLOC=1 (With automatic local function)** When searching upward from the frequency currently received in the local state, and 6 or more broadcasting stations are not detected after search for one frequency cycle is completed, the state is switched to DX and the search operation is performed again. When six or more broadcasting stations have been detected in the local state, or one search frequency cycle has been completed in DX state, the automatic storage memory stops operating. If this key is pressed during the search process in the local state, the state is changed to DX and search is performed from the frequency at which the search was started. Broadcasting stations detected in the local state are regarded as invalid. (Broadcasting stations which were detected in the local state are not included in the preset memory update.) If this key is pressed during the search process in the DX state, the automatic storage memory stops operating, and the starting frequency of the automatic store memory is received. Only when six or more broadcasting stations are detected in the local state, or auto store memory operation is ended after one research frequency cycle in the DX state with any broadcasting station detected, the preset memory is updated and preset scanning starts from M1. The preset memory update operation varies depending on the number of detected broadcast stations as follows: • **In case six or more broadcasting stations are detected in the local state** When six or more broadcasting stations are detected in the local state, the six stations are selected with the highest SD input level, and are written to the memory in ascending order with the lowest frequency station being assigned to the lowest preset memory number. • **When broadcasting stations are detected in the DX state after detecting fewer than six broadcasting stations, with six or more stations detected in total** The broadcasting stations with the highest SD input level among the ones detected in the DX state are added to the broadcasting stations detected in the local state, to make the number of detected broadcasting stations six in total. However, the broadcasting stations detected in the local state are not included among the broadcasting stations selected in the DX state. The six broadcasting stations are written to the memory in ascending order, with the one with the lower frequency being assigned to the smallest preset memory number.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>P.SCAN</td><td>

• When broadcasting stations are detected in the DX state after detecting fewer than six broadcasting stations in the local state, and fewer than six stations are detected in total
If broadcasting stations detected in the DX state and local state share the same frequency, the one detected in the DX state is deleted to prevent writing the same frequency to two memories. The six or fewer broadcasting stations are written to the memory in ascending order with the one with the lowest frequency being assigned to the smallest preset memory number. The contents of the remaining preset memory are not changed at that time.
The operation of each key in the auto store memory is shown below.

<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>P.SCAN</td><td>3 Key 4 The auto store memory operation is interrupted and the frequency at which the auto store memory operation started is received.
However, the local mode is switched when the auto local function is used.</td></tr>
<tr><td>BAND</td><td>The operation depends on the mode.

(1) In the radio mode, tape radio monitor mode, or CD radio moni- tor mode
The auto store memory operation is interrupted, and key operation is done from the frequency at which the auto store memory operation started.

(2) In the tape DK stand-by mode, or CD DK stand-by mode
The auto store memory operation is continued. This key is regarded as invalid.</td></tr>
<tr><td>SCAN UP
SCAN DWN
SEEK UP
SEEK DWN
MAN UP
MAN DWN
VF</td><td>The auto store memory operation is interrupted and key operation is done from the frequency at which the auto store memory operation was started.</td></tr>
<tr><td>RDMONI</td><td>The operation depends on the mode.

(1) In the DK stand-by mode, CD DK Stand-by mode, tape radio monitor mode, or CD radio monitor mode
The auto store memory operation is interrupted,
and the key operation is done from the frequency at which the auto store memory operation was started.

(2) In the radio mode
The auto store memory operation is continued. This key is regarded as invalid.</td></tr>
</table>

</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>P.SCAN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>LOUD
POWER</td><td>The auto store memory operation is continued. The operation of the pressed key is performed.</td></tr>
<tr><td>LOC</td><td>The operation depends on the state of the initial setting diode AUTOLOC.

(1) When AUTOLOC = 0
The LOCAL/DX state is switched. The broadcasting stations detected so far are invalid.

(2) When AUTOLOC = 1
The auto store memory operation is continued. This key is regarded as invalid.</td></tr>
<tr><td>MONO</td><td>The auto store memory operation is continued. The operation of the key is performed.</td></tr>
<tr><td>M1 (TP1)
to
M6</td><td>The operation varies in the state of the initial setting diodes KAMS, KNR, KMTL or mode as shown below.
<table>
<tr><th>KAMS
KNR
KMTL</th><th>Mode</th><th>Operation</th></tr>
<tr><td rowspan="2">Note 1</td><td>• Radio Mode
• Tape Radio Monitor Mode
• CD Radio Monitor Mode
•CD DK Stand-by Mode</td><td>The auto store memory operation is interrupted, and the frequency in the preset memory corresponding to the key is received.</td></tr>
<tr><td>Tape DK Stand-by Mode</td><td>The auto store memory operation is continued.
The key also used for the tape function becomes the key of the tape function.
The key which is not also used for the tape function is invalid.</td></tr>
<tr><td>Note 2</td><td>—</td><td>The auto store memory operation is interrupted and the frequency of the pre-set memory corresponding to the key is received.</td></tr>
</table>
Notes 1. When any key is switched on.
2. When all the switches are off.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SEEK UP
SEEK DWN</td><td>
These keys are for automatic tuning (seek operation).
Seek up (by SEEK UP key) or down (by SEEK DWN key) the frequency by one channel space, checks the existence of broadcasting stations by each receiving frequency (the checking method for the existence of broadcasting stations is determined by the initial setting diodes ENFMIF and ENAMIF), end the SEEK operation if there is any broadcasting station (in the case of the VF band, if there is any VF broadcasting station).
The seek operation depends on the state of the initial setting diode AUTOLOC as shown below.

(1) When AUTOLOC = 0 (without auto local function)
Search operation is performed from the frequency currently received. The search operation is done in the LOCAL or DX state selected when the search operation was started, and continues until the broadcasting station is detected (for the VF band, until any VF broadcasting station is detected).

(2) When AUTOLOC = 1 (with auto local function)
Search in the local state from the frequency currently received. When one frequency cycle has been searched, the state changes to the DX state, and search operation is performed again. Search in the DX state continues until a broadcasting station is detected. If this key is pressed during the search operation in the local state, LOCAL or DX is changed to the DX state and the frequency becomes the one from which the search operation was started. If this key is pressed during search in the DX state, the search operation is terminated and the frequency at which the search operation was started is received.

Set the initial setting diode AUTO500 if the SEEK UP and SEEK DWN keys are used. If it is set to 1, those keys are invalid.
The operation of each key during the seek operation is as shown below.
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>SEEK UP
SEEK DWN</td><td>
• When SEEK UP key is pressed during seek up operation, or SEEK DWN key is pressed during the seek down operation
The seek operation is interrupted and it is returned to the frequency used at the start of seek operation.
However, the local mode is switched when the auto local function is used.
• When SEEK DWN key is pressed during seek up operation, or SEEK UP key is pressed during the seek down operation
The operation of the pressed key (during seek up, seek down) is started from the frequency selected when the key was pressed.
</td></tr>
</table>
</td></tr>
</table>

Symbol	Description
SEEK UP SEEK DWN	

Key	Description
MAN UP MAN DWN	The operation depends on the state of the initial setting diode AUTO500. **(1) When AUTO500 = 0** The manual tuning operation is started from the frequency when the key is pressed. **(2) When AUTO500 = 1** **(a) When MAN UP key is pressed during seek up, or MAN DWN key is pressed during seek down** Interrupts the seek operation and returns to the frequency when seek was started. However, the local mode is switched when the auto local function is used. **(b) When MAN DWN key is pressed during seek up operation, or MAN UP key is pressed during the seek down operation.** The operation of the pressed key (during seek up, seek down) is started from the frequency when the key is pressed
SCAN UP SCAN DWN P.SCAN	The seek operation is interrupted, and the operation of the key is done from the frequency at the time the key is pressed.
VF	Returns to the frequency at which the seek operation is started, and the operation of the key is performed.
BAND	The operation depends on the mode. **(1) In the radio mode, tape radio monitor mode, or CD radio monitor mode** The seek operation is interrupted, and the key operation is done from the frequency at which the auto store memory operation is started. **(2) In the tape DK stand-by mode, or CD DK stand-by mode** The seek operation is continued. This key is regarded as invalid.
RDMONI	The operation depends on the mode. **(1) In the tape DK stand-by mode, CD DK Stand-by mode, tape radio monitor mode, or CD radio monitor mode** The seek operation is interrupted, and the key operation is done from the frequency at which the seek operation started. **(2) In the radio mode** The seek operation is continued. This key is regarded as invalid.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SEEK UP
SEEK DWN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>LOUD
POWER</td><td>The seek operation is continued. The operation of the pressed key is performed.</td></tr>
<tr><td>LOC</td><td>The operation depends on the state of the initial setting diode AUTOLOC.

(1) When AUTOLOC = 0
The seek operation is continued. The operation of the key is performed.

(2) When AUTOLOC = 1
The seek operation is continued. This key is regarded as invalid.</td></tr>
<tr><td>MONO</td><td>Seek operation is continued. The operation of the key is per- formed.</td></tr>
<tr><td>M1 (TP1)
to
M6</td><td>The operation varies in the state of the initial setting diodes KAMS, KNR, KMTL or mode as shown below.
<table>
<tr><th>KAMS
KNR
KMTL</th><th>Mode</th><th>Operation</th></tr>
<tr><td rowspan="2">Note 1</td><td>• Radio Mode
• Tape Radio Monitor Mode
• CD Radio Monitor Mode
• CD DK Stand-by Mode</td><td>Stop the seek operation, and receive the frequency of the preset memory corresponding to the key.</td></tr>
<tr><td>Tape DK Stand-by Mode</td><td>The seek operation is continued. The key also used for the tape function becomes the key of the tape function.
The key which is not also used for the tape function is regarded as invalid.</td></tr>
<tr><td>Note 2</td><td>—</td><td>Interrupts the seek operation and receive the frequency of pre-set memory corresponding to the key.</td></tr>
</table>
Notes 1. When any key is switched on.
2. When all the switches are off.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>
These keys are for automatic tuning (scan operation).
Seek up (by SCAN UP key) or down (by SCAN DWN key) the frequency by one channel space, check the existence of a broadcasting station in the receiving frequency (frequency counter and SD signal) (Seek operation), and keeps that frequency for 5 seconds. Similar to the seek operation, the existence of the SK signal is also detected for the VF band. If no operation is performed during this period of 5 seconds, the seek operation is performed again, and the next broadcasting stations are received in sequence for five seconds each (scan operation). During the period of hold for five seconds, the frequency display is blinking by 1 Hz (duty 50%). When the hold for five seconds ends, the beep is output. The seek operation is the same as when using the SEEK UP , SEEK DWN keys.
The operation of each key during the seek operation (other than 5 second hold) is as follows.
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>
• When the SCAN UP key is pressed during the scan up operation, or SCAN DWN key is pressed during the scan down operation
The scan operation is interrupted and the frequency used at the start of scanning is returned to. However, the local mode is switched when the auto local function is used.
• When SCAN DWN key is pressed during scan up operation, or SCAN UP key is pressed during the scan down operation
The operation of the pressed key (if in seek up, scan down) is started from the frequency selected when the key was pressed.
</td></tr>
<tr><td>SEEK UP
SEEK DWN
MAN UP
MAN DWN
P.SCAN</td><td>The scan operation is interrupted, and the operation of the key is done from the frequency selected at the time the key is pressed.</td></tr>
<tr><td>VF</td><td>The scan operation was interrupted, and the frequency at which the seek operation was started is returned to, then the operation of the key is performed.</td></tr>
<tr><td>BAND</td><td>
The operation depends on the mode.
(1) In the radio mode, tape radio monitor mode, or CD radio monitor mode
The scan operation is interrupted (the broadcasting station is detected by the scan operation and if the hold operation is processed, the frequency at the start of holding is returned to), and the key operation is done from the frequency which the scan operation is started.
(2) In the tape DK stand-by mode, or CD DK stand-by mode
The scan operation is continued. This key is regarded as invalid.
</td></tr>
<tr><td>RDMONI</td><td>
The operation depends on the mode.
(1) In the DK stand-by mode, CD DK Stand-by mode, tape radio monitor mode, or CD radio monitor mode
The scan operation is interrupted (the broadcasting station is detected by the scan operation and if the hold operation is processed, the frequency at the start of holding is returned to), and the key operation is done from the frequency at which the scan operation is started.
(2) In the radio mode
The scan operation is continued. This key is regarded as invalid.
</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>LOUD
POWER</td><td>The scan operation is continued. The operation of the pressed key is performed.</td></tr>
<tr><td>LOC</td><td>The operation depends on the state of the initial setting diode AUTOLOC.

(1) When AUTOLOC = 0
The scan operation is continued. The operation of the key is performed.

(2) When AUTOLOC = 1
The scan operation is continued. This key is regarded as invalid.</td></tr>
<tr><td>MONO</td><td>Scan operation is continued. The operation of the key is performed.</td></tr>
<tr><td>M1 (TP1)
to
M6</td><td>The operation varies depending on the state of the initial setting diodes KAMS, KNR, KMTL or mode as shown below.
<table>
<tr><th>KAMS
KNR
KMTL</th><th>Mode</th><th>Operation</th></tr>
<tr><td rowspan="2">Note 1</td><td>• Radio Mode
• Tape Radio Monitor Mode
• CD Radio Monitor Mode
• CD DK Stand-by Mode</td><td>Stop the scan operation, and receive the frequency in preset memory corresponding to the key.</td></tr>
<tr><td>Tape DK Stand-by Mode</td><td>The scan operation is continued. The key also used for the tape function becomes the key of the tape function.
The key which is not also used for the tape function is regarded as invalid.</td></tr>
<tr><td>Note 2</td><td>—</td><td>Interrupts the scan operation and receive the pre-set memory corresponding to the key.</td></tr>
</table>
Notes 1. When any key is switched on.
2. When all the switches are off.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>The following keys operate as follows when held down for 5 seconds.
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>• When SCAN UP key is pressed during scan up operation, or SCAN DWN key is pressed during the scan down operation
The scan operation is interrupted and the frequency during the hold is kept.
• When SCAN DWN key is pressed during scan up operation, or SCAN UP key is pressed during the scan down operation
The operation is changed to the one specified by the pressed key.</td></tr>
<tr><td>SEEK UP
SEEK DWN
MAN UP
MAN DWN
P.SCAN
VF</td><td>The scan operation is interrupted, and the operation of the key is done from the frequency under hold condition.</td></tr>
<tr><td>BAND</td><td>The operation depends on the mode.

(1) In the radio mode, tape radio monitor mode, or CD radio moni- tor mode
The scan operation is interrupted, and the key operation is done from the frequency under hold condition.
(2) In the tape DK stand-by mode, or CD DK stand-by mode
The scan operation is continued. This key is regarded as invalid.</td></tr>
<tr><td>RDMONI</td><td>The operation depends on the mode.
(1) In the tape DK stand-by mode, CD DK Stand-by mode, tape radio monitor mode, or CD radio monitor mode
The scan operation is interrupted, and the key operation is done from the frequency under hold.

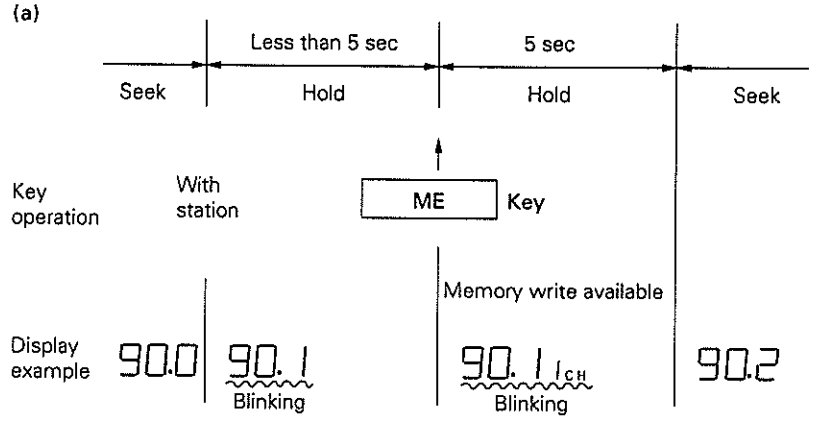
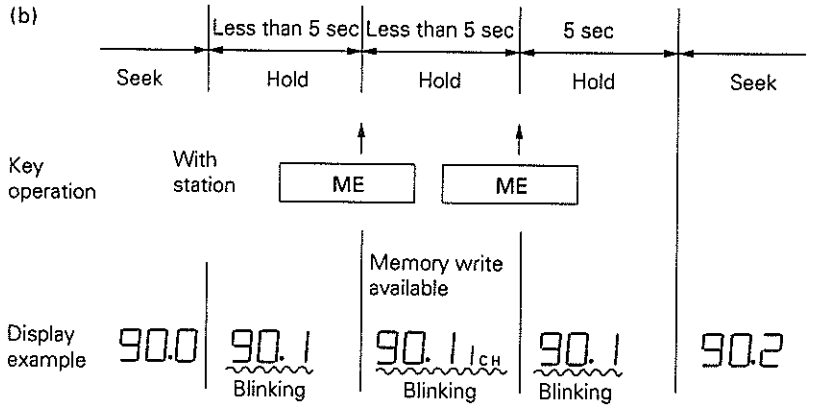
(2) In the radio mode
The scan operation is continued. This key is regarded as invalid.</td></tr>
<tr><td>LOUD
POWER</td><td>The scan operation is continued. The operation of the pressed key is performed.</td></tr>
<tr><td>LOC</td><td>The operation depends on the state of the initial setting diode AUTOLOC.

(1) When AUTOLOC = 0
The scan operation is continued. The operation of the key is performed.

(2) When AUTOLOC = 1
The scan operation is continued. This key is regarded as invalid.</td></tr>
</table></td></tr>
</table>

Symbol	Description

SCAN UP
SCAN DWN

Key	Description
MONO	The scan operation is continued. The operation of the pressed key is performed.
ME	The operation depends on the state of the initial setting diode M2S. **(1) When M2S = 1** The scan operation is continued. This key is regarded as invalid. **(2) When M2S = 0** The state of memory write possibility is reversed each time the key is pressed, as shown below. (a)  (b) 
M1 (TP1) **to** **M6**	The operation depends on the state of the initial setting diode M2S. **(1) When M2S = 0** The operation depends on the state of the memory write availability, hold state, the initial setting diodes KAMS, KNR, KMTL or mode as shown below.

Symbol	Description

SCAN UP
SCAN DWN

Key	Description

M1 (TP1)
to
M6

(a) Operation under Hold condition

KAMS KNR KMTL	Mode	Operation
Note 1	• Radio Mode • Tape Radio Monitor Mode • CD Radio Monitor Mode • CD DK Stand-by Mode	Stop the scan operation, and receive the frequency in the preset memory corresponding to the key.
	Tape DK Stand-by Mode	The scan operation is continued. The key also used for the tape function becomes the key of the tape function. The key which is not also used for the tape function is regarded as invalid.
Note 2	—	Interrupts the scan operation and receive the frequency in the preset memory corresponding to the key.

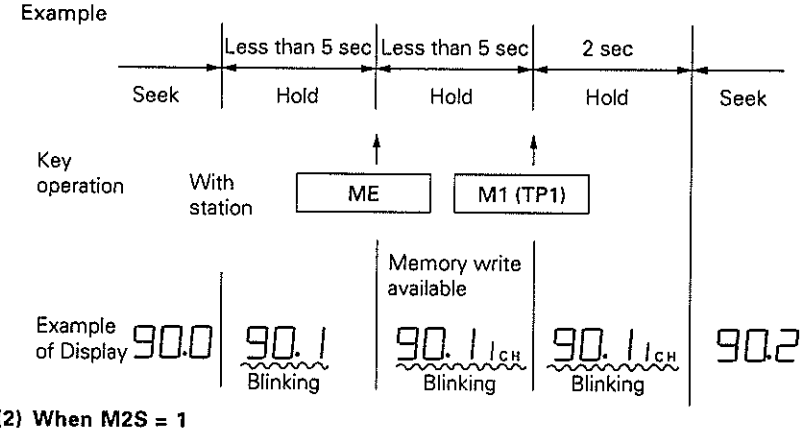
Notes 1. When any key is switched on.
2. When all the switches are off.

(b) Operation under write available condition

KAMS KNR KMTL	Mode	Operation
Note 1	• Radio Mode • Tape Radio Monitor Mode • CD Radio Monitor Mode • CD DK Stand-by Mode	Write the frequency, which is currently being received, to the appropriate preset memory and resume scanning operation after two seconds.
	Tape DK Stand-by Mode	The memory write enabled state is continued. The key also used for the tape function becomes the key of the tape function. The key which is not also used for the tape function is regarded as invalid.
Note 2	—	Write the frequency, which is currently being received, to the appropriate preset memory and resume scanning operation after two seconds.

Notes **1.** When any key is switched on.
2. When all the switches are off.

Symbol	Description
SCAN UP SCAN DWN	

Key	Description
M1 (TP1) to M6	Example  **(2) When M2S = 1** The operation depends on the state of the initial setting diodes KAMS, KNR, KMTL or mode as shown below.

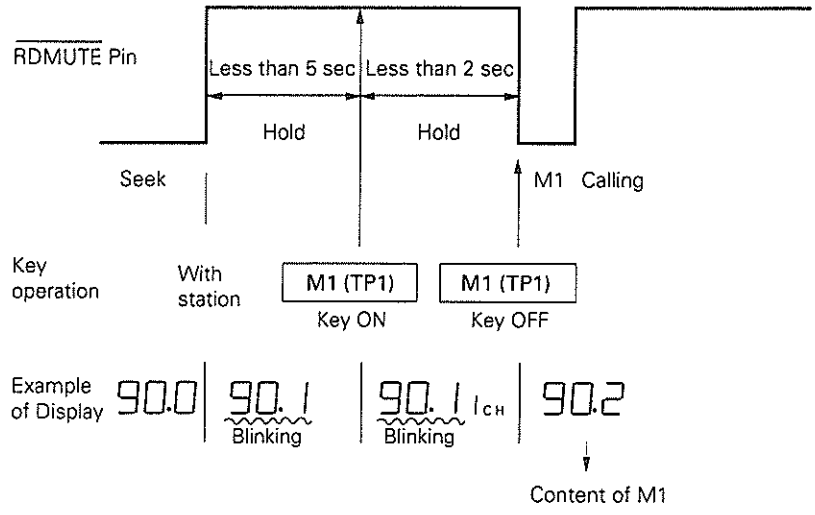
KAMS KNR KMTL	Mode	Operation
Note 1	• Radio Mode • Tape Radio Monitor Mode • CD Radio Monitor Mode • CD DK Stand-by Mode	Stop the scan operation. The operation depends on when the key is released as shown below. • Releasing the key within two seconds Call the preset memory corresponding to the key. • Pressing the key for two seconds or longer Write the current receiving frequency, to the preset memory corresponding to the pressed key.
	Tape DK Stand-by Mode	The scan operation is continued. The key also used for the tape function becomes the key of the tape function. The key which is not also used for the tape function is regarded as invalid.
Note 2	—	Interrupts the scan operation. The operation depends on the timing of releasing the key as shown below. • Releasing the key within two seconds Call the preset memory corresponding to the key. • Pressing the key for two secondsor longer Write the current receiving frequency, to the preset memory corresponding to the pressed key.

Notes 1. When any key is switched on.

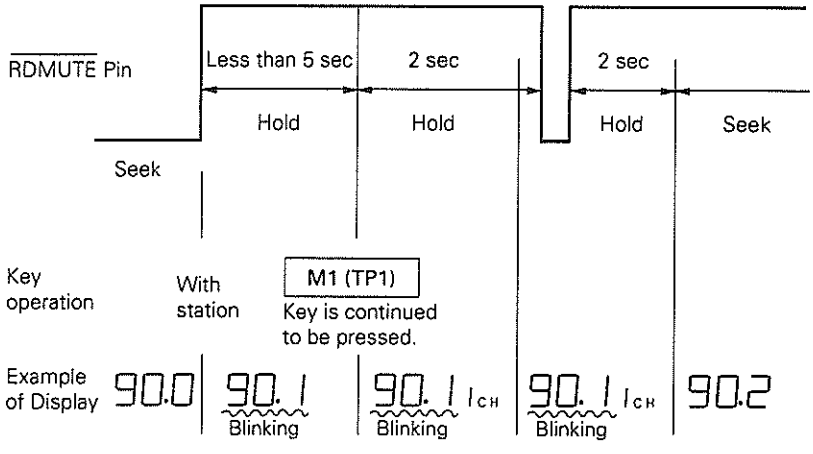
2. When all the switches are off.

Symbol	Description
SCAN UP SCAN DWN	

Key	Description
M1 (TP1) to M6	**Example 1. Releasing the key within two seconds** When the key is released, the contents of the preset memory which corresponds to the key pressed, are received and the scanning operation is released.



2. Pressing the key for two seconds or longer After pressing the key for two seconds, the frequency of the preset memory under hold condition is written to the preset memory corresponding to the pressed key. The hold state is released after the end of writing, and the next broadcasting station is searched (by the seek operation).



<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>BAND</td><td>This is the key for switching the band to be received. In the radio mode, tape radio monitor mode, or CD radio monitor mode it is valid. Every time this key is pressed, the band is switched sequentially as shown below.

FM1 → FM2 → FM3 → MW1 → MW2 → LW

Note that the bands prohibited by initial setting diodes for receiving area AREA1, AREA2, and AREA3, and the initial setting diodes for receiving band ENFM, DISFM3, ENMW2, or DISLW are not switched. When the band in the same band (FM, MW) is switched (FM1 → FM2 → FM3, MW1 → MW2), the band display and last channel are changed.
When the BAND key is pressed while receiving the VF band in the radio mode, the VF band is released and it is returned to the band selected before receiving the VF band. In the tape mode, CD mode, tape DK stand-by mode, CD DK stand-by mode, tape DK on mode, and CD DK on mode, the BAND key becomes invalid.</td></tr>
<tr><td>ME</td><td>While the frequency is displayed in the radio mode, this key is used for setting the preset memory write enabled state. It is used with the MAN UP and MAN DWN key for adjusting the clock while the clock is displayed (CE pin = High level).

The operation depends on the initial setting diode M2S as follows.

(1) When M2S = 0
It is used for setting the preset memory write enabled state or adjusting the clock.
(a) Frequency display
If this key is pressed, the preset memory write enabled state is provided for five seconds from the time it is pressed.
During the period of preset memory write enabled state, "CH" display is blinking by 1 Hz (duty 50%). If the preset memory is being received, the display of the preset memory number also blinks.
Under the seek operation (including the seek operation at scan) this key is invalid. However, the preset scanning and 5 second holding during the scan operation are valid.
The operation of other keys during the preset memory write avail- able condition is as shown below.

<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN
SEEK UP
SEEK DWN
MAN UP
MAN DWN
VF
P.SCAN</td><td>Release the preset memory write enabled state, and perform the operation of each key.</td></tr>
</table>
</td></tr>
</table>

Symbol	Description
ME	

Key	Description
BAND	The following operation is provided by each mode. **(1) In the radio mode, tape radio monitor mode, or CD radio monitor mode** The preset memory write enabled state is released and the operation of the key is performed. **(2) In the tape DK stand-by mode, CD DK stand-by mode, tape DK on mode, or CD DK on mode** The preset memory write enabled state is continued. This key is regarded as invalid.
RDMONI	The following operation is provided by each mode. **(1) In the tape DK stand-by mode, CD DK stand-by mode, tape DK on mode, CD DK on mode, tape radio monitor mode, or CD radio monitor mode** The preset memory write enabled state is released and the operation of the key is performed. **(2) In the radio mode** The preset memory write enabled state is continued. This key is regarded as invalid.
LOUD POWER	The preset memory write enabled state is continued. The operation of the key is performed.
LOC	The operation depends on the state of the initial setting diode AUTOLOC as shown below. **(1) When AUTOLOC = 0** The preset memory write enabled state is continued. The operation of the key is performed. **(2) When AUTOLOC = 1** The preset memory write enabled state is continued. This key is regarded as invalid.
MONO	The preset memory write enabled state is continued. The operation of the key is performed.

Symbol	Description
ME	

Key	Description
M1 (TP1) to M6	The operation varies depending on the state of the initial setting diodes KAMS, KNR, KMTL or mode as shown below.

KAMS KNR KMTL	Mode	Operation
Note 1	• Radio Mode • Tape Radio Monitor Mode • CD Radio Monitor Mode • Tape DK Mode • CD DK Mode • CD DK Stand-by Mode	Write the frequency currently being received to the preset memory corresponding to the key, and release the preset memory write enabled state.
Note 1	Tape DK Stand-by Mode	The preset memory write enabled state is continued. The key also used for the tape function becomes the key of the tape function. The key which is not also used for the tape function is regarded as invalid.
Note 2	—	Write the frequency which is currently being received to the preset memory corresponding to the key, and release the preset memory write enabled state.

Notes 1. When any key is switched on.
2. When all the switches are off.

If the radio is turned off in the preset memory write enabled state and again turned on, the write available state is released (switching the tape mode and CD mode is included).

(b) In case of Tape display or "[ ]" display

Invalid

(c) In case of clock display

Used as the key for correcting the clock

Adjust the second and hour by pressing MAN UP or MAN DWN key while pressing the ME key as described below.

- **Adjustment of Hour**

  Each time the MAN DWN key is pressed it advances by one hour. If the key is pressed for 0.5 seconds or longer, the time continuously changes at the speed of 4 hours/second (1 hour per 250 ms) until the key is released.

  The operation of the minute, second counter value, and hands of clock are not affected.

- **Adjustment of Minute**

  Each time the MAN UP key is pressed it advances by one minute. If the key is pressed for 0.5 seconds or longer, minutes continuously change at the speed of 8 minutes/second (1 minute per 125 ms) until the key is released.

  It is not carried to the hour indication part.

  The second counter is reset each time it is adjusted.

Symbol	Description
ME	**(2) When MS2 = 1** This is used as the key for switching the display and adjusting the clock. **(a) In case of frequency display, tape display or "[ ]" display** When the initial setting diode NOCLK = 1, it is invalid. And it is also invalid in the tape DK on mode or CD DK on mode. When NOCLK = 0, if the ME key is pressed and released, the display is switched. For the operation to switch the display, see the section describing the DISP key. **(b) In case of clock display, regardless of mode** It is used as the key for correcting the clock. Adjust the minute and hour by pressing MAN UP or MAN DWN key while pressing the ME key as described below. • **Adjustment of Hour** Each time the MAN DWN key is pressed, it advances by one hour. If the key is pressed for 0.5 seconds or longer, the hour is continuously changed at the speed of 4 hours/second (1 hour per 250 ms) until the key is released. The operation of the minute, second counter value, and hands of clock are not affected. • **Adjustment of Minute** Each time the MAN UP key is pressed, it advances by one minute. If the key is pressed for 0.5 seconds or longer, minutes change at the speed of 8 minutes/second (1 minute per 125 ms) until the key is released. It is not carried to the hour indication part. The second counter is reset at each time it is adjusted. When the ME key is released without adjusting the clock, the display is switched. For the operation to switch the display, see the section describing the DISP key.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>MAN UP
MAN DWN</td><td>
When the clock is displayed, it is used as the key for up/down of the receiving frequency in the radio mode by being used with the ME key.

(1) In the radio mode, tape radio monitor mode, CD radio monitor, mode, tape DK stand-by mode, CD DK stand-by mode, tape DK on mode, or DC DK on mode
It is operated by the state of initial setting diode AUTO500 as described below.
<table>
<tr><th>AUTO500</th><th>Description</th></tr>
<tr><td>0</td><td>Each time the key is pressed, the frequency goes up or down one step (1 channel space).
When the key is pressed for 0.5 seconds or longer, the fast feed mode is set, and the operation is continuously performed at the speed of 50 ms step.</td></tr>
<tr><td>1</td><td>Each time the key is pressed, the frequency is up or down for one step (1 channel space).
When the key is pressed for 0.5 seconds or longer, the seek operation (MAN UP key for seek up, and MAN DWN key for seek down) is started after 0.5 seconds. The operation provided is the same as that by the SEEK UP , or SEEK DWN key.</td></tr>
</table>
(1 : Short with diode, 0 : Open)

(2) When "TAPE" indicating the tape mode or "CD" for CD mode is displayed
This key is invalid.

(3) During clock display
It is possible to adjust the seconds and hours by pressing MAN UP or MAN DWN key if the clock is displayed and the ME key is being pressed.
For the operation to adjust the second and hour, see the section describing the ME key.
</td></tr>
<tr><td>LOUD</td><td>
This is the key for controlling LOUD (loudness).
It is valid in the radio mode, tape mode, or CD mode.
Each time this key is pressed, ON/OFF state of loudness is switched.
The states of loudness, "LOUD" display and LOUD pin output are described below.
<table>
<tr><th>State of loudness</th><th>"LOUD" display</th><th>LOUD pin</th></tr>
<tr><td>ON</td><td>Light up</td><td>High level</td></tr>
<tr><td>OFF</td><td>Light off</td><td>Low Level</td></tr>
</table>
The loudness state is maintained when the radio mode, tape mode and CD mode are switched.
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>LOC</td><td>
This is the key for local (LOCAL/DX) control.
In the radio mode, CD radio monitor mode, CD DK stand-by mode, CD DK on mode, tape radio monitor mode, tape DK stand-by mode, or tape DK on mode, it is valid if the initial setting diode AUTOLOG = 0.
Each time this key is pressed, LOCAL/DX state is switched.
The states of LOCAL/DX, "LOC" display and LOC pin output are described below.
<table>
<tr><th>LOCAL/DX State</th><th>"LOC" Display</th><th>LOC Pin</th></tr>
<tr><td>LOCAL</td><td>Light up</td><td>High level Note</td></tr>
<tr><td>DX</td><td>Light off</td><td>Low Level</td></tr>
</table>
Note The high level is output only during auto tuning.
In other cases, the low level is output.
</td></tr>
<tr><td>MONO</td><td>
This is the key for MONO (monophonic)/STEREO control.
In the radio mode, CD radio monitor mode, CD DK stand-by mode, CD DK on mode, tape radio monitor mode, tape DK stand-by mode, or tape DK on mode, it is valid if FM, VF or MW band is selected. (For the MW band, it is valid only when the initial setting diode MWS = 1 during stereo broadcasting is received.)
Each time this key is pressed, MONO/STEREO state is switched.
The states of MONO/STEREO, "MONO"display and MONO/NR pin output are described below.
<table>
<tr><th>MONO/STEREO State</th><th>"ST" Display</th><th>"MONO" Display</th><th>MONO/NR Pin</th></tr>
<tr><td>MONO</td><td>Light off</td><td>Light up</td><td>High level</td></tr>
<tr><td>STEREO</td><td>Light up</td><td>Light off</td><td>Low Level</td></tr>
</table>
</td></tr>
<tr><td>MTL</td><td>
This is the key for MTL (METAL) control.
It is valid in the radio mode, tape DK stand-by mode, tape DK on mode, or tape radio monitor mode.
Each time this key is pressed, the METAL ON/OFF state is switched.
The on/off states of METAL, "METAL"display and METAL pin output are described below.
<table>
<tr><th>METAL State</th><th>"METAL" Display</th><th>METAL Pin</th></tr>
<tr><td>ON</td><td>Light up</td><td>High level</td></tr>
<tr><td>OFF</td><td>Light off</td><td>Low Level</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>NR</td><td>
This is the key for NR (noise reduction) control.
It is valid in the tape mode, tape DK stand-by mode, tape DK on mode, or tape radio monitor mode.
Each time this key is pressed, the NR ON/OFF state is switched.
The on/off states of NR, "NR" display and NR/MONO pin output are described below.
<table>
<tr><th>NR State</th><th>"NR" Display</th><th>NR/MONO Pin</th></tr>
<tr><td>ON</td><td>Light up</td><td>High level Note</td></tr>
<tr><td>OFF</td><td>Light off</td><td>Low Level Note</td></tr>
</table>
Note In the tape DK on mode and tape radio monitor mode, the NR/MONO pin is operated as the MONO/STEREO state output pin. Therefore, the level its output corresponds to the state of MONO/STEREO.
</td></tr>
<tr><td>AMS</td><td>
This is the key for AMS (Auto Music Search) control.
It is valid in the tape mode, tape DK stand-by mode, tape DK on mode, or tape radio monitor mode.
Each time this key is pressed, the AMS ON/OFF state is switched.
The on/off states of AMS, "AMS" display and AMS pin output are described below.
<table>
<tr><th>AMS State</th><th>"AMS" Display</th><th>AMS Pin</th></tr>
<tr><td>ON</td><td>Light up</td><td>High level</td></tr>
<tr><td>OFF</td><td>Light off</td><td>Low Level</td></tr>
</table>
</td></tr>
<tr><td>RDMONI</td><td>
This is the key for radio monitor.
It is valid in the tape mode, tape DK stand-by mode, tape DK on mode, CD mode, CD DK stand-by mode, CD DK on mode, tape radio monitor mode, or CD radio monitor mode.
Each time this key is pressed, the radio monitor mode is reversed, and "RDMONI" display on the LCD panel lights up in the radio monitor mode.
In the radio monitor mode, tuning operation of all bands is available, and the radio mute ($\overline{\text{RDMUTE}}$ pin) is set to OFF, while the audio mute ($\overline{\text{AMUTE}}$ pin) is ON.
The radio monitor mode is released if the state is changed by the following factors.
• State of TPSET switch is changed.
• State of CDSET switch is changed.
• CE pin level is changed from High to Low.
</td></tr>
</table>

Symbol	Description
DISP	This is the key for switching the display. It is valid when the initial setting diode NOCLK = 0 (with clock). Note that it is invalid in the tape DK on mode or CD DK on mode even NOCLK is set to 0. The display is switched by the following operation. **(1) In Radio Mode** Each time this key is pressed, the display of frequency and clock are switched. It is invalid during seek scan, auto preset, or scan. It is operated by the initial setting diodes PRIO1 and PRIO2 as described below.

PRIO1	PRIO2	Priority display	Description
0	0	None	Each time the DISP key is pressed, the display is switched to/from frequency/clock.
1	0	Frequency display	If the DISP key is pressed while the frequency is displayed, the display is changed to display the clock for five seconds. If the DISP key is pressed again within five seconds, the display is returned to the frequency display.
0	1	Clock Display	If the DISP key is pressed while the clock is displayed, the display is changed to indicate the frequency for five seconds. If the DISP key is pressed again within five seconds, the display is returned to the clock display.

(1 : Short by diode, 0 : Open)

When it is switched to the radio mode, the frequency is displayed first.

(2) In tape mode

Each time this key is pressed, the "TAPE" display and clock display are switched.
It is operated by the initial setting diodes PRIO1 and PRIO2 as described below.

PRIO1	PRIO2	Priority display	Description
0	0	None	Each time the DISP key is pressed, the display is switched to/from frequency/clock.
1	0	"TAPE" Display	If the DISP key is pressed while "TAPE" is displayed, the display is changed to display the clock for five seconds. If the DISP key is pressed again within five seconds, the display is returned to "TAPE".
0	1	Clock Display	If the DISP key is pressed while the clock is displayed, the display is changed to "TAPE" for five seconds. If the DISP key is pressed again within five seconds, the display is returned to the clock display.

(1 : Short by diode, 0 : Open)

When it is switched to the tape mode, "TAPE" is displayed first.

Symbol	Description
DISP	**(3) In CD mode** Each time this key is pressed, the "CD" display and clock display are switched. It is operated by the initial setting diodes PRIO1 and PRIO2 as described below.

PRIO1	PRIO2	Priority display	Description
0	0	None	Each time this key is pressed, the "CD" display and clock display are switched.
1	0	"CD" Display	If the DISP key is pressed while "CD" is displayed, the display is changed to display the clock for five seconds. If the DISP key is pressed again within five seconds, the display is returned to "CD".
0	1	Clock Display	If the DISP key is pressed while the clock is displayed, the display is changed to "CD" for five seconds. If the DISP key is pressed again within five seconds, the display is returned to the clock display.

(1 : Short by diode, 0 : Open)

When it is switched to the tape mode, "CD" is displayed at first.

(4) In tape radio monitor mode and tape DK stand-by mode

Each time this key is pressed, the "TAPE" display, frequency display, and clock display are switched.

It is operated by the initial setting diodes PRIO1 and PRIO2 as described below.

PRIO1	PRIO2	Priority display	Description
0	0	None	Each time this key is pressed, the display is changed by toggle as shown below. "TAPE" → Frequency → Clock
1	0	"TAPE" Display	Each time this key is pressed, the display is changed by toggle as shown below. "TAPE" → Frequency → Clock When no operation is performed while the frequency or clock is displayed, the display is returned to "TAPE" after five seconds.
0	1	Clock Display	Each time this key is pressed, the display is changed by toggle as shown below. "TAPE" → Frequency → Clock When no operation is performed while the frequency or "TAPE" is displayed, it is returned to the clock display after five seconds.

(1 : Short by diode, 0 : Open)

When the mode is changed to the tape radio monitor mode or tape DK stand-by mode, the frequency is displayed first.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>DISP</td><td>
(5) In CD monitor mode and CD DK stand-by mode
Each time this key is pressed, the "[ ]" display, frequency display, and clock display are switched.
It is operated by the initial setting diodes PRIO1 and PRIO2 as described below.
<table>
<tr><th>PRIO1</th><th>PRIO2</th><th>Priority display</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>None</td><td>Each time this key is pressed, the display is changed by toggle as shown below.
"[ ]" → Frequency → Clock</td></tr>
<tr><td>1</td><td>0</td><td>"[ ]" Display</td><td>Each time this key is pressed, the display is changed by toggle as shown below.
"[ ]" → Frequency → Clock
When no operation is performed while the frequency or clock is displayed, the display is returned to "[ ]" after five seconds.</td></tr>
<tr><td>0</td><td>1</td><td>Clock Display</td><td>Each time this key is pressed, the display is changed by toggle as shown below.
"[ ]" → Frequency → Clock
When no operation is performed while the frequency or "[ ]" is displayed, it is returned to the clock display after five seconds.</td></tr>
</table>
(1 : Short by diode, 0 : Open)
When the mode is changed to the CD radio monitor mode or CD DK stand-by mode, the frequency is displayed first.
</td></tr>
<tr><td>POWER</td><td>This is used for turning on/off the radio and illumination control by using the momentary key.
It is valid when CE pin = high level.
By pressing the key, the output of the POWER pin is reversed.
The radio can be switched on/off by switching ON/OFF the RDON of the transistor switch with the POWER pin.</td></tr>
</table>

3. MODE TRANSITION

The following two ways are provided by the μPD17012GF-011 to turn ON/OFF the radio.

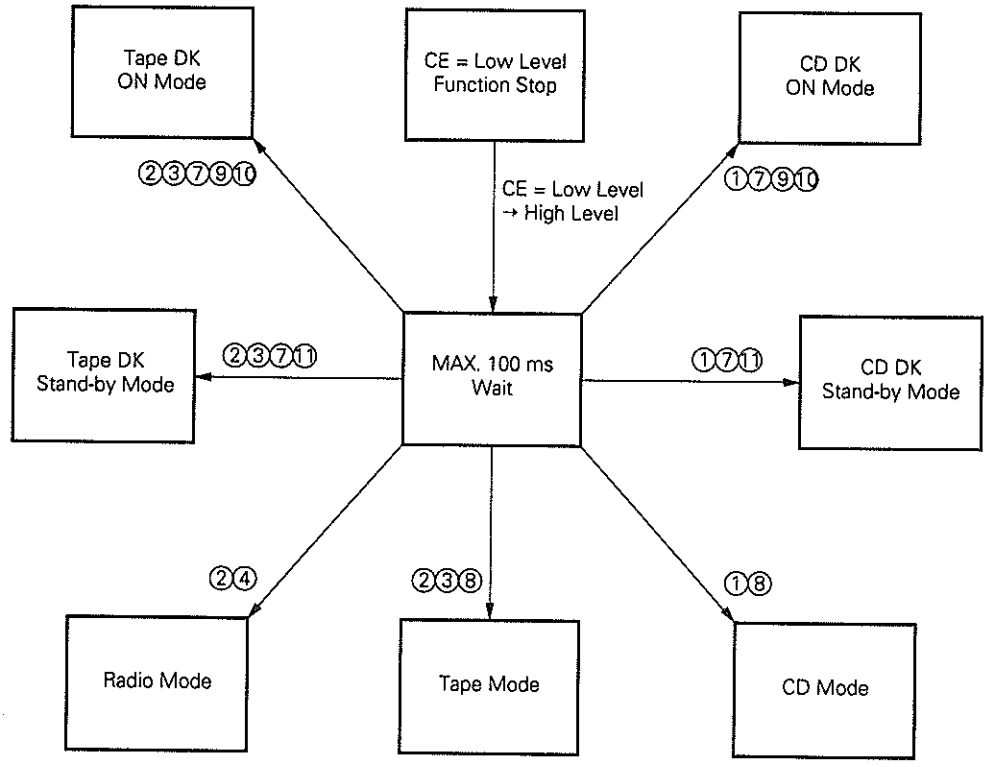
(1) Set "1" to the initial setting diode RDON to turn on/off the radio by switching the status of the CE pin.
(2) Set "0" to the initial setting diode RDON to turn on/off the radio by ON/OFF of the transistor or alternate switch RDSET when the CE pin is at High level.

The transition state diagram for each operation is described in the following sections 3.1 and 3.2.

3.1 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS 1 (Radio ON/OFF by switching the state of CD pin)

The radio mode is turned on/off by switching the state of the CE pin.
The TPSET switch and CDSET switch are valid only when CE pin = high level.
The RDSET switch is invalid.
If the CE pin is set to low level, the clock is not displayed regardless of the state of the initial setting diode NOCLK. However, in the case where NOCLK = 0 (with clock), the hands of the clock are moved.

(1) Mode transition when CE pin changed from low level to high level

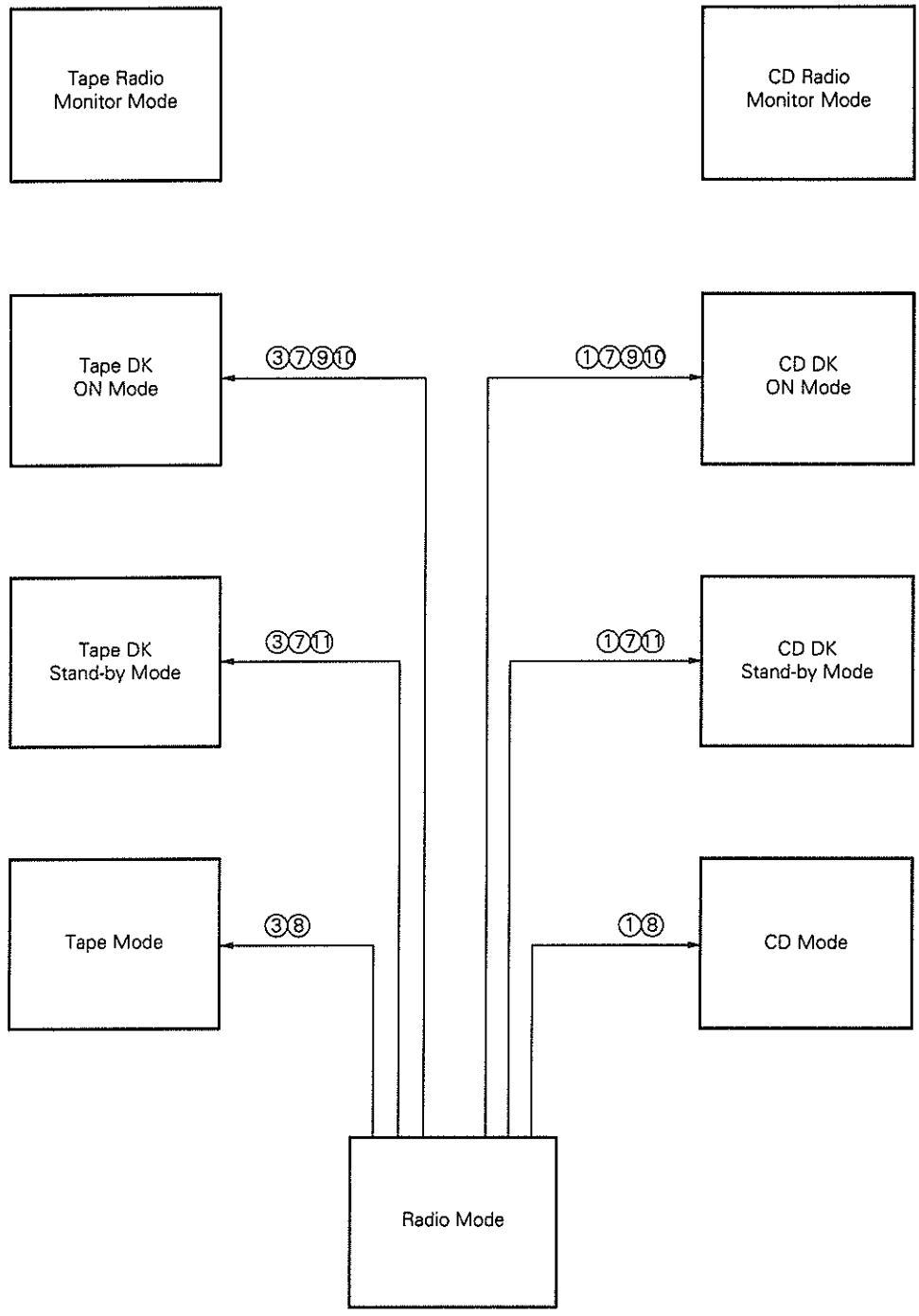


Remark The circled numbers in the above figure indicate the following functions.

①: CDSET Switch ON
②: CDSET Switch OFF
③: TPSET Switch ON
④: TPSET Switch OFF
⑤: RDMONI Key ON
⑥: VF Key ON
⑦: Receiving VF Band
⑧: Receiving band other than VF Band
⑨: Receiving traffic information station
⑩: DK Switch ON
⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫: RDSET Switch ON
⑬: RDSET Switch OFF

(2) Mode transition when CE pin is at high level

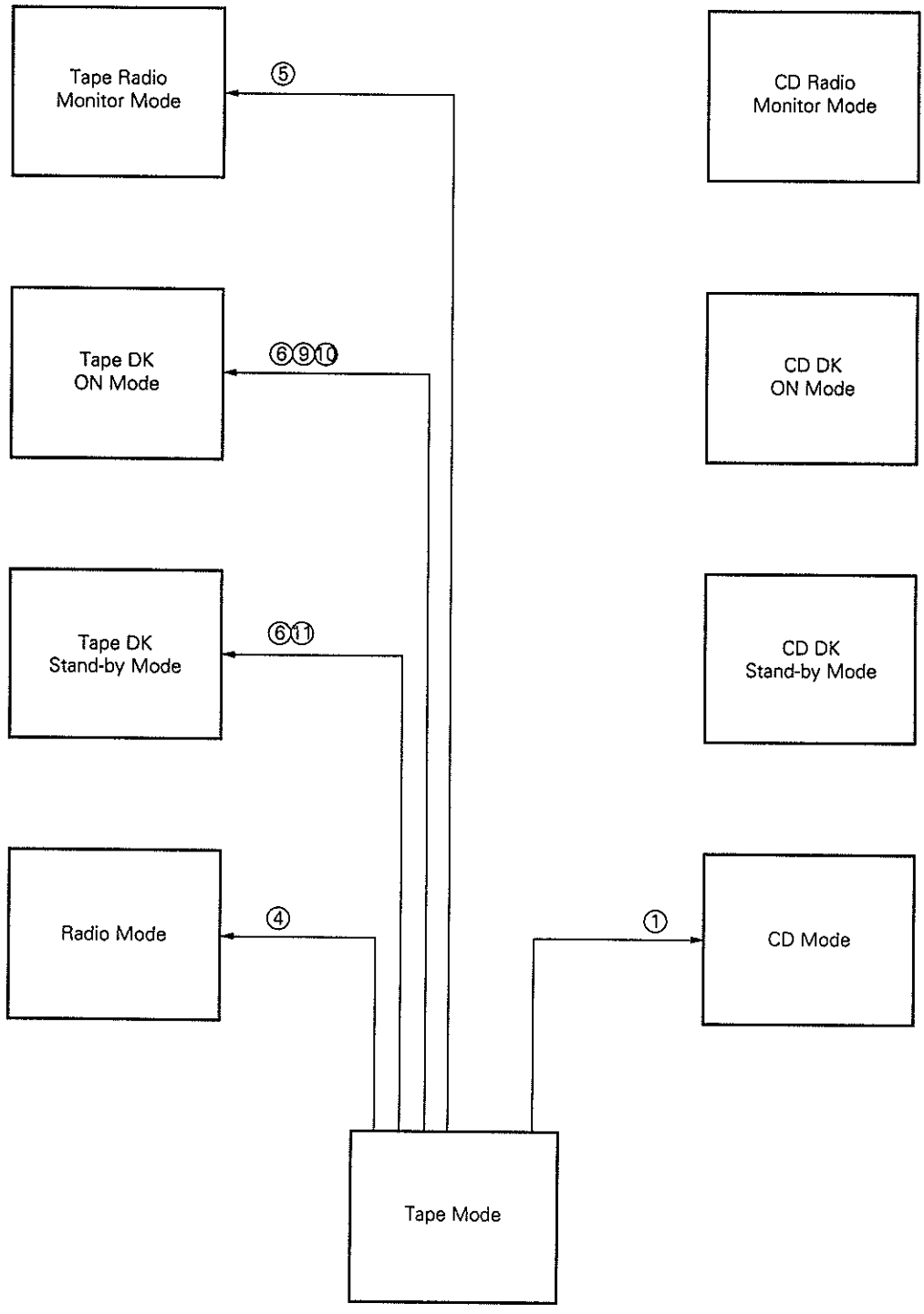
(a) Transition from Radio Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

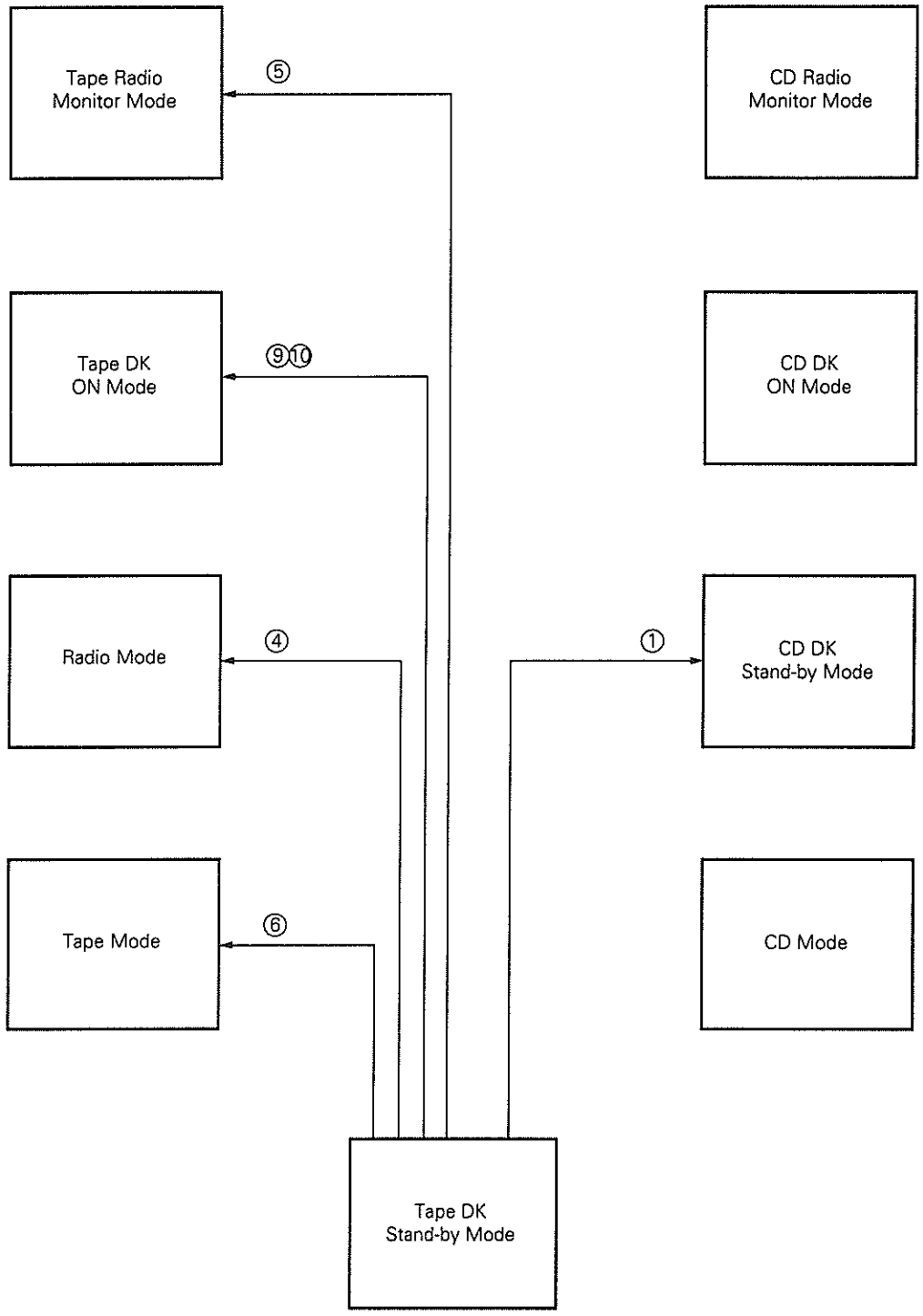
(b) Transition from Tape Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ① : CDSET Switch ON
- ② : CDSET Switch OFF
- ③ : TPSET Switch ON
- ④ : TPSET Switch OFF
- ⑤ : RDMONI Key ON
- ⑥ : VF Key ON
- ⑦ : Receiving VF Band
- ⑧ : Receiving band other than VF Band
- ⑨ : Receiving traffic information station
- ⑩ : DK Switch ON
- ⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫ : RDSET Switch ON
- ⑬ : RDSET Switch OFF

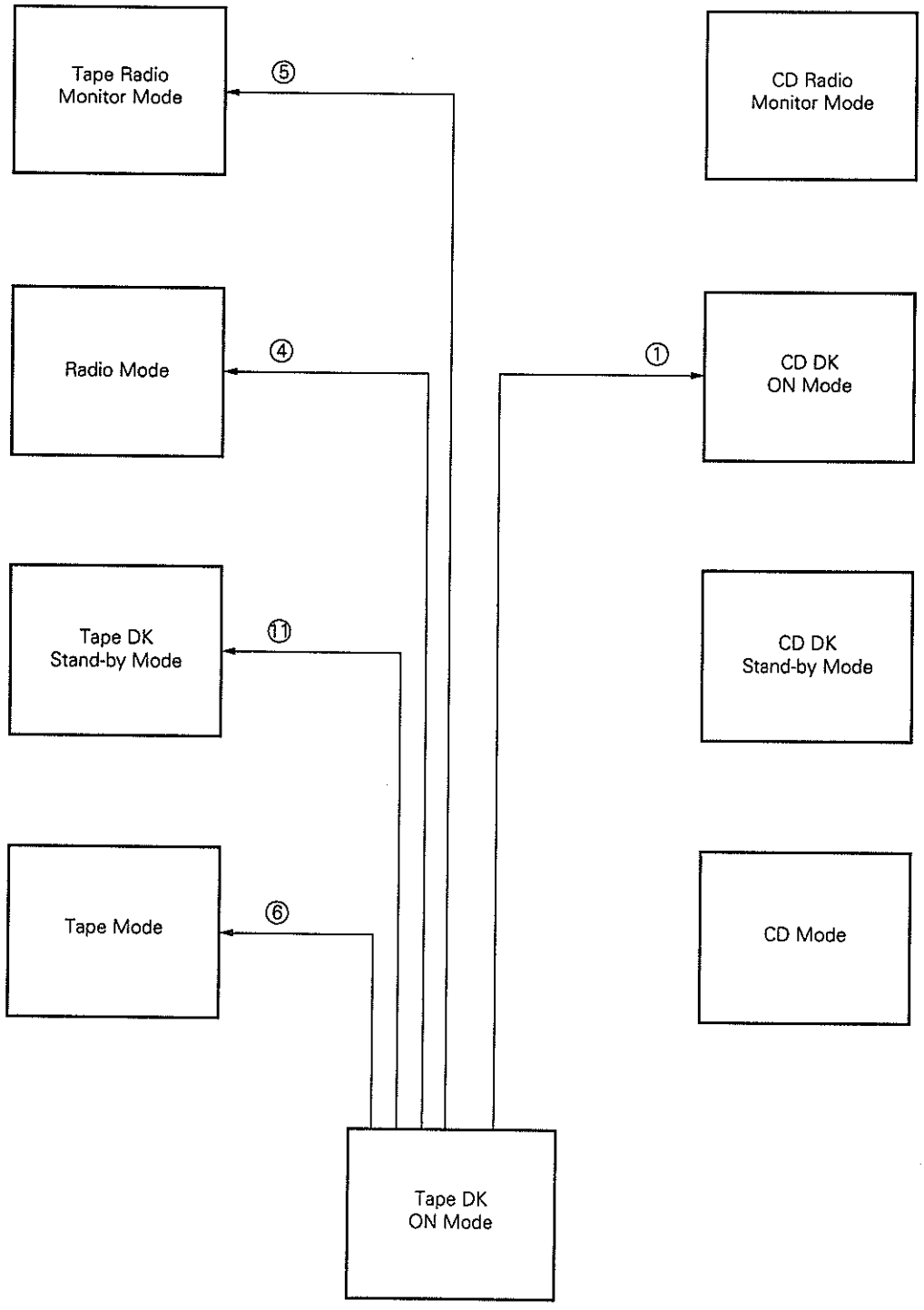
(c) Transition from Tape DK Stand-by Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ①: CDSET Switch ON
- ②: CDSET Switch OFF
- ③: TPSET Switch ON
- ④: TPSET Switch OFF
- ⑤: RDMONI Key ON
- ⑥: VF Key ON
- ⑦: Receiving VF Band
- ⑧: Receiving band other than VF Band
- ⑨: Receiving traffic information station
- ⑩: DK Switch ON
- ⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫: RDSET Switch ON
- ⑬: RDSET Switch OFF

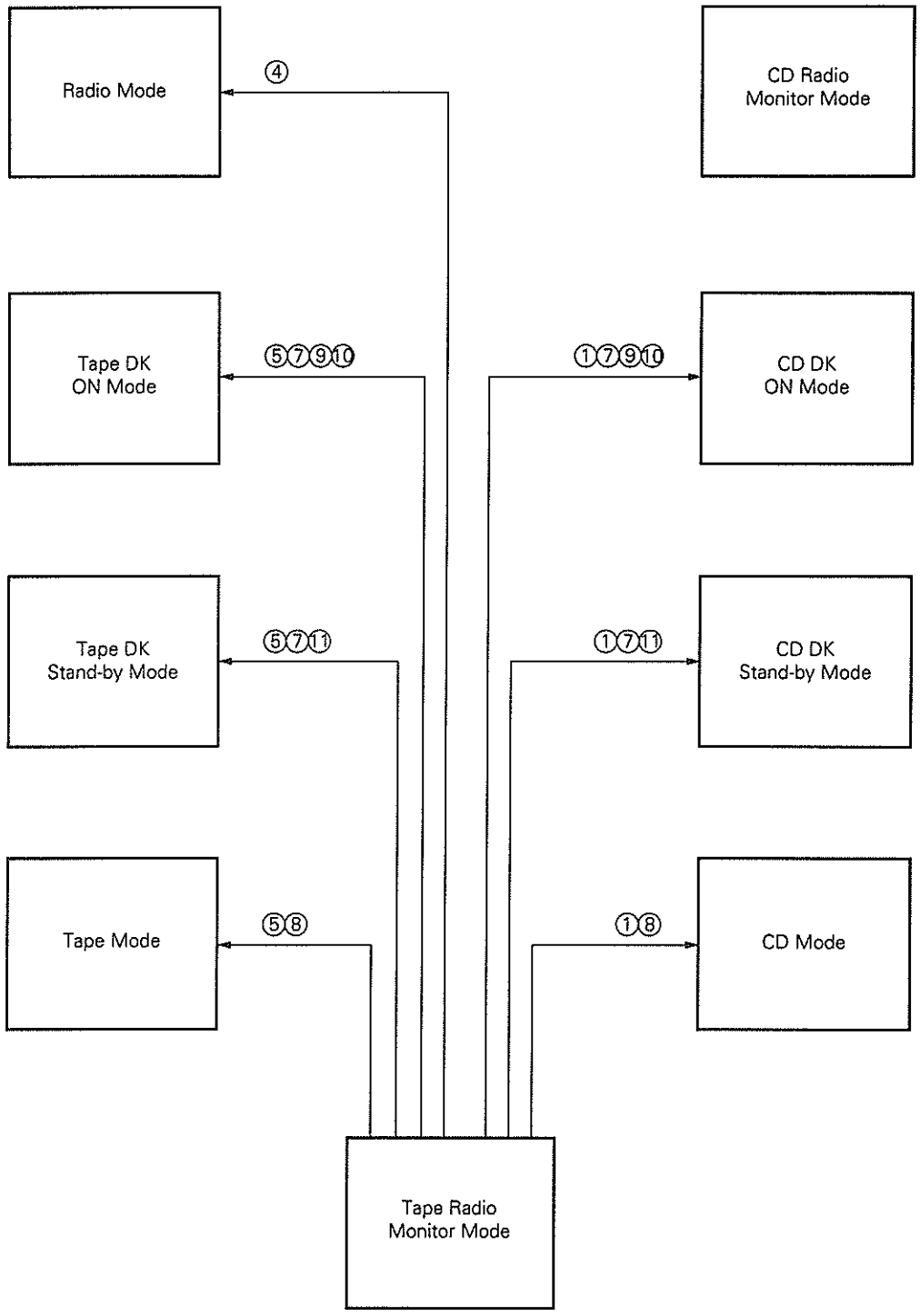
(d) Transition from Tape DK ON Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

①: CDSET Switch ON
②: CDSET Switch OFF
③: TPSET Switch ON
④: TPSET Switch OFF
⑤: RDMONI Key ON
⑥: VF Key ON
⑦: Receiving VF Band
⑧: Receiving band other than VF Band
⑨: Receiving traffic information station
⑩: DK Switch ON
⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫: RDSET Switch ON
⑬: RDSET Switch OFF

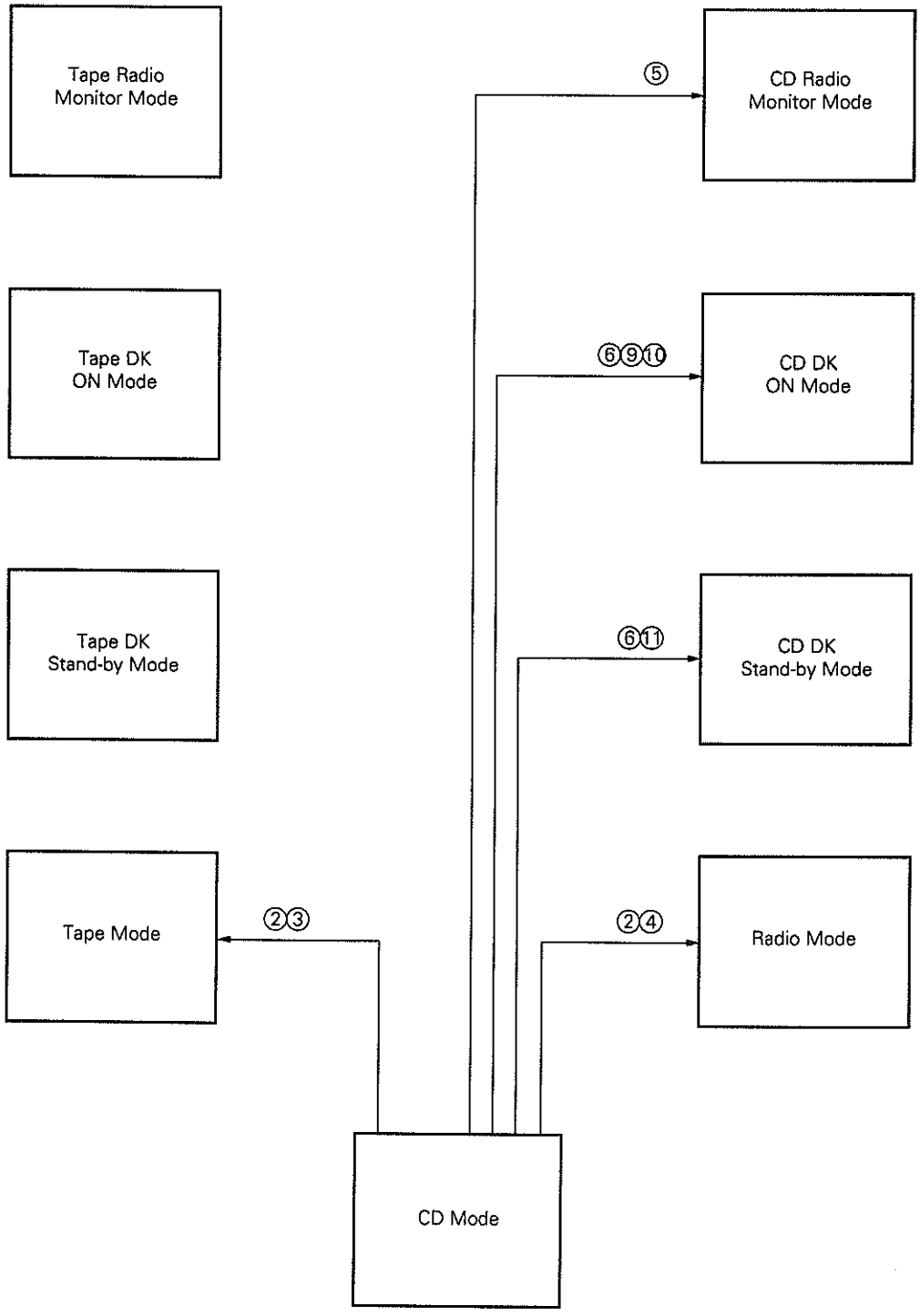
(e) Transition from Tape Radio Monitor Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

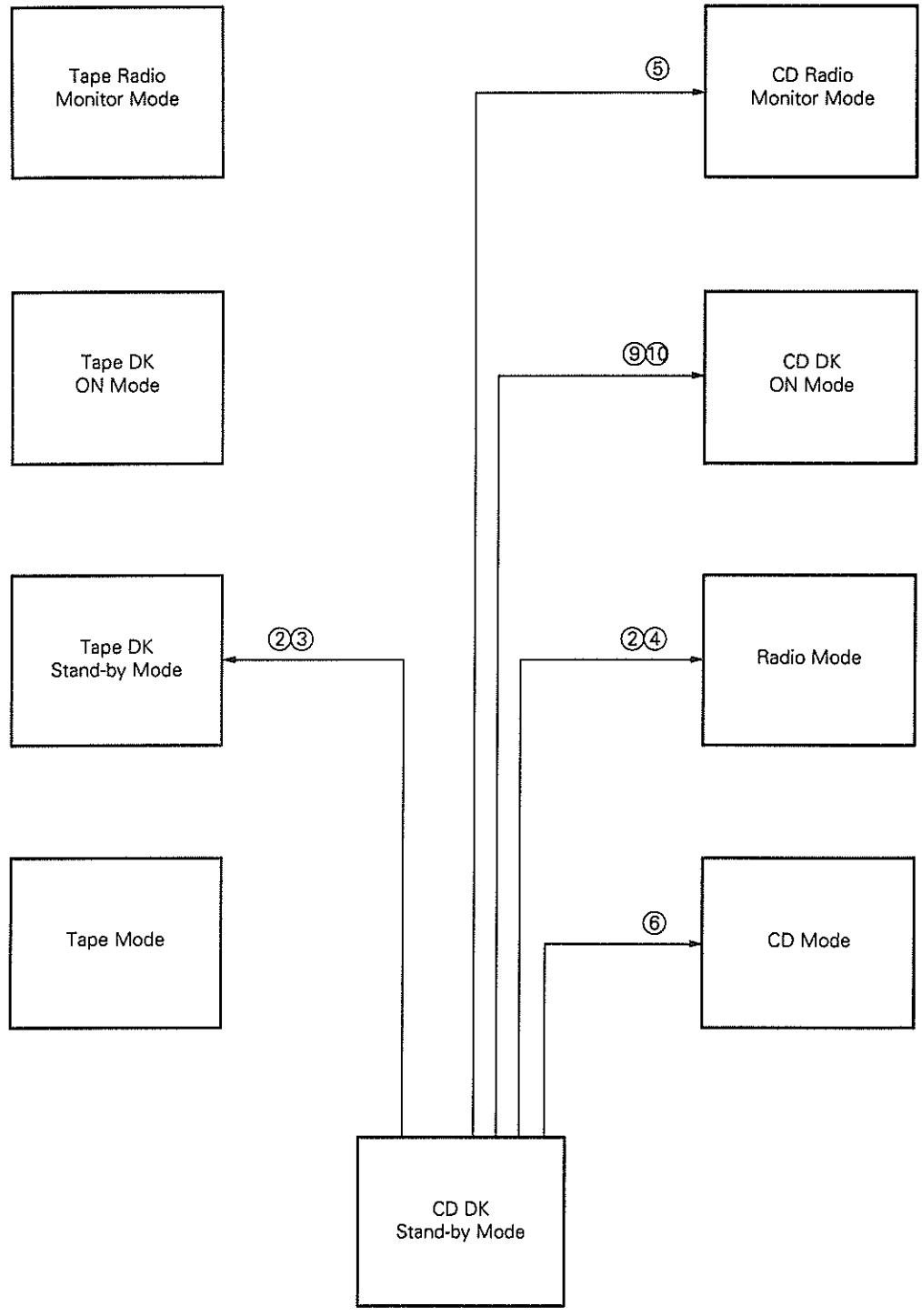
(f) Transition from CD Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ①: CDSET Switch ON
- ②: CDSET Switch OFF
- ③: TPSET Switch ON
- ④: TPSET Switch OFF
- ⑤: RDMONI Key ON
- ⑥: VF Key ON
- ⑦: Receiving VF Band
- ⑧: Receiving band other than VF Band
- ⑨: Receiving traffic information station
- ⑩: DK Switch ON
- ⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫: RDSET Switch ON
- ⑬: RDSET Switch OFF

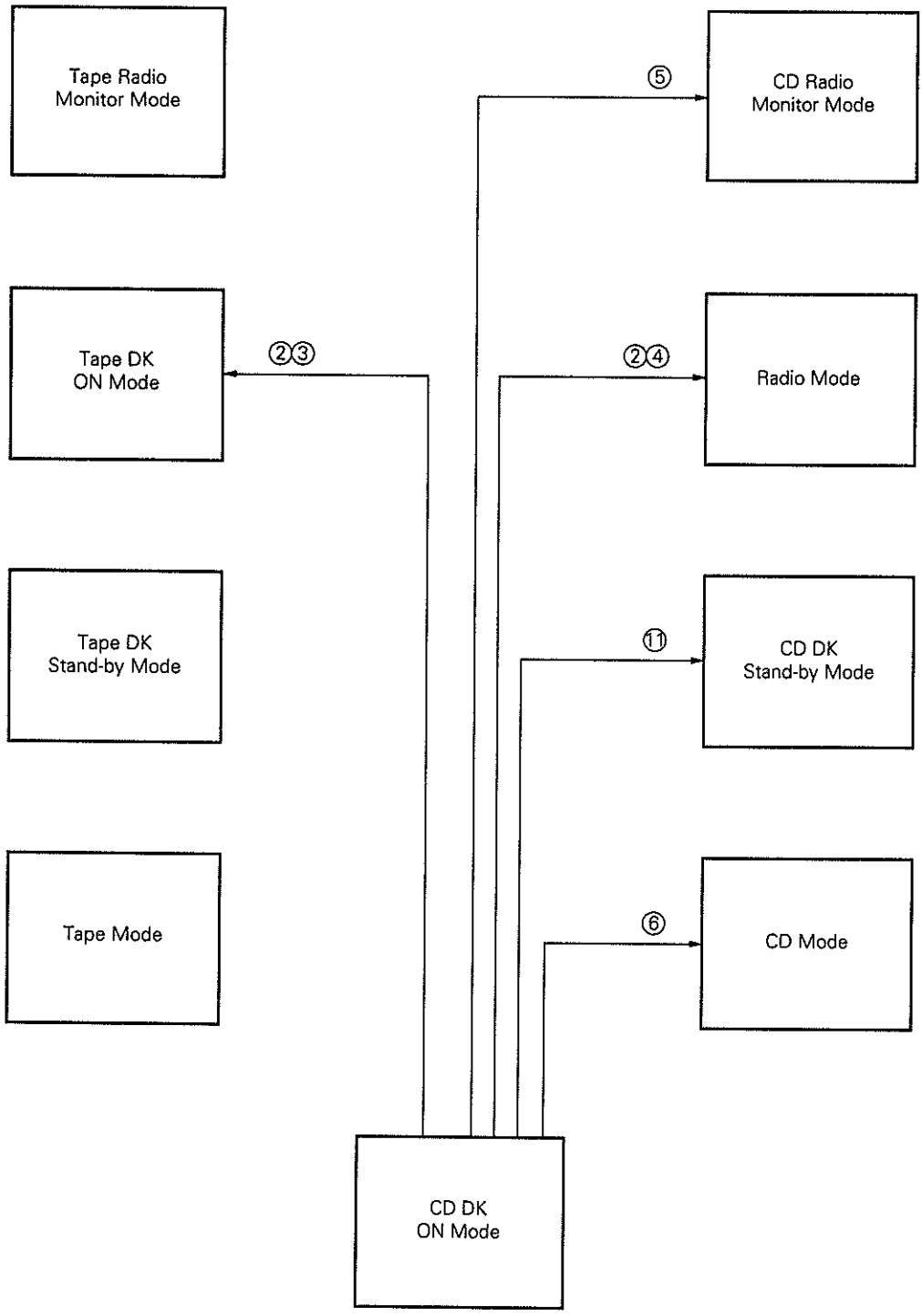
(g) Transition from CD DK Stand-by Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

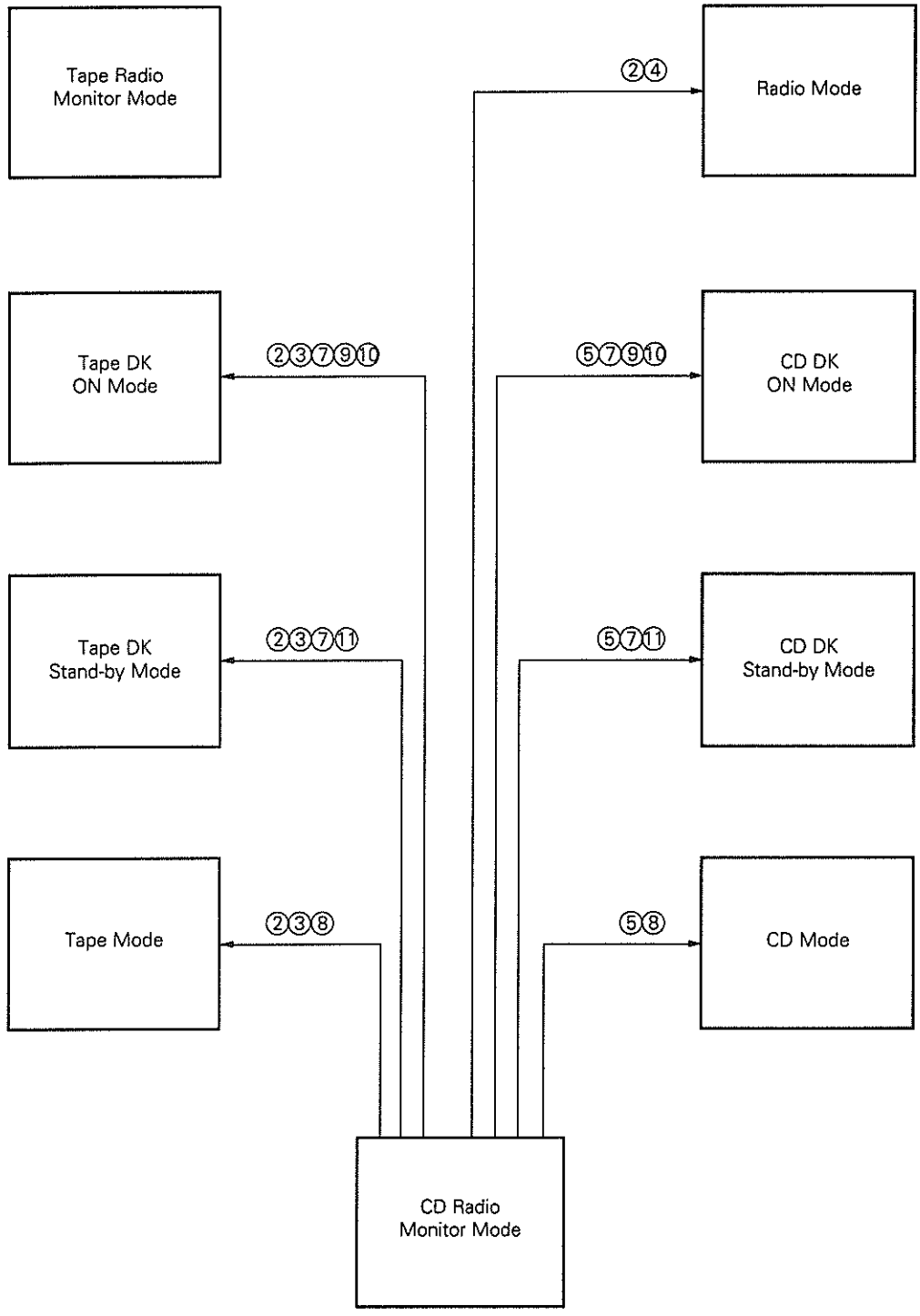
(h) Transition From CD DK ON mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

(i) Transition from CD Radio Monitor Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

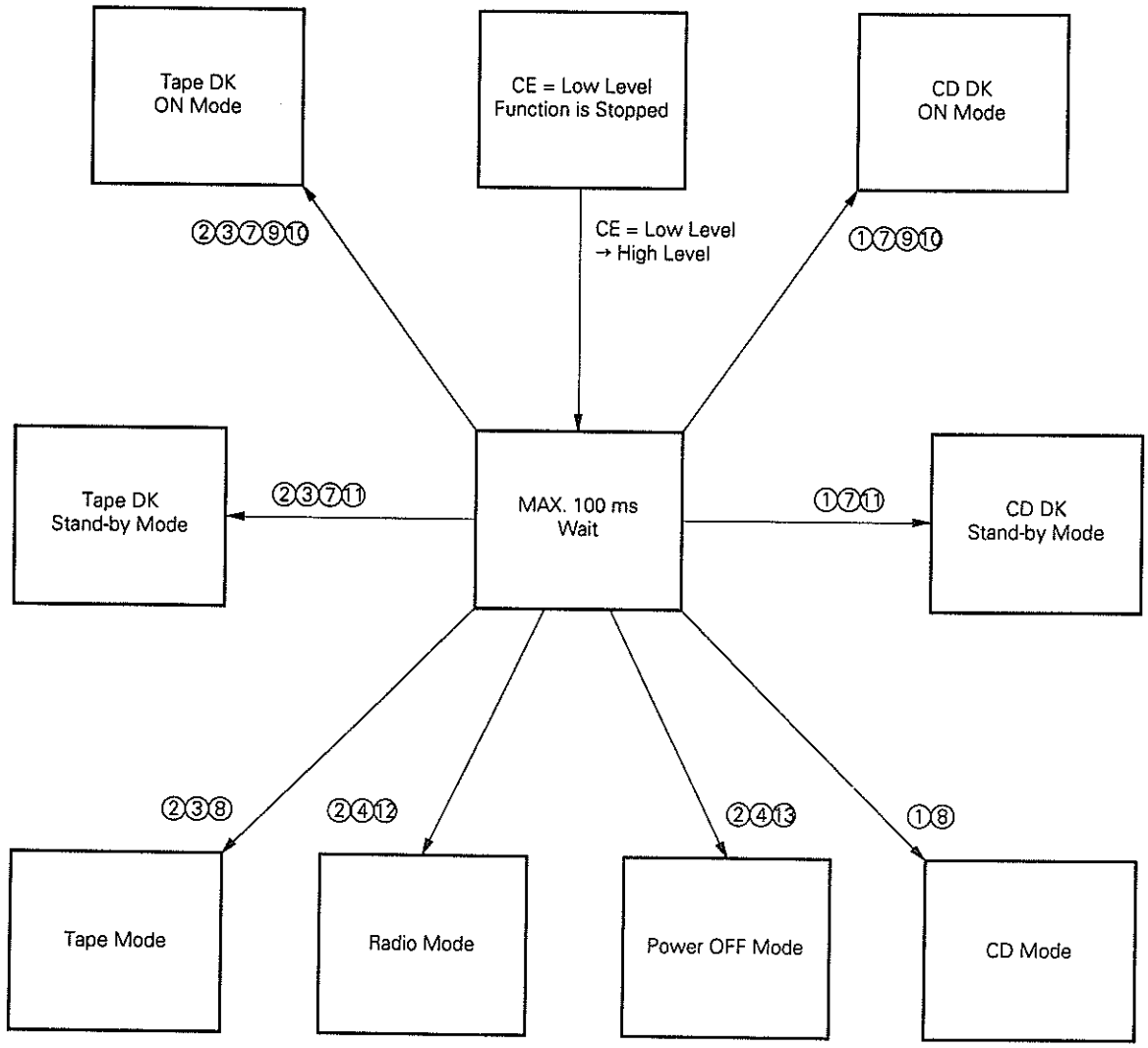
① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

3.2 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS 0
(Radio ON/OFF by switching the state of RDSET switch)

The radio is turned on/off by switching the state of the RDSET switch.
The RDSET, TPSET, and CDSET switches are valid only when CE pin = high level.
If the CE pin is set to low level, the clock is not displayed, regardless of the state of the initial setting diode NOCLK.
However, in the case where NOCLK = 0 (with clock), the hands of the clock are moved.

(1) Mode transition when CE pin is changed low level → high level

The radio mode is turned on/off by switching the state of the RDSET switch.
For switching to the tape mode and CD mode, the TPSET switch and CDSET switch are used respectively.

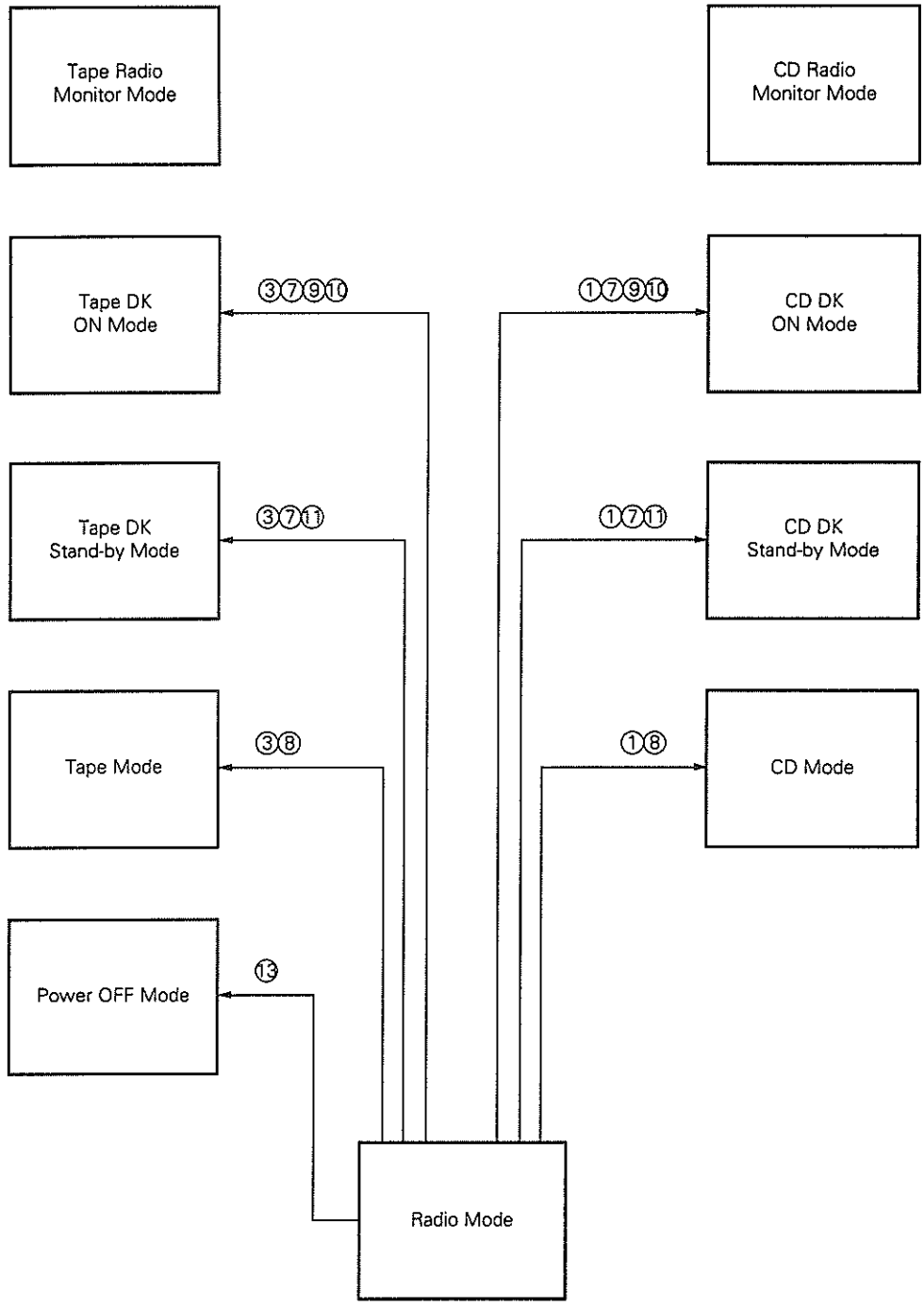


Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

(2) Mode transition when CE pin is at high level

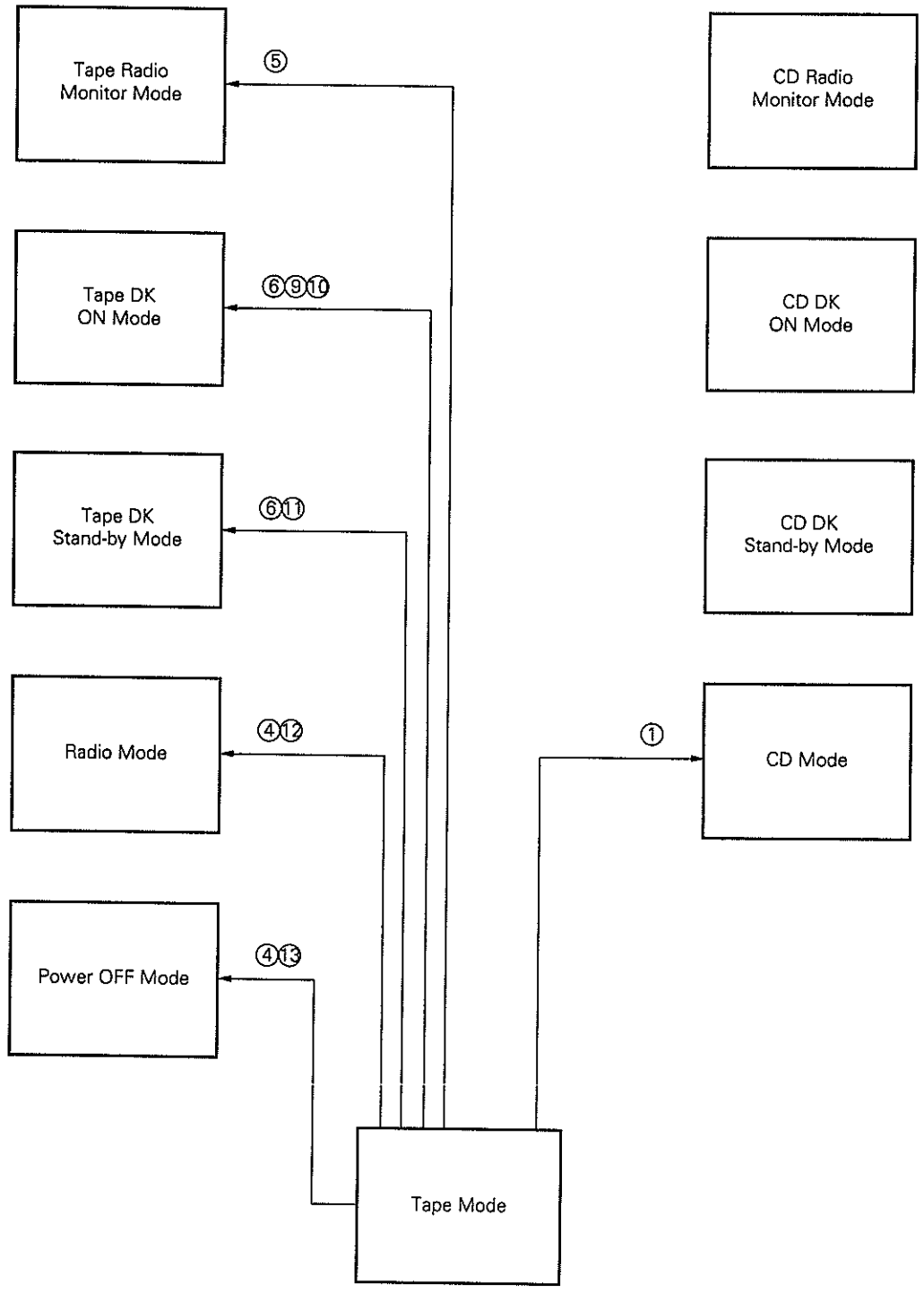
(a) Transition from Radio Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

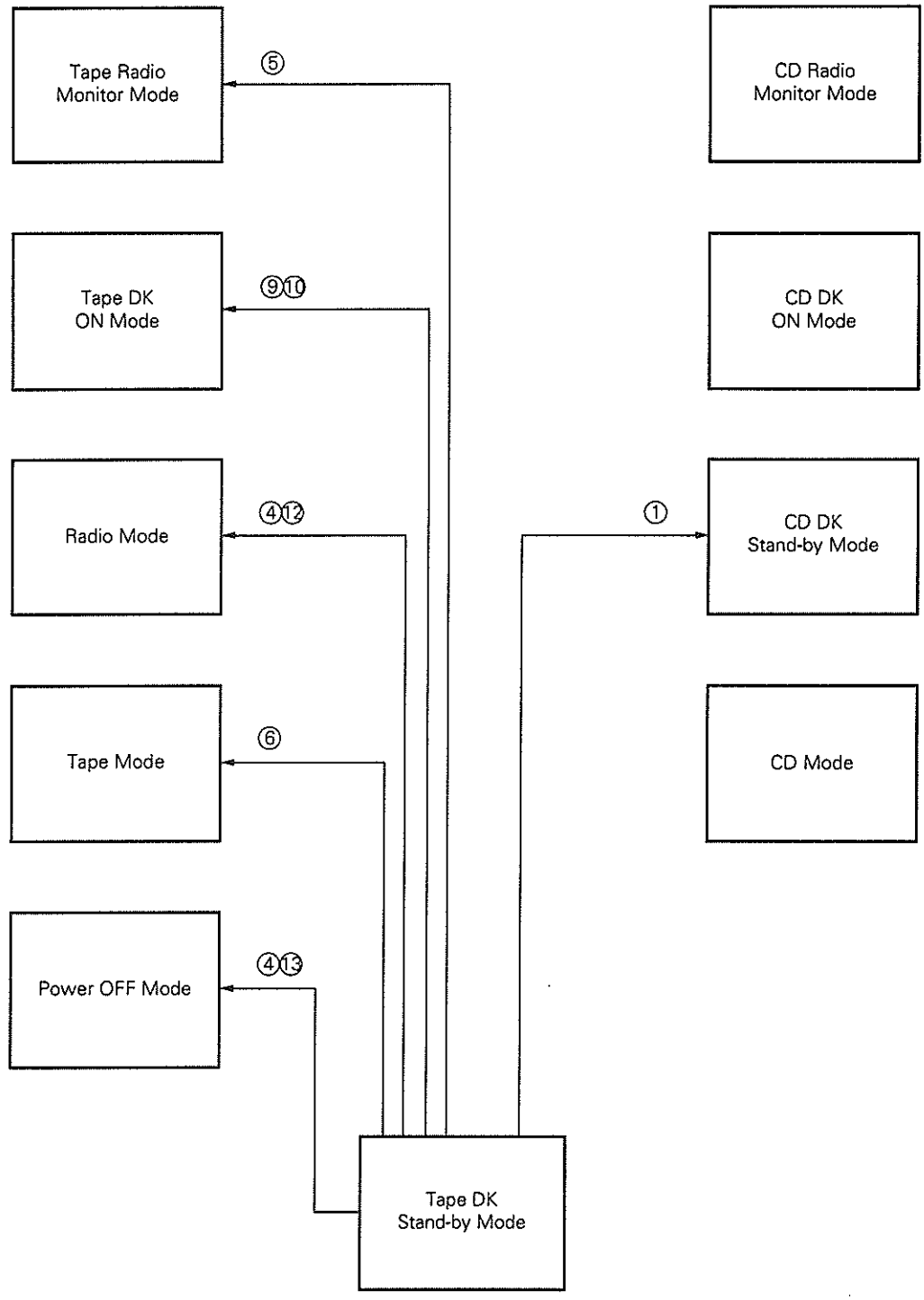
(b) Transition from Tape Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ①: CDSET Switch ON
- ②: CDSET Switch OFF
- ③: TPSET Switch ON
- ④: TPSET Switch OFF
- ⑤: RDMONI Key ON
- ⑥: VF Key ON
- ⑦: Receiving VF Band
- ⑧: Receiving band other than VF Band
- ⑨: Receiving traffic information station
- ⑩: DK Switch ON
- ⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫: RDSET Switch ON
- ⑬: RDSET Switch OFF

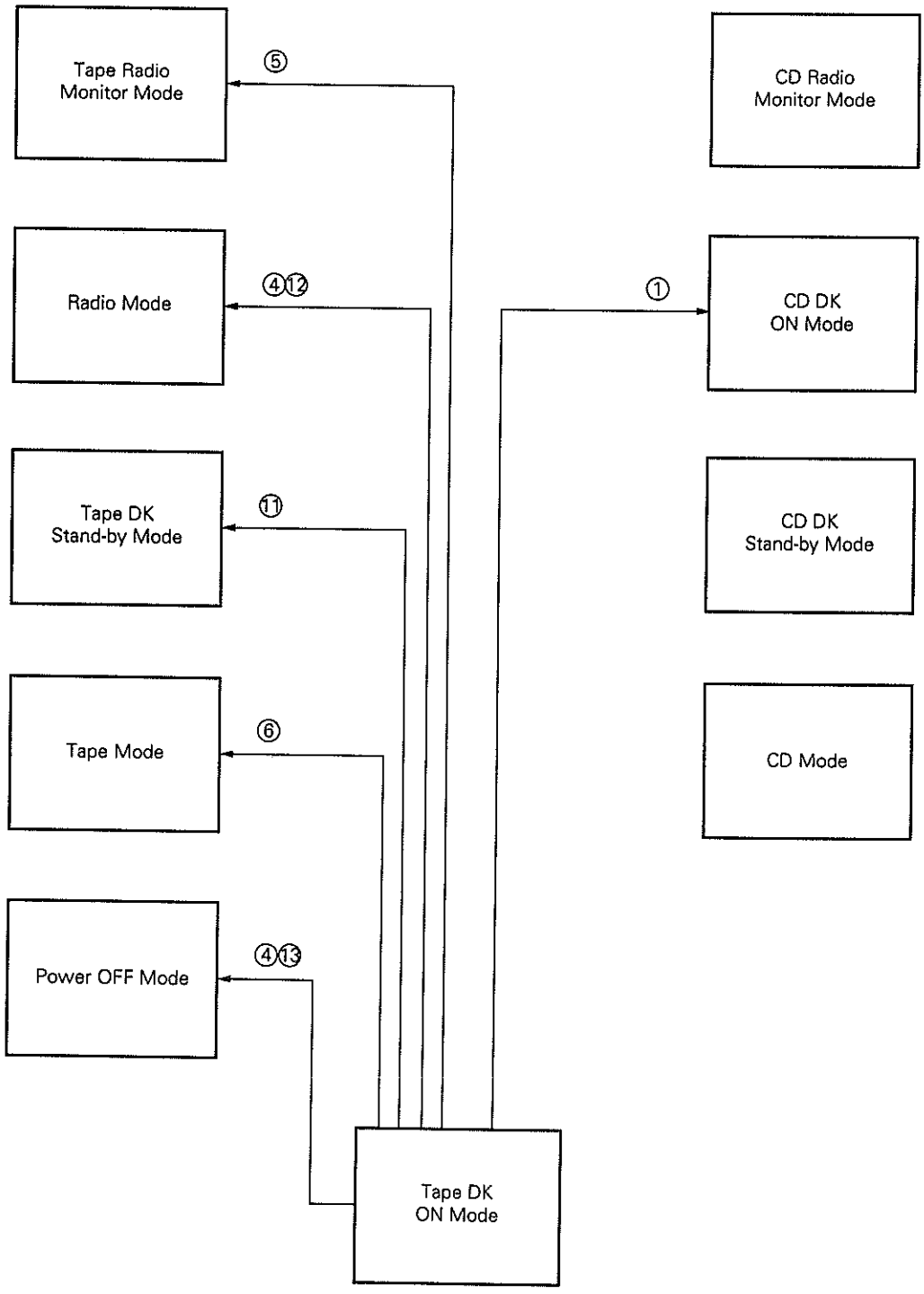
(c) Transition from Tape DK Stand-by Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

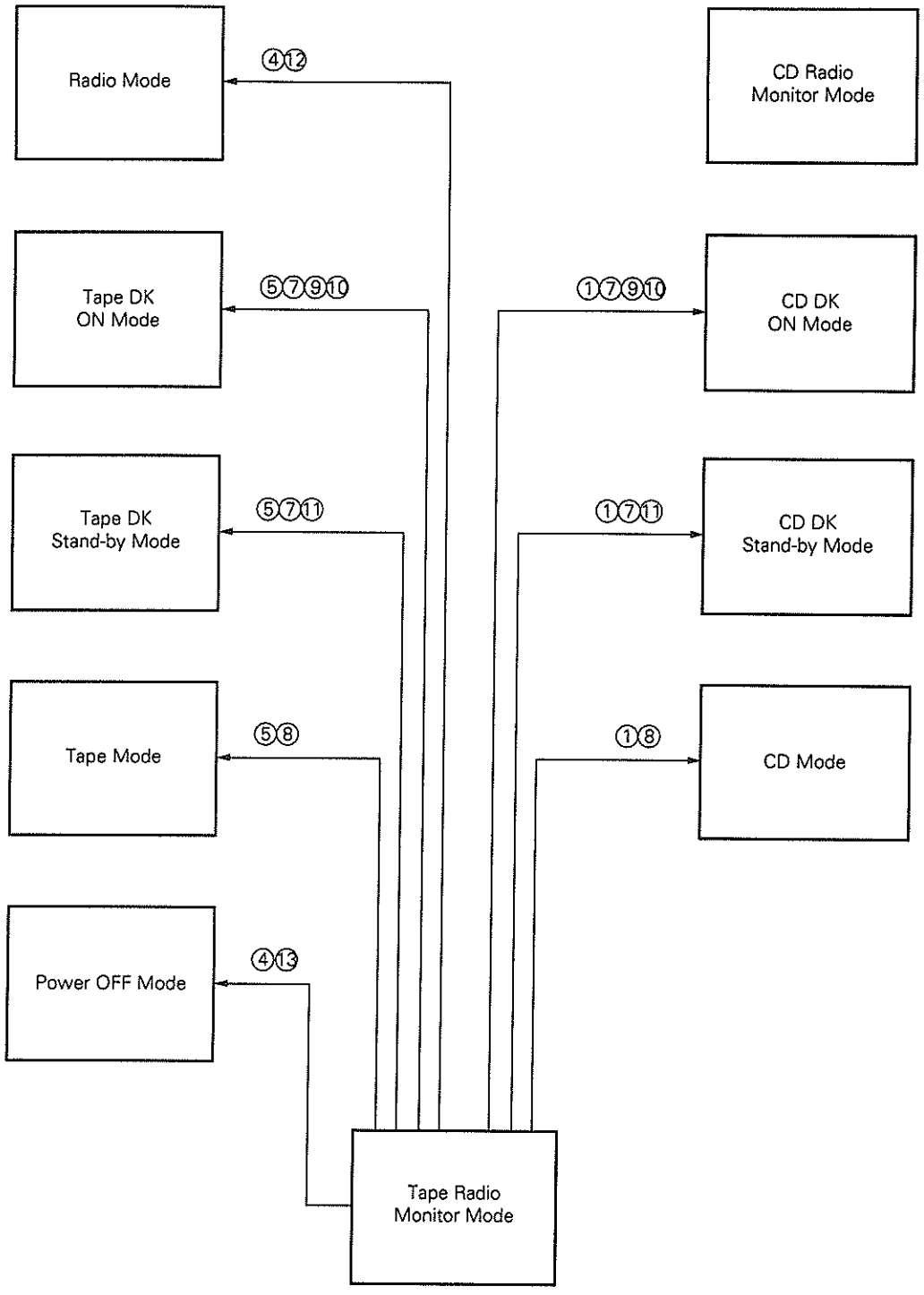
(d) Transition from Tape DK ON Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ①: CDSET Switch ON
- ②: CDSET Switch OFF
- ③: TPSET Switch ON
- ④: TPSET Switch OFF
- ⑤: RDMONI Key ON
- ⑥: VF Key ON
- ⑦: Receiving VF Band
- ⑧: Receiving band other than VF Band
- ⑨: Receiving traffic information station
- ⑩: DK Switch ON
- ⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫: RDSET Switch ON
- ⑬: RDSET Switch OFF

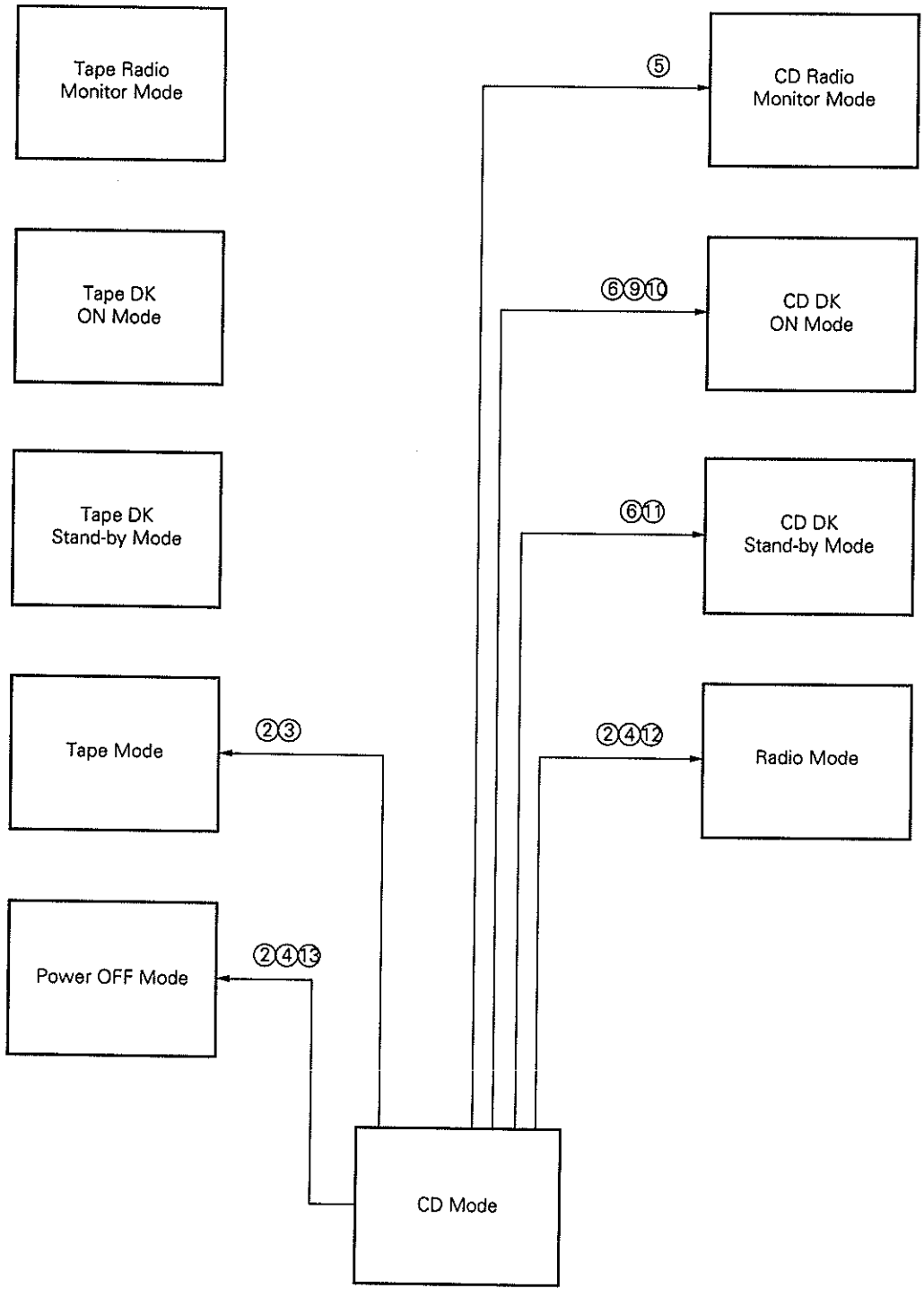
(e) Transition from Tape Radio Monitor Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ① : CDSET Switch ON
- ② : CDSET Switch OFF
- ③ : TPSET Switch ON
- ④ : TPSET Switch OFF
- ⑤ : RDMONI Key ON
- ⑥ : VF Key ON
- ⑦ : Receiving VF Band
- ⑧ : Receiving band other than VF Band
- ⑨ : Receiving traffic information station
- ⑩ : DK Switch ON
- ⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫ : RDSET Switch ON
- ⑬ : RDSET Switch OFF

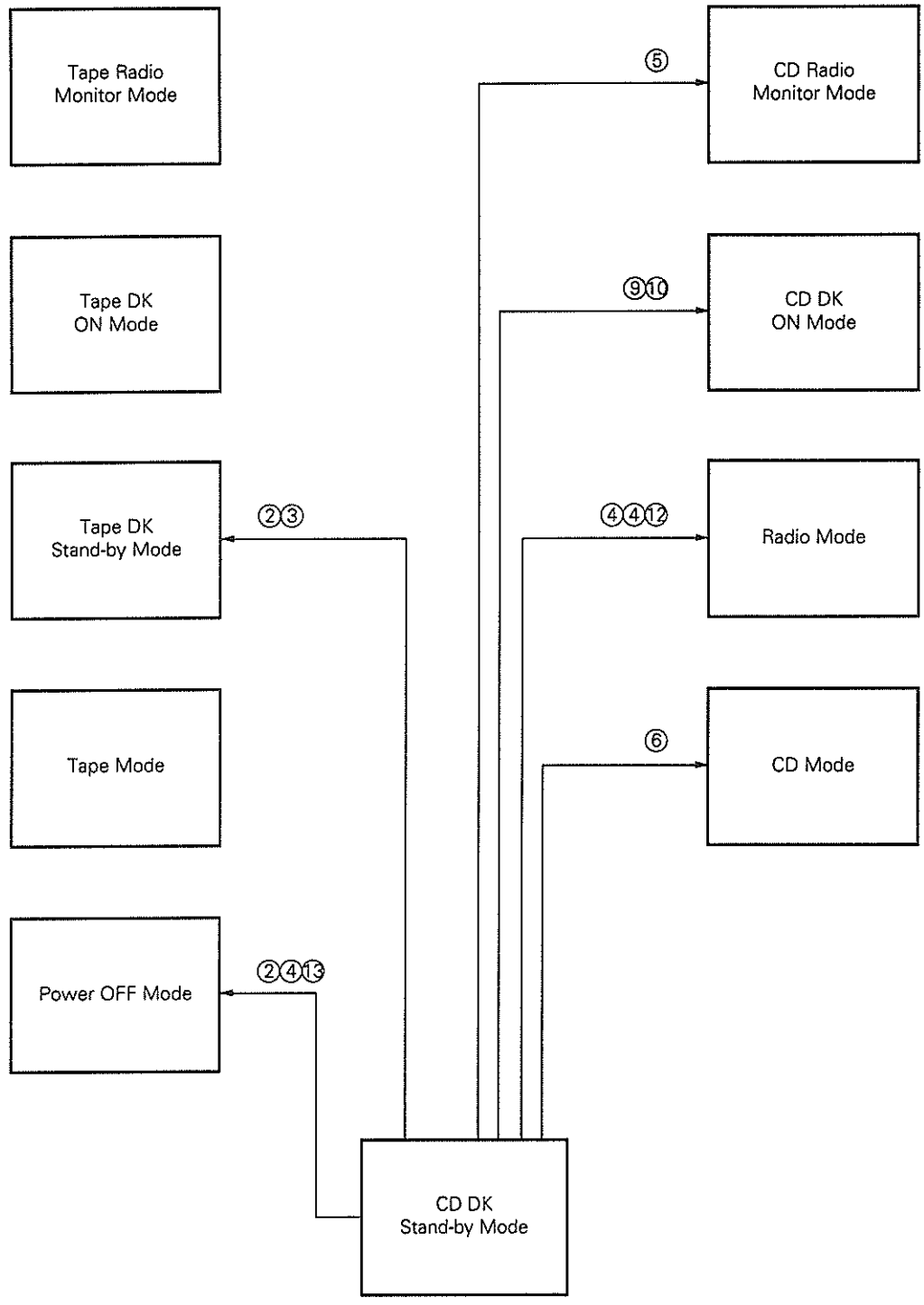
(f) Transition from CD Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ①: CDSET Switch ON
- ②: CDSET Switch OFF
- ③: TPSET Switch ON
- ④: TPSET Switch OFF
- ⑤: RDMONI Key ON
- ⑥: VF Key ON
- ⑦: Receiving VF Band
- ⑧: Receiving band other than VF Band
- ⑨: Receiving traffic information station
- ⑩: DK Switch ON
- ⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫: RDSET Switch ON
- ⑬: RDSET Switch OFF

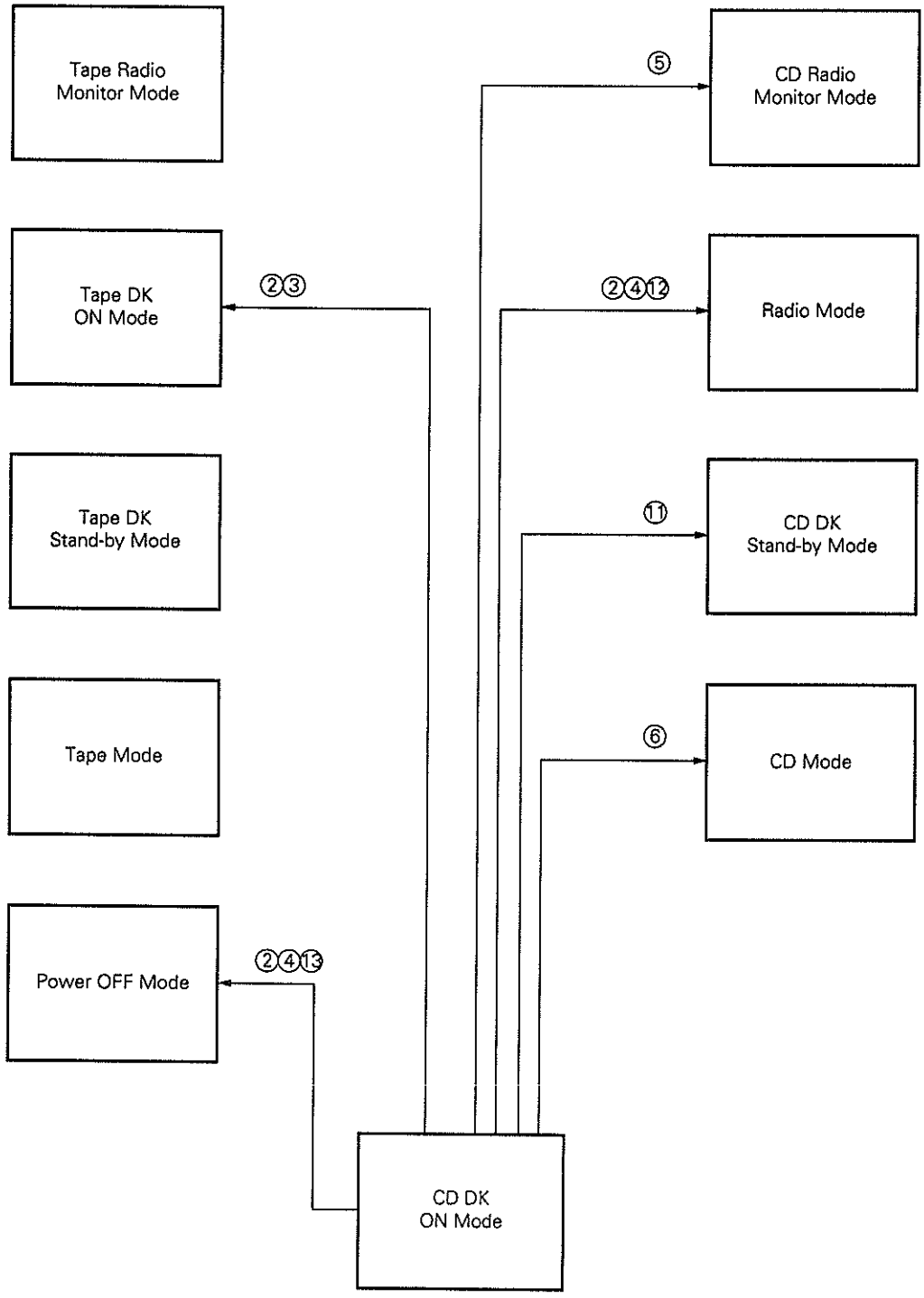
(g) Transition from CD DK Stand-by Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ① : CDSET Switch ON
- ② : CDSET Switch OFF
- ③ : TPSET Switch ON
- ④ : TPSET Switch OFF
- ⑤ : RDMONI Key ON
- ⑥ : VF Key ON
- ⑦ : Receiving VF Band
- ⑧ : Receiving band other than VF Band
- ⑨ : Receiving traffic information station
- ⑩ : DK Switch ON
- ⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫ : RDSET Switch ON
- ⑬ : RDSET Switch OFF

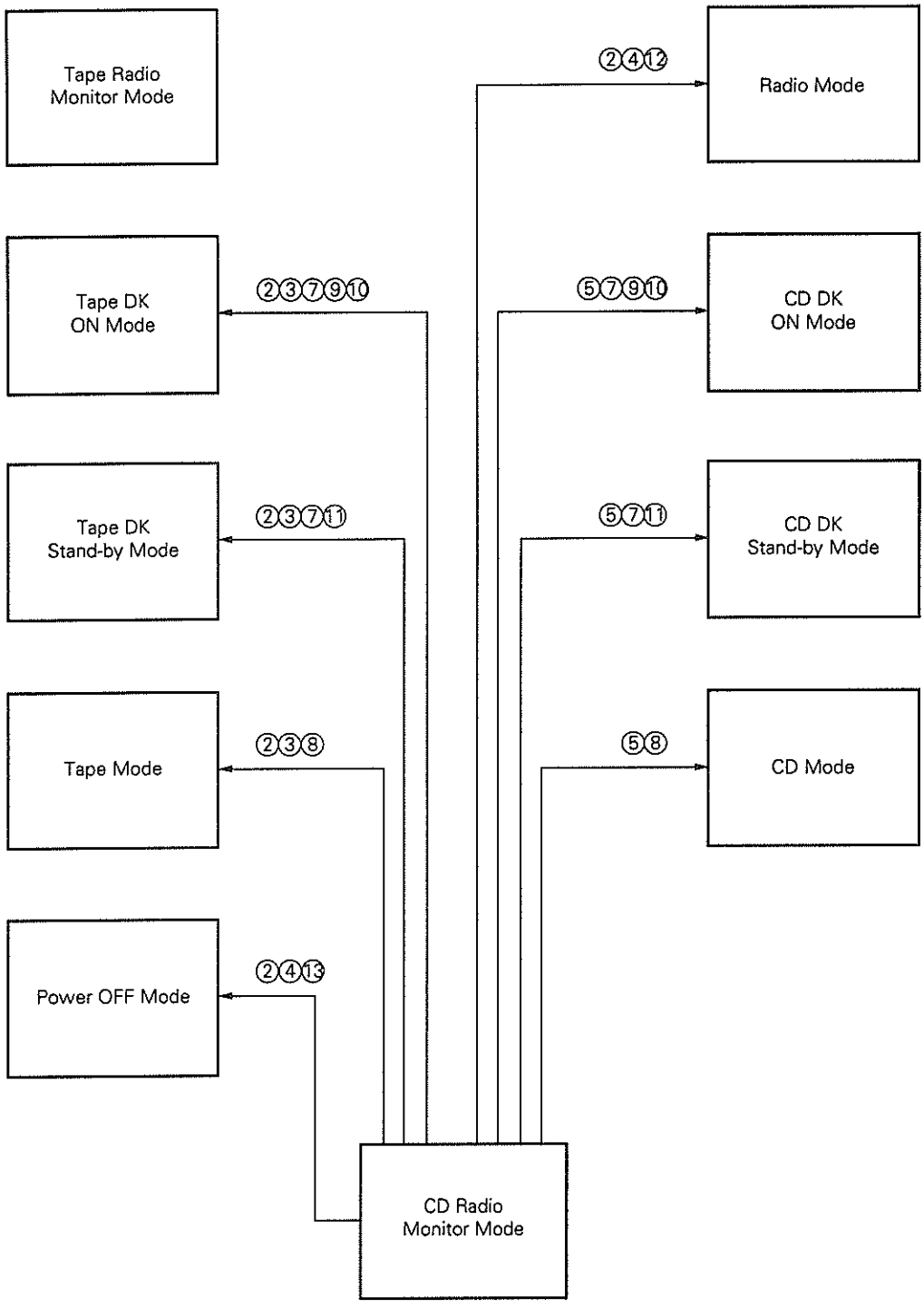
(h) Transition from CD DK ON mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

- ①: CDSET Switch ON
- ②: CDSET Switch OFF
- ③: TPSET Switch ON
- ④: TPSET Switch OFF
- ⑤: RDMONI Key ON
- ⑥: VF Key ON
- ⑦: Receiving VF Band
- ⑧: Receiving band other than VF Band
- ⑨: Receiving traffic information station
- ⑩: DK Switch ON
- ⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
- ⑫: RDSET Switch ON
- ⑬: RDSET Switch OFF

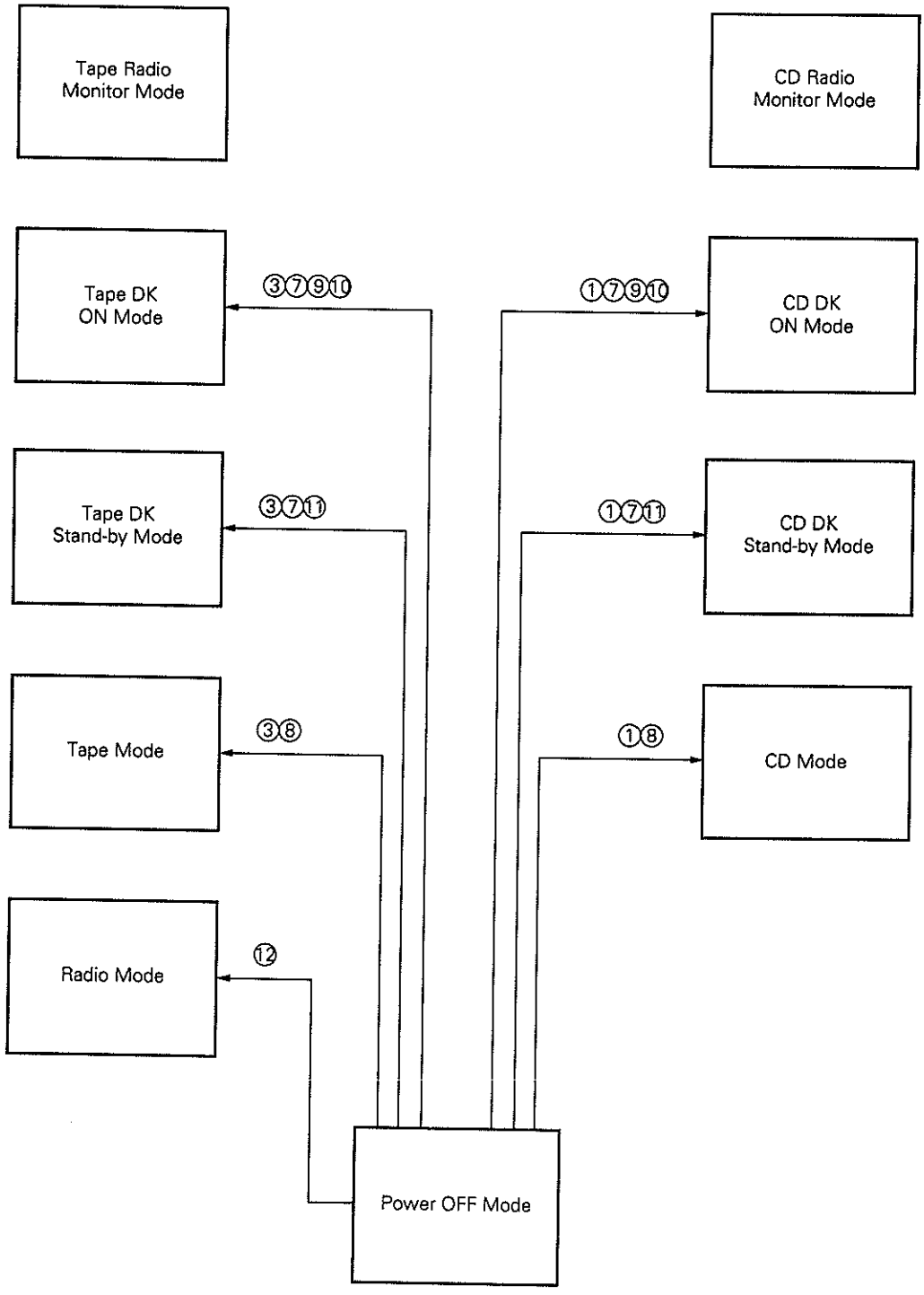
(i) Transition from CD Radio Monitor Mode to Other Mode



Remark The circled numbers in the above figure indicate the following functions.

① : CDSET Switch ON
② : CDSET Switch OFF
③ : TPSET Switch ON
④ : TPSET Switch OFF
⑤ : RDMONI Key ON
⑥ : VF Key ON
⑦ : Receiving VF Band
⑧ : Receiving band other than VF Band
⑨ : Receiving traffic information station
⑩ : DK Switch ON
⑪ : Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫ : RDSET Switch ON
⑬ : RDSET Switch OFF

(j) Transition from Power OFF Mode to Other Mode

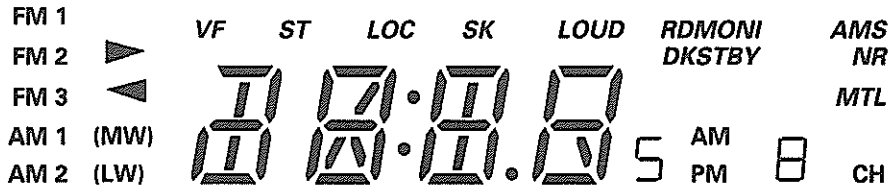


Remark The circled numbers in the above figure indicate the following functions.

①: CDSET Switch ON
②: CDSET Switch OFF
③: TPSET Switch ON
④: TPSET Switch OFF
⑤: RDMONI Key ON
⑥: VF Key ON
⑦: Receiving VF Band
⑧: Receiving band other than VF Band
⑨: Receiving traffic information station
⑩: DK Switch ON
⑪: Broadcast non receiving state or SK Switch OFF or DK Switch OFF
⑫: RDSET Switch ON
⑬: RDSET Switch OFF

4. DISPLAY

4.1 LCD PANEL



For information about the LCD panel, please contact:

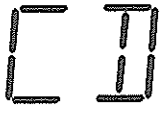
LCD Device Division
Hoshiden Corporation
1-4-33 Kita Kyuhoji, Yao-shi, Osaka-fu, 581
Tel : 0729 - 93 - 1010

4.2 FONT

4.3 DISPLAY EXAMPLE

(1) Tape mode

(2) CD Mode



(3) Automatic Store

4.4 LCD ALLOCATION

Common Line (Pin Number) / Segment Line (Pin Number)	COM_0 (37)	COM_1 (36)	COM_2 (35)
LCD_0 (57)	ST	AM1 (MW)	FM1
LCD_1 (56)	◀	AM2 (LW)	▶
LCD_2 (55)	VF	FM3	FM2
LCD_3 (54)	1d, g	1e	1a
LCD_4 (53)	1k,h	1c	1b
LCD_5 (52)	2l, i	2e	2f
LCD_6 (51)	2g	2d	2a
LCD_7 (50)	2j	2c	2b
LCD_8 (49)	:	3e	3f
LCD_9 (48)	3g	3d	3a
LCD_{10} (47)	3h,k	3c	3b
LCD_{11} (46)	.	4e	4f
LCD_{12} (45)	4g	4d	4a
LCD_{13} (44)	4j	4c	4b
LCD_{14} (43)	AM	PM	MONO
LCD_{15} (42)	5g	5e	5f
LCD_{16} (41)	5a, 5d	5c	5b
LCD_{17} (40)	RDMONI	CH	MTL
LCD_{18} (39)	5	NR	LOUD
LCD_{19} (38)	SK	AMS	LOC

4.5 DESCRIPTION OF DISPLAY

Display	Description
VF	VF This display indicates that the VF band is selected. **(1) In CD Mode or Tape Mode** It lights off. **(2) In the modes other than (1) above** It lights up when the VF band is selected.
SK	This display indicates that the traffic information broadcast station is selected. **(1) In CD Mode or Tape Mode** It turns off. **(2) In the modes other than (1) above** It lights up during reception of traffic information broadcast on FM or VF band. Reception of traffic information broadcast means that the SK switch is ON in the broadcast receiving state.
ST	This display indicates that stereo broadcasting is received. **(1) In CD Mode or Tape Mode** It turns off. **(2) In the modes other than (1) above** It lights up when the FM, VF or MW band is selected and the ST switch is ON and monophonic OFF in the broadcast receiving state. (When the MW band is selected, it lights up the ST display only when the initial setting diode MWS = 1 and the stereo receiving function is provided.) Note that it is OFF during the tuning operation, regardless of the selected band.
LOC	This display indicates the local state. **(1) In CD Mode or Tape Mode** It turns off. **(2) In the modes other than (1) above** It lights up in the local state.
LOUD	This display indicates loudness ON state. Note that it is OFF during the loudness ON regardless of the mode.
MTL	This display indicates the metal ON state. **(1) In Tape Mode, Tape DK Stand-by Mode, Tape DK ON Mode, Tape Radio Monitor Mode** It lights up in the metal ON state. **(2) In the modes other than (1) above** It turns off.
NR	This display indicates the NR ON state. **(1) In Tape Mode, Tape DK Stand-by Mode, Tape DK ON Mode, Tape Radio Monitor Mode** It lights up in the NR ON state. **(2) In the modes other than (1) above** It turns off.

Display	Description
MONO	This display indicates the monophonic mode. (1) In CD Mode or Tape Mode It turns off. (2) In the modes other than (1) above It lights up in the monophonic OFF state when the FM, VF, or MW band is selected. (When the MW band is selected, the monophonic display lights up only when the initial setting diode MWS = 1 and the stereo receiving function is provided.)
▶ ◀	This display indicates the direction of tape winding. (1) In Tape Mode, Tape DK Stand-by Mode, Tape DK ON Mode, Tape Radio Monitor Mode The direction of tape winding is indicated by the state of RL switch. It blinks if the FF switch is set to ON. (2) In the modes other than (1) above It turns off.
FM1 FM2 FM3 AM1 (MW) AM2 (LW)	This display indicates the receiving band. (1) In CD Mode or Tape Mode It turns off. (2) In the modes other than (1) above The receiving band is lit.
	The receiving frequency, "ATP", "CD", "TAPE" and the clock are displayed.
AMS	This display indicates Auto Music Search (AMS) state. (1) In Tape Mode, Tape DK Stand-by Mode, Tape Radio Monitor Mode It lights up when the AMS is ON. (2) In the modes other than (1) above It turns off.
AM PM	It indicates AM or PM in the 12-hour system
8 CH	This display indicates the preset memory number. When preset memory is written or called, the corresponding preset memory number and "CH" display are lit up. It lights up during the frequency is displayed, and it turns off while the clock is displayed. In the preset memory write available state, "CH" display blinks by 1 Hz. During the scan of the preset memory, the corresponding memory number blinks by 1 Hz.

5. REMOTE CONTROL

The μPD6121G is used as the IC for the remote control transmitter. This IC has a custom code. If this custom code is not correctly set, it is not possible to control the μPD17012GF-011 remotely.

The custom code for operating the μPD17012GF-011 is 8604H, and it is to be set by connecting the diode and pull-up resistor on the key matrix of the IC for transmitter (μPD6121G). (See 5.4 **EXAMPLE OF REMOTE CONTROL CIRCUIT BY USING THE μPD6121G-002.**)

5.1 ALLOCATION OF REMOTE CONTROL KEY (WHEN CASE USING THE μPD6121G)

Input pin (Pin Number) / Output pin (Pin Number)	KI_0 (1)	KI_1 (2)	KI_2 (3)	KI_3 (4)
KI/O_0 (19)	M1 (TP1)	M2 (TP2)	M3 (TP3)	M4
KI/O_1 (18)	M5	M6	SEEK UP	SEEK DWN
KI/O_2 (17)	SCAN UP	SCAN DWN	P.SCAN	BAND
KI/O_3 (16)	VF	LOC	MONO	POWER
KI/O_4 (15)	DISP	LOUD	RDMONI	—
KI/O_5 (14)	ME	MAN UP	MAN DWN	—
KI/O_6 (13)	AMS	NR	MTL	—
KI/O_7 (12)	—	—	—	—

5.2 DESCRIPTION OF REMOTE CONTROL KEY

The operation of the remote control key is similar to the momentary key of the μPD17012GF-011.

5.3 LIST OF REMOTE CONTROL DATA CODES

Single Pressing

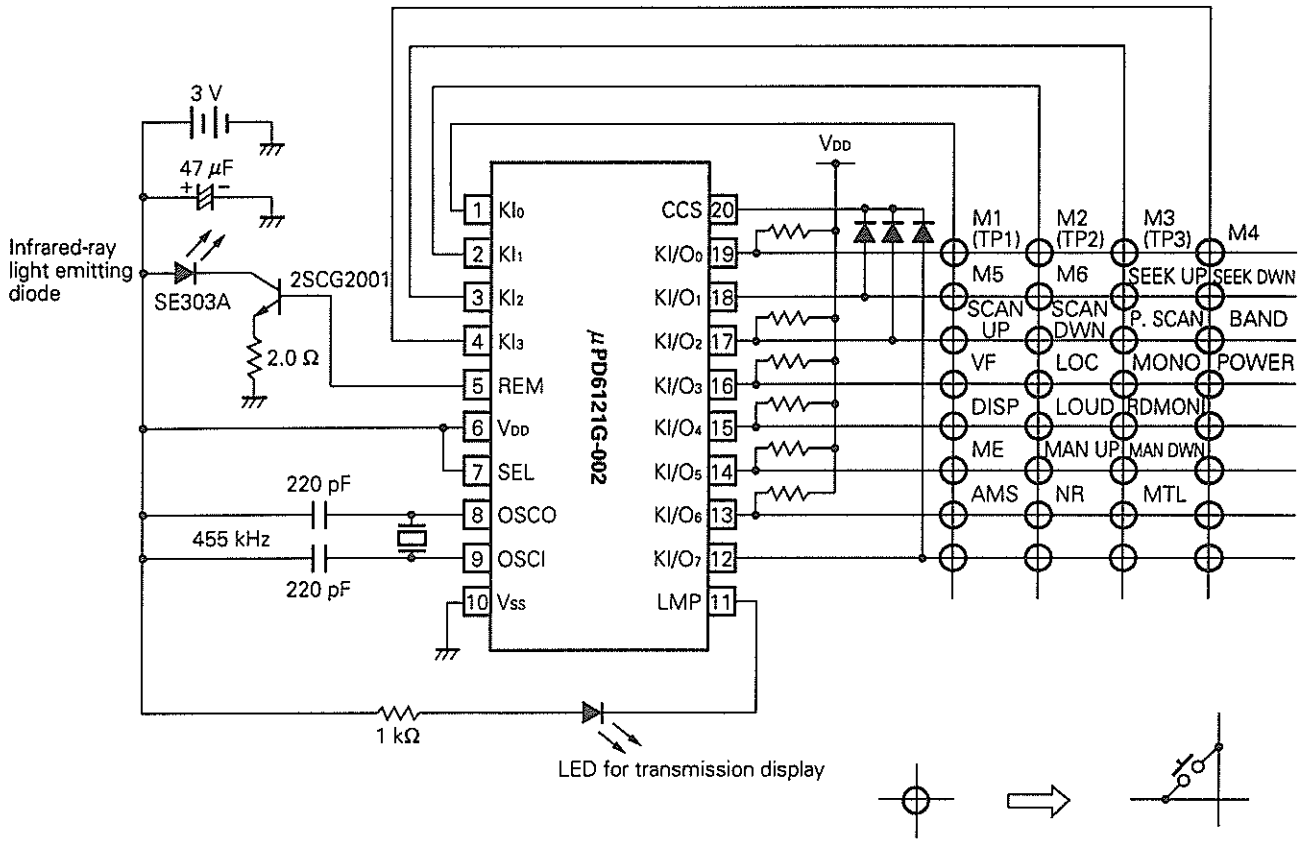
Remote control key	Data code							
	D0	D1	D2	D3	D4	D5	D6	D7
M1 (TP1)	0	0	0	0	0	0	0	0
M2 (TP2)	1	0	0	0	0	0	0	0
M3 (TP3)	0	1	0	0	0	0	0	0
M4	1	1	0	0	0	0	0	0
M5	0	0	1	0	0	0	0	0
M6	1	0	1	0	0	0	0	0
SEEK UP	0	1	1	0	0	0	0	0
SEEK DWN	1	1	1	0	0	0	0	0
SCAN UP	0	0	0	1	0	0	0	0
SCAN DWN	1	0	0	1	0	0	0	0
P.SCAN	0	1	0	1	0	0	0	0
BAND	1	1	0	1	0	0	0	0
VF	0	0	1	1	0	0	0	0
LOC	1	0	1	1	0	0	0	0
MONO	0	1	1	1	0	0	0	0
POWER	1	1	1	1	0	0	0	0

Remote control key	Data code							
	D0	D1	D2	D3	D4	D5	D6	D7
DISP	0	0	0	0	1	0	0	0
LOUD	1	0	0	0	1	0	0	0
RDMONI	0	1	0	0	1	0	0	0
—	1	1	0	0	1	0	0	0
ME	0	0	1	0	1	0	0	0
MAN UP	1	0	1	0	1	0	0	0
MAN DWN	0	1	1	0	1	0	0	0
—	1	1	1	0	1	0	0	0
AMS	0	0	0	1	1	0	0	0
NR	1	0	0	1	1	0	0	0
MTL	0	1	0	1	1	0	0	0
—	1	1	0	1	1	0	0	0
—	0	0	1	1	1	0	0	0
—	1	0	1	1	1	0	0	0
—	0	1	1	1	1	0	0	0
—	1	1	1	1	1	0	0	0

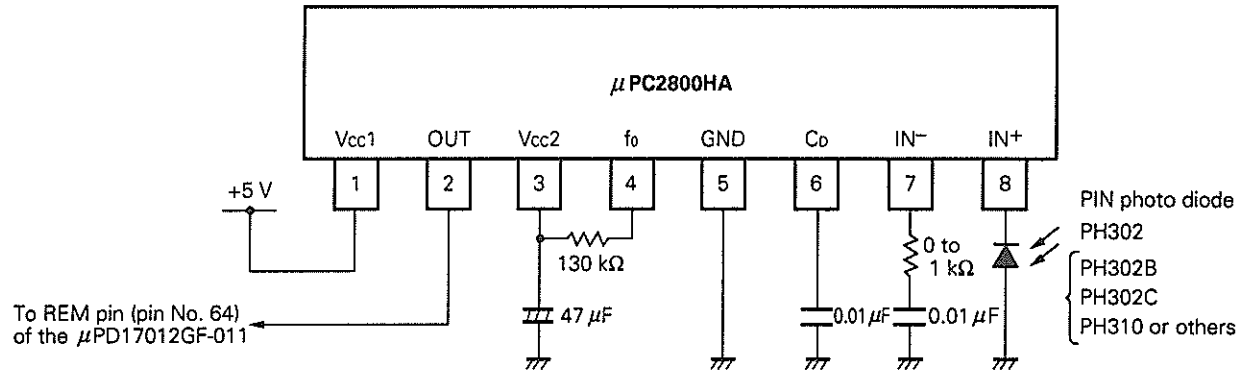
Double Pressing

Remote control key	Data code							
	D0	D1	D2	D3	D4	D5	D6	D7
ME + MAN UP	1	0	1	0	1	1	0	0
ME + MAN DWN	0	1	1	0	1	1	0	0

5.4 EXAMPLE OF REMOTE CONTROL CIRCUIT USING THE μPD6121G-002



5.5 EXAMPLE OF REMOTE CONTROL PREAMPLIFIER CIRCUIT USING THE μPC2800HA



6. MUTE OUTPUT TIMING CHART

THE timing charts in this chapter shows the following items.

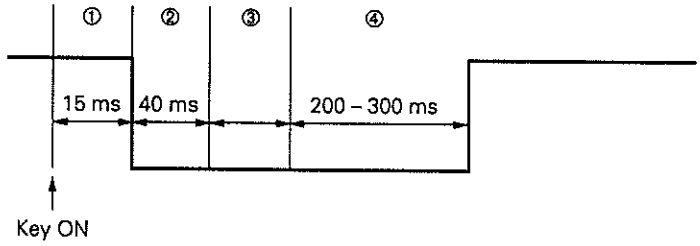
① : Prevention from Key ON chattering
② : Preceding mute and beep output
③ : Setting division frequency ratio and updating display content
④ : Late Mute
⑤ : Scanning time
⑥ : Waiting for PLL locking

6.1 RADIO MUTE ($\overline{\text{RDMUTE}}$ PIN) OUTPUT TIMING CHART

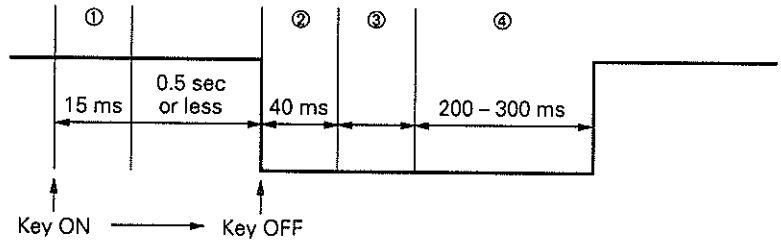
(1) Manual UP/DOWN

(a) 1 Channel UP/DOWN

(i) When AUTO500 Switch = 0



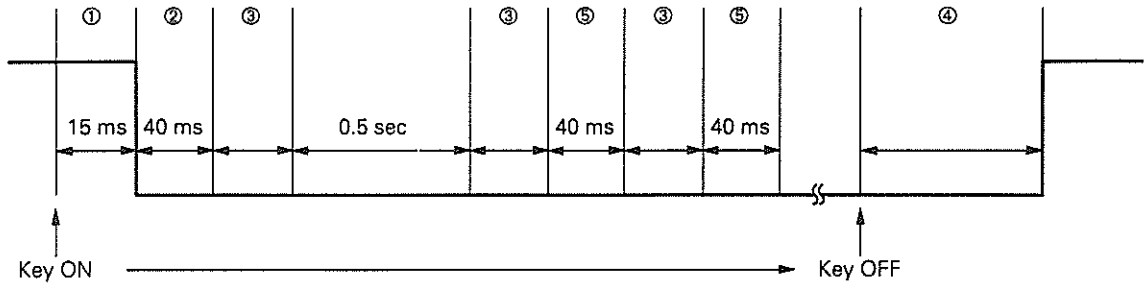
(ii) When AUTO500 Switch = 1



For both (i) and (ii), the time indicated in stage ④ is 600 to 700 ms at the band edge (minimum frequency $\rightleftarrows$ maximum frequency).

(b) Continuous UP/DOWN

(i) When AUTO500 Switch = 0



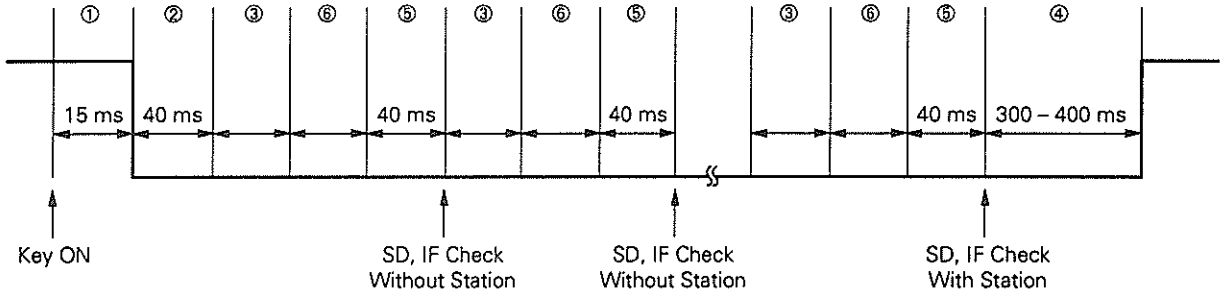
The duration of stage ⑤ is 500 ms and the duration of stage ④ is 600 to 700 ms at the band edge.

(ii) When AUTO500 Switch = 1

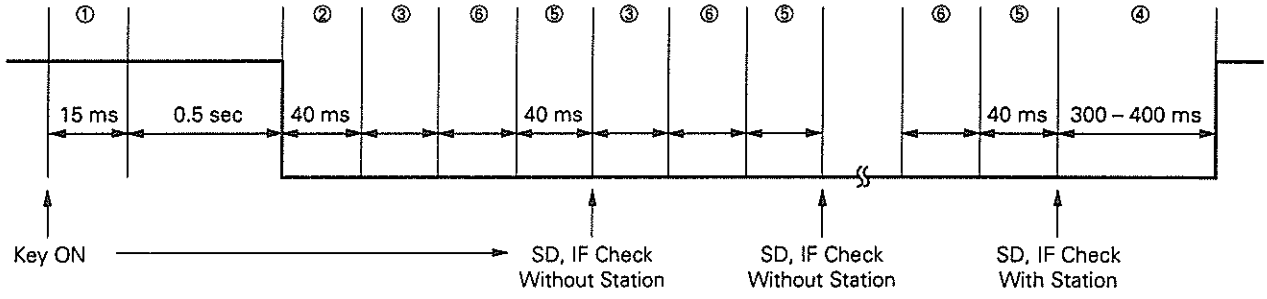
Since automatic tuning is set by continuously pressing the key for 0.5 seconds or more, continuous UP/DOWN is not performed.

(2) Automatic UP/DOWN

(a) [SEEK UP], [SEEK DWN], [SCAN UP], [SCAN DWN] key



(b) In the case the [MAN UP] and [MAN DWN] keys are pressed for 0.5 second or more when AUTO500 Switch = 1

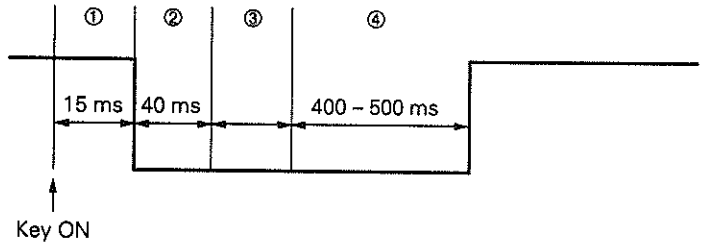


In both (a) and (b), the duration of stage ⑤ is 540 ms.

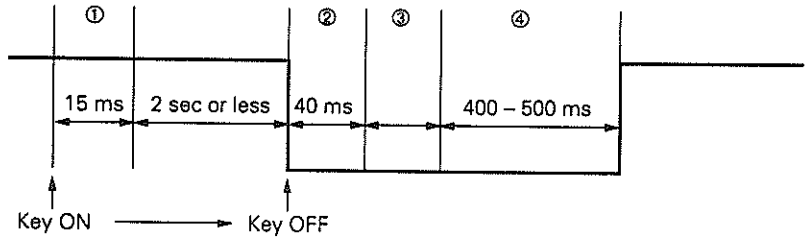
The IF check is performed two times, in FAST mode and SLOW mode.

(3) Calling pre-set Memory

(a) When M2S Switch = 0

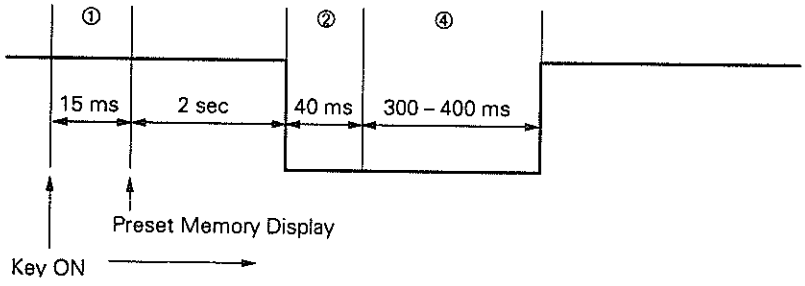


(b) When M2S Switch = 1



(4) Writing Preset Memory

(a) When M2S Switch = 0

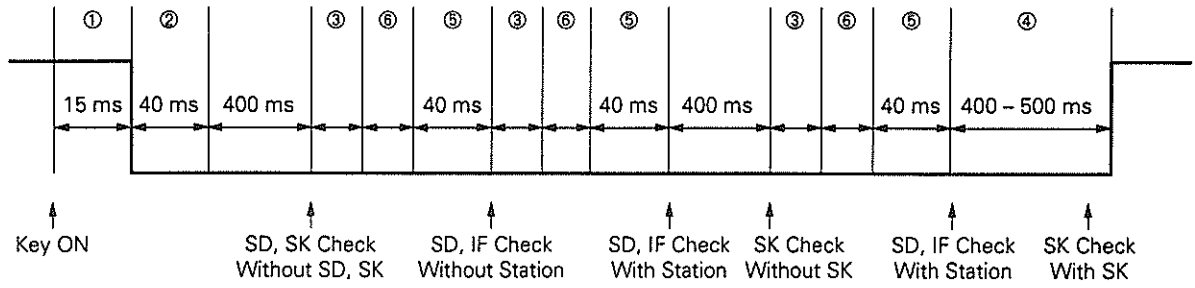


(b) When M2S Switch = 1

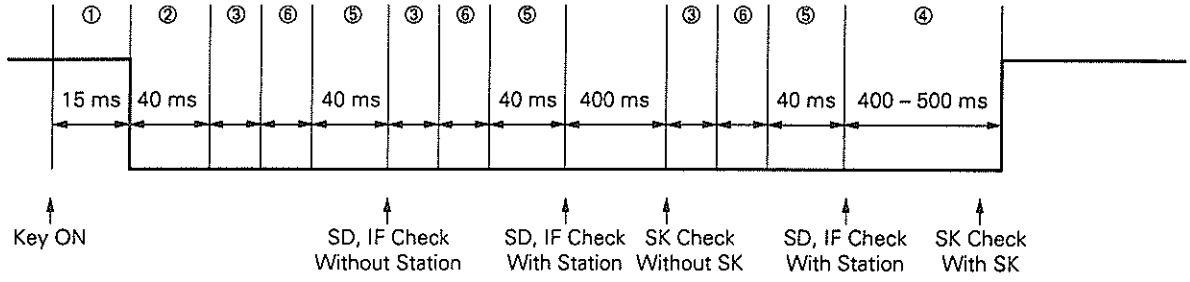
Mute is not output.

(5) VF Mode

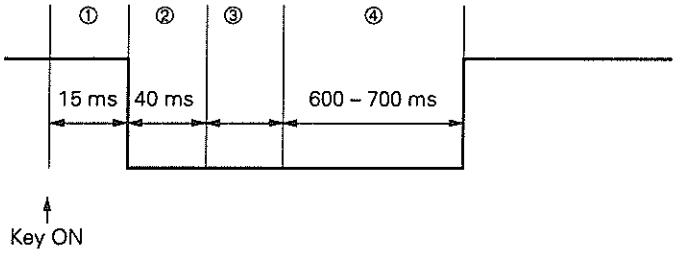
(a) When VF mode is set by VF key ON



(b) Seek and Scan in VF Mode

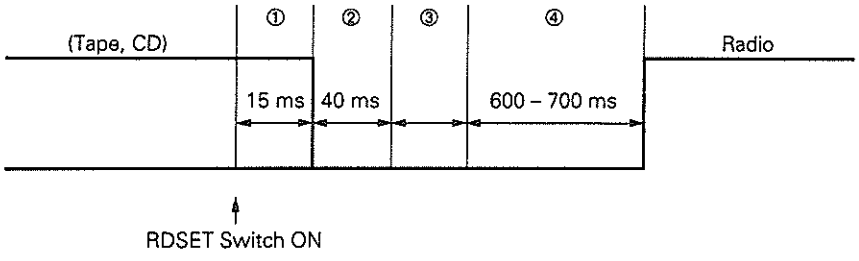


(6) Switching Bands

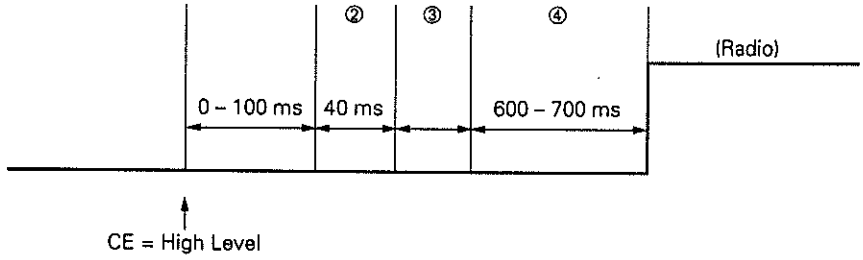


(7) Radio OFF → ON

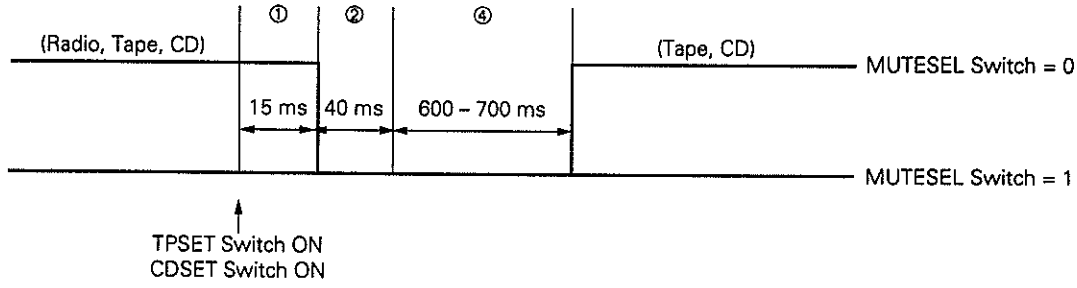
(a) In case of RDSET Switch



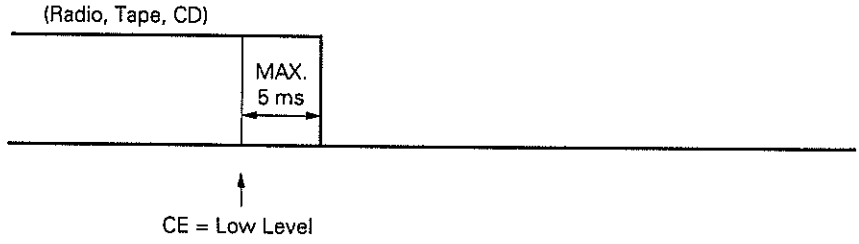
(b) CE = Low Level → High Level by RDON Switch = 1



(8) Tape or CD : OFF → ON

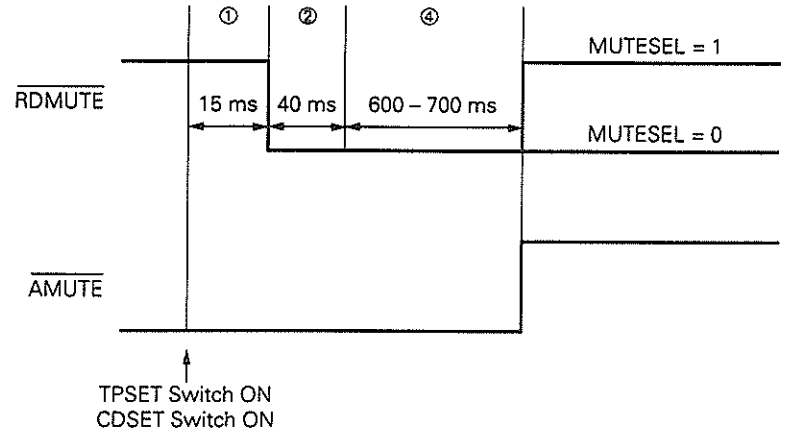


(9) CE Pin : High Level → Low Level

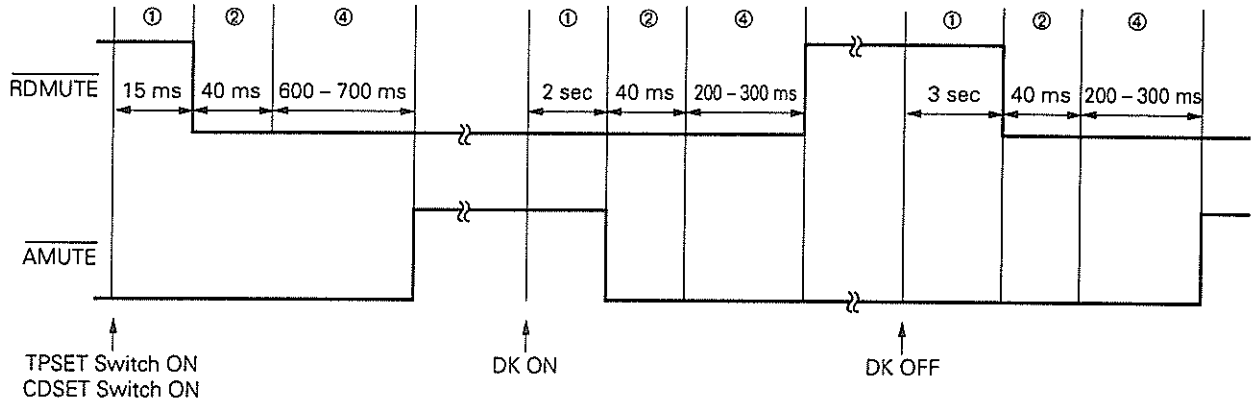


6.2 OUTPUT TIMING CHART OF RADIO MUTE ($\overline{\text{RDMUTE}}$ PIN) AND AUDIO MUTE ($\overline{\text{AMUTE}}$ PIN)

(1) From Radio Mode to Tape or CD Mode

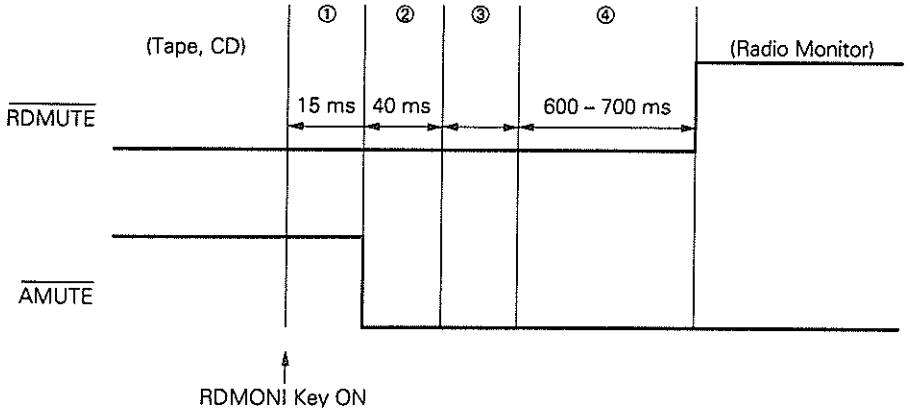


(2) From VF Band to Tape or CD Mode (MUTESEL should be set to 0.)

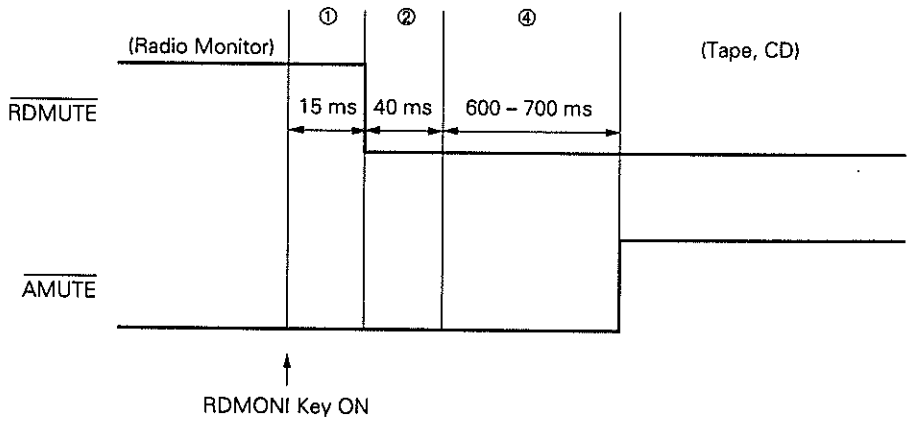


(3) At Radio Monitor (MUTESEL shall be set to 0.)

(a) Radio Monitor OFF → ON



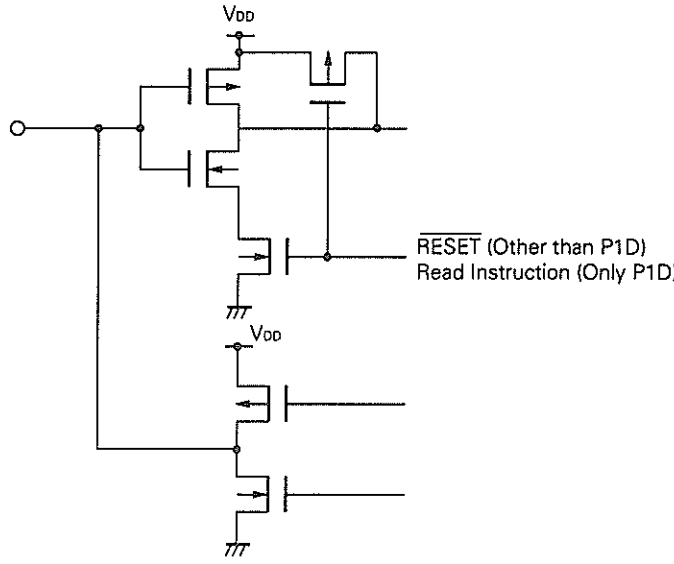
(b) Radio Monitor ON → OFF



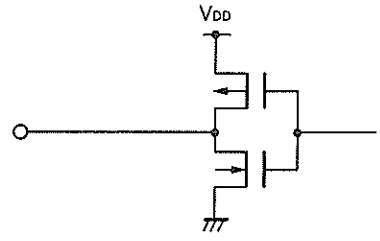
7. INPUT/OUTPUT CIRCUIT OF PINS

The input/output circuit of each pin of the μPD17012GF-011 is shown below in a simplified representation.

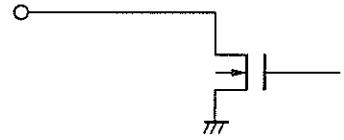
(1) P0A (P0A0/LOUD)
P0B (P0B3/SK, P0B2/DK, P0B1/BEEP/MODE2, P0B0/KEYS4)
P1A (P1A2/METAL, P1A1/MONO/NR, P1A0/AMS)
P1D (P1D3/MODE, P1D2/POWER, P1D1/BAND1, P1D0/BAND2)
} (Input/Output)



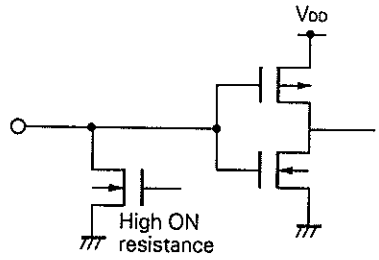
(2) P1C (P1C3/AGCC, P1C2/LOC, P1C1/$\overline{\text{AMUTE}}$, P1C0/$\overline{\text{RDMUTE}}$)
LCD19/P2H0, LCD18/POUT/P2G0, LCD17/P2F0, LCD16/$\overline{\text{LCD CS}}$/P2E0
LCD15 to LCD9
LCD8/KS8 to LCD0/KS0
} (Output)



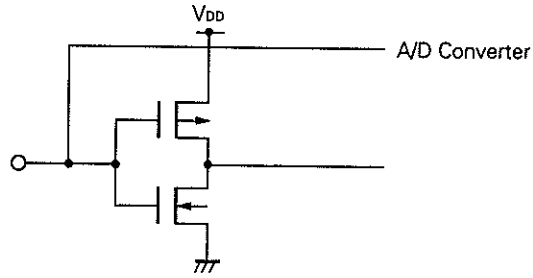
(3) P0C (P0C3/KEYS3 to P0C0/KEYS0) (Output)



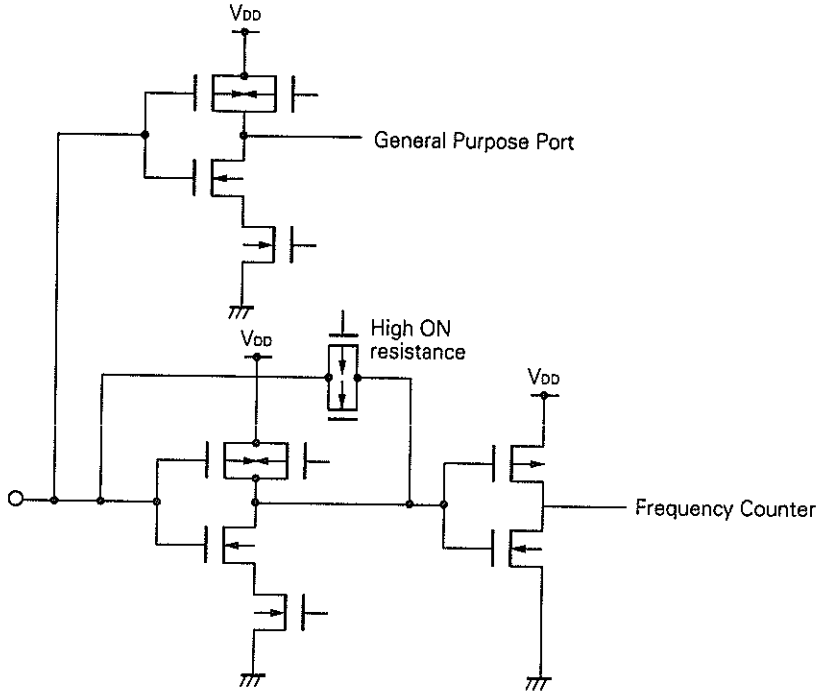
(4) K_3 to K_0 (Input)



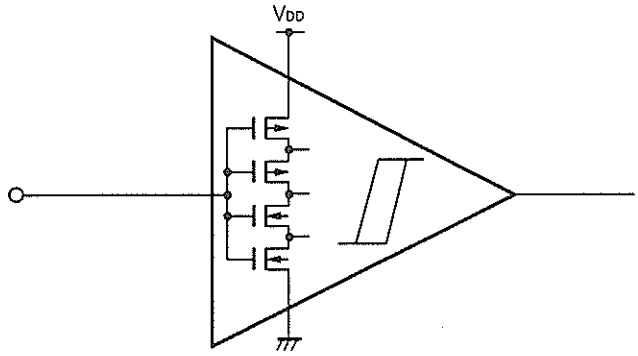
(5) KY to IN, SD (Input)



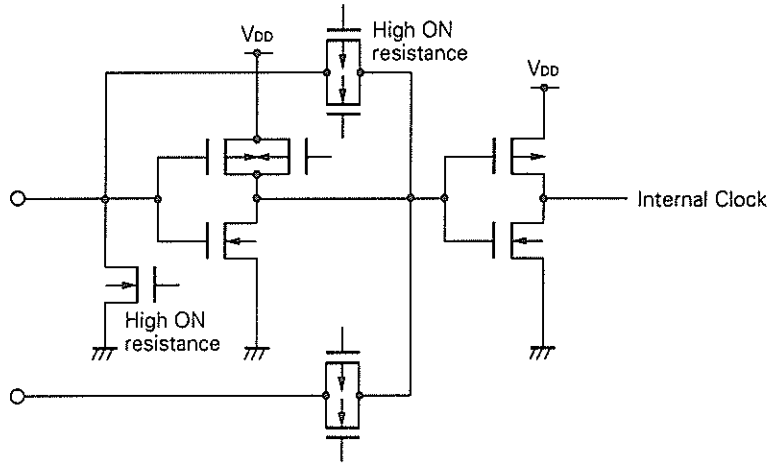
(6) FMIFC, AMIFC (Input)



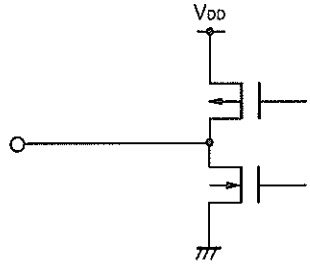
(7) CE, INT/$\overline{REM}$ } (Schmitt Trigger Input)



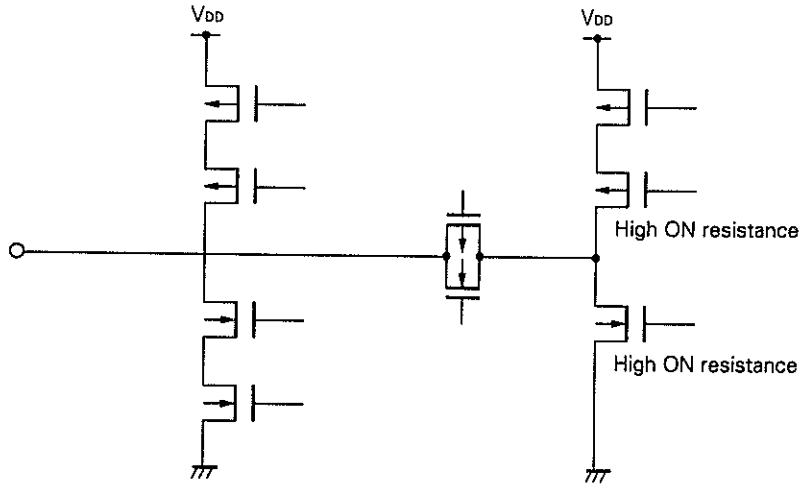
(8) XOUT (Output), XIN (Input)



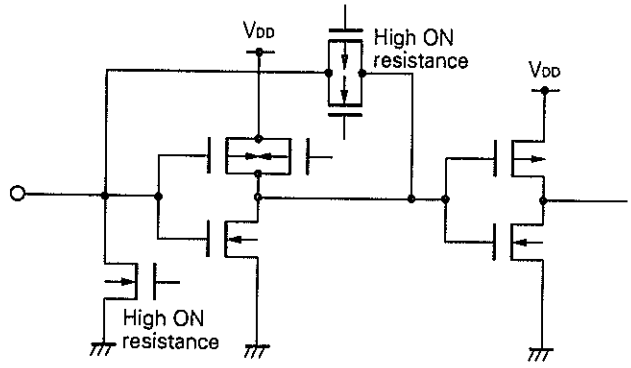
(9) EO (Output)



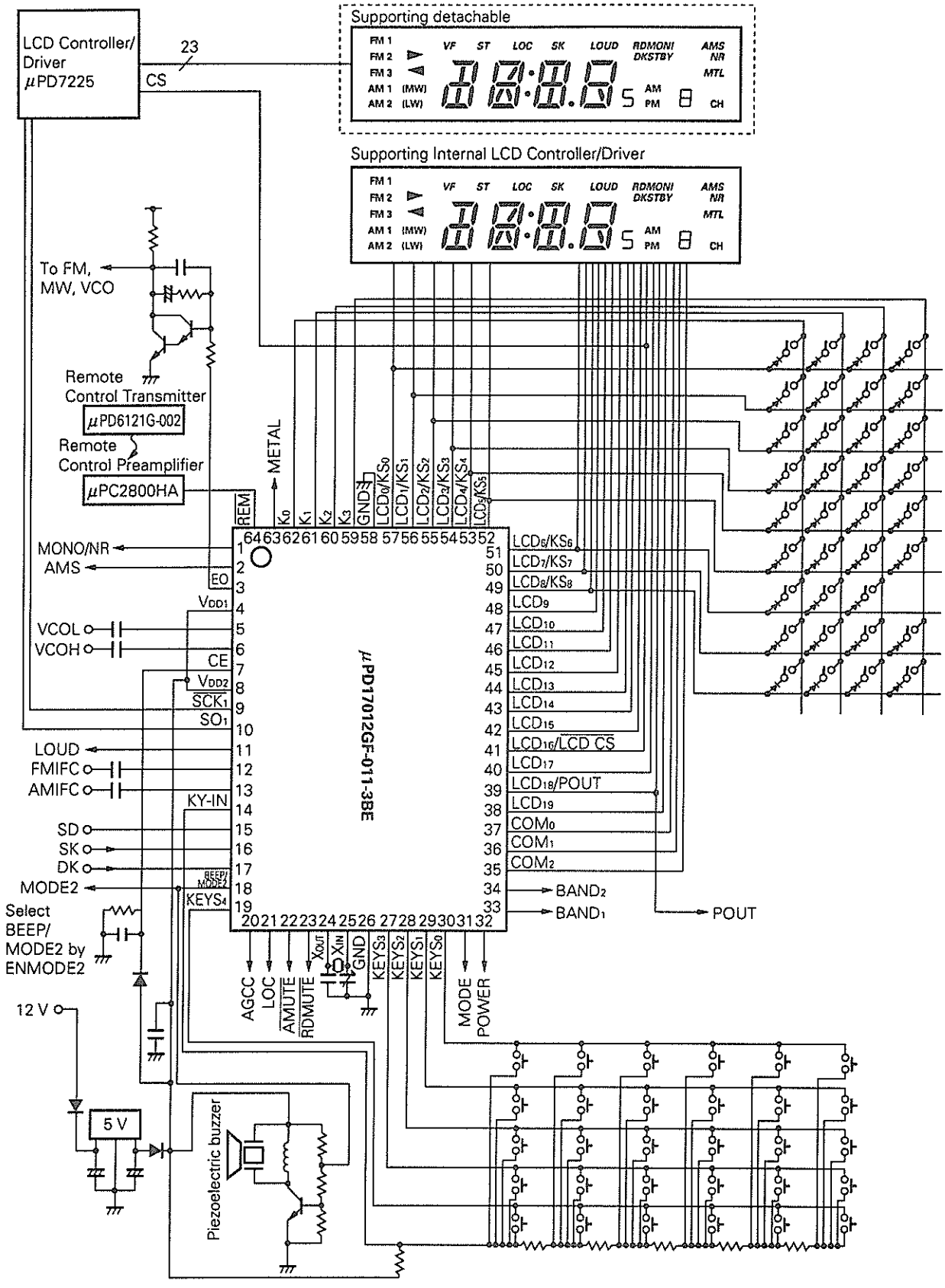
(10) COM_0, COM_1, COM_2 (Output)



(11) VCOH, VCOL } **(Input)**



8. EXAMPLE OF APPLICATION CIRCUIT



9. ELECTRICAL CHARACTERISTICS (PRELIMINARY)

MAXIMUM ABSOLUTE RATING (T_a = 25 °C)

Item	Symbol	Condition	Rating	Unit
Power 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	Other than $P0C_0$-$P0C_3$	−0.3 to V_{DD} + 0.3	V
High Level Output Current	I_{OH}	1 pin	−12.0	mA
		Total of all pins	−20.0	mA
Low Level Output Current	I_{OL}	1 pin	15.0	mA
		Total of all pins	30.0	mA
Output Breakdown Voltage	V_{BDS}	$P0C_0$-$P0C_3$	10.0	V
Total Power Dissipation	P_t		400	mW
Operating Temperature	T_{opt}	All functions operate	−40 to +85	°C
Storage Temperature	T_{stg}		−55 to +125	°C

Caution If any of the above items exceeds the specified ratings, even momentarily, the quality of the product may be impaired. In other words, the absolute maximum rating indicates the value beyond which the product will be impaired physically. Be sure to use the product within the indicated operating range.

RECOMMENDED OPERATING RANGE (T_a = −40 to +85 °C)

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Power Supply Voltage	V_{DD1}	All functions operate	4.5	5.0	5.5	V
	V_{DD2}	CPU operates and PLL is stopped	3.5	5.0	5.5	V
Data Storage Voltage	V_{DDR}	Crystal oscillation is stopped	2.3		5.5	V
Output Breakdown Voltage	V_{BDS}	$P0C_0$-$P0C_3$			9.0	v
Power Supply Voltage Rise Up Time	t_{rise}	V_{DD} : 0 → 4.5 V			500	ms

DC CHARACTERISTICS (T_a = −40 to +85 °C, V_{DD} = 5 V ± 10%)

Item	Symbol	Condition		MIN.	TYP.	MAX.	Unit
Power Supply Current	I_{DD1}	CPU is operated, PPL is stopped, the X_{IN} pin Sine-Wave Input (f_{IN} = 4.5 MHz, V_{IN} = V_{DD})			2.0	3.0	mA
	I_{DD2}	CPU is operated, PPL is stopped, the X_{IN} pin Sine-Wave Input (f_{IN} = 4.5 MHz, V_{IN} = V_{DD}) HALT instruction is used			0.5	1.0	mA
Data Storage Voltage	V_{DDR1}	Crystal Oscillation	Power interruption detection by Timer FF is used	3.5			V
	V_{DDR2}	Crystal oscillation is stopped.	Power interruption detection by Timer FF is used	2.3			V
	V_{DDR3}		Data Memory keep	2.0			V
Data Storage Current	I_{DDR1}	Crystal oscillation is stopped.	V_{DD} = 5 V, T_a = 25 °C		2.0	4.0	μA
	I_{DDR2}				2.0	20.0	μA
	I_{DDR3}		V_{DD} = 2.3 V, T_a = 25 °C		1.0	2.0	μA
	I_{DDR4}		V_{DD} = 2.3 V		1.0	10.0	μA
Middle 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}	$P0A_1$, $P0B_0$-$P0B_3$, $P0D_0$-$P0D_3$, $P1A_0$-$P1A_2$, $P1B_0$-$P1B_3$, $P1D_0$-$P1D_3$				0.2 V_{DD}	V
	V_{IL2}	$P0A_0$, $P0A_2$, CE, INT				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_{19}, 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_{19}, 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}	VCOH Pin Pulled-down. V_{IH} = V_{DD}		0.1			mA
	I_{IH2}	VCOL Pin Pulled-down. V_{IH} = V_{DD}		0.1			mA
	I_{IH3}	X_{IN} Pin Pulled-down. V_{IH} = V_{DD}		0.1			mA
	I_{IH4}	$P0D_0$-$P0D_3$ 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 CHARACTERISTICS (T_a = −40 to +85 °C, V_{DD} = 5 V ± 10%)

Item	Symbol	Condition	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 Pin FMIFC Pin 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

A/D CONVERTER CHARACTERISTICS (T_a = −40 to +85 °C, V_{DD} = 5 V ± 10%)

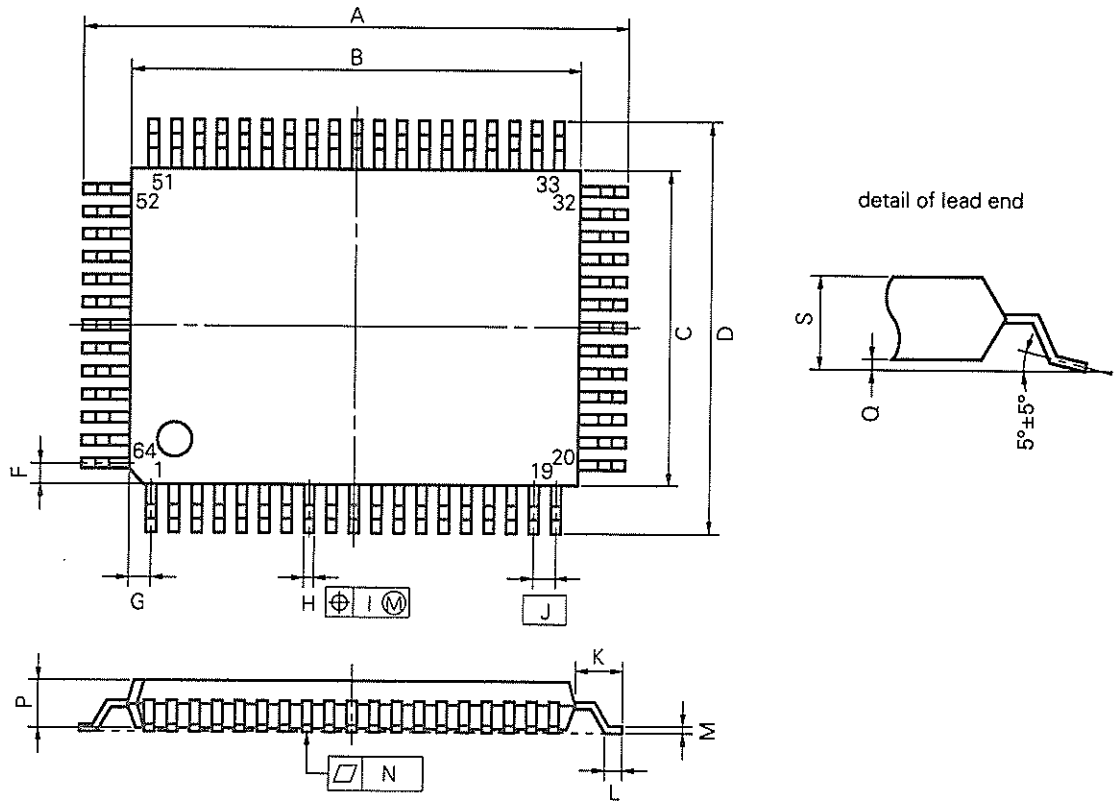
Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
A/D Conversing Resolution					6	bit
A/D Conversion Total Error		Ta = −10 to +50°C		±1.0	±1.5	LSB

REFERENCE CHARACTERISTICS (T_a = +25 °C, V_{DD} = 5.0 V)

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Power Supply Current	I_{DD3}	CPU and PLL are operated, the VCOH pin Sine-Wave Input (f_{IN} = 130 MHz, V_{IN} = 0.3 V_{P-P})		15		mA
	I_{DD4}	CPU and PLL are operated, the VCOH pin Sine-Wave Input (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
Middle 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

10. PACKAGE DRAWING

64 PIN PLASTIC QFP (14×20)



S64GF-100-3B8,3BE-1

NOTE

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

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.

[MEMO]

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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