

## PLL FREQUENCY SYNTHESIZER AND CONTROLLER FOR FM/MW/LW TUNER (AUTOMOBILE APPLICATIONS)

The  $\mu$ PD17012GF-057 is a CMOS LSI chip designed for use in FM/MW/LW tuners utilizing a PLL frequency synthesizer design for worldwide applications.

The device incorporates a PLL frequency synthesizer controller, LCD controller/key scan driver, and IF counter. The device enables detachable stereo systems, and is ideal for use in electronic volume control circuits for automobile applications, high-performance FM/MW/LW tuners with a clock, and similar applications where compact dimensions are essential. The  $\mu$ PD17012GF-057 also supports non-detachable stereo systems.

### FEATURES

- Capable of receiving broadcasts from stations in all of the world's FM and MW bands, as well as the European LW band
- Applicable to AM up-conversion
- Many preset functions including manual tuning, auto-tuning (seek, scan), and preset memory scanning
- Independent preset memory with six buttons: up to 18 FM stations (six stations, each enabling the setting of FM1, FM2, and FM3), up to 12 MW stations (six stations, each enabling the setting of MW1 and MW2), up to six LW stations, and six VF stations
- Last channel memory for three FM stations, two MW stations, one LW station, and one VF station
- DK-standby function and auto-tuning (SK signal search) for VF (traffic information) stations
- ST (stereo) display (The ST display is also supported for the MW band.)
- Display and control output of MTL (METAL), NR (noise reduction), and AMS (auto music search)
- Auto-preset memory function
- "CD" (compact disc) / "TPE" (cassette tape) display
- LOUD (loudness) control output and display
- Clock function for 12-hour or 24-hour clock display
- Internal LCD controller/key scan driver (capable of switching to the external LCD controller/key scan driver)
- Compatible with the external LCD controller/key scan driver ( $\mu$ PD17202AGF-011)
- Built-in IF counter
- Detachable key and LCD panel
- Electronic volume control function (compatible with the I<sup>2</sup>C bus)

### Ordering information

Part number	Package
$\mu$ PD17012GF-057-3BE	64-pin plastic QFP (14 × 20 mm, 1.0-mm pitch)

**The information contained in this document is being issued in advance of the production cycle for the device. The parameters for the device may change before final production or NEC Corporation, at its own discretion, may withdraw the device prior to its production.  
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.**

**FUNCTION OVERVIEW**

**FREQUENCY TO BE RECEIVED, CHANNEL SEPARATION, REFERENCE FREQUENCY, AND INTERMEDIATE FREQUENCY**

Area	Band	Frequency to be received	Channel separation	Reference frequency	Intermediate frequency
Eastern Europe	FM	87.5 - 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	522 - 1620 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
	LW	144 - 290 kHz	1 kHz	1 kHz	450 kHz/10.71 MHz
Western Europe	FM	87.5 - 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	522 - 1620 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
	LW	144 - 290 kHz	1 kHz	1 kHz	450 kHz/10.71 MHz
China	FM	87.0 - 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	531 - 1602 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
Australia, Middle East	FM	87.5 - 108.0 MHz	100 kHz	25 kHz	10.7 MHz
	MW	531 - 1602 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
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/10.71 MHz
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/10.71MHz
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/10.71 MHz
Japan	FM	76.0 - 90.0 MHz	100 kHz	25 kHz	-10.7 MHz
	MW	522 - 1629 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz

**RADIO FUNCTIONS**

(1) Manual tuning

Function	Description
Manual up	Carries out tuning in step-by-step or fast-forward mode.
Manual down	

(2) Auto-tuning

Function	Description
Seek up Seek down	Detects a station and retains the frequency.
Scan up Scan down	Tunes to broadcasts of different stations for five seconds each.

(3) Preset memory scanning: Tunes to broadcasts of stations held in preset memory for five seconds each.

(4) VF auto-tuning

Function	Description
SK seek up SK seek down	Detects a traffic information station and retains its frequency.
SK scan up SK scan down	Tunes to broadcasts of different traffic information stations for five seconds each.

(5) Preset memory

- FM band: FM1: Six stations, FM2: Six stations, FM3: Six stations
- MW band: MW1: Six stations, MW2: Six stations
- LW band: Six stations
- VF band: Six stations

(6) Last channel memory: One station each for FM1, FM2, FM3, MW1, MW2, LW, VF

(7) LOC (local) control output and display (The auto-local function can be selected.)

(8) ST (stereo) display function: Supported for the FM and VF bands. The display function is also supported for the MW band. (A switching function is supported.)

(9) Auto-storage

(10) DK-standby function, SK alarm function

**TAPE FUNCTIONS**

(1) Tape running direction display: Can be blinked at 2.5 Hz in fast-forward mode

(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

**ELECTRONIC VOLUME CONTROL FUNCTIONS (ELECTRONIC VOLUME CONTROL A OR B IS SUPPORTED)**

(1) Volume/bass/treble/balance/fader function

(2) "VOL"/"BAS"/"TREB"/"BAL"/"FAD" display on the LCD panel

(3) Mute function (In the mute state, the entire panel display blinks.)

(4) Loudness function (supported only for the electronic volume control A)

**CLOCK FUNCTIONS**

(1) Selectable 12-hour clock display (with AM/PM indication) or 24-hour clock display

(2) Selectable colon (:) flashing (1 Hz)

(3) Capable of back-up with low current consumption (up to 10 μA) in no-clock mode

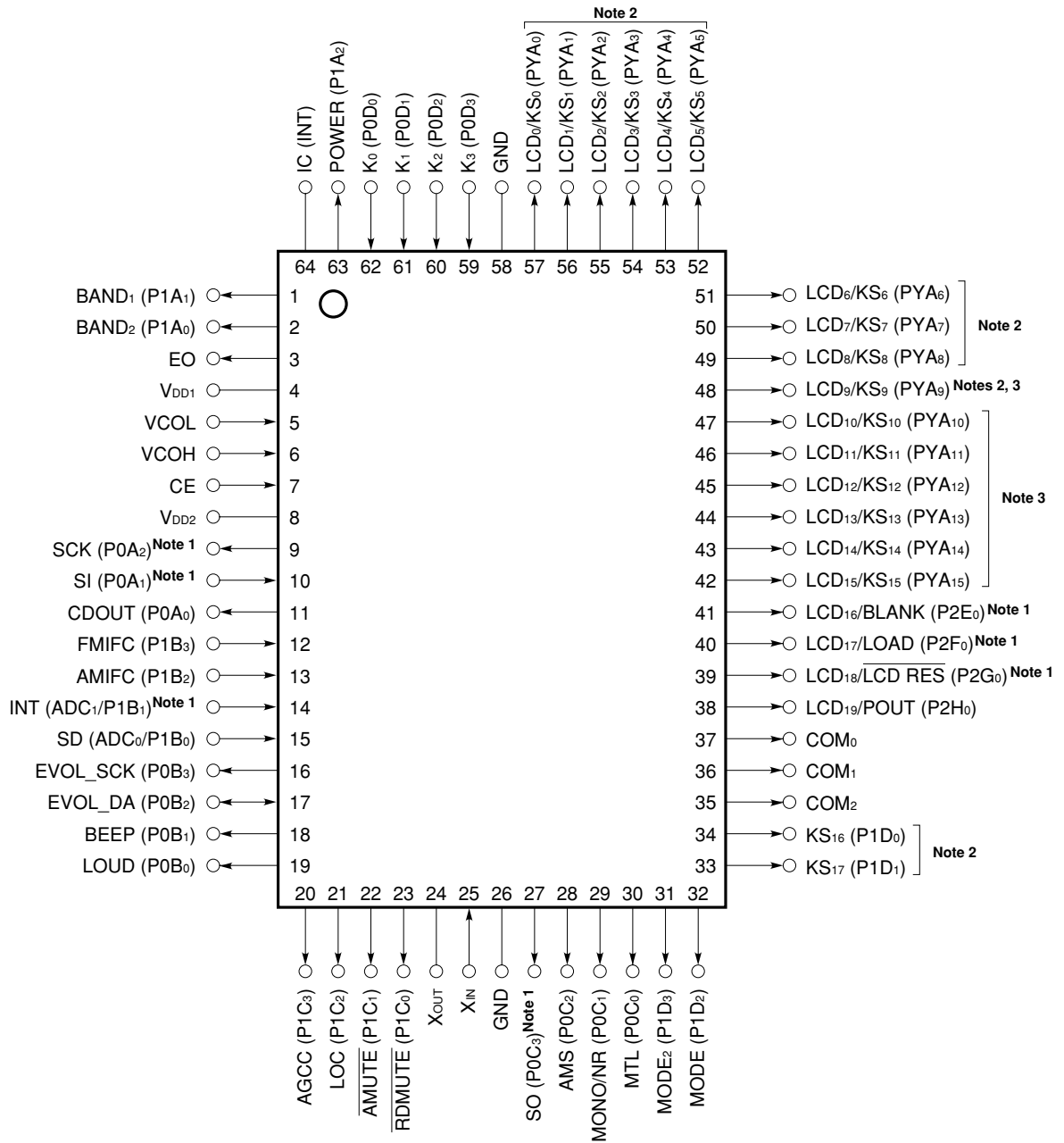
**OTHERS**

- (1) LOUD (loudness) control output and display: Common to radio, tape, and CD modes
- (2) Key acknowledge (beep) output: Performed if a valid momentary key is on
- (3) Display switching function and privileged display function
- (4) "[CD]" (compact disc) display
- (5) Compatible with the external LCD controller/key scan driver ( $\mu$ PD17202AGF-011)
- (6) Detachable key and LCD panel (only when the  $\mu$ PD17202AGF-011 is used)

PIN CONFIGURATION (TOP VIEW)

64-pin plastic QFP (14 × 20 mm, 1.0-mm pitch)

μPD17012GF-057-3BE



- Notes**
1. Pins used when the external LCD controller/key scan driver (μPD17202AGF-011) is used
  2. Initial setting diode or transistor switch
  3. Valid only for momentary keys when KLCD = 0 (internal LCD controller/key scan driver is used)

**Caution** Directly connect the IC pin to GND.

- Remarks**
1. IC indicates that the pin is internally connected.
  2. Pin names on the μPD17012GF-xxx-3BE are given in parentheses.

CONTENTS

1. PIN FUNCTIONS ..... 8

2. KEY MATRIX STRUCTURE ..... 18

    2.1 KEY MATRIX PLACEMENT ..... 18

    2.2 SWITCH CONNECTION ..... 19

    2.3 KEY MATRIX CONNECTION ..... 20

    2.4 INITIAL SETTING DIODE MATRIXES ..... 21

    2.5 ALTERNATION OR TRANSISTOR SWITCH ..... 34

    2.6 MOMENTARY KEYS ..... 36

        2.6.1 Momentary Key Matrix Placement  
                (When KLCD = 1 (The μPD17202AGF-011 Is Used) ..... 36

        2.6.2 Momentary Key Matrix Connection  
                (When KLCD = 1 (The μPD17202AGF-011 Is Used)) ..... 36

        2.6.3 Description of the Momentary Keys  
                (When KLCD = 0 (Internal LCD Controller/Key Scan Driver Is Used)  
                or KLCD = 1 (the μPD17202AGF-011 Is Used)) ..... 37

3. MODE TRANSITION ..... 73

    3.1 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS SET TO 1  
        (TURNING ON OR OFF THE RADIO SET BY SWITCHING THE STATE OF THE CE PIN) ..... 73

    3.2 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS SET TO 0  
        (TURNING ON OR OFF THE RADIO SET BY SWITCHING THE RDSET SWITCH) ..... 83

4. DISPLAY ..... 94

    4.1 LCD PANEL ..... 94

    4.2 CHARACTER STYLE ..... 94

    4.3 EXAMPLES OF DISPLAY ..... 94

    4.4 LCD ASSIGNMENT ..... 95

    4.5 LCD ASSIGNMENT TABLE ..... 95

        4.5.1 Table of LCD Assignment for the Internal LCD Controller/Key Scan Driver ..... 95

        4.5.2 Table of LCD Assignment for the External LCD Controller/Key Scan Driver  
                (μPD17202AGF-011) ..... 96

    4.6 DESCRIPTION OF DISPLAY ..... 97

5. MUTE OUTPUT TIMING CHARTS ..... 99

    5.1 RADIO MUTE ( $\overline{\text{RDMUTE}}$  PIN) OUTPUT TIMING CHARTS ..... 99

    5.2 RADIO MUTE ( $\overline{\text{RDMUTE}}$  PIN) AND AUDIO MUTE ( $\overline{\text{AMUTE}}$  PIN)  
        OUTPUT TIMING CHARTS ..... 104

6. PIN I/O CIRCUITS ..... 106

7. SAMPLE APPLICATION CIRCUITS ..... 110

8. ELECTRICAL CHARACTERISTICS (PRELIMINARY) .....	112
9. PACKAGE DRAWING .....	115
10. RECOMMENDED SOLDERING CONDITIONS .....	116
APPENDIX A LCD CONTROLLER/KEY SCAN DRIVER (μPD17202AGF-011).....	117
APPENDIX B COMMUNICATION .....	119

1. PIN FUNCTIONS

Pin No.	Symbol	Pin name	Description	I/O type																					
1 2	BAND <sub>1</sub> BAND <sub>2</sub>	Band switching signal output	<p>Output pin of the band switching signal in radio mode The operation depends on the mode, as described below:</p> <p><b>(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode</b> If the band to be received is switched by pressing the band switching key, the output depends on the band, as listed below:</p> <table border="1"> <thead> <tr> <th>Pin \ Band</th> <th>BAND<sub>1</sub></th> <th>BAND<sub>2</sub></th> </tr> </thead> <tbody> <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> </tbody> </table> <p>(0: Low, 1: High)</p> <p><b>(2) In DK-receiving tape mode, DK-receiving CD mode, DK-standby tape mode, DK-standby CD mode</b></p> <table border="1"> <thead> <tr> <th>Pin \ Band</th> <th>BAND<sub>1</sub></th> <th>BAND<sub>2</sub></th> </tr> </thead> <tbody> <tr> <td>VF</td> <td>1</td> <td>1</td> </tr> </tbody> </table> <p>(1: High)</p> <p><b>(3) In tape mode, CD mode, power-off mode</b> The output goes low.</p>	Pin \ Band	BAND <sub>1</sub>	BAND <sub>2</sub>	MW	0	0	LW	0	1	FM	1	0	VF	1	1	Pin \ Band	BAND <sub>1</sub>	BAND <sub>2</sub>	VF	1	1	CMOS push-pull output
Pin \ Band	BAND <sub>1</sub>	BAND <sub>2</sub>																							
MW	0	0																							
LW	0	1																							
FM	1	0																							
VF	1	1																							
Pin \ Band	BAND <sub>1</sub>	BAND <sub>2</sub>																							
VF	1	1																							
3	EO	Error out	<p>Charge pump output pin of phase detector built into a PLL. If a divided oscillator frequency is higher than the reference frequency, the output of this pin goes high. If the divided oscillator frequency is lower, the output goes low. If the divided oscillator frequency agrees with the reference frequency, the output enters the floating state.</p>	CMOS tristate output																					
4 8	V <sub>DD1</sub> V <sub>DD2</sub>	Power supply	<p>Power-supply pin of the device</p> <p>This pin supplies a voltage of 5 V ±10% while the device is operating. The rise time (0 to 4.5 V) of V<sub>DD</sub> must not exceed 500 ms. If the rise time is significantly long or if the voltage falls below the operating voltage but is between 0 V and 3.5 V, the state of an initial setting diode switch may be read incorrectly. (If this occurs, re-read the state of the initial setting diode switch, using the CE pin.)</p> <p>When V<sub>DD</sub> is input for the first time, the CE pin going high causes the lowest frequency of the FM band to be called.</p>	—																					



Pin No.	Symbol	Pin name	Description	I/O type
5	VCOL	AM local oscillator input	Input pin of the local oscillator output (VCO) in the AM (MW, LW) band When tuned to broadcasts in the MW or LW band, this pin becomes active. Otherwise, the pin is internally pulled down. A frequency of between 0.58 and 30 MHz (0.3V <sub>p-p</sub> ) can be input. To protect the built-in AC amplifier, block the flow of direct current with a capacitor, then input the frequency.	Input
6	VCOH	FM local oscillator input	Input pin of the local oscillator output (VCO) in the FM (FM, VF) band When tuned to broadcasts in the FM or VF band, this pin becomes active. Otherwise, the pin is internally pulled down. A frequency of between 9 and 150 MHz (0.3V <sub>p-p</sub> ) can be input. Because an AC amplifier is incorporated, block the flow of direct current with a capacitor, then input the frequency.	Input
7	CE	Chip enable	Input pin of the device selection signal To operate the device normally (radio, tape, CD, clock display, etc.), set the input high. To disable the device, set the input low. A high or low state within a period of 165 μs is not accepted. A low on this pin causes the radio, tape, CD, and display to all be set to off, resulting in the data retention state. If the initial setting diode NOCLK is set to 1 (no-clock mode is selected by connecting the diode) in this state, the current consumption in the data retention state can be reduced. (See <b>Section 2.4.</b> )	Input
9	SCK	Serial clock output of the external LCD controller/key scan driver	Serial clock output pin for controlling the external LCD controller/key scan driver (μPD17202AGF-011)	CMOS push-pull output
10	SI	Serial data input of the external LCD controller/key scan driver	Serial data input pin for controlling the external LCD controller key scan driver (μPD17202AGF-011)	Input
11	CDOUT	CD mode output	CD mode output pin Each time the <span style="border: 1px solid black; padding: 0 2px;">CD</span> momentary key is pressed, the CDOUT output is inverted. In the following modes, the CDOUT output is always set low: <ul style="list-style-type: none"> <li>• When CE is low</li> <li>• In power-off mode (when CE is high and the radio, tape, and CD are off)</li> <li>• When the DTH transistor switch is set to off</li> </ul>	CMOS push-pull output

Pin No.	Symbol	Pin name	Description	I/O type												
12	FMIFC	FM intermediate frequency input	<p>Input pin of the intermediate frequency (IF) in the FM or AM (MW, LW) band when the initial setting diode IFAM is set to 1 A frequency of between 5 and 15 MHz (0.3V<sub>p-p</sub>) can be input. To protect the built-in AC amplifier, block the flow of direct current with a capacitor, then input the frequency. If the ENFMIF initial setting diode is set to 1, the pin is used to detect whether a station is found by means of auto-tuning. If the input frequency range and conditions listed below are satisfied, it is judged that a station has been found.</p> <table border="1"> <thead> <tr> <th>Item Band</th> <th>Input frequency range ①</th> <th>Input frequency range ②</th> </tr> </thead> <tbody> <tr> <td>FM, VF</td> <td>10.7 MHz ±50 kHz</td> <td>10.7 MHz ±12.5 kHz</td> </tr> <tr> <td>MW</td> <td>10.71 MHz ±5 kHz</td> <td>10.71 MHz ±2 kHz</td> </tr> <tr> <td>LW</td> <td>10.71 MHz ±5 kHz</td> <td>10.71 MHz ±1 kHz</td> </tr> </tbody> </table> <p>A frequency within input frequency range ① must be input within 20 ms of the PLL being locked. If a frequency is included in both input frequency ranges ① and ②, it is judged that a station has been found. Auto-tuning is stopped.</p>	Item Band	Input frequency range ①	Input frequency range ②	FM, VF	10.7 MHz ±50 kHz	10.7 MHz ±12.5 kHz	MW	10.71 MHz ±5 kHz	10.71 MHz ±2 kHz	LW	10.71 MHz ±5 kHz	10.71 MHz ±1 kHz	Input
Item Band	Input frequency range ①	Input frequency range ②														
FM, VF	10.7 MHz ±50 kHz	10.7 MHz ±12.5 kHz														
MW	10.71 MHz ±5 kHz	10.71 MHz ±2 kHz														
LW	10.71 MHz ±5 kHz	10.71 MHz ±1 kHz														
13	AMIFC	AM intermediate frequency input	<p>Input pin of the intermediate frequency (IF) in the AM (MW, LW) band when the initial setting diode IFAM is set to 0 A frequency of between 0.3 and 1.0 MHz (0.3V<sub>p-p</sub>) can be input. To protect the built-in AC amplifier, block the flow of direct current with a capacitor, then input the frequency. If the initial setting diode ENAMIF is set to 1, this pin is used to detect whether a station is found in auto-tuning. If the input frequency range and conditions listed below are satisfied, it is judged that a station has been found.</p> <table border="1"> <thead> <tr> <th>Item Band</th> <th>Input frequency range ① [kHz]</th> <th>Input frequency range ② [kHz]</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>A frequency within input frequency range ① must be input within 20 ms of the PLL being locked. If a frequency is included in both input frequency ranges ① and ②, it is judged that a station has been found. Auto-tuning is stopped.</p>	Item Band	Input frequency range ① [kHz]	Input frequency range ② [kHz]	MW	450 ±5	450 ±2	LW	450 ±5	450 ±0.5	Input			
Item Band	Input frequency range ① [kHz]	Input frequency range ② [kHz]														
MW	450 ±5	450 ±2														
LW	450 ±5	450 ±0.5														

Pin No.	Symbol	Pin name	Description	I/O type																				
14	INT	Key scan complete input of the external LCD controller/ key scan driver	<p>Pin of the key scan complete input from the external LCD controller/ key scan driver (μPD17202AGF-011)</p> <p>The input level depends on the key scan state, as listed below:</p> <table border="1"> <thead> <tr> <th>Key scan state</th> <th>Input level</th> </tr> </thead> <tbody> <tr> <td>Key scan in progress</td> <td>Low</td> </tr> <tr> <td>Key scan complete</td> <td>High</td> </tr> </tbody> </table>	Key scan state	Input level	Key scan in progress	Low	Key scan complete	High	Input														
Key scan state	Input level																							
Key scan in progress	Low																							
Key scan complete	High																							
15	SD	SD input	<p>SD (station detector) signal input pin</p> <p>If the following voltage is applied to this pin, it is judged that an SD is found.</p> <table border="1"> <thead> <tr> <th rowspan="2">Band</th> <th rowspan="2">LOCAL/DX mode</th> <th colspan="2">Voltage by which the presence of an SD is assumed</th> </tr> <tr> <th></th> <th>When V<sub>DD</sub> is set to 5 V</th> </tr> </thead> <tbody> <tr> <td rowspan="2">FM</td> <td>LOCAL</td> <td><math>\frac{28.5}{64} \times V_{DD}</math> or higher</td> <td>2.227</td> </tr> <tr> <td>DX</td> <td><math>\frac{12.5}{64} \times V_{DD}</math> or higher</td> <td>0.977</td> </tr> <tr> <td rowspan="2">MW</td> <td>LOCAL</td> <td><math>\frac{15.5}{64} \times V_{DD}</math> or higher</td> <td>1.211</td> </tr> <tr> <td>DX</td> <td><math>\frac{12.5}{64} \times V_{DD}</math> or higher</td> <td>0.977</td> </tr> </tbody> </table> <p>The SD signal is used to judge whether a station is found.</p>	Band	LOCAL/DX mode	Voltage by which the presence of an SD is assumed			When V <sub>DD</sub> is set to 5 V	FM	LOCAL	$\frac{28.5}{64} \times V_{DD}$ or higher	2.227	DX	$\frac{12.5}{64} \times V_{DD}$ or higher	0.977	MW	LOCAL	$\frac{15.5}{64} \times V_{DD}$ or higher	1.211	DX	$\frac{12.5}{64} \times V_{DD}$ or higher	0.977	Input
Band	LOCAL/DX mode	Voltage by which the presence of an SD is assumed																						
			When V <sub>DD</sub> is set to 5 V																					
FM	LOCAL	$\frac{28.5}{64} \times V_{DD}$ or higher	2.227																					
	DX	$\frac{12.5}{64} \times V_{DD}$ or higher	0.977																					
MW	LOCAL	$\frac{15.5}{64} \times V_{DD}$ or higher	1.211																					
	DX	$\frac{12.5}{64} \times V_{DD}$ or higher	0.977																					
16	EVOL_SCK	Clock output of electronic volume control	Clock output pin of electronic volume control	CMOS push-pull output																				
17	EVOL_DA	Data input/output of electronic volume control	Data input/output pin of electronic volume control	Input/output CMOS push-pull output																				
18	BEEP	Beep output	<p>Beep sound output pin that functions when a momentary key is pressed</p> <p>If a momentary key is pressed, square waves (duty cycle 50%) of 3 kHz are output for about 40 ms. This period agrees with the period of the preceding mute.</p> <p>A beep sound is output if a press of a momentary key causes the LCD panel display or output port state to be changed, or if a hold period of five seconds ends during scanning or preset memory scanning.</p> <p>The beep sound output can be used as an SK alarm in the DK-standby mode. If this output is not used, leave the pin open.</p>	CMOS push-pull output																				

Pin No.	Symbol	Pin name	Description	I/O type											
19	LOUD	Loudness output	Output pin of the loudness control signal The output goes high in the loudness-on state.	CMOS push-pull output											
20	AGCC	AGC cut output	<p>AGC (auto gain control) cut signal output pin in radio mode The output goes high in auto-tuning, as shown below.</p> <p>① : Waiting for key-on chattering ② : Preceding mute ③ : Following mute</p>	CMOS push-pull output											
21	LOC	Local signal output	<p>Local signal output pin in radio mode The operation depends on the mode, as described below:</p> <p><b>(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode, DK-standby tape mode, DK-standby CD mode</b> The LOC output goes high only in auto-tuning in the local state. The level of the LOC output depends on both the tuning state and LOCAL/DX state. The relationships are listed below:</p> <table border="1"> <thead> <tr> <th>Auto-tuning state</th> <th>LOCAL/DX state</th> <th>LOC output level</th> </tr> </thead> <tbody> <tr> <td rowspan="2">In progress</td> <td>LOCAL</td> <td>High</td> </tr> <tr> <td>DX</td> <td>Low</td> </tr> <tr> <td>Not performed</td> <td>Don't care</td> <td>Low</td> </tr> </tbody> </table> <p><b>(2) In other modes</b> The output goes low.</p>	Auto-tuning state	LOCAL/DX state	LOC output level	In progress	LOCAL	High	DX	Low	Not performed	Don't care	Low	CMOS push-pull output
Auto-tuning state	LOCAL/DX state	LOC output level													
In progress	LOCAL	High													
	DX	Low													
Not performed	Don't care	Low													

Pin No.	Symbol	Pin name	Description	I/O type
22	$\overline{\text{AMUTE}}$	Audio mute output	Output pin of the tape or CD mute signal The operation depends on the mode, as described below: <b>(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode, power-off mode</b> The output goes low. <b>(2) In CD mode, tape mode, DK-standby CD mode, DK-standby tape mode</b> The output goes high. See <b>Chapter 5</b> for details.	CMOS push-pull output
23	$\overline{\text{RDMUTE}}$	Radio mute output	Output pin of radio mute signal The operation depends on the mode, as described below: <b>(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode; at radio-on, radio-off; at band switching; at switching of the frequency to be received</b> The output goes low. <b>(2) In CD mode, tape mode, DK-standby CD mode, DK-standby tape mode</b> The output method can be selected by setting the initial setting diode MUTESEL. (See <b>Section 2.4</b> ) If the DK-standby or radio-monitor function is used, set MUTESEL to 0 and bring the output low. See <b>Chapter 5</b> for details.	CMOS push-pull output
24	X <sub>OUT</sub>	Crystal	Pin for connecting a crystal	—
25	X <sub>IN</sub>		A 4.5-MHz crystal is connected.	Input
26 58	GND	Ground	Ground pin Connect pins No. 26 and No. 58 to an identical potential.	—
27	SO	Serial data output of the external LCD controller/key scan driver	Serial data output pin for controlling the external LCD controller/key scan driver (μPD17202AGF-011)	N-ch open-drain output

Pin No.	Symbol	Pin name	Description	I/O type																												
28	AMS	AMS signal output	<p>AMS (auto music search) signal output pin The output level depends on the AMS state, as listed below:</p> <table border="1"> <thead> <tr> <th>AMS state</th> <th>Output level</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>High</td> </tr> <tr> <td>OFF</td> <td>Low</td> </tr> </tbody> </table> <p>If the TPSET switch is set to on, the output level depends on the AMS state, regardless of the current mode.</p>	AMS state	Output level	ON	High	OFF	Low	CMOS push-pull output																						
AMS state	Output level																															
ON	High																															
OFF	Low																															
29	MONO/NR	MONO output or noise reduction signal output	<p>MONO signal output pin or noise reduction signal output pin The operation depends on the mode, as described below: <b>(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode</b> This pin functions as a MONO signal output pin. The output level depends on the selected band and the MONO state, as listed below:</p> <table border="1"> <thead> <tr> <th>Selected band</th> <th>MONO state</th> <th>Output level</th> </tr> </thead> <tbody> <tr> <td rowspan="2">FM</td> <td>ON</td> <td>High</td> </tr> <tr> <td>OFF</td> <td>Low</td> </tr> <tr> <td>LW</td> <td>Don't care</td> <td>Low</td> </tr> </tbody> </table> <p>If the MW band is selected, the output level depends on the setting of the initial setting diode MWS, as listed below:</p> <table border="1"> <thead> <tr> <th>MWS</th> <th>MONO state</th> <th>Output level</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>(1: Closed by the diode, 0: Open)</p> <p><b>(2) In tape mode, DK-standby tape mode</b> The pin functions as an output pin of the noise reduction signal. The output level depends on the NR state, as listed below:</p> <table border="1"> <thead> <tr> <th>NR state</th> <th>Output level</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>High</td> </tr> <tr> <td>OFF</td> <td>Low</td> </tr> </tbody> </table> <p><b>(3) In CD mode, DK-standby CD mode, power-off mode</b> The output goes low.</p>	Selected band	MONO state	Output level	FM	ON	High	OFF	Low	LW	Don't care	Low	MWS	MONO state	Output level	1	ON	High	OFF	Low	0	Don't care	Low	NR state	Output level	ON	High	OFF	Low	CMOS push-pull output
Selected band	MONO state	Output level																														
FM	ON	High																														
	OFF	Low																														
LW	Don't care	Low																														
MWS	MONO state	Output level																														
1	ON	High																														
	OFF	Low																														
0	Don't care	Low																														
NR state	Output level																															
ON	High																															
OFF	Low																															

Pin No.	Symbol	Pin name	Description	I/O type																												
30	MTL	METAL signal output	<p>IMETAL signal output pin The output level depends on the METAL state, as listed below:</p> <table border="1"> <thead> <tr> <th>METAL state</th> <th>Output level</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>High</td> </tr> <tr> <td>OFF</td> <td>Low</td> </tr> </tbody> </table> <p>If the TPSET switch is set to on, the output level depends on the METAL state, regardless of the current mode.</p>	METAL state	Output level	ON	High	OFF	Low	CMOS push-pull output																						
METAL state	Output level																															
ON	High																															
OFF	Low																															
31 32	MODE <sub>2</sub> MODE	Mode signal output	<p>Mode switching signal output pin The output depends on the mode, as listed below:</p> <table border="1"> <thead> <tr> <th>Mode</th> <th>MODE</th> <th>MODE<sub>2</sub></th> </tr> </thead> <tbody> <tr> <td>When CE is low</td> <td>0</td> <td>0</td> </tr> <tr> <td>When CE is high and the radio, tape, and CD are off (power-off mode)</td> <td>0</td> <td>0</td> </tr> <tr> <td>In radio mode</td> <td>1</td> <td>0</td> </tr> <tr> <td>In tape mode</td> <td>0</td> <td>0</td> </tr> <tr> <td>In CD mode</td> <td>0</td> <td>1</td> </tr> <tr> <td>In DK-standby tape mode</td> <td rowspan="2">1</td> <td>0</td> </tr> <tr> <td>In DK-standby CD mode or DK-receiving CD mode</td> <td>1</td> </tr> <tr> <td>In radio-monitor tape mode</td> <td rowspan="2">1</td> <td>0</td> </tr> <tr> <td>In radio-monitor CD mode</td> <td>1</td> </tr> </tbody> </table> <p>(0: Low, 1: High)</p>	Mode	MODE	MODE <sub>2</sub>	When CE is low	0	0	When CE is high and the radio, tape, and CD are off (power-off mode)	0	0	In radio mode	1	0	In tape mode	0	0	In CD mode	0	1	In DK-standby tape mode	1	0	In DK-standby CD mode or DK-receiving CD mode	1	In radio-monitor tape mode	1	0	In radio-monitor CD mode	1	CMOS push-pull output
Mode	MODE	MODE <sub>2</sub>																														
When CE is low	0	0																														
When CE is high and the radio, tape, and CD are off (power-off mode)	0	0																														
In radio mode	1	0																														
In tape mode	0	0																														
In CD mode	0	1																														
In DK-standby tape mode	1	0																														
In DK-standby CD mode or DK-receiving CD mode		1																														
In radio-monitor tape mode	1	0																														
In radio-monitor CD mode		1																														
33 34	KS <sub>17</sub> KS <sub>16</sub>	Key source signal output	Output pin of the key source signal of the key matrix	CMOS push-pull output																												
35   37	COM <sub>2</sub>   COM <sub>0</sub>	LCD common signal output	Common signal output pin. The signal is sent to the LCD panel.	CMOS tristate output																												
38	LCD <sub>19</sub> /POUT	LCD segment signal output or detachable panel state signal output	<p>Output pin of the segment signal to the LCD panel, or the detachable panel state signal output pin The operation depends on the state of the KLCD initial setting diode.</p> <p><b>(1) When KLCD = 0</b> The pin outputs the segment signal to the LCD panel.</p> <p><b>(2) When KLCD = 1</b> When the DTH switch is set to off, the pin outputs the detachable panel state signal, having a frequency of 1 Hz and a duty cycle of 1/2.</p>	CMOS push-pull output																												

Pin No.	Symbol	Pin name	Description	I/O type						
39	LCD <sub>18</sub> / LCD RES	LCD segment signal output or reset signal output of the external LCD controller/key scan driver	<p>Pin to output the segment signal to the LCD panel or the reset signal of the LCD controller/key scan driver (μPD17202AGF-011). The operation depends on the state of the KLCD initial setting diode.</p> <p><b>(1) When KLCD = 0</b> The pin outputs the segment signal to the LCD panel.</p> <p><b>(2) When KLCD = 1</b> The pin outputs the reset signal to the external LCD controller/key scan driver (μPD17202AGF-011). When the output goes low, the external LCD controller/key scan driver enters the reset state.</p>	N-ch open-drain output						
40	LCD <sub>17</sub> /LOAD	LCD segment signal output or load signal output of the external LCD controller/key scan driver	<p>Pin to output the segment signal to the LCD panel or output the load signal for controlling the external LCD controller/key scan driver (μPD17202AGF-011).</p> <p><b>(1) When KLCD = 0</b> The pin outputs the segment signal to the LCD panel.</p> <p><b>(2) When KLCD = 1</b> The pin outputs the load signal to the external LCD controller/key scan driver (μPD17202AGF-011).</p>	CMOS push-pull output						
41	LCD <sub>16</sub> /BLANK	LCD segment signal output or blank output of the external LCD controller/key scan driver	<p>Pin to output the segment signal to the LCD panel or the control signal to the LCD controller/key scan driver (μPD17202AGF-011) to turn on or off the LCD. The output level depends on the LCD display state, as listed below;</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>LCD display state</th> <th>Output level</th> </tr> </thead> <tbody> <tr> <td>Lit</td> <td>Low</td> </tr> <tr> <td>Not Lit</td> <td>High</td> </tr> </tbody> </table> <p><b>(1) When KLCD = 0</b> The pin outputs the segment signal to the LCD panel.</p> <p><b>(2) When KLCD = 1</b> The pin outputs the blank signal to the external LCD controller/key scan driver (μPD17202AGF-011).</p>	LCD display state	Output level	Lit	Low	Not Lit	High	N-ch open-drain output
LCD display state	Output level									
Lit	Low									
Not Lit	High									




Pin No.	Symbol	Pin name	Description	I/O type
42   57	LCD <sub>15</sub> /KS <sub>15</sub>   LCD <sub>0</sub> /KS <sub>0</sub>	LCD segment signal output or key source signal output	Pin to output the segment signal to the LCD panel or output the key source signal of the key matrix. These pins are used to output both the key source signal of the key matrix and the LCD segment signal. Therefore, when used as the key source signal output pin, a diode must be connected to the pin to prevent backward current.	CMOS push-pull output
59   62	K <sub>3</sub>   K <sub>0</sub>	Key return signal input	Input pin of the key return signal of the key matrix The pins which output key source signals are also used to output LCD segment signals. Do not connect pull-down resistors to the key return signal input pins.	Input
63	POWER	Power output	The output is inverted each time the <span style="border: 1px solid black; padding: 0 2px;">POWER</span> key is pressed. Use this pin to turn the power on or off.	CMOS push-pull output
64	IC	IC	Internally connected pin. Directly connect the pin to GND.	—


## 2. KEY MATRIX STRUCTURE

### 2.1 KEY MATRIX PLACEMENT

Input pin (pin number) Output pin (pin number)	K <sub>3</sub> (59)	K <sub>2</sub> (60)	K <sub>1</sub> (61)	K <sub>0</sub> (62)
KS <sub>17</sub> (33)	ENFM	DISFM3	ENMW2	DISLW
KS <sub>16</sub> (34)	RDON	AREA3	AREA2	AREA1
LCD <sub>15</sub> /KS <sub>15</sub> (42)	M6	M5	M4	M3 (TP3)
LCD <sub>14</sub> /KS <sub>14</sub> (43)	M2 (TP2)	M1 (TP1)	MTL	LOC
LCD <sub>13</sub> /KS <sub>13</sub> (44)	LOUD	P.SCAN	DISP	ME
LCD <sub>12</sub> /KS <sub>12</sub> (45)	VF	BAND	SCAN UP	SEEK UP
LCD <sub>11</sub> /KS <sub>11</sub> (46)	MAN DWN	MAN UP	RDMONI	NR
LCD <sub>10</sub> /KS <sub>10</sub> (47)	AMS	MONO	SCAN DWN	SEEK DWN
LCD <sub>9</sub> /KS <sub>9</sub> (48)	CD	MUTE	VOL DWN	VOL UP
LCD <sub>8</sub> /KS <sub>8</sub> (49)	VOL SEL	POWER	SK	DK
LCD <sub>7</sub> /KS <sub>7</sub> (50)	RDSET	ST	DTH	CDSET
LCD <sub>6</sub> /KS <sub>6</sub> (51)	FF	RL	TPSET	VKysel
LCD <sub>5</sub> /KS <sub>5</sub> (52)	VOLATT_L	VOLATT_H	EVOLSEL	KLCD
LCD <sub>4</sub> /KS <sub>4</sub> (53)	IFAM	M2S	VF1	MWS
LCD <sub>3</sub> /KS <sub>3</sub> (54)	AUTO500	MUTESEL	AUTOLOC	FAD_SEL
LCD <sub>2</sub> /KS <sub>2</sub> (55)	CKHLT	KAMS	KNR	KMTL
LCD <sub>1</sub> /KS <sub>1</sub> (56)	NOCLK	CLKDISP	FLASH	DISAMEMO
LCD <sub>0</sub> /KS <sub>0</sub> (57)	ENFMIF	ENAMIF	PRI02	PRI01

 : Initial setting diode

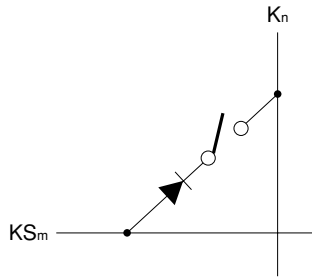
 : Alternation or transistor switch

 : Momentary key

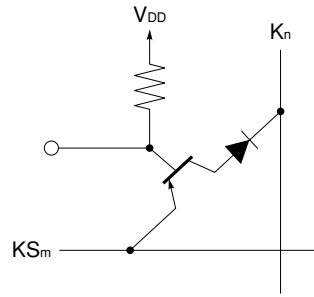
**Remark** Momentary keys are effective only when KLCD = 0 (see **Section 2.4**).

2.2 SWITCH CONNECTION

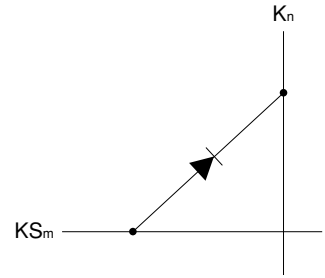
Alternation switch



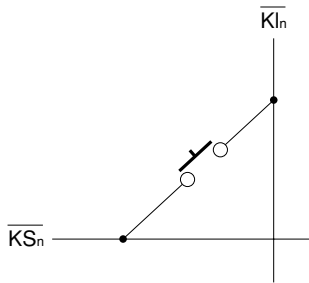
Transistor switch






Initial setting diode

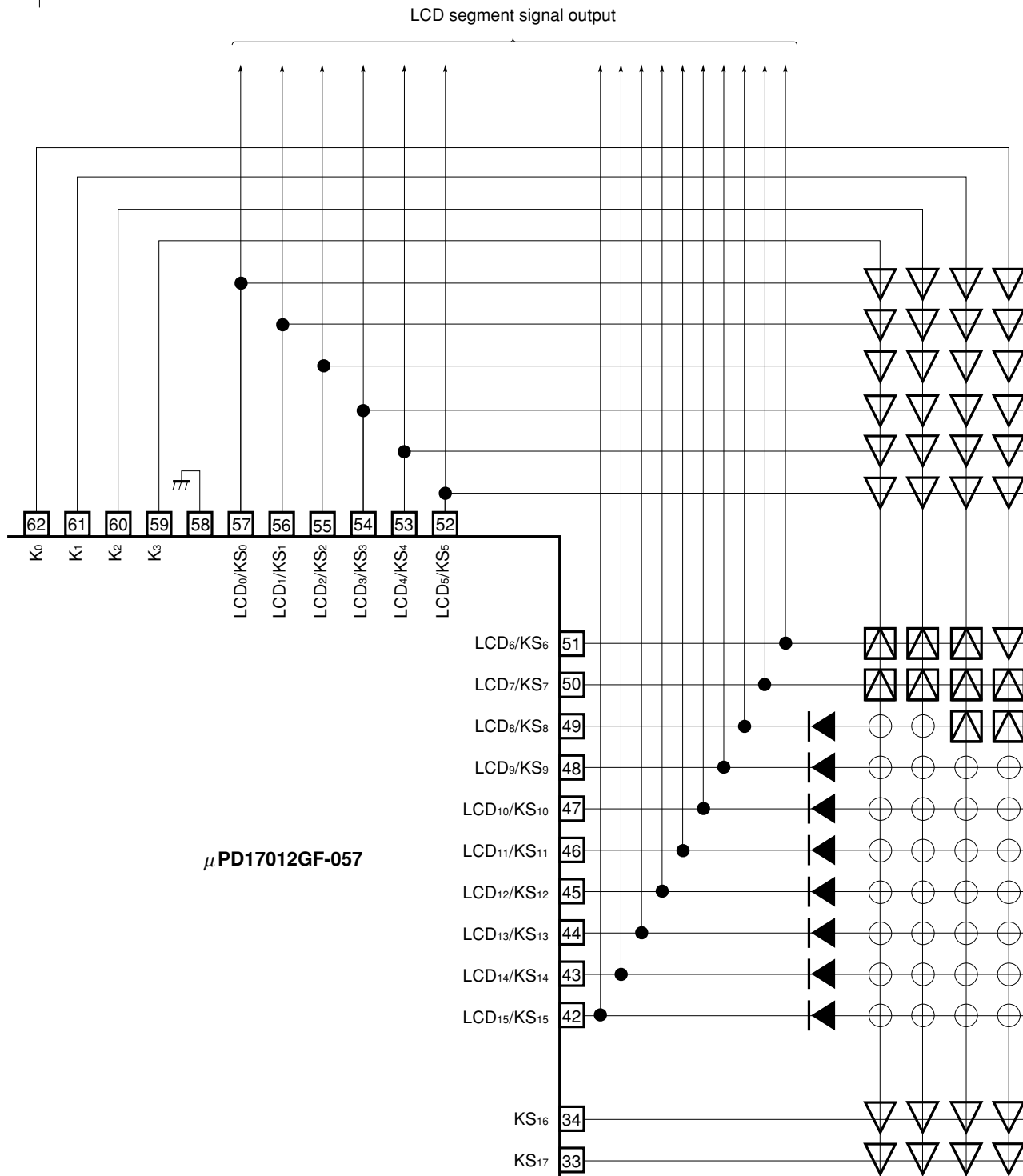


Momentary key



2.3 KEY MATRIX CONNECTION

-  Alternation or transistor switch
-  Initial setting diode
-  Momentary key



**Remark** Momentary keys are effective only when KLCD = 0.

## 2.4 INITIAL SETTING DIODE MATRIXES

The  $\mu$ PD17012GF-057 has the following 21 initial setting diode matrixes. When the  $V_{DD}$  is supplied with power for the first time (at a power-on reset) or when the CE pin goes from a low level to a high level (at a CE reset), the states of the diodes in these matrixes are read in. In all other occasions, they are ignored.

**(1) Switch to specify the reception area**

AREA1, AREA2, and AREA3

**(2) Switch to specify the reception band**

DISFM3, ENMW2, DISLW, and ENFM

**(3) Switch to specify whether to use the auto-storage function**

DISAMEMO

**(4) Switch to specify whether to use the frequency counter for detecting broadcasting stations**

ENFMIF and ENAMIF

**(5) Switch to specify preset memory operation**

M2S

**(6) Switch to specify tuning operation**

AUTO500

**(7) Switch to specify display priority**

PRI01 and PRI02

**(8) Switch to specify whether to switch on or off the radio**

RDON

**(9) Switch to specify the clock function**

NOCLK, CLKDISP, and FLASH

**(10) Switch to specify the tape function**

KAMS, KNR, and KMTL

**(11) Switch to specify the mute output**

MUTESEL

**(12) Switch to specify the local operation**

AUTOLOC

- (13) **Switch to specify the intermediate frequency for the AM (MW, LW) band**  
IFAM
- (14) **Switch to specify whether the VF band auto-returning function (to trigger a seek-up operation automatically upon detection of deteriorated reception state) is available**  
VF1
- (15) **Switch to specify whether the MW band stereo reception function is available**  
MWS
- (16) **Switch to specify that the standby mode has no clock**  
CKHLT
- (17) **Switch to specify whether the electronic volume control fader function is available**  
FAD\_SEL
- (18) **Switch to specify which key (VOL UP/VOL DWN or MAN UP/MAN DWN) is used for electronic volume control**  
VKYSEL
- (19) **Switch to specify the electronic volume control**  
EVOLSEL
- (20) **Switch to specify the LCD controller/key scan driver to be used**  
KLCD
- (21) **Switch to specify the attenuator of the preamplifier incorporated in the electronic volume control (only when electronic volume control A is used)**  
VOLATT\_H  
VOLATT\_L

To set these switches, short-circuit or keep open the diodes in each matrix. The functions of the initial setting diode matrixes are summarized below.

Symbol	Description																																																																														
<p>AREA1 AREA2 AREA3</p>	<p>These switches are used to specify the reception area. The following table lists the settings of the switches and the corresponding reception areas. See <b>the summary of functions</b> for the reception frequencies in each reception area.</p> <table border="1"> <thead> <tr> <th>AREA3</th> <th>AREA2</th> <th>AREA1</th> <th>Area</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Western Europe</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Australia Middle and Near East</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Japan</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>USA 1</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>USA 2</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Eastern Europe</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>USA 3</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>China</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	AREA3	AREA2	AREA1	Area	0	0	0	Western Europe	0	0	1	Australia Middle and Near East	0	1	0	Japan	0	1	1	USA 1	1	0	0	USA 2	1	0	1	Eastern Europe	1	1	0	USA 3	1	1	1	China																																										
AREA3	AREA2	AREA1	Area																																																																												
0	0	0	Western Europe																																																																												
0	0	1	Australia Middle and Near East																																																																												
0	1	0	Japan																																																																												
0	1	1	USA 1																																																																												
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1	0	1	Eastern Europe																																																																												
1	1	0	USA 3																																																																												
1	1	1	China																																																																												
<p>DISFM3 ENMW2 DISLW ENFM</p>	<p>These switches are used to specify the reception band. Each switch has the following functions.</p> <ul style="list-style-type: none"> <li>DISFM3 : When set to 1, disables the FM3 band.</li> <li>ENMW2 : When set to 1, enables the MW2 band.</li> <li>DISLW : When set to 1, disables the LW band for Western Europe and Eastern Europe. This switch is ineffective in the other areas.</li> <li>ENFM : When set to 1, enables only the FM band.</li> </ul> <p>The following table lists the settings of these switches and the corresponding reception bands in each area.</p> <table border="1"> <thead> <tr> <th>Area</th> <th>ENFM</th> <th>DISFM3</th> <th>ENMW2</th> <th>DISLW</th> <th>Reception band</th> </tr> </thead> <tbody> <tr> <td rowspan="8">Western Europe Eastern 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="6">The 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> </tbody> </table> <p>(1: Shorted by the diode; 0: Open; –: Don't care)</p>	Area	ENFM	DISFM3	ENMW2	DISLW	Reception band	Western Europe Eastern Europe	1	0	–	–	FM1, FM2, FM3	1	1	–	–	FM1, FM2	0	0	0	0	FM1, FM2, FM3, MW1, LW	0	0	0	1	FM1, FM2, FM3, MW1	0	0	1	–	FM1, FM2, FM3, MW1, MW2	0	1	0	0	FM1, FM2, MW1, LW	0	1	0	1	FM1, FM2, MW1	0	1	1	–	FM1, FM2, MW1, MW2	The other areas	1	0	–	–	FM1, FM2, FM3	1	1	–	–	FM1, FM2	0	0	0	–	FM1, FM2, FM3, MW1	0	0	1	–	FM1, FM2, FM3, MW1, MW2	0	1	0	–	FM1, FM2, MW1	0	1	1	–	FM1, FM2, MW1, MW2
Area	ENFM	DISFM3	ENMW2	DISLW	Reception band																																																																										
Western Europe Eastern Europe	1	0	–	–	FM1, FM2, FM3																																																																										
	1	1	–	–	FM1, FM2																																																																										
	0	0	0	0	FM1, FM2, FM3, MW1, LW																																																																										
	0	0	0	1	FM1, FM2, FM3, MW1																																																																										
	0	0	1	–	FM1, FM2, FM3, MW1, MW2																																																																										
	0	1	0	0	FM1, FM2, MW1, LW																																																																										
	0	1	0	1	FM1, FM2, MW1																																																																										
	0	1	1	–	FM1, FM2, MW1, MW2																																																																										
The other areas	1	0	–	–	FM1, FM2, FM3																																																																										
	1	1	–	–	FM1, FM2																																																																										
	0	0	0	–	FM1, FM2, FM3, MW1																																																																										
	0	0	1	–	FM1, FM2, FM3, MW1, MW2																																																																										
	0	1	0	–	FM1, FM2, MW1																																																																										
	0	1	1	–	FM1, FM2, MW1, MW2																																																																										

Symbol	Description						
M2S	<p>This switch specifies the method to write to the preset memory as follows:</p> <table border="1"> <thead> <tr> <th>M2S</th> <th>Writing method</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Press the <b>ME</b> key to enable writing to the preset memory for 5 seconds, then the <b>M1 (TP1)</b> to <b>M6</b> key.</td> </tr> <tr> <td>1</td> <td>Keep the <b>M1 (TP1)</b> to <b>M6</b> key pressed for at least 2 seconds.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open) See the descriptions of the <b>ME</b> and the <b>M1 (TP1)</b> to <b>M6</b> keys for details.</p>	M2S	Writing method	0	Press the <b>ME</b> key to enable writing to the preset memory for 5 seconds, then the <b>M1 (TP1)</b> to <b>M6</b> key.	1	Keep the <b>M1 (TP1)</b> to <b>M6</b> key pressed for at least 2 seconds.
M2S	Writing method						
0	Press the <b>ME</b> key to enable writing to the preset memory for 5 seconds, then the <b>M1 (TP1)</b> to <b>M6</b> key.						
1	Keep the <b>M1 (TP1)</b> to <b>M6</b> key pressed for at least 2 seconds.						
AUTO500	<p>This switch specifies the function of the <b>MAN UP</b> and <b>MAN DWN</b> keys. With the AUTO500 switch, it is possible to use the <b>MAN UP</b> and <b>MAN DWN</b> keys also for auto-tuning (seek operation), as follows.</p> <table border="1"> <thead> <tr> <th>AUTO500</th> <th><b>MAN UP</b> and <b>MAN DWN</b> key function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Only manual tuning is performed. Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds triggers manual fast increment/decrement.</td> </tr> <tr> <td>1</td> <td>Both manual and auto-tuning are performed. Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds causes auto-tuning (seek operation) to begin at the next channel. The <b>SEEK UP</b> and <b>SEEK DWN</b> keys become ineffective.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	AUTO500	<b>MAN UP</b> and <b>MAN DWN</b> key function	0	Only manual tuning is performed. Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds triggers manual fast increment/decrement.	1	Both manual and auto-tuning are performed. Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds causes auto-tuning (seek operation) to begin at the next channel. The <b>SEEK UP</b> and <b>SEEK DWN</b> keys become ineffective.
AUTO500	<b>MAN UP</b> and <b>MAN DWN</b> key function						
0	Only manual tuning is performed. Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds triggers manual fast increment/decrement.						
1	Both manual and auto-tuning are performed. Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds causes auto-tuning (seek operation) to begin at the next channel. The <b>SEEK UP</b> and <b>SEEK DWN</b> keys become ineffective.						
AUTOLOC	<p>This switch specifies the local function, as follows:</p> <table border="1"> <thead> <tr> <th>AUTOLOC</th> <th>Local function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Either the local or DX mode is selected according to a key entry (no auto-local function available). Each time the <b>LOC</b> key is pressed, switching occurs between the local and DX modes. The local output is high in the local mode during auto-tuning (seek, scan, or auto-store).</td> </tr> <tr> <td>1</td> <td>The auto-local function is performed (if available). The <b>LOC</b> key becomes ineffective. Keeping the <b>SEEK UP</b>, <b>SEEK DWN</b>, <b>SCAN UP</b>, <b>SCAN DWN</b> or <b>P.SCAN</b> key for at least 2 seconds triggers auto-tuning, turns on the "LOC" display, and makes the local output high. After one cycle of auto-tuning is completed, a search begins in the DX mode (with the "LOC" display off and local output at a low level). In modes other than auto-tuning, the "LOC" display is off and the local output is low. If a key for the same operation (for example, the <b>SEEK UP</b> key during seek operation) is pressed in the local mode during auto-tuning, a search begins in the DX mode at the same frequency used when auto-tuning began. If the key is pressed during the DX mode, auto-tuning stops, and the frequency that was selected when auto-tuning began is reselected. The same operation as above occurs when the AUTO500 is set to 1 (by keeping the <b>MAN UP</b> or <b>MAN DWN</b> key pressed for at least 0.5 seconds).</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	AUTOLOC	Local function	0	Either the local or DX mode is selected according to a key entry (no auto-local function available). Each time the <b>LOC</b> key is pressed, switching occurs between the local and DX modes. The local output is high in the local mode during auto-tuning (seek, scan, or auto-store).	1	The auto-local function is performed (if available). The <b>LOC</b> key becomes ineffective. Keeping the <b>SEEK UP</b> , <b>SEEK DWN</b> , <b>SCAN UP</b> , <b>SCAN DWN</b> or <b>P.SCAN</b> key for at least 2 seconds triggers auto-tuning, turns on the "LOC" display, and makes the local output high. After one cycle of auto-tuning is completed, a search begins in the DX mode (with the "LOC" display off and local output at a low level). In modes other than auto-tuning, the "LOC" display is off and the local output is low. If a key for the same operation (for example, the <b>SEEK UP</b> key during seek operation) is pressed in the local mode during auto-tuning, a search begins in the DX mode at the same frequency used when auto-tuning began. If the key is pressed during the DX mode, auto-tuning stops, and the frequency that was selected when auto-tuning began is reselected. The same operation as above occurs when the AUTO500 is set to 1 (by keeping the <b>MAN UP</b> or <b>MAN DWN</b> key pressed for at least 0.5 seconds).
AUTOLOC	Local function						
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1	The auto-local function is performed (if available). The <b>LOC</b> key becomes ineffective. Keeping the <b>SEEK UP</b> , <b>SEEK DWN</b> , <b>SCAN UP</b> , <b>SCAN DWN</b> or <b>P.SCAN</b> key for at least 2 seconds triggers auto-tuning, turns on the "LOC" display, and makes the local output high. After one cycle of auto-tuning is completed, a search begins in the DX mode (with the "LOC" display off and local output at a low level). In modes other than auto-tuning, the "LOC" display is off and the local output is low. If a key for the same operation (for example, the <b>SEEK UP</b> key during seek operation) is pressed in the local mode during auto-tuning, a search begins in the DX mode at the same frequency used when auto-tuning began. If the key is pressed during the DX mode, auto-tuning stops, and the frequency that was selected when auto-tuning began is reselected. The same operation as above occurs when the AUTO500 is set to 1 (by keeping the <b>MAN UP</b> or <b>MAN DWN</b> key pressed for at least 0.5 seconds).						

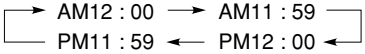
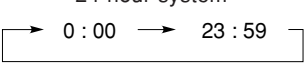
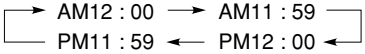
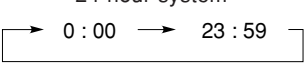
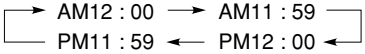
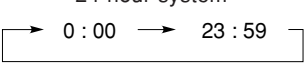


Symbol	Description											
PRI01 PRI02	<p>These switches specify a privileged display. The term privileged display means the display which is resumed in five seconds after any other display is selected, if no key is pressed.</p> <p>The PRI01 and PRI02 switches can determine the privileged display only when the NOCLK initial setting diode = 0 (with a clock). If NOCLK = 1 (without a clock), the states of these switches are ignored.</p> <table border="1"> <thead> <tr> <th>PRI01</th> <th>PRI02</th> <th>Privileged display</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>None</td> <td> <p>Display switching occurs when the <b>DISP</b> key or a preset number key is pressed.</p> <ul style="list-style-type: none"> <li>• <b>During the radio mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the frequency and clock displays. Pressing a preset number key during clock display causes the frequency display to appear.</li> <li>• <b>During the tape mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the "TRPE" and clock displays.</li> <li>• <b>During the CD mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the "CD" and clock displays.</li> <li>• <b>During the DK-standby tape and radio-monitor tape modes</b> Each time the <b>DISP</b> key is pressed, switching occurs among the "TRPE", frequency, and clock displays. Pressing the preset number key during "TRPE" or clock display causes the frequency display to appear. The DK-standby tape and radio-monitor tape modes begin with the frequency display.</li> <li>• <b>During the DK-standby CD and radio-monitor CD modes</b> Each time the <b>DISP</b> key is pressed, switching occurs among the "CD", frequency, and clock displays. Pressing a preset number key during "CD" or clock display causes the frequency display to appear. The DK-standby CD and radio-monitor CD modes begin with the frequency display.</li> <li>• <b>During the DK-receiving tape and DK-receiving CD modes</b> Usually the frequency display appears and remains. The <b>DISP</b> key is ineffective.</li> </ul> </td> </tr> </tbody> </table> <p>(0: Open)</p>				PRI01	PRI02	Privileged display	Description	0	0	None	<p>Display switching occurs when the <b>DISP</b> key or a preset number key is pressed.</p> <ul style="list-style-type: none"> <li>• <b>During the radio mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the frequency and clock displays. Pressing a preset number key during clock display causes the frequency display to appear.</li> <li>• <b>During the tape mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the "TRPE" and clock displays.</li> <li>• <b>During the CD mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the "CD" and clock displays.</li> <li>• <b>During the DK-standby tape and radio-monitor tape modes</b> Each time the <b>DISP</b> key is pressed, switching occurs among the "TRPE", frequency, and clock displays. Pressing the preset number key during "TRPE" or clock display causes the frequency display to appear. The DK-standby tape and radio-monitor tape modes begin with the frequency display.</li> <li>• <b>During the DK-standby CD and radio-monitor CD modes</b> Each time the <b>DISP</b> key is pressed, switching occurs among the "CD", frequency, and clock displays. Pressing a preset number key during "CD" or clock display causes the frequency display to appear. The DK-standby CD and radio-monitor CD modes begin with the frequency display.</li> <li>• <b>During the DK-receiving tape and DK-receiving CD modes</b> Usually the frequency display appears and remains. The <b>DISP</b> key is ineffective.</li> </ul>
PRI01	PRI02	Privileged display	Description									
0	0	None	<p>Display switching occurs when the <b>DISP</b> key or a preset number key is pressed.</p> <ul style="list-style-type: none"> <li>• <b>During the radio mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the frequency and clock displays. Pressing a preset number key during clock display causes the frequency display to appear.</li> <li>• <b>During the tape mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the "TRPE" and clock displays.</li> <li>• <b>During the CD mode</b> Each time the <b>DISP</b> key is pressed, switching occurs between the "CD" and clock displays.</li> <li>• <b>During the DK-standby tape and radio-monitor tape modes</b> Each time the <b>DISP</b> key is pressed, switching occurs among the "TRPE", frequency, and clock displays. Pressing the preset number key during "TRPE" or clock display causes the frequency display to appear. The DK-standby tape and radio-monitor tape modes begin with the frequency display.</li> <li>• <b>During the DK-standby CD and radio-monitor CD modes</b> Each time the <b>DISP</b> key is pressed, switching occurs among the "CD", frequency, and clock displays. Pressing a preset number key during "CD" or clock display causes the frequency display to appear. The DK-standby CD and radio-monitor CD modes begin with the frequency display.</li> <li>• <b>During the DK-receiving tape and DK-receiving CD modes</b> Usually the frequency display appears and remains. The <b>DISP</b> key is ineffective.</li> </ul>									

Symbol	Description			
PRI01 PRI02	PRI01	PRI02	Privileged display	Description
	1	0	Frequency <i>CD</i> <i>TAPE</i>	<p>In 5 seconds after the <b>[DISP]</b> key is pressed to shift from the frequency, "<i>CD</i>", or "<i>TAPE</i>" display to the clock display, the previous display is resumed if no other key is pressed.</p> <ul style="list-style-type: none"> <li> <p>• <b>During the radio mode</b>                              Usually the frequency display appears and remains. Pressing the <b>[DISP]</b> key causes the clock display to appear for 5 seconds.                              Pressing the <b>[DISP]</b> key or a preset number key within this 5-second period of the clock display resumes the frequency display.</p> </li> <li> <p>• <b>During the tape mode</b>                              Usually the "<i>TAPE</i>" display appears and remains. Pressing the <b>[DISP]</b> key causes the clock display to appear for 5 seconds.                              Pressing the <b>[DISP]</b> key again within this 5-second period of clock display resumes the "<i>TAPE</i>" display.</p> </li> <li> <p>• <b>During the CD mode</b>                              Usually the "<i>CD</i>" display appears and remains. Pressing the <b>[DISP]</b> key causes the clock display to appear for 5 seconds.                              Pressing the <b>[DISP]</b> key again within this 5-second period of the clock display resumes the "<i>CD</i>" display.</p> </li> <li> <p>• <b>During the DK-standby tape and radio-monitor tape modes</b>                              Usually the "<i>TAPE</i>" display appears and remains. Pressing the <b>[DISP]</b> key causes the frequency display to appear for 5 seconds.                              Pressing the <b>[DISP]</b> key again within this 5-second period of the frequency display causes the clock display to appear.                              Pressing the <b>[DISP]</b> key again within this 5-second period of the clock display causes the "<i>TAPE</i>" display to appear.                              Pressing a preset number key during "<i>TAPE</i>" or clock display causes the frequency display to appear for 5 seconds.</p> </li> <li> <p>• <b>During the DK-standby CD and radio-monitor CD modes</b>                              Usually the "<i>CD</i>" display appears and remains. Pressing the <b>[DISP]</b> key causes the frequency display to appear for 5 seconds.                              Pressing the <b>[DISP]</b> key again within this 5-second period of the frequency display causes the clock display to appear.                              Pressing the <b>[DISP]</b> key again within this 5-second period of the clock display causes the "<i>CD</i>" display to appear.                              Pressing a preset number key during "<i>CD</i>" or clock display causes the frequency display to appear for 5 seconds.</p> </li> <li> <p>• <b>During the DK-receiving tape and DK-receiving CD modes</b>                              Always the frequency display appears and remains. The <b>[DISP]</b> key is ineffective.</p> </li> </ul>
(1: Shorted by the diode; 0: Open)				

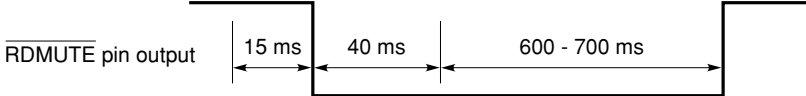
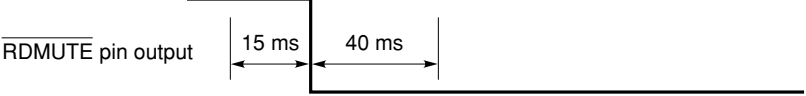
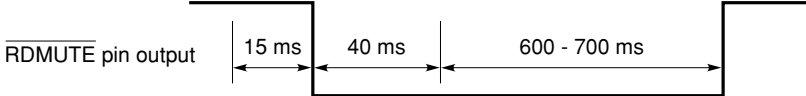
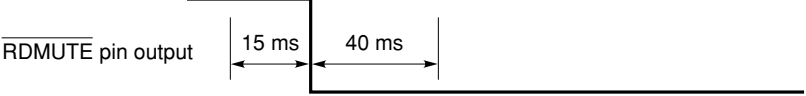
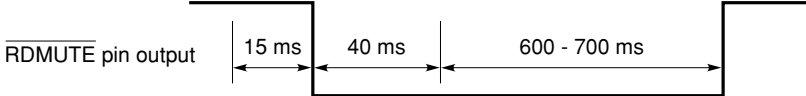
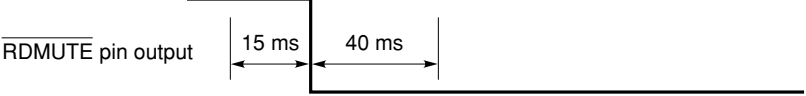
Symbol	Description			
PRI01 PRI02	PRI01	PRI02	Privileged display	Description
	0	1	Clock	<p>The clock display has precedence over the other displays.</p> <ul style="list-style-type: none"> <li> <b>• During the radio mode</b>                      Usually the clock display appears and remains. Pressing the <b>DISP</b> key causes the frequency display to appear for 5 seconds.                      Pressing the <b>DISP</b> key again within this 5-second period of frequency display resumes the clock display.                 </li> <li> <b>• During the tape mode</b>                      Usually the clock display appears and remains. Pressing the <b>DISP</b> key causes the "TAPPE" display to appear for 5 seconds.                      Pressing the <b>DISP</b> key again within this 5-second period of "TAPPE" display resumes the clock display.                 </li> <li> <b>• During the CD mode</b>                      Usually the clock display appears and remains. Pressing the <b>DISP</b> key causes the "CD" display to appear for 5 seconds.                      Pressing the <b>DISP</b> key again within this 5-second period of the "CD" display resumes the clock display.                 </li> <li> <b>• During the DK-standby tape and radio-monitor tape modes</b>                      Usually the clock display appears and remains. Pressing the <b>DISP</b> key causes the "TAPPE" display to appear for 5 seconds.                      Pressing the <b>DISP</b> key again within this 5-second period of the "TAPPE" display causes the frequency display to appear.                      Pressing the <b>DISP</b> key again within this 5-second period of the frequency display causes the clock display to appear.                      Pressing a preset number key during "TAPPE" or clock display causes the frequency display to appear for 5 seconds.                 </li> <li> <b>• During the DK-standby CD and radio-monitor CD modes</b>                      Usually the clock display appears and remains. Pressing the <b>DISP</b> key causes the "CD" display to appear for 5 seconds.                      Pressing the <b>DISP</b> key again within this 5-second period of the "CD" display causes the frequency display to appear.                      Pressing the <b>DISP</b> key again within this 5-second period of the frequency display causes the clock display to appear.                      Pressing a preset number key during "CD" or clock display causes the frequency display to appear for 5 seconds.                 </li> <li> <b>• During the DK-receiving tape and DK-receiving CD modes</b>                      The frequency display appears and remains. The <b>DISP</b> key is ineffective.                 </li> </ul>
	1	1	—	Do not select this mode.

(1: Shorted by the diode; 0: Open)

Symbol	Description										
PRIO1 PRIO2	<p>If a clock is unavailable (NOCLK = 1), one of the displays listed below appears depending on what the current mode is, regardless of the states of the PRIO1 and PRIO2 switches. The <b>DISP</b> key is ineffective.</p> <table border="1"> <thead> <tr> <th>Mode</th> <th>Display</th> </tr> </thead> <tbody> <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> <ul style="list-style-type: none"> <li>• DK-standby tape mode</li> <li>• DK-standby CD mode</li> <li>• DK-receiving tape mode</li> <li>• DK-receiving CD mode</li> <li>• Radio-monitor tape mode</li> <li>• Radio-monitor CD mode</li> </ul> </td> <td>Frequency</td> </tr> </tbody> </table>	Mode	Display	Radio mode	Frequency	Tape mode	TAPE	CD mode	CD	<ul style="list-style-type: none"> <li>• DK-standby tape mode</li> <li>• DK-standby CD mode</li> <li>• DK-receiving tape mode</li> <li>• DK-receiving CD mode</li> <li>• Radio-monitor tape mode</li> <li>• Radio-monitor CD mode</li> </ul>	Frequency
Mode	Display										
Radio mode	Frequency										
Tape mode	TAPE										
CD mode	CD										
<ul style="list-style-type: none"> <li>• DK-standby tape mode</li> <li>• DK-standby CD mode</li> <li>• DK-receiving tape mode</li> <li>• DK-receiving CD mode</li> <li>• Radio-monitor tape mode</li> <li>• Radio-monitor CD mode</li> </ul>	Frequency										
RDON	<p>This switch specifies the method to switch on and off the radio, as follows:</p> <table border="1"> <thead> <tr> <th>RDON</th> <th>Method to switch on and off the radio</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Turn on the RDSET switch.</td> </tr> <tr> <td>1</td> <td>Set the CE pin to a high level. The RDSET switch is ineffective.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	RDON	Method to switch on and off the radio	0	Turn on the RDSET switch.	1	Set the CE pin to a high level. The RDSET switch is ineffective.				
RDON	Method to switch on and off the radio										
0	Turn on the RDSET switch.										
1	Set the CE pin to a high level. The RDSET switch is ineffective.										
NOCLK	<p>This switch specifies whether a clock is available.</p> <table border="1"> <thead> <tr> <th>NOCLK</th> <th>Clock</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Available</td> </tr> <tr> <td>1</td> <td>Unavailable</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p> <p>If a clock is unavailable, setting the CE pin to a low level makes it possible to back up the circuit with a low current of 10 μA (maximum).</p>	NOCLK	Clock	0	Available	1	Unavailable				
NOCLK	Clock										
0	Available										
1	Unavailable										
CLKDISP	<p>This switch specifies the clock display system (12/24) as follows:</p> <table border="1"> <thead> <tr> <th>CLKDISP</th> <th>Clock display system</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>                     12-hour system   </td> </tr> <tr> <td>1</td> <td>                     24-hour system   </td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	CLKDISP	Clock display system	0	12-hour system 	1	24-hour system 				
CLKDISP	Clock display system										
0	12-hour system 										
1	24-hour system 										

Symbol	Description						
FLASH	<p>This switch specifies how a colon (:) is used in the clock display, as follows:</p> <table border="1"> <thead> <tr> <th>FLASH</th> <th>Colon (:) display</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Stays on.</td> </tr> <tr> <td>1</td> <td>                     Blinks.                     <ul style="list-style-type: none"> <li>• Frequency: 1 Hz</li> <li>• Duty cycle: 6 on and 4 off</li> </ul> </td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	FLASH	Colon (:) display	0	Stays on.	1	Blinks. <ul style="list-style-type: none"> <li>• Frequency: 1 Hz</li> <li>• Duty cycle: 6 on and 4 off</li> </ul>
FLASH	Colon (:) display						
0	Stays on.						
1	Blinks. <ul style="list-style-type: none"> <li>• Frequency: 1 Hz</li> <li>• Duty cycle: 6 on and 4 off</li> </ul>						
CKHLT	<p>When the NOCLK initial setting diode = 1, and CE = low, the CKHLT switch specifies which standby mode is to be used, STOP or HALT.</p> <table border="1"> <thead> <tr> <th>CKHLT</th> <th>CE = low</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>STOP mode</td> </tr> <tr> <td>1</td> <td>HALT mode</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	CKHLT	CE = low	0	STOP mode	1	HALT mode
CKHLT	CE = low						
0	STOP mode						
1	HALT mode						

Symbol	Description																																																																					
KAMS KNR KMTL	<p>These keys are used to assign tape functions (such as AMS, NR, and MTL) to the radio function keys. The shared keys are selected as follows:</p> <table border="1"> <thead> <tr> <th rowspan="2">KAMS</th> <th rowspan="2">KNR</th> <th rowspan="2">KMTL</th> <th colspan="3">Shared key</th> </tr> <tr> <th>M1 (TP1)</th> <th>M2 (TP2)</th> <th>M3 (TP3)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>1</td> <td>AMS</td> <td>NR</td> <td>MTL</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>AMS</td> <td>NR</td> <td>—</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>AMS</td> <td>MTL</td> <td>—</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>AMS</td> <td>—</td> <td>—</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>NR</td> <td>MTL</td> <td>—</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>NR</td> <td>—</td> <td>—</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>MTL</td> <td>—</td> <td>—</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>—</td> <td>—</td> <td>—</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p> <p>When these tape functions are used, the M1 (TP1) to M6 keys function in the DK-standby tape mode as follows:</p> <table border="1"> <thead> <tr> <th>KAMS</th> <th>KNR</th> <th>KMTL</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>The M1 (TP1) to M6 keys are used to access a preset memory and enable or disable writing to it (radio function).</td> </tr> <tr> <td colspan="3">When any switch is 1:</td> <td>Any of the M1 (TP1) to M6 keys has no radio function. The M1 (TP1) to M3 (TP3) have the tape functions.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p> <p>Regardless of the states of the KAMS, KNR, and KMTL switches, the M1 (TP1) to M6 keys are used to access a preset memory and enable or disable writing to it.</p> <ul style="list-style-type: none"> <li>• DK-receiving tape mode</li> <li>• Radio-monitor tape mode</li> <li>• DK-receiving CD mode</li> <li>• DK-standby CD mode</li> <li>• Radio-monitor CD mode</li> </ul>	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	—	—	—	KAMS	KNR	KMTL	Description	0	0	0	The M1 (TP1) to M6 keys are used to access a preset memory and enable or disable writing to it (radio function).	When any switch is 1:			Any of the M1 (TP1) to M6 keys has no radio function. The M1 (TP1) to M3 (TP3) have the tape functions.
KAMS	KNR				KMTL	Shared key																																																																
		M1 (TP1)	M2 (TP2)	M3 (TP3)																																																																		
1	1	1	AMS	NR	MTL																																																																	
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Symbol	Description																																				
<p>MUTESEL</p>	<p>This switch specifies how the state of the <math>\overline{\text{RDMUTE}}</math> pin output is to change during the tape and CD modes, as follows:</p> <table border="1"> <thead> <tr> <th>MUTESEL</th> <th><math>\overline{\text{RDMUTE}}</math> pin output</th> </tr> </thead> <tbody> <tr> <td> <p>1</p> </td> <td> <p>The mute function is disabled during the tape and CD modes.</p>  <p>Low level output at the MODE pin</p> <p>The mode is switched by the TPSET and CDSET switches.</p> <p>When MUTESEL = 1, do not use the DK standby and radio monitor functions.</p> </td> </tr> <tr> <td> <p>0</p> </td> <td> <p>The mute function remains turned on during the tape and CD modes.</p>  <p>Low level output at the MODE pin</p> <p>The mode is switched by the TPSET and CDSET switches.</p> </td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open) See <b>Chapter 5</b> for details.</p>	MUTESEL	$\overline{\text{RDMUTE}}$ pin output	<p>1</p>	<p>The mute function is disabled during the tape and CD modes.</p>  <p>Low level output at the MODE pin</p> <p>The mode is switched by the TPSET and CDSET switches.</p> <p>When MUTESEL = 1, do not use the DK standby and radio monitor functions.</p>	<p>0</p>	<p>The mute function remains turned on during the tape and CD modes.</p>  <p>Low level output at the MODE pin</p> <p>The mode is switched by the TPSET and CDSET switches.</p>																														
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<p>ENFMIF ENAMIF</p>	<p>These switches specify whether to use the frequency counter to detect a broadcasting station, as follows:</p> <table border="1"> <thead> <tr> <th>ENFMIF</th> <th>ENAMIF</th> <th>Band</th> <th>Method to detect a station</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>FM, VF</td> <td>Frequency counter and SD method</td> </tr> <tr> <td>1</td> <td>1</td> <td>MW, LW</td> <td>Frequency counter and SD method</td> </tr> <tr> <td>1</td> <td>0</td> <td>FM, VF</td> <td>Frequency counter and SD method</td> </tr> <tr> <td>1</td> <td>0</td> <td>MW, LW</td> <td>SD method</td> </tr> <tr> <td>0</td> <td>1</td> <td>FM, VF</td> <td>SD method</td> </tr> <tr> <td>0</td> <td>1</td> <td>MW, LW</td> <td>Frequency counter and SD method</td> </tr> <tr> <td>0</td> <td>0</td> <td>FM, VF</td> <td>SD method</td> </tr> <tr> <td>0</td> <td>0</td> <td>MW, LW</td> <td>SD method</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	ENFMIF	ENAMIF	Band	Method to detect a station	1	1	FM, VF	Frequency counter and SD method	1	1	MW, LW	Frequency counter and SD method	1	0	FM, VF	Frequency counter and SD method	1	0	MW, LW	SD method	0	1	FM, VF	SD method	0	1	MW, LW	Frequency counter and SD method	0	0	FM, VF	SD method	0	0	MW, LW	SD method
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<p>DISAMEMO</p>	<p>This switch is used to inhibit the auto-storage function, as follows:</p> <table border="1"> <thead> <tr> <th>DISAMEMO</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>The auto-storage function is enabled. Keeping the <b>[P.SCAN]</b> key pressed for at least 2 seconds triggers the auto-storage operation.</td> </tr> <tr> <td>1</td> <td>The auto-storage function is disabled. The <b>[P.SCAN]</b> key can be used only for the preset scan function.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	DISAMEMO	Description	0	The auto-storage function is enabled. Keeping the <b>[P.SCAN]</b> key pressed for at least 2 seconds triggers the auto-storage operation.	1	The auto-storage function is disabled. The <b>[P.SCAN]</b> key can be used only for the preset scan function.																														
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Symbol	Description						
IFAM	<p>This switch specifies the intermediate frequency for the AM band (MW and LW), as follows:</p> <table border="1"> <thead> <tr> <th>IFAM</th> <th>Intermediate frequency</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>450 kHz</td> </tr> <tr> <td>1</td> <td>10.71 MHz</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	IFAM	Intermediate frequency	0	450 kHz	1	10.71 MHz
IFAM	Intermediate frequency						
0	450 kHz						
1	10.71 MHz						
VF1	<p>This switch specifies whether to enable the VF band auto-retuning function (to perform an automatic seek-up operation upon deteriorated reception state), as follows:</p> <table border="1"> <thead> <tr> <th>VF1</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>The VF band auto-retuning function is enabled.</td> </tr> <tr> <td>0</td> <td>The VF band auto-retuning function is disabled. However, a seek-up operation is performed to detect a traffic information station if one has not been received when the VF band is selected.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	VF1	Description	1	The VF band auto-retuning function is enabled.	0	The VF band auto-retuning function is disabled. However, a seek-up operation is performed to detect a traffic information station if one has not been received when the VF band is selected.
VF1	Description						
1	The VF band auto-retuning function is enabled.						
0	The VF band auto-retuning function is disabled. However, a seek-up operation is performed to detect a traffic information station if one has not been received when the VF band is selected.						
MWS	<p>This switch specifies whether to enable the MW band stereo reception function, as follows:</p> <table border="1"> <thead> <tr> <th>MWS</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>The MW band stereo reception function is enabled.</td> </tr> <tr> <td>0</td> <td>The MW band stereo reception function is disabled.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	MWS	Description	1	The MW band stereo reception function is enabled.	0	The MW band stereo reception function is disabled.
MWS	Description						
1	The MW band stereo reception function is enabled.						
0	The MW band stereo reception function is disabled.						



Symbol	Description						
FAD_SEL	<p>This switch specifies whether to enable the electronic volume control fader function, as follows:</p> <table border="1"> <thead> <tr> <th>FAD_SEL</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td> <p>The fader function is enabled. Pressing the <b>VOL SEL</b> key switches the electronic volume control mode as shown below.</p> </td> </tr> <tr> <td>1</td> <td> <p>The fader function is disabled. Pressing the <b>VOL SEL</b> key switches the electronic volume control mode as shown below.</p> </td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	FAD_SEL	Description	0	<p>The fader function is enabled. Pressing the <b>VOL SEL</b> key switches the electronic volume control mode as shown below.</p>	1	<p>The fader function is disabled. Pressing the <b>VOL SEL</b> key switches the electronic volume control mode as shown below.</p>
FAD_SEL	Description						
0	<p>The fader function is enabled. Pressing the <b>VOL SEL</b> key switches the electronic volume control mode as shown below.</p>						
1	<p>The fader function is disabled. Pressing the <b>VOL SEL</b> key switches the electronic volume control mode as shown below.</p>						
VKysel	<p>This switch specifies what keys are used for volume control in each electronic volume control mode, as follows:</p> <table border="1"> <thead> <tr> <th>VKysel</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>The <b>VOL UP</b> and <b>VOL DWN</b> keys are used for volume control in each electronic volume control mode.</td> </tr> <tr> <td>1</td> <td>The <b>MAN UP</b> and <b>MAN DWN</b> keys are used for volume control in each electronic volume control mode. The <b>VOL UP</b> or <b>VOL DWN</b> key is unusable for volume control.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	VKysel	Description	0	The <b>VOL UP</b> and <b>VOL DWN</b> keys are used for volume control in each electronic volume control mode.	1	The <b>MAN UP</b> and <b>MAN DWN</b> keys are used for volume control in each electronic volume control mode. The <b>VOL UP</b> or <b>VOL DWN</b> key is unusable for volume control.
VKysel	Description						
0	The <b>VOL UP</b> and <b>VOL DWN</b> keys are used for volume control in each electronic volume control mode.						
1	The <b>MAN UP</b> and <b>MAN DWN</b> keys are used for volume control in each electronic volume control mode. The <b>VOL UP</b> or <b>VOL DWN</b> key is unusable for volume control.						
EVOLSEL	<p>This switch specifies the electronic volume control as follows:</p> <table border="1"> <thead> <tr> <th>EVOLSEL</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Electronic volume control A is used.</td> </tr> <tr> <td>1</td> <td>Electronic volume control B is used.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	EVOLSEL	Description	0	Electronic volume control A is used.	1	Electronic volume control B is used.
EVOLSEL	Description						
0	Electronic volume control A is used.						
1	Electronic volume control B is used.						
KLCD	<p>This switch specifies the LCD controller/key scan driver to be used, as follows:</p> <table border="1"> <thead> <tr> <th>KLCD</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>The internal LCD controller/key scan driver is used. Momentary keys are read by the μPD17012GF-057.</td> </tr> <tr> <td>1</td> <td>The external LCD controller/key scan driver (μPD17202AGF-011) is used. Momentary keys are read by the μPD17202AGF-011.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	KLCD	Description	0	The internal LCD controller/key scan driver is used. Momentary keys are read by the μPD17012GF-057.	1	The external LCD controller/key scan driver (μPD17202AGF-011) is used. Momentary keys are read by the μPD17202AGF-011.
KLCD	Description						
0	The internal LCD controller/key scan driver is used. Momentary keys are read by the μPD17012GF-057.						
1	The external LCD controller/key scan driver (μPD17202AGF-011) is used. Momentary keys are read by the μPD17202AGF-011.						

Symbol	Description															
VOLATT_H VOLATT_L	<p>These switches specify the attenuator of the preamplifier incorporated in the electronic volume control (only when electronic volume control A is used).</p> <table border="1"> <thead> <tr> <th>VOLATT_H</th> <th>VOLATT_L</th> <th>Volume attenuator (dB)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>11.25</td> </tr> <tr> <td>0</td> <td>1</td> <td>7.5</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>3.75</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p>	VOLATT_H	VOLATT_L	Volume attenuator (dB)	0	0	11.25	0	1	7.5	1	0	0	1	1	3.75
VOLATT_H	VOLATT_L	Volume attenuator (dB)														
0	0	11.25														
0	1	7.5														
1	0	0														
1	1	3.75														

**2.5 ALTERNATION OR TRANSISTOR SWITCH**

In the following table, a statement that a switch is on (off) means that a high (low) level is input.

Symbol	Description													
CDSET	This switch selects the CD mode. It is effective only when the CE pins is at a high level. Setting this switch to on selects the CD mode.													
TPSET	This switch selects the tape mode. It is effective only when the CE pins is at a high level. If the CDSET switch is off, setting the TPSET switch to on selects the tape mode.													
RDSET	This switch selects the radio mode. It is effective only when the CE pin is at a high level. If both CDSET and TPSET switches are off, setting the RDSET switch to on selects the radio mode. The RDSET switch is effective if the RDON initial setting diode = 0. It is ineffective if RDON = 1.													
FF	<p>This is the fast forward signal input switch for the tape mode.</p> <p>The tape run direction indicator (◀▶) may light depending on the state of the RL switch as listed below.</p> <table border="1"> <thead> <tr> <th>FF</th> <th>RL</th> <th>Indicator</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>(▶ : Does not light   ▶ : Lights   ▶ : Blinks (at 2.5 Hz) 0 : Off   1 : On)</p>	FF	RL	Indicator	0	0	◀▶	1	▶▶	1	0	▶▶	1	◀▶
FF	RL	Indicator												
0	0	◀▶												
	1	▶▶												
1	0	▶▶												
	1	◀▶												
RL	This is the forward run signal input switch for the tape mode. The tape run direction indicator (◀▶) is controlled according to the state of the FF switch. See the description of the FF switch for the state of the indicator.													

Symbol	Description
DTH	This is the input switch to specify whether the detachable panel is attached. When this switch is off, it indicates that the panel is detached.
ST	This switch is a stereo signal input switch for the radio mode. For the FM and VF bands during the radio mode, setting this switch to on turns on the "ST" display. If the stereo reception function is available for the MW band (initial setting diode MWS = 1), setting the ST switch to on with the MW band selected turns on the "ST" display. However, the display is turned off in the monaural state.
DK	DK signal input switch of a VF station If the input on this switch is kept high for two seconds or longer in the DK-standby tape mode or DK-standby CD mode, traffic information is received. The mode is changed to the DK-receiving tape mode or DK-receiving CD mode.
SK	SK signal input switch of a VF station If the input goes high when it is judged that a station is found in the FM or VF band (the judging method depends on the setting of the initial setting diode ENFMIF), the presence of a traffic information station is assumed. In the VF band, this input is used as the auto-tuning stop signal. The input is checked 400 ms after a station is found while auto-tuning in the VF band. If the input is high, it is judged that a traffic information station has been found. Auto-tuning is stopped.

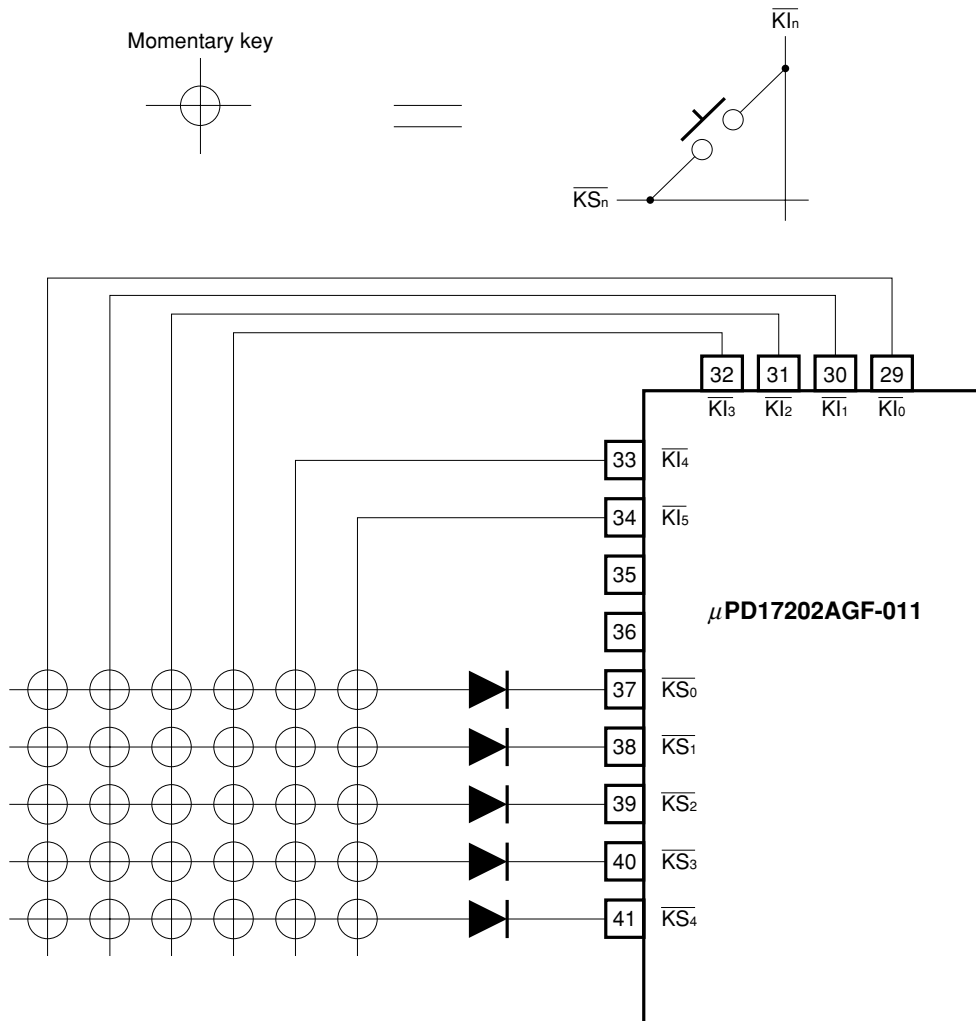
2.6 MOMENTARY KEYS

2.6.1 Momentary Key Matrix Placement (When KLCD = 1 (The μPD17202AGF-011 Is Used))

Key return (pin number) / Key source (pin number)	$\overline{KI}_5$ (34)	$\overline{KI}_4$ (33)	$\overline{KI}_3$ (32)	$\overline{KI}_2$ (31)	$\overline{KI}_1$ (30)	$\overline{KI}_0$ (29)
$\overline{KS}_0$ (37)	M1 (TP1)	M2 (TP2)	M3 (TP3)	M4	M5	M6
$\overline{KS}_1$ (38)	ME	DISP	P. SCAN	LOUD	LOC	MTL
$\overline{KS}_2$ (39)	MAN UP	MAN DWN	SEEK UP	SCAN UP	BAND	VF
$\overline{KS}_3$ (40)	SEEK DWN	SCAN DWN	MONO	AMS	NR	RDMONI
$\overline{KS}_4$ (41)	POWER	VOL SEL	VOL UP	VOL DWN	MUTE	CD

- Remarks 1.**  $\overline{KI}_0$  to  $\overline{KI}_5$  and  $\overline{KS}_0$  to  $\overline{KS}_4$  are the pins of the μPD17202AGF-011.  
**2.** See Section 2.4 for details of KLCD.

2.6.2 Momentary Key Matrix Connection (When KLCD = 1 (The μPD17202AGF-011 Is Used))



**2.6.3 Description of the Momentary Keys (When KLCD = 0 (Internal LCD Controller/Key Scan Driver Is Used) or KLCD = 1 (the μPD17202AGF-011 Is Used))**

Symbol	Description				
M1(TP1)	<p>During the radio mode, these keys are used to access a preset memory and control whether to enable writing to it. During the tape mode, the keys are used for a tape function depending on the settings of the KAMS, KNR, and KMTL initial setting diodes.</p> <p><b>(1) During the radio, DK-standby tape, DK-standby CD, DK-receiving tape, DK-receiving CD, radio-monitor tape, and radio-monitor CD modes</b></p> <p>The M1 (TP1) to M6 keys are used to access a preset memory and control whether to enable writing to it. Each key can be set to the FM1, FM2, FM3, VF, MW1, MW2 and LW bands (up to six bands) separately.</p> <p>The functions of these keys vary depending on the state of the M2S initial setting diode, as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">M2S</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td> <p>Pressing the ME key during frequency display enables writing to the preset memories for 5 seconds. Pressing one of the M1 (TP1) to M6 keys during this 5-second period writes the frequency being currently received to the preset memory corresponding to the pressed key.</p> <p>If the ME key is kept pressed, writing to the preset memories is disabled. The radio mute signal is not output during writing.</p> <p>The "CH" display and preset number (if displayed) blink at 1 Hz with a duty cycle of 1/2.</p> <p><b>Example</b></p> <p>When the frequency recorded in the currently selected preset memory is being received, pressing the key corresponding to this preset memory does not output a beep except during clock display. During clock display, pressing the key not only generates a beep but also switches to the frequency display.</p> </td> </tr> </tbody> </table> <p>(0: Open)</p>	M2S	Description	0	<p>Pressing the ME key during frequency display enables writing to the preset memories for 5 seconds. Pressing one of the M1 (TP1) to M6 keys during this 5-second period writes the frequency being currently received to the preset memory corresponding to the pressed key.</p> <p>If the ME key is kept pressed, writing to the preset memories is disabled. The radio mute signal is not output during writing.</p> <p>The "CH" display and preset number (if displayed) blink at 1 Hz with a duty cycle of 1/2.</p> <p><b>Example</b></p> <p>When the frequency recorded in the currently selected preset memory is being received, pressing the key corresponding to this preset memory does not output a beep except during clock display. During clock display, pressing the key not only generates a beep but also switches to the frequency display.</p>
M2S		Description			
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M2(TP2)					
M3(TP3)					
M4					
M5					
M6					

Symbol	Description												
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and Near East</td> <td>MW1(kHz)</td> <td>531</td> <td>612</td> <td>963</td> <td>1395</td> <td>531</td> <td>531</td> </tr> <tr> <td>Japan</td> <td>FM1(MHz)</td> <td>76.0</td> <td>76.4</td> <td>85.6</td> <td>76.0</td> <td>76.0</td> <td>76.0</td> </tr> <tr> <td></td> <td>MW1(kHz)</td> <td>522</td> <td>603</td> <td>954</td> <td>1386</td> <td data-bbox="1234 1711 1339 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	<p>The lowest frequency for each area is written to the M1 to M6 preset memories for the MW2 band for the areas other than Europe 1 or Europe 2 and for the FM2, FM3, and VF bands.</p> <ul style="list-style-type: none"> <li>• <b>Operation during the tape mode</b></li> </ul> <p>Some of the <b>M1</b> to <b>M6</b> keys may also be used as the tape function keys depending on the states of the KAMS, KNR, and KMTL initial setting diodes. See <b>Section 2.4</b> for details. For the operation of each of these keys, see the descriptions of the <b>AMS</b>, <b>NR</b>, and <b>MTL</b> keys.</p>																																																																																																								

Symbol	Description
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">VF</div>	<p>This key selects the VF (traffic information) band. The operation triggered by this key varies depending on the state of the VF1 initial setting diode.</p> <p><b>(1) When VF1 = 0 (with no auto-retuning function)</b>            Each time the <span style="border: 1px solid black; padding: 0 2px;">VF</span> key is pressed, the reception band is switched as follows:            VF band ↔ FM, MW, or LW band (whichever band was in use before the VF band was selected)            If the VF band is selected, the "VF" display appears. When the VF band is selected, it is checked whether a VF station is being received. If a station is received (with an SD), and the SK signal is received, the tuner is set to the VF station reception state.            When the VF band is selected, but no VF station is being received, an automatic seek-up operation occurs to search for a VF station. See the description of the <span style="border: 1px solid black; padding: 0 2px;">SEEK UP</span> and <span style="border: 1px solid black; padding: 0 2px;">SEEK DWN</span> keys for the seek-up operation.            During VF station reception, an attempt is made to detect the SD and SK signals at every 40 ms. If it turns out that the SD or SK signal is off more than 256 times at 512 attempts, a beep with 100 ms on and 100 ms off is generated five times.            During VF station reception, either of the following operations occurs depending on the state of the DK signal.</p> <ul style="list-style-type: none"> <li><b>(a) When the DK signal input remains high for at least 2 seconds</b> (checked at every 100 ms): Reception of a traffic information station is assumed.</li> <li><b>(b) When the DK signal input remains low for at least 3 seconds</b> (checked at every 100 ms): It is assumed that a traffic information station is off.</li> </ul> <p><b>(2) When VF1 = 1 (with no auto-retuning function)</b>            Each time the <span style="border: 1px solid black; padding: 0 2px;">VF</span> key is pressed, the reception band is switched as follows:            VF band ↔ FM, MW, or LW band (whichever band was in use before the VF band was selected)            If the VF band is selected, the "VF" display appears. When the VF band is selected, it is checked whether a VF station is being received.            When the VF band is selected, but no VF station is being received, an automatic seek-up operation occurs to search for a VF station. See the description of the <span style="border: 1px solid black; padding: 0 2px;">SEEK UP</span> and <span style="border: 1px solid black; padding: 0 2px;">SEEK DWN</span> keys for the seek-up operation.            During VF station reception, an attempt is made to detect the SD and SK signals at every 40 ms. If it turns out that the SD or SK signal is off more than 256 times at 512 attempts, it is assumed that no VF station is being received, and a seek-up operation occurs.            During VF station reception, either of the following operations occurs depending on the state of the DK signal.</p> <ul style="list-style-type: none"> <li><b>(a) When the DK signal input remains high for at least 2 seconds</b> (checked at every 100 ms): Reception of a traffic information station is assumed.</li> <li><b>(b) When the DK signal input remains low for at least 3 seconds</b> (checked at every 100 ms): It is assumed that a traffic information station is off.</li> </ul>



Symbol	Description				
<p><b>P.SCAN</b></p>	<p>This key functions as a preset scan and auto-storage key. The operation triggered by the key varies depending on the state of the DISAMEMO initial setting diode.</p> <p><b>(1) When DISAMEMO = 0 (with the auto-storage function):</b>                      The operation varies depending on the timing at which the key is operated.</p> <p><b>(a) If the key is released within 2 seconds:</b>                      The preset scan operation begins immediately when the key is released.</p> <p><b>(b) If the key is pressed for at least 2 seconds:</b>                      The auto-storage operation begins when 2 seconds elapse.</p> <p><b>(2) When DISAMEMO = 1 (without the auto-storage function):</b>                      The preset scan operation begins immediately when the key is pressed.</p> <p>The preset scan and auto-storage functions are described below.</p> <ul style="list-style-type: none"> <li>• Preset scan operation                      The contents of each preset memory are called for 5 seconds each time automatically. If a frequency other than those in the preset memories is being received, calling begins at M1. If a frequency recorded in a preset memory is being received, calling begins at the preset memory numbered one higher than that preset memory (for example, at the M4 preset memory if a frequency recorded in the M3 preset memory is being received). This operation is illustrated below.</li> </ul> <p><b>Example</b> If the FM1 band is being received:</p> <p style="text-align: center;">FM1</p> <div style="text-align: center; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>➔ M1 → M2 → M3 → M4 → M5 → M6 —</p> </div> <p>The same operation occurs for the MW (MW1 and MW2) and LW bands. When the next preset memory is accessed after a 5-second hold period, a beep is generated. During each 5-second period, the preset memory number display blinks at 1 Hz (with a duty cycle of 50%). The "CH" display does not blink. To stop preset memory scanning during a 5-second hold period, press the <b>P. SCAN</b> key again or a preset memory key that corresponds to the preset memory being currently accessed. It is possible to write to a preset memory when another preset memory is on hold (for example, write to the M5 when the M1 is on hold). When a write operation is completed, the preset scan operation ends. During preset scanning, writing to the preset memory is performed as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">M2S</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td>                     Pressing the <b>ME</b> key enables writing to the preset memories for 5 seconds. When the preset memories are write-enabled, the functions of the <b>M1 (TP1)</b> to <b>M6</b> keys vary depending on what the current mode is, as follows:                     <p><b>(1) During the radio, radio-monitor tape, radio-monitor CD, and DK-standby CD modes</b>                              A frequency is written to the preset memory corresponding to the pressed key, and the preset scan ends.</p> </td> </tr> </tbody> </table> <p>(0: Open)</p>	M2S	Description	0	Pressing the <b>ME</b> key enables writing to the preset memories for 5 seconds. When the preset memories are write-enabled, the functions of the <b>M1 (TP1)</b> to <b>M6</b> keys vary depending on what the current mode is, as follows: <p><b>(1) During the radio, radio-monitor tape, radio-monitor CD, and DK-standby CD modes</b>                              A frequency is written to the preset memory corresponding to the pressed key, and the preset scan ends.</p>
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<p>P.SCAN</p>	<table border="1"> <thead> <tr> <th>Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>M1(TP1)</td> <td rowspan="6"> <p>(2) <b>When M2S = 1:</b></p> <p>(a) <b>During the radio, radio-monitor tape, radio-monitor CD, and DK-standby CD modes</b></p> <p>The scan operation stops. The other operations vary depending on the timing at which the key is released.</p> <ul style="list-style-type: none"> <li>• <b>If the key is released within 2 seconds:</b> The preset memory corresponding to the pressed key is accessed.</li> <li>• <b>If the key is kept pressed for at least 2 seconds:</b> A frequency being currently received is written to the preset memory corresponding to the pressed key.</li> </ul> <p>(b) <b>During the DK-standby tape mode</b></p> <ul style="list-style-type: none"> <li>• <b>When any of the KAMS, KNR, and KMTL switches is on:</b> The scan operation continues. If the pressed key also has a tape function, it works as a tape function key. If the key has no tape function, it becomes ineffective.</li> <li>• <b>When all the KAMS, KNR, and KMTL switches are off:</b> The scan operation stops. The other operations vary depending on the timing at which the key is released.                             <ul style="list-style-type: none"> <li>– <b>If the key is released within 2 seconds:</b> The preset memory corresponding to the pressed key is accessed.</li> <li>– <b>If the key is kept pressed for at least 2 seconds:</b> A frequency being currently received is written to the preset memory corresponding to the pressed key.</li> </ul> </li> </ul> </td> </tr> <tr> <td>M2(TP2)</td> </tr> <tr> <td>M3(TP3)</td> </tr> <tr> <td>M4</td> </tr> <tr> <td>M5</td> </tr> <tr> <td>M6</td> </tr> </tbody> </table> <p>• Auto-storage function</p> <p>Broadcasting stations are searched for automatically. The frequency of a detected station is written to a preset memory. A method used to detect a station is determined according to the states of the ENFMIF and ENAMIF initial setting diodes. A broadcasting station search begins at the frequency being currently received and is performed through the frequencies in the ascending order. When a station is detected, its frequency is written to a preset memory.</p> <p>For the VF band, only when a VF broadcasting station is received, its frequency is written to the preset memory. (The VF station is a station with the SK signal on.)</p> <p>For the voltage with SD, see the description of the SD in <b>Chapter 1</b>.</p> <p>The auto-storage operation varies depending on the state of the AUTOLOC initial setting diode as follows:</p> <p>(1) <b>When AUTOLOC = 0 (with no auto-local function):</b></p> <p>The auto-storage function varies depending on which mode has been selected, local or DX, when the function begins.</p>	Key	Description	M1(TP1)	<p>(2) <b>When M2S = 1:</b></p> <p>(a) <b>During the radio, radio-monitor tape, radio-monitor CD, and DK-standby CD modes</b></p> <p>The scan operation stops. The other operations vary depending on the timing at which the key is released.</p> <ul style="list-style-type: none"> <li>• <b>If the key is released within 2 seconds:</b> The preset memory corresponding to the pressed key is accessed.</li> <li>• <b>If the key is kept pressed for at least 2 seconds:</b> A frequency being currently received is written to the preset memory corresponding to the pressed key.</li> </ul> <p>(b) <b>During the DK-standby tape mode</b></p> <ul style="list-style-type: none"> <li>• <b>When any of the KAMS, KNR, and KMTL switches is on:</b> The scan operation continues. If the pressed key also has a tape function, it works as a tape function key. If the key has no tape function, it becomes ineffective.</li> <li>• <b>When all the KAMS, KNR, and KMTL switches are off:</b> The scan operation stops. The other operations vary depending on the timing at which the key is released.                             <ul style="list-style-type: none"> <li>– <b>If the key is released within 2 seconds:</b> The preset memory corresponding to the pressed key is accessed.</li> <li>– <b>If the key is kept pressed for at least 2 seconds:</b> A frequency being currently received is written to the preset memory corresponding to the pressed key.</li> </ul> </li> </ul>	M2(TP2)	M3(TP3)	M4	M5	M6
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<p>P.SCAN</p>	<p><b>(a) If the DX mode has been selected when the auto-storage function starts:</b></p> <p>A search begins at the frequency being currently received and continues in the ascending order of the frequency. When all frequencies are searched through, the search operation ends. If the <b>P. SCAN</b> key is pressed during the search operation, the auto-storage operation ends, and the frequency selected when the auto-storage operation began is received.</p> <p>When all frequencies are searched through, if at least one station is detected, the contents of the preset memories are updated, and the preset scan begins at the M1 preset memory.</p> <p>How the contents of the preset memories are updated varies depending on the number of stations detected.</p> <ul style="list-style-type: none"> <li>• <b>If six or more stations are detected:</b> If six or more stations are detected, six stations with a higher SD input are selected and written to the preset memories. A lower frequency is written to a lower-numbered preset memory.</li> <li>• <b>If less than six stations are detected:</b> If less than six stations are detected, lower frequencies are written to lower-numbered preset memories. The contents of a preset memory will not be changed if there is no frequency corresponding to it.</li> </ul> <p><b>(b) If the local mode has been selected when the auto-storage function starts:</b></p> <p>A search begins in the local mode at the frequency being currently received and continues in the ascending order of the frequency. When all frequencies are searched through, if six or more stations are not detected, the search switches to the DX mode and continues in it. If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operation ends.</p> <p>Pressing the <b>P. SCAN</b> key during the search operation stops the auto-storage operation, and causes the frequency selected when the auto-storage memory began to be received.</p> <p>If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operation ends. If at least one station is detected, the contents of the preset memories are updated, and the preset scan begins with the M1 preset memory.</p> <p>How the contents of the preset memories are updated varies depending on the number of stations detected, as follows:</p> <ul style="list-style-type: none"> <li>• <b>If six or more stations are detected in the local mode:</b> If six or more stations are detected, six stations with a higher SD input are selected and written to the preset memories. A lower frequency is written to a lower-numbered preset memory</li> <li>• <b>If less than six stations are detected in the local mode and some are detected in the DX mode, resulting in a total of six or more stations being detected:</b> Stations detected in the DX mode with higher SD input levels are selected and added to the number of stations detected in the local mode so that the total becomes six. In this case, the stations detected in the local mode are excluded from those detected in the DX mode. The frequencies of the six stations are written to the preset memories, with a lower frequency written to a lower-numbered preset memory.</li> </ul>

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<p>P.SCAN</p>	<ul style="list-style-type: none"> <li> <p>• <b>If less than six stations are detected in the local mode and some are detected in the DX mode, resulting in a total of less than six stations being detected:</b>                      If the same station is detected in the DX and local modes, the station detected in the DX mode is deleted so that the same frequency will not be written to two preset memories. The frequencies of the less than six stations detected are written to the preset memories, with a lower frequency written to a lower-numbered preset memory. The contents of a preset memory will not be changed if there is no frequency corresponding to it.</p> </li> </ul> <p><b>(2) When AUTOLOC = 1 (with the local function):</b>                      A search begins in the local mode at the frequency being currently received and continues in the ascending order of the frequency. When all frequencies are searched through, if six or more stations are not detected, the search switches to the DX mode and continues in it. If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operations ends.                      Pressing the <b>P. SCAN</b> key in the local mode switches to the DX mode, and restarts the search operation at the frequency selected when the previous search began. Any stations detected in the local mode are made ineffective. (Stations detected in the local mode are excluded during preset memory updating.)                      Pressing the <b>P. SCAN</b> key in the DX mode ends the auto-storage operation, and causes the frequency selected when the auto-storage operation began to be received.                      If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operation ends. If at least one station is detected, the contents of the preset memories are updated, and the preset scan begins with the M1 preset memory.                      How the contents of the preset memories are updated varies depending on the number of stations detected, as follows:</p> <ul style="list-style-type: none"> <li> <p>• <b>If six or more stations are detected in the local mode:</b>                      If six or more stations are detected in the local mode, six stations with a higher SD input are selected and written to the preset memories, with a lower frequency written to a lower-numbered preset memory.</p> </li> <li> <p>• <b>If less than six stations are detected in the local mode, and some are detected in the DX mode, resulting in a total of six or more stations being detected:</b>                      Stations detected in the DX mode with higher SD input levels are selected and added to the number of stations detected in the local mode so that the total becomes six. In this case, the stations detected in the local mode are excluded from those detected in the DX mode.                      The frequencies of the six stations are written to the preset memories, with a lower frequency written to a lower-numbered preset memory.</p> </li> </ul>

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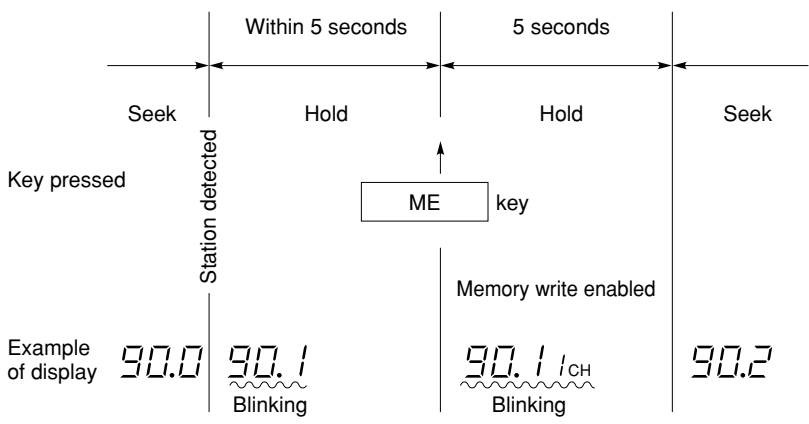
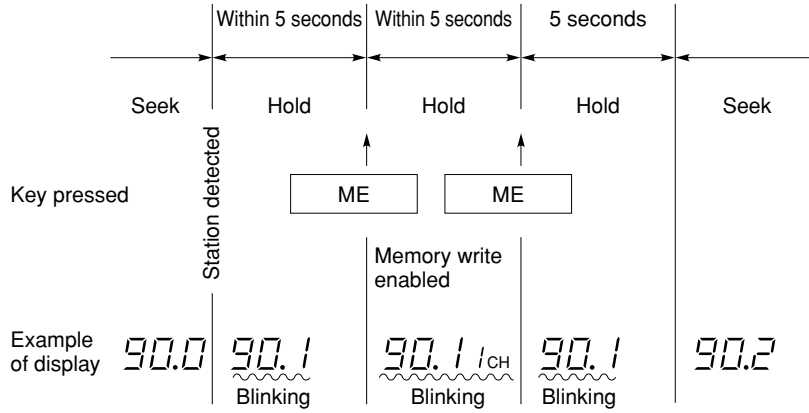
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This operation is repeated (scan operation) sequentially.</p> <p>The frequency display blinks at 1 Hz (with a duty cycle of 50%) during the five-second hold time. A beep occurs at the end of the hold time.</p> <p>The seek operation here is the same as one performed with the <b>SEEK UP</b> or <b>SEEK DWN</b> key. 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Symbol	Description
SCAN UP	
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Key	Description
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<p style="text-align: center;"><b>ME</b></p>	<p>The <b>ME</b> key is used to enable or disable writing to the preset memories during frequency display in the radio mode. During clock display (when the CE pin is at a high level), the <b>ME</b> key is used to adjust the clock in connection with the <b>MAN UP</b> and <b>MAN DWN</b> keys.</p> <p>The operations that occur here vary depending on the state of the M2S initial setting diode.</p> <p><b>(1) When M2S = 0:</b></p> <p style="padding-left: 20px;">The <b>ME</b> key is used to enable or disable writing to the preset memories and to adjust the clock.</p> <p><b>(a) When the frequency is displayed:</b></p> <p style="padding-left: 20px;">The <b>ME</b> key is used to enable or disable writing to the preset memories. Pressing the <b>ME</b> key enables writing to the preset memories for five seconds. During the preset memory write enabled state, the CH display blinks at 1 Hz (with a duty cycle of 50%). If the frequency recorded in a preset memory is being received, the preset memory number display also blinks. The key becomes ineffective during the seek operation (including the seek operation in the scan mode). However, it is effective during the five-second hold time in the scan operation and preset scan operation.</p> <p style="padding-left: 20px;">The other keys function as listed below during the preset memory write enabled state.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 20%;">Key</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>SCAN UP</b></td> <td rowspan="9" style="vertical-align: top;">Writing to the preset memories is inhibited, and the operation corresponding to the pressed key occurs.</td> </tr> <tr> <td style="text-align: center;"><b>SCAN DWN</b></td> </tr> <tr> <td style="text-align: center;"><b>SEEK UP</b></td> </tr> <tr> <td style="text-align: center;"><b>SEEK DWN</b></td> </tr> <tr> <td style="text-align: center;"><b>MAN UP</b></td> </tr> <tr> <td style="text-align: center;"><b>MAN DWN</b></td> </tr> <tr> <td style="text-align: center;"><b>VF</b></td> </tr> <tr> <td style="text-align: center;"><b>P.SCAN</b></td> </tr> </tbody> </table>	Key	Description	<b>SCAN UP</b>	Writing to the preset memories is inhibited, and the operation corresponding to the pressed key occurs.	<b>SCAN DWN</b>	<b>SEEK UP</b>	<b>SEEK DWN</b>	<b>MAN UP</b>	<b>MAN DWN</b>	<b>VF</b>	<b>P.SCAN</b>
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<p style="text-align: center;">ME</p>	<p><b>(2) When M2S = 1</b></p> <p>The <b>ME</b> key is used to switch the display and adjust the clock.</p> <p><b>(a) During frequency, tape, or "CD" display</b></p> <p>The <b>ME</b> key is ineffective if NOCLK initial setting diode = 1. It is also ineffective in the DK-receiving tape and DK-receiving CD modes.</p> <p>When NOCLK = 0, pressing and releasing the <b>ME</b> key switches the display. See the description of the <b>DISP</b> key for details of display switching.</p> <p><b>(b) During clock display in any mode</b></p> <p>The <b>ME</b> key is used to adjust the clock.</p> <p>The minute and hour displays are adjusted by pressing the <b>MAN UP</b> and <b>MAN DWN</b> keys with the <b>ME</b> key held pressed, as follows:</p> <ul style="list-style-type: none"> <li>• <b>Hour adjustment</b></li> </ul> <p>Each time the <b>MAN DWN</b> key is pressed, the hour display is incremented by one. Keeping the key pressed for at least 0.5 seconds increments the hour display at a rate of four per second (one per 250 ms). The continuous increment continues until the key is released. The minute display, second count, or pointer movement is not affected.</p> <ul style="list-style-type: none"> <li>• <b>Minute adjustment</b></li> </ul> <p>Each time the <b>MAN UP</b> key is pressed, the minute display is incremented by one. Keeping the key pressed for at least 0.5 seconds increments the minute display at a rate of eight per second (one per 125 ms). The continuous increment continues until the key is released. No carry-over occurs to the hour display. The second count is reset to 0 at each adjustment.</p> <p>Releasing the <b>ME</b> key without adjusting the clock switches the display. See the description of the <b>DISP</b> key for details of display switching.</p>

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<p>MAN UP MAN DWN</p>	<p>The MAN UP and MAN DWN keys are used to increment and decrement the reception frequency during the radio mode, respectively. During clock display, they are also used in connection with the ME key to adjust the clock. They are again used to increase/decrease the volume of sound during electronic volume control if VKYSEL = 1.</p> <p><b>(1) During the radio, radio-monitor tape, radio-monitor CD, DK-standby tape, DK-standby CD, DK-receiving tape, and DK-receiving CD modes</b>            Either of the following operations occurs depending on the state of the AUTO500 initial setting diode.</p> <table border="1"> <thead> <tr> <th>AUTO500</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td> <p>Each time the MAN UP or MAN DWN key is pressed, the frequency counter is incremented (MAN UP key) or decremented (MAN DWN key) by one step (one channel space).                Keeping the key pressed for at least 0.5 seconds speeds the increment/decrement to a rate of one step per 50 ms.</p> </td> </tr> <tr> <td>1</td> <td> <p>Each time the MAN UP or MAN DWN key is pressed, the frequency counter is incremented (MAN UP key) or decremented (MAN DWN key) by one step (one channel space).                Keeping the key pressed for at least 0.5 seconds triggers a seek operation in the seek-up (MAN UP key) or seek-down mode (MAN DWN key). This seek operation is the same as that triggered by the SEEK UP or SEEK DWN key.</p> </td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p> <p><b>(2) During "TAPE" display in a tape mode or "CD" display in a CD mode</b>            The MAN UP and MAN DWN keys are ineffective.</p> <p><b>(3) During clock display</b>            While the ME key is held pressed during clock display, pressing the MAN UP and MAN DWN keys enables adjusting the minute and hour displays, respectively. See the description of the ME key for how to adjust the minute and hour displays.</p>	AUTO500	Description	0	<p>Each time the MAN UP or MAN DWN key is pressed, the frequency counter is incremented (MAN UP key) or decremented (MAN DWN key) by one step (one channel space).                Keeping the key pressed for at least 0.5 seconds speeds the increment/decrement to a rate of one step per 50 ms.</p>	1	<p>Each time the MAN UP or MAN DWN key is pressed, the frequency counter is incremented (MAN UP key) or decremented (MAN DWN key) by one step (one channel space).                Keeping the key pressed for at least 0.5 seconds triggers a seek operation in the seek-up (MAN UP key) or seek-down mode (MAN DWN key). This seek operation is the same as that triggered by the SEEK UP or SEEK DWN key.</p>
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<div style="border: 1px solid black; padding: 2px;">LOUD</div>	<p>The <b>LOUD</b> key controls the loudness of sound. It is effective in the radio, tape, and CD modes. Each time the <b>LOUD</b> key is pressed, the control of loudness and the electronic volume control loudness function are switched on or off.</p> <p>The following table lists the states of loudness, "LOUD" display, the LOUD pin output, and the electronic volume control IC.</p> <table border="1"> <thead> <tr> <th>Loudness state</th> <th>"LOUD" display</th> <th>LOUD pin</th> <th>Electronic volume control IC state</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>Lights</td> <td>High level</td> <td>Loudness ON mode</td> </tr> <tr> <td>OFF</td> <td>Does not light</td> <td>Low level</td> <td>Loudness OFF mode</td> </tr> </tbody> </table> <p>Switching the radio, tape, or CD mode does not affect the state of loudness.</p>	Loudness state	"LOUD" display	LOUD pin	Electronic volume control IC state	ON	Lights	High level	Loudness ON mode	OFF	Does not light	Low level	Loudness OFF mode												
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<p style="text-align: center;">LOC</p>	<p>The <b>LOC</b> key controls the local (local/DX) mode.</p> <p>The key is effective when the current mode is the radio, radio-monitor CD, DK-standby CD, DK-receiving CD, radio-monitor tape, DK-standby tape, or DK-receiving tape mode and when AUTOLOC initial setting diode = 0.</p> <p>Each time the key is pressed, switching occurs between the local and DX modes.</p> <p>The following table lists the local/DX mode, the state of the "LOC" display, and LOC pin output.</p> <table border="1"> <thead> <tr> <th>Local mode</th> <th>"LOC" display</th> <th>LOC pin</th> </tr> </thead> <tbody> <tr> <td>LOCAL</td> <td>Lights</td> <td>High level<sup>Note</sup></td> </tr> <tr> <td>DX</td> <td>Does not light</td> <td>Low level</td> </tr> </tbody> </table> <p><b>Note</b> A high level is output only during auto-tuning. The LOC pin is always at a low level during a tuning type other than auto-tuning.</p>	Local mode	"LOC" display	LOC pin	LOCAL	Lights	High level <sup>Note</sup>	DX	Does not light	Low level			
Local mode	"LOC" display	LOC pin											
LOCAL	Lights	High level <sup>Note</sup>											
DX	Does not light	Low level											
<p style="text-align: center;">MONO</p>	<p>The <b>MONO</b> key controls the MONO (monaural)/STEREO mode.</p> <p>The key is effective, when the current mode is the radio, radio-monitor CD, DK-standby CD, DK-receiving CD, radio-monitor tape, DK-standby tape, or DK-receiving tape mode and the FM, VF, or MW band is selected. (For the MW band, the key is effective if the MWS initial setting diode = 1 and the tuner has a stereo capability.)</p> <p>Each time the key is pressed, switching occurs between the MONO and STEREO modes.</p> <p>The following table lists the MONO/STEREO mode, the state of the "ST" display, and MONO/NR pin output.</p> <table border="1"> <thead> <tr> <th>MONO/STEREO mode</th> <th>"ST" display</th> <th>"MONO" display</th> <th>MONO/NR pin</th> </tr> </thead> <tbody> <tr> <td>MONO</td> <td>Does not light</td> <td>Lights</td> <td>High level</td> </tr> <tr> <td>STEREO</td> <td>Lights</td> <td>Does not light</td> <td>Low level</td> </tr> </tbody> </table>	MONO/STEREO mode	"ST" display	"MONO" display	MONO/NR pin	MONO	Does not light	Lights	High level	STEREO	Lights	Does not light	Low level
MONO/STEREO mode	"ST" display	"MONO" display	MONO/NR pin										
MONO	Does not light	Lights	High level										
STEREO	Lights	Does not light	Low level										
<p style="text-align: center;">MTL</p>	<p>The <b>MTL</b> key controls the MTL (METAL) mode. It is effective when the current mode is radio, DK-standby tape, DK-receiving tape, or radio-monitor tape mode. Each time the key is pressed, the METAL mode is switched on or off.</p> <p>The following table lists the METAL mode on/off, the states of the "METAL" display, and METAL pin output.</p> <table border="1"> <thead> <tr> <th>METAL mode</th> <th>"METAL" display</th> <th>METAL pin</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>Lights</td> <td>High level</td> </tr> <tr> <td>OFF</td> <td>Does not light</td> <td>Low level</td> </tr> </tbody> </table>	METAL mode	"METAL" display	METAL pin	ON	Lights	High level	OFF	Does not light	Low level			
METAL mode	"METAL" display	METAL pin											
ON	Lights	High level											
OFF	Does not light	Low level											

Symbol	Description									
<p style="text-align: center;">NR</p>	<p>The <b>NR</b> key is used to control noise reduction (NR). It is effective when the current mode is the tape, DK-standby tape, DK-receiving tape, or radio-monitor tape mode. Each time the key is pressed, the NR mode is switched on or off.</p> <p>The following table lists the NR mode on/off, the state of the "NR" display, and NR/MONO pin output.</p> <table border="1"> <thead> <tr> <th>NR mode</th> <th>"NR" display</th> <th>NR/MONO pin</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>Lights</td> <td>High level<sup>Note</sup></td> </tr> <tr> <td>OFF</td> <td>Does not light</td> <td>Low level<sup>Note</sup></td> </tr> </tbody> </table> <p><b>Note</b> In the DK-receiving tape or radio-monitor tape mode, the NR/MONO pin functions as the MONO/STEREO mode output pin, and its output level corresponds to the MONO/STEREO mode.</p>	NR mode	"NR" display	NR/MONO pin	ON	Lights	High level <sup>Note</sup>	OFF	Does not light	Low level <sup>Note</sup>
NR mode	"NR" display	NR/MONO pin								
ON	Lights	High level <sup>Note</sup>								
OFF	Does not light	Low level <sup>Note</sup>								
<p style="text-align: center;">AMS</p>	<p>The <b>AMS</b> key controls the auto music search (AMS). It is effective in the tape, DK-standby tape, DK-receiving tape, or radio-monitor tape mode. Each time the key is pressed, switching occurs between the AMS on/off states.</p> <p>The following table lists the states of AMS on/off, "AMS" display, and AMS pin output.</p> <table border="1"> <thead> <tr> <th>AMS state</th> <th>"AMS" display</th> <th>AMS pin</th> </tr> </thead> <tbody> <tr> <td>ON</td> <td>Lights</td> <td>High level</td> </tr> <tr> <td>OFF</td> <td>Does not light</td> <td>Low level</td> </tr> </tbody> </table>	AMS state	"AMS" display	AMS pin	ON	Lights	High level	OFF	Does not light	Low level
AMS state	"AMS" display	AMS pin								
ON	Lights	High level								
OFF	Does not light	Low level								
<p style="text-align: center;">RDMONI</p>	<p>The <b>RDMONI</b> key controls radio monitoring. It is effective in the tape, DK-standby tape, DK-receiving tape, CD, DK-standby CD, DK-receiving CD, radio-monitor tape, or radio-monitor CD mode. Each time the key is pressed, the radio monitor mode is set or reset. During the radio monitor mode, the "RDMONI" display on the LCD panel lights.</p> <p>During the radio monitor mode, tuning is enabled for all bands, the radio mute function (<math>\overline{\text{RDMUTE}}</math> pin) is switched off, and the audio mute function (<math>\overline{\text{AMUTE}}</math> pin) is switched on.</p> <p>The radio monitor mode is reset by:</p> <ul style="list-style-type: none"> <li>• Change in the TPSET switch state</li> <li>• Change in the CDSET switch state</li> <li>• Change at the CE pin from high level to low level</li> </ul>									

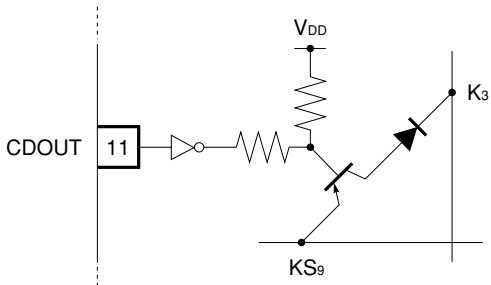
Symbol	Description																																
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">DISP</div>	<p>The <b>DISP</b> key is used to switch the display. It is effective when NOCLK initial setting diode = 0 (with a clock). However, if it is ineffective in the DK-receiving tape and DK-receiving CD mode even if a clock is available.</p> <p>Display switching occurs as follows:</p> <p><b>(1) During the radio mode</b></p> <p>Each time the key is pressed, the display switches between the frequency and clock.</p> <p>The <b>DISP</b> key is ineffective during seek-scanning and auto-preset scanning.</p> <p>The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:</p> <table border="1"> <thead> <tr> <th>PRIO1</th> <th>PRIO2</th> <th>Privileged display</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>None</td> <td>Each time the <b>DISP</b> key is pressed, the display switches between the frequency and clock.</td> </tr> <tr> <td>1</td> <td>0</td> <td>Frequency display</td> <td>Pressing the <b>DISP</b> key during frequency display causes the clock display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of clock display causes the frequency display to appear again.</td> </tr> <tr> <td>0</td> <td>1</td> <td>Clock display</td> <td>Pressing the <b>DISP</b> key during clock display causes the frequency display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of frequency display causes the clock display to appear again.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p> <p>When the radio mode is selected, the display begins with the frequency.</p> <p><b>(2) During the tape mode</b></p> <p>Each time the <b>DISP</b> key is pressed, the display switches between "TAPE" and the clock.</p> <p>The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:</p> <table border="1"> <thead> <tr> <th>PRIO1</th> <th>PRIO2</th> <th>Privileged display</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>None</td> <td>Each time the <b>DISP</b> key is pressed, the display switches between the frequency and clock.</td> </tr> <tr> <td>1</td> <td>0</td> <td>"TAPE" display</td> <td>Pressing the <b>DISP</b> key during "TAPE" display causes the clock display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of clock display causes the "TAPE" display to appear again.</td> </tr> <tr> <td>0</td> <td>1</td> <td>Clock display</td> <td>Pressing the <b>DISP</b> key during clock display causes the "TAPE" display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of "TAPE" display causes the clock display to appear again.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)</p> <p>When the radio mode is selected, the display begins with the "TAPE" display.</p>	PRIO1	PRIO2	Privileged display	Description	0	0	None	Each time the <b>DISP</b> key is pressed, the display switches between the frequency and clock.	1	0	Frequency display	Pressing the <b>DISP</b> key during frequency display causes the clock display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of clock display causes the frequency display to appear again.	0	1	Clock display	Pressing the <b>DISP</b> key during clock display causes the frequency display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of frequency display causes the clock display to appear again.	PRIO1	PRIO2	Privileged display	Description	0	0	None	Each time the <b>DISP</b> key is pressed, the display switches between the frequency and clock.	1	0	"TAPE" display	Pressing the <b>DISP</b> key during "TAPE" display causes the clock display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of clock display causes the "TAPE" display to appear again.	0	1	Clock display	Pressing the <b>DISP</b> key during clock display causes the "TAPE" display to appear for 5 seconds. Pressing the <b>DISP</b> key during the 5-second period of "TAPE" display causes the clock display to appear again.
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The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:</p> <table border="1"> <thead> <tr> <th>PRI01</th> <th>PRI02</th> <th>Privileged display</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>None</td> <td>Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows:  <div style="border: 1px solid black; padding: 2px; text-align: center; margin: 5px 0;">                     → "TAPE" → frequency → clock →                 </div> </td> </tr> <tr> <td>1</td> <td>0</td> <td>"TAPE" display</td> <td>Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows:  <div style="border: 1px solid black; padding: 2px; text-align: center; margin: 5px 0;">                     → "TAPE" → frequency → clock →                 </div>                     If no key is pressed during frequency or clock display, the "TAPE" display appears again after 5 seconds.</td> </tr> <tr> <td>0</td> <td>1</td> <td>Clock display</td> <td>Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows:  <div style="border: 1px solid black; padding: 2px; text-align: center; margin: 5px 0;">                     → "TAPE" → frequency → clock →                 </div>                     If no key is pressed during frequency or "TAPE" display, the clock display appears again after 5 seconds.</td> </tr> </tbody> </table> <p>(1: Shorted by the diode; 0: Open)                      When the radio-monitor tape or DK-standby tape mode is selected, the display begins with the frequency.</p>	PRI01	PRI02	Privileged display	Description	0	0	None	Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display switches between "┌┐" and clock.	1	0	"┌┐" display	Pressing the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key during "┌┐" display causes the clock display to appear for 5 seconds. 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<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">DISP</div>	<p><b>(5) During the radio-monitor CD and DK-standby CD modes</b>                      Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display switches among "┌┐", frequency, and clock.                      The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:</p> <table border="1"> <thead> <tr> <th>PRIO1</th> <th>PRIO2</th> <th>Privileged display</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">None</td> <td>Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows:  <div style="text-align: center; margin-top: 5px;"> <span style="border: 1px solid black; padding: 2px;">┌┐ → frequency → clock</span> </div> </td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">"┌┐" display</td> <td>Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows:  <div style="text-align: center; margin-top: 5px;"> <span style="border: 1px solid black; padding: 2px;">┌┐ → frequency → clock</span> </div>                     If no key is pressed during frequency or clock display, the "┌┐" display appears again after 5 seconds.                 </td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">Clock display</td> <td>Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows:  <div style="text-align: center; margin-top: 5px;"> <span style="border: 1px solid black; padding: 2px;">┌┐ → frequency → clock</span> </div>                     If no key is pressed during frequency or "┌┐" display, the clock display appears again after 5 seconds.                 </td> </tr> </tbody> </table> <p style="text-align: center; margin-top: 10px;">(1: Shorted by the diode; 0: Open)</p> <p>When the radio-monitor CD or DK-standby CD mode is selected, the display begins with the frequency.</p>	PRIO1	PRIO2	Privileged display	Description	0	0	None	Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows: <div style="text-align: center; margin-top: 5px;"> <span style="border: 1px solid black; padding: 2px;">┌┐ → frequency → clock</span> </div>	1	0	"┌┐" display	Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows: <div style="text-align: center; margin-top: 5px;"> <span style="border: 1px solid black; padding: 2px;">┌┐ → frequency → clock</span> </div> If no key is pressed during frequency or clock display, the "┌┐" display appears again after 5 seconds.	0	1	Clock display	Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows: <div style="text-align: center; margin-top: 5px;"> <span style="border: 1px solid black; padding: 2px;">┌┐ → frequency → clock</span> </div> If no key is pressed during frequency or "┌┐" display, the clock display appears again after 5 seconds.
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1	0	"┌┐" display	Each time the <span style="border: 1px solid black; padding: 0 2px;">DISP</span> key is pressed, the display is toggled as follows: <div style="text-align: center; margin-top: 5px;"> <span style="border: 1px solid black; padding: 2px;">┌┐ → frequency → clock</span> </div> If no key is pressed during frequency or clock display, the "┌┐" display appears again after 5 seconds.														
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<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">POWER</div>	<p>The <span style="border: 1px solid black; padding: 0 2px;">POWER</span> key is used to control the power-on/off of the radio in the momentary key mode. It is effective when the CE pin is at a high level. Pressing this key inverts the output of the POWER pin. When the POWER pin output is set to low (the power is turned off), the tape recorder, CD player and radio are forced to be turned off even when they have been in the power-on state. In this case, they are turned off with or without clock display, according to whether they were in clock mode or noclock mode. The power-on mode varies as follows according to the state of the RDSET, TPSET, and CDSET switches.</p> <table border="1"> <thead> <tr> <th>Mode</th> <th>RDSET</th> <th>TPSET</th> <th>CDSET</th> </tr> </thead> <tbody> <tr> <td>Radio mode</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">OFF</td> <td style="text-align: center;">OFF</td> </tr> <tr> <td>Tape mode</td> <td style="text-align: center;">ON/OFF</td> <td style="text-align: center;">ON</td> <td style="text-align: center;">OFF</td> </tr> <tr> <td>CD mode</td> <td style="text-align: center;">ON/OFF</td> <td style="text-align: center;">ON/OFF</td> <td style="text-align: center;">ON</td> </tr> </tbody> </table> <p><b>Cautions</b></p> <ol style="list-style-type: none"> <li>1. At the initial power-on, the POWER pin outputs the high level. When the level of CE pin changes from low to high, the POWER pin outputs the level which have been set before CE becomes low, until the primary power supply is turned off.</li> <li>2. Do not turn the power on or off when diode switch RDON is set to 1. Doing this may cause malfunction. When RDON is set to 1, turn the power on or off by switching CE between low and high.</li> </ol>	Mode	RDSET	TPSET	CDSET	Radio mode	ON	OFF	OFF	Tape mode	ON/OFF	ON	OFF	CD mode	ON/OFF	ON/OFF	ON
Mode	RDSET	TPSET	CDSET														
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Tape mode	ON/OFF	ON	OFF														
CD mode	ON/OFF	ON/OFF	ON														

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<p><b>MUTE</b></p>	<p>The <b>MUTE</b> key controls the electronic volume control mute function. Pressing the <b>MUTE</b> key in a mode other than the mute mode selects the mute (silent) mode. During the mute mode, the volume value is displayed, and the display is caused to blink.</p> <p>The mute function is reset under the following conditions.</p> <ul style="list-style-type: none"> <li>• When an effective key other than the <b>DISP</b> key is pressed</li> <li>• When the mode is changed</li> <li>• When a station is detected during a seek or scan operation, with the <b>MUTE</b> pressed.</li> <li>• When the <b>MUTE</b> key is pressed during muting</li> </ul>																		
<p><b>CD</b></p>	<p>Each time the <b>CD</b> key is pressed, the output of the CDOUT pin (pin 11) is inverted.</p> <p>Using the CDOUT output makes it possible to implement an application such as described below: Turning on/off a transistor switch connected to the CDSET pin according to the CDOUT output can switch on/off the CD mode according to the state of the <b>CD</b> key.</p> 																		



### 3. MODE TRANSITION

With the μPD17012GF-057, two methods are available to turn on and off the radio set.

- (1) After the initial setting diode RDON is set to 1, the radio set can be turned on or off by switching the CE pin state.
- (2) After the initial setting diode RDON is set to 0, the radio set can be turned on or off by turning on or off the transistor or alternative switch RDSET with the CE pin held high.

Sections 3.1 and 3.2 describe the state transition diagrams of each method.

#### 3.1 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS SET TO 1 (TURNING ON OR OFF THE RADIO SET BY SWITCHING THE STATE OF THE CE PIN)

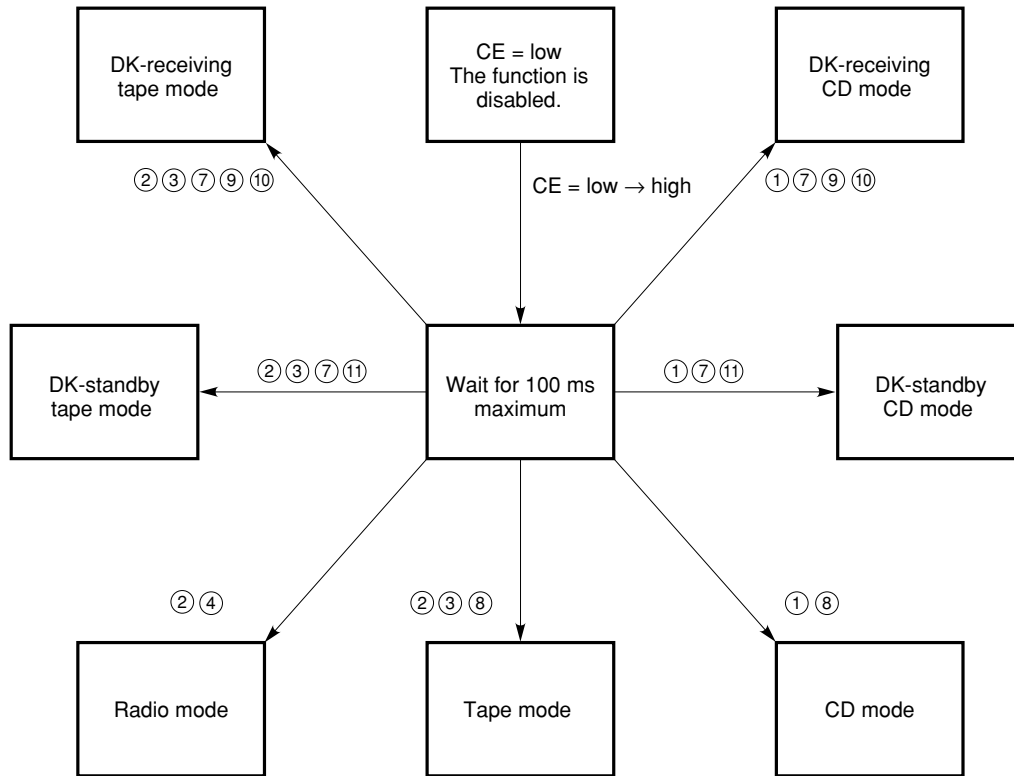
The radio set is turned on or off by switching the state of the CE pin.

The TPSET and CDSET switches are enabled only when the CE pin is high.

The RDSET is disabled.

When the CE pin is made low, clock display is not provided regardless of state of the initial setting diode NOCLK. However, when NOCLK = 0 (for using the clock), the clock operates.

##### (1) Mode transition when the CE pin is raised from low to high

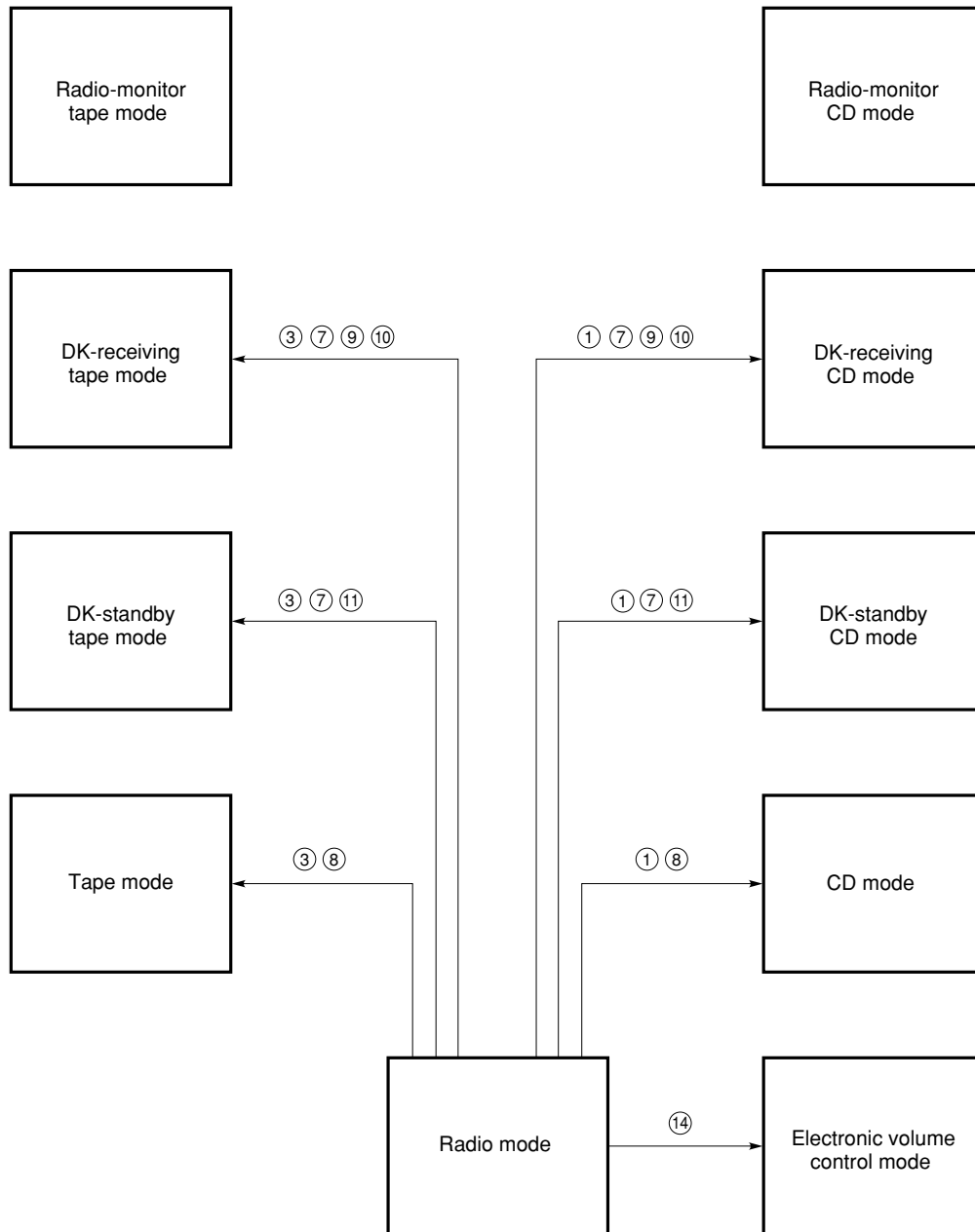


**Remark** The circled numbers represent the following:

- |   |  |   |
|---|--|---|
| ①: CDSET switch on                        | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off                       | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on                        | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off                       |  |   |
| ⑤: <input type="checkbox"/> RDMONI key on |  |   |
| ⑥: <input type="checkbox"/> VF key on     |  |   |

(2) Mode transition when the CE pin is held high

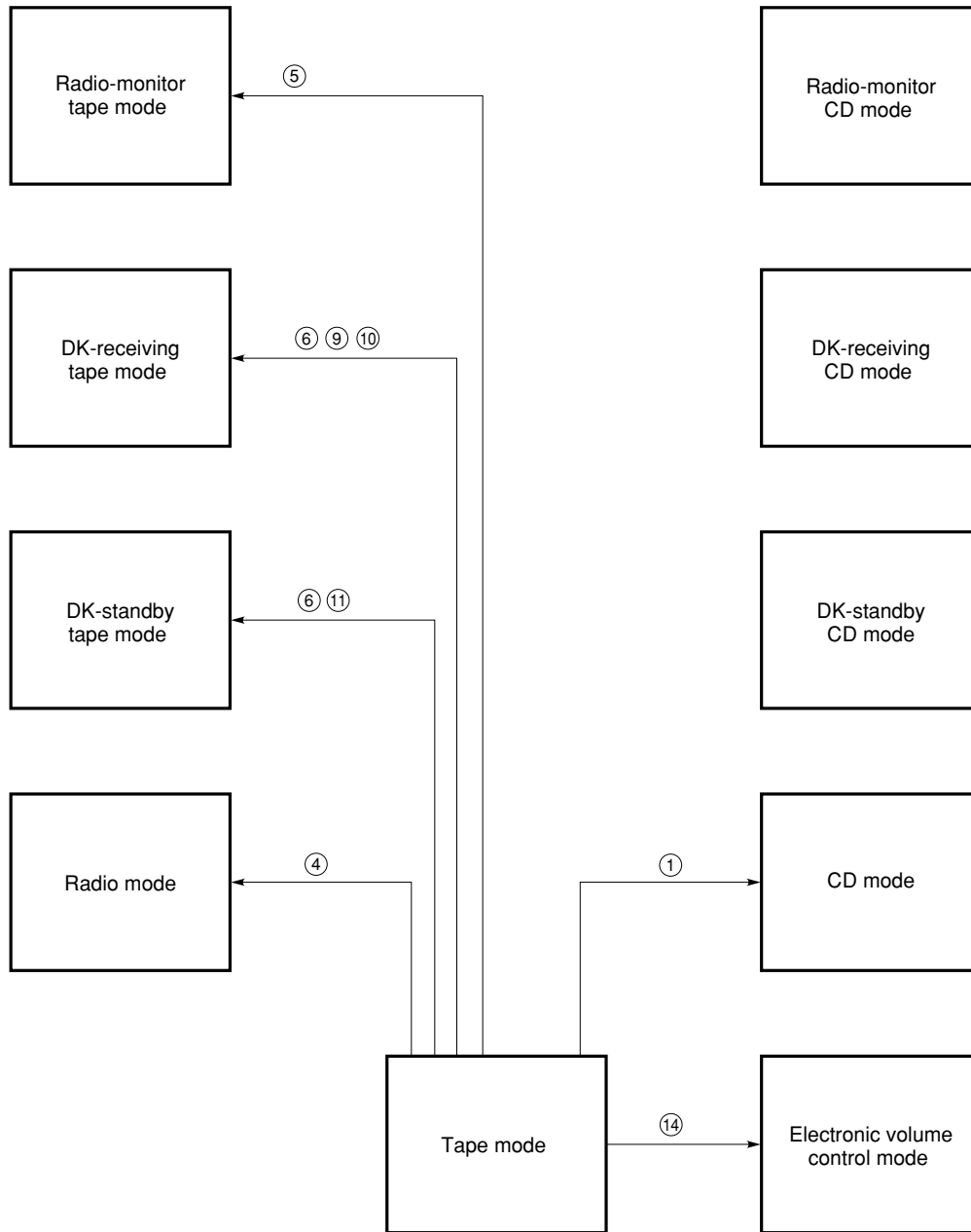
(a) Transition from the radio mode to another mode



**Remark** The circled numbers represent the following:

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|--|--|---|
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| ③: TPSET switch on   | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off  | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <span style="border: 1px solid black; padding: 0 2px;">RDMONI</span> key on |  |   |
| ⑥: <span style="border: 1px solid black; padding: 0 2px;">VF</span> key on     |  |   |

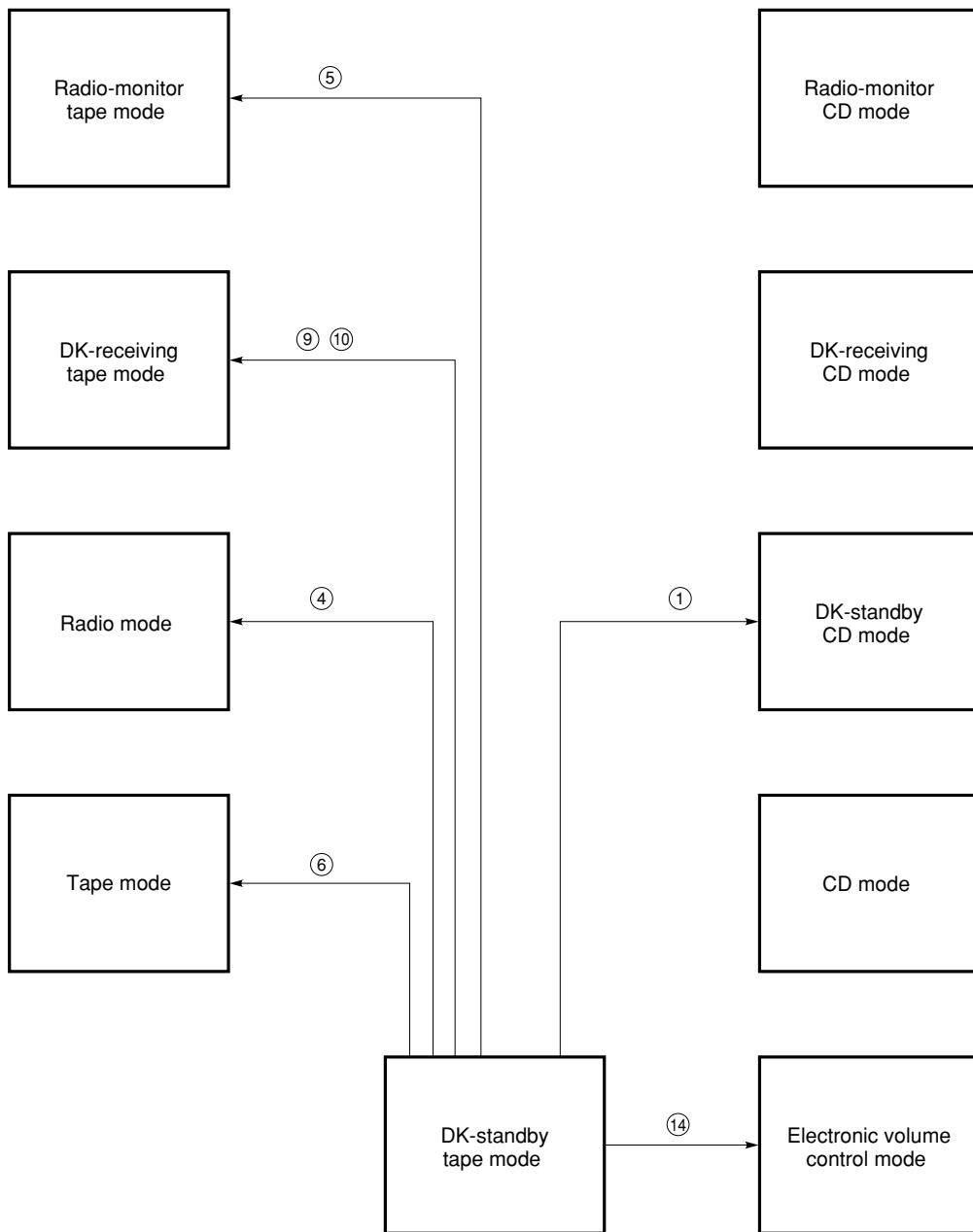
(b) Transition from the tape mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

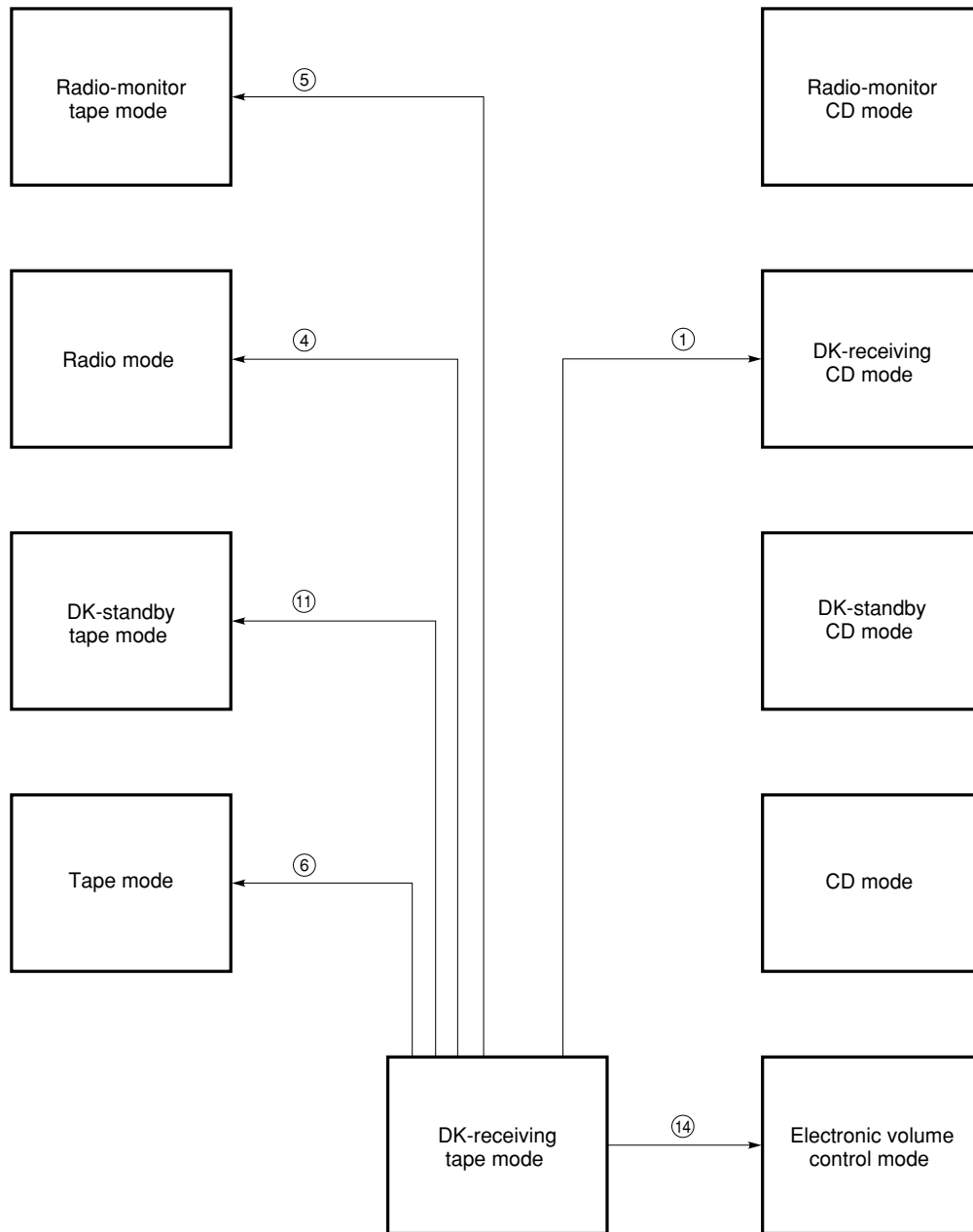
(c) Transition from the DK-standby tape mode to another mode



**Remark** The circled numbers represent the following:

- |  |  |   |
|--|--|---|
| ①: CDSET switch on   | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off  | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on   | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off  | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <span style="border: 1px solid black; padding: 0 2px;">RDMONI</span> key on |  |   |
| ⑥: <span style="border: 1px solid black; padding: 0 2px;">VF</span> key on     |  |   |

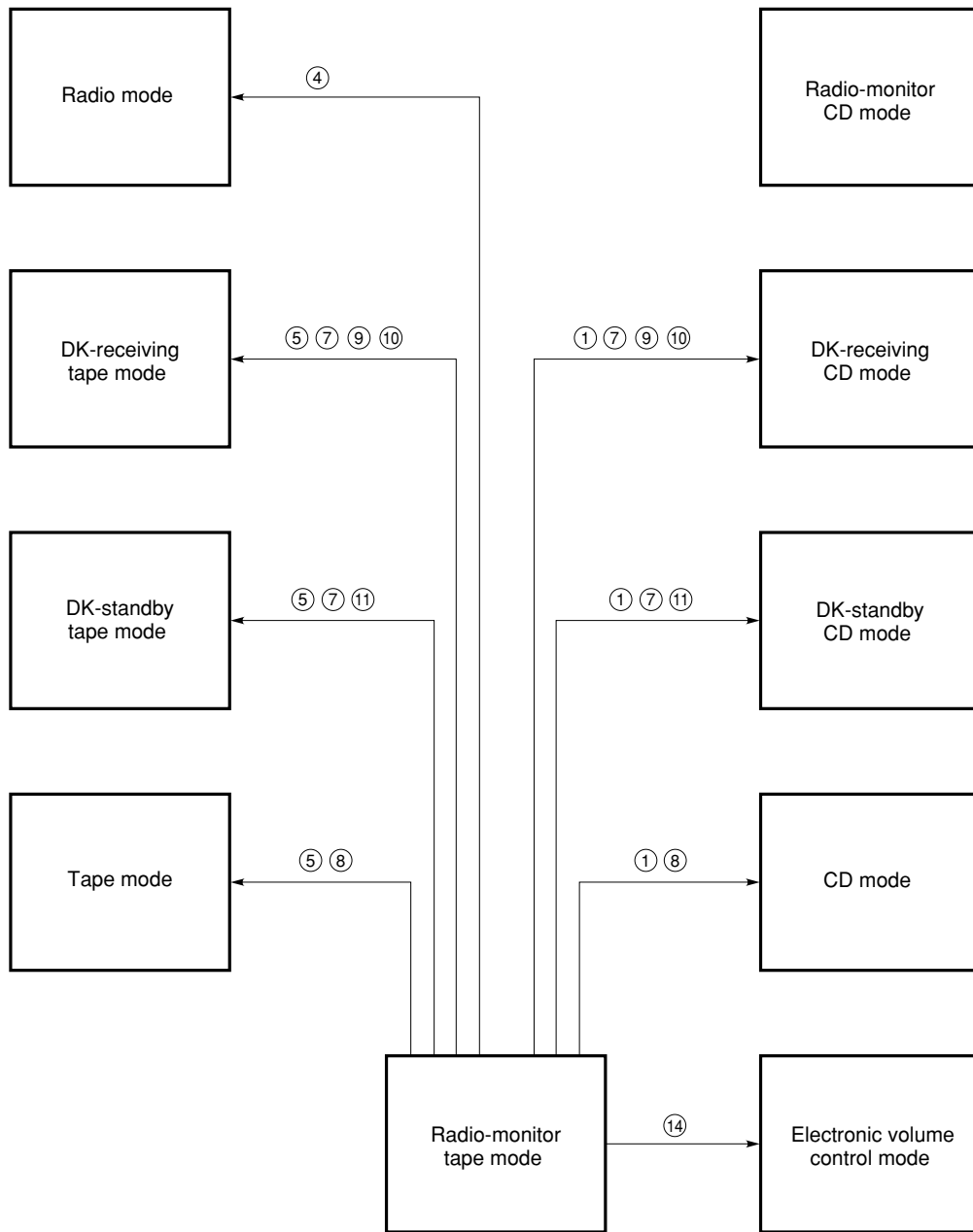
(d) Transition from the DK-receiving tape mode to another mode



**Remark** The circled numbers represent the following:

- |  |  |   |
|--|--|---|
| ①: CDSET switch on   | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off  | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on   | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off  | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <span style="border: 1px solid black; padding: 0 2px;">RDMONI</span> key on |  |   |
| ⑥: <span style="border: 1px solid black; padding: 0 2px;">VF</span> key on     |  |   |

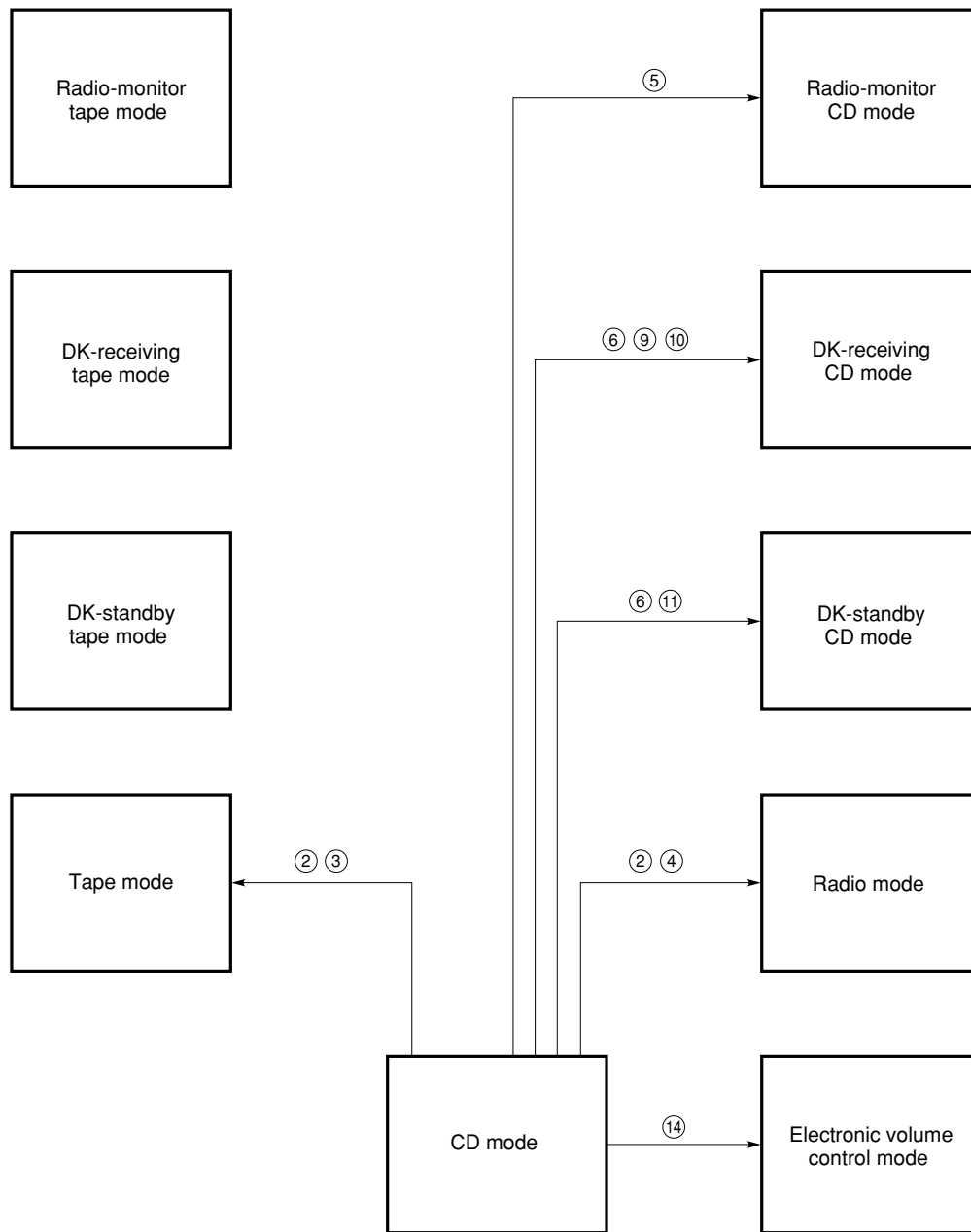
(e) Transition from the radio-monitor tape mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

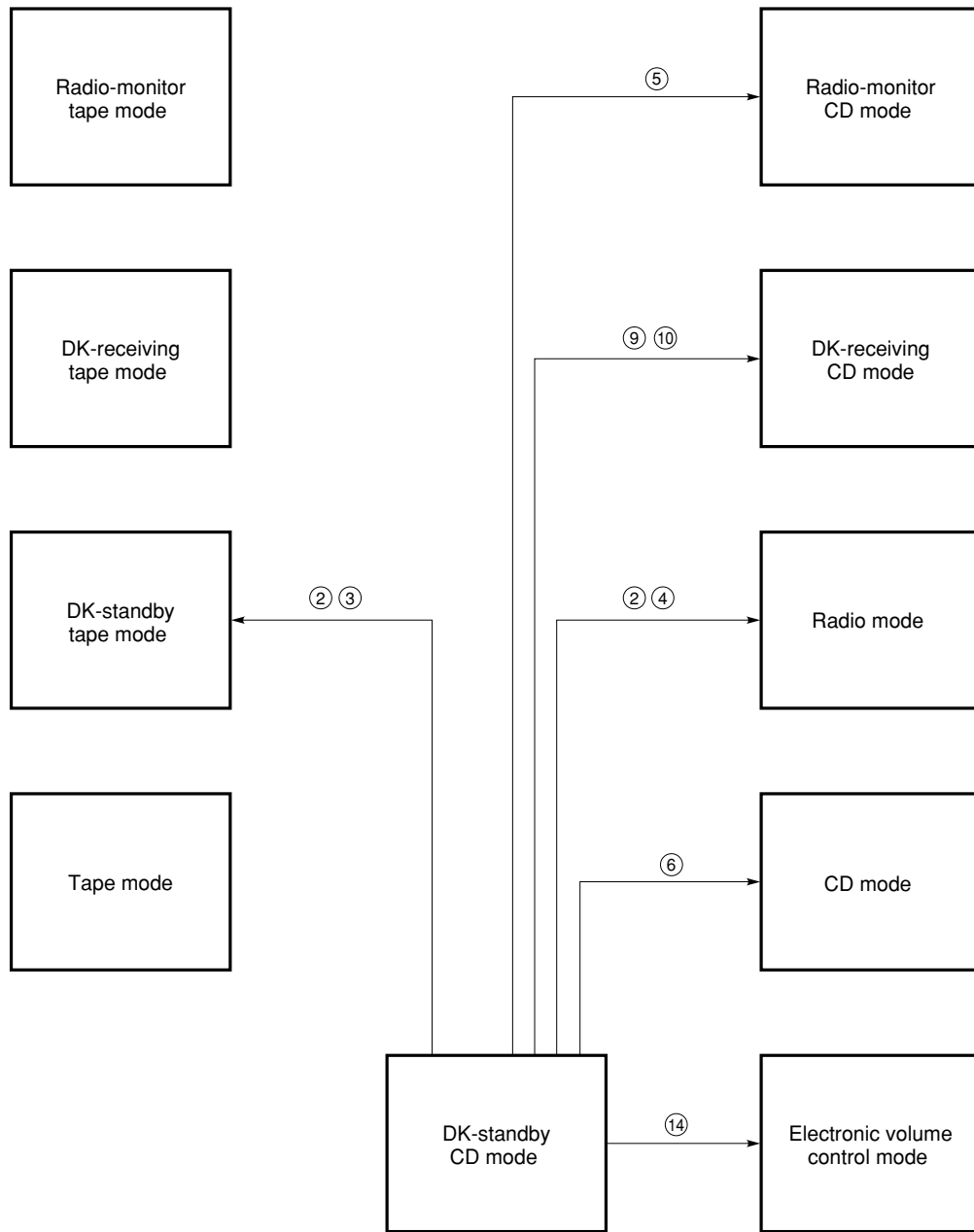
(f) Transition from the CD mode to another mode



**Remark** The circled numbers represent the following:

- |  |  |   |
|--|--|---|
| ①: CDSET switch on   | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off  | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on   | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off  | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <span style="border: 1px solid black; padding: 0 2px;">RDMONI</span> key on |  |   |
| ⑥: <span style="border: 1px solid black; padding: 0 2px;">VF</span> key on     |  |   |

(g) Transition from the DK-standby CD mode to another mode

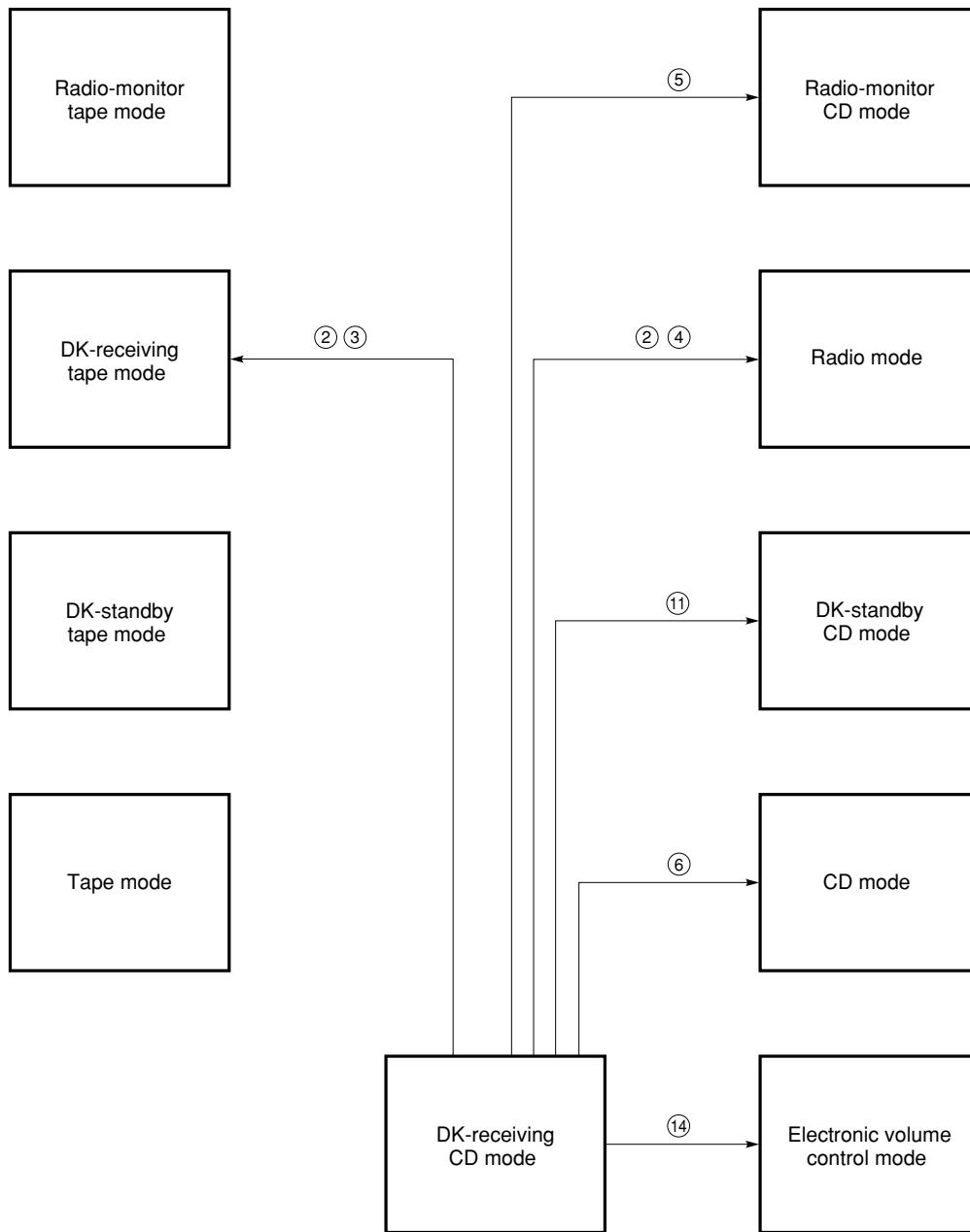


**Remark** The circled numbers represent the following:

- |  |  |   |
|--|--|---|
| ①: CDSET switch on   | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off  | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on   | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off  | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <span style="border: 1px solid black; padding: 0 2px;">RDMONI</span> key on |  |   |
| ⑥: <span style="border: 1px solid black; padding: 0 2px;">VF</span> key on     |  |   |



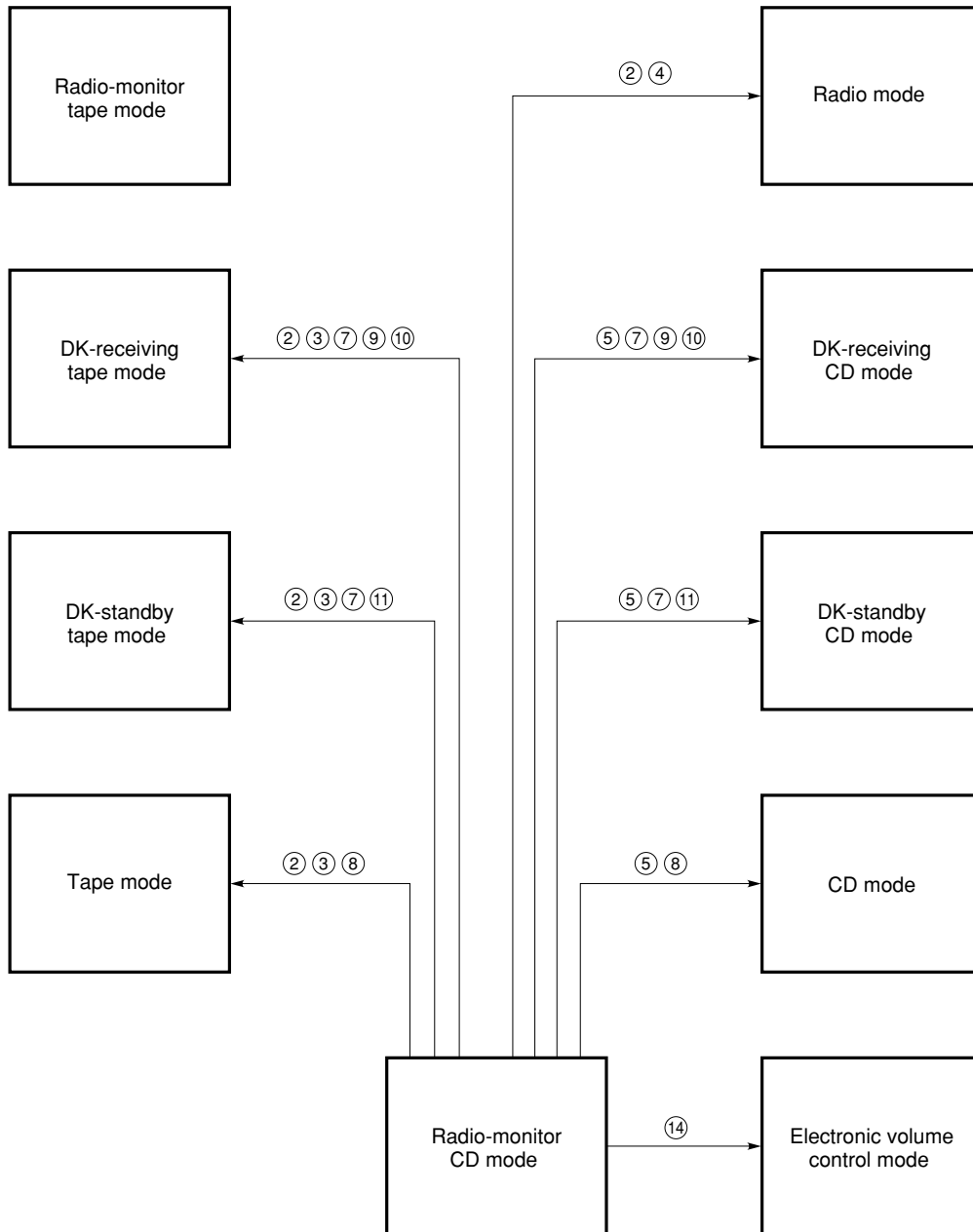
(h) Transition from the DK-receiving CD mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

(i) Transition from the radio-monitor CD mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

**3.2 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS SET TO 0 (TURNING ON OR OFF THE RADIO SET BY SWITCHING THE RDSET SWITCH)**

The radio set is turned on or off by switching the RDSET switch.

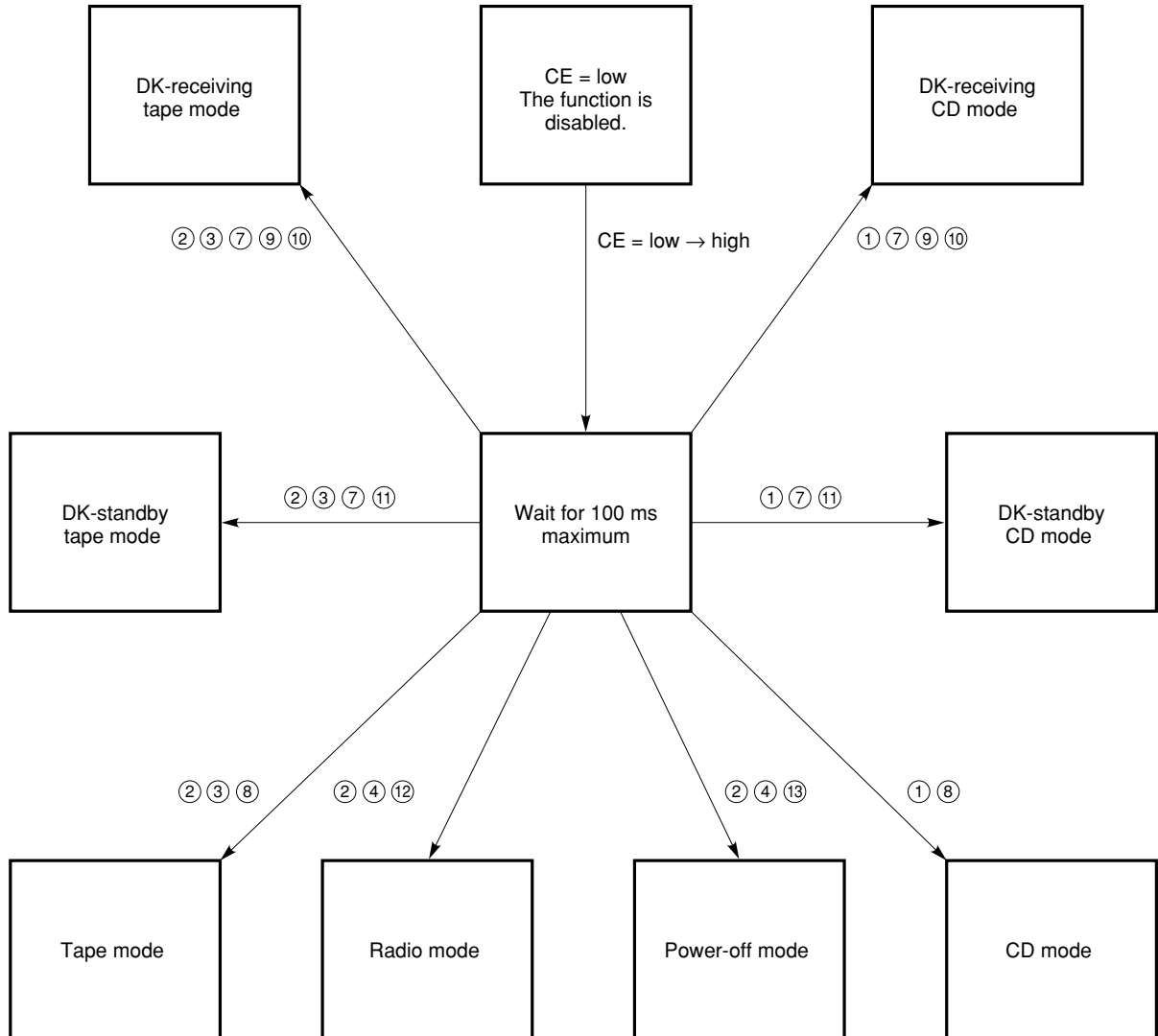
The RDSET, TPSET, and CDSET switches are enabled only when the CE pin is high.

When the CE pin is made low, clock display is not provided regardless of state of the initial setting diode NOCLK. However, when NOCLK = 0 (for using the clock), the clock operates.

**(1) Mode transition when the CE pin is raised from low to high**

The RDSET switch is used to turn on or off the radio mode.

The TPSET and CDSET switches are used to switch to the tape mode and CD mode.

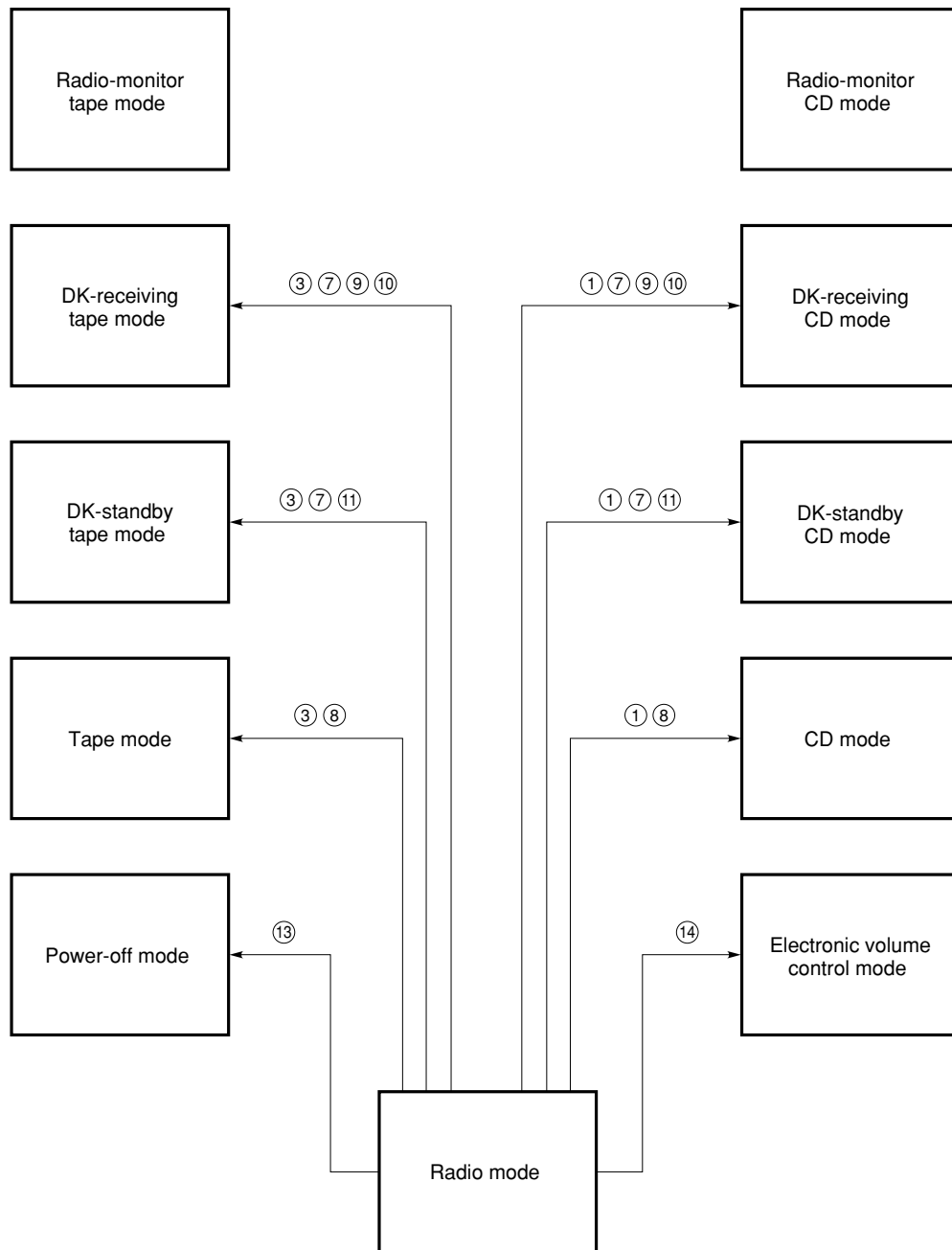


**Remark** The circled numbers represent the following:

- |  |  |   |
|--|--|---|
| ①: CDSET switch on   | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off  | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on   | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off  | ⑩: DK switch on                                |   |
| ⑤: <span style="border: 1px solid black; padding: 0 2px;">RDMONI</span> key on |  |   |
| ⑥: <span style="border: 1px solid black; padding: 0 2px;">VF</span> key on     |  |   |

(2) Mode transition when the CE pin is held high

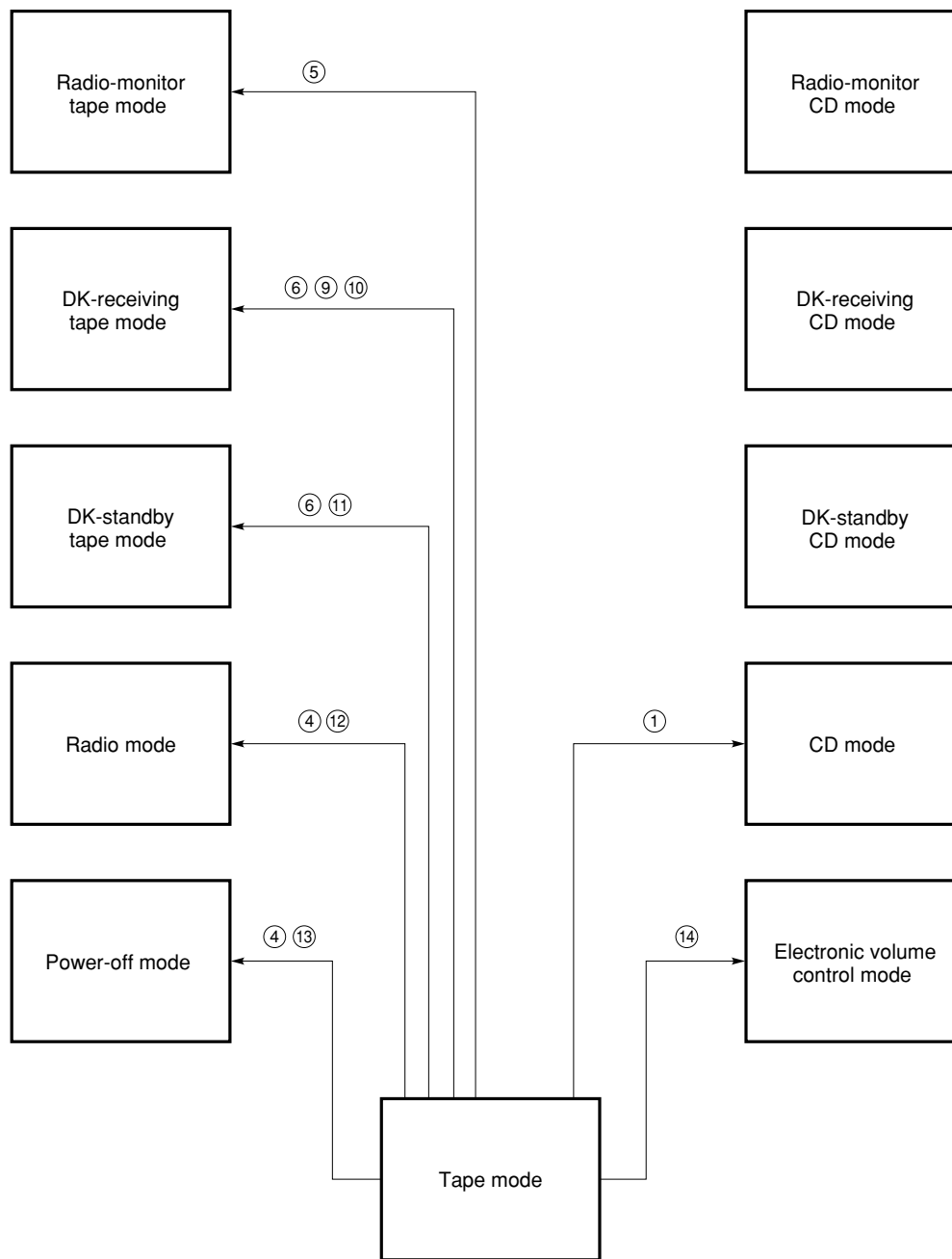
(a) Transition from the radio mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

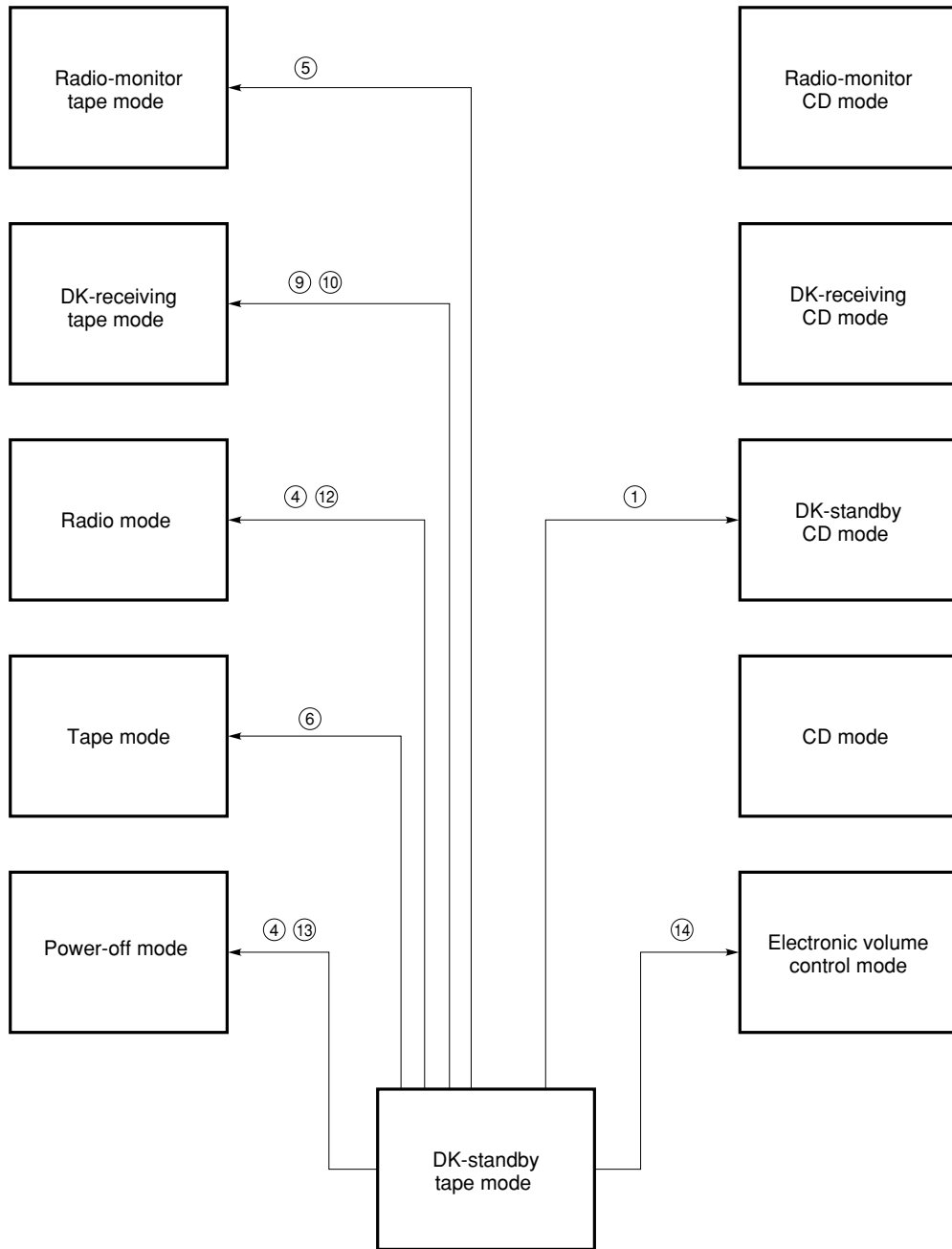
(b) Transition from the tape mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

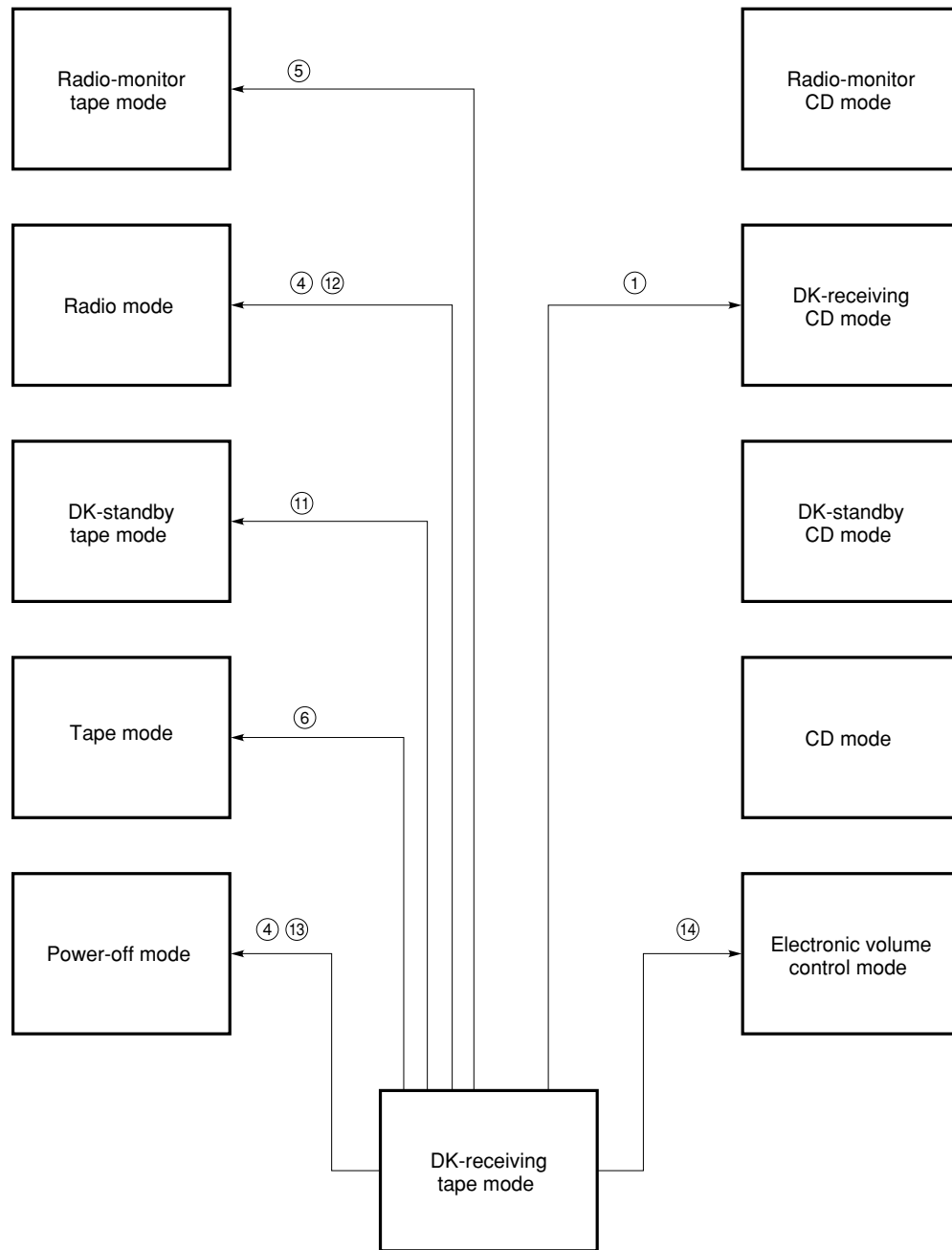
(c) Transition from the DK-standby tape mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

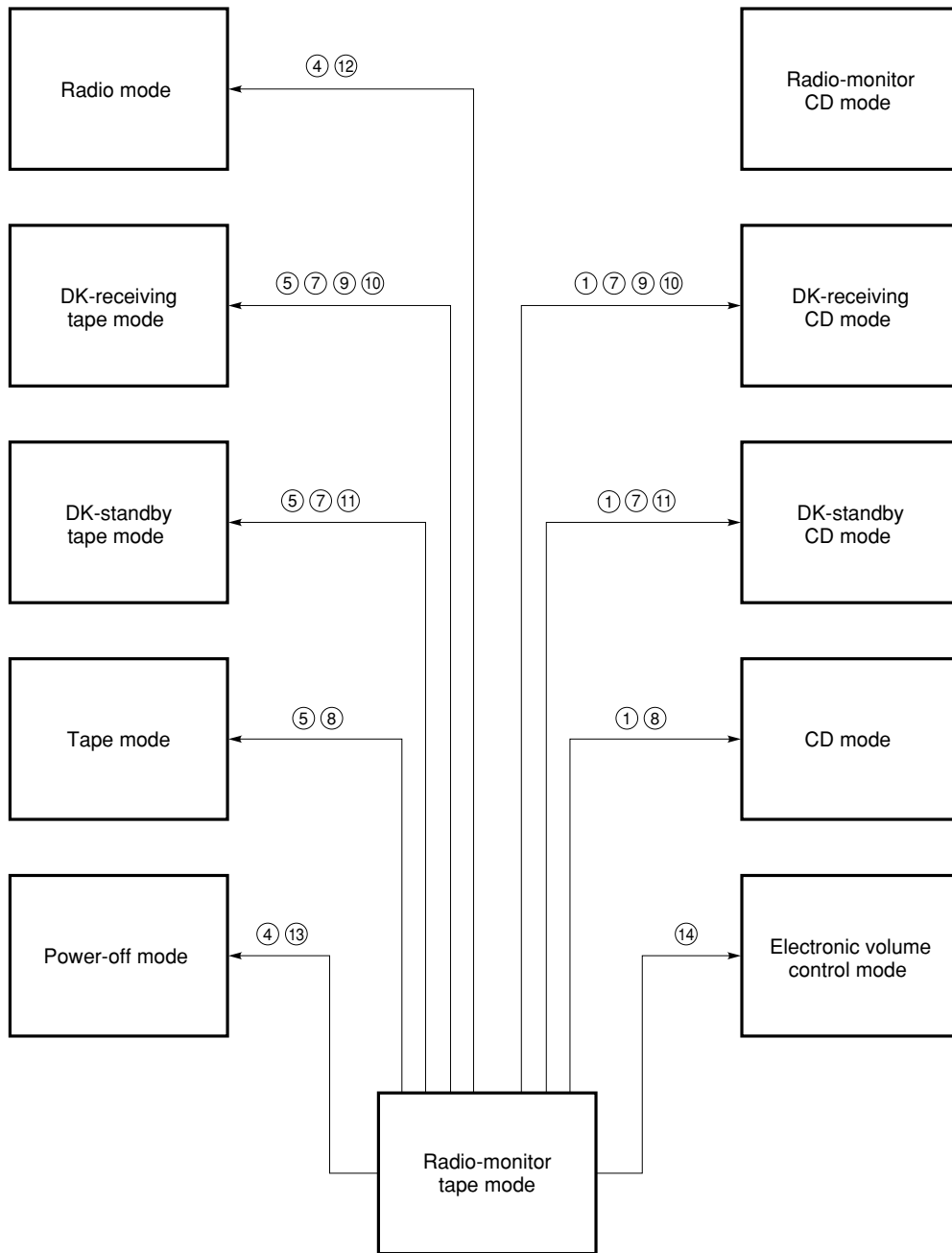
(d) Transition from the DK-receiving tape mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

(e) Transition from the radio-monitor tape mode to another mode

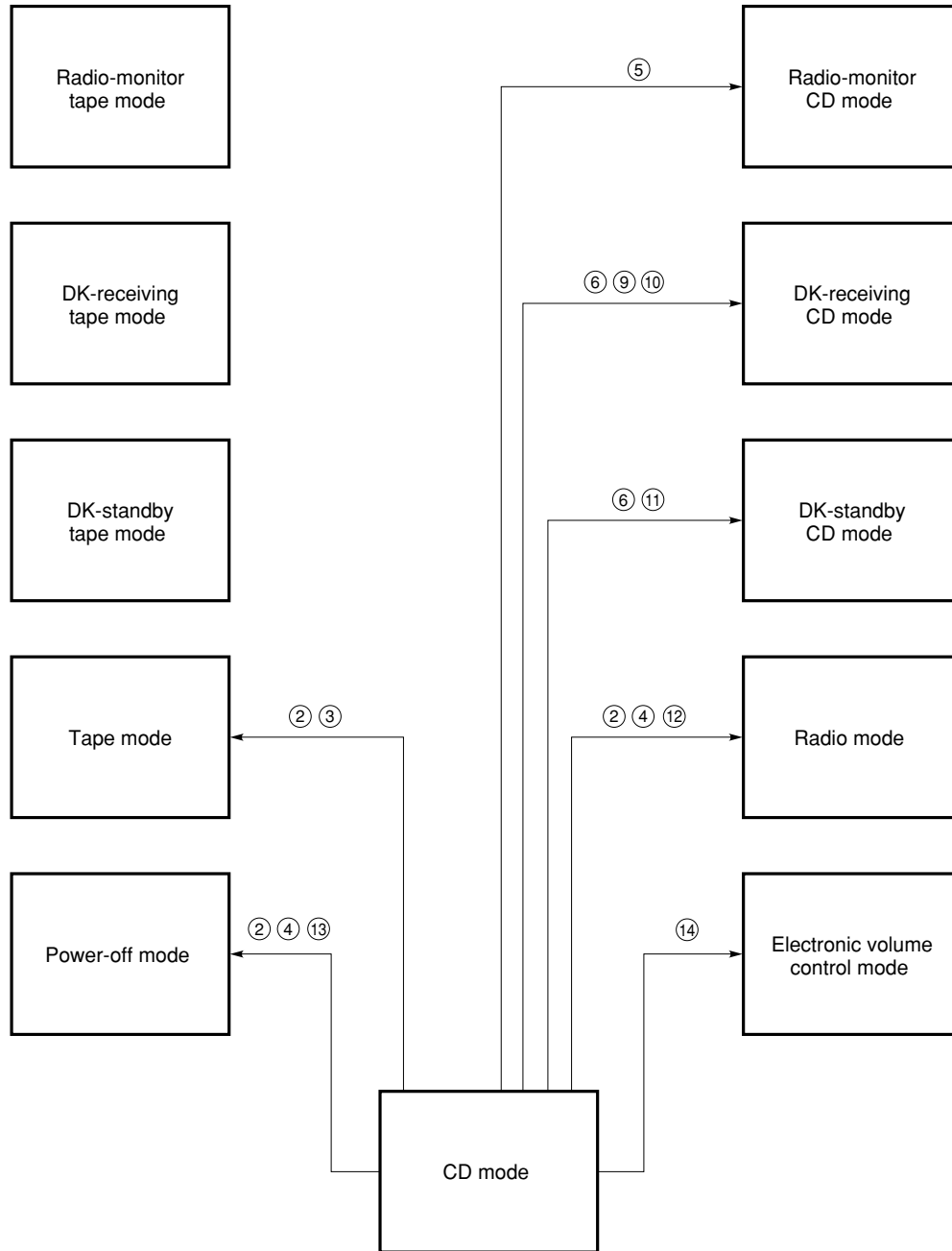


**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |



(f) Transition from the CD mode to another mode



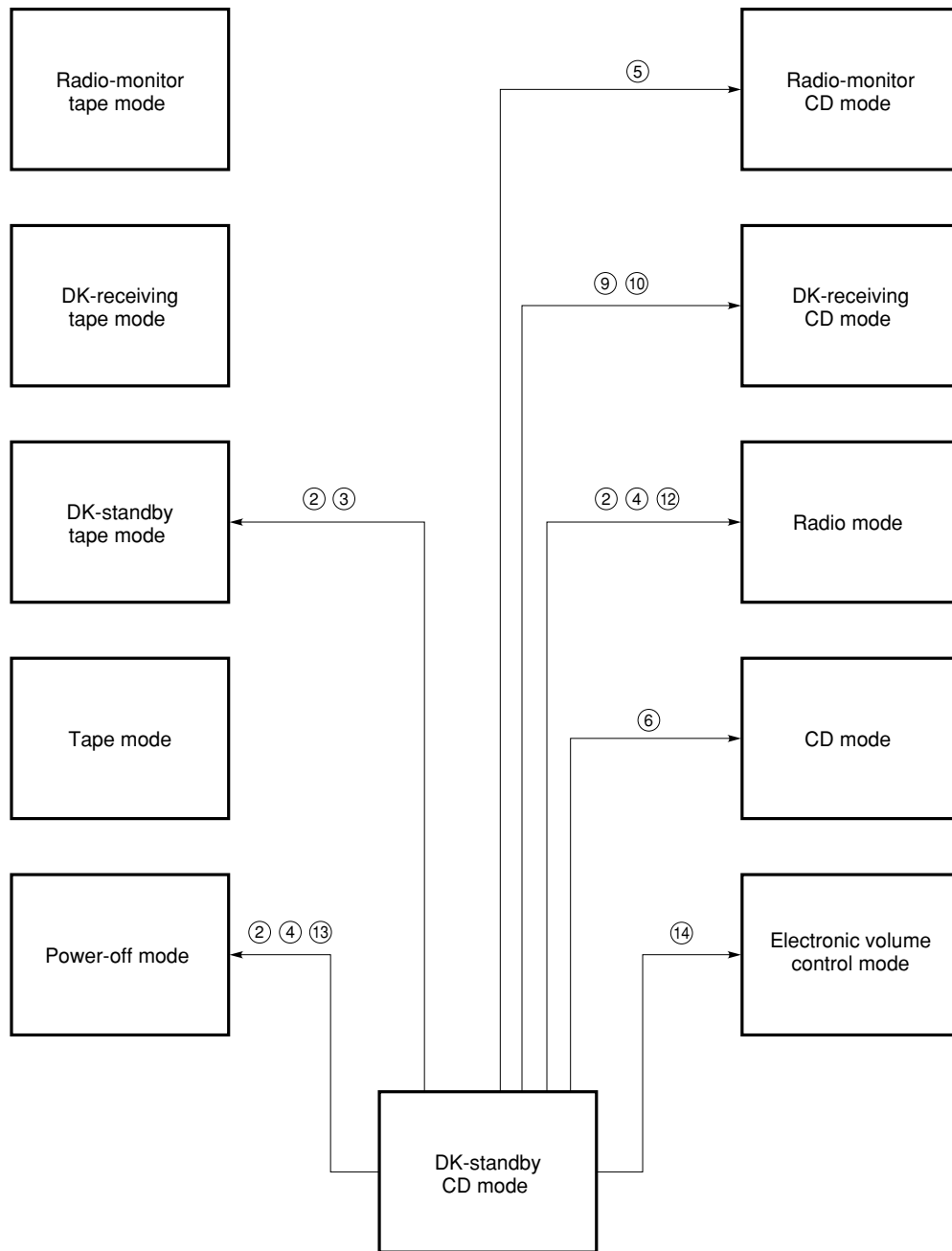
**Remark** The circled numbers represent the following:

- 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: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on

- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

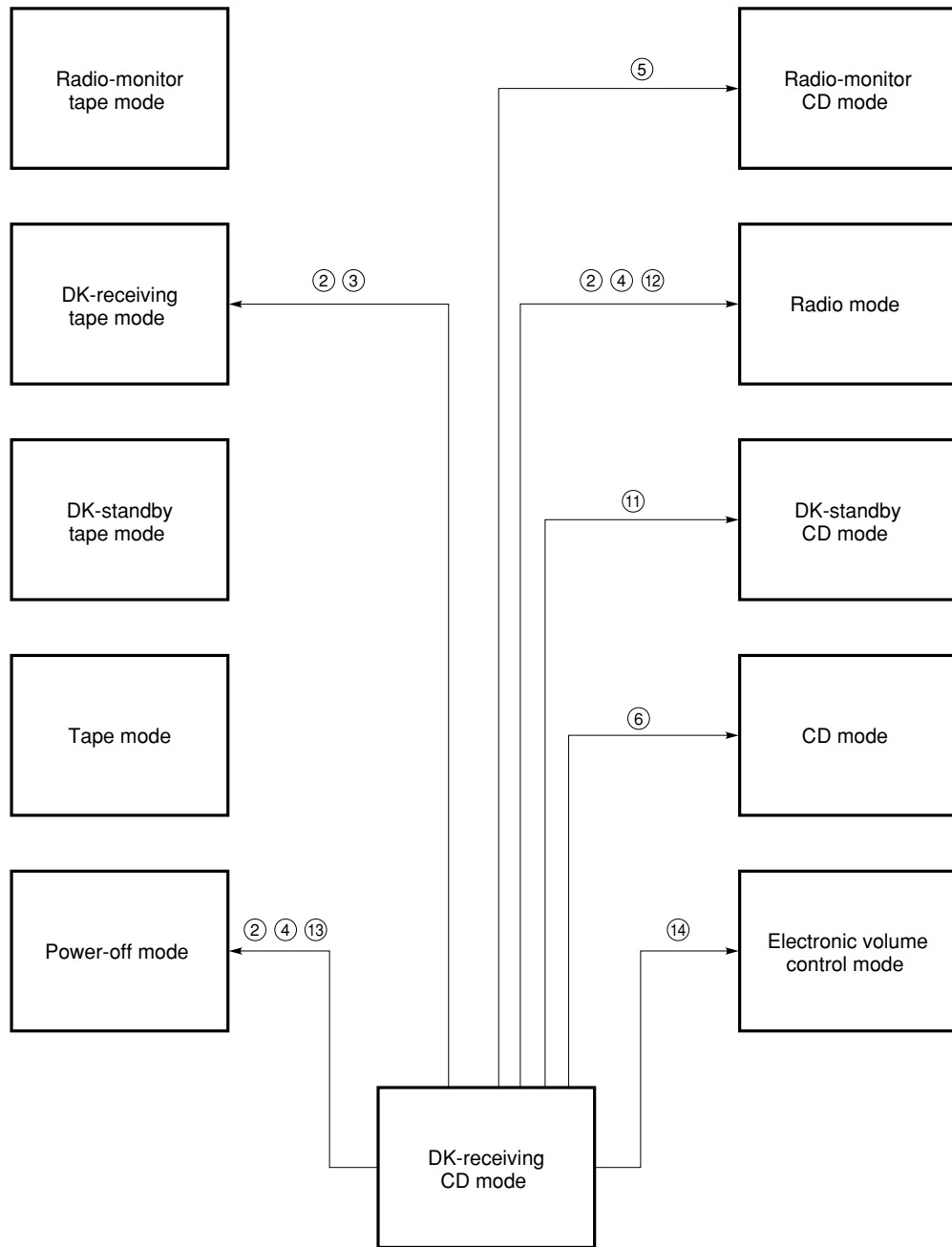
(g) Transition from the DK-standby CD mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

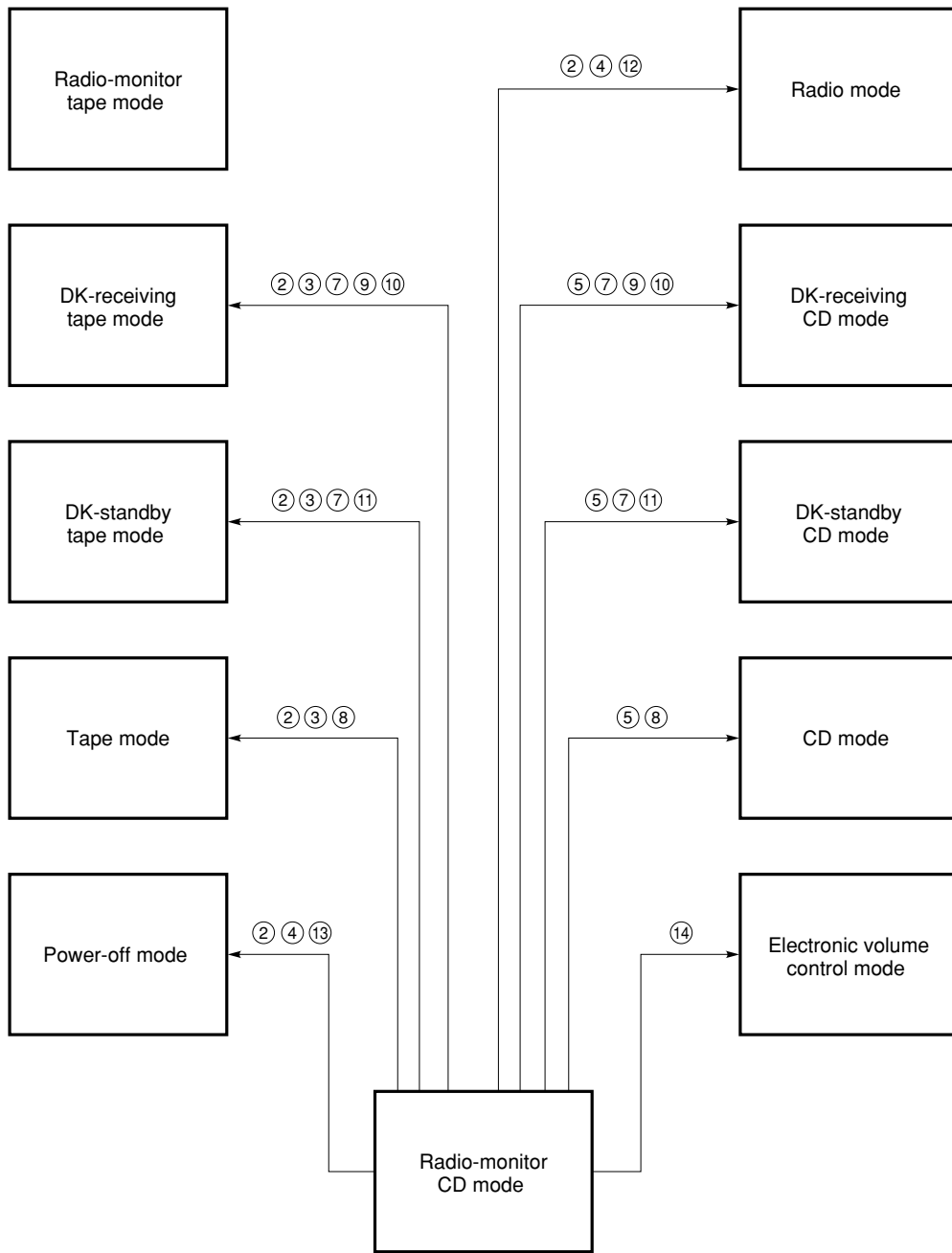
(h) Transition from the DK-receiving CD mode to another mode



**Remark** The circled numbers represent the following:

- |  |  |   |
|--|--|---|
| ①: CDSET switch on   | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off  | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on   | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off  | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <span style="border: 1px solid black; padding: 0 2px;">RDMONI</span> key on |  |   |
| ⑥: <span style="border: 1px solid black; padding: 0 2px;">VF</span> key on     |  |   |

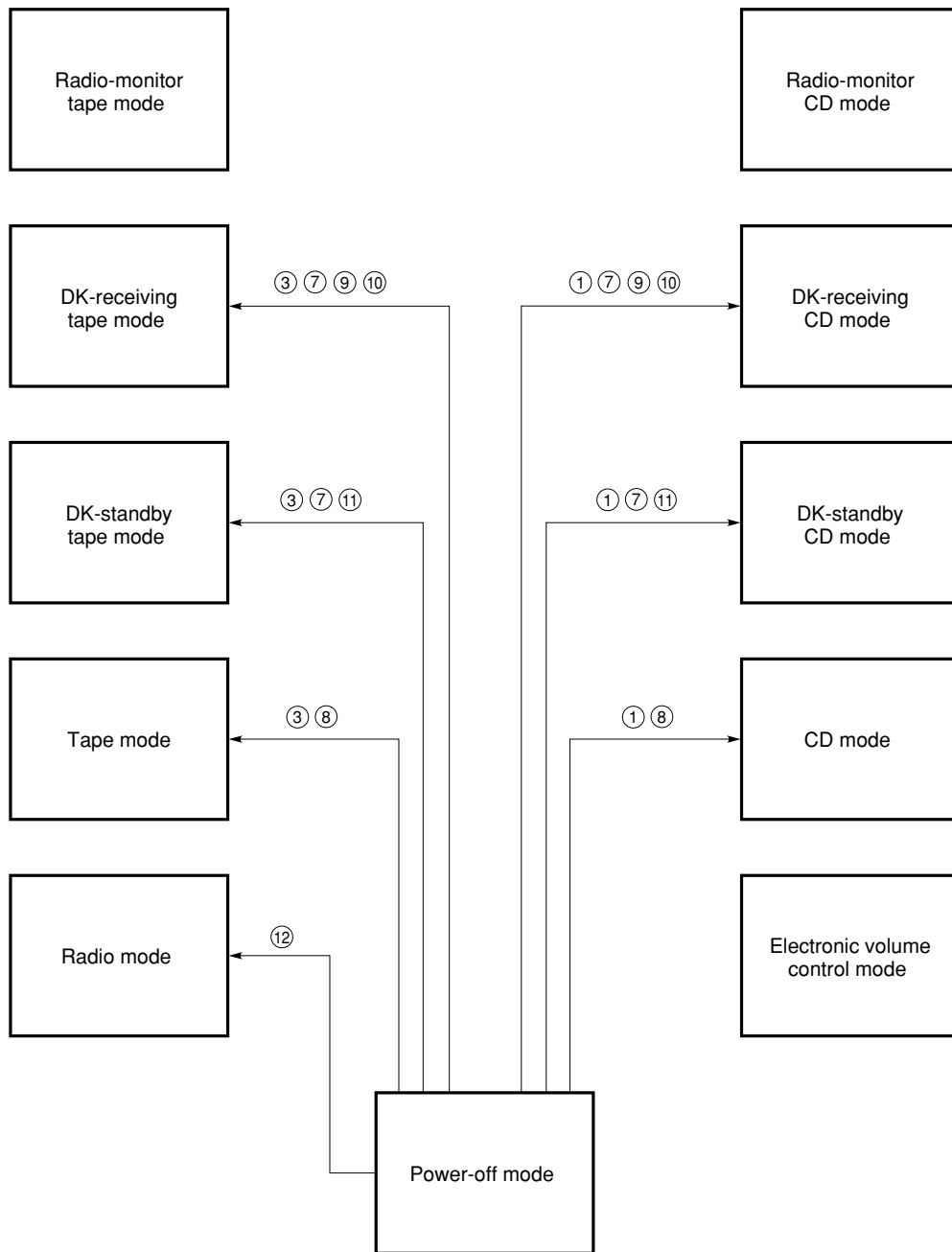
(i) Transition from the radio-monitor CD mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

(j) Transition from the power-off mode to another mode



**Remark** The circled numbers represent the following:

- |                         |  |   |
|-------------------------|--|---|
| ①: CDSET switch on      | ⑦: Reception of the VF band                    | ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off |
| ②: CDSET switch off     | ⑧: Reception of bands other than the VF band   | ⑫: RDSET switch on  |
| ③: TPSET switch on      | ⑨: Reception from traffic information stations | ⑬: RDSET switch off   |
| ④: TPSET switch off     | ⑩: DK switch on                                | ⑭: Electronic volume control key on   |
| ⑤: <b>RDMONI</b> key on |  |   |
| ⑥: <b>VF</b> key on     |  |   |

4. DISPLAY

4.1 LCD PANEL

FM 1	▶	VF	ST	LOC	SK	LOUD	RDMONI	AMS
FM 2	▶							NR
FM 3	▶						DKSTBY	MTL
MW1							AM	
MW2							PM	18 CH

88:8.8 5

4.2 CHARACTER STYLE

1234567890

ABCDEFGHIJLQPRSTV

4.3 EXAMPLES OF DISPLAY

(1) Tape mode

TAPE

(4) Volume mode

VOL

(7) Balance mode

BAL

(2) CD mode

Cd

(5) Bass mode

BAS

(8) Fader mode

FAd

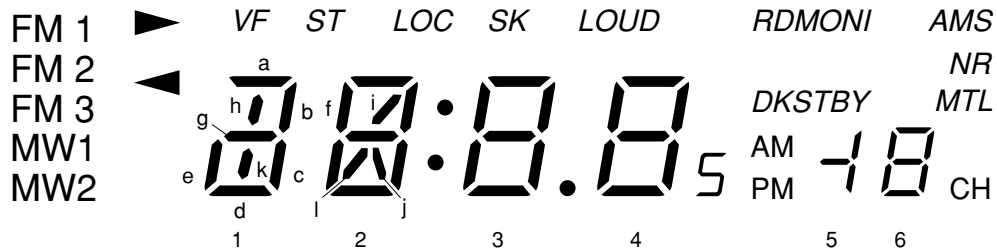
(3) Auto-storage

AP.

(6) Treble mode

TREb

4.4 LCD ASSIGNMENT



4.5 LCD ASSIGNMENT TABLE

4.5.1 Table of LCD Assignment for the Internal LCD Controller/Key Scan Driver

Pin name (pin number) / Pin name (pin number)	COM <sub>0</sub> (37)	COM <sub>1</sub> (36)	COM <sub>2</sub> (35)
LCD <sub>0</sub> (57)	MW2	MW1	FM3
LCD <sub>1</sub> (56)	FM2	1d, 1e, 1g	1a
LCD <sub>2</sub> (55)	1c	1k, 1h	1b
LCD <sub>3</sub> (54)	2e	2l, 2i	2f
LCD <sub>4</sub> (53)	2d	2g	2a
LCD <sub>5</sub> (52)	2c	2j	2b
LCD <sub>6</sub> (51)	:	FM1	▶
LCD <sub>7</sub> (50)	3e	◀	3f
LCD <sub>8</sub> (49)	3d	3g	3a
LCD <sub>9</sub> (48)	3c	.	3b
LCD <sub>10</sub> (47)	4e	ST	4f
LCD <sub>11</sub> (46)	4d	4g	4a
LCD <sub>12</sub> (45)	4c	VF	4b
LCD <sub>13</sub> (44)	LOC	5	SK
LCD <sub>14</sub> (43)	PM	AM	LOUD
LCD <sub>15</sub> (42)	RDMONI	5g	DKSTBY
LCD <sub>16</sub> (41)	AMS	NR	5b, 5c
LCD <sub>17</sub> (40)	6e	MTL	6f
LCD <sub>18</sub> (39)	6d	6g	6a
LCD <sub>19</sub> (38)	6c	CH	6b

**Remark** The numbers in parentheses are the pin numbers of the μPD17012GF-057.

4.5.2 Table of LCD Assignment for the External LCD Controller/Key Scan Driver (μPD17202AGF-011)




Pin name (pin number) / Pin name (pin number)	COM <sub>0</sub> (62)	COM <sub>1</sub> (63)	COM <sub>2</sub> (64)
LCD <sub>0</sub> (25)	MW2	MW1	FM3
LCD <sub>1</sub> (24)	FM2	1d, 1e, 1g	1a
LCD <sub>2</sub> (23)	1c	1k, 1h	1b
LCD <sub>3</sub> (22)	2e	2l, 2i	2f
LCD <sub>4</sub> (21)	2d	2g	2a
LCD <sub>5</sub> (20)	2c	2j	2b
LCD <sub>6</sub> (19)	:	FM1	▶
LCD <sub>7</sub> (18)	3e	◀	3f
LCD <sub>8</sub> (17)	3d	3g	3a
LCD <sub>9</sub> (16)	3c	.	3b
LCD <sub>10</sub> (15)	4e	ST	4f
LCD <sub>11</sub> (14)	4d	4g	4a
LCD <sub>12</sub> (13)	4c	VF	4b
LCD <sub>13</sub> (12)	LOC	5	SK
LCD <sub>14</sub> (11)	PM	AM	LOUD
LCD <sub>15</sub> (10)	RDMONI	5g	DKSTBY
LCD <sub>16</sub> (9)	AMS	NR	5b, 5c
LCD <sub>17</sub> (8)	6e	MTL	6f
LCD <sub>18</sub> (7)	6d	6g	6a
LCD <sub>19</sub> (6)	6c	CH	6b

**Remark** Blank: Not used. The numbers in parentheses are the pin numbers of the μPD17202AGF-011.



4.6 DESCRIPTION OF DISPLAY

Display	Description
VF	<p>Indicates that the VF band is selected.</p> <p><b>(1) In the CD mode and tape mode</b> This indication is off.</p> <p><b>(2) In other modes</b> This indication is on when the VF band is selected.</p>
SK	<p>Indicates that a traffic information station is selected for reception.</p> <p><b>(1) In the CD mode and tape mode</b> This indication is off.</p> <p><b>(2) In other modes</b> This indication is on when the FM or VF band is selected or in the traffic information station reception state. The traffic information station reception state is the state where the SK switch is on in the station reception state.</p>
ST	<p>Indicates that a stereo broadcast is currently received.</p> <p><b>(1) In the CD mode or tape mode</b> This indication is off.</p> <p><b>(2) In other modes</b> This indication is on when the FM, VF, or MW band is selected, the ST switch is on in the station reception state, and the MONO-off state is set. (For the MW band, this indication is on only when the initial setting diode MWS = 1, and the stereo reception function is enabled.) This indication is off during tuning operation regardless of which band is selected.</p>
LOC	<p>Indicates that the local state is set.</p> <p><b>(1) In the CD mode and tape mode</b> This indication is off.</p> <p><b>(2) In other modes</b> This indication is on in the local state.</p>
LOUD	<p>Indicates that the loudness-on state is set. This indication is on in the loudness-on state, regardless of which mode is set.</p>
MTL	<p>Indicates that the METAL-on state is set.</p> <p><b>(1) In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode</b> This indication is on in the METAL-on state.</p> <p><b>(2) In other modes</b> This indication is off.</p>
NR	<p>Indicates that the NR-on state is set.</p> <p><b>(1) In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode</b> This indication is on in the NR-on state.</p> <p><b>(2) In other modes</b> This indication is off.</p>
RDMONI	<p>Indicates that the radio-monitor state is set.</p>

Display	Description
DKSTBY	<p>Indicates that the DK-standby state or the DK-on state is set.</p> <p>(1) <b>In the CD mode and tape mode</b> This indication is on in the DK-standby state or the DK-on state.</p> <p>(2) <b>In other modes</b> This indication is off.</p>
	<p>Indicates a tape running direction.</p> <p>(1) <b>In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode</b> A tape running direction is displayed according to the state of the RL switch. A tape running direction blinks when the FF switch is on.</p> <p>(2) <b>In other modes</b> This indication is off.</p>
<p>FM1 FM2 FM3 MW1 MW2</p>	<p>Indicates a band received.</p> <p>(1) <b>In the CD mode and tape mode</b> This indication is off.</p> <p>(2) <b>In other modes</b> The band currently received is displayed.</p>
	<p>Displays a receive frequency, "AP", "CD", "TAPE", "VOL", "BAS", "TREB", "BAL", "FRD", and the clock. When the entire panel is blinking while "VOL" is displayed, the mute state is set.</p>
AMS	<p>Indicates that the Auto Music Search (AMS) state is set.</p> <p>(1) <b>In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode</b> This indication is on in the AMS-on state.</p> <p>(2) <b>In other modes</b> This indication is off.</p>
<p>AM PM</p>	<p>Indicates AM (before noon) or PM (after noon) when the 12-hour system is used for display.</p>
	<p>Indicates a preset memory number or electronic volume control value.</p> <p>When a preset memory is written to or called, the preset memory number is displayed together with "CH." In the electronic volume control mode, the value of the volume control is displayed; the "CH" is turned off in this case.</p> <p>This indication is on when a frequency is displayed; this indication is off when the clock is displayed.</p> <p>When preset memory write operation is enabled, "CH" blinks at a frequency of 1 Hz.</p> <p>When a preset memory is being scanned, the preset memory number blinks at a frequency of 1 Hz.</p>

**5. MUTE OUTPUT TIMING CHARTS**

The circled numbers ① through ⑥ in this chapter represent the following:

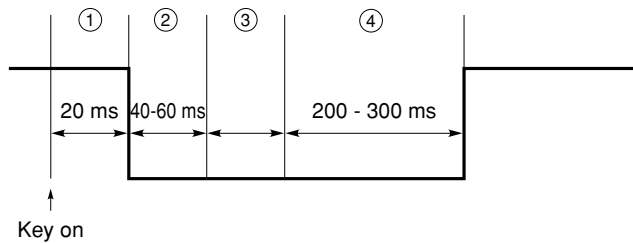
- ①: Key-on chattering protection
- ②: Preceding mute and beep output
- ③: Updating of the frequency division ratio setting and indication
- ④: Following mute
- ⑤: Scan time
- ⑥: Wait for PLL locking

**5.1 RADIO MUTE (RDMUTE PIN) OUTPUT TIMING CHARTS**

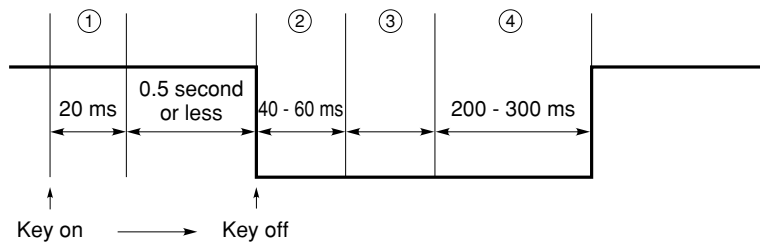
**(1) Manual up/down**

**(a) 1-channel up/down**

**(i) When AUTO500 switch = 0**



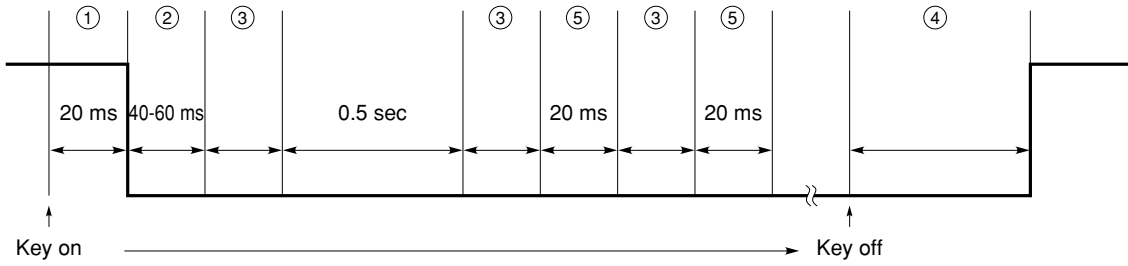
**(ii) When AUTO500 switch = 1**



In either case (i) or case (ii), the time of ④ is 600 ms to 700 ms at the band edges (lowest frequency ⇔ highest frequency).

(b) Continuous up/down

(i) When AUTO500 switch = 0



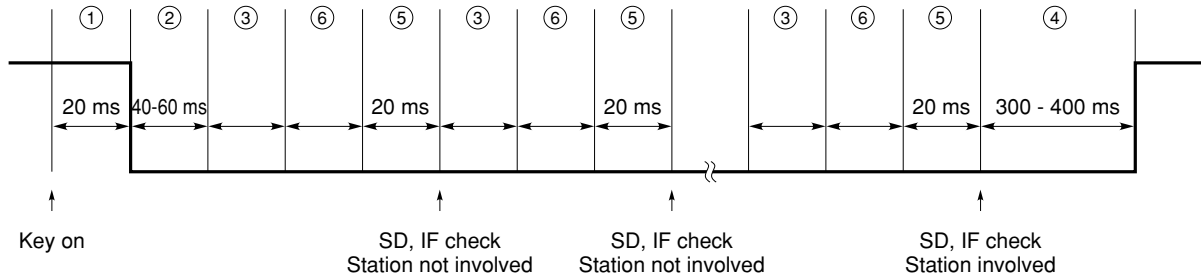
At the band edges, the time of (5) is 500 ms, and the time of (4) is 600 ms to 700 ms.

(ii) When AUTO500 switch = 1

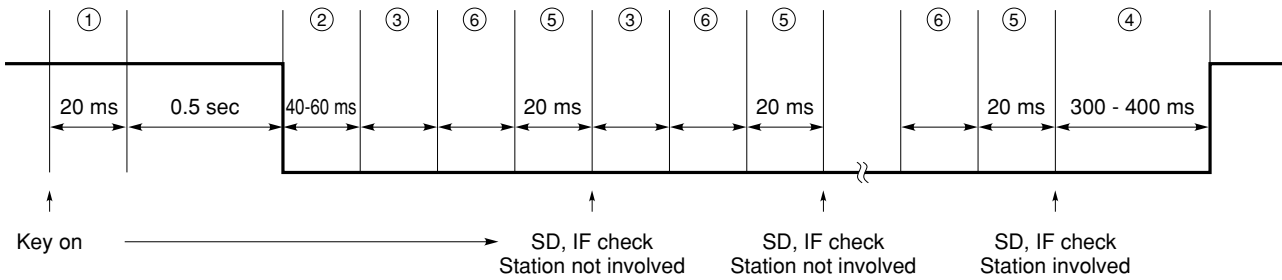
The auto-tuning function is enabled by holding down the key for 0.5 second or more, so that continuous up/down operation is not performed.

(2) Automatic up/down

(a) SEEK UP, SEEK DWN, SCAN UP, or SCAN DWN key



(b) When the MAN UP or MAN DWN key is held down for 0.5 second or more when AUTO500 switch = 1

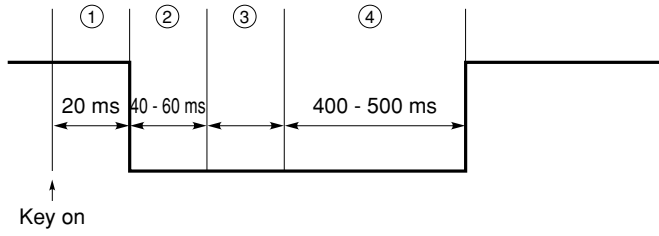


In either case (a) or case (b), the time of (5) is 540 ms at the band edges.

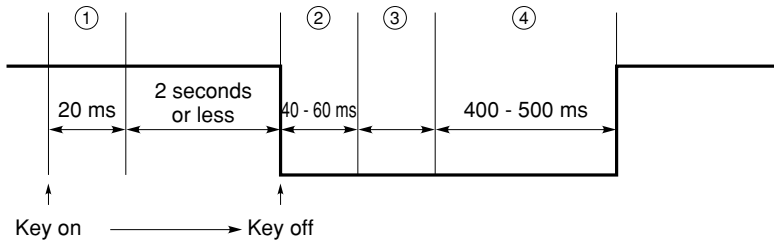
An IF check is made twice in the FAST mode and SLOW mode.

(3) Calling a preset memory

(a) When M2S switch = 0

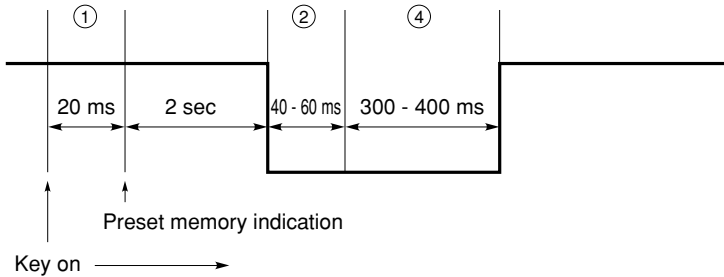


(b) When M2S switch = 1



(4) Write to a preset memory

(a) When M2S switch = 0

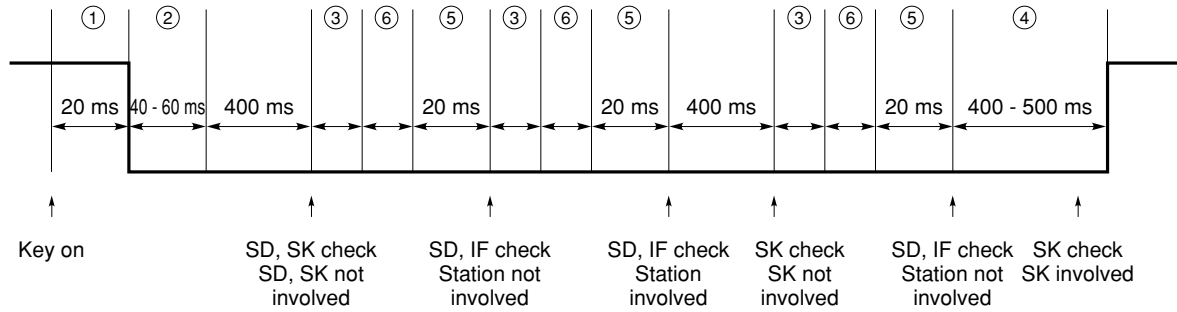


(b) When M2S switch = 1

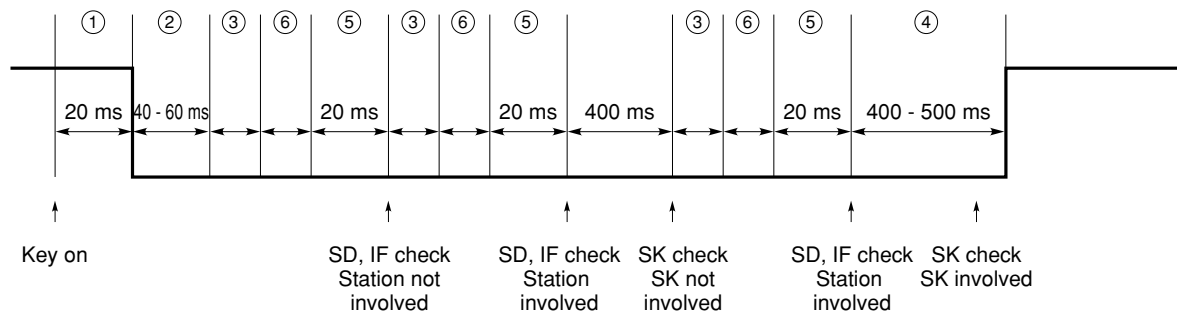
Mute output operation is not performed.

(5) VF mode

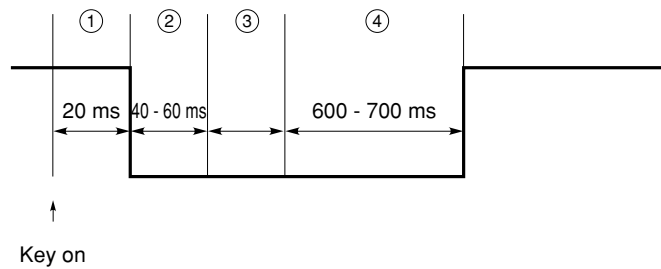
(a) When the VF mode is set with the VF key on



(b) Seek and scan operation in the VF mode

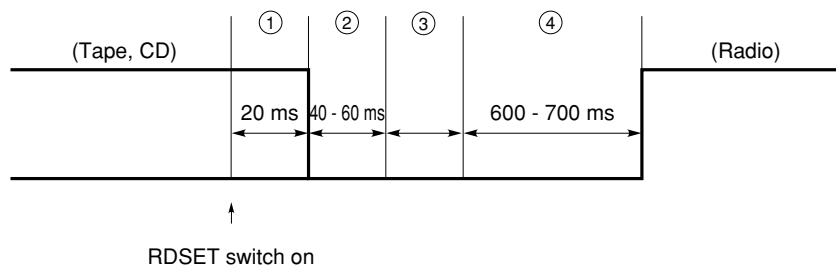


(6) Band switching

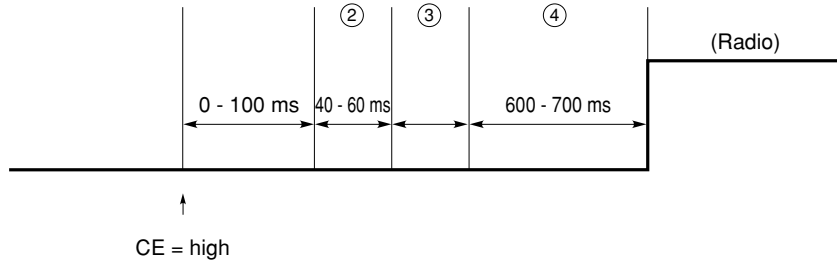


(7) Turning on or off the radio set

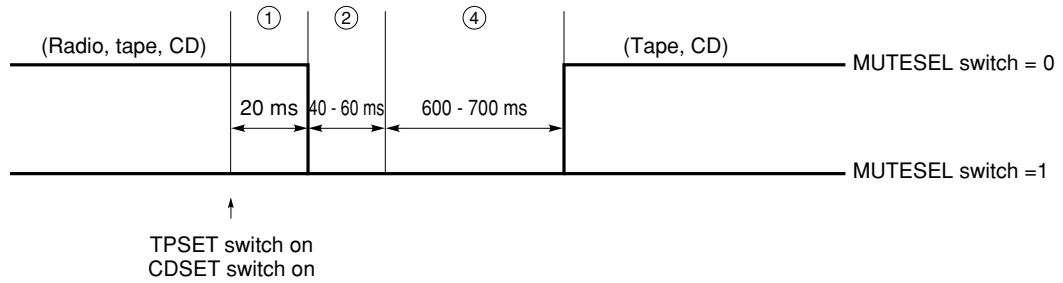
(a) When the RDSET switch is used



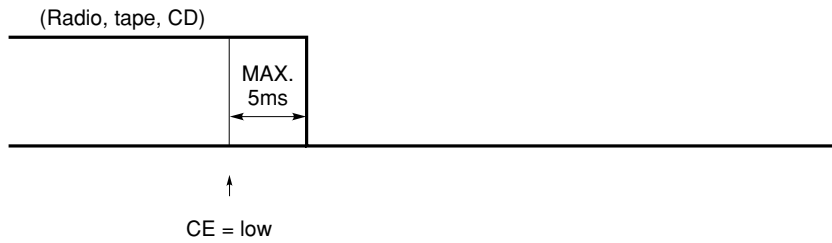
(b) When the CE pin is raised from low to high with the RDON switch set to 1



(8) Turning on or off the tape or CD

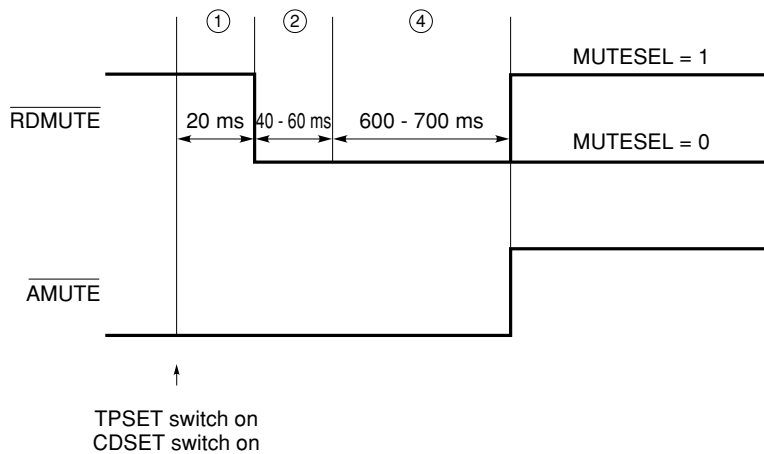


(9) Pulling the CE pin from high to low

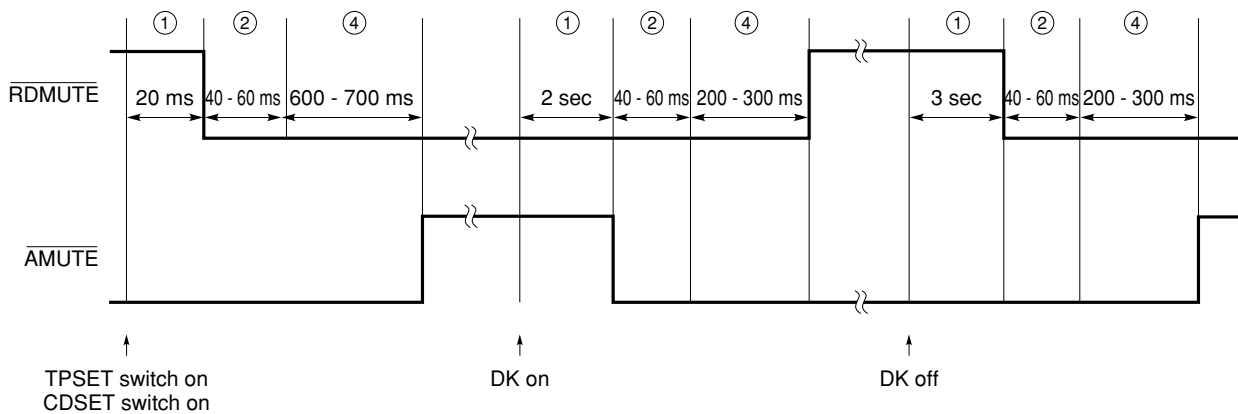


5.2 RADIO MUTE (RDMUTE PIN) AND AUDIO MUTE (AMUTE PIN) OUTPUT TIMING CHARTS

(1) When the mode is switched from the radio mode to the tape or CD mode

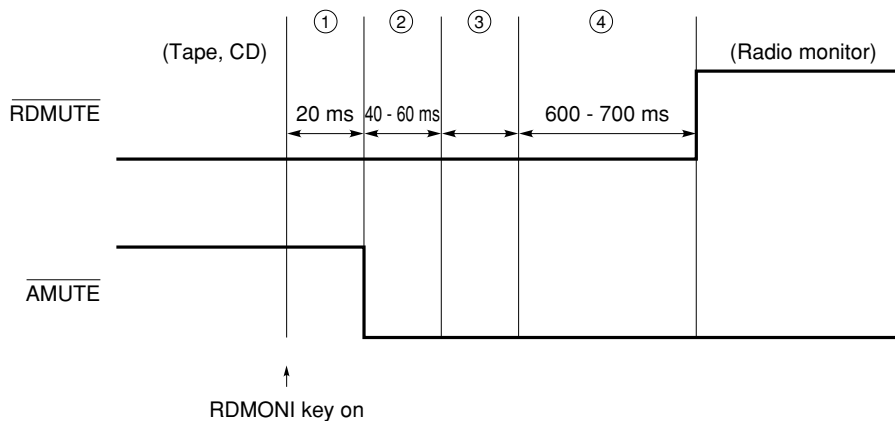


(2) When the mode is switched from the VF band to the tape or CD mode (Set MUTESEL to 0.)



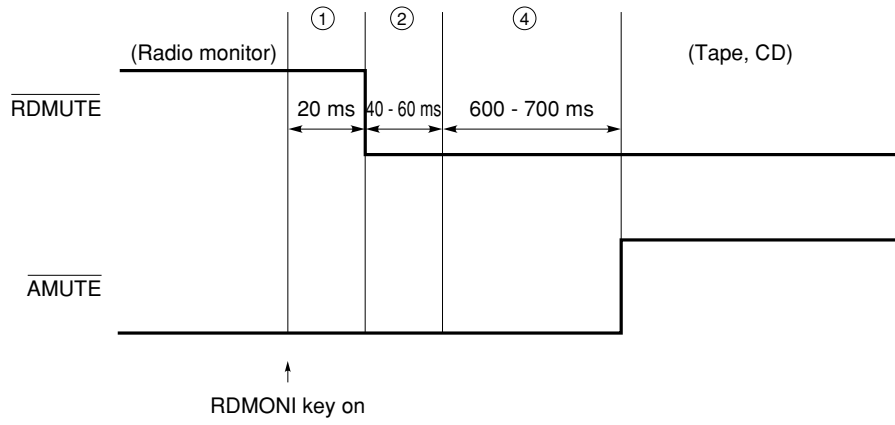
(3) When the radio monitor function is used (Set MUTESEL to 0.)

(a) Switching the radio monitor function from off to on





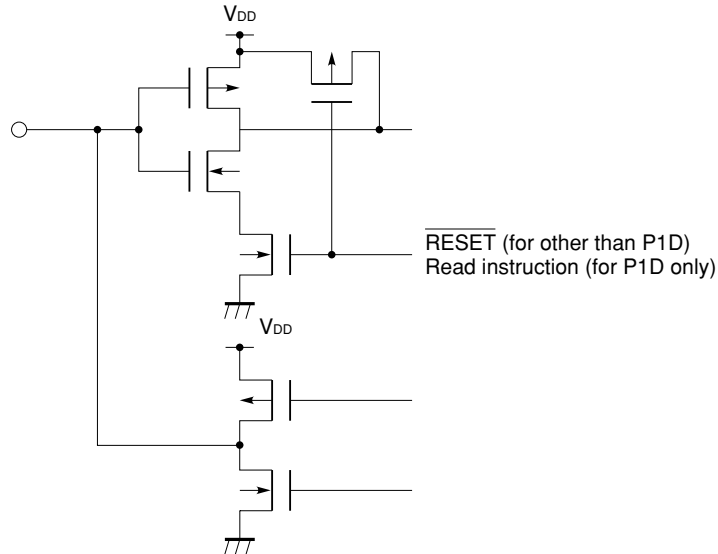
(b) Switching the radio monitor function from on to off



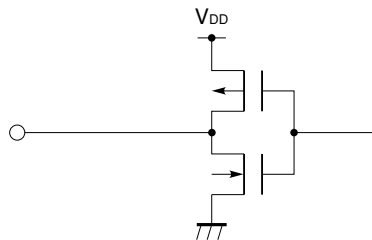
6. PIN I/O CIRCUITS

The I/O circuit of each pin of the μPD17012GF-057 is illustrated below in a simplified form.

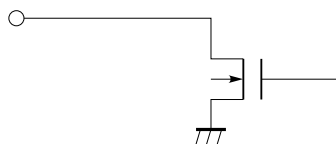
- (1) P0A (P0A<sub>0</sub>/CDO<sub>UT</sub>, P0A<sub>1</sub>/SI, P0A<sub>2</sub>/SCK)
  - P0B (P0B<sub>3</sub>/EVOL\_SCK, P0B<sub>2</sub>/EVOL\_DA, P0B<sub>1</sub>/BEEP, P0B<sub>0</sub>/LOUD)
  - P1A (P1A<sub>2</sub>/POWER, P1A<sub>1</sub>/BAND<sub>1</sub>, P1A<sub>0</sub>/BAND<sub>2</sub>)
  - P1D (P1D<sub>3</sub>/MODE<sub>2</sub>, P1D<sub>2</sub>/MODE, P1D<sub>1</sub>/KS<sub>17</sub>, P1D<sub>0</sub>/KS<sub>16</sub>)
- } (I/O)



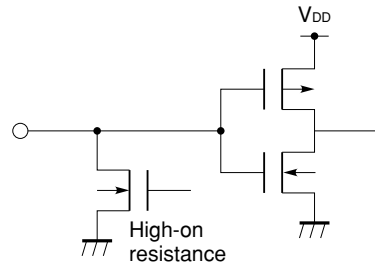
- (2) P1C (P1C<sub>3</sub>/AGCC, P1C<sub>2</sub>/LOC, P1C<sub>1</sub>/AMUTE, P1C<sub>0</sub>/RDMUTE)
  - P2E<sub>0</sub>/LCD<sub>16</sub>/BLANK, P2F<sub>0</sub>/LCD<sub>17</sub>/LOAD
  - P2G<sub>0</sub>/LCD<sub>18</sub>/LCD RES, P2H<sub>0</sub>/LCD<sub>19</sub>/POUT
  - PYA<sub>15</sub>/LCD<sub>15</sub>/KS<sub>15</sub>-PYA<sub>0</sub>/LCD<sub>0</sub>/KS<sub>0</sub>
- } (Output)



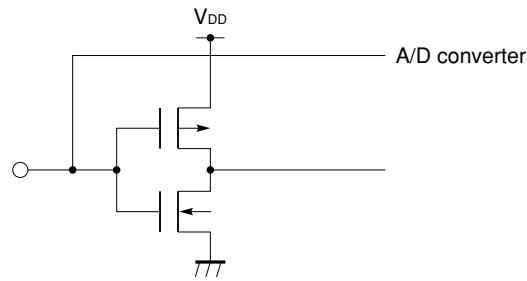
- (3) P0C (P0C<sub>3</sub>/SO, P0C<sub>2</sub>/AMS, P0C<sub>1</sub>/MONO/NR, P0C<sub>0</sub>/MTL) (Output)



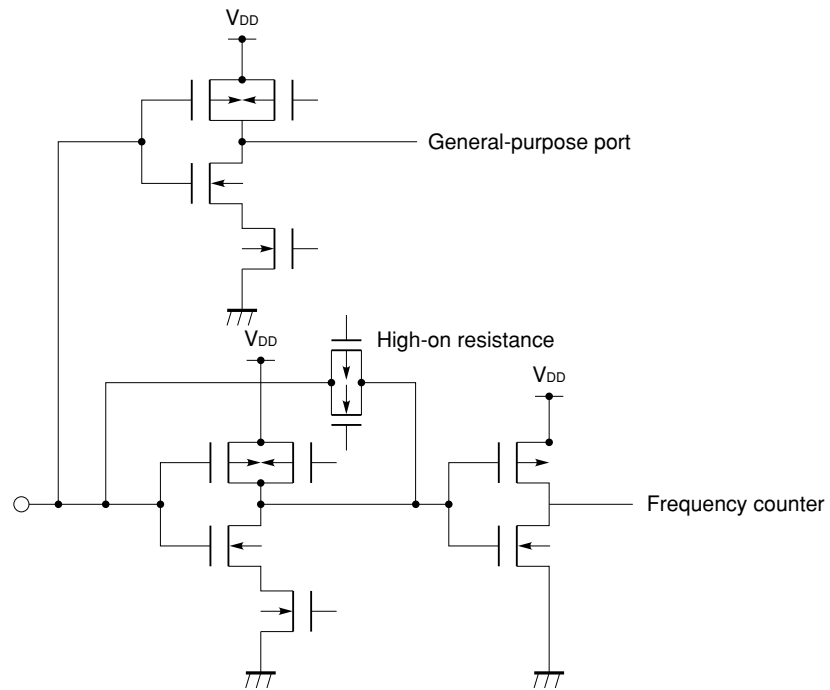
(4) P0D (P0D<sub>3</sub>/K<sub>3</sub>-P0D<sub>0</sub>/K<sub>0</sub>) (Input)



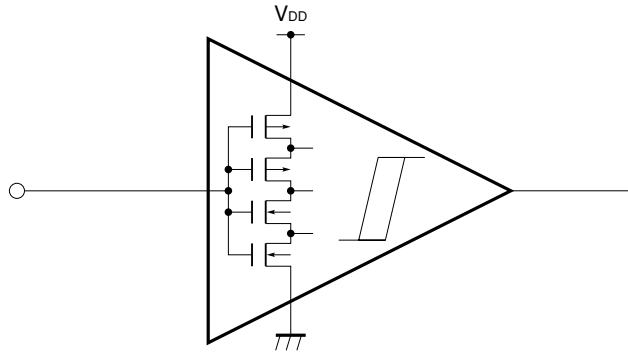
(5) P1B (P1B<sub>1</sub>/ADC<sub>1</sub>/INT, P1B<sub>0</sub>/ADC<sub>0</sub>/SD) (Input)



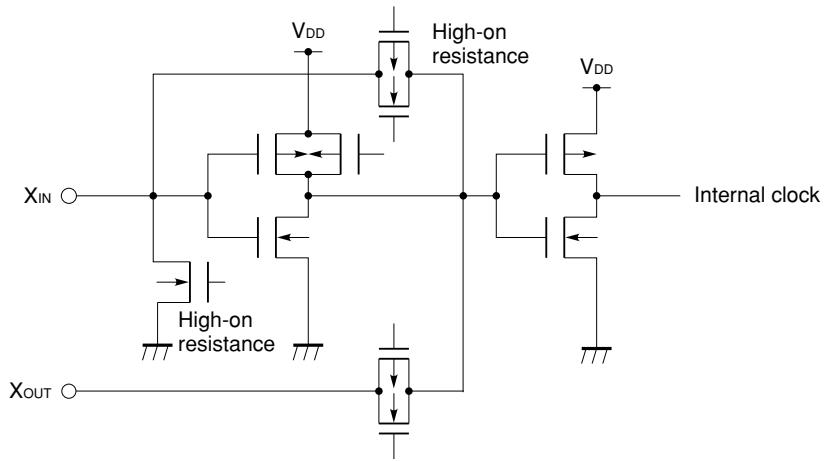
(6) P1B (P1B<sub>3</sub>/FMIFC, P1B<sub>2</sub>/AMIFC) (Input)



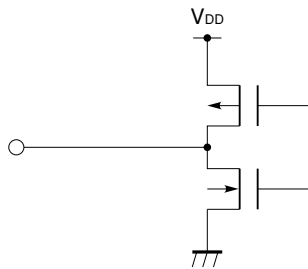
(7) CE (Schmitt-triggered input)



(8)  $X_{OUT}$  (Output),  $X_{IN}$  (Input)

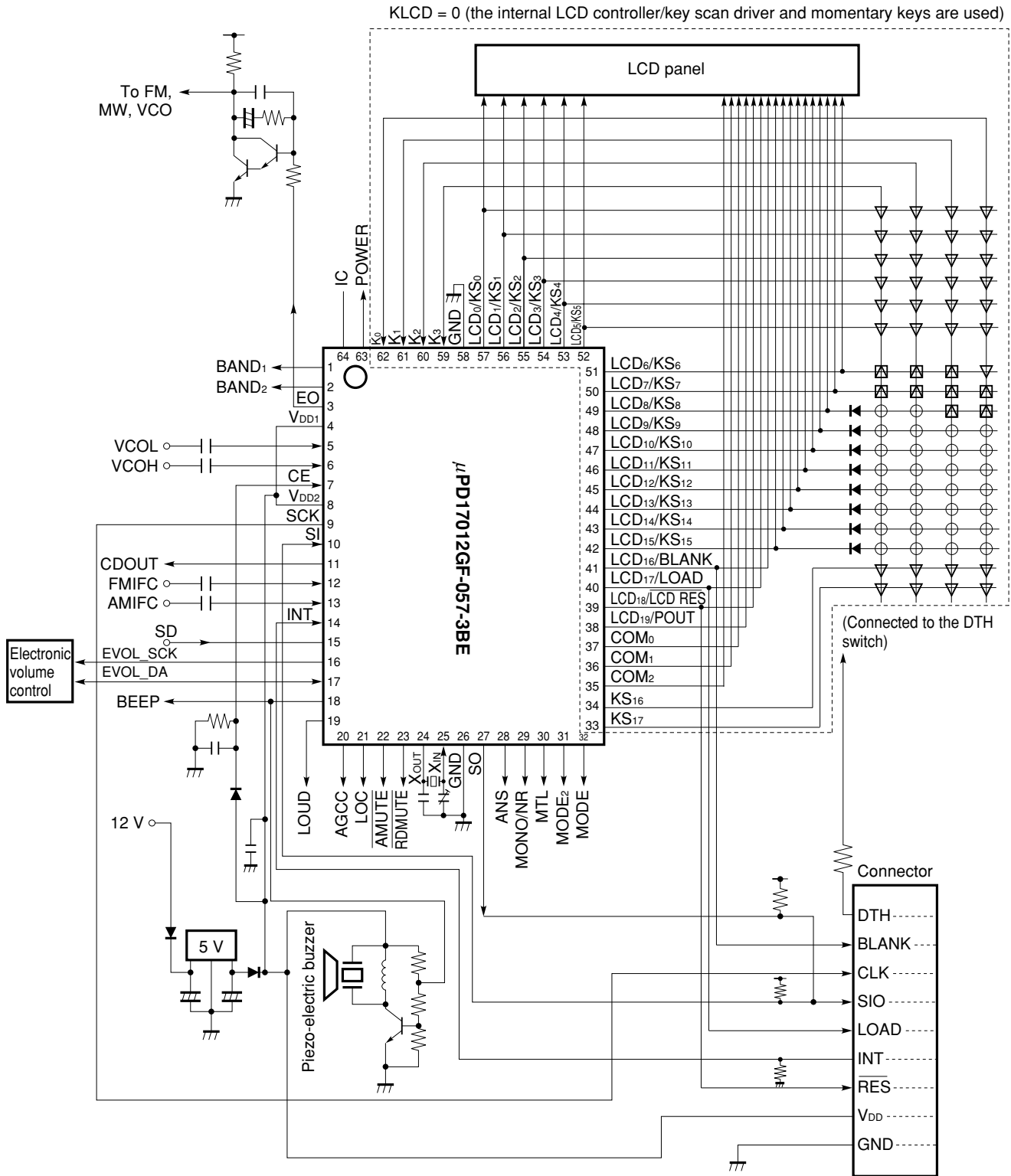





(9) EO (Output)



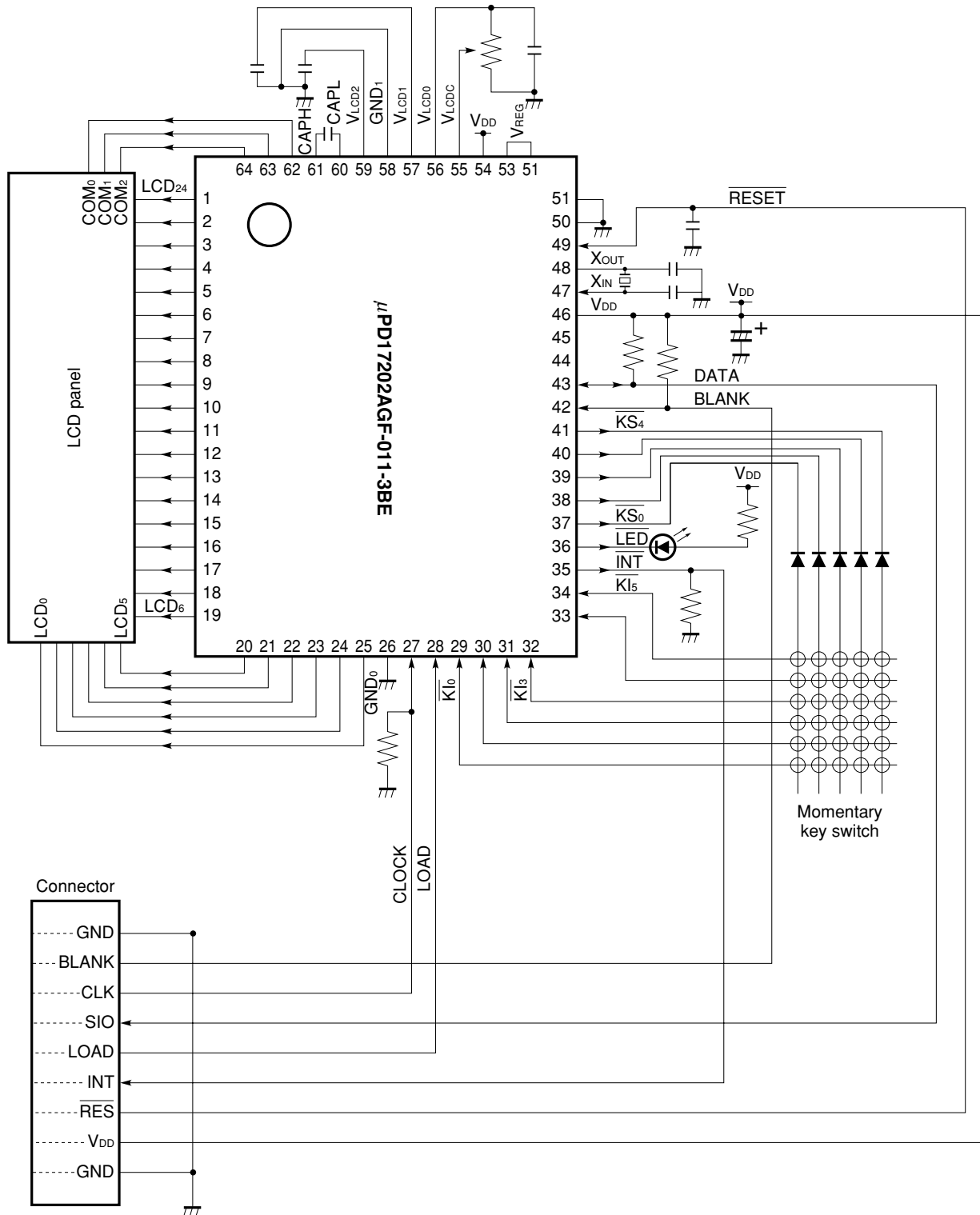


7. SAMPLE APPLICATION CIRCUITS



-  Alternation or transistor switch
-  Initial setting diode
-  Momentary key

KLCD = 1 (Momentary keys of the external LCD controller/key scan driver are used)



8. ELECTRICAL CHARACTERISTICS (PRELIMINARY)

ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C)

Parameter	Symbol	Conditions	Rated value	Unit
Supply voltage	V <sub>DD</sub>		-0.3 to +6.0	V
Input voltage	V <sub>I</sub>		-0.3 to V <sub>DD</sub> + 0.3	V
Output voltage	V <sub>O</sub>	Except for P0C <sub>0</sub> to P0C <sub>3</sub>	-0.3 to V <sub>DD</sub> + 0.3	V
Output high current	I <sub>OH</sub>	Each pin	-12.0	mA
		Total for all pins	-20.0	mA
Output low current	I <sub>OL</sub>	Each pin	15.0	mA
		Total for all pins	30.0	mA
Output withstand voltage	V <sub>BDS</sub>	P0C <sub>0</sub> - P0C <sub>3</sub>	10.0	V
Total loss	P <sub>t</sub>		400	mW
Operating ambient temperature	T <sub>A</sub>	When the entire chip is operating	-40 to +85	°C
Storage temperature	T <sub>stg</sub>		-55 to +125	°C

**Caution** Absolute maximum ratings are rated values beyond which physical damage will be caused to the product; if the rated value of any of the parameters in the above table is exceeded, even momentarily, the quality of the product may deteriorate. Always use the product within its rated values.

RECOMMENDED OPERATING RANGES (T<sub>A</sub> = -40 to +85 °C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V <sub>DD1</sub>	When the entire chip is operating	4.5	5.0	5.5	V
	V <sub>DD2</sub>	When the CPU is operating, but the PLL is not	3.5	5.0	5.5	V
Data hold voltage	V <sub>DDR</sub>	When the crystal oscillator is stopped	2.3		5.5	V
Output withstand voltage	V <sub>BDS</sub>	P0C <sub>0</sub> - P0C <sub>3</sub>			9.0	V
Rise time of supply voltage	t <sub>rise</sub>	V <sub>DD</sub> : 0 → 4.5 V			500	ms



DC CHARACTERISTICS (T<sub>A</sub> = -40 to +85 °C, V<sub>DD</sub> = 5 V ±10%)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Supply current	I <sub>DD1</sub>	When the CPU is operating but the PLL is not, with a sinusoidal wave applied to the X <sub>IN</sub> pin (f <sub>IN</sub> = 4.5 MHz, V <sub>IN</sub> = V <sub>DD</sub> )			2.0	3.0	mA
	I <sub>DD2</sub>	When the CPU is operating but the PLL is not, with a sinusoidal wave applied to the X <sub>IN</sub> pin (f <sub>IN</sub> = 4.5 MHz, V <sub>IN</sub> = V <sub>DD</sub> ) When the HALT instruction is issued			0.5	1.0	mA
Data hold voltage	V <sub>DDR1</sub>	When the crystal oscillator is operating	With timer FF for interruption detection	3.5			V
	V <sub>DDR2</sub>	When the crystal oscillator is stopped	With timer FF for interruption detection	2.3			V
	V <sub>DDR3</sub>		For holding data memory	2.0			V
Data hold current	I <sub>DDR1</sub>	When the crystal oscillator is stopped	V <sub>DD</sub> = 5 V, T <sub>A</sub> = 25 °C		2.0	4.0	μA
	I <sub>DDR2</sub>				2.0	20.0	μA
	I <sub>DDR3</sub>		V <sub>DD</sub> = 2.3 V, T <sub>A</sub> = 25 °C		1.0	2.0	μA
	I <sub>DDR4</sub>		V <sub>DD</sub> = 2.3 V		1.0	10.0	μA
Input high voltage	V <sub>IH1</sub>	P0A <sub>1</sub> , P0B <sub>0</sub> - P0B <sub>3</sub> , P1A <sub>0</sub> - P1A <sub>2</sub> , P1B <sub>0</sub> - P1B <sub>3</sub> , P1D <sub>0</sub> - P1D <sub>3</sub>		0.7V <sub>DD</sub>		V <sub>DD</sub>	V
	V <sub>IH2</sub>	P0A <sub>0</sub> , P0A <sub>2</sub> , CE, INT		0.8V <sub>DD</sub>		V <sub>DD</sub>	V
	V <sub>IH3</sub>	P0D <sub>0</sub> - P0D <sub>3</sub>		0.6V <sub>DD</sub>		V <sub>DD</sub>	V
Input low voltage	V <sub>IL1</sub>	P0A <sub>1</sub> , P0B <sub>0</sub> - P0B <sub>3</sub> , P0D <sub>0</sub> - P0D <sub>3</sub> , P1A <sub>0</sub> - P1A <sub>2</sub> , P1B <sub>0</sub> - P1B <sub>3</sub> , P1D <sub>0</sub> - P1D <sub>3</sub>				0.2V <sub>DD</sub>	V
	V <sub>IL2</sub>	P0A <sub>0</sub> , P0A <sub>2</sub> , CE, INT				0.2V <sub>DD</sub>	V
Output high current	I <sub>OH1</sub>	P0A <sub>0</sub> - P0A <sub>2</sub> , P0B <sub>0</sub> - P0B <sub>3</sub> , P1A <sub>0</sub> - P1A <sub>2</sub> , P1C <sub>0</sub> - P1C <sub>3</sub> , P1D <sub>0</sub> - P1D <sub>3</sub> V <sub>OH</sub> = V <sub>DD</sub> - 1 V		-1.0			mA
	I <sub>OH2</sub>	PYA <sub>0</sub> - PYA <sub>15</sub> , P2G <sub>0</sub> , EO V <sub>OH</sub> = V <sub>DD</sub> - 1 V		-1.0			mA
Output low current	I <sub>OL1</sub>	P0A <sub>0</sub> - P0A <sub>2</sub> , P0B <sub>0</sub> - P0B <sub>3</sub> , P1A <sub>0</sub> - P1A <sub>2</sub> , P1C <sub>0</sub> - P1C <sub>3</sub> , P1D <sub>0</sub> - P1D <sub>3</sub> V <sub>OL</sub> = 1 V		1.0			mA
	I <sub>OL2</sub>	PYA <sub>0</sub> - PYA <sub>15</sub> , P2G <sub>0</sub> , EO V <sub>OL</sub> = 1 V		1.0			mA
	I <sub>OL3</sub>	P0C <sub>0</sub> - P0C <sub>3</sub> V <sub>OL</sub> = 1 V		10			mA
Input high current	I <sub>IH1</sub>	When the VCOH pin is pulled down V <sub>IH</sub> = V <sub>DD</sub>		0.1			mA
	I <sub>IH2</sub>	When the VCOL pin is pulled down V <sub>IH</sub> = V <sub>DD</sub>		0.1			mA
	I <sub>IH3</sub>	When the X <sub>IN</sub> pin is pulled down V <sub>IH</sub> = V <sub>DD</sub>		0.1			mA
	I <sub>IH4</sub>	When the P0D <sub>0</sub> to P0D <sub>3</sub> pins are pulled down V <sub>IH</sub> = V <sub>DD</sub>		10		150	μA
Output-off leakage current	I <sub>L1</sub>	P0C <sub>0</sub> - P0C <sub>3</sub> V <sub>OH</sub> = 9 V				1.0	μA
	I <sub>L2</sub>	EO V <sub>OH</sub> = V <sub>DD</sub> , V <sub>OL</sub> = 0 V				±1.0	μA

**AC CHARACTERISTICS (T<sub>A</sub> = -40 to +85 °C, V<sub>DD</sub> = 5 V ±10%)**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating frequency	f <sub>IN1</sub>	VCOL pin in MF mode, with a sinusoidal wave applied at V <sub>IN</sub> = 0.3V <sub>p-p</sub>	0.58		30	MHz
	f <sub>IN2</sub>	VCOL pin in HF mode, with a sinusoidal wave applied at V <sub>IN</sub> = 0.3V <sub>p-p</sub>	5		40	MHz
	f <sub>IN3</sub>	VCOH pin in VHF mode, with a sinusoidal wave applied at V <sub>IN</sub> = 0.3V <sub>p-p</sub>	30		250	MHz
	f <sub>IN4</sub>	AMIFC and FMIFC pins in AMIF count mode, with a sinusoidal wave applied at V <sub>IN</sub> = 0.3V <sub>p-p</sub>	0.3		1.0	MHz
	f <sub>IN5</sub>	AMIFC pin in AMIF count mode, with a sinusoidal wave applied at V <sub>IN</sub> = 0.1V <sub>p-p</sub>	0.44		0.46	MHz
	f <sub>IN6</sub>	FMIFC pin in FMIF count mode, with a sinusoidal wave applied at V <sub>IN</sub> = 0.3V <sub>p-p</sub>	5		15	MHz
	f <sub>IN7</sub>	FMIFC pin in FMIF count mode, with a sinusoidal wave applied at V <sub>IN</sub> = 0.1V <sub>p-p</sub>	10.5		10.9	MHz

**A/D CONVERTER CHARACTERISTICS (T<sub>A</sub> = -40 to +85 °C, V<sub>DD</sub> = 5 V ±10%)**

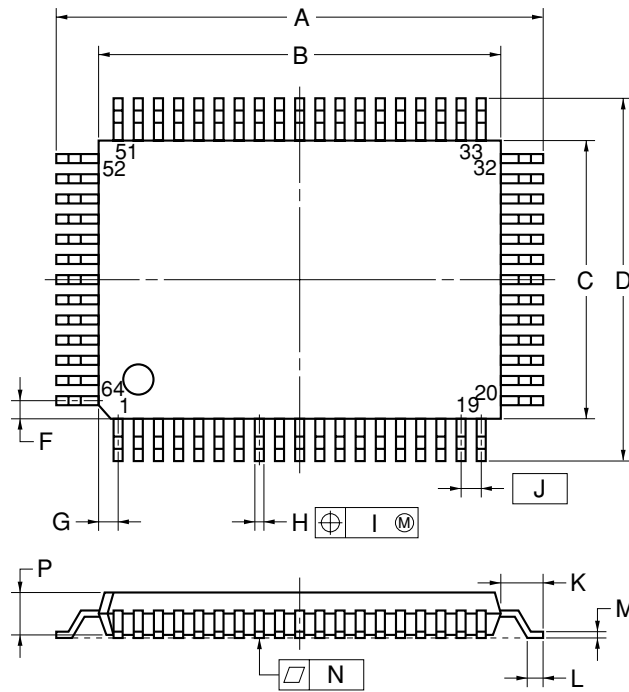
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Resolution of A/D conversion					6	bit
Total error in A/D conversion		T <sub>A</sub> = -10 to +50 °C		±1.0	±1.5	LSB

**OTHER CHARACTERISTICS (T<sub>A</sub> = +25 °C, V<sub>DD</sub> = 5.0 V, for reference purposes only)**

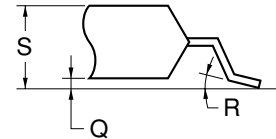
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply current	I <sub>DD3</sub>	When the CPU and PLL are operating, with a sinusoidal wave applied to the VCOH pin (f <sub>IN</sub> = 130 MHz, V <sub>IN</sub> = 0.3V <sub>p-p</sub> )		15		mA
	I <sub>DD4</sub>	When the CPU and PLL are operating, with a sinusoidal wave applied to the VCOH pin (f <sub>IN</sub> = 250 MHz, V <sub>IN</sub> = 0.3V <sub>p-p</sub> )		18		mA

9. PACKAGE DRAWING

64 PIN PLASTIC QFP (14×20)



detail of lead end



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±0.2	0.913 <sup>+0.009</sup> <sub>-0.008</sub>
B	20.0±0.2	0.787 <sup>+0.009</sup> <sub>-0.008</sub>
C	14.0±0.2	0.551 <sup>+0.009</sup> <sub>-0.008</sub>
D	17.2±0.2	0.677±0.008
F	1.0	0.039
G	1.0	0.039
H	0.40±0.10	0.016 <sup>+0.004</sup> <sub>-0.005</sub>
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 <sup>+0.009</sup> <sub>-0.008</sub>
M	0.15 <sup>+0.10</sup> <sub>-0.05</sub>	0.006 <sup>+0.004</sup> <sub>-0.003</sub>
N	0.10	0.004
P	2.7	0.106
Q	0.125±0.075	0.005±0.003
R	5°±5°	5°±5°
S	3.0 MAX.	0.119 MAX.

S64GF-100-3B8, 3BE-3

10. RECOMMENDED SOLDERING CONDITIONS

The conditions listed below shall be met when soldering the μPD17012GF-057.

For details of the recommended soldering conditions, refer to our document *SMD Surface Mount Technology Manual* (C11531E).

Please consult with our sales offices in case any other soldering process is used, or in case soldering is done under different conditions.

Table 10-1 Soldering Conditions for Surface-Mount Devices

μPD17012GF-057-3BE: 64-pin plastic QFP (14 × 20 mm, 1.0-mm pitch)

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 235 °C Reflow time: 30 seconds or less (at 210 °C or more) Maximum allowable number of reflow processes: 2 Exposure limit <b>Note</b> : 7 days (20 hours of pre-baking is required at 125 °C afterward.)  <Caution> Non-heat-resistant trays, such as magazine and taping trays, cannot be baked before unpacking.	IR35-207-2
VPS	Peak package's surface temperature: 215 °C Reflow time: 40 seconds or less (at 200 °C or more) Maximum allowable number of reflow processes: 2 Exposure limit <b>Note</b> : 7 days (20 hours of pre-baking is required at 125 °C afterward.)  <Caution> Non-heat-resistant trays, such as magazine and taping trays, cannot be baked before unpacking.	VP15-207-2
Wave soldering	Temperature in the soldering vessel: 260 °C or less Soldering time: 10 seconds or less Number of soldering processes: 1 Pre-heating temperature: 120 °C max. (package surface temperature) Exposure limit <b>Note</b> : 7 days (20 hours of pre-baking is required at 125 °C afterward.)	WS60-207-1
Partial heating method	Terminal temperature: 300 °C or less Flow time: 3 seconds or less (for each side of device)	—

**Note** Exposure limit before soldering after dry-pack package is opened.

Storage conditions: Temperature of 25 °C and maximum relative humidity at 65% or less

**Caution** Do not apply more than a single process at once, except for "Partial heating method."

**APPENDIX A LCD CONTROLLER/KEY SCAN DRIVER ( $\mu$ PD17202AGF-011)**

The  $\mu$ PD17202AGF-011 is a CMOS 4-bit single-chip microcontroller for the front panel of car stereo systems. The package is 64-pin plastic QFP. The  $\mu$ PD17202AGF-011 contains an LCD controller/key scan driver and key scan driver and can thus minimize the wiring between the master microcontroller and front panel.

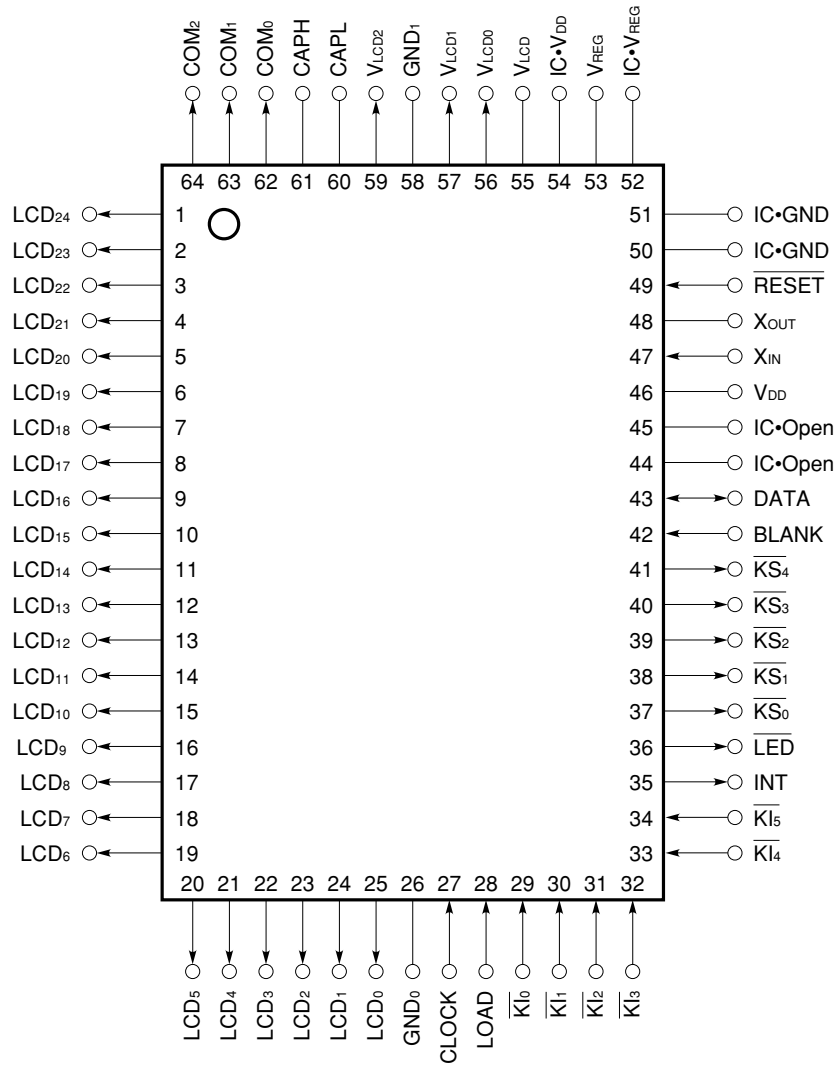
**Features**

- LCD controller/key scan driver (1/3 duty, 1/3 bias, frame frequency of 325.5 Hz, display consisting of up to 75 segments.)
- Key scan driver which can read up to 30 (5  $\times$  6) keys
- One LED output
- Three-wire serial interface for communication with the master microcontroller (CLOCK, DATA, and LOAD)
- Supply voltage:  $V_{DD} = 5.0 \text{ V} \pm 10\%$
- System clock:  $f_x = 8 \text{ MHz}$

Pin configuration (top view)

64-pin plastic QFP (14 × 20 mm, 1.0-mm pitch)

μPD17202AGF-011-3BE



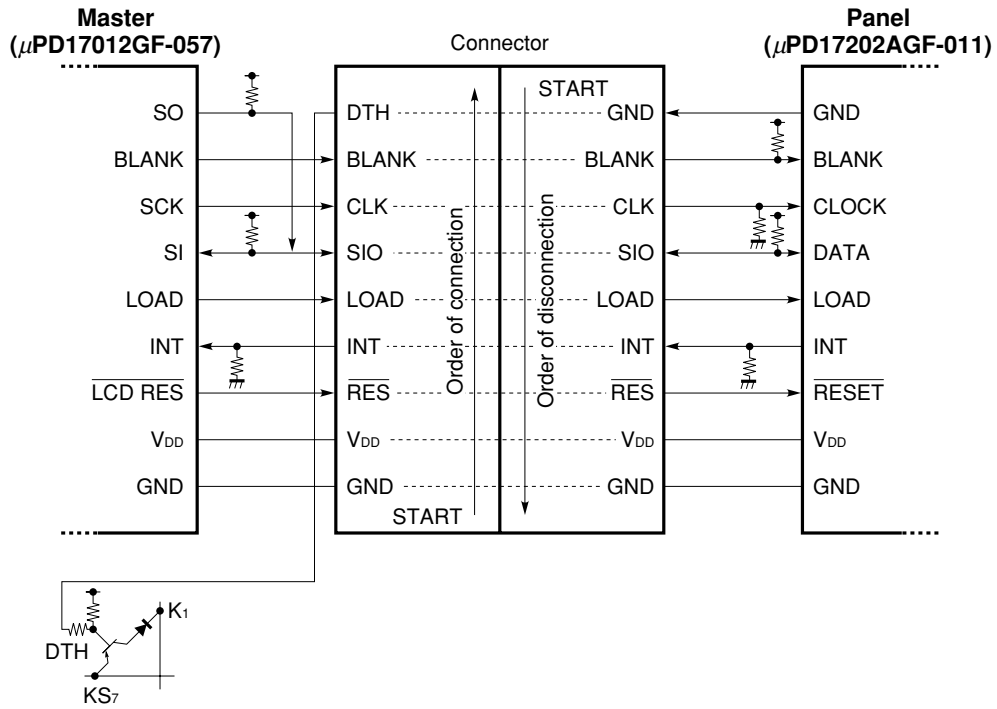
- Cautions**
1. Leave the IC•Open pin open.
  2. Connect the IC•GND pin directly to GND.
  3. Connect the IC•V<sub>REG</sub> pin directly to V<sub>REG</sub>.
  4. Connect the IC•V<sub>DD</sub> pin directly to V<sub>DD</sub>.

**Remark** IC: Internally connected

APPENDIX B COMMUNICATION

(1) Signal lines between the master (μPD17012GF-057) and panel (μPD17202AGF-011)

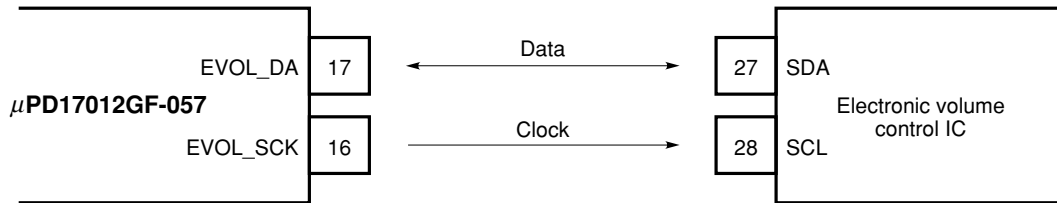
Connect pull-up and pull-down resistors as follows:



**(2) Communication with electronic volume control IC (I<sup>2</sup>C bus interface)**

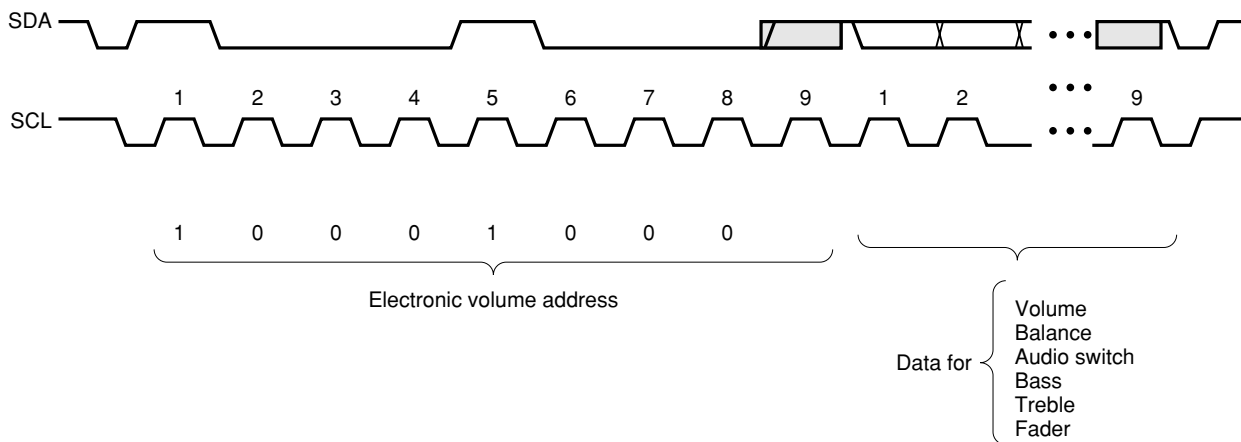
The μPD17012GF-057 sends specified data, such as volume and balance data, to the electronic volume control IC. Two buses, the data bus and clock bus, are necessary to output data to the electronic volume control IC. Data and clock signals are output from the EVOL\_DA pin (pin 17) and EVOL\_SCK pin (pin 16) of the μPD17012GF-057.

**Fig. B-1 Pin Connections (Electronic Volume Control)**



Electronic volume control data consists of nine bits (eight bits for data and a check bit). The electronic volume address (nine bits) and control data (nine bits) are sequentially transferred N times, where N is the number of transferred data items, such as the volume and balance data.

**Fig. B-2 Data Transfer Format (Electronic Volume Control)**





## 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.

**Caution** This product contains an I<sup>2</sup>C bus interface circuit.  
When using the I<sup>2</sup>C bus interface, notify its use to NEC when ordering custom code. NEC can guarantee the following only when the customer informs NEC of the use of the interface:  
Purchase of NEC I<sup>2</sup>C components conveys a license under the Philips I<sup>2</sup>C Patent Rights to use these components in an I<sup>2</sup>C system, provided that the system conforms to the I<sup>2</sup>C Standard Specification as defined by Philips.

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- Device availability
- Ordering information
- Product release schedule
- Availability of related technical literature
- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
- Network requirements

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