

MOS DIGITAL INTEGRATED CIRCUITS

μ PD1708AG-020, μ PD1708AG-220

PLL FREQUENCY SYNTHESIZER AND CONTROLLER FOR MOBILE FM/MW/LW RADIO WITH CLOCK

DESCRIPTION

The μ PD1708AG-020/ μ PD1708AG-220, a CMOS LSI chip developed for worldwide PLL frequency synthesizer FM/MW/LW radios, is a 52pin flat package incorporating PLL, controller, prescaler, and LCD driver. It enables construction of a compact, high-performance FM/MW/LW digital tuning system equipped with a clock, such as a car stereo, home stereo, and radio cassette.

FEATURES

- Single power supply 5 V \pm 10 %
- LCD direct drive (1/2 duty, 1/2 bias drive, frame frequency: 100 Hz)
- Built-in prescaler
- Built-in 12 hour/24 hour clock
- 6-station preset memory (6 FM/MW/LW stations can be preset, independent of each other, with 6 buttons.)
- Manual up/down and auto up/down (SCAN/SEEK) station selection (saw tooth tuning)
- Endless rotary switch can be used for manual up/down.
- FM/MW/LW stations in Europe, USA, Australia, Japan, South Africa, Latin America, and Middle East can be selected.
- The Japanese MW band has wide band range (522—1 629 kHz) for automotive radio information.
- Alternate switch or momentary switch can be used for band switching. Band switching can be done with one button.
- AM (MW/LW) IF offset is possible.
- Last channel memory memorizes one FM/MW/LW station each.
- ARI (traffic information) auto tuning is possible.
- STEREO can be indicated.
- Preset memory indication (number indication)
- Selectable lead type
 - Lead bended type : μ PD1708AG-020-00
 - Straight lead type : μ PD1708AG-220-03

ABSOLUTE MAXIMUM RATINGS

| | | | |
|---------------------------|-----------|-------------------------|----|
| Power supply voltage | V_{DD} | -0.3 to +6.0 | V |
| Input voltage | V_I | -0.3 to $+V_{DD} + 0.3$ | V |
| Output voltage | V_O | -0.3 to $+V_{DD} + 0.3$ | V |
| Output absorption current | I_O | 10 | mA |
| Operating temperature | T_{opt} | -40 to +85 | °C |
| Storage temperature | T_{stg} | -55 to +125 | °C |

RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITION |
|----------------------|----------|------|------|------|------|----------------|
| Power supply voltage | V_{DD} | 4.5 | 5.0 | 5.5 | V | |
| Ambient temperature | T_a | -40 | | +85 | °C | |
| Input oscillation | V_{in} | 0.3 | | 4.5 | Vp-p | AM pin |
| Input oscillation | V_{in} | 0.5 | | 4.5 | Vp-p | FM pin |

ELECTRICAL CHARACTERISTICS
(V_{DD} = +4.5 V to +5.5 V, T_a = -40 °C to 85 °C)

| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITION |
|---------------------------|-------------------|---------------------|------|---------------------|------|---|
| Power supply voltage | V _{DD1} | 4.5 | 5.0 | 5.5 | V | CPU and PLL operation |
| Power supply voltage | V _{DD2} | 3.5 | | 5.5 | V | CPU operation only (clock operation only) |
| Power supply current | I _{DD1} | | 15 | | mA | When 120 MHz is input from FM pin only |
| Power supply current | I _{DD2} | | 400 | | μA | CPU operation only (clock operation only) |
| Data retention voltage | V _{DR} | 2.5 | | V _{DD} | V | When clock oscillation is stopped (no clock mode) |
| Data retention current | I _{DR} | | 1 | 10 | μA | When clock oscillation is stopped (no clock mode) (V _{DD} =5 V) |
| High-level output current | I _{OH1} | -1.0 | -2.5 | | mA | SD, MUTE, KS ₀ to KS ₅ , EO ₁ , EO ₂ pins (V _{OH} =V _{DD} - 1 V) |
| High-level output current | I _{OH2} | -10 | -18 | | μA | LCD1 to LCD23 pins (V _{OH} =V _{DD} - 1 V) |
| High-level output current | I _{OH3} | -20 | -60 | | μA | COM1 and COM2 pins (V _{OH} =V _{DD} - 1 V) |
| Low-level output current | I _{OL1} | 1.0 | 3.8 | | mA | SD, MUTE, FM BAND, AM BAND, EO ₁ , EO ₂ pins (V _{OL} =1 V) |
| Low-level output current | I _{OL2} | 25 | 100 | | μA | KS ₀ to KS ₅ pins (V _{OL} =1 V) |
| Low-level output current | I _{OL3} | 10 | 30 | | μA | LCD1 to LCD23 pins (V _{OL} =1 V) |
| Low-level output current | I _{OL4} | 20 | 80 | | μA | COM1 and COM2 pins (V _{OL} =1 V) |
| High-level input current | I _{IH1} | 10 | 35 | 60 | μA | K ₀ to K ₃ pins (V _{IH} =V _{DD} =5 V) |
| High-level input current | I _{IH2} | 100 | 300 | | μA | FM, AM, X1 pins (V _{IH} =V _{DD} =5 V) |
| Output leak current | I _L | -1 | | +1 | μA | EO ₁ and EO ₂ pins (V _{DD} =V _{OL} =5 V, V _{OH} =0 V) |
| High-level input voltage | V _{IH1} | 0.7 V _{DD} | | | V | SD, K ₄ , K ₅ pins |
| High-level input voltage | V _{IH2} | 0.6 V _{DD} | | | V | K ₀ to K ₃ pins |
| High-level input voltage | V _{IH3} | 0.8 V _{DD} | | | V | CE pin |
| Low-level input voltage | V _{IL1} | | | 0.3 V _{DD} | V | SD, K ₄ , K ₅ pins |
| Low-level input voltage | V _{IL2} | | | 0.2 V _{DD} | V | K ₀ to K ₃ pins |
| Low-level input voltage | V _{IL3} | | | 0.2 V _{DD} | V | CE pin |
| Output level | V _O | 2.3 | | 2.8 | V | COM1, COM2 pin 1/2 bias voltage (V _{DD} =5 V) |
| Operating frequency | f _{AML} | 0.5 | | 20 | MHz | AM pin V _i =0.1 Vp-p (V _{DD} =4.5 V) |
| Operating frequency | f _{FM-1} | 10 | | 130 | MHz | FM pin V _i =0.3 Vp-p (V _{DD} =4.5 V) |
| Operating frequency | f _{FM-2} | 10 | | 150 | MHz | FM pin V _i =0.5 Vp-p (V _{DD} =4.5 V) |

FUNCTION OUTLINE

Receive frequency, comparison frequency, channel space, and intermediate frequency

| Area | Band | Item | FREQUENCY RANGE | CHANNEL SPACING | REFERENCE FREQUENCY | INTERMEDIATE FREQUENCY |
|---------------|------|------|---------------------------|-----------------|---------------------|------------------------|
| Europe | FM | | 87.50 MHz to 108.00 MHz | 50 kHz | 25 kHz | 10.70 MHz |
| | MW | | 522 kHz to 1 620 kHz | 9 kHz | 9 kHz | 450,459 kHz |
| | LW | | 153 kHz to 281 kHz | 1 kHz (Note 1) | 1 kHz | |
| USA1 | FM | | 87.5 MHz to 108.0 MHz | 100 kHz | 25 kHz | 10.7 MHz |
| | MW | | 530 kHz to 1 620 kHz | 10 kHz | 10 kHz | 450,460 kHz |
| USA2 | FM | | 87.5 MHz to 107.9 MHz | 200 kHz | 25 kHz | 10.7 MHz |
| | MW | | 530 kHz to 1 620 kHz | 10 kHz | 10 kHz | 450,460 kHz |
| Australia | FM | | 87.5 MHz to 108.0 MHz | 100 kHz | 25 kHz | 10.7 MHz |
| Middle East | MW | | 531 kHz to 1 602 kHz | 9 kHz | 9 kHz | 450,459 kHz |
| Latin America | FM | | 87.5 MHz to 108.0 MHz | 100 kHz | 25 kHz | 10.7 MHz |
| | MW | | 520 kHz to 1 620 kHz | 5 kHz | 5 kHz | 450,455 kHz |
| Japan | FM | | 76.0 MHz to 90.0 MHz | 100 kHz | 25 kHz | -10.7 MHz |
| | MW | | 522 kHz to 1 629 kHz | 9 kHz | 9 kHz | 450,459 kHz |
| South Africa | FM | | 87.604 MHz to 107.986 MHz | 86 kHz (Note 2) | 10 kHz | -10.700 MHz |
| | MW | | 531 kHz to 1 602 kHz | 9 kHz | 9 kHz | 450,459 kHz |

Notes: 1. Auto tuning stops at only 9 kHz step.

2. Tunes up/down at 80 or 100 kHz steps to the frequency nearest the normal channel plan. (Maximum error: ±10 kHz) Frequency indication is 0 when the tens place of kHz is 0 to 4, and 5 when it is 5 to 9, ignoring units place of kHz.

Tuning function

(1) Auto tuning (saw tooth mode)

Scan up/down: Receives at 5-second intervals.

Seek up/down: Once received, retains the station.

(2) Manual tuning (saw tooth mode)

Manual up/down: Step up/down or fast feed by push-button switch. Pulse count tuning can be done with a rotary switch.

(3) Preset memory call

Six FM/MW/LW stations can be selected independent of each other with six buttons. Last station memory is available for each band.

Clock function

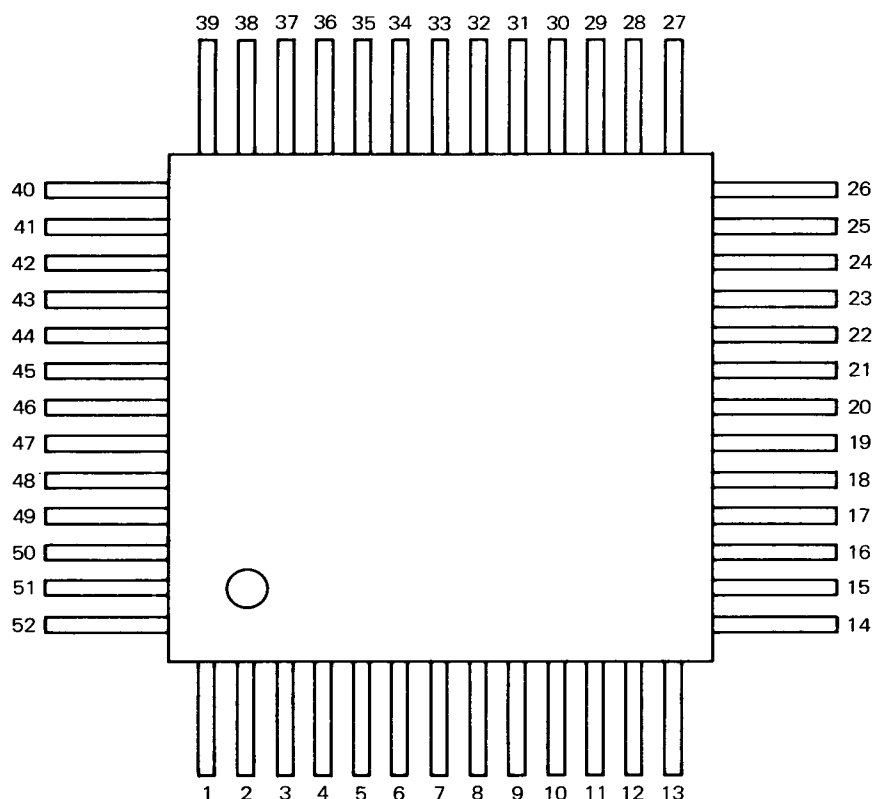
24 hour/12 hour clock for Europe, and 12 hour clock in other areas (with AM/PM indication).

LCD check function

Checks the LCD assembly state or whether or not LCD lights up normally. During the initial power up (V_{DD}: low to high), all segments of the LCD light up for about 1 second.

PIN DESCRIPTIONS

PIN CONFIGURATION (Top View)



| PIN NO. | PIN NAME | PIN NO. | PIN NAME |
|---------|------------------------------------|---------|------------------------------------|
| 1 | LCD4 | 52 | LCD5 |
| 2 | LCD3 | 51 | LCD6 |
| 3 | LCD2 | 50 | LCD7 |
| 4 | LCD1 | 49 | LCD8 |
| 5 | COM2 | 48 | LCD9 |
| 6 | COM1 | 47 | LCD10 |
| 7 | V _{DD} | 46 | LCD11 |
| 8 | FM | 45 | LCD12 |
| 9 | AM | 44 | LCD13 |
| 10 | GND | 43 | LCD14 |
| 11 | EO ₁ | 42 | LCD15 |
| 12 | EO ₂ | 41 | LCD16 |
| 13 | CE | 40 | LCD17 |
| 14 | N.C. | 39 | LCD18 |
| 15 | XI | 38 | LCD19 |
| 16 | XO | 37 | LCD20 |
| 17 | SD(PA ₃) | 36 | LCD21 |
| 18 | MUTE(PA ₂) | 35 | LCD22 |
| 19 | K ₅ (PA ₁) | 34 | LCD23 |
| 20 | K ₄ (PA ₀) | 33 | * V _{DD} |
| 21 | K ₃ | 32 | AM BAND(PC ₀) |
| 22 | K ₂ | 31 | FM BAND(PC ₁) |
| 23 | K ₁ | 30 | KS ₀ (PC ₂) |
| 24 | K ₀ | 29 | KS ₁ (PC ₃) |
| 25 | KS ₅ (PB ₃) | 28 | KS ₂ (PB ₀) |
| 26 | KS ₄ (PB ₂) | 27 | KS ₃ (PB ₁) |

*: Internally connected to pin 7.

N.C.: No Connection

PIN DESCRIPTION

| PIN NO. | SYMBOL | PIN NAME | DESCRIPTION |
|--------------|--------------------------|-----------------------------------|---|
| 1–4 34–52 | LCD1 to LCD23 | LCD segment signal | LCD segment signal output pin (LCD is 1/2 duty, 1/2 bias. Frame frequency is 100 Hz, and drive voltage is V_{DD} .) |
| 5 6 | COM2 COM1 | LCD common Signal | LCD common signal output pin |
| 7 33 | V_{DD} | Power input | Device power supply pin 5 V \pm 10 % power is supplied during device operation. It is also possible to supply power to pin 7 or 33 only. The rise time of V_{DD} must be 500 ms or less (0.0 \rightarrow 4.5 V). If the rise time is too long or V_{DD} does not completely drop to 0 V, but rises from below operating voltage to 3.5 V, the initialization diode switch state may not be correctly read. In such a case, the CE pin is used to read the initialization diode switch state. |
| 8 | FM | FM VCO input | Inputs FM local oscillator output. AC amplifier is built in; cut DC with capacitor. |
| 9 | AM | LW, MW VCO input | Inputs LW/MW local oscillator output. AC amplifier is built in; cut DC with capacitor. |
| 10 | GND | Ground | Connect this pin to the set ground. |
| 11 12 | EO1 EO2 | Error out | Charge pump output from the phase detector composing PLL. If the divided frequency is higher than the reference frequency, these pins output high level. If it is lower, low level is output. If it is equivalent, it results in floating. The same signal is output to EO1 and EO2; these pins can be connected to LPF (Low Pass Filter) of LW/MW/FM. |
| 13 | CE | Chip Enable | Device select signal input pin. High level to operate PLL, and low level to stop PLL. In low level, display becomes blank. Low level or high level under 134 μ s is not accepted. In clock mode, connect this pin to V_{DD} . In no-clock mode, set this pin to low level when radio is OFF, and high level when radio is ON. In no-clock mode, setting this pin to low level enters the radio in backup mode to enable backup with low current consumption. (10 μ A MAX.) |
| 15 16 | XI XO | Crystal | Connects crystal oscillator. Connects 4.5 MHz crystal oscillator. |
| 17 | SD | Station detection signal input | This input pin detects whether the station is received during auto tuning (auto UP/DOWN). (CMOS input) Input high level when station is received. It must be input within 50 ms (30 ms for European FM band) after dividing ratio changes. |
| 18 | $\overline{\text{MUTE}}$ | Mute output | Outputs muting signal to suppress shock noise when PLL is unlocked; active low. (CMOS output) For details of timing, see "Mute Output Timing Chart." |

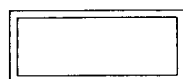
| PIN NO. | SYMBOL | PIN NAME | DESCRIPTION | | | | | | | | | | | | | | | |
|-------------|------------------------------------|------------------------------|---|-------------|---------|---------|----|---|---|----|---|---|----|---|---|----|---|---|
| 19—24 | K ₅ to K ₀ | Key return signal input | Key matrix key return signal input pin. Connect pull-down resistor. (CMOS input) | | | | | | | | | | | | | | | |
| 25—30 | KS ₅ to KS ₀ | Key return signal source | Key source signal output pin. (CMOS output) | | | | | | | | | | | | | | | |
| 31 32 | FM BAND AM BAND | Band switching signal output | <div>Band switching signal output pin. (CMOS output) Outputs the following. (*1* means high level, and *0* means low level.)<table><tr><th>Pin Band</th><th>FM BAND</th><th>AM BAND</th></tr><tr><td>FM</td><td>1</td><td>0</td></tr><tr><td>MW</td><td>0</td><td>0</td></tr><tr><td>LW</td><td>0</td><td>1</td></tr><tr><td>VF</td><td>1</td><td>1</td></tr></table><div>←(VF mode in FM band)</div></div> | Pin Band | FM BAND | AM BAND | FM | 1 | 0 | MW | 0 | 0 | LW | 0 | 1 | VF | 1 | 1 |
| Pin Band | FM BAND | AM BAND | | | | | | | | | | | | | | | | |
| FM | 1 | 0 | | | | | | | | | | | | | | | | |
| MW | 0 | 0 | | | | | | | | | | | | | | | | |
| LW | 0 | 1 | | | | | | | | | | | | | | | | |
| VF | 1 | 1 | | | | | | | | | | | | | | | | |

1. KEY MATRIX CONFIGURATION

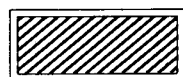
1.1 Key Matrix Layout

| Input pin Output pin | K ₅ (19) | K ₄ (20) | K ₃ (21) | K ₂ (22) | K ₁ (23) | K ₀ (24) |
|-------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| KS ₅ (25) | MAN UP | MAN DOWN | M1 | M2 | VF | MEMORY |
| KS ₄ (26) | SCAN UP | SCAN DOWN | M3 | M4 | M5 | M6 |
| KS ₃ (27) | SEEK UP | SEEK DOWN | MINADJ | HORADJ | OADJ | RCAL |
| KS ₂ (28) | MODE1 | MODE0 | LOCK | LW | MW | FM |
| KS ₁ (29) | STEREO | SK | 9N/9N+2 | NOCLOCK | PRIORITY | ROTARY |
| KS ₀ (30) | BAND | DISLW | AMIF | AREA2 | AREA1 | AREA0 |

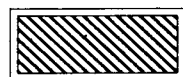
(): Pin No.



: Momentary switch



: Momentary or alternate switch



: Transistor switch



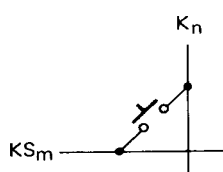
: Alternate or transistor switch



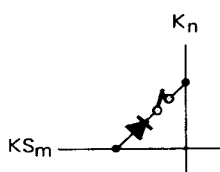
: Diode matrix (Diode short circuit or open)

1.2 Switch Connection

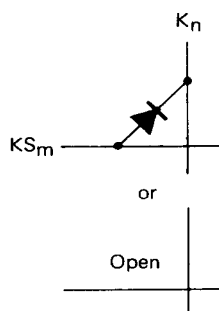
Momentary switch



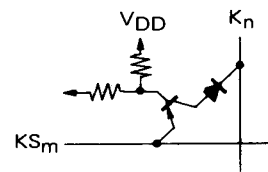
Alternate switch



Diode matrix



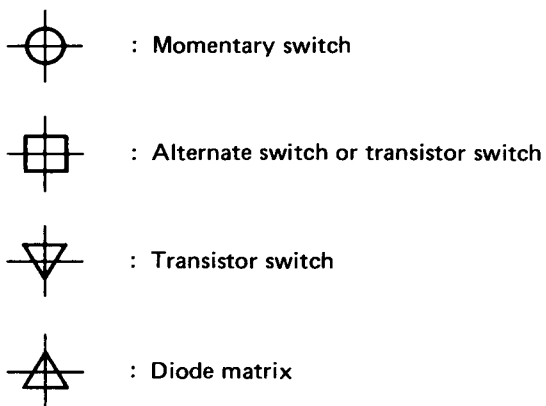
Transistor switch



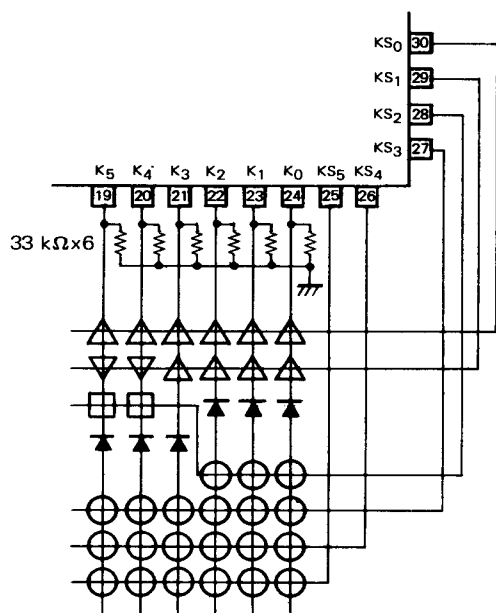
1.3 Key Matrix Connection Example

The band selection keys can be set as alternate or momentary switches; the diode (for preventing key source signal seep-in) insertion position differs by switch selection. Examples are shown below.

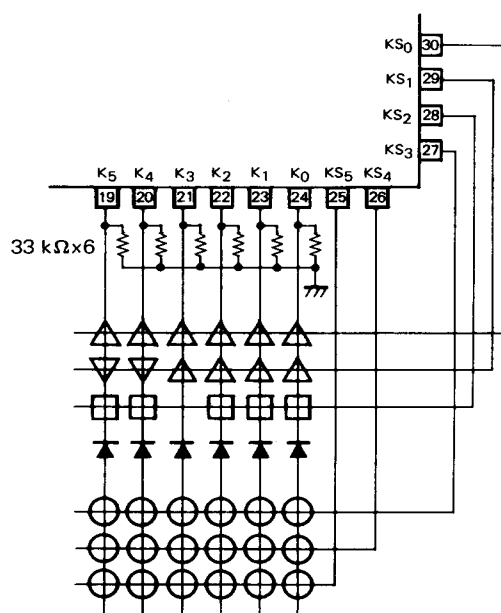
Key source (KS₀ to KS₅) has low sink current; the diode for backflow prevention on the key source side can be omitted.



Example 1 Using momentary switch as band key



Example 2 Using alternate switch as band key



2. KEY MATRIX EXPLANATION

2.1 Initialization Diode Matrices

Eight types of initialization diode matrices are used, which are read at initial power up of V_{DD} (initialization) and when the CE pin changes from low to high level:

- (1) Switch to set the band key to one key
BAND
- (2) Switch to disable LW band
DISLW
- (3) Switch to set the IF offset value for MW and LW
AMIF
- (4) Switch to set area
AREA0, AREA1, AREA2
- (5) Switch to set stop frequency for LW band autotuning
 $9N/9N+2$
- (6) Switch to set clock or no-clock mode
NOCLOCK
- (7) Switch to set display priority
PRIORITY
- (8) Switch to use the rotary switch for manual tuning
ROTARY

For the above settings, shortcircuit the crossing point concerned on the matrix with diode or leave it open, as preferred. (In the table below, *1* means diode shortcircuiting, and *0* means open.)

| SYMBOL | FUNCTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|---|----------|--|---------------|---|-------|---|---------|---------|-------|---------------|---------|---------|---|-------|---------------|---|---|---|------------------------|---------------|---|---|---|--------|---------------|---|---|---|--------|---------------|---|---|---|-------|---------------|---|---|---|--------------|---------------|---|---|---|---------------|---------------|
| AMIF | <p>Switch to set IF offset value for MW and LW bands. Intermediate frequency can be set as shown in the following table without changing the displayed frequency:</p> <table><tr><td>AMIF</td><td>Europe, Australia, Middle East, Japan, South America bands</td><td>USA band</td><td>Latin America band</td></tr><tr><td>0</td><td>450 kHz</td><td>450 kHz</td><td>450 kHz</td></tr><tr><td>1</td><td>459 kHz</td><td>460 kHz</td><td>455 kHz</td></tr></table> | AMIF | Europe, Australia, Middle East, Japan, South America bands | USA band | Latin America band | 0 | 450 kHz | 450 kHz | 450 kHz | 1 | 459 kHz | 460 kHz | 455 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AMIF | Europe, Australia, Middle East, Japan, South America bands | USA band | Latin America band | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 450 kHz | 450 kHz | 450 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 459 kHz | 460 kHz | 455 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AREA2 AREA1 AREA0 | <p>Switch to set area for FM and MW Band. The band and clock display mode can be selected as follows:</p> <table><tr><td>AREA2</td><td>AREA1</td><td>AREA0</td><td>Area</td><td>Clock</td></tr><tr><td>0</td><td>1</td><td>0</td><td>USA 1</td><td>12-hour clock</td></tr><tr><td>0</td><td>1</td><td>1</td><td>USA 2</td><td>12-hour clock</td></tr><tr><td>0</td><td>0</td><td>1</td><td>Australia, Middle East</td><td>12-hour clock</td></tr><tr><td>0</td><td>0</td><td>0</td><td>Europe</td><td>24-hour clock</td></tr><tr><td>1</td><td>1</td><td>1</td><td>Europe</td><td>12-hour clock</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Japan</td><td>12-hour clock</td></tr><tr><td>1</td><td>0</td><td>1</td><td>South Africa</td><td>12-hour clock</td></tr><tr><td>1</td><td>1</td><td>0</td><td>Latin America</td><td>12-hour clock</td></tr></table> | AREA2 | AREA1 | AREA0 | Area | Clock | 0 | 1 | 0 | USA 1 | 12-hour clock | 0 | 1 | 1 | USA 2 | 12-hour clock | 0 | 0 | 1 | Australia, Middle East | 12-hour clock | 0 | 0 | 0 | Europe | 24-hour clock | 1 | 1 | 1 | Europe | 12-hour clock | 1 | 0 | 0 | Japan | 12-hour clock | 1 | 0 | 1 | South Africa | 12-hour clock | 1 | 1 | 0 | Latin America | 12-hour clock |
| AREA2 | AREA1 | AREA0 | Area | Clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | USA 1 | 12-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | USA 2 | 12-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | Australia, Middle East | 12-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | Europe | 24-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | Europe | 12-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | Japan | 12-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | South Africa | 12-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 0 | Latin America | 12-hour clock | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9N/9N+2 | <p>Switch to set the stop frequency for LW band autotuning (SEEK, SCAN). LW band autotuning is done at 1 kHz steps at the timing shown in (3) of Section 4. Up/down is stopped only at the frequency set with this switch.</p> <table><tr><td>9N/9N+2</td><td>Stop frequency</td></tr><tr><td>0</td><td>153, 162, 171, 180, 189, 198 270, 279 kHz</td></tr><tr><td>1</td><td>155, 164, 173, 182, 191, 200 272, 281 kHz</td></tr></table> | 9N/9N+2 | Stop frequency | 0 | 153, 162, 171, 180, 189, 198 270, 279 kHz | 1 | 155, 164, 173, 182, 191, 200 272, 281 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9N/9N+2 | Stop frequency | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 153, 162, 171, 180, 189, 198 270, 279 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 155, 164, 173, 182, 191, 200 272, 281 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NOCLOCK | <p>Switch to select clock or no-clock mode. When the no-clock mode is selected, backup with low power consumption is enabled by setting the CE pin to low level. (10 μA MAX.)</p> <table><tr><td>NO CLOCK</td><td>Clock/no-clock mode</td></tr><tr><td>0</td><td>Clock mode</td></tr><tr><td>1</td><td>No-clock mode</td></tr></table> | NO CLOCK | Clock/no-clock mode | 0 | Clock mode | 1 | No-clock mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NO CLOCK | Clock/no-clock mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | Clock mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | No-clock mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIORITY | <p>Switch to select display priority. This switch setting is invalid when the display mode determined by MODE 0 and MODE 1 is not priority display.</p> <table><tr><td>PRIORITY</td><td>Display mode</td></tr><tr><td>0</td><td>Clock priority</td></tr><tr><td>1</td><td>Frequency priority</td></tr></table> | PRIORITY | Display mode | 0 | Clock priority | 1 | Frequency priority | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRIORITY | Display mode | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | Clock priority | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Frequency priority | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| SYMBOL | FUNCTION | | | | | | |
|--------|---|--------|--------------------|---|------------------|---|---------------|
| ROTARY | <p>Switch to select whether or not to use the rotary switch for manual tuning. When this switch is set to ON, the key chattering time is shortened to enable response to the high-speed pulse.</p> <table> <tr> <th>ROTARY</th><th>MANUP, MANDOWN Key</th></tr> <tr> <td>0</td><td>Momentary switch</td></tr> <tr> <td>1</td><td>Rotary switch</td></tr> </table> | ROTARY | MANUP, MANDOWN Key | 0 | Momentary switch | 1 | Rotary switch |
| ROTARY | MANUP, MANDOWN Key | | | | | | |
| 0 | Momentary switch | | | | | | |
| 1 | Rotary switch | | | | | | |
| BAND | <p>Switch to select whether or not to set the band key to one key. When this switch is set to ON, the band switches $\text{FM} \rightarrow \text{MW} \rightarrow \text{LW}$ cyclically each time a band key (FM/MW/LW) is pressed. If the DISLW switch is set to ON, the band switching is between FM and MW only. The alternate switch cannot be used for the band key when this switch is set to ON. When this switch is set to OFF, a band is selected by pressing the FM, MW, or LW key.</p> | | | | | | |
| DISLW | <p>Switch to disable the LW band. The LW band selection is disabled by setting this switch to ON while the BAND switch is set to ON.</p> | | | | | | |

2.2 Mode Selection Switches

These switch settings can be changed at any time.

| SYMBOL | FUNCTION | | | | | |
|--|--|-------|---------------------|---------------------------------|--------------------------------------|-----------------------------------|
| MODE1 MODE0 | Switch the display mode as shown in the following table. (These operations are done with CE = high level.) These switches are invalid in the no-clock mode (NO CLOCK = 1). | | | | | |
| | MODE1 | MODE0 | Display mode | Priority | IC operation | Keys accepted |
| | 0 | 0 | Clock only | Clock only | Clock operation and memory retention | Time adjust keys and MODE0, MODE1 |
| | 1 | 0 | Frequency and clock | Set by PRIORITY switch (Note 1) | All functions | All keys |
| | 0 | 1 | No display | — | Clock operation and memory retention | MODE0, MODE1 only |
| | 1 | 1 | Frequency and clock | None (Note 2) | All functions | All keys |
| <p>Notes: 1. ○ While the priority is set to frequency, the frequency is displayed in normal operation and, when the RCAL key is pressed, the time is displayed for only 5 seconds, then the mode returns to frequency display. If the RCAL key is pressed again or any station selection key is pressed within 5 seconds after the RCAL key is pressed, the mode returns to frequency display.</p> <p>○ While the priority is set to clock, the RCAL key operation displays the frequency of the selected station for only 5 seconds. However, frequency display lasts until 5 seconds after the autotuning or manual tuning fast-feed operation is completed if such operation is selected. The mode returns to time display upon pressing the RCAL key during frequency display.</p> <p>2. ○ The 5-second timer is not affected by display switching; it operates only when the RCAL key or station selection key is operated.</p> <p>RCAL key : Each time this key is pressed, display changes between time and frequency.</p> <p>Station key : During time display, frequency is displayed when a station key is set to ON.</p> <p>Station keys are as follows:</p> <p>MANUP, MANDOWN, SCANUP, SCANDOWN, SEEKUP, SEEKDOWN, M1—M6, VF</p> | | | | | | |

| SYMBOL | FUNCTION |
|----------------|---|
| MODE1 MODE0 | When the CE pin is set to low (GND), the IC operation is limited to clock operation and memory retention regardless of these switch settings; no display appears nor is any key operation accepted. (Clock mode (NO CLOCK = 0)) |

2.3 Transistor Switches

| SYMBOL | FUNCTION |
|--------|--|
| SK | Set this switch to ON when a traffic information station is received. Operation stops during ARI autotuning by the input from the SD pin and this switch operation. |
| STEREO | Switch to indicate stereo broadcasting. When this switch is set to ON, the STEREO indication on the LCD panel lights up. This display is done only during frequency display, that is, while the CE pin is at low level or during clock-only operation. This switch is invalid in the display OFF mode. |
| LOCK | Key lock switch for M1–M6, ME. When this switch is set to ON, M1–M6, ME switches are useful for cassette tape control switch. When LOCK switch is set to ON, M1–M6, ME switches are locked on frequency display mode. But on clock display mode, clock adjustment is enable using ME key. |

2.4 Momentary Switches

| SYMBOL | FUNCTION |
|------------------|--|
| MANUP MANDOWN | Manual tuning key. Momentary switch or rotary pulse generation switch can be used. When ROTARY setting of the initialization switch is set to OFF, the rotary switch can be used if the momentary switch is set to ON. In the momentary switch mode, this can be used for time adjustment of the clock. (i) Momentary switch mode (ROTARY = OFF) <ul style="list-style-type: none"> Frequency display mode Each time this switch is pressed, the frequency goes up (MANUP) or goes down (MANDOWN) by one step (channel space). The frequency goes up or down continuously by holding this key down for over 0.5 second. Time display mode Press the MANUP or MANDOWN key while holding the MEMORY key to adjust the hour or minute. In this case, the MANUP key operates as the MINADJ key, and the MANDOWN key operates as the HORADJ key. (ii) Rotary switch mode (ROTARY = ON) Each time this switch is set to ON, the frequency goes up (MANUP) or goes down (MANDOWN). The frequency goes up or down continuously at a rate of one step per second by holding this switch ON. |
| M1 to M6 | Preset memory read/write key. For each button, FM, MW, and LW can be memorized independent of each other. (1) Memory Writing During frequency display, the currently received frequency is written in the memory which corresponds to the key pressed when one of M1 to M6 keys is pressed within 5 seconds after the MEMORY key is pressed. |

| SYMBOL | FUNCTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|--|---------------|-------|-------|--------|--------|-------|----|----|------|------|--|--|--|--|--|--|----|--------|-------|-------|-------|--------|--------|-------|---|------|------|------|-------|-------|------|-------|------|------|------|-------|-------|------|-------|------|------|------|------|------|------|---------------------|-------|-------|-------|--------|--------|-------|----|--------|-----|-----|-----|-------|-------|-----|------------------------------------|-----|-----|-----|-------|-------|-----|-----|-----|-----|-------|-------|-------|-----|---------------|-----|-----|-------|-------|-------|-----|-------|-----|-----|-----|-------|-------|-----|----|--------|-----|-----|-----|-----|-----|-----|
| M1 to M6 | <p>(2) Memory Call</p> <p>When any of M1 to M6 keys is pressed, the content (frequency) of the memory corresponding to the key pressed is recalled.</p> <p>The minimum frequency of the MW band is recalled when the radio is switched on after initial power up (input of V_{DD}). The following frequencies are assigned to M1 to M6 to make adjustment easy for mass production:</p> <table><tr><th colspan="2">Preset memory</th><th>M1</th><th>M2</th><th>M3</th><th>M4</th><th>M5</th><th>M6</th></tr><tr><th>Band</th><th>Area</th><th></th><th></th><th></th><th></th><th></th><th></th></tr><tr><td rowspan="5">FM</td><td>Europe</td><td>87.50</td><td>88.00</td><td>98.00</td><td>106.00</td><td>108.00</td><td>87.50</td></tr><tr><td>USA 1/Australia/Middle East/Latin America</td><td>87.5</td><td>88.0</td><td>98.0</td><td>106.0</td><td>108.0</td><td>87.5</td></tr><tr><td>USA 2</td><td>87.5</td><td>87.9</td><td>97.9</td><td>105.9</td><td>107.9</td><td>87.5</td></tr><tr><td>Japan</td><td>76.0</td><td>80.0</td><td>83.0</td><td>86.0</td><td>90.0</td><td>76.0</td></tr><tr><td>South Africa (Note)</td><td>87.60</td><td>88.00</td><td>98.00</td><td>106.00</td><td>107.95</td><td>87.60</td></tr><tr><td rowspan="5">MW</td><td>Europe</td><td>522</td><td>603</td><td>999</td><td>1 404</td><td>1 620</td><td>522</td></tr><tr><td>Australia/Middle East/South Africa</td><td>531</td><td>603</td><td>999</td><td>1 404</td><td>1 602</td><td>531</td></tr><tr><td>USA</td><td>530</td><td>600</td><td>1 000</td><td>1 400</td><td>1 620</td><td>530</td></tr><tr><td>Latin America</td><td>520</td><td>600</td><td>1 000</td><td>1 400</td><td>1 620</td><td>520</td></tr><tr><td>Japan</td><td>522</td><td>603</td><td>999</td><td>1 404</td><td>1 629</td><td>522</td></tr><tr><td>LW</td><td>Europe</td><td>153</td><td>164</td><td>218</td><td>272</td><td>281</td><td>153</td></tr></table> <p>Note: The South African FM band in the above table shows the displayed frequencies, which differ from the actual frequencies received. (See 5. *South African FM Band Frequency Table* for the received frequencies.)</p> | Preset memory | | M1 | M2 | M3 | M4 | M5 | M6 | Band | Area | | | | | | | FM | Europe | 87.50 | 88.00 | 98.00 | 106.00 | 108.00 | 87.50 | USA 1/Australia/Middle East/Latin America | 87.5 | 88.0 | 98.0 | 106.0 | 108.0 | 87.5 | USA 2 | 87.5 | 87.9 | 97.9 | 105.9 | 107.9 | 87.5 | Japan | 76.0 | 80.0 | 83.0 | 86.0 | 90.0 | 76.0 | South Africa (Note) | 87.60 | 88.00 | 98.00 | 106.00 | 107.95 | 87.60 | MW | Europe | 522 | 603 | 999 | 1 404 | 1 620 | 522 | Australia/Middle East/South Africa | 531 | 603 | 999 | 1 404 | 1 602 | 531 | USA | 530 | 600 | 1 000 | 1 400 | 1 620 | 530 | Latin America | 520 | 600 | 1 000 | 1 400 | 1 620 | 520 | Japan | 522 | 603 | 999 | 1 404 | 1 629 | 522 | LW | Europe | 153 | 164 | 218 | 272 | 281 | 153 |
| Preset memory | | M1 | M2 | M3 | M4 | M5 | M6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Band | Area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FM | Europe | 87.50 | 88.00 | 98.00 | 106.00 | 108.00 | 87.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | USA 1/Australia/Middle East/Latin America | 87.5 | 88.0 | 98.0 | 106.0 | 108.0 | 87.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | USA 2 | 87.5 | 87.9 | 97.9 | 105.9 | 107.9 | 87.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Japan | 76.0 | 80.0 | 83.0 | 86.0 | 90.0 | 76.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | South Africa (Note) | 87.60 | 88.00 | 98.00 | 106.00 | 107.95 | 87.60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MW | Europe | 522 | 603 | 999 | 1 404 | 1 620 | 522 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Australia/Middle East/South Africa | 531 | 603 | 999 | 1 404 | 1 602 | 531 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | USA | 530 | 600 | 1 000 | 1 400 | 1 620 | 530 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Latin America | 520 | 600 | 1 000 | 1 400 | 1 620 | 520 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Japan | 522 | 603 | 999 | 1 404 | 1 629 | 522 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LW | Europe | 153 | 164 | 218 | 272 | 281 | 153 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MEMORY | <p>Preset memory write key. When ROTARY = OFF, this key can be used for time adjustment of the clock.</p> <ul style="list-style-type: none">○ Frequency display mode Used to write a new frequency in the preset memory. Press one of the M1 to M6 keys within 5 seconds after MEMORY key is pressed, then the displayed frequency is written in the memory corresponding to the key pressed. When the MEMORY key is pressed, the 'ch' display on the LCD blinks at 1 Hz for 5 seconds, which indicates that you can write in the memory. To cancel the memory write enable state, press a key other than M1 to M6 and MEMORY.○ Time display mode Press the MANUP or MANDOWN key while holding the MEMORY key down to adjust the minute or hour. The MANUP key operation is the same as the MINADJ key operation and the MANDOWN key operation is the same as the HORADJ key operation. (See MINADJ and HORADJ below.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MINADJ | <p>Minute adjustment key. Each time this key is pressed, the time advances 1 minute. The minute setting continuously advances at a rate of 8 minutes/second by pressing this key for over 0.5 second until the key is released. No carry over to the hour setting. Although the second is not displayed, the second value is reset to 0 each time the minute setting is adjusted. This key is valid only in the time display mode.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

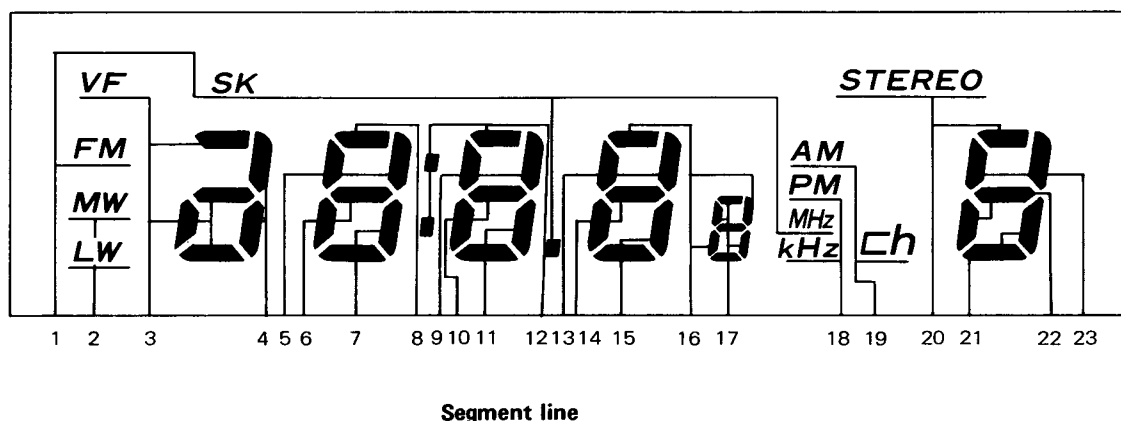
| SYMBOL | FUNCTION |
|--------------------|--|
| HORADJ | Hour adjustment key. Each time this key is pressed, the time advances 1 hour. The hour setting continuously advances at a rate of 4 hours/second by pressing this key for over 0.5 second until this key is released. The hour adjustment does not affect the minute or second setting. This key is valid only in the time display mode. |
| OADJ | Rounds down the minute and second settings to minute 0, second 0. This key is used for time setting. The hour setting remains if the minute setting is 29 minutes or less; however, if the minute setting is 30 minutes or more, the hour is advanced by 1 hour. This key is valid only in the time display mode. |
| SCANUP SCANDOWN | Autotuning key. Holds the frequency for 5 seconds if a high level is input to the SD pin during autotuning. Continues to receive the frequency if the SCANUP or SCANDOWN key is pressed again during this period. If no operation is done during this 5 seconds, autotuning is restarted. During this 5 second hold, the number display blinks to indicate the scan mode. Checks the SD pin again (also checks the SK signal in the VF mode) after muting following high level input to the SD pin and, if a high level input is found, receives the frequency; otherwise, restarts scanning immediately. Scan is restarted after 5 seconds even if a high level is input to the SD pin while this key is held down. To cancel scanning, release the key, then press it again. |
| SEEKUP SEEKDOWN | Autotuning key. Holds the current frequency if a high level is input to the SD pin during autotuning. Checks the SD pin again (also the SK signal in the VF mode) after muting (250–375 ms) following high level input to the SD pin and, if no high level is input, restarts the seek operation. Operation stops if this key is pressed during autotuning. |
| RCAL | Display switch. When this key is pressed, time display changes to frequency display, and vice versa if allowed by the display mode determined by the MODE0 and MODE1 switch settings. This switch is invalid in the no-clock mode (NO CLOCK = 1). |
| VF | Key to search for ARI (traffic information) broadcasting station. Each time this switch is pressed, the VF indication on the LCD panel blinks. When an autotuning key (SCANUP, SCANDOWN, SEEKUP, SEEKDOWN) is pressed in the VF mode (while the VF indication on the LCD panel is ON), scan or seek operation is done and, up/down operation is stopped only when a high level is input to the SD pin and the SK switch is set to ON. This key is invalid outside the FM band. When this key is pressed while receiving the FM band, the SD and SK signals are detected after 375 to 500 ms. If such a signal is not found, seek up operation is started at the frequency until an ARI broadcasting station is found. |
| FM MW LW | FM/MW/LW band selection switch. These keys can be operated by the momentary or alternate switch. Take the key for unused band, if any. If BAND = 1 is set, the band switches as follows each time FM or MW key is set to ON. <div style="text-align: center;"> $\text{FM} \rightarrow \text{MW} \rightarrow \text{LW} \text{ or } \text{FM} \rightleftarrows \text{MW}$ </div> During band switching, a mute signal (about 750 ms) is output from the $\overline{\text{MUTE}}$ pin. |

Note:

During auto tuning, the frequency is changed after checking PLL lock. If PLL is unlocked during auto frequency change, waits until it is locked. During this time, the alternate switch can be operated, but the momentary key cannot be operated (band switching can be done). To change the frequency during adjustment of the set and PLL unlocking is expected, use the Preset Memory buttons (M1 to M6) or MANUP/MANDOWN. The PLL data can then be set whether or not the PLL is locked.

Note:

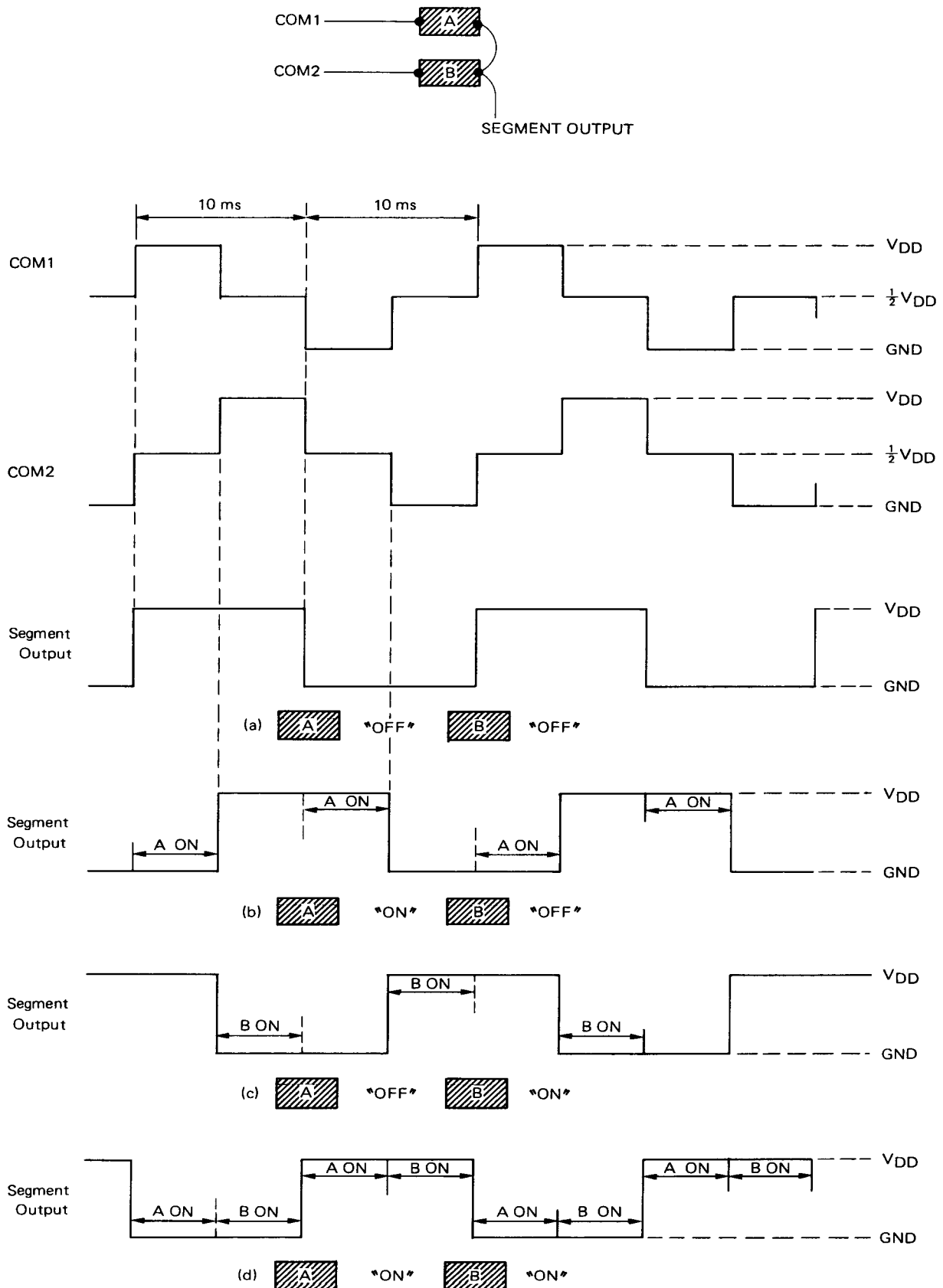
To blink display colon (:) during clock display, connect the segment line as follows:



3.4 Display Explanation

| DISPLAY | EXPLANATION |
|------------------------|--|
| VF | Indicates the VF mode. This lights up only in the frequency display mode. |
| FM MW LW | Band display. The display which corresponds to the currently received band lights up only in the frequency display mode. |
| SK | Indicates that an SK signal is input. This is displayed only during frequency display in the FM band VF mode. |
| AM PM | A.M./P.M. indication for 12-hour clock. |
| STEREO | Indicates that a STEREO signal is input. This lights up in FM/MW/LW band only during frequency display. |
| MHz kHz | Lights up during frequency display. MHz lights up only for FM band, and kHz lights up for MW and LW bands. |
| ch 8 | Lights up during preset memory display. It remains lighted when the preset memory is read or written, and it blinks at 1 Hz intervals when the preset memory can be written (for 5 seconds after the MEMORY key is pressed). |
| 2222.8 | The lowest digit lights up only for the FM band in Europe and South Africa. The lowest digit indicates only 0 or 5. The FM/MW/LW bands in other areas are indicated with the upper four digits only. (The uppermost digit is not used for the LW band.) The clock time is also displayed with the upper four digits. |
| (.) (decimal point) | Decimal point indication. This lights up during frequency display of the FM band. |
| (:) (colon) | Lights up during time display. It can remain lighted or blink at 1 Hz intervals, depending on the LCD segment line connection. |

3.5 LCD Drive Signal

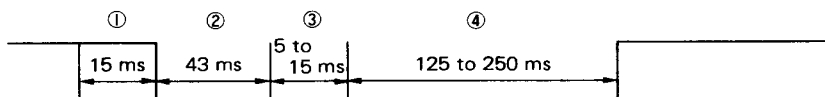


4. MUTE OUTPUT TIMING CHART

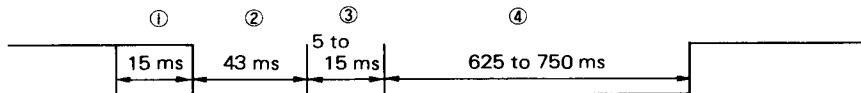
- ① Key ON chattering silence time
- ② Mute leading time
- ③ Dividing ratio setting and display contents update
- ④ Mute trailing time
- ⑤ Scan time
- ⑥ PLL lock time

(1) Manual up/down (momentary switch)

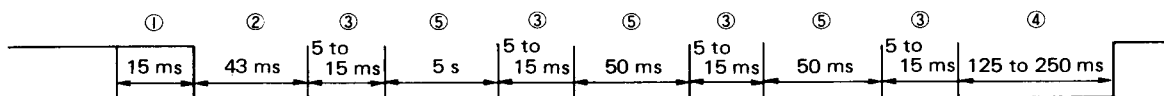
- (i) When key is released within 0.5 second (outside band edge)



- (ii) When key is released within 0.5 second (band edge: maximum frequency – minimum frequency)



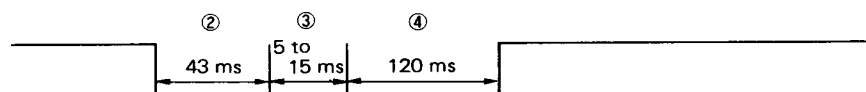
- (iii) When key is held down over 0.5 second



(If band edge appears during this operation, time ⑤ is 625 to 750 ms.)

(2) Manual up/down (rotary switch)

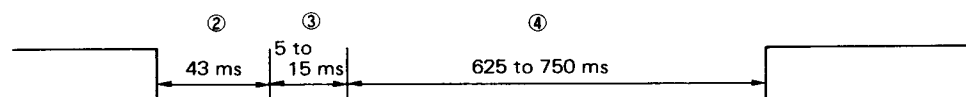
- (i) Outside band edge



Note:

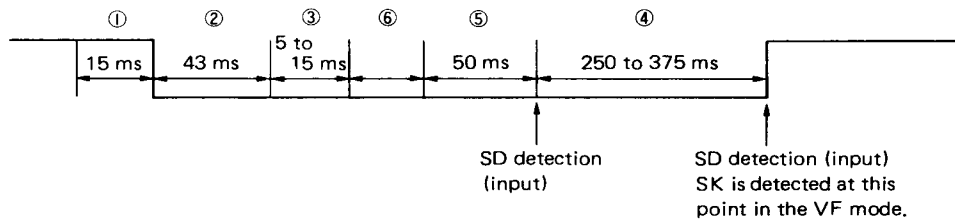
When the up/down switch is held down, time ③ may become longer.

- (ii) Band edge (maximum frequency – minimum frequency)

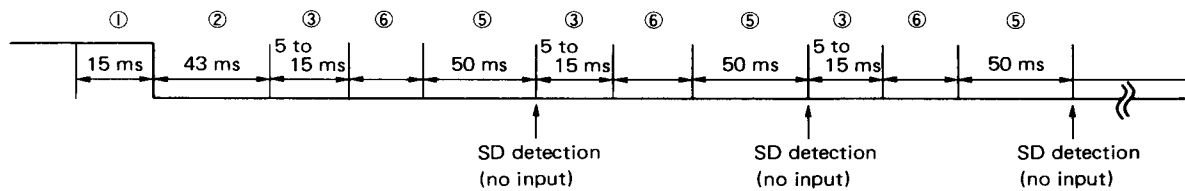


(3) Auto up/down

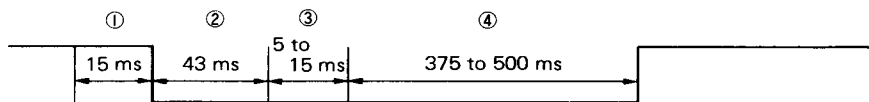
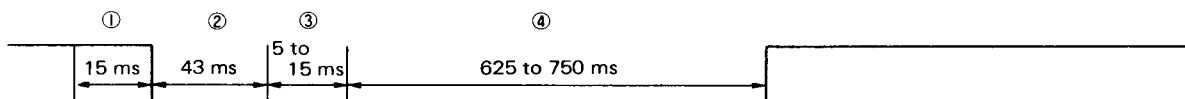
(i) When SD signal is input



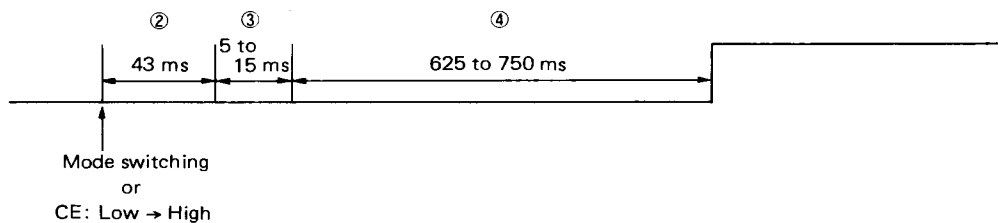
(ii) When SD signal is not input

**Note:**If band edge (maximum frequency \leftrightarrow minimum frequency) appears during this operation, time ⑤ is 375 to 500 ms.

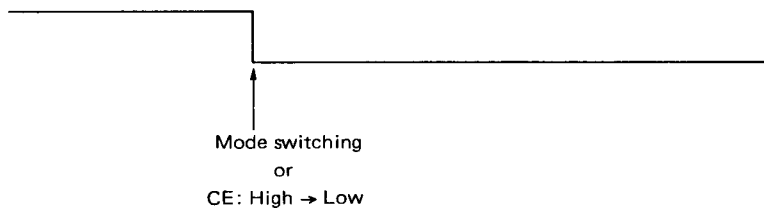
Time ⑤ is 30 ms for European FM band.

(4) Preset memory recall**(5) Band switching**

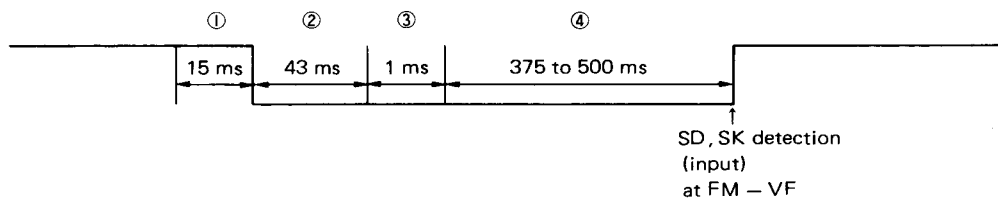
(6) Mode switching (radio OFF→ON), CE pin: Low→High



(7) Mode switching (radio ON→OFF), CE pin: High→Low



(8) VF mode switching (FM↔VF)



5. SOUTH AFRICAN FM BAND FREQUENCY TABLE

| CHANNEL PLAN FREQUENCY | DISPLAY FREQUENCY | RECEIVED FREQUENCY | DIFFERENCE |
|------------------------|-------------------|--------------------|------------|
| 87.604 MHz | 87.60 MHz | 87.60 MHz | -4 kHz |
| 87.690 | 87.65 | 87.68 | -10 |
| 87.776 | 87.75 | 87.78 | 4 |
| 87.862 | 87.85 | 87.86 | -2 |
| 87.948 | 87.90 | 87.94 | -8 |
| 88.034 | 88.00 | 88.04 | 6 |
| 88.120 | 88.10 | 88.12 | 0 |
| 88.206 | 88.20 | 88.20 | -6 |
| 88.292 | 88.25 | 88.30 | 8 |
| 88.378 | 88.35 | 88.38 | 2 |
| 88.464 | 88.45 | 88.46 | -4 |
| 88.550 | 88.55 | 88.54 | -10 |
| 88.636 | 88.60 | 88.64 | 4 |
| 88.722 | 88.70 | 88.72 | -2 |
| 88.808 | 88.80 | 88.80 | -8 |
| 88.894 | 88.85 | 88.90 | 6 |
| 88.980 | 88.95 | 88.98 | 0 |
| 89.066 | 89.05 | 89.06 | -6 |
| 89.152 | 89.15 | 89.16 | 8 |
| 89.238 | 89.20 | 89.24 | 2 |
| 89.324 | 89.30 | 89.32 | -4 |
| 89.410 | 89.40 | 89.40 | -10 |
| 89.496 | 89.45 | 89.50 | 4 |
| 89.582 | 89.55 | 89.58 | -2 |
| 89.668 | 89.65 | 89.66 | -8 |
| 89.754 | 89.75 | 89.76 | 6 |
| 89.840 | 89.80 | 89.84 | 0 |
| 89.926 | 89.90 | 89.92 | -6 |
| 90.012 | 90.00 | 90.02 | 8 |
| 90.098 | 90.05 | 90.10 | 2 |
| 90.184 | 90.15 | 90.18 | -4 |
| 90.270 | 90.25 | 90.26 | -10 |
| 90.356 | 90.35 | 90.36 | 4 |
| 90.442 | 90.40 | 90.44 | -2 |
| 90.528 | 90.50 | 90.52 | -8 |
| 90.614 | 90.60 | 90.62 | 6 |
| 90.700 | 90.70 | 90.70 | 0 |
| 90.786 | 90.75 | 90.78 | -6 |
| 90.872 | 90.85 | 90.88 | 8 |
| 90.958 | 90.95 | 90.96 | 2 |
| 91.044 | 91.00 | 91.04 | -4 |
| 91.130 | 91.10 | 91.12 | -10 |
| 91.216 | 91.20 | 91.22 | 4 |
| 91.302 | 91.30 | 91.30 | -2 |
| 91.388 | 91.35 | 91.38 | -8 |
| 91.474 | 91.45 | 91.48 | 6 |
| 91.560 | 91.55 | 91.56 | 0 |
| 91.646 | 91.60 | 91.64 | -6 |
| 91.732 | 91.70 | 91.74 | 8 |
| 91.818 | 91.80 | 91.82 | 2 |

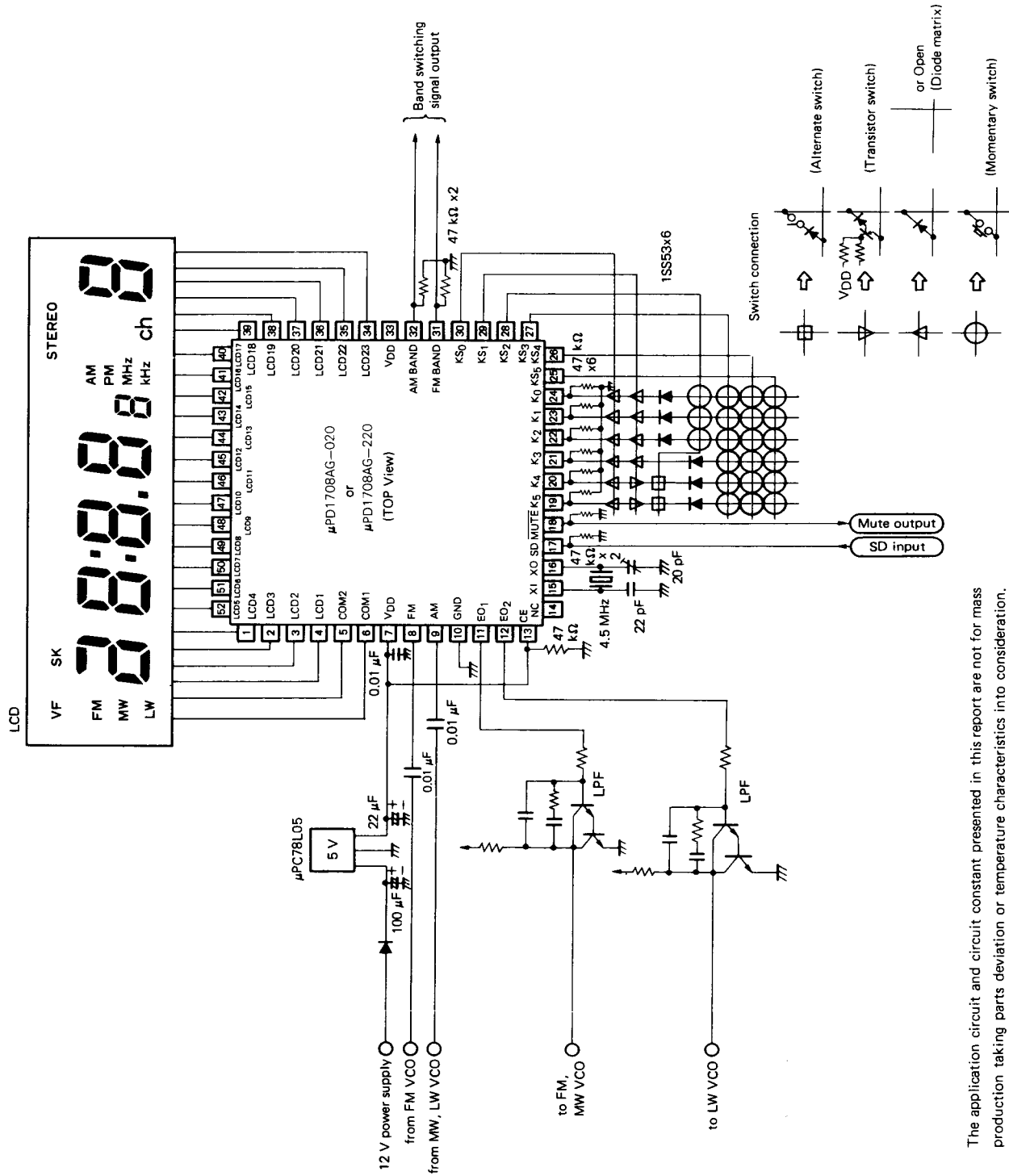
| CHANNEL PLAN FREQUENCY | DISPLAY FREQUENCY | RECEIVED FREQUENCY | DIFFERENCE |
|------------------------|-------------------|--------------------|------------|
| 91.904 MHz | 91.90 MHz | 91.90 MHz | -4 kHz |
| 91.990 | 91.95 | 91.98 | -10 |
| 92.076 | 92.05 | 92.08 | 4 |
| 92.162 | 92.15 | 92.16 | -2 |
| 92.248 | 92.20 | 92.24 | -8 |
| 92.334 | 92.30 | 92.34 | 6 |
| 92.420 | 92.40 | 92.42 | 0 |
| 92.506 | 92.50 | 92.50 | -6 |
| 92.592 | 92.55 | 92.60 | 8 |
| 92.678 | 92.65 | 92.68 | 2 |
| 92.764 | 92.75 | 92.76 | -4 |
| 92.850 | 92.85 | 92.84 | -10 |
| 92.936 | 92.90 | 92.94 | 4 |
| 93.022 | 93.00 | 93.02 | -2 |
| 93.108 | 93.10 | 93.10 | -8 |
| 93.194 | 93.15 | 93.20 | 6 |
| 93.280 | 93.25 | 93.28 | 0 |
| 93.366 | 93.35 | 93.36 | -6 |
| 93.452 | 93.45 | 93.46 | 8 |
| 93.538 | 93.50 | 92.54 | 2 |
| 93.624 | 93.60 | 93.62 | -4 |
| 93.710 | 93.70 | 93.70 | -10 |
| 93.796 | 93.75 | 93.80 | 4 |
| 93.882 | 93.85 | 93.88 | -2 |
| 93.968 | 93.95 | 93.96 | -8 |
| 94.054 | 94.05 | 94.06 | 6 |
| 94.140 | 94.10 | 94.14 | 0 |
| 94.226 | 94.20 | 94.22 | -6 |
| 94.312 | 94.30 | 94.32 | 8 |
| 94.398 | 94.35 | 94.40 | 2 |
| 94.484 | 94.45 | 94.48 | -4 |
| 94.570 | 94.55 | 94.56 | -10 |
| 94.656 | 94.65 | 94.66 | 4 |
| 94.742 | 94.70 | 94.74 | -2 |
| 94.828 | 94.80 | 94.82 | -8 |
| 94.914 | 94.90 | 94.92 | 6 |
| 95.000 | 95.00 | 95.00 | 0 |
| 95.086 | 95.05 | 95.08 | -6 |
| 95.172 | 95.15 | 95.18 | 8 |
| 95.258 | 95.25 | 95.26 | 2 |
| 95.344 | 95.30 | 95.34 | -4 |
| 95.430 | 95.40 | 95.42 | -10 |
| 95.516 | 95.50 | 95.52 | 4 |
| 95.602 | 95.60 | 95.60 | -2 |
| 95.688 | 95.65 | 95.68 | -8 |
| 95.774 | 95.75 | 95.78 | 6 |
| 95.860 | 95.85 | 95.86 | 0 |
| 95.946 | 95.90 | 95.94 | -6 |
| 96.032 | 96.00 | 96.04 | 8 |
| 96.118 | 96.10 | 96.12 | 2 |

| CHANNEL PLAN FREQUENCY | DISPLAY FREQUENCY | RECEIVED FREQUENCY | DIFFERENCE |
|------------------------|-------------------|--------------------|------------|
| 96.204 MHz | 96.20 MHz | 96.20 MHz | -4 kHz |
| 96.290 | 96.25 | 96.28 | -10 |
| 96.376 | 96.35 | 96.38 | 4 |
| 96.462 | 96.45 | 96.46 | -2 |
| 96.548 | 96.50 | 96.54 | -8 |
| 96.634 | 96.60 | 96.64 | 6 |
| 96.720 | 96.70 | 96.72 | 0 |
| 96.806 | 96.80 | 96.80 | -6 |
| 96.892 | 96.85 | 96.90 | 8 |
| 96.978 | 96.95 | 96.98 | 2 |
| 97.064 | 97.05 | 97.06 | -4 |
| 97.150 | 97.15 | 97.14 | -10 |
| 97.236 | 97.20 | 97.24 | 4 |
| 97.322 | 97.30 | 97.32 | -2 |
| 97.408 | 97.40 | 97.40 | -8 |
| 97.494 | 97.45 | 97.50 | 6 |
| 97.580 | 97.55 | 97.58 | 0 |
| 97.666 | 97.65 | 97.66 | -6 |
| 97.752 | 97.75 | 97.76 | 8 |
| 97.838 | 97.80 | 97.84 | 2 |
| 97.924 | 97.90 | 97.92 | -4 |
| 98.010 | 98.00 | 98.00 | -10 |
| 98.096 | 98.05 | 98.10 | 4 |
| 98.182 | 98.15 | 98.18 | -2 |
| 98.268 | 98.25 | 98.26 | -8 |
| 98.354 | 98.35 | 98.36 | 6 |
| 98.440 | 98.40 | 98.44 | 0 |
| 98.526 | 98.50 | 98.52 | -6 |
| 98.612 | 98.60 | 98.62 | 8 |
| 98.698 | 98.65 | 98.70 | 2 |
| 98.784 | 98.75 | 98.78 | -4 |
| 98.870 | 98.85 | 98.86 | -10 |
| 98.956 | 98.95 | 98.96 | 4 |
| 99.042 | 99.00 | 99.04 | -2 |
| 99.128 | 99.10 | 99.12 | -8 |
| 99.214 | 99.20 | 99.22 | 6 |
| 99.300 | 99.30 | 99.30 | 0 |
| 99.386 | 99.35 | 99.38 | -6 |
| 99.472 | 99.45 | 99.48 | 8 |
| 99.558 | 99.55 | 99.56 | 2 |
| 99.644 | 99.60 | 99.64 | -4 |
| 99.730 | 99.70 | 99.72 | -10 |
| 99.816 | 99.80 | 99.82 | 4 |
| 99.902 | 99.90 | 99.90 | -2 |
| 99.988 | 99.95 | 99.98 | -8 |
| 100.074 | 100.05 | 100.08 | 6 |
| 100.160 | 100.15 | 100.16 | 0 |
| 100.246 | 100.20 | 100.24 | -6 |
| 100.332 | 100.30 | 100.34 | 8 |
| 100.418 | 100.40 | 100.42 | 2 |

| CHANNEL PLAN FREQUENCY | DISPLAY FREQUENCY | RECEIVED FREQUENCY | DIFFERENCE |
|------------------------|-------------------|--------------------|------------|
| 100.504 MHz | 100.50 MHz | 100.50 MHz | -4 kHz |
| 100.590 | 100.55 | 100.58 | -10 |
| 100.676 | 100.65 | 100.68 | 4 |
| 100.762 | 100.75 | 100.76 | -2 |
| 100.848 | 100.80 | 100.84 | -8 |
| 100.934 | 100.90 | 100.94 | 6 |
| 101.020 | 101.00 | 101.02 | 0 |
| 101.106 | 101.10 | 101.10 | -6 |
| 101.192 | 101.15 | 101.20 | 8 |
| 101.278 | 101.25 | 101.28 | 2 |
| 101.364 | 101.35 | 101.36 | -4 |
| 101.450 | 101.45 | 101.44 | -10 |
| 101.536 | 101.50 | 101.54 | 4 |
| 101.622 | 101.60 | 101.62 | -2 |
| 101.708 | 101.70 | 101.70 | -8 |
| 101.794 | 101.75 | 101.80 | 6 |
| 101.880 | 101.85 | 101.88 | 0 |
| 101.966 | 101.95 | 101.96 | -6 |
| 102.052 | 102.05 | 102.06 | 8 |
| 102.138 | 102.10 | 102.14 | 2 |
| 102.224 | 102.20 | 102.22 | -4 |
| 102.310 | 102.30 | 102.30 | -10 |
| 102.396 | 102.35 | 102.40 | 4 |
| 102.482 | 102.45 | 102.48 | -2 |
| 102.568 | 102.55 | 102.56 | -8 |
| 102.654 | 102.65 | 102.66 | 6 |
| 102.740 | 102.70 | 102.74 | 0 |
| 102.826 | 102.80 | 102.82 | -6 |
| 102.914 | 102.90 | 102.92 | 8 |
| 102.998 | 102.95 | 103.00 | 2 |
| 103.084 | 103.05 | 103.08 | -4 |
| 103.170 | 103.15 | 103.16 | -10 |
| 103.256 | 103.25 | 103.26 | 4 |
| 103.342 | 103.30 | 103.34 | -2 |
| 103.428 | 103.40 | 103.42 | -8 |
| 103.514 | 103.50 | 103.52 | 6 |
| 103.600 | 103.60 | 103.60 | 0 |
| 103.686 | 103.65 | 103.68 | -6 |
| 103.772 | 103.75 | 103.78 | 8 |
| 103.858 | 103.85 | 103.86 | 2 |
| 103.944 | 103.90 | 103.94 | -4 |
| 104.030 | 104.00 | 104.02 | -10 |
| 104.116 | 104.10 | 104.12 | 4 |
| 104.202 | 104.20 | 104.20 | -2 |
| 104.288 | 104.25 | 104.28 | -8 |
| 104.374 | 104.35 | 104.38 | 6 |
| 104.460 | 104.45 | 104.46 | 0 |
| 104.546 | 104.50 | 104.54 | -6 |
| 104.632 | 104.60 | 104.64 | 8 |
| 104.718 | 104.70 | 104.72 | 2 |

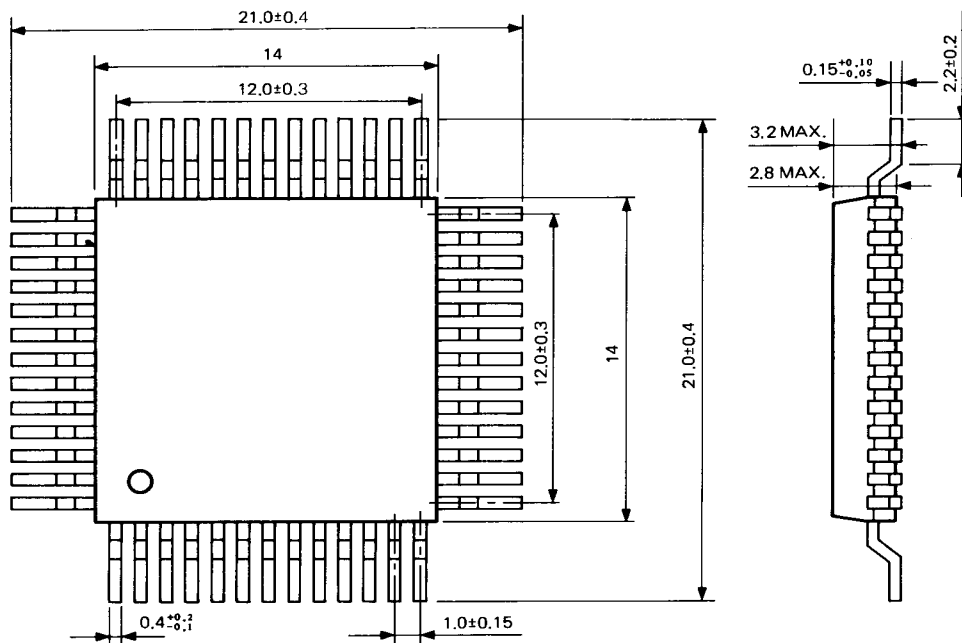
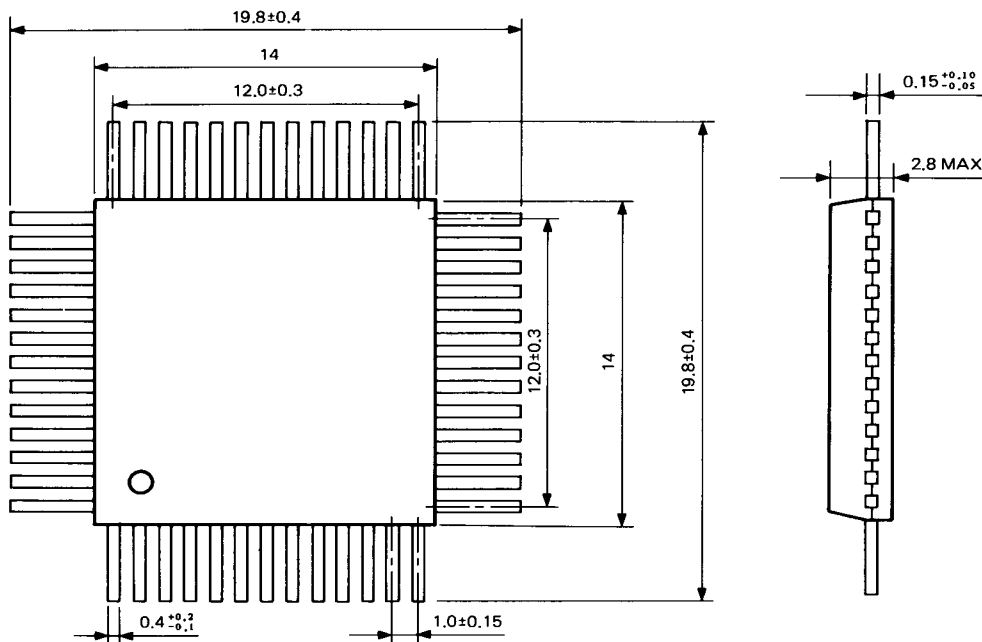
| CHANNEL PLAN FREQUENCY | DISPLAY FREQUENCY | RECEIVED FREQUENCY | DIFFERENCE |
|------------------------|-------------------|--------------------|------------|
| 104.804 MHz | 104.80 MHz | 104.80 MHz | -4 kHz |
| 104.890 | 104.85 | 104.88 | -10 |
| 104.976 | 104.95 | 104.98 | 4 |
| 105.062 | 105.05 | 105.06 | -2 |
| 105.148 | 105.10 | 105.14 | -8 |
| 105.234 | 105.20 | 105.24 | 6 |
| 105.320 | 105.30 | 105.32 | 0 |
| 105.406 | 105.40 | 105.40 | -6 |
| 105.492 | 105.45 | 105.50 | 8 |
| 105.578 | 105.55 | 105.58 | 2 |
| 105.664 | 105.65 | 105.66 | -4 |
| 105.750 | 105.75 | 105.74 | -10 |
| 105.836 | 105.80 | 105.84 | 4 |
| 105.922 | 105.90 | 105.92 | -2 |
| 106.008 | 106.00 | 106.00 | -8 |
| 106.094 | 106.05 | 106.10 | 6 |
| 106.180 | 106.15 | 106.18 | 0 |
| 106.266 | 106.25 | 106.26 | -6 |
| 106.352 | 106.35 | 106.36 | 8 |
| 106.438 | 106.40 | 106.44 | 2 |
| 106.524 | 106.50 | 106.52 | -4 |
| 106.610 | 106.60 | 106.60 | -10 |
| 106.696 | 106.65 | 106.70 | 4 |
| 106.782 | 106.75 | 106.78 | -2 |
| 106.868 | 106.85 | 106.86 | -8 |
| 106.954 | 106.95 | 106.96 | 6 |
| 107.040 | 107.00 | 107.04 | 0 |
| 107.126 | 107.10 | 107.12 | -6 |
| 107.212 | 107.20 | 107.22 | 8 |
| 107.298 | 107.25 | 107.30 | 2 |
| 107.384 | 107.35 | 107.38 | -4 |
| 107.470 | 107.45 | 107.46 | -10 |
| 107.556 | 107.55 | 107.56 | 4 |
| 107.642 | 107.60 | 107.64 | -2 |
| 107.728 | 107.70 | 107.72 | -8 |
| 107.814 | 107.80 | 107.82 | 6 |
| 107.900 | 107.90 | 107.90 | 0 |
| 107.986 | 107.95 | 107.98 | -6 |

APPLICATION CIRCUIT EXAMPLE



The application circuit and circuit constant presented in this report are not for mass production taking parts deviation or temperature characteristics into consideration. For patent regarding the circuits in this report, NEC does not bear any responsibility.

PACKAGE DIMENSIONS (Unit:mm)

 μ PD1708AG-020-00 (Lead bended type) μ PD1708AG-220-03 (Straight lead type)

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