

# MOS INTEGRATED CIRCUIT

## $\mu$ PD1704C-023

### PLL FREQUENCY SYNTHESIZER AND CONTROLLER FOR MOBILE FM AND MW RADIO

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The  $\mu$ PD1704C-023 (42-pin DIP) is a CMOS LSI with a built-in PLL frequency synthesizer and controller which can receive FM and MW broadcasts in the U.S.A., Australia, and Japan. It is possible to construct a multi-function, high performance FM/MW digital tuning system for car stereos, home stereos, radio cassettes, etc., by combining this unit with the special prescaler  $\mu$ PB553AC.

#### FEATURES

- LED/FIP dynamic display
- Preset memory: FM 6 channels, MW 6 channels
- Read-out and write-in keys are independent (6 keys + 6 keys)
- Auto-tuning (Seek action), manual tuning, plus scan function with 5 second hold
- Control output can be used for LOC/DX, LOUDNESS, METAL, Dolby NR\*, STEREO, AMS, etc.
- AGCCUT signal output to prevent erroneous action during auto-tuning
- Complete leading mute effectuated by band switching signal output from controller side as countermeasure against pop noise
- Realizing feather-touch operation of all switches as well as band switching.
- Check sound output when keys operated (connected to external oscillator)
- Dimmer function
- 12-hour display clock function

\* Dolby<sup>®</sup> and the double-D symbol are registered trademarks of Dolby Laboratories Licensing Corporation.

**FUNCTION****Receiving frequency, Channel spacing, Reference frequency, Intermediate frequency**

DISTRICT	ITEM BAND	RECEIVING FREQUENCY	CHANNEL SPACING	REFERENCE FREQUENCY	INTERMEDIATE FREQUENCY
U.S.A.	FM	87.7 to 107.9 MHz	200 kHz	25 kHz	10.700, 10.725 MHz
	MW	530 to 1620 kHz	10 kHz	10 kHz	450 kHz
Australia	FM	87.7 to 107.9 MHz	100 kHz	25 kHz	107.00, 10.725 MHz
	MW	531 to 1602 kHz	9 kHz	9 kHz	450 kHz
Japan	FM	76.1 to 89.9 MHz	100 kHz	25 kHz	-10.700, -10.675 MHz
	MW	531 to 1602 kHz	9 kHz	9 kHz	450 kHz

**Radio Function**

- (1) SEEK UP, SEEK DOWN (Sawtooth wave mode)
- (2) MANUAL UP, MANUAL DOWN (Sawtooth wave mode)
- (3) SCAN (UP direction only)
- (4) Preset memory: FM 6 channels, MW 6 channels
- (5) Last station memory: FM 1 channel, MW 1 channel
- (6) LOC/DX control output
- (7) LOUDNESS control output
- (8) STEREO control output (effective for both FM, MW)
- (9)  $\overline{\text{AGCCUT}}$  signal output during auto-tuning
- (10) Preset memory display (dot display)
- (11) Preset memory write-in – 6 independent keys (ME1 to ME6)

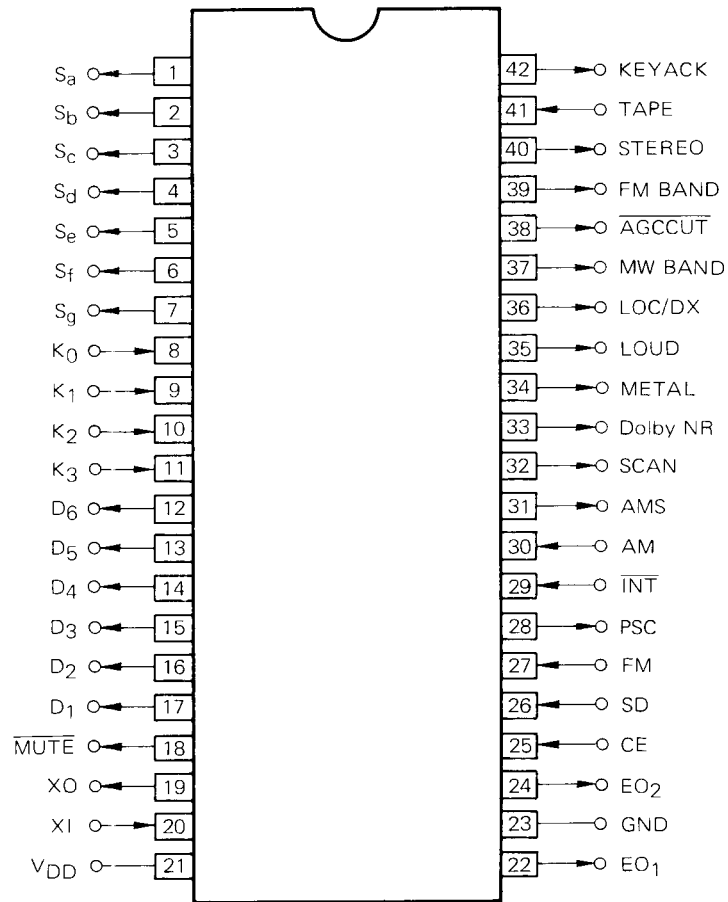
**Cassette Tape Function**

- (1) METAL control output
- (2) Dolby NR control output
- (3) AMS control output
- (4) LOUDNESS control output

**Clock Function**

- (1) 12-hour display (no AM/PM display)
- (2) Hours and minutes can be adjusted independently (HRADJ, MINADJ)

### PIN CONFIGURATION (Top View)



## PIN DESCRIPTION

PIN NO.	SYMBOL	NAME	DESCRIPTION	OUTPUT TYPE
1 to 7	S <sub>a</sub> to S <sub>g</sub>	Segment Output	Active-high pins for dynamic display segment signal output and key return signal source.	P-ch open drain
8 to 11	K <sub>0</sub> to K <sub>3</sub>	Key-return Signal Input	These are the input pins for the key-return signal from the key matrix. In order to reliably carry out a low-level read, use about a 33 kΩ pull-down resistor at these pins.	Input
12 to 17	D <sub>6</sub> to D <sub>1</sub>	Digit Output	Active-high pins for dynamic display column signal output. D <sub>1</sub> , D <sub>2</sub> , and D <sub>3</sub> are also used as the key-return signal source.	CMOS push-pull
18	$\overline{\text{MUTE}}$	Mute Output	Active-low pin for MUTE output to eliminate pop noise when unlocking PLL and turning TAPE pin ON and OFF. When the CE pin is at low level (back-up status), low level occurs unconditionally. For details, refer to MUTE output timing chart.	CMOS push-pull
19 20	XO XI	X'tal	4.5 MHz is used at the connection pins for the quartz oscillator.	Input (XI), CMOS push-pull (XO)
21	V <sub>DD</sub>	Power Supply	5 V ±10 % is supplied through this device power source pin during operation. When the clock is not being used (NOCLOCK is ON), a voltage drop of up to 2.5 V can occur on back-up. V <sub>DD</sub> rise time must be less than 500 ms, and if the rising is extremely long the internal power-ON reset circuit may not be activated normally. In addition, malfunction may also occur when the voltage is raised from medium potential though it is required to rise from 0 V.	—
22 24	EO <sub>1</sub> EO <sub>2</sub>	Error Output	These are charge pump outputs for a phase comparator which constructs PLL. The same signal is output simultaneously at EO <sub>1</sub> and EO <sub>2</sub> , so it is immaterial whether the connection is made to the FM or MW low pass filter (LPF).	CMOS 3-state
23	GND	Ground	Connect to system GND.	—
25	CE	Chip Enable	This is a device selection signal input pin. Normally high level when device is operated; low level when device is not being used. High level . . . Normal operation Low level . . . (With clock; when NOCLOCK = OFF) Memory maintenance, display OFF, PLL action halted, only clock function operating internally. (No clock; when NOCLOCK = ON) Memory maintenance, display OFF, all internal operations halted, 10 μA MAX. back-up current at that time.  However, high level below 134 μs and low level are not received. Also, when rising, always rise from 0 V. From the medium level, it is possible for the internal reset circuit to be incorrectly activated.	Input

PIN NO.	SYMBOL	NAME	DESCRIPTION	OUTPUT TYPE																														
26	SD	Station detector	Active-high input pin for which detects whether broadcasting station is received during auto-tuning (SEEK UP, SEEK DOWN, SCAN). High level voltage must be input within 40 ms after PLL lock.	Input																														
27	FM	FM VCO Signal Input	Input pin for Local FM output signal divided into 1/16, 1/17 by prescaler $\mu$ PB553AC. Cut and input DC current with condenser since AC amplifier is incorporated.	Input																														
28	PSC	Pulse swallowing control	This is a pulse swallow control pin connected to PSC pin for special prescaler $\mu$ PB553AC through C and R.	CMOS push-pull																														
29	$\overline{\text{INT}}$	Interrupt	This is an external interrupt input pin. However, because it is not used, apply a pull-up at $V_{DD}$ .	Input																														
30	AM	AM VCO Signal Input	Inputs a local MW output. Cut and input DC current with condenser since AC amplifier is incorporated.	Input																														
31 33 34 35 36 40	AMS Dolby NR METAL LOUD LOC/DX STEREO	AMS Dolby NR METAL LOUD LOC/DX STEREO	Reverses the output for every corresponding key input at this optional function output pins. However, the possible key input and the effective output obtained vary according to the mode, as shown in the following table. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th rowspan="2">Output \ TAPE Input</th> <th rowspan="2">TAPE input High</th> <th colspan="2">TAPE Input Low</th> </tr> <tr> <th>FM</th> <th>MW</th> </tr> </thead> <tbody> <tr> <td>LOUD</td> <td>○</td> <td>○</td> <td>○</td> </tr> <tr> <td>LOC/DX</td> <td>×</td> <td>○</td> <td>○</td> </tr> <tr> <td>STEREO</td> <td>×</td> <td>○</td> <td>○</td> </tr> <tr> <td>METAL</td> <td>○</td> <td>×</td> <td>×</td> </tr> <tr> <td>Dolby NR</td> <td>○</td> <td>×</td> <td>×</td> </tr> <tr> <td>AMS</td> <td>○</td> <td>×</td> <td>×</td> </tr> </tbody> </table> <p>○ : possible key input, output also effective            × : key input ignored, output low</p> <p>Original output is recovered status when TAPE input is switched. Also, at the time of power ON, these outputs are all low level. Because this optional function has only a conditional latch function according to the mode, objects other than those with the above titles can be used.</p>	Output \ TAPE Input	TAPE input High	TAPE Input Low		FM	MW	LOUD	○	○	○	LOC/DX	×	○	○	STEREO	×	○	○	METAL	○	×	×	Dolby NR	○	×	×	AMS	○	×	×	CMOS push-pull (I/O)
Output \ TAPE Input	TAPE input High	TAPE Input Low																																
		FM	MW																															
LOUD	○	○	○																															
LOC/DX	×	○	○																															
STEREO	×	○	○																															
METAL	○	×	×																															
Dolby NR	○	×	×																															
AMS	○	×	×																															
32	SCAN	SCAN signal output	During SCAN action only, high-level output occurs so can be used as a SCAN indicator.	CMOS push-pull																														
37	MW BAND	MW control output	MW tuner control output pin. High-level is output only when low-level (radio mode) at the TAPE pin and MW selection. Other than this, signal is low-level.	CMOS push-pull (I/O)																														










PIN NO.	SYMBOL	NAME	DESCRIPTION	OUTPUT TYPE
38	$\overline{\text{AGCCUT}}$	$\overline{\text{AGCCUT}}$ signal output	<p>Only when <b>SEEK UP</b> , <b>SEEK DWN</b> , and <b>SCAN</b> keys are depressed (during auto-tuning), the <math>\overline{\text{AGCCUT}}</math> signal indicated below is output (active-low). As a result, <b>STOP</b> becomes more reliable during auto-tuning.</p> <p>This signal can also be used as the auto-tuning indicator output.</p>	CMOS push-pull (I/O)
39	FM BAND	FM control output	FM tuner control output pin. High-level is output only when low-level (radio mode) at TAPE pin and FM selection. Other than this, signal is low-level.	CMOS push-pull (I/O)
41	TAPE	Tape mode signal input	This input pin is for setting tape mode (high-level) or radio mode (low-level).	CMOS push-pull (I/O)
42	KEYACK	Key input signal output	Only when the controller receives key input, high-level is output for about 40 ms. It is possible to get a confirming sound during key input by connecting to an external generator.	CMOS push-pull (I/O)

## CONTENTS

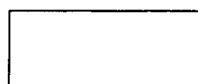
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# 1. KEY MATRIX

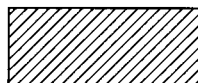
## 1.1 CONFIGURATION OF KEY MATRIX

Input Output	K <sub>3</sub> (11)	K <sub>2</sub> (10)	K <sub>1</sub> (9)	K <sub>0</sub> (8)
S <sub>a</sub> (1)	MAN UP	MAN DWN	HRADJ	MINADJ
S <sub>b</sub> (2)	SEEK UP	SEEK DWN	SCAN	DISP
S <sub>c</sub> (3)	M1	M2	M3	M4
S <sub>d</sub> (4)	M5	M6	ME5	ME6
S <sub>e</sub> (5)	ME1	ME2	ME3	ME4
S <sub>f</sub> (6)	LDC/DX	LOUD	METAL	Dolby NR
S <sub>g</sub> (7)	ST	AMS	BAND	—
D <sub>1</sub> (17)	—	—	 DIM	 PRIO
D <sub>2</sub> (16)	 FMSEL1	 FMSEL2	 MWSEL	 NOCLOCK
D <sub>3</sub> (15)	 IF	 M/R	 BLANK	—

( ) : Pin No.



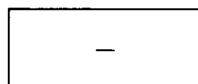
Momentary switch



Alternate switch



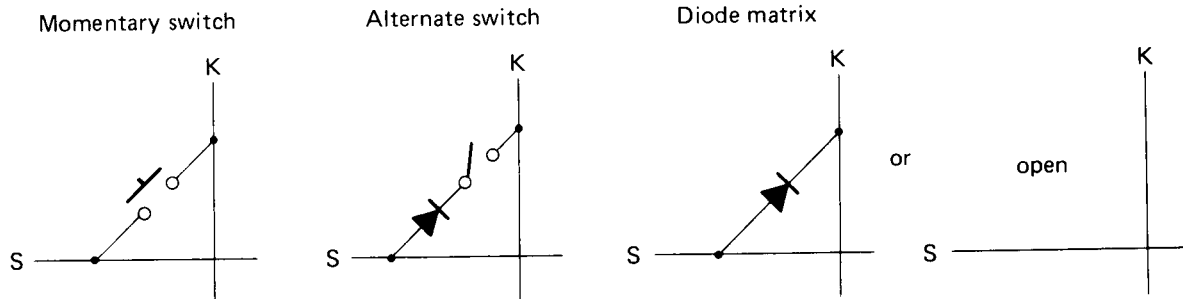
Diode matrix



Open



## 1.2 SWITCH CONNECTION



**Note:** The signal from the diode switch is read only when power is first fed to  $V_{DD}$ , or when voltage at the CE pin goes from low to high. In other cases, it is ignored. Momentary and Alternate switches can be changed at anytime.

## 1.3 DESCRIPTION OF KEY MATRIX

### 1.3.1 Initialization Diode Switch

There are a total of seven initialization switches. Their signals are read only when power is first fed to the  $V_{DD}$  pin (Power-ON Reset), and when voltage at the CE pin changes from low to high (CE reset). At any other time the status of these switches is ignored.

The switch setting is determined by whether the diode at the matrix nodal point is closed (ON) or open (OFF).

- (1) Area setting switches for FM band  
FMSEL1, FMSEL2
- (2) Channel spacing setting switch for MW band  
MWSEL
- (3) Switch for setting whether or not the clock will be used.  
NOCLOCK
- (4) Switch for setting the FM IF  
IF
- (5) Selection switch that either the momentary switch or the rotary switch to be used as the manual UP/DOWN key.  
M/R
- (6) Blank display setting switch (PRIO = OFF, TAPE input pin = High)  
BLANK

SYMBOL	DESCRIPTION																									
FMSEL1 FMSEL2	<p>These switches are for setting the FM band for the particular territory.</p> <table border="1"> <thead> <tr> <th>FMSEL1</th> <th>FMSEL2</th> <th>Area</th> <th>Frequency Range</th> <th>Channel Spacing</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>U.S.A.</td> <td>87.7 to 107.9 MHz</td> <td>200 kHz</td> </tr> <tr> <td>1</td> <td>0</td> <td>Japan</td> <td>76.1 to 89.9 MHz</td> <td>100 kHz</td> </tr> <tr> <td>0</td> <td>1</td> <td>Australia</td> <td>87.7 to 107.9 MHz</td> <td>100 kHz</td> </tr> <tr> <td>*</td> <td>1</td> <td>—</td> <td>—</td> <td>—</td> </tr> </tbody> </table> <p>* Do not turn both FMSEL1 and FMSEL2 ON simultaneously. The territory cannot be properly set.</p>	FMSEL1	FMSEL2	Area	Frequency Range	Channel Spacing	0	0	U.S.A.	87.7 to 107.9 MHz	200 kHz	1	0	Japan	76.1 to 89.9 MHz	100 kHz	0	1	Australia	87.7 to 107.9 MHz	100 kHz	*	1	—	—	—
FMSEL1	FMSEL2	Area	Frequency Range	Channel Spacing																						
0	0	U.S.A.	87.7 to 107.9 MHz	200 kHz																						
1	0	Japan	76.1 to 89.9 MHz	100 kHz																						
0	1	Australia	87.7 to 107.9 MHz	100 kHz																						
*	1	—	—	—																						
MWSEL	<p>This switch is for setting the MW band channel spacing.</p> <table border="1"> <thead> <tr> <th>MWSEL</th> <th>Frequency Range</th> <th>Channel Spacing</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>530 to 1 620 kHz</td> <td>10 kHz</td> </tr> <tr> <td>1</td> <td>531 to 1 602 kHz</td> <td>9 kHz</td> </tr> </tbody> </table>	MWSEL	Frequency Range	Channel Spacing	0	530 to 1 620 kHz	10 kHz	1	531 to 1 602 kHz	9 kHz																
MWSEL	Frequency Range	Channel Spacing																								
0	530 to 1 620 kHz	10 kHz																								
1	531 to 1 602 kHz	9 kHz																								
NOCLOCK	<p>This switch is for setting whether or not the clock will be used.</p> <table border="1"> <thead> <tr> <th>NOCLOCK</th> <th>Clock Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Present</td> </tr> <tr> <td>1</td> <td>Absent</td> </tr> </tbody> </table> <p>When the clock is used (NOCLOCK = OFF), the setting of the display switching mode is carried out by a combination of the PRIO and BLANK switches.</p>	NOCLOCK	Clock Function	0	Present	1	Absent																			
NOCLOCK	Clock Function																									
0	Present																									
1	Absent																									
IF	<p>This switch is for setting the FM IF.</p> <p style="text-align: right;">(MHz)</p> <table border="1"> <thead> <tr> <th>IF</th> <th>U.S.A.</th> <th>Japan</th> <th>Australia</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>10.700</td> <td>-10.700</td> <td>10.700</td> </tr> <tr> <td>1</td> <td>10.725</td> <td>-10.675</td> <td>10.725</td> </tr> </tbody> </table>	IF	U.S.A.	Japan	Australia	0	10.700	-10.700	10.700	1	10.725	-10.675	10.725													
IF	U.S.A.	Japan	Australia																							
0	10.700	-10.700	10.700																							
1	10.725	-10.675	10.725																							
M/R	<p>This switch is used to select either the momentary switch or the rotary switch to be used as the manual UP/DOWN key.</p> <table border="1"> <thead> <tr> <th>M/R</th> <th>Manual UP/DOWN</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Rotary Switch</td> </tr> <tr> <td>1</td> <td>Momentary Switch</td> </tr> </tbody> </table>	M/R	Manual UP/DOWN	0	Rotary Switch	1	Momentary Switch																			
M/R	Manual UP/DOWN																									
0	Rotary Switch																									
1	Momentary Switch																									
BLANK	<p>This switch is used to set whether the display is blank or shows the clock when the tape is loaded (TAPE input pin = high), when not in clock priority display mode (PRIO = OFF).</p> <p>When PRIO = OFF and TAPE input = high</p> <table border="1"> <thead> <tr> <th>BLANK</th> <th>Display status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Clock Display</td> </tr> <tr> <td>1</td> <td>Display OFF (blank)</td> </tr> </tbody> </table> <p>When in clock priority display mode (PRIO = ON) and when the tape is loaded (TAPE input pin = high), the clock is displayed unconditionally, regardless of the status of the BLANK switch.</p>	BLANK	Display status	0	Clock Display	1	Display OFF (blank)																			
BLANK	Display status																									
0	Clock Display																									
1	Display OFF (blank)																									

### 1.3.2 Alternate Switch

There are two alternate switches – DIM and PRIO. Unlike the initializing switches, it is always possible to change these switches.

SYMBOL	DESCRIPTION						
DIM	This switch changes the brightness of the display						
	<table border="1"> <thead> <tr> <th data-bbox="400 360 523 401">DIM</th> <th data-bbox="528 360 794 401">Display Brightness</th> </tr> </thead> <tbody> <tr> <td data-bbox="400 408 523 449">0</td> <td data-bbox="528 408 794 449">Bright</td> </tr> <tr> <td data-bbox="400 455 523 497">1</td> <td data-bbox="528 455 794 497">Dark</td> </tr> </tbody> </table>	DIM	Display Brightness	0	Bright	1	Dark
	DIM	Display Brightness					
	0	Bright					
1	Dark						
0	Bright						
1	Dark						
PRIO	This switch is used to set the display priority mode.						
	<table border="1"> <thead> <tr> <th data-bbox="400 542 555 584">PRIO</th> <th data-bbox="560 542 874 584">Display Mode</th> </tr> </thead> <tbody> <tr> <td data-bbox="400 590 555 631">0</td> <td data-bbox="560 590 874 631">Frequency display priority</td> </tr> <tr> <td data-bbox="400 638 555 679">1</td> <td data-bbox="560 638 874 679">Clock display priority</td> </tr> </tbody> </table>	PRIO	Display Mode	0	Frequency display priority	1	Clock display priority
	PRIO	Display Mode					
	0	Frequency display priority					
1	Clock display priority						
0	Frequency display priority						
1	Clock display priority						

### 1.3.3 Momentary Switch

There are a total of 27 momentary switches.

SYMBOL	DESCRIPTION																																																				
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">MAN UP</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">MAN DWN</div>	<p>This key is used for manual tuning. The momentary switch and the rotary switch can be selected by the diode switch M/R used for initialization.</p> <p>Momentary Switch (M/R = ON)</p> <p>Each time the switch is depressed the frequency moves one step UP or DOWN. If continuously depressed for more than 0.5 seconds, fast forwarding is performed until the key is released (sawtooth wave mode). The speed of the fast forwarding is 40 ms per one step.</p> <p>Rotary Switch (M/R = OFF)</p> <p>The frequency moves one step UP or DOWN for each pulse. A pulse of up to about 4 ms can be received. If a long pulse is input the fast forwarding does not occur.</p>																																																				
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">SEEK UP</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">SEEK DWN</div>	<p>This key is used for auto-tuning. In the sawtooth wave mode, a continuous search is made for the station in the UP or DOWN direction until the SD pin reaches high level. When the SD pin once reaches the high level, that frequency is maintained.</p> <p>The auto-tuning action can be halted by depressing this key twice, regardless of the status of the SD pin. The auto-tuning speed is about 40 ms per one step.</p>																																																				
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;">SCAN</div>	<p>This key is used for auto-scanning. A continuous search is made for the station in the UP direction in the sawtooth wave mode until the SD pin reaches the high level. With the SD pin at the high level frequency, there is about a 5 second HOLD, then the search continues for the next station.</p> <p>This action continues until any key is operated, with the exception of <span style="border: 1px solid black; padding: 2px;">SCAN</span> and <span style="border: 1px solid black; padding: 2px;">ME1</span> to <span style="border: 1px solid black; padding: 2px;">ME6</span>. When the <span style="border: 1px solid black; padding: 2px;">SCAN</span> key is once again depressed, the auto-SCAN action halts. Also, during about 5 seconds of HOLD, ME1 to ME6 are activated to write in memory without interrupting auto-SCAN action. It is then possible to write into memory. In this case, after the <span style="border: 1px solid black; padding: 2px;">M1</span> to <span style="border: 1px solid black; padding: 2px;">M6</span> keys are released and after that frequency is held for about 5 seconds, the auto-SCAN, action resumes. During SCAN action outside of the HOLD period, the <span style="border: 1px solid black; padding: 2px;">ME1</span> to <span style="border: 1px solid black; padding: 2px;">ME6</span> keys are ineffective.</p>																																																				
<div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">M1</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">M2</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">M3</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">M4</div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 5px;">M5</div> <div style="border: 1px solid black; padding: 2px; width: fit-content;">M6</div>	<p>This key is used to access preset memory. One key corresponds to FM and MW independently, and each band can contain 6 stations with different frequencies, making a total of 12 stations.</p> <p>When power is first fed to <math>V_{DD}</math> the following frequencies are automatically recorded.</p> <table border="1" data-bbox="370 1558 1177 1856"> <thead> <tr> <th>BAND</th> <th>AREA</th> <th>M1</th> <th>M2</th> <th>M3</th> <th>M4</th> <th>M5</th> <th>M6</th> </tr> </thead> <tbody> <tr> <td rowspan="3">FM (MHz)</td> <td>U.S.A.</td> <td>87.7</td> <td>88.1</td> <td>98.1</td> <td>107.9</td> <td>87.7</td> <td>87.7</td> </tr> <tr> <td>Australia</td> <td>87.7</td> <td>88.1</td> <td>98.1</td> <td>107.9</td> <td>87.7</td> <td>87.7</td> </tr> <tr> <td>Japan</td> <td>76.1</td> <td>76.1</td> <td>83.0</td> <td>89.9</td> <td>76.1</td> <td>76.1</td> </tr> <tr> <td rowspan="3">MW (kHz)</td> <td>U.S.A.</td> <td>530</td> <td>600</td> <td>1 000</td> <td>1 400</td> <td>1 602</td> <td>530</td> </tr> <tr> <td>Australia</td> <td>531</td> <td>594</td> <td>954</td> <td>1 314</td> <td>1 602</td> <td>531</td> </tr> <tr> <td>Japan</td> <td>531</td> <td>594</td> <td>954</td> <td>1 314</td> <td>1 620</td> <td>531</td> </tr> </tbody> </table>	BAND	AREA	M1	M2	M3	M4	M5	M6	FM (MHz)	U.S.A.	87.7	88.1	98.1	107.9	87.7	87.7	Australia	87.7	88.1	98.1	107.9	87.7	87.7	Japan	76.1	76.1	83.0	89.9	76.1	76.1	MW (kHz)	U.S.A.	530	600	1 000	1 400	1 602	530	Australia	531	594	954	1 314	1 602	531	Japan	531	594	954	1 314	1 620	531
BAND	AREA	M1	M2	M3	M4	M5	M6																																														
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SYMBOL	DESCRIPTION																															
<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">ME1</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">ME2</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">ME3</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">ME4</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">ME5</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">ME6</div>	<p>This key is used for writing in to preset memory. One key corresponds to FM and MW independently, and each band can contain 6 stations with different frequencies, making a total of 12 stations. Call key <span style="border: 1px solid black; padding: 2px;">M1</span> corresponds to write-in key <span style="border: 1px solid black; padding: 2px;">ME1</span>. There are respectively 6 independent write-in keys.</p>																															
<div style="border: 1px solid black; padding: 2px; width: 80px; margin: auto;">BAND</div>	<p>These keys are used to switch bands. They switch the display and power source control signals (FM, MW output). Each time the key is depressed, the FM and MW bands are switched. FM is selected when <math>V_{DD}</math> is initially powered on.</p>																															
<div style="border: 1px solid black; padding: 2px; width: 80px; margin: auto;">DISP</div>	<p>This key is used to switch the frequency and clock displays.</p>																															
<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: 80px; margin: auto;">HRADJ</div> <div style="border: 1px solid black; padding: 2px; width: 80px; margin: auto;">MINADJ</div>	<p>These keys are used to adjust the time while the clock is being displayed. Hours and minutes can be adjusted independently. Each time the <span style="border: 1px solid black; padding: 2px;">MINADJ</span> key is pressed the figure in the minutes column moves up once, and at the same time the internal second counter is reset. Carry to the hours column does not occur. Each time the <span style="border: 1px solid black; padding: 2px;">HRADJ</span> key is pressed the hours column moves up. This is a 12 hour display clock. AM and PM are not differentiated.</p>																															
<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: 80px; margin: auto;">LOUD</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: 80px; margin: auto;">LOC/DX</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: 80px; margin: auto;">ST</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: 80px; margin: auto;">METAL</div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; width: 80px; margin: auto;">Dolby NR</div> <div style="border: 1px solid black; padding: 2px; width: 80px; margin: auto;">AMS</div>	<p>These are the option function keys. Each time a key is depressed the corresponding output pin voltage reverses. When first powered on these output pins are all at the low level.</p> <p>As shown in the following table, the key which is effective in each mode (and the output) varies.</p> <table border="1" data-bbox="399 1087 1005 1440"> <thead> <tr> <th rowspan="2">Key and Output</th> <th>TAPE input</th> <th colspan="2">TAPE input Low</th> </tr> <tr> <th>High</th> <th>FM</th> <th>MW</th> </tr> </thead> <tbody> <tr> <td>LOUD</td> <td style="text-align: center;">○</td> <td style="text-align: center;">○</td> <td style="text-align: center;">○</td> </tr> <tr> <td>LOC/DX</td> <td style="text-align: center;">×</td> <td style="text-align: center;">○</td> <td style="text-align: center;">○</td> </tr> <tr> <td>ST</td> <td style="text-align: center;">×</td> <td style="text-align: center;">○</td> <td style="text-align: center;">○</td> </tr> <tr> <td>METAL</td> <td style="text-align: center;">○</td> <td style="text-align: center;">×</td> <td style="text-align: center;">×</td> </tr> <tr> <td>Dolby NR</td> <td style="text-align: center;">○</td> <td style="text-align: center;">×</td> <td style="text-align: center;">×</td> </tr> <tr> <td>AMS</td> <td style="text-align: center;">○</td> <td style="text-align: center;">×</td> <td style="text-align: center;">×</td> </tr> </tbody> </table> <p style="margin-left: 40px;">○ : key input possible, output also effective          × : key input ignored, output low</p> <p>Because this accessory function only has a conditional latch function according to the mode, objects other than the titles shown above can be used.</p>	Key and Output	TAPE input	TAPE input Low		High	FM	MW	LOUD	○	○	○	LOC/DX	×	○	○	ST	×	○	○	METAL	○	×	×	Dolby NR	○	×	×	AMS	○	×	×
Key and Output	TAPE input		TAPE input Low																													
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ST	×	○	○																													
METAL	○	×	×																													
Dolby NR	○	×	×																													
AMS	○	×	×																													

### 1.4 INITIALIZATION

1. The following status results when power is first fed to  $V_{DD}$ .

- (1) The frequencies for tracking adjustment, represented in keys  to  are stored in preset memory. The lowest frequency for the band is stored in the last station memory.
- (2) In TAPE eject status (TAPE input pin = low), FM mode results (FM output pin = high), and the contents of the FM last station memory, that is, the lowest FM frequency, are accessed.
- (3) The output corresponding to the option key is always low-level.

(  ,  ,  ,  ,  ,  )

(4) The clock setting is 1:00.

2. Without cutting power to  $V_{DD}$ , when only the CE pin goes from low to high, the following status occurs.

- (1) The contents of preset memory, last station memory, last preset memory, and last band memory are maintained. The contents of the last station memory for the last band received are accessed. In the case where the contents of finally preset memory is received, its indicator is also returned.
- (2) The option key status is maintained and the output reverts to the previous status.

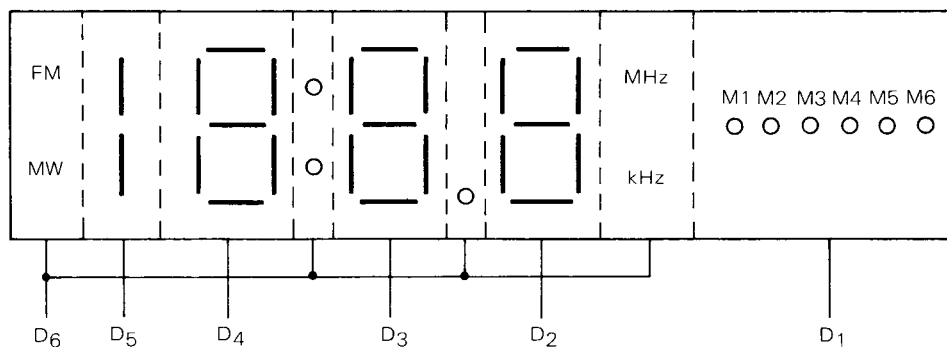
(  ,  ,  ,  ,  ,  )

### 2. DISPLAY

	D <sub>6</sub>	D <sub>5</sub>	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>
S <sub>a</sub>	FM	—	a	a	a	M1
S <sub>b</sub>	D.P. MHz	b	b	b	b	M2
S <sub>c</sub>	—	c	c	c	c	M3
S <sub>d</sub>	—	—	d	d	d	M4
S <sub>e</sub>	MW	—	e	e	e	M5
S <sub>f</sub>	COLON	—	f	f	f	M6
S <sub>g</sub>	kHz	—	g	g	g	—

Uppermost column
Lowermost column

Frequency and clock display
Preset memory display

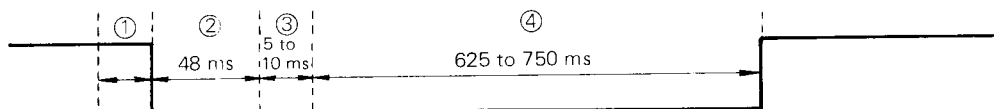


### 3. TIMING CHARTS

#### MUTE Output (Active-Low) Timing Chart

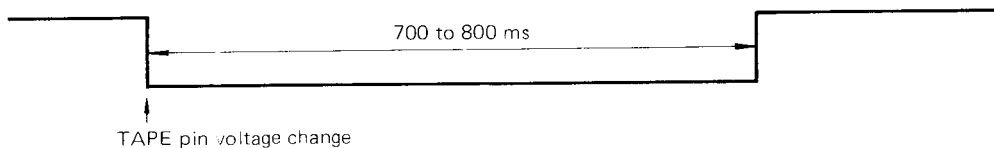
- ① Key ON chattering prevention time (about 15 ms)
- ② Mute leading time
- ③ Setting dividing ratio and display contents renewal time
- ④ Mute trailing time
- ⑤ Wait time until SD terminal signal detected
- ⑥ Wait time until PLL locked (changes according to the constant of externally connected LPF)

#### (1) Receiving band change (FM, MW)

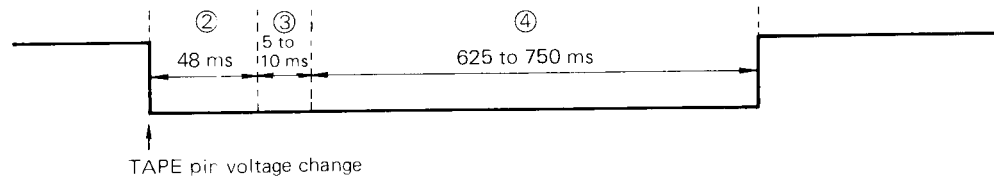


#### (2) TAPE pin voltage change

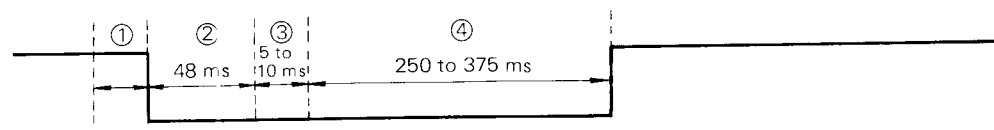
##### (i) Low (RADIO) → High (TAPE)



##### (ii) High (TAPE) → Low (RADIO)

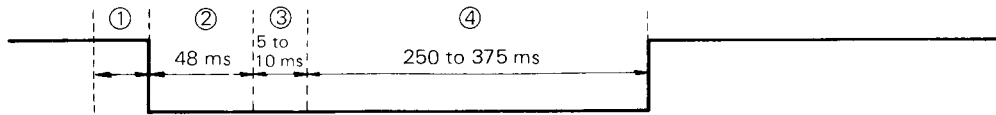


#### (3) Preset memory access

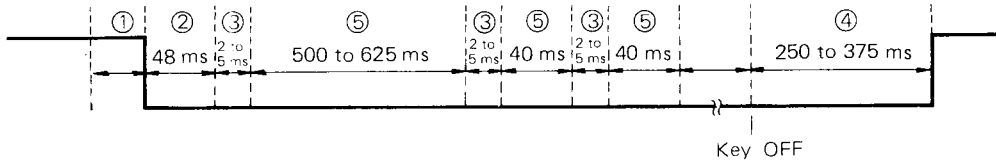


(4) **MAN UP** , **MAN DWN** key depressed

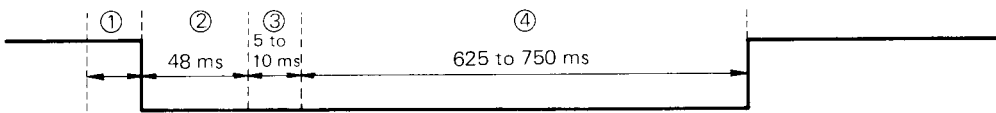
(i) Key ON less than 500 ms (step feed)



(ii) Key ON more than 500 ms (fast forwarding)

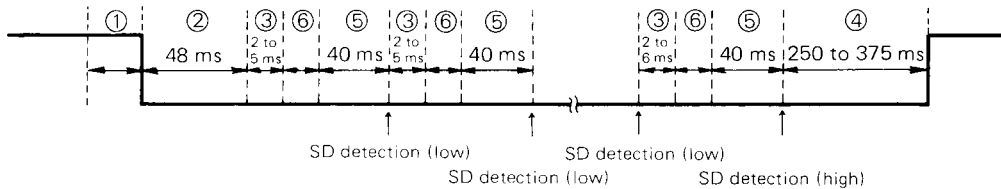


(iii) Band edge (upper limit → lower limit, lower limit → upper limit)

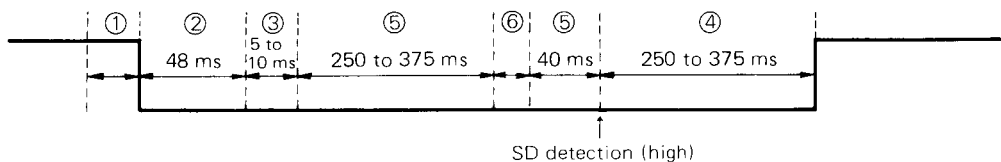


(5) **SEEK UP** , **SEEK DWN** key depressed

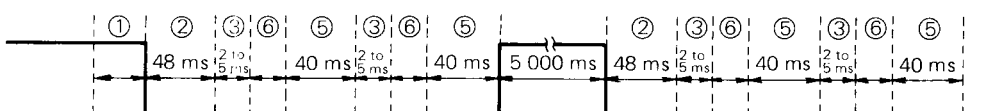
(i) Normal



(ii) Band edge (upper limit → lower limit, lower limit → upper limit)

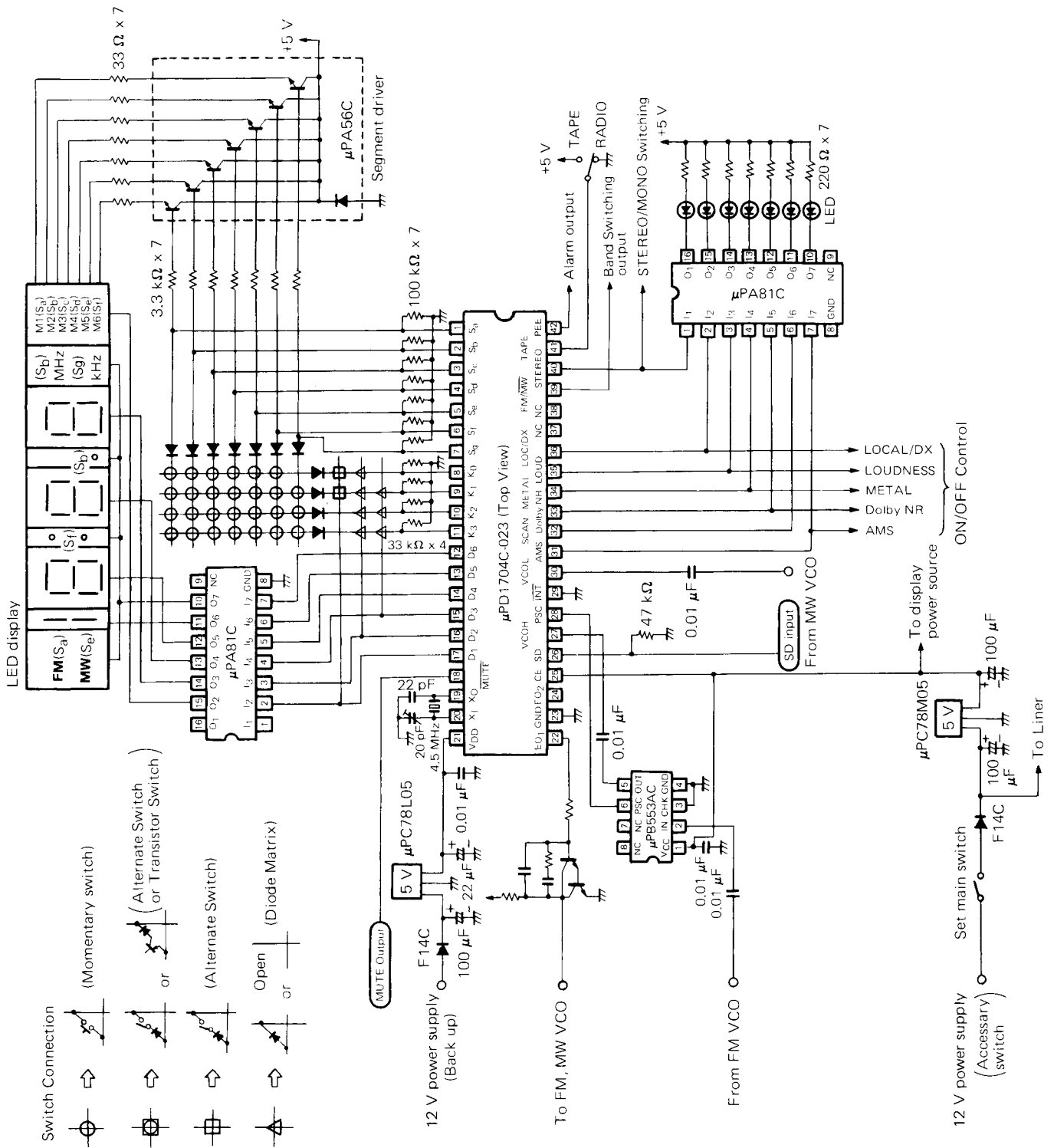


(6) **SCAN** key depressed





### 4. APPLICATION CIRCUIT



## 5. ELECTRICAL CHARACTERISTICS

### 5.1 ABSOLUTE MAXIMUM RATINGS

Supply Voltage	$V_{DD}$	-0.3 to +6.0	V
Input Voltage	$V_I$	-0.3 to $V_{DD}$	V
Output Voltage	$V_O$	-0.3 to $V_{DD}$	V
Output Sink Current	$I_O$	10	mA
Operating Temperature	$T_{opt}$	-35 to +75	°C
Storage Temperature	$T_{stg}$	-55 to +125	°C

### 5.2 RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Supply Voltage	$V_{DD}$	4.5	5.0	5.5	V	
Data Retention Voltage	$V_{DR}$	2.5		5.5	V	CE=0, NOCLOCK = ON
Oscillation Stop Voltage	$V_{DDS}$		3.2	3.8	V	
Supply Voltage Rise Time	$T_{rise}$			500	ms	$V_{DD}=0 \rightarrow 4.5$ V

5.3 DC CHARACTERISTICS ( $V_{DD} = +4.5$  to  $5.5$  V,  $T_a = -35$  to  $+75$  °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
High Level Input Voltage	$V_{IH1}$	$0.8 V_{DD}$		$V_{DD}$	V	SD pin
High Level Input Voltage	$V_{IH2}$	$0.7 V_{DD}$		$V_{DD}$	V	I/O port, CE pin (Note)
High Level Input Voltage	$V_{IH3}$	$0.6 V_{DD}$		$V_{DD}$	V	K <sub>0</sub> to K <sub>3</sub> pins
Low Level Input Voltage	$V_{IL1}$	0		$0.3 V_{DD}$	V	I/O port, CE pin (Note)
Low Level Input voltage	$V_{IL2}$	0		$0.2 V_{DD}$	V	K <sub>0</sub> to K <sub>3</sub> , SD pins
High Level Output Voltage	$V_{OH1}$	4.0			V	EO <sub>1</sub> , EO <sub>2</sub> pins $I_{OH} = -0.5$ mA
High Level Output Voltage	$V_{OH2}$	4.0			V	D <sub>1</sub> to D <sub>6</sub> , $\overline{MUTE}$ , I/O port (Note) $I_{OH} = -0.2$ mA
High Level Output Voltage	$V_{OH3}$	4.0			V	PSC pin $I_{OH} = -0.1$ mA
High Level Output Voltage	$V_{OH4}$	3.0			V	S <sub>a</sub> to S <sub>g</sub> pins $I_{OH} = -0.5$ mA
Low Level Output Voltage	$V_{OL1}$			0.5	V	EO <sub>1</sub> , EO <sub>2</sub> pins, I/O port (Note) $I_{OL} = 0.5$ mA
Low Level Output Voltage	$V_{OL2}$			0.5	V	D <sub>1</sub> to D <sub>6</sub> , $\overline{MUTE}$ , PSC pins $I_{OL} = 0.2$ mA
High Level Input Current	$+I_{IH1}$	10	40	100	$\mu$ A	K <sub>0</sub> to K <sub>3</sub> pins $V_{IN} = V_{DD} = 5.5$ V
High Level Input Current	$+I_{IH2}$		300		$\mu$ A	XI pin (when Pull Down) $V_{IN} = V_{DD} = 5.0$ V
Low Level Input Current	$-I_{IL1}$		300		$\mu$ A	AM, FM pins (when Pull Down) $V_{IN} = 0, V_{DD} = 5.0$ V
Output Leakage Current	$I_L$		$10^{-3}$	1	$\mu$ A	EO <sub>1</sub> , EO <sub>2</sub> pin, $T_a = 25$ °C $V_{p-p}(\text{MIN.})$
Supply Current	$I_{DD1}$		3		mA	Without input output current from input output pin
Supply Current	$I_{DD2}$		0.6		mA	CE=0 at NOCLOCK = OFF $V_{DD} = 5.0$ V
Data Retention Current	$I_{DR}$			10	$\mu$ A	CE=0 at NOCLOCK = ON, $T_a = 25$ °C, $V_{DD} = 5.0$ V

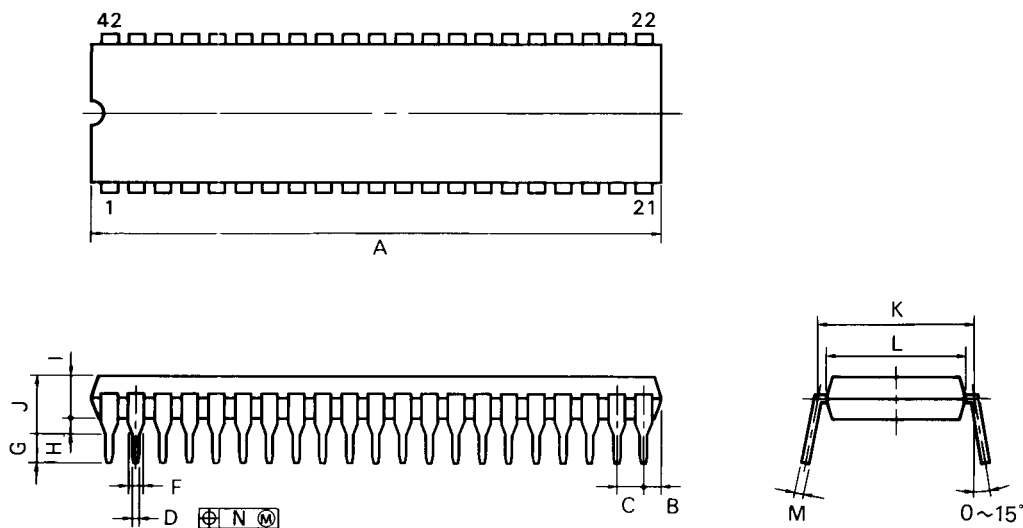
(Note) I/O ports means the KEYACK, TAPE, STEREO, FM BAND, AGCCUT, MW BAND, LOC/DX, LOUD, METAL, Dolby NR, SCAN, AMS pins.

5.4 AC CHARACTERISTICS ( $V_{DD} = +4.5$  to  $5.5$  V,  $T_a = -35$  to  $+75$  °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Operating Frequency	$f_{in1}$	0.5		2.5	MHz	AM pin, $V_{in} = 1.0 V_{p-p}(\text{MIN.})$ , DC cut
Operating Frequency	$f_{in2}$	0.5		8.8	MHz	FM pin, $V_{in} = 0.8 V_{p-p}(\text{MIN.})$ , square wave form, DC cut

### 6. PACKAGE DIMENSIONS (Unit: mm)

42 pin plastic DIP (600 mil)



P42C-100-600A,B

#### NOTES

- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	55.88 MAX.	2.200 MAX.
B	2.54 MAX.	0.100 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50 $\pm 0.10$	0.020 $\begin{smallmatrix} +0.004 \\ -0.005 \end{smallmatrix}$
F	1.2 MIN.	0.047 MIN.
G	3.6 $\pm 0.3$	0.142 $\pm 0.012$
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.72 MAX.	0.226 MAX.
K	15.24 (T.P.)	0.600 (T.P.)
L	13.2	0.520
M	0.25 $\begin{smallmatrix} +0.10 \\ -0.05 \end{smallmatrix}$	0.010 $\begin{smallmatrix} +0.004 \\ -0.003 \end{smallmatrix}$
N	0.25	0.01