Ordering number : ENN*4643

CMOS IC

LC7232N-8819

Single-Chip PLL and Controller

Preliminary

Overview

The LC7232N-8819 is a single chip radio receiver controller that is optimal for use in home stereos. The LC7232N-8819 includes an LCD controller and the PLL circuits required for LW, MW, SW, and FM reception in all major areas including China, the United States, Europe, and the Middle East.

Features

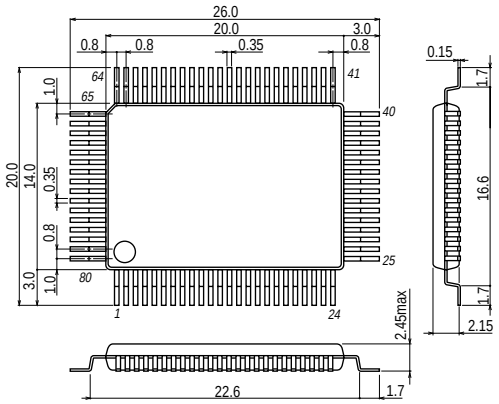
- Handles reception of frequencies used throughout the world, including China, the United States, Europe, the Middle East, Japan, and South Africa.
- Supports easy interfacing with the 33D1 and 11T1 CD modules. (Sanyo products)
- Supports remote controller access.
- Provides electronic VR and source select control functions.
- Preset memories
  FM: 16 stations
  MW: 8 stations
  SW1: 8 stations
  SW2: 8 stations
  max = 40 stations
- Tuning: Auto or manual up/down
- High speed search; FM: 60 ms/step, AM: 70 ms/step
- Clock function
- On/off timer and sleep functions
- LCD display: Wide viewing angle, high contrast, wide operating temperature range

Package Dimensions

unit: mm

3044-QFP80A

[LC7232N-8819]



SANYO: QFP80A (QIP80A)

SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

Reception Frequencies

	Band		Reception frequency range (FM, SW: MHz, AM: kHz)	Step size (kHz)	Comparison frequency (kHz)	Center frequency (FM: MHz, AM: kHz)	B2	B1	B0
China	FM		87.0 to 108.0	100/50	25	10.7	0	0	0
	MW	a	531 to 1602	9	9	450/468			
		b	522 to 1611	9	9	450/468			
	SW1		2.28 to 6.23	5	5	450			
	SW2		7.1 to 21.85	5	5	450			
USA (1)	FM		87.5 to 107.9	200	50	10.7	0	0	1
	MW	a	531 to 1602	9	9	450/468			
		b	530 to 1710	10	10	450			
USA (2)	FM		87.5 to 108.0	100	50	10.7	0	1	0
	MW	a	531 to 1602	9	9	450/468			
		b	530 to 1710	10	10	450			
Europe	FM		87.5 to 108.0	100/50	25	10.7	1	0	0
	MW	a	531 to 1602	9	9	450/468			
		b	522 to 1611	9	9	450/468			
	LW		146 to 281	1	1	450/468			
Middle East	FM		87.5 to 108.0	100/50	25	10.7	0	1	1
	MW	a	531 to 1602	9	9	450/468			
		b	522 to 1611	9	9	450/468			
	SW1		2.28 to 6.23	5	5	450			
	SW2		7.1 to 21.85	5	5	450			
Eastern Europe	FM		66.0 to 72.0	100/50	25	10.7	1	0	1
	MW	a	531 to 1602	9	9	450/468			
		b	522 to 1611	9	9	450/468			
	LW		146 to 281	1	1	450/468			
	SW	SWA	5.95 to 15.6	5	5	450			
		SWB	3.8 to 12.5	5	5	450			
Japan/South Africa	FM		76.0 to 108.0	100/50	25	–10.7	1	1	0
	MW	a	531 to 1602	9	9	450/468			
		b	522 to 1611	9	9	450/468			
	LW		146 to 281	1	1	450/468			
	SW	SWA	5.95 to 15.6	5	5	450			
		SWB	3.8 to 12.5	5	5	450			
World	FM		87.5 to 108.0	100/50	25	10.7	1	1	1
	MW	a	531 to 1602	9	9	450/468			
		b	522 to 1611	9	9	450/468			
	LW		146 to 281	1	1	450/468			
	SW	SWA	5.95 to 15.6	5	5	450			
		SWB	3.8 to 12.5	5	5	450			

Specifications

Absolute Maximum Ratings at Ta = 25°C, V_{SS} = 0 V

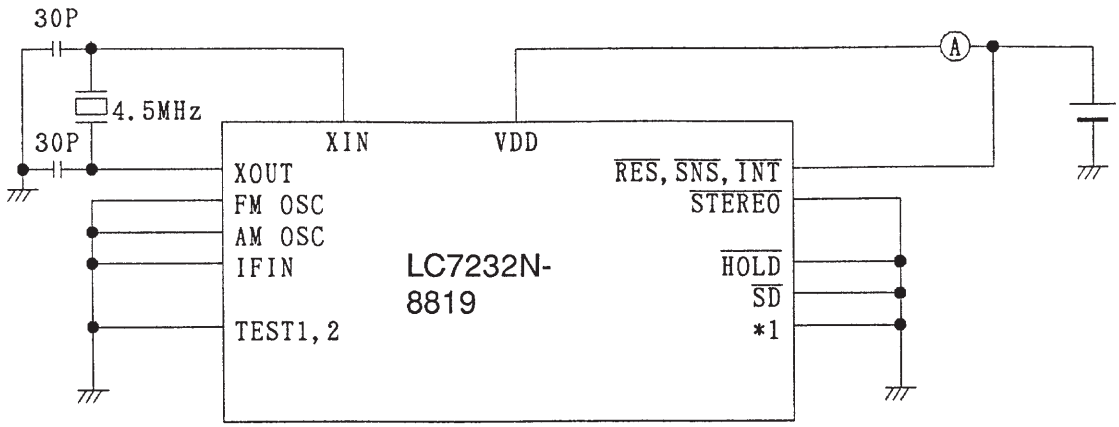
Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	V_{DD} max		–0.3 to +6.5	V
Input voltage	$V_{IN\ (1)}$	$\overline{HOLD}$, $\overline{INT}$, $\overline{RES}$, $\overline{SNS}$, REMO, $\overline{SD}$, $\overline{STEREO}$, K5, K4	–0.3 to +13	V
	$V_{IN\ (2)}$	Input other than $V_{IN\ (1)}$	–0.3 to V_{DD} + 0.3	V
Output voltage	$V_{OUT\ (1)}$	$\overline{MO}$/ST, FM/$\overline{AM}$, $\overline{MW}$, $\overline{LW}$/$\overline{SW1}$	–0.3 to +15	V
	$V_{OUT\ (2)}$	Output other than $V_{OUT\ (1)}$	–0.3 to V_{DD} + 0.3	V
Output current	$I_{OUT\ (1)}$	$\overline{BASS}$, T-ON, $\overline{MUTE}$, $\overline{POWOUT}$, $\overline{MO}$/ST, FM/$\overline{AM}$, $\overline{MW}$, $\overline{LW}$/$\overline{SW1}$	0 to 5	mA
	$I_{OUT\ (2)}$	VDN, CE, DO, CLK, SW2/A/B, VUP	0 to 3	mA
	$I_{OUT\ (3)}$	T0, T1, T2, T3, T4, T5, T6, T7	0 to 1	mA
Allowable power dissipation	Pd max	Ta = –40 to +85°C	400	mW
Operating temperature	Topr		–40 to +85	°C
Storage temperature	Tstg		–45 to +125	°C

Allowable Operating Ranges at Ta = –40 to +85°C, V_{DD} = 3.5 to 5.5 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply voltage	$V_{DD\ (1)}$	CPU and PLL operating	4.5		5.5	V
	$V_{DD\ (2)}$	CPU operating	3.5		5.5	V
	$V_{DD\ (3)}$	Memory hold	1.3		5.5	V
Input high level voltage	$V_{IH\ (1)}$	REMO, $\overline{STEREO}$, K4, K5	0.7 V_{DD}		8.0	V
	$V_{IH\ (2)}$	$\overline{RES}$, $\overline{INT}$, $\overline{HOLD}$	0.8 V_{DD}		8.0	V
	$V_{IH\ (3)}$	$\overline{SNS}$	2.5		8.0	V
	$V_{IH\ (4)}$	K0, K1, K2, K3	0.6 V_{DD}		V_{DD}	V
	$V_{IH\ (5)}$	$\overline{FUNC}$1, FUNC0	0.7 V_{DD}		V_{DD}	V
Input low level voltage	$V_{IL\ (1)}$	REMO, $\overline{STEREO}$, K4, K5	0		0.3 V_{DD}	V
	$V_{IL\ (2)}$	$\overline{RES}$, $\overline{INT}$	0		0.2 V_{DD}	V
	$V_{IL\ (3)}$	$\overline{SNS}$	0		1.3	V
	$V_{IL\ (4)}$	K0, K1, K2, K3	0		0.2 V_{DD}	V
	$V_{IL\ (5)}$	FUNC1, FUNC0	0		0.3 V_{DD}	V
	$V_{IL\ (6)}$	$\overline{HOLD}$	0		0.4 V_{DD}	V
Input frequency	$F_{IN\ (1)}$	XIN	4.0	4.5	5.0	MHz
	$F_{IN\ (2)}$	FM OSC $V_{IN\ (2)}$ $V_{DD\ (1)}$	10		130	MHz
	$F_{IN\ (3)}$	AM OSC (LW, MW) $V_{IN\ (3)}$ $V_{DD\ (1)}$	0.5		10	MHz
	$F_{IN\ (4)}$	AM OSC (SW) $V_{IN\ (4)}$ $V_{DD\ (1)}$	2.0		40	MHz
	$F_{IN\ (5)}$	IFIN $V_{IN\ (5)}$ $V_{DD\ (1)}$	0.4		12	MHz
Input amplitude	$V_{IN\ (1)}$	XIN	0.50		1.5	Vrms
	$V_{IN\ (2)}$	FM OSC	0.10		1.5	Vrms
	$V_{IN\ (3),\ (4)}$	AM OSC	0.10		1.5	Vrms
	$V_{IN\ (5)}$	IFIN	0.10		1.5	Vrms

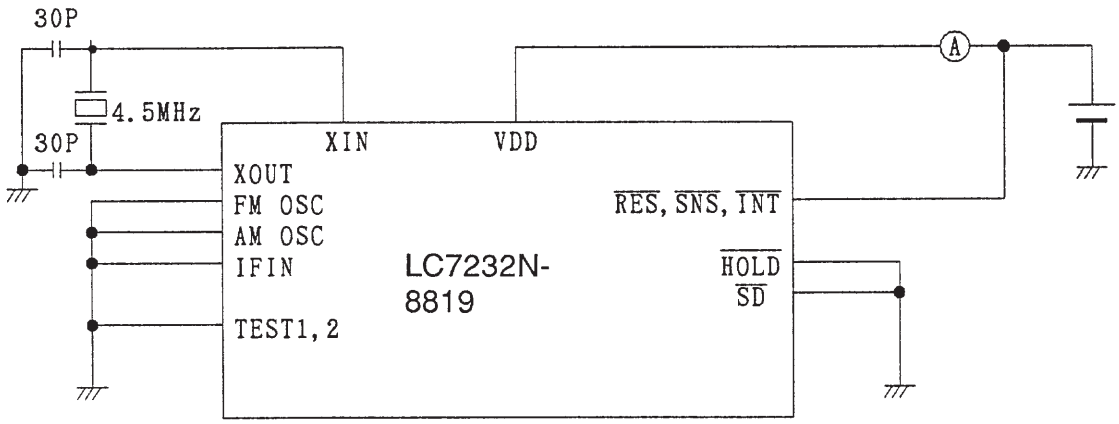
Electrical Characteristics within the Allowable Operating Ranges

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power down detection voltage	V_{DET}		2.7	3.0	3.3	V
Input high level voltage	$I_{IH\ (1)}$	$\overline{INT}$, $\overline{HOLD}$, $\overline{RES}$, $\overline{SD}$, $\overline{SNS}$, REMO, $\overline{STEREO}$, K4, K5: V_I = 5.5 V			3.0	µA
	$I_{IH\ (2)}$	XIN: $V_I = V_{DD}$ = 5.0 V	2.0	5.0	15	µA
	$I_{IH\ (3)}$	FMOSC, AMOSC, IFIN: $V_I = V_{DD}$ = 5.0 V	4.0	10	30	µA
	$I_{IH\ (4)}$	K0, K1, K2, K3: $V_I = V_{DD}$ = 5.0 V		50		µA
	$I_{IH\ (5)}$	FUNC1, FUNC0: $V_I = V_{DD}$			3.0	µA
Input low level voltage	$I_{IL\ (1)}$	$V_I = V_{SS}$ $\overline{INT}$, $\overline{HOLD}$, $\overline{RES}$, $\overline{SD}$, $\overline{SNS}$, REMO, $\overline{STEREO}$, K4, K5			3.0	µA
	$I_{IL\ (2)}$	$V_I = V_{SS}$ XIN	2.0	5.0	15	µA
	$I_{IL\ (3)}$	$V_I = V_{SS}$ FMOSC, AMOSC, IFIN	4.0	10	30	µA
	$I_{IL\ (4)}$	$V_I = V_{SS}$ FUNC1, FUNC0			30	µA
Input floating voltage	V_{IF}	K0, K1, K2, K3			0.05 V_{DD}	V
Pull-down resistance	R_{PD}	K0, K1, K2, K3, V_{DD} = 5 V	75	100	200	kΩ
Output off leakage current	$I_{OFFH\ (1)}$	EO1, EO2: $V_O = V_{DD}$		0.01	10	nA
	$I_{OFFH\ (2)}$	T0, T1, T2, T3, T4, T5, T6, T7, POWOUT, MUTE, T-ON, BASS, CLK, DO, CE, VDN, VUP, SW2/A/B: $V_O = V_{DD}$			3.0	µA
	$I_{OFFH\ (3)}$	$\overline{MO}$/ST, $\overline{FM}$/$\overline{AM}$, $\overline{MW}$, $\overline{LW}$/$\overline{SW1}$: V_O = 13 V			5.0	µA
Output off leakage current	$I_{OFFL\ (1)}$	EO1, EO2: $V_O = V_{SS}$		0.01	10	nA
	$I_{OFFL\ (2)}$	T0, T1, T2, T3, T4, T5, T6, T7, POWOUT, MUTE, T-ON, BASS, CLK, DO, CE, VDN, VUP, SW2/A/B: $V_O = V_{SS}$			3.0	µA
Output high level voltage	$V_{OH\ (1)}$	T0, T1, T2, T3, T4, T5, T6, T7: I_O = 1 mA	V_{DD} – 2.0	V_{DD} – 1.0	V_{DD} – 0.5	V
	$V_{OH\ (2)}$	BASS, CLK, DO, CE, VDN, VUP, SW2/A/B: I_O = 1 mA	V_{DD} – 1.0			V
	$V_{OH\ (3)}$	EO1, EO2: I_O = 500 µA	V_{DD} – 1.0			V
	$V_{OH\ (4)}$	XOUT: I_O = 200 µA	V_{DD} – 1.0			V
	$V_{OH\ (5)}$	S1 to S28: I_O = –0.1 mA	V_{DD} – 1.0			V
	$V_{OH\ (6)}$	COM1, COM2: I_O = 25 µA	V_{DD} – 0.75	V_{DD} – 0.5	V_{DD} – 0.3	V
	$V_{OH\ (7)}$	POWOUT, MUTE, T-ON, BASS: I_O = 5 mA	V_{DD} – 1.0			
Output low level voltage	$V_{OL\ (1)}$	T0, T1, T2, T3, T4, T5, T6, T7: I_O = 50 µA	0.5	1.0	2.0	V
	$V_{OL\ (2)}$	BASS, CLK, DO, CE, VDN, VUP, SW2/A/B: I_O = 1 mA			1.0	V
	$V_{OL\ (3)}$	EO1, EO2: I_O = 500 µA			1.0	V
	$V_{OL\ (4)}$	XOUT: I_O = 200 µA			1.0	V
	$V_{OL\ (5)}$	S1 to S28: I_O = 0.1 mA			1.0	V
	$V_{OL\ (6)}$	POWOUT, MUTE, T-ON, BASS: I_O = 5 mA			1.0	V
	$V_{OL\ (7)}$	COM1, COM2: I_O = 25 µA	0.3	0.5	0.75	V
	$V_{OL\ (8)}$	$\overline{MO}$/ST, FM/$\overline{AM}$, $\overline{MW}$, $\overline{LW}$/$\overline{SW1}$: I_O = 5 mA	0.75 (150 Ω)		2.0 (400 Ω)	V
Output middle level voltage	V_M	COM1, COM2, V_{DD} = 5 V, I_O = 20 µA	2.0	2.5	3.0	V
Power supply current	$I_{DD\ (1)}$	$V_{DD\ (1)}$, $F_{IN\ (2)}$ = 130 MHz		15	20	mA
	$I_{DD\ (2)}$	$V_{DD\ (2)}$ PLL stop (HOLD figure 1)		1.5		mA
	$I_{DD\ (3)}$	V_{DD} = 5.5 V. OSC stop. Ta = 25 °C (BACK UP figure 2)			5	µA
	$I_{DD\ (4)}$	V_{DD} = 2.2 V. OSC stop. Ta = 25 °C (BACK UP figure 2)			1	µA



Notes: T0, T1, T2, T3, T4, T5, T6, T7, POWOUT, MUTE, T-ON, BASS, CLK, CE, VDN, VUP, SW2/A/B, LW/SW1, MW, FM/AM, MO/ST = "Open"
*1: K0, K1, K2, K3, FUNC1, FUNC0

Figure 1 $I_{DD\,(2)}$ in Hold Mode



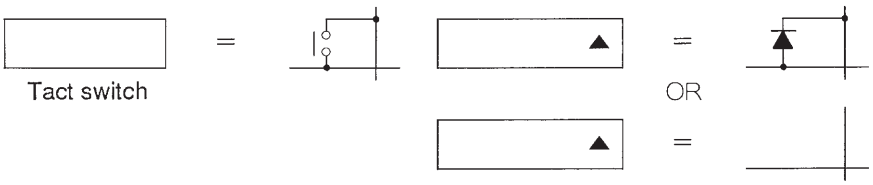
Note: All ports other than the ones specified above must be left open.

Figure 2 $I_{DD\,(3)}$ in Back-Up Mode

Unit (capacitance: F)

Key Matrix and Diode Matrix (DIMRX)

	K0	K1	K2	K3	K4	K5
T0	CH1/TIMER ON	CH2/TIMER OFF	CH3	CH4	B0 ▲	B1 ▲
T1	CH5	CH6	CH7	CH8	B2 ▲	FM ▲
T2	T-UP	T-DOWN	BAND	ME	MW ▲	LW ▲
T3	MO/ST	MUTE	BASS	FUNC.	SW1 ▲	SW2 ▲
T4	POWER	V-UP	V-DN	PHONO	IFSHIFT ▲	SELFUN ▲
T5	TUNER	CD	TAPE	AUX	C0 ▲	C1 ▲
T6	FM	MW	LW (SW1)	SW2 (SWA), (SWB)	C2 ▲	C3 ▲
T7	SLEEP	DISPLAY	TIMER		CLOCK ▲	ANTIPHON ▲



Diode Matrix Descriptions

Diode matrix name	On/off	Function	Invalid regions
B0, B1, B2	0	See the descriptions of the reception frequencies.	—
	1		
FM	0	FM step = 100 kHz	Invalid in the USA (1) and USA (2) regions.
	1	FM step = 50 kHz	
MW	0	MW ‘a’ frequency range	Valid in all regions.
	1	MW ‘b’ frequency range	
LW	0	LW disabled	Invalid in China, the USA (1), USA (2) and the Middle East.
	1	LW enabled	
SW1	0	SW1 (SWA) disabled	Invalid in the USA (1), USA (2) and Europe. Selects SW1 or SW2 when LW = 0, and selects SWA or SWB when LW = 1.
	1	SW1 (SWA) enabled	
SW2	0	SW2 (SWB) disabled	
	1	SW2 (SWB) enabled	
IF SHIFT	0	450 kHz selected	Valid in all regions.
	1	468 kHz selected	
SELFUN	0	Function switching is performed by the FUNC0 and FUNC1 inputs.	
	1	Function switching is performed by the tact switch.	
C0 to C3	0	These should be set to match the LC7232N-8819 and/or LC7461M-8103 custom code.	
	1		
CLOCK	0	Clock and timer disabled	
	1	Clock and timer enabled	
ANTI-PHON	0	Phono function enabled	
	1	Phono function disabled	

Pin Functions

Pin	Symbol	I/O	Allocation	Active	Function	Initial value	Handling when unused
1	XIN	I	XIN	—	Connection for the 4.5 MHz crystal	—	Must be used.
2	TEST2	I	TEST2	—	Connect to GND	—	Must be used.
3	PG3	I	REMO	L	Remote control input pin; REMO and $\overline{\text{INT}}$ are connected together.	—	Connect directly to V_{DD}.
4	PG2	I	$\overline{\text{STEREO}}$	L	In FM mode with stereo selected by the MO/ST key, when this pin goes low the ST indicator will be lit.	—	Connect directly to V_{DD}.
5	PG1	I	K5	—	Diode matrix inputs	—	Must be used.
6	PG0	I	K4	—		—	Must be used.
7	PH3	O	$\overline{\text{MO}}$/ST	H	Mono = low, stereo = high	L	Open
8	PH2	O	FM/$\overline{\text{AM}}$	—	Tuner band switching output See the Band Switching Output Table for details.	H	Open
9	PH1	O	$\overline{\text{MW}}$	—		H	Open
10	PH0	O	$\overline{\text{LW}}$/$\overline{\text{SW1}}$	—		H	Open
11	PF3	O	SW2/A/B	—		L	Open
12	PF2	I	FUNC1	—	Switches the function according to the input state. (Connect these pins to GND when SELFUN = 1.)	L	Connect to GND.
13	PF1	I	FUNC0	—		L	Connect to GND.
14	PF0	O	VUP	H	For use with the motorized volume control. Outputs a high level while the V-UP key is pressed.	L	Open
15	PE3	O	VDN	H	For use with the motorized volume control. Outputs a high level while the V-DN key is pressed.	L	Open
16	PE2	O	CE	H	For control of the electronic volume IC and the source selector IC.	L	Open
17	PE1	O	DO	H		L	Open
18	PE0	O	CLK	H		L	Open
19	PD3	O	BASS	H	For use with super bass control. The bass indicator will be on when this signal is high, and off when low.	L	Open
20	PD2	O	T-ON	H	After a power on due to the timer, waits one second and then outputs a high level for 500 ms. (For use by on timer auto-play.)	L	Open
21	PD1	O	MUTE	H	Audio mute (audio signal cutoff) Used for both mute output due to the mute key as well as IF counter output.	L	Open
22	PD0	O	POWOUT	H	Power control Power on = high, power off = low	L	Open
23	PC3	O	T7	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open
24	PC2	O	T6	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open
25	PC1	O	T5	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open
26	PC0	O	T4	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open
27	PB3	O	T3	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open
28	PB2	O	T2	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open
29	PB1	O	T1	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open
30	PB0	O	T0	H	Scans only when a key is pressed. Holds a high level when the scan is stopped. (The chattering exclusion time is 40 ms.)	H	Open

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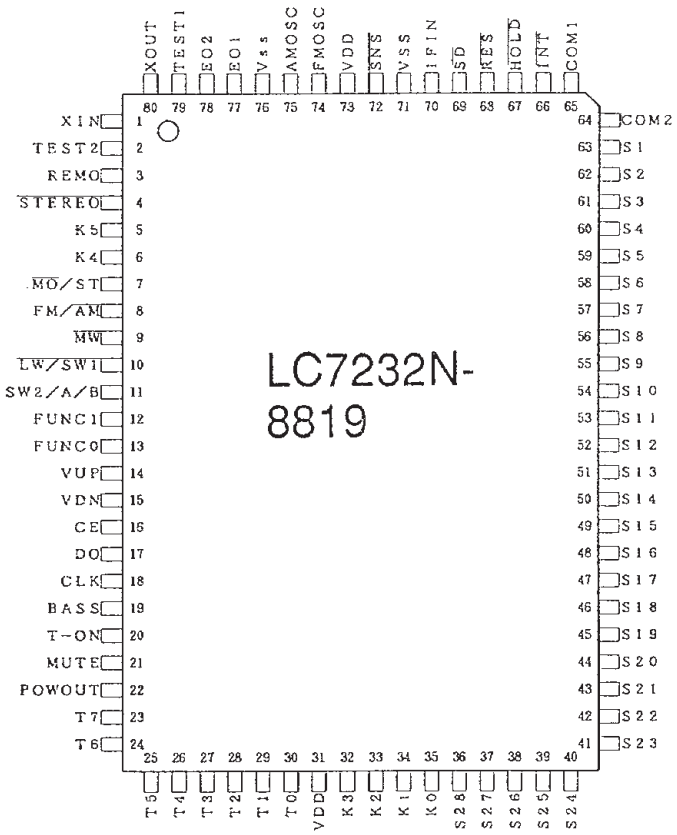
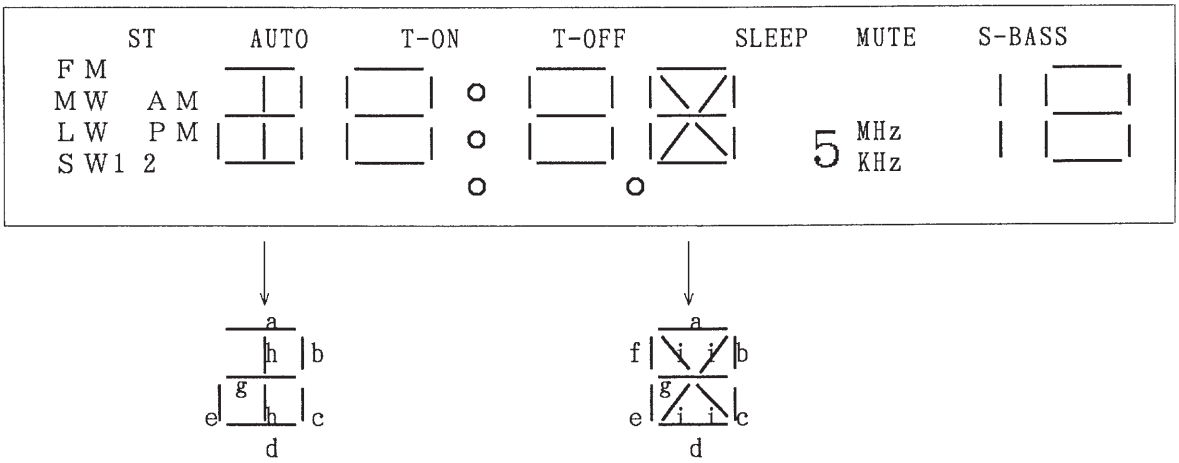
Pin	Symbol	I/O	Allocation	Active	Function	Initial value	Handling when unused
31	V_{DD}	—	V_{DD}	—	Connect to +5 V.		Must be used.
32	PA3	I	K3	—	Key scan input		Connect to GND.
33	PA2	I	K2	—	Key scan input		Connect to GND.
34	PA1	I	K1	—	Key scan input		Connect to GND.
35	PA0	I	K0	—	Key scan input		Connect to GND.
36 to 63	S28 to S1	O	S28 to S1	—	LCD segment driver		Open
64	COM2	O	COM2	—	LCD COM2 driver		Must be used.
65	COM1	O	COM1	—	LCD COM1 driver		Must be used.
66	$\overline{INT}$	I	$\overline{INT}$	—	Remote control input pin; REMO and $\overline{INT}$ are connected together.		Connect directly to V_{DD}.
67	$\overline{HOLD}$	I	$\overline{HOLD}$	L	Normal mode when HOLD is high Back up mode when HOLD is low (regardless of whether the clock is enabled)		Connect directly to V_{DD}.
68	$\overline{RES}$	I	$\overline{RES}$	L	Connect to +5 V.		Must be used.
69	ADI	I	$\overline{SD}$	L	Reports when a station is received during auto-tuning.		Connect directly to V_{SS}.
70	HCTR	I	IFIN	AC	AM/FM IF input		Connect directly to V_{SS}.
71	LCTR	I	—		Connect to GND.		Connect directly to V_{SS}.
72	SNS	I	$\overline{SNS}$	L	Power failure determination input pin		Connect directly to V_{SS}.
73	V_{DD}	—	V_{DD}	—	Connect to +5 V.		Must be used.
74	FMIN	I	FMOSC	AC	FM local oscillator input		Must be used.
75	AMIN	I	AMOSC	AC	AM local oscillator input		Connect directly to V_{SS}.
76	V_{SS}	—	V_{SS}	—	Connect to GND.		Connect directly to V_{SS}.
77	E01	O	E01	H/L	Phase comparator output		Must be used.
78	E02	O	E02	H/L	Phase comparator output		Connect directly to V_{SS}.
79	TEST1	I	TEST1	—	Connect to GND.		Must be used.
80	XOUT	O	XOUT	—	Connection for the 4.5 MHz crystal		Must be used.

Pin Assignment



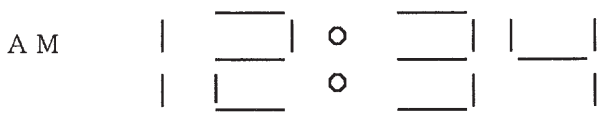
LCD Panel



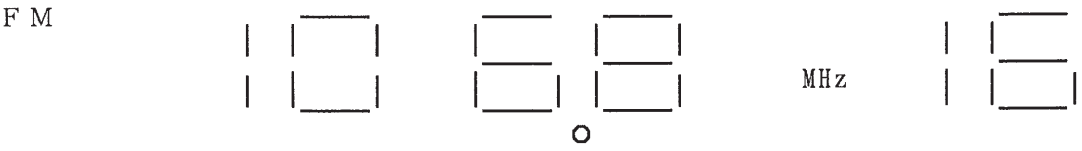
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17
COM1	FM	LW	1	1a	AM	1h	1c	T-ON	2f	2e	2d	2a	3f	3e	3d	3a	4f
COM2	MW	SW	2	ST	PM	1d, e, g	1b	AUTO	2b	2g	2c	dp1	3b	3g	3c	dp2	4b

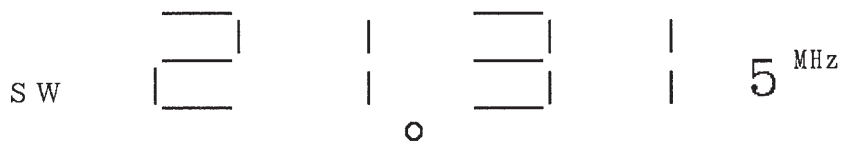
	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
COM1	4e	4d	4a	COLON	5	kHz	MUTE	7f	7e	7d	7a
CMO2	4g	4c	4i	T-OFF	SLEEP	MHz	6b, c	7b	7g	7c	S-BASS

1. Clock



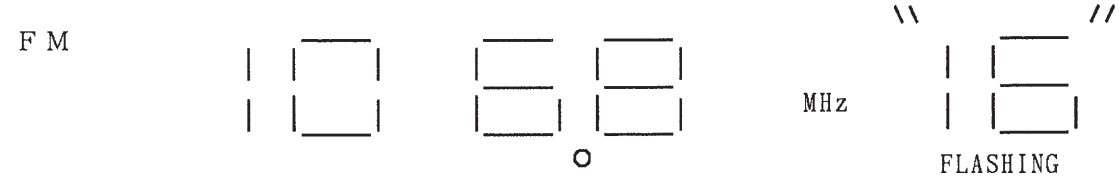
2. Tuner



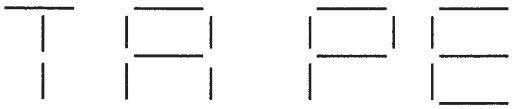


3. Memory write
   ME key

   RME key



4. CD 

5. Tape 

6. Aux 

7. Phono 

Function Selection Table

When SELFUN = 0:
The function is determined by the states of the FUNC0 and FUNC1 input ports. (The chattering exclusion time is 40 ms.)

FUNC0	FUNC1	Function
0	0	Tuner
1	0	CD
0	1	Tape
1	1	Phono

"0" = GND, "1" = +5 V

Band Switching Output Table

Band	Pin			
	FM/$\overline{AM}$	$\overline{MW}$	$\overline{LW}$/$\overline{SW1}$	SW2/AB
FM	H	H	H	L
MW	L	L	H	L
LW	L	H	L	L
SW1	L	H	L	L
SW2	L	H	H	H
SWA/B	L	H	H	H
Any setting other than TUNER	L	H	H	L

SW Band Limits

	Frequency range (MHz)
SW1	2.28 to 2.495
	3.2 to 3.4
	3.8 to 4.0
	4.75 to 5.06
	5.95 to 6.23
SW2	7.1 to 7.3
	9.5 to 9.9
	11.65 to 12.5
	13.6 to 13.8
	15.1 to 15.6
	17.55 to 17.9
	21.45 to 21.85

	Frequency range (MHz)
SWA	5.95 to 6.23
	7.1 to 7.3
	9.5 to 9.9
	11.65 to 12.5
	13.6 to 13.8
	15.1 to 15.6
SWB	3.8 to 4.0
	4.75 to 5.06
	5.95 to 6.23
	7.1 to 7.3
	9.5 to 9.9
	11.65 to 12.5

Key Functions

1. CH1/TIMER-ON, CH2/TIMER-OFF, CH3 to CH8, ME

• During frequency display

These keys are used to write to and read from preset memory.

Write

When the ME key is pressed the figure "1" flashes in the frequency display and the write state is entered for 5 seconds. If one of the CH1 to CH8 keys is pressed again during that 5 second interval, the frequency is stored in that channel memory. If the FM band is selected, and the ME key is pressed during the 5-second write state interval, the figure "2" flashes in the display, and the frequency can be stored in channel CH9 to CH16 by pressing one of the CH1 to CH8 keys. Pressing the ME key again clears the write state. If the AM band is selected, pressing the ME key while the "1" display is flashing clears the write state.

For the FM band, the MO/ST state is also stored with the frequency.

Pressing either the CH-UP/T-ON or the CH-DOWN/T-OFF key during the write enabled state clears the write state and recalls the contents of the preset memory.

Read

When the FM band is selected, pressing one of the CH1 to CH8 keys once recalls the frequency and MO/ST state for that channel, and pressing that key a second time recalls the frequency for the corresponding channel in channels 9 through 16.

When an AM band is selected, pressing one of the CH1 to CH8 keys once recalls the frequency for that channel.

• During clock or timer adjustment display (The CH3 to CH8 keys function in the same manner as they do in frequency display.)

When the ME key is pressed, the colon between the hour and minute displays flashes, and the system enters clock adjustment mode. In this mode the T-UP key adjusts the minute setting and the T-DOWN key adjusts the hour setting.

T-UP key :	Pressing this key once increments the minute setting, and holding it down in excess of 500 ms increments the minute setting at 8 minutes per second. During this operation the seconds setting is set to zero by the reset, and there is no carry performed out of the minutes settings.
T-DOWN key:	Pressing this key once increments the hour setting, and holding it down in excess of 500 ms increments the hour setting at 4 minutes per second. During this operation the seconds setting is not affected.

The colon between the hour and minute displays remains lit while either of the T-UP or T-DOWN key is pressed.

Return to normal operation:
- If no key is pressed for 5 seconds, clock adjustment mode is automatically cleared.
- Pressing the ME key twice clears clock adjustment mode.
- Pressing any other key clears clock adjustment mode and executes that key's function.

Pressing the CH1/TIMER-ON key recalls the on timer setting, lights the T-ON indicator, and flashes the colon between the hour and minute displays. In this mode, the T-UP key adjusts the minute setting and the T-DOWN key adjusts the hour setting. (500 ms lit, 500 ms off)

Pressing the CH2/TIMER-OFF key recalls the off timer setting, lights the T-OFF indicator, and sets the colon between the hour and minute displays flashing. In this mode, the T-UP key adjusts the minute setting and the T-DOWN key adjusts the hour setting.

T-UP key : Pressing this key once increments the minute setting, and holding it down in excess of 500 ms increments the minute setting at 8 minutes per second.

T-DOWN key : Pressing this key once increments the hour setting, and holding it down in excess of 500 ms increments the hour setting at 4 minutes per second.

The colon between the hour and minute displays remains lit while either the T-UP or T-DOWN key is pressed.

When the on timer setting was adjusted: CH2/TIMER-OFF key → Recalls the time of the on timer setting.

When the on timer setting was not adjusted: CH2/TIMER-OFF key → Recalls the previous time setting.

Return to normal operation:
- If no key is pressed for 5 seconds, timer adjustment mode is automatically cleared.
- Pressing any key twice clears timer adjustment mode.
- Pressing any other key clears timer adjustment mode and executes that key's function.

When timer adjustment mode is cleared, the T-ON or T-OFF indicator will be lit and the system will enter timer operation mode.

2. CH-UP/T-ON, CH-DOWN/T-OFF, R-ME, SET, DISP/TIME

These keys are for use with the remote control.

- During frequency display

These keys are used to write to and read from preset memory.

Write

When the R-ME key is pressed MCH NO "1" flashes in the frequency display and the write state is entered for 5 seconds. During this interval, the CH-UP/T-ON and CH-DOWN/T-OFF keys are used to select the MCH NO to write to. Each time one of these keys is pressed the write time is updated. If the R-ME key is pressed while the display is flashing the frequency is stored in the flashing MCH, the write state is cleared, and the flashing display returns to normal.

If the FM band is selected, the MO/ST state is also saved.

When no MCH NO is displayed, MCH NO 1 will flash when the R-ME key is pressed, and if an MCH NO is displayed, that number will flash when the R-ME key is pressed.

If one of the CH1 to CH8 keys are pressed during this write enable state, the write enable state is cleared and contents of that preset memory are recalled.

Read

When no channel number is displayed, pressing the CH-UP/T-ON key recalls MCH1, and pressing CH-DOWN/T-OFF recalls MCH8 (MCH16 for the FM band).

When a channel number is displayed, pressing the CH-UP/T-ON key recalls the channel with the next higher number, and pressing the CH-DOWN/T-OFF key recalls the channel with the next lower number.

If either key is held down for over 700 ms, then the channel will be changed every 400 ms.

- During clock or timer adjustment display

  When the SET and DISP/TIME keys are pressed at the same time, the colon between the hour and minute displays flashes, and the system enters clock adjustment mode. In this mode the T-UP key adjusts the minute setting and the T-DOWN key adjusts the hour setting.

  * The system will not respond to an independent press of the SET key.

  T-UP key: Pressing this key once increments the minute setting, and holding it down in excess of 500 ms increments the minute setting at 8 minutes per second.
  During this operation the seconds setting is set to zero by the reset, and there is no carry performed out of the minutes settings.

  T-DOWN key: Pressing this key once increments the hour setting, and holding it down in excess of 500 ms increments the hour setting at 4 minutes per second.
  During this operation the seconds setting is not affected.

  The colon between the hour and minute displays remains lit while either the T-UP or T-DOWN key is pressed.

  Return to normal operation:
  - If no key is pressed for 5 seconds, clock adjustment mode is automatically cleared.
  - Pressing the SET key clears clock adjustment mode.
  - Pressing any other key clears clock adjustment mode and executes that key's function.

Pressing the SET and CH-UP/T-ON keys at the same time recalls the on timer setting, lights the T-ON indicator, and flashes the colon between the hour and minute displays. In this mode, the T-UP key adjusts the minute setting and the T-DOWN key adjusts the hour setting. (500 ms lit, 500 ms off)

Pressing the SET and CH-DOWN/T-OFF keys at the same time recalls the off timer setting, lights the T-OFF indicator, and flashes the colon between the hour and minute displays. In this mode, the T-UP key adjusts the minute setting and the
T-DOWN key adjusts the hour setting.

T-UP key: Pressing this key once increments the minute setting, and holding it down in excess of 500 ms increments the minute setting at 8 minutes per second.

T-DOWN key: Pressing this key once increments the hour setting, and holding it down in excess of 500 ms increments the hour setting at 4 minutes per second.

The colon between the hour and minute displays remains lit while either the T-UP or T-DOWN key is pressed.

SET key + CH-DOWN/T-OFF key

When the on timer setting was adjusted: Recalls the time of the on timer setting.

SET key + CH-DOWN/T-OFF key

When the on timer setting was not adjusted: ⟶ Recalls the previous time setting.

Return to normal operation: • If no key is pressed for 5 seconds, timer adjustment mode is automatically cleared.
• Pressing the SET key clears timer adjustment mode.
• Pressing any other key clears timer adjustment mode and executes that key's function.

When timer adjustment mode is cleared, the T-ON and/or T-OFF indicators will be lit and the system will enter timer operation mode.

3. T-UP, T-DOWN

Pressing one of these keys increments the frequency by 1 step, either up or down. If the key is held down for over 500 ms, the IC enters search mode, and it automatically searches for the next station and holds the received station. The search speed is 60 ms per step for the FM band, and 70 ms per step for the AM bands. When the frequency gets to the boundary of one band and switches to the next band, the IC waits for about 500 ms.

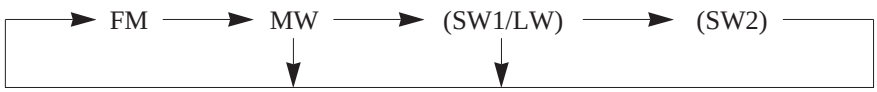
4. FM, MW, LW (SW1), SW2 (SWA) (SWB)

These are band switching keys.

5. BAND

This is a band selection key. Each time it is pressed the band changes.

Other than world mode:



World mode:

6. TUNER, CD, TAPE, AUX, PHONO

These are function switching keys.

TUNER key

When this key is pressed, data is sent to the source selector (LC7821N), and the source is switched to the tuner. The display then displays the frequency.

CD key

When this key is pressed, data is sent to the source selector (LC7821N), and the source is switched to the CD player. The display then displays "Cd".

TAPE key

When this key is pressed, data is sent to the source selector (LC7821N), and the source is switched to the tape player. The display then displays "TAPE".

AUX key

When this key is pressed, data is sent to the source selector (LC7821N), and the source is switched to the AUX input. The display then displays "AUX".

PHONO key

When this key is pressed, data is sent to the source selector (LC7821N), and the source is switched to the record player. The display then displays “PHO”.

7. FUNC

This is a function selection key. Each time it is pressed the function switches as follows.

When ANTIPHON = 0:

When ANTIPHON = 1:

8. MO/ST

This key is only accepted when the FM band is selected. It switches the MO/ST port output.

9. MUTE

Each time this key is pressed the states of the mute indicator and the mute output are inverted. However, note that if this key is pressed to clear the muting function while band switching or seeking, although the key will be accepted and the muting indicator turned off, the muting function itself will not be cleared.

Pressing any key other than the clock related keys will clear the muting function if the muting function is enabled.

Key	Indicator state		Output state
MUTE	MUTE	On	H
		Off	L

10. BASS

This key controls the super-bass function. Each time this key is pressed the states of the bass indicator and the bass output are inverted. Also, loudness switching data is sent to the electronic volume control (LC7535).

Key	Indicator state		Output state	Transmitted data
BASS	BASS	On	H	Loudness on
		Off	L	Loudness off

11. POWER

This key controls the system power. Each time the key is pressed the POWOUT output state is inverted. When the power is on, the frequency and the name of the current function are displayed, and when the power is off, if the clock is enabled the clock is displayed, and if the clock is disabled, the display is turned off.

12. V-UP, V-DOWN

These are the electronic volume up and down keys, and they transmit data to the electronic volume IC (LC7535). Each time one of these keys is pressed the volume is increased or decreased by 1 dB, and if one of these keys is held down for over 500 ms, the volume is increased or decreased at 1 dB every 150 ms. While these keys are held down, a high level is output from the VUP or VDOWN port.

13. SLEEP

This key sets the sleep function time. When the sleep key is pressed when the sleep indicator is off, the sleep indicator lights and 50 is displayed. While the sleep time is displayed, each time the sleep key is pressed the sleep time is reduced by 10 minutes. However, if this key is pressed when 10 is displayed, the sleep time will be reduced by 9 minutes, and the display will then read 1. If the sleep time becomes 0, the sleep indicator is turned off and sleep setting mode is cleared. When the sleep time has been set to the desired value, the display will return to the previous state after 5 seconds.

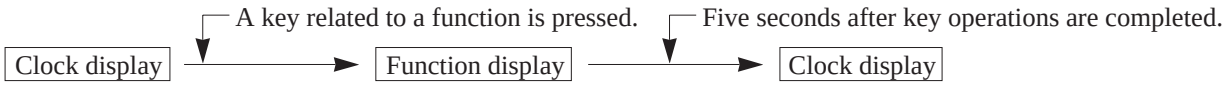
To confirm the remaining sleep time, press the sleep key when the system is in clock or function display mode. After 5 seconds the display will return to its previous state.

The IC does not respond to the sleep key in the power off state.

14. DISPLAY

This key switches the display priority.

In clock priority display:



- While the mute key is on, display for the current function is performed.

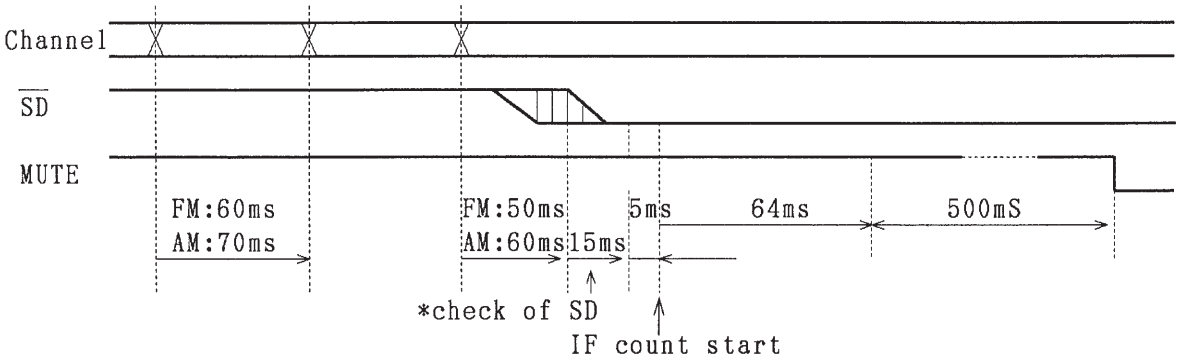
In function priority display, the clock is only displayed when the power is off. When the power is on the current function is displayed.

15. TIMER

This key turns the T-ON and T-OFF indicators on and off. When on, timer operations can be performed, and when off timer operations cannot be performed.

Timing

1. Auto up, auto down

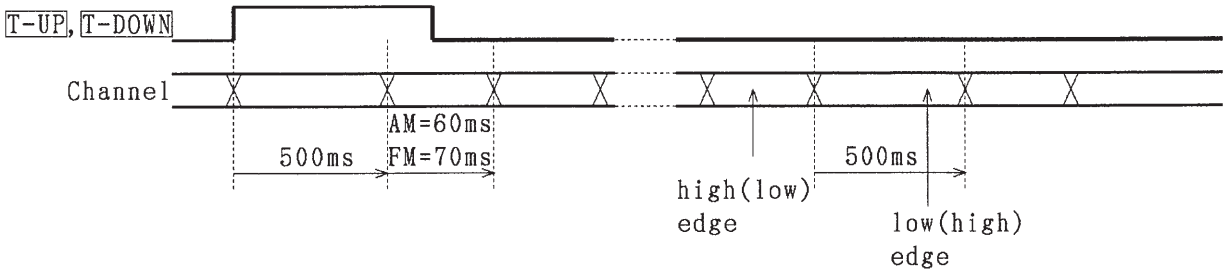


Notes: IF count tolerance

FM	10.7 MHz ± 10 kHz
MW	450/468 kHz ± 3 kHz
SW	450 kHz ± 1.5 kHz
LW	450/468 kHz ± 0.6 kHz

* SD is checked every 5 ms, and if three out of three were OK, then SD is considered on.

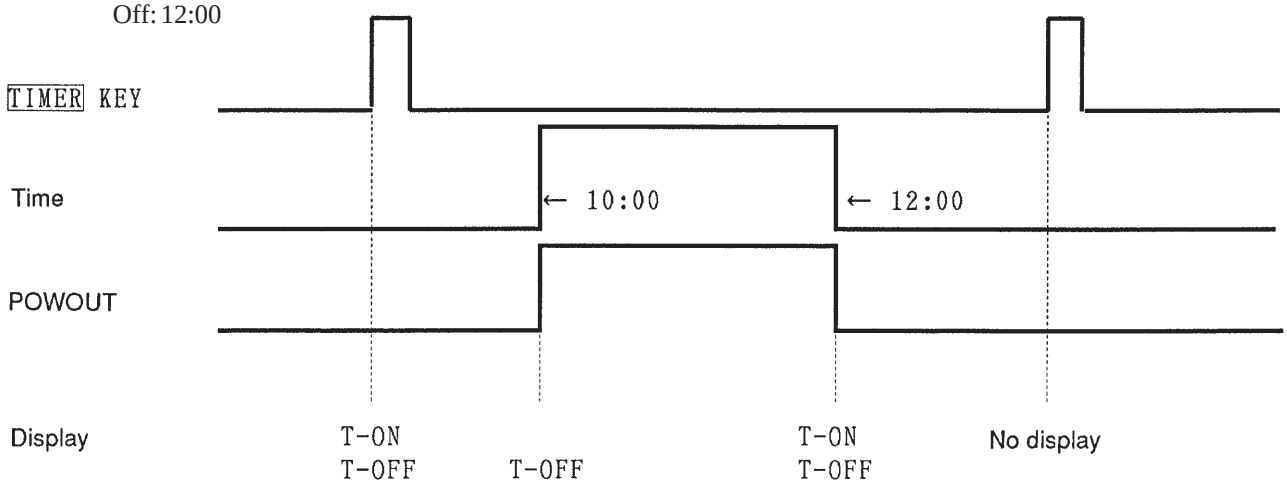
2. Up, down (for both FM and AM)



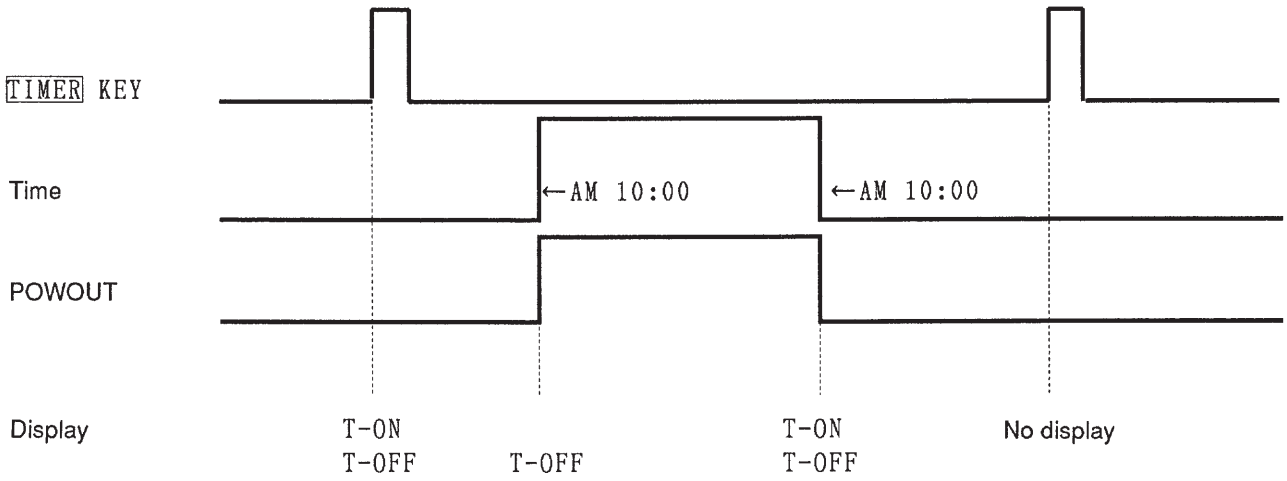
3. Timer timings

- During timer operation, the timing is as follows when the timer set time arrives.

Example: Timer set times
On: 10:00
Off: 12:00



Example: Timer set times
On: 10:00
Off: 10:00

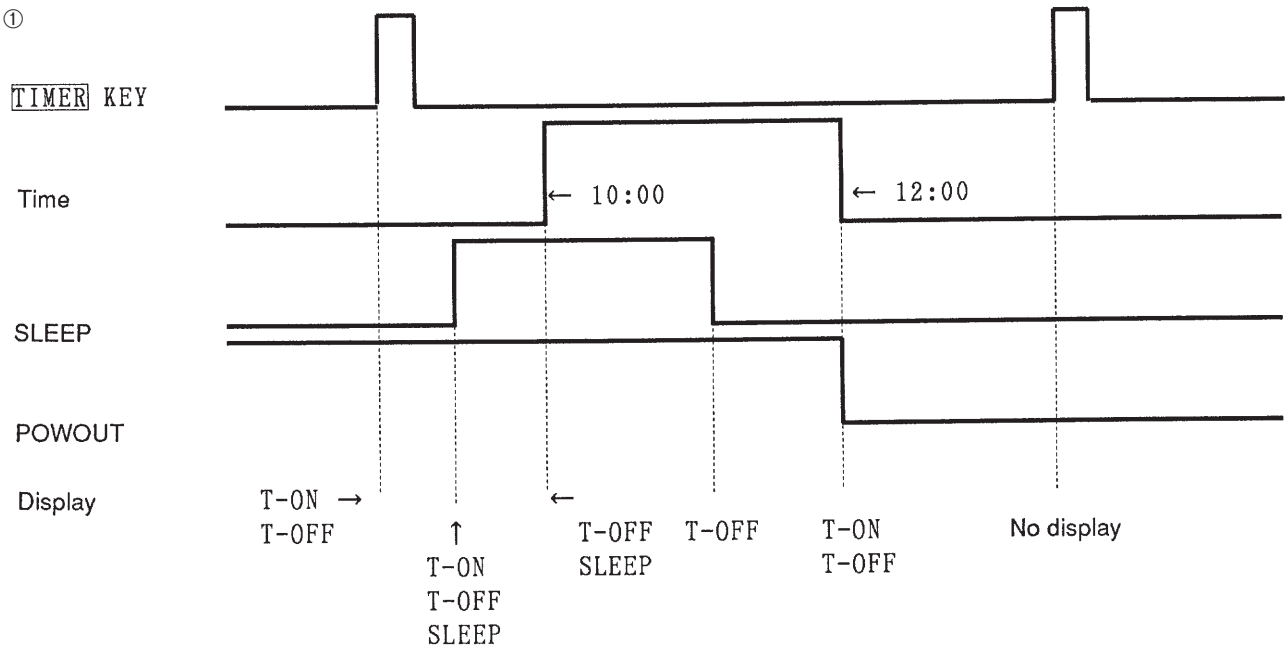


4. Relation between sleep and timer operation

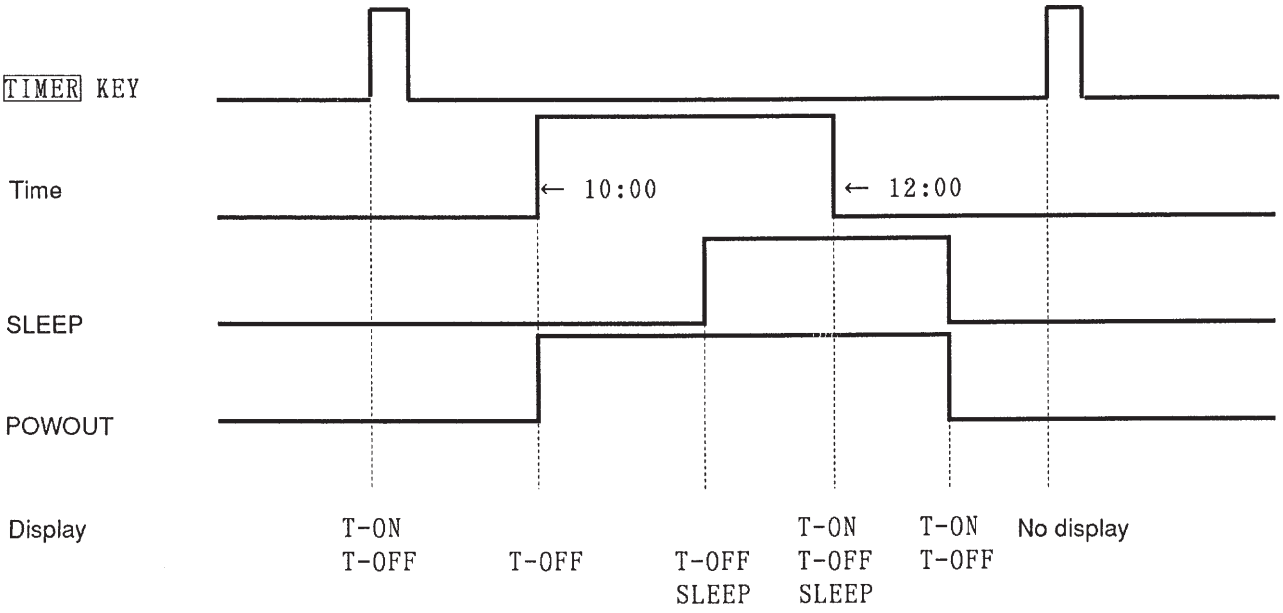
- When timer and sleep operations overlap, the following sequence occurs.

Example: Timer set times
On: 10:00
Off: 12:00

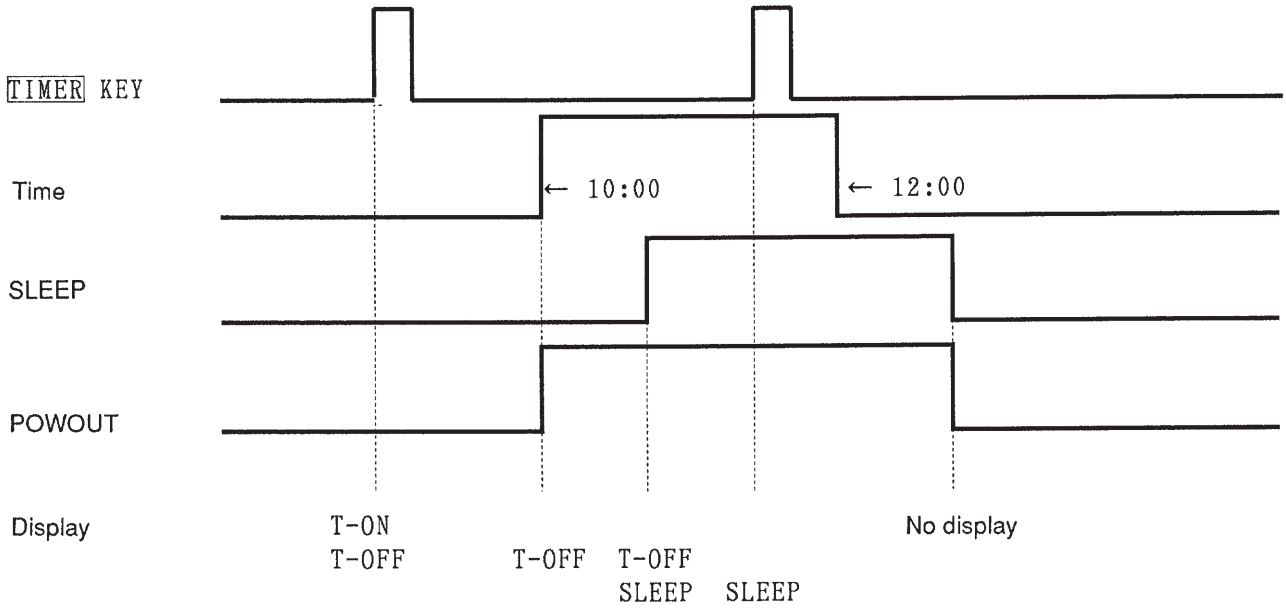
①



②


TIMER KEY
Time
← 10:00
← 12:00
SLEEP
POWOUT
Display
T-ON
T-OFF
T-OFF
T-OFF
SLEEP
T-ON
T-OFF
SLEEP
T-ON
T-OFF
No display

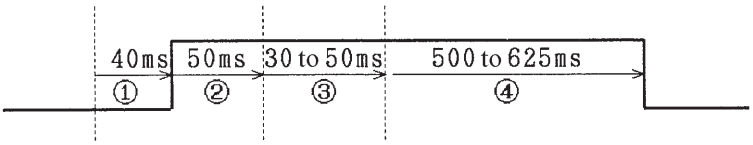
③


TIMER KEY
Time
← 10:00
← 12:00
SLEEP
POWOUT
Display
T-ON
T-OFF
T-OFF
T-OFF
SLEEP
SLEEP
No display

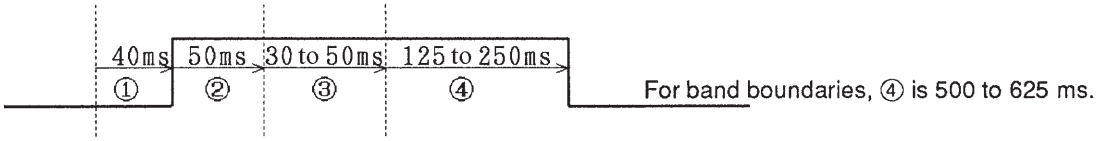
5. Audio mute (MUTE)

- Key chattering time (40 ms)
- Audio mute function lead time (50 ms) (Note that the lead time for items e and f is 100 ms.)
- Inter-station waiting and processing times, e.g., the time to transfer data to the PLL
- Audio mute function tail time
- Processing time for data transfer to the source selector (LC7821N) (1 to 5 ms)

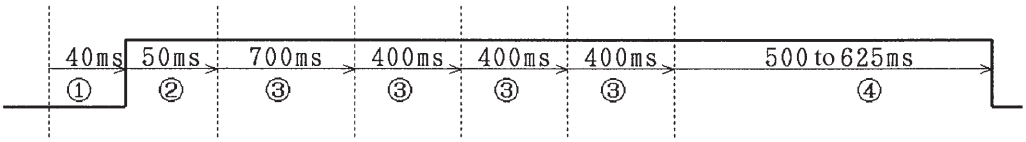
a. Band, CH1 to CH8, CH-UP, CH-DOWN



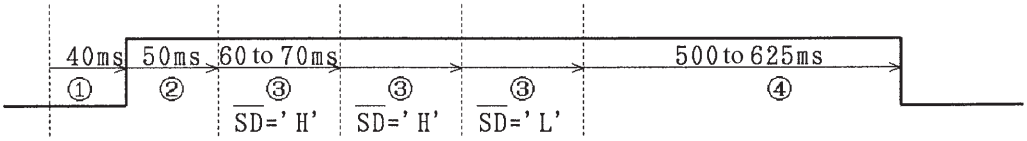
b. T-UP, T-DOWN



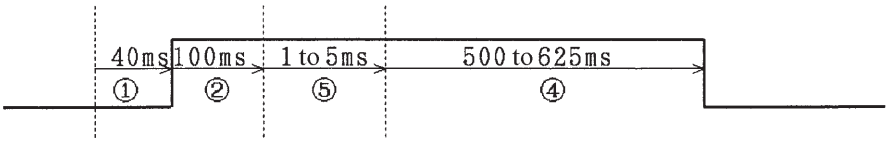
c. Holding down the CH-UP or CH-DOWN key



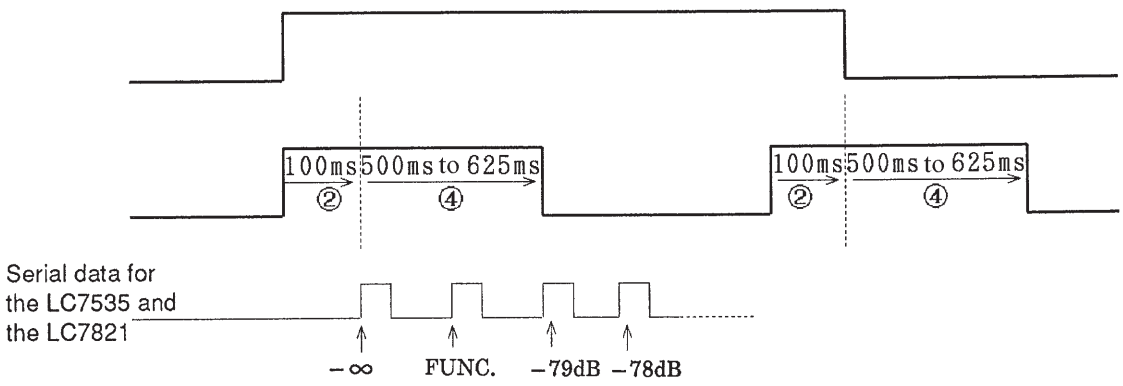
d. Auto up, auto down



e. Function switching



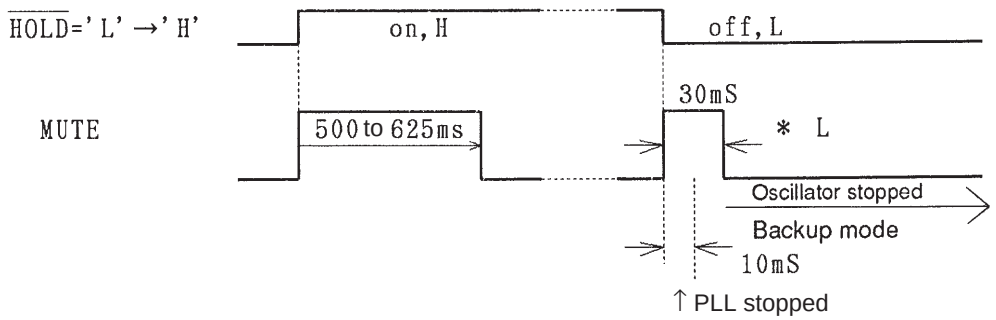
f. Power on/off



A –∞ data item is sent to the LC7535 just before power off.
A –∞ data item is sent to the LC7535 just after power on.
Following power on, the original volume is restored from the –∞ setting at a speed of 1 dB every 40 ms.
If the original volume level was over –16 dB, the volume is restored only to –16 dB, i.e., levels greater than –16 dB will not be restored automatically.

g. Backup mode

When the HOLD input is switched from high to low, input to the FMOSC, AMOSC, IFIN, and SD pin is disabled, the 4.5 MHz crystal oscillator is stopped, and the IC enters the power save mode state. This is called backup mode.

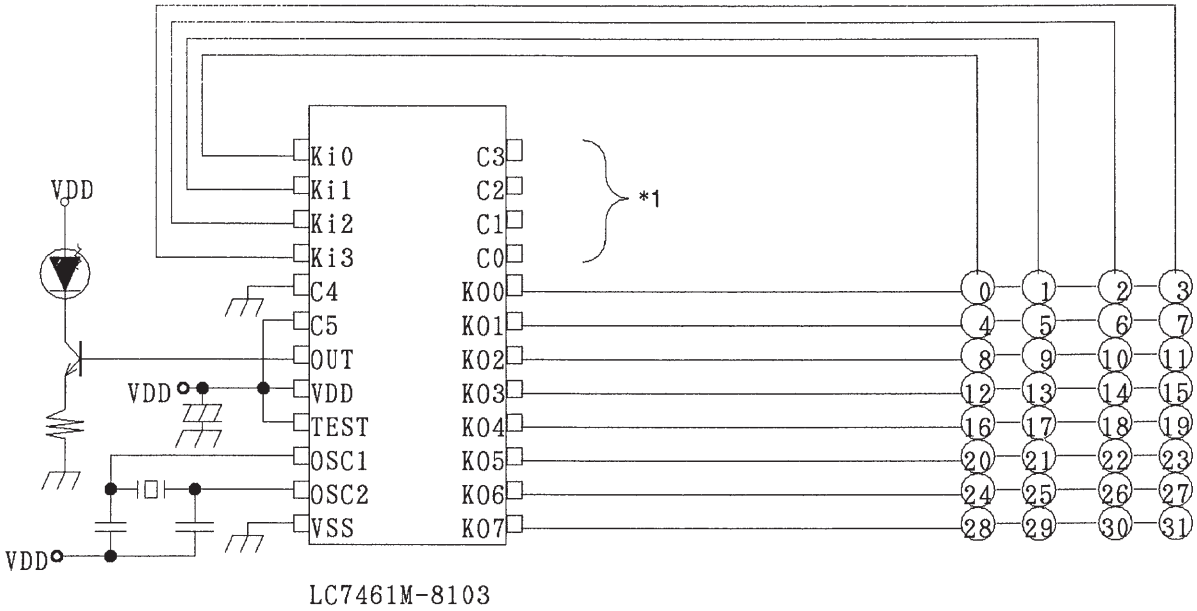


* Since the MUTE pin goes to the high impedance state, a pull down resistor is used to hold it at the low level.

Tracking Point Frequency

Area	Band		CH1	CH2	CH3	CH4	CH5	CH6	CH7	Channels 8 and above
China	FM		87.0	90.1	98.1	106.1	108.0	87.0	87.0	87.0
	MWa		531	603	999	1404	1602	531	531	531
	MWb		522	603	999	1404	1611	522	522	522
	SW1		2.28	2.495	4.0	6.0	6.23	2.28	2.28	2.28
	SW2		7.1	9.5	15.1	21.45	21.85	7.1	7.1	7.1
USA (1)	FM		87.5	90.1	98.1	106.1	107.9	87.5	87.5	87.5
	MWa		531	603	999	1404	1602	531	531	531
	MWb		530	600	1000	1400	1710	530	530	530
USA (2)	FM		87.5	90.1	98.1	106.1	108.0	87.5	87.5	87.5
	MWa		531	603	999	1404	1602	531	531	531
	MWb		530	600	1000	1400	1710	530	530	530
Europe	FM		87.5	90.0	98.0	106.0	108.0	87.5	87.5	87.5
	MWa		531	603	999	1404	1602	531	531	531
	MWb		522	603	999	1404	1611	522	522	522
	LW		146	164	209	263	281	146	146	146
Middle East	FM		87.5	90.0	98.0	106.0	108.0	87.5	87.5	87.5
	MWa		531	603	999	1404	1602	531	531	531
	MWb		522	603	999	1404	1611	522	522	522
	SW1		2.28	2.495	4.0	6.0	6.23	2.28	2.28	2.28
	SW2		7.1	9.5	15.1	21.45	21.85	7.1	7.1	7.1
Eastern Europe	FM		66.0	67.5	69.0	71.5	72.0	66.0	66.0	66.0
	MWa		531	603	999	1404	1602	531	531	531
	MWb		522	603	999	1404	1611	522	522	522
	LW		146	164	209	263	281	146	146	146
	SW	SWA	5.95	6.20	9.9	13.80	15.60	5.95	5.95	5.95
		SWB	3.80	5.00	7.10	11.65	12.50	3.80	3.80	3.80
Japan/South Africa	FM		76.0	78.6	83.0	86.6	90.0	98.0	106.0	108.0
	MWa		531	603	999	1404	1602	531	531	531
	MWb		522	603	999	1404	1611	522	522	522
	SW	SWA	5.95	6.20	9.9	13.80	15.60	5.95	5.95	5.95
		SWB	3.80	5.00	7.10	11.65	12.50	3.80	3.80	3.80
World	FM		87.5	90.0	98.0	106.0	108.0	87.5	87.5	87.5
	MWa		531	603	999	1404	1602	531	531	531
	MWb		522	603	999	1404	1611	522	522	522
	LW		146	164	209	263	281	146	146	146
	SW	SWA	5.95	6.20	9.9	13.80	15.60	5.95	5.95	5.95
		SWB	3.80	5.00	7.10	11.65	12.50	3.80	3.80	3.80

Remote Control



Note: *1. The states of C0 to C3 should be set to match the diode matrix. (0 = GND, 1 = V_{DD})

Key No.	Key name
0	CLEAR
1	ONE PLAY
2	FB/B-SCAN
3	FF/F-SCAN
4	CD-DISPLAY
5	STOP
6	PLAY/PAUSE
7	REPEAT
8	PROGRAM
9	RANDOM
10	INTRO
11	A-B REPEAT
12	OPEN/CLOSE
13	P-MODE
14	
15	BAND

Key No.	Key name
16	MO/ST
17	BASS
18	V-DN
19	V-UP
20	SET
21	DISP/TIME
22	CH-DOWN/T-OFF
23	CH-UP/T-ON
24	TIMER
25	SLEEP
26	T-DN
27	T-UP
28	R-ME
29	MUTE
30	FUNC.
31	POWER

• The keys from key number 0 to 13 are used for the CD player.
• The keys from key number 14 to 31 are used for the radio.

Function Switch (LC7821N) States

This table shows the states of the LC7821N switches for each function.

	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Tuner	1	0	0	0	1	0	0	0
CD	0	1	0	0	1	0	0	1
Tape	0	0	0	0	0	1	1	0
Aux	0	0	0	1	1	0	0	0
Phono	0	0	1	0	1	0	0	0

Note: 0: Off
1: On

Initial States

- Function: Tuner
- Band: FM, Frequency: Lower edge of the band
- Preset memory: Tracking point frequency
- Memory write: Off
- MO/ST: Stereo
- Mute: Off
- Power: Off
- Volume setting: –50 dB
- Clock: 12H: 12:00
24H: 0:00 } The flashing continues.
- Timer setting: 10:00
- Sleep timer: Off
- Display priority: Function
- T-ON, T-OFF indicators: Off

Conditions

- Clock display: Europe, Eastern Europe, World: 24 hour
China, USA, Middle East, Japan, South Africa: 12 hour
- Colon: Lit