Ordering number : ENN*6633

CMOS IC

LC72348G-9970

Portable Stereo Software Specifications

Preliminary

Overview

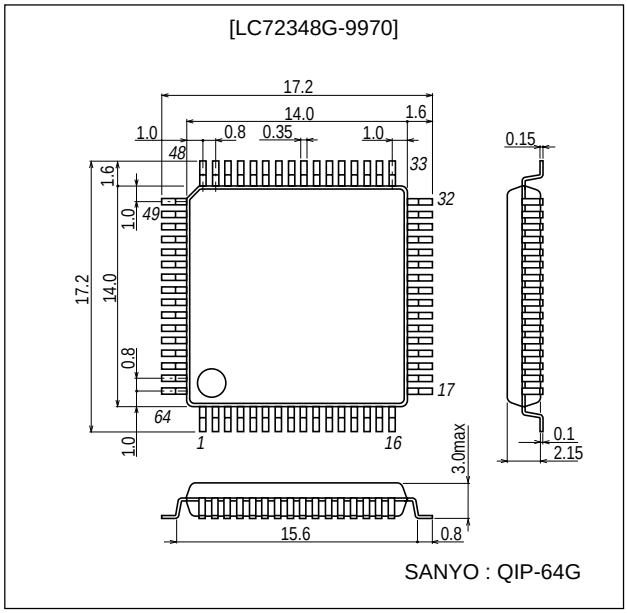
The LC72348G-9970 is a single chip controller designed for portable stereo applications.
It incorporates an AM / FM PLL tuner covering the frequency requirements in the USA, Europe, East Europe, and Japan.
A 1/4 duty cycle, 1/2 bias LCD driver is also built in.

Features and Functions

- 10 station memories in each of three bands: AM, FM I, FM II
- Integrated 1/4 duty cycle, 1/2 bias LCD driver.
- On / off switchable clock / alarm function (2 clock settings).
- 12/24-hour display switching.
- World area switching.
- Tape function display.
- Remaining battery capacity display.
- Mono / stereo switching.
- Hold function.
- Equipped for AM / FM reception in USA,Europe, East Europe, and Japan.
- Integrated LPF amplifier.
- Tuning voltage generating circuit.
- Single 3V power supply.
- QIP64G package.

Package Dimensions

unit : mm
3231-QIP64G

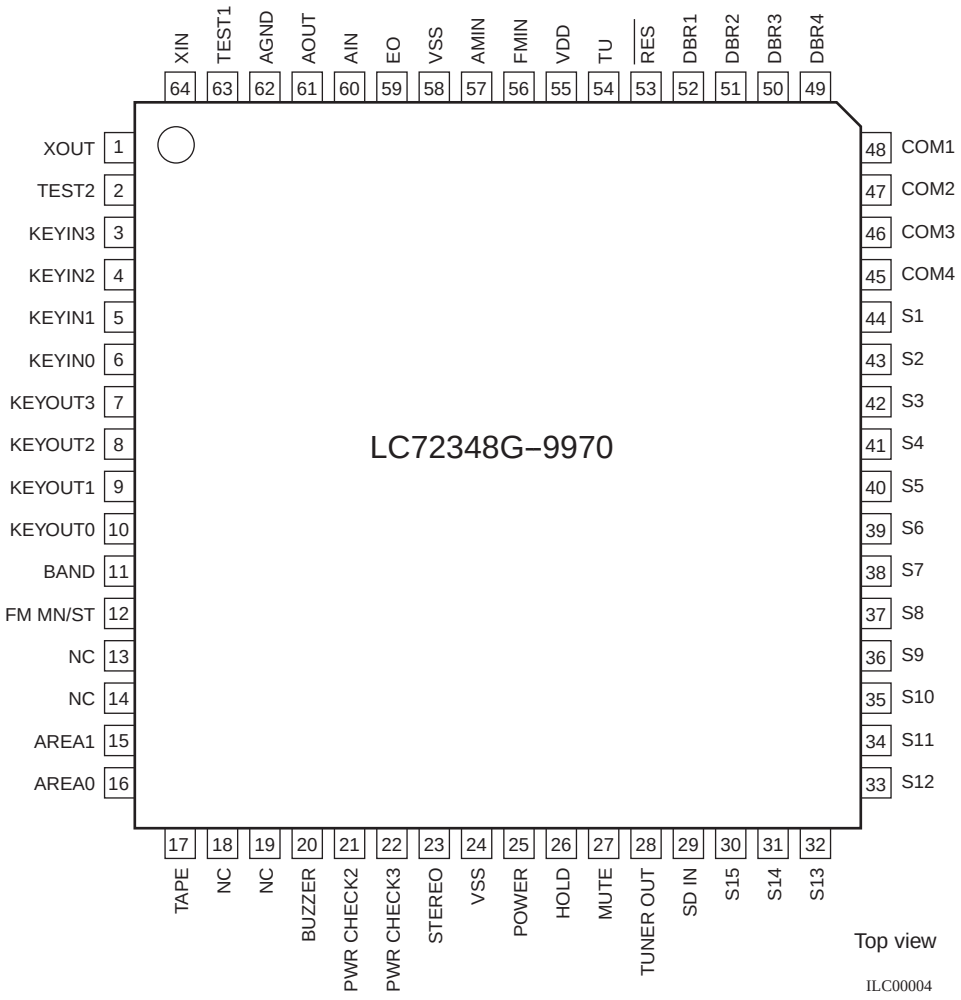


■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

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

Pin Assignment



Pin Function

No.	Pin name	Designation	I / O	Function description	Logical "High"	Logical "Low"	Initial state	Remarks
1	XOUT	XOUT	OUT	Quartz output				
2	TEST2	TEST2	IN	Connect to GND				
3	PA3	KEYIN3	IN	Key input	Key pressed	Key not pressed		Pull-down enabled
4	PA2	KEYIN2	IN	Key input	Key pressed	Key not pressed		Pull-down enabled
5	PA1	KEYIN1	IN	Key input	Key pressed	Key not pressed		Pull-down enabled
6	PA0	KEYIN0	IN	Key input	Key pressed	Key not pressed		Pull-down enabled
7	PB3	KEYOUT3	OUT	Key output	Scan	Standby	"Low"	
8	PB2	KEYOUT2	OUT	Key output	Scan	Standby	"Low"	
9	PB1	KEYOUT1	OUT	Key output	Scan	Standby	"Low"	
10	PB0	KEYOUT0	OUT	Key output	Scan	Standby	"Low"	
11	PC3	BAND	OUT	Band output	FM band	AM band	"Low"	
12	PC2	FM MN / ST	OUT	FM MN / ST (mono / stereo) output	FM Stereo	FM Mono	"Low"	FM MN / ST key state
13	PC1	NC	OUT	OPEN				
14	PC0	NC	OUT	OPEN				
15	PD3	AREA1	IN	Destination area input	See information on input combinations given on next page			*1
16	PD2	AREA0	IN					*1
17	PD1	TAPE	IN	TAPE input	See next page			*2 No chattering
18	PD0 / $\overline{INT}$	NC	OUT	OPEN				
19	PE1	NC	OUT	OPEN				
20	PE0 / BEEP	BUZZER	OUT	Beep output	Normal "Hi", 2 beep types		"Hi"	
21	PF2	PWR CHECK2	IN	Backup input	Normal	Backup		Pull-down enabled
22	PF1 / ADI1	PWR CHECK3	IN	Power check input (A / D)				*3 ADC input select
23	PF0 / ADI0	STEREO	IN	STEREO input	See next page			*4 No chattering
24	VSS	VSS		Ground pin				
25	S20 / PG3	POWER	OUT	Power output	Power off	Power on	"Hi"	
26	S19 / PG2	HOLD	IN	HOLD key input	HOLD off	HOLD on		No chattering
27	S18 / PG1	MUTE	OUT	Muting output	Muting on	Muting off	"Low"	
28	S17 / PG0	TUNER OUT	OUT	Tape / radio switching output	Tape mode	Radio mode	"Hi"	
29	S16 / PH3	SD IN	IN	SD input	SD not pressed	SD pressed		Chattering 20 – 30 ms
30	S15 / PH2	S15	OUT	Segment output				
31	S14 / PH1	S14	OUT	Segment output				
32	S13 / PH0	S13	OUT	Segment output				
33	S12	S12	OUT	Segment output				
34	S11	S11	OUT	Segment output				
35	S10	S10	OUT	Segment output				
36	S9	S9	OUT	Segment output				
37	S8	S8	OUT	Segment output				
38	S7	S7	OUT	Segment output				
39	S6	S6	OUT	Segment output				
40	S5	S5	OUT	Segment output				
41	S4	S4	OUT	Segment output				
42	S3	S3	OUT	Segment output				
43	S2	S2	OUT	Segment output				
44	S1	S1	OUT	Segment output				
45	COM4	COM4	OUT	Common output				

No.	Pin name	Designation	I / O	Function description	Logical "High"	Logical "Low"	Initial state	Remarks
46	COM3	COM3	OUT	Common output				
47	COM2	COM2	OUT	Common output				
48	COM1	COM1	OUT	Common output				
49	DBR4	DBR4	OUT	LCD power supply step-up pin				
50	DBR3	DBR3	OUT	LCD power supply step-up pin				
51	DBR2	DBR2	OUT	LCD power supply step-up pin				
52	DBR1	DBR1	OUT	LCD power supply step-up pin				
53	$\overline{RES}$	$\overline{RES}$	IN	Reset input				
54	TU	TU	OUT	Tuning voltage generating circuit output				
55	VDD	VDD		+3V power supply				
56	FMIN	FMIN	IN	FM input				
57	AMIN	AMIN	IN	AM input				
58	VSS	VSS		Ground pin				
59	E0	E0	OUT	Error output				
60	AIN	AIN	IN	Low-pass filter input				
61	AOUT	AOUT	OUT	Low-pass filter output				
62	AGND	AGND		Connect to GND				
63	TEST1	TEST1	IN	Connect to GND				
64	XIN	XIN	IN	Quartz input				

*1 : PD3 (AREA 1), PD2 (AREA 0) inputs

PD3	PD2	Destination area
Hi	Low	USA
Low	Hi	Europe
Low	Low	East Europe
Hi	Hi	Japan

*2 : PD1 (TAPE) input

Tuner off changes the following functions

Condition	PD1	State (display)
Tuner off (TAPE input)	Hi	Tape mode ("TAPE" displayed)
	Low	Power off (clock display)

*3 : PF1 / ADI1 (PWR CHECK 3) input

A/D value and operation status are shown below. A/D is read only at power-on.

Input voltage	Detection method	P-FUL	P-MID	P-LOW	Operation state	A / D input value
–2.64V	PF1(A / D)	Lit	Lit	Lit	Normal	00h-0Eh
2.45V–2.10V	PF1(A / D)	Out	Lit	Lit	Normal	0Fh-10h
2.09V–1.81V	PF1(A / D)	Out	Out	Flashing	Normal	11h-15h
1.80V–	PF1(A / D)	Out	Out	Out	Transition to radio off	16h-1Fh
	PF2	Out	Out	Out	Backup mode	

*4: PF0 / ADI0 (STEREO) input

PF0 input switches functions as shown below during Tuner ON.

Condition	PF0	State (display)
Tuner ON (FM ST input)	Hi	"FM ST" flashing (when FM band tuning only)
	Low	"FM ST" lit (when FM band tuning only)

Key Operation Description

Key	Operation Description
Up / Hour	Tuner mode - Frequency changes upwards by one step when a key is depressed for less than 0.5 second and released. In this case, a 3.125 kHz buzzer is output. - Keeping the key depressed for more than 0.5 second changes frequency upwards by one step every 100 ms. - At the band edge (changeover from maximum frequency to minimum frequency), there is a 500 ms wait. Tape mode - Key is inoperative. Clock setting mode - During clock 1 and 2 setting, hour indication changes upwards by one step with each push. Keeping the key depressed for more than 0.5 seconds causes a change by one step every 250 ms, until the key is released. Alarm setting mode - During alarm setting, hour indication changes upwards by one step with each push. Keeping the key depressed for more than 0.5 seconds causes a change by one step every 250 ms, until the key is released.
Down / Min	Tuner mode - Frequency changes downwards by one step when a key is depressed for less than 0.5 second and released. In this case, a 3.125 kHz buzzer is output. - Keeping the key depressed for more than 0.5 second changes frequency downwards by one step every 100 ms. - At the band edge (changeover from minimum frequency to maximum frequency), there is a 500 ms wait. Tape mode - Key is inoperative. Clock setting mode - During clock 1 and 2 setting, minute indication changes upwards by one step with each push. Keeping the key depressed for more than 0.5 seconds causes a change by one step every 150 ms, until the key is released. Alarm setting mode - During alarm setting, hour indication changes upwards by one step with each push. Keeping the key depressed for more than 0.5 seconds causes a change by one step every 150 ms, until the key is released.
Memo 1 Memo 2 Memo 3 Memo 4 Memo 5	Tuner mode - Serve for preset station recall and store. - Pressing a key and releasing it within less than 2 seconds calls up the frequency stored in the corresponding preset number (1 – 10). Keeping a key depressed for 2 seconds or more writes the currently received frequency to the corresponding preset number (1 – 10). - For information on switching between presets 1 – 5 and 6 – 10, see the Memo+ key section. - When recall or store is confirmed, a 1.56 kHz beep corresponding to the preset number is output. Tape mode - Keys are inoperative. Power off mode - Keeping a key depressed for more than 500 seconds calls up the corresponding clock display for Memo1 or Memo2.

<table>
<tr><th>Key</th><th>Operation Description</th></tr>
<tr><td>Memo+</td><td>
Tuner mode
- Pressing this key and then one of the Memo1 – Memo5 keys within 5 seconds causes the preset numbers 6 – 10 to be called. Pressing one of the Memo1 – Memo5 keys after 5 seconds have elapsed or after another key was pressed causes the preset numbers 1 – 5 to be called.
- At each push of the key, a 1.56 kHz beep is output for 50 ms.
Tape mode
- Key is inoperative.
Power off mode
- Serves for activating and terminating the clock/alarm setting mode.
- Keeping the key depressed for at least 1 second causes the following mode change.
Clock display → Alarm setting mode → Clock setting mode
- In alarm setting mode, the alarm time is placed in the setting area. During the setting procedure, the DOLBY mark flashes on the display, regardless of the alarm ON / OFF state.
- Pressing the key again during alarm setting terminates the setting procedure and causes the set time to be placed in the setting area and serves for clock setting mode. The DOLBY display indication depends on the alarm ON / OFF state.
- In clock setting mode, the time of the currently selected clock number is placed in the setting area.
During the setting procedure, the colon of the time display stops flashing and stays constantly lit, but the clock count continues.
- Pressing the key once more during clock setting cause the currently set time to be placed in the area for the currently selected clock number. By resetting the minute figures the seconds area is cleared to 00, count restart, and the colon of the time display starts flashing.
- 12-hour notation; colon
24-hour notation; JAZZ, not colon
</td></tr>
<tr><td>ALARM</td><td>
Tuner mode / tape mode / power off mode
- Alarm ON / OFF key
When alarm is turned ON, DOLBY mark on display is shown.
When alarm is turned OFF, DOLBY mark on display is out.
- Alarm sound is output from BUZZER terminal as 3.125 kHz pulse for 5 minutes. Pressing this key again during alarm output stops the alarm sound. Last alarm time setting is retained.
- Alarm sound is output in all modes.
- Alarm sound is output to when the displayed time matches the alarm set time regardless of the clocks 1 and 2.
</td></tr>
<tr><td>Function</td><td>
- This key serves for power on / off control and band switching. The operation sequence is as follows.
Power OFF (TAPE) -> AM band -> FM I band -> FM II band -> Power OFF (TAPE).
- Keeping the key depressed for 2 seconds or more while AM band or FM I band is selected switches to Power OFF (TAPE).
Releasing the key within less than 2 seconds switches to the next band.
- Power OFF or TAPE is determined by the tape input port.
</td></tr>
<tr><td>FM MN / ST</td><td>
- This key serves for toggling between FM mono and FM stereo. It is valid in the FM I and FM II bands. FM stereo <–> FM mono.
- When FM stereo is set
When STEREO is ”High”, ”FM STEREO” flashes.
When STEREO is ”Low”, ”FM STEREO” is lit.
- When FM mono is set, ”Low” is output from the FM MN / ST port.
- When no FM band is set, ”Low” is output from the FM MN / ST port.
</td></tr>
<tr><td>World area switching</td><td>
- This function is available in tuner mode except for the destination area East Europe. To perform switching, the two keys shown in the table below must be pressed together for 7 seconds or more.
<table>
<tr><th>Initial destination area setting / Key</th><th>JP</th><th>US</th><th>EU</th></tr>
<tr><td>” Memo + ” + ” UP ”</td><td>US</td><td>JP</td><td>–</td></tr>
<tr><td>” Memo + ” + ” Down ”</td><td>EU</td><td>EU</td><td>US</td></tr>
<tr><td>” UP ” + ” Down ”</td><td>JP</td><td>US</td><td>EU</td></tr>
</table>
- When switching is confirmed, and if a different area was selected, preset numbers 1 – 10 in all bands will be set to the default values for the new area, and the lowest frequency in the currently selected band is received.
- When switching is confirmed, the following indication is shown for 1 second in the 7-segment display area:
Japan : JP USA : US Europe : EU
</td></tr>
<tr><td>CLOCK Sel (Diode switch)</td><td>
- Selects whether clock function is enabled or not.
- During initialization, data are read and the setting is made as follows.
OFF : Clock function enabled (12-hour notation; 2 time settings possible)
ON : Clock function disabled
</td></tr>
<tr><td>ALARM Sel (Diode switch)</td><td>
- Selects whether alarm function is enabled or not.
- During initialization, data are read and the setting is made as follows. If the clock is disabled, the alarm function is also not available.
OFF : Alarm function enabled
ON : Alarm function disabled
</td></tr>
</table>

Key	Operation Description
12 / 24 Sel (Diode switch)	- Selects 12/24-hour display. - During initialization, data are read and the setting is made as follows. If the clock is disabled, 12/24-hour display is also not available. OFF : 12-hour display (Initial display : 12:00) ON : 24-hour display (Initial display : 0:00) JAZZ, not colon
LCD Check (Diode switch)	- Selects whether LCD check is performed or not. - During initialization, data are read and the setting is made as follows. OFF : LCD check disabled ON : LCD check enabled - Display check is performed after reading diode switches. All display elements are turned on for 3 seconds,and the display then switches to normal operation.

Key Matrix

	PA0 input	PA1 input	PA2 input	PA3 input
PB0 output	Up / Hour	Down / Min	FM MN / ST	Memo1
PB1 output	Memo2	Memo3	Memo+ / Time set	Memo5
PB2 output	FUNC	ALARM		Memo4
PB3 output	Clock Sel	ALARM Sel	12/24 Sel	LCD Check

* PB3 output line is Diode switch.
* When CLOCK Sel is turned OFF, alarm function enabled can be selected and 12/24-hour display can’t be selected.

Reception Frequencies

Destination area : Japan (A1 = ”High”, A2 = ”High”)

Area	BAND	Reception Frequency	Step	Reference frequency	Intermediate frequency
JPN	AM	531–1629kHz	9kHz	3kHz	+450kHz
	FM I	76.0–90.0 / 90.0–108.0MHz	100 / 50kHz	12.5kHz	–10.7MHz
	FM II	76.0–90.0 / 90.0–108.0MHz	100 / 50kHz	12.5kHz	–10.7MHz
USA	AM	530–1710kHz	10kHz	5kHz	+450kHz
	FM I	87.5–108.1MHz	200kHz	12.5kHz	–10.7MHz
	FM II	87.5–108.1MHz	200kHz	12.5kHz	–10.7MHz
EUR	AM	531–1602kHz	9kHz	3kHz	+450kHz
	FM I	87.5–108.0MHz	50kHz	12.5kHz	–10.7MHz
	FM II	87.5–108.0MHz	50kHz	12.5kHz	–10.7MHz

Destination area : USA (A1 = ”High”, A2 = ”Low”), Europe (A1 = ”Low”, A2 = ”High”)

Area	BAND	Reception Frequency	Step	Reference frequency	Intermediate frequency
JPN	AM	531–1629kHz	9kHz	3kHz	+450kHz
	FM I	76.0–90.0 / 90.0–108.0MHz	100 / 50kHz	12.5kHz	+10.7MHz
	FM II	76.0–90.0 / 90.0–108.0MHz	100 / 50kHz	12.5kHz	+10.7MHz
USA	AM	530–1710MHz	10kHz	5kHz	+450kHz
	FM I	87.5–108.1MHz	200kHz	12.5kHz	+10.7MHz
	FM II	87.5–108.1MHz	200kHz	12.5kHz	+10.7MHz
EUR	AM	531–1602kHz	9kHz	3kHz	+450kHz
	FM I	87.5–108.0MHz	50kHz	12.5kHz	+10.7MHz
	FM II	87.5–108.0MHz	50kHz	12.5kHz	+10.7MHz

Destination area : East Europe (A1 = ”Low”, A2 = ”Low”)

Area	BAND	Reception Frequency	Step	Reference frequency	Intermediate frequency
	AM	531–1602kHz	9kHz	3kHz	+450kHz
EAST EUR	FM I	65.0–74.0MHz	10kHz	5kHz	+10.7MHz
	FM II	87.5–108.0MHz	50kHz	12.5kHz	+10.7MHz

Initial Reception Frequencies

Area : Japan

	1	2	3	4	5	6	7	8	9	10
AM	531	630	999	1440	1629	531	630	999	1440	1629
FM I	76.00	80.00	90.00	100.00	108.00	76.00	80.00	90.00	100.00	108.00
FM II	76.00	80.00	90.00	100.00	108.00	76.00	80.00	90.00	100.00	108.00

Area : USA

	1	2	3	4	5	6	7	8	9	10
AM	530	630	1000	1440	1710	530	630	1000	1440	1710
FM I	87.50	93.10	98.10	103.10	108.10	87.50	93.10	98.10	103.10	108.10
FM II	87.50	93.10	98.10	103.10	108.10	87.50	93.10	98.10	103.10	108.10

Area : Europe

	1	2	3	4	5	6	7	8	9	10
AM	531	630	999	1440	1602	531	630	999	1440	1602
FM I	87.50	93.10	98.10	103.10	108.00	87.50	93.10	98.10	103.10	108.00
FM II	87.50	93.10	98.10	103.10	108.00	87.50	93.10	98.10	103.10	108.00

Area : East Europe

	1	2	3	4	5	6	7	8	9	10
AM	531	630	999	1440	1602	531	630	999	1440	1602
FM I	65.00	67.00	70.00	72.00	74.00	65.00	67.00	70.00	72.00	74.00
FM II	87.50	93.00	98.00	103.00	108.00	87.50	93.00	98.00	103.00	108.00

* AM band unit : kHz, FM band unit : MHz

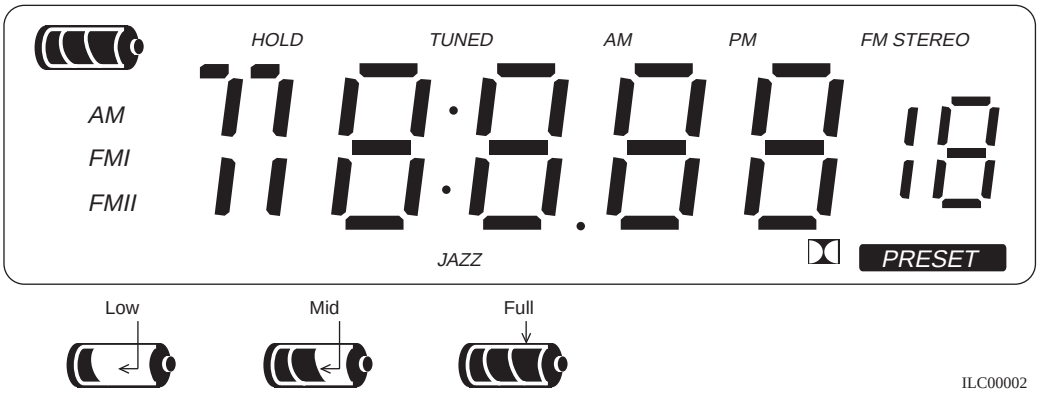
LCD Panel Description

LCD Matrix

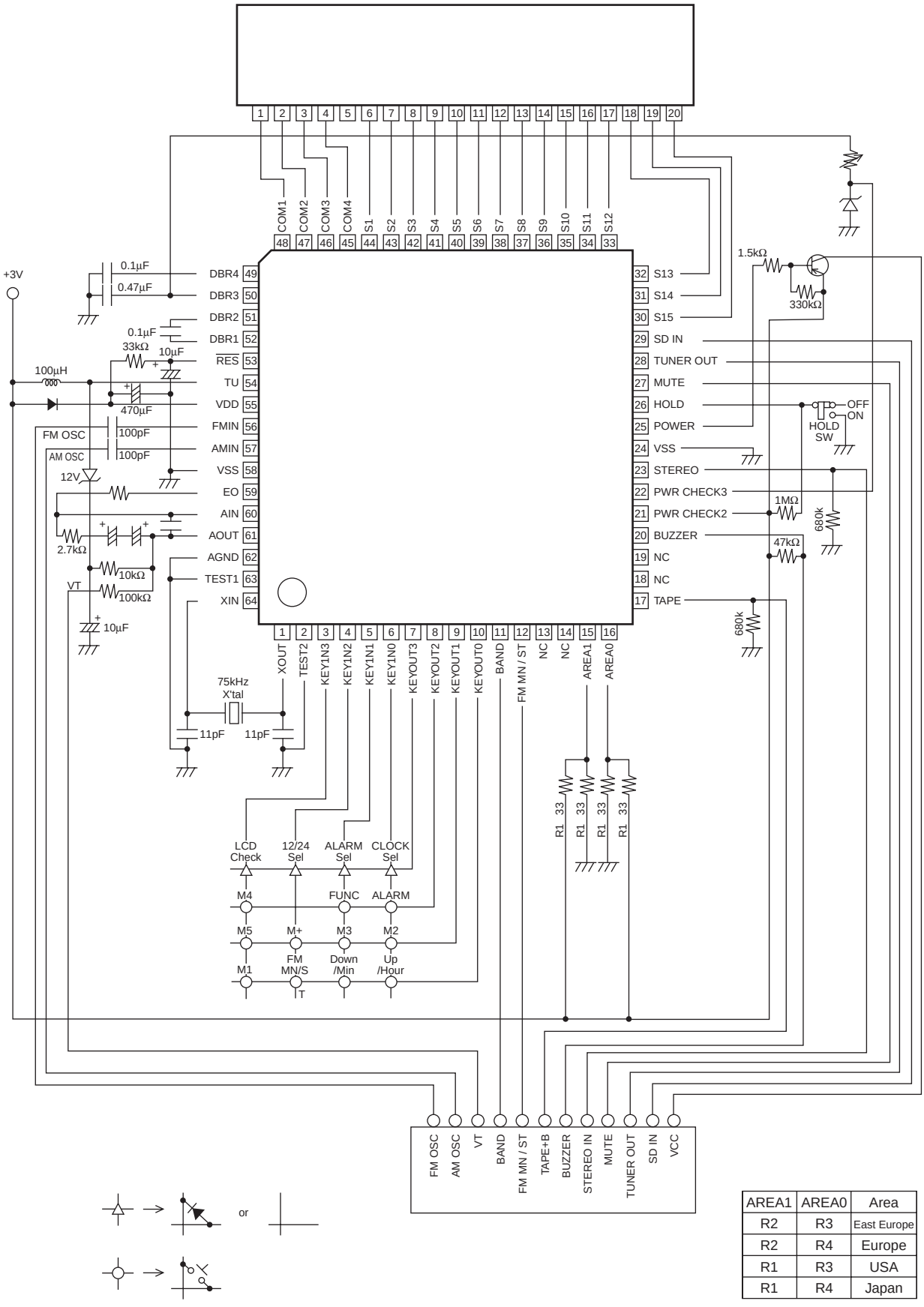
segment	PIN No.	COM1	COM2	COM3	COM4
S1	44	Low	AM(1)	FM I	FM II
S2	43	Mid	T mark	1 mark	
S3	42	1a	1f	1g	1e
S4	41	colon	1b	1c	1d
S5	40	Full	2f	2e	
S6	39	2a	2g	2d	
S7	38	HOLD	2b	2c	JAZZ
S8	37	TUNED	3f	3e	dot mark
S9	36	3a	3g	3d	
S10	35	AM(2)	3b	3c	
S11	34	PM	4f	4e	
S12	33	4a	4g	4d	DOLBY
S13	32	pre 1	4b	4c	PRESET
S14	31	5a	5f	5g	5e
S15	30	FM STEREO	5b	5c	5d

*JAZZ mark is used to the colon of the 24-hour display.
*DOLBY mark is used to display the ALARM on / off state.

LCD Panel



Sample Application Circuit



AREA1	AREA0	Area
R2	R3	East Europe
R2	R4	Europe
R1	R3	USA
R1	R4	Japan

ILC00005

- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products(including technical data,services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of August, 2000. Specifications and information herein are subject to change without notice.