SHARP

LCD Data Sheet

LQ10DH11
TFT-LCD Module

FEATURES

- Display Diagonal: 10.4"

- Display Format: 640×480

- Overall Dimensions:
  283.0 (W) $\times 217.0$ (H) $\times 25.0$ (D) mm

- Active Area: 211.2 (W) $\times 158.4$ (D) mm

- Dot Pitch: 0.33 (W) $\times 0.33$ (H) mm

- Viewing Angle: 6 O'Clock

- Bits Per Color: 3

- Backlight: HCFT Dual Backlit

DESCRIPTION

The SHARP LQ10DH11 Color TFT-LCD module is an active matrix Liquid Crystal Display (LCD) incorporating amorphous silicon Thin Film Transistor (TFT). The module is composed of a color TFT-LCD panel, driver ICs, control circuit, and a power supply circuit. Graphics and text can be displayed on a 640×480 pixel panel in 512 colors by supplying a 9-bit data signal, three kinds of timing signals, +5 VDC and +12 VDC supply voltages, and supply voltage for the backlight. The detachable backlight case design allows easy replacement of backlight for user's convenience.

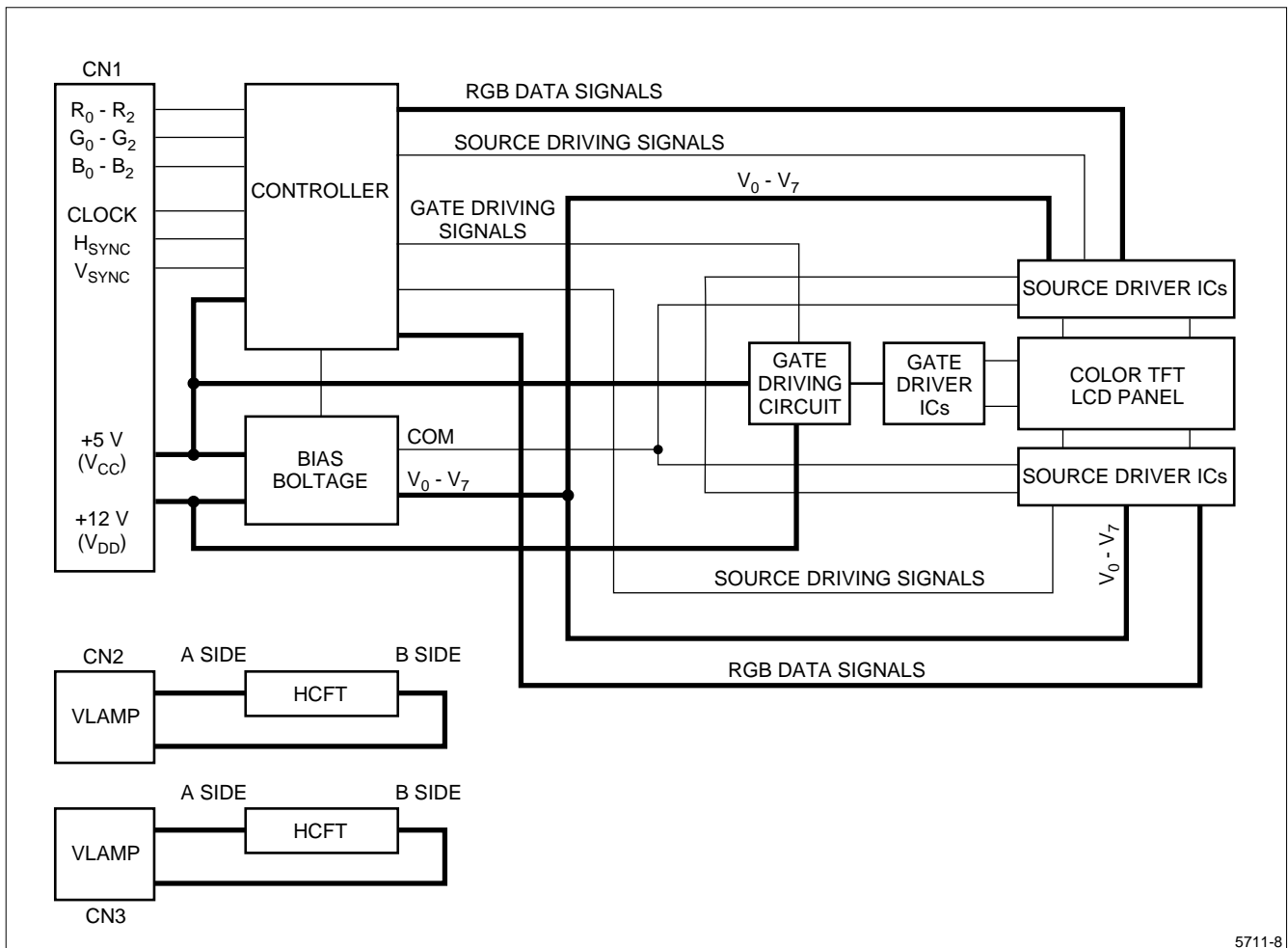*NOTE:* A backlight-driving DC/AC inverter is not built into this module.

Figure 1. LQ10DH11 Block Diagram

MECHANICAL SPECIFICATIONS

PARAMETER	SPECIFICATIONS	UNIT
Screen Size	10.4 (Diagonal)	inch
Active Area	211.2 (W) $\times$ 158.4 (H)	mm
Display Pixels	640 $\times$ 480 (1 Pixel = R + G + B Dots)	pixel
Pixel Pitch	0.33 (W) $\times$ 0.33 (H)	mm
Pixel Configuration	RGB Vertical Stripe	–
Display Mode	Normally White	–
Outline Dimensions	283 (W) $\times$ 217 (H) $\times$ 25 (D)	mm
Weight	960	g
Surface Treatment	Anti-Glare and Hard-Coating 2H	–

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	CONDITION	RATINGS	UNIT	NOTE
V_I	Input Voltage		-0.3 to V_{CC} +0.3	V	1
V_{CC}	+5 V Supply Voltage	tA = 25°C	-0.3 to +7	V	
V_{DD}	+12 V Supply Voltage		-0.3 to +14	V	
Tstg	Storage Temperature	–	-25 to +60	°C	2
Topp	Operating Panel Temperature	–	0 to +60	°C	2, 3

NOTES:

1. CK, R0 to R2, G0 to G2, B0 to B2, Hsync, Vsync.

2. Humidity: 95% RH maximum at $t_A \leq 40$°C. Maximum wet-bulb temperature ≤ 39°C at t_A >40°C.
   No condensation.

3. Maximum panel surface temperature. Top heated by backlight should be maintained below +60°C.
   The recommended maximum ambient operating temperature with backlight should be +40°C.

INPUT TERMINALS – TFT-LCD PANEL DRIVING SECTION

CN1 (Interface Signal) [1]

PIN NUMBER	SYMBOL	FUNCTION	POLARITY
1	GND	–	–
2	CK	Clock Signal for Sampling Each Data Signal	–
3	R1	RED Data Signal	Positive
4	R0	RED Data Signal (LSB)	Positive
5	GND	–	–
6	R2	RED Data Signal (MSB)	Positive
7	G1	GREEN Data Signal	Positive
8	G0	GREEN Data Signal (LSB)	Positive
9	GND	–	–
10	G2	GREEN Data Signal (MSB)	Positive
11	B1	BLUE Data Signal	Positive
12	B0	BLUE Data Signal (LSB)	Positive
13	GND	–	–
14	B2	BLUE Data Signal (MSB)	Positive
15	GND	–	–
16	Hsync	Horizontal Sync Signal	Negative
17	V_{CC}	+5 V Power Supply (for Logic LCD Drive)	–
18	Vsync	Vertical Sync Signal	Negative
19	V_{DD}	+12 V Power Supply (for LCD Drive)	–
20	GND	–	–
21	–	This Shall be Electrically Opened During Operation	–
22	–	This Shall be Electrically Opened During Operation	–

NOTE:
1. Connector used: DF11-22P-2DSA(01) (Hirose Electric Co., Ltd.)
   Mating connector: DF11-22DS-2C (Hirose Electric Co., Ltd.)

CN2, CN3 (Power Supply for Backlight) [1]

PIN NUMBER	SYMBOL	FUNCTION	PIN NUMBER	SYMBOL	FUNCTION
1	Vlamp1	Power Supply for Lamp (A Side)	5	Vlamp2	Power Supply for Lamp (B Side)
2	–	NC	6	–	NC
3	Vlamp1	Power Supply for Lamp (A Side)	7	Vlamp2	Power Supply for Lamp (B Side)
4	–	NC	8	–	NC

NOTE:
1. Connector used: 51006-0800 (Molex)
   Mating connector: 51005-0800 (Molex)

ELECTRICAL CHARACTERISTICS AND CURRENT DISSIPATION
TFT-LCD PANEL DRIVING (t_A = 25°C)

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
V_{CC}	+5 V Supply Voltage	–	+4.75	+5.0	+5.25	V	–
I_{CC}	+5 V Current Dissipation	–	–	–	150	mA	1
V_{DD}	+12 V Supply Voltage	–	+11.4	+12.0	+12.6	V	–
I_{DD}	+12 V Current Dissipation	–	–	–	420	mA	2
V_{IL}	Input Voltage (Low)	–	–	–	+0.8	V	–
V_{IH}	Input Voltage (High)	–	+2.0	–	–	V	–
I_{OL}	Input Leakage Current	V_I = 0 V	–10	–	0	µA	–
I_{OH}		$V_I = V_{CC}$	0	–	+10	µA	–

NOTES:
1. Maximum current situation produced with every two vertical-line 'on' pattern.
2. Maximum current situation produced with an all-black pattern.

ELECTRICAL CHARACTERISTICS – BACKLIGHT (t_A = 25°C)

Backlight unit is composed with 2 HCFTs.

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
V_L	Lamp Voltage	Just for reference	51	61	71	V_{RMS}	–
I_L	Lamp Current	Just for reference	90	100	110	mARMS	–
P_L	Lamp Power Consumption	–	–	6.1	7.8	W	1
V_F	Filament Voltage	–	6.5	7.5	8.5	V_{RMS}	2
I_F	Filament Current	–	95	105	115	mA_{RMS}	2
F_L	Frequency	–	20	–	60	kHz	3
V_S	Kick-Off Voltage	–	–	–	360	V_{RMS}	–
T_L	Lamp Lifetime	–	–	5000	–	Hour	4

NOTES:
1. Calculated value for reference ($I_L \times V_L$).
2. Before turning on the lamp, preheat the filament for at least three seconds.
3. Lamp frequency may produce interference with horizontal sync frequency, causing heat on the display. Therefore, make lamp frequency as different as possible from the ones of horizontal sync and harmonics horizontal sync to avoid interference.
4. The definition of lifetime is the period it takes the lamp to meet one or both of the following conditions (in rating continuous lighting at t_A = 25°C):
   a. Brightness becomes 50% of the original brightness at standard condition.
   b. It becomes abnormal lighting conditions.

TIMING CHARACTERISTICS OF INPUT SIGNALS

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
$1/t_C$	Clock Frequency	–	25.175	28.322	MHz
t_{CH}	Clock High Time	5	–	–	ns
t_{CL}	Clock Low Time	10	–	–	ns
t_{DS}	Data Setup Time	0	–	–	ns
t_{DH}	Data Hold Time	10	–	–	ns
t_H	Horizontal Sync Signal Cycle	–	31.78	–	µs
		770	800	900	Clock
t_{HP}	Horizontal Sync Signal Pulse Width	–	96	–	Clock
t_V	Vertical Sync Signal Cycle	–	16.7	–	ms
		–	525	–	Line
t_{VP}	Vertical Sync Signal Pulse Width	–	2	–	Line
t_{HS}	Horizontal Signal Display Start	–	144	–	Clock
t_{HD}	Horizontal Signal Display Period	–	640	–	Clock
t_{VS}	Vertical Sync Signal Display Start	–	34	–	Line
t_{VD}	Vertical Sync Signal Display Period	–	480	–	Line
t_{VF}	Hsync-Vsync Phase Difference – Front	0	–	–	ns
t_{VB}	Hsync-Vsync Phase Difference – Back	–10	–	–	ns

NOTE:

1. Make sure that timing of the signals are above data (standard VGA) to ensure right display position and display quality.
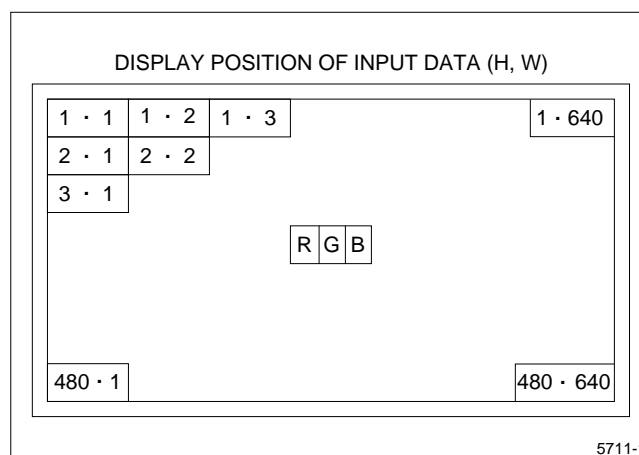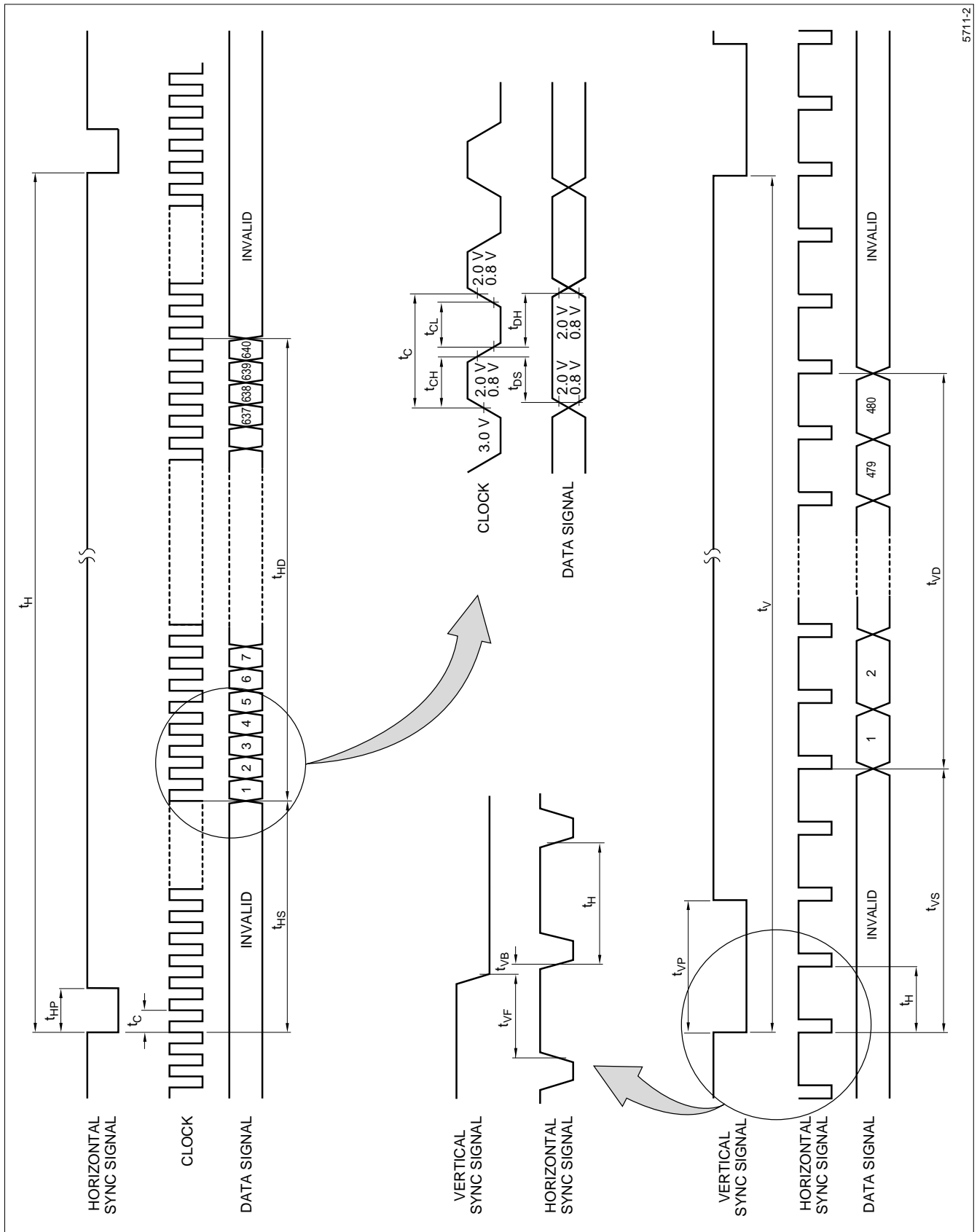

Figure 2. Input Signals and Display on Screen

Figure 3. Input Signal Waveform (480-Line Mode)

INPUT SIGNALS, BASIC DISPLAY COLORS, AND GRAY SCALE OF EACH COLOR

COLOR AND GRAY SCALE		DATA SIGNAL [2]								
		R_0	R_1	R_2	G_0	G_1	G_2	B_0	B_1	B_2
Basic Color	Black	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	1	1	1
	Green	0	0	0	1	1	1	0	0	0
	Light Blue	0	0	0	1	1	1	1	1	1
	Red	1	1	1	0	0	0	0	0	0
	Purple	1	1	1	0	0	0	1	1	1
	Yellow	1	1	1	1	1	1	0	0	0
	White	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0
	↑	1	1	0	0	0	0	0	0	0
	↓	0	0	1	0	0	0	0	0	0
	Brighter	1	0	1	0	0	0	0	0	0
	↓	0	1	1	0	0	0	0	0	0
	Red	1	1	1	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0
	↑	0	0	0	1	0	0	0	0	0
	Darker	0	0	0	0	1	0	0	0	0
	↑	0	0	0	1	1	0	0	0	0
	↓	0	0	0	0	0	1	0	0	0
	Brighter	0	0	0	1	0	1	0	0	0
	↓	0	0	0	0	1	1	0	0	0
	Green	0	0	0	1	1	1	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0	1	0	0
	Darker	0	0	0	0	0	0	0	1	0
	↑	0	0	0	0	0	0	1	1	0
	↓	0	0	0	0	0	0	0	0	1
	Brighter	0	0	0	0	0	0	1	0	1
	↓	0	0	0	0	0	0	0	1	1
	Blue	0	0	0	0	0	0	1	1	1

NOTES:

1. Each color is displayed in eight gray scales from 3-bit data signal input. According to the combination of the total 9-bit data, 512 colors are displayed.

2. 0 = Low-Level Voltage
   1 = High-Level Voltage

OPTICAL CHARACTERISTICS (t_A = 25°C, V_{CC} = +5 V, V_{DD} = +12 V) [1]

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
θ21.22	Horizontal Viewing Angle Range	CR > 10	45	–	–	degrees	2, 5
θ11	Vertical Viewing Angle Range		10	–	–		
θ12			30	–	–		
CR	Contrast Ratio	Optimum Viewing Angle	60	–	–	–	3, 4
t_R	Response Time – Rise	θ = 0°	–	30	–	ms	4, 5
t_F	Response Time – Decay		–	50	–	ms	
x	Chromaticity of White		–	0.3101	–	–	5
y			–	0.3162	–	–	
Y_L	Luminance of White		60	80	–	nt	

NOTES:

1. The measurement shall be executed 15-20 minutes after the module has been lit at the proper rating. The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Figure 4.

2. Figure 5 shows the definitions of the viewing angle range.

3. The Contrast Ratio is defined as follows: $\text{Contrast Ratio} = \dfrac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$

4. The Response Time is measured as shown in Figure 6 by switching the input signals for 'black' ON and OFF.

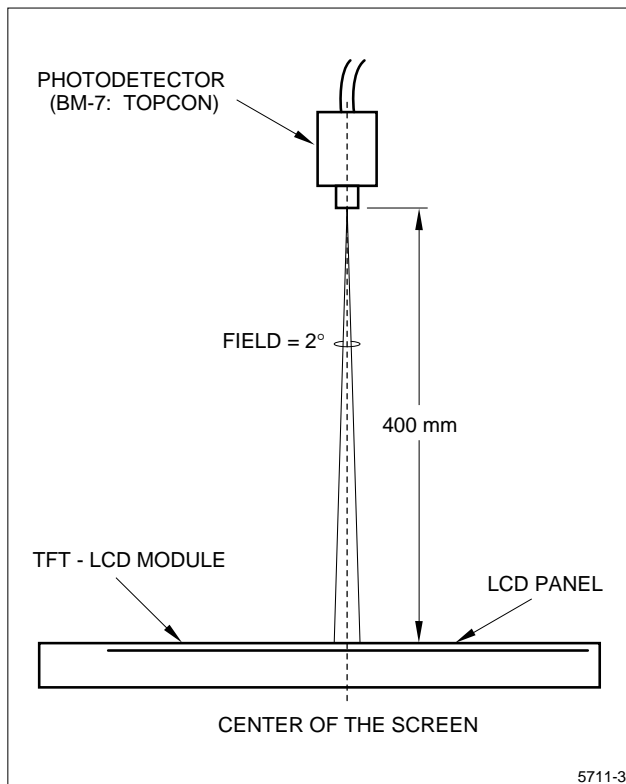5. Measurements shall be taken at the center of the screen.

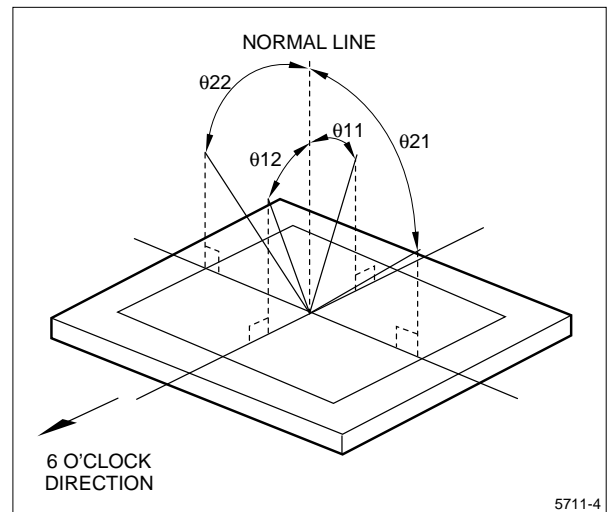**Figure 4. Optical Characteristics Measurement Method**
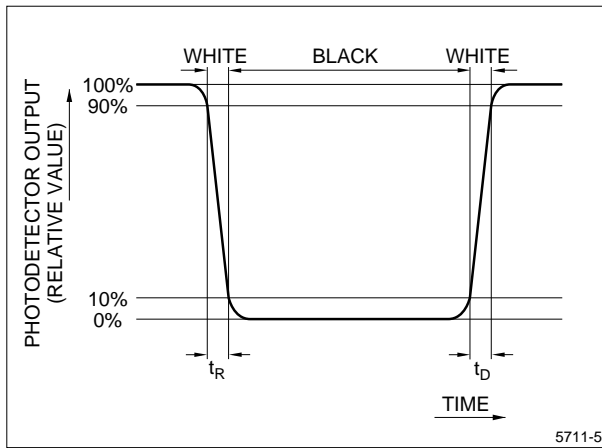

Figure 5. Definition of Viewing Angle

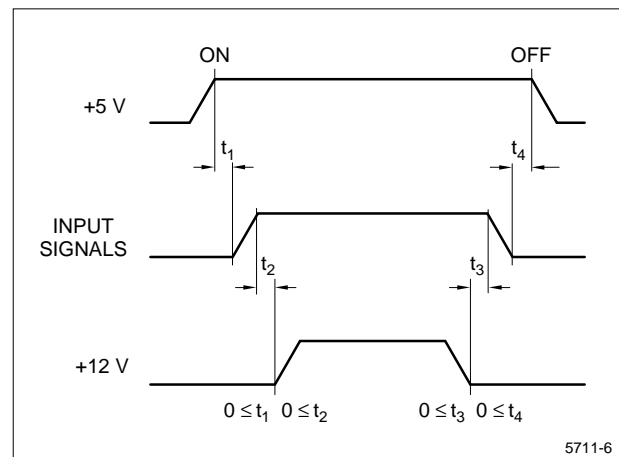**Figure 6. Definition of Response Time**

Figure 7. Power ON/OFF Sequence

DISPLAY QUALITY

The display quality of the color TFT-LCD module shall be in compliance with the Delivery Inspection Standard.

HANDLING PRECAUTIONS

- Be sure to insert the cable into the connector or remove it from the connector after turning off the power supply on the set side.

- Power ON/OFF sequential timing – To prevent the latch-up of the circuit in the module, keep the sequential timing between input signals and supply voltages as shown in Figure 7.

- When installing the module, be sure to fix the module on the same plane, taking care not to warp or twist the module.

- A transparent acrylic resin board or other type of transparent protective plate is recommended to be attaced to the front of the module to protect the LCD panel.

- Handle the front polarizer carefully since it scratches easily.

- Wipe off liquid immediately since it can cause color changes and staining.

- When the panel surface is soiled, wipe it with a soft cloth.

- The LCD unit is made of glass plates. Use care when handling it to avoid breakage.

- This unit contains CMOS LSIs which are senesitive to electrostatic charges. Use care to protect the unit from electrostatic discharge.

- Adjusting volumes have been optimally set before shipment, so do not change any adjusted values. If adjusted values are changed, the specifications described here may not be satisfied.

- Do not disassemble the unit.

- Observe all other precautionary requirements in handling components.
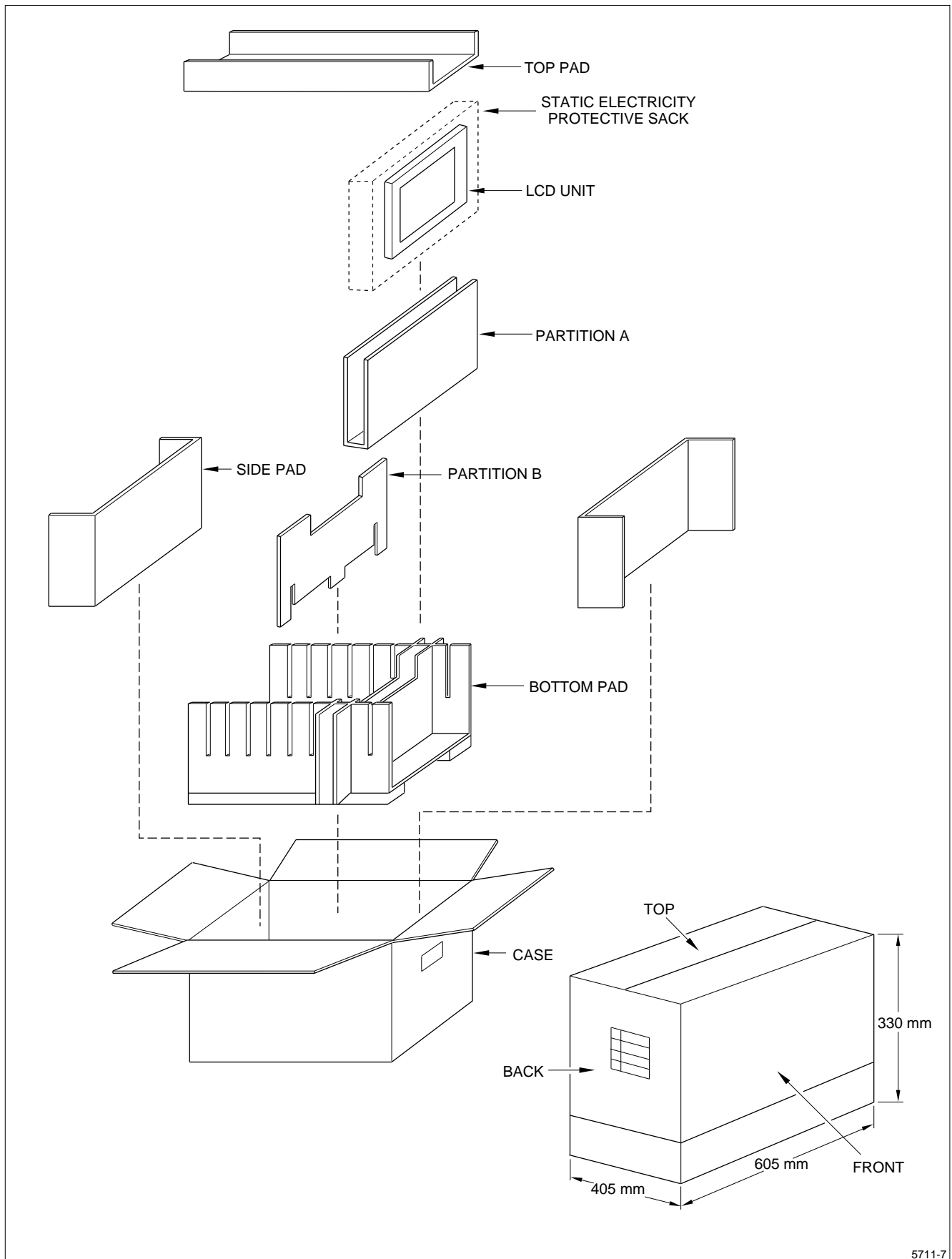
RESULT EVALUATION CRITERIA

Under the display quality test conditions with normal operation state, there shall be no change which may affect practical display function.

OTHER INFORMATION

If any problem should arise from this specification, the supplier and user should work out a mutually acceptable solution.
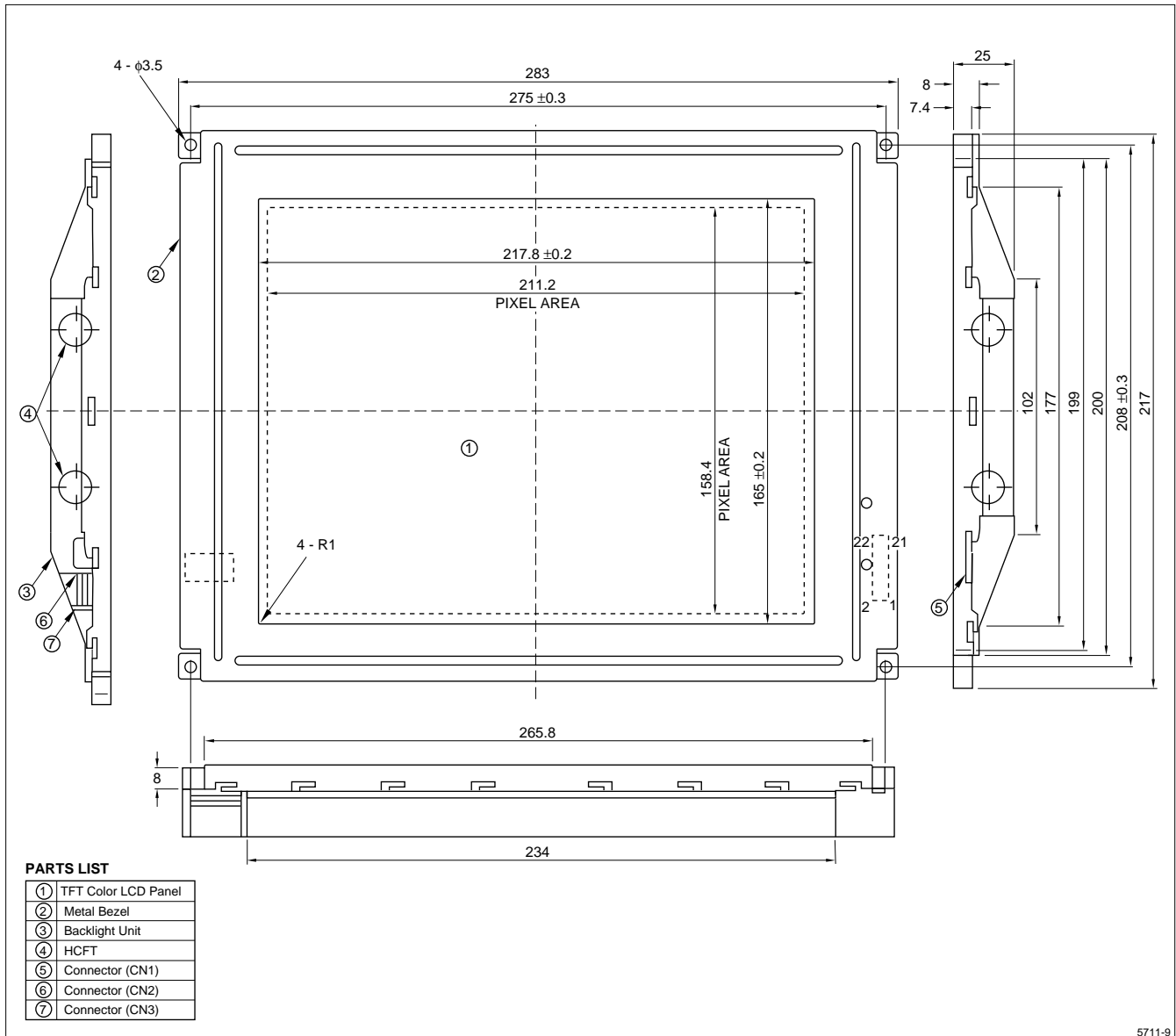
RELIABILITY TEST ITEMS

NUMBER	TEST ITEM	CONDITIONS
1	High-Temperature Storage Test	t_A = 60°C, 240 H
2	Low-Temperature Storage Test	t_A = −25°C, 240 H
3	High-Temperature and High-Humidity Operation Test	t_A = 40°C, 95% RH, 240 H (No condensation)
4	High-Temperature Operation Test	t_A = 40°C, 240 H (The panel temperature must be less than 60°C)
5	Low-Temperature Operation Test	t_A = 0°C, 240H
6	Vibration Test (Non-Operating)	Frequency: 10 Hz to 57 Hz/Vibration width (one side): 0.075 mm, 58 Hz to 500 Hz/Gravity: 1 G Sweep Time: 11 minutes Test Period: three hours total (one hour for each direction of X/Y/Z)
7	Shock Test (Non-Operating)	Maximum Gravity: 50 G Pulse Width: 11 ms, sine wave Direction: ±X/±Y/±Y, once for each direction

TOP PAD

STATIC ELECTRICITY
PROTECTIVE SACK

LCD UNIT

PARTITION A

SIDE PAD

PARTITION B

BOTTOM PAD

CASE

TOP

BACK

330 mm

605 mm

405 mm

FRONT

5711-7

Figure 8. Packing Form

OUTLINE DIMENSIONS

PARTS LIST

①	TFT Color LCD Panel
②	Metal Bezel
③	Backlight Unit
④	HCFT
⑤	Connector (CN1)
⑥	Connector (CN2)
⑦	Connector (CN3)

5711-9