

### FEATURES

- Display Diagonal: 10.4"
- Display Format: 640 × 480
- Overall Dimensions:  
283.0 (W) × 217.0 (H) × 12.5 (D) mm
- Active Area: 211.2 (W) × 158.4 (H) mm
- Dot Pitch: 0.33 (W) × 0.33 (H) mm
- Viewing Angle: 6 O'Clock
- Backlight: CCFT Dual Edgelit

### DESCRIPTION

The SHARP LQ10D311 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 dot panel in 262,144 colors by supplying 6-bit data signals for RGB, four kinds of timing signals, +5 VDC, and supply voltage for the backlight. Optimum viewing angle is at the 6 o'clock direction.

400-line and 350-line modes, in addition to 480-line mode, can also be applied to this module.

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

## MECHANICAL SPECIFICATIONS

PARAMETER	SPECIFICATIONS	UNIT	NOTES
Screen Size	10.4 (Diagonal)	inch	–
Active Area	211.2 (W) × 158.4 (H)	mm	–
Display Pixels	640 × 480 (1 Pixel = R + G + B Dots)	pixel	–
Pixel Pitch	0.33 (W) × 0.33 (H)	mm	–
Pixel Configuration	RGB Vertical Stripe	–	–
Display Mode	Normally White	–	–
Outline Dimensions	283 (W) × 215.6 (H) × 12.5 (D)	mm	1
Weight	850 ± 20	g	–
Surface Treatment	Anti-Glare and Hard-Coating 2H	–	–

### NOTE:

1. Excluding backlight cables.

## ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	CONDITION	RATINGS	UNIT	NOTE
$V_I$	Input Voltage	$t_A = 25^\circ\text{C}$	-0.3 to $V_{CC} + 0.3$	V	1
$V_{CC}$	+5 V Power Supply Voltage		-0.3 to +7.0	V	
Tstg	Storage Temperature	–	-25 to +60	°C	2
Topa	Operating Temperature (Ambient)	–	0 to +50	°C	

### NOTES:

1. CK, R0 to R5, G0 to G5, B0 to B5, Hsync, Vsync, ENAB.
2. Humidity: 95% RH maximum at  $t_A \leq 40^\circ\text{C}$ . Maximum wet-bulb temperature  $39^\circ\text{C}$  or less at  $t_A > 40^\circ\text{C}$ .  
No condensation.

## INPUT TERMINALS – TFT-LCD PANEL DRIVING SECTION

### CN1 (Interface Signal) <sup>1</sup>

PIN NUMBER	SYMBOL	FUNCTION	POLARITY	NOTE
1	CK	Clock Signal for Sampling Each Data Signal	–	–
2	GND	–	–	–
3	Hsync	Horizontal Sync Signal	–	2
4	Vsync	Vertical Sync Signal	–	2
5	R3	RED Data Signal	Positive	–
6	R4	RED Data Signal	Positive	–
7	R5	RED Data Signal (MSB)	Positive	–
8	GND	–	–	–
9	G3	GREEN Data Signal	Positive	–
10	G4	GREEN Data Signal	Positive	–
11	G5	GREEN Data Signal (MSB)	Positive	–
12	GND	–	–	–
13	B3	BLUE Data Signal	Positive	–
14	B4	BLUE Data Signal	Positive	–
15	B5	BLUE Data Signal (MSB)	Positive	–

#### NOTES:

- Connector used: DF13-15P-1.25H (Hirose Electric Co., Ltd.)  
Mating connector: DF13-15S-1.25C (Hirose Electric Co., Ltd.)
- Polarity of the sync signals:

MODE	480 LINES	400 LINES	350 LINES
Hsync	Negative	Negative	Positive
Vsync	Negative	Positive	Negative

### CN2 (Signal & Power Supply) <sup>1</sup>

PIN NUMBER	SYMBOL	FUNCTION	POLARITY	NOTE
1	V <sub>CC</sub>	+5 V Power Supply	–	–
2	V <sub>CC</sub>	+5 V Power Supply	–	–
3	GND	–	–	–
4	GND	–	–	–
5	ENAB	Data Enable Signal (To Settle the Display Position)	Positive	2
6	TST	This Shall Be Electrically Opened During Operation	–	–

#### NOTES:

- Connector used: DG13-6P-1.25H (Hirose Electric Co., Ltd.)  
Mating connector: DF13-6S-1.25C (Hirose Electric Co., Ltd.)
- The horizontal display position starts from the rising of the data enable signal or predetermined position in the module when the terminal 'ENAB' is fixed 'Low.'

**CN3 (Interface Signal) <sup>1,2</sup>**

PIN NUMBER	SYMBOL	FUNCTION	POLARITY
1	R0	RED Data Signal (LSB)	Positive
2	R1	RED Data Signal	Positive
3	R2	RED Data Signal	Positive
4	GND	–	–
5	G0	GREEN Data Signal (LSB)	Positive
6	G1	GREEN Data Signal	Positive
7	G2	GREEN Data Signal	Positive
8	GND	–	–
9	B0	BLUE Data Signal (LSB)	Positive
10	B1	BLUE Data Signal	Positive
11	B2	BLUE Data Signal	Positive
12	TST	This Shall be Electrically Opened During Operation	–
13	TST	This Shall be Electrically Opened During Operation	–
14	TST	This Shall be Electrically Opened During Operation	–

**NOTES:**

- Connector used: DF13-14P-1.25H (Hirose Electric Co., LTD.)  
Mating Connector: DF13-14S-1.25C (Hirose Electric Co., LTD).
- The shielding case is connected with signal GND.

**INPUT TERMINALS – BACKLIGHT****CNA, CNB <sup>1,2</sup>**

PIN NO.	SYMBOL	FUNCTION
1	V <sub>HIGH</sub>	Power Supply For Lamp (High-Voltage Side)
2	NC	–
3	V <sub>LOW</sub>	Power Supply For Lamp (Low-Voltage Side)

**NOTES:**

- Connector used: QZ-19-3F01 (Honda Tsushin Kogyo Co., Ltd.)  
Mating connector: QZ-19-3MYL (Honda Tsushin Kogyo Co., Ltd.)
- Cable length: CNA & CNB 50-15 mm, 50-0 mm

## ELECTRICAL CHARACTERISTICS AND CURRENT DISSIPATION

TFT-LCD Panel Driving ( $t_A = 25^\circ\text{C}$ )

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
$V_{CC}$	+5 V Supply Voltage	–	+4.75	+5.0	+5.25	V	2
$I_{CC}$	+5 V Current Dissipation	–	–	650	980	mA	3
$V_{RP}$	Permissive Input Ripple Voltage	VCC	–	–	50	mV <sub>P-P</sub>	–
$V_{IL}$	Input Signal Voltage (Low)	$V_{CC} = +5\text{ V}$	–	–	1.5	V	
$V_{IH}$	Input Signal Voltage (High)		+3.5	–	–	V	
$I_{IL1}$	Input Signal Current (Low)	Excluding ENAB	–	–	1.0	$\mu\text{A}$	–
$I_{IL2}$		ENAB	–	–	60.0	$\mu\text{A}$	–
$I_{IH}$	Input Signal Current (High)	–	–	–	1.0	$\mu\text{A}$	–

## NOTES:

- Input capacitance (for reference):  
10pF, (R0 – R5, G0 – G5, B0 – B5, Hsync, Vsync, ENAB),  
60pF (CK)
- ON-OFF condition for supply voltage (see Figure 1).
- Typical value: Display pattern is eight color-bar pattern ( $V_{CC} = 5.0\text{ V}$ , 480-line mode).

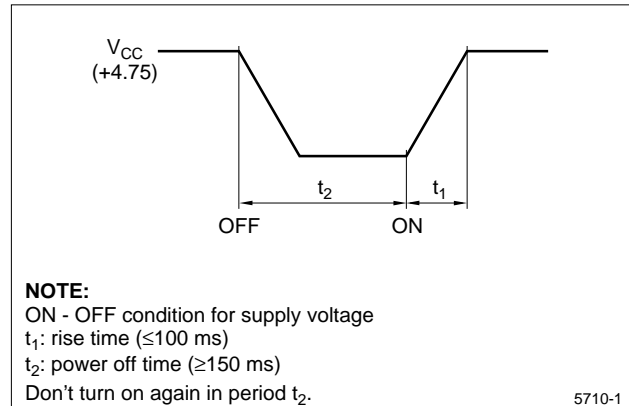


Figure 1. ON-OFF Condition for Supply Voltage

Backlight ( $t_A = 25^\circ\text{C}$ )<sup>1</sup>

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
$I_L$	Lamp Current	Just for reference	6.5	7.0	7.5	mARMS	–
$V_L$	Lamp Voltage		–	455	–	VRMS	–
$P_L$	Lamp Power Consumption	–	–	3.2	–	W	2
$F_L$	Frequency	–	20	–	60	kHz	3
$V_S$	Kick-Off Voltage	$t_A = 25^\circ\text{C}$	–	–	1000	$V_{RMS}$	–
		$t_A = 0^\circ\text{C}$	–	–	1200	$V_{RMS}$	–
$T_L$	Lamp Life Time	–	10,000	–	–	Hour	4

## NOTES:

- The backlight system is an edge lighting type (a couple of CCFT).  
The characteristics of its single lamp are shown in the table above.
- Calculated value for reference ( $I_L \times V_L$ ).
- Lamp frequency may produce interference with horizontal sync frequency, causing heat on the display. Therefore, lamp frequency should be as different as possible from the ones of Horizontal sync and harmonics horizontal sync to avoid interference.
- Brightness becomes 50% of the original brightness at standard conditions.

TIMING CHARACTERISTICS OF INPUT SIGNALS <sup>1</sup>

SYMBOL	PARAMETER	MODE	MIN.	TYP.	MAX	UNIT
1/t <sub>C</sub>	Clock Frequency	ALL	–	25.18	28.33	MHz
t <sub>CH</sub>	Clock High Time	ALL	5	–	–	ns
t <sub>CL</sub>	Clock Low Time	ALL	10	–	–	ns
t <sub>DS</sub>	Data Setup Time	ALL	5	–	–	ns
t <sub>DH</sub>	Data Hold Time	ALL	10	–	–	ns
t <sub>H</sub>	Horizontal Sync Signal Cycle	ALL	30.00	31.78	–	μs
		ALL	770	800	900	Clock
t <sub>HP</sub>	Horizontal Sync Signal Pulse Width	ALL	2	96	200	Clock
t <sub>V</sub>	Vertical Sync Signal Cycle	480	515	525	560	Line
		400	445	499	480	Line
		350	447	499	510	Line
t <sub>VP</sub>	Vertical Sync Signal Pulse Width	ALL	2	–	34	Line
t <sub>HD</sub>	Horizontal Signal Display Period	ALL	640	640	640	Clock
t <sub>HC</sub>	Hsync-Clock Phase Difference	ALL	10	–	TC-10	ns
t <sub>VH</sub>	Hsync-Vsync Phase Difference	ALL	0	–	T <sub>H</sub> -T <sub>Hp</sub>	ns

## NOTE:

1. If the frequency is lower, deterioration of display quality, such as flickering, may occur.

HORIZONTAL DISPLAY POSITION AND DATA ENABLE SIGNAL <sup>1</sup>

SYMBOL	PARAMETER	MODE	MIN.	TYP.	MAX.	UNIT
t <sub>ES</sub>	Data Enable Signal Setup Time	ALL	5	–	T <sub>C</sub> -10	ns
t <sub>EP</sub>	Data Enable Signal Pulse Width	ALL	2	640	640	Clock
t <sub>HE</sub>	Hsync Data Enable Signal Phase Difference	ALL	84	–	204	Clock

## NOTE:

1. Horizontal display starts from rising edge of data enable signal.

## VERTICAL DISPLAY POSITION

MODE	V-DATA START ( $T_{Vs}$ )	V-DATA PERIOD ( $T_{Vd}$ )	V-DISPLAY START	V-DISPLAY PERIOD	UNIT	NOTE
480	34	480	34	480	Line	
400	34	400	$433-T_V$	480	Line	2
350	61	350	$445-T_V$	480	Line	2

### NOTES:

- The vertical display position is centered in 480-line, 400-line, and 350-line modes of VGA in accordance with the polarity of the sync signals and values in the above table. The data enable signal does not affect the vertical display position.
- The vertical invalid data period is displayed in 400-line and 350-line modes. All data is recommended to be '0' during vertical invalid data period. See Figure 2. In 400-line and 350-line modes, the display position will not be centered on the screen if the vertical sync signal,  $T_V$ , does not have above typical values.

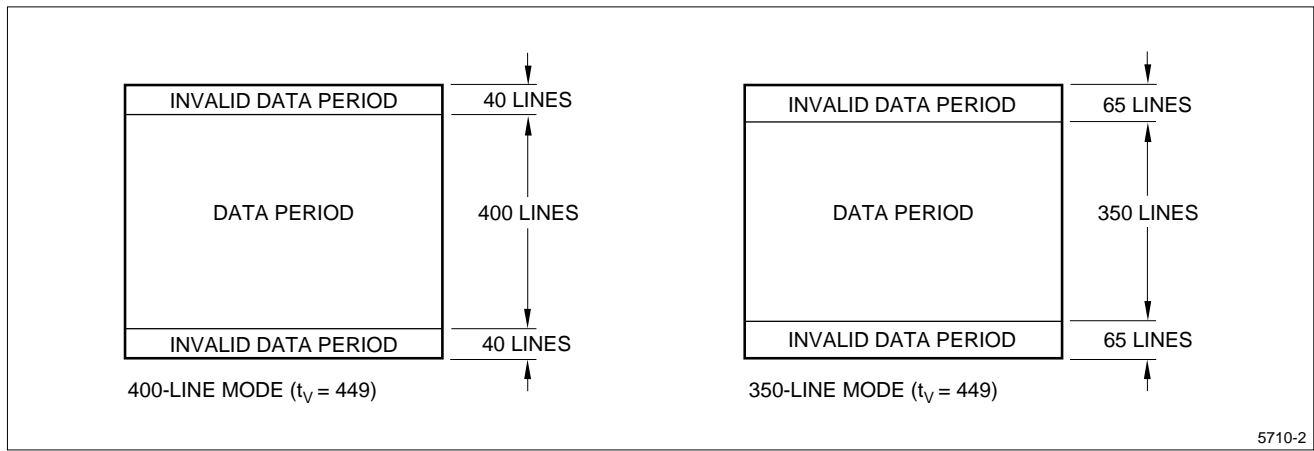


Figure 2. Vertical Display Position

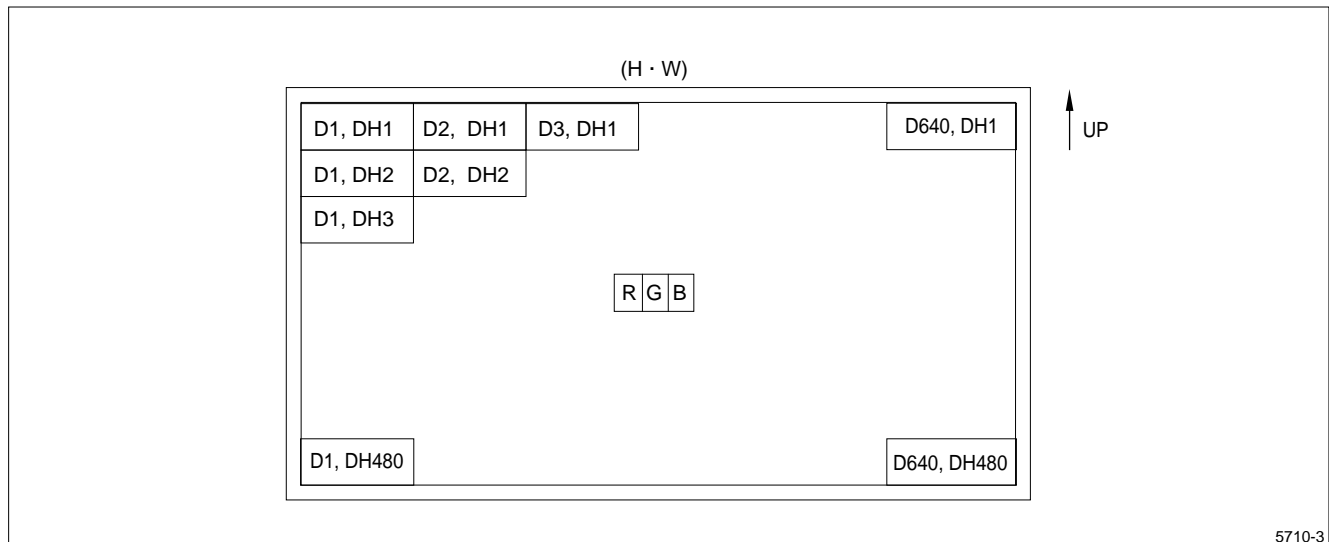
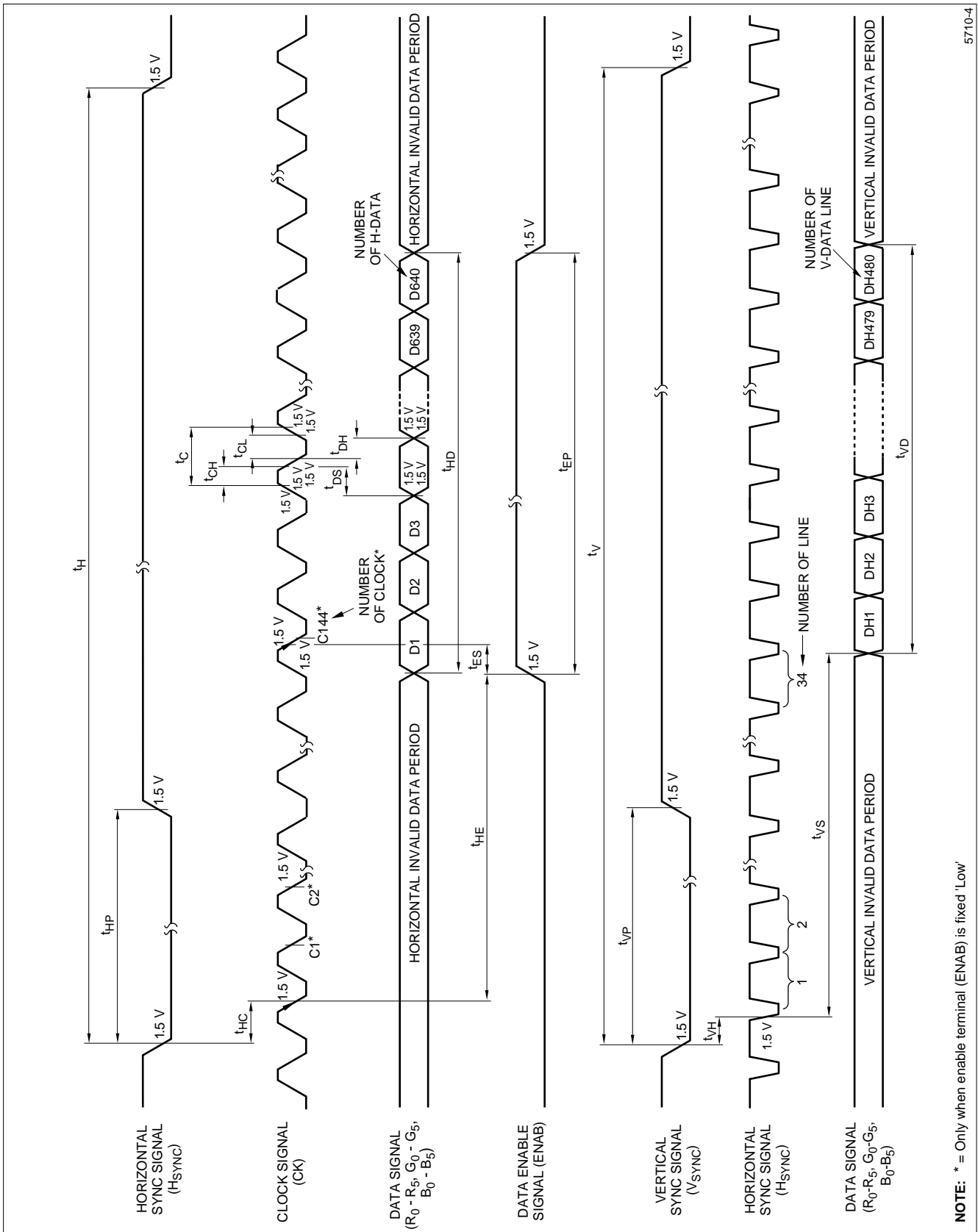


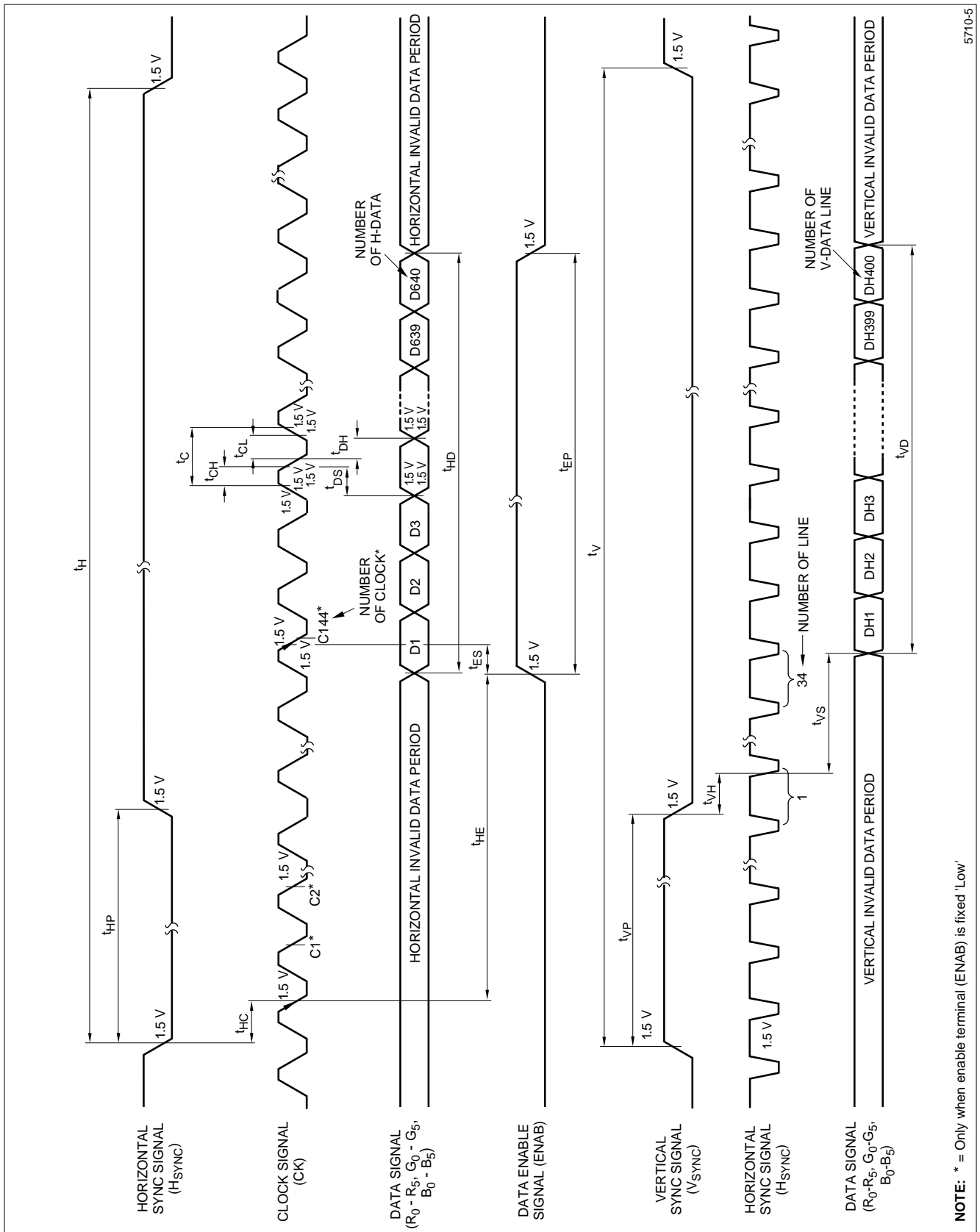
Figure 3. Input Data Signals and Display Position on the Screen (480-Line Mode)



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Figure 4. Input Signal Waveforms (480-Line Mode)

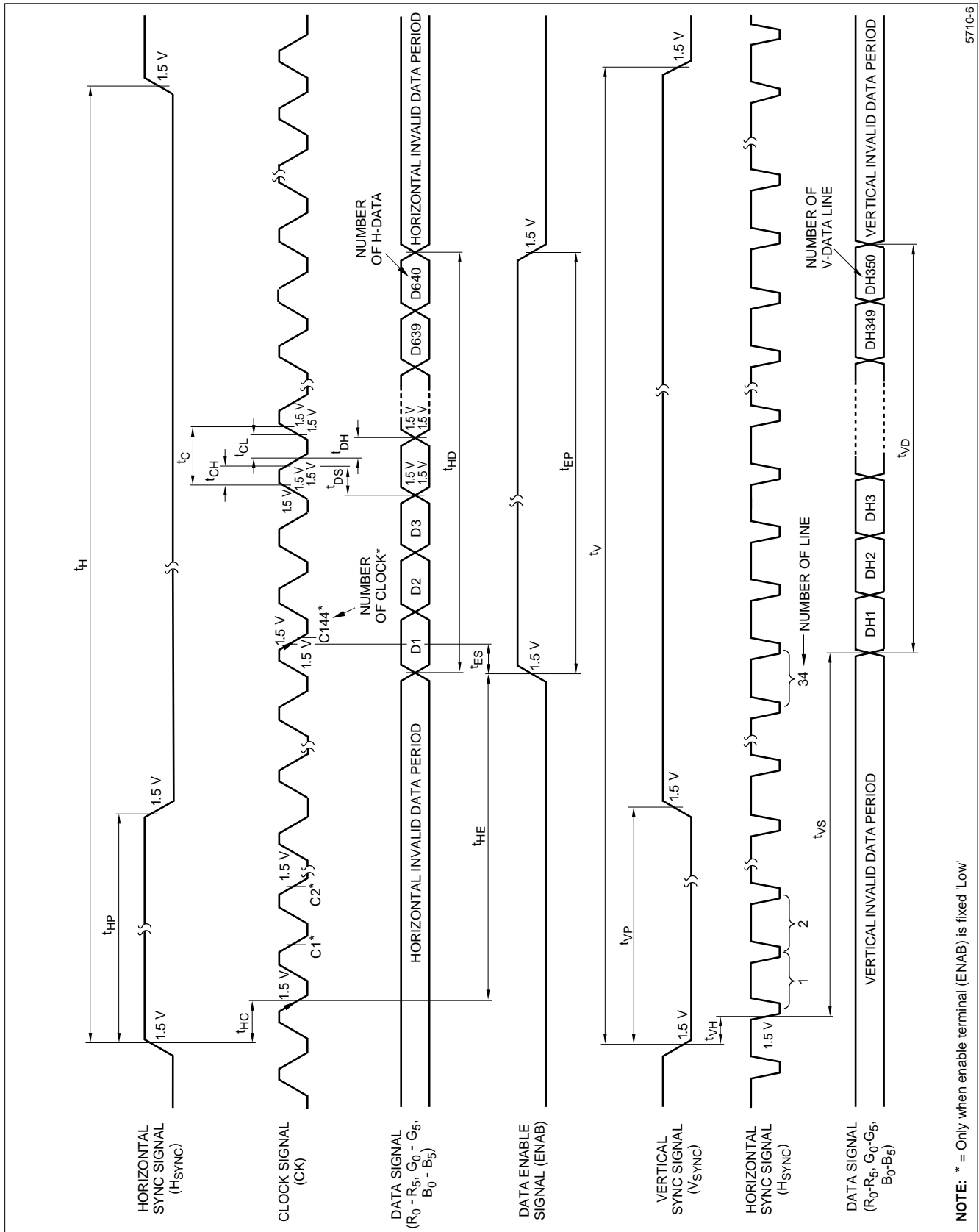




NOTE: \* = Only when enable terminal (ENAB) is fixed 'Low'

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Figure 5. Input Signal Waveforms (400-Line Mode)



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Figure 6. Input Signal Waveforms (350-Line Mode)

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

COLOR AND GRAY SCALE		DATA SIGNAL																	
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Light Blue	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Purple	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑			.						.						.			
	↓			.						.						.			
	Brighter	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	↓	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	↑			.						.						.			
	↓			.						.						.			
	Brighter	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	↓	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	↑			.						.						.			
	↓			.						.						.			
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	↓	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

## NOTES:

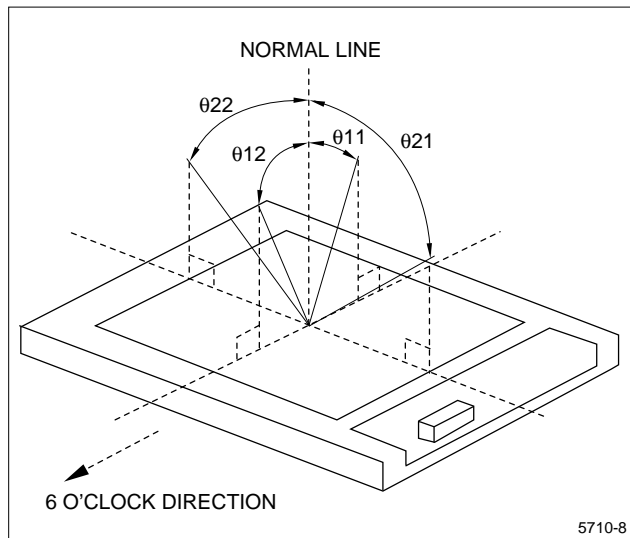
- Each color is displayed in 64 gray scales from 6-bit data signal input. According to the combination of the total 18-bit data, 262,144 colors are available.
- 0 = Low-Level Voltage  
1 = High-Level Voltage

**OPTICAL CHARACTERISTICS ( $t_A = 25^\circ\text{C}$ ,  $V_{CC} = +5.0\text{ V}$ )<sup>1</sup>**

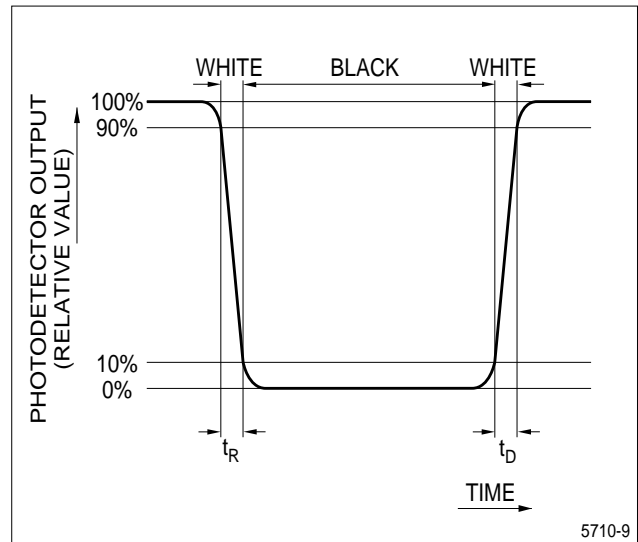
SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
$\theta_{21.22}$	Horizontal Viewing Angle Range	CR > 10	45	-	-	degrees	2, 5
$\theta_{11}$	Vertical Viewing Angle Range		10	-	-		
$\theta_{12}$			30	-	-		
CR	Contrast Ratio	Optimum Viewing Angle	60	-	-	-	3, 5
$t_R$	Response Time – Rise	$\theta = 0^\circ$	-	30	-	ms	4, 5
$t_D$	Response Time – Decay		-	50	-	ms	
x	Chromaticity of White		-	0.313	-	-	5
y			-	0.329	-	-	
$Y_L$	Luminance of White		80	100	-	cd/m <sup>2</sup>	
$\delta_W$	White Uniformity		-	-	1.25	-	6

**NOTES:**

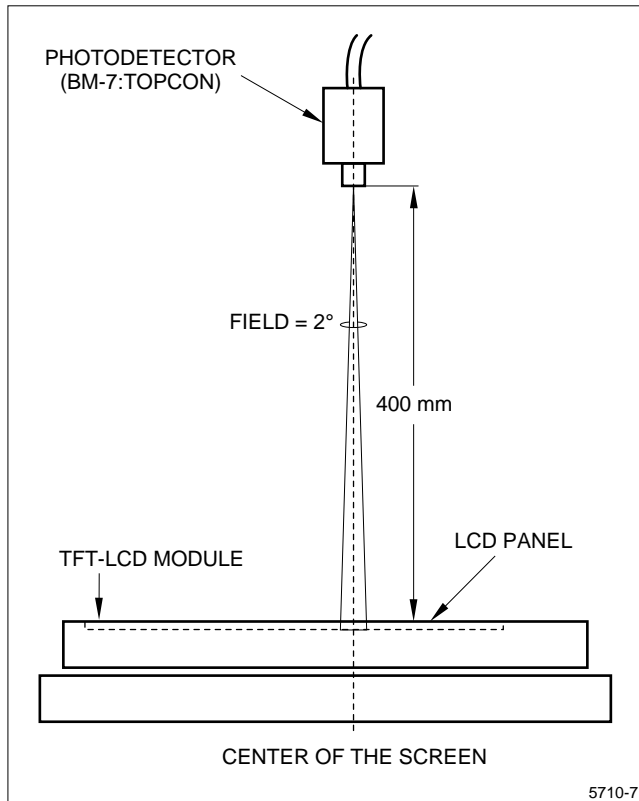
1. The measurement shall be executed 15-20 minutes after the module has been lit at the proper rating. The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Figure 9.
2. Figure 7 shows the definitions of the viewing angle range.
3. The Contrast Ratio is defined as follows: Contrast Ratio =  $\frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$
4. The Response Time is measured as shown in Figure 8 by switching the input signals for 'black' ON and OFF.
5. Measurements shall be taken at the center of the screen.
6. White Uniformity is defined as the following with five measurements (A-E) (Refer to Figure 10):  $\frac{\text{Maximum Luminance (brightness)}}{\text{Minimum Luminance (brightness)}}$



**Figure 7. Definition of Viewing Angle**



**Figure 8. Definition of Response Time**



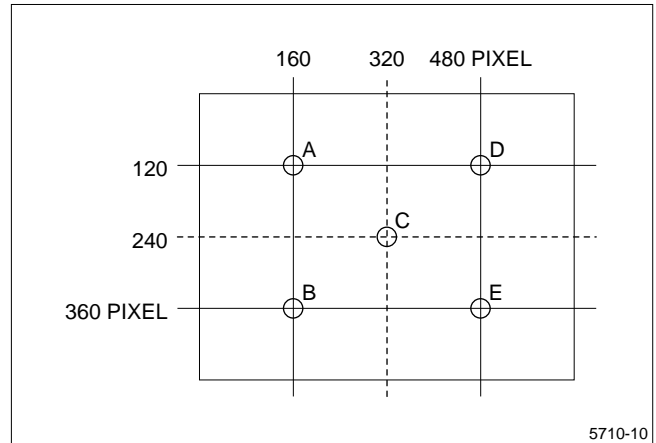
**Figure 9. Optical Characteristics Measurement Method**

## DISPLAY QUALITY

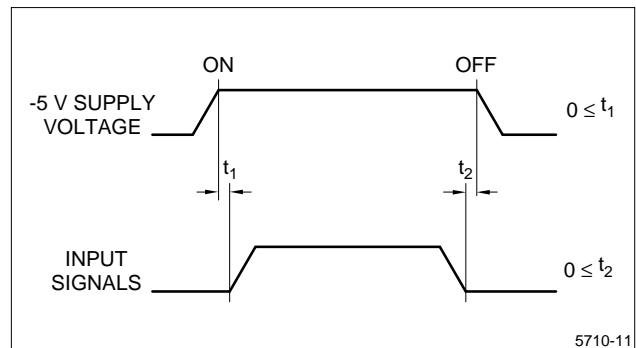
The display quality of the color TFT-LCD module shall be in compliance with the Delivery Inspection Standard.

## 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 11.
- When installing the module, be sure to fix the module on the same plane, taking care not to warp or twist the module.
- Handle the front polarizer carefully since it scratches easily.
- Wipe off liquid immediately since it can cause color changes or staining.
- When the panel surface is soiled, wipe it with a soft cloth.
- The LCD is made of glass plates. Use care when handling it to avoid breakage.



**Figure 10. Definition of White Uniformity**



**Figure 11. Power On/Off Sequential Timing**

- This unit contains CMOS LSIs which are sensitive 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.

**RELIABILITY TEST ITEMS**

NUMBER	TEST ITEM	CONDITIONS
1	High Temperature Storage Test	$t_A = 60^\circ\text{C}$ , 240 H
2	Low Temperature Storage Test	$t_A = -25^\circ\text{C}$ , 240 H
3	High Temperature and High Humidity Operation Test	$t_A = 40^\circ\text{C}$ , 95% RH, 240 H (No condensation)
4	High Temperature Operation Test	$t_A = 50^\circ\text{C}$ , 240 H
5	Low Temperature Operation Test	$t_A = 0^\circ\text{C}$ , 240 H
6	Vibration Test (Non-Operating)	Frequency: 10 Hz to 57 Hz/Vibration width (one side): 0.075 mm, 58 Hz to 500 Hz/Gravity: 9.8 m/s <sup>2</sup> (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: 490m/s <sup>2</sup> (50 G) Pulse Width: 11 ms, sine wave Direction: $\pm X/\pm Y/\pm Z$ , once for each direction

**PACKING SPECIFICATIONS**

Refer to the Packing Form shown in Figure 12.

- Piling number of cartons: 6 (MAX)
- Package quantity in one carton: 10 (MAX)
- Carton size:  
420 mm (W) × 330 mm (H) × 400 mm (D)
- Total weight of 1 carton filled with full modules:  
12,000 g

**RESULT EVALUATION CRITERIA**

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

**OTHER INFORMATION**

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

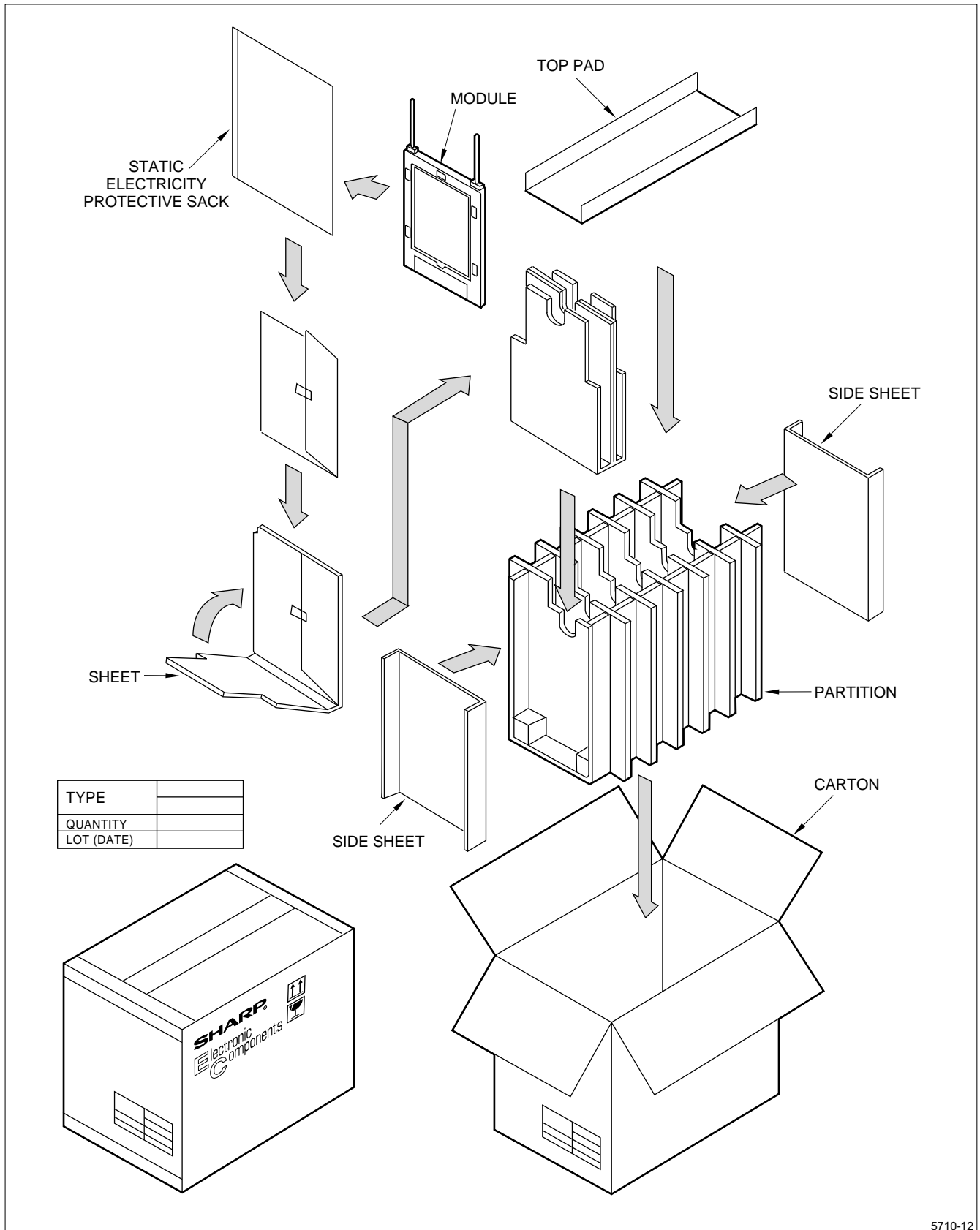
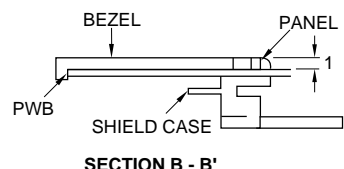
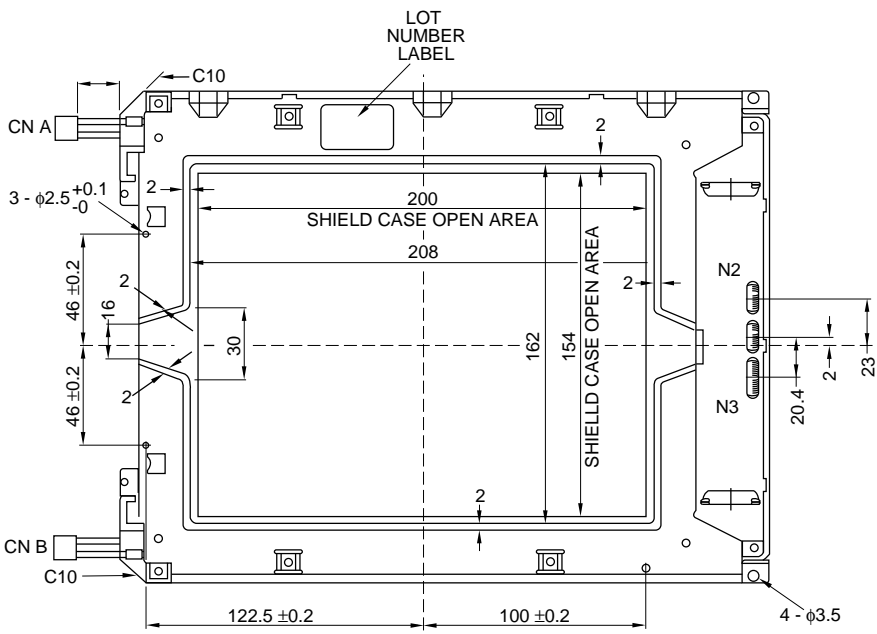
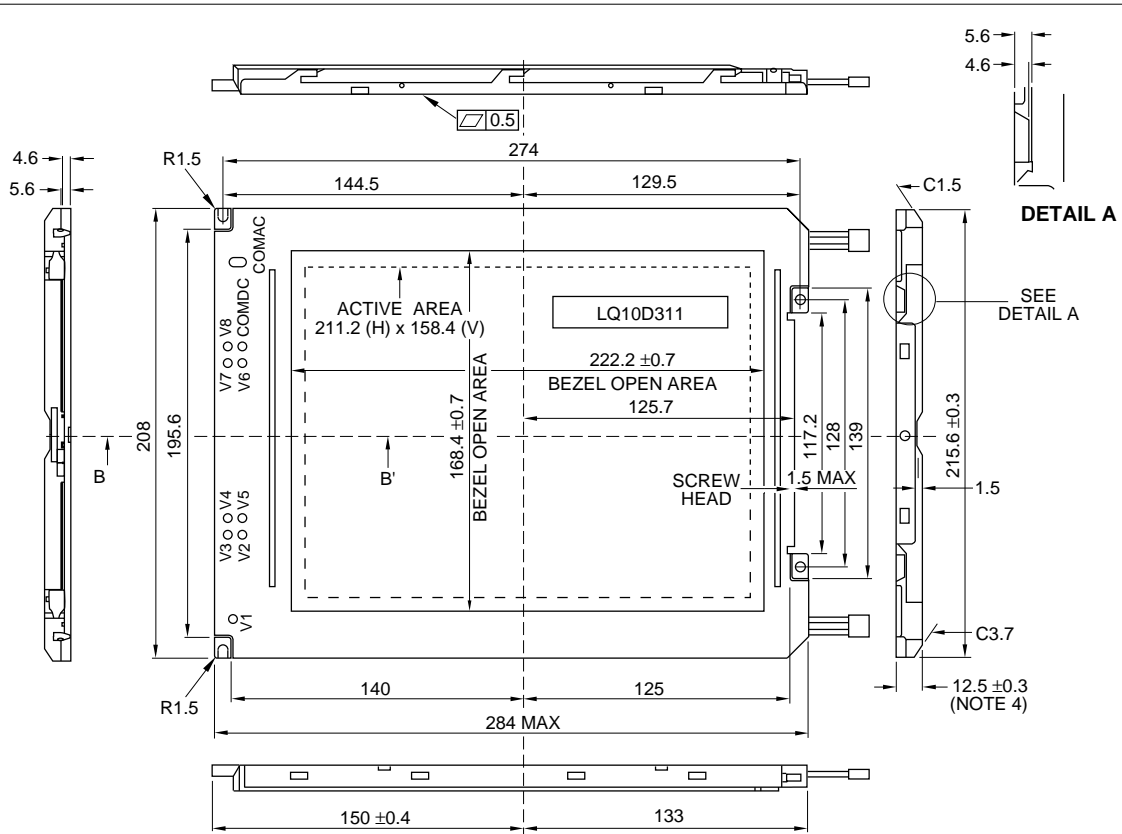


Figure 12. Packing Form

OUTLINE DIMENSIONS



- NOTES:**
1. φ2.5 Hole (x3) is locating hole of module.
  2. Inserted depth of locating pin is 1.5 mm MAX.
  3. Tolerances are ±0.3 mm unless otherwise specified.
  4. The flatness is not included in the specified tolerance.

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