

### FEATURES

- Display Diagonal: 10.4"
- Display Format: 640 × 480
- Overall Dimensions:  
283 (W) × 215.6 (H) × 8 (D) mm
- Active Area: 211.2 (W) × 158.4 (H) mm
- Dot Pitch: 0.33 (W) × 0.33 (H) mm

### DESCRIPTION

The SHARP LQ10P311 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 supply voltage.

400-line and 350-line modes, in addition to 480-line mode, can also be applied to this module. Horizontal display reverse function is built into this module.

## MECHANICAL SPECIFICATIONS

PARAMETER	SPECIFICATIONS	UNIT	NOTE
Screen Size	10.4 (Diagonal)	inch	–
Effective Display 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) × 8.0 (D)	mm	1
Weight	580 ±20	g	–

### NOTE:

1. Excludes electric parts and protrusions.

## 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 Supply Voltage		-0.3 to +7.0	V	–
Tstg	Storage Temperature	–	-25 to +60	°C	2
Top	Operating Temperature	–	0 to +55	°C	
$\lambda_1$	Wave Length of Light Source	–	≥ 400	nm	
$I_1$	Illumination Intensity of Light Source	–	≤ 300,000	lx	3

### NOTES:

1. CK, R<sub>0</sub> to R<sub>5</sub>, G<sub>0</sub> to G<sub>5</sub>, B<sub>0</sub> to B<sub>5</sub>, H<sub>SYNC</sub>, V<sub>SYNC</sub>, ENAB, NBH.
2. Panel surface temperature should not be higher than the specification even partially. The panel surface should be cooled if necessary. Humidity: 95% RH maximum at  $t_A \leq 40^\circ\text{C}$ . Maximum wet-bulb temperature 39°C or less at  $t_A > 40^\circ\text{C}$ . No condensation.
3. Measurement point: Panel surface. The light source should be placed at the incident-light-side. See Figure 1.

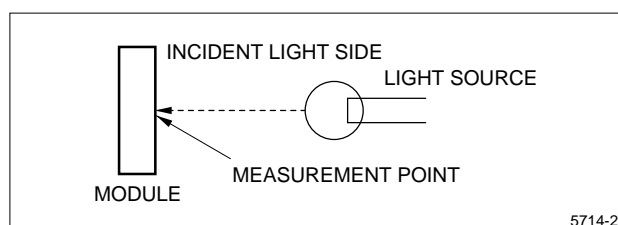


Figure 1. Measurement Point: Panel Surface

## INPUT TERMINALS – TFT-LCD PANEL DRIVER

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

PIN NUMBER	SYMBOL	FUNCTION	POLARITY	NOTE
1	CK	Clock Signal for Sampling Each Data Signal	–	–
2	GND	–	–	–
3	H <sub>SYNC</sub>	Horizontal Sync Signal	–	2
4	V <sub>SYNC</sub>	Vertical Sync Signal	–	2
5	R <sub>3</sub>	RED Data Signal	Positive	–
6	R <sub>4</sub>	RED Data Signal	Positive	–
7	R <sub>5</sub>	RED Data Signal (MSB)	Positive	–
8	GND	–	–	–
9	G <sub>3</sub>	GREEN Data Signal	Positive	–
10	G <sub>4</sub>	GREEN Data Signal	Positive	–
11	G <sub>5</sub>	GREEN Data Signal (MSB)	Positive	–
12	GND	–	–	–
13	B <sub>3</sub>	BLUE Data Signal	Positive	–
14	B <sub>4</sub>	BLUE Data Signal	Positive	–
15	B <sub>5</sub>	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-LINE	400-LINE	350-LINE
Hsync	Negative	Negative	Positive
Vsync	Negative	Positive	Positive

### 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	NBH	Horizontal Display Mode (Direction) Select Signal	–	3

#### NOTES:

- Connector used: DF13-6P-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.'
- See Figure 2.

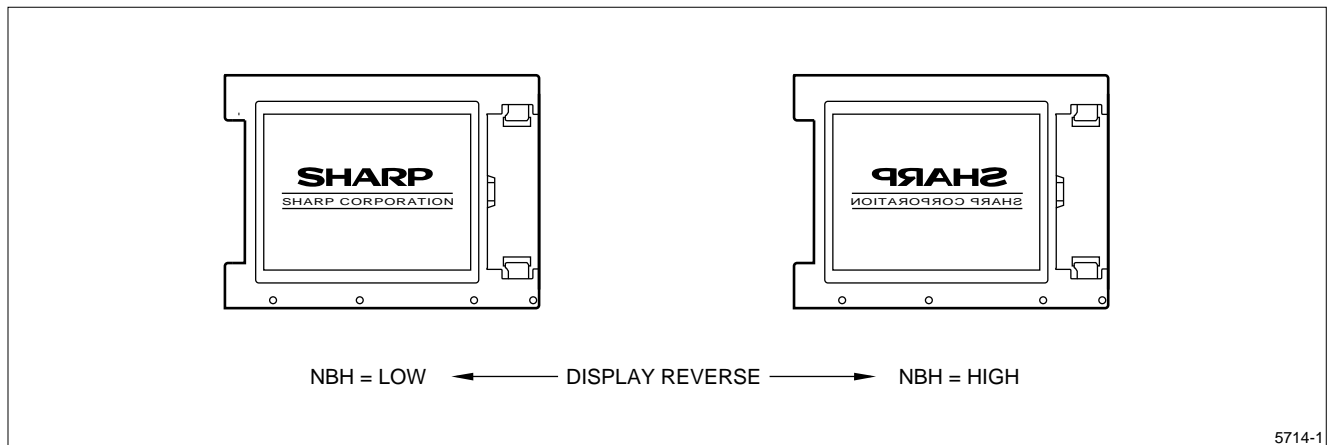


Figure 2. Horizontal Display Mode

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

PIN NUMBER	SYMBOL	FUNCTION	POLARITY
1	R <sub>0</sub>	RED Data Signal (LSB)	Positive
2	R <sub>1</sub>	RED Data Signal	Positive
3	R <sub>2</sub>	RED Data Signal	Positive
4	GND	—	—
5	G <sub>0</sub>	GREEN Data Signal (LSB)	Positive
6	G <sub>1</sub>	GREEN Data Signal	Positive
7	G <sub>2</sub>	GREEN Data Signal	Positive
8	GND	—	—
9	B <sub>0</sub>	BLUE Data Signal (LSB)	Positive
10	B <sub>1</sub>	BLUE Data Signal	Positive
11	B <sub>2</sub>	BLUE Data Signal	Positive
12	TST	This is Electrically Opened During Operation	—
13	TST	This is Electrically Opened During Operation	—
14	TST	This is 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.

## 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	–	–	700	980	mA	3
$V_{RP}$	Permissive Input Ripple Voltage	$V_{CC}$	–	–	50.0	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 and NBH	–	–	1.0	$\mu\text{A}$	–
$I_{IL2}$		ENAB, NBH	–	–	60.0	$\mu\text{A}$	–
$I_{IH}$	Input Signal Current (High)	–	–	–	1.0	$\mu\text{A}$	–

#### NOTES:

- Input capacitance (for reference):  
10 pF, (R0-R5, G0-G5, B0-B5, HSYNC, VSYNC, ENAB, NBH),  
60 pF (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).

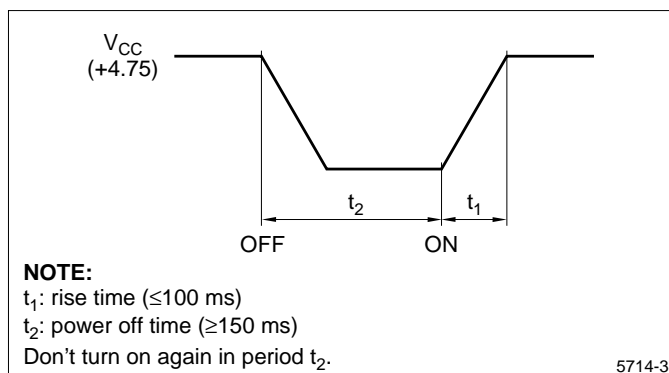


Figure 3. ON/OFF Condition for Supply Voltage

## 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	449	480	Line
		350	447	449	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 Setup Time	ALL	5	–	T <sub>C</sub> -10	ns
T <sub>EP</sub>	Data Enable Pulse Width	ALL	2	640	640	Clock
T <sub>HE</sub>	Hsync Data Enable Signal Phase Difference	ALL	84	–	204	Clock

### NOTE:

1. When the data enable terminal (ENAB) is fixed 'Low,' the horizontal display starts at the data of C144 (clock).

## VERTICAL DISPLAY POSITION <sup>1</sup>

MODE	V-DATA START (T <sub>Vs</sub> )	V-DATA PERIOD (T <sub>Vd</sub> )	V-DISPLAY START	V-DISPLAY PERIOD	UNIT	NOTE
480	34	480	34	480	Line	–
400	34	400	433-T <sub>V</sub>	480	Line	2
350	61	350	445-T <sub>V</sub>	480	Line	2

### NOTES:

1. 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.
2. 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 4. In 400-line and 350-line modes, the display position will not be centered on the screen if the vertical sync signal, T<sub>V</sub>, does not have above typical values.

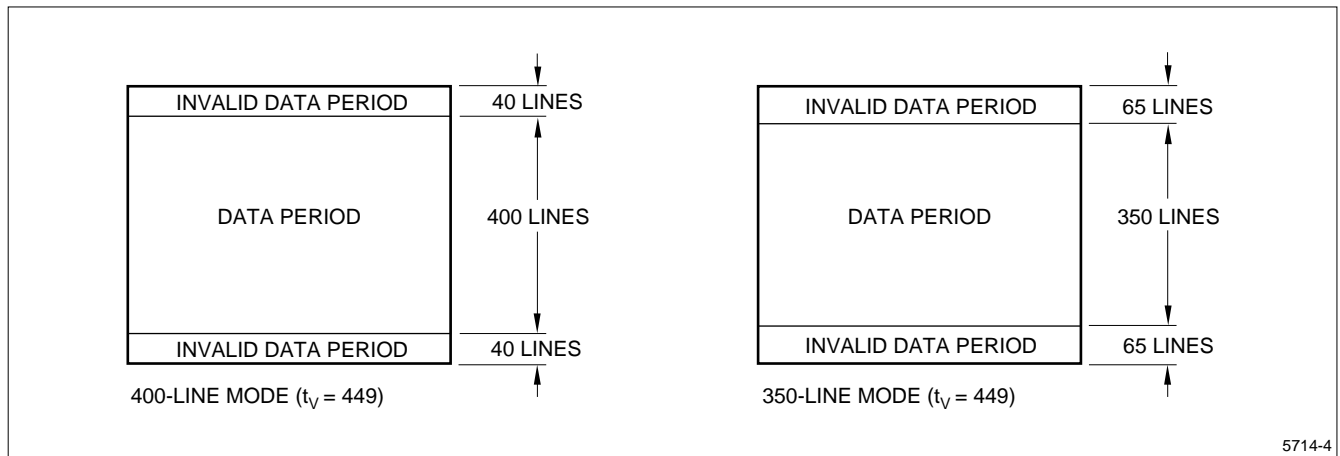


Figure 4. Vertical Display Position

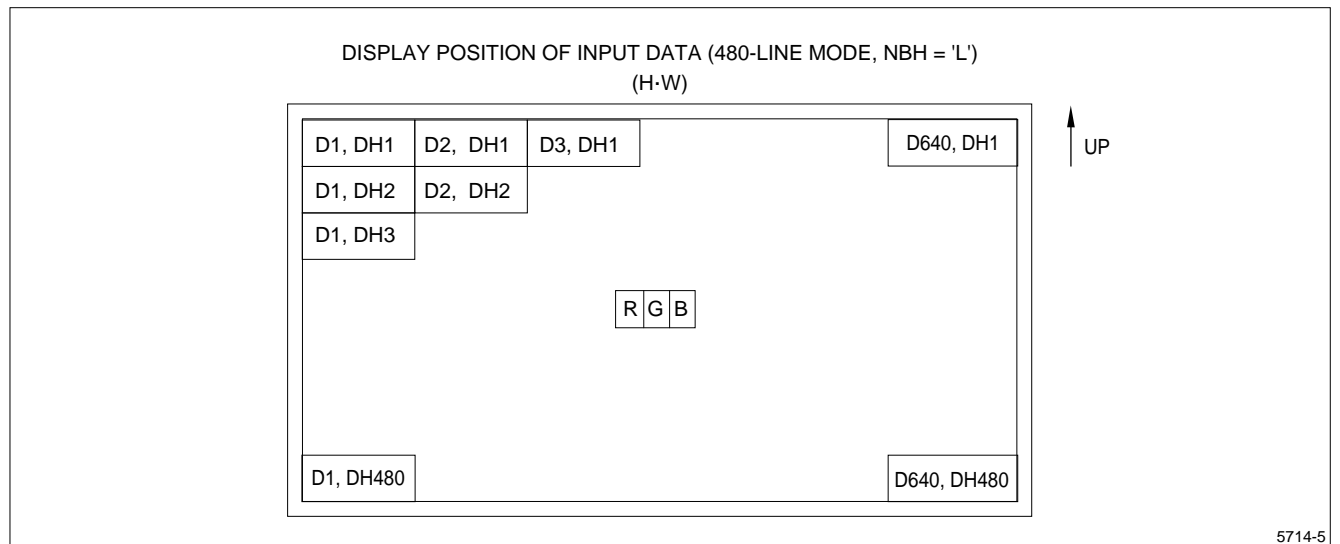
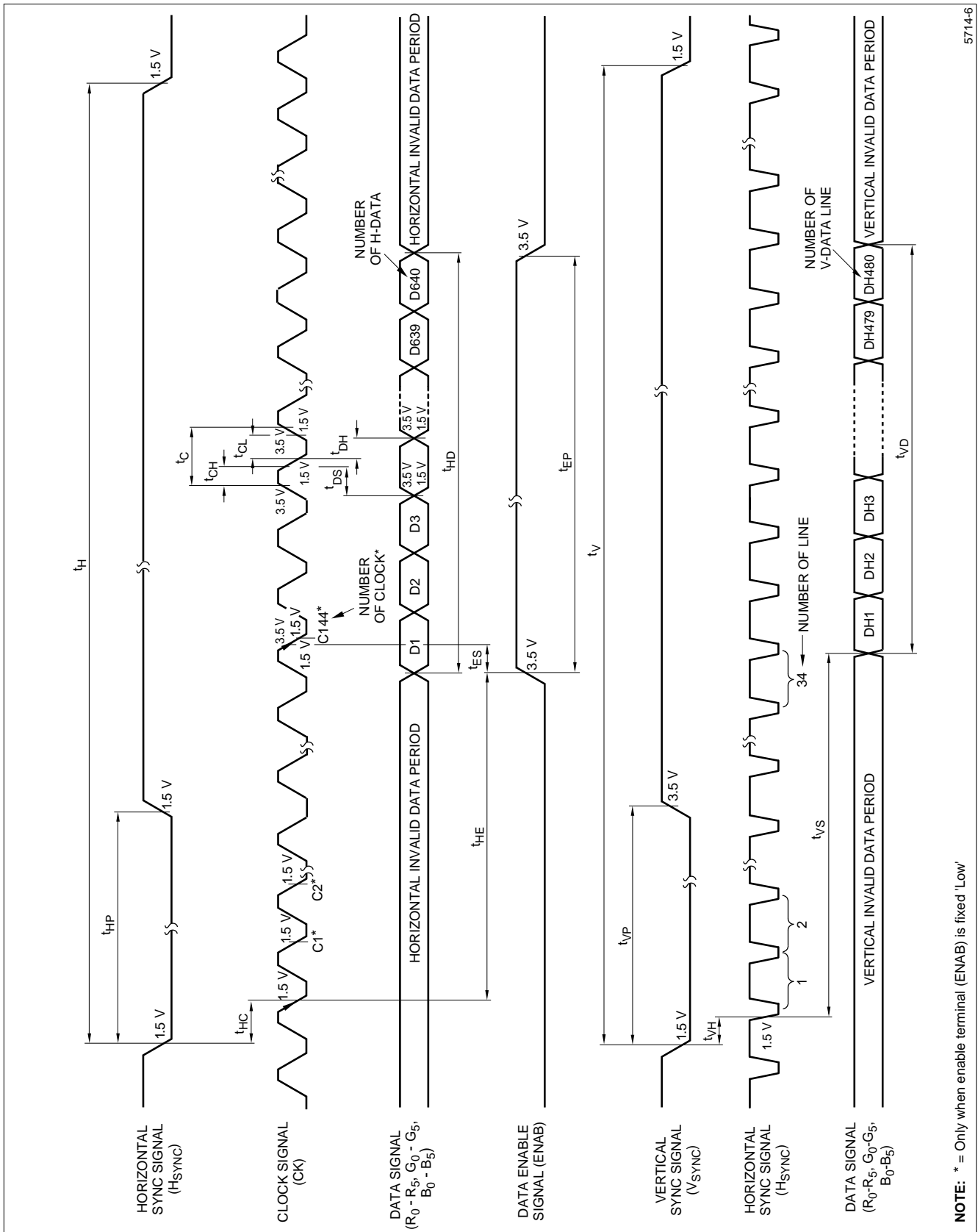


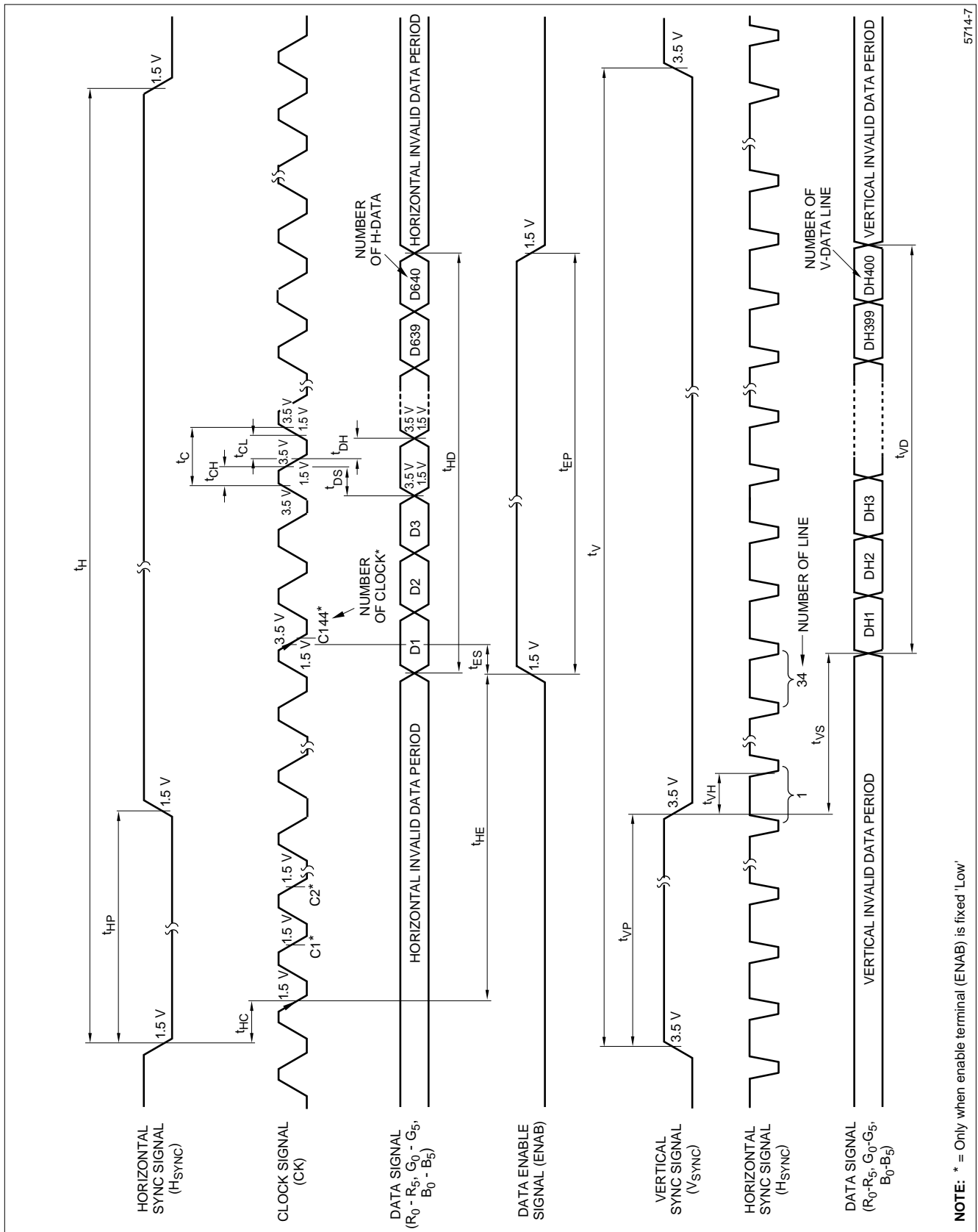
Figure 5. Input Data Signals and Display Position



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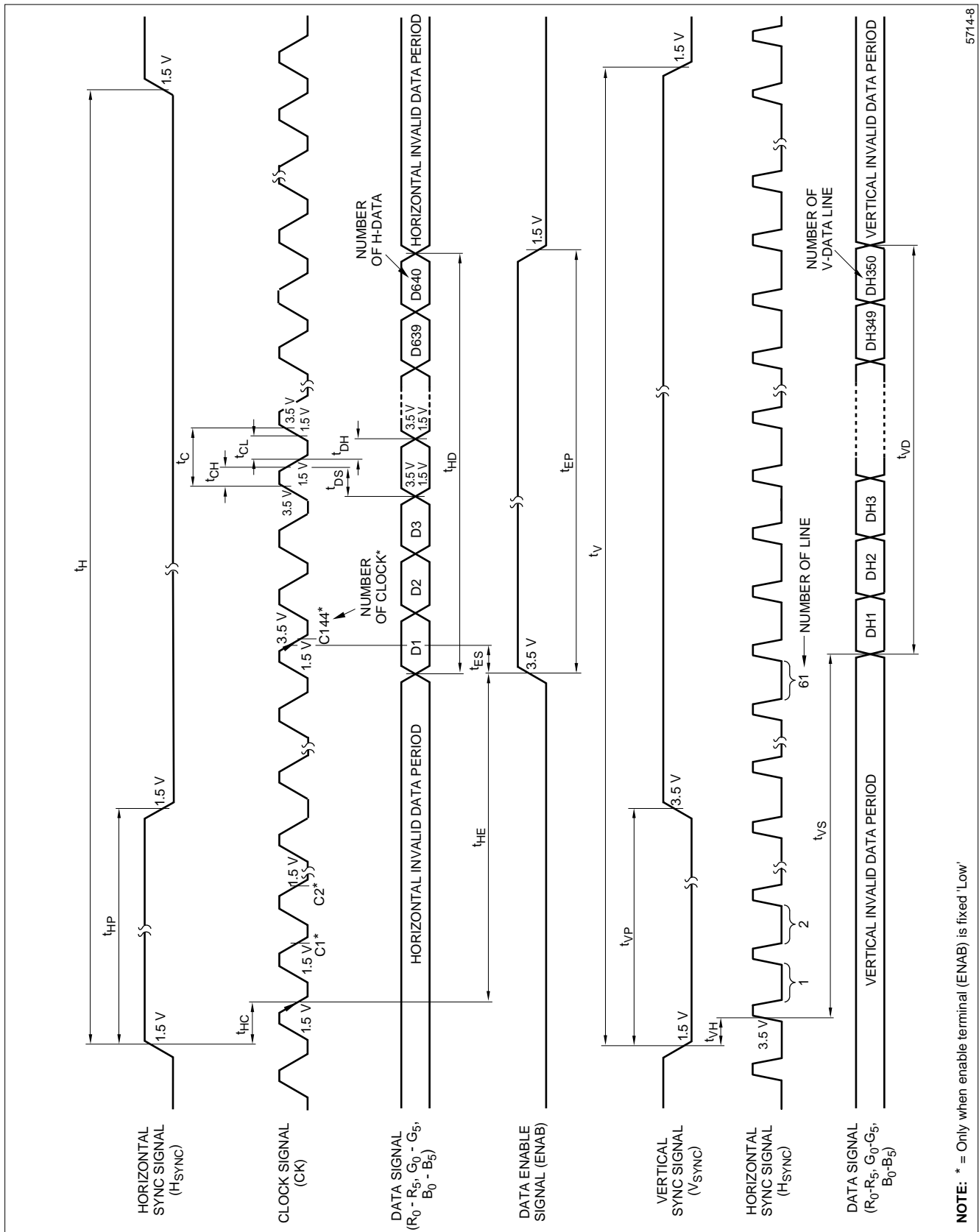
Figure 6. Input Signal Waveforms (480-Line Mode)





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Figure 7. Input Signal Waveforms (400-Line Mode)



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

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Figure 8. Input Signal Waveforms (350-Line Mode)

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

COLOR AND GRAY SCALE		DATA SIGNAL																	
		R <sub>0</sub>	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>	G <sub>0</sub>	G <sub>1</sub>	G <sub>2</sub>	G <sub>3</sub>	G <sub>4</sub>	G <sub>5</sub>	B <sub>0</sub>	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	B <sub>5</sub>
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:

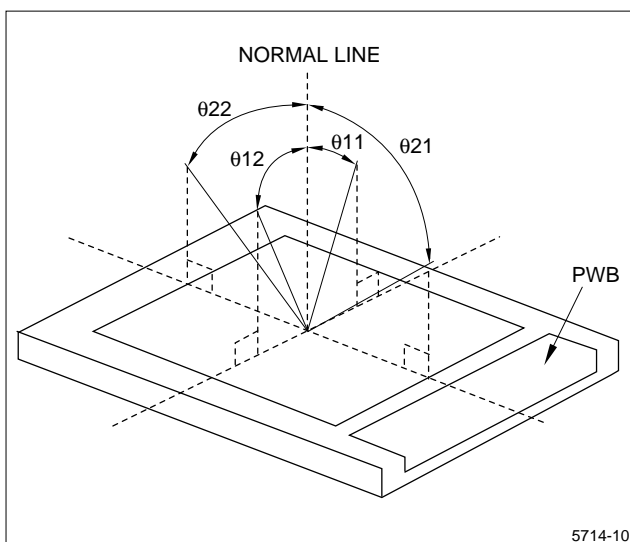
- Each color is displayed in 64 gray scales from 6-bit data signal input. According to the combination of the total 18-bit data, 262,144 colors are available.
- 0 = Low Level Voltage  
1 = High Level Voltage

**OPTICAL CHARACTERISTICS** ( $t_A = 25^\circ\text{C}$ ,  $V_{CC} = +5\text{ V}$ )<sup>1,2</sup>

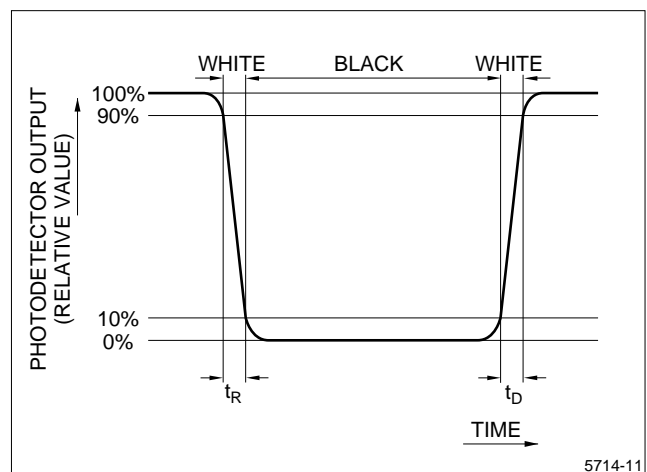
SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
$\theta_{21,22}$	Horizontal Viewing Angle Range	CR > 10	35	–	–	degrees	3
$\theta_{11}$	Vertical Viewing Angle Range		30	–	–		
$\theta_{12}$	Vertical Viewing Angle Range		10	–	–		
CR	Contrast Ratio	Optimum Viewing Angle	60	–	–	–	4
$t_R$	Response Time (Rise)	$\theta = 0^\circ$	–	30	–	ms	5
$t_D$	Response Time (Decay)		–	50	–	ms	
$t_r$	Transmissivity		4.3	5.8	–	%	6
$\Delta x$	Chromaticity of White		–0.035	–0.005	+0.025	–	–
$\Delta y$			–0.010	+0.020	+0.050	–	–

**NOTES:**

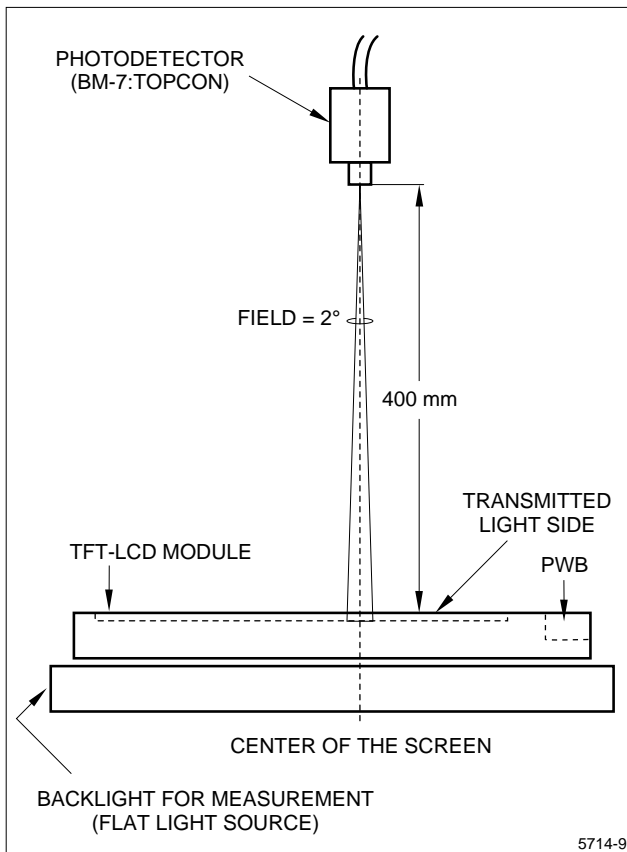
- Conditions of the backlight for measurement:  
Luminance: more than 3500 cd/m<sup>2</sup>, Wave length: cut off the rays less than 400 nm, Chromaticity: x = 0.3118, y = 0.2978
- The measurement shall be executed 15-20 minutes after the module has been lit at the proper rating. The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Figure 9. The specifications should be measured at the center of the screen.
- Definition of viewing angle as shown in Figure 10.
- The Contrast Ratio is defined as follows: Contrast Ratio =  $\frac{\text{Luminance(brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$
- The Response Time is measured as shown in Figure 11 by switching the input signals for 'black' ON and OFF.
- Definition of transmissivity is defined as follows: Transmissivity =  $\frac{\text{Luminance of transmitted light} *}{\text{Luminance of the incident light}} \times 100$   
(\*Being not supplied power source)



**Figure 9. Definition of Viewing Angle**



**Figure 10. Definition of Response Time**



**Figure 11. Optical Characteristics Measurement Method**

## 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	$t_A = 55^\circ\text{C}$ , 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 in 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

## 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 take it out of the connector after turning off the power supply on the set side.
- 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 12.
- 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 and staining.
- When the surface of the LCD cells need cleaning, wipe it with a soft cloth.

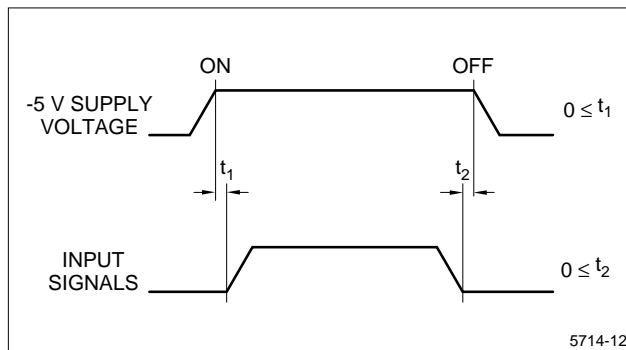


Figure 12. Power ON/OFF Sequential Timing

- The LCD is made of glass plates. Use care when handling it to avoid breakage.
- This unit contains CMOS LSIs which are sensitive to electrostatic charges. Use care to protect the unit from electrostatic discharges.
- 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.

## PACKING SPECIFICATIONS

Refer to the Packing Form shown in Figure 13.

- 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 one carton filled with full modules:  
10,000 g

## RESULT EVALUATION CRITERIA

Under the display quality test conditions with normal operation 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.

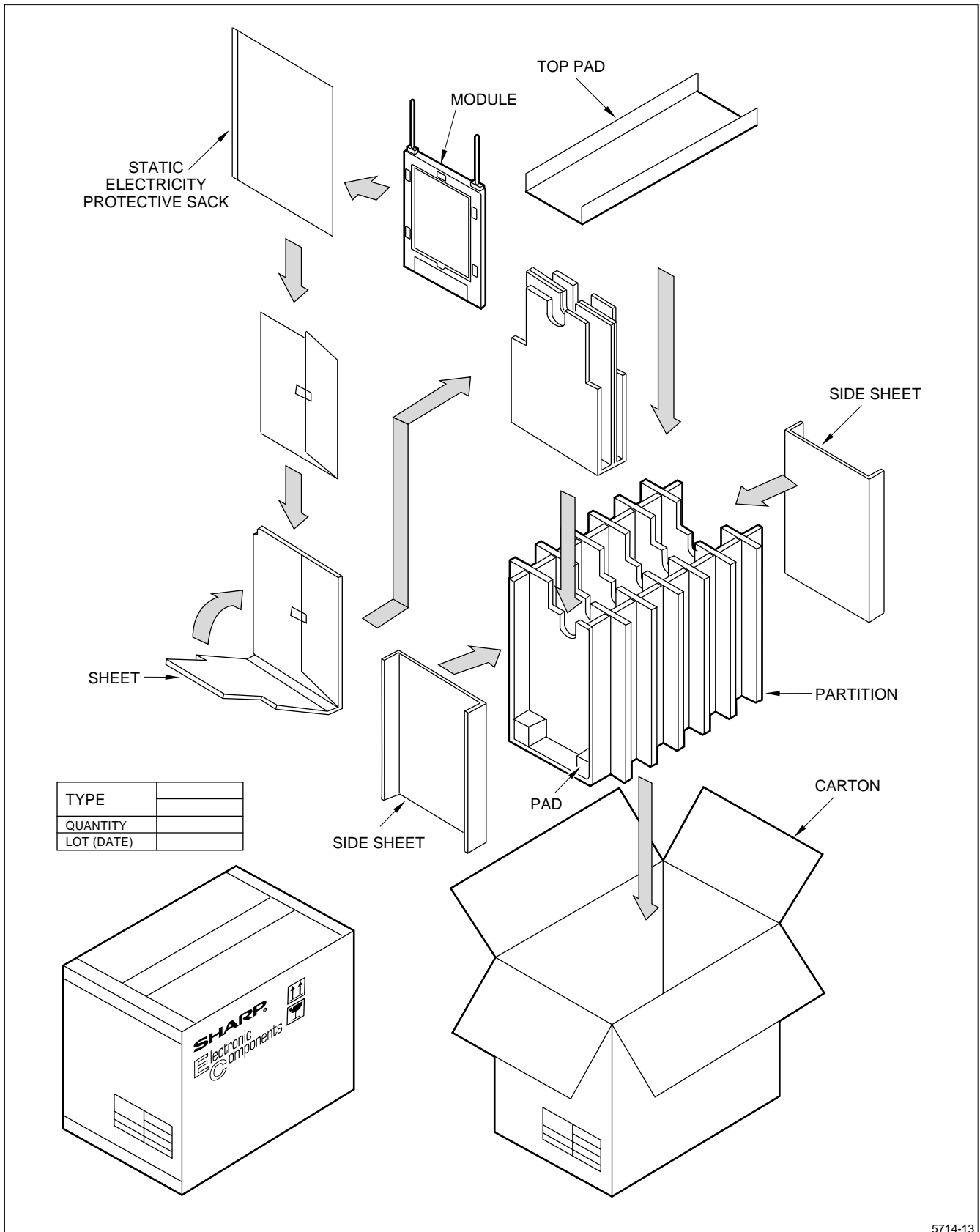
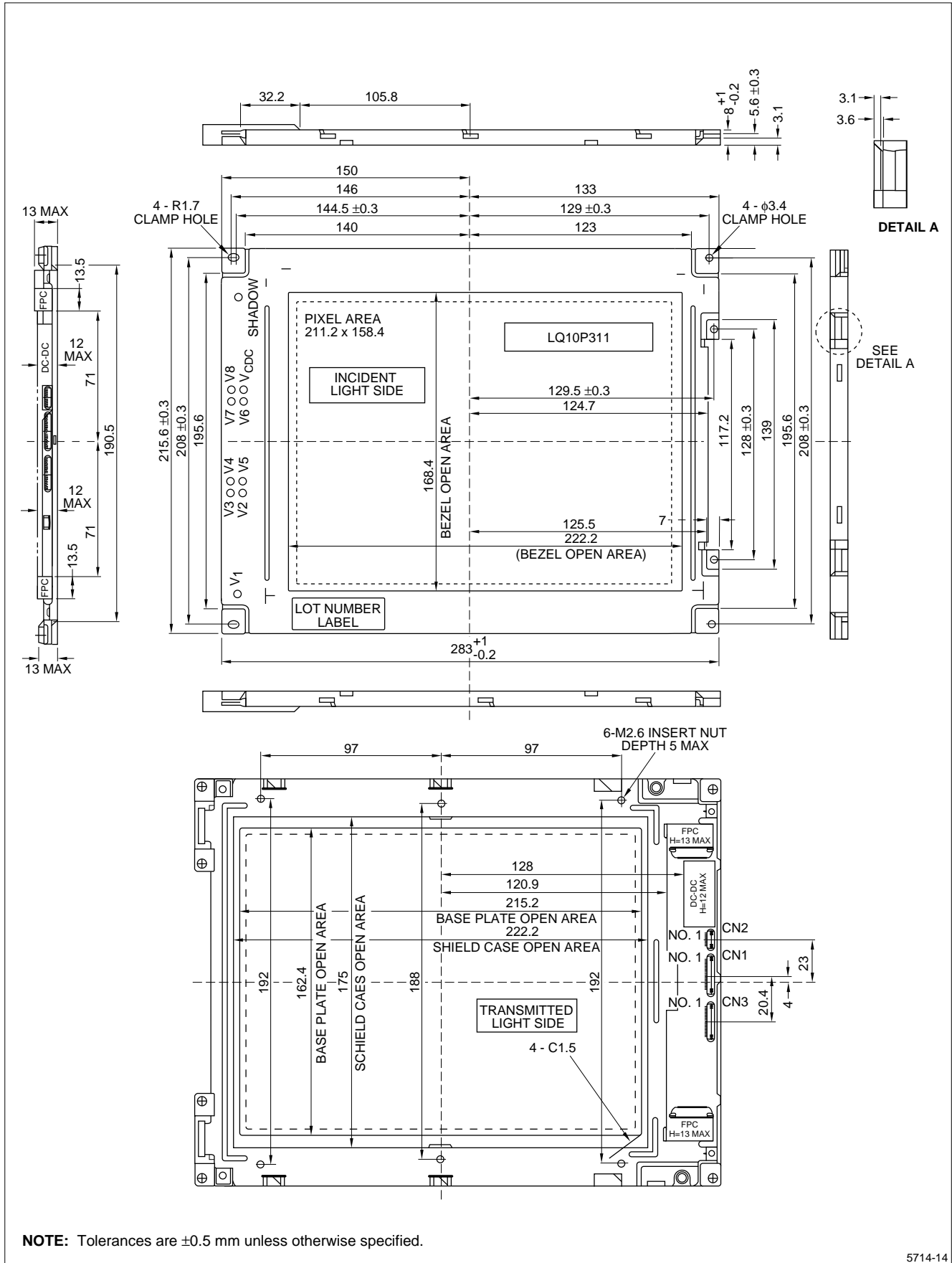


Figure 13. Packing Form

OUTLINE DIMENSIONS



NOTE: Tolerances are ±0.5 mm unless otherwise specified.

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