

FEATURES

- Display Diagonal: 10.4"
- Display Format: 640 × 480
- Overall Dimensions:
283.0 (W) × 217.0 (H) × 20.7 (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
- Bits Per Color: 3
- Backlight: CCFT 6 Tube Backlit

DESCRIPTION

The SHARP LQ10DH15 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 × 3 × 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. 400-line and 350-line modes, in addition to the 480-line mode, can also be applied. 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.

MECHANICAL SPECIFICATIONS

PARAMETER	SPECIFICATIONS	UNIT
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) × 217 (H) × 20.7 (D)	mm
Weight	950 maximum	g
Surface Treatment	Anti-Glare and Hard-Coating 2H	–

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	CONDITION	RATINGS	UNIT	NOTE
V _I	Input Voltage	t _A = 25°C	–0.3 to V _{CC} +0.3	V	1
V _{CC}	+5 V Supply Voltage		–0.3 to +7	V	–
V _{DD}	+12 V Supply Voltage		–0.3 to +14	V	–
T _{stg}	Storage Temperature	–	–25 to +60	°C	2
T _{opa}	Operating Temperature – Ambient	–	0 to +40	°C	
T _{opp}	Operating Temperature – Panel	–	0 to +60	°C	

NOTES:

1. CK, R0 – R2, G0 – G2, B0 – B2, Hsync, Vsync, ENAB.
2. Humidity: 95% RH maximum at t_A ≤ 40°C. Normal humidity: 80% RH maximum at t_A > 40°C.
No condensation.

INPUT TERMINALS – TFT-LCD PANEL DRIVING SECTION

CN1 (Interface Signal)

PIN NUMBER	SYMBOL	FUNCTION	POLARITY	NOTE
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	–	2
17	V _{CC}	+5 V Power Supply (for Logic, LCD Drive)	–	–
18	Vsync	Vertical Sync Signal	–	2
19	V _{DD}	+12 V Power Supply (for LCD Drive)	–	–
20	GND	–	–	–
21	–	This is Electrically Opened During Operation	–	–
22	ENAB	Data Enable Signal (To Settle the Viewing Area)	Positive	–

NOTES:

- Connector used: DF11-22P-2DSA(01) (Hirose Electric Co., Ltd.)
Mating connector: DF11-22DS-2C (Hirose Electric Co., Ltd.)
- Polarity of the sync signals:

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

INPUT TERMINALS – BACKLIGHT DRIVING SECTION**CN2 (Up Side) ¹**

PIN NO	SYMBOL	FUNCTION
1	V _{LO}	Power Supply for Lamp (Low-Voltage Side)
2	NC	–
3	NC	–
4	V _{L1}	Power Supply for Lamp (High-Voltage Side)
5	NC	–
6	V _{L2}	Power Supply for Lamp (High-Voltage Side)
7	NC	–
8	V _{L3}	Power Supply for Lamp (High-Voltage Side)

NOTE:

- Connector used: 5102-08 (Molex)
Mating connector: 5045-08A (Molex)

CN3 (Down Side) ¹

PIN NO	SYMBOL	FUNCTION
1	NC	–
2	NC	–
3	NC	–
4	V _{L4}	Power Supply for Lamp (High-Voltage Side)
5	NC	–
6	V _{L5}	Power Supply for Lamp (High-Voltage Side)
7	NC	–
8	V _{L6}	Power Supply for Lamp (High-Voltage Side)

NOTE:

- Connector used: 5102-08 (Molex)
Mating connector: 5045-08A (Molex)

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	–
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	$V_I = 0\text{ V}$	–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 (at 480-line mode).
2. Maximum current situation produced with an all black pattern (at 480-line mode).

ELECTRICAL CHARACTERISTICS – BACKLIGHT ($t_A = 25^\circ\text{C}$)

Backlight unit is composed with six pieces of CCFT.

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
V_L	Lamp Voltage	Just for Reference	260	290	320	V_{RMS}	–
I_L	Lamp Current	Just for Reference	6.3	7.0	7.7	mARMS	–
P_L	Lamp Power Consumption	–	–	2.0	–	W	1
F_L	Frequency	–	20	–	40	kHz	2
V_S	Kick-Off Voltage	$t_A = 25^\circ\text{C}$	–	–	560	V_{RMS}	–
T_L	Lamp Lifetime	–	10,000	–	–	Hour	3

NOTES:

1. Calculated value for reference ($I_L \times V_L$).
2. 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.
3. Brightness becomes 50% of the original brightness (in rating continuous lighting at $t_A = 25^\circ\text{C}$).

TIMING CHARACTERISTICS OF INPUT SIGNALS ¹

SYMBOL	PARAMETER	MODE	MIN.	TYP.	MAX.	UNIT
1/t _c	Clock Frequency	All	–	25.175	28.322	MHz
t _{CH}	Clock High Time	All	5	–	–	ns
t _{CL}	Clock Low Time	All	10	–	–	ns
t _{DS}	Data Setup Time	All	0	–	–	ns
t _{DH}	Data Hold Time	All	10	–	–	ns
t _{ES}	Enable Signal Setup Time	All	0	–	–	ns
t _H	Horizontal Sync Signal Cycle	All	–	31.78	–	μs
		All	770	800	900	Clock
t _{HP}	Horizontal Sync Signal Pulse Width	All	–	96	–	Clock
t _V	Vertical Sync Signal Cycle	480	–	16.7/525	–	ms/Line
		400	–	14.3/449	–	ms/Line
		350	–	14.3/449	–	ms/Line
t _{VP}	Vertical Sync Signal Pulse Width	All	–	2	–	Line
t _{HS}	Horizontal Signal Display Start	All	–	144	–	Clock
t _{HD}	Horizontal Signal Display Period	All	–	640	–	Clock
t _{VS}	Vertical Sync Signal Display Start	480	–	34	–	Line
		400	–	34	–	Line
		350	–	61	–	Line
t _{VD}	Vertical Sync Signal Display Period	480	–	480	–	Line
		400	–	400	–	Line
		350	–	350	–	Line
t _{VF}	Hsync-Vsync Phase Difference – Front	All	0	–	–	ns
t _{VB}	Hsync-Vsync Phase Difference – Back	All	–10	–	–	ns

NOTE:

1. Make sure that timing of the signals are within the specifications to ensure right display position and display quality.

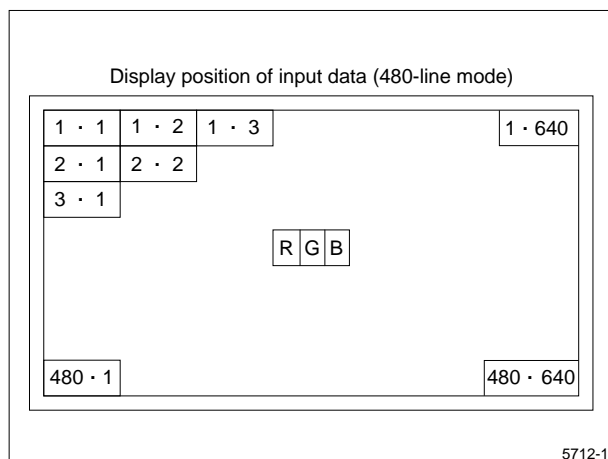
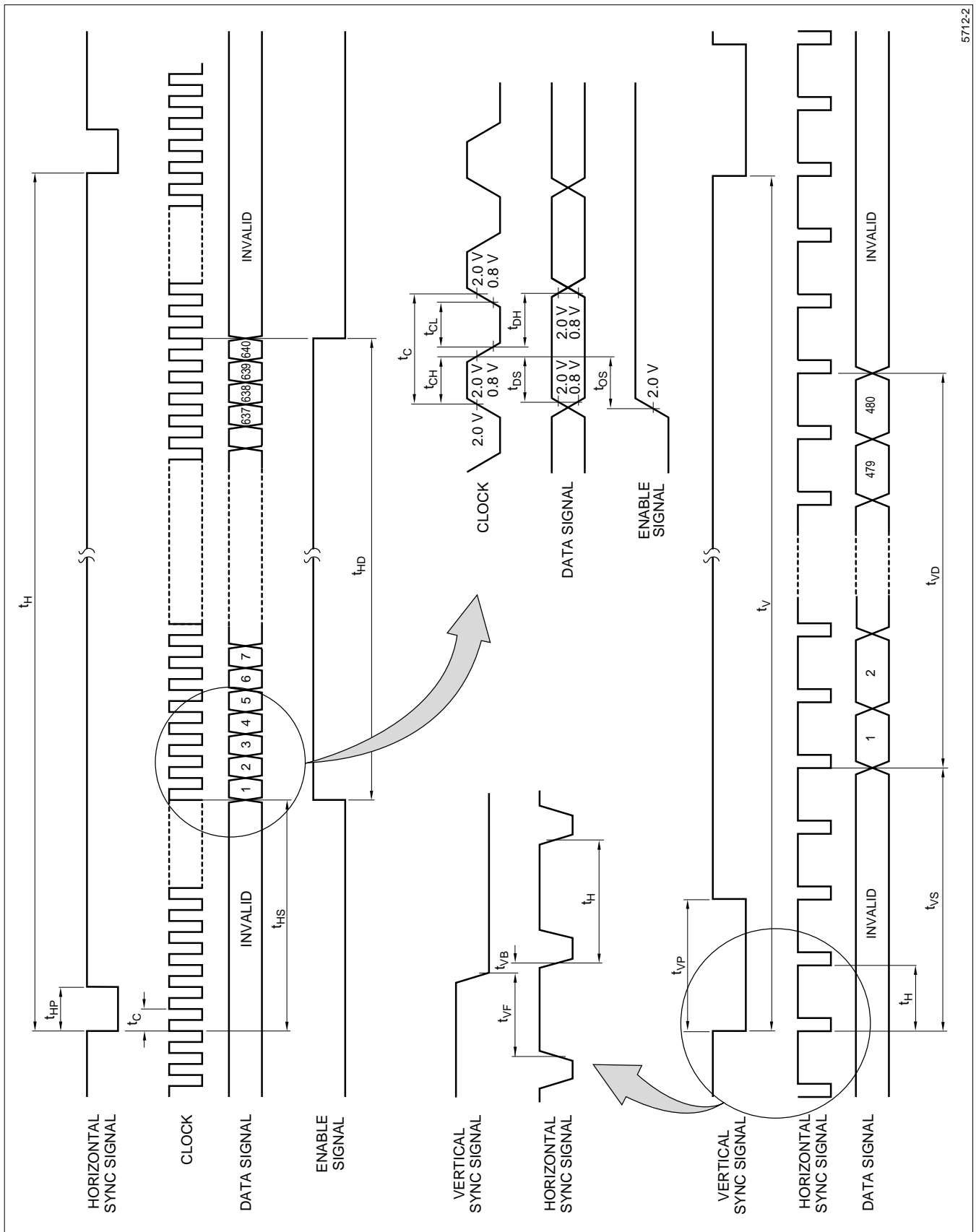
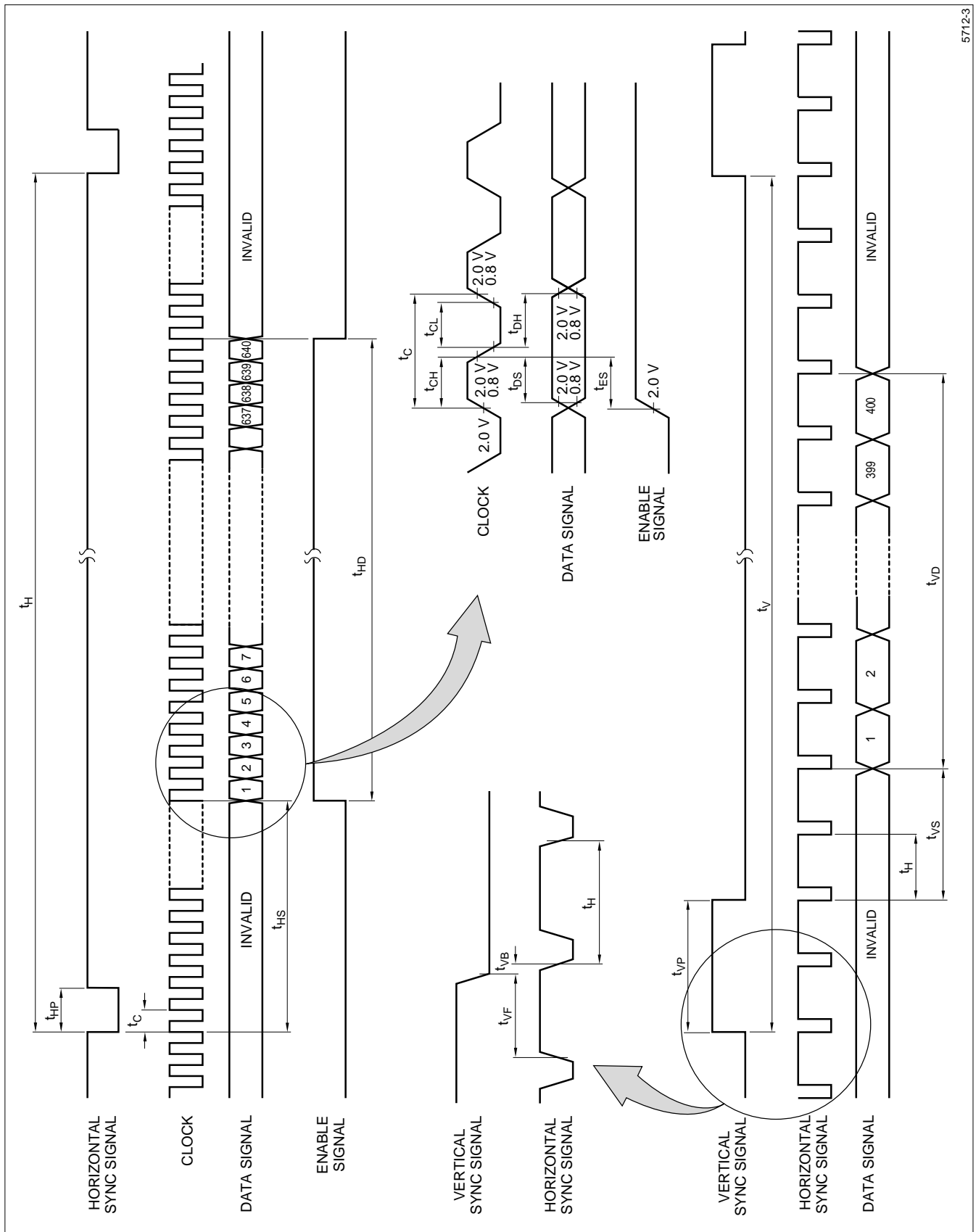


Figure 1. Input Signals and Display on the Screen



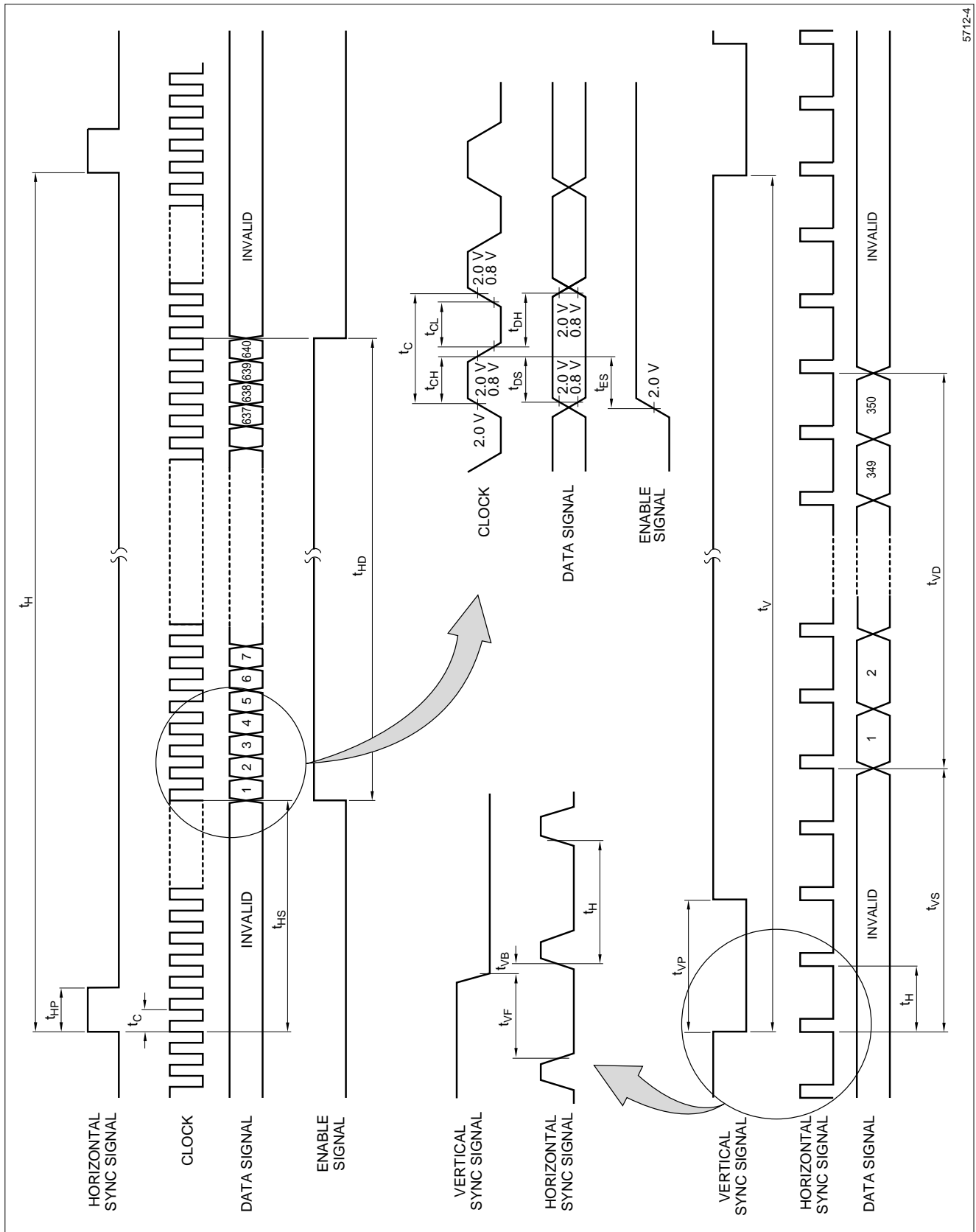
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Figure 2. Input Signal Waveforms (480-Line Mode)



5712-3

Figure 3. Input Signal Waveforms (400-Line Mode)



5712-4

Figure 4. Input Signal Waveforms (350-Line Mode)

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

COLOR AND GRAY SCALE		DATA SIGNAL								
		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:

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

OPTICAL CHARACTERISTICS ($t_A = 25^\circ\text{C}$, $V_{CC} = +5.0\text{ V}$, $V_{DD} = +12.0\text{ V}$)

SYMBOL	PARAMETER	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
$\theta_{21.22}$	Horizontal Viewing Angle Range	CR > 10	45	–	–	degrees	1
θ_{11}	Vertical Viewing Angle Range		10	–	–		
θ_{12}			30	–	–		
CR	Contrast Ratio	Optimum Viewing Angle	60	–	–	–	2
t_R	Response Time – Rise	$\theta_{12} = 15^\circ$	–	30	–	ms	3
t_D	Response Time – Decay		–	50	–	ms	
x	Chromaticity of White	$\theta = 0^\circ$	–	0.290	–	–	4
y			–	0.315	–	–	
Y_L	Luminance of White		60	100	–	nt	

NOTES:

- Figure 5 shows the definitions of the viewing angle range.
- 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 6 by switching the input signals for 'black' ON and OFF.
- Measurements shall be taken at the center of the screen (as shown in Figure 7).

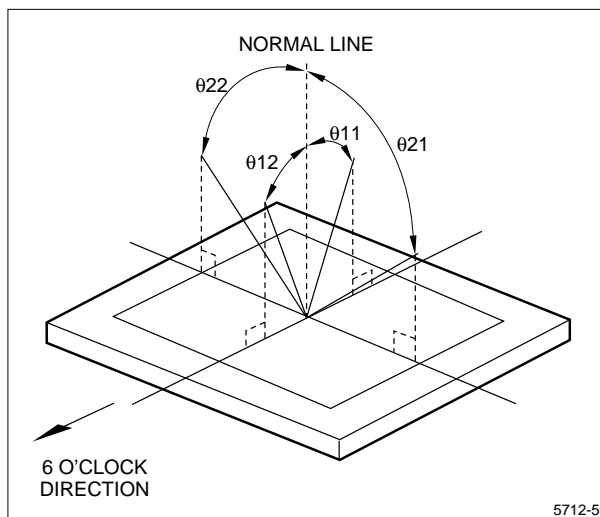


Figure 5. Definition of Viewing Angle

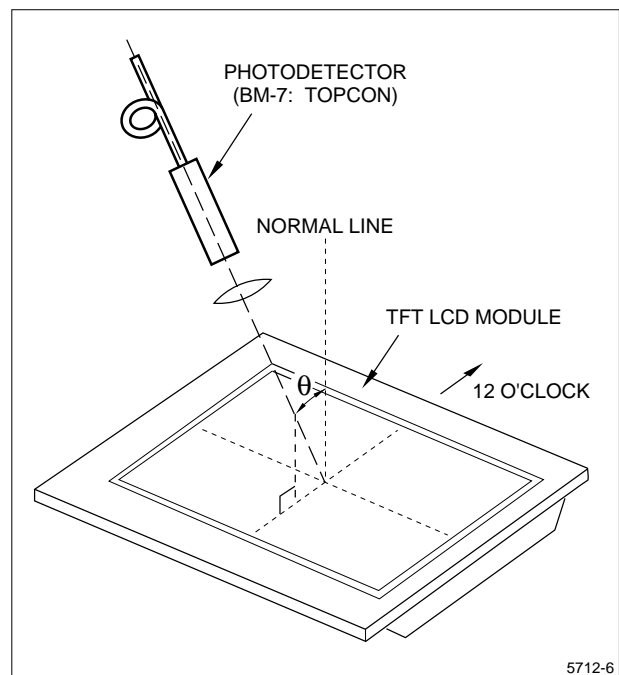


Figure 7. Optical Characteristics Measurement Method

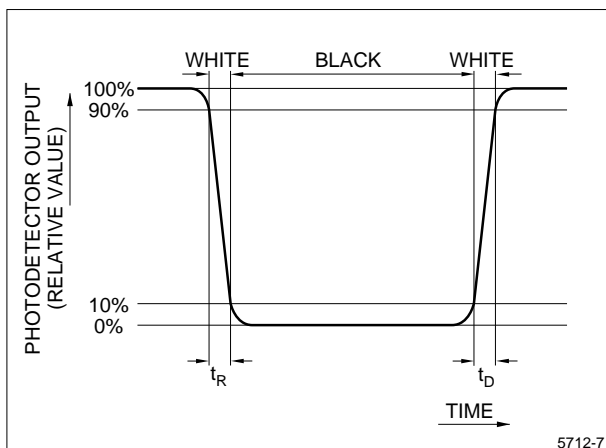


Figure 6. Definition of Response Time

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 8.
- 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 attached to the front of the module to protect the LCD panel.
- Since the front polarizer is easily damaged, use care to not scratch the face.
- Wipe liquid off immediately since it can cause color changes or staining.
- If the surface of the LCD needs cleaning, wipe it with a soft cloth.
- 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 discharge.
- Cables for the backlight unit should be as short as possible. Use high-voltage cable (600 V max) and do not bundle both high and low lines.
- 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.

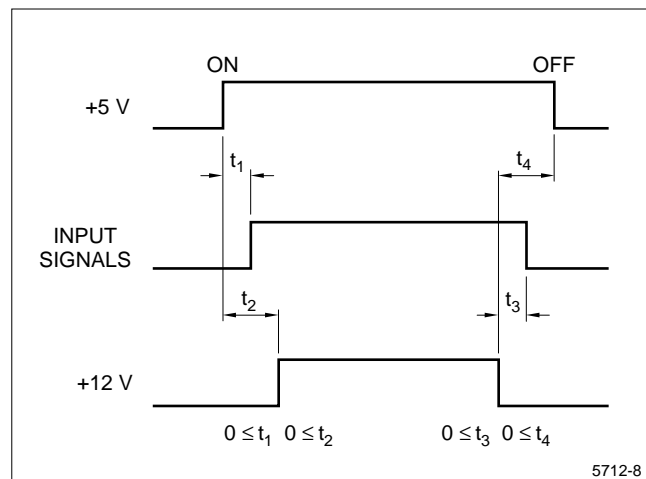


Figure 8. Power ON/OFF Sequential Timing

PACKING SPECIFICATIONS

Refer to the Packing Form shown in Figure 9.

- Piling number of cartons: 8 (MAX)
- Package quantity in one carton: 10 (MAX)
- Carton size: Refer to Figure 9

RESULT EVALUATION CRITERIA

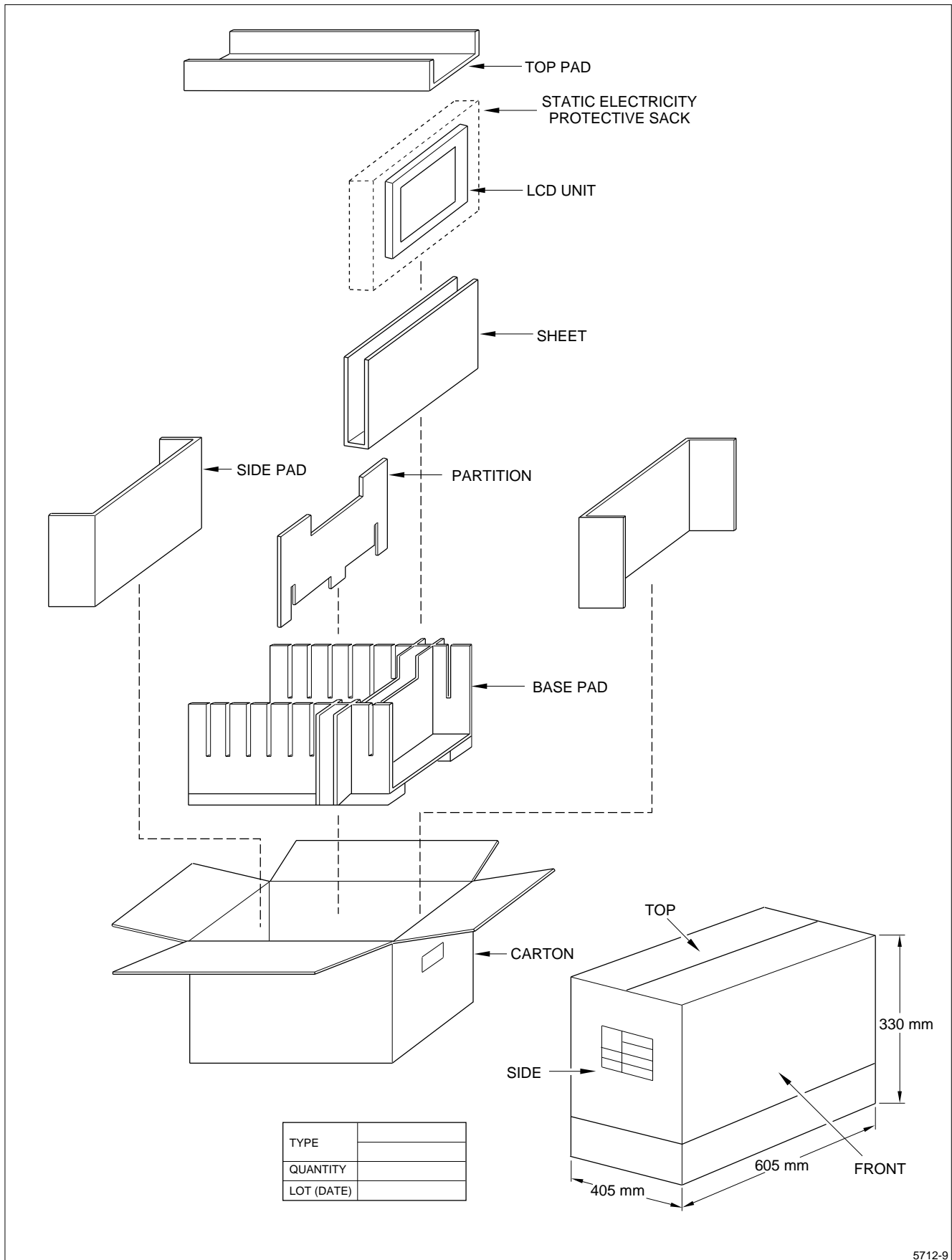
Under the display quality test conditions with normal operation state, there shall be no change which may affect practical display function.

OTHER INFORMATION

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

RELIABILITY TEST ITEMS

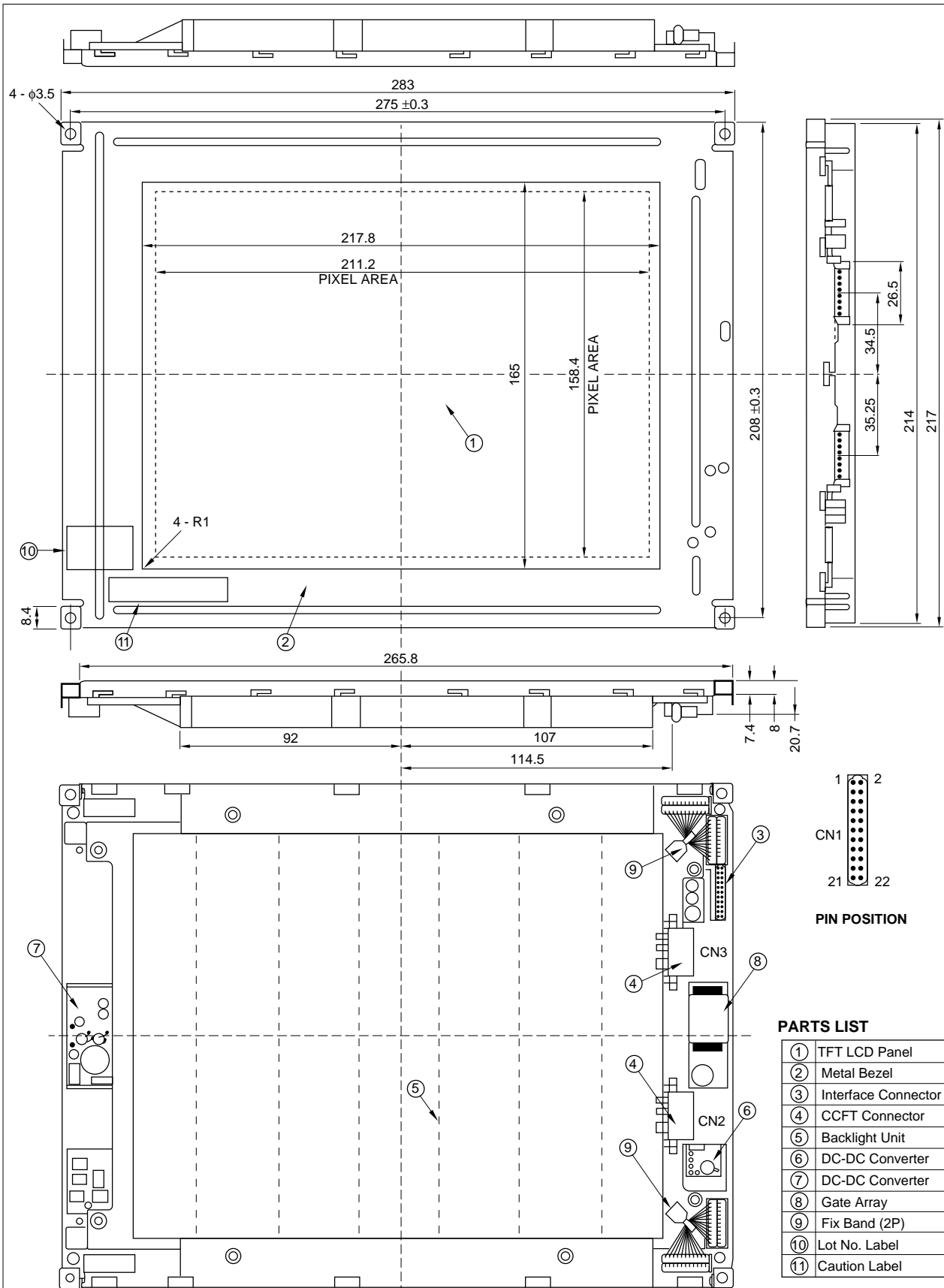
NUMBER	TEST ITEM	CONDITIONS
1	High Temperature Storage Test	$t_A = 60^\circ\text{C}$, 240 H
2	Low Temperature Storage Test	$t_A = -25^\circ\text{C}$, 240 H
3	High Temperature and High Humidity Operation Test	$t_A = 40^\circ\text{C}$, 95% RH, 240 H (No condensation)
4	High Temperature Operation Test	$t_A = 40^\circ\text{C}$, 240 H (The panel temperature must be less than 60°C)
5	Low Temperature Operation Test	$t_A = 0^\circ\text{C}$, 240H
6	Vibration Test (Non-Operating)	Frequency: 10 to 57 Hz/Vibration width (one side): 0.075 mm 58 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: $\pm X/\pm Y/\pm Z$, once for each direction



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Figure 9. Packing Form

OUTLINE DIMENSIONS



NOTE: Tolerances are ±0.5 unless otherwise specified.

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