Product Specification

E215HVN-A02

☐ Preliminary Specifications

■ Final Specifications

Module	21.5” High Brightness TFT-LCD
Model Name	E215HVN-A02
Document Version	Rev.01

Customer	
Approved by	Date
Notice: This Specification is subject to change without notice.	

Approved By	Prepared By
	

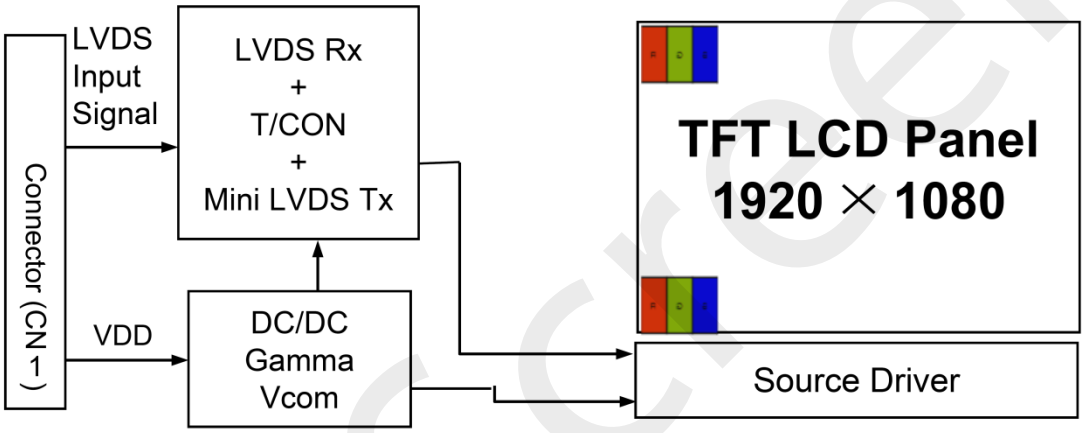
Contents

Revised Record				
Version	Date	Revised Content/Summary	Page	Remark
01	2018/05/19	First Edition	All	

1. General Description

1.1 Display Characteristics

E215HVN-A02 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 21.5 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- LVDS Interface with 2 pixel / clock
- High-speed response
- 0.5t Glass
- 6-bit (Hi-FRC) color depth, display 16. 7M colors
- Incorporated edge type back-light (One Light Bar)
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only
- RoHS/Halogen Free
- ES 7.0 compliant
- Gamma Correction
- Reverse type

1.3 Application

- RoHS/Halogen Free
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller

1.4 General Specification

The followings are general specifications at the model E215HVN-A02.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	476.064(H) × 267.786(V)	mm	
Number of pixels	1920(H) × 1080(V)	pixels	
Pixel pitch	0.24795(H) × 0.24795(V)	mm	
Pixel arrangement	RGB Vertical stripe	–	
Display colors	16.7M	colors	
Display mode	Normally Black	–	
Dimensional outline	495.6(H) × 292.2(V) × 10.7(D) type.	mm	Detail refer to drawing
Weight	1.97	Kg	
Bezel width(L/R/U/D)	1.9/7.9/10.5/10.5	mm	
Surface Treatment	Anti-glare,3H	–	
Back-light	Lower side 1-LED Light bar Type	–	

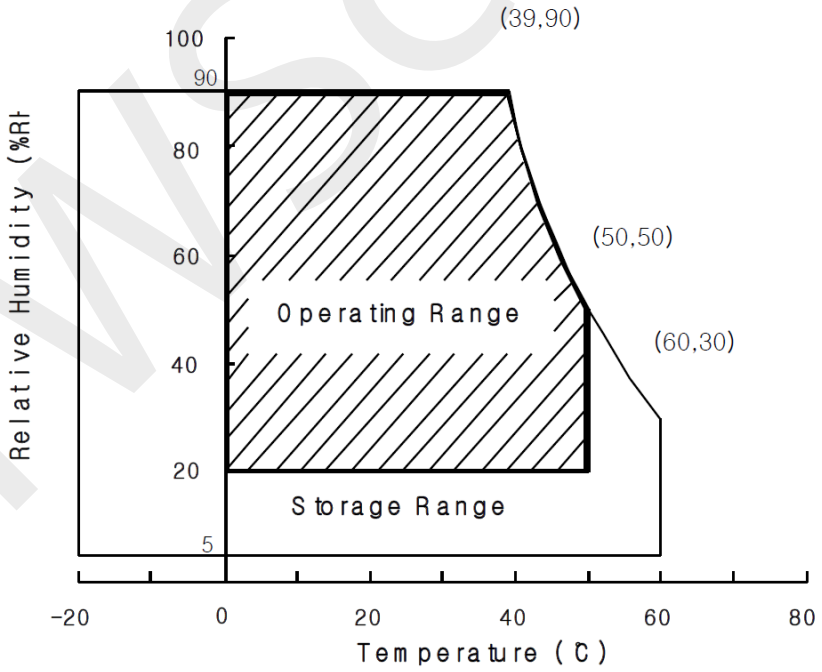
2. ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings> [VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	5.5	V	Ta = 25 ℃
Logic Supply Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	V	
Operating Temperature	T_{OP}	0	+50	℃	1)
Storage Temperature	T_{ST}	-20	+60	℃	1)

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 °C max. and no condensation of water.



3. ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	4.5	5.0	5.5	V	**Note1**
Power Supply Current	I_{DD}	-	500	1200	mA	
In-Rush Current	I_{RUSH}	-	2.0	3	A	**Note 2**
Permissible Input Ripple Voltage	V_{RF}	-	-	300	mV	**V_{DD} = 5.0V**
High Level Differential Input Threshold Voltage	V_{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	-	-	mV	
Differential input voltage	$\|V_{ID}\|$	200	-	600	mV	
Differential input common mode voltage	Vcm	1.0	1.2	1.5		V_{IH}=100mV, V_{IL}=-100mV
Voltage of LED Backlight	V_{BL}	-	29	-	V	
Current of LED Backlight	I_{BL}	-	870	-	mA	
LED Lifetime		50,000	-	-	Hrs	I_L=870 mA, **Note 3**
Power Consumption	P_D	-	2.5	6	W	
	P_{BL}	-	25.23	-	W	I_L=870mA,
	P_{total}	-	27.73	-	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VDD=5.0V, Frame rate=75Hz. Test Pattern of power supply current
a) Typ : Color Bar pattern
b) Max : Gray level 255 pattern

2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %
3. Definition of life time:
a) Brightness of LED becomes to 50% of its original value
b) Test condition: I_L =**87**0mA and 25℃ (Room Temperature)

4. OPTICAL SPECIFICATIONS

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCONE PR730) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0 . We refer to $\theta_{Ø=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{Ø=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{Ø=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{Ø=270}$(= θ_6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 5.0V +/-10% at 25 C. Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 78MHz, I_{BL} = 780mA, Ta =25±2 ℃]

< Table 4. Module Optical >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle	700	1000			Note 2
Luminance of White		Y_w		800	1000	-	cd/m²	Note 3
White luminance uniformity		ΔY		75	-	-	%	Note 4
Reproduction of color	White	W_x		0.283	0.313	0.343	-	Note 5
		W_y		0.299	0.329	0.359	-	
	Red	R_x		0.608	0.638	0.668	-	
		R_y		0.327	0.357	0.387	-	
	Green	G_x		0.284	0.314	0.344	-	
		G_y		0.608	0.638	0.668	-	
	Blue	B_x		0.122	0.152	0.182	-	
		B_y		0.038	0.068	0.098	-	
Response Time	GTG	T_g			14	20	ms	Note 6
Cross Talk		CT		-	-	2.0	%	Note 7

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of = 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIGURE 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
4. The White luminance uniformity on LCD surface is then expressed as : ΔY = (Minimum Luminance of 9points / Maximum Luminance of 9points) * 100 (See FIGURE 2 shown in Appendix).
5. The color chromaticity coordinates specified in Table 4. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
6. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =60Hz to optimize.
   Each time in below table is defined as appendix Figure 3and shall be measured by switching the input signal for "any level of gray(bright)"and "any level of gray(dark)".

Measured Response Time		Target																
		0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
Start	0																	
	15																	
	31																	
	47																	
	63																	
	79																	
	95																	
	111																	
	127																	
	143																	
	159																	
	175																	
	191																	
	207																	
	223																	
	239																	
	255																	

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) of that same area when any adjacent area is driven dark. (See FIGURE 4 shown in Appendix).

5. INTERFACE CONNECTION

5.1 Electrical Interface Connection

Module Side Connector : UJU IS100-L30R-C23or Equivalent
User Side Connector : JAE FI-X30H or Equivalent

Pin No	Symbol	Function	Remark
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	BIST	Bist function	Note1
8	RXOC-	Negative Transmission Clock (ODD)	
9	RXOC+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Power Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GND	Power Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXEC-	Negative Transmission Clock (EVEN)	
21	RXEC+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Power Ground	Note 2
25	CTL	*Reserved for LCD manufacturer's(CTL_DVR)	
26	CE	*Reserved for LCD manufacturer's(CE_DVR)	
27	NC		
28	VDD	Power Supply: +5V	
29	VDD		
30	VDD		

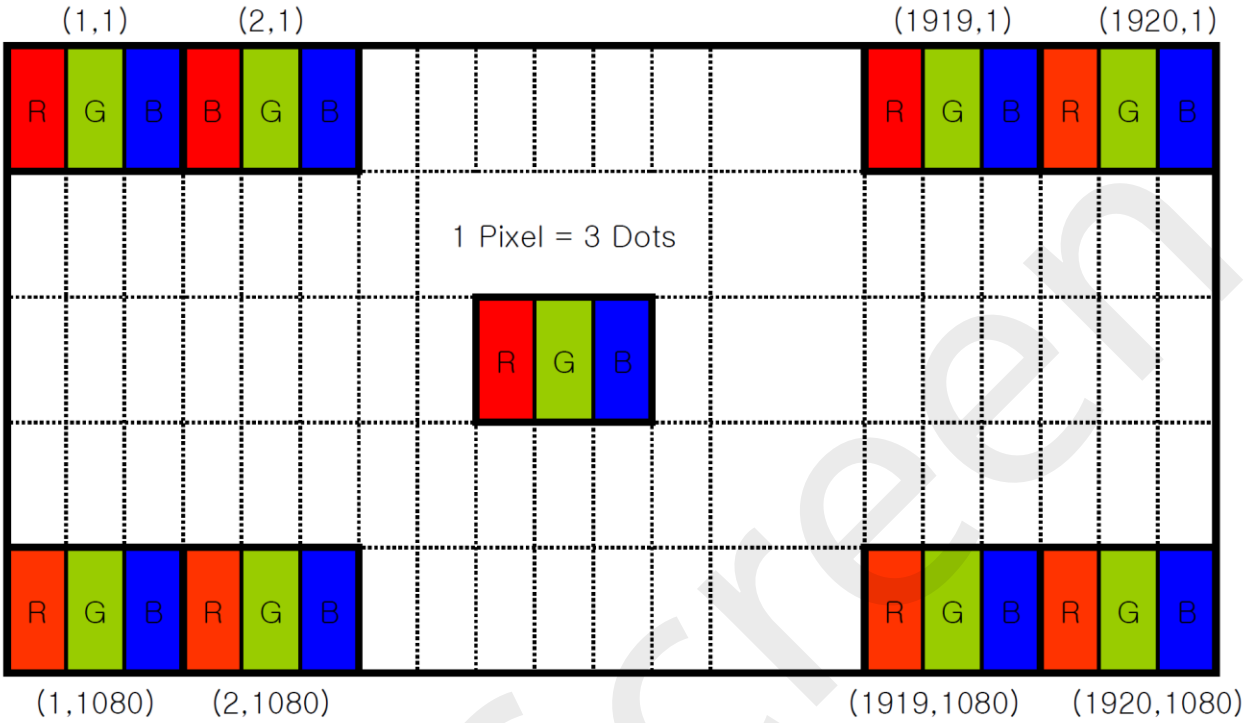
Note 1 : H: White-Black-Red-Green-Blue Pattern Aging, L:Black pattern , when no LVDS signal
Note2: This pin should be connected with GND.

5.2 LVDS Interface (Tx; THC63LVDF83A or Equivalent)

5.2.1 LVDS Interface

	Input Signal	Transmitter		Interface		MV215FHB-N30 (CN11)	Remark
		Pin No.	Pin No.	System (Tx)	TFT-LCD (Rx)	Pin No.	
LVDS	OR0	51	48 47	OUT0- OUT0+	RXO0- RXO0+	1 2	
	OR1	52					
	OR2	54					
	OR3	55					
	OR4	56					
	OR5	3					
	OG0	4					
	OG1	6	46 45	OUT1- OUT1+	RXO1- RXO1+	3 4	
	OG2	7					
	OG3	11					
	OG4	12					
	OG5	14					
	OB0	15					
	OB1	19					
	OB2	20	42 41	OUT2- OUT2+	RXO2- RXO2+	5 6	
	OB3	22					
	OB4	23					
	OB5	24					
	Hsync	27					
	Vsync	28		CLK	RXO		
	DE	30					
	MCLK	31	40 39	OUT- CLK	CLK- RXO	8 9	
	OR6	50	38 37	OUT+	CLK+	10 11	
	OR7	2					
	OG6	8		OUT3- OUT3+	RXO3- RXO3+		
	OG7	10					
	OB6	16					
	OB7	18					
	RSVD	25					

5.3 Data Input Format



Display Position of Input Data (V-H)

6. SIGNAL TIMING SPECIFICATION

6.1 The E215HVN-A02 is operated by the DE only

Item	Symbols		Min	Typ	Max	Unit
DCLK	Period	tCLK	11.1	13.47	16.7	ns
	Frequency	-	60	74	90	MHz
Horizontal Display Term	Period	tHP	1050	1100	1120	tCLK
	Horizontal Valid	tHV	960	960	960	tCLK
	Horizontal Blank	tHB	90	140	160	tCLK
	Frequency	fH	64	67	83	KHz
Vertical Display Term	Period	tVP	1110	1125	1251	tHP
	Vertical Valid	tVV	1080	1080	1080	tHP
	Vertical Blank	tVB	30	45	171	tHP
	Frequency	fV	50	60	75	Hz
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%

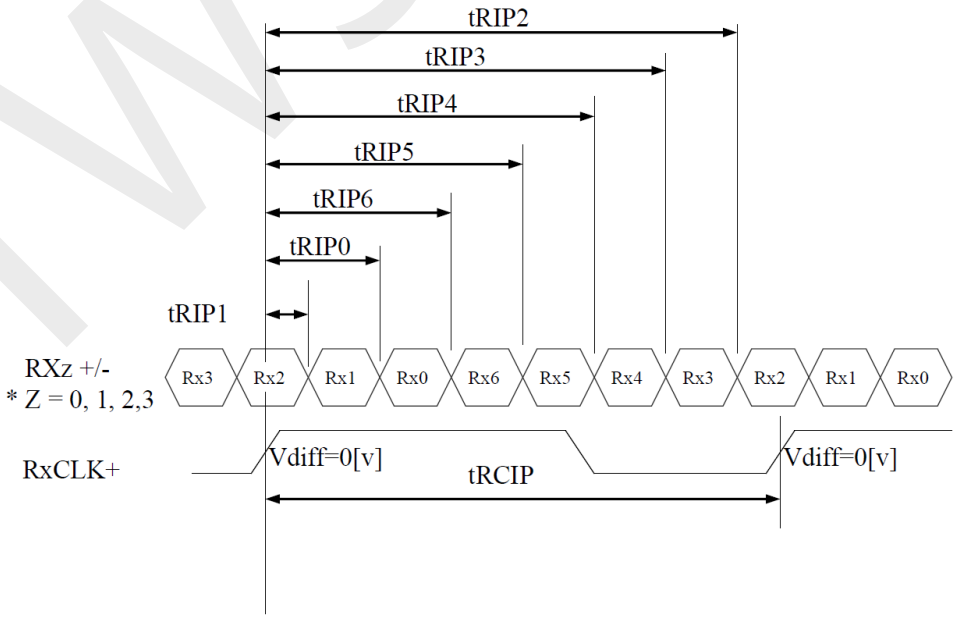
Note 1 : This DCLK range at last line of V-blanking should be set in 0~987.

6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 5.

<Table 5. LVDS Rx Interface Timing Specification>

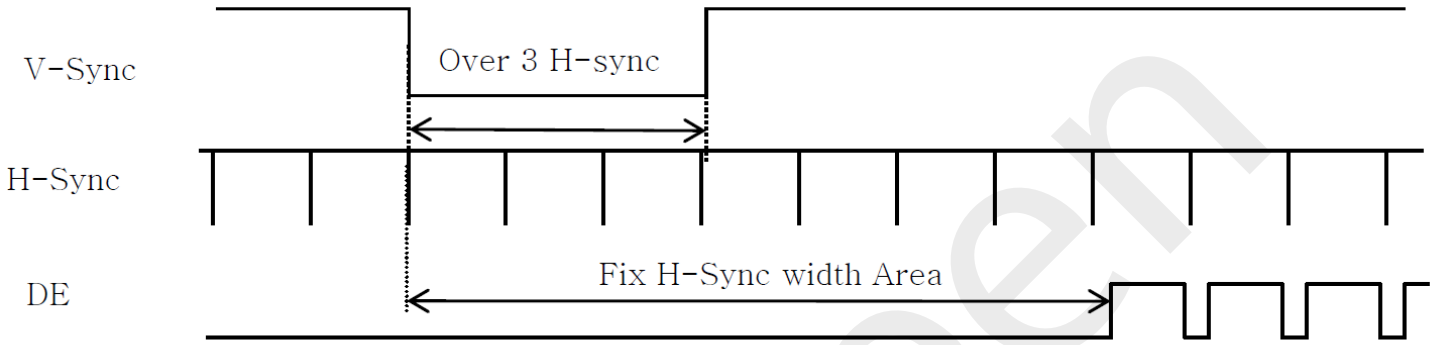
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	15.4	19.3	23.1	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.4	2 ×tRCIP/7	2 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.4	3 ×tRCIP/7	3 ×tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 ×tRCIP/7-0.4	4 ×tRCIP/7	4 ×tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 ×tRCIP/7-0.4	5 ×tRCIP/7	5 ×tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 ×tRCIP/7-0.4	6 ×tRCIP/7	6 ×tRCIP/7+0.4	nsec	



* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

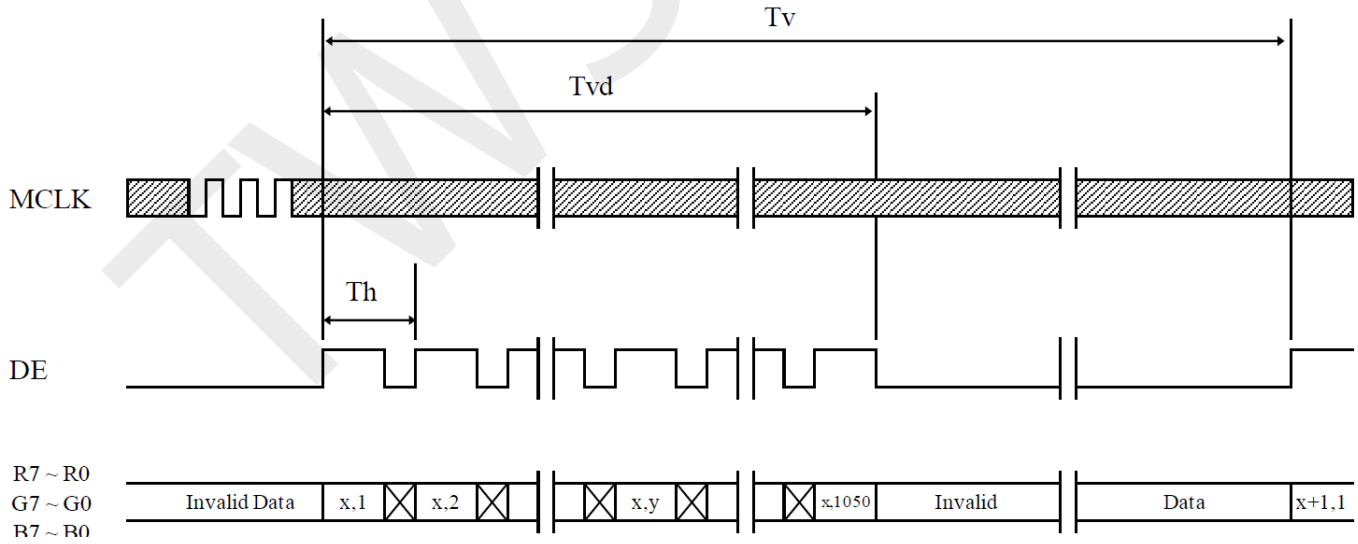
7. SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms

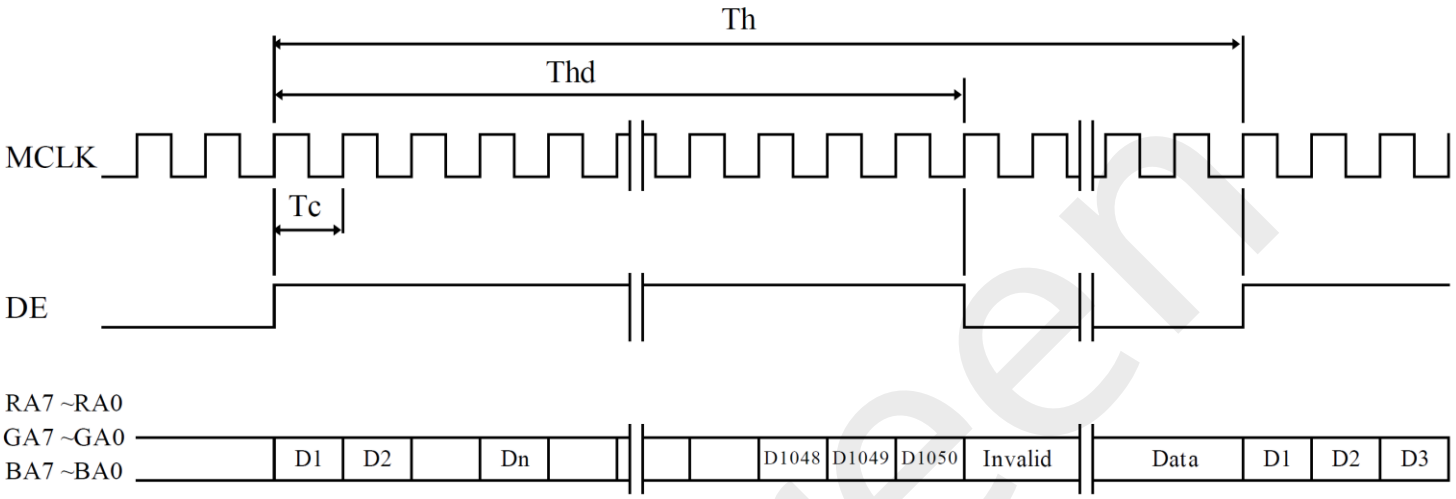


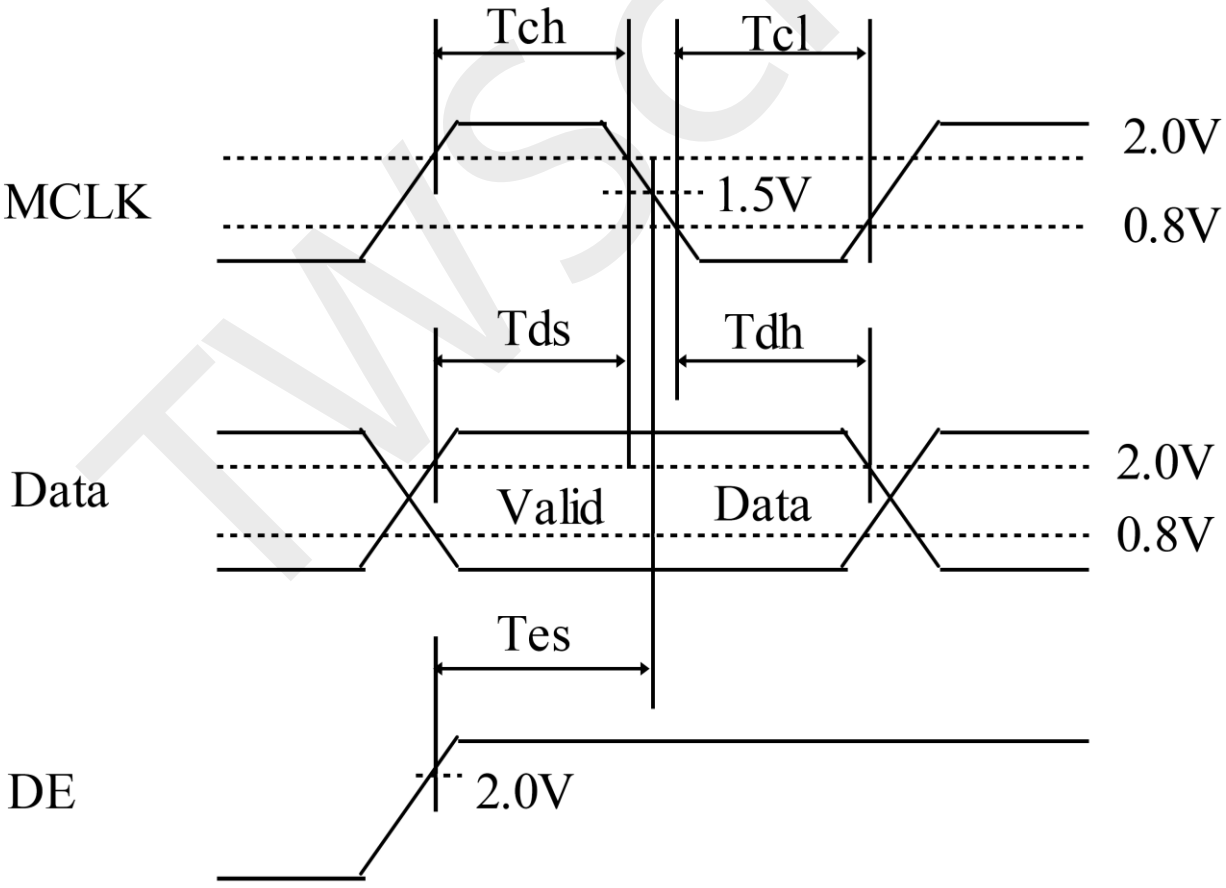
1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



7.3 Horizontal Timing Waveforms



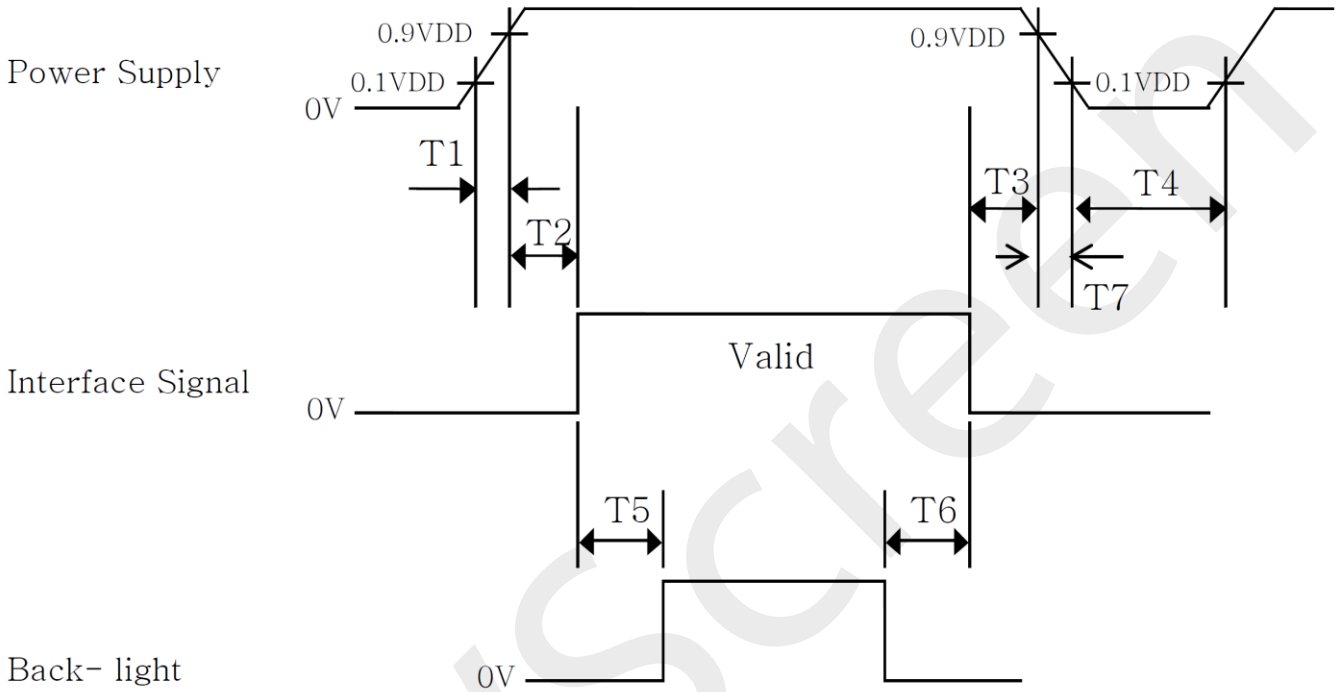


8. INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		RED DATA								GREEN DATA								BLUE DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	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	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
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of WHITE	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	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

9. POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



- 0.5 ms ≤ T1 ≤ 10 ms
- 0 ≤ T2 ≤ 50 ms
- 0 ≤ T3 ≤ 50 ms
- 1 sec ≤ T4
- 200 ms ≤ T5
- 200 ms ≤ T6

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.
5. During changing the resolution or mode changing, the logic power/ back-light/interface signal should be turned off as shown above; after the changing, power on as shown above.

10. MECHANICAL CHARACTERISTICS

10.1Dimensional Requirements

FIGURE 5 (located in Appendix) shows mechanical outlines for the model E215HVN-A02.
Other parameters are shown in Table 6.

<Table 6. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	495.6(H)×292.2(V)×10.7(D) type	mm
Weight	1.97	Kg
Active area	476.064(H) × 267.786(V)	mm
Pixel pitch	0.24795(H) x 0.24795(V)	mm
Number of pixels	1920(H)×1080(V) (1 pixel = R + G + B dots)	pixels
Back-light	Lower side 1-LED Light bar Type	

10.2 Mounting

See FIGURE 5 .（shown in Appendix）

10.3 Anti-Glare and Polarizer Hardness

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.

10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

11. APPENDIX

Figure 1. Measurement Set Up

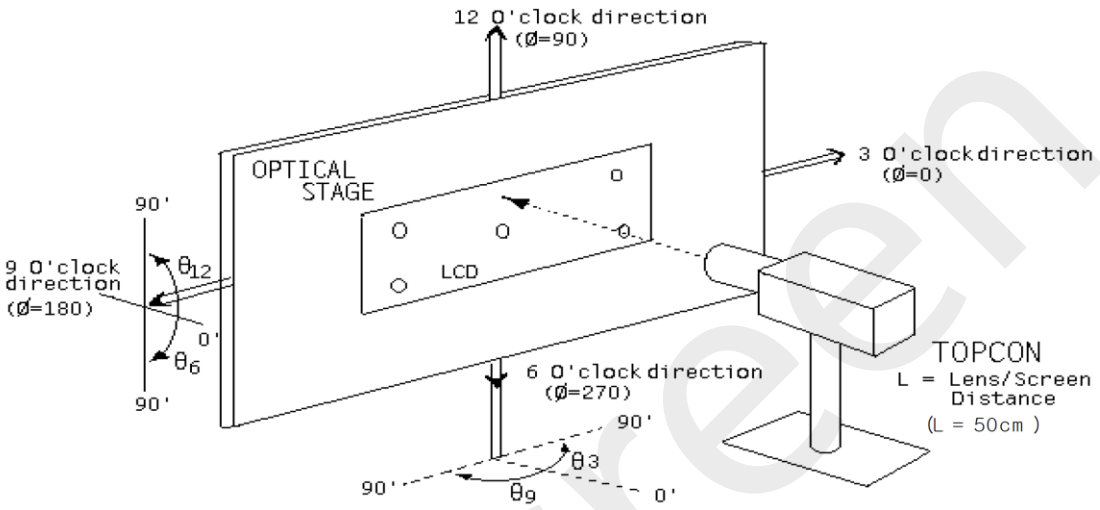


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

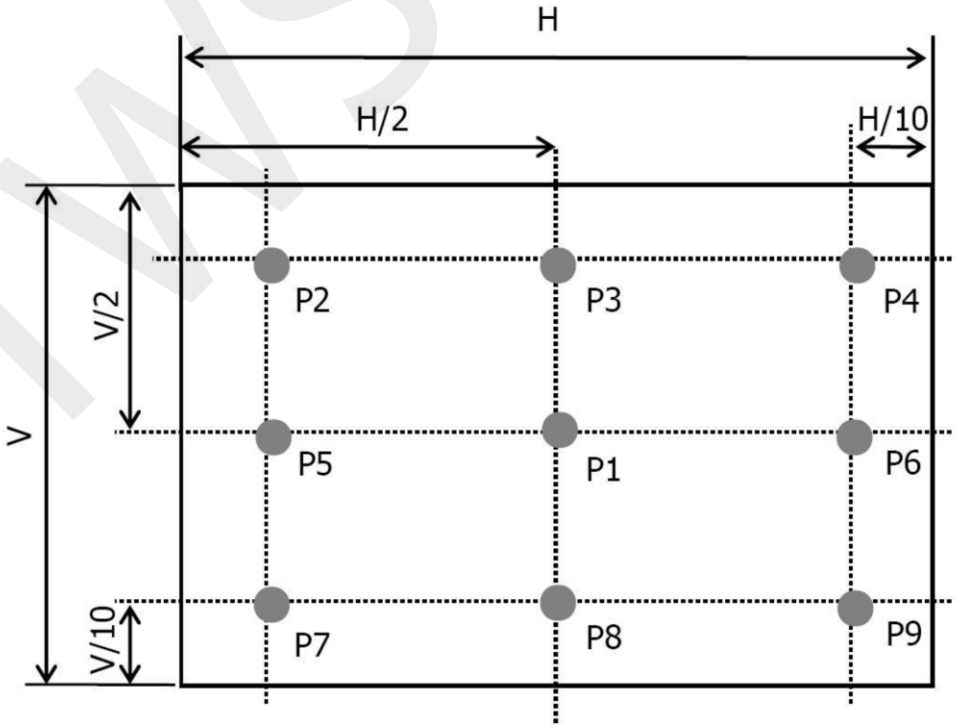
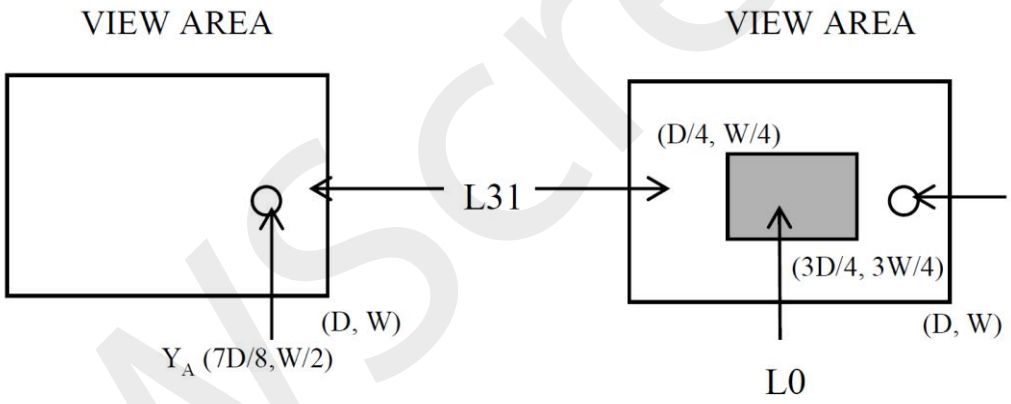


Figure 3. Response Time Testing

Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where: Y_A = Initial luminance of measured area (cd/m^2)

Y_B = Subsequent luminance of measured area (cd/m^2)

The location measured will be exactly the same in both patterns

Figure 5. TFT-LCD Module Outline Dimensions (Front view)

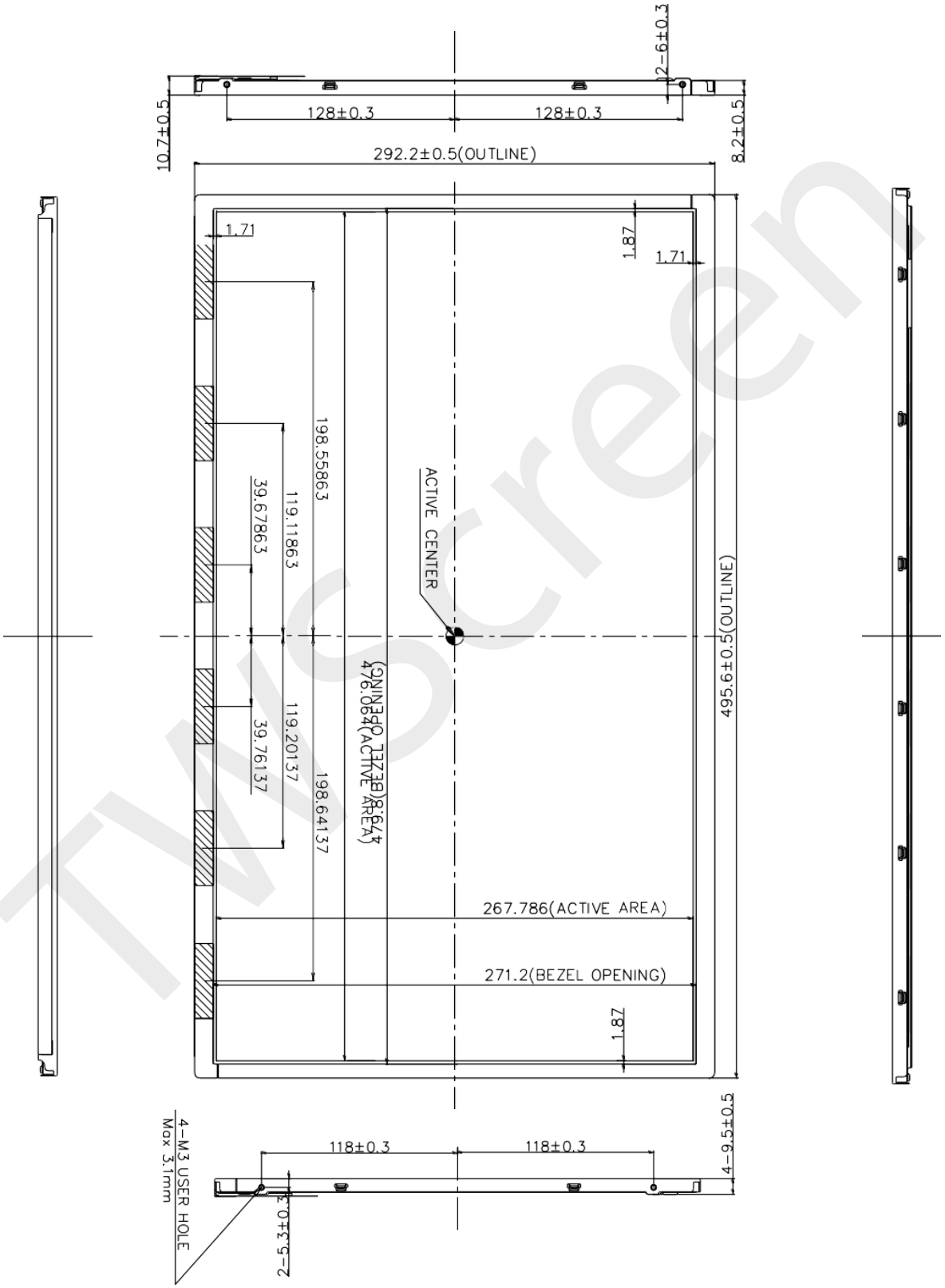
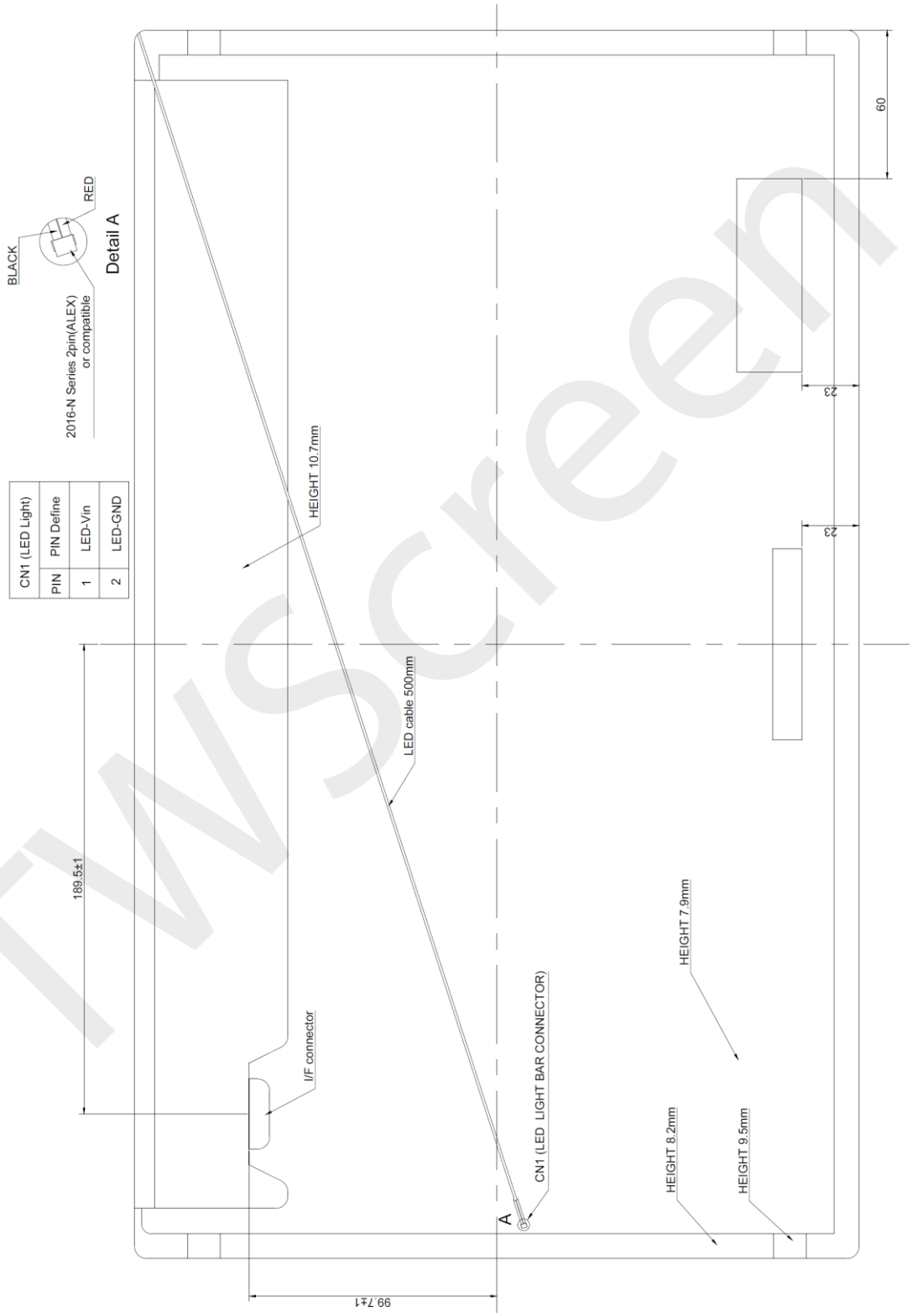


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)



Product Specification

DB-LB0C-09

☐ Preliminary Specifications
■ Final Specifications

Product	LED Driver Board
Model Name	DB-LB0C-09
Document Version	Rev.01

Customer

_____ _____

Approved by Date

_____ _____

Notice: This Specification is subject to change without notice.

Approved By	Prepared By
	

Contents

Revised Record				
Version	Date	Revised Content/Summary	Page	Remark
01	2018/05/19	First Edition	All	

1. General Description

This Product Specification is made to be the standard of Elite manufactured LED Driving Board such a standard will be followed in Taiwan Screen production, shipment, and quality inspection.

2. Feature

- 30W LED Driver
- Constant-Current Control
- Support PWM Dimming

3. Protection

Item	Max.	Remark
Over current protection (OCP)	Depending on LED B/L	
Over voltage protection (OVP)	56V(Note1)	

Note : When the LED string is opened, over voltage protection will limit the output to approximately 56V

4. Optional Backlight Driving Condition

Item	Symbol	Min.	TYP.	Max.	Unit	Remark
LED Voltage	V_{LED}		29		V	
LED Current	I_{LED}		870		mA	

5. Absolute maximum ratings

Parameter	Symbol	Min.	TYP	Max.	Unit	Remark
Input Voltage	Vin	10.8	12	15	V	
Output Voltage	Vout			50	V	
Output Current	Iout			1000	mA	

6. Interface Characteristics

Parameter	Symbol	Min.	TYP.	Max.	Unit	Remark
Backlight ON Voltage	INVON	1.25	5	Vin	V	
Backlight OFF Voltage	INVON			0.4	V	
PWM Control	PWM	3.3	5		V	
PWM Control Frequency	PWM	85	100		Hz	
PWM Control Duty	PWM	0		100	%	

7. Environmental

Item	Symbol	Conditions	MIN	MAX	Unit	Remark
Operating Temperature	Top	Ha=90%RH	0	60	℃	
Storage Temperature	Tstg	Ha=95%RH	-20	85	℃	

8. Connector Socket

8.1 Connector Type

Connector (J1)

Connector Name / Designation	For Signal Connector
Manufacturer	JST or compatible
Type / Part Number	S7B-PH-SM4-TB or compatible
Mating Housing / Part Number	PHR-7 or compatible

Connector (J2 & J3)

Connector Name / Designation	For Signal Connector
Manufacturer	JST or compatible
Type / Part Number	S2B-PH-SM4-TB or compatible
Mating Housing / Part Number	PHR-2 or compatible

J1 S7B-PH-SM4-TB

(Pin 1)

J2 & J3 S2B-PH-SM4-TB

(Pin 1)

8.2 Pin Definition

Connector (J1)

PIN No.	Symbol	Description
1	Vin	Power Input (+12V)
2	Vin	Power Input (+12V)
3	Vin	Power Input (+12V)
4	GND	Ground
5	PWM	PWM Brightness Control
6	GND	Ground
7	EN	Backlight on/off Control (5V / 0V)

Connector (J2 & J3)

PIN No.	Symbol	Description
1	V_LED+	LED Power +
2	V_LED-	LED Power -

9. Mechanical Characteristics

Dimension: 75(L) *30(W) *8.5(H) mm

Weight: MAX. 20g