

UV215FHM-N11 Product Specification

BEIJING BOE Display TECHNOLOGY

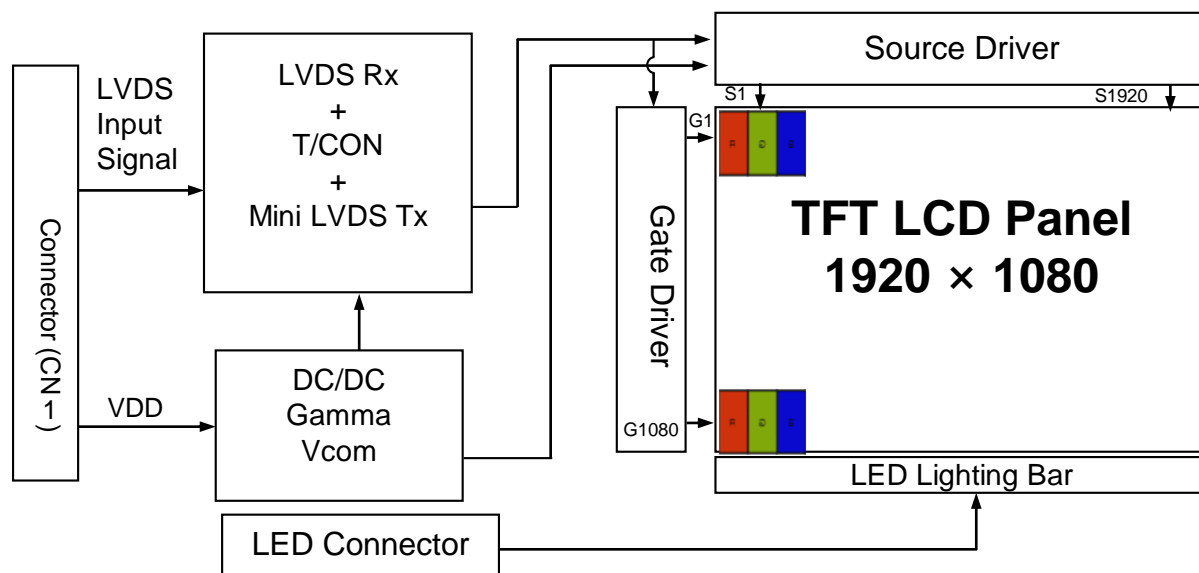
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1.0 GENERAL DESCRIPTION

1.1 Introduction

UV215FHM-N11 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
- Gamma Correction
- Normal type
- 7*16h usage support with dynamic video

1.3 Application

- Desktop Type of PC & Workstation Use
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller
- Digital Signage for Class Information

1.4 General Specification

The followings are general specifications at the model UV215FHM-N11

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active Area	476.64(H) × 268.11(V)	mm	
Number Of Pixels	1920(H) × 1080(V)	pixels	
Pixel Pitch	0.24825(H) x 0.24825(V)	mm	
Pixel Arrangement	RGB Vertical stripe		
Display Mode	Normally Black		
Display Colors	16.7M	colors	6+FRC
Surface Treatment	Haze 25%, 3H		
Contrast Ratio	Typ 1000		
Viewing Angle(CR>10)	89/89/89/89	deg.	CR > 10
Response Time	Typ 17	ms	
Color Gamut	Typ 72% NTSC		
Brightness	Typ 550	cd/m2	
Brightness Uniformity	Typ 80%		
Power Consumption	Typ 24.31	watt	
Outline Dimension	495.6(H) × 292.2(V) × 11.1(D) typ.	mm	L/B CNT 12.9mm
Weight	1.93	Kg	
Display Orientation	Landscape and Portrait		

2.0 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 >

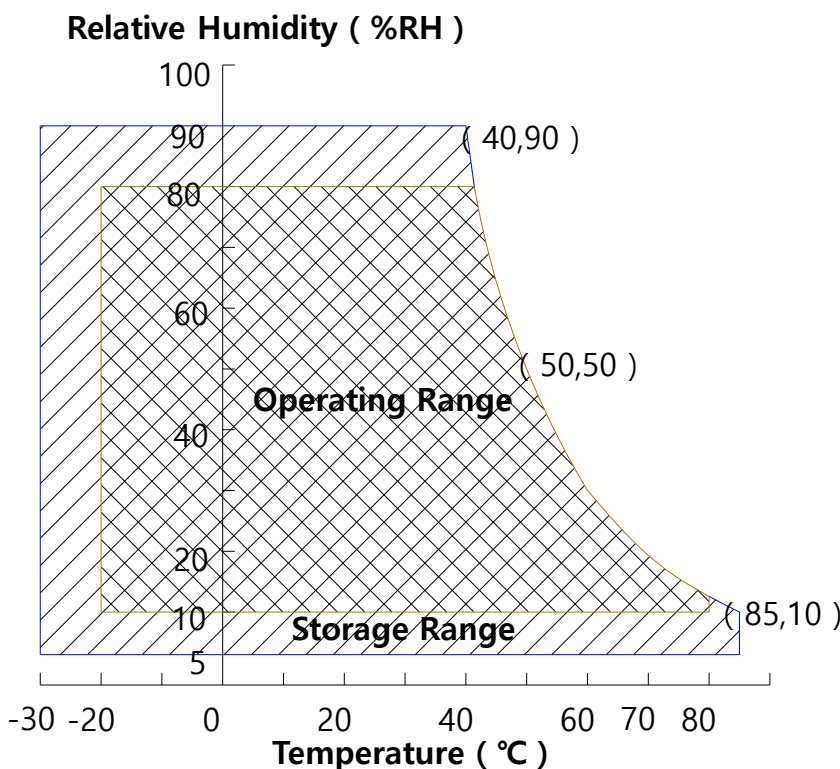
[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	5.5	V	Ta = 25 °C
Logic Supply Voltage	V_{IN}	VSS-0.3	$V_{DD}+0.3$	V	
Operating Temperature	T_{OP}	-20	+80	°C	
Storage Temperature	T_{ST}	-30	+85	°C	
Liquid crystal clear point	T_{Lc}	104.9		°C	Typ.

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.

Note 2 : When used near the limit conditions of temperature and humidity, the life will be reduced



3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

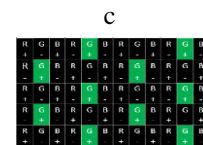
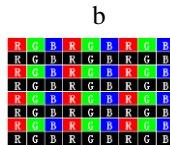
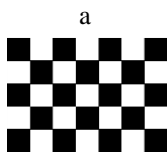
[Ta = 25 ± 2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	4.5	5.0	5.5	V	Note1
Power Supply Current	I _{DD}	-	700	1200	mA	
In-Rush Current	I _{RUSH}	-	-	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	V _{cm}	1.0	1.2	1.5		V _{IH} =100mV, V _{IL} =-100mV
LED Voltage	V _{LED}	-	3.0	3.3	V	
LED Channel Voltage	V _{LB}	-	51	56.1	V	Duty 100%
LED Channel Current	I _L		102		mA	Duty 100%, Each channel
LED Lifetime		30000	-	-	Hrs	I _L =100 mA, Note 4
Power Consumption	P _D	-	3.5	5.4	W	
	P _{BL}	-	20.81	22.89	W	I _L =100mA, Note 3
	P _{total}	-	24.31	27.6	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=60Hz. Test Pattern of power supply current

- a) Typ : Color Bar pattern
- b) Max : Gray Level 255 Pattern
- c) Flicker Test Pattern



2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %

3. Calculated value for reference (VL × IL) × 4(channel) excluding driver loss. (LED Light bar: 17S4P)

4. The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=100mA on condition of continuous operating at 25 ± 2 °C

SPEC. NUMBER

S8-64-8A-551

SPEC. TITLE

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4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance \leq 1 lux and temperature $=25\pm 2^{\circ}\text{C}$) with the equipment of Luminance meter system (Goniometer system and 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 $\theta_{\Phi=0}$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{\Phi=90}$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta_{\Phi=180}$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta_{\Phi=270}$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , 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 12.0V \pm 10% at 25°C . Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

< Table 4. Module Optical >

[VDD = 5.0V, Frame rate = 60Hz, Clock = 74.25MHz, IBL = 400mA, Ta = $25\pm 2^{\circ}\text{C}$]

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	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.	
Contrast ratio		CR		700:1	1000:1	-		Note 2
Reproduction of color	White	W_x	$\Theta = 0^{\circ}$ (Center) Normal Viewing Angle	TYP. - 0.03	0.285	TYP. + 0.03		Note 5
		W_y			0.293			
	Red	R_x			0.634			
		R_y			0.349			
	Green	G_x			0.289			
		G_y			0.603			
	Blue	B_x			0.148			
		B_y			0.047			
Response Time	G to G	T_g		-	17	25	ms	Note 6
Gamma Scale				2.0	2.2	2.4		
Brightness				450	550		nit	Note3
NTSC Color Gamut				68	72		%	
Brightness Uniformity		δ_{white}	9point	75	80		%	Note 4

Note :

- 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.
- Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ 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.

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

- 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.
- The White luminance uniformity on LCD surface is then expressed as :
 $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$
 (See FIGURE 2 shown in Appendix).
- The color chromaticity coordinates specified in Table 5. 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.
- Response time T_g is the average time required for display transition by switching the input signal as below table and is based on Frame rate $f_V = 60\text{Hz}$ to optimize. Each time in below table is defined as appendix Figure 3 and shall be measured by switching the input signal for "any level of gray(bright)" and "any level of gray(dark)".

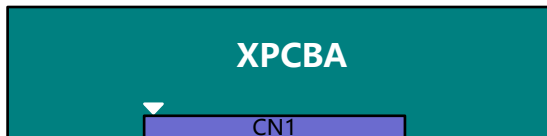
Measured Response Time	Target																
	0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
0																	
15																	
31																	
47																	
63																	
79																	
95																	
111																	
127																	
143									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

- 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).

5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

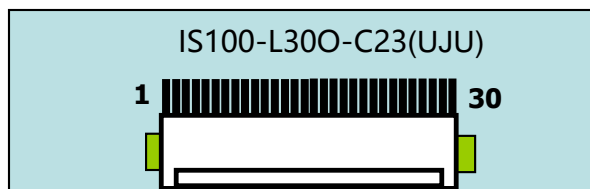
Cable length suggest less than 200 mm



Pin No	Symbol	Description	Pin No	Symbol	Description
1	RX00-	Negative Transmission data of Pixel 0 (ODD)	16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)
2	RX00+	Positive Transmission data of Pixel 0 (ODD)	17	GND	Power Ground
3	RX01-	Negative Transmission data of Pixel 1 (ODD)	18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)
4	RX01+	Positive Transmission data of Pixel 1 (ODD)	19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)
5	RX02-	Negative Transmission data of Pixel 2 (ODD)	20	RXEC-	Negative Transmission Clock (EVEN)
6	RX02+	Positive Transmission data of Pixel 2 (ODD)	21	RXEC+	Positive Transmission Clock (EVEN)
7	GND	Power Ground	22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)
8	RXOC-	Negative Transmission Clock (ODD)	23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)
9	RXOC+	Positive Transmission Clock (ODD)	24	GND	Power Ground
10	RX03-	Negative Transmission data of Pixel 3 (ODD)	25	NC	Not connection, this pin should be open
11	RX03+	Positive Transmission data of Pixel 3 (ODD)	26	NC	Not connection, this pin should be open
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	27	NC	Not connection
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	28	VDD	Power Supply: +5V
14	GND	Power Ground	29	VDD	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	30	VDD	

Notes : 1. Input Level of LVDS signal is based on the EIA-644 Standard.

Rear view of LCM



SPEC. NUMBER

SPEC. TITLE

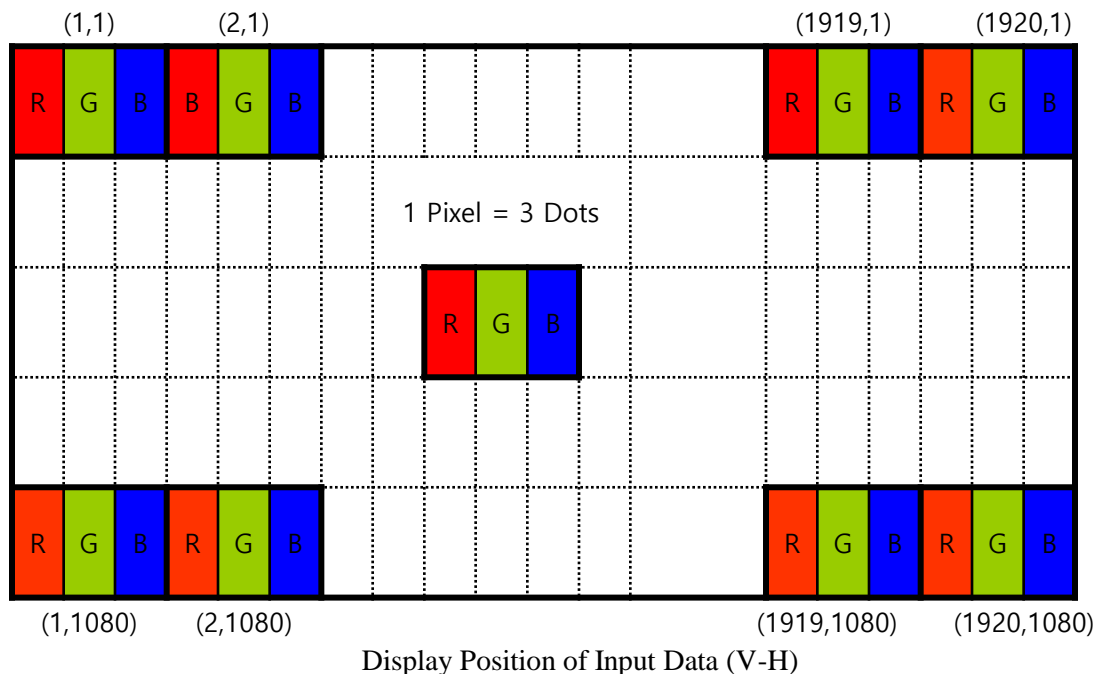
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5.2 Data Input Format



5.3 Back-light Interface Connection

-LED connector : 3707K-Q06N-08X manufactured by Entry

Pin No	Symbol	Description
1	IRLED1	LED current sense for string1
2	IRLED2	LED current sense for string2
3	VLED	LED power supply
4	VLED	LED power supply
5	IRLED3	LED current sense for string3
6	IRLED4	LED current sense for string4

6.0 SIGNAL TIMING SPECIFICATION**6.1 Timing Parameters (DE only mode)**

< Table 8. Timing Table >

Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	11.36	13.47	15.87	ns	
	Frequency	-	63	74.25	88	MHz	
Horizontal	Horizontal Period	tHP	1050	1100	1120	tCLK	
	Horizontal Valid	tHV	960			tCLK	
	Horizontal Blank	tHB	90	140	160		
	Frequency	fH	60	67.5	78.5	KHz	
Vertical	Vertical Period	tVP	1100	1125	1200	tHP	
	Vertical Valid	tVV	1080			tHP	
	Vertical Blank	tVB	30	45	171	tHP	
	Frequency	fV	55	60	65	Hz	
LVDS Rx Clock	CLK Jitter	TJitter	-	-	200	ps	

Note

1. DE Only Mode , While operation, DE signal should be have the same cycle. The input of HSYNC & VSYNC signal does not have an effect on normal operation.

2. Best operation clock frequency is 74.25 Mhz.

3. Frequency] = [H Total] * [V Total] * [vertical Frame rate]

H Total, V Total and Frame rate should operate within the range between Frequency_Min and Max

4. Except Best operation clock frequency, FOS(Flicker & Brightness & Crosstalk, Etc.) are not guaranteed.

5. Main frequency Max is 88Mhz MHz without spread spectrum

< Table 9. LVDS Input SSCG>

Symbol	Parameter	Condition	Min	Typ	Max	Unit
F_{LVMOD}	Modulating frequency of input clock during SSC	F=75MHz	30	-	125	KHz
F_{LVDEV}	Maximum deviation of input clock frequency during SSC		-0.5	-	+0.5	%

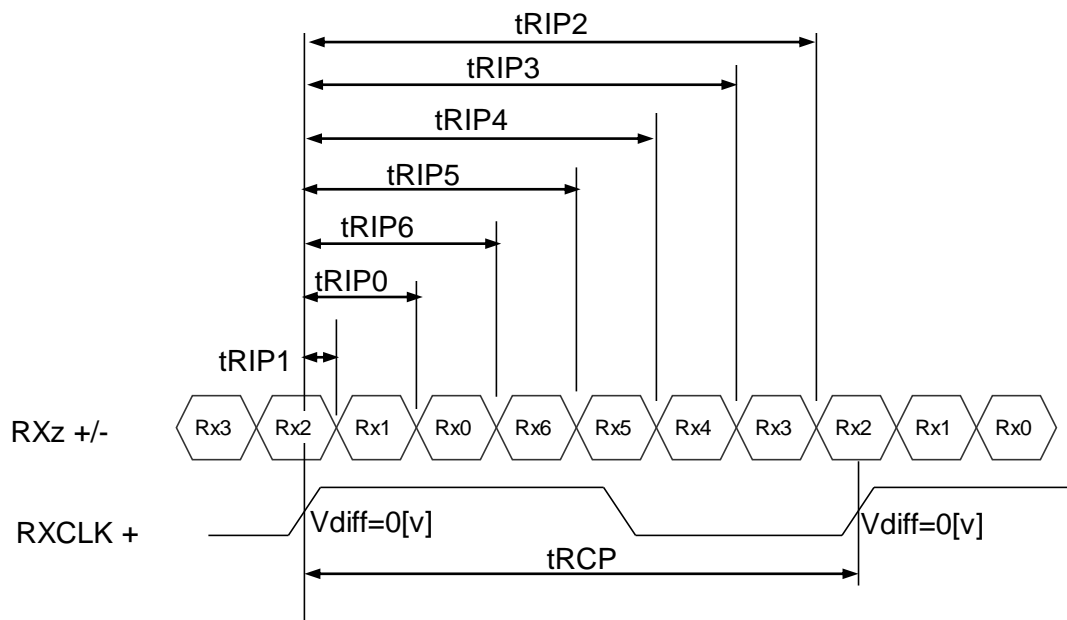
Note 1 : This DCLK range at last line of V-blanking should be set in 0~987.

6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 4.

<Table 4. LVDS Rx Interface Timing Specification>

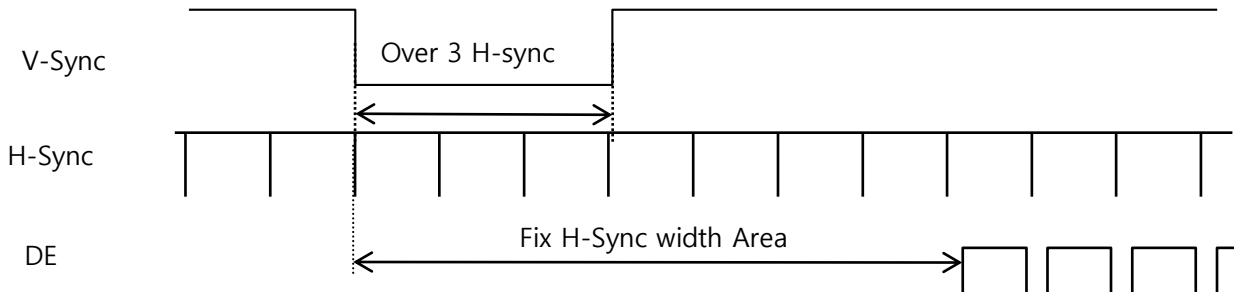
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCP	10	T	40	nsec	
Receiver Data Input Margin	tRMG	-0.4	0.0	+0.4	nsec	74.25MHZ
Input Data 0	tRIP1	- tRMG	0.0	tRMG	Clock	
Input Data 1	tRIP0	T/7- tRMG	T/7	T/7+ tRMG	Clock	
Input Data 2	tRIP6	2 T/7- tRMG	2T/7	2T/7+ tRMG	Clock	
Input Data 3	tRIP5	3T/7- tRMG	3T/7	3T/7+ tRMG	Clock	
Input Data 4	tRIP4	4T/7- tRMG	4T/7	4T/7+ tRMG	Clock	
Input Data 5	tRIP3	5T/7- tRMG	5T/7	5T/7+ tRMG	Clock	
Input Data 6	tRIP2	6T/7- tRMG	6T/7	6T/7+ tRMG	Clock	



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

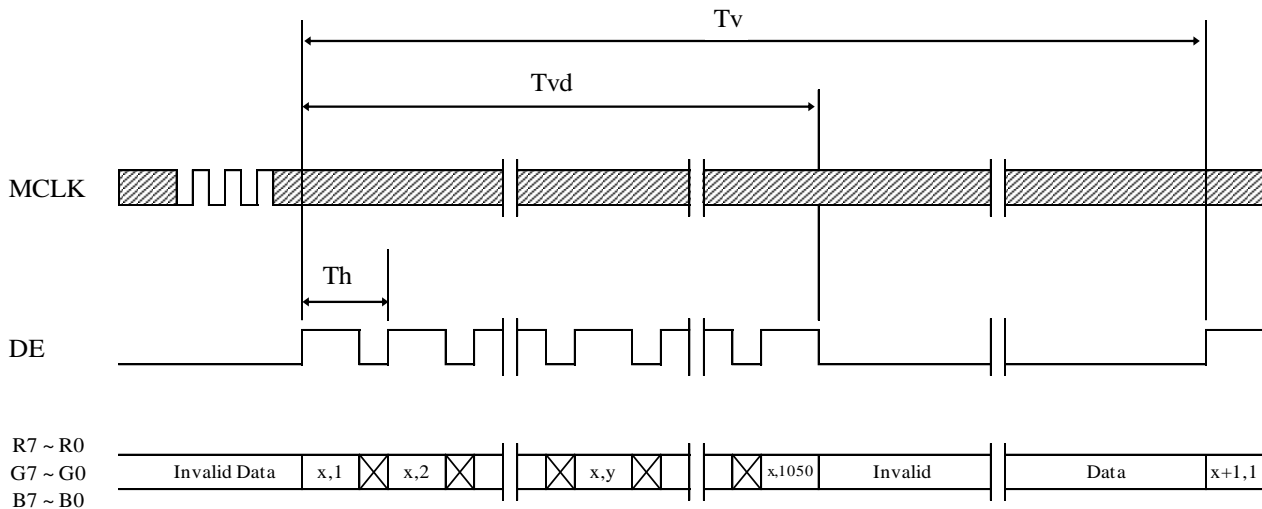
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms

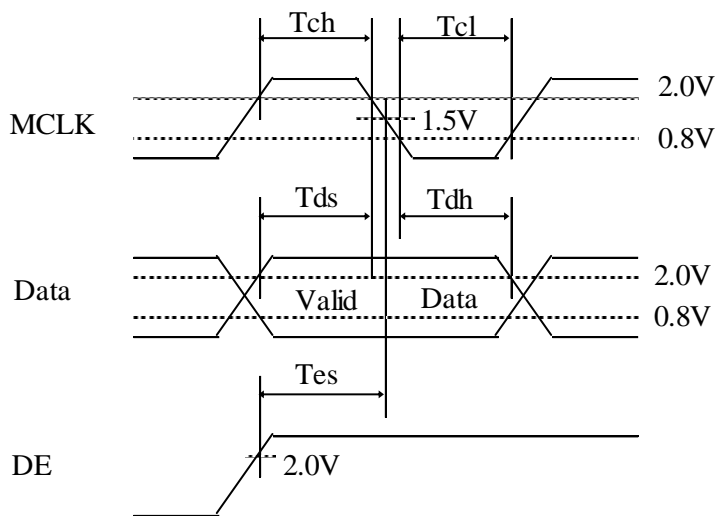
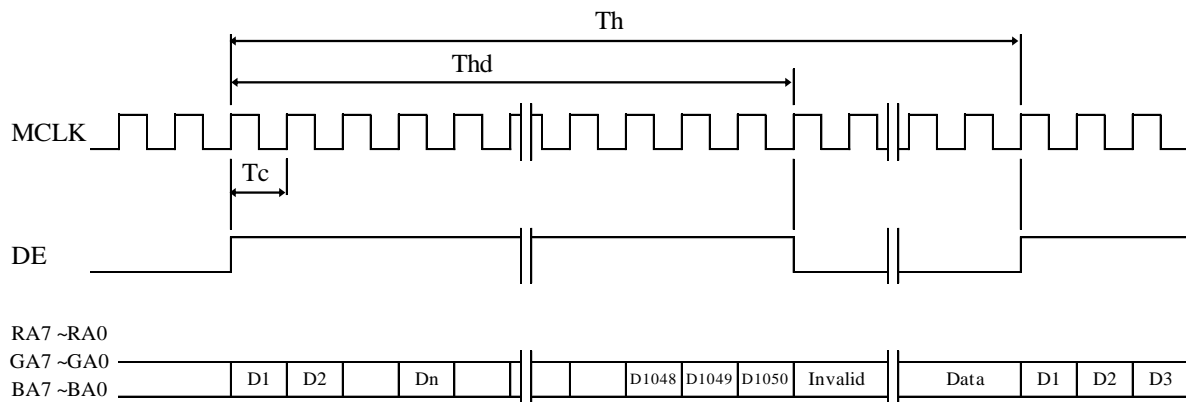


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



7.3 Horizontal Timing Waveforms

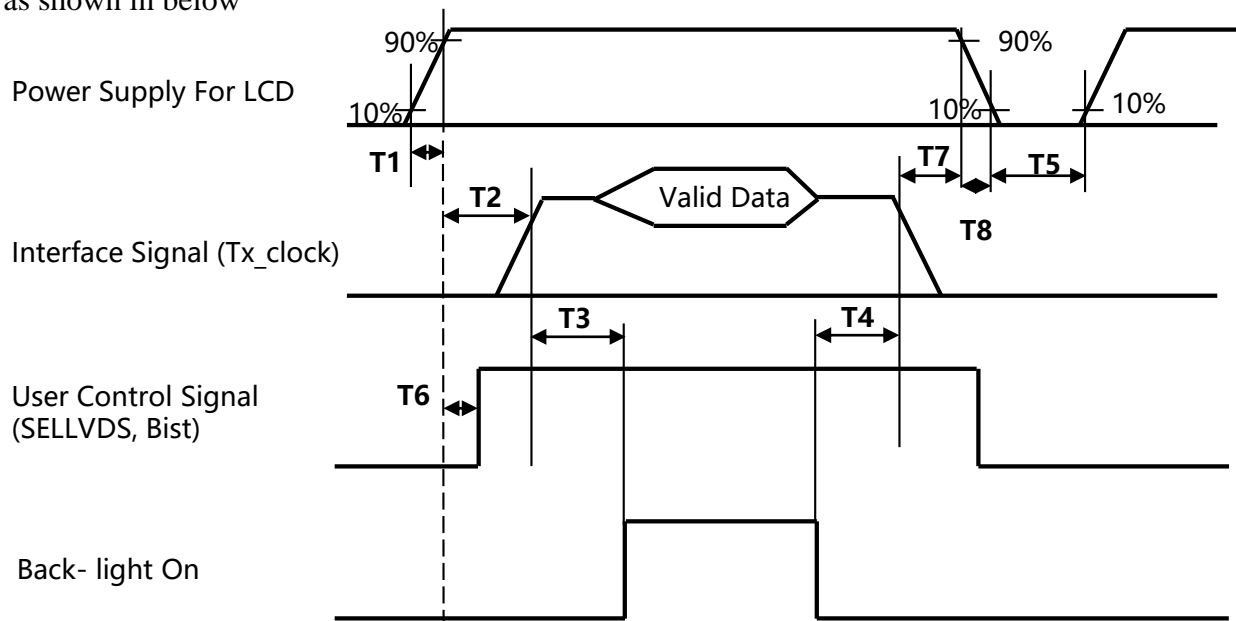


8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Darker	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	1	0	0	0	0	0	0	0	0	
	Darker	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	0	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	1	
	Darker	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	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	
	Darker	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	

9.0 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



Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0.1	-	T7	ms
T3	400	-	-	ms
T4	200	-	-	ms
T5	1	-	-	s
T6	0.1	-	T2	ms
T7	0.1	-	-	ms
T8	0.5	-	10	Ms

Note 1: Even though T1 is over the specified value, there is no problem if the rush current is within Spec.

Note 2: When the power supply VDD is 0V, keep the level of input signals on the low or high impedance ;

※ Please avoid floating state of interface signal at invalid period.

※ When the power supply for LCD (VDD) is off, be sure to pull down the valid and invalid data to 0V.

Note 3: The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown.

There is no reliability problem.

Note 4 : T5 should be measured after the Module has been fully discharged between power off and on period

Note 5 : If the on time of signals (Interface signal and user control signals) precedes the on time of Power (VLCD), it will be happened abnormal display. When T6 is NC status, T6 doesn't need to be measured

Note 6: T8: Voltage of VDD must decay smoothly after power-off , there should be none re-bouncing voltage. (customer system decide this value)

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 5 (located in Appendix) shows mechanical outlines for the model UV215FHM-N11. Other parameters are shown in Table 8.

<Table 8. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	495.6(H)×292.2(V)×10.7(D) type	mm
Weight	1.93(Tpy.)	Kg
Active area	476.64(H) × 268.11(V)	mm
Pixel pitch	0.24825(H) x 0.24825(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.

11.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 9 Reliability Test Parameters >

No	Test Items	Conditions		Remark
1	High temperature storage test	Ta = 85 °C, 240 hrs		After test ,The Module can normal operation and have no function problem
2	Low temperature storage test	Ta = -30 °C, 240 hrs		
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs		
4	High temperature & high humidity storage test	Ta = 60 °C, 90%RH, 240hrs		
5	High temperature operation test	Ta = 80 °C, 240hrs		
6	Low temperature operation test	Ta = -20°C, 240hrs		
7	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle		
8	Packing Vibration Test (non-operating)	Frequency	Random,10 ~ 300 Hz, 30 min/Axis	
		Gravity / AMP	1.05 Grms	
		Period	X, Y, Z 30 min	
9	Electro-static discharge test	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV		

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12.0 HANDLING & CAUTIONS

12.1 Handling

- (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (2) You must mount a module using specified mounting holes (Details refer to the drawings).
- (3) Please make sure to avoid external forces applied to the Source PCB and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) Note that polarizers are very fragile and could be easily damaged. Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
- (5) Do not pull or fold the source D-IC which connect the source PCB and the panel. Do not pull or fold the LED wire.
- (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water. Do not use strong polar solvent because they cause chemical damage to the polarizer.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- (10) Do not disassemble the module.
- (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (12) If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- (13) Do not drop water or any chemicals onto the LCD's surface.

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12.2 Operating Precautions

- (1) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (2) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- (5) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals.
Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the Open cell at the "Power On" condition.
- (9) When the Open cell is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the Open cell would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.

12.3 Electrostatic Discharge Control

- (1) Since a Open cell is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

12.4 Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter. It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time.

12.5 Storage Precautions

When storing Open cells as spares for a long time, the following precautions are necessary.

- (1) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.
Temperature : 5 ~ 40 °C
- (2) Humidity : 35 ~ 75 %RH
- (3) Period : 6 months
- (4) Control of ventilation and temperature is necessary.
- (5) Please make sure to protect the product from strong light exposure, water or moisture.
Be careful for condensation.
- (6) Store in a polyethylene bag with sealed.
- (7) Do not store the LCD near organic solvents or corrosive gasses.
- (8) Please keep the Open cells at a circumstance shown below Fig.

12.6 Handling Precautions for Protection Film

- (1) Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- (2) In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

12.7 Operation Condition Guide

- (1) Normal operating condition
 - Temperature: $20 \pm 15^{\circ}\text{C}$
 - Operating Ambient Humidity : $55 \pm 20\%$
 - Display pattern: dynamic pattern (Real display)
 - Suitable operating time: under 16 hours a day.
- (2) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc., It is strongly recommended to contact BOE for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.
- (3) Black image or moving image is strongly recommended as a screen save.

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- (4) Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.
- (5) Please contact BOE in advance for outdoor operation.
- (6) Please contact BOE in advance when you display the same pattern for a long time.
- (7) If the Open cell keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (8) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Open cell may be damaged.
- (9) Dew drop atmosphere should be avoided.
- (10) The storage room should be equipped with a good ventilation facility, which has a temperature controlling system.
- (11) When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- (12) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black attemperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- (13) For long-term lighting products, it is recommended to shut down periodically.
- (14) If the product is used for a long time under the condition of 7*24 hr, it is strongly recommended to contact BOE for filed application engineering advice.
- (15) Long time and large angle forward use or unconventional use , It is strongly recommended to contact BOE for filed application engineering advice.

12.8 Others

- (1)When returning the Open cell for repair or etc., Please pack the Open cell not to be broken. We recommend to use the original shipping packages.
- (2) In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer LCM Line through the I2C Interface.
- (3) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (4) For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- (5) If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- (6) If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.

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13.0 PRODUCT SERIAL NUMBER

UV215FHM-N11		B4	   MADE IN CHINA
			
XXXX	XXXXXXXXXXXXXXXXXXXXXX		
			
XX-XXXXXX-XXXXX-XXX-XXXX			



1. Control Number

2. Rank / Grade

3. Line Classification

4. Year (2001 : 01, 2002 : 02, ...)

5. Month (1,2,3, ... , 9, X, Y, Z)

6. Internal Use

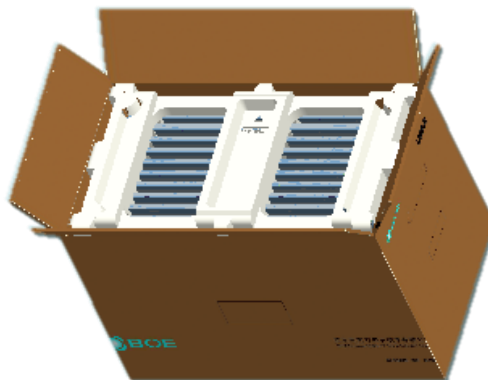
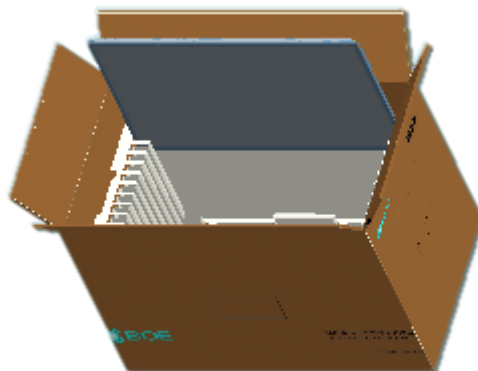
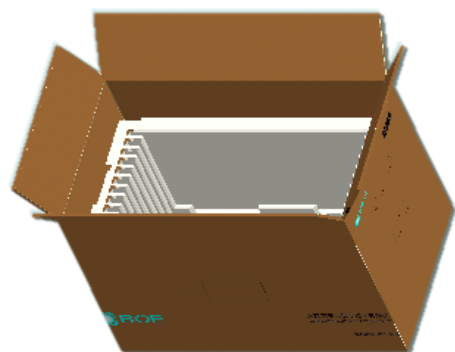
7. Serial Number

14.0 Packing

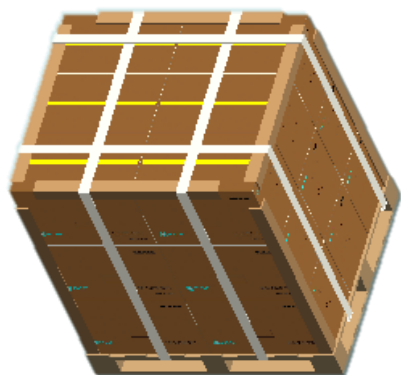
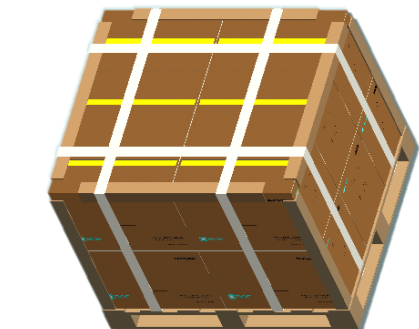
14.1 Packing Order

-Put 1Pcs EPO Bottom into the box

-Put each module into a PE bag
-Put 10Pcs MDL into the box



-Put 1 Pcs EPO cover in and seal the box.



-Put the boxes on the Pallet

12boxes/Pallet:6boxes per layer, total 2 layers

18boxes/Pallet:6Boxes per layer, total 3 layers

-Place paper corners and wrap film around the boxes

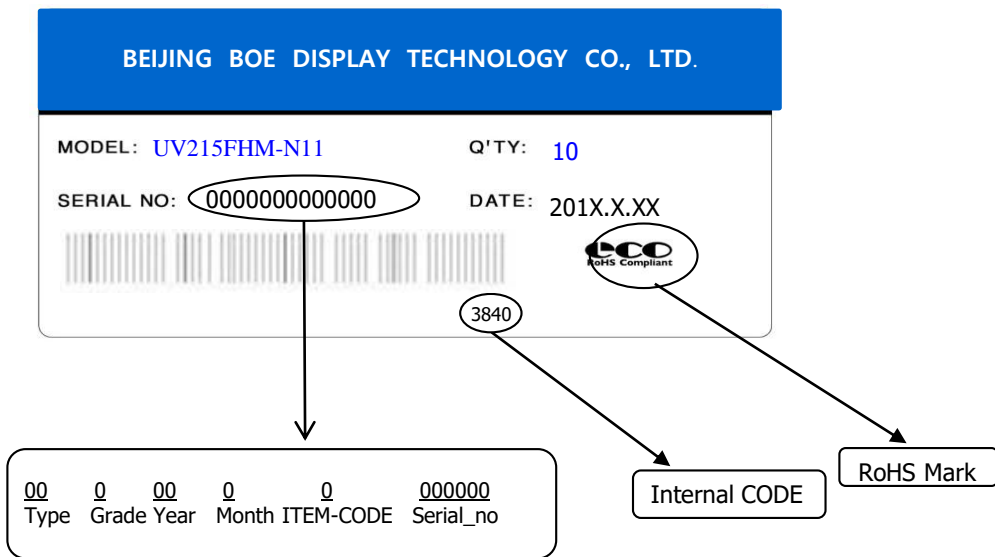
-Pack with 4 packing belts

14.2 Packing Specification and Note

Item	Specification			Remark
	Q'ty	Dimension(mm)	Weight (kg)	
Panel	1	495.6(H) × 292.2(V) × 10.7(D) typ.	2	Estimated
Cushion	1	-	-	-
Box	1	578(L)×358(W)×363(H)	1.2	-
Packing Box	10pcs/Box	578(L)×368(W)×383(H)	22.2	Estimated
Pallet	1	1180(L)×1140(W)×130(H)	18	-
Packing Pallet	12Box/Pallet	1180(H)×1140(H)×896(H)	284.4	-
	18Box/Pallet	1140(H)×1000(H)×1279(H)	417.6kg	-

14.3 Box label

- Label Size : 110 mm (L) × 55 mm (W)
- Contents
 - Model : UV215FHM-N11
 - Q`ty : Module 10 Q`ty in one box
 - Serial No. : Box Serial No. See next page for detail description.
 - Date : Packing Date
 - FG Code : FG Code of Product



15.0 APPENDIX

Figure 1. Measurement Set Up

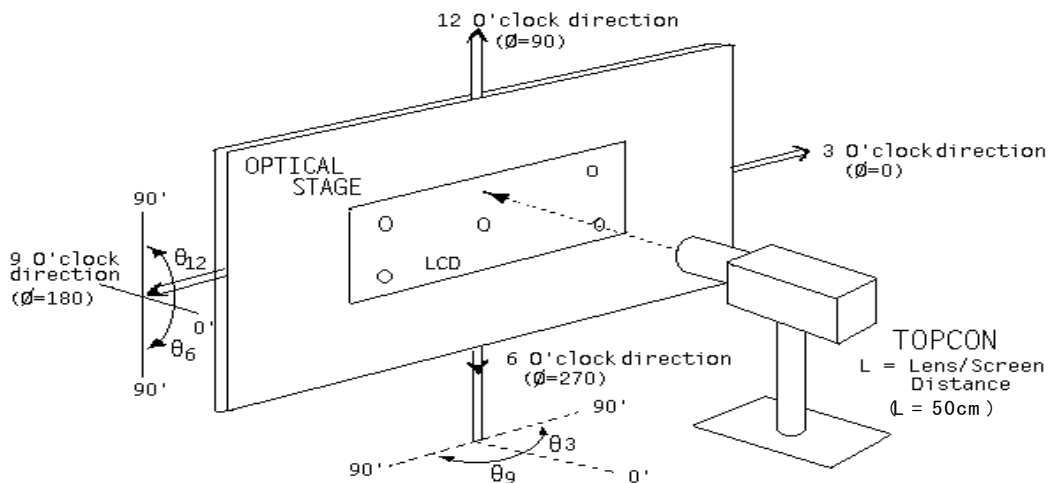


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

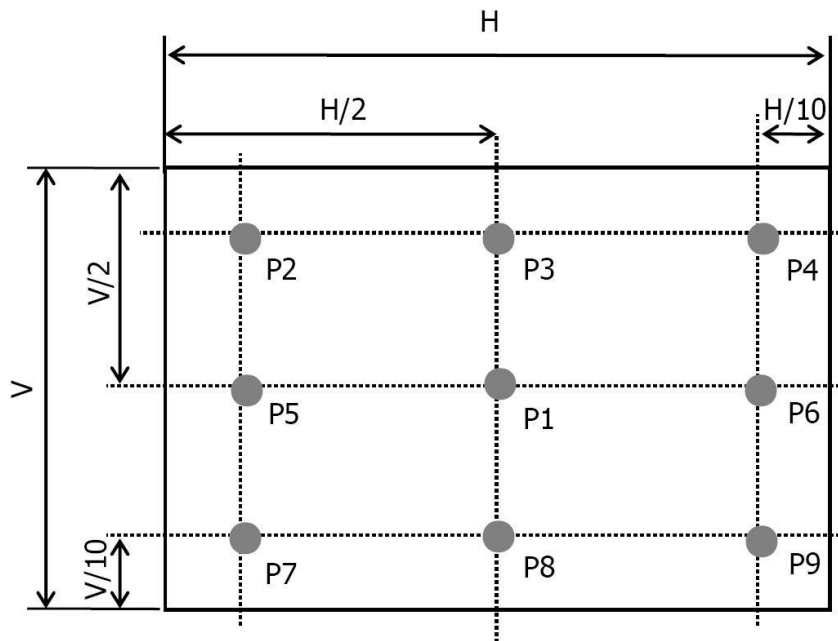
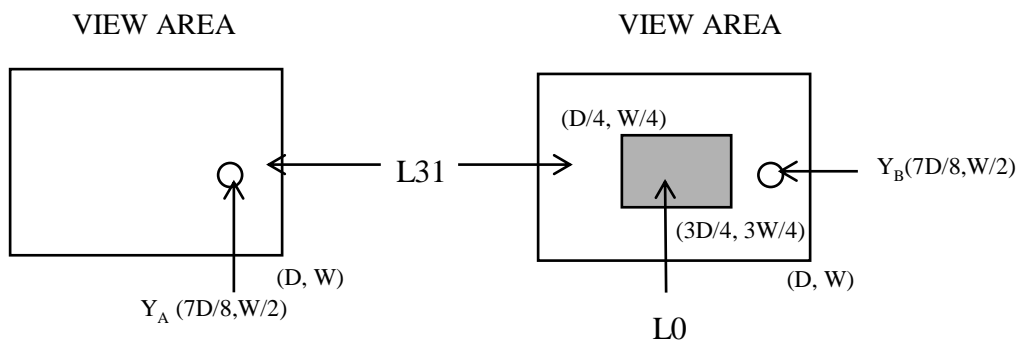


Figure 3. Response Time Testing



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/m²)
 Y_B = Subsequent luminance of measured area (cd/m²)
 The location measured will be exactly the same in both patterns

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

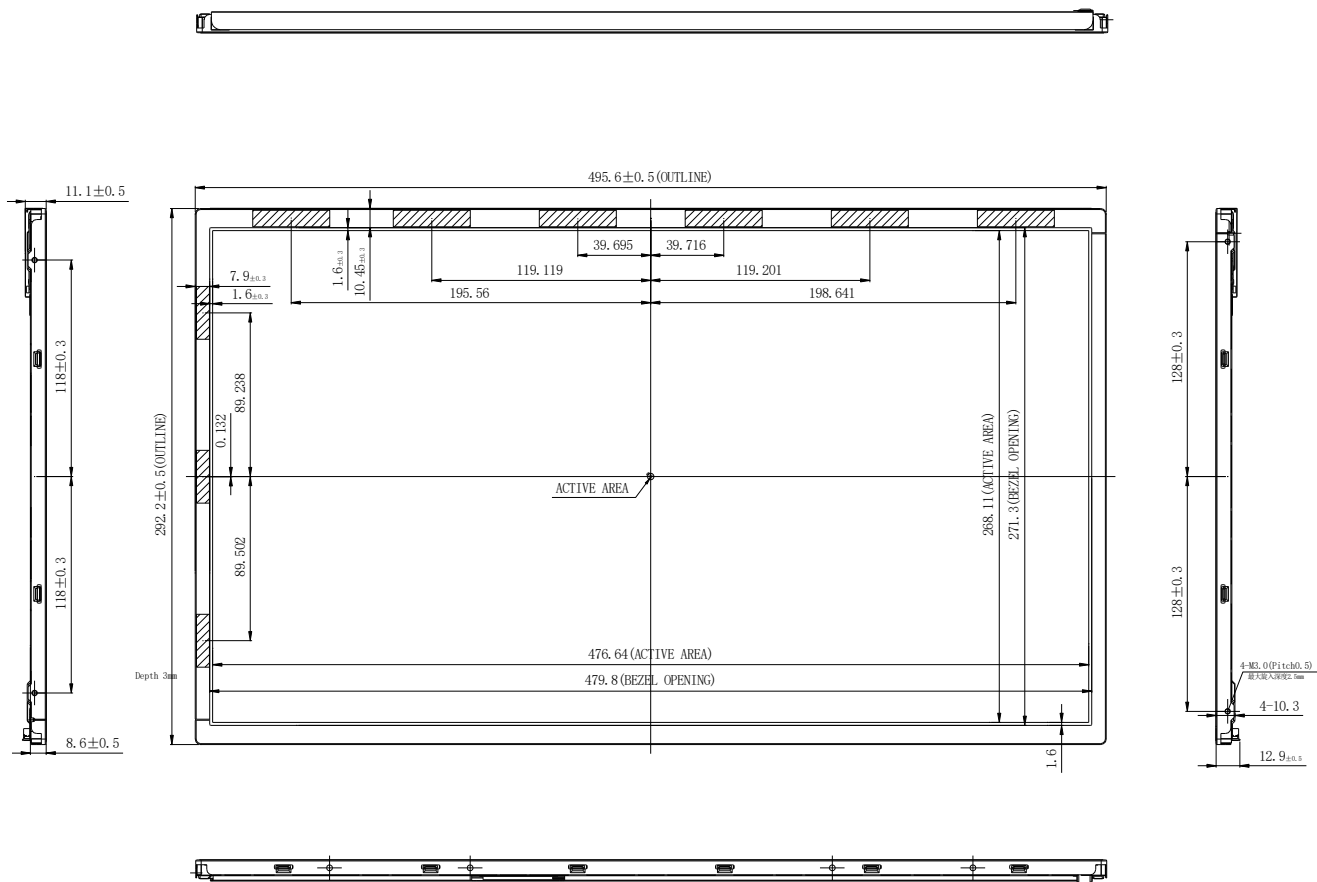
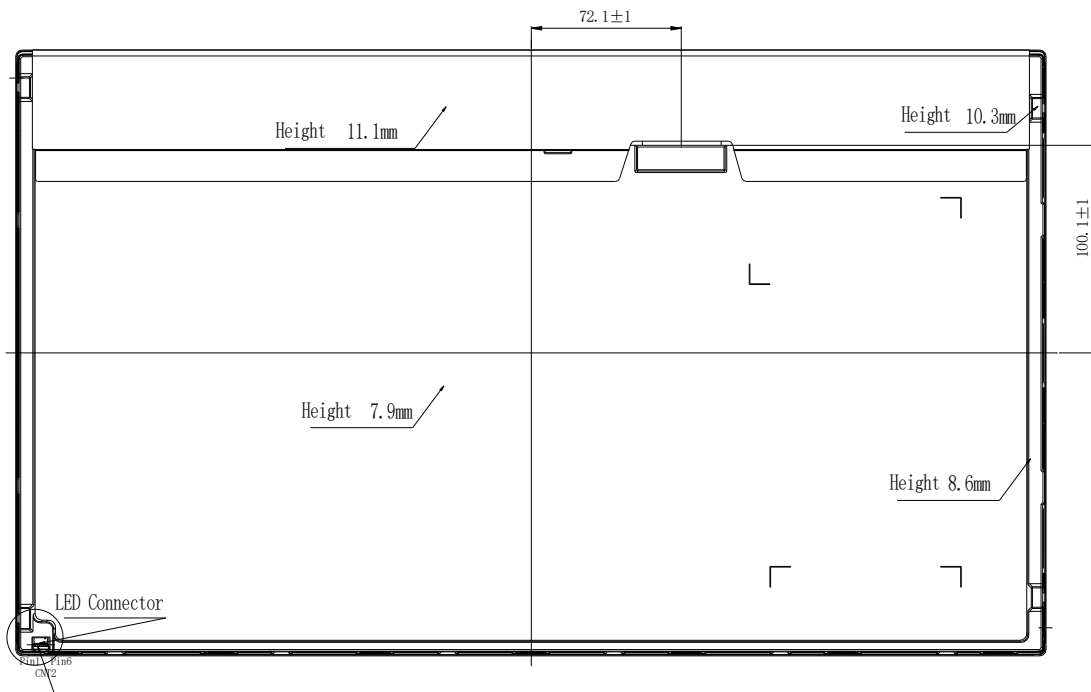
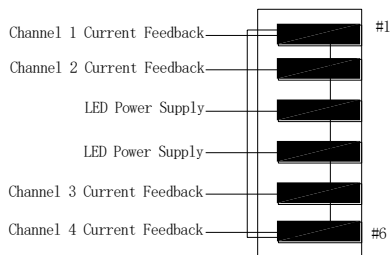


Figure 6. TFT-LCD Module Outline Dimensions (Rear view , Horizontal placement)



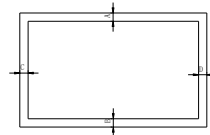
LED Connector on the ground side When Placed Vertically(Horizontally)

LED Connector PIN MAP



NOTE:

1. 1/F CONNECTOR SPECIFICATION IS100-L300-C23(UJU)
2. LED CONNECTOR SPECIFICATION 3707K-Q06N-08X(ENTERY)
3. Torque of userhole:3.0~4.0kgf-cm.
4. Tilt and partial desposition tolerance of display area as following:
 (1) Y-direction:|A-B|≤1.4
 (2) X-direction:|C-D|≤1.4



5. Unspecified tolerances to be ±0.5mm.
6. The COF area is weak & sensitive, so don't press the COF area.
7. Outside Flatness :0.6mm MAX.

Figure 7. TFT-LCD Module Outline Dimensions (Front view , Vertical placement)

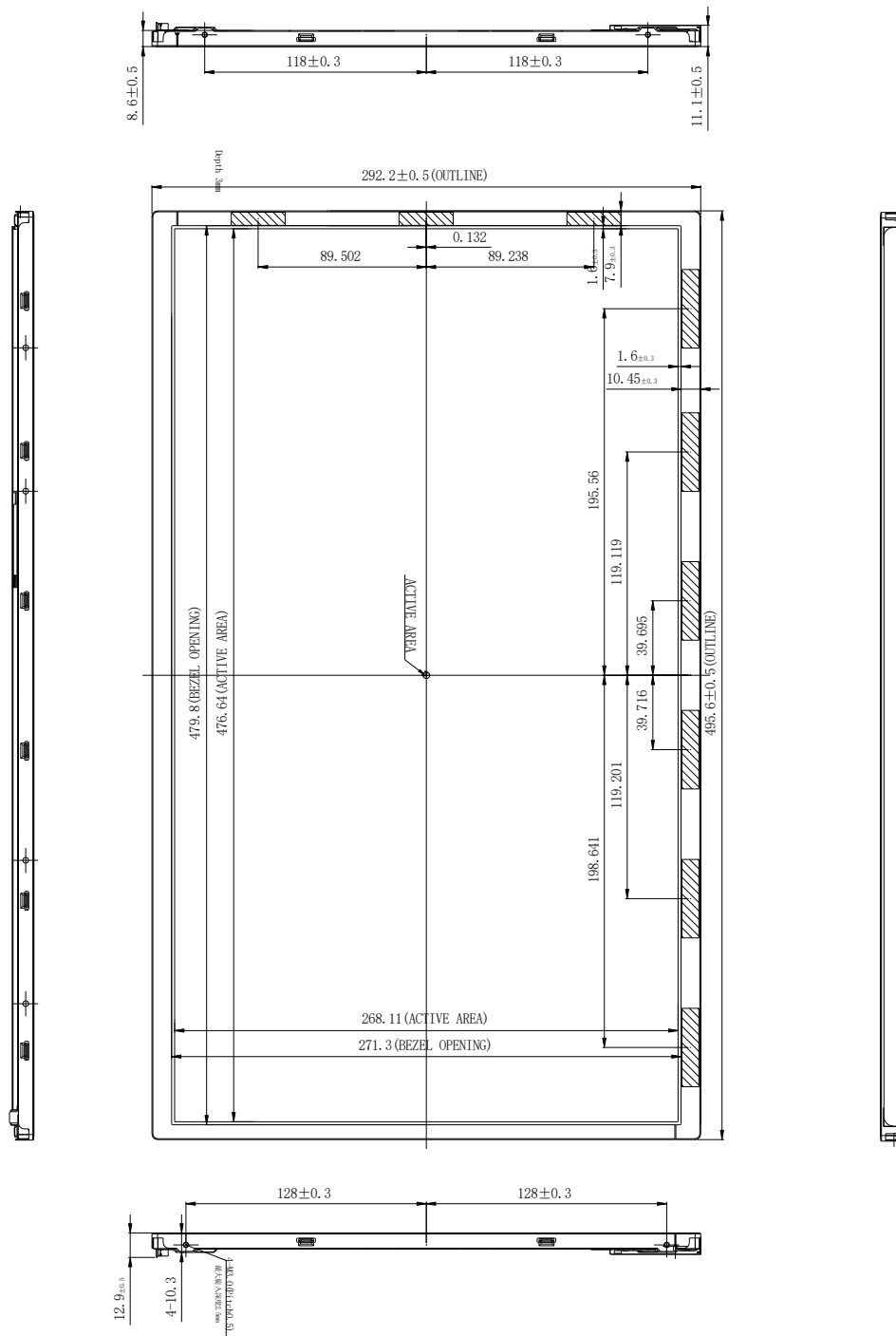
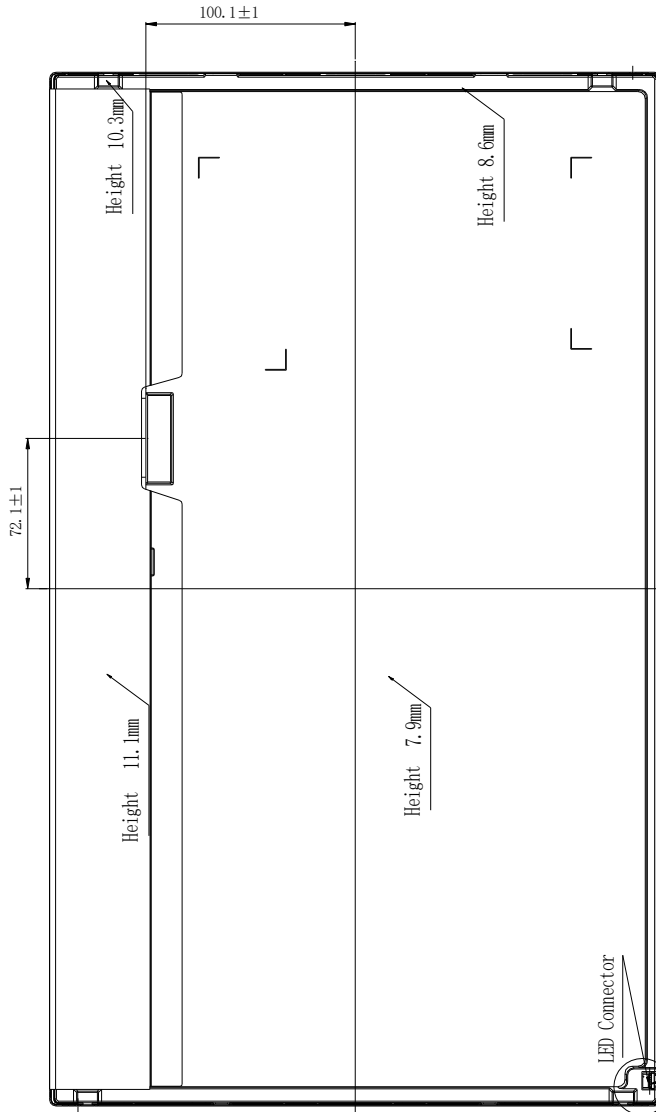


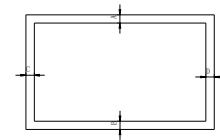
Figure 8. TFT-LCD Module Outline Dimensions (Rear view , Vertical placement)



LED Connector on the ground side When Placed Vertically (Horizontally)

NOTE:

1. 1/F CONNECTOR SPECIFICATION IS100-L300-C23(UJU)
2. LED CONNECTOR SPECIFICATION 3707K-Q06N-08X(ENTERY)
3. Torque of userhole:3.0~4.0kgf·cm.
4. Tilt and partial desposition tolerance of display area as following:
 - (1) Y-direction: |A-B| ≤ 1.4
 - (2) X-direction: |C-D| ≤ 1.4



5. Unspecified tolerances to be ±0.5mm.
6. The COF area is weak & sensitive, so don't press the COF area.
7. Outside Flatness :0.6mm MAX.

LED Connector PIN MAP

