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■ Preliminary Specifications
☐ Final Specifications

Title	21.5-inch LCM Product Specifications
Model Name	ET215FH01-R
Version	0.2

Customer

Approved by Date

Notice: This Specification is subject to change without notice.

Approved By	Prepared By
Jim 2023-12-19	Aurice 2023-12-19

REVISION HISTORY

Version	Description of Changes	Date	Prepared
0	First Edition	2023-04-26	Aurice
0.1	Add Package Specification	2023-12-08	Aurice
0.2	Modify I_{BL} current、Color chromaticity	2023-12-19	Aurice

Contents

1. General Description

No.	Item	Specification	Remark
1	LCD size	21.5 inch (Diagonal)	
2	Driver element	a-Si TFT	
3	Resolution	1920 x 3 (RGB) x1080 pixel	
4	Display mode	Normally Black	
5	Pixel pitch	0.24825(H) x0.24825(V)	
6	Active area	476.64(H) x 268.11(V) mm	
7	Module size	495.6(W) x 292.2(H) x10.5(D) mm (Typ.) (w/o PWB)	Note 1
8	Weight	1500g(Max)	
9	Surface treatment	Haze 25%, 3H	
10	Colors	16.7M (Hi-FRC)	
11	Interface	LVDS	
12	Backlight Type	LED	
13	Operating Temperature	-20℃~80℃	
14	Storage Temperature	-30℃~85℃	

Note 1 : Refer to Mechanical Drawing

2. Pin Assignment

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	GND	Power Ground	
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 1
25	NC	Not connection, this pin should be opne	
26	NC	Not connection, this pin should be opne	
27	NC	Not Connection	

28	VDD	Power Supply +5V	
29	VDD		
30	VDD		

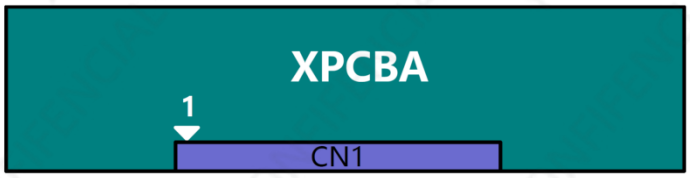
Module Side Connector : UJU IS100-L30O-C23 or MSBKT2407P30

User Side Connector : JAE FI-X30H

(3ASCREEN is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)

All terminals except NC terminal must be connected to input signal described as above or supply voltage or GND each.

Note 1: This pin should be connected with GND.



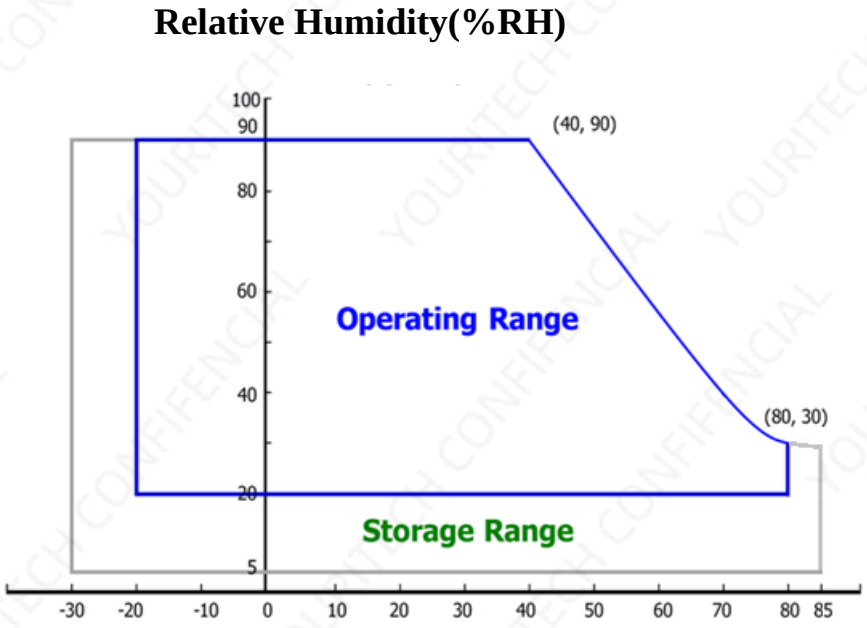
3. Operation Specifications

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 below table.

3.1 Absolute Maximum Ratings

[VSS=GND=0V]

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power Supply Voltage	V_{DD}	-0.3	5.5	V	Ta=25℃
Logic Supply Voltage	TV_{INopOP}	VSS-0.3	V_{DD}+0.3	V	Ta=25℃
Operation Temperature	T_{OP}	-20	80	℃	
Storage Temperature	T_{ST}	-30	85	℃	
Liquid crystal clear point	T_{LC}	104.9		℃	Typ.



3.2 Electrical Specifications

3.2.1 TFT-LCD panel driving

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply voltage	V_{DD}	4.5	5.0	5.5	V	Note1
Power Supply Current	I_{DD}	-	700	1200	mA	
In-Rush Current	Irush	-	-	3	A	Note2
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_{IH}	-100	-	-	mV	
Differential input voltage	$\lvert V_{ID} \rvert$	200	-	600	mV	
Differential input common mode voltage	V_{cm}	1.0	1.2	1.5		V_{IH} =100mV V_{IL} =100mV
Power Consumption	P_D	-	3.5	5.4	W	

Notes: 1. The supply voltage is measured and specified at the interface connector of open cell.
The current draw and power consumption specified is for VDD=5.0V, Frame rate=60Hz. Test Pattern of power 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 us +/- 20%

3.2.2 Backlight Driving

The backlight system is two edge-lighting type with white-LED.

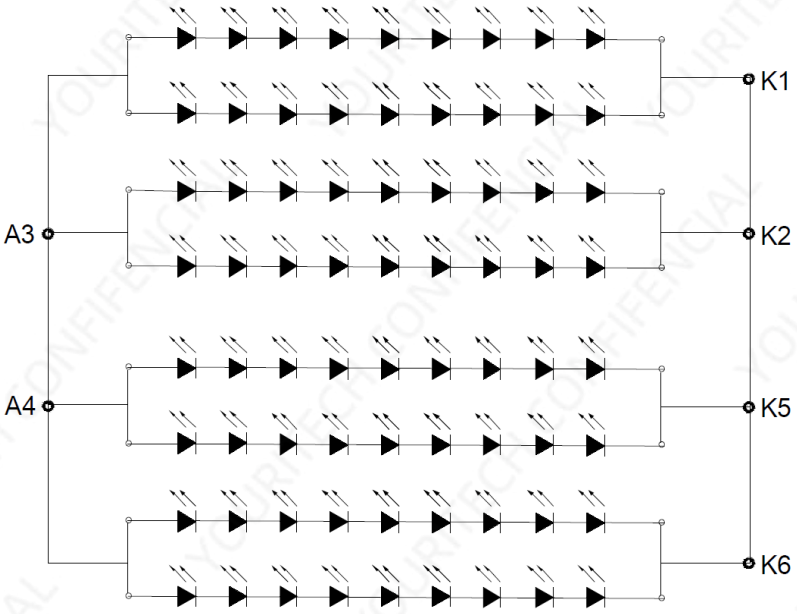
(It is usually required to measure under the following condition: Ta=25℃±2℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	V_{BL}	26.1	27.9	29.7	V	BL_PWR
Current dissipation	I_{BL}	-	720	-	mA	LBx1
Power consumption	P_{BL}	-	40.176	-	W	LBx2
LED Life time	-	-	50000	-	hrs	

LED Connector Type : 3707K-Q06N-08X (Entery)

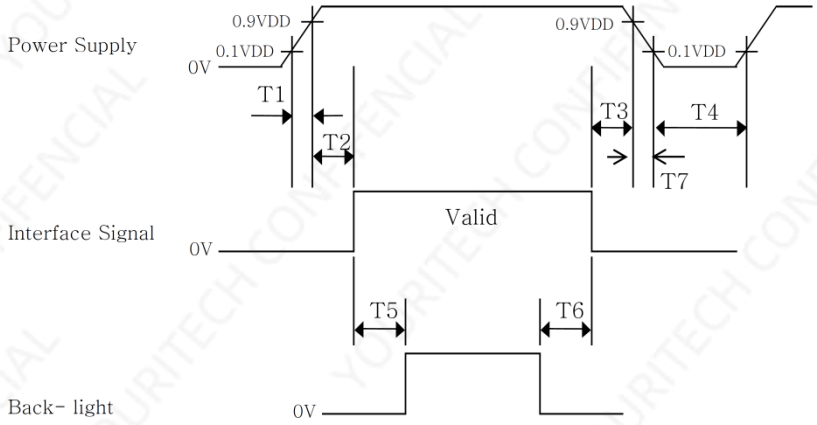
PIN	Symbol	Description
1	K1	Current Feedback(-)
2	K2	Current Feedback(-)
3	A3	LED Power Supply(+)
4	A4	LED Power Supply(+)
5	K5	Current Feedback(-)
6	K6	Current Feedback(-)

Light bar circuit diagram



3.3 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



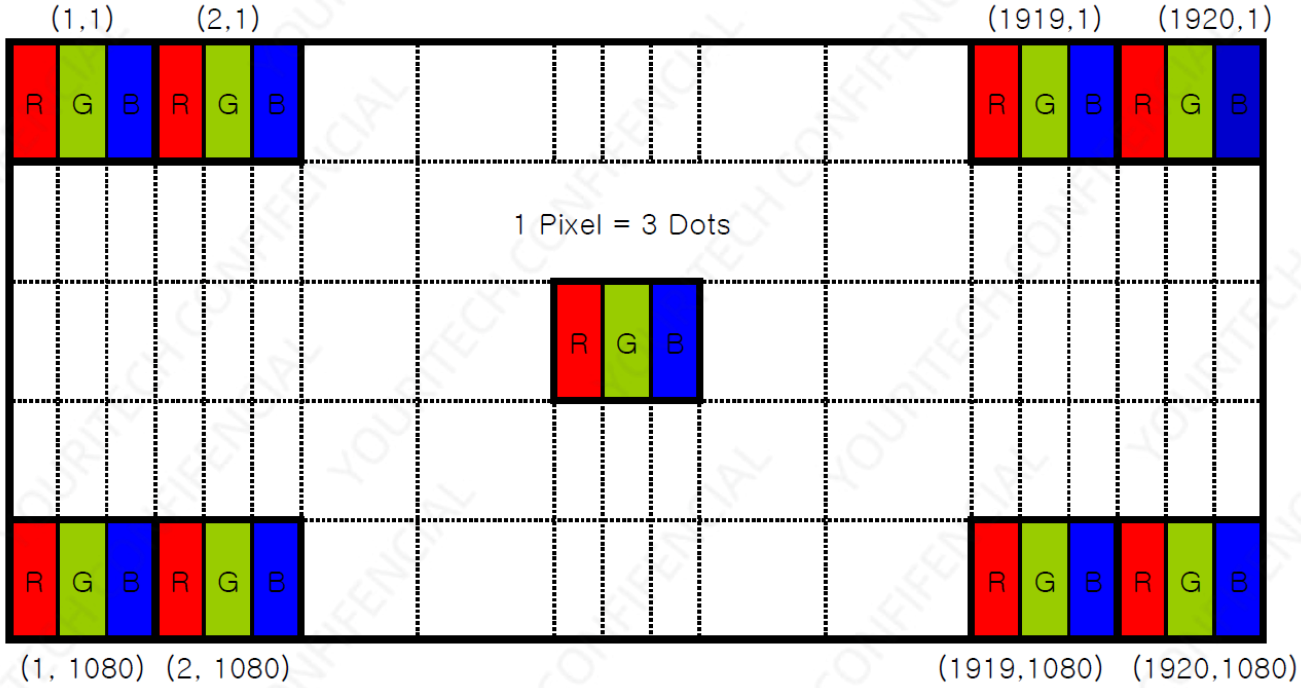
- 0.5 ms ≦ T1 ≦ 10 ms
- 0 ≦ T2 ≦ 50 ms
- 0 ≦ T3 ≦ 50 ms
- 1 sec ≦ T4
- 200 ms ≦ T5
- 200 ms ≦ T6

Note:

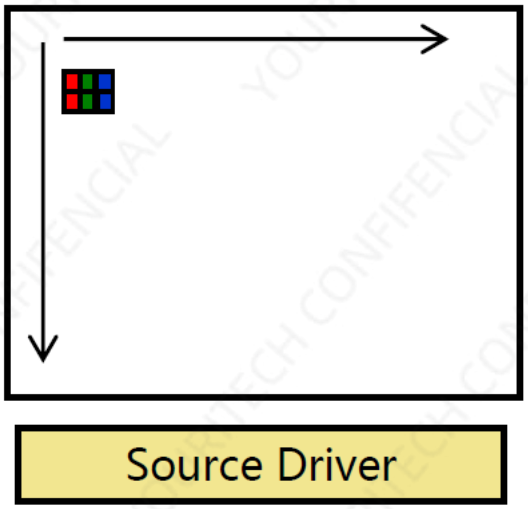
1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing 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.

3.4 Timing Characteristics

3.4 .1 Input Data Signals and Display position on the screen



Display Position of Input Data (V-H)



Scan direction

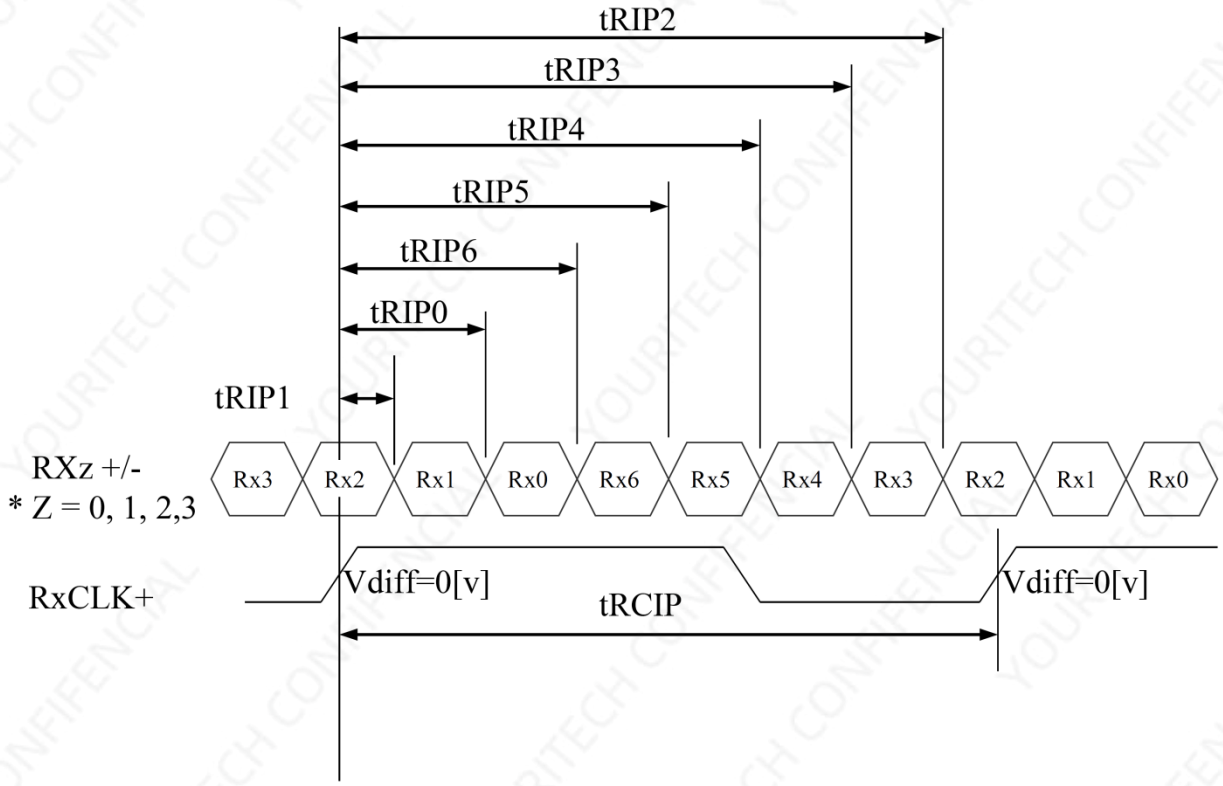
3.4.1 Input signal, basic display colors & gray scale of colors

Color & Gray Scale		Input Data Signal																							
		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

3.4.2 LVDS Rx Interface Timing parameter

The Specification of the LVDS Rx interface timing parameter is shown as below table.

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.76	13.46	16.15	nsec	
Input Data 0	tRIP 1	0.0	+0.4	+0.4	nsec	
Input Data 1	tRIP 0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP 6	2xtRCIP/7-0.4	2xtRCIP/7	2xtRCIP/7+0.4	nsec	
Input Data 3	tRIP 5	3xtRCIP/7-0.4	3xtRCIP/7	3xtRCIP/7+0.4	nsec	
Input Data 4	tRIP 4	4xtRCIP/7-0.4	4xtRCIP/7	4xtRCIP/7+0.4	nsec	
Input Data 5	tRIP 3	5xtRCIP/7-0.4	5xtRCIP/7	5xtRCIP/7+0.4	nsec	
Input Data 6	tRIP 2	6xtRCIP/7-0.4	6xtRCIP/7	6xtRCIP/7+0.4	nsec	



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

3.4.3 Timing Condition

Item		Symbol	Values			Unit
			Min.	Typ.	Max.	
Clock	Frequency	1/Tc	63	74.25	88	MHz
	High Time	-	-	4/7Tc	-	
	Low Time	-	-	3/7Tc	-	
Frame Period		T_V	1100	1125	1200	line
			55	60	65	Hz
			15.38	16.67	18.18	ms
Vertical display Period		T_{Vd}	-	1080	-	line
One line Scanning Period		Th	1050	1100	1120	clocks
Horizontal Display Period		Thd	-	960	-	clocks

Note : This panel is operated by DE only.

4. Optical Specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ_3	CR>10 Θ=0° (Center)	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Response time	GTG	T_g		-	14	25	ms	Note 5
Contrast ratio		CR	Θ=0° (Center)	700	1000	-	-	Note 2
Color chromaticity	White	W_x		0.246	0.296	0.346	-	Note 4
		W_y		0.276	0.326	0.376	-	
	Red	R_x		0.582	0.632	0.682		
		R_y		0.301	0.351	0.401		
	Green	G_x		0.238	0.288	0.338		
		G_y		0.563	0.613	0.663		
	Blue	B_x		0.097	0.147	0.197		
		B_y		0.006	0.056	0.106		
Luminance (center)		L		1350	1500	-	cd/m^2	
NTSC		-			72		%	
Cross Talk		-		-	-	2.0	%	Note 6
Luminance uniformity 9 pt		LV		65	75	-	%	Note 3

Note:

1. Viewing angles is the angle at which the contrast ration 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 Θ=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) Luminance Contrast Ration (CR) is defined mathematically.

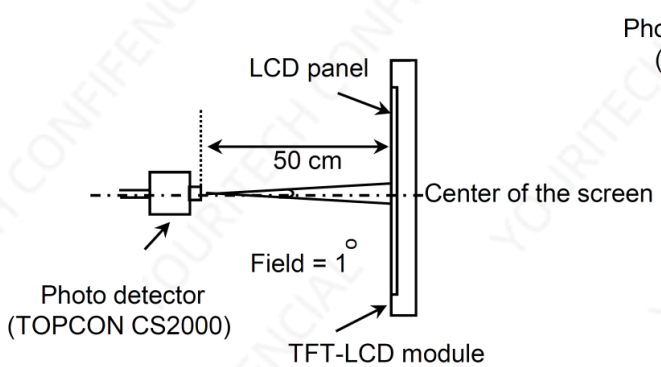
$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. The White luminance uniformity on LCD surface is then expressed as:
   △Y=(Minimum Luminance of 9points / Maximum Luminance of 9point) * 100 (See FIGURE 2)
4. The color chromaticity coordinates specified in above table, 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.
5. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.

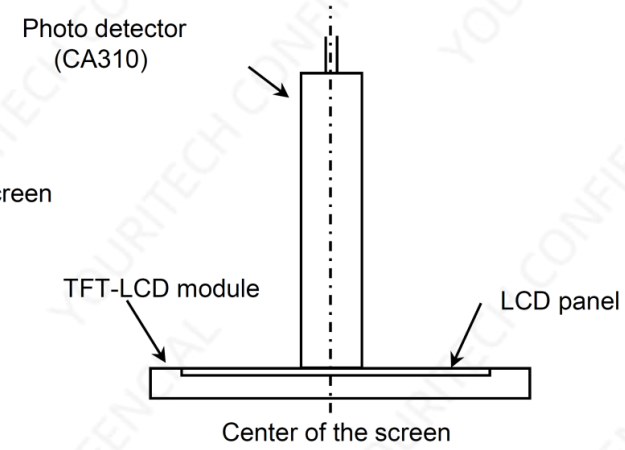
6. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance(Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance(Y_B) of the same area when any adjacent area is driven dark.

Optical measurements:

Figure 1. Measurement Set Up

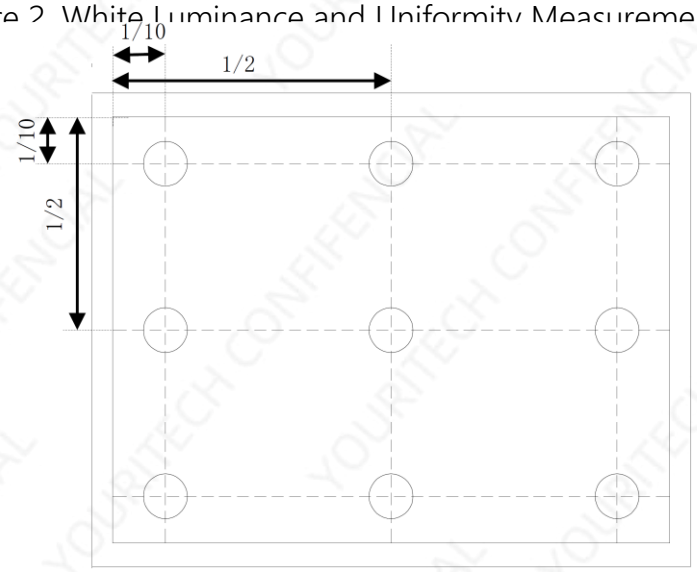


View angel range, uniformity, etc. measurement setup



Flicker, measurement setup

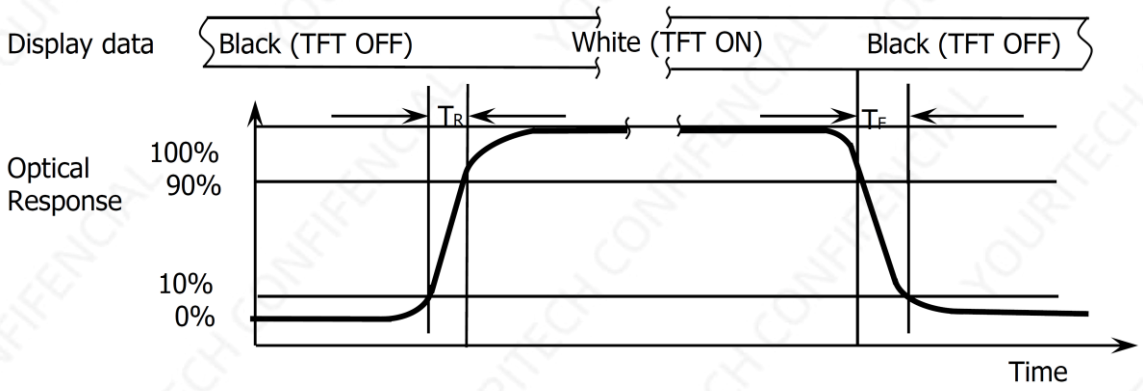
LF2 Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



Luminance of white is defined as luminance values of center of the LCD surface. Luminance shall be measured with all pixel 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 : △Y9= Minimum Luminance of 9 points / Maximum Luminance of 9points (see FIGURE 2).

Figure 3. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Tf.

5. Reliability Test Items

No.	Item	Test Conditions
1	High Temperature Storage	85℃, 240hrs
2	Low Temperature Storage	-30℃, 240hrs
3	High Temperature Operation	80℃, 240hrs
4	Low Temperature Operation	-20℃, 240hrs
5	High Temperature and High Humidity operation test	50℃, 80%RH, 240hrs
6	High Temperature and High Humidity storage test	60℃, 90%RH, 240hrs
7	Thermal shock	-20℃←→60℃(0.5 hr), 100 cycle

Result Evaluation Criteria: Under the display quality test condition with normal operation state. Do not change the condition as such changes may affect practical display function. Normal operation state temperature: 15~35℃, Humidity: 45~75%.

6. General Precautions

1 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.
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. Pins of I/F connector shall not be touched directly with bare hands.

2 Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

3 Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.
3. 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.
4. 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.

4 Storage

1. Store the module in a dark room where must keep at 25±10℃ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.
4. It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

5 Operation

1. Do not connect, disconnect the module in the “Power On” condition.
2. Power supply should always be turned on/off by following item “POWER ON OFF SEQUENCE ”.
3. 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 minimize the interference.
4. The FPC cable between the LED chips and its converter power supply shall be a minimized length and be connected directly. The longer cable between the back-light and the converter may cause lower luminance of light source (LED).

6 Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

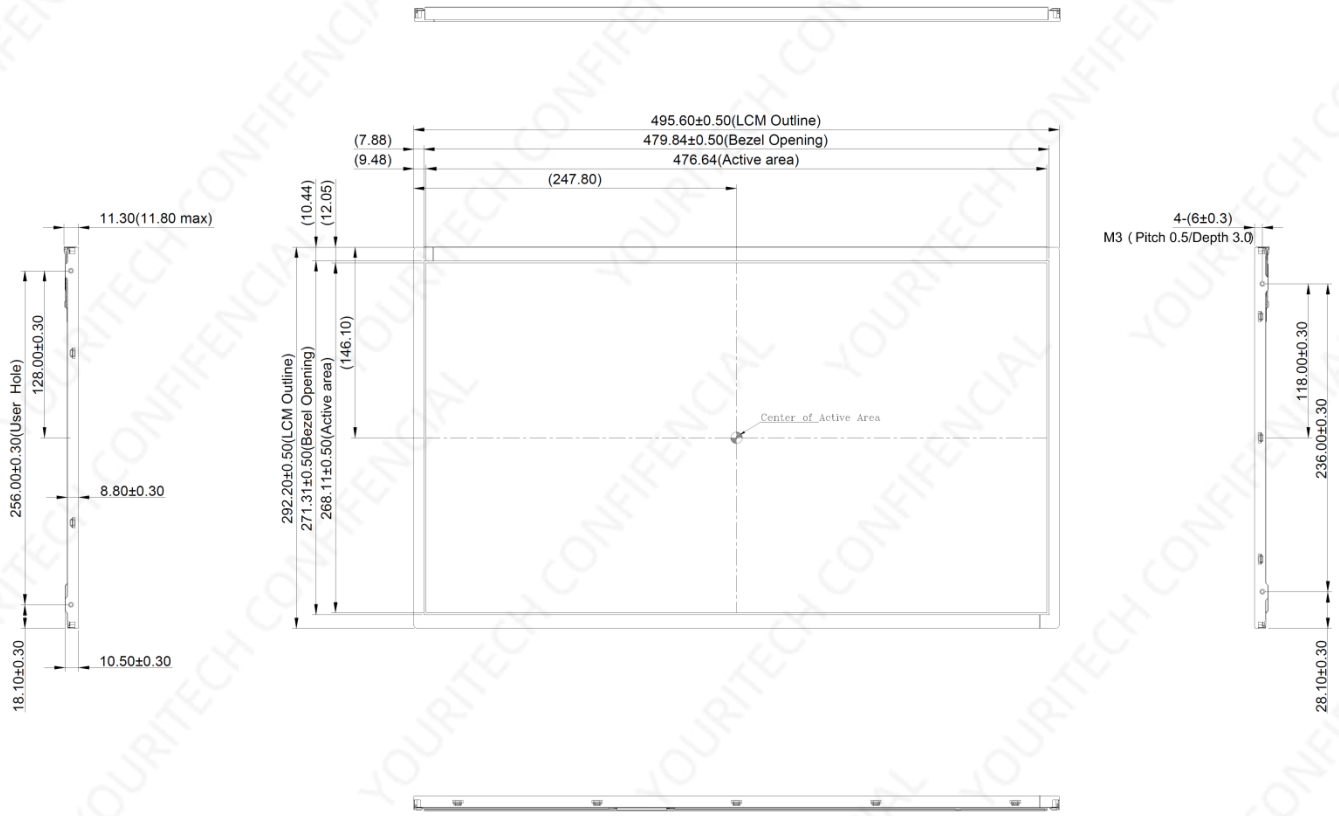
7 Other

1. Ultra-violet ray filter is necessary for outdoor operation.
2. Avoid condensation of water. It may result in improper operation or disconnection of electrode.
3. Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, Variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.
4. If the module displays the same pattern continuously for a long period of time, it can be the situation when the image “sticks” to the screen.
5. The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.
6. This module has its circuitry PCB’s on the front or rear side and should be handled carefully in order not to be stressed.

7. Appendix

7.1 Mechanical Drawing

(1)Front Side (Unit： mm)



(2) Rear Side (Unit： mm)