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Mechanical design

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Optical Bonding



☒ Preliminary Specifications

☐ Final Specifications

Title	15.6-inch LCM Product Specifications
Model Name	ET156FH03-R
Version	0

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

Approved By	Prepared By
Leo	William
2024-08-30	2024-08-30



REVISION HISTORY

Version	Description of Changes	Date	Prepared
0	First Edition	2024-08-30	William



Contents

1.	General Description.....	4
2.	Absolute Maximum Ratings.....	5
3.	Electrical Specifications	6
	3.1 Pin Assignment.....	6
	3.2 Signal Electrical Characteristics.....	8
	3.3 Interface Timings.....	8
	3.4 Input Power Specifications.....	9
	3.5 Power ON/OFF Sequence	10
	3.6 Backlight Unit.....	11
4.	Optical Specifications.....	12
5.	Reliability Test Items.....	15
6.	General Precautions.....	16
7.	Appendix	18
	7.1. Mechanical Drawing.....	18
	7.2. EDID Table.....	19



1. General Description

The specification is a 15.6inch model TFT Liquid Crystal Display. The matrix uses a-Si Thin Film Transistor as a switching device. This TFTLCD has a 15.6 inch diagonally measured active display area with FHD resolution (1920 horizontal by 1080 vertical pixels array). All input signals are eDP1.2 interface compatible.

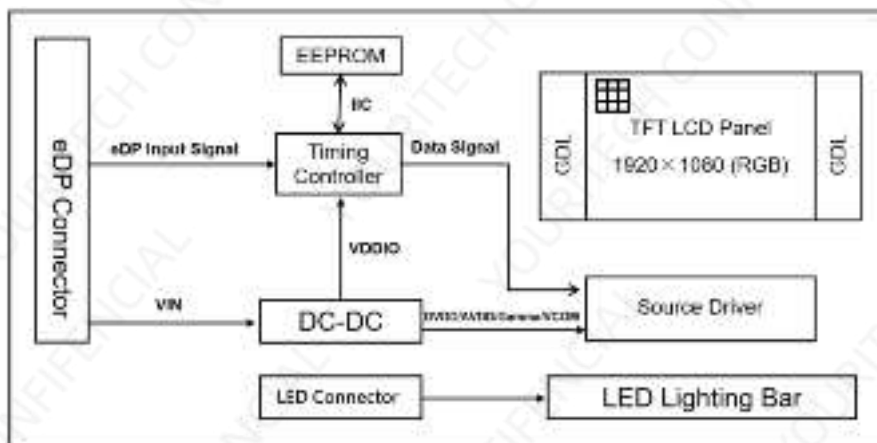
Features

- (1) 2 lane eDP interface with 2.7 Gbps link rates
- (2) 16.7M(6bits+Hi FRC)color depth, color gamut 45%
- (3) Green product (RoHS & Halogen free product)

No.	Item	Specification	Remark
1	LCD size	15.6 inch (Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	1920 x 3 (RGB) x1080	
4	Display mode	Normally Black	
5	Pixel pitch	0.17925(H) mm x 0.17925(V) mm	
6	Active area	344.16(H) mm x 193.59(V) mm	
7	Module size	359.5(W) x 215.95(H) x 3.0(D) mm	Note 1
8	Surface treatment	Anti-Glare,3H	
9	Color arrangement	RGB-stripe	
10	Interface	eDP 1.2	
11	Weight	470g(Max.)	

Note 1 : Refer to Mechanical Drawing

Drive Architecture



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.

Table : Absolute Maximum Ratings

Ta=25+/-5°C

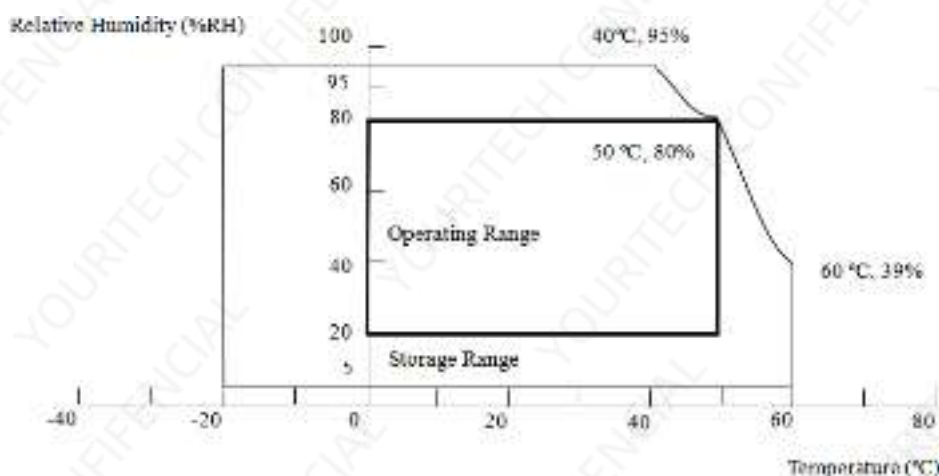
Parameter	Symbol	Min.	Max.	Unit	Remarks
Logic Supply Voltage	V _{CC}	-0.3	3.6	V	(1),(2),(3),(4)
Logic Input Signal Voltage	V _{Signal}	-0.3	V _{CC}	V	
B/L Supply Voltage	V _{LED}	- 0.3	24	V	
Operating Temperature	T _{OP}	0	50	°C	
Storage Temperature	T _{ST}	-20	60	°C	

Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded.

Note (2) All the contents of electro-optical specifications and display fineness are guaranteed under Normal Conditions. All the display fineness should be inspected under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 50±10%RH.

Note (3) Unpredictable results may occur when it was used in extreme conditions. T_a= Ambient Temperature, T_{gs}= Glass Surface Temperature. All the display fineness should be inspected under normal conditions.

Note (4) Temperature and relative humidity range are shown in the figure below.



Absolute Ratings of Environment of the LCD Module



3. Electrical Specifications

3.1 Pin Assignment

Connector used : Starconn/ 300E30-0010RA-G3

PIN No.	SIGNAL NAME	DESCRIPTION
1	NC	No Connection
2	H_GND	Ground
3	LANE1_N	eDP RX Channel 1 Negative
4	LANE1_P	eDP RX Channel 1 Positive
5	H_GND	Ground
6	LANE0_N	eDP RX Channel 0 Negative
7	LANE0_P	eDP RX Channel 0 Positive
8	H_GND	Ground
9	AUX_CH_P	eDP AUX CH Positive
10	AUX_CH_N	eDP AUX CH Negative
11	H_GND	Ground
12	LCD_VCC	Power Supply, 3.3V (typ.)
13	LCD_VCC	Power Supply, 3.3V (typ.)
14	BIST	Self Test(BIST) prohibit pull up resistor on LCD side
15	GND	Ground
16	GND	Ground
17	HPD	Hot Plug Detect Output
18	NC	No Connection
19	NC	No Connection
20	NC	No Connection
21	NC	No Connection
22	NC	No Connection
23	NC	No Connection
24	NC	No Connection
25	NC	No Connection
26	NC	No Connection
27	NC	No Connection
28	NC	No Connection
29	NC	No Connection
30	NC	No Connection



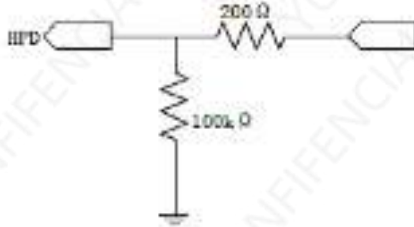
The shielding case is connected with signal GND

Connector used: Starconn / 300E30-0010RA-G3

Note 1: Don't input any signals or any powers into a NC pin. Keep the NC pin Open.

Note 2: The shielding case is connected with signal GND.

Note 3: The equivalent circuit figure of the terminal.



(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.



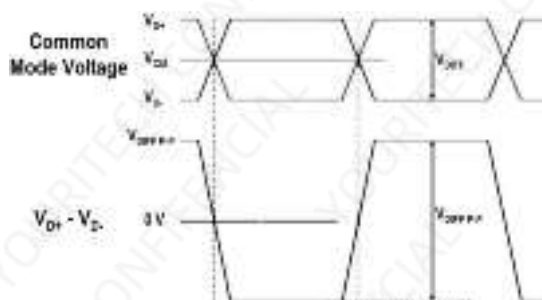
3.2 Signal Electrical Characteristics

Display Port Main Link

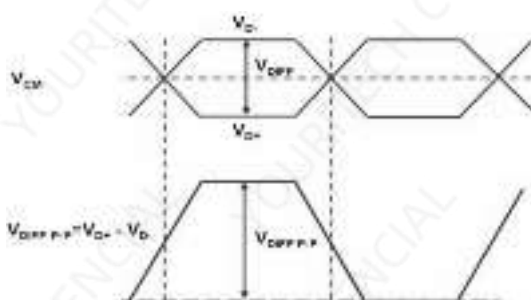
Parameter	Description	Min.	Typ.	Max.	Unit
V_{CM}	Differential Common Mode Voltage	-	0	-	V
$V_{Diff\ P-P}$ Level	Differential Peak to Peak Voltage Level 1	0.4	-	1.3	V

Note:

- (1) Input signals shall be low or Hi- resistance state when VCC is off.
- (2) It is recommended to refer the specifications of VESA Display Port Standard.



Display Port Main Link Signal



Display Port AUX_CH Signal

Display Port AUX_CH

Parameter	Description	Min.	Typ.	Max.	Unit
V_{CM}	Common Mode Voltage When receiving	0	-	2.0	V
	Common Mode Voltage When transmitting	-	0.15	-	V
$V_{Diff\ P-P}$	Differential Peak to Peak Voltage	0.4	-	0.8	V

Note: Follow as VESA Display Port standard

Display Port VHPD

Parameter	Description	Min.	Typ.	Max.	Unit
V_{HPD}	HPD Voltage	2.25	-	3.6	V

Note: Follow as VESA Display Port standard.

3.3 Interface Timings

Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Frequency	Fclk	111.0	138.8	150.3	MHz
H Total Time	HT	2,040	2,080	2,120	Clocks
H Active Time	HA	1,920			Clocks
V Total Time	VT	1,104	1,112	1,120	Lines
V Active Time	VA	1,080			Lines
Frame Rate	Fv	48	60	65	Hz

Note1: $HT * VT * \text{Frame Frequency} \leq 150.3 \text{ MHz}$

Note2: All reliabilities are specified for timing specification based on refresh rate of 60Hz.



3.4 Input Power Specifications

Input power specifications are as follows.

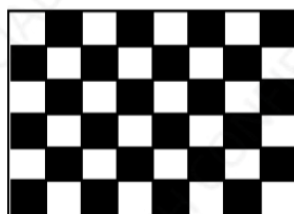
Input Power Specifications

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
System Power Supply							
LCD Drive Voltage (Logic)		V_{CC}	3.0	3.3	3.6	V	(1),(2)
V_{CC} Current	mosaic Pattern	I_{VCC}	-	0.233	-	A	(1),(3)
V_{CC} Power Consumption	mosaic Pattern	P_{VCC}	-	-	0.77	W	
Rush Current		I_{rush}	-	-	1.5	A	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage		V_{VCC-RP}	-	-	200	mV	(1)

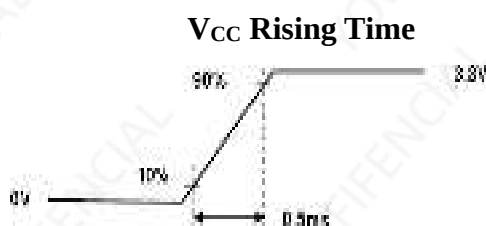
Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 50±10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified V_{CC} current and power consumption are measured under the $V_{CC} = 3.3V$, $F_V = 60Hz$ condition and 8*6 mosaic Pattern.



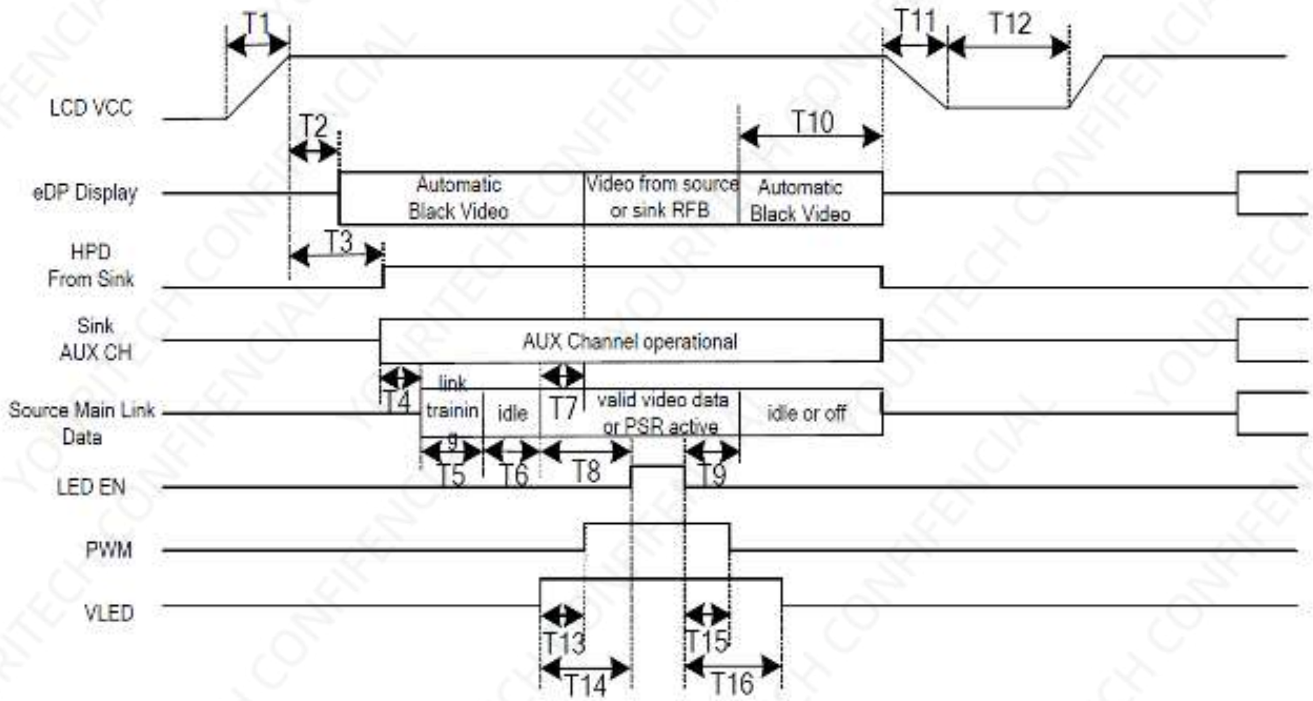
Note (4) The figures below is the measuring condition of V_{CC} Rush current can be measured when T_{rush} is 0.5ms.



3.5 Power ON/OFF Sequence

Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VCC voltage is off.

Power Sequence



Power Sequencing Requirements

Parameter	Symbol	Min.	Typ.	Max.	Unit
V _{CC} Rise Time (10% to 90%)	T1	(0.5)	-	(10)	ms
Delay from V _{CC} to automatic Black Video generation	T2	(0)	-	(200)	ms
Delay from V _{CC} to HPD high	T3	(0)	-	(200)	ms
Delay from HPD high to link training initialization	T4	-	-	-	ms
Link training duration	T5	-	-	-	ms
Link idle	T6	-	-	-	ms
Delay from valid video data from Source to video on display	T7	(0)	-	(50)	ms
Delay from valid video data from Source to backlight enable	T8	(200)	-	-	ms
Delay from backlight disable to end of valid video data	T9	-	-	-	ms
Delay from end of valid video data from Source to V _{CC} off	T10	(0)	-	(500)	ms
V _{CC} fall time (90% to 10%)	T11	(0.5)	-	(10)	ms
V _{CC} off time	T12	(500)	-	-	ms
Delay from V _{LED} to PWM	T13	0	-	-	ms
Delay from V _{LED} to backlight enable	T14	0	-	-	ms
Delay from backlight disable to V _{LED} off	T15	0	-	-	ms
Delay from PWM off to V _{LED} off	T16	0	-	-	ms

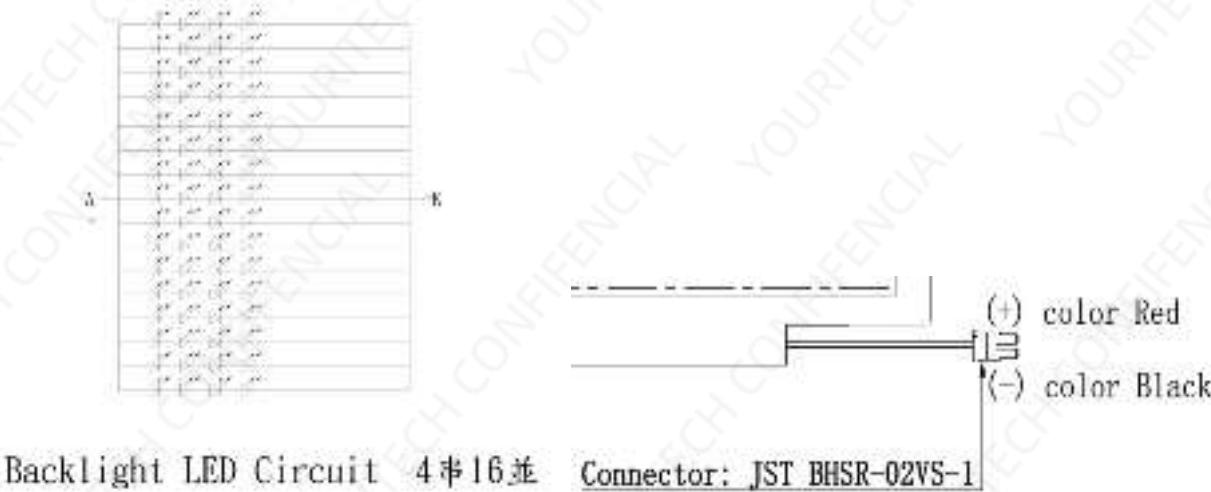


3.6 Backlight Unit

The backlight system is an edge-lighting type with white-LED.
(It is usually required to measure under the following condition: Ta=25°C±2°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Forward Voltage	V _{LED}	-	24	25.2	V	BL PWR
LED Forward Current	I _{LED}	-	320	-	mA	
LED Power Consumption	P _{BL}		7.68	-	W	
Inrush Current	I _{rushBL}	-	-	2	A	
LED Life time	-	30000	-	-	Hour	

Connector : JST BHSR-02VS-1



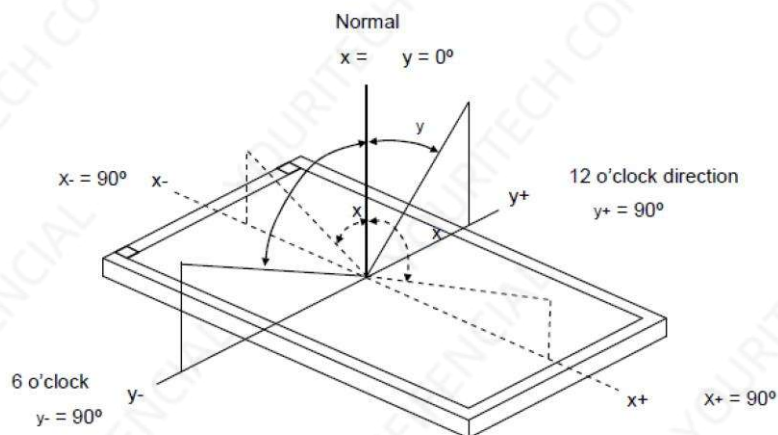
4. Optical Specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	θ_{x+}	CR>10 $\theta_x=0^\circ,\theta_y=0^\circ$	80	85	-	Deg.	Note 1
		θ_{x-}		80	85	-	Deg.	
	Vertical	θ_{y+}		80	85	-	Deg.	
		θ_{y-}		80	85	-	Deg.	
Response time		T _{On} +T _{Off}	$\theta=0^\circ$ (Center)	-	(25)	(30)	ms	Note 2 Note 3
Contrast ratio		CR		600	800	-	-	Note 2 Note 4
Color chromaticity (CIE 1931)	White	W _x		(0.28)	(0.320)	(0.36)	-	Note 2 Note 5 Note 6
		W _y		(0.300)	(0.340)	(0.380)		
	Red	R _x		(0.540)	(0.580)	(0.620)		
		R _y		(0.320)	(0.360)	(0.400)		
	Green	G _x		(0.293)	(0.333)	(0.373)		
		G _y		(0.544)	(0.584)	(0.624)		
	Blue	B _x		(0.118)	(0.158)	(0.198)		
		B _y		(0.089)	(0.129)	(0.169)	-	
Luminance (AA Center point)		L		1000		-	cd/m ²	
NTSC ratio		%		42	45	-		
Luminance uniformity 13pt		Yu		68	74	-	%	

Test Conditions: The ambient temperature is 25°C.

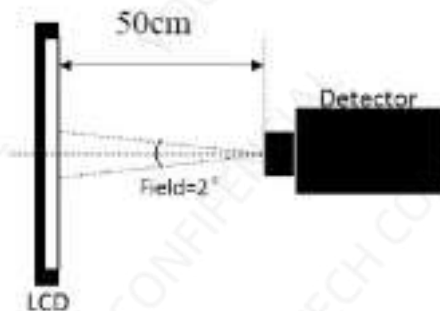
Note1: Definition of viewing angle range

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles 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.



Note2: Definition of optical measurement

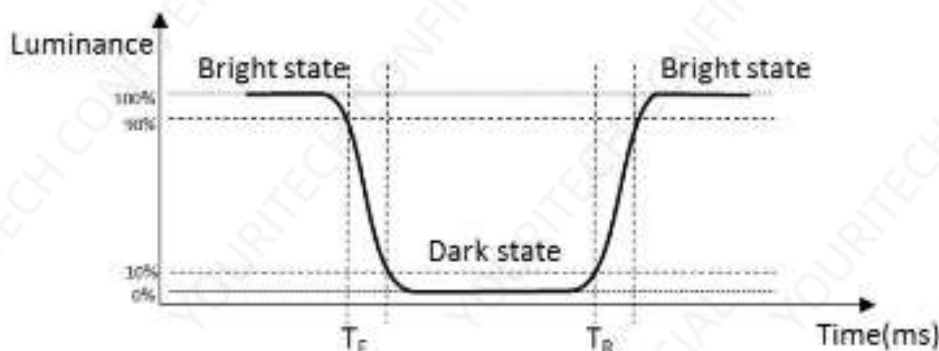
The optical characteristic should be measured in darkroom. After 15 minutes operation, the optical properties are measured at the center point of the LCD screen.



Measurement equipment

Note3: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_R) is the time between photo detector output intensity changed from 10% to 90%. And fall time (T_F) is the time between photo detector output intensity changed from 90% to 10%.



The definition of T_R and T_F

Note4: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

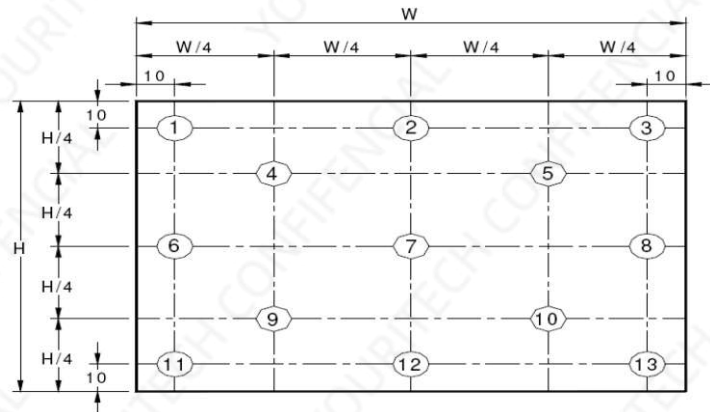
Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.



Note6: Definition of Luminance Uniformity (“White” state)

Active area is divided in to 13 measuring areas. (1~13)



Every measuring point is placed at the center of each measuring area.

$$(13\text{pt}) Y_u = \frac{\text{Minimum Luminance of 13 points (Brightness)}}{\text{Maximum Luminance of 13 points (Brightness)}} \times 100\%$$



5. Reliability Test Items

No.	Item	Test Conditions
1	High Temperature Storage	Ta=60°C, 240hrs
2	Low Temperature Storage	Ta=-20°C, 240hrs
3	High Temperature Operation	Ts=50°C, 240hrs
4	Low Temperature Operation	Ta=0°C, 240hrs
5	Operate at High Temperature and Humidity	Ta=40°C, 80%RH, 240hrs
6	Thermal Shock	-20°C~+60°C per 30min,100 cycles, storage

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°C, 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 $25\pm 10^{\circ}\text{C}$ 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

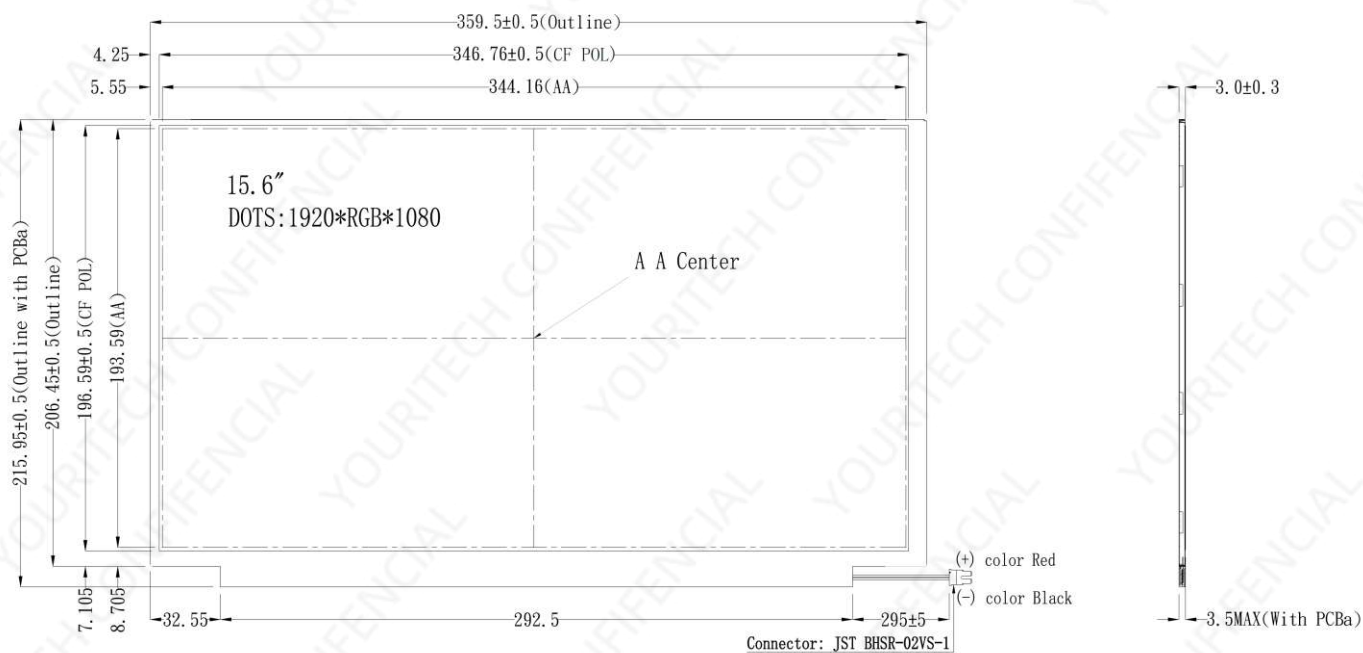
1. Ultra-violet ray filter is necessary for outdoor operation.
2. Avoid condensation of water. It may result in improper operation or disconnection of electrode.
3. Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, Variation in part contents and 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. 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

Unit : mm



7.2. EDID Table

Address	Field Name & Comments		Value	Value	Value
(HEX)			(HEX)	(BIN)	(DEC)
0	Header		00	00000000	0
1	Header		FF	11111111	255
2	Header		FF	11111111	255
3	Header		FF	11111111	255
4	Header		FF	11111111	255
5	Header		FF	11111111	255
6	Header		FF	11111111	255
7	Header		00	00000000	0
8	manufacture code	HKC	21	00100001	33
9			63	01100011	99
0A	Product Code	PID:5290	52	01010010	82
0B			90	10010000	144
0C	LCD module Serial No – (“0” if not used)		00	00000000	0
0D	LCD module Serial No – (“0” if not used)		00	00000000	0
0E	LCD module Serial No – (“0” if not used)		00	00000000	0
0F	LCD module Serial No – (“0” if not used)		00	00000000	0
10	Week of manufacture	week0	00	00000000	0
11	Year of manufacture	Year2021	1F	00011111	31
12	EDID Structure Ver #		01	00000001	1
13	EDID revision #		04	00000100	4
14	Video I/P definition = Digital I/P (80h)		A5	10100101	165
15	Max H image size = (Rounded to cm)	34cm	22	00100010	34
16	Max V image size = (Rounded to cm)	19cm	13	00010011	19
17	Display Gamma	2.2	78	01111000	120
18	Feature support (no DPMS, Active off, RGB, timing BLK1)		E3	11100011	227
19	Red/Green Low bits (RxRy/GxGy)	Rx:0.581 Ry:0.358 Gx:0.347 Gy:0.57 Bx:0.159 By:0.122 Wx:0.313 Wy:0.329	AF	10101111	175
1A	Blue/White Low bits (BxBY/WxWy)		80	10000000	128
1B	Red X Rx		94	10010100	148
1C	Red Y Ry		5B	01011011	91
1D	Green X Gx		58	01011000	88
1E	Green Y Gy		91	10010001	145
1F	Blue X Bx		28	00101000	40
20	Blue Y By		1F	00011111	31
21	White X Wx		50	01010000	80
22	White Y Wy		54	01010100	84
23	Established timings 1 (00h if not used)		00	00000000	0



24	Established timing 2 (00h if not used)		00	00000000	0
25	Manufacturer's timings (00h if not used)		00	00000000	0
26	Standard timing ID1 (01h if not used)		01	00000001	1
27	Standard timing ID1 (01h if not used)		01	00000001	1
28	Standard timing ID2 (01h if not used)		01	00000001	1
29	Standard timing ID2 (01h if not used)		01	00000001	1
2A	Standard timing ID3 (01h if not used)		01	00000001	1
2B	Standard timing ID3 (01h if not used)		01	00000001	1
2C	Standard timing ID4 (01h if not used)		01	00000001	1
2D	Standard timing ID4 (01h if not used)		01	00000001	1
2E	Standard timing ID5 (01h if not used)		01	00000001	1
2F	Standard timing ID5 (01h if not used)		01	00000001	1
30	Standard timing ID6 (01h if not used)		01	00000001	1
31	Standard timing ID6 (01h if not used)		01	00000001	1
32	Standard timing ID7 (01h if not used)		01	00000001	1
33	Standard timing ID7 (01h if not used)		01	00000001	1
34	Standard timing ID8 (01h if not used)		01	00000001	1
35	Standard timing ID8 (01h if not used)		01	00000001	1
36	Pixel Clock LSB	CLK:138.78	35	00110101	53
37	Pixel Clock HSB		36	00110110	54
38	Horizontal Active (lower 8 bits)	H active:1920 CLK	80	10000000	128
39	Hor blanking (lower 8 bits)	H blank:160 CLK	A0	10100000	160
3A	Horizontal Active/Horizontal blanking (upper4:4 bits)		70	01110000	112
3B	Vertical active(lower 8 bits)	V Active:1080 Line	38	00111000	56
3C	Vertical blanking(lower 8 bits)	V blank:32Line	20	00100000	32
3D	Vertical Active : Vertical Blanking (upper4:4 bits)		40	01000000	64
3E	Horizontal Sync Offset	H front porch:24 CLK	18	00011000	24
3F	Horizontal Sync Pulse Width	H sync pulse:48 CLK	30	00110000	48
40	Vertical Sync Offset , Sync Width	V front porch:3Line	3C	00111100	60
41	Horizontal Vertical Sync Offset/Width upper 2 bits	V sync pulse:12 Line	00	00000000	0
42	Horizontal Image Size	344mm	58	01011000	88
43	Vertical image Size	194mm	C2	11000010	194
44	Horizontal Image Size /Vertical image size		10	00010000	16
45	Horizontal Border = (0 for Notebook LCD)		00	00000000	0
46	Vertical Border = (0 for Notebook LCD)		00	00000000	0
47	Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives,	DE only mode	19	00011001	25
48	Reserved for definition		00	00000000	0
49	Reserved for definition		00	00000000	0
4A	Reserved for definition		00	00000000	0
4B	ASCII String	Display Range Limits	FD	11111101	253
4C	Vertical Rate Offset		00	00000000	0
4D	Minimum Vertical Rate	40Hz	28	00101000	40
4E	Maximum Vertical Rate	60Hz	3C	00111100	60



4F	Minimum Horizontal Rate	67KHz	43	01000011	67
50	Maximum Horizontal Rate	67KHz	43	01000011	67
51	Maximum Pixel Clock	130Hz	0D	00001101	13
52	Video Timing Support Flag 01h	Range Limits Only	01	00000001	1
53	Line Feed		0A	00001010	10
54	Space		20	00100000	32
55	Space		20	00100000	32
56	Space		20	00100000	32
57	Space		20	00100000	32
58	Space		20	00100000	32
59	Space		20	00100000	32
5A	Panel Supplier Manufacture Code		00	00000000	0
5B			00	00000000	0
5C			00	00000000	0
5D			FE	11111110	254
5E			00	00000000	0
5F			48	01001000	72
60			4B	01001011	75
61			43	01000011	67
62			20	00100000	32
63			4D	01001101	77
64			59	01011001	89
65			20	00100000	32
66			20	00100000	32
67			20	00100000	32
68			20	00100000	32
69	New line character indicates end of ASCII string		0A	00001010	10
6A			20	00100000	32
6B			20	00100000	32
6C	Detailed timing/monitor descriptor #4		00	00000000	0
6D			00	00000000	0
6E			00	00000000	0
6F	FE (hex) defines ASCII string		FE	11111110	254
70	Flag		00	00000000	0
71	Manufacture P/N		4D	01001101	77
72	Manufacture P/N		42	01000010	66
73	Manufacture P/N		31	00110001	49
74	Manufacture P/N		35	00110101	53



75	Manufacture P/N		36	00110110	54
76	Manufacture P/N		43	01000011	67
77	Manufacture P/N		53	01010011	83
78	Manufacture P/N		30	00110000	48
79	Manufacture P/N		31	00110001	49
7A	Manufacture P/N		27	00100111	39
7B	Manufacture P/N		32	00110010	50
7C	Manufacture P/N		20	00100000	32
7D	Manufacture P/N		20	00100000	32
7E	Extension Flag = 00		00	00000000	0
7F	Checksum		0F	00001111	15

