



- (V) Preliminary Specifications
() Final Specifications

Module	12.1 Inch Color TFT-LCD
Model Name	FT121-EDC12 V1 (G121XTN01.0)

Customer

Date

Checked &
Approved by

Note: This Specification is subject to change
without notice.

Approved by

Date

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Prepared by

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Engineering Division /
ARES Optronics Corp.



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Record of Revision

[illegible]



1. Operating Precautions

- 1) Since front polarizer is easily damaged, please be cautious and not to scratch it.
- 2) Be sure to turn off power supply when inserting or disconnecting from input connector.
- 3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or soft cloth.
- 5) Since the panel is made of glass, it may be broken or cracked if dropped or bumped on hard surface.
- 6) To avoid ESD (Electro Static Discharge) damage, be sure to ground yourself before handling TFT-LCD Module.
- 7) Do not open nor modify the module assembly.
- 8) Do not press the reflector sheet at the back of the module to any direction.
- 9) In case if a module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED light bar edge. Instead, press at the far ends of the LED light bar edge softly. Otherwise the TFT Module may be damaged.
- 10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
- 11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
- 12) Small amount of materials without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
- 13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
- 14) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
- 15) The data on this specification sheet is applicable when LCD module is placed in landscape position.
- 16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.



2. General Description

This specification applies to the Color Active Matrix Liquid Crystal Display FT121-EDC12 V1 (G121XTN01.0) composed of a TFT-LCD display, a driver and power supply circuit, and a LED backlight system.

The screen format is intended to support XGA (1024(H) x 768(V)) screen and 16.2M (RGB 8-bits) or 262k colors (RGB 6-bits).

LED driving board for backlight unit is included in FT121-EDC12 V1 . All input signals are LVDS interface and compatible with G121SN01 V3 and G121SN01 V4. G121XTN01.0 designed with wide viewing angle; wide temperature and long life LED backlight is well suited for industrial applications. FT121-EDC12 V1 is a RoHS product.

2.1 Display Characteristics

Items	Unit	Specifications
Screen Diagonal	[inch]	12.1
Active Area	[mm]	245.76 (H) x 184.32 (V)
Pixels H x V		1024 x 768
Pixel Pitch	[mm]	0.24 x 0.24
Pixel Arrangement		R.G.B.W Rectangle
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 (typ.)
Typical Power Consumption	[Watt]	TBD(typ.) All black pattern
Weight	[Grams]	495 (Max.)
Physical Size	[mm]	279.0(H) x 209.0(V) x 9.0(D) (Max.)
Electrical Interface		1 channel LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		16.2M / 262K colors
Temperature Range Operating Storage (Non-Operating)	[°C] [°C]	-30 to +85 (Panel surface temp.) -30 to +85
RoHS Compliance		RoHS Compliance



2.2 Optical Characteristics

Item	Unit	Conditions	Min.	Typ.	Max.	Remark
White Luminance	[cd/m ²]	I _F =240mA/1 LED Line (center point)	1400	1500	-	Note 1
Uniformity	%	5 Points	75	-	-	Note 2, 3
Contrast Ratio			500	700	-	Note 4
Response Time	[msec]	Rising	-	25	35	Note 5
	[msec]	Falling	-	10	20	
	[msec]	Raising + Falling	-	35	55	
Viewing Angle	[degree]	Horizontal (Right) (Left)	70	80	-	Note 6
	[degree]		70	80	-	
	[degree]	Vertical (Upper) (Lower)	70	80	-	
	[degree]		70	80	-	
Color / Chromaticity Coordinates (CIE 1931)		Red x	TBD	TBD	TBD	
		Red y	TBD	TBD	TBD	
		Green x	TBD	TBD	TBD	
		Green y	TBD	TBD	TBD	
		Blue x	TBD	TBD	TBD	
		Blue y	TBD	TBD	TBD	
		White x	0.260	0.310	0.360	
		White y	0.280	0.330	0.380	
Color Gamut	%		-	70	-	

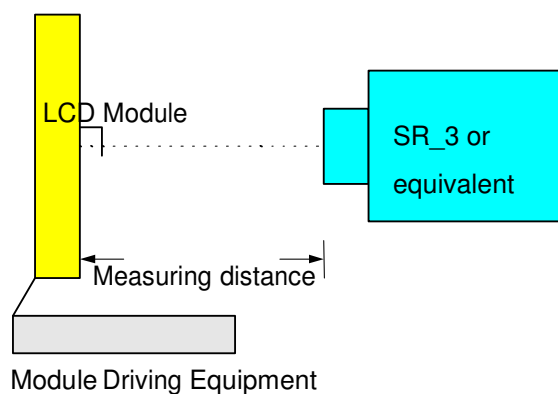
Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

Aperture

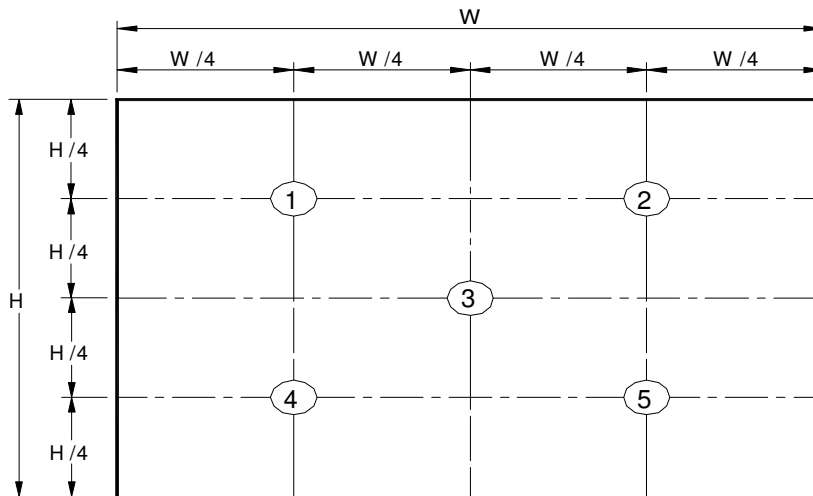
Test Point Center

Environment < 1 lux





Note 2: Definition of 5 points position (Display active area: 245.76mm (H) x 184.32mm (V))



Note 3: The luminance uniformity of 5 points is defined by dividing the minimum luminance values by the maximum test point luminance

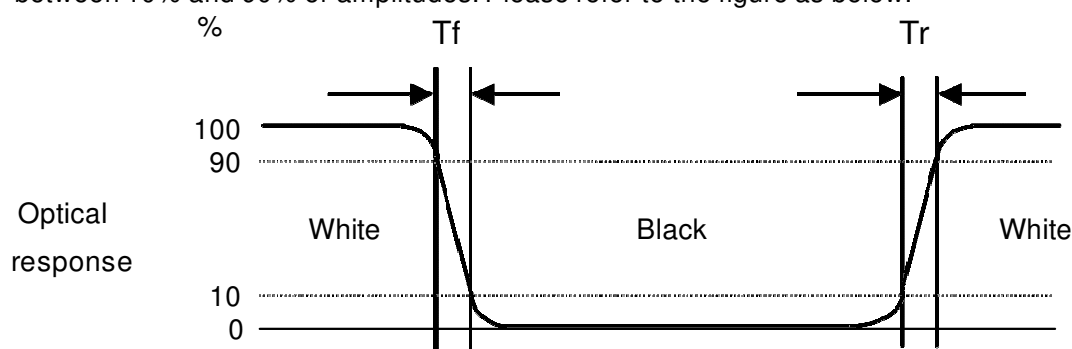
$$\delta_{W9} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

Note 4: Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

Note 5: Definition of response time:

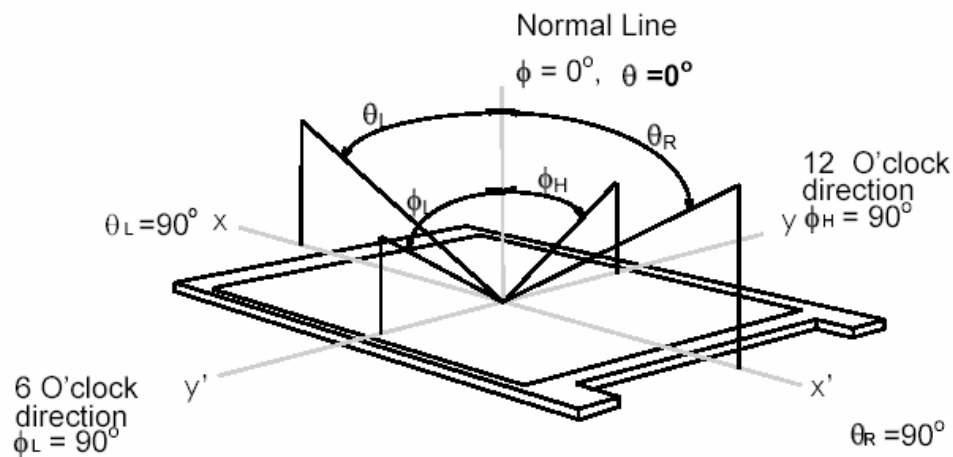
The output signals of photo detector are measured when the input signals are changed from "White" to "Black" (falling time) and from "Black" to "White" (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.



**Note 6: Definition of viewing angle**

Viewing angle is the measurement of contrast ratio

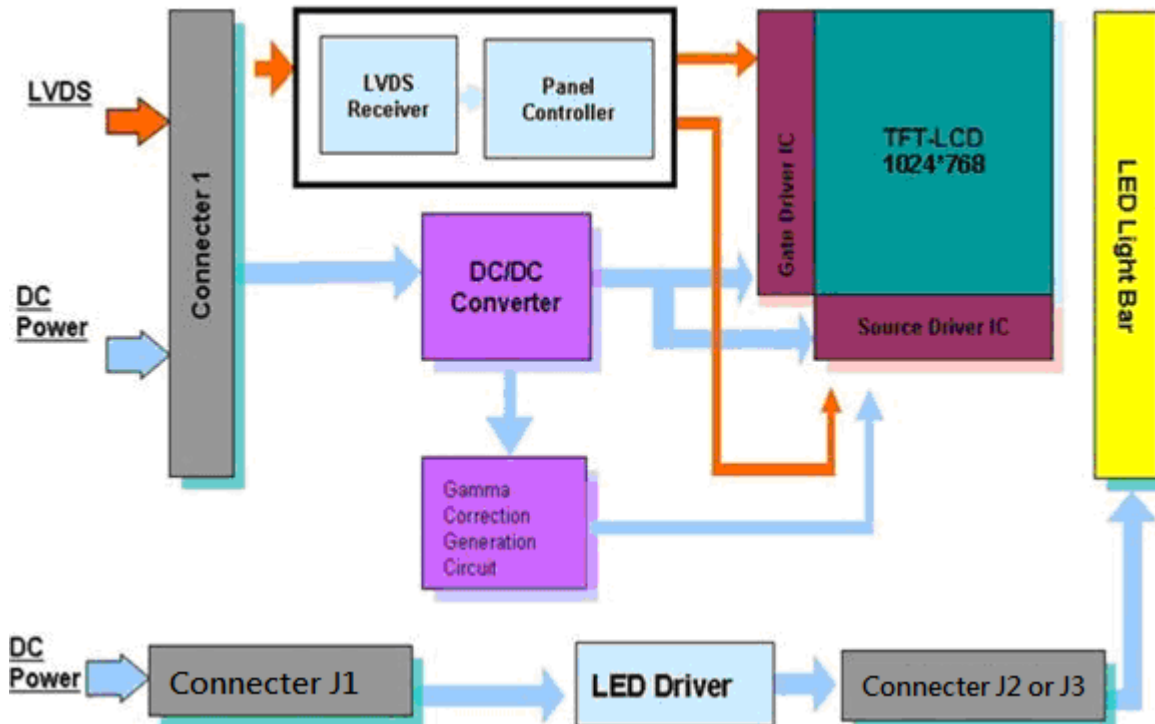
180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below:
90° (è) horizontal left and right, and 90° (Ö) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.





3. Functional Block Diagram

The following diagram shows the functional block of the 12.1 inch color TFT/LCD module:





4. Absolute Maximum Ratings

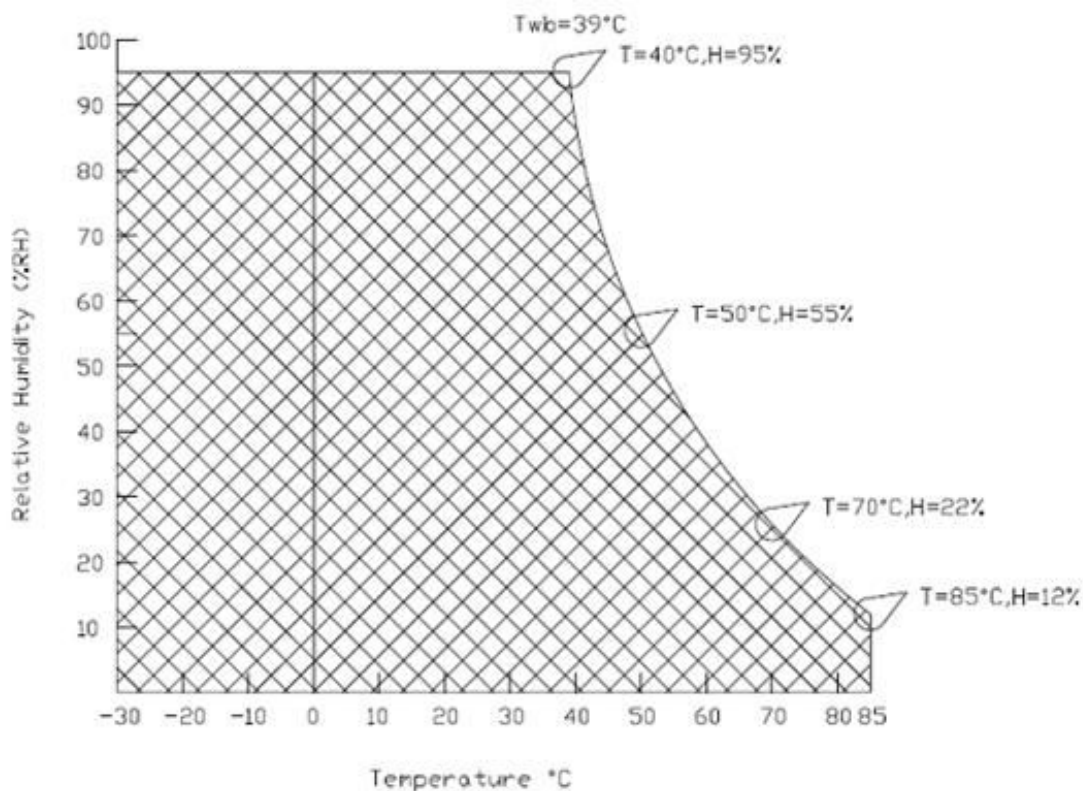
4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD Drive Voltage	Vin	-0.3	+3.6	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	+85	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-30	+85	[°C]
Storage Humidity	HST	5	90	[%RH]

Note: Maximum Wet- and no condensation.





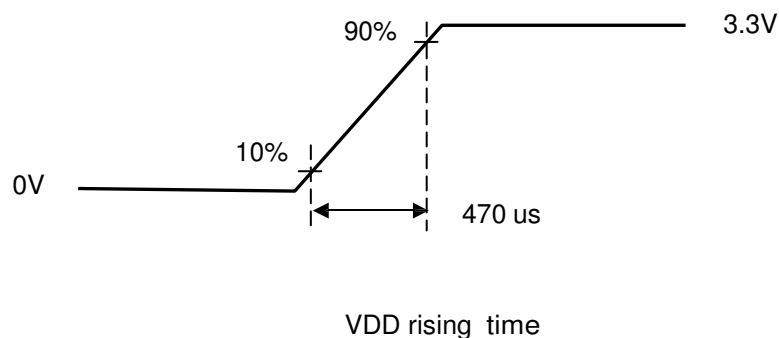
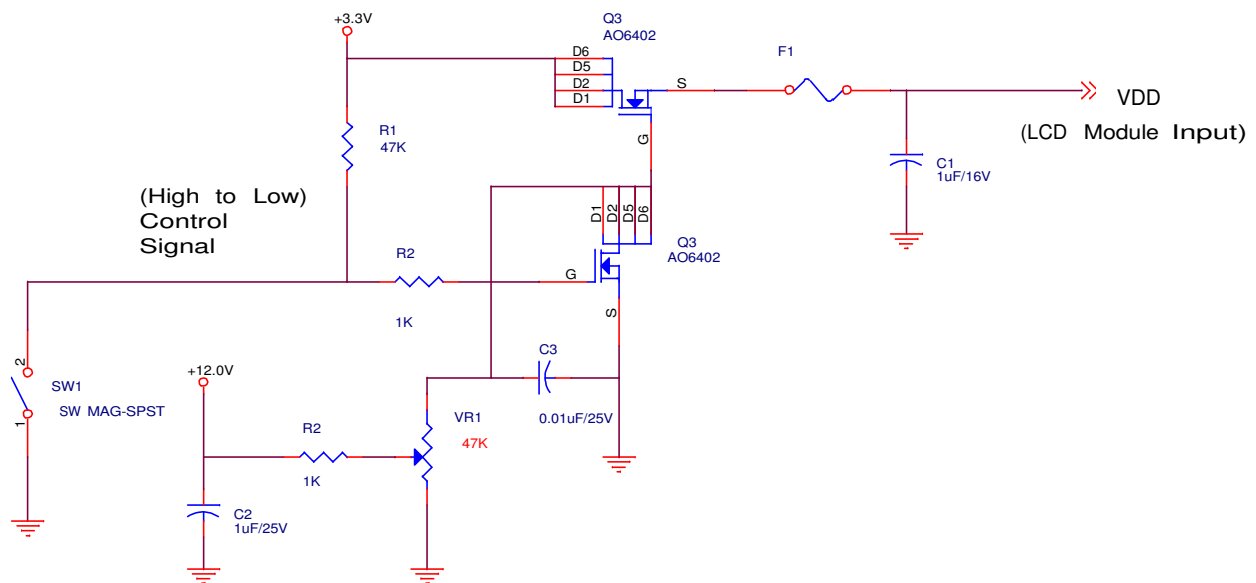
5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Input Voltage	3.0	3.3	3.6	[Volt]	
I _{VDD}	LCD Input Current	-	TBD	TBD	[mA]	VDD=3.3V at 60 HZ, all Black Pattern
P _{VDD}	LCD Power consumption	-	TBD	TBD	[Watt]	VDD=3.3V at 60 HZ, all Black Pattern
I _{rush LCD}	LCD Inrush Current	-	-	TBD	[A]	Note 1; VDD=3.3V Black Pattern, Rising time=470us
VDD _{rp}	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	VDD=3.3V at 60 HZ, all Black Pattern

Note 1: Measurement condition:





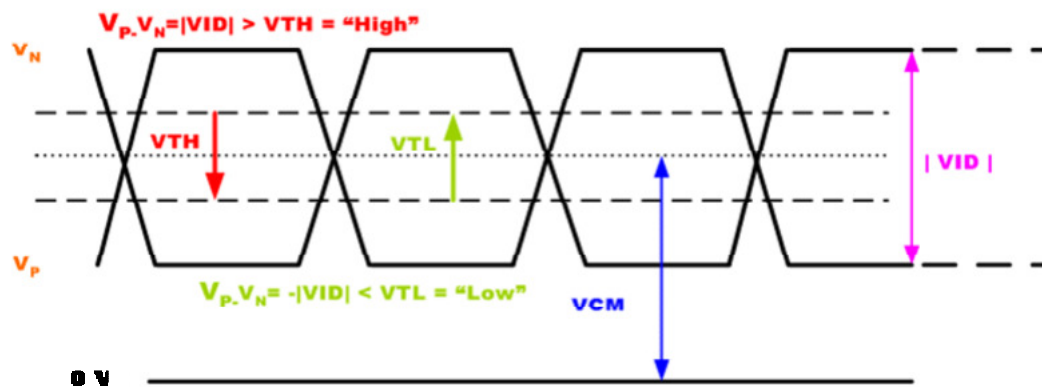
5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

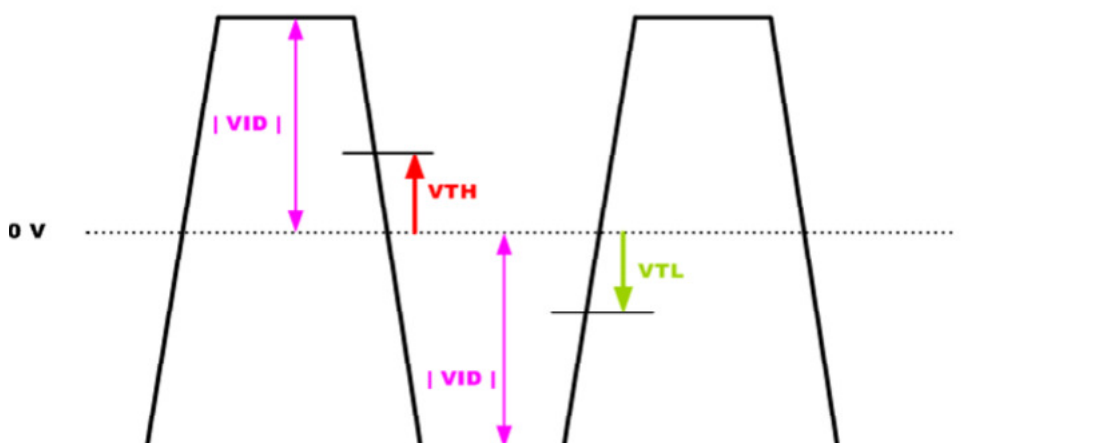
Symbol	Item	Min.	Typ.	Max.	Unit	Remark
V _{TH}	Differential Input High Threshold	-	-	100	[mV]	V _{CM} =1.2V
V _{TL}	Differential Input Low Threshold	100	-	-	[mV]	V _{CM} =1.2V
V _{ID}	Input Differential Voltage	100	400	600	[mV]	
V _{ICM}	Differential Input Common Mode Voltage	1.15	1.2	1.45	[V]	V _{TH} /V _{TL} =+/-100mV

Note: LVDS Signal Waveform.

Single-end Signal



Differential Signal





5.2 Backlight Unit

5.2.1 Parameter guideline for LCD

Following characteristics are measured under a stable condition using a inverter at 25C . (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VCC	Input Voltage	10.8	12	12.6	[Volt]	
I _{VCC}	Input Current	-	0.85	--	[A]	100% PWM Duty Ta= 25°C
P _{VCC}	Power Consumption	-	10.2	--	[Watt]	100% PWM Duty Ta= 25°C
F _{PWM}	Dimming Frequency	200	-	20K	[Hz]	
	Swing Voltage	3	3.3	5.5	[Volt]	
	Dimming duty cycle	5	-	100	%	
V adj	Brightness Adjustment	0		5	[Volt]	Note 6
I _F	LED Forward Current	-	240	-	[mA]	Ta = 25°C
V _F	LED Forward Voltage	-		--	[Volt]	I _F =240mA, Ta = -25 C
		-	34.1		[Volt]	I _F =240mA, Ta = 25 C
		-			[Volt]	I _F =240mA, Ta = 25 C
P _{LED}	LED Power Consumption	-	8.18	--	[Watt]	I _F =240mA, Ta = 25 C
Operation Life		30,000	-	-	Hrs	I _F =240mA, Ta= 25 C

Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: VCC, I_{VCC}, I_{rushLED}, P_{VCC} are defined for LED backlight.(100% duty of PWM dimming)

Note 3: I_F, V_F are defined for LED Light Bar unit.

Note 4: If FT121-EDC12 V1 module is driven by high current or at high ambient temperature & humidity condition.
The operating life will be reduced.

Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

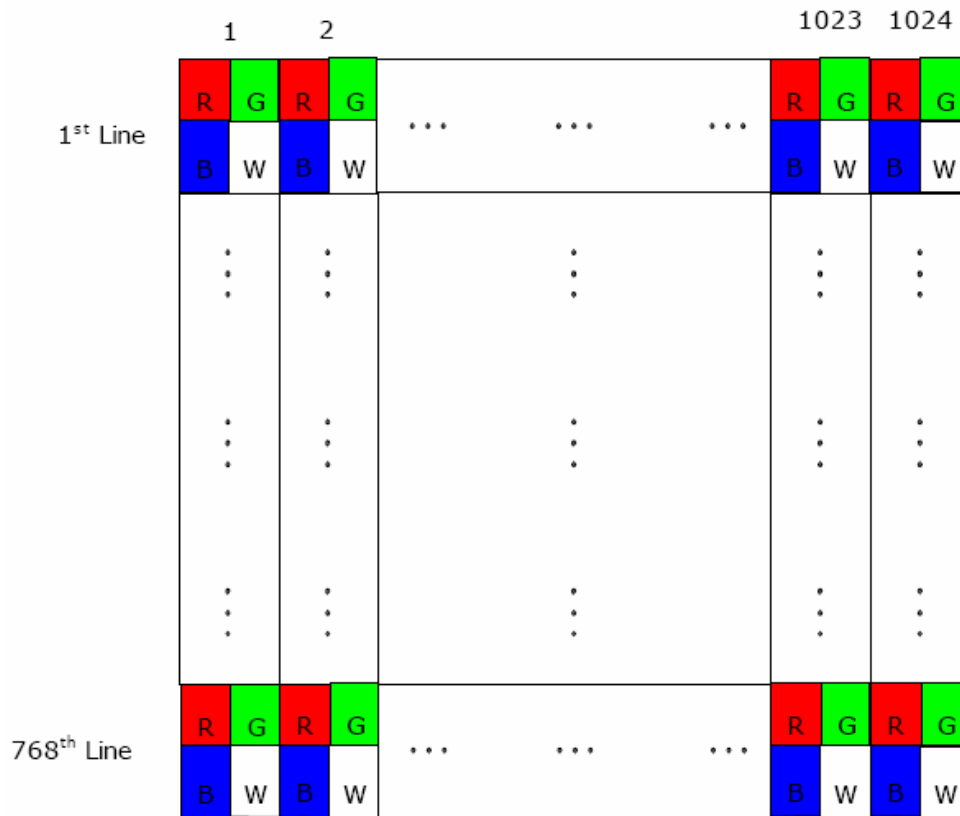
Note 6: Brightness adjustment supports PWM or DC voltage



6. Signal Characteristics

6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



6.2 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.

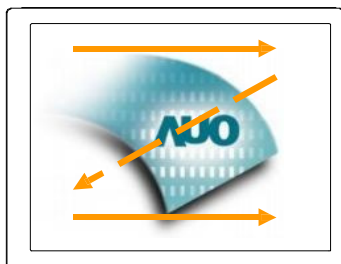


Fig. 1 Normal scan (Pin19, RSV = Low or NC)

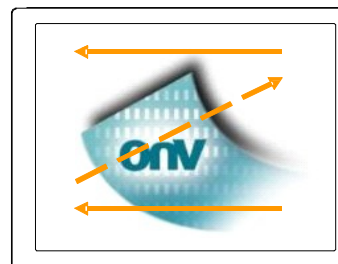


Fig. 2 Reverse scan (Pin19, RSV = High or VDD)



6.3 TFT-LCD Interface Signal Description

The module using a LVDS receiver embedded in AUO's ASIC. LVDS is a differential signal technology for LCD interface and a high-speed data transfer device.

Input Signal Interface		
Pin No.	Symbol	Description
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	GND	Ground
4	SEL68	6/ 8bits LVDS data input selection [H: 8bits L/NC: 6bit] *Note4
5	RIN0-	LVDS receiver signal channel 0
6	RIN0+	LVDS Differential Data Input (R0, R1, R2, R3, R4, R5, G0)
7	GND	Ground
8	RIN1-	LVDS receiver signal channel 1
9	RIN1+	LVDS Differential Data Input (G1, G2, G3, G4, G5, B0, B1)
10	GND	Ground
11	RIN2-	LVDS receiver signal channel 2
12	RIN2+	LVDS Differential Data Input (B2, B3, B4, B5, HS, VS, DE)
13	GND	Ground
14	CLKIN-	LVDS receiver signal clock
15	CLKIN+	
16	GND	Ground
17	RIN3-	LVDS receiver signal channel 3, NC for 6 bit LVDS Input. *Note5
18	RIN3+	LVDS Differential Data Input (R6, R7, G6, G7, B6, B7, RSV)
19	RSV	Reverse Scan Function [H: Enable; L/NC: Disable]
20	NC/GND	Reserved for AUO internal test. Please treat it as NC.

Note 1: Input Signals shall be in low status when VDD is off.

Note 2: High stands for "3.3V", Low stands for "0V", NC stands for "No Connection".

Note 3: RSV stands for "Reserved".

Note 4: Input signals shall be in low status when VDD is off.

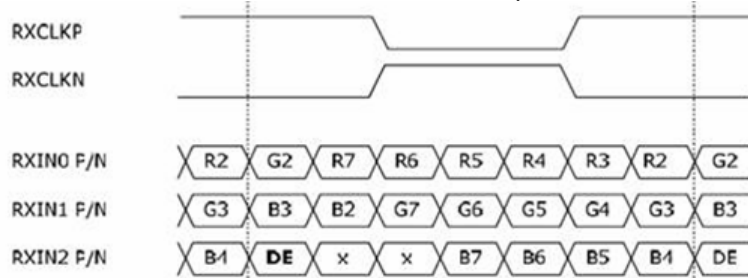
Note 5: If 6 bits mode, please keep the Pin 17 & Pin 18 NC or make sure that the Voltage of Pin 17 is always higher than the Voltage of Pin 18.



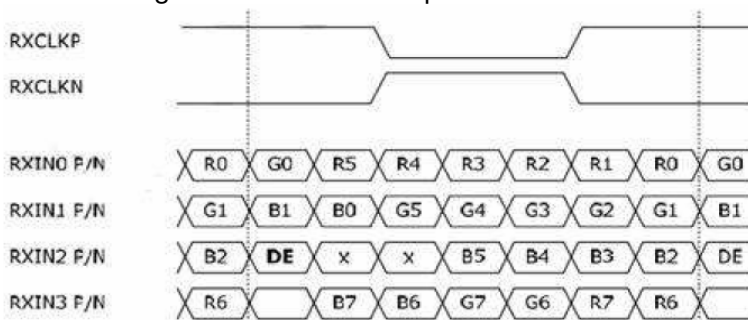
6.4 The Input Data Format

6.4.1 SEL68

SEL68 = "Low" or "NC" for 6 bits LVDS Input



SEL68 = "High" for 8 bits LVDS Input



Note1: Please follow PSWG.

Note2: R/G/B data 7:MSB, R/G/B data 0:LSB

Signal Name	Description	
+RED5(R5) +RED4(R4) +RED3(R3) +RED2(R2) +RED1(R1) +RED0(R0)	Red Data 5 (MSB) Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB) Red-pixel Data	Red-pixel Data Each red pixel's brightness data consists of these 6 bits pixel data.
+GREEN5(G5) +GREEN4(G4) +GREEN3(G3) +GREEN2(G2) +GREEN1(G1) +GREEN0(G0)	Green Data 5 (MSB) Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0 (LSB) Green-pixel Data	Green-pixel Data Each green pixel's brightness data consists of these 6 bits pixel data.
+BLUE5(B5) +BLUE4(B4) +BLUE3(B3) +BLUE2(B2) +BLUE1(B1) +BLUE0(B0)	Blue Data 5 (MSB) Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB) Blue-pixel Data	Blue-pixel Data Each blue pixel's brightness data consists of these 6 bits pixel data.
CLK	Data Clock	The typical frequency is 65MHz. The signal is used to strobe the pixel data and DE signals. All pixel data shall be valid at the falling edge when the DE signal is high.
DE	Display Timing	This signal is stored at the falling edge of CLK. When the signal is high, the pixel data shall be valid to be displayed.

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.



6.5 TFT-LCD Interface Timing

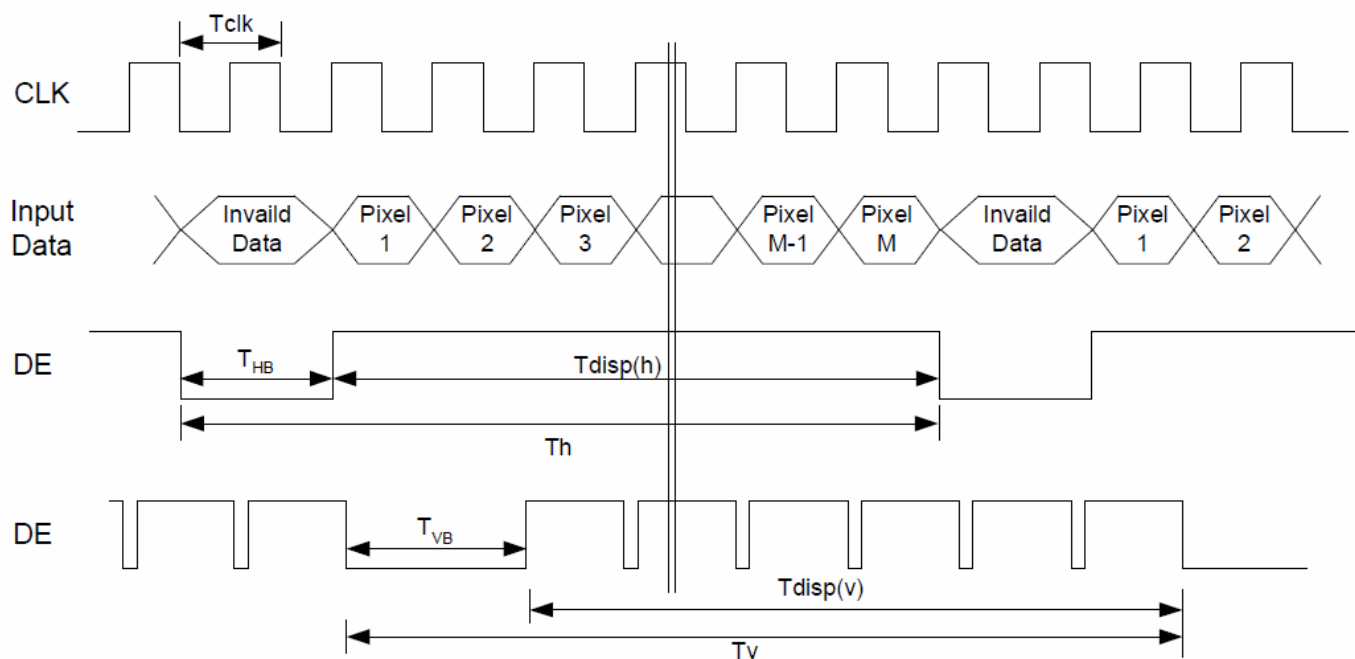
6.5.1 Timing Characteristics

Signal	Symbol	Min.	Typ.	Max.	Unit
Clock Frequency	$1/T_{\text{Clock}}$	50	65	80	MHz
Vertical Section	Period	T_V	776	806	T_{Line}
	Active	T_{VD}	-	768	
	Blanking	T_{VB}	8	38	
Horizontal Section	Period	T_H	1054	1344	T_{Clock}
	Active	T_{HD}	-	1024	
	Blanking	T_{HB}	40	320	

Note 1: Frame rate is 60 Hz.

Note 2: DE mode.

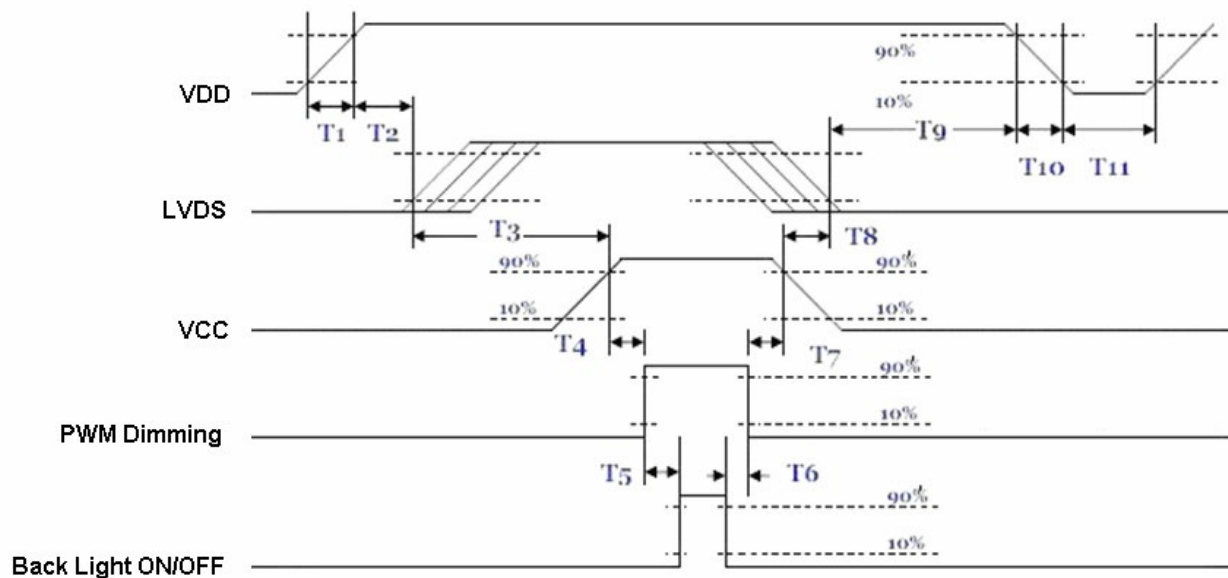
6.5.2 Input Timing Diagram





6.6 Power ON/OFF Sequence

VDD power and lamp on/off sequence is as below. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	200	-	-	[ms]
T4	10	-	-	[ms]
T5	10	-	-	[ms]
T6	0	-	-	[ms]
T7	10	-	-	[ms]
T8	100	-	-	[ms]
T9	0	16	50	[ms]
T10	-	-	10	[ms]
T11	1000	-	-	[ms]

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.



7. Connector & Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT-LCD Signal (CN1): LCD Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	MSB240420-E or compatible
Adaptable Plug	P240420 or compatible

Pin No.	Symbol	Pin No.	Symbol
1	VDD	2	VDD
3	GND	4	SEL68
5	RIN0-	6	RIN0+
7	GND	8	RIN1-
9	RIN1+	10	GND
11	RIN2-	12	RIN2+
13	GND	14	CLKIN-
15	CLKIN+	16	GND
17	RIN3-	18	RIN3+
19	RSV	20	NC/GND

7.2 LED Backlight Unit : Light Bar Connector

Connector Name / Designation	Lamp Connector
Manufacturer	
Connector Model Number	A20D/HD2-2P
Mating Model Number(CN3)	S2B-PH-SM4-TB or compatible

Pin No.	symbol	Description	Color
Pin1	H	LED anode	Red
Pin2	L	LED cathode	Black



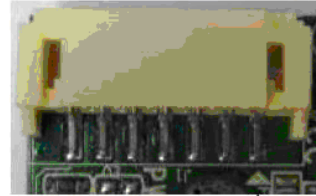
7.2 LED Backlight Unit : LED Driver

Model Name : S7B-PH-SM4-TB(JST)

(J1)

Connector Type: 2.0mm 7pin Wafer (SMD)

Pin No.	Description
1	+12V
2	+12V
3	+12V
4	Ground
5	PWM or Vadj control
6	Ground
7	ON/OFF Control



(pin1)

7.3 LED Backlight Unit (CN4): Light bar Connector

Output connector : J2 , J3

Model Name : S2B-PH-SM4-TB(JST)

(J2)

Connector Type: 2.0mm 2pin Wafer (SMD)

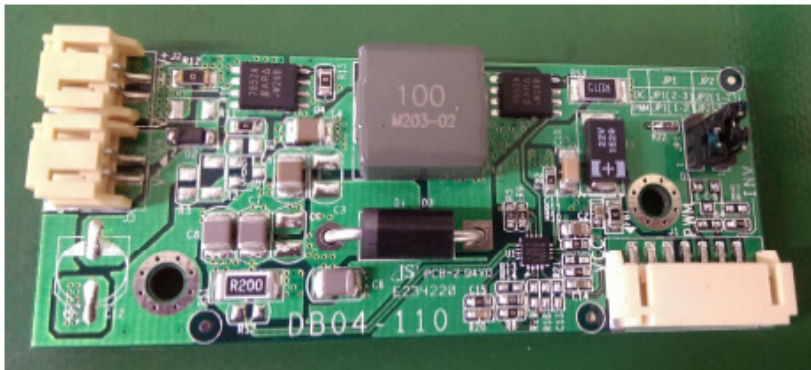
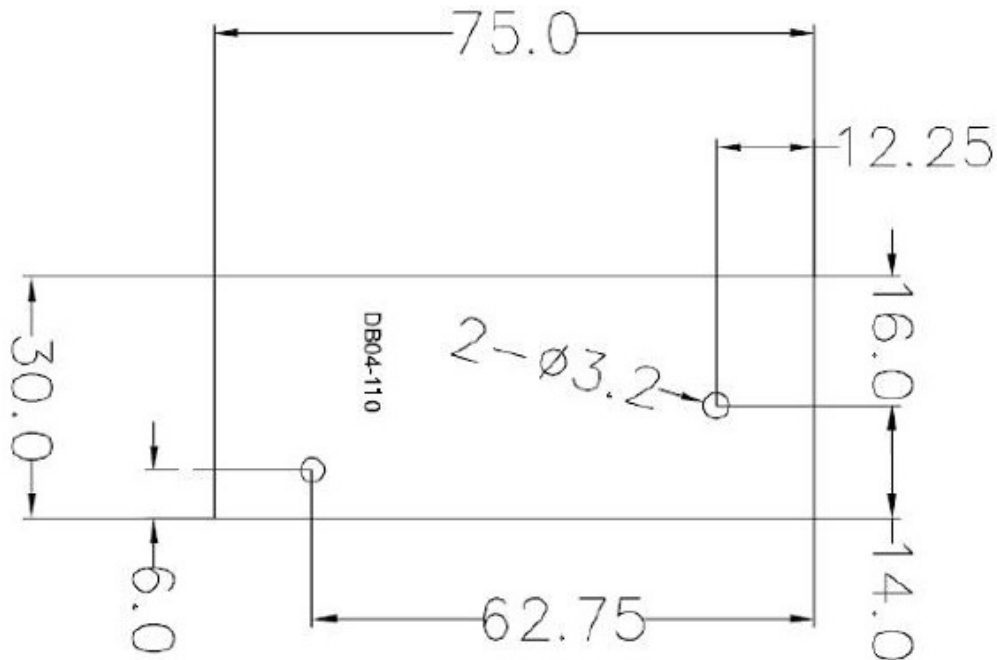
Pin No.	Description
1	VLED+
2	VLED-

(J3)

Connector Type: 2.0mm 2pin Wafer (SMD)

Pin No.	Description
1	VLED+
2	VLED-

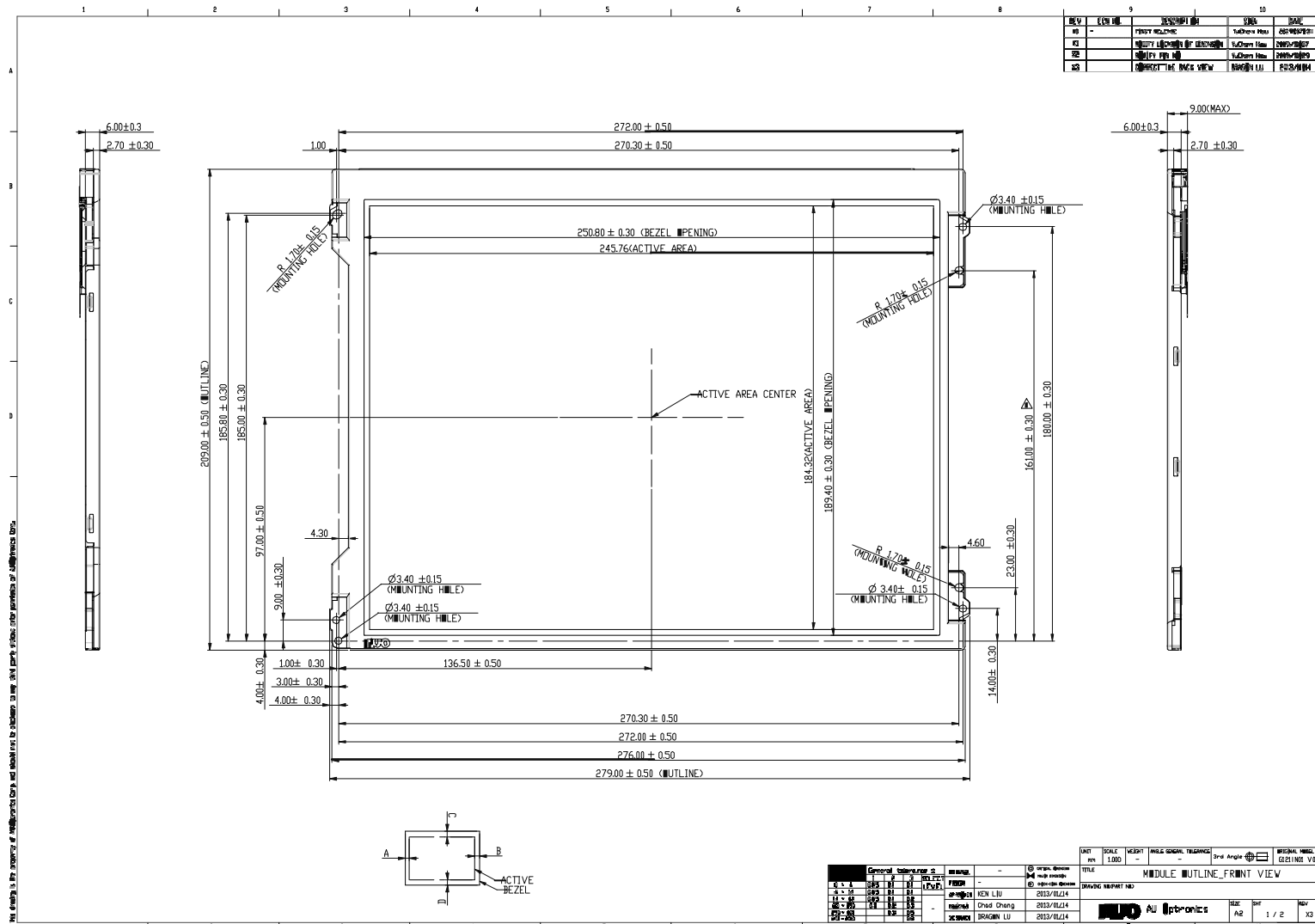
Note: J2 = J3 , only one connector for single light bar use

**LED Driving Board Outline Dimension (Rear View)****Dimension : 75(L)*30(W)*8.65(H)mm****Note: Brightness Control:**

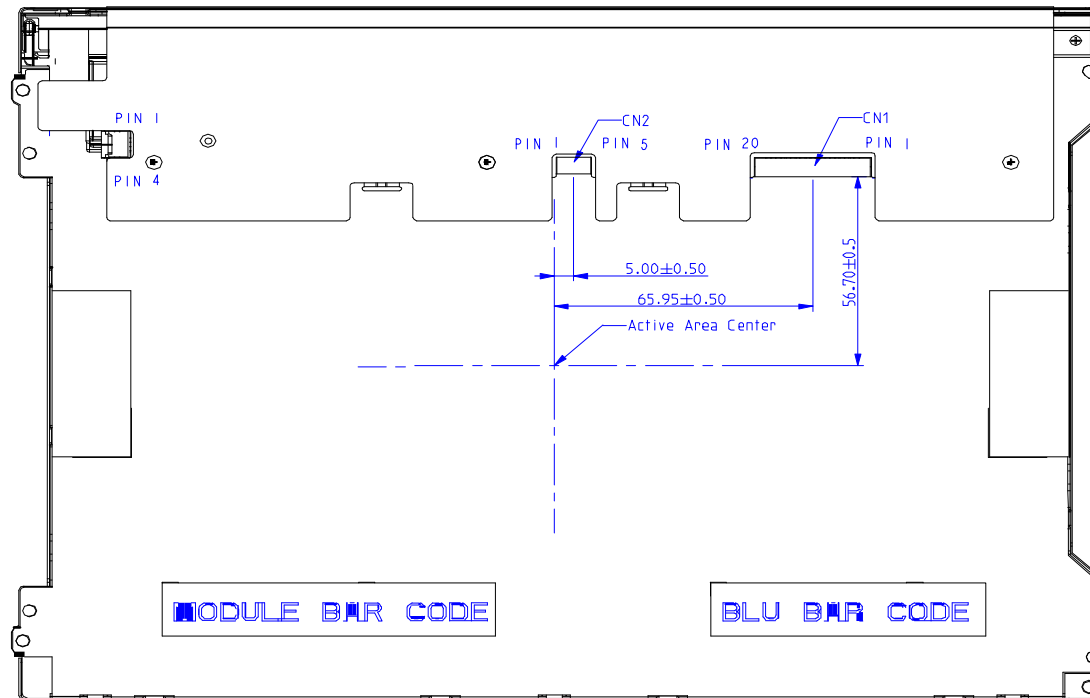
	JP1	JP2
DC (Vadj)	2-3 close	1-2 close
PWM	1-2 close	2-3 close

8. Mechanical Characteristics

8.1 LCM Outline Dimension (Front View)



8.2 LCM Outline Dimension (Rear View)



INTERFACE CONNECTOR IS STM MSB240420
 LED POWER CONNECTOR IS E&T 3808N-F05N-02R
 IS ±0.5mm IF NOT SPECIFIED.