

**(V) Preliminary Specifications****() Final Specifications**

Module	12.1 Inch Color TFT-LCD
Model Name	FT121-EDC07 V.0 (AUO G121XN01 V.0)

Customer	Date	Checked & Approved by	Date
_____	_____	Michael Yeh	2011/08/19
_____	_____	_____	_____
Approved by		Prepared by	
_____	_____	_____	_____
Note: This Specification is subject to change without notice.			



Contents

1. Operating Precautions	4
2. General Description	5
2.1 Display Characteristics	5
2.2 Optical Characteristics	6
3. Functional Block Diagram	9
4. Absolute Maximum Ratings	10
4.1 TFT LCD Module	10
4.2 Backlight Unit	10
4.3 Absolute Ratings of Environment.....	10
5. Electrical characteristics	11
5.1 TFT LCD Module	11
5.2 Backlight Unit	13
6. Signal Characteristic	14
6.1 Pixel Format Image	14
6.2 Signal Description	15
6.3 The Input Data Format	17
6.4 Interface Timing	18
6.5 Power ON/OFF Sequence	19
7. Connector & Pin Assignment	20
7.1 TFT LCD Module	20
7.2 Backlight Unit	20
7.3 LED Driver Board	21
8. Mechanical Characteristics	22
9. Reliability Test Criteria	25



Record of Revision

Version & Date	Page	Old Description	New Description	Remark
0.0 2011/08/19	All	First Edition		



1. Operating Precautions

- 1) Since front polarizer is easily damaged, pay attention 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 other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open or modify the Module Assembly.
- 8) Do not press the reflector sheet at the back of the module to any directions.
- 9) In case if a Module has to be put back into the packing container slot after once 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) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentarily. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
- 12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.



2. General Description

A Color Active Matrix Liquid Crystal Display 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). All input signals are LVDS interface compatible. Driver board of backlight is not included. From modification by AUO G121XN01 V0.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25°C condition:

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]	0.3075 x 0.3075
Pixel Arrangement		R.G.B.W Rectangle
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 typ.
Typical Power Consumption	[Watt]	12.27
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	[°C]	-30 to +80
Storage (Non-Operating)	[°C]	-30 to +80
RoHS Compliance		RoHS Compliance



2.2 Optical Characteristics

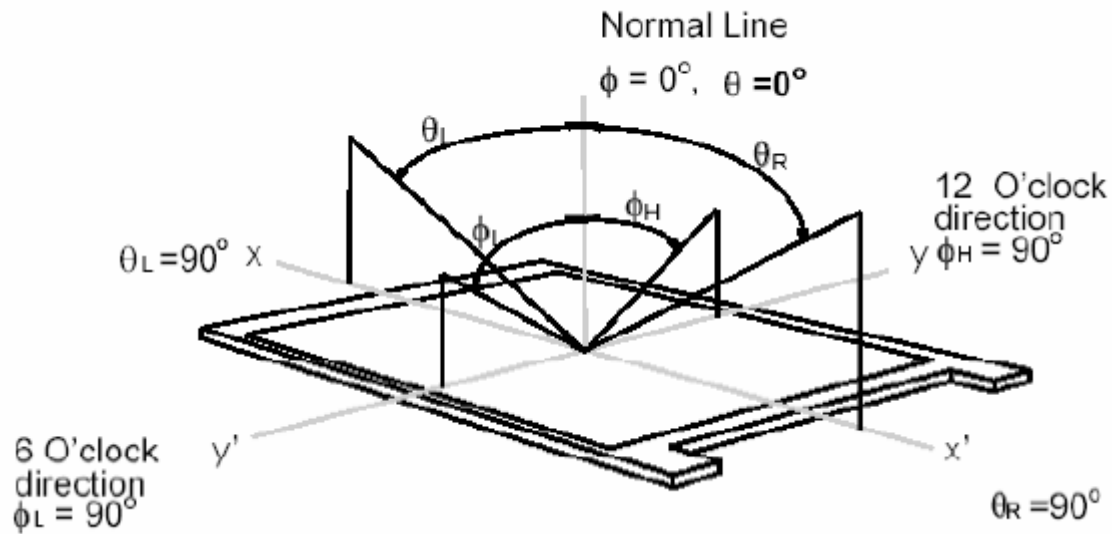
The optical characteristics are measured under stable conditions at 25°C (Room Temperature):

Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance	[cd/m ²]	100% Dimming (center point)	900	1000	-	4
Uniformity	[%]	9 Points	75	80	-	2, 3, 4
Contrast Ratio			500	700	-	4
Response Time	[msec]	Rising	-	25	35	5
	[msec]	Falling	-	10	20	
	[msec]	Rising + Falling	-	35	55	
Viewing Angle	[degree]	Horizontal (Right) CR = 10	70	80	-	1
		(Left)	70	80		
		Vertical (Upper) CR = 10	45	80		
		(Lower)	55	80		
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.592	0.642	0.692	
		Red y	0.292	0.342	0.392	
		Green x	0.276	0.326	0.376	
		Green y	0.565	0.615	0.665	
		Blue x	0.098	0.148	0.198	
		Blue y	0.006	0.056	0.106	
		White x	0.260	0.310	0.360	
		White y	0.280	0.330	0.380	

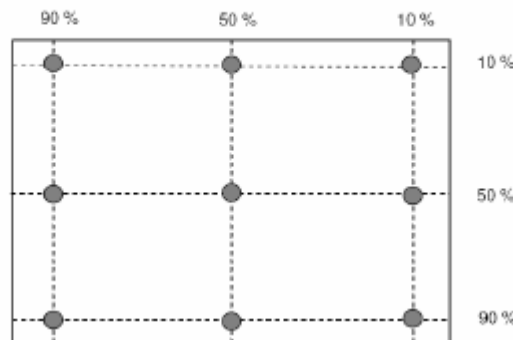
Optical Equipment: BM-7, DT-100, or equivalent

Note 1: Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≥ 10 , at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° (θ) ° horizontal left and right, and 90° (Φ) 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.



Note 2: Definition of 9 points position

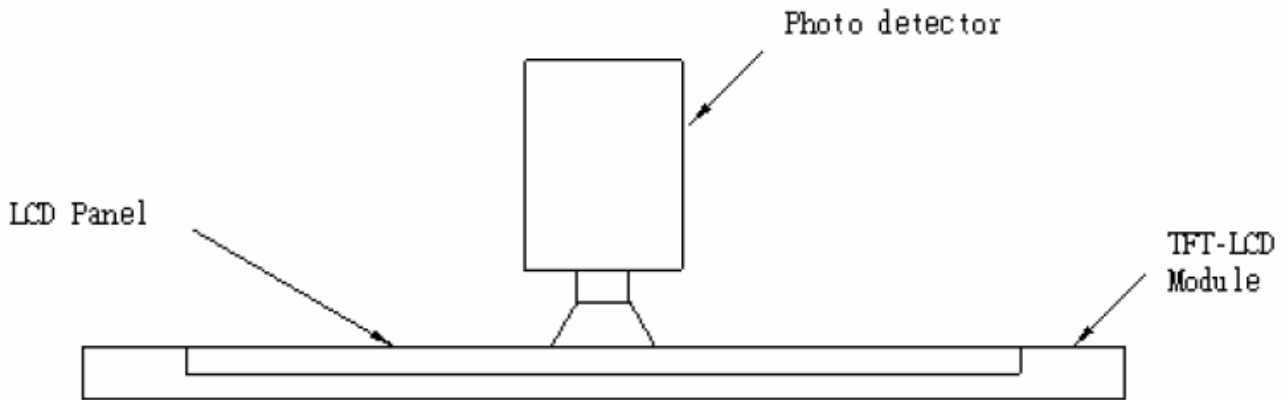


Note 3: The luminance uniformity of 9 points is defined by dividing the minimum luminance values by the maximum test point luminance

$$\delta W_9 = \frac{\text{Minimum Luminance of 9 points}}{\text{Maximum Luminance of 9 points}}$$

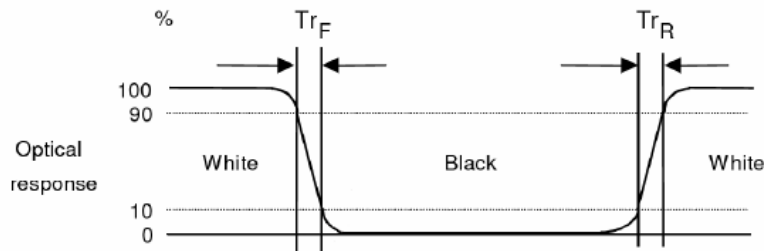
Note 4: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room. Optical Equipment: DT-100, or equivalent



Note 5: Definition of response time:

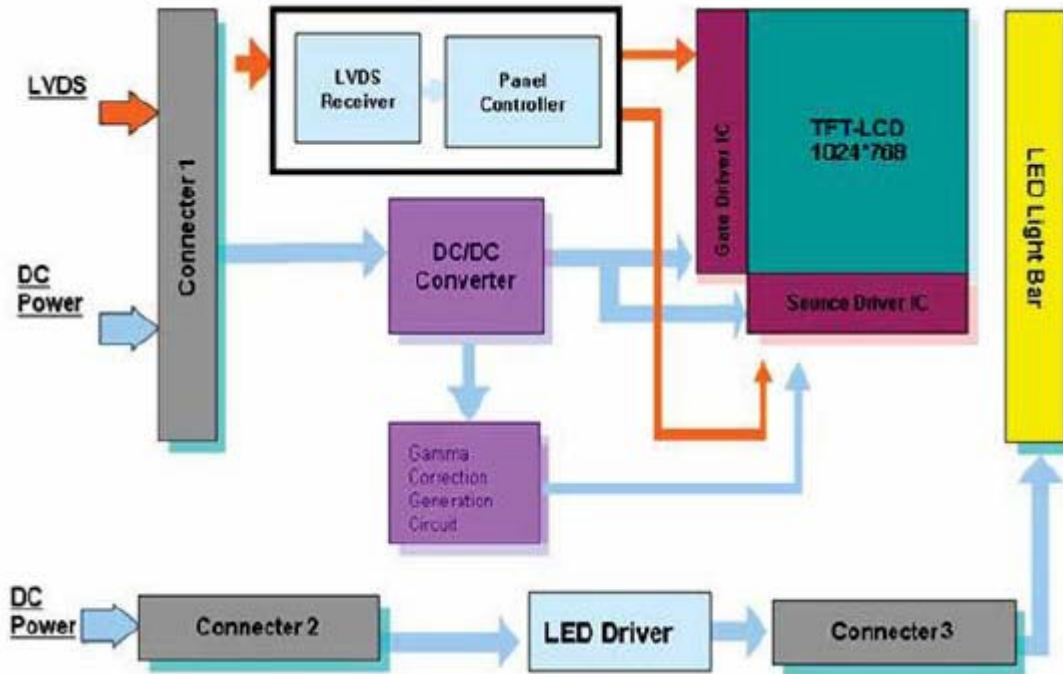
The output signals of photo detector are measured when the input signals are changed from “White” to “Black” (falling time) and from “Black” to “White”(rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.





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	V _{in}	-0.3	+3.6	[Volt]

4.2 Absolute Ratings of Backlight Unit

Item	Symbol	Min.	Max.	Unit
LED Light Bar Current	I _F	-	450	[mA]

4.3 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit
Operating Temperature	TOP	-30	+80	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-30	+80	[°C]
Storage Humidity	HST	5	90	[%RH]

Note: Maximum Wet-Bulb should be 39°C and no condensation.



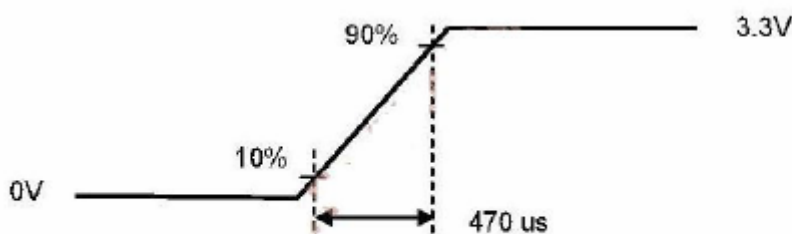
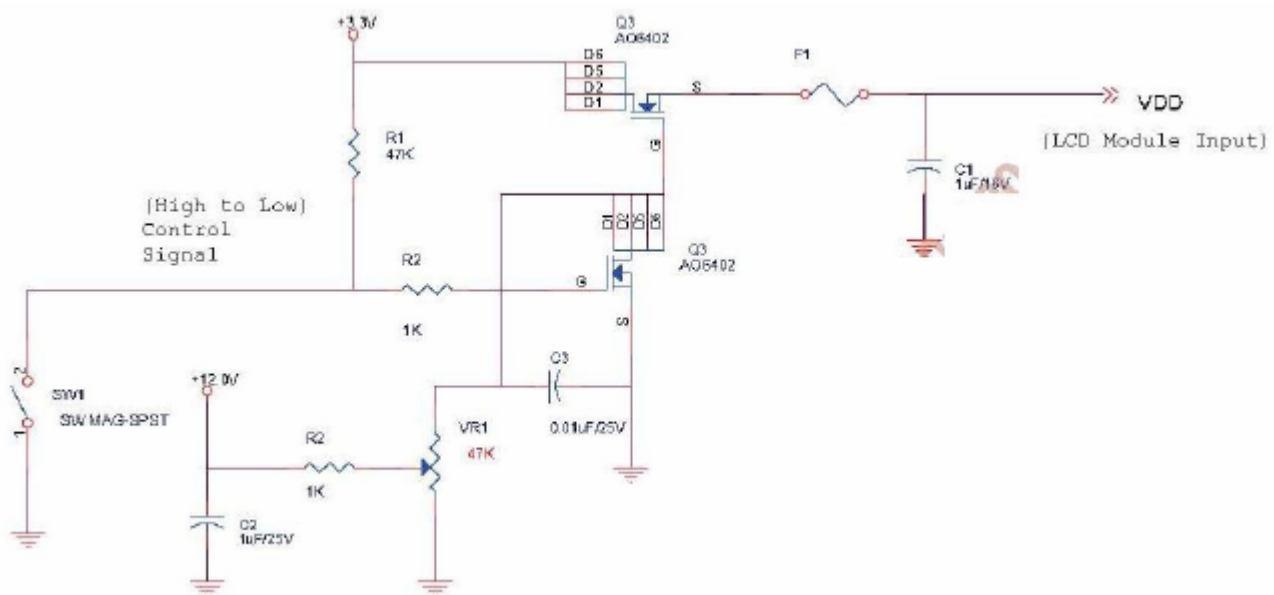
5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

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

Note 1: Measurement condition:



VDD rising time

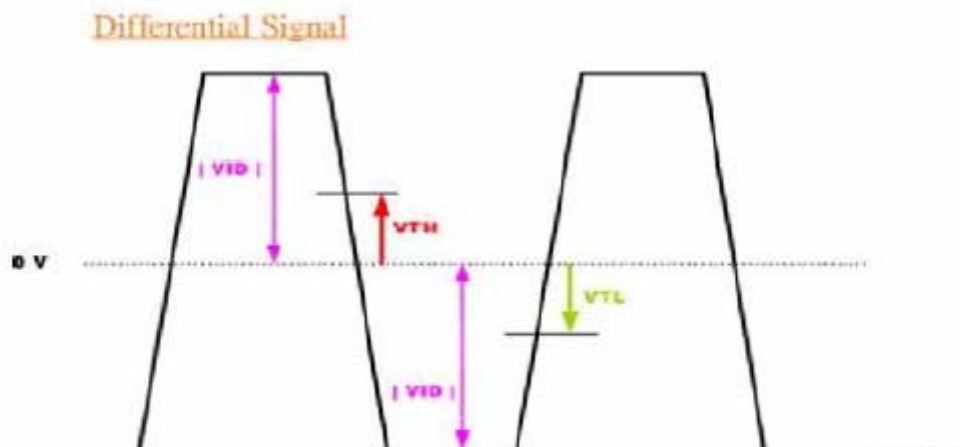
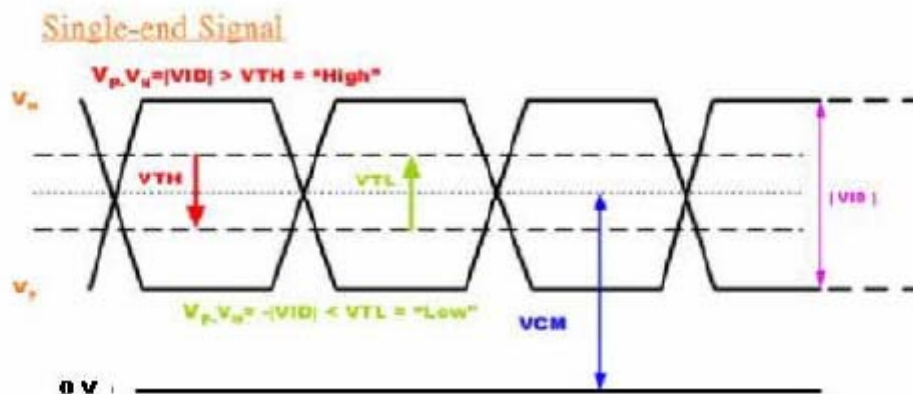


5.1.2 Signal Electrical Characteristics

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

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
VID	Input Differential Voltage	100	400	600	[mV]	
VICM	Differential Input Common Mode Voltage	1.1	-	1.45	[V]	VTH/VTL=+-100mV
VTH	Differential Input High Threshold	-	-	100	[mV]	VCM=1.2V
VTL	Differential Input Low Threshold	100	-	-	[mV]	VCM=1.2V

Note: LVDS Signal Waveform.





5.2 Backlight Unit

5.2.1 Parameter guideline for LED

Following characteristics are measured under a stable condition using a LED driver at 25°C (Room Temperature).

Symbol	Parameter	Values			Unit	Remark
		Min.	Typ.	Max.		
VCC	Input Voltage	10.8	12.0	15.0	Volt	
Ivcc	Input Current	-	0.86		A	100% Dimming
Pvcc	Power Consumption		10.32		Watt	100% Dimming
FPWM	Dimming Frequency	85	100		Hz	Note 1,2
VPWM DIM	Control Voltage	3.3	5.0			
DPWM	Dimming Duty Cycle	0		100	%	
IF	LED Forward Current		450		mA	Ta = 25°C
VLED ON/OFF	On Control Voltage	1.25	5.0	-	Volt	Note 3, 4
	Off Control Voltage		0.0	0.4	Volt	
Operating Life		50,000	-	-	Hrs	Note 5, 6

Note 1: PWM dimming function can be operated by PWM signal. PWM duty cycle can adjust white Luminance.

(PWM High: ON and PWM Low: OFF)

Note 2: PWM signal can not be floating and pull-down to ground when waiting.

Note 3: Enable (VLED On/Off) must be turned on late than VLED and PWM Signal.

Note 4: Enable (VLED On/Off) must be turned off early than VLED and PWM Signal.

Note 5: If the module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

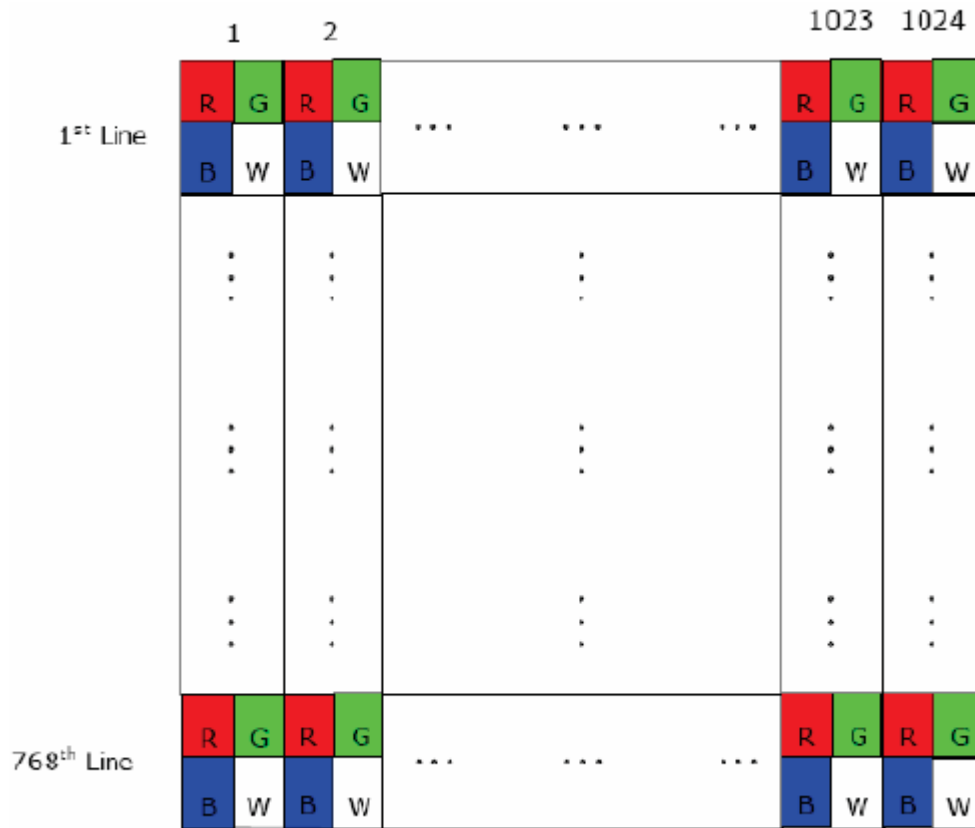
Note 6: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.



6. Signal Characteristic

6.1 Pixel Format Image

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





6.2 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.

Pin Assignment:

PIN#	SIGNAL NAME	DESCRIPTION
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	GND	Ground
4	SEL6/8	Select 6 or 8 bits LVDS input(H:8bit, L/NC: 6bit)
5	Rin0-	LVDS Receiver signal channel 0
6	Rin0+	+ LVDS differential data input (R0-R5, G0)
7	GND	Ground
8	Rin1-	LVDS Receiver signal channel 1
9	Rin1+	+ LVDS differential data input (G1-G5, B0-B1)
10	GND	Ground
11	Rin2-	LVDS Receiver signal channel 2
12	Rin2+	+ LVDS differential data input (B2-B5, HS, VS, DE)
13	GND	Ground
14	ClkIN-	- LVDS differential clock input
15	ClkIN+	+ LVDS differential clock input
16	GND	Ground
17	Rin3-	LVDS Receiver signal channel 3, NC for 6 bit LVDS input
18	Rin3+	- LVDS differential data input (R6-R7, G6-G7, B6-B7)
19	RSV	Reverse scan function(H: Enable/ L: Disable)
20	NC/GND	AUO Test function pin(Please treat it as NC)

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

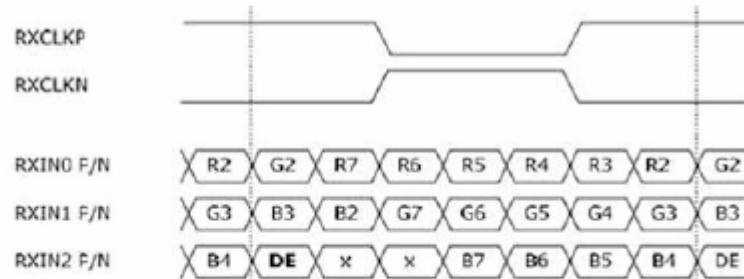
Note 2: High stands for " 3.3V" , Low stands for " 0V" , NC stands for " No Connection" .

Note 3: RSV stands for " Reserved" .

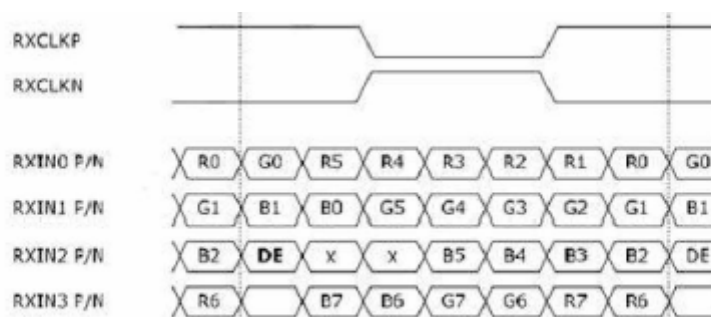


6.3.1 SEL68

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 40MHz. 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 strobed 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.



6.4 Interface Timing

6.4.1 Timing Characteristics

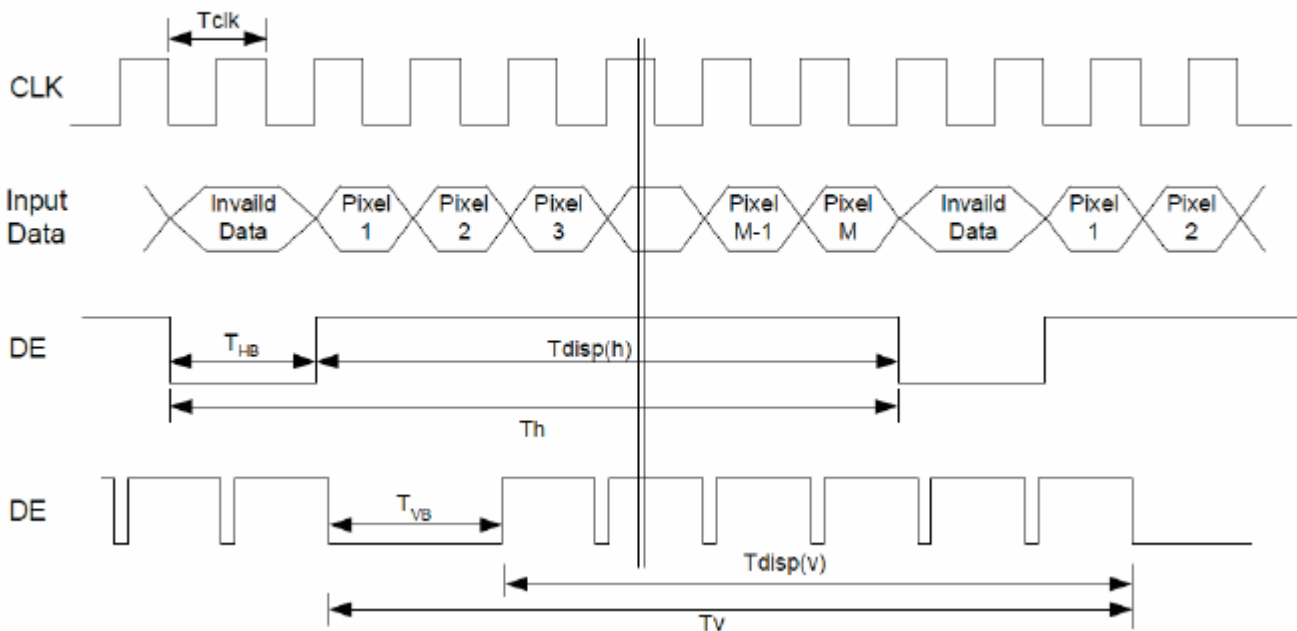
DE only mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition	
Clock Frequency	$1/T_{clock}$	50	65	80	MHz		
Vertical Section	Period	T_v	776	806	1023	T_{Line}	
	Active	T_{VD}	-	768	-		
	Blanking	T_{VB}	8	38	255		
Horizontal Section	Period	T_H	1054	1344	2047	T_{Clock}	
	Active	T_{HD}	-	1024	-		
	Blanking	T_{HB}	40	320	1023		

Note1: Frame rate is 60 Hz.

Note2: DE mode.

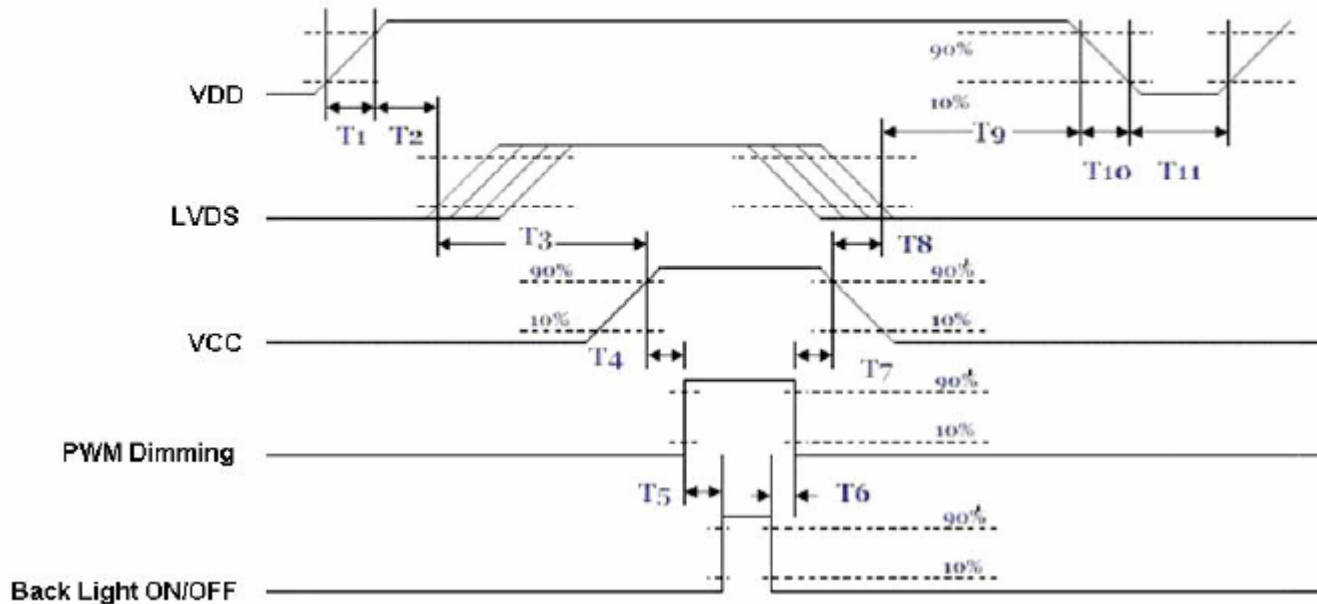
6.4.2 Input Timing Diagram





6.5 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 Module

7.1.1 LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM
Connector Model Number	MSB240420-E
Mating Housing Part Number	P240420 or compatible

Mating LVDS transmitter: THC63LVDM83A or equivalent device

7.2 LED Backlight Unit: LED Driver Connector

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

Connector Name / Designation	LED Light Bar Connector
Manufacturer	
Connector Model Number	A20D/HD2-2P
Mating Model Number	S2B-PH-SM4-TB

7.2.1 Signal for LED light bar connector

Pin no.	Symbol	Cable Color	Function
1	HV	Red	LED High Voltage
2	LV	Black	Ground

- ◆ Cable length: 250 ± 5 mm
- ◆ Connector-output position: right side (front view)
- ◆ LED light bar assembly design shall be easy for replacement and repair

**7.3 LED Driver Board****7.3.1 Input connector : J1****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 Control
6	Ground
7	ON/OFF Control



(pin1)

7.3.2 Output connector : J2 , J3**Model Name : S2B-PH-SM4-TB(JST)****(J2)**

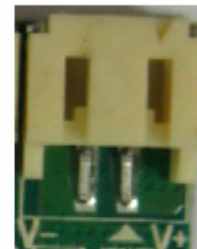
Connector Type: 2.0mm 2pin Wafer (SMD)

Pin No.	Description
1	VLED+
2	VLED-

(J3)

Connector Type: 2.0mm 2pin Wafer (SMD)

Pin No.	Description
1	VLED+
2	VLED-

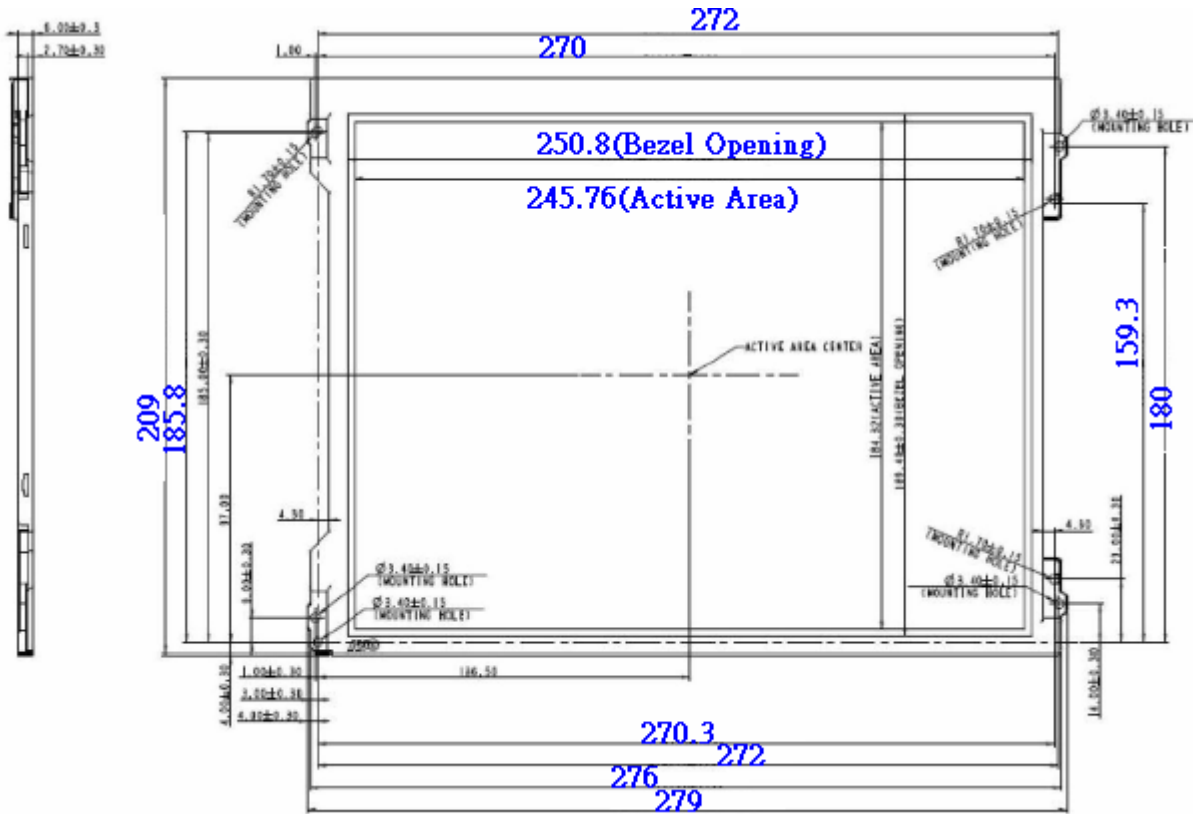


(pin1)

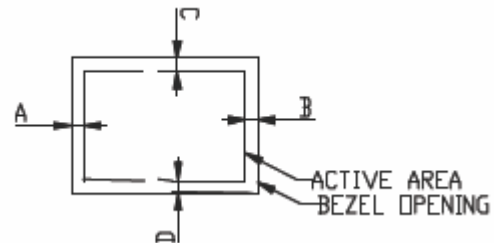


8. Mechanical Characteristic

8.1 LCM Outline Dimension (Front View)

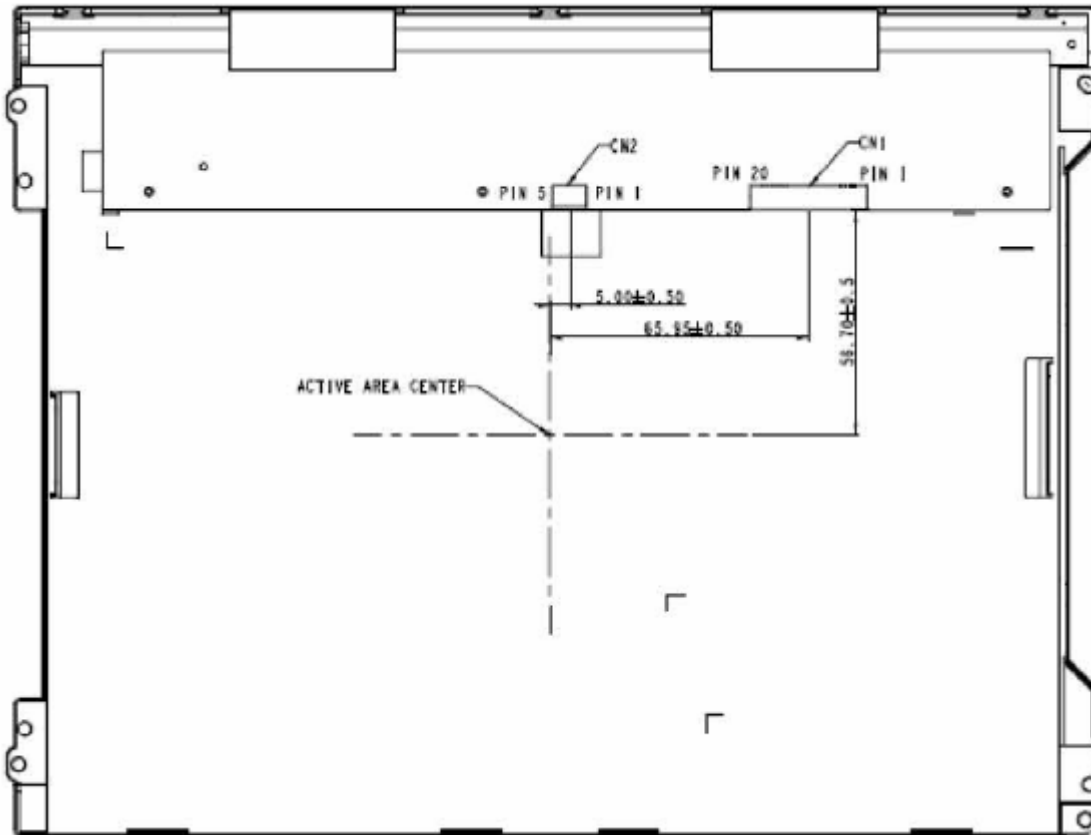


- NOTE:
1. BILIGQUITY TOLERANCE OF DISPLAY AREA SHOWN AS RIGHT:
 X-DIRECTION: IA-BI $\leq 1.0\text{mm}$
 Y-DIRECTION: IC-DI $\leq 1.0\text{mm}$
 2. TOLERANCE JS $\pm 0.5\text{mm}$ IF NOT SPECIFIED.





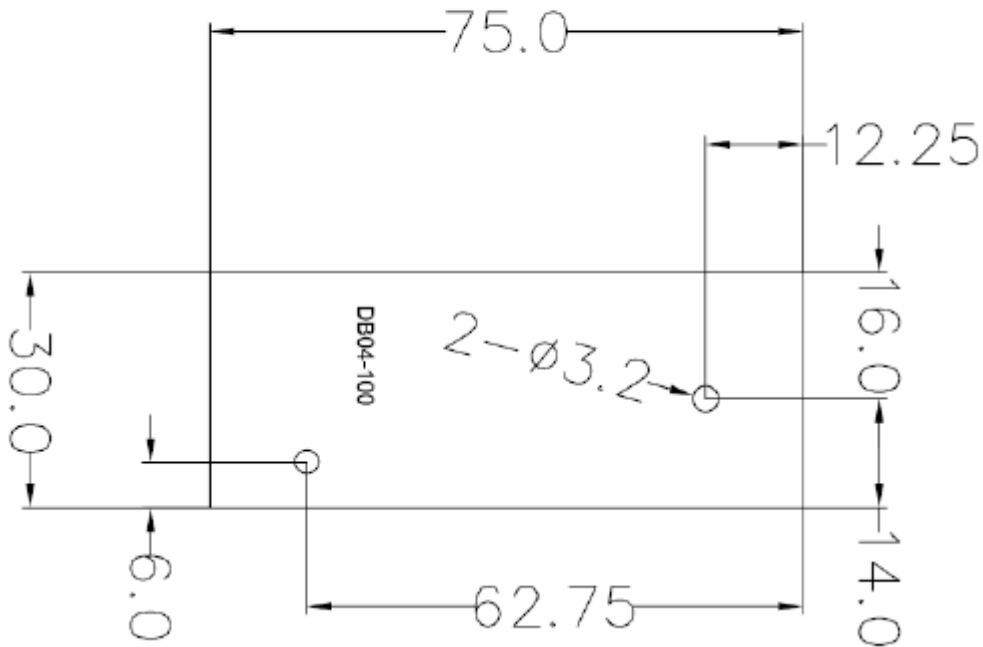
8.2 LCM Outline Dimension (Rear View)





8.3 LED Driver Board Outline Dimension

Dimension : 75(L)*30(W)*8.65(H)mm





9. Reliability Test Criteria

Items	Required Condition	Note
High Temperature Operation	80 °C, 300 hours	
Low Temperature Operation	-30 °C, 300 hours	
High temperature & high humidity	40°C, 90%RH, 300 hours	
Vibration Test (Non-Operating)	1.5G, (10~200Hz, Sine wave) 30 mins/axis, 3 direction (X, Y, Z)	
Thermal shock Test	-20 °C / 30 min, 60 °C / 30 min, 100cycles, 40 °C minimum ramp rate	