10.4 inch High Brightness TFT-LCD Product Specification (LED Backlight)

MODEL	**:**	**GL104AS10-1200**
P/N	**:**	**GL104AS10-1200**
REV.	**:**	**0.0**
(○)Preliminary Specification		
( )Final Specification		

RECORD OF REVISIONS

Revision No	Revision Date	Page	DESCRIPTION
0.0	Oct. 08 . 2012	-	First release

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 Discharde) 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 GL104AS10-1200 composed of a TFT-LCD display, a driver and power supply circuit, and a LED backlight system. The screen format is intended to support SVGA (800(H) x 600(V)) screen and 16.2M (RGB 8-bits) or 262k colors (RGB 6-bits). All input signals are LVDS interface.
GL104AS10-1200 designed with wide viewing angle; wide temperature and long life LED backlight is well suited for industrial applications. It's based on AUO G140SN02 V2.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	10.4
Active Area	[mm]	211.2(H) x 158.4(V)
Pixels H x V		800 x 3(RGB) x 600
Pixel Pitch	[mm]	0.264 x 0.264
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 typ.
Typical Power Consumption	[Watt]	6.384Watt (0.924Watt@LCD, 5.46Watt@LED Driver)
Weight	[Grams]	400 (Typ.)
Physical Size	[mm]	243.0±0.5(H)x 184.0±0.5(V) x 8.5(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)	 [℃] [℃]	 -30 to +85 -30 to +85
RoHS Compliance		RoHS Compliance
Matching LED Driver		DG5-012V-10A1120 By GSD

2.2 Optical Characteristics

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

Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance	[cd/m2]	IRLED= Dim 100% (center point)	-	1200	-	1
Uniformity	%	5 Points	75	-	-	2,3
Contrast Ratio			500	700	-	4
Response Time	[msec]	Rising	-	10	20	5
	[msec]	Falling	-	20	30	
	[msec]	Raising + Falling	-	30	50	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	70 70	80 80	- -	6
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	50 70	60 80	- -	
Color / Chromaticity Coordinates (CIE1931)		Red x	0.490	0.540	0.590	
		Red y	0.263	0.313	0.363	
		Green x	0.301	0.351	0.401	
		Green y	0.530	0.580	0.630	
		Blue x	0.115	0.165	0.215	
		Blue y	0.085	0.135	0185	
		White x		T.B.D		
		White y		T.B.D		
Color Gamut	%		-	45	-	

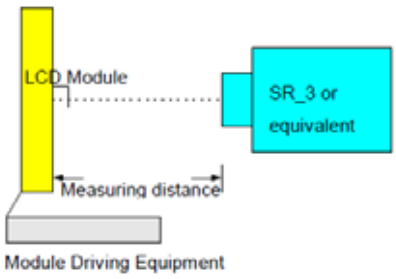
Note 1: Measurement method

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

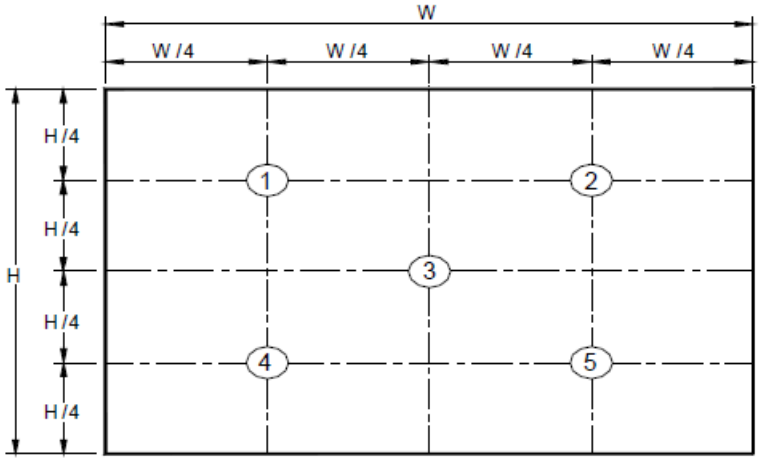
Aperture 1° with 50cm viewing distance

Test Point Center

Environment < 1 lux



Note 2 : Definition of 5 points position (Display active area: 211.2mm (H) x 158.4mm (V))



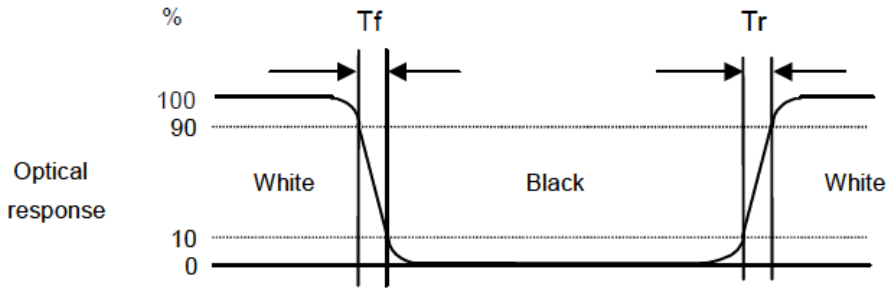
Note 3 : The luminance uniformity of 5 points is defined by dividing the minimum luminance values by the maximum test point luminance

$$\delta_{W5} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

Note 4 : Definition of contrast ratio (CR):

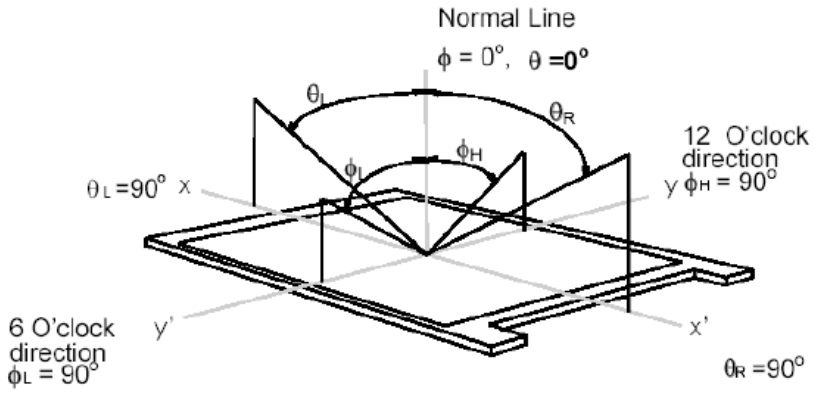
$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$

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.



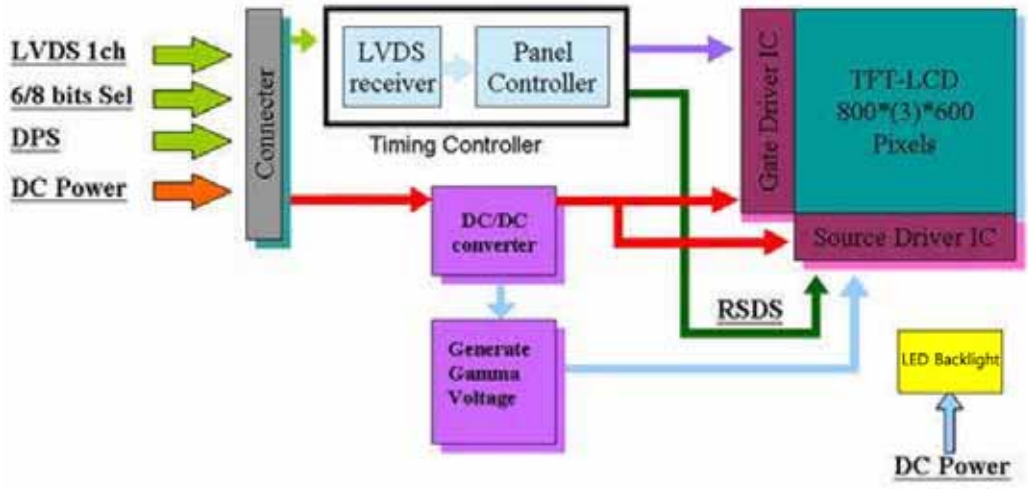
Note 6 : Definition of viewing angle

Viewing angle is the measurement of contrast ratio 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.



3. Functional Block Diagram

The following diagram shows the functional block of the 10.4 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	+4.0	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	+85	[℃]
Operation Humidity	HOP	5	95	[%RH]
Storage Temperature	TST	-30	+85	[℃]
Storage Humidity	HST	5	95	[%RH]

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

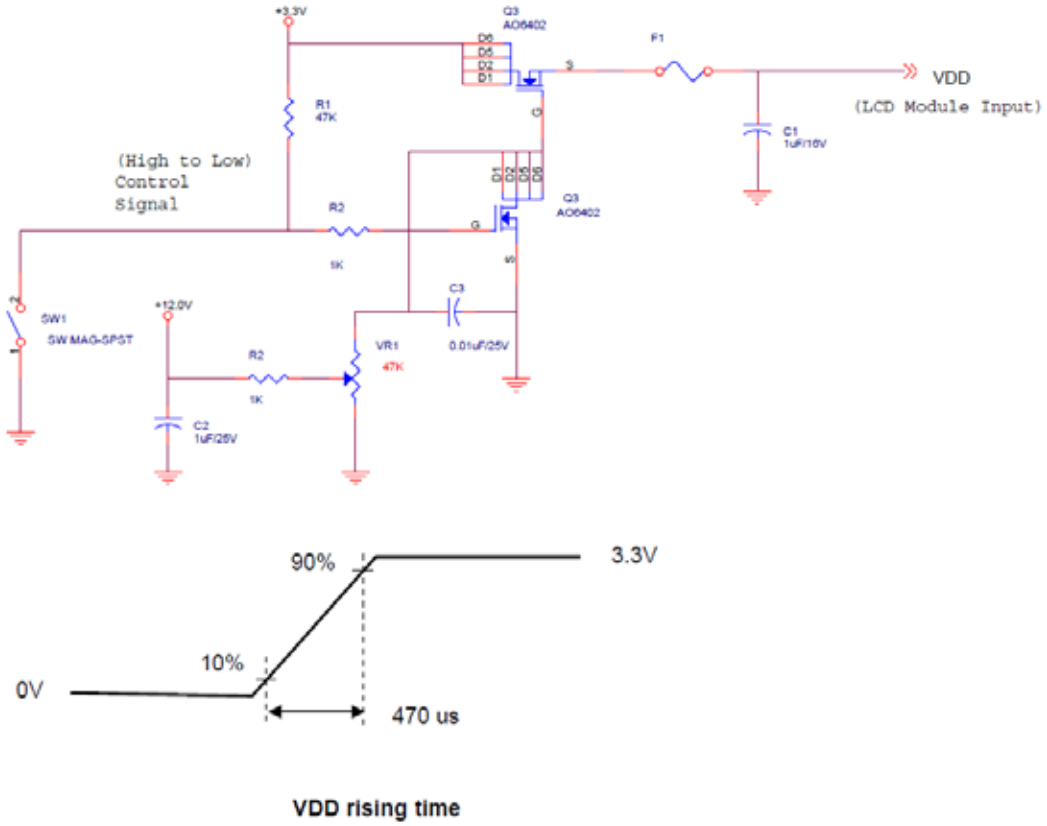
5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
IVDD	LCD Input Current	-	280	-	[mA]	VDD=3.3V, at 60Hz, all Black Pattern
PVDD	LCD Power comsumption	-	0.924	-	[Watt]	VDD=3.3V, at 60Hz, all Black Pattern
Irush LCD	LCD Inrush Current	-	-	1.5	[A]	Note 1; VDD=3.3V, Black Pattern, Rising time=470us
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV]p-p	VDD=3.3V, at 60Hz, all Black Pattern

Note 1 : Measurement condition:



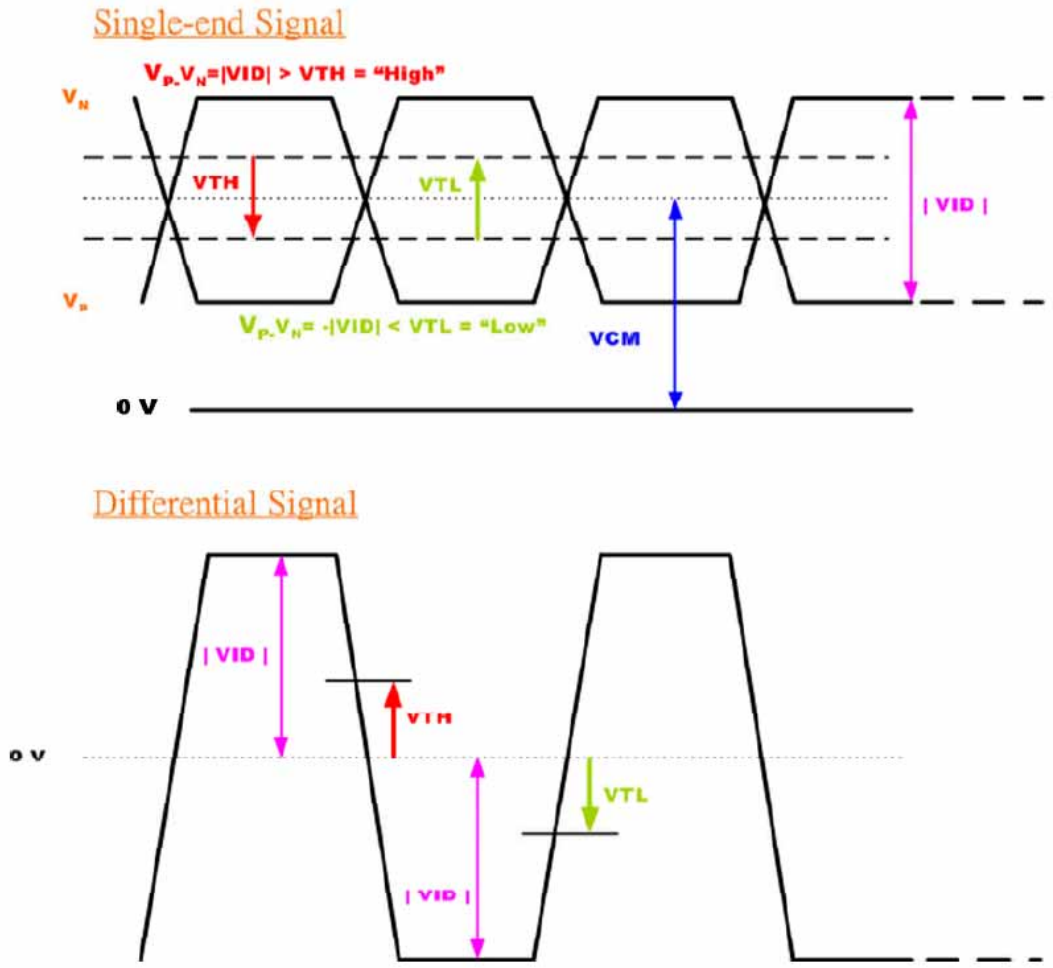
VDD rising time

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
VTH	Differential Input High Threshold	-	-	100	[mV]	VCM=1.2V
VTL	Differential Input Low Threshold	100	-	-	[mV]	VCM=1.2V
| VID |	Input Differential Voltage	100	400	600	[mV]	
VICM	Differential Input Common Mode Voltage	1.1		1.45	[V]	VTH/VTL=±100mV

Note : LVDS Signal Waveform.



5.2 LED Driver

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

Parameter			Symbol	Values			Unit	Notes
				Min	Typ	Max		
LED DRIVER :								
Power Supply Input Voltage			VBL	11	12	13	Vdc	1
Power Supply Input Current			IBL_A		0.455		A	1(Dim = 100%)
Power Consumption			PBL		5.46		W	
Input Voltage for Control System Signals	On/Off	On	V on	2.5	-	5.0	Vdc	
		Off	V off	-0.3	-	0.8	Vdc	
	Dim Adjust (LED Current Control)		VBRT	0.0~4.0 Volt (PWM Dimming)			Vdc	VBRT=0V : Max Current
Life Time				30,000				

Notes :

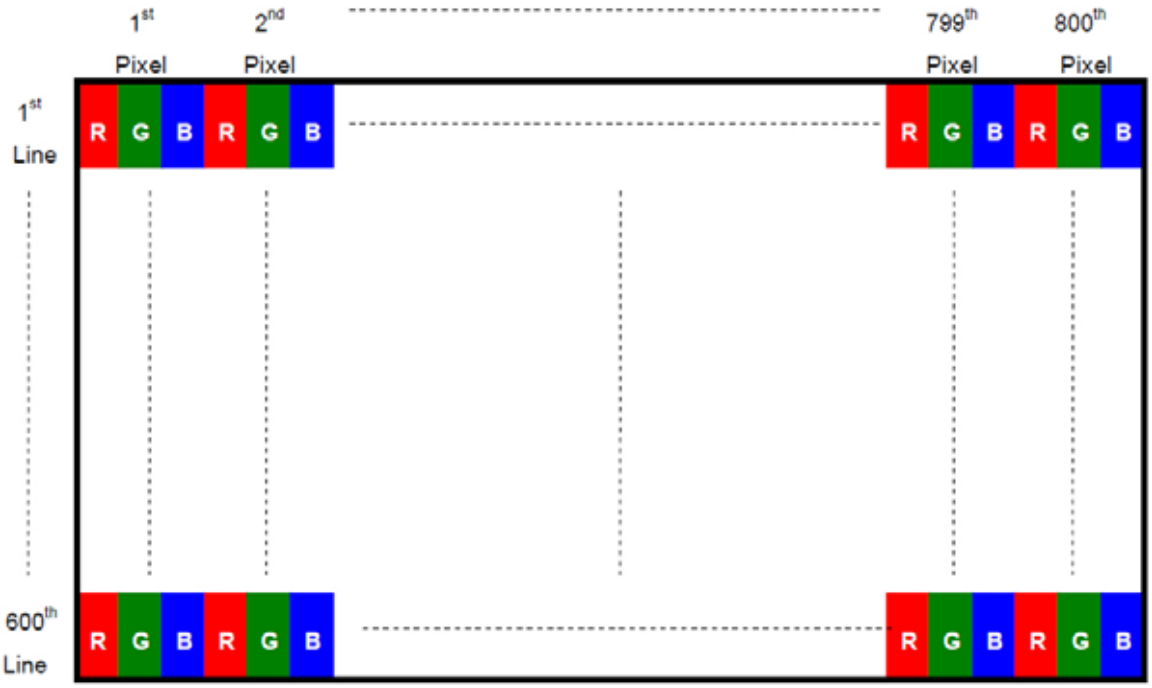
1. Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 60minutes at 25±2°C. The specified current and power consumption are under the typical supply Input voltage 12V and Dim = 100%, it is total power consumption.
2. Electrical characteristics are determined within 30 minutes at 25±2°C. The specified currents are under the typical supply Input voltage 12V.
3. The life time (MTTF) is determined as the time which luminance of the LED is 50% compared to that of initial value at the typical LED current (Dim:100%) on condition of continuous operating in LCM state at 25±2°C.
4. The duration of rush current is about 10ms.

5.Even though inrush current is over the specified value, there is no problem if I2T spec of fuse is satisfied.

6. Signal Characteristic

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)

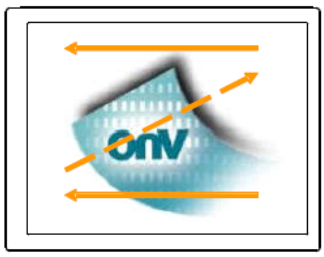


Fig. 2 Reverse scan (Pin19, RSV = High)

6.3 Signal Description

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

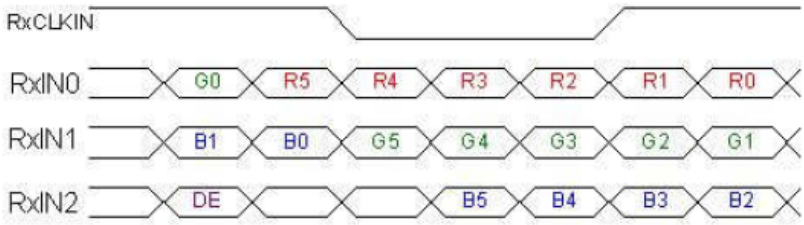
3804-F20N-06R (E&T) / MSB240420E(STM)		
PIN	Symbol	Description
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	GND	Ground
4	DPS	Reverse Scan Function [H: Enable; L/NC: Disable]
5	RxIN0-	LVDS receiver signal channel 0 LVDS Differential Data Input (R0, R1, R2, R3, R4, R5, G0)
6	RxIN0+	
7	GND	Ground
8	RxIN1-	LVDS receiver signal channel 1 LVDS Differential Data Input (G1, G2, G3, G4, G5, B0, B1)
9	RxIN1+	
10	GND	Ground
11	RxIN2-	LVDS receiver signal channel 2 LVDS Differential Data Input (B2, B3, B4, B5, DE)
12	RxIN2+	
13	GND	Ground
14	RxCLKIN-	LVDS receiver signal clock
15	RxCLKIN+	
16	GND	Ground
17	RxIN3-	LVDS receiver signal channel 3, NC for 6 bit LVDS Input LVDS Differential Data Input (R6, R7, G6, G7, B6, B7, RSV)
18	RxIN3+	
19	RSV	Reserved for AUO internal test. Please treat it as NC.
20	SEL68	6/8bits LVDS data input selection [H: 8bits L/NC: 6bit]

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".

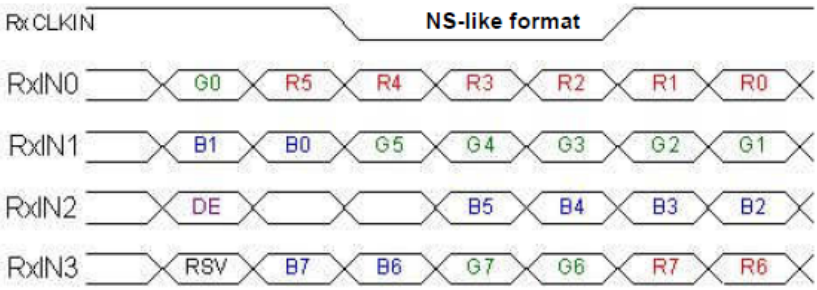
6.4 The Input Data Format

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	Remark
R7 R6 R5 R4 R3 R2 R1 R0	Red Data 7 Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0	Red-pixel Data For 8Bits LVDS input MSB: R7 ; LSB: R0 For 6Bits LVDS input MSB: R5 ; LSB: R0
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7 Green Data 6 Green Data 5 Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0	Green-pixel Data For 8Bits LVDS input MSB: G7 ; LSB: G0 For 6Bits LVDS input MSB: G5 ; LSB: G0
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0	Blue-pixel Data For 8Bits LVDS input MSB: B7 ; LSB: B0 For 6Bits LVDS input MSB: B5 ; LSB: B0
RxCLKIN	LVDS Data Clock	
DE	Data Enable Signal	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.

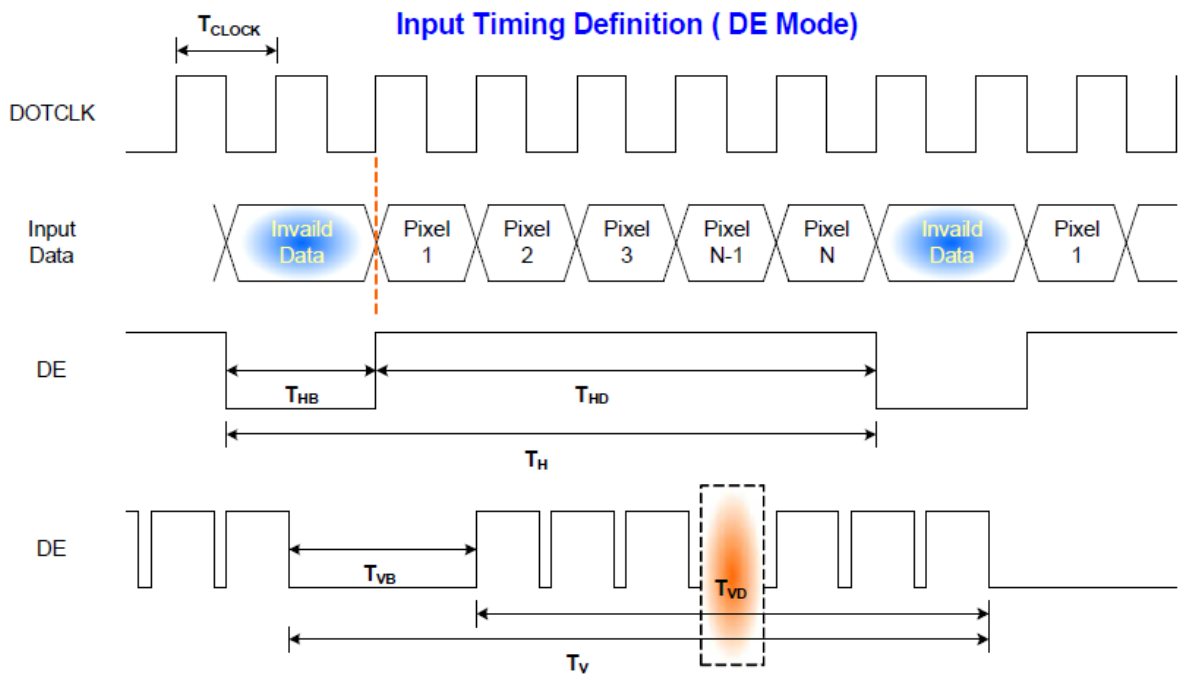
6.5 Interface Timing

6.5.1 Timing Characteristics

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		1/ T_{Clock}	30	40	50	MHz
Vertical Section	Period	T_V	608	628	1024	T_{Line}
	Active	T_{VD}	--	600	--	
	Blanking	T_{VB}	8	28	424	
Horizontal Section	Period	T_H	960	1056	1060	T_{Clock}
	Active	T_{HD}	--	800	--	
	Blanking	T_{HB}	160	256	260	

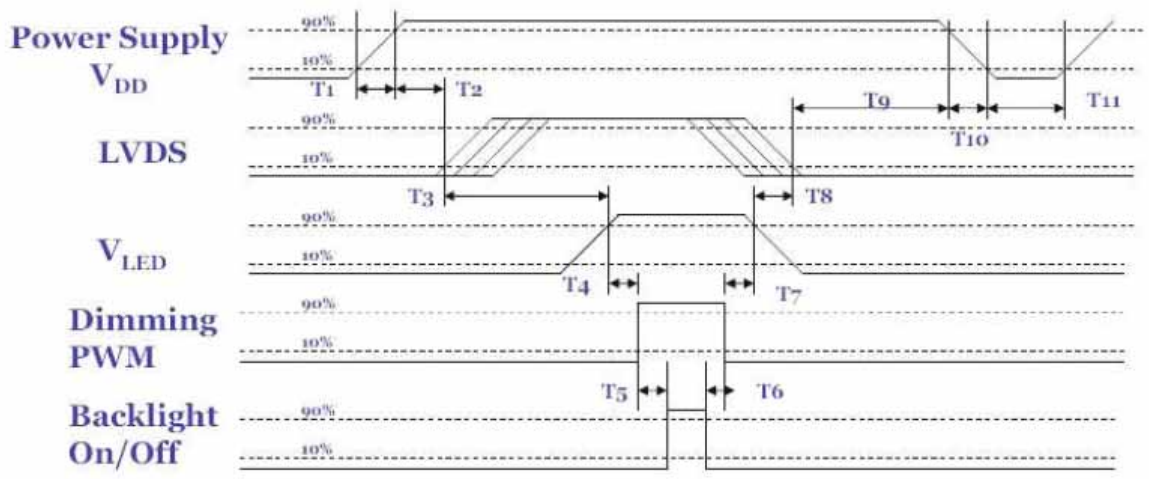
Note 1 : Frame rate is 60 Hz.
Note 2 : DE mode.

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 Module: LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	MSB24013P20HA or compatible
Adaptable Plug	P24013P20 or compatible

Pin#	Signal Name	Pin#	Signal Name
1	VDD	2	VDD
3	GND	4	DPS
5	RxIN0-	6	RxIN0+
7	GND	8	RxIN1-
9	RxIN1+	10	GND
11	RxIN2-	12	RxIN2+
13	GND	14	RxCKIN-
15	RxCKIN+	16	GND
17	RxIN3-	18	RxIN3+
19	RSV	20	SEL68

7.2 Backlight Unit: LED Connector

Connector Name / Designation	LED Connector
Manufacturer	JST or compatible
Connector Model Number	JST BHR-03VS-1 or compatible
Mating Model Number	SM03B-BHS-1R

7.3 LED Connector Pin Assignment

Pin#	Symbol	Cable color	Signal Name
1	LV	White	Ground
2	NC	NC	No Connection
3	HV	Pink	LED High Voltage

-. Connector-output position: right side (front view)

-. LED assembly design shall be easy for replacement and repair

8. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	40℃, 90%RH, 300 hours	
High Temperature Operation	85℃, 300 hours	
Low Temperature Operation	-30℃, 300 hours	
Hot Storage	85℃, 300 hours	
Cold Storage	-30℃, 300 hours	
Thermal Shock Test	-20℃/ 30 min, 60℃/ 30 min, 100cycles, 40℃ minimun ramp rate	
Hot Start Test	85℃/ 1Hr min. power on/off per 5 minutes, 5 times	
Cold Start Test	-30℃/ 1Hr min. power on/off per 5 minutes, 5 times	
Shock Test (Non-Operating)	50G, 20ms, Half-sine wave, (±X, ±Y, ±Z)	
Vibration Test (Non-Operating)	1.5G, (10~200Hz, Sine wave) 30 mins/axis, 3 direction (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point Air Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point	Note 1
EMI	30-230 MHz, limit 40 dBu V/m, 230-1000 MHz, limit 47 dBu V/m	

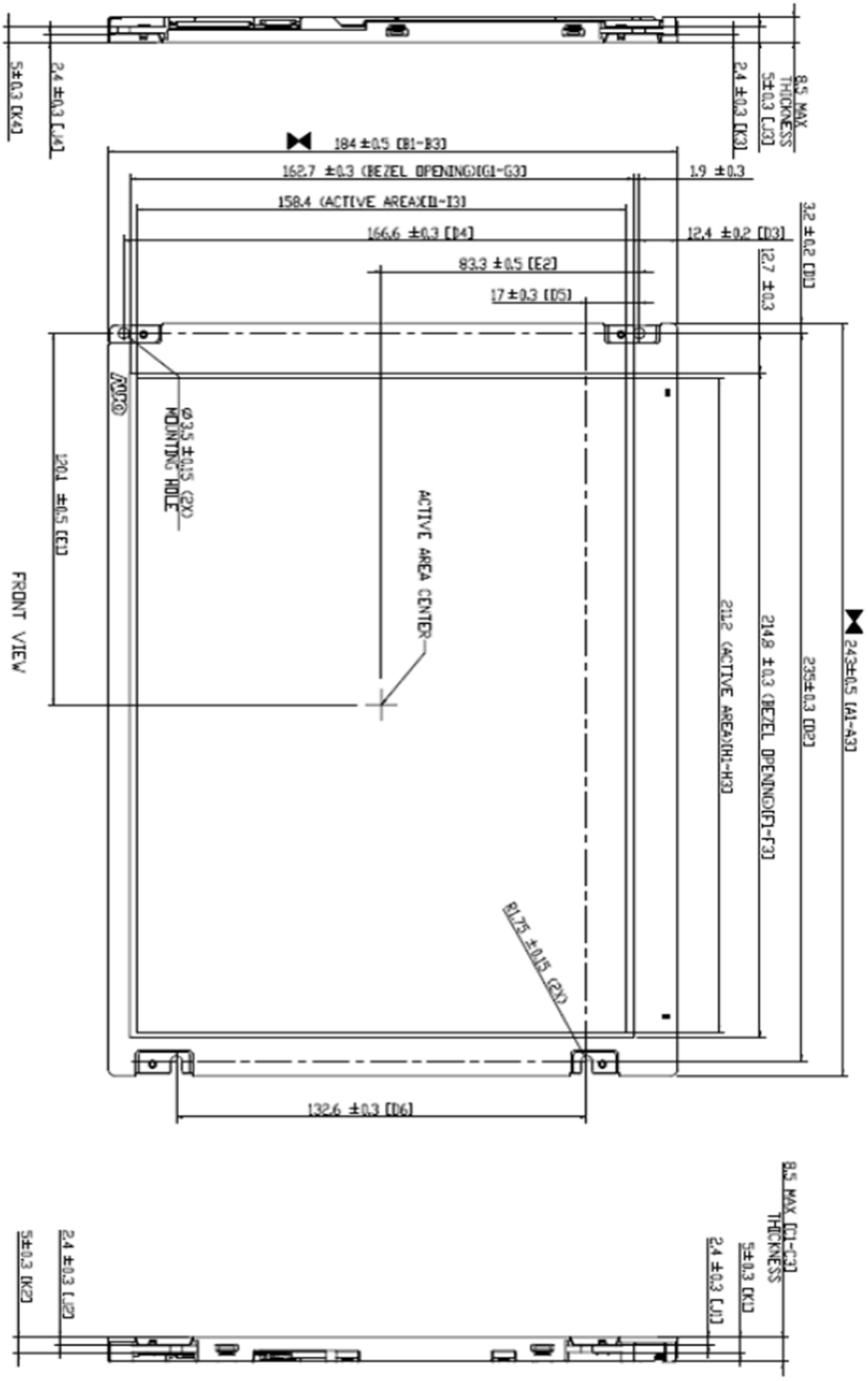
Note 1 : According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 2 :

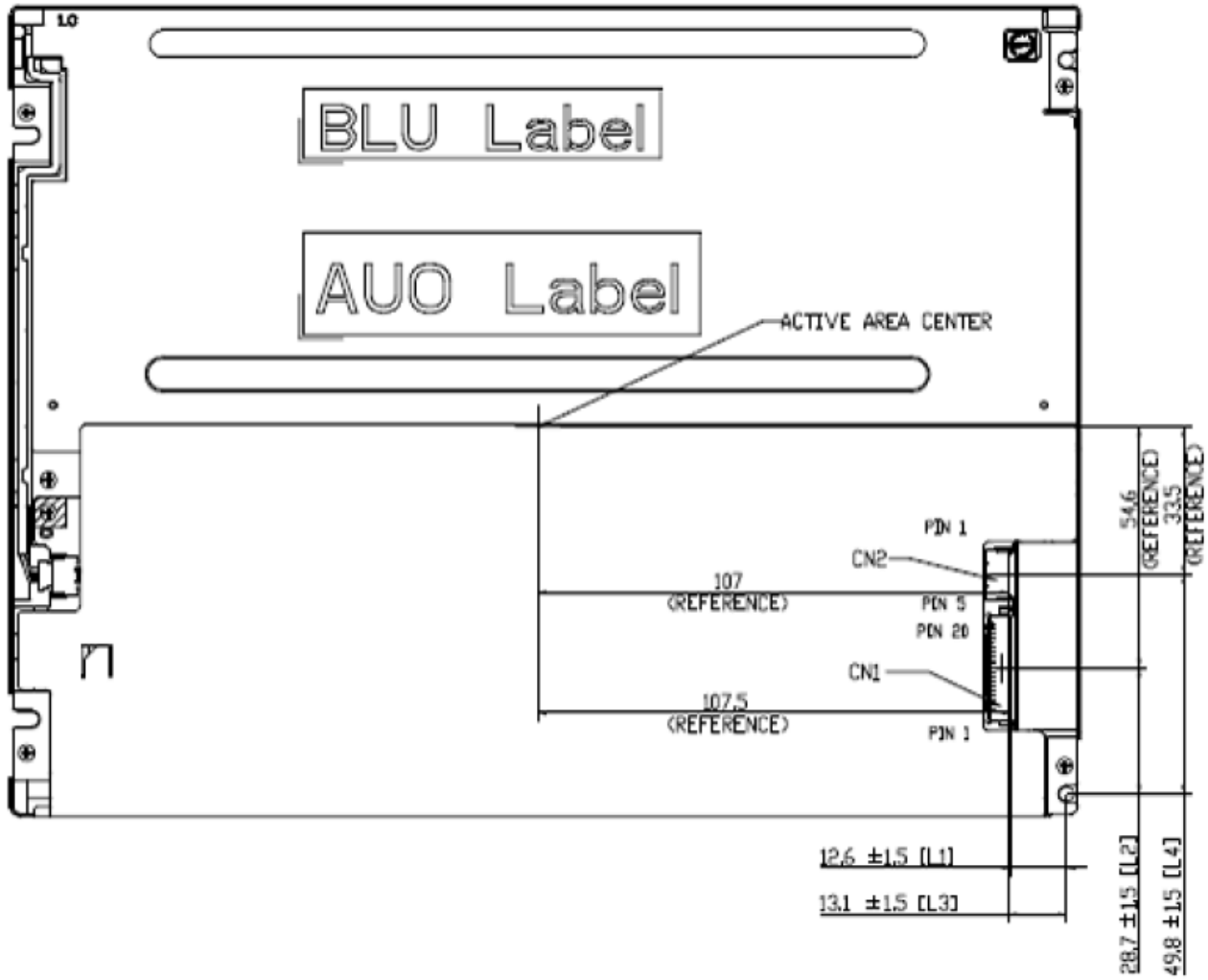
- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.

9. Mechanical Characteristics

9.1 LCM Outline Dimension (Front View)



9.2 LCM Outline Dimension (Rear View)



Appendix : LED Driver Specification

1. Electrical Characteristics

No	Items (Unit)	Symbol	Condition		Min	Typ	Max
1	Input Voltage(V)	Vdc			11.0	12.0	13.0
2	Input Current(A)	Iin	Vin= 12V	Vdim=0V		0.455	
				Vdim=4V	0	0	0
3	On/Off Control	On	Vin=12V,On=5V		Normal Operation		
		Off	Vin=12V,On=0V		Shut Down(Lamp Off)		
4	Dim. Adjust (Lamp Current Control)	CTRL	Vdim=0V, Max		0.0~4.0 Volt PWM Dimming		
			Vdim=4V, Min				
5	Efficiency		Vin=12V, Vdim=0V			85%	

2. Absolute Maximum Ratings

No	Items (Unit)	Description
1	Input Voltage	11.0~13.0 DCV
2	Ambient Operating Temperature	0℃ ~ 60℃
3	Storage Temperature	-30℃ ~ 80℃
4	Storage & Operating Temperature	10~85%

3. Functional Pin Description

3.1 CN1 : Input Connector(12505WR-06A00 / YEON-HO or Equipment)

Pin No	Items (Unit)	Description
1,2	Vin	Input Voltage
5,6	GND	Ground
3	On/Off(Enable)	LED Back Light On/Off
4	Dimming	Vdim(Bright Adjust : 0V Max)

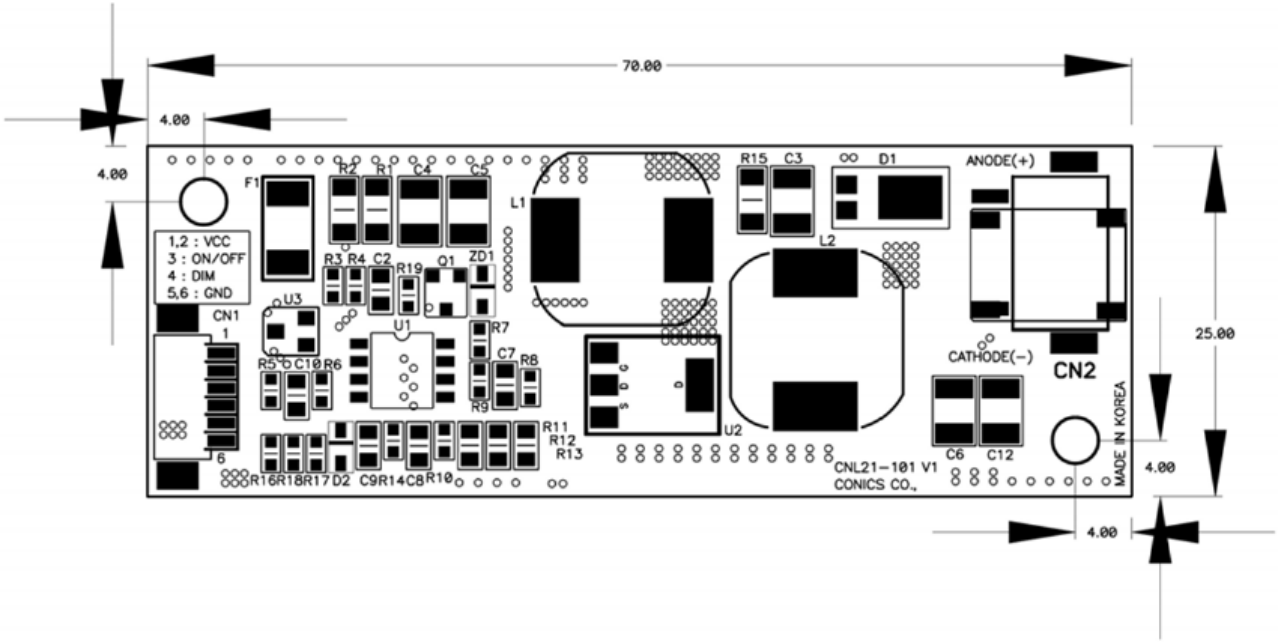
3.2 CN2 : Output Connector(20015WR-05A00 - YEON-HO)

Pin No	Items (Unit)	Description
1	LED H1	Output Voltage Connection to High side of LED
2	LED L1	Output Voltage Connection to Low side of LED

4. Mechanical Drawings

4-1.P.W.B Dimensions

*. Unit : mm
*.Tolerance : ± 0.3mm



4-2.Thickness