

Stretched LCD Module
MODEL : JL215AH539E
 [PN: JL215AH539E-V0]

(●)	Preliminary Specification
()	Final Specification

Customer

Customer's Approval	
<u>Signature</u>	<u>Date</u>

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CONTENTS

1. Description	4
2. Absolute Maximum Ratings	5
3. Electrical Specifications	6
4. Signal Characteristics	10
5. Optical Specifications	19
6. Functional Block Diagram	23
7. Mechanical Characteristics	24
8. Mechanical Specification	25
9. Reliability	28
10. Precautions	29

1. Description

This specification applies to the 19.5 inch stretched Color a-Si TFT-LCD Module JL215AH539E-V0. The display supports the 1920(H) x 539(V) screen format and 16.7M colors (RGB 8-bits). All input signals are 2-channel LVDS interface and this module does contain an LED Driver board for backlight.

JL215AH539E-V0 based on AUO T215HVN01.1

General Features

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

Active Display Area	476.64mm(H) x 133.80675mm(V)
Outline Dimension	495.60 mm(H) x 158.20 mm(V) x 10.80 mm(D)
Pixel Pitch	248.25um(per one triad) × 248.25um
Pixel Format	1920(x3) x 539. RGB vertical stripe
Color Depth	16.7M colors
Luminance, White	700 cd/m ² (Center 1 point) (Typ.)
Viewing Angle (CR=10)	L/R : 89°/89°, U/D : 89°/89° (Typ.)
Power Consumption	Total 21.74W (Typ.) (VDD line : Black Pattern, Fv=60Hz =3.1W, LED Driver=18.64W)
Weight	1.10 Kg
Display Operating Mode	VA Mode, Normally Black
Surface Treatment	Anti-Glare, 3H
Life time (MTTF)	30,000 Hr (Min.)

2. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following :

2-1. TFT LCD Module

Description	Symbol	Min.	Max.	Unit	Conditions
Power Supply Input Voltage	VDD	-0.3	+6.0	[Volt]	Ta=25°C

2-2. Backlight Unit

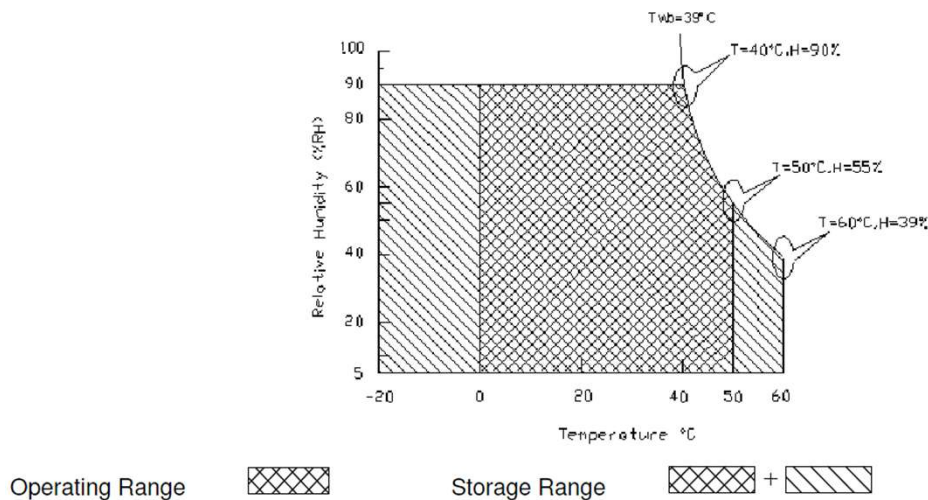
Description	Symbol	Min.	Max.	Unit	Remark
LED String Current	Is	0	+90	[mA]	100% duty ratio
			+150	[mA]	Duty ratio ≤ 10% Pulse time=10 ms

2-3. Absolute Ratings of Environment

Items	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 1
Glass surface Temperature (operation)	TGS	0	+65	[°C]	
Operating Humidity	HOP	5	90	[%RH]	
Storage Temperature	TST	-20	+60	[°C]	
Storage Humidity	HST	5	90	[%RH]	

Note 1 : Temperature and relative humidity range are shown as the below figure.

- 1) 90% RH Max.(Ta ≤ 39°C)
- 2) Max wet-bulb temperature at 39°C or less.(Ta ≤ 39°C)
- 3) No condensation.



3. Electrical Specifications

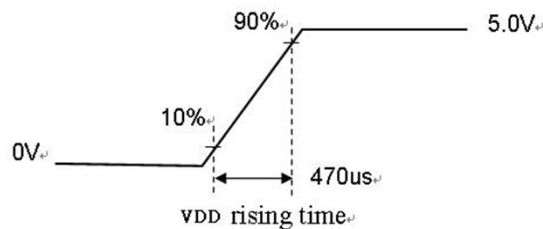
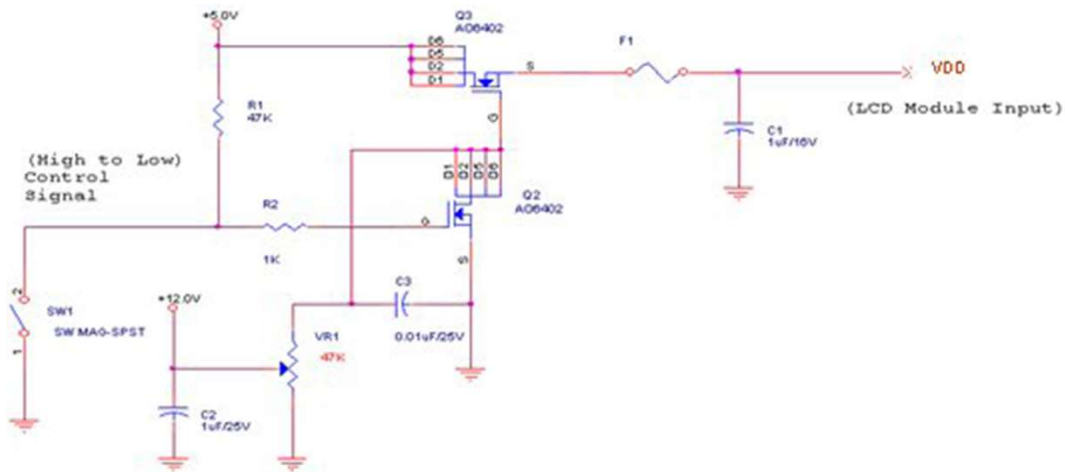
3-1. TFT LCD Module

3-1-1. Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Power supply Input voltage	4.5	5.0	5.5	[Volt]	
IDD	Power supply Input Current	-	0.62	0.74	[A]	VDD= 5.0V, Black Pattern, Fv=60Hz
		-	0.7	0.84	[A]	VDD= 5.0V, Black Pattern, Fv=75Hz
PDD	VDD Power Consumption	-	3.1	3.7	[Watt]	VDD= 5.0V, Black Pattern, Fv=60Hz
		-	3.5	4.2	[Watt]	VDD= 5.0V, Black Pattern, Fv=75Hz
IRush	Inrush Current	-	-	3.0	[A]	Note 1
VDDrp	Allowable VDD Ripple Voltage	-	-	500	[mV]	VDD= 5.0V, Black Pattern, Fv=75Hz

Note 1 : Inrush Current measurement:

Test circuit:



The duration of VDD rising time: 470us.

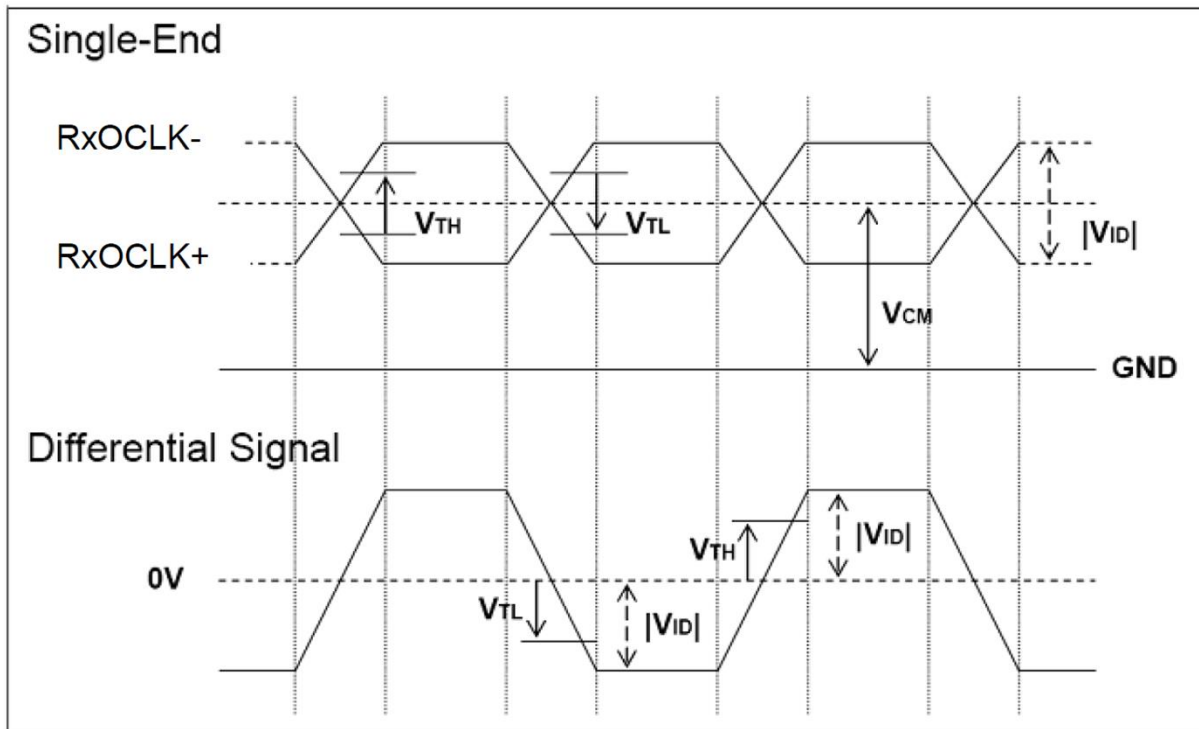
3-1-2. Signal Electrical Characteristics

1) DC Specification

Symbol	Parameter	Min	Typ	Max	Units	Ramark
V_{TH}	LVDS Differential Input High Threshold	-	-	+100	[mV]	$V_{CM} = 1.2V$
V_{TL}	LVDS Differential Input Low Threshold	-100	-	-	[mV]	$V_{CM} = 1.2V$
$ V_{ID} $	LVDS Differential Input Voltage	100	-	600	[mV]	
V_{CM}	LVDS Common Mode Voltage	+1.0	+1.2	+1.5	[V]	$V_{TH}-V_{TL}=200mV$

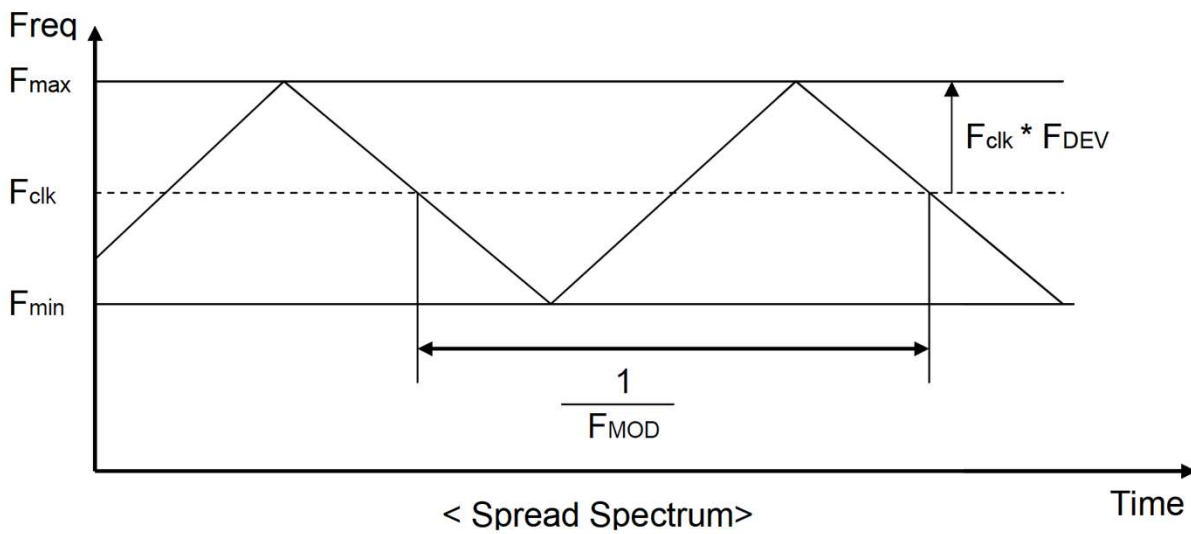
Note 1 : LVDS Signal Waveform.

Use RxOCLK- & RxOCLK+ as example.



2) AC Specification

Description	Symbol	Min	Max	Units	Note
Maximum deviation of input clock frequency during Spread Spectrum	F_{DEV}	-	± 3	%	
Maximum modulation frequency of input clock during Spread Spectrum	F_{MOD}	-	200	KHz	



Fclk: LVDS Clock Frequency

3-2. Backlight Unit(LED Driver_DGB-012V)

Parameter guideline for LED driving is under stable conditions at 25°C (Room Temperature):

No.	Items (Unit)	Sign	Condition	Min.	Typ.	Max.
1	Input Voltage	Vdc		11	12	13
2	Input Current (A)	lin	Vin=12V Dim=MAX	-	1.553	-
3	ON/OFF Control	ON	Vin=12V, ON=5V	Normal Operation		
		OFF	Vin=12V, OFF=0V	Shunt-down(LED off)		
4	Dim Adjust (LED Current Control)	CTRL	VBRT=0V : Max Current	0.0~5.0 Volt		
			VBRT=5V : Min Current			
5	Efficiency(%)		Vin=12V, VBRT=0V		85	

4. Signal Characteristic

4-1. Signal Timing Specifications

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
V- section	Period	Tv	1092	1130	1818	Th	
	Active	Tdisp(v)	1080	1080	1080	Th	
	Blanking	Tblk(v)	12	50	738	Th	
	Frequency	Fv	50	60	76	Hz	
H- section	Period	Th	1034	1050	1100	Tclk	
	Active	Tdisp(h)	960	960	960	Tclk	
	Blanking	Tblk(h)	74	90	140	Tclk	
	Frequency	Fh	55	68	91	KHz	Note 1
Clock	Period	Tclk	10.6	14.0	17.7	ns	1/Fclk
	Frequency	Fclk	56.5	71.2	94.0	MHz	Note 2

Note 1 : The equation is listed as following. Please don't exceed the above recommended value.

$$Fh (\text{Min.}) = Fclk (\text{Min.}) / Th (\text{Min.}) ;$$

$$Fh (\text{Typ.}) = Fclk (\text{Typ.}) / Th (\text{Typ.}) ;$$

$$Fh (\text{Max.}) = Fclk (\text{Max.}) / Th (\text{Min.}) ;$$

Note 2 : The equation is listed as following. Please don't exceed the above recommended value.

$$Fclk (\text{Min.}) = Fv (\text{Min.}) \times Th (\text{Min.}) \times Tv (\text{Min.}) ;$$

$$Fclk (\text{Typ.}) = Fv (\text{Typ.}) \times Th (\text{Typ.}) \times Tv (\text{Typ.}) ;$$

$$Fclk (\text{Max.}) = Fv (\text{Max.}) \times Th (\text{Typ.}) \times Tv (\text{Typ.}) ;$$

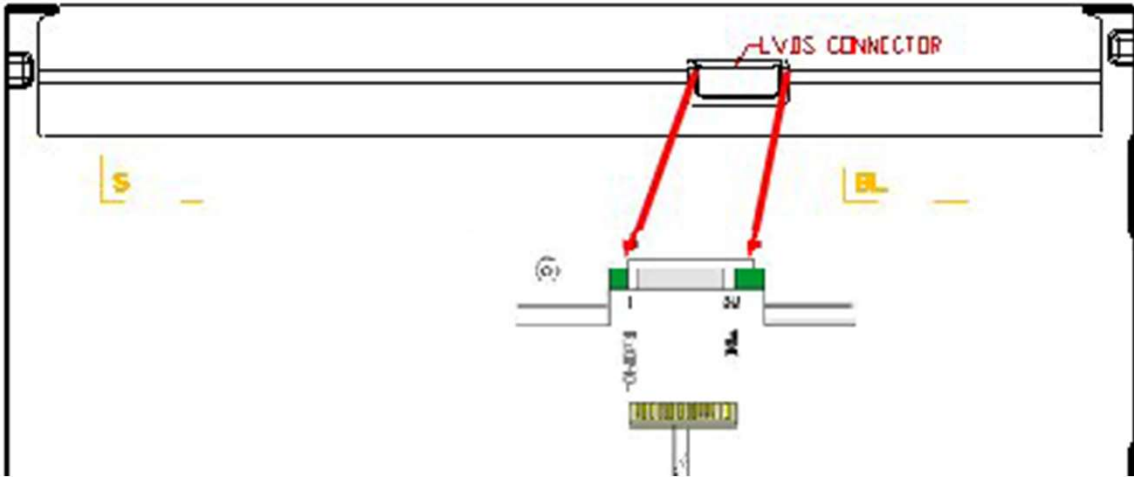
4-2. Signal Description

4-2-1. LCD Module

Connector Name / Designation	Signal Connector
Manufacturer	P-TWO STM JAE
Connector Model Number	AL230F-A0G1D-P MSCKT2407P30HB
Adaptable Plug	FI-X30HL (Locked Type)

PIN #	SIGNAL NAME	DESCRIPTION
1	RxO0-	Negative LVDS differential data input (Odd data)
2	RxO0+	Positive LVDS differential data input (Odd data)
3	RxO1-	Negative LVDS differential data input (Odd data)
4	RxO1+	Positive LVDS differential data input (Odd data)
5	RxO2-	Negative LVDS differential data input (Odd data)
6	RxO2+	Positive LVDS differential data input (Odd data)
7	GND	Power Ground
8	RxOCLK-	Negative LVDS differential data input (Odd clock)
9	RxOCLK+	Positive LVDS differential data input (Odd clock)
10	RxO3-	Negative LVDS differential data input (Odd data)
11	RxO3+	Positive LVDS differential data input (Odd data)
12	RxE0-	Negative LVDS differential data input (Even data)
13	RxE0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RxE1-	Negative LVDS differential data input (Even data)
16	RxE1+	Positive LVDS differential data input (Even data)
17	GND	Power Ground
18	RxE2-	Negative LVDS differential data input (Even data)
19	RxE2+	Positive LVDS differential data input (Even data)
20	RxECLK-	Negative LVDS differential data input (Even data)
21	RxECLK+	Positive LVDS differential data input (Even clock)
22	RxE3-	Negative LVDS differential data input (Even clock)

PIN #	SIGNAL NAME	DESCRIPTION
23	RxE3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No connection
26	NC	No connection
27	NC	No connection
28	VDD	Power Supply Input Voltage
29	VDD	Power Supply Input Voltage
30	VDD	Power Supply Input Voltage



4-2-2. LED Driver(DGB)

1) Input Connector CN1 : 12505WR-12A00 (YEON-HO)

Pin No.	Symbol	Description
1, 2, 3	V_{IN}	Input Voltage
4, 5, 6, 7, 8	GND	Ground
9	DIM	DC Dimming
11	ON / OFF	Power ON/OFF Control
10, 12		NC

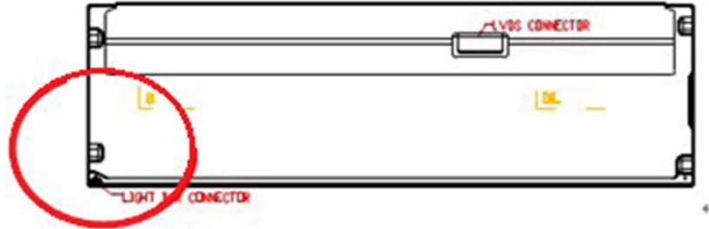
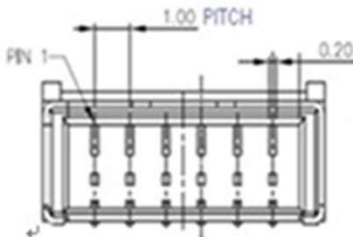
2) Output Connector CN2 : 12505WR-06A00 (YEON-HO)

Pin No.	Symbol	Description
3, 4	V_o	Output Voltage Connection to high side of LED
1, 2, 5, 6	V_o	Output Voltage Connection to low side of LED

4-2-3. Backlight Unit

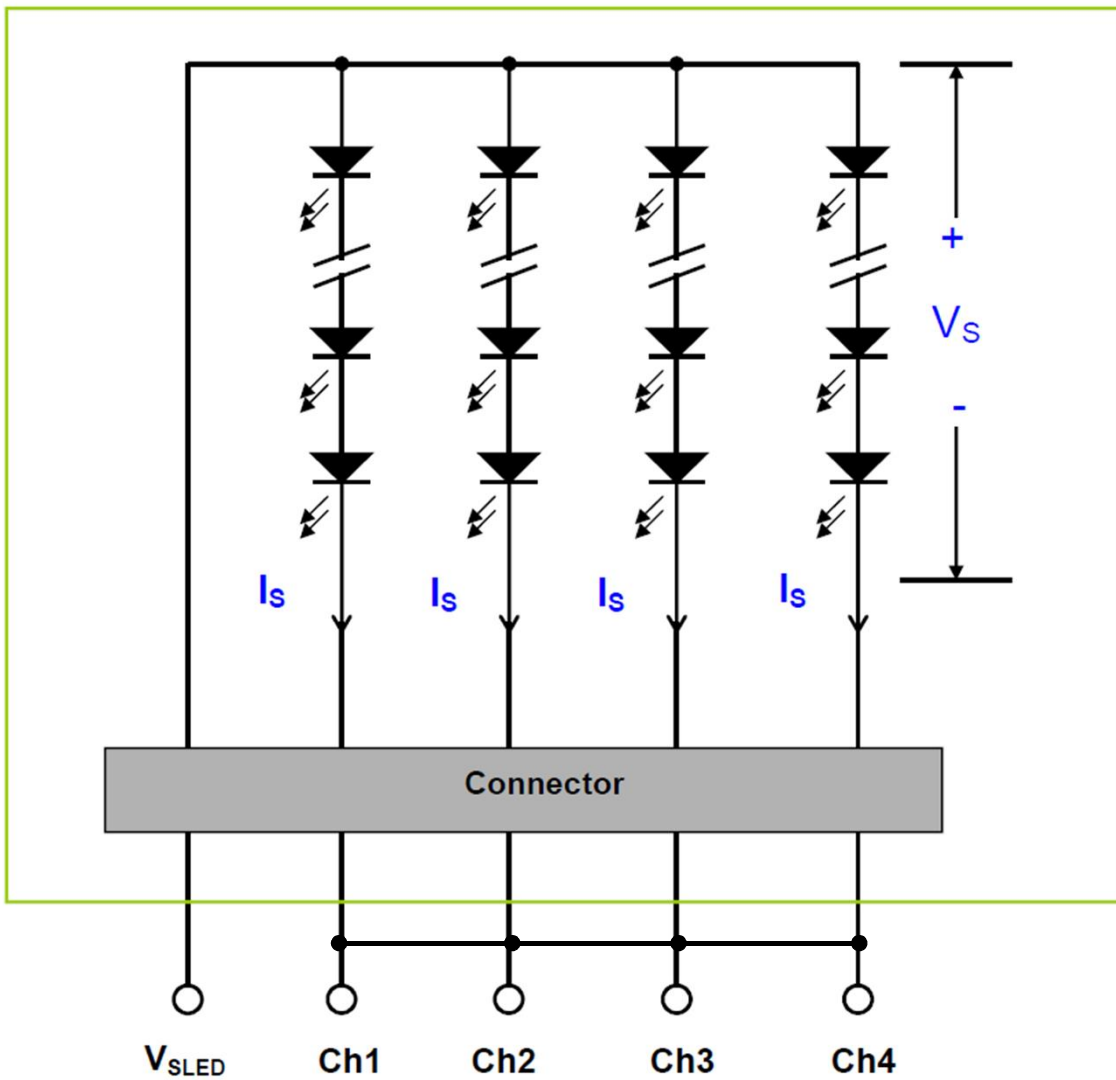
Connector Name / Designation	Signal Connector
Manufacturer	ENTERY
Connector Model Number	3707K-S06N-21R
Adaptable Plug	H112K-P06N-00B (Non-Locking type) H112K-P06N-03B (Locking type)

PIN #	Symbol	SIGNAL NAME
1	Ch1	LED Current Feedback Terminal (Channel 1)
2	Ch2	LED Current Feedback Terminal (Channel 2)
3	V _{SLED}	LED Power Supply Voltage Input Terminal
4	V _{SLED}	LED Power Supply Voltage Input Terminal
5	Ch3	LED Current Feedback Terminal (Channel 3)
6	Ch4	LED Current Feedback Terminal (Channel 4)

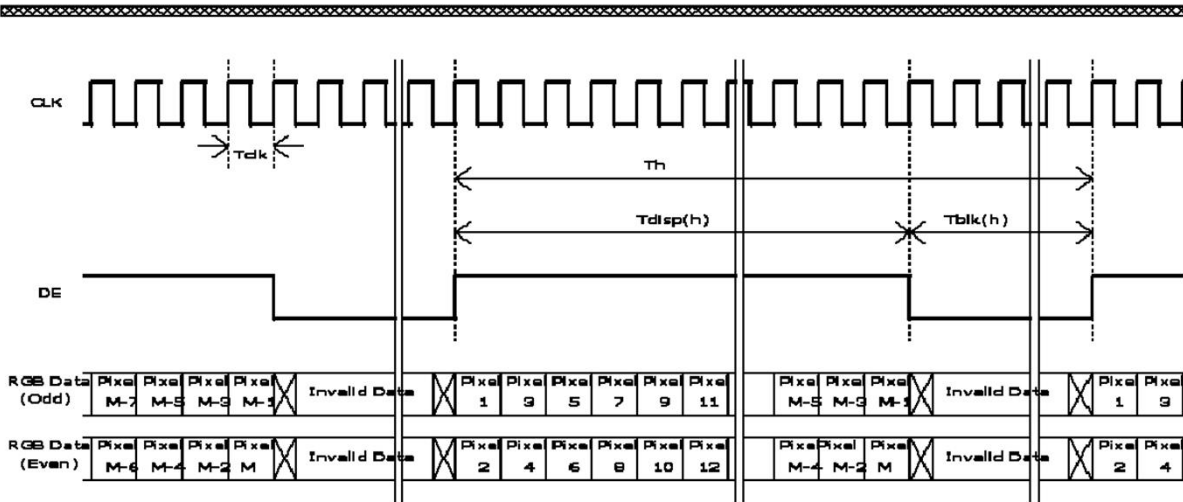
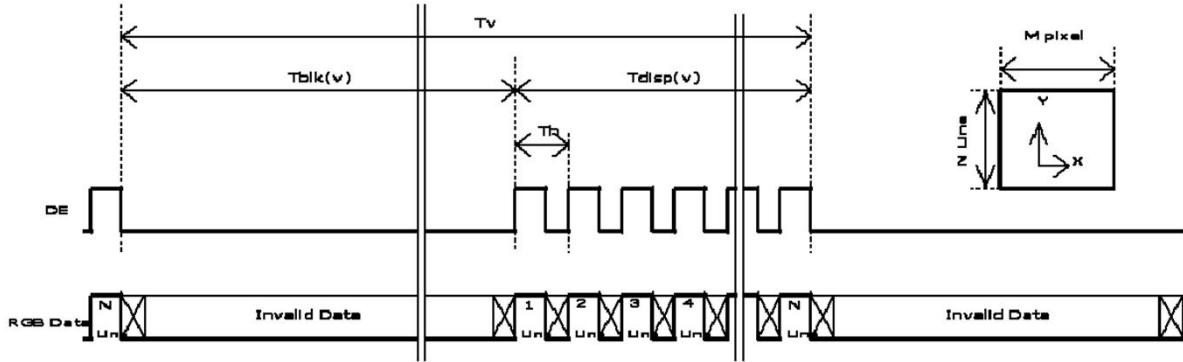


4-2-4. Backlight Block Diagram

The following shows the block diagram of the 21.5 inch Backlight Unit. And it includes 56 pcs LED in the LED light bar. (4 strings and 14 pcs LED of one string).

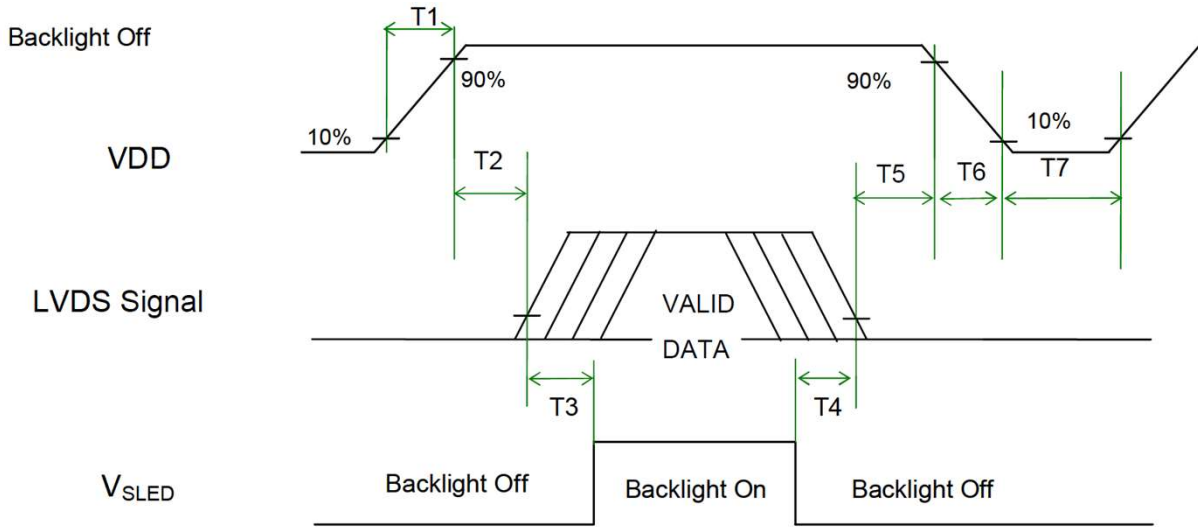


4-3. Timing diagram



4-4. Power ON/OFF Sequence

VDD power, LVDS signal and backlight on/off sequence are as following. LVDS signals from any system shall be Hi-Z state when VDD is off.



Power Sequence Timing

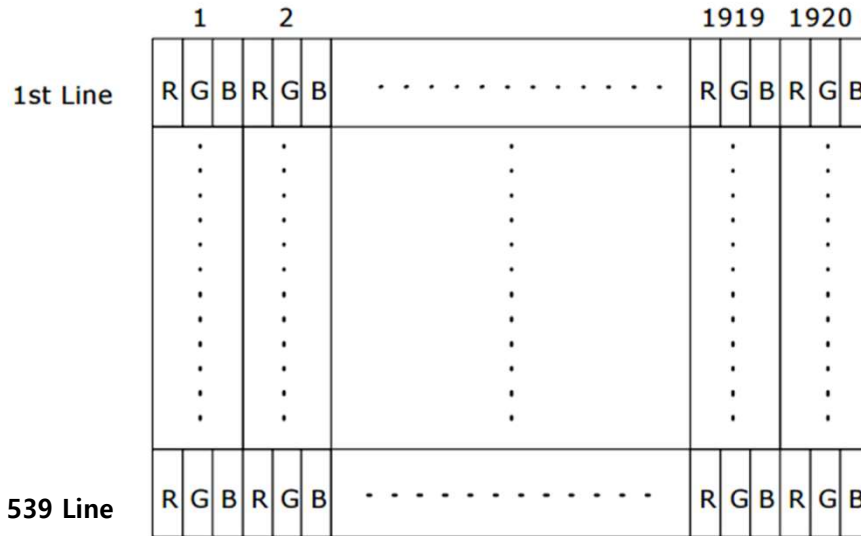
Symbol	Value			Unit	Notes
	Min.	Typ.	Max.		
T1	0.5	-	10	[ms]	
T2	0	-	50	[ms]	
T3	500	-	-	[ms]	
T4	100	-	-	[ms]	
T5	0	-	50	[ms]	Note 1,2
T6	0	-	100	[ms]	Note 1,2
T7	1000	-	-	[ms]	

Note 1 : Recommend setting T5=0ms to avoid electronic noise when VDD is off.

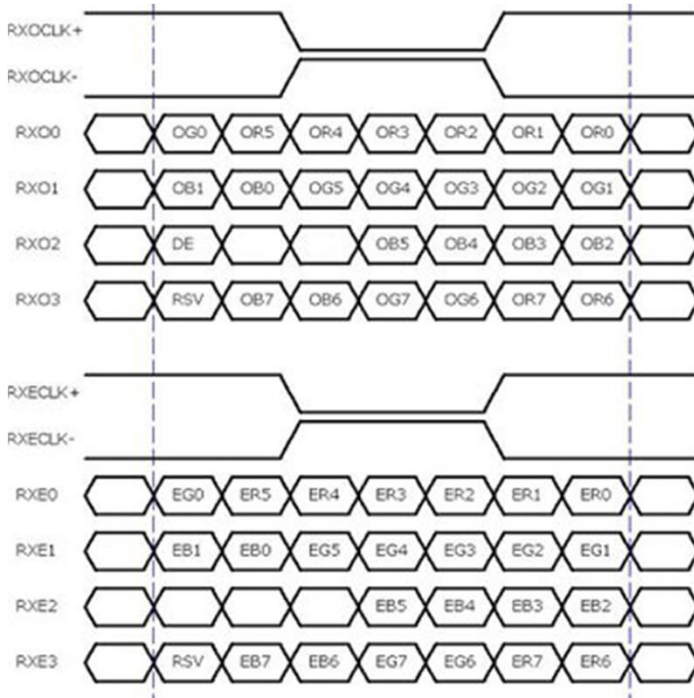
Note 2 : During T5 and T6 period, please keep the level of input LVDS signals with Hi-Z state.

4-5. Pixel Format Image

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



4-6. The input data format



8 Bit Color Bit Order			
MSB	R7	G7	B7
	R6	G6	B6
	R5	G5	B5
	R4	G4	B4
	R3	G3	B3
	R2	G2	B2
	R1	G1	B1
LSB	R0	G0	B0

Note 1 :

- a. O = "Odd Pixel Data" E = "Even Pixel Data"
- b. Refer to 3.4.1 LCD pixel format, the 1st data is 1 (Odd Pixel Data), the 2nd data is 2 (Even Pixel Data) and the last data is 1920 (Even Pixel Data).

5. Optical Specification

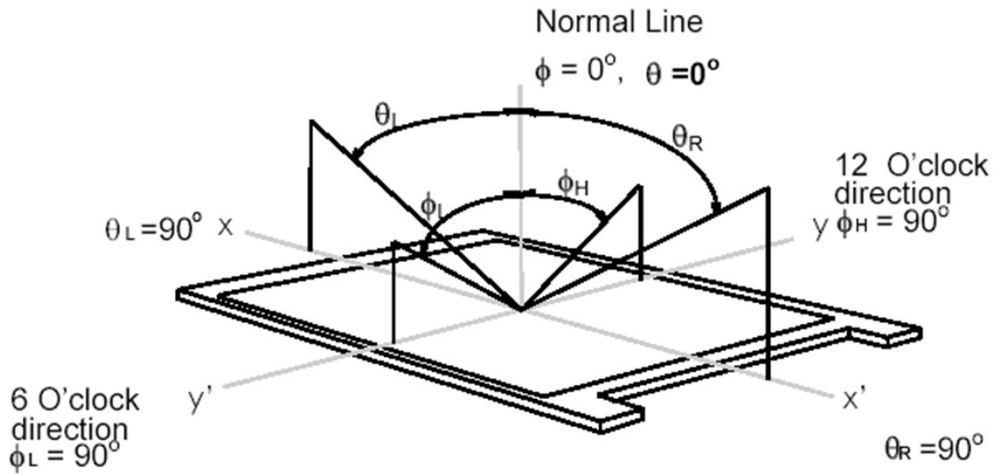
The optical characteristics are measured under stable conditions at 25°C :

Parameter	Symbol	Specifications			Unit	Notes
		Min.	Typ.	Max.		
Viewing Angle						1
Horizontal (Right) CR = 10 (Left)	θ_R	75	89	-	degree	
	θ_L	75	89	-	degree	
Vertical (Up) CR = 10 (Down)	Φ_U	75	89	-	degree	
	Φ_D	75	89	-	degree	
Contrast Ratio	CR	2000	3000	-		2
Response Time (Raising + Falling)	T	-	18	36	ms	3
Color Coordinates						
Red	Rx	Typ. -0.03	0.660	Typ. +0.03		
	Ry		0.330			
Green	Gx		0.290			
	Gy		0.660			
Blue	Bx		0.140			
	By		0.080			
White	Wx		0.313			
	Wy		0.329			
Surface Luminance (White)		560	700	-	cd/m ²	4
Luminance Uniformity	3point	75	80	-	%	5
Crosstalk		-	-	2.0	%	6
Flicker		-	-	-20	dB	7

Note 1 : Viewing angle measurement

Definition: The angle at which the contrast ratio is greater than 10 & 5 .

- a. Horizontal view angle: Divide to left & right (θ_L & θ_R)
- Vertical view angle: Divide to up & down (Φ_H & Φ_L)



Note 2 : Contrast Ratio Measurement

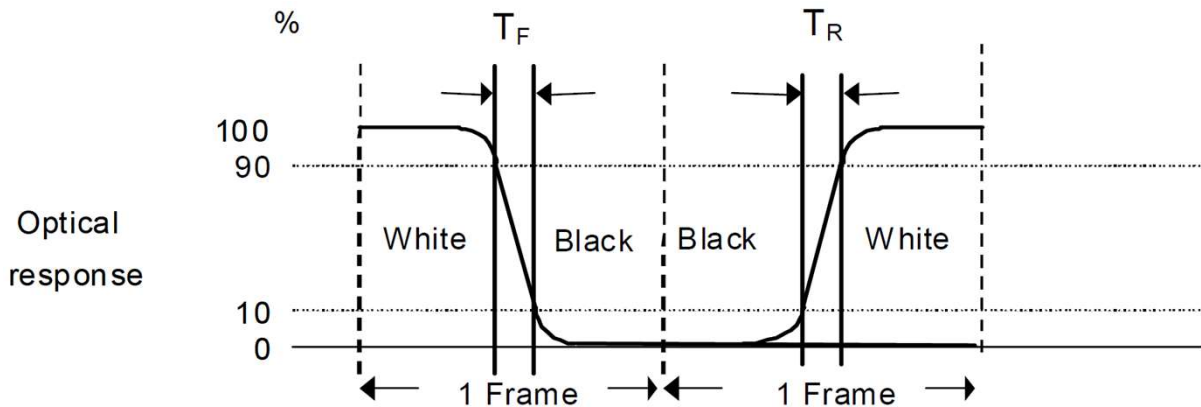
Definition:

$$\text{Contrast Ratio} = \frac{\text{Luminance of White pattern}}{\text{Luminance of Black pattern}}$$

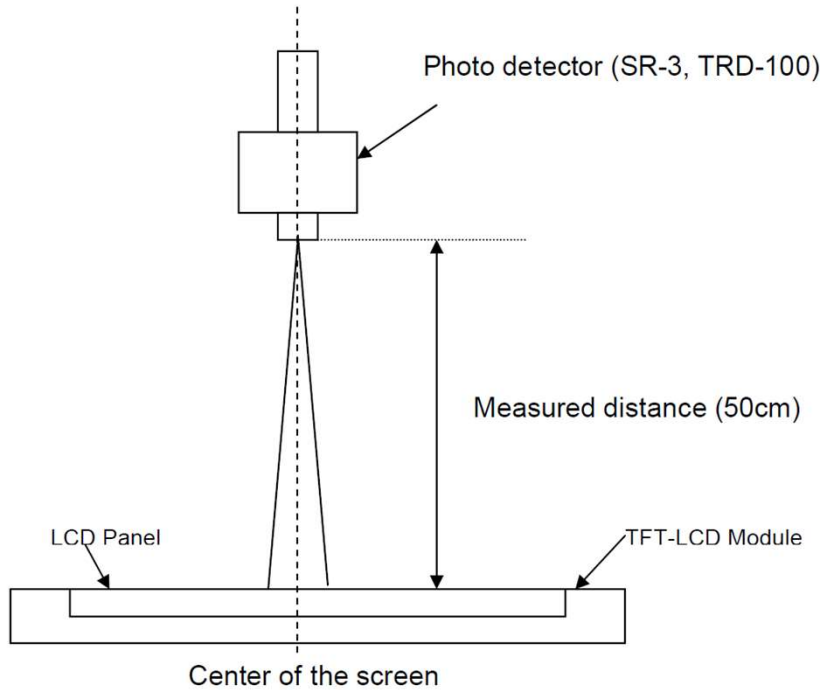
- a. Measured position: Center of screen (P5) & perpendicular to the screen ($\theta = \Phi = 0^\circ$)

Note 3 : Response time measurement

The output signals of photo detector are measured when the input signals are changed from "Black" to "White" (rising time, T_R), and from "White" to "Black" (falling time, T_F), respectively. The response time is interval between the 10% and 90% of optical response.



Note 4 : Equipment setup :

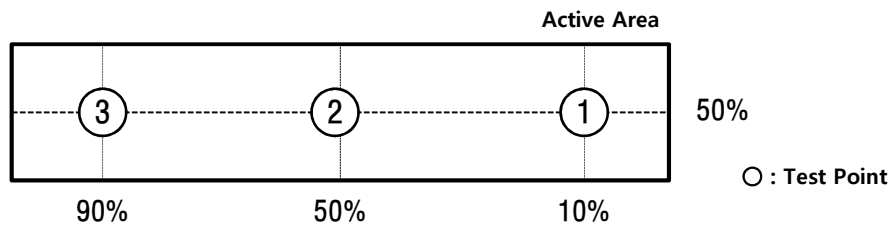


Note 5 : Luminance Uniformity Measurement

Definition:

$$\text{Luminance Uniformity} = \frac{\text{Minimum Luminance of 3 points}}{\text{Maximum Luminance of 3 points}}$$

a. Test pattern: White Pattern



Note 6 : Crosstalk measurement

Definition:

$$CT = \text{Max. } (CT_H, CT_V);$$

Where

a. Maximum Horizontal Crosstalk :

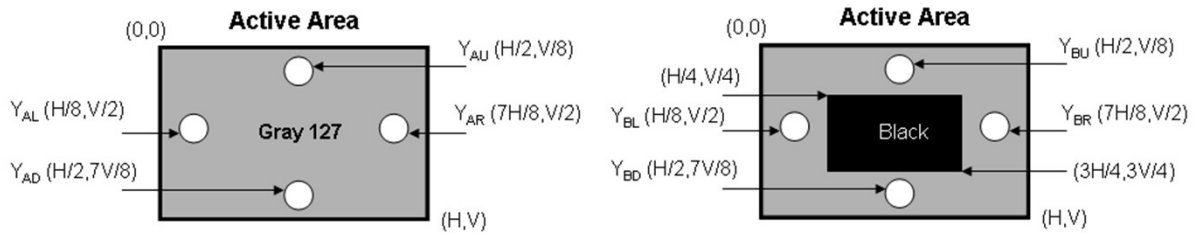
$$CT_H = \text{Max. } (| Y_{BL} - Y_{AL} | / Y_{AL} \times 100 \%, | Y_{BR} - Y_{AR} | / Y_{AR} \times 100 \%);$$

Maximum Vertical Crosstalk:

$$CT_V = \text{Max. } (| Y_{BU} - Y_{AU} | / Y_{AU} \times 100 \%, | Y_{BD} - Y_{AD} | / Y_{AD} \times 100 \%);$$

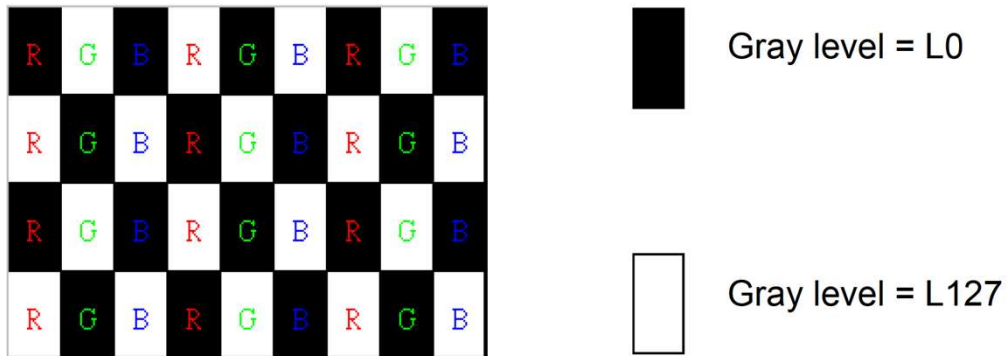
b. $Y_{AU}, Y_{AD}, Y_{AL}, Y_{AR}$ = Luminance of measured location without Black pattern

$Y_{BU}, Y_{BD}, Y_{BL}, Y_{BR}$ = Luminance of measured location with Black pattern



Note 7 : Flicker measurement

a. Test pattern: It is listed as following.

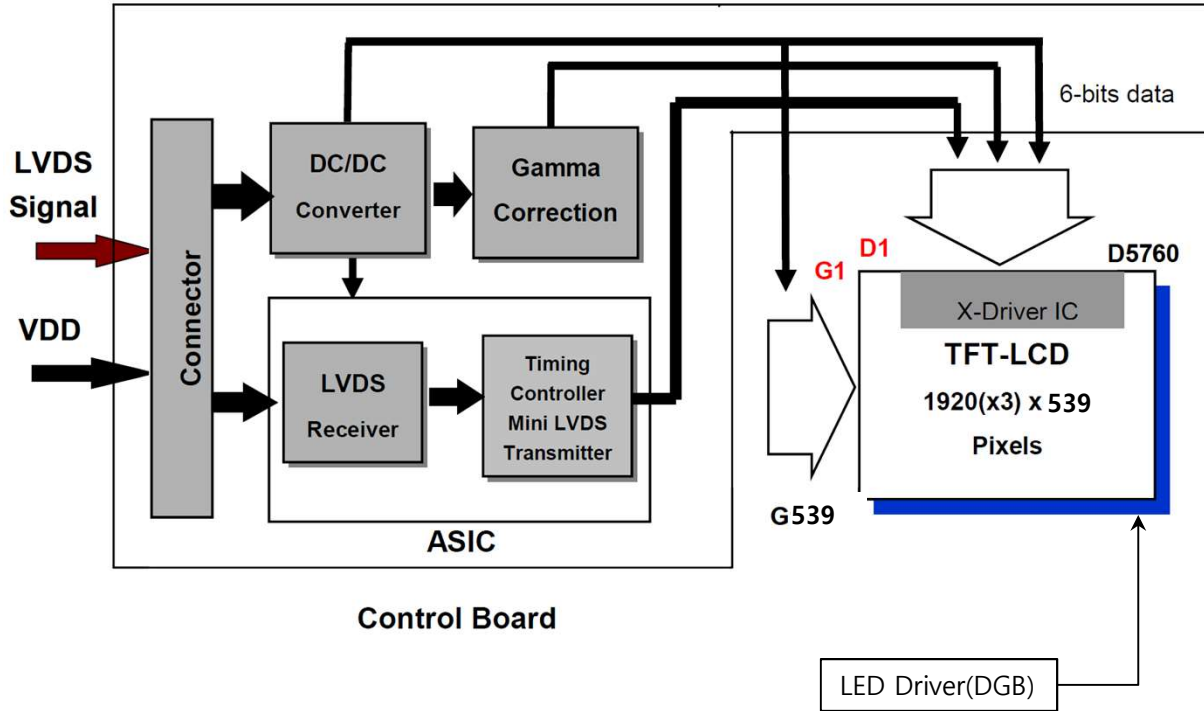


R: Red, **G:** Green, **B:** Blue

b. Measured position: Center of screen (P5) & perpendicular to the screen ($\theta = \Phi = 0^\circ$)

6. Functional Block Diagram

The following diagram shows the functional block of the TFT-LCD Module :



7. Mechanical Characteristics

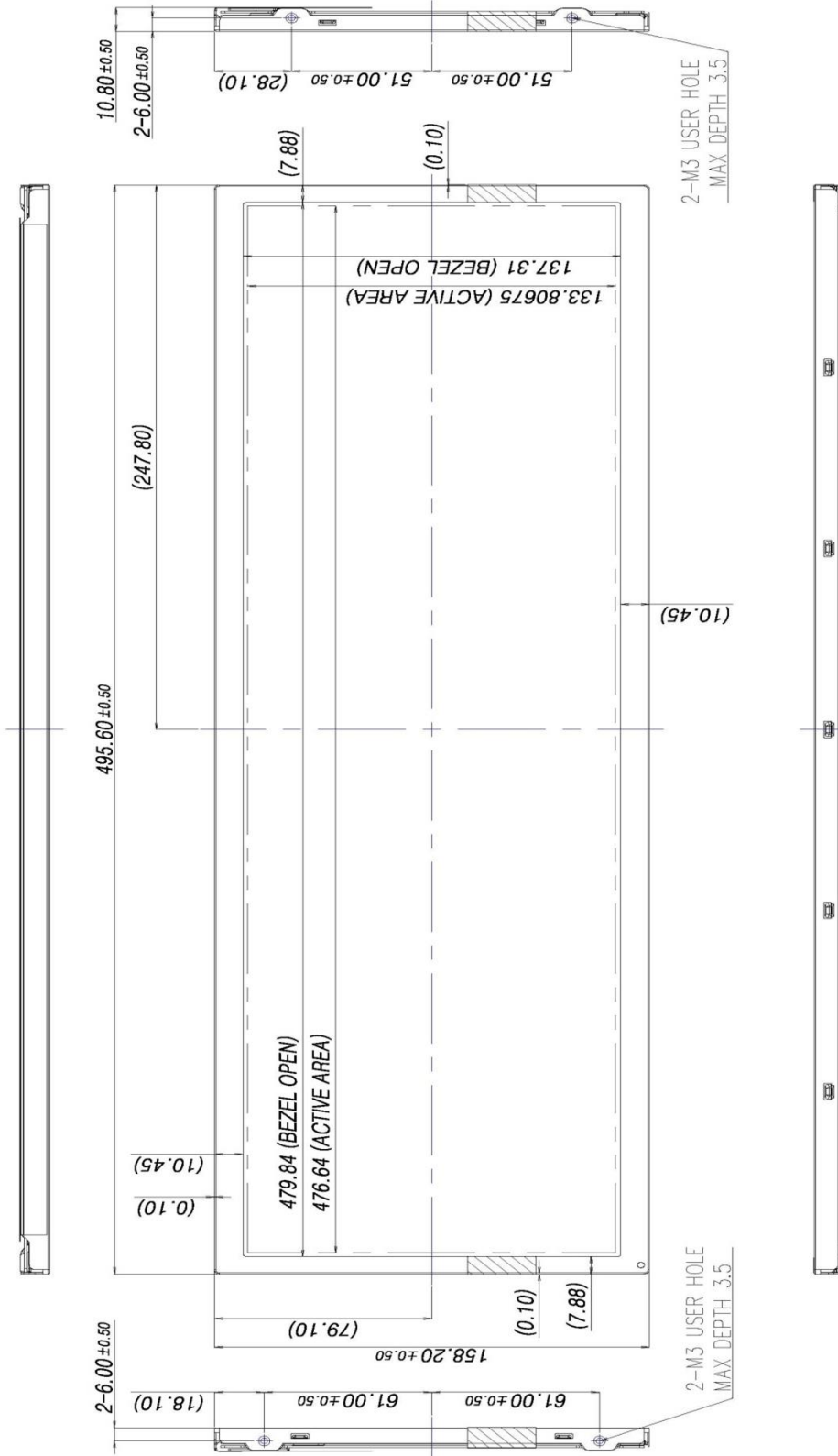
7-1. TFT LCD Module

Item	Value	
Outline Dimension	Horizontal	495.60 mm
	Vertical	158.20 mm
	Depth	10.80 mm
Bezel Open	Horizontal	479.84 mm
	Vertical	137.31 mm
Active Display Area	Horizontal	476.64 mm
	Vertical	133.80675 mm
Weight	1.10 kg	

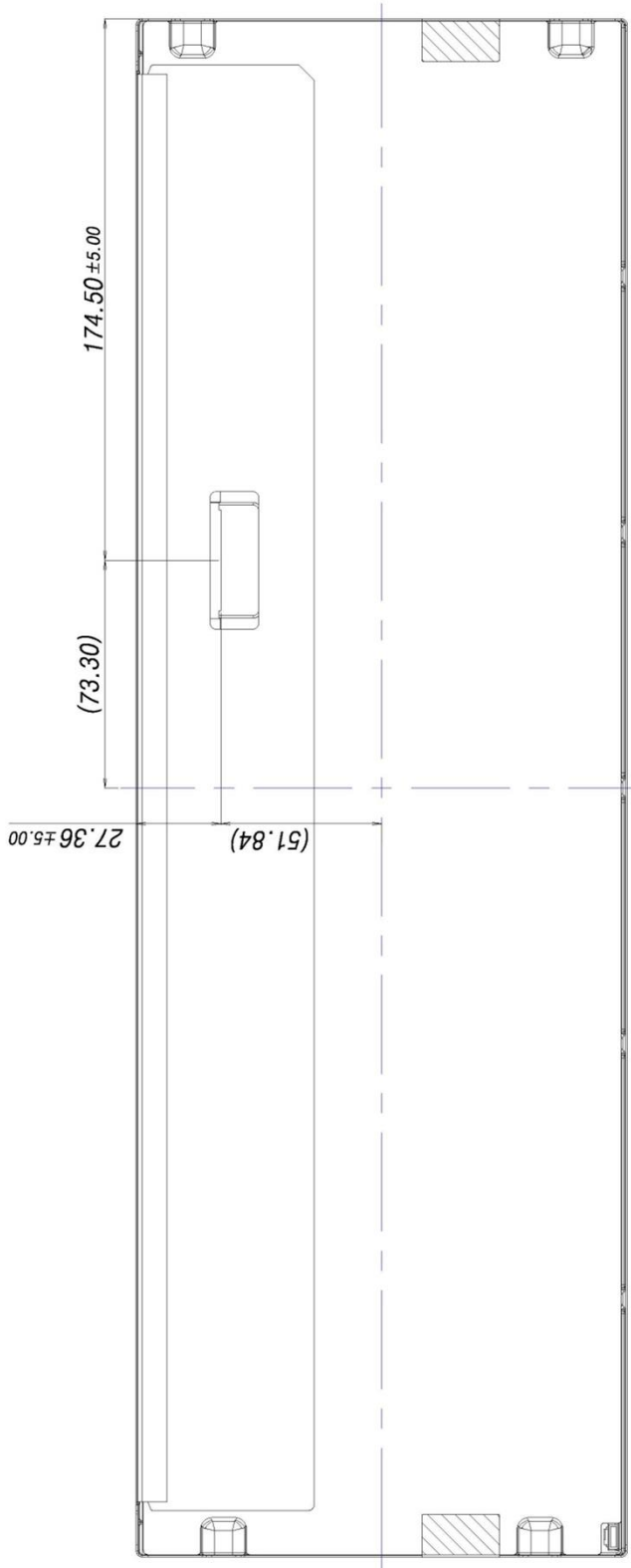
Note : Please refer to a mechanical drawing in terms of tolerance at the next page.

8. Mechanical Specification

< FRONT VIEW >



< REAR VIEW >

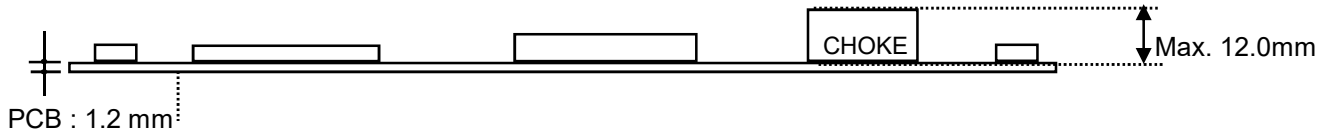
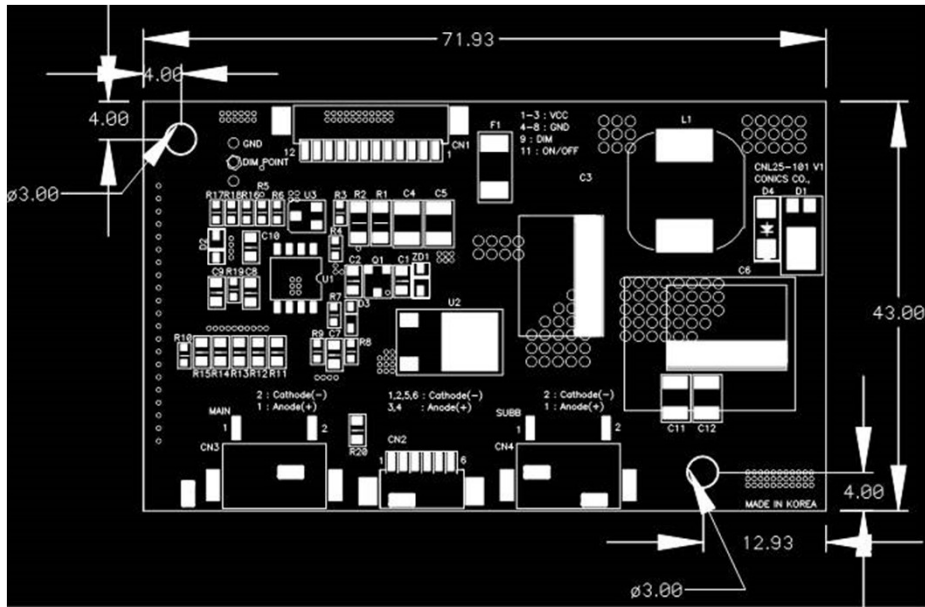


< LED DRIVER (DGB) >

P.W.B Dimensions

*. Unit : mm

*.Tolerance : $\pm 0.3\text{mm}$



9. Reliability

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity (THB)	Ta=50°C, 80%RH, 300hours	
High Temperature Operation(HTO)	Ta=50°C, 50%RH, 300hours	
Low Temperature Operation(LTO)	Ta=0°C, 300hours	
High Temperature Storage(HTS)	Ta=60°C, 300hours	
Low Temperature Storage(LTS)	Ta=-20°C, 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5Grms Wave: Random Frequency: 10 - 200Hz Duration: 30 Minute each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 20ms Direction: ±X, ±Y, ±Z (one time for each Axis)	
Thermal Shock Test(TST)	-20°C/30min, 60°C/30min, 100 cycles	Note 1
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ±15KV, 150pF(330Ω) 1sec 8 points, 25 times/point	Note 2
	Air Discharge: ±15KV, 150pF(330Ω) 1sec 8 points, 25 times/point	
Altitude Test	Operation: 18,000ft Non-Operation: 40,000ft	

Note 1 : a. A cycle of rapid temperature change consists of varying the temperature from -20°C to 60°C, and back again. Power is not applied during the test.
b. After finish temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

Note 2 : EN61000-4-2, ESD class B: Certain performance degradation allowed

- No data lost
- Self-recoverable
- No hardware failures.

10. 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 momentary. 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.
- 13) Please avoid touching COF position while you are doing mechanical design.
- 14) When storing modules as spares for a long time, the following precaution is necessary:
Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- 15) When fixed patterns are displayed for a long time, remnant image is likely to occur.