CUSTOMER APPROVE

SPECIFICATION

FOR

DOUBLE LIN TFT- LCD MODULE

Edition : Preliminary spec 1 . 0

Date of issue : 2022-05-03

Product No. : T215HVN01. 1

APPROVED	CHECKED	PREPARED
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Revision History

Date	Rev.	Page	Old Description	New Description	Remark
2022-05-03	1.0	All	The specification was first issued		

CONTENTS

1. General Description

This specification applies to the 21.5 inch wide Color a-Si TFT-LCD Module T215HVN01. 1.

The display supports the Full HD - 1920(H) x 1080(V) screen format and 16.7M colors (8 bits RGB data input). The input interface is Dual channel LVDSand this module doesn't contain a driver board for backlights.

1.1.Display Characteristics

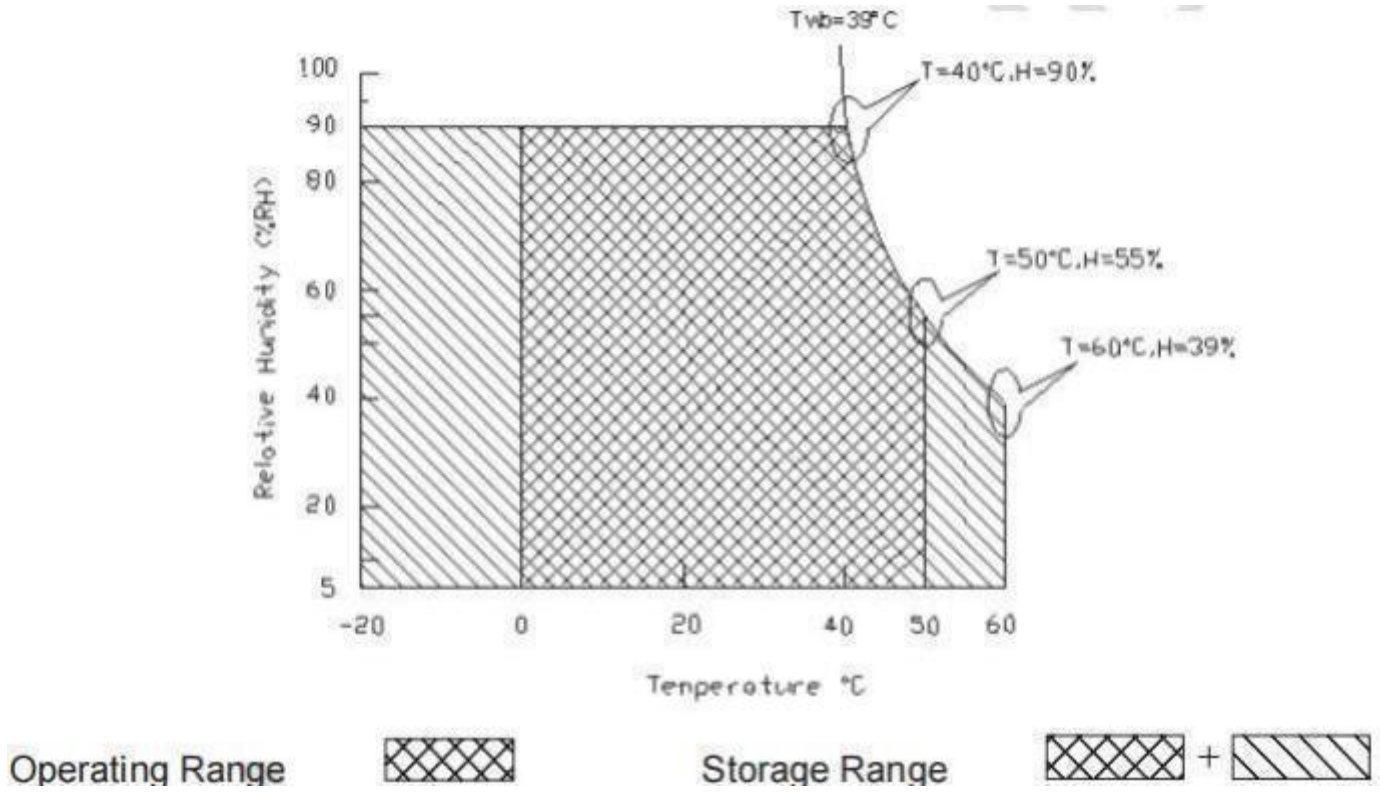
The following items are characteristics summary on the table under 25 Ccondition:

ITEMS	Unit	SPECIFICATIONS
Active Area	[mm]	476.64 (H) ×268.11 (V)
Pixels H x V	-	1920 x 3(RGB)×1080
Pixels Pitch	[um]	248.25(per one triad) × 248.25
Pixels Arrangement	-	R.G.B. Vertical Stripe
Display Mode	-	VA Mode,Nomrally Black
White Luminance(Center)	[cd/m2]	250 (Typ.)
Contrast Ratio	-	3000 (Typ.)
Response Time	[msec]	18ms (Typ.on/off)
Viewing Angle	[degree]	89/89/89/89
Outline Dimension	[mm]	495.4(H) x 292.2(V) x 11.1(D) (Typ.)
Electrical Interface	-	Dual Channel LVDS
Support Color		16.7M colors (RGB 6 -bits +Hi -FRC data)
Surface Treatment		Anti -glare type, Hardness 3H
Temperature Operating Range Storage(Shipping)	[oC] [oC]	0 to +50C -20 to+60C

1.2 Absolute Maximum Rating of Environment

Permanent damage may occur if exceeding the following maximum rating.

Symbol	Description	Min.	Max.	Unit	Remark
TOP	Operating Temperature	0	+50	[**C**]	Note 2-1
TGS	Glass surface temperature	0	+65	[**C**]	Note 2-1 Function judged only
HOP	Operation Humidity	5	90	[%RH]	Note 2-1
TST	Storage Temperature	-20	+60	[**C**]	
HST	Storage Humidity	5	90	[%RH]	

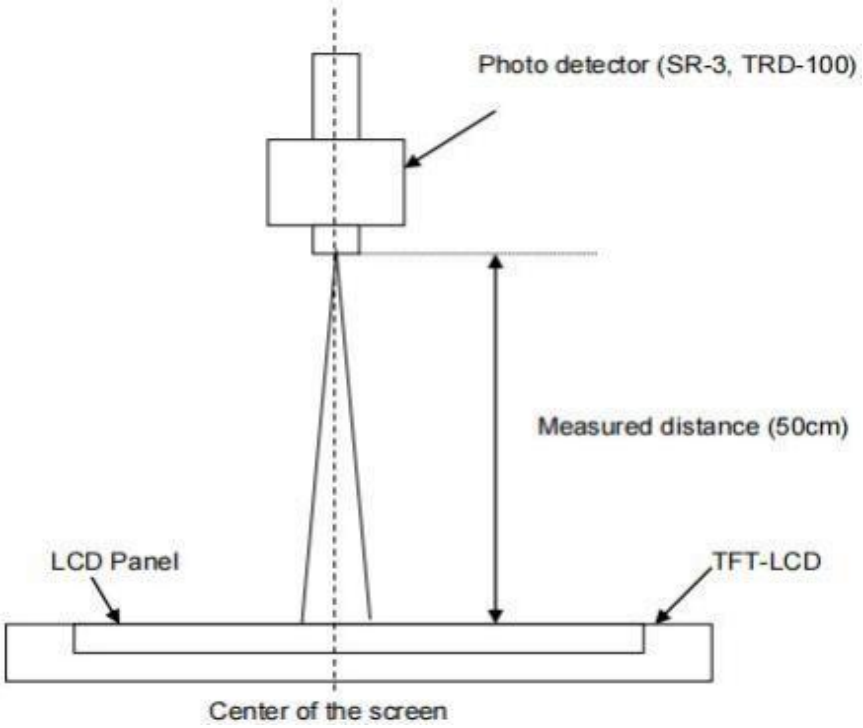


1.3.Optical Characteristics

The optical characteristics are measured on the following test condition .
Test Condition:
1. Equipment setup: Please refer to Note 2 - 2.
2. Panel Lighting time: 30 minutes
3. VDD=5.0V, Fv=60Hz,Is=60mA,Ta=25C

Symbol	Description		Min.	Typ.	Max.	Unit	Remark
Lw	White Luminance (Center of screen)		200	250	-	[cd/m2]	Note 2 - 2 By SR - 3
Luni	Luminance Uniformity (9 points)		75	80	-	%	Note 2 - 3 By SR - 3
Crr	Contrast Ratio (Center of screen)		2000	3000	-	-	Note 2 - 4 By SR - 3
θR	Horizontal Viewing Angle (CR=10)	Right	75	89	-	[degree]	Note 2 - 5 By SR - 3
θL		Left	75	89	-		
ΦH	Vertical Viewing Angle(CR=10)	Up	75	89	-		
ΦL		Down	75	89	-		
θR	Horizontal Viewing Angle (CR=5)	Right	75	89	-		
θL		Left	75	89	-		
ΦH	Vertical Viewing Angle (CR=5)	Up	75	89	-		
ΦL		Down	75	89	-		
TR	Response Time	Rising Time	-	13	28	[msec]	Note 2 - 6 By TRD - 100
TF		Falling Time	-	5	8		
-		Rising + Falling	-	18	36		
Rx	Color Coordinates (CIE 1931)	Red x	0.622	0.652	0.682	-	By SR - 3
Ry		Red y	0.305	0.335	0.385		
Gx		Green x	0.291	0.321	0.351		
Gy		Green y	0.595	0.625	0.655		
Bx		Blue x	0. 123	0. 153	0. 183		
By		Blue y	0.037	0.067	0.097		
Wx		White x	0.283	0.313	0.343		
Wy		White y	0.299	0.329	0.359		
NTSC Area Ratlo				72		[%]	By SR-3
CT	Crosstalk		-	-	1.5	[%]	Note 2 - 7 By SR - 3
FdB	Flicker (Center of screen)		-	-	-20	[dB]	Note 2 - 8 By SR - 3

Note2-2:Equipment setup

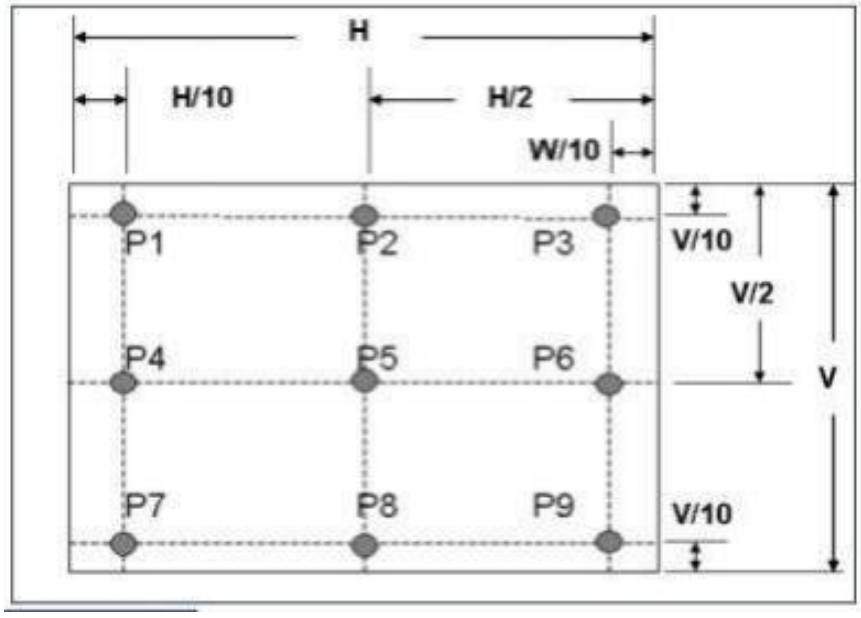


Note 2-3: Luminance UniformityMeasurement

Definition:

$$\text{Luminance Uniformity} = \frac{\text{Minimum Luminance of 9 Points(P1~p9)}}{\text{Maximun Luminance of 9 Points(P~P9)}}$$

a. Test pattern: White Pattern



Note 2-4: ContrastRatio Measurement

Definition:

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

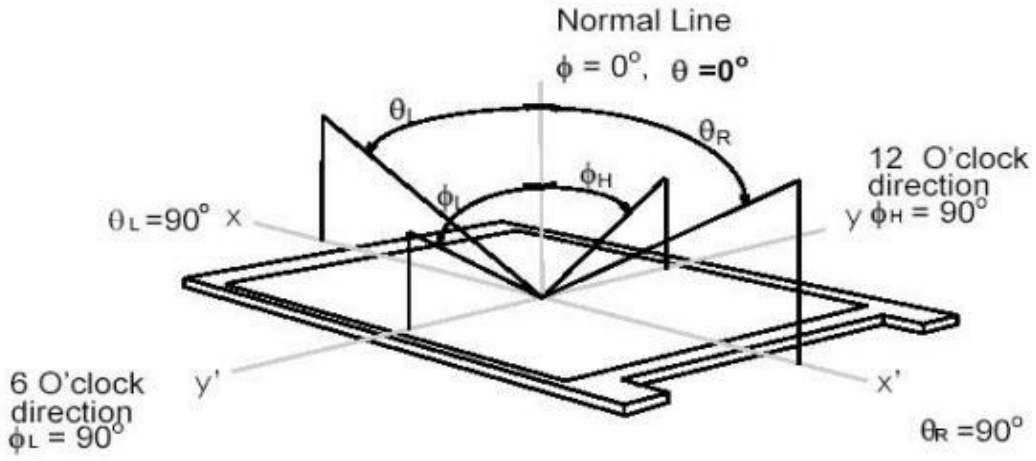
a. Measured position: Center of screen (P5) & perpendicularto the screen (θ=Φ=0°) **Note**

2-5: Viewing angle measurement

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

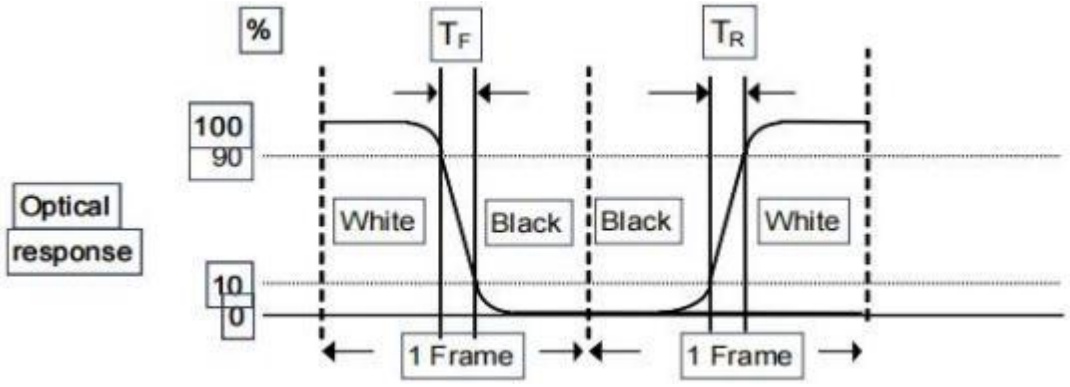
a. Horizontal view angle: Divide to left &right(θL & θR)

Vertical view angle: Divideto up& down (ΦH &ΦL)



Note 2-6: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.(Black & White color definition: Please refer section 3.4.3)



Note 2-7: Crosstalk measurement

Definition:

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

Where

a. Maximum Horizontal Crosstalk :

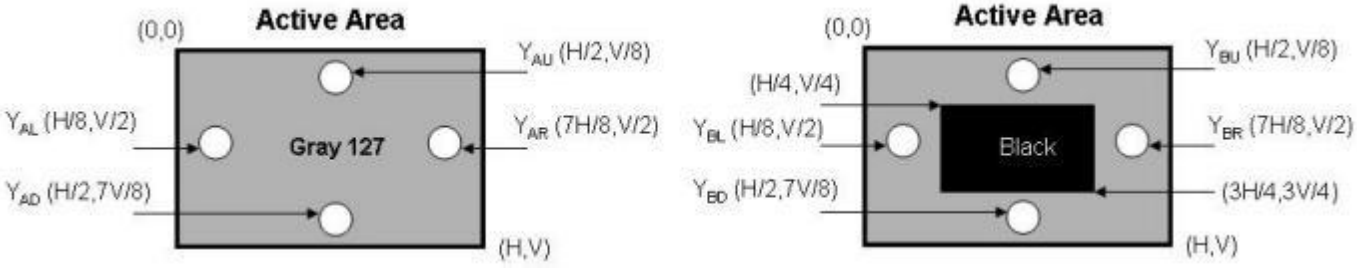
$$CT_H = \text{Max.}\ (|\ Y_{BL} - Y_{AL}\ |\ /\ Y_{AL} \times 100\ \%,\ |\ Y_{BR} - Y_{AR}\ |\ /\ Y_{AR} \times 100\ \%);$$

Maximum Vertical Crosstalk:

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

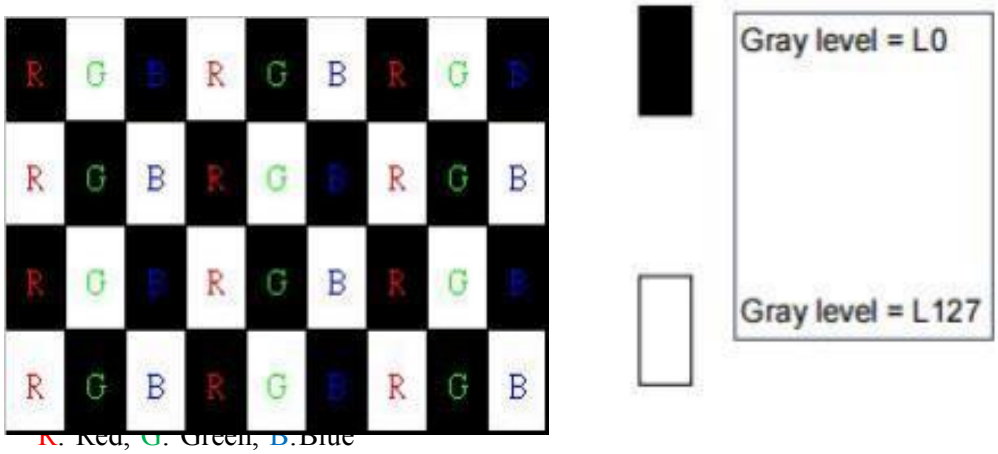
b. Y_{AU}, Y_{AD}, Y_{AL}, Y_{AR}= Luminance of measured location without Black pattern

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



Note 2-8: Flickermeasurement

a. Test pattern: It is listed as following.



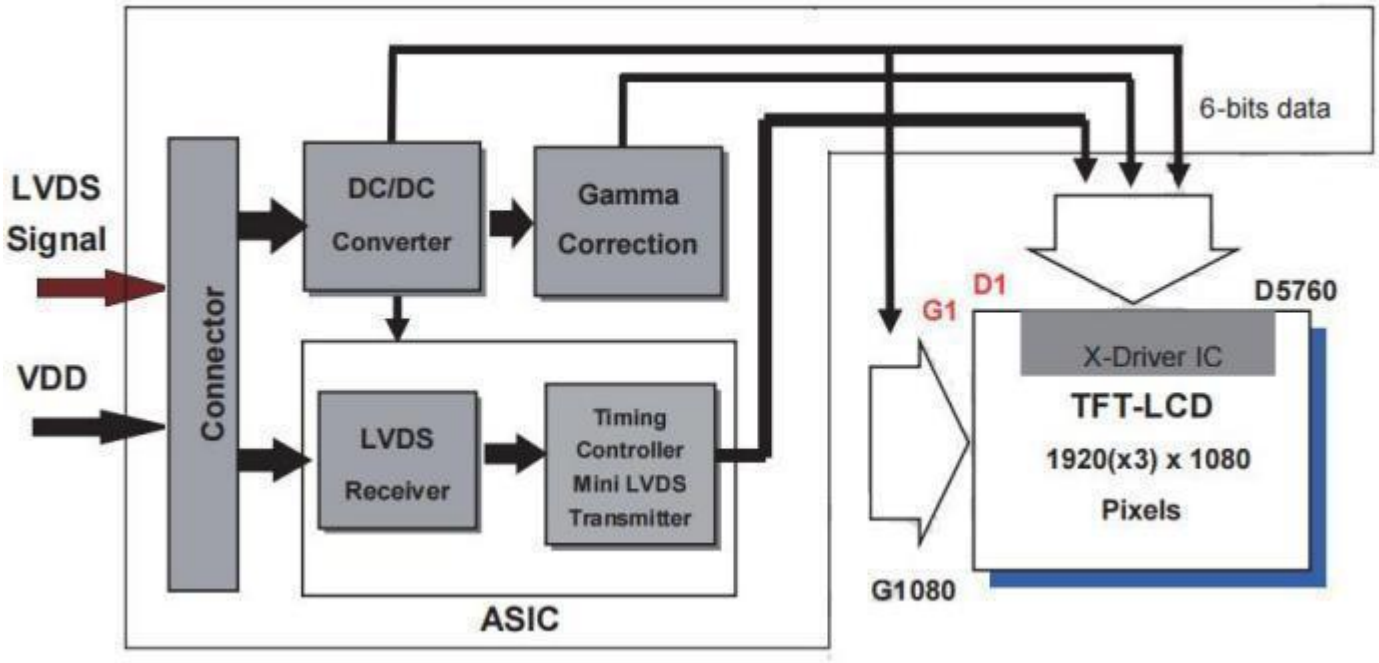
R: Red, G: Green, B: Blue

b. Measured position: Center of screen (P5) & perpendicular to the scree (θ=Φ=0°)

2.TFT-LCD Module

2.1.Block Diagram

The following shows the block diagram of the 21.5inch Color TFT-LCD Module.



2.2 Interface Connection

2.2.1 Connector Type

TFT-LCD Connector	Manufacturer	P-TWO	STM
	Part Number	AL230F-A0G1D-P	MSCKT2407P30HB
Mating Connector	Manufacture	JAE	
	Part Number	FI-X30HL (Locked Type)	

2.2. 2 LCD Connector Pin Assignment

PIN#	SIGNAL NAME	DESCRIPTION
1	RxOIN0-	Negative LDVS differential data input (Odd data)
2	RxOIN0+	Positive LDVS differential data input (Odd data)
3	RxOIN1-	Negative LDVS differential data input (Odd data)
4	RxOIN1+	Positive LDVS differential data input (Odd data)
5	RxOIN2-	Negative LDVS differential data input (Odd data)
6	RxOIN2-	Positive LDVS differential data input (Odd data)
7	GND	Power Ground
8	RxOCLKIN-	Negative LDVS differential data input (Odd clock)
9	RxOCLKIN+	Positive LDVS differential data input (Odd clock)
10	RxOIN3-	Negative LDVS differential data input (Odd data)
11	RxOIN3+	Positive LDVS differential data input (Odd data)
12	RxEIN0-	Negative LDVS differential data input (Even data)
13	RxEIN0+	Positive LDVS differential data input (Even data)
14	GND	Power Ground
15	RxEIN1-	Negative LDVS differential data input (Even data)
16	RxEIN1+	Positive LDVS differential data input (Even data)
17	GND	Power Ground
18	RxEIN2-	Negative LDVS differential data input (Even data)
19	RxEIN2+	Positive LDVS differential data input (Even data)
20	RXECLKIN-	Negative LDVS differential data input (Even clock)
21	RXECLKIN+	Positive LDVS differential data input (Even clock)
22	RxEIN3-	Negative LDVS differential data input (Even data)
23	RxEIN3+	Positive LDVS differential data input (Even data)
24	GND	Power Ground
25	NC	No connection (For AUO test only.Do not connect)
26	NC	No connection (For AUO test only.Do not connect)
27	NC	No connection (For AUO test only.Do not connect)
28	VDD	Power Supply Input Voltage
29	VDD	Power Supply Input Voltage
30	VDD	Power Supply Input Voltage

2.3Electrical characteristics

2.3.1 Absolute Maxlmum Rating

Permanent damage mayoccur if exceeding the following maximum rating .

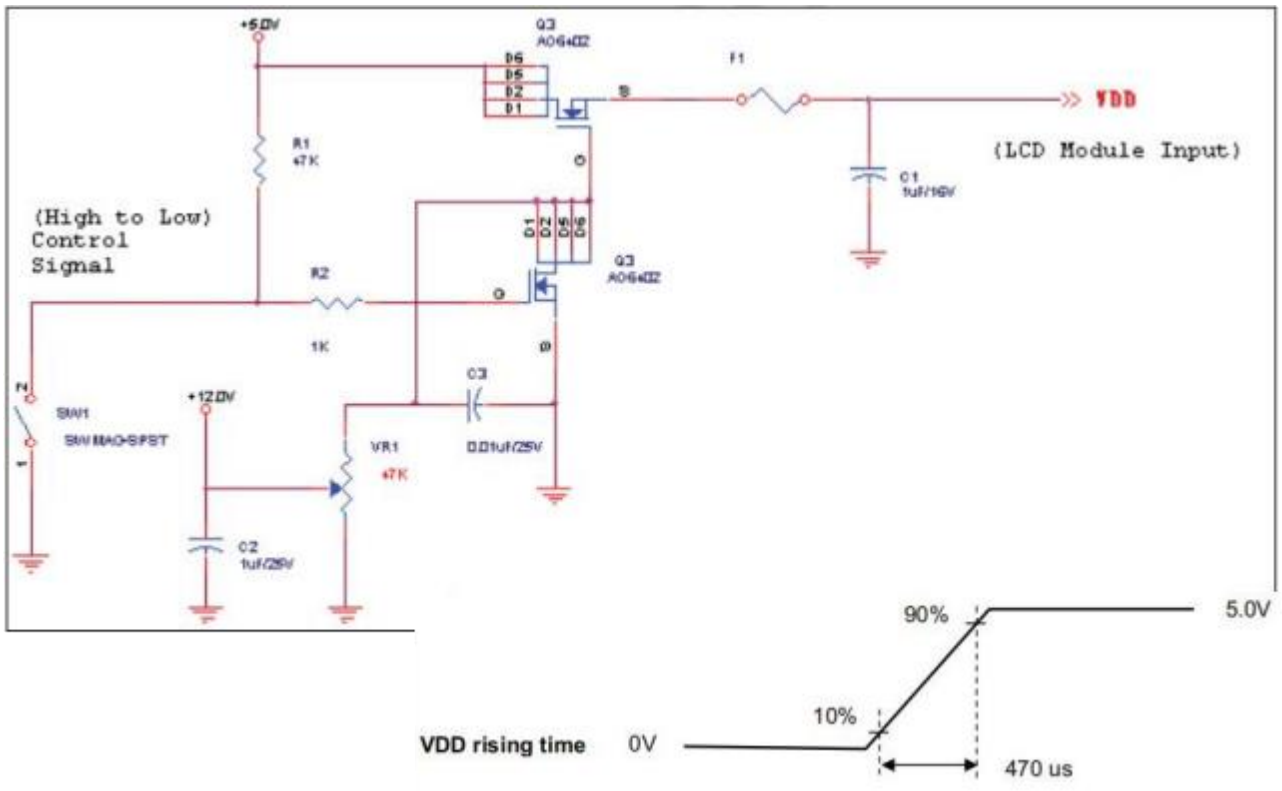
Symbol	Description	Min .	Max .	Unit .	Remark
VDD	Power Supply Input Voltage	GND-0.3	6.0	[Volt]	T a =25C

2 .3 .2Recommeomded O perating Condition

Symble	Description	Min.	Typ.	Max.	Unit	Remark
V_{DD}	Power Supply Input Voltage	4.5	5.0	5.5	[Volt]	
I_{DD}	Power Supply nput Current	-	0.62	0.74	[A]	VDD=5V， ALL white Pattern,FV= 60Hz
			0.7	0.84	[A]	VDD=5V， ALL white Pattern,FV= 75Hz
I_{Rush}	Input Current	-		5	[A]	Note 3- 1
P_{DD}	VDD Power Cornsumption	-	3.1	3.7	[Watt]	VDD=5V， ALL white Pattern,FV= 60Hz
			3.5	4.2	[Watt]	VDD=5V， ALL white Pattern,FV= 70Hz
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	500	[mV]	VDD=5V， ALL white Pattern,FV= 75Hz

Note 3- 1 ： Inrush Current measurement

Test circuit:



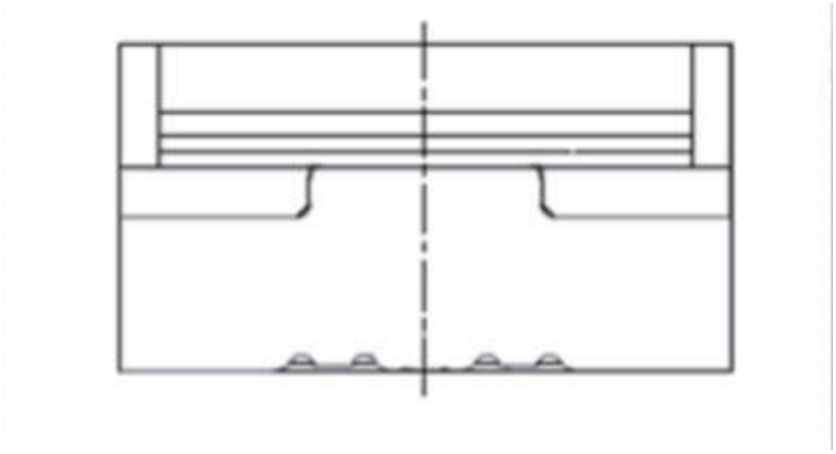
3 Backlight Unit

3.1 Connector Type

Backlinght Connector	Manufacturer	ENTERY
	Part Number	3707K-S06N-21R
Mating Connector	Manufacturer	ENTERY
	Part Number	H112K-P06N-00b(Non-Locking type) H112K-P06N-00b(Locking type)

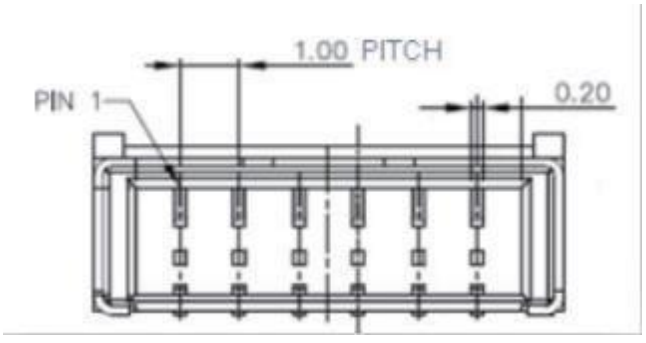
Backinght Connector dimension

H x V x D =13.9 x 3.00x 4.25,pitch =1.0 (unit=mm)



3.1.2 Connector Pin Assignment

Pin#	Symbol	Description	Remark
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)	



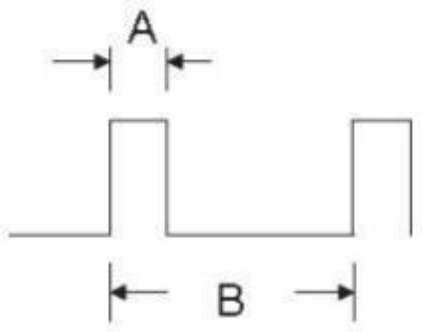
3.2 Electrical Characteristics

3.2.1 Absolute Maximum Rating

Permanent damage may occur if exceeding the following maximum rating.

(Ta=25C)

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



Duty ratio=（A/B）X 100%；　（A：Pules time, B:Period）

3.2.2 Recommednded Operating Condition

it includes 64 pcs (4014) LED in theLED light bar.(4 strings and 16 pcs LED of one string)

（Ta=25C）

Item	Symbol	Min.	Typ.	Max.	Unit
LED operation Voltage	V led	37.7	-	45.5	V
LED operation Curent	I led	-	240	-	mA
BackLinght Power	P_{BL}	8.95	-	10.9	W
Lumi nance	L	200	250		nit
LED Life Time		30000			Hrs
Luminance uniformity	△L	75	80		%

4 Reliability Test

AUO reliability test items are listed ad following table.(Bare panel only)

Ltems	Condition	Remark
Temperature Humidity Bias(THB)	Ta= 50C，80%RH，300huurs	
High Temperature Operation(HTO)	Ta= 50C，50%RH，300huurs	
Low Temperature Operation(LTO)	Ta= 0C，300huurs	
High Temperature Storage （HTS）	Ta= 60C，300huurs	
Low Temperature Storage （LTS）	Ta= -20C，300huurs	
Vibration Test （Non-operation）	Acceleration: 1.5 Grms Wave: Random Frequency:10-200 Hz Sweep:30 Minutes each Axis (X,Y,Z)	
Shock Test （Non-operation）	Acceleration: 50Grms Wave: Half-sine Active TIMIE：20ms Direction： ± X,± Y,± Z(one time for each Axis)	
Thermal Shock Test(TST)	-20C/30min, 60C/30min,100 cycles	
On/ Off Test	On/10sec,Off/10sec,30,000 cycles	Note 4-1
ESD(Elector Static Dishcharge)	Contact Discharge: ± 15KV， 150pF(330 Ω) 1sec, 8 points, 25 times/point	Note 4-2
	Air Discharge: ± 15KV，150pF(330 Ω) 1sec, 8 points, 25 times/point	
Altitude Test	Operation:18,000 ft Non-Operation:40,000ft	

Note 4-1 a. A cycle of rapid temperature change consists of varying the temperature fron -20℃ to 60℃， 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 4-2 EN61000-4-2,ESD class B： Certain performance degradtion allowed

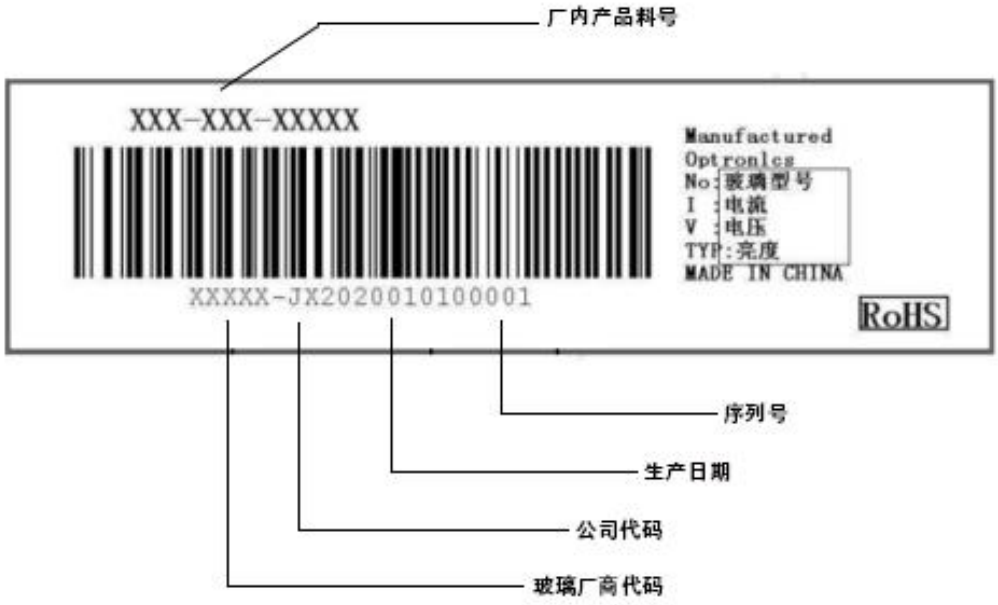
No data lost

Self-recoverable

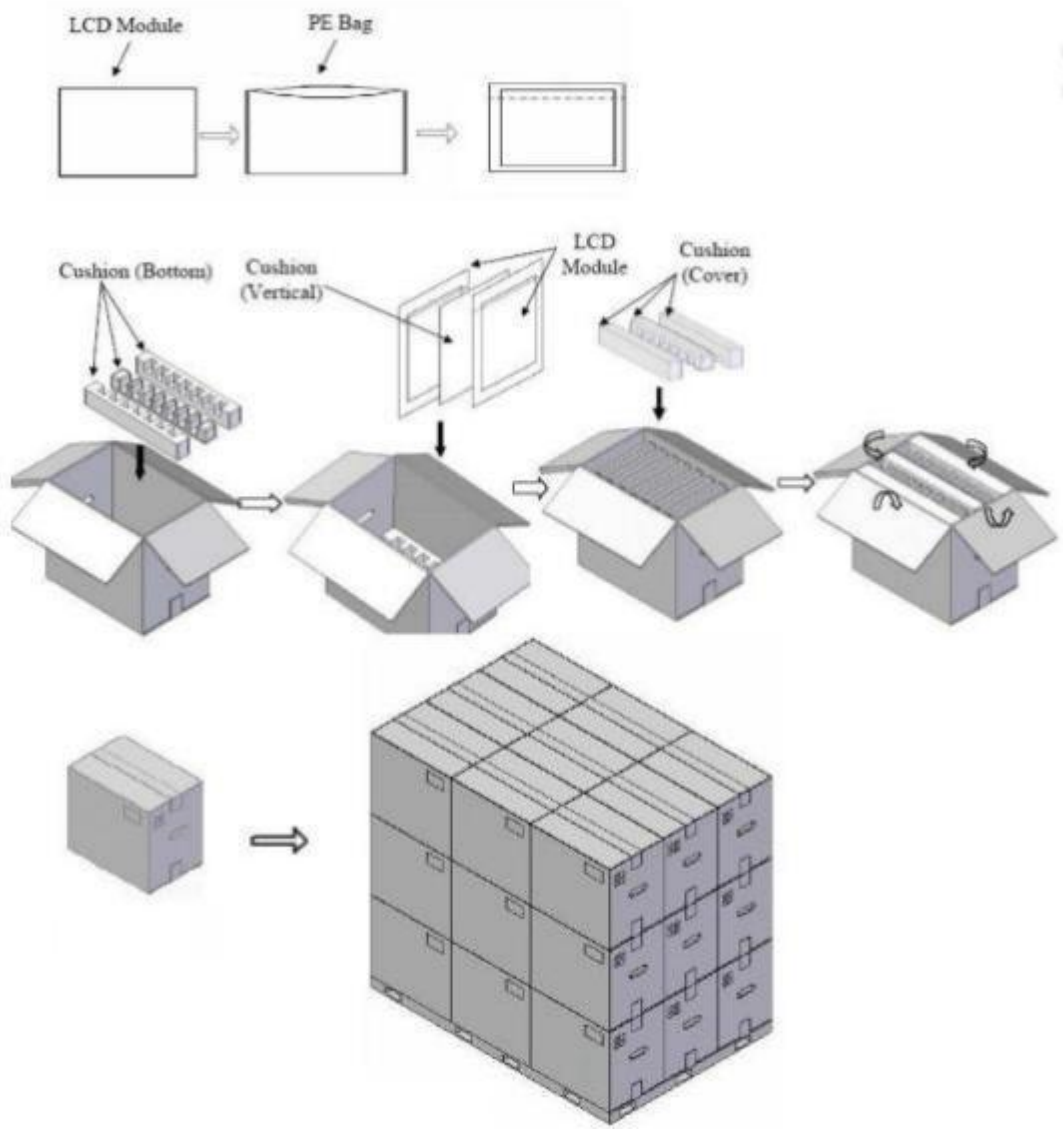
No hardware failures.

5.Shipping Label

The label is on the panel as shown below



Parameter	Packing box	Unit
Size	555 (L) x275 (W) x345 (H) (typ.)	mm
Weight	1.67(typ.)	kg
Total weight	1 6 . 7 (typ.) (with 10 products)	kg



6.Precaution

6.1 Assembly and handling precautions

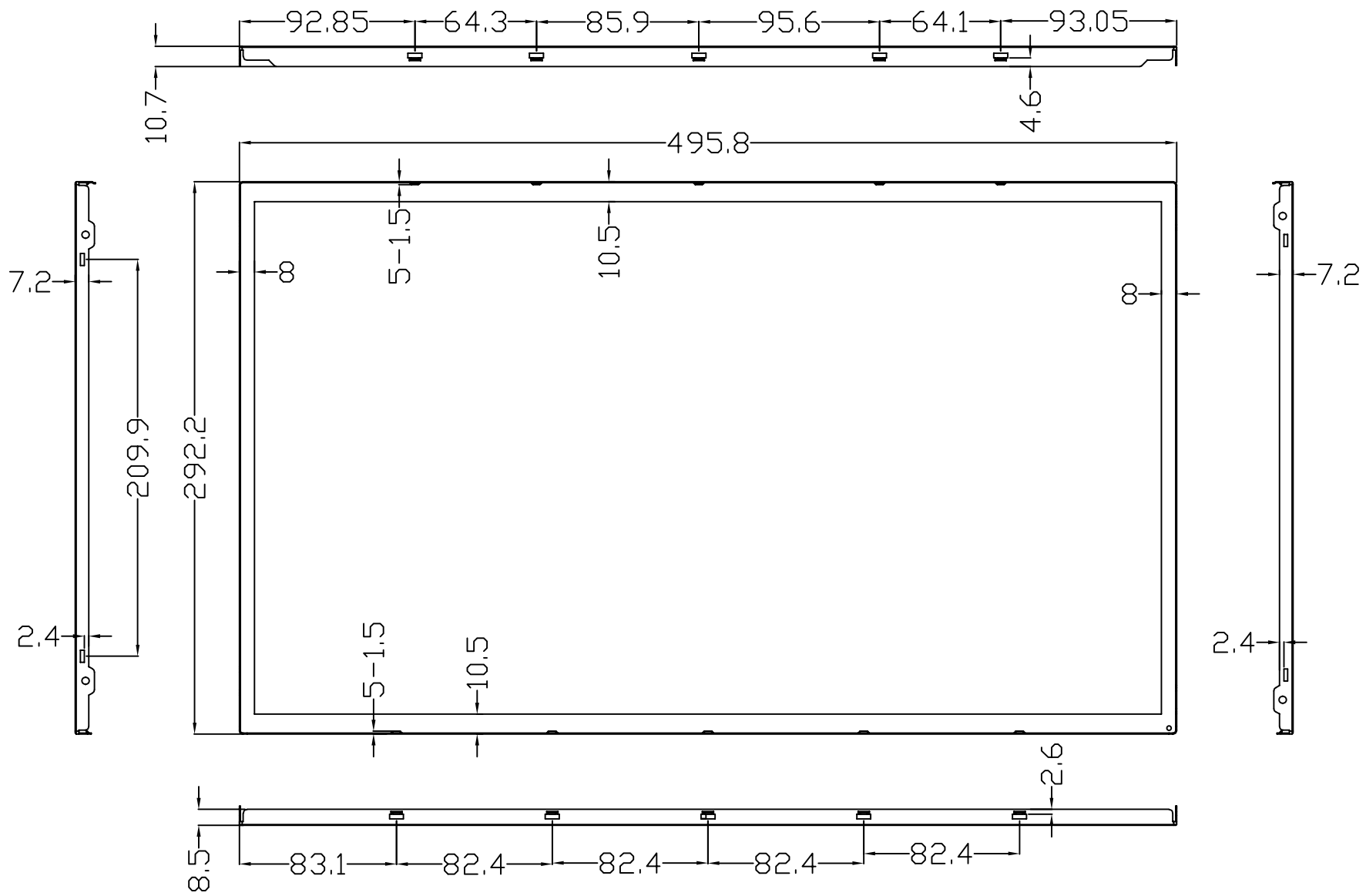
1. Do not apply rough force such as bending or twisting to the module during assembly.
2. To assemble or install module into user' s system can be in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
3. It' s not permitted to have pressure or impulse on the module because the LCD panel and Bac- klight will will be damaged.
4. Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch- up.
5. Do not pull the I/ F connector in or out while the module is operating . 6 6 . Do not disassemble themodule.
Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very
6. soft and easily scratched.
7. It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
8. High temperature or humidity may reduce the performance of module. Please store LCD mo- dule within the specified storage conditions.

9. When ambient temperature is lower than 10 C may reduce the display quality. For example, the response time will become slowly.

6.2 Safety precautions

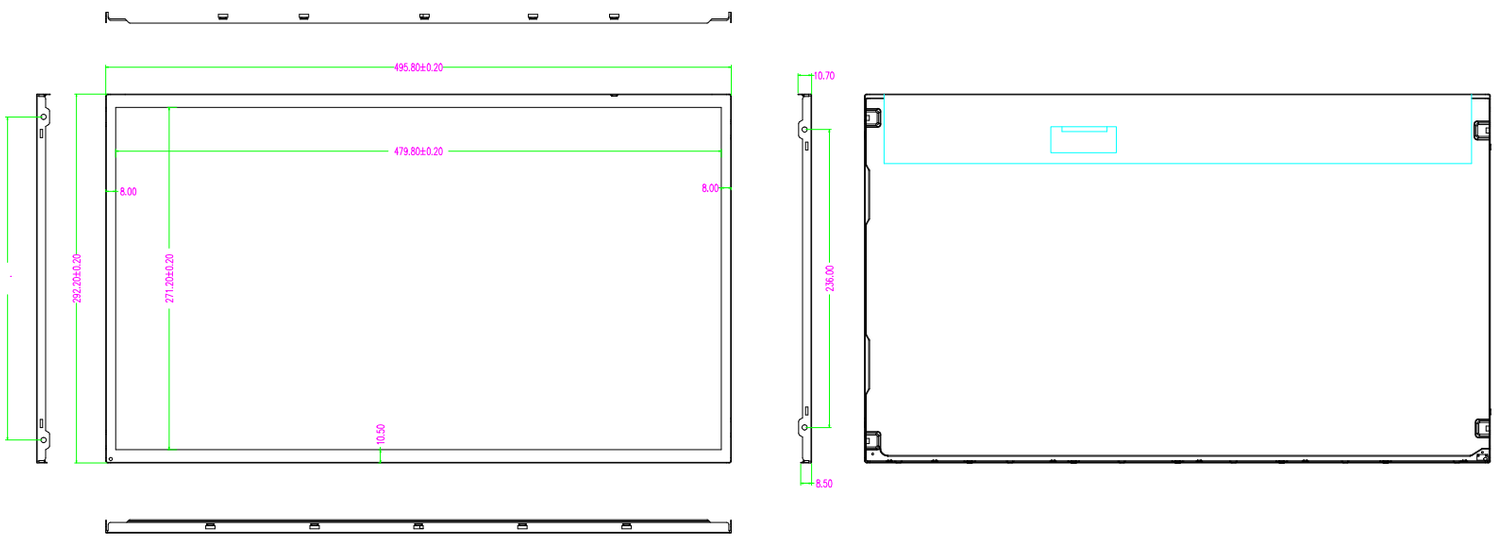
1. It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
2. If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth, in case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
3. After the modlule's end of life, it is not harmful in case of normal operation and stora.

Rev	ECN NO.	DESCRIPTION	APPD	DATE:



RM:來料	M:手工備料	MC:CNC備料	H:熱處理	GP:平面研磨	NF:CNC精銑	KW:快走絲	MW:中走絲	WE:慢走絲	G:成型研磨	ES:放電加工	QC:品檢

		BP TOOLS NUMBER: ××××	UNIT'S: MM	CUSTOMER: A001
		PART NAME: 21.5前框	APPD:	DATE:
Rev: A00	ITEM: 工程模	PART NUMBER: 12345	CHKD:	DATE:
SHEET: /		PART M & T: SGCC T=0.5	DRAW: ×××	DATE: 2018.09.28


495.80±0.20
479.80±0.20
8.00
8.00
292.20±0.20
271.20±0.20
10.50
10.70
236.00
8.50