



## **NF-M215-FF-03A00**

Thank you for choosing the NF-M215-FF-03A00 21.5" Capacitive Touch Display.

This module consists of:

**Coverglass** - 2mm, tempered glass with bezel decoration

**Touch Digitizer** - powered by Nuovo Film's Crystode Silver Nanowire technology

**Display** - TFT-LCD, 1920x1080 pixels, 4-lane LVDS with LED backlight.

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### **Directory:**

#### **Overall Dimensions and Touch Driver Information:**

[NF-M215](#)

#### **NuovoFilm Touch Sensor Datasheet:**

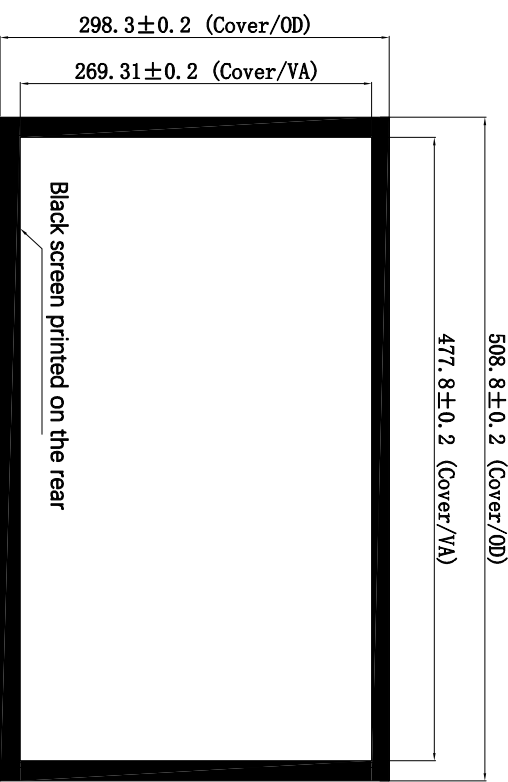
[NF-C215](#)

#### **CPT TFT Display Module Datasheet:**

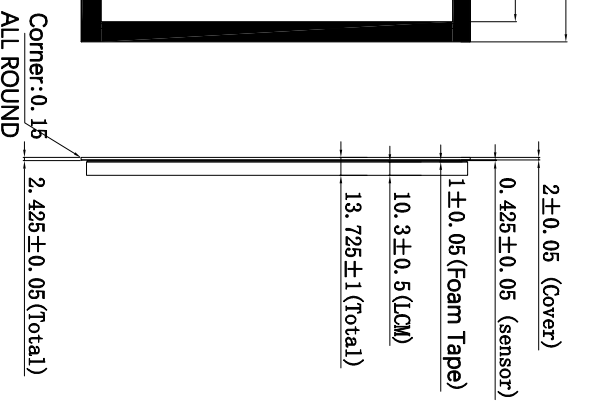
[CLAA215FDV1](#)

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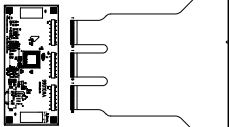
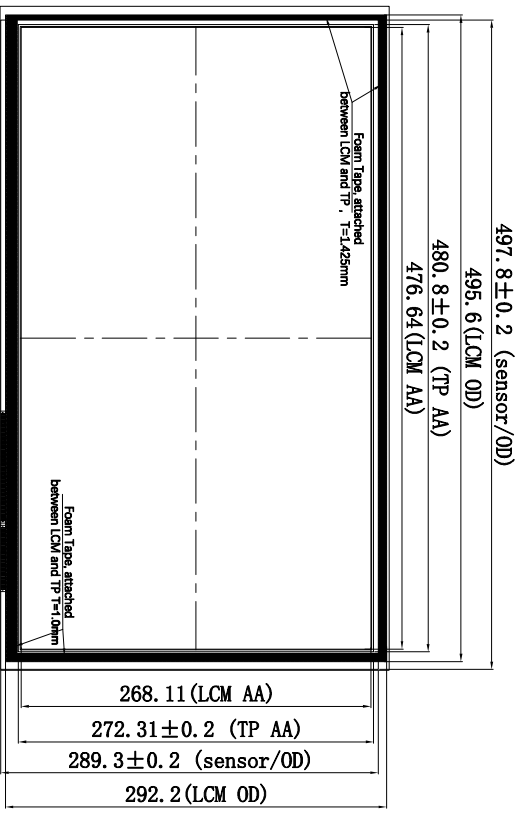
# TOP VIEW



# SIDE VIEW



# REAR VIEW



Notes:  
 Manufacturer: G++F/COB: SIS9279 TX44, RX78  
 Character material: Soda lime Glass, Chemical tempered, Hardness>6H;  
 marked tolerance: ±0.2mm;  
 Mark [ ] -critical control dimensions must meet a tolerance.  
 ROHS compliance;

- LCM Notes:
1. Display V/pe: 21.5" a-silicon TFT
  2. Resolution: 1920\*1080
  3. Back light: 60LED (4 parallel \* 15 serial) 250 cd/m<sup>2</sup>;
  4. Connector: MSCKT240/P30HB (module side), C11406M1HRK-NH (LED)
  5. unmarked tolerance: ±0.2mm;
  6. Operate temp: -10~60°C, Storage Temp: -20~70°C.
  7. ROHS compliance;

GFF STACK UP

COVER GLASS	OCOA 0.125mm	
AGWV FILM 0.125mm	OCOA 0.05mm	
AGWV FILM 0.125mm		Foam Tape
LCM		

BOM

Part Name	Part Code	QTY
Sensor	NF-S215-FF-03A	1
FPCL	FPCL-NF-C215-FF-03A	1
CG	CG-NF-C215-FF-03A00	1
Controller	99010AB	1
LCM (CP7)	CAA215FV1 CW	1

first issue	冯晓丽	2018.06.12	Customer Signature	Rick	2018.06.12	Model Number:	NF-M215-FF-03A00	Drawing No:	NF-M215-FF-03A00	Unit	mm	Scale	FIT
Revision	Sign	Date	APP							Projection		Sheet:	1/1

## Specification of AgNW Capacitive Touch Panel

<b>Product Name</b>	<b>21.5" CTP</b>
<b>Product Model</b>	<b>NF-C215-FF-03A00</b>
<b>Issue Date</b>	<b>2018.06.30</b>

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# 1. Introduction

## 1.1 Purpose

The purpose of this specification is to define the quality standard, test criteria, and engineering drawing of the AgNW capacitive touch panel.

## 1.2 Scope

This specification applies to the 21.5" AgNW Touch Panel model NF-C215-FF-03A00 provided by Nuovo Film.

## 1.3 Precaution

### 1.3.1 Storage

The touch panel should be stored under the environment condition as suggested, and avoid storing in direct sunlight.

### 1.3.2 Handling

- i. Hold the touch panel body instead of the FPC all the time.
- ii. Ensure that static precautions are observed at all times during handling of the TP modules.

### 1.3.3 Cleaning

- i. Prevent using any kind of the chemical solvent, acidic or alkali solution when cleaning.
- ii. Neutral detergent or isopropyl alcohol is suggested if the panel need cleaning.

### 1.3.4 Assembly

- i. Do not apply rough force such as bending or twisting to the touch panel during assembly.
- ii. Excessive force or strain to the panel or FPC is prohibited.

### 1.3.5 Operation

- i. The panel must be operated in a steady environment, the abrupt change of the environment conditions may cause malfunction.
- ii. Do not pull the interface connector in or out while the touch panel is operating.
- iii. Any sharp edged or hard objects are inhibited to contact the touch panel when under operation.

## 1.4 Warranty

Nuovo Film provides one year product guarantee under normal storage condition and operational guideline as defined in this document.

## 2. General Description

### 2.1 General Information

Item	Description
Panel Size	21.5"
Aspect Ratio	16:9
Interface	USB 2.0 (Full Speed)
Power Supply	5V(USB:4.7V~6.0V, Typical: 5V)
Power Consumption	82mA (typ.) 90mA (Max)
Touch Controller IC	SIS9279
Linearity	±1~2mm
Respond Rate	>100HZ
Stylus	Passive (tip:4~6mm)
Active Points	Multi-touch 10 points (typ.) 20points (Max)
Channel number	RX78*TX44
OS	Window/ Android/ Linux

### 2.2 Dimension Overview

Item	Spec
Cover Lens OD	508.8mm(L)* 298.30mm(W)
View Area	477.8mm(L)* 269.31mm(W)
Sensor OD	497.8mm (L)* 289.3mm (W)

### 2.3 Stack-up

Layer	Thickness	Materials
Cover Lens	2mm	Chemically strengthened glass
OCA	0.125mm	Adhesive
Sense side SNW	0.125mm	AgNW Film
OCA	0.05mm	Adhesive

Drive side SNW	0.125mm	AgNW Film
Total Thickness	2.425±0.3mm	

## 2.4 Optical Inspection

Item	Specification	Measurement Method
Transparency	≥87.5%	Hunterlab
Haze	≤3.7	Hunterlab
b*	≤3.2	Hunterlab

## 2.5 Environment Conditions

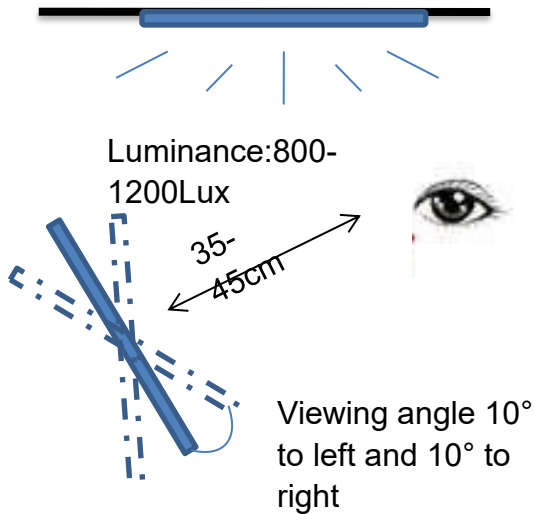
Operating: -20°C ~ +70°C; 45% ~ 85%RH

Storage: -30°C ~ +80°C; 45% ~ 85%RH

## 3 Inspection

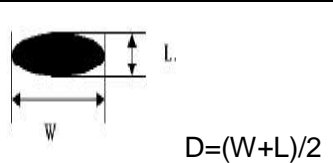
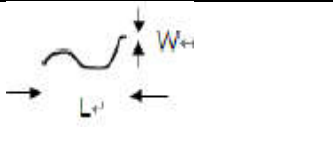
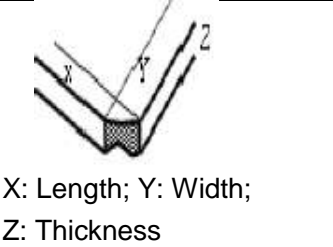
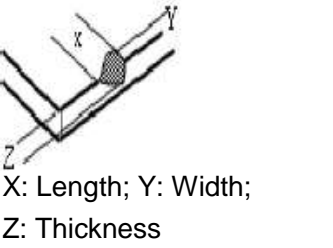
### 3.1 Inspection Condition

- i. The touch panel should be inspected at a clean room of at least class 10,000
- ii. Brightness at test site: 800-1200LUX
- iii. Inspection distance: 35-45cm
- iv. Viewing angle: 90±10°
- v. Light source: 40W fluorescent light
- vi. Inspection time: 25±5s



### 3.3 Cosmetic Inspection ① ②

Defect Type	Criteria	Notes
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Dot defects (Bubble/Fiber/Particle /Spot/Dent)	<ol style="list-style-type: none"> <li><math>D \leq 0.35\text{mm}</math>, Ignored</li> <li><math>0.35\text{mm} &lt; D \leq 0.5\text{mm}</math>, <math>N \leq 5</math>, <math>DS \geq 10\text{mm}</math></li> <li><math>D &gt; 0.5\text{mm}</math>, not allowed</li> </ol>	 <p><math>D = (W + L) / 2</math></p>
Linear defects (Scratch/Fiber)	<ol style="list-style-type: none"> <li><math>L \leq 15\text{mm}</math>, <math>W \leq 0.1\text{mm}</math>, Ignored</li> <li><math>0.1\text{mm} &lt; W \leq 0.3\text{mm}</math>, <math>L \leq 15\text{mm}</math>, <math>N \leq 5</math>, <math>DS \geq 10\text{mm}</math></li> <li><math>W &gt; 0.3\text{mm}</math>, not allowed</li> </ol>	
Corner chipping	<ol style="list-style-type: none"> <li><math>X \leq 3\text{mm}</math> &amp; <math>Y \leq 3\text{mm}</math>, <math>Z \leq T/2</math>, <math>DS &gt; 20</math>, <math>N \leq 5</math></li> <li>Otherwise not allowed</li> </ol>	 <p>X: Length; Y: Width; Z: Thickness</p>
Side chipping	<ol style="list-style-type: none"> <li><math>X \leq 8\text{mm}</math> &amp; <math>Y \leq 3\text{mm}</math>, <math>Z \leq T/2</math>, <math>DS &gt; 20</math>, <math>N \leq 5</math></li> <li>Otherwise not allowed</li> </ol>	 <p>X: Length; Y: Width; Z: Thickness</p>
Smudge	Can be wipe clean within 15 seconds that judged to be OK	/
Color of cover lens/logo typeface/shade of background	Color shows no difference from that of the samples	/
	Clear typeface and clear pattern	
	Good shade of back color	

**Note 1:**

"D" means Diameter;

"L" means Length;

"W" means Width;

"N" means Quantity;

"T" means Glass Thickness;

"DS" means the distance between two defects.

**Note 2:**

Total number of defects for each piece:  $N \leq 10$ ,  $DS \geq 10\text{mm}$

**4 Reliability Test**

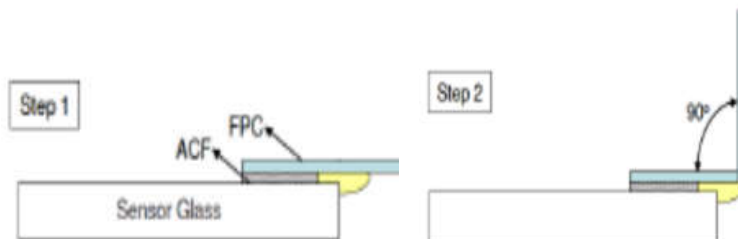
Test Item	Test Condition	Criteria
Damp Heat	Temperature: $60^\circ\text{C}$ Humidity: 90%RH Duration: 240hrs	<ol style="list-style-type: none"> <li>No cosmetic defect</li> <li>Function OK</li> </ol>



Thermal Shock	High temperature: 80°C Low temperature: -30°C Duration: 30 cycles	1.No cosmetic defect 2.Function OK
High Temperature	Temperature: 80°C Duration: 240hrs	1.No cosmetic defect 2.Function OK
Low Temperature	Temperature: -30°C Duration: 240hrs	1.No cosmetic defect 2.Function OK
Salt Spray Test	Concentration: 5% NaCl solution Temperature: 35°C Duration: 48hrs	1.No cosmetic defect 2.Function OK
Sweat Test	PH=4.7 sweat Duration: 48hrs	1.No cosmetic defect 2.Function OK
Static Electricity	1.Air discharge: 8KV/10KV/12KV 2. Contact discharge: 4KV/6KV/8KV 3.10 times for each point	1.No cosmetic defect 2.Function OK

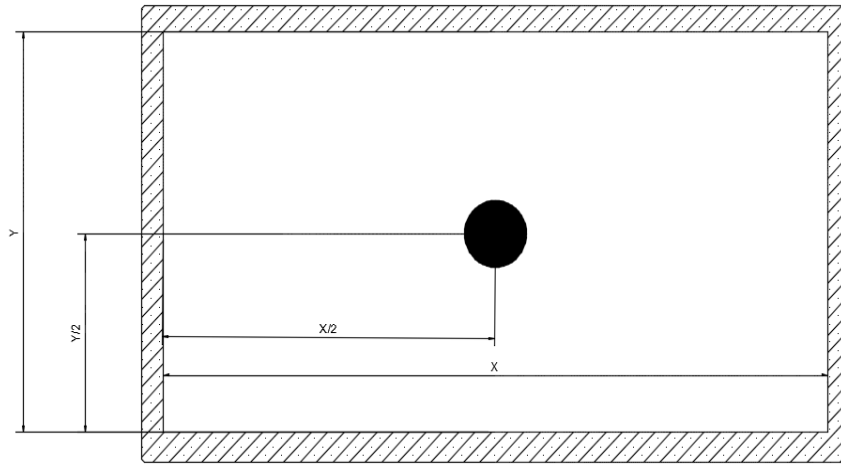
#### 5 FPC Peeling Test

Item	Test Condition	Result
FPC Peeling Test	1. Pulling weight: 500g 2. Pulling speed: 25 mm/min 3. Pulling angle: 90°	1.FPC has no damage 2.Function OK

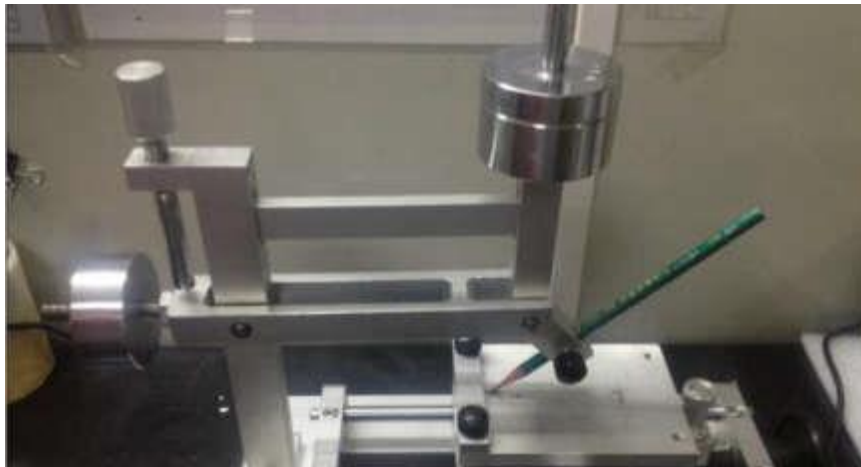


#### 6. Cover Lens Test

Item	Spec
Pressure Value	400 ~500 mPA above 6u
Ball Drop Test ①	227g±2g, 35cm, No damage after one time impact at the central area.
Hardness ②	6H (Pencil: 6H, Pressure: 1N/45)



Note 2: The hardness test follows the JIS K-5400 serials industry standard and the test illustration is shown as below.



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# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

This module is color active matrix LCD module incorporating amorphous silicon TFT(Thin Film Transistor) LCD panel. It is composed of a color TFT-LCD panel, driver ICs, LED Backlight...etc. Graphics and texts can be displayed on a 1920×RGB×1080 dots panel with about 16.7M colors (R/G/B 6bits+Hi FRC data in each color) by using LVDS(Low Voltage Differential Signaling) to interface, +5V of DC supply voltage.

## 1.2 CHARACTERISTICS

CHARACTERISTICS ITEMS	SPECIFICATIONS
Screen Diagonal [in]	21.5"
Pixels [lines]	1920×1080
Active Area [mm]	476.64 (H) x 268.11 (V)
Pixel Pitch [mm]	0.24825 (H) x 0.24825 (V)
Pixel Arrangement	RGB vertical stripe
Display Mode	Normally White
Surface treatment (Without the protection film)	Anti-glare,3H,Hase 25±5%

## 1.3 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Remark
Module Size	Horizontal (H)	495.1	495.6	496.1	mm	[Note 1]
	Vertical (V)	291.7	292.2	292.7	mm	[Note 1]
	Depth (D)	9.8	10.3	10.8	mm	[Note 1]
Weight	0.7mm glass	-	1880	-	g	
	-	-	-	-	g	

[Note 1] Please refer to the attached drawings for more information of front and back outline dimensions and the dimension of bosses are not included.

# 2. ABSOLUTE MAXIMUM RATINGS

## 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

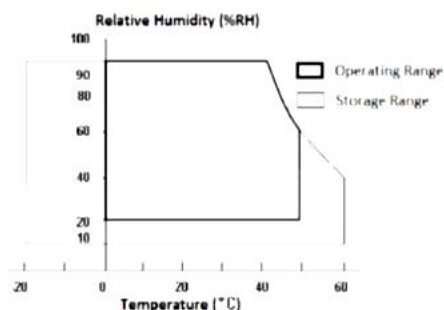
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T <sub>ST</sub>	-20	+70	°C	[Note 1,3]
Operating Ambient Temperature	T <sub>OP</sub>	-10	60	°C	[Note 1,2,3]

Storage Condition: With shipping package.

[Note 1] Temperature and relative humidity range is shown in the figure below.

\*1) 90 %RH Max. (Ta ≤ 40 °C).

\*2) Wet-bulb temperature should be 40 °C Max. (Ta > 40 °C).



\*3) No condensation.

[Note 2] The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 50°C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over 60°C. The range of operating temperature may degrade in case of improper thermal management in your product design.

[Note 3] The rating of environment is base on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.

### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 ABSOLUTE MAXIMUM RATING

Parameter	Symbol	Condition	Ratings	Unit	Remark
+5V supply voltage	VCC	Ta=25°C	0~+6	V	
Storage temperature	Tstg	-	-20~+70	°C	
Operation temperature	Topa	-	-10~+60	°C	

#### 3.2 CONTROL CIRCUIT DRIVING

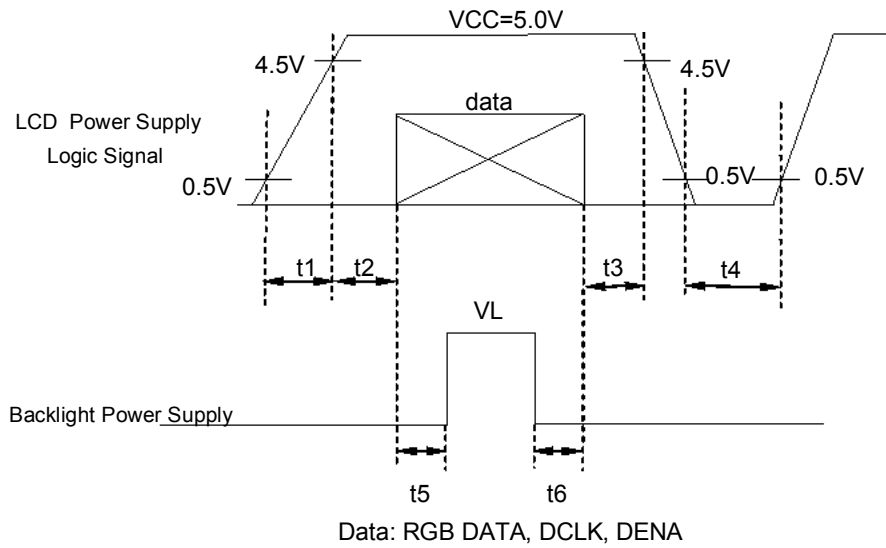
Parameter		Symbol	Min	Typ	Max	Unit	Remark
+5V supply voltage	Supply voltage	VCC	4.5	5.0	5.5	V	[Note 1]
	Current dissipation	ICC	—	900	1000	mA	VCC=5.0V,60Hz Black Pattern
		IRush	—	—	3	A	[Note 2]
Permissible input ripple voltage		VRP	—	—	300	mVp-p	VCC=5.0V
Differential Input Threshold Voltage	High	VTH	—	—	100	mV	VCM=1.2V [Note 3]
	Low	VTL	-100	—	—	mV	
Input Differential Voltage		VID	100	—	600	mV	
Differential Input Common Mode Voltage		VCM	1.0	1.2	1.5	V	
Power consumption		P	—	4.5	5.0	W	

[VCM]: Common mode voltage of LVDS driver.

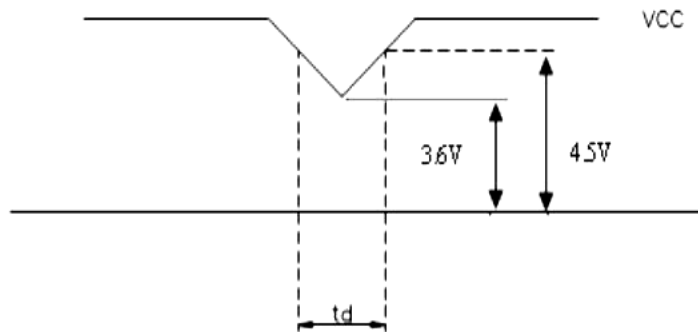
[Note1]

Power, data sequence

$0.50\text{ms} \leq t_1 \leq 10\text{ms}$	$t_4 \geq 1 \text{ sec}$
$0.01\text{ms} < t_2 \leq 50\text{ms}$	$t_5 \geq 500\text{ms}$
$0.01\text{ms} < t_3 \leq 50\text{ms}$	$t_6 \geq 200\text{ms}$



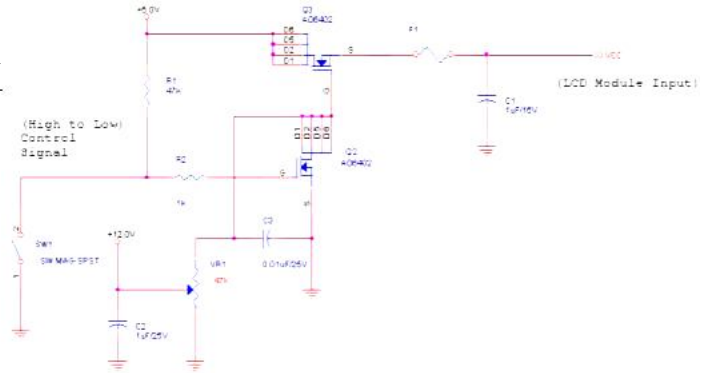
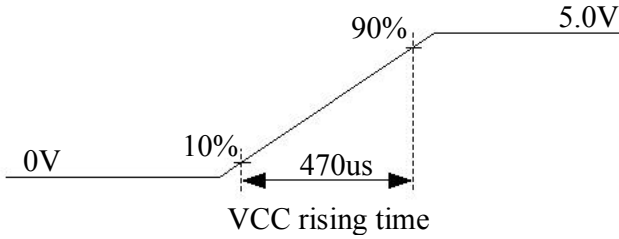
- ※ Data: CLKIN±, RIN0±, RIN1±, RIN2±, RIN3±
- ※ About the relation between data input and back light lighting, please base on the above-mentioned input sequence.
- ※ When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.
- ※ VCC-dip conditions:
  - (1) When  $3.6V \leq VCC(\min) < 4.5V$ ,  $t_d \leq 10$  ms
  - (2) When  $VCC < 3.6$  V, VCC-dip conditions should also follow the VCC-turn-on conditions.



[Note2]

IRush Measurement Condition:

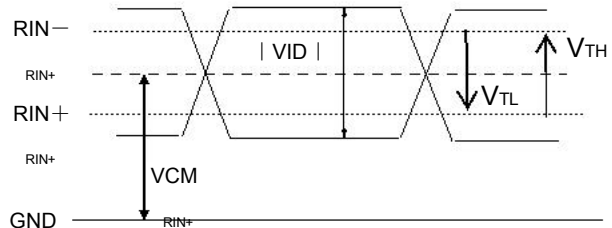
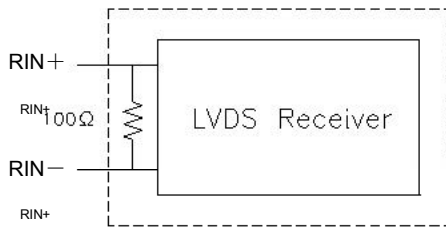
The duration of rising time of power input is 470us.



[Note3]

RIN+: Positive differential DATA & CLK Input

RIN -: Negative differential DATA & CLK Input



### 3.3 LED LIGHTBAR SPECIFICATION FOR BACKLIGHT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Input Voltage	$V_{pin}$	43.5	49.5	54	VDC	Duty 100% [Note 1,4]
LED Light bar Current per input pin	$I_{pin}$	-	60	63	mADC	Duty 100% [Note 1,4]
Plus forward current	$I_{FP}$			100	mADC	[Note 2]
LED Life Time	LT	30,000	-	-	Hrs	[Note 3]
Power Consumption	PBL	10.44	-	12.96	W	
Dimming Duty Ratio	-	20	-	100	%	

[Note 1] Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

[Note 2]  $I_{FP}$  Condition: 1/10 Duty Cycle @1kHz.

[Note 3] The life time of LED is defined as the time when it continues to operate under the condition at  $T_a = 25 \pm 2^\circ\text{C}$  and  $I_{pin} = 60 \text{ mA}$  until the brightness becomes  $\leq 50\%$  of its original value.

[Note 4] The backlight unit contains 1pcs lightbar.

## 4. INTERFACE PIN CONNECTION

### 4.1 TFT LCD MODULE

CN1 (Interface signals and +5V DC power supply) Shown on the next table.

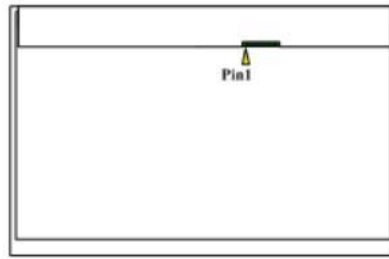
Using connector: MSCKT2407P30HB (STM) or compatible

Matching connector: PK2407P30W (STM) or compatible

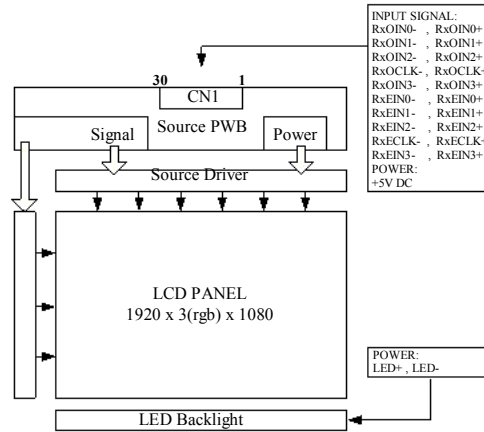
Pin No. ↵	Symbol ↵	Function ↵	Remark ↵
1 ↵	RxOIN0- ↵	Negative LVDS DATA input(ODD) ↵	LVDS ↵
2 ↵	RxOIN0+ ↵	Positive LVDS DATA input(ODD) ↵	LVDS ↵
3 ↵	RxOIN1- ↵	Negative LVDS DATA input(ODD) ↵	LVDS ↵
4 ↵	RxOIN1+ ↵	Positive LVDS DATA input(ODD) ↵	LVDS ↵
5 ↵	RxOIN2- ↵	Negative LVDS DATA input(ODD) ↵	LVDS ↵
6 ↵	RxOIN2+ ↵	Positive LVDS DATA input(ODD) ↵	LVDS ↵
7 ↵	GND ↵	Ground ↵	
8 ↵	RxOCLK- ↵	Negative LVDS Clock input(ODD) ↵	LVDS ↵
9 ↵	RxOCLK+ ↵	Positive LVDS Clock input(ODD) ↵	LVDS ↵
10 ↵	RxOIN3- ↵	Negative LVDS DATA input(ODD) ↵	LVDS ↵
11 ↵	RxOIN3+ ↵	Positive LVDS DATA input(ODD) ↵	LVDS ↵
12 ↵	RxEIN0- ↵	Negative LVDS DATA input(EVEN) ↵	LVDS ↵
13 ↵	RxEIN0+ ↵	Positive LVDS DATA input(EVEN) ↵	LVDS ↵
14 ↵	GND ↵	Ground ↵	
15 ↵	RxEIN1- ↵	Negative LVDS DATA input(EVEN) ↵	LVDS ↵
16 ↵	RxEIN1+ ↵	Positive LVDS DATA input(EVEN) ↵	LVDS ↵
17 ↵	GND ↵	Ground ↵	
18 ↵	RxEIN2- ↵	Negative LVDS DATA input(EVEN) ↵	LVDS ↵
19 ↵	RxEIN2+ ↵	Positive LVDS DATA input(EVEN) ↵	LVDS ↵
20 ↵	RxCLK- ↵	Negative LVDS Clock input(EVEN) ↵	LVDS ↵
21 ↵	RxCLK+ ↵	Positive LVDS Clock input(EVEN) ↵	LVDS ↵
22 ↵	RxEIN3- ↵	Negative LVDS DATA input(EVEN) ↵	LVDS ↵
23 ↵	RxEIN3+ ↵	Positive LVDS DATA input(EVEN) ↵	LVDS ↵
24 ↵	GND ↵	Ground ↵	
25 ↵	NC ↵	No connection(Do not connect) ↵	
26 ↵	NC ↵	No connection(Do not connect) ↵	
27 ↵	NC ↵	No connection(Do not connect) ↵	
28 ↵	VDD ↵	POWER +5V ↵	
29 ↵	VDD ↵	POWER +5V ↵	
30 ↵	VDD ↵	POWER +5V ↵	



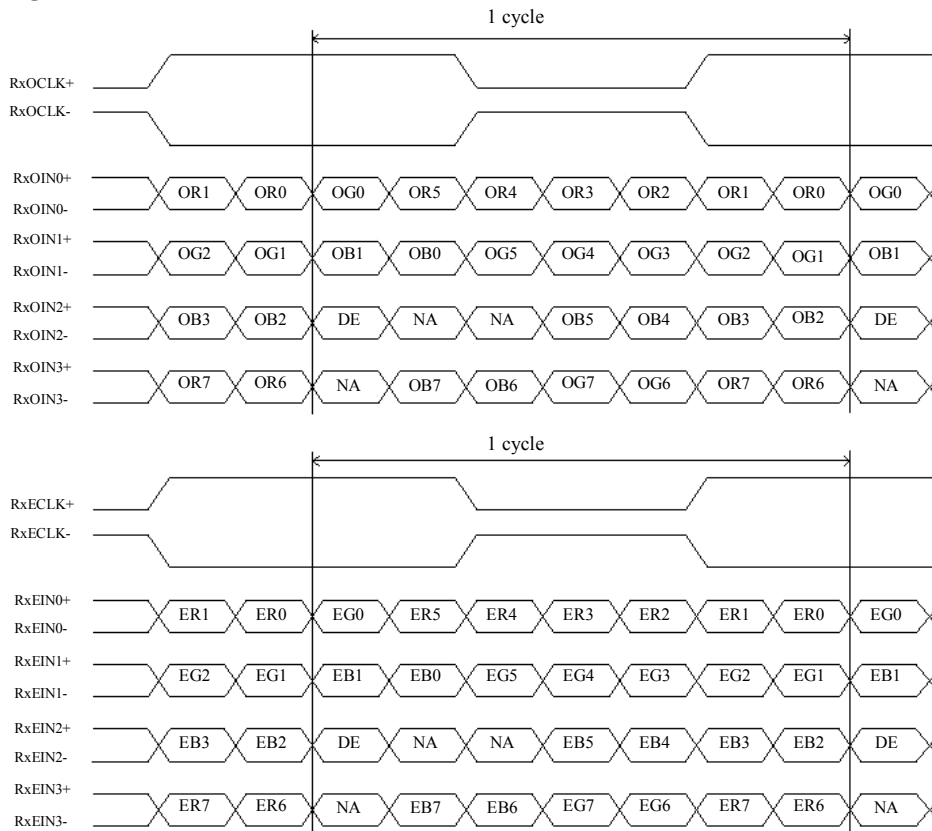
[Note 1] Pin1 start from left side.



## 4.2 BLOCK DIAGRAM



## 4.3 LVDS INTERFACE



DE: Display Enable

NA: Not Available (Fixed Low)

R/G/B Data 7: MSB, R/G/B Data 0:LSB, O : "First Pixel Data" E : "Second Pixel Data"

#### 4.4 COLOR DATA INPUT ASSIGNMENT

Colors & Gray scale	Gray Scale	Data signal																							
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
Basic Color	Black	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	—	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	—	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	—	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	—	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	—	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	↓					↓						↓								↓				
	↓	↓					↓						↓								↓				
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↓	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	↓					↓							↓							↓				
	↓	↓					↓							↓							↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	
	↓	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	
	Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	↑	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
	↑	↓					↓							↓							↓				
	↓	↓					↓							↓							↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	
	↓	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	

0: Low level voltage,

1: High level voltage.

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16,7M colors display can be achieved on the screen.

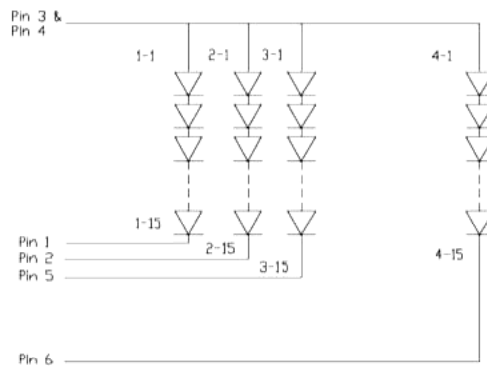
## 4.5 BACKLIGHT INTERFACE CONNECTION

LED light bar connector type: CI1406M1HRK-NH manufactured by CVILUX or equivalent.

Pin No.	Signal name
1	ILED (current out)
2	ILED (current out)
3	VLED (voltage in)
4	VLED (voltage in)
5	ILED (current out)
6	ILED (current out)

## 4.6 BACKLIGHT UNIT

The backlight unit contains one lightbar.



Electrical Circuit of lightbar

## 5. INTERFACE TIMING

### 5.1 INPUT SIGNAL TIMING SPECIFICATIONS

(a) The input signal timing specifications are shown as the following table and timing diagram.

Item		Symbol	Min	Typ.	Max.	Unit		
LCD Timing	DCLK	Freq.	F <sub>CLK</sub>	55	72	90	MHz	
		Cycle	T <sub>CLK</sub>	18.18	13.89	11.11	ns	
		Input cycle to cycle jitter	T <sub>RCL</sub>	-	-	200	ps	
		Spread Spectrum Modulation range	F <sub>clk_mod</sub>	F <sub>clk</sub> -3%	-	F <sub>clk</sub> +3%	MHz	
		Spread Spectrum Modulation frequency	F <sub>SSM</sub>	30	-	100	KHz	
	DE	Horizontal	Horizontal effective time	T <sub>HA</sub>	960	960	960	T
			Horizontal blank time	T <sub>HB</sub>	32	100	115	T <sub>CLK</sub>
			Horizontal total time	T <sub>H</sub>	992	1060	1075	T <sub>CLK</sub>
		Vertical	Vertical frame Rate	F <sub>r</sub>	50	60	75	Hz
			Vertical total time	T <sub>v</sub>	1084	1130	1170	T <sub>H</sub>
			Vertical effective time	T <sub>VA</sub>	1080	1080	1080	T <sub>H</sub>
			Vertical blank time	T <sub>VB</sub>	4	50	90	T <sub>H</sub>

[Note]

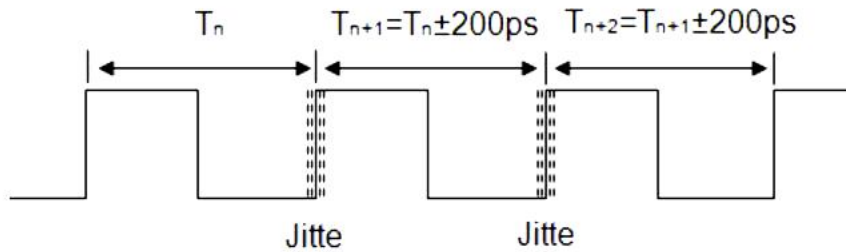
\*1) DE (data enable) usually is positive.

\*2) DCLK still inputs during blanking.

\*3) DE mode only.

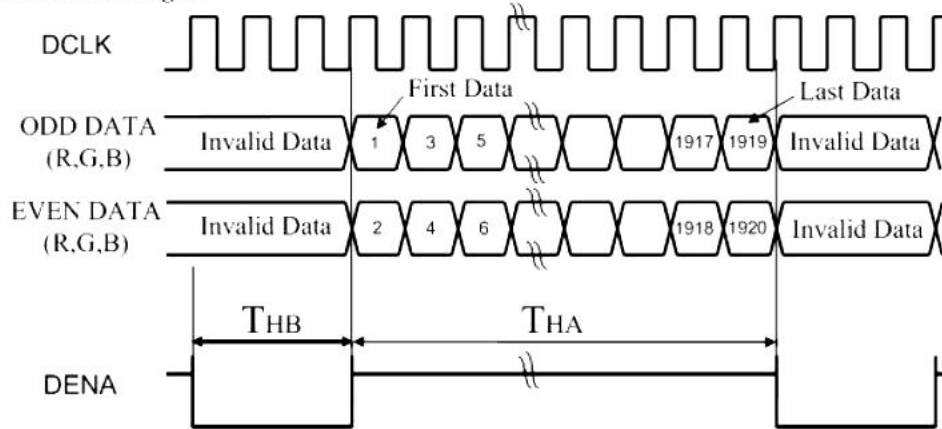
\*4) It may cause flicker at 50Hz.

\*5) The input cycle to cycle jitter is defined as below figure,  $T_{RCL} = |T^{n+1} - T^n|$

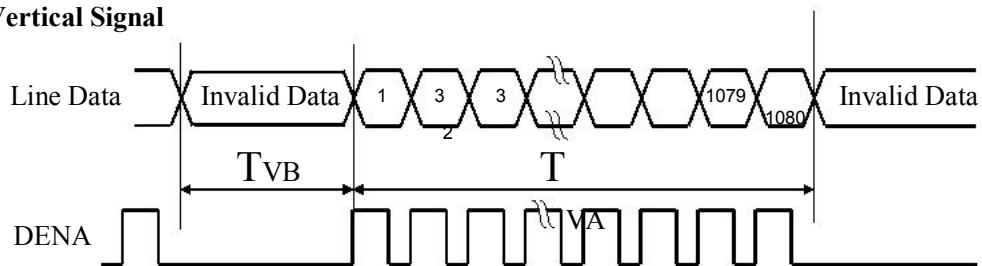


(b) Timing Chart

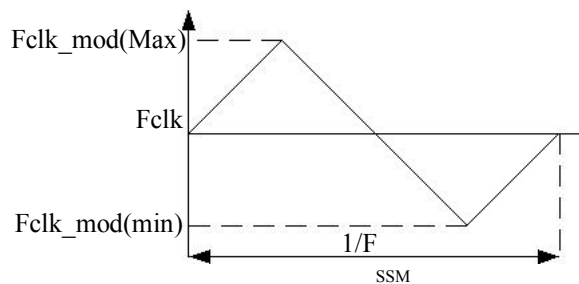
**a. Horizontal Signal**



**b. Vertical Signal**



(c) SSCG (Spread spectrum clock generator)



## 6. OPTICAL CHARACTERISTICS

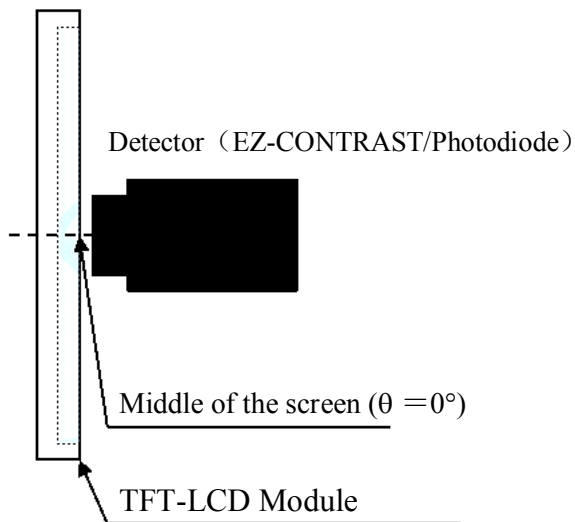
### 6.1 OPTICAL SPECIFICATION

Ta=25°C

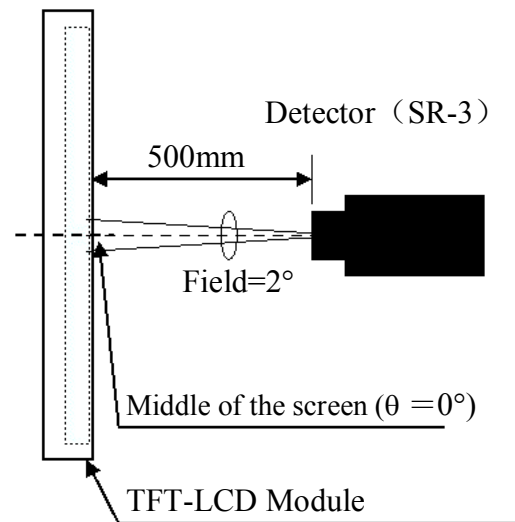
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Luminance	L	$\theta = 0 \text{ deg.}$	-	250	-	cd/m <sup>2</sup>	[Note 1,4]	
Luminance uniformity	$\Delta L$	$\theta = 0 \text{ deg.}$	75	-	-	%	[Note 1,5]	
Contrast ratio	CR	$\theta = 0 \text{ deg.}$	-	1000	-	-	[Note2,4]	
Response time	Tr+Tf		-	5	8	ms	Tr+Tf [Note3,4]	
Chromaticity of white	x		Typ-0.03	0.313	Typ+0.03	-	[Note 4]	
	y		Typ-0.03	0.329	Typ+0.03	-		
Chromaticity of red	x		Typ-0.03	0.645	Typ+0.03	-		
	y		Typ-0.03	0.347	Typ+0.03	-		
Chromaticity of green	x		Typ-0.03	0.320	Typ+0.03	-		
	y		Typ-0.03	0.630	Typ+0.03	-		
Chromaticity of blue	x		Typ-0.03	0.155	Typ+0.03	-		
	y		Typ-0.03	0.063	Typ+0.03	-		
Color Gamut	C.G	-	72	-	%			
Viewing angle range	Horizontal	$\theta 21 + \theta 22$	$CR \geq 10$	-	160	-		Deg.
	Vertical	$\theta 11 + \theta 12$		-	140	-	Deg.	

\*The measurement shall be executed 30 minutes after lighting at rating.

\* The optical characteristics are measured using the following equipment.

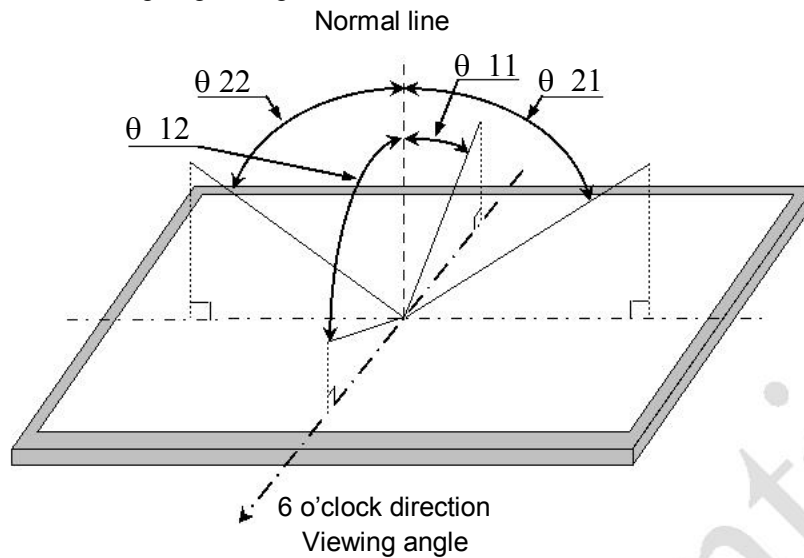


Measurement of viewing angle range, Response time.



Measurement of Contrast, Luminance, Chromaticity.

[Note 1] Definitions of viewing angle range:



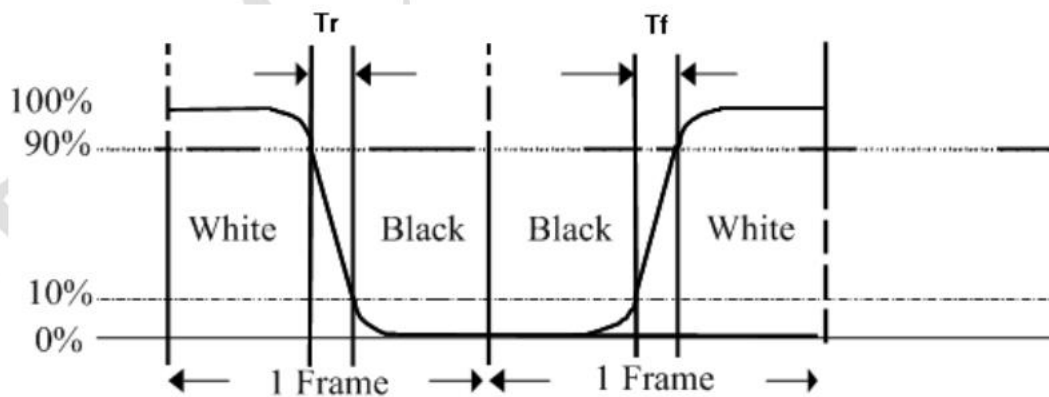
[Note 2] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (Brightness) with white screen}}{\text{Luminance (Brightness) with black screen}}$$

[Note 3] Definition of response time

The output signals of photo detector are measured when the input signals are changed from “Full White” to “Full Black” (rising time, TR), and from “Full Black” to “Full Black” (falling time, TF), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.



$$\text{Response time} = T_r + T_f$$

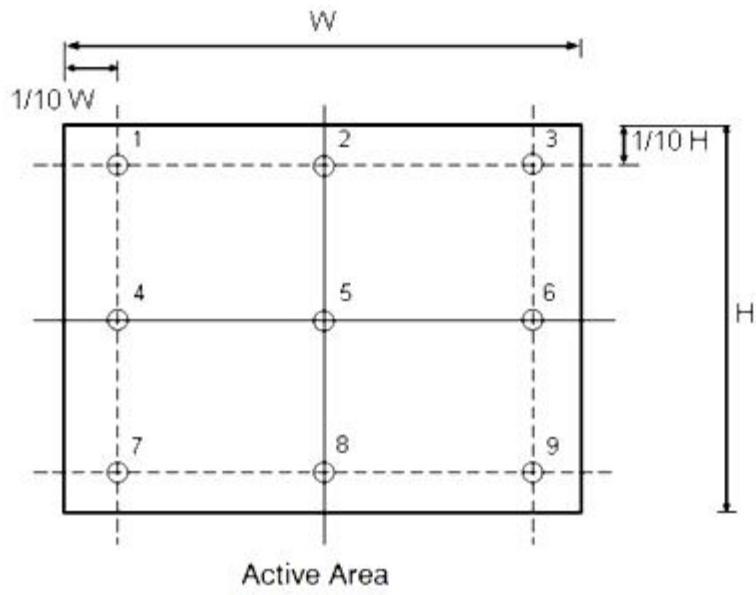
[Note 4] This shall be measured at center of the screen.

[Note 5] Definition of Luminance and Luminance uniformity:

Luminance: To measure at the center position “5” on the screen (NO.5).

Luminance uniformity:  $L_w(\text{MAX})$  and  $L_w(\text{MIN})$  are the maximum and minimum luminance value measure at the position “1~9” on the screen (NO.1~9) and the equation:

$$\Delta Lw = Lw(\text{MIN}) / Lw(\text{MAX}) \times 100\%$$



## 7. PACKING

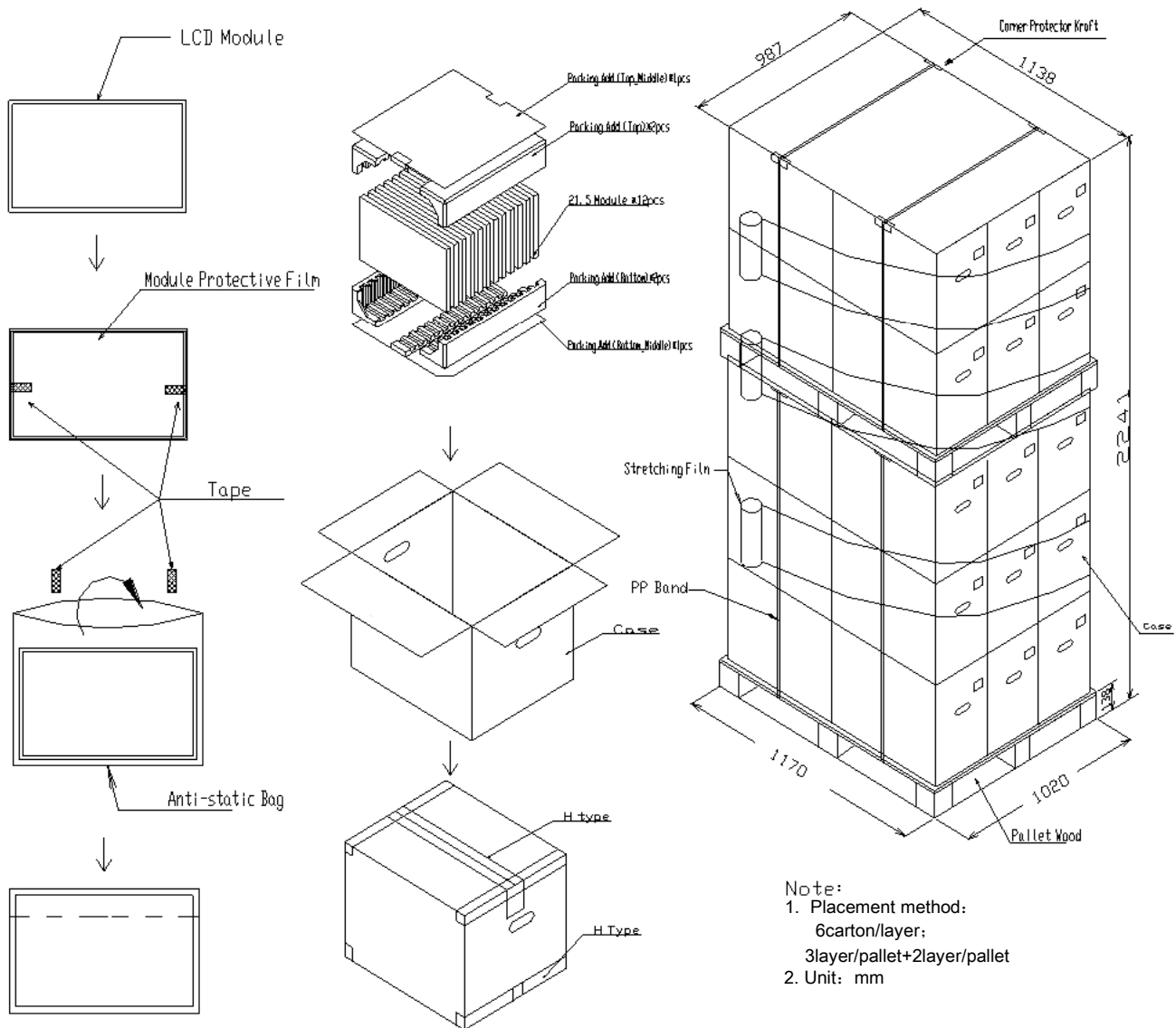
### 7.1 PACKING SPECIFICATIONS

PILING NUMBER OF CARTON	30(18 carton/pallet + 12 carton/pallet)
Packing quantity in one carton	12 pcs
Carton size	569(L)x329(W)x399(H) mm
Pallet size	1170(L)x1020(W)x138(H) mm
Total mass of one carton filled with full module	23.5 kg or 25 kg *

\*23.5 kg : This module assembly Open-cell is 0.5 mm thickness of glass.

25 kg: This module assembly Open-cell is 0.7 mm thickness of glass.

### 7.2 PACKING METHOD





## 8. CARTON STORAGE CONDITION

Temperature: 0°C to 40°C

Humidity: 80%RH or less

Reference condition: 20°C to 35°C, 80%RH or less (summer)  
5°C to 15°C, 80%RH or less (winter)

The total storage time (40°C, 80%RH): 240h or less

Sunlight Be sure to shelter a product from the direct sunlight.

Atmosphere Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.

Be sure to put cartons on pallet or base, don't put it on floor, and store them with removing from wall.

Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment.

## 9. PRECAUTIONS

### 9.1 ASSEMBLY AND HANDLING PRECAUTIONS

(a) Do not apply rough force such as bending or twisting to the module during assembly.

(b) It is recommended to assemble or to install a module into the user's system in clean working areas.

The dust and oil may cause electrical short or worsen the polarizer.

(c) Since the LCM consists of TFT and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharge, person who is handling an LCM should be grounded through adequate methods such as an anti-static wrist band. Connector pins should not be touched directly with bare hands.

Reference: Process control standard is shown as follow,

item	Management standard value and performance standard
1 Anti-static mat(shelf)	1to50 [Mega ohm]
2 Anti-static mat(floor, desk)	1to100 [Mega ohm]
3 Ionizer	Attenuate from $\pm 1000V$ to $\pm 100V$ within two seconds.
4 Anti-static wrist band	0.8 to 10 [Mega ohm]
5 Anti-static wrist band entry and ground resistance	Below 1000 [ohm]
6 Temperature	22 to 26 [°C]
7 Humidity	60 to 70 [%]

(d) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.

(e) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

(f) Be sure to turn off the power supply when inserting or disconnecting the cable.

(g) Do not disassemble the module.

(h) Front polarizer can easily be damaged, so please pay attention on it.

(i) Using a absorbent cotton or other soft cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(j) Since long contact with drops of water may cause discoloration or spots, please wipe off them as soon as possible.

(k) The Panel will be broken or chipped when it is dropped or bumped against a hard substance.

(l) Applying too much force and stress to PWB and drivers may cause a malfunction electrically and mechanically.

(m) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

(n) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(o) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(p) This LCM is corresponded to RoHS.

(q) When any question or issue occurs, it shall be solved by mutual discussion.

**9.2 SAFETY PRECAUTIONS**

(a) 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.

(b) After the module's end of life, it is not harmful in case of normal operation and storage.

**10. Reliability test items**

(a) Environment test condition(LCM)

Test item	Condition
High temperature storage test	Ta= 70°C, 240h
Low temperature storage test	Ta= -20°C, 240h
High temperature and high humidity storage test	Ta=60°C, 80%RH, 240h (No condensation)
High temperature operation test	Ta= 60°C, 240h
Low temperature operation test	Ta= -10°C, 240h
Thermal Shock Test	-10°C/30min, 60°C/30min, 100 cycles
On/Off Test	On/10sec, Off/10sec, 30,000 cycles

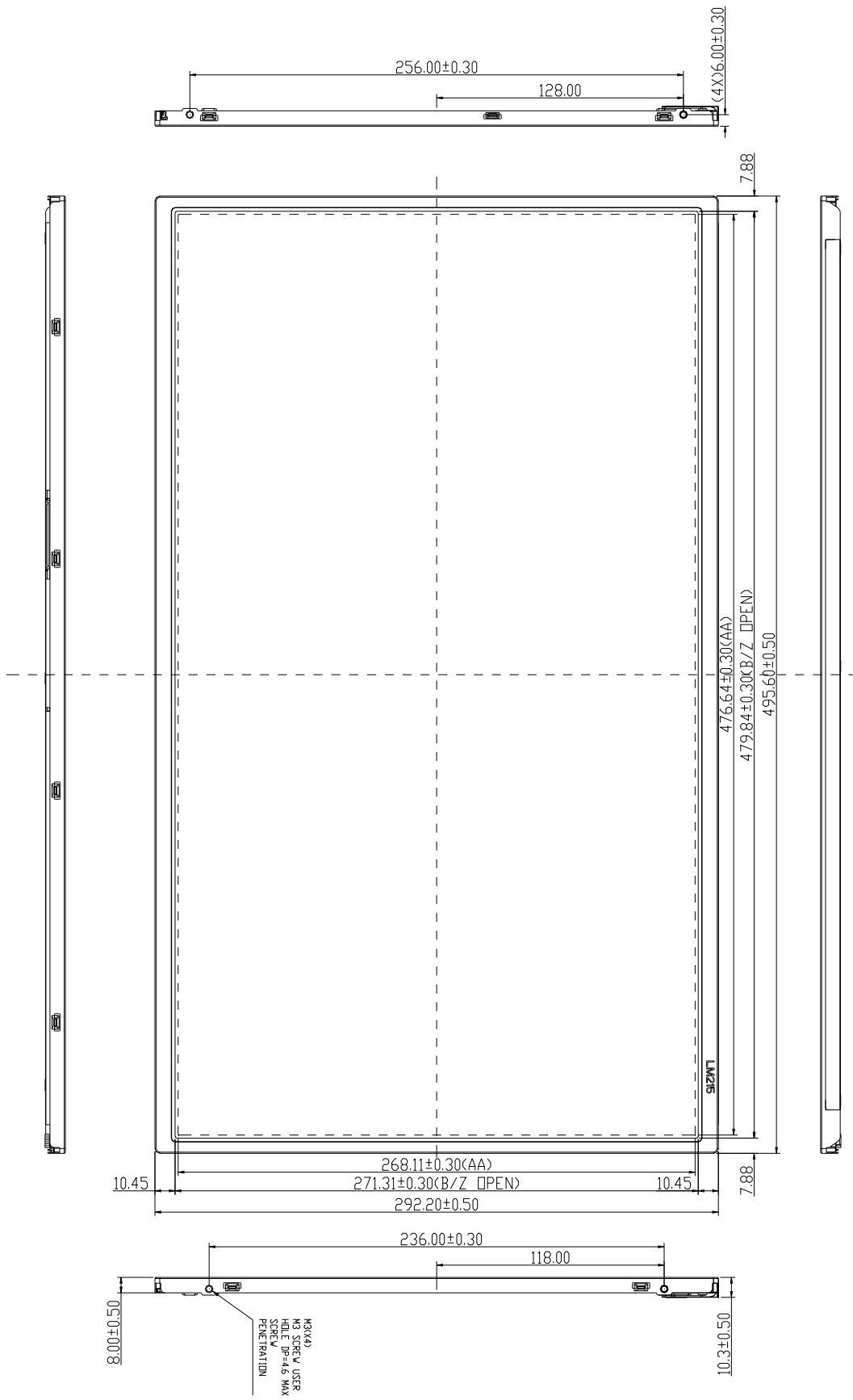
(b) Shock & Vibration(LCM)

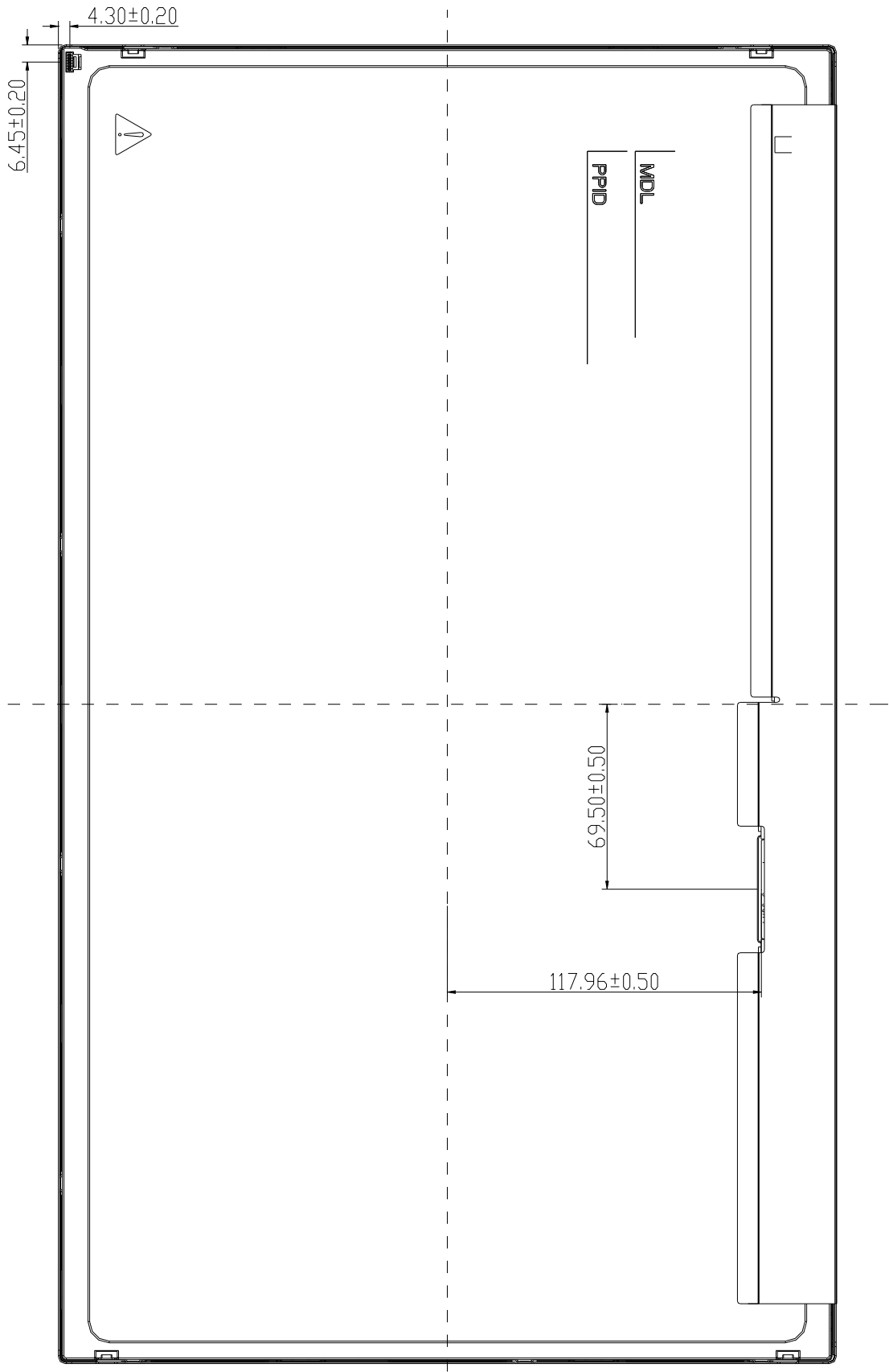
Test item	Condition
Shock (Non-Operation)	Shock level: 50 Grms Waveform: half sine wave, 20ms Direction: ±X,±Y,±Z One time each direction
Vibration (Non-Operation)	Wave form: Random Vibration level: 1.5 Grms Bandwidth: 10-200 Hz Duration: X,Y,Z each direction per 30 min

[Result evaluation criteria]

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

**11. Mechanical Drawing**







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