B2 EV156FHM-N12-2HP0 Product Specification Rev.P0

BUYER	
SUPPLIER	Chengdu BOE Optoelectronics Technology CO., LTD
FG-Code	EV156FHM-N12-2HP0

ITEM	BUYER SIGNATURE	DATE

ITEM	SUPPLIER SIGNATURE	DATE
Prepared		
Reviewed		
Approved		

REVISION HISTORY

( )preliminary specification
(√)Final specification

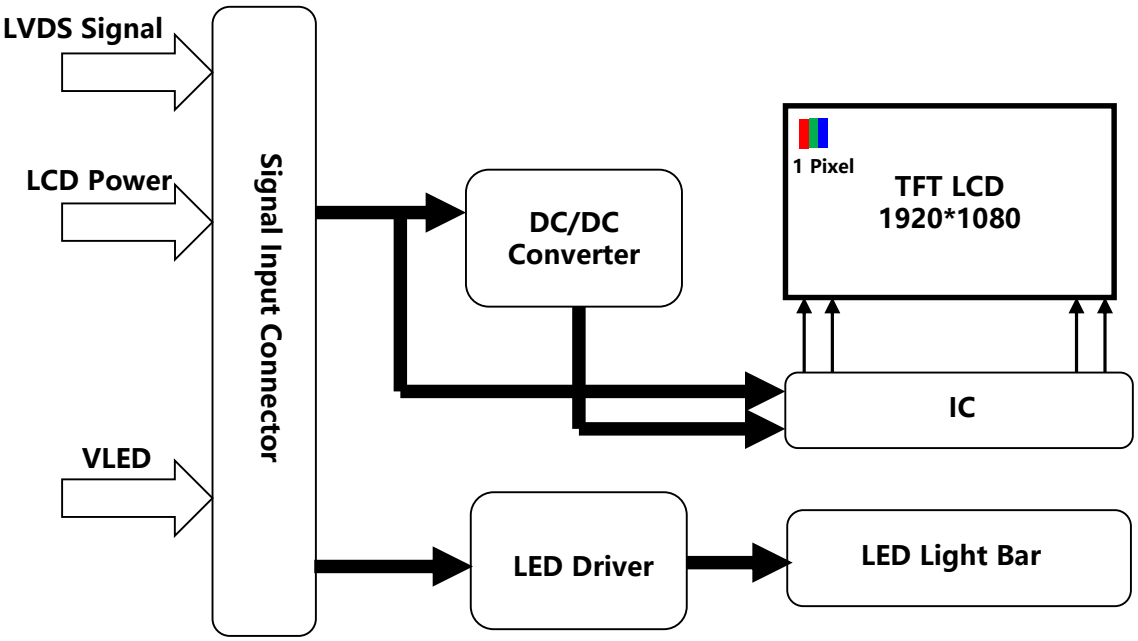
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		Initial Release	2023-2-14	All

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

EV156FHM-N12 is a color active matrix TFT LCD module using amorphous silicon TFT ‘s (Thin Film Transistors) as an active switching devices. This module has a 15.6 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M colors.



1.2 Features

- 0.8T Glass
- Reverse Type
- 8bits LVDS data input selection
- RoHS compliant

1.3 Application

- HMI (Human Machine Interface)

1.4 General Specification

The followings are general specifications at the ET104S0M-N11

<Table 1. LCD Module Specifications>

Parameter	Specification	Unit	Remarks
Active Area	345.6(W) x 194.4(H)	mm	16:9
Number Of Pixels	1920 x RGB x 1080	pixels	
Pixel Pitch	0.18(W) x 0.18(H)	mm	
Pixel Arrangement	RGB Vertical stripe		
Display Mode	Normally black		
Display Colors	8bits	colors	
Surface Treatment	HC		
Contrast Ratio	Typ. 1200 Min.1000		
Viewing Angle(CR>10)	Typ.85/85/85/85	deg.	
Color Gamut	72% NTSC		
Brightness	500typ 425min	cd/m2	
Brightness Uniformity	80% typ 75% min		9 point
Power Consumption	Max.10.65W Typ. 9.55 W	watt	
Outline Dimension	363.8*215.9	mm	
Weight	Typ. 850g	gram	

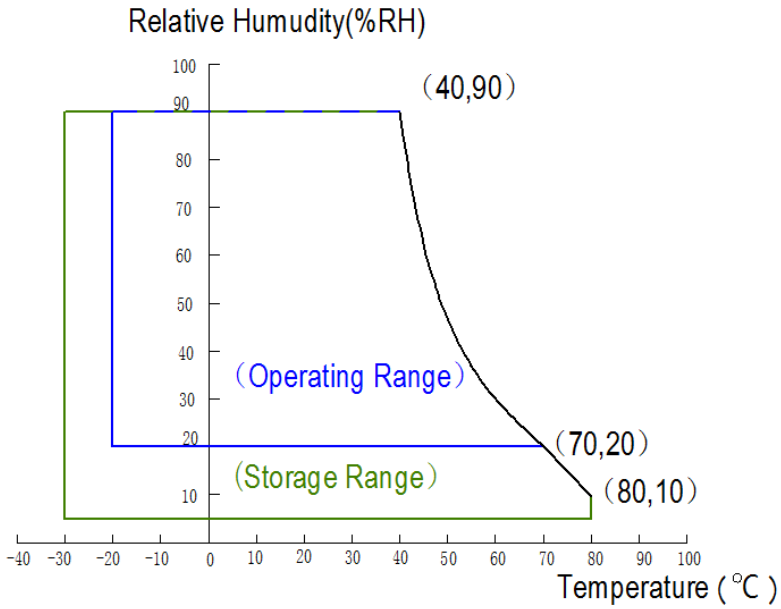
2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings>

Parameter		Symbol	Min.	Max.	Unit	Remarks
Power Supply	LCD Module	VDD	0	3.6	V	Ta = 25 ℃
	BLU	V_{LED}	-	12.5	V	
Operating Temperature		T_{OP}	-20	+70	℃	Note 1
Storage Temperature		T_{ST}	-30	+80	℃	

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ max. and no condensation of water.



3.0 ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Module

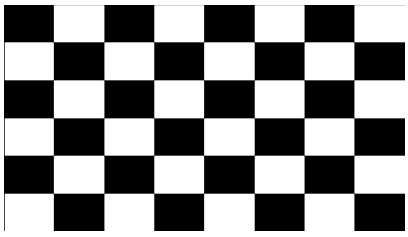
[Ta =25±2 ℃]

< Table 3. LCD Module Electrical specifications >

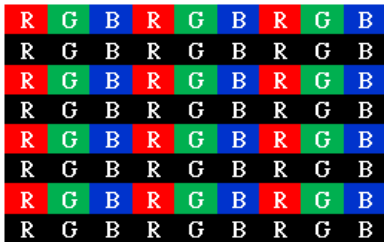
Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	VDD	3.0	3.3	3.6	V	Note 1
Power Supply Current	IDD		200	473	mA	
BLU Supply Voltage	V_{LED}	11.5	12	12.5	V	
BLU Supply Current	I_{LED}	-	766	-	mA	
Power Consumption	P_D	-	0.66	1.56	W	Note 2
	P_{LED}	-	8.89	9.19	W	
	P_{total}	-	9.55	10.65	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VBAT=3.8V, Frame rate f_V=60Hz and Clock frequency = **65.71MHz.** Test Pattern of power supply current

a) Typ : Mosaic 8 x 6 Pattern(L0/L255)



b) Max : H1L



2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

3.2 Back-Light Unit

Table 4. LED Bar Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
LED Supply Voltage	V_{LED}	28	30	31	V	
LED Supply Current	I_{LED}	-	252	-	mA	Note 1
Power Consumption	P_{LED}	-	8.89	9.19	W	
LED Quantity	QLED	-	40	-	EA	
LED Life Time	TLED	30000	-	-	Hrs	Note 2/3

Notes: **1. LED Bar:4Parallel*10String ） ，I_{LED}=63mA*4=252mA**

$P_{LED} = V_{LED} \times I_{LED}$/ transfer efficiency

2. The life time of LED, 30,000Hrs, is determined as the time at which luminance of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at 25 ± 2℃.

3. Only under the above operating conditions could the life time of LED be guaranteed.

3.3 INPUT TERMINAL PIN ASSIGNMENT

Connector : I-PEX 20455-040E-66 or Compatible

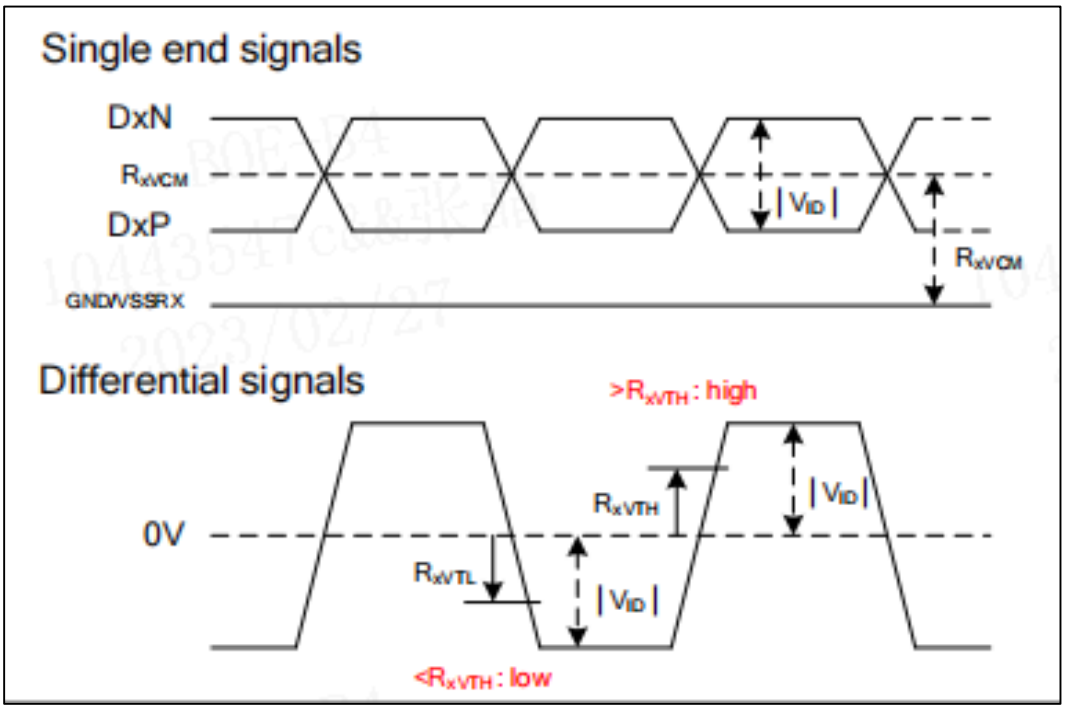
< Table5. Pin Assignment for LCD Module Connector >

No.	Symbol		No.	Symbol	
1	RE3P	Positive LVDS differential data input Channel E3(Even)	21	RO1N	Negative LVDS differential data i nput Channel O1(Odd)
2	RE3N	Negative LVDS differential data inpu t Channel E3(Even)	22	RO0P	Positive LVDS differential data in put Channel O0(Odd)
3	RECLKP	Positive LVDS differential clock inpu t (Even)	23	RO0N	Negative LVDS differential data i nput Channel O0(Odd)
4	RECLKN	Negative LVDS differential clock inp ut(Even)	24	GND	LCD Ground
5	RE2P	Positive LVDS differential data input Channel E2(Even)	25	NC	SDA for BOE use, this pin should be open
6	RE2N	Negative LVDS differential data inpu t Channel E2(Even)	26	NC	SCL for BOE use, this pin should be open
7	GND	LCD Ground	27	NC	MTP for BOE use, this pin should be open
8	RE1P	Positive LVDS differential data input Channel E1(Even)	28	LCD_VCC	LCD Power 3.3V
9	RE1N	Negative LVDS differential data inpu t Channel E1(Even)	29	LCD_VCC	LCD Power 3.3V
10	RE0P	Positive LVDS differential data input Channel E0(Even)	30	LCD_VCC	LCD Power 3.3V
11	RE0N	Negative LVDS differential data inpu t Channel E0(Even)	31	LED_PW M	Backlight Adjust，3.3V(3V~3.6V)
12	RO3P	Positive LVDS differential data input Channel O3(Odd)	32	LED_EN	Enable pin，3.3V(3V~3.6V)
13	RO3N	Negative LVDS differential data inpu t Channel O3(Odd)	33	GND	Ground
14	GND	LCD Ground	34	STBYB	Deep standby mode setting pin.
15	ROCLKP	Positive LVDS differential clock inpu t (Odd)	35	RSTB	Device Reset for LCD driver IC, Low active
16	ROCLKN	Negative LVDS differential clock inp ut(Odd)	36	GND	Ground
17	GND	LCD Ground	37	BL_POW ER	+12V Vi power supply
18	RO2P	Positive LVDS differential data input Channel O2(Odd)	38	BL_POW ER	+12V Vi power supply
19	RO2N	Negative LVDS differential data inpu t Channel O2(Odd)	39	BL_POW ER	+12V Vi power supply
20	RO1P	Positive LVDS differential data input Channel O1(Odd)	40	BL_POW ER	+12V Vi power supply

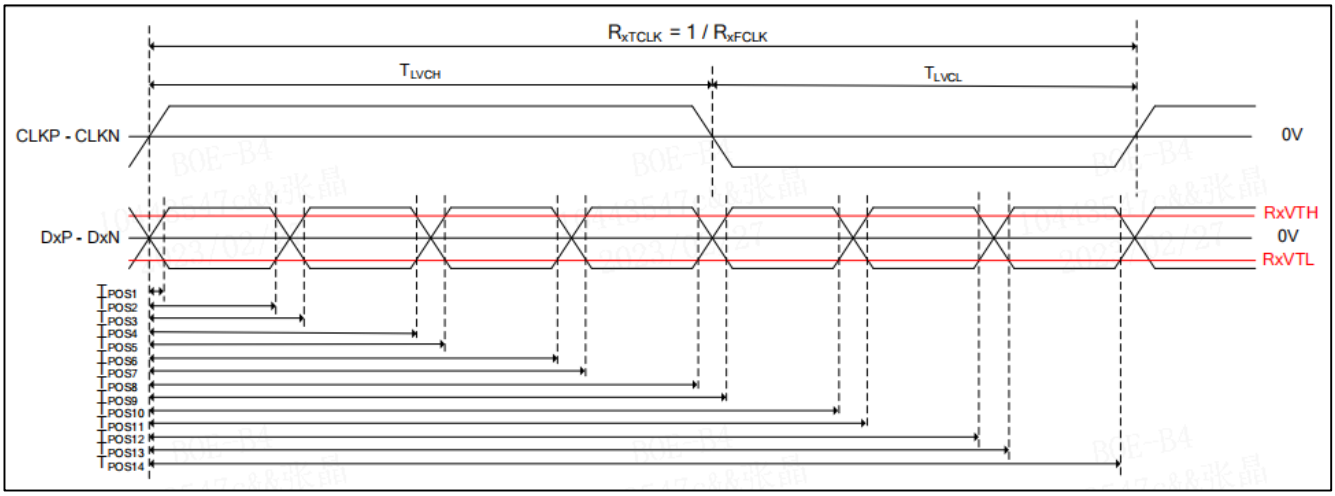
3.4 DC Specification

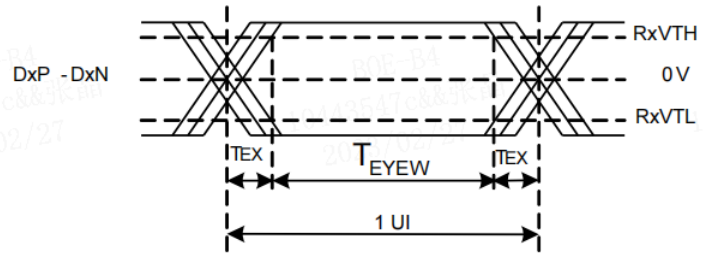
< Table6. DC Specification >

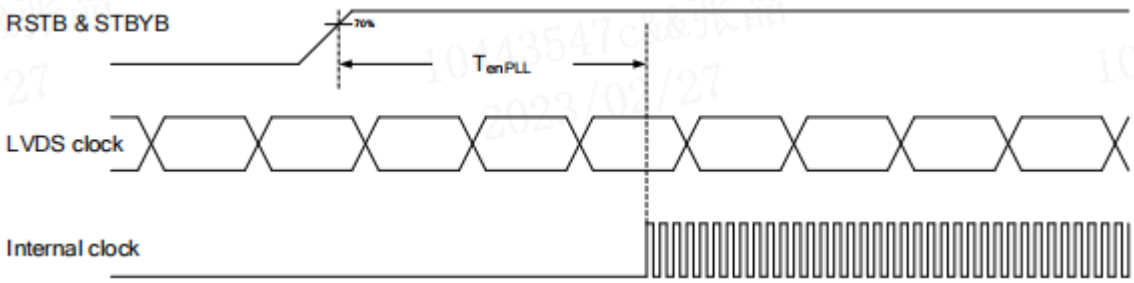
Parameter	Symbol	Min	Typ	Max	Unit	Condition
LVDS DC specifications						
Differential input high threshold	RxVTH	-	-	+100	mV	V_{IC}=1.2V
Differential input low threshold	RxVTL	-100	-	-	mV	
LVDS common mode voltage	RxVCM	0.6	1.2	2.4-|VID|/21.6	V	
LVDS swing voltage	|VID|	±200	±400	±600	mV	



3.5 AC Specification







< Table7. AC Specification >

3.5 AC Specification

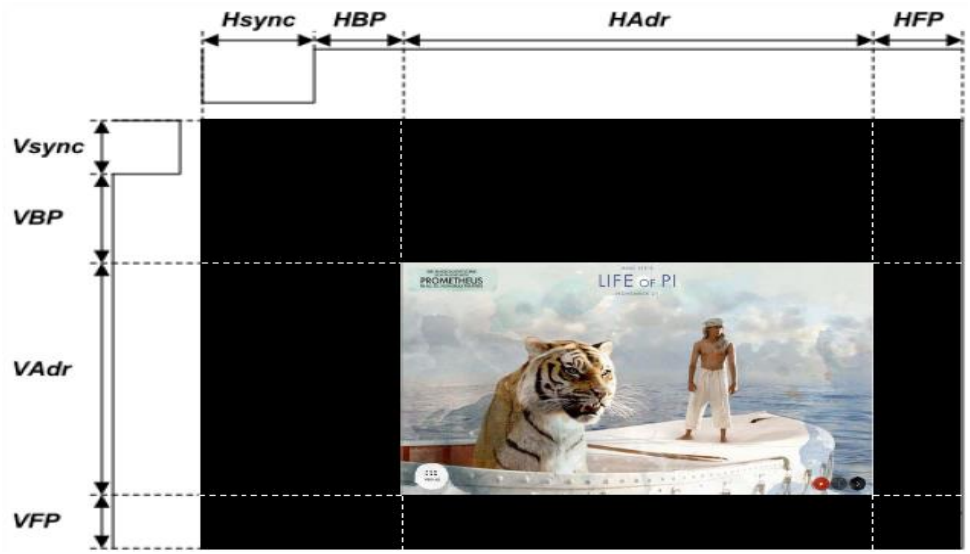
Item	Signal	Symbol	Rating			Unit
			Min.	Typ.	Max.	
Clock Frequency	CLK	R_{xFCLK}	20	-	100	MHz
Clock Period		R_{xTCLK}	10	-	50	ns
1 data bit time		UI	-	1/7	-	R_{xTCLK}
Clock high time	CLK	T_{LVCH}		4		UI
Clock low time		T_{LVCL}		3		UI
Position 1	DATA	T_{POS1}	-0.25	0	0.25	UI
Position 2		T_{POS2}	0.75	-	1.25	
Position 3		T_{POS3}	0.75	1	1.25	
Position 4		T_{POS4}	1.75	-	2.25	
Position 5		T_{POS5}	1.75	2	2.25	
Position 6		T_{POS6}	2.75	-	3.25	
Position 7		T_{POS7}	2.75	3	3.25	
Position 8		T_{POS8}	3.75	-	4.25	
Position 9		T_{POS9}	3.75	4	4.25	
Position 10		T_{POS10}	4.75	-	5.25	
Position 11		T_{POS11}	4.75	5	5.25	
Position 12		T_{POS12}	5.75	-	6.25	
Position 13		T_{POS13}	5.75	6	6.25	
Position 14		T_{POS14}	6.75	-	7.25	
Input eye width		T_{EYEW}	0.5	-	-	
Input eye border		T_{EX}	-	-	0.25	
PLL wake-up time		TenPLL	-	-	150	us

< Table8. AC Specification >

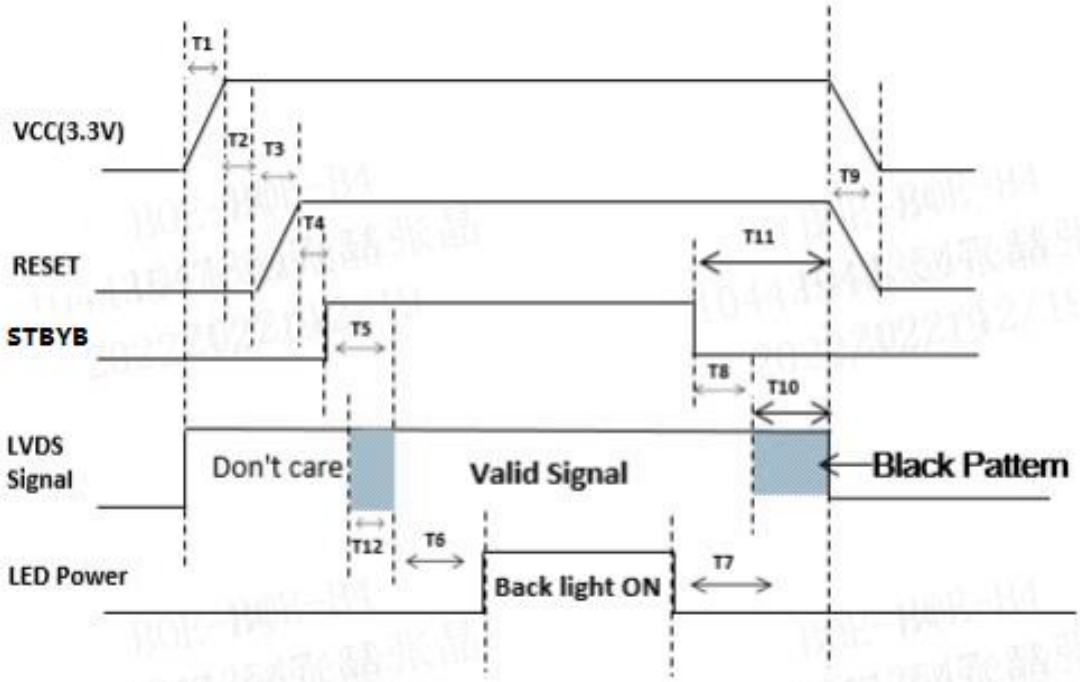
3.6 Interface timing Parameter

< Table9. Timing Parameter >

Item			Symbol	min	typ	max	UNIT
LCD	Frame Rate		-	-	60	-	Hz
	Pixels Rate		-	64.50	65.71	84.99	MHz
Timing	Horizontal	Horizontal total time	tHP	1008	1010	1059	t_{CLK}
		Horizontal Active time	tHadr		960		t_{CLK}
		Horizontal Back Porch	tHBP	48	50	99	t_{CLK}
		Horizontal Front Porch	tHFP		2		t_{CLK}
	Vertical	Vertical total time	tvp	1100	1120	1180	t_H
		Vertical Active time	tVadr		1080		t_H
		Vertical Back Porch	tVBP	20	40	100	t_H
		Vertical Front Porch	tVFP		2		t_H
Lane				-	2	-	Lane



3.7 Power Sequence



< Table10. Sequence Table >

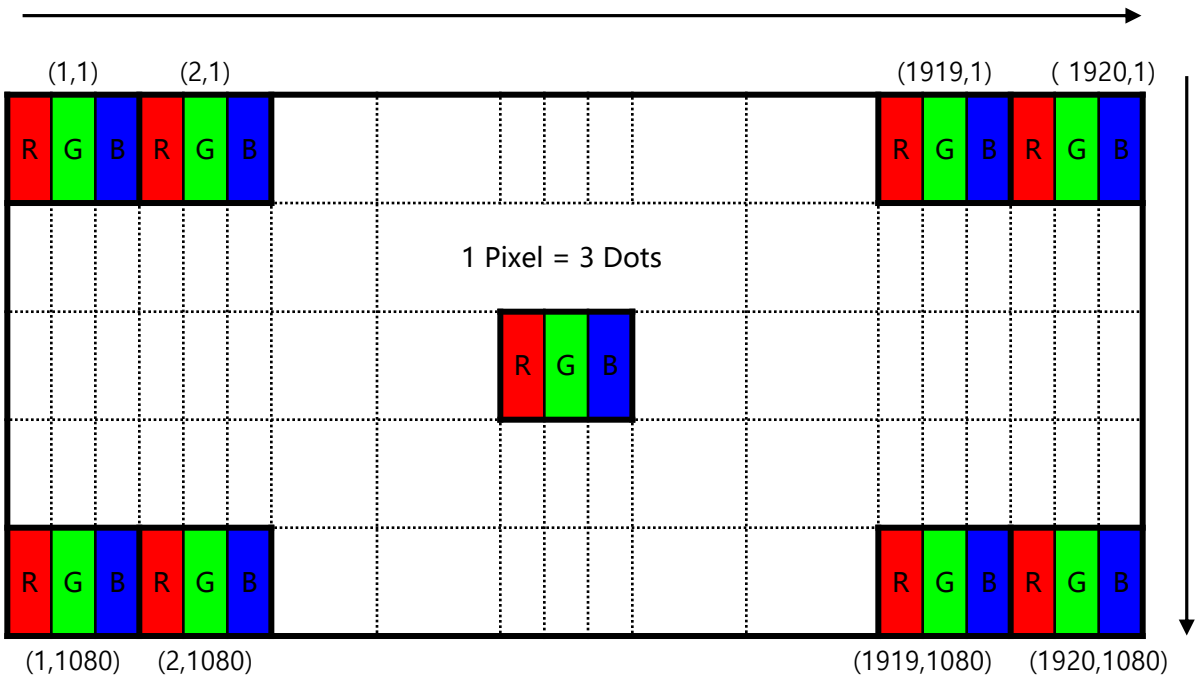
Parameter	Value			Unit	Note
	Min	Typ	Max		
T1	-	-	20	ms	
T2	1	-	-	ms	
T3	-	-	20	ms	
T4	20	-	-	ms	
T5	50	-	-	ms	
T6	120	-	-	ms	
T7	90	-	-	ms	
T8	50	-	-	ms	
T9	-	-	20	ms	
T10	150	-	-	ms	
T11	200	-	-	ms	
T12	35	-	-	ms	

3.8 Input Color Data Mapping

< Table11. Input Signal and Display Color Table >

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	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	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	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	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	0
	Magenta	1	1	1	1	1	1	1	1	0	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	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	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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	1

3.9 Input Color Data Mapping



Display Position of Input Data (V-H)

4.0 OPTICAL SPECIFICATIONS

4.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Gonio meter system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ =0 (=θ3) as the 3 o′ clock direction (the "right"), θØ=90 (= θ12) as the 12 O′ clock direction ("upward"), θØ=180 (= θ9) as the 9 O′ clock direction ("left") and θØ=270(= θ6) as the 6 O′ clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed.

4.2 Optical Specifications

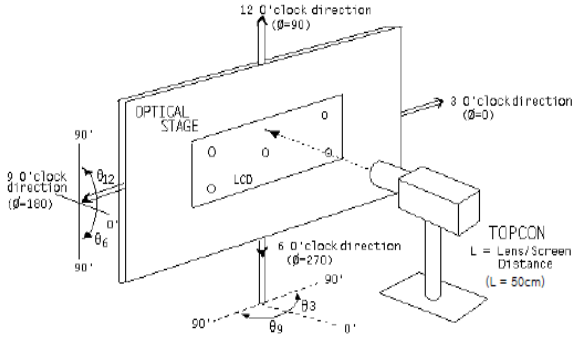
< Table12. Optical Table >

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
luminance	Bp	θ=0°	425	500	--	cd/m2	Note 1
L255 Uniformity	△Bp		75	80	--	%	Note 2
Viewing Angle	θL	Cr≥10	--	85	--	deg	Note 3
	θ_R		--	85	--		
	ψ_T		--	85	--		
	ψ_B		--	85	--		
Contrast Ratio	Cr	θ=0° FF=0°	1000	1200		-	Note 4
Color Coordinate of CIE1931	Wx	θ=0°	0.283	0.313	0.343	-	Note 5
	Wy		0.299	0.329	0.359		
Color Gamut		NTSC	--	72	--	%	
Gamma		25℃	2.0	2.2	2.4	%	Note 6
Crosstalk		25℃	--	--	2	%	Note 7

Note1:Luminance measurement

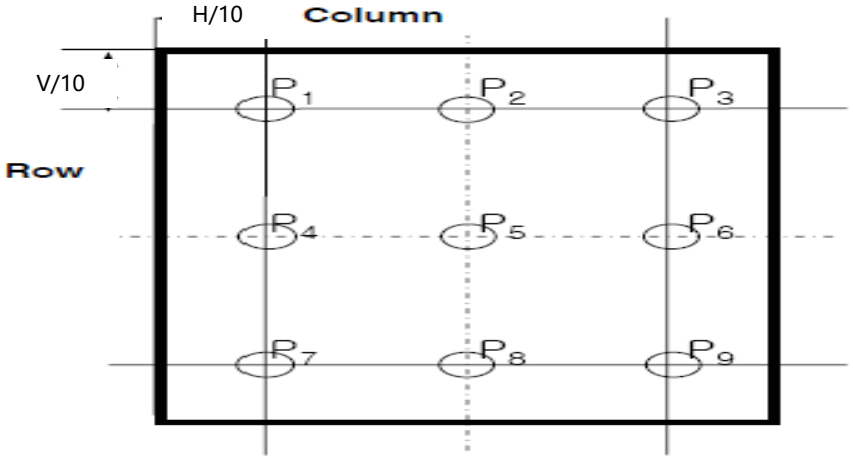
The test condition is at ILED=100mA and measured on the surface of LCD module at 25℃.

- The data are measured after LEDs are lighted on for more than 5 minutes and LCM displays are fully white. The brightness is the center of the LCD. Measurement equipment CS2000 or similar equipments (Field of view:1deg,Distance:50cm)
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.
- Measured value at the center point of LCD panel must be after more than 5 minutes while backlight turning on.

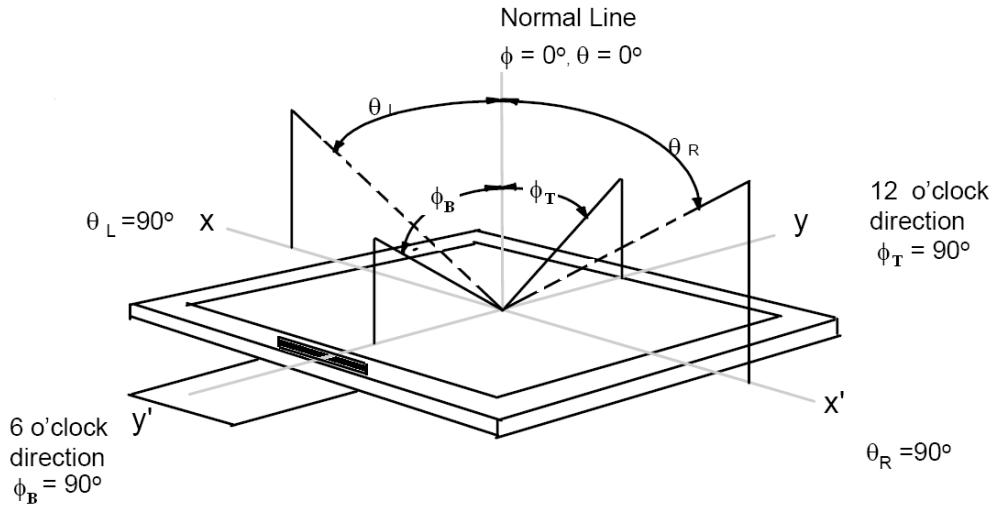


Note2:Uniformity

- The test condition is at ILED=252mA and measured on the surface of LCD module at 25℃
- Measurement equipment:CS2000 or similar equipments
- The luminance uniformity is calculated by using following formula:
- ▵Bp = Bp (Min.) / Bp (Max.)×100 (%)
- Bp (Max.) = Maximum brightness in 9 measured spots
- Bp (Min.) = Minimum brightness in 9 measured spots.



Note 3:**The definition of Viewing Angle**
Refer to the graph below marked by θ and Φ.



Note4:**ThedefinitionofContrastRatio** (Test LCM using CS2000 or similar equipments):

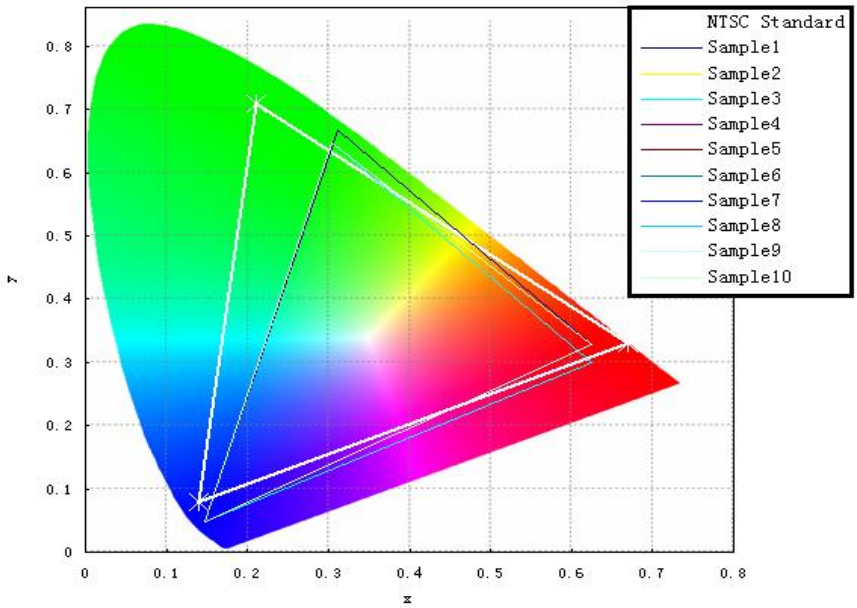
$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is at “White” state}}{\text{Luminance When LCD is at “Black” state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

Note 5: Color Coordinates of CIE 1931
The test condition is at ILED=252mA and measured on the surface of LCD module at 25℃.
Measurement equipment:CS2000 or similar equipments
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

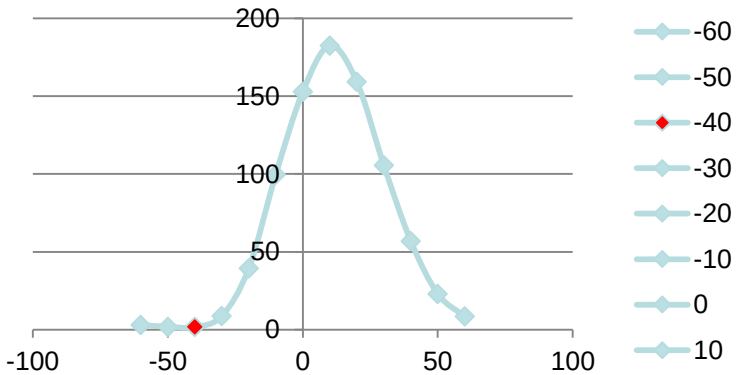
Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$



Note 7: **Definition of gray inversion angle**

- Refer to the graph of note 9.
- Using luminance test method.
- Test pattern : 128 gray
- If the viewing direction is 12 o' clock ,then test the luminance while θ=-60°,θ=-50°, θ=-40°, θ=-30°, θ=-20°, θ=-10°, θ=0°, θ=10°, θ=20°, θ=30°, θ=40°, θ=-50°, θ=60°. The luminance test as figure below:



5.0 RELIABLITY TEST

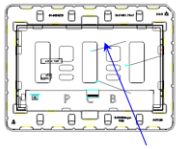
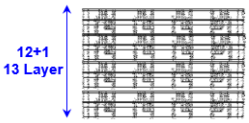
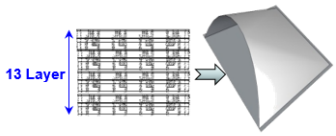
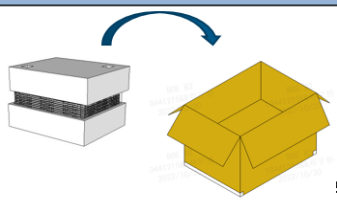
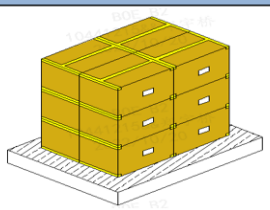
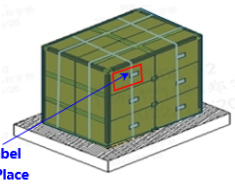
The Reliability test items and its conditions are shown in below.

<Table 13. Reliability Test Parameters >

No	Test Items	Conditions
1	High Temperature Storage	+80℃, 240h
2	Low Temperature Storage	-30℃, 240h
3	High Temperature Operation	+70℃, 240h
4	Low Temperature Operation	-20℃, 240h
5	High Temperature & Humidity Operation Test	50℃, 80%RH ,240h
6	Temperature Shock Test storage	-20℃(30min)~+60℃(30min) 100cycles (No Operation)
7	ESD	MDL: Air:±15 KV Contact :±8 KV 150 pF, 330Ω Class B，OK

6.0 PACKING INFORMATION(产品形态： LCM)

Packing procedure:

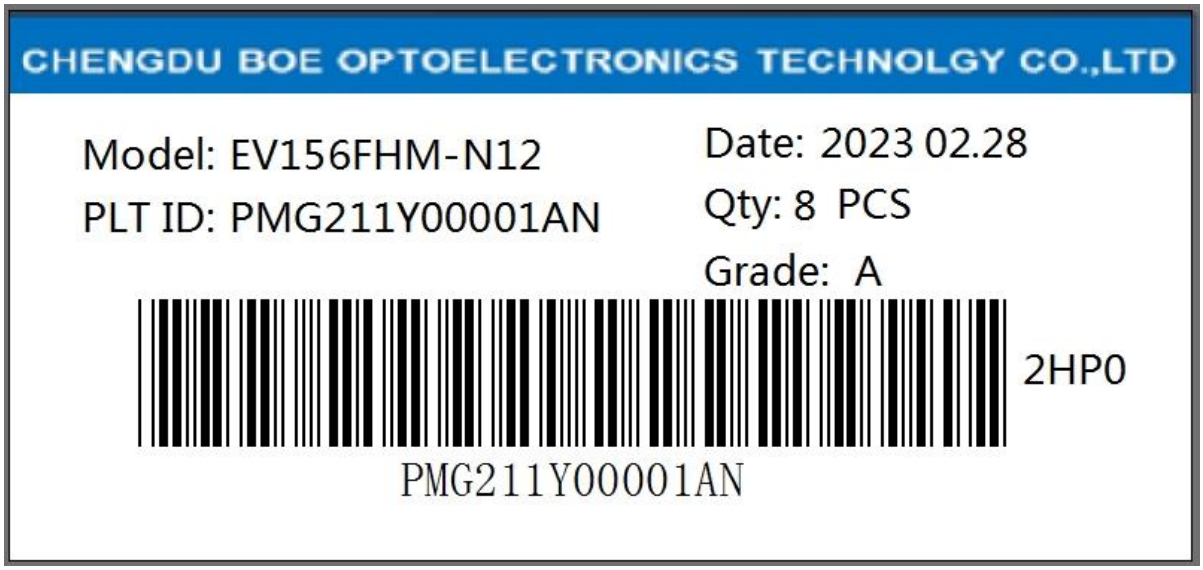
Put 1 MDL in the Tray. 1 MDL/1 Tray	Put 12 full Tray with MDL , Put 1 dummy Tray on the top.**(Straight fold)** 12 MDL/13 Tray	Put the 13 Tray in a shielding bag vacuum . 12 MDL/ Shielding Bag
 Step 1	 Step 2	 Step 3
Put 2 Cushion & 13 Tray into 1 Box , sealing box with type "H" . 2 Cushion/Box ; 12 MDL/Box	Put 12 Outer Box on Pallet,2x2x3. 12 Outer Box/Pallet	Put 8 Paper Corner , belt pack with total 4 line , 3 layers stretch film wind 5 surface , paste Label. 144 FOG/Pallet
 Step 4	 Step 5	 Step 6

6.1 Packing Note(产品形态：LCM)

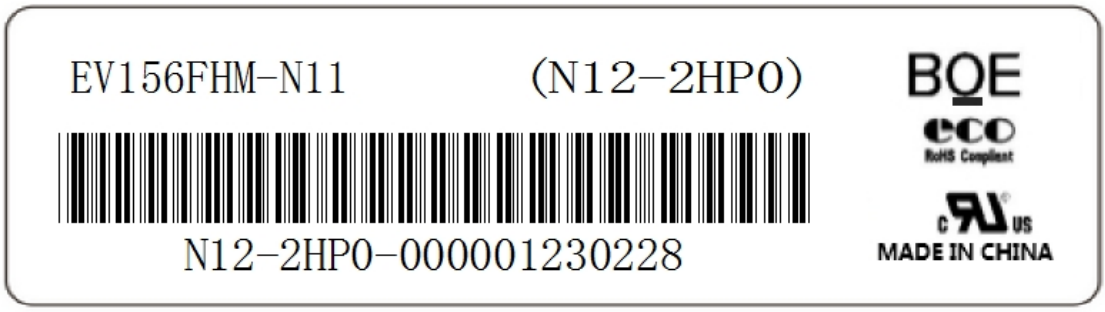
- Box Dimension: 496mm(W) x 396mm(D) x 290mm(H)
- Package Quantity in one Box: 12pcs

6.2 Box label (产品形态：LCM)

- Contents
  Model : LCM
  Q`ty : 12pcs/Box
  Serial No. : Box Serial No. as shown below.
  Date : Packing Date
  FG Code : FG Code of Product



7.0 Product Label



8.0 Handling & Cautions

Please pay attention to the followings when you use this TFT LCD Module.

8.1 Mounting Precautions

- Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- You must mount a module using specified mounting holes (Details refer to the drawings).
- You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress)is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- Do not apply mechanical stress or static pressure on module; Abnormal display cause by pressing some parts of module during assembly process , do not belong to product failure, the press should be agreed by two sides.
- Determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Do not apply mechanical stress or static pressure on module , and avoid impact, vibration and falling.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Protection film for polarizer on the module should be slowly peeled off before display.
- Be careful to prevent water & chemicals contact the module surface.
- You should adopt radiation structure to satisfy the temperature specification.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.

  Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)

- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane & alcohol is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene , because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- This module has its circuitry PCB' s on the rear side and Driver IC, should be handled carefully in order not to be stressed.
- Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package & wire.
- Do not disassemble the module.

8.2 Operating Precautions

- Do not connector or disconnect the cable to/from the Module at the "Power On" Condition.
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the module would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- Do not allow to adjust the adjustable resistance or switch.
- The electrochemical reaction caused by DC voltage will lead to LCD module degradation, so DC drive should be avoided.
- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipment to protect against static electricity.
- Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

- The cables should be as short as possible between System Board and PCB interface.
- Connectors are precision devices to transmit electrical signals, and operators should plug in parallel.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

8.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc.
- Do not close to static electricity to avoid product damage.
- Do not touch interface pin directly.

8.4 Precautions for Strong Light Exposure

- Do not leave the module operation or storage in Strong light . Strong light exposure causes degradation of polarizer and color filter.

8.5 Precautions for Storage

A. Atmosphere Requirement

ITEM	UNIT	MIN	MAX
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	40	75
Storage Life	6 months		
Storage Condition	• The storage room should be equipped with a dark and good ventilation facility. • Prevent products from being exposed to the direct sunlight, moisture and water. • The product need to keep away from organic solvent and corrosive gas. • Be careful for condensation at sudden temperature change. • Storage condition is guaranteed under packing conditions.		

B. Package Requirement

- The product should be placed in a sealed polythene bag.
- Product Should be placed on the pallet, Which is away from the floor, Be cautions not to pile the product up.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
- As the original protective film, do not use the adhesive protective film to avoid change of Pol color and characteristic.

8.6 Precautions for protection film

- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- People who peeled off the protection film should wear anti-static strap and grounded well.

8.7 Appropriate Condition for Commercial Display

-Generally large-sized LCD modules are designed for consumer applications . Accordingly, long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize module's lifetime and function, several operating usages are required.

1. Normal operating condition
   - Temperature: 20±15℃
   - Operating Ambient Humidity : 55±20%
   - Display pattern: dynamic pattern (Real display)
   - Well-ventilated place is recommended to set up Commercial Display system
2. Special operating condition

   a. Ambient condition

   - Well-ventilated place is recommended to set up Commercial Display system.

   b. Power and screen save

   - Periodical power-off or screen save is needed after long-term display.

   c. As the low temperature, the response time is greatly delayed. As the high temperatures (higher than the operating temperature) the LCD module may turn black screen. The above phenomenon cannot explain the failure of the display. When the temperature returns to the normal operating temperature, the LCD module will return to normal display.

   d. When expose to drastic fluctuation of temperature (hot to cold or cold to hot ）,the LCD module may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD module ‘s surface which may affect the operation of the polarizer and LCD module .

   e. Do not exceed the absolute maximum rating value. (supply voltage variation, input v oltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.

   f. Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions such as high temperature, high humidity, high altitude, special display images, running time, long time operation, outdoor operation, etc. It is strongly recommended to contact BOE for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

3. Operating usages to protect against image sticking due to long-term static display.
   a. Suitable operating time: under 20 hours a day.
   b. Static information display recommended to use with moving image.
   - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
   c. Background and character (image) color change
   - Use different colors for background and character, respectively.
   - Change colors themselves periodically.
   d. Avoid combination of background and character with large different luminance.
   1) Abnormal condition just means conditions except normal condition.
   2) Black image or moving image is strongly recommended as a screen save
4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.

8.8 Other Precautions

A. LC Leak

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- 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.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

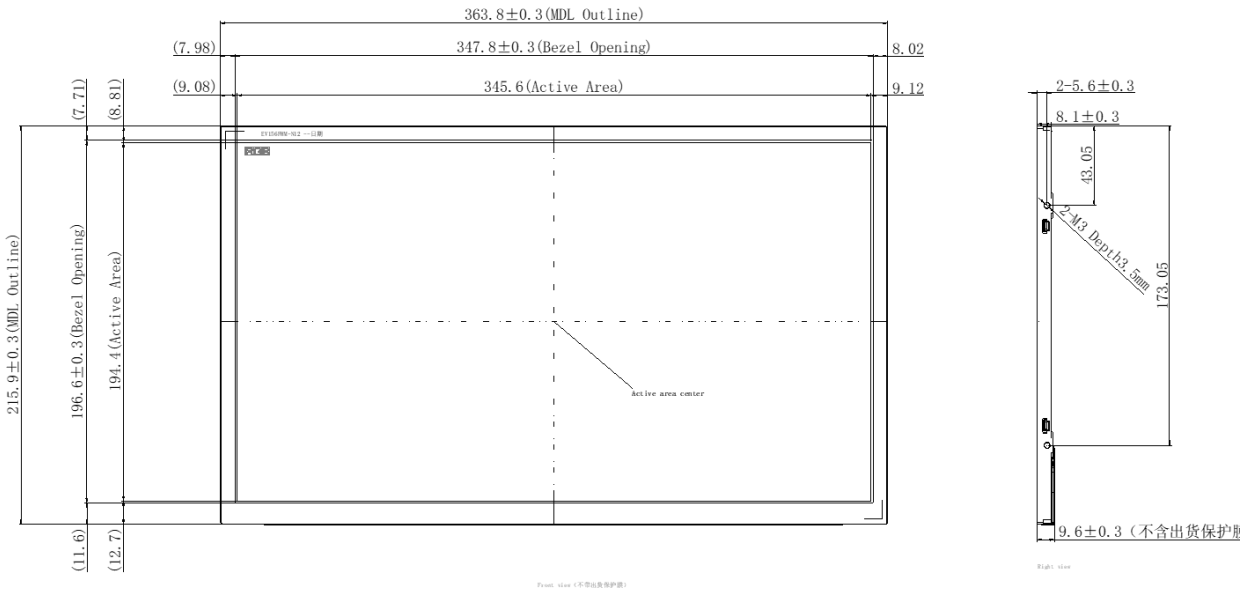
B. Rework

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

9.0 APPENDIX

Mechanical Drawing

Drawing Attachment: Landscape Front View



Mechanical Drawing

Drawing Attachment: Landscape Back View