BOE

SPEC. NUMBER	PRODUCT GROUP	REV.	ISSUE DATE	PAGE
S8-*	TFT- LCD	P0	2020-11-10	1 OF 32

B3 EV190WPM-N10 Product Specification Rev.P0

BUYER	
SUPPLIER	HEFEI BOE Optoelectronics Technology CO., LTD
FG-Code	EV190WPM-N10-39K0

ITEM	BUYER SIGNATURE	DATE

ITEM	SUPPLIER SIGNATURE	DATE
Prepared	张晓磊	2020.11.10
Reviewed	王盛 王贺陶	
Approved	李乘揆 布占场	

PRODUCT GROUP	REV	ISSUE DATE	BOE
TFT- LCD PRODUCT	P0	2020-11-10	

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REVISION HISTORY

(√)preliminary specification
( )Final specification

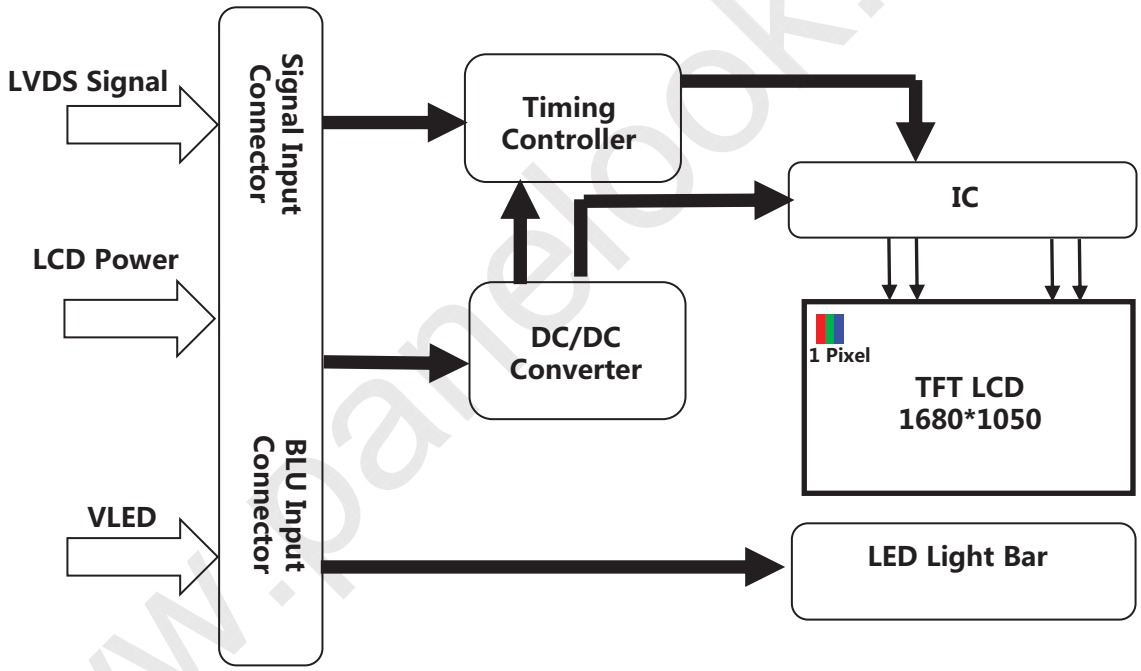
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		Initial Release	2020-11-10	张晓磊
P1		更新LVDS timing	2021-01-15	姜晓宁

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

EV190WPM-N10 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 19 inch diagonally measured active area with WSXGA resolutions (1680 horizontal by 1050 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

- 0.5T Glass (Single)
- Normal Type
- 8bits LVDS data input
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS compliant

1.3 Application

- Monitoring

1.4 General Specification

The followings are general specifications at the EV190WPM-N10

<Table 1. LCD Module Specifications>

Parameter	Specification	Unit	Remarks
Active Area	409.5*255.9375	mm	
Number Of Pixels	1680*RGB*1050	pixels	
Pixel Pitch	81.25*243.75	um	
Pixel Arrangement	Transmissive		
Display Mode	HADS		
Display Colors	16.7M	colors	8bit
Surface Treatment	AG25		
Contrast Ratio	1000:1		Typ
Viewing Angle(CR>10)	89/89/89/89	deg.	Typ
Response Time	25	ms	Typ
Color Gamut	73%		NTSC
Brightness	350	cd/m2	Typ.
Brightness Uniformity	75%		Min.
Power Consumption	TBD	watt	
Outline Dimension	444mm*283.3mm*15.5mm	mm	typ
Weight	1650g	gram	max
Display Orientation	Landscape Only		

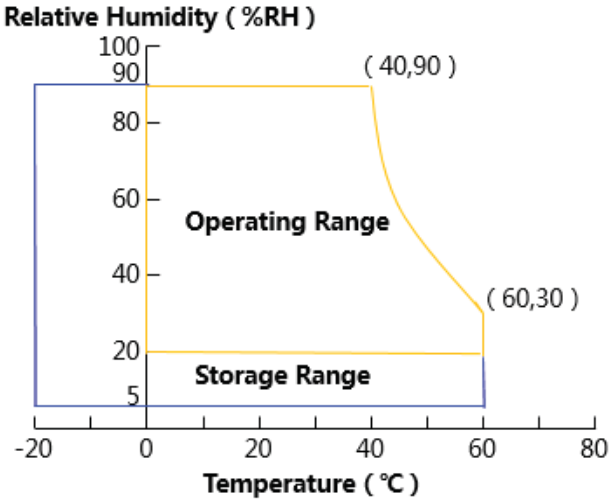
2.0 ABSOLUTE MAXIMUM RATINGS

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	18	V	Ta = 25 ℃
	BLU	V_{LED}	-	24	V	
Operating Temperature		T_{OP}	0	+60	℃	Note 1
Storage Temperature		T_{ST}	-20	+60	℃	

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

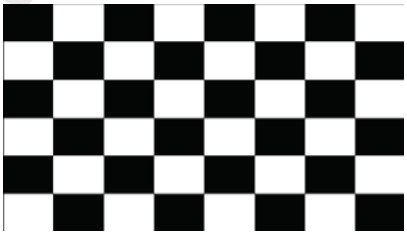
3.1 TFT LCD Module

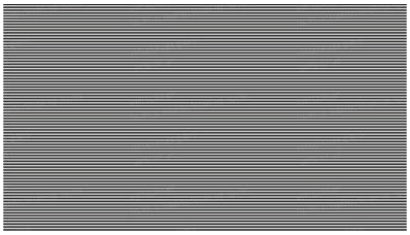
[Ta =25±2 ℃]

< Table 3. LCD Module Electrical specifications >

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	VDD	10.8	12	13.2	V	Note 1
Power Supply Current	IDD	-	330	660	mA	
Rush current	IRUSH	-	-	2.5	A	Note 2
BLU Supply Voltage	V_{LED}	8	12	21	V	
BLU Supply Current	I_{LED}	-	1.1	-	A	
Power Consumption	P_D	-	4	8	W	Note 1
	P_{LED}	-	13.2	-	W	
	P_{total}	-	17.2	-	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 VDD=12V, Frame rate f_V=60Hz and Clock frequency = 156.8MHz. Test Pattern of power supply current
a) Typ : Mosaic 7 x 5 Pattern(L0/L255) b) Max : H 1 line





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			Min.	Typ.	Max.	Unit	Remarks
LED Forward Voltage		V_F		3.0	3.2	V	
LED Forward Current		I_F	-	90	-	mA	-
LED Power Input Voltage		V_{LED}	8	12	21	V	
LED Power Input Current		I_{LED}	-	1.13	-	A	
LED Power Consumption		PLED	-	13.56	-	Watt	
LED Power Supply for LED driver Inrush		I_{RUSH}	-	-	TBD	A	
EN Control Level	Backlight on		2	-	3.3	V	
	Backlight off		0	-	0.8	V	
PWM Control Level	PWM High Level		2	-	3.3	V	
	PWM Low Level		0	-	0.8	V	
PWM Control Frequency		F_{PWM}	120	-	1000	Hz	
Duty Ratio		-	1	-	100	%	Note1
LED Quantity		QLED	-	40	-	EA	
LED Life Time		TLED	30000	-	-	Hrs	Note 2/3

Notes: 1. Power supply voltage 12V for LED driver.

Calculator value for reference V_F*I_F* 40/driver efficiency=PLED

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°C.

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

3.3 INPUT TERMINAL PIN ASSIGNMENT

This LCD employs two interface connections, a 30 pin connector is used for the LCD module electronics interface and a 10 pin connector is used for the backlight system.

3.3.1 Pin assignment for LCD module

Connector : IS100-L30O-C23(UJU)or equivalent

< Table5. Pin Assignment for LCD Module Connector >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	17	GND	Power Ground
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	20	RXEC-	Negative Transmission Clock (EVEN)
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	21	RXEC+	Positive Transmission Clock (EVEN)
7	GND	Power Ground	22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)
8	RXOC-	Negative Transmission Clock (ODD)	23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)
9	RXOC+	Positive Transmission Clock (ODD)	24	GND	Power Ground
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	25	SCL	CTL_DVR for LCD manufacturer
11	RXO3+	PositiveTransmission data of Pixel 3 (ODD)	26	SDA	CE_DVR for LCD manufacturer
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	27	NC	Not connection
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	28	VDD	Power Supply : +12V
14	GND	Power Ground	29	VDD	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	30	VDD	

3.3.2 Pin assignment for BLU

Connector : SM10B-SHLS-TF (J.S.T.)or equivalent

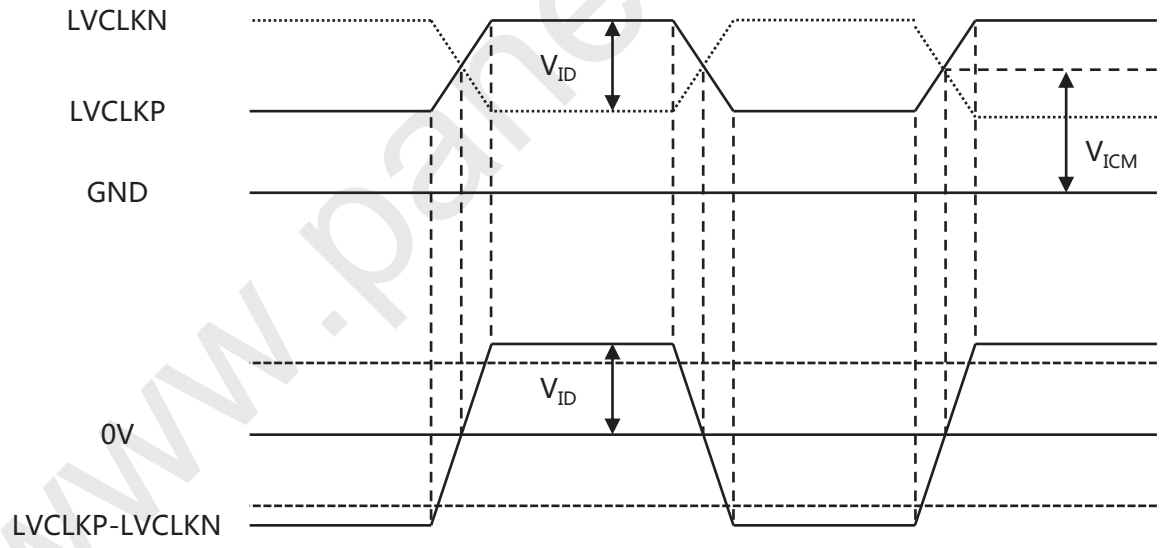
< Table6. Pin assignment for BLU>

Pin No	Symbol	Description	Remarks
1	VLED	+12V Power supply	
2	VLED	+12V Power supply	
3	VLED	+12V Power supply	
4	VLED	+12V Power supply	
5	GND	GND	
6	GND	GND	
7	GND	GND	
8	GND	GND	
9	BL_EN	ON/OFF Control single for backlight	
10	PWM	PWM single for backlight dimming	

3.4 LVDS DC Electrical Specification

< Table7. LVDS DC Specification >

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VTH	Differential input High Threshold	VICM=1200	-	-	+100	mV
V_{TL}	Differential input Low Threshold	VICM=1200	-100	-	-	mV
|VID|	Input Differential Voltage		±100	±350	±600	mV
RTERM	Termination resister @ 100ohm Resistor		-	100	-	ohm
IIHL	Input current in power down mode		-40	-	+40	uA
VICM	Differential input Common Mode Voltage	LRHVDD=3.3V		1.2		V

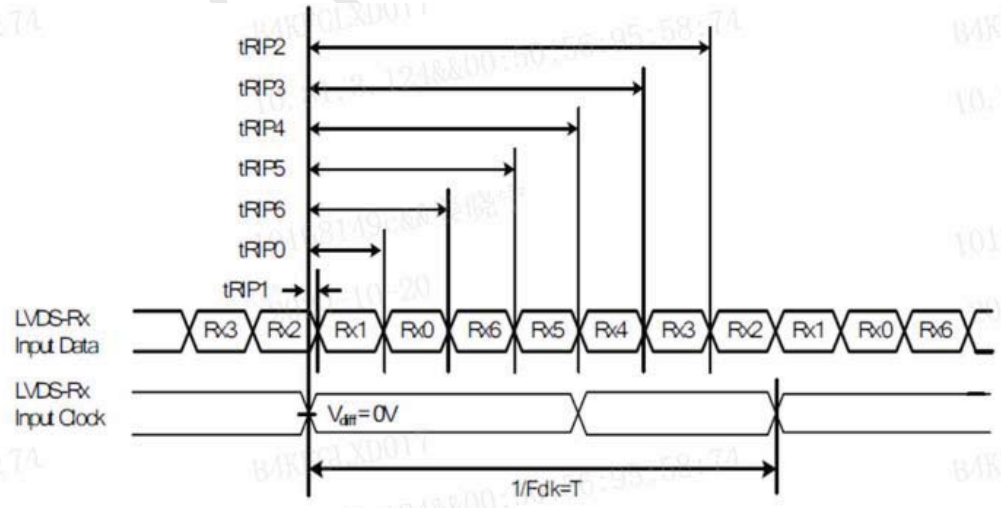


< LVDS V_{ID} and V_{ICM} definition>

3.5 LVDS AC Electrical Specification

Symbol	Parameter	Min	Typ	Max	Unit
fCLKIN	Input clock frequency	40		100	MHz
tRCP	CLKORP1 Period	10		25	ns
tRCH	CLKORP1 High time	0.45T	0.5T	0.55T	TCK
tRCL	CLKORP1 Low time	0.45T	0.5T	0.55T	TCK
tRMG	Receiver Data Input Margin FCLKIN = 100MHz FCLKIN = 85MHZ FCLKIN = 65MHZ	 -0.30 -0.45 -0.60		 0.30 0.45 0.60	ns
tRIP 1	Input data Position1	-|tRMG|	0.0	+|tRMG|	Clock
tRIP 0	Input data Position0	T/7-|tRMG|	T/7	T/7+|tRMG|	Clock
tRIP 2	Input data Position2	6T/7-|tRMG|	6T/7	6T/7+|tRMG|	Clock
tRIP 3	Input data Position3	5T/7-|tRMG|	5T/7	5T/7+|tRMG|	Clock
tRIP 4	Input data Position4	4T/7-|tRMG|	4T/7	4T/7+|tRMG|	Clock
tRIP 5	Input data Position5	3T/7-|tRMG|	3T/7	3T/7+|tRMG|	Clock
tRIP 6	Input data Position6	2T/7-|tRMG|	2T/7	2T/7+|tRMG|	Clock
tRPLL	Phase Locked Loop set time			300	us

LVDS Receiver AC Electrical Characteristics

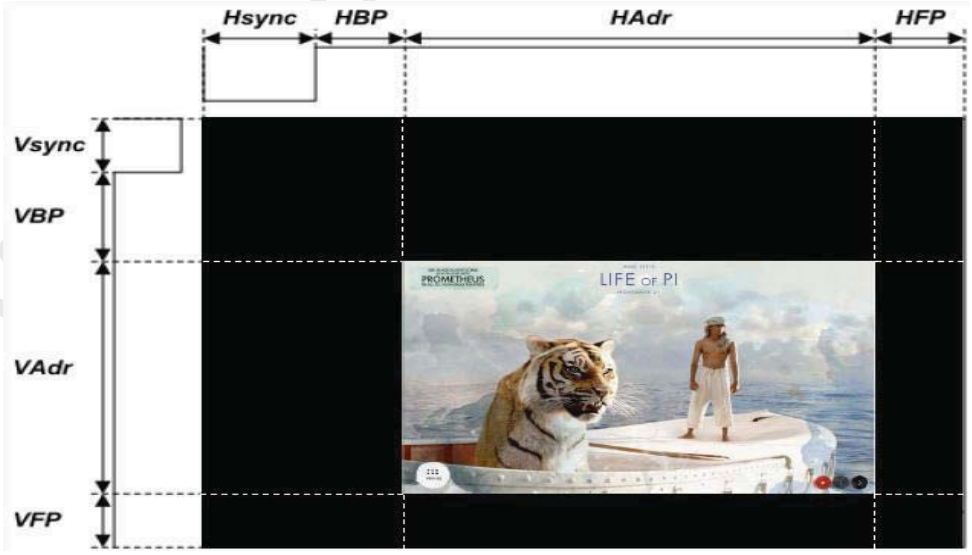


LVDS RX data Margin

3.6 Interface timing Parameter

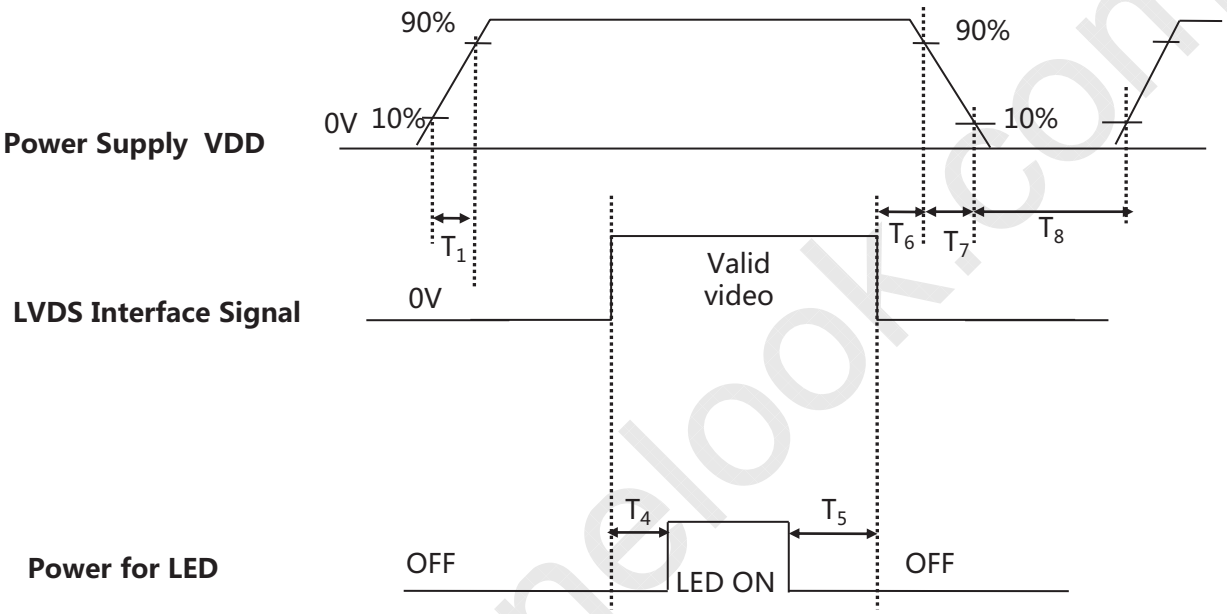
< Table9. Timing Parameter >

Item			Symbol	min	typ	max	UNIT
LCD	Frame Rate		-	-	60	-	Hz
	Pixels Rate		-	-	61.56	82.5	MHz
Timing	Horizontal	Horizontal total time	tHP	920	950	980	t_{CLK}
		Horizontal Active time	tHadr	840			t_{CLK}
	Vertical	Vertical total time	tvp	1060	1080	1100	t_H
		Vertical Active time	tVadr	1050			t_H
port				-	2	-	port



3.7 Power Sequence

[Ta =25±2 ℃]



< Table10. Sequence Table >

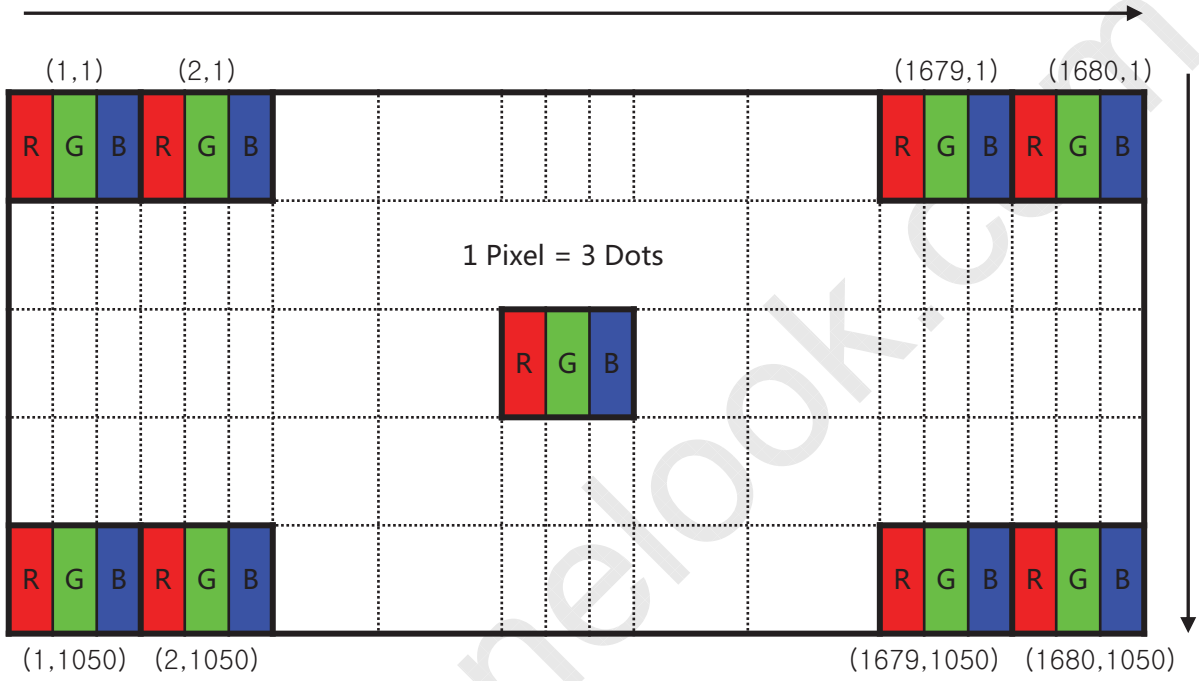
Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.1	-	5	(ms)
T4	200	-	-	(ms)
T5	200	-	-	(ms)
T6	0	-	50	(ms)
T7	0	-	10	(ms)
T8	500	-	-	(ms)

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

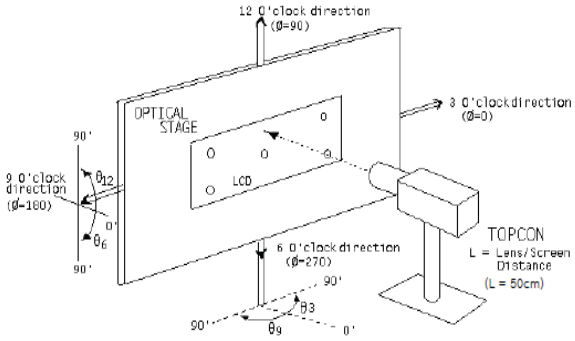
< Table11. Optical Table >

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
luminance	Bp	θ=0°	280	350	--	cd/m2	Note 1
Brightness Uniformity	▵Bp		75	--	--	%	Note 2
Viewing Angle	θL	Cr≥10	--	89	--	deg	Note 3
	θ_R		--	89	--		
	ψ_T		--	89	--		
	ψ_B		--	89	--		
Contrast Ratio	Cr	θ=0° FF=0°	800	1000	--	-	Note 4
Response Time	Tr+Tf		-	25	30	ms	Note 5
Color Coordinate of CIE1931	Rx	θ=0°	TBD	TBD	TBD	-	Note 6
	Ry		TBD	TBD	TBD		
	Gx		TBD	TBD	TBD		
	Gy		TBD	TBD	TBD		
	Bx		TBD	TBD	TBD		
	By		TBD	TBD	TBD		
	Wx		0.280	0.310	0.340		
	Wy		0.296	0.326	0.356		
NTSC Ratio	NTSC	CIE1931	70	73	--	%	Note 7

Note1:Luminance measurement

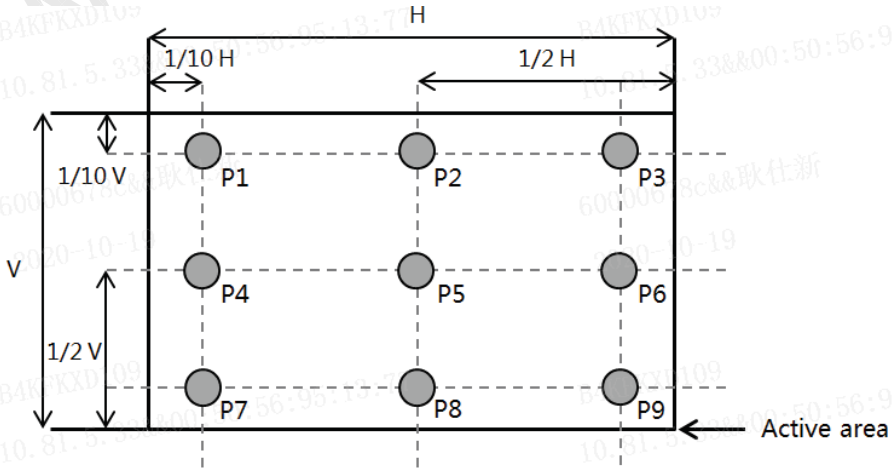
The test condition is at ILED=360mA and measured on the surface of LCD module at 25℃.

- 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.

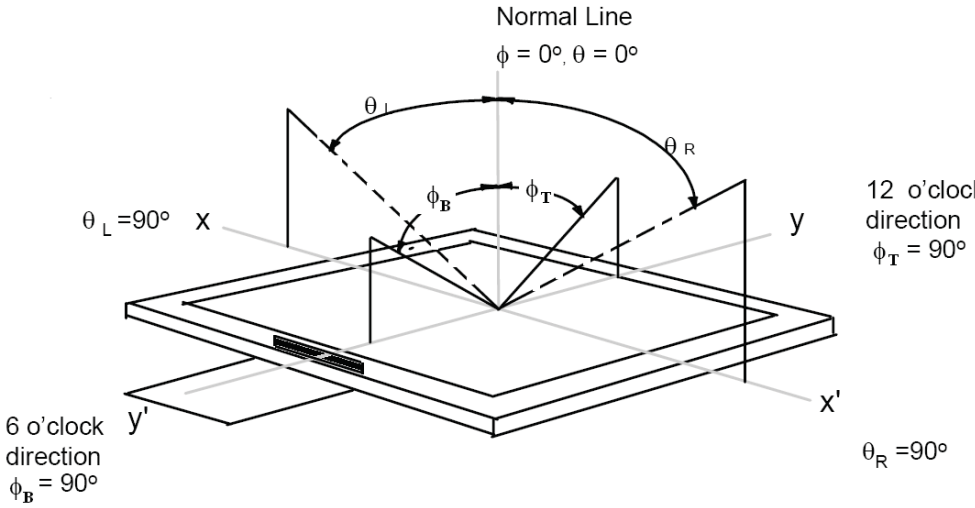


Note2:Uniformity

- The test condition is at ILED=360mA 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.

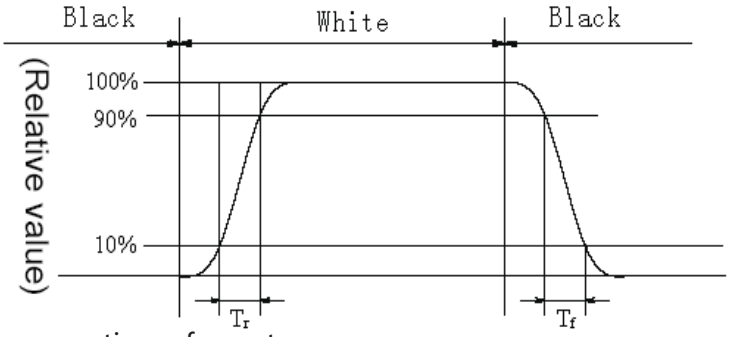


Note4:ThedefinitionofContrastRatio (Test LCM using CS2000 or similar equipments):

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

(Contrast Ratio is measured in optimum common electrode voltage)

Note5:DefinitionofResponse time.(Test LCD using DMS501 or similar equipments):
The output sign also photo detector are measured when the input sign also are changed from "black" to "white" (Voltage falling time)and from "white" to "black" (Voltage rising time), respectively . The response time is defined as the time interval between the 10% and 90% of amplitudes . Refer to figures below.



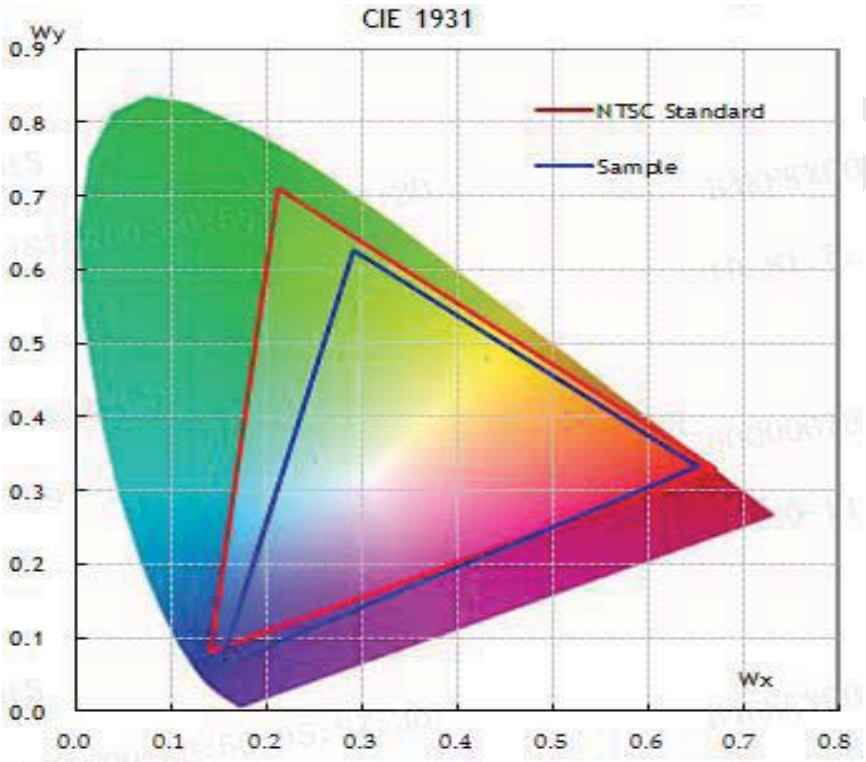
	L0	L1	L2	L3	L4	L5	L6	L7
L0	■							
L1		■						
L2			■					
L3				■				
L4					■			
L5						■		
L6							■	
L7								■

Response time of gray to gray:
Measurement equipment: DMS501 or similar equipments.
Test method: we define 8 grays L0-L7,the grays of L0-L7 were defined as:0,36,73, 109, 146, 182, 219, 255. Theoutputsignalsofphotodetectoraremeasuredwhentheinputsignalsarechanged from "Lx" to "Ly", x, y= [0, 7]. The response time is defined as the time interval between the 10% and 90% of amplitudes. The result of the test can be noted as below:

Note 6: Color Coordinates of CIE 1931
The test condition is at ILED=360mA 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 7: Definition of Color of CIE Coordinate and NTSC Ratio.

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



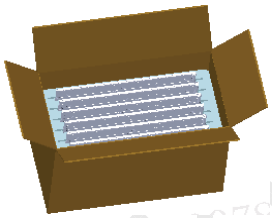
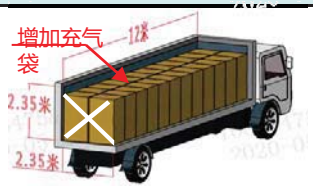
5.0 RELIABLITY TEST

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

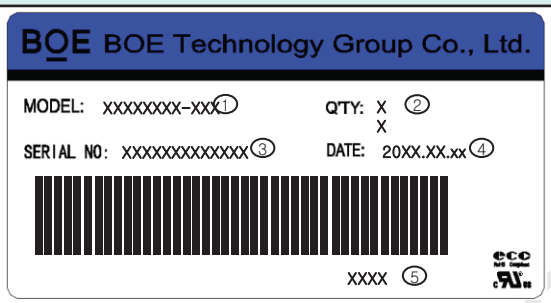
<Table 12. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature & high humidity (storage test)	60℃，90%RH，240hr
2	High temperature storage test	60℃，240hr
3	Low temperature storage test	-20℃，240hr
4	High temperature & high humidity (operation test)	50℃，80%RH，240hr
5	Low temperature operation test	0℃，240hr
6	High temperature operation test	60℃，240hr
7	Thermal Shock Test	-20℃~60℃，1hr/cycle，100cycle
8	ESD	150pF，330Ω，±8kV(Contact)，±15kV（Air） Class B：允许可以自动恢复的偶发性息屏或功能异常
9	Packing VIB	1.47G，1-200hz，Random，X，Y，±Z，30min/Axis

6.0 PACKING INFORMATION(产品形态： LCM)

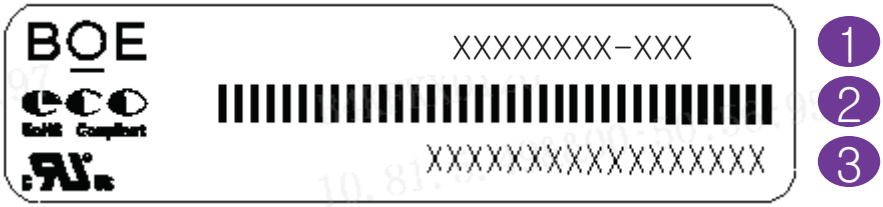
将 EPE Bottom 放入纸箱内	将LCM装入PE袋中，并沿产品边缘折叠，再将8pcs套有PE袋的LCM（PCB朝上）依次放入Bottom对应的卡槽内	将 EPE Cover 盖在 Bottom 上，再将纸箱用胶带封装 容量：8pcs LCM/Box， 8 pcs PE Bag/Box
 Step 1	 Step 2	 Step 3
将16ea 封装好的纸箱放到木托上，回字形排布 容量：128 LCM/Pallet	放置8ea纸护角，用缠绕裹包（≥3层）再用打包带“井”字形固定	厢车装载方式：两横摆放，单层码放 厢车装载量_12m： 2816pcs（22托）
 Step 4	 Step 5	 Step 6

6.2 Box label (产品形态：LCM)

Item	Box Label
Picture	
代号 说明	序列号标注部分需打印, 说明如下： 1. FG-CODE(前12位)：EV190WPM-N10 2. 产品数量：8 3. Box ID 4. 包装日期 5. FG-Code后四位：39K0 Total Size:110×55mm
编码 规则	

Digit	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	S	L	S	5	1	2	3	D	0	0	0	6	8
Description	Products/GBN		Grade	Line	Year		Month	Revision Code	Serial Number				

7.0 Product Label



Label Size: 48mmx12mmx0.08mm,
1. FG-CODE: EV190WPM-N10
2. MDL ID bar code
3. MDL ID

BOE MDL ID rule

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	X	X	X	3	X	X	X	3	9	K	0	X	X	X	X	X	X
	GBN		Grade	B3	Year	Month	Day	FG Code last four digits				Serial number					

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.

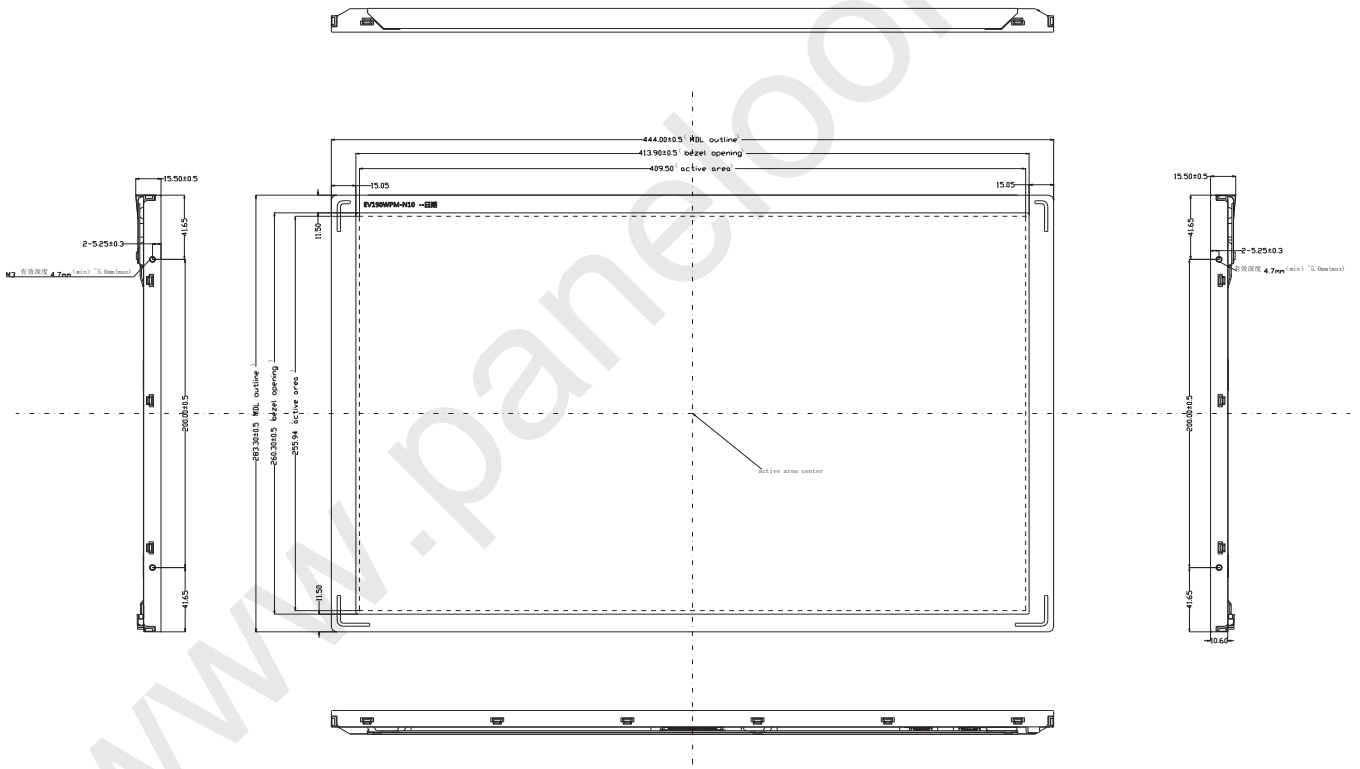
B. Rework

- 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

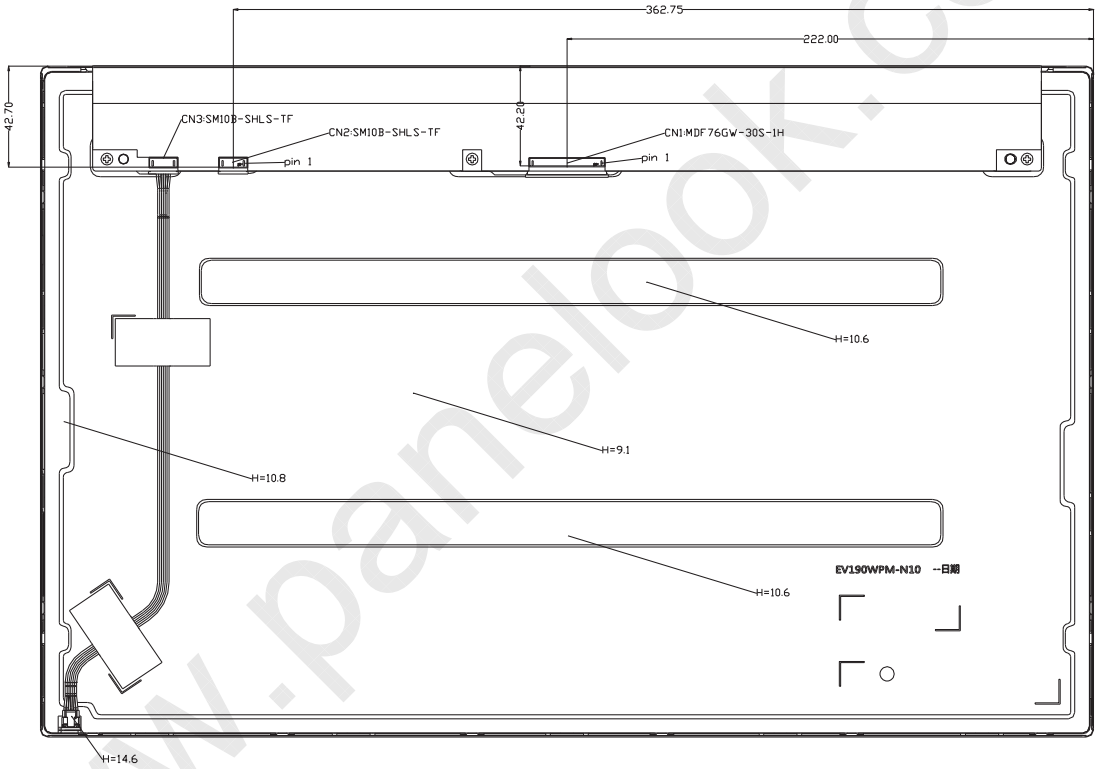
Mechanical Drawing

Drawing Attachment: Landscape Front View



Mechanical Drawing

Drawing Attachment: Landscape Back View



NOTE

1. General tolerance is ±0.5mm
2. CNT1:MDF76GW-30S-1H
   CNT2:SM10B-SHLS-TF