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BOE

SPEC. NUMBER	PRODUCT GROUP	REV.	ISSUE DATE	PAGE
S8-*	TFT- LCD	P0	2018-03-22	1 OF 31

B3 ET104S0M-N11 Product Specification Rev.P0

BUYER	
SUPPLIER	HEFEI BOE Optoelectronics Technology CO., LTD
FG-Code	ET104S0M-N11-3850

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Prepared		
Reviewed		
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HEFEI BOE OPTOELECTRONICS TECHNOLOGY

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PRODUCT GROUP	REV	ISSUE DATE	BOE
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SPEC. NUMBER	SPEC . TITLE	PAGE
S8-*	B3 ET104S0M-N11 Product Specification	2 OF 31

REVISION HISTORY

REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		Initial Release	2019-03-22	彭金宝

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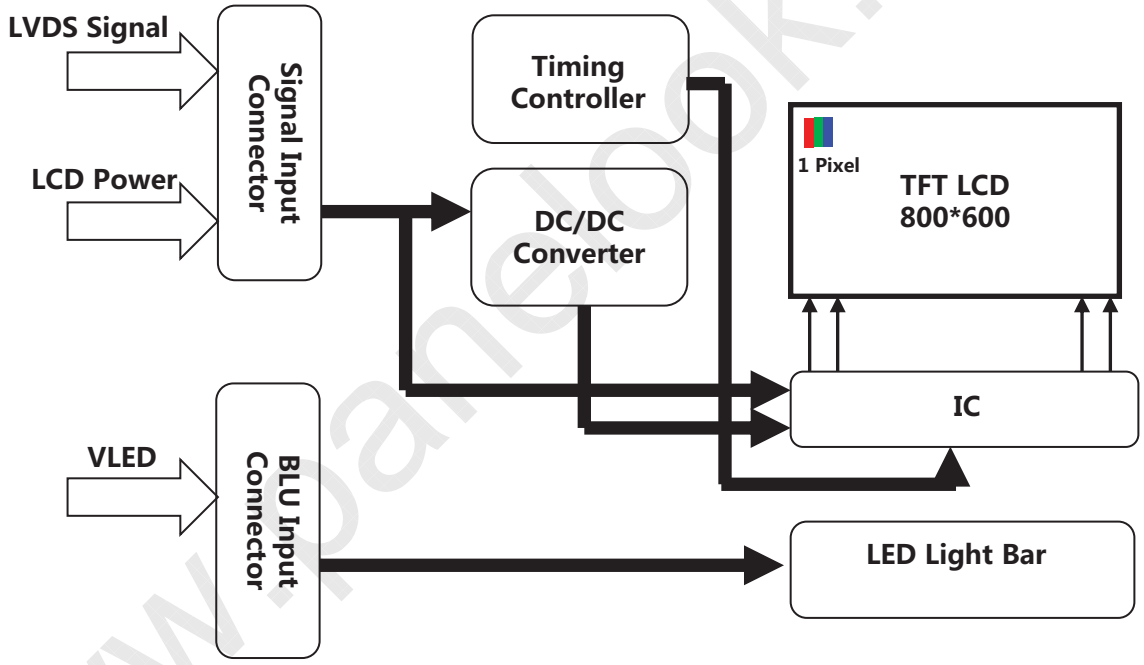
1.0 GENERAL DESCRIPTION

1.1 Introduction

ET104S0M-N11 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 10.4 inch diagonally measured active area with SVGA resolutions (800 horizontal by 600 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.2M colors.



1.2 Features

- 0.5T Glass (Single)
- Reverse Type
- 6/ 8bits LVDS data input selection
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS compliant

1.3 Application

- Medical & Industrial application

1.4 General Specification

The followings are general specifications at the ET104S0M-N11

<Table 1. LCD Module Specifications>

Parameter	Specification	Unit	Remarks
Active Area	211.2(H)*158.4(V)	mm	
Number Of Pixels	800(H)×600(V)	pixels	
Pixel Pitch	0.264(H)×RGB×0.264(V)	mm	
Pixel Arrangement	Pixels RGB stripe arrangement		
Display Mode	Normally White		
Display Colors	16.2M	colors	6+FRC
Surface Treatment	AG25 (CF) , Clear (TFT)		
Contrast Ratio	800:1(typ.)		
Viewing Angle(CR>10)	80/80/65/75(typ.)	deg.	
Response Time	30(typ.)	ms	
Color Gamut	55%		
Brightness	300(min)/350(typ.)	cd/m2	
Brightness Uniformity	9 point: min 70% 9 point: typ. 80%		
Power Consumption	LCD: 0.59(Max.)(Black Pattern) BLU: 1.98W(Max.)	watt	
Outline Dimension	236(H)*176.9(V)*5.6(typ)(LCM)	mm	
Weight	300(Max.)	gram	
Display Orientation	Landscape Only		

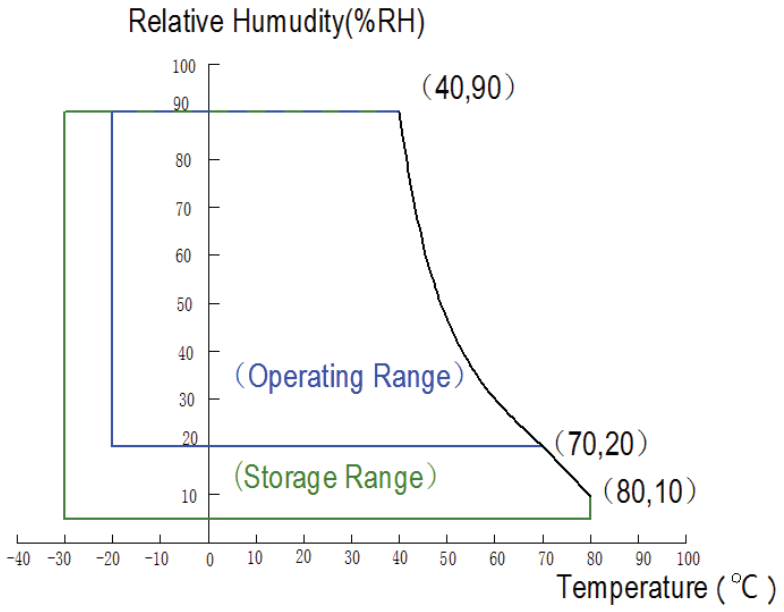
2.0 ABSOLUTE MAXIMUM RATINGS

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	3.9	V	Ta = 25 ℃
	BLU	V_{LED}	-	19.8	V	
		I_{LED}	-	100	mA	
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

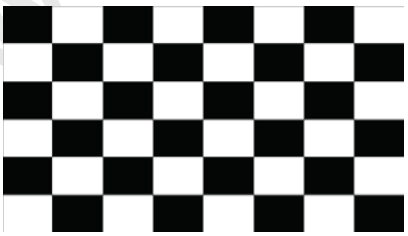
3.1 TFT LCD Module

[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	120	150	180	mA	
BLU Supply Voltage	V_{LED}	-	19.2	19.8	V	
BLU Supply Current	I_{LED}	-	100	-	mA	
Power Consumption	P_D	0.4	0.495	0.59	W	Note 2
	P_{LED}	-	-	1.98	W	
	P_{total}	-	-	2.57	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 = 156.8MHz. Test Pattern of power supply current
a) Typ : Mosaic 8 x 6 Pattern(L0/L255) b) Max : Black



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}	-	19.2	19.8	V	
LED Supply Current	I_{LED}	-	100	-	mA	Note 1
Power Consumption	P_{LED}	-	1.92	1.98	W	
LED Quantity	QLED	-	24	-	EA	
LED Life Time	TLED	30000	-	-	Hrs	Note 2/3

Notes: 1. LED Bar:4Parallel*6String) , I_{LED}=25mA*4=100mA

$P_{LED} = V_{LED} \times I_{LED}$(Without LED converter 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°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 20 pin connector is used for the LCD module electronics interface and a 2 pin connector is used for the backlight system.

3.3.1 Pin assignment for LCD module

Connector : MSB24013P20 _HA(STM) or equivalent

< Table5. Pin Assignment for LCD Module Connector >

Pin No.	Symbol	Description	I/O
1	VCC	Logic Power 3.3V(Panel logic)	P
2	VCC	Logic Power 3.3V(Panel logic)	P
3	GND	Ground	-
4	GND	Ground	-
5	RIN0-	LVDS receiver negative signal channel 0	I
6	RIN0+	LVDS receiver positive signal channel 0	I
7	GND	Ground	-
8	RIN1-	LVDS receiver negative signal channel 1	I
9	RIN1+	LVDS receiver positive signal channel 1	I
10	GND	Ground	-
11	RIN2-	LVDS receiver negative signal channel 2	I
12	RIN2+	LVDS receiver positive signal channel 2	I
13	GND	Ground	-
14	CLKIN-	LVDS receiver negative signal clock	I
15	CLKIN+	LVDS receiver positive signal clock	I
16	GND	Ground	-
17	RIN3-	LVDS receiver negative signal channel 3 (NC for 6bit LVDS input)	I
18	RIN3+	LVDS receiver positive signal channel 3 (NC for 6bit LVDS input)	I
19	GND	Ground	-
20	SEL68	6/8 bits LVDS data input selection[H:8bit,L/NC:6bits]	-

3.3.2 Pin assignment for LED Bar

Connector : JST BHSR-02VS-1 or equivalent

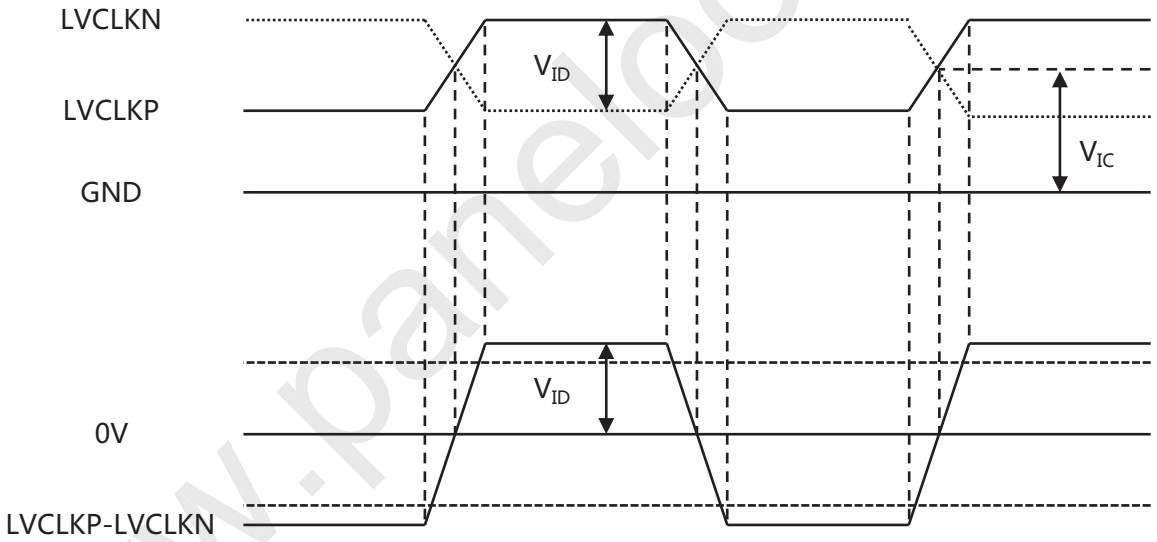
< Table6. Pin assignment for LED Bar >

Pin No	Symbol	Description	Remarks
1	VLED+	Power supply	
2	VLED-	Power supply	

3.4 DC Specification

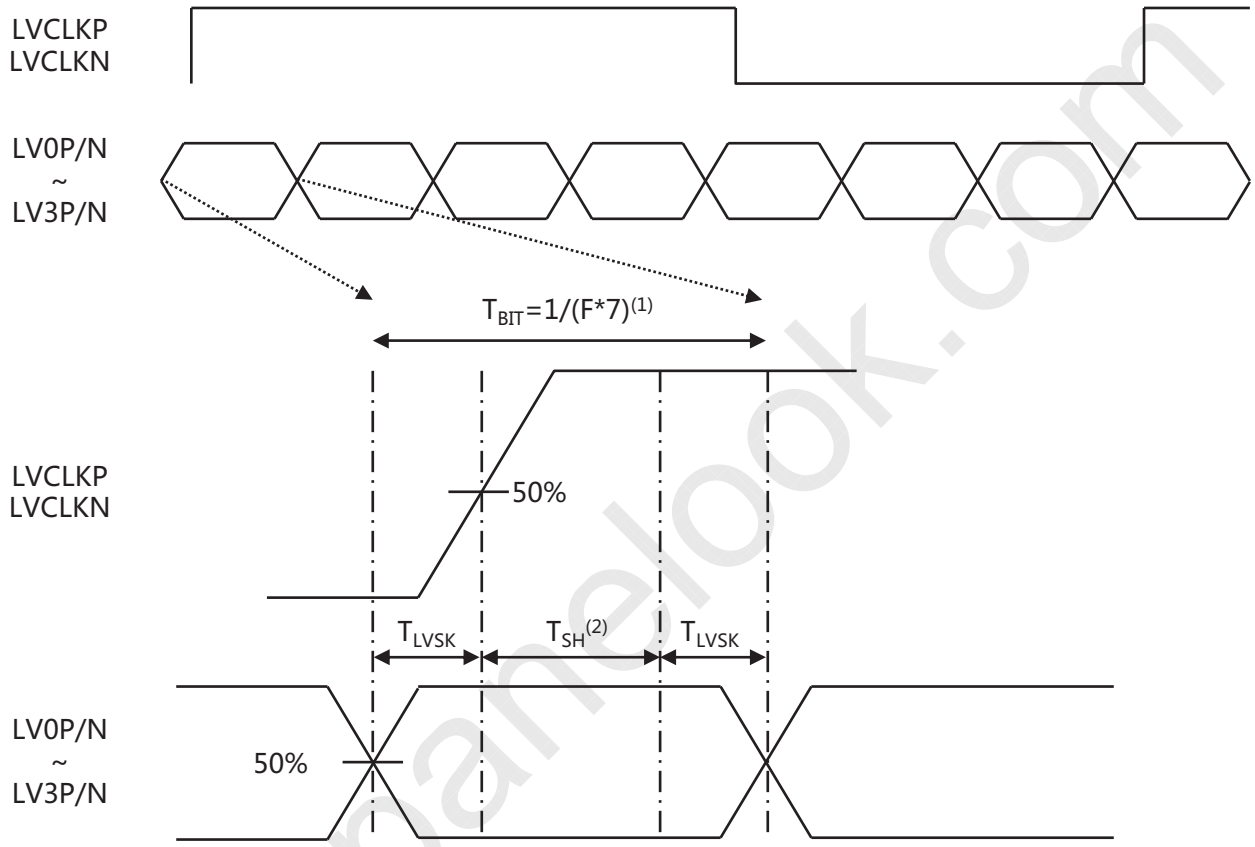
< Table7. DC Specification >

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Supply current	I_{DD}	120	150	180	mA	
LVDS DC specifications						
Differential input high threshold	V_{TH}	-	-	+100	mV	V_{IC}=1.2V
Differential input low threshold	V_{TL}	-100	-	-	mV	
LVDS common mode voltage	V_{IC}	0.7	-	1.6	V	
LVDS swing voltage	V_{ID}	±100	-	±600	mV	



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

3.5 AC Specification



Note:
(1) T_{BIT}: Data period
(2) Internal CLK sampling data window

< LVDS channel to channel skew>

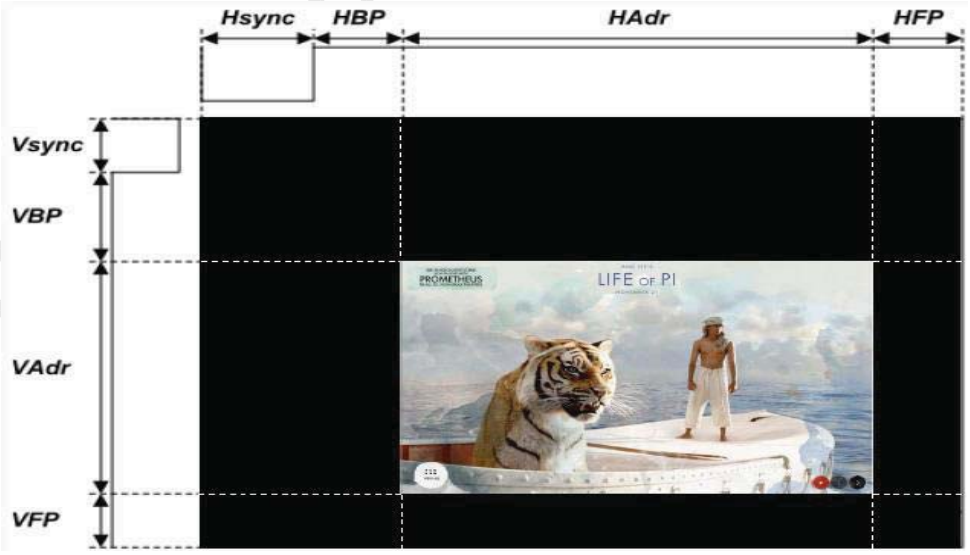
< Table8. AC Specification >

Description	Symbol	Condition	Min	Typ	Max	Unit
LVDS Input frequency	F	-	20	-	85	MHz
LVDS channel to channel skew	T_{LVSK}	F=65MHz V_{IC}=1.2V V_{ID}=±200mV	-600	-	+600	ps

3.6 Interface timing Parameter

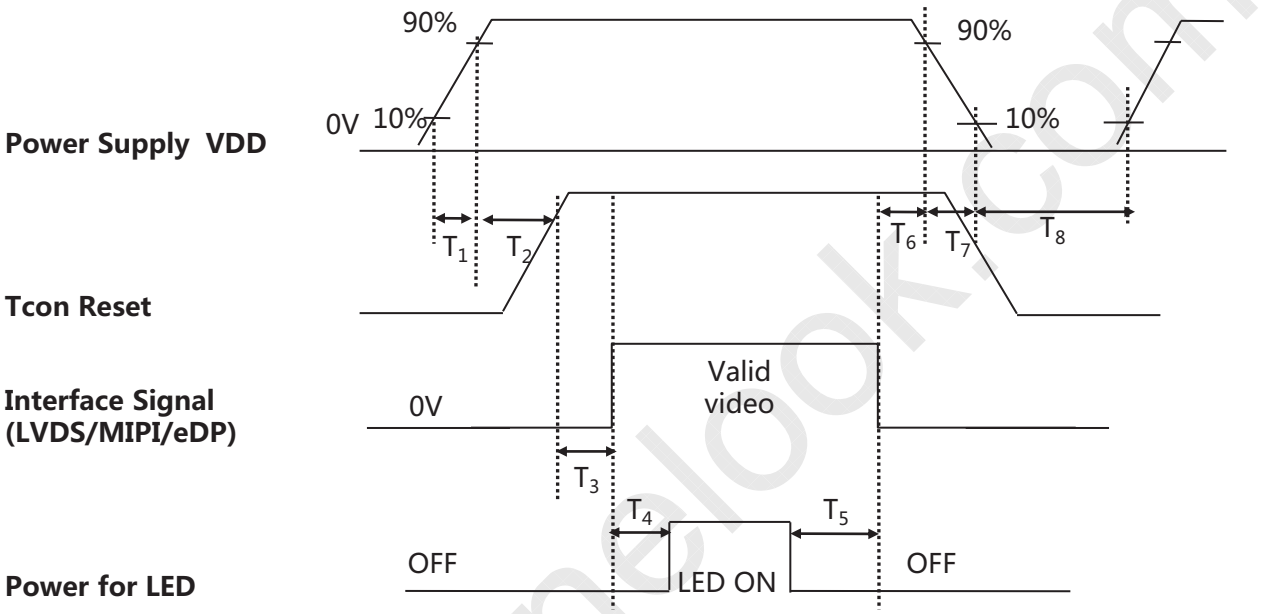
< Table9. Timing Parameter >

Item			Symbol	min	typ	max	UNIT
LCD	Frame Rate		-	-	60	-	Hz
	Pixels Rate		-	37.69	37.879	38.068	MHz
Timing	Horizontal	Horizontal total time	tHP	-	1056	-	t_{CLK}
		Horizontal Active time	tHadr		800		t_{CLK}
		Horizontal Back Porch	tHBP		88		t_{CLK}
		Horizontal Front Porch	tHFP		40		t_{CLK}
	Vertical	Vertical total time	tvp		628		t_H
		Vertical Active time	tVadr		600		t_H
		Vertical Back Porch	tVBP		23		t_H
		Vertical Front Porch	tVFP		1		t_H
Lane				-	1	-	Lane



3.7 Power Sequence

[Ta =25±2 ℃]



< Table10. Sequence Table >

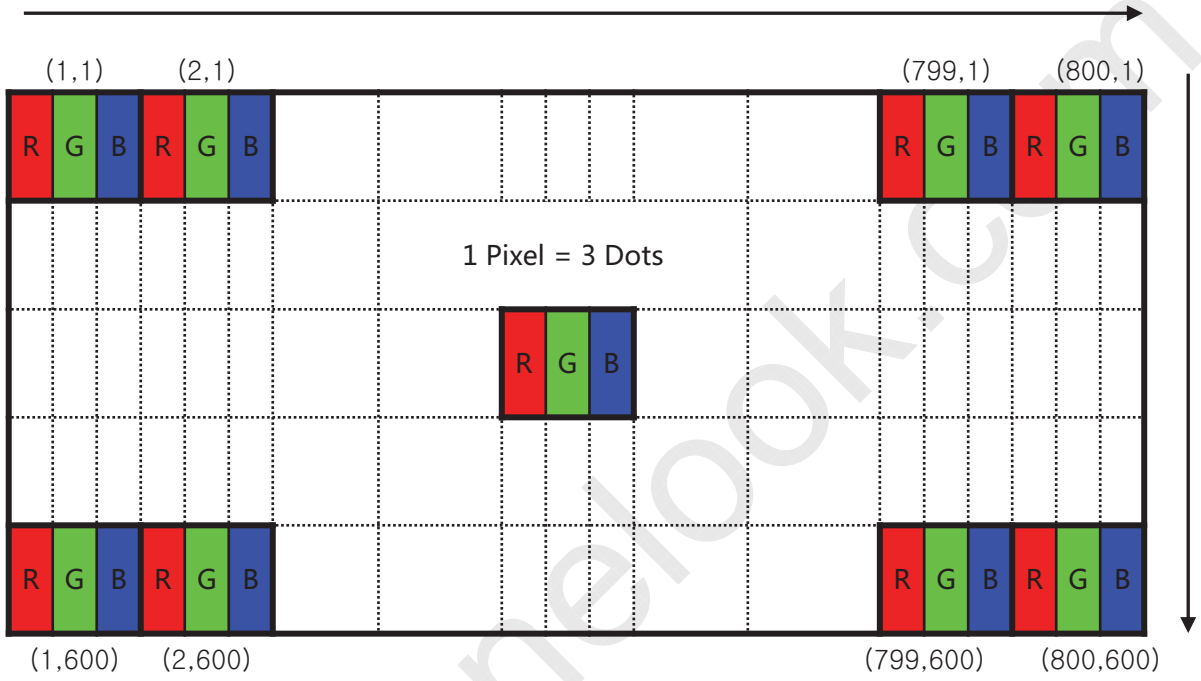
Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.1	-	5	(ms)
T2	10	-	30	(ms)
T3	5	-	100	(ms)
T4	200	-	-	(ms)
T5	200	-	-	(ms)
T6	0	-	50	(ms)
T7	0	-	10	(ms)
T8	500	-	-	(ms)

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

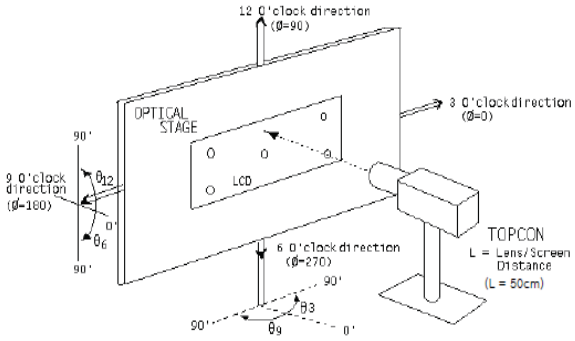
< Table11. Optical Table >

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
luminance	Bp	θ=0°	300	350	--	cd/m2	Note 1
Brightness Uniformity	▵Bp		70	80	--	%	Note 2
Viewing Angle	θL	Cr≥10	70	80	--	deg	Note 3
	θ_R		70	80	--		
	ψ_T		55	65	--		
	ψ_B		65	75	--		
Contrast Ratio	Cr	θ=0° FF=0°	600	800		-	Note 4
Response Time	Tr+Tf		-	30	35	ms	Note 5
Color Coordinate of CIE1931	Rx	θ=0°	0.574	0.604	0.634	-	Note 6
	Ry		0.296	0.326	0.356		
	Gx		0.279	0.309	0.339		
	Gy		0.548	0.578	0.608		
	Bx		0.119	0.149	0.179		
	By		0.070	0.100	0.130		
	Wx		0.254	0.284	0.314		
	Wy		0.290	0.320	0.350		
NTSC Ratio	NTSC	CIE1931	50	55	--	%	Note 7
Polarization Direction of Front Polarizer	PdF			45°		deg	Note 8
Polarization Direction of Rear Polarizer	PdR			45°		Deg	
Gray inversion angle				6点钟			Note 9

Note1:Luminance measurement

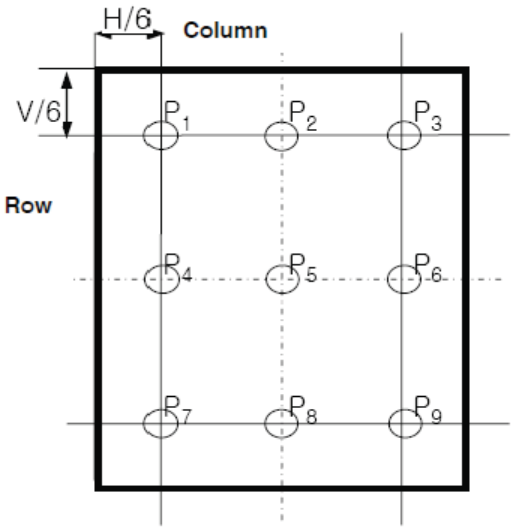
The test condition is at ILED=100mA and measured on the surface of LCD module at 25℃.

- 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.

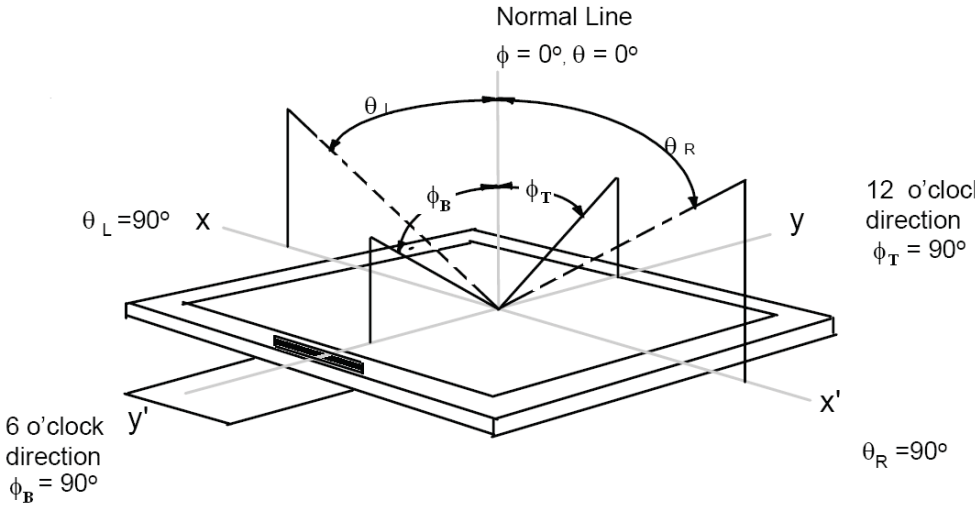


Note2:Uniformity

- The test condition is at ILED=100mA 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.

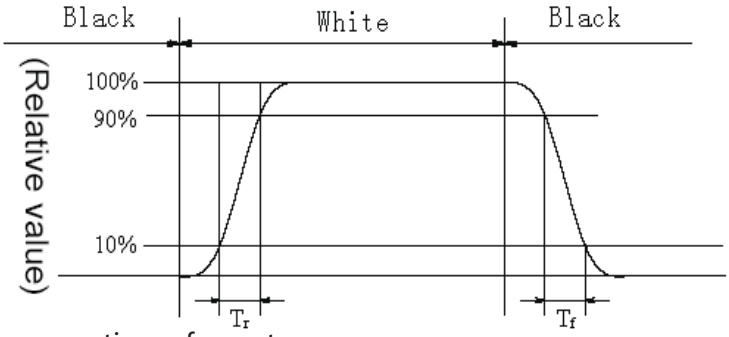


Note4:ThedefinitionofContrastRatio (Test LCM using CS2000 or similar equipments):

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

(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.



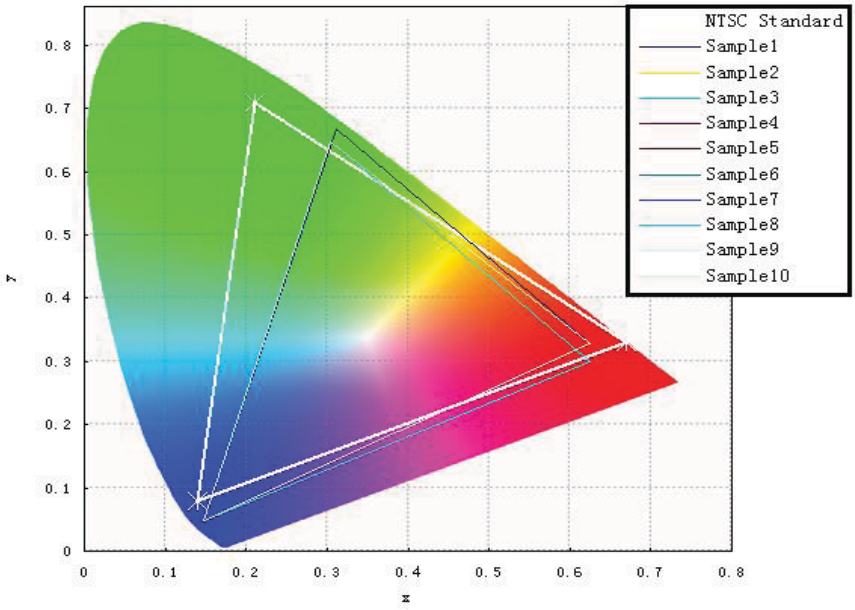
	L0	L1	L2	L3	L4	L5	L6	L7
L0	■							
L1		■						
L2			■					
L3				■				
L4					■			
L5						■		
L6							■	
L7								■

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:

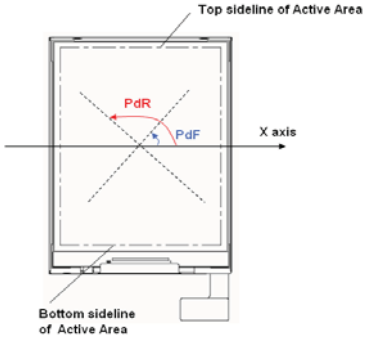
Note 6: Color Coordinates of CIE 1931
The test condition is at ILED=100mA and measured on the surface of LCD module at 25℃.
Measurement equipment:CS2000 or similar equipments
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

Note 7: Definition of Color of CIE Coordinate and NTSC Ratio.

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

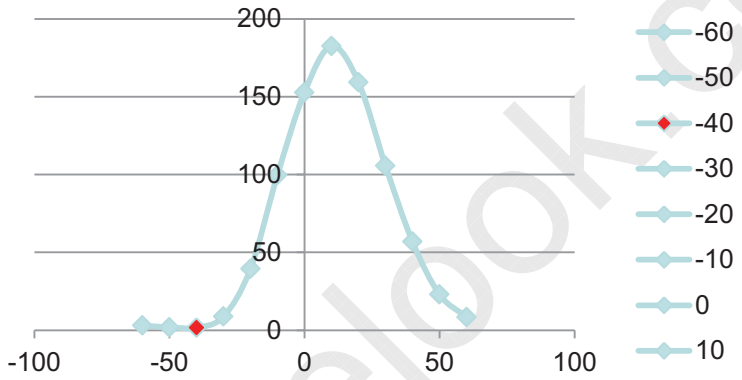


Note 8: Polarization Direction Definition
- Viewing direction is normal user viewing direction which is vertical to the display surface
- The polarizer which is closer to viewer is defined as Front Polarizer
- The polarizer which is on the rear side of viewer is defined as Rear Polarizer
- The X axis is defined as parallel line to top & bottom sidelines of the Active Area
- PdF which is marked in blue arrow is polarization degree of Front polarizer
- PdB which is marked in red arrow is polarization degree of Back polarizer
- The polarization degree parameter must be indicated in range of 0deg to 180deg according to above definition



Note 9: **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

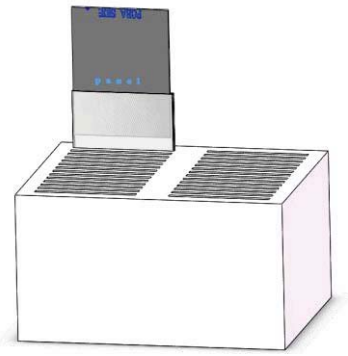
The Reliability test items and its conditions are shown in below.

<Table 12. Reliability Test Parameters >

No	Test Items	Conditions
1	HAST	110℃、85%RH、0.122Mpa，8hr
2	High temperature & high humidity (storage test)	60℃，90%RH，240hr
3	High temperature storage test	80℃，240hr
4	Low temperature storage test	-30℃，240hr
5	High temperature & high humidity (operation test)	60℃，90%RH，240hr
6	Low temperature operation test	-20℃，240hr
7	High temperature operation test	70℃，240hr
8	Thermal Shock Test	-40℃~85℃，1hr/cycle，100cycle
9	PCT	121℃，100%RH，2atm，12hr
10	ESD	150pF，330Ω，±6kV(Contact)，±8kV（Air）
11	Packing VIB	1.47G，1-200hz，X，Y，±Z，30min/Axis

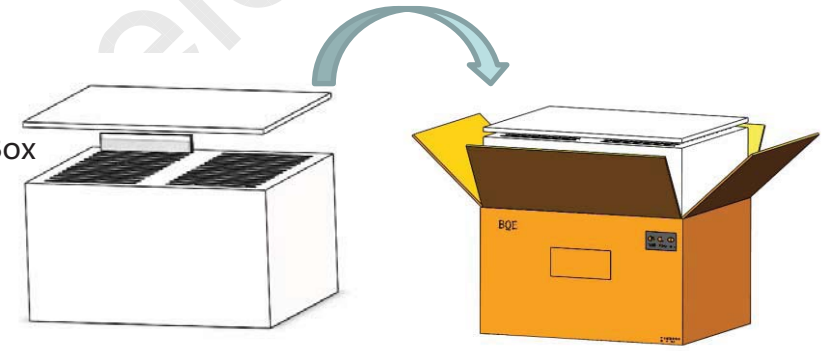
6.0 PACKING INFORMATION(产品形态： LCM)

Packing procedure:



-.Put 1pcs Panel into PE Bag
Crimp PE Bag opening
-. Insert 1pcs panel horizontally into the slot
-. 28pcs Panel /EPE Box

-. Put 1pcs EPE cover upon EPE box
-.Put EPE Box& EPE cover into Inner Box
-. 28pcs Panel /Inner Box



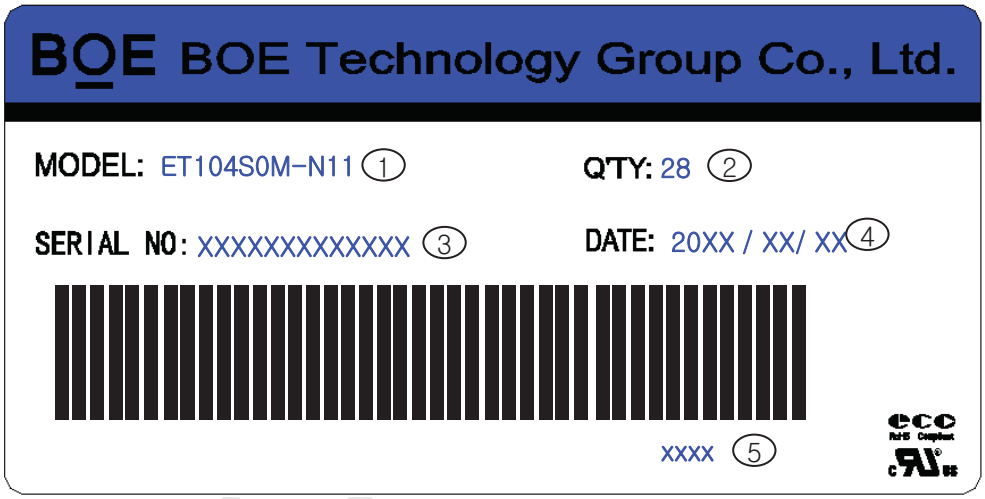
-. 4 layers/ Pallet
-. 4 boxes/ Layer
-. 448pcs Panel / Pallet

6.1 Packing Note(产品形态：LCM)

- Box Dimension: 500mm(W) x 400mm(D) x 300mm(H)
- Package Quantity in one Box: 28pcs

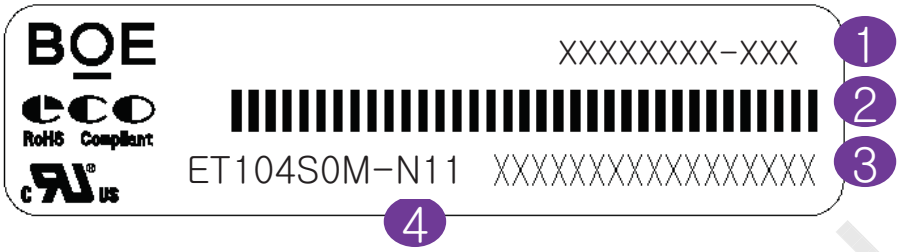
6.2 Box label (产品形态：LCM)

- Label Size :115mm*55mm
- Contents
  Model : LCM
  Q`ty : 28pcs/Box
  Serial No. : Box Serial No. as shown below.
  Date : Packing Date
  FG Code : FG Code of Product



No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	X	X	S	3	1	8	B	0	0	0	1	H	D
	GBN		Grade	B3	Year		Month	Rev	Serial number				

7.0 Product Label



Label Size: 48mmx12mmx0.08mm,
44-9231007

1. Customer Code
2. MDL ID bar code
3. MDL ID
4. FG-CODE First 12 digits

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	S	3	8	3	2	D	8	5	0	0	0	0	0	2	1
	GBN		Grade	B3	Year	Month	Day	FG Code last four digits				Serial number					

8.0 Handling & Cautions

8.1 Mounting Method

- The panel of the LCD consists of two thin glasses with polarizers which easily get damaged. So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided , and avoid scratching polarizer (The strength should not be more than that of HB pencil).Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Mount a LCD module with the specified mounting parts.
- Avoid stressing PCB and Driver IC during the installation.
- Drawing or bending of the COF & wire in any process is avoided.
- Careful installation and handling are necessary to prevent damage to PCB circuit .
- Installation of heat dissipation structure should meet the temperature requirements.
- Touching or rubbing the POL surface with bare hands or oilcloth is not allowed.

8.2 Caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration , and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- The polarizers on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizers or it leads the polarizers to be deteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent (recommended below) to clean the LCD 's surface with wipe lightly.
  -IPA(Isopropyl Alcohol), Ethyl Alcohol, Trichlorotrifluoroethane.
- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizers and others. Do not use the following solvent.
  -Water, Ketone, Aromatics
- It is recommended that the LCD be handled with soft gloves during assembly, etc. The polarizers on the LCD's surface are vulnerable to scratch and thus to be damaged by sharp particles.。
- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.

- The ITO pad area needs special careful caution because it could be easily corroded.
- Do not contact the ITO pad area with HCFC,Soldering flux,Chlorine,Sulfur,saliva or fingerprint. To prevent the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.
- Water/oil stains should be wiped immediately to prevent stains pollution and discoloration
- Surface dust could be wiped by hydrophilic cotton cloth or other soft materials (such as the light gasoline solvent soaked suede). The adherent dust should be cleaned by recommended n-hexane instead of acetone, ethanol and toluene, etc.

8.3 Caution Against Static Charge

- The LCD modules use C-MOS 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 equipments to protect against static electricity.
- 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. The person who will tear off the protection film should wear anti-static wristband and the wristband should be grounded.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.
- Grounding and shielding actions should be adopted to avoid electromagnetic interference.
- Connection line between the system board and PCB CNT should be as short as possible.
- Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug the pin connectors parallelly when assembling MDL.
- Bare-handed touching of the pin connector is not allowed.
- Stay away from the static electricity to avoid electrostatic damage.

8.4 Caution For operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher Voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive should avoid.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.
- Consultation is necessary if a long-time use for the same pattern were required.
- Consultation is necessary when under the non-specified using conditions.
- Extreme operating conditions (high temperature, high humidity, high altitude, special display mode, running time, etc.) should be consulted with the manufacturer, otherwise, reliability of the function may not be guaranteed. Extreme condition usually occurs at airports, stations, banks, stock markets, control systems, etc.
- Specified parameters can not be exceeded. (power supply voltage, input voltage, ambient temperature, etc.)
- Consultation is necessary for a long-time operation.
- Consultation is necessary for outdoor application
- Consultation is necessary when using the vertical mode. (The MDL should be rotated clockwise when using the vertical mode.)

8.5 Packaging

- Modules use LCD element, and must be treated as such.
  -Avoid intense shock and falls from a height.
  -To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity for long periods.

8.6 Storage

- Original protective film should be used on LCD' s surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizers.
- Do not store the LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.
  -Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
  -It is recommended to be stored in a ventilated dark room to avoid illumination, UV- light and moisture entering and avoid water vapor entering.
  -Keep temperature in the specified storage temperature range. Recommended storage temperature range : 5-40℃ , Environment humidity : 35-75%RH , Recommended storage time length : ≤6 Mons。It was recommended that baking process should be done after the product has been stored for a certain period of time. The suggestions are as follows:
  ①. NO processing is needed when the storage period is less than 2 months;
  ②. 50 C, 10% RH, 24 hr baking process is needed when the storage period is during 2-3 months;
  ③. 50 C. 10% RH, baking 48 hr baking process is needed when the storage period 。
  -Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation LCD when it was delivered.

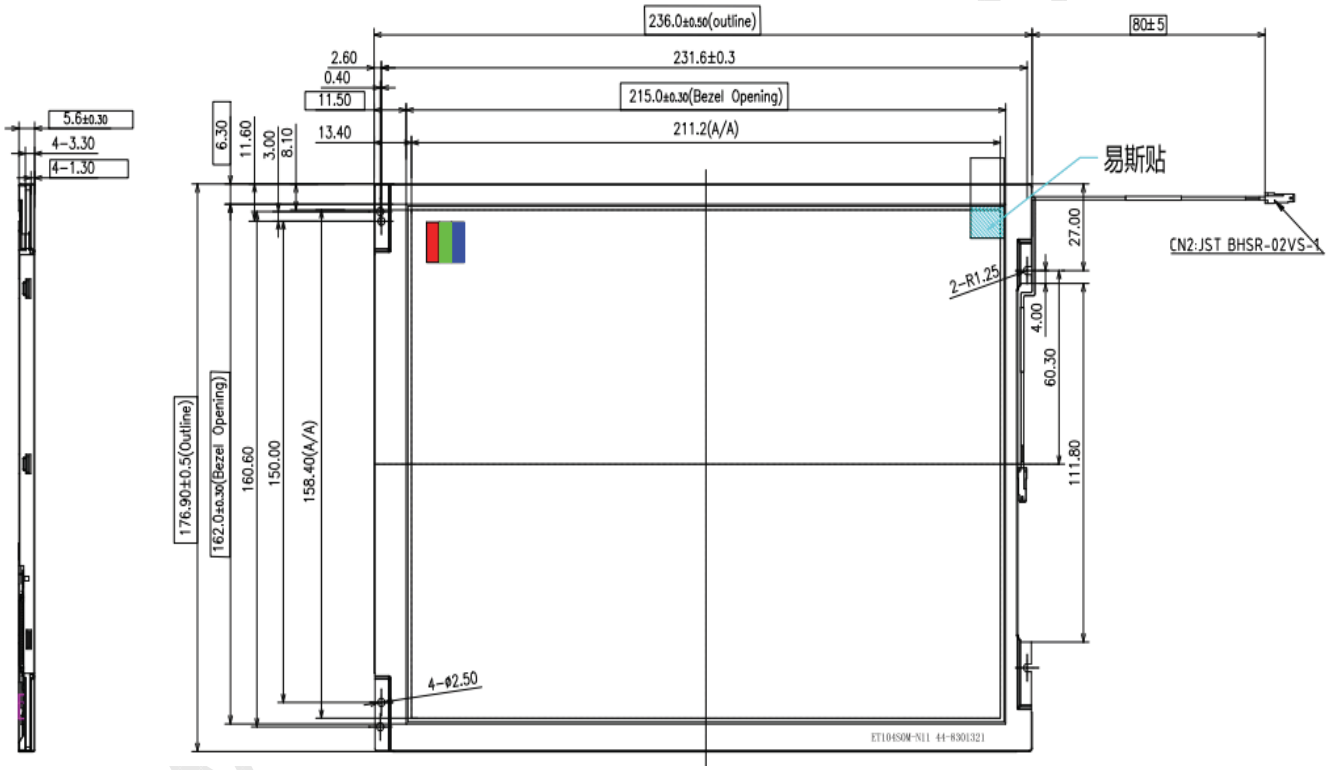
8.7 Safety

- For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case the LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water an soap as soon as possible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

9.0 APPENDIX

Mechanical Drawing

Drawing Attachment: Landscape Front View



Mechanical Drawing

Drawing Attachment: Landscape Back View