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SPEC. NUMBER S8-*	PRODUCT GROUP TFT- LCD	REV. P0	ISSUE DATE 2022-04-19	PAGE 1 OF 33
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B3 EV156FHM-N80 Product Specification Rev.P0

BUYER	
SUPPLIER	HEFEI BOE Optoelectronics Technology CO., LTD
FG-Code	EV156FHM-N80-3RA0

ITEM	BUYER SIGNATURE	DATE
_____	_____	_____
_____	_____	_____
_____	_____	_____

ITEM	SUPPLIER SIGNATURE	DATE
Prepared	<u>史高健</u>	20220419
Reviewed	_____	_____
Approved	_____	_____

PRODUCT GROUP	REV	ISSUE DATE	BOE
TFT- LCD PRODUCT	P0	202-04-19	

SPEC. NUMBER S8-*	SPEC . TITLE B3 EV156FHM-N80 Product Specification	PAGE 2 OF 33
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REVISION HISTORY

(√) preliminary specification

() Final specification

REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		Initial Release	2022-04-19	史高健

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PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			3 OF 29

Contents

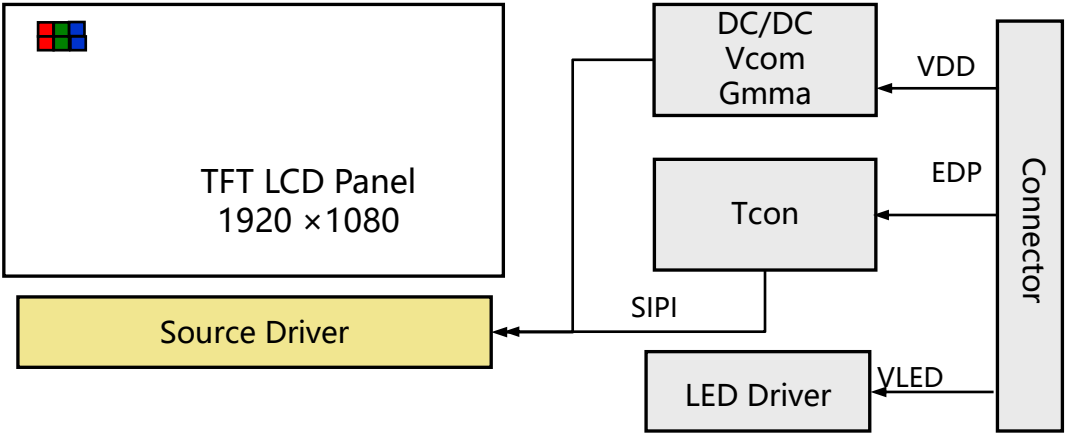
No.	Items	Page
1.0	General Description	4
2.0	Absolute Maximum Ratings	6
3.0	Electrical Specifications	7
4.0	Optical Specifications	14
5.0	Reliability Test	18
6.0	Packing Information	19
7.0	Product Label	21
8.0	Handling & Cautions	22
9.0	Appendix	28

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			4 OF 29

1.0 GENERAL DESCRIPTION

1.1 Introduction

EV156FHM-N80 is a color active matrix TFT LCD FOB using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This FOB 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. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- 0.4T Glass (Single)
- Normal Type
- EDP interface
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS compliant

1.3 Application

- Ultrasonic

1.4 General Specification

The followings are general specifications at the EV121WXM-N12

<Table 1. LCD Module Specifications>

Parameter	Specification	Unit	Remarks
Active Area	344.16 (H) ×193.59 (V)	mm	
Number Of Pixels	1920(H)×1080(V)	pixels	
Pixel Pitch	59.75*179.25	μm	
Pixel Arrangement	Transmissive		
Display Mode	Normally Black		
Display Colors	16.7M	colors	8bit
Surface Treatment	高精细AG25		
Contrast Ratio	1200typ/900min		
Viewing Angle(CR>10)	85°/85°/85°/85°Typ	deg.	U/D/L/R
Response Time	30typ/35max	ms	
Color Gamut	72%typ./67%min.		NTSC
Brightness	350	cd/m2	Typ.
Brightness Uniformity	80%@5P, 65%@13P		Min.
Power Consumption	10.54	watt	Max.
Outline Dimension	350.66 (H) x 215.245(V)	mm	
Weight	320g (Max)	gram	
Display Orientation	Landscape Only		

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			6 OF 29

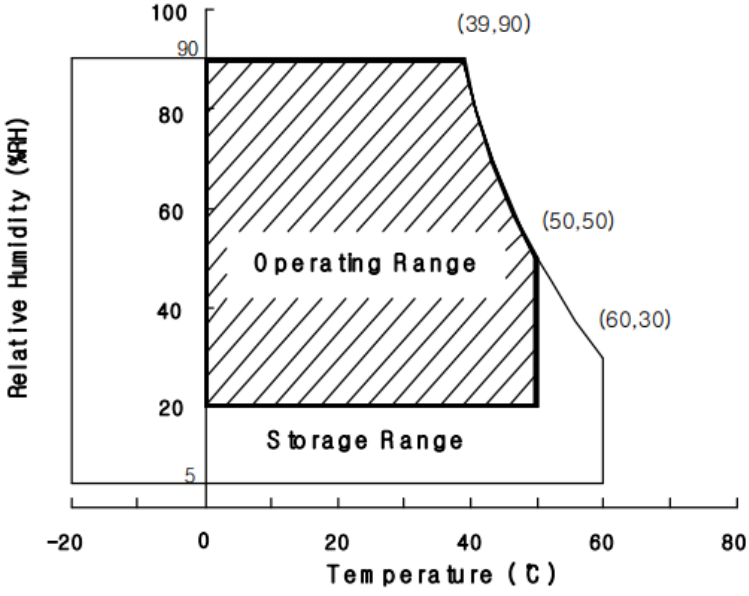
2.0 ABSOLUTE MAXIMUM RATINGS

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	2.6		V	Ta = 25 °C
	BLU	V _{BLU}	-		V	
		I _{BLU}	-	780	mA	
Operating Temperature		T _{OP}	0	+50	°C	Note 1
Storage Temperature		T _{ST}	-20	+60	°C	

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



3.0 ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Module

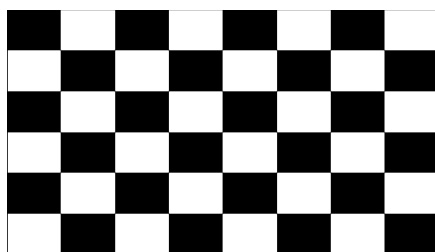
< Table 3. LCD Module Electrical specifications >

[Ta =25±2 °C]

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(Tpy)	-	268	320	mA	
	IDD(Max)	-	717	860	mA	
Inrush Current	I _{RUSH}	-	2	3	A	
Permissible Input Ripple Voltage	VRF	-	-	300	mV	
BLU Supply Voltage	V _{BLU}	10.8	12	13.2	V	
BLU Supply Current	I _{BLU}	-	620	744	mA	
Power Consumption	P _D (Tpy)	-	0.88	1.05	W	Note 1
	P _D (Max)	-	2.37	2.84	W	
	P _{BLU}	-	7.44	8.93	W	
	P _{total} (Tpy)	-	8.32	8.49	W	
	P _{total} (Max)	-	9.81	11.77	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=3.3V, Frame rate f_v=60Hz and Clock frequency = 72.4MHz. Test Pattern of power supply current

- a) Typ : Mosaic 8 x 6 Pattern(L0/L255)
- b) Max : skip subPixel(L255)



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 °C]

Parameter	Symbol	Values			Unit	Notes
		Min.	Typ.	Max.		
LED Supply Voltage	V_{LED}	-	34.8	38.4	V	
LED Supply Current	I_{LED}	-	180	-	mA	Note 1
Power Consumption	P_{LED}	-	6.26	6.91	W	
EN Control Level	Backlight on	2.5	-	-	V	
	Backlight off	-	-	0.6	V	
PWM Control Level	PWM High Level	2.5	-	-	V	
	PWM Low Level	-	-	0.6	V	
PWM Control Frequency	F_{PWM}	200	-	10K	Hz	
Duty Ratio	Duty	1%		100%	%	
LED Quantity	QLED	-	48	-	EA	
LED Life Time	TLED	30000	-	-	Hrs	Note 2/3

Notes: 1. LED Bar:4Parallel*12String) , $I_{LED}=45mA*4=180mA$

$$P_{LED} = V_{LED} \times I_{LED} \text{ (Without LED converter transfer efficiency)}$$

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 $25 \pm 2^{\circ}C$.

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

3.3 INPUT TERMINAL PIN ASSIGNMENT

The electronics interface connector is MSAK24025P30(30P).

< Table5. Pin Assignment for LCD Module Connector >

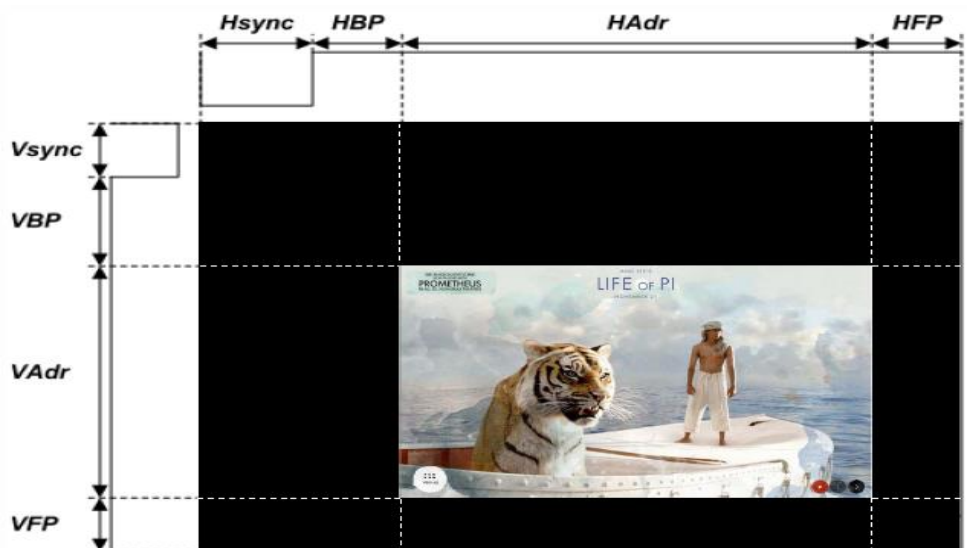
Pin No	Symbol	Description	Pin No	Symbol	Description
1	CABC_EN	Enable, H (1.75~2.5V) , L (0~0.6V)	16	H_GND	Ground
2	H_GND	Ground	17	HPD	Hot Plug Detect Output
3	LANE1_N	eDP RX Channel 1 Negative	18	BL_GND	LED Ground
4	LANE1_P	eDP RX Channel 1 Positive	19	BL_GND	LED Ground
5	H_GND	Ground	20	BL_GND	LED Ground
6	LANE0_N	eDP RX Channel 0 Negative	21	BL_GND	LED Ground
7	LANE0_P	eDP RX Channel 0 Positive	22	BL_ENABL E	LED Enable Pin, L(0-0.6V)H (2.5-3.6V)
8	H_GND	Ground	23	BL_PWM	System PWM Signal Input, (200Hz-10kHz; 1-100%) L(0-0.6V)H(2.5-3.6V)
9	AUX_CH_ P	eDP AUX CH Positive	24	SDA	For BOE use only
10	AUX_CH_ N	eDP AUX CH Negative	25	SCL	For BOE use only
11	H_GND	Ground	26	BL_POWE R	LED Power Supply 12V (typ.) [10.8-13.2V]
12	LCD_VCC	Power Supply, 3.3V (typ.)	27	BL_POWE R	LED Power Supply 12V (typ.) [10.8-13.2V]
13	LCD_VCC	Power Supply, 3.3V (typ.)	28	BL_POWE R	LED Power Supply 12V (typ.) [10.8-13.2V]
14	BIST	Panel Self Test Enable	29	BL_POWE R	LED Power Supply 12V (typ.) [10.8-13.2V]
15	H_GND	Ground	30	NC	No Connection

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			10 OF 29

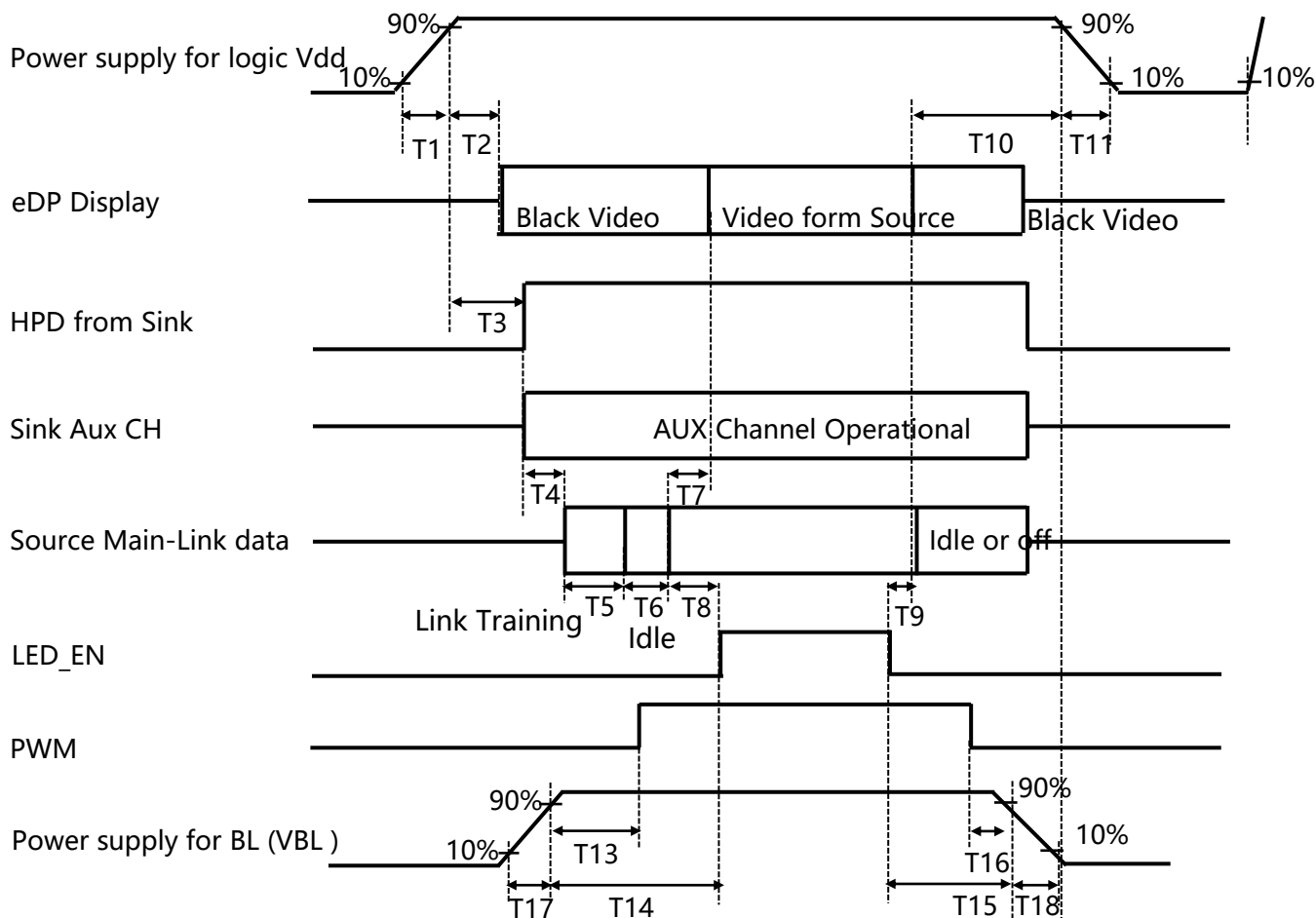
3.4 Interface timing Parameter

< Table9. Timing Parameter >

Item		Symbol	min	typ	max	UNIT	
LCD	Frame Rate	-	58	60	62	Hz	
	Pixels Rate	-	138.5	148.5	177.1	MHz	
Timing	Horizontal	Horizontal total time	tHP	2080	2200	2400	t _{CLK}
		Horizontal Active time	tHadr	1920			t _{CLK}
		Horizontal Back Porch	tHBP	-	200	-	t _{CLK}
		Horizontal Front Porch	tHFP	-	80	-	t _{CLK}
	Vertical	Vertical total time	tvp	1100	1125	1230	t _H
		Vertical Active time	tVadr	1080			t _H
		Vertical Back Porch	tVBP	-	25	-	t _H
		Vertical Front Porch	tVFP	-	20	-	t _H
Lane			-	2	-	Lane	



3.5 Power Sequence



- 0.5ms ≤ T1 ≤ 10 ms
- 0ms ≤ T2 ≤ 200 ms
- 0ms ≤ T3 ≤ 200 ms
- 0ms ≤ T13
- 0ms ≤ T14
- 0ms ≤ T17
- 80ms ≤ T8
- 0ms ≤ T7 ≤ 50ms
- 0ms ≤ T10 ≤ 500 ms
- 0.5ms ≤ T11 ≤ 10 ms
- 5ms ≤ T12
- 0ms ≤ T15
- 0ms ≤ T16
- 0ms ≤ T18

Notes:

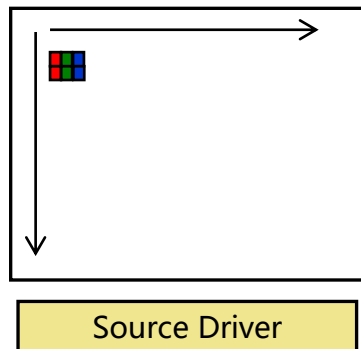
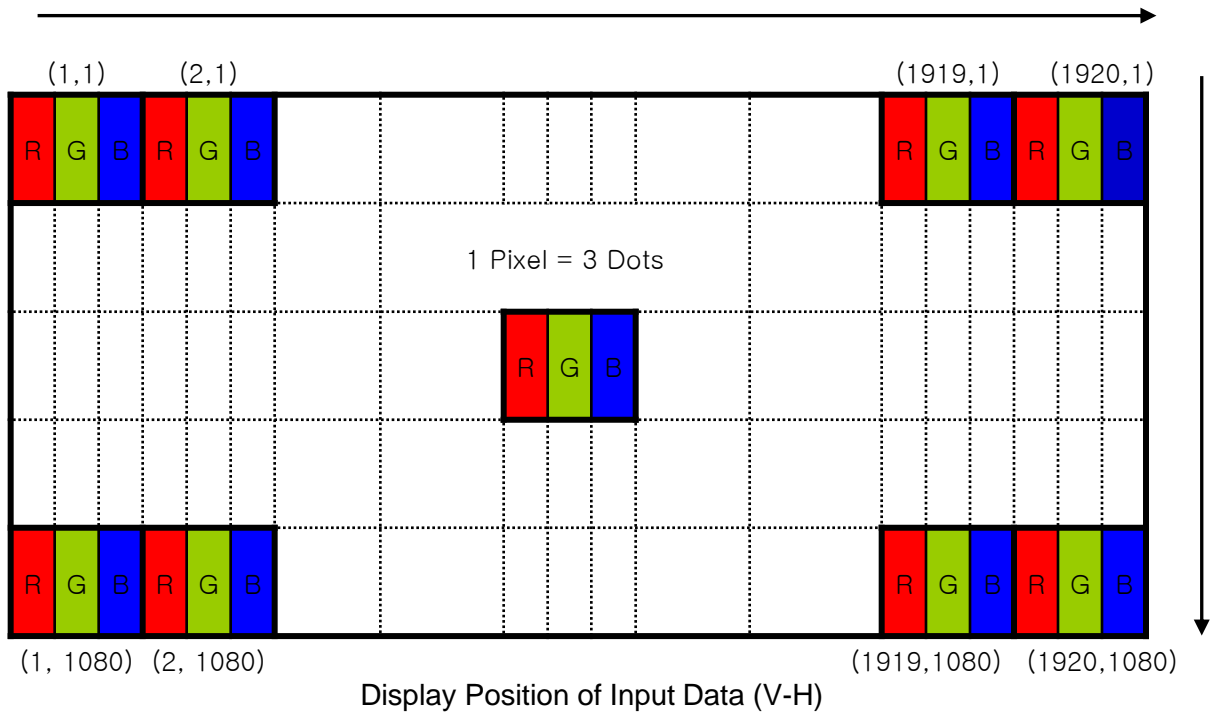
1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

3.6 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
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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	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	
	Darker	0	0	0	0	0	0	1	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
	▽	1	1	1	1	1	1	1	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
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	1	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	
	△	↑								↑				↑										
	▽	↓								↓				↓										
	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	1	1	1	1	1	1	1	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
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	1	
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	△	↑								↑				↑										
	▽	↓								↓				↓										
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
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	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
	△	↑								↑				↑										
	▽	↓								↓				↓										
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	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	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

3.7 Input Color Data Mapping



PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			14 OF 29

4.0 OPTICAL SPECIFICATIONS

4.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) 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 $\theta\emptyset=0$ ($=\theta3$) as the 3 o' clock direction (the "right"), $\theta\emptyset=90$ ($=\theta12$) as the 12 O' clock direction ("upward"), $\theta\emptyset=180$ ($=\theta9$) as the 9 O' clock direction ("left") and $\theta\emptyset=270$ ($=\theta6$) as the 6 O' clock direction ("bottom"). While scanning θ and/or \emptyset , the center of the measuring spot on the Display surface shall stay fixed.

4.2 Optical Specifications

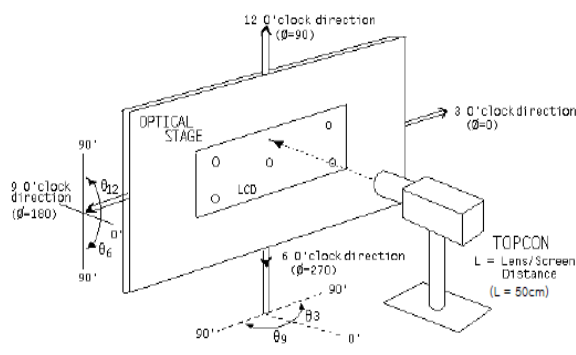
< Table11. Optical Table >

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
luminance	Bp	$\theta=0^\circ$	280	350	--	cd/m ²	Note 1
Brightness Uniformity	5P		80	--	--	%	Note 2
	13P		65	--	--	%	
Viewing Angle	θ_L	$Cr \geq 10$	80	85	--	deg	Note 3
	θ_R		80	85	--		
	ψ_T		80	85	--		
	ψ_B		80	85	--		
Contrast Ratio	Cr	$\theta=0^\circ$	900	1200		-	Note 4
Response Time	Tr+Tf	FF=0°	-	30	35	ms	Note 5
Color Coordinate of CIE1931	Rx	$\theta=0^\circ$	0.619	0.649	0.679	-	Note 6
	Ry		0.307	0.337	0.367		
	Gx		0.273	0.303	0.333		
	Gy		0.578	0.608	0.638		
	Bx		0.114	0.144	0.174		
	By		0.028	0.058	0.088		
	Wx		0.283	0.313	0.343		
	Wy		0.299	0.329	0.359		
NTSC Ratio	NTSC	CIE1931	67	72	--	%	Note 7
Polarization Direction of Front Polarizer	PdF		--	0°	--	deg	Note 8
Polarization Direction of Rear Polarizer	PdR		--	90°	--	Deg	

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			15 OF 29

Note1:Luminance measurement

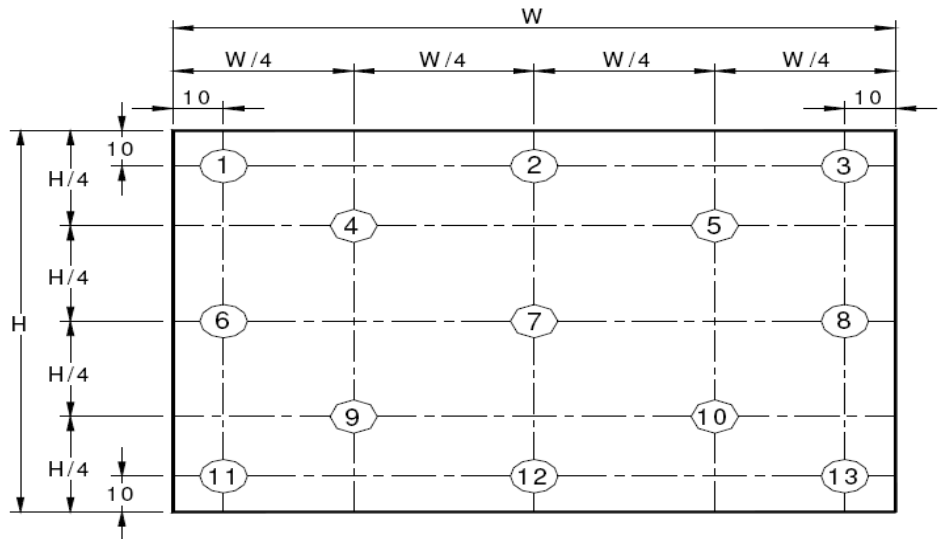
- The test condition is at ILED=160mA and measured on the surface of LCD module at 25°C.
- The data are measured after LEDs are lighted on for more than 5 minutes and LCM displays are fully white. The brightness is the center of the LCD. Measurement equipment CS2000 or similar equipments (Field of view:1deg,Distance:50cm)
 - Measuring surroundings: Dark room.
 - Measuring temperature: Ta=25°C.
 - 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=180mA and measured on the surface of LCD module at 25°C.
- Measurement equipment:CS2000 or similar equipments
- The luminance uniformity is calculated by using following formula:
- The White luminance uniformity on LCD surface is then expressed as : $\Delta Y5 = \text{Minimum Luminance of five points} / \text{Maximum Luminance of five points}$ (see FIGURE 2) , $\Delta Y13 = \text{Minimum Luminance of 13 points} / \text{Maximum Luminance of 13 points}$ (see Figure).

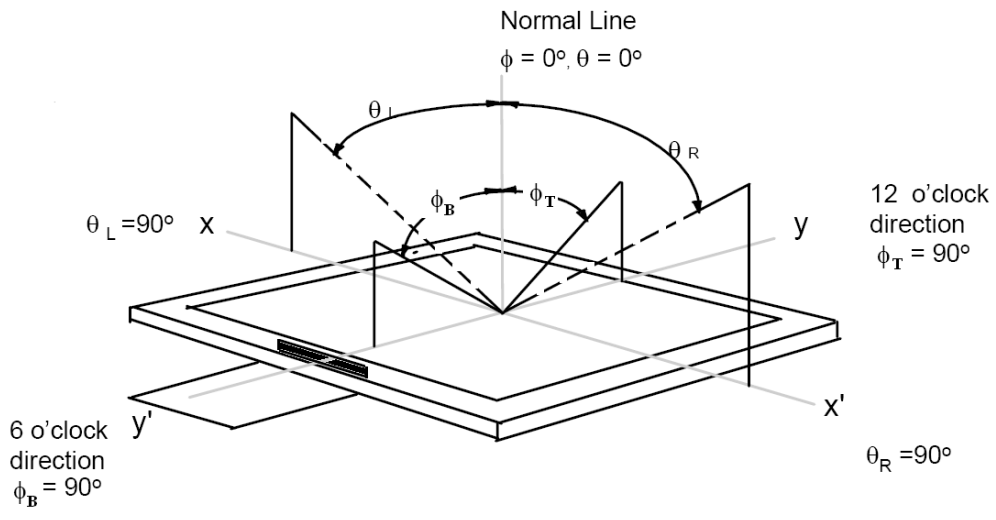
Figure . Uniformity Measurement Locations (13 points)



PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			16 OF 29

Note 3: The definition of Viewing Angle

Refer to the graph below marked by θ and ϕ .



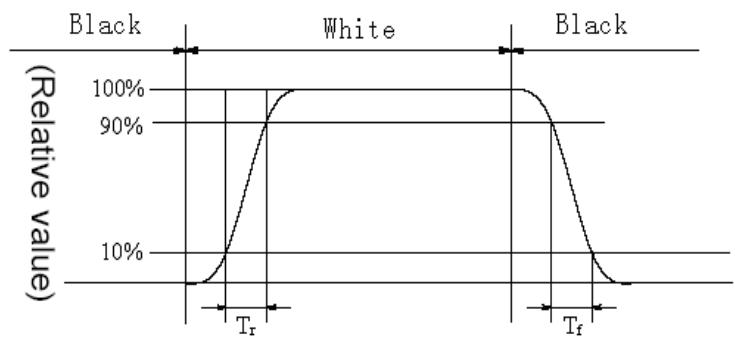
Note 4: The definition of Contrast Ratio (Test LCM using CS2000 or similar equipments):

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

(Contrast Ratio is measured in optimum common electrode voltage)

Note 5: Definition of Response 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. The output signals of photodetector are measured when the input signals are changed 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:

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			17 OF 29

Note 6: Color Coordinates of CIE 1931

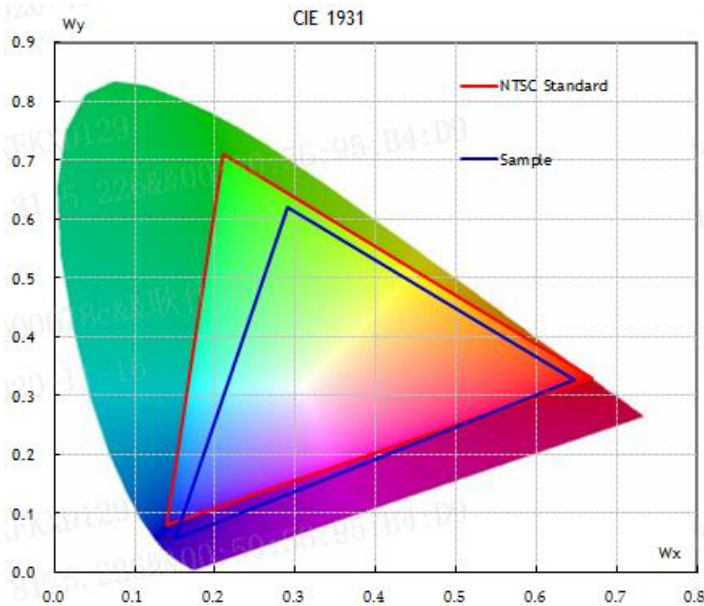
The test condition is at ILED=180mA and measured on the surface of LCD module at 25°C.

Measurement equipment:CS2000 or similar equipments

The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

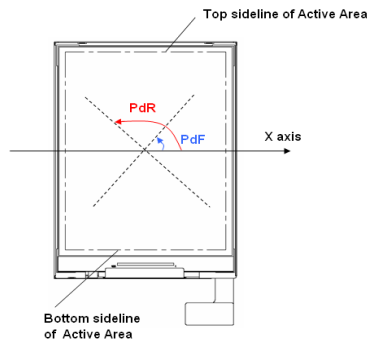
Note 7: Definition of Color of CIE Coordinate and NTSC Ratio.

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



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
- PdR 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



5.0 RELIABILITY TEST

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

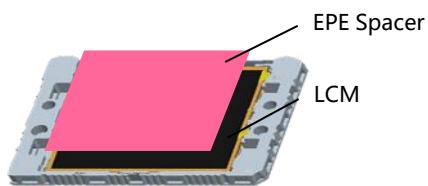
<Table 12. Reliability Test Parameters >

No	Test Items	Conditions
2	High temperature & high humidity (storage test)	50°C, 80%RH, 240hr
3	High temperature storage test	60°C, 240hr
4	Low temperature storage test	-20°C, 240hr
5	High temperature & high humidity (operation test)	60°C, 90%RH, 240hr
6	Low temperature operation test	0°C, 240hr
7	High temperature operation test	50°C, 240hr
8	Thermal Shock Test	-20°C~60°C, 0.5hr/cycle, 100cycle
9	PCT	121°C, 100%RH, 2atm, 12hr
10	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
11	Packing VIB	1.47G, 1-200hz, X, Y, ±Z, 30min/Axis

6.0 PACKING INFORMATION(产品形态: LCM)

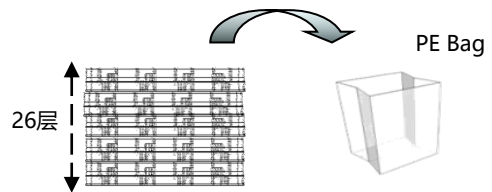
Packing procedure:

将1pcs LCM放入Tray中 (Panel朝上), 然后在LCM上放置
1pcs EPE Spacer
容量: 1pcs EPE Spacer/Tray
1pcs LCM/Tray



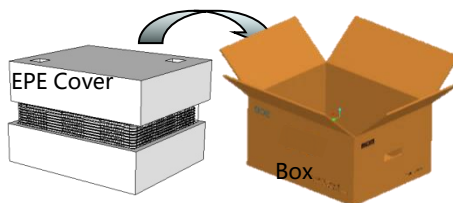
Step 1

堆叠放置25pcs Tray (不旋转堆叠), 顶部再放置1pcs 空
Tray, 然后将26pcs Tray 平放入PE Bag



Step 2

在Inner Box放置1pcs EPE Cover, 将堆叠好的26pcs Tray
平放入Box, 再放置1pcs EPE Cover, 对Box进行封箱, 并粘
贴Box标签
容量: 25pcs LCM/Box



Step 3

每个Pallet上放3层Box, 1层6箱, 共计18箱, Pallet外进行
打包带、缠膜包装
容量: 18pcs Box/Pallet
450pcs LCM/Pallet



Step 4

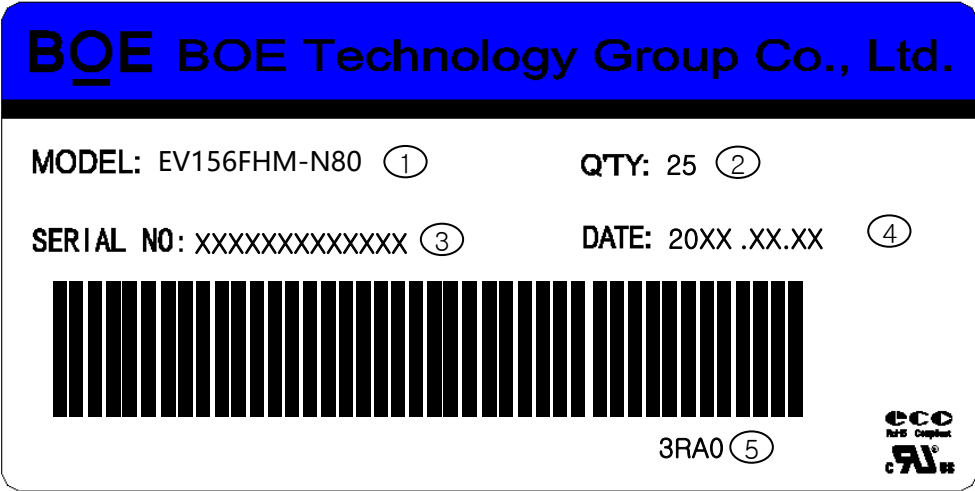
6.1 Packing Note(产品形态: LCM)

- Box Dimension: 495mm(W) x 395mm(D) x 313mm(H)
- Package Quantity in one Box: 25pcs

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			20 OF 29

6.2 Box label (产品形态: LCM)

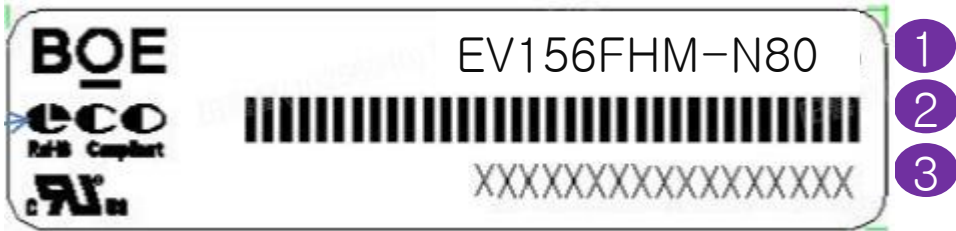
- Label Size :110mm*55mm
- Contents
 - Model : First 12 digits of FG-Code: EV156FHM-N80
 - Q`ty : 25pcs/Box
 - Serial No. : Box Serial No. as shown below.
 - Date : Packing Date
 - FG Code : Last 4 digits of FG-Code



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

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			21 OF 29

7.0 Product Label



Label Size: 48mmx12mmx0.075mm, 44-9231007

1. FG-CODE: EV156FHM-N80
2. MDL ID对应条形码
3. MDL ID

BOE MDL ID rule

序列号	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
代码	X	X	X	3	X	X	X	D	R	A	0	X	X	X	X	X	X
描述	GBN代码		等级	B3	年份	月	FG Code后四位				序列号						

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			22 OF 29

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.)

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			23 OF 29

- 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.

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			24 OF 29

- 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.

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			25 OF 29

8.5 Precautions for Storage

A. Atmosphere Requirement

ITEM	UNIT	MIN	MAX
Storage Temperature	(°C)	5	40
Storage Humidity	(%rH)	40	75
Storage Life	6 months		
Storage Condition	<ul style="list-style-type: none"> • 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.

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			26 OF 29

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°C
- 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 voltage 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.

PRODUCT GROUP		REV	ISSUE DATE	BOE
TFT- LCD PRODUCT		P0	2022-04-19	
SPEC. NUMBER	SPEC. TITLE			PAGE
S8-*	B3 EV156FHM-N80 Product Specification			27 OF 29

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.

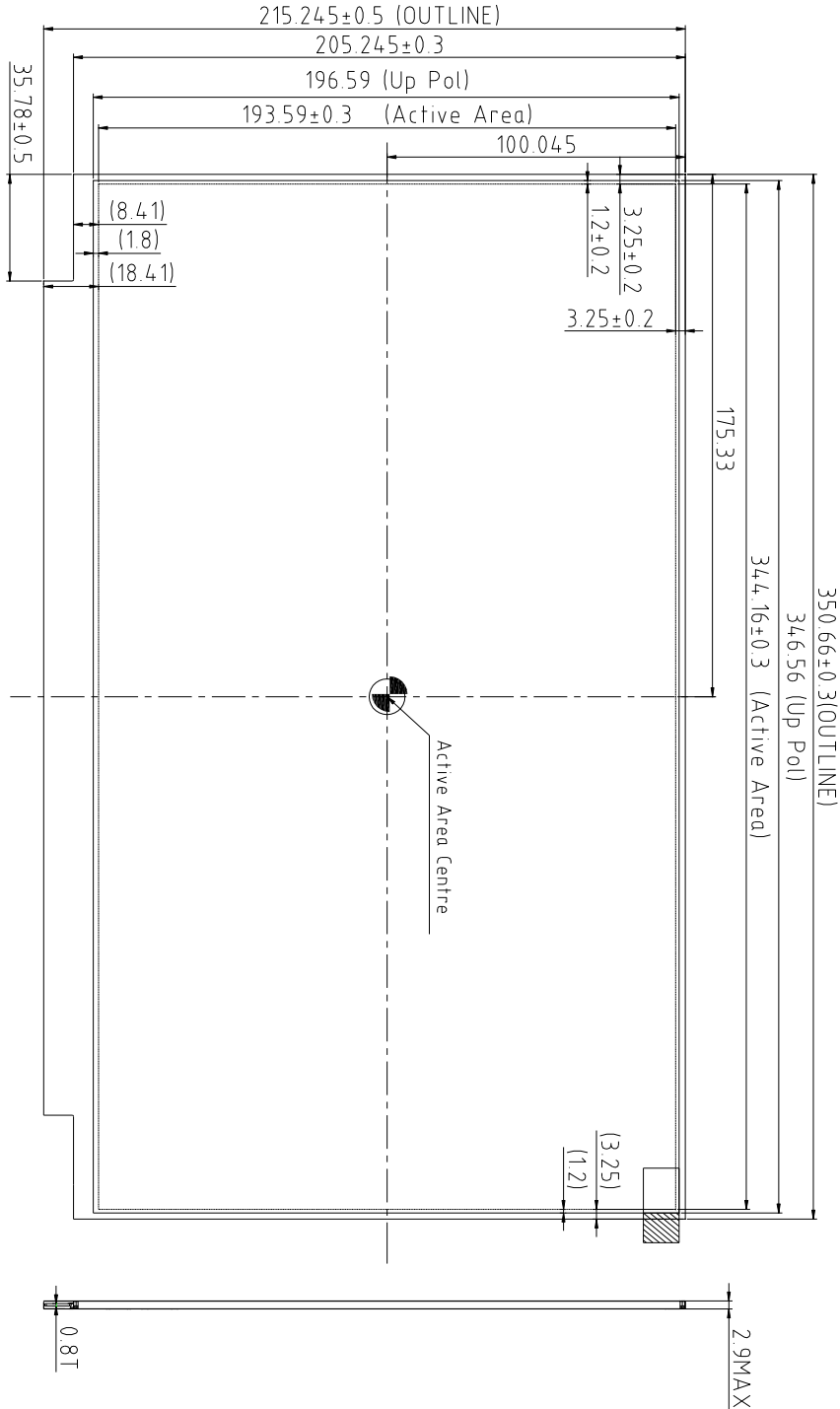
B. Rework

- 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



PRODUCT GROUP

REV

ISSUE DATE

BOE

TFT- LCD PRODUCT

P0

2022-04-19

SPEC. NUMBER

SPEC. TITLE

PAGE

S8-*

B3 EV156FHM-N80 Product Specification

29 OF 29

Mechanical Drawing

Drawing Attachment: Landscape Back View

