

SPECIFICATION FOR LCM MODULE

MODULE NO.: BF7050-03

REVISION NO.: V0

Customer Approval:

--

	SIGNATURE
PREPARED BY	Shawn
VERIFIED BY	William
APPROVED BY	Rio

BOCEN Bocen Display Technology Co., Ltd.

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Address: 603 Esun Tech Building, No.22 Jia'an South Road, Bao'an District, 518101 Shenzhen, China.

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REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
V1	2023-06-14	First Release	

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GENERAL DESCRIPTION

1.1 Introduction

Bocen BF7050-03 is a 7.0" color active matrix LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 5.0 inch diagonallymeasured active area with resolutions (1024 horizontal by 600 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical Stripe.

1.2 Features

- Thin and light weight
- 0.5 t Glass
- COG Design

1.3 Application

- GPS Device

Item	Contents	Unit
LCD Type	TFT TRANSMISSIVE	/
Viewing direction	IPS	
Module outline(WxHxD)	164.9(H) × 100.00(V)x2.8(Typ)	Mm
Active area (W×H)	154.21(H) × 85.92(V)	Mm
Pixel pitch	0.05(W) x 0.15(H)	Mm
Pixel arrangement	Parallel RGB 24-BIT	
Number of pixel	1024(H) ×600(V)	Pixels
Driver IC	JD79001DCGB+JD73215BCGA	/
Display color	16.7M	Color
Backlight Type	7(Series)*6(Parallel) chips white LED	/
Weight		
Input voltage	3.3	V

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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
Digital supply voltage	VDD	-0.3	5	V
Analog Supply voltage	AVDD	-0.5	13.5	V
Gate On Voltage	VDDG	-0.3	+42	V
Gate Off Voltage	VEEG	-20	+0.3	v
Gate on –Gate Off Voltage	VDDG-VEEG	12	40	V
Operating temperature	TOP	-20	+70	°C
Storage temperature	TST	-30	80	°C
Humidity	RH		90%(Max60°C)	RH

*1) Liquid Crystal driving voltage

Due to the characteristics of LC Material, this voltage varies with environmental temperature.

ELECTRICAL SPECIFICATIONS

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications > Ta=25+/-2°C

Parameter	Symbol	MIN	TYP	MIX	Unit
Supply Voltage	DVDD	3.0	3.3	3.6	V
	AVDD	9.9	10.4	10.6	V
	VDDG	17	18	19	V
	VEEG	-9	-8	-5.4	V
	VCOM	4.6	5.3	5.4	
DIGITAL SUPPLY VOLTAGE	VDD	3	3.3	3.6	V
ANALOG SUPPLY VOLTAGE	AVDD	9.4	9.6	9.8	V
GATE ON VOLTAGE	VDDG	17	18	19	V
GATE OFF VOLTAGE	VEEG	-6.6	-6	-5.4	V
COMMON ELECTRODE DRIVING SIGNAL	VCOM	3.8	4	4.3	V

Notes :

Please adjust vcom to make the flicker level be minimum.

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3.2 BACKLIGHT CHARACTERISTICS

ITEM	Symbol	MIN	TYP	MIX	Unit	CONDITION
FORWARD VOLTAGE	VF	-	21	-	V	IF=120MA
LUMINANCE	LV	2800	3200	-	CD/M2	IF =45MA
NUMBER OF LED	--	12			PIECE	
CONNECTION MODE	P				--	

Notes :

Please adjust vcom to make the flicker level be minimum.

OPTICAL SPECIFICATION

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 (Goniometer 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 $\theta=0^{\circ}$ ($\Phi=0^{\circ}$) as the 3 o'clock direction (the "right"), $\theta=90^{\circ}$ ($\Phi=0^{\circ}$) as the 12 o'clock direction ("upward"), $\theta=180^{\circ}$ ($\Phi=0^{\circ}$) as the 9 o'clock direction ("left") and

$\theta=270^{\circ}$ ($\Phi=0^{\circ}$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed.

Optimum viewing angle direction is 6 o'clock.

<Table 4. Optical Specifications>

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Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	-	90	-	Deg.	Normal Pol Note 1
		Θ_9		-	90	-	Deg.	
	Vertical	Θ_{12}		-	90	-	Deg.	
		Θ_6		-	90	-	Deg.	
Luminance Contrast ratio		CR	$\Theta = 0^\circ$	350	500			Note 2
Transmittance		T(%)	$\Theta = 0^\circ$	7.0	-	-	%	Base on C light Note 3
White Chromaticity		x_w	$\Theta = 0^\circ$	0.278	0.298	0.318		Note 4 CF Glass
		y_w		0.307	0.327	0.347		
Reproduction of color	Red	x_R	$\Theta = 0^\circ$	0.585	0.605	0.625		
		y_R		0.311	0.331	0.351		
	Green	x_G		0.269	0.289	0.309		
		y_G		0.526	0.546	0.566		
	Blue	x_B		0.121	0.141	0.161		
		y_B		0.109	0.129	0.149		
Threshold Voltage		Vsat			2.5		V	Figure 3
		Vth			1.45		V	
Response Time (Rising + Falling)		T _{RT}	Ta= 25° C $\Theta = 0^\circ$	-	20		ms	Note 5

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 4 shown in Appendix).

2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state.

(see Figure 4) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

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3. Transmittance is the Value with Polarizer
4. The color chromaticity coordinates specified in Table 4 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel. Measurement condition is C- light Source & Halogen Lampe.
5. The electro-optical response time measurements shall be made as Figure 5 by switching the "data" input signal ON and OFF. The times needed for the transmittance to change from 10% to 90% is Tr, and 90% to 10% is Td.

RELIABILITY TEST

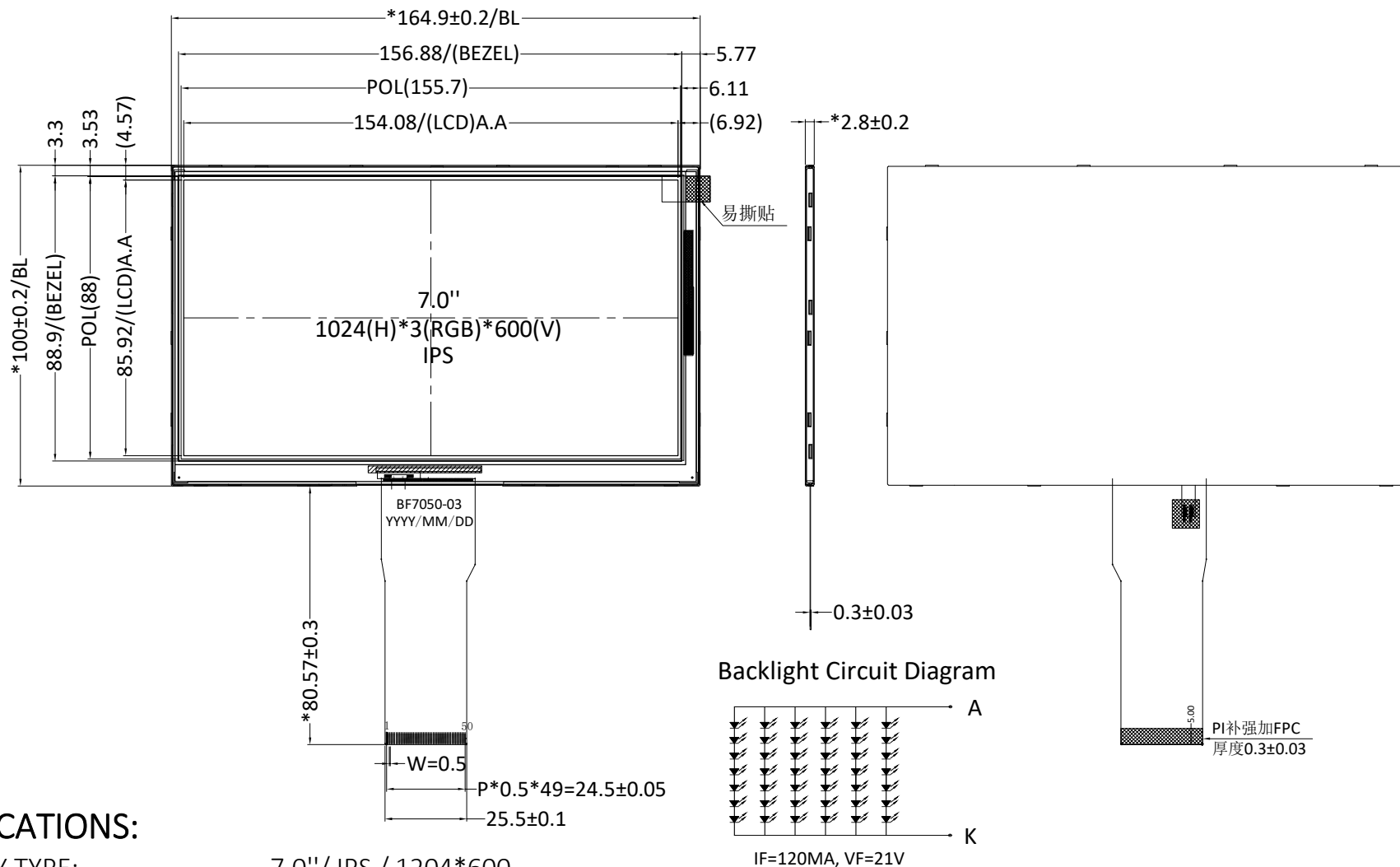
<Table 6. Reliabilitytest>

NO	Test Items	Conditions
1	High temperature storage test	Ta=80°C, 240hrs
2	Low temperature storage test	Ta=-30°C, 240hrs
3	High temperature operation test	Ta=70°C, 240hrs
4	Low temperature operation test	Ta=-20°C, 240hrs
5	High temperature and high humidity operation test	Ta=60°C,90%RH, 240hrs
6	Thermal shock	Ta=-30°C ~80°C (0.5hr), 100cycle
7	Press cooking test	2atm, 121°C, 100%, 12h
8	Altitude test(non-operating)	25°C,24h,40000ft
9	Electro-static discharge test(non-operating)	Air 150pF330,100point Contact 150pF330, 100point

Notes : OT will respond to the issue which is caused by panel

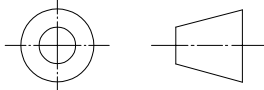
EXTERNAL DIMENSION

Version	1.0	2023-06-14	New Issue						



PIN	SYMBOL
1	LED A
2	LED A
3	LED K
4	LED K
5	GND
6	VCOM
7	DVDD
8	MODE
9	DE
10	VSD
11	HSD
12	B7
13	B6
14	B5
15	B4
16	B3
17	B2
18	B1
19	B0
20	G7
21	G6
22	G5
23	G4
24	G3
25	G2
26	G1
27	G0
28	R7
29	R6
30	R5
31	R4
32	R3
33	R2
34	R1
35	R0
36	GND
37	DCLK
38	GND
39	SHLR
40	UPDN
41	VDDG
42	VEEG
43	AVDD
44	RSTB
45	NC
46	VCOM
47	DITH
48	GND
49	NC
50	NC

SPECIFICATIONS:

BOCEN DISPLAY TECHNOLOGY CO., LTD.		
DESIGNED BY: Shawn	BF7050-03	VERSION: 1.0
CHECKED BY: William		NO.: 1 OF 1
APPROVED BY: Rio		UNIT: mm
Website: http://www.bocentech.com		DATE: 2023-06-14

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I/O description

Pin.No	Symbol	Function
1,2	VLED+	Power for LED backlight (Anode)
3,4	VLED-	Power for LED backlight (Cathode)
5	GND	Power ground
6	VCOM	Common Voltage
7	DVDD	Digital Power
8	MODE	DE/SYNC mode select. Normally pull high H: DE mode. L: HSD/VSD mode
9:	DE	Data Enable signal.
10	VSD	Vertical sync input. Negative polarity
11	HSD	Horizontal sync input. Negative polarity
12-19	B7-R0	Blue Data
20-27	G7-G0	Green Data
28-35	R7-R0	Red Data
36	GND	Ground
37	DCLK	Clock signal
38	GND	Display on/off
39	SHLR	Left or Right Display Control
40	UPDN	Up / Down Display Control
41	VDDG	Positive Power for TFT
42	VEEG	Negative Power for TFT
43	AVDD	Analog Power
44	RSTB	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10K Ω 'C=1-F)
45	NC	Not connect
46	VCOM	Common Voltage
47	DITH	Dithering setting DITH= $\bar{a}H\bar{a}$ 6bit resolution(last 2 bit of input data truncated) DITH= $\bar{a}L\bar{a}$ 8bit resolution(default setting)
48	GND	Power ground
49	NC	Not connect

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50 NC Not connect

DE mode

DE mode

Parameter	Symbol	Val			Unit
		Min.	Typ.	Max.	
DCLK frequency @Frame	fc	40.8	51.2	67.2	Mh
rate=60hz Horizontal display	lk	1024			z
area	t	1114	1344	1400	DC
HSYNC period	h	90	320	376	LK
time HSYNC	d	600			DC
blanking Vertical	t	610	6	8	LK
display area	h	1	3	0	DC
			5	0	

HV mode(1)

HV mode Horizontal input timing

Parameter		Symbol	Val			Unit
Horizontal display area		th	1024			DCLK
DCLK frequency@ Frame		d	Min.	Typ.	Max.	Mhz
			44.9	51.2	6	
rate=60hz 1 Horizontal Line		fcl	1200	1344	3	
HSYNC pulse width		Mi k	1			DCLK
			Ty			
			M			
		th	140			
HSYNC back porch			160	1	1	
HSYNC front porch		thpw	1	6	6	
				0	0	

HV mode(2)

Vertical input timing

Parameter	Symbol	Val			Unit
		Min.	Typ.	Max.	
Vertical display	tv	600			H H H

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area	VSYNC	d	624	635	750	H
period	time	tv	1		20	
VSYNC	pulse	tv	23	23	23	
VSYNC front porch		tvfp	1	12	1	H

Handling precaution for LCM

LCM is easy to be damaged.

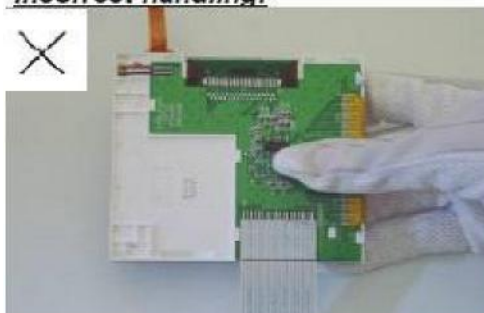
Please note below and be careful for handling!

Correct handling:

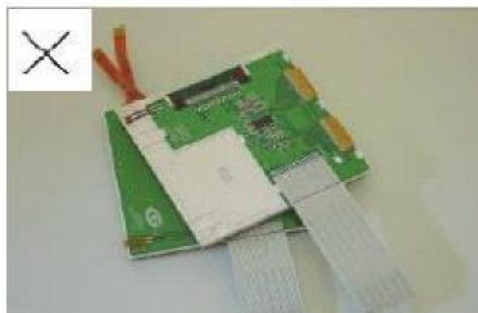


As above picture, please handle with anti-static gloves around LCM edges.

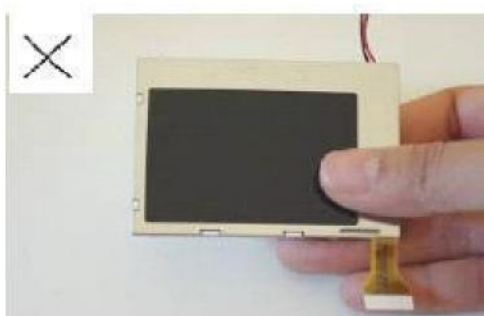
Incorrect handling:



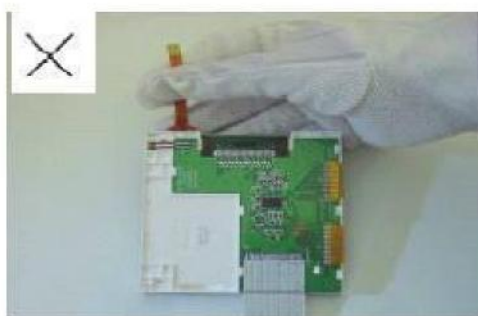
Please don't touch IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.



Please don't stretch interface of output, such as FPC cable.

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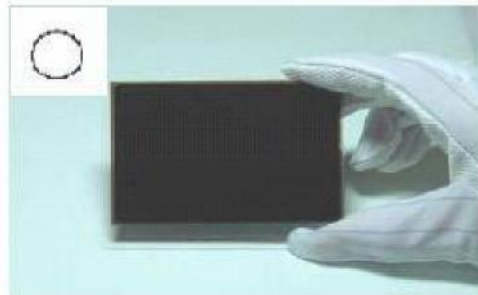
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Handling precaution for LCD

LCD is easy to be damaged.

Please note below and be careful for handling!

Correct handling:

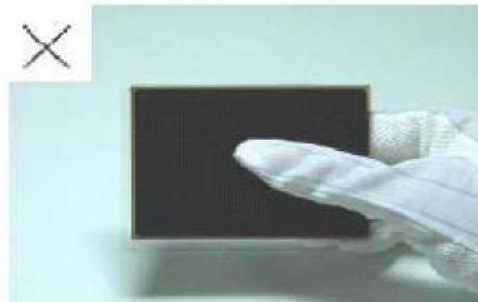


As above photo, please handle with anti-static gloves around LCD edges.

Incorrect handling:



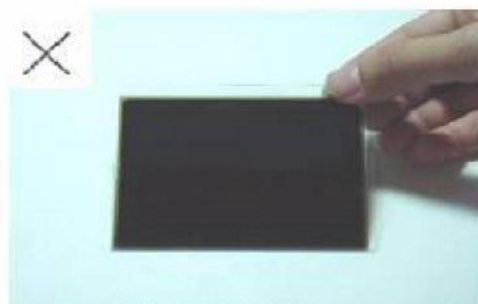
Please don't stack the LCDS.



Please don't hold the surface of LCD.



Please don't operate with sharp stick such as pens.



Please don't touch ITO glass without anti-static gloves.

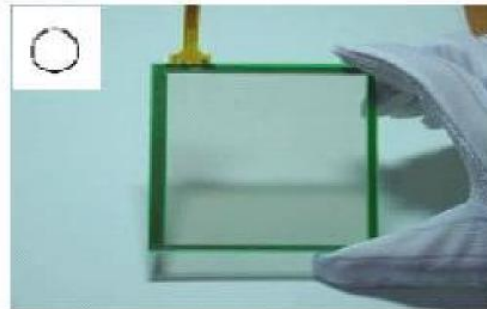
Handling precaution for Touch panel

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Touch Panel is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

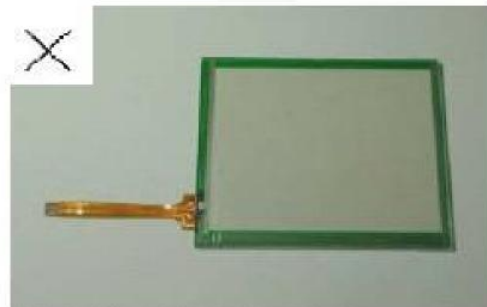


As above picture, please handle with anti-static gloves around touch panel edges.

Incorrect handling:



Please don't operate with sharp stick such as pencil.



Please keep film surface on upper side.



Please don't hold the surface of touch panel.



Please don't hold FPC, stretch FPC, or twist FPC.

Storage Precautions

When storing the LCD modules, the following precaution is necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.

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(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the anti-static electricity container in which they were shipped.

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

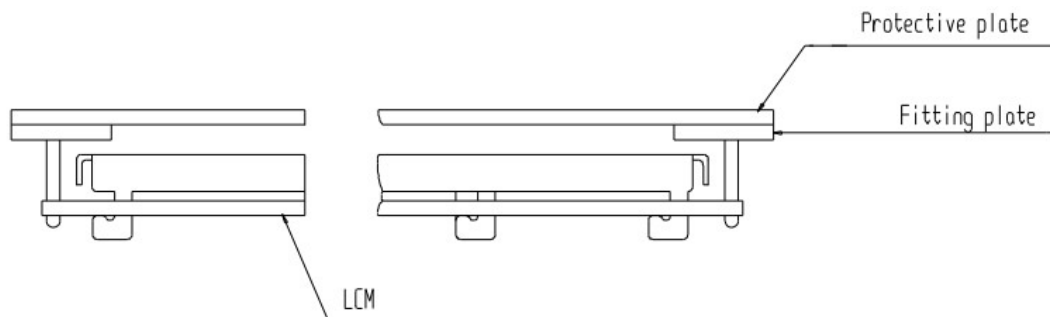
- Exposed area of the printed circuit board.
- Terminal electrode sections.
-

USING LCD MODULES

Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



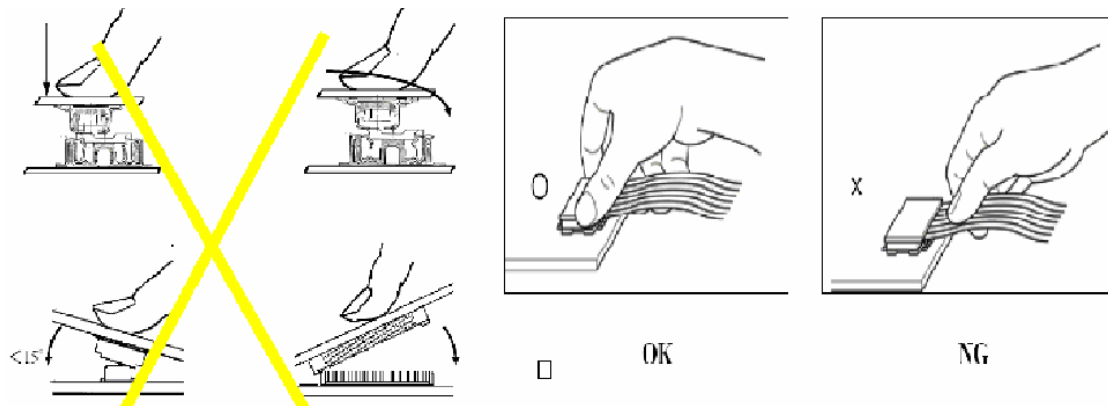
(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be $\pm 0.1\text{mm}$.

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Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows



Precaution for soldering the LCM

	Manual soldering	Machine drag soldering	Machine press soldering
No ROHS product	290°C ~350°C. Time : 3-5S.	330°C ~350°C. Speed : 4-8 mm/s.	300°C ~330°C. Time : 3-6S. Press: 0.8~1.2Mpa
ROHS product	340°C ~370°C. Time : 3-5S.	350°C ~370°C. Time : 4- 8 mm/s.	330°C ~360°C. Time : 3-6S. Press: 0.8~1.2Mpa

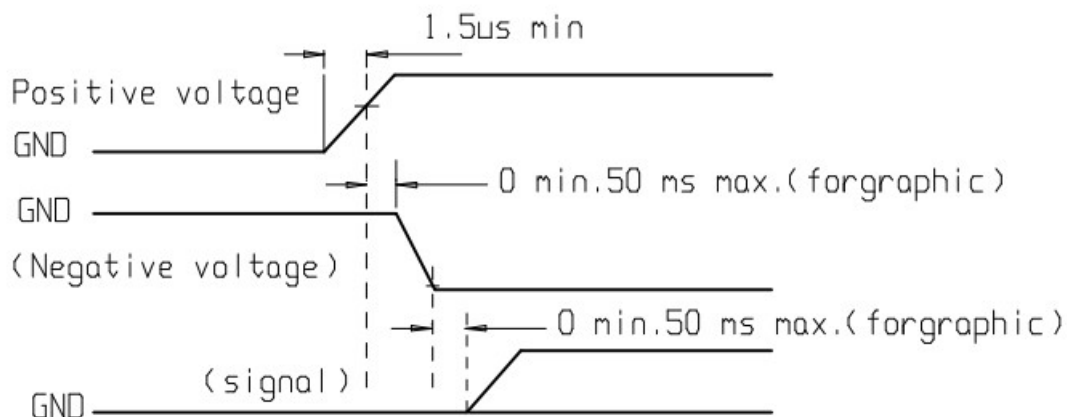
- (1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.
- (2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
- (3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

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Precautions for Operation

- (1) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.
- (2) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- (3) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature.
- (4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- (5) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.
- (6) Input each signal after the positive/negative voltage becomes stable.
- (7) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.



Safety

- (1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

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(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

Limited Warranty

Unless agreed between BOCEN and customer, BOCEN will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with BOCEN LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to BOCEN within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of BOCEN limited to repair and/or replacement on the terms set forth above. BOCEN will not be responsible for any subsequent or consequential events.

Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

PACKING SPECIFICATION

TBD

PRIOR CONSULT MATTER

1.For Bocen standard products, we keep the right to change material, process ... for improving the product property without notice on our customer.

2.For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.

BOCEN Bocen Display Technology Co., Ltd.

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3.If you have special requirement about reliability condition, please let us know before you start the test on our samples.