



Display Future Ltd

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LCD MODULE SPECIFICATION

Model: DF-TFR0496FB-F1

This module uses ROHS materials

For customer acceptance

Customer		date
Approved		
Comments		

The standard product specification may change without prior notice in order to improve performance or quality. Please contact Display Future Ltd for updated specification and product status before design for the standard product or release of the order.

Revision	1.0
Engineering	
Date	2018/01/4
Our Reference	

Table Of Contents

List	Description	Page No.
0	Cover	1
0	Table Of Contents	2
1	Revision Record	3
2	General Description	4
3	External Dimensions	5
4	Interface Description	6
5	Absolute Maximum Ratings	7
6	Electrical Characteristics	7
7	Timing Characteristics	8
8	Backlight Characteristics	11
9	Optical Characteristics	12
10	Reliability Test Conditions And Methods	14

2. General Description

2.1 Description

DF-TFR0496FB-F1 is a Transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver IC, FPC ,TP and backlight unit . The following table described the features of DF-TFR0496FB-F1.

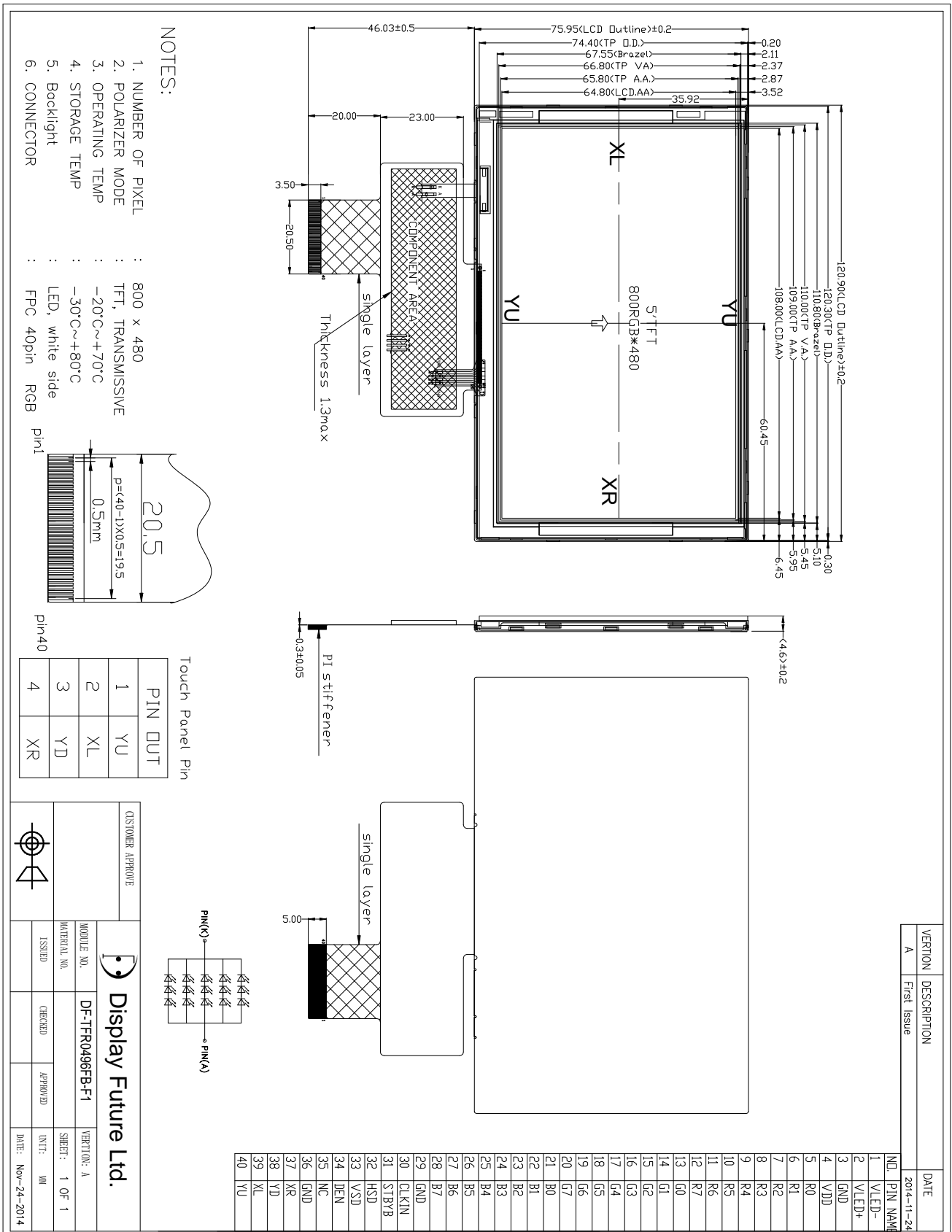
2.2 Application

Mobile phone, Multimedia products
and other electronic Products
Etc.

2.3 Features:

Features	Description	UNITS
LCD type	5" TFT	--
Dot arrangement	800 (RGB) × 480	dots
Driver IC	OTA7001A and OTD9960A	--
Color Depth	16.7M	
Interface	24-Bit RGB Interface	--
View Direction	6 O'clock	--
Module size	120.9(W) × 75.95 (H) × 4.2(T)	mm
Active area	108.00(W) × 64.80(H)	mm
Dot pitch	0.135 (W) × 0.135 (H)	mm
Back Light	15 White LED In serial/parallel	--
With/Without TSP	With TSP	
Weight(g)	TBD	

3. External Dimensions



4. Interface Description

Pin No.	Symbol	Functional	Remark
1	VLED-	Power for LED backlight cathode.	
2	VLED+	Power for LED backlight anode.	
3	GND	Power ground.	
4	VDD	Power voltage.	
5	R0	Red data(LSB).	
6	R1	Red data.	
7	R2	Red data.	
8	R3	Red data.	
9	R4	Red data.	
10	R5	Red data.	
11	R6	Red data.	
12	R7	Red data(MSB).	
13	G0	Green data(LSB).	
14	G1	Green data.	
15	G2	Green data.	
16	G3	Green data.	
17	G4	Green data.	
18	G5	Green data.	
19	G6	Green data.	
20	G7	Green data(MSB).	
21	B0	Blue data(LSB).	
22	B1	Blue data.	
23	B2	Blue data.	
24	B3	Blue data.	
25	B4	Blue data.	
26	B5	Blue data.	
27	B6	Blue data.	
28	B7	Blue data(MSB).	
29	GND	Power Ground.	
30	CLKIN	Pixel clock.	
31	STBYB	Display on/off.	
32	HSD	Line synchronizing signal for RGB interface operation.	
33	VSD	Frame synchronizing signal for RGB interface operation.	
34	DE	Data Enable.	
35	NC	No Connector.	
36	GND	Power Ground.	
37	XR	Touch Panel Right Side Wire.	
38	YD	Touch Panel Down Side Wire.	
39	XL	Touch Panel Left Side Wire.	
40	YU	Touch Panel Up Side Wire.	

5. Absolute Maximum Ratings

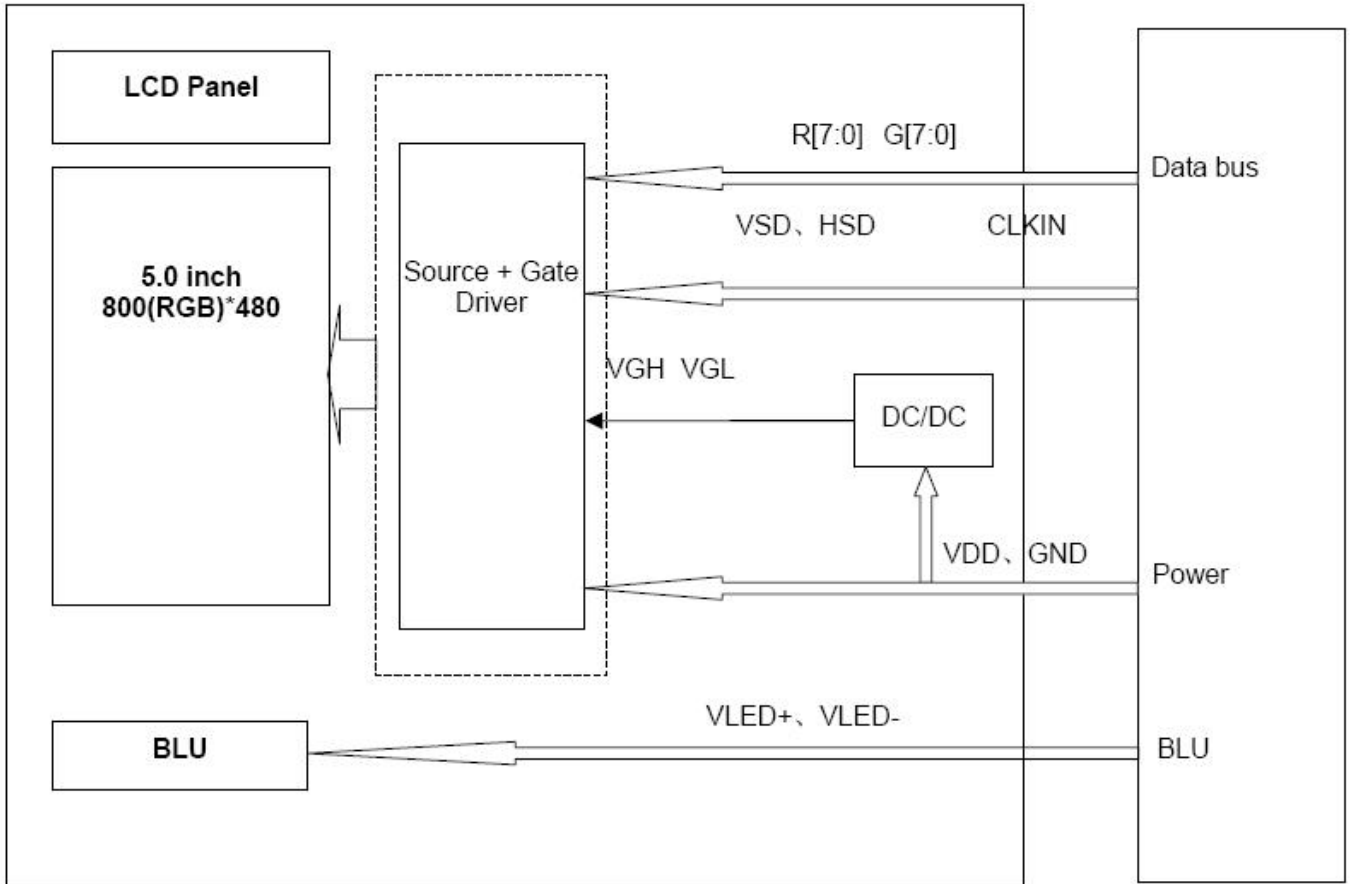
Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	V_{DD}	-0.3	5.0	V
Operating temperature	T_{OP}	-20	+70	°C
Storage temperature	T_{ST}	-30	+80	°C

6. Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage for logic	V_{DD}	3.0	3.3	3.6	V	V_{DD}
Input voltage	V_{IL}	0	-	$0.3V_{DD}$	V	
	V_{IH}	$0.7 V_{DD}$	-	V_{DD}	V	

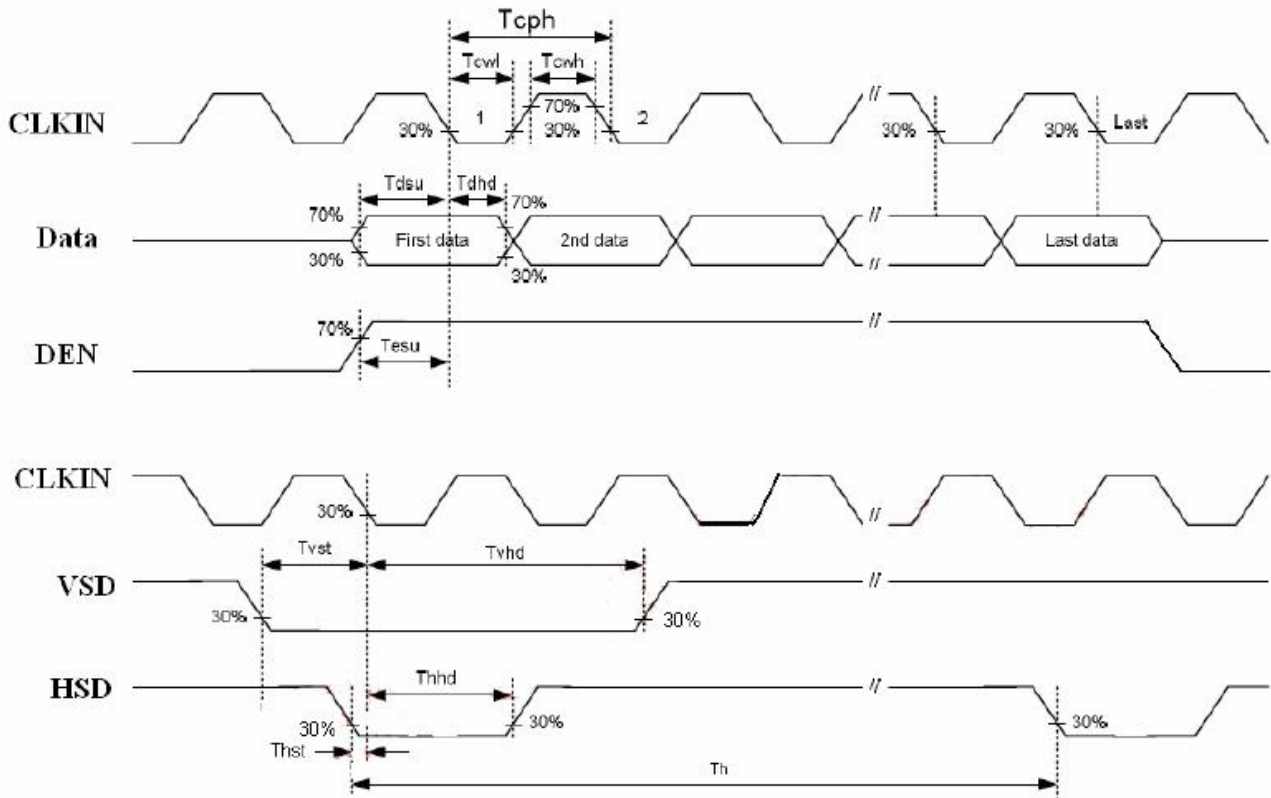
7. Timing Characteristics.

7.1 Block Diagram.



7.2 Input Clock And Data Timing

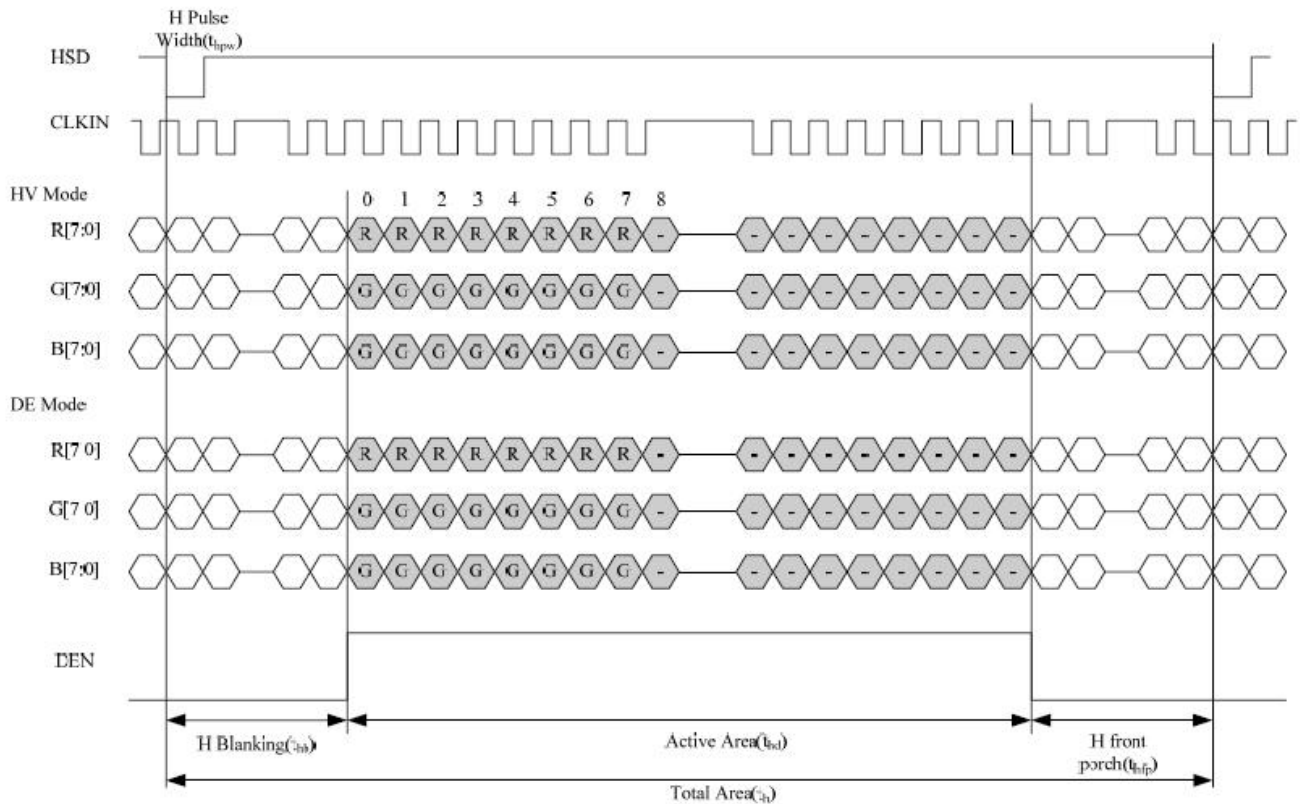
Parameter	Symbol	Min	Typ	Max	Unit	Remark
HSD Setup Time	T_{hst}	8			ns	
HSD Hold Time	T_{hhd}	8	-	-	ns	
VSD Setup Time	T_{vst}	8			ns	
VSD Hold Time	T_{vhd}	8	-	-	ns	
Data Setup Time	T_{dsu}	8			ns	
Data Hold Time	T_{dhd}	8	-	-	ns	
DE Setup Time	T_{esu}	8			ns	
DE Hold Time	T_{ehd}	8	-	-	ns	
CLKIN Cycle Time	T_{cph}	20	-	-	ns	
CLKIN Pulse Width	T_{cwh}	40	50	60	%	
Output stable time	T_{sst}	-	-	6	us	
VDD Power ON Slew rate	T_{por}			20	ms	
RSTB pulse width	T_{Rst}	10	-	-	us	



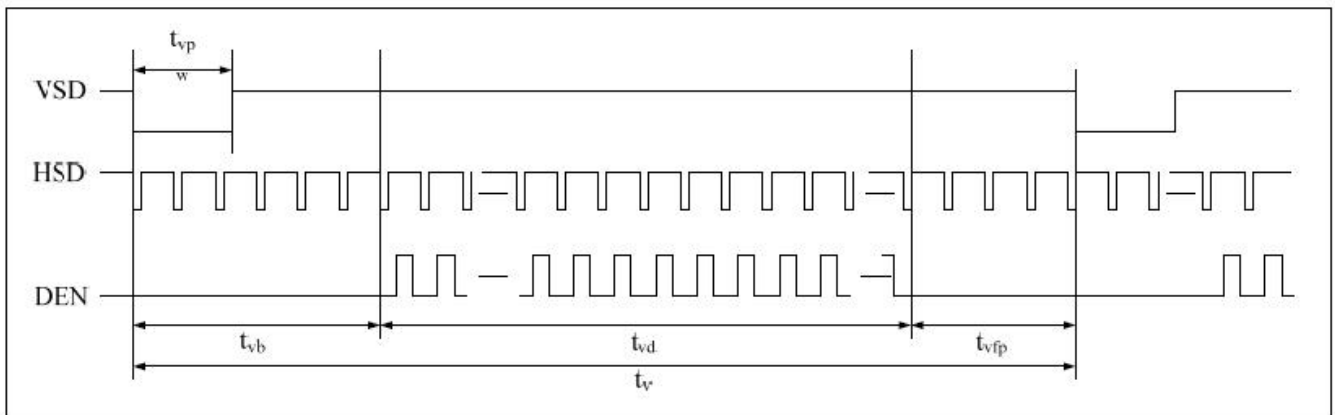
7.3 Parameter Setting Of Timing

Parameter	Symbol	Spec			Unit
		Min	Typ	Max	
Horizontal display area	t_{hd}		800		CLKIN
CLKIN frequency (60Hz)	f_{clk}	-	30	50	MHZ
One Horizontal Line	t_h	889	928	1143	CLKIN
HSD pulse width	t_{hpw}	1	48	255	CLKIN
HSD blanking	t_{hb}		88		CLKIN
HSD front porch	t_{hfp}	1	40	255	CLKIN
Vertical display area	t_{vd}		480		T_H
VSD period time	t_v	513	525	767	T_H
VSD pulse width	t_{vpw}	3	3	255	T_H
VSD Blanking(t_{vb})	t_{vb}		32		T_H
VSD Front porch (t_{vfp})	t_{vfp}	1	13	255	T_H

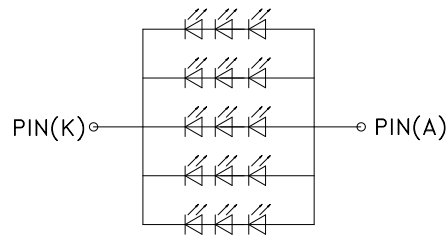
7.4 Horizontal Input Timing Diagram



7.5 Vertical Input Timing Diagram



8. Backlight Characteristics.



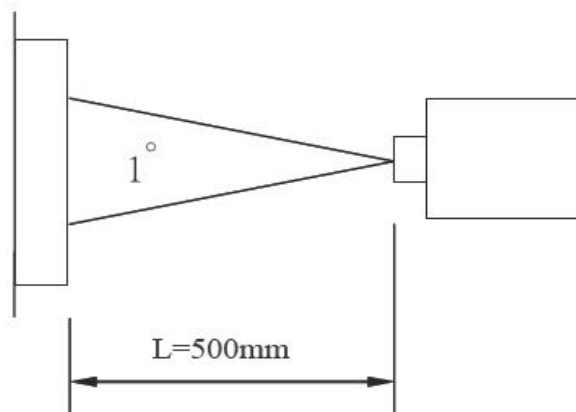
Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	9.1	9.6	10.1	V	If=100 mA	-
Supply Current	If	-	100	-	mA	-	-
Reverse Voltage	Vr	-	-	5	V	10uA	
Power dissipation	Pd	-	960	-	mW	-	
Luminous Intensity for LCM		350	400	-	cd/m²	If=100 mA	
Uniformity for LCM	-	80	-	-	%	If=100 mA	
Life Time	-	50000	-	-	Hr	If=100 mA	-
Backlight Color	White						

9.Optical Characteristics

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance	T		3.3	3.97		%	
Contrast Ratio	CR	*1)		350	-	--	Note 3
Response Time	Tr+ Tf	*3)	-	20		ms	Note 4
Viewing Angle	U	$\theta^{*2)}$	$CR \geq 10$	45	50	-	Note 5
	D			55	60	-	
	L	$\psi^{*2)}$		60	65	-	
	R			60	65	-	
Color Filter Chromacicity	White	x y Y	$\theta = \phi = 0^\circ$	0.297	0.317	0.337	Note 6
				0.304	0.324	0.344	
				27.5	30.5	33.5	
	Red	x y Y	$\theta = \phi = 0^\circ$	0.613	0.633	0.653	
				0.321	0.341	0.361	
				18.3	21.3	24.3	
	Green	x y Y	$\theta = \phi = 0^\circ$	0.304	0.324	0.344	
				0.531	0.551	0.571	
				48.4	52.4	56.4	
	Blue	x y Y	$\theta = \phi = 0^\circ$	0.133	0.153	0.173	
				0.123	0.143	0.163	
				14.8	17.8	20.8	
NTSC			-	50%	-		

Note 1.Ambient condition : 25°C±2°C , 60±10%RH , under 10 Lux in the darkroom ◦

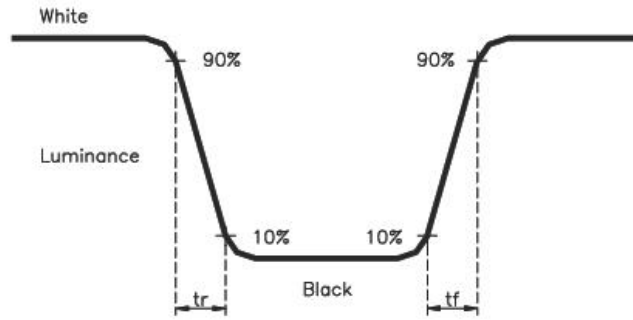
Note 2.Measure device : BM-5A (TOPCON) , viewing cone=1° , I_L=20mA ◦



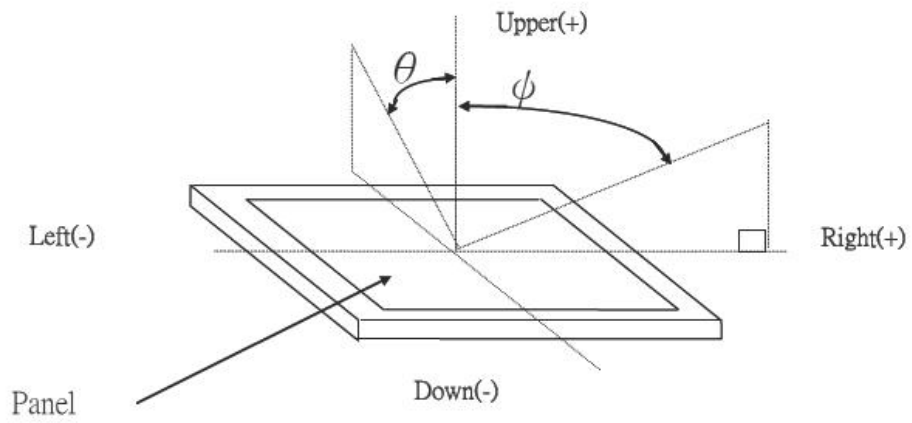
Note 3. Definition of Contrast Ratio :

$$CR = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$$

Note 4. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ , ψ) :



Note 6. Light source: C light.

■ Inspection Standard

Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

If the Customer has other agreements with Display Future Ltd for standards, please refer to that agreement.

Inspection Condition

Room Temperature: 25±5°C.

Humidity: 65±5% RH. Illu-

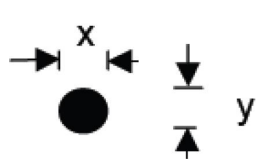
mination: 300 ~ 700 Lux.

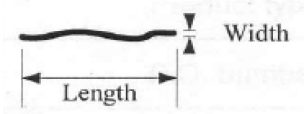
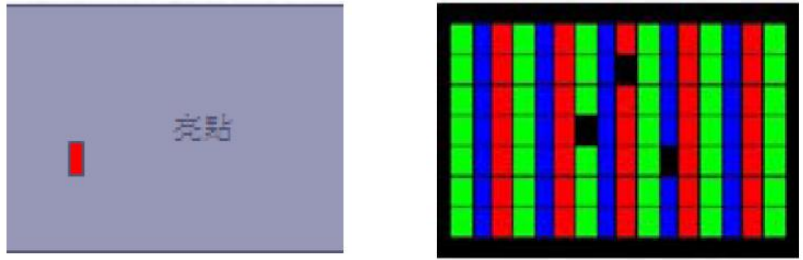
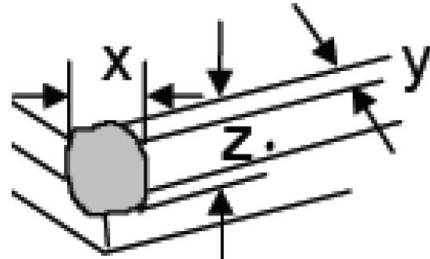
Distance: 35±5 cm

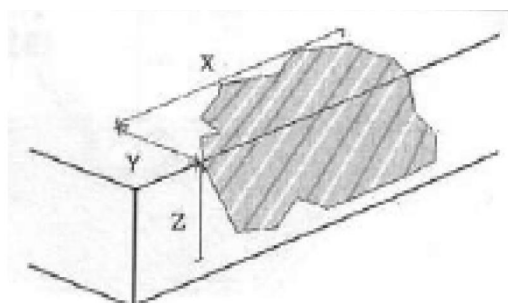
Major defect.

Item No	Items to be inspected	Inspection Standard
1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
2	missing	Missing function component
3	Crack	Glass Crack

Minor defect.

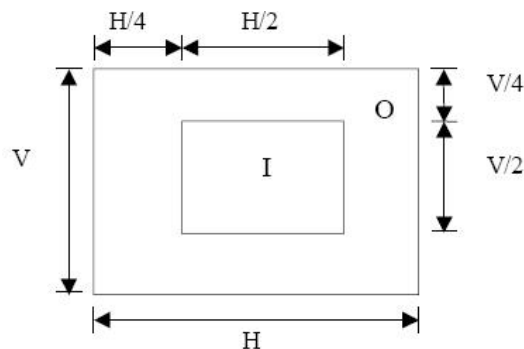
Item No	Items to be inspected	Inspection standard	
1	Spot Defect Including Black spot White spot Pinhole Foreign particle Polarizer dirt	For dark/white spot is defined: $\varphi = (x+y) / 2$ 	
		Size φ (mm)	Size φ (mm)
		$\varphi \leq 0.15$	Ignore
		$0.15 < \varphi \leq 0.30$	3
		$0.30 < \varphi$	Not allowed

2	Line Defect Including Black line White line Scratch	Define:			
					
		Width(mm)	Length(mm)	Acceptable Quantity	
		$W \leq 0.03$		Ignore	
		$0.03 < W \leq 0.05$	$L \leq 4.0$	3	
	$0.03 < W \leq 0.08$	$L \leq 4.0$	1		
	$0.08 < W$	$L > 4.0$	Not allowed		
3	Polarizer Dent/Bubble	Width(mm) Length(mm)			
		$\phi \leq 0.25$			
		$0.2 < \phi \leq 0.3$			
		$0.3 < \phi \leq 0.5$			
		$0.5 < \phi$	0		
4.	Electrical Dot Defect	Bright and Black dot define:			
					
		Inspection pattern: Full white、 Full black、 Red、 green and blue screens			
		Item	Acceptable Quantity		
			I area	O area	Total
	Black dot defect	1	3	3	
	Bright dot defect	1	1	1	
	Total Dot	2	4	4	
5	Glass defect	1. Corner Fragment:			
					
		Size(mm)	Acceptable Quantity		

		$X \leq 4.0\text{mm}$ $Y \leq 3.0\text{mm}$ $Z \leq T$	Ignore T: Glass thickness X: Length Y: Width Z: thickness
		2.Side Fragment: 	
		Size(mm)	Acceptable Quantity
		$X \leq 5.0\text{mm}$ $Y \leq 2.0\text{mm}$ $Z \leq T$	Ignore T: Glass thickness X: Length Y: Width $Z \leq T$ Z: thickness

Note:

1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.
2. The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.
3. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.
4. The definitions of the inner display area
 And outer display area
 I: Inner display area
 O: Outer display area



■ PRECAUTIONS FOR USING LCD MODULES

Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control, Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential

- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated

(13) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

Handling precaution for LCM

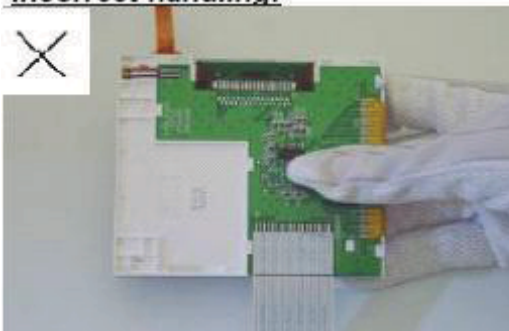
LCM is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

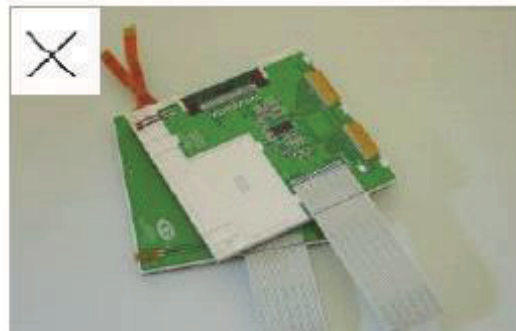


As above picture, please handle with anti-static gloves around LCM edges.

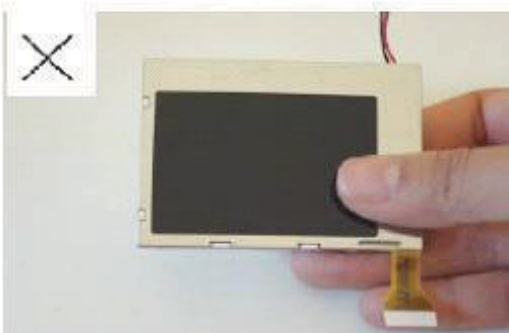
Incorrect handling:



Please don't touch IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.

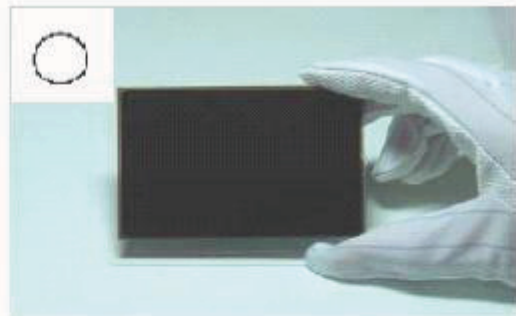
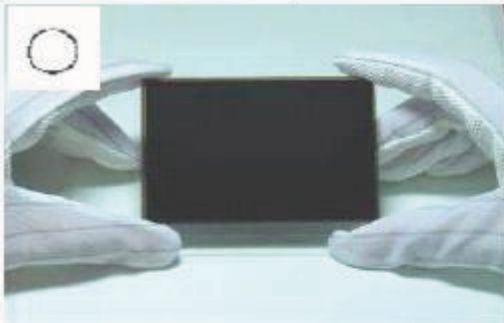


Please don't stretch interface of output, such as FPC cable.

Handling precaution for LCD

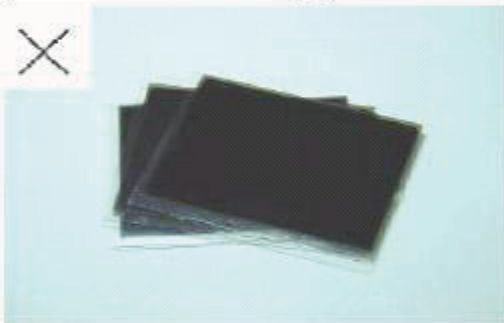
LCD is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

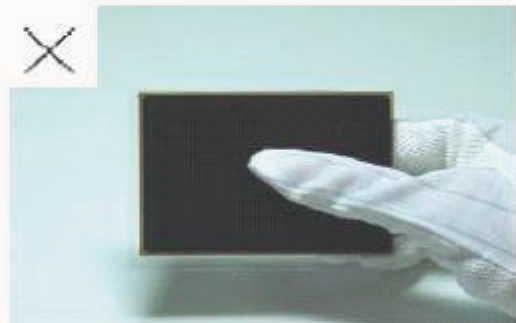


As above photo, please handle with anti-static gloves around LCD edges.

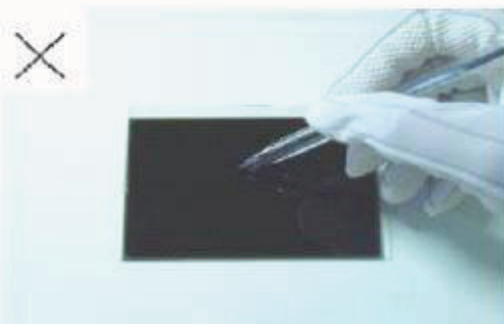
Incorrect handling:



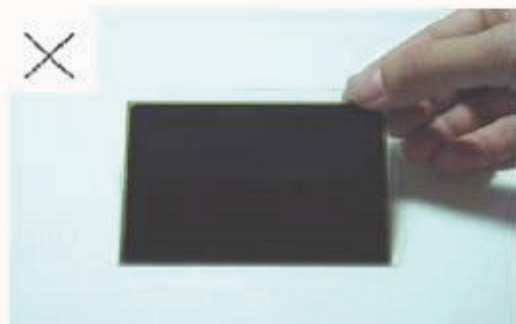
Please don't stack the LCDS.



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.

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.
- (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.

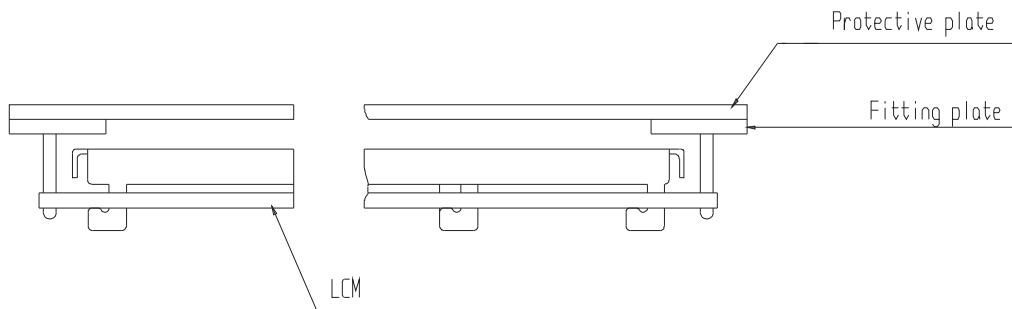
- Exposed area of the printed circuit board.
- Terminal electrode sections.

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.

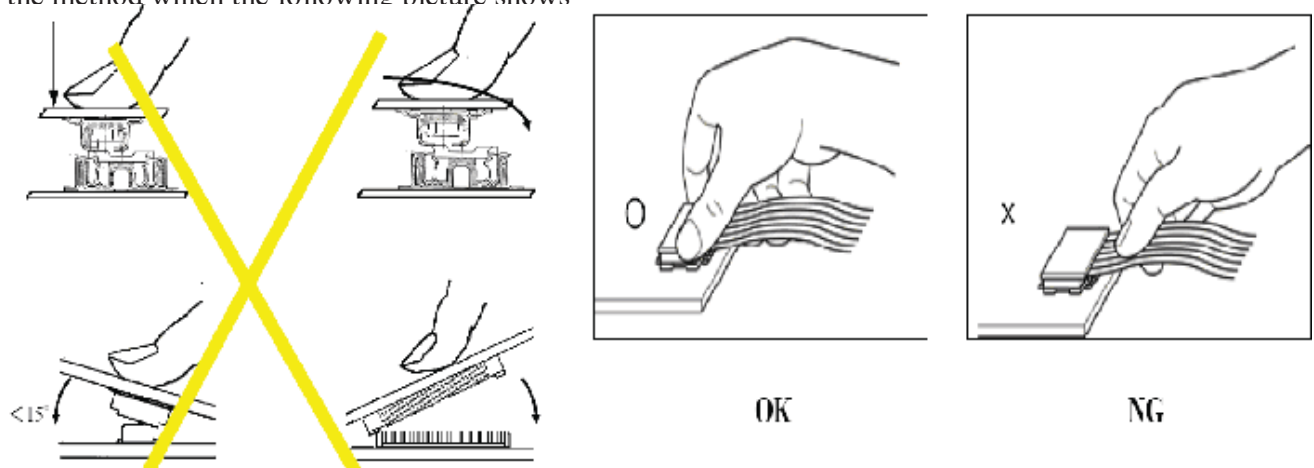
- (1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



- (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 ± 0.1 mm.

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 to the LCM

	Hand 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.

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.

(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.

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Limited Warranty

Unless agreed otherwise between Display Future Ltd and customer, Display Future will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned within 90 days of the shipment. Confirmation of such date shall be based on data code on the product.

The warranty liability of Display Future limited to repair and/or replacement on the terms set forth above. Display Future 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.

■ PRIOR CONSULT MATTER

1.①For Display Future standard products, we keep the right to change material and processes for improving the product, without notice to our customers.

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

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