



MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0160AT-1

This module uses ROHS material

For Customer's Acceptance:

Customer	
Approved	
Comment	

This specification may change without prior notice in order to improve performance or quality. Please contact Multi-Inno for updated specification and product status before design for this product or release of this order.

Revision	1.0
Engineering	
Date	2013-07-30
Our Reference	



REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2013-07-30	First release	

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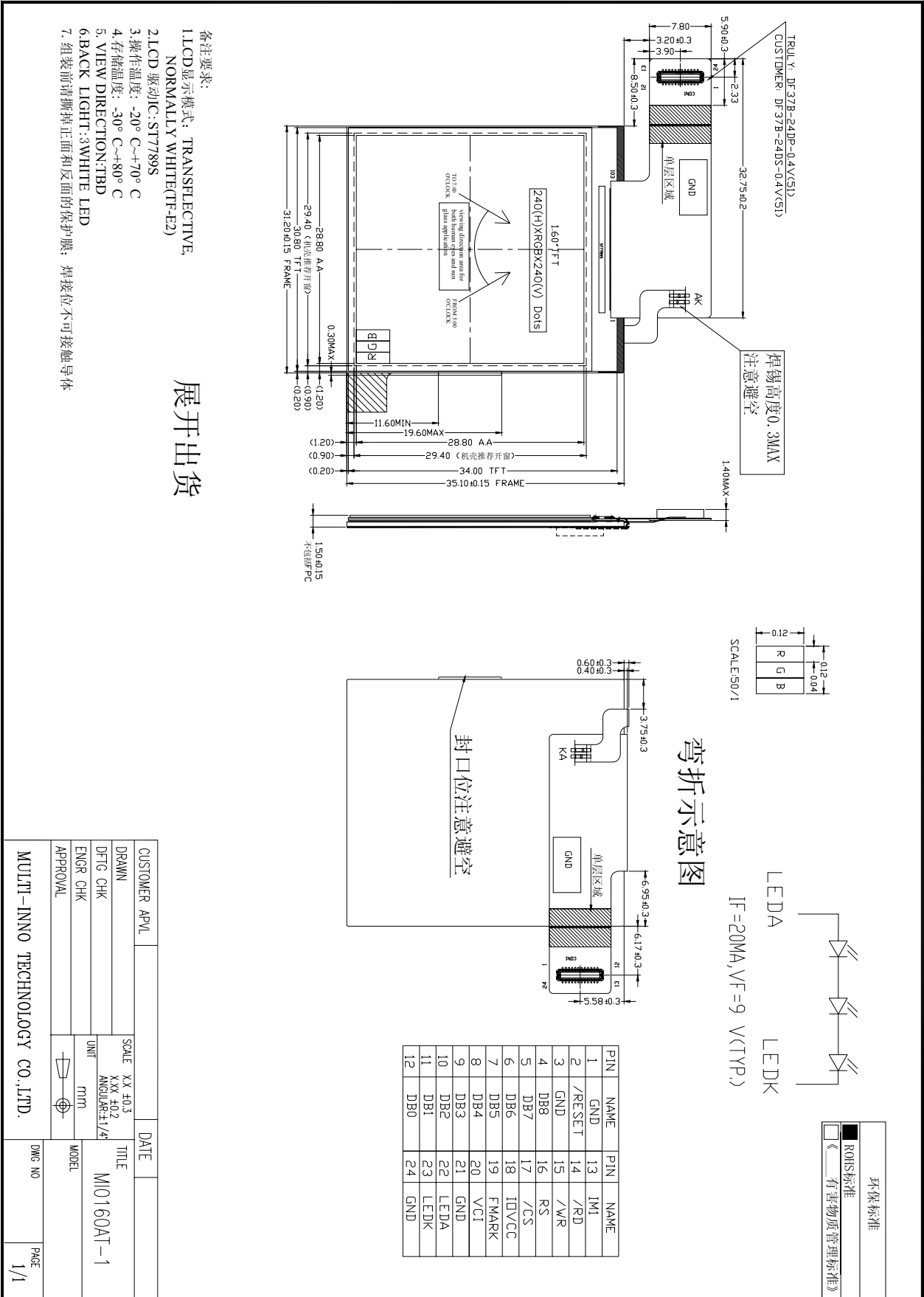
**■ GENERAL INFORMATION**

Item of general information	Contents	Unit
LCD Type	TFT/TRANSFLECTIVE	/
Recommended viewing direction	from 5:00 O'clock to 7:00 O'clock	O' Clock
Module area (W × H×T)	31.20×35.10×1.50	mm ³
Active area (W×H)	28.80×28.80	mm ²
Number of Dots 点阵	240RGB×240	/
Pixel pitch (W × H)	0.12×0.12	mm ²
Driver IC	ST7789S	/
Interface Type	MCU	/
Input voltage	2.8	V
Module Power consumption	TBD	mw
Colors	262K	/
Backlight Type	3 LEDs	/
With/Without TSP	Without TSP	/
Weight	TBD	g

Note 1 : RoHS compliant;

Note 2: LCM weight tolerance: ± 5% .

EXTERNAL DIMENSIONS



■ ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	Symbol	Min	Max	Unit
Supply voltage for logic	VCI	-0.3	4.6	V
I/O power supply	IOVCC	-0.3	4.6	V
Input voltage	VIN	0.5	IOVCC+0.5	V
Operating temperature	Top	-20	70	°C
Storage temperature	TST	-30	80	°C
Humidity	RH	-	90%(Max60 °C)	RH

Note: Absolute maximum ratings means the product can withstand short-term, NOT more than 120 hours. If the product is a long time to withstand these conditions, the life time would be shorter.

■ ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Parameter of DC characteristics	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VCI	2.4	2.8	3.3	V
I/O power supply	IOVCC	1.65	1.8/2.8	3.3	V
Input Current	I _{dd}	-	TBD	TBD	mA
Input voltage 'H' level	V _{IH}	0.7IOVCC	-	IOVCC	V
Input voltage 'L' level	V _{IL}	GND	-	0.3IOVCC	V
Output voltage 'H' level	V _{OH}	0.8IOVCC	-	IOVCC	V
Output voltage 'L' level	V _{OL}	GND	-	0.2IOVCC	V

■ BACKLIGHT CHARACTERISTICS

Item of backlight characteristics	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	V _f	7.8	9.0	10.0	V	If=20mA;Ta=25°C
Number of LED	-	-	3	-	Piece	-
Connection mode	S	-	Serial	-	-	-

Using condition: constant current driving method If=20mA(+/-10%).

■ ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+ Tf	$\theta=0^\circ$ $\varnothing=0^\circ$ $T_a=25^\circ\text{C}$	-	TBD	TBD	ms	FIG 1.	4
Contrast ratio	Cr		TBD	TBD	-	---	FIG 2.	1
Luminance uniformity	δ WHITE		TBD	TBD	-	%	FIG 2.	3
Surface Luminance	Lv		TBD	TBD	-	cd/m ²	FIG 2.	2
Viewing angle range	θ	$\varnothing = 90^\circ$	TBD	TBD	-	deg	FIG 3.	6
		$\varnothing = 270^\circ$	TBD	TBD	-	deg	FIG 3	
		$\varnothing = 0^\circ$	TBD	TBD	-	deg	FIG 3	
		$\varnothing = 180^\circ$	TBD	TBD	-	deg	FIG 3	
NTSC ratio	-	-	-	TBD	-	%	-	-
CIE (x, y) chromaticity CIE	Red x	$\theta=0^\circ$ $\varnothing=0^\circ$ $T_a=25^\circ\text{C}$	TBD	TBD	TBD	-	FIG 2.	5
	Red y		TBD	TBD	TBD	-		
	Green x		TBD	TBD	TBD	-		
	Green y		TBD	TBD	TBD	-		
	Blue x		TBD	TBD	TBD	-		
	Blue y		TBD	TBD	TBD	-		
	White x		TBD	TBD	TBD	-		
	White y		TBD	TBD	TBD	-		

Note1. Contrast Ratio(CR) is defined mathematically by the following formula. For more information see FIG 2.:

$$\text{Contrast Ratio(CR)} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, \dots)}}{\text{Average Surface Luminance with all black pixels (P1, P2, \dots)}}$$

Note2. Surface luminance is the LCD surface luminance with all white pixels. For more information see FIG 2.

$$L_v = \text{Average Surface Luminance with all white pixels (P1, P2, \dots)}$$

Note3. The uniformity in surface luminance (δ WHITE) is determined by measuring luminance at each test position, and then dividing the maximum luminance of all white pixels by minimum luminance of all white pixels. For more information see FIG 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, \dots)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, \dots)}}$$

Note4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1..

Note5. CIE(x, y) chromaticity is the Center point value. For more information see FIG 2.

Note6. Viewing angle is the angle at which the contrast ratio is greater than a specific value. For TFT module, the specific value of contrast ratio is 10; For monochrome and color stn module, the specific value of contrast ratio is 2. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

Note7. For Viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments. For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing data is base on CS-2000 photo detector.

Note8. For TN type TFT transmissive module, Gray scale reverse occurs in the direction of panel viewing angle

FIG.1. The definition of Response Time

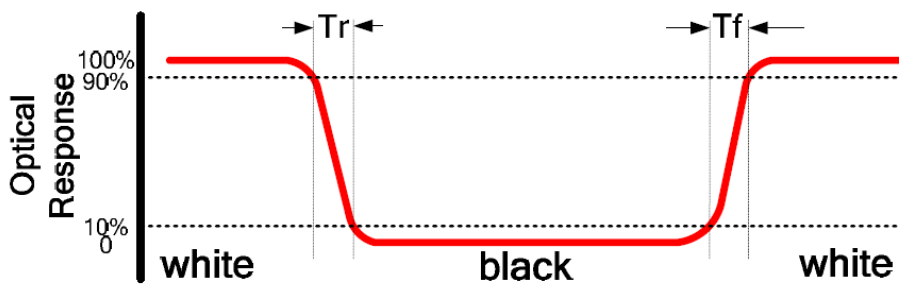


FIG.2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

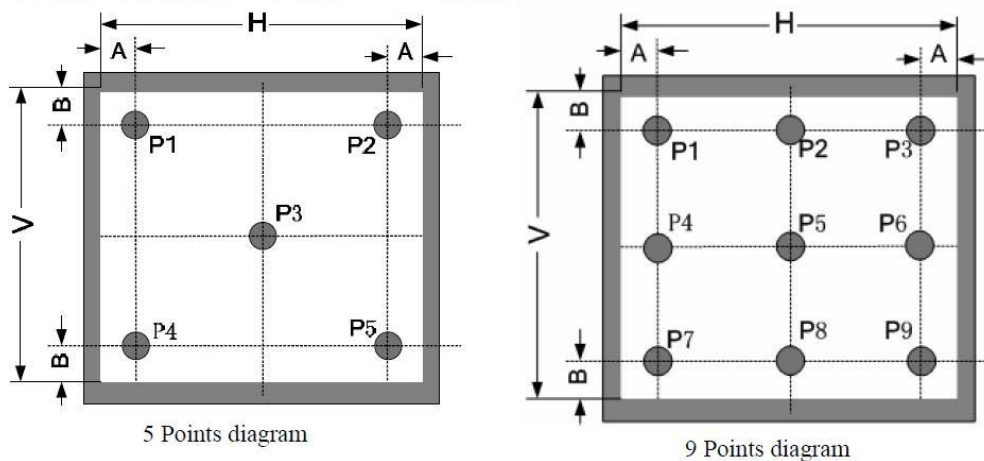


Fig2 Note1 For TFT Module Test point:9 points(as 9 Points diagram)

A : $H/6$ (if AA size < 4.0 inch); $H/10$ (if AA size ≥ 4.0 inch)

B : $V/6$ (if AA size < 4.0 inch); $V/10$ (if AA size ≥ 4.0 inch)

H, V : Active Area(AA) size

Measurement instrument: CS-2000; Light spot size $\varnothing=5$ mm, 350mm distance from the LCD surface to detector lens.

Fig2 Note2 For non-TFT Module and Dot-Matrix type Module

- 2.1 If the minimum side size is bigger than 20 mm, the testing method is the same as TFT module.
- 2.2 If the minimum side size is less than 20 mm, then testing 5 point datas (as 5 Points diagram), Both A and B are 5 mm.
- 2.3 Measurement instrument: CS-2000 is priority selected to measure.

Light spot size $\varnothing=5\text{mm}$, 350mm distance from the LCD surface to detector lens.

- 2.4 Measurement instrument : ConoScope will be selected to measure If CS-2000 cannot meet the measurement requirement.

Light spot size $\varnothing=0.2-2.0\text{mm}$. About 2-3mm distance from the LCD surface to detector lens, but suggest to confirm the best distance on focusing the picture to be clearest when actually measuring.

Fig2 Note3 For non-TFT Module and non-Dot-Matrix type Module

The test point is defined by the fact size and shape of module, but the center point and four edges should be selected.

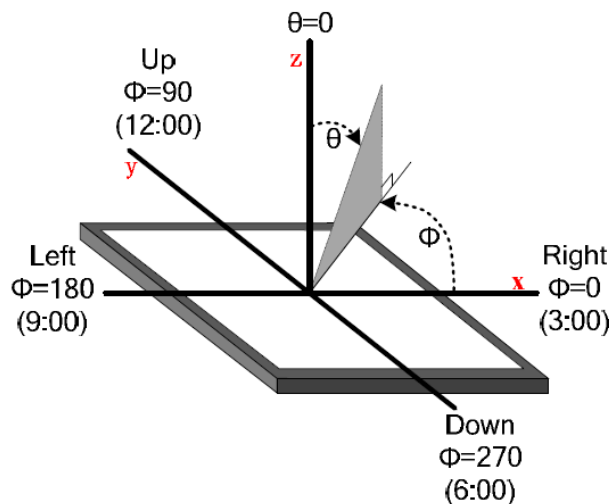
- 3.1 Measurement instrument: CS-2000 is priority selected to measure..

Light spot size $\varnothing=5\text{mm}$, 350mm distance from the LCD surface to detector lens.

- 3.2 Measurement instrument : ConoScope will be selected to measure If CS-2000 cannot meet the measurement requirement.

Light spot size $\varnothing=0.2-2.0\text{mm}$. About 2-3mm distance from the LCD surface to detector lens, but suggest to confirm the best distance on focusing the picture to be clearest when actually measuring.

FIG.3. The definition of viewing angle



■ INTERFACE DESCRIPTION

Interface NO.	Symbol	I/O or connect to	Description	When not in use
1	GND	Power supply	Power Ground	/
2	RESET	I Host processor	This signal will reset the device and it must be applied to properly initialize the chip. Signal is active low	/
3	GND	Power supply	Power Ground	/
4	DB08	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
5	DB07	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
6	DB06	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
7	DB05	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
8	DB04	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
9	DB03	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
10	DB02	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
11	DB01	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
12	DB00	I/O Host processor	MCU parallel interface data bus	IOVCC /GND
13	IM1	I Host processor	The MCU interface mode select. IM1=0 is 80-8bit parallel I/F (DB[7:0]) .IM1=1 is 80-9bit parallel I/F (DB[8:0])	IOVCC /GND
14	RD	I Host processor	Read enable in 8080 MCU parallel interface.	IOVCC /GND
15	WR	I Host processor	Write Enable pin in MCU paralle interface	IOVCC /GND
16	RS	I Host processor	Display data/command selection pin in MCU interface Low: display data . High: command data.	IOVCC /GND
17	CS	I Host processor	Chip selection pin Low enable. High disable.	/
18	IOVCC	Power supply	Power Supply for I/O system.IOVCC=1.65V ~ 3.3V	/
19	FMARK	O Host processor	Tearing effect signal is used to synchronize MCU to frame memory writing.	open
20	VCI	Power supply	Power Supply for Analog, Digital System and Booster Circuit.VCI=2.4V ~ 3.3V	/
21	GND	Power supply	Power Ground	/



22	LEDA	Power supply	LED Anode	/
23	LEDK	Power supply	LED Cathode	/
24	GND	Power supply	Power Ground	/

■ REFERENCE APPLICATION CIRCUIT

Please consult our technical department for detail information.

■ RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±2℃/200 hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value.
2	Low Temperature Storage	-30±2℃/200 hours	
3	High Temperature Operating	70±2℃/120 hours	
4	Low Temperature Operating	-20±2℃/120 hours	
5	Temperature Cycle storage	-20±2℃~25~70±2℃×10cycles (30min.) (5min.) (30min.)	
6	Damp proof Test operating	50℃±5℃×90%RH/120 hours	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm, X, Y, Z direction for total 3hours (Packing condition)	
8	Dropping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	

Remark:

- The test samples should be applied to only one test item.
- Sample size for each test item is 5~10pcs.
- For Damp Proof Test, Pure water(Resistance>10MΩ) should be used.
- In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

■ INSPECTION CRITERION

	OUTGOING QUALITY STANDARD	PAGE 1 OF 5
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TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	TFT-LCD Module product (Industrial Type)
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This specification is made to be used as the standard of acceptance/rejection criteria for industrial type TFT-LCD module product

1. Sample plan

Sampling plan according to GB/T2828.1-2003/ISO 2859-1: 1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:

Major defect: AQL 0.65

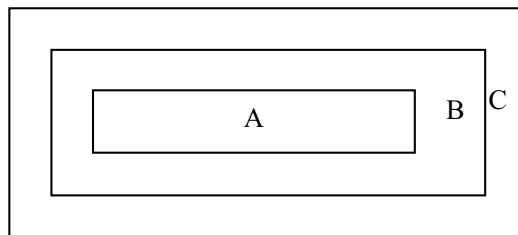
Minor defect: AQL 1.5

2. Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line. ((Normal temperature 20~25°C and normal humidity 60±15%RH)

3. Definition of Inspection Item.

3.1 Definition of inspection zone in LCD.



Zone A: character/Digit area

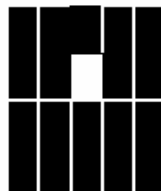
Zone B: viewing area except Zone A (Zone A+Zone B=minimum Viewing area)


Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

3.2 Definition of some visual defect

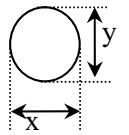
Bright dot	<p>Because of losing all or part function, bad pixel dots appear bright and the size is more than 50% of one dot in which LCD panel is displaying under black pattern.</p> 
Dark dot	<p>Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture, or pure whiter picture.</p>

 OUTGOING QUALITY STANDARD	PAGE 2 OF 5
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	TFT-LCD Module product (Industrial Type)

4. Major Defect

Item No.	Items to be inspected	Inspection Standard	Classification of defects
4.1	Functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Excess power consumption 6) Back-light no lighting, flickering and abnormal lighting	major
4.2	Missing	Missing component	
4.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	

5. Minor Defect

Item No.	Items to be inspected	Inspection Standard	Classification of defects																													
5.1	Bright dot /dark dot defect	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="3" style="width:30%;">Zone</th> <th colspan="2" style="width:40%;">Acceptable Qty</th> <th rowspan="3" style="width:30%;"></th> </tr> <tr> <th colspan="2" style="text-align: center;">A+B</th> <th rowspan="2" style="text-align: center;">C</th> </tr> <tr> <th style="width:15%; text-align: center;"><4.3"</th> <th style="width:15%; text-align: center;">≥4.3"</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Size</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Bright pixel dot</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td rowspan="6" style="text-align: center; vertical-align: middle;">Acceptable</td> </tr> <tr> <td style="text-align: center;">Dark pixel dot</td> <td style="text-align: center;">4</td> <td style="text-align: center;">4</td> </tr> <tr> <td style="text-align: center;">2 bright dots adjacent</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">2 dark dots adjacent</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">Total bright and dark dots</td> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> </tr> </tbody> </table>	Zone	Acceptable Qty			A+B		C	<4.3"	≥4.3"	Size				Bright pixel dot	1	2	Acceptable	Dark pixel dot	4	4	2 bright dots adjacent	0	0	2 dark dots adjacent	0	0	Total bright and dark dots	5	6	Minor
		Zone		Acceptable Qty																												
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		Dark pixel dot	4	4																												
		2 bright dots adjacent	0	0																												
2 dark dots adjacent	0	0																														
Total bright and dark dots	5	6																														
<p>Note: Minimum distance between defective dots is more than 5 mm; Pixel dots' function is normal, but bright dots caused by foreign material and other reasons are judged by the dot defect of 5.2.</p>																																
5.2	Dot defect  $\Phi=(x+y)/2$	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="3" style="width:30%;">Zone</th> <th colspan="2" style="width:40%;">Acceptable Qty</th> <th rowspan="3" style="width:30%;"></th> </tr> <tr> <th colspan="2" style="text-align: center;">A+B</th> <th rowspan="2" style="text-align: center;">C</th> </tr> <tr> <th style="width:15%; text-align: center;"><4.3"</th> <th style="width:15%; text-align: center;">≥4.3"</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Size (mm)</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">$\Phi \leq 0.1$</td> <td style="text-align: center;">Acceptable</td> <td rowspan="2" style="text-align: center;">Acceptable</td> <td rowspan="6" style="text-align: center; vertical-align: middle;">Acceptable</td> </tr> <tr> <td style="text-align: center;">$0.1 < \Phi \leq 0.2$</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">$0.2 < \Phi \leq 0.3$</td> <td style="text-align: center;">1</td> <td rowspan="2" style="text-align: center;">5</td> </tr> <tr> <td style="text-align: center;">$0.3 < \Phi \leq 0.5$</td> <td style="text-align: center;">0</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.5$</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> </tbody> </table>	Zone	Acceptable Qty			A+B		C	<4.3"	≥4.3"	Size (mm)				$\Phi \leq 0.1$	Acceptable	Acceptable	Acceptable	$0.1 < \Phi \leq 0.2$	3	$0.2 < \Phi \leq 0.3$	1	5	$0.3 < \Phi \leq 0.5$	0	$\Phi > 0.5$	0	0	Minor		
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<p>Note: 1. Minimum distance between defective dots is more than 5 mm; 2. The quantity of defect (adjacent dots) is zero in operating condition.</p>																																

	OUTGOING QUALITY STANDARD	PAGE 3 OF 5
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA		TFT-LCD Module product (Industrial Type)

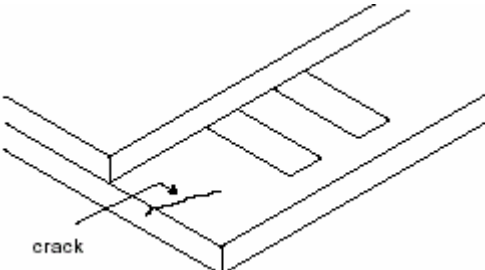
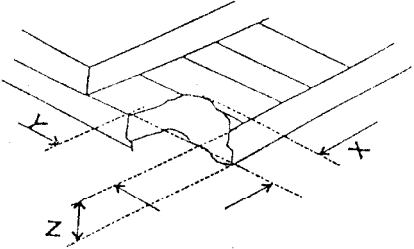
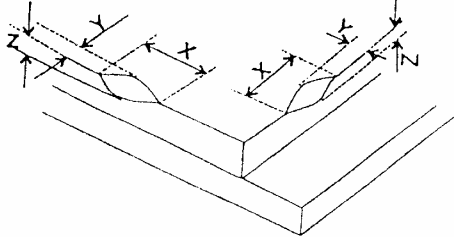
5. Minor Defect


Item No.	Items to be inspected	Inspection Standard	Classification of defects																																																										
5.3	Linear defect	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Zone</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th colspan="2" style="text-align: center;">Size (mm)</th> <th colspan="2" style="text-align: center;">A+B</th> <th rowspan="2" style="text-align: center;">C</th> </tr> <tr> <th style="text-align: center;">Length</th> <th style="text-align: center;">Width</th> <th style="text-align: center;"><4.3"</th> <th style="text-align: center;">≥4.3"</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Ignore</td> <td style="text-align: center;">W ≤ 0.03</td> <td style="text-align: center;">Acceptable</td> <td style="text-align: center;">Acceptable</td> <td rowspan="3" style="text-align: center;">Acceptable</td> </tr> <tr> <td style="text-align: center;">L ≤ 5.0</td> <td style="text-align: center;">0.03 < W ≤ 0.10</td> <td style="text-align: center;">4</td> <td style="text-align: center;">5</td> </tr> <tr> <td style="text-align: center;">L > 5.0</td> <td style="text-align: center;">W > 0.10</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> </tbody> </table>	Zone		Acceptable Qty			Size (mm)		A+B		C	Length	Width	<4.3"	≥4.3"	Ignore	W ≤ 0.03	Acceptable	Acceptable	Acceptable	L ≤ 5.0	0.03 < W ≤ 0.10	4	5	L > 5.0	W > 0.10	0	0	Minor																															
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L ≤ 5.0	0.03 < W ≤ 0.10	4	5																																																										
L > 5.0	W > 0.10	0	0																																																										
5.4	Polarizer defect	<p>5.4.1 Polarizer Position (i) Shifting in position should not exceed the glass outline dimension. (ii) Incomplete covering of the viewing area due to shifting is not allowed.</p> <p>5.4.2 Dirt on polarizer Dirt which can be wiped easily should be acceptable.</p> <p>5.4.3 Polarizer Dent & Air bubble</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Zone</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th colspan="2" style="text-align: center;">Size (mm)</th> <th colspan="2" style="text-align: center;">A+B</th> <th rowspan="2" style="text-align: center;">C</th> </tr> <tr> <th colspan="2" style="text-align: center;">Φ</th> <th style="text-align: center;"><4.3"</th> <th style="text-align: center;">≥4.3"</th> </tr> </thead> <tbody> <tr> <td colspan="2" style="text-align: center;">Φ ≤ 0.3</td> <td style="text-align: center;">Acceptable</td> <td style="text-align: center;">Acceptable</td> <td rowspan="4" style="text-align: center;">Acceptable</td> </tr> <tr> <td colspan="2" style="text-align: center;">0.3 < Φ ≤ 1.0</td> <td style="text-align: center;">3</td> <td style="text-align: center;">3</td> </tr> <tr> <td colspan="2" style="text-align: center;">1.0 < Φ ≤ 1.5</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td colspan="2" style="text-align: center;">Φ > 1.5</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> </tbody> </table> <p>5.4.4 Polarizer scratch (i) If the polarizer scratch can be seen after cover assembling or in the operating condition, judge by the linear defect of 5.3. (ii) If the polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Zone</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th colspan="2" style="text-align: center;">Size (mm)</th> <th colspan="2" style="text-align: center;">A+B</th> <th rowspan="2" style="text-align: center;">C</th> </tr> <tr> <th style="text-align: center;">Length</th> <th style="text-align: center;">Width</th> <th style="text-align: center;"><4.3"</th> <th style="text-align: center;">≥4.3"</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Ignore</td> <td style="text-align: center;">W ≤ 0.05</td> <td style="text-align: center;">Acceptable</td> <td style="text-align: center;">Acceptable</td> <td rowspan="3" style="text-align: center;">Acceptable</td> </tr> <tr> <td style="text-align: center;">1.0 < L ≤ 5.0</td> <td style="text-align: center;">0.05 < W ≤ 0.20</td> <td style="text-align: center;">4</td> <td style="text-align: center;">5</td> </tr> <tr> <td style="text-align: center;">L > 5.0</td> <td style="text-align: center;">W > 0.20</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> </tbody> </table>	Zone		Acceptable Qty			Size (mm)		A+B		C	Φ		<4.3"	≥4.3"	Φ ≤ 0.3		Acceptable	Acceptable	Acceptable	0.3 < Φ ≤ 1.0		3	3	1.0 < Φ ≤ 1.5		1	1	Φ > 1.5		0	0	Zone		Acceptable Qty			Size (mm)		A+B		C	Length	Width	<4.3"	≥4.3"	Ignore	W ≤ 0.05	Acceptable	Acceptable	Acceptable	1.0 < L ≤ 5.0	0.05 < W ≤ 0.20	4	5	L > 5.0	W > 0.20	0	0	Minor
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	OUTGOING QUALITY STANDARD	PAGE 4 OF 5
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TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA	TFT-LCD Module product (Industrial Type)
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5. Minor Defect

Item No.	Items to be inspected	Inspection Standard	Classification of defects								
5.5	MURA	Using 5% ND filter, it's NG if it can be seen in R,G,B picture.	Minor								
	White/Black dot (MURA)	Visible under: ND5%; $D \leq 0.15\text{mm}$, Acceptable; $0.15\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$; $D > 0.5\text{mm}$, Not allowable.									
5.6	Glass defect	(i) Crack Cracks are not allowed. 	Minor								
		(ii) TFT chips on corner  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> <th>Acceptable</th> </tr> </thead> <tbody> <tr> <td>≤ 3.0</td> <td>≤ 3.0</td> <td>Not more than the thickness of glass</td> <td>$N \leq 3$</td> </tr> </tbody> </table> Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.	X	Y	Z	Acceptable	≤ 3.0	≤ 3.0	Not more than the thickness of glass	$N \leq 3$	Minor
		X	Y	Z	Acceptable						
≤ 3.0	≤ 3.0	Not more than the thickness of glass	$N \leq 3$								
(iii) Usual surface crack  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> <th>Acceptable</th> </tr> </thead> <tbody> <tr> <td>≤ 1.5</td> <td>≤ 1.5</td> <td>Not more than the thickness of glass</td> <td>$N \leq 4$</td> </tr> </tbody> </table> It is only applicable to the upper glass of LCD.	X	Y	Z	Acceptable	≤ 1.5	≤ 1.5	Not more than the thickness of glass	$N \leq 4$	Minor		
X	Y	Z	Acceptable								
≤ 1.5	≤ 1.5	Not more than the thickness of glass	$N \leq 4$								

 OUTGOING QUALITY STANDARD		PAGE 5 OF 5	
TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA		TFT-LCD Module product (Industrial Type)	
6. Module Cosmetic Criteria			
Item No.	Items to be inspected	Inspection Standard	Classification of defects
1	Difference in Spec.	Not allowable	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Minor
4	Resist flaw on PCB	Visible copper foil (Ø0.5 mm or more) on substrate pattern is not allowed	Minor
5	FPC gold finger	No dirt, breaking, oxidation lead to black	Major
6	Backlight plastic frame	No deformation, crack, breaking, backlight positioning column breaking, obvious nick.	Minor
7	Marking printing effect	No dark marking, incomplete, deformation lead to unable to judge	Minor
8	Accretion of metallic Foreign matter	No accretion of metallic foreign matter (Not exceed Ø0.2mm)	Minor
9	Stain	No stain to spoil cosmetic badly	Minor
10	Plate discoloring	No plate fading, rusting and discoloring	Minor
11	Solder amount	a. Soldering side of PCB Solder to form a 'Filet' all around the lead. Solder should not hide the lead form perfectly. (too much)	Minor
	1. Lead parts	b. Components side (In case of 'Through Hole PCB') Solder to reach the Components side of PCB.	Minor
	2. Flat packages	Either 'Toe' (A) or 'Seal' (B) of the lead to be covered by 'Filet'. Lead form to be assume over Solder.	Minor
	3. Chips	$(3/2) H \geq h \geq (1/2) H$	Minor
11	4. Solder ball/Solder splash	a. The spacing between solder ball and the conductor or solder pad $h \geq 0.13$ mm. The diameter of solder ball $d \leq 0.15$ mm.	Minor
		b. The quantity of solder balls or solder splashes isn't beyond 5 in 600 mm^2 .	Minor
		c. Solder balls/Solder splashes do not violate minimum electrical clearance.	Major
		d. Solder balls/Solder splashes must be entrapped / encapsulated or attached to the metal surface .	Minor
		Note: Entrapped/encapsulated/attached is intended to mean that normal service environment of the product will not cause a solder ball to become dislodged.	

■ PRECAUTIONS FOR USING LCD MODULES

1 Handling Precautions

- 1.1 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.
- 1.2 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.
- 1.3 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).
- 1.4 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 it. 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 in to contact with room temperature air.
- 1.5 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 alcoholDo not scrub hard to avoid damaging the display surface.
- 1.6 Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
 - Water
 - Ketone
 - Aromatic solventsWipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contact with oil and fats.
- 1.7 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.
- 1.8 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.
- 1.9 Do not attempt to disassemble or process the LCD module.
- 1.10 NC terminal should be open. Do not connect anything.
- 1.11 If the logic circuit power is off, do not apply the input signals.
- 1.12 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 removing 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 dry. 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.

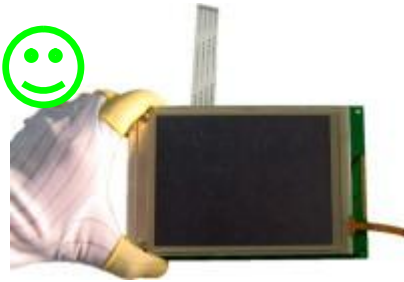
1.13 Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- 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 the LCM.

2 Handling precaution for LCM

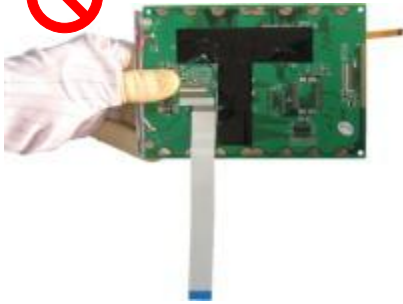
2.1 LCM is easy to be damaged. Please note below and be careful for handling.

2.2 Correct handling:

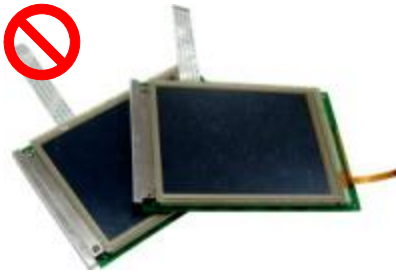


As above picture, please handle with anti-static gloves around LCM edges.

2.3 Incorrect handling:



Please don't touch IC directly.



Please don't stack LCM.



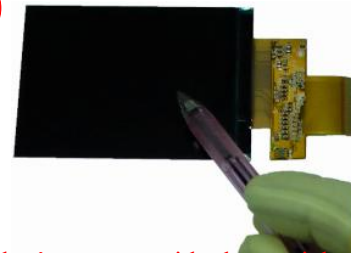
Please don't hold the surface of panel.



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



Please don't hold the surface of IC.



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

3 Storage Precautions

3.1 When storing the LCD modules, the following precaution are necessary.

3.1.1 Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.

3.1.2 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.

3.1.3 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).

3.2 Transportation Precautions

3.2.1 During shipment, please handle with care. The packaging bag can not be broken, step on trap. Packaging Carton layer height can not be over two meters.

3.2.2 The transportation process should pay attention to the waterproof and moisture-proof measures. Product can not be watering. Ethylene sealed bags can not be unsealed.

3.3 Others

3.3.1 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.

3.3.2 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.

3.3.3 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.

3.3.3.1 - Exposed area of the printed circuit board.

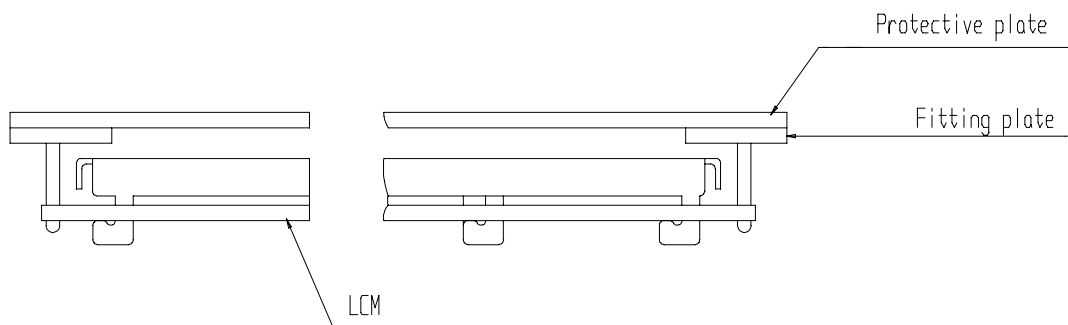
3.3.3.2 -Terminal electrode sections.

4 USING LCD MODULES

4.1 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.

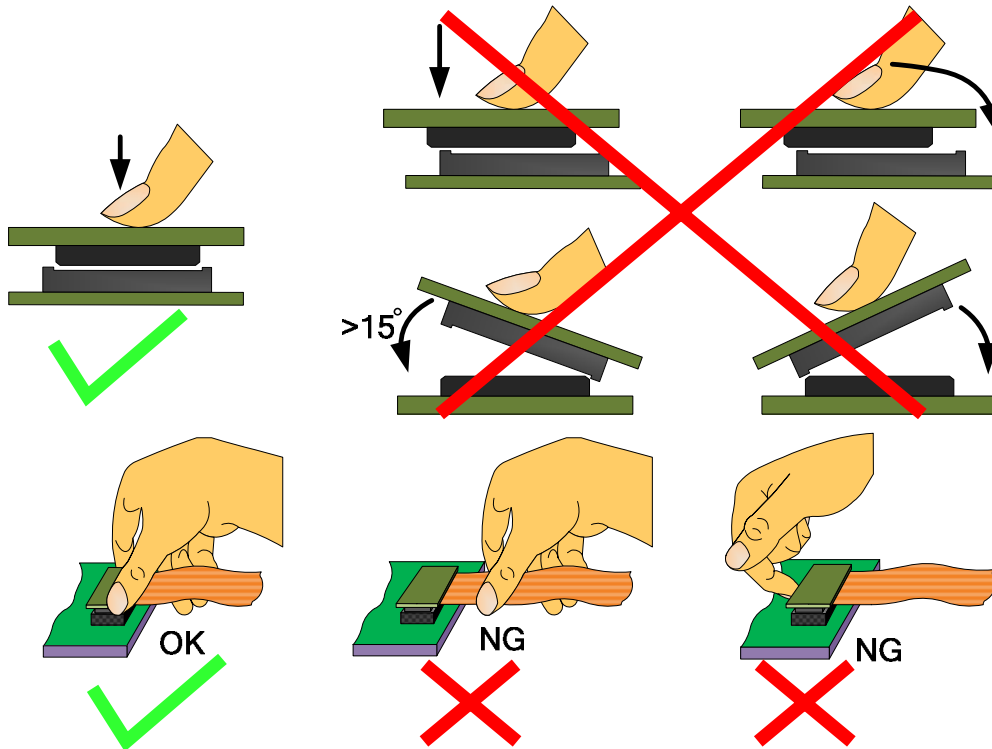
4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



4.1.2 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 $\pm 0.1\text{mm}$.

4.2 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



4.3 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

4.3.1 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.

4.3.2 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.

4.3.3 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.

4.4 Precautions for Operation

4.4.1 Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

4.4.2 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.

4.4.3 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.

4.4.4 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.

4.4.5 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.

4.4.6 Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

4.4.7 Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

4.5 Safety

4.5.1 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.

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

4.6 Limited Warranty

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

4.7 Return LCM under warranty

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

4.7.1.1 - Broken LCD glass.

4.7.1.2 - PCB eyelet is damaged or modified.

4.7.1.3 -PCB conductors damaged.

4.7.1.4 - Circuit modified in any way, including addition of components.

4.7.1.5 - PCB tampered with by grinding, engraving or painting varnish.

4.7.1.6 - Soldering to or modifying the bezel in any manner.

4.7.2 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

Please consult our technical department for detail information.

■ PRIOR CONSULT MATTER

- 1 For Multi-Inno standard products, we keep the right to change material, process ... for improving the product property without prior notice to our customer.
- 2 For OEM products, if any changes are needed which may affect the product property, we will consult with our customer in advance.
- 3 If you have special requirement about reliability condition, please let us know before you start the test on our samples.