



MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI13232A-G

For Customer's Acceptance:

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2013-01-04
Our Reference	



REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2013-01-04	First release	\

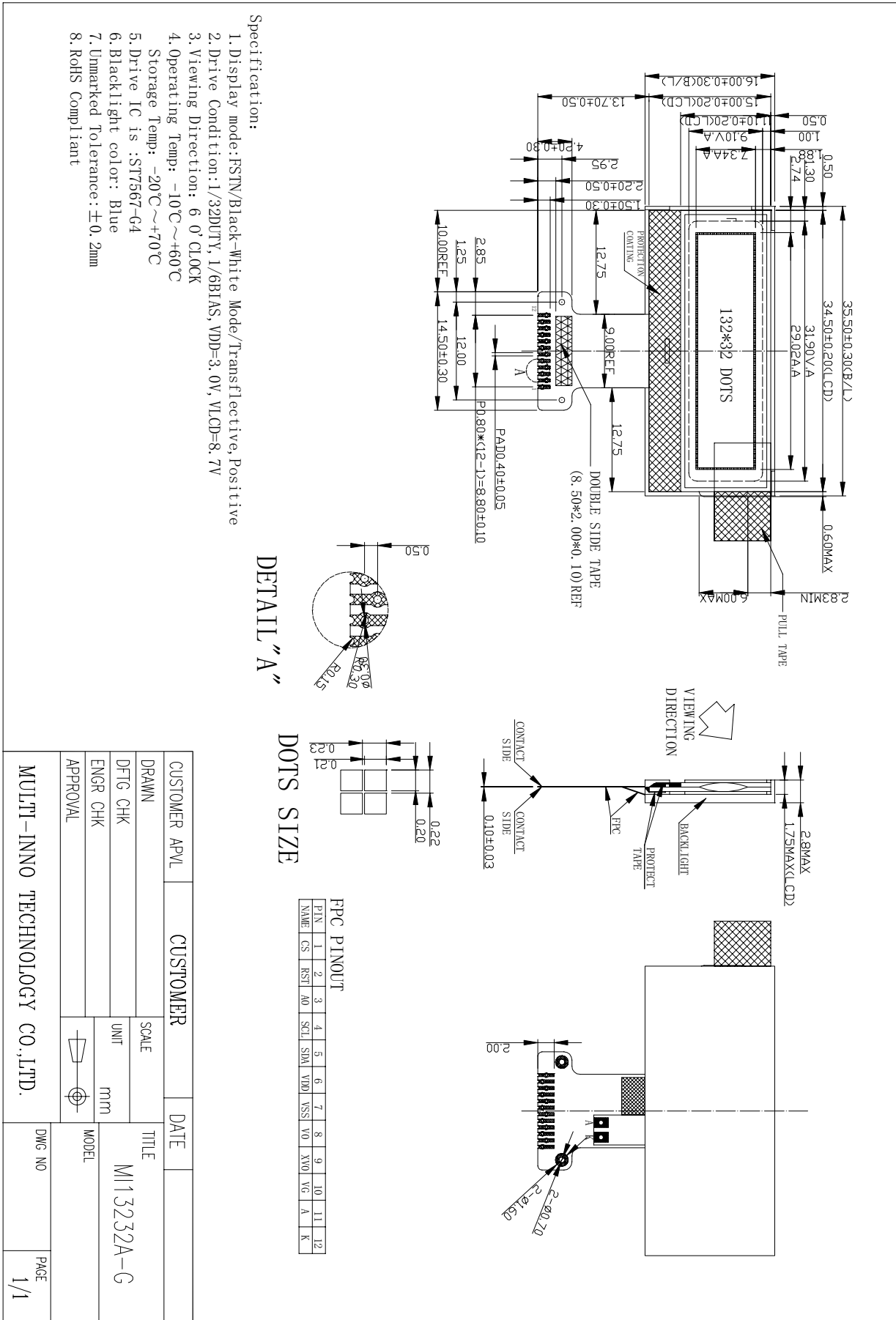
CONTENTS

- GENERAL INFORMATION
- EXTERNAL DIMENSIONS
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL CHARACTERISTICS
- ELECTRO-OPTICAL CHARACTERISTICS
- INTERFACE DESCRIPTION
- CIRCUIT BLOCK DIAGRAM
- REFERENCE APPLICATION CIRCUIT NOTES
- REFERENCE INITIAL CODE
- RELIABILITY TEST
- INSPECTION CRITERION
- PRECAUTIONS FOR USING LCD MODULES
- PRIOR CONSULT MATTER

**■ GENERAL INFORMATION**

Item of general information	Contents	Unit
LCD type	FSTN/Black-white mode/Transflective/Positive	/
Recommended Viewing Direction	6:00	O' Clock
Module area (W × H×T)	35.50×16.00×2.80	mm
Viewing area (W×H)	31.90×9.10	mm
Active area (W×H)	29.02×7.34	mm
Dots pitch (W × H)	0.22×0.23	mm
Dots size (W×H)	0.20×0.21	mm
Number of Dots	132×32	/
Driver IC	ST7567	/
Interface Type	The MUC interface:serial 4-line SPI	/
Duty	1/32	/
Bias	1/6	/
Input voltage	3.0	V
Backlight Type	Blue LED	/

EXTERNAL DIMENSIONS



■ ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	Symbol	Min	Max	Unit
Supply voltage range	VDDIO	-0.3	3.3	V
	VinA	-0.3	6.0	V
LCD supply voltage range	VCC-VEE	0	9.5	V
Input voltage range	Vci	-0.3	VDDIO+0.3	V
Operating temperature	Top	-10	60	°C
Storage temperature	TST	-20	70	°C
Humidity	RH	-	90	%RH

■ ELECTRICAL CHARACTERISTICS

Parameter of DC characteristics	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VDD	2.8	3.0	3.3	V
Supply voltage for LCD	V0	-	8.8	-	V
Supply current	Idd	-	TBD	-	uA
Input voltage 'H' level	VIH	0.8VDDIO	-	VDDIO	V
Input voltage 'L' level	VIL	VSS	-	0.2VDDIO	V
Output voltage 'H' level	VOH	0.8VDDIO	-	VDDIO	V
Output voltage 'L' level	VOL	VSS	-	0.2VDDIO	V

■ ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+ Tf	$\theta=0^\circ$ $\varnothing=0^\circ$ $T_a=25^\circ\text{C}$	-	356	556	ms	Fig.1	4
Contrast ratio	Cr		-	12	-	---	FIG 2.	1
Luminance uniformity	δ WHITE		-	TBD	-	%	FIG 2.	3
Surface Luminance	Lv		130	-	-	cd/m ²	FIG 2.	2
Viewing angle range	θ	$\varnothing = 90^\circ$	-	80	-	deg	FIG 3.	6
		$\varnothing = 270^\circ$	-	80	-	deg	FIG 3.	
		$\varnothing = 0^\circ$	-	70	-	deg	FIG 3.	
		$\varnothing = 180^\circ$	-	70	-	deg	FIG 3.	

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

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P 1,P2, P 3,P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P 3,P4, P5)}}$$

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

$$L_v = \text{Average Surface Luminance with all white pixels (P1, P2, P 3,P4, P5)}$$

Note3. The uniformity in surface luminance (δ WHITE) is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P}_1, \text{P}_2, \text{P}_3, \text{P}_4, \text{P}_5)}{\text{Maximum Surface Luminance with all white pixels (P}_1, \text{P}_2, \text{P}_3, \text{P}_4, \text{P}_5)}$$

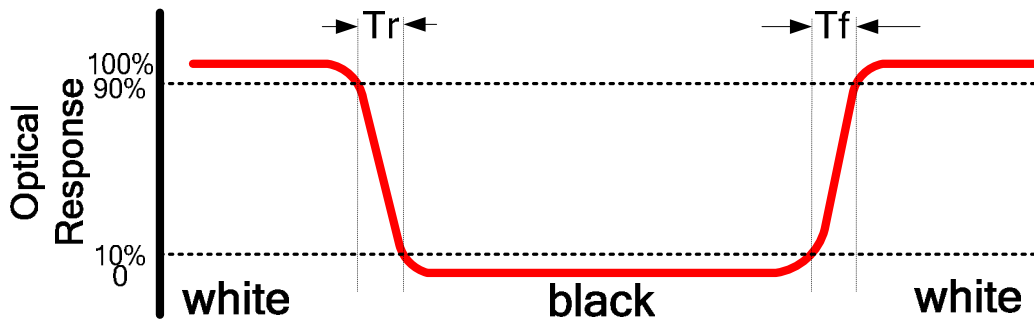
Note4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1..

Note5. CIE (x, y) chromaticity, The x,y value is determined by screen active area position 5. For more information see FIG 2.

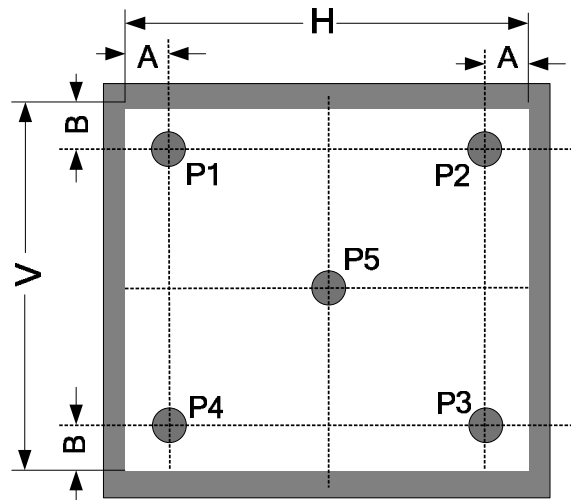
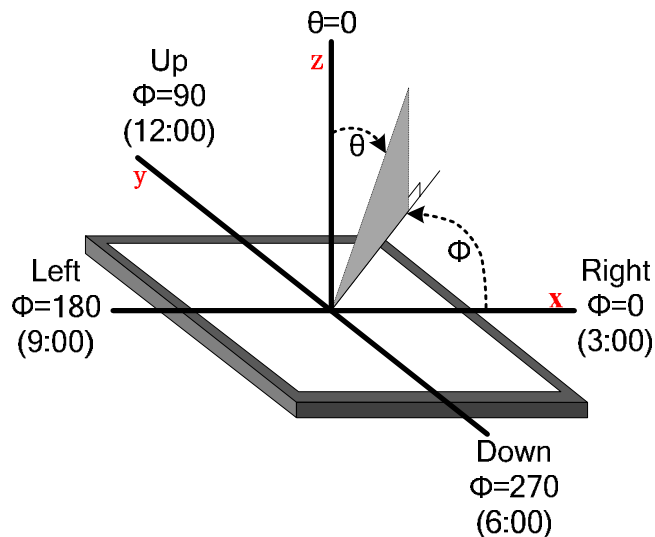
Note6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information 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 TOPCON's BM-5 photo detector.

Note8. For 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

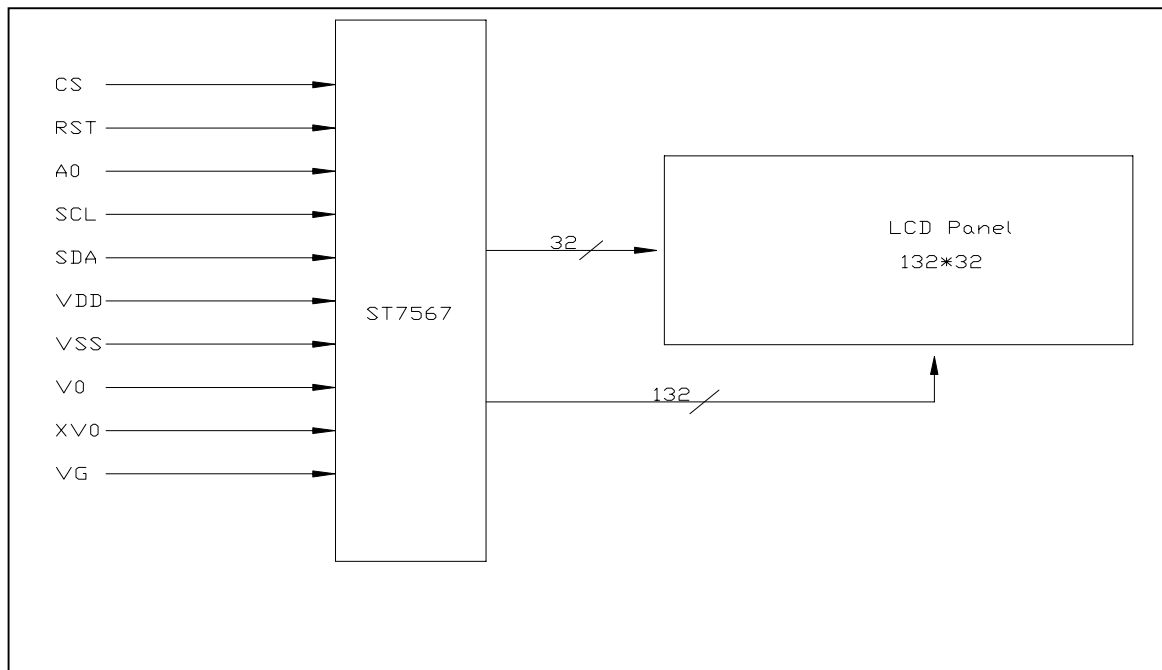
A : 5 mm
 B : 5 mm
 H, V : Active Area
 Light spot size $\varnothing=5\text{mm}$, 500mm distance from the LCD surface to detector lens
 measurement instrument is TOPCON's luminance meter BM-5


FIG.3. The definition of viewing angle


■ INTERFACE DESCRIPTION

Pin	Symbol	Description
1	CS	ENABLE CONTROL INPUT
2	RST	RESET INPUT PIN
3	A0	DATA/COMMAND SELECT INPUT PIN
4	SCL	SERIAL CLOCK INPUT
5	SDA	SERIAL DATA INPUT
6	VDD	MAIN POWER SUPPLY
7	VSS	POWER GROUND
8	V0	DRIVING FOR COMMON
9	XV0	DRIVING FOR COMMON
10	VG	DRIVING FOR SEGMENT
11	A	BL+
12	K	BL-

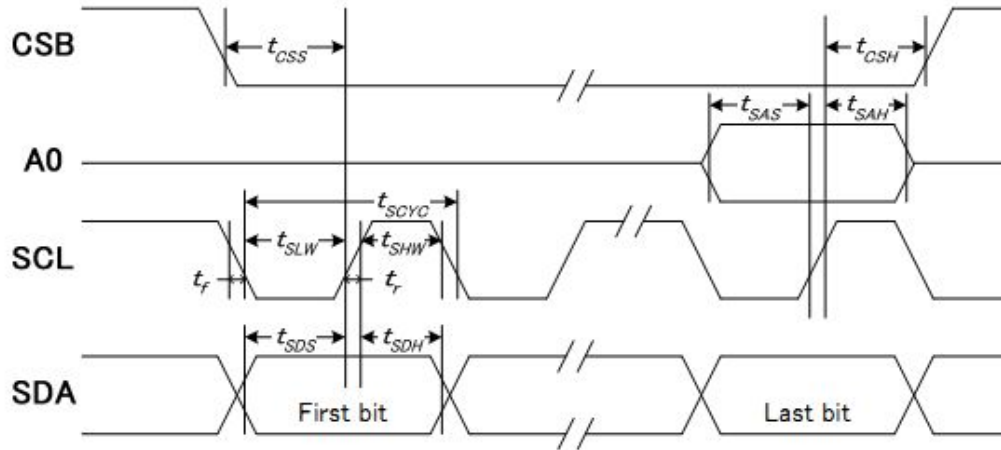
■ CIRCUIT BLOCK DIAGRAM



■ REFERENCE APPLICATION CIRCUIT NOTES

1. Signal Timing Diagram For Main LCD Driver ST7567

SERIAL BUS TIMING CHARACTERISTICS (FOR 4-LINE SERIAL INTERFACE)



(VDD1 = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		50	—	ns
SCLK "H" pulse width		tSHW		25	—	
SCLK "L" pulse width		tSLW		25	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		10	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		10	—	
CSB-SCLK time	CSB	tCSS		20	—	
CSB-SCLK time		tCSH		40	—	

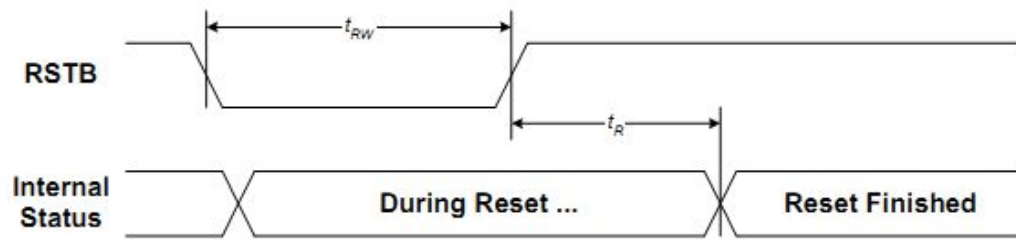
(VDD1 = 2.8V, Ta = 25°C)

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		100	—	ns
SCLK "H" pulse width		tSHW		50	—	
SCLK "L" pulse width		tSLW		50	—	
Address setup time	A0	tSAS		30	—	
Address hold time		tSAH		20	—	
Data setup time	SDA	tSDS		30	—	
Data hold time		tSDH		20	—	
CSB-SCLK time	CSB	tCSS		30	—	
CSB-SCLK time		tCSH		60	—	

*1 The input signal rise and fall time (tr, tf) are specified at 15 ns or less.

*2 All timing is specified using 20% and 80% of VDD1 as the standard.

2. Reset Timing



(VDD1 = 3.3V, Ta = 25°C)

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	1.0	us
Reset "L" pulse width	tRW		1.0	—	

(VDD1 = 2.8V, Ta = 25°C)

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	2.0	us
Reset "L" pulse width	tRW		2.0	—	

■ RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	$70 \pm 2^\circ\text{C}/240$ 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	$-20 \pm 2^\circ\text{C}/240$ hours	
3	High Temperature Operating	$60 \pm 2^\circ\text{C}/240$ hours	
4	Low Temperature Operating	$-10 \pm 2^\circ\text{C}/240$ hours	
5	Temperature Cycle storage	$-20 \pm 2^\circ\text{C} \sim 25 \sim 70 \pm 2^\circ\text{C} \times 20$ cycles (30min.) (5min.) (30min.)	
6	Damp proof Test operating	$60^\circ\text{C} \pm 5^\circ\text{C} \times 90\%RH/240$ 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: $\pm 2KV$ R: 1500 Ω C: 100pF Air discharge, 10time	

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10M Ω) should be used.
- 4.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.
- 5.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.
- 6.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

■ INSPECTION CRITERION

This specification is made to be used as the standard acceptance/rejection criteria for Normal LCM 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

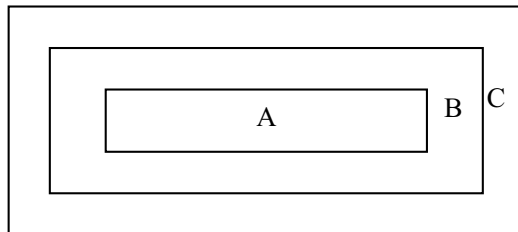
2. Inspection condition

- 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).

- Driving voltage

The Vop value from which the most optimal contrast can be obtained near the specified Vop in the specification (Within ±0.5V of the typical value at 25°C.).

3. Definition of inspection zone in LCD.



Zone A: character/Digit area

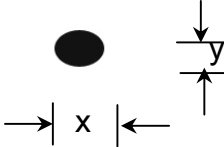
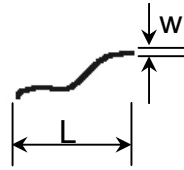
Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)

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

Fig.1 Inspection zones in an LCD.

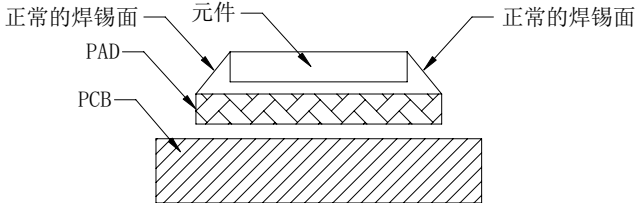
Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer’s product.

4. Inspection Standard

No	Item	Criterion															
01	Outline Dimension	In accord with drawing															
02	Position-finding Dimension Assemble Dimension	In accord with drawing															
03	LCD black spots, white spots (Round type)	<div style="display: flex; align-items: center;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Dimension</th> <th>Qualified Quantity</th> </tr> </thead> <tbody> <tr> <td>$D \leq 0.1$</td> <td>Ignore</td> </tr> <tr> <td>$0.1 < D \leq 0.15$</td> <td>2</td> </tr> <tr> <td>$0.15 < D \leq 0.20$</td> <td>1</td> </tr> <tr> <td>$D > 0.20$</td> <td>0</td> </tr> </tbody> </table> </div> <p style="text-align: center;">C-STN : if $D > 0.1$, unqualified</p>	Dimension	Qualified Quantity	$D \leq 0.1$	Ignore	$0.1 < D \leq 0.15$	2	$0.15 < D \leq 0.20$	1	$D > 0.20$	0					
Dimension	Qualified Quantity																
$D \leq 0.1$	Ignore																
$0.1 < D \leq 0.15$	2																
$0.15 < D \leq 0.20$	1																
$D > 0.20$	0																
04	LCD black spots, white spots (Line Style)	<div style="display: flex; align-items: center;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Qualified Quantity</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>≤ 0.015</td> <td>Ignore</td> </tr> <tr> <td>≤ 2.0</td> <td>$0.015 < W \leq 0.025$</td> <td>2</td> </tr> <tr> <td>≤ 1.0</td> <td>$0.025 < W \leq 0.05$</td> <td>1</td> </tr> <tr> <td>-</td> <td>$D > 0.05$</td> <td>According to circle</td> </tr> </tbody> </table> </div> <p style="text-align: center;">CSTN : If $W \geq 0.015$, unqualified Ignore beyond viewing area</p>	Length	Width	Qualified Quantity	-	≤ 0.015	Ignore	≤ 2.0	$0.015 < W \leq 0.025$	2	≤ 1.0	$0.025 < W \leq 0.05$	1	-	$D > 0.05$	According to circle
Length	Width	Qualified Quantity															
-	≤ 0.015	Ignore															
≤ 2.0	$0.015 < W \leq 0.025$	2															
≤ 1.0	$0.025 < W \leq 0.05$	1															
-	$D > 0.05$	According to circle															
05	LCD Scratch 、 Threadlike Fiber	Same to NO.3 circle sightline and surface of LCD is vertical (2) Same to NO.3 line style															

06	POL	It is not admissible that POL is beyond the edge of glass, else, unqualified. It is essential that POL is over the 50 percent of width of frame , else ,unqualified. According to the drawing in case of special definition.	
07	IC/FPC Bonding	Scratch	Reject
		Intensity Of Adhesion	If lower than specification, reject
		Gold Fold Twist	Reject
		Silicon	According to outline, no gold outside, seal can not be higher than LCD
		FPC Gold Sever	Reject
08	SMT	Lack of Component、Polarity Inverse	If exist, reject
		Leak Solder、Virtual Solder	If exist, reject
		Short Circuit In Solder Point	If exist, reject
		Tin Ball	If exist, reject
		Tin Acumination	If visual, reject
		Height Solder Point	If higher 0.5mm than component. reject
		Height of component	Either side higher 0.5mm than component, reject

		Component Shift	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>$X < 3/4Z$</td> <td>不合格</td> </tr> <tr> <td>$Y < 1/3D$</td> <td>不合格</td> </tr> </table>	$X < 3/4Z$	不合格	$Y < 1/3D$	不合格	
$X < 3/4Z$	不合格							
$Y < 1/3D$	不合格							
08	SMT	Few Tin	<p>$\theta \leq 20^\circ$ 不合格</p>					
		Component Deflection	<p>$Y > 1/3 D$ 不合格</p>					
		Component Carcass Sideways	Reject					
		Component Carcass Sideways	If exist with visual inspection , reject					
		Lot Tin	A: Tin accrete the solder side completely , hollowly ,Ok B: Tin accrete the solder side completely , full circle arc , ok C: Jointing include whole solder side, height of tin > 50 percent of height of component, reject					
Few Tin	A: Tin accrete the solder side completely , hollowly ,Ok B: height of tin > 1/3 of solder side of component , ok C: height of tin \leq 1/3 of solder side of component, reject							

08	SMT		
09	CR (Max)	According to specification	According to product specification Measure instrument (DMS-501)
10	Response time	According to specification	According to product specification Measure instrument (DMS-501)
11	Viewing angle	According to specification	According to product specification Measure instrument (DMS-501)
12	Vibration、Ring	Compare with the sample customer supply	Compare with the sample customer supply when assemble
13	Frequency Of FPC Bend	According to the use of product (main FPC of foldaway cell phone ≥ 6 thousand)	Measure instrument Bend angle : 150° Fix FPC in the casement when customer supply

■ 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.

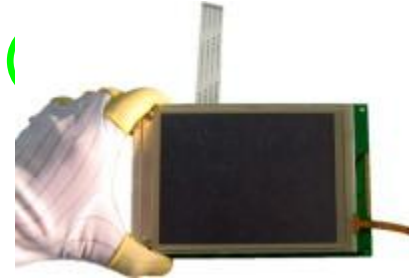
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

- 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:

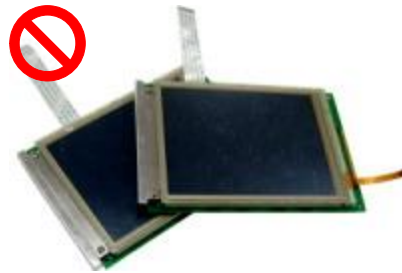


As above picture, please handle with anti-static gloves around LCM edges.

2.3 Incorrect handling:



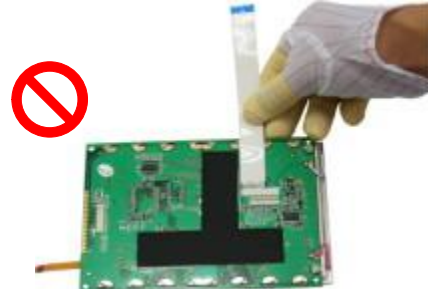
Please don't touch IC directly.



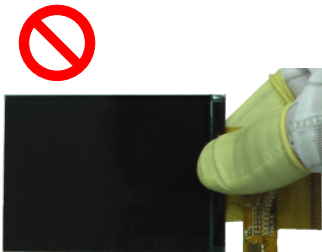
Please don't stack LCM.



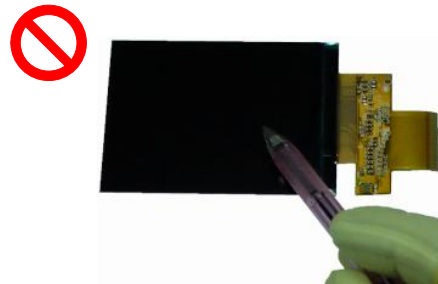
Please don't hold the surface of panel.



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

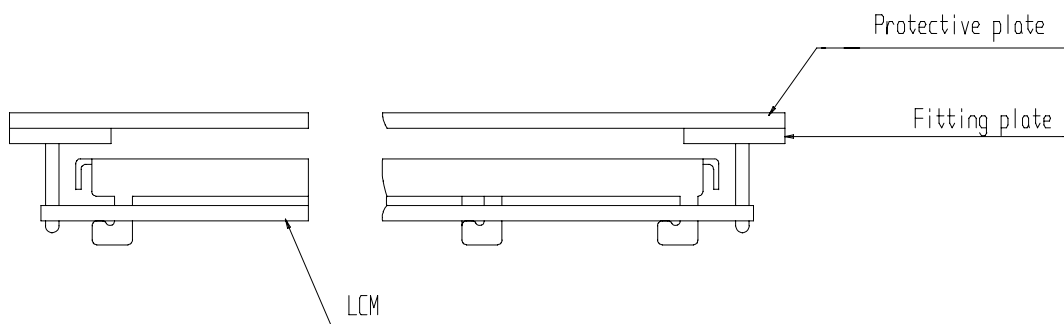
- 3.1 When storing the LCD modules, the following precaution are necessary.
- 3.1.1 Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.
 - 3.1.2 Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 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 Others
- 3.2.1 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.
 - 3.2.2 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.
 - 3.2.3 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.
 - 3.2.3.1 - Exposed area of the printed circuit board.
 - 3.2.3.2 - 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.

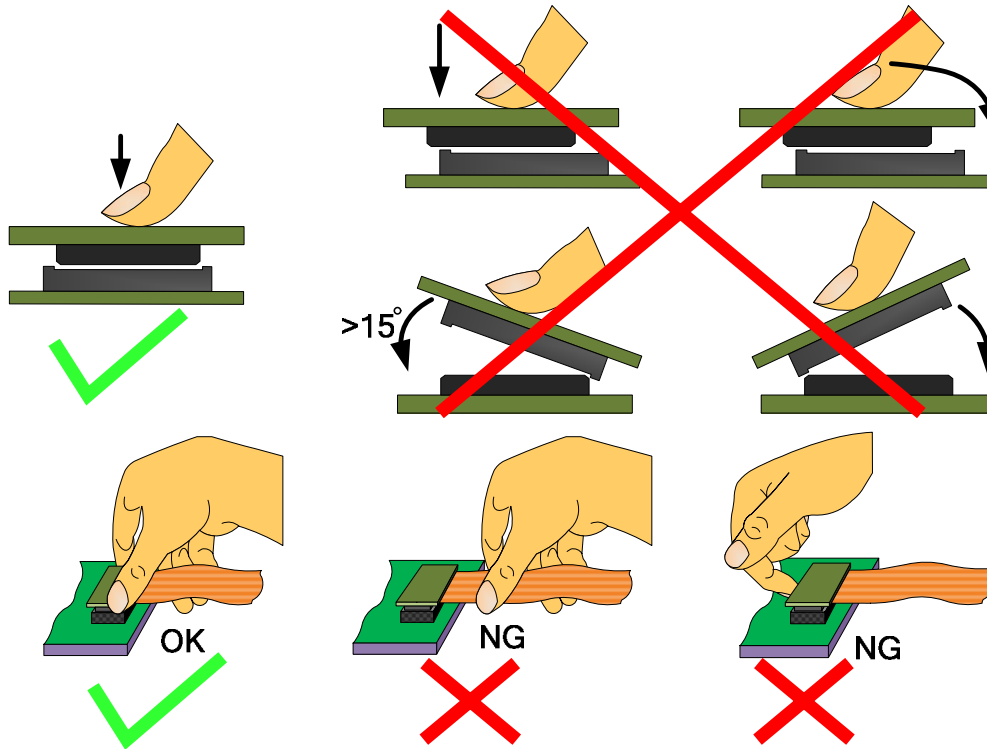
- 4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



- 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 ± 0.1 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 : 15-17 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. Speed : 15-17 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.