

PRODUCT : LCD MODULE**MODEL NO.** : TFT8K5393**SUPPLIER** : TRULY SEMICONDUCTORS LTD.**DATE** : October 26, 2010CERT. No. QAC0946535
(ISO9001)CERT. No. HKG002005
(ISO14001)

SPECIFICATION

Revision: 1.2

TFT8K5393(MONO TFT)

This module uses ROHS material

If there is no special request from the customer, TRULY SEMICONDUCTORS LTD. will not reserve the tooling of the product under the following conditions:

1. There is no response from the customer in two years after TRULY SEMICONDUCTORS LTD. submit the samples.
2. There is no order in two years after the latest mass production.

And correlated data (including quality records) will be reserved for one year more after tooling is discarded.

TRULY SEMICONDUCTORS LTD:**CUSTOMER:**

Quality Assurance Department: _____

Approved by: _____

Technical Department: _____

Approved by:

CONTENTS

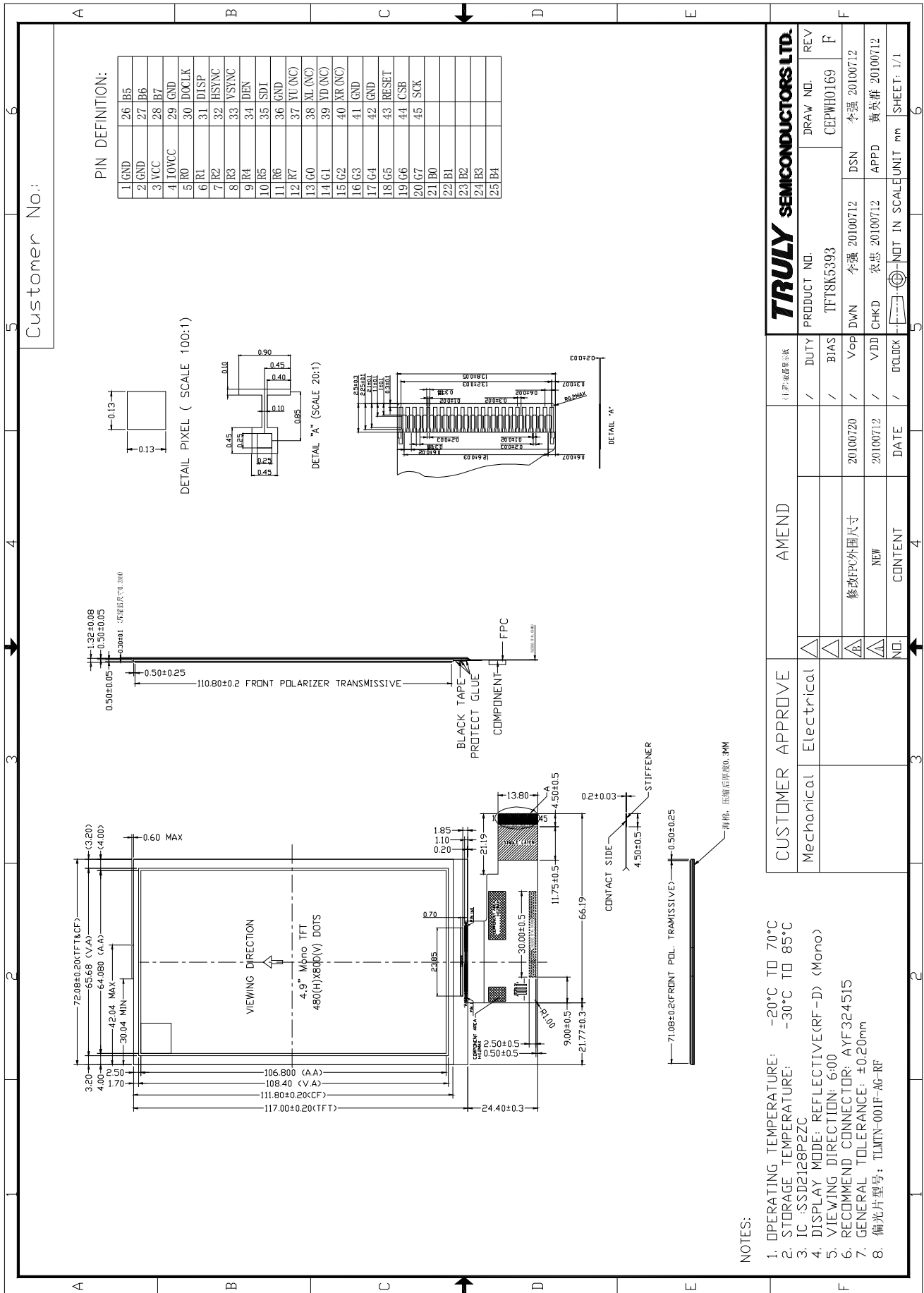
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WRITTEN BY	CHECKED BY	APPROVED BY
HUANG SU LING	GUO JIAN	NONG ZHONG

■ GENERAL INFORMATION

Item of general information	Contents	Unit
LCD type	a-Si TFT	/
Active Screen size	4.9" diagonal	inch
Viewing Direction	6:00	O'Clock
Resolution	480×800	Dots
Outline Dimension	72.08(W)×117.00(H)×1.65(T)	mm
Active area	64.08(W)×106.80(H)	mm
DOT Pitch	0.1335(W)×0.1335(H)	mm
Display Mode	Reflective, Normally White	/
Driver IC	SSD2128	/
Color Depth	Gray Scale:256(Mono-TFT)	/
Input voltage	3.3	V
Module Power consumption	50	MW
Applications	CPA etc	/

EXTERNAL DIMENSIONS



TRULY SEMICONDUCTORS LTD.		DRAW NO.	REV
AMEND		PRODUCT NO.	CEPWH0169
CUSTOMER APPROVE		PROJECT NO.	TFT8K5393
Mechanical	Electrical	DWY	BIAS
		VOP	VDD
		DCLK	
		DATE	
		CONTENT	
		NO.	
		DATE	
		APPD	
		DSN	
		REV	

- NOTES:**
- OPERATING TEMPERATURE: -20°C TO 70°C
 - STORAGE TEMPERATURE: -30°C TO 85°C
 - IC :SSD2128P2ZC
 - DISPLAY MODE: REFLECTIVE(RF-D) (Mono)
 - VIEWING DIRECTION: 6:00
 - RECOMMEND CONNECTOR: AYF324515
 - GENERAL TOLERANCE: ±0.20mm
 - 偏光片型号: TLMTN-001F-AG-RF

■ ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	Symbol	Min	Max	Unit
Supply voltage for Analog	VCC	-0.3	5.0	V
Supply voltage for logic	IOVCC	-0.3	4.0	V
Operating temperature	Top	-20	70	°C
Storage temperature	TST	-30	85	°C
Humidity	RH	-	90%(Max60 °C)	RH

■ ELECTRICAL CHARACTERISTICS**DC CHARACTERISTICS**

Parameter of DC characteristics	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VCC-VSS	2.5	3.3	3.3	V
I/O power supply	IOVCC	1.65	2.8	3.3	V
Input Current	Icc	-	15	35.4	mA
Input voltage 'H' level	VIH	0.7IOVCC	-	IOVCC	V
Input voltage 'L' level	VIL	0	-	0.3IOVCC	V
Output voltage 'H' level	VOH	0.9IOVCC	-	IOVCC	V
Output voltage 'L' level	VOL	0.7IOVCC	-	IOVCC	V

■ ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr +Tf	θ=0° ∅=0° Ta=25°C	-	28	42	ms	Fig.1	4
Contrast ratio	Cr		3.4	6.8	-	---	FIG 2.	1
Reflective (with POL)	R(%)		15	28	-	-	-	-
Viewing angle range	θ	∅ = 90°	70	80	-	deg	FIG 3.	6
		∅ = 270°	70	80	-	deg	FIG 3.	
		∅ = 0°	70	80	-	deg	FIG 3.	
		∅ = 180°	70	80	-	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

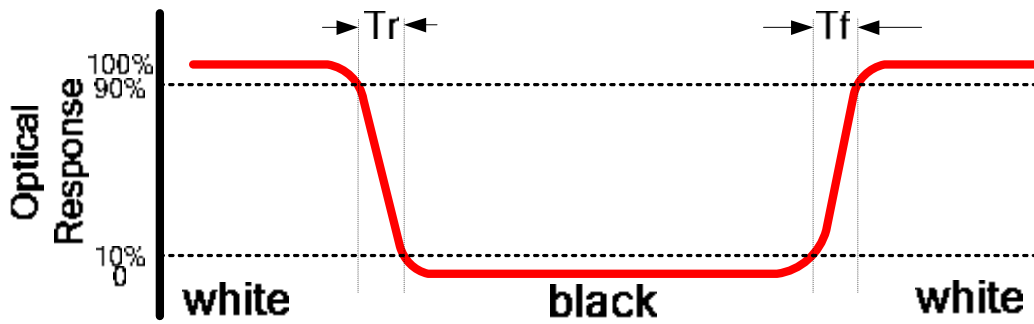


FIG.2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

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

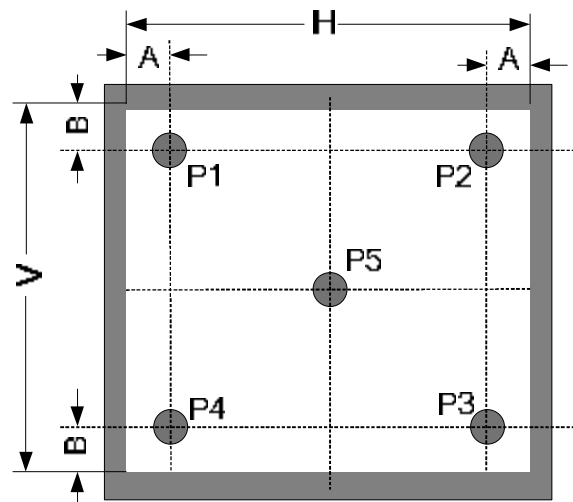
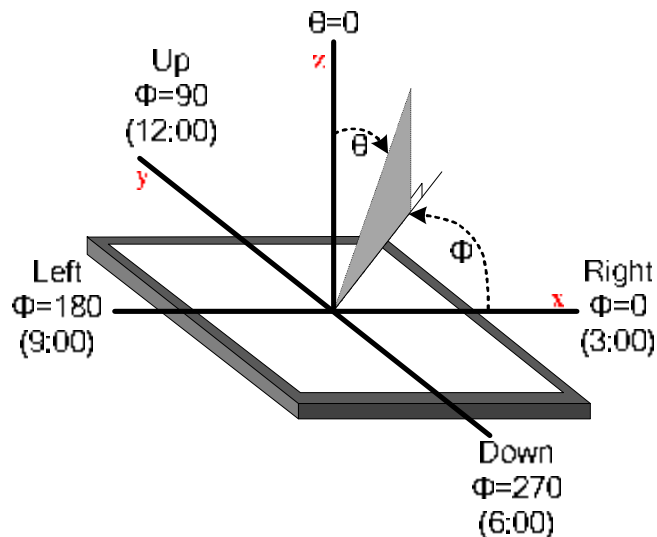


FIG.3. The definition of viewing angle



■ INTERFACE DESCRIPTION

Interface NO.	Symbol	Level	Description	when not in use
1	GND	Power supply	Power Ground	-
2	GND	Power supply	Power Ground	-
3	VCC	Power supply	A supply voltage to the analog circuit. Connect to an external power supply of 2.5 ~ 3.3V.	-
4	IOVCC	Power supply	A supply voltage to the interface pins (IOVCC = 1.65 ~ 3.3V).	-
5	R0	I/O Host processor	R[7:0] : Red Data -24bit parallel	R[7:6], When using the 18-bit parallel interface, R[1:0] is connected to R[7:6]
6	R1			
7	R2			
8	R3			
9	R4			
10	R5			
11	R6			
12	R7			
13	G0	I/O Host processor	G[7:0] : Green Data -24bit parallel	G[7:6], When using the 18-bit parallel interface, G[1:0] is connected to G[7:6]
14	G1			
15	G2			
16	G3			
17	G4			
18	G5			
19	G6			
20	G7			
21	B0	I/O Host processor	B[7:0] : Blue Data -24bit parallel	B[7:6], When using the 18-bit parallel interface, B[1:0] is connected to B[7:6]
22	B1			
23	B2			
24	B3			
25	B4			
26	B5			
27	B6			
28	B7			
29	GND	Power supply	Power Ground	-
30	DOTCLK	I/O Host processor	Dot clock signal for RGB interface operation.	-
31	DISP	I/O Host processor	Display On / Off Mode Control	Fixed to IOVCC
32	HSYNC	I/O Host processor	Line synchronous signal for RGB interface operation.	Fixed to IOVCC or GND
33	VSYNC	I/O Host processor	Frame synchronous signal for RGB interface operation.	Fixed to IOVCC or GND
34	DEN	I/O Host processor	Data enable signal for RGB interface operation.	Fixed to IOVCC
35	SDI	I/O Host processor	Data input pin in serial mode	Fixed to GND
36	GND	Power supply	Power Ground	-
37	YU(NC)	TP driver	Touch panel coordinate in the up side of envisage drawing.	GND

38	XL(NC)	TP driver	Touch panel coordinate in the left side of envisage drawing.	GND
39	YD(NC)	TP driver	Touch panel coordinate in the down side of envisage drawing.	GND
40	XR(NC)	TP driver	Touch panel coordinate in the right side of envisage drawing.	GND
41	GND	Power supply	Power Ground	-
42	GND	Power supply	Power Ground	-
43	RESET	I/O Host processor	System reset pin.	Fixed to IOVCC
44	CSB	I/O Host processor	Chip select pin of serial interface.	Fixed to IOVCC
45	SCK	I/O Host processor	Clock input pin in serial mode.	Fixed to GND

■ 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	85 ± 2°C/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°C/200 hours	
3	High Temperature Operating	70 ± 2°C/200 hours	
4	Low Temperature Operating	-20 ± 2°C/200 hours	
5	Temperature Cycle	-20 ± 2°C~25~70 ± 2°C × 10cycles (30min.) (5min.) (30min.)	
6	Damp Proof Test	50°C ± 5°C × 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:±4KV R: 330Ω C: 150pF Air discharge, 5time	

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 > 10MΩ) 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

TRULY [®] OUTGOING QUALITY STANDARD	PAGE 1 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product
<p>This specification is made to be used as the standard acceptance/rejection criteria for Mono COG Product.</p> <p>1. Sample plan</p> <p>Sampling plan according to GB/T2828.1-2003/ISO 2859-1 : 1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:</p> <p>Major defect: AQL 0.65</p> <p>Minor defect: AQL 1.5</p> <p>2. Inspection condition</p> <p>Viewing distance for cosmetic inspection is 30cm with bare eyes, and under an environment of 800 lux(20W~40W) light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.</p> <p>3. Definition of inspection zone in LCD.</p> <div data-bbox="491 1155 1015 1384" data-label="Diagram"></div> <p>Fig.1 Inspection zones in an LCD.</p> <p>Definition:</p> <p>Zone A: Character/Digit area</p> <p>Zone B: Viewing area except Zone A (Zone A + Zone B =minimum Viewing area)</p> <p>Zone C: Outside viewing area (invisible area after assembly in customer's product)</p> <p>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.</p>	

OUTGOING QUALITY STANDARD	<p>PAGE 2 OF 7</p>
<p>TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA</p>	<p>Mono COG Product</p>

4. Major Defect


All functional defects such as open(or missing segment), short and serious cosmetic defects are classified as major defects.

5. Minor Defect.

Except the major defects mentioned above, cosmetic defects such as spots, glass defects are classified as minor defects.

6. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																					
6.1	Spot defect (Defects in spot form, such as dark/white spot)	<table border="1"> <thead> <tr> <th data-bbox="424 875 684 999" rowspan="2">Zone Size(mm)</th> <th colspan="3" data-bbox="684 875 1171 936">Acceptable Qty</th> </tr> <tr> <th data-bbox="684 936 847 999">A</th> <th data-bbox="847 936 991 999">B</th> <th data-bbox="991 936 1171 999">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="424 999 684 1093">$\Phi \leq 0.15$</td> <td colspan="3" data-bbox="684 999 1171 1093">Acceptable(cluster of spots not allowed)</td> </tr> <tr> <td data-bbox="424 1093 684 1155">$0.15 < \Phi \leq 0.20$</td> <td data-bbox="684 1093 847 1155">1</td> <td data-bbox="847 1093 991 1155">2</td> <td data-bbox="991 1093 1171 1155" rowspan="3">Acceptable</td> </tr> <tr> <td data-bbox="424 1155 684 1218">$0.20 < \Phi \leq 0.25$</td> <td data-bbox="684 1155 847 1218">0</td> <td data-bbox="847 1155 991 1218">1</td> </tr> <tr> <td data-bbox="424 1218 684 1281">$\Phi > 0.25$</td> <td data-bbox="684 1218 847 1281">0</td> <td data-bbox="847 1218 991 1281">0</td> </tr> </tbody> </table> <p data-bbox="424 1346 999 1429">Remark: For dark/white spot, size Φ is defined as $\Phi = (X+Y) / 2$</p> <div data-bbox="756 1451 896 1599" style="text-align: center;"> </div>	Zone Size(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.15$	Acceptable(cluster of spots not allowed)			$0.15 < \Phi \leq 0.20$	1	2	Acceptable	$0.20 < \Phi \leq 0.25$	0	1	$\Phi > 0.25$	0	0	Minor
Zone Size(mm)	Acceptable Qty																							
	A	B	C																					
$\Phi \leq 0.15$	Acceptable(cluster of spots not allowed)																							
$0.15 < \Phi \leq 0.20$	1	2	Acceptable																					
$0.20 < \Phi \leq 0.25$	0	1																						
$\Phi > 0.25$	0	0																						

 OUTGOING QUALITY STANDARD	PAGE 3 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product

6. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																																	
6.2	Line defect (Defects in line form)	<table border="1" data-bbox="453 539 1171 1068"> <thead> <tr> <th colspan="2" data-bbox="453 539 865 595">Size(mm)</th> <th colspan="2" data-bbox="865 539 1171 595">Acceptable Qty</th> </tr> <tr> <th data-bbox="453 595 639 680">L(Length)</th> <th data-bbox="639 595 865 680">W(Width)</th> <th colspan="2" data-bbox="865 595 1171 636">Zone</th> </tr> <tr> <td colspan="2"></td> <th data-bbox="865 636 1062 680">A、 B</th> <th data-bbox="1062 636 1171 680">C</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 680 639 736">$L \leq 10.0$</td> <td data-bbox="639 680 865 736">$W \leq 0.01$</td> <td colspan="2" data-bbox="865 680 1171 736">Acceptable</td> </tr> <tr> <td data-bbox="453 736 639 792">$L \leq 3.0$</td> <td data-bbox="639 736 865 792">$W \leq 0.03$</td> <td data-bbox="865 736 1062 792">2</td> <td data-bbox="1062 736 1171 792" rowspan="4">Acceptable</td> </tr> <tr> <td data-bbox="453 792 639 851">$L > 3.0$</td> <td data-bbox="639 792 865 851">$W \leq 0.03$</td> <td data-bbox="865 792 1062 851">0</td> </tr> <tr> <td data-bbox="453 851 639 909">$L \leq 2.5$</td> <td data-bbox="639 851 865 909">$0.03 < W \leq 0.05$</td> <td data-bbox="865 851 1062 909">2</td> </tr> <tr> <td data-bbox="453 909 639 967">$L > 2.5$</td> <td data-bbox="639 909 865 967">$0.03 < W \leq 0.05$</td> <td data-bbox="865 909 1062 967">0</td> </tr> <tr> <td colspan="2"></td> <td data-bbox="639 967 865 1068">$W > 0.05$</td> <td data-bbox="865 967 1171 1068">Counted as spot defect (follows item 5.1)</td> </tr> </tbody> </table> <p data-bbox="453 1122 1193 1189">Remark: The total of spot defects and line defects shall not exceed four.</p>	Size(mm)		Acceptable Qty		L(Length)	W(Width)	Zone				A、 B	C	$L \leq 10.0$	$W \leq 0.01$	Acceptable		$L \leq 3.0$	$W \leq 0.03$	2	Acceptable	$L > 3.0$	$W \leq 0.03$	0	$L \leq 2.5$	$0.03 < W \leq 0.05$	2	$L > 2.5$	$0.03 < W \leq 0.05$	0			$W > 0.05$	Counted as spot defect (follows item 5.1)	Minor
Size(mm)		Acceptable Qty																																		
L(Length)	W(Width)	Zone																																		
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$L \leq 10.0$	$W \leq 0.01$	Acceptable																																		
$L \leq 3.0$	$W \leq 0.03$	2	Acceptable																																	
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$L > 2.5$	$0.03 < W \leq 0.05$	0																																		
		$W > 0.05$	Counted as spot defect (follows item 5.1)																																	
6.3	Orientation defect (such as misalignment of L.C)	Not allowed inside viewing area(Zone A and Zone B)	Minor																																	
6.4	Polarizer defect	6.4.1 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.																																		

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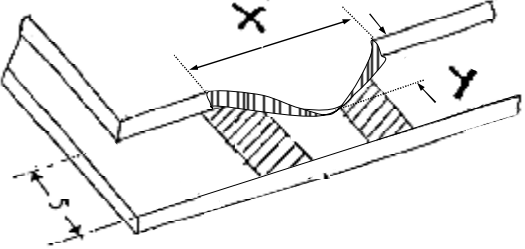
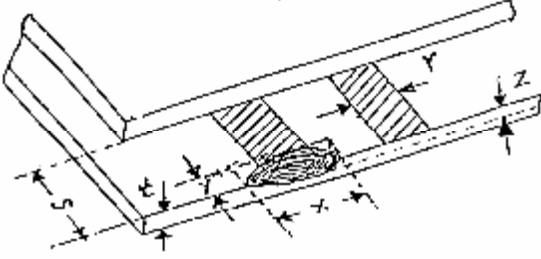
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product
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6. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																								
6.4	Polarizer defect	<p>6.4.2 Scratches, bubbles or dents on glass/polarizer/Reflector, bubbles between polarizers & reflector/glass:</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th rowspan="3">Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th colspan="3">Zone</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.15$</td> <td colspan="3">Acceptable</td> </tr> <tr> <td>$0.15 < \Phi \leq 0.20$</td> <td>3</td> <td>5</td> <td rowspan="3">Acceptable</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.30$</td> <td>3</td> <td>5</td> </tr> <tr> <td>$\Phi > 0.30$</td> <td>0</td> <td>0</td> </tr> </tbody> </table>	Size(mm)	Acceptable Qty			Zone			A	B	C	$\Phi \leq 0.15$	Acceptable			$0.15 < \Phi \leq 0.20$	3	5	Acceptable	$0.20 < \Phi \leq 0.30$	3	5	$\Phi > 0.30$	0	0	Minor
Size(mm)	Acceptable Qty																										
	Zone																										
	A	B	C																								
$\Phi \leq 0.15$	Acceptable																										
$0.15 < \Phi \leq 0.20$	3	5	Acceptable																								
$0.20 < \Phi \leq 0.30$	3	5																									
$\Phi > 0.30$	0	0																									
6.5	Segment deformity	<p>6.5.1 Deformity (void or Excess)</p> <p>(i) Void in segment Accept for $A \leq 0.10\text{mm}$</p> <p>(ii) Excess in segment Accept for $B < 0.02\text{mm}$</p> <div style="text-align: center;"> </div> <p>(iii) Thicker and Thinner</p> <p>Note: Permissible level</p> <p>$A-B \leq 0.10\text{mm}$</p> <div style="text-align: center;"> </div> <p>Remark: where d =segment width</p>	Minor																								

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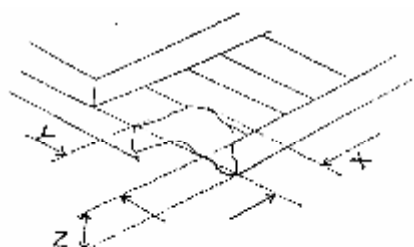
6. Cosmetic Defect

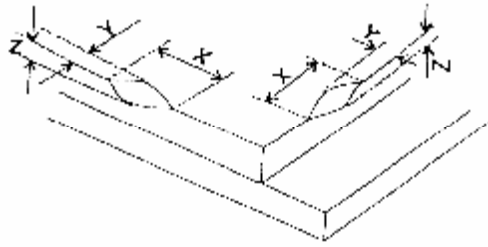
Item No	Items to be inspected	Inspection Standard	Classification of defects				
6.5	Segment deformity	<p>6.5.2 Pinhole</p> <p>Acceptable if the following cases are fulfill: $0.1 \leq \Phi \leq 0.25\text{mm}$ acceptable MAX 5/piece where $\Phi = 1/2(X+Y)$</p>	Minor				
6.6	Glass defect	<div style="text-align: center;">  </div> <p>Fig. 2 Glass protrusion on LCD.</p> <div style="text-align: center;">  </div> <p>Fig. 3 Glass chips on LCD.</p> <p>Definition:</p> <ul style="list-style-type: none"> r=contact pad width s=contact pad length t=glass thickness x=width of chipped or protrusion area y=length of chipped or protrusion area z=depth of chipped area a=dimension of glass length 	Major				
		<p>6.6.1 Maximum glass protrusion of outline: For the small side's glass (Fig.2)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 50%; text-align: center;">X</td> <td style="width: 50%; text-align: center;">Y</td> </tr> <tr> <td style="text-align: center;">acceptable</td> <td style="text-align: center;">$\leq s/3$</td> </tr> </table>	X	Y	acceptable	$\leq s/3$	
X	Y						
acceptable	$\leq s/3$						
		6.6.2 Cracks on glass are not acceptable.					

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TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product
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6. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects																		
6.6	Glass defect	<p>6.6.3 Chipped glass:</p> <p>(i) Chips on contact pad(unit: mm) (Fig.3)</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>acceptable</td> <td>≤ 0.3</td> <td>$\leq t$</td> </tr> <tr> <td>$\leq a/6$</td> <td>≤ 0.5</td> <td>$\leq t$</td> </tr> <tr> <td>$\leq a/8$</td> <td>≤ 0.8</td> <td>$\leq t$</td> </tr> </tbody> </table> <p>(ii) Chips between top/bottom glass. Acceptable for chips not extend to seal part.</p> <p>(iii) Chips inside viewing area: spot chips located inside viewing area should be treated as spot defect.</p> <p>(iv) Crack on corner</p>  <table border="1" style="margin-left: 20px; margin-top: 10px;"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤ 5.0</td> <td>Note</td> <td>$\leq t$</td> </tr> </tbody> </table> <p>Note:</p> <ol style="list-style-type: none"> Not to reach B zone and no damage to epoxy frame. Target mark must be remained. At least 2/3 of the electrode area should be remained. 	X	Y	Z	acceptable	≤ 0.3	$\leq t$	$\leq a/6$	≤ 0.5	$\leq t$	$\leq a/8$	≤ 0.8	$\leq t$	X	Y	Z	≤ 5.0	Note	$\leq t$	Minor
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acceptable	≤ 0.3	$\leq t$																			
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OUTGOING QUALITY STANDARD		PAGE 7 OF 7													
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		Mono COG Product													
6. Cosmetic Defect															
Item No	Items to be inspected	Inspection Standard	Classification of defects												
6.6	Glass defect	6.6.3 Chipped glass: (v) Usual surface cracks  <table border="1" data-bbox="422 869 1066 1064"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>Acceptable</td> <td>≤ 0.3</td> <td>$\leq t$</td> </tr> <tr> <td>$\leq a/6$</td> <td>≤ 1.0</td> <td>$\leq t$</td> </tr> <tr> <td>$\leq a/8$</td> <td>≤ 1.5</td> <td>$\leq t$</td> </tr> </tbody> </table> <p>Note: 1. Not to reach B zone and no damage to epoxy frame. 2. The total number of the glass defects should not be more than five.</p>	X	Y	Z	Acceptable	≤ 0.3	$\leq t$	$\leq a/6$	≤ 1.0	$\leq t$	$\leq a/8$	≤ 1.5	$\leq t$	Minor
X	Y	Z													
Acceptable	≤ 0.3	$\leq t$													
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$\leq a/8$	≤ 1.5	$\leq t$													
6.7	Distance between foreign dots	The distance between the foreign dots must exceed 30mm.	Minor												
6.8	Total number of dots	The total number of luminous dots, dark dots, contamination particles, bubbles, scratch defects, pinholes must not exceed 4 /piece.													

■ 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.

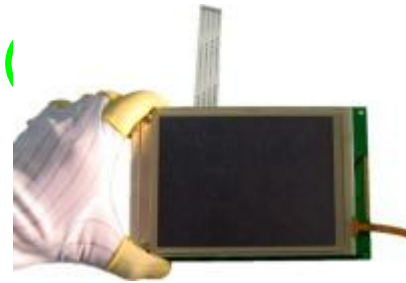
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

- 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:

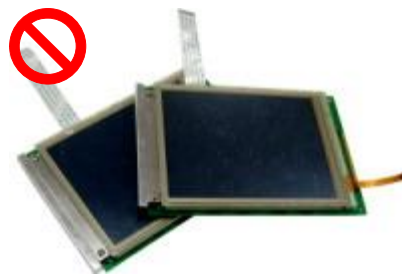


As above picture, please handle with anti-static gloves around LCM edges.

2.3 Incorrect handling:



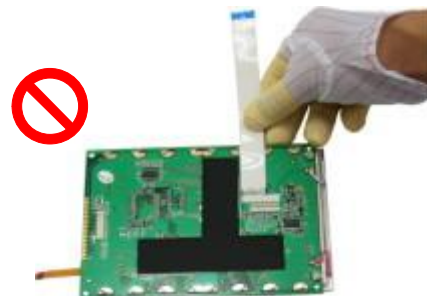
Please don't touch IC directly.



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

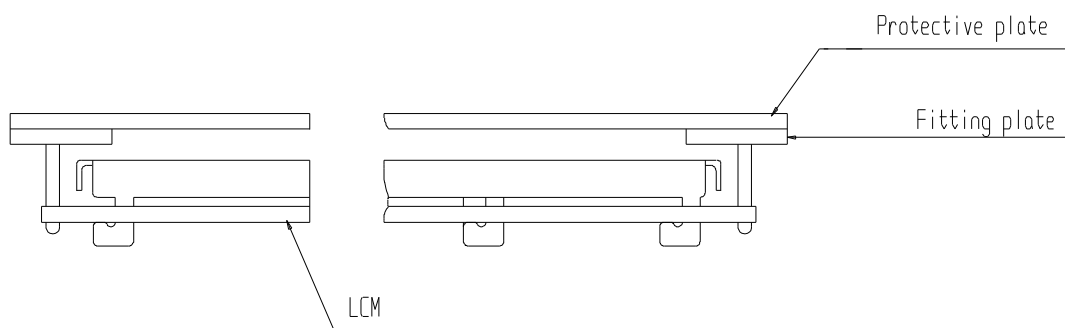
- 3.2.1 Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
- 3.2.2 If the LCD modules have been operating 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.

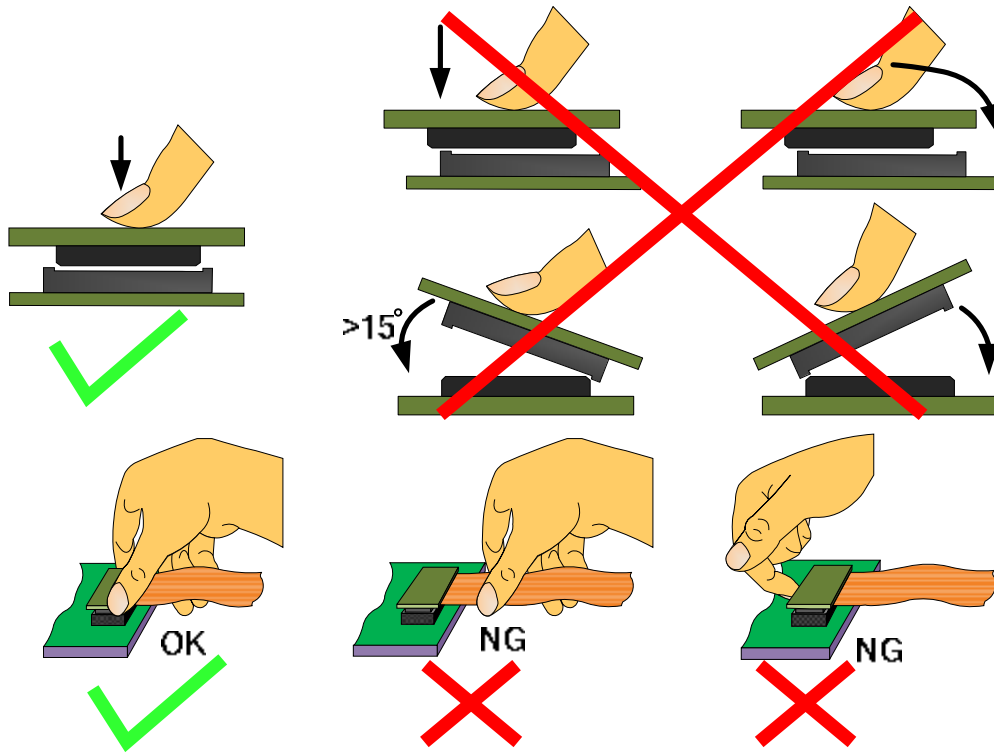
4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



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 TRULY and the customer, TRULY will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with TRULY LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of TRULY limited to repair and/or replace on the terms set forth above. TRULY 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 Truly 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.

■ FACTORY CONTACT INFORMATION

FACTORY NAME: TRULY SEMICONDUCTORS LTD.

FACTORY ADDRESS: Truly Industrial Area, ShanWei City,GuangDong,China

P.C: 516600 **URL:** <http://www.truly.com.hk> <http://www.trulysemi.com>