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With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

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Contact us

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Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

PRODUCT : LCD MODULE

MODEL NO. : TSB1G7000-E

SUPPLIER : TRULY SEMICONDUCTORS LTD.

DATE : July 29, 2008

CERT. No. QAC0946535
(ISO9001)

CERT. No. HKG002005
(ISO14001)

SPECIFICATION

Revision: 1.0

TSB1G7000-E
This module uses ROHS material

If there is no special request from customer, TRULY SEMICONDUCTORS Co., Ltd will not reserve the tooling of the product under the following conditions:
1.There is no response from customer in two years after TRULY SEMICONDUCTORS Co., Ltd submit the samples;
2.There is no order in two years after the latest mass production.
And correlated data (include quality record) will be reserved one year more after tooling was discarded.

TRULY SEMICONDUCTORS LTD: **CUSTOMER:**

Quality Assurance Department:_____
Approved by:

Technical Department:_____

Approved by:

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2008-7-29	First Release	

CONTENTS

WRITTEN BY	CHECKED BY	APPROVED BY
XT LIU	WU JIN KUN	LUO SHAN LIANG

■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	FSTN	/
Viewing direction	6:00	O' Clock
Glass area (W × H)	66.0 × 27.7	mm^2
Viewing area (W×H)	61.0 × 15.7	mm^2
Dot size (W × H)	0.55 × 0.60	mm^2
Dot pitch (W × H)	0.60 × 0.65	mm^2
Driver IC	NT7603	/
Interface Type	Parallel	/
Input voltage	3.3	V

■ EXTERNAL DIMENSIONS

NOTES:
1. DISPLSY TYPE :FSTN MODE
2. POLARIZER MODE: REFLECTIVE/POSITIVE
3. OPERATING TEMP: -10° C TO -60° C
4. STORAGE TEMP: -30° C TO +70° C
5. DRIVER IC: NT7603
6. ROHS COMPLIANT (环保材料)
7. PIN TYPE: W584070DK
   GENERAL TOLERANCE:±0.2MM

PIN DESCRIPTION

1	VSS
2	NC
3	VDD
4	RS
5	R/W
6	E
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7

TRULY®

LCD MODULE   TSB1G7000-E   Version :1.0   July 29, 2008

Customer No. :

1 VSS
NC
VDD
RS
R/W
E
DB0
DB1
DB2
DB3
DB4
DB5
DB6
14 DB7

Customer No. :

Left title block:

PRODUCT NO. TSB1G7000
DRAW NO. CXMLCM0178
REV D
DWN 黎汉祥 2008/2/19
DSN 钟志见 2008/06/06
CHKD 李红梅 2008/06/06
APPD 黄木辉 2008/06/06
UNIT mm
SHEET: 3/3
NOT IN SCALE

TRULY SEMICONDUCTORS LTD.

Right schematic labels:

SEG7 SEG6 SEG5 SEG4 SEG3 SEG2 SEG1 SEG0 COM7 COM6 COM5 COM4 COM3 COM2 COM1 TEST TESTM

SEG8
SEG9
SEG10
SEG11
SEG12
SEG13
SEG14
SEG15
SEG16
SEG17
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SEG71
SEG72
SEG73

SEG74 SEG75 SEG76 SEG77 SEG78 SEG79 SEG80 COM16 COM15 COM14 COM13 COM12 COM11 COM10 COM9 TESTD GND

GND
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GND
GND
GND
GND
GND — VSS
GND
GND
GND
GND
GND
OSC1
OSC2
V1
V2
V3
V4
V5
V5
V5
V5
OPT_R0
GND
OPT_R1
VCC
VCC
VCC
VCC
VCC
VCC
VCC — VDD
VCC
VCC
VCC
VCC
VCC
VCC
RS
RS — RS
R\W
R\W — R\W
E
E — E
DB0
DB0 — DB0
DB1
DB1 — DB1
DB2
DB2 — DB2
DB3
DB3 — DB3
DB4
DB4 — DB4
DB5
DB5 — DB5
DB6
DB6 — DB6
DB7
DB7 — DB7
OPT_LCD

UNIT :uM
PAD SIZE:42X90
CHIP SIZE:1220X5010
NT7603BDT-01

PRODUCT NO. TSB1G7000
DRAW NO. CXMLCM0178
REV D
DWN 黎汉祥 2008/2/19
DSN 钟志见 2008/06/06
CHKD 李红梅 2008/06/06
APPD 黄木辉 2008/06/06
UNIT um
SHEET: 2/3
NOT IN SCALE

TRULY SEMICONDUCTORS LTD.

■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	V_{DD}	-0.3	7.0	V
Input voltage	V_{IN}	-0.3	$V_{DD} + 0.3$	V
Operating temperature	T_{OP}	-10	60	°C
Storage temperature	T_{ST}	-30	70	°C
Humidity	RH		90%(Max60°C)	RH

■ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	V_{DD}-V_{SS}	3.2	3.3	3.4	V
Input Current	Idd	-	0.6	1.5	mA
Operating voltage for LCD	V_{OP}	3.1	3.3	3.5	V
Input voltage ' H ' level	V_{IH}	$0.8V_{DD}$	-	V_{DD}	V
Input voltage ' L ' level	V_{IL}	-0.3	-	$0.2V_{DD}$	V
Output voltage ' H ' level	V_{OH}	V_{DD} -0.6	-	-	V
Output voltage ' L ' level	V_{OL}	-	-	0.6	V

■ TIMING OF POWER SUPPLY

PLEASE REFER TO THE DRIVER IC SPECIFICATION.

■ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+ Tf	θ=30° Ta=25℃	---	508.2	762.3	ms		2
Contrast ratio	Cr		5.35	10.7	---	---	FIG4.	1
Reflectance	R%		---	19.4	---	%	FIG4.	4

Note 1. Contrast Ratio(CR) is defined mathematically :   **Contrast Ratio** = $\dfrac{L_{MAX}}{L_O}$

Where

L_{MAX} :Luminace of maximal gray level

L_O :   Luminace of gray level 0

Note 2. 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. The test equipment is Autronic-Melchers's ConoScope. series

Note 3. CIE (x, y) chromaticity, The x,y value is determined by measuring luminance at each test position 1 through 5,and then make average value

Note4. For Reflectance and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments. For contrast ratio, Surface Luminance, Luminance uniformity,CIE The test data is base on TOPCON's BM-5 photo detector.

FIG. 4 Measuring method for optical characteristics in Reflective mode

<Reflective Mode>
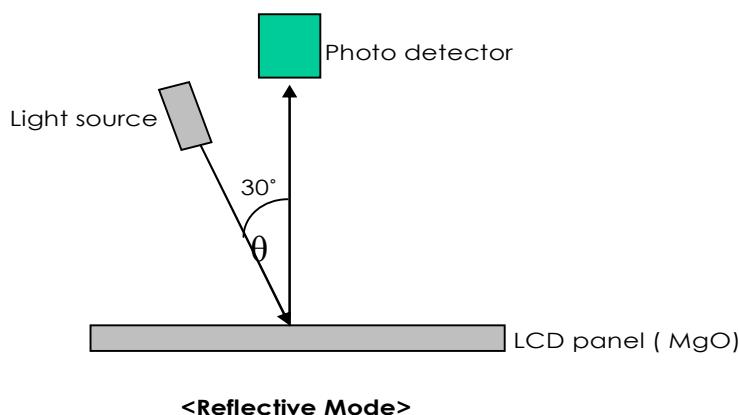
■ INTERFACE DESCRIPTION

Pin No.	Symbol	Level	Description
1	VSS	0V	Ground
2	NC	---	No connection
3	VDD	+3.3V	Power supply
4	RS	H/L	Register select signal 0: Instruction register (write), Busy flag, address counter (read) 1: Data register (write, read)
5	R/W	H/L	Read/Write control signal 0: Write 1: Read
6	E	H/L	Read/Write start signal
7	DB0	H/L	Lower 4 tri-state bi-directional data bus for transmitting data between MPU and NT7603. Not used during 4-bit operation.
8	DB1		
9	DB2		
10	DB3		
11	DB4	H/L	Higher 4 tri-state bi-directional data bus for transmitting data between MPU and NT7603. DB7 is also used as a busy flag.
12	DB5		
13	DB6		
14	DB7		

■ APPLICATION CIRCUIT

Please consult our technical department for detail information.

■ INITIAL CODE

Please consult our technical department for detail information.

■ RELIABILITY TEST

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	70±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	60±2℃/200 hours	
4	Low Temperature Operating	-10±2℃/200 hours	
5	Temperature Cycle	-10±2℃~25~60±2℃×10cycles (30min.) (5min.) (30min.)	
6	Damp Proof Test	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:±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 judge as a good part.

Using ionizer(an antistatic blower) is recommended at working area in order to reduce electro-static voltage.

When removing protection film from LCM panel, peel off the tag slowly(recommended more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

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.Please use automatic switch menu(or roll menu) testing mode when test operating mode.

■ **INSPECTION CRITERION**

TRULY ® OUTGOING QUALITY STANDARD	PAGE 1 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product

This specification is made to be used as the standard acceptance/rejection criteria for Mono COG 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 cosmeetic inspection is 30cm with bare eyes, and under an environment of 800 lus(20W~40W) light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.

3. Definition of inspection zone in LCD.
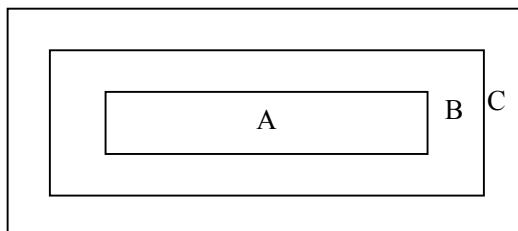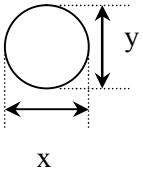
Zone A: character/Digit area

Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)
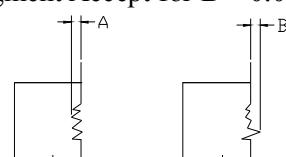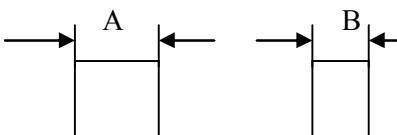
Zone C: Outside viewing area (invisible area after assembly in customer`s product)
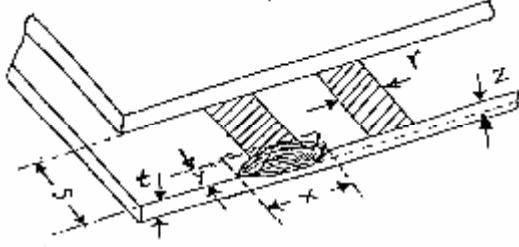
Fig.1 Inspection zones in an LCD.
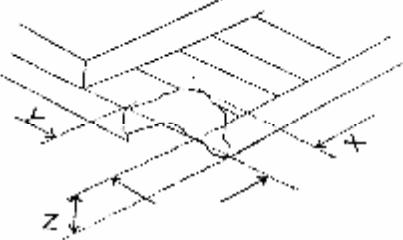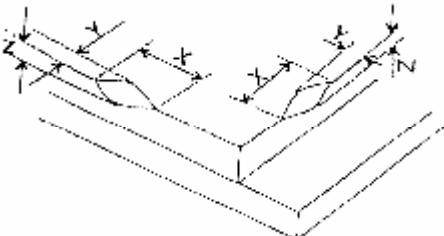
Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer`s product.

TRULY ® OUTGOING QUALITY STANDARD	PAGE 2 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product

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 above, cosmetic defects such as spot, glass defect are classified as minor
defects.

Item No	Items to be inspected	Inspection Standard				Classification of defects
5.1	Spot defect (Defects in spot form, such as dark/white spot)					Minor

Size(mm) \ Zone	Acceptable Qty		
	A	B	C
$\Phi \leqslant 0.15$	Acceptable(clutering of spot not allowed)		Acceptable
$0.15 < \Phi \leqslant 0.20$	1	2	
$0.20 < \Phi \leqslant 0.25$	0	1	
$\Phi > 0.25$	0	0	

Remarks: For dark/white spot, size Φ is defined

as $\Phi = (X+Y)/2$

y

x

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

5. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.2	Line defect (Defects in line form)	(see table below)	Minor
5.3	Orientation defect (such as misalignment of L.C)	Not allowed inside viewinw area(Zone A and Zone B)	Minor
5.4	Polarizer defect	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.	

Inspection Standard for item 5.2:

Size(mm)		Acceptable Qty	
		Zone	
L(Length)	W(Width)	A、B	C
L≤10.0	W≤0.01	Acceptable	Accep-table
L≤3.0	W≤0.03	2	
L>3.0	W≤0.03	0	
L≤2.5	0.03<W≤0.05	2	
L>2.5	0.03<W≤0.05	0	
	W>0.05	Counted as spot defect (follows item 5.1)	

Remarks: The total of spot defect and line defect shall not exceed four.

| *TRULY* ® OUTGOING QUALITY STANDARD	PAGE　4　OF　7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product

5. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.4	Polarizer defect	5.4.2 Seratches, bubble or dent on glass/polarizer/Reflector, bubble between polarizers & reflector/glass:	Minor
5.5	Segment deformity	5.5.1 Deformity (void or Excess)	Minor

5.4.2 table:

Zize(mm)	Acceptable Qty		
	Zone		
	A	B	C
Φ≤0.15	Acceptable		Acceptable
0.15＜Φ≤0.20	3	5	Acceptable
0.20＜Φ≤0.30	3	5	Acceptable
Φ＞0.30	0	0	

5.5.1 Deformity (void or Excess)

(i)　void in segment Accept for　A≤0.10mm

(ii)　Excess in segment Accept for B < 0.02mm

(iii)　Thicker and Thinner

Note: Permissible level

$\left| A\text{-}B \right|$ ≤0.10mm

Remarks: where d =segment width

TRULY ® OUTGOING QUALITY STANDARD	PAGE 5 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product

5. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.5	Segment deformity	5.5.2 PIN Hole Acceptable if the following cases are fulfill: $0.1 \leqslant \Phi \leqslant 0.25$ mm acceptable MAX 5/PCS where $\Phi = 1/2(X+Y)$	Minor
5.6	Glass defect	5.6.1 glass protrusion (i) Maximum protrusion of outline should not exceed the maximum outline dimension in product drawing.	Major
		5.6.2 Cracks on glass is not acceptable.	
		5.6.3 Chipped glass definition: 　　r=contact pad width 　　s=contact pab length 　　t=glass thickness 　　x=width of chipped area 　　y=length of chipped area 　　z=depth of chipped area 　　a=dimension of glass length Fig. 2 glass chips on LCD. (i) Chips on contact pab(unit:mm)	Minor

X	Y	Z
acceptable	$\leqslant 0.3$	$\leqslant t/2$
$\leqslant a/8$	$\leqslant 0.8$	$\leqslant t$
$\leqslant a/6$	$\leqslant 0.5$	$\leqslant t$

| TRULY ® OUTGOING QUALITY STANDARD	PAGE 6 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	Mono COG Product

5. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.6	Glass defect	(ii) Chips between top/bottom glass. Acceptable for chips not extend to seal part. (ii) chips inside viewing area:spot chips located inside viewing area should be treated as spot defect. (iii) Crack on corner 	Minor

X	Y	Z
≤5.0	≤S/3	t

Notes: 1. Not to reach B zone

2. Target mark must be remained.

3. At least 2/3 of the electrode area should be remained .

(iv) Usual surface cracks

X	Y	Z
Acceptable	≤0.3	T/2
≤A/6	≤1.5	T/2
≤A/8	≤1.0	T

Notes: 1. Not to reach B zone

2. The total number of the glass defect should not be more than five.

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

5. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.7	Distance between foreign	The distance between the foreign dot must exceed 30mm.	
5.8	Total number of dot	The total number of luminous dot, dart defect, contamination particle, bubble, scratch defect, pinhole must not exceed 4/piece.	

■PRECAUTIONS FOR USING LCD MODULES

Handing Precautions

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

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

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

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

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

      - Isopropyl alcohol
      - Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

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

      - Water
      - Ketone
      - Aromatic solvents

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

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

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

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

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

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

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

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

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

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

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

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

      - Do not alter, modify or change the shape of the tab on the metal frame.

      - Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

      - Do not damage or modify the pattern writing on the printed circuit board.

      - Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

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

      - Do not drop, bend or twist LCM.

Handling precaution for LCM

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

<u>**Correct handling:**</u>

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

<u>**Incorrect handling:**</u>

Please don't touch IC directly.
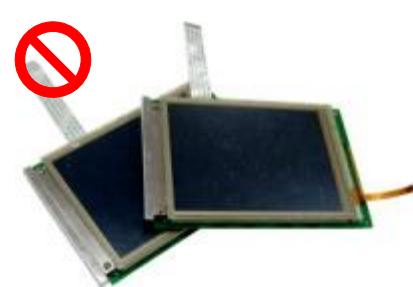
Please don't stack LCM.

Please don't hold the surface of panel.
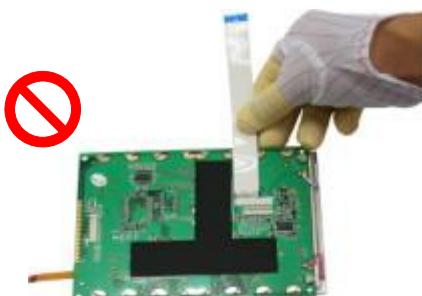
Please don't stretch interface of output, such as FPC cable.

Please don't hold the surface of IC.

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

Storage Precautions

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

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

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

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

Others

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

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

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

- Exposed area of the printed circuit board.

-Terminal electrode sections.

■ **USING LCD MODULES**

Installing LCD Modules

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

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
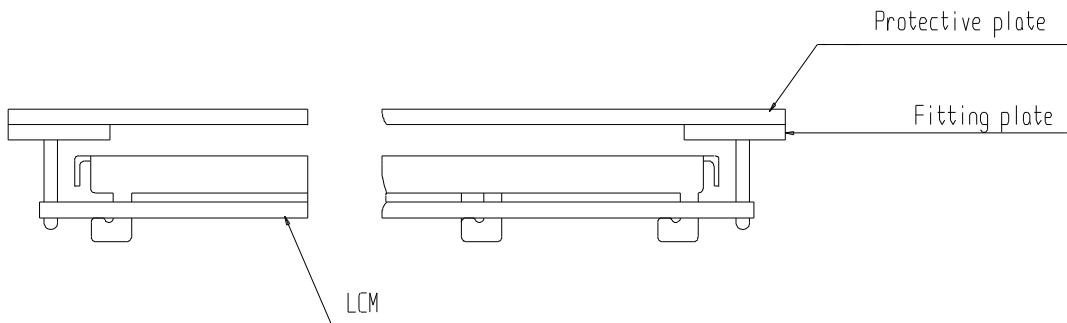
(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

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

| OK | NG |
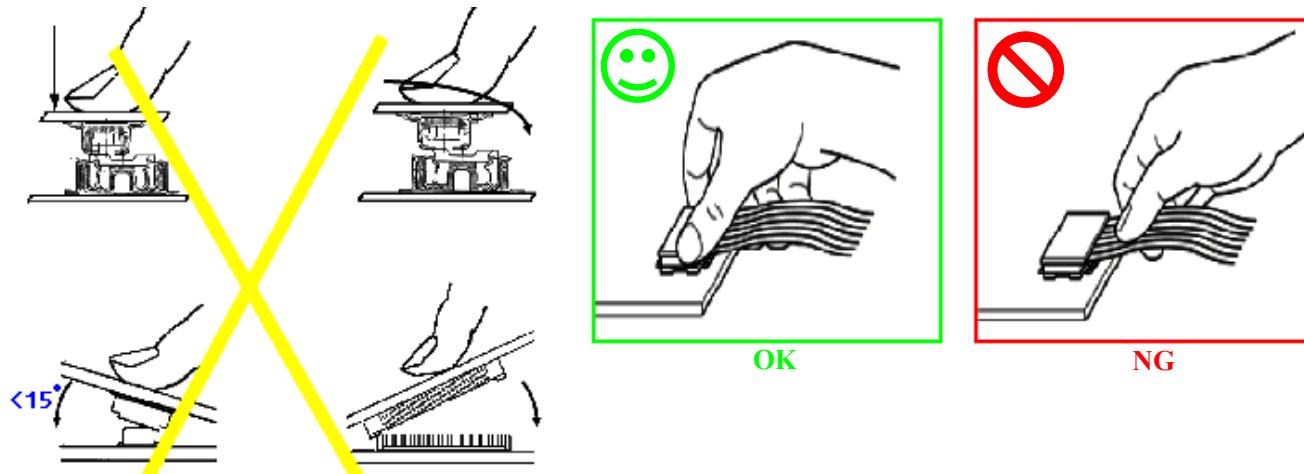
Precaution for soldering the LCM

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

(1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

Precautions for Operation

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

(2) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.   An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

(3) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.   However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.

(6) Input 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.

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

Safety

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

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

Limited Warranty

Unless agreed between TRULY and 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 replacement on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :
- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

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

■ **PRIOR CONSULT MATTER**

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

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

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

■ **FACTORY**

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