



CERT.No.946535



CERT.No.H2005

## **TRULY LCM**

# **PRODUCT SPECIFICATIONS**

MODEL NO. :	<u>MCT-G320240DFSW-33W</u>
PRODUCT TYPE :	<u>STANDARD</u>
REVISION :	<u>1.0</u>
WRITTEN BY :	<u>Liuxiaoting</u>
APPROVED BY :	<u>K.K HO</u>
DATE :	<u>2005-08-03</u>

This specification may be changed without any notices in order improve performance or quality.

## History of versions and modifications

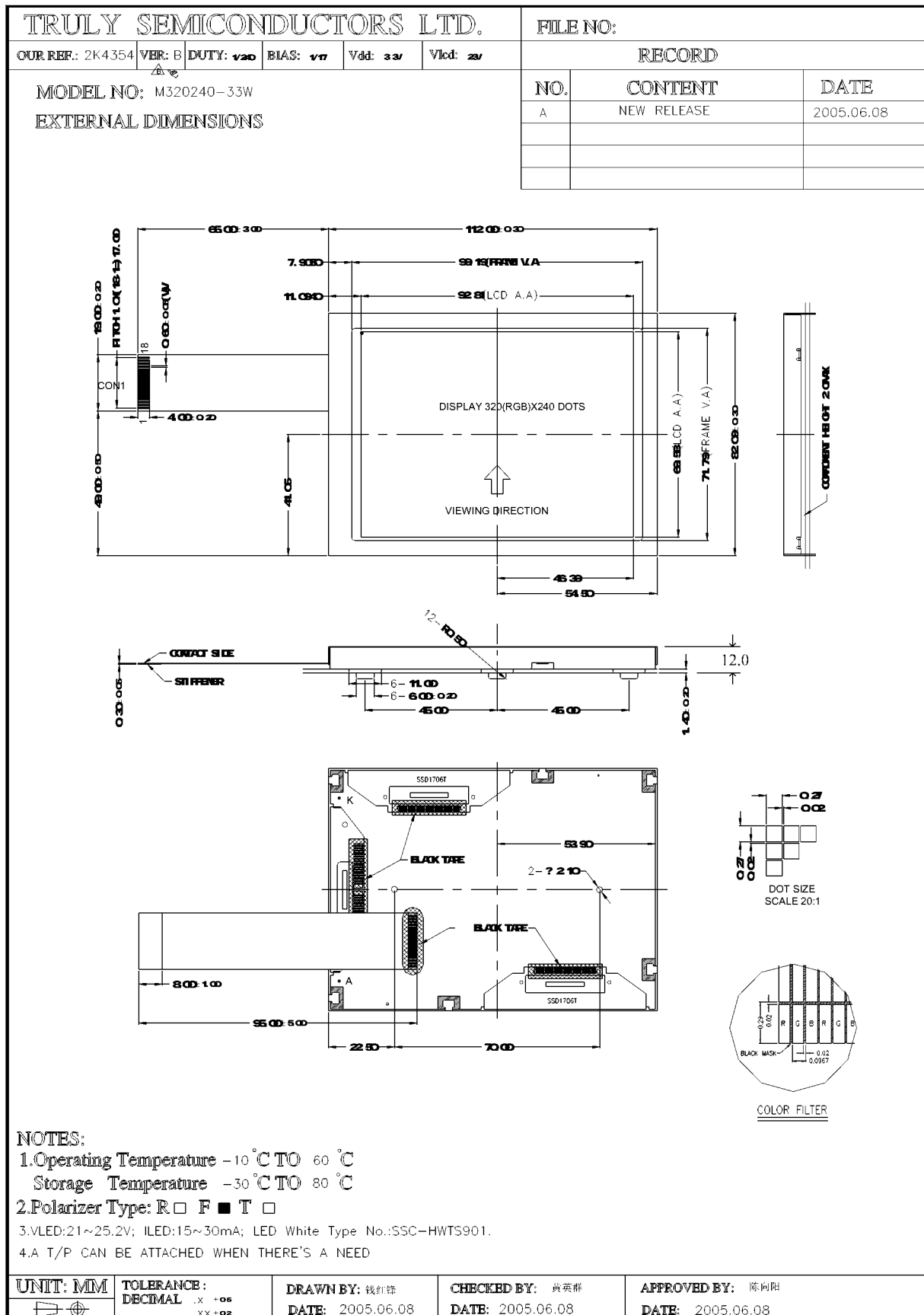
Revision	Modifications	Date
1.0	Generation first version	2005.08.03

## PRODUCT SPECIFICATIONS

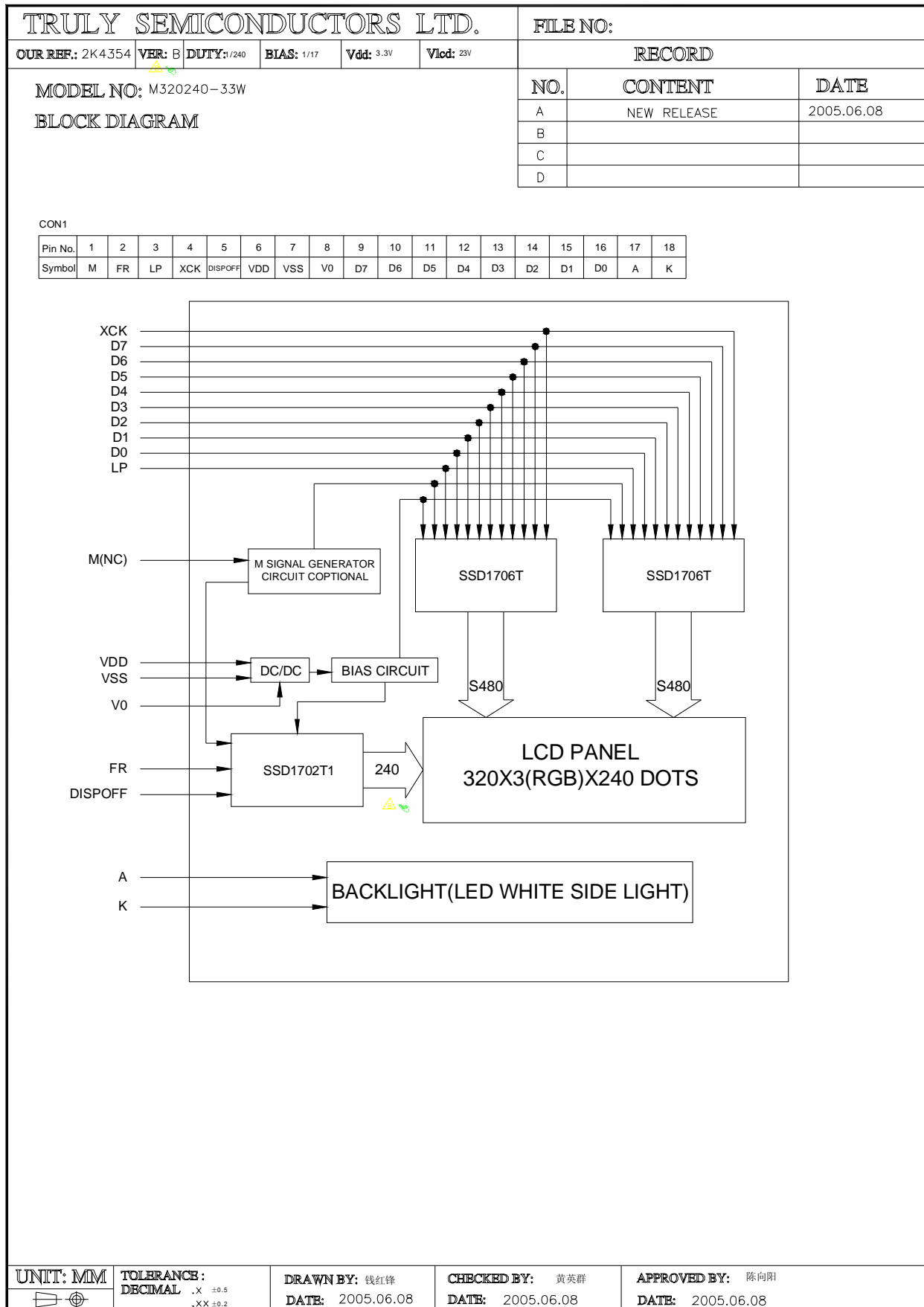
- n PHYSICAL DATA
- n EXTERNAL DIMENSIONS
- n BLOCK DIAGRAM
- n ABSOLUTE MAXIMUM RATINGS
- n ELECTRICAL CHARACTERISTICS
- n TIMING CHART OF INPUT SIGNALS
- n EXAMPLE OF POWER CONNECTION
- n ELECTRO-OPTICAL CHARACTERISTICS
- n INTERFACE PIN CONNECTIONS
- n PART LIST
- n RELIABILITY
- n QUALITY GUARANTEE
- n INSPECTION CRITERIA
- n PRECAUTIONS FOR USING LCD MODULES
- n USING LCD MODULES

**n PHYSICAL DATA**

Item	Contents	Unit
LCD type	CSTN Transflective	---
LCD duty	1/240	---
LCD bias	1/17	---
Viewing direction	6	O'clock
Module size (W×H×T)	112.0(W) X 82.0(H) X 10.0max. (D)	mm
Viewing area (W×H)	99.2(W) X 71.8(H)	mm
Dot size (W×H)	0.27 × 0.27	mm
Dot pitch (W×H)	0.29× 0.29	mm
Backlight	LED White Side Light	



## n BLOCK DIAGRAM



UNIT: MM



TOLERANCE:

DECIMAL .X ±0.5  
.XX ±0.2

DRAWN BY: 钱红锋

DATE: 2005.06.08

CHECKED BY: 黄英群

DATE: 2005.06.08

APPROVED BY: 陈向阳

DATE: 2005.06.08

**n ABSOLUTE MAXIMUM RATINGS** (*Exclude Touch Penel* Ta = 25°C )

Parameter	Symbol	Min	Type	Max	Unit
Supply voltage for logic	$V_{DD}-V_{SS}$	-0.3	3.3	3.6	V
Driver supply voltage	$V_{LCD}=V_{DD}-V_{cap3}$	0	---	23	V
Input voltage	$V_I$	-0.3	$V_{DD}$	$V_{DD}+0.3$	V
Operating temperature	$T_{OP}$	-10	25	60	°C
Storage temperature	$T_{ST}$	-30	25	80	°C

**n ELECTRICAL CHARACTERISTICS** (VSS = 0V, Ta = 25°C)

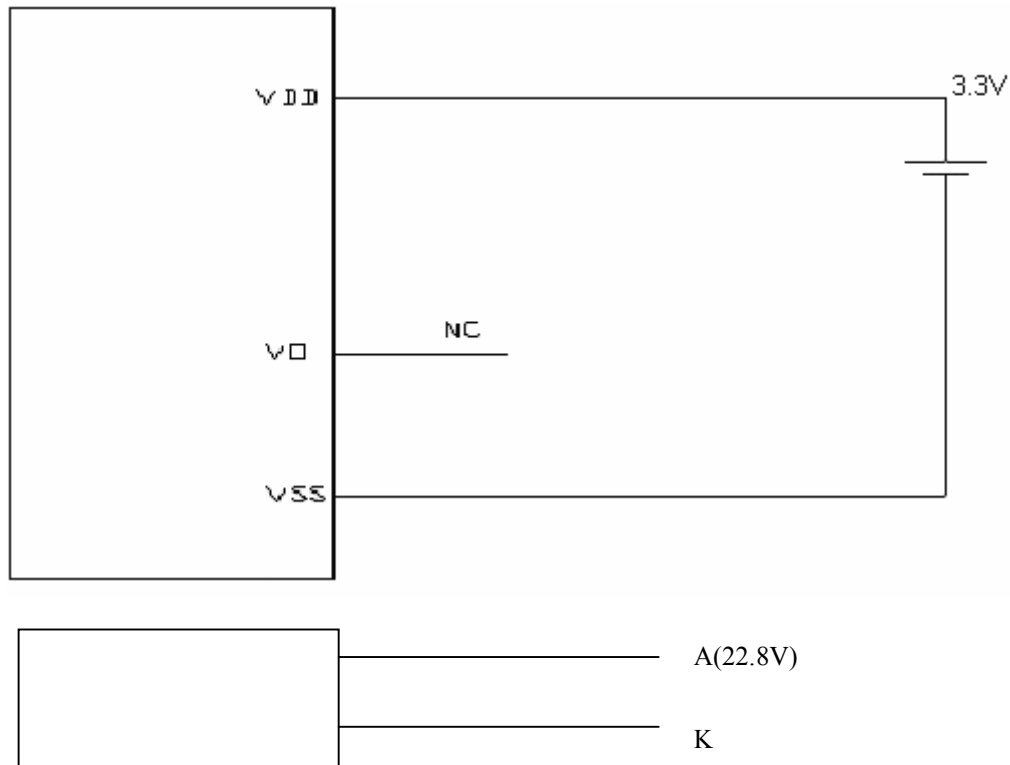
## ◇ DC Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage for logic	$V_{DD}-V_{SS}$	---	2.4	3.5	3.6	V
Supply current for logic	$I_{DD}$	---	---	58	90	mA
voltage for Back light	Vbl			23	25	V
Current for Back light	Ibl			30		mA

## n TIMING CHART OF INPUT SIGNALS

please refer to SSD1702R1 Datasheet

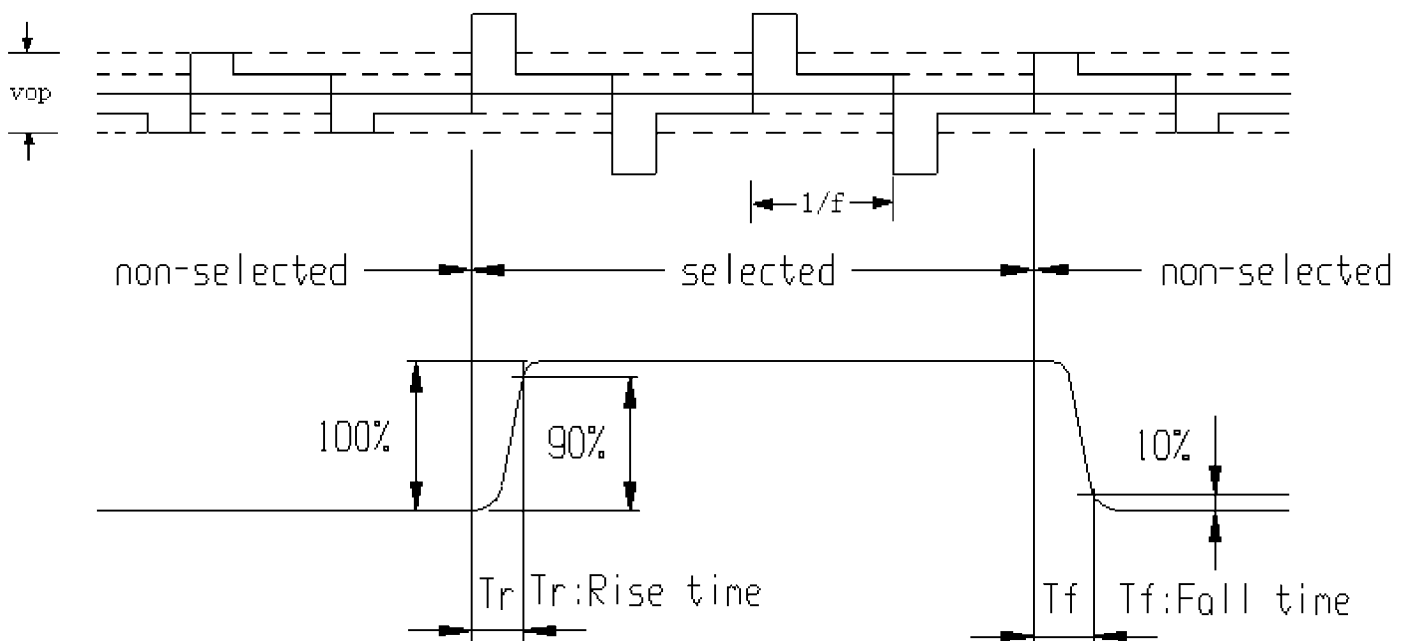
## n EXAMPLE OF POWER CONNECTION



**■ ELECTRO-OPTICAL CHARACTERISTICS**(TEMP=25°C, VOP=24.91V,  $\theta=0^\circ$ )

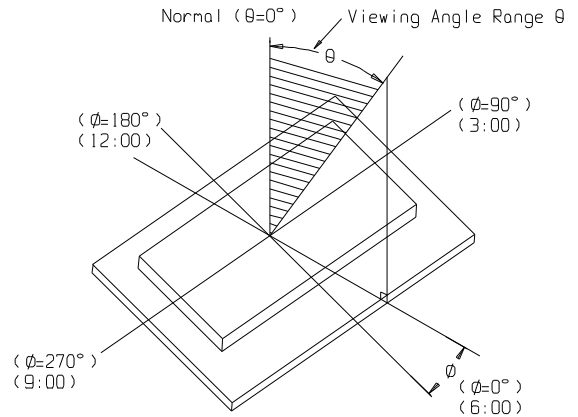
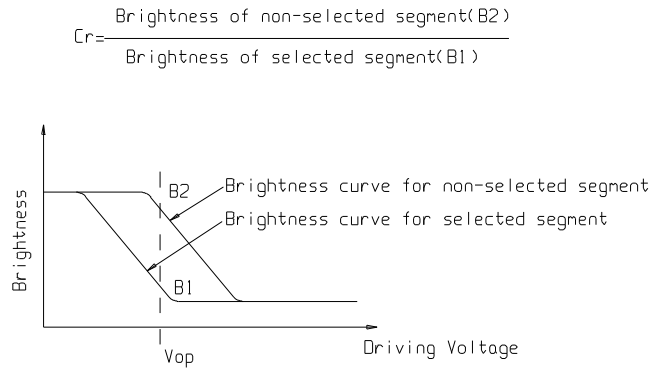
Item	Symbol	Condition	Min	Typ	Max	Unit	Remarks	Note
Response(up)	$T_R$	Vop=24.91V 25°C	---	150		ms		1
Response(down)	$T_F$	Vop=24.91V 25°C	---	155	---	ms	---	1
Contrast Ratio	Cr	Vop=24.91V	---	25	---	---	---	2
Viewing Angle Range	$\theta$	$Cr \geq 2$	---	50	---	deg	$\varnothing = 90^\circ$	3
			---	50	---	deg	$\varnothing = 270^\circ$	3
			---	40	---	deg	$\varnothing = 0^\circ$	3
			---	55	---	deg	$\varnothing = 180^\circ$	3
Brightness	L	---	---	60	---	Cd/m <sup>2</sup>	---	---

Note 1. Definition of response time



Note 2. Definition of Contrast Ratio 'Cr'

Note 3. Definition of Viewing Angle Range ' $\theta$ '



## INTERFACE PIN CONNECTIONS

### CN1

Pin No.	Symbol	Level	Description
1	M	H/L	Input of signal to AC electrify the liquid crystal drive output
2	FR	H/L	Scan start pulse
3	LP	H/L	Display data latch pulse input
4	XCK	H/L	Display data shift clock input
5	DISPOFF	H/L	H : display on, L : display off
6	VDD	3.3V	Supply voltage for logic
7	VSS	0V	Ground
8	V0	---	change the voltage(0V to 26V)to adjust contrast.leave this pin open during normal use.
9	D7	H/L	Data bit 7
10	D6	H/L	Data bit 6
11	D5	H/L	Data bit 5
12	D4	H/L	Data bit 4
13	D3	H/L	Data bit 3
14	D2	H/L	Data bit 2
15	D1	H/L	Data bit 1
16	D0	H/L	Data bit 0
17	A	+23(TYP)	LED light anode
18	K	0	LED light cathode

## PART LIST

Part Name	Description	Quantity
IC	SSD1702T1R1	1
IC	SSD1706T	2
LCD	TSF8105	1

**n RELIABILITY****◇ Content of Reliability Test**

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80℃±2℃/200 hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects:
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.)	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.
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	Drooping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	

**Remark:**

- 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.
- 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.

**◇ Failure Judgment Criterion**

Criterion Item	Failure Judgment Criterion									
	1	2	3	4	5	6	7	8	9	
Basic specification	O	O	O	O	O	O	O	O	O	Out of the Basic Specification
Electrical characteristic	O	O	O	O	O	O	O	O	O	Out of the DC and AC Characteristic
Mechanical characteristic	O	O	O	O	O	O	O	O	O	Out of the Mechanical Specification Color change : Out of Limit Appearance Specification
Optical characteristic	O	O	O	O	O	O	O	O	O	Out of the Appearance Standard

Note: O—OK X--NG

**n QUALITY GUARANTEE****◇ Acceptable Quality Level**

Each lot should satisfy the quality level defined as follows.

- Inspection method : MIL-STD-105E LEVEL II Normal one time sampling
- AQL

Partition	AQL	Definition
A: Major	0.65%	Functional defective as product
B: Minor	1.5%	Satisfy all functions as product but not satisfy cosmetic standard

**◇ Definition of 'LOT'**

One lot means the delivery quantity to customer at one time.

**◇ Conditions of Cosmetic Inspection****I Environmental condition**

The inspection should be performed at the 1m of height from the LCD module under 2 pieces of 40W white fluorescent lamps (Normal temperature 20~25°C and normal humidity 60±15%RH).

**I Inspection method**

The visual check should be performed vertically at more than 30cm distance from the LCD panel.

**n INSPECTION CRITERIA**

<b>TRULY®</b> OUTGOING QUALITY STANDARD	PAGE 1 OF 5				
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	CSTN COG Product				
<p>This specification is made to be used as the standard acceptance/rejection criteria for CSTN COG Product.</p> <p><b>1. Sample plan</b></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><b>2. Inspection condition</b></p> <p>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.</p> <p><b>3. Definition of Inspection Item.</b></p> <p>3.1 Definition of inspection zone in LCD.</p> <div data-bbox="486 1162 1005 1393" data-label="Diagram"> </div> <p>Zone A: character/Digit area</p> <p>Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)</p> <p>Zone C: Outside viewing area (invisible area after assembly in customer's product)</p> <p>Fig.1 Inspection zones in an LCD.</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> <p><b>3.2 Definition of some visual defect</b></p> <table border="1"> <tr> <td>Black/White spot, Black/White line, Foreign Particle Bubble.</td><td>The spots or lines defect can be found at operating condition and remain unvaried in terms of size or shade with varying the LCD operating voltage.</td></tr> <tr> <td>Contrast variation</td><td>When the LCD operating the color of a small area is different from the remainder. The phenomenon changes with voltage.</td></tr> </table>		Black/White spot, Black/White line, Foreign Particle Bubble.	The spots or lines defect can be found at operating condition and remain unvaried in terms of size or shade with varying the LCD operating voltage.	Contrast variation	When the LCD operating the color of a small area is different from the remainder. The phenomenon changes with voltage.
Black/White spot, Black/White line, Foreign Particle Bubble.	The spots or lines defect can be found at operating condition and remain unvaried in terms of size or shade with varying the LCD operating voltage.				
Contrast variation	When the LCD operating the color of a small area is different from the remainder. The phenomenon changes with voltage.				

**TRULY®** OUTGOING QUALITY STANDARD

PAGE 2 OF 5

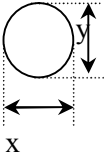
TITLE:FUNCTIONAL TEST &amp; INSPECTION CRITERIA

CSTN COG Product

**4. Major Defect**

	Items to be inspected	Inspection Standard	Classification of defects
4.1	All functional defects	1) No display 2) Display abnormally 3) Open or missing segment 4) Short circuit 5) Excess power consumption	Major
4.2	Missing	Missing component	
4.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	
4.4	Crack	Creaks tend to break are not allowed.	

**5. Minor Defect**

	Items to be inspected	Inspection Standard	Classification of defects																							
5.1	Black and white Spot defect Pin hole defect  $\Phi = (x+y) / 2$	<table border="1"> <tr> <th rowspan="2">Zone Size(mm)</th><th colspan="3">Acceptable Qty</th></tr> <tr> <th>A</th><th>B</th><th>C</th></tr> <tr> <td><math>\Phi \leq 0.10</math></td><td colspan="3">Acceptable (clustering of spot not allowed)</td></tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.15</math></td><td colspan="3">3</td></tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.20</math></td><td colspan="3">1</td></tr> <tr> <td><math>\Phi &gt; 0.20</math></td><td colspan="3">0</td></tr> </table>	Zone Size(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.10$	Acceptable (clustering of spot not allowed)			$0.10 < \Phi \leq 0.15$	3			$0.15 < \Phi \leq 0.20$	1			$\Phi > 0.20$	0			Minor
Zone Size(mm)	Acceptable Qty																									
	A	B	C																							
$\Phi \leq 0.10$	Acceptable (clustering of spot not allowed)																									
$0.10 < \Phi \leq 0.15$	3																									
$0.15 < \Phi \leq 0.20$	1																									
$\Phi > 0.20$	0																									

5.2	Contrast variation	<table><tr><th rowspan="2">Zone Size(mm)</th><th colspan="3">Acceptable Q'ty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td><math>\Phi \leq 0.20</math></td><td colspan="2">Acceptable</td><td rowspan="4">Acceptable</td></tr><tr><td><math>0.20 &lt; \Phi \leq 0.30</math></td><td colspan="2">5</td></tr><tr><td><math>0.30 &lt; \Phi \leq 0.50</math></td><td colspan="2">3</td></tr><tr><td><math>\Phi &gt; 0.50</math></td><td colspan="2">0</td></tr></table>	Zone Size(mm)	Acceptable Q'ty			A	B	C	$\Phi \leq 0.20$	Acceptable		Acceptable	$0.20 < \Phi \leq 0.30$	5		$0.30 < \Phi \leq 0.50$	3		$\Phi > 0.50$	0	
		Zone Size(mm)		Acceptable Q'ty																		
			A	B	C																	
		$\Phi \leq 0.20$	Acceptable		Acceptable																	
		$0.20 < \Phi \leq 0.30$	5																			
		$0.30 < \Phi \leq 0.50$	3																			
		$\Phi > 0.50$	0																			
Note: Total defective point shall not exceed 3 pcs																						

Note: Total defective point shall not exceed 3 pcs

**TRULY®** OUTGOING QUALITY STANDARD

PAGE 3 OF 5

TITLE:FUNCTIONAL TEST &amp; INSPECTION CRITERIA

CSTN COG Product

	Items to be inspected	Inspection Standard					Classification of defects
5.3	Line defect  Black line,  White line,   Foreign material under polarizer,						Minor
		Size( m)		Acceptable Qty			
		L(Length)	W(Width)	Zone			
				A	B	C	
		Acceptable	$W \leq 0.03$	Acceptable		Acceptable	
		$L \leq 3.0$	$0.03 < W \leq 0.05$	2			
		$L \leq 2.0$	$0.05 < W \leq 0.1$	1			
		---	$W > 0.1$	Counted as spot defect (follows item 5.1)			
		Remarks: The total of spot defect and line defect shall not exceed 4 pcs.					

5.4	Polarizer defect	5.4.1 Polarizer Position	Minor																				
		(i) Shifting in position should not exceed the glass outline dimension																					
		(ii) Incomplete covering of the viewing area due to shifting is not allowed.																					
		5.4.2 Dirt on polarizer																					
		Dirt which can be wiped easily should be accepted.																					
		5.4.3 Polarizer Nick & Dent																					
		<table><tr><th rowspan="3">Sizes(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><tr><td><math>\Phi \leq 0.20</math></td><td colspan="2">Acceptable</td><td rowspan="3">Acceptable</td></tr><tr><td><math>0.20 &lt; \Phi \leq 0.25</math></td><td colspan="2">1</td></tr><tr><td><math>\Phi &gt; 0.25</math></td><td colspan="2">0</td></tr></table>		Sizes(mm)	Acceptable Qty			Zone			A	B	C	$\Phi \leq 0.20$	Acceptable		Acceptable	$0.20 < \Phi \leq 0.25$	1		$\Phi > 0.25$	0	
		Sizes(mm)			Acceptable Qty																		
					Zone																		
				A	B	C																	
$\Phi \leq 0.20$	Acceptable		Acceptable																				
$0.20 < \Phi \leq 0.25$	1																						
$\Phi > 0.25$	0																						
TRULY SEMICONDUCTORS LTD.			P.17 of 22																				

**TRULY®** OUTGOING QUALITY STANDARD

PAGE 4 OF 5

TITLE:FUNCTIONAL TEST &amp; INSPECTION CRITERIA

CSTN COG Product

## 5. Minor Defect

	Items to be inspected	Inspection Standard	Classification of defects																														
5.4	Polarizer defect	5.4.4Air bubbles between glass & polarizer: <table><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><tr><td><math>\Phi \leq 0.15</math></td><td colspan="2">Acceptable</td><td rowspan="4">Acceptable</td></tr><tr><td><math>0.15 &lt; \Phi \leq 0.30</math></td><td colspan="2">3</td></tr><tr><td><math>0.30 &lt; \Phi \leq 0.60</math></td><td colspan="2">2</td></tr><tr><td><math>\Phi &gt; 0.60</math></td><td colspan="2">0</td></tr></table>	Size(mm)	Acceptable Qty			Zone			A	B	C	$\Phi \leq 0.15$	Acceptable		Acceptable	$0.15 < \Phi \leq 0.30$	3		$0.30 < \Phi \leq 0.60$	2		$\Phi > 0.60$	0		Minor							
		Size(mm)		Acceptable Qty																													
Zone																																	
A	B		C																														
$\Phi \leq 0.15$	Acceptable		Acceptable																														
$0.15 < \Phi \leq 0.30$	3																																
$0.30 < \Phi \leq 0.60$	2																																
$\Phi > 0.60$	0																																
		5.4.5 Polarizer scratch <p>(i) If the Polarizer scratch can be seen after cover assembling or in the operating condition, judge by the line defect of 5.3.</p> <p>(ii) If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.</p> <table><tr><th colspan="2">Size(mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th rowspan="2">L(Length)</th><th rowspan="2">W(Width)</th><th colspan="3">Zone</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Ignore</td><td><math>W \leq 0.03</math></td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td><math>5.0 &lt; L \leq 10.0</math></td><td><math>0.03 &lt; W \leq 0.05</math></td><td colspan="2">2</td></tr><tr><td><math>L \leq 5.0</math></td><td><math>0.05 &lt; W \leq 0.08</math></td><td colspan="2">1</td></tr><tr><td></td><td><math>0.08 &lt; W</math></td><td colspan="2">0</td></tr></table>	Size(mm)		Acceptable Qty			L(Length)	W(Width)	Zone			A	B	C	Ignore	$W \leq 0.03$	Ignore		Ignore	$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2		$L \leq 5.0$	$0.05 < W \leq 0.08$	1			$0.08 < W$	0		Minor
Size(mm)		Acceptable Qty																															
L(Length)	W(Width)	Zone																															
		A	B	C																													
Ignore	$W \leq 0.03$	Ignore		Ignore																													
$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2																															
$L \leq 5.0$	$0.05 < W \leq 0.08$	1																															
	$0.08 < W$	0																															

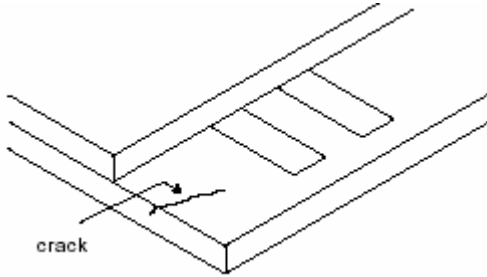
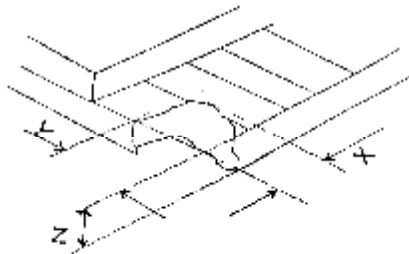
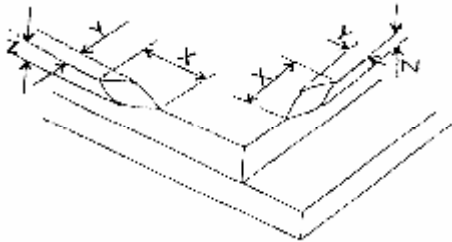
**TRULY®** OUTGOING QUALITY STANDARD

PAGE 5 OF 5

TITLE:FUNCTIONAL TEST &amp; INSPECTION CRITERIA

CSTN COG Product

## 5. Minor Defect

	Items to be inspected	Inspection Standard	Classification of defects						
5.5	Glass defect	<p>(i) Crack</p> <p>Cracks tend to break are not allowed.</p> 	Minor						
		<p>(ii) Chips on corner</p>  <table border="1" data-bbox="467 1238 1102 1337"><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤2.0</td><td>≤S</td><td>Disregard</td></tr></table> <p>Notes: S=contact pad length</p> <p>Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</p>	X	Y	Z	≤2.0	≤S	Disregard	Minor
		X	Y	Z					
	≤2.0	≤S	Disregard						
<p>(iii)Usual surface cracks</p>  <table border="1" data-bbox="446 1792 1125 1888"><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0</td><td>&lt;Inner border line of the seal</td><td>Disregard</td></tr></table>	X	Y	Z	≤3.0	<Inner border line of the seal	Disregard	Minor		
X	Y	Z							
≤3.0	<Inner border line of the seal	Disregard							
Glass defect	Note: The total number of the glass defect should not be more than 3 pcs.								

## PRECAUTIONS FOR USING LCD MODULES

### ◇ Handling Precautions

- (1) The display panel is made of glass. 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.
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- (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
- (6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
  - Water
  - Ketone
  - Aromatic solvents
- (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) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD modules.
  - Tools required for assembling, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
  - 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.

### ◇ Storage Precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

### ◇ 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

### ◇ Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

- (1) 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.
- (2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzine. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

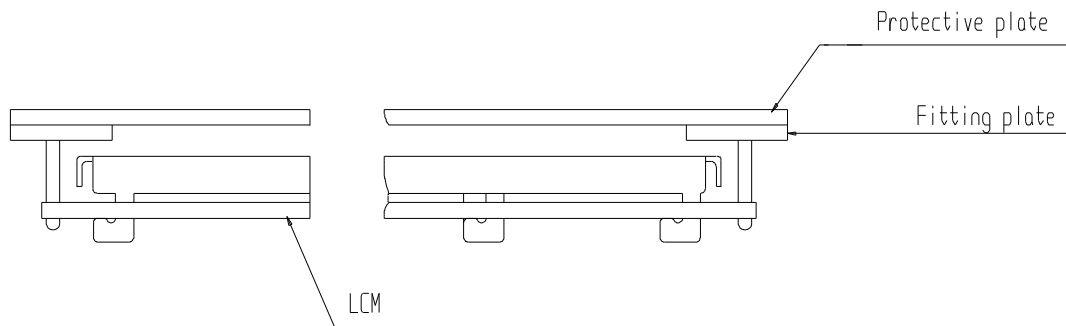
(9) Do not touch the display with bare hands. This will stain the display area and degrade insulation between terminals (some cosmetics are detrimental to the polarizers).

(10) As glass is fragile. It tends to become chipped during handling especially on the edges. Please avoid dropping or jarring.

### ◇ 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  $\pm 0.1$  mm.

### ◇ Precaution for Handling LCD Modules

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.

(1) Do not alter, modify or change the shape of the tab on the metal frame.

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

(3) Do not damage or modify the pattern writing on the printed circuit board.

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

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

(6) Do not drop, bend or twist LCM.

### ◇ 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.

(1) Make certain that you are grounded when handling LCM.

(2) 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.

(3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.



(4) 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.

(5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

(6) 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.

### ◇ Precaution for soldering to the LCM

(1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.

- Soldering iron temperature :  $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$ .
- Soldering time : 3-4 sec.
- Solder : eutectic solder.

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.

### ◇ Storage

When storing LCDs as spares for some years, the following precaution are necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between  $0^{\circ}\text{C}$  and  $35^{\circ}\text{C}$ .
- (3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)
- (4) Environmental conditions :
  - Do not leave them for more than 168hrs. at  $90^{\circ}\text{C}$ .
  - Should not be left for more than 48hrs. at  $-20^{\circ}\text{C}$ .

### ◇ 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 shipments. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on freight documents. 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's 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's, conductors and terminals.