PRODUCT : LCD MODULE

MODEL NO. : TFT480800-50-E

SUPPLIER : TRULY SEMICONDUCTORS LTD.

DATE : September 6, 2011

CERT. No. QAC0946535   CERT. No. HKG002005
(ISO9001)   (ISO14001)

SPECIFICATION

Revision: 1.1

TFT480800-50-E

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:

Approved by: ＿＿＿＿＿＿＿＿

Technical Department:＿＿＿＿＿＿＿

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
0.1	2011-4-30	First release	Preliminary
0.2	2011-5-9	Update the drawing	P.5
1.0	2011-6-8	Full spec	/
1.1	2011-9-6	Update the drawing	P.5

CONTENTS

WRITTEN BY	CHECKED BY	APPROVED BY
HUANG YAN XUE	GUI FU YANG	ZHANG SHU HANG

ŋ GENERAL INFORMATION

Item of general information	Contents	Unit
LCD type	TFT/TRANSMISSIVE	/
Recommended Viewing Direction	Full viewing angle	O' Clock
Module area (W × H×T)	57.06×98.10×2.30	mm^3
Viewing area (W×H)	53.44×88.00	mm^2
Active area (W×H)	51.84×86.40	mm^2
Number of Dots	480RGB×800	/
Pixel pitch (W × H)	0.108×0.108	mm^2
Driver IC	NT35510	/
Interface Type	MPU/(SPI+RGB)/MIPI/MDDI Interface	/
Input voltage	3.3	V
Module Power consumption	555	mw
Backlight Type	LED	/

n EXTERNAL DIMENSIONS

NOTES:
1. DISPLAY MODE: 16.7M Color TFT, Transmissive
2. DRIVE IC: NT35510
3. ROHS COMPLIANT
4. VCI: 3.3V IOVCC 3.3V
5. BACKLIGHT: 8CHIP WHITE LED Serial connection
6. OPERATING TEMPERATURE: -20 C TO 70 C
   STORAGE TEMPERATURE: -30 C TO 80 C
7. GENERAL TOLERANCE ±0.2
8. RECOMMEND CONNECTOR: FH23-61S-0.3SHW(HIROSE)

CUSTOMER APPROVE		AMEND		液晶显示模块	TRULY SEMICONDUCTORS LTD.		
Mechanical	Electrical				PRODUCT NO.	DRAW NO.	REV
				TOLERANCE: DECIMAL	TFT480800-50-E	LCM1073	A
				.x ± .30	DWN 陈兴龙	DSN 陈兴龙	
				.xx ± .20	CHKD 尹少桢	APPD 黄英群	
		NEW	2011.04.15	∠ ± 1/4°			
NO.		CONTENT	DATE	NOT IN SCALE	UNIT mm	SHEET: 1/1	

� ABSOLUTE MAXIMUM RATINGS

Parameter of absolute maximum ratings	Symbol	Min	Max	Unit
Supply voltage for logic	VCI/IOVCC	-0.3	5.5	V
Input voltage	VIN	-0.3	IOVCC+0.3	V
Operating temperature	Top	-20	70	°C
Storage temperature	TST	-30	80	°C
Humidity	RH	-	90%(Max60 °C)	RH

⌐ ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Parameter of DC characteristics	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VCI	2.3	2.8/3.3	4.8	V
Input Current	Idd	-	30.48	60.96	mA
Input voltage 'H' level	VIH	0.7IOVCC	-	IOVCC	V
Input voltage 'L' level	VIL	GND	-	0.3IOVCC	V
Output voltage 'H' level	VOH	0.8IOVCC	-	IOVCC	V
Output voltage 'L' level	VOL	GND	-	0.2IOVCC	V
I/O power supply	IOVCC	1.65	2.8/3.3	3.3	V

⌐ BACKLIGHT CHARACTERISTICS

Item of backlight characteristics	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	23.2	25.6	27.2	V	If=15mA
Luminance	Lv	3800	4200	4700	cd/m^2	Ta=25℃
Number of LED	-	-	8	-	Piece	-
Connection mode	S	-	Serial	-	-	-

Using condition: constant current driving method If=15mA(+/-10%).

n ELECTRO-OPTICAL CHARACTERISTICS

Item of electro-optical characteristics	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+ Tf	$\theta=0°$ $\varnothing=0°$ Ta=25℃	-	38	57	ms	Fig.1	4
Contrast ratio	Cr		256	512	-	---	FIG 2.	1
Luminance uniformity	δ WHITE		80	92	-	%	FIG 2.	3
Surface Luminance	Lv		225	281	-	cd/m^2	FIG 2.	2
Viewing angle range	θ	$\varnothing = 90°$	80	-	-	deg	FIG 3.	6
		$\varnothing = 270°$	80	-	-	deg	FIG 3.	
		$\varnothing = 0°$	80	-	-	deg	FIG 3.	
		$\varnothing = 180°$	80	-	-	deg	FIG 3.	
NTSC ratio	---	---	---	70	---	%	-	-
CIE (x, y) chromaticity	Red x	$\theta=0°$ $\varnothing=0°$ Ta=25℃	0.5838	0.6338	0.6838	-	FIG 2.	5
	Red y		0.2918	0.3418	0.3918	-		
	Green x		0.2691	0.3191	0.3691	-		
	Green y		0.5769	0.6269	0.6769	-		
	Blue x		0.1023	0.1523	0.2023	-		
	Blue y		0.0204	0.0704	0.1204	-		
	White x		0.2256	0.2856	0.3456	-		
	White y		0.2454	0.3054	0.3654	-		

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.

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

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.

$$\text{d WHITE} = \frac{\textbf{Minimum} \text{ Surface Luminance with all white pixels } (\mathbf{P_1, P_2, P_3, P_4, P_5})}{\textbf{Maximum} \text{ Surface Luminance with all white pixels } (\mathbf{P_1, P_2, P_3, P_4, P_5})}$$

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 conrast 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.
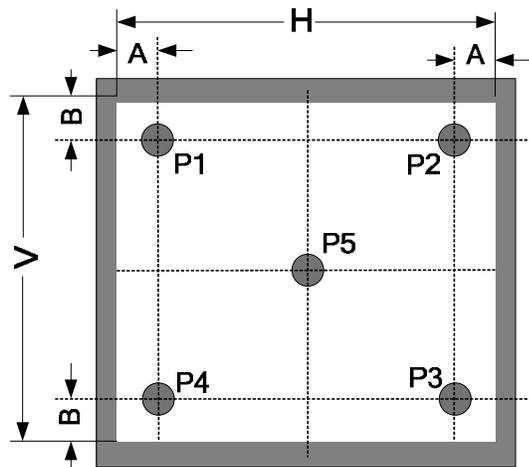
Note8. For TFT transmissive module, Gray scale reverse occurs in the direction of panel viewing angle.
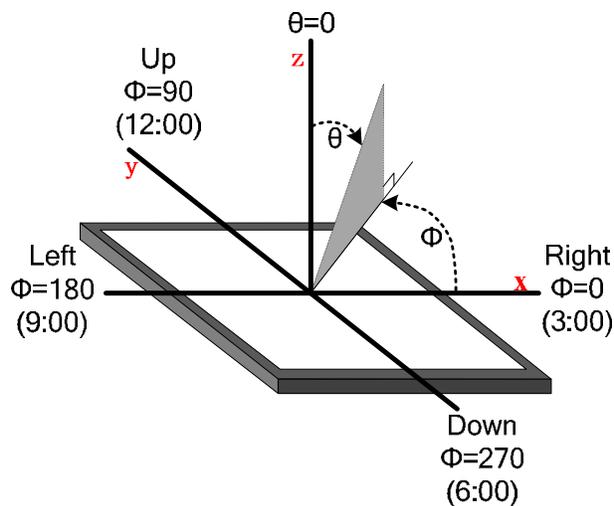
FIG.1.   The definition of Response Time
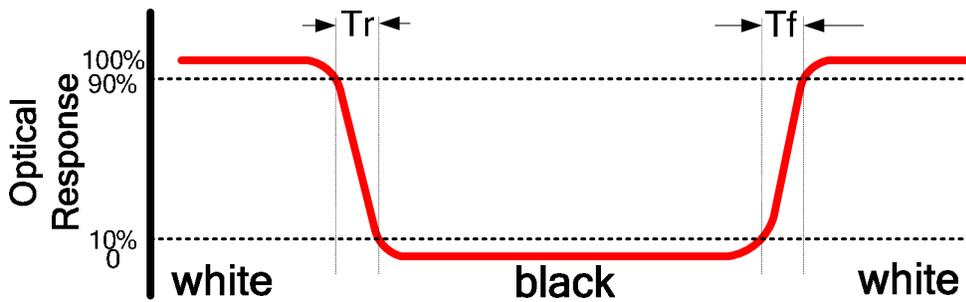
FIG.2.   Measuring method for Contrast ratio,surface luminance, Luminance uniformity,CIE (x, y) chromaticity

A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size $\varnothing$=5mm, 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

ⴖ INTERFACE DESCRIPTION

Interface NO.	Symbol	I/O or connect to	Description	When not in use
1	LEDK	LED driver	BACKLIGHT LED CATHODE	-
2	LEDA	LED driver	BACKLIGHT LED ANODE	-
3	YU(NC)	-	No connection	-
4	XR(NC)	-	No connection	-
5	YD(NC)	-	No connection	-
6	XL(NC)	-	No connection	-
7	GND	Power supply	Power Ground	-
8	VCI	Power supply	Power supply to the liquid crystal power supply analog circuit.Connect VCI to an external power supply (VCI = 2.3V ~4.8V).	-
9	LANSEL	I Host processor	Input pin to select 1 data lane or 2 data lanes in MIPI/MDDI interface. LANSEL=0: 1 data lane LANSEL=1: 2data lane	GND
10	IOVCC	I Host processor	Power supply to the I/O except MDDI interface.(IOVCC = 1.65V to 3.3 V).	Open
11	TE_L	O Host processor	earing effect output pin to synchronize MCU to frame writing, activated by S/W command.When this pin is not activated, this pin is output low.If not used, please open this pin.	Open
12	SDO	O Host processor	Serial output signal in SPI I/F. The data is output on the rising/falling edge of the SCL signal. If the host places the SDI line into high-impedance state during the read interval, the SDI and SDO can be tied together.This pin is not used for 80-series MPU, please open this pin.	Open
13	SDI	I/O Host processor	Serial input signal in SPI I/F. The data is input on the rising/falling edge of the SCL signal.This pin is not used for 80-series MPU, please connect to GND.	GND
14	WR/SCL	I Host processor	Writes strobe signal to write data when WRX is "Low" in 80-series MPU I/F. SCL: A synchronous clock signal in SPI I/F. This pin is not used for MIPI I/F, please connect to GND.	GND
15	CS	I Host processor	Chip select input pin ("Low" enable) in 80-series MPU I/F and SPI I/F.This pin is not used for MIPI or MDDI I/F, please connect to GND.	GND
16	RESET	I Host processor	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.	-

17~40	DB23~DB00	I/O Host processor	24-bit bi-directional data bus for 80-series MPU I/F and 24-bit input data bus for RGB I/F.For 8080-series MPU I/F:8-bit interface: D[7:0] are used, D[23:8] should be connected to VSSI 16-bit interface: D[15:0] are used, D[23:16] should be connected to VSSI 24-bit interface: D[23:0] are used For RGB I/F: 16-bit/pixel: D[20:16]=R[4:0], D[13:8]=G[5:0] and D[4:0]=B[4:0], connect unused pins to VSSI 18-bit/pixel: D[21:16]=R[5:0], D[13:8]=G[5:0] and D[5:0]=B[5:0], connect unused pins to VSSI 24-bit/pixel: D[23:16]=R[7:0], D[15:8]=G[7:0] and D[7:0]=B[7:0]	GND
41	ENABLE	I Host processor	Data enable signal in RGB I/F mode.This pin is not used for 80-series MPU, please connect to GND	GND
42	DOTCLK	I Host processor	Dot clock signal in RGB I/F.This pin is not used for 80-series MPU,, please connect to GND .	GND
43	HSYNC	I Host processor	Horizontal sync. Signal in RGB I/F.This pin is not used for 80-series MPU, please connect to GND .	GND
44	VSYNC	I Host processor	Vertical sync. Signal in RGB I/F.This pin is not used for 80-series MPU, please connect to GND .	GND
45	LEDPWM	O LED Driver IC	PWM signal output to control LED driver for LED brightness dimming.	Open
46	LEDON	O LED Driver IC	This pin is connected to external LED driver.It's a LED driver control pin which is used for turning ON/OFF of LED backlight.	Open
47	RS	I Host processor	Display data / command selection in 80-series MPU I/F. RS = "0" : Command RS = "1" : Display data or Parameter This pin is not used for RGB+3-SPI, please connect to GND.	GND
48	RD	I Host processor	Reads strobe signal to write data when RDX is "Low" in 80-series MPU interface.This pin is not used for RGB+SPI, please connect to GND .	GND
49	IM0	I Host processor	Interface type selection.For the details,please refer to NOTE1.	-
50	IM1			-
51	IM2			-
52	GND	Power supply	Power Ground	-
53	HS_D1P	I Host processor	These pins are DSI D1 +/- differential data signals if MIPI interface is used.These pins are MDDI_DATA1_P/M differential strobe signals if MDDI interface is used.HSSI_D1_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm.	GND
54	HS_D1N			
55	GND	Power supply	Power Ground	-

56	HS_CL KP	I Host processor	These pins are DSI-CLK+/- differential clock signals if MIPI interface is used. These pins are MDDI_STB_P/M differential strobe signals if MDDI interface is used.HSSI_CLK_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm.	GND
57	HS_CL KN	I Host processor	These pins are DSI-CLK+/- differential clock signals if MIPI interface is used. These pins are MDDI_STB_P/M differential strobe signals if MDDI interface is used.HSSI_CLK_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm.	GND
58	GND	Power supply	Power Ground	-
59	HS_D0P	I Host processor	These pins are DSI-D0+/- differential data signals if MIPI interface is used. These pins are MDDI_DATA0_P/M differential strobe signals if MDDI interface is used.HSSI_D0_P/N are differential small amplitude signals. Ensure the trace length is shortest so that the COG resistance is less than 10 ohm.	GND
60	HS_D0N			
61	GND	Power supply	Power Ground	-

Note1:

IM3	IM2	IM1	IM0	SRAM	Register
0	0	0	0	80-series 8-bit MPU interface, D[7:0]	80-series 8-bit MPU interface, D[7:0]
0	0	0	1	80-series 16-bit MPU interface, D[15:0]	80-series 16-bit MPU interface, D[15:0]
0	0	1	0	80-series 24-bit MPU interface, D[23:0]	80-series 24-bit MPU interface, D[23:0]
0	0	1	1	RGB interface, D[23:0]	16-bit SPI, SDI/SDO serial data, SCL rising trigger
0	1	0	0	RGB interface, D[23:0]	I2C interface, I2C_SDA serial data
0	1	0	1	MIPI DSI, HSSI_D0_P/N, HSSI_D1_P/N	MIPI DSI, HSSI_D0_P/N, HSSI_D1_P/N
0	1	1	0	MDDI, HSSI_D0_P/N, HSSI_D1_P/N	MDDI, HSSI_D0_P/N, HSSI_D1_P/N SPI, SDI/SDO serial data, SCL rising trigger
0	1	1	1	MDDI, HSSI_D0_P/N, HSSI_D1_P/N	MDDI, HSSI_D0_P/N, HSSI_D1_P/N I2C interface, I2C_SDA serial data

∩ REFERENCE APPLICATION CIRCUIT

Please consult our technical department for detail information.

ŋ RELIABILITY TEST CONDITIONS

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

Remark:
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.

ŋ INSPECTION CRITERION

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

1 Sample plan

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

Major defect: AQL 0.65

Minor defect: AQL 1.5

2. Inspection condition

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

l Driving voltage

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

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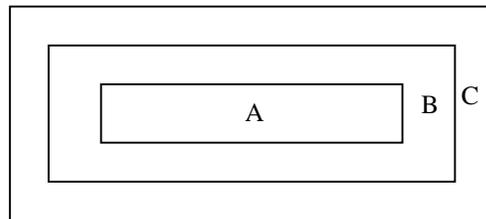
Zone A: character/Digit area

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

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

Fig.1 Inspection zones in an LCD.

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

4.Inspection Standard

4.1 Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical，horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
4.1.2	Missing	Missing component	
4.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	

4.2 Cosmetic Defect
4.2.1 Module Cosmetic Criteria

No.	Item	Judgement Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Minor
4	Resist flaw on Printed Circuit Boards	visible copper foil ($\varnothing$0.5mm or more) on substrate pattern	Minor
5	Accretion of metallic Foreign matter	No accretion of metallic foreign matters (Not exceed $\varnothing$0.2mm)	Minor Minor
6	Stain	No stain to spoil cosmetic badly	Minor
7	Plate discoloring	No plate fading, rusting and discoloring	Minor

8	Solder amount
	
	1. Lead parts
		a. Soldering side of PCB
		    Solder to form a 'Filet'
		    all around the lead.
		    Solder should not hide the
		    lead form perfectly. (too much)
		b. Components side
		    (In case of 'Through Hole PCB')
		
		Solder to reach the Components side of PCB.
			Minor

	2. Flat packages	Either 'Toe' (A) or 'Seal' (B) of the lead to be covered by 'Filet'. Lead form to be assume over solder.	Minor
	3. Chips	(3/2) H $\geq$ h $\geq$ (1/2) H	Minor

9	Solder ball/Solder splash	a. The spacing between solder ball and the conductor or solder pad h ≥0.13mm The diameter of solder ball d ≤0.15mm.	Minor
		b. The quantity of solder balls or solder Splashes isn't beyond 5 in 600 mm ^{2} .	Minor
		c. Solder balls/Solder splashes do not violate minimum electrical clearance.	Major
		d. Solder balls/Solder splashes must be entrapped/encapsulated Or attached to the metal surface .	Minor
		NOTE: Entrapped/encapsulated/attached is intended to mean that normal service environment of the product will not cause a solder ball to become dislodged.	

4.2.2 Cosmetic Criteria (Non-Operating)

No.	Defect	Judgment Criterion	Partition
1	Spots	In accordance with *Screen Cosmetic Criteria (Operating) No.1*.	Minor
2	Lines	In accordance with *Screen Cosmetic Criteria (Operating) No.2*.	Minor
3	Bubbles in polarizer		Minor

Size : d mm	Acceptable Qty in active area
d ≤ 0.3	Disregard
0.3 < d ≤ 1.0	3
1.0 < d ≤ 1.5	1
1.5 < d	0

No.	Defect	Judgment Criterion	Partition
4	Scratch	In accordance with spots and lines operating cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
5	Allowable density	Above defects should be separated more than 30mm each other.	Minor
6	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-lit type should be judged with back-lit on state only.	Minor
7	Contamination	Not to be noticeable.	Minor

4.2.3   Cosmetic Criteria (Operating)

No.	Defect	Judgment Criterion	Partition
1	Spots	A) Clear	Minor

A) Clear

Lcd size	Size : d mm	Acceptable Qty in active area
	d≤0.1	Disregard
Lcd size≤8.0'	0.1＜d≤0.2	6
	0.2＜d≤0.3	2
	0.3 < d	0
	d ≤0.1	Disregard
Lcd size＞8.0'	0.1＜d≤0.3	10
	0.3＜d≤0.5	5
	0.5 < d	0

Note :   Including pin holes and defective dots which must be within one pixel size; Total defective point shall not exceed 6 pcs no more than 8 inch LCD and 10PCS for more than 8 inch LCD.

B) Unclear

Lcd size	Size : d mm	Acceptable Qty in active area
	d≤0.2	Disregard
Lcd size≤ 8.0'	0.2＜d≤0.5	6
	0.5＜d≤0.7	2
	0.7＜d	0
	d≤0.2	Disregard
Lcd size ＞8.0'	0.2＜d≤0.5	10
	0.5＜d≤0.7	3
	0.7＜d≤1.0	1
	1.0< d	0

Note :   Total defective point shall not exceed 6 pcs for no more than 8 inch LCD and 10PCS for more than 8 inch LCD.

2	Lines	A) Clear	Minor

A) Clear

Note :   ( )   - Acceptable Qty in active area
  L   - Length (mm)
  W   - Width (mm)
  ∞   - Disregard

B) Unclear
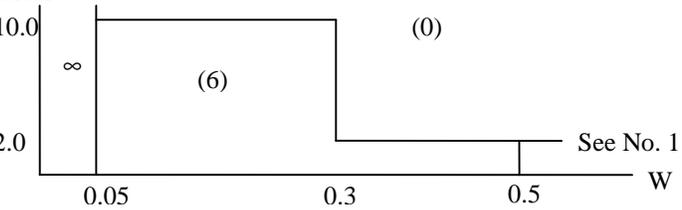
'Clear'   = the shade and size of the line or dot are not changed with   the LCD operation voltage changing .the defect looks very apparent.
'Unclear' =   the shade and size of the line or dot are changed with   the LCD operation voltage changing ,the defect looks not so apparent

3	Rubbing line	Not to be noticeable.	Minor
4	Allowable density	Above defects should be separated more than 10mm each other.	Minor
5	Rainbow	Not to be noticeable.	Minor
6	Dot size	To be 95% ~ 105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex. pin-hole) should be treated as 'Spot'. (see *Screen Cosmetic Criteria (Operating) No.1*)	Minor
7	Uneven brightness (only back-lit type module)	Uneven brightness must be BMAX / BMIN $\leq$ 2 - BMAX : Max. value by measure in 5 points - BMIN : Min. value by measure in 5 points Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure. **¡** : Measuring points	Minor
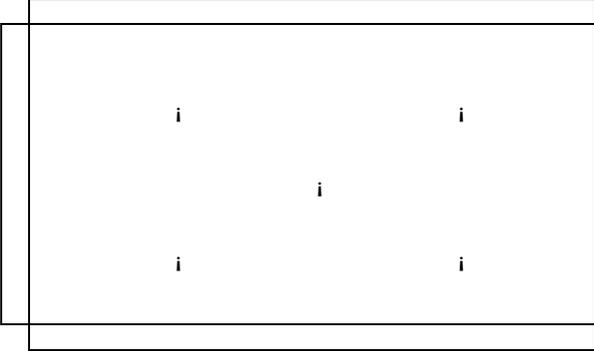
Note :

    (1) Size : d = (long length + short length) / 2

    (2) The limit samples for each item have priority.

    (3) Complex defects are defined item by item, but if the numbers of defects are defined in above table, the total number should not exceed 10.

    (4) In case of 'concentration', even the spots or the lines of 'disregarded' size should not allowed. Following three situations should be treated as 'concentration'.

        - 7 or over defects in circle of $\varnothing$5mm.

        - 10 or over defects in circle of $\varnothing$10mm.

        - 20 or over defects in circle of $\varnothing$20mm.

ת PRECAUTIONS FOR USING LCD MODULES

1   Handing 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 alcohol
        Do 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 solvents
        Wipe 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.
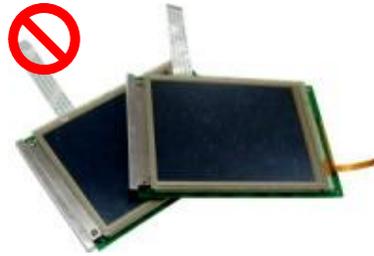
2.2   Correct handling:

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

2.3   Incorrect handling:

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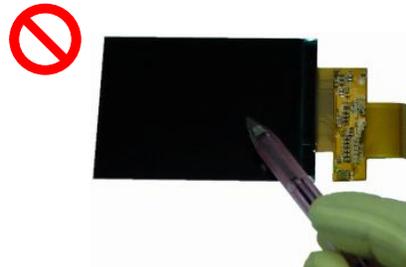
Please don't stack LCM.

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.
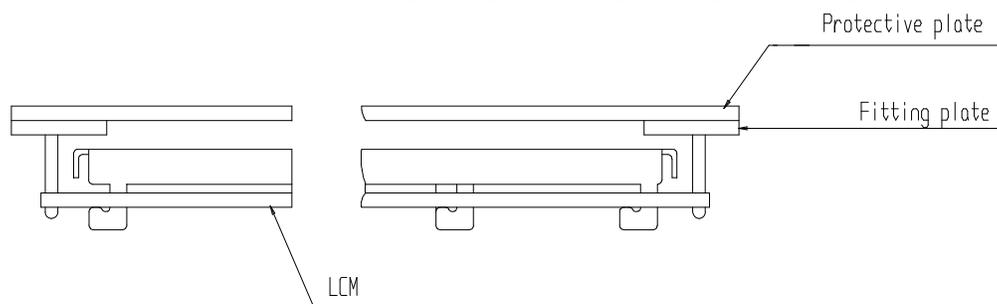
        4.1.2 When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

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
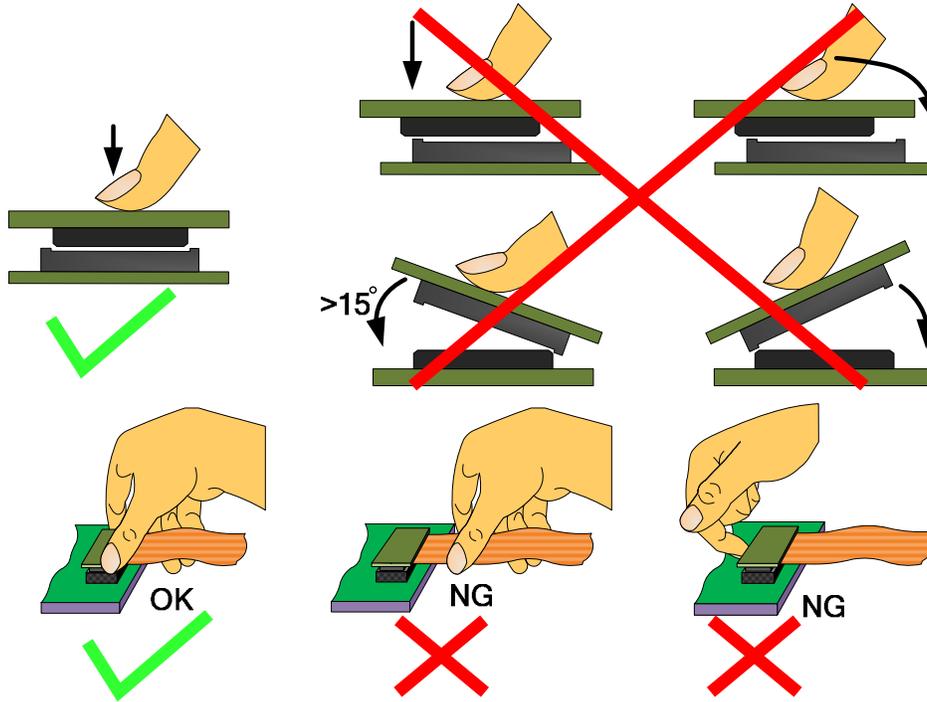
4.3   Precaution for soldering the LCM

	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.

46 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.

n PACKING SPECIFICATION

Please consult our technical department for detail information.

n 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.

n FACTORY CONTACT INFORMATION

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