PRODUCT	:	LCD MODULE
MODEL NO.	:	TFT320480-24-E
SUPPLIER	:	TRULY SEMICONDUCTORS LTD.
DATE	:	June 14, 2010

CERT. No. QAC0946535
(ISO9001)

CERT. No. HKG002005
(ISO14001)

SPECIFICATION

Revision: 1.1

TFT320480-24-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: _____

Technical Department:_____

Approved by:

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2009-11-28	First release	
1.1	2010-6-14	Update the drawing	P.5

CONTENTS

WRITTEN BY	CHECKED BY	APPROVED BY
YU JI PING	ZHANG SHU HANG	ZHU JIN BAO

■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	TFT/TRANSMISSIVE	/
Viewing direction	All viewing angle	/
Module area (W × H ×T)	50.54×78.71×2.30	mm^3
Viewing area (W×H)	46.72×69.28	mm^2
Active area (W×H)	45.12×67.68	mm^2
Number of Dots	320(RGB)×480	/
Pixel pitch (W × H)	0.141×0.141	mm^2
Driver IC	HX8357	/
Interface Type	Parallel /SPI+RGB interface	/
Input voltage	2.8	V
Module Power consumption	265	mw
Colors	262K	/
Backlight Type	LED	/

■ EXTERNAL DIMENSIONS

Customer No.: TRULY

1	LEDK5	27	DB16	
2	LEDK4	28	DB15	
3	LEDK3	29	DB14	
4	LEDK2	30	DB13	
5	LEDK1	31	DB12	
6	LEDA	32	DB11	
7	GND	33	DB10	
8	VCI	34	DB9	
9	IOVCC	35	DB8	
10	RS3	36	DB7	
11	RS2	37	DB6	
12	RS1	38	DB5	
13	RS0	39	DB4	
14	RGB1	40	DB3	
15	RGB0	41	DB2	
16	DCTL_SCL	42	DB1	
17	CSX	43	DB0	
18	VS	44	TE	
19	HS	45	PWR-OUT	
20	PCLK	46	VCC	
21	DE	47	GND	
22	RESX	48	YU	
23	RDX_E	49	XR	
24	WRX_DCX	50	YD	
25	SDA	51	XL	
26	DB17			

70.00±0.3
13.05±0.3
1.27±0.3
2.00±0.3
43.00±0.3
2.00±0.3

Tin Soldering height 0.3 MAX

YELLOW TRANPARENT PROTECTING TAPE
CUSTOMER REFERENCE

0.56±0.2
75.70±0.2
47.50±0.2
4-ø0.95
1.52±0.2
1.50±0.3

FPC UNFOLDED SHIPMENT

DOTS DETAIL
0.141 / 0.047
R G B
0.141

2.30±0.1(WITH D.S.T)
2.20±0.1
0.80
COMPONENT
0.90MAX
CONTACT SIDE
DOUBLE SIDE TAPE
CONTACT SIDE

LED CIRCUIT DIAGRAM:
K1 K2 K3 K4 K5 A

0.91
1.91
2.71
REMOVE TAPE
6.82±0.1
5.82
4.14

50.54±0.2(OUTLINE)(TFT)
48.72±0.2(TFT)
46.72±0.2(V.A)
45.12(A.A)

3.2" TFT
262K COLOR
320×480 DOTS
VIEWING DIRECTION: ALL

R G B
(17.15)
32.65±0.1
P0.7×50=35.00(W=0.35)
38.35±0.2
45.94±0.2
157

2.00±0.3
2.50±0.2
3.00±0.3
5.30±0.3
6.65±0.1

2.30±0.3
12.95±0.2

2.45
1.65
0.95
67.68(A.A)
69.28±0.2(V.A)
74.90±0.2(TFT)
78.71±0.2(OUTLINE)
16.44±0.3

NOTES:
1. DRIVE IC : HX8357
2. DISPLAY MODE : TFT, 262K Color LCD, Transmissive,Normal Black
3. VIEWING DIRECTION : ALL
4. BACKLIGHT:5 CHIP-WHITE LED, parallel connection
5. OPERATING TEMPERATURE: -20° C TO 70° C
   STORAGE TEMPERATURE: -30° C TO 80° C
6. 产品满足ROHS要求
7. GENERAL TOLERANCE : ± 0.2

S-MDS液晶显示模块

TRULY SEMICONDUCTORS LTD.
PRODUCT NO. TFT320480-24-E
DRAW NO. LCM0868 REV A
DWN LLB 20091107   DSN LLB 20091107
CHKD YSZ 20091107   APPD HYQ 20091107
NOT IN SCALE UNIT mm SHEET: 1/1

TOLERANCE:
DECIMAL
.xx ± .20
∠ ± 1/4°

AMEND
NEW 20091107
NO. CONTENT DATE

CUSTOMER APPROVE
Electrical
Mechanical

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	VCC/VCI/IOVCC	-0.3	4.6	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	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VCC/VCI	2.3	2.8	3.3	V
I/O power supply	IOVCC	1.65	1.8/2.8	3.3	V
Input Current	Idd	-	4.55	9.1	mA
Input voltage 'H' level	VIH	0.7IOVCC	-	IOVCC	V
Input voltage 'L' level	VIL	-0.3	-	0.3IOVCC	V
Output voltage 'H' level	VOH	0.8IOVCC	-	-	V
Output voltage 'L' level	VOL	-	-	0.2IOVCC	V

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	3.0	3.2	3.4	V	If=75mA
Luminance	Lv	3200	3600	4000	cd/m^2	Ta=25℃
Number of LED	-	-	5	-	Piece	-
Connection mode	P	-	Parallel	-	-	-

Using condition: constant current driving method If=75mA(+/-10%).

■ ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+ Tf		-	32	48	ms	Fig.1	4
Contrast ratio	Cr	θ=0° ∅=0° Ta=25℃	300	818	-	---	FIG 2.	1
Luminance uniformity	δ WHITE		85	94	-	%	FIG 2.	3
Surface Luminance	Lv		225	281	-	cd/m²	FIG 2.	2
Viewing angle range	θ	∅ = 90°	70	80	-	deg	FIG 3.	6
		∅ = 270°	70	80	-	deg	FIG 3.	
		∅ = 0°	70	80	-	deg	FIG 3.	
		∅ = 180°	70	80	-	deg	FIG 3.	
CIE (x, y) chromaticity	Red x	θ=0° ∅=0° Ta=25℃	0.5758	0.6258	0.6758	-	FIG 2.	5
	Red y		0.2839	0.3339	0.3839	-		
	Green x		0.2833	0.3333	0.3933	-		
	Green y		0.5600	0.6100	0.6600	-		
	Blue x		0.0932	0.1432	0.1932	-		
	Blue y		-	0.0485	0.0985	-		
	White x		0.2423	0.2923	0.3523	-		
	White y		0.2590	0.3190	0.3790	-		

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

$$ContrastRatio = \frac{AverageSurface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5)}{Average\ SurfaceLuminance\ with\ all\ black\ pixels\ (P1, P2, P3, P4, P5)}$$

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

$$Lv = Average\ Surface\ Luminance\ with\ all\ white\ pixels\ (P1, P2, P3, P4, P5)$$

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

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

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 module, Gray scale reverse occurs in the direction of panel viewing angle

FIG.1.   The definition of Response Time
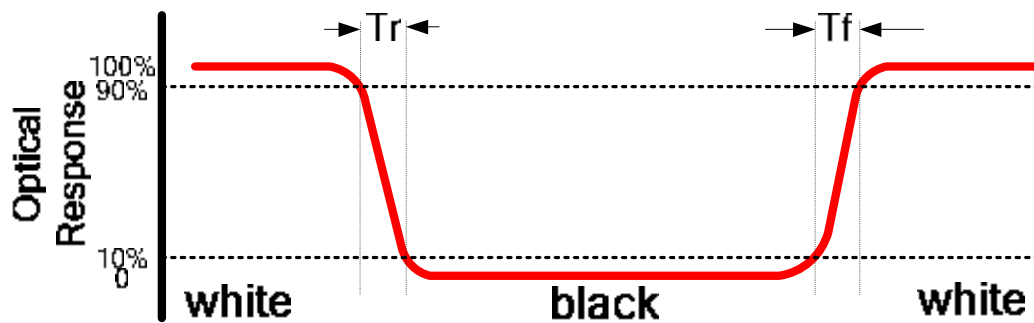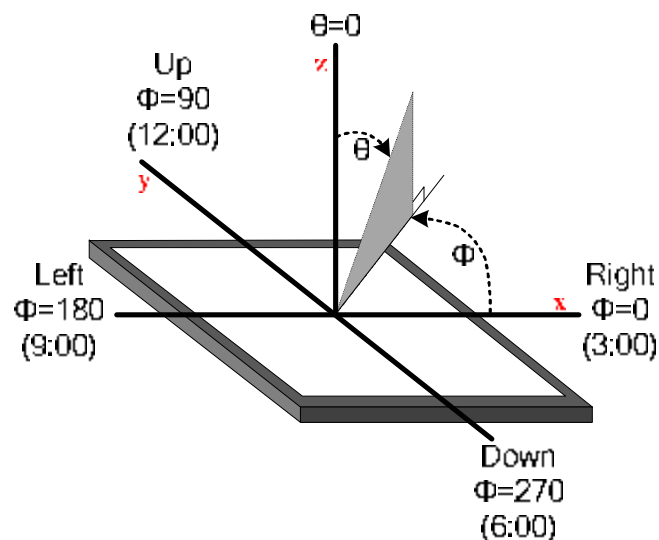

FIG.2.   Measuring method for Contrast ratio,surface luminance, Luminance uniformity,CIE (x, y) chromaticity

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
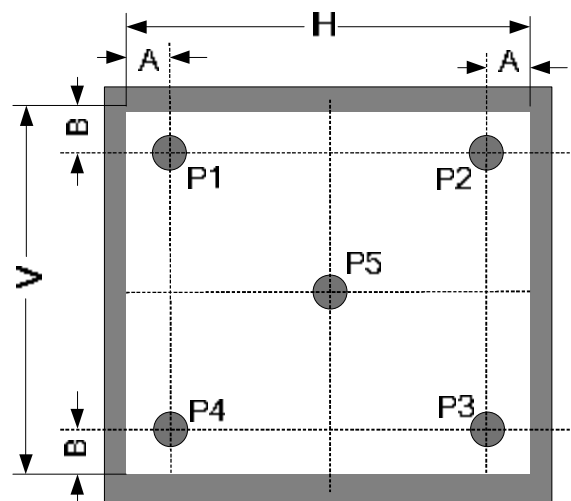
FIG.3.   The definition of viewing angle

■ INTERFACE DESCRIPTION

NO.	Symbol	I/O or connect to	DESCRIPTION	When not in use
1	LEDK5	LED driver	LEDK5(CATHODE)	-
2	LEDK4	LED driver	LEDK4(CATHODE)	-
3	LEDK3	LED driver	LEDK3(CATHODE)	-
4	LEDK2	LED driver	LEDK2(CATHODE)	-
5	LEDK1	LED driver	LEDK1(CATHODE)	-
6	LEDA	LED driver	LEDA(ANODE)	-
7	GND	Power supply	Ground	-
8	VCI	Power supply	Analog power supply, AMP:2.3V~3.3V;TYPE:2.8V	-
9	IOVCC	Power supply	IO Pad and Digital power supply. AMP:1.65V~3.3V;TYPE:1.8V/2.8V	-
10	BS3	I Host processor	See "System interface select" table below	IOVCC or GND
11	BS2			
12	BS1			
13	BS0			
14	RCM1	I Host processor	See "RGB and System interface mode selection pin" table below	GND
15	RCM0			
16	DCX_SCL	I Host processor	Data / Command Selection pin. When under SPI interface, it servers as SCL (Serial Clock). If not use, let it open or connected to IOVCC.	OPEN/IO VCC
17	CSX	I Host processor	Chip select signal. Low: chip can be accessed; High: chip cannot be accessed. If not use, let it open or connected to IOVCC.	OPEN/IO VCC

System interface select.

BS3	BS2	BS1	BS0	Interface
0	0	0	0	8080 MCU 16-bits Parallel type I
0	0	0	1	8080 MCU 8-bits Parallel type I
0	0	1	0	8080 MCU 16-bits Parallel type II
0	0	1	1	8080 MCU 8-bits Parallel type II
0	1	0	ID	3-wire Serial interface
1	1	0	-	4-wire Serial interface
1	0	0	0	8080 MCU 18-bits Paralle type I
1	0	0	1	8080 MCU 9-bits Parallel type I
1	0	1	0	8080 MCU 18-bits Parallel type II
1	0	1	1	8080 MCU 9-bits Parallel type II
1	1	1	1	MDDI Interface

If not used, please fix this pin to IOVCC or VSSD lev

RGB and System interface mode selection pin.

RCM1, RCM0	MCU and RGB Interface Mode Select
0x	System Interface (1)
10	RGB Interface (1) (VS+HS+DE)
11	RGB Interface (2) (VS+HS)

As internal RCM[1:0] bits are written, the external pin RCM[1:0] control is invalid, and RGB and System interface mode selection is controlled by internal RCM[1:0] bits.
If not used, please fix this pin to GND.

18	VS	I Host processor	Frame synchronizing signal for RGB I/F mode.. Must be connected to GND or IOVCC.	IOVCC or GND
19	HS	I Host processor	Frame synchronizing signal for RGB I/F mode.. Must be connected to GND or IOVCC.	IOVCC or GND
20	PCLK	I Host processor	Pixel clock signal for RGB I/F mode.. Must be connected to GND or IOVCC.	IOVCC or GND
21	DE	I Host processor	A data ENABLE signal for RGB I/F mode. Must be connected to GND or IOVCC.	IOVCC or GND
22	RESX	I Host processor	Reset pin. Setting either pin low initializes the LSI. Must be reset after power is supplied. Must be connected to GND or IOVCC.	IOVCC or GND
23	RDX_E	I Host processor	I80 I/F mode: Serves as a read signal and read data at the low level. M68 I/F mode: Read/Write disable, 1: Read/Write enable. If not used, let it open or connected to IOVCC.	OPEN/IO VCC
24	WRX_DC X	I Host processor	I80 I/F mode: Serves as a write signal and write data at the low level. M68 I/F mode: 0: Read/Write disable, 1: Read/Write enable.When under 4-wire SPI interface, it servers as DCX(Data /Command Selection) If not use, let it open or connected to IOVCC.	OPEN/IO VCC
25	SDA	I/O Host processor	Serial data input pin and output pin in serial bus system interface.The data is inputted on the rising edge of the SCL signal.	OPEN
26~ 43	DB17~DB 0	I/O Host processor	When Operates in MPU interface mode, it is used liked an 18-bit bi-directional data bus. About data bus format, please refer "Table 5. 1 Input Bus Format Selection of System Interface Circuit". When Operation in RGB interface mode, it is an 18-bit bus RGB data bus. About RGB data bus format, please refer "Table 5. 20 RGB interface Bus Width Set Table" Let unused pins to the open.	OPEN
44	TE	O	Tearing effect output. If not used, please open this pin.	OPEN
45	PWM_OU T	O	Backlight On/Off control pin. If use ABC function, the pin can connect to external LED driver IC. The output voltage rage =GND~ IOVCC.	OPEN
46	VCC	Power supply	Analog power supply, AMP:2.3V~3.3V;TYPE:2.8V	-
47	GND	Power supply	Ground	-
48	YU	NC	NC	-

49	XR	NC	NC	-
50	YD	NC	NC	-
51	XL	NC	NC	-

Table 5.1:

BS3	BS2	BS1	BS0	Interface	WRX_DCX	DCX_SCL	Register/Content	GRAM
0	0	0	0	8080 MCU 16-bits Parallel type I	WRX	DCX	DB7-DB0	DB15-DB0: 16-bit data
0	0	0	1	8080 MCU 8-bits Parallel type I	WRX	DCX	DB7-DB0	DB7-DB0: 8-bits Data
0	0	1	0	8080 MCU 16-bits Parallel type II	WRX	DCX	DB8-DB1	DB17-DB10, DB8-DB1: 16-bit data
0	0	1	1	8080 MCU 8-bits Parallel type II	WRX	DCX	DB17-DB10	DB17-DB10: 8-bits Data
0	1	0	ID	3-wire Serial interface	x	SCL		SDA
1	1	0	-	4-wire Serial interface	DCX	SCL		SDA
1	0	0	0	8080 MCU 18-bits Parallel type I	WRX	DCX	DB7-DB0	DB17-DB0: 18-bits Data
1	0	0	1	8080 MCU 9-bits Parallel type I	WRX	DCX	DB7-DB0	DB8-DB0: 9-bits Data
1	0	1	0	8080 MCU 18-bits Parallel type II	WRX	DCX	DB8-DB1	DB17-DB0: 18-bits Data
1	0	1	1	8080 MCU 9-bits Parallel type II	WRX	DCX	DB17-DB10	DB17-DB9: 9-bits Data
Other Setting				Setting Invalid				

Data Bus use heading spans Register/Content and GRAM columns.

Table 5.1 Input Bus Format Selection of System Interface Circuit

Table 5.20:

All 3-kinds of bus width can be available during RGB interface mode (selected by COLMOD (17H) command for 6-bits, 16-bits and 18-bits data width)

17H	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Bus width
50h	x	x	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B4	B3	B2	B1	B0	16-bits data
60h	R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0	18-bits data
17H	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Bus width
E0h	x	x	x	x	x	x	x	x	x	x	R5	R4	R3	R2	R1	R0	x	x	6-bits data
	x	x	x	x	x	x	x	x	x	x	G5	G4	G3	G2	G1	G0	x	x	
	x	x	x	x	x	x	x	x	x	x	B5	B4	B3	B2	B1	B0	x	x	

Note: (1) When 17H="E0h", 6-bits data width of 3-times transfer is used to transmit 1 pixel data with the 18-bits color depth information.
  (2) Only 17H= "50h","60h", "E0h" are valid on RGB I/F, Others are invalid.
  (3) 'x' don't care, but need to set IOVCC or VSSD level.

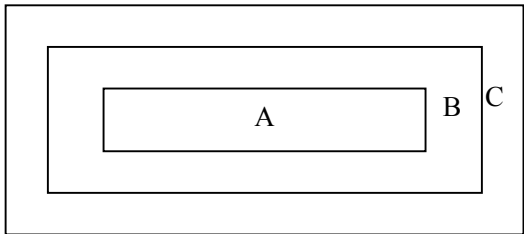Table 5.20 RGB interface Bus Width Set Table

■ REFERENCE APPLICATION CIRCUIT

Please consult our technical department for detail information.

■ RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±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	70±2℃/120 hours	
4	Low Temperature Operating	-20±2℃/120 hours	
5	Temperature Cycle	-20±2℃~25~70±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:±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.

■ INSPECTION CRITERION

TRULY ® OUTGOING QUALITY STANDARD	PAGE 1 OF 4
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product

This specification is made to be used as the standard acceptance/rejection criteria for Color mobile phone LCM.

1 Sample plan

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

Major defect: AQL 0.65

Minor defect: AQL 1.5

2. Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45°against perpendicular line.

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.

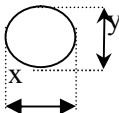| *TRULY* ® OUTGOING QUALITY STANDARD	PAGE 2 OF 4
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product

4. Inspection standards

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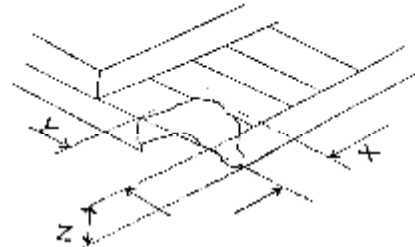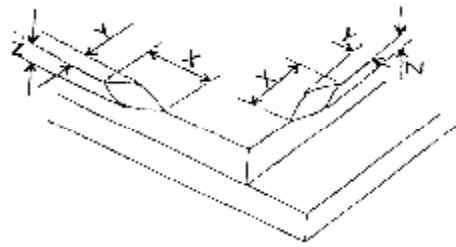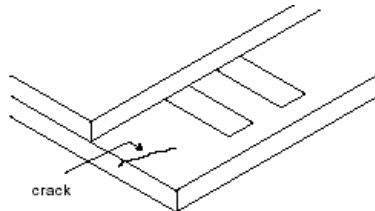
Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical，horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
4.1.2	Missing	Missing component	
4.1.3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

4.2 Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.2.1	Clear Spots Black and white Spot defect Pinhole, Foreign Particle, Dirt under polarizer	For dark/white spot, size$\Phi$is defined as $\Phi = \frac{(x+y)}{2}$ 1.	Minor

Zone \ Size(mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.10$	Ignore		Ignore
$0.10 < \Phi \leq 0.15$	2		
$0.15 < \Phi \leq 0.20$	1		
$\Phi > 0.20$	0		

Dim Spots Circle shaped and dim edged defects	2.	Minor

2. Zone \ Size(mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		Ignore
$0.20 < \Phi \leq 0.40$	3		
$0.40 < \Phi \leq 0.60$	2		
$0.60 < \Phi \leq 0.80$	1		
$0.80 < \Phi$	0		

TRULY ® OUTGOING QUALITY STANDARD | PAGE 3 OF 4

TITLE: FUNCTIONAL TEST & INSPECTION CRITERIA | MDS Product

4.2. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard					Classification of defects

4.2.2 Line defect Black line, White line, Foreign material under polarizer,

Size(mm)		Acceptable Qty			Classification
L(Length)	W(Width)	A	B	C	
Ignore	W≤0.02	Ignore			Minor
L≤3.0	0.02＜W≤0.03	2		Ignore	
L≤2.0	0.03＜W≤0.05	1			
	0.05＜W	Define as spot defect			

4.2.3 Polarizer scratch

If the Polarizer scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2.

If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.

Size(mm)		Acceptable Qty			
L(Length)	W(Width)	A	B	C	
Ignore	W≤0.03	Ignore			Minor
5.0＜L≤10.0	0.03＜W≤0.05	2		Ignore	
L≤5.0	0.05＜W≤0.08	1			
	0.08＜W	0			

4.2.4 Polarize Air bubble

Air bubbles between glass & polarizer

Size(mm) / 2. Zone	Acceptable Qty			
	A	B	C	
Φ≤0.2	Ignore			Minor
0.20＜Φ≤0.30	2		Ignore	
0.30＜Φ≤0.50	1			
0.50＜Φ	0			

TRULY ® OUTGOING QUALITY STANDARD

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TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

MDS Product

4.3. Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.3.5	Glass defect	(i) Chips on corner | X	Y	Z
---	---	---
≤2.0	≤S	Disregard | Notes: S=contact pad length Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.	Minor
		(ii)Usual surface cracks | X	Y	Z
---	---	---
≤3.0	<Inner border line of the seal	Disregard		Minor
		(iii) Crack 　Cracks tend to break are not allowed. 	Major
4.3.6	Parts alignment	1) Not allow IC and FPC/heat-seal lead width is more than 50% beyond lead pattern. 2) Not allow chip or solder component is off center more than 50% of the pad outline.	Minor
4.3.7	SMT	According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.	

■ 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.
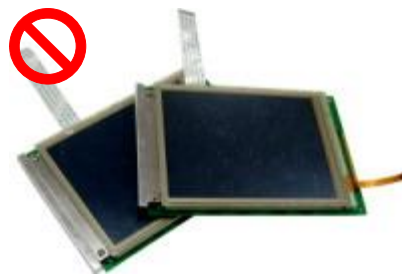### 2.2   Correct handling:

As above picture, please handle with anti-static gloves around LCM edges.
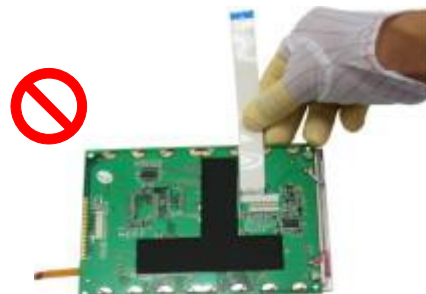
2.3   Incorrect handling:

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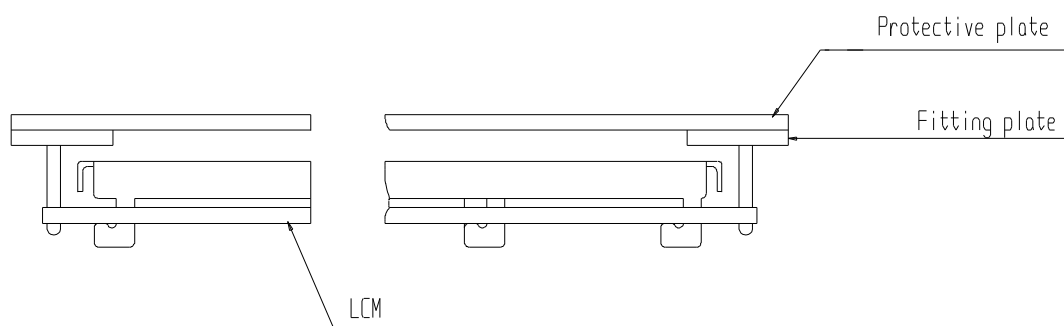
      4.1.2 When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

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
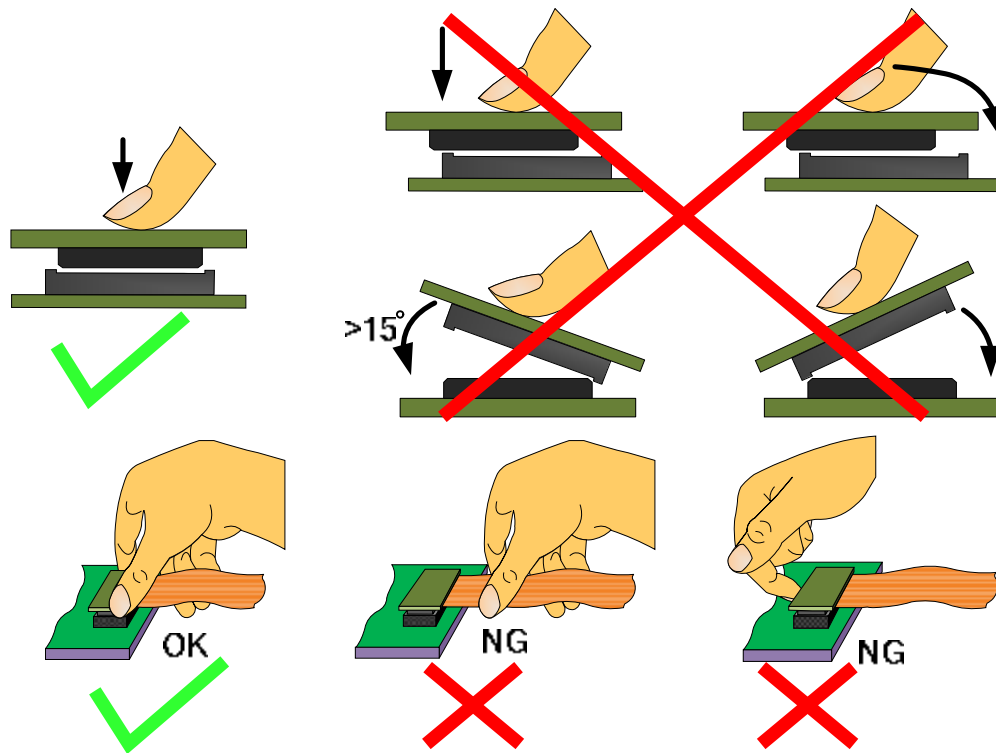
4.3   Precaution for soldering the LCM

	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.

4. 6   Limited Warranty

Unless agreed between TRULY and the customer, TRULY will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with TRULY LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of TRULY limited to repair and/or replace on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

4.7   Return LCM under warranty

4.7.1 No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

4.7.1.1 - Broken LCD glass.

4.7.1.2 - PCB eyelet is damaged or modified.

4.7.1.3 -PCB conductors damaged.

4.7.1.4 - Circuit modified in any way, including addition of components.

4.7.1.5 - PCB tampered with by grinding, engraving or painting varnish.

4.7.1.6 - Soldering to or modifying the bezel in any manner.

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

■ PACKING SPECIFICATION

Please consult our technical department for detail information.

■ PRIOR CONSULT MATTER

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

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

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

■ FACTORY CONTACT INFORMATION

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