MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI0560DT-2

For Customer's Acceptance:

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2012-05-15
Our Reference	

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2012-05-15	First release	

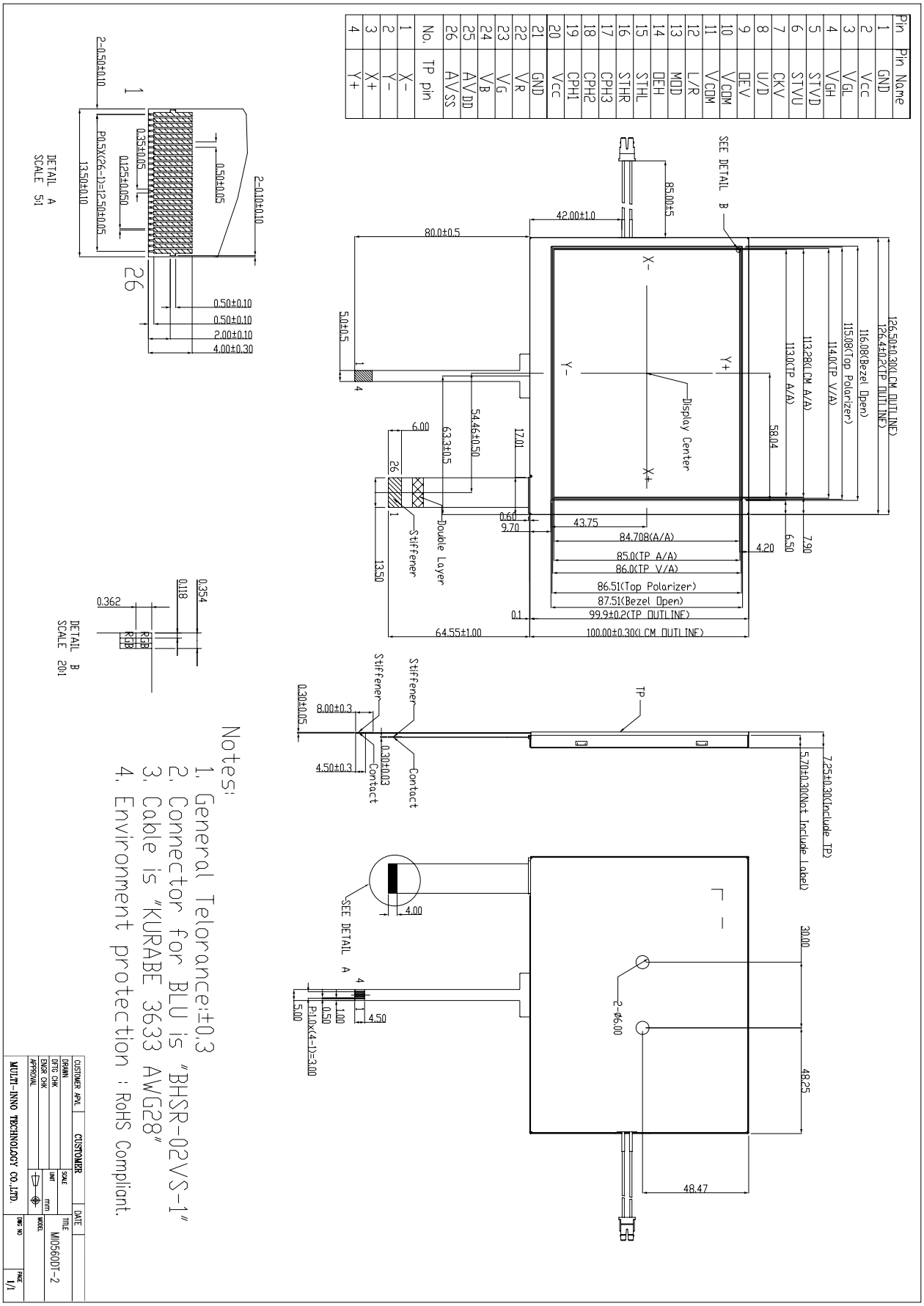
CONTENTS

■ GENERAL INFORMATION

Item	Contents	Unit
LCD type	TFT/Transimissive/Normally white	/
Size	5.6	Inch
Viewing direction	12:00	O' Clock
Gray scale inversion direction	6:00	O' Clock
LCM (W × H × D)	126.50×100.00×7.25	mm^3
Active area (W×H)	113.28×84.708	mm^2
Pixel pitch (W×H)	0.118×0.362	mm^2
Number of dots	320 (RGB) × 234	/
Backlight type	14 LEDs	/
Interface type	Analog RGB	/
Color depth	Full color	/
Pixel configuration	R.G.B vertical stripe	/
Surface treatment(Up polarizer)	Anti-glare	/
Input voltage	5.0	V
With/Without TSP	With TSP	/
Weight	TBD	g

Note 1:Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.
Note 2 : RoHS compliant;
Note 3: LCM weight tolerance: ± 5% .

■ EXTERNAL DIMENSIONS



■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Power voltage	VCC	-0.3	7.0	V
	AVDD	-0.3	7.0	V
	VGH	-0.3	18.0	V
	VGL	-15.0	0.3	V
	VGH-VGL	-	33.0	V
Input signal voltage	V_A	-0.2	AVDD+0.2	V
	V_L	-0.3	AVDD+0.3	V
Operating temperature	T_{OP}	-10	60	°C
Storage temperature	T_{ST}	-20	70	°C
Humidity	RH	-	90%(Max60°C)	RH

Note 1: VR, VG, VB
Note 2: STHL, STHR, OEH, L/R, CPH1-3, STVU, STVD, OEV, CKV, U/D

■ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

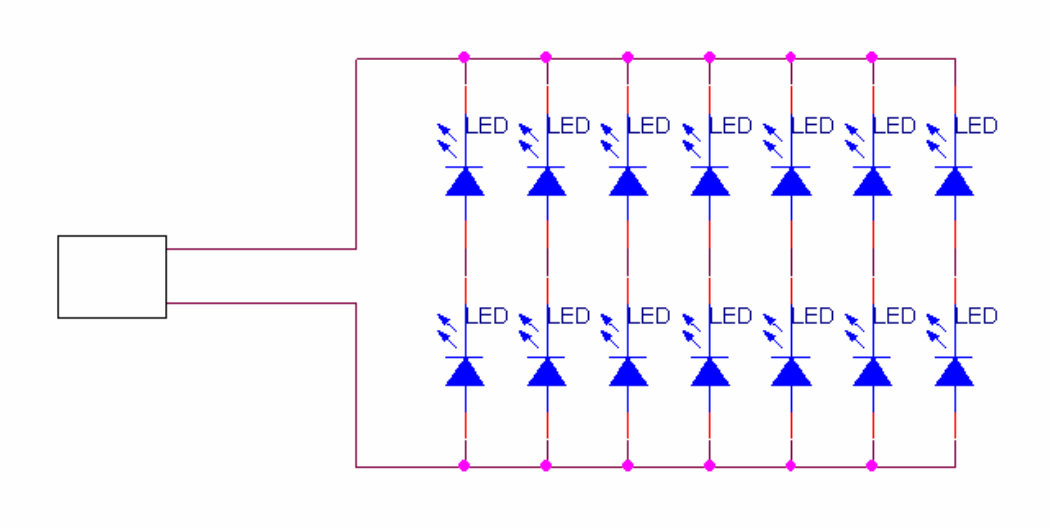
Parameter	Symbol	Min	Typ	Max	Unit
Logic supply voltage	VCC	4.8	5.0	5.2	V
Analog supply voltage	AVDD	4.8	5.0	5.2	V
Negative power for scan driver	VGL	-10.5	-10.0	-9.5	V
Positive power for scan driver	VGH	14.3	15.0	15.7	V
Inputvoltage'H'level	VIH	0.8VCC	-	VCC	V
Inputvoltage'L'level	VIL	0	-	0.2VCC	V
Outputvoltage'H'level	VOH	0.8VCC	-	VCC	V
Outputvoltage'L'leve	VOL	0	-	0.2VCC	V
Video signal amplitude	V_{IA}	0.2	-	AVDD- 0.2	V
	V_{IAC}	-	3.5	-	V
	V_{IDC}	-	AVDD/2	-	V
VCOM	V_{CAC}	-	5.4	-	V
	V_{CDC}	1.55	1.7	1.95	V
Power consumption	I_{VCC}	-	0.8	1.2	mA
	I_{AVDD}	-	3.41	5.12	mA
	I_{VGH}	-	0.056	0.084	mA
	I_{VGL}	-	0.056	0.084	mA

Note 1: STHL, STHR, OEH, L/R, CPH1-3, STVU, STVD, OEV, CKV, U/D
Note 2: Test condition: Voltage fix on: VCC=5.0V, AVDD=5.0V,VGH=15.0V, VGL=-10V

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	-	140	-	mA	Note 1
Forward Current Voltage	V_F	-	6.4	-	V	
Backlight Power Consumption	W_{BL}	-	896	-	mW	

Note1: For each LED, I_L=20mA



LED driver circuit

■ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr +Tf	θ=0° ∅=0° Ta=25℃	-	50	100	ms	Fig.1	4
Contrastratio	Cr		200	300	-	---	FIG 2.	1
Luminance uniformity	δ WHITE		70	80	-	%	FIG 2.	3
Surface Luminance	Lv		144	180	-	cd/m^2	FIG 2.	2
Viewing angle range	θ	∅ = 90°	35	45	-	deg	FIG 3.	6
		∅ = 270°	55	65	-	deg	FIG 3.	
		∅ = 0°	55	65	-	deg	FIG 3.	
		∅ = 180°	55	65	-	deg	FIG 3.	
CIE (x, y) chromaticity	Red x	θ=0° ∅=0° Ta=25℃	0.535	0.585	0.635		FIG 2.	5
	Red y		0.292	0.342	0.392			
	Green x		0.276	0.326	0.376			
	Green y		0.525	0.575	0.625			
	Blue x		0.091	0.141	0.191			
	Blue y		0.060	0.110	0.160			
	White x		0.260	0.310	0.360			
	White y		0.280	0.330	0.380			
NTSC Ratio	S		45	50	-	%		

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 2.:

$$\textbf{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels } (P_1, P_2, P_3, P_4, P_5)}{\text{Average Surface Luminance with all black pixels } (P_1, P_2, P_3, P_4, P_5)}$$

Note 2. 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 $(P_1, P_2, P_3, P_4, P_5)$

Note 3. 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.

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

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope. Series

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

Note 6. 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.

Note 7. 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,CIE The test data is base on TOPCON's BM-5 photo detector.

Note 8. For TFT module, Gray scale reverse occurs in the direction of panel viewing angle.

FIG.1. The definition of Response Time

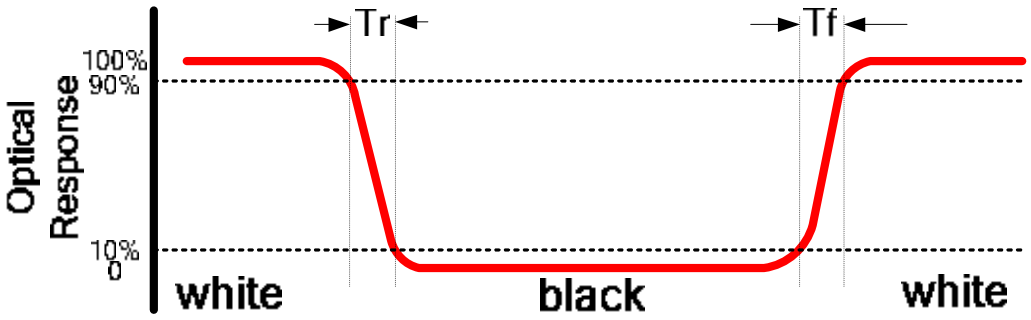


FIG.2. Measuring method for Contrast ratio,surface luminance, Luminance uniformity , CIE (x, y) chromaticity

A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=5mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

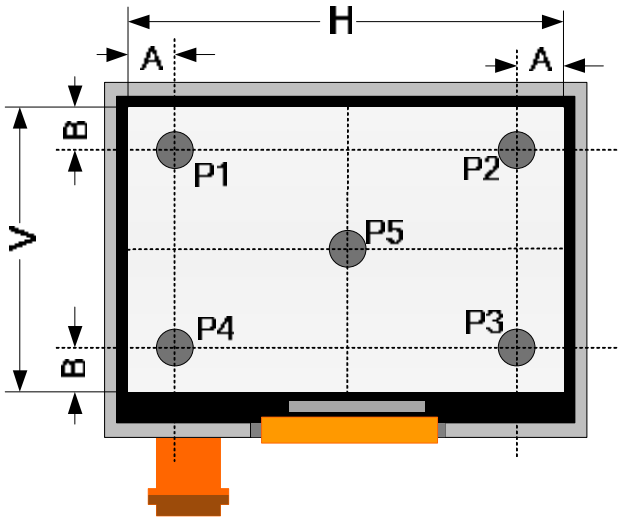
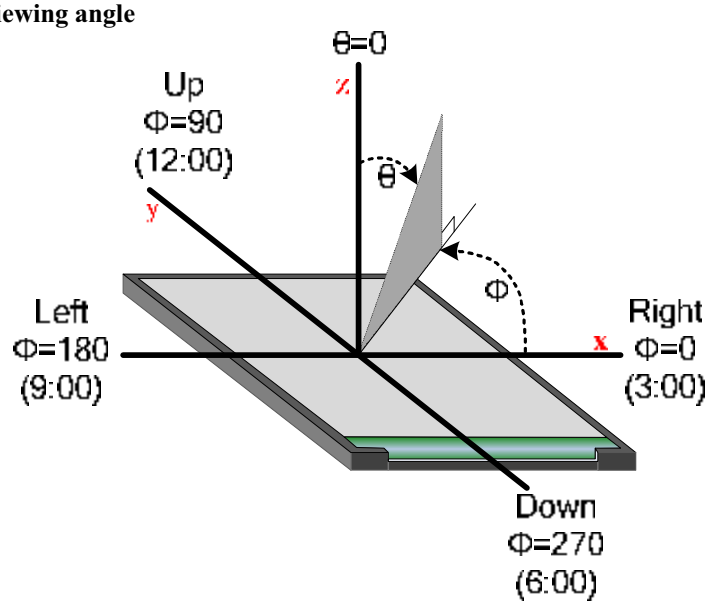
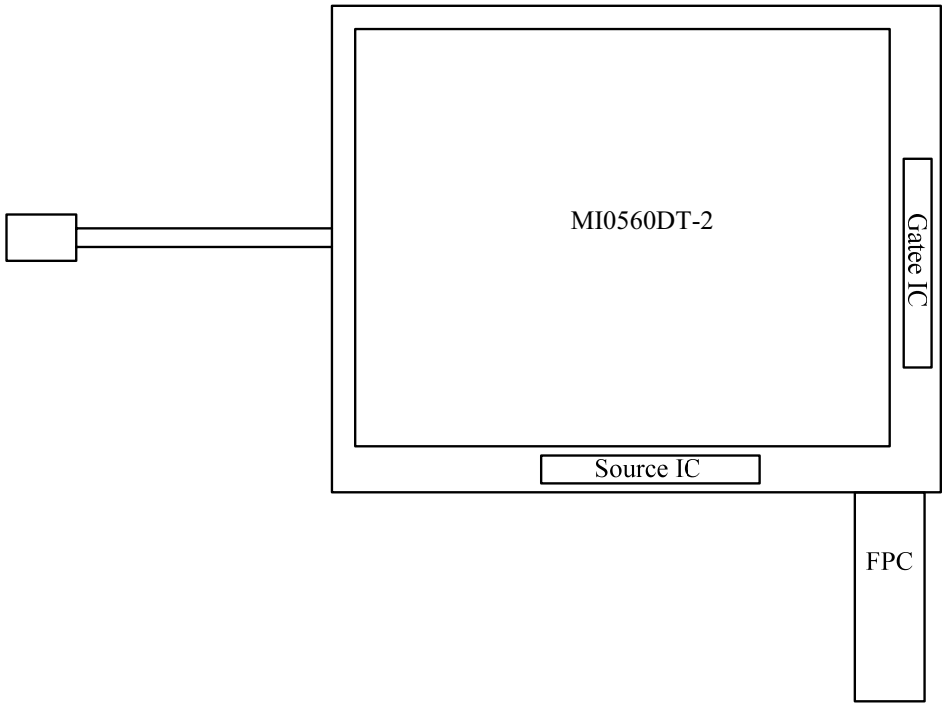


FIG.3. The definition of viewing angle



■ INTERFACE DESCRIPTION

1. BlockDiagram



2. Interface Signals

2.1 TFT LCD panel driving section

FPC Connector type is : FH12-26S-0.5SH

No	Symbol	I/O	Description	Remark
1	GND	P	Ground	
2	VCC	P	Supply voltage for scan driver	
3	VGL	P	Negative power for scan driver	
4	VGH	P	Positive power for scan driver	
5	STVD	I/O	Vertical start pulse down side	Note 1
6	STVU	I/O	Vertical start pulse up side	Note 1
7	CKV	I	Shift clock input	
8	U/D	I	UP/DOWN scan control input	Note 1
9	OEV	I	Output enable control for scan	
10	VCOM	I	Common electrode driving signal	
11	VCOM	I	Common electrode driving signal	
12	L/R	I	LEFT/RIGHT scan control input	Note 1
13	MOD	I	Sequential sampling and simultaneous sampling setting	Note 2
14	OEH	I	Output enable control for data driver	
15	STHL	I/O	Start pulse for horizontal scan line left side	Note 1
16	STHR	I/O	Start pulse for horizontal scan line right side	Note 1
17	CPH3	I	Sampling and shifting clock pulse for data driver	Note 2
18	CPH2	I	Sampling and shifting clock pulse for data driver	Note 2
19	CPH1	I	Sampling and shifting clock pulse for data driver	Note 2
20	VCC	P	Supply voltage for data driver	
21	GND	P	Ground	
22	VR	I	Alternated video signal(Red)	
23	VG	I	Alternated video signal(Green)	
24	VB	I	Alternated video signal(Blue)	
25	AVDD	P	Supply voltage for analog circuit	
26	AVSS	P	Ground for analog circuit	

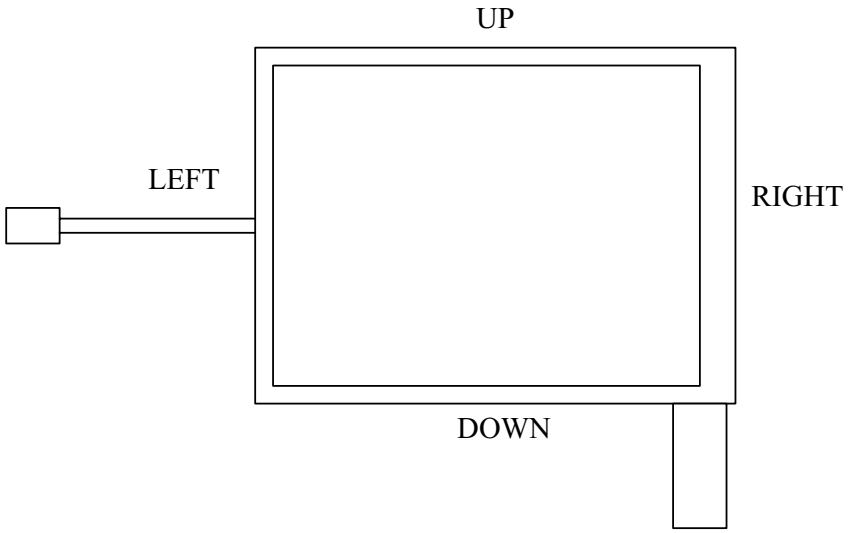
Table 2.1 input terminal pin assignment

I: input pin; I/O: input/output pin; P: Power/GND;

Note 1: select of scanning mode

Setting of scan control input		In/out state for start pulse				Scanning direction
U/D	L/R	STVD	STVU	STHR	STHL	
GND	VCC	O	I	O	I	Up to down, left to right
VCC	GND	I	O	I	O	Down to up, right to left
GND	GND	O	I	I	O	Up to down, right to left
VCC	VCC	I	O	O	I	Down to up, left to right

Refer to the figure as below



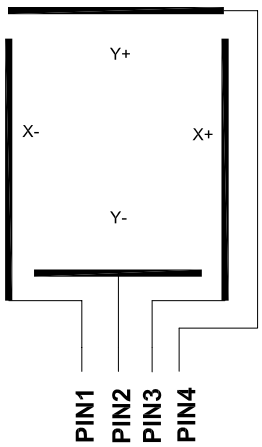
Note 2: MOD=H, simultaneous sampling.
MOD=L, sequential sampling.
Please set CPH2 and CPH3 to GND when MOD=H.

2.2 Backlight unit section

Pin No.	Symbol	I/O	Function	Remark
1	HI	P	Power supply for backlight unit	Pink line
2	GND	P	Ground for backlight unit	White line

2.3 Touch screen panel section

Pin No.	Symbol	I/O	Function	Remark
1	X-	Left	Left electrode-differential analog	
2	Y-	Bottom	Bottom electrode-differential analog	
3	X+	Right	Right electrode-differential analog	
4	Y+	Top	Top electrode-differential analog	



■ TOUCH SCREEN PANEL SPECIFICATIONS

1 Electrical Characteristics

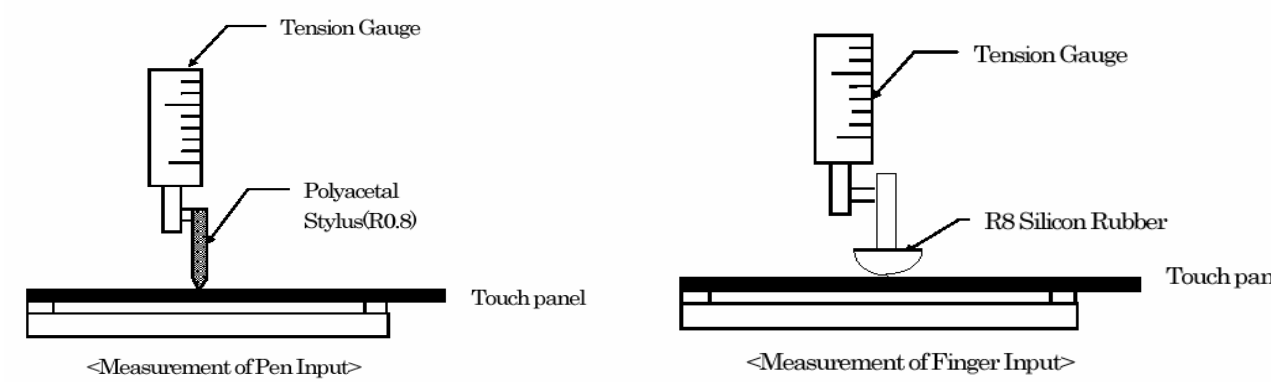
Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal Resistance	-	-	-	Ω	X(Film side)
	-	-	-	Ω	Y(Glass side)
Insulation resistance	10	-	-	MΩ	DC 25V
Voltage	-	-	5	V	DC
Chattering	-	-	10	ms	100kΩ pull-up
Transparency	80	-	-	%	

Note: Avoid operating with hard or sharp material such as a ball point pen or a mechanical pencil except a polyacetal pen (tip R0.8mm or less) or a finger.

2 Mechanical And Reliability Characteristics

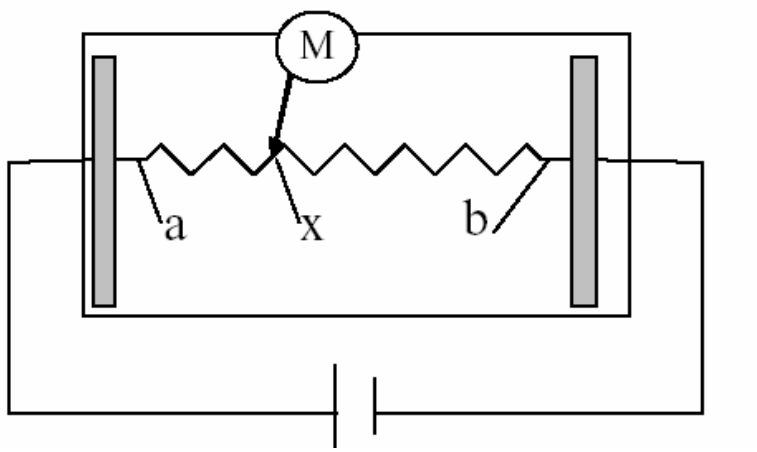
Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Active force	100	-	-	gf	Note 1
Durability-surface scratching	Write 100,000	-	-	characters	Note 2
Durability-surface pitting	1,000,000	-	-	touches	Note 3
Surface hardness	3	-	-	H	

Note 1: Active force test condition
(1) Input DC 5V on X direction, Drop off Polyacetal Stylus (R0.8), until output voltage stabilize ,then get the activation force ◦
(2) R8.0mm Silicon rubber for finger Activation force test
(3) Test point: 9 points

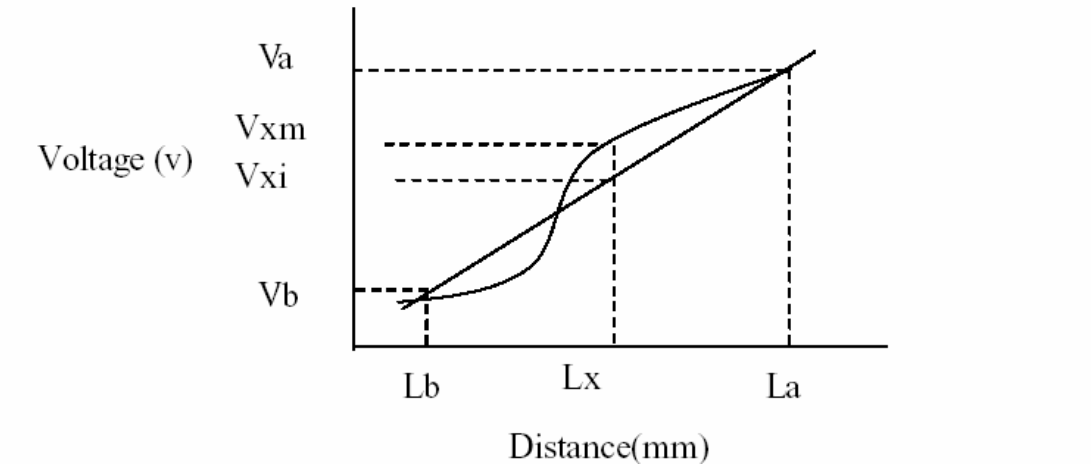


Note 2: Measurement for surface area.
-Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.
-Force: 250gf.
-Speed: 60mm/sec.
-Stylus: R0.8 polyacetal tip.
Note 3: Pit 1,000,000 times on the film with a R0.8 silicon rubber.
-Force: 250gf.
-Speed: 2times/sec.

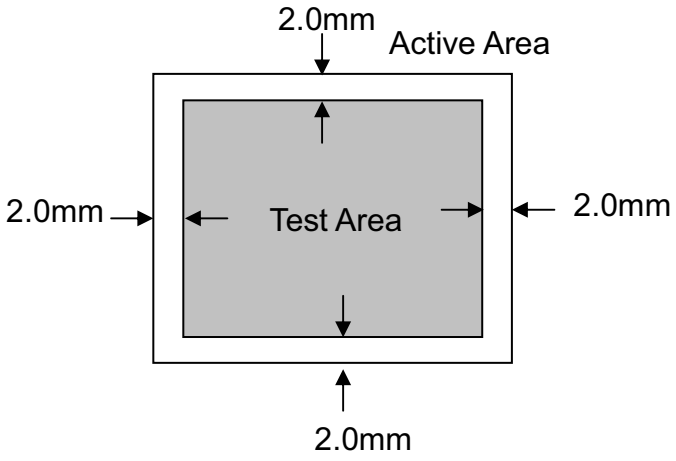
3 Linearity Definition



Va: maximum voltage in the active area of touch panel
Vb: minimum voltage in the active area of touch panel
X: random measuring point
Vxm: actual voltage of Lx point
Vxi: theoretical voltage of Lx point



Linearity = [|Vxi-Vxm |/(Va-Vb)]*100%
Note: Test area is as follows and operation force is 150gf.

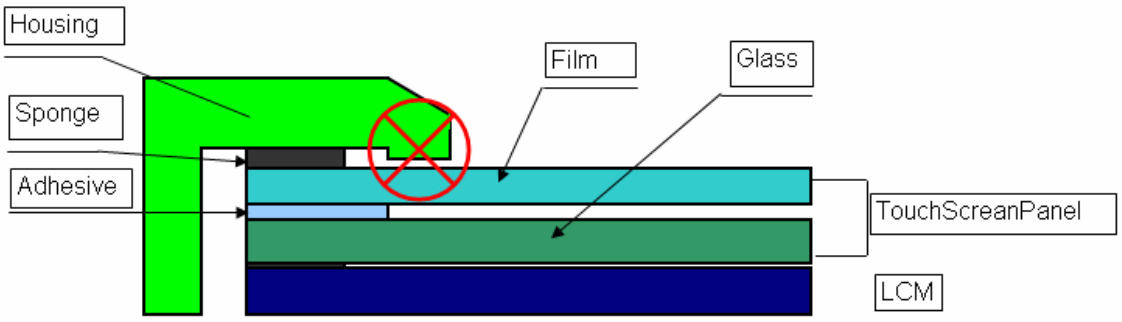


4 Housing Design Guide

Housing design follow as below.

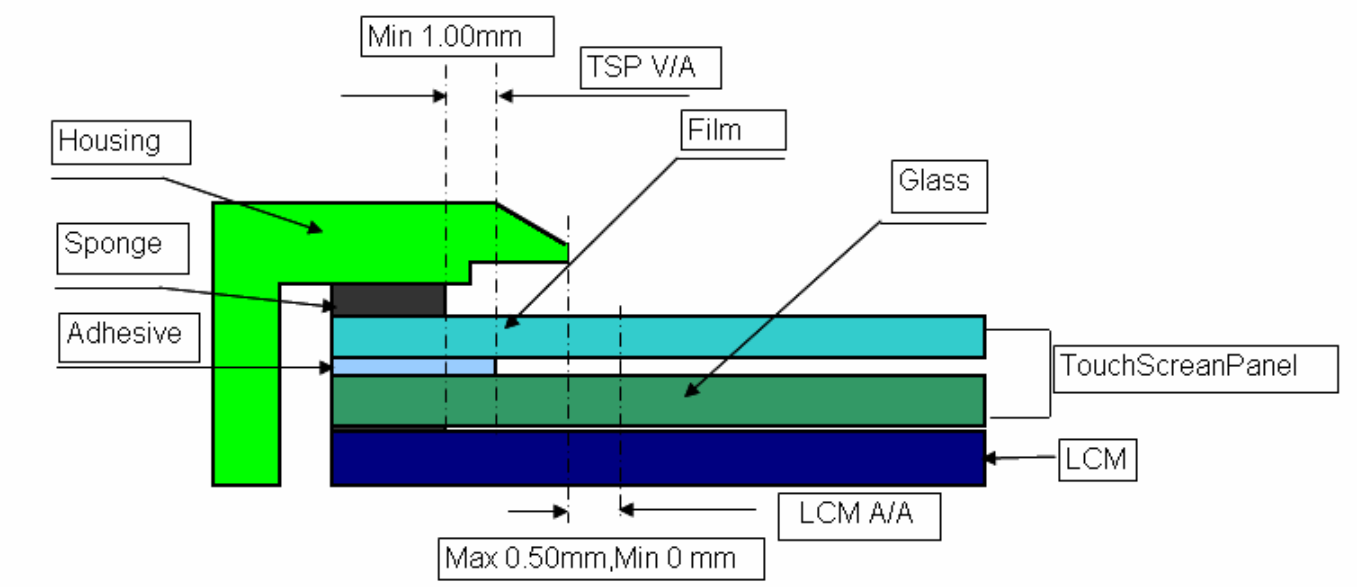
1) Avoid the design that housing overlap and press on the active area of the LCM.

2) Give enough gap(over 0.5mm at compressed) between the housing and TSP to protect wrong operating.



3) Use a buffer material(Gasket) between the TSP and housing to protect damage and wrong operating.

4) Avoid the design that buffer material overlap and press on the inside of TSP view area.



■ APPLICATION NOTES

1 Timing Chart

1.1 Timing Parameter

Parameter	Symbol	Min.	Typ.	Max.	Unit.	Remark
Rising time	t_r	-	-	60	ns	Note 1
Falling time	t_f	-	-	60	ns	Note 1
High and low level pulse width	t_{CPH}	150	154	158	ns	CPH1-3
CPH pulse width	t_{CWH}	40	50	60	%	CPH1-3
CPH pulse delay	t_{C12} t_{C23} t_{C31}	30	$t_{CPH}/3$	$t_{CPH}/2$	ns	CPH1-3
STH setup time	t_{SUH}	20	-	-	ns	STHL/R
STH hold time	t_{HDH}	20	-	-	ns	STHL/R
STH pulse width	t_{STH}	-	1	-	t_{CPH}	STHL/R
STH period	t_H	61.5	63.5	65.5	us	STHL/R
OEH pulse width	t_{OEH}	-	7	-	us	
Sample and hold disable time	t_{DIS1}	-	55	-	us	
OEV pulse width	t_{OEV}	-	27	-	us	
CKV pulse width	t_{CKV}	16	-	40	us	
Clean enable time	t_{DIS2}	-	16	-	us	
Horizontal display time range	t_{DH}	-	960	-	$t_{CPH}/3$	
STV setup time	t_{SUV}	400	-	-	ns	STVD/U
STV hold time	t_{HDV}	400	-	-	ns	STVD/U
STV pulse width	t_{STV}	-	-	1	t_H	STVD/U
Horizontal line per field	t_V	256	262.5	268	t_H	Note 2
Vertical display start	t_{SV}	-	3	-	t_H	
Vertical display range	t_{DV}	-	234	-	t_H	
Vertical start line	t_{SLV}	-	-	21	t_H	
VCOM rising time	t_{rCOM}	-	-	5	us	
VCOM falling time	t_{fCOM}	-	-	5	us	
VCOM delay time	t_{DCOM}	-	-	3	us	
RGB delay time	t_{DRGB}	-	-	1	us	

Note 1: For all of logic signal.

Note 2: Please don't use odd horizontal lines to drive LCD panel for both odd and even field simultaneously.

1.2 Timing Diagram

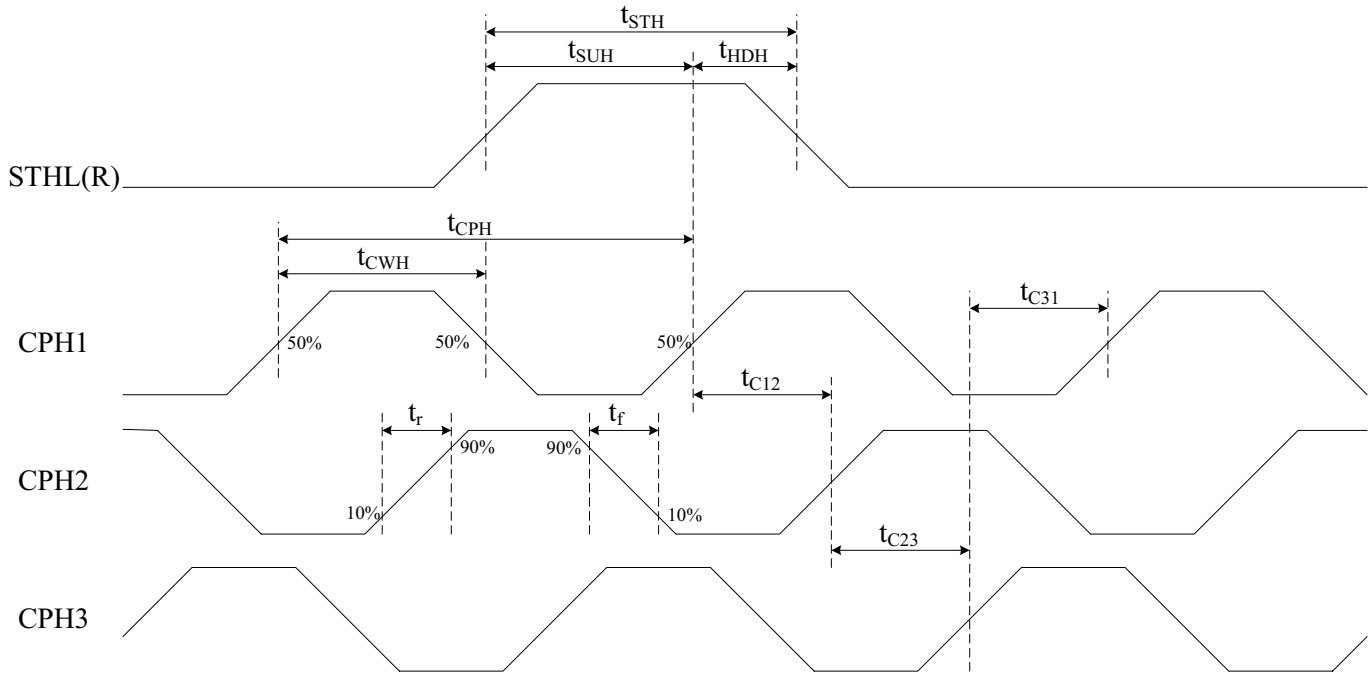


Figure 1.1: sampling clock timing

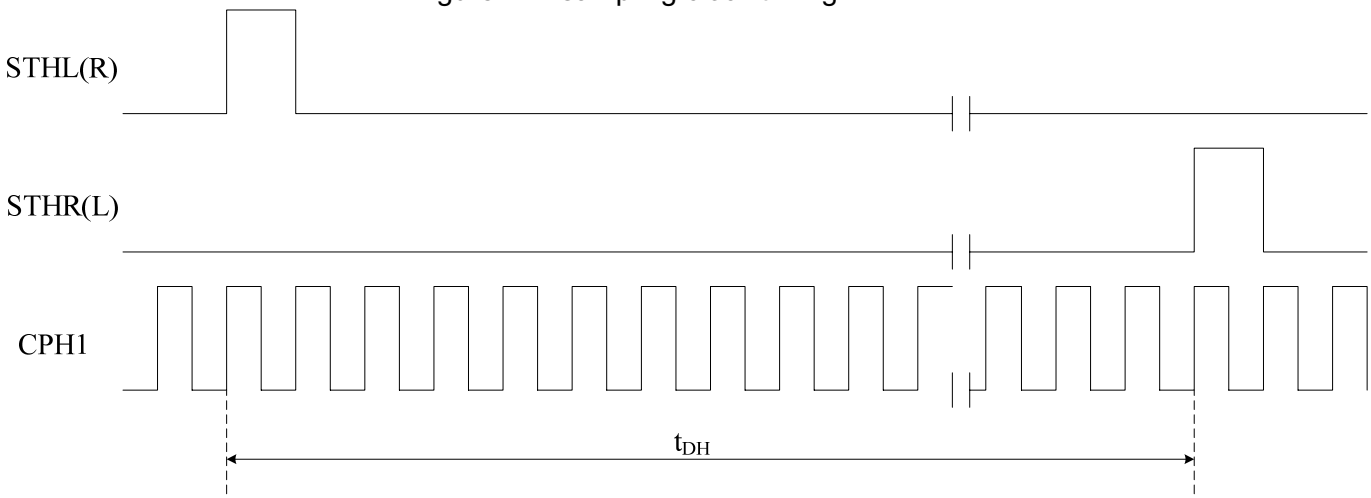


Figure 1.2: horizontal display range timing

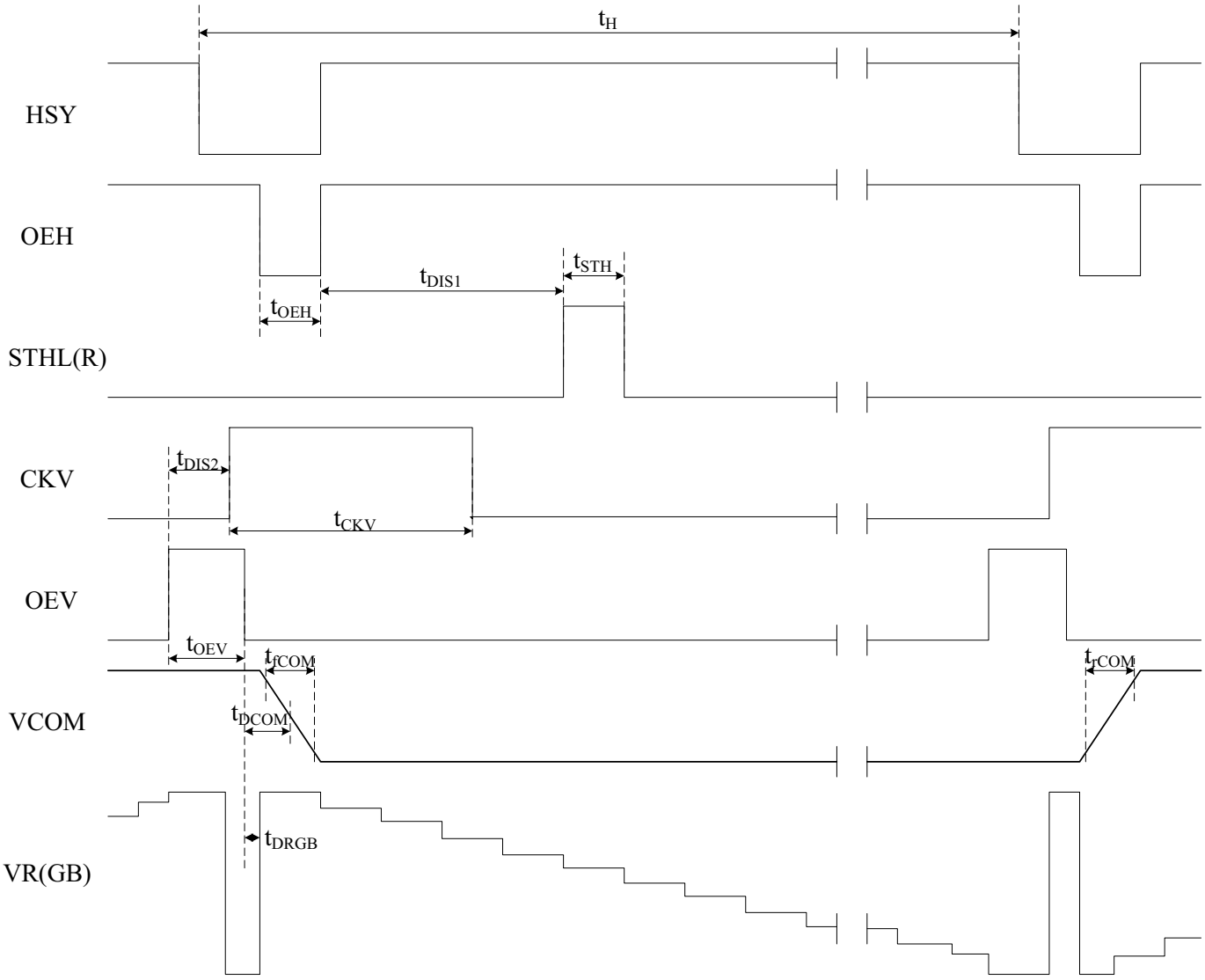


Figure 1.3: horizontal display timing

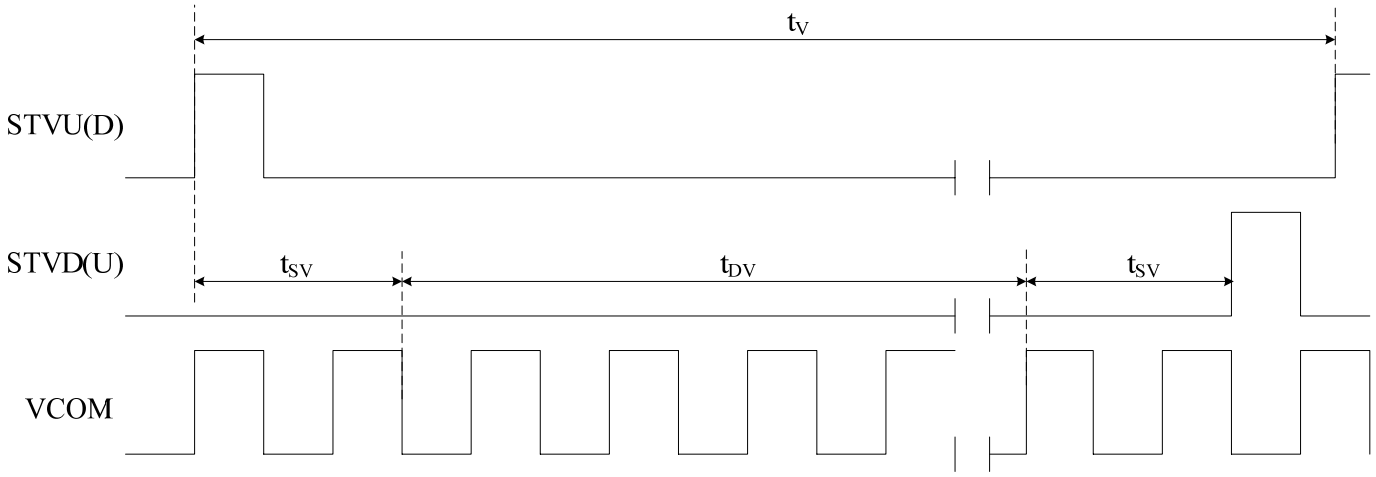


Figure 1.4: vertical display timing

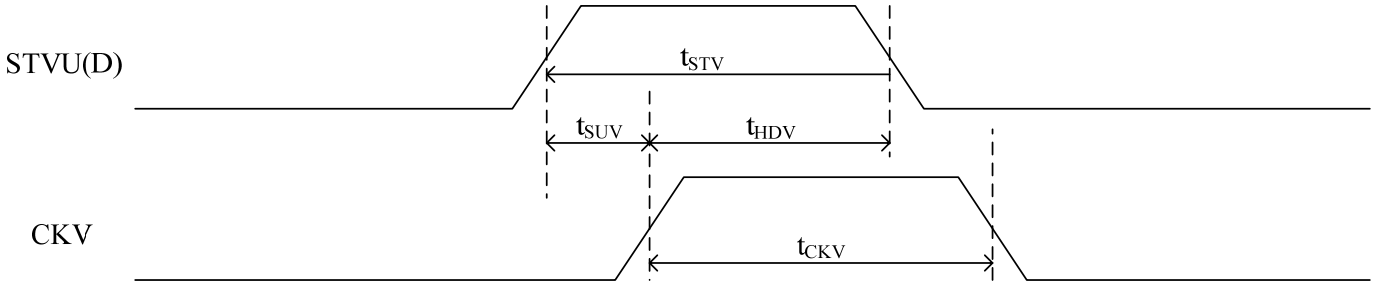


Figure 1.5: vertical shift clcok timing

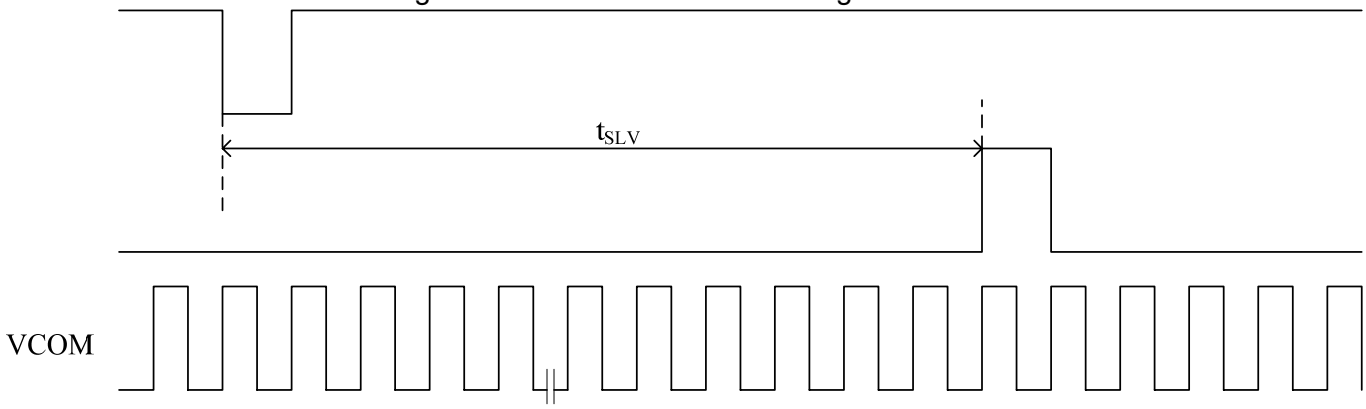


Figure 1.5: vertical start line timing

1.2. Power on/off Sequence

1.2.1 Power on Sequence

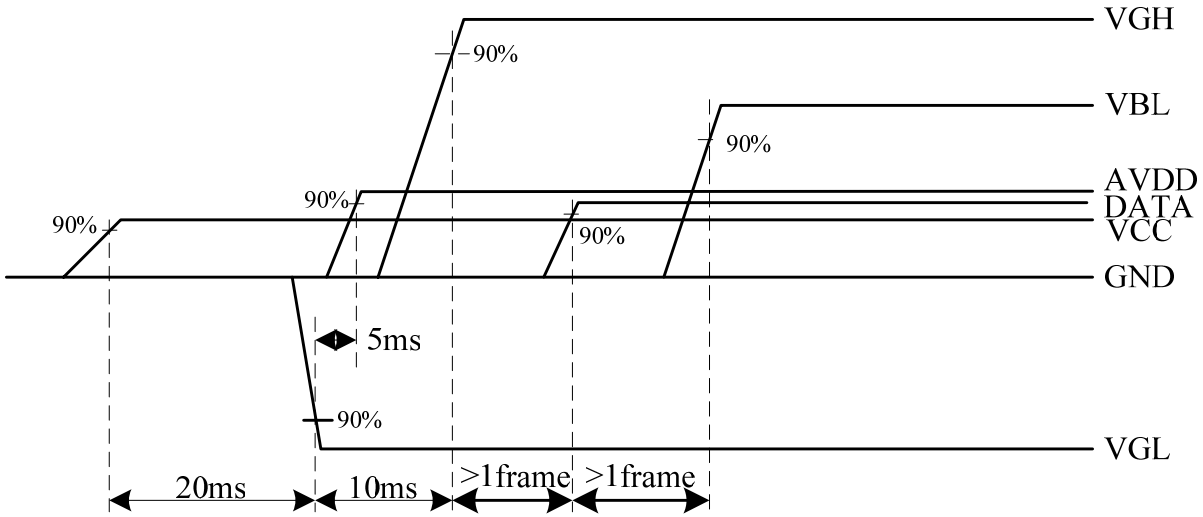


Figure 5.6 Power on sequence

VCC→VGL→AVDD→VGH→DATA→VBL

Note: the interval time should more than the label

1.2.2 Power off Sequence

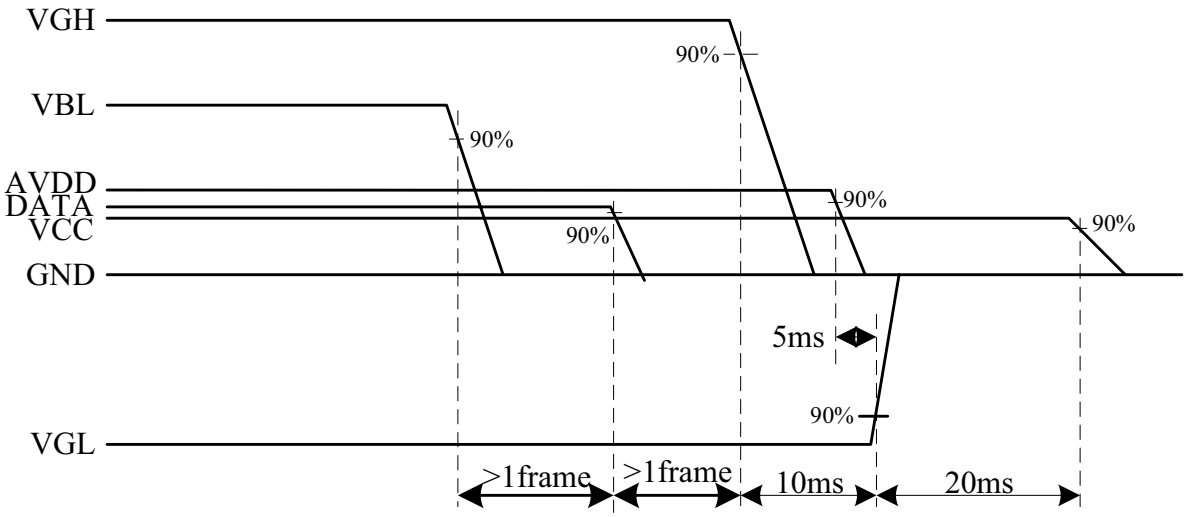


Figure 5.7 Power off sequence

VBL→DATA→VGH→AVDD→VGL→VCC

Note: the interval time should more than the label

■ RELIABILITY TEST

No.	Test Item	Test Condition	Remark
1	High Temperature Storage	70±2℃/240 hours	IEC60068-2-1 GB2423.2
2	Low Temperature Storage	-20±2℃/240 hours	IEC60068-2-1 GB2423.1
3	High Temperature Operating	60±2℃/240 hours	Note 1,IEC60068-2-1 GB2423.2
4	Low Temperature Operating	-10±2℃/240 hours	IEC60068-2-1 GB2423.1
5	Temperature Cycle storage	-20±2℃~25~70±2℃×100cycles (30min.) (5min.) (30min.)	Start with cold temperature, End with high temperature, IEC60068-2-14 GB2423.22
6	Damp proof Test operating	60℃±5℃×90%RH/240 hours	Note 2,IEC60068-2-78 GB/T2423.3
7	Vibration Test (non-operation)	Frequency range:10Hz~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2hours for each direction of X,Y,Z(6 hours for total)	IEC60068-2-6 GB/T2423.10
8	Package drop test	Height:80 cm,1 corner,3 edges,6 surfaces	IEC60068-2-32,GB2423.8
9	ESD test (operation)	± 2KV,Human Body Mode, 100pF/1500Ω	IEC61000-4-2 GB/T17626.2
10	Shock(non-operation)	100G 6ms,±X,± Y,± Z 3times each direction	IEC60068-2-27 GB/T2423.5
11	Package vibration test	Random Vibration: 0.015G*G/Hz for 5-200Hz,-6dB/Octave from 200-500Hz 2 hours for each direction of X,Y,Z (6 hours for total)	IEC60068-2-34

Note 1:Ts is the temperature of panel's surface.
Note 2:Ta is the ambient temperature of sample.

■ INSPECTION CRITERION

OUTGOING QUALITY STANDARD	PAGE 1 OF 8
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

This specification is made to be used as the standard acceptance/rejection criteria for Wider Screen TFT-LCD module product.

1. Sample plan

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

Major defect: AQL 0.65

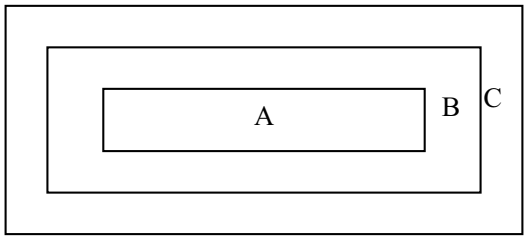
Minor defect: AQL 1.5

2. Inspection condition

Viewing distance for 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).

3. Definition of Inspection Item.

3.1 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)

ZoneB+ZoneC= Around opaque edge area on TP.

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.

3.2 Definition of some visual defect

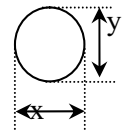
Bright dot.	Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
Dark dot.	Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture, or pure whiter picture.
Dark / Bright Lines.	Lines on display which appear dark/bright and usually result from the contamination.

OUTGOING QUALITY STANDARD	PAGE 2 OF 8
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

4. Major Defect

Item No	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 6) Back-light no lighting, flickering and abnormal lighting.	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.	

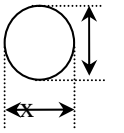
5. Minor Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
5.1	Bright dot. defect.  Φ=(x+y) /2	Zone / Size(mm): A, B, C Φ≤0.15: Acceptable (clustering of spot not allowed) 0.15<Φ≤0.25: N≤6. 0.25<Φ≤0.50: N≤2 Acceptable	Minor
5.2	Dark dot defect.	Zone / Size(mm): A, B, C Φ≤0.15: Acceptable 0.15<Φ≤0.30: N≤6 0.30<Φ≤0.50: N≤4 Acceptable	
5.3	Bright / Dark line.	0.01 < W ≤ 0.10, 0.30 < L ≤ 1.50, N≤1	Acceptable

Note: 1. Total defective dots shall not exceed 6 pcs.
2. Minimum distance between defective dots is more than 5mm.
3. 2 Adjacent dark sub pixel defect or bright sub pixel defect is not more than 1pair.
4. W: Width, L: Length, N: Count.

OUTGOING QUALITY STANDARD | PAGE 3 OF 8

TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="2">5.4</td><td>Linear defect
Foreign material under polarizer,</td><td>
<table>
<tr><td colspan="2">Size(m)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="3">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.05</td><td colspan="2">Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>L≤5.0</td><td>0.05＜W≤0.15</td><td colspan="2">N≤5</td></tr>
<tr><td>5.0≤L</td><td>0.15≤W</td><td colspan="2">0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>Circular Defect,
Foreign material under polarizer,
 
Φ=(x+y) /2</td><td>
<table>
<tr><td rowspan="2">Zone
Size(mm)</td><td colspan="3">Acceptable Q’ty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.25</td><td colspan="2">Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>0.25＜Φ≤0.50</td><td colspan="2">N≤4</td></tr>
<tr><td>0.50≤Φ</td><td colspan="2">0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>5.5</td><td>Polarizer defect.</td><td>5.4.1 Polarizer Position
(i) Shifting in position should not exceed the glass outline dimension.
(ii) Incomplete covering of the viewing area due to shifting is not allowed.
5.4.2 Dirt on polarizer
Dirt which can be wiped easily should be accepted.
5.4.3 Polarizer Nick & Dent
<table>
<tr><td rowspan="3">Sizes(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="3">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ＜0.25</td><td colspan="2">Acceptable</td><td rowspan="3">Acceptable</td></tr>
<tr><td>0.25≤Φ≤0.5</td><td colspan="2">N≤4</td></tr>
<tr><td>Φ＞0.5</td><td colspan="2">0</td></tr>
</table>
</td><td>Minor</td></tr>
</table>

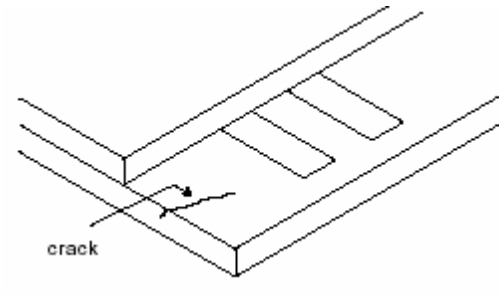
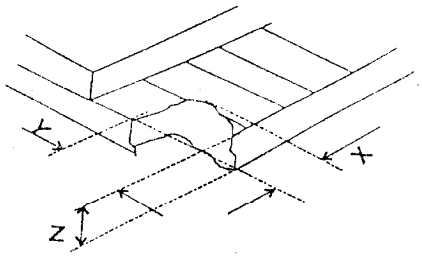
OUTGOING QUALITY STANDARD	PAGE 4 OF 8
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

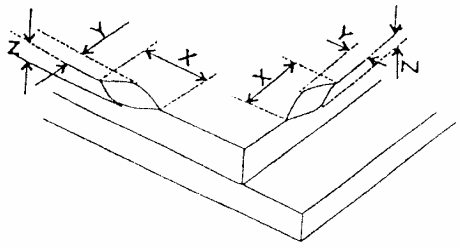
5. Minor Defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="2">5.6</td><td rowspan="2">Polarizer defect</td><td>5.4.4Air bubbles between glass & polarizer:
<table>
<tr><td rowspan="3">Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td colspan="3">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.3</td><td colspan="2">Acceptable</td><td rowspan="4">Acceptable</td></tr>
<tr><td>0.3＜Φ≤1.0</td><td colspan="2">3</td></tr>
<tr><td>1.0＜Φ≤1.5</td><td colspan="2">1</td></tr>
<tr><td>Φ＞1.5</td><td colspan="2">0</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>5.4.5 Polarizer scratch
(i) If the Polarizer scratch can be seen after cover assembling or in the operating condition, judge by the line defect of 5.4.
(ii) If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.
<table>
<tr><td colspan="2">Size(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="3">Zone</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Ignore</td><td>W≤0.02</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>1.0＜L≤5.0</td><td>0.02＜W≤0.2</td><td colspan="2">N≤4.</td></tr>
<tr><td>5.0＜L</td><td>0.2＜W</td><td colspan="2">0</td></tr>
</table></td><td>Minor</td></tr>
</table>

OUTGOING QUALITY STANDARD	PAGE 5 OF 8
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

5. Minor Defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="3">5.7</td><td rowspan="3">Glass defect</td><td>(i) Crack
Cracks are not allowed.
 
</td><td>Minor</td></tr>
<tr><td>(ii) TFT chips on corner
 

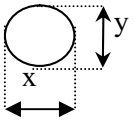
<table><tr><th>X</th><th>Y</th><th>Z</th><th>Acceptable</th></tr><tr><td>≤3.0</td><td>≤3.0</td><td>Not more than the thickness of glass.</td><td>N≤3.</td></tr></table>Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</td><td>Minor</td></tr>
<tr><td>(iii)Usual surface cracks
 

<table><tr><th>X</th><th>Y</th><th>Z</th><th>Acceptable</th></tr><tr><td>≤1.5</td><td>≤1.5</td><td>Not more than the thickness of glass.</td><td>N≤4.</td></tr></table>It is only applicable to the upper glass of LCD.</td><td>Minor</td></tr>
</table>

OUTGOING QUALITY STANDARD | PAGE 6 OF 8

TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA

6. TP Cosmetic Defect.

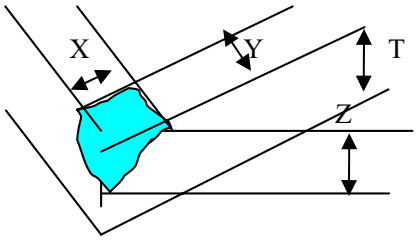
Item No	Items to be inspected	Inspection Standard	Classification of defects
6.1	Black and white Spot defect Foreign Particle,	For dark/white spot, size Φ is defined as $\Phi = \frac{(x+y)}{2}$ 	Minor

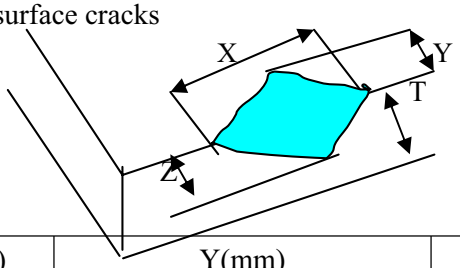
Zone / Size(mm)	Acceptable Qty A	Acceptable Qty B+C	
Φ≤0.15	Ignore		distance 5mm over
0.15<Φ≤0.25	6		
0.25<Φ≤0.50	4		
Φ>0.5	0		
Total defective dots shall not exceed 6 pcs on the same TP.			

Item No	Items to be inspected	Inspection Standard	Classification of defects
6.2	Black line, White line, Scratch, Foreign material under film,		Minor

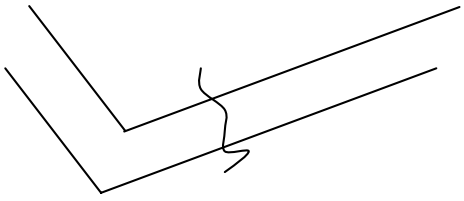
Size(mm) L(Length)	Size(mm) W(Width)	Acceptable Qty Zone A	Acceptable Qty Zone B+C	
Ignore	W≤0.03	Ignore		distance 5mm over
L≤5.0	0.03<W≤0.05	5		
L≤5.0	0.05<W≤0.1	2		
	0.1<W	0		

6. TP Cosmetic Defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="2">6.3</td><td rowspan="2">TP defect ,</td><td>(i) Chips on corner
 

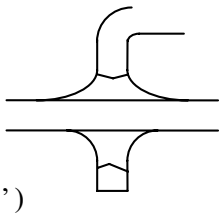
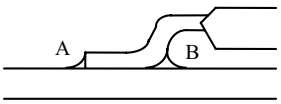
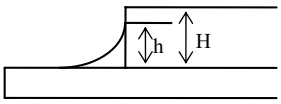
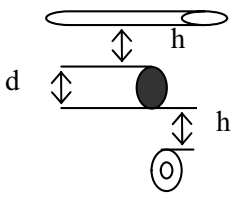
<table><tr><th>X(mm)</th><th>Y(mm)</th><th>Z(mm)</th></tr><tr><td>≤3.0</td><td>≤3.0</td><td>Z<T</td></tr></table>
(ii)Usual surface cracks
 

<table><tr><th>X(mm)</th><th>Y(mm)</th><th>Z(mm)</th></tr><tr><td>≤6.0</td><td><2.0</td><td>Z<T</td></tr></table></td><td>Minor

Minor</td></tr>
<tr><td>(iii) Crack
Cracks tending to break are not allowed.
  </td><td>Major</td></tr>
<tr><td>6.4</td><td>Total number of dots</td><td>The total number of luminous dots, dark dots, contamination particles, bubbles, scratch defects, pinholes must not exceed 10 /piece on the same TP.</td><td></td></tr>
</table>

OUTGOING QUALITY STANDARD	PAGE 8 OF 8
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

7. **Module Cosmetic Criteria**

Item No	Items to be inspected	Inspection Standard	Classification of defects
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 (∅0.5mm or more) on substrate pattern.	Minor
5	Accretion of metallic Foreign matter	No accretion of metallic foreign matters (Not exceed ∅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 ≥ h ≥ (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.  b.The quantity of solder balls or solder. Splashes isn't beyond 5 in 600 mm^2 . c.Solder balls/Solder splashes do not violate minimum electrical clearance. d.Solder balls/Solder splashes must be entrapped / encapsulated or attached to the metal surface . Note: Entrapped/encapsulated/attached is intended to mean that normal service environment of the product will not cause a solder ball to become dislodged.	Minor Minor Major Minor

■ 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.

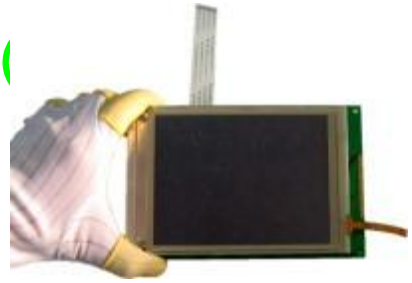
1.13 Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- 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.

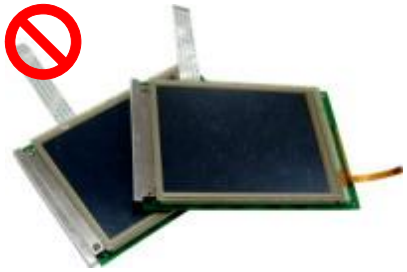
2.2 Correct handling:



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

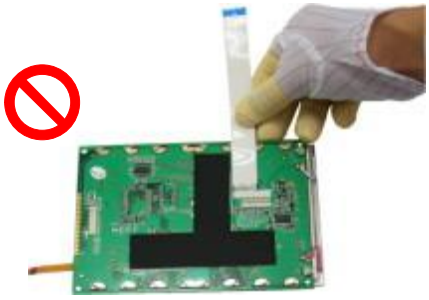
2.3 Incorrect handling:

Please don't touch IC directly.

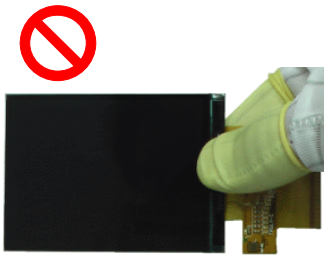


Please don't stack LCM.

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.

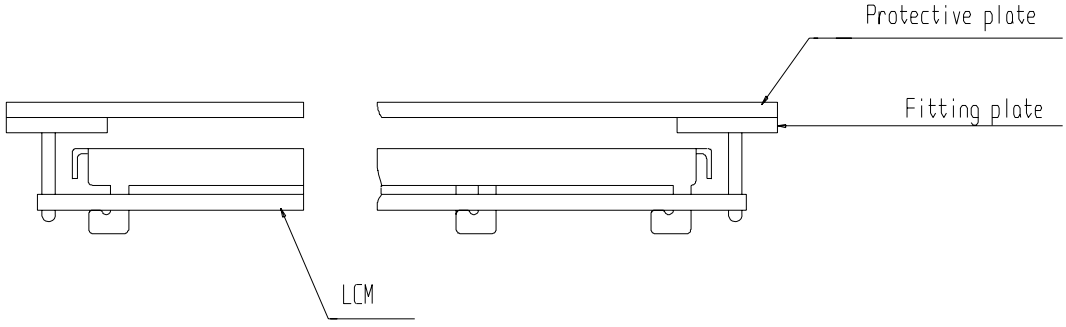
3.2.3.2 -Terminal electrode sections.

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.

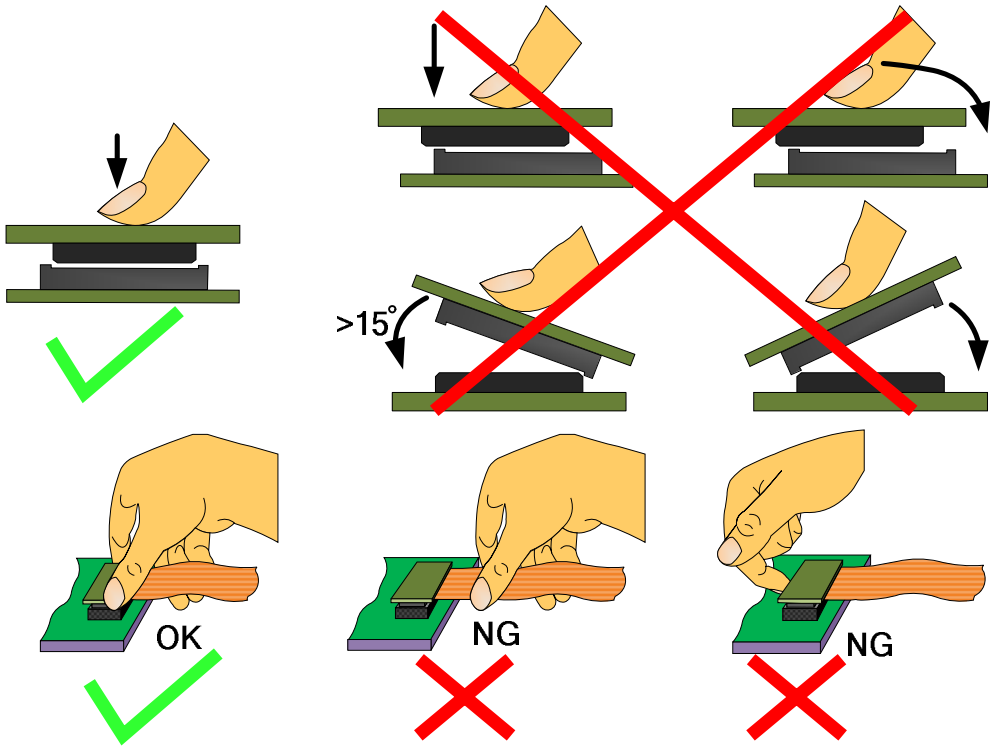
4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



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