



**MULTI-INNO TECHNOLOGY CO., LTD.**

[www.multi-inno.com](http://www.multi-inno.com)

## LCD MODULE SPECIFICATION

**Model : MI1010ET-3**

**For Customer's Acceptance:**

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2013-03-18
Our Reference	



**REVISION RECORD**

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2013-03-18	First Release	

# CONTENTS

- GENERAL INFORMATION
- EXTERNAL DIMENSIONS
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL CHARACTERISTICS
- BACKLIGHT CHARACTERISTICS
- ELECTRO-OPTICAL CHARACTERISTICS
- INTERFACE DESCRIPTION
- APPLICATION NOTES
- RELIABILITY TEST
- INSPECTION CRITERION
- PRECAUTIONS FOR USING LCD MODULES
- PRIOR CONSULT MATTER

**■ GENERAL INFORMATION**

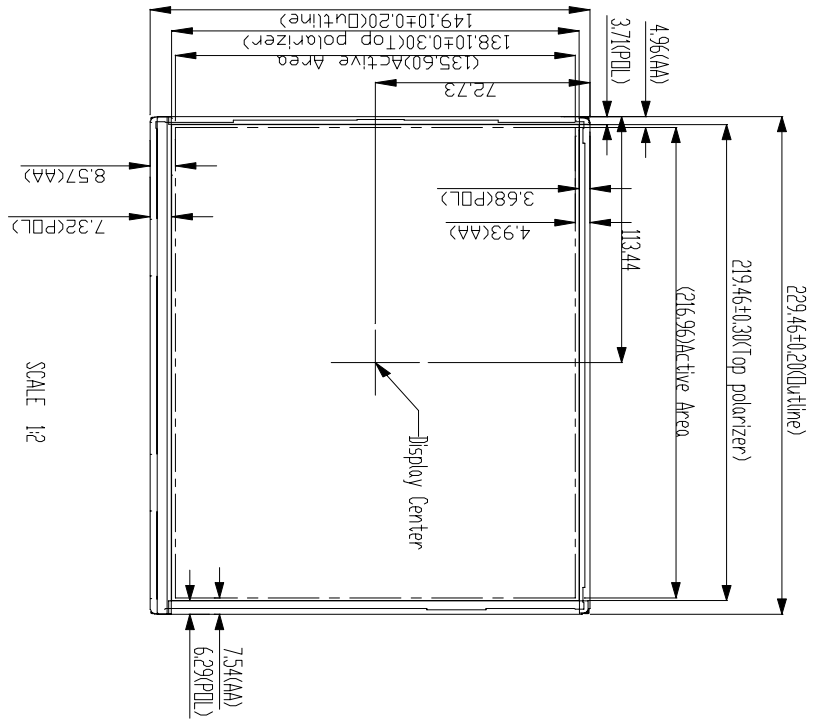
Item	Contents	Unit
LCD type	TFT/Transmissive/Normally black	/
Size	10.1	Inch
Viewing direction	Full viewing angle	O' Clock
LCM (W × H × D )	229.46×149.10×2.50	mm <sup>3</sup>
Active area (W×H)	216.96×135.60	mm <sup>2</sup>
Pixel pitch (W×H)	0.0565×0.1695	mm <sup>2</sup>
Number of dots	1280(RGB) × 800	/
Backlight type	30 LEDs	/
Interface type	LVDS	/
Color depth	262K	/
Color arrangement	RGB-stripe	/
Surface treatment	HC	/
Backlight power consumption	1.86	W
Panel power consumption	1.0	W
Input voltage	3.3	V
With/Without TSP	Without TSP	/
Weight	TBD	g

Note 1:Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

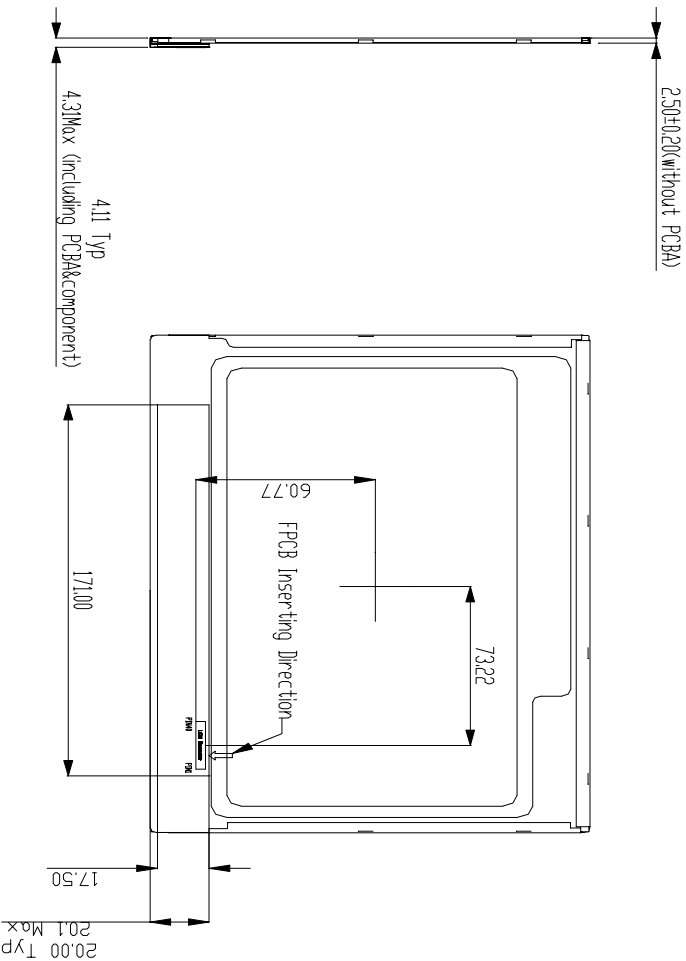
Note 2 : RoHS compliant;

Note 3: LCM weight tolerance: ± 5% .

EXTERNAL DIMENSIONS



- Note:
- 1.General Tolerance  $\pm 0.30\text{mm}$ ;
  - 2.The LCM Connector is F62240-H1210A
  - 3.RoHS compliant



DIMENSION		GENERAL LINEAR TOLERANCE			SELECT LEVEL			CUSTOMER APVL		DATE	
RANGE	LEVEL	1	2	3	LEVEL	1	2	3	LEVEL	LEVEL	
0 - 4	005	01	02	03	LEVEL	DRAWN	SCALE	TITLE			
4 - 14	04	02	03	04	LEVEL	DTG CHK	UNIT	MI1010ET-3	DWG NO	PAGE	
14 - 63	04	03	04	05	LEVEL	ENGR CHK	mm			1/1	
63 - 250	04	04	05	06	LEVEL	APPROVAL					
250 - 600	04	05	06	07	LEVEL						
600 - 4000	04	06	07	08	LEVEL						
GENERAL ANGLAR TOLERANCE		1.5			GENERAL ANGLAR TOLERANCE		MULTI-INNO TECHNOLOGY CO.,LTD.				

## ■ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Power voltage	VDD	-0.3	3.9	V
	AVDD	-0.3	14	V
	VGH	-0.3	42	V
	VGL	-19	0.3	V
	VGH-VGL	12	40	V
LED reverse voltage(each LED)	V <sub>R</sub>	-	1.2	V
LED forward current(each LED)	I <sub>F</sub>	-	25	mA
Operating temperature	T <sub>OP</sub>	0	50	°C
Storage temperature	T <sub>ST</sub>	-20	60	°C
Humidity	RH	-	90%(Max60°C)	RH

## ■ELECTRICAL CHARACTERISTICS

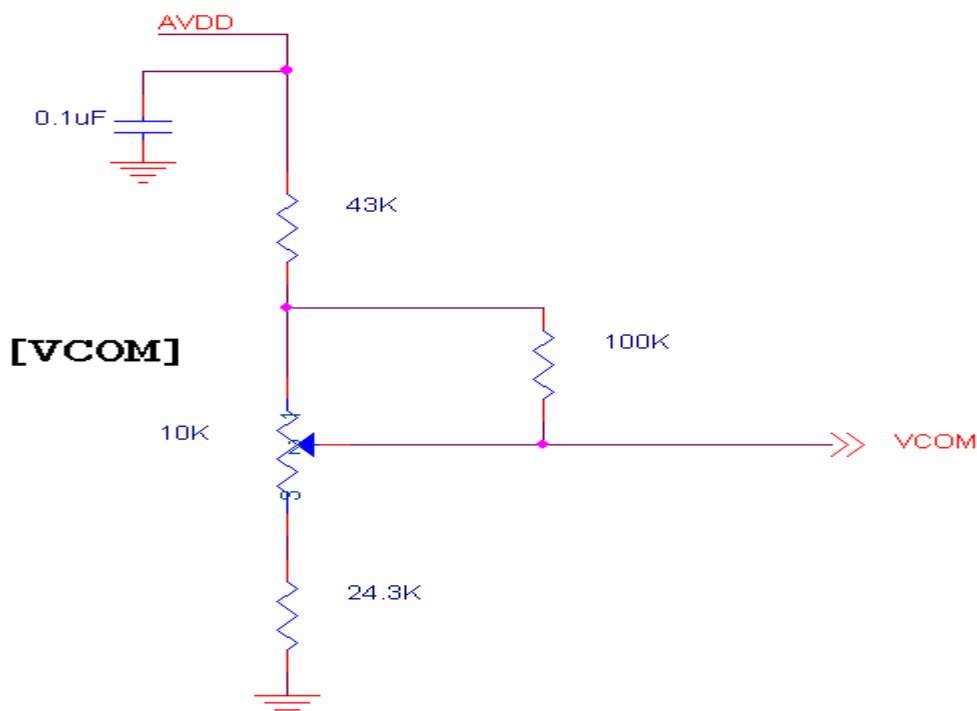
### DC CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Power voltage	VDD	2.3	2.5	2.7	V
	AVDD	8.0	8.2	8.4	V
	VGH	21.7	22	22.3	V
	VGL	-7.3	-7	-6.7	V
Input signal voltage	VCOM	3.0	3.3	3.6	V
Input voltage 'H' level	V <sub>IH</sub>	0.8VDD	-	VDD	V
Input voltage 'L' level	V <sub>IL</sub>	0	-	0.2VDD	V

Note 1:Be sure to apply VDD and VGL to the LCD first, and then apply VGH.

Note 2:VDD setting should match the signals output voltage (refer to Note 3)of customer's system board.

Note 3:Typical VCOM is only a reference value, it must be optimized according to each LCM. Be sure to use VR.



## ■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Forward voltage	Vf	8.7	9.3	9.9	V	Note 1
Forward current	If	180	200	220	mA	
Operating life time	-	15000	20000	-	Hrs	Note 2

Note 1: The LED supply voltage is defined by the number of LED at Ta=25°C and If=200mA.

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25 and If=200mA. The LED lifetime could be decreased if operating If is larger than 200mA.

## ■ ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time	Tr+Tf	θ=0° ∅=0° Ta=25°C	-	25	50	ms	FIG 1.	4
Contrast ratio	Cr		600	800	-	---	FIG 2.	1
Luminance uniformity	δ WHITE		70	75	-	%	FIG 2.	3
Surface Luminance	Lv		300	350	-	cd/m <sup>2</sup>	FIG 2.	2
Viewing angle range	θ	∅ = 90°	75	85	-	deg	FIG 3.	6
		∅ = 270°	75	85	-	deg	FIG 3.	
		∅ = 0°	75	85	-	deg	FIG 3.	
		∅ = 180°	75	85	-	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	-	-	-	FIG 2.	5	
		y	-	-	-			
	Green	x	-	-	-			
		y	-	-	-			
	Blue	x	-	-	-			
		y	-	-	-			
	White	x	0.26	0.31	0.36			
		y	0.28	0.33	0.28			

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

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

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

$$L_v = \text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}$$

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.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

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 contrast 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.

FIG. 1 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

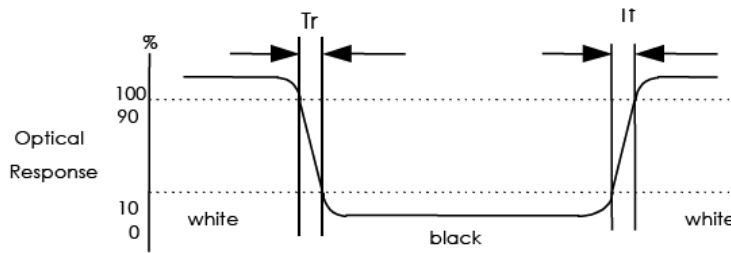


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity

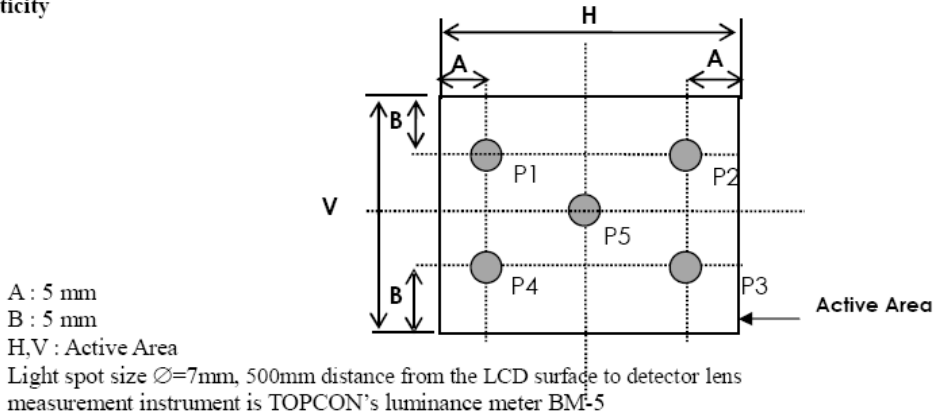
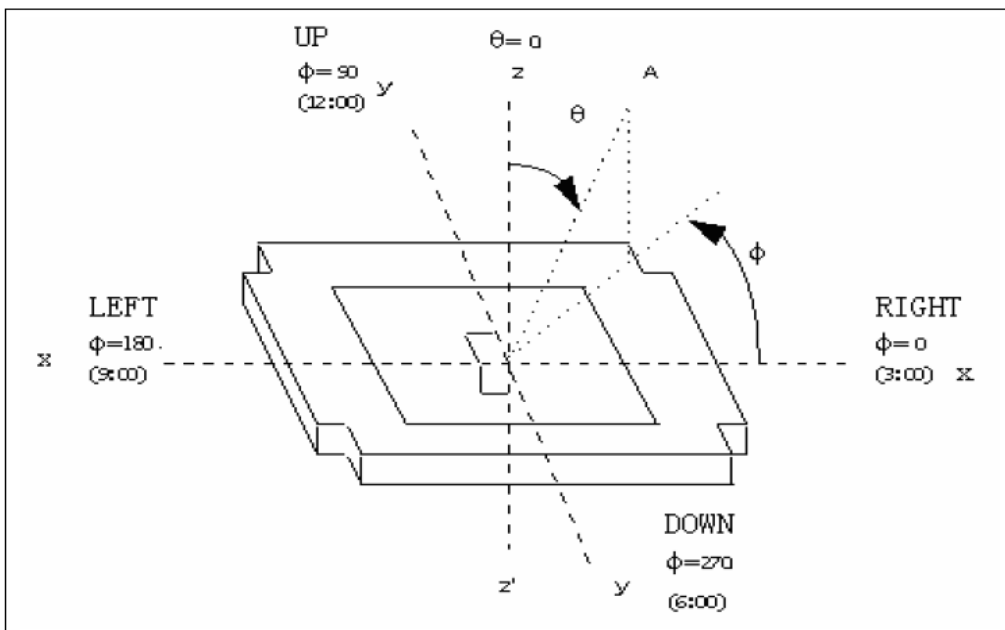


FIG. 3 The definition of viewing angle





## ■ INTERFACE DESCRIPTION

A 40pin connector is used for the module electronics interface. The recommended model is F62240-H1210A manufactured by Vigorconn.

Pin No.	Symbol	I/O	Function	Remark
1	VCOM	P	Common Voltage	
2	VDD	P	Power Supply	
3	VDD	P	Power Supply	
4	NC	---	No connection	
5	NC	---	No connection	
6	NC	---	No connection	
7	GND	P	Ground	
8	Rxin0-	I	-LVDS Differential Data Input	R0-R5, G0
9	Rxin0+	I	+LVDS Differential Data Input	
10	GND	P	Ground	
11	Rxin1-	I	-LVDS Differential Data Input	G1~G5, B0,B1
12	Rxin1+	I	+LVDS Differential Data Input	
13	GND	P	Ground	
14	Rxin2-	I	-LVDS Differential Data Input	B2-B5,HS,VS, DE
15	Rxin2+	I	+LVDS Differential Data Input	
16	GND	P	Ground	
17	RxCLK-	I	-LVDS Differential Clock Input	LVDS CLK
18	RxCLK+	I	+LVDS Differential Clock Input	
19	GND	P	Ground	
20	Rxin3-	I	-LVDS Differential Data Input	R6, R7, G6, G7, B6, B7
21	Rxin3+	I	+LVDS Differential Data Input	
22	GND	P	Ground	
23	NC	---	No connection	
24	NC	---	No connection	
25	GND	P	Ground	
26	NC	---	No connection	

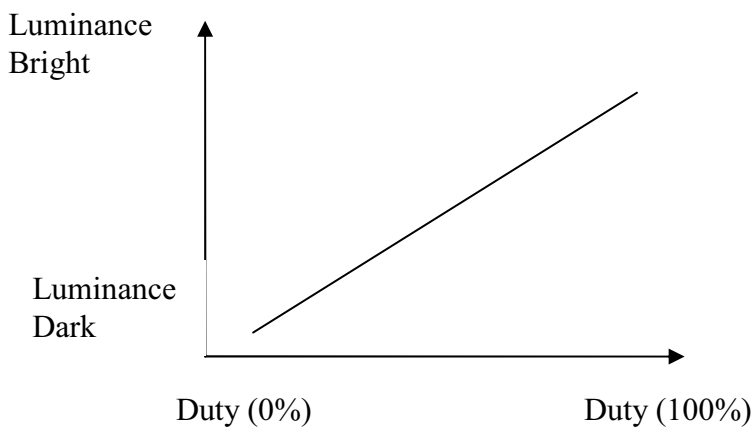
27	LED_PWM	O	CABC controller signal output for backlight	Note2
28	NC	---	No connection	
29	AVDD	P	Power for Analog Circuit	
30	GND	P	Ground	
31	LED-	P	LED Cathode	
32	LED-	P	LED Cathode	
33	NC	---	No connection	
34	NC	---	No connection	
35	VGL	P	Gate OFF Voltage	
36	NC	---	No connection	
37	CABC_EN	I	CABC Enable Input	Note1
38	VGH	P	Gate ON Voltage	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

I: input, O: output, P: Power

Note1: The setting of CABC function are as follows.

Pin	Enable	Disable
CABC_EN	High Voltage	Low Voltage or open

Note2: LED\_PWM is used to adjust backlight brightness.

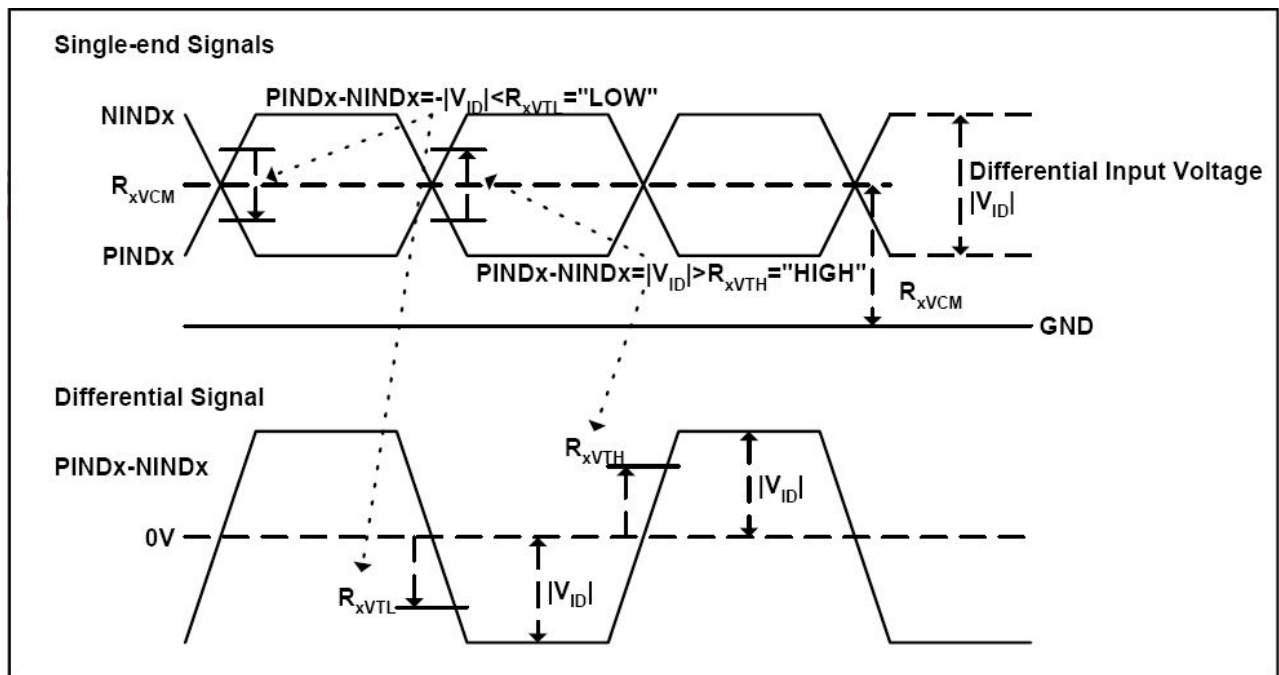


## ■ APPLICATION NOTES

### 1 LVDS SIGNAL TIMING CHARACTERISTICS

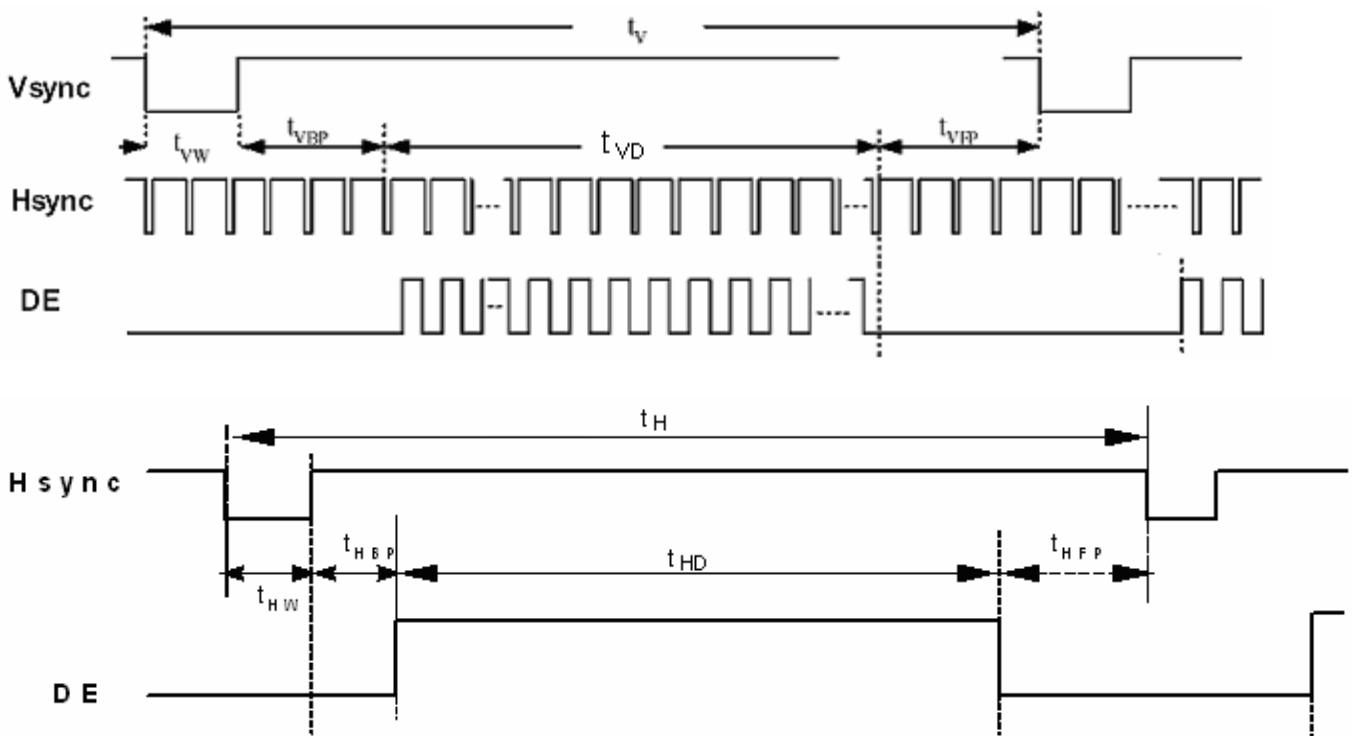
#### 1.1 AC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LVDS Differential input high Threshold voltage	$R_{xVTH}$	-	-	+100	mV	$R_{xVCM}=1.2V$
LVDS Differential input low Threshold voltage	$R_{xVTL}$	-100	-	-	mV	
LVDS Differential input common mode voltage	$R_{xVCM}$	0.7	-	1.6	V	
LVDS Differential voltage	$ V_{ID} $	100	-	600	mV	

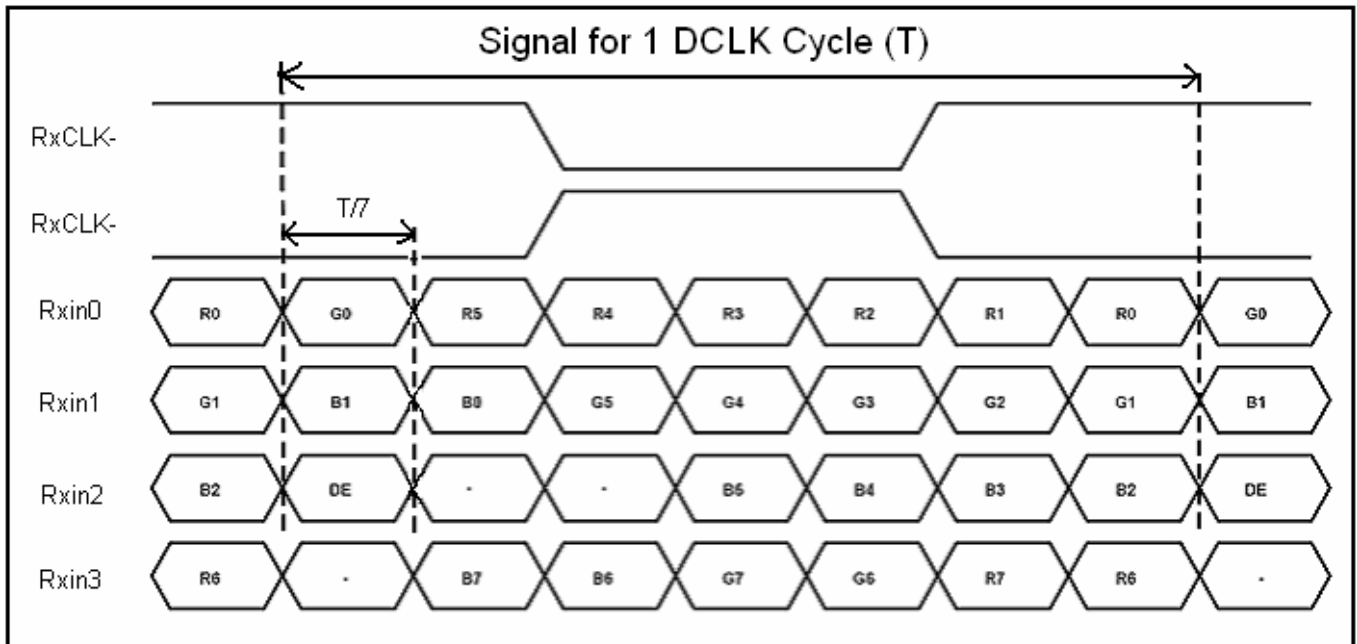


## 1.2 TIMING TABLE

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Clock Frequency	1/Tc	(68.9)	71.1	(73.4)	MHz	Frame rate =60Hz
Horizontal display area	t <sub>HD</sub>	1280			Tc	
HS period time	t <sub>H</sub>	(1410)	1440	(1470)	Tc	
HS Width +Back Porch +Front Porch	t <sub>HW</sub> + t <sub>HBP</sub> +t <sub>HFP</sub>	(60)	160	(190)	Tc	
Vertical display area	t <sub>VD</sub>	800			t <sub>H</sub>	
VS period time	t <sub>V</sub>	(815)	823	(833)	t <sub>H</sub>	
VS Width +Back Porch +Front Porch	t <sub>VW</sub> + t <sub>VBP</sub> +t <sub>VFP</sub>	(15)	23	(33)	t <sub>H</sub>	

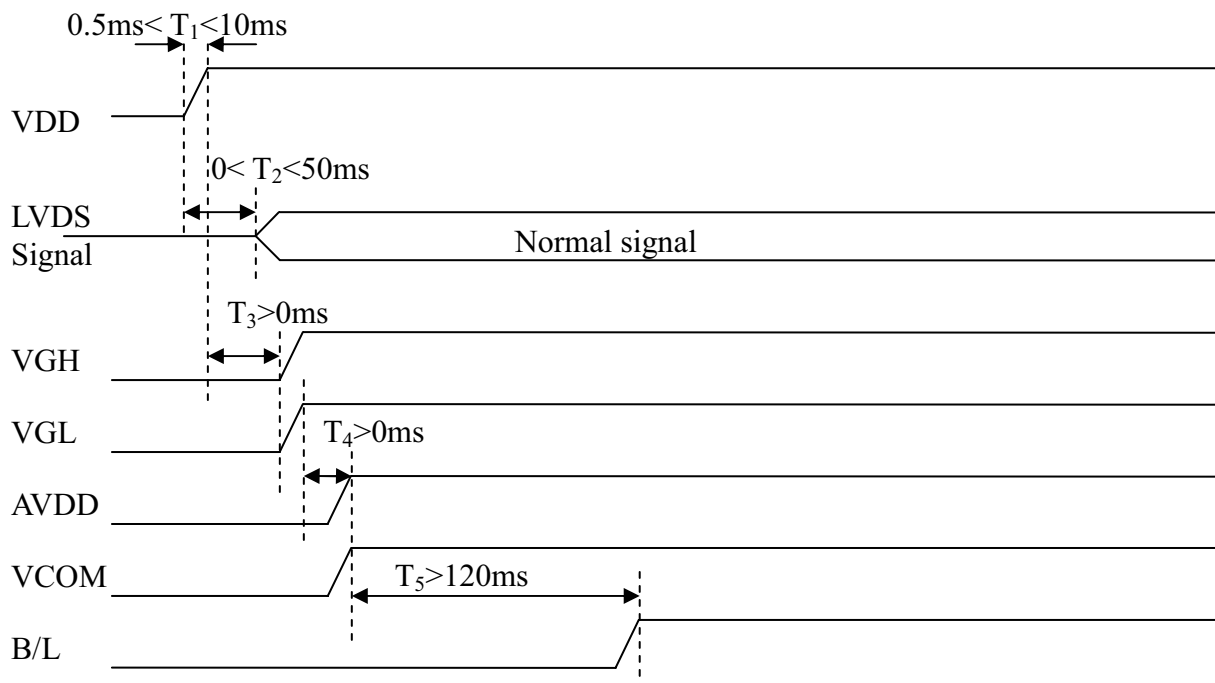


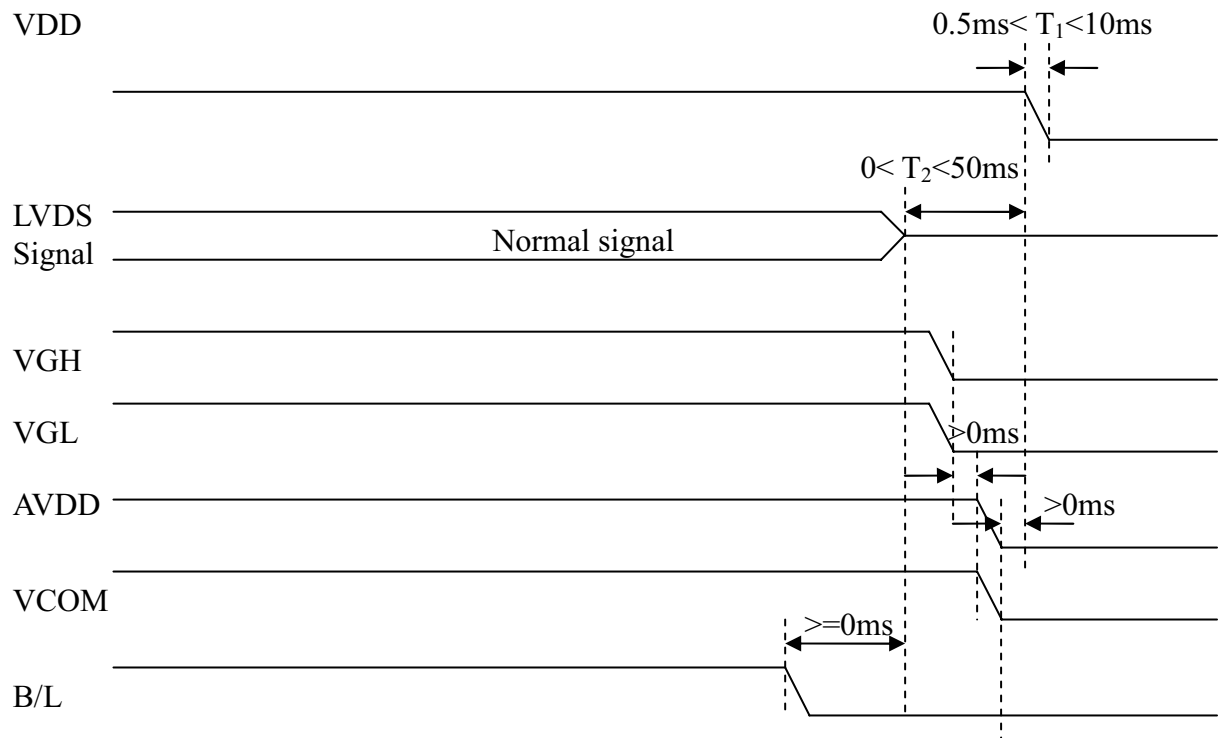
1.3 LVDS DATA INPUT FORMAT



2. POWER SEQUENCE

a. Power on:



**b. Power off:**

## ■ RELIABILITY TEST

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	$60 \pm 2^\circ\text{C}/120$ hours	Note 1,Note 4
2	Low Temperature Storage	$-20 \pm 2^\circ\text{C}/120$ hours	Note 1,Note 4
3	High Temperature Operating	$50 \pm 2^\circ\text{C}/120$ hours	Note 2,Note 4
4	Low Temperature Operating	$0 \pm 2^\circ\text{C}/120$ hours	Note 1,Note 4
5	Temperature Cycle	$-20 \pm 2^\circ\text{C} \sim 25 \sim 60 \pm 2^\circ\text{C} \times 100$ cycles	Note 4
6	Damp Proof Test	$40^\circ\text{C} \pm 5^\circ\text{C} \times 90\% \text{RH}/120$ hours	Note 4
7	Vibration Test	Frequency range: 10Hz~55Hz Stroke: 1.5mm, Sweep: 10Hz~55Hz~10Hz 2hours for each direction of X,Y,Z. (6 hours for total)	
8	Mechanical Shock	100G 6ms, $\pm X, \pm Y, \pm Z$ 3times for each direction	
9	Package Drop Test	Height: 60 cm 1 corner, 3 edges, 6 surfaces	
10	Package Vibration Test	Random Vibration : ISTA-3A 1Hz~200Hz, Grms=0.53 Half hours for direction of Z.	
11	ESD test	$\pm 2\text{KV}$ , Human Body Mode, 100pF, /1500 $\Omega$	

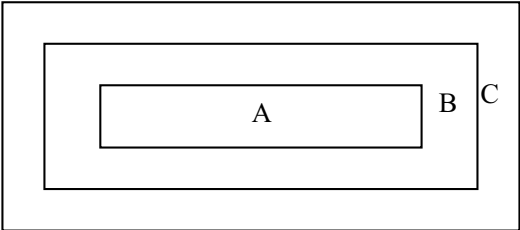
Note 1:  $T_a$  is the ambient temperature of samples.

Note 2:  $T_s$  is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 4: Before cosmetic and function tests, the product must have enough recovery time, at least 2 hours at room temperature.

**■ INSPECTION CRITERION**

OUTGOING QUALITY STANDARD	PAGE 1 OF 6
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product
<p>This specification is made to be used as the standard acceptance/rejection criteria for minimum 4.3 ” Color mobile phone LCM.</p> <p><b>1 Sample plan</b></p> <p>Sampling plan according to GB/T2828.1-2003/ISO 2859-1 : 1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:</p> <p style="padding-left: 40px;">Major defect: AQL 0.65</p> <p style="padding-left: 40px;">Minor defect: AQL 1.5</p> <p><b>2. Inspection condition</b></p> <p>Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.</p> <p><b>3. Definition of inspection zone in LCD</b></p> <div style="text-align: center; margin: 20px 0;">  </div> <p>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)</p> <p>Fig.1 Inspection zones in an LCD.</p> <p>Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer’s product.</p>	



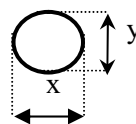
OUTGOING QUALITY STANDARD	PAGE 2 OF 6
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product

**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																				
For dark/white spot, size $\Phi$ is defined as $\Phi = \frac{(x+y)}{2}$																							
																							
4.2.1	Clear Spots  Black and white Spot defect Pinhole, Foreign Particle, Dirt under polarizer	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th rowspan="2">Zone Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.1</math></td> <td colspan="2">Ignore</td> <td rowspan="4" style="text-align: center;">Ignore</td> </tr> <tr> <td><math>0.10 &lt; \Phi \leq 0.20</math></td> <td colspan="2">2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.25</math></td> <td colspan="2">1</td> </tr> <tr> <td><math>0.25 &lt; \Phi</math></td> <td colspan="2">0</td> </tr> </tbody> </table>	Zone Size(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore		Ignore	$0.10 < \Phi \leq 0.20$	2		$0.20 < \Phi \leq 0.25$	1		$0.25 < \Phi$	0		Minor
Zone Size(mm)	Acceptable Qty																						
	A	B	C																				
$\Phi \leq 0.1$	Ignore		Ignore																				
$0.10 < \Phi \leq 0.20$	2																						
$0.20 < \Phi \leq 0.25$	1																						
$0.25 < \Phi$	0																						



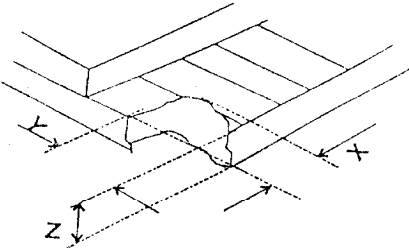
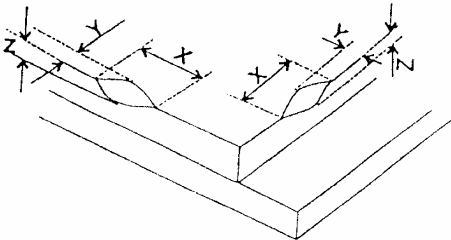
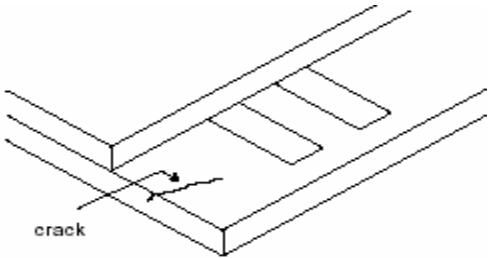
OUTGOING QUALITY STANDARD	PAGE 3 OF 6
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product

Item No	Items to be inspected	Inspection Standard	Classification of defects																														
4.2.1	Dim Spots Circle shaped and dim edged defects	<table border="1"> <thead> <tr> <th rowspan="2">Zone Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.2</math></td> <td colspan="2">Ignore</td> <td rowspan="4">Ignore</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.40</math></td> <td colspan="2">2</td> </tr> <tr> <td><math>0.40 &lt; \Phi \leq 0.60</math></td> <td colspan="2">1</td> </tr> <tr> <td><math>0.60 &lt; \Phi</math></td> <td colspan="2">0</td> </tr> </tbody> </table>	Zone Size(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore		Ignore	$0.20 < \Phi \leq 0.40$	2		$0.40 < \Phi \leq 0.60$	1		$0.60 < \Phi$	0		Minor										
Zone Size(mm)	Acceptable Qty																																
	A	B	C																														
$\Phi \leq 0.2$	Ignore		Ignore																														
$0.20 < \Phi \leq 0.40$	2																																
$0.40 < \Phi \leq 0.60$	1																																
$0.60 < \Phi$	0																																
4.2.2	Line defect Black line, White line, Foreign material under polarizer	<table border="1"> <thead> <tr> <th colspan="2">Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th rowspan="2">L(Length)</th> <th rowspan="2">W(Width)</th> <th colspan="3">Zone</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>Ignore</td> <td><math>W \leq 0.02</math></td> <td colspan="2">Ignore</td> <td rowspan="4">Ignore</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.02 &lt; W \leq 0.03</math></td> <td colspan="2">2</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="2">1</td> </tr> <tr> <td></td> <td><math>0.05 &lt; W</math></td> <td colspan="2">Define as spot defect</td> </tr> </tbody> </table>	Size(mm)		Acceptable Qty			L(Length)	W(Width)	Zone			A	B	C	Ignore	$W \leq 0.02$	Ignore		Ignore	$L \leq 5.0$	$0.02 < W \leq 0.03$	2		$L \leq 3.0$	$0.03 < W \leq 0.05$	1			$0.05 < W$	Define as spot defect		Minor
Size(mm)		Acceptable Qty																															
L(Length)	W(Width)	Zone																															
		A	B	C																													
Ignore	$W \leq 0.02$	Ignore		Ignore																													
$L \leq 5.0$	$0.02 < W \leq 0.03$	2																															
$L \leq 3.0$	$0.03 < W \leq 0.05$	1																															
	$0.05 < W$	Define as spot defect																															

OUTGOING QUALITY STANDARD		PAGE 4 OF 6																																		
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		MDS Product																																		
Item No	Items to be inspected	Inspection Standard	Classification of defects																																	
4.2.3	Polarizer scratch	<p>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.</p> <p>If the Polarizer scratch can be seen only in non-operating condition or some special angle, judge by the following.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2">Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th rowspan="2">L(Length)</th> <th rowspan="2">W(Width)</th> <th colspan="3">Zone</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Ignore</td> <td style="text-align: center;"><math>W \leq 0.03</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>5.0 &lt; L \leq 10.0</math></td> <td style="text-align: center;"><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="3" style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;"><math>L \leq 5.0</math></td> <td style="text-align: center;"><math>0.05 &lt; W \leq 0.08</math></td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td></td> <td style="text-align: center;"><math>0.08 &lt; W</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table>	Size(mm)		Acceptable Qty			L(Length)	W(Width)	Zone			A	B	C	Ignore	$W \leq 0.03$	Ignore			$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2			$L \leq 5.0$	$0.05 < W \leq 0.08$	1				$0.08 < W$	0			Minor
Size(mm)		Acceptable Qty																																		
L(Length)	W(Width)	Zone																																		
		A	B	C																																
Ignore	$W \leq 0.03$	Ignore																																		
$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2																																		
$L \leq 5.0$	$0.05 < W \leq 0.08$	1																																		
	$0.08 < W$	0																																		
4.2.4	Polarize Air bubble	<p>Air bubbles between glass &amp; polarizer</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th rowspan="2">2. Zone Size(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><math>\Phi \leq 0.2</math></td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;"><math>0.20 &lt; \Phi \leq 0.30</math></td> <td colspan="3" style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;"><math>0.30 &lt; \Phi \leq 0.50</math></td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;"><math>0.50 &lt; \Phi</math></td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table>	2. Zone Size(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.20 < \Phi \leq 0.30$	2			$0.30 < \Phi \leq 0.50$	1			$0.50 < \Phi$	0			Minor										
2. Zone Size(mm)	Acceptable Qty																																			
	A	B	C																																	
$\Phi \leq 0.2$	Ignore																																			
$0.20 < \Phi \leq 0.30$	2																																			
$0.30 < \Phi \leq 0.50$	1																																			
$0.50 < \Phi$	0																																			

OUTGOING QUALITY STANDARD	PAGE 5 OF 6
---------------------------	-------------

TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	MDS Product
---	-------------

Item No	Items to be inspected	Inspection Standard	Classification of defects						
4.2.5	Glass defect	<p>(i) Chips on corner</p>  <table border="1" style="margin: 10px auto;"> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Z</td> </tr> <tr> <td style="text-align: center;"><math>\leq 2.0</math></td> <td style="text-align: center;"><math>\leq S</math></td> <td style="text-align: center;">Disregard</td> </tr> </table> <p>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.</p>	X	Y	Z	$\leq 2.0$	$\leq S$	Disregard	Minor
		X	Y	Z					
		$\leq 2.0$	$\leq S$	Disregard					
<p>(ii) Usual surface cracks</p>  <table border="1" style="margin: 10px auto;"> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Z</td> </tr> <tr> <td style="text-align: center;"><math>\leq 5.0</math></td> <td style="text-align: center;">&lt; Inner border line of the seal</td> <td style="text-align: center;">Disregard</td> </tr> </table>	X	Y	Z	$\leq 5.0$	< Inner border line of the seal	Disregard	Minor		
X	Y	Z							
$\leq 5.0$	< Inner border line of the seal	Disregard							
<p>(iii) Crack</p> <p>Cracks tend to break are not allowed.</p> 	Major								



OUTGOING QUALITY STANDARD		PAGE 6 OF 6	
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA		MDS Product	
Item No	Items to be inspected	Inspection Standard	Classification of defects
4.2.6	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
4.2.7	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

### Handling Precautions

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

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

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

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

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

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

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

- Water
- Ketone
- Aromatic solvents

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

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

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

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

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

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

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

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

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

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

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

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

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

### **Storage Precautions**

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

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- (3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

### **Others**

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

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

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

- Exposed area of the printed circuit board.
- Terminal electrode sections.

## 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:

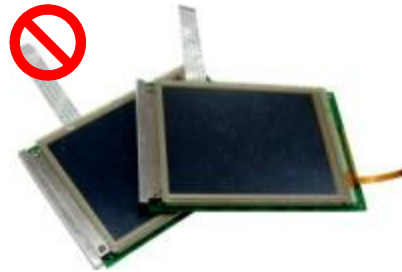


As above picture, please handle with anti-static gloves around LCM edges.

### 2.3 Incorrect handling:



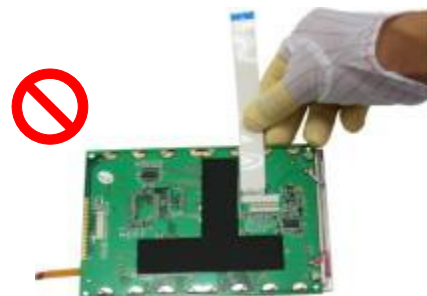
Please don't touch IC directly.



Please don't stack LCM.



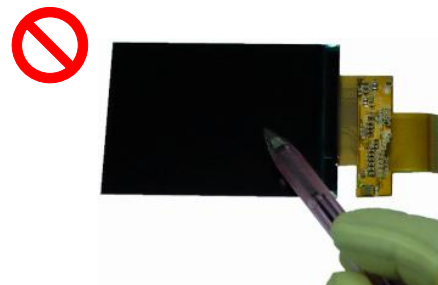
Please don't hold the surface of panel.



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 Transportation Precautions

- 3.2.1 During shipment, please handle with care. The packaging bag can not be broken, step on trap. Packaging Carton layer height can not be over two meters.
- 3.2.2 The transportation process should pay attention to the waterproof and moisture-proof measures. Product can not be watering. Ethylene sealed bags can not be unsealed.

3.3 Others

- 3.3.1 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.
- 3.3.2 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.
- 3.3.3 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.
  - 3.3.3.1 - Exposed area of the printed circuit board.
  - 3.3.3.2 -Terminal electrode sections.

#### 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 : 4-8 mm/s.	300°C ~330°C. Time : 3-6S. Press: 0.8~1.2Mpa
RoHS Product	340°C ~370°C. Time : 3-5S.	350°C ~370°C. Time : 4-8 mm/s.	330°C ~360°C. Time : 3-6S. Press: 0.8~1.2Mpa

- 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.