

# DMT101H4HLCMU-1F

## PRODUCT SPECIFICATION

Version 1.3  
Sep 01, 2023



<i>Customer's Approval</i>	
<u>Signature</u>	<u>Date</u>

Prepared by *Yvette Hsieh*  
Approved by *Eric Wan*

## Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
1.0	Jun 13, 2023	Initial Release	Yvette Hsieh
1.1	Jun 29, 2023	Changed LCD panel	Yvette Hsieh
1.2	Aug 07, 2023	Add p.6 FW Version, modified p.7 weight, 3.2.1 DE Electrical Characteristics, P.12 No.6, 3.5.3 Timing Table, 5.1 Optical Characteristics.	Yvette Hsieh
1.3	Sep 01, 2023	Modify p.10 Normal mode current, p.12 VBUS function, p.16 timing table	Yvette Hsieh

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# 1. General Description

## 1.1 Introduction

This is a 10.1" size colour active matrix TFT LCD module that uses amorphous silicon TFT as a switching device. The display is normally black mode, transmissive, and featuring high contrast and excellent colour saturation. The resolution of the TFT-LCD is 1280 x 800 and can display up to 16.7M colours. The display module supports 8BIT LVDS interface and optical bonding touch panel.

## 1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	10.1" Diagonal
Display Format	1280 x RGB x 800 Dots
No. of Colour	16.7M
Overall Dimensions	252.96 (W) x 171.60 (H) x 4.86 (D) mm
Active Area	216.96 (W) x 135.60 (H) mm
Mode	Normally Black / Transmissive
Surface Treatment	Glare, 6H
Viewing Direction	All round
Interface	8-BIT LVDS
Backlight Type	LED, White, 45 chips
Touch Panel	PCT
Touch Interface	I <sup>2</sup> C & USB
Touch Driver IC	EXC80W60
Bonding Type	Optical Bonding
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
ROHS	Compliant to RoHS 2.0

### 1.3 CTP Features

Item	Contents
Structure	G+G
Touch Mode	Multiple Touch
Touch Controller	EXC80W60
Interface	I <sup>2</sup> C & USB
FW Version	PCAP80H60_4083_v00_M01_00_C002_Easy-Touch_URI_DThqa.H60

## 2. Mechanical Specification

### 2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	1280 x RGB x 800	Dots
Overall Dimensions	252.96 (W) x 171.60 (H) x 4.86 (D)	mm
Active Area	216.96 (W) x 135.60 (H)	mm
Dot Pitch	0.0565 x 0.1695	mm
Weight	414	g
IC Controller/Driver	EXC80W60	



### 3. Electrical Specification

#### 3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Power Voltage	VDD	-0.5	4	V	-
	AVDD	-0.3	18	V	-
	VGH	-0.5	VGL+32	V	-
	VGL	-17	0.3	V	-
	VGH-VGL	12	32	V	-
Operating Temperature	T <sub>OP</sub>	-20	70	°C	-
Storage Temperature	T <sub>ST</sub>	-30	80	°C	-

**Note 1:** When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. For normal operations, it is desirable to use this module under the conditions according to Section 3.2 "Electrical Characteristics", to avoid malfunctioning.

**Note 2:** Background colour changes slightly depending on ambient temperature. This phenomenon is reversible.

**Note 3:** Please refer to item of RELIABILITY.

## 3.2 Electrical Characteristics

### 3.2.1 DE Electrical Characteristics

Item	Symbol	Min	Typ.	Max	Unit
Power Voltage	VDD	2.3	3.3	3.6	V
	AVDD	8.0	8.2	8.4	V
	VGH	14.5	15.0	15.5	V
	VGL	-13.5	-13	-12.5	V
Normal Mode Current	IDD	26	31	36	mA
	IAVDD	17	22	27	mA
	IVGH	1.0	1.4	1.8	uA
	IVGL	1.0	1.4	1.8	uA
Level Input Voltage	VIH	0.7VDD	-	VDD	V
	VIL	GND	-	0.3VDD	V
Level Output Voltage	VOH	0.8VDD	-	VDD	V
	VOL	GND	-	0.2VDD	V

### 3.3 Interface Pin Assignment

#### 3.3.1 TFT PIN Definition

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

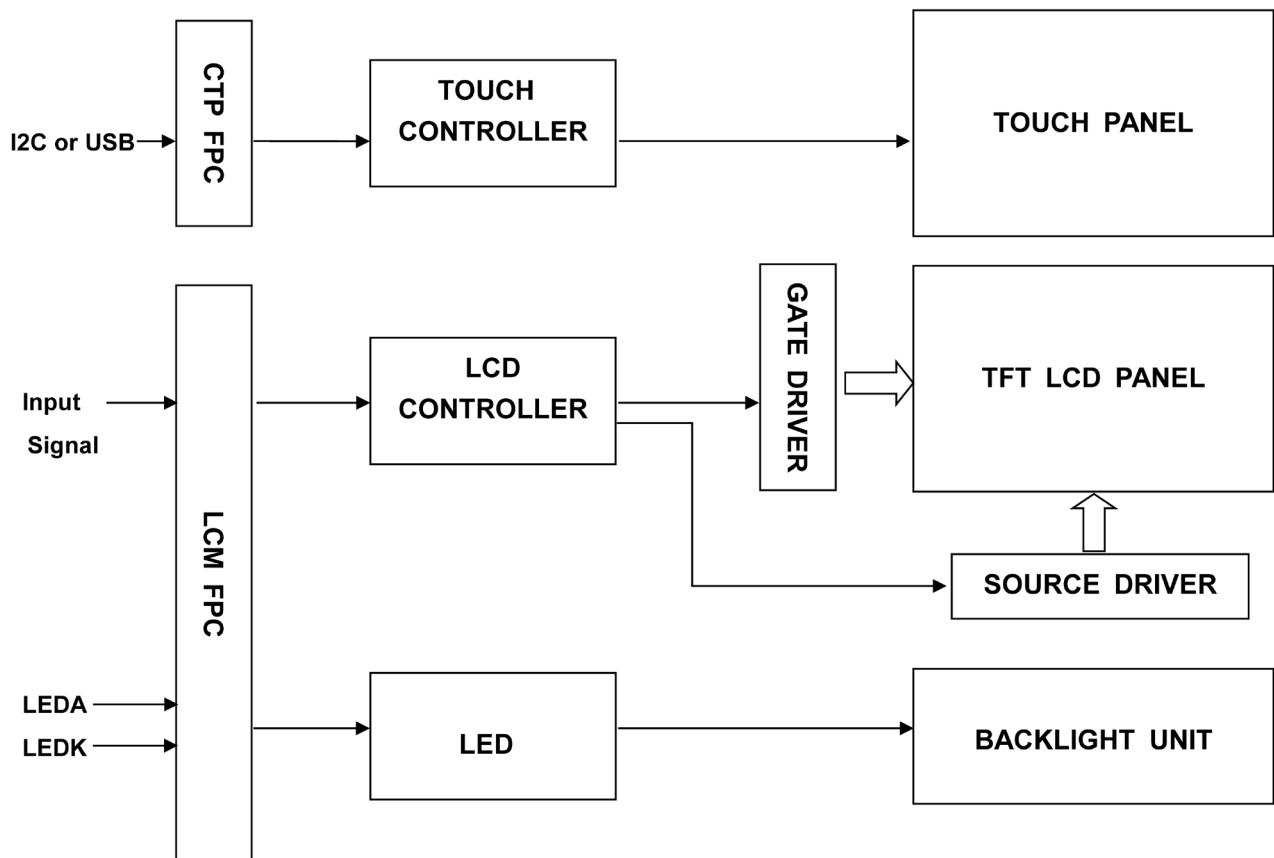
No.	Symbol	I/O	Function	Remark
1	NC	-	No Connection	-
2	VDD	P	Power Supply	-
3	VDD	P	Power Supply	-
4	NC	-	No Connection	-
5	NC	-	No Connection	-
6	NC	-	No Connection	-
7	GND	P	Ground	-
8	Rxin0-	I	-LVDS Differential Data Input	R0-R5,G0
9	Rxin0+	I	+LVDS Differential Data Input	
10	GND	P	Ground	-
11	Rxin1-	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	NC	-	No Connection	-
28	NC	-	No Connection	-
29	AVDD	P	Power for Analog Circuit	-

No.	Symbol	I/O	Function	Remark
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	NC	-	No Connection	-
38	VGH	P	Gate ON Voltage	-
39	LED+	P	LED Anode	-
40	LED+	P	LED Anode	-

### 3.3.2 CTP PIN Assignment

No.	Symbol	I/O	Function
1	PSEL (NC)	-	No Connection
2	VBUS	P	VBUS sensor input. The pin should be connected to USB 4.5~5.5V power supply. This pin must be floating or connected to VDD3 when USB Power is not adopted. A 1μF ceramic capacitor to ground is required.
3	DN	I/O	USB interface, D- signal.
4	DP	I/O	USB interface, D+ signal.
5	GND	P	Ground
6	IOVCC	P	I/O power supply voltage (I <sup>2</sup> C interface select)
7	VDD	P	Supply voltage (I <sup>2</sup> C interface select)
8	SCL	I	I <sup>2</sup> C clock input.
9	SDA	I/O	I <sup>2</sup> C data input and output
10	INT	I	External interrupt to the host
11	RESET	I	External Reset, Low is active.
12	SS	P	Ground (I <sup>2</sup> C interface select)

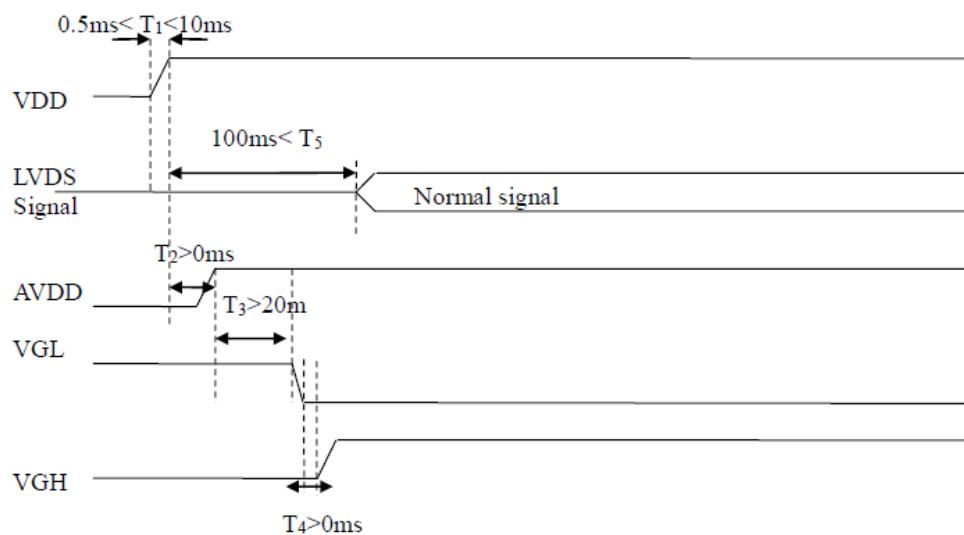
### 3.4 Block Diagram



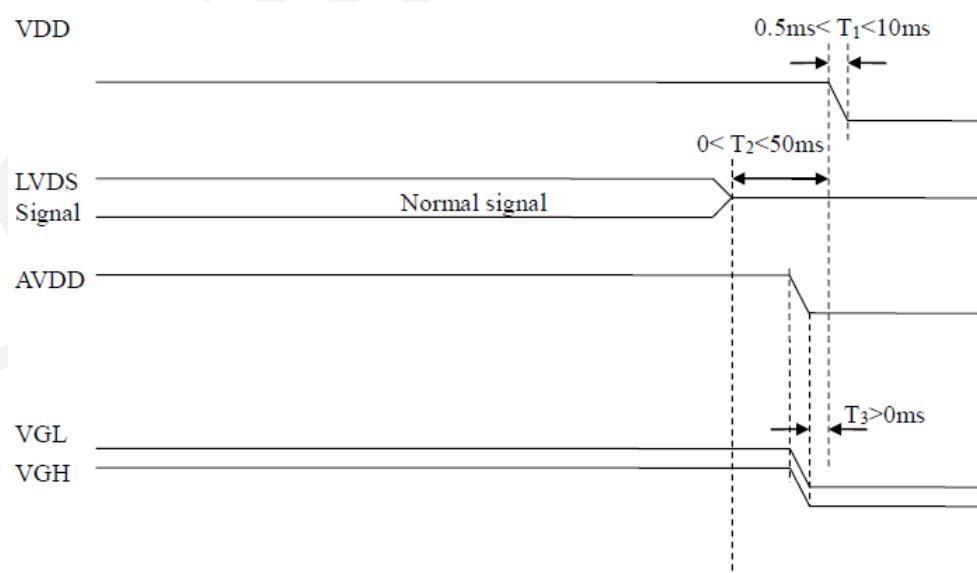
## 3.5 Timing Characteristics

### 3.5.1 Power Sequence

#### 3.5.1.1 Power on:



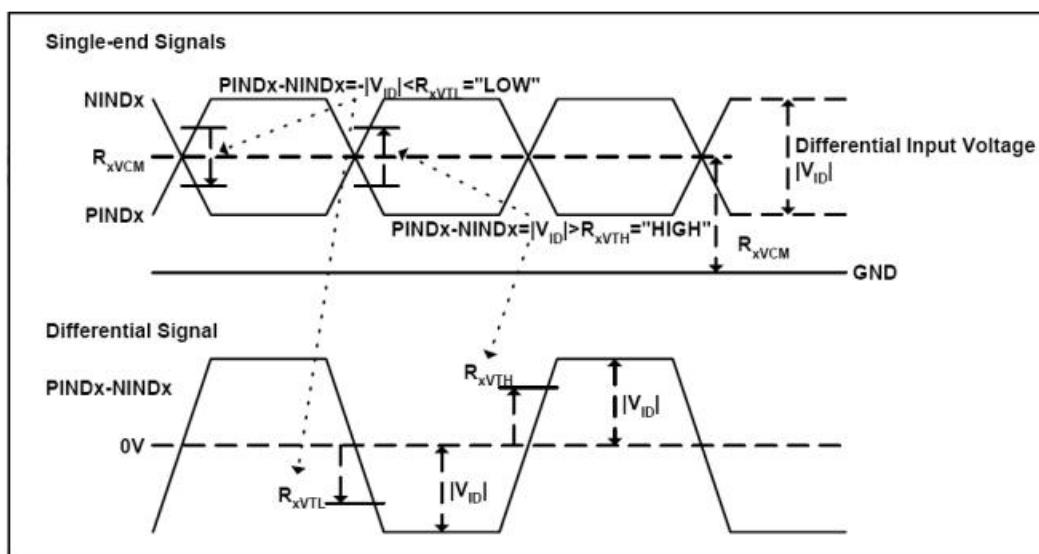
#### 3.5.1.2 Power off:



**Note:** VGH voltage is powered off before VGL or at the same time.

### 3.5.2 LVDS Signal Timing Characteristics

Symbol	Description	Condition	Min	Typ.	Max	Unit	Note
RxVTH	LVDS Differential Input High Threshold Voltage	-	-	-	100	mV	
RxVTL	LVDS Differential Input Low Threshold Voltage	-	-100	-	-	mV	RxVCM=1.2V
RxVCM	LVDS Differential Input Common Mode Voltage	-	0.7	-	1.6	V	-
VID	LVDS Differential Voltage	-	100	-	600	mV	-

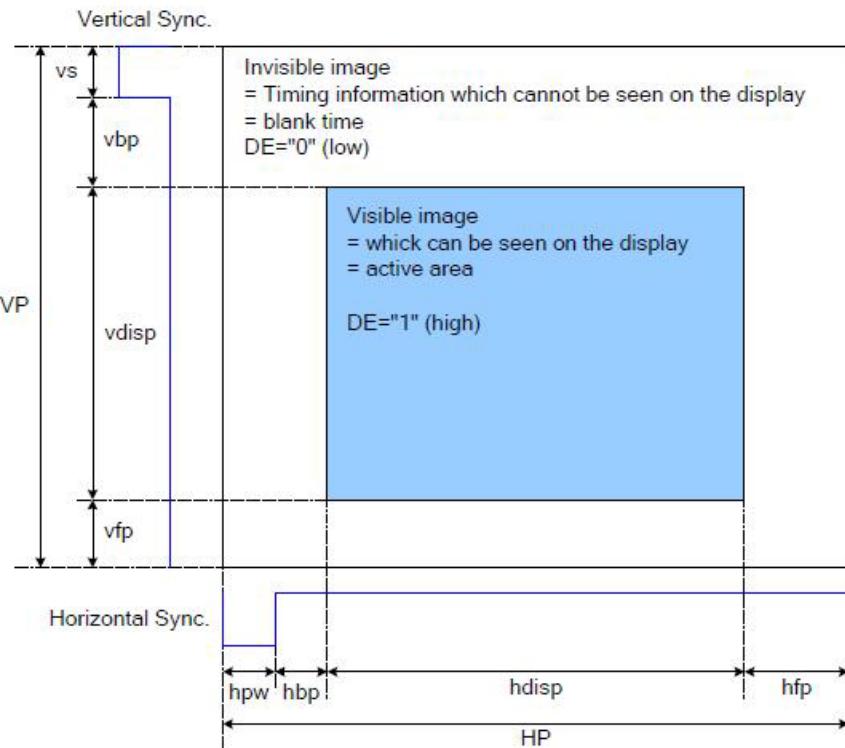


### 3.5.3 Timing Table

The display operation via the RGB interface is synchronized with the VSYNC, HSYNC, and DOTCLK signals.

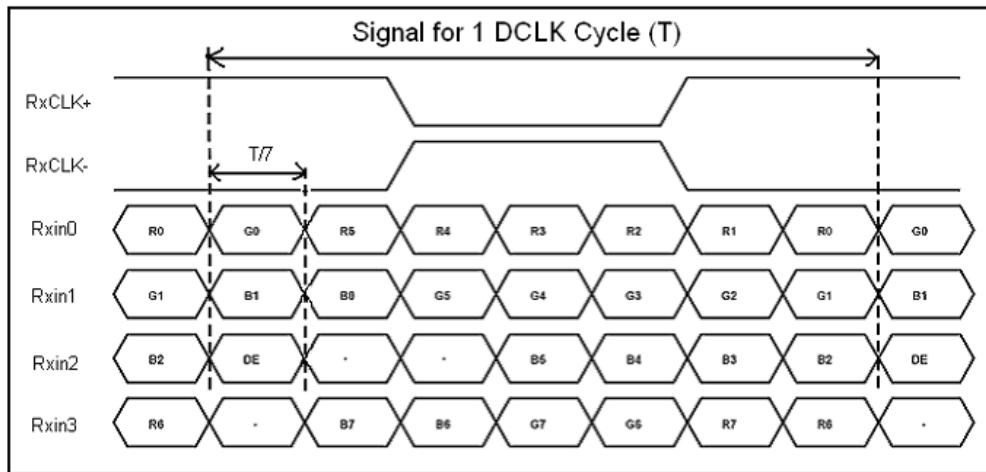
The data can be written only within the specified area with low power consumption by using window address function.

The back porch and front porch are used to set the RGB interface timing.



Item	Symbol	Min	Typ.	Max	Unit
DCLK Frequency	FCLK	66.3	72.4	78.9	MHz
Horizontal address	hdisp		1280		Clock
HSYNC period time	th	1380	1440	1500	Clock
HSYNC width	hpw	2	-	40	Clock
HSYNC back porch	hbp	88	88	88	Clock
HSYNC front porch	hfp	12	72	132	Clock
Vertical address	vdisp		800		Line
VSYNC period time	tv	824	838	872	Line
VSYNC width	vs	2	-	20	Line
VSYNC back porch	vbp	23	23	23	Line
VSYNC front porch	vfp	1	15	49	Line
Frame-Rate	FR	-	60	-	Hz

### 3.5.4 LVDS Data Input Format



## 4. Electrical Specification Touch

### 4.1 Electrical Characteristics

#### 4.1.1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage for I2C	VDD	-0.3	3.6	V	-
Power Supply Voltage for USB	VBUS	2.2	6	V	-
Operating Temperature	T <sub>OP</sub>	-20	+70	°C	-
Storage Temperature	T <sub>ST</sub>	-30	+80	°C	-

#### 4.1.2 DC Electrical Characteristics (Ta=25°C)

Item	Symbol	Min	Typ.	Max	Unit	Note
Power Supply Voltage for I2C	VDD	3.0	3.3	3.6	V	-
Power Supply Voltage for USB	VBUS	2.2	5	5.5	V	-
Operation Current	I <sub>OP</sub>	-	100	-	mA	Active Mode
Input Low Voltage	V <sub>IL1</sub>	0	-	0.3VDD	mA	-
Input High Voltage	V <sub>IH1</sub>	0.6VDD	-	VDD+0.5	mA	-
Hysteresis voltage	V <sub>HY</sub>	-	0.2VDD	-	uA	-
Input Low Voltage, XT_In	V <sub>IL2</sub>	0	-	0.6	mA	-
Input High Voltage, XT_In	V <sub>IH2</sub>	2.6	-	VDD+0.2	V	-
Negative going threshold/Reset	V <sub>ILS</sub>	0	-	0.2VDD	V	-
Positive going threshold/Reset	V <sub>IHS</sub>	0.6VDD	-	VDD+0.5	V	-
Output High Voltage	V <sub>OH</sub>	0.7VDD	-	-	V	VDD =3.3V, IOH=8mA
Output Low Voltage	V <sub>OL</sub>	-	-	0.3VDD	-	VDD =3.3V, IOL=10mA

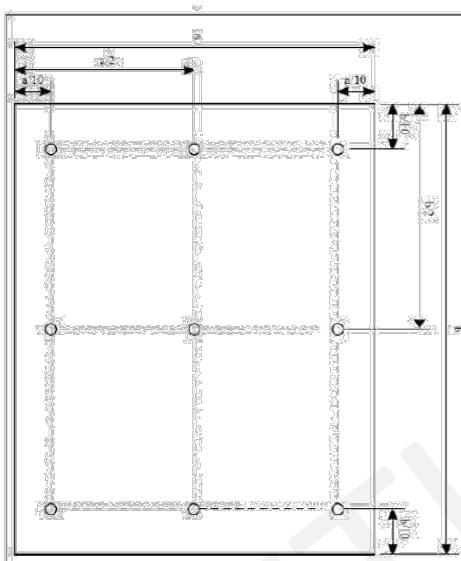
## 5. Optical Specification

### 5.1 Optical Characteristics

Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio	CR	$\theta = 0^\circ$		800	1000	-	-	1, 2
Response time	TR + TF	$25^\circ\text{C}$		-	35	50	msec	1, 3
Color Gamut	S (%)	-		-	47	-	%	-
Viewing Angle	Left	$\theta_x-$	$\text{CR} \geq 10$	75	85	-	Degree	1, 4
	Right	$\theta_x+$		75	85	-		
	Up	$\theta_y+$		75	85	-		
	Down	$\theta_y-$		75	85	-		
Colour Chromaticity	Red	Rx	$\theta = 0^\circ$	-0.04	0.594	+0.04	-	1, 4 CF-glass
		Ry			0.371			
	Green	Gx			0.335			
		Gy			0.564			
	Blue	Bx			0.151			
		By			0.122			
	White	Wx			0.330			
		Wy			0.370			
Luminance	U	$I_F = 300\text{mA}$		700	800	-	$\text{cd}/\text{m}^2$	5
Uniformity	Avg	-		80	-	-	%	5

Measuring Condition: in dark room, at ambient temperature =  $25 \pm 2^\circ\text{C}$ , 15 min. warm-up time

Note	Item	Test method
1	Definition of Viewing Angle	
2	Definition of Contrast Ratio (CR)	$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is at "white state"}}{\text{Luminance measured when LCD is at "black state"}}$
3	Definition of Response Time	
4	Definition of Optical Measurement Setup	

Note	Item	Test method
5	Definition of Luminance Uniformity	 <p>Uniformity = <math>\frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}</math></p> <p>Luminance = <math>\frac{\text{Total Luminance of 9 points}}{9}</math></p>

## 6. LED Backlight Specification

### 6.1 LED Backlight Characteristics

The back-light system is edge-lighting type with 45 chips LED.

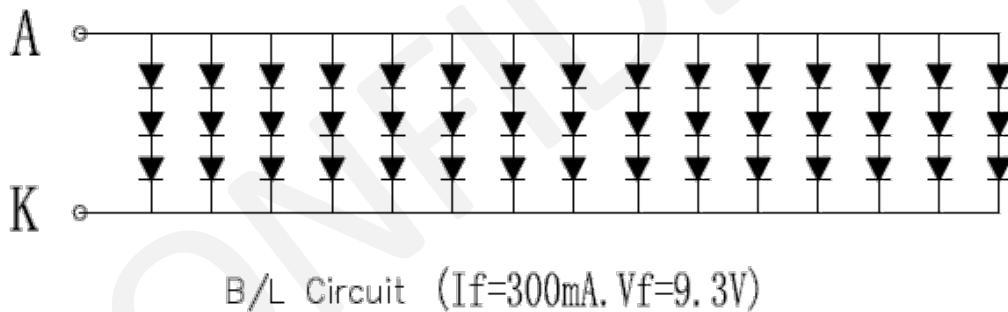
Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Voltage	Vf	-	-	9.6	-	V	-
Forward Current	IF	-	-	300	-	mA	-
LED Life Time	-	-	-	50000	-	Hour	1, 2

**Note 1:** LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

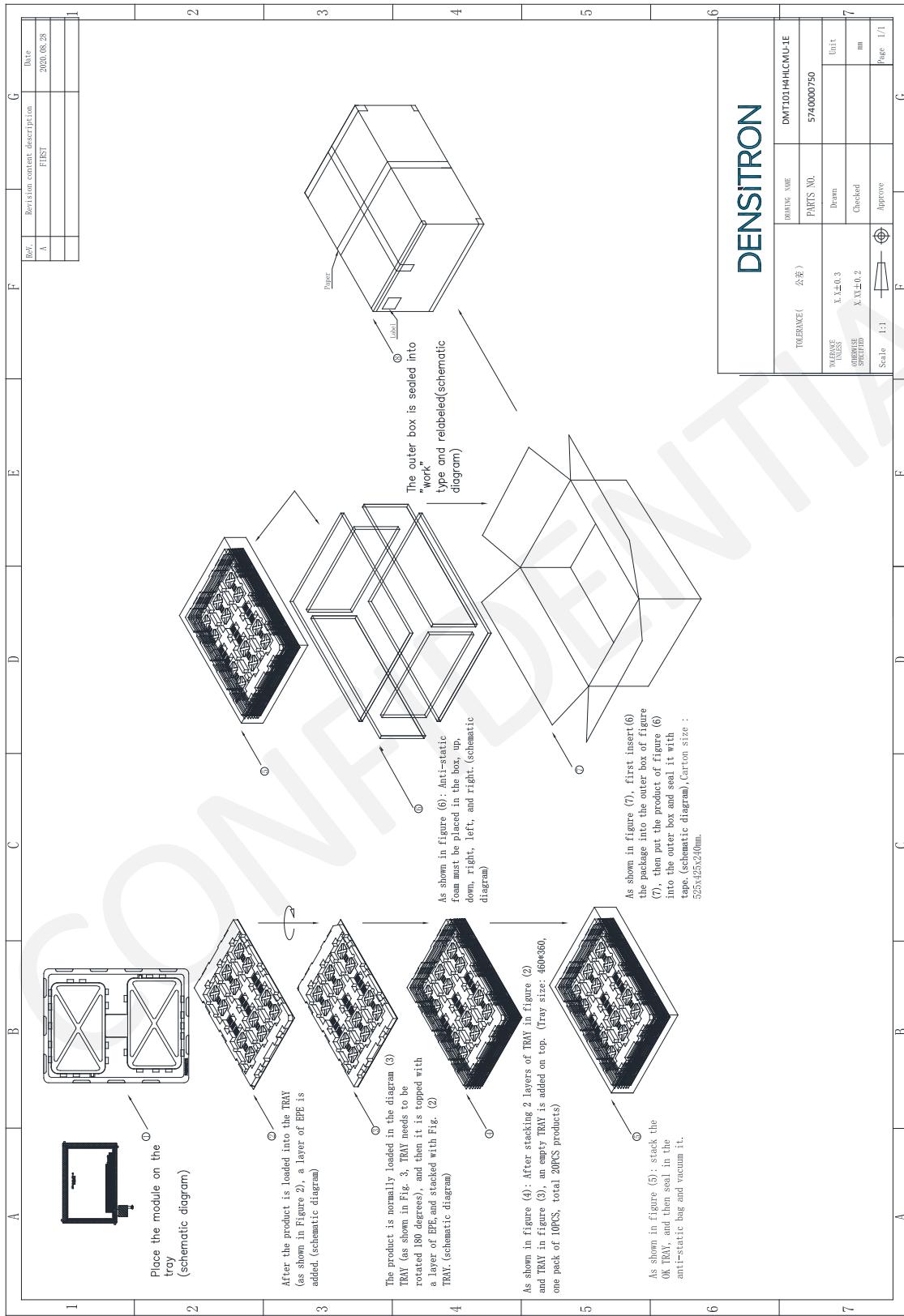
Ta=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

**Note 2:** The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=300mA. The LED lifetime could be decreased if operating IL is larger than 300mA. The constant current driving method is suggested.

### 6.2 INTERNAL CIRCUIT DIAGRAM



## 7. Packaging



## 8. Quality Assurance Specification

### 8.1 Conformity

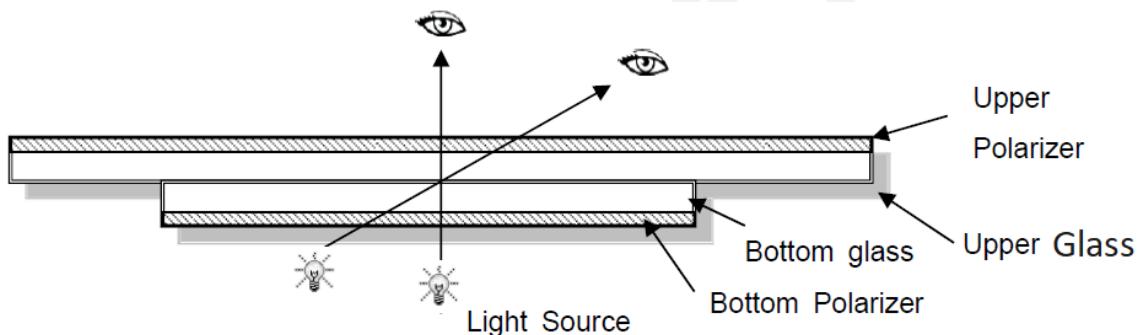
The performance, function and reliability of the shipped products conform to the Product Specification.

### 8.2 Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature:	25 ± 5°C
Humidity:	65% ± 10% RH
Viewing Angle	Normal viewing angle
Illumination:	Single fluorescent lamp (300 to 700Lux)
Viewing distance:	30 - 50cm

Finger glove (or finger cover) must be worn by the inspector.  
Inspection table or jig must be anti-electrostatic.

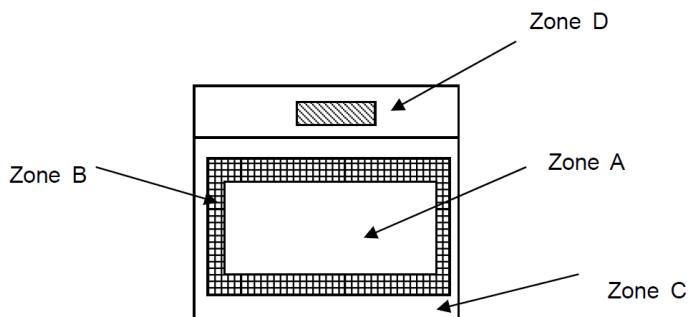


### 8.3 Delivery Assurance

#### 8.3.1 Delivery Inspection Standards

Class II, Normal Inspection, MIL-STD-105E

### 8.3.2 Zone Definition



Zone A: Effective Viewing Area (Character or Digit can be seen)

Zone B: Viewing Area except Zone A

Zone C: Outside (Zone A + Zone B) Area which cannot be seen after assembly by customer.

Zone D: IC Bonding Area

**Note:** Generally, visual defects in Zone C can be ignored when it doesn't affect product function or appearance after assembly by customer

### 8.3.3 Criteria & Acceptable Quality Level

Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.5	Defects in Cosmetic Check (Display Off)

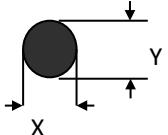
LCD: Liquid Crystal Display, TP: Touch Panel, LCM: Liquid Crystal Module

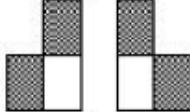
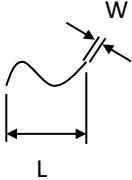
No.	Items	Criteria	Classification of defects
1	Functional defects	1) No display, open or miss line 2) Display abnormally 3) Backlight no lighting, abnormal lighting.	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	
5	Spot Line defect	Light dot, Dim spot, Polarizer Bubble; Polarizer accidented spot.	Minor
6	Soldering Appearance	Good soldering, peeling off is not allowed.	
7	LCD/Polarizer/CTP	Black/White spot/line, scratch, crack, etc.	

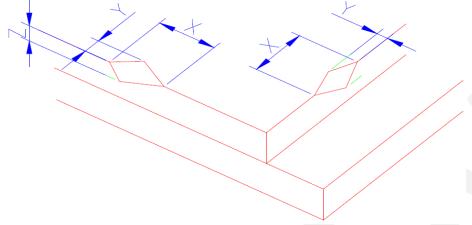
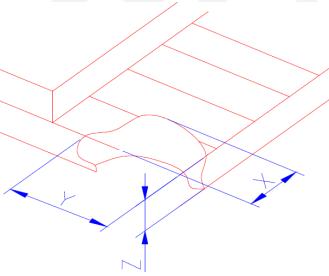
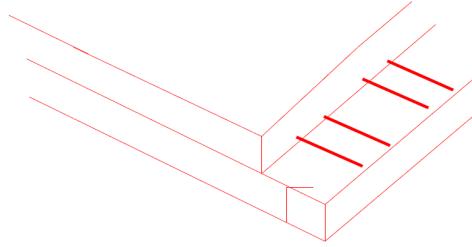
**Note 1:** Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

**Note 2:** Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

### 8.3.4 Criteria & Classification

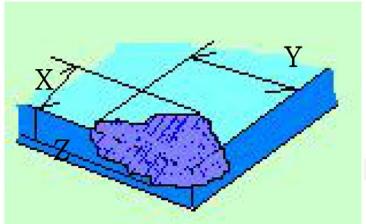
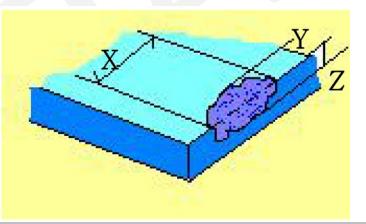
Class	Item	Criteria																									
		Round type: as per following drawing, $\varnothing = (X+Y)/2$																									
																											
	1) Light Dot (Black/white spot, pinhole, stain, etc.)	<table border="1"> <thead> <tr> <th rowspan="2">Size\Zone</th><th colspan="3">Acceptable Quantity</th></tr> <tr> <th>A</th><th>B</th><th>C</th></tr> </thead> <tbody> <tr> <td><math>\varnothing \leq 0.15</math></td><td colspan="2">Ignore</td><td rowspan="5">Ignore</td></tr> <tr> <td><math>0.15 &lt; \varnothing \leq 0.25</math></td><td colspan="3">3 (distance <math>\geq 10mm</math>)</td></tr> <tr> <td><math>0.25 &lt; \varnothing \leq 0.40</math></td><td colspan="3">2 (distance <math>\geq 10mm</math>)</td></tr> <tr> <td><math>0.4 &lt; \varnothing</math></td><td colspan="3">0</td></tr> </tbody> </table>			Size\Zone	Acceptable Quantity			A	B	C	$\varnothing \leq 0.15$	Ignore		Ignore	$0.15 < \varnothing \leq 0.25$	3 (distance $\geq 10mm$ )			$0.25 < \varnothing \leq 0.40$	2 (distance $\geq 10mm$ )			$0.4 < \varnothing$	0		
Size\Zone	Acceptable Quantity																										
	A	B	C																								
$\varnothing \leq 0.15$	Ignore		Ignore																								
$0.15 < \varnothing \leq 0.25$	3 (distance $\geq 10mm$ )																										
$0.25 < \varnothing \leq 0.40$	2 (distance $\geq 10mm$ )																										
$0.4 < \varnothing$	0																										
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	4) Pixel Bad Points (light dot, dim dot, colour dot)	<table border="1"> <thead> <tr> <th>Item</th><th>Zone A</th><th>Acceptable Qt</th></tr> </thead> <tbody> <tr> <td rowspan="3">Bright Dot</td><td>Random</td><td><math>N \leq 2</math></td></tr> <tr> <td>2 dots adjacent</td><td><math>N \leq 0</math></td></tr> <tr> <td>3 dots adjacent</td><td><math>N \leq 0</math></td></tr> <tr> <td rowspan="2">Dark Dot</td><td>Random</td><td><math>N \leq 3</math></td></tr> <tr> <td>2 dots adjacent</td><td><math>N \leq 0</math></td></tr> </tbody> </table>			Item	Zone A	Acceptable Qt	Bright Dot	Random	$N \leq 2$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	Dark Dot	Random	$N \leq 3$	2 dots adjacent	$N \leq 0$								
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Class	Item	Criteria		
		3 dots adjacent	N≤0	
	Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm	
		Total bright and dark dot	N≤4	
<b>Note:</b>				
A) Bright dot : Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.				
B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.				
C) 2 dot adjacent = 1 pair = 2 dots				
Picture:				
 <b>2 dot adjacent</b>  <b>2 dot adjacent</b>				
 <b>2 dot adjacent (vertical)</b>  <b>2 dot adjacent (slant)</b>				
5) Polarizer Bubble				
	Line Defect (LCD/ Polarizer backlight black/white line, scratch, stain)	Acceptable Quantity		
		A	B	C
		Ø≤0.2	Ignore	
		0.2<Ø≤0.4	2 (distance $\geq$ 10mm)	Ignore
		0.4<Ø	0	
Minor	Line Defect (LCD/ Polarizer backlight black/white line, scratch, stain)	Line type: as per following drawing		
			Length	Acceptable quantity

Class	Item	Criteria									
		Width		A	B	C					
		$W \leq 0.05$	Ignore	Ignore		Ignore					
		$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$							
		$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$							
		$0.08 < W$	Define as spot defect								
Minor	LCD Crack/Broken	<p>Symbols:            X: Length, Y: Width, Z: Height, L: Length of ITO, T: Height of LCD</p> <p>1) The edge of LCD broken: <math>X \leq 3.0\text{mm}</math>; <math>Y &lt; \text{Inner border line of the seal}</math>; <math>Z \leq T</math></p>  <p>2) LCD corner broken: <math>X \leq 3.0\text{mm}</math>; <math>Y \leq L</math>; <math>Z \leq T</math></p> 									
Major	LCD Crack	<p>The LCD with extensive crack is not acceptable.</p> 									
Major	Electronic Components SMT	<p>Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite</p>									

Class	Item	Criteria
Minor	Display colour & Brightness	<p>1) Colour: Measuring the colour coordinates in accordance with the datasheet or samples.</p> <p>2) Brightness: Measuring the brightness of white screen in accordance with the datasheet or samples.</p>
Minor	LCD Mura/Waving/ Hot Spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.

Class	Item	Criteria																																																																												
Minor	CTP Related	<p>1) CTP Cover Sensor Accidental Black/White Spot</p> <table border="1"> <thead> <tr> <th rowspan="2">Size\Zone</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\emptyset \leq 0.15</math></td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.15 &lt; \emptyset \leq 0.25</math></td> <td colspan="3">4 ( distance <math>\geq 10mm</math> )</td> </tr> <tr> <td><math>0.25 &lt; \emptyset \leq 0.35</math></td> <td colspan="3">3 ( distance <math>\geq 10mm</math> )</td> </tr> <tr> <td><math>0.35 &lt; \emptyset</math></td> <td colspan="3">1</td> </tr> </tbody> </table> <p>2) CTP Cover Scratch</p> <table border="1"> <thead> <tr> <th rowspan="2">Width</th> <th rowspan="2">Length</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 0.05</math></td> <td>Ignore</td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.06</math></td> <td><math>L \leq 4.0</math></td> <td colspan="3"><math>N \leq 3</math></td> </tr> <tr> <td><math>0.06 &lt; W \leq 0.08</math></td> <td><math>L \leq 3.0</math></td> <td colspan="3"><math>N \leq 2</math></td> </tr> <tr> <td><math>0.08 &lt; W</math></td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table> <p>3) CTP Cover Pinhole / Lack of ink</p> <table border="1"> <thead> <tr> <th rowspan="2">Size\Zone</th> <th colspan="2">Acceptable Qty</th> </tr> <tr> <th colspan="2">C</th> </tr> </thead> <tbody> <tr> <td><math>\emptyset \leq 0.2</math></td> <td colspan="2">Ignore</td> </tr> <tr> <td><math>0.2 &lt; \emptyset \leq 0.3</math></td> <td colspan="2">4 ( distance <math>\geq 10mm</math> )</td> </tr> <tr> <td><math>0.3 &lt; \emptyset \leq 0.4</math></td> <td colspan="2">2 ( distance <math>\geq 10mm</math> )</td> </tr> <tr> <td><math>0.4 &lt; \emptyset</math></td> <td colspan="2">0</td> </tr> </tbody> </table> <p>4) CTP Bonding Bubble / Accidental Spot</p> <table border="1"> <thead> <tr> <th rowspan="2">Size\Zone</th> <th colspan="2">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td></td> <td colspan="2"></td> </tr> </tbody> </table>	Size\Zone	Acceptable Qty			A	B	C	$\emptyset \leq 0.15$	Ignore			$0.15 < \emptyset \leq 0.25$	4 ( distance $\geq 10mm$ )			$0.25 < \emptyset \leq 0.35$	3 ( distance $\geq 10mm$ )			$0.35 < \emptyset$	1			Width	Length	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore			$0.05 < W \leq 0.06$	$L \leq 4.0$	$N \leq 3$			$0.06 < W \leq 0.08$	$L \leq 3.0$	$N \leq 2$			$0.08 < W$	Define as spot defect				Size\Zone	Acceptable Qty		C		$\emptyset \leq 0.2$	Ignore		$0.2 < \emptyset \leq 0.3$	4 ( distance $\geq 10mm$ )		$0.3 < \emptyset \leq 0.4$	2 ( distance $\geq 10mm$ )		$0.4 < \emptyset$	0		Size\Zone	Acceptable Qty		A	B			
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Class	Item	Criteria	
		$\emptyset \leq 0.1$	Ignore
		$0.1 < \emptyset \leq 0.2$	3(distance $\geq 10mm$ )
		$0.2 < \emptyset \leq 0.3$	2(distance $\geq 10mm$ )
		$0.3 < \emptyset$	0
		Assembly Deflection: beyond the edge of backlight $\leq 0.2mm$	
Minor	CTP Related	TP cover broken X: length, Y: width, Z: height $X \leq 0.5mm$ ; $Y \leq 0.5mm$ ; $Z <$ Cover thickness *Circuitry broken is not allowed.	
		TP cover broken X: length, Y: width, Z: height $X \leq 0.3mm$ ; $Y \leq 0.3mm$ ; $Z <$ LCD thickness *Circuitry broken is not allowed.	

## Criteria (functional items)

No.	Item	Criteria
1	No display	Not allowed
2	Missing segment	
3	Short	
4	Backlight no lighting	
5	CTP no function	

## 8.4 Dealing with Customer Complaints

### 8.4.1 Non-conforming Analysis

Purchaser should supply Densitron with detailed data of non-conforming sample.

After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.

If the analysis cannot be completed on time, Densitron must inform the purchaser.

### 8.4.2 Handling of Non-conforming Displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.

Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.

Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

## 9. Reliability Specification

### 9.1 Reliability Tests

Test Item	Test Condition	Evaluation and assessment
High Temperature Operation	70°C, 96H	
Low Temperature Operation	-20°C, 96HR	
High Temperature Storage	80°C, 96HR	
Low Temperature Storage	-30°C, 96HR	
High Temperature & High Humidity Operating	+60°C, 90% RH ,96 hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects:
Thermal Shock (Non-operation)	-10°C,30 min ↔ 60°C,30 min, Change time:5min 20CYC.	1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm (MEDIUM BOX)	

**Note 1:** The test samples should be applied to only one test item.

**Note 2:** Sample size for each test item is 5~10pcs.

**Note 3:** For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

**Note 4:** In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.

**Note 5:** Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

**Note 6:** The color fading mura of polarizing filter should not care.

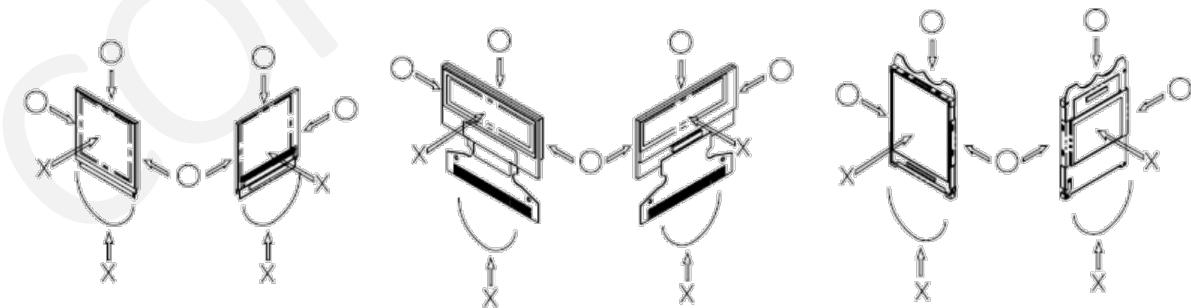
#### 9.1.1 Inspection Check Standard

After the completion of the described reliability test, the samples are to be left at room temperature for 4 hrs prior to conducting the inspection check at 25±5 °C, 65±10% RH.

## 10. Handling Precautions

### 10.1 Handling Precautions

- 1) Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position.
- 2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
- 3) If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water
- 4) If pressure is applied to the display surface or its neighbourhood of the display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
- 5) The polarizer covering the surface of the display module is soft and easily scratched. Please be careful when handling the display module.
- 6) When the surface of the polarizer of the display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
  - a. Scotch Mending Tape No. 810 or an equivalent
  - b. Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
  - c. Also, pay attention that the following liquid and solvent may spoil the polarizer:
    - Water
    - Ketone
    - Aromatic Solvents
- 7) Hold the display module very carefully when placing it into the system housing. Do not apply excessive stress or pressure to display module. And, do not over bend the film with electrode pattern layouts. These stresses will



influence the display performance. Also, secure sufficient rigidity for the outer cases.

- 8) Do not apply stress to the LSI chips and the surrounding molded sections.
- 9) Do not disassemble nor modify the display module.
- 10) Do not apply input signals while the logic power is off.
- 11) Pay sufficient attention to the working environments when handing display modules to prevent occurrence of element breakage accidents by static electricity.

- a. Be sure to make human body grounding when handling display modules.
  - b. Be sure to ground tools to use or assembly such as soldering irons.
  - c. To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
  - d. Protective film is being applied to the surface of the display panel of the display module. Be careful since static electricity may be generated when exfoliating the protective film.
- 12) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. If the display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
- 13) If electric current is applied when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

## 10.2 Storage Precautions

- 1) When storing display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps, etc. and, also, avoiding high temperature and high humidity environments or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Densitron) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
- 2) If electric current is applied when water drops are adhering to the surface of the display module, when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

## 10.3 Designing Precautions

- 1) The absolute maximum ratings are the ratings which cannot be exceeded for display module, and if these values are exceeded, panel damage may be happen.
- 2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.
- 3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
- 4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighbouring devices.
- 5) As for EMI, take necessary measures on the equipment side basically.
- 6) When fastening the display module, fasten the external plastic housing section.
- 7) If power supply to the display module is forcibly shut down by such errors as taking out the main battery while the display panel is in operation, we cannot guarantee the quality of this display module.

## 10.4 Operation Precautions

- 1) It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.
- 2) Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.
- 3) Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged.
- 4) To protect display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the display modules.
  - a. Pins and electrodes
  - b. Pattern layouts such as the FPC
- 5) When the driver is being exposed (COG), semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if the driver is exposed to light, malfunctioning may occur.
  - a. Design the product and installation method so that the driver may be shielded from light in actual usage.
  - b. Design the product and installation method so that the driver may be shielded from light during the inspection processes.
- 6) Although the display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- 7) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

## 10.5 Other Precautions

- 1) Request the qualified companies to handle industrial wastes when disposing of the display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.