

# DMT070WSNLCMX-1A

## PRODUCT SPECIFICATION

Version 0.1  
Oct 27, 2023

TBD

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

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Approved by Evan Huang

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Oct 27, 2023	Preliminary	Yvette Hsieh

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# Table of Contents

<b>1. GENERAL DESCRIPTION .....</b>	<b>5</b>
1.1 Introduction .....	5
1.2 Main Features .....	5
1.3 CTP Features .....	6
<b>2. MECHANICAL SPECIFICATION .....</b>	<b>7</b>
2.1 Mechanical Characteristics .....	7
2.2 Mechanical Drawing.....	8
<b>3. ELECTRICAL SPECIFICATION .....</b>	<b>9</b>
3.1 Absolute Maximum Ratings .....	9
3.2 Interface Pin Assignment .....	10
3.3 Block Diagram .....	13
3.4 Timing Characteristics .....	14
<b>4. ELECTRICAL SPECIFICATION TOUCH .....</b>	<b>17</b>
4.1 Absolute Maximum Ratings .....	17
4.2 Power Consumption.....	17
4.3 I/O Ports Circuit.....	18
4.4 Power On/Reset Sequence .....	19
4.5 USB.....	20
<b>5. OPTICAL SPECIFICATION .....</b>	<b>21</b>
5.1 Optical Characteristics .....	21
<b>6. LED BACKLIGHT SPECIFICATION .....</b>	<b>24</b>
6.1 LED Backlight Characteristics .....	24
6.2 INTERNAL CIRCUIT DIAGRAM .....	24
<b>7. PACKAGING .....</b>	<b>25</b>
<b>8. QUALITY ASSURANCE SPECIFICATION.....</b>	<b>26</b>
8.1 Conformity .....	26
8.2 Environment Required .....	26
8.3 Delivery Assurance .....	27
8.4 Dealing with Customer Complaints.....	34
<b>9. RELIABILITY SPECIFICATION .....</b>	<b>35</b>

9.1 Reliability Tests..... 35

**10. HANDLING PRECAUTIONS.....36**

10.1 Handling Precautions ..... 36

10.2 Storage Precautions ..... 37

10.3 Designing Precautions..... 37

10.4 Operation Precautions ..... 37

10.5 Cleaning Precautions..... 38

10.6 Other Precautions ..... 39

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# 1. General Description

## 1.1 Introduction

This is a 7.0" 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 1024 x 600 and can display up to 16.7M colours. The display module supports 6/8 Bit LVDS interface and tape bonding touch panel.

## 1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	7.0" Diagonal
Display Format	1024 x RGB x 600 Dots
No. of Colour	262K / 16.7M
Overall Dimensions	182.07 (W) x 117.60 (H) x 8.13 (D) mm
Active Area	154.21 (W) x 85.92 (H) mm
Mode	Normally Black / Transmissive
Surface Treatment	Glare
Viewing Direction	All round
Driver IC	EK73215 + EK79001
Interface	6/8 BIT LVDS
Backlight Type	LED, White, 24 chips
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
ROHS	Compliant to RoHS 2.0

1.3 CTP Features

Item	Contents
Touch Panel	PCT
Touch Interface	I <sup>2</sup> C & USB
Touch Driver IC	FT5826QSL
Bonding Type	Tape Bonding
Structure	G+G
Slave Address	0x5D(7bit) or 0x14(7bit)
Touch Mode	Ten points and Gestures

## 2. Mechanical Specification

### 2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	1024 x RGB x 600	Dots
Overall Dimensions	182.07 (W) x 117.60 (H) x 8.13 (D)	mm
Active Area	154.21 (W) x 85.92 (H)	mm
Dot Pitch	0.1506 x 0.1432	mm
Weight	TBD	g
IC Controller/Driver	EK73215 + EK79001	

[illegible]



## 3. Electrical Specification

### 3.1 Absolute Maximum Ratings

#### 3.1.1 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Note
Digital Supply Voltage	$V_{DD}$	-0.3	6.0	V	1
Operating Temperature	$T_{OP}$	-30	+85	°C	-
Storage Temperature	$T_{ST}$	-40	+90	°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:** Please refer to item of RELIABILITY.

#### 3.1.2 DC Electrical Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
Digital Supply Voltage	$V_{DD}$	3.0	3.3	5.8	V	-
Normal Mode Current	$I_{DD}$	-	120	240	mA	-
Level Input Voltage	$V_{IH}$	$0.7 V_{DD}$	-	$V_{DD}$	V	-
	$V_{IL}$	0	-	$0.3 V_{DD}$	V	-
Level Output Voltage	$V_{OH}$	$V_{DD}-0.4$	-	-	V	-
	$V_{OL}$	0	-	0.4	V	-

## 3.2 Interface Pin Assignment

### 3.2.1 TFT PIN Definition

No.	Symbol	Function	I/O	Note
1	NC	-	-	-
2	VDD	Supply voltage (3.3V)	P	-
3	VDD			-
4	NC	-	-	-
5	RESET	Global reset pin. Active low to enter reset state	I	-
6	STBYB	Standby mode setting pin. Normally pulled high. STBYB = "1", normal operation STBYB = "0". Timing controller, source drive will turn off, all input are High-Z	I	-
7	GND	Ground	P	-
8	RXIN0-	- LVDS differential data input	I	-
9	RXIN0+	+ LVDS differential data input	I	-
10	GND	Ground	P	-
11	RXIN1-	- LVDS differential data input	I	-
12	RXIN1+	+ LVDS differential data input	I	-
13	GND	Ground	P	-
14	RXIN2-	- LVDS differential data input	I	-
15	RXIN2+	+ LVDS differential data input	I	-
16	GND	Ground	P	-
17	RXCLKN-	- LVDS differential data input	I	-
18	RXCLKN+	+ LVDS differential data input	I	-
19	GND	Ground	P	-
20	RXIN3-	- LVDS differential data input	I	-
21	RXIN3+	+ LVDS differential data input	I	-
22	GND	Ground	P	-
23-24	NC	-	-	-
25	GND	Ground	P	-
26	NC	-	-	-

No.	Symbol	Function	I/O	Note
27	DIMO (NC)	NO connection	-	-
28	SELB	Input data format selection. SELB = 0, 8-bit LVDS SELB = 1, 6-bit LVDS	I	-
29	NC	-	-	-
30	GND	Ground	P	-
31-32	LED-	LED Cathode	P	-
33	L/R	Horizontal shift direction (source output) selection	I	1
34	U/D	Vertical shift direction (gate output) selection	I	1
35-38	NC	-	-	-
39-40	LED+	LED Anode	P	-

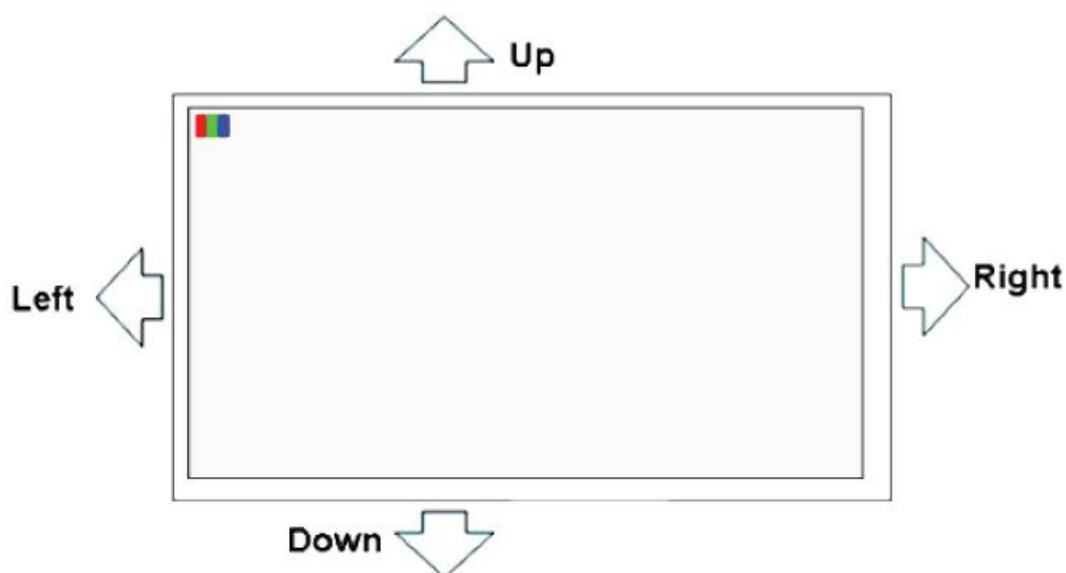
**Note 1:**

When L/R="1", set left to right scan direction.

When L/R="0", set right to left scan direction.

When U/D="1", set bottom to top scan direction.

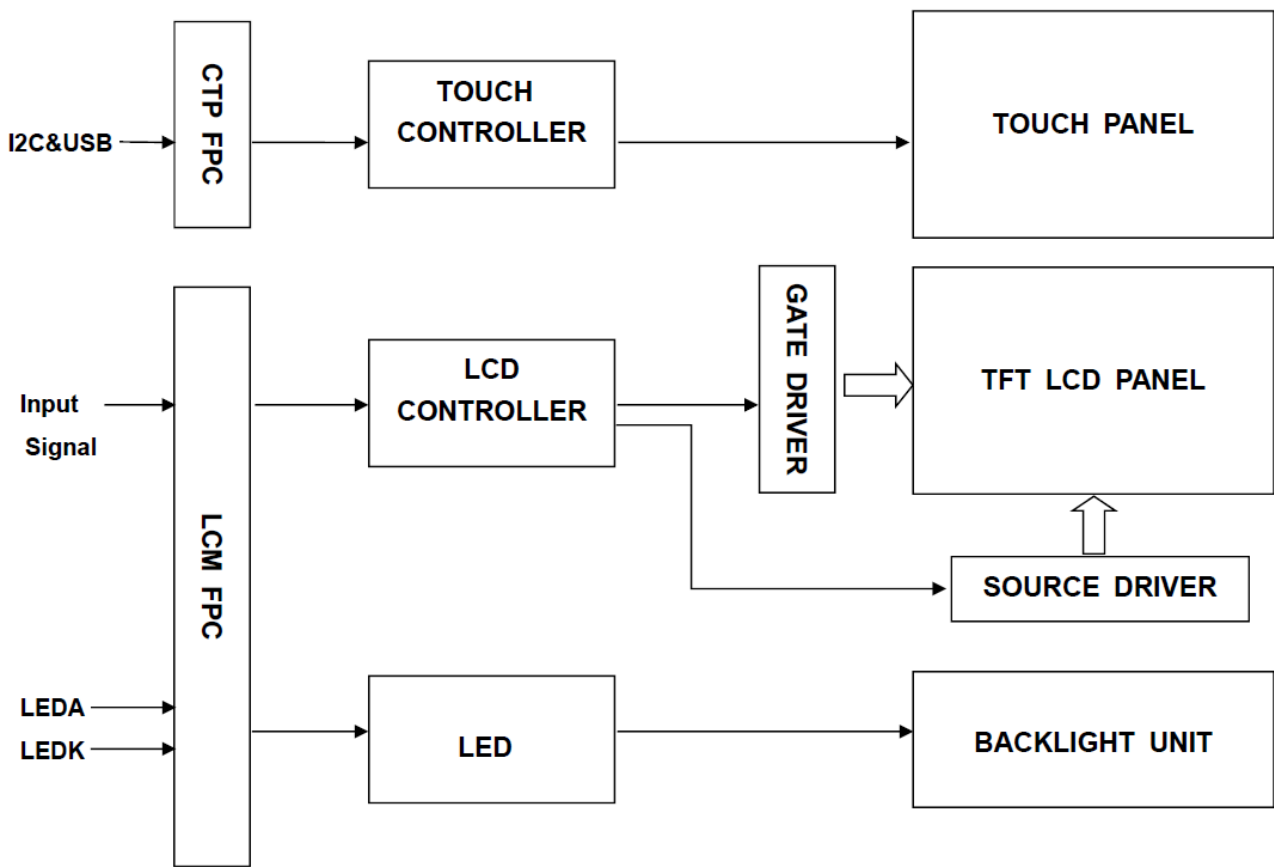
When U/D="0", set top to bottom scan direction.



### 3.2.2 CTP PIN Definition

No.	Symbol	Function	I/O
1	PESL	Power select pin. PSEL = 0, powered by external voltage	I
2	VBUS	VBUS sensor input. The pin should be connected to USB 4.5 ~ 5.5V power supply. A 1uF ceramic capacitor to ground is required.	P
3	DN	USB D-	I/O
4	DP	USB D+	I/O
5	GND	Ground	P
6	IOVCC	I/O power supply voltage. (Dummy)	P
7	VDD	Supply voltage	P
8	SCL	I <sup>2</sup> C clock input	I
9	SDA	I <sup>2</sup> C data input and output	I/O
10	INT	External interrupt to the host	I
11	RST	External reset, low is active	I
12	SS	Ground	P

3.3 Block Diagram

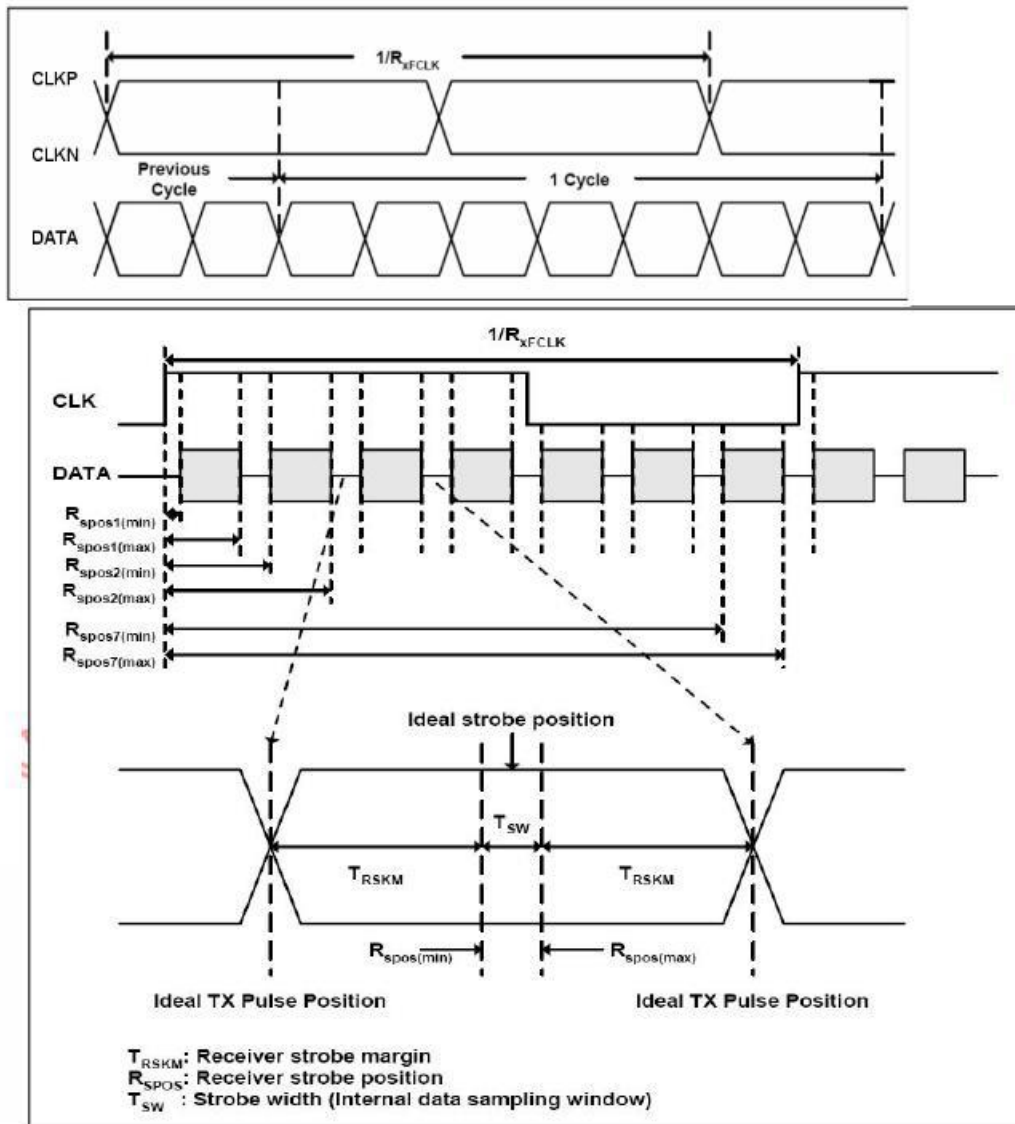


## 3.4 Timing Characteristics

### 3.4.1 AC Electrical Characteristics

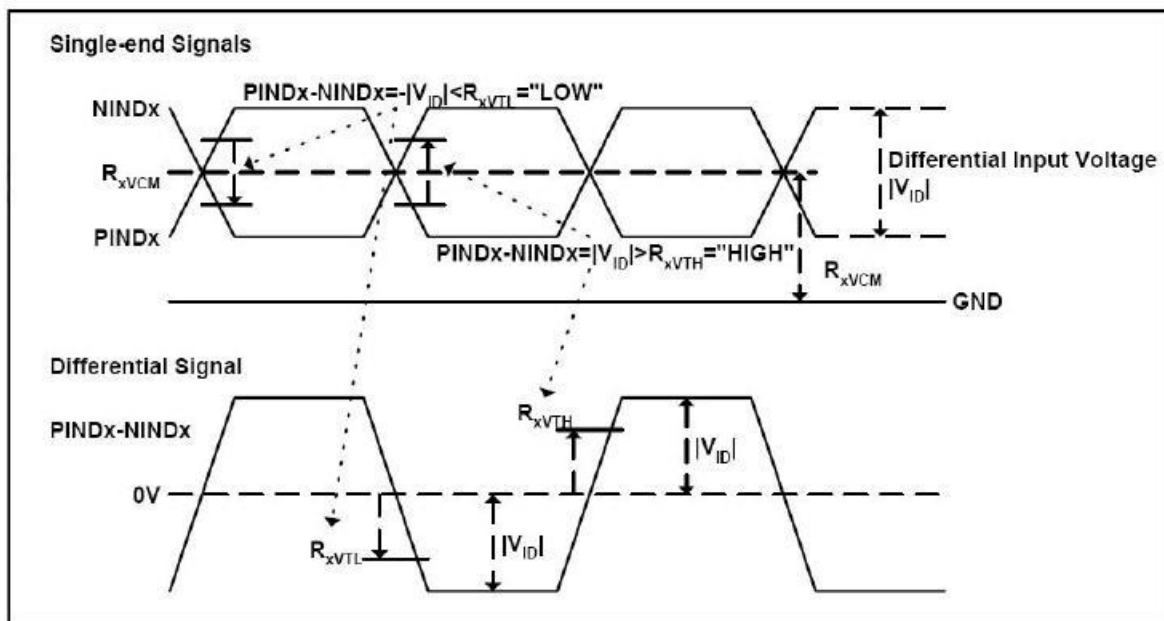
Item	Symbol	Min	Typ.	Max	Unit	Note
Clock Frequency	$R_{XFCLK}$	40.8	51.2	67.2	MHz	-
Input Data Skew Margin	$T_{RSKM}$	500	-	-	ps	-
Clock High Time	$T_{LVCH}$	-	$4/(7 \cdot R_{XFCLK})$	-	ns	-
Clock Low Time	$T_{LVCL}$	-	$3/(7 \cdot R_{XFCLK})$	-	ns	-

### 3.4.2 Input Clock and Data Timing Diagram



### 3.4.3 DC Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Differential Input High Threshold Voltage	$R_{xVTH}$	-	-	0.1	V	$R_{xVCM} = 1.2V$
Differential Input Low Threshold Voltage	$R_{xVTL}$	-0.1	-	-	V	
Input Voltage Range (Singed-end)	$R_{xVIN}$	0	-	2.4	V	-
Differential Input Common Mode Voltage	$R_{xVCM}$	$IV_{ID}/2$	-	$2.4 - IV_{ID}/2$	V	-
Differential Voltage	$IV_{ID}$	0.2	-	0.6	V	-
Differential Input Leakage Current	$RV_{xliz}$	-10	-	10	uA	-

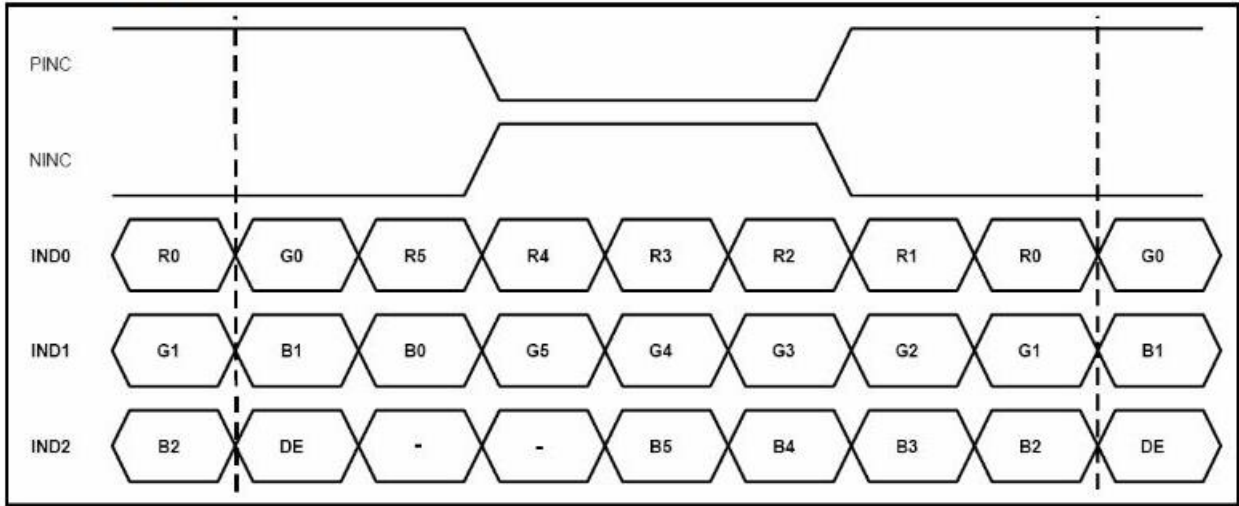


### 3.4.4 Timing

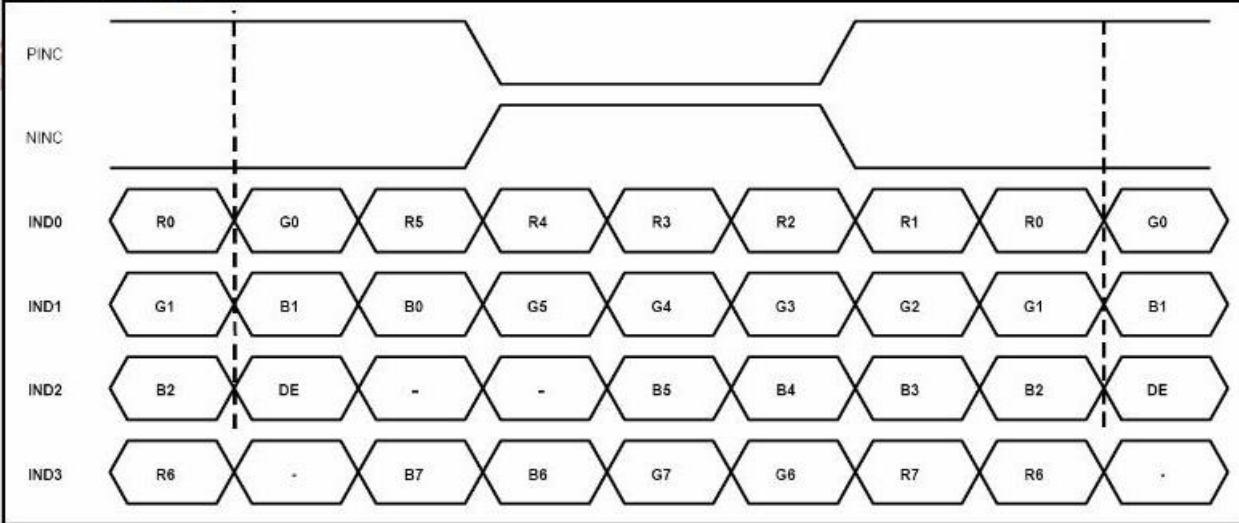
Item	Symbol	Min	Typ	Max	Unit	Note
Clock Frequency	fclk	40.8	51.2	67.2	MHz	Frame rate = 60Hz
Horizontal Display Area	thd	1024			DCLK	-
HS Period Time	th	1114	1344	1400	DCLK	-
HS Blanking	thb	90	320	376	DCLK	-
Vertical Display Area	tvd	600			H	-
VS Period Time	tv	610	635	800	H	-
VS Blanking	th	10	35	200	H	-

3.4.5 Data Input Format

6bit LVDS input



8bit LVDS input



**Note:** Support DC timing mode only. SYNC mode not supported.



## 4. Electrical Specification Touch

### 4.1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V <sub>BUS</sub>	-0.3	5.5	V	1, 2
Operating Temperature	T <sub>OP</sub>	-20	+70	°C	1
Storage Temperature	T <sub>ST</sub>	-30	+80	°C	1

**Note 1:** If used beyond the absolute maximum rating, FT5X26 may be permanently damaged. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.

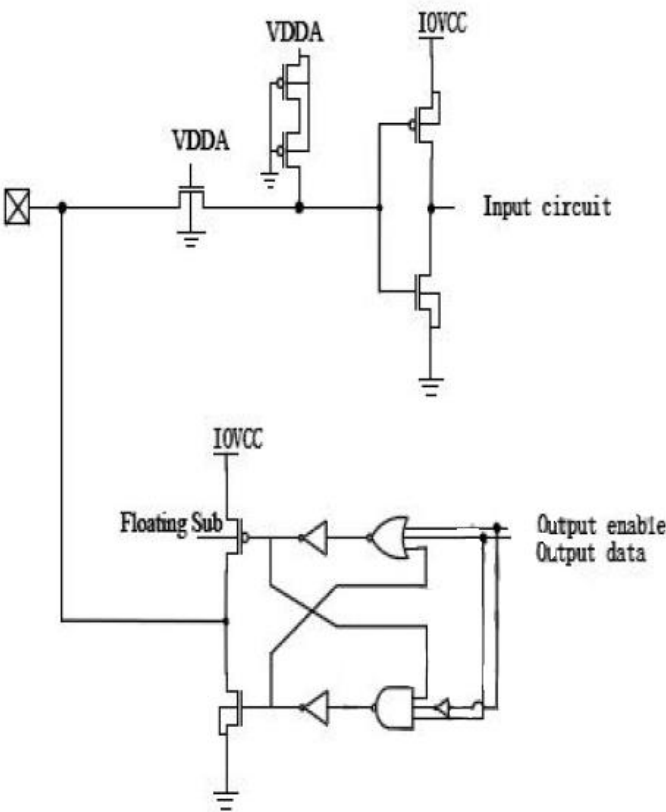
**Note 2:** Make sure VDDA (high) ≥ VSSA (low).

**Note 3:** Make sure VDD (high) ≥ VSS (low).

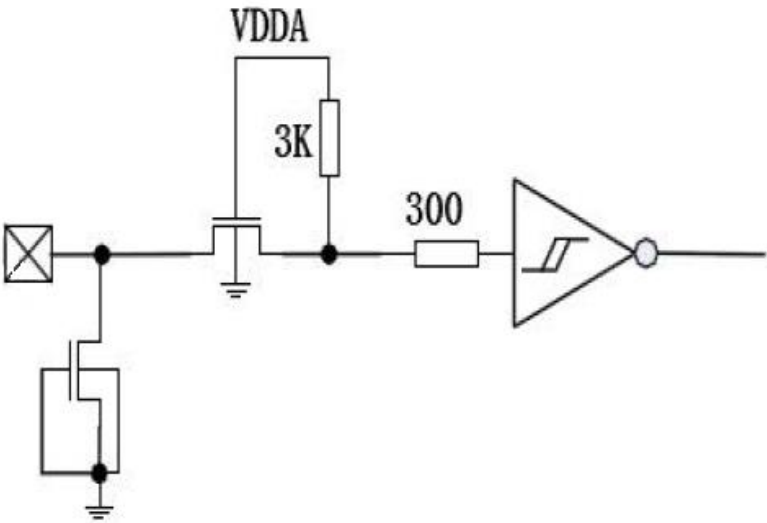
### 4.2 Power Consumption

IC	Interface	Active (mA)	Monitor (mA)	Sleep (uA)
FT5C26	I <sup>2</sup> C	19.16	9.88	35.4
	I <sup>2</sup> C-HID	19..21	9.66	188.5
	USD-HID	20.73	10.27	187.5
FT5B26	I <sup>2</sup> C	17.2	8.63	35.4
	I <sup>2</sup> C-HID	17.21	8.67	188.5
	USD-HID	18.77	9.48	187.5
FT5926	I <sup>2</sup> C	15.12	7.77	35.4
	I <sup>2</sup> C-HID	15.01	7.58	188.5
	USD-HID	16.68	8.56	187.5
FT5826	I <sup>2</sup> C	12.97	6.85	35.4
	I <sup>2</sup> C-HID	12.91	6.78	188.5
	USD-HID	14.55	7.44	187.5

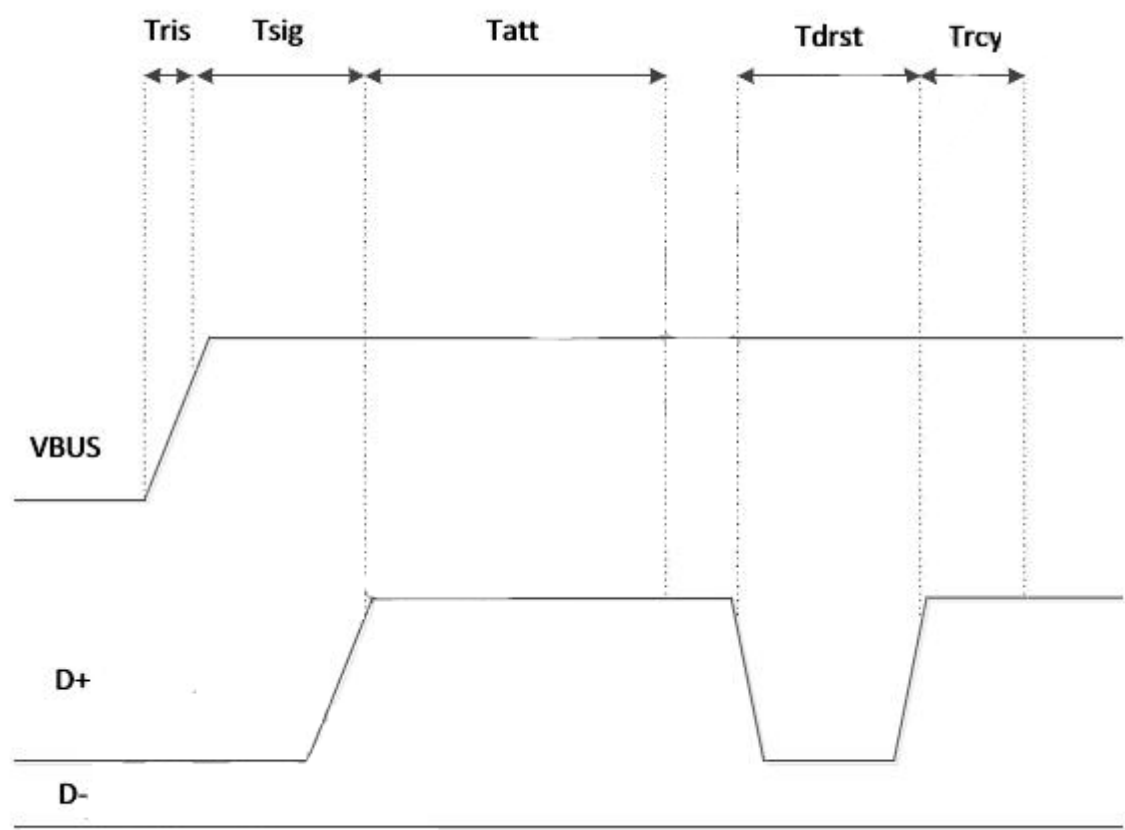
4.3 I/O Ports Circuit



The input/output property can be configured via firmware setting, The firmware can also control its output behavior as push-pull or open-drain that SDA of I<sup>2</sup>C interface is required.



4.4 Power On/Reset Sequence



Parameter	Description	Min	Max	Unit
Tris	Rise time from 0.1VDD to 0.9VDD	-	5	ns
Tsig	Time required for the device internal power rail to stabilize and for D+ or D- to reach VIH (min)	100	-	ms
Tatt	Time ensures that the electrical and mechanical connection is stable before software attempts to reset the attached device	100	-	ms
Tdrst	Time hubs drive reset to a device	10	-	ms
Tecy	The USB system software guarantees a minimum of 10ms for reset recovery	10	-	ms

## 4.5 USB

USB is configured in device mode, and a Full speed USB function is supported. The USB function controller is as follows.

USB 2.01-compliant composite device , full speed (12Mbps);

Require external crystal (12MHz);

Support USB LPM L1;

integrated transceiver;

Support USB-HID protocol for Win8.

Vendor ID: 0x2808

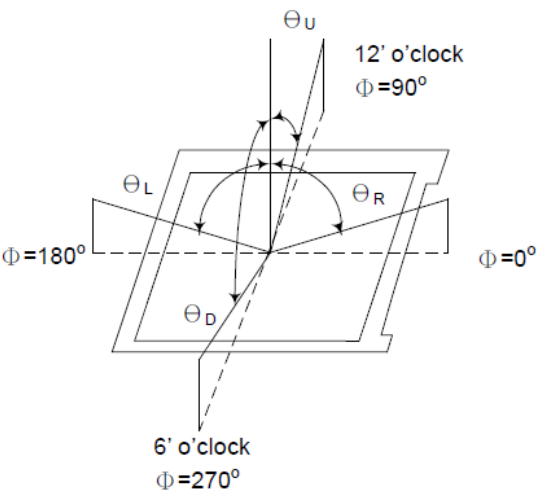
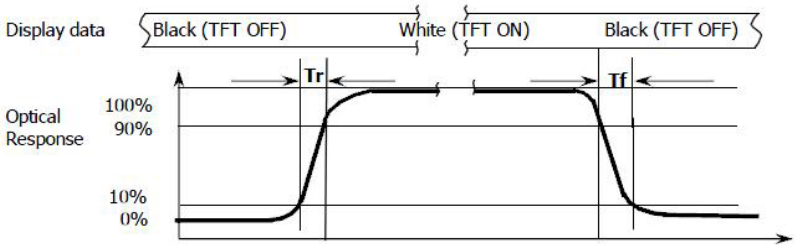
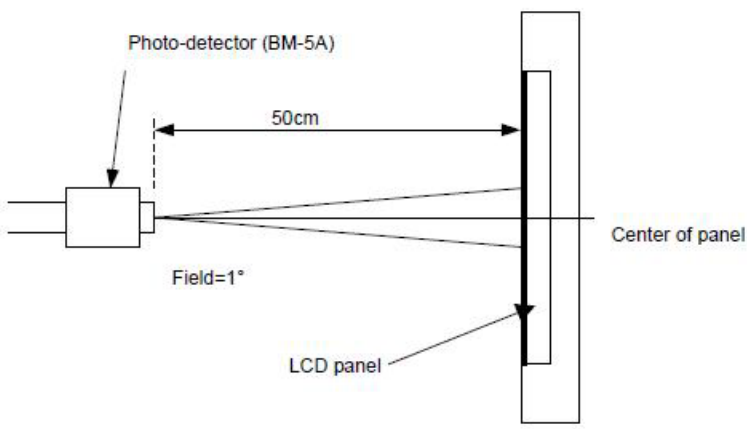
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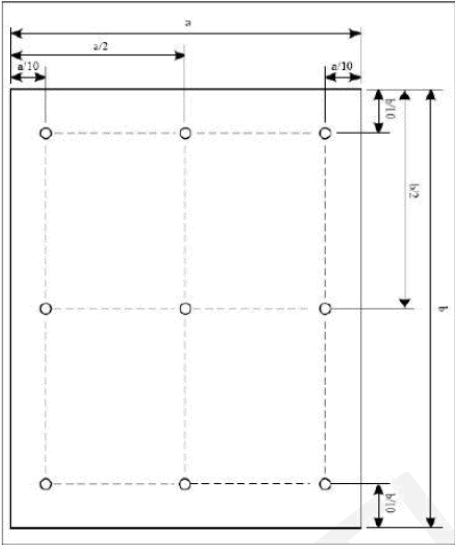
## 5. Optical Specification

### 5.1 Optical Characteristics

Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	$\theta=0$	600	800	-	-	2
Response time		TR + TF	Normal Viewing Angle	-	25	40	msec	3
Viewing Angle	Left	$\theta_{x-}$	CR > 10	-	85	-	-	1, 4
	Right	$\theta_{x+}$		-	85	-		
	Up	$\theta_{y+}$		-	85	-		
	Down	$\theta_{y-}$		-	85	-		
Colour Chromaticity	Red	Rx	$\theta=0$ Normal Viewing Angle	0.5531	0.5931	0.6331	-	CA-310
		Ry		0.3152	0.3552	0.3952		
	Green	Gx		0.2709	0.3109	0.3509		
		Gy		0.5144	0.5544	0.5944		
	Blue	Bx		0.1134	0.1534	0.1934		
		By		0.0672	0.1072	0.1472		
	White	Wx		0.2584	0.2984	0.3384		
		Wy		0.30	0.34	0.38		
LCM Luminance		L <sub>v</sub>	-	500	600	-	cd/m <sup>2</sup>	5
Uniformity		S(%)	-	-	50	-	%	5

**Measuring Condition:** in dark room, at ambient temperature = 25±2°C, 15 min. warm-up time

Note	Item	Test method
1	Definition of Viewing Angle	
2	Definition of Contrast Ratio (CR)	Measured at the center point of panel $CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$
3	Definition of Response Time	
4	Definition of Optical Measurement Setup	
5	Definition of Luminance and Uniformity	Luminance Uniformity of these 9 points is defined as below:

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

# 6. LED Backlight Specification

## 6.1 LED Backlight Characteristics

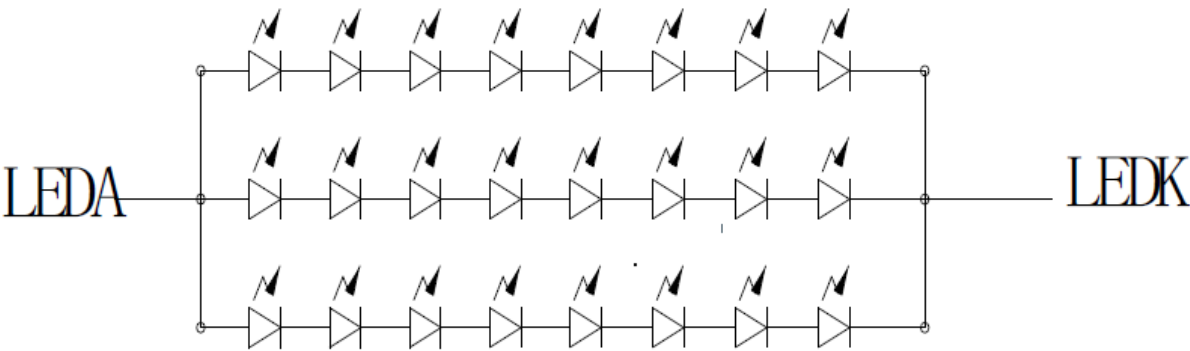
The back-light system is edge-lighting type with 24 chips white LED.

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	I <sub>F</sub>	-	90	-	mA	-
Forward Voltage	V <sub>F</sub>	-	24	-	V	-
LED Lifetime	Hr	50000	-	-	Hour	1, 2

**Note 1:** LED lifetime (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 lifetime” is defined as the module brightness decrease to 50% original brightness at Ta = 25°C and IL = 90mA. The LED lifetime could be decreased if operating IL is larger than 90mA. The constant current driving method is suggested.

## 6.2 INTERNAL CIRCUIT DIAGRAM



B/L Circuit



## 7. Packaging

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## 8. Quality Assurance Specification

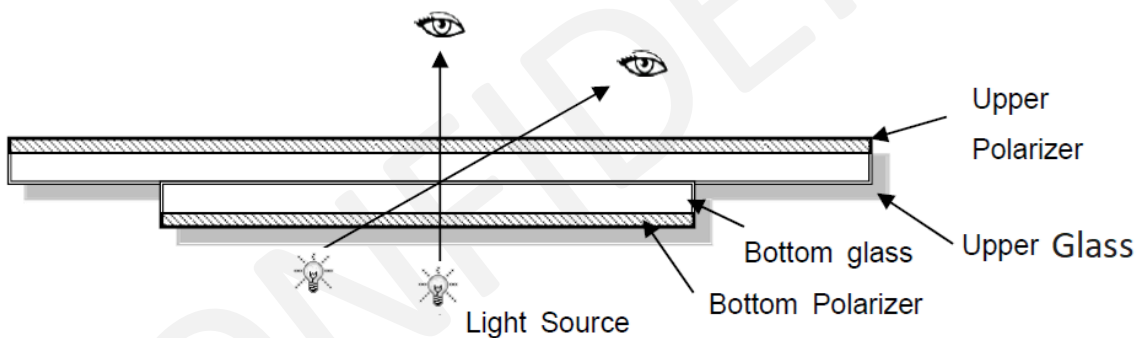
### 8.1 Conformity

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:	$25 \pm 5^{\circ} \text{C}$
Humidity:	$65\% \pm 10\% \text{ RH}$
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.	

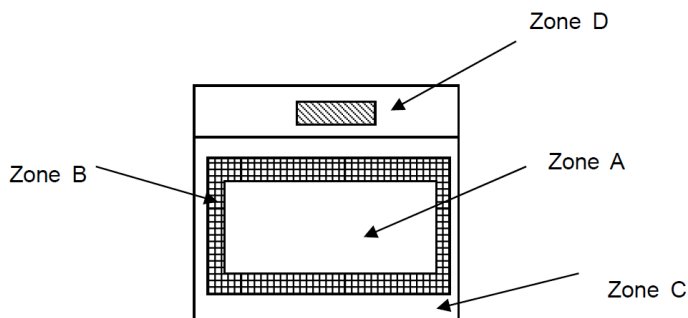


## 8.3 Delivery Assurance

### 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

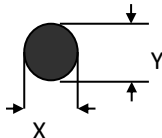
No.	Items	Criteria	Classification of defects
1	Functional Defects	1) No display, open or miss line 2) Display abnormally 3) Backlight no lighting, abnormal lighting.	Major
2	Missing	Missing component and etc.	
3	Outline Dimension	Overall outline dimension beyond the drawing is not allowed, deformation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




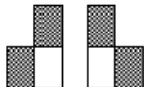
**Note 1:**

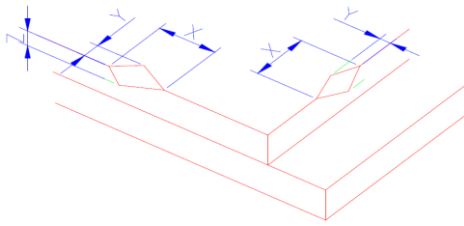
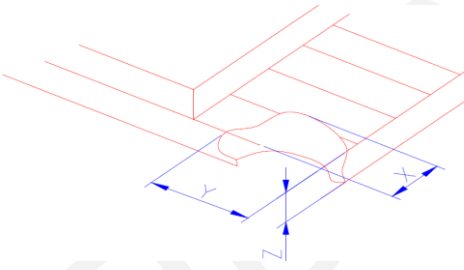
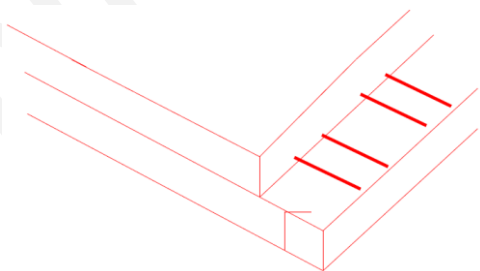
- a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.
- b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

### 8.3.4 Criteria & Classification

Units: mm

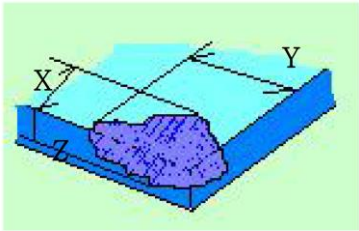
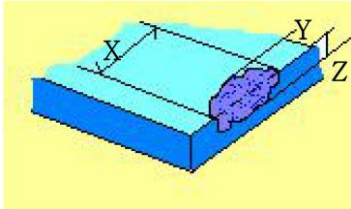
Item	Criteria																							
Spot Defect	Round type: as per following drawing, $\varnothing = (X+Y)/2$ <div></div>																							
	1) Light Dot (LCD/TP/Polarizer black/white spot, light dot, pinhole, dent, stain)																							
	<table><tr><th rowspan="2">Size\Zone</th><th colspan="3">Acceptable Quantity</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td><math>\varnothing \leq 0.15</math></td><td colspan="3">Ignore</td></tr><tr><td><math>0.15 &lt; \varnothing \leq 0.25</math></td><td colspan="3">3 (distance <math>\geq 10\text{mm}</math>)</td></tr><tr><td><math>0.25 &lt; \varnothing \leq 0.40</math></td><td colspan="3">2 (distance <math>\geq 10\text{mm}</math>)</td></tr><tr><td><math>0.4 &lt; \varnothing</math></td><td colspan="3">0</td></tr></table>	Size\Zone	Acceptable Quantity			A	B	C	$\varnothing \leq 0.15$	Ignore			$0.15 < \varnothing \leq 0.25$	3 (distance $\geq 10\text{mm}$ )			$0.25 < \varnothing \leq 0.40$	2 (distance $\geq 10\text{mm}$ )			$0.4 < \varnothing$	0		
	Size\Zone		Acceptable Quantity																					
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	2) Dim Spot (Light leakage, dent, dark spot, etc.)																							
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	3) Polarizer Accidented Spot																							
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	Size\Zone		Acceptable Quantity																					
		A	B	C																				
	$\varnothing \leq 0.2$	Ignore																						
	$0.2 < \varnothing \leq 0.5$	2 (distance $\geq 10\text{mm}$ )																						
	$0.5 < \varnothing$	0																						
	4) Pixel Bad Points (light dot, dim dot, color dot)																							
	<table><tr><th>Item</th><th>Zone A</th><th>Acceptable Quantity</th></tr><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>Dark Dot</td><td>Random</td><td><math>N \leq 3</math></td></tr></table>	Item	Zone A	Acceptable Quantity	Bright Dot	Random	$N \leq 2$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	Dark Dot	Random	$N \leq 3$										
	Item	Zone A	Acceptable Quantity																					
Bright Dot	Random	$N \leq 2$																						
	2 dots adjacent	$N \leq 0$																						
	3 dots adjacent	$N \leq 0$																						
Dark Dot	Random	$N \leq 3$																						

Item	Criteria			
		2 dots adjacent	$N \leq 0$	
		3 dots adjacent	$N \leq 0$	
	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			$N \leq 4$
	<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: <div>   </div> <div>   </div> <div> 2 dot adjacent           2 dot adjacent (vertical)           2 dot adjacent (slant)         </div>			
	5) Polarizer Bubble			
	Size\Zone	Acceptable Quantity		
		A	B	C
		Ignore		
		2 (distance $\geq 10\text{mm}$ )		
	$\varnothing \leq 0.2$			
	$0.2 < \varnothing \leq 0.4$			
	$0.5 < \varnothing$	0		
Line Defect (LCD/TP/ Polarizer backlight black/white line, scratch,	Width	Length	Acceptable quantity	
			A	B
	$W \leq 0.05$	Ignore	Ignore	
	$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$	

Item	Criteria			
stain)	$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$	
	$0.08 < W$	Define as spot defect		
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> 			
LCD Crack	<p>The LCD with extensive crack is not acceptable.</p> 			
Electronic Components SMT	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite			
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>			
LCD Mura/Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.			

Item	Criteria				
CTP Related	1) CTP Cover sensor accidented black/white spot				
	Size\Zone	Acceptable Qty			
		A	B	C	
	$\varnothing \leq 0.15$	Ignore		Ignore	
	$0.15 < \varnothing \leq 0.25$	4 ( distance $\geq 10\text{mm}$ )			
	$0.25 < \varnothing \leq 0.35$	3 ( distance $\geq 10\text{mm}$ )			
	$0.35 < \varnothing$	0			
	2) CTP Cover Scratch				
	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			
	3) CTP Cover Pinhole/Lack of Ink				
	Size\Zone	Acceptable Quantity			
		C			
	$\Phi \leq 0.2$	Ignore			
	$0.2 < \Phi \leq 0.3$	4(distance $\geq 10\text{mm}$ )			
	$0.3 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$ )			
	$\Phi > 0.4$	0			
	4) CTP Bonding Bubble/Accidented Spot				
	Size (mm)	Acceptable Quantity			
		A	B		
	$\Phi \leq 0.1$	Ignore			
	$0.1 < \Phi \leq 0.2$	3(distance $\geq 10\text{mm}$ )			
	$0.2 < \Phi \leq 0.3$	2(distance $\geq 10\text{mm}$ )			
	$\Phi > 0.3$	0			
Assembly deflection	Beyond the edge of backlight $\leq 0.2\text{mm}$				



Item	Criteria	
CTP Related	CTP cover broken X: length, Y: width, Z: height $X \leq 0.5\text{mm}$ ; $Y \leq 0.5\text{mm}$ ; $Z < \text{Cover thickness}$ *Circuitry broken is not allowed.	
	CTP edge broken X: length, Y: width, Z: height $X \leq 0.3\text{mm}$ ; $Y \leq 0.3\text{mm}$ ; $Z < \text{cover thickness}$ *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 reasonable time and update the status to 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	Inspection after Test
High Temperature Operation	70°C, 96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects. 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.
Low Temperature Operation	-20°C, 96HR	
High Temperature Storage	70°C, 96H	
Low Temperature Storage	-20°C, 96HR	
High Temperature & High Humidity Operating	+60°C, 90% RH ,96 hours.	
Thermal Shock (Non-Operation)	-20°C, 30 min ↔ 70°C, 30 min, Change time:5min 20CYC.	
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 judged as a good part.

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

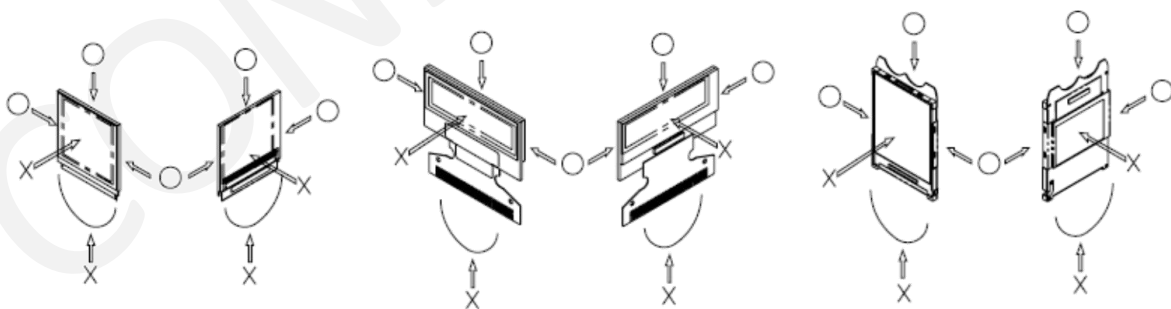
#### 9.1.1 Inspection Check Standard

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 made of glass, do not apply mechanical impacts such as dropping from a high position.
- 2) If the display panel is broken by 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 handling 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) A 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 store these modules in the packaged state when they are 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 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 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 the influences of noise on the system design.
- 7) We recommend you construct its software to make periodical refreshments of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

## 10.5 Cleaning Precautions

- 1) **Keep TFT Scratch free:** Avoid using abrasive materials like paper towels and newspaper in cleaning TFT LCD screens as they may scratch the surface. Instead, opt for a lint-free cloth. Don't spray the liquid directly on the monitor and remember to put gentle pressure when wiping the screen.
- 2) **Avoid Vibration:** During cleaning process, try to keep the TFT on shock proof platform to avoid strong shock and vibration. Do not apply pressure to the LCD screen of the LCD or bump or squeeze the LCD display back cover.
- 3) When the surface of the polarizer of the display module has soil, clean the surface. It takes advantage of using the following adhesion tape:
  - a) Scotch Mending Tape No. 810 or an equivalent.
  - b) Never try to breathe upon the soiled surface.
  - c) List of Safe and Unsafe solvents to clean TFT display:

Safe Solvents	Unsafe Solvents
Distilled Water	Ammonia
Isopropyl Alcohol	Acetone
Diluted White Vinegar = Water (Mix 1 part vinegar + 5 parts of Water)	Ethyl Alcohol
	Methyl Chloride
	Ethyl Acid

10.6 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.