Densitron

TFT LCD DISPLAY MODULE

Product Specification

Customer	Standard	
Product Number	DMT070F3NHCMU-1A	
Customer Part Number		
Customer Approval	**Date:**	

Internal Approvals		
Product Mgr	Doc. Control	Electr. Eng.
Luo Luo	Filip Kaczorowski	Filip Kaczorowski
Date: 30/05/2019	**Date: 30/05/19**	**Date: 30/05/19**

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Revision Record

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	08/05/19	--	--	Initial Release	
B	30/05/19	6	1.5	Updated power consumption to 2.8W from 4W.	

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1.0 General Description

1.1 Introduction

This specification covers the requirements of 7.0” TFT-LCD module with HDMI interface. This module is consist of a Transmissive TFT-LCD Panel, driver circuit, a capacitive touch panel, backlight unit. The LCD module meets the requirement of RoHS compliance.

1.2 Main Features

Item	Contents
Screen Size	7.0” Diagonal
Display Format	1200 x RGB x 1920 Dots
N° of Colour	16.7M colours
Overall Dimensions	119.46 mm(H) x 176.78 mm(V) x 4.0 mm (D)
Active Area	94.5 mm (H) x 151.2 mm (V)
Display Mode	Transmissive / Normally Black
Viewing Direction	Free
TFT Interface	4 Lane MIPI
PTC Interface	Micro-USB
Touch Mode	Five points and Gestures
Touch Cover Option	1.1mm with chemical strengthening
Module Bonding Technology	Optical bonding between LCM and PCT
Operating Temperature	-10C ~ +60°C
Storage Temperature	-30°C ~ +70°C
ROHS	Compliant to 2011/65/EU

1.3 Recommended Resolution

Recommended Resolution	1200(RGB)*1920 @55~60 Hz

1.4 Plug & Play

DDC2B / VESA Standard

1.5 Power Supply Rating

Power Consumption	2.8W (Typical)
Micro USB DC Power	5V 2A(Typical)

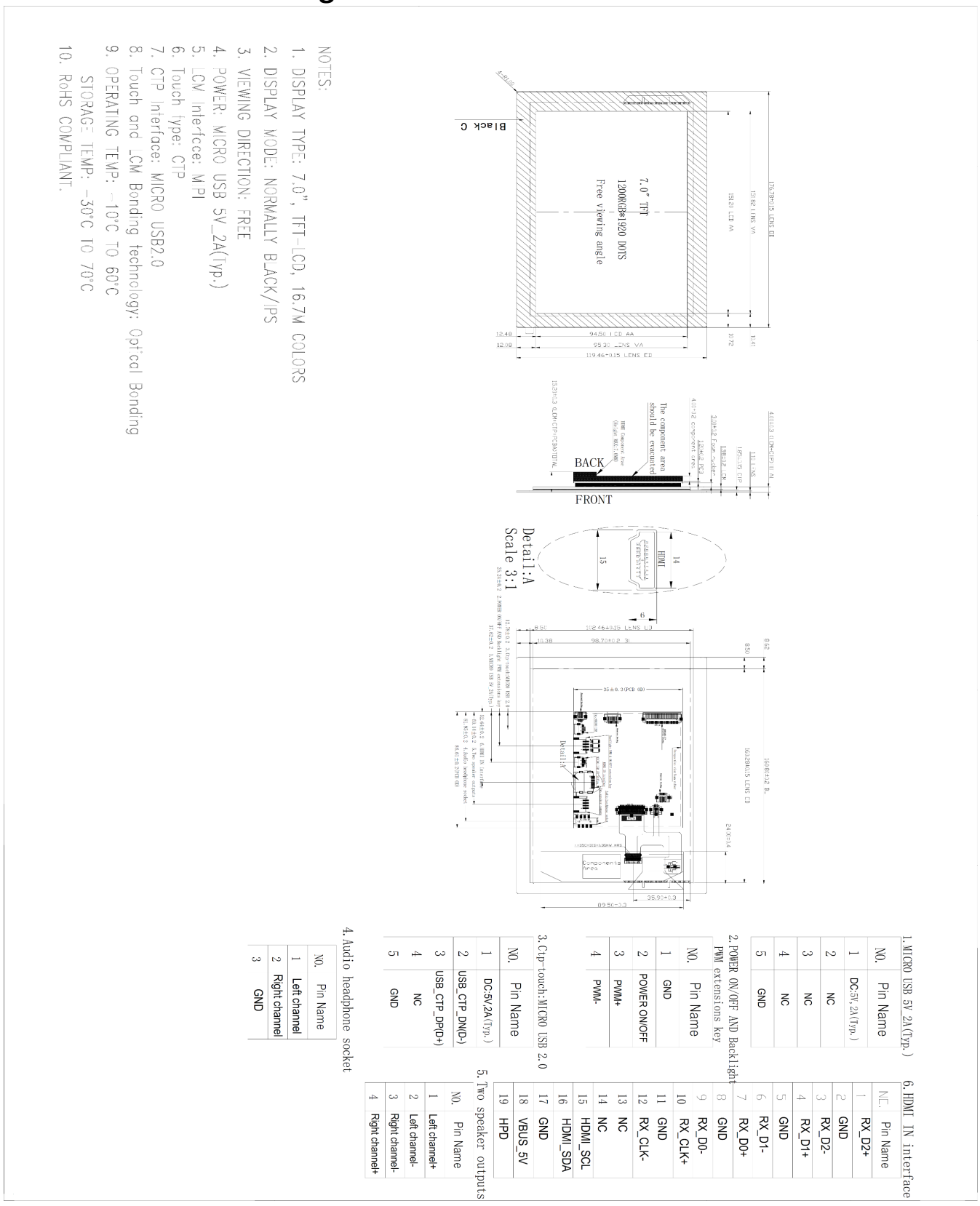
2.0 Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	1200 x RGB x 1920	Dots
Overall Dimensions	119.46 (H) x 178.78 (V) x 4.0 (D)	mm
Active Area	94.5 (H) x 151.2 (V)	mm
Pixel Pitch	0.07875 (H) x 0.07875 (V)	mm
Weight	180	g

Note: Depth is specified without the components on the PCB.

2.2 Mechanical Drawing



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3.0 Electrical Specification

3.1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage (Analog)	VDD	-0.3	6.0	V	-
	VDDp	-0.3	6.0	V	-
Power Supply Voltage (Logic)	IOVCC	-0.3	4.6	V	-
Input Signal Voltage (RES)	V_I	-0.3	IOVCC +0.3	V	XRES
Input Signal Voltage (DSI)	$V_{I(DSI)}$	-0.3	1.8	V	-
Input Signal Voltage (LED)	$V_{I(LED)}$	-0.3	6.0	V	LED_EN
Input Signal Voltage (PWR)	$V_{I(PWR)}$	-0.3	5.5	V	DCDC_EN
Operating Temperature	T_{OP}	-10	+60	°C	-
Storage Temperature	T_{STG}	-30	+70	°C	-

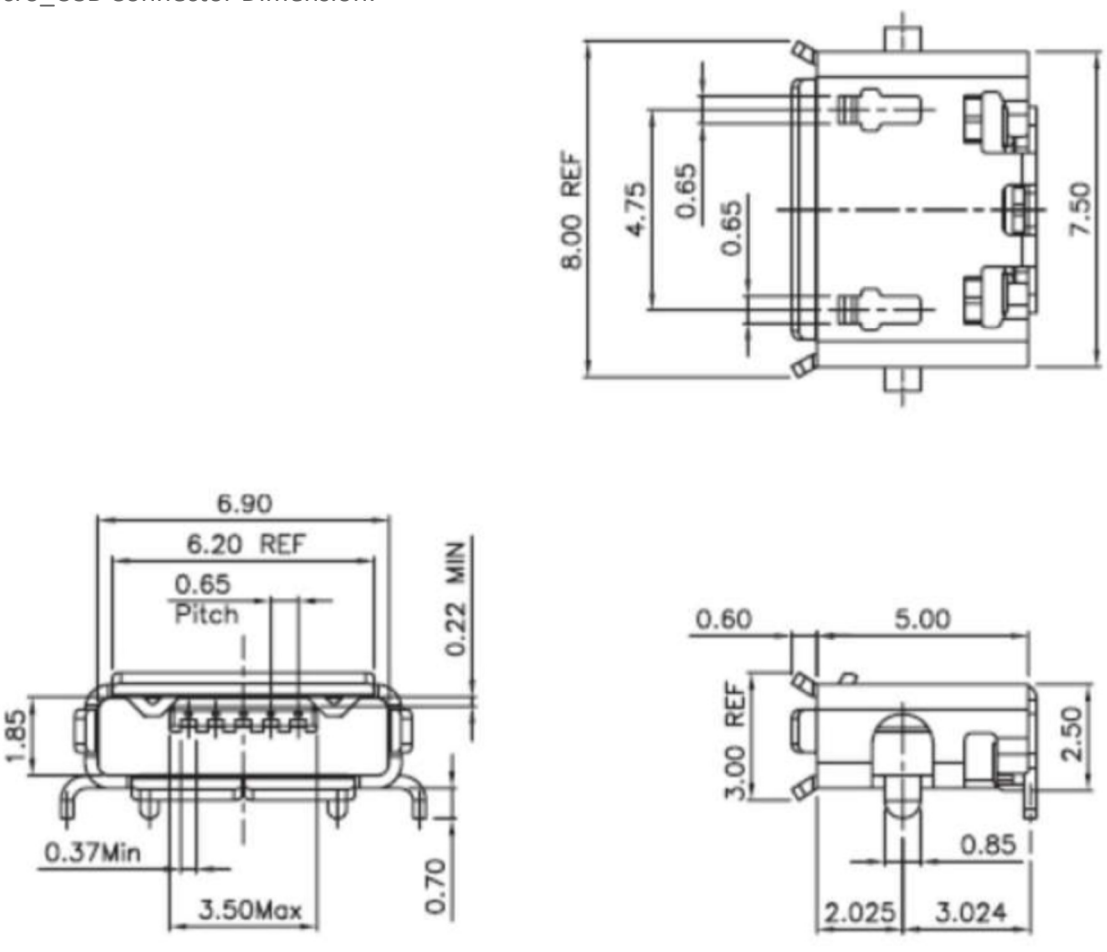
Note: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

3.2 Input Terminal Pin Assignment

3.2.1 Micro USB 5V_2A PIN

No.	Symbol	Function
1	DC:5V,2A	Supply voltage (5.0V, 2A Typical).
2	NC	No Connection.
3	NC	No Connection.
4	NC	No Connection.
5	GND	Ground.

Micro_USB Connector Dimension:

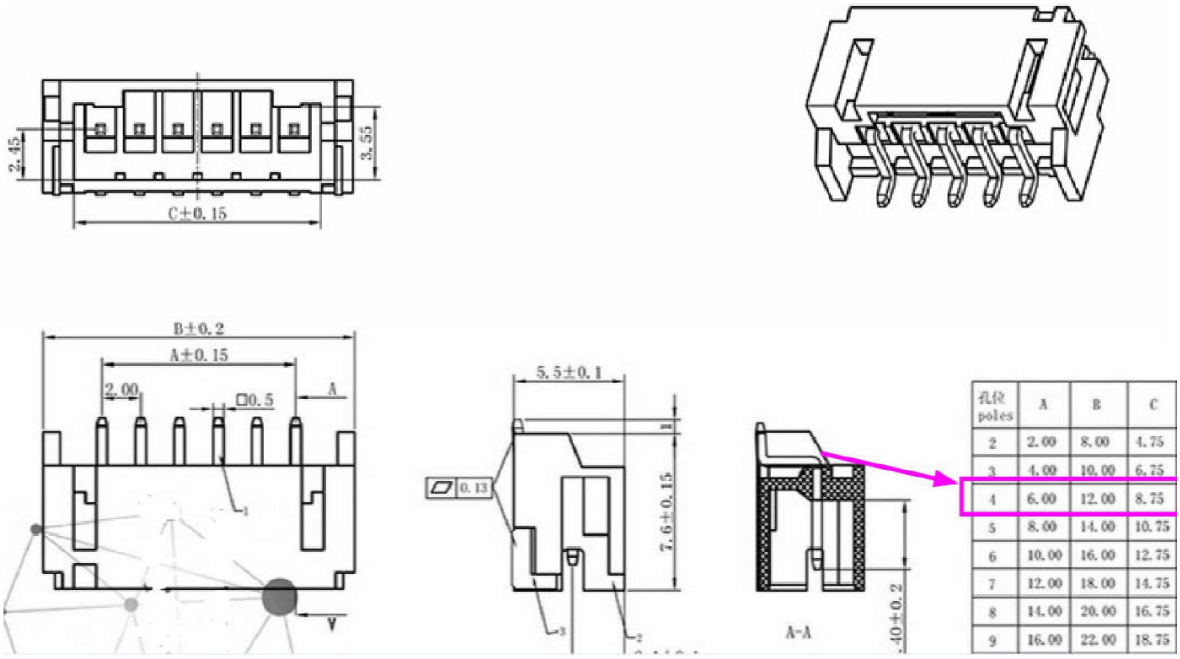


3.2.2 Power ON/OFF and Backlight PWM extension key

No.	Symbol	Function
1	GND	Ground.
2	POWER ON/OFF	ON/OFF Key.
3	PWM+	The backlight brightness of each button is increased by one level until the maximum brightness reaches (9 level).
4	PWM-	The backlight brightness of each button is reduced by one evel until the lowest brightness reaches (level 9).

Note: SMT PH2.00mm spacing connector 4p.

Connector Dimensions:

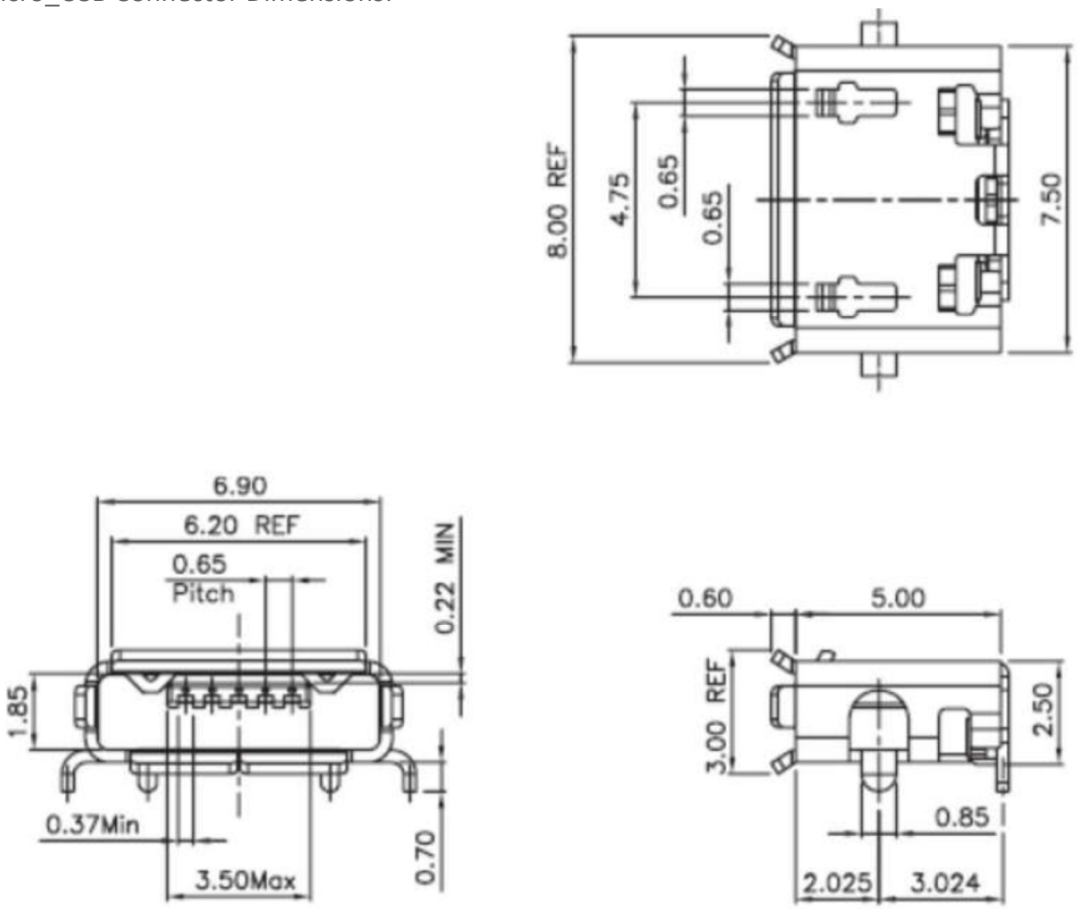


孔数 poles	A	B	C
2	2.00	8.00	4.75
3	4.00	10.00	6.75
4	6.00	12.00	8.75
5	8.00	14.00	10.75
6	10.00	16.00	12.75
7	12.00	18.00	14.75
8	14.00	20.00	16.75
9	16.00	22.00	18.75

3.2.3 PCT Micro-USB

No.	Symbol	Function
1	DC:5V,2A	Supply voltage (5.0V, 2A Typical).
2	USB_PCT_DN(D-)	USB data negative analogue input.
3	USB_PCT_DP(D+)	USB data positive analogue input.
4	NC	No Connection.
5	GND	Ground.

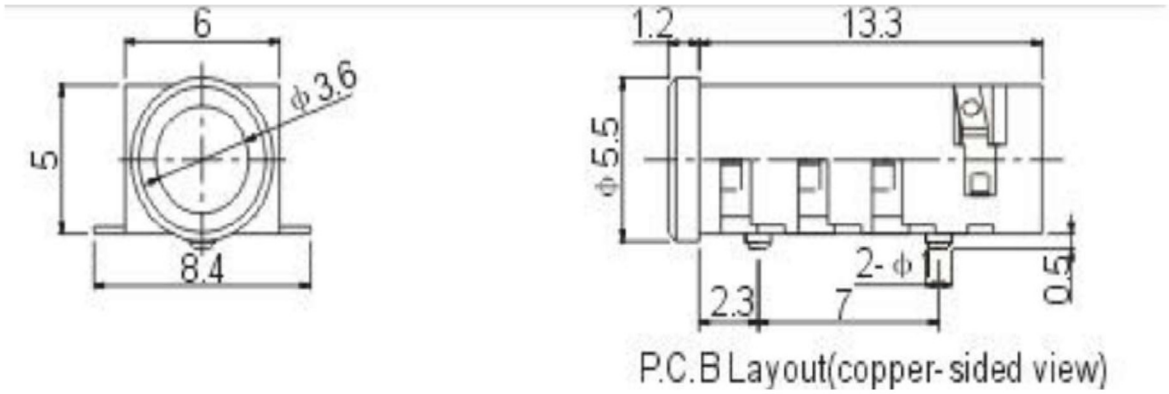
Micro_USB Connector Dimensions:



3.2.4 Audio headphone socket

No.	Symbol	Function
1	Left channel	Audio output left channel.
2	Right channel	Audio output right channel.
3	GND	Ground.
4	GND	Ground.

Connector Dimensions:

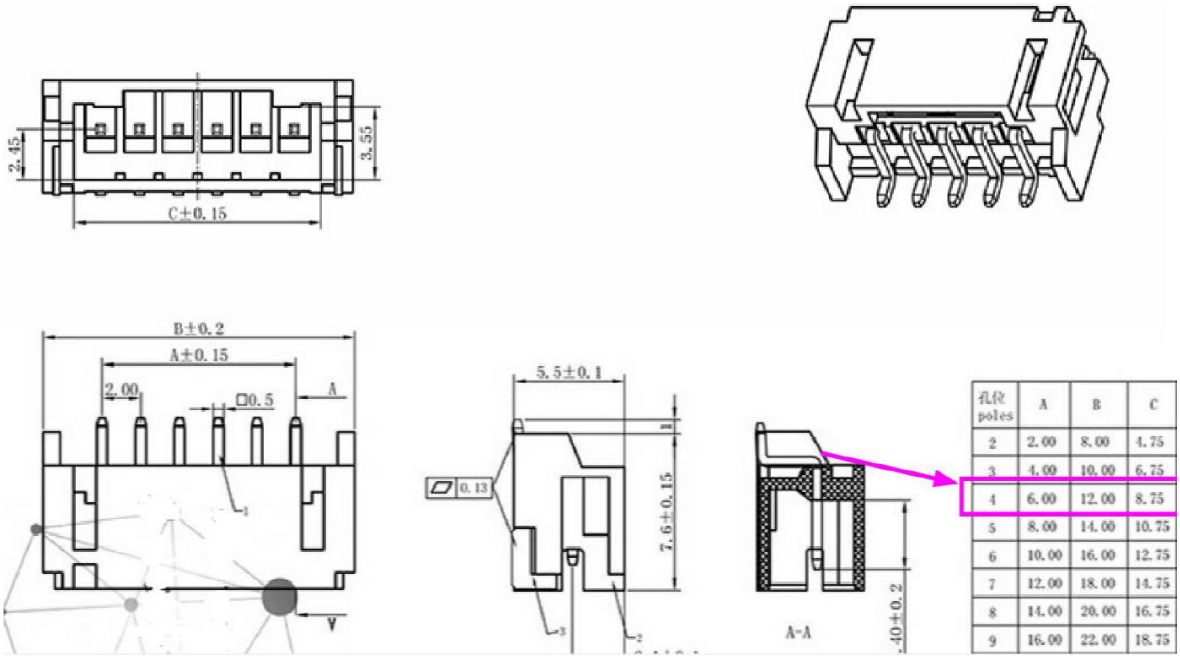


3.2.5 Two speaker outputs

No.	Symbol	Function
1	Left channel +	Audio output left channel.
2	Left channel -	
3	Right channel +	Audio output right channel.
4	Right channel -	

Note: SMT PH2.00mm spacing connector 4p.

Connector Dimensions:

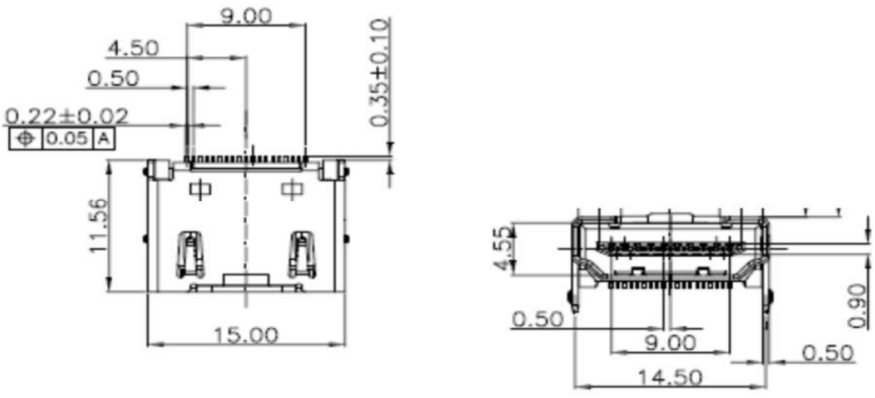


孔数 poles	A	B	C
2	2.00	8.00	4.75
3	4.00	10.00	6.75
4	6.00	12.00	8.75
5	8.00	14.00	10.75
6	10.00	16.00	12.75
7	12.00	18.00	14.75
8	14.00	20.00	16.75
9	16.00	22.00	18.75

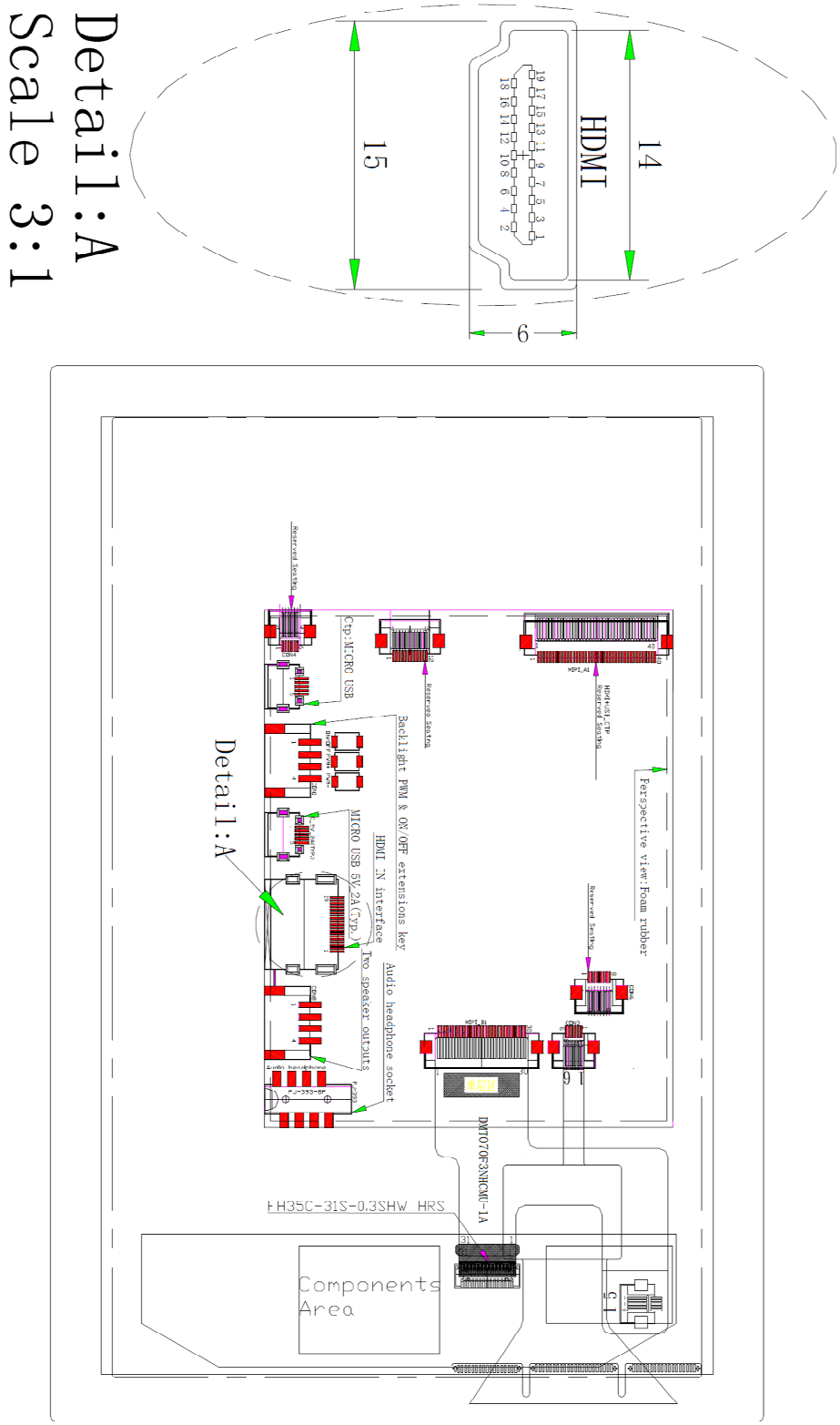
3.2.6 HDMI

No.	Symbol	Function
1	RX_D2+	HDMI Receiver channel 2 positive analogue input.
2	GND	Ground.
3	RX_D2-	HDMI Receiver channel 2 negative analogue input.
4	RX_D1+	HDMI Receiver channel 1 positive analogue input.
5	GND	Ground.
6	RX_D1-	HDMI Receiver channel 2 negative analogue input.
7	RX_D0+	HDMI Receiver channel 0 positive analogue input.
8	GND	Ground.
9	RX_D0-	HDMI Receiver channel 0 negative analogue input.
10	RX_CLK+	HDMI Receiver clock positive analogue input.
11	GND	Ground.
12	RX_CLK-	HDMI Receiver clock positive analogue input.
13	NC	Not connected.
14	NC	Not connected.
15	HDMI_SCL	HDMI Receiver DDC data channel.
16	HDMI_SDA	HDMI Receiver DDC clock channel.
17	GND	Ground.
18	HDMI_5V	HDMI Supply voltage (5.0V).
19	HPD	HDMI Receiver hot plug detect output.

HDMI Connector Dimension:



3.3 Block Diagram



3.4 Initialisation Timing Command Sequence

sequence	DataType (hex)	index (hex)	parameters #	(hex)	description	comment
SLEEP MODE						
DCDC_EN L->H					DCDC_EN L->H (VSP,VSN on)	
wait 20ms						
command	05	01	-	-	soft reset	
wait 5ms						
command	23	B0	1	00	MCAP	
command	29	B3	1	04	Interface setting	
			2	08		
			3	00		
			4	22		
			5	00		
command	29	B4	1	0C	Interface ID setting	
command	29	B6	1	3A	DSI control	
			2	D3		
command	15	51	1	E6	write display brightness	
command	15	53	1	2C	write control display	
command	15	3A	1	77	set pixel format	
command	39	2A	1	00	set column address	
			2	00		
			3	04		
			4	AF		
command	39	2B	1	00	set page address	
			2	00		
			3	07		
			4	7F		
send image	39	2C/3C			write memory / write memory continue	
command	05	11	-	-	exit sleep mode	
wait 120ms						
command	05	29	-	-	set display on	
wait min 0ms						
LED_EN L->H					LED_EN L->H	
NORMAL MODE						

4.0 Operating instructions

- This product supports the following operating systems
  - Windows 7/8/10
  - Raspberry PI
  - Ubuntu
  - Android
- Connect the HDMI cable to target board
- Connect the PCT micro USB to target board
- Connect the micro USB power to target board

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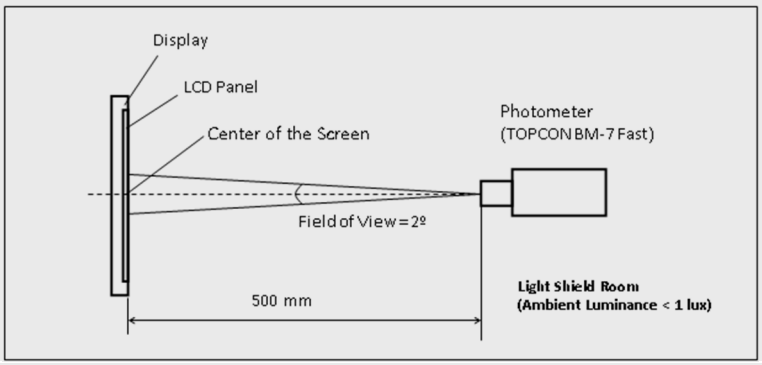
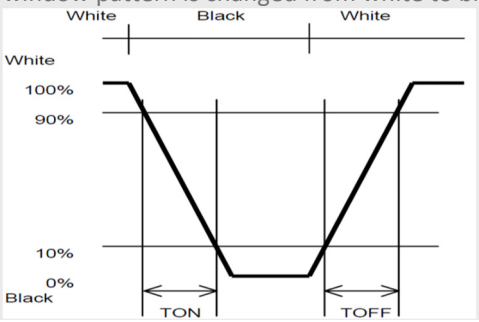
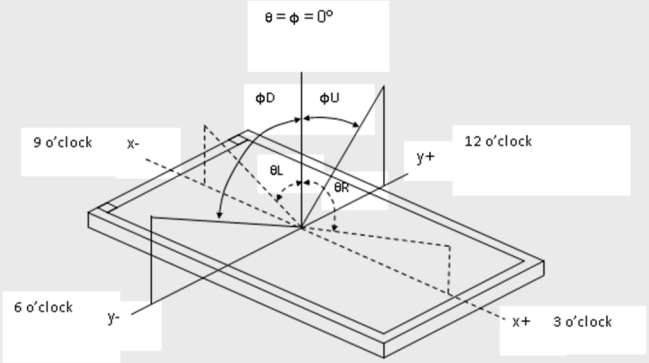
5.0 Optical Specification

5.1 Optical Characteristics

Measuring instruments: LCD-5100, Eldim, Topcon BM-7
Measured temperature: Ta = 25°C

Characteristics		Symbol	Conditions	Min	Typ	Max	Unit	Note
Contrast Ratio		CR	θ=Φ=0° Normal Viewing Angle	700	1100	-	-	3
Colour Gamut		S(%)		-	71.5	-	%	
Viewing Angle	Left	θL	CR≥10	80	-	-	deg	4
	Right	θR		80	-	-		
	Up	θU		80	-	-		
	Down	θD		80	-	-		
Colour Chromaticity	Red	Rx	CR≥10	0.60	0.64	0.68	-	5
		Ry		0.29	0.33	0.37		
	Green	Gx		0.27	0.31	0.35		
		Gy		0.57	0.61	0.65		
	Blue	Bx		0.11	0.15	0.19		
		By		0.01	0.05	0.09		
	White	Wx		0.27	0.31	0.35		
		Wy		0.29	0.33	0.37		

Note	Item	Test method
1	Setup	The display should be stabilised at a given temperature for 30 minutes to avoid abrupt temperature change during measuring. To stabilise the luminance, measurements should be executed after lighting the backlight for 30 minutes in a windless room. 
2	Response time	Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white. 
3	Contrast ratio	Measure maximum brightness and minimum brightness at the centre of the screen by displaying raster or window pattern. Then calculate the ratio between these two values. Contrast Ratio (CR) = Brightness of unselected position (white) / Brightness of selected position (black)
4	Viewing angle Horizontal θ Vertical Ø	Move the luminance meter from right to left and up and down and determinate the angles where contrast ratio is 10 
5	Colour chromaticity	Measure chromaticity coordinates x and y of CIE1931 colorimetric system

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6.0 Quality Assurance Specification

6.1 Delivery Inspection Standards

6.1.1 Inspection Conditions

Inspection distance: 30 cm - 50cm
Viewing angle: ±45°

6.1.2 Environmental Conditions

Ambient temperature: 25°C ± 5°C
Ambient humidity: 65±10% RH
Ambient illumination: 300~700 lux

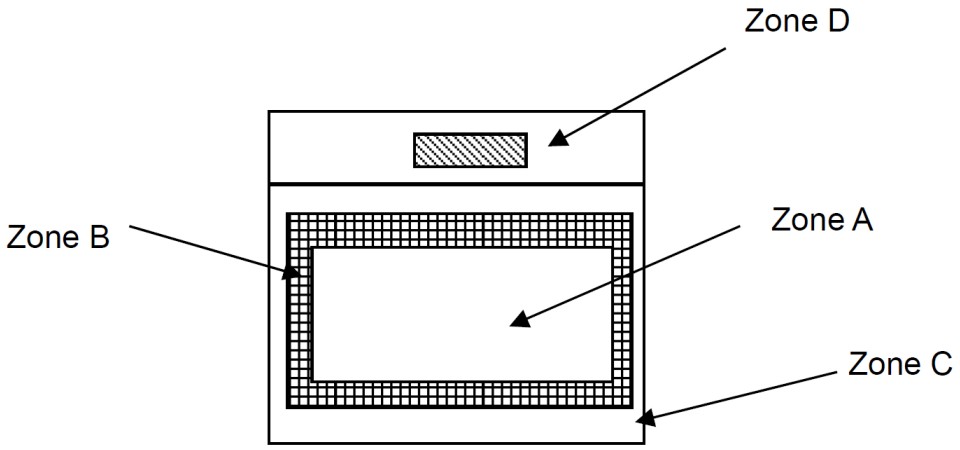
6.1.3 Sampling Conditions

1. Lot size: quantity of shipment lot per model
2. Sampling method:

Sampling plan		GB/T 2828-2003
		Normal inspection, Class II
AQL	Major Defect	0.65%
	Minor Defect	1.5%

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

6.1.4 Zone Definition



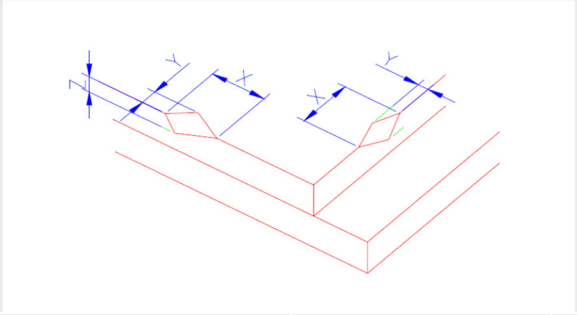
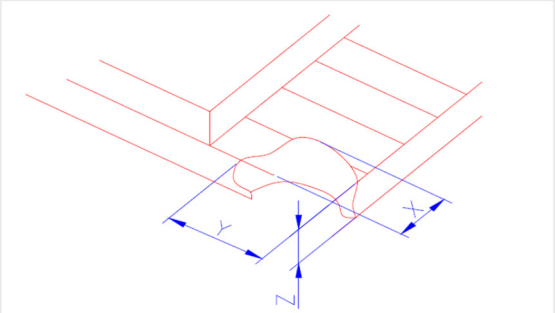
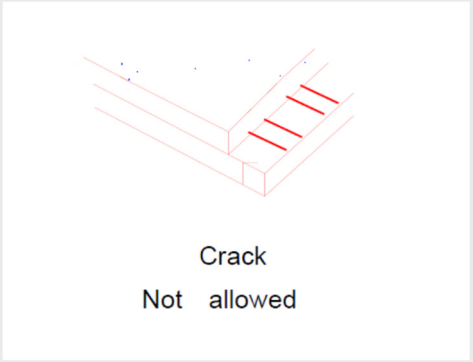
Zone A: Effective Viewing Area (Character or Digit can be seen)
Zone B: Viewing Area except Zone A
Zone C: Outside (ZoneA+ZoneB) which can't be seen after assembly by customer.
Zone D: IC Bonding Area
Note: Generally, visual defects in Zone C can be ignored when it doesn't affect product function or appearance after assembly by customer.

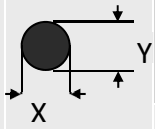
6.1.5 Basic Principle

A set of sample to indicate the limit of acceptable quality level shall be discussed should a dispute occur.

6.1.6 Inspection Criteria

<table>
<tr><th>Number</th><th>Items</th><th colspan="3">Criteria (mm)</th></tr>
<tr><td rowspan="5">1.0 LCD Crack/ Broken

Note:
X: Length
Y: Width
Z: Height
L: Length of ITO
T: Height of LCD</td><td rowspan="2">(1) The edge of LCD broken</td><td colspan="3">  </td></tr>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr>
<tr><td rowspan="3">(2) LCD corner broken</td><td colspan="3">  </td></tr>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr>
<tr><td>(3) LCD crack</td><td colspan="3"> 
Crack
Not allowed</td></tr>
</table>

<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td>2.0</td><td>Spot defects
 

Φ=(X+Y)/2</td><td>
① Light dot (LCD/TP/Polarizer black/white spot, light dot, pinhole, dent, stain)
<table>
<tr><th rowspan="2">Size (mm)</th><th rowspan="2">Zone</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td colspan="2">Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td colspan="2">0.10<Φ≤0.25</td><td colspan="2">4(distance≧10mm)</td></tr>
<tr><td colspan="2">0.25<Φ≤0.35</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Φ>0.4</td><td colspan="2">0</td></tr>
</table>
②Dim spot (LCD/TP/Polarizer dim dot, light leakage, dark spot)
<table>
<tr><th rowspan="2">Size (mm)</th><th rowspan="2">Zone</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td colspan="2">Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td colspan="2">0.10<Φ≤0.25</td><td colspan="2">4(distance≧10mm)</td></tr>
<tr><td colspan="2">0.25<Φ≤0.35</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Φ＞0.40</td><td colspan="2">0</td></tr>
</table>
③ Polarizer accidented spot
<table>
<tr><th rowspan="2">Size (mm)</th><th rowspan="2">Zone</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td colspan="2">Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td colspan="2">0.3<Φ≤0.5</td><td colspan="2">3(distance≧10mm)</td></tr>
<tr><td colspan="2">Φ>0.5</td><td colspan="2">1</td></tr>
</table>
</td></tr>
<tr><td></td><td>
④ Pixel bad points (light dot, Dim dot, colour dot)
<table>
<tr><th rowspan="2">Size (mm)</th><th rowspan="2">Zone</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td colspan="2">Φ≤0.15</td><td>Ignore</td><td rowspan="3" colspan="2">Ignore</td></tr>
<tr><td colspan="2">0.2<Φ≤0.3</td><td>2(distance≧10mm)</td></tr>
<tr><td colspan="2">Φ>0.4</td><td>1</td></tr>
</table>
⑤ Polarizer Bubble
<table>
<tr><th rowspan="2">Size (mm)</th><th rowspan="2">Zone</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td colspan="2">Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td colspan="2">0.3<Φ≤0.4</td><td colspan="2">4(distance≧10mm)</td></tr>
<tr><td colspan="2">0.4<Φ≤0.5</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Φ>0.5</td><td colspan="2">1</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td rowspan="5">3.0</td><td rowspan="5">Line defect (LCD/TP/ Polarizer black/ white line, scratch, stain)</td><td rowspan="2">Width (mm)</td><td rowspan="2">Length (mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤5.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤4.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="5">Define as spot defect</td></tr>
<tr><td>4.0</td><td>SMT</td><td colspan="5">Do not allow: missing parts, solderless connection, cold solder joint, miss match, the positive and negative polarity oppose</td></tr>
<tr><td>5.0</td><td>Display colour & Brightne ss</td><td colspan="5">1. Colour: Measuring the colour coordinates, The measurement standard according to the datasheet or samples
2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples</td></tr>
<tr><td>6.0</td><td>LCD Mura</td><td colspan="5">By 5% ND filter invisible</td></tr>
</table>

- Criteria (functional items)

Number	Items	Criteria
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed

6.2 Dealing with Customer Complaints

6.2.1 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.

6.2.2 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.

Densitron

7.0 Reliability Specification

7.1 Reliability Tests

Test Item	Test Condition		Sample Size
High Temperature Operation	Ta= 70°C	96 h	3pcs
Low Temperature Operation	Ta = -20°C	96 h	3pcs
High Temperature Storage	Tp = 80°C	96 h	3pcs
Low Temperature Storage	Tp = -30°C	96 h	3pcs
High Temperature & High Humidity Operation	60°C, 90% RH	96 h	3pcs
Thermal Shock (Non-operation)	-30℃,30 min ↔ 80℃,30 min, Change time: 5min 20 Cycles.		3pcs
ESD test	C=150pF, R=330,5points/panel Air: ±8KV, 5times; Contact: ±6KV, 5 times; (Environment: 15℃~35℃, 30%~60%).		3pcs
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).		3pcs
Box Drop Test	1 Corner 3 Edge 6 faces, 80 cm (Medium Box)		1 box

Note: Ta = ambient temperature, Tp= panel temperature

Notes:
1.The test samples should be applied to only one test item.
2. No dew condensation to be observed.
3. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
4. No cosmetic or functional defects should be allowed.
5. Total current consumption should be less than twice the initial value.
6. In case of malfunction defect caused by ESD damage, if it recovers to normal state after resetting, it is judged as a good part.

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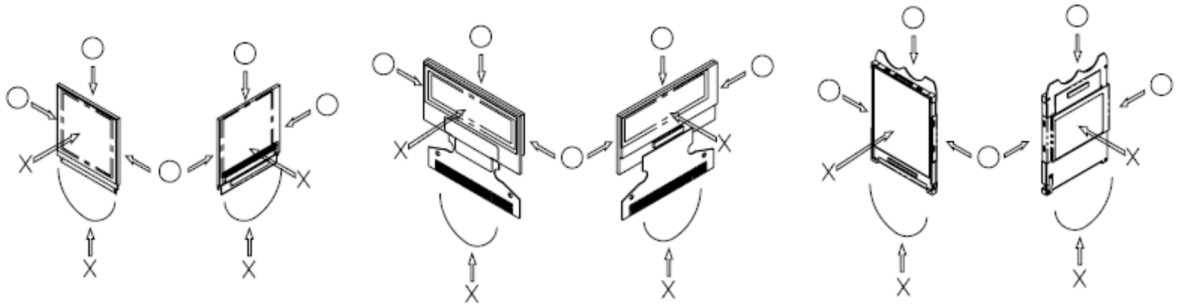
8.0 Handling Precautions

8.1 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
2. 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.
3. 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.
    - Be sure to make human body grounding when handling display modules.
    - Be sure to ground tools to use or assembly such as soldering irons.
    - To suppress generation of static electricity, avoid carrying out assembly work under dry environments.

- 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.

8.2 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.

8.3 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.

8.4 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. Consider 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.
    - Pins and electrodes
    - 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.
    - Design the product and installation method so that the driver may be shielded from light in actual usage.
    - 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 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 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.

8.5 Other Precautions

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.