

DMT121XGHLNT0-2C

PRODUCT SPECIFICATION

Version 0.1
Jun 17, 2023

TBD

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

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Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Jun 17, 2023	Preliminary	Yvette Hsieh

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1. General Description

1.1 Introduction

This is a 12.1" 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 1024 x 768 and can display up to 16.7M/262K colours. The display module supports 1 port LVDS 8bit interface.

1.2 Main Features

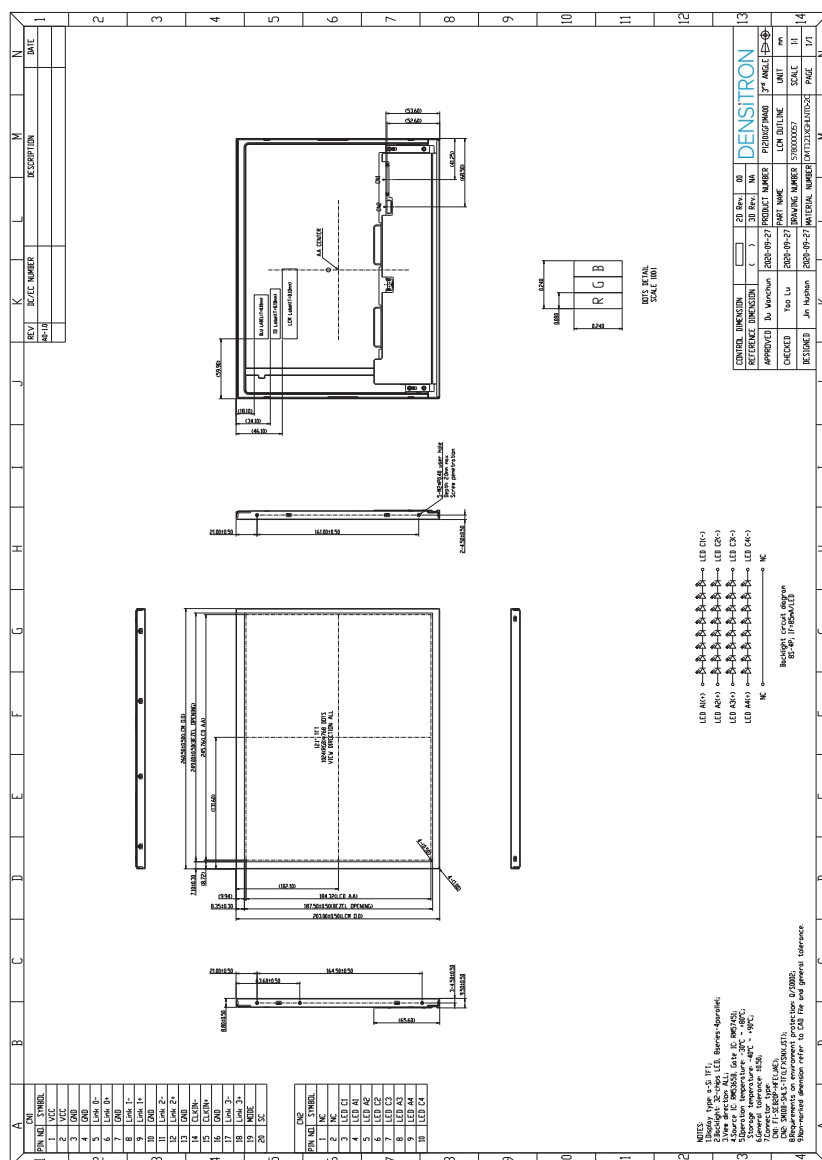
Item	Contents
Display Type	TFT LCD
Screen Size	12.1" Diagonal
Display Format	1024 x RGB x 768 Dots
No. of Colour	16.7M/262K
Overall Dimensions	260.5 (W) x 203.0 (H) x 9.5 (D) mm
Active Area	245.76 (W) x 184.32 (H) mm
Mode	Transmissive, Normally Black
Surface Treatment	Anti-Glare (3H)
Viewing Direction	All round
Interface	1 port LVDS 6/ 8bit
Driver IC	Source: RM5365B Gate: RM57451
Backlight Type	LED, White, 32 chips
Operating Temperature	-30°C ~ +80°C
Storage Temperature	-40°C ~ +90°C
ROHS	Compliant to RoHS 2.0

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	1024 x RGB x 768	Dots
Overall Dimensions	260.5 (W) x 203.0 (H) x 9.5 (D)	mm
Active Area	245.76 (W) x 184.32 (H)	mm
Dot Pitch	0.24 x 0.24	mm
Weight	550	g

2.2 Mechanical Drawing



3. Electrical Specification

3.1 Absolute Maximum Ratings

3.1.1 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Note
Voltage Input	V_{in}	-0.5	5	V	1
Operating Temperature	T_{op}	-30	80	°C	-
Storage Temperature	T_{ST}	-40	90	°C	-
Relatively Humidity	RH	-	≤95	%	$T_a \leq 40^{\circ}\text{C}$
		-	≤85	%	$40^{\circ}\text{C} \leq T_a \leq 50^{\circ}\text{C}$
		-	≤55	%	$50^{\circ}\text{C} \leq T_a \leq 60^{\circ}\text{C}$
		-	≤36	%	$60^{\circ}\text{C} \leq T_a \leq 70^{\circ}\text{C}$
		-	≤24	%	$70^{\circ}\text{C} \leq T_a \leq 80^{\circ}\text{C}$
Absolute Humidity	AH	-	≤70	g/m^2	$T_a > 70^{\circ}\text{C}$

Note1: The parameter is for driver IC (gate driver, source driver) only.

Note2: T_a means the ambient temperature.

It is necessary to limit the relative humidity to the specified temperature range.

Condensation on the module is not allowed.

Note 3: 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 4: The response time will be extremely slow when the operating temperature is around -10°C , and the background will become darker at high temperature operating.

3.2 Electrical Characteristics

3.2.1 TFT LCD module

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{DD}	-	-	3.3	-	V
Power Supply ripple	V_{p-p}	-	-	-	-	mV
Power supply current	I_{DD}	-	-	-	-	mA
LCD power consumption	P	-	-	200	-	mW
Gate On Voltage	V_{GH}	-	-	23	-	mV
Differential input voltage	I_{VidI}	-	-	-	-	mV
Gate on Voltage	V_{GL}	-	-	-7	-	V
Power For Analog Circuit	A_{VDD}	-	-	12.5	-	V
Logic Input Voltage	Low level	V_{IL}	-	0	-	$0.3V_{DD}$
	High level	V_{IH}	-	$0.7V_{DD}$	-	V_{DD}
Inrush current	I_{rush}	-	-	-	-	A

3.3 Interface Pin Assignmen

3.3.1 TFT LCD Panel

Connector type: JAE FI SEB20P HFE

No.	Symbol	I/O	Function	Note
1	VCC	P	+3.3V Power supply	-
2	VCC	P	+3.3V Power supply	-
3	GND	P	Ground	-
4	GND	P	Ground	-
5	D0-	I	LVDS Channel 0-	-
6	D0+	I	LVDS Channel 0	-
7	GND	P	Ground	-
8	D1-	I	LVDS Channel 1-	-
9	D1+	I	LVDS Channel 1+	-
10	GND	P	Ground	-

No.	Symbol	I/O	Function	Note
11	D2-	I	LVDS Channel 2-	-
12	D2+	I	LVDS Channel 2+	-
13	GND	P	Ground	-
14	CLK-	I	LVDS Clock-	-
15	CLK+	I	LVDS Clock+	-
16	GND	P	Ground	-
17	D3-	I	LVDS Channel 3-	-
18	D3+	I	LVDS Channel 3+	-
19	Mode	I	Low=ISP 6bit compatibility mode High=ISP 8bit compatibility mode	-
20	SC	I	Scan direction control (Low: Normal High: Reverse)	-

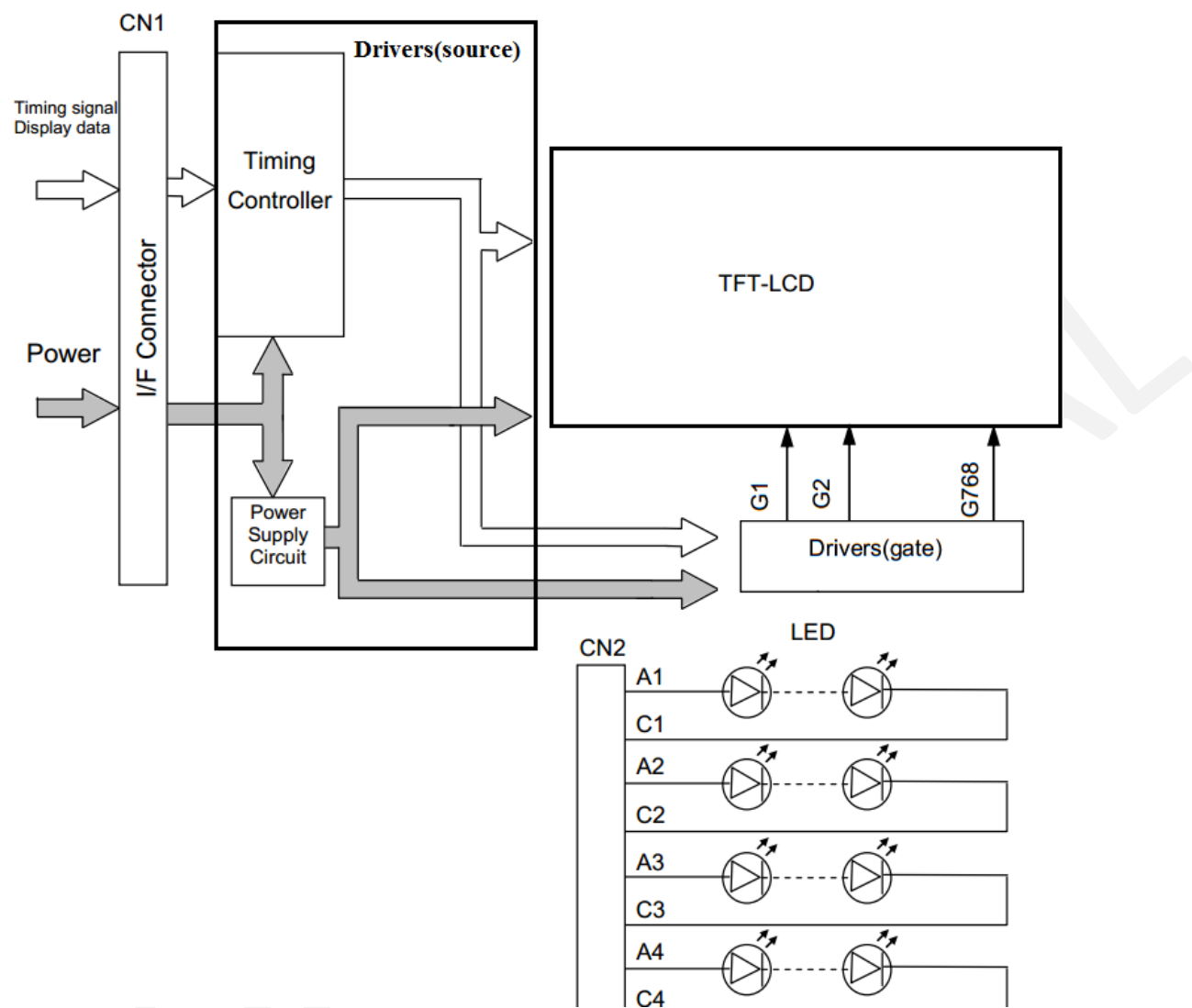
Note: :I/O definition. I Input pin, O Output pin, P Power/Ground, N No Connection

3.3.2 Backlight (CN2)

Connector type: SM10B-SHLS-TF(LF)

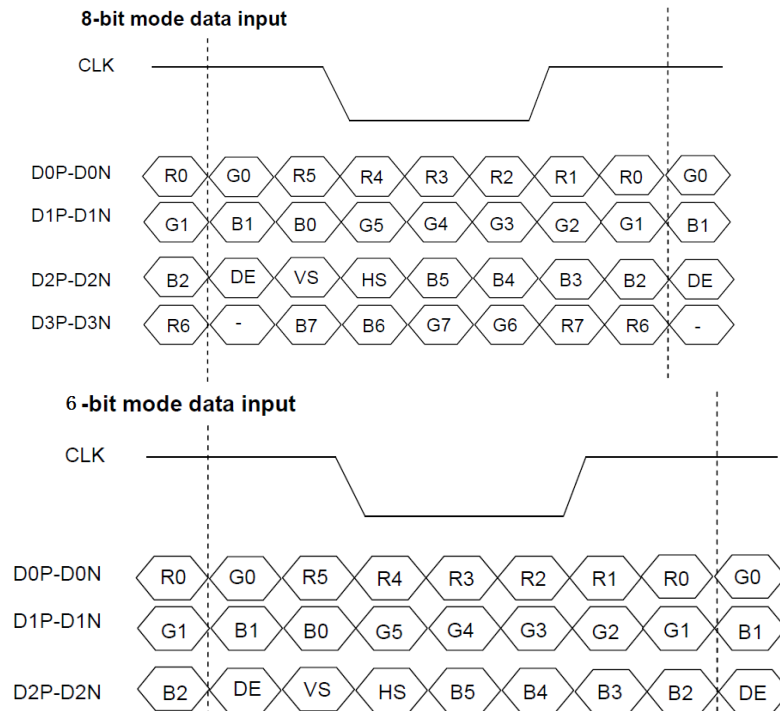
No.	Symbol	I/O	Function	Note
1	NC	N	This pin should be open	-
2	NC	N	This pin should be open	-
3	LEDC1	P	Cathode 1	-
4	LEDA1	P	Anode 1	-
5	LEDA2	P	Anode 2	-
6	LEDC2	P	Cathode 2	-
7	LEDC3	P	Cathode 3	-
8	LEDA3	P	Anode 3	-
9	LEDA4	P	Anode 4	-
10	LEDC4	P	Cathode 4	-

3.4 Block Diagram

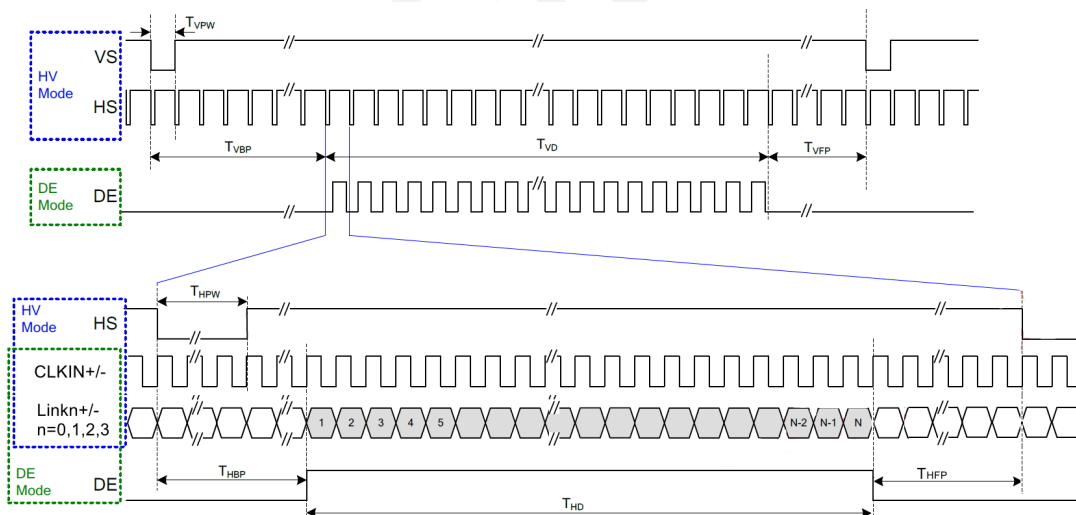


3.5 Timing Characteristics

3.5.1 LVDS data input format



3.5.2 DE mode for 1024RGB*768



Note: As shown in the figure above, the customer only needs to look at the DE mode section, instead of the SYNC section.

4. Optical Specification

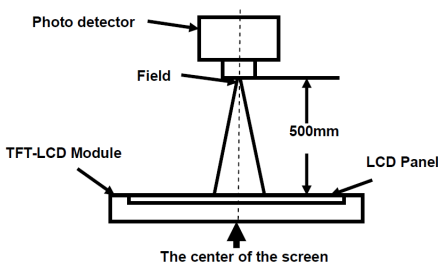
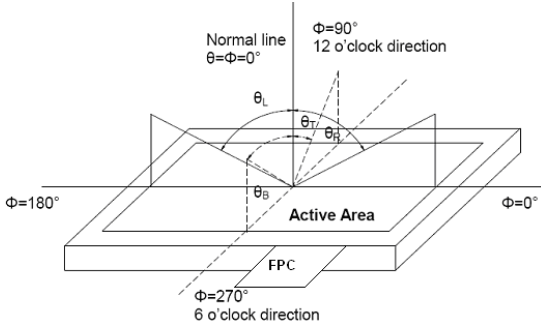
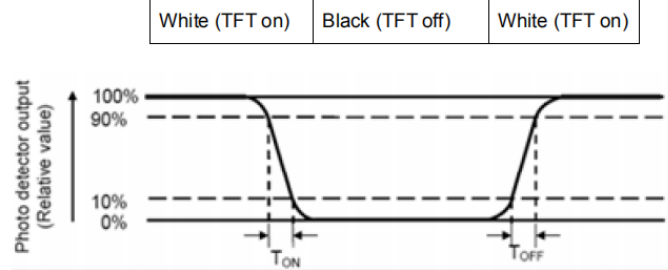
4.1 Optical Characteristics

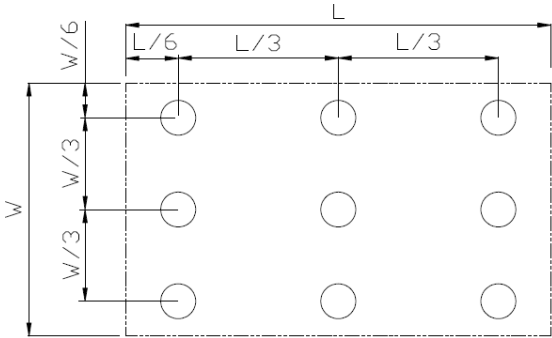
Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	$\theta=0$	800	1000	-	-	1, 3
Response time		TR + TF	Normal Viewing Angle	-	50	70	ms	1, 4
Viewing Angle	Left	θ_{x-}	CR \geq 10	80	88	-	-	2
	Right	θ_{x+}		80	88	-		
	Up	θ_{y+}		80	88	-		
	Down	θ_{y-}		80	88	-		
Colour Chromaticity	Red	Rx	Backlight is on	TBD			-	1, 5
		Ry						
	Green	Gx						
		Gy						
	Blue	Bx						
		By						
	White	Wx						
		Wy						
Luminance 1		L	IF =85mA	1000	1300	-	cd/m ²	1
Luminance 2		L	IF =100mA	1150	1500	-	cd/m ²	1
Uniformity		U	-	75	80	-	%	1, 6
NTSC		-	-	67	72	-	%	5

Test Conditions:

1. The ambient temperature is 25 \pm 2 $^{\circ}$ C .humidity is 65 \pm 7%
2. The test systems refer to Note 1 and Note 2.

Note	Item	Test method
1	Definition of optical measurement system	The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

Note	Item	Test method
		
2	Definition of viewing angle range and measurement system.	<p>viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo 80)</p> 
3	Definition of contrast ratio	<p>Contrast ratio (CR) = $\frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$</p> <p>White</p> <p>state: The state is that the LCD should driven by Vwhite.</p> <p>Black state: The state is that the LCD should driven by Vblack.</p> <p>Vwhite: To be determined Vblack: To be determined</p>
4	Definition of Response time	<p>The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.</p> 
5	Definition of color chromaticity (CIE1931)	<p>Color coordinates measured at center point of LCD.</p>

Note	Item	Test method
6	Definition of Luminance Uniformity	<p>Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.</p> <p>Luminance Uniformity(U) = Lmin/ Lmax</p> <p>L-----Active area length W----- Active area width</p>  <p>Lmax: The measured maximum luminance of all measurement position</p> <p>Lmin: The measured minimum luminance of all measurement position.</p>
7	Definition of Luminance	Measure the luminance of white state at center point

5. LED Backlight Specification

5.1 LED Backlight Characteristics

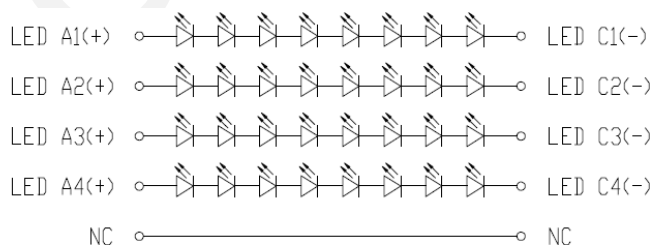
Luminance 1: 13 00 cd/m² (typ.)

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Current Voltage (per string)	V _F	-	-	24	26.4	V	-
Forward Current(per string)	I _F	-	-	85	-	mA	-
Backlight Power Consumption	W _{BL}	-	-	8160	8976	mW	-
LED Life Time	-	-	-	100000	-	Hrs	-

Luminance 2: 15 00 cd/m² (typ.)

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Current Voltage (per string)	V _F	-	-	24	26.4	V	-
Forward Current(per string)	I _F	-	-	100	-	mA	-
Backlight Power Consumption	W _{BL}	-	-	9600	10560	mW	-
LED Life Time	-	-	-	100000	-	Hrs	-

5.2 INTERNAL CIRCUIT DIAGRAM



Backlight circuit diagram
8S-4P; I_F=85mA/LED

6. Packaging

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7. Quality Assurance Specification

7.1 Conformity

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

7.2 Environment Required

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7.3 Delivery Assurance

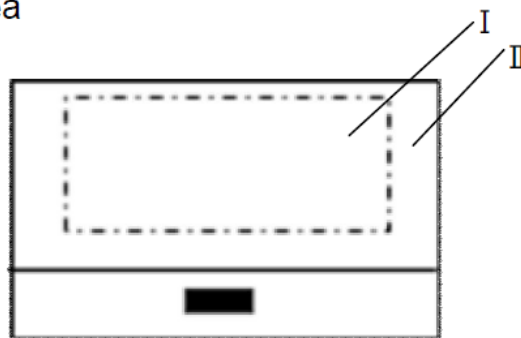
7.3.1 Delivery Inspection Standards

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

7.3.2 Zone Definition

I area: viewing area

II area: outside viewing area



7.3.3 Criteria & Acceptable Quality Level

TBD

7.3.4 Criteria & Classification

TBD

7.4 Dealing with Customer Complaints

7.4.1 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.

7.4.2 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.

8. Reliability Specification

8.1 Reliability Tests

Item	Test Condition	Note
High Temperature Operation	Ta = 80°C, t=500 hrs	-
Low Temperature Operation	Ta = -30°C, t=500 hrs	-
High Temperature Storage	Ta = 90°C, t=500 hrs	-
Low Temperature Storage	Ta = -40°C, t=500 hrs	-
High Temperature & High Humidity Operation	Ta = 60°C, 90% RH max, t=500hrs	-
Thermal Shock (non operation)	-30°C 30 min~+ 80°C 30 min, Change time:5min, 100 Cycle	-
ESD	C=150pF, R=330Ω, 9 point/panel Air: ± 15 Kv, 5 times. Contact: ± 8 Kv, 5 times (Environment:15°C ~35°C, 30%~60%.86Kpa~106Kpa)	-
Vibration Test (Non Op)	5~100HZ, 19.60m/s ² 1min/cycle 120times Per X/Y/Z	-
Mechanical Shock (Non Op)	539m/s ² , 11ms, 5times ±X, ±Y, ±Z	-

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display. function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

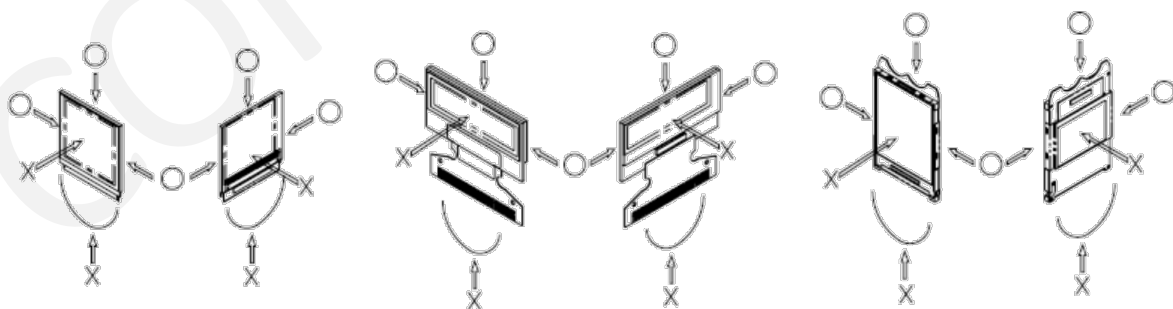
8.1.1 Inspection Check Standard

TBD

9. Handling Precautions

9.1 Handling Precautions

- 1) Since the display panel is being made of glass, do not apply mechanical impacts such as 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 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) 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.

9.2 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.

9.3 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.

9.4 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.

9.5 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.