DMT070WVNLCMI-2B
PRODUCT SPECIFICATION

Version 0.1
Feb 17, 2023

TBD

Customer's Approval	
Signature	*Date*

Prepared by *Victoria Ho*
Approved by *Kenny Lin*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Feb 17, 2023	Preliminary	Victoria Ho

Legal Notice

Table of Contents

1. General Description

1.1 Introduction

This is a 7" size colour active matrix TFT LCD module that uses amorphous silicon TFT as a switching device. The display is normally white mode, transmissive, and featuring high contrast and excellent colour saturation. The resolution of the TFT-LCD is 800 x 480 and can display up to 262K colours. The display module supports 6-bit LVDS interface and tape bonding touch panel.

1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	7" Diagonal
Display Format	800 x RGB x 480 Dots
No. of Colour	65K / 262K
Overall Dimensions	182.00 (W) x 125.00 (H) x 15.65 (D) mm
Active Area	154.08 (W) x 85.92 (H) mm
Mode	Normally White / Transmissive / TN
Viewing Direction	6 o'clock (12 o'clock gray inversion)
Driver IC	EK9713/EK7330
Interface	6-bit LVDS
Backlight Type	LED, White
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	CTP
Touch Interface	I²C
Touch Driver IC	ST1633i
Bonding Type	Tape Bonding
Structure	G+G
Slave Address	0x55
Touch Mode	Five points

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	800 x RGB x 480	Dots
Overall Dimensions	182.00 (W) x 125.00 (H) x 15.65 (D) mm	mm
Active Area	154.80 (W) x 85.92 (H) mm	mm
Pixel Pitch	0.1926 x 0.1790	mm
Weight	TBD	g
IC Controller/Driver	EK9713/EK7330	

2.2 Mechanical Drawing
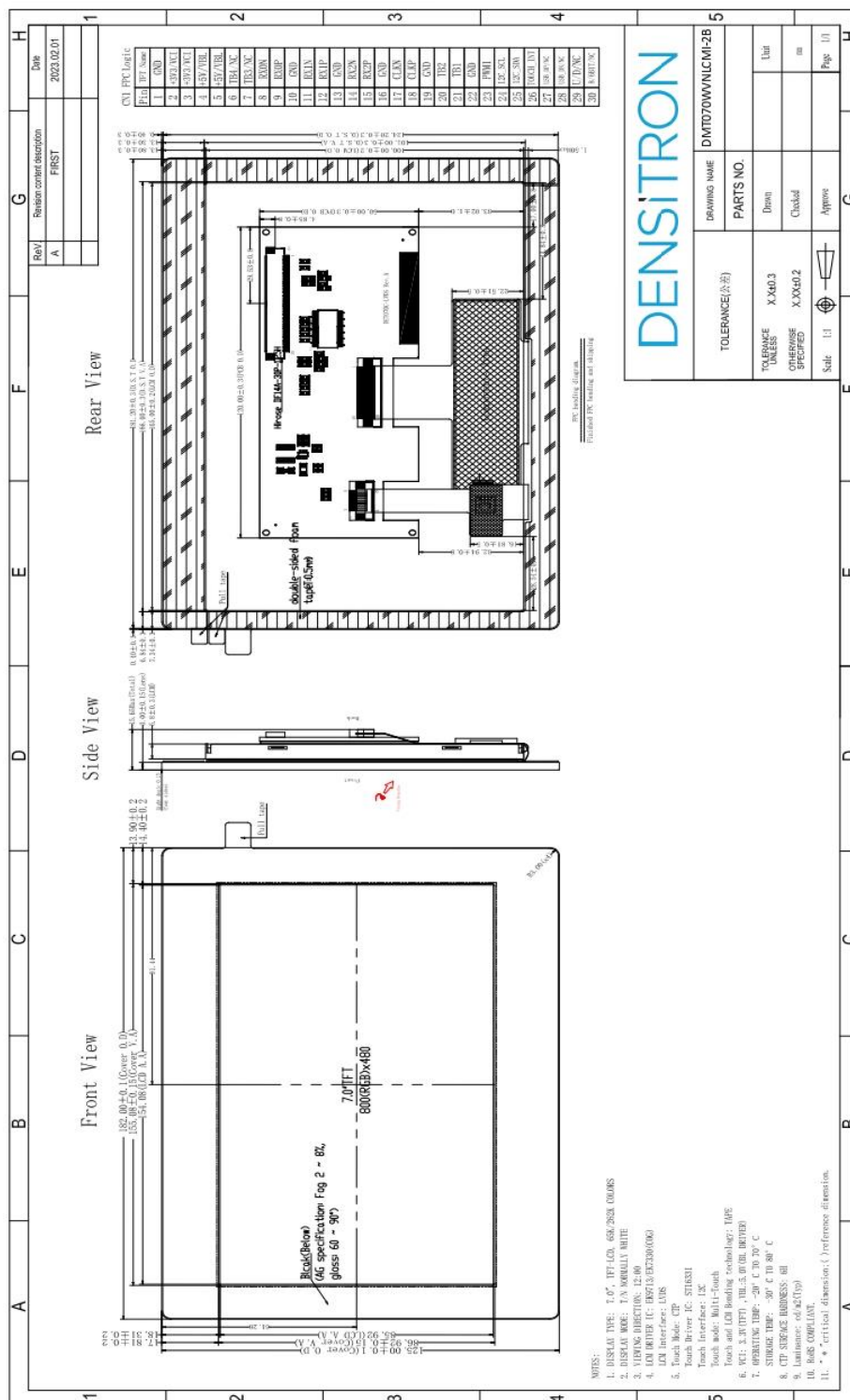
3. Electrical Specification

3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Digital Supply Voltage	VCI	-0.5	5.0	V	1
BL Supply Voltage	VBL	-0.3	20	V	
Operating Temperature	T_{OP}	-20	+70	°C	-
Storage Temperature	T_{ST}	-30	+80	°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 rating.

3.2 DC Electrical Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
Digital Supply Voltage	VCI	3.0	3.3	3.6	V	-
Normal Mode Current	IDD	-	TBD	-	mA	-
Level Input Voltage	V_{IH}	$0.7V_{CC}$	-	VCC	V	-
	V_{IL}	GND	-	$0.3V_{CC}$	V	-
Level Output Voltage	V_{OH}	$0.8V_{CC}$	-	VCC	V	-
	V_{OL}	GND	-	$0.2V_{CC}$	V	-

3.3   Interface Pin Assignment

3.3.1   TFT PIN Definition

No.	Symbol	I/O	Function
1	GND	P	Ground
2	+3V3/VCI	P	Supply voltage (3.3V).
3	+3V3/VCI	P	Supply voltage (3.3V).
4	+5V/BL	P	Supply voltage (5.0V).
5	+5V/BL	P	Supply voltage (5.0V).
6	TB4/NC	-	No connection
7	TB3/NC	-	No connection
8	RXIN0-	I	- LVDS differential data input
9	RXIN0+	I	+ LVDS differential data input
10	GND	P	Ground
11	RXIN1-	I	- LVDS differential data input
12	RXIN1+	I	+ LVDS differential data input
13	GND	P	Ground
14	RXIN2-	I	- LVDS differential data input
15	RXIN2+	I	+ LVDS differential data input
16	GND	P	Ground
17	RXCLKIN-	I	- LVDS differential clock input
18	RXCLKIN+	I	+ LVDS differential clock input
19	GND	P	Ground
20	TB2	-	No Connection
21	TB1	-	No Connection
22	GND	P	Ground
23	PWM1	O	Backlight CABC controller signal output
24	I^2C_SCL	I	I^2C clock input.
25	I^2C_SDA	I/O	I^2C data input and output
26	TOUCH_INT	I	External interrupt to the host.
27	USB_DP/NC	-	No connection
28	USB_DP/NC	-	No connection

No.	Symbol	I/O	Function
29	U/D/NC	-	No connection
30	8/6-bit/NC	-	No connection

3.4 Block Diagram
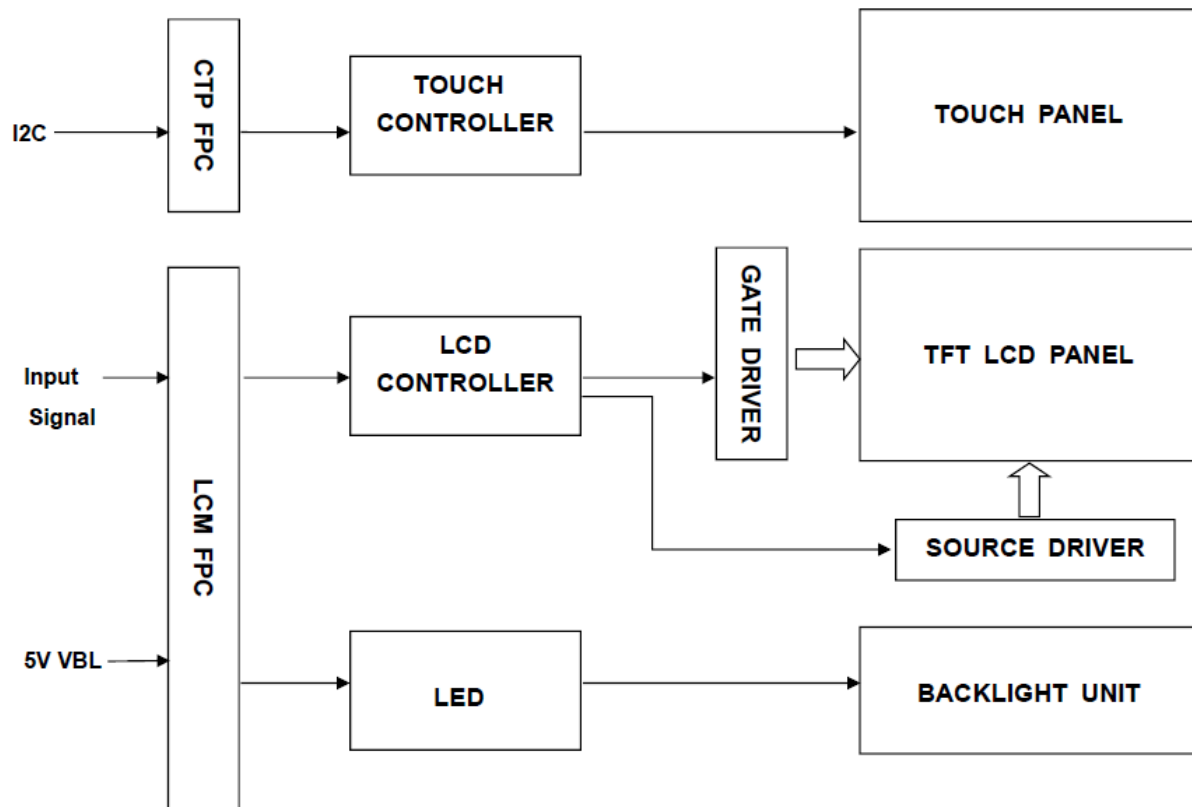
3.5 Timing Characteristics

3.5.1 AC Electrical Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
LVDS Differential input high Threshold voltage	R_XVTH	-	-	+100	mV	RXVCM=1.2V
LVDS Differential input low Threshold voltage	R_XVTL	-100	-	-	mV	
LVDS Differential input common mode voltage	RxVCM	0.7	-	1.6	V	
LVDS Differential voltage	$\lvert VID \rvert$	200	-	600	mV	
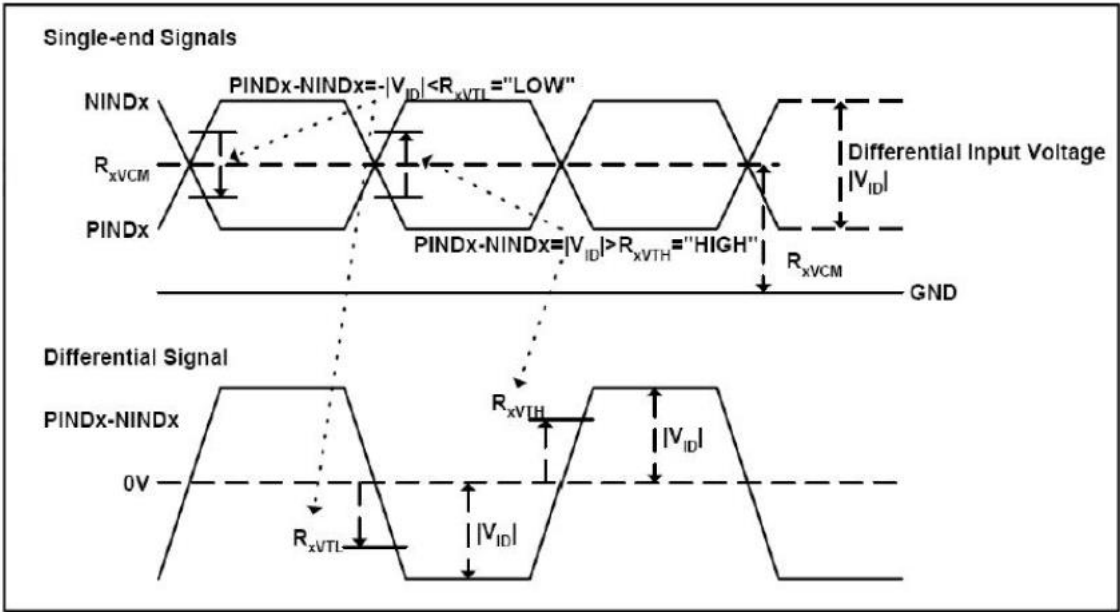
3.5.2 Timing Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
CLK Frequency	1/Tc	26.4	33.3	46.8	MHZ	Frame rate = 60hz
Horizontal display area	THD		800		Tc	
HS period time	TH	862	1056	1200	TC	
HS Width Back Porch + Front Porch	THW+THBP+THFP	16	210	354	TC	
Vertical display area	TVD		480		TH	
VS period time	TV	515	525	650	TH	
VS Width Back Porch + Front Porch	TVW+TVBP+TVFP	7	22	147	TH	
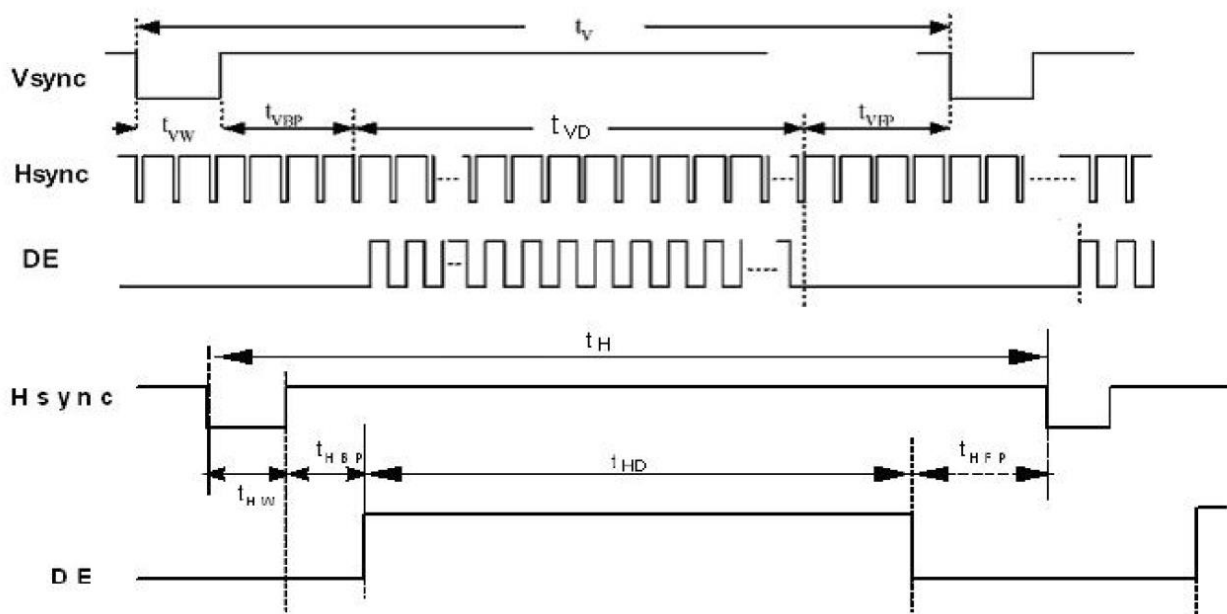
3.5.3   Data Input Format for LVDS
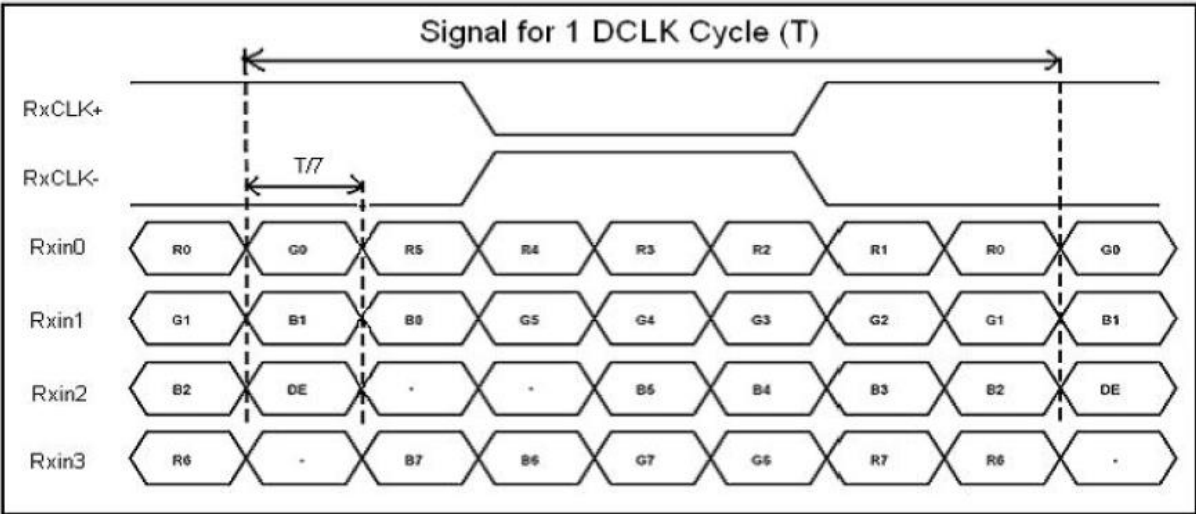
4. Electrical Specification Touch

4.1 Electrical Characteristics

4.1.1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Note
USB Power Supply Voltage	VDD	-0.3	6.0	V	
Operating temperature	T_{OP}	-20	+70	℃	
Storage temperature	T-	-30	+80	℃	

Note: If used beyond the absolute maximum ratings, ILI2511 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.

4.1.2 DC Electrical Characteristics

(Ambient temperature:25℃, VDD=3.3V, VDDIO=1.8V or VDDIO=VDD)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	2.7	3.3	3.6	V	
Normal mode operating current	-	-	16.1	24	V	
Green mode operating current	-	-	8.1	12.2	V	
Power Down Current	-	-	-	20	V	
Digital Input low voltage	VIL	-	-	0.15*VDD	V	
Digital Input high voltage	VIH	0.85*VDD	-	-	mV	

4.1.3 AC Electrical Characteristics
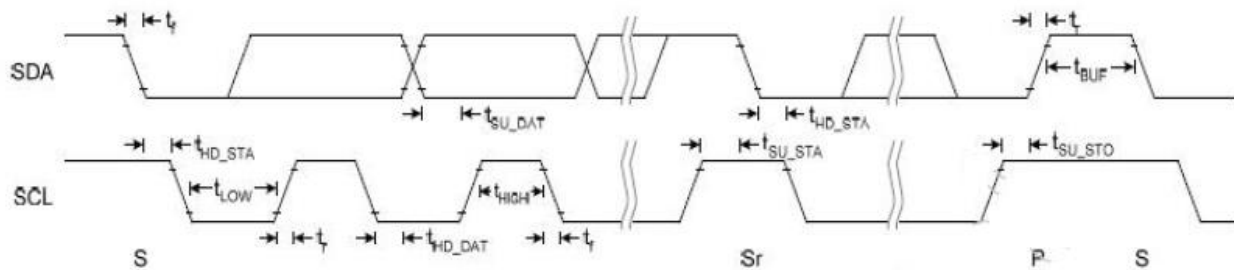
Conditions: VDD = 3.3V, GND = 0V, T_A = 25°C

Item	Symbol	Min.	Typ.	Max.	Unit
SCL clock frequency	f_{SCL}	0	-	400	kHz
Low period of the SCL clock	t_{LOW}	1.3	-	-	µs
High period of the SCL clock	t_{HIGH}	0.6	-	-	µs
Signal falling time	t_f	-	-	300	ns
Signal rising time	t_r	-	-	300	ns
Set up time for repeated START condition	t_{SU_STA}	0.6	-	-	µs
Hold time (repeated) START condition. After this period, the first clock pulse is generated	t_{HD_STA}	0.6	-	-	µs
Data set up time	t_{SU_DAT}	100	-	-	ns
Data hold time	t_{HD_DAT}	0	-	0.9	µs
Set up time for STOP condition	t_{SU_STD}	0.6	-	-	µs
Bus free time between a STOP and START condition	t_{BUF}	1.3	-	-	µs
Capacitive load for each bus line	C_b	-	-	400	pF

4.1.4   SYSTEM MANAGEMENT

Power Down

In power down mode, all of the clocks of ST1633i are stopped. The way to exit power down mode is by a hardware reset or I²C.

Reset

Master can reset ST1633i through RESET pin. RESET pin is low active and needs hold low for 1μs to take effect.
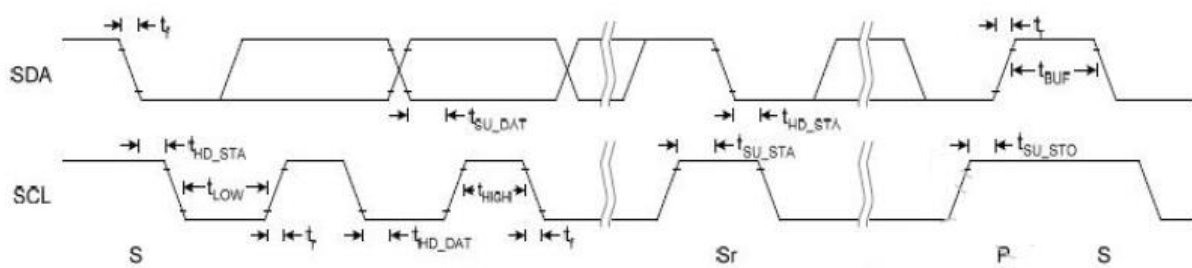
Power On/Off Sequence

RESET pin should be held low before power on and power off. During power on, after both VDD and IOVDD reach normal voltage, RESET pin needs to be held low for 5ms to ensure internal block stable. Note: IOVDD and VDD had connected together.

5. Optical Specification

5.1 Optical Characteristics

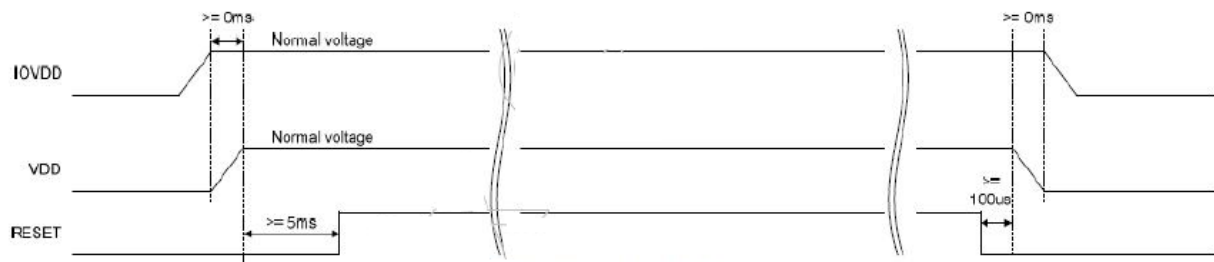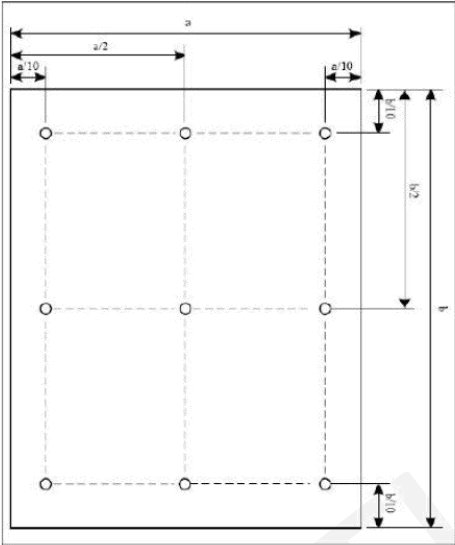| Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	θ=0	400	500	-	-	1, 2
Response time		TR + TF	Normal Viewing Angle	-	15	30	msec	1, 3
Color Gamut		S(%)	-	-	TBD	-	-	
Viewing Angle	Left	θ_x-	CR≥10	40	50	-	-	1, 4
	Right	θ_x+		60	70	-		
	Up	θ_Y+		60	70	-		
	Down	θ_Y-		60	70	-		
Colour Chromaticity	Red	Rx	θ=0 Normal Viewing Angle	-0.04	TBD	+0.04	-	1, 4 CF-glass
		Ry			TBD			
	Green	Gx			TBD			
		Gy			TBD			
	Blue	Bx			TBD			
		By			TBD			
	White	Wx			TBD			
		Wy			TBD			
LCM Luminance		Lv	-	-	(500)	-	cd/m^2	4
Uniformity		AVg	-	TBD	-	-	%	4

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 Uniformity of these 9 points is defined as below:

Note	Item	Test method
	Luminance and Uniformity	$$Uniformity = \frac{minimum\ luminance\ in\ 9\ points\ (1-9)}{maximum\ luminance\ in\ 9\ points\ (1-9)}$$ $$Luminance = \frac{Total\ Luminance\ of\ 9\ points}{9}$$

6. LED Backlight Specification

6.1 LED Backlight Characteristics

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
VLED Current consumption	IDD	-	-	180	-	mA	-
VLED Supply Voltage	VBL	-	4.5	5.0	12	V	VBL=5.0V
LED_EN logic high voltage	VIH	-	1.4	-	-	V	
LED_EN logic low voltage	VIL	-	-	-	0.4	V	
LED Lifetime	Hr	-	TBD	-	-	Hour	1, 2

Note: There is an LED driver IC inside the module to drive the backlight, IC number: LP3310.

# 7. Packaging

TBD

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.

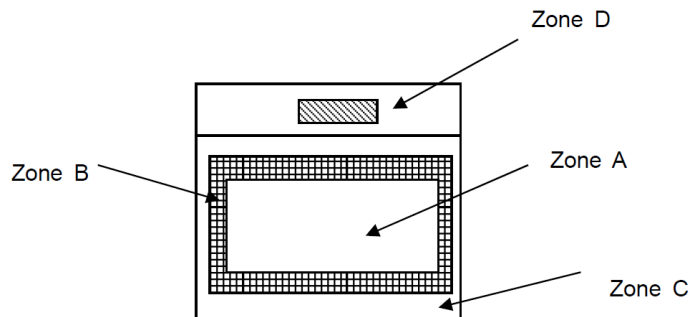Inspection table or jig must be anti-electrostatic.
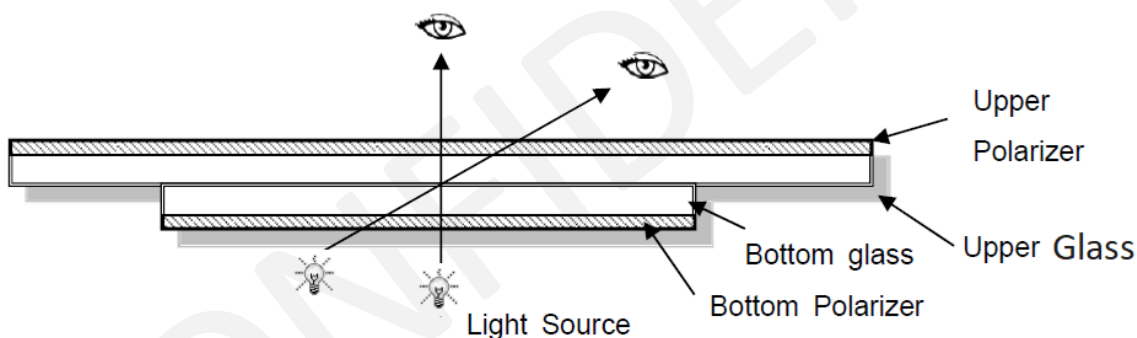
8.3   Delivery Assurance

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)

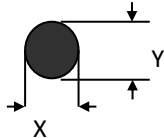LCD: Liquid Crystal Display, TP: Touch Panel, LCM: Liquid Crystal Module

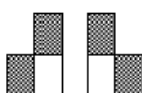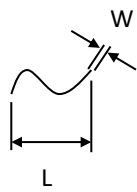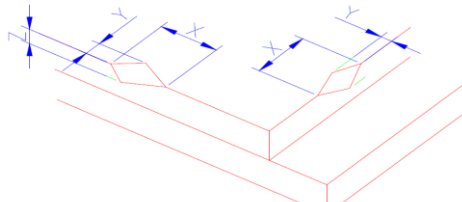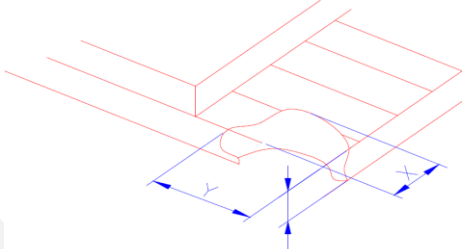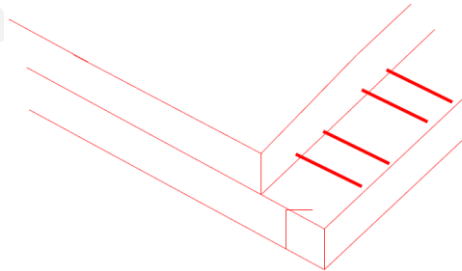| No.	Items	Criteria	Classification of defects
1	Functional Defects	1) No display, open or miss line 2) Display abnormally 3) Backlight no lighting, abnormal lighting.	Major
2	Missing	Missing component and etc.	
3	Outline Dimension	Overall outline dimension beyond the drawing is not allowed, deformation 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
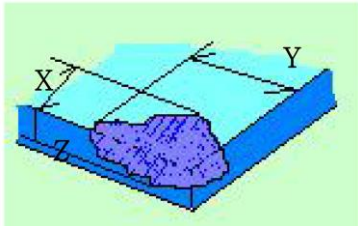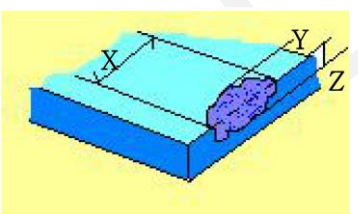
Class	Item	Criteria
Minor	Spot Defect	Round type: as per following drawing, $\varnothing = (X+Y)/2$

1) Light Dot (LCD/TP/Polarizer black/white spot, light dot, pinhole, dent, stain)

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.15$	Ignore		
$0.15 < \varnothing \leq 0.25$	3 (distance $\geqq$ 10mm)	Ignore	
$0.25 < \varnothing \leq 0.40$	2 (distance $\geqq$ 10mm)		
$0.4 < \varnothing$	0		

2) Dim Spot (Light leakage, dent, dark spot, etc.)

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.15$	Ignore		
$0.15 < \varnothing \leq 0.25$	3 (distance $\geqq$ 10mm)	Ignore	
$0.25 < \varnothing \leq 0.40$	2 (distance $\geqq$ 10mm)		
$0.4 < \varnothing$	0		

3) Polarizer Accidented Spot

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.2$	Ignore		
$0.2 < \varnothing \leq 0.5$	2 (distance $\geqq$ 10mm)		Ignore
$0.5 < \varnothing$	0		

4) Pixel Bad Points (light dot, dim dot, color dot)

Item	Zone A	Acceptable Quantity
Bright Dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Dark Dot	Random	N≤3

Class	Item	Criteria		
		2 dots adjacent		N≤0
		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

Note:

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:

2 dot adjacent   2 dot adjacent

2 dot adjacent (vertical)   2 dot adjacent (slant)

5)   Polarizer Bubble

Size\Zone	Acceptable Quantity		
	A	B	C
∅≤0.2	Ignore		Ignore
0.2<∅≤0.4	2 (distance ≥ 10mm)		
0.4<∅	0		

Class	Item	Criteria				
Minor	Line Defect (LCD/TP/ Polarizer backlight black/white line, scratch, stain)	Line type: as per following drawing	W / L			
		Width	Length	Acceptable quantity		
				A	B	C

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

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

Class	Item	Criteria
Minor	CTP Related	(see below)

1) CTP Cover sensor accidented black/white spot

Size\Zone	Acceptable Qty		
	A	B	C
∅≤0.15	Ignore		
0.15<∅≤0.25	4（distance≧10mm）		Ignore
0.25<∅≤0.35	3（distance≧10mm）		
0.35<∅	0		

2) CTP Cover Scratch

Width	Length	Acceptable Qty		
		A	B	C
Φ≤0.05	Ignore	Ignore		
0.05<W≤0.06	L≤4.0	N≤3		
0.06<W≤0.08	L≤3.0	N≤2		
0.08<W	Define as spot defect			

3) CTP Cover Pinhole/Lack of Ink

Size\Zone	Acceptable Quantity
	C
Φ≤0.2	Ignore
0.2<Φ≤0.3	4(distance≧10mm)
0.3<Φ≤0.4	2(distance≧10mm)
Φ>0.4	0

4) CTP Bonding Bubble/Accidented Spot

Size (mm)	Acceptable Quantity	
	A	B
Φ≤0.1	Ignore	
0.1<Φ≤0.2	3(distance≧10mm）	
0.2<Φ≤0.3	2(distance≧10mm）	

Class	Item	Criteria	
		Φ>0.3	0
		Assembly Deflection: beyond the edge of backlight ≤0.2mm	
Minor	CTP Related	CTP cover broken X: length, Y: width, Z: height X≤0.5mm; Y≤0.5mm; Z<Cover thickness *Circuitry broken is not allowed.	
		CTP edge broken X: length, Y: width, Z: height X≤0.3mm; Y≤0.3mm; Z<cover thickness *Circuitry broken is not allowed.	

Criteria (functional items)

No.	Item	Criteria
1	No display	Not allowed
2	Missing segment	
3	Short circuit	
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	Inspection after Test
High Temperature Operation	70℃, 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℃, 96HR	
High Temperature Storage	80℃, 96HR	
Low Temperature Storage	-30℃, 96HR	
High Temperature & High Humidity Operating	+60℃, 90% RH ,96 hours.	
Thermal Shock (Non-Operation)	-30℃, 30 min ↔ 80℃, 30 min, Change time:5min 20CYC.	
ESD Test	C=150pF, R=330, 5points/panel Air: ±8KV, 5times; Contact: ±6KV, 5 times; (Environment: 15℃~35℃, 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,80 ㎝ (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 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
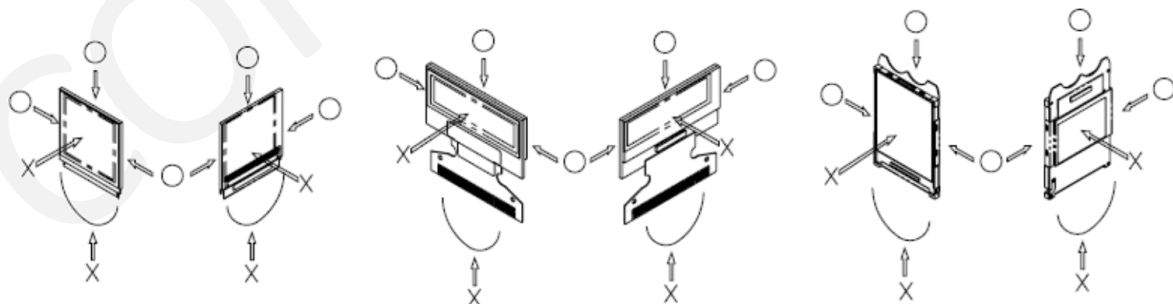
influence the display performance. Also, secure sufficient rigidity for the outer cases.

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 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 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 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 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.