DMT050WVNTRS0-1A
PRODUCT SPECIFICATION

Version 0.1
May 12, 2020

TBD

Customer's Approval	
Signature	*Date*

Prepared by *Joyce Huang*
Approved by *Evan Huang*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	May 12, 2020	Preliminary	Joyce Huang

Legal Notice

Table of Contents

1. General Description

1.1 Introduction

This is a 5" 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 480 x 854 and can display up to 65K / 262K / 16.7M colours. The display module supports 3-SPI+16/18/24-bits RGB interface and tape bonding touch panel.

1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	5" Diagonal
Display Format	480 x RGB x 854 Dots
No. of Colour	65K / 262K / 16.7M
Overall Dimensions	67.56 (W) x 122.35 (H) x 3.80 (D) mm
Active Area	61.63 (W) x 109.65 (H) mm
Mode	Normally Black / Transmissive / IPS
Surface Treatment	HC
Viewing Direction	All round
Interface	3-SPI+16/18/24-bits RGB
Driver IC	ILI9806E
Backlight Type	LED, White, 12 chips
Touch Panel	Resistive Touch Panel
Bonding Type	Air Bonding
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
ROHS	Compliant to RoHS 2.0

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	480 x RGB x 854	Dots
Overall Dimensions	67.56 (W) x 122.35 (H) x 3.80 (D)	mm
Active Area	61.632 (W) x 109.6536 (H)	mm
Dot Pitch	0.1284 (W) x 0.1284 (H)	mm
Weight	TBD	g
IC Controller/Driver	ILI9806E	

2.2 Mechanical Drawing
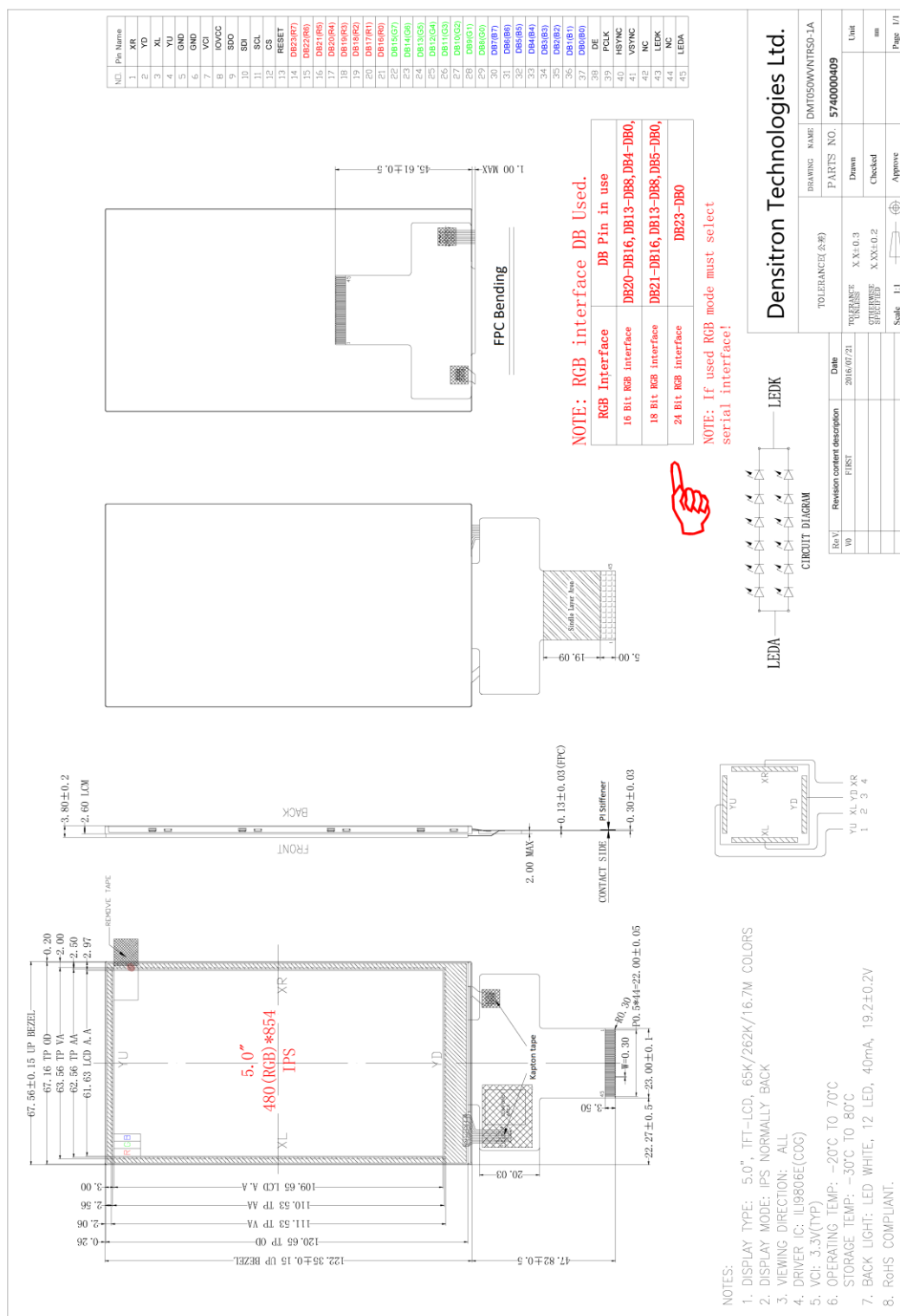
3. Electrical Specification

3.1 Absolute Maximum Ratings

(Ta=25 VSS=0V)

Item	Symbol	Min	Max	Unit	Note
Digital Supply Voltage	VDD	-0.3	4.6	V	-
Digital Interface Supple Voltage	VDDIO	-0.3	4.6	V	-
Operating Temperature	T_{OP}	-20	+70	°C	-
Storage Temperature	T_{ST}	-30	+80	°C	-

Note 1: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module

may occur. For normal operations, it is desirable to use this module under the conditions according to Section

3.2 "Electrical Characteristics", to avoid malfunctioning.

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

Note 3: Please refer to item of RELIABILITY.

3.2 Electrical Characteristics

3.2.1 DC Electrical Characteristics

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	-	2.5	2.8	3.6	V	-
Digital Interface Supple Voltage	VDDIO	-	1.65	1.8	3.3	-	-
Normal Mode Current Consumption	IDD	-	-	30	-	mA	-
Level Input Voltage	V_{IH}	-	$0.7V_{DDIO}$	-	V_{DDIO}	V	-
	V_{IL}	-	-0.3	-	$0.3\ V_{DDIO}$	V	-
Level Output Voltage	V_{OH}	-	$0.8*V_{DDIO}$	-	V_{DDIO}	V	-
	V_{OL}	-	GND	-	$0.2\ V_{DDIO}$	V	-

3.3   Interface Pin Assignment

3.3.1   TFT Pin Define

NO.	Symbol	I/O	Function
1	XR (NC)	A/D	Touch panel Right Glass Terminal.
2	YD (NC)	A/D	Touch panel Right Glass Terminal.
3	XL (NC)	A/D	Touch panel Right Glass Terminal.
4	YU (NC)	A/D	Touch panel Right Glass Terminal.
5	GND	P	Ground.
6	GND	P	Ground.
7	VCI	P	Supply voltage (3.3V)
8	IOVCC	P	I/O power supply voltage.
9	SDO	O	SPI interface output pin. The data is output on the falling edge of the SCL signal. If not used, let this pin open.
10	SDI	I	Data lane in 1 data lane serial interface. The data is latched on the rising edge of the SCL signal.
11	SCL	I	This pin is used to select "Data or Command" in the parallel interface. When D/CX = '1', data is selected. When D/CX = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface. fix this pin at IOVCC or GND when not in use.
12	CS	I	Chip select input pin ("Low" enable). fix this pin at IOVCC or GND when not in use.
13	RESET	I	Reset pin. Setting either pin low initializes the LSI. Must be reset after power is supplied.
14-37	DB23-DB0	I/O	24-bit parallel bi-directional data bus for MCU system and RGB interface mode. Fix to GND level when not in use
38	DE	I	Data enable signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.
39	DOTCLK	I	Dot clock signal for RGB interface operation. Fix this pin at IOVCC or GND when not in use.
40	HSYNC	I	Line synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.

NO.	Symbol	I/O	Function
41	VSYNC	I	Frame synchronizing signal for RGB interface operation. fix this pin at IOVCC or GND when not in use.
42	NC	-	-
43	LEDK	P	Cathode pin of backlight.
44	NC	-	-
45	LEDA	P	Anode pin of backlight.

3.4 Block Diagram

```
I2C ——————[ Capacitive Touch Panel ]

LEDA ————[ Back Light ]
LEDK ————

            480(RGB)*854
Gate   >       Panel        <   Gate


              Source

              Driver

                ↑
               FPC
```
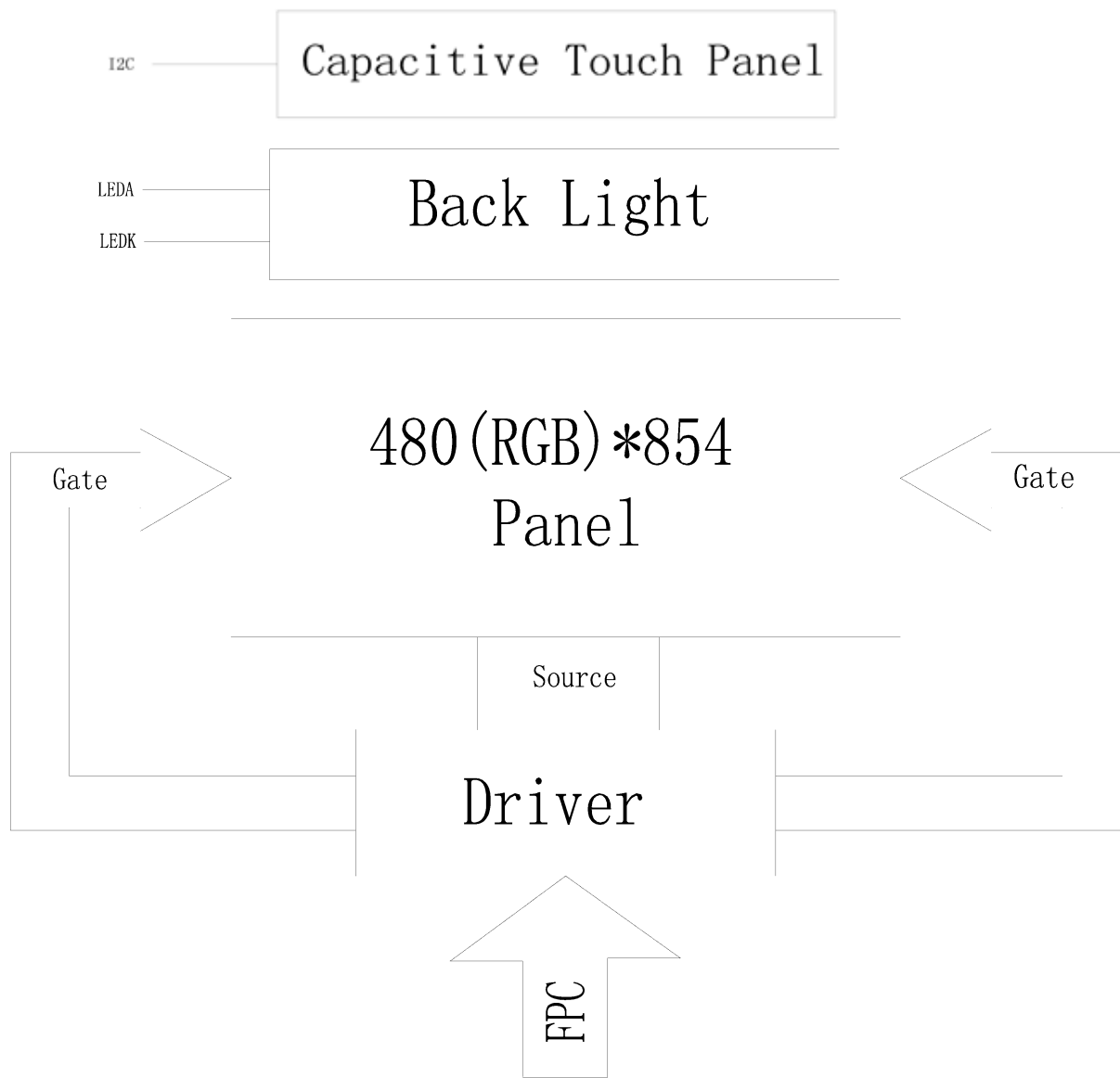
3.5 Timing Characteristics

3.5.1 Display Serial Interface Timing Characteristics (3-line SPI system)
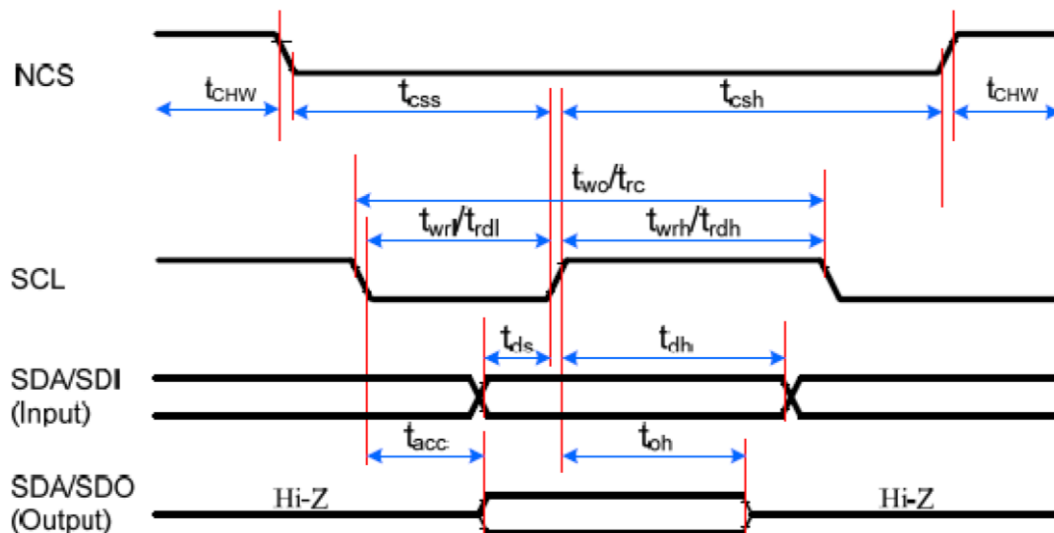
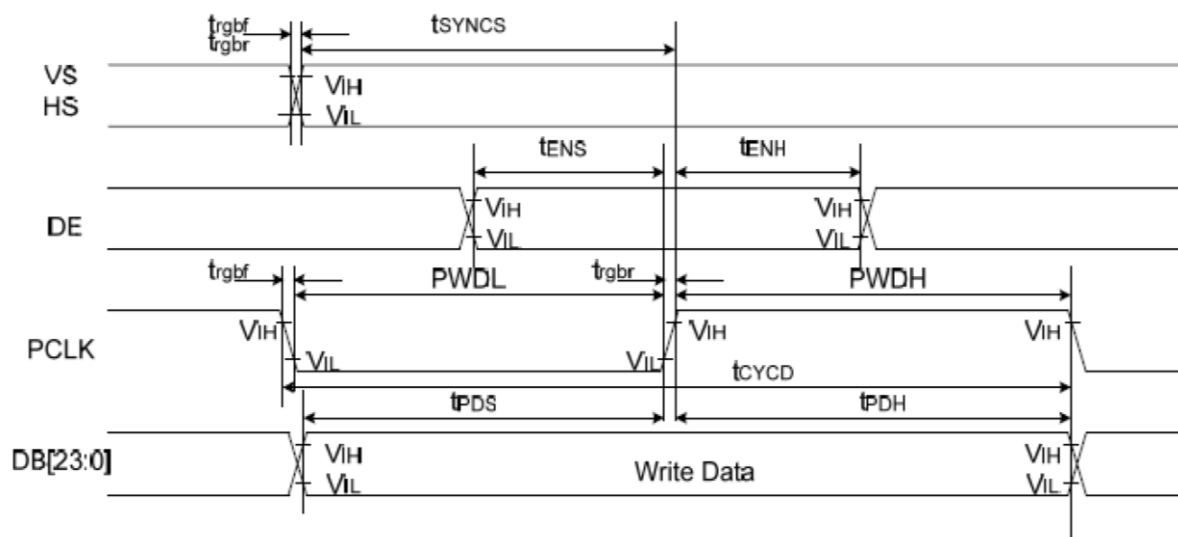| Signal	Symbol	Description	Min	Typ.	Max	Unit	Note
CSX	tcss	Chip Select Time (Write)	15	-	-	ns	-
	tcsh	Chip Select Hold Time (Read)	15	-	-	ns	-
	tCHW	CS "H" Pulse Width	40	-	-	ns	-
SCL	twc	Serial Clock Cycle (Write)	30	-	-	ns	-
	twrh	SCL "H" Pulse Width (Write)	10	-	-	ns	-
	twrl	SCL "L" Pulse Width (Write)	10	-	-	ns	-
	trc	Serial Clock Cycle (Read)	150	-	-	ns	-
	trdh	SCL "H" Pulse Width (Read)	60	-	-	ns	-
	trdl	SCL "L" Pulse Width (Read)	60	-	-	ns	-
SDA/SDO (Output)	tacc	Access Time (Read)	10	-	100	ns	For maximum CL = 30pF
	toh	Output Disable Time (Read)	15	-	100	ns	For minimum CL=8pF
SDA/SDO (Input)	tds	Data Setup Time (Write)	10	-	-	ns	-
	tdh	Data Hold Time (Write)	10	-	-	ns	-

Note 1: Ta=-30 to 70℃, IOVCC=1.65V to 3.6V, VCI=2.5V to 3.6V, T=10+/-0.5ns.

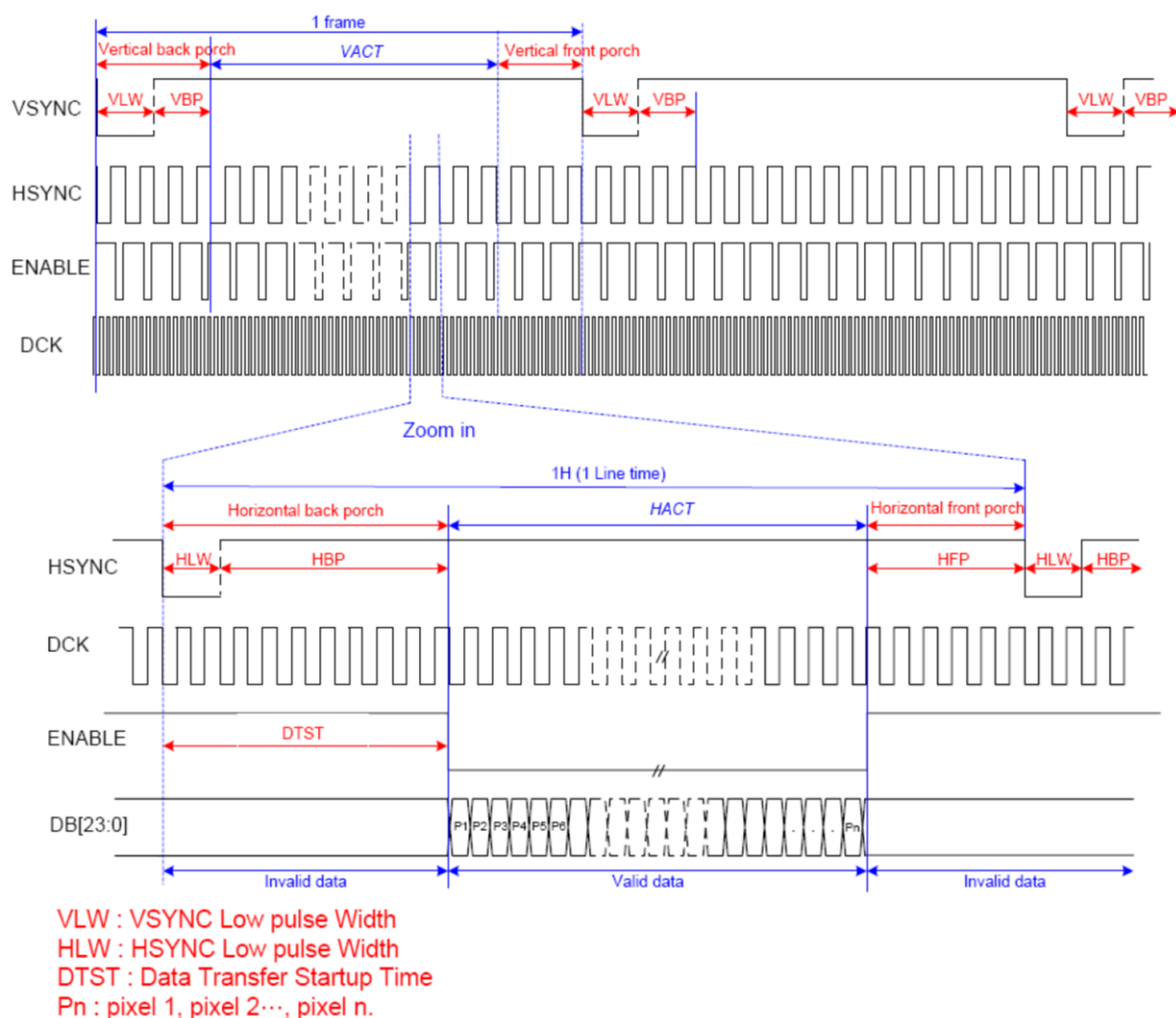**Note 2:** Does not include signal rise and fall times.

3.5.2 Parallel 24/18/16-bit RGB Interface Timing Characteristics

Signal	Symbol	Description	Min	Typ.	Max	Unit	Note
VS/HS	tSYNCS	VS/HS Setup Time	5	-	-	ns	
	tSYNCS	VS/HS Hold Time	5	-	-	ns	
DE	tENS	DE Setup Time	5	-	-	ns	
	tENH	DE Hold Time	5	-	-	ns	
DB [23:0]	tPOS	Data Setup Time	5	-	-	ns	24/18/16-bit bus RGB interface mode
	tPDH	Data Hold Time	5	-	-	ns	
PCLK	PWDH	PCLK High-Level Period	13	-	-	ns	
	PWDL	PCLK Low-Level Period	13	-	-	ns	
	tCYCD	PCLK Cycle Time	28	-	-	ns	
	trgbr, trgbf	PCLK, HS, VS rise/fall time	-	-	15	ns	

Note1: Ta=-30 to 70℃, IOVCC=1.65V to 3.6V, VCI=2.5V to 3.6V, DGND=0V.

3.5.3 DPI Interface Timing

VLW : VSYNC Low pulse Width
HLW : HSYNC Low pulse Width
DTST : Data Transfer Startup Time
Pn : pixel 1, pixel 2···, pixel n.

Symbol	Description	Min	Typ.	Max	Unit	Note
FR	Frame Rate	54	-	66	Fps	-
HLW	Horizontal Low Pulse Width	1	-	-	DOTCLK	-
HBP	Horizontal Back Porch	2	-	126	DOTCLK	-
HACT	Horizontal Address	-	480	-	DOTCLK	-
HFP	Horizontal Front Porch	2	-	-	DOTCLK	-
VLW	Vertical Low Pulse Width	1	-	126	Line	-
VBP	Vertical Back Porch	1	-	126	Line	-
VACT	Vertical Address	-	-	864	Line	-
VFP	Vertical Front Porch	1	-	255	Line	-
DCLK	Data Clock	16.6	-	41.7	MHz	-

3.5.4   Reset Input Timing

Figure: Reset Timing
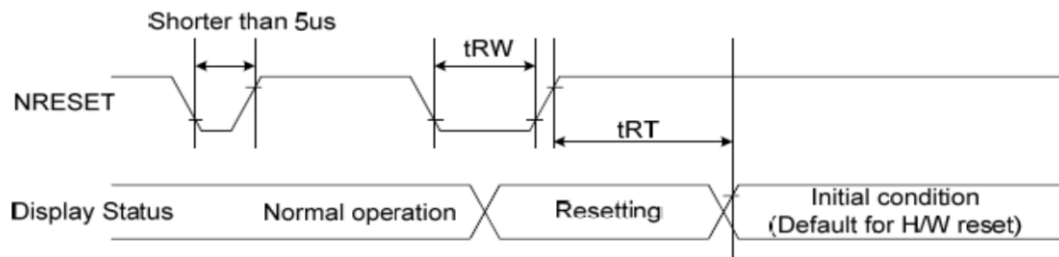
Table: Reset Timing

Signal	Symbol	Description	Min	Max	Unit	Note
RESX	t_{RW}	Reset Pulse Duration	10	-	us	-
	t_{RT}	Reset Cancel	-	5	ms	1, 5
			-	120	ms	1, 6, 7

Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from OTP to registers. This loading is done every time when there is H/W reset cancel time (tRT) within 5ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the Table above.

Table: Reset Description

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset Starts

Note 3: During the Resetting Period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in Sleep Out Mode. The display remains the blank state in Sleep In Mode) and then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:

Figure: Positive Noise Pulse during Reset Low
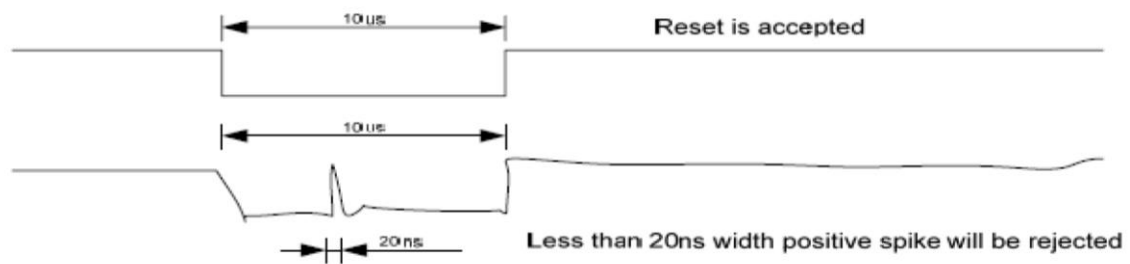
Note 5: When Reset applies during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

4. Electrical Specification Touch

4.1 Conditions of Use and Storage

Item	Value (Condition)	Note
Temperature Range Upon Operation	Humidity: 20%~90% non dew, Condensation: -20℃~70℃	In a simple substance
Temperature Range Upon Storage	Humidity: 20%~90% non dew, condensation -30℃~80℃	In a simple substance

4.2 Electrical Property

Item	Value	Note
Maximum Voltage	DC5V	-
Resistance between Terminals	X direction [Film side]: 200-600Ω	-
	Y direction [Glass side]:300-900Ω	
Insulation Resistance	DC 25V 20MΩor above	Connect X + ～X- and Y+ ～Y-, apply 25VDC Between X and Y for perform measurements
Chattering	10 msec or below	-
Rating	Voltage is DC 5V	-
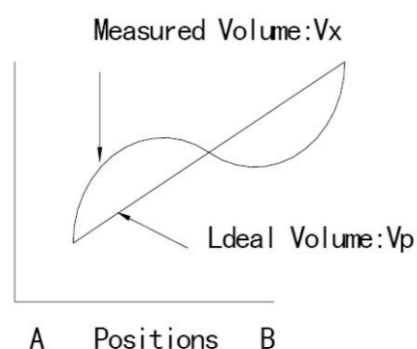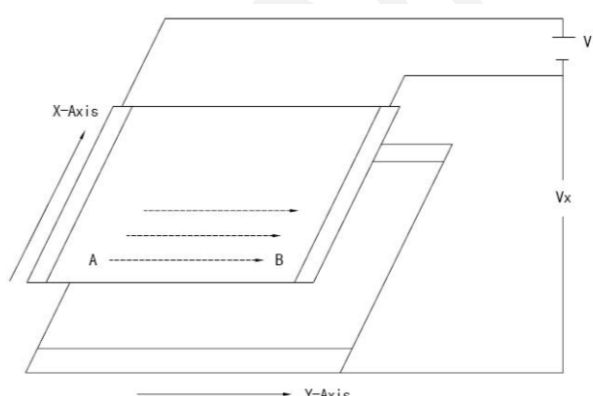
4.3 Mechanical Property

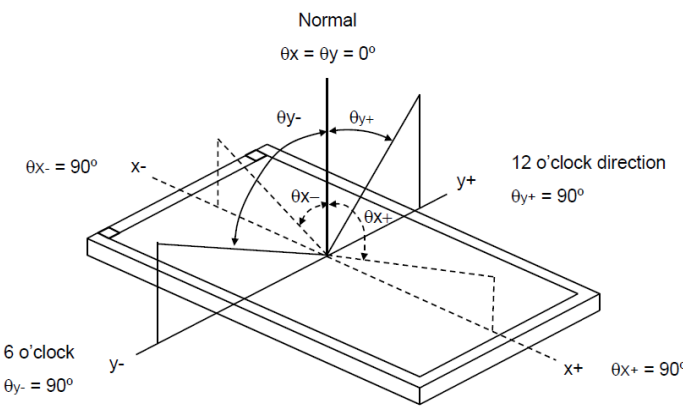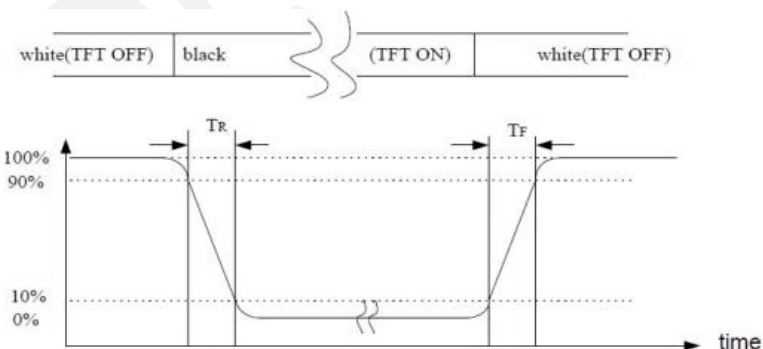| Item	Performance		Note
Input Method	Used of an exclusive pen or finger		
Load Upon Operation	Exclusive Pen	60~100g or below	Operation and measurement with a pen must be carried out under the following tip conditions: Stylus pen material: POM (ployacetal). Tip: Diameter 3.0mm, SR 0.8 mm
	Finger	60~100g or below	Operations and measurement methods simulated for a finger must be carried out under the following tip conditions. Material: Silicon rubber (Hardness: 30°Hs) Tip: Diameter 12.0 mm, SR 12.5mm
Surface Hardness	Pencil Hardness: 3H or above		It complies with the way of test method JIS K5400.

4.4 Optical Property

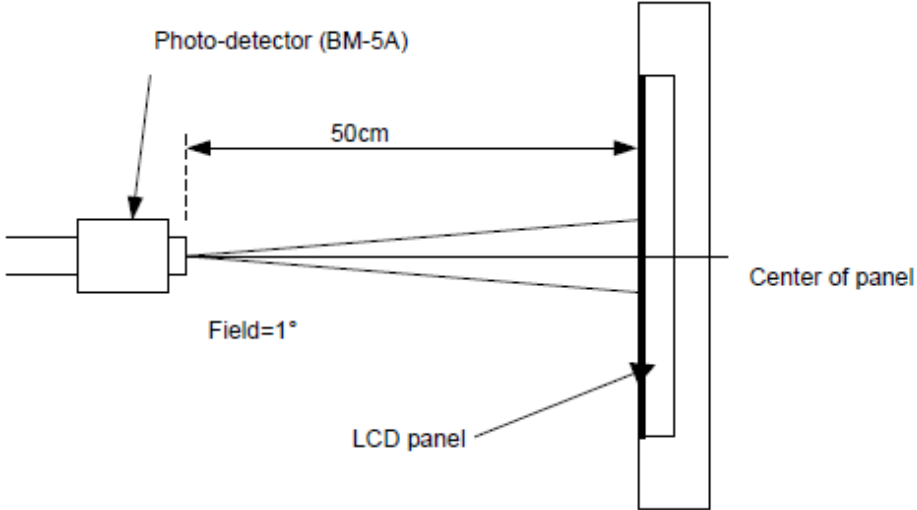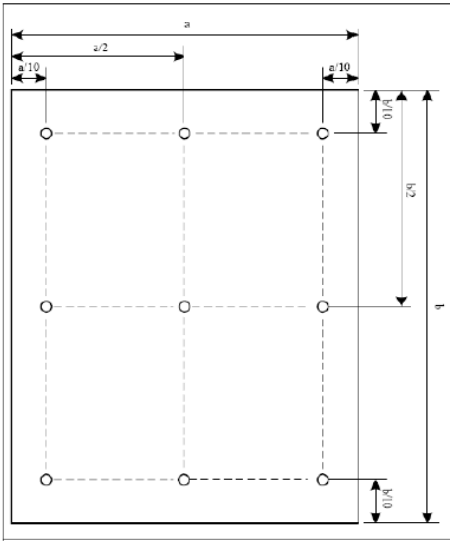| Item	Performance	Note
Total Light Transmittance	80% or above	JIS K7105
Haze	5% or below	JIS K7136
Film Specification	Polished type with hard coated surface	-

5. Optical Specification

5.1 Optical Characteristics

Characteristics		Symbol	Condition	Min	Typ	Max	Unit	Note
Contrast Ratio		CR	$\theta = 0°$ Normal viewing angle	640	800	-	-	1, 2
Response Time	Rising	$T_R + T_F$		-	16	21	msec	1, 3
	Falling			-	19	24		
Colour Gamut		S(%)		-	70	-	%	C-light
Viewing Angle	Left	θ_{x-}	CR>10	-	80	-	-	1, 4 Measuring with Polarizer, Reference Only
	Right	θ_{x+}		-	80	-		
	Up	θ_{Y+}		-	80	-		
	Down	θ_{Y-}		-	80	-		
Colour Chromaticity	Red	Rx	$\theta = 0°$ Normal viewing angle	0.602	0.642	0.682	-	1, 4 CF glass
		Ry		0.306	0.346	0.386		
	Green	Gx		0.280	0.320	0.360		
		Gy		0.576	0.616	0.656		
	Blue	Bx		0.102	0.142	0.182		
		By		0.039	0.079	0.119		
	White	Wx		0.264	0.304	0.344		
		Wy		0.302	0.342	0.382		
Luminance		Lv	IF=40mA	380	430	-	cd/m^2	5
Uniformity		AVg	-	80	-	-	%	5

Note: 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	Normal θx = θy = 0º θy- θy+ θx- = 90º x- 12 o'clock direction y+ θy+ = 90º θx- θx+ 6 o'clock y- x+ θx+ = 90º θy- = 90º
2	Definition of Contrast Ratio (CR)	measured at the center point of panel $$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is at "white state"}}{\text{Luminance measured when LCD is at "black state"}}$$
3	Definition of Response Time	Sum of T_R and T_F white(TFT OFF) black (TFT ON) white(TFT OFF) T_R T_F Optical response 100% 90% 10% 0% time

Note	Item	Test method
4	Definition of Optical Measurement Setup	
5	Definition of Luminance and Uniformity	Luminance Uniformity of these 9 points is defined as below: $$Uniformity = \frac{minimum\ luminance\ in\ 9\ points\ (1\text{-}9)}{maximum\ luminance\ in\ 9\ points\ (1\text{-}9)}$$ $$Luminance = \frac{Total\ Luminance\ of\ 9\ points}{9}$$

6. LED Backlight Specification

6.1 LED Backlight Characteristics

The back-light system is edge-lighting type with 12 chips White LED

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Forward Current	I_F	-	30	40	-	mA	-
Forward Voltage	V_F	-	-	19.2	-	V	-
LED Life Time	Hr	-	-	-	-	Hour	1, 2

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

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

Note 2: The "LED Life Time" is defined as the module brightness decreases to 50% original brightness at Ta=25℃ and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.

6.2 Internal Circuit Diagram

LEDA ──── [LED array] ──── LEDK

CIPCUIT DIACPAM

# 7. Packaging

TBD
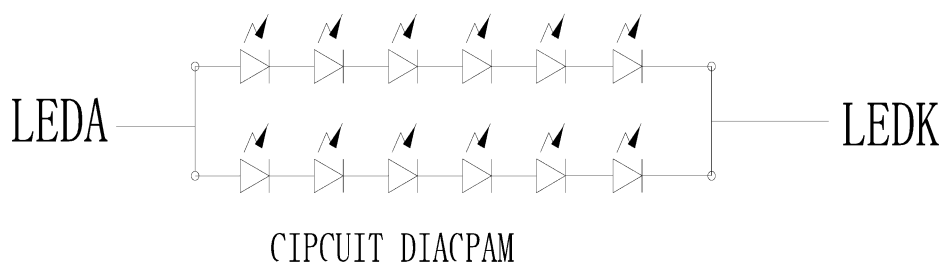
8. Quality Assurance Specification

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 700 Lux)

Viewing distance: 30 - 50cm

Finger glove (or finger cover) must be worn by the inspector.

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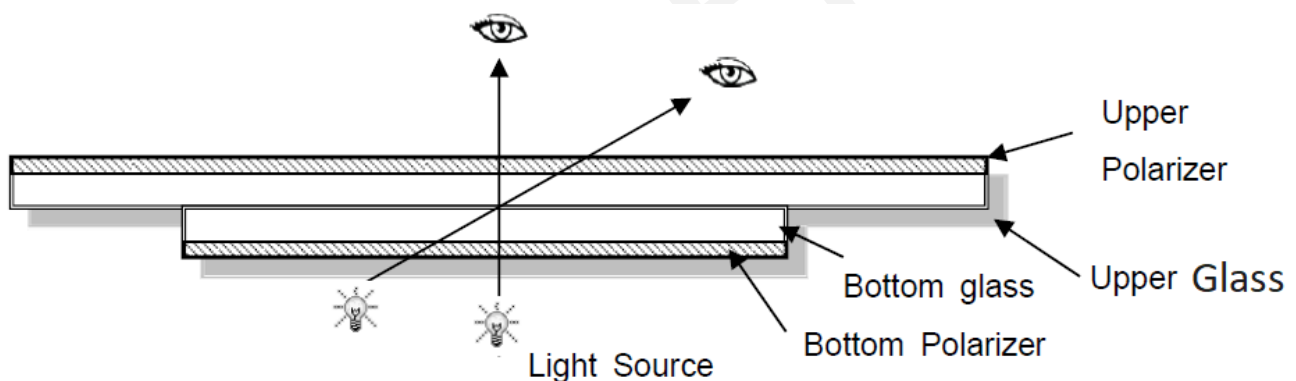
8.3 Delivery Assurance

8.3.1 Delivery Inspection Standards

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

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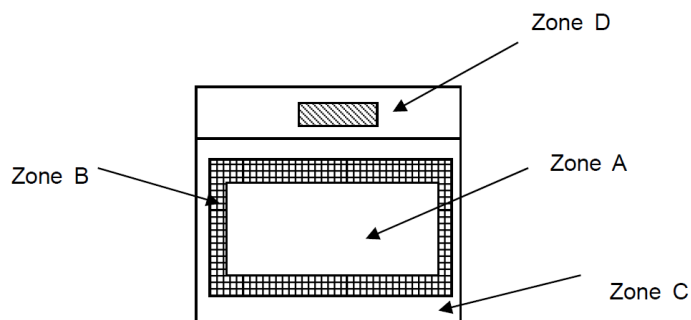
Zone A: Effective Viewing Area (Character or Digit can be seen)

Zone B: Viewing Area except Zone A

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

Zone D: IC Bonding Area

Note 1: Generally, visual defects in Zone C can be ignored when it doesn't affect product function or appearance after
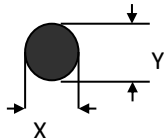
assembly by customer

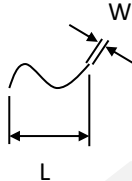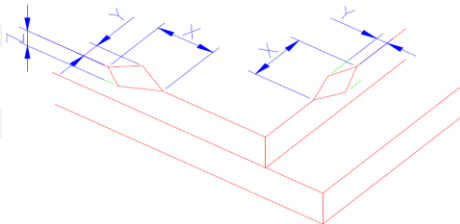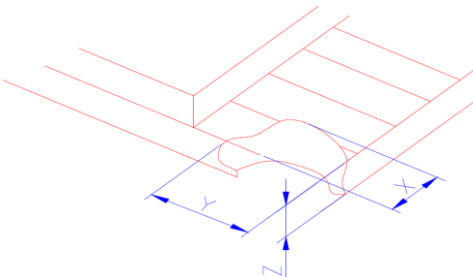### 8.3.3   Criteria & Acceptable Quality Level

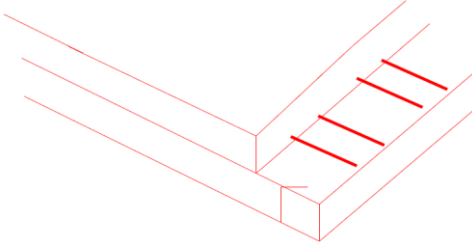| Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.5	Defects in Cosmetic Check (Display Off)

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

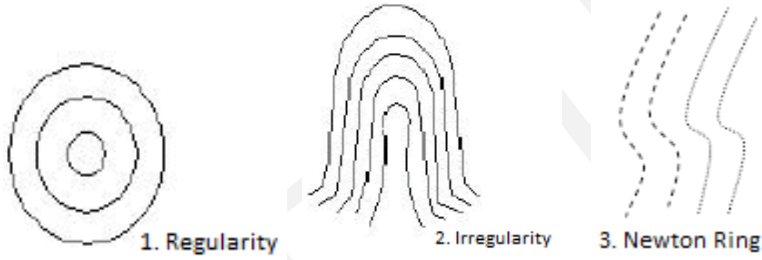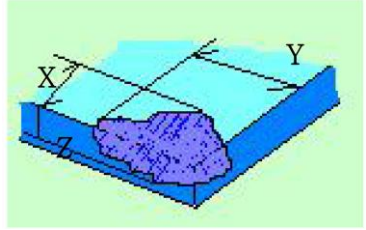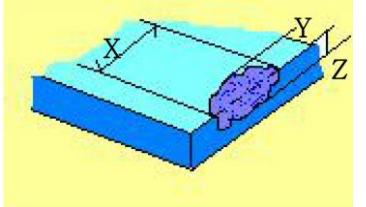| No.	Items	Criteria	Classification of defects
1	Functional defects	1) No display, open or miss line 2) Display abnormally 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
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.	

8.3.4   Criteria & Classification

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) 2) Dim Spot (LCD/TP/Polarizer dim dot, light leakage, dark spot) 3) Polarizer Accidented Spot 4) Pixel Bad Points (light dot, dim dot, colour dot) 5) Polarizer Bubble

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

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.10$	Ignore		Ignore
$0.10 < \varnothing \leq 0.25$	3 (distance $\geqq$ 10mm)		
$0.25 < \varnothing \leq 0.3$	2		
$0.35 < \varnothing$	0		

2) Dim Spot (LCD/TP/Polarizer dim dot, light leakage, dark spot)

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.1$	Ignore		Ignore
$0.10 < \varnothing \leq 0.25$	3 (distance $\geqq$ 10mm)		
$0.25 < \varnothing \leq 0.3$	2		
$0.35 < \varnothing$	0		

3) Polarizer Accidented Spot

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.2$	Ignore		Ignore
$0.3 < \varnothing \leq 0.5$	2 (distance $\geqq$ 10mm)		
$0.5 < \varnothing$	0		

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

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.1$	Ignore		Ignore
$0.15 < \varnothing \leq 0.25$	2 (distance $\geqq$ 10mm)		
$0.3 < \varnothing$	0		

5) Polarizer Bubble

Class	Item	Criteria			

		Size\Zone	Acceptable Quantity		
			A	B	C
		∅≤0.2	Ignore		Ignore
		0.3<∅≤0.4	3 (distance ≧ 10mm)		
		0.4<∅≤0.5	2		
		0.5<∅	0		

Line type: as per following drawing

Minor	Line Defect (LCD/TP/ Polarizer backlight black/white line, scratch, stain)	Width	Length	Acceptable quantity		
				A	B	C
		Φ≤0.05	Ignore	Ignore		Ignore
		0.05<W≤0.06	L ≤ 3.0	N ≤ 2		
		0.07<W≤0.08	L ≤ 2.0	N ≤ 1		
		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

Class	Item	Criteria
Major	LCD Crack	The LCD with extensive crack is not acceptable.
Major	Electronic Components SMT	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite
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.
Minor	LCD Mura	By 5% ND filter invisible.

Class	Item	Criteria			

Major | RTP Related:

1) TP Film Bubble / Accidented Spot

Size\Zone	Acceptable Qty		
	A	B	C
$\varnothing$≤0.1	Ignore		Ignore
0.1<$\varnothing$≤0.2	3（distance≥10mm）		
0.25<$\varnothing$≤0.3	2		
0.35<$\varnothing$	0		

2) TP Film Scratch

Width	Length	Acceptable Qty		
		A	B	C
Φ≤0.05	Ignore	Ignore		
0.05<W≤0.06	L≤3.0	N≤2		
0.07<W≤0.08	L≤2.0	N≤1		
0.08<W	Define as spot defect			

3) Assembly Deflection

Class	Item	Criteria
		beyond the edge of backlight ≤0.2mm
		4) Bulge (undulation included) The ITO film plumped below 0.40mm, it's ok. <0.4mm
		5) Newton Ring Newton Ring area>1/3 TP area: NG Newton Ring area≤1/3 TP area: OK 1. Regularity 2. Irregularity 3. Newton Ring
		TP cover broken X: length, Y: width, Z: height X≤3mm; Y≤3mm; Z<Cover thickness *Circuitry broken is not allowed.
		TP cover broken X: length, Y: width, Z: height X≤4mm; Y≤2mm; Z<LCD thickness *Circuitry broken is not allowed.

Criteria (functional items)

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

8.4   Dealing with Customer Complaints

8.4.1   Non-conforming Analysis

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

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

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

8.4.2   Handling of Non-conforming Displays

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

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

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

9. Reliability Specification

9.1 Reliability Tests

Test Item	Test Condition	Evaluation and Assessment
High Temperature Operation	70°C, 96 hrs	
Low Temperature Operation	-20°C, 96 hrs	
High Temperature Storage	80°C, 96 hrs	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects:
Low Temperature Storage	-30°C, 96 hrs	
High Temperature & High Humidity Storage	+60℃, 90％RH, 96HR	
Thermal Shock (Non-operation)	-30℃,30 min ↔ 80℃,30 min, Change time:5min 20CYC.	1.Air bubble in the LCD; 2.Non-display;
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15℃~35℃, 30%~60%).	3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
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.

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

9.1.1 Inspection Check Standard

After the completion of the described reliability test, the samples are to be left at room temperature for 4 hrs prior to conducting the inspection check at 23±5 °C, 55±15% RH.

10. Handling Precautions

10.1 Handling Precautions

1) Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position.

2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.

3) If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water

4) If pressure is applied to the display surface or its neighbourhood of the display module, the cell structure may be damaged and be careful not to apply pressure to these sections.

5) The polarizer covering the surface of the display module is soft and easily scratched. Please be careful when handling the display module.

6) When the surface of the polarizer of the display module has soil, clean the surface. It takes advantage of by using following adhesion tape.

   a. Scotch Mending Tape No. 810 or an equivalent

   b. Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.

   c. Also, pay attention that the following liquid and solvent may spoil the polarizer:

      • Water

      • Ketone

      • Aromatic Solvents

7) Hold the display module very carefully when placing it into the system housing. Do not apply excessive stress or pressure to display module. And, do not over bend the film with electrode pattern layouts. These stresses will
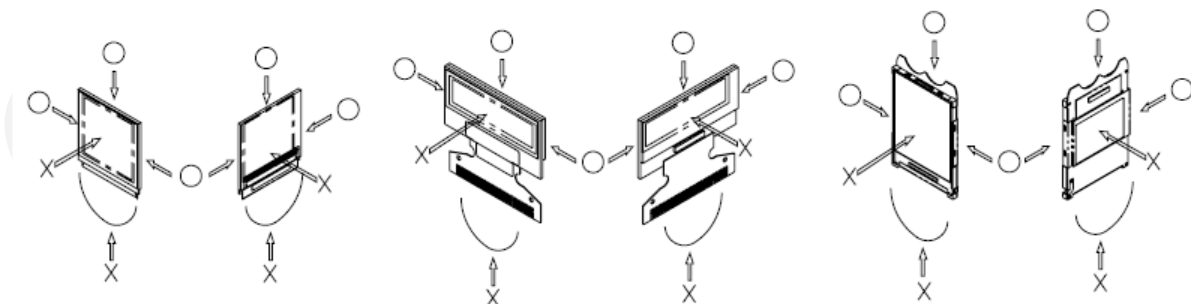
influence the display performance. Also, secure sufficient rigidity for the outer cases.

8) Do not apply stress to the LSI chips and the surrounding molded sections.

9) Do not disassemble nor modify the display module.

10) Do not apply input signals while the logic power is off.

11) Pay sufficient attention to the working environments when handing display modules to prevent occurrence of element breakage accidents by static electricity.

    a. Be sure to make human body grounding when handling display modules.

    b. Be sure to ground tools to use or assembly such as soldering irons.

    c. To suppress generation of static electricity, avoid carrying out assembly work under dry environments.

    d. Protective film is being applied to the surface of the display panel of the display module. Be careful since static electricity may be generated when exfoliating the protective film.

12) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. If the display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).

13) If electric current is applied when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

10.2 Storage Precautions

1) When storing display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps, etc. and, also, avoiding high temperature and high humidity environments or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Densitron) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.

2) If electric current is applied when water drops are adhering to the surface of the display module, when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

10.3 Designing Precautions

1) The absolute maximum ratings are the ratings which cannot be exceeded for display module, and if these values are exceeded, panel damage may be happen.

2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.

3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)

4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighbouring devices.

5) As for EMI, take necessary measures on the equipment side basically.

6) When fastening the display module, fasten the external plastic housing section.

7) If power supply to the display module is forcibly shut down by such errors as taking out the main battery while the display panel is in operation, we cannot guarantee the quality of this display module.

10.4 Operation Precautions

1) It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.

2) Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.

3) Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged.

4) To protect display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the display modules.
   a. Pins and electrodes
   b. Pattern layouts such as the FPC

5) When the driver is being exposed (COG), semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if the driver is exposed to light, malfunctioning may occur.
   a. Design the product and installation method so that the driver may be shielded from light in actual usage.
   b. Design the product and installation method so that the driver may be shielded from light during the inspection processes.

6) Although the display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.

7) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

10.5 Other Precautions

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