DMT035QVNTRS0-4A
PRODUCT SPECIFICATION

Version 0.1
Oct 19, 2023

TBD

Customer's Approval	
Signature	*Date*

Prepared by *Yvette Hsieh*
Approved by *Kenny Lin*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Oct 19, 2023	Preliminary	Yvette Hsieh

Legal Notice

Table of Contents

1. General Description

1.1 Introduction

This is a 3.5" 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 320 x 240 and can display up to 262K colours. The display module supports 3SPI + 16/18/24-bit RGB interface and tape bonding touch panel. This product is an assembly of two Kyocera product sourced and consigned by Thales with bonding service arranged by Densitron in China. Prior to assembly, the RTP panels and TFT are inspected and after assembly the complete set is tested as well.

1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	3.5" Diagonal
Display Format	320 x RGB x 240 Dots
No. of Colour	65K/262K
Overall Dimensions	76.90 (W) x 63.90 (H) x 6.98 (D) mm
Active Area	70.56 (W) x 52.92 (H) mm
Mode	Normally white / Transmissive
Surface Treatment	Anti-glare (TFT-only)
Viewing Direction	6 o'clock
Interface	3SPI + 16/18/24-bit RGB
Backlight Type	LED, White, 8 chips
Touch Panel	Resistive Touch Panel (RTP)
Touch Interface	4-wire resistive
Bonding Type	Tape Bonding
Operating Temperature	-30°C ~ +80°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	320 x RGB x 240	Dots
Overall Dimensions	76.90 (W) x 63.90 (H) x 6.98 (D)	mm
Active Area	70.56 (W) x 52.92 (H)	mm
Dot Pitch	0.0735 (W) x 0.2205 (H)	mm
Weight	57	g

2.2 Mechanical Drawing

Rev	Revision content description	Date
V0	First Issue	2023.05.06
V1	Modify the Temp and Pin of RTP	2023.06.01
V2	Add up bezel for tape bonding	2023.06.02

Pin	Name	Pin	Name
1	GND	26	B5
2	GND	27	B6
3	VDD	28	B7
4	VDD	29	GND
5	R0	30	CK
6	R1	31	CSB
7	R2	32	HSYNC
8	R3	33	VSYNC
9	R4	34	ENAB
10	R5	35	GND
11	R6	36	REST
12	R7	37	SCK
13	G0	38	SDI
14	G1	39	GND
15	G2	40	NC
16	G3	41	NC
17	G4	42	NC
18	G5	43	NC
19	G6	44	GND
20	G7	45	CA1
21	B0	46	NC
22	B1	47	AN1
23	B2	48	AN2
24	B3	49	NC
25	B4	50	CA2

Logic diagram /逻辑图

Pin	Logic
1	XR
2	YL
3	XL
4	YU

Schematic diagram of routing /走线示意图

DRAWING NAME: DMT035QVNTRS0-4A
PARTS NO.
Drawn
Checked
Approve
Unit: mm
Page 1/1

TOLERANCE (公差)
TOLERANCE UNLESS: X.X±0.3 X.XX±0.2
OTHERWISE SPECIFIED
Scale 1:1

The unmarked size shall be subject to CAD (未标注尺寸以CAD为准)!

Note:
1. The opening of top case must bigger than "RTP A.A" 0.3mm at least (客户机壳开窗需比RTP的A/A单边大至少0.3毫米);
2. The distance from "RTP V.A" to the foam of top case recommended 0.6mm at least (客户机壳泡棉距RTP V.A至少0.6mm);
3. The distance from top case to RTP must bigger than 0.2mm at least (客户机壳与RTP表面应距离0.2至0.3mm);

Detail:"C" Scale:2.5/1

Detail:"B" Scale:4/1

Detail:"A" Scale:2.5/1

Bottom view (背视图)

Front view (正视图)

Side view (侧视图)

NOTES:
1. DISPLAY TYPE: 3.5" TFT-LCD
2. DISPLAY MODE: NORMALLY White
3. VIEWING DIRECTION: 12 O'Clock
4. LCM DRIVER IC: /
   LCM Interface: 24 Bit RGB Interface
5. Touch and LCM Bonding technology: Tape bonding
6. VDD:3.3V
7. OPERATING TEMP: -30°C TO 80°C
   STORAGE TEMP: -30°C TO 80°C
8. RoHS COMPLIANT.
9. "*" critical dimension; () reference dimension.

3. Electrical Specification

3.1 Absolute Maximum Ratings

(Ta=25±2°C, GND=VSS=0V)

Item	Symbol	Min	Max	Unit
Digital Power Supply Voltage	V_{DD}	-0.3	4.0	V
Operating Temperature	T_{OP}	-30	+80	°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: Please refer to item of RELIABILITY.

3.2 Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit
Digital Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V
Normal Mode Current Consumption	I_{DD}	-	7	14	mA
Input High Threshold Voltage	V_{IH}	0.7 V_{DD}	-	V_{DD}	V
Input Low Threshold Voltage	V_{IL}	GND	-	0.3 V_{DD}	V
Output High Threshold Voltage	V_{OH}	0.8 V_{DD}	-	V_{DD}	V
Output Low Threshold Voltage	V_{OL}	GND	-	0.2 V_{DD}	V

3.3 Interface Pin Assignment

3.3.1 TFT-LCD Module

No.	Symbol	I/O	Function
1-2	GND	P	Ground
3-4	VDD	P	Supply voltage (3.3V)
5	R0	I	Red data (LSB)
6-11	R1-R6	I	Red data
12	R7	I	Red data (MSB)
13	G0	I	Green data (LSB)
14-19	G1-G6	I	Green data
20	G7	I	Green data (MSB)
21	B0	I	Blue data (LSB)
22-27	B1-B6	I	Blue data
28	B7	I	Blue data (MSB)
29	GND	P	Ground
30	CK	I	Sampling clock
31	CSB	I	Select signal A (SPI)
32	HSYNC	I	Horizontal synchronous signal (negative)
33	VSYNC	I	Vertical synchronous signal (negative)
34	ENAB	I	Data enable (low signal only)
35	GND	P	Ground
36	RESET	I	Reset signal
37	SCK	I	Clock (SPI)
38	SDI	I	Data signal (SPI)
39	GND	I	Ground
40-43	NC	-	NC (open)
44	GND	P	Ground
45	CA1	P	Cathode pin of backlight 1
46	NC	-	NC (open)

No.	Symbol	I/O	Function
47	AN1	P	Anode pin of backlight 1
48	AN2	P	Anode pin of backlight 2
49	NC	-	NC (open)
50	CA2	P	Cathode pin of backlight 2

3.3.2   Touch Panel

| No.	Symbol	I/O	Function
1	XR	A/D	Touch panel Right glass terminal
2	YD	A/D	Touch panel Bottom film terminal
3	XL	A/D	Touch panel Lift glass terminal
4	YU	A/D	Touch panel Top film terminal

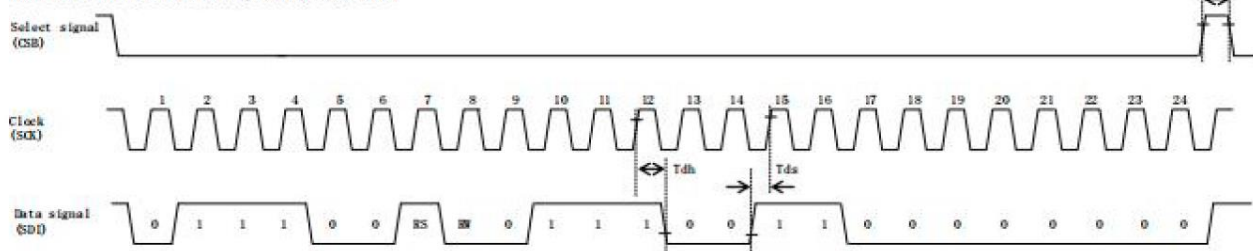## 3.4 Block Diagram
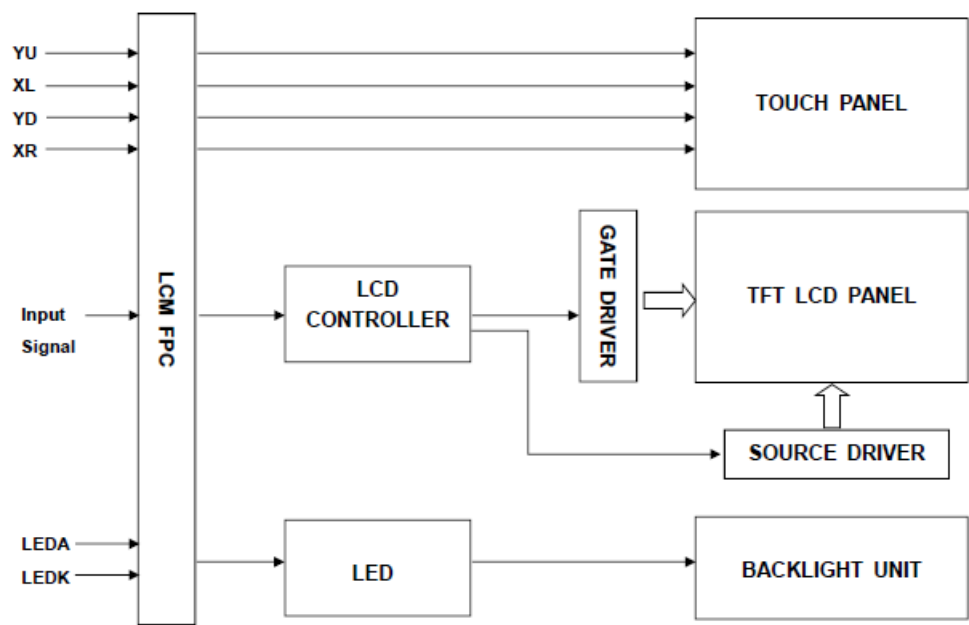
3.5 Timing Characteristics

3.5.1 SPI Serial Data Transfer Interface Characteristics

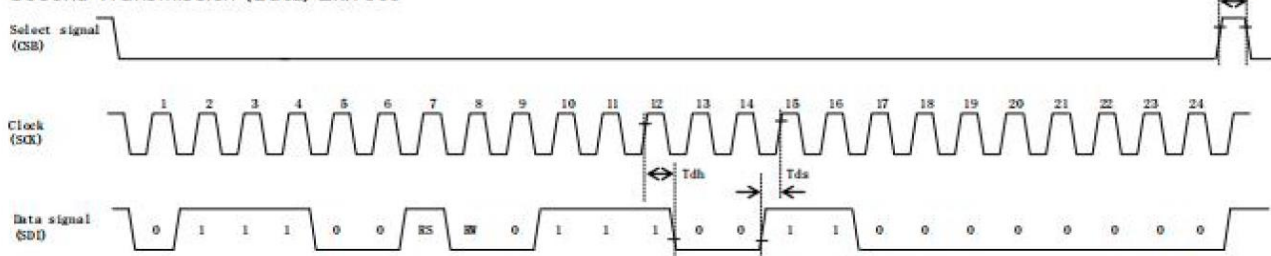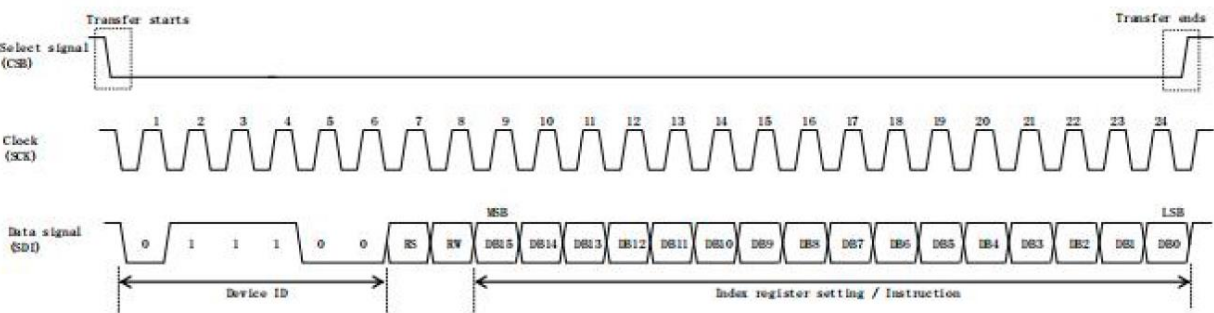| Item		Symbol	Min	Typ	Max	Unit
Clock (SCK)	Period	Tsc	50	-	-	ns
	High Time	Tsch	25	-	-	ns
	Low Time	Tscl	25	-	-	ns
Select Signal (CSB)	Setup Time	Tcss	50	--		ns
	Hold Time	Tcsh	50	-	-	ns
	High Time	Tcs	50	-	-	ns
Data Signal (SDI)	Setup Time	Tds	15	-	-	ns
	Hold Time	Tdh	15	-	-	ns
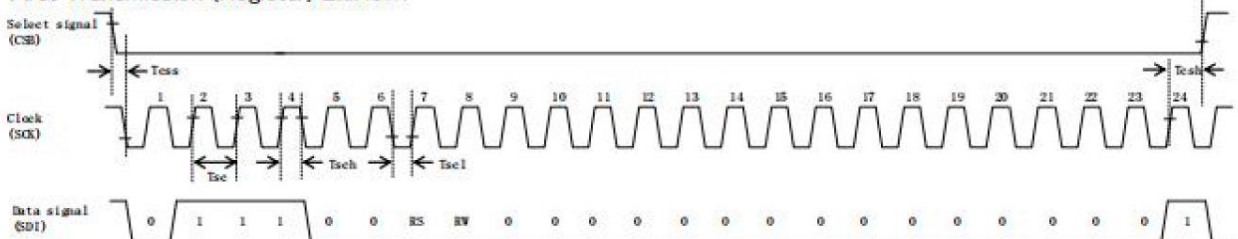
Transmission Format

3.5.2 LCD (Necessity of V-Hsync)

Item		Symbol	Min	Typ	Max	Unit
Clock (CK)	Frequency	1/Tc	-	6.5	10	MHz
	Period	Tc	100	154	-	ns
	High Time	Tch	50	-	-	ns
	Low Time	Tcl	50	-	-	ns
Data (R0~R5, G0~G5, B0~B5)	Setup Time	Tds	12	-	-	ns
	Hold Time	Tdh	12	-	-	ns
Horizontal Sync Signal (H$_{SYNC}$)	Setup Time	Ths	20	-	-	ns
	Hold Time	Thh	20	-	-	ns
	Frequency	1/Th	-	15.9	24.5	kHz
	Period	Th	-	408	-	Tc
	Pulse Width	Thp	-	2	-	Tc
	Front Porch	Thf	-	20	-	Tc
	Back Porch	Thb	-	68	-	Tc
Horizontal Display Period		Thd		320		Tc
Vertical Sync Signal (V$_{SYNC}$)	Setup Time	Tvs	20	-	-	ns
	Hold Time	Tvh	20	-	-	ns
	Period	Tv	-	262	-	Th
	Pulse Width	Tvp	-	2	-	Th
	Front Porch	Tvf	-	4	-	Th
	Back Porch	Tvb	-	18	-	Th
Vertical Display Period		Tvd		24		Th
Synchronous Signal Phase Lag		Thv	0	-	240	Tc
Refresh Rate		1/Tv	-	60	93.5	Hz
Reset Singal (REST)	Pulse Width	Tres	10	-	-	us

Note 1: If the display is used under the condition which out of specification such as higher clock frequency than specified value, there is a possibility phenomenon such as display error including white display, malfunction and no image may occur.

Note 2: In case of lower frequency, the deterioration of the display quality, flicker etc. may occur.
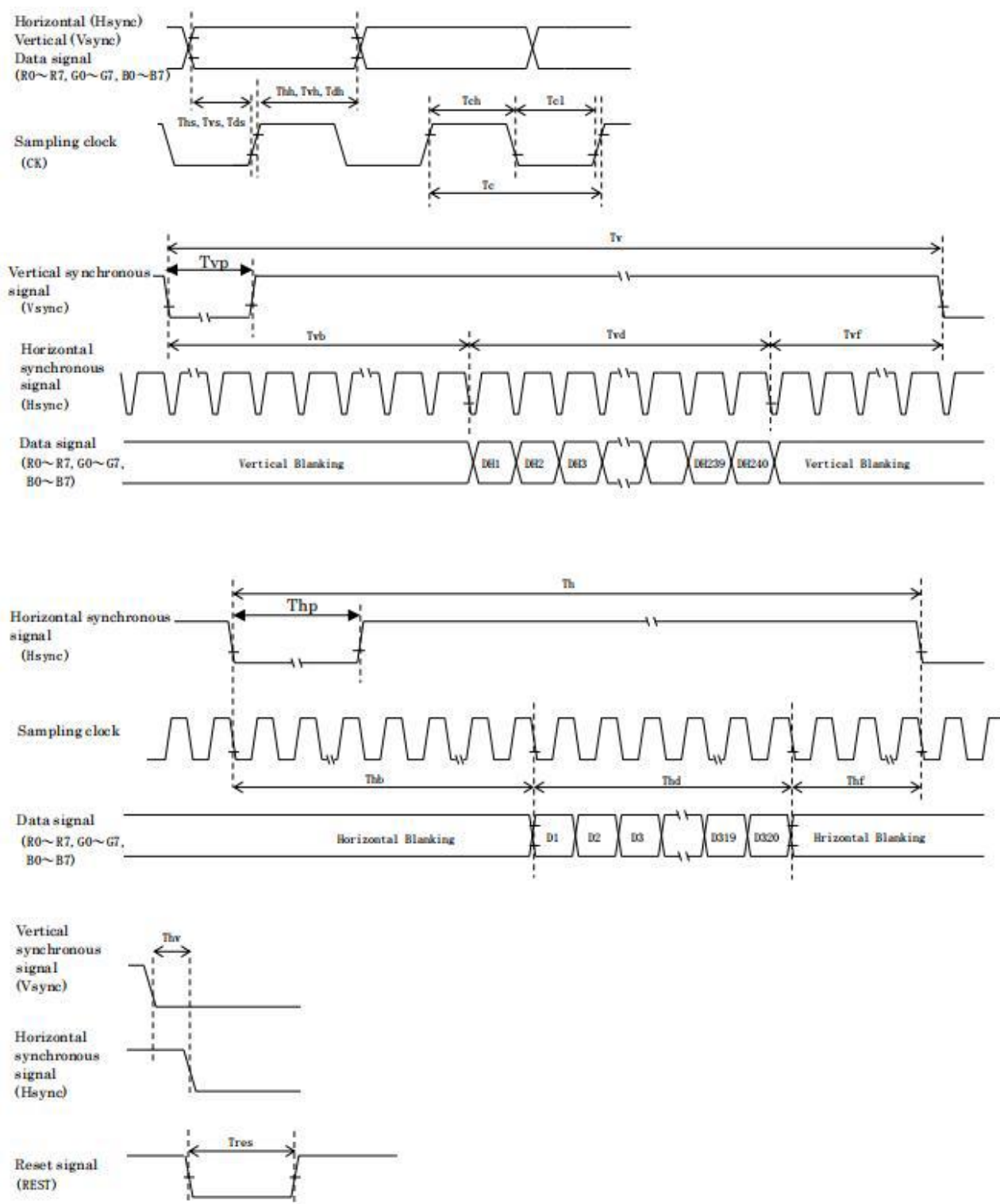
3.5.3 Reset Timing
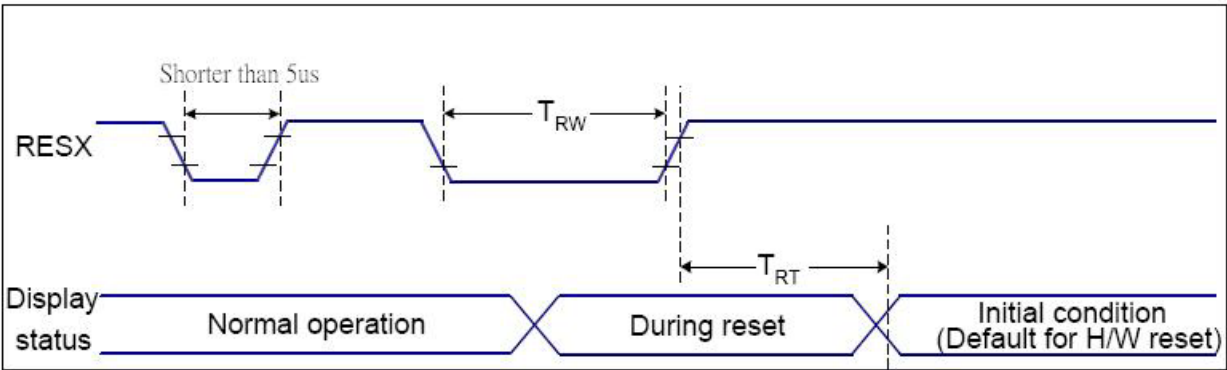
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70°C

| Related Pin	Symbol	Parameter	Min	Max	Unit	Note
RESX	TRW	Reset pulse duration	10	-	us	-
	TRT	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 setting from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (t_{RT}) 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 below.

Reset 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 start in Sleep-In mode) and then return to Default condition for Hardware Reset

Note 4: Spike Rejection also applied during a valid reset pulse as shown below.
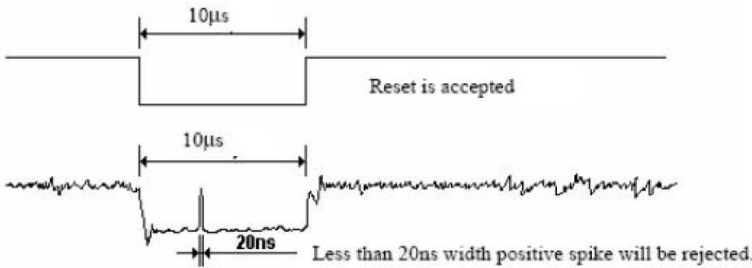
Note 5: When Reset applied during Sleep-In mode.

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.

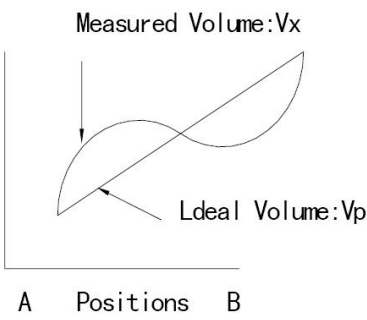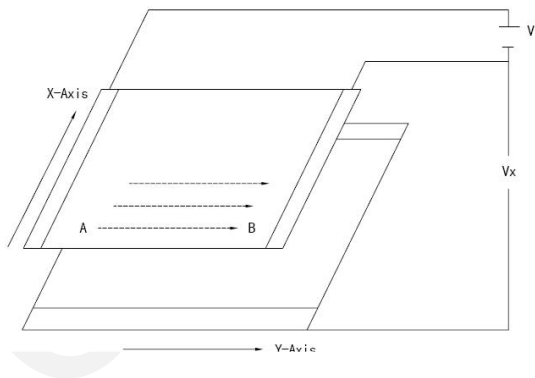# 4. Electrical Specification Touch

4.1 Condition of use and storage

Item	Value	Note
Temperature range upon operation	Humidity: 20%~90%, no dew, condensation -30°C~80°C	In a simple substance
Temperature range upon storae	Humidity: 20%~90%, no dew, condensation -30°C~80°C	In a simple substance

4.2 Electrical Property

Item	Value	Note
Maximum Voltage	DC5V	-
Resistance between terminals	X direction (film side): 200~900Ω	-
	Y direction (glass side): 300~900Ω	-
Insulation Resistance	DC 25V 20MΩ or above	Connect X+~X- and Y+~Y-, apply 25VDC between X and Y for perform measurement.
Chattering	10msec or below	-
Rating	Voltage is DC 5V	-

4.3 Mechanical Property

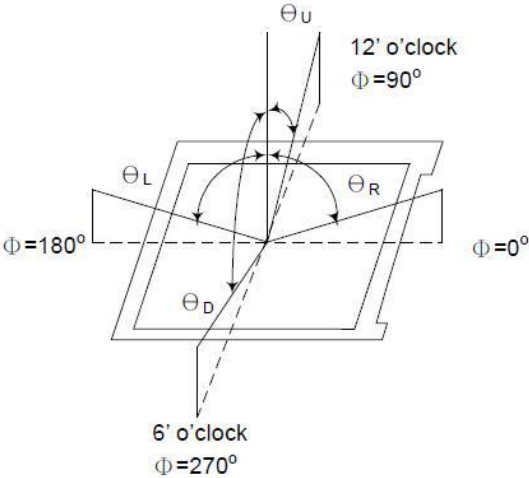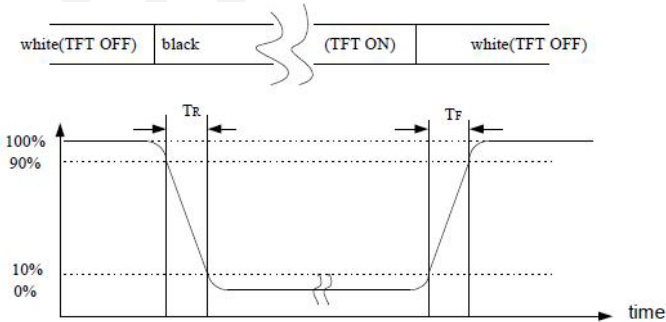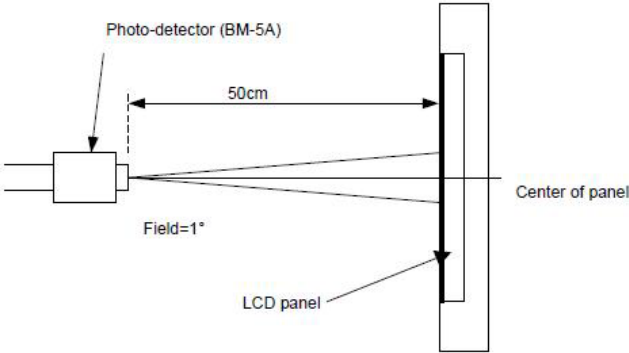| Item	Value		Note
Input Method	Used of and exclusive pen or finger		-
Load Upon Operation	Exclusive pen	60~100g or below	Operation and measurement with a pen must be carried out under the following tip conditions: Stylus pen material: POM (polyacetal) Tip: Diameter 3.0mm, SR 0.8mm
	Finger	60~100 or below	Operation and measurement methods simulated for a finger must be carried out under the following tip conditions: Material: Silicon rubber (Hardness: 30°HS) Tip: Diameter 12.0mm, 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	Value	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	Conditions	Min	Typ	Max	Unit	Note
Contrast Ratio		CR	$\theta = 0°$ Normal viewing angle	700	1000	-	-	1, 2
Response time		$T_R + T_F$		-	30	-	msec	1, 3
Viewing Angle	Left	θ_x-	CR ≥ 10	-	80	-	Deg	1, 4 CF glass
	Right	θ_x+		-	80	-		
	Up	θ_Y+		-	60	-		
	Down	θ_Y-		-	80	-		
Colour Chromaticity	Red	Rx	$\theta = 0°$ Normal viewing angle	0.55	0.60	0.65	-	1, 4
		Ry		0.30	0.35	0.40		
	Green	Gx		0.295	0.345	0.395		
		Gy		0.53	0.58	0.63		
	Blue	Bx		0.11	0.16	0.21		
		By		0.07	0.12	0.17		
	White	Wx		0.265	0.315	0.365		
		Wy		0.28	0.33	0.38		
Luminance		Lv	IF = 15mA/Line	280	400	-	cd/m^2	-

Measuring Condition = Dark room, 25±2°C, 15min 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	

6. LED Backlight Specification

6.1 LED Backlight Electrical Characteristics

The back-light system is edge-lighting type with 8 chips White LED

| Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Forward Current	I_F	Ta = -20 ~ 70°C	-	15	-	mA	1
Forward Voltage	V_F	IF = 15mA, Ta = -20°C	-	13.0	13.8	V	1
		IF = 15mA, Ta = 25°C	-	12.5	13.3		
		IF = 15mA, Ta = 70°C	-	12.2	13.0		
LED Lifetime	Hr		-	60000	-	H	2, 3

Note 1: For each "AN-CA".

Note 2: When brightness decreases 50% of minimum brightness. The average life of a LED will decrease when the LCD is operating at higher temperatures.

Note 3: Life time is estimated data. (Condition: IF = 15mA, Ta = 25°C in chamber).

Note 4: An input current below 5mA may reduce the brightness uniformity of the LED backlight. This is because the amount of light from each LED chip is different. Therefore, please evaluate carefully before finalizing the input current.

6.2 Internal Circuit Diagram

AN1 ──▷│──▷│──▷│──▷│── CA1

AN2 ──▷│──▷│──▷│──▷│── CA2
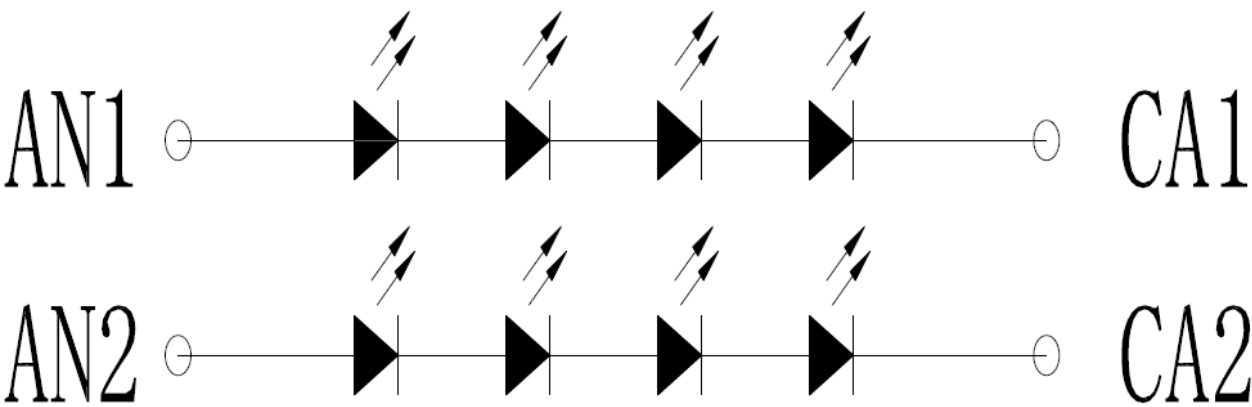
B/L Circuit

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:	$25 \pm 5°C$
Humidity:	65% ± 10% RH
Viewing Angle:	Normal Viewing Angle
Illumination:	Single fluorescent lamp (300 to 700 Lux)
Viewing distance:	30 - 50 cm

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

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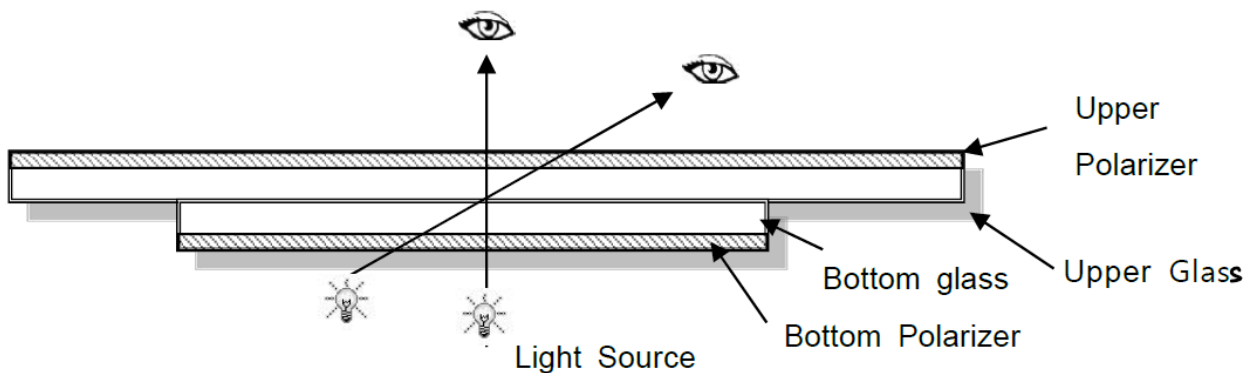
8.3 Delivery Assurance

8.3.1 Delivery Inspection Standards

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

8.3.2 Criteria & Acceptable Quality Level

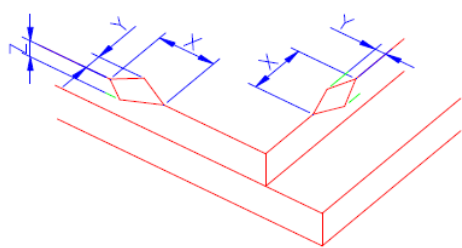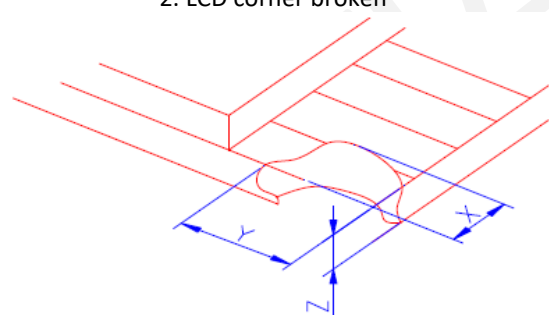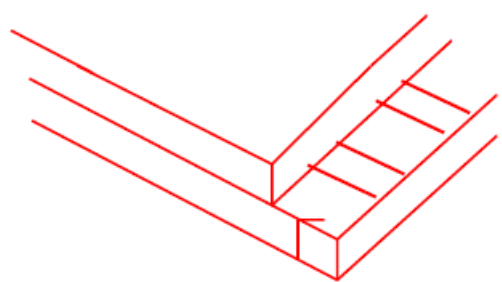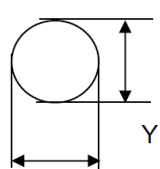| Class of Defects	AQL
Major	0.65
Minor	1.5

LCD: Liquid Crystal Display, LCM: Liquid Crystal Module, RTP: Resistance Touch Panel

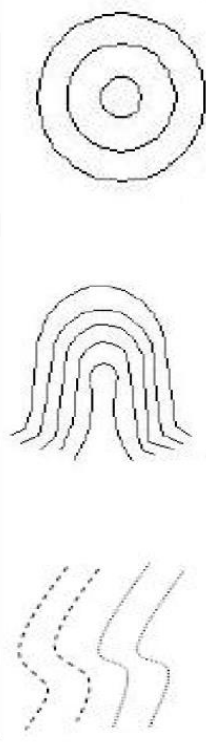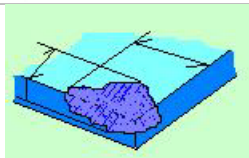| Item	Criteria	Classification of Defects
Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc.	Major
Missing	Missing components and etc.	
Outline dimension	Overall outline dimension beyond the drawing is not allowed, deformation and etc.	
Color tone	Color unevenness, refer to limited sample	Minor
Spot/Line defect	Light dot, Dim spot, Polarizer Air Bubble, Polarizer accidented spot and etc.	
Soldering appearance	Good soldering, peeling off is not allowed and etc.	
LCD/Polarizer/RTP	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.

8.3.3 Criteria & Classification

Item	Criteria
LCD Crack/Broken 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 **3. LCD crack** Crack not allowed
Spot Defect Y X Φ=(X+Y)/2	**1. Light dot (black/white spot, pinhole, stain etc.)**

Size	Acceptable Qty		
	A	B	C
Φ ≤ 0.2	Ignore		
0.2 < Φ ≤ 0.4	3 (distance ≥ 10mm)	Ignore	
0.4 < Φ ≤ 0.5	2 (distance ≥ 10mm)		
Φ > 0.5	0		

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

Item	Criteria			

Size	Acceptable Qty		B	C
	A			
Φ ≤ 0.15	Ignore		Ignore	
0.15 < Φ ≤ 0.25	3 (distance ≥ 10mm)			
0.25 < Φ ≤ 0.4	2 (distance ≥ 10mm)			
Φ > 0.4	0			

3. Polarizer accidented spot

Size	Acceptable Qty		B	C
	A			
Φ ≤ 0.2	Ignore		Ignore	
0.2 < Φ ≤ 0.4	5 (distance ≥ 10mm)			
0.4 < Φ ≤ 0.5	3 (distance ≥ 10mm)			
Φ > 0.5	0			

4. Polarizer Bubble

Size	Acceptable Qty		B	C
	A			
Φ ≤ 0.2	Ignore		Ignore	
0.2 < Φ ≤ 0.3	5 (distance ≥ 10mm)			
0.3 < Φ ≤ 0.5	3 (distance ≥ 10mm)			
Φ > 0.5	0			

Pixel bad points

Item	Zone A	Acceptable Qty
Bright dot	Random	N ≤ 2
	2 dots adjacent	N ≤ 0
	3 dots adjacent	N ≤ 0
Dark dot	Random	N ≤ 2
	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	5mm

LCD Pixel Defect

Item	Criteria	
	dark and bright dot.	
	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.
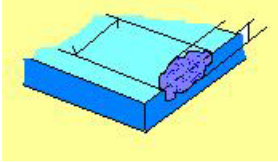C) 2 dot adjacent = 1 pair = 2 dots

2 dot adjacent   2 dot adjacent

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

Item	Criteria				
Line defect (LCD/Polarizer backlight black/white line, scratch, stain) W: width, L : length	Width	Length	Acceptable Qty		
			A	B	C
	W ≤ 0.05	Ignore	Ignore		Ignore
	0.05 < W ≤ 0.06	L ≤ 4.0	N ≤ 3		
	0.06 < W ≤ 0.08	L ≤ 3.0	N ≤ 2		
	W > 0.08	Defined as spot defect			

Item	Criteria
Electronic Components SMT	Not allow missing parts, solderless connection, cold solder joint, mismatch, the positive and negative polarity opposite
Display color & Brightness	1. Color: Measuring the color 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
LCD Mura/Waving/Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.

Item		Size	Acceptable Qty		
			A	B	C
RTP Related X: Length, Y: Width, Z: Height	RTP film bubble/ accidented spot	Φ ≤ 0.1	Ignore		Ignore
		0.1 < Φ ≤ 0.25	3 (distance ≥ 10mm)		
		0.25 < Φ ≤ 0.35	2 (distance ≥ 10mm)		
		Φ > 0.35	0		
	RTP film scratch	Width	Length	Acceptable Qty	
				A	B	C

Item	Criteria			
	W ≤ 0.05	Ignore	Ignore	Ignore
	0.05 < W ≤ 0.06	L ≤ 3.0	N ≤ 2	
	0.06 < W ≤ 0.08	L ≤ 2.0	N ≤ 1	
	W > 0.08	Defined as spot defect		
Assembly deflection	beyond the edge of backlight ≤ 0.2mm			
Bulge (undulation include)	It's ok if The ITO film plumped below 0.40mm. <0.4mm			
Newton Ring	Newton Ring area > 1/3 TP area: NG Newton Ring area ≤ 1/3 TP area: OK 			
RTP corner broken	 X ≤ 3mm, Y ≤ 3mm, Z < cover thickness Circuitry broken is not allewed			

Item	Criteria
RTP edge broken	 X ≤ 4mm, Y ≤ 2mm, Z < cover thickness Circuitry broken is not allewed

Functional Item

Item	Criteria
No Display	
Missing Segment	
Short	Not allowed
Backlight No Lighting	
RTP No Function	

8.4 Dealing with Customer Complaints

8.4.1 Non-conforming Analysis

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

After accepting it, Densitron should complete the analysis in reasonable time and update the status to the purchaser.

8.4.2 Handling of Non-conforming Displays

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

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

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

9.   Reliability Specification

9.1   Reliability Tests

Test Item	Test Condition	Inspection after test
High Temperature Operation	80°C, 96 hours	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	-30°C, 96 hours	
High Temperature Storage	80°C, 96 hours	
Low Temperature Storage	-30°C, 96 hours	
High Temperature & High Humidity Storage	Ta = 60°C, 90% RH ,96 hours.	
Thermal Shock Test (non-operating)	-10°C (30min) ~ 60°C (30min), 20 cycles	
Electro Static Discharge Test (non-operating)	C=150pF, R=330,5points/panel Air: ±8KV, 5times; Contact: ±6KV, 5 times; (Environment: 15°C~35 °C, 30%~60%).	
Vibration Test (non-operating)	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).	
Drop Test	Height: 80cm 1 corner, 3 edges, 6 surfaces (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.

10. Handling Precautions

10.1 Handling Precautions

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

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

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

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

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

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

   a. Scotch Mending Tape No. 810 or an equivalent

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

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

      • Water

      • Ketone

      • Aromatic Solvents

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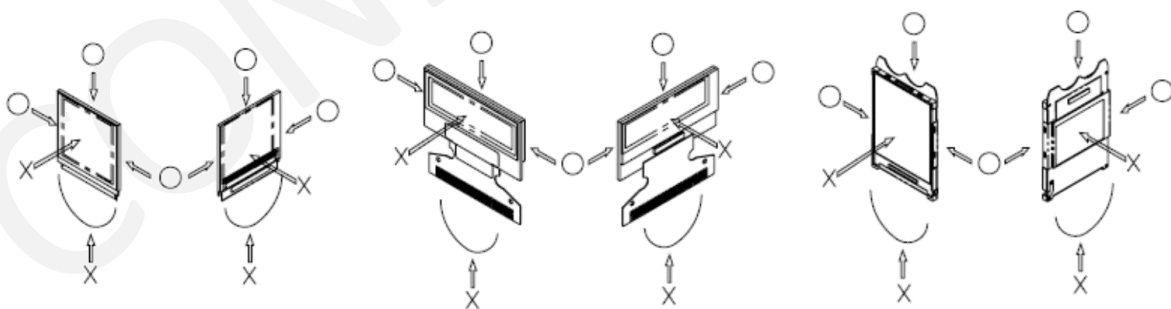
influence the display performance. Also, secure sufficient rigidity for the outer cases.

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

9) Do not disassemble nor modify the display module.

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

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

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

10.2 Storage Precautions

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

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

10.3 Designing Precautions

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

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

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

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

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

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

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

10.4 Operation Precautions

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

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

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

4) To protect display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the display modules.

   a. Pins and electrodes

   b. Pattern layouts such as the FPC

5) When the driver is being exposed (COG), semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if the driver is exposed to light, malfunctioning may occur.

   a. Design the product and installation method so that the driver may be shielded from light in actual usage.

   b. Design the product and installation method so that the driver may be shielded from light during the inspection processes.

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

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

10.5 Cleaning Precautions

1) Keep TFT Scratch free: Avoid using abrasive materials like paper towels and newspaper in cleaning TFT LCD screens as they may scratch the surface. Instead, opt for a lint-free cloth. Don't spray the liquid directly on the monitor and remember to put gentle pressure when wiping the screen.

2) Avoid Vibration: During cleaning process, try to keep the TFT on shock proof platform to avoid strong shock and vibration. Do not apply pressure to the LCD screen of the LCD or bump or squeeze the LCD display back cover.

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

a) Scotch Mending Tape No. 810 or an equivalent.

b) Never try to breathe upon the soiled surface.

c) List of Safe and Unsafe solvents to clean TFT display:

Safe Solvents	Unsafe Solvents

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

10.6 Other Precautions

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