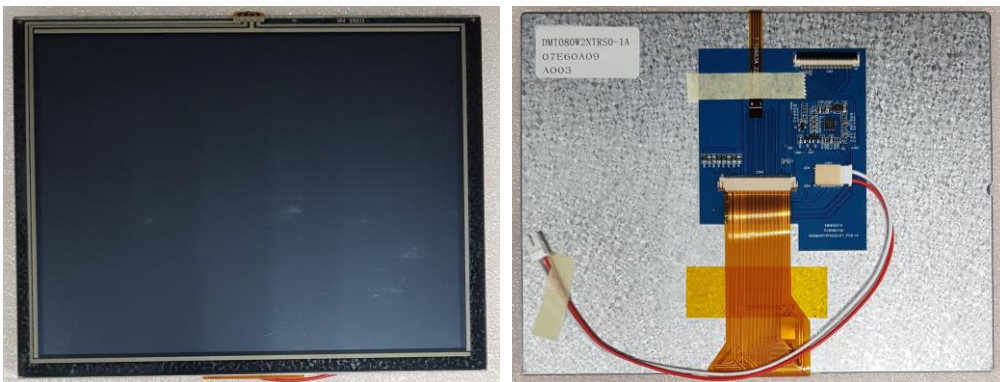


DMT080W2NTRS0-1A

PRODUCT SPECIFICATION

Version 0.1
Feb 06, 2023



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

Prepared by *Victoria Ho*
Approved by *Evan Huang*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
0.1	Feb 06, 2023	Preliminary	Victoria Ho

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1. General Description

1.1 Introduction

This is a 8" size colour active matrix TFT LCD module that uses amorphous silicon TFT as a switching device. The display is normally white, transmissive, and featuring high contrast and excellent colour saturation. The resolution of the TFT-LCD is 800 x 600 and can display up to 262K colours. The display module supports 18-bit RGB interface and tape bonding touch panel.

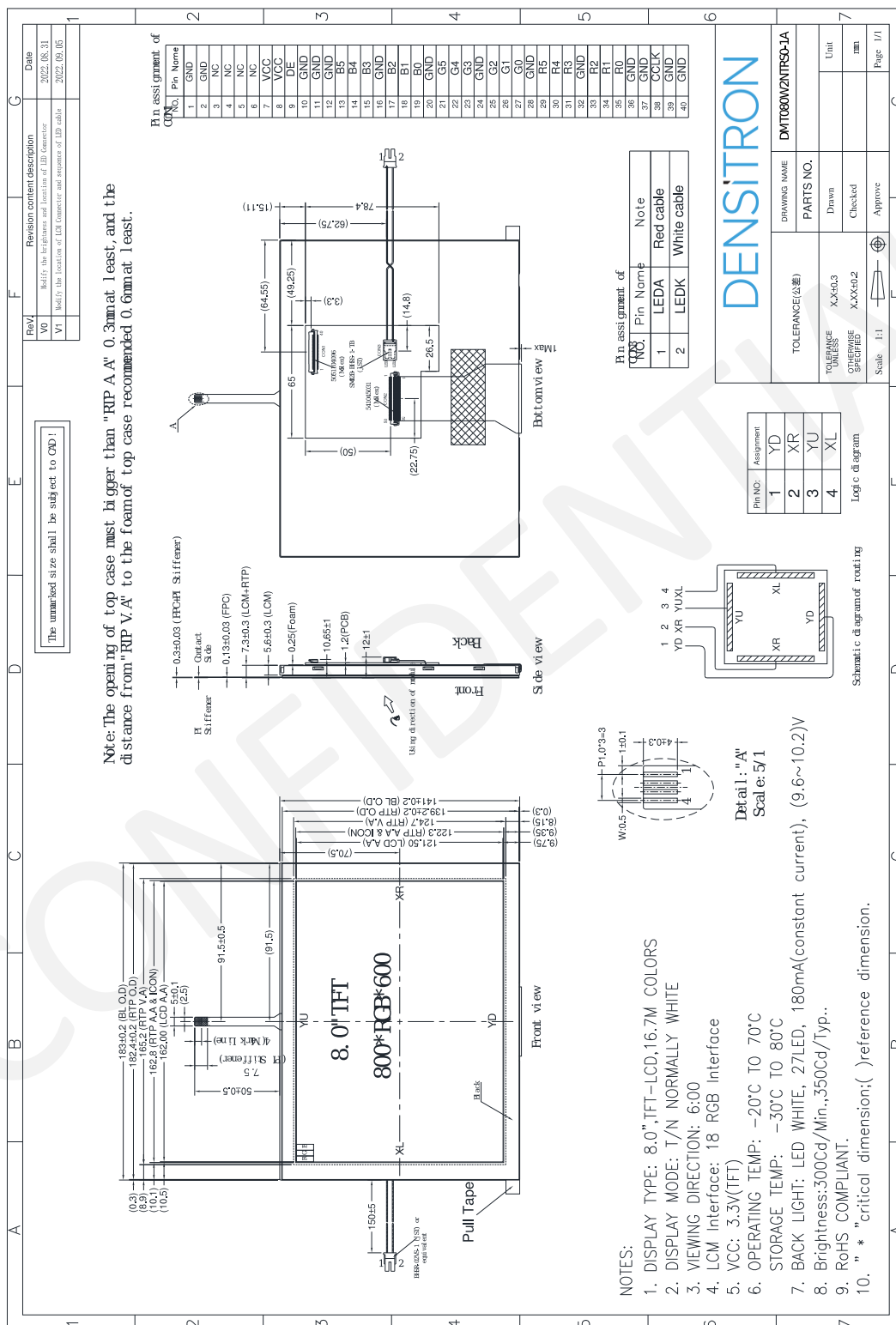
1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	8" Diagonal
Display Format	800 x RGB x 600 Dots
No. of Colour	262K
Overall Dimensions	183.00 (W) x 141.00 (H) x 12.00 (D) mm
Active Area	162.00 (W) x 121.50 (H) mm
Mode	Normally White / Transmissive / TN
Surface Treatment	Anti-glare
Viewing Direction	12 o'clock 6 o'clock (Gray Inversion)
Interface	18-bit RGB
Driver IC	EK9713/EK7330
Backlight Type	LED, White, 27 chips
Touch Panel	Resistive Touch Panel (RTP)
Touch Interface	4-wire resistive
Bonding Type	Tape 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	800 x RGB x 600	Dots
Overall Dimensions	183.00 (W) x 141.00 (H) x 12.00 (D)	mm
Active Area	162.00 (W) x 121.50 (H)	mm
Dot Pitch	0.0642 (W) x 0.1790 (H)	mm
Weight	325	g
IC Controller/Driver	EK9713/EK7330	



3. Electrical Specification

3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Digital Supply Voltage	VDD	-0.5	5.0	V	1
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

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Digital Supply Voltage	VDD	-	2.7	3.3	3.6	V	-
Normal Mode Current	IDD	-	-	80	-	mA	-
Level Input Voltage	V _{IH}	-	0.7*VDD	-	VDD	V	-
	V _{IL}	-	GND	-	0.3*VDD	V	-
Level Output Voltage	V _{OH}	-	VDD-0.4	-	-	V	-
	V _{OL}	-	GND	-	GND+0.4	V	-

3.3 Interface Pin Assignment

3.3.1 TFT PIN Define

No.	Symbol	I/O	Function
1	GND	P	Power ground
2	GND	P	Power ground
3	NC	-	No connection
4	NC	-	No connection
5	NC	-	No connection
6	NC	-	No connection
7	VCC	P	Power for Digital circuit
8	VCC	P	Power for Digital circuit
9	DE	I	Data Input Enable
10	GND	P	Power ground
11	GND	P	Power ground
12	GND	P	Power ground
13	B5	I	Blue data (MSB)
14	B4	I	Blue data
15	B3	I	Blue data
16	GND	P	Power ground
17	B2	I	Blue data
18	B1	I	Blue data
19	B0	I	Blue data (LSB)
20	GND	P	Power ground
21	G5	I	Green data (MSB)
22	G4	I	Green data
23	G3	I	Green data
24	GND	P	Power ground
25	G2	I	Green data
26	G1	I	Green data
27	G0	I	Green data (LSB)
28	GND	P	Power ground
29	R5	P	Red data (MSB)

No.	Symbol	I/O	Function
30	R4	P	Red data
31	R3	P	Red data
32	GND	P	Power ground
33	R2	P	Red data
34	R1	P	Red data
35	R0	P	Red data (LSB)
36	GND	P	Ground
37	GND	P	Ground
38	DCLK	I	Clock signal.
39	GND	P	Ground
40	GND	P	Ground
37	XR	A/D	Touch panel right glass terminal
38	YD	A/D	Touch panel bottom film terminal
39	XL	A/D	Touch panel left glass terminal
40	YU	A/D	Touch panel top film terminal

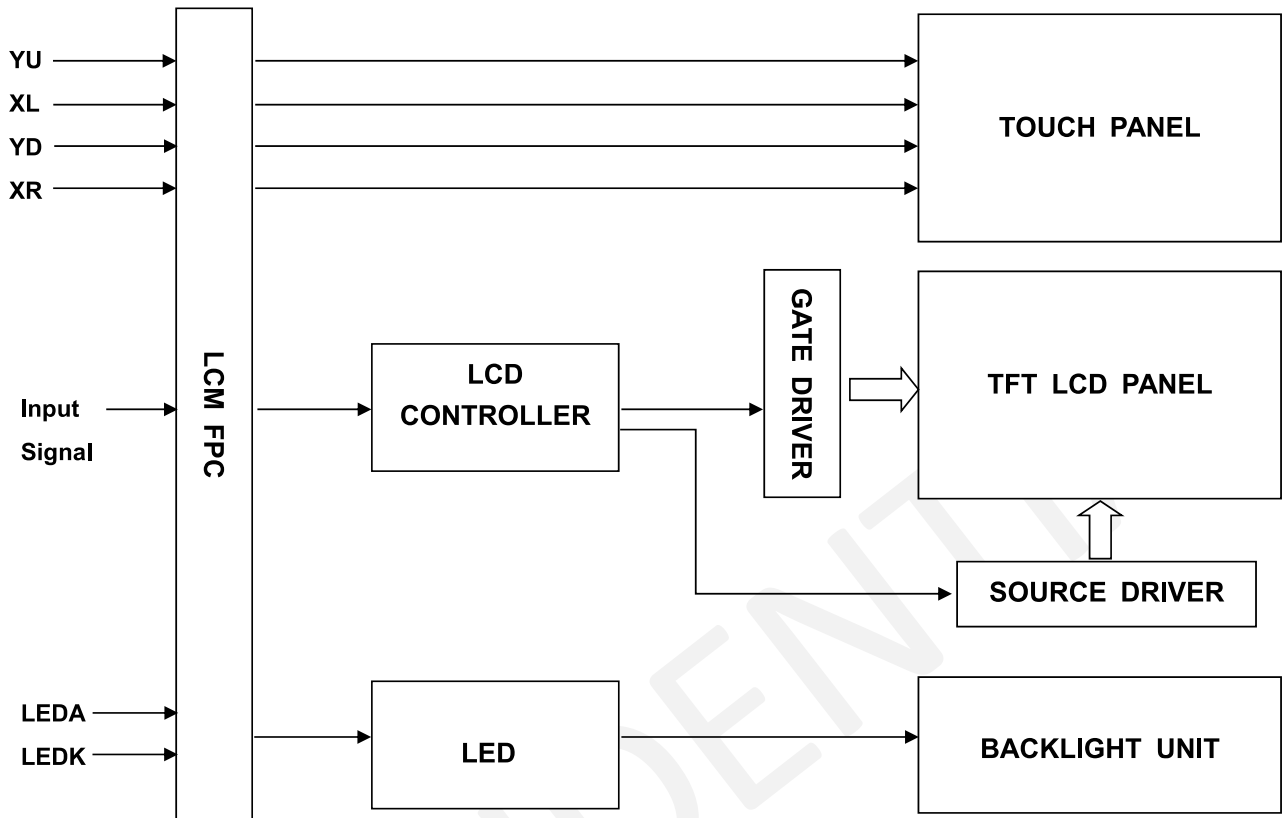
3.3.2 CON2 JST:BHSMR-02VS

No.	Symbol	I/O	Function
1	LEDA	P	LED Anode
2	LEDK	P	LED Cathode

3.3.3 TP

No.	Symbol	I/O	Function
1	YD	A/D	Touch panel bottom film terminal
2	XR	A/D	Touch panel right glass terminal
3	YU	A/D	Touch panel top film terminal
4	XL	A/D	Touch panel left glass terminal

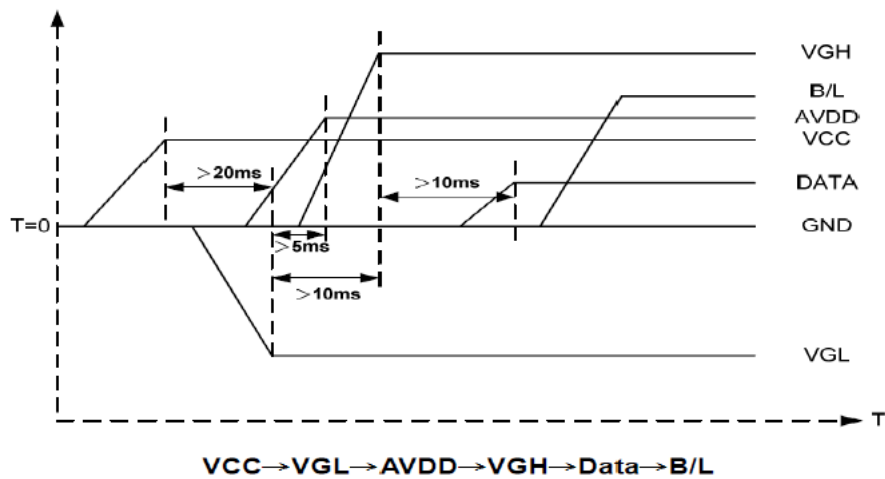
3.4 Block Diagram



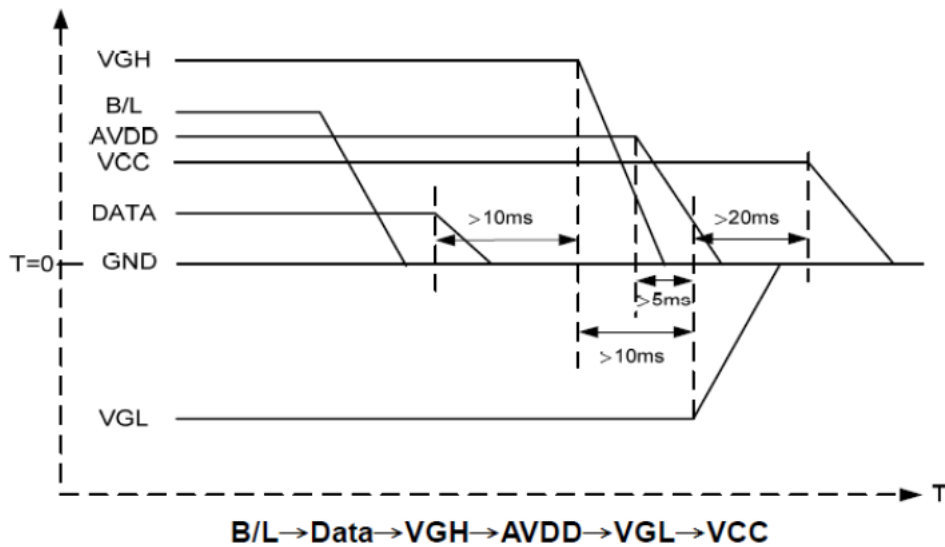
3.5 Timing Characteristics

3.5.1 Display Interface Timing Characteristics

Power ON:



Power OFF:



Note: Data include R0~R5, B0~B5, GO~G5, STLR,UPDN, DCLK, HS,VS,DE.

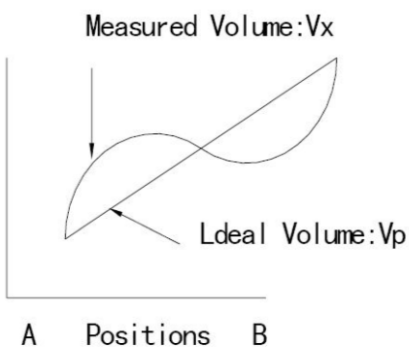
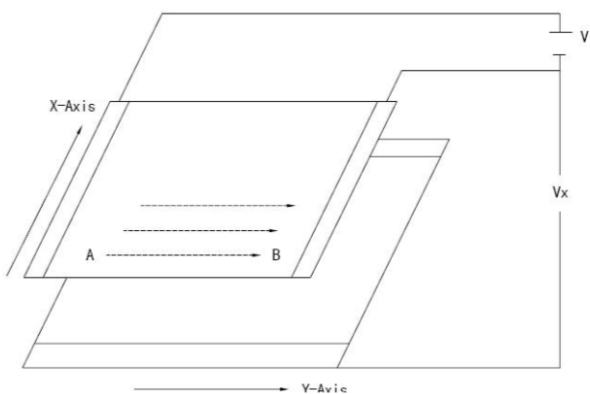
4. Electrical Specification Touch

4.1 Conditions of Use and Storage

Item	Value (Condition)	Note
Temperature Range Upon Operation	Humidity: 20%~90% non dew, Condensation: -20°C~70°C	In a simple substance
Temperature Range Upon Storage	Humidity: 20%~90% non 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]: 200-600Ω	-
	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 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 (polyacetal). 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	-

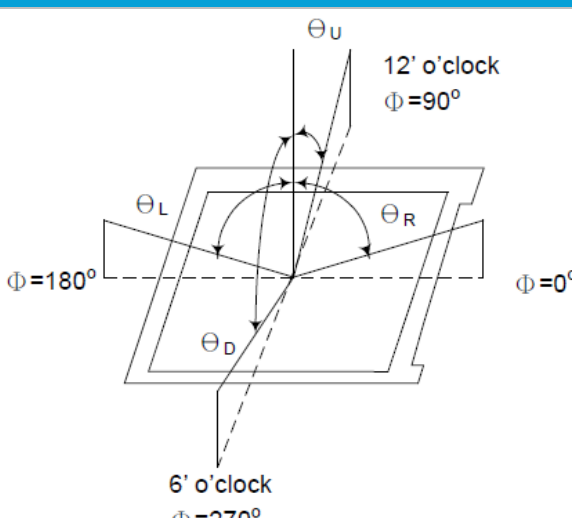
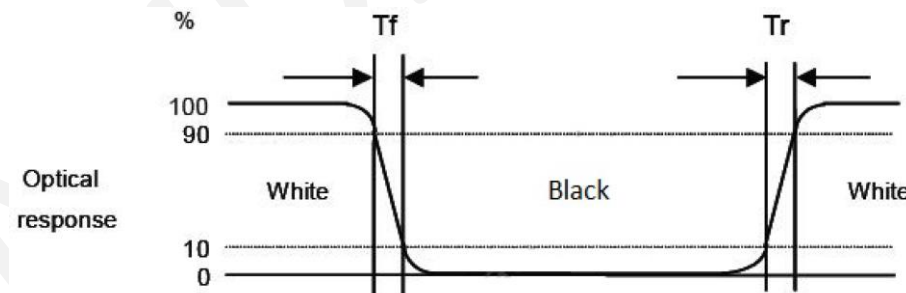
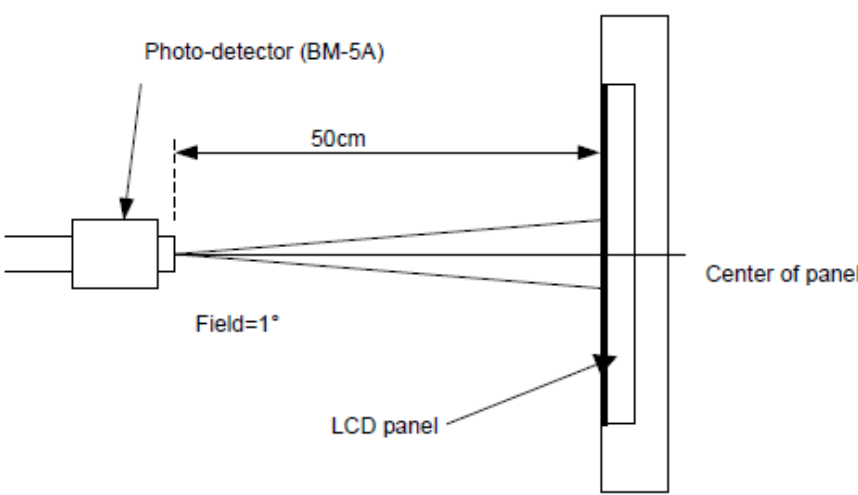
5. Optical Specification

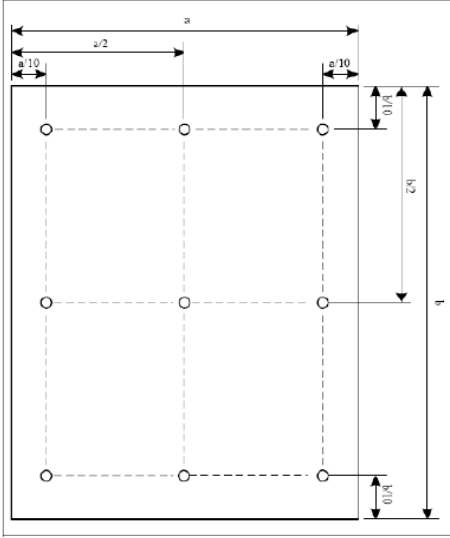
5.1 Optical Characteristics

Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	$\theta = 0^{\circ}$	400	500	-	-	1,2
Response time		TR + TF	Normal viewing angle	-	25	50	msec	1,3
Viewing Angle	Left	θ_{x-}	CR > 10	60	70	-	-	1,4
	Right	θ_{x+}		60	70	-		
	Up	θ_{y+}		40	50	-		
	Down	θ_{y-}		60	70	-		
Colour Chromatic	White	Wx	$\theta = 0^{\circ}$ Normal viewing angle	0.26	0.31	0.36	-	2, 5
		Wy		0.28	0.33	0.38	-	
Luminance		Lv		300	350	-	cd/m ²	5
Uniformity		Avg		70	75	-	%	5

Measuring Condition: in dark room, at ambient temperature = $25 \pm 2^\circ\text{C}$, 15 min. warm-up time

Measuring Equipment: FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note	Item	Test method
1	Definition of Viewing Angle	
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 
4	Definition of Optical Measurement Setup	

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

6. LED Backlight Specification

6.1 LED Backlight Characteristics

The back-light system is edge-lighting type with 27 chips White LED.

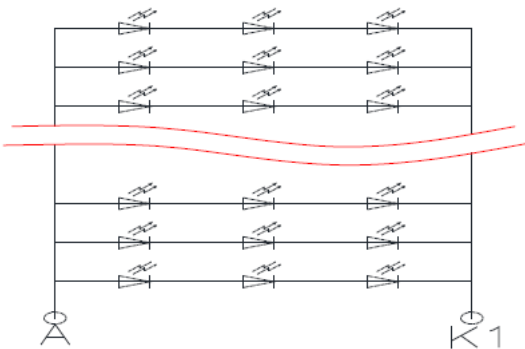
Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Current	I_F	-	-	180	-	mA	-
Forward Voltage	V_F	-	-	9.6	-	V	-
LED Lifetime	Hr	-	50000	-	-	Hour	1, 2

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

$T_a=25\pm3^{\circ}\text{C}$, typical IL (I_F) value indicated in the above table until the brightness becomes less than 50%.

Note 2: The “LED lifetime” is defined as the module brightness decreases to 50% original brightness at $T_a=25^{\circ}\text{C}$ and IL (I_F)=180mA. The LED lifetime could be decreased if operating IL (I_F) is larger than 180mA. The constant current driving method is suggested.

6.2 INTERNAL CIRCUIT DIAGRAM



7. Packaging

TBD

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8. Quality Assurance Specification

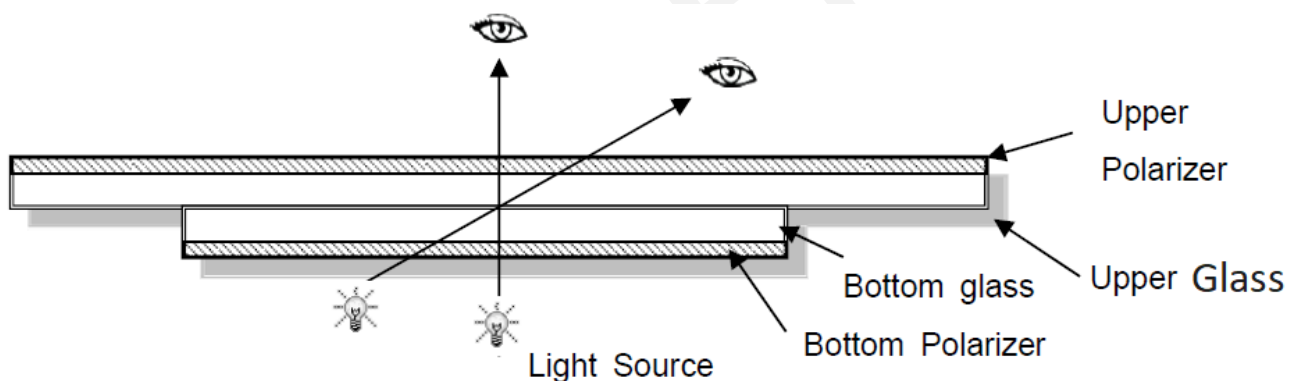
8.1 Conformity

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:	$25 \pm 5^{\circ}\text{C}$
Humidity:	$65\% \pm 10\% \text{ RH}$
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.	

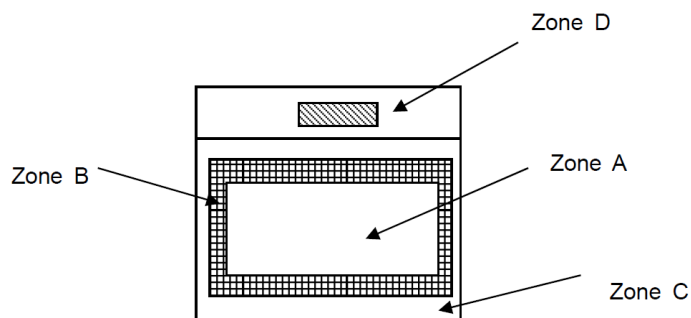


8.3 Delivery Assurance

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: 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	Colour Tone	Colour unevenness, refer to limited sample	Minor
5	Spot Line Defect	Light dot, dim spot (Note 1), polarizer air bubble, polarizer accidented spot.	
6	Soldering Appearance	Good soldering, peeling off is not allowed.	
7	LCD/Polarizer/RTP	Black/White spot/line, scratch, crack, etc.	

Note1:

- a) Light dot: Dots appear bright and are unchanged in size in which LCD panel is displaying under black pattern.
- b) Dim dot: Dots appear dark and are unchanged in size in which LCD panel is displaying under pure red, green, or blue picture.

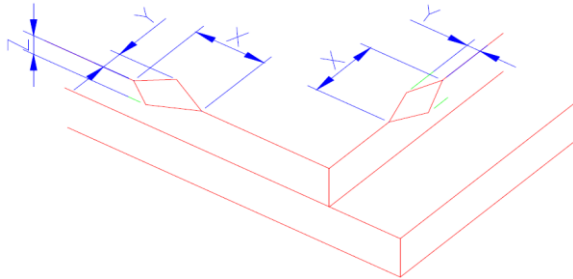
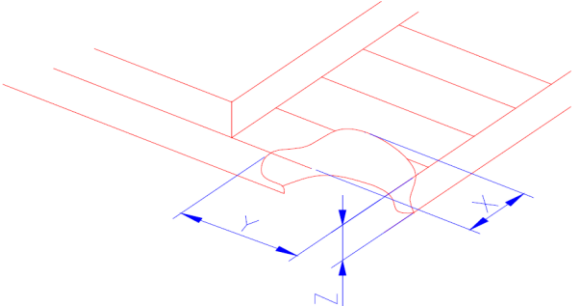
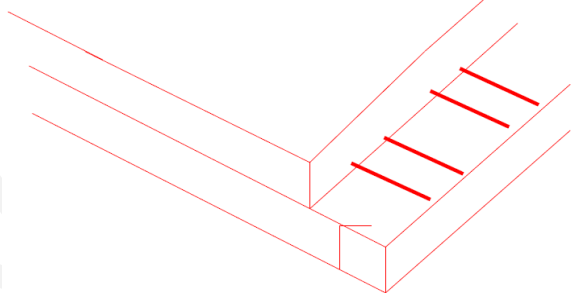
8.3.4 Criteria & Classification



Units: mm

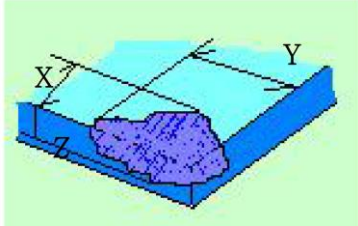
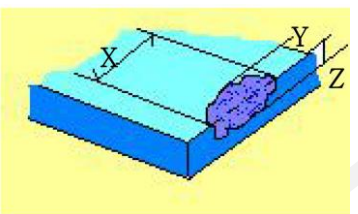
Class	Item	Criteria				
Minor	Spot Defect	Round type: as per following drawing, $\varnothing = (X+Y)/2$				
		1) Light Dot (Black/white spot, pinhole, stain, etc.)				
		Size\Zone	Acceptable Quantity			
			A	B	C	
		$\varnothing \leq 0.15$	Ignore	Ignore		
		$0.15 < \varnothing \leq 0.25$	3 (distance $\geq 10\text{mm}$)			
		$0.25 < \varnothing \leq 0.4$	2 (distance $\geq 10\text{mm}$)			
		$0.4 < \varnothing$	0			
		2) Dim Spot (light leakage, dent, dark spot, etc.)				
		Size\Zone	Acceptable Quantity			
			A	B	C	
		$\varnothing \leq 0.15$	Ignore	Ignore		
		$0.15 < \varnothing \leq 0.25$	3 (distance $\geq 10\text{mm}$)			
		$0.25 < \varnothing \leq 0.40$	2 (distance $\geq 10\text{mm}$)			
		$0.4 < \varnothing$	0			
		3) Polarizer Accidented Spot				
		Size\Zone	Acceptable Quantity			
			A	B	C	
		$\varnothing \leq 0.2$	Ignore	Ignore		
		$0.2 < \varnothing \leq 0.5$	2 (distance $\geq 10\text{mm}$)			
		$0.5 < \varnothing$	0			
		4) Polarizer Bubble				
		Size\Zone	Acceptable Quantity			
			A	B	C	
		$\varnothing \leq 0.2$	Ignore	Ignore		
		$0.2 < \varnothing \leq 0.4$	2 (distance $\geq 10\text{mm}$)			

Class	Item	Criteria		
		0.1<Ø≤0.5	1	
		0.4<Ø	0	
Minor	LCD Pixel Defect	Pixel Bad Points		
		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
			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 Quantity of Bright and Dark Dots		N≤4

Class	Item	Criteria																										
		<p>Note:</p> <p>A) Bright dot : Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p>C) 2 dot adjacent = 1 pair = 2 dots</p> <p>Picture:</p> <div><p>Picture:</p><div></div><p>2 dot adjacent</p><div></div><p>2 dot adjacent (vertical)</p><div></div><p>2 dot adjacent</p><div></div><p>2 dot adjacent (slant)</p></div>																										
Minor	Line Defect (LCD/ Polarizer backlight black/white line, scratch, stain)	<div><p>Line type: as per following drawing</p></div> <table><tr><th rowspan="2">Width</th><th rowspan="2">Length</th><th colspan="3">Acceptable quantity</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$W \leq 0.05$</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.05 < W \leq 0.06$</td><td>$L \leq 5.0$</td><td colspan="2">$N \leq 3$</td></tr><tr><td>$0.06 < W \leq 0.08$</td><td>$L \leq 4.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$0.08 < W$</td><td colspan="4">Define as spot defect</td></tr></table>	Width	Length	Acceptable quantity			A	B	C	$W \leq 0.05$	Ignore	Ignore		Ignore	$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$		$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$		$0.08 < W$	Define as spot defect			
Width	Length	Acceptable quantity																										
		A	B	C																								
$W \leq 0.05$	Ignore	Ignore		Ignore																								
$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$																										
$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$																										
$0.08 < W$	Define as spot defect																											
Minor	LCD Crack/Broken	<p>Symbols:</p> <p>X: Length, Y: Width, Z: Height, L: Length of ITO, T: Height of LCD</p> <p>1) The edge of LCD broken: $X \leq 3.0\text{mm}$; $Y < \text{Inner border line of the seal}$; $Z \leq T$</p>																										

Class	Item	Criteria
		 <p>2) LCD corner broken: $X \leq 3.0\text{mm}$; $Y \leq L$; $Z \leq T$</p> 
Major	LCD Crack	<p>The LCD with extensive crack is not acceptable.</p> 
Major	Electronic Components SMT	Missing parts, solderless connection, cold solder joint, mismatch, the positive and negative polarity opposite, are not allowed.
Minor	Display colour & Brightness	<p>1) Colour: Measuring the colour coordinates in accordance with the datasheet or samples.</p> <p>2) Brightness: Measuring the brightness of white screen in accordance with the datasheet or samples.</p>
Minor	LCD Mura/Waving/ Hot Spot	LCD mura, waving, and hot spot should be invisible through 5% ND filter in 50% gray or judged by limited sample if necessary.

Class	Item	Criteria				
Minor	RTP Related	1) RTP Film Bubble / Accidented Spot				
		Size\Zone	Acceptable Qty			
			A	B	C	
		$\varnothing \leq 0.1$	Ignore		Ignore	
		$0.1 < \varnothing \leq 0.25$	4 (distance $\geq 10\text{mm}$)			
		$0.25 < \varnothing \leq 0.35$	3 (distance $\geq 10\text{mm}$)			
		$0.35 < \varnothing$	0			
		2) RTP Film Scratch				
		Width	Length	Acceptable Qty		
				A	B	C
		$\Phi \leq 0.05$	Ignore	Ignore		Ignore
		$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$		
		$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$		
		$0.08 < W$	Define as spot defect			
		3) Assembly Deflection: beyond the edge of backlight $\leq 0.2\text{mm}$				
		4) Bulge (undulation included)				
		It's ok that the ITO film plumped below 0.4mm.				
						
		5) Newton Ring				
		Newton Ring area $> 1/3$ TP area: NG				
		Newton Ring area $\leq 1/3$ TP area: OK				
						

Class	Item	Criteria
		<p>RTP corner broken X: length, Y: width, Z: height $X \leq 3\text{mm}$; $Y \leq 3\text{mm}$; $Z < \text{Cover thickness}$ *Circuitry broken is not allowed.</p> 
		<p>RTP edge broken X: length, Y: width, Z: height $X \leq 4\text{mm}$; $Y \leq 2\text{mm}$; $Z < \text{LCD thickness}$ *Circuitry broken is not allowed.</p> 

Criteria (functional items)

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

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	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°C, 96 hrs	
High Temperature Storage	80°C, 96 hrs	
Low Temperature Storage	-30°C, 96 hrs	
High Temperature & High Humidity Operation	+60°C, 90%RH, 96 hrs	
Thermal Shock (Non-operation)	-30°C, 30 min ↔ 80°C, 30 min, Change time: 5min 20CYC.	
ESD test	C=150pF, R=330, 5 points/panel Air: ±8KV, 5 times; Contact: ±6KV, 5 times	
Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	
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 5~10 pieces.

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 be ignored.

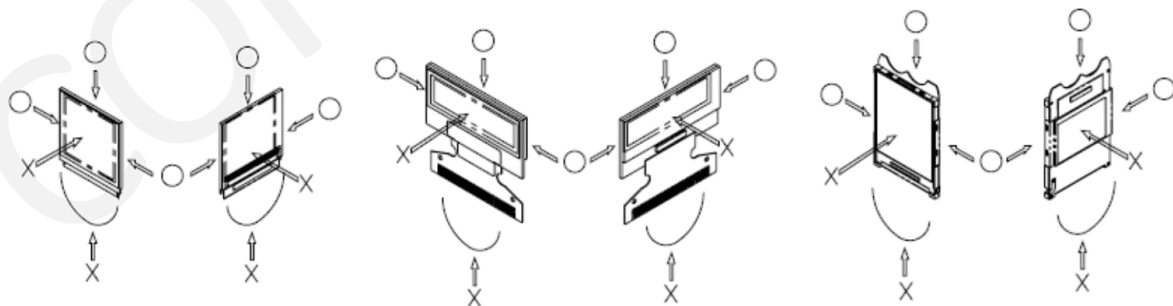
9.1.1 Inspection Check Standard

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 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.