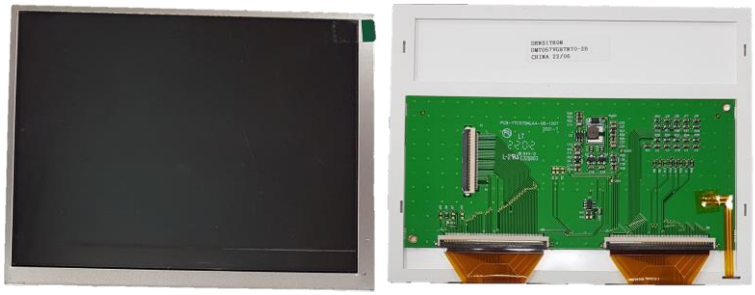
DMT057VGHTNT0-2B

PRODUCT SPECIFICATION

Version 1.0
Aug 25, 2022



Customer's Approval	
Signature	*Date*

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

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
1.0	Aug 25, 2022	Initial Release	Victoria Ho

Legal Notice

Table of Contents

1. General Description

1.1 Introduction

This is a 5.7” size colour active matrix TFT LCD module that uses amorphous silicon TFT as a switching device. The display is normally white mode, transmissive, and featuring high contrast and excellent colour saturation. The resolution of the TFT-LCD is 640 x 480 and can display up to 262Kcolours. The display module supports 18-bit RGB interface.

1.2 Main Features

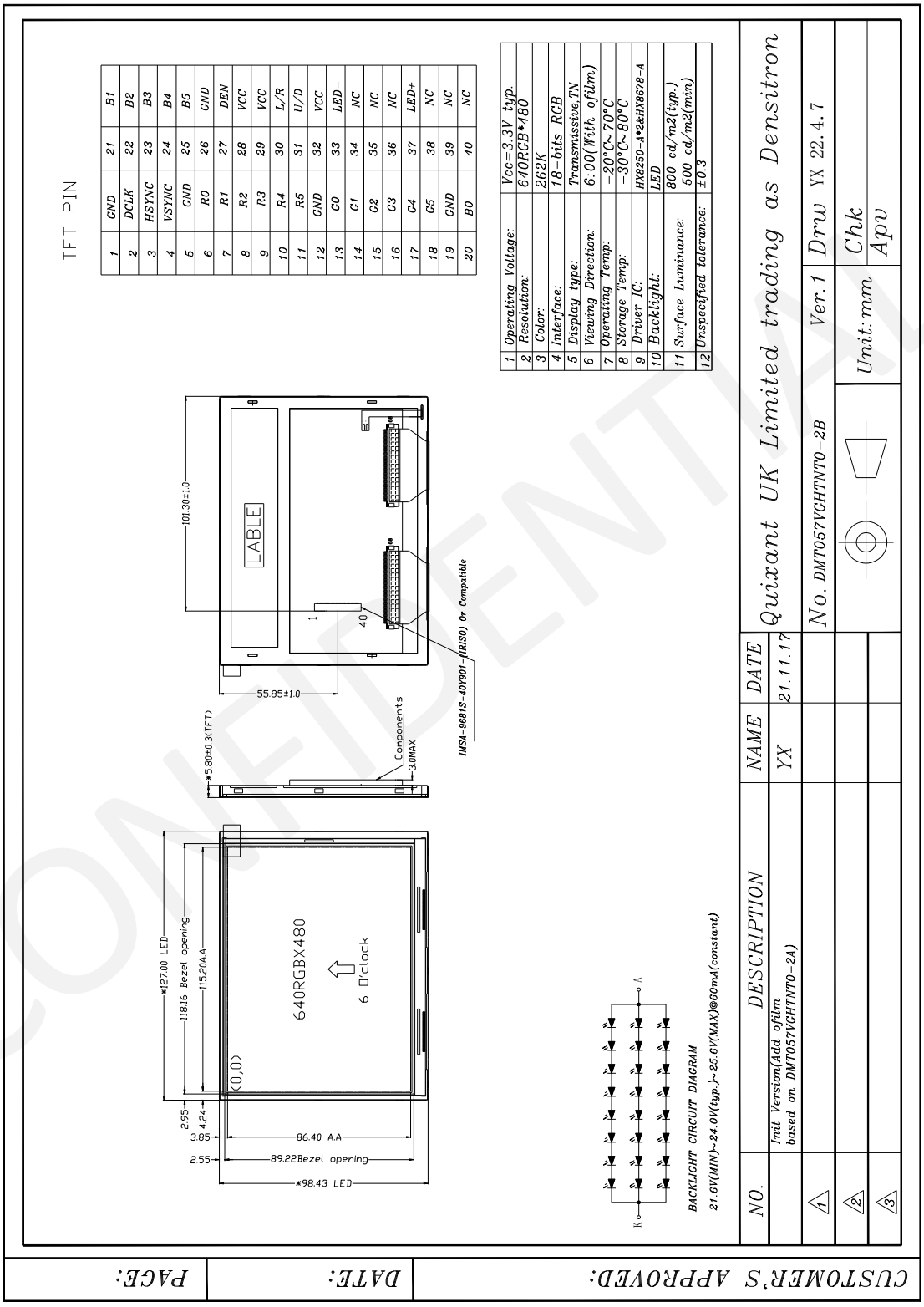
Item	Contents
Display Type	TFT LCD
Screen Size	5.7” Diagonal
Display Format	640 x RGB x 480 Dots
No. of Colour	262K
Overall Dimensions	127(W) x 98.43 (H) x 5.8 (D) mm
Active Area	115.2 (W) x 86.4 (H) mm
Mode	Normally White / TN / Transmissive, With O-Film
Viewing Direction	6 o’clock
Interface	18-bit RGB
Driver IC	HX8250-A *2 & HX8678-A
Backlight Type	LED, White, 24 chips
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
ROHS	Compliant to RoHS

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	640 x RGB x 480	Dots
Overall Dimensions	127(W) x 98.43 (H) x 5.8 (D)	mm
Active Area	115.2 (W) x 86.4 (H)	mm
Dot Pitch	0.18 (W) x 0.18(H)	mm
Weight	106	g
IC Controller/Driver	HX8250-A *2 & HX8678-A	

2.2 Mechanical Drawing



3. Electrical Specification

3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Digital Supply Voltage	VCC	-0.3	7.0	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

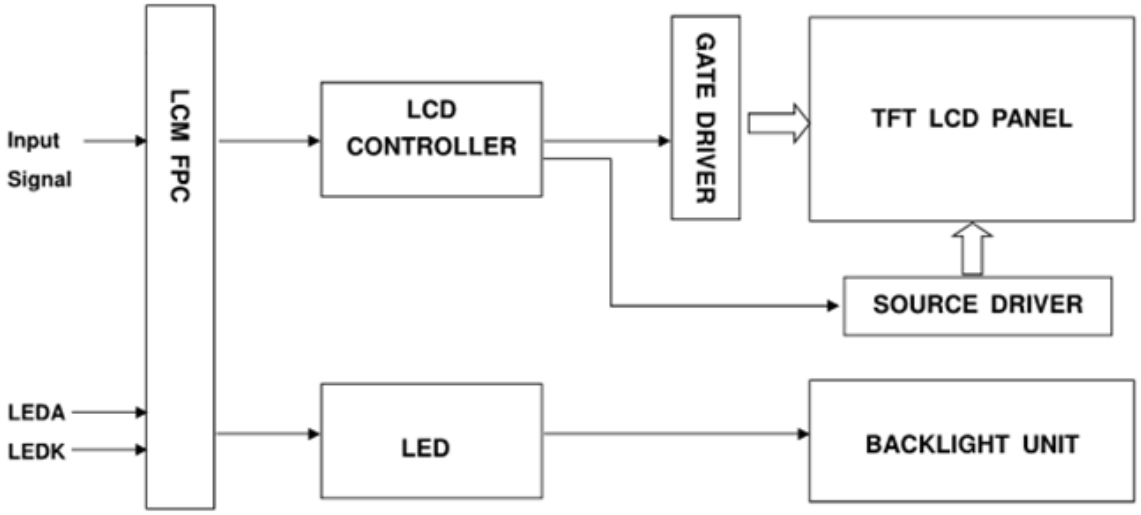
3.2.1 DC Electrical Characteristics

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Digital Supply Voltage	VCC	-	3.0	3.3	3.6	V	-
Normal Mode Current	ICC	-	-	120	170	mA	-
Level Input Voltage	V_{IH}	-	0.7*VCC	-	VCC	V	-
	V_{IL}	-	0	-	0.3*VDD	V	-
Level Output Voltage	V_{OH}	-	0.8*VCC	-	VCC	V	-
	V_{OL}	-	0	-	0.2*VCC	V	-

3.3 Interface Pin Assignment

No.	Symbol	I/O	Function
1	GND	P	Ground
2	DCLK	I	Input clock signal. Latch data at DCLK falling edge. (Default)
3	HSYNC	I	Horizontal sync input in digital RGB and CCIR601 mode.(Short to GND if not used)
4	VSYNC	I	Vertical sync input in digital RGB and CCIR601 mode.(Short to GND if not used)
5	GND	P	Ground
6-11	R0-R5	I	Red data input
12	GND	P	Ground
13-18	G0-G5	I	Green data input
19	GND	P	Ground
20-25	B0-B5	I	Blue data input
26	GND	P	Ground
27	DEN	I	Data Enable
28	VCC	P	Power supply for LCD
29	VCC	P	Power supply for LCD
30	L/R	I	The shift direction of device internal shift register is controlled by this pin as shown below: LR=H: STH→SO1→• • •→SO960→STHO LR=L: STH→SO960→• • •→SO1→STHO
31	U/D	I	Up/down scan setting. When UD=H, reverse scan. When UD=L, normal scan.
32	VCC	P	Power supply for LCD
33	LED-	P	LED Cathode
34-36	NC	-	-
37	LED+	P	LED Anode
38-40	NC	-	-

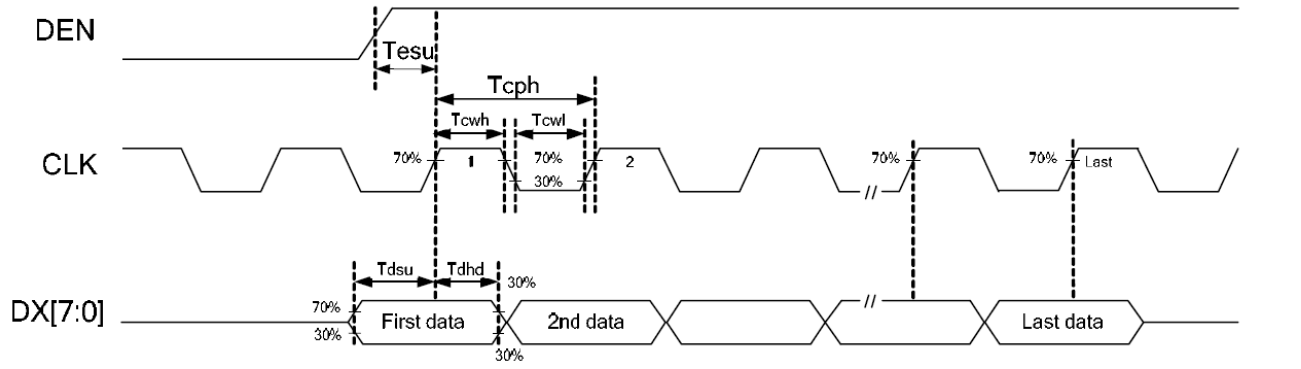
3.4 Block Diagram

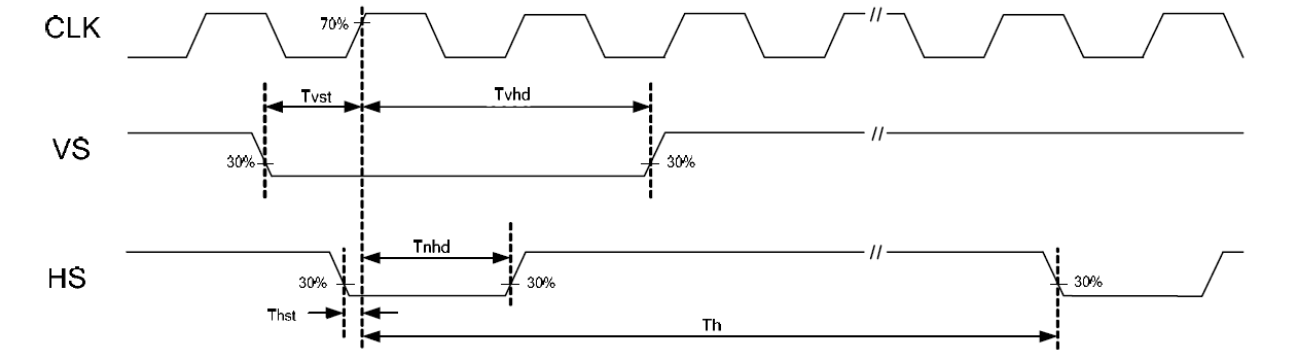


3.5 AC Timing Characteristics

3.5.1 Input Clock and Data Timing

Item	Symbol	Condition	Min	Typ.	Max	Unit
HSD Setup Time	Thst	-	10	-	-	ns
HSD Hold Time	Thhd	-	10	-	-	ns
VSD Setup Time	Tcst	-	10	-	-	ns
VSD Hold Time	Tchd	-	10	-	-	ns
Data Setup Time	Tdsu	D0[5:0], D1[5:0], D2[5:0] to DCLK	10	-	-	ns
Data Hold Time	Tdhd	D0[5:0], D1[5:0], D2[5:0] to DCLK	10	-	-	ns
RSTB Low Pulse Width	TRst	-	10	-	-	us
DCLK Cycle Time	Tcph	-	-	39.7	-	ns
DCLK Pulse Duty	Tcwh	-	40	50	60	%
DEN Setup Time	Tesu	-	10	-	-	ns



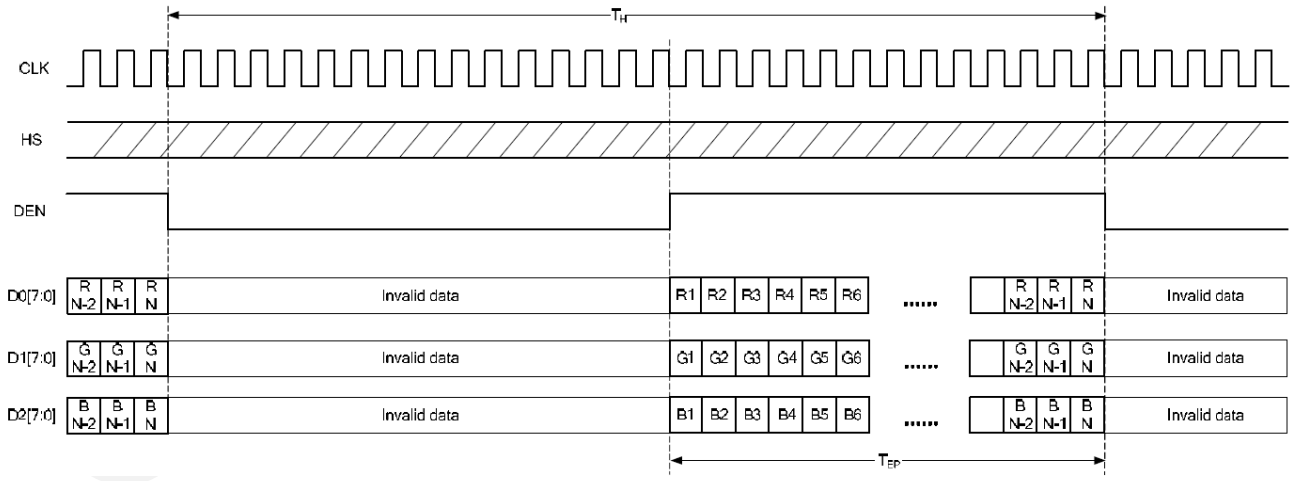


3.5.2 Input Timing

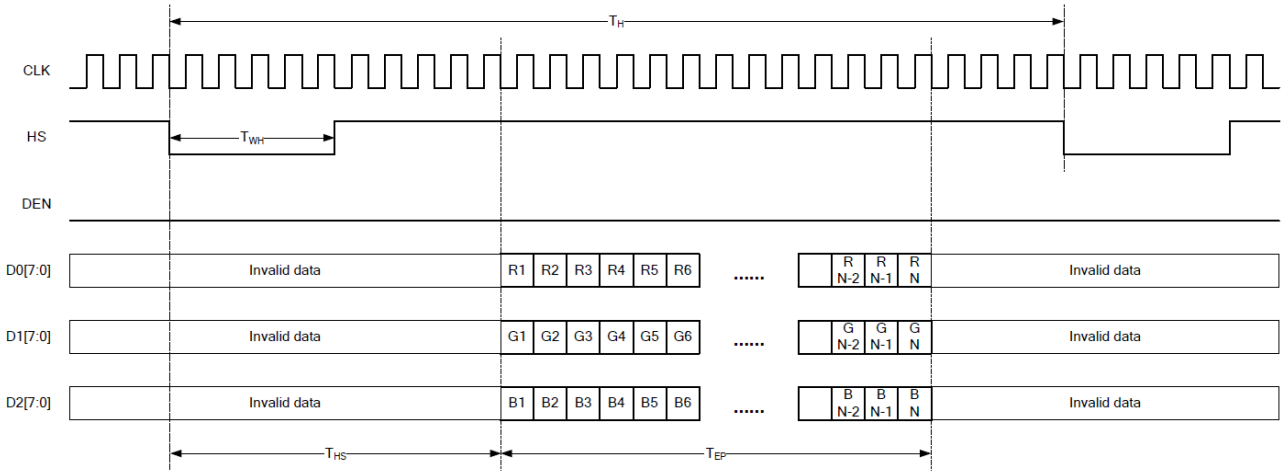
Item	Symbol	Min	Typ.	Max	Unit	Note
CLK frequency	F_{CPH}	-	25.175	-	MHz	-
CLK period	T_{CPH}	-	39.7	-	ns	-
CLK pulse duty	T_{CWH}	40	50	60	%	-
HS period	T_H	-	800	-	T_{CPH}	-
HS Effective time	T_{HA}		640		T_{CPH}	
HS pulse width	T_{WH}	5	30		T_{CPH}	-
HS-first horizontal data time	T_{HS}	112	144	175	T_{CPH}	-
DEN pulse width	T_{EP}	-	640	-	T_{CPH}	-
VS pulse width	T_{WV}	1	3	5	T_H	-
VS-DEN time	T_{STV}	-	35	-	T_H	-
VS period	T_V	-	525	-	T_H	-
VS Effective time	T_{VA}		480		T_H	-

Note: When SYNC mode is used, 1st data start from 144th CLK after HS falling.

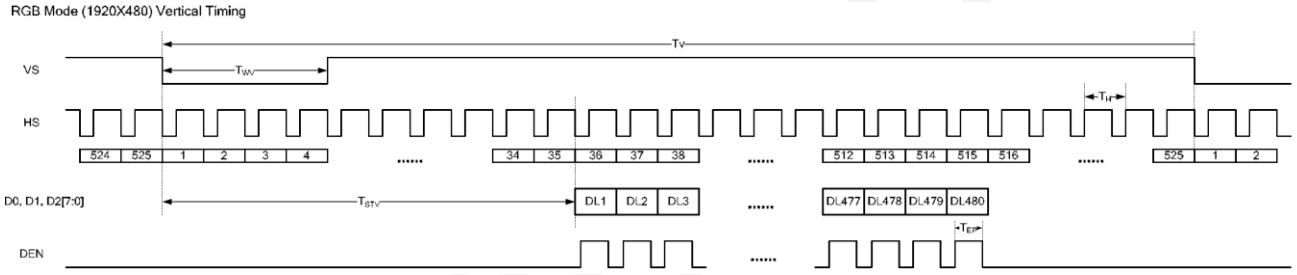
RGB DE Mode Horizontal Data Format



RGB SYNC Mode Horizontal Data Format



RGB Mode Vertical Data Format



3.6 Power ON/OFF Sequence

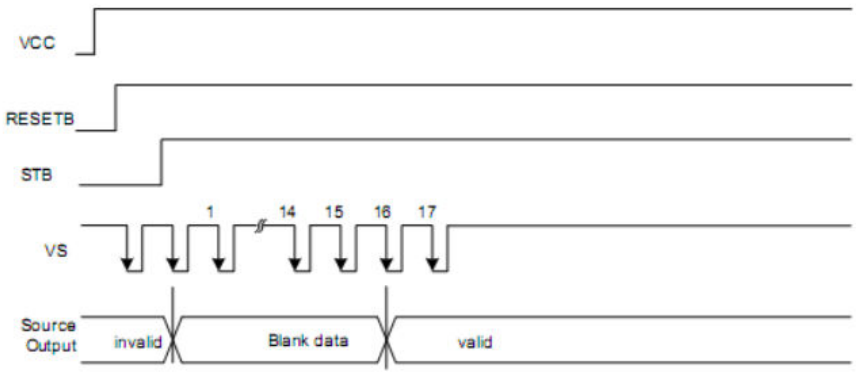
To prevent the device damage from latch up, the power ON/OFF sequence shown below must be followed.

Power ON: VCC, GND VDD, VSS

Power OFF: VDD, VSS VCC, GND

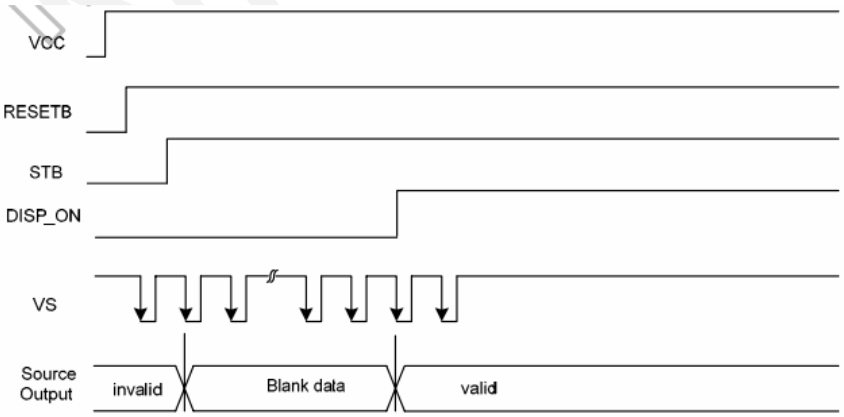
HX8250-A01 has a power ON sequence control function. There are two kinds of the mode. One is auto mode, and another is manual mode.

Auto Mode: When power is ON, blank data is outputted for 16-frames (default value) first, from the falling edge of the following VS signal. The blank data would be gray level 255 for normally white panel. It can be defined in register R5 A_TIME1(bit 5) and A_TIME0(bit 4) when AUTO_DP (bit 7) =”H”



Power on control for Auto Mode

Manual Mode: When power is ON, you should set the register R5 AUTO_DP (bit 7) =”L” to stay at the manual mode. Blank data is outputted until the DISP_ON (bit 6) = H then display the normal image.



Power on control for Manual Mode

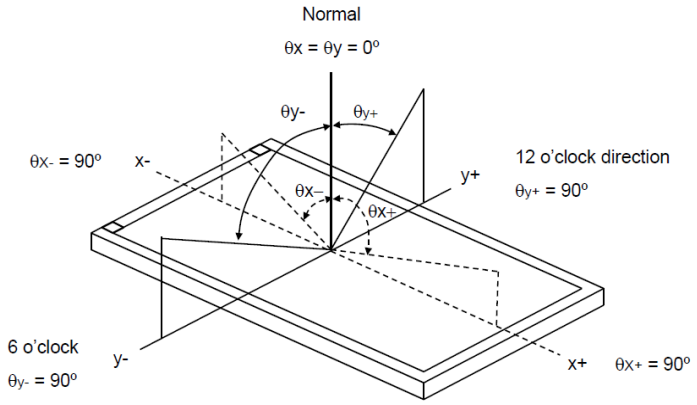
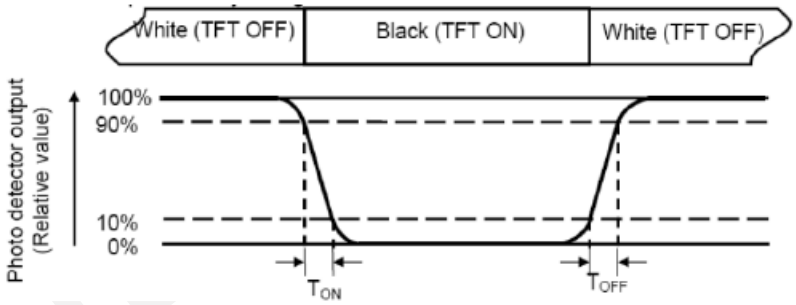
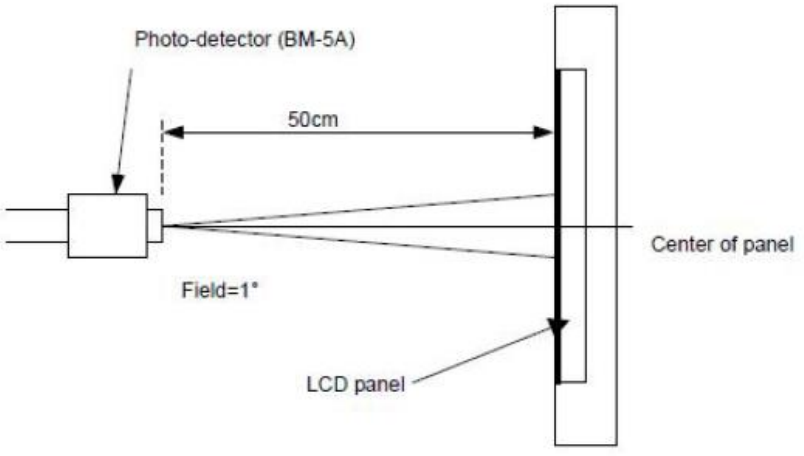
4. Optical Specification

4.1 Optical Characteristics

Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	θ = 0° Normal viewing angle	200	300	-	-	1, 2
Response time		TR + TF		-	20	30	msec	1, 3
Viewing Angle	Left	θ_x-	CR>10	-	70		-	1, 4
	Right	θ_x+		-	70			
	Up	θ_Y+		-	70	-		
	Down	θ_Y-		-	70	-		
Colour Chromatici	White	Rx	θ = 0° Normal viewing angle	0.272	0.322	0.372	-	1, 4
		Ry		0.296	0.346	0.396		
Luminance		Lv	I_F = 60mA	500	800	-	cd/m^2	4

Note: Measuring Condition

1. If=60mA(Backlight current), VCC = 3.3 V, the ambient temperature is 25°C. for 15min, warm-up time.

Note	Item	Test method
1	Definition of Viewing Angle (θx, θy)	
2	Definition of Contrast Ratio (CR)	Measured at the center point of panel Contrast ratio (CR) = Luminance measured when LCD is at "white state" / Luminance measured when LCD is at "black state"
3	Definition of Response Time (T_R, T_F)	
4	Definition of Optical Measurement Setup	

5. LED Backlight Specification

5.1 LED Backlight Characteristics

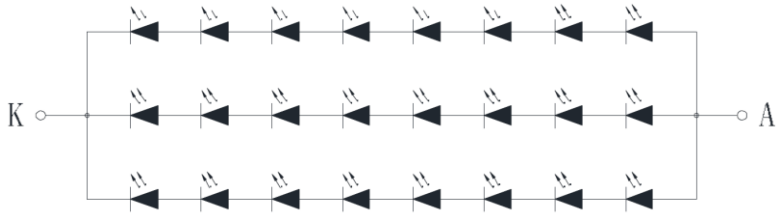
The back-light system is edge-lighting type with 24 chips LED.

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Current	I_F	-	-	60	-	mA	-
Forward Voltage	V_F	-	21.6	24	25.6	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: Ta=25±3℃, 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 Ta=25℃ and IL=60mA. The LED lifetime could be decreased if operating IL is larger than 60mA. The constant current driving method is suggested.

5.2 INTERNAL CIRCUIT DIAGRAM



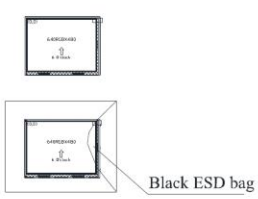
6. Packaging

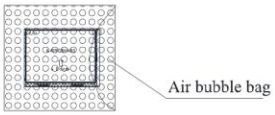
Packing Process:

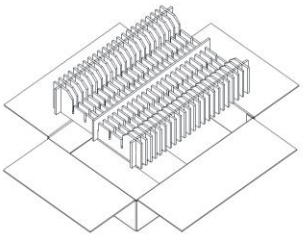
1) Putting one module into each black ESD bag.

2) Putting the modules with black ESD bag into one air bubble bag.

3) Putting 44 pcs Modules into the inner box .

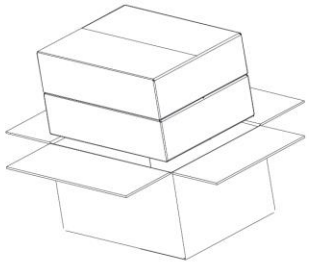


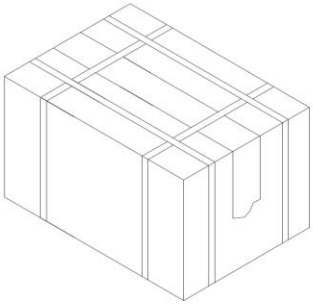




4)After filling, putting the two inner bowes into the out carton.

5) Packing finished





Note: 88 pcs/Outcarton

Dimension (Out carton):595*439*320mm

7. Quality Assurance Specification

7.1 Conformity

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

7.2 Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature:	25 ± 5°C
Humidity:	65% ± 5% RH
Illumination:	under 40W fluorescent light
Viewing distance:	35 ± 5cm

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

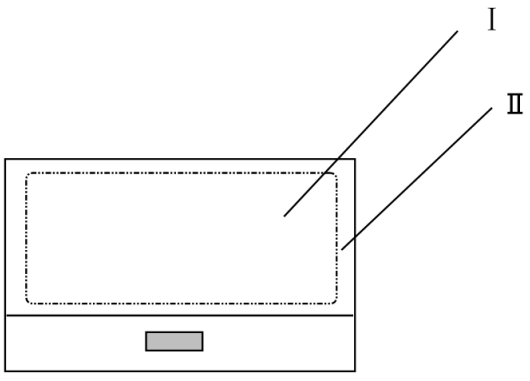
Inspection table or jig must be anti-electrostatic.

7.3 Delivery Assurance

7.3.1 Delivery Inspection Standards

Inspection Level II, GB2828-87

7.3.2 Packing Inspection



Ⅰ area: viewing area

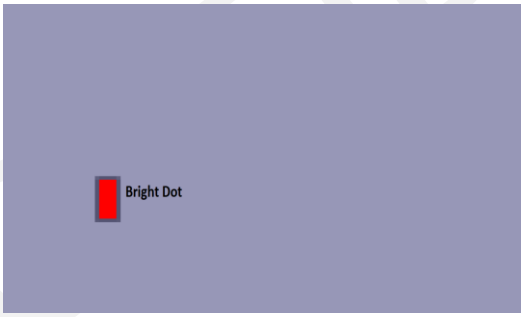
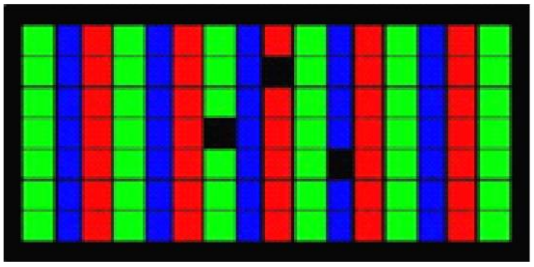
Ⅱ area: outside viewing area

7.3.3 Criteria & Acceptable Quality Level

Partition	AQL	Definition
Major	0.25	1. Liquid crystal leakage 2. Wrong polarizer 3. Outside dimension 4. Bright dot、dark dot 5. Display abnormal 6. Class crack
Minor	1.0	1. Spot defect (including black spot, white spot, pinhole, foreign particle, bubbles, hurt) 2. Fragment 3. Line defect (including black line, white line, scratch) 4. Incision defect 5. Newton's ring 6. Other visual defects

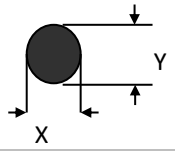
7.3.4 Criteria & Classification

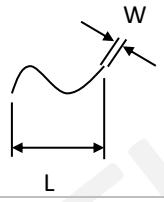
Bright/Dark Dots explain

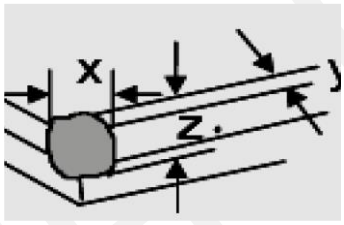
Item	Description	Definition
Bright Dot	Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. 	The definition of dot: The size of a defective dot over 1/2 of single pixel dot is regarded as one defective dot. **Note:** One pixel consists of 3 sub-pixels, including R, G, and B dot. (Sub-pixel = Dot)
Dark Dot	Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern. 	
Adjacent Dot	Adjacent two sub-pixel are defect (define two dot defect)	

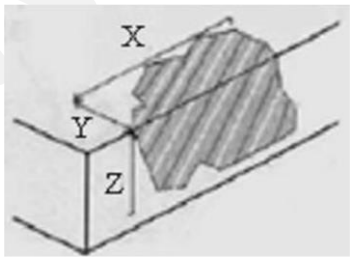
Inspection standard

Units: mm

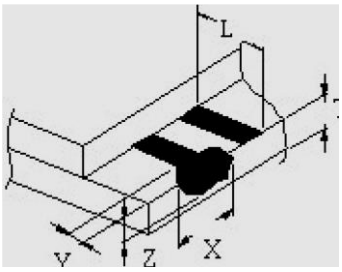
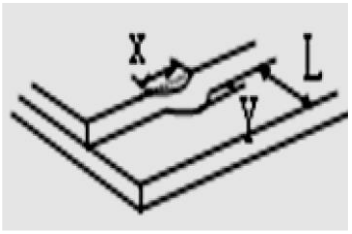
Class	Item	Criteria	
Major	Bright / Dark Dot	1) LCD≦4.3”	
		Bright Dot: N≦2 Dark Dot: N≦3 Total: N≦4	
		2) 4.3"＜LCD＜7"	
		Bright Dot: N≦3 Dark Dot: N≦4 Total: N≦6	
		3) 7"≤LCD≤ 12"	
		Bright Dot: N≦4 Dark Dot: N≦5 Total: N≦8	
		4) LCD > 12”	
		Bright Dot: N≤5 Dark dot: N≤6 Total: N≤10	
		The distance between the two defect dots shall be greater than 5mm The distance between two defect dots above 7 inches shall be more than 10mm	
		Note: Adjacent dot defect N≦0	
Minor	Spot Defects (black and white spot, pinhole, foreign matter, dent, backlight foreign matter)	Round type: as per following drawing, ∅ = (X+Y)/2 	
		1) LCD≦4.3”	
		Φ≤0.15	Ignore
		0.15<Φ≤0.30	N≦3
		0.3<∅	N=0
		2) 4.3"＜LCD ＜7"	
		∅≤0.2	Ignore
		0.2<∅≤0.5	N≦4
		0.5<∅	N=0
		3) 7"≤LCD≤ 12"	
		∅≤0.2	Ignore

Class	Item	Criteria		
		0.2<∅≤0.5	N≦5	
		0.5<∅	N=0	
		4) LCD > 12”		
		∅≤0.2	Ignore	
		0.2<∅≤0.5	N≦6	
		0.5<∅	N=0	
Minor	Line Defects (black and white line, backlight foreign matter etc.)	Line type: as per following drawing 		
		1) LCD≦4.3”		
		W≤0.03	Ignore	
		0.03<W≤0.06	L ≤ 5	N ≤ 3
		0.06<W	L > 5	N = 0
		2) 4.3"＜LCD ＜7"		
		W≤0.03	Ignore	
		0.03<W≤0.1	L ≤ 5	N ≤ 4
		0.1<W	L > 5	N = 0
		1) 7"≤LCD≤ 12"		
		W≤0.03	Ignore	
		0.03<W≤0.1	L ≤ 5	N ≤ 5
		0.1<W	L > 5	N = 0
		2) LCD > 12”		
		W≤0.03	Ignore	
		0.03<W≤0.1	L ≤ 5	N ≤ 6
		0.1<W	L > 5	N = 0
Minor	Scratch	1) LCD≦4.3”		
		W≤0.03	Ignore	
		0.03<W≤0.2	1.0< L ≤ 5.0	N ≤ 3
		0.2<W	L > 5	N = 0
		2) 4.3"＜LCD ＜7"		
		W≤0.03	Ignore	
		0.03<W≤0.2	1.0 < L ≤ 5.0	N ≤ 4
		0.2<W	L > 5	N = 0

<table>
<tr><th>Class</th><th>Item</th><th colspan="3">Criteria</th></tr>
<tr><td rowspan="8"></td><td rowspan="8"></td><td colspan="3">3) 7"≤LCD≤ 12"</td></tr>
<tr><td>W≤0.03</td><td colspan="2">ignore</td></tr>
<tr><td>0.03<W≤0.2</td><td>1.0＜L ≤ 5.0</td><td>N≤ 5</td></tr>
<tr><td>0.2<W</td><td>L > 5</td><td>N = 0</td></tr>
<tr><td colspan="3">4) LCD > 12”</td></tr>
<tr><td>W≤0.03</td><td colspan="2">Ignore</td></tr>
<tr><td>0.03<W≤0.2</td><td>1.0＜L ≤ 5.0</td><td>N≤6</td></tr>
<tr><td>0.2<W</td><td>L > 5</td><td>N = 0</td></tr>
<tr><td>Major</td><td>Display Abnormal</td><td colspan="3">Not allowed</td></tr>
<tr><td>Major</td><td>Outside Dimension</td><td colspan="3">Accord with drawing</td></tr>
<tr><td>Major</td><td>Glass Crack</td><td colspan="3">Not allowed</td></tr>
<tr><td>Major</td><td>Leak</td><td colspan="3">Not allowed</td></tr>
<tr><td>Minor</td><td>Corner Fragment</td><td colspan="3"> 

X≤3; Y≤3; Z≤T => Ignore
Note 1: No hurt identifying, wire, seal
Note 2: T: Glass thickness; X: Length; Y: Width; Z: thickness</td></tr>
<tr><td>Minor</td><td>Side Fragment</td><td colspan="3"> 

Y≤1; Z≤T => Ignore
Note 1: No hurt identifying, wire, seal
Note 2: T: Glass thickness; X: Length; Y: Width; Z: thickness</td></tr>
</table>

Class	Item	Criteria
Minor	Step Fragment	 Y≤1 and Y≤1/4 L
Minor	Incision Defect	 Y≤1 and accord with outside dimension

7.4 Dealing with Customer Complaints

7.4.1 Non-conforming Analysis

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

After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.
If the analysis cannot be completed on time, Densitron must inform the purchaser.

7.4.2 Handling of Non-conforming Displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.
Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.
Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

8. Reliability Specification

8.1 Reliability Tests

Test Item	Test Condition	Evaluation and assessment
High Temperature Storage	80±2℃/240 hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.Missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value.
Low Temperature Storage	-30±2℃/240 hours	
High Temperature Operating	70±2℃/240 hours	
Low Temperature Operating	-20±2℃/240 hours	
Temperature Cycle	-30℃~ 25℃~ 80℃ × 10cycles (30min.) (5min.) (30min.)	
Damp Proof Test	40℃±5℃×90%RH/240 hours	
Vibration Test	Frequency：10Hz~55Hz~10Hz Amplitude：1.5mm, X，Y，Z direction for total 3hours (Packing condition)	
Dropping test	Drop to the ground from 1m height, one time,every side of carton. (Packing condition)	
ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	
	Voltage:±6KV R: 330Ω C: 150pF Contact discharge, 10time	

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 judge as a good part.

Note 5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

Note 6. Please use automatic switch menu (or roll menu) testing mode when test operating mode.

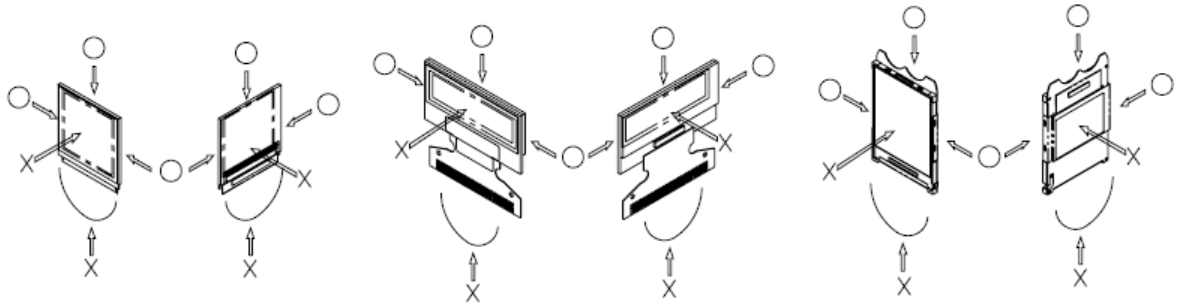
8.1.1 Inspection Check Standard

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.

9. Handling Precautions

9.1 Handling Precautions

1) Since the display panel is being made of glass, do not apply mechanical impacts such as dropping from a high position.
2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
3) If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water
4) If pressure is applied to the display surface or its neighbourhood of the display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
5) The polarizer covering the surface of the display module is soft and easily scratched. Please be careful when handling the display module.
6) When the surface of the polarizer of the display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
   a. Scotch Mending Tape No. 810 or an equivalent
   b. Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
   c. Also, pay attention that the following liquid and solvent may spoil the polarizer:
      - Water
      - Ketone
      - Aromatic Solvents
7) Hold the display module very carefully when placing it into the system housing. Do not apply excessive stress or pressure to display module. And, do not over bend the film with electrode pattern layouts. These stresses will



influence the display performance. Also, secure sufficient rigidity for the outer cases.
8) Do not apply stress to the LSI chips and the surrounding molded sections.
9) Do not disassemble nor modify the display module.
10) Do not apply input signals while the logic power is off.
11) Pay sufficient attention to the working environments when 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.

9.2 Storage Precautions

1) When storing display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps, etc. and, also, avoiding high temperature and high humidity environments or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Densitron) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
2) If electric current is applied when water drops are adhering to the surface of the display module, when the display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

9.3 Designing Precautions

1) The absolute maximum ratings are the ratings which cannot be exceeded for display module, and if these values are exceeded, panel damage may be happen.
2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.
3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighbouring devices.
5) As for EMI, take necessary measures on the equipment side basically.
6) When fastening the display module, fasten the external plastic housing section.
7) If power supply to the display module is forcibly shut down by such errors as taking out the main battery while the display panel is in operation, we cannot guarantee the quality of this display module.

9.4 Operation Precautions

1) It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.
2) Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.
3) Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged.
4) To protect display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the display modules.
   a. Pins and electrodes
   b. Pattern layouts such as the FPC
5) When the driver is being exposed (COG), semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if the driver is exposed to light, malfunctioning may occur.
   a. Design the product and installation method so that the driver may be shielded from light in actual usage.
   b. Design the product and installation method so that the driver may be shielded from light during the inspection processes.
6) Although the display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
7) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

9.5 Other Precautions

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