DMT035QVNTRS0-3B PRODUCT SPECIFICATION

Version 1.1
Dec 12, 2022

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

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Approved by *Evan Huang*

Revision History

VERSION	DATE	DESCRIPTION	AUTHOR
1.0	Dec 08, 2022	Initial Release	Victoria Ho
1.1	Dec 12, 2022	Page.7 correct the typo Page.15 correct the typo Page.31 Revised the Dealing with Customer Complaints Page.32 Revised the note	Victoria Ho

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 black mode, transmissive, and featuring high contrast and excellent colour saturation. The resolution of the TFT-LCD is 240 x 320 and can display up to 262K colours. The display module supports 3 SPI + 16/18-bit RGB interface and tape bonding 4-wire resistive touch panel.

1.2 Main Features

Item	Contents
Display Type	TFT LCD
Screen Size	3.5" Diagonal
Display Format	240 x RGB x 320 Dots
No. of Colour	65K / 262K
Overall Dimensions	63.0 (W) x 85.0 (H) x 5.6 (D) mm
Active Area	53.28 (W) x 71.04 (H) mm
Mode	Normally Black / Transmissive /IPS
Surface Treatment	Anti-glare (3H)
Viewing Direction	All round
Interface	3 SPI + 16/18-bit RGB
Driver IC	HX8347A
Backlight Type	LED, White, 10 chips
Touch Panel	Resistive Touch Panel
Touch Interface	4 Wire
Bonding Type	Tape Bonding
Operating Temperature	-30°C ~ +85°C
Storage Temperature	-40°C ~ +90°C
ROHS	Compliant to RoHS 2.0

2. Mechanical Specification

2.1 Mechanical Characteristics

Item	Characteristic	Unit
Display Format	240 x RGB x 320	Dots
Overall Dimensions	63 (W) x 85 (H) x 5.6 (D)	mm
Active Area	53.28 (W) x 71.04 (H)	mm
Dot Pitch	0.222 (W) x 0.222 (H)	mm
Weight	56	g
IC Controller/Driver	HX8347A	

2.2 Mechanical Drawing

3. Electrical Specification

3.1 Absolute Maximum Ratings

Ta = 25°C, VSS = 0V

Item	Symbol	Min	Max	Unit	Note
Digital Supply Voltage	VCI	-0.3	4.0	V	1
Digital Interface Supply Voltage	IOVCC	-0.3	4.0	V	1
Operating Temperature	T_{OP}	-30	+85	°C	-
Storage Temperature	T_{ST}	-40	+90	°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	VCI	-	2.5	3.3	3.6	V	-
Digital Interface Supply Voltage	IOVCC	-	1.65	1.8	3.3	V	-
Normal Mode Current Consumption	IDD	-	-	9	30	mA	-
Level Input Voltage	V_{IH}	-	0.7*IOVCC	-	IOVCC	V	-
	V_{IL}	-	GND	-	0.3*IOVCC	V	-
Level Output Voltage	V_{OH}	-	0.8*IOVCC	-	IOVCC	V	-
	V_{OL}	-	GND	-	0.2*IOVCC	V	-

3.3   Interface Pin Assignment

3.3.1   LCM Pin

No.	Symbol	I/O	Function
1	LEDA	P	Anode pin of backlight
2	LEDC	P	Anode pin of backlight
3	NC	-	No connection
4	VCC	P	Supply voltage (3.3V)
5	GND	P	Ground
6	GND	P	Ground
7	RESX	I	System reset pin. S
8	CSX	I	Chip select signal
9	NC	-	No connection
10	WRX/SCL	I	Serial clock input pin
11	VD	I	Frame synchronizing signal for RGB interface operation.
12	HD	I	Line synchronizing signal for RGB interface operation.
13	DENA	I	Data enable signal for RGB interface operation.
14	DCLK	I	Dot clock signal for RGB interface operation
15	GND	P	Ground
16	SDA	I	Serial data input pin
17~22	B0~B5	I	
23~28	G0~G5	I	18-bit data bus for RGB interface.
29~34	R0~R5	I	
35	TE	I	Tearing effect output. If it's not used, please open this pin.
36	SDO	I	Serial data output. If it's not used, please open this pin.

No.	Symbol	I/O	Function
37	VCCIO	P	Digital IO pad power supply
38	GND	P	Ground.
39	ID1	-	No connection
40	ID0	-	No connection

3.3.2   RTP Pin

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 Left Glass Terminal
4	YU	A/D	Touch panel Top Film Terminal

3.4 Block Diagram
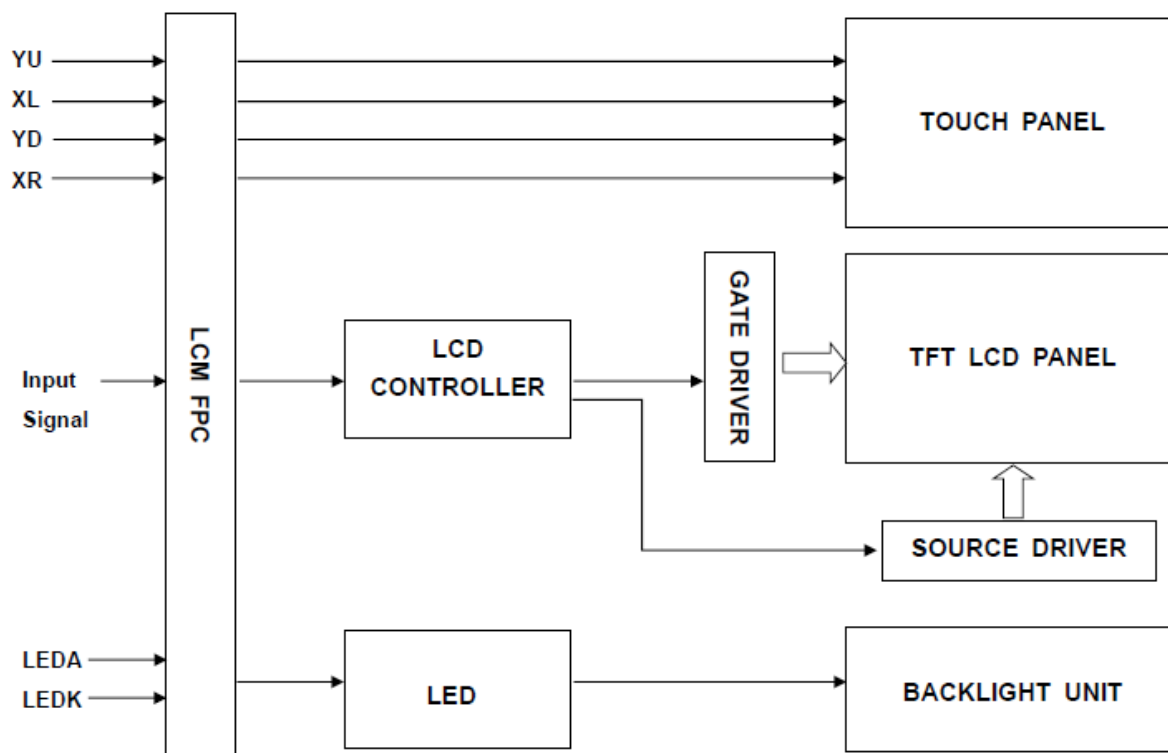
3.5　Timing Characteristics
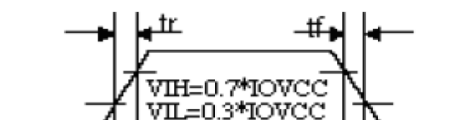
3.5.1　Display Serial Interface Timing Characteristics
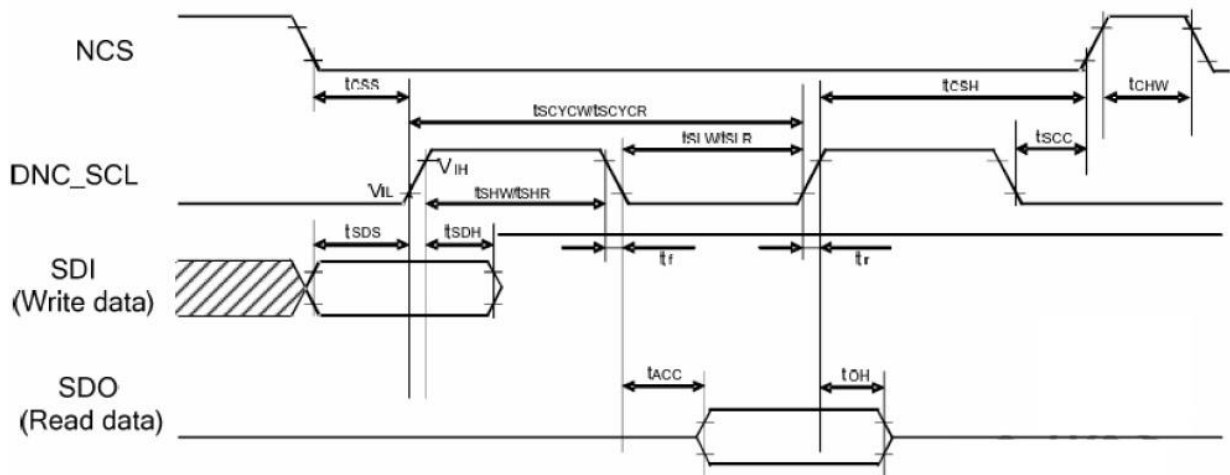
VSSA = 0V, IOVCC = 1.65V to 3.3V, VCI = 2.3V to 3.3V, Ta = -40 to 85℃

Item	Symbol	Conditions	Min	Typ.	Max	Unit
Serial Clock Cycle (Write)	t_{SCYCW}		100			
DNC_SCL "H" Pulse Width (Write)	t_{SHW}	DNC_SCL	35	-	-	ns
DNC_SCL "L" Pulse Width (Write)	t_{SLW}		35			
Data Setup Time (Write)	t_{SDS}	SDI	30	-	-	ns
Data Hold Time (Write)	t_{SDH}		30			
Serial Clock Cycle (Read)	t_{SCYCR}		150			
DNC_SCL "H" Pulse Width (Read)	t_{SHR}	DNC_SCL	60	-	-	ns
DNC_SCL "L" Pulse Width (Read)	t_{SLR}		100			
Access Time	t_{ACC}	SDO for maximum C_L = 30pF,	10	-	100	ns
Output Disable Time	t_{OH}	for minimum C_L = 8pF	15	-	100	ns
DNC_SCL to Chip Select	t_{SCC}	DNC_SCL, NCS	50	-	-	ns
NCS "H" Pulse Width	t_{CHW}	NCS	45	-		ns
Chip Select Setup Time	t_{CSS}	NCS	60	-	-	ns
Chip Select Hold Time	t_{CSH}		80			

Note: The input signal rise time and fall time (tr, tf) is specified at 15ns or less. Logic high and low levels are specified as 30% and 70% of IOVCC for input signals
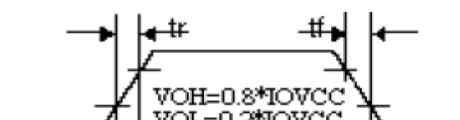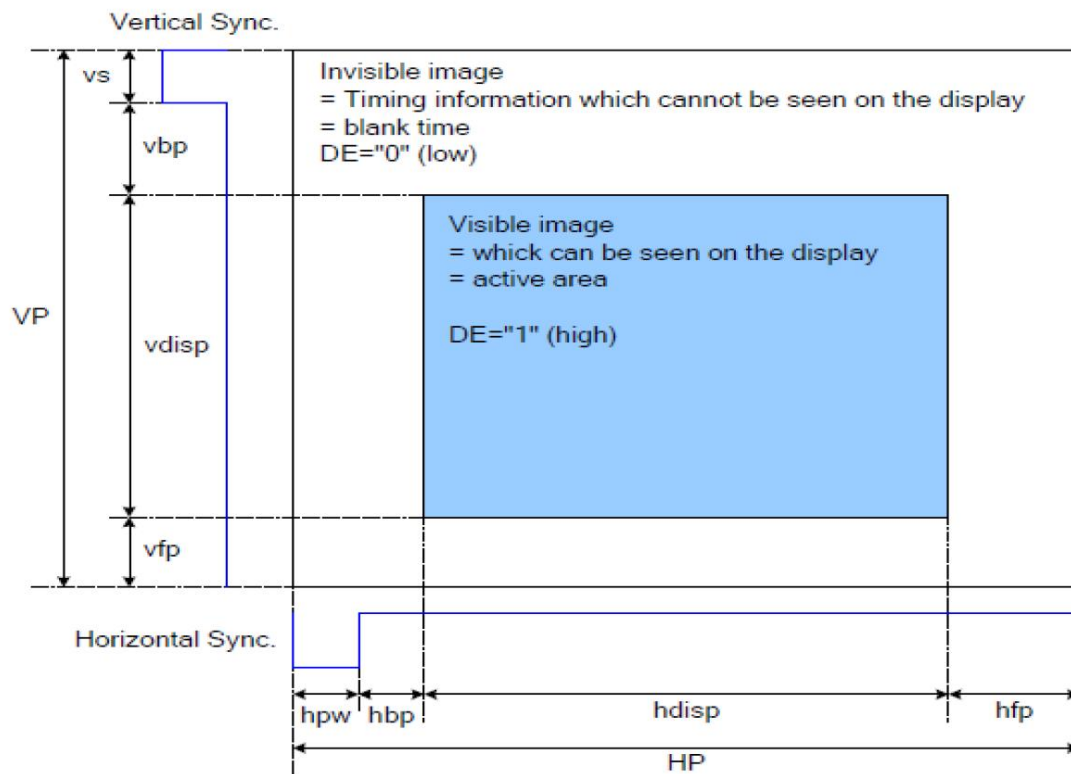
## 3.5.2 Parallel RGB Interface Timing Characteristics

The display operation via the RGB interface is synchronized with the VSYNC, HSYNC, and DOTCLK signals. The data can be written only within the specified area with low power consumption by using window address function. The back porch and front porch are used to set the RGB interface timing.

Please refer to the following table for the setting limitation of RGB interface signals.

Parameter	Symbol	Min.	Typ.	Max.	Unit
DCLK Frequency	FCLK	-	(6)	-	MHz
Horizontal Address	hdisp	-	240	-	Clock
Horizontal Sync. Width	hpw	1	4	-	Clock
Horizontal Sync. Back Porch	hbp	1	10	-	Clock
Horizontal Sync. Front Porch	hfp	1	20	-	Clock
Vertical Address	vdisp	-	320	-	Line
Vertical Sync. Width	vs	2	4	-	Line
Vertical Sync. Back Porch	vbp	2	10	-	Line
Vertical Sync. Front Porch	vfp	2	20	-	Line
Frame Rate	FR	-	60	-	Hz

3.5.3 Reset Input Timing
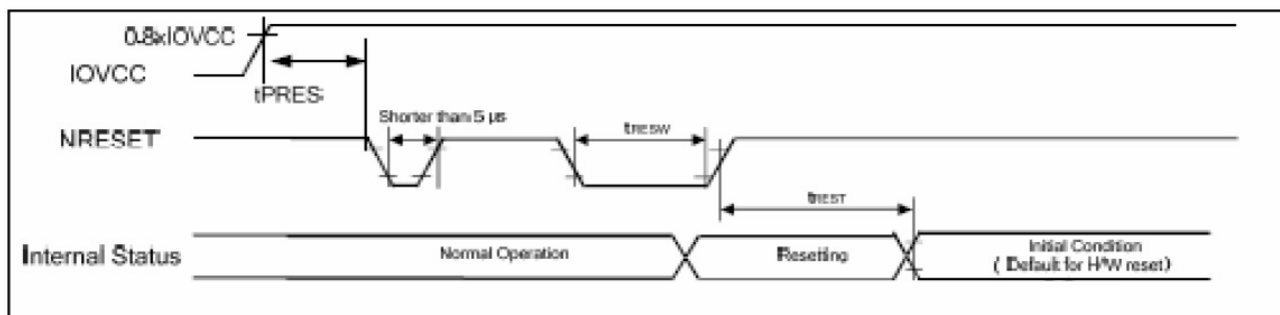
| Item	Symbol	Related Pins	Min	Typ.	Max	Unit	Note
Reset Low Pulse Width	tRESW	NRESET	10	-	-	μs	-
Reset Complete Time	tREST	-	-	-	5	ms	When reset applied during STB mode
		-	-	-	120	ms	
Reset goes high level after Power on time	tPRES	NRESET & IOVCC	1	-	-	ms	Rest goes high level after Power on

Note 1: Spike duo to an electrostatic discharge on NRESET line does not cause irregular system reset according to the table below.

NRESET Pulse	Action
Shorter than 5µs	Reset Rejected
Longer than 10µs	Reset
Between 5µs and 10µs	Reset starts

Note 2: During the Resetting period, the display will be blanked (The display enters the blanking sequence, which maximum time is 120ms, when Reset Starts in the STB Out mode. The display remains the blank state in STB mode.) and then return to Default condition for Hardware Reset.

Note 3: During Reset Complete Time, ID2 and VCOMOF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of NRESET.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:
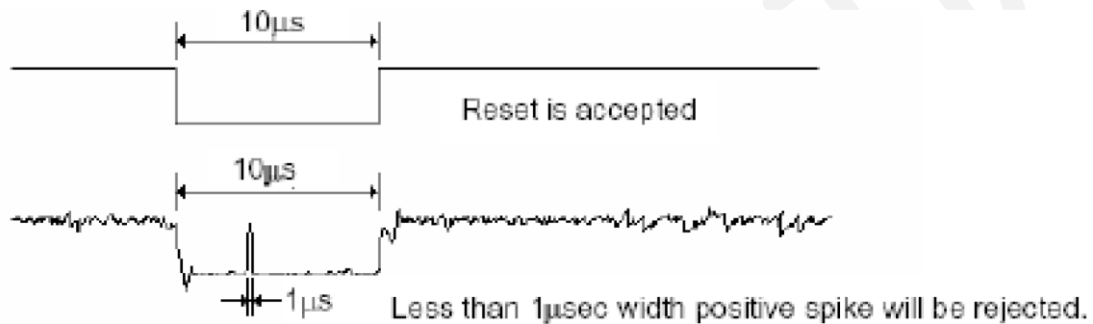
Note 5: It is necessary to wait 5msec after releasing NRESET before sending commands. Also, STB Out command cannot be sent for 120 msec.
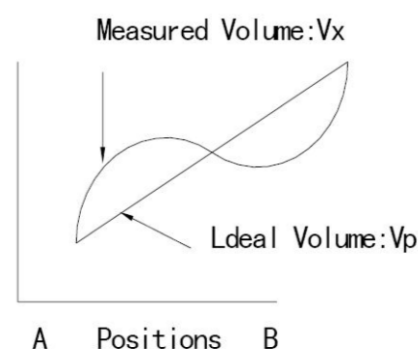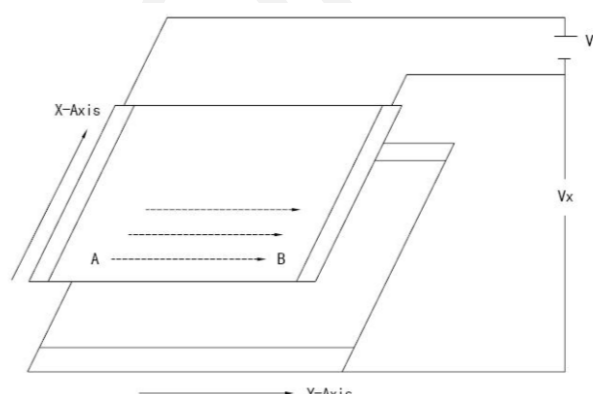
4. Electrical Specification Touch

4.1 Conditions of Use and Storage

Item	Value (Condition)	Note
Temperature Range Upon Operation	-40℃~85℃ (Humidity: 20%~90%, non-condensing)	In a simple substance
Temperature Range Upon Storage	-40℃~90℃ (Humidity: 20%~90%, non-condensing)	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 performing measurements
Chattering	10 msec or below	-
Rating	Voltage is DC 5V	-

4.3 Mechanical Property

Item	Performance		Note
Input Method	Use 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

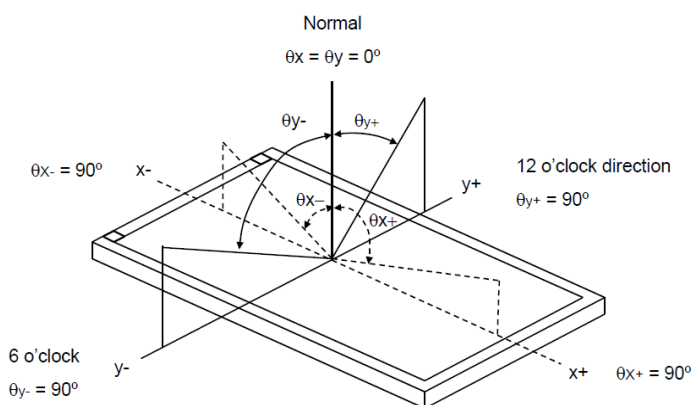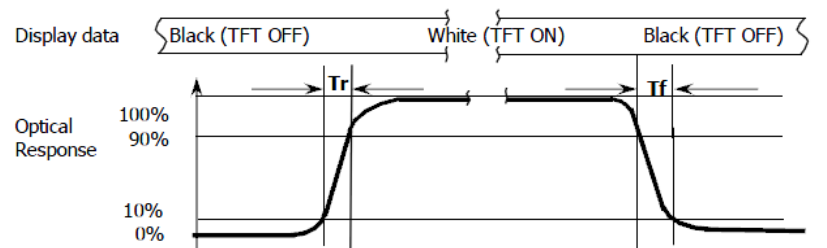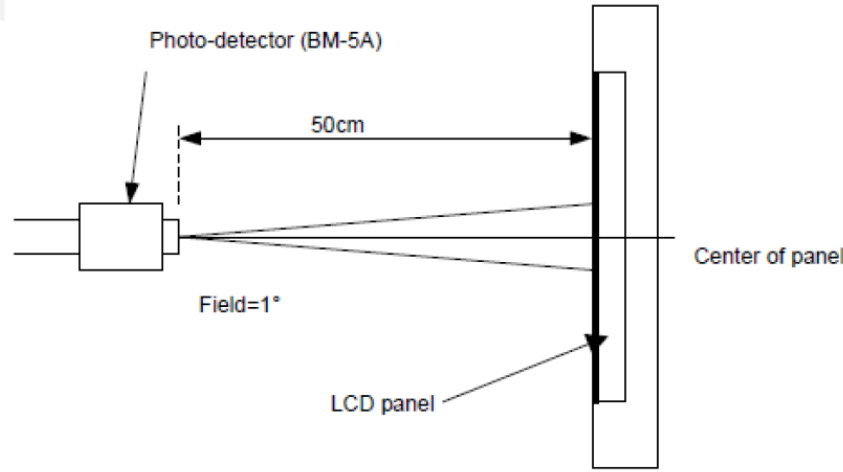| Item	Performance	Note
Total Light Transmittance	80% or above	JIS K7105
Haze	5% or below	JIS K7136
Film Specification	Polished type with hard coated surface	-

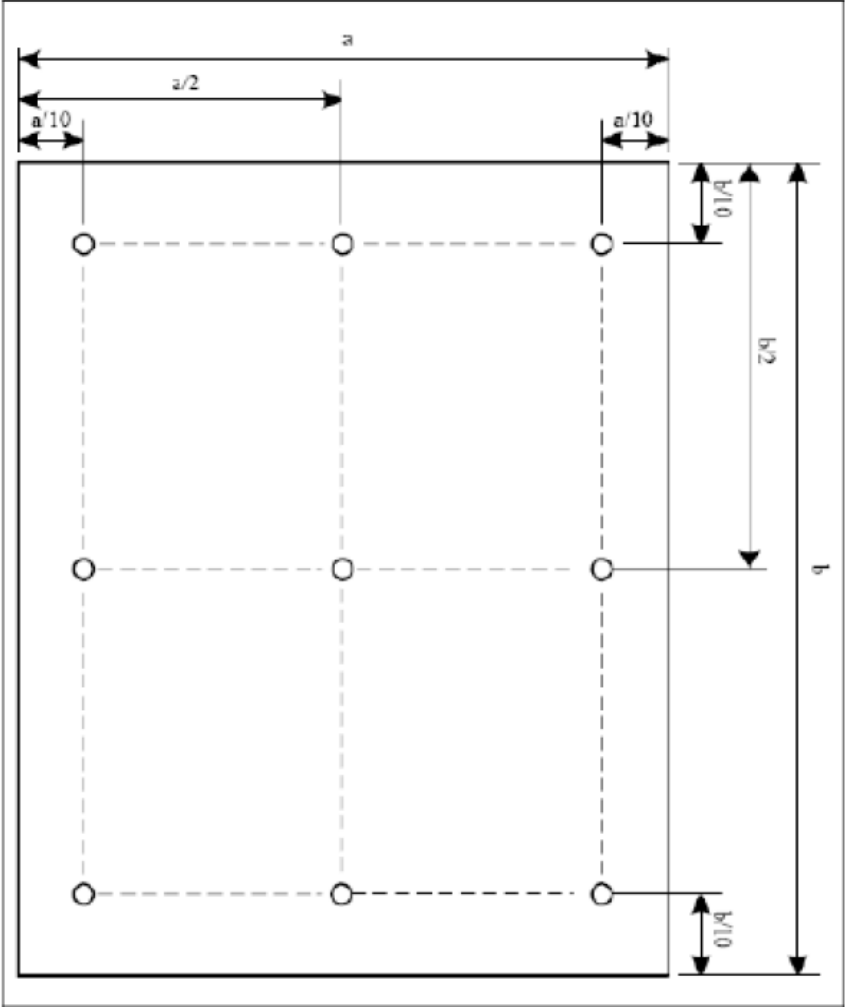# 5. Optical Specification

5.1 Optical Characteristics

Characteristics		Symbol	Conditions	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	$\theta = 0°$ Normal viewing angle	500	-	-	-	1, 2
Response time		$T_R + T_F$		-	35	45	msec	1, 3
Color Gamut		S		55	60	-	%	-
Viewing Angle	Left	θ_x-	CR>10	-	80	-	-	1, 4
	Right	θ_x+		-	80	-		
	Up	θ_Y+		-	80	-		
	Down	θ_Y-		-	80	-		
Colour Chromaticity	Red	Rx	$\theta = 0°$ Normal viewing angle	0.591	0.631	0.671	-	1, 4
		Ry		0.306	0.346	0.386		
	Green	Gx		0.315	0.355	0.395		
		Gy		0.354	0.394	0.434		
	Blue	Bx		0.107	0.147	0.187		
		By		0.009	0.049	0.089		
	White	Wx		0.273	0.313	0.353		
		Wy		0.298	0.338	0.378		
Luminance		Lv	$I_F = 40mA$	300	350	-	cd/m^2	5
Uniformity		Avg	-	-	80	-	%	5

*The data comes from the LCD specification.

**Measuring Condition = in dark room, at ambient temperature 25±2°C, for 15min. 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 (θx, θy)	
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 (T_R, T_F)	
4	Definition of Optical Measurement Setup	

Note	Item	Test method
5	Definition of Luminance & Uniformity	$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$ $$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points }(1-9)}{Maximum\ Luminance\ in\ 9\ points\ (1-9)}$$

6. LED Backlight Specification

6.1 LED Backlight Characteristics

The back-light system is edge-lighting type with 10 White LED chips.

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Forward Current	I_F	-	-	40	50	mA	-
Forward Voltage	V_F	-	14.0	16.0	17.0	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=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
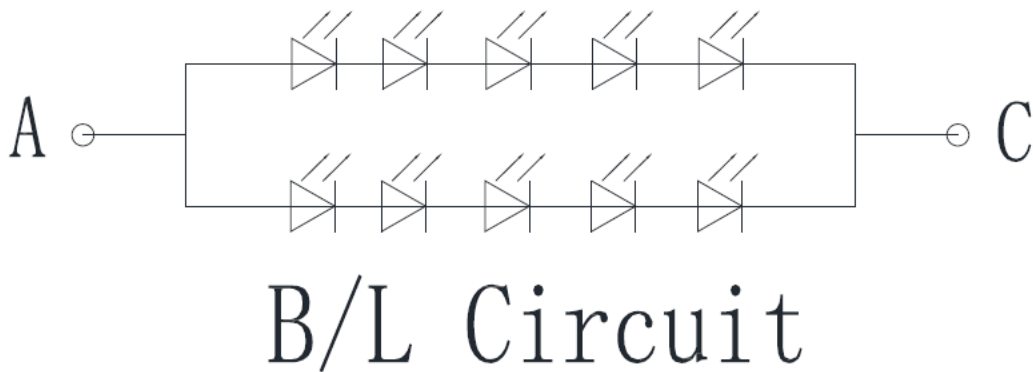
7. Packaging
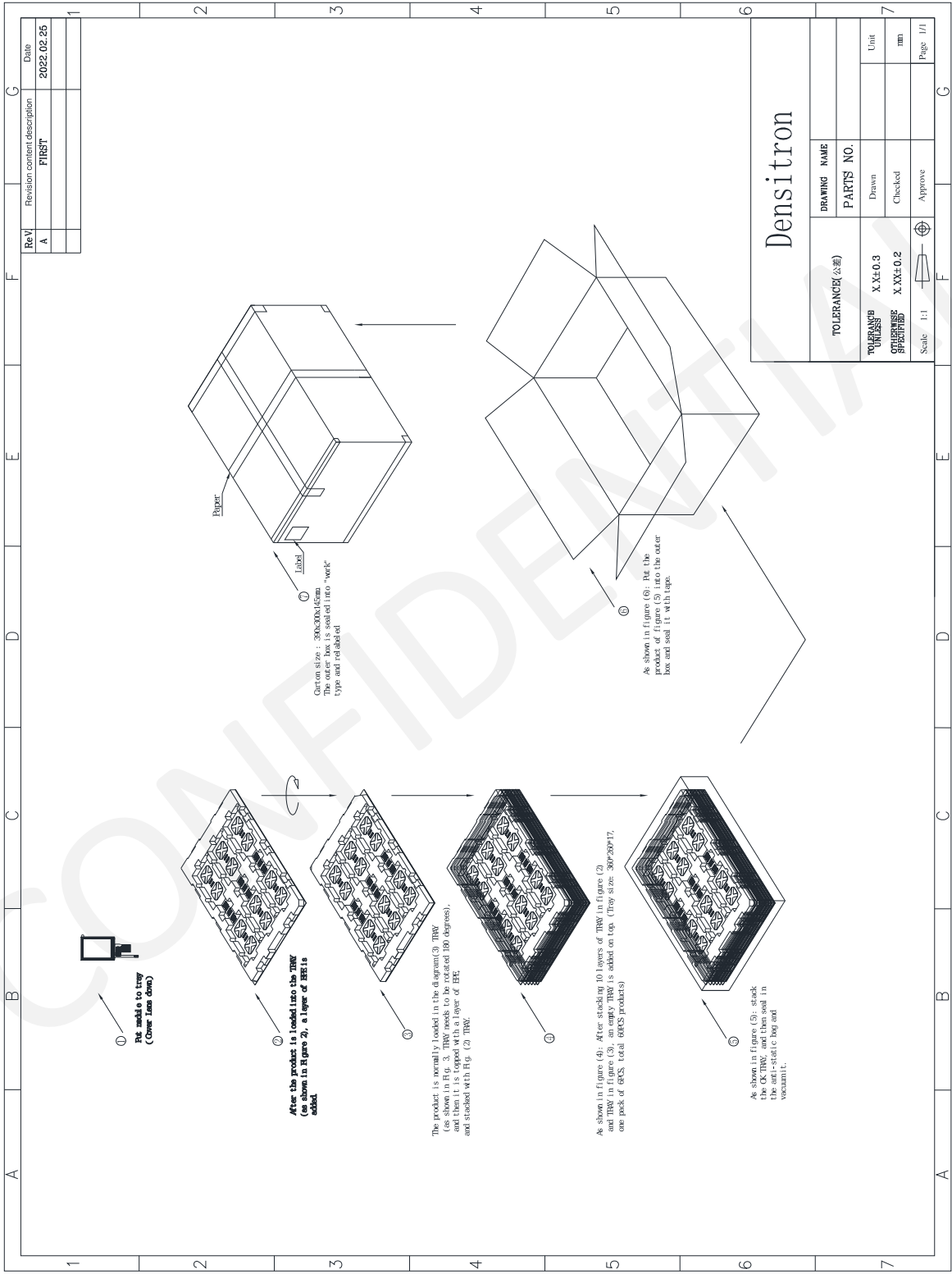
# 8. Quality Assurance Specification

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.
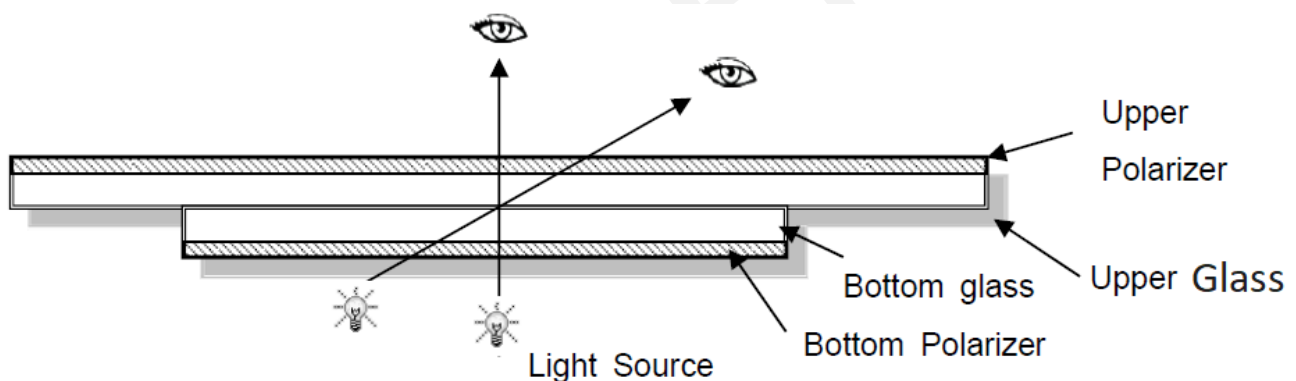
8.3 Delivery Assurance

8.3.1 Delivery Inspection Standards

Class II, Normal Inspection, GB/T 2828-2003

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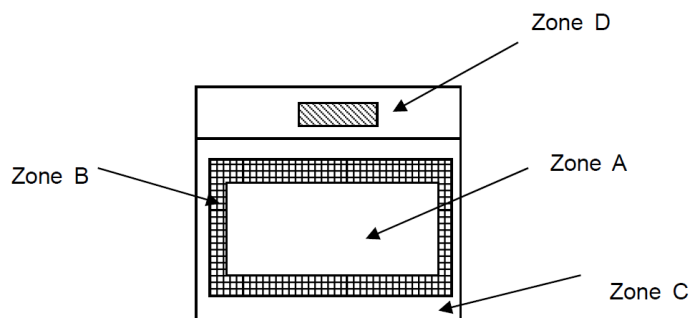
Zone A: Effective Viewing Area (Character or Digit can be seen)

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, RTP: Resistance Touch Panel, LCM: Liquid Crystal Module
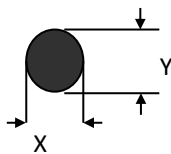
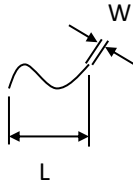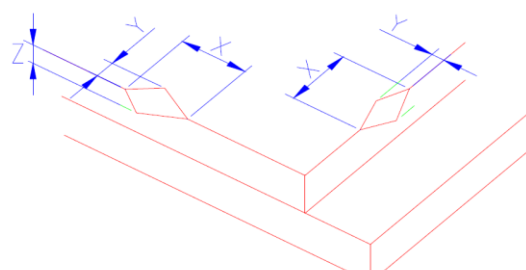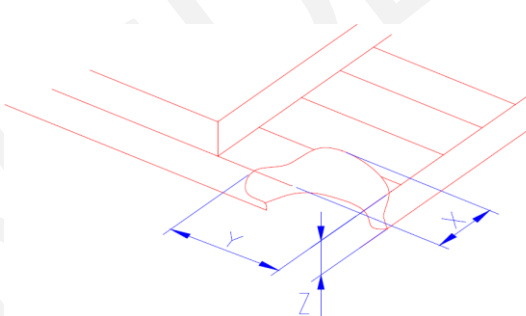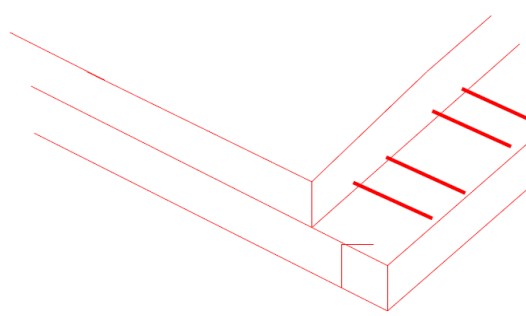| No.	Items	Criteria	Classification of defects
1	Functional defects	1) No display, open or missing line 2) Display abnormally, short circuit 3) Backlight no lighting, abnormal lighting	Major
2	Missing	Missing components	
3	Outline dimension	Overall outline dimension beyond the drawing or deformation is not allowed.	
4	Color tone	To judge color unevenness, please refer to limited sample.	Minor
5	Spot Line defect	Light dot, dim spot, polarizer air bubble, polarizer accidented spot, etc.	
6	Soldering Appearance	Good soldering. Peeling off is not allowed.	
7	LCD/Polarizer/RTP	Black/White spot/line, scratch, crack, etc.	
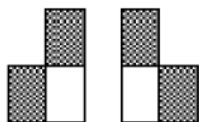
Note:

a) Light dot: Dots appearing bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Dim dot: Dots appearing dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.
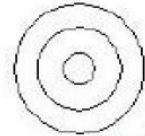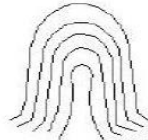
8.3.4 Criteria & Classification
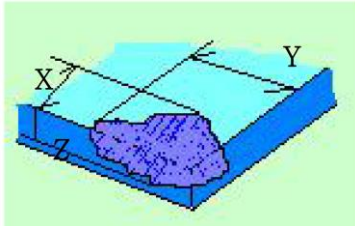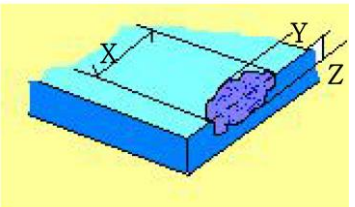
Units: mm

Class	Item	Criteria
Minor	Spot Defect	Round type: as per following drawing, $\varnothing = (X+Y)/2$ 1) Light Dot (black/white spot, pinhole, stain, etc.) **2) Dim Spot (light leakage, dent, dark spot, etc.)** **3) Polarizer Accidented Spot** **4) Polarizer Bubble**

1) Light Dot (black/white spot, pinhole, stain, etc.)

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.15$	Ignore		
$0.15 < \varnothing \leq 0.25$	3 (distance $\geq$ 6mm)	Ignore	
$0.25 < \varnothing \leq 0.4$	2 (distance $\geq$ 6mm)		
$0.4 < \varnothing$	0		

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

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.15$	Ignore		
$0.15 < \varnothing \leq 0.25$	3 (distance $\geq$ 6mm)	Ignore	
$0.25 < \varnothing \leq 0.4$	2 (distance $\geq$ 6mm)		
$0.4 < \varnothing$	0		

3) Polarizer Accidented Spot

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.2$	Ignore		
$0.2 < \varnothing \leq 0.5$	2 (distance $\geq$ 6mm)	Ignore	
$0.5 < \varnothing$	0		

4) Polarizer Bubble

Size\Zone	Acceptable Quantity		
	A	B	C
$\varnothing \leq 0.2$	Ignore		
$0.2 < \varnothing \leq 0.4$	3 (distance $\geq$ 6mm)	Ignore	
$0.4 < \varnothing$	0		

Class	Item	Criteria		
		Pixel Bad Points		
		Item	Zone A	Acceptable Q'ty
		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 dark and bright dots.	5mm
		Total quantity of bright and dark dots		N≤4

Note:

A) Bright dot: Dots appearing bright and unchanged in size in which LCD panel is displaying under black pattern.

B) Dark dot: Dots appearing dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

C) 2 dot adjacent = 1 pair = 2 dots

Picture:

2 dot adjacent   2 dot adjacent

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

Class	Item	Criteria		
Minor	Line Defect (LCD/ Polarizer backlight black/white line, scratch, stain)	Line type: as per following drawing (W, L)		

Class	Item	Criteria				
		Width	Length	Acceptable quantity		
				A	B	C
		W≤0.03	Ignore	Ignore		Ignore
		0.03<W≤0.04	L ≤ 3.0	N ≤ 2		
		0.04<W≤0.05	L ≤ 2.0	N ≤ 1		
		0.05<W	Define as spot defect			
Minor	LCD Crack/Broken	Symbols: X: Length, Y: Width, Z: Height, L: Length of ITO, T: Height of LCD 1) The edge of LCD broken: X≦3.0mm; Y<Inner border line of the seal; Z≦T 2) LCD corner broken: X≦3.0mm; Y≦L; Z≦T 				
Major	LCD Crack	The LCD with extensive crack is not acceptable. 				
Major	Electronic Components SMT	Missing parts, solderless connection, cold solder joint, mismatch, or the positive and negative polarity opposite is not allowed.				

Class	Item	Criteria
Minor	Display color & Brightness	1. Color: Measure the color coordinates according to the datasheet or samples. 2. Brightness: Measure the brightness of White Screen according to the datasheet or samples.
Minor	LCD Mura/Waving/ Hot Spot	Not visible through 5% ND filter in 50% gray or judged by limit sample if necessary.

Class	Item	Criteria			
Minor	RTP Related	1) RTP Film Bubble/Accidented Spot			

1) RTP Film Bubble/Accidented Spot

Size\Zone	Acceptable Qty		
	A	B	C
∅≤0.1	Ignore		Ignore
0.1<∅≤0.25	3（distance≧6mm）		
0.25<∅≤0.35	2（distance≧6mm）		
∅>0.35	0		

2) RTP Film Scratch

Width	Length	Acceptable Qty		
		A	B	C
Φ≤0.03	Ignore	Ignore		Ignore
0.03<W≤0.04	L≤3.0	N≤2		
0.04<W≤0.05	L≤2.0	N≤1		
0.05<W	Define as spot defect			

3) Assembly Deflection: beyond the edge of backlight ≤0.2mm

4) Bulge (Undulation Included)

It's ok if the ITO film plumped below 0.40mm.

<0.4mm

<table>
<tr><td></td><td></td><td>

5) Newton Ring:

Newton Ring area>1/3 TP area: NG

Newton Ring area≤1/3 TP area: OK

</td><td>

1. Regularity

2. Irregularity

3. Newton Ring

</td></tr>
</table>

| | | RTP corner broken X: length, Y: width, Z: height
X≤3mm; Y≤3mm; Z<Cover thickness
*Circuitry broken is not allowed. | |
| | | RTP edge broken X: length, Y: width, Z: height
X≤4mm; Y≤2mm; Z<Cover thickness
*Circuitry broken is not allowed. | |

Criteria (functional items)

No.	Item	Criteria
1	No display	
2	Missing segment	
3	Short circuit	Not allowed
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 analyze 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	85°C, 96 hrs	
Low Temperature Operation	-30°C, 96 hrs	
High Temperature Storage	90°C, 96 hrs	
Low Temperature Storage	-40°C, 96 hrs	
High Temperature & High Humidity Operation	+60°C, 90% RH, 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/lines; 4) Glass cracks; 5) Current IDD is twice higher than initial value.
Thermal Shock (Non-operation)	-30℃, 30 min. ↔ 85℃, 30 min., Change time: 5min. 20 cycles.	
ESD test	C=150pF, R=330, 5points/panel Air: ±8KV, 5times; Contact: ±6KV, 5 times (Environment: 15℃~35℃, 30%~60%).	
Vibration (Non-operation)	Frequency range: 10~55Hz, Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces, 80 cm (MEDIUM BOX)	

Note 1: The test samples should be applied to only one test item.

Note 2: Sample size for each test item is 3 pieces.

Note 3: 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 4: Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

Note 5: The color fading mura of polarizing filter can 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
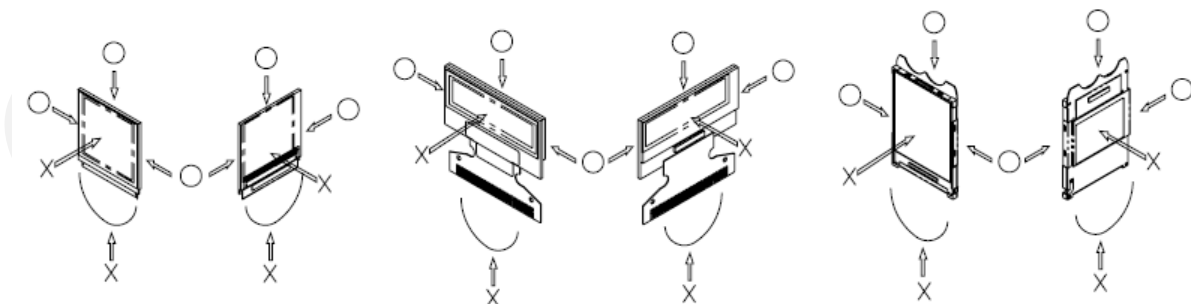
influence the display performance. Also, secure sufficient rigidity for the outer cases.

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.