Product *Specification*

Customer: _____

Product No.: TMT035DNAFWU

Date: 2007/1/13

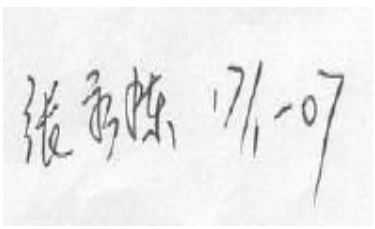
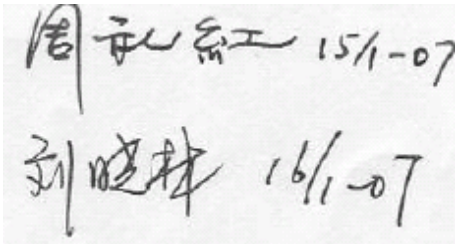
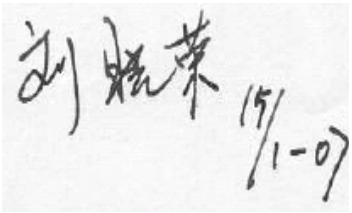
Version: 2.2

■ **Preliminary Specification**

□ **Final Specification**

For Customer's Comment

Approved	Customer's Comment

Approved By	Checked By	Prepared By
		

This specification is subject to change without notice.

Please contact Tianma or its representative before designing your product based on this specification.

Revision Record

Date	Rev. No.	Revision Items
Otc.1.2005	1.0	Initial Release
Nov.2.2005	1.1	Add mechanical dimensions
Dec.26.2005	1.2	Add electrical characteristics
Dec.5.2006	2.0	Updated to new format.
Dec.16.2006	2.1	Modify 9 Optical characteristics CR 600->300 Modify 10 Reliability Test Table 3,4,5 Ta->Tp
Jan.13.2007	2.2	Modify the block diagram on page 5 Add Connector On Page 6 Modify 9 Optical characteristics Viewing Angle

Contents

1. Applications

TMT035DNAFWU is designed for DSC (Digital Still Camera), PMP (Portable Multimedia Player) application products which require high quality flat panel displays. This product is composed of a TFT-LCD panel, driver ICs, FPC and a backlight unit.

2. Features

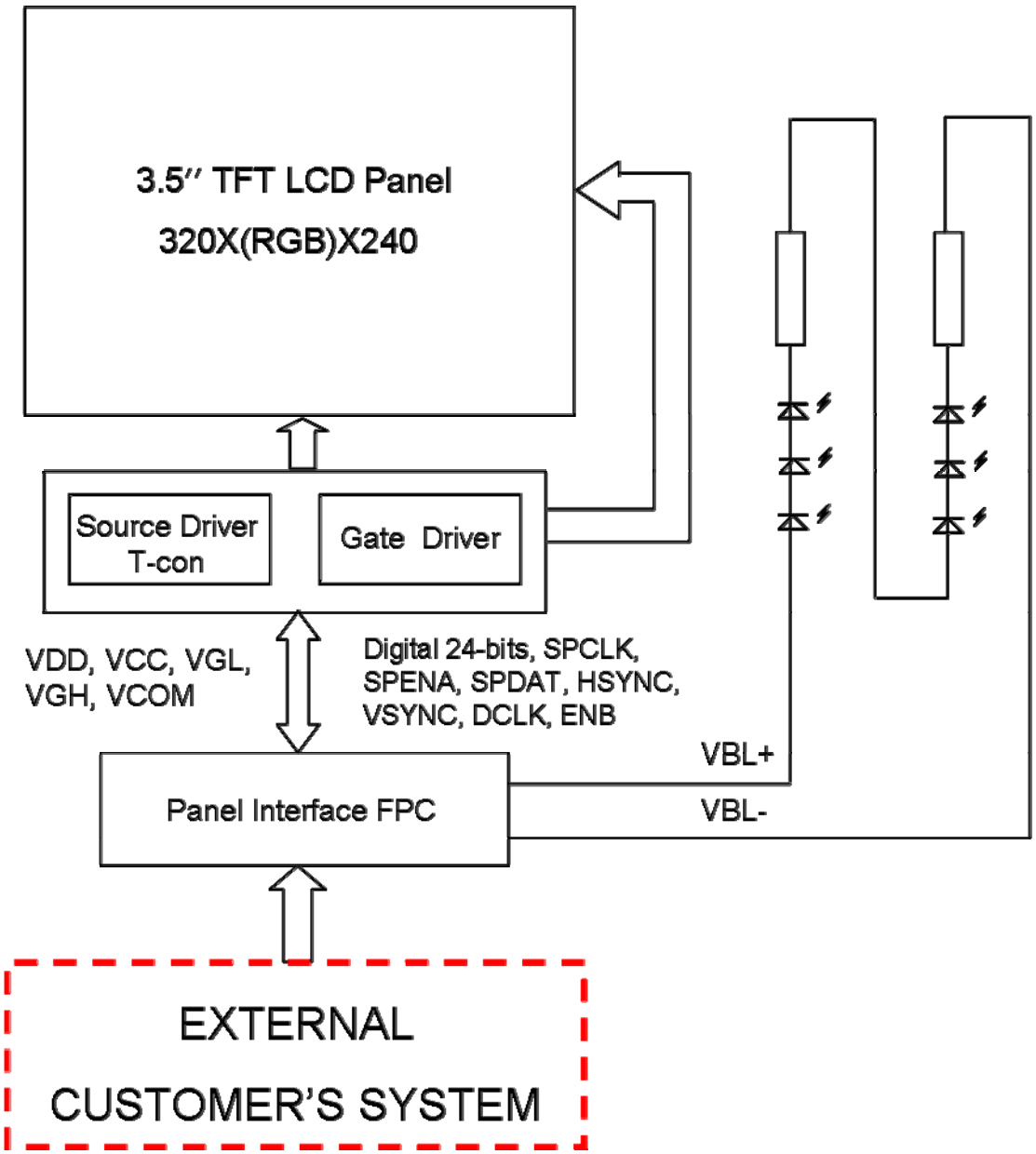
High Resolution: 230400 Dots
Display Color: 16.7M
Optimum Viewing Direction: 12 o'clock
Wide viewing angle technology is employed

3. General Specifications

Item	Specification	Unit	Remark
Display Mode	Transmissive / Normal White	-	-
Display Technology	α-Si TFT active matrix	-	-
Screen Size(Diagonal)	3.5	inch	-
Outline Dimension	76.9(H)×63.9(V)×3.2(T)	mm	Note3-1
Active Area	70.08(H)X52.56(V)	mm	-
Resolution	320X(RGB)X240	dots	-
Pixel Pitch	219X219	μm	-
Pixel Configuration	RGB Stripe	-	-
Weight	33	g	-
Backlight	6*LED	-	-
Luminance	250	cd/m^2	-
Surface Treatment	Anti-Glare	-	-
Signal Interface	Digital 24-bits RGB	-	-
Viewing Direction	12	o'clock	Note3-2
Operating Temperature	-10~70	°C	-
Storage Temperature	-20~80	°C	-

Note3-1: Refer to the mechanical drawing on page17.
Note3-2: Refer the definition of the viewing direction on page 14.

4. Block Diagram



5. Interface

(Connector: MOLEX 51296-5494)

Pin No.	Symbol	I/O	Description	Remark
1	VBL-	I	Backlight LED Ground	-
2	VBL-	I	Backlight LED Ground	-
3	VBL+	I	Backlight LED Power	-
4	VBL+	I	Backlight LED Power	-
5	NC	-	No Connection	-
6	NC	-	No Connection	-
7	POL	O	Polarity Signal Connect to Vcom Driving Circuit	Note 5-1
8	/RESET	I	Hardware Reset	-
9	SPENA	I	SPI Interface Data Enable Signal	Note 5-3
10	SPCLK	I	SPI Interface Data Clock	Note 5-3
11	SPDAT	I	SPI Interface Data	-
12	B0	I	Blue Data Bit 0	-
13	B1	I	Blue Data Bit 1	-
14	B2	I	Blue Data Bit 2	-
15	B3	I	Blue Data Bit 3	-
16	B4	I	Blue Data Bit 4	-
17	B5	I	Blue Data Bit 5	-
18	B6	I	Blue Data Bit 6	-
19	B7	I	Blue Data Bit 7	-
20	G0	I	Green Data Bit 0	-
21	G1	I	Green Data Bit 1	-
22	G2	I	Green Data Bit 2	-
23	G3	I	Green Data Bit 3	-
24	G4	I	Green Data Bit 4	-
25	G5	I	Green Data Bit 5	-
26	G6	I	Green Data Bit 6	-
27	G7	I	Green Data Bit 7	-
28	R0	I	Red Data Bit 0	-

29	R1	I	Red Data Bit 1	-
30	R2	I	Red Data Bit 2	-
31	R3	I	Red Data Bit 3	-
32	R4	I	Red Data Bit 4	-
33	R5	I	Red Data Bit 5	-
34	R6	I	Red Data Bit 6	-
35	R7	I	Red Data Bit 7	-
36	HSYNC	I	Horizontal Sync Input	-
37	VSYNC	I	Vertical Sync Input	-
38	DCLK	I	Dot Data Clock	-
39	VDD	I	Analog Power	-
40	VDD	I	Analog Power	-
41	VCC	I	Digital Power	-
42	VCC	I	Digital Power	-
43	NC	-	No Connection	-
44	NC	-	No Connection	-
45	VGL	I	Gate off Power	-
46	NC	-	No Connection	-
47	VGH	I	Gate on Power	-
48	NC	-	No Connection	-
49	NC	-	No Connection	-
50	NC	-	No Connection	-
51	VCOM	I	Driving Input	Note 5-1
52	ENB	I	Data Enable Input	Note 5-2
53	GND	I	Ground	-
54	AVSS	I	Ground	-

Note 5-1: The polarity of VCOM (pin 51) should be generated from POL (pin7).
Note 5-2: For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If ENB signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC is used.
Note 5-3: Pin 9 & Pin 10 always pull high.

6. Absolute Maximum Ratings

(GND=0V, Ta=25°C)

Item		Symbol	Min.	Max.	Unit	Remark
Supply Voltage for Source Driver	Analog	VDD	-0.3	+7.0	V	-
	Digital	VCC	-0.3	+7.0		-
Supply Voltage for Gate Driver	Positive	VGH	-0.3	+32	V	-
	Negative	VGL	-22	+0.3		-
	-	VGH-VGL	-0.3	+45		-
Analog Input Voltage		V_{Video}	-0.3	+7.3	V	-
Operation Temperature		-	-20	+70	°C	-
Storage Temperature		-	-30	+80	°C	-

7. Electrical Conditions

7.1. TFT-LCD Panel Driving Section

(Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Digital Power Supply	VCC	3	3.3	3.6	V	-
Analog Power Supply	VDD	3.8	5.0	5.5	V	-
Gate on Power	VGH	14	15	17	V	-
Gate off Power	VGL	-11	-10	-8	V	-
VCOM High Voltage	$VCOM_H$	2	-	4	V	Note7-1
VCOM Low Voltage	$VCOM_L$	-2	-	0	V	
Frame Frequency	f_{FRAME}	-	60	90	Hz	-

Note7-1: $VCOM_H$ & $VCOM_L$: Adjust the color with gamma data.

7.2. Backlight Driving Section

Fig. 7-2 LED Circuit

(Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Voltage	V_L	-	20	-	V	-
LED Current	I_L	-	20	-	mA	-
Power Consumption	P_{LED}	-	400	-	mW	-
Life Time	-	-	50,000	-	hr	Note7-2

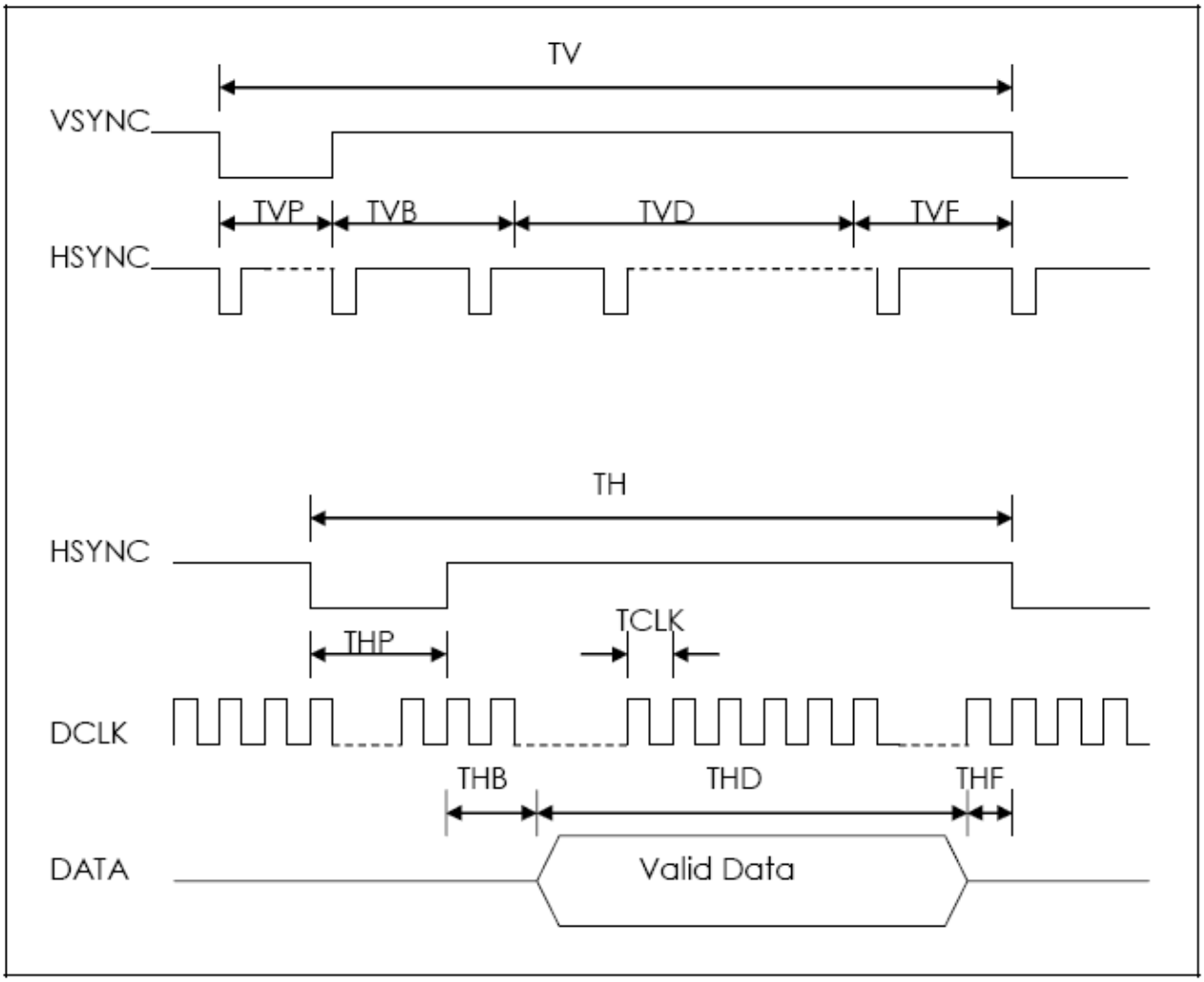
Note7-2：The “lamp life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃， I_L=20 mA

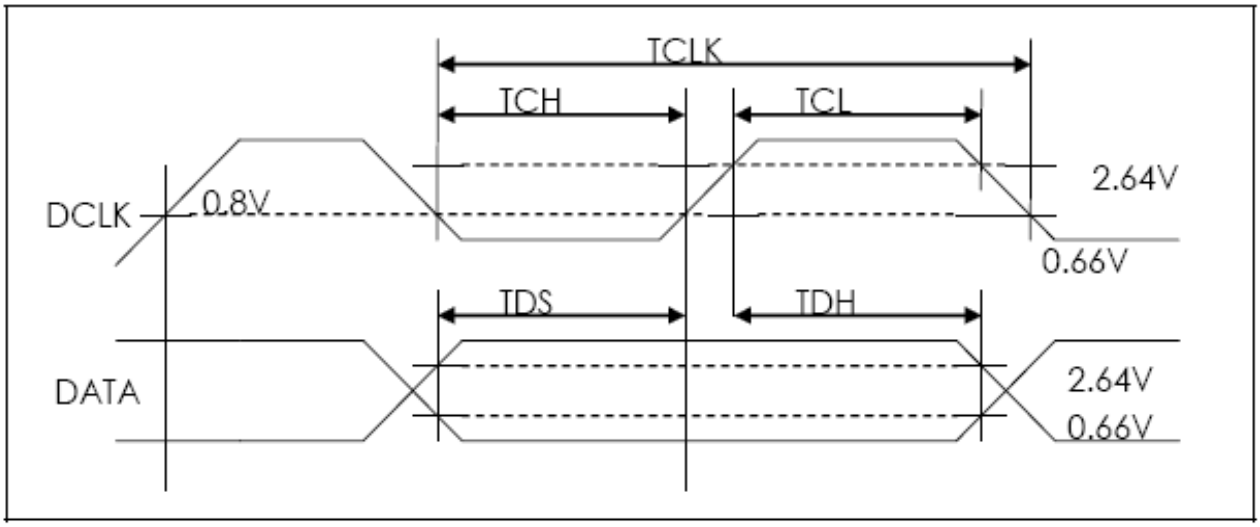
8. Timing Characteristics

8.1. Timing Conditions

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK	Frequency		Dclk	-	6.4	-	MHz	-
	High Time		Tch	-	78	-	ns	-
	Low Time		Tcl	-	78	-	ns	-
Data	Setup Time		Tds	12	-	-	ns	-
	Hold Time		Tdh	12	-	-	ns	-
HSYNC	Period		TH	-	408	-	DCLK	-
	Pulse Width		Thp	-	30	-	DCLK	-
	Back-Parach		Thb	-	38	-	DCLK	-
	Display Period		Thd	-	320	-	DCLK	-
	Front-Porch		Thf	-	20	-	DCLK	-
VSYNC	Period	NTSC	Tv	-	262.5	-	TH	-
		PAL			312.5			
	Pulse With		Tvp	1	3	5	TH	-
	Back-Porch	NTSC	Tvb	-	15	-	TH	-
		PAL			23			
	Display Period		Tvd	-	240	-	TH	-
	Front-Porch	NTSC	Tvf	-	4.5	-	TH	-
		PAL			46.5	-		

8.2. Timing Diagram

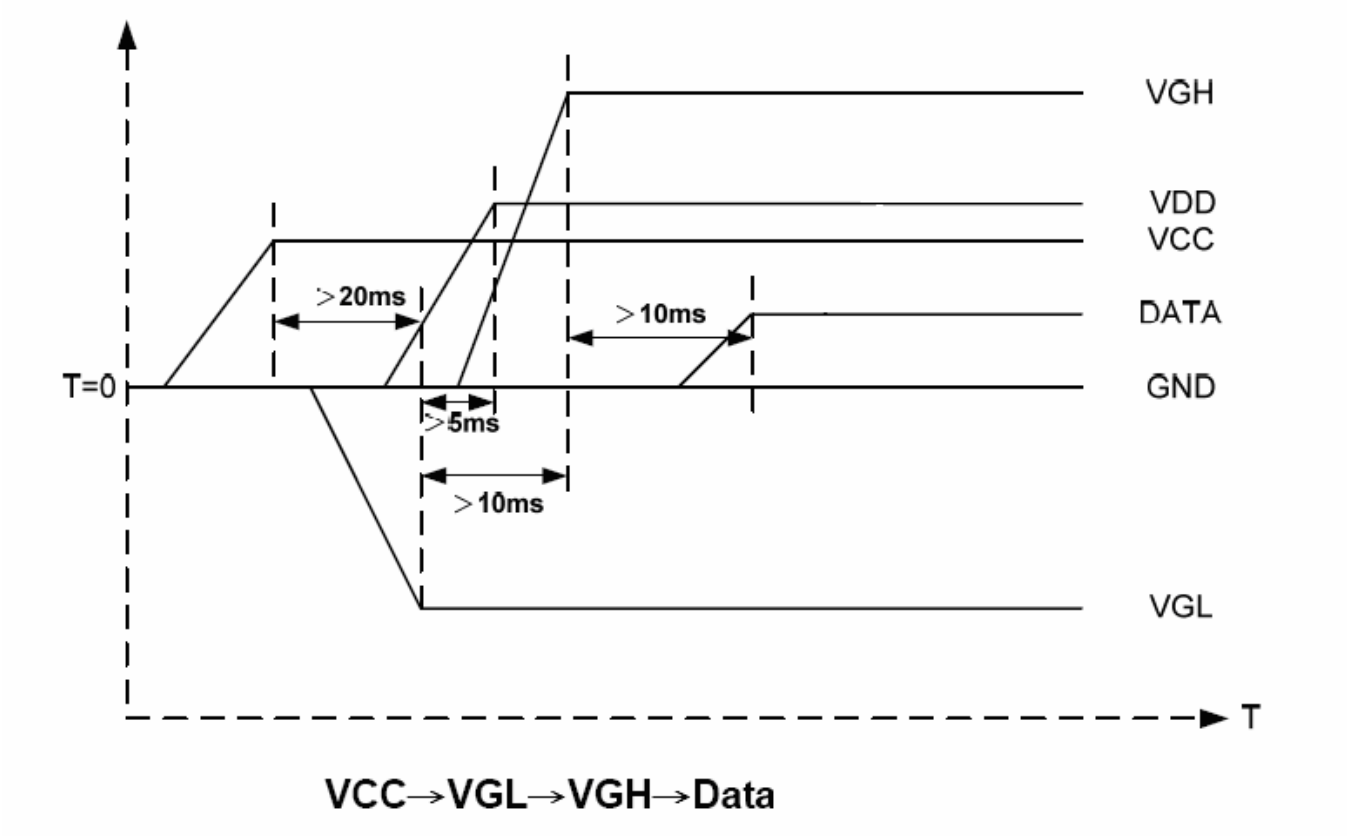




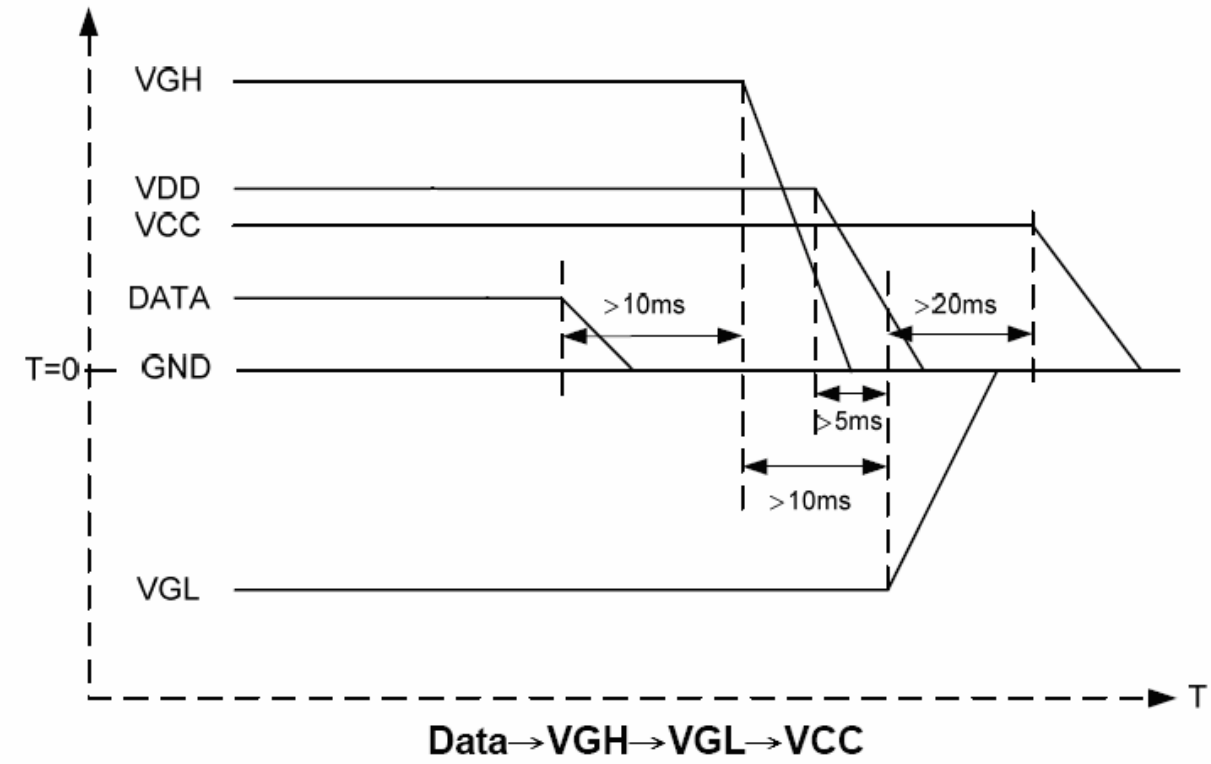
8.3 Power Sequence (Voltage Source)

The LCD panel adopts high voltage driver ICs, so it could be damaged permanently if a wrong power on/off sequence is used. To prevent the LCD panel from damage due to latch up, the power ON/OFF sequence shown below must be followed.

POWER ON



POWER OFF



9. Optical Characteristics

(Ta = 25 °C, I_f = 20 mA, V_L= 20 V)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ_L	Center CR≥10	-	60	-	Deg.	Note 9-2
		Θ_R		-	60	-		
	Vertical	Θ_U		-	40	-		
		Θ_D		-	60	-		
Viewing Direction		-	-	-	12	-	O'clock	Note 9-3
Contrast Ratio		CR	At optimized View Angle	250	300	-	-	Note 9-1,4
Response Time		T_r	Θ=0°	-	8	-	ms	Note 9-5
		T_f		-	24	-	ms	
Brightness		-	Θ=0°	200	250	-	cd/m^2	-
Uniformity		L_U		-	90	-	%	Note 9-1,6
Color Chromaticity	White	X	Θ=0°	-	0.31	-	-	Note 9-7
		Y		-	0.32	-		
	Red	X		-	0.57	-		
		Y		-	0.35	-		
	Green	X		-	0.35	-		
		Y		-	0.35	-		
	Blue	X		-	0.15	-		
		Y		-	0.12	-		
NTSC		-	-	-	50	-	-	

Note 9-1: Measured on the center area of the panel by DMS-501, PR-705 or similar equipment.

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.
- Measured value at the center point of LCD panel after more than 10 minutes while backlight turning on.

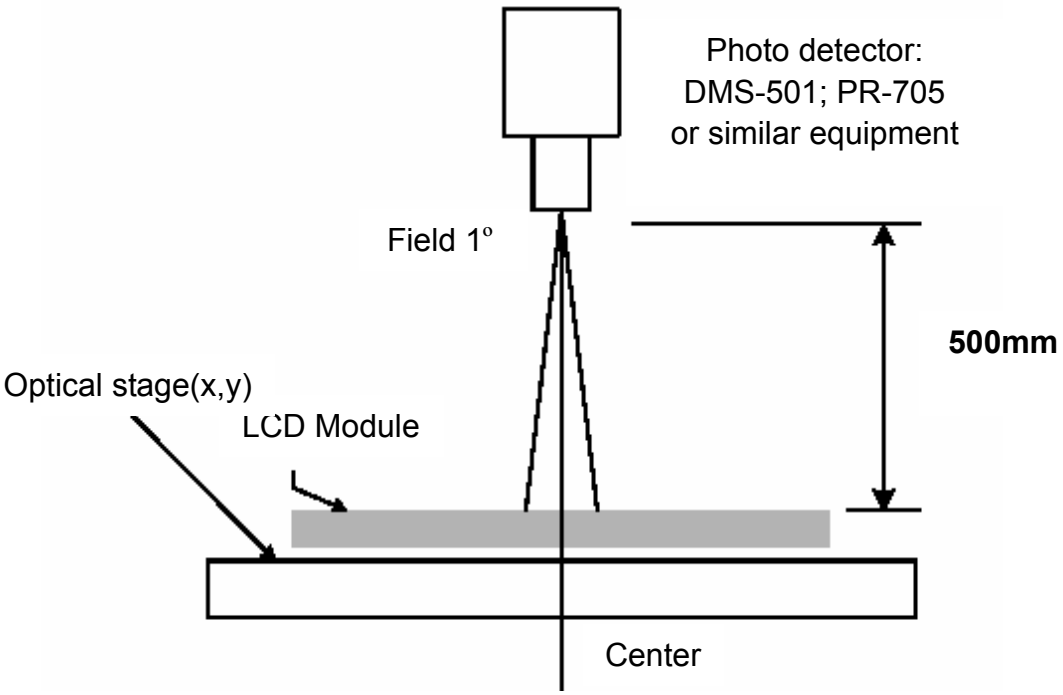


Fig.9-1 The photo detector

Note 9-2: The definition of viewing angle:

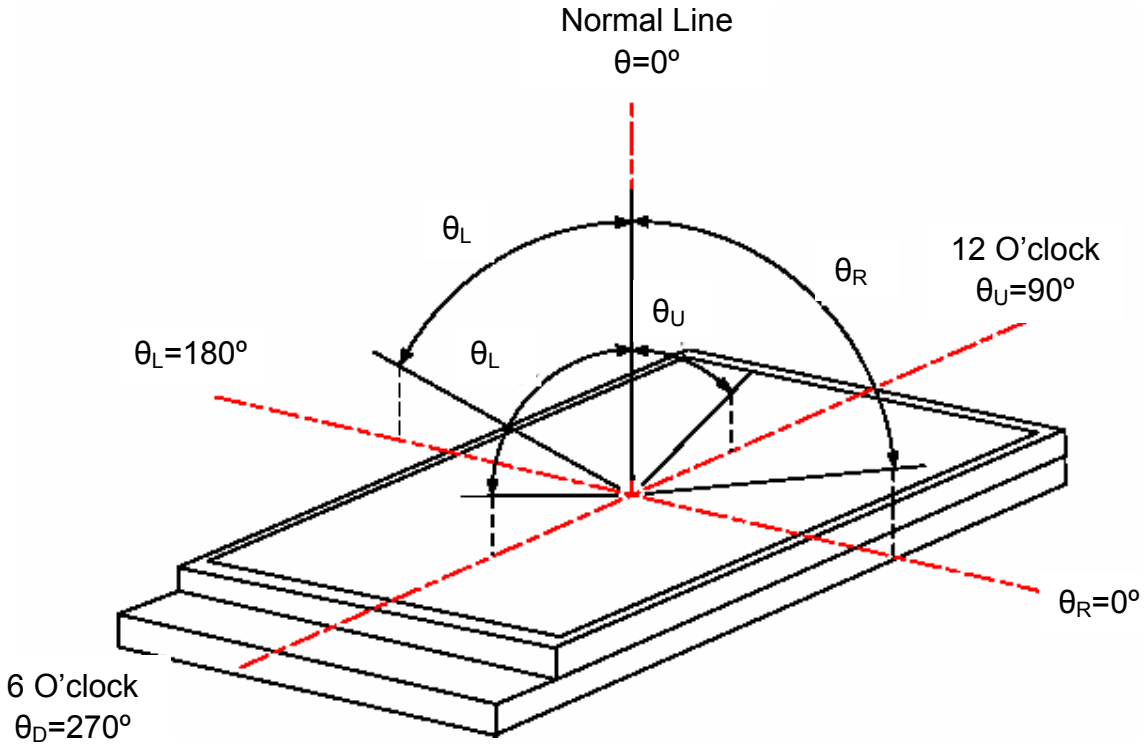


Fig.9-2 The definition of viewing angle

Note 9-3: The definition of viewing direction:

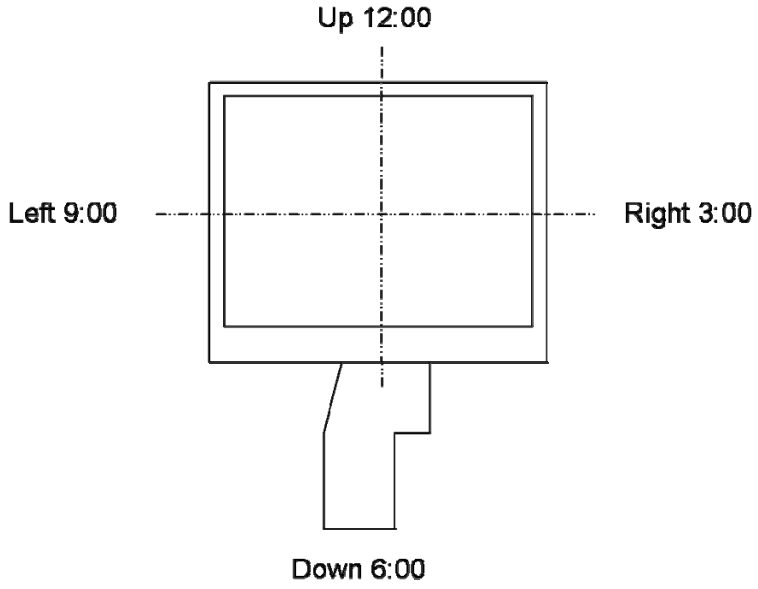


Fig.9-3 The definition of viewing direction

*** The definition of viewing direction is for good image quality, which is 12 O'clock. View Direction for Largest Contrast Ratio is 6 O'clock.

Note 9-4: The definition of contrast ratio (Test LCM using PR-705):

$$\text{Contrast Ratio(CR)} = \frac{\text{Luminance When LCD is White}}{\text{Luminance When LCD is Black}}$$

Contrast Ratio is measured in optimum common electrode voltage

Note 9-5: The definition of response time (Test LCD using DMS-501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.

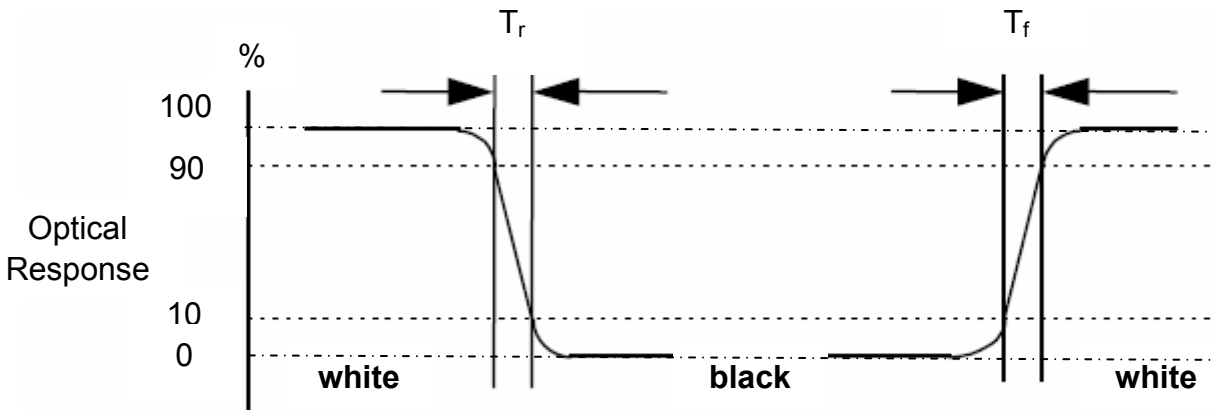


Fig.9-4 The definition of f response time

Note 9-6: The definition of luminance uniformity (Test LCM using PR-705):

The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity (Lu)} = \frac{\text{Maximum luminance from ① to ⑨}}{\text{Minimum luminance from ① to ⑨}}$$

The luminance is measured at near the 9 points shown below.

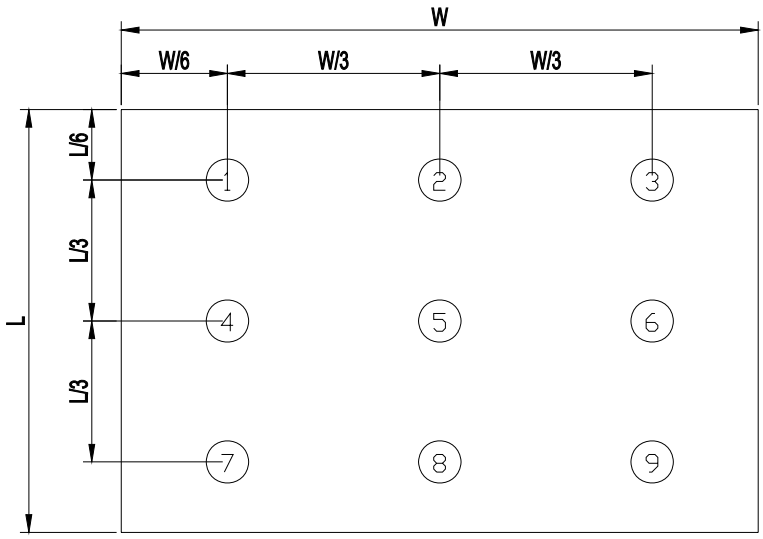
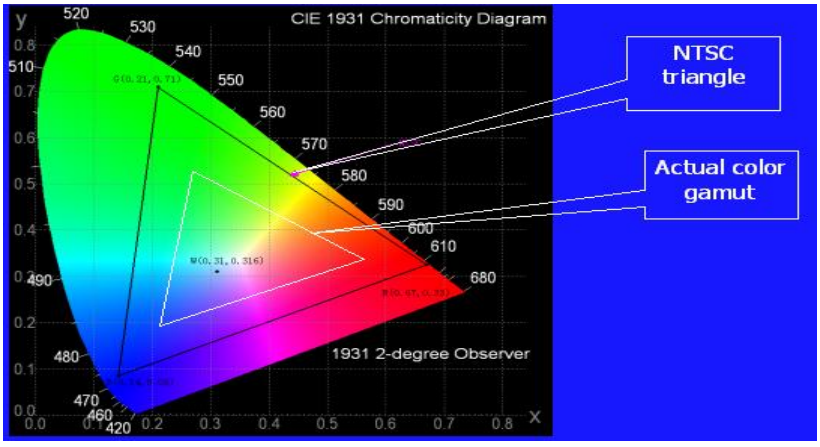


Fig.9-5 The definition of f luminance uniformity

Note 9-7: Definition of Color of CIE Coordinate and NTSC Ratio (Test LCM using PR-705):



Color Gamut:

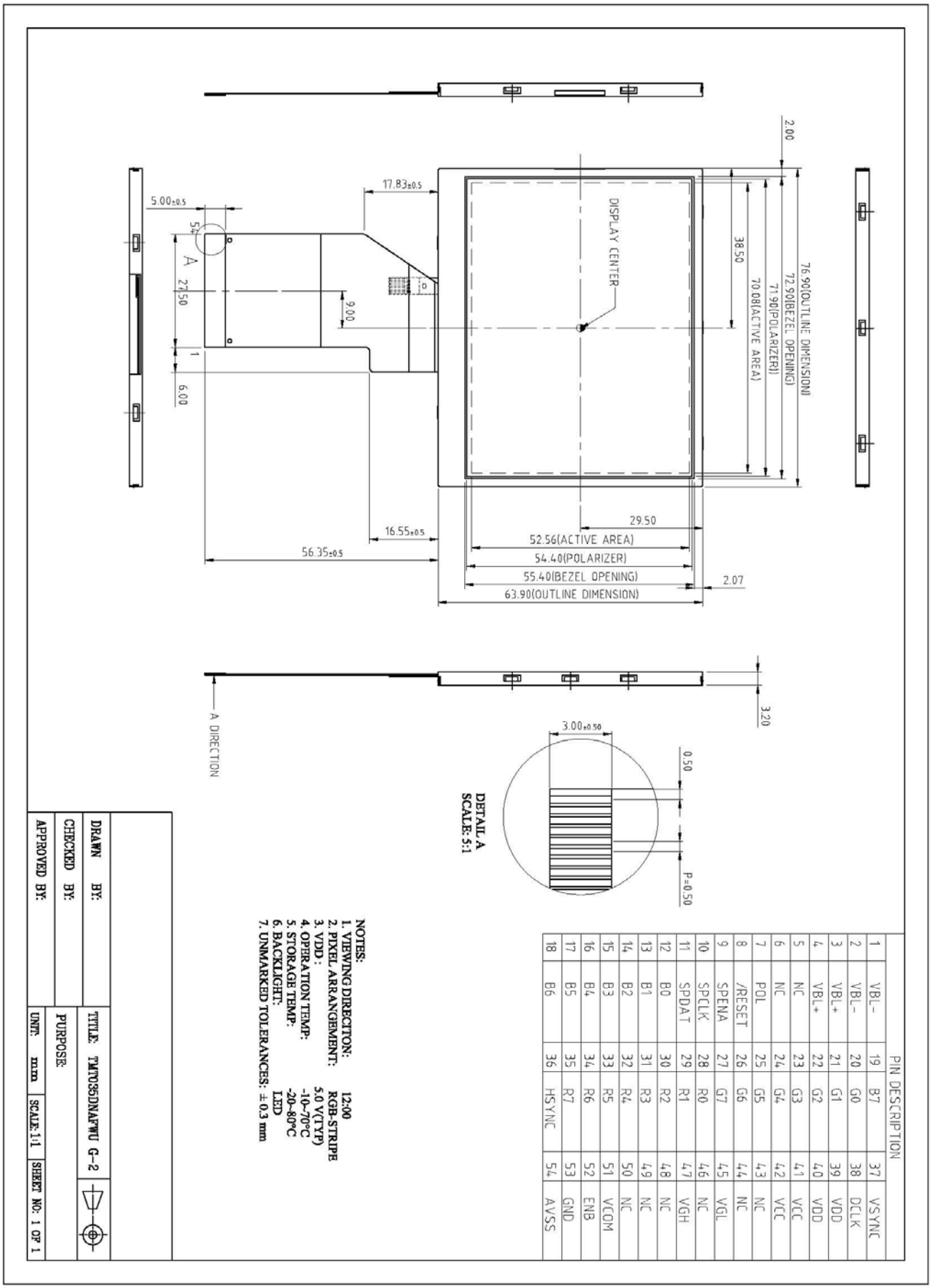
$$S = \frac{area\ \ of\ \ RGB\ \ triangle}{area\ \ of\ \ NTSC\ \ triangle} \times 100\%$$

10. Reliability Test

No.	Test Item	Test Condition
1	High Temperature Storage	Ta=+80 ±2 °C, 120 hrs
2	Low Temperature Storage	Ta=-20 ±2 °C, 120 hrs
3	High Temperature Operation Test	Tp=+70 ±2 °C, 120 hrs
4	Low Temperature Operation Test	Tp=-10 ±2 °C, 120 hrs
5	High Temperature & High Humidity Operation Test	Tp=+60 ±2 °C, 90±2% RH, 96 hrs
6	Temperature Cycle Test (Non-Operating)	-20 °C↔+25 °C↔+80 °C,10 Cycles 30min 5min 30min
7	Vibration Test (Non-Operating)	Frequency: 10~150~10 Hz, Acceleration: 100 m/S^2 Test Period: 6 Cycles for each direction of X,Y,Z,120 min every direction
8	Shock Test (Non-Operating)	Waveform : Half Sinusoidal Wave Amplitude acceleration: 500 m/S^2, pulse width:11 ms, Direction: ±X, ±Y, ±Z, Cycle:3 times

Ta: Ambient Temperature
Tp: Panel Temperature
Criteria: Under the display quality test conditions with normal operation state, there should be no change which may affect practical display function.

11. Mechanical Drawing



12. Package

TBD

13. Precautions for Use of LCD Modules

13.1. Handling Precautions

13.1.1. The display panel is made of glass. **Do not** subject it to a mechanical shock by dropping it from a high place, etc.

13.1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

13.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

13.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

13.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol
— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, **do not** use the following:

— Water
— Ketone
— Aromatic solvents

13.1.6. Do not attempt to disassemble the LCD Module.

13.1.7. If the logic circuit power is off, **do not** apply the input signals.

13.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, **do not** conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

13.2. Storage precautions

13.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

13.2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃
Relatively humidity: ≤80%

13.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

13.3. Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.