



MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI0350RT

Revision	
Engineering	
Date	
Our Reference	



Revision Record

Date	Rev. No.	Page	Revision Items
2007/06/06	0.0		Initial Release
2007/07/17	1.0	10~12	Change the Timing Characteristics
2007/07/20	1.1	6	Modify some of the pin description



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1. Description

MI0350RT is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, a driver IC, FPC, a back light unit and TSP (Touch Screen Panel). The 3.5" display area contains 320 x 240 pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

2. Applications

- ◆ Digital Still Camera (DSC)
- ◆ Portable Multimedia Player (PMP)
- ◆ Global Position System (GPS)

3. Features

- ◆ 6 bits color depth
- ◆ Using the 4-wires Touch Screen Panel
- ◆ Built-in Charge-pump circuits(including VGH,VGL,VCOM set-up circuits)

4. General Specifications

Item	Specification	Unit	Remark
Display Mode	Normally White	-	-
Display Technology	α -Si TFT active matrix	-	-
Outline Dimension	76.9(H)X63.9(V)X4.29(T)	mm	Note 4-1
Active Area	70.08(H)X52.56(V)	mm	-
Resolution	320X(RGB)X240	dots	-
Pixel Pitch	219X219	μ m	-
Pixel Configuration	RGB Stripe	-	-
Weight	40.5	g	-
Backlight	6*LED	-	-
Luminance	(250)(Typ.)	cd/m ²	-
Surface Treatment	Anti-Glare	-	-
Signal Interface	Digital 18-bits RGB	-	Note 4-2
Viewing Direction	12	o'clock	Note 4-3
Power Consumption	409	mW	Note 4-4

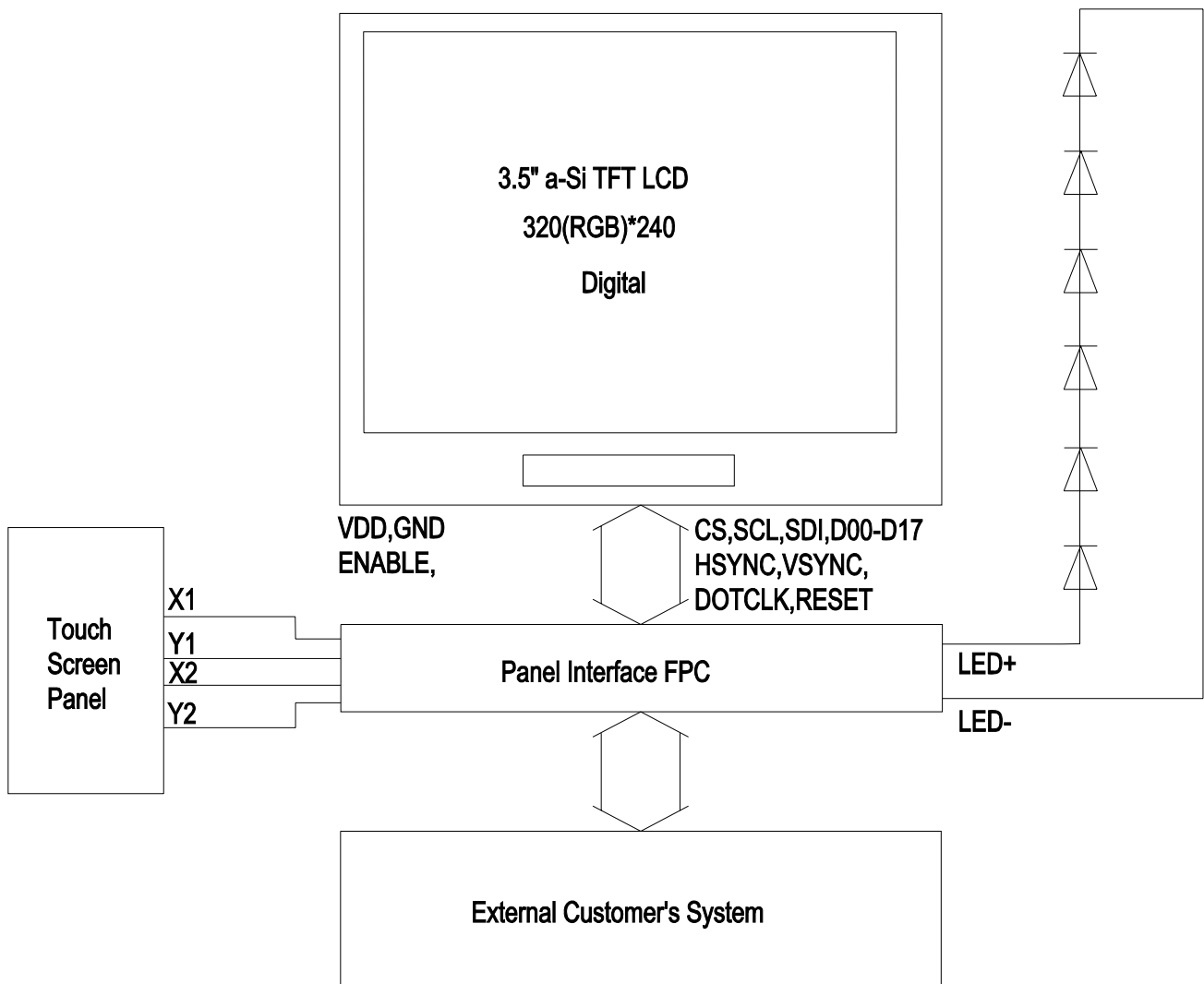
Note 4-1: Refer to the mechanical drawing on page18.

Note 4-2: The LCD can display 16.7M, with a parallel 24-bit RGB interface, but we cut short 24-bit to 18-bit in the FPC.

Note 4-3: Refer the definition of the viewing direction on page15.

Note 4-4: The Power Consumption is a calculated reference value ($P_{LCD}+P_{LED}$).

5. Block Diagram



6. Interface

(Recommended Connector: HRS FH26-39S-0.3SHW or Omron XF3H-3955-31A)

Pin No.	Symbol	I/O	Description	Remark
1	LED-	P	Backlight LED Power Supply(Cathode)	-
2	LED+	P	Backlight LED Power Supply(Anode)	-
3	GND	P	Power Ground(0V)	-
4	X1	I	Touch Panel X Input Terminal, right side	-
5	Y1	I	Touch Panel Y Input Terminal, down side	-
6	X2	I	Touch Panel X Input Terminal, left side	-
7	Y2	I	Touch Panel Y Input Terminal, up side	-
8	GND	P	Power Ground(0V)	-
9	RESET	I	Chip Reset Execution Control Pin	-
10	CS	I	Chip Select in SPI Interface	-
11	SCL	I	Clock input in SPI Interface	-
12	SDI	I	Data Input in SPI Interface	-
13	DATA0	I/O	Blue Data(LSB)	-
14	DATA1	I/O	Blue Data	-
15	DATA2	I/O	Blue Data	-
16	DATA3	I/O	Blue Data	-
17	DATA4	I/O	Blue Data	-
18	DATA5	I/O	Blue Data(MSB)	-
19	DATA6	I/O	Green Data(LSB)	-
20	DATA7	I/O	Green Data	-
21	DATA8	I/O	Green Data	-
22	DATA9	I/O	Green Data	-
23	DATA10	I/O	Green Data	-
24	DATA11	I/O	Green Data(MSB)	-
25	DATA12	I/O	Red Data(LSB)	-
26	DATA13	I/O	Red Data	-
27	DATA14	I/O	Red Data	-
28	DATA15	I/O	Red Data	-
29	DATA16	I/O	Red Data	-
30	DATA17	I/O	Red Data(MSB)	-
31	NC	-	No Connection	-
32	HSYNC	I	Horizontal Sync Input	-
33	VSNC	I	Vertical Sync Input	-



34	DOTCLK	I	Dot Clock Input	-
35	GND	P	Power Ground(0V)	-
36	VDD	P	Power Supply(+3.3V Type)	-
37	NC	-	No Connection	-
38	ENABLE	I	Data Enable Input	-
39	GND	P	Power Ground(0V)	-

7. Absolute Maximum Ratings

(GND=0V, Ta=25°C)

Item	Symbol	Min.	Max.	Unit	Remark
Supply Voltage for VDD	VDD	-0.3	+4.0	V	-
Data Input Voltage	V _{data}	-0.3	+4.0	V	-
Storage Temperature(Ambient)	T _{STG}	-30	+80	°C	Note 7-1,2
Operation Temperature(Ambient)	T _{OPR}	-20	+70	°C	Note 7-1,2,3,4

Note 7-1: No parameter is allowed to exceed to the temperature range.

Note 7-2: 95% RH Max. ($40\text{ °C} \geq T_a$).

Maximum wet-bulb temperature at 39°C or less. ($T_a > 40\text{ °C}$) No dew condensation.

Note 7-3: Only operation is guaranteed at operating temperature. Contrast, response time and another display quality are evaluated at +25°C.

Note 7-4: The ambient temperature, when backlight is on. (Reference).

8. Electrical Conditions

8.1. TFT- LCD Panel Driving Section

(Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage for VDD	VDD	2.7	3.3	3.6	V	-
VDD Operation Current	IVDD	-	7.5	-	mA	Note 8-1
Data (RGB signal) Voltage	V _{SIG}	0	-	VDD	V	-
Data Voltage High	V _{SIG-H}	0.7VDD	-	VDD	V	-
Data Voltage Low	V _{SIG-L}	0	-	0.3VDD	V	-
Frame Frequency	f _{FRAME}	-	60	-	Hz	-
Dot Data Clock	Dclk	-	6.4	-	MHz	-
Power Consumption	P _{LCD}	-	25	-	mW	Note 8-2

Note 8-1: The current IVDD is tested under the condition of 8-grayscale, VDD=3.3V.

Note 8-2: The power consumption P_{LCD} is a calculated reference value (IVDD × VDD).

8.2 Backlight Driving Section



(Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Voltage	V_L	18.0	19.2	19.8	V	-
LED Current	I_L	-	20	-	mA	-
Power Consumption	P_{LED}	-	384	-	mW	Note 8-3
Life Time	-	-	(50,000)	-	hrs	Note 8-4

Note 8-3: P_{LED} is a calculated reference value ($I_L \times V_L$);

Note 8-4: The “lamp life time” is defined as the module luminance decrease to 50% original luminance at Ta=25°C, $I_L=20$ mA. (This is the reference value).

9. Touch Screen Panel Specifications

9.1. Electrical Characteristics

Item	Min.	Typ.	Max.	Unit.	Remark
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal resistance	160	-	640	Ω	X(Film side)
	160	-	840	Ω	Y(Film side)
Insulation resistance	25	-	-	M Ω	DC 25V
Voltage	-	-	7	V	DC
Chattering	-	-	10	ms	100K Ω pull-up
Transparency	-	80	-	%	Non-glare

Caution: Do not operate it with a thing expect a polyacetal pen (tip R0.8mm or less) or a finger especially those with hard of sharp tips such as a ball point pen or a mechanical pencil.

9.2. Mechanical & Reliability Characteristics

Item	Min.	Typ.	Max.	Unit.	Remark
Activation force	-	-	80	G	Note 9-1
Durability-surface scratching	Write 100,000	-	-	Characters	Note 9-2
Durability-surface pitting	1000,000			Touches	Note 9-3
Surface Hardness	3	-	-	H	JIS K5400_ASTM D3363

Note 9-1: Styles pen Input: R0.8mm polyacetal pen or finger

Note 9-2: Measurement for surface area

- Scratch 100,000 times straight line on the film with a stylus change every 20,000 times
- Force: 250 gf
- Speed: 60mm/sec
- Stylus: R0.8mm polyacetal tip

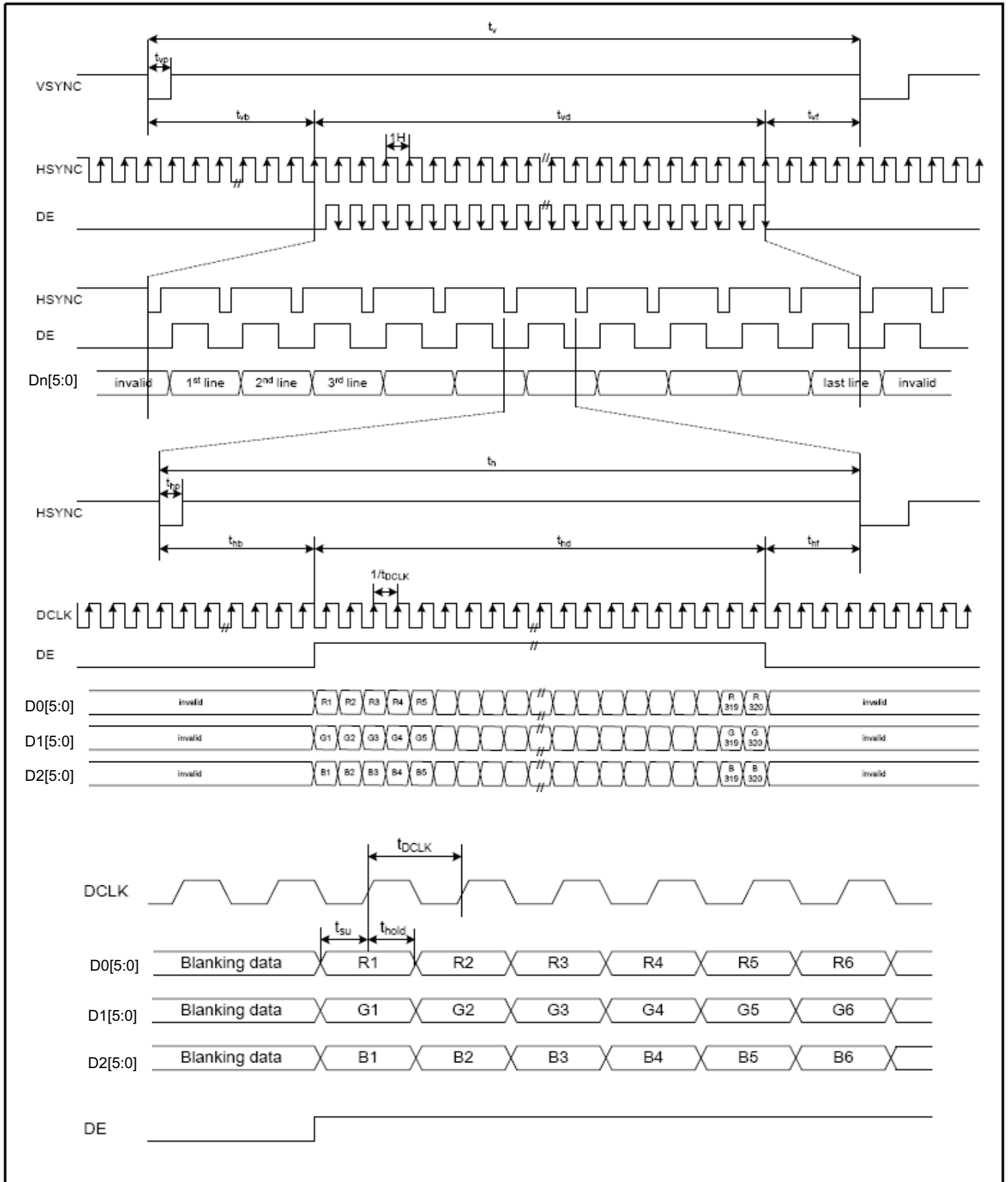
Note 9-3: Pit 1,000,000 times on the film with a R0.8mm silicon rubber.

- Force: 250 gf
- Speed: 2times/sec

10. Timing Characteristics

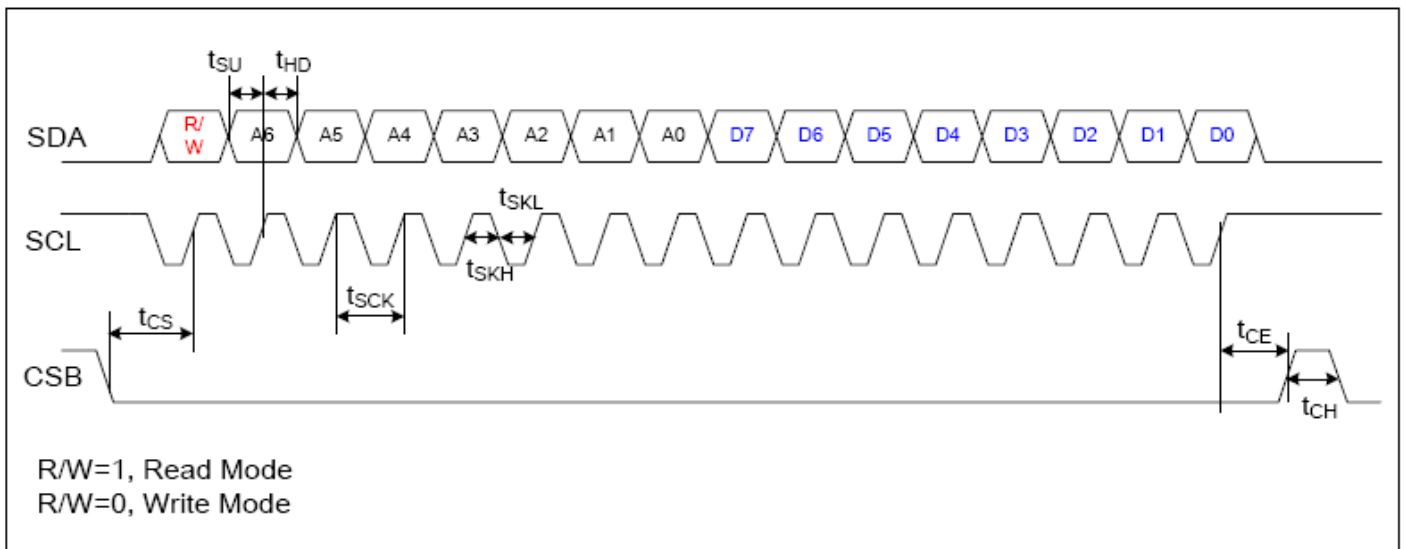
This part is partially intercepted form the datasheet of the LCD Driver IC. For more Details you can contact our Design department.

10.1. RGB Interface Timing



Parameter	Symbol	Min.	Typ.	Max.	Unit.	Note
DCLK Frequency	$1/t_{DCLK}$	-	6.4	11	MHZ	
Horizontal Period	t_h	-	408	-	t_{DCLK}	
Horizontal Display Period	t_{hd}	320	320	320	t_{DCLK}	
Horizontal Back Porch	t_{hb}	2	38	-	t_{DCLK}	
Horizontal Front Porch	t_{hf}	2	-	-	t_{DCLK}	
Horizontal Pulse Width	t_{hp}	1	1	-	t_{DCLK}	
Vertical Period	t_v	-	262	-	t_h	
Vertical Display Period	t_{vd}	240	240	240	t_h	
Vertical Back Porch	t_{vb}	2	18	-	t_h	
Vertical Front Porch	t_{vf}	2	4	-	t_h	
Vertical Pulse Width	t_{vp}	1	1	-	t_h	
Data setup time	t_{su}	12	-	-	ns	
Data hold time	t_{hold}	12	-	-	ns	

10.2. SPI Interface Timing



SPI Timing Specification

Items	Symbol	Min.	Typ.	Max.	Unit	Note
CSB to SCL Setup time	T_{CS}	50	-	-	ns	
CSB to SCL Hold time	T_{CE}	50	-	-	ns	
SCL Period	T_{SCK}	50	-	-	ns	
SCL High Period	T_{SKH}	25	-	-	ns	
SCL Low Period	T_{SKL}	25	-	-	ns	
Data Setup Time	T_{SU}	15	-	-	ns	
Data Hold Time	T_{HD}	15	-	-	ns	
CSB High Pulse Period	T_{CH}	50	-	-	ns	



10.3 Instruction Set

NO.	Description	D7	D6	D5	D4	D3	D2	D1	D0
R00	Chip ID	1	0	0	1	0	0	1	1
R01	VCOM Amplitude	-	-	-	VDV[4]	VDV[3]	VDV[2]	VDV[1]	VDV[0]
R02	VCOM High Voltage	-	-	VCM[5]	VCM[4]	VCM[3]	VCM[2]	VCM[1]	VCM[0]
R03	VREG1OUT Voltage	-	-	-	VREG[4]	VREG[3]	VREG[2]	VREG[1]	VREG[0]
R04	Global Reset	-	-	-	-	-	-	-	GRESET
R05	Power Setting	-	VC[2]	VC[1]	VC[0]	-	BT[2]	BT[1]	BT[0]
R06	Entry Control	IN_SEL[3]	IN_SEL[2]	IN_SEL[1]	IN_SEL[0]	NTPAL[1]	NTPAL[0]	VDIR	HDIR
R07	Power Control	AUTO_EN	VCL_EN	VCOM_EN	-	DDVDH_EN	VGH_EN	VGL_EN	STB
R08	Vertical Back Porch	-	-	VBP[5]	VBP[4]	VBP[3]	VBP[2]	VBP[1]	VBP[0]
R09	Horizontal Back Porch	HBP[7]	HBP[6]	HBP[5]	HBP[4]	HBP[3]	HBP[2]	HBP[1]	HBP[0]
R0A	Polarity	-	REV	Formula	CbCr/BGR	DE_POL	VS_POL	HS_POL	DK_POL
R0B	Display	-	-	WNSEL1	WNSEL0	RGBIF[1]	RGBIF[0]	-	F/L
R0C	DC/DC	-	DC2[2]	DC2[1]	DC2[0]	-	DC1[2]	DC1[1]	DC1[0]
R0D	Driving	-	AP[1]	AP[0]	-	GAP[1]	GAP[0]	SAP[1]	SAP[0]
R0E	CONTRAST	-	-	-	-	CONTRAST[3:0]			
R0F	BRIGHT	BRIGHTNESS[7:0]							
R10	Gamma1	Neg_Gamma_1[3:0]				Pos_Gamma_1[3:0]			
R11	Gamma2	Neg_Gamma_2[3:0]				Pos_Gamma_2[3:0]			
R12	Gamma3	Neg_Gamma_3[3:0]				Pos_Gamma_3[3:0]			
R13	Gamma4	Neg_Gamma_4[3:0]				Pos_Gamma_4[3:0]			
R14	Gamma5	Neg_Gamma_5[3:0]				Pos_Gamma_5[3:0]			
R15	Gamma6	Neg_Gamma_6[3:0]				Pos_Gamma_6[3:0]			
R16	Gamma7	Neg_Gamma_7[3:0]				Pos_Gamma_7[3:0]			
R17	Gamma8	Neg_Gamma_8[3:0]				Pos_Gamma_8[3:0]			
R30	Power	-	POL_OUT	-	-	AUTO_DP	DISP_ON	A_TIME[1]	A_TIME[0]
R42	OTP Program	OTP_PGM_EN	VCM_EN	VCM_OTP5	VCM_OTP4	VCM_OTP3	VCM_OTP2	VCM_OTP1	VCM_OTP0
R43	OTP Status	PGM_CNT1	PGM_CNT0	VCM_D5	VCM_D4	VCM_D3	VCM_D2	VCM_D1	VCM_D0
R44	OTP Key	OTP_KEY7	OTP_KEY6	OTP_KEY5	OTP_KEY4	OTP_KEY3	OTP_KEY2	OTP_KEY1	OTP_KEY0

11. Optical Characteristics

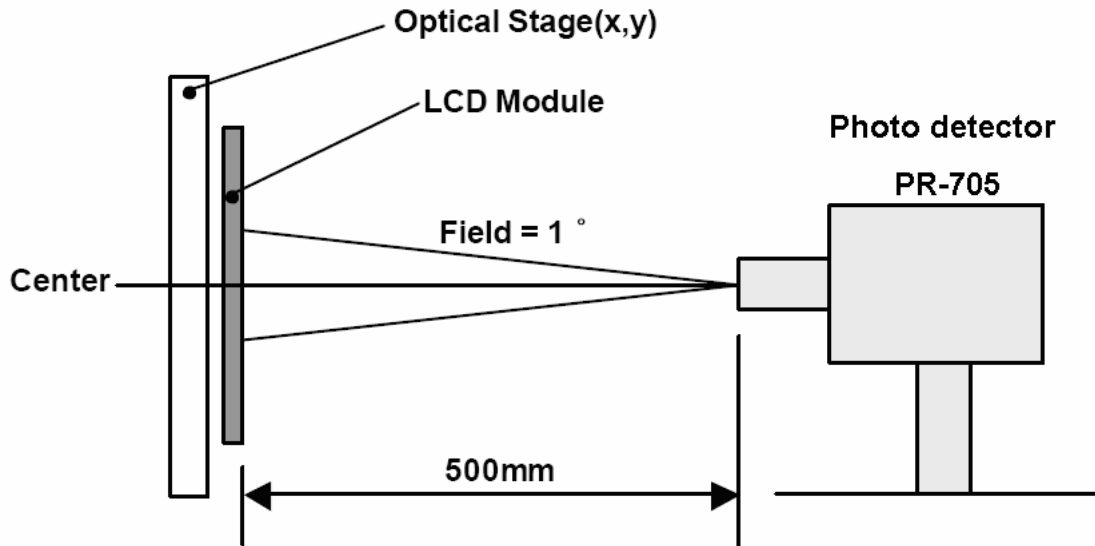
($T_a = 25\text{ }^\circ\text{C}$, $I_f = 20\text{ mA}$, $V_L = 19.8\text{ V}$)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ_L	Center CR \geq 10	(50)	(60)	-	Deg.	Note 11-2
		Θ_R		(50)	(60)	-		
	Vertical	Θ_U		(40)	(50)	-		
		Θ_D		(50)	(60)	-		
Contrast Ratio		CR	At optimized View Angle	(200)	(300)	-	-	Note 11-1,4
Luminance		Y_L	$\Theta=0^\circ$	(150)	(250)	-	cd/m ²	Note 11-1,5
Uniformity		L_U		(70)	(80)	-	%	Note 11-1,6
Response Time		T_r	$\Theta=0^\circ$	-	(10)	(20)	ms	Note 11-7
		T_f		-	(20)	(30)	ms	
Color Chromaticity	White	X	$\Theta=0^\circ$	0.265	0.305	0.345	-	-
		Y		0.294	0.334	0.374		
	Red	X		0.607	0.647	0.687		
		Y		0.296	0.336	0.376		
	Green	X		0.270	0.310	0.340		
		Y		0.536	0.576	0.616		
	Blue	X		0.096	0.136	0.176		
		Y		0.089	0.129	0.169		

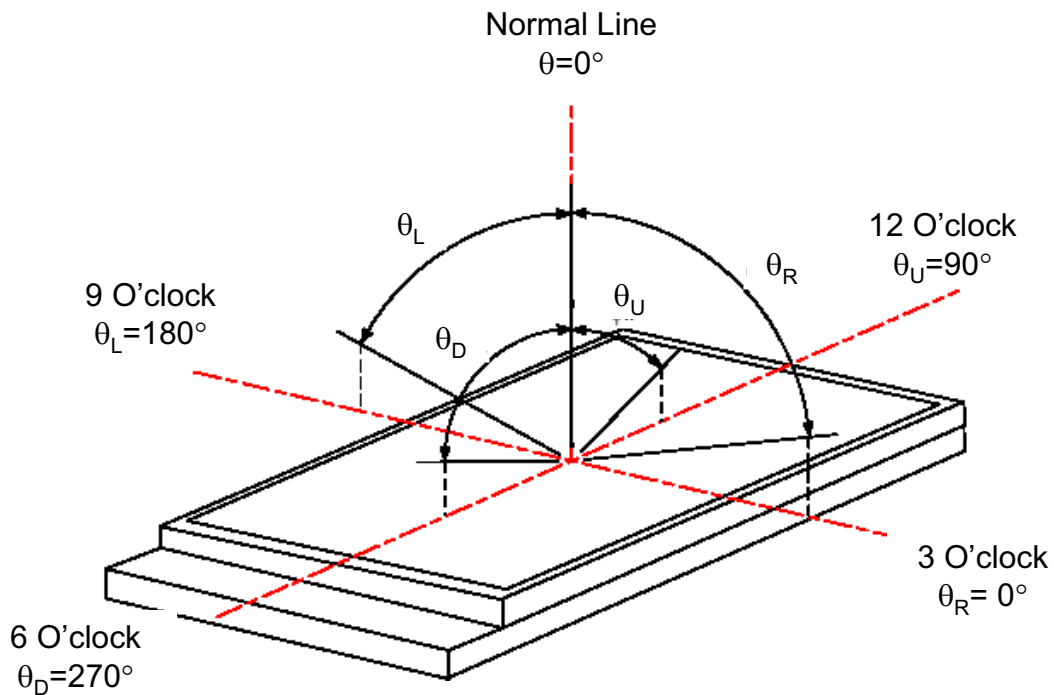
Note 11-1: Measuring equipments: DMS-501, PR-705.

Measuring condition:

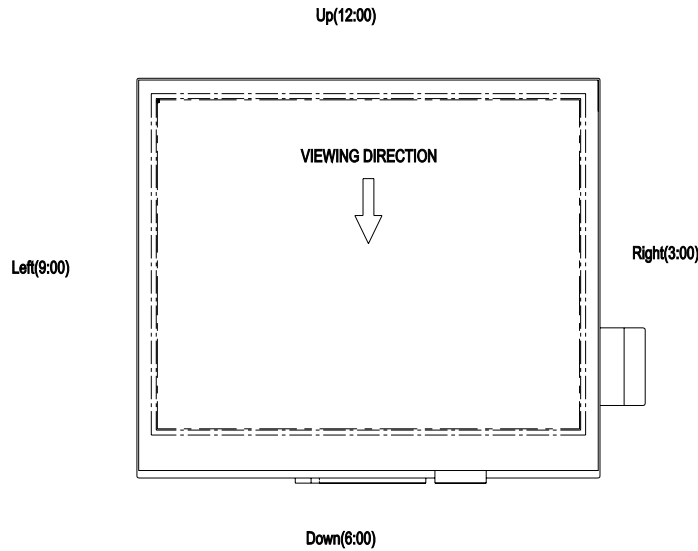
- After stabilizing and leaving the panel alone at a given temperature for 30 min, the measurement should be executed,
- Measuring surroundings: a stable, windless and dark room,
- Measuring temperature: $T_a=25^{\circ}\text{C}$,
- 30 min after lighting the back-light.



Note 11-2: The definition of viewing angle:



Note 11-3: 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 11-4: The contrast ratio (CR) is defined as follows:

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Measure the luminance at the center of the screen.

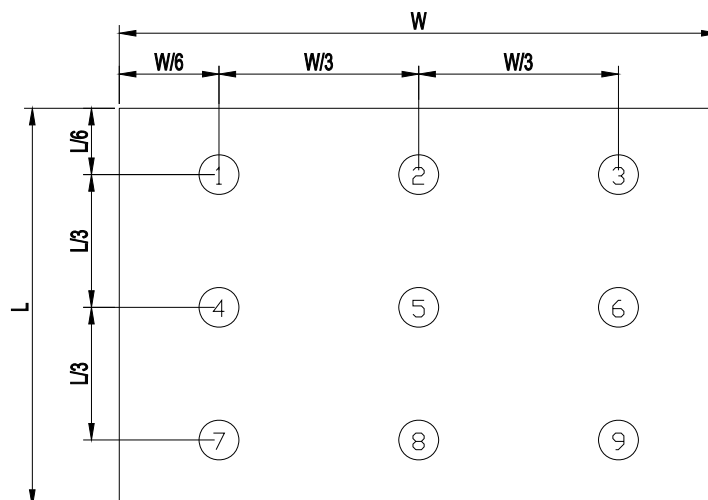
Note 11-5: Definition luminance of White: measure the luminance of White at the center of the screen.

Note 11-6: The definition of luminance uniformity:

The luminance uniformity is calculated by using following formula.

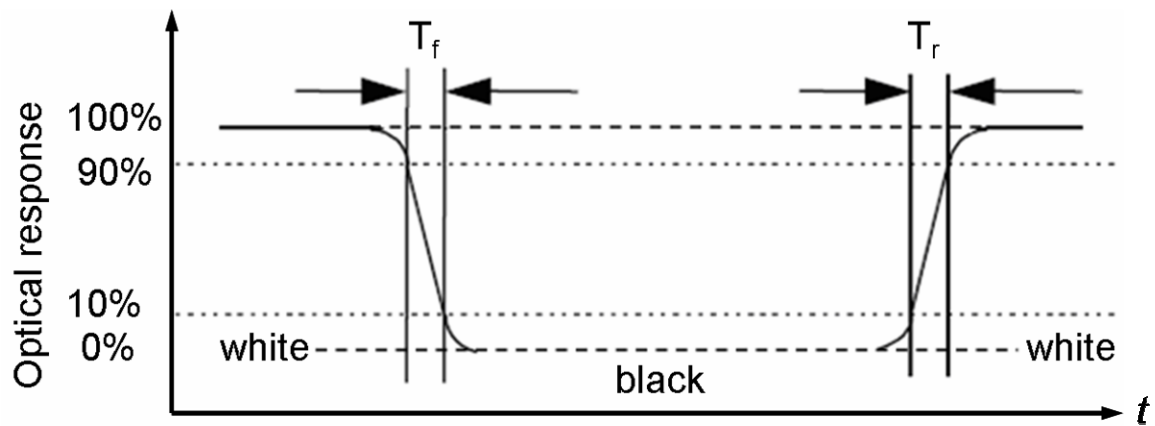
$$\text{Luminance uniformity (Lu)} = \frac{\text{Minimum luminance from ① to ⑨}}{\text{Maximum luminance from ① to ⑨}}$$

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



Note 11-7: The definition of response time:

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:

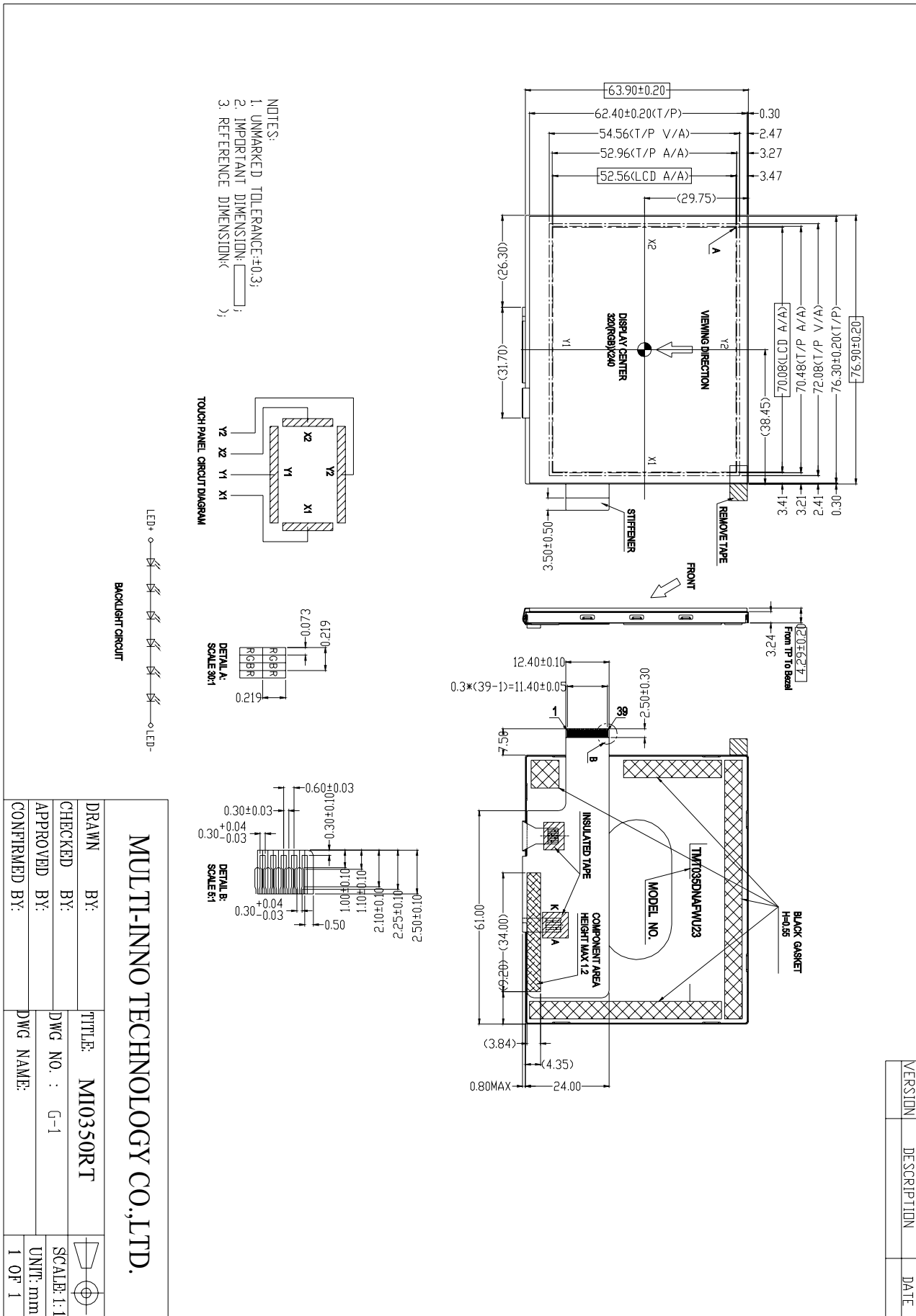


12. Reliability Test

No.	Test Item	Test Condition
1	High Temperature Storage	Ta=+80 °C, 240 hrs
2	Low Temperature Storage	Ta=-30 °C, 240 hrs
3	High Temperature Operation Test	Ta=+70 °C, 240 hrs
4	Low Temperature Operation Test	Ta=-20 °C, 240 hrs
5	High Temperature & High Humidity Operation Test	Ta=+60 °C, 90% RH, 240 hrs
6	Temperature Cycle Test (Non-Operating)	-30 °C ↔ +25 °C ↔ +80 °C, 100 Cycles 30min 5min 30min
7	Vibration Test (Non-Operating)	Frequency: 10 ~150 Hz, Stroke: 1.5mm Sweep time: 11 min Test Period: 6 Cycles for each direction of X,Y,Z, 120 min every direction
8	Shock Test (Non-Operating)	Waveform : Half Sinusoidal Wave Shock Level: 30 G, Pulse Width: 18 ms, Direction: ±X, ±Y, ±Z, Cycle: 3 times
9	Electrical Static Discharge HBM (Operating)	Air : ± 8 kV, 150 pF/ 330 Ω (10 times/point)
		Contact : ± 4 kV, 150 pF/ 330 Ω (10 times/point)

- Note:
1. Ta=Ambient Temperature.
 2. The tested samples have recovery time for 2hrs at room temperature before estimating these appearance and display effect.
 3. Under the display quality test conditions with normal operation state, there should be no change which may affect practical display function.

13. Mechanical Drawing





14. Package

TBD

15. Indication of Model number

$$\begin{array}{cccc} \underline{\text{MI}} & \underline{\text{xxxx}} & \underline{\text{R}} & \underline{\text{T}} \\ \underline{1} & \underline{2} & \underline{3} & \underline{4} \end{array}$$

1 : MI, the Code name of Multi-Inno TFT-LCM

2: The diagonal length of visible area, for example, 3.5 inch is 0350, 10.4 inch is 1040.

3: R: Series number.

4: T means TFT module designed and produced by Multi-Inno Company (without driving board)

16. Precautions for Use of LCD Modules

16.1 Handling Precautions

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

16.1.2. 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.

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

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

16.1.5. 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

16.1.6. Do not attempt to disassemble the LCD Module.

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

16.1.8. 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.

16.2 Storage precautions

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

16.2.2. 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°C ~ 40°C
Relatively humidity: ≤80%

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

16.3 Transportation Precautions

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