Product Specification

SPECIFICATION
FOR
APPROVAL

( ) Preliminary Specification
(●) Final Specification

Title	5.0” (480 x RGB x 800) TFT- LCD

BUYER	
MODEL	

SUPPLIER	LG Display Co., Ltd.
MODEL	LD050WV1
SUFFIX	SP01

SIGNATURE	DATE
/	
/	
/	

Please return 1 copy for your confirmation with your signature and comments.

APPROVED BY	DATE
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Products Engineering Dept.
LG Display Co., Ltd

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Record Of Revisions

Revision No	Revision Date	Page	Description	Note
0.1	Apr.30, 2010	-	First Draft	
0.2	May.7.2010	7	Pin map Drawing change	
		16	C0h/2nd: 10h→18h	
		17	C3h/5th: 07h→04h	
		27	Pin map Drawing change	
0.3	May.14.2010	7	Typing error is fixed. (Pin No 30→40)	
		17	C4h/5th: 00h→02h /6th: 6Ch→69h C6h/1st: 23h→24h	
0.4	June.03.2010	15~19	Change table 3-9-2 to table 3-9-6 .	
0.5	Aug.27.2010	5	Table1 Update	
		6	Table2 Update	
		12	Signal Timing Specifications update	
		15~18	Table 3-9-3 Update	
		20	Color chromaticity update	
		24~25	Mechanical drawing update	
		29	Package drawing update	
0.6	Oct. 05. 2010	15~19	Table 3-9-3 Update	
		26	Change Test item	
1.0	Nov. 15.2010	10~11	Serial Peripheral Interface Characteristics update	
		-	Final	

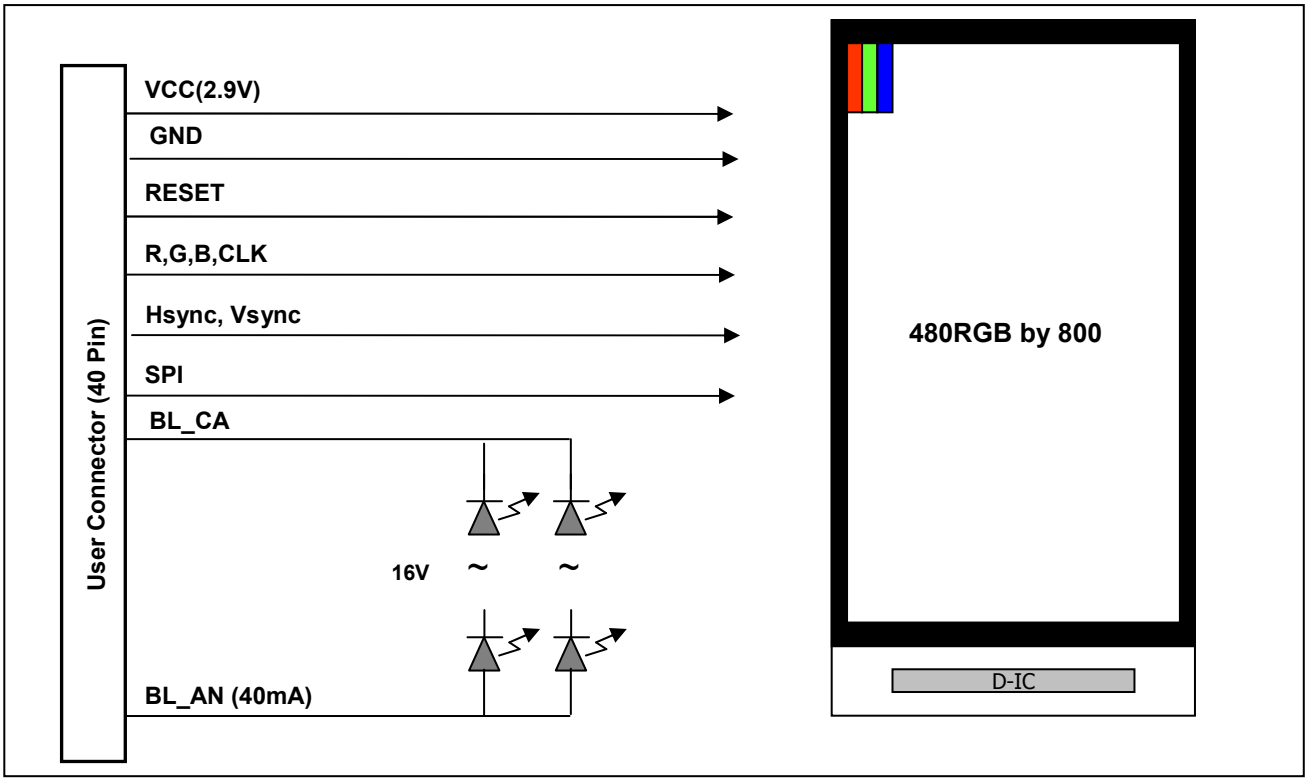
Product Specification

1. General Description

The LD050WV1 is a Color Active Matrix Liquid Crystal Display with an integral WHITE LED backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. This TFT-LCD has 5.0 inches diagonally measured active display area with WVGA resolution(480 horizontal by 800 vertical pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in horizontal stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16M colors.

The LD050WV1 has been designed to apply the interface method that enables low power, high speed, low EMI.

The LD050WV1 is intended to support applications where thin thickness, low power are critical factors.



General Features

Active Screen Size	5 inches diagonal
Outline Dimension	71.4(H) × 120.4(V) × 2.5(T) mm (Typ.)
Pixel Pitch	0.135 × 0.135 mm
Pixel Format	480 horiz. by 800 vert. Pixels RGB strip arrangement
Color Depth	8-bit, 16,777,216 colors
Luminance, White	500 cd/m^2(Typ.)
Signal Interface	SPI+RGB
Power Consumption	Total 0.756W(Typ.) Logic : 0.116W (Typ.@ Mosaic), B/L : 0.64W (Typ.)
Weight	43.6g(Typ.), 45g(Max.)
Display Operating Mode	Transmissive mode, normally black
Surface Treatment	Anti-glare
RoHS Compliance	Yes

2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Table 1. ABSOLUTE MAXIMUM RATINGS

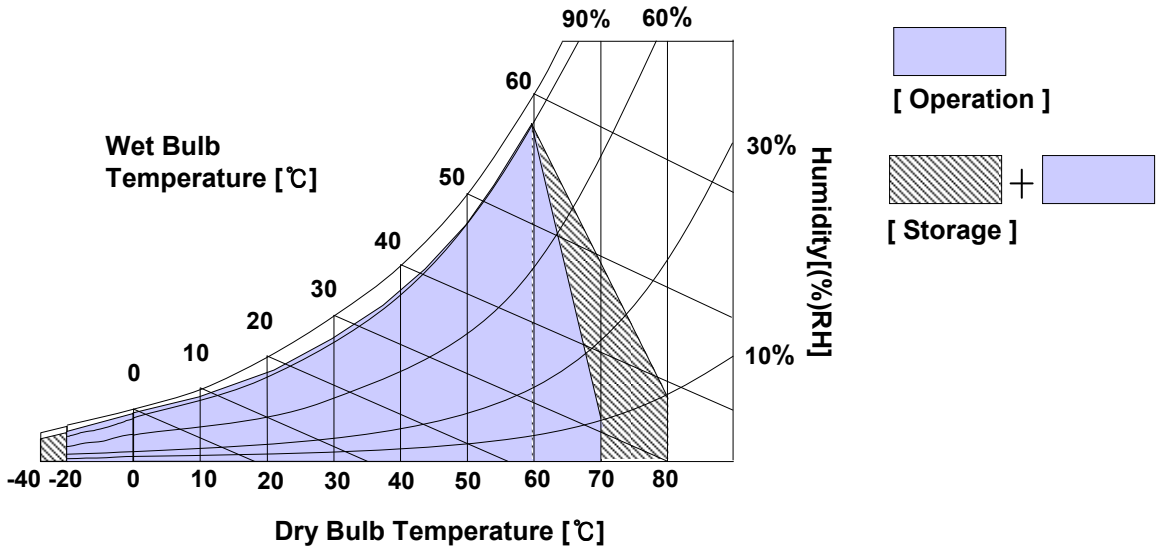
Parameter	Symbol	Values		Units	Notes
		Min	Max		
Power supply Voltage	VCC	-0.3	4.5	Vdc	at 25 ± 5°C
Logic Input Voltage	Vio	-0.3	4.5	Vdc	2-1
LED Forward current	If		20	mA	Per LED
LED Reverse Voltage	VR		5	V	Per LED
Storage Temperature	HST	-30	80	°C	
Operating Temperature	Top	-20	70	°C	2-2
Operating Ambient Humidity	HOP	10	90	%RH	2-3
Storage Humidity	HST	10	90	%RH	2-3

Notes :

2-1. I/O voltage: R[7:0],G[7:0],B[7:0], CLK, Hsync, Vsync, Reset, CS, SCL, SDI

2-2. The operating temperature means that LCD Module guarantees operation of the circuit.
All the contents of Electro-optical specifications are guaranteed under the room temperature condition.

2-3. Non-condensation. Maximum value is 90%RH at 60°C.



3. Electrical Specifications

3-1. Electrical Characteristics

The LD050WV1 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the LED, is typically generated by an LED-driver. The LED-driver is an external unit to the LCD.

Table 2. ELECTRICAL CHARACTERISTICS $(T_a = 25^\circ C)$

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	Notes
Module:						
power supply input voltage	VCC	2.8	2.9	3.0	V	3-1
Power supply input current	Icc	-	35	50	mA	3-2
Power Consumption	P_C	-	101.5	145	mW	
LED:						
LED Current	I_{LED}	-	40	-	mA	
LED Power Consumption	P_{LED}	-	640	-	mW	

Note)
3-1. The measuring position is the connector of LCM.
3-2. The specified Icc current and power consumption are under the VCC = 2.9V , 25℃, fv = 60Hz condition and Mosaic pattern(6x8).

3-2. Backlight Driving Condition

Parameter	Symbol	Value			Unit	Notes
		Min.	Typ.	Max.		
LED current	ILED	-	40	-	mA	
LED voltage	VLED	-	16	-	V	

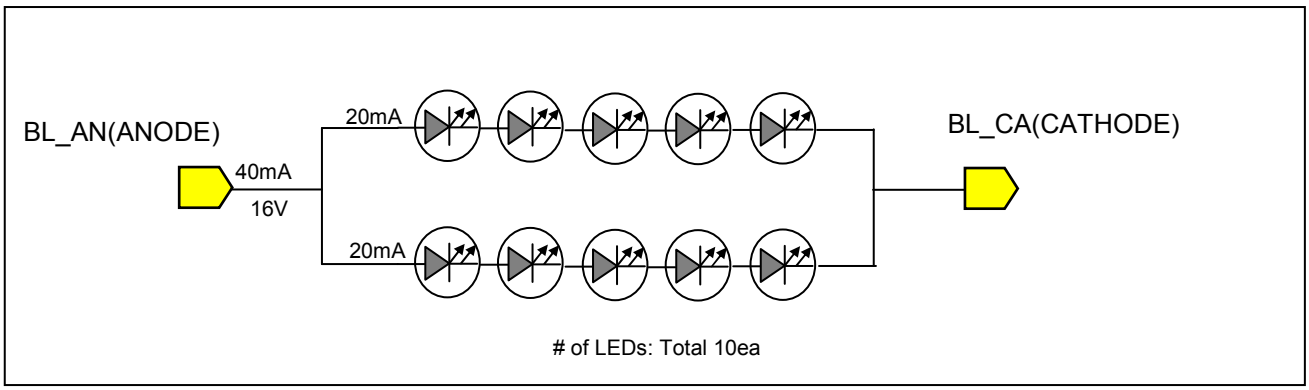


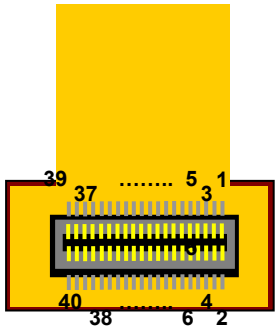
Fig 1. LED configuration

3-3. Interface Connections

This LCD employs one interface connection for the operation of module. The pin configuration is shown in the table below.

Table 3. MODULE PIN CONFIGURATION (FPC)

Pin	Symbol	Description	Remark
1	RESET	Be sure to execute a power-on reset after supplying power.	
2	PCLK	Clock	**[Connector]**
3	GND	Ground	**1. LCD: AX540124 manufactured by PANASONIC**
4	R0	RED DATA(LSB)	**2. Mating: AX640124 manufactured by PANASONIC or equivalent**
5	R1	RED DATA	
6	R2	RED DATA	
7	R3	RED DATA	
8	R4	RED DATA	
9	R5	RED DATA	**[Connector Pin Arrangement]**
10	R6	RED DATA	
11	R7	RED DATA(MSB)	
12	GND	Ground	
13	G0	GREEN DATA(LSB)	
14	G1	GREEN DATA	
15	G2	GREEN DATA	
16	G3	GREEN DATA	
17	G4	GREEN DATA	
18	G5	GREEN DATA	
19	G6	GREEN DATA	
20	G7	GREEN DATA(MSB)	
21	GND	Ground	
22	B0	BLUE DATA(LSB)	
23	B1	BLUE DATA	
24	B2	BLUE DATA	
25	B3	BLUE DATA	
26	B4	BLUE DATA	
27	B5	BLUE DATA	
28	B6	BLUE DATA	
29	B7	BLUE DATA(MSB)	
30	GND	Ground	
31	VSYNC	Vertical Sync	
32	VCC	LCD Power supply input	
33	VCC	LCD Power supply input	
34	BL_AN	Backlight Anode of all chains	
35	HSYNC	Horizontal Sync	
36	BL_CA	Backlight Cathode of all chains	
37	NC	No connection	
38	CS	Chip select	
39	SCL	Serial Clock line	
40	SDI	Serial Data Input	



3-4. RGB Signal Interface Characteristics

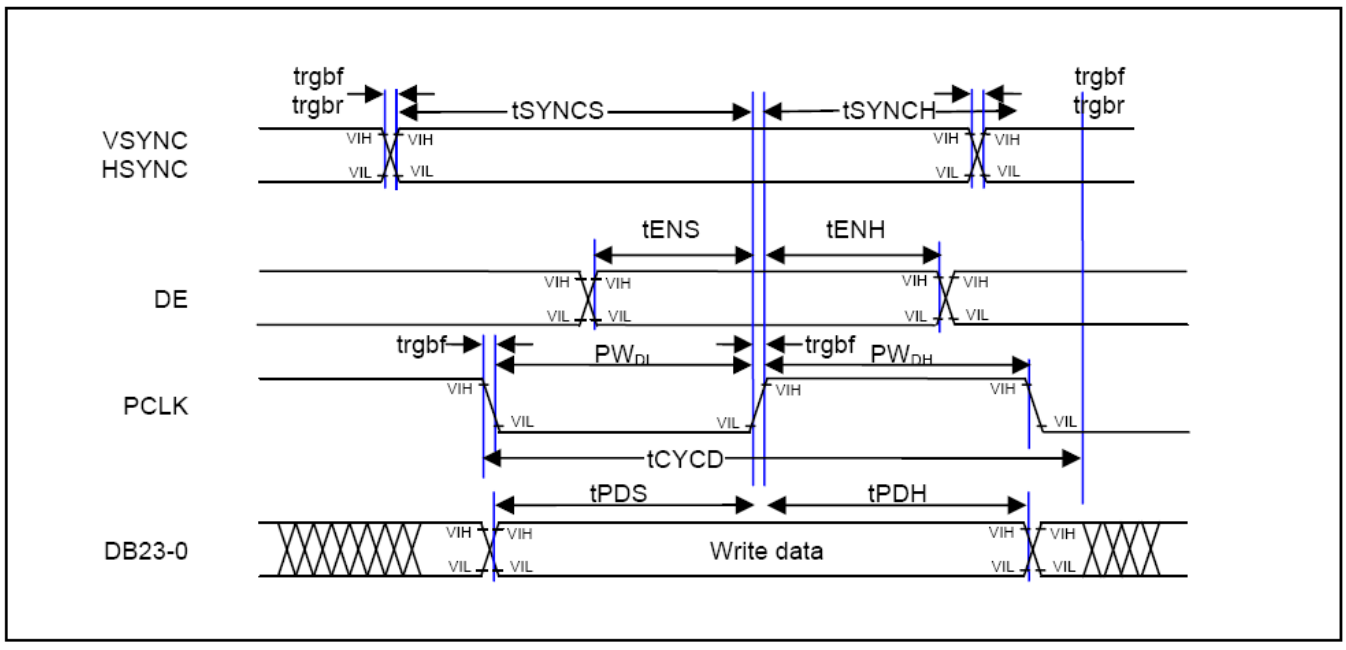
3-4-1. DC Specification

$(T_a = 25^{\circ}C)$

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Input high voltage	VIH	0.8*VCC		VCC	V	
Input low voltage	VIL	-0.3		0.2*VCC	V	

3-4-2. AC Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
VSYNC/HSYNC setup time	tSYNCS	5	-	-	ns	
VSYNC/HSYNC hold time	tSYNCH	5	-	-	ns	
DE setup time	tENS	5	-	-	ns	
DE hold time	tENH	5	-	-	ns	
PCLK " Low" level pulse width	PWDL	10	-	-	ns	
PCLK " High" level pulse width	PWDH	10	-	-	ns	
PCLK cycle time	tCYCD	20	-	-	ns	
Data setup time	tPDS	6	-	-	ns	
Data hold time	tPDH	6	-	-	ns	
PCLK,VSYNC,HSYNC,DE rise/fall time	trgbr, trgbr	-	-	13	ns	



3-5. Serial Peripheral Interface Characteristics

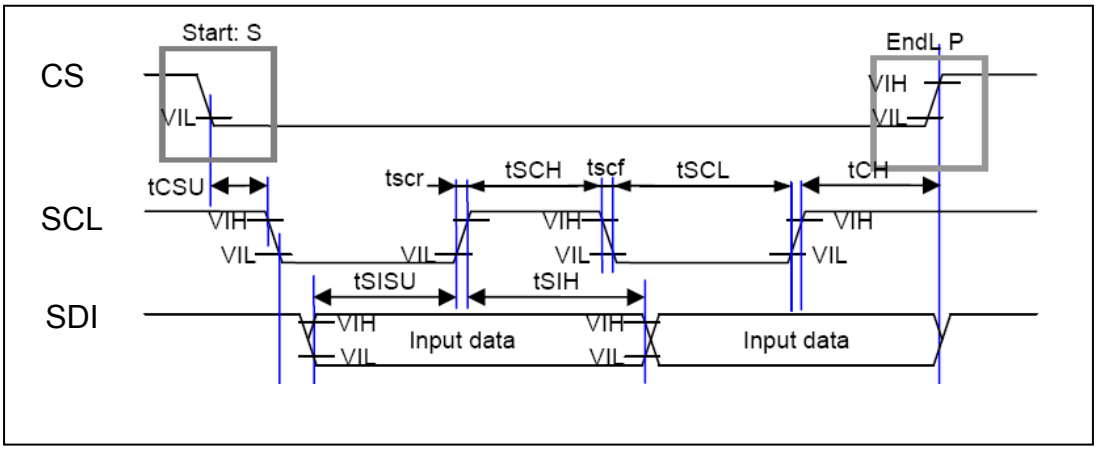
3-5-1. DC Specification

$(T_a = 25^{\circ}C)$

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Input high voltage	VIH	0.8*VCC		VCC	V	
Input low voltage	VIL	-0.3		0.2*VCC	V	

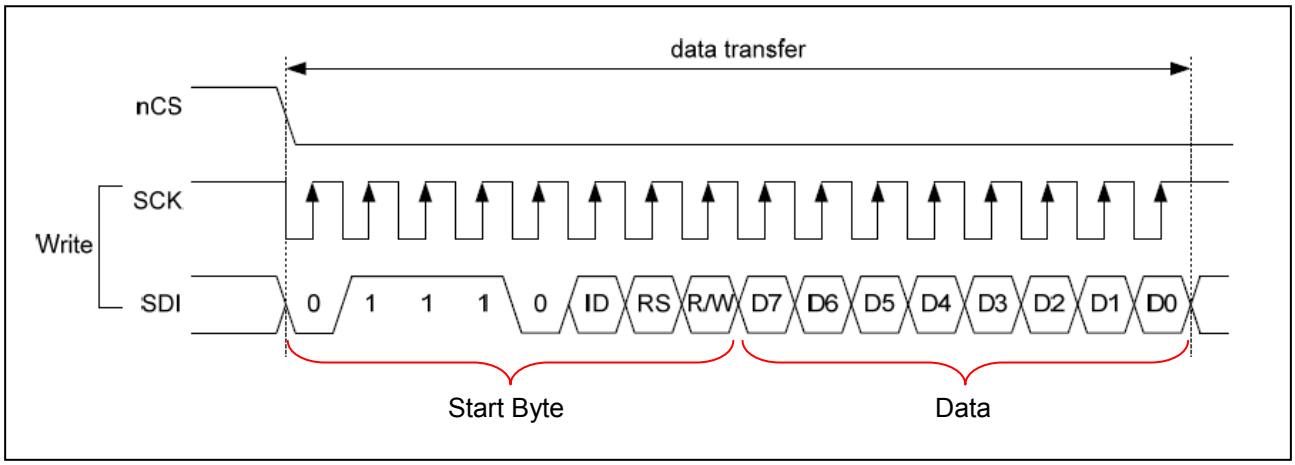
3-5-2. AC Specification

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
Serial clock cycle time	Write (received)	tSCYC	20	-	-	ns	
	Read (transmitted)		100	-	-	ns	
Serial clock "High" level pulse width	Write (received)	tSCH	10	-	-	ns	
	Read (transmitted)		50	-	-	ns	
Serial clock "Low" level pulse width	Write (received)	tSCL	10	-	-	ns	
	Read (transmitted)		50	-	-	ns	
Serial clock rise/fall time		tscr, tscf	-	-	20	ns	
Chip select setup time		tCSU	20	-	-	ns	
Chip select hold time		tCH	10	-	-	ns	
Serial input data setup time		tSISU	5	-	-	ns	
Serial input data hold time		tSIH	10	-	-	ns	
Serial output data setup time		tSOD	80	-	150	ns	
Serial output data hold time		tSOH	-	-	80	ns	



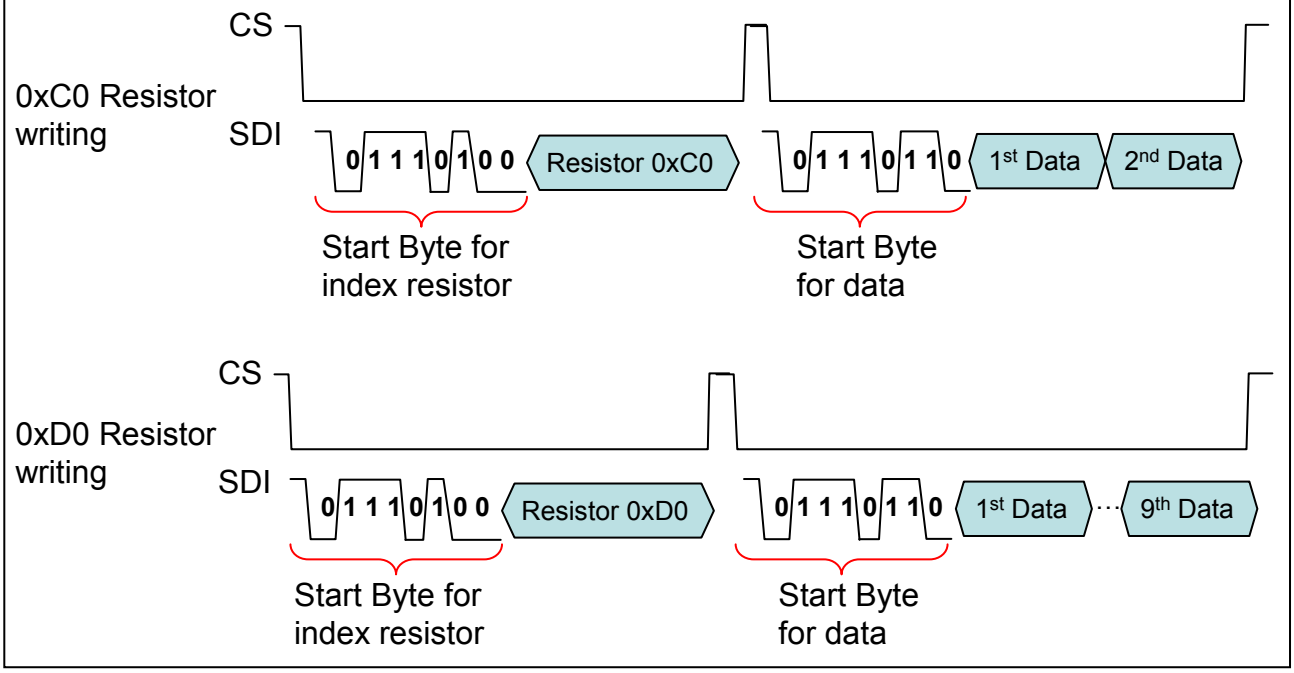
3-5-3. Structure of SPI signal

After receiving the start byte , D-IC start transferring or receiving data. D-IC executes data transfer form the MSB



ID	RS	R/W	Function
1	0	0	Set an index resistor
1	1	0	Write an instruction or RAM data

Example of SPI signal (0xC0, 0xD0 Writing)



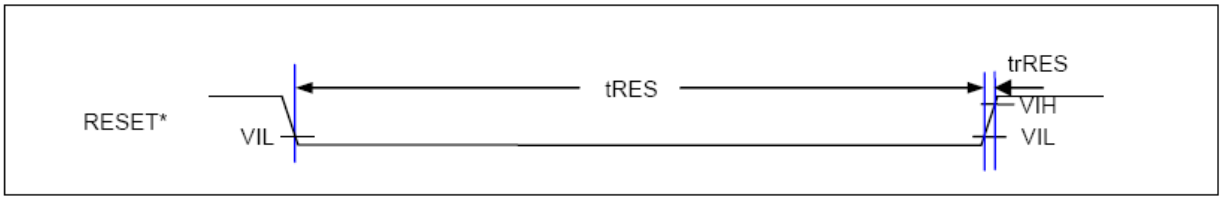
Note)

* In Serial interface operation (CS Low), RBG Data signal must be fixed at VCC or Ground level.

** SPI Signal must keep the Serial Peripheral Interface Characteristics

3-6. Reset Characteristics

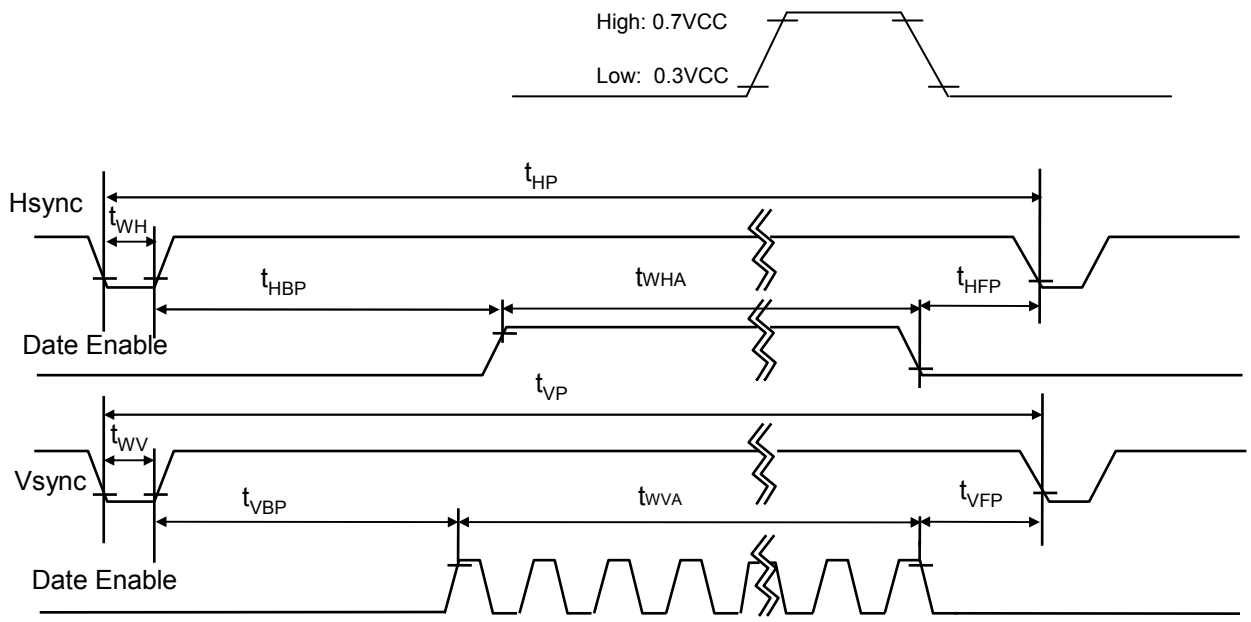
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Reset “ Low” level width	tRES	1	-	-	ms	
Reset rise time	trRES	-	-	10	us	



3-7. Signal Timing Specifications

This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications.

ITEM	Symbol		Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	f_{CLK}	26.7	31	36	MHz	
Hsync	Period	t_{HP}	500	624	-	tCLK	
	Width	t_{WH}	20	48	-		
	Width-Active	tw_{HA}	480	480	480		
Vsync	Period	t_{VP}	820	831	-	tHP	
	Width	t_{WV}	4	10	-		
	Width-Active	tw_{VA}	800	800	800		
Data Enable	Horizontal back porch	t_{HBP}	20	72	-	tCLK	
	Horizontal front porch	t_{HFP}	10	24	-		
	Vertical back porch	t_{VBP}	15	18	-	tHP	
	Vertical front porch	t_{VFP}	2	3	-		

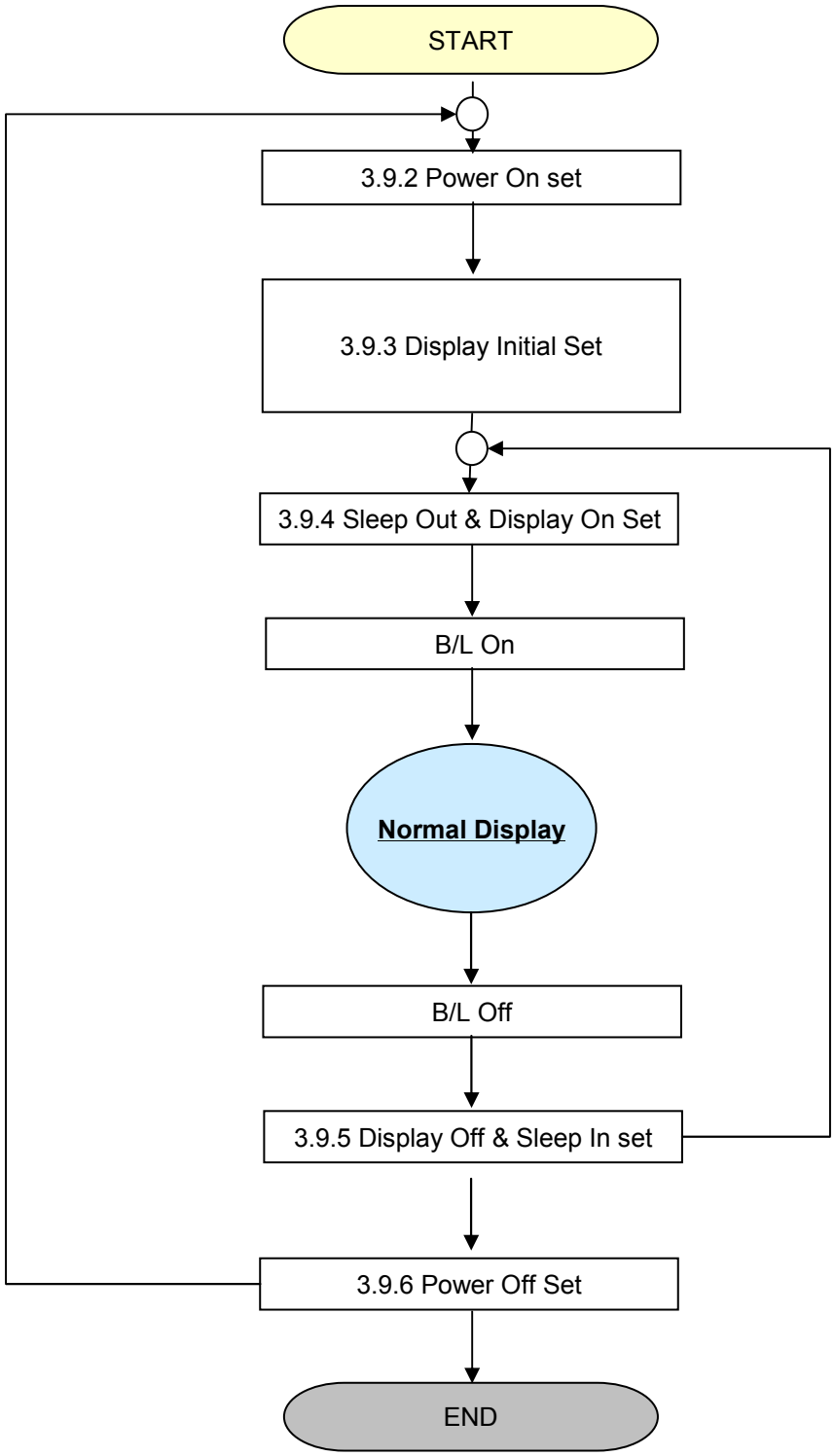


3-8. Color Input Data Reference

Colors & Gray Scale	Gray Scale Levels	Data Signal																							
		RED								GREEN								BLUE							
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	
Black	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Blue	--	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
Green	--	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Cyan	--	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Red	--	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Magenta	--	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
Yellow	--	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
White	--	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Black	R0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	R1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Darker	R2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
Brighter	R253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	R254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Red	R255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Black	G0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	G1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Darker	G2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
Brighter	G253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	
	G254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Green	G255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Black	B0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	B1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
Darker	B2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
Brighter	B253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	
	B254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	
Blue	B255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	

3-9. Resister Value

3-9-1. Operation Flow Chart



3-9-2. Power On Set

Step	Register Setting		Operation
	Register	Data	
1	Power (VCC) ON		
2	Delay 1ms or more		
	Reset		
3	Delay 10ms or more		

3-9-3. Display Initial Set

Step	Register Setting			Operation
	Register		Data	
1	C0	1st	01	
2		2nd	18	
3	Delay 10ms (Min.)			
4	20	1st	00	
5	36	1st	00	
6	3A	1st	70	
7	B1	1nd	12	
8		2rd	1F	
9		3th	1C	
10	B2	1st	20	
11		2nd	C8	
12	B3	1st	00	
13	B4	1st	04	
14	B5	1st	12	
15		2nd	0F	
16		3rd	0F	
17		4th	00	
18		5th	00	
19	B6	1st	03	
20		2nd	18	
21		3rd	02	
22		4th	40	
23		5th	10	
24		6th	33	

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Step	Register Setting			Operation
	Register		Data	
25	Delay 10ms(Min.)			
26	C3	1st	07	
27		2nd	05	
28		3rd	04	
29		4th	04	
30		5th	03	
31	C4	1st	12	
32		2nd	34	
33		3rd	13	
34		4th	13	
35		5th	00	
36		6tf	0C	
37	Delay 10ms(Min.)			
38	C5	1st	76	
39	Delay 10ms(Min.)			
40	C6	1st	23	
41		2nd	50	
42		3rd	00	
43	Delay 10ms(Min.)			
44	C7	1st	00	
45		2nd	FF	

Step	Register Setting			Operation
	Register		Data	
53	D0	1st	00	
54		2nd	04	
55		3rd	57	
56		4th	02	
57		5th	00	
58		6th	00	
59		7th	02	
60		8th	00	
61		9th	03	
62	D2	1st	00	
63		2nd	04	
64		3rd	57	
65		4th	02	
66		5th	00	
67		6th	00	
68		7th	02	
69		8th	00	
70		9th	03	
71	D4	1st	00	
72		2nd	04	
73		3rd	57	
74		4th	02	
75		5th	00	
76		6th	00	
77		7th	02	
78		8th	00	
79		9th	03	
80	D1	1st	00	
81		2nd	04	
82		3rd	57	
83		4th	02	
84		5th	00	

Step	Register Setting			Operation
	Register		Data	
85		6th	00	
86		7th	00	
87		8th	00	
89		9th	03	
90		1st	00	
91		2nd	04	
92		3rd	57	
93		4th	02	
94	D3	5th	00	
95		6th	00	
96		7th	00	
97		8th	00	
98		9th	03	
99		1st	00	
100		2nd	04	
101		3rd	57	
102		4th	02	
103	D5	5th	00	
104		6th	00	
105		7th	00	
106		8th	00	
107		9th	03	

3-9-4. Sleep Out & Display On Set

Step	Register Setting		Operation
	Register	Data	
1	11	00	Sleep out
2	Delay 100ms		
4	29	00	Display On

3-9-5. Display Off & Sleep In Set

Step	Register Setting		Operation
	Register	Data	
1	10	00	Sleep In
2	28	00	Display Off

3-9-6. Power Off Set

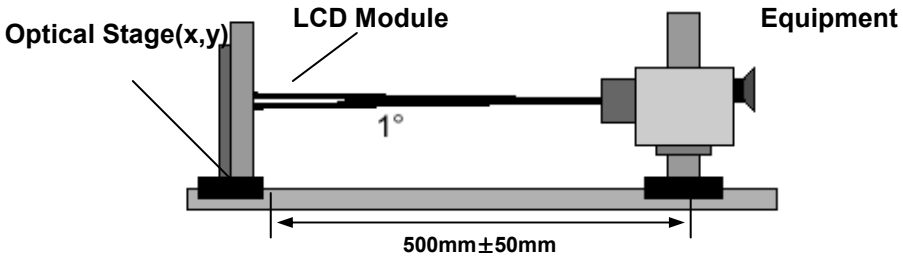
Step	Register Setting		Operation
	Register	Data	
1	Delay 100ms		
2	Power (VCC) OFF		

4. Optical Characteristics

4-1. TFT LCD Module

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 20 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and Θ equal to 0°.
FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 2 Optical Characteristic Measurement Equipment and Method



Ta=25°C, VCC=2.9V, fv=60Hz, Dclk= 31MHz, Iled=40mA

PARAMETER		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Notes
Luminance		Y	I_{led}=40mA	400	500		cd/m^2	4-1
Contrast Ratio		CR	Optimal	500	700	-	-	4-2
Viewing Angle X axis, right(ϕ=0°) X axis, left(ϕ=180°) Y axis, up(ϕ=90°) Y axis, down(ϕ=270°)		θr	CR ≥ 10	75	85	-	Degrees	4-3
		θl		75	85	-		
		θu		75	85	-		
		θd		75	85	-		
Response Time	**Rising**	Tr	Tr=TrR+TrF	-	30	40	msec	4-4
	Falling							
Color Chromaticity (CIE 1931)		Wx	Center	0.270	0.310	0.350	-	
		Wy	Center	0.290	0.330	0.370		
		Rx	Center	0.550	0.590	0.630		
		Ry	Center	0.315	0.355	0.395		
		Gx	Center	0.285	0.325	0.365		
		Gy	Center	0.530	0.570	0.610		
		Bx	Center	0.115	0.155	0.195		
		By	Center	0.080	0.120	0.160		
Luminance Uniformity		δ WHITE	I_{led} =40mA	-	1.25	1.40	-	4-5

Note.

4-1. Surface luminance is the average of 5 point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 2.

LWH = Average(L1,L2, … L5)

4-2. Contrast Ratio(CR) is defined mathematically as

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

4-3. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

4-4. Response time is the time required for the display to transition from white to black (rise time, TrR) and from black to white (Decay Time, TrD). For additional information see FIG 4

4-5. The variation in surface luminance , The panel total variation (δ WHITE) is determined by measuring LN at each test position 1 through 13 and then defined as following numerical formula. For more information see FIG 5.

$$\delta \text{WHITE} = \frac{\text{Maximum}(L1,L2, \ldots L13) - \text{Minimum}(L1,L2, \ldots L13)}{\text{Maximum}(L1,L2, \ldots L13)} * 100(\%)$$

FIG. 3 Viewing angle

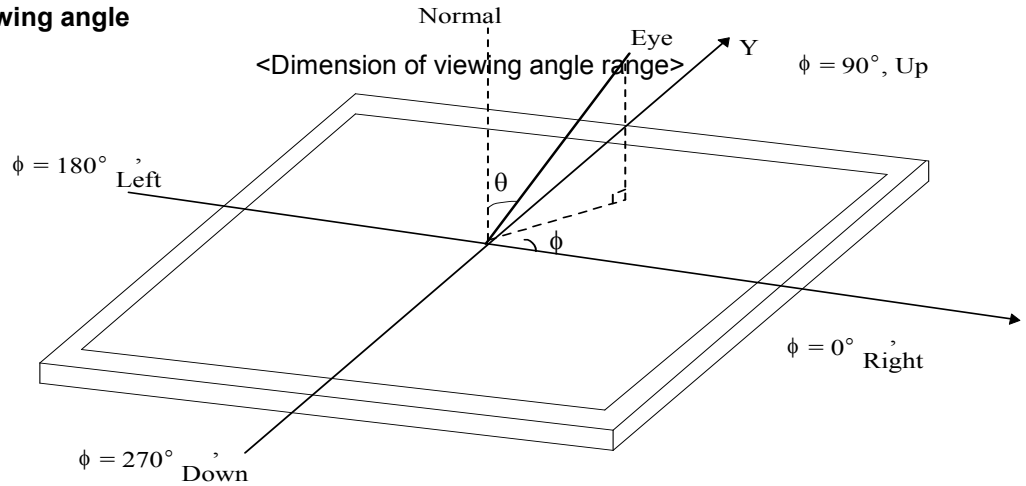


FIG. 4 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

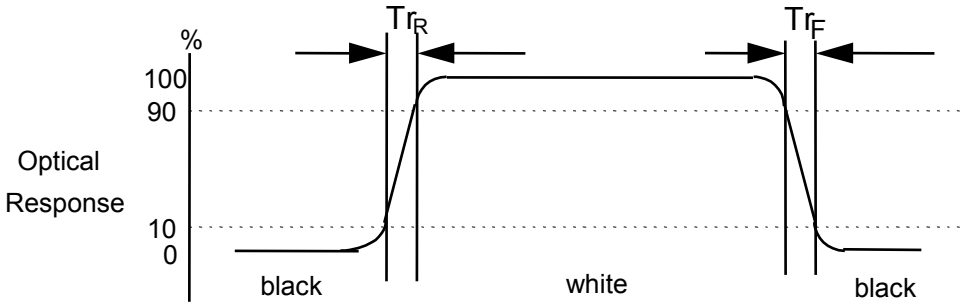
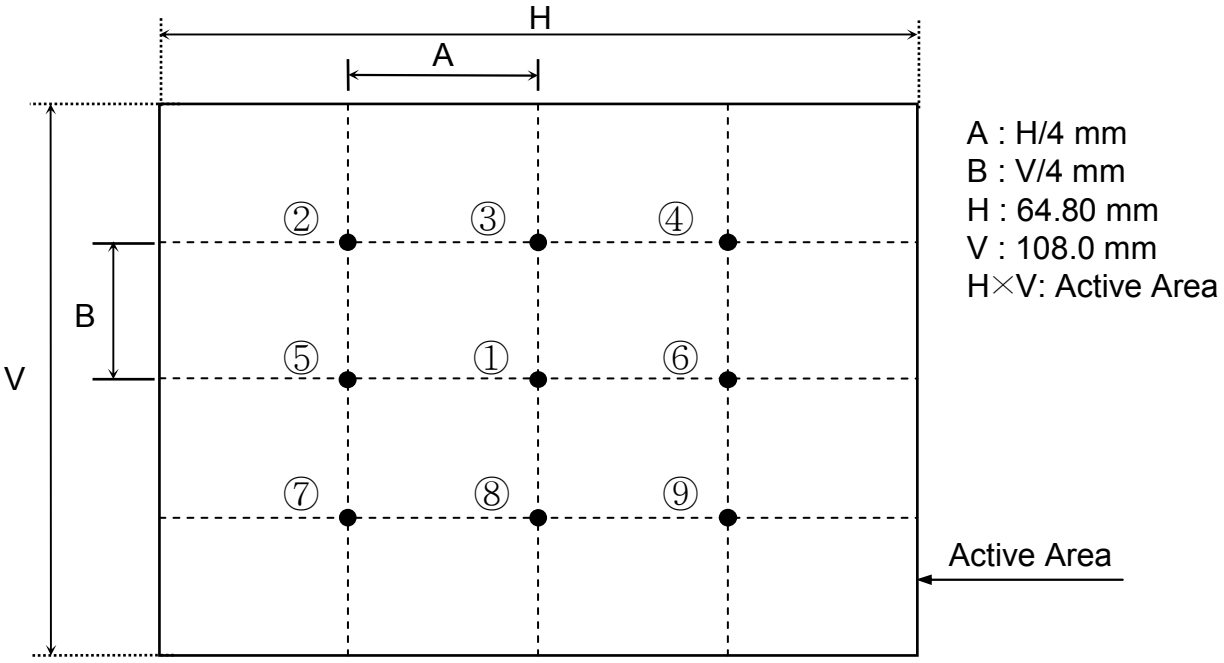


FIG. 5 Luminance uniformity



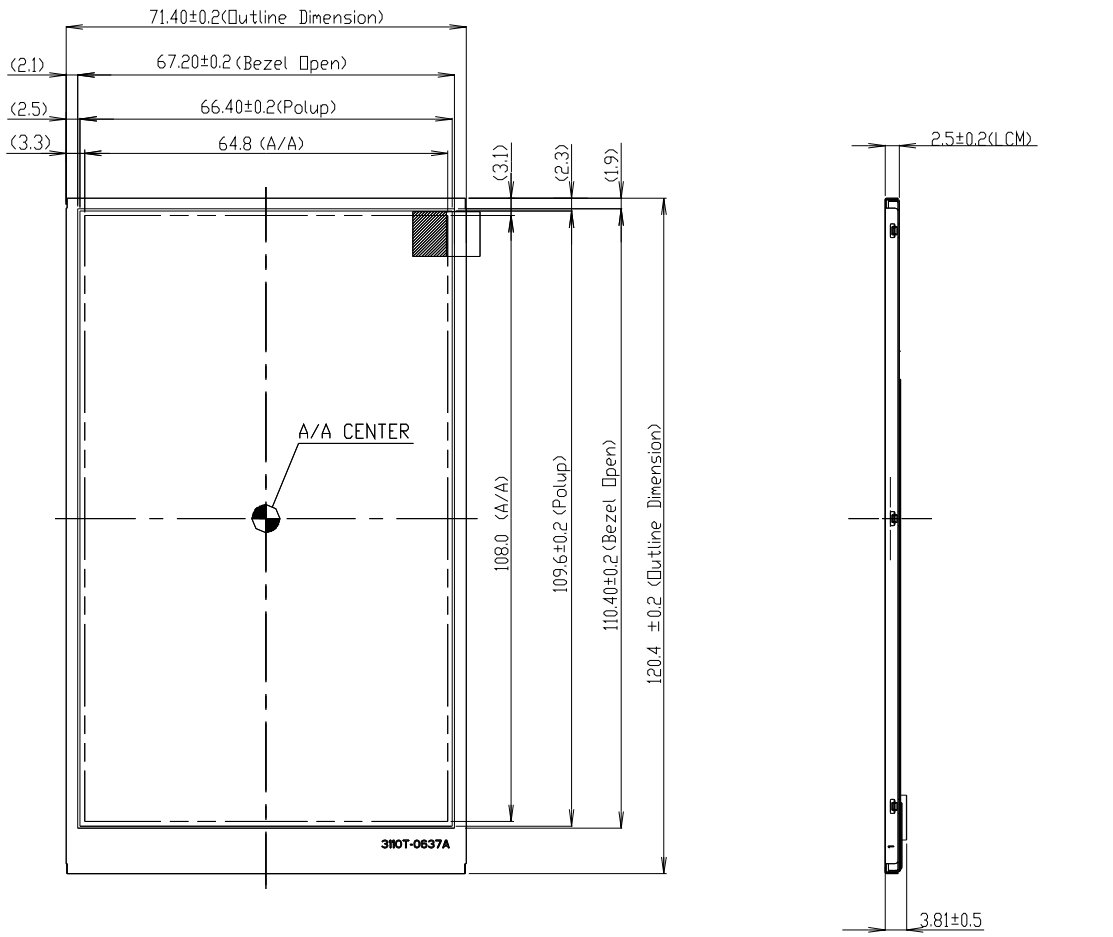
5. Mechanical Characteristics

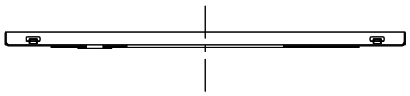
The contents provide general mechanical characteristics for the model LD050WV1. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Parameter	Specification		Unit	Notes
Outline Dimension	Horizontal	71.4	mm	
	Vertical	120.4	mm	
	Depth	2.5	mm	
Active Display Area	Horizontal	64.8	mm	
	Vertical	108.0	mm	
Weight	43.6(Typ), 45(Max)		g	
Surface Treatment	Anti-Glare Treatment		-	

<FRONT VIEW>

Note) Unit:[mm], General tolerance: ± 0.2mm





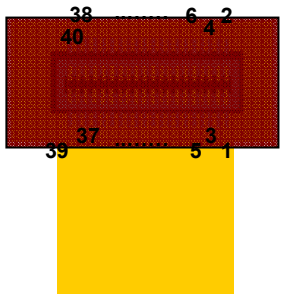
Note

1. Unspecified dimensional tolerances : 0.3mm

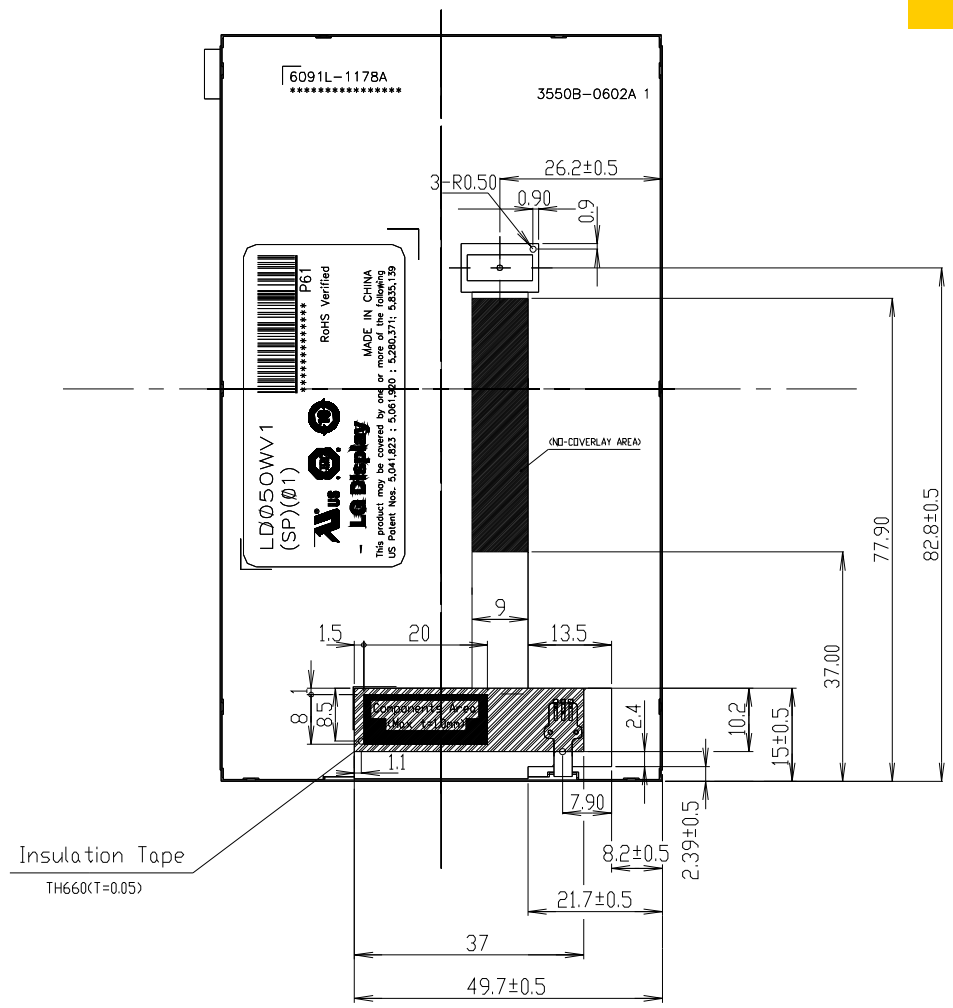
Product Specification

<REAR VIEW>

Note) Unit:[mm], General tolerance: ± 0.3mm



CNT: Bottom side



6. Reliability

Environment test condition

NO	TEST ITEMS	CONDITION	Notes
1	High Temperature Storage Test	Ta = 80℃ 240h	6-1,2
2	Low Temperature Storage Test	Ta = -30℃ 240h	6-1,2
3	High Temperature Operation Test	Ta = 70℃ 240h	6-1,2
4	Low Temperature Operation Test	Ta = -20℃ 240h	6-1,2
5	High Temperature and High Humidity Operation Test	Ta = 60℃ 90%RH 240h	6-1,2
6	Packing Vibration	Random 1.5Grms Z direction 60min	-
7	Thermal Shock Test	-30℃(0.5h) ~ 80℃(0.5h) / 100 cycles	6-1,2
8	Shock Test (non-operating)	Half sine wave, 180G, 2ms 1 times shock of each six faces	-
9	Vibration Test (non-operating)	Random vibration, 3 ~ 100Hz, 1.0Grms, 3 axis, 0.5hour/axis	-
10	Electro Static Discharge Test	- Panel Surface / Top Case: 150pF, 150Ω (Air : ±15kV , Contact : ±15kV) - FPC input terminal : 100pF ±200V 0Ω	6-3

[Note 6-1]
T_a= Ambient Temperature
In the standard condition, there shall be no practical problems that may affect the display function.

[Note 6-2] Result Evaluation Criteria
TFT-LCD panel should be at room temperature for 48 hours when the display quality test is over.
There should be no particular change which might affect the practical display function.

[Note 6-3] Result Evaluation Criteria: Level A or B ➔ OK, Level C or D ➔ NG

■ Description of Level
- Level "A" : Normal display
- Level "B" : Abnormal dsiplay temporarily, but recovers within 3 seconds
- Level "C" : Abnormal display, but recovers after quite long time or after On/Off
- Level "D" : Abnormal display, never recovers

■ Description of Abnormal display
- Blinking, Noise, Block Dim, Line defect, etc.

7. International Standards

7-1. Safety

a) UL 60950-1, Second Edition, Underwriters Laboratories Inc.
Information Technology Equipment - Safety - Part 1 : General Requirements.

b) CAN/CSA C22.2 No.60950-1-07, Second Edition, Canadian Standards Association.
Information Technology Equipment - Safety - Part 1 : General Requirements.

c) EN 60950-1 :2006 + A11:2009, European Committee for Electrotechnical Standardization (CENELEC).
Information Technology Equipment - Safety - Part 1 : General Requirements.

7-2. Environment

a) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

7-3. EMC

a) ANSI C63.4 “American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.” American National Standards Institute (ANSI), 2003.
b) CISPR 22 “Information technology equipment – Radio disturbance characteristics – Limit and methods of measurement." International Special Committee on Radio Interference (CISPR), 2005.
c) CISPR 13 “Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and method of measurement." International Special Committee on Radio Interference (CISPR), 2006.

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M

A,B,C : SIZE(INCH)
D : YEAR
E : MONTH
F ~ M : SERIAL NO.

Note

1. YEAR

Year	2001 2011	2002 2012	2003 2013	2004 2014	2005 2015	2006 2016	2007 2017	2008 2018	2009 2019	2010 2020
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

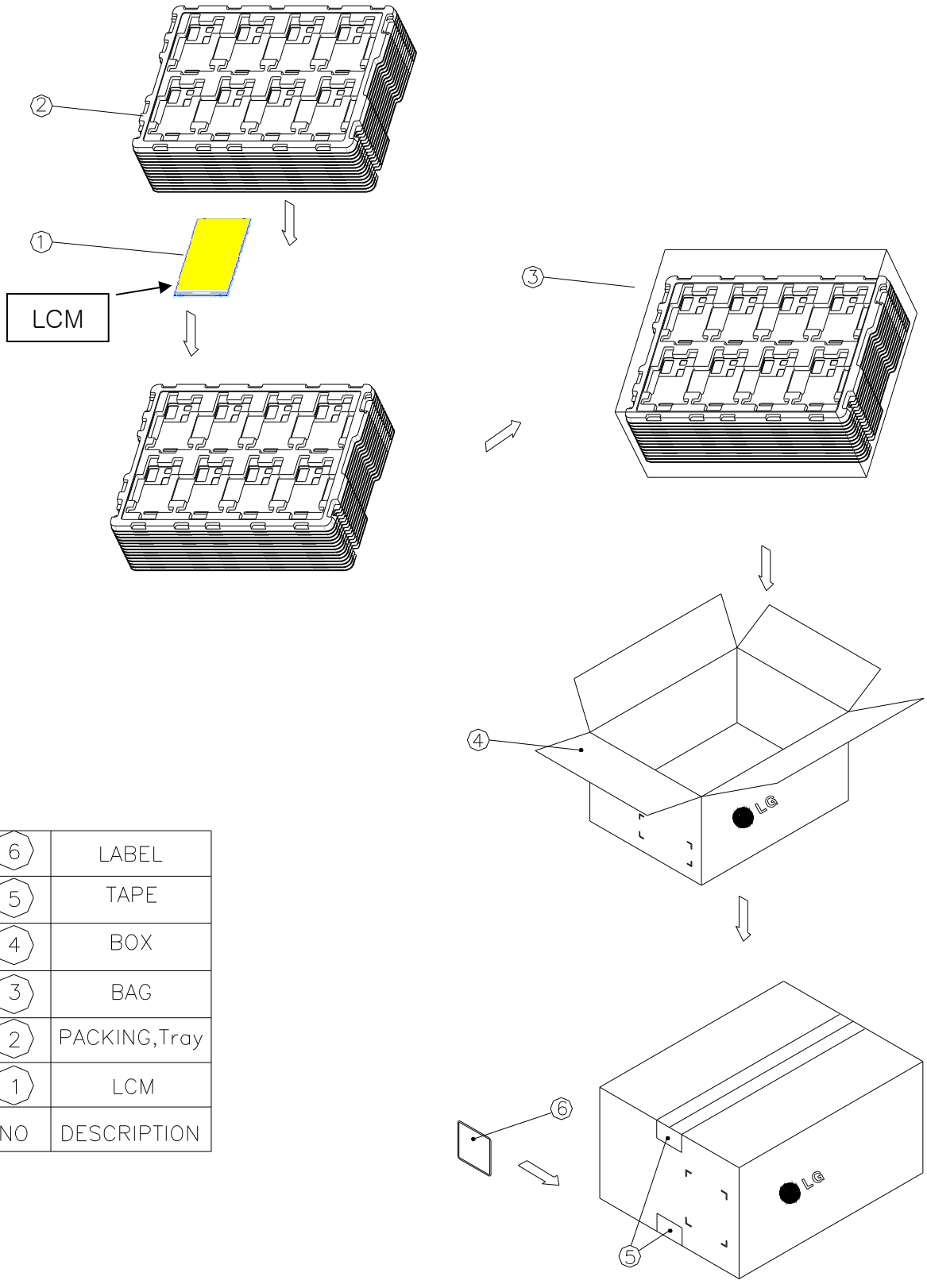
b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one box : 112 pcs
b) Box Size : 478 X 365 X 162 (mm)

8-3. Method of Package



NO	DESCRIPTION
6	LABEL
5	TAPE
4	BOX
3	BAG
2	PACKING,Tray
1	LCM

9. Precautions

Please pay attention to the following when you use this TFT LCD module.

9-1. Mounting Precautions

(1) You should consider the mounting structure so that uneven force(ex. Twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
(2) Please attach a transparent protective plate to the surface in order to protect the polarizer.
Transparent protective plate should have sufficient strength in order to the resist external force.
(3) You should adopt radiation structure to satisfy the temperature specification.
(4) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(5) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics deteriorate the polarizer.)
(6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
(7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(8) The metal case of a module should be contacted to electrical ground of your system.

9-2. Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=±200mV(Over and under shoot voltage)
(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.
(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. Handling Precautions for Protection Film

(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.
Please carefully peel off the protection film without rubbing it against the polarizer.
(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.