LG Display

Product Specification

SPECIFICATION
FOR
APPROVAL

( ) **Preliminary Specification**
(●) **Final Specification**

Title	2.2inch (240 × RGB × 320) TFT-LCD

BUYER	
MODEL	

SUPPLIER	LG Display Co., Ltd.
MODEL	LH220Q13
SUFFIX	SD01

SIGNATURE	DATE
/	
/	
/	

APPROVED BY	DATE
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Product Specification

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RECORD OF REVISIONS

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1. General Description

The LH220Q13-SD01 is a Color Active Matrix Liquid Crystal Display with Light Emission Diode(LED) backlight system. The matrix employs poly-Si Thin Film Transistor as the active element.
It is transmissive type display operating in the normally black mode. This TFT-LCD has 2.2inch diagonally measured active display area with qVGA(240×RGBx320) resolution. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes.

1.1 Block Diagram
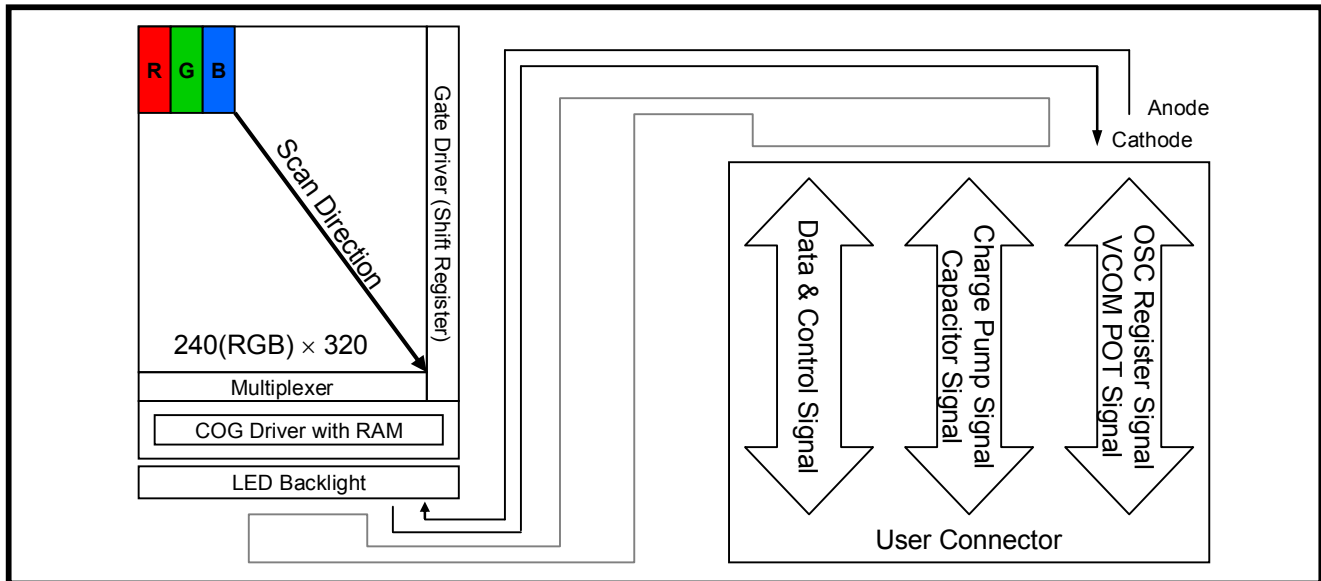
Fig 1.1. Block Diagram

1.2 General Features

Active screen size	2.2inches (55.88mm) diagonal
Outline Dimension	40.5(H) × 69.7(V) × 1.7(D) mm (Typ.)
Pixel Pitch	0.047(H) × 0.141(V) mm
Pixel format	240(H) × 320(V) (RGB Stripe)
Color depth	18-bits (6R, 6G, 6B used)
Interface	8-bit/16-bit selectable CPU bus
Color Gamut	63% (Typ.), only Color Filter
Brightness	450 cd/㎡ (Typ. With LED 5ea – each 20mA)
Contrast Ratio	350:1 (Typ.)
Viewing Angle	85/85/85/85 deg (U/D/L/R @ CR>10)
Response Time	25 msec (Tr + Tf)
Weight	6.65g (Typ.)
Surface treatment	Hard coating (2H)
LCD Driver	S6D1121 (Source, Power)

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### 2. Absolute Maximum Ratings

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

Table 2.1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Values		Units	Notes
		Min.	**Max**		
Power Supply for Interface(I/O)	V_{DDIO}	-0.3	4.0	V	
Power Supply for Analog	V_{CC}	-0.3	4.0	V	
LED Power Consumption	P_{ED}	-	120	mW	1
LED Current	I_{LED}	-	30	mA	1
Operating Temperature	T_{OP}	-20	70	°C	2
Storage Temperature	T_{STG}	-30	80	°C	3
Humidity	H	5	90	RH	2

Notes:
 1. Applies for each LED individually
 2. Temp. ≤ 60℃ , 90% RH MAX. 96hr, Non-condensation
 3. Absolute humidity shall be less than 80% RH at 70℃, 24hr
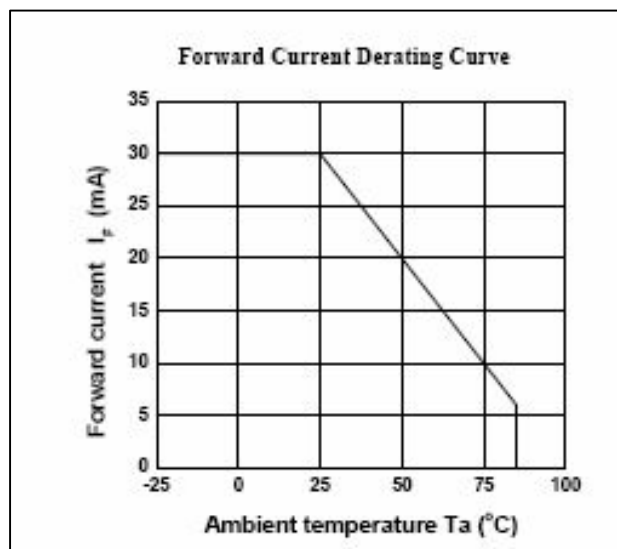
Fig 2.1. Ambient Temperature vs. Allowable Forward Current

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3. Electrical Specifications

3-1. Electrical Characteristics

Table 3.1. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Units	Notes
		Min	Typ.	Max		
I/O Supply Voltage	$V_{DDIO} - V_{ss}$	1.65	2.8	3.3	V	2
Analog Supply Voltage	$V_{CC} - V_{ss}$	2.5	2.8	3.3	V	-
Input Current	$I_{DDIO} + I_{CC}$	-	6	8	mA	1
Power Supply Input Current	I_{LED}	-	20	-	mA	-
"H"Level Input Voltage	V_{IH}	$0.7V_{CC1}$	-	-	V	-
"L"Level Input Voltage	V_{IL}	-	-	$0.3 V_{CC1}$	V	2
"H"Level Output Voltage	V_{OH}	$0.8V_{CC1}$	-	-	V	3
"L"Level Output Voltage	V_{OL}	-	-	$0.2 V_{CC1}$	V	3
Power Consumption, Panel	P_{LCD}	-	18	-	mW	1
Power Consumption, Backlight	P_B	-	-	370	mW	4
Power Consumption, Standby	P_S	-	-	30	uW	5
In-Rush current	$I_{RUSH\ CC}$	-	-	200	mA	-

Notes:
1. The specified current and power consumption are under the conditions at VDDIO = 2.8V, VCC = 2.8V, T=25°C, and fv=70Hz, white pattern is displayed and fv is the frame frequency
2. Input mode of D0~D15, RD, WR, ADS, CS, RESET
3. Output mode of D0~D15, ID, VSYNCO, IF1, IF2
4. LED Backlight assumptions : 3.3Vf, 20mA, 5LED's
5. VDDIO & VCC are present ; RD, WR, ADS, CS are high; 2.0V applied to 5 LED's in parallel

3-2. Back Light Unit of LCD

The edge-lighting type of back light unit consists of 5 LEDs which is connected in parallel.

Table 3.2. LED Forward Electrical CHARACTERISTICS

Items	Symbol	Unit	Min	Typ	Max	Remark
I_VBAT	ILED (IF)	mA	-	20	30	Forward Current
V_VBAT	VBAT (VF)	V	2.7	3.2	3.7	Forward Voltage

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3-3. LED

3.3.1 Maker : Seoul Semi-Conductor Co., Ltd
3.3.2 Part number : SWAA07
3.3.3 Rank : J8 / f
3.3.4 Size : 3.8mm(L)×1.05mm(W)×0.6mm(H)
3.3.5 Quantity : 5 EA(Parallel)
3.3.6 Absolute Maximum Ratings: The following are maximum values which, if exceeded, may cause faulty operation or damage to the LED

Table 3.3 Absolute Maximum Ratings of LED

Parameter	Symbol	Values	Units	Notes
Power Dissipation	P_d	120	mV	1
Forward Current	I_F	30	mA	
Peak Forward Current	I_{FM}	100	mW	2
Reverse Voltage	V_R	5	mA	
Operating Temperature	T_{OP}	-30~+85	°C	
Storage Temperature	T_{ST}	-40~+100	°C	
Junction Temperature	T_j	125	°C	

Notes:
1. Care is to be taken that Power Dissipation does not exceed the Absolute Maximum Ration of the product.
2. I_{FM} conditions : Pulse width $T_W \leq 0.1ms$, Duty ratio $\leq 1/10$

**Table 3.4 Electro-Optical Characteristics of LED**

Parameter	Symbol	Condition	Min	Typ	Max	Units	Notes
Forward Voltage	V_F	I_F=20mA	2.7	3.2	3.7	V	
Reverse Current	I_R	V_R=5V	-	-	50	μA	
Luminous Intensiyt(J8)	I_V	I_F=20mA	1,800	-	1,900	mcd	1

Notes:
1. The luminous intensity I_V is measured at the peak of the spatial pattern which may not be aligned with the mechanical axis of the LED package. Luminous Intensity Measurement allowance is ±10%.

Table 3.5 Color rank of LED

CIE 1931(I_F=20mA, Ta=25℃)					
		Min	Typ	Max
F	X	0.307	-	0.330
	Y	0.294	-	0.339
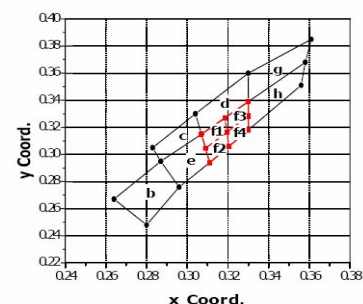
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3. Electrical Specifications

3-4. Interface Connections

The pin connections are provided in Table 3.3. The mating connector for the flex tail is IRISO IMSA-9671S-35Y902 or equivalent.

Table 3.6. PIN DESCRIPTION

Pin	SYMBOL	I/O	Description	Comment
1	VCC	I	Analog Supply Voltage	-
2	VDDIO	I	I/O Supply Voltage	-
3	GND	-	GROUND	-
4	MAKER_ID	O	Vendor select input	Connected to VDDIO
5	D0	I/O	Data Bus(LSB)	S6D1121(D1)
6	D1	I/O	Data Bus	S6D1121(D2)
7	D2	I/O	Data Bus	S6D1121(D3)
8	D3	I/O	Data Bus	S6D1121(D4)
9	D4	I/O	Data Bus	S6D1121(D5)
10	D5	I/O	Data Bus	S6D1121(D6)
11	D6	I/O	Data Bus	S6D1121(D7)
12	D7	I/O	Data Bus	S6D1121(D8)
13	D8	I/O	Data Bus	S6D1121(D10)
14	D9	I/O	Data Bus	S6D1121(D11)
15	D10	I/O	Data Bus	S6D1121(D12)
16	D11	I/O	Data Bus	S6D1121(D13)
17	D12	I/O	Data Bus	S6D1121(D14)
18	D13	I/O	Data Bus	S6D1121(D15)
19	D14	I/O	Data Bus	S6D1121(D16)
20	D15	I/O	Data Bus(MSB)	S6D1121(D17)
21	GND	-	GROUND	-
22	RESET	I	Reset signal input	-
23	WR	I	Write control input	-
24	RD	I	Read control input	-
25	CS	I	Chip select input	-
26	RS	I	Resister select input	-
27	IF1	I	Interface Mode select input	Note 1,2
28	GND	-	GND	-
29	VSYNCO	O	VSYNC out	Indicates start of frame
30	LED_C5	-	LED Cathode	-
31	LED_C4	-	LED Cathode	-
32	LED_C3	-	LED Cathode	-
33	LED_C2	-	LED Cathode	-
34	LED_C1	-	LED Cathode	-
35	LED_A	-	LED Anode	-

Notes: 1. IF1=L then 16bit interface   2. IF1=H, then 8 bit interface

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3. Electrical Specifications

3-5. Interface Timing

Table 3.7. Register Selection(68-/80-system 8/16bit Parallel Interface)

SYSTEM	RW_WRB	E_RDB	RS	Operations
68	0	1	0	Write index to IR
	1	1	0	Read internal status (Current Gate Line Status)
	0	1	1	Write to control register and GRAM through WDR
	1	1	1	Read from GRAM and control register through RDR
80	0	1	0	Write index to IR
	1	0	0	Read internal status (Current Gate Line Status)
	0	1	1	Write to control register and GRAM through WDR
	1	0	1	Read from GRAM and control register through RDR

(a) 16-bit Interface Mode
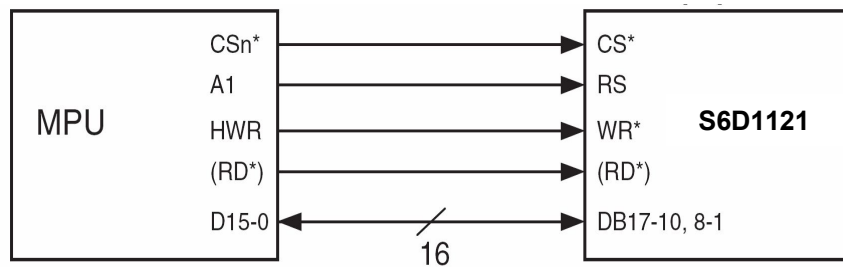
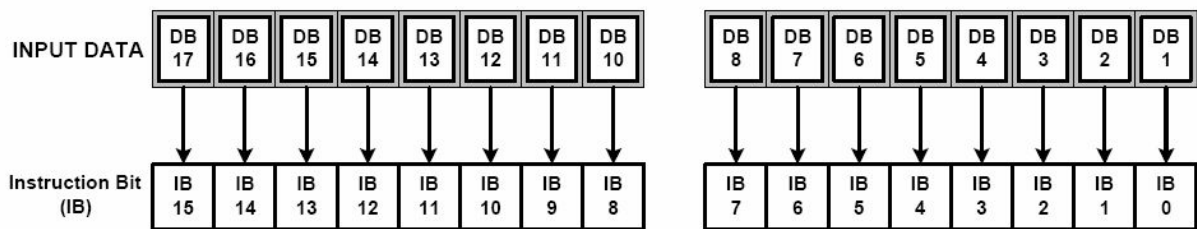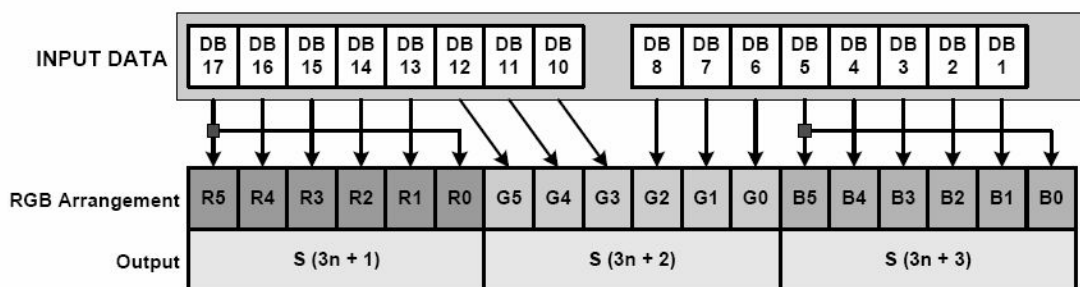**Fig 3.1. 16-bit Interface with Microcomputer**

Fig 3.2. 16-bit Interface Instruction Data Format

Note: n= lower 8 bits of address (0 to 239)

Fig 3.3. 16-bit Interface Graphic Data Format(TRI=0, DFM=0)

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3-5. Interface Timing
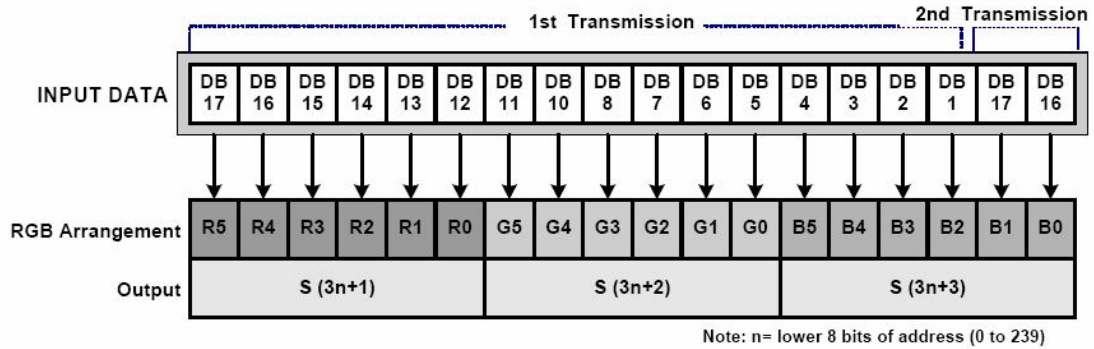
(a) 16-bit Interface Mode(continued)

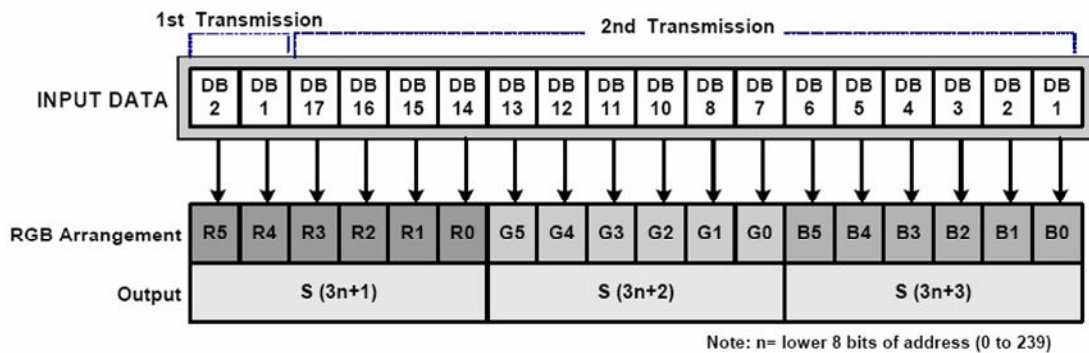**Fig 3.4. 16-bit Interface Graphic Data Format(TRI=1, DFM=0)**

Fig 3.5. 16-bit Interface Graphic Data Format(TRI=1, DFM=1)

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3. Electrical Specifications
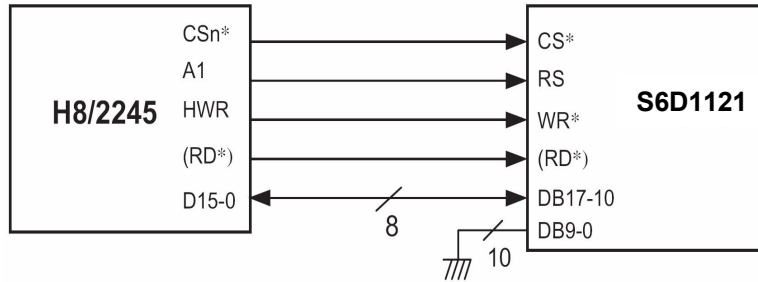
3-5. Interface Timing

(b) 8-bit Interface Mode
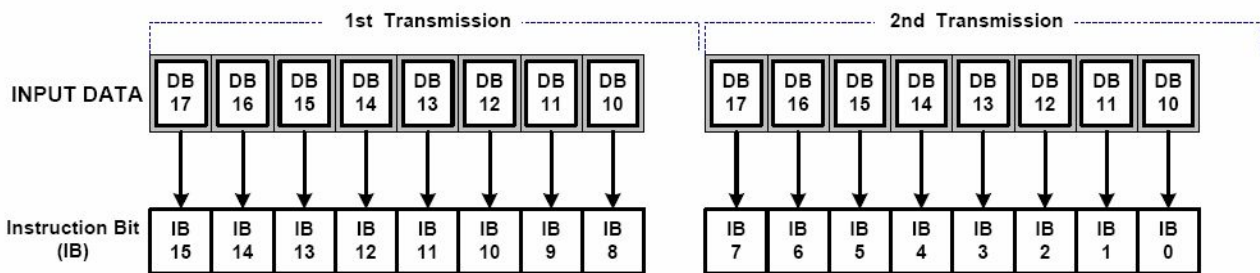

Fig 3.6. 8-bit Interface with Microcomputer

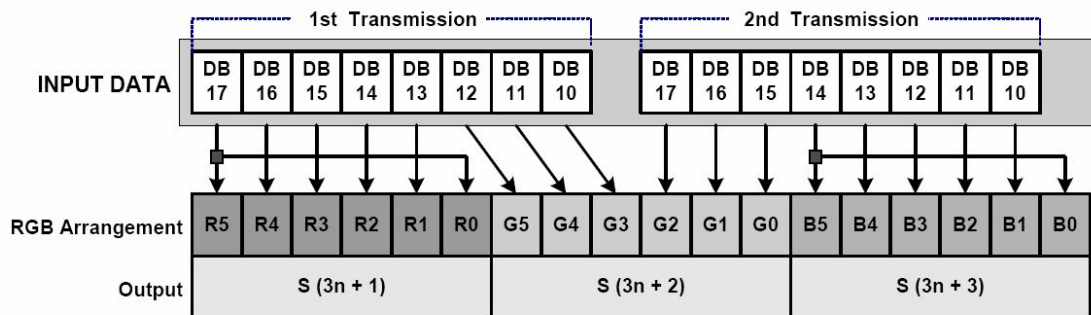**Fig 3.7. 8-bit Interface Instruction Data Format**

Note: n= lower 8 bits of address (0 to 239)

Fig 3.8. 8-bit Interface Graphic Data Format(TRI=0, DFM=0)

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3. Electrical Specifications

3-5. Interface Timing

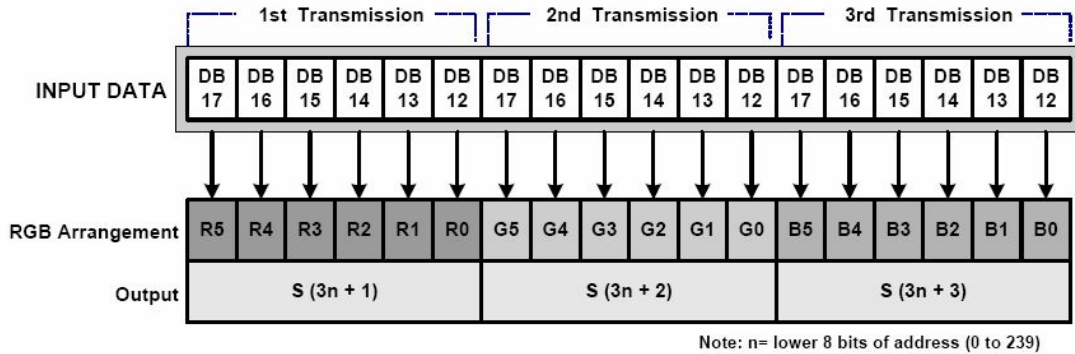### (b) 8-bit Interface Mode(continued)

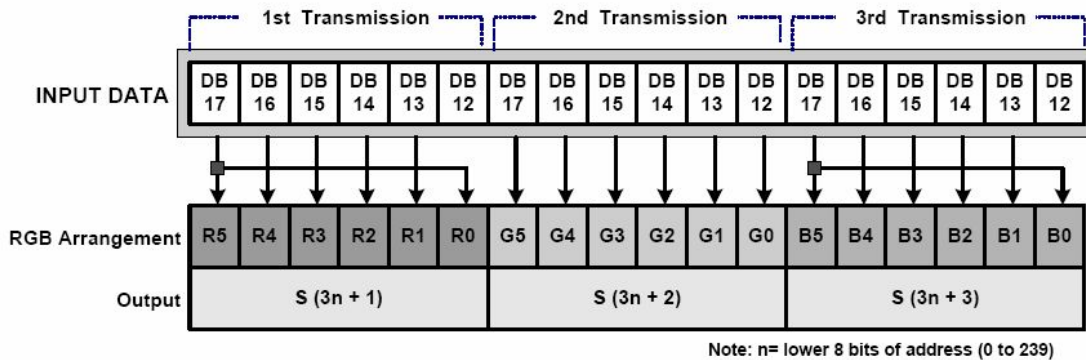**Fig 3.9. 8-bit Interface Graphic Data Format(TRI=1, DFM=0)**

Fig 3.10. 8-bit Interface Graphic Data Format(TRI=1, DFM=1)

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3. Electrical Specifications

3-6. Interface Timing

(c) 68-System 16/8-bit interface

Fig 3.11. AC Timing Parameter and Timing Diagram of 68-system interface

(VDD = 1.5 V, VDD3 = 1.65 to 3.3V, T_A = -40 to +85 ^{o}C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Address setup time	tAS68	RS ~ CSB	5	-	ns
Address hold time	tAH68	RW_WRB ~ CSB	5	-	ns
Chip select setup time	tCSS68	CSB ~ E_RDB	5	-	ns
Chip select holed time	tCSH68		5	-	ns
Chip select wait time	tCSF68		10	-	ns
Write enable period	tCYCW68	E_RDB when RW_WRB = 0	65	-	ns
Write enable high pulse width	tWHW68		22.5	-	ns
Write enable low pulse width	tWLW68		22.5	-	ns
Read enable period	tCYCR68	E_RDB when RW_WRB = 1	400	-	ns
Read enable high pulse width	tWHR68		190	-	ns
Read enable low pulse width	tWLR68		190	-	ns
Write data setup time	tWDS68	DB ~ E_RDB	10	-	ns
Write data hold time	tWDH68		10	-	ns
Read data delay time	tRDD68	DB ~ E_RDB	-	160	ns
Read data hold time	tRDH68		5	40	ns
Rising time	tR	All signals	-	10	ns
Falling time	tF		-	10	ns

Fig 3.12. AC Timing Characteristics of 68-system interface

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3. Electrical Specifications

3-6. Interface Timing

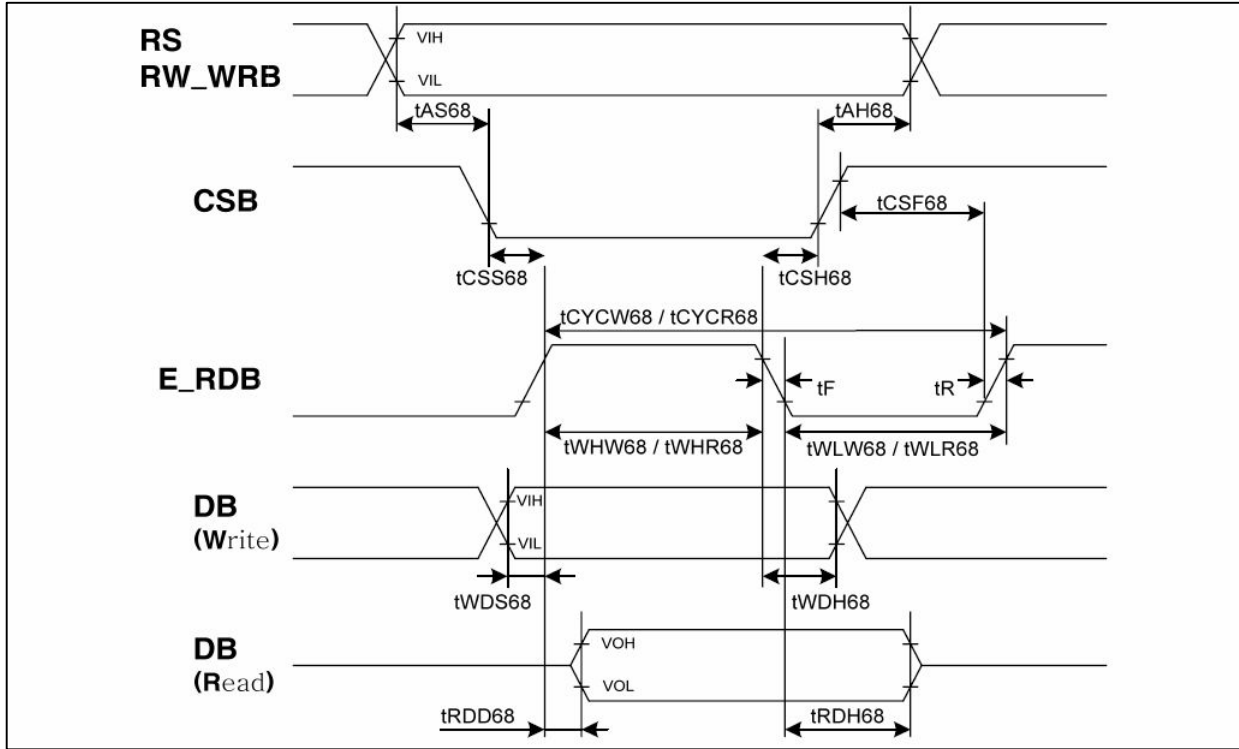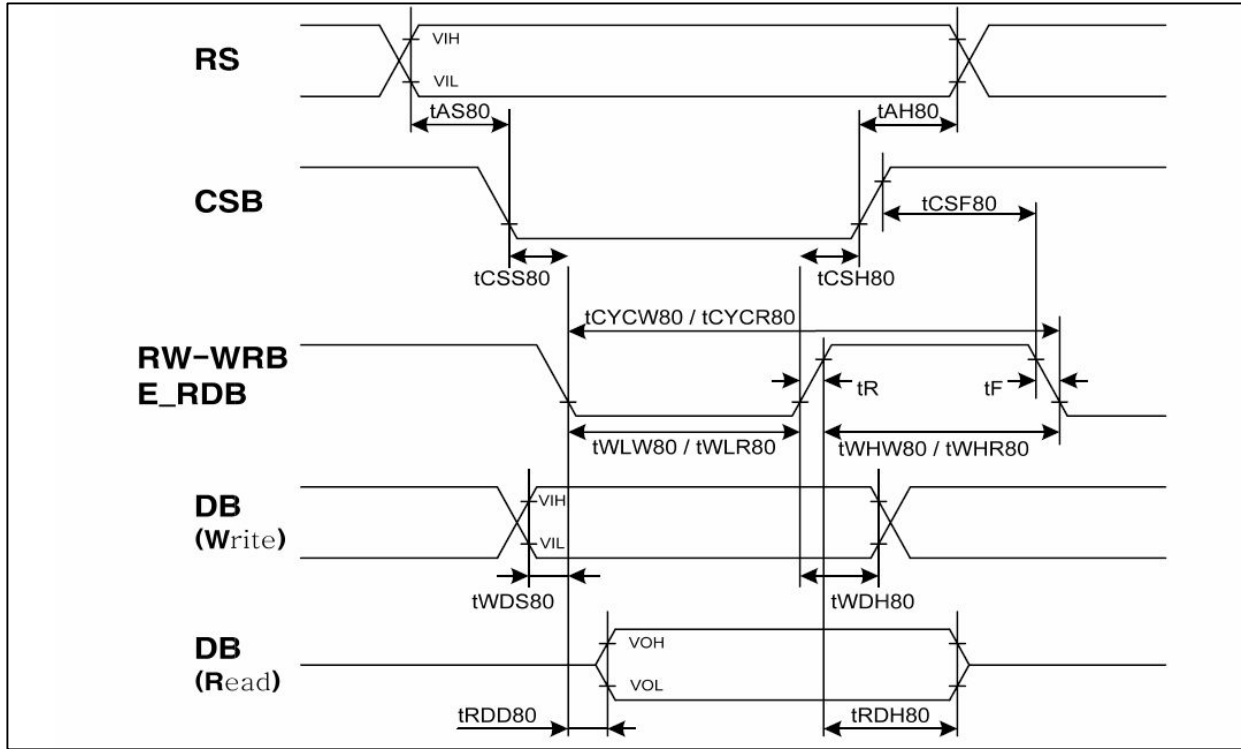### (d) 80-System 16/8-bit interface

Fig 3.13. AC Timing Parameter and Timing Diagram of 80-system interface

(VDD = 1.5 V, VDD3 = 1.65 to 3.3V, T_A = -40 to +85 °C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Address setup time	tAS80	RS ~ CSB	5	-	ns
Address hold time	tAH80		5	-	ns
Chip select setup time	tCSS80	CSB ~ RW_WRB CSB ~ E_RDB	5	-	ns
Chip select holed time	tCSH80		5	-	ns
Chip select wait time	tCSF80		10	-	ns
Write enable period	tCYCW80	RW_WRB	65	-	ns
Write enable low pulse width	tWLW80		22.5	-	ns
Write enable high pulse width	tWHW80		22.5	-	ns
Read enable period	tCYCR80	E_RDB	400	-	ns
Read enable low pulse width	tWLR80		190	-	ns
Read enable high pulse width	tWHR80		190	-	ns
Write data setup time	tWDS80	DB ~ RW_WRB	5	-	ns
Write data hold time	tWDH80		5	-	ns
Read data delay time	tRDD80	DB ~ E_RDB	10	-	ns
Read data hold time	tRDH80		10	-	ns
Rising time	tR	All signals	-	160	ns
Falling time	tF		5	40	ns

Fig 3.14. AC Timing Characteristics of 80-system interface

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3. Electrical Specifications
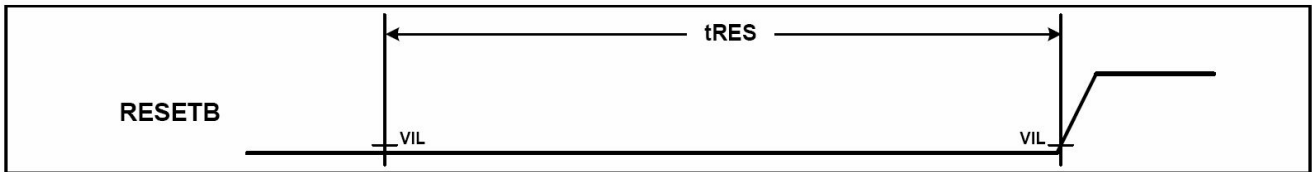
3-7. Reset Timing

Fig 3.15. AC Timing Parameter and Timing Diagram of RESET

(VDD = 1.5 V, VDD3 = 1.65 to 3.3V, T_A = -40 to +85 $^\circ$C)

Characteristic	Symbol	Min.	Max.	Unit
Reset low pulse width	tRES	15	-	us

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3. Electrical Specifications

3-8. Color Input Data Reference

Colors & Gray Scale	Gray Scale Level	Data Signal																	
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Black	-	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	1	1	1	1	1	1
Green	-	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Cyan	-	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Red	-	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Magenta	-	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
Yellow	-	1	1	1	1	1	1	1	1	1	1	1	1	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
Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑ Darker ↑ ↓ Brighter ↓	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↓	↓						↓						↓					
	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑ Darker ↑ ↓ Brighter ↓	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	↓	↓						↓						↓					
	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
↑ Darker ↑ ↓ Brighter ↓	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	↓	↓						↓						↓					
	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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4. Optical Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing angle range	θ UP	CR $\geq$ 10	-	85	-	°(degree)	Note 3
	θ DOWN		-	85	-	°(degree)	Note 3
	θ LEFT		-	85	-	°(degree)	Note 3
	θ RIGHT		-	85	-	°(degree)	Note 3
Contrast ratio	CR	Optimal		300	-	-	Note 2
Brightness	Y	Optimal	300	450		cd/m^2	Note 5
Brightness Uniformity	Y	Optimal	80	85	-	%	Note 5
Response time	$\tau_f + \tau_r$	-	-	25	40	ms	Note 4
Color Temp.	CCT	-	5,500	-	9,000	K	-
Color Gamut	NTSC	-	50	60	-	%	Note1 Equipment (PR650)
White Chromaticity	X	CIE 1931	0.264	0.304	0.344	-	
	Y		0.306	0.346	0.386	-	
Red Chromaticity	X	CIE 1931	0.587	0.627	0.667	-	
	Y		0.312	0.352	0.392	-	
Green Chromaticity	X	CIE 1931	0.303	0.343	0.383	-	
	Y		0.567	0.607	0.647	-	
Blue Chromaticity	X	CIE 1931	0.110	0.150	0.190	-	
	Y		0.061	0.101	0.141	-	

1. Optical Test Equipment & method refer to Note1.

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4. Optical Characteristics

[Note 1] Optical Test Equipment Setup

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface. And back light LED current 20mA/1EA
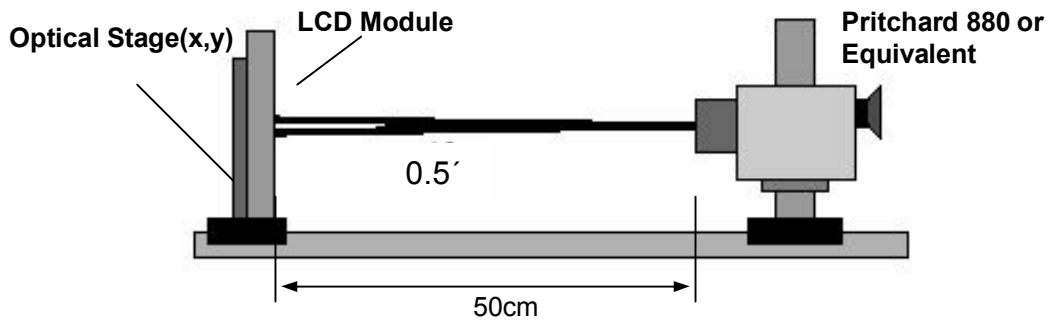
Optical Stage(x,y)   **LCD Module**   **Pritchard 880 or Equivalent**

0.5´

50cm

Fig 4.1. Optical Characteristic Measurement Equipment and Method

[Note 2]

Contrast ratio is defined as follows ;

$$\text{Contrast Ratio(CR)} \ = \ \frac{\text{Photo detector output with LCD being "white"}}{\text{Photo detector output with LCD being "black"}}$$

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4. Optical Characteristics

[Note 3]

Viewing angle range is defined as follows;

UP
(12 o'clock)
$\Phi=90º$

$\theta=0º$
z

A

yu

θ

LEFT
(9 o'clock)
$\Phi=180º$

xl

**TFT-LCD
Module**

Φ

xr

RIGHT
(3 o'clock)
$\Phi=0º$

yd

DOWN
(6 o'clock)
$\Phi=270º$
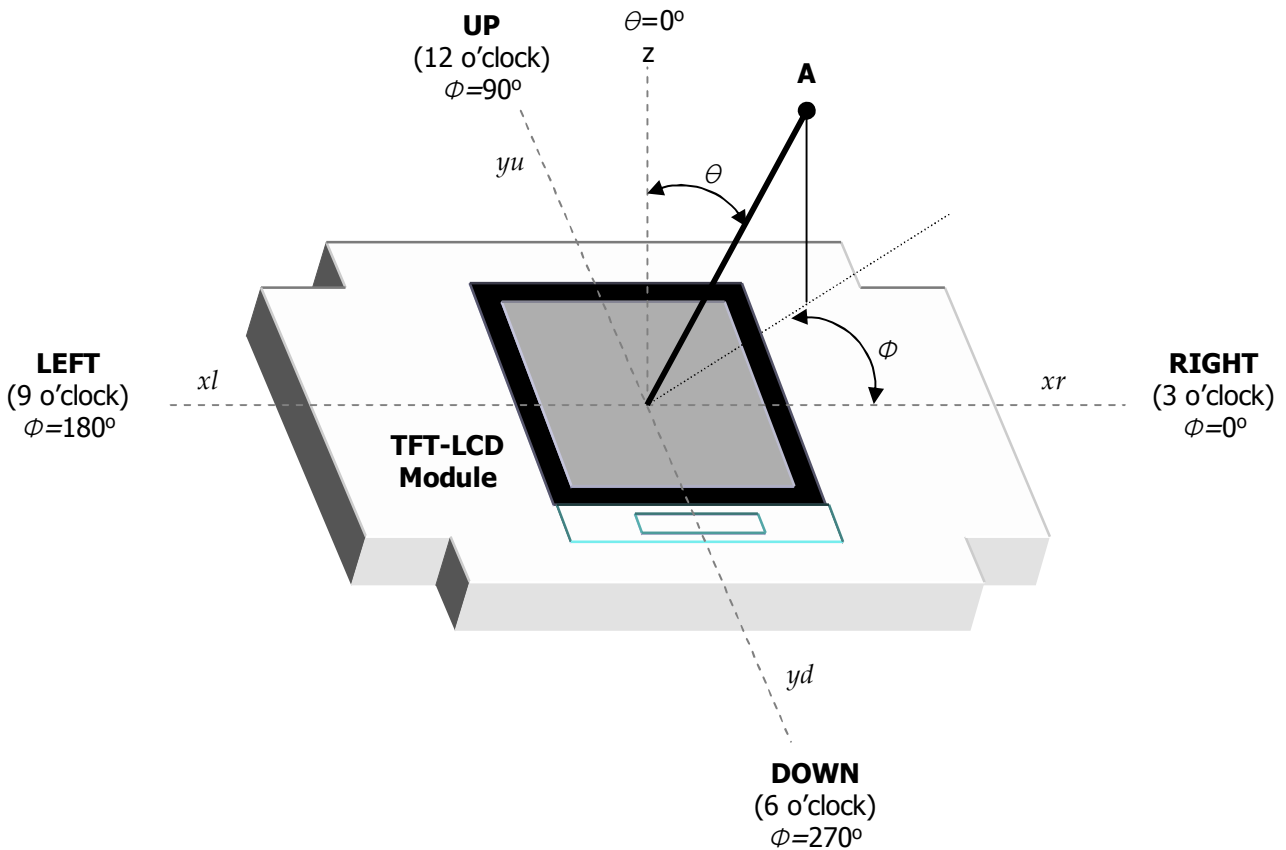
Fig 4.2. Viewing Angle

[Note 4]

Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".

Photo detector Output

White

100%
90%

White

10%
0%

Black

τ_f

τ_r
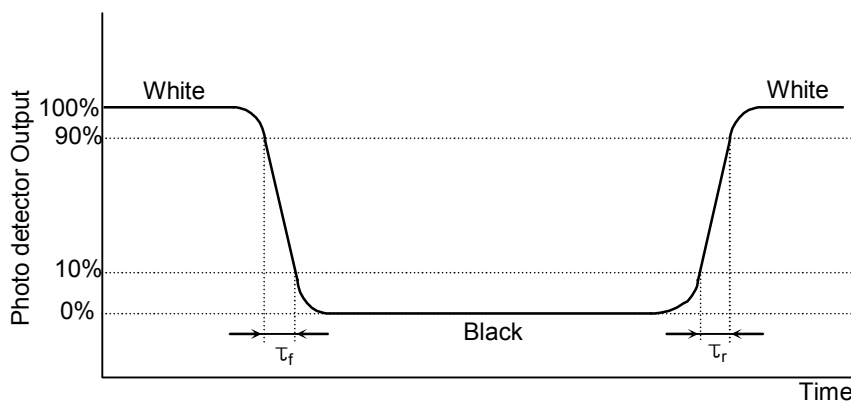
Time

Fig 4.3. Response Time

Product Specification

4. Optical Characteristics

[Note 5]

The brightness measurement is taken at point B5.

$$\text{Brightness Uniformity} = \frac{\text{Minimum Photo detector output for B1-B9 with all pixels white}}{\text{Maximum Photo detector output for B1-B9 with all pixels white}} \times 100(\%)$$
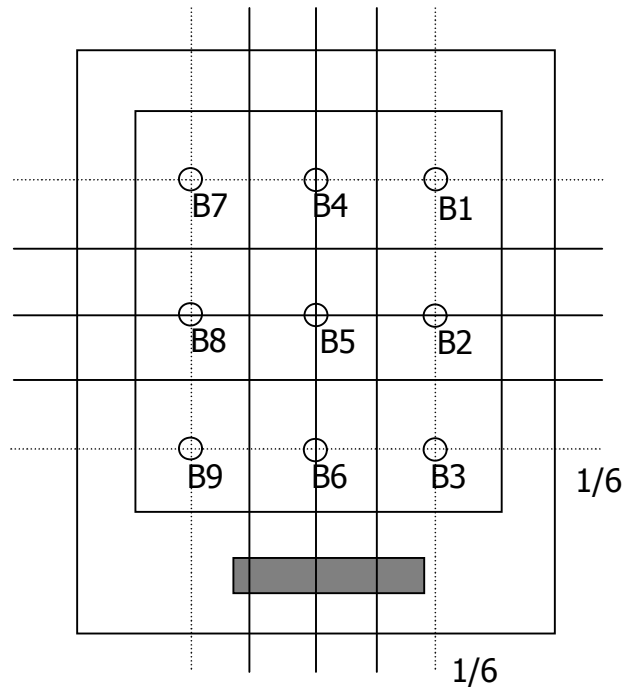
Fig 4.4. Brightness measurement points
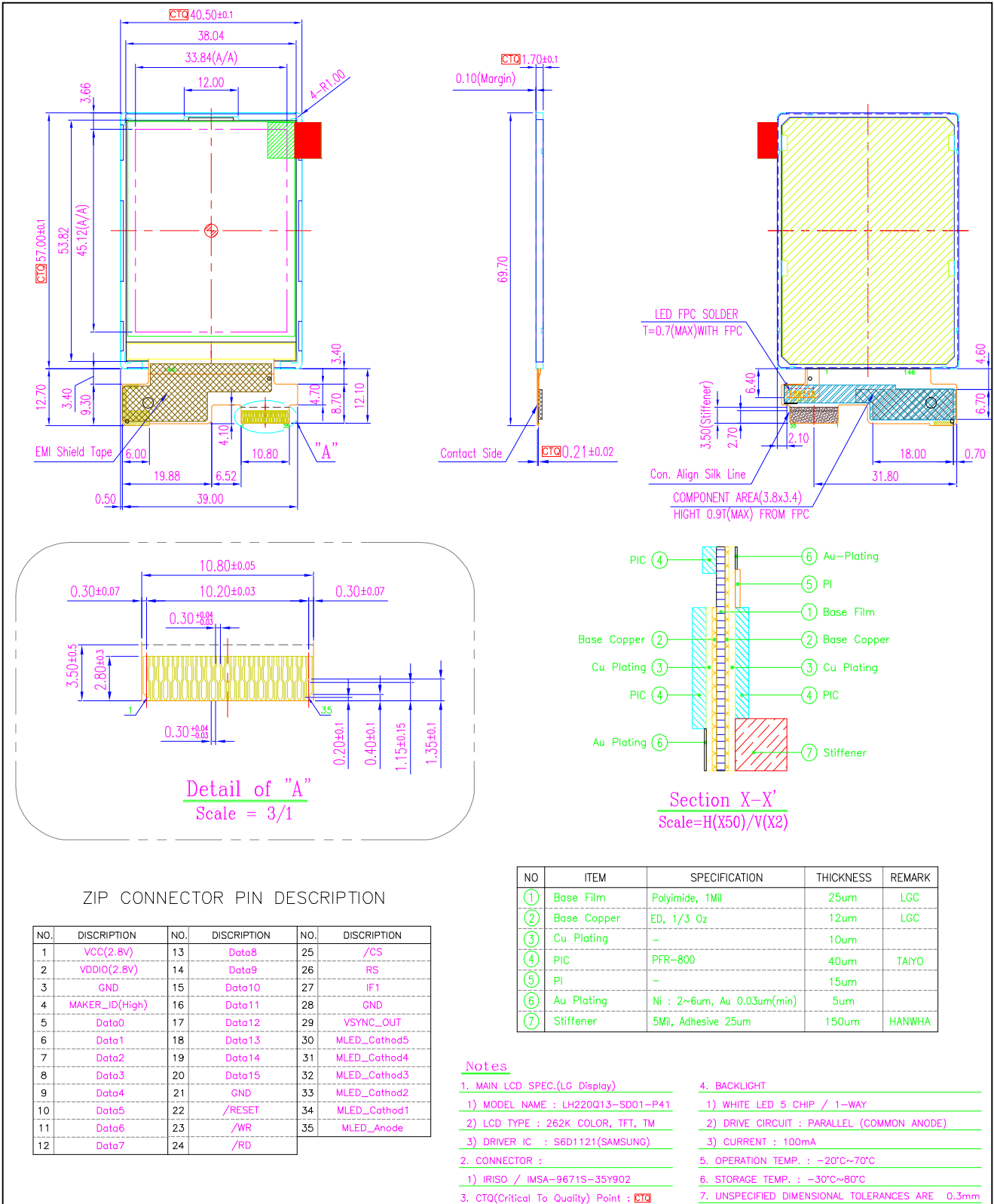
Product Specification

5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LH220Q13-SD01. In addition the figures in the next page are detailed mechanical drawing of the LCD

DIMENSION	MIN	TYP	MAX	UNIT
HORIZONTAL (H)	40.4	40.5	40.6	mm
VERTICAL (V)	69.6	69.7	69.8	mm
DEPTH (D)	1.6	1.7	1.8	mm

Product Specification

5. Mechanical Characteristics

[Outline Dimension]

Detail of "A"
Scale = 3/1

Section X-X'
Scale=H(X50)/V(X2)

LED FPC SOLDER
T=0.7(MAX)WITH FPC

Con. Align Silk Line

COMPONENT AREA(3.8x3.4)
HIGHT 0.9T(MAX) FROM FPC

EMI Shield Tape

Contact Side

	Section X-X' labels
PIC ④	⑥ Au-Plating
	⑤ PI
	① Base Film
Base Copper ②	② Base Copper
Cu Plating ③	③ Cu Plating
PIC ④	④ PIC
Au Plating ⑥	⑦ Stiffener

ZIP CONNECTOR PIN DESCRIPTION

NO.	DISCRIPTION	NO.	DISCRIPTION	NO.	DISCRIPTION
1	VCC(2.8V)	13	Data8	25	/CS
2	VDDIO(2.8V)	14	Data9	26	RS
3	GND	15	Data10	27	IF1
4	MAKER_ID(High)	16	Data11	28	GND
5	Data0	17	Data12	29	VSYNC_OUT
6	Data1	18	Data13	30	MLED_Cathod5
7	Data2	19	Data14	31	MLED_Cathod4
8	Data3	20	Data15	32	MLED_Cathod3
9	Data4	21	GND	33	MLED_Cathod2
10	Data5	22	/RESET	34	MLED_Cathod1
11	Data6	23	/WR	35	MLED_Anode
12	Data7	24	/RD		

NO	ITEM	SPECIFICATION	THICKNESS	REMARK
①	Base Film	Polyimide, 1Mil	25um	LGC
②	Base Copper	ED, 1/3 Oz	12um	LGC
③	Cu Plating	–	10um	
④	PIC	PFR-800	40um	TAIYO
⑤	PI	–	15um	
⑥	Au Plating	Ni : 2~6um, Au 0.03um(min)	5um	
⑦	Stiffener	5Mil, Adhesive 25um	150um	HANWHA

Notes

1. MAIN LCD SPEC.(LG Display)
   1) MODEL NAME : LH220Q13-SD01-P41
   2) LCD TYPE : 262K COLOR, TFT, TM
   3) DRIVER IC : S6D1121(SAMSUNG)
2. CONNECTOR :
   1) IRISO / IMSA-9671S-35Y902
3. CTQ(Critical To Quality) Point : CTQ

4. BACKLIGHT
   1) WHITE LED 5 CHIP / 1-WAY
   2) DRIVE CIRCUIT : PARALLEL (COMMON ANODE)
   3) CURRENT : 100mA
5. OPERATION TEMP. : -20°C~70°C
6. STORAGE TEMP. : -30°C~80°C
7. UNSPECIFIED DIMENSIONAL TOLERANCES ARE 0.3mm

Product Specification

5. Mechanical Characteristics

[Layout of FPC]

VCOUT

GVST
GCLK1
VCLK1
S241

LG Display   VGOUT
DESC : LH220Q13-SD01 V1.0
P/N : 6850L-0158A
DESIGNED : 2008/03/03
ACT ▲ 0811

1   35

Fig 5.1 Silk Layer (Top)

Fig 5.2 Top Layer

Product Specification

5. Mechanical Characteristics

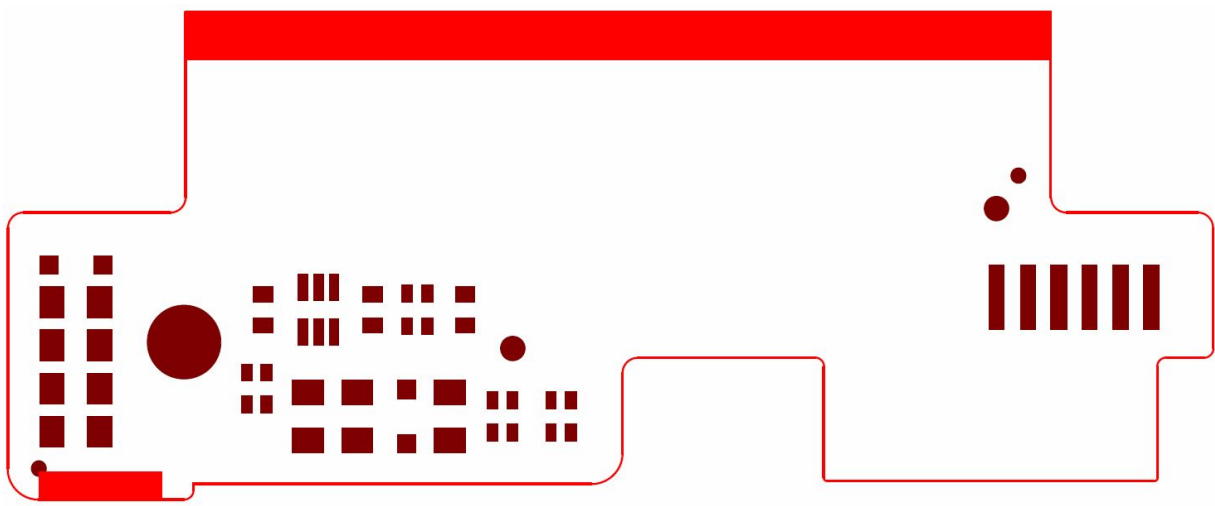### [Layout of FPC]
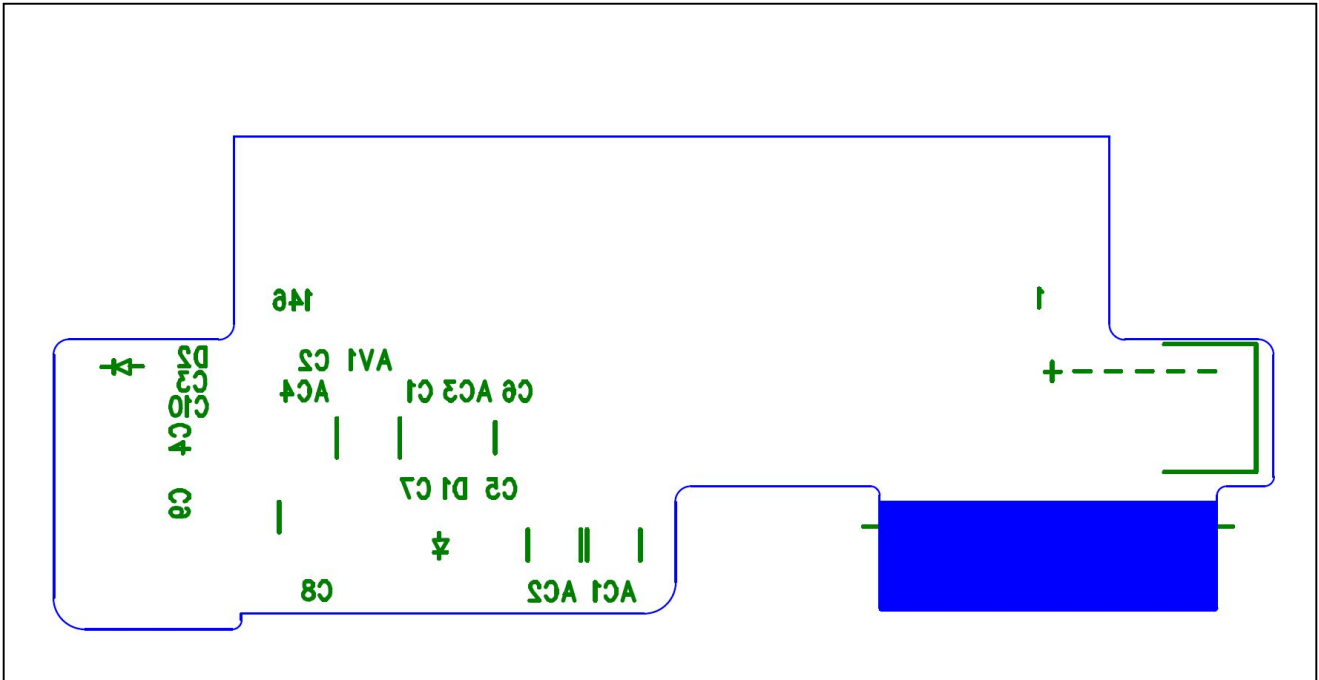
Fig 5.3 Silk Layer (Bottom)

Fig 5.4 Solder Mask (Bottom)

LG Display

5. Mechanical Characteristics

[Circuit of FPC]
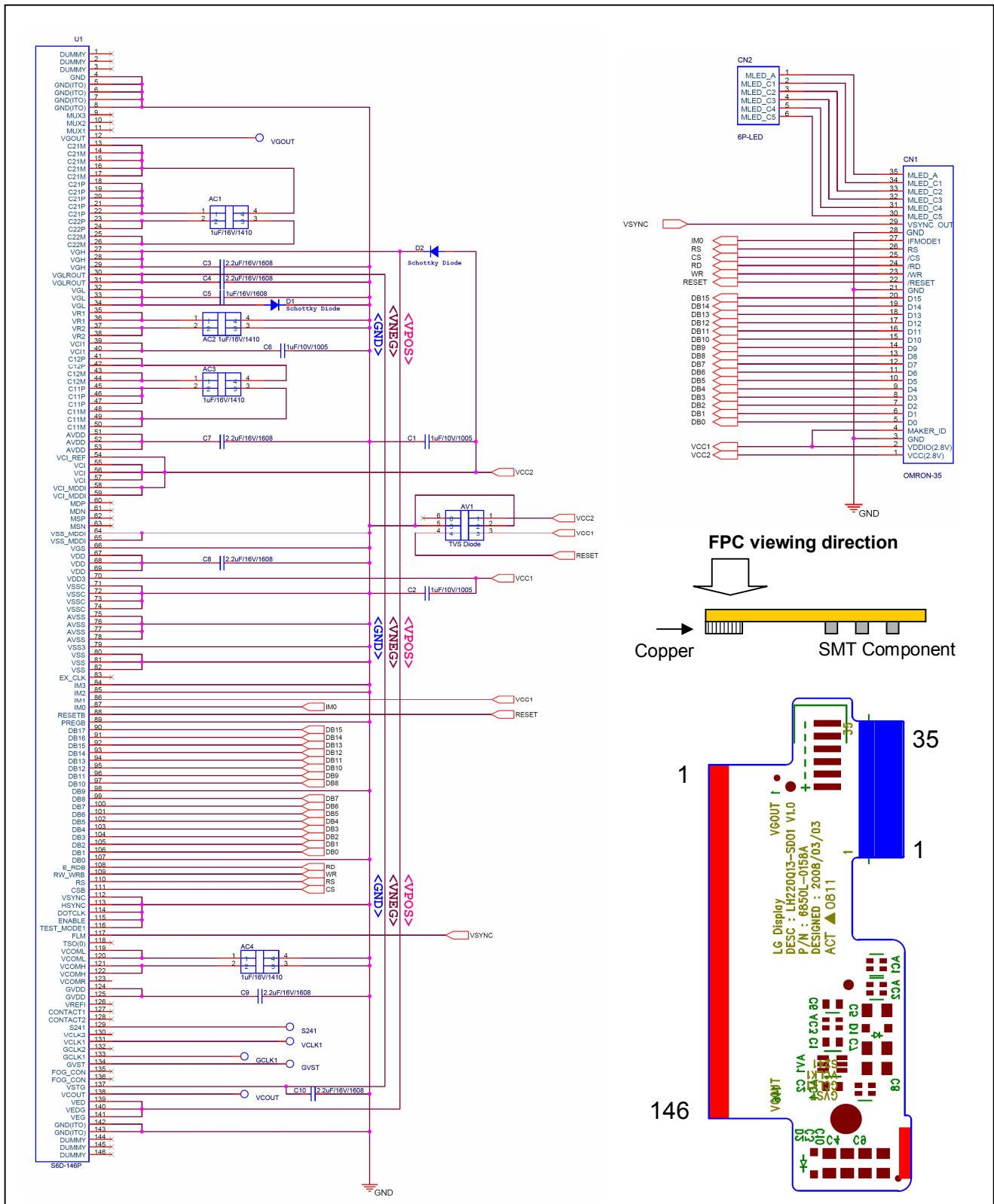
Product Specification

6. Reliability Test

6-1. Reliability Condition

No.	Test Items	Test Condition	Remark
1	High Temperature Operation	70℃ , 120Hr	
2	Low Temperature Operation	-20℃, 120Hr	
3	High Temperature and High Humidity Operation	60℃, 90% RH, 120Hr	
4	High Temperature and High Humidity Storage	60℃, 90% RH, 120Hr	
5	Low Temperature Storage	-30℃, 120Hr	
6	Thermal Shock	-30℃, 80℃(45Min) 50clcye	
7	Temperature Humidity Cycle	25℃(5Min)/25% → -25℃(30Min)/0% → 25℃(5Min)/25% →80℃(30Min)/80% 5 cycle	
8	Vibration Test	1~22Hz(05s)→ 22Hz(15s)→ 22~48Hz(05s) → 48Hz(15s)→ 48~55Hz(05s)→ 55Hz(15s), 2Hr	
9	Drop Test	76cm / 1Corners, 3Edges, 6Faces / 1cycle	Packaged in a box
10	Electrostatic Withstanding Voltage	Air : 0Ohm 200pF ± 200V	
10	Electrostatic Withstanding Voltage	Contact : 0Ohm 200pF ± 200V	
11	Mechanical Test	3Point Bending Test : 3.5 kgf(min)	
11	Mechanical Test	COG Test : 1.5 kfgf(min)	

{ Result Evaluation Criteria }
There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

Product Specification

7. Packing

7-1. Designation of Lot Mark

(1) 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	2002	2003	2004	2005	2006	2007	2008	2009	2010
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

(2) Location of Lot Mark

Serial NO. is printed on the surface of LCM
This is subject to change without prior notice.

Product Specification

7. Packing

7-2. Packing Form

(1) Package quantity in one box : 400 pcs
(2) Box Size : 475mm × 348mm × 210mm
(3) 1Box = tray 20 + 1 tray(dummy , top) = 21 tray
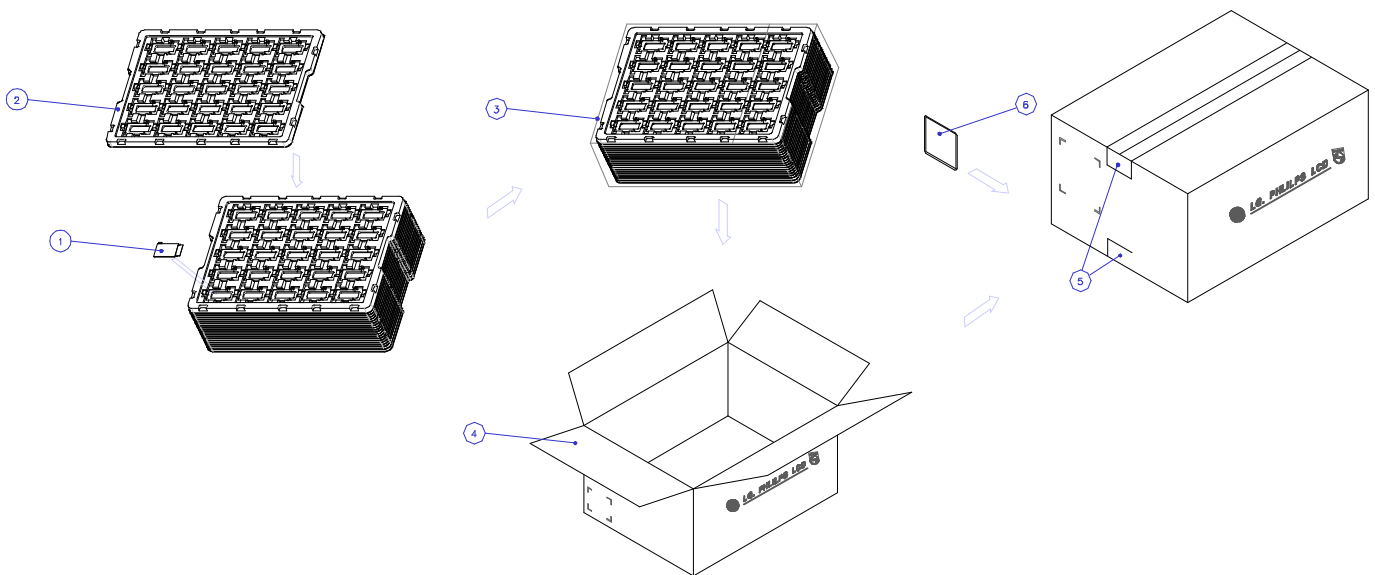
NO.	Description	Material
1	Module	-
2	Packing, Tray	PET(0.8t)
3	Bag	PE, 560mm x 830mm
4	Box	SWR4, 475mm x 348mm x210mm
5	Tape	OPP, 70mm x 300m
6	Label	Art Paper, 100mm x 100mm

LG Display

8. PRECAUTIONS

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

8-1. ASSEMBLING PRECAUTIONS

(1) 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.

(2) 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.)

(3) 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.

(4) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(5) Do not open the case because inside circuits do not have sufficient strength.

(6) The metal case of a module should be contacted to electrical ground of your system.

8-2. 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.

Product Specification

8. PRECAUTIONS

8-3. 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.

8-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

8-5. 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.
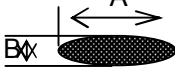
8-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

(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.

LG Display

Product Specification

9. Inspection Standard

9-1. Inspection Standard for Main LCD

No	Item	Criterion for Defects	Remark
1	Non Lighting	Nothing	Major
2	Irregular Operation	Nothing	Major
3	Short	Nothing	Major
4	Open	Nothing	Major
5	Back Light	① No light is rejectable ② Flickering and abnormal lighting are rejectable ※ In case of the model with back light (E/L, LED)	Major

6	Dot Defect	<table><tr><td>Item</td><td>Bright Dot</td><td>Dark Dot</td></tr><tr><td>Acceptable No.</td><td>0</td><td>(Note 1)</td></tr></table>
		Note1) Case of Dot defect is below
		① Bright Dot (whit spot) : "0"
		② Dark Dot (black spot) : "0" (In case of Dark Dot on Main TFT LCD)
		  - NG if there's full Dot defect.
		  - Damaged less than half size of sub-pixel is not counted as defect
		  - Dots darker than half size of sub-pixel are not defined as bright dot defect
			Minor

7	Blemish & Foreign matters Black/White Spot Size : Φ=(A+B)/2	<table><tr><td>Size Φ (mm)</td><td>Acceptable number</td></tr><tr><td>Φ ≤ 0.10</td><td>Ignore</td></tr><tr><td>0.10 < Φ ≤ 0.20</td><td>1</td></tr><tr><td>0.20 < Φ</td><td>0</td></tr></table>	Minor

LG Display

9. Inspection Standard

9-1. Inspection Standard for Main LCD

No	Item	Criterion for Defects	Remark
8	Black/White Line	<table><tr><td>Length (mm)</td><td>Width (mm)</td><td>Acceptable number</td></tr><tr><td>Linear L≤1.0</td><td>W ≤0.02</td><td>Ignore</td></tr><tr><td></td><td>0.02 < W ≤0.03</td><td>1</td></tr></table> <table><tr><td>Length (mm)</td><td>Width (mm)</td><td>Acceptable number</td></tr><tr><td>Linear L≤2.0</td><td>W ≤0.03</td><td>Ignore (Note 2)</td></tr><tr><td></td><td>0.03 < W ≤0.05</td><td>1</td></tr></table>	Minor
9	Scratch on Polarizer	<table><tr><td>Width (mm)</td><td>Length (mm)</td><td>Acceptable number</td></tr><tr><td>W ≤ 0.03</td><td>Ignore</td><td>Ignore</td></tr><tr><td>0.03 < W ≤ 0.05</td><td>L ≤ 2.0</td><td>1</td></tr><tr><td>0.05 < W</td><td>L>2.0</td><td>0</td></tr></table>	Minor
10	Bubble in Polarizer	<table><tr><td>Size Φ (mm)</td><td>Acceptable number</td></tr><tr><td>Φ ≤ 0.20</td><td>Ignore</td></tr><tr><td>0.20 < Φ ≤ 0.50</td><td>3</td></tr><tr><td>0.50 < Φ ≤ 0.80</td><td>2</td></tr><tr><td>0.80 < Φ</td><td>0</td></tr></table>	Minor
11	Stains on LCD Panel Surface	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning too are rejectable.	Minor
12	Rust in Bezel	Rust which is visible in the bezel is rejectable.	Minor
13	Defect of land surface Contact	Evident crevices which is visible are rejectable.	Minor
14	Parts Mounting	① Failure to mount parts ② Parts not in the specifications are mounted ③ Polarity, for example, is reversed	Major Major Major

Product Specification

9. Inspection Standard

9-1. Inspection Standard for Main LCD

No	Item	Criterion for Defects	Remark
15	Parts Alignment	① LSI, IC Lead width is more than 50% beyond pad outline. ② Chip component is off center and more tan 50% of the leads is off the pad outline.	Minor Minor
16	Conductive Foreign matter	① On open space(GND, manual solder) solder ball is allowed up to Φ0.1mm(1EA). ② In case of shield space is allowed up to Φ0.2mm(1EA)	Major
17	Faculty PWB correction	① Due to PWB copper foil pattern burnout, the pattern is connected, using a jumper wire for repair ; 2 or more places are corrected per PWB ② Short circuited part is cut, and no resist coating has been performed.	Minor Minor