Product Specification

SPECIFICATION
FOR
APPROVAL

(●) Preliminary Specification
( ) Final Specification

Title	2.19” (240XRGBX376) TFT LCD

BUYER	
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LH219WQ1
SUFFIX	FD01

*When you obtain standard approval,
please use the above model name without suffix.

SIGNATURE	DATE
/	
/	
/	

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

APPROVED BY	DATE
REVIEWED BY	
PREPARED BY	

Product Engineering Dept.
LG Display Co., Ltd

CONTENTS

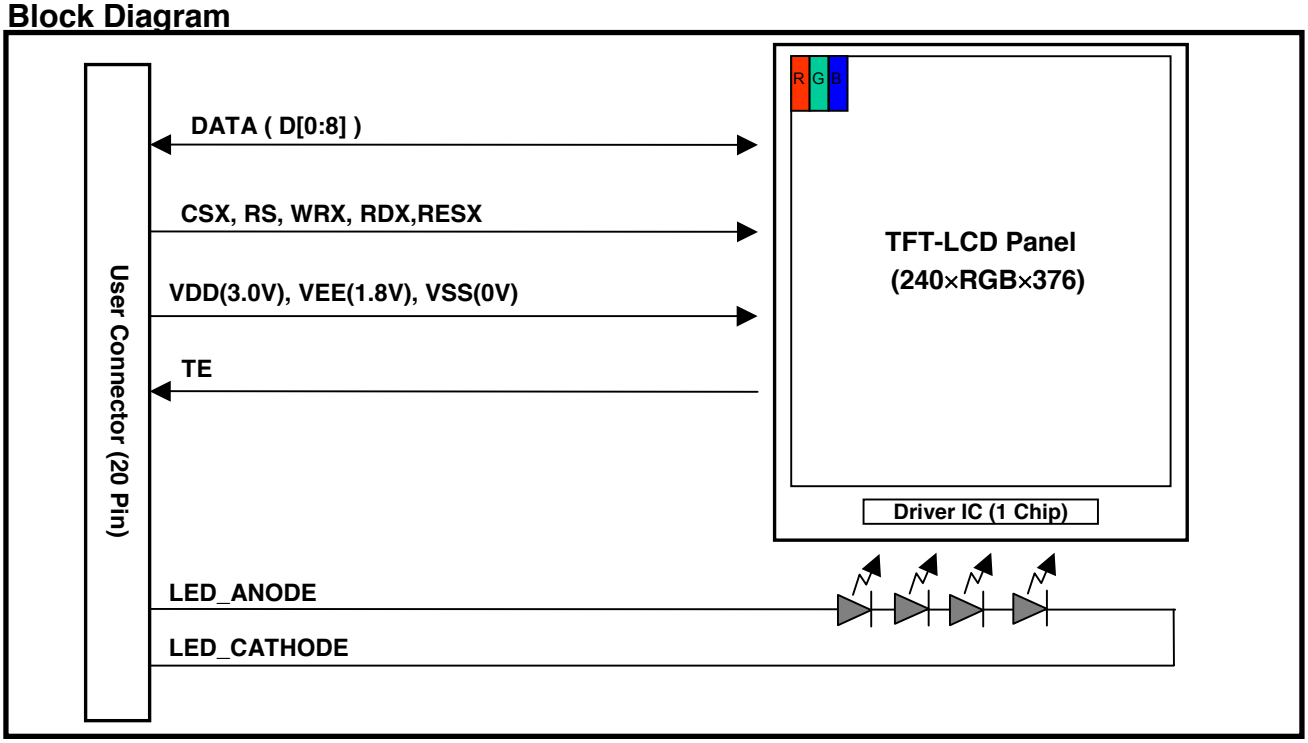
RECORD OF REVISIONS

Revision No.	Revision Date	Page	Description
0.0	Sept. 22, 2009	-	First draft

1. GENERAL DESCRIPTION

The LH219WQ1 is a Color Active Matrix Liquid Crystal Display with Light Emission Diode(LED) backlight system. The matrix employs a-Si Thin Film Transistor as the active element.
It is transflective type display operating in the normally white mode. This TFT-LCD has 2.19 inch diagonally measured active display area with (240*RGB*376) resolution. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes.

Block Diagram



LCM Connector: JAE AA07-S020VA1

Fig 1.1 Block Diagram of TFT-LCD Module with LED Backlight Unit

General Features

Active screen size	2.19” diagonal
Outline Dimension	34.38 (H) x 53.81 (V) x 1.40 (T) Typ.
Pixel Pitch	0.1245(H) × 0.1245(V)
Pixel format	240(H) X 376 (V) (RGB Stripe)
Color depth	18-bits (R6, G6, B6)
Interface	CPU (80-system, 9bit 2 transfer)
Power Consumption	254mW (max. B/L on), 30mW (max. B/L off)
Luminance	425nit(typ.) @16mA
Viewing Direction	7:30 o’clock (Non-inversion)
LCD Driver	COG 1Chip

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 Input	VDD	-0.3	4.0	V	
Power Supply Input	VEE	-0.3	4.0	V	
LED Power Consumption	P_{LED}	-	88	mW	1
LED Current	I_{LED}	-	25	mA	1, 2

Notes:
1. Applies to each LED individually.
2. Allowable forward current is refer to Fig 2.1

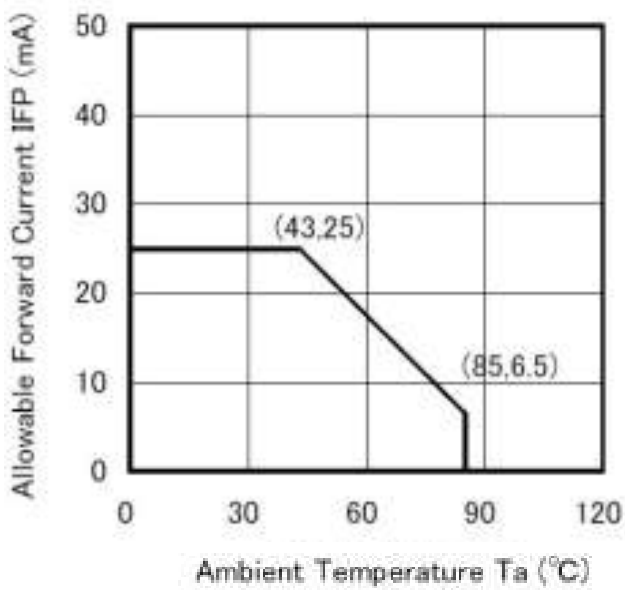


Fig 2.1 Ambient Temperature vs. Allowable Forward Current

3. ELECTRICAL SPECIFICATIONS

3-1. ELECTRICAL CHARACTERISTICS

Table 3.1 Electrical Characteristics Of TFT-LCD Module

Parameter	Symbol	Values			Units	Notes
		Min	Typ.	Max		
Power Supply Input	VDD	2.9	3.0	3.1	V	
Power Supply Input	VEE	1.7	1.8	1.9	V	
"H"Level Input Voltage	V_{IH}	0.8 V_{EE}	-	-	V	
"L"Level Input Voltage	V_{IL}	-	-	0.2 V_{EE}	V	
Current Consumption, Panel	P_B		25	30	mW	1

Notes:
1. Large black/white checker pattern(20 pixel blocks) at 60Hz

3-2. BACK LIGHT UNIT

The edge-lighting type of back light unit consists of 4 LEDs which is connected in serial.

Table 3.2 Electrical Characteristics Of Back Light Unit

Parameter	Symbol	Values			Units	Notes
		Min	Typ.	Max		
LED Current	I_{LED}	-	16	25	mA	
LED Forward Voltage	V_{LED}	-	3.2	3.5	V	
LED Power Consumption	P_{LED}	-	204.8	224	mW	@16mA

3-3. INTERFACE CONNECTIONS

The pin connections are provided in Table 3.3 The connector is JAE AA07-S020VA1.

Table 3.3 Module Connector Pin Configuration

Pin No.	Symbol	I/O	Description	Comment
1	TE	O	Indicates start of frame	-
3	VDD	-	LCD Power Supply	-
5	VEE(Vddi)	-	Logic I/O Power Supply	-
7	CSX	I	Chip select input	"L" Active
9	RS	I	Register select input	-
11	WRX	I	Write control input	"L" Active
13	RDX	I	Read control input	"L" Active
15	D0	I/O	Data Bus(LSB)	-
17	D1	I/O	Data Bus	-
19	D2	I/O	Data Bus	-
2	LED-	-	LED Cathode	-
4	LED+	-	LED Anode	-
6	VSS(GND)	-	GND	-
8	RESX	I	Reset Signal input	"L" Active
10	D8	I/O	Data Bus	-
12	D7	I/O	Data Bus	-
14	D6	I/O	Data Bus	-
16	D5	I/O	Data Bus	-
18	D4	I/O	Data Bus	-
20	D3	I/O	Data Bus	-

3-4. COLOR INPUT DATA REFERENCE

Table 3.4 Color vs. Data

Display Colors		Data Signal																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	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
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	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
Red Gray Scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↕	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	↓	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Brighter	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green Gray Scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	↑	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↕	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	↓	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Brighter	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue Gray Scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↕	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

3-5. Power On/off Conditions

Power On Requirements

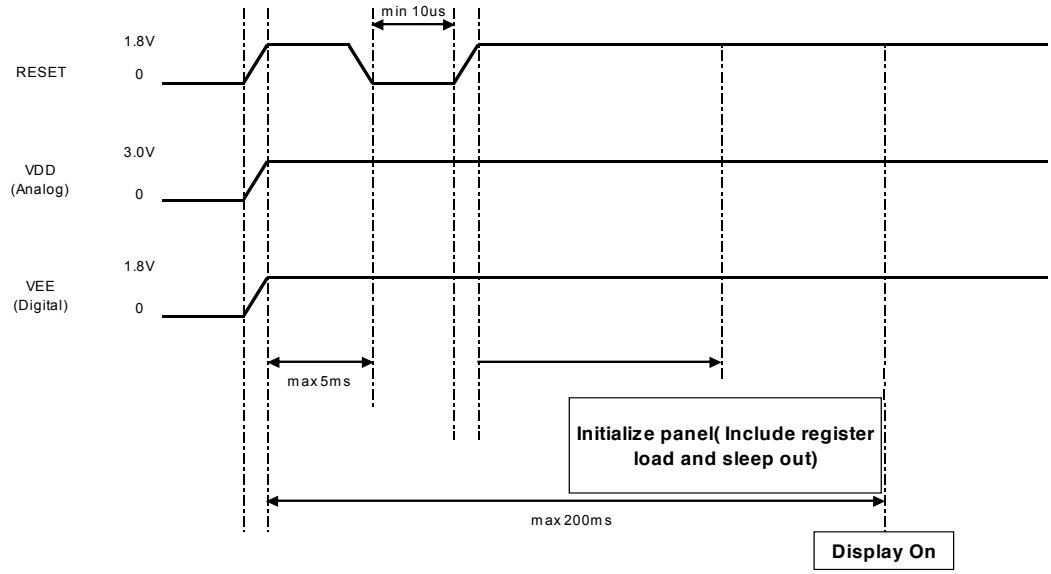


Fig 3.1 Power on Requirements

Power Off Requirements

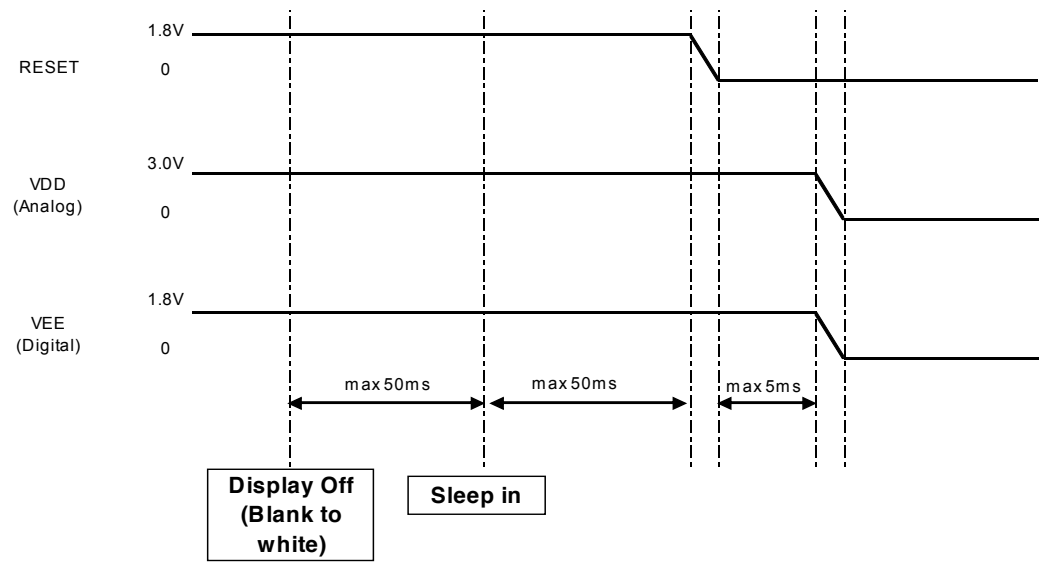


Fig 3.2 Power off Requirements

Hard Reset

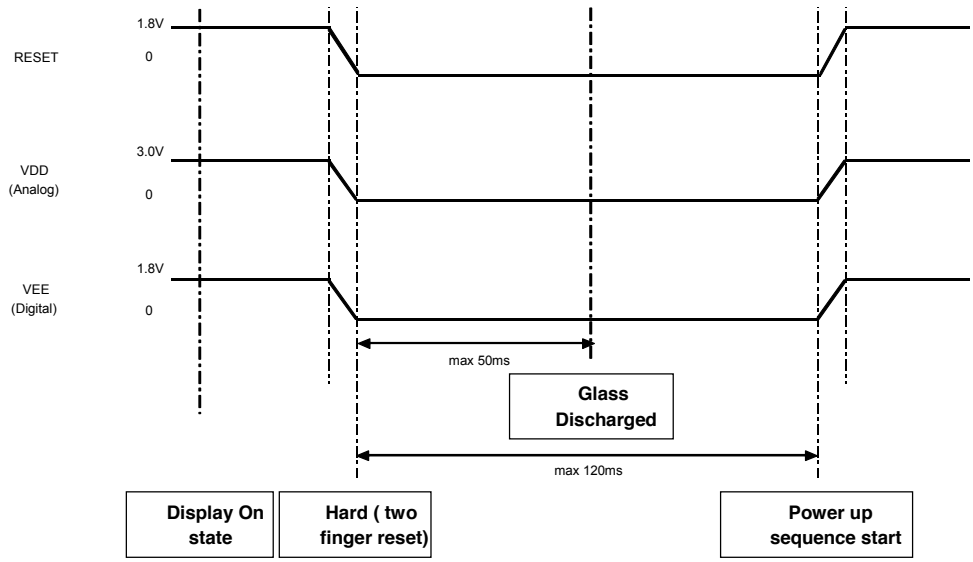


Fig 3.3 Hard Reset Sequence

3-6. Timing Characteristics

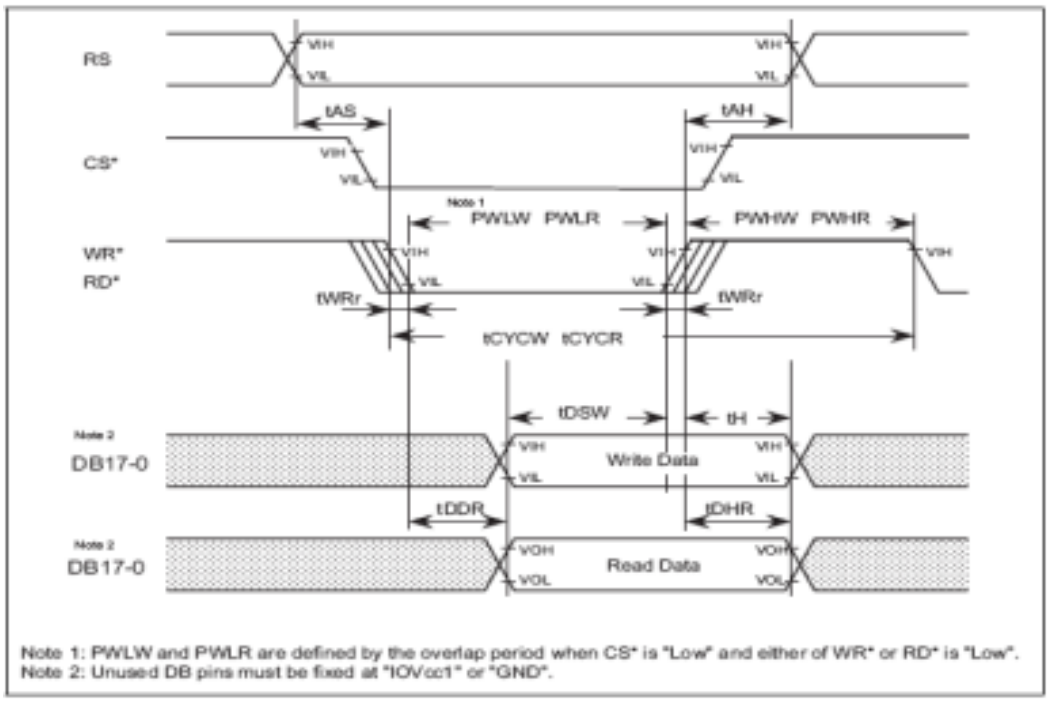


Fig 3.4 Timing Characteristics (80-system bus)

Item		Symbol	Unit	Min	Max
Bus cycle time	Write	tCYCW	ns	100	-
	Read	tCYCR		450	-
Write "Low" level pulse width	Write	PWLW	ns	35	-
Read "Low" level pulse width	Read	PWLR		45	-
Write "High" level pulse width	Write	PWHW	ns	35	-
Read "High" level pulse width	Read	PWHR		90	-
Write/Read rise/Fall time		twRr, twRf	ns	-	15
Setup time	Write(RS ~ CS, WR)	tAS	ns	35	-
	Read(RS ~ CS, RD)			35	-
Address hold time		tAH	ns	10	-
Write data setup time		tDSW	ns	25	-
Write data hold time		tH	ns	10	-
Read data delay time		tDDR	ns	-	340
Read data hold time		tDHr	ns	20	-
Time from read cycle to write cycle			ns	90	-
Time from write cycle to read cycle			ns	20	-

Note : V_{DD} = 3.0 V , V_{EE} = 1.8 V

Table 3.5 Timing Characteristics (80-system bus)

4. OPTICAL CHARACTERISTICS

4-1. Optical Characteristics – Backlight Off

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing angle range	θUP	CR ≥2	30		-	°(degree)	Note 3
	θDOWN					°(degree)	Note 3
	θLEFT		30		-	°(degree)	Note 3
	θRIGHT					°(degree)	Note 3
Contrast ratio	CR	Optimal	5	7	-		Note 2 (Spot light)
Reflectivity	R	Optimal	1.0	1.8	-	%	Note 1 (Diffuse light)
White Chromaticity	Wx		-	0.309	-	CIE	Note 1 (Diffuse light)
	Wy		-	0.333	-	CIE	

1. Optical Test Equipment & method refer to Note1,2,3,4.

4-2. Optical Characteristics – Backlight On

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing angle range	θUP	CR ≥10	40	50		°(degree)	Note 3
	θDOWN		40	45		°(degree)	Note 3
	θLEFT		40	50		°(degree)	Note 3
	θRIGHT		40	50		°(degree)	Note 3
Contrast ratio	CR	Optimal	100	150		--	Note 2
Brightness	Y	I_{LED}= 16mA	380	425		cd/㎡	Note 1 [PR880]
Brightness Uniformity	Y	I_{LED}=16mA	80			%	Note 5 [PR880]
Response time	$\tau_f + \tau_r$	θ =0 ° Ta =25 °C		35	50	ms	Note 4
White Chromaticity	Wx	θ =0 ° Ta =25 °C		0.309			Note 1 [PR650]
	Wy			0.330			
Red Chromaticity	Rx			0.612			
	Ry			0.338			
Green Chromaticity	Gx			0.320			
	Gy			0.555			
Blue Chromaticity	Bx			0.152			
	By			0.120			
Color Gamut	NTSC			50		%	

1. Optical Test Equipment & method refer to Note1,2,3,4.

[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. In case of backlight on, measured on the center area of the panel by PHOTO RESEARCH photometer PR-880&PR650 or Equivalent.
In case of backlight off, measured on the center area of the panel by DMS-803

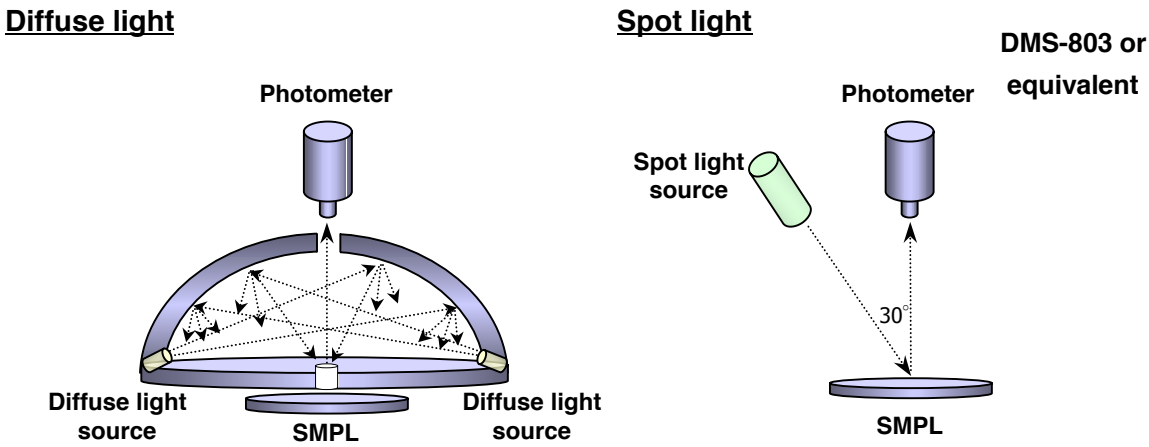


Fig 4.1 Backlight Off (Optical Characteristic Measurement Equipment and Method)

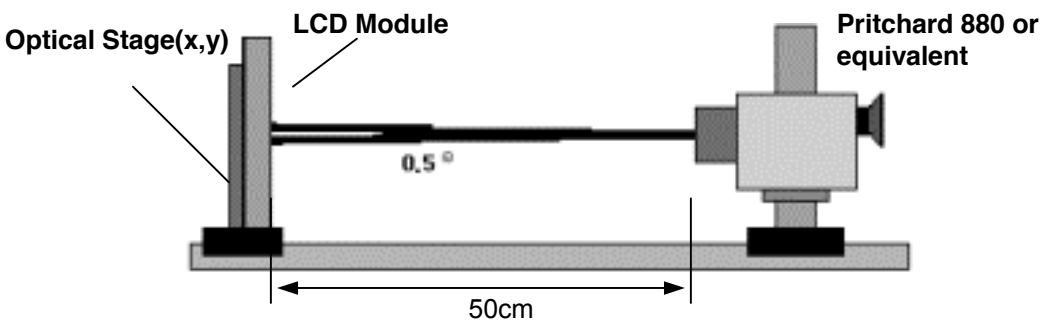


Fig 4.2 Backlight On (Optical Characteristic Measurement Equipment and Method)

[Note 2]

Contrast ratio is defined as follows ;

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

[Note 3]

Viewing angle range is defined as follows;

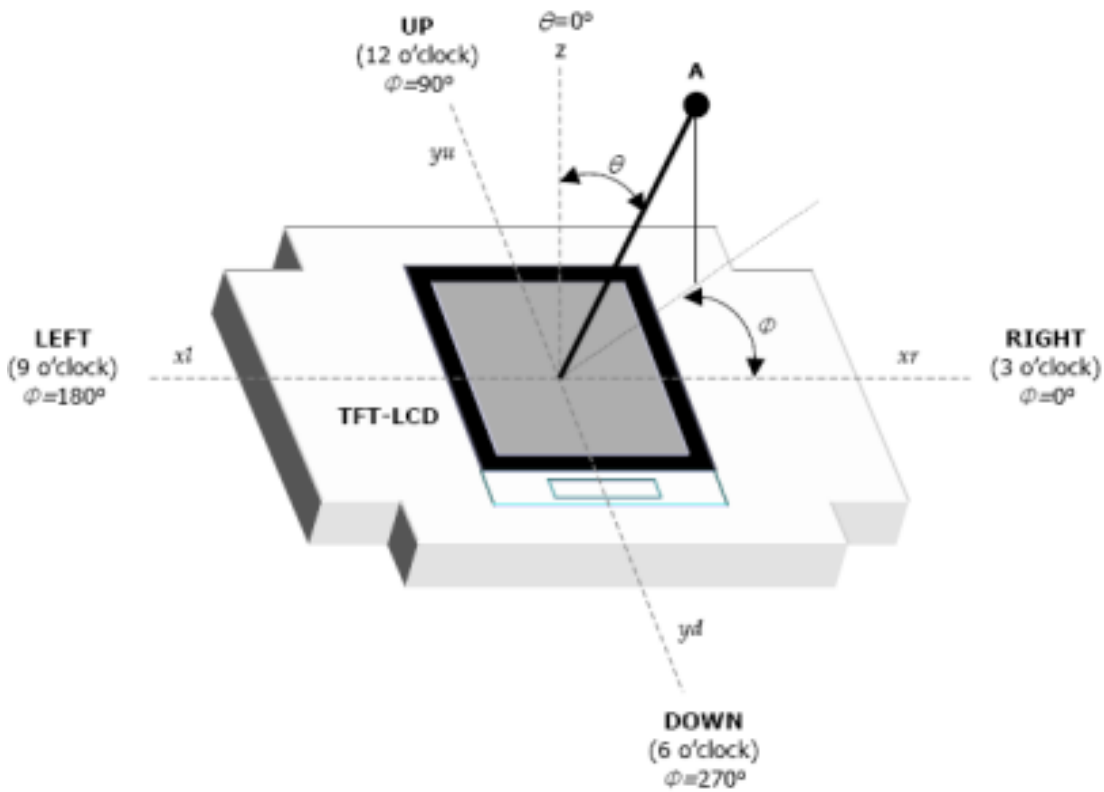


Fig 4.3 Viewing Angle Definitions

[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”.

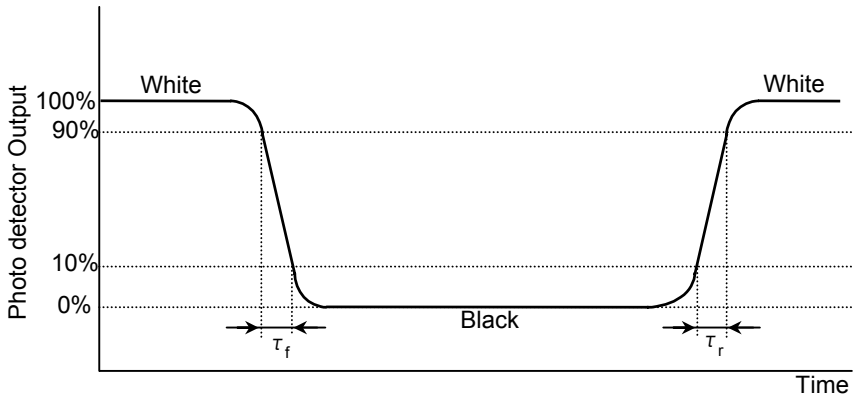


Fig 4.4 Response Time Definition

[Note 5]

The brightness measurement is taken at point B5.

$$\text{Brightness Uniformity} = \left(\frac{\text{Minimum Photo detector output for B1-B9 with all pixels white}}{\text{Maximum Photo detector output for B1-B9 with all pixels white}}\right) \times 100$$

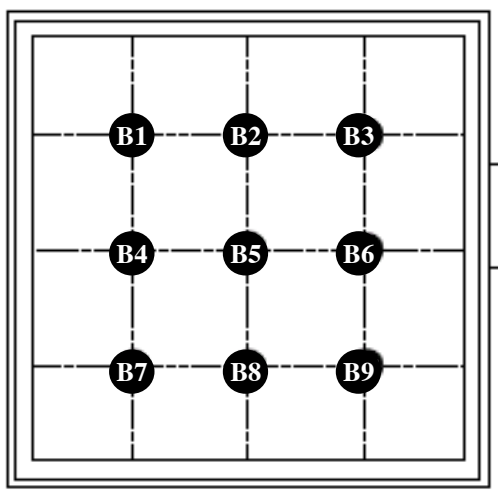


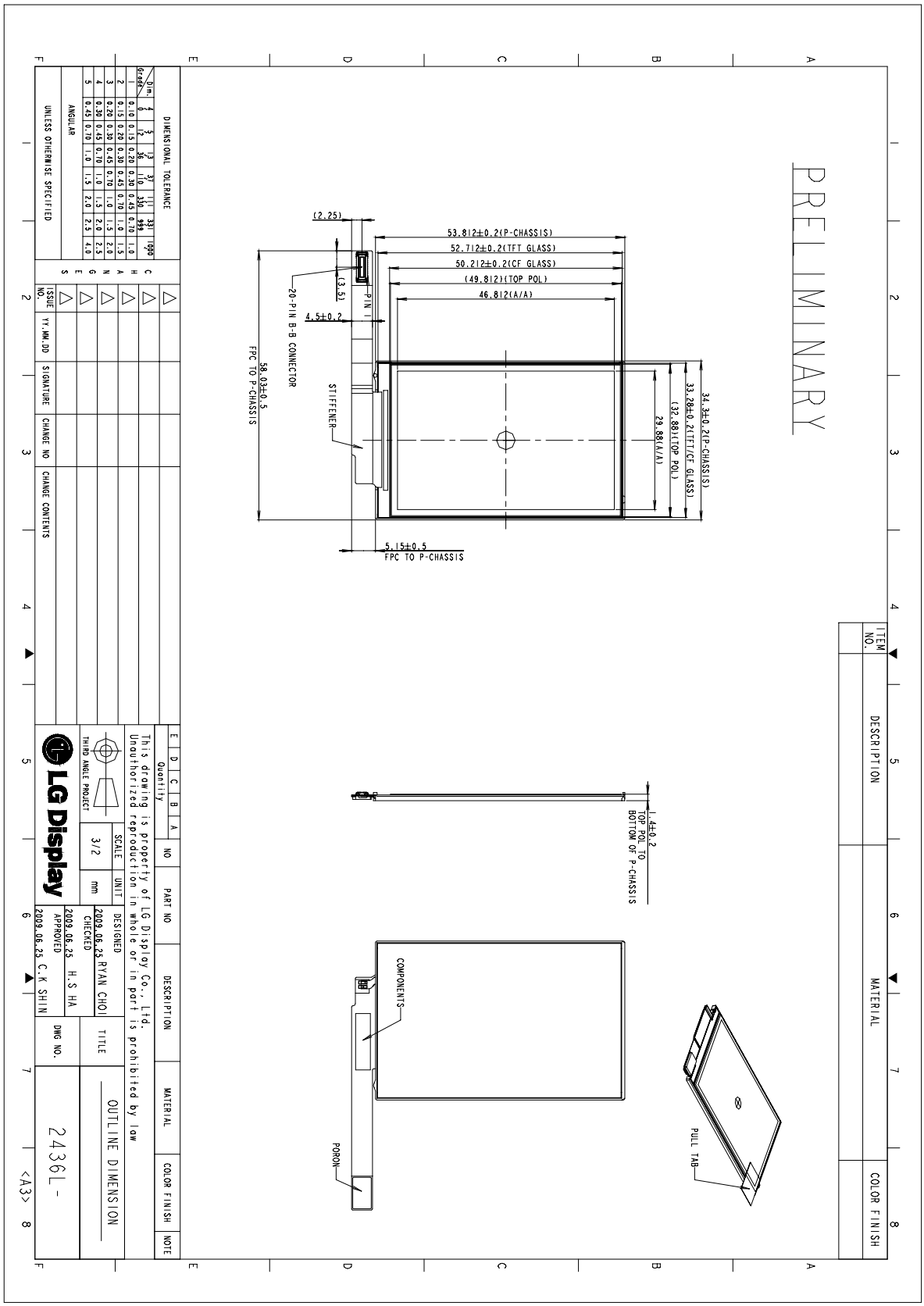
Fig 4.5 Brightness measurement points

5. MECHANICAL CHRACTERISTICS

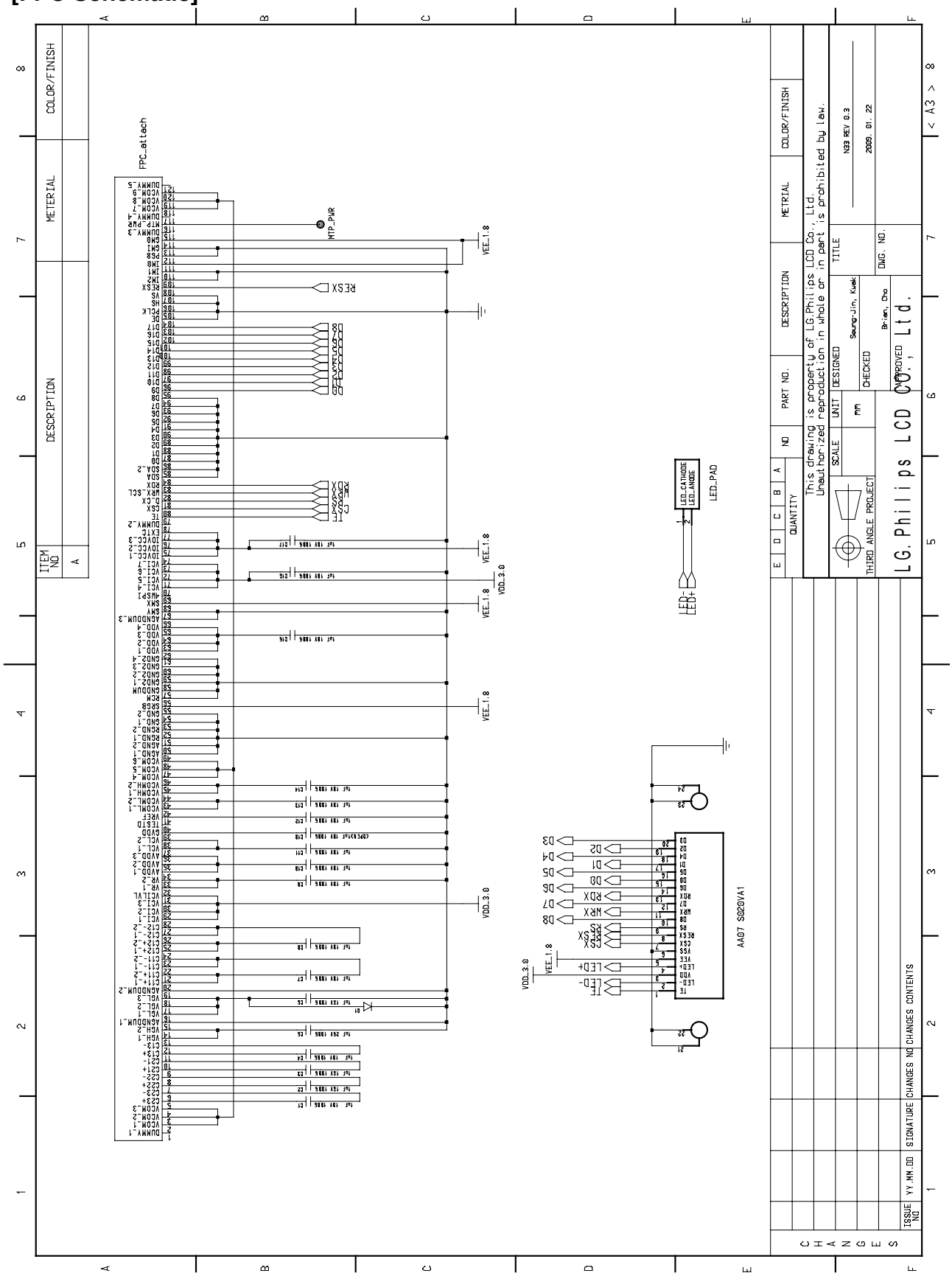
The contents provide general mechanical characteristics for the model.
In addition the figures in the next page are detailed mechanical drawing of the LCD.

DIMENSION	MIN	TYP	MAX	UNIT
HORIZONTAL (H)	-	34.38	-	mm
VERTICAL (V)	-	53.81	-	mm
THICKNESS (T)	-	1.40	-	mm

[Outline Dimension]



[FPC Schematic]



6. Application Note

Software flow chart

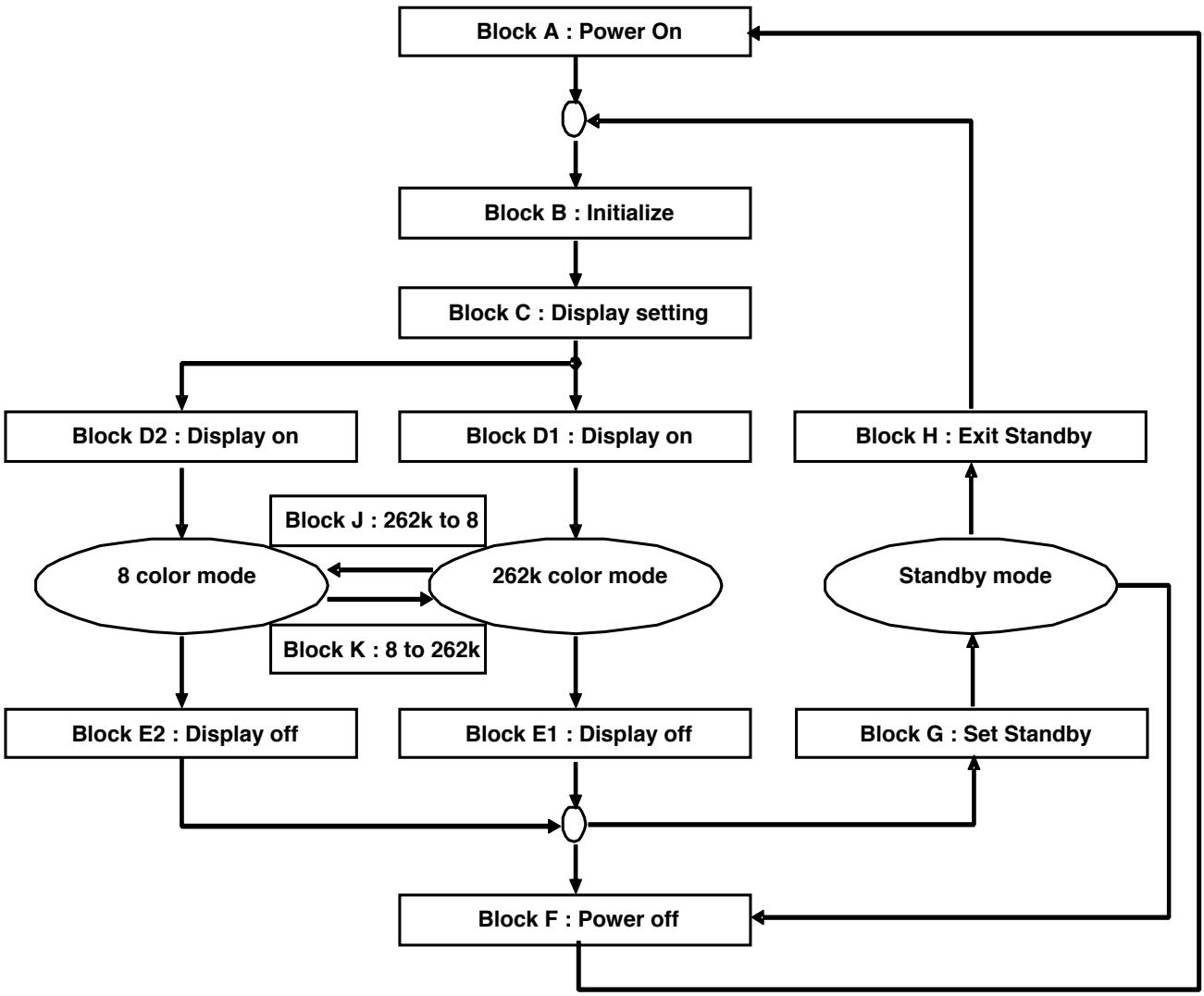


Table 6.1 Block A : Power off & Reset

Step	Command Parameter	Command name	Operation
1	IOVCC(1.8V) on		
2	VCI(3.0V) on		
3	RESX = 0		
4	Wait 1ms		
5	RESX = 1		
6	Wait 5ms		

Table 6.2 Block B : Initialize

Step	Command Parameter	Command name	Operation
1	11	Sleep Out	Send SLPOUT
2	Wait 120ms		

Table 6.3 Block C : Display settings

Step	Command Parameter	Command name	Operation
1	35 00	Tearing effect on	
2	36 00	Memory Data Access Control	Send MADCTL Send P1:MX=0, RGB=0
3	3A 66	Interface Pixel Format	Send COLMOD Send P1:VIPF[3:0]=0x06, IFPF[2:0]=0x06
4	2A 00 00 00 EF	Row Address Set	Send CASET Send P1:XS[15:8]=0x00 Send P2:XS[7:0]=0x00 Send P3:XE[15:8]=0x00 Send P4:XE[7:0]=0xEF
5	2B 00 00 01 77	Row Address Set	Send RASET Send P1:YS[15:8]=0x00 Send P2:YS[7:0]=0x00 Send P3:YE[15:8]=0x01 Send P4:YE[7:0]=0x77
6	B1 11 1B	Set Division ratio for internal clocks of Normal mode	Send FRMCTR1 Send P1:DIVA[4:0]=0x11 Send P2:VBPA[6:0]=0x1B
7	B2 11 1B	Set Division ratio for internal clocks of Idle mode	Send FRMCTR2 Send P1:DIVB[4:0]=0x11 Send P2:VBPB[6:0]=0x1B
8	B3 11 1B	Set Division ratio for internal clocks of Partial mode	Send FRMCTR3 Send P1:DIVC[4:0]=0x11 Send P2:VBPC[6:0]=0x1B
9	B4 02	Inversion control	Send INVCTR Send P1:NLB=1
10	B6 01 02	Display Function set 5	Send DISSET5 Send P1:EQ[1:0]=0x01 Send P2:PT[1:0]=0x02
11	C0 24	Power control 1	Send PWCTR1 Send P1:VRH[5:0]=0x24
12	C1 02 00	Power control 2	Send PWCTR2 Send P1:BT[2:0]=0x02 Send P2:VRA[3:0]=0x00

13	C2 05 01	Power control 3 (in Normal mode/Full colors)	Send PWCTR3 Send P1:APA[2:0]=0x05 Send P2:DCA[2:0]=0x01
14	C3 02 05	Power control 4 (in Idle mode/8-colors)	Send PWCTR4 Send P1:APA[2:0]=0x02 Send P2:DCA[2:0]=0x05
15	C4 02 04	Power control 5 (in Partial mode/full-colors)	Send PWCTR5 Send P1:APC[2:0]=0x02 Send P2:DCC[2:0]=0x04
16	C5 14 2E	VCOM control	Send VMCTR1 Send P1:VMH[6:0]=0x14 Send P2:VML[6:0]=0x2E
17	EA 01	Gamma Selection	Send GAM_R_SEL Send P1:GAM_R_SEL=1
18	E0 27 2B 2E 06 0D 11 28 7B 35 0C 20 26 25 28 3C	Positive RED Gamma Control	Send GMCTRP0 Send P1 Send P2 Send P3 Send P4 Send P5 Send P6 Send P7 Send P8 Send P9 Send P10 Send P11 Send P12 Send P13 Send P14 Send P15
19	E1 08 21 26 09 0F 12 1F 38 31 0D 23 29 2C 2F 33	Negative RED Gamma Control	Send GMCTRN0 Send P1 Send P2 Send P3 Send P4 Send P5 Send P6 Send P7 Send P8 Send P9 Send P10 Send P11 Send P12 Send P13 Send P14 Send P15
20	E2 27 2C 2F 07 0E 11 29 7A 35 0C 20 26 24 29 3C	Positive GREEN Gamma Control	Send GMCTRP1 Send P1 Send P2 Send P3 Send P4 Send P5 Send P6 Send P7 Send P8 Send P9 Send P10 Send P11 Send P12 Send P13 Send P14 Send P15

21	E3	Negative GREEN Gamma Control	Send GMCTRN1
	08		Send P1
	20		Send P2
	26		Send P3
	09		Send P4
	0F		Send P5
	12		Send P6
	1F		Send P7
	48		Send P8
	30		Send P9
	0D		Send P10
	22		Send P11
	28		Send P12
	2B		Send P13
	2E		Send P14
	33		Send P15
22	E4	Positive BLUE Gamma Control	Send GMCTRP2
	1F		Send P1
	24		Send P2
	27		Send P3
	08		Send P4
	0F		Send P5
	12		Send P6
	25		Send P7
	7B		Send P8
	32		Send P9
	0C		Send P10
	20		Send P11
	26		Send P12
	20		Send P13
	25		Send P14
	3C		Send P15
23	E5	Negative BLUE Gamma Control	Send GMCTRN2
	08		Send P1
	24		Send P2
	2B		Send P3
	09		Send P4
	0F		Send P5
	12		Send P6
	22		Send P7
	38		Send P8
	35		Send P9
	0C		Send P10
	21		Send P11
	27		Send P12
	33		Send P13
	36		Send P14
	3B		Send P15
24	F0		Send Eng Mode
	AA		Send P1
	55		Send P2
	25		Send P3
25	F6	Enable Sink Current Funtion	Send Test Mode
	7F		Send P1
	8A		Send P2
	34		Send P3
	00		Send P4
	04		Send P5
	26		Send P6
	07		Send P7

Table 6.4 Block D1 : Display on into 262k color mode

Step	Command Parameter	Command name	Operation
1	2C **	Memory write	Send RAMWR Send Display data
2	13	Normal display mode on	Send NORON
3	29	Dispay on	Send DISPON

Table 6.5 Block D2 : Display on into 8 color mode

Step	Command Parameter	Command name	Operation
1	2C **	Memory write	Send RAMWR Send Display data
2	39	Idle mode on	Send IDMON
3	29	Dispay on	Send DISPON

Table 6.6 Block E1 : Display off into 262k color mode

Step	Command Parameter	Command name	Operation
1	28	Display off	Send DISPOFF

Table 6.7 Block E2 : Display off into 8 color mode

Step	Command Parameter	Command name	Operation
1	28	Display off	Send DISPOFF
2	38	Idle mode off	Send IDMOFF

Table 6.8 Block F : Power off

Step	Command Parameter	Command name	Operation
1	Delay 120ms		
2	RESX = 0		
3	Delay 120ms		
4	VCI(3.0V) off		
5	IOVCC(1.8V) off		

Table 6.9 Block G : Set standby

Step	Command Parameter	Command name	Operation
1	F6 7F 8A 34 00 04 26 00	Diable Sink Current Funtion	Send Test Mode Send P1 Send P2 Send P3 Send P4 Send P5 Send P6 Send P7
2	10	Sleep in	Send SLPIN

Table 6.10 Block H : Exit standby

Step	Command Parameter	Command name	Operation
1	Delay 120ms		
2	11	Sleep Out	Send SLPOUT
3	Delay 120ms		

Table 6.11 Block J : 262k to 8 color mode

Step	Command Parameter	Command name	Operation
1	39	Idle mode on	Send IDMON
2	F6	Diable Sink Current Funtion	Send Test Mode
	7F		Send P1
	8A		Send P2
	34		Send P3
	00		Send P4
	04		Send P5
	26		Send P6
	00		Send P7

Table 6.12 Block K : 8 to 262k color mode

Step	Command Parameter	Command name	Operation
1	F6	Enable Sink Current Funtion	Send Test Mode
	7F		Send P1
	8A		Send P2
	34		Send P3
	00		Send P4
	04		Send P5
	26		Send P6
	07		Send P7
2	38	Idle mode off	Send IDMOFF

7. RELIABLITY TEST

7-1. RELIABLITY TEST

No.	Test Items	Test Condition	Remark
1	Low Temperature Storage	Ta=-30℃ 240hrs	
2	High Temperature Storage	Ta=70℃ 240hrs	
3	Low Temperature Operation	Ta=-10℃ 240hrs	
4	High Temperature Operation	Ta=60℃ 240hrs	
5	High Temperature and High Humidity Operation	Ta=40℃ 95%RH 240hrs	
6	High temperature and Humidity Storage	Ta=60℃ 90%RH 240hrs	
7	Low Pressure Non-operating	303hpa(40,000ft), RT, 48hrs	
8	Heat Shock	-30C to +70C, 10 cycles, 1.5h	
9	Shock Test	Half sine wave, 180G, 2ms, 1 time shock of X, Y, Z axis	
10	Vibration Test	- X, Y, Z : 1hr(axis, sweep) - Acceleration : 10mm/4.4G/2.5G the amplitude is 10mm - Sweep range: 5~15Hz/10mm P-P/ 16~30Hz/4.4G, 30~300Hz/2.5G	

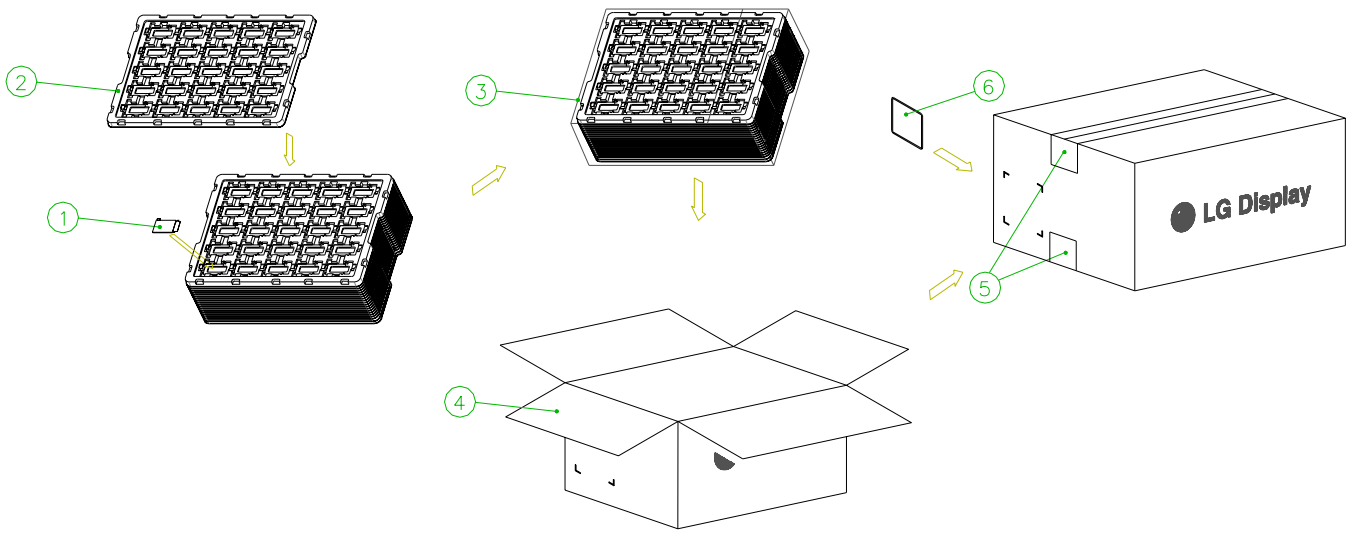
{ Result Evaluation Criteria }
TFT-LCD Panel should be at room temperature for 2 hours after the reliability test is over.
There should be no particular change which might affect the practical display function
and the display quality should be conducted under normal operating condition.

8. PACKING

a) Package quantity in one box : 500 pcs

b) Box Size : 475mm X 348mm X 210mm

c) 1Box = 20(Full tray) + 1 (dummy / top tray) = 21 tray



No.	Description	Material
1	Module	
2	Packing, tray	PET(0.8t)
3	Bag	PE 560x830
4	Box	SWR4
5	Tape	OPP 70MMx300m
6	Label	Art Paper 100x70

9. PRECAUTIONS

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

9-1. ASSEMBLY PRECAUTIONS

(1) 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.
(2) You should adopt radiation structure to satisfy the temperature specification.
(3) 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.
(4) 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.)
(5) 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.
(6) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
(7) Do not open the case because inside circuits do not have sufficient strength.
(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.

10. International Standards

10-1. 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.

10-2. Environment

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

10-3. EMC

a) ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHZ to 40GHz. “American National Standards Institute(ANSI), 1992
b) CISPR22 “Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment.“ International Special Committee on Radio Interference.
c) EN 55022 “Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment.“ European Committee for Electrotechnical Standardization.(CENELEC), 1998
(Including A1: 2000)