Cover page

APPROVAL SHEET

Title	SPECIFICATION FOR APPROVAL LH500WF1-SD02(GV-JP PJT)

CUSTOMER	LG Electronics
MODEL	GV-JP

SUPPLIER	LG Display
MODEL	LH500WF1

SIGNATURE	DATE

APPROVED BY	DATE
정상덕	2013.02.13
구태훈	2013.02.13
이윤길	2013.02.13

☐ Preliminary Specification
■ Final Specification

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1. RECORD Of REVISION

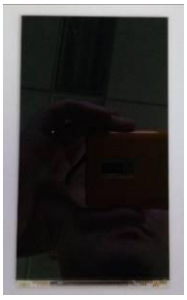
Revision	Date	Contents of Revision Change	Remark
1.0	13.01.02	Final Specification Release	All page
1.1	13.0118	Weight change (17.54g → 18.5g)	4page
1.2	13.01.24	Comment change (→LG Display)	56page
1.3	13.01.26	Source Timing Setting (C4 Register Changed)	32page
1.4	13.02.06	Added the Inspection Condition & AQL Level	50page
1.4	13.02.13	Added the FOG ACF (CP5731AL)	6page

2. GENERAL DESCRIPTION

2.1. General Feature

No	ITEM	Specification	Remark
1	Display method	Active matrix TFT	
2	Display mode	Transmissive Type	
3	Display Resolution	1080(H) X 1920(V)	
4	Active area (mm)	62.37mm(W) X 110.88mm(H)	
5	Screen Size (inch)	5.01”	
6	Pixel pitch (mm)	0. 01925mm X 0.05775mm	440ppi
7	Display Color	16.7M color	
8	Surface Treatment	Clear	
9	Outside Dimension (mm)	65.27mm(W) x 117.88mm(H) x 1.45mm(D)	
10	Viewing Angle	Wide view(80˚/80˚/80˚/80˚)	
11	Weight (g)	18.5± 10%	
12	Driver IC	R63311	29.8(H) x 0.85(V) x 0.17(D)
13	Method of inversion	Column inversion	
14	Interface	MIPI 4Lane 1GHz	

2.2. Module Part List


COG ass'y

FPC ass'y

BLU ass'y

Insulation Tape

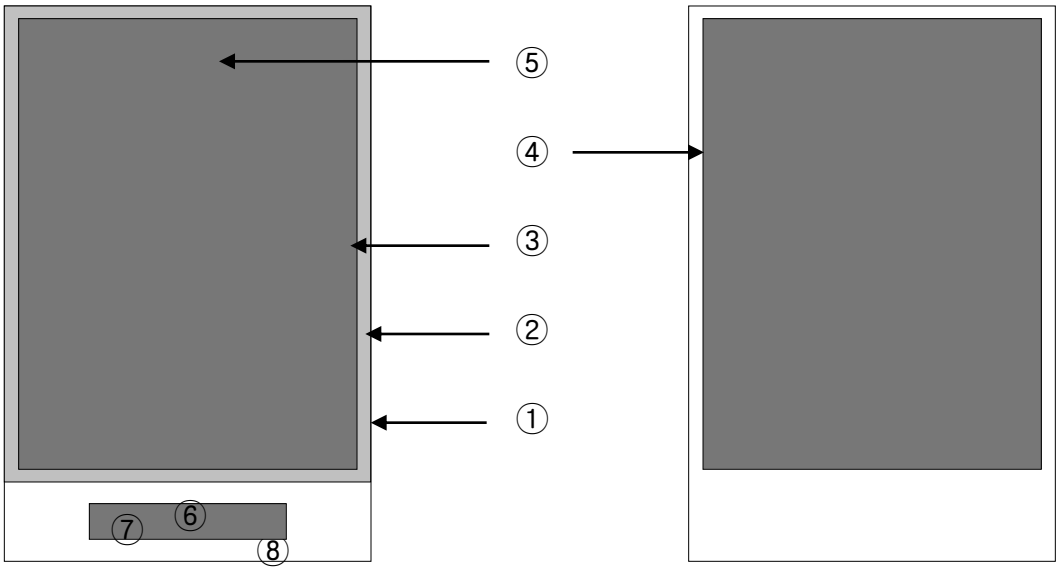
Gap Filling Tape

Remove Tape

No.	Name	Part name	Maker	Amount
1	COG ass'y	6061L-2407	LG Display[1)]	1
2	FPC ass'y	6841L-0337A	Newflex	1
3	BLU ass'y	6091L-2175A	KJP	1
4	Insulation Tape	7250L-2544A	SERVEONE	1
5	Insulation Tape	7250L-2545A	SERVEONE	1
6	Remove Tape	7250L-2188A	SERVEONE	1
7	Gap Filling Tape	7250L-3005A	SERVEONE	1
8	Gap Filling Tape	7250L-3013A	SERVEONE	1

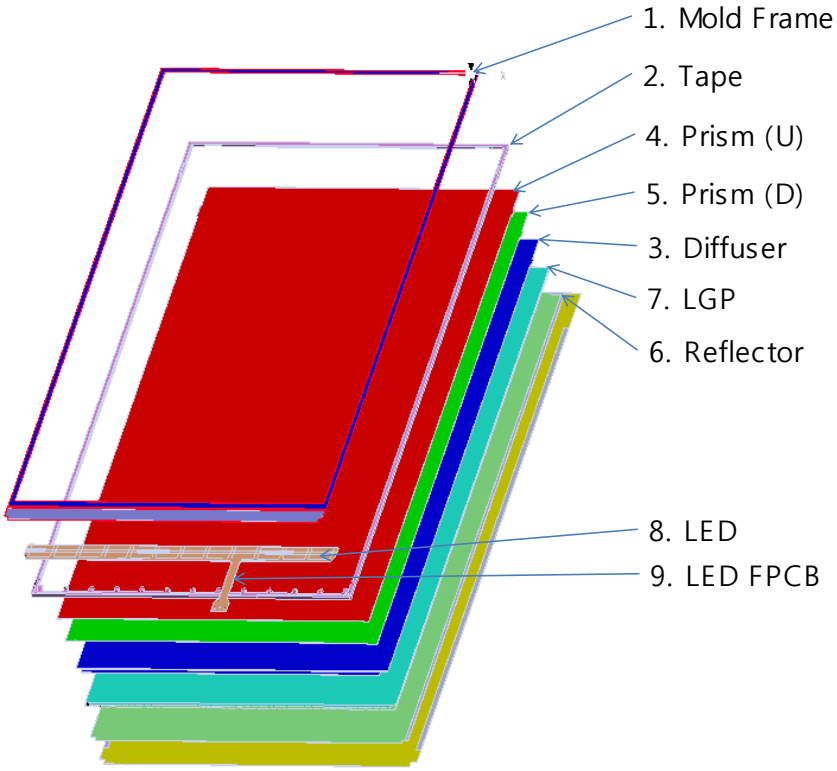
Note. 1) COG ass'y의Panel은 LG Display 패널을 사용함.

2.3. Panel Part List



No.	Name	Spec.	Maker
1	TFT Glass	0.18t	Asahi
2	Color Filter Glass	0.18t	Asahi
3	Upper Polarizer	HC+QWP	Nitto
4	Lower Polarizer	APCF + HAZE 50%	Nitto
5	Liquid Crystal	ML1102	Merck
6	Driver IC	R63311 29.8(H) x 0.85(V) x 0.17(D)	RSP
7	ACF(COG)	CP33731-18YA, 1.5mm	Sony
8	ACF(FOG)	AC-7823YM-18, 1.0mm	Hitachi
		CP5731AL, 1.0mm	Sony

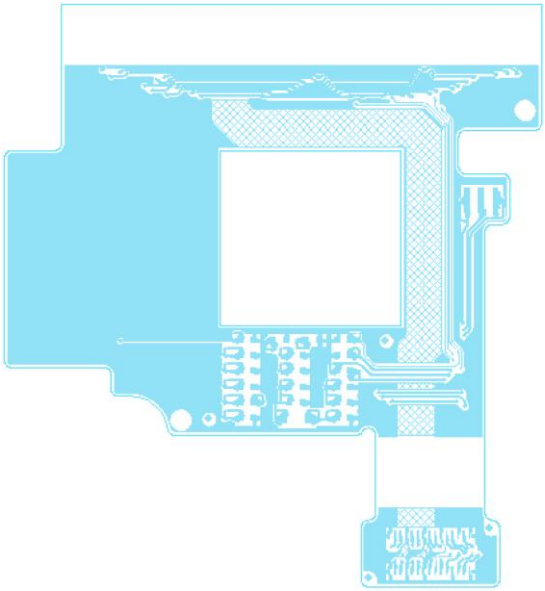
2.4. BLU & Bezel Part List



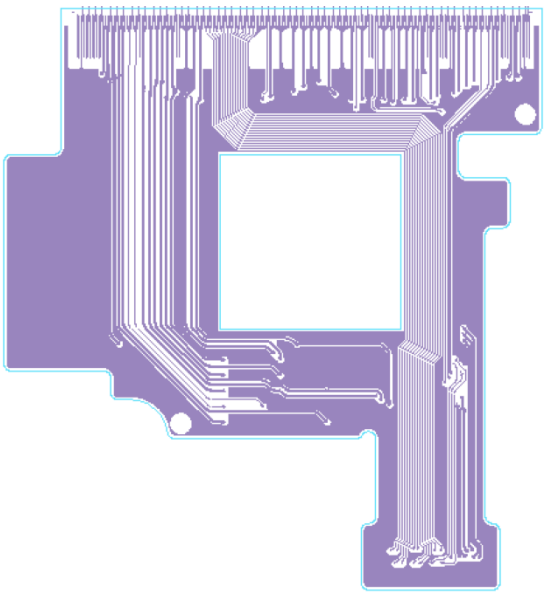
No.	Part name	Material Maker P/N	Q'TY	Specification	Maker
1	Mold Frame	4980L-0975A	1	PC (LB1010W)	KJP
2	Tape (Light Shielding, Double Adhesive, etc.)	7250L-3008A	1	5684E	NITTO
3	Diffuser	3022L-2316A	1	38K2S	KIMOTO
4	Prism (U)	3032L-1736A	1	BEF4-GMv2	3M
5	Prism (D)	3032L-1735A	1	TBEF2-GT	3M
6	Reflector	3034L-1444A	1	ESR	3M
7	LGP	5150L-0985A	1	HL8002	KJP
8	LED	6915L-0497A	12	SMFD07	SSC
9	LED FPCB	6850L-1072A	1	1 Layer	-

2.5. FPCB Part list & Structure

Top Layer



Bottom Layer



No.	Part Name	Specification	Maker	EA	Note
1	FPC	37.25 * 40.32mm, 2L, Max. 0.135T	Newflex	1	-
2	Capacitor	1uF,25V,1005, 0.55T(Max)	Note 1)	6	C1~C4,C15,C16
3	Capacitor	4.7uF,10V,1005, 0.70T(Max)	Note 1)	2	C5,C7
4	Capacitor	2.2uF,10V,1005, 0.55T(Max)	Note 1)	2	C6,C8
5	Capacitor	1uF,6.3V,1005, 0.55T(Max)	Note 1)	2	C9,C14
6	Capacitor	2.2uF,6.3V,1005, 0.55T(Max)	Note 1)	4	C10~C13
7	Diode	SDM10U45, SOD-523, 0.70T(Max)	ROHM	1	D1
8	Connector	Board to Board GB042-30P-H10, LS Mtron, 30, 0.4, HEADER, 1.0 R/TP, AU	LS MTRON	1	CNT1

Note 1) Capacitor/Resistor Maker : MURATA, TAYO YUDEN, TDK, AVX-KYOCERA, Samsung Electro-Mechanics, Walsin

2.6. Optical Characteristic

Item		Symbol	Condition	Unit	Min.	Typ.	Max	Notes
Response Time	Rise	Tr	25˚C	ms	-	20	-	
	Fall	Tf	25˚C	ms	-	20	-	
Luminance		Bp	Θ = 0˚	cd/㎡	360	450	-	
Luminance uniformity		ΔL	Θ = 0˚	%	80	85	-	
Contrast Ratio		C/R	Θ = 0˚		700	1000	-	
Viewing Angle		Top	CR>10˚	Degree	70	80	-	
		Bottom			70	80	-	
		Right			70	80	-	
		Left			70	80	-	
Color Coordination		Rx	Θ = 0˚	NTSC (x.y)	0.612	0.642	0.672	1)
		Ry			0.301	0.331	0.361	1)
		Gx			0.270	0.300	0.330	1)
		Gy			0.591	0.621	0.651	1)
		Bx			0.122	0.152	0.182	1)
		By			0.033	0.063	0.093	1)
		Wx			0.277	0.302	0.327	1)
		Wy			0.298	0.323	0.348	1)
Color Gamut (CIE 1931)			Θ = 0˚	%	65	70	-	
CCT			Θ = 0˚	K	5,000	-	9,000	
Cross Talk		C/T	Θ = 0˚	%	-	3	5	
Flicker		F/K	Θ = 0˚	%	-	-	20	

2.7. Optical Specification (Note)

[Note 1] Optical Test Equipment Setup

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 5 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface. And backlight LED current is 20mA.

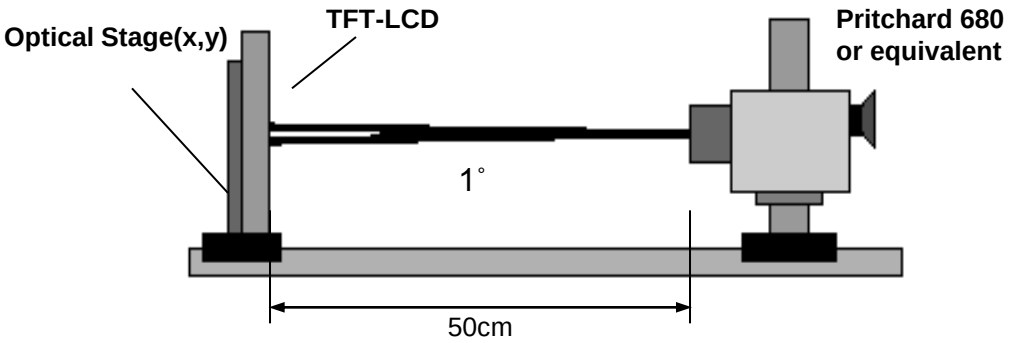


Fig. 2-1. Optical Characteristic Measurement Equipment and Method

※ Measuring Condition:
- Measuring surroundings : Dark Room
- Measuring temperature : T_a=25°C
- Adjust operating voltage to get optimum contrast at the center of the display.
- Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

[Note 2] Color Coordination

Measured value in ±0.03~0.035, LCD Modules require the separate discuss.

[Note 3] Viewing Angle

Viewing angle range is defined as follows;

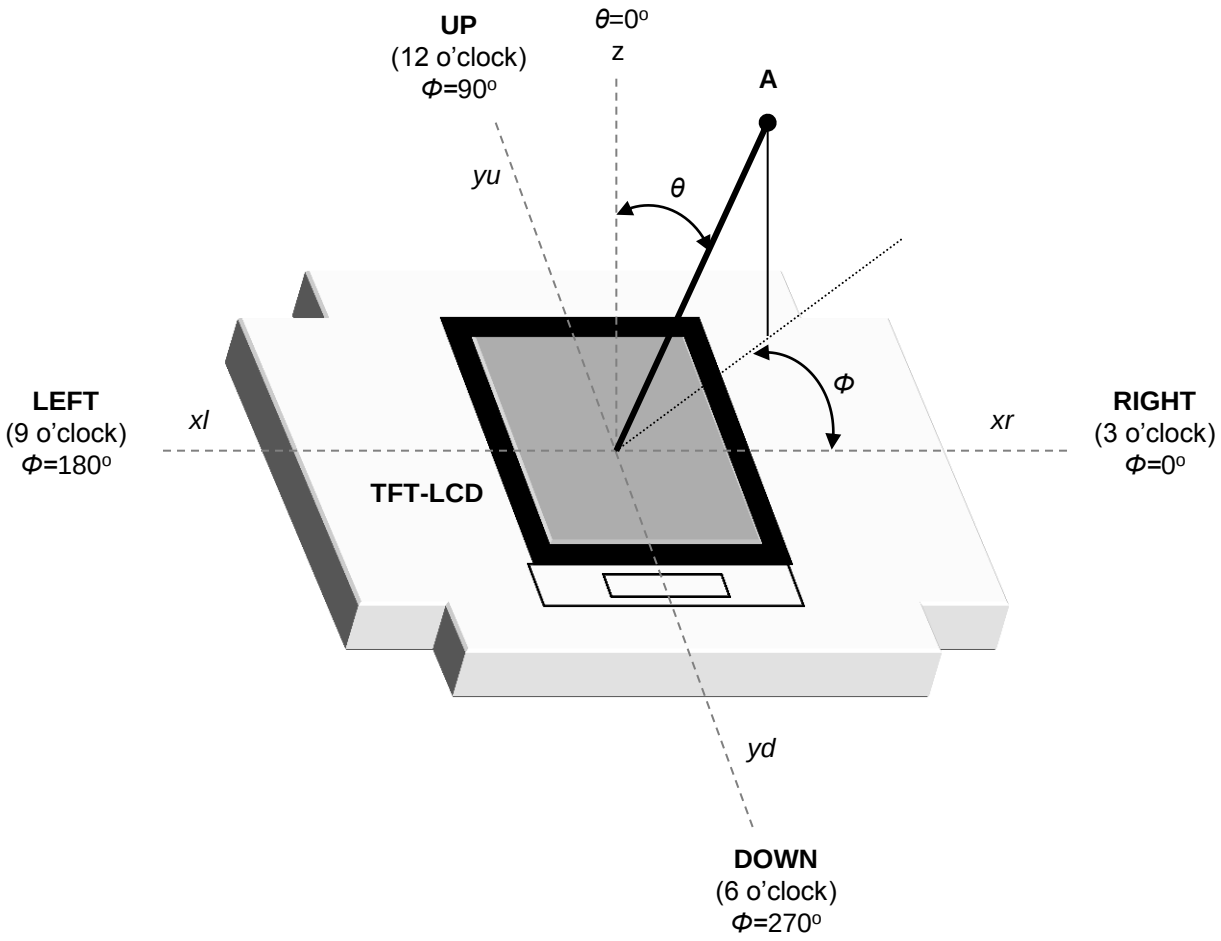


Fig. 2-2. Viewing angle

[Note 4] Contrast Ratio

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 5] Luminance

The luminance measurement is taken at point P5.

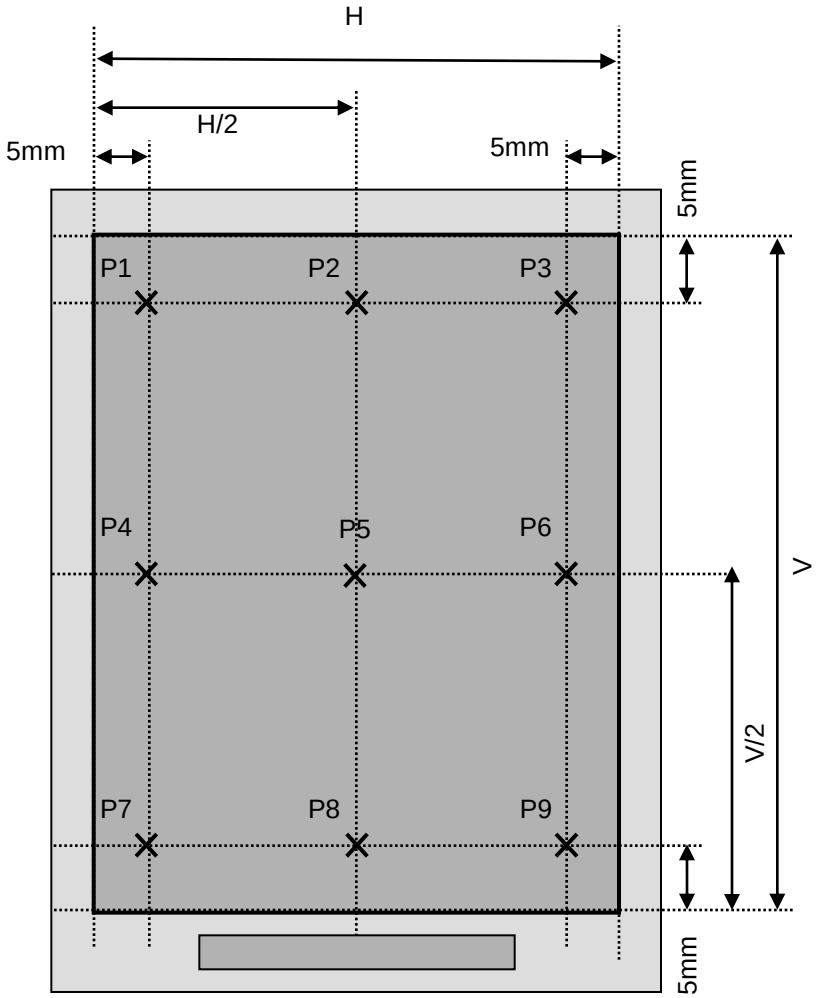


Fig. 2-3. Luminance measurement points

[Note 6] Luminance Uniformity

$$\text{Luminance Uniformity} = \frac{\text{Minimum Luminance for P1 ~ P9 with all white pixels}}{\text{Maximum Luminance for P1 ~ P9 with all white pixels}}$$

[Note 7] Response Time

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”.

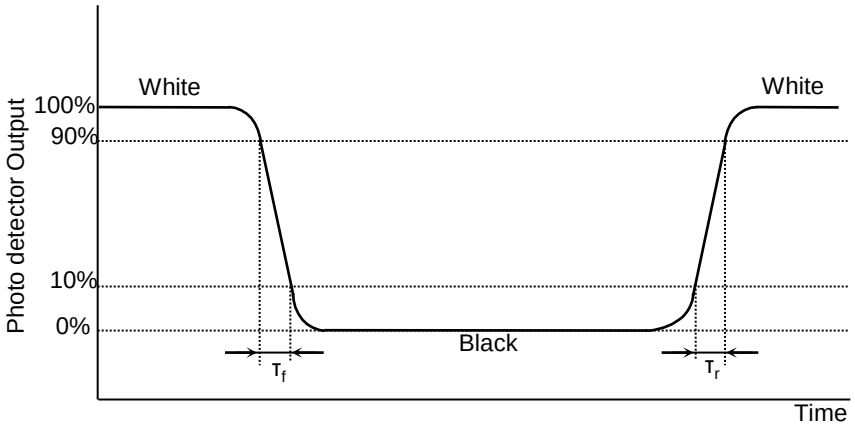
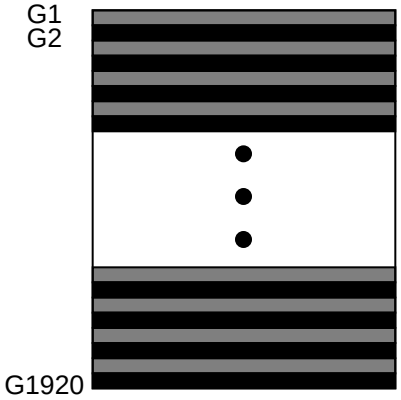


Fig. 2-4. Response Time

[Note 8] Flicker

The flicker level should be measured with horizontal gray/black stripes. The flicker is essentially a ratio of the powers in the frequency spectrum at 30 Hz (P_X) and 0 Hz (P_{0-} DC level).

$$F = 20 \text{ Log } (P_X / P_0)$$



[Note 9] Crosstalk

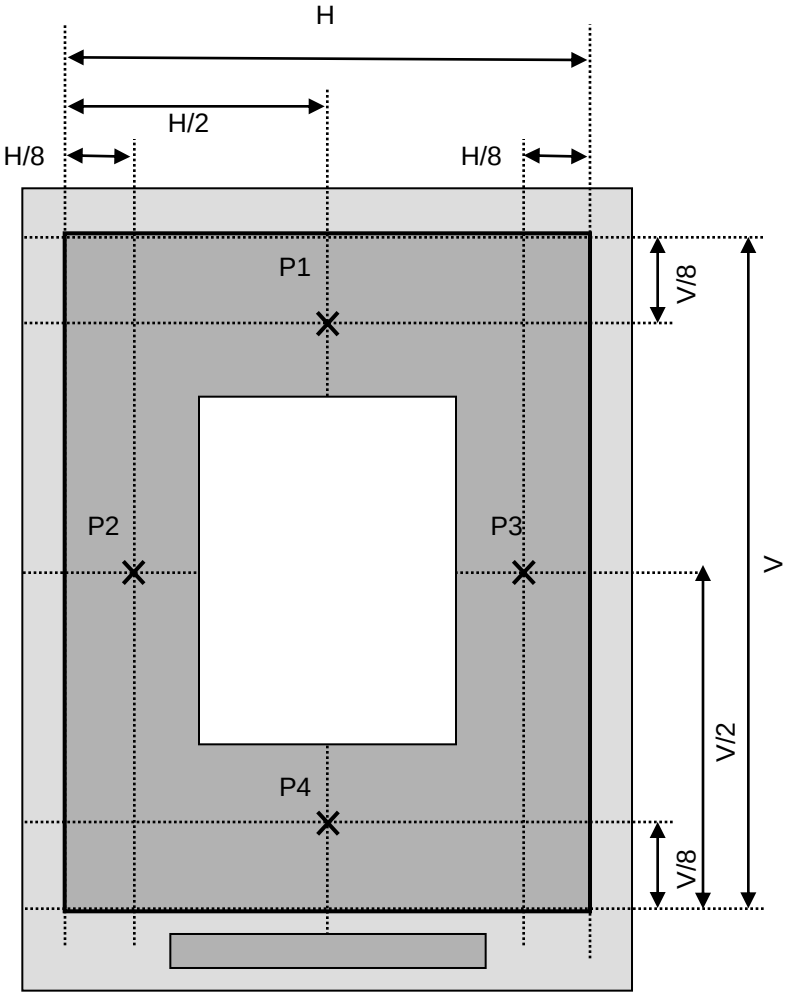


Fig. 2-5. Crosstalk measurement points

A: Luminance for P1 ~ P4 with all 127gray pixels

B: Luminance for P1 ~ P4 with 127gray pixels when the black box is applied

$$\text{Crosstalk [\%]} = \text{Maximum}\left[\text{Absolute}\left(\frac{A - B}{A}\right)\right]$$

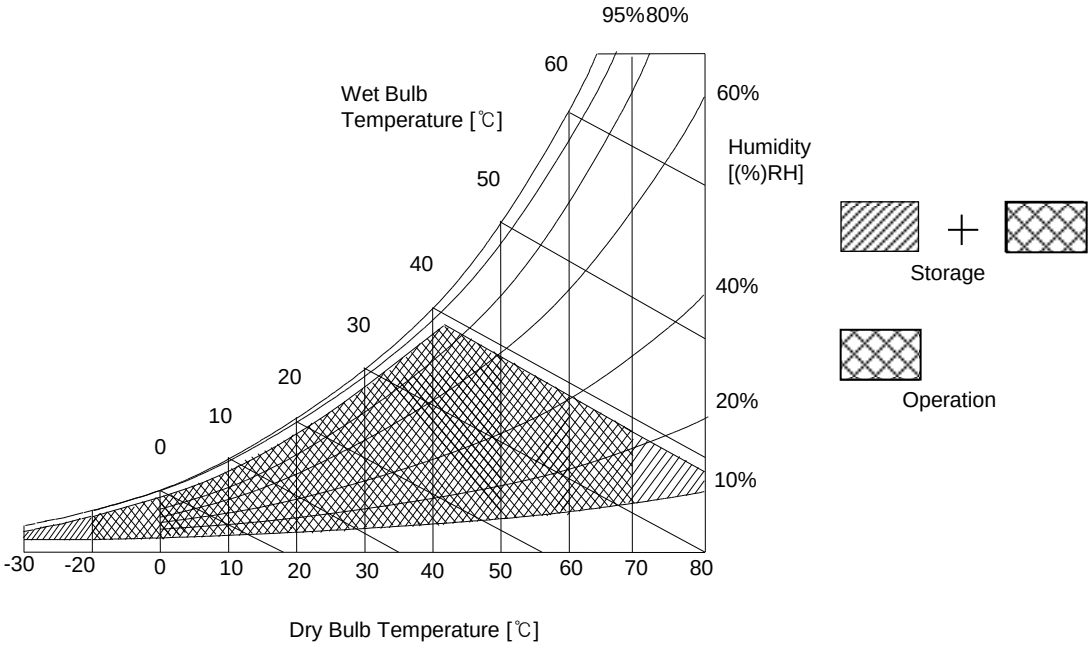
3. Electrical Characteristic

3.1. Absolute Maximum Rating

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power for Analog Circuit	VSP	4.5	5.0	6.0	V	
Power for Logic Circuit	VSN	-6.0	-5.0	4.5	V	
Power for Interface Circuit	IOVCC	1.65	1.8	3.3	V	
Storage Humidity	Hstg	10	-	90	%RH	Note 1), 2)
Storage Temperature	T_{STG}	-30	-	80	°C	Note 1), 2)
Operating Ambient Humidity	H_{OP}	10	-	90	%RH	Note 1), 2)
Operating Ambient Temperature	T_{OP}	-20	-	70	°C	Note 1), 2)

Note 1) Temp. ≤ 60℃ , 90% RH MAX.
Temp. ＞60℃ , Absolute humidity shall be less than 90% RH at 60℃.

Note 2) The diagram below indicates the peripheral environment of the module.
The wet bulb temperature should be kept under 39 °C and there should be no compensation.
If the LSI is used above these absolute maximum ratings, it may become permanently damaged.

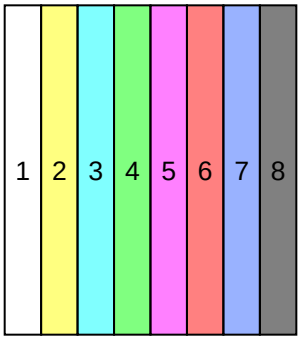


3.2. Electrical Characteristic

Ta + 25˚C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power for Interface Circuit		IOVCC	1.65	1.8	3.3	V	
Power for Positive Source		VSP	4.9	5.0	5.1	V	
Power for Negative Source		VSN	-5.1	-5.0	-4.9	V	
Power for BLU Driving		IBAT	-	20	-	mA	12LEDs serial
Logic Input High Voltage		VIH	0.7×IOVCC	-	IOVCC	V	
Logic Input Low Voltage		VIL	0	-	0.3×IOVCC	V	
Frame Frequency		Ff	60			Hz	
Current Consumption	Normal Display	Iiovcc	-	17	20	mA	
		Ivsp	-	14	23	mA	
		Ivsn	-	11	20	mA	
	Sleep Mode	$I_{iovcc\text{-}stb}$	-	0.5	1.5	mA	
		$I_{iovcc\text{-}dsb}$	-	0.01	0.1	mA	
	BLU Driving	Ibat	-	20	-	mA	20mA/LED
Power Consumption	Normal Display	Iiovcc	-	30	35	mW	
		Ivsp	-	70	115	mW	
		Ivsn	-	55	100	mW	
	Sleep Mode	$I_{iovcc\text{-}stb}$	-	1	3	mW	
		$I_{iovcc\text{-}dsb}$	-	0.02	0.2	mW	
	BLU Driving	Ibat	-	720	-	mW	20mA/LED

* All kinds of specifications and functions are optimized with the below Test condition
 - IOVCC : 1.8V, VSP : 5.0V, VSN : -5.0V, Column inversion, Ta 25℃
** The Typ. current/power consumption is measured at the below color bar test pattern



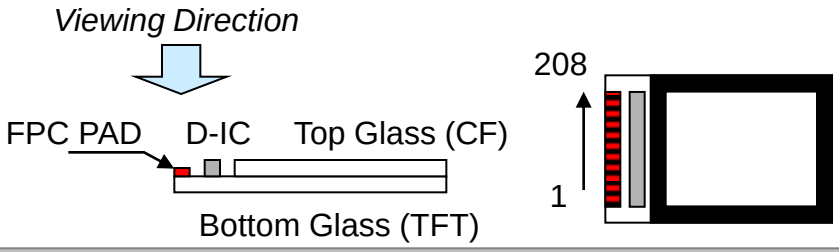
1. White
2. Yellow
3. Light blue
4. Green
5. Purple
6. Red
7. Blue
8. Black

3.3. FPC PAD Pin Assignment (Panel)

No.	Symbol	Description	No.	Symbol	Description
1	Dummy	NC	50	VCOMDC	-
2	GND	GND	51~52	AGND	GND
3	Dummy	NC	53~54	VDD	-
4	AG_Paste	-	55	IOVCCRF	IOVCC
5~6	VCOM	-	56~58	IOVCC	
7	AGND	GND	59	GNDRF	GND
8	GVSS	-	60~61	GND	
9	GND	GND	62	LEDPWM	LEDPWM
10	PBCTLA1	NC	63	EXCK	GND
11	PBCTLA2		64	DBIST	
12	PBCTLB1		65	LNSW1	IOVCC
13	PBCTLB2		66	LNSW0	
14~15	GVDD	-	67	PNSW	
16~17	VGH	-	68	IM2	
18~20	C21P	Capacitor connection Pins for step-up 2	69	IM1	
21~23	C21M		70	IM0	GND
24~26	SVDD	-	71	VSOUT	VSYNC
27~29	VSP	VSP	72	HSOUT	NC
30	EXPWRP		73	TE2	
31	VSWP	NC	74	TE	
32~33	SVSS	-	75	CSX	IOVCC
34~35	VSN	VSN	76	DCX	
36~37	AGND	GND	77	WRX/SCL	
38~39	C41M	NC	78	DOUT	NC
40~41	C41P		79	DIN	IOVCC
42~43	VCL	-	80	RESX	RESET
44~46	VCI	VCI	81~82	IOVCC	IOVCC
47	Dummy	NC	83~86	GND	GND
48~49	VCOM	-	87~90	AGND	

3.3. FPC PAD Pin Assignment (Panel) *continued*

No.	Symbol	Description	No.	Symbol	Description
91~94	VCI	-	151~153	IOVCC	IOVCC
95~99	SVDD	-	154~155	VDDLP	-
100~101	VGS	GND	156~158	GND	GND
102~106	SVSS	-	159~161	AGND	
107~110	VCL	-	162	Dummy1	NC
111~114	AGND	GND	163	Dummy2	
115~118	GND		164~165	VCL	-
119~120	VDD	-	166~168	VCI	-
121	IOVCC	IOVCC	169~170	SVDD	-
122~123	GND	GND	171~172	VSP	VSP
124~126	DPHYGND		173	EXPWRN	
127~128	DATA2P	MIPI Data2+	174~176	VSN	VSN
129~130	DATA2N	MIPI Data2-	177~179	SVSS	-
131	DPHYGNDDUM1	GND	180	VSWN	NC
132~133	DATA1P	MIPI Data1+	181~183	C31P	Capacitor connection Pins for step-up 3
134~135	DATA1N	MIPI Data1-	184~186	C31M	
136	DPHYGNDDUM2	GND	187~188	VGL	-
137~138	CLKP	MIPI CLK +	189~190	GVSS	-
139~140	CLKN	MIPI CLK -	191~192	GND	GND
141	DPHYGNDDUM3	GND	193	GVDD	-
142~143	DATA0P	MIPI Data0+	194~195	AGND	GND
144~145	DATA0N	MIPI Data0-	196~197	VCOM	-
146	DPHYGNDDUM4	GND	198~208	Dummy	NC
147~148	DATA3P	MIPI Data3+	207	GND	GND
149~150	DATA3N	MIPI Data3-	208	Dummy	NC



3.4. Pin Description (FPCB Connector)

Pin No.	Symbol	Description	Remark
1	GND	I	Ground
2	LED_C1	I	LED Cathode connection
3	LED_C2	I	LED Cathode connection
4	GND	I	Ground
5	IOVCC	I	Power supply for internal logic circuits
6	LEDPWM	O	LED PWM signal
7	VSYNC	O	Frame synchronization signal
8	/RESET	I	Hardware reset signal
9	GND	I	Ground
10	DATA1P	I/O	MIPI Data1 pin
11	DATA1N	I/O	MIPI Data1 pin
12	GND	I	Ground
13	DATA0P	I/O	MIPI Data0 pin
14	DATA0N	I/O	MIPI Data0 pin
15	ID_Maker	I	Distinction of LCD maker (LGD: Low = GND)
16	GND	I/O	Ground
17	DATA3N	I/O	MIPI Data 3 pin
18	DATA3P	I/O	MIPI Data 3 pin
19	GND	I	Ground
20	CLKN	I	MIPI Clock pin
21	CLKP	I	MIPI Clock pin
22	GND	I	Ground
23	DATA2N	I/O	MIPI Data 3 pin
24	DATA2P	I/O	MIPI Data 3 pin
25	GND	I	Ground
26	VSN	I	VSP(+5.0V)
27	VSP	I	VSN(-5.0V)
28	GND	I	Ground
29	LED_A	I	LED Anode connection
30	GND	I	Ground

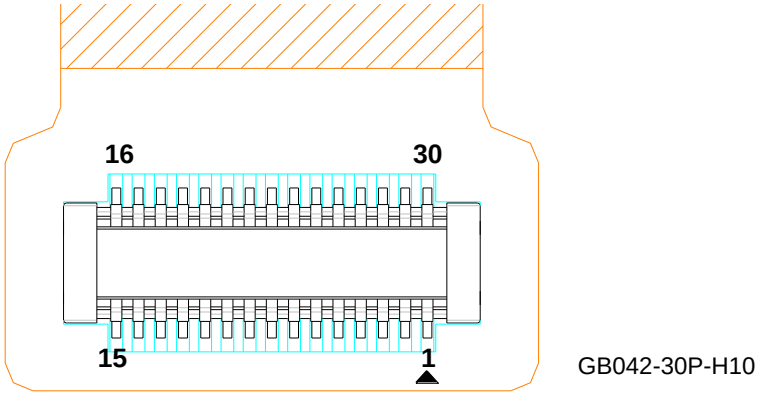
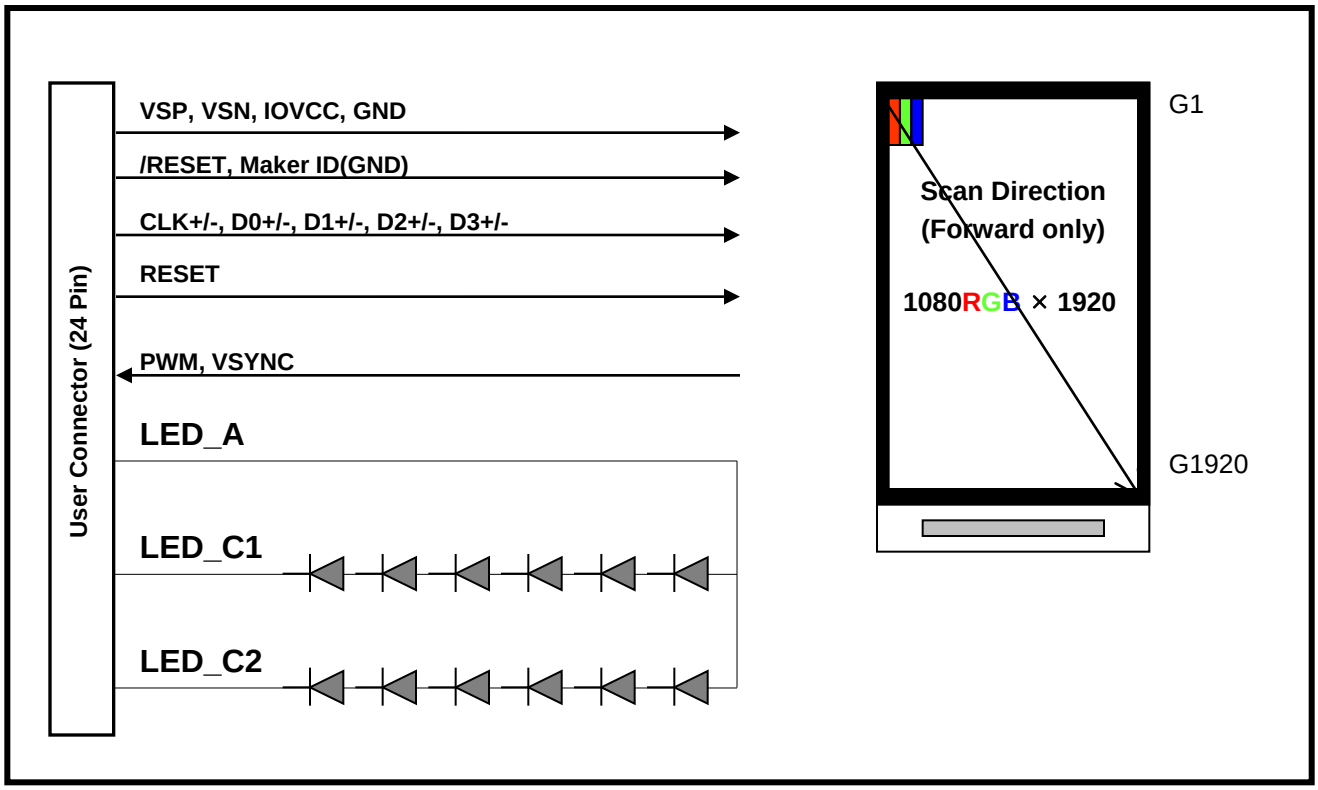


Fig. 3-1. FPC Connector Top View

3.5. Block Diagram

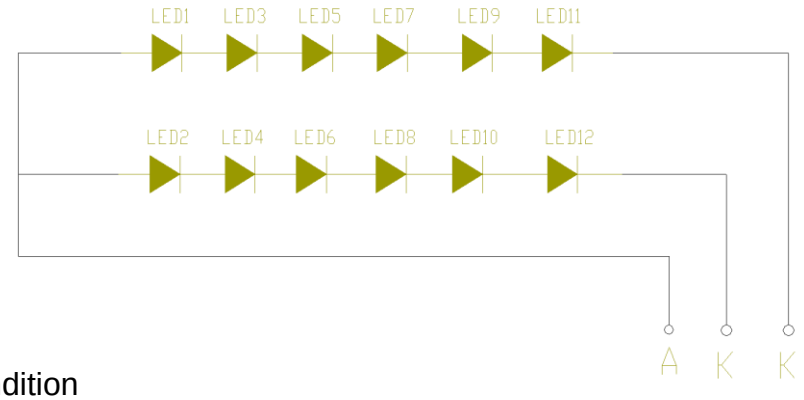


3.6. Backlight Unit

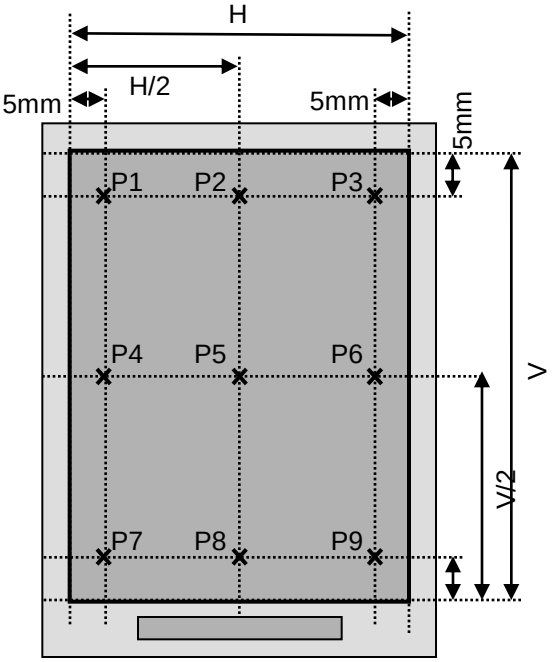
Item	Symbol	Min.	Typ.	Max.	Units
Surface Luminance	B	12,250	13,600	-	cd/m^2
Surface Brightness Uniformity	B_9	80	85	-	%
LED Voltage	V_f	-	3.0	-	V (per LED)
LED Current	I_f	-	20	-	mA (per LED)

Note 1)
LED Maker : SSC
LED Part name : SMFD07

IF=40mA



Note 2) Uniformity measure condition



3.7. LED Specification

1) Absolute Maximum Ratings

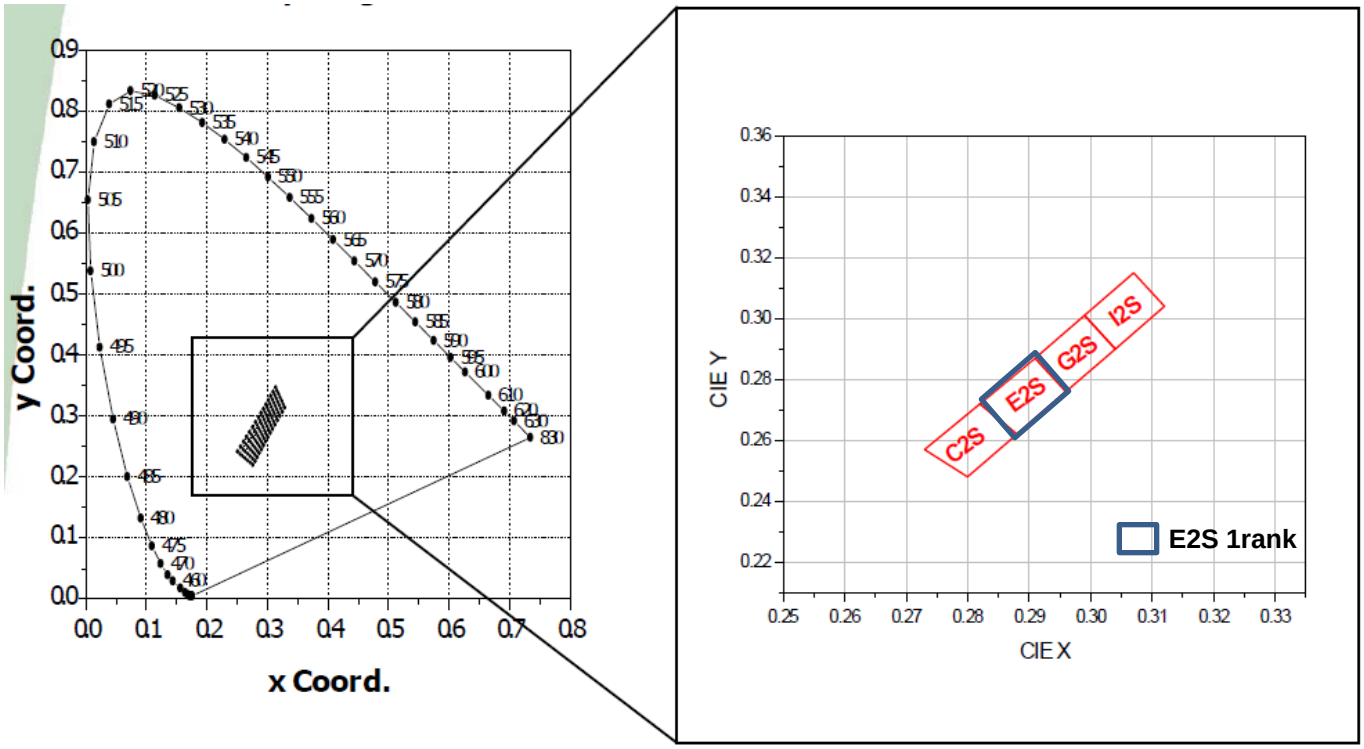
Parameter	Symbol	Value	Unit
Power Dissipation	P_d *1	96	mW
Forward Current	I_F	30	mA
Peak Forward Current	I_{FM} *2	100	mA
Reverse Voltage	V_R	5	V
Operating Temperature	T_{opr}	-30 ~ +85	°C
Storage Temperature	T_{stg}	-40 ~ +100	°C
Junction Temperature	*Tj max*	105	°C
Life Time (Ta=25℃) *3	-	15000	hrs
Life Time (Ta=60℃) *3	-	10000	hrs

*1 Care is to be taken that power dissipation does not exceed the absolute maximum rating of the product.
*2 I_{FM} was measured at $T_W \leq$ 0.1msec of pulse width and D ≤ 1/10 of duty ratio.
*3 Estimated time to 50% degradation of initial luminous intensity.
Condition: Ta=25/60℃, Tj≤75℃ (Using SSC testing circuit board)

2) Initial Electrical/Optical Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_{F1}	I_F = 20mA	2.8	-	3.2	V
Reverse Current	I_R	V_R = 5V	-	-	50	uA
Luminous Flux	I_V	I_F = 20mA	7.75	-	8.50	lm

3) Rank



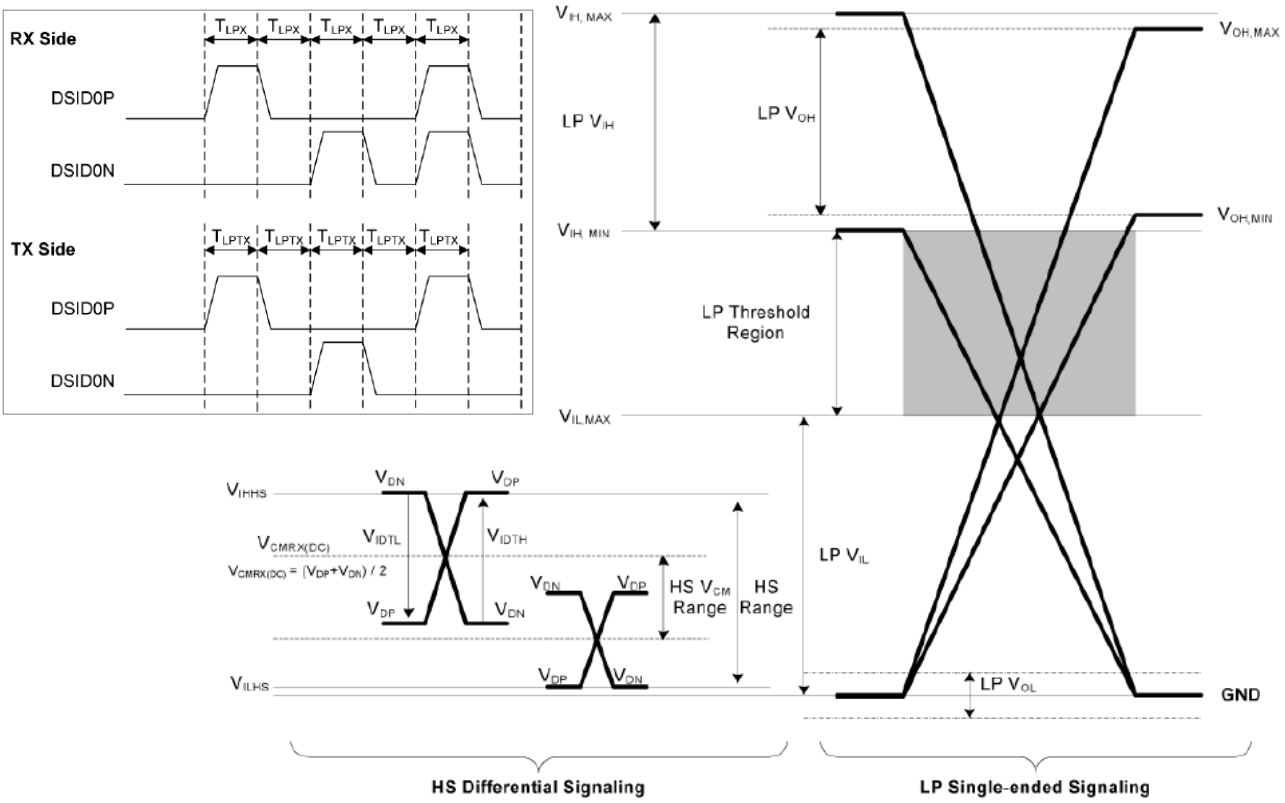
3.8. Timing Characteristics

3.8.1. MIPI DSI Characteristics

Item		Symbol	Unit	Min.	Typ.	Max.	Note
HS-RX	Differential input high threshold	VIDTH	mV	-	-	70	3
	Differential input low threshold	VIDTL	mV	-70	-	-	3
	Single-ended input low voltage	VILHS	mV	-40	-	-	
	Single-ended input high voltage	VIHHS	mV	-	-	460	
	Common-mode voltage HS receive mode	VCMRX(DC)	mV	70	-	330	1
	Differential input impedance	ZID	Ω	-	100	-	2
LP-RX	Logic 0 input voltage not in ULP State	VIL	mV	-50	-	550	
	Logic 1 input voltage	VIH	mV	880	-	1350	
	I/O leakage current	ILEAK	μA	-10	-	10	
LP-TX	Thevenin output low level	VOL	mV	-50	-	50	
	Thevenin output high level	VOH	V	1.1	1.2	1.3	
	Output impedance of LP transmitter	ZOLP	Ω	110	-	-	2
CD-RX	Logic 0 contention threshold	VILCD	mV	-	-	200	
	Logic 1 contention threshold	VIHCD	mV	450	-	-	

Notes 1. VCMRX (DC) = (VP+VDN)/2
Notes 2. Excluding COG resistance (contact resistance and ITO wiring resistance). The values are tentative
Notes 3. Minimum 110mV/-110mV HS differential swing is required for display data transfer

Fig. 3.8.1. Signaling and Contention Voltage Levels

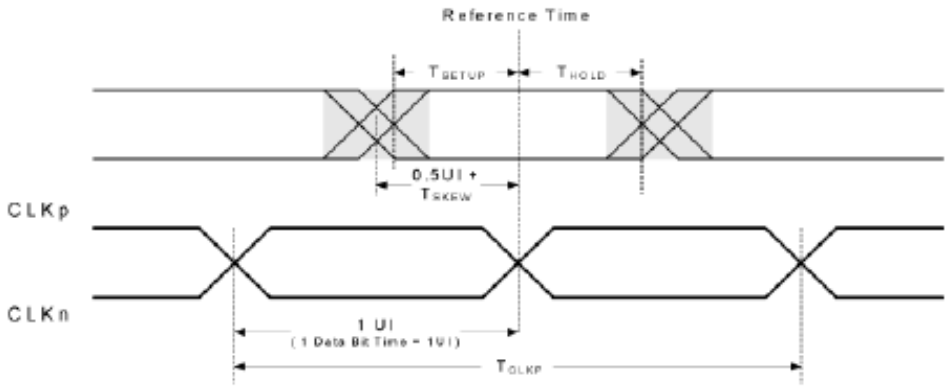


3.8.2. MIPI DSI HS-RX Clock and Data-Clock Specifications

Item	Symbol	Unit	Min.	Typ.	Max.	Note
DSICLK Frequency	fDSICLK	MHz	100	-	450	4
DSICLK Cycle time	tCLKP	Ns	1.11	-	10	
DSI Data Transfer Rate	tDSIR	Mbps	200	-	900	4
Data to Clock Setup Time	tSETUP	UI	0.15	-	-	6
		Ns	0.15	-	-	5,6
Clock to Data Hold Time	tHOLD	UI	0.15	-	-	6
		ns	0.15	-	-	5,6

Notes 4. When fDSICLK<125MHz, change auto load NV setting so that it is compliant with THS-PREPARE+THS-ZERO spec.
Notes 5. Minimum tSETUP/tHOLD Time is 0.15UI. This value may change according to DSI transfer rate.
Notes 6. tSETUP/tHOLD Time are measured without HS-TX Jitter.

Fig. 3.8.2. AC Timing Waveform for HS Mode MIPI Operation

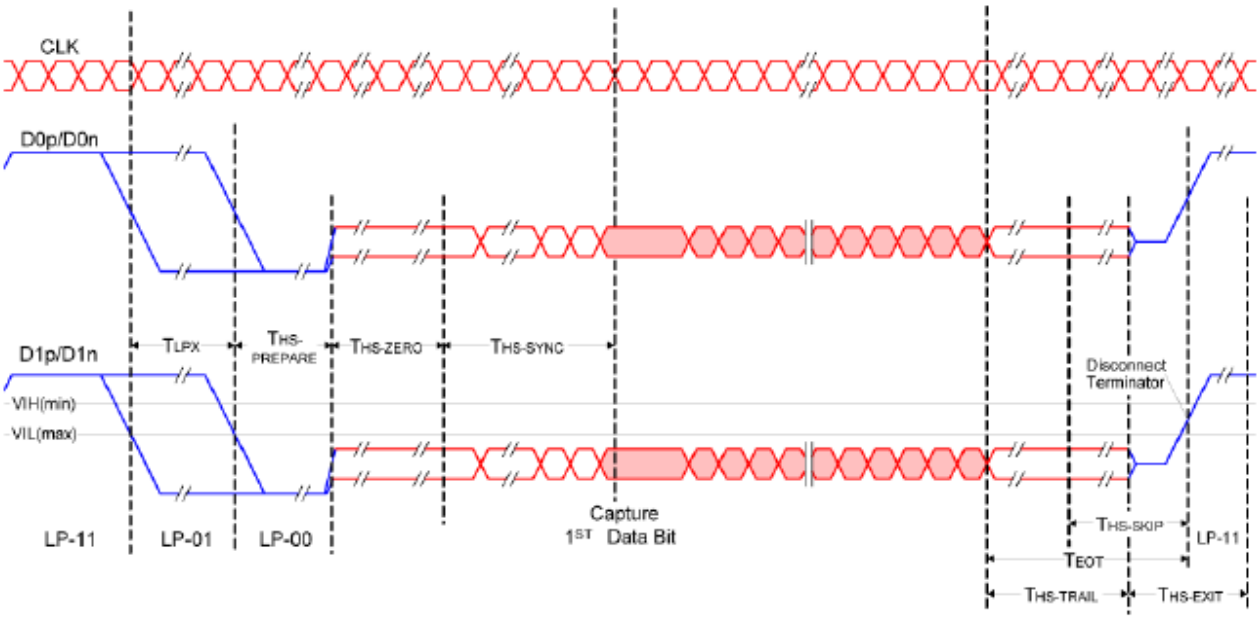


3.8.3. MIPI DSI LP-RX/TX Clock and Data-Clock Specifications

Item	Symbol	Unit	Min.	Typ.	Max.	Note
Time to drive LP-00 to prepare for HS transmission	THS-PREPARE	ns	40ns + 4*UI	-	85ns + 6*UI	
THS-PREPARE + Time to drive HS-0 before the Sync sequence	THS-PREPARE + THS-ZERO	ns	145ms + 10*UI	-	-	
Time to drive flipped differential state after last payload data bit of a HS transmission burst	THS-TRAIL	ns	max (n*8*UI, 60ns + n*4*UI)	-	-	1,2
Time to drive LP-11after HS burst	THS-EXIT	ns	100	-	-	
Time to drive LP-00 after Turnaround Request	TTA-GO		4*TLPTX			
Time-out before new TX side starts driving	TTA-SURE		1*TLPTX	-	2*TLPTX	
Time to drive LP-00 by new TX	TTA-GET		5*TLPTX			
Length of any Low-Power state period	TLPX	ns	50	-	-	
Ratio of TLPX(MASTER)/TLPX(SLAVE) between Master and Slave side	Ratio TLPX		2/3	-	3/2	
Time that the transmitter shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	TCLK-POST	UI	60ns + 52UI	-	-	3
TCLK-PREPARE +time for lead HS-0 drive period before starting Clock	TCLK-PREPARE + TCLK-ZERO	ns	300	-	-	
Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode	TCLK-PRE	UI	8	-	-	
Time to drive LP-00 to prepare for HS clock transmission	TCLK-PREPARE	ns	38	-	95	
Time to drive HS differential state after last payload clock bit of an HS transmission burst	TCLK-TRAIL	ns	60	-	-	
Time from start of THS-TRAIL period to start of LP-11 state	TEOT		-	-	105ns + n*12*UI	2
Length of Low-Power TX period in case of using DSI clock	TLPTX1	UI	-	32	-	4
Length of Low-Power TX period in case of using internal OSC clock	TLPTX2	ns	-	1/fosc	-	

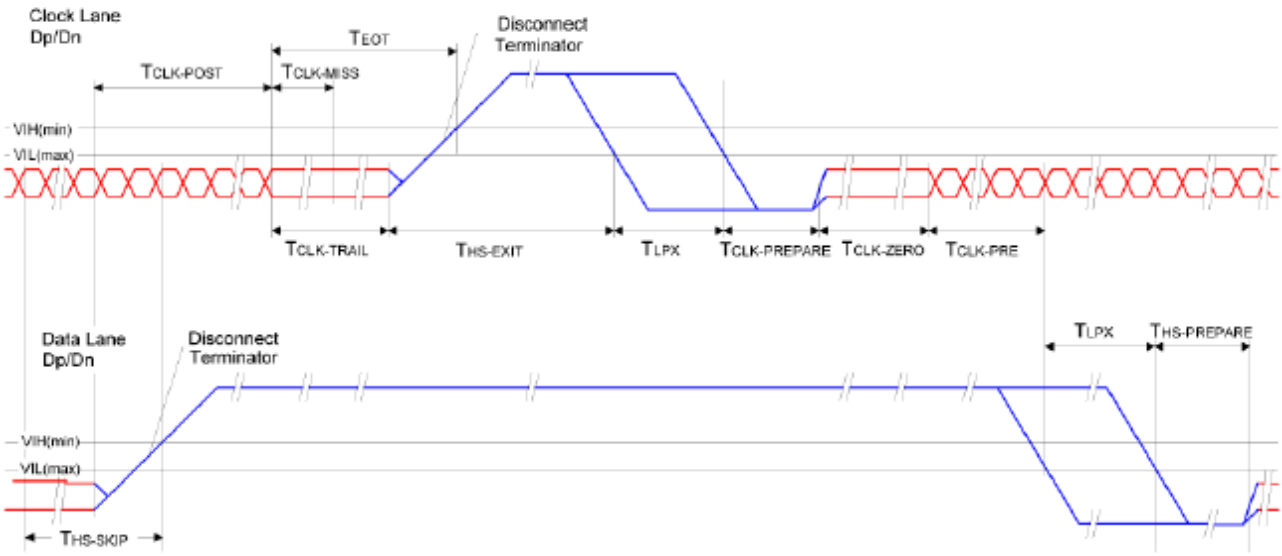
Notes 1. If a > b then max(a, b) = a, otherwise max(a, b) = b
Notes 2. Where n = 1 for Forward-direction HS mode.
Notes 3. The R63311 can work with this specification although the end part of internal process is remained when Clock Lane enter LP-11 and the R63311 can work without the remained process if tCLK-POST is more than 256 UI.
Notes 4. The R63311 uses DSI clock from the Host processor if Clock Lane is active, and internal oscillator clock if Clock Lane is disabled. Here, “fosc” is the frequency of oscillator clock, typical 28 MHz.

Fig. 3.8.3. HS Data Transmission in Bursts



Note : THS-SYNC : Proper match found for Sync sequence in HS stream,the following bits are payload data.

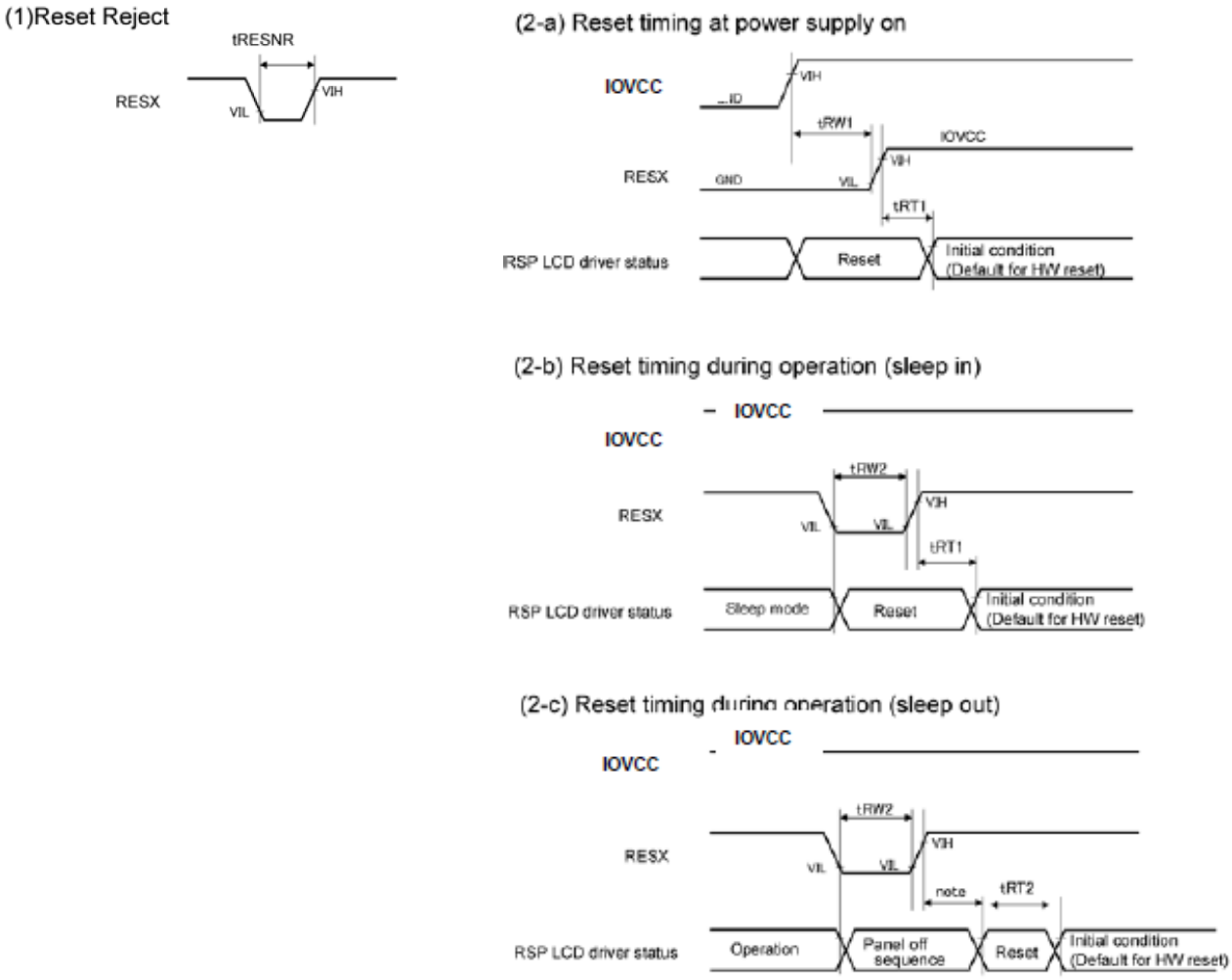
Fig. 3.8.3.1. Switching the Clock Lane between Clock Transmission and LP Mode



3.8.4. Reset Characteristics

Item	Symbol	Test Condition	Unit	Min.	Typ.	Max.	Note
Reset low-level width1	tRW1	Power supply on	us	1000	-	-	
Reset low-level width1	tRW2	Operation	us	1000	-	-	
Reset time (Sleep IN)	tRT1	-	ms	-	-	3	
Reset time (Sleep OUT)	tRT2	-	ms	-	-	3	
Noise reject width	tRESNR	-	us	-	-	1	

Fig. 3.7.4. Reset operation



3.9. Operation Flow Chart

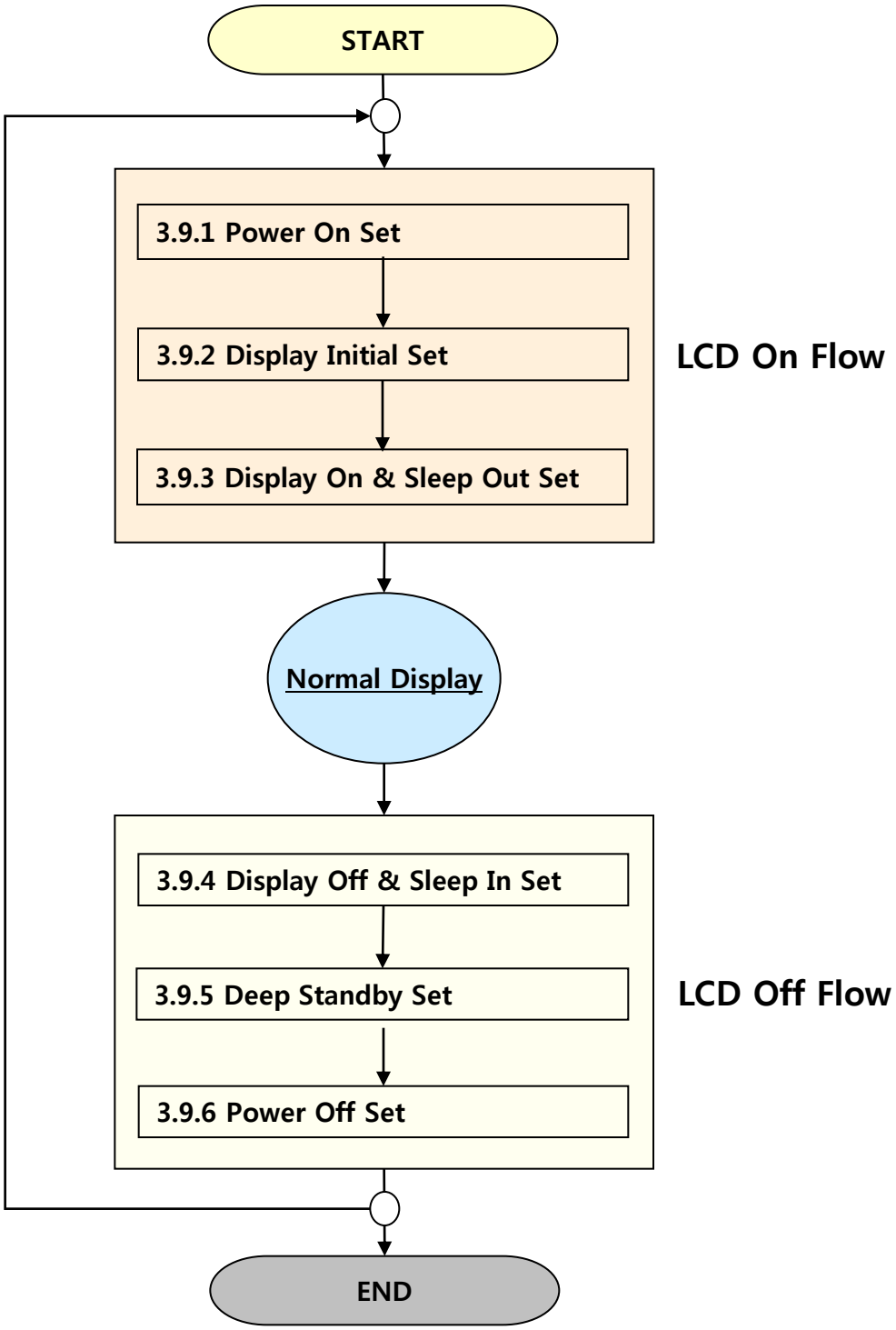
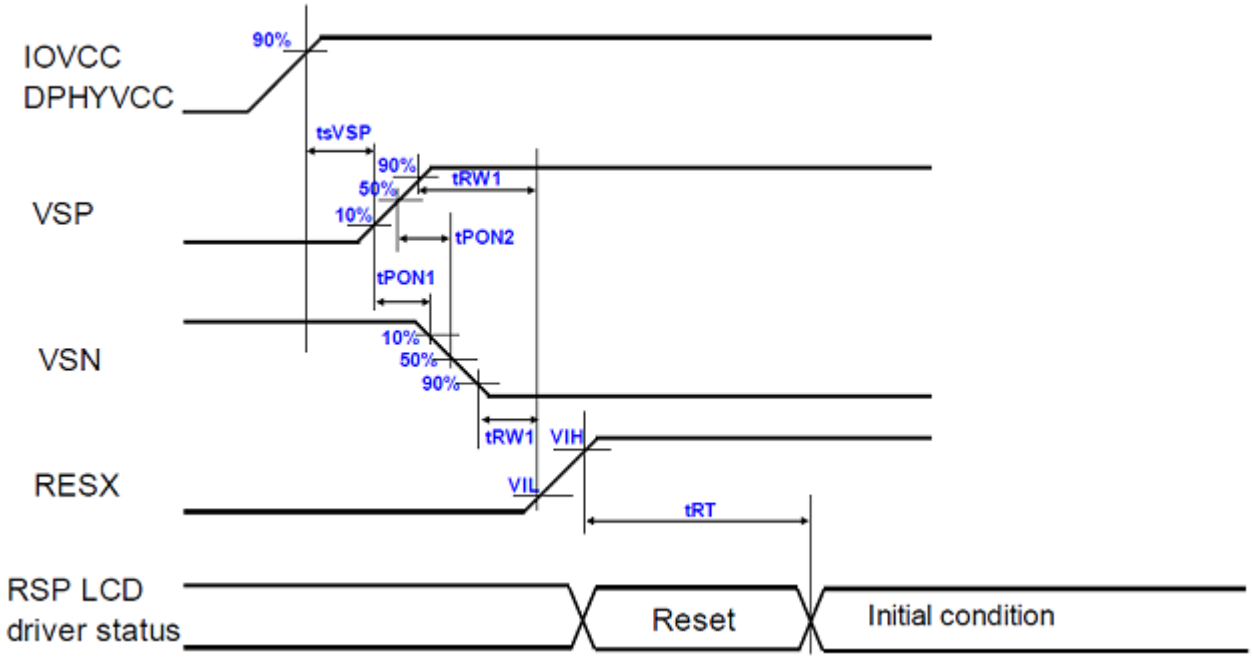


Table 3.9.1. Power On Set

Step	REGISTER FUNCTION	INDEX/DATA	HEX
1	/RES = LOW		
2	Power (IOVCC, VSP, VSN) ON IOVCC → 100ms or more → VSP / VSN simultaneously ON		
3	40ms or more		
4	/RES = LOW		
5	10ms or more		
6	/RES = HIGH		
7	10ms or more		

Fig. 3.9.1 Power on sequence & Timing



Item	Symbol	Unit	Test Condition	Min	Max
VSP-VSN delay time(10% to 10%)	tPON1	us	Power On	0	–
VSP-VSN delay time(50% to 50%)	tPON2	us	Power On	0	–
System power on to VSP ON time	tsVSP	ms	Power On	1	–
Reset low-level width1	tRW1	ms	Power On	1	–
Reset time(Sleep IN)	tRT	ms	Power On	3	–

Table 3.9.2. Display Initial Set

Step	REGISTER FUNCTION	INDEX/DATA	HEX
1	Manufacturer Command Access Protect	INDEX	0xB0
		DATA	0x04
2	nop Command	INDEX	0x00
3	nop Command	INDEX	0x00
4	Interface Setting	INDEX	0xB3
		DATA	0x14 0x00 0x00 0x00 0x00
			0x00
5	DSI Control (MIPI SPEED)	INDEX	0xB6
		DATA	0x3A 0xD3
6	Display Setting1	INDEX	0xC1
		DATA	0x84 0x60 0x50 0x00 0x00
			0x00 0x00 0x00 0x00 0x0C
			0x01 0x58 0x73 0xAE 0x31
			0x20 0x06 0x00 0x00 0x00
			0x00 0x00 0x00 0x10 0x10
			0x10 0x10 0x00 0x00 0x00
			0x22 0x02 0x02 0x00
7	Display Setting2	INDEX	0xC2
		DATA	0x31 0xF7 0x80 0x0A 0x08
			0x00 0x00
8	Touch Panel Sync Function (VSYNC Enable)	INDEX	0xC3
		DATA	0x01 0x00 0x00

Table 3.9.2. *continued*

Step	REGISTER FUNCTION	INDEX/DATA	HEX
9	Source Timing Setting	INDEX	0xC4
		DATA	0x70 0x00 0x00 0x00 0x07
			0x05 0x05 0x09 0x09 0x0C
			0x06 0x00 0x00 0x00 0x00
			0x07 0x05 0x05 0x09 0x09
			0x0C 0x06
	LTPS Timing Setting	INDEX	0xC6
		DATA	0x00 0x69 0x00 0x69 0x00
			0x69 0x00 0x00 0x00 0x00
10			0x00 0x69 0x00 0x69 0x00
			0x69 0x10 0x19 0x07 0x00
			0x01 0x00 0x69 0x00 0x69
			0x00 0x69 0x00 0x00 0x00
			0x00 0x00 0x69 0x00 0x69
			0x00 0x69 0x10 0x19 0x07
11	Gamma Setting A set	INDEX	0xC7
		DATA	0x00 0x09 0x14 0x26 0x31
			0x48 0x3B 0x52 0x5F 0x67
			0x6B 0x70 0x00 0x09 0x14
			0x26 0x31 0x48 0x3B 0x52
			0x5F 0x67 0x6B 0x70
12	Gamma Setting B set	INDEX	0xC8
		DATA	0x00 0x09 0x14 0x26 0x31
			0x48 0x3B 0x52 0x5F 0x67
			0x6B 0x70 0x00 0x09 0x14
			0x26 0x31 0x48 0x3B 0x52
			0x5F 0x67 0x6B 0x70

Table 3.9.2. *continued*

Step	REGISTER FUNCTION	INDEX/DATA	HEX
13	Gamma Setting C set	INDEX	0xC9
		DATA	0x00 0x09 0x14 0x26 0x31
			0x48 0x3B 0x52 0x5F 0x67
			0x6B 0x70 0x00 0x09 0x14
			0x26 0x31 0x48 0x3B 0x52
			0x5F 0x67 0x6B 0x70
14	Panel Interface Control	INDEX	0xCC
		DATA	0X09
15	Power Setting (Charge Pump Setting)	INDEX	0xD0
		DATA	0x00 0x00 0x19 0x18 0x99
			0x99 0x19 0x01 0x89 0x00
			0x55 0x19 0x99 0x01
16	Power Setting for Internal Power	INDEX	0xD3
		DATA	0x1B 0x33 0xBB 0xCC 0xC4
			0x33 0x33 0x33 0x00 0x01
			0x00 0xA0 0xD8 0xA0 0x0D
			0x37 0x33 0x44 0x22 0x70
			0x02 0x37 0x03 0x3D 0xBF
			0x00
17	Vcom Setting	INDEX	0xD5
		DATA	0x06 0x00 0x00 0x01 0x39
			0x01 0x39
18	Vcom Setting (send 2 times)	INDEX	0xD5
		DATA	0x06 0x00 0x00 0x01 0x39
			0x01 0x39
19	If Customer want to set other things, add Index/Data in here.		

Table 3.9.3. Sleep Out & Display On Set

Step	REGISTER FUNCTION	INDEX/DATA	HEX
1	Display On	INDEX	0x29
2	Sleep Out	INDEX	0x11
3	MIPI Video Pixel Stream ON		
4	6 Frames or more		
5	Android Image Display		
6	Vcom Setting	INDEX	0xD5
		DATA	0x06 0x00 0x00 0x01 0x2C
			0x01 0x2C
7	Vcom Setting (send 2 times)	INDEX	0xD5
		DATA	0x06 0x00 0x00 0x01 0x2C
			0x01 0x2C
8	1 Frames or more		

Table 3.9.3. Sleep Out & Display On Set

Step	REGISTER FUNCTION	INDEX/DATA	HEX
1	Vcom Setting	INDEX	0xD5
		DATA	0x06 0x00 0x00 0x00 0x48
			0x00 0x48
2	Vcom Setting (send 2 times)	INDEX	0xD5
		DATA	0x06 0x00 0x00 0x00 0x48
			0x00 0x48
3	1 Frames or more		
4	Display Off	INDEX	0x28
5	20ms or more		
6	Sleep In	INDEX	0x10
7	100ms or more		

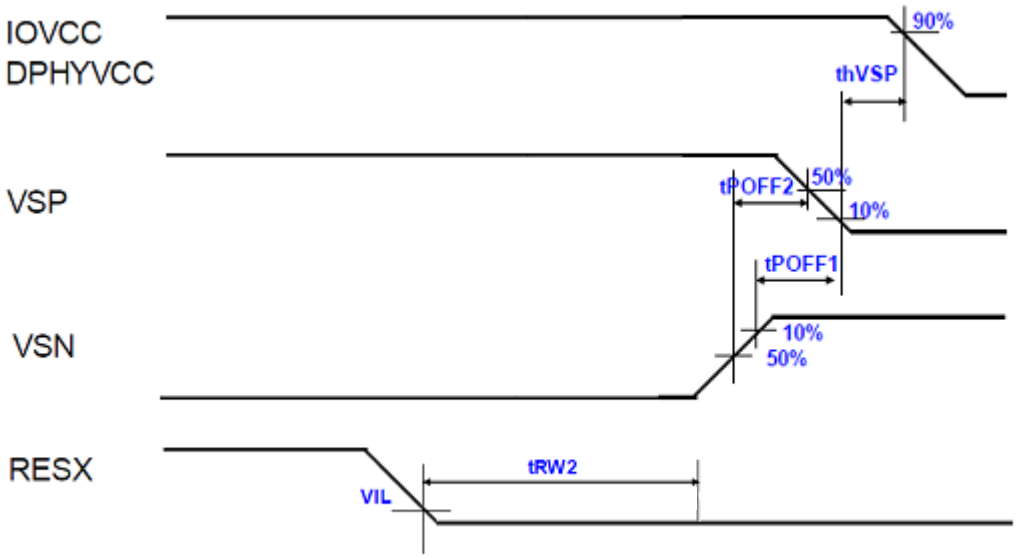
Table 3.9.5. Deep Standby Set

Step	REGISTER FUNCTION	INDEX/DATA	HEX
1	Deep Standby Mode In	INDEX	0xB1
		DATA	0x01
2	40ms or more		

Table 3.9.6. Power Off Set

Step	REGISTER FUNCTION	INDEX/DATA	HEX
1	MIPI Video Pixel Stream OFF		
2	/RES = LOW		
3	10ms or more		
4	Power (VSN, VSP, IOVCC) Off VSN / VSP simultaneously Off → 20ms or more → IOVCC Off		

Fig. 3.9.6 Power off sequence & Timing



Item	Symbol	Unit	Test Condition	Min	Max
Reset low-level width2	tRW2	ms	Power Off	1	–
VSN-VSP delay time(10% to 10%)	tPOFF1	us	Power Off	0	–
VSN-VSP delay time(50% to 50%)	tPOFF2	us	Power Off	0	–
VSP OFF to system power off time	thVSP	us	Power Off	0	–

Table 3.9.7. DCS Data Type List

DCS Command/Parameter		W/R	Host to RSP LCD driver Data Type (RX)									
			Write Type						Read Type			Other
		Data Type	05'h	15'h	39'h	13'h	23'h	29'h	14'h	24'h	06'h	37'h
		Packet	Short	Short	Long	Short	Short	Long	Short	Short	Short	Short
		DCS para	DCS no para	DCS 1 para	DCS	Generic 1 para	Generic 2 para	Generic -	Generic 1 para	Generic 2 para	DCS no para	Set max. return packet size
00h	nop	C	Yes	No	Yes	No	No	No	No	No	No	-
01h	soft_reset	C	Yes	No	Yes	No	No	No	No	No	No	-
04h	read_DDB_start	16	No	No	No	No	No	No	No	No	Yes	16'h10
05h	read_Number_of_the_Errors_on_DSI	1	No	No	No	No	No	No	No	No	Yes	16'h1
06h	get_red_channel	1	No	No	No	No	No	No	No	No	Yes	
07h	get_green_channel	1	No	No	No	No	No	No	No	No	Yes	
08h	get_blue_channel	1	No	No	No	No	No	No	No	No	Yes	
0Ah	get_power_mode	1	No	No	No	No	No	No	No	No	Yes	16'h1
0Bh	get_address_mode	1	No	No	No	No	No	No	No	No	Yes	16'h1
0Ch	get_pixel_format	1	No	No	No	No	No	No	No	No	Yes	16'h1
0Dh	get_display_mode	1	No	No	No	No	No	No	No	No	Yes	16'h1
0Eh	get_signal_mode	1	No	No	No	No	No	No	No	No	Yes	16'h1
0Fh	get_diagnostic_result	1	No	No	No	No	No	No	No	No	Yes	16'h1
10h	enter_sleep_mode	C	Yes	No	Yes	No	No	No	No	No	No	-
11h	exit_sleep_mode	C	Yes	No	Yes	No	No	No	No	No	No	-
20h	exit_invert_mode	C	YES	NO	YES	No	No	No	No	No	No	-
21h	enter_invert_mode	C	YES	NO	YES	No	No	No	No	No	No	-
26h	set_gamma_curve	1	No	Yes	Yes	No	No	No	No	No	No	-
28h	set_display_off	C	Yes	No	Yes	No	No	No	No	No	No	-
29h	set_display_on	C	Yes	No	Yes	No	No	No	No	No	No	-

Table 3.9.7. *continued*

DCS Command/Parameter		W/R	Host to RSP LCD driver Data Type (RX)									
			Write Type						Read Type			Other
		Data Type	05'h	15'h	39'h	13'h	23'h	29'h	14'h	24'h	06'h	37'h
		Packet	Short	Short	Long	Short	Short	Long	Short	Short	Short	Short
		DCS para	DCS no para	DCS 1 para	DCS	Generic 1 para	Generic 2 para	Generic -	Generic 1 para	Generic 2 para	DCS no para	Set max. return packet size
34h	set_tear_off	C	Yes	No	Yes	No	No	No	No	No	No	-
35h	set_tear_on	1	No	Yes	Yes	No	No	No	No	No	No	-
36h	set_address_mode	1	No	Yes	Yes	No	No	No	No	No	No	-
3Ah	set_pixel_format	1	No	Yes	Yes	No	No	No	No	No	No	-
44h	set_tear_scanline	2	No	Yes	Yes	No	No	No	No	No	No	-
51h	write_display_brightness	2	No	Yes	Yes	No	No	No	No	No	No	-
52h	read_display_brightness_value	2	No	No	No	No	No	No	No	No	Yes	16'h1
55h	write_content_adaptive_brightness_control	1	No	Yes	Yes	No	No	No	No	No	No	-
56h	read_content_adaptive_brightness_control	1	No	No	No	No	No	No	No	No	Yes	16'h1
5Eh	write_CABC_minimum_brightness	2	No	Yes	Yes	No	No	No	No	No	No	-
5Fh	read_CABC_minimum_brightness	2	No	No	No	No	No	No	No	No	Yes	16'h1
68h	read_automatic_brightness_control_self-diagnostic_result	1	No	No	No	No	No	No	No	No	No	16'h1
A1h	read_DDB_start (Note1)	16	No	No	No	No	No	No	No	No	Yes	16'h10
A8h	read_DDB_continue (Note1)	N	No	No	No	No	No	No	No	No	Yes	16'h10
DAh	Read ID1	1	No	No	No	No	No	No	No	No	Yes	-
DBh	Read ID2	1	No	No	No	No	No	No	No	No	Yes	-
DCh	Read ID3	1	No	No	No	No	No	No	No	No	Yes	-

Note. When each data type packet is sent, it is necessary to write all parameters of each DCS and MCS.
Note 1. maximum return packet size ≧ 2

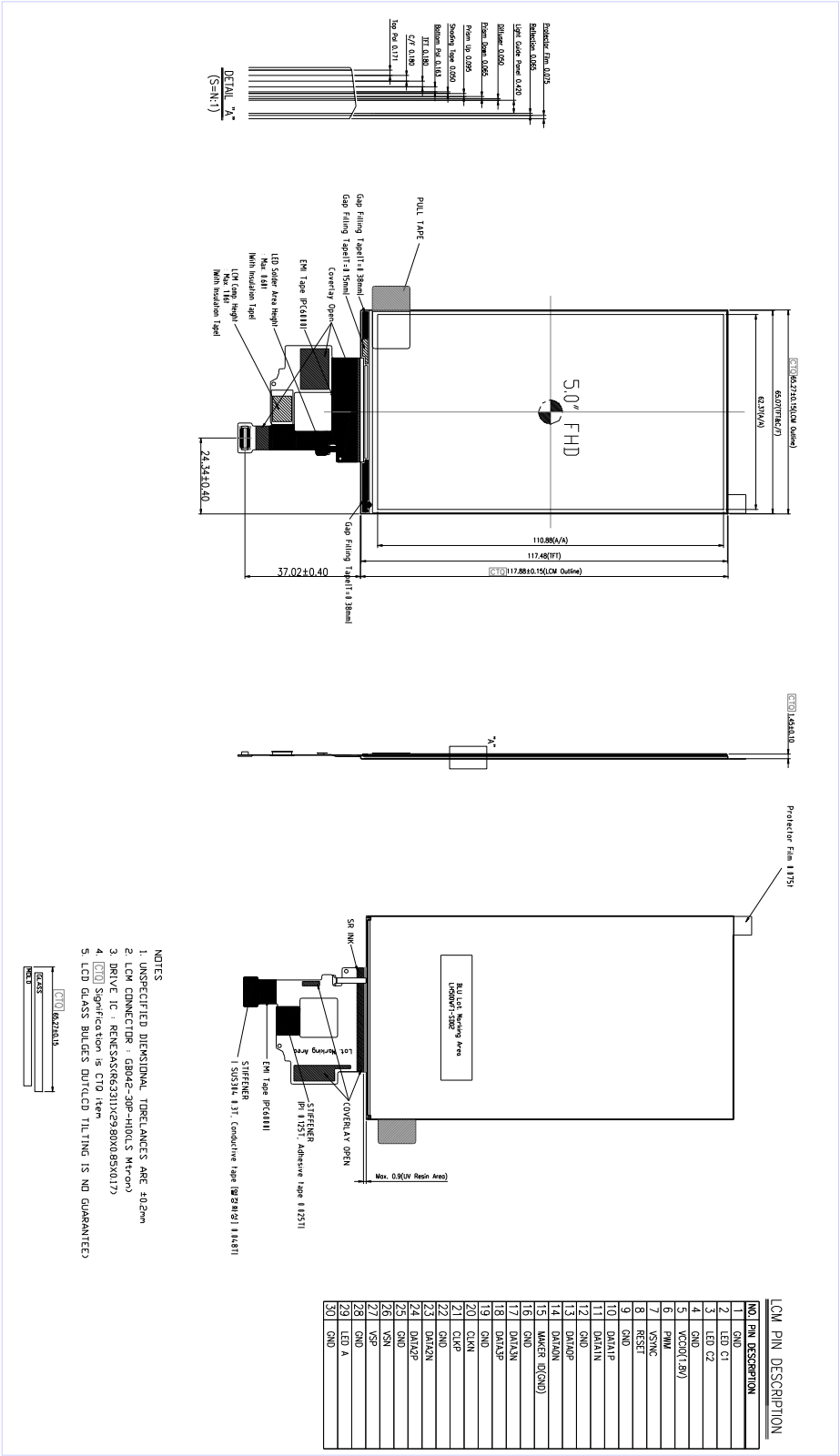
Table 3.9.8. MCS Data Type List

MCS Command/Parameter		Host to RSP LCD driver Data Type (RX)									
	W/R	Write Type						Read Type			Other
	Data Type	05'h	15'h	39'h	13'h	23'h	29'h	14'h	24'h	06'h	37'h
	Packet	Short	Short	Long	Short	Short	Long	Short	Short	Short	Short
	MCS para	DCS no para	DCS 1 para	DCS	Generic 1 para	Generic 2 para	Generic -	Generic 1 para	Generic 2 para	DCS no para	Set max. return packet size
MCS Read only command	1	No	No	No	No	No	No	Yes	No	No	16'h1
MCS write/read command	1	No	No	No	No	Yes	Yes	Yes	No	No	16'h1
MCS write/read command	1 < n	No	No	No	No	No	Yes	Yes	No	No	16'hn

Note. When each data type packet is sent, it is necessary to write all parameters of each DCS and MCS.

4. Mechanical Drawing

4.1 Module Layout

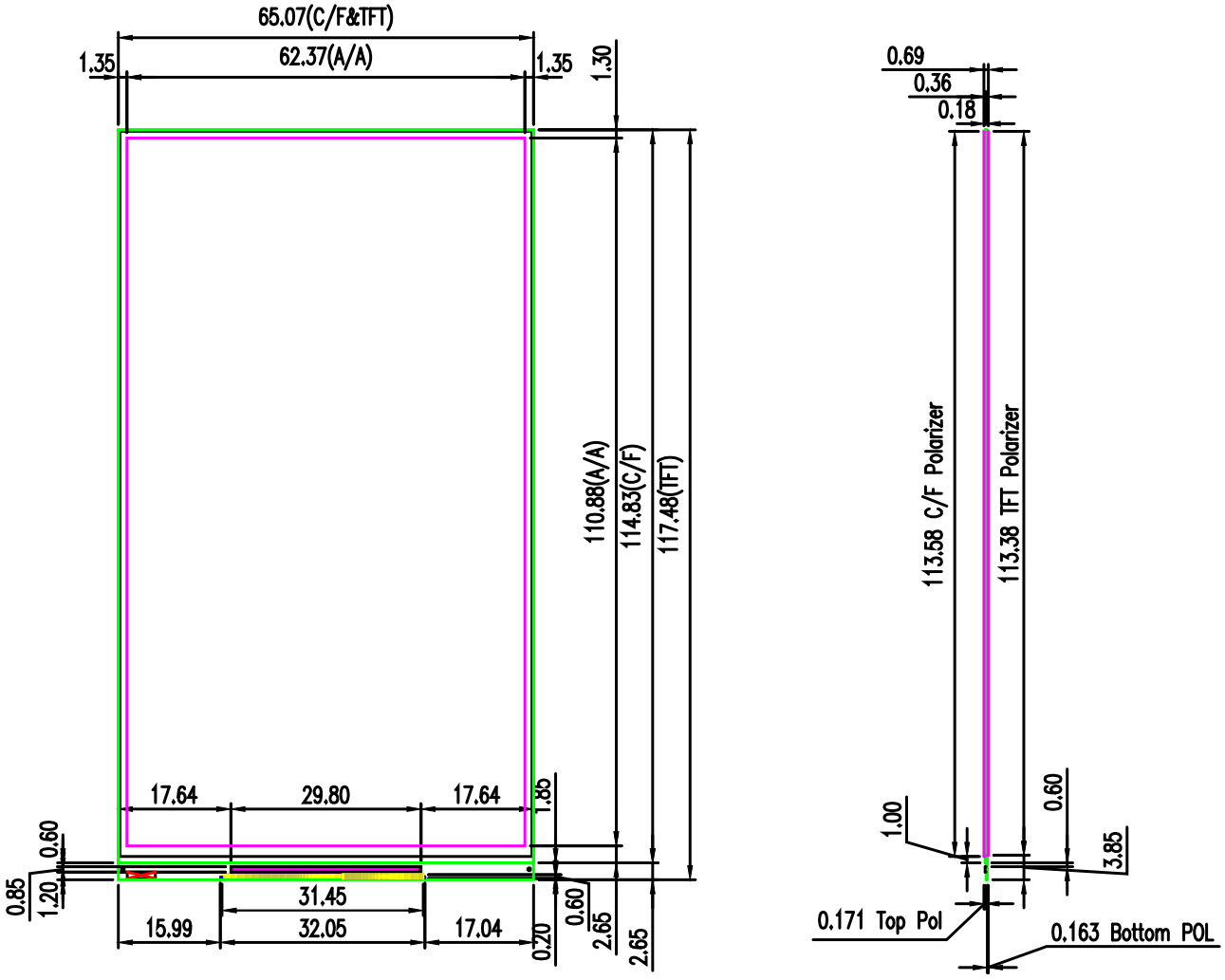


LCM PIN DESCRIPTION

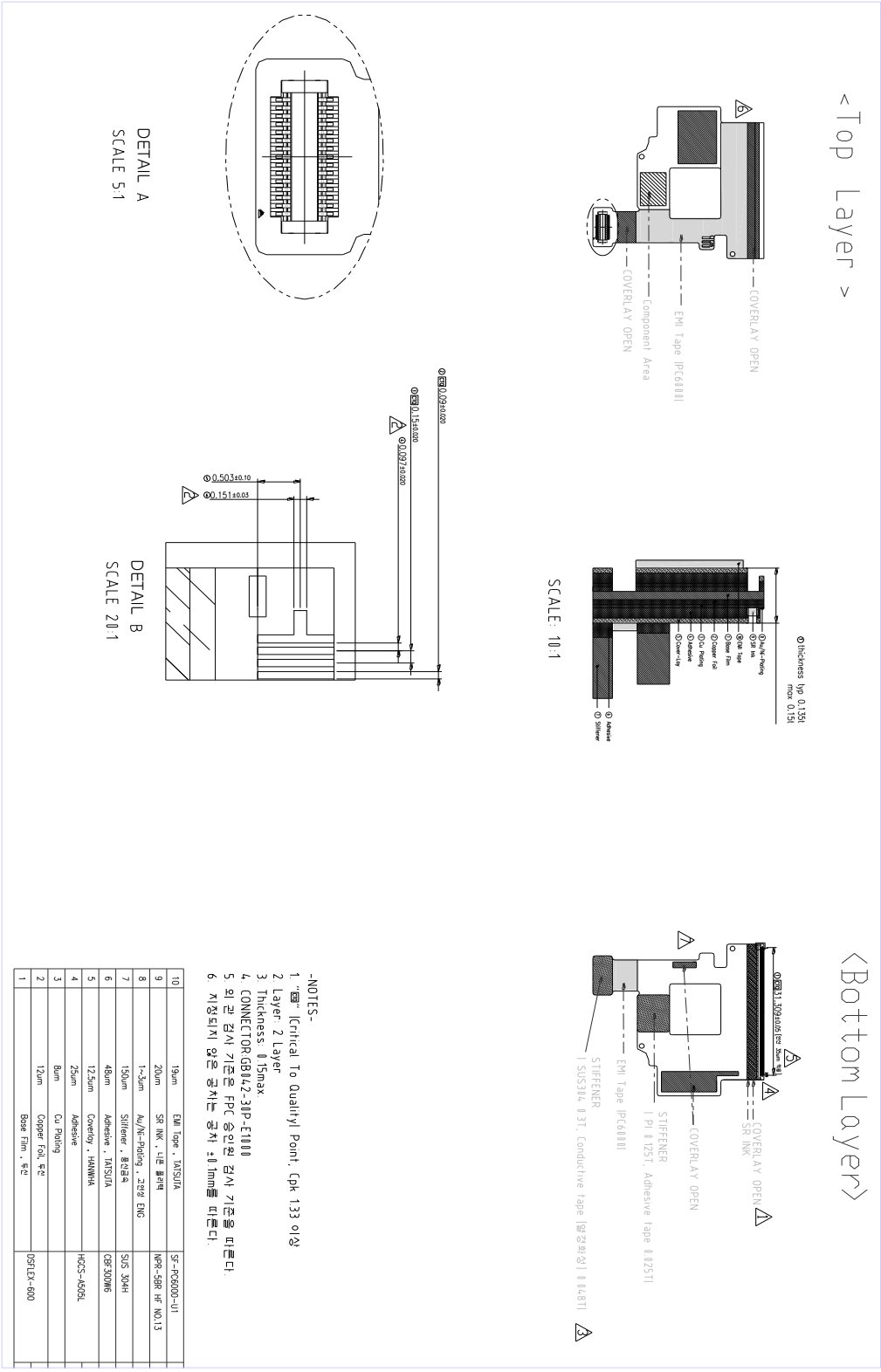
NO.	PIN DESCRIPTION
1	GND
2	LED C1
3	LED C2
4	GND
5	VCOM(1.8V)
6	PWM
7	VSYNC
8	RESET
9	GND
10	DATA1P
11	DATA1N
12	GND
13	DATA0P
14	DATA0N
15	MAKER ID(GND)
16	GND
17	DATA3N
18	DATA3P
19	GND
20	CLKN
21	CLKP
22	GND
23	DATA2N
24	DATA2P
25	GND
26	VSN
27	VSP
28	GND
29	LED A
30	GND

NOTES
1. UNSPECIFIED DIEMSIONAL TOLERANCES ARE ±0.2mm
2. LCM CONNECTOR : GB042-30P-H10(LS Mtron)
3. DRIVE IC : RENESAS(R63313X29800B5X0177)
4. CTQ Signification is CTQ item
5. LCD GLASS BULGES OUT(LCD TILTING IS NO GUARANTEED)

4.2. Panel Layout



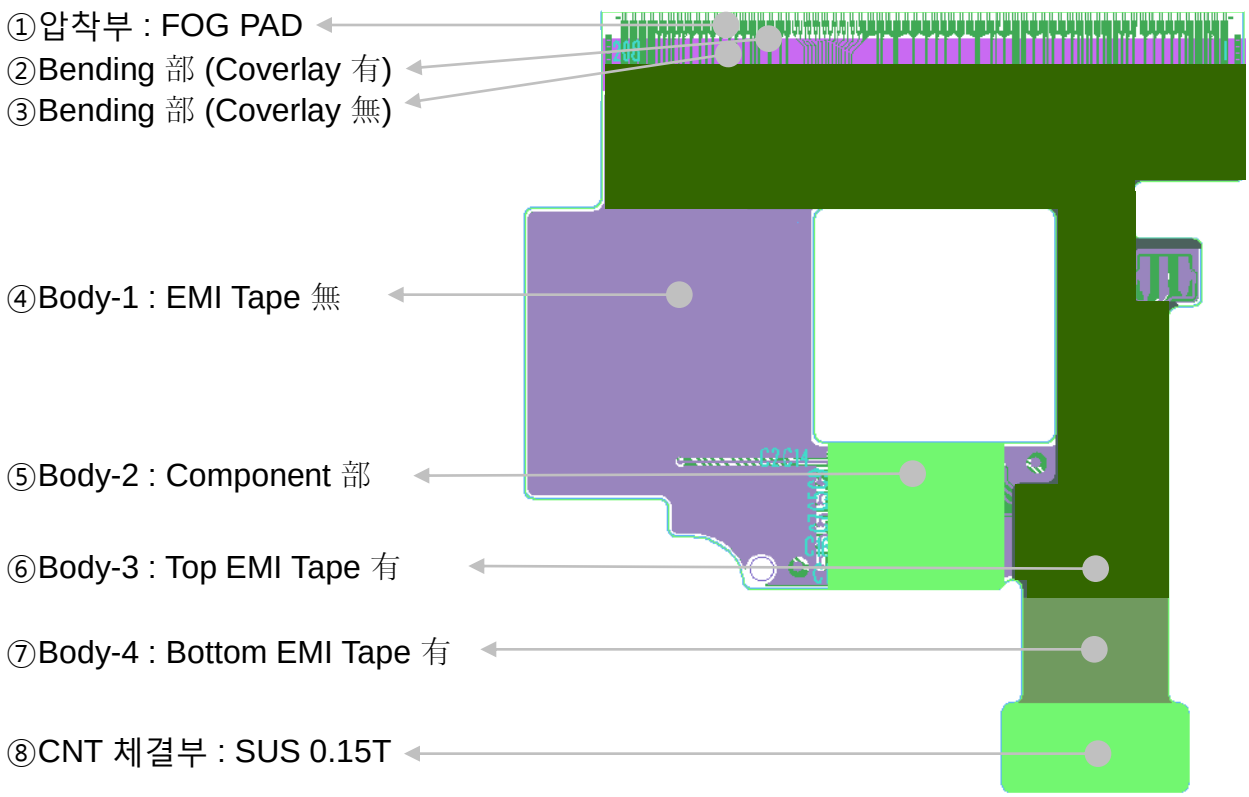
4.3. FPCB Layout



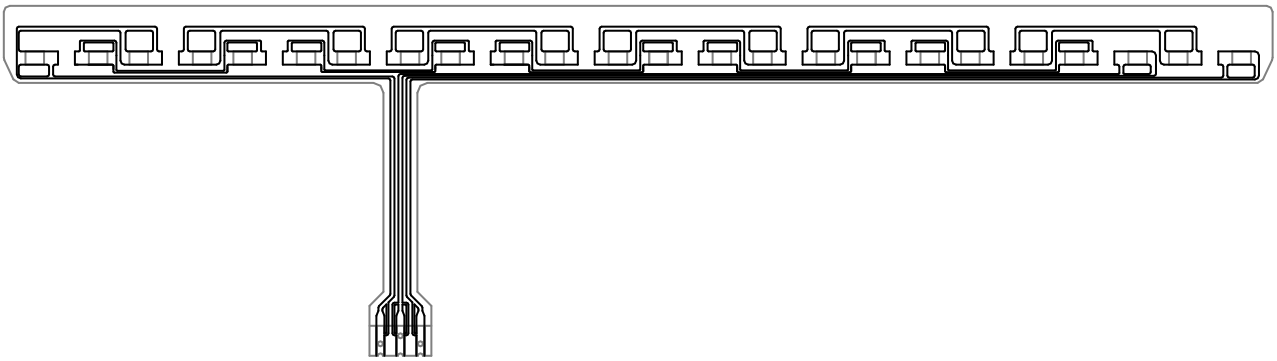
4.3. FPCB Layout

< 사용 원자재 및 규격 >

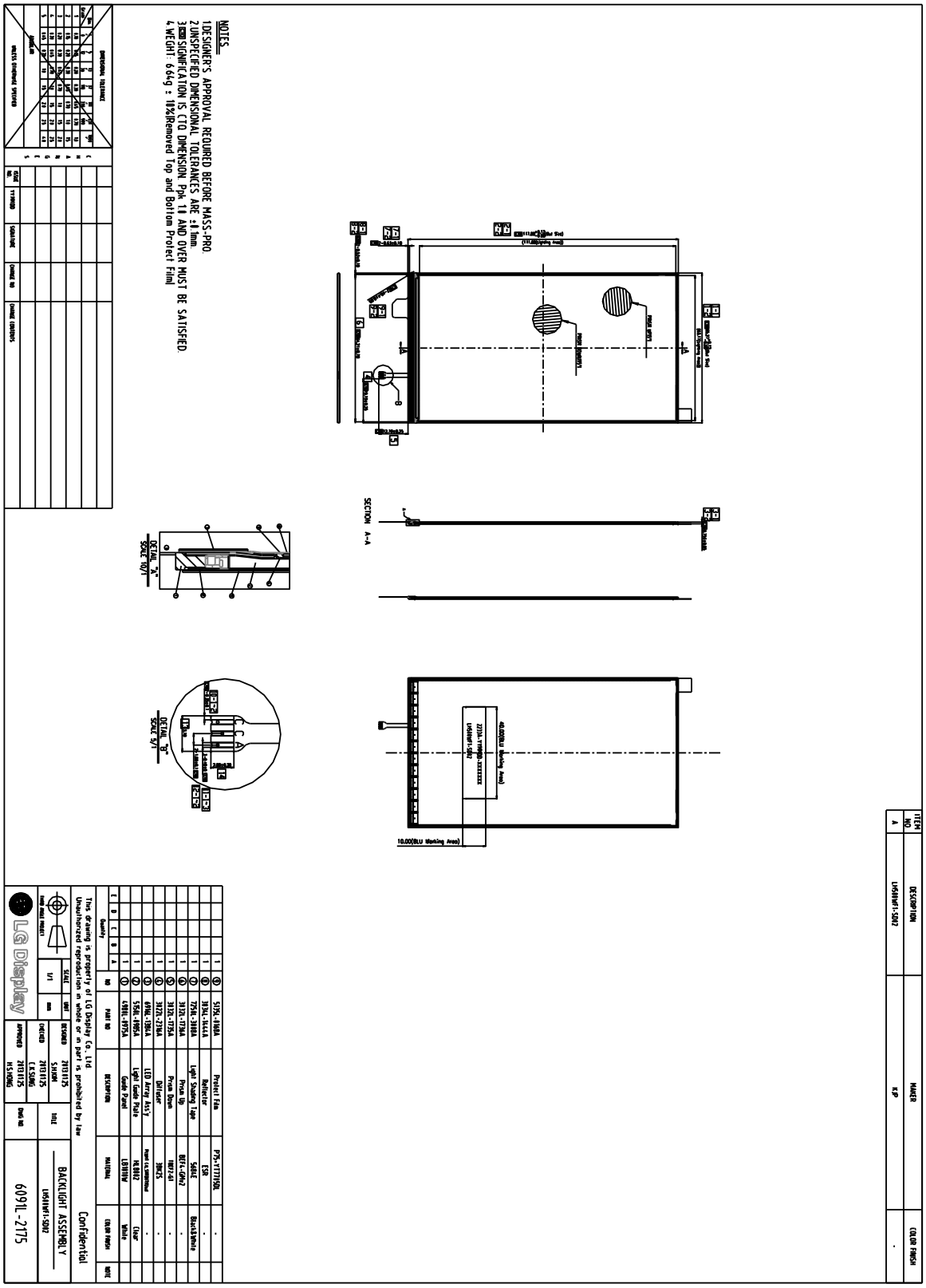
			기 준	1	2	3	4	5	6	7	8
SILVER TAPE	AD	[TATSUTA] PC6000 U1 , AD:19㎛	19						19		
COVERLAY	PI	[HANWHA] 0.5MIL , AD : 25㎛	12.5	12.5	12.5		12.5	12.5	12.5		12.5
	AD	자재명 : HGCS-A505L(Y)	25	25	25		25	25	25		25
동도금	CU-PLAT	HOLE속 MIN 10㎛ 관리	10				10	10	10		10
BASE	CU	[DOOSAN] 0.8MIL 0.3oz / 0.3oz ED 자재명 :DSFlex-600 122012E	12				12	12	12		12
	PI		20	20	20	20	20	20	20	20	20
	CU		12	12	12	12	12	12	12	12	12
동도금	CU-PLAT	HOLE속 MIN 10㎛ 관리	10	10	10	10	10	10	10	10	10
COVERLAY	AD	자재명 : HGCS-A505L(Y)	25		25		25	25	25	25	25
	PI	[HANWHA] 0.5MIL , AD : 25㎛	12.5		12.5		12.5	12.5	12.5	12.5	12.5
SR	INK	[니폰폴리텍] NPR-5BR HF No.13 , (두께 : 15±5㎛)	15			15					
SILVER TAPE		[TATSUTA] PC6000 U1 , AD:19㎛	19							19	
KAPTON	AD	자재명 : HGCU-B550L	25					25			
	PI	[HANWHA] 5MIL , AD : 40㎛	125					125			
TAPE	AD	[TATSUTA]CBF300-W6 , AD:60㎛	60								60
SUS	-	0.15TSUS(Scratch)	150								150
		TOTAL		79.5	117	57	139	289	158	98.5	349



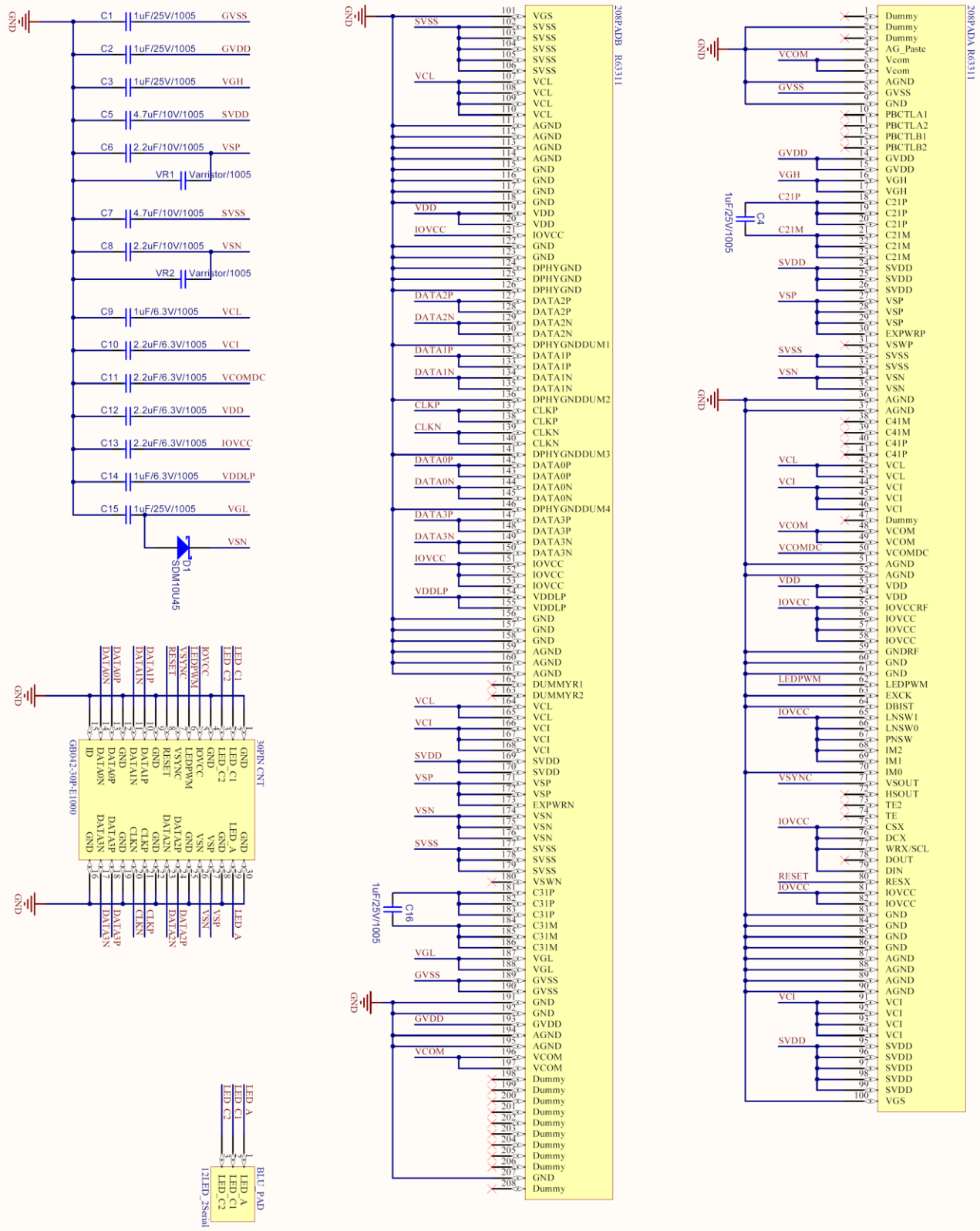
4.4. LED FPCB Layout



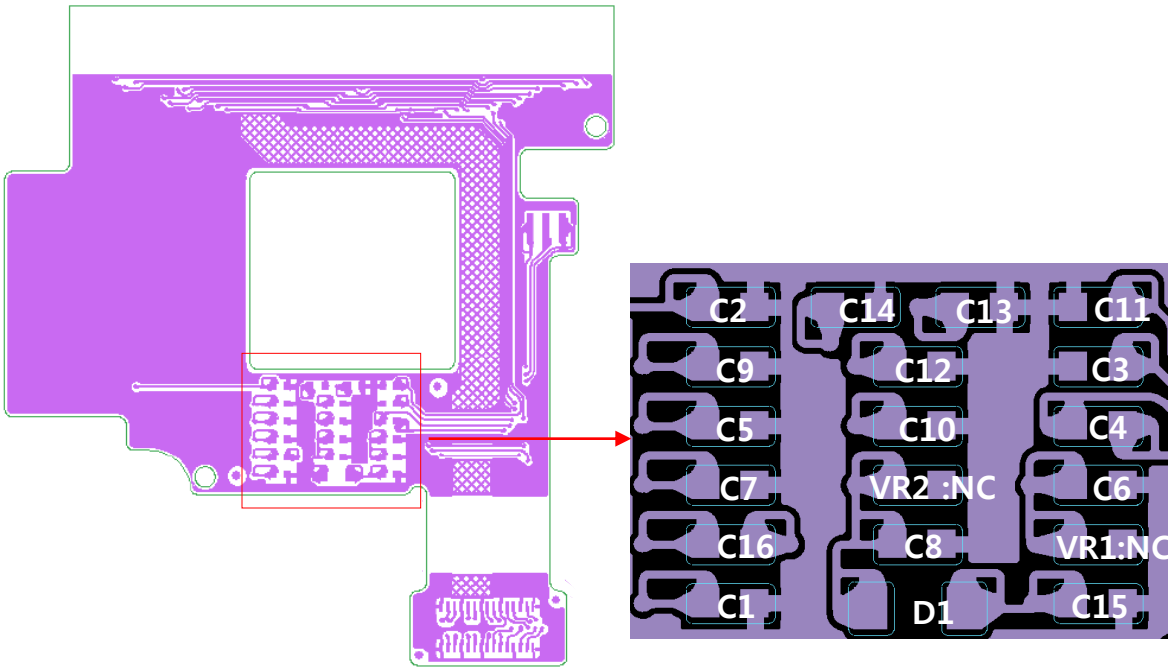
4.5. BLU Layout



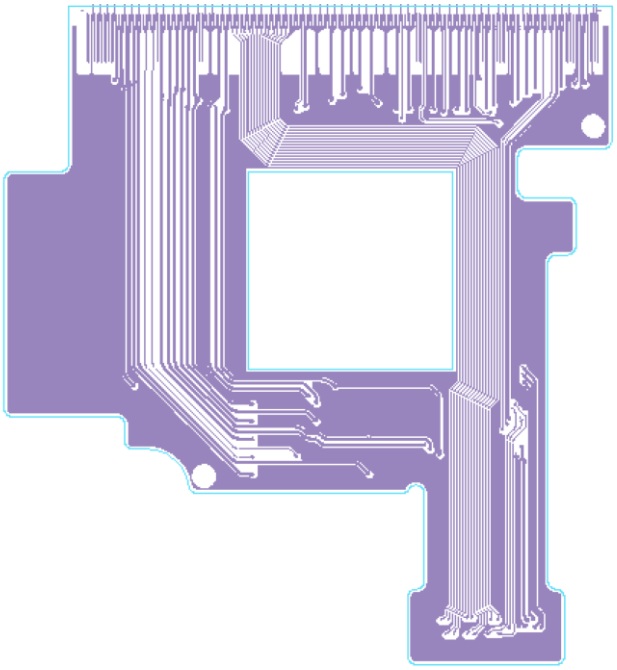
4.6. FPCB Schematic



4.7. Gerber Data

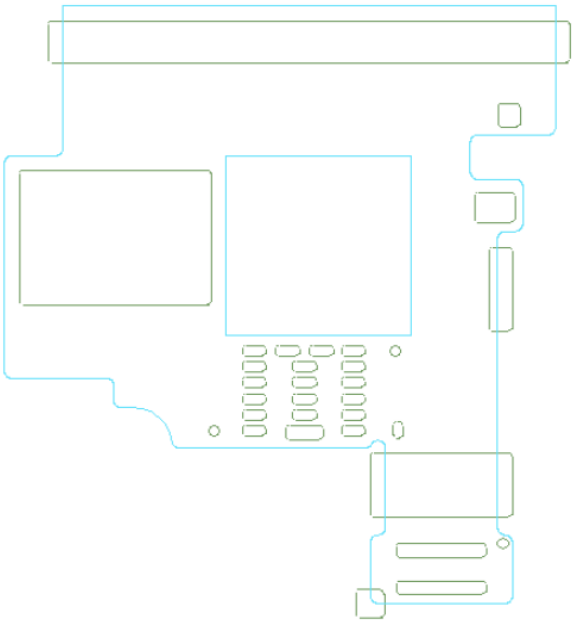


< Top >

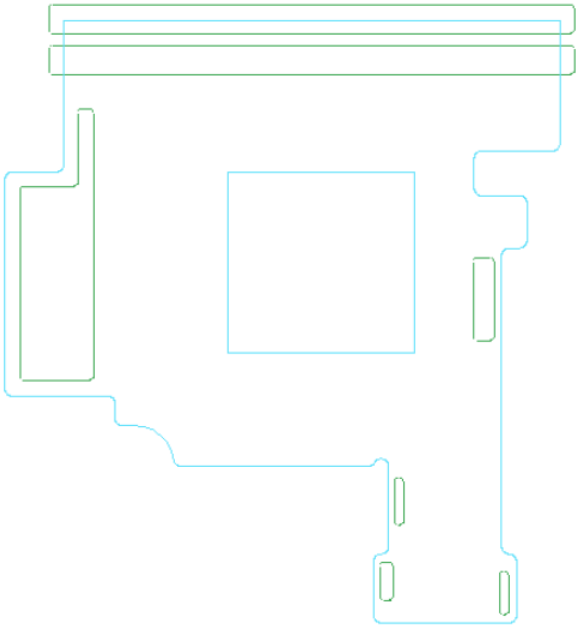


< Bottom >

4.7. Gerber Data

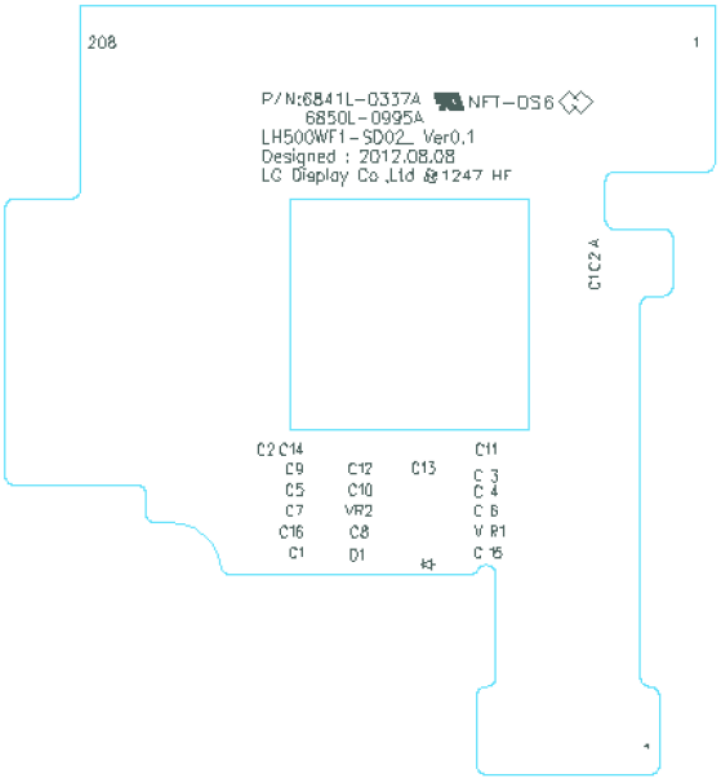


< Top_Coverlay open >

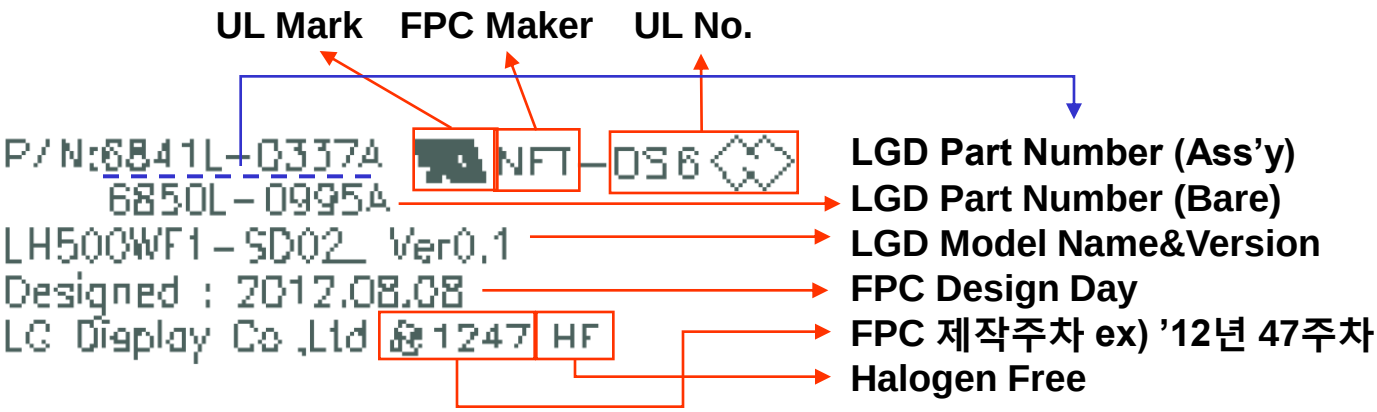


< Bottom_Coverlay open >

4.7. Gerber Data

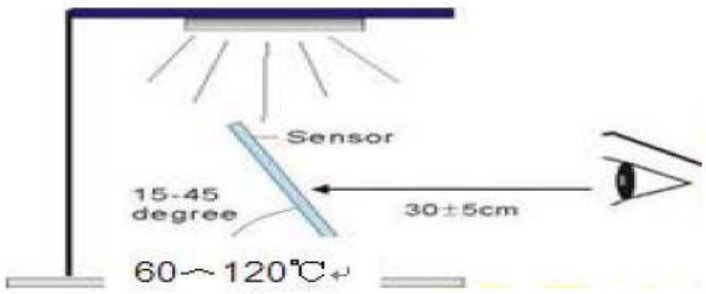


< Top_Slikscreen >

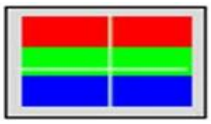
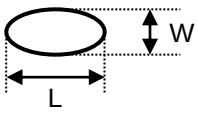
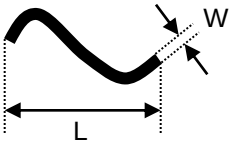


5. Incoming Inspection Specification

5.1. Inspection Condition & AQL Level

No	Items	Condition
1	Ambient Illumination	Cosmetic : 500~1000lux
2	Background Color	Black/White
3	Viewing angle	Perpendicular to DUT surface ±45 degree  Reflect Mode
4	Viewing distance	30±5cm
5	Ambient Temperature	20 ~ 25 ℃
6	AQL Level	Major : 0.4 / Minor : 0.65

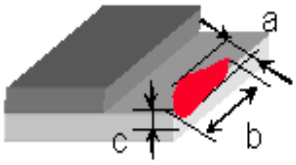
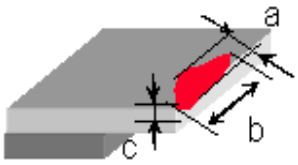
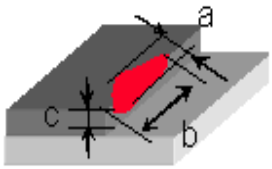
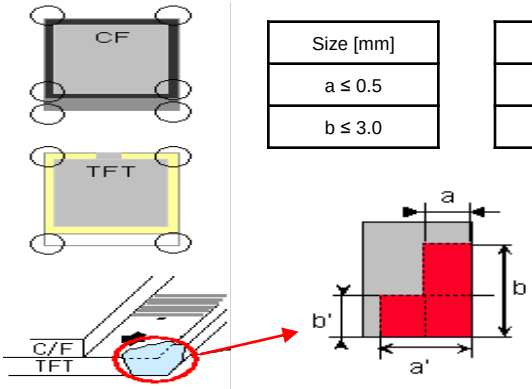
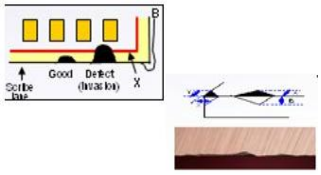
5.2. Display Quality Specification

No	Defect	Criteria		Remark
1	No Display (Major)	Not allowed		
2	Missing Line (Major)	Not allowed		
3	Darker or Lighter Line (Major)	Not allowed		
4	Bright / Dark Point (Minor)	Spec.	Permissible Qty	1: If blue sub-pixel number is 1 or 2ea, it is OK. But if 2ea in diameter 20mm, it is NG. 2. If particle bright dot size is under 0.2mm, 2ea is OK. But if 2ea in diameter 20mm, it is NG.
		Bright Point	0	
		Dark Point	2	
5	Round Type (Particle, bubble) (Minor)	Spec.	Permissible Qty	1: Φ=(L+W)/2, L=Length W=Width 2: Disregard if out of A/A + 0.5mm (V/A + 0.1mm) 
		Φ ≤ 0.10mm	Disregard	
		① 0.10mm < Φ ≤ 0.15mm	1	
		② 0.10mm < Φ ≤ 0.25mm	0	
6	Line Type (Particle, Scratch) (Minor)	Spec.	Permissible Qty	1: L=Length, W=Width 2: Disregard if out of A/A + 0.5mm (V/A + 0.1mm)  3: Ignore Scratch on Ground area of FPCB
		W ≤ 0.03mm	Disregard	
		0.03mm < W ≤ 0.05mm , L ≤ 3.0mm	1	
		0.05mm < W ≤ 0.1mm , L ≤ 1.0mm	1	

5.3. Scratches, Dent and Extraneous Substances

No	Defect	Criteria		Remark
1	Surface F/M on POL. & LCD Back side	-	-	Ignore if F/M is removed after cleaning
2	LCD Back side S/C	-	-	Ignore if S/C is no affect LCM Operating.
3	Visible of POL. Edge Adhesive	-	-	1: Missing : Ignore if it exists within 0.5mm from V/A to B/M 2: Bleed-out : Ignore

5.4 Chipping and Broken

No	Item	Criterion for Defects	Defect Type	Remark
1	Glass Chipping [Pad Area]	 Size [mm] a ≤ 0.3 b ≤ 5.0 c ≤ t	Minor	
2	Glass Chipping [Rear of Pad Area]	 Size [mm] a ≤ 0.5 b ≤ 5.0 c ≤ t	Minor	
3	Glass Chipping [Except Pad Area]	 Size [mm] a ≤ 0.5 b ≤ 5.0 c ≤ t	Minor	
4	Glass Chipping [Corner]	 Size [mm] a ≤ 0.5 b ≤ 3.0 Size [mm] a' ≤ 3.0 b' ≤ 0.5	Minor	
5	D-IC Chipping [Top/Back side]	 Scribe Line 침범 없을것 (Red Line) X,Y(모서리)≤50um A,B(중앙) ≤40um	Minor	

6. Reliability

6.1 Environmental Reliability Tests

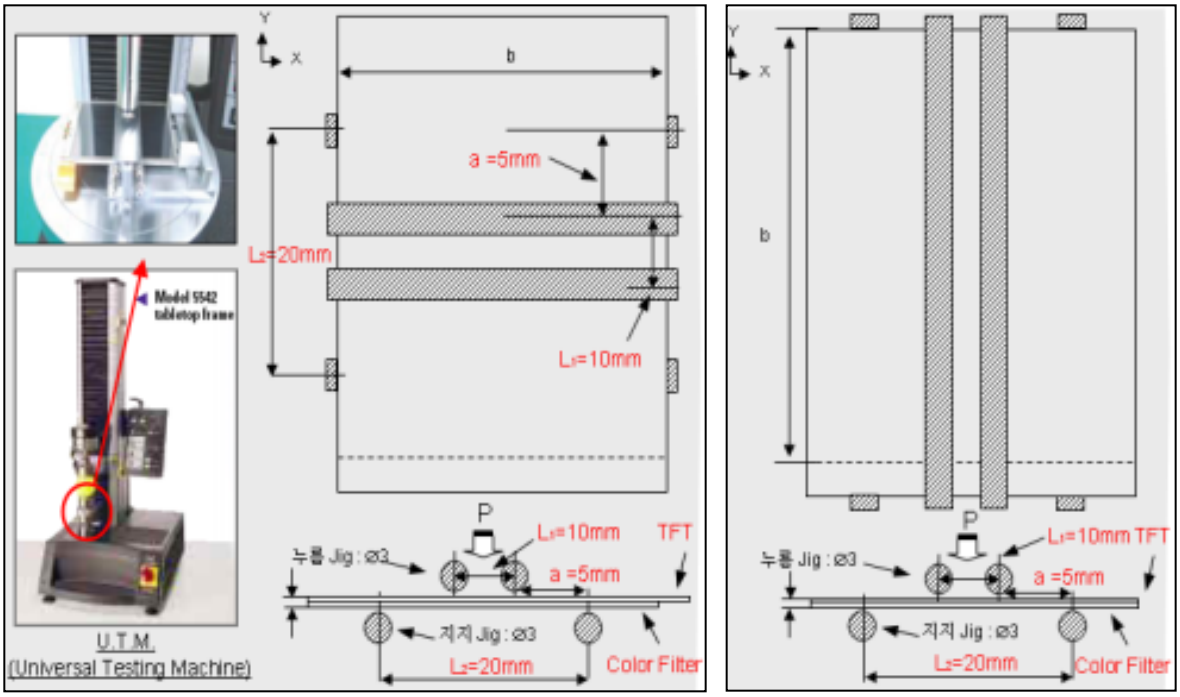
No	Test Item	Test Conditions	Quantity	Remark
1	고온동작 High Temperature Operation	70℃, 96 Hr	10	
2	저온동작 Low Temperature Operation	-20℃, 96 Hr	10	
3	고온고습동작 High Temperature and High Humidity Operation	60℃, 90% RH, 96 Hr	10	
4	고온저장 High Temperature Storage	80℃, 96Hr	10	
5	저온저장 Low Temperature Storage	-30℃, 96 Hr	10	
6	고온고습저장 High Temperature and High Humidity Storage	60℃, 90% RH, 96 Hr	10	
7	열충격 Thermal Shock	-30℃ (30min) ~ 80℃ (30min), 24 Cycle	5	
8	ESD Electrostatic Withstanding Voltage	Air : 0Ohm 200pF ± 200V Contact : 0Ohm 200pF ± 200V	2	
9	포장 진동 Package Vibration Test	10~55Hz, 1.5mm, X/Y/Z 6시간	1	1Hr
10	포장 충격 Packing shock	76㎝, 8corner , 6 face / Drop	1	Packing In a box

6.2 Fault Judgment Criteria

TFT- LCD Module should be at room temperature for 24 hours when the display quality test is over. There should be no particular change which might affect the practical display function and the display quality test should be conducted under normal operating condition.

6.3 Mechanical Reliability Tests

1) Panel 4 Point Bending



- Test Condition
  1. Supporting Jig : Ø3, Loading Jig : Ø3
  2. Jig Speed : 1mm/min
  3. Test Point : X axis rear, Y axis rear
  4. Jig length (L):
     - L1 : 10mm, L2 : 20mm

- Criteria (SPEC)

Item	4-Point Bending Test
Criteria	B10 (Weibull 10%)
Spec	B10 : X axis 90Mpa, Y axis 90Mpa
No. of Panel	24ea for each condition (48ea)

2) Driver IC 3PB Test

- Test Condition

Test Method : 3 Point Bending Test
1. Supporting Jig : 3mm, Loading Jig : 3mm
2. Jig Speed : 1mm/min
3. Test Point : X axis, Y axis
4. Jig length (L) : 10mm
5. Jig Material : Steel (or Al)

- Criteria (SPEC)

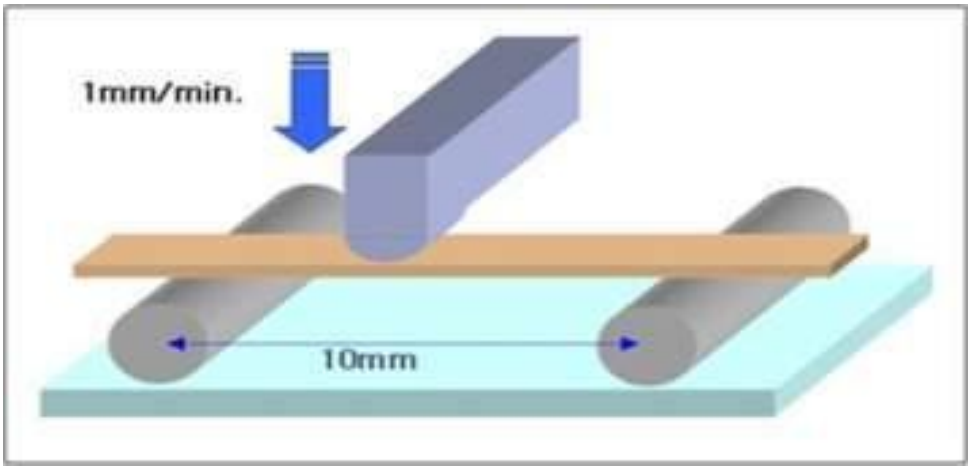
Item	3-Point Bending Test
Criteria	B10 (Weibull 10%)
Spec	B10 : Higher than 350Mpa
No. of IC	24ea

Formula for Stress :

$$\sigma = \frac{3 \cdot 9.8 \cdot P \cdot (L2-L1)}{2 \cdot b \cdot h^2} \text{(Mpa)}$$

(σ : Flexural Stress)

b : item width (mm)
h : item thickness (mm)
L : Length between supports (mm)
P : Load (kgf)



7. Precautions for Use

7.1. Safety

1) DISASSEMBLING OR MODIFICATION

Do not disassemble or modify the modules. Sensitive parts inside LCD module may be damaged, and dusts or scratches may mar the displays. LG Display does not warrant the modules, if customer disassembled or modified them.

2) BREAKAGE OF LCD PANEL

Do not Ingest liquid crystal material, Do not Inhale this material, and Do not Permit this material to contact the skin, if glass of LCD panel is broken. If liquid crystal material contacts the skin, mouth or clothing, take the following actions immediately.

In case contact to the eye or mouth, rinse with large amount of running water for more than 15 minutes. In case contact to the skin or clothing, wipe it off immediately and wash with soap and large amount of running water for more than 15 minutes. The skin or closing may be damaged if liquid crystal material is left adhered. In case ingestion, rinse out the mouth well with water. After spewing up by drinking large amount of water, get medical treatment.

3) GLASS OF LCD PANEL

Be careful with chips of Glass that may cause injuring fingers or skin, when the glass is broken.

4) ABSOLUTE MAXIMUM RATINGS

Do not exceed the absolute maximum rating values under the worst probable conditions caused by the supply voltage variation, input voltage variation, variation in parts' constants, environmental temperature, etc., otherwise LCD module may be damaged.

5) POWER PROTECTION CIRCUIT

Employ protection circuit for power supply, whenever the specification specifies it.
A suitable protection circuit should be applied, based on each system design.
A fuse is not fitted to this module. Therefore, without a suitable power-supply protection device, dust or partial circuit failure may cause overheating and/or burning , which may lead to injury.

6) DISPOSAL

Always comply with all applicable environmental regulations, when disposing of the LCD.

7) EDGES OF PARTS

Be careful with edges of glass parts and metal frame, it may cause injuring.
For designing the system, give special consideration that the wiring and parts do not touch those edges.

8) RECOMMENDED OPERATING CONDITIONS

Don't exceed “the recommended operation conditions” in this specification. The performance and quality of the LCD module are warranted only when the LCD module is used within “the recommended operation conditions”. To use the LCD module over “the recommended operation conditions” may have bad influence on the characteristics and reliability of the LCD module and may shorten the life of the LCD module.

Therefore, when designing the whole set, not to be over “the recommended operation conditions”, you should fully take care of supply voltage change, characteristic of connection parts, serge of input-and-output line , and surrounding temperature.

7.2. Installation in Assembly

7.2.1. ESD (ELECTRO-STATIC DISCHARGE) PREVENTION

The circuit used in LCD module is very sensitive to ESD. The following caution should be taken when installing LCD module to an enclosure of the system in order to prevent damage of circuit used in LCD module.

1) HUMIDITY

Ambient humidity of working area is recommended to be higher than 50%(RH) in order to avoid ESD.

2) GROUNDING

- Person handling LCD modules should be grounded with wrist band.
- Tools like soldering iron and screw drivers and working benches should be grounded.
- Grounded electro-conductive mats are recommended to be covered on the floor of working area and surface of working benches.
- The grounding should be done through a resister of 0.5~1Mohms in order to prevent spark of ESD.

3) Be careful with touching metal portion of testing instruments in order to prevent unnecessary ESD.

4) Do not touch the electrode area of PCB and electrical parts like LSI, capacitor, connector pin, etc.

5) IONIZER

Using ionizer (an antistatic blower) is recommended at working area in order to reduce electro-static voltage.

6) REMOVING PROTECTION FILM

When removing protection film from LCD panel, peel off the tag slowly (more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.

7.2.2. DUST AND STAIN PREVENTION

1) WORKING AREA
Reduce dust level in working area. Especially the level of metal particle should be decreased, otherwise electrical circuit in LCD module may be damaged due to short circuit by metal particles.

2) FINGER PRINT
Use finger stalls or soft and dust-free gloves in order to keep clean appearance of LCD module when handled for incoming inspection and assembly.

3) PROTECTION FILM
LCD module may be shipped with "protection film" on LCD panel in order to prevent from scratches and dust. It is recommended to remove the film at later process of assembling.

4) WIPING OFF DUST ON THE PANEL
When LCD panel becomes dirty, wipe the panel surface off softly with absorbent cotton or another soft cloth. If necessary, breathe upon the panel surface and then wipe off immediately and softly again. Be careful not to spill organic solvents into the inside of LCD module. The solvents may damage driver IC and PCB area used inside module. The polarizer laminated to LCD panel and adhesives may be damaged by the solvents, so do not use any organic solvents for wiping off LCD panel.

5) ADHESIVE ON LCD PANEL
Be careful not to attach adhesive, grease, etc., on LCD panel, because it is difficult to remove them without any damages on LCD panel.

6) WATER SPOTS ON THE PANEL
Avoid the dewing or water condensation.
Wipe off a spot or spots of water or mist on LCD panel softly with absorbent cotton or another cloth as soon as possible if happened, otherwise discoloration or stain may be caused. And, damage may occur if water penetrates the inside.

7.2.3. INSTALLING LCD MODULE TO THE ENCLOSURE

1) INSTALLING LCD MODULE TO THE ENCLOSURE
Do not bend or twist LCD module even momentarily when the LCD module is installed into the system. Bending or twisting the LCD module may cause permanent damage.
When the FPC is bent, the radius of FPC curvature must be more than value of recommendation to prevent bending and twisting forces from affecting the connection of FPC.
Even temporary bending or twisting sometimes causes damage.

2) INTERFACE
Do not fasten screws, with catching interface FPC between LCD module and the enclosure.
This may cause bending of LCD module, or become the cause of a failure by damaging FPC.

7.2.4. MECHANICAL FORCES

1) CARRY

Hold the side of the plastic frame when you carry an LCD module by hand. If an LCD is carried using the FPC, it is likely to be damaged and the LCD will then malfunction. If you turn on the LCD with a broken FPC, it may cause smoke or burning.
Protection (eg gloves) for fingers and hands is recommended to avoid injury by broken glass.

2) STRONG MECHANICAL SHOCK

Avoid strong mechanical shock, such as dropping the LCD from the work bench, or knocking it against a hard object.
These may cause the glass panel to crack, or cause other mis-operation.

3) EXCESSIVE FORCE

Avoid applying excessive force, like pushing the surface of LCD panel. This may cause scratches or breakage of the panel, or a failure of the module.

4) SCRATCHES ON THE PANEL

Do not put heavy object such as tools, books, etc., and do not pile up LCD modules.
Be careful not to touch the surface of the polarizer with any hard and sharp object. These parts are so sensitive and can easily be scratched, even if protected by a film.

5)Connector

When inserting or disconnecting the connector into a connector of the LCD module, care should be taken to ensure that no strong external force is applied to the connector on the LCD module side.
A strong external force applied to the connector or the FPC may damage their connections.
When assembling a module into a system, pay extra attention to ensure that no part such as the FPC etc. should be caught between the case of the system and the module. Make sure that the input signal connector of a module is securely and correctly connected to the connector on the system, not skewed, or incompletely connected.
Inputting a signal etc. into the module with connectors incorrectly inserted may cause a circuit component or components to malfunction.

6) FPC

When inserting or disconnecting the connector of the LCD module into a connector of the system, care should be taken to ensure that no strong external force is applied to the FPC on the LCD module side. A strong external force applied to the FPC may damage their connections.
When assembling a module into a system, pay extra attention to ensure that no part such as the FPC etc. should be caught between the case of the system and the module.
Make sure that the input signal connector of a module is securely and correctly connected to the connector on the system, not skewed, or incompletely connected. Inputting a signal etc. into the module with connectors incorrectly inserted may cause a circuit component or components to malfunction. Be careful not to pull or damage the FPC cables, to avoid mechanical damage in FPC and connection part of FPC and cell.

7.2.5. OPERATION

1) POWER SUPPLY

Power supplies should always be turned off during the assembly process.
Do not connect or disconnect the power cables and connectors with power applied to LCD module. This may cause damage to the LCD module circuit.
In operating module at the inspection process, and so on, the supply voltage and signals of driving device must satisfy the sequence of power supplies and signals described in this specifications.

2) GAS

Do not expose the LCD module to any gas which is not normally contained in the atmosphere, it may cause mis-operation or defects.

3) USED FOR LONG TERM

When a LCD module is used for a long term, the characteristics of LCD module might be changed and it may be out of the standard of “4.0 Optical Specifications” due to LED discoloration.
LED has the characteristics of shifting optical characteristics by the long term use.

7.3. Transportation and Storage

1) TEMPERATURE

Do not store LCD modules in a high temperature and high humidity condition, higher than 35ºC and 70%(RH) for a long term, meaning about one month or more, otherwise this may deteriorate the quality of the display. When you unavoidably store LCD modules for a long time, store between 0 and 35ºC, with a relative humidity 70% or lower.

2) LOW TEMPERATURE

Be careful not to leave it where the temperature is below specified storage temperature because the liquid crystal of the display panel may be damaged.

3) ULTRA VIOLET RAY

Store LCD module without exposure to direct sunlight or fluorescent lamps in order to prevent the module from strong ultra violet ray.

4) CLEANLINESS

Keep the LCD module in clean place, because any dust, hard particle may damage the polarizer, or dust invades the inside of the LCD module.

5) CONDENSATION OF WATER

The modules should be stored under a condition where no condensation of water is allowed. It may cause mis-operation or defects. Be especially careful not to make a module work under the condition that condensation of water appears.

6) PACKAGING

When you must re-package a LCD module after it has been removed from the original packaging, it is recommended to re-pack using the original package box and package material.

8. Package

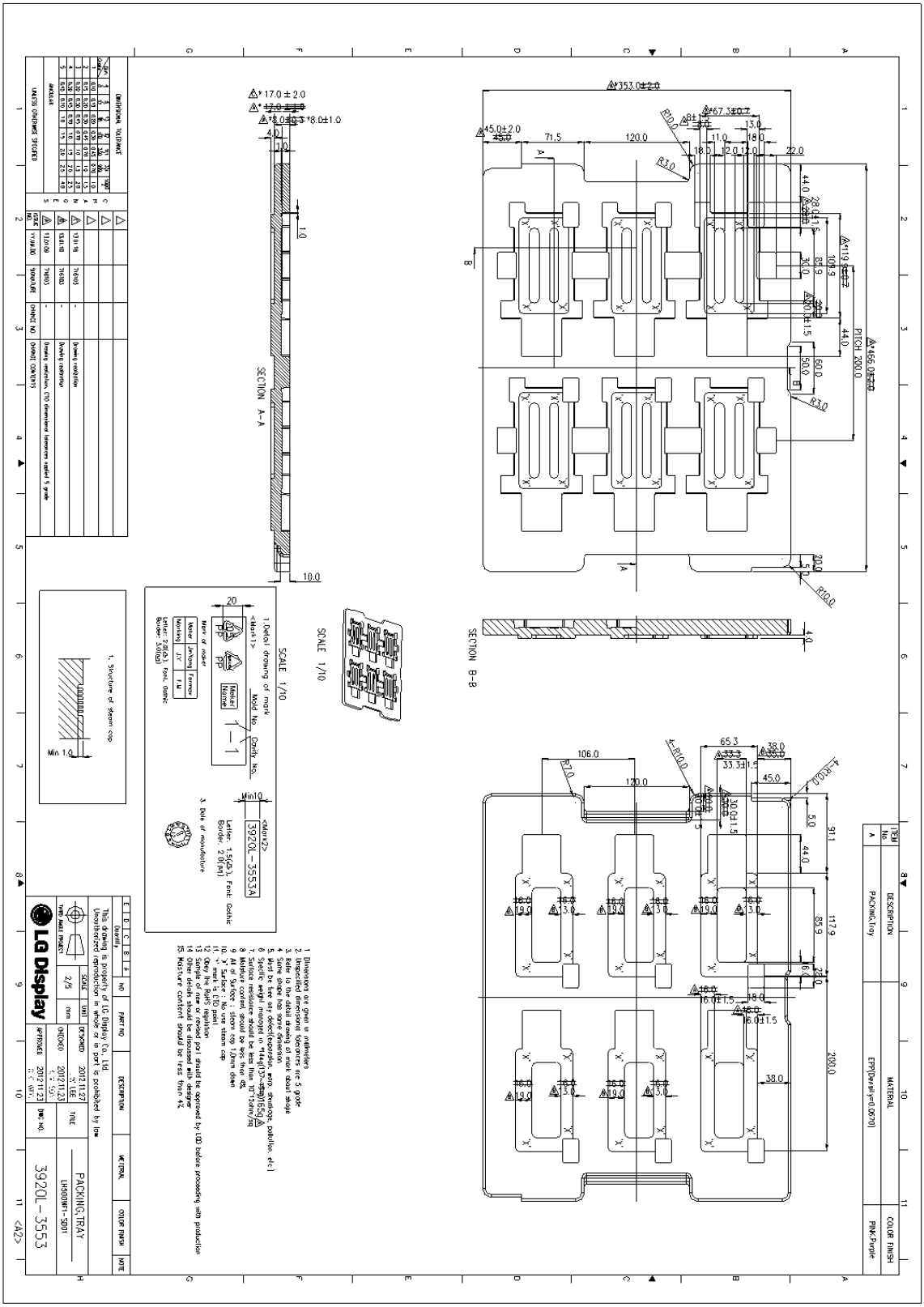
8.1. Packing Description

Packing Condition	Contents
Packing Type	EPP packing type
EPP material model	EPP (10^9~10^{12} Ω)
EPP packing type	See the picture 1
Number of panels per EPP	6 pieces
Number of EPP per carton	11+1(empty) units
Number of panels per carton	66 pieces

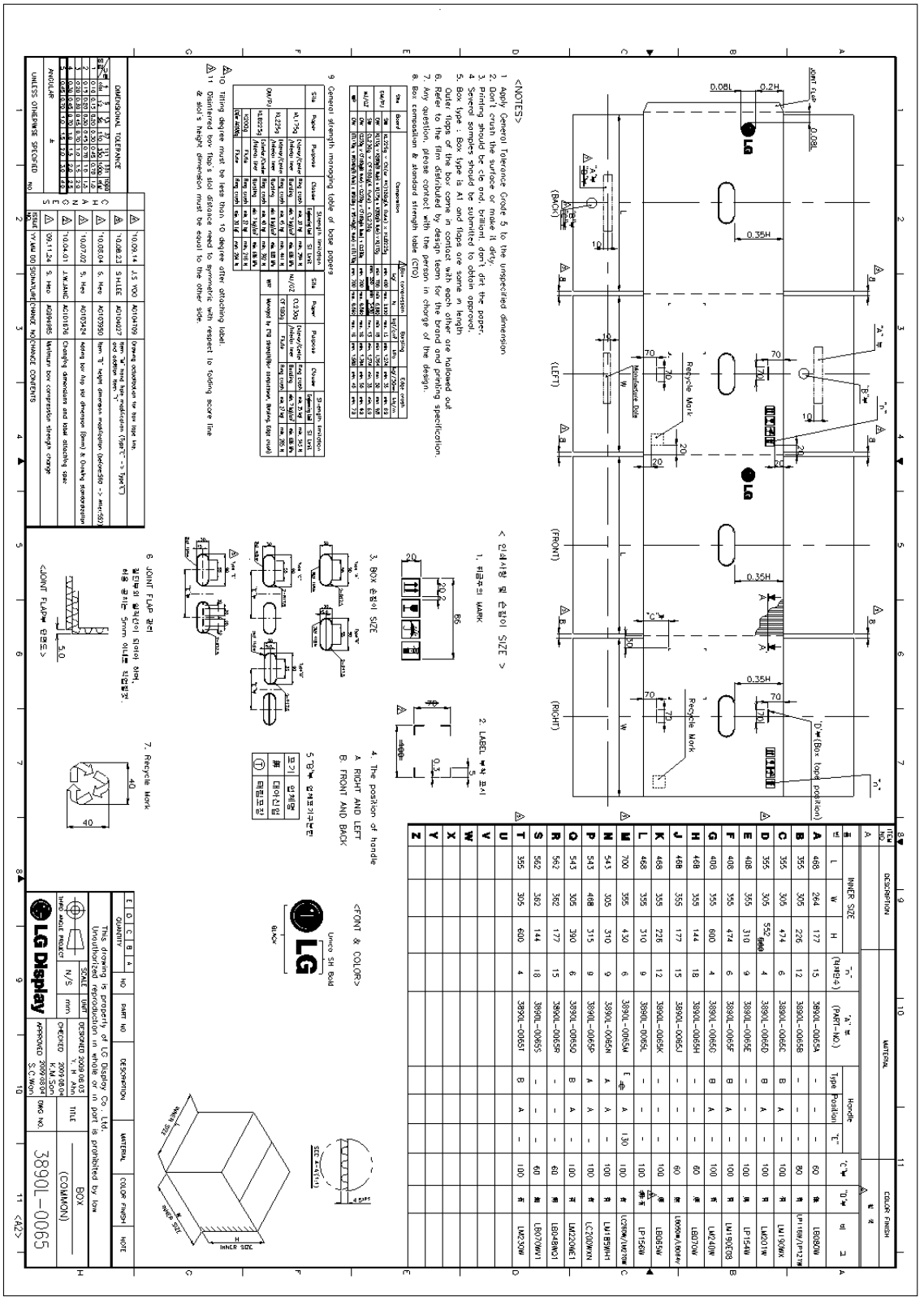
8.2. Description of Carton Material Composed

No.	1	2	3	4	5
Description	LCD Module	EPP Tray	Packing Carton	PE Bag	Carton
Quantity	66	12	1	1	1

8.3. Description of Packing Procedure



8.4. Packing Box Dimension



8.5. Packing Label Design

< BOX, Pallet Label >

1) Base model name

2) Suffix1

3) LCD's Part Number at Customer

4) Product Volume : declaring the volume of product in the BOX/PALLET

5) Lot/MM-DD

- Lot No : declaring the BOX/PALLET No. in the number according to Production plan in sequence.
- MM-DD :declaring packing Month/day

6) REMARK

- Register the Production change facts

7) Origin declaration : (Only Module business)

- LGD KUMI : MADE IN KOREA

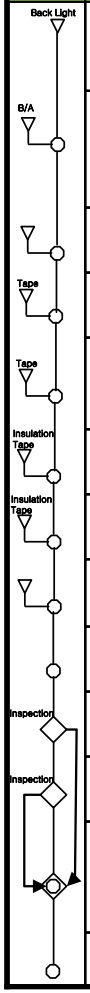
8) Declaration RoHS and halogen free verified expression

9) Barcode Type : Code 128A Type

10) Suffix2

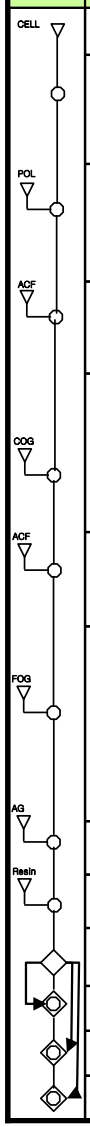
8.6. QC Flow Chart

QC Flow Chart_Assembly(Rev.01)



Process Flow Chart	No.	Process	Process Section	Management Item	Relation Standard	Standard No.	Management Standard			Facility Management		Measuring Machine Management			Monitoring			Control/Process Capability			Abnormal Occurrence Action			
							Detail Standard	Standard	Standard No.	Facility	Period	Equipment	Calibration	Gage R&R	Data	SMPL Size	Frequency	Type	Action Criteria	Judgment Criteria	Method	Person in charge	Standard	Standard No.
	1	B/L Input	Normal Process	Material Management	Mass Production Component Quality Guarantee Work Criteria	B-QA-ST-00008	P/N Check	BLU&B/A Input Working Manual	B-MO-WI-MA050	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Return	Line Chief	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	2	Board Assy Assembly	Normal Process	ESD Management	Module ESD Management Criteria	B-MO-ST-00018	Under ±200V	Module ESD Management Criteria	B-MO-ST-00018	Ionizer	One time Per Quarter	Measuring Machine	One time Per Year	Unnecessary	Occurrence Quantity	-	One time Per Month	Unnecessary	Unnecessary	Unnecessary	Readjustment	PM	Module ESD Management Criteria	B-MO-ST-00018
				Edge Damage	Module Defective Product Action Criteria	B-MO-ST-00009	Not Existence	B/A Working Manual	B-MO-ST-00051	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Discard	Supervisor	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	3	LED FPC Soldering	Normal Process	Process Management Temperature	Module Process Management Criteria	B-MO-ST-00001	340±20℃	LED FPC Soldering Working Manual	B-MO-ST-00054	Soldering Iron	Unnecessary	Measuring Machine	One time Per Year	Unnecessary	Temperature	-	Three times Per Day	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	4	Gap Filling Tape	Normal Process	Process Management Misalign	Module Process Management Criteria	B-MO-ST-00001	Not Existence	Insulation Tape Sticking Working Manual	B-MO-ST-00057	Pincette	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	5	Gap Filling Tape	Normal Process	Process Management Misalign	Module Process Management Criteria	B-MO-ST-00001	Not Existence	Insulation Tape Sticking Working Manual	B-MO-ST-00057	Pincette	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	6	Insulation Tape Sticking	Normal Process	Process Management Misalign	Module Process Management Criteria	B-MO-ST-00001	Not Existence	Insulation Tape Sticking Working Manual	B-MO-ST-00057	Pincette	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	7	Insulation Tape Sticking	Normal Process	Process Management Misalign	Module Process Management Criteria	B-MO-ST-00001	Not Existence	Insulation Tape Sticking Working Manual	B-MO-ST-00057	Pincette	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	8	Pulling Tape Sticking	Normal Process	Process Management Misalign	Module Process Management Criteria	B-MO-ST-00001	Not Existence	Pulling Tape Sticking Working Manual	B-MO-ST-00060	Pincette	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	9	Marking	Normal Process	Process Management Omission/Repetition	Module Process Management Criteria	B-MO-ST-00001	Not Existence	Serial Number Print Working Manual	B-MO-ST-00059	Marking Machine	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	10	Final Inspection	Inspection Process	Quality Test	Module Inspection Working Criteria	B-MO-ST-00011	Model Inspection Standard	MES System Management		Final Inspection Machine	One time Per Month	Unnecessary	Unnecessary	Unnecessary	Faulty Quantity	-	All	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	11	Surface Inspection	Inspection Process	Quality Test	Module Inspection Working Criteria	B-MO-ST-00011	Model Inspection Standard	MES System Management		Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Faulty Quantity	-	All	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	12	Repair	Repair Process	Process Condition	Module Faulty Production Action Criteria	B-MO-ST-00009	Process	Repair Working Manual	B-MO-ST-00064 B-MO-ST-00065 B-MO-ST-00066 B-MO-ST-00067	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Repair Quantity	-	All	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	13	BOX Packing	Normal Process	BCR Input	Module Process Management Criteria	B-MO-ST-00001	Model	Outer Packing Working Manual	B-MO-ST-00062	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	-	-	Unnecessary	Unnecessary	Unnecessary	Return	OP		

8.6. QC Flow Chart



QC Flow Chart_TAB(Rev.01)

Process Flow Chart	No.	Process	Process Section	Management Item	Relation Standard	Standard No.	Management Standard			Facility Management		Measuring Machine Management			Monitoring			Control/Process Capability			Abnormal Occurrence Action			
							Detail Standard	Standard	Standard No.	Facility	Period	Equipment	Calibration	Gage R&R	Data	SMPL Size	Frequency	Type	Action Criteria	Judgment Criteria	Method	Person in charge	Standard	Standard No.
CELL	1	Cell Stock	Normal Process	Cell History	Module Process Management Criteria	B-MO-ST-00001	Stock Quantity Check	Cell Stock Management Working Manual	B-MO-WI-MA003	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	ALL	When Stocked	Unnecessary	Unnecessary	Unnecessary	Notice	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	2	Clean	Normal Process	Abrasive Cloth Input Quantity	Module PM Working Criteria	B-MO-ST-00022	1.5±1.0mm	Clean Machine Working Criteria	B-MG-WI-MC022	Clean Machine	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Input Quantity	n=1	M/C	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022
				Abrasive Cloth Rotary Speed	Module PM Working Criteria	B-MO-ST-00022	300±200 RPM	Clean Machine Working Criteria	B-MG-WI-MC022	Clean Machine	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Rotary Speed	n=1	M/C	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022
				ESD	Module ESD Working Criteria	B-MO-ST-00018	Under ±200V	Module ESD Working Criteria	B-MO-ST-00018	Ionizer	One time Per Quarter	Measurement Machine	necessary	necessary	Occurrence Quantity	n=1	One time Per Month	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module ESD Working Criteria	B-MO-ST-00018
POL	3	POL Sticking	Normal Process	Roller Gap Adjustment	M_PM Working Criteria	B-MO-ST-00022	Model	POL Sticking M/C Working Manual	B-MG-WI-MC021	POL Sticking Machine	One time Per Month	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	M/C	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
				ESD	Module ESD Management Criteria	B-MO-ST-00018	Under ±200V	Module ESD Management Criteria	B-MO-ST-00018	Ionizer	One time Per Quarter	Measurement Machine	necessary	Unnecessary	Occurrence Quantity	n=1	One time Per Month	Unnecessary	Unnecessary	Unnecessary	Readjustment	Worker	Module ESD Management Criteria	B-MO-ST-00018
			Inspection Process	Sticking Level	Module Inspection Working Criteria	B-MO-ST-00011	Model	POL Sticking Level Measurement Working Manual	B-MO-WI-MA022	Unnecessary	Unnecessary	Vernier Callipers	necessary	Unnecessary	Sticking Level	n=2 ea	One time Per 2 Hours	Unnecessary	Unnecessary	UCL,LCL	Readjustment	Tech	Module Faulty Production Action Criteria	B-MO-ST-00009
ACF	4	ACF Sticking	Normal Process	Material Management (ACF)	M_ Material Management Criteria	B-MO-ST-00005	-10~5℃	ACF Management Working Manual	B-MO-WI-MA026	Refrigerator	Unnecessary	Thermometer	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Discard /Return	Material Management Worker	M_ Faulty Component Action Criteria	B-MO-ST-00015
				Process Management Temperature Pressure Time	Module Process Management Criteria	B-MO-ST-00001	Model	COG M/C Working Manual	B-MG-WI-MC023	ACF Sticking	Unnecessary	Gage	Unnecessary	Unnecessary	Process Condition	n=1	M/C	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
COG	5	COG 2nd Bonding	Normal Process	Process Management Temperature Pressure Time	Module Process Management Criteria	B-MO-ST-00001	Model	COG M/C Working Manual	B-MG-WI-MC023	2nd Bonding Machine	Unnecessary	Gage	Unnecessary	Unnecessary	Process Condition	n=1	M/C	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
				Misalign (CTQ)	M_Inspection Working Criteria	B-MO-ST-00011	Over 15um	COG Align Level Measurement Working Manual	B-MO-WI-MA020	1st Bonding Machine	Unnecessary	Microscope	Unnecessary	Unnecessary	M/A Quantity	n=2 (unit)	M/C One time Per 2 Hours	X-bar/R	Ideal value	LSL	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
				Conductive Ball Pressure Mark (CTQ)	M_Inspection Working Criteria	B-MO-ST-00011	Over 3 Level	COG Conductive Ball Pressure Mark Level Measurement Working Manual	B-MO-WI-MA031	2nd Bonding Machine	Unnecessary	Microscope	Unnecessary	necessary	Pressure Mark Quantity	n=2 (unit)	M/C One time Per 2 Hours	X-bar/R	Ideal value	LSL	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
ACF	6	ACF Sticking	Normal Process	Material Management (ACF)	M_ Material Management Criteria	B-MO-ST-00005	-10~5℃	ACF Management Working Manual	B-MO-WI-MA026	Refrigerator	Unnecessary	Thermometer	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Discard /Return	Material Management Worker	M_ Faulty Component Action Criteria	B-MO-ST-00015
				Process Management Temperature Pressure Time	Module Process Management Criteria	B-MO-ST-00001	Model	FOG M/C Working Manual	B-MG-WI-MC023	ACF Sticking	Unnecessary	Gage	Unnecessary	Unnecessary	Process Condition	n=1	M/C	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
FOG	7	FOG 2nd Bonding	Normal Process	Process Management Temperature Pressure Time	Module Process Management Criteria	B-MO-ST-00001	Model	FOG M/C Working Manual	B-MG-WI-MC023	2nd Bonding Machine	Unnecessary	Gage	Unnecessary	Unnecessary	Process Condition	n=1	M/C	Unnecessary	Unnecessary	Unnecessary	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
				Bonding Strength	Module Process Management Criteria	B-MO-ST-00001	500gf/Cm↑	FOG Bonding Strength Measurement Working Manual	B-MG-WI-MA032	Unnecessary	Unnecessary	Strength Measurement Machine	necessary	Unnecessary	Bonding Strength	n=2 (unit)	M/C One time /Shift	X-bar/R	Ideal value	LSL	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
				Misalign	M_Inspection Working Criteria	B-MO-ST-00011	Over X 50% Over Y 20%	FOG Align Level Measurement	B-MO-WI-MA028	1st Bonding Machine	Unnecessary	Microscope	Unnecessary	Unnecessary	M/A Quantity	n=2 (unit)	M/C One time Per 2 Hours	Unnecessary	Unnecessary	LSL	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
				Conductive Ball Pressure Mark	M_Inspection Working Criteria	B-MO-ST-00011	Over 10ea /Single Pad	FOG Conductive Ball Pressure Mark Level Measurement	B-MO-WI-MA027	2nd Bonding Machine	Unnecessary	Microscope	Unnecessary	necessary	Pressure Mark Quantity	n=2 (unit)	M/C One time Per 2 Hours	Unnecessary	Unnecessary	LSL	Readjustment	Tech	Module PM Working Criteria	B-MO-ST-00022)-R7
AG	8	AG Dotting	Normal Process	Material Management (AG Paste) Spread Management	M_ Material Management Criteria	B-MO-ST-00005	Under 25℃	Spread Machine M/C Working Manual	B-MO-WI-MC024	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Discard /Return	Material Management Worker	M_ Faulty Component Action Criteria	B-MO-ST-00015
Resin	9	Rear Resin Spread	Normal Process	Material Management (UV Resin) Spread Management	M_ Material Management Criteria	B-MO-ST-00005	10~25℃	Spread Machine M/C Working Manual	B-MO-WI-MC024	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Discard /Return	Material Management Worker	M_ Faulty Component Action Criteria	B-MO-ST-00015
	10	B/A Inspection	Inspection Process	Quality Test	Module Inspection Working Criteria	B-MO-ST-00011	Model Inspection Standard	Model Inspection Working Criteria (E-memo)		B/A Inspection Machine	One time Per Month	Unnecessary	Unnecessary	Unnecessary	Faulty Quantity	ALL	ALL	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	11	POL Repair	Repair Process	Process Condition	Module Faulty Production Action Criteria	B-MO-ST-00009	Model	POL Repair Working Manual	B-MO-WI-MA039	POL Repair Machine	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Repair Quantity	ALL	ALL	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	12	COG Repair	Repair Process	Process Condition	Module Faulty Production Action Criteria	B-MO-ST-00009	Model	TAB Repair Working Manual	B-MO-WI-MA040	COG Repair Machine	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Repair Quantity	ALL	ALL	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013
	13	FOG Repair	Repair Process	Process Condition	Module Faulty Production Action Criteria	B-MO-ST-00009	Model	FPC Repair Working Manual	B-MO-WI-MA037	POL Repair Machine	Unnecessary	Unnecessary	Unnecessary	Unnecessary	Repair Quantity	ALL	ALL	Unnecessary	Unnecessary	Unnecessary	Repair /Discard	Worker	Module Line Abnormal Occurrence Action Criteria	B-MO-ST-00013

8.7. Designation of Lot Mark

Byte	1	2	3	4	5	6	7	8	9	10

1. Factory Code

Byte	1	2

Mark		Description	Mark		Description
M	4	Gumi	X	P	Dasol
X	C	KRems	X	T	H&H
X	U	Tovis (Dalian)	J	1	LGD (Yantai)
X	L	Raygen (Yantai)	X	K	Dasol (Yantai)

2. Lot Type

Byte	3

Mark	Desc.
B	Normal
R	Rework
G	GIB
P	Packing

3. Year/Month/Data of Production

Byte	4	→	Year : 0~9
Byte	5	→	Month : 1~9, A~C (Except I/O)
Byte	6	→	Date : 1~9, A~Z (Except I/O)

4. Serial Number : 0001 ~ Z999 (Except I/O)

Byte	7	→	0~Z (Except I/O)
Byte	8	→	0~9
Byte	9	→	0~9
Byte	10	→	0~9