TO: **TOSHIBA CORPORATION**

DATE: **'09.11.09**

Specification of 15.6" TFT/LCD
MODEL: LP156WH2 (TLBB)

Prepared	Checked	Approved	
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NOTICE of RECEIPT
We accepted this specification. **OME Operations, TOSHIBA Corp.**

Purchasing Dept.	Eng.	Senr. Eng.	Senr. Mgr
PC Hardware Dept.	Eng.	Senr. Eng.	Senr. Mgr

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Record of Revision

Date	Rev. No.	Sheet(New)	Item	Old	New	Reason
09’.09.09	0.0	All	-	-	-	First Edition
09’.09.09	0.1	6,8,40-45 48-50	Label	Normal	TSB Gcode	
		38	Package Label	Gcode (G33C0004R110)	Gcode (G33C0005M110)	
		18	Cross Modulation Position	1280x800	1366x768	
		19	White Variation Position	1280x800	1366x768	
		38, 39, 41	Gcode	(G33C0004R110)	(G33C0005M110)	
’09.11.09	0.2	23	PWM Frequency (Min.)	200Hz	190Hz	
		23	PWM Duty Ratio (Min.)	12.5%	5%	

1. Scope

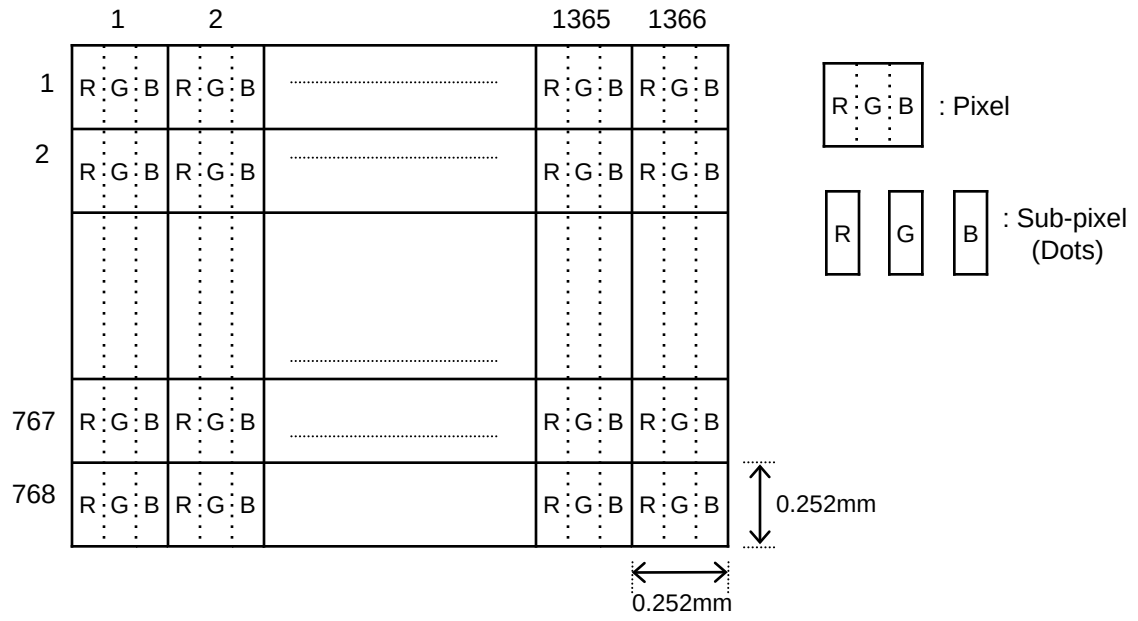
This specification is applicable to LCD manufacturer's 15.6" diagonal size TFT-LCD module "LP156WH2(TLBB)" designed for Personal Computer.

2. General Specification

2.1. Features

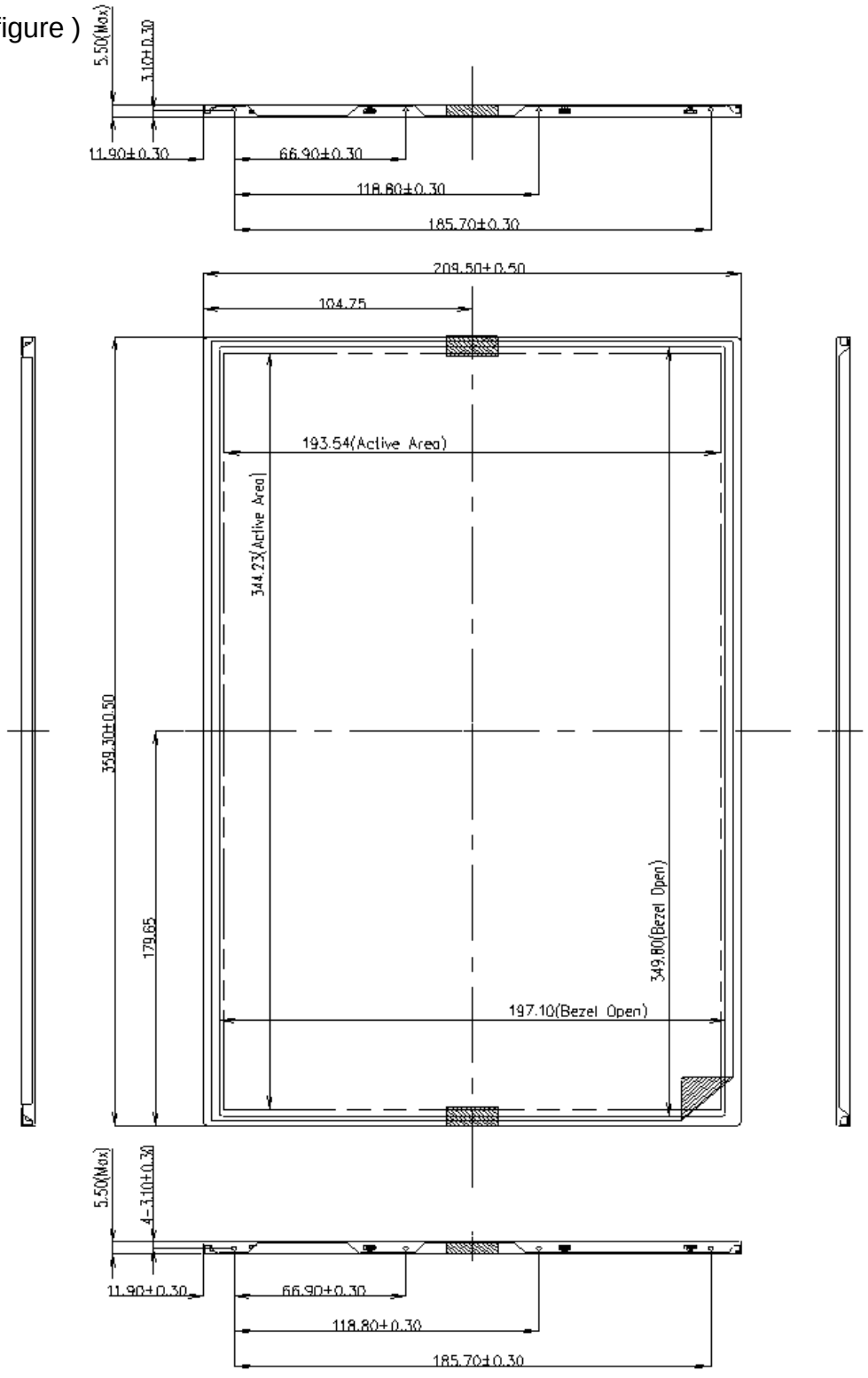
Item	Specifications
Display area (Active area)	344.232 (W) × 193.536 (H) (mm) (15.6 " diagonal)
Driving Method	TFT active matrix
Number of Pixels	1366 (W) × 768 (H) × R,G,B (WXGA) (pixels) 1)
Pixel pitch	0.252 (H) × 0.252 (V) (mm) 1)
Pixel Arrangement	RGB vertical stripes 1)
Display color	262,144 (colors)
Display Mode	Transmissive mode, Normally white
Viewing Direction	6 o'clock (in direction of maximum contrast)
Surface Treatment	Anti-Glare treatment (3H) of the front Polarizer
Interface	LVDS
Backlight	White LED array for side-lighting
Dimensional Outline	359.3±0.5 (W) × 209.5±0.5 (H) / 5.5 (Max) (D) (mm)
Bezel Opening	349.8±0.5 (W) × 197.1±0.5 (H) (mm)
Weight	435g(Typ.) 450g(Max.)

Note 1)

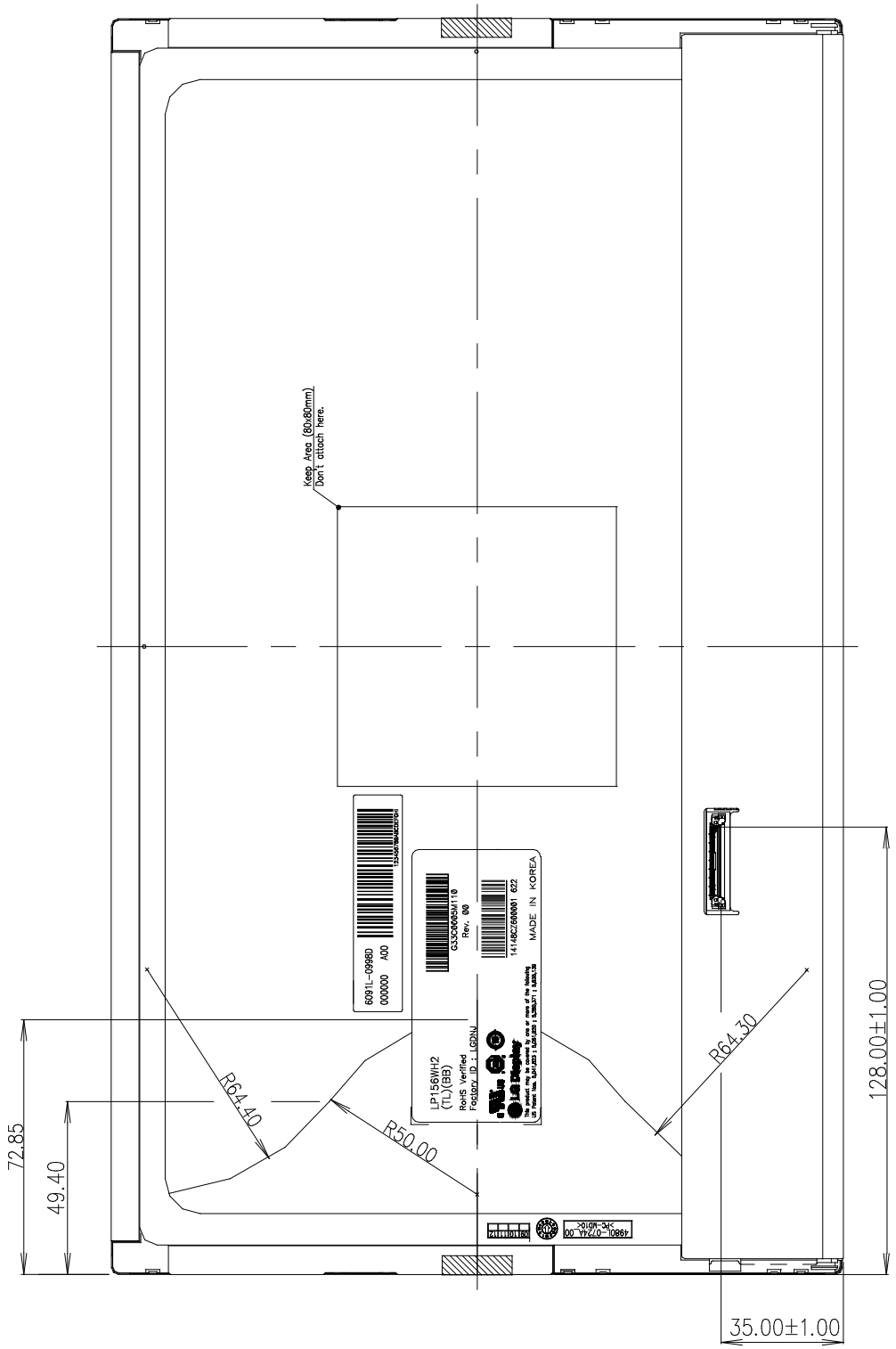


2.2. Dimensional Outline

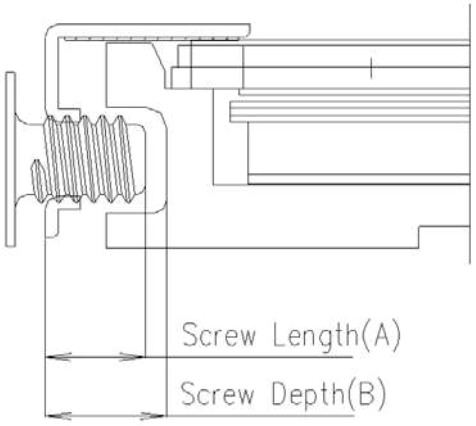
(Front figure)



(Back figure)


Keep Area (80x80mm)
Don't attach here.
LP156WH2
(TL)(BB)
RoHS Verified
Factory ID : LGDNJ
MADE IN KOREA
R64.40
R50.00
R64.30
72.85
49.40
128.00±1.00
35.00±1.00

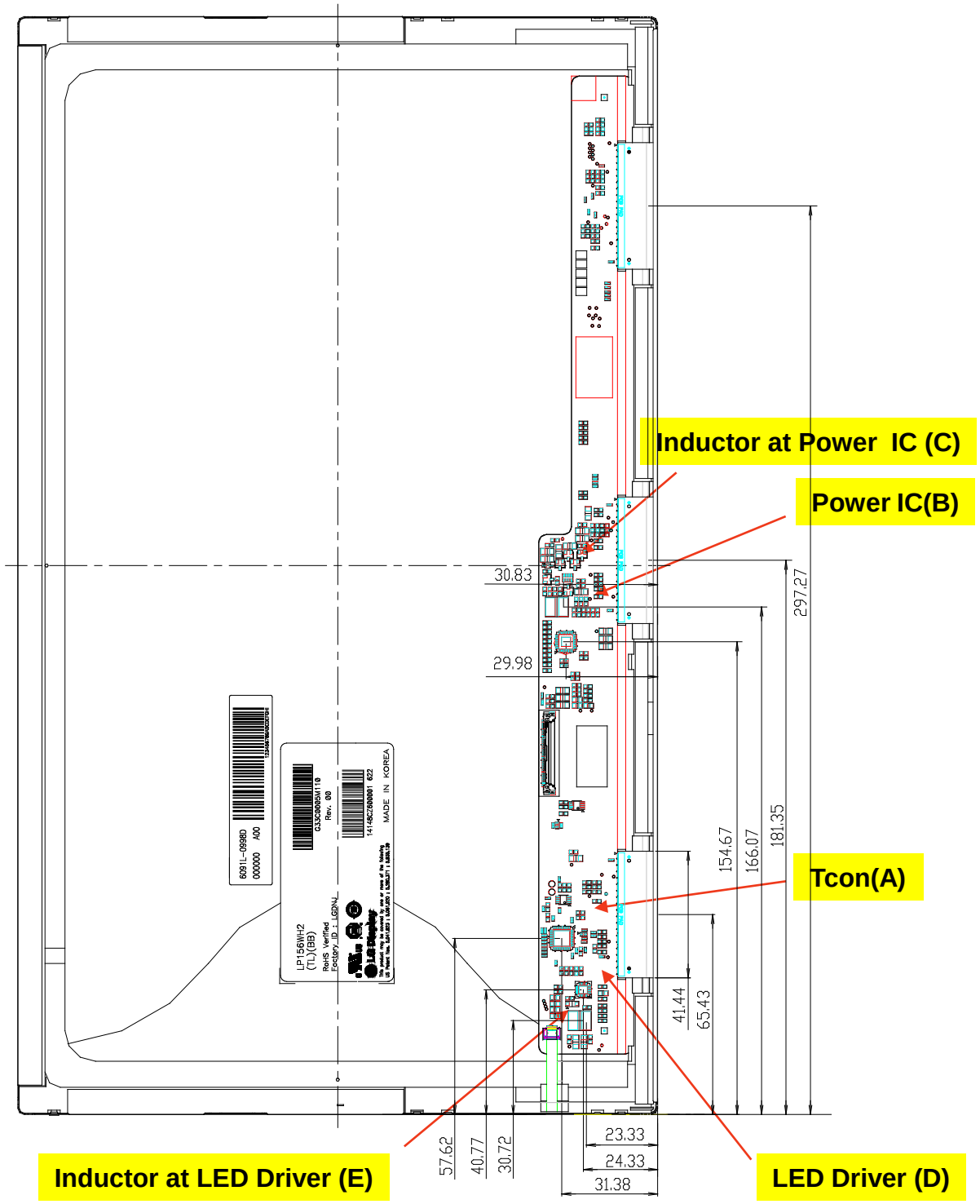
(Detail description of side mounting screw)



*Mounting Screw Length (A)
= 2.0(Min) / 2.5(Max)
*Mounting Screw Hole Depth (B)
= 2.5(Min)
*Torque : 2.0 kgf.cm(Max)

Notes : 1. Screw plated through the method of non-electrolytic nickel plating is preferred to reduce possibility that results in vertical and/or horizontal line defect due to the conductive particles from screw surface.

(Detail description of height of LCM back side & TAB Zone)

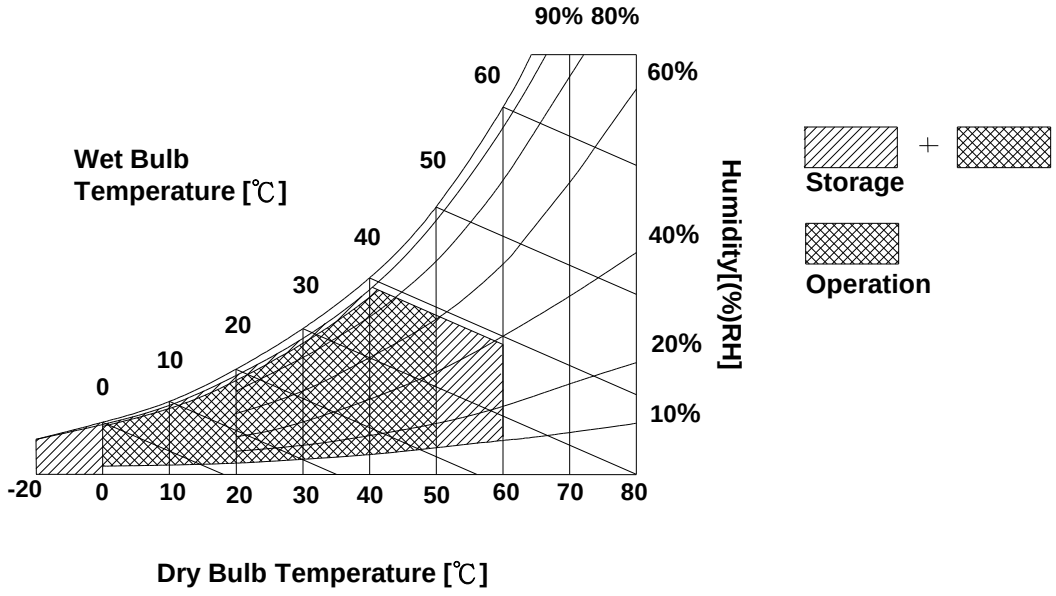


3. Absolute Maximum Ratings

3.1. Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Note
Operating Ambient Temperature	TOP	0	+50	°C	(1)
Operating Temperature for Panel	-	0	+50	°C	(2)
Storage Temperature	TSTG	-20	+60	°C	(1)
Operating Ambient Humidity	HOP	10	90	%RH	(1)
Storage Humidity	HSTG	10	90	%RH	(1)
Air Pressure	-	57	101.3	kPa	Operation
Air Pressure	-	12	101.3	kPa	Non-operation
Altitude	-	-	3	Km	Operation
Altitude	-	-	12	Km	Non-operation

Note 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39°C Max, and no condensation of water.



Note 2) The surface temperature caused by self heat radiation of cell itself is specified on this item.

3.2. Electrical Absolute Maximum

(1) TFT LCD Module

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	V_{DD}	-0.3	+4.0	V	at 25 ± 5°C
Logic Input Voltage	V_{IN}	-0.3	VDD+0.3	V	LVDS interface

(2) Back Light Unit

Item	Symbol	Min	Max	Unit	Note
LED Driver Supply Voltage	V_L	-0.3	23	V	damage to the device
LED PWM / LED_EN Voltage	V_{PWM} V_{LED_EN}	-0.3	6.0	V	

3.3. Mechanical Ratings

Test Item	Test Conditions	Note
Mechanical Vibration	Frequency Range 5 - 500 Hz, 14.7m/s^2 1.5G) constant, 0.5Hrs each axis (X, Y, Z direction).	Non Operation
	Frequency Range 5 - 500 Hz, 4.9m/s^2 (0.5G) constant, 0.5Hrs each axis (X, Y, Z direction).	Operation
Mechanical Shock LCD fix condition -> See Note (2)	* 240G, Pulse width 2 ms, Sine Wave, ±X, ±Y, ±Z direction. 70G, Pulse width 11ms, Sine Wave ±X, ±Y, ±Z direction. * Note) Normal function is only checking points.	Non Operation
	98 m/s^2 (10G), Pulse width 11 ms, Sine Wave, ±X, ±Y, ±Z direction.	Operation
Pressure Resistance -> See Note (1)	No Destruction with the force 196 N (20 kgf, 16 mm in diameter) to the display surface at the vertical direction.	Non Operation Fig 1-1 Fig 1-2 Fig 1-3
	No Destruction with the force 294.2 N (30 kgf, 30 mm in diameter) to the back of the display surface at the vertical direction. Only the breakage of below items will not happen after test. (Glass.LED & Circuit parts)	
Connector tension test	Input connector : With 50 times of connector trial there must be no damage to the shape and functionaly.	Non Operation
	Back light connector : With 50 times of connector trial there must be no damage to the shape and functionaly.	
Assured torque value at side-mount part	M2 : Max 2.5 kgf	Non Operation
Re-screwed test	15 times under Max. torque	Non Operation
Tapping test	Tapping area : All bezel(Metal cover) side, LCD: Full-screen gray (L32). “Ripple (Pooling)” can not be seen in Active Area Tapping Force: Max 3kgf.cm	Operation

Definitions of failure for judgment shall be as follows:

(1) Function of the module should be maintained.

(2) Current consumption should be smaller than the specified value.

(3) Appearance and display quality should not have distinguished degradation.

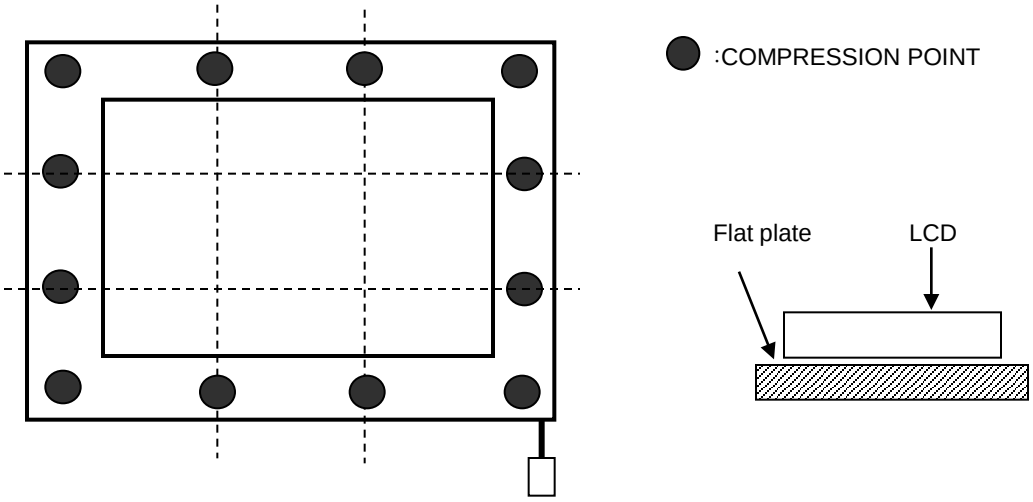
(4) Luminance should be larger than the minimum value specified in optical specification.

Note 1)

(1) The compression condition of front side

(a) Compression point : 12 points (refer to Fig 1-1)

(b) Compression condition: 20kgf, 3 sec, Tool diameter: 16 mm in diameter (refer to Fig 1-3)

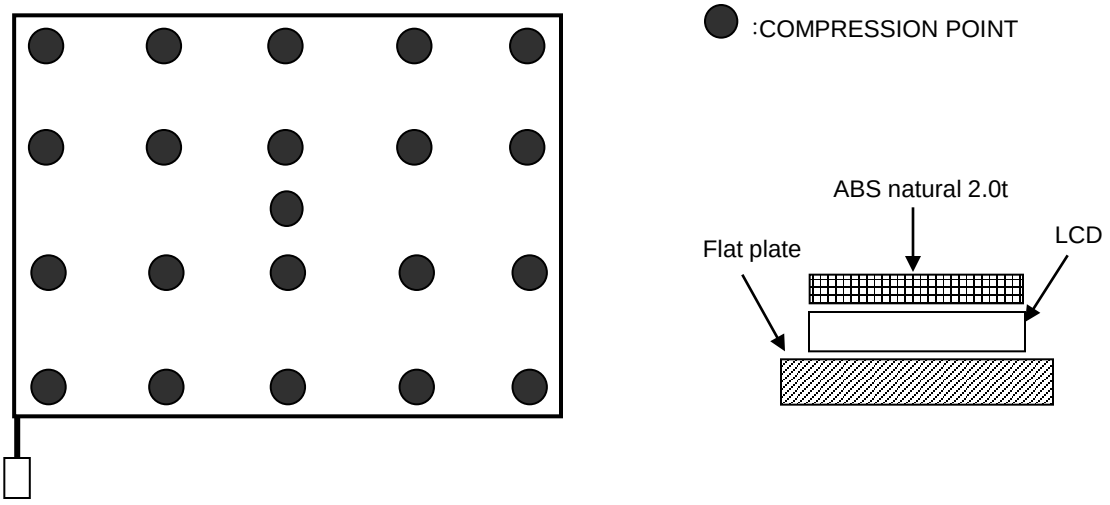


[Fig 1-1]

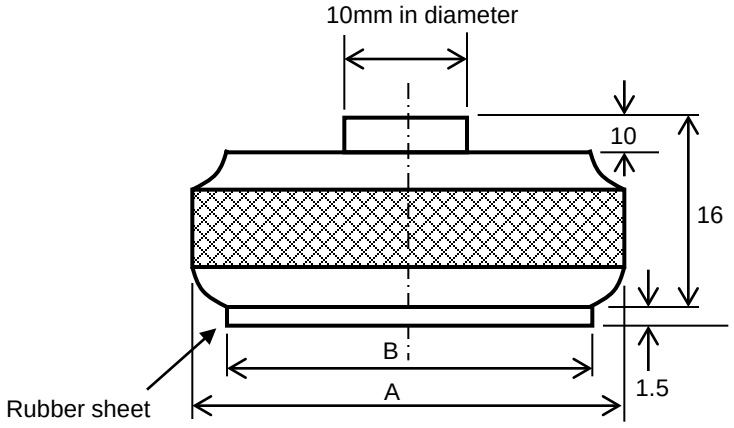
(2) The compression condition of rear side

(a) Compression point : 21 points (refer to Fig 1-2)

(b) Compression condition : 30kgf, 3 sec, Tool radius: 30 mm in diameter (refer to Fig 1-3)



[Fig 1-2]



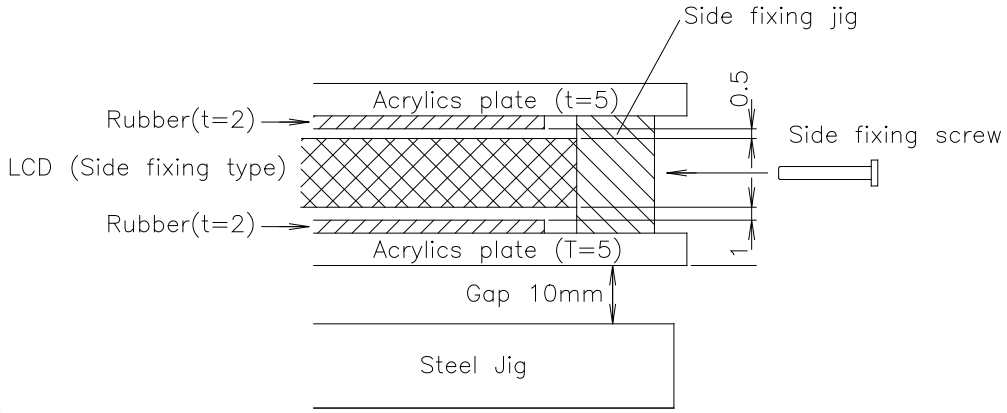
[Fig 1-3]

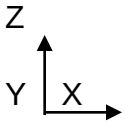
(3) Dimension of the compression jig

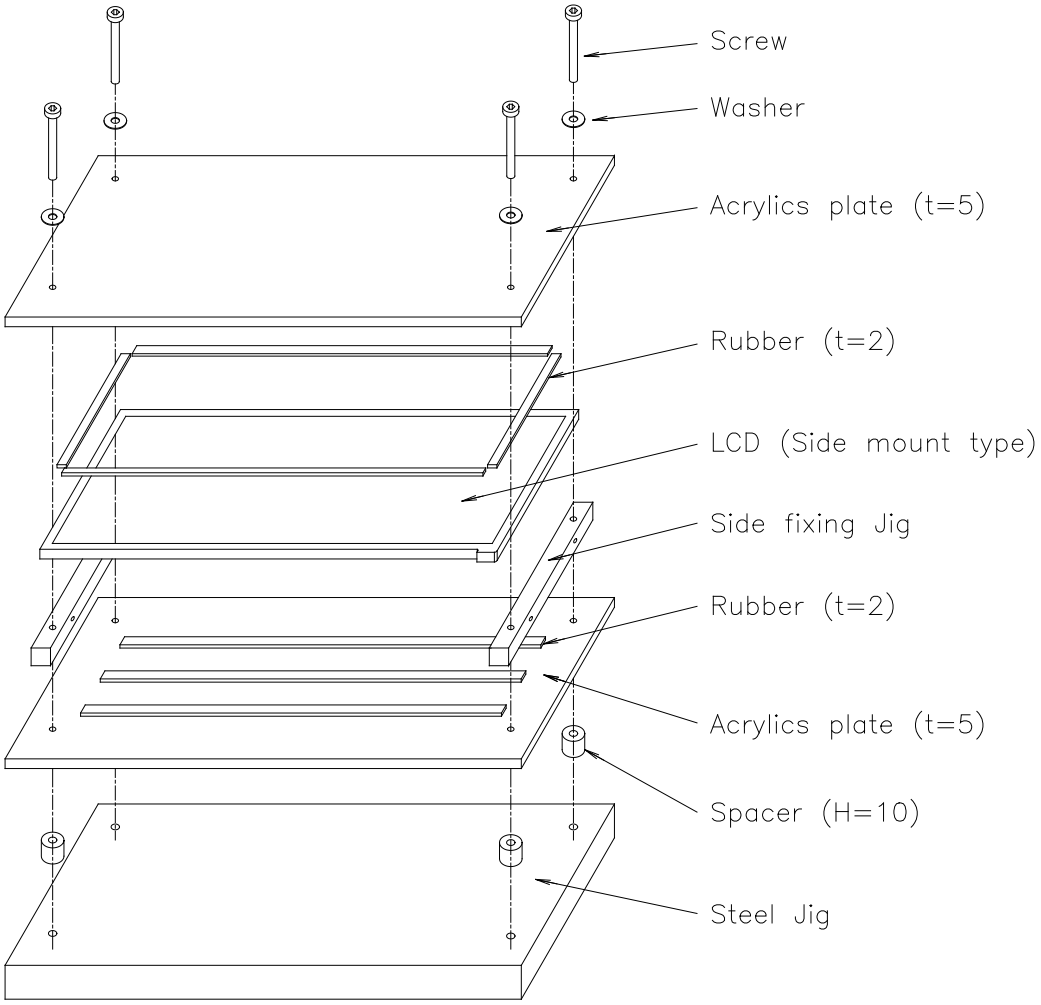
(a) compression jig for front side A = 16 mm in diameter
B = 16 mm in diameter

(b) compression jig for rear side A = 30 mm in diameter
B = 28 mm in diameter

Note 2) LCD fixing condition for z direction.







3.4. The Others

(1) Static electricity pressure resistance

Item	Testing conditions	Operation	Non Operation
Contact discharge	150pF, 330 ohm	±8KV	± 10 kV
Air discharge	150pF, 330 ohm	±15KV	±20 KV

(2) Sound noise

There should be no uncomfortable noise.

Being used under whatever surrounds, when power on/off, the panel should not generate uncomfortable noise. And regarding specified values are negotiated if it is needed.

(3) Open / Short

No smoke, no fiery at any open/ short test

(4) MTBF : 50,000 Hr (except for backlight LED)

4. Optical Characteristics

4.1. Test Conditions

Ambient Temperature : T_a 25±5°C
Ambient Humidity : H_a 65±20%RH
Supply Voltage : V_{DD} 3.3V
Input Signal : According to typical value in "Electrical Characteristics"
LED Driver Supply Voltage : V_{LED} = 12V
LED PWM Duty : D_{PWM} = 100%

The measuring method is shown in 4.2. The following items are measured under stable conditions. The optical characteristics should be measured in a dark room (Screen illuminance < 2 lx) or equivalent state with the methods shown in Note (6).

4.2. Optical Specifications

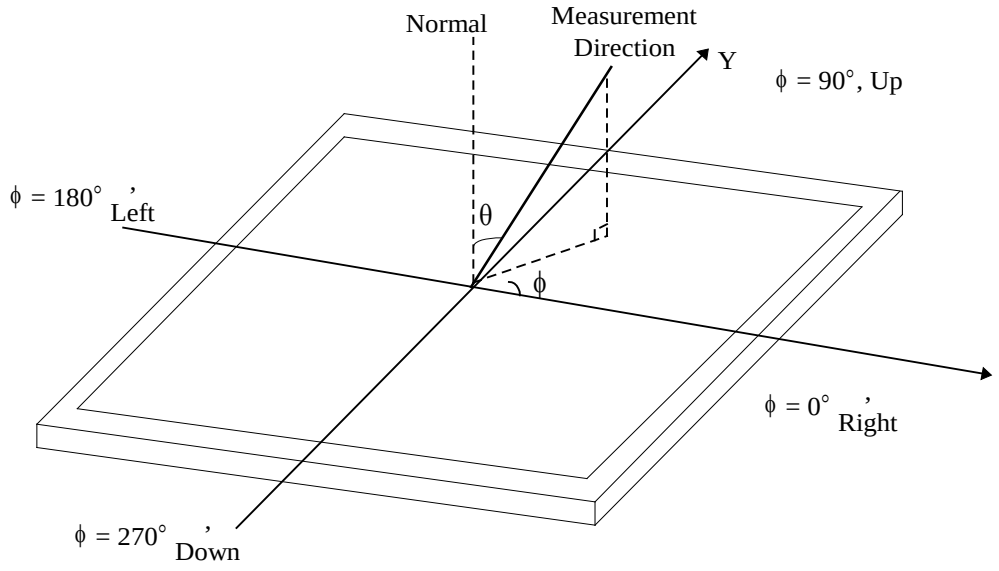
Item		Symbol	Conditions		Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center 1 Point)		CR	θ=0°, ϕ=0° Viewing normal angle		300	400	-	-	(2), (6)
Response Time		t_{TOTAL} (t_{ON}+t_{OFF})			-	16	25	ms	(3)
Average luminance (5 Point Average)		Y_L			185	220	-	cd/m²	*V_{LED}=12V D_{PWM}=100% Gray Scale Level = L63 (White)
Cross Modulation		D_{SHA}			-	-	2.0	%	(5)
Luminance Uniformity Chromaticity	Red	Rx Ry			0.592 0.335	0.622 0.365	0.652 0.395	-	(1), (6) PR650 Only for Color Coordinate
	Green	Gx Gy			0.310 0.577	0.340 0.607	0.370 0.637		
	Blue	Bx By			0.115 0.070	0.145 0.100	0.175 0.130		
	White	Wx Wy			0.283 0.299	0.313 0.329	0.343 0.359		
Viewing Angle	Hor.	θ_L θ_R	CR>=10	ϕ = 180 ϕ = 0°	40 40	45 45	- -	deg.	(Color Coordinate of the R,G,B is based on LPL's equipment, and Color Coordinate of the W is based on LPL's equipment)
	Ver.	θ_{up} θ_{Low}		ϕ = 90° ϕ = -90°	10 30	15 35	- -		
	Hor.	θ_L θ_R	CR>=5	ϕ = 180 ϕ = 0°	45 45	50 50	- -		
	Ver.	θ_{up} θ_{Low}		ϕ = 90° ϕ = -90°	15 35	20 40	- -		
13 Points White Variation		δW	θ=0°, ϕ=0° Viewing normal angle		-	-	1.6		(7)
13 Points CR Variation		δC_R			-	-	2.0		(7)
White Variation		dL			-	-	2.0		(8)

A. Present CR Variation(13Point) Spec is based on PR-880 Equipment and can be changed by the measuring equipment.

Item	Gray level	Conditions	Min.	Typ.	Max.	Unit	Note
Normalized luminance at each gray level	63	θ=0°, ϕ=0° Viewing normal angle	100	100	100	%	(1), (6) (Center 1 Point)
	55		60.0	74.2	88.0		
	47		36.8	52.5	68.0		
	39		20.0	34.8	50.0		
	31		9.50	21.0	33.0		
	23		3.50	12.2	21.5		
	15		0.95	5.36	11.6		
	7		0.09	1.45	4.90		
	0		0.00	0.16	0.90		

At normal viewing direction, during displaying the L0-L63 gray scale bar, luminance intensity inversion can not be seen.

Note 1) Definition of viewing angle θ and ϕ



Note 2) LCD fixing condition for z direction.

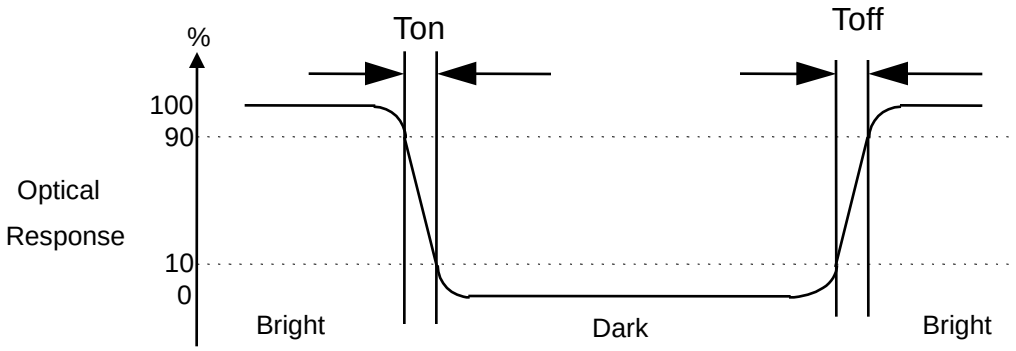
The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

L63 : Luminance on the white raster (gray scale level L63)

L 0 : Luminance on the black raster (gray scale level L0)

Note 3) Definition of response time



Note 4) Definition of surface luminance of white

Measure the luminance of white at Center point. Surface luminance of white Y_L

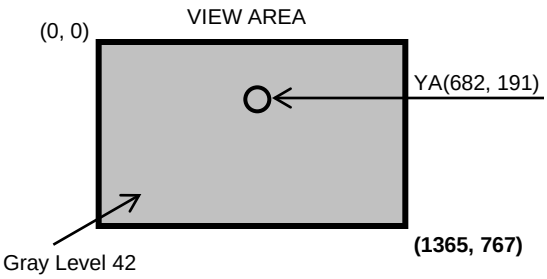
Note 5) Definition of Cross Modulation (D_{SHA})

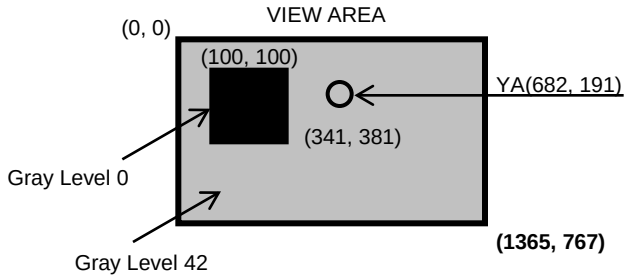
$$D_{SHA} = | Y_B - Y_A | / Y_A \times 100 \ (\%)$$

Where:

Y_A = Luminance of measured location without darkest gray pattern (cd/m^2)

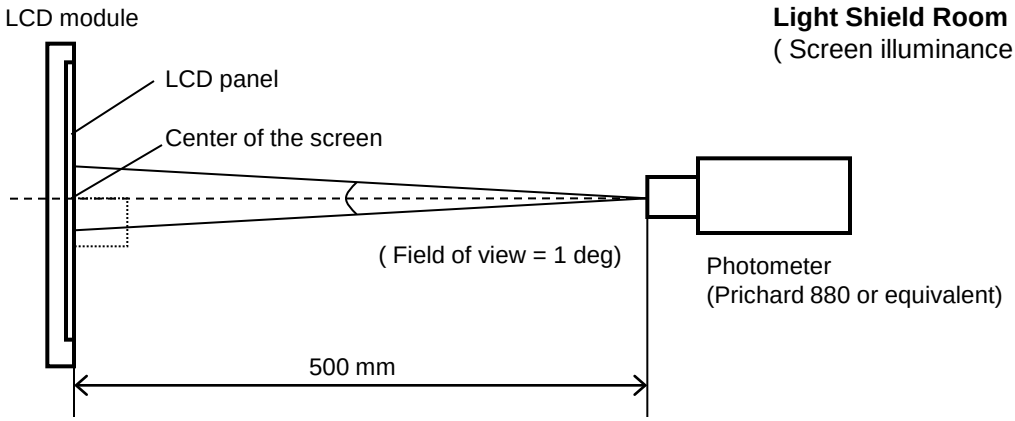
Y_B = Luminance of measured location with darkest gray pattern (cd/m^2)





Note 6) Measuring setup

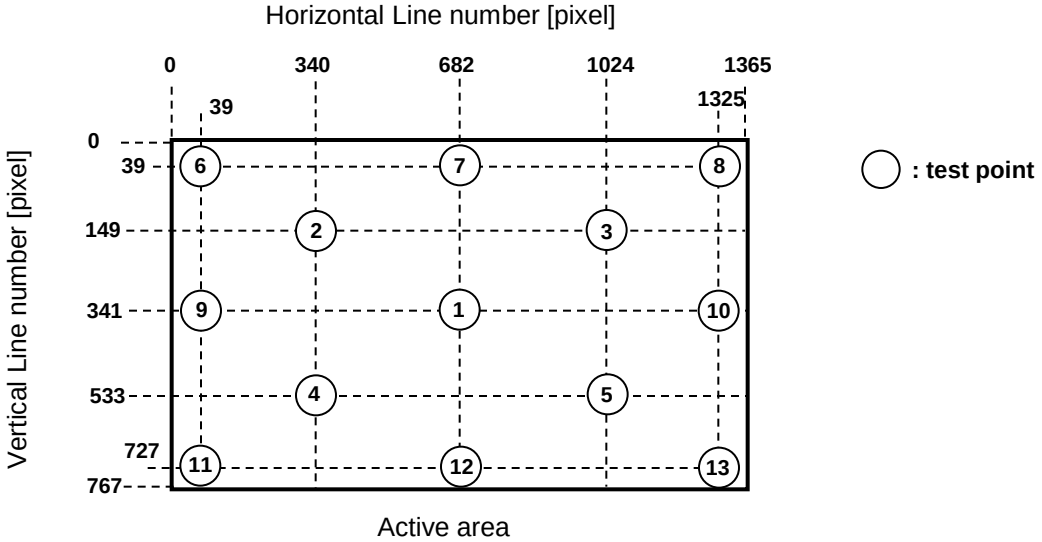
The measurement suppose to be executed after stabilized the panel at given temperature during 30 min. The measurement shall be executed 30 minutes after lighting at rating. The luminance of white should be typical luminance (Typical Condition IL=6.0mA). In order to stable the luminance, LCD s hall not be got winds.



Note 7) Definition of 13 points white variation δW, CR variation δC_R

δW = Maximum luminance of 13 points / Minimum luminance of 13 points

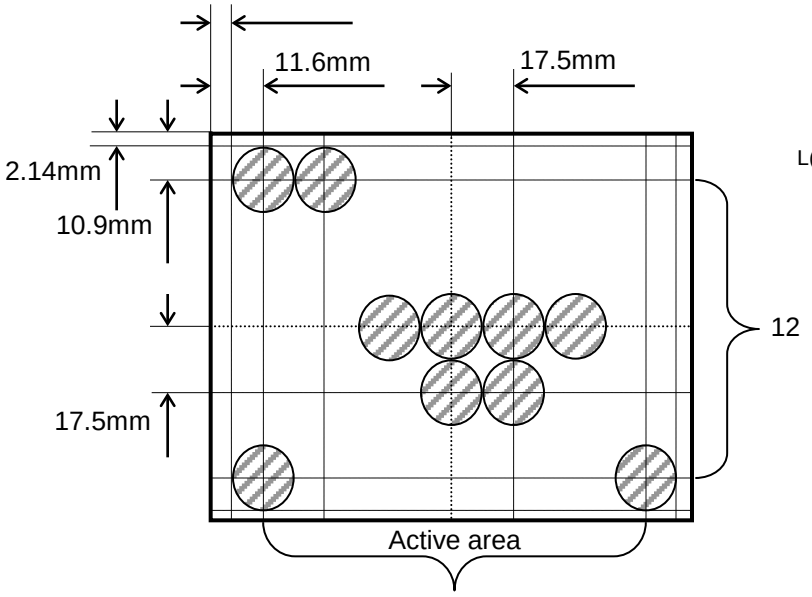
δC_R = Maximum CR 13 points / Minimum CR of 13 points

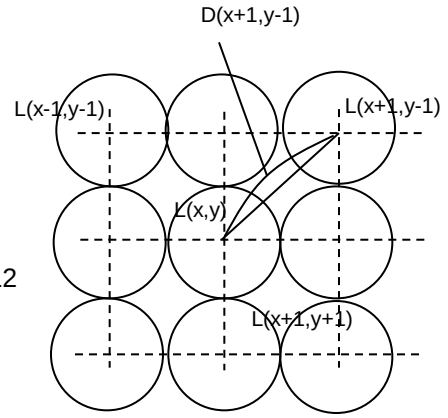


Note 8) Definition of White Variation dL : measure the luminance of white at 13 ×11 points.

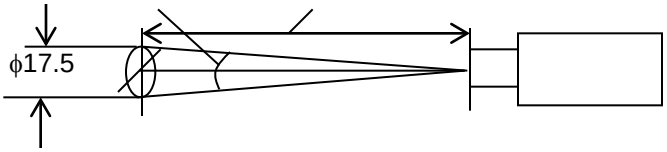
$$dL = [\ |\ L(x,y) - L(x+I,\ y+j)\ |\ /\ (\ L(x,y) \times D(x+I,\ y+j)\ )\ ] \times 100 \quad (\%/mm)$$

where $2 \le x \le 15$, $2 \le y \le 11$, $I = \pm 1$, $j = \pm 1$





Measuring Spot 16
(Field of View : 2deg. Measuring Distance : 500 mm)



5. Electrical Characteristics

5.1. TFT LCD module

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage		V_{DD}	3.0	3.3	3.6	V	
Differential Input Threshold Voltage	High	Vth		-	+100	mV	
	Low	Vtl	-100	-	-	mV	
Rush Current		I_{RUSH}	-	-	1.5	A	(5)
Power Supply Current	White(L63)	I_{DD}	270	320	370	mA	(3), (4) (a)
	Mosaic		325	385	445		(3), (4) (b)
	Max. Pattern		400	470	540		(3), (4) (c)

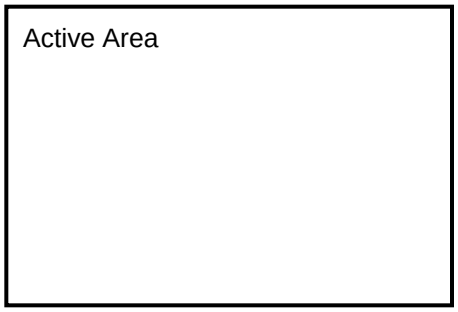
Note 1) The module should be always operated within these ranges. The "Typ." shows the recommendable value.

Note 2) Recommended LVDS transmitter : SN75LVDS84 (made by TI).
LVDS receiver included in this module is SW0633.(1 chip)

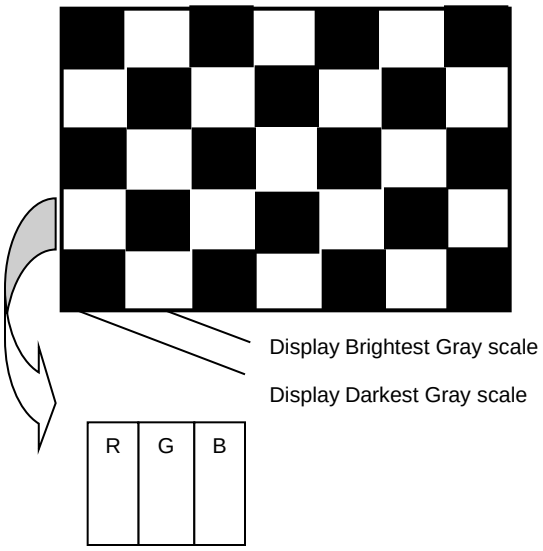
Note 3) Typical condition as follows. : fV= 60Hz, fDCLK = 72.3 MHz, V_{DD}= 3.3V, DC current.

Note 4) Power dissipation check pattern.

(a) White pattern

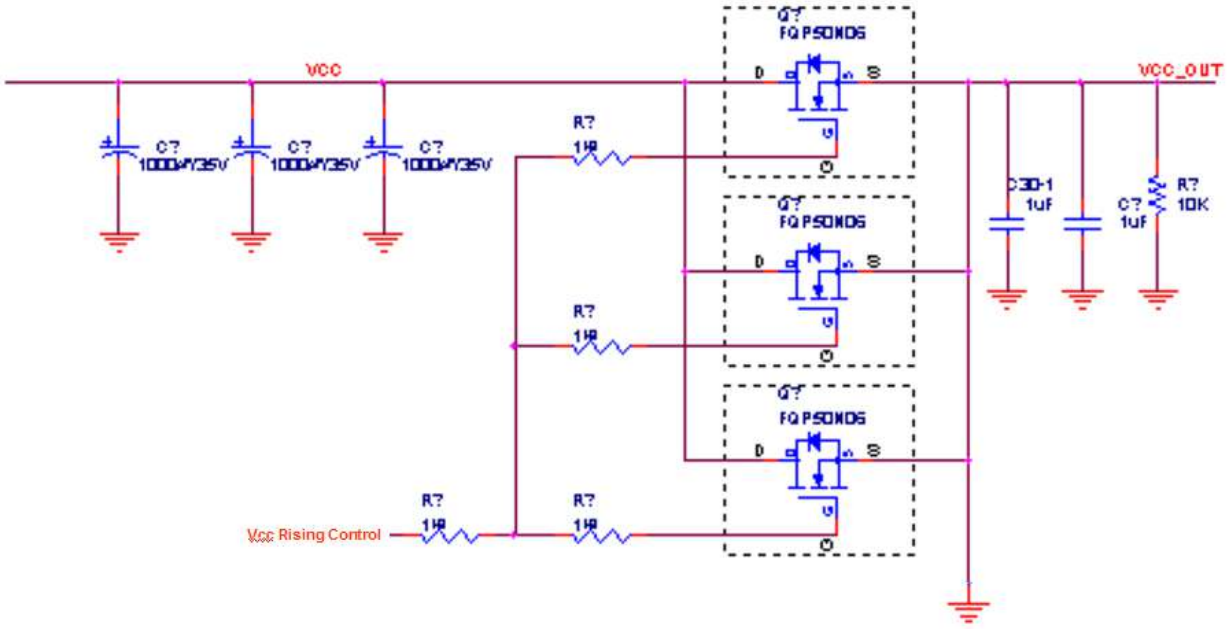


(b) Mosaic pattern

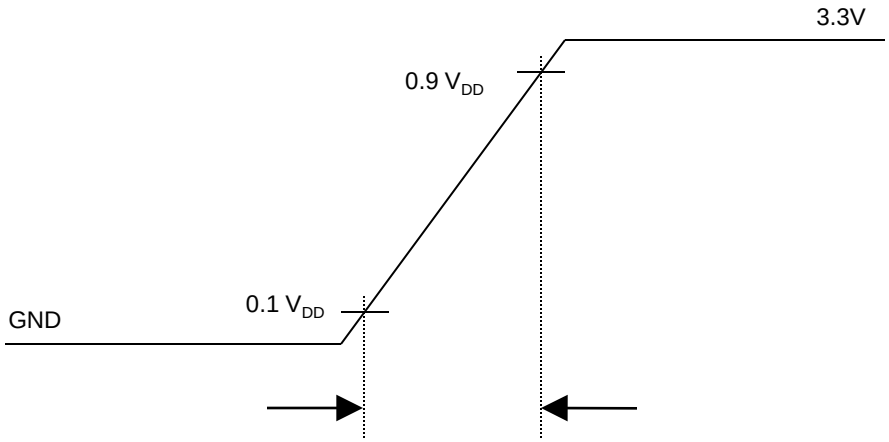


(C) Max. pattern (Black pattern)

Note 5) Measuring condition of rush current.



V_{DD} rising time is 500us



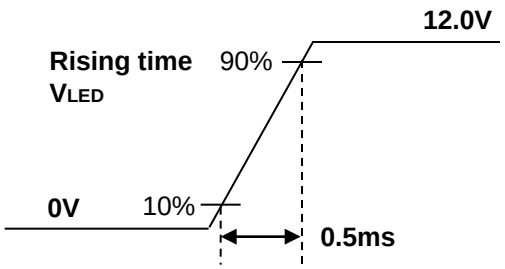
5.2. Backlignt Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Power Input Voltage	V_{LED}	7.0	12.0	20.0	V	5
LED Power Input Current	I_{LED}	-	275	-	mA	6
LED Power Consumption	P_{LED}	-	3.3	-	W	6
LED Power Inrush Current	I_{LED_P}	-	-	1500	mA	7
PWM Duty Ratio	-	5	-	100	%	8
PWM Jitter	-	0	-	0.3	%	9
PWM Impedance	Z_{PWM}	20	40	60	kΩ	
PWM Frequency	F_{PWM}	190	-	1000	Hz	10
PWM High Level Voltage	V_{PWM_H}	3.0	-	5.3	V	
PWM Low Level Voltage	V_{PWM_L}	0	-	0.5	V	
LED_EN Impedance	Z_{LED_EN}	20	40	60	kΩ	
LED_EN High Voltage	$V_{LED\_EN\_H}$	3.0	-	5.3	V	
LED_EN Low Voltage	$V_{LED\_EN\_L}$	0	-	0.5	V	

Note 1) The measuring position is the connector of LCM and the test conditions are under 25℃.

Note 2) The current and power consumption with LED Driver are under the V_{LED} = 12.0V , 25℃, Dimming of Max luminance whereas White pattern is displayed and fv is the frame frequency.

Note 3) The below figures are the measuring V_{LED} condition and the V_{LED} control block LGD used.
V_{LED} control block is same with Vcc control block.



Note 4) The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.

Note 5) If Jitter of PWM is bigger than maximum. It may cause flickering.

Note 6) This Spec. is not effective at 100% dimming ratio as an exception because it has DC level equivalent to 0Hz. In spite of acceptable range as defined, the PWM Frequency should be fixed and stable for more consistent brightness control at any specific level desired.

5.3. Regulation

The set (which LCD module is assembled into) should conform to the regulations below.

(1) EMC Regulations.
- a) ANSI C63.4
- b) CISPR 22
- c) CISPR 13

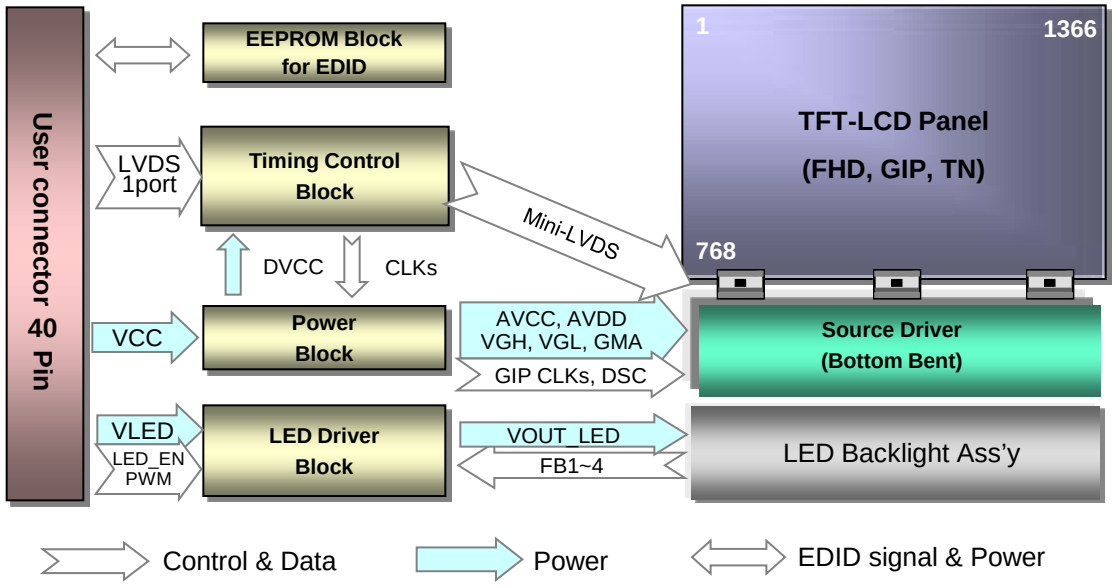
(2) Safety Regulations (Only LCD)
- a) UL 60950-1, Second Edition, Underwriters Laboratories Inc.
- b) CAN/CSA C22.2 No.60950-1-07, Second Edition, Canadian Standards Association.
- c) EN 60950-1:2006 + A11:2009, European Committee for Electrotechnical Standardization (CENELEC).
- d) IEC 60950-1:2005, Second Edition, The International Electrotechnical Commission (IEC).

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

(4) Material list concerning

Item		Silk	Product	Rating	Maker
TCON	TCON OUTPUT (Data Output)	R95,98,103,106	Resistor	100Ω	
	Power V_{cc}(2.5V)	UC1	TCON	2.5V	Siliconworks
DC/DC	Control IC for Power supply	US1	SW5008	48PIN, TQFN-48, R/TP, (LEVEL SHIFTER+BOOST+OP-AMP+LDO, Pvcom+D/C), PB FREE) DC/DC Switching frequency (400Khz ~ 1200Khz)	Siliconworks
	Switching Diode	D2,D4,D5,D6	BAV99		DIODES
	Schottky Barrier Diode	D3	BAT750	0.75A	DIODES
	Inductor	L1	NRS6010T100M0	10 uH±20% (Inductance) 0.27Ω±20% (DC Resistance) 1.0A Max (Rated DC Current)	KTY
LED Driver	Control IC for LED	US2	ADD5207	21V (Max supply voltage), 4ch, DFN, R/TP, 14 Pin, NBPC	Analog Device
	Inductor	L2	NRS6010T100M0	10 uH±20% (Inductance) 0.27Ω±20% (DC Resistance) 1.0A Max (Rated DC Current)	KTY

6. Block Diagram



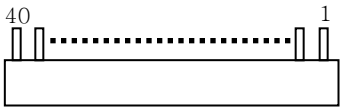
7. Input Terminal Pin Assignment

7.1. TFT LCD module

Pin	Symbol	Description	Notes
1	NC	No Connection.	
2	VCC	Power Supply, 3.3V Typ.	
3	VCC	Power Supply, 3.3V Typ.	
4	V EEDID	DDC 3.3V power	
5	NC	No Connection	
6	Clk EEDID	DDC Clock	
7	DATA EEDID	DDC Data	
8	Odd_R_{IN} 0-	Negative LVDS differential data input	
9	Odd_R_{IN} 0+	Positive LVDS differential data input	
10	GND	Ground	
11	Odd_R_{IN} 1-	Negative LVDS differential data input	
12	Odd_R_{IN} 1+	Positive LVDS differential data input	
13	GND	Ground	
14	Odd_R_{IN} 2-	Negative LVDS differential data input	
15	Odd_R_{IN} 2+	Positive LVDS differential data input	
16	GND	Ground	
17	Odd_CLKIN-	Negative LVDS differential clock input	
18	Odd_CLKIN+	Positive LVDS differential clock input	
19	GND	Ground	
20	NC	No Connection	
21	NC	No Connection	
22	GND	Ground	
23	NC	No Connection	
24	NC	No Connection	
25	GND	Ground	
26	NC	No Connection	
27	NC	No Connection	
28	GND	Ground	
29	NC	No Connection	
30	NC	No Connection	
31	VLED_GND	LED Ground	
32	VLED_GND	LED Ground	
33	VLED_GND	LED Ground	
34	NC	No Connection.	
35	BLIM	PWM for Luminance control	
36	BL_On	Backlight On/Off Control	
37	NC	No Connection	
38	VLED	LED Power Supply (7V-20V)	
39	VLED	LED Power Supply (7V-20V)	
40	VLED	LED Power Supply (7V-20V)	

1, Interface chips
1.1 LCD : SW, SW0633 (LCD Controller) including LVDS Receiver
1.2 System : SN75LVDS84 or equivalent
* Pin to Pin compatible with LVDS

2. Connector
2.1 LCD :IS050-L40B-C10, UJU or its compatibles
2.2 Mating : 20453-040T-0x, I-PEX or equivalent.
2.3 Connector pin arrangement



[LCD Module Rear View]

7.3. LVDS Transmitter

LVDS Transmitter : SN75LVDS84 (made by TI) or compatible.

Pin #	Pin Name	Require Signals	Pin #	Pin Name	Require Signals
1	D4	R4	48	D3	R3
2	Vcc	Vcc	47	D2	R2
3	D5	R5	46	GND	GND
4	D6	G0	45	D1	R1
5	DND	GND	44	D0	R0
6	D7	G1	43	NC	NC
7	D8	G2	42	LVDS GND	LVDS GND
8	Vcc	Vcc	41	Y0M	A0M
9	D9	G3	40	Y0P	A0P
10	D10	G4	39	Y1M	A1M
11	GND	GND	38	Y1P	A1P
12	D11	G5	37	LVDS Vcc	LVDS Vcc
13	D12	B0	36	LVDS GND	LVDS GND
14	NC	NC	35	Y2M	A2M
15	D13	B1	34	Y2P	A2P
16	D14	B2	33	CLKOUTM	CLKM
17	GND	GND	32	CLKOUTP	CLKP
18	D15	B3	31	LVDS GND	LVDS GND
19	D16	B4	30	PLL GND	PLL GND
20	D17	B5	29	PLL Vcc	PLL Vcc
21	Vcc	Vcc	28	PLL GND	PLL GND
22	D18	HSYNC	27	SHDN	SHDN
23	D19	VSYNC	26	CLKIN	Dclk
24	GND	GND	25	D20	DE(Data Enable)

7.4. Timing Diagrams of LVDS Transmission

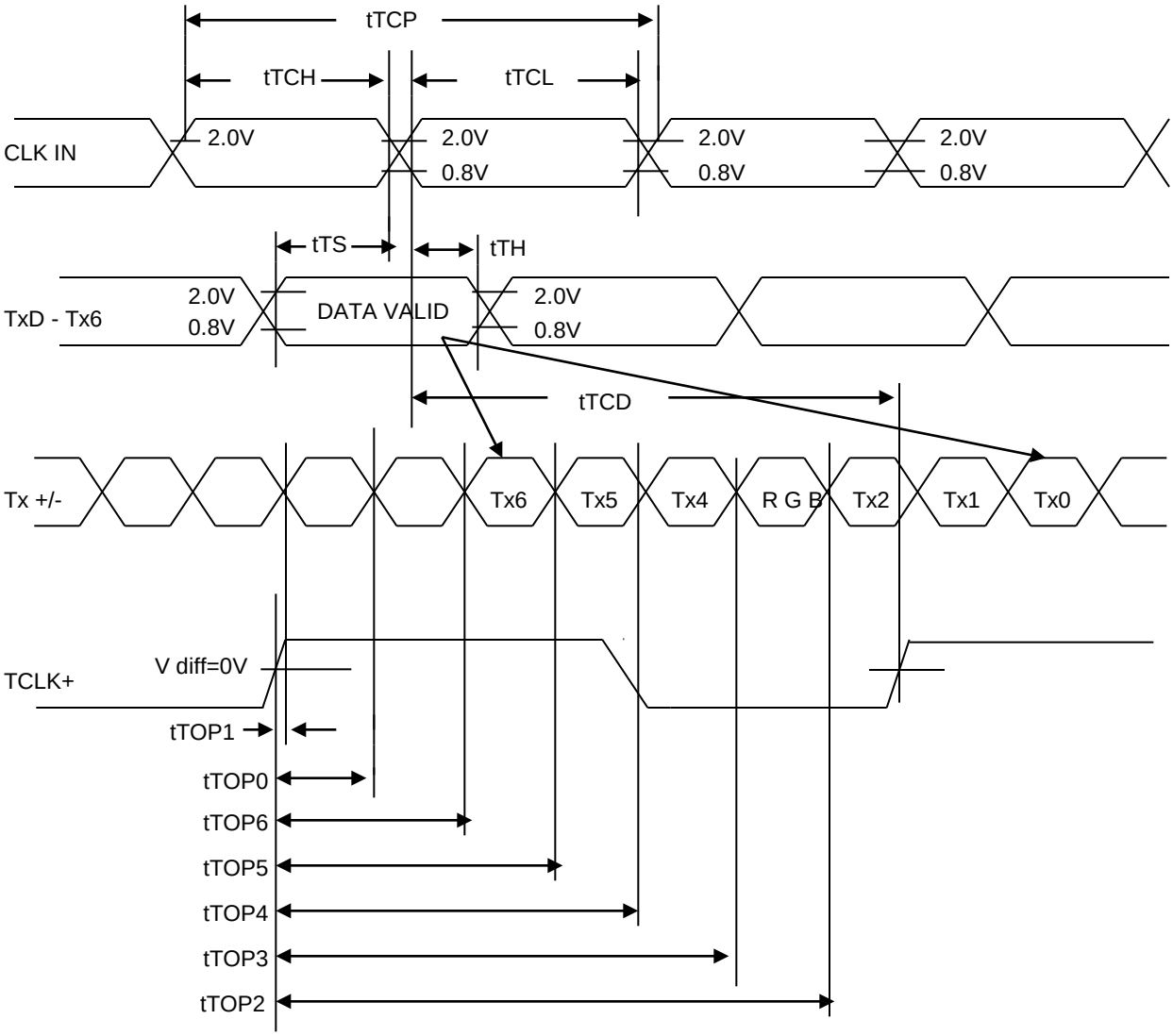
Switching Characteristic

VCC = 3.0 ~ 3.6V, Ta = -10 ~ +70℃

Transmitter

Symbol	Parameter	Min.	Typ.	Max.	Unit
tTCIT	CLK IN Transition Time	-	-	5	ns
tTCP	CLK IN Period	14.7	T	32.4	ns
tTCH	CLK IN High Time	0.4T	0.5T	0.6T	ns
tTCL	CLK IN Low Time	0.4T	0.5T	0.6T	ns
tTCD	CLK IN to TCLK +/- Delay	-	14.2	-	ns
tTS	TTL Data Setup to CLK IN	3.0	-	-	ns
tTH	TTL Data Hold from CLK IN	1.5	-	-	ns
tLVT	LVDS Transition Time	0.26	0.7	1.5	ns
tTOP1	Output Data Position 0 (T= 15.38ns)	-0.2	0	0.2	ns
tTOP0	Output Data Position 1 (T= 15.38ns)	T/7 - 0.2	T/7	T/7 + 0.2	ns
tTOP2	Output Data Position 2 (T= 15.38ns)	2T/7 - 0.2	2T/7	2T/7 + 0.2	ns
tTOP3	Output Data Position 3 (T= 15.38ns)	3T/7 - 0.2	3T/7	3T/7 + 0.2	ns
tTOP4	Output Data Position 4 (T= 15.38ns)	4T/7 - 0.2	4T/7	4T/7 + 0.2	ns
tTOP5	Output Data Position 5 (T= 15.38ns)	5T/7 - 0.2	5T/7	5T/7 + 0.2	ns
tTOP6	Output Data Position 6 (T= 15.38ns)	6T/7 - 0.2	6T/7	6T/7 + 0.2	ns
tTPLL	Phase Lock Loop Set	-	-	10	ns

AC Timing Diagrams
Transmitter Device



7.5. Input Signal, Basic Display Colors and Gray Scale of each Color

Color		Input Color Data																	
		RED						GREEN						BLUE					
		MSB					LSB	MSB					LSB	MSB					LSB
		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	RED (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (01)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	...	...						...						...					
	RED (62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (01)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	...	...						...						...					
	GREEN (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	...	...						...						...					
	BLUE (62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note 1) 0: Low level voltage, 1: High level voltage

8. Interface Timing

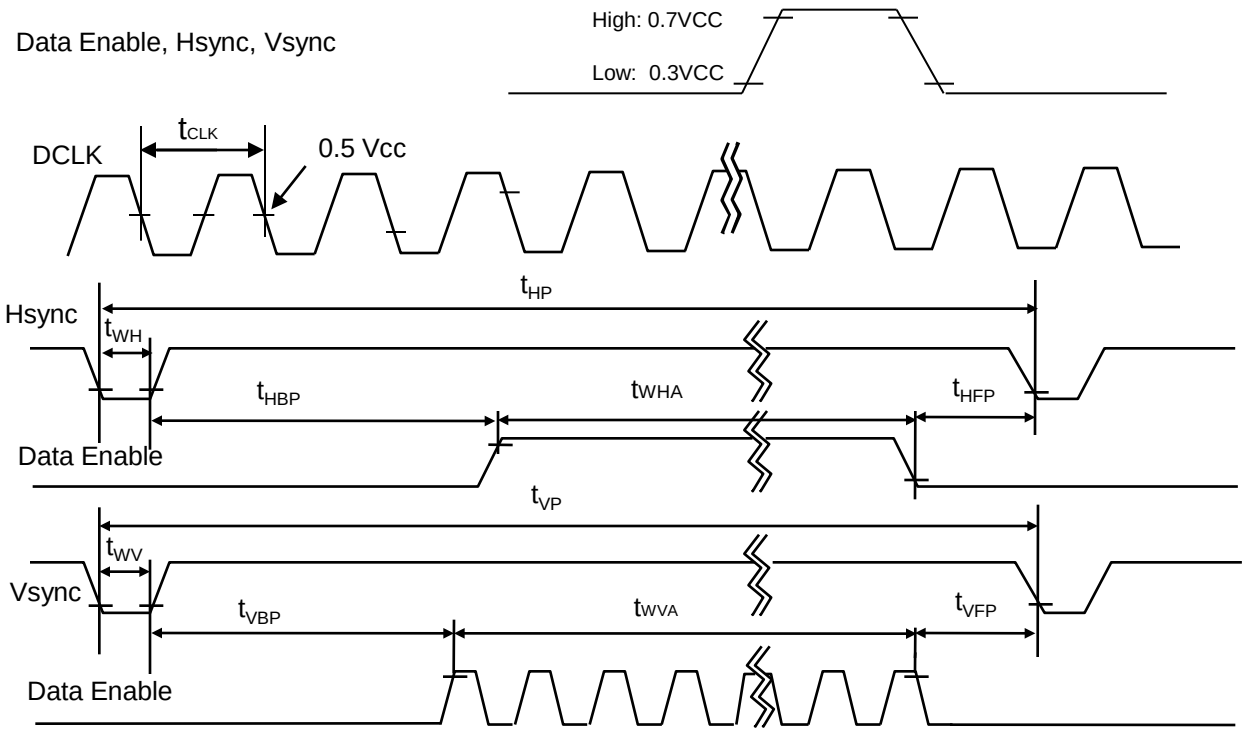
8.1. Timing Parameters

This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	-	72.3	-	MHz	
Hsync	Period	t_{HP}	1470	1526	1586	tCLK	
	Width	t_{WH}	23	32	40		
	Width-Active	t_{WHA}	1366	1366	1366		
Vsync	Period	t_{VP}	779	790	801	tHP	
	Width	t_{WV}	2	5	8		
	Width-Active	t_{WVA}	768	768	768		
Data Enable	Horizontal back porch	t_{HBP}	72	80	124	tCLK	
	Horizontal front porch	t_{HFP}	8	48	48		
	Vertical back porch	t_{VBP}	8	14	20	tHP	
	Vertical front porch	t_{VFP}	1	3	5		

8.2. Timing Diagrams of LVDS Transmission

Condition : VCC =3.3V



8.3. Power On/Off Sequence

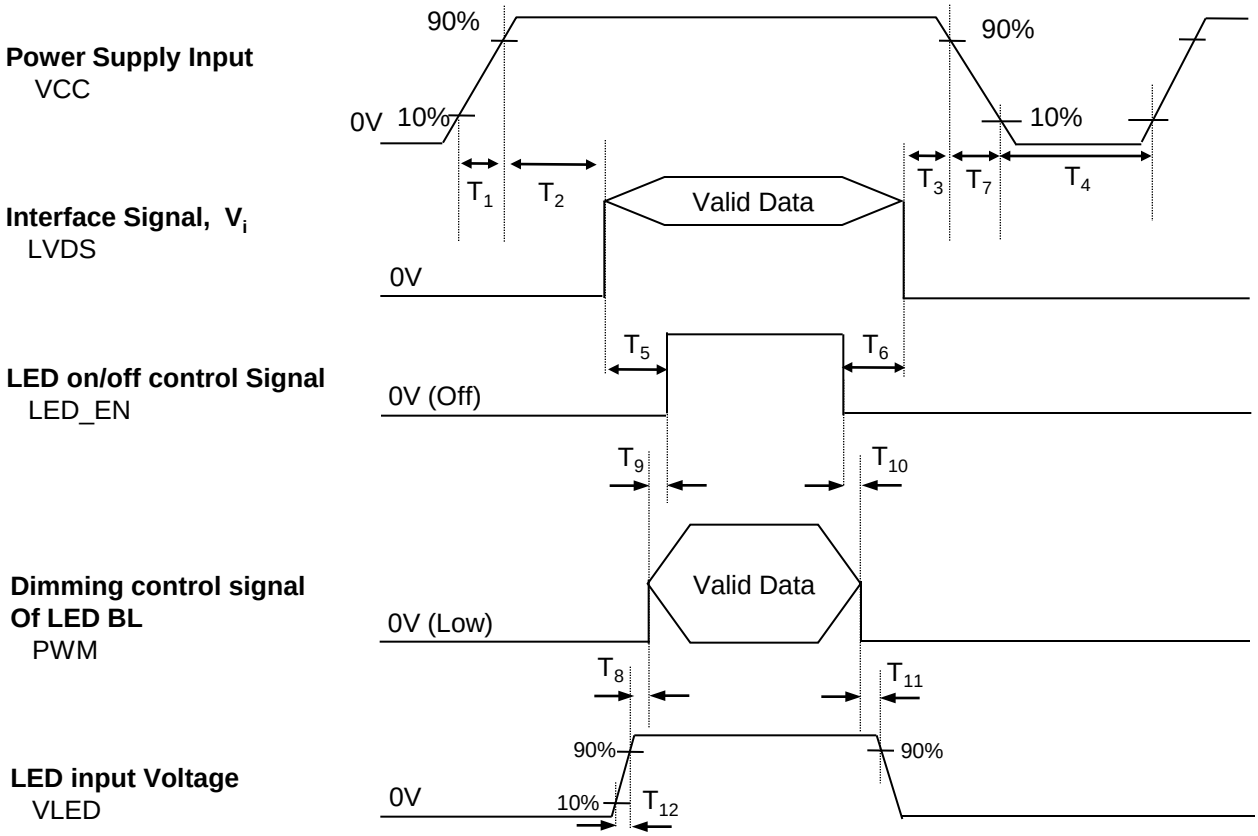


Table 6. POWER SEQUENCE TABLE

Logic Parameter	Value			Units	LED Parameter	Value			Units
	Min.	Typ.	Max.			Min.	Typ.	Max.	
T_1	0.5	-	10	ms	T_8	10	-	-	ms
T_2	0	-	50	ms	T_9	0	-	-	ms
T_3	0	-	50	ms	T_{10}	0	-	-	ms
T_4	400	-	-	ms	T_{11}	10	-	-	ms
T_5	200	-	-	ms	T_{12}	0.5	-	-	ms
T_6	200	-	-	ms					
T_7	3	-	10	ms					

Note)
1. Do not insert the mating cable when system turn on.
2. Valid Data have to meet "3-3. LVDS Signal Timing Specifications"
3. LVDS, LED_EN and PWM need to pull-down condition on invalid status.
4. LGD recommend the rising sequence of VLED after the Vcc and valid status of LVDS turn on.

9. Cosmetic Specification

9.1. Sampling

A.Q.L (Acceptable Quality Level): MIL-STD, 105E Level II,
Major: 0.65 , Minor: 1.5

9.2. Conditions of Inspections

(1) Ambient Temperature : 25±5°C
(2) Ambient Humidity : 65±20%RH
(3) Illumination : 200 – 500 Lux (nominal 350 Lux) under the fluorescent lamp
(4) Viewing Distance: Approximately 30cm by the eyes of the inspector from the module
(5) Viewing angle : The surface of the module and the inspector's line shall be at 90 ± 45 degrees.
(6) Display pattern: Pure Red, Green, Blue, Black, White, Gray level 0 - 63

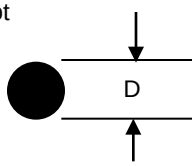
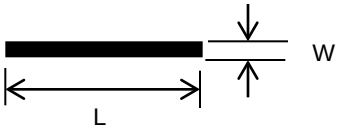
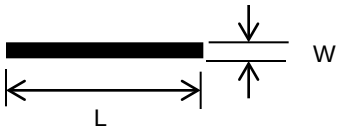
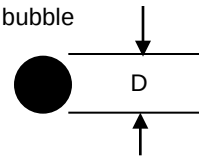
9.3. Defect modes

Defect Mode	Description
Dark / Bright spots	Points on the display which appear dark / bright and remain unchanged in size
Dark / Bright lines	Lines on the display which appear dark / bright and remain unchanged in size
Polarizer scratch	When the unit is lit a light , line is seen across a darker background; line does not vary in size
Polarizer dent	When the unit is lit a light, light (white) spots appear against a darker background, and do not vary in size
Bright / dark dot	A sub-pixel (R,G,B dot) stuck off / on
Rubbing line	Diagonal lines that appear gray with the display patterns dark and vary in size
Dim line	When the unit lights, lines in the minor (Vertical) or major (Horizontal) axis appear dim
Cross line	When the unit lights, lines in the both minor and major axis do not appear
Interference	Interference can not be seen with any bright plane display at any viewing angle
Flicker	When displaying sub-pexel checker(gray level and darkest gray), flicker can not be seen
Ripple (Pooling)	Tapping Test, Tapping area : All bezel(Metal cover) side, LCD: Full-screen gray (L32) "Ripple (Pooling)" can not be seen in Active Area

9.4. Mechanical Inspection

(1) Light leakage: No light leakage between metal chassis (bezel) and glass
(2) No sharp edge
(3) The mounting holes: No Changed (Side fixed type)
(4) PCB Appearance: No pattern peeling snapping / No electrically short
If there are repair portions, the repair portions on PCB is covered by epoxy resign
(5) Soldering: No cold solder joint, lead move when pulled
(6) Bezel, Frame, Connectors: No distinct stain, rust or scratch, no pin bending

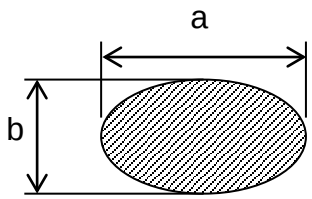
9.5. Visual Inspection

Defect type	Count (mm)	Reject (mm)
Dark / bright spot 	0.2 < D ≤ 0.5 N ≤ 3	D > 0.5
Dark / Bright lines 	0.05 < W ≤ 0.1 0.3 < L ≤ 3.0 N ≤ 3	W > 0.1 L > 3.0
Polarizer scratch 	0.01 < W ≤ 0.1 0.3 < L ≤ 0.5 N ≤ 3	W > 0.1 L > 0.5
Polarizer dent / bubble 	0.2 ≤ D ≤ 0.5 N ≤ 3	D > 0.5
Maximum allowable number of defects	N ≤ 7	N > 7
Rubbing defect	Not allowed	
Dim line	Not allowed	

[D : diameter, W : width, L : length, N : count]

Note 1) Inspection area should be within bezel opening.
Note 2) Dusts which are bigger not less than 0.10mm (0.1≤W) shall be judged by "Average Diameter".
Note 3) Scratches which are bigger not less than 0.05mm (0.05≤W) shall be judged by "Average Diameter".

Average Diameter D = (a+b)/2 (mm)

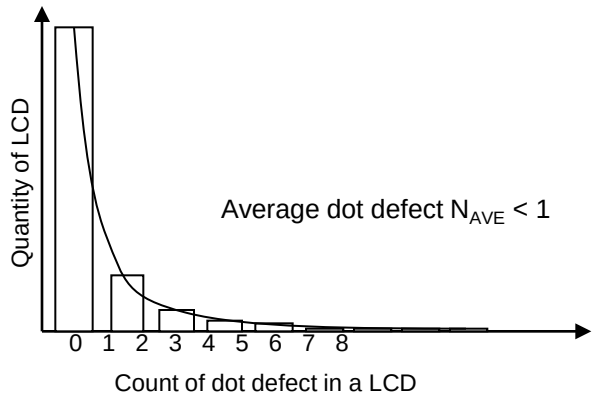


9.6. Electrical Inspection

(1) Dot defect

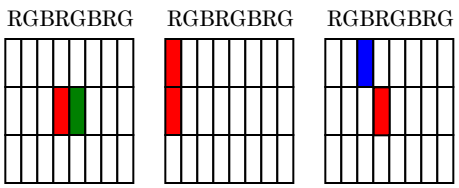
Defect type		Count	Reject
Bright dots	Random	N ≤ 2	N > 3
	Two adjacent	Not allowed	
	Three or more adjacent	Not allowed	
Dark dots	Random	N ≤ 4	N > 5
	Two adjacent	N ≤ 1	N > 2
	Three or more adjacent	Not allowed	
Maximum allowable number of dot defect		N ≤ 5	N > 6
Maximum distance between defects	Bright - to - bright dot	L ≤ 15mm	L>15.1mm
	Dark - to - dark dot	L ≤ 10mm	L>10.1mm

1) Inspection patterns for dot defect are Pure Red, Green, Blue, Black, and White.
2) Adjacent two dots will be counted as two dots.
3) The distribution of dot defects should be below. Average value of dot defect s should be less than 1.



Required distribution of dot defect

4) The definition of 2 adjacent dots.

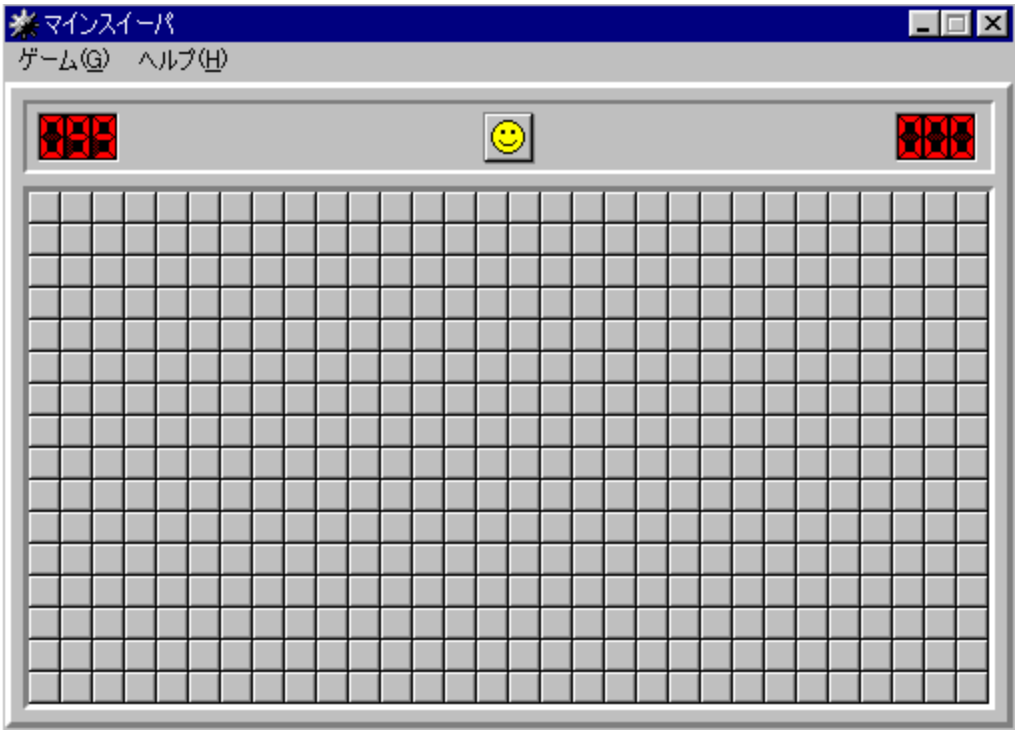


(2) Light leakage

Light leakage can not be seen between metal chassis (bezel) and glass when displaying black plane.

(3) Image sticking

Image sticking pattern shall not be to persist longer than 1second after displaying following pattern 8 hours in the room temperature condition.



(4) Glue/stain/dirt

Glue, non-removable stain and dirt which are visible in the inspection area are not acceptable.

10. Packing

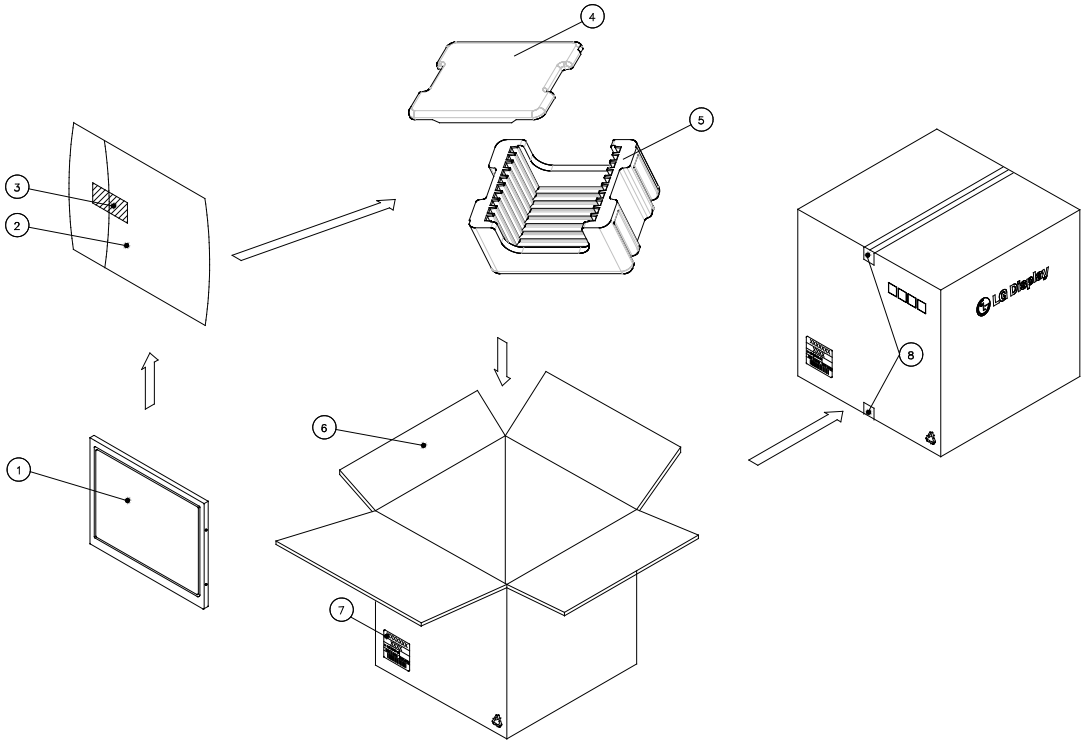
10.1. Carton

(1) Packing Form

Corrugated cardboard box and EPS Packing

(2) Packing Method

Packing Material : EPS (Expanded Polystyrene)
Packing Weight: : 1.3Kg
(1Box/20Module)
Packing weight, 20 pcs modules included :13kg



NO.	Description	Material
1	Module	LP156WH2-TLAB
2	Bag	LDPE 360x225
3	Tape	Masking 20mmx50M
4	Packing Bottom	EPS
5	Packing Top	EPS
6	Box	SW 482x358x275
7	Label	Art paper 80g
8	Tape	OPP 70mmx300M

(3) Packing Specification

Item	Conditions
Packing Vibration	Random=1.50Grms, Non-Operating LCM, To driving way / 1hr
Packing Drop Test	Refer to below table

Vibration frequency

Hz	G^2/Hz(PSD)
3	0.0001
10	0.0024
18	0.0024
27	0.02
54	0.02
100	0.0015
150	0.0015
200	0.01
250	0.01
300	0.01

Bottom side	drop test, repeat 3x. Drop height according table.
Left side	drop test from 0.30 m
Front side	drop test from 0.30 m
Right side	drop test from 0.30 m
Rear side	drop test from 0.30 m
Top side	drop test from 0.30 m

Drop Height

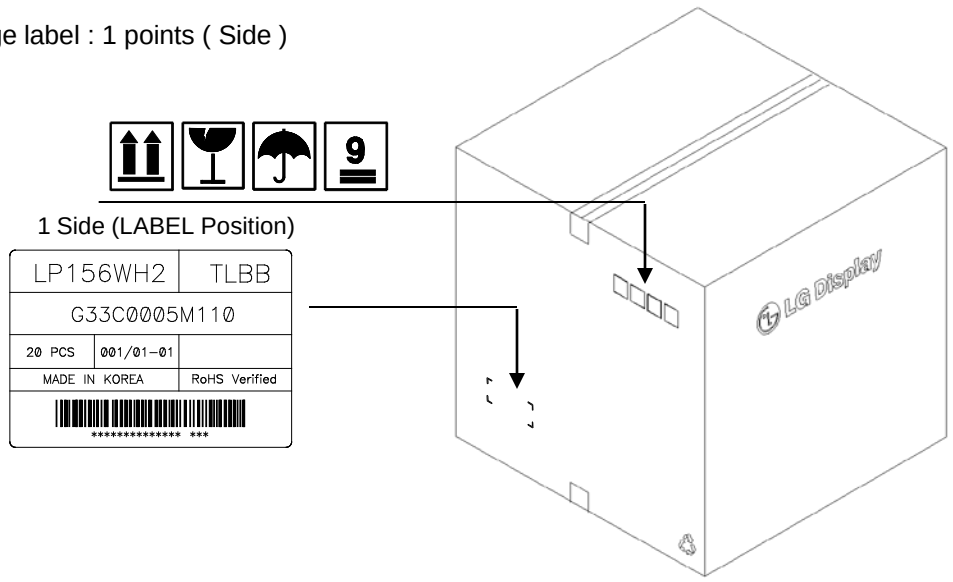
Mass [kg]	Height [cm]	Mass [kg]	Height [cm]
1	70	15	43
2	70	16	42
3	67	17	41
4	63	18	40
5	60	19	39
6	57	20	38
7	55	21	38
8	53	22	37
9	51	23	37
10	49	24	36
11	48	25	36
12	46	26	36
13	45	27	36
14	44	28 – 50	35

(4) Package Label

Package label should be at least shown the following information.

a) TOSHIBA code name(G33C0005M110) which will be numbered by Toshiba
b) Revision number which be numbered by LCD maker
c) Quantity
d) LCD maker
e) Model number which be numbered by LCD maker
f) Production Year / Month

(5) Location of Package label : 1 points (Side)



11. Labels and LED A'ssy Exchange

11.1. LCD code Label on LCD

LCD code label should be at least shown the following information.

(1) TOSHIBA code name (G33C0005M110) which will be numbered by Toshiba & Bar code
(Bar code : CODE-39 High-density)

(2) LGPL Serial number CODE (numbered by LCD maker , less than equal 13 digits)

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

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

Note

1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

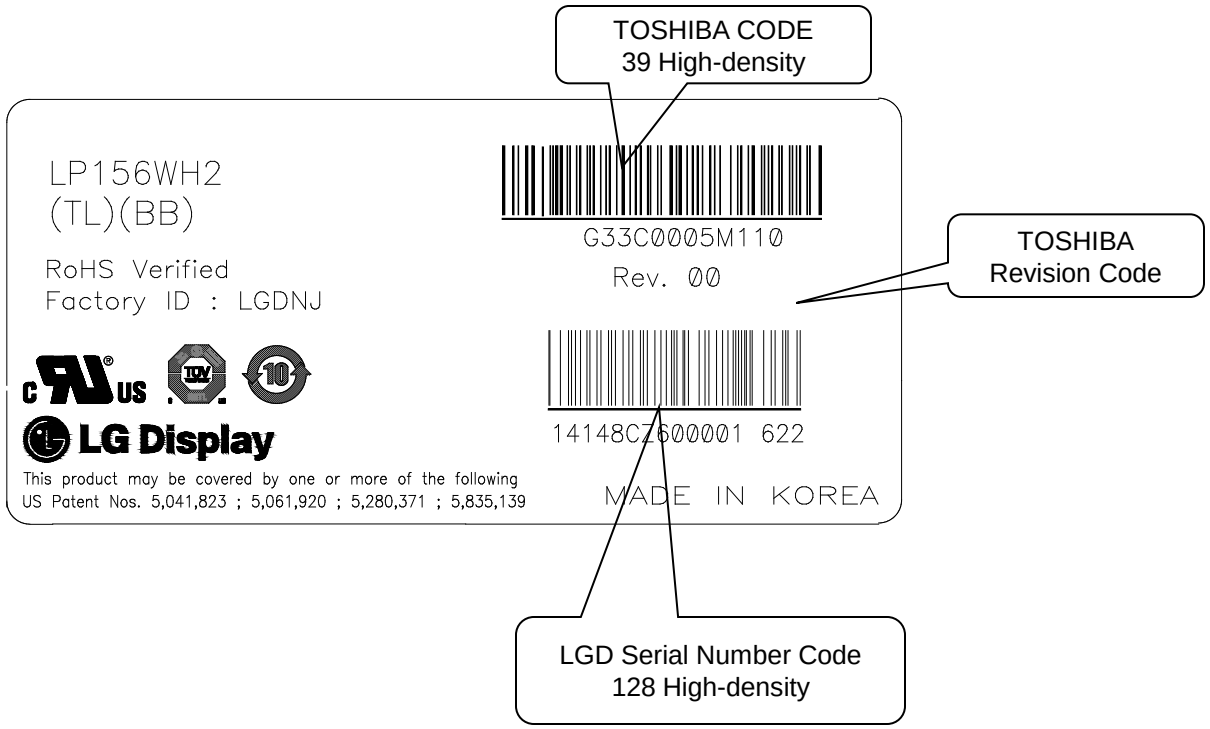
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

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

Example >

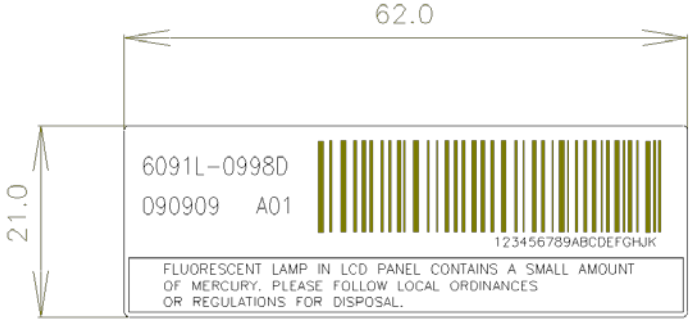
LABEL : 78mm X 37mm



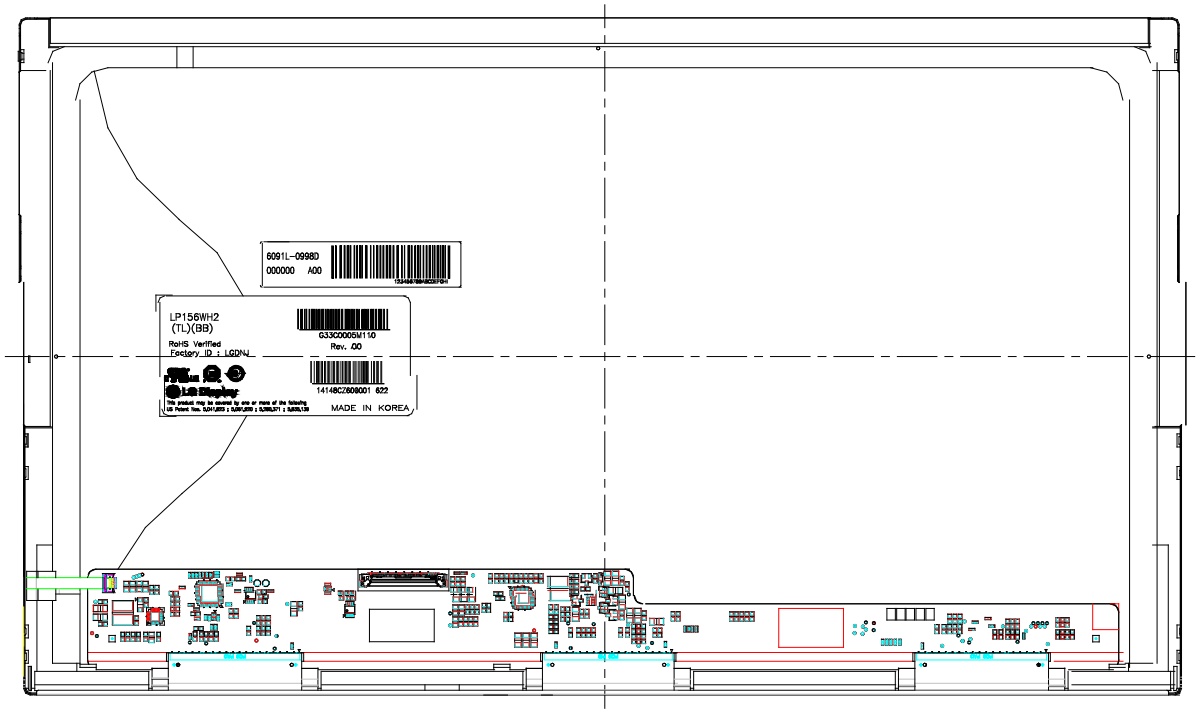
The revision code is inserted in the label by Toshiba request. If the contents of the specification need to be change under mass-production, the code can be revised after Toshiba's approval. Although there is not items in the contents of the specification, Toshiba can requests LPL to change the revision code.

11.2. Caution Texture and Labels on LCD

[Disposal of LED]



11.3. Label Locations on LCD



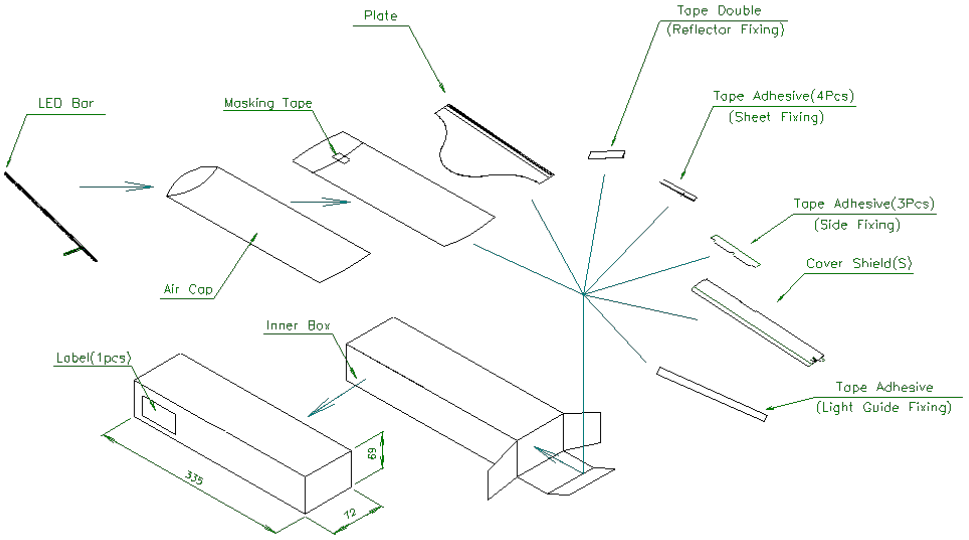
11.4. Others

(1) Backlight repair parts kit : 6091L-0998D (G33C0005M110001)

No.	Part	Product Code	Maker	Qt'y	Note
1	Cover Shield(S)	3550S-0837A	Geo rim	1	
2	Tape Adhesive	7250L-0116H	Geo rim	1	
3	Tape Adhesive	7250L-0080M	Geo rim	2	
4	Tape Adhesive	7250L-0319A	Hwa sung	1	
5	Tape Adhesive	7250L-0023A	Hwa sung	2	
6	Tape Adhesive	7250L-0517L	Jinfu	2	Light Guide
7	Tape Adhesive	7250L-0562E	Jinfu	1	FPCB
8	Tape Adhesive	7250L-0136P	Jinfu	1	Reflector
9	Tape Adhesive	7250L-0276G	Jinfu	1	LED Housing
10	Plate	3300L-0288B	Taesung LCD	1	
11	LED Bar	6916L-0115B	LGIT	1	

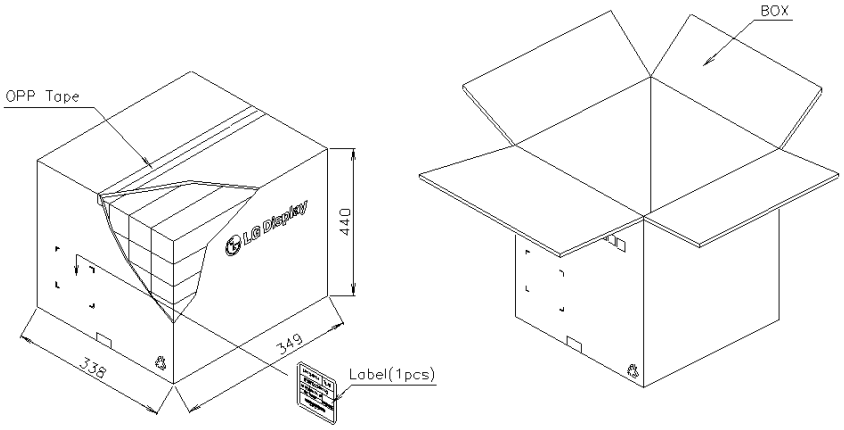
(2) Package specification of Backlight repair parts kit

a) Individual packing



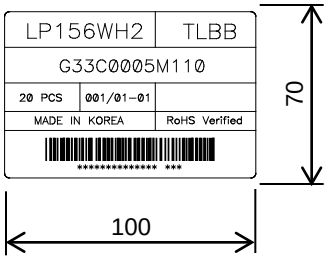
b) Master carton Packing method

TBD



[6(V) X 5(H) = 30 Boxes Inner]

c) Label



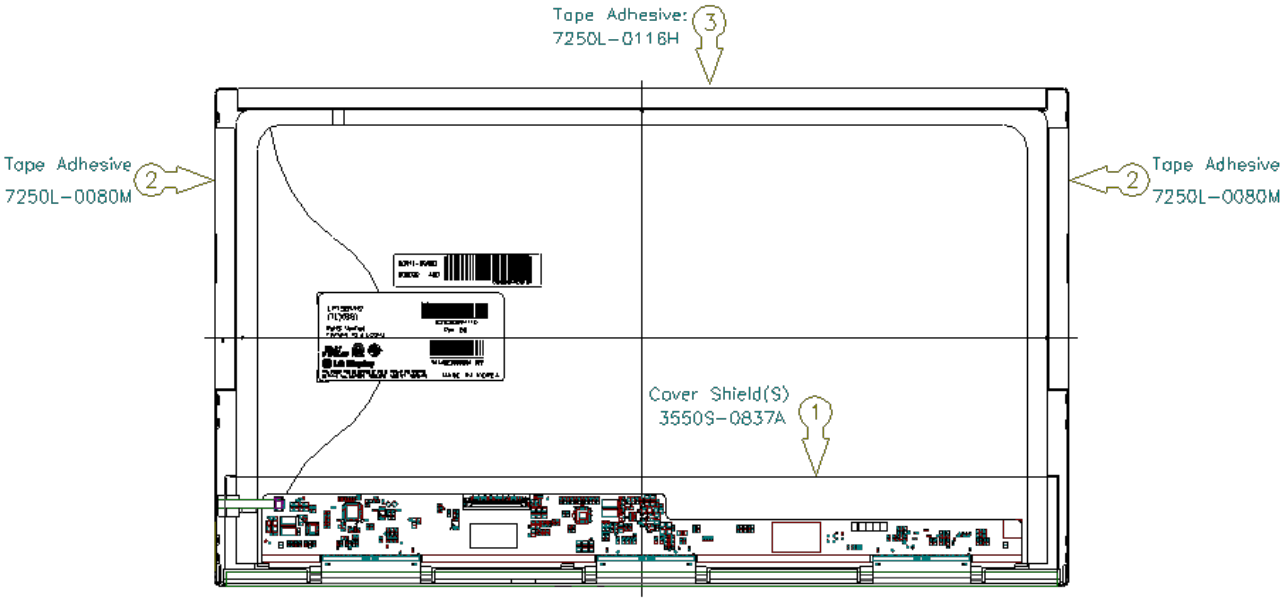
11.5. Instruction of changing the LED parts - LED Ass'y Exchange process

11.5.1. Disassembly of outside tape / Cover shield

(1) ① Disassembly of Cover shield(S)
Caution: Pressure or stress should not be given on Source PCB.
Usage of gloves with anti-electric discharge coating is recommended.
To eliminate possible damage on circuits occurred by ESC.

(2) ② Disassembly of Tape Adhesive used for Top case fixing.(2Pcs)
Caution: Pressure or stress should not be given on Top case during this process.

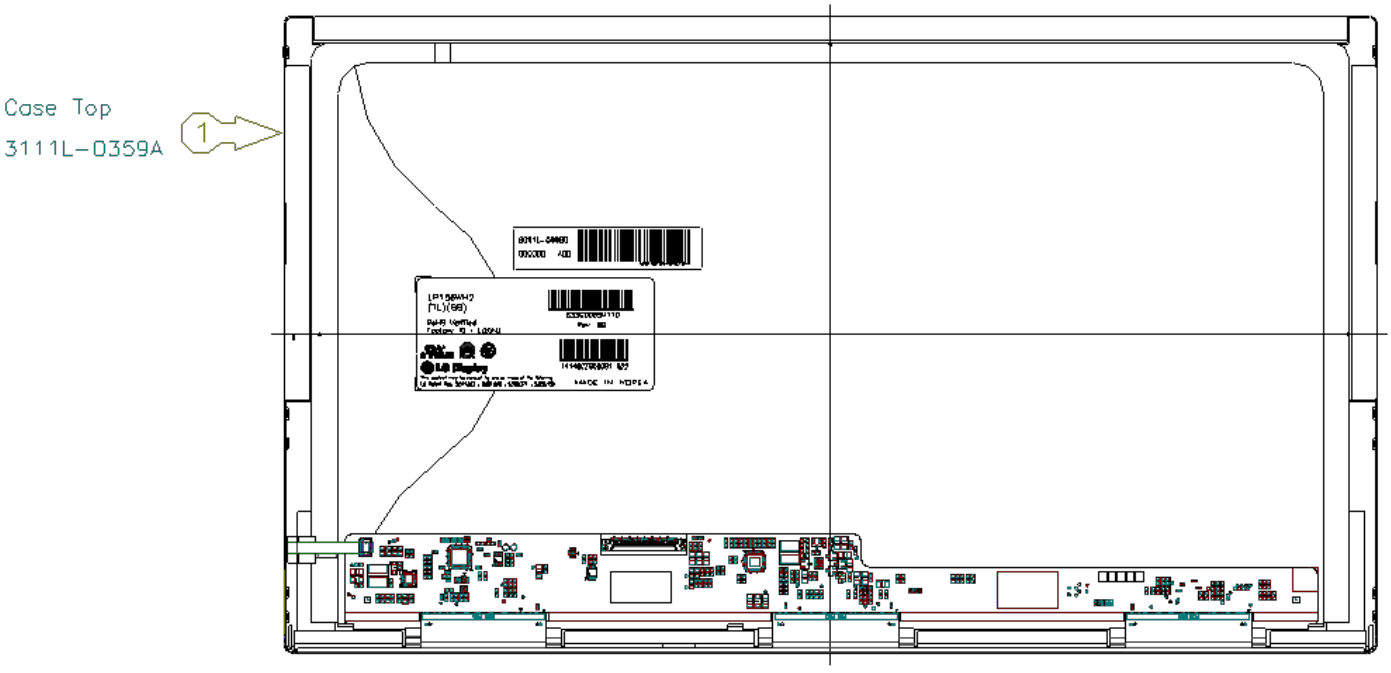
(3) ③ Disassembly of Tape Adhesive used for Top case fixing.
Caution: Pressure or stress should not be given on Top case during this process.



11.5.2. Disassembly of Top Case

(1) ① Disassembly of Top Case

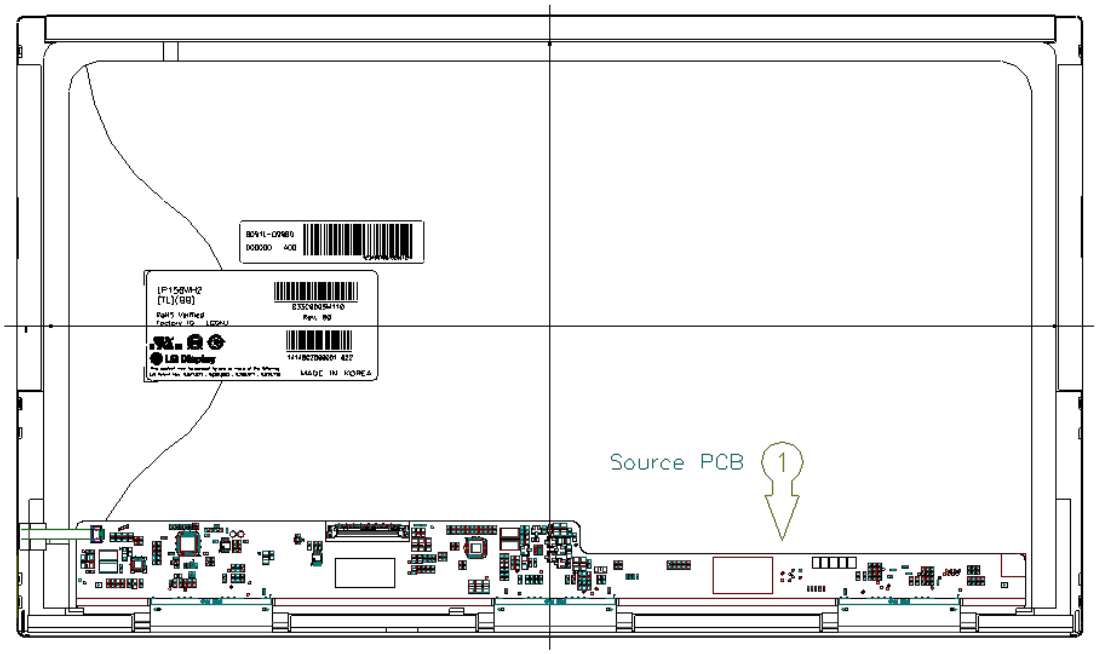
Caution: Pressure or stress should not be given on Source COF.



11.5.3. Disassembly of Source PCB

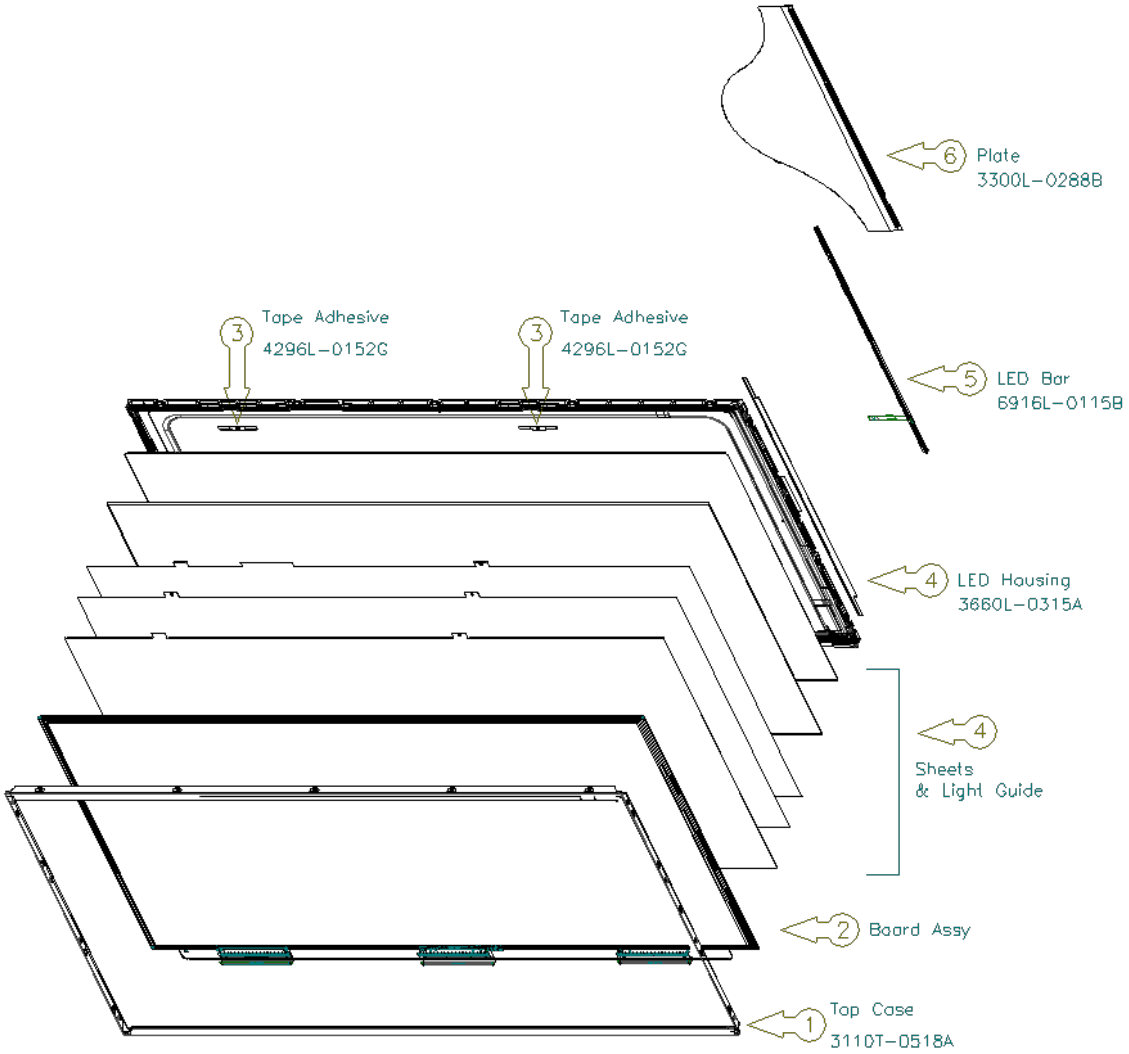
(1) ① Disassembly of Source PCB.

Caution: Pressure or stress should not be given on PCB and COF.



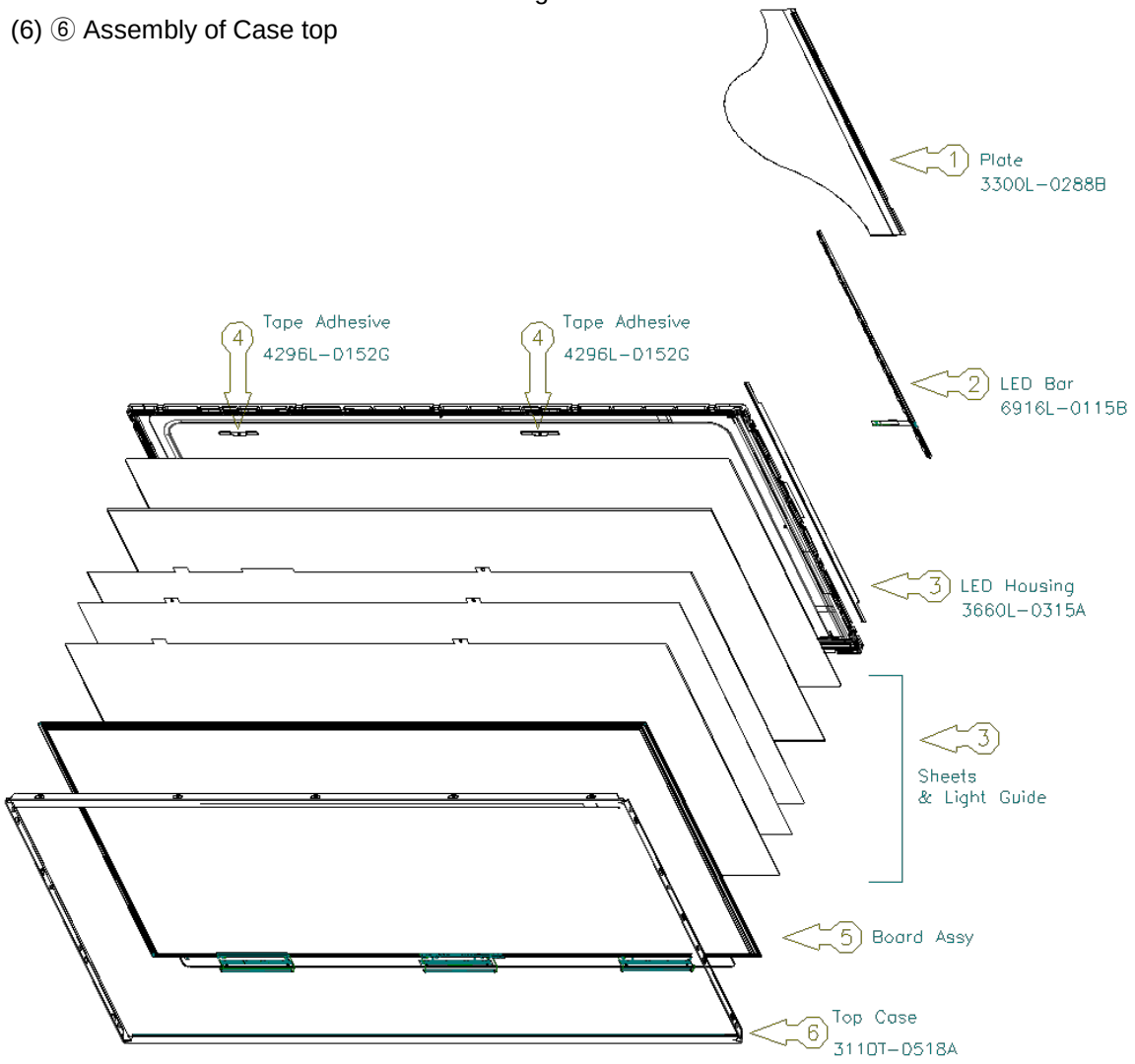
11.5.4. Disassembly of Case top, Board Ass'y, Tape Adhesive, Light guide, Cover Ass'y

(1) ① Disassembly of Case top
(2) ② Disassembly of Board Ass'y.
Caution: This process should be made in Clean room with no scratch nor particle on Polarizer and B/L Ass'y.
(3) ③ Disassembly of Tape Adhesive used for Sheets fixing (4Point).
(4) ④ Disassembly of Sheets, Light guide, LED housing
Caution: No penetration of foreign body is indispensable with no scratch on the surface of each Sheets.
(5) ⑤ Disassembly of LED BAR
(6) ⑥ Disassembly of Plate



11.5.5. Assembly of Plate, LED Bar, LED Housing, Sheets, Light guide, Tape Adhesive, Board Ass'y and Case top.

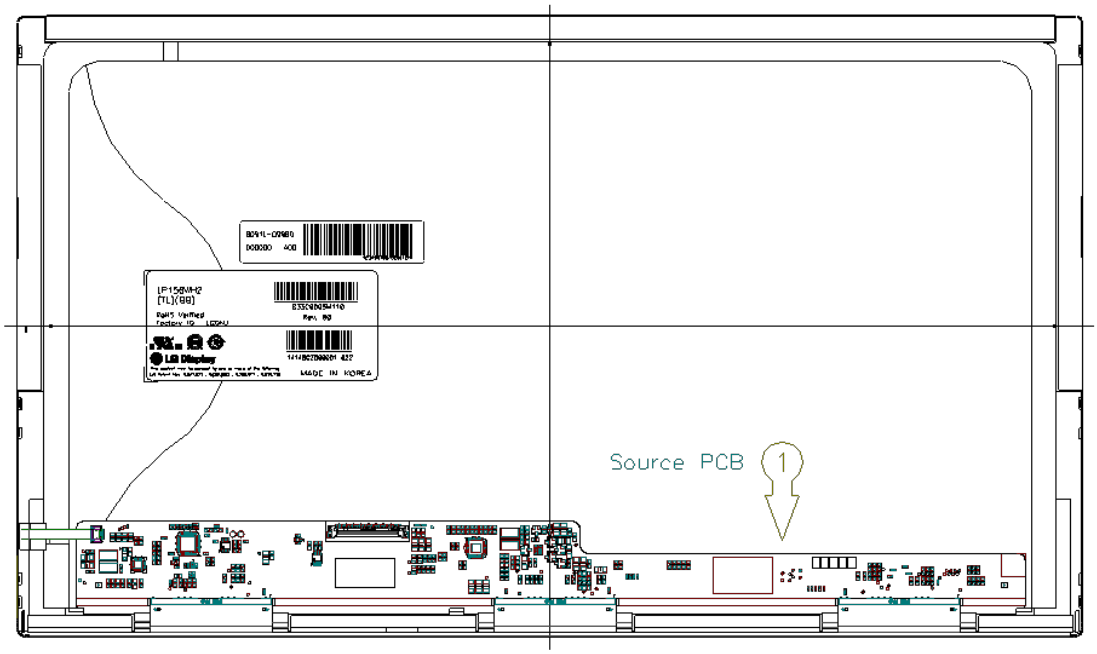
(1) ① Assembly of Plate
(2) ② Assembly of LED Bar
(3) ③ Assembly of Light Guide and Sheets and LED Housing.
(Reflector Sheet fixing with one Double Tape)
Caution: No penetration of foreign body is indispensable with no scratch on the surface of each Sheet and Light guide.
(4) ④ Assembly of Tape adhesive used for Sheets fixing(4Point)
(5) ⑤ Assembly of Board Ass'y.
Caution: Pressure or stress should not be given on PCB and COF.
(6) ⑥ Assembly of Case top



11.5.6. Assembly of Source PCB

(1) ① Assembly of Source PCB.

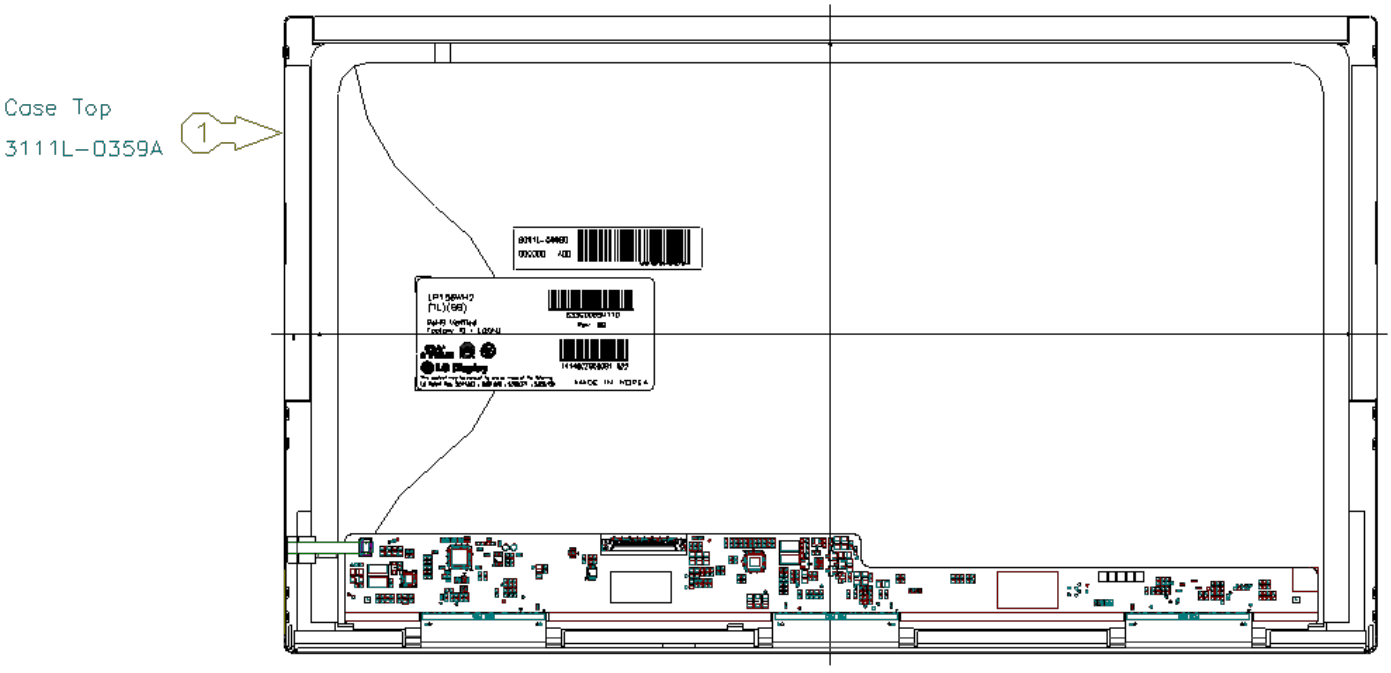
Caution: Stress should not be given on COF.



11.5.7. Assembly of Top Case

(1) ① Assembly of Top Case.

Caution: Pressure should not be given on Source COF.



11.5.8. Assembly of outside Tape and Cover shield

(1) ① Assembly of Cover shield(S)

Caution: Pressure or stress should not be given on Source PCB.

Usage of gloves with anti-electric discharge coating is recommended

To eliminate possible damage on circuits occurred by ESC.

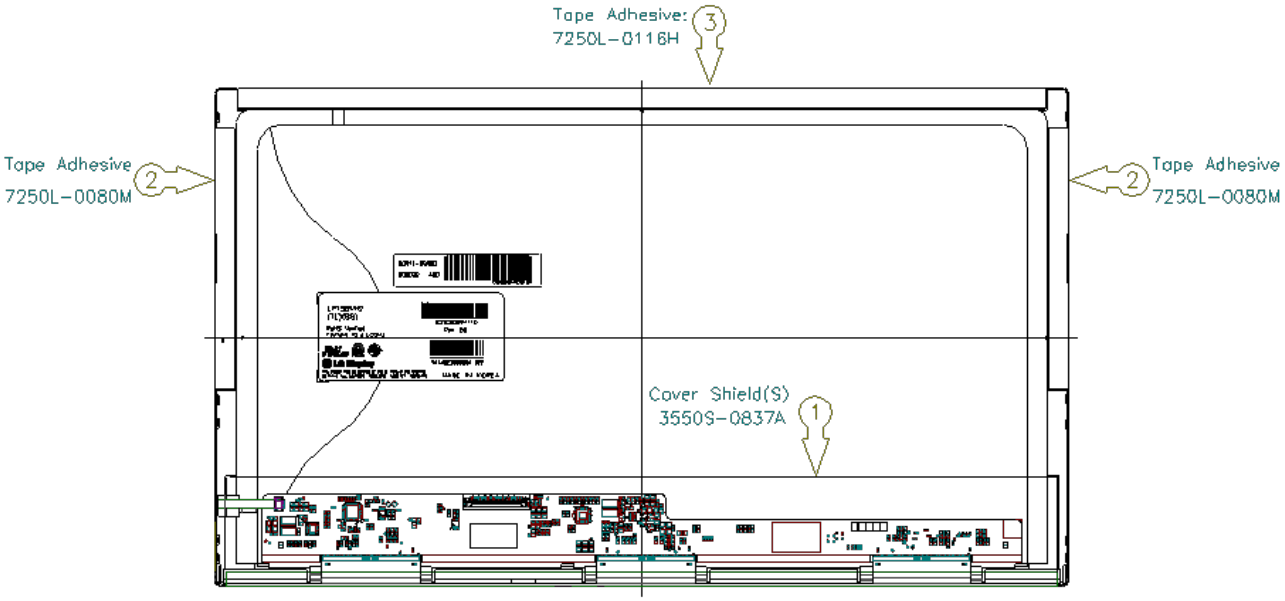
(2) ② Assembly of Tape Adhesive used for Top case fixing.

Caution: Pressure or stress should not be given on Top case during this process

(3) ③ Assembly of Tape Adhesive used for Top case fixing

④ Assembly of Tape Adhesive used for B/L Wire fixing

Caution: Pressure or stress should not be given on Top case during this process



12. General Precaution

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

12.1. Mounting Precautions

(1) You must mount a module using holes arranged in four corners or four sides.

(2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(3) 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 resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case aren't desirable because the former generates corrosive gas of attacking the polarlizer at high temperature and the latter causes circuit break by electro-chemical reaction.

(6) 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 are detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. 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.

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

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

12.2. 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) A module has high frequency circuit. If you need to shield the electromagnetic noise, please co-work. When a Back-light unit is operating, it sounds. If you need to shield the noise, please co-work**.**

12.3. 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.

12.4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

12.5. 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℃ and 35℃ 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.

12.6. 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.

APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 1/3

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
0	00	Header	0	0	0000 0000	Header
1	01	Header	F	F	1111 1111	
2	02	Header	F	F	1111 1111	
3	03	Header	F	F	1111 1111	
4	04	Header	F	F	1111 1111	
5	05	Header	F	F	1111 1111	
6	06	Header	F	F	1111 1111	
7	07	Header	0	0	0000 0000	
8	08	EISA manufacturer code(3 Character ID) = LGD	3	0	0011 0000	Vender/ Product ID
9	09	Compressed ASCII	E	4	1110 0100	
10	0A	Product code = (0275)	7	5	0111 0101	
11	0B	(Hex, LSB first)	0	2	0000 0010	
12	0C	LCD module Serial No - Preferred but Optional ("0" if not used)	0	0	0000 0000	
13	0D	LCD module Serial No - Preferred but Optional ("0" if not used)	0	0	0000 0000	
14	0E	LCD module Serial No - Preferred but Optional ("0" if not used)	0	0	0000 0000	
15	0F	LCD module Serial No - Preferred but Optional ("0" if not used)	0	0	0000 0000	
16	10	Week of Manufacture	0	0	0000 0000	
17	11	Year of Manufacture = 2009	1	3	0001 0011	
18	12	EDID Structure version # = 1	0	1	0000 0001	EDID Version/ Revision
19	13	EDID Revision # = 3	0	3	0000 0011	
20	14	Video Input Definition = Digital I/P,non TMDS CRGB	8	0	1000 0000	Display Parameter
21	15	Max H image size(㎝)=34.4232cm(34)	2	2	0010 0010	
22	16	Max V image size(㎝)=19.3536cm(19)	1	3	0001 0011	
23	17	Display gamma =2.2	7	8	0111 1000	
24	18	Feature support(DPMS) = Active off, RGB Color	0	A	0000 1010	
25	19	Red/Green low Bits	6	2	0110 0010	Color Characteristic
26	1A	Blue/White Low Bits	2	5	0010 0101	
27	1B	Red X = 0.622	9	F	1001 1111	
28	1C	Red Y = 0.365	5	D	0101 1101	
29	1D	Green X = 0.340	5	7	0101 0111	
30	1E	Green Y = 0.607	9	B	1001 1011	
31	1F	Blue X = 0.145	2	5	0010 0101	
32	20	Blue Y = 0.100	1	9	0001 1001	
33	21	White X = 0.313	5	0	0101 0000	
34	22	White Y = 0.329	5	4	0101 0100	
35	23	Established Timing I = 00h(If not used)	0	0	0000 0000	Established Timings
36	24	Established Timing II = 00h(If not used)	0	0	0000 0000	
37	25	Manufacturer's Timings = 00h(If not used)	0	0	0000 0000	
38	26	Standard Timing Identification 1 was not used	0	1	0000 0001	Standard Timing ID
39	27	Standard Timing Identification 1 was not used	0	1	0000 0001	
40	28	Standard Timing Identification 2 was not used	0	1	0000 0001	
41	29	Standard Timing Identification 2 was not used	0	1	0000 0001	
42	2A	Standard Timing Identification 3 was not used	0	1	0000 0001	
43	2B	Standard Timing Identification 3 was not used	0	1	0000 0001	
44	2C	Standard Timing Identification 4 was not used	0	1	0000 0001	
45	2D	Standard Timing Identification 4 was not used	0	1	0000 0001	
46	2E	Standard Timing Identification 5 was not used	0	1	0000 0001	
47	2F	Standard Timing Identification 5 was not used	0	1	0000 0001	
48	30	Standard Timing Identification 6 was not used	0	1	0000 0001	
49	31	Standard Timing Identification 6 was not used	0	1	0000 0001	
50	32	Standard Timing Identification 7 was not used	0	1	0000 0001	
51	33	Standard Timing Identification 7 was not used	0	1	0000 0001	
52	34	Standard Timing Identification 8 was not used	0	1	0000 0001	
53	35	Standard Timing Identification 8 was not used	0	1	0000 0001	

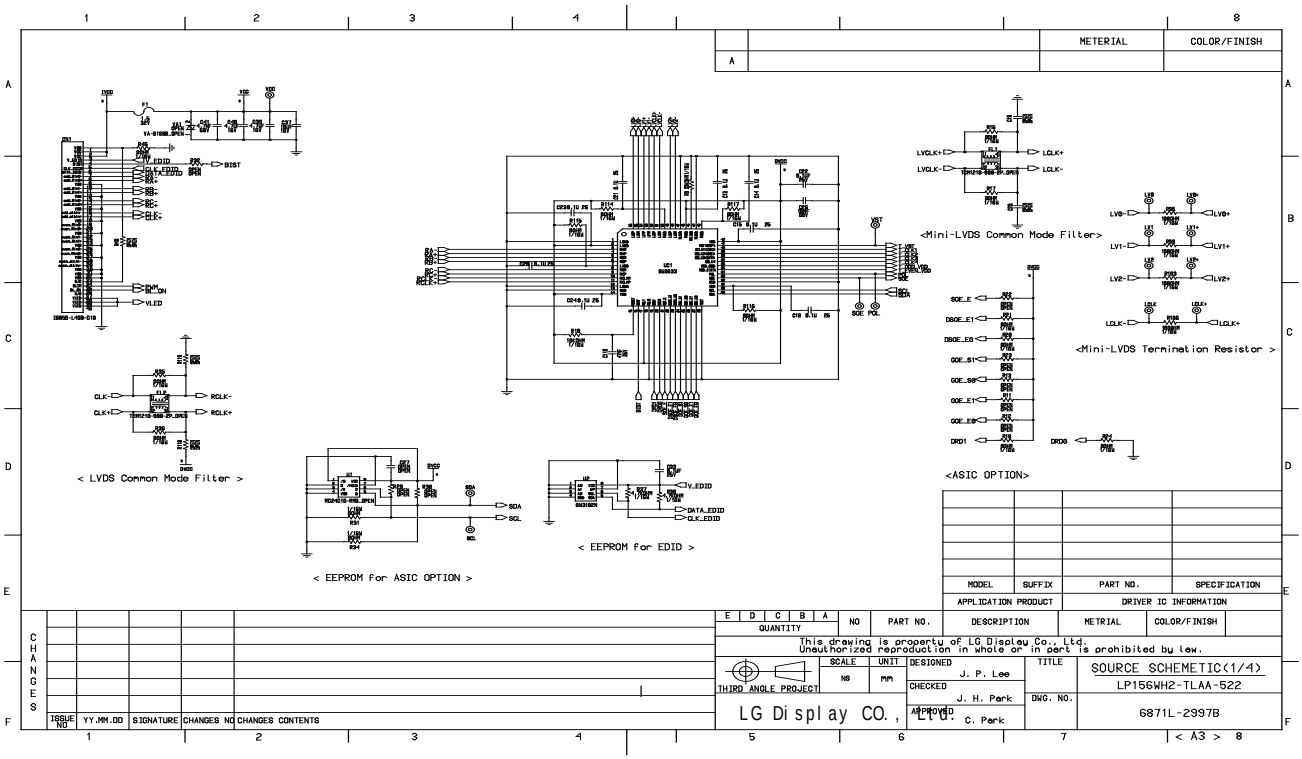
APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 2/3

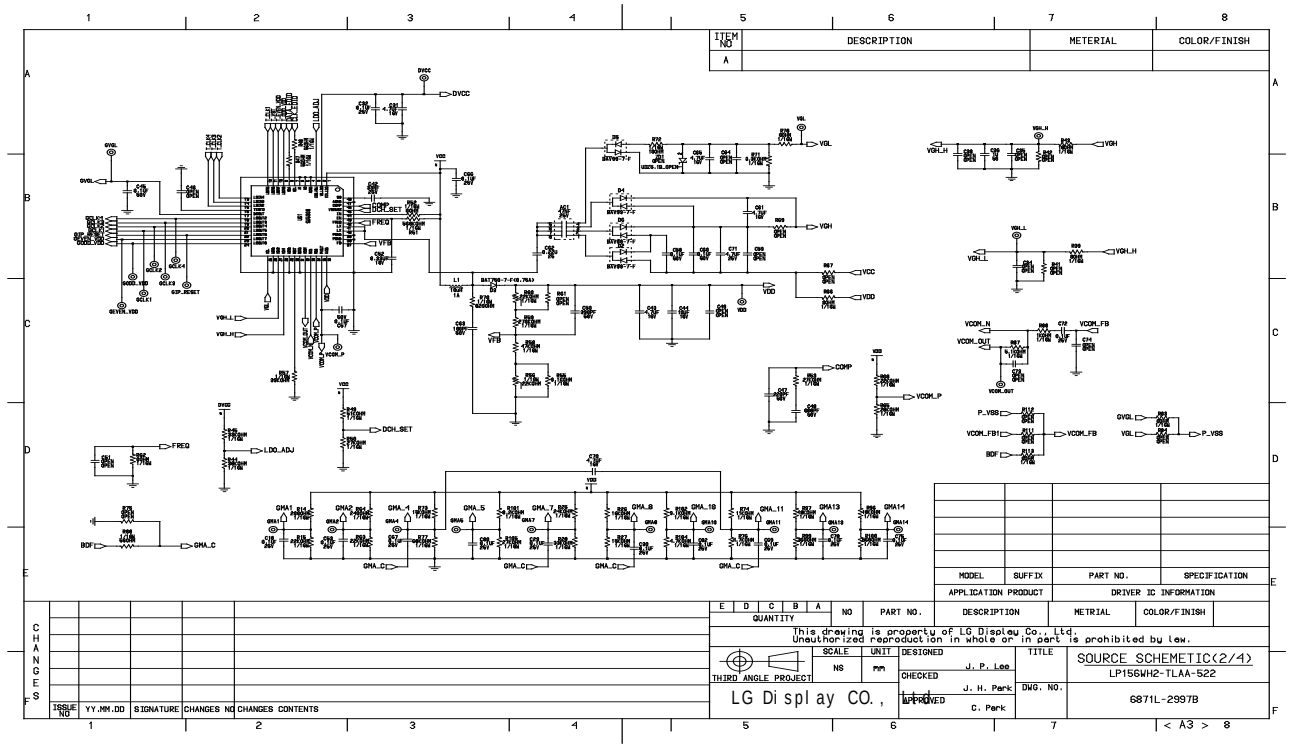
Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
54	36	1366X768 @60Hz mode pixel clock (LSB) => 72.3MHz	3	E	0011 1110	Timing Descriptor #1
55	37	(Stored LSB first)	1	C	0001 1100	
56	38	Horizontal Active = 1366 pixels (lower 8bits)	5	6	0101 0110	
57	39	Horizontal Blanking = 160 pixels (lower 8bits)	A	0	1010 0000	
58	3A	Horizontal Active : Horizontal Blanking (upper 4:4bits)	5	0	0101 0000	
59	3B	Vertical Avtive = 768 lines (lower 8bits)	0	0	0000 0000	
60	3C	Vertical Blanking = 22 lines (lower 8bits)	1	6	0001 0110	
61	3D	Vertical Active : Vertical Blanking (upper 4:4bits)	3	0	0011 0000	
62	3E	Horizontal Sync. Offset = 48 pixels	3	0	0011 0000	
63	3F	Horizontal Sync Pulse Width = 32 pixels	2	0	0010 0000	
64	40	Vertical Sync Offset = 3 lines : Sync Width = 5 lines	3	5	0011 0101	
65	41	Horizontal Vertical Sync Offset/Width upper 2bits = 0	0	0	0000 0000	
66	42	Horizontal Image Size = 344.232mm(344)	5	8	0101 1000	
67	43	Vertical Image Size = 193.536mm(194)	C	2	1100 0010	
68	44	Horizontal & Vertical Image Size	1	0	0001 0000	
69	45	Horizontal Border = 0	0	0	0000 0000	
70	46	Vertical Border = 0	0	0	0000 0000	
71	47	Non-interlaced,Normal display,no stereo,Digital separate sync,H/V pol negatives	1	9	0001 1001	
72	48	Flag	0	0	0000 0000	Timing Description #2
73	49	Flag	0	0	0000 0000	
74	4A	Flag	0	0	0000 0000	
75	4B	Data Type Tag (Descriptor Defined by manufacturer)	0	0	0000 0000	
76	4C	Flag	0	0	0000 0000	
77	4D	Descriptor Defined by manufacturer	0	0	0000 0000	
78	4E	Descriptor Defined by manufacturer	0	0	0000 0000	
79	4F	Descriptor Defined by manufacturer	0	0	0000 0000	
80	50	Descriptor Defined by manufacturer	0	0	0000 0000	
81	51	Descriptor Defined by manufacturer	0	0	0000 0000	
82	52	Descriptor Defined by manufacturer	0	0	0000 0000	
83	53	Descriptor Defined by manufacturer	0	0	0000 0000	
84	54	Descriptor Defined by manufacturer	0	0	0000 0000	
85	55	Descriptor Defined by manufacturer	0	0	0000 0000	
86	56	Descriptor Defined by manufacturer	0	0	0000 0000	
87	57	Descriptor Defined by manufacturer	0	0	0000 0000	
88	58	Descriptor Defined by manufacturer	0	0	0000 0000	
89	59	Descriptor Defined by manufacturer	0	0	0000 0000	
90	5A	Flag	0	0	0000 0000	Timing Description #3
91	5B	Flag	0	0	0000 0000	
92	5C	Flag	0	0	0000 0000	
93	5D	Data Type Tag (ASCII String)	F	E	1111 1110	
94	5E	Flag	0	0	0000 0000	
95	5F	L	4	C	0100 1100	
96	60	G	4	7	0100 0111	
97	61		2	0	0010 0000	
98	62	D	4	4	0100 0100	
99	63	i	6	9	0110 1001	
100	64	s	7	3	0111 0011	
101	65	p	7	0	0111 0000	
102	66	l	6	C	0110 1100	
103	67	a	6	1	0110 0001	
104	68	y	7	9	0111 1001	
105	69	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASCII code 0Ah,set remaining ch	0	A	0000 1010	
106	6A	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASCII code 0Ah,set remaining ch	2	0	0010 0000	
107	6B	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASCII code 0Ah,set remaining ch	2	0	0010 0000	

APPENDIX A. Enhanced Extended Display Identification Data (EEDID™) 3/3

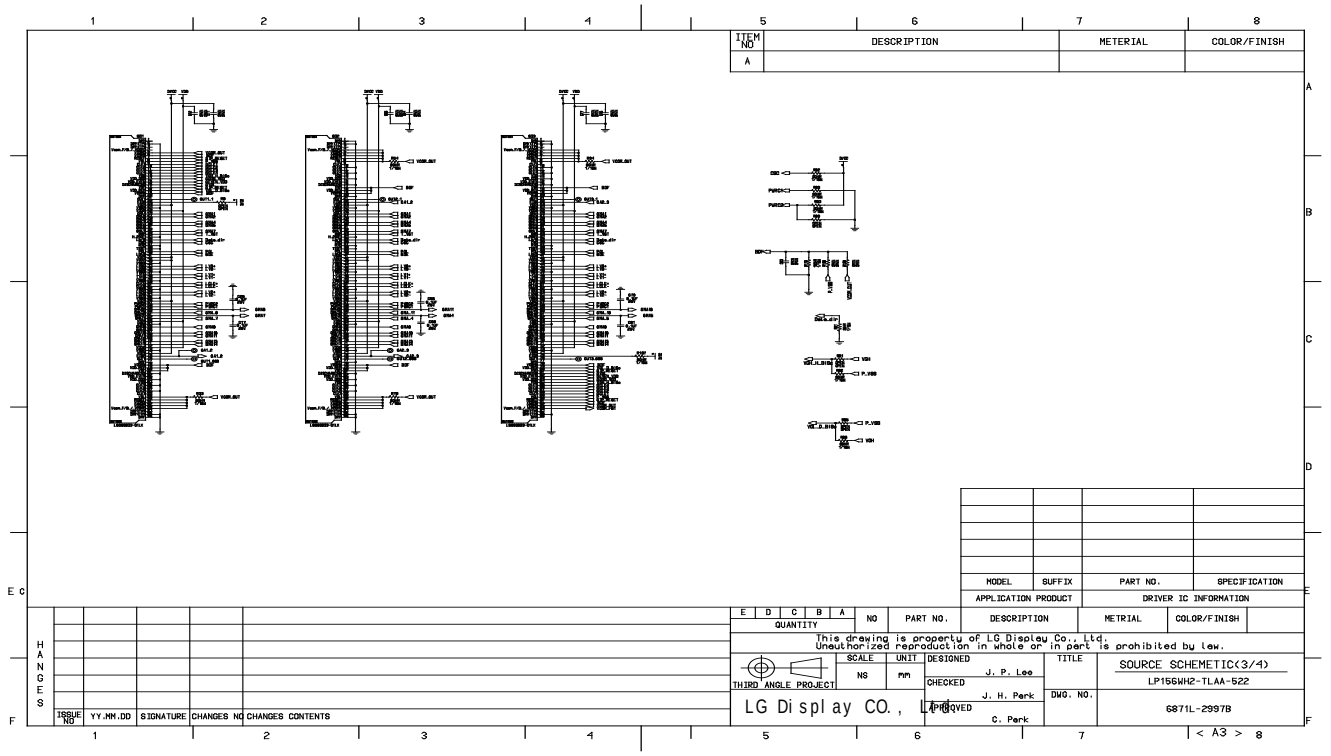
Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)		Value (binary)	
108	6C	Flag	0	0	0000 0000	
109	6D	Flag	0	0	0000 0000	
110	6E	Flag	0	0	0000 0000	
111	6F	Data Type Tag (Monitor Name, stored as ASCII)	F	C	1111 1100	
112	70	Flag	0	0	0000 0000	
113	71	L	4	C	0100 1100	
114	72	P	5	0	0101 0000	
115	73	1	3	1	0011 0001	Timing Description #4
116	74	5	3	5	0011 0101	
117	75	6	3	6	0011 0110	
118	76	W	5	7	0101 0111	
119	77	H	4	8	0100 1000	
120	78	2	3	2	0011 0010	
121	79	-	2	D	0010 1101	
122	7A	T	5	4	0101 0100	
123	7B	L	4	C	0100 1100	
124	7C	B	4	2	0100 0010	
125	7D	B	4	2	0100 0010	
126	7E	Extension flag = 00	0	0	0000 0000	Extension Flag
127	7F	Checksum	F	1	1111 0001	Checksum

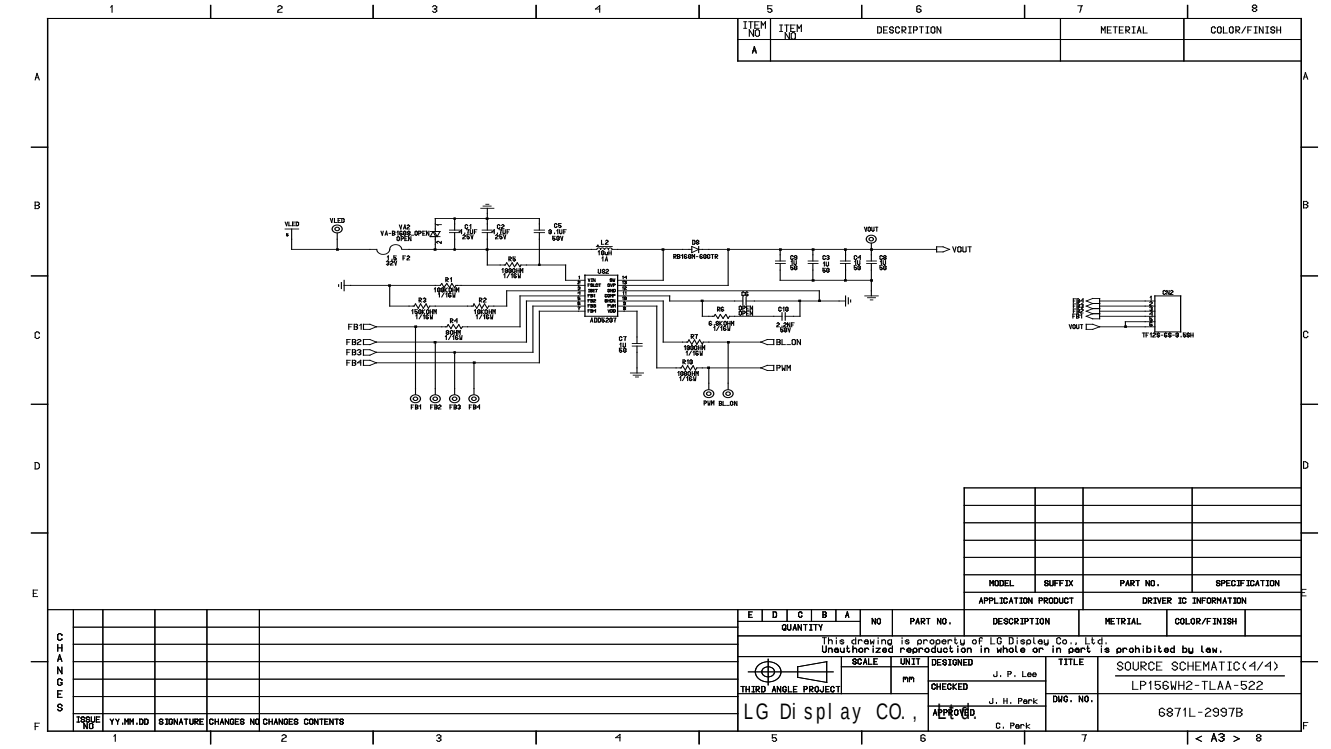
APPENDIX B. Schematics of Circuit 1/2





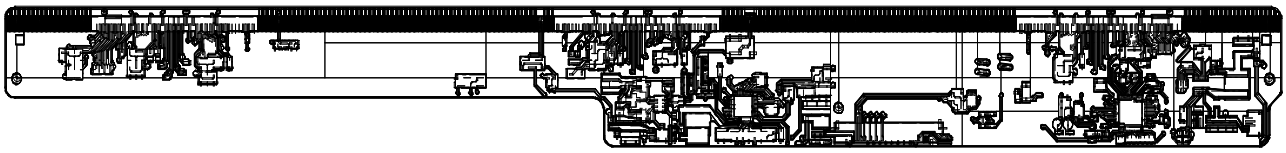
APPENDIX B. Schematics of Circuit 2/2





APPENDIX C. PCB layout of Circuit

-1 Layer



-2 Layer