TO:

DATE: **'03.12.10.**

Specification of 15.4" TFT/LCD
MODEL: LP154W01(A3K2)

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
03.12.10	0.0	All				

1. Scope

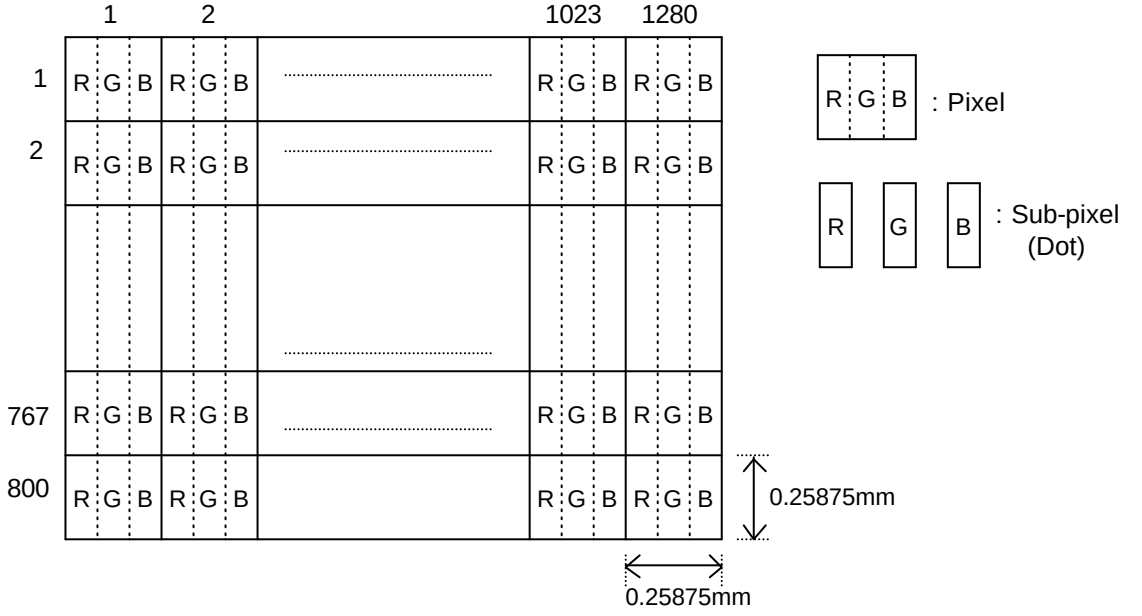
This specification is applicable to LCD manufacturer's 39.116cm (15.4") diagonal size TFT-LCD module "LP154W01(A3)(K2)" designed for Personal Computer.

2. General Specification

2.1. Features

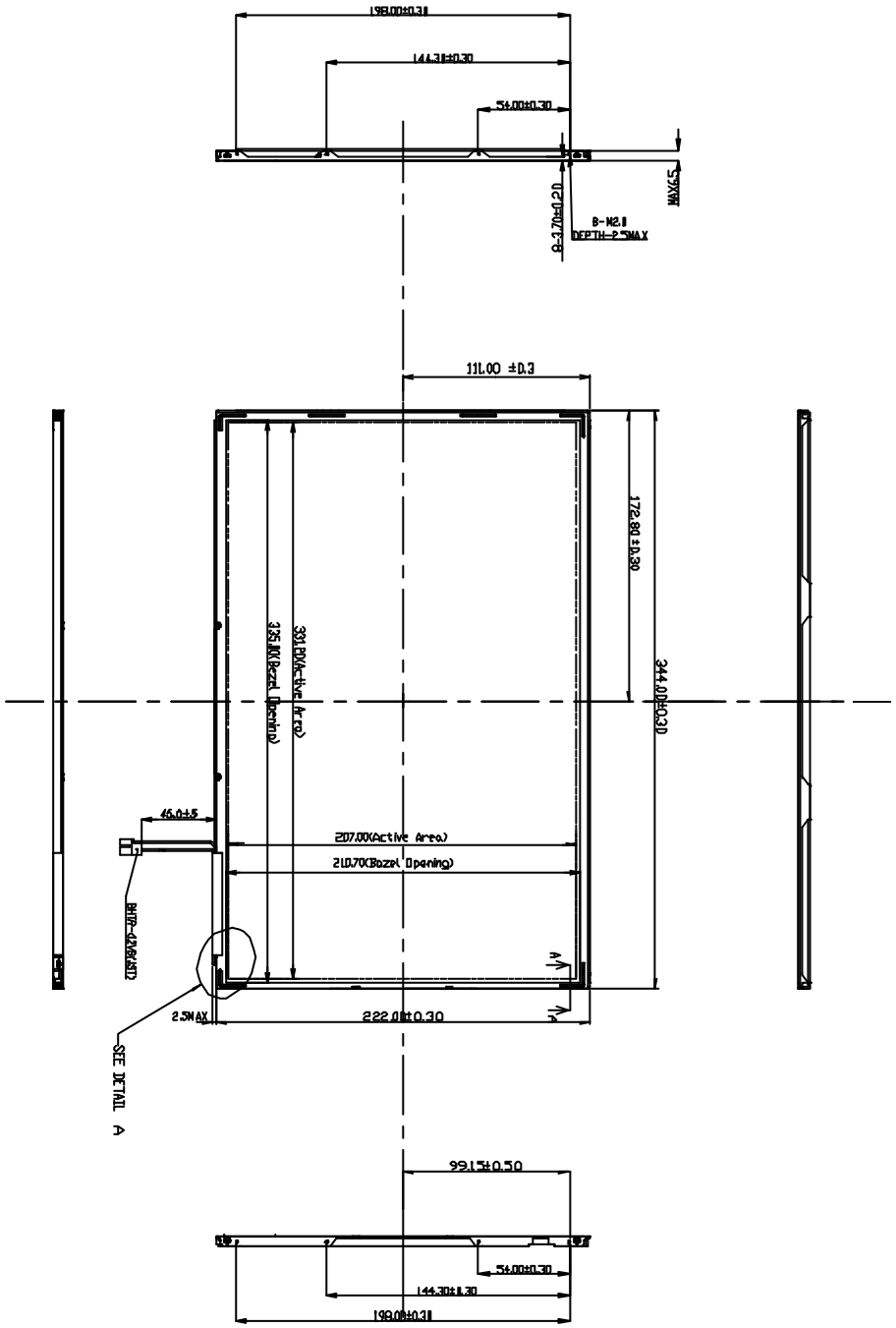
Item	Specifications
Display area (Active area)	331.2 (W) × 207.0 (H) (mm) (15.4 " diagonal)
Driving Method	TFT active matrix
Number of Pixels	1280 (W) × 800 (H) × R,G,B (XGA) (pixels) 1)
Pixel pitch	0.25875 (H) × 0.25875 (V) (mm) 1)
Pixel Arrangement	RGB vertical stripes 1)
Display color	262,144 (colors)
Display Mode	Transmissible type, Normally white
Viewing Direction	6 o'clock (in direction of maximum contrast)
Surface Treatment	Hard coating(2H) Glare reflective treatment of the front polarizer
Interface	LVDS
Backlight	Single cold-cathode fluorescent lamp for sidelighting
Dimensional Outline	344.0 (W) × 222.0 (H) × 6.2(Typ.)/ 6.5(Max.) (D) (mm)
Bezel Opening	335.0 (W) × 210.7 (H) (mm)
Weight	575g(Typ) 590g(Max)

Note 1)

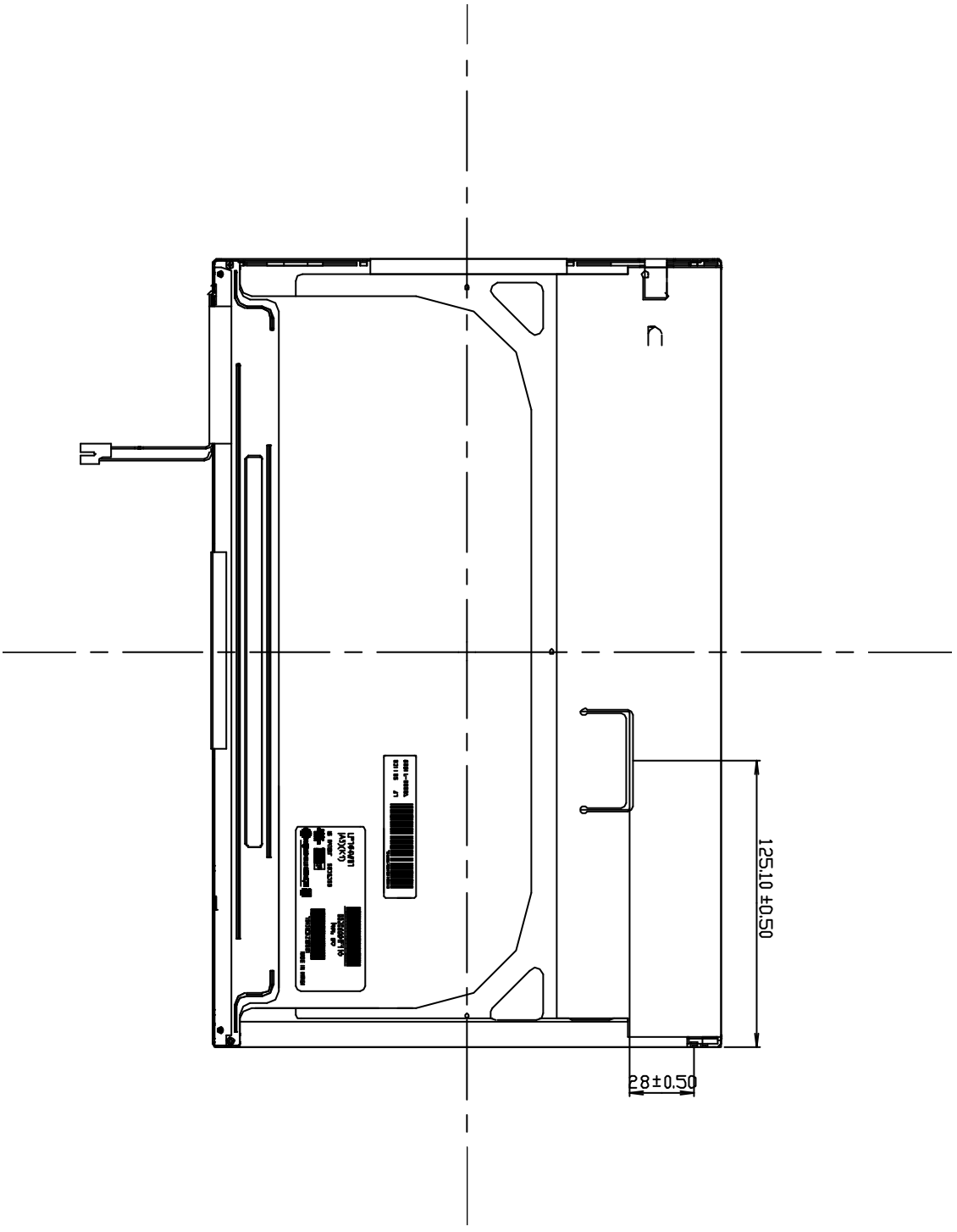


2.2. Dimensional Outline

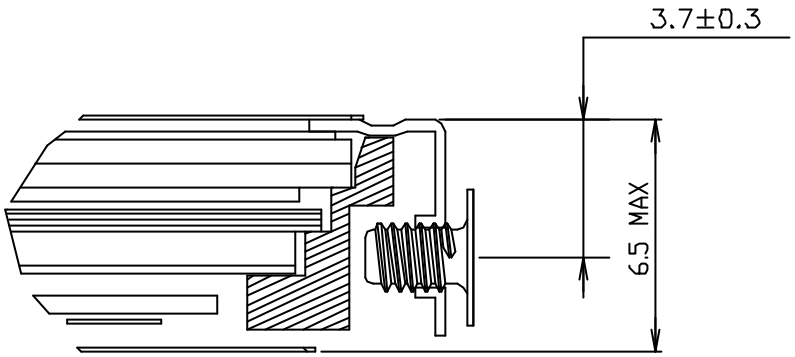
(Front figure)



(Back figure)



(Detail description of side mounting screw)



SECTION A-A
SCALE 5/1

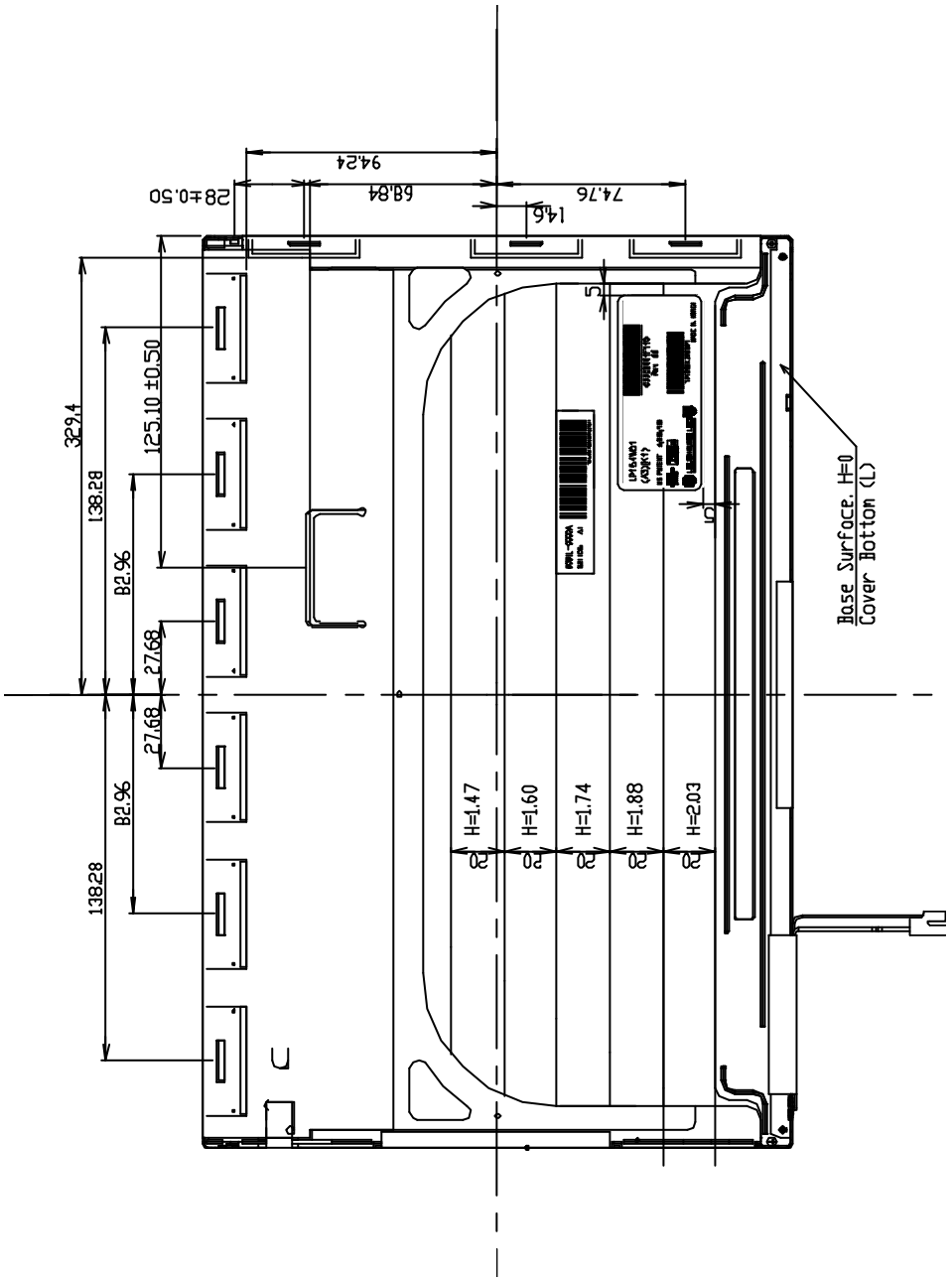
*SCREW(8ea) TORQUE : max 3kgf.cm

*Mounting SCREW Depth : max 2.5

*SCREW Length : max 2.5, min 2.0

(Both side mounting screw is identical)

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

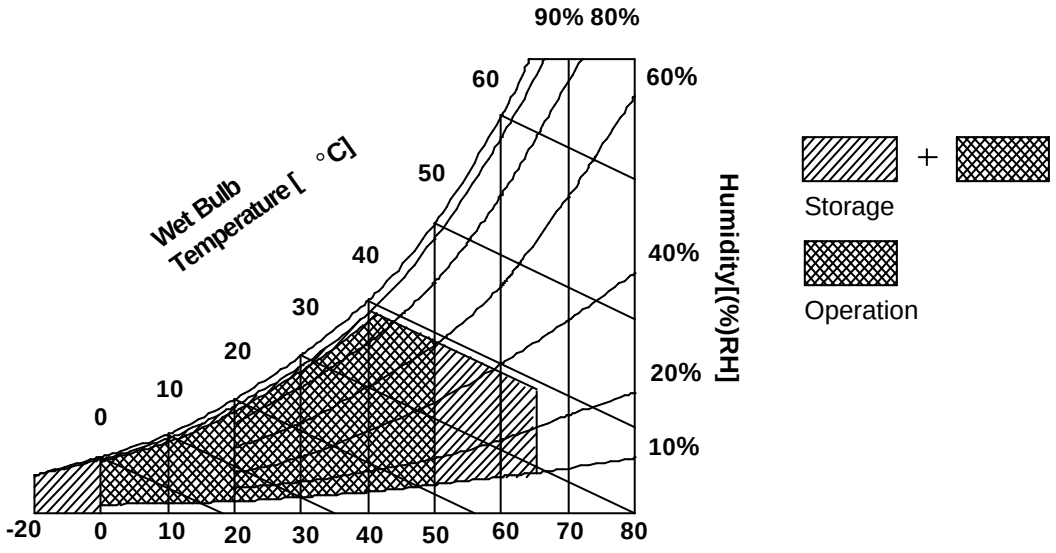


3. Absolute Maximum Ratings

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	+60	°C	(2)
Storage Temperature	TSTG	-20	+65	°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

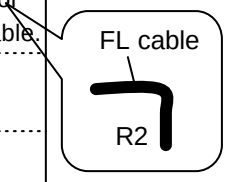
(1) TFT LCD Module

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
Lamp Voltage	V_L	-	5000	V_{RMS}	Broken lamp Max Voltage
Lamp Current	I_L	3.0	7.0	mA_{RMS}	
Lamp Frequency	F_L	40	80	KHz	

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 Resistanace -> 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.Lamp & Circuit parts)		
Strength of FL Cable	Strength of Rotation force	Cable : No disconnection of cable to the 5 trial of 360 degree rotation. See a bended state of cable.	Non Operation 
		Connector : No disconnection of cable to 10 trial of 180 degree rotation. See a bended state of cable.	
	Lead Pull Test	Soldering portion 29.4N(3.0kgf) 10mins *1.08mm Wire applied	
		Connector : 12.9N (1.32kgf) 1 sec *1.08mm Wire applied	
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-mout part	M2 : Max 3.0 kgf		Non Operation
Rescrewed 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.

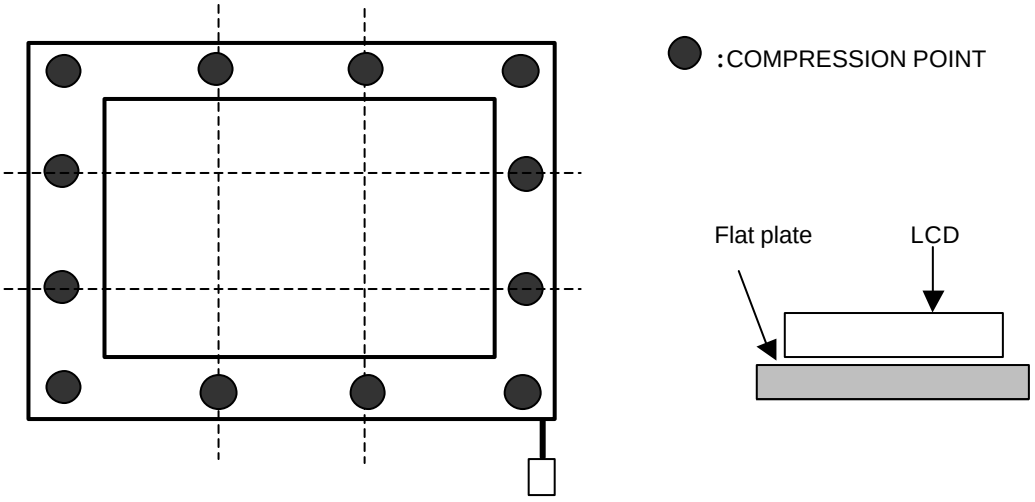
(4) Luminance should be larger than the minimum value specified in optical specification.

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)

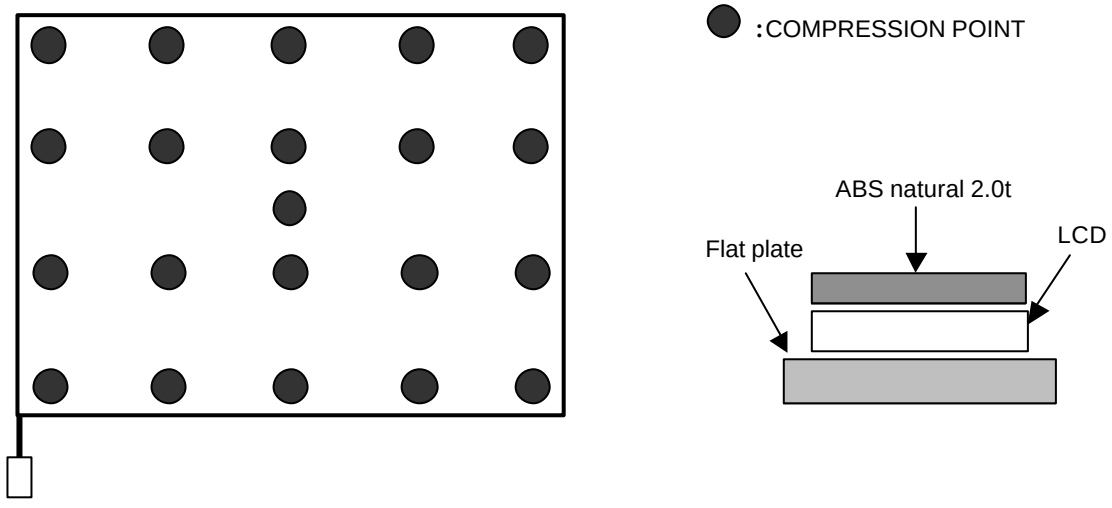


[Fig 1-1]

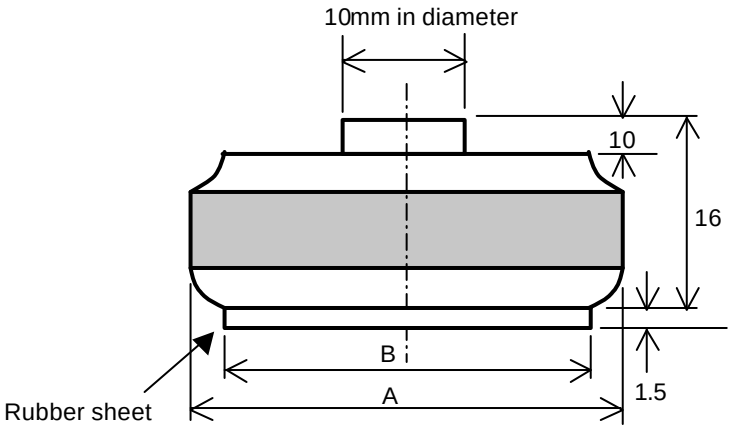
(2) The compression condition of rear side

(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]



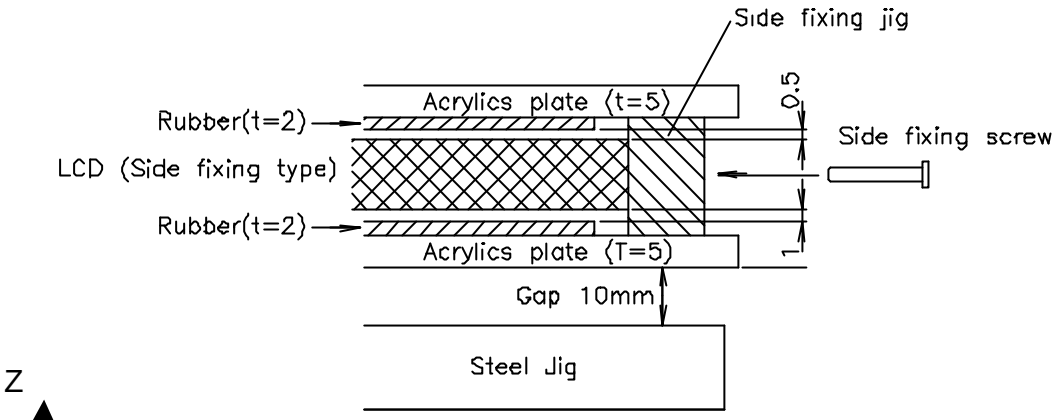
[Fig 1-3]

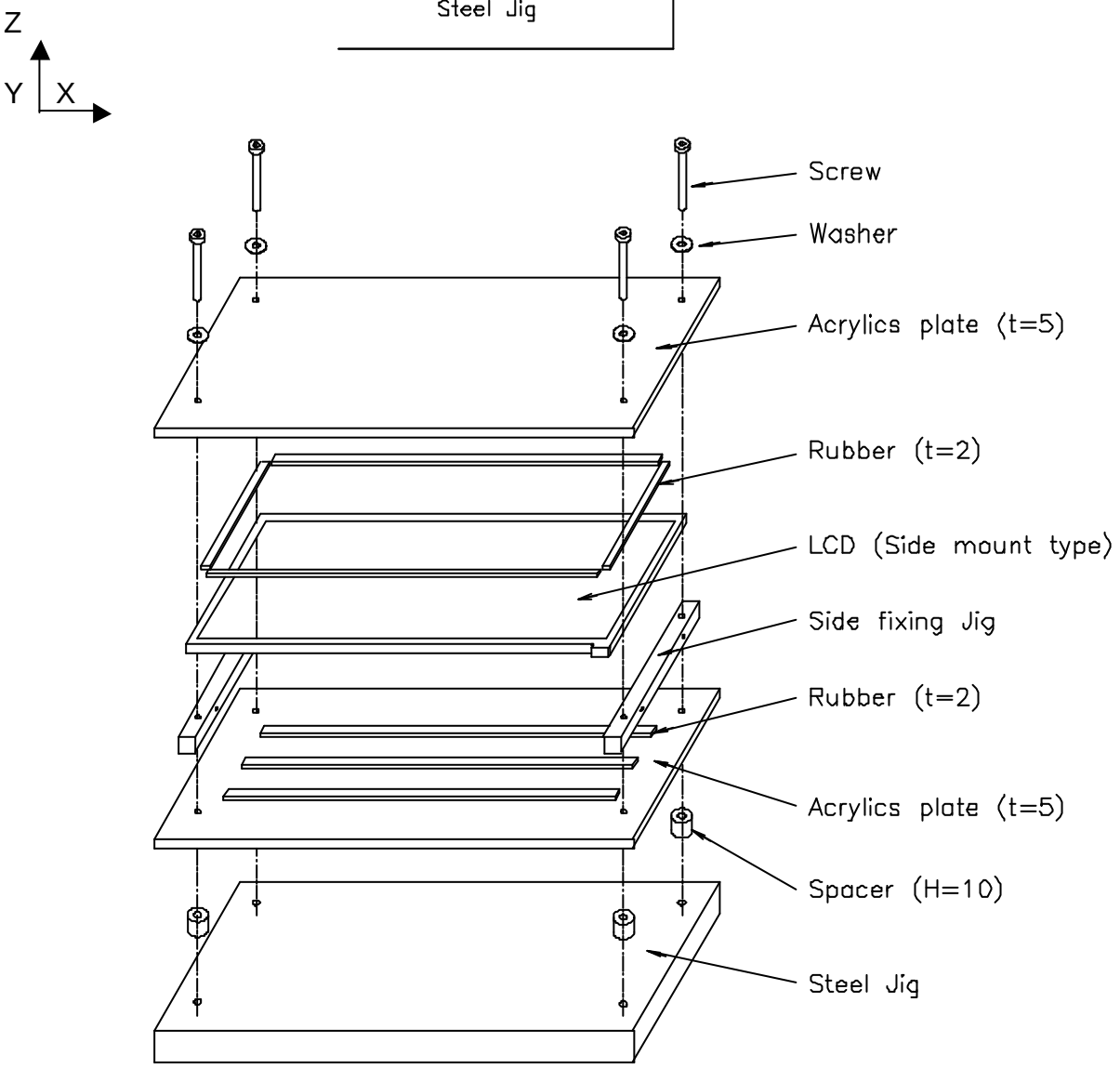
(3) Dimension of the compression jig

(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 lamp)

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"
FL Input Current : I_L = 6.0mA_{RMS}
FL Driving Frequency : f_{LF} = (60±5 kHz)
FL Inverter : LG Inverter (6632Z-1301A)

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		250	300	-	-	(2), (6)
Response Time		t_{ON}			-	8	15	ms	(3)
		t_{OFF}			-	22	30	ms	
Average luminance (Center 1 Point)		Y_L			155	185	-	cd/m²	*I_{FL}=6.0mA_{RMS} F_L=60±5kHz Gray Scale Level = L63 (White)
Cross Modulation		D_{SHA}			-	-	2.0	%	(5)
Luminance Uniformity Chromaticity	Red	Rx Ry			0.568 0.314	0.598 0.344	0.628 0.374	-	(1), (6) PR650 Only for Color Coordinate (Color Coordinate of the R,G,B is based on LPL's equipment, and Color Coordinate of the W is based on Toshiba's equipment)
	Green	Gx Gy			0.293 0.500	0.323 0.530	0.353 0.560		
	Blue	Bx By			0.125 0.113	0.155 0.143	0.185 0.173		
	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°	55 55	60 60	- -	deg.	
	Ver.	θ_{up} θ_{Low}		ϕ = 90° ϕ = -90°	35 45	40 50	- -		
	Hor.	θ_L θ_R	CR>=5	ϕ = 180 ϕ = 0°	65 65	70 70	- -		
	Ver.	θ_{up} θ_{Low}		ϕ = 90° ϕ = -90°	45 55	50 60	- -		
13 Points White Variation		⊥_W	θ=0°, ϕ=0° Viewing normal angle		-	-	1.7		(7)
13 Points CR Variation		⊥_C_R			-	-	2.0		(7), A
White Variation		dL			-	-	1.7		(8)

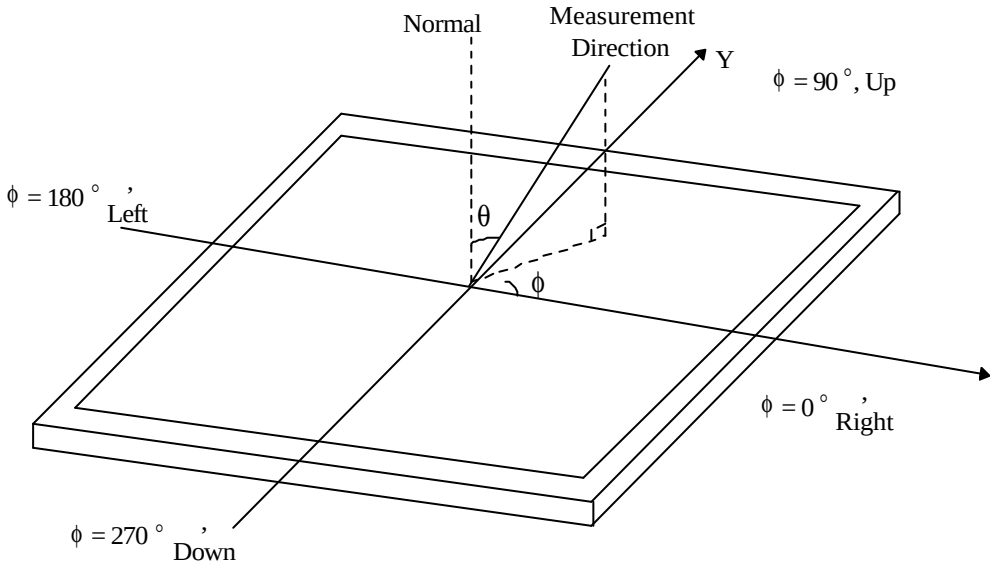
Attach the Lamp current – Luminance characteristics. The range of lamp current is shown in 3.2 (2)

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		65.8	77.5	88.4		
	47		42.99	56.69	70.29		
	39		26.53	38.88	50.88		
	31		15.68	24.06	32.76		
	23		7.74	11.50	16.6		
	15		2.19	4.21	6.74		
	7		0.15	0.86	1.56		
	0		0.01	0.21	0.42		

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.

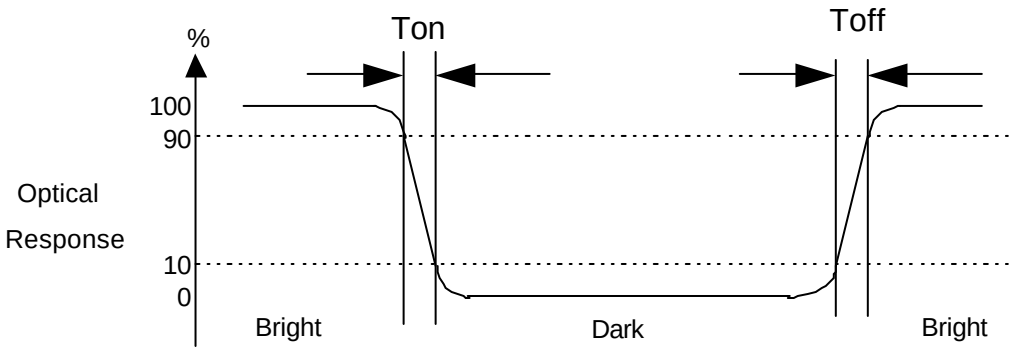
The contrast ratio can be calculated by the following expression.

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) Surface luminance is the 5point (1~5)average across the LCD surface 50cm from the surface with all pixels displaying white. When IBL= 6.0mA, LWH=185cd/m2(typ.)

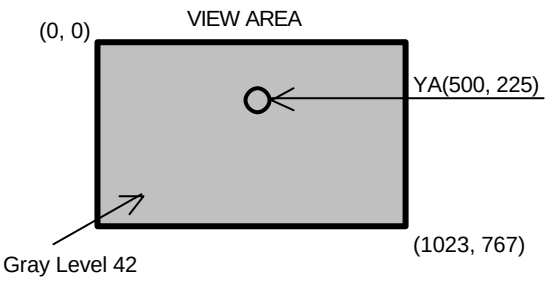
Note 5) Definition of Cross Modulation (D_{SHA})

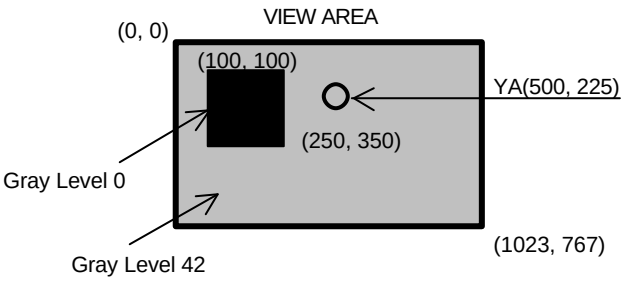
$$D_{SHA} = | Y_B - Y_A | / Y_A \times 100 \ (\%)$$

Where:

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

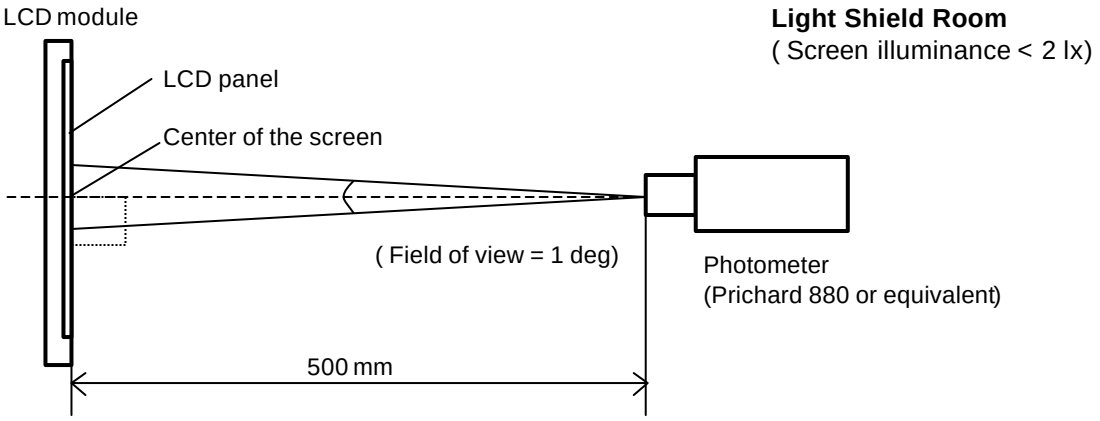
Y_B = Luminance of measured location with darkest gray pattern (cd/m^2)





Note 6) Measuring setup

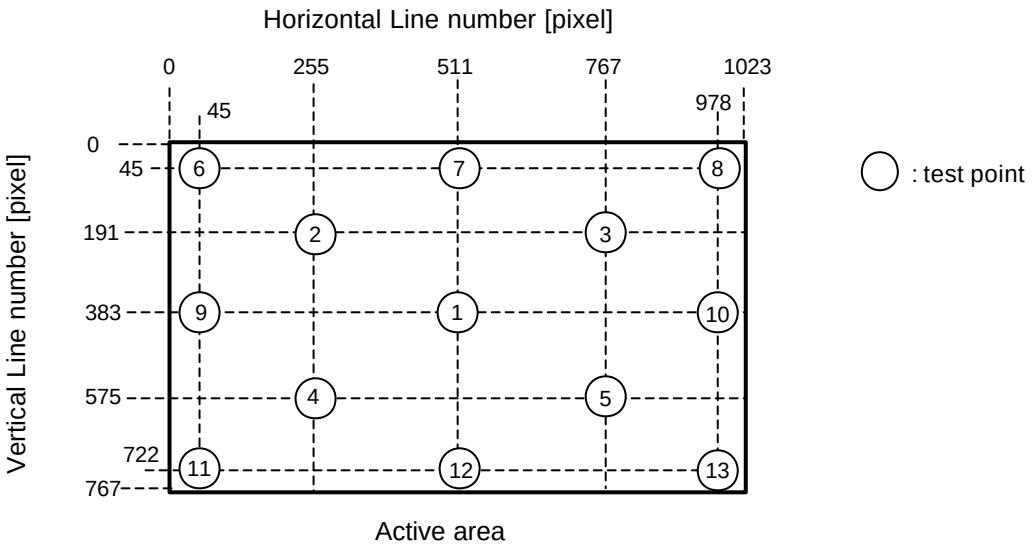
The measurement suppose to be executed after stabilized the panel at given temperature during 30 min. The measurement shall be executed 30 minutes after lighting at rating. The luminance of white should be typical luminance (Typical Condition IL=6.0mA). In order to stable the luminance, LCD s hall not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

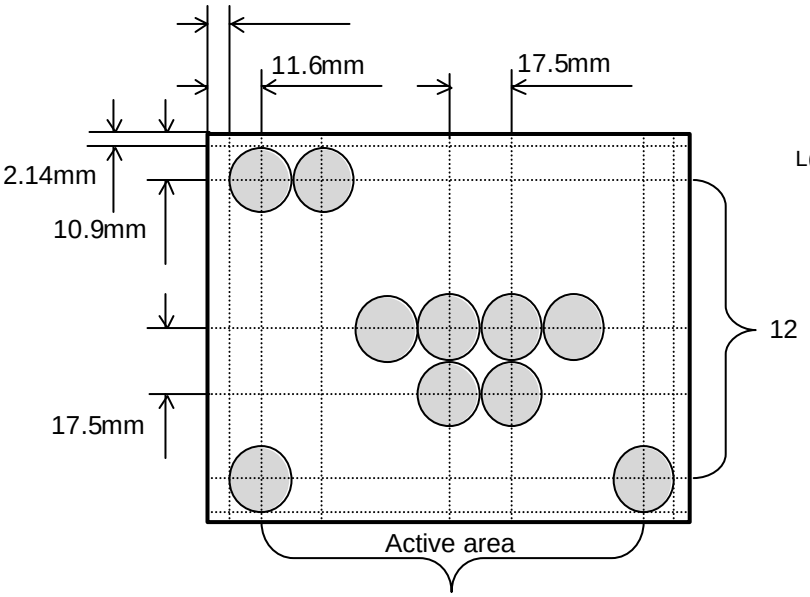
δC_R = Maximum CR 13 points / Minimum CR of 13 points

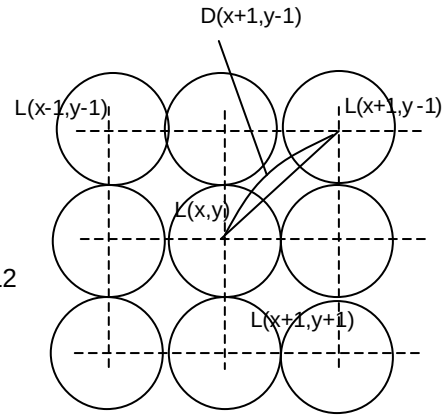


Note 8) Definition of White Variation dL : measure the luminance of white at 13 ×11 points.

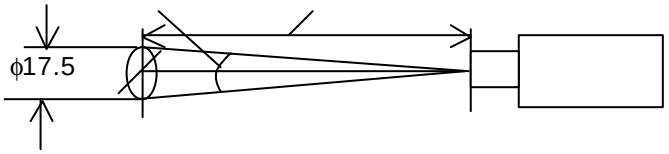
$$dL = [\ |\ L(x,y) - L(x+I,\ y+j)\ |\ /\ (\ L(x,y) \times D(x+I,\ y+j)\ )\ ] \times 100 \quad (\%/mm)$$

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}	-	-	1.8	A	(5)
Power Supply Current	White(L63)	I_{DD}	200	235	270	mA	(3), (4) (a)
	Mosaic		245	290	335		(3), (4) (b)
	Max. Pattern		290	340	390		(3), (4) (c)

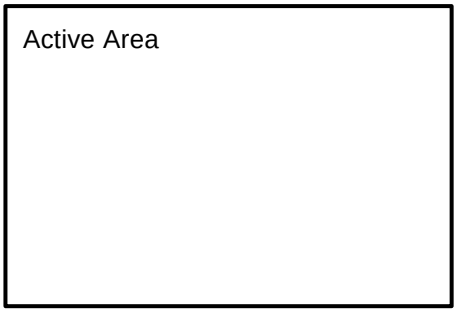
Note 1) The module should be always operated within these ranges. The "Typ." shows the recommendable value.

Note 2) Recommended LVDS transmitter : SN75LVDS84 made by TI.
LVDS receiver included in this module is SN75LVDS86.(1 chip)

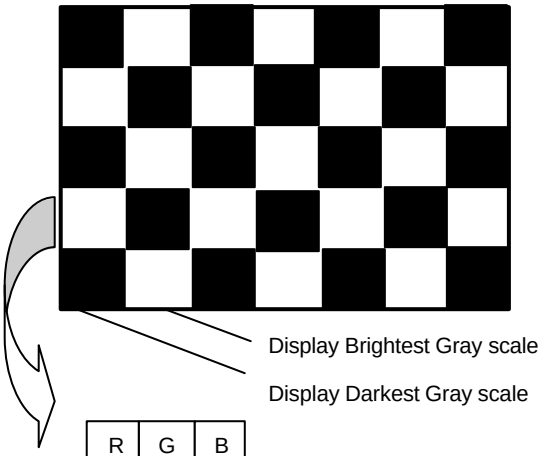
Note 3) Typical condition as follows. : fV= 60Hz, fDCLK = 68.9 MHz, V_{DD}= 3.3V, DC current.

Note 4) Power dissipation check pattern.

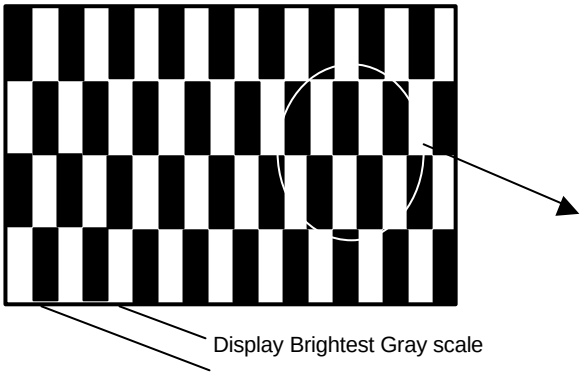
(a) White pattern



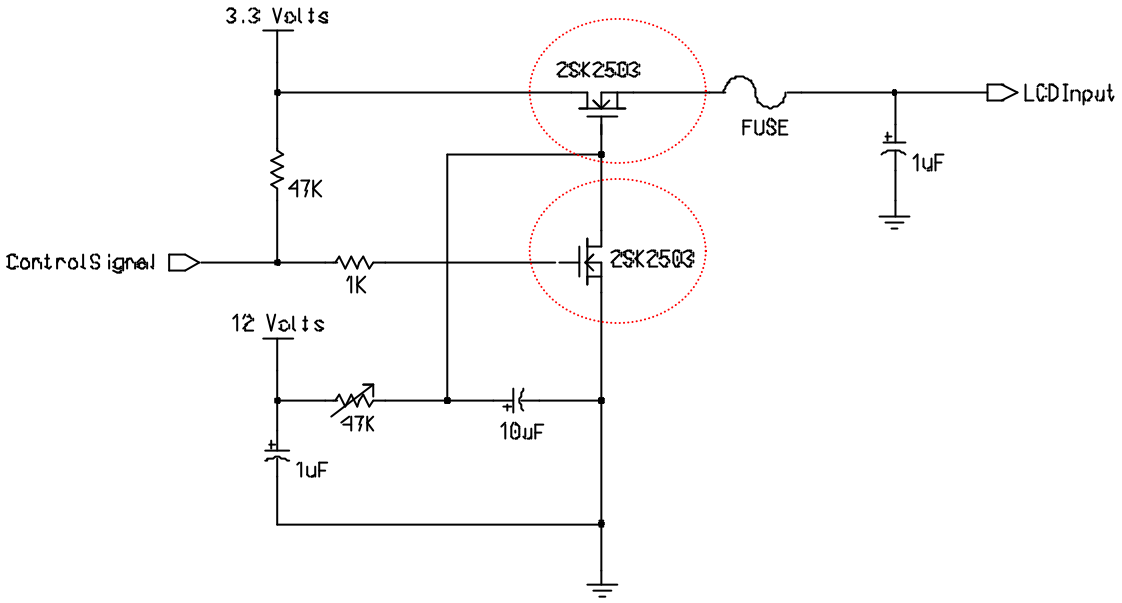
(b) Mosaic pattern



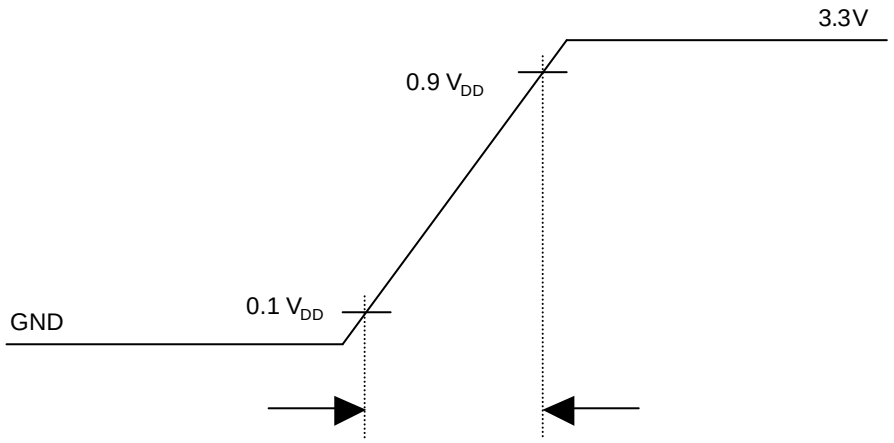
(C) Max. pattern



Note 5) Measuring condition of rush current.



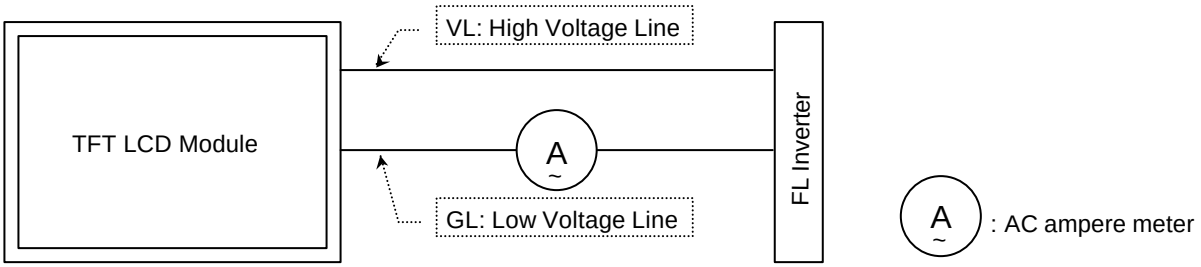
V_{DD} rising time is 470us



5.2. Backlignt Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I_L	3.0	6.0	7.0	mA_{RMS}	(1)
Lamp Voltage	V_L	660	690	830	V_{RMS}	
Power Consumption	P_L	-	4.14	4.62	W	(2)
Frequency	f_{FL}	40	60	80	kHz	
Operating Life Time	Hr	15,000	-	-	Hour	(3)
Ignition Voltage at 0°C	V_{IV}	-	-	1500	V_{RMS}	(5)
		-	-	-		(4)
Ignition Voltage at 25°C	V_{IV}	-	-	1200		(5)
		-	-	-		(4)
Creepage Distance	-	5.0	5.2	-	mm	
Mercury Qt'y of CCFL	-	-	-	2.5	mg	

Note 1) Lamp current is measured with a high frequency current as shown below.



Note 2) Refer to I_L X V_L to calculate.

Note 3) Life time of Lamp can be defined as the time in which it continues to operate under the condition T = 25°C ± 2°C and IL= 6.0 mArms until one of the following events occurs.

1. When the brightness becomes 50% or lower than it's original.
2. When the Effective ignition length becomes 80% or lower than it's original value.

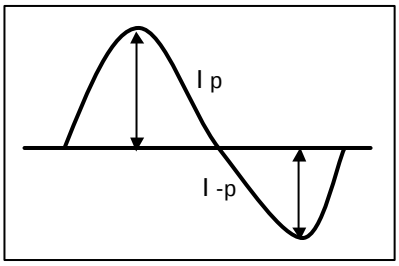
(Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note 4) The discharge shall be connected uniformly. Slide up method shall be used for voltage application. Above voltage is applied voltage to both ends of the lamp as the starting voltage.
(Above value is not out put voltage of inverter.)

Note 5) The lamp shall be lighted stably. Slide up method shall be used for voltage application. Above voltage is applied voltage to both ends of the lamp as the established starting voltage. (Above value is not out put voltage of inverter)

*** Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp, are following.
It shall help increase the lamp lifetime and reduce leakage current.

a. The asymmetry rate of the inverter waveform should be less than 10%.
b. The distortion rate of the waveform should be within ◦Ò2 ◦Ì10%.
* Inverter output waveform had better be more similar to ideal sine wave.



* Asymmetry rate:

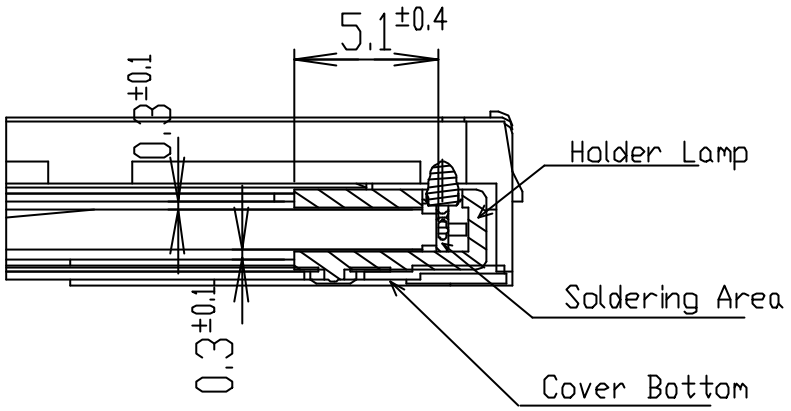
$| I_p - I_{-p} | / I_{rms} * 100\%$

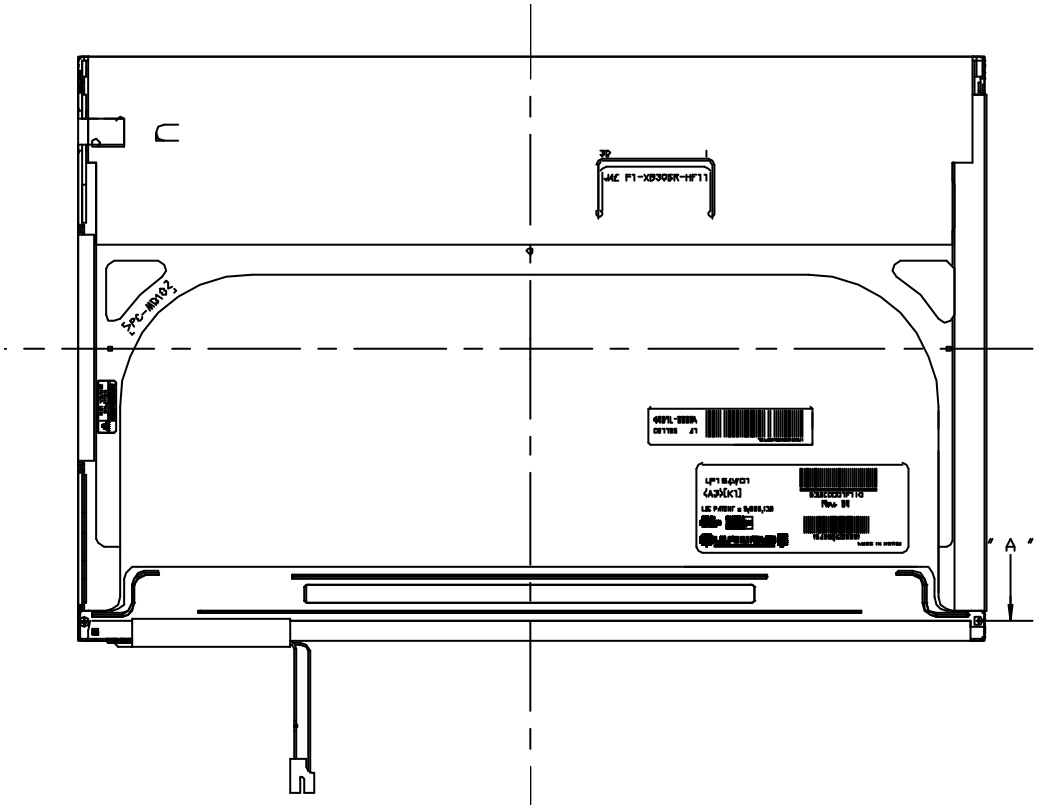
* Distortion rate

I_p (or I_{-p}) / I_{rms}

Note 6) Detail description of creepage distance

[Section 'A']





5.3. Regulation

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

(1) EMI Regulations.

CISPR : Pub.22 CLASS B

FCC : PART15 CLASS B

VCCI : CLASS B

(2) Safety Regulations (Only LCD)

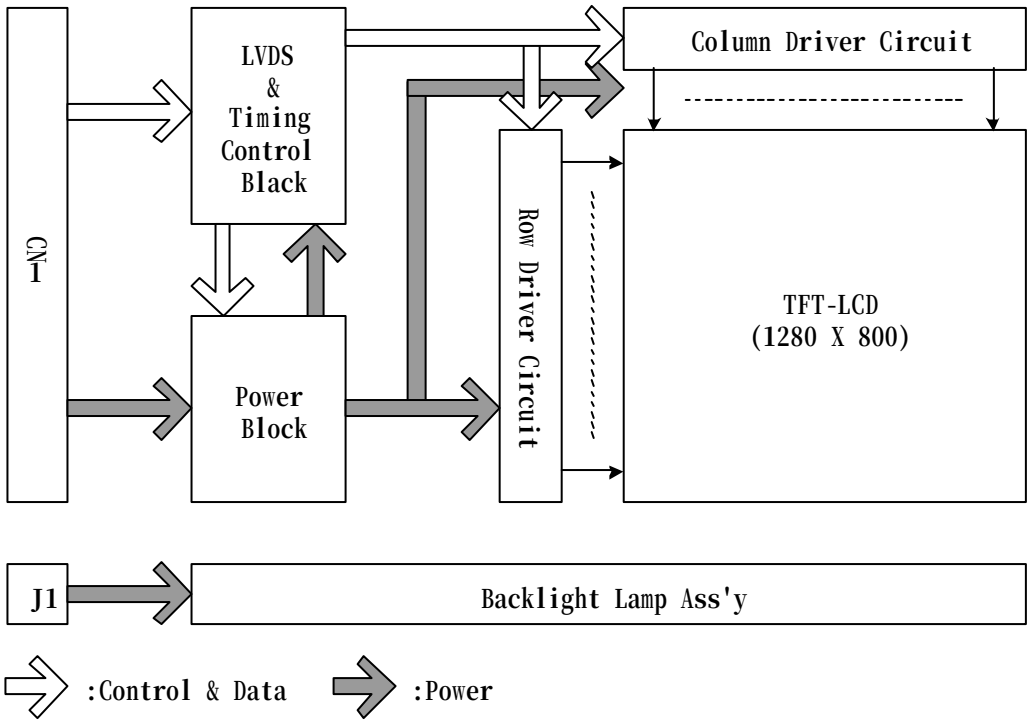
IEC 950

UL 1950

(3) Material list concerning

Item		Silk	Product	Rating	Maker
EMI Filter	ASIC (Data Output)	AR1,2,3,4,5,6,7,8,9	Array Resistor	47 1/16W 5% 3216 R/TP	-
		-	-	-	
	ASIC (Clock Output)	FL5	BLM18BD121SN	120 (100MHZ)1608	MURATA
		-	-	-	
	Power V_{DD}(2.85V)	C45,47,49/ C46,48,50	Capacitor	0.1? 50V/ 10? 50V	
DC/DC	Control IC for Power supply	U3	MAX1543	Frequency oscillator min 0.64 ~ max 1.2 (MHz) typ 1.2MHz	MAXIM
	Switching Diode	D2,D3,D4	BAV99	SOT-23(3pin)	DIODES
	Zener Diode	ZD1	UDZS5.1B	SOD323(2pin)	ROHM
	Schottky Barrier Diode	D1	BAT750	SOT-23(3pin)	DIODES
	Inductor	L1	PLN6012T-100MR80	10 uH ∂ 20% (Inductance) 0.24? ∂ 20%(DC Resistance) 0.9A Max(Rated DC Current)	TDK

6. Block Diagram

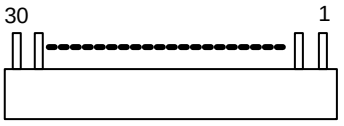


Lamp: MBTK2JB5ZX336NWLFH/C

1. Hot (Pink)
2. Cold (Green)

7. Input Terminal Pin Assignment

7.1. TFT LCD module

Pin	Symbol	Description	Notes
1	VSS	Ground	[LVDS Transmitter] TI, SN75LVDS84 or equivalent [LVDS Receiver] THINE, THC63LVDF64A [Connector] LCD : GT101-30S-HR11, LG Cable *** JAE FI-XB30Sx-HFxx or** **JAE FI-XB30S-HF or equivalent.** Matching : JAE FI-X30M or equivalent [Connector pin arrangement]  < LCD rear view >
2	VCC	Power Supply, 3.3V Typ.	
3	VCC	Power Supply, 3.3V Typ.	
4	NC	No Connection	
5	NC	No Connection	
6	NC	No Connection	
7	NC	No Connection	
8	R_{IN} 0 -	- LVDS differential data input (R0-R5, G0)	
9	R_{IN} 0 +	+ LVDS differential data input (R0-R5, G0)	
10	VSS	Ground	
11	R_{IN} 1 -	- LVDS differential data input (G1-G5, B0-B1)	
12	R_{IN} 1 +	+ LVDS differential data input (G1-G5, B0-B1)	
13	VSS	Ground	
14	R_{IN} 2 -	- LVDS differential data input (B2-B5, HS, VS, DE)	
15	R_{IN} 2 +	+ LVDS differential data input (B2-B5, HS, VS, DE)	
16	VSS	Ground	
17	ClkIN -	- LVDS differential clock input	
18	ClkIN +	+ LVDS differential clock input	
19	VSS	Ground	
20	NC	No Connection	
21	NC	No Connection	
22	NC	No Connection	
23	NC	No Connection	
24	NC	No Connection	
25	NC	No Connection	
26	NC	No Connection	
27	NC	No Connection	
28	NC	No Connection	
29	NC	No Connection	
30	NC	No Connection	

7.2. Backlight Unit

Using Connector : BHTR-02VS (Maker : JST)
(Contact Pin of VL : SBHT-002T-P0.5 (Maker :JST))
(Contact Pin of GL : SBHT-002T-P0.5 (Maker :JST))

Pin	Symbol	Cable Color	Function
1	VL	Pink	High Voltage
2	GL	Green	Low Voltage

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

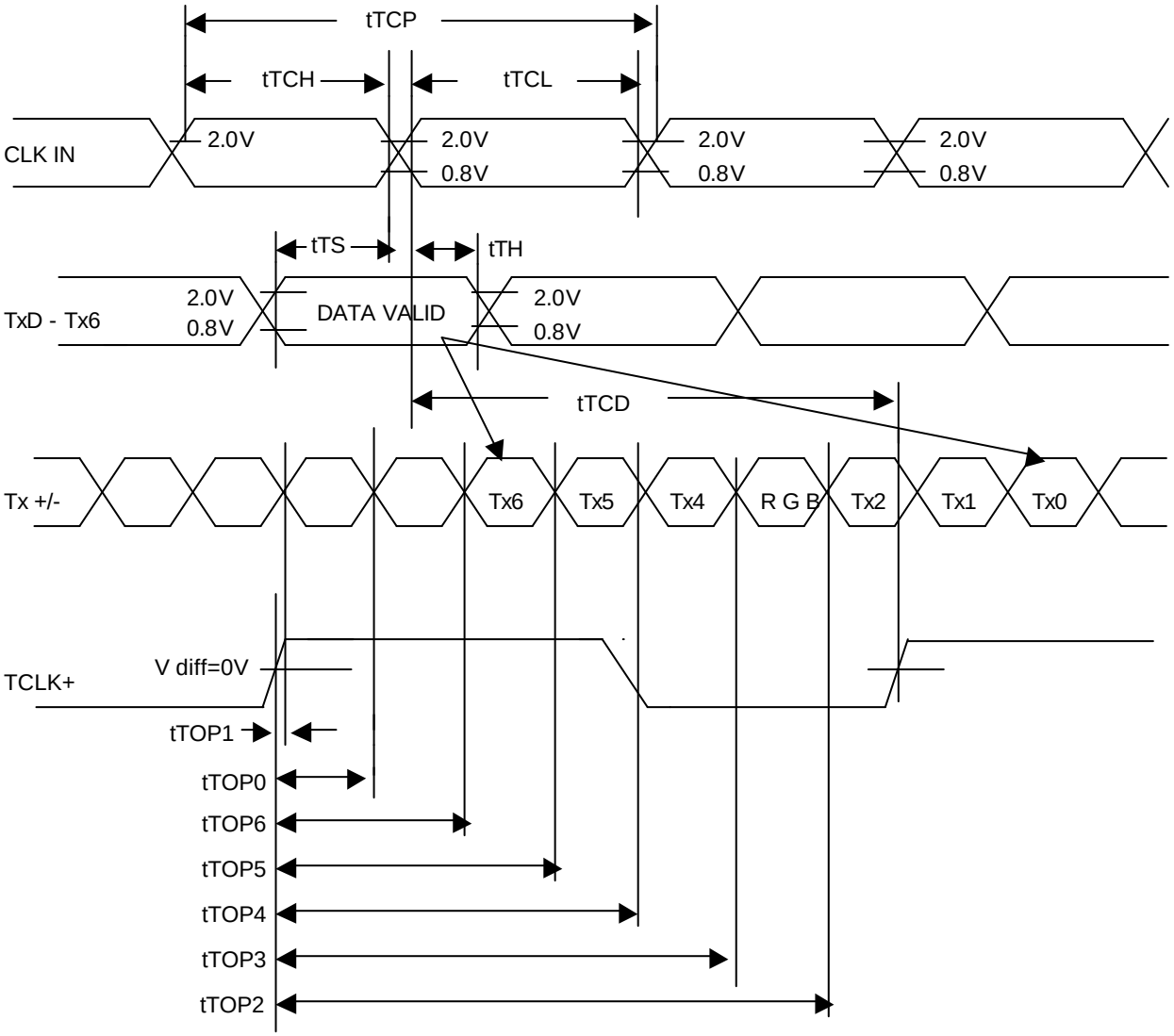
Switching Characteristic

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	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(Dark)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	…			…						…						…			
	RED(Bright)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(Dark)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	...			…						…						…			
	GREEN(Brigth)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(Dark)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	…			…						…						…			
	BLUE(Bright)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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

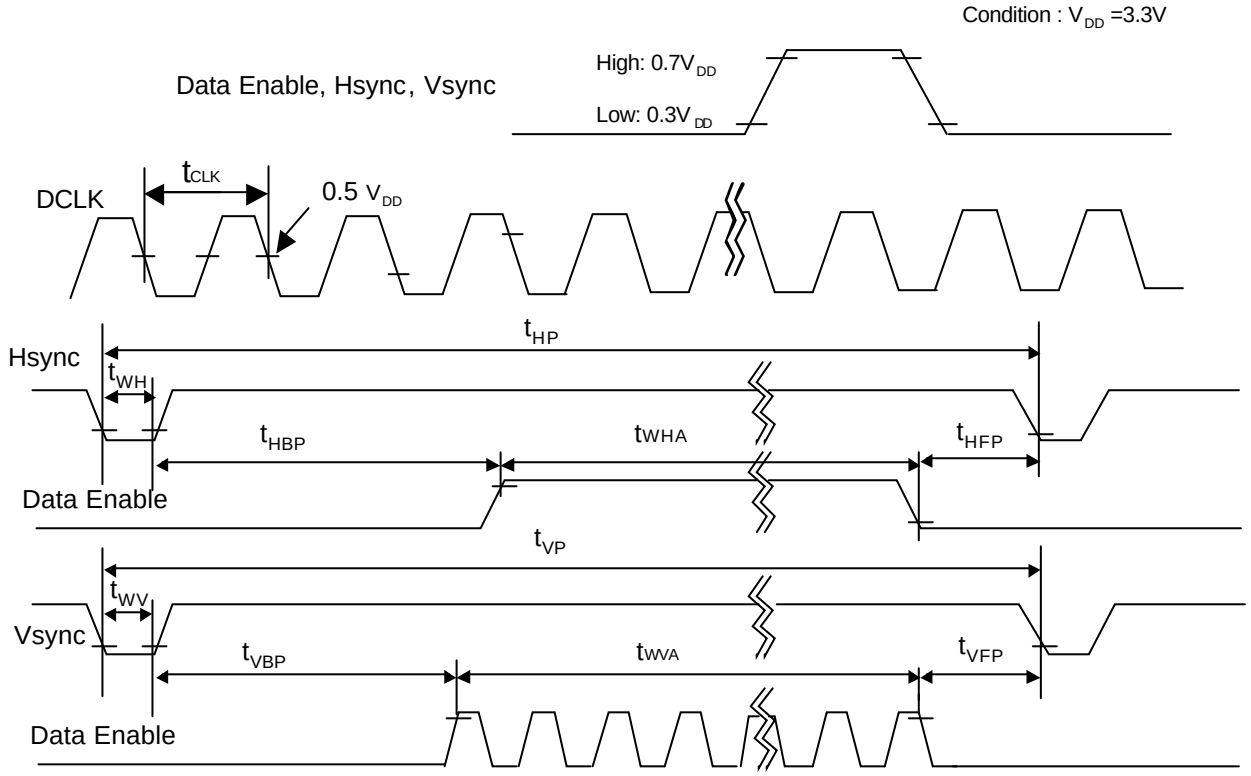
8. Interface Timing

8.1. Timing Parameters

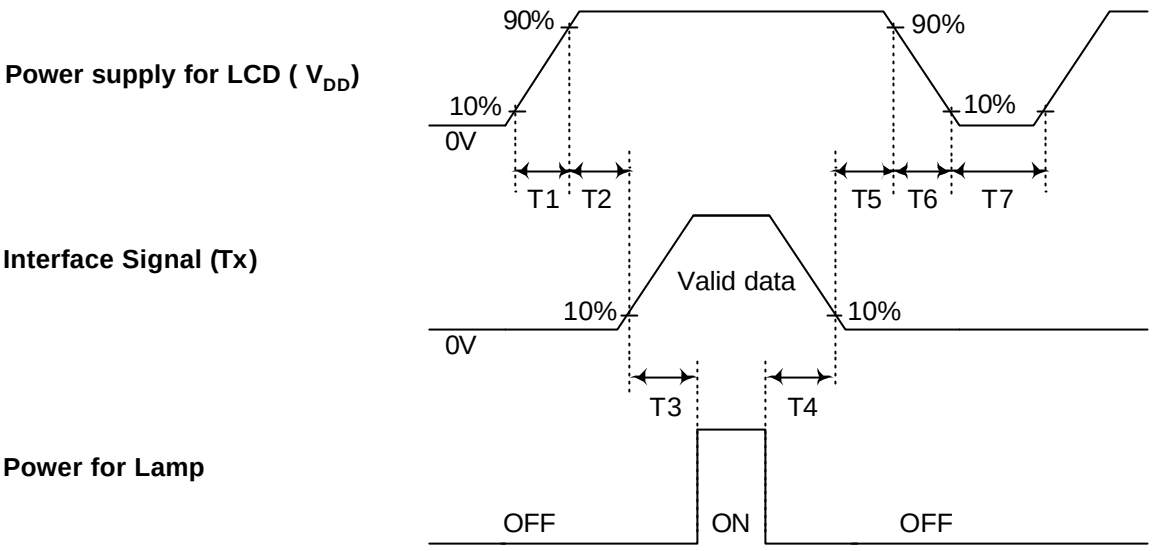
This is the signal timing required at the input of the LVDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

Item	Symbol		Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	fCLK	66.9	68.9	71.97	MHz	
Hsync	Period	tHP	1380	1408	1500	tCLK	
	Width	tWH	16	32	-		
Vsync	Period	tVP	808	816	840	tHP	
	Width	tWV	2	4	-		
Data Enable	Horizontal back porch	tHBP	68	75	-	tCLK	
	Horizontal front porch	tHFP	16	21	-		
	Vertical back porch	tVBP	5	8	-	tHP	
	Vertical front porch	tVFP	1	4	-		

8.2. Timing Diagrams of LVDS Transmission



8.3. Power On/Off Sequence



Parameter	Min.	Typ.	Max.	Unit
T_1	-	-	10	(ms)
T_2	0	-	50	(ms)
T_3	200	-	-	(ms)
T_4	200	-	-	(ms)
T_5	0	-	50	(ms)
T_6	-	-	-	(ms)
T_7	200	-	-	(ms)

Note 1) Please avoid floating state of interface signal at invalid period.
Note 2) When the interface signal is invalid, be sure to pull down the power supply for LCD V_{CC} to 0V.
Note 3) Lamp power must be turn on after power supply for LCD and interface signal are valid.

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

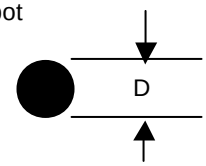
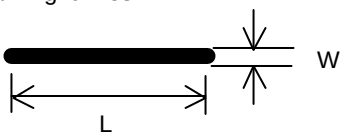
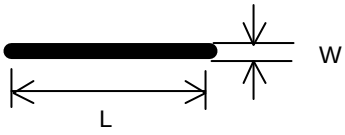
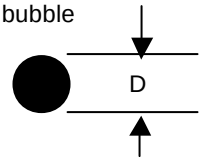
9.3. Defect modes

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

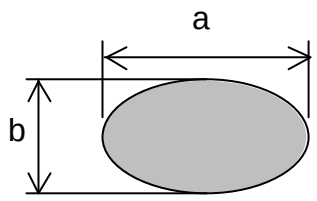
9.5. Visual Inspection

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 ≤ 0.07 0.3 < L ≤ 3.0 N ≤ 3	W > 0.07 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)

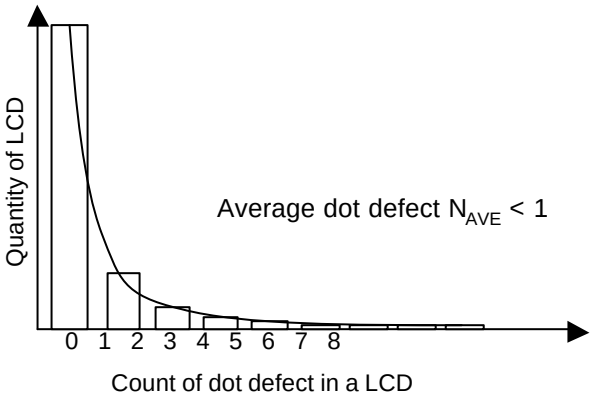


9.6. Electrical Inspection

(1) Dot defect

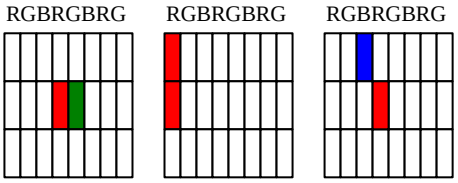
Defect type		Count	Reject
Bright dots	Random	N ≤ 5 (Green ≤ 3)	N > 5 (Green > 3)
	Two adjacent	N = 0	N > 0
	Three or more adjacent	Not allowed	
Dark dots	Random	N ≤ 5	N > 5
	Two adjacent	N = 1	N > 1
	Three or more adjacent	Not allowed	
Maximum allowable number of dot defect		N ≤ 8	N > 8
Maximum distance between defects	Bright - to - bright dot		L<15mm
	Dark - to - dark dot		L<10mm

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.

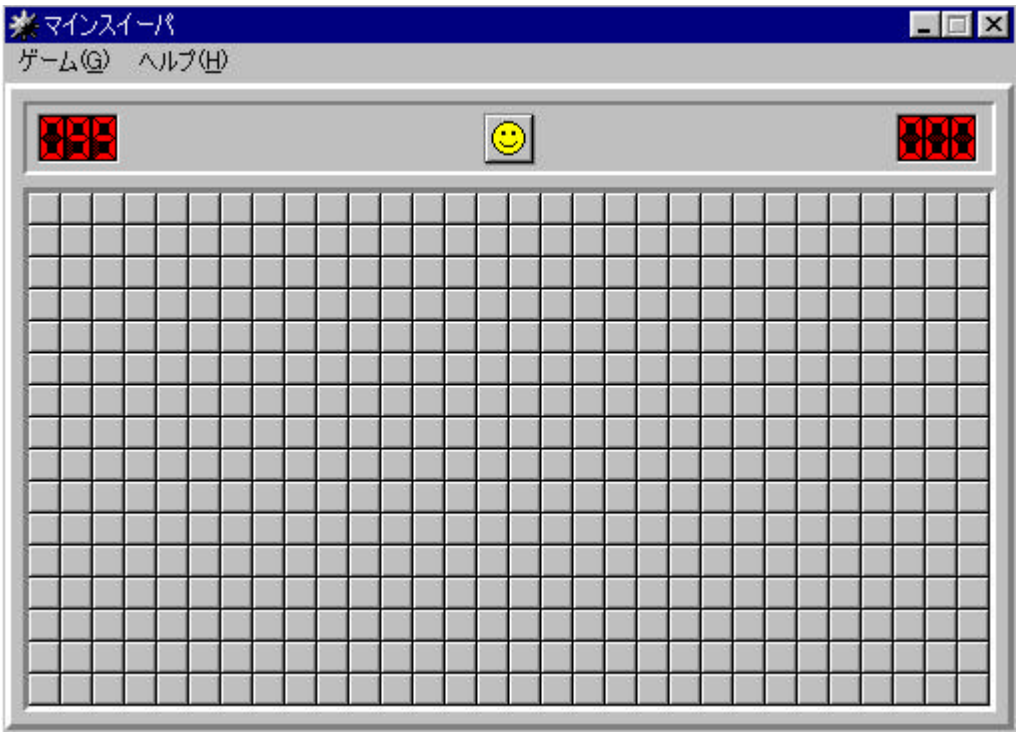


(2) Light leakage

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

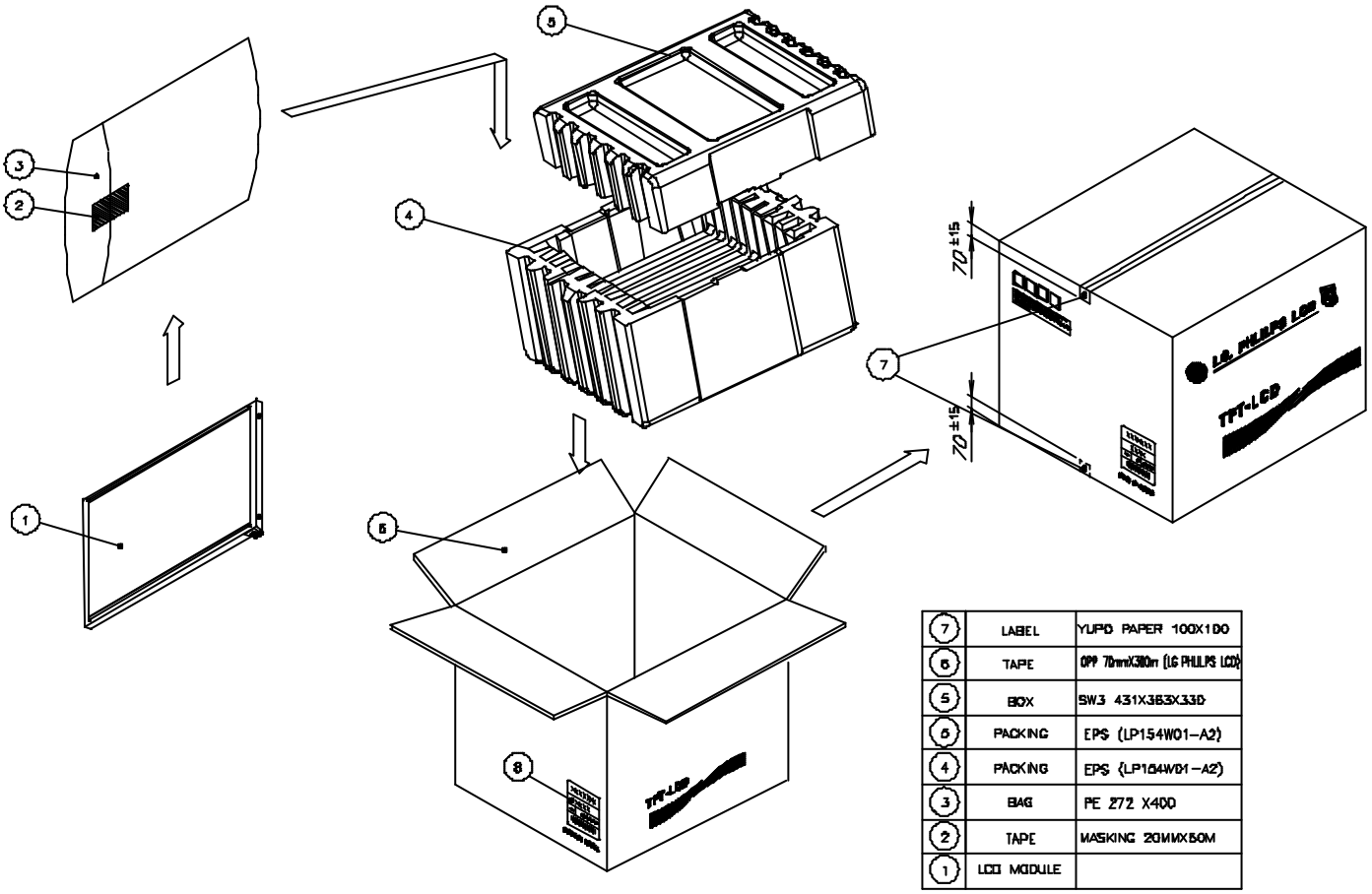
(1) Packing Form

Corrugated cardboard box and EPS

(2) Packing Method

Packing Material

Packing Weight: 470g
(1BOX/10Module)



7	LABEL	YUPO PAPER 100X180
6	TAPE	OPP 70mmX300m (LG PHILIPS LCD)
5	BOX	SW3 431X383X330
5	PACKING	EPS (LP154W01-A2)
4	PACKING	EPS (LP154W01-A2)
3	BAG	PE 272 X400
2	TAPE	MASKING 20MMX50M
1	LCD MODULE	

(3) Packing Specification

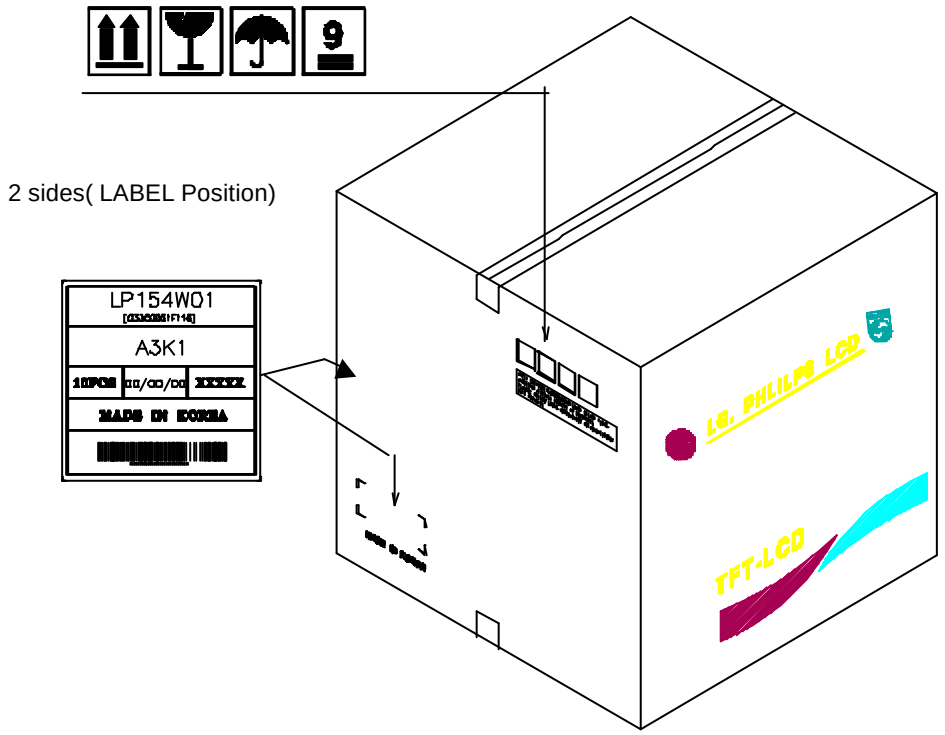
Item	Conditions
Packing Vibration	Frequency Range : 5 - 500 - 5 Hz, Degree of acceleration 1.0G(9.8m/s^2). Sweep rate 27 minutes Resonance Frequency : 1.0G(9.8m/s^2), 30minutes each Axis(X, Y, Z direction) : Non Operation Random 1.06Grms, 30minutes each Axis(X, Y, Z direction) : Non Operation
Packing Drop Test	1 Angle, 3 Edge, 6 Face, 70 cm

(4) Package Label

Package label should be at least shown the following information.

a) TOSHIBA code name(G33C0001F110) 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 : 2 points (Side)



11. Labels and Lamp Ass'y Exchange

11.1. LCD code Label on LCD

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

(1) TOSHIBA code name (G33C0001F110) 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 : Inch
D : Year
E : Month
F : Panel Code
G : Factory Code
H : Assembly Code
I,J,K,L,M : Serial No

Note:

1. Year

Year	97	98	99	2000	2001	2002	2003	2004	2005	2006	2007
Mark	7	8	9	0	1	2	3	4	5	6	7

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

3. Panel Code

Panel Code	P1 Factory	P2 Factory	P3 Factory	P4 Factory	P5 Factory	Hydis Panel
Mark	1	2	3	4	5	H

4. Factory Code

Factory Code	LPL Gumi	LPL Nanjing
Mark	K	C

5. Serial No

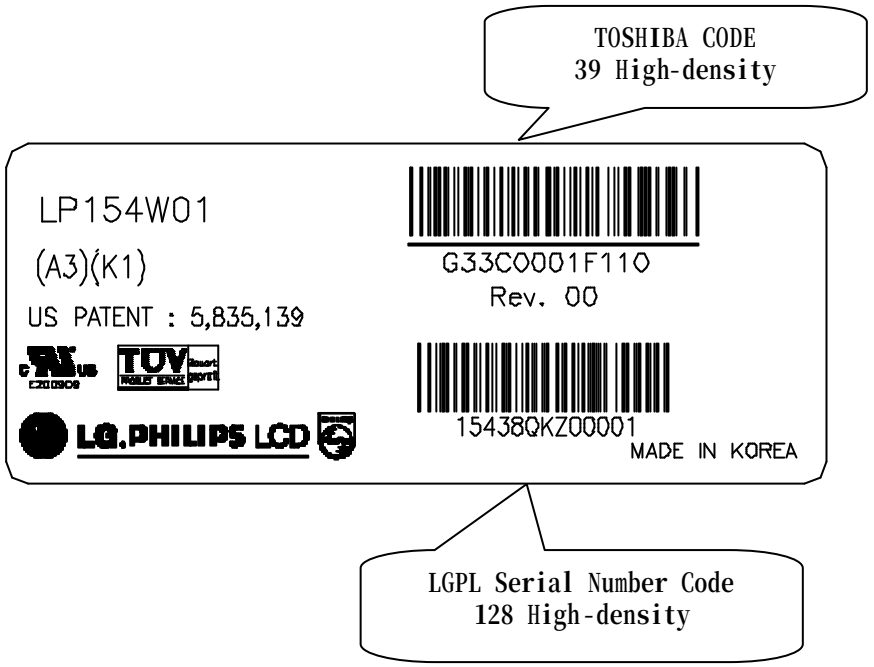
Serial No.	1 ~ 99,999	100,000 ~
Mark	00001 ~ 99999	A0001 ~ A9999, - - - - , Z9999

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.

a) Bar code of Serial number
b) Revision number (numbered by LCD maker)
c) Bar code of Revision number
d) LCD maker
e) LCD Model number (numbered by LCD maker)
f) Production Year / Month

Example >

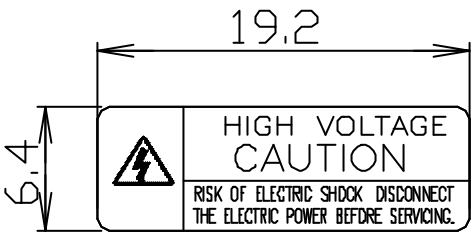
LABEL : 72mm X 30mm



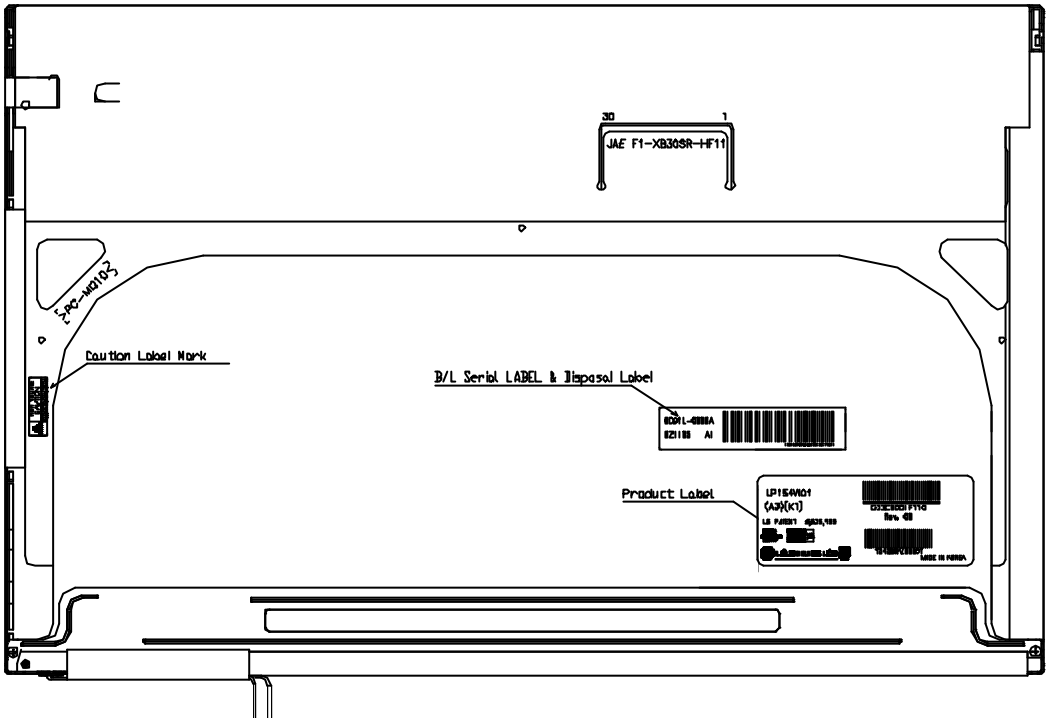
11.2. Caution Texture and Labels on LCD

[Disposal of CCFL]

[High Voltage]



11.3. Label Locations on LCD



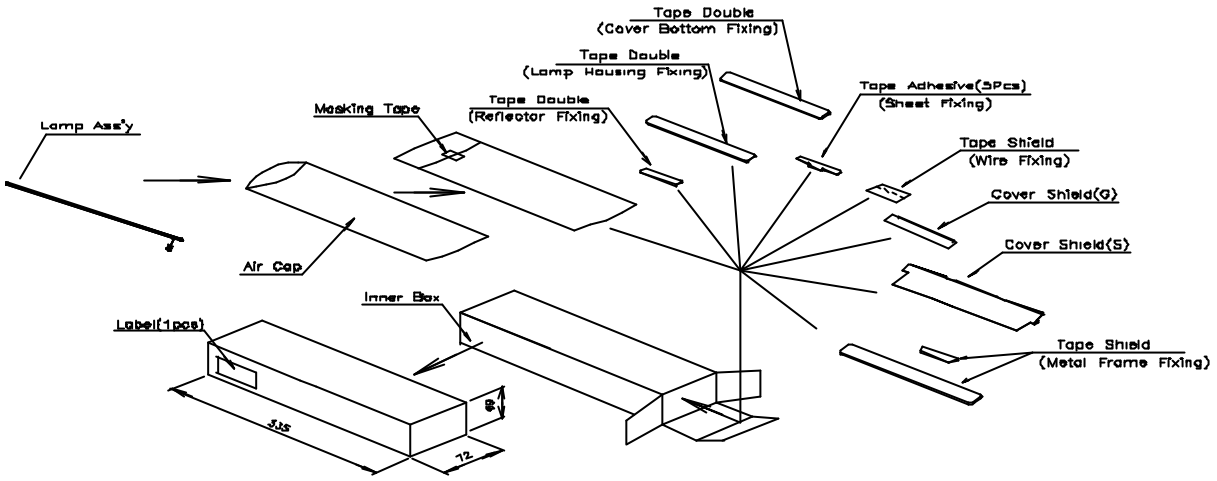
11.4. Others

(1) Backlight repair parts kit : 6913L-0194A(G33C0001F110001)

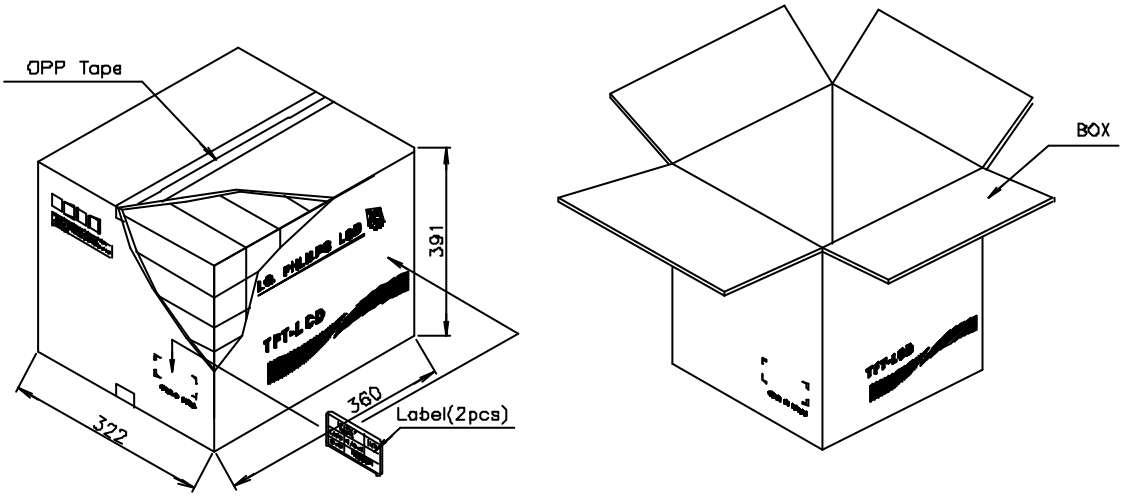
No.	Part	Product Code	Maker	Qt'y	Note
1	Lamp ass'y	6913L-0152C	Hee Sung	1	
2	Tape Double	7250L-0025H	3M	3	
3	Tape Adhesive	7250L-0045L	Tae Sung LCD	5	
4	Cover Shield(s)	3550S-0079A	Jae Hyun	1	
5	Cover Shield(G)	3550S-0080A	Jae Hyun	1	
6	Tape Shield	7250L-0074A	Jae Hyun	1	
7	Tape Shield	7250L-0083B	Jae Hyun	1	
8	Tape Shield	7250L-0050K	Jae Hyun	1	

(2) Package specification of Backlight repair parts kit

a) Individual packing



b) Master carton Packing method



[5(V) X 5(H) = 25 Boxes Inner]

c) Label

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

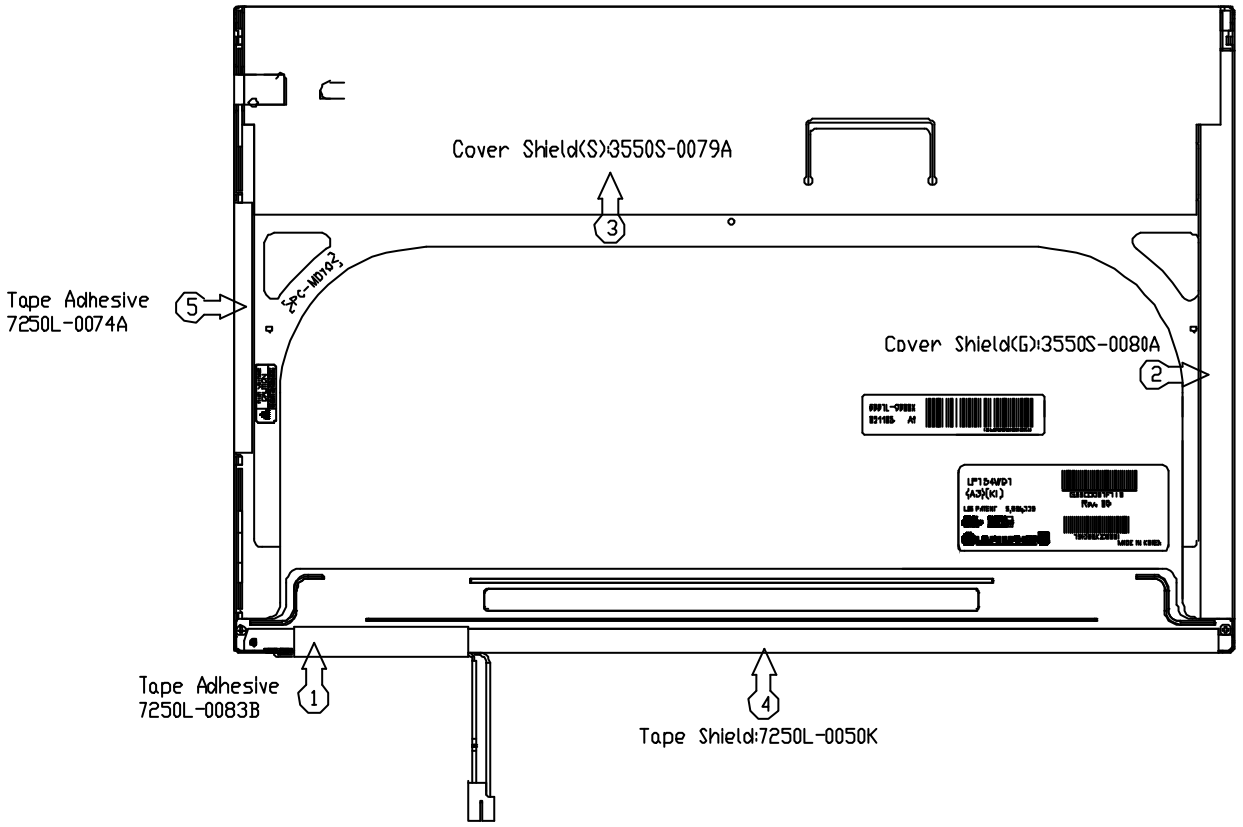
11.5.1. Disassembly of outside tape / Cover shield

(1) Disassembly of Tape adhesive used for B/L Wire fixing
Caution: Pressure or stress should not be given on B/L Wire.

(2) Disassembly of Cover shield(G)
Caution: Pressure or stress should not be given on Gate COF.

(3) 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.

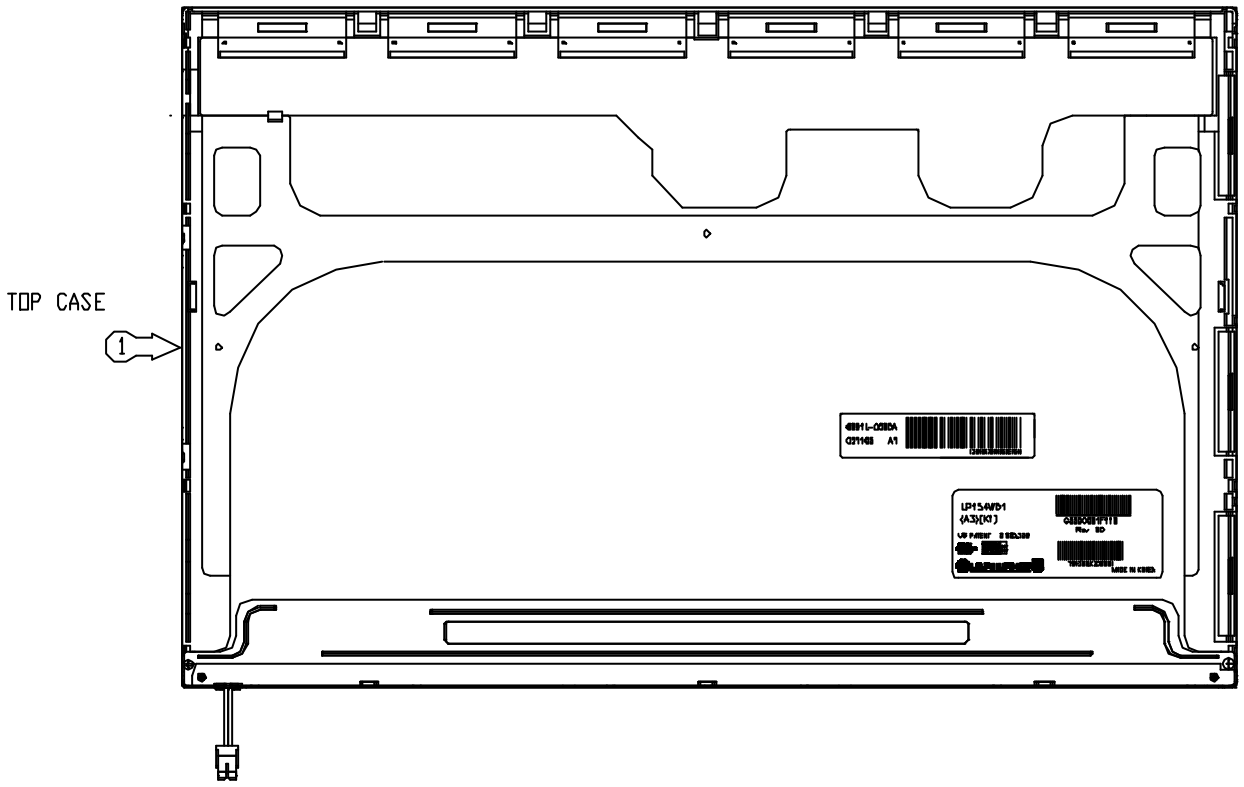
(4) Disassembly of Tape shield and Tape Adhesive used for Top case fixing
Caution: Pressure or stress should not be given on Top case during this process



11.5.2. Disassembly of Top case

(1) Disassembly of Top Case

Caution: Pressure or stress should not be given on Top Case and Gate COF.



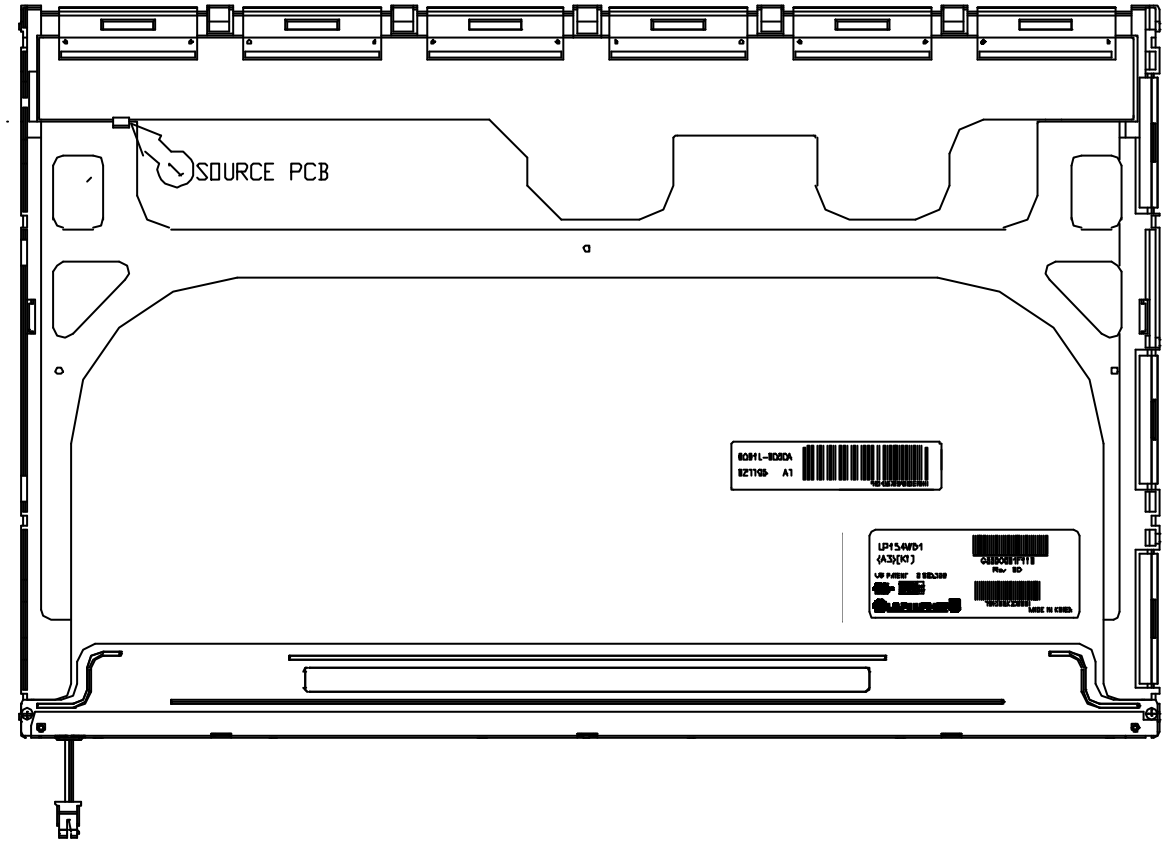
11.5.3. Disassembly of Source PCB and Gate PCB

(1) ? Disassembly of Source PCB.

Caution: Pressure or stress should not be given on PCB and TCP during removing double tape.

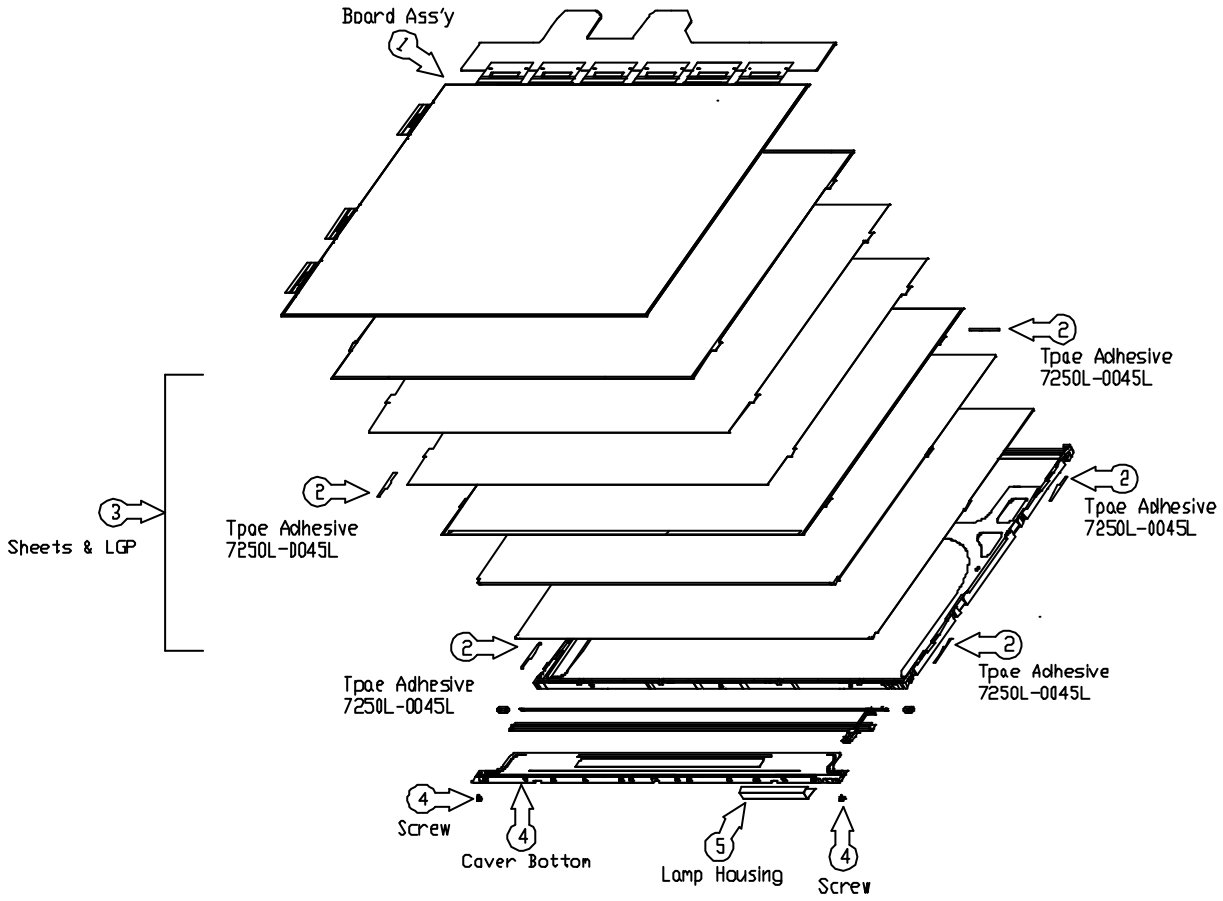
(2) ? Disassembly of Gate PCB.

Caution: Pressure or stress should not be given on PCB and TCP during removing double tape.



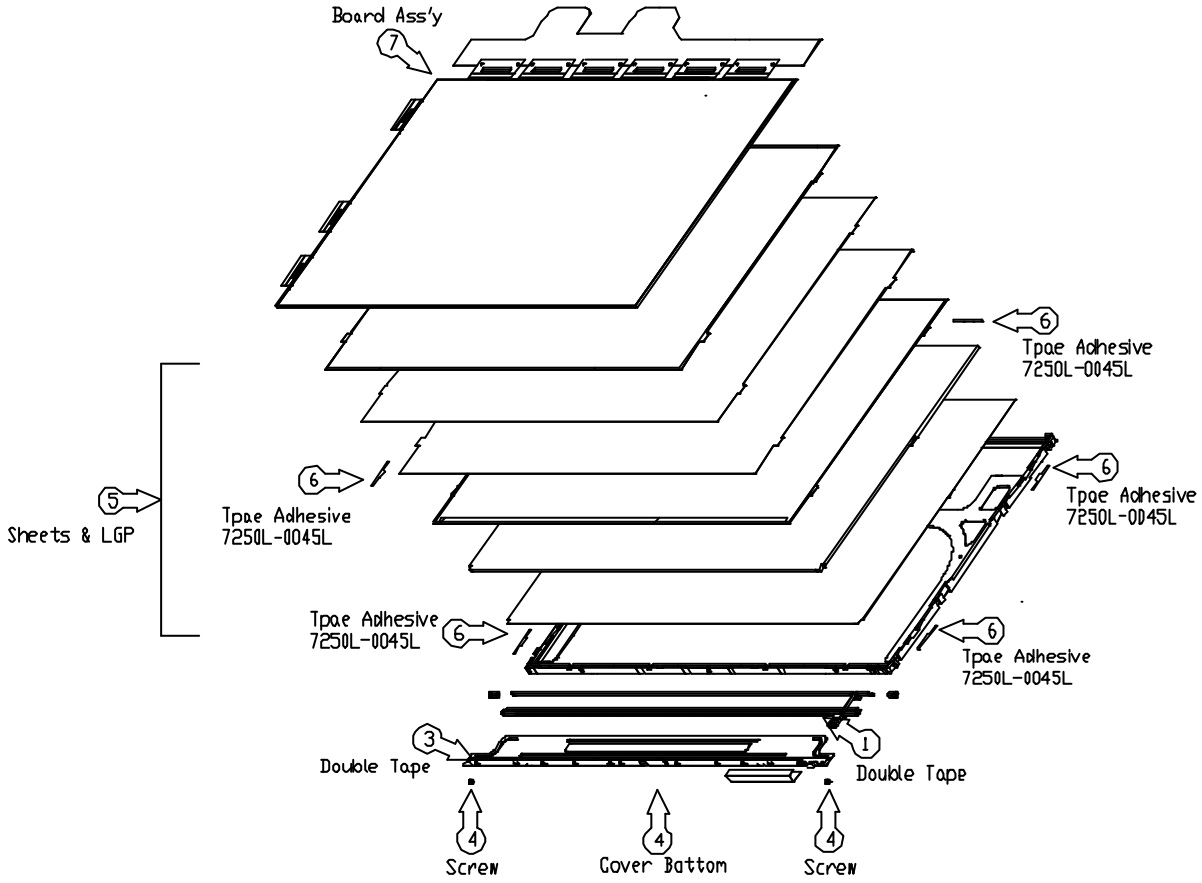
11.5.4. Disassembly of Board Ass'y, Tape Adhesive, Light guide,Cover Ass'y bottom(L)

(1) 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.
(2) Disassembly of Tape Adhesive used for Sheets fixing (5Point).
(3) Disassembly of Sheets, Light guide.
Caution: No penetration of foreign body is indispensable with no scratch on the surface of each Sheets.
(4) Disassembly of Screw and Cover bottom.
Caution: Maximum value of torque with Screw should be below 3.0kgf·cm
Pressure or stress should not be given on Lamp Housing during detaching double tape.
(5) Disassembly of Lamp Ass'y
Caution: Pressure or stress should not be given on Lamp Ass'y during detaching double tape.



11.5.5. Assembly of Cover bottom, Sheets, Light guide, Tape Adhesive, Double Tape and Board Ass'y.

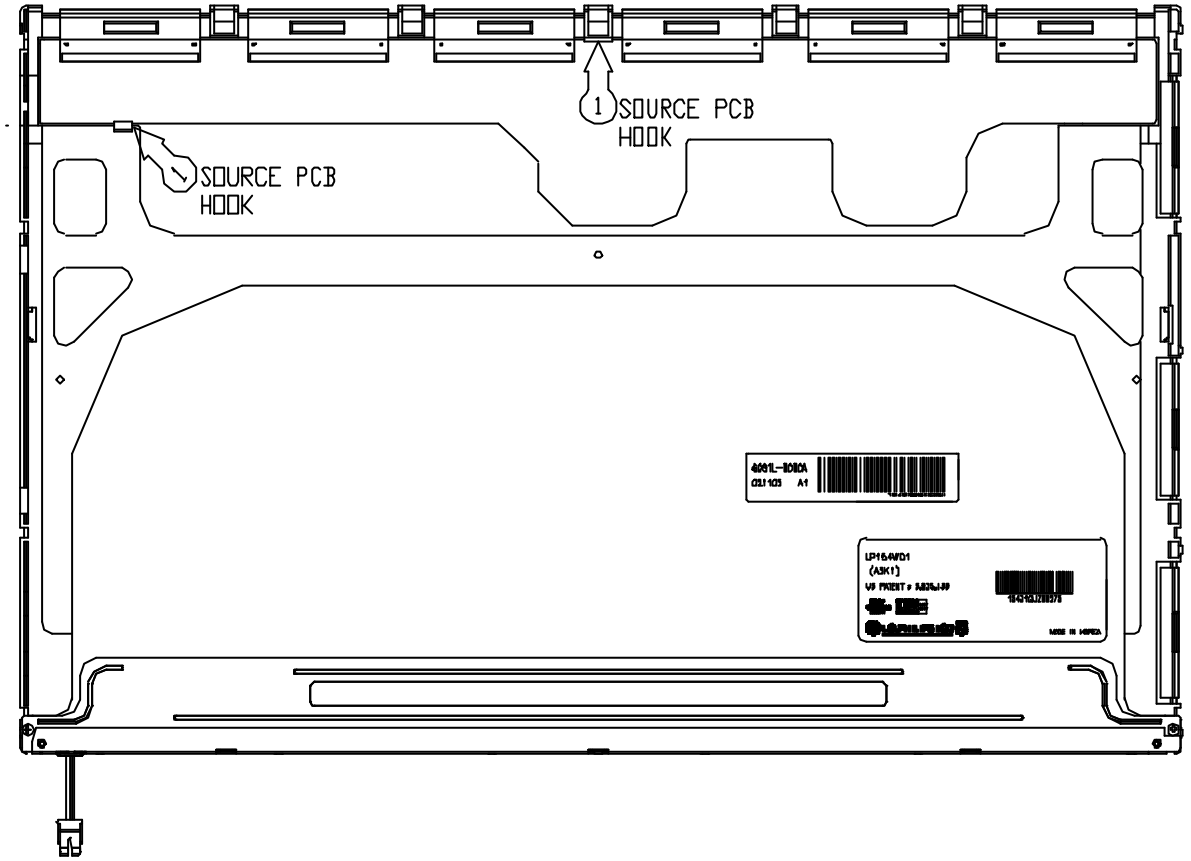
(1) Detach a protect film from Double Tape at the Lamp Ass'y
(2) Attach the Lamp Ass'y to the Support Main.
(3) Detach a protect film from Double Tape at the inside of Cover Bottom.
(4) Assembly the Cover Bottom and Screw to the Support Main.
Caution: Maximum value of torque with Screw should be below 3.0kgf·cm
(5) Assembly of Light Guide and Sheets.(Reflector Sheet fixing with one Double Tapes)
Caution: No penetration of foreign body is indispensable with no scratch on the surface of each Sheet and Light guide.
(6) Assembly of Tape adhesive used for Sheets fixing (5Point).
(7) Assembly of Board Ass'y.
Caution: Pressure or stress should not be given on PCB and TCP.



11.5.6. Assembly of Source PCB

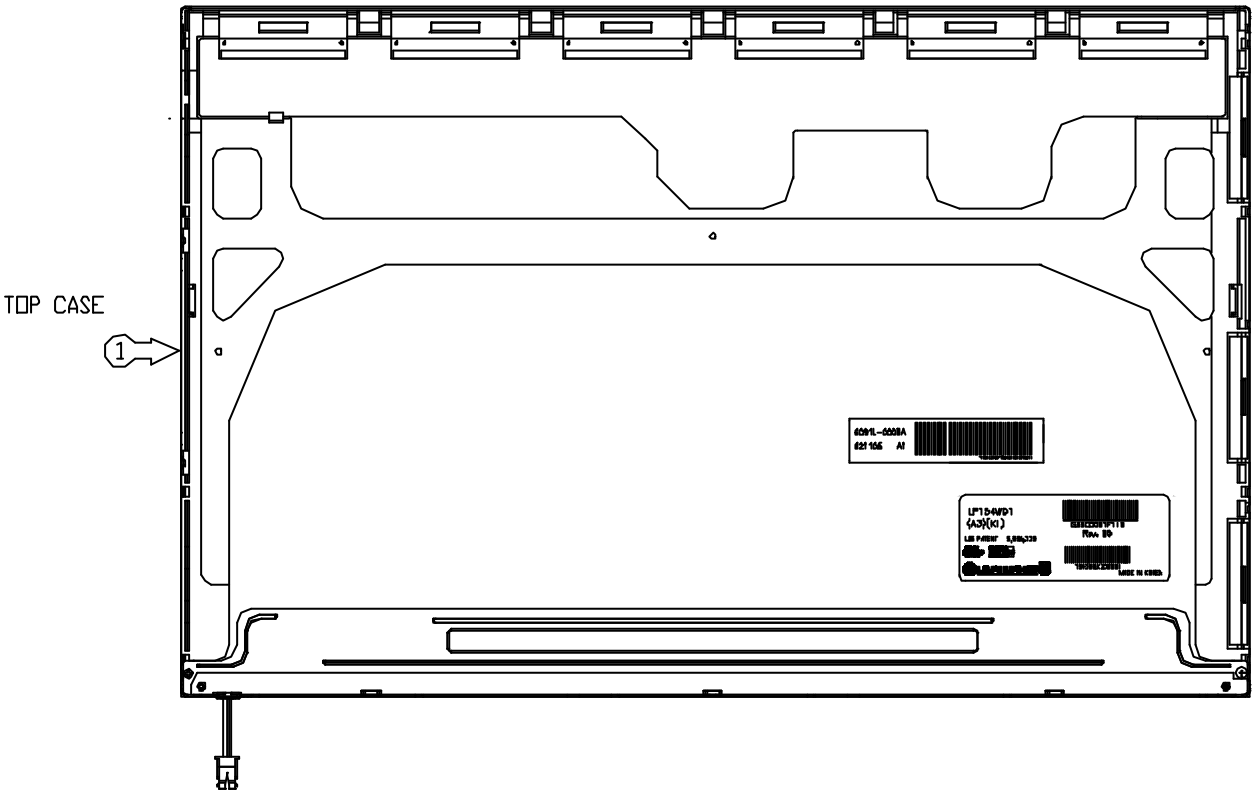
(1) Assembly of Source PCB.

Caution: stress should not be given on TCP during assembling S/M hook



11.5.7. Assembly of Cover Ass'y, Screw, Top Case

(1) ? Assembly of Top Case .
Caution: Pressure should not be given on Gate COF.



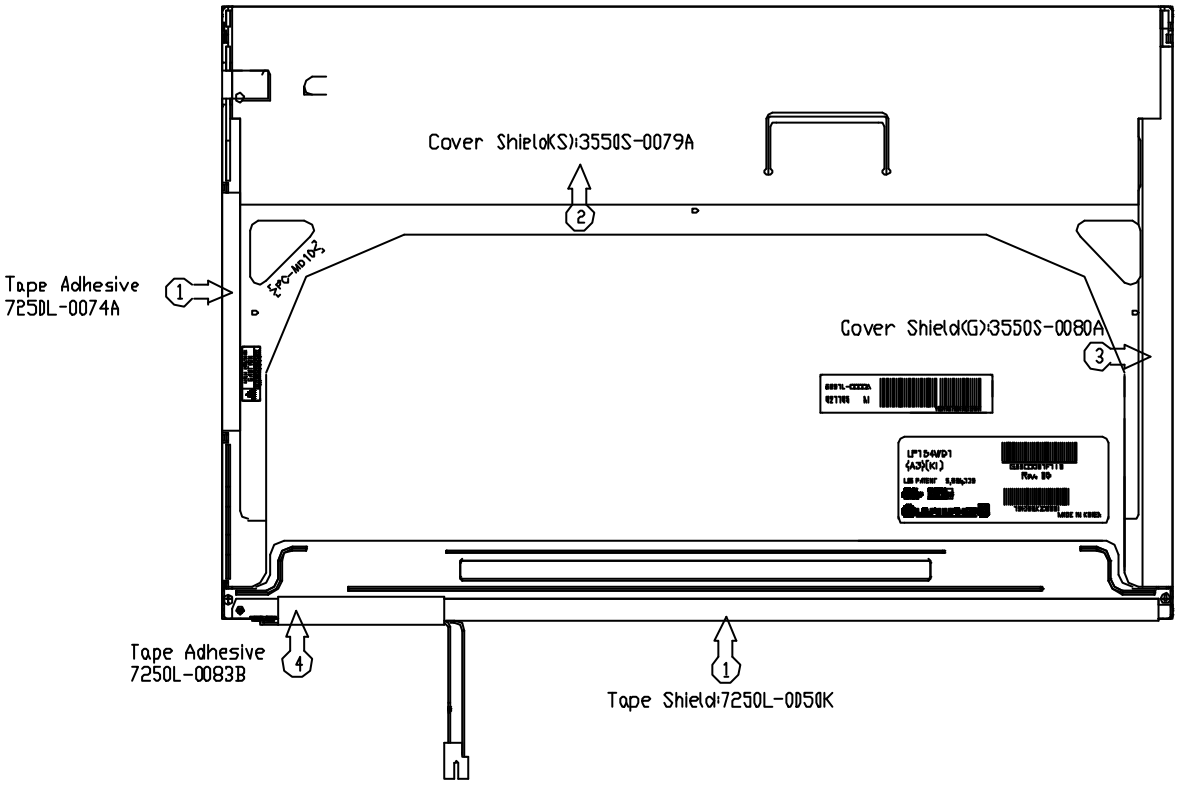
11.5.8. Assembly of outside Tape and Cover shield

(1) Assembly of Tape shield and Tape Adhesive used for Top case fixing
Caution: Pressure or stress should not be given on Top case during this process

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

(3) Assembly of Cover shield(G)
Caution: Pressure or stress should not be given on Gate COF.

(4) Assembly of Tape adhesive used for B/L Wire fixing
Caution: Pressure or stress should not be given on B/L Wire.



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 polalizer 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 wist 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.