SPECIFICATION
FOR
APPROVAL

(◆) **Preliminary Specification**
( ) **Final Specification**

Title	15.6” Full HD TFT LCD

Customer	
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LP156WF4
Suffix	SPK1

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

APPROVED BY	SIGNATURE
/	
/	
/	

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

APPROVED BY	SIGNATURE
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S. Y. Kim / Engineer S. H. Jung / Engineer	

Products Engineering Dept.
LG Display Co., Ltd

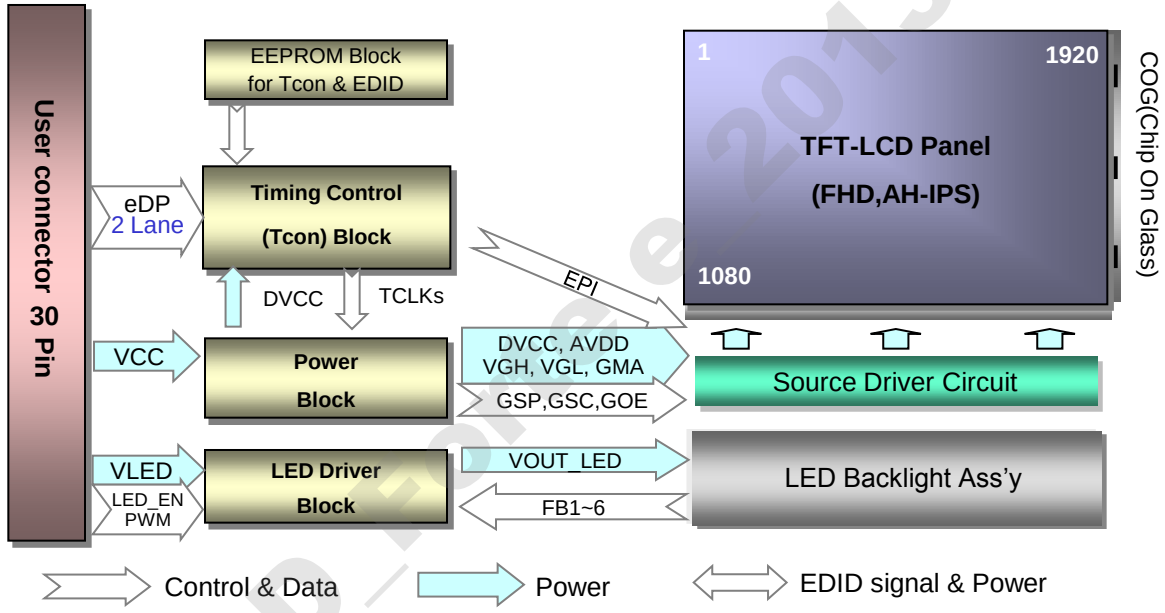
Contents

RECORD OF REVISIONS

Revision No	Revision Date	Page	Description	EDID ver.
0.0	Feb., 23, 2013	-	Preliminary Specification	V0.0
0.1	Apr., 29, 2013	29 ~ 31	Update EDID	V0.2

1. General Description

The LP156WF4 is a Color Active Matrix Liquid Crystal Display with an integral LED backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive type display operating in the normally black mode. This TFT-LCD has 15.6 inches diagonally measured active display area with FHD resolution (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors. The LP156WF4 has been designed to apply the interface method that enables low power, high speed, low EMI. The LP156WF4 is intended to support applications where thin thickness, low power are critical factors and graphic displays are important. In combination with the vertical arrangement of the sub-pixels, the LP156WF4 characteristics provide an excellent flat display for office automation products such as Notebook PC.



General Features

Active Screen Size	15.6 inches diagonal
Outline Dimension	359.5 (H, Typ.) × 223.8 (V, Typ.) × 3.2 (D, Max.) [mm] (with Bracket & PCB Board)
Pixel Pitch	0.17925 mm x 0.17925 mm
Pixel Format	1920 horiz. By 1080 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	300 cd/m^2 (Typ. 5 point)
Power Consumption	Total 5.7W (Typ.) Logic : 1.1W (Typ. @ Mosaic), B/L : 4.6W (Typ. @VLED12V)
Weight	350 g (Max.) / 340 g (Typ.)
Display Operating Mode	Normally Black
Surface Treatment	Anti glare treatment of the front Polarizer
RoHS Compliance	Yes
BFR / PVC / As Free	Yes for all

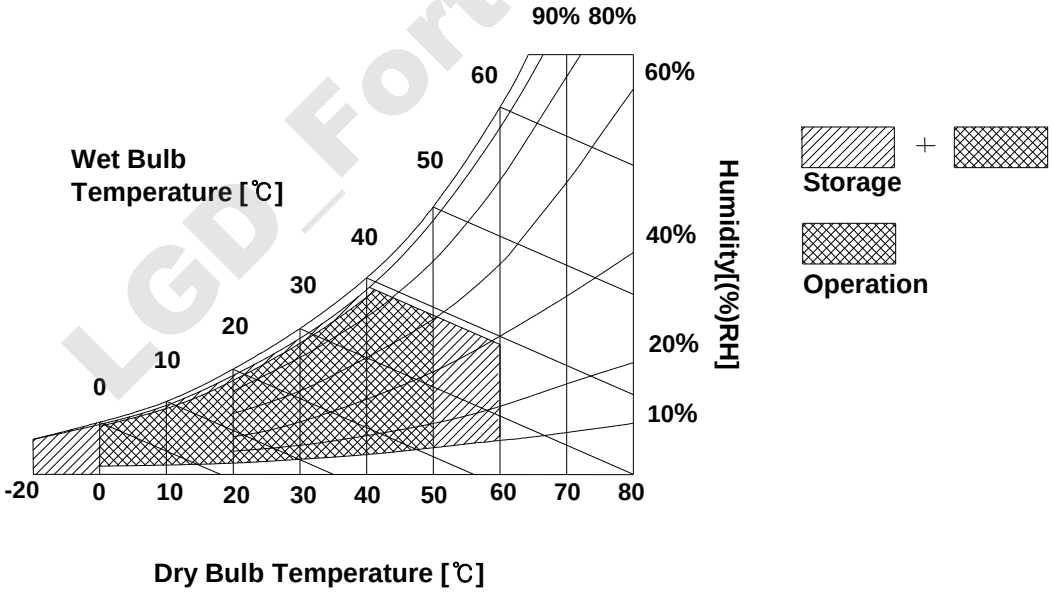
2. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Values		Units	Notes
		Min	Max		
Power Input Voltage	VCC	-0.3	4.0	Vdc	at 25 ± 5°C
Operating Temperature	TOP	0	50	°C	1
Storage Temperature	HST	-20	60	°C	1
Operating Ambient Humidity	HOP	10	90	%RH	1
Storage Humidity	HST	10	90	%RH	1

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. Storage Condition is guaranteed under packing condition.



3. Electrical Specifications

3-1. Electrical Characteristics

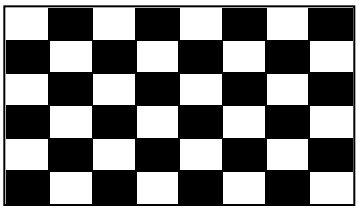
The LP156WF4 requires two power inputs. The first logic is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second backlight is the input about LED BL with LED Driver.

Table 2. ELECTRICAL CHARACTERISTICS

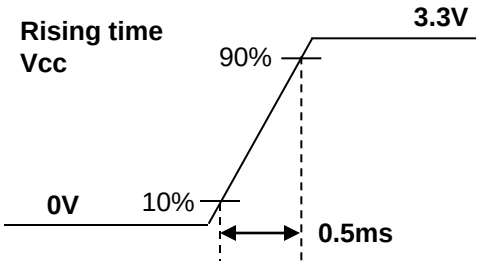
Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
LOGIC :						
Power Supply Input Voltage	V_{CC}	3.0	3.3	3.6	V	1
Power Supply Input Current Mosaic	I_{CC}	-	330	390	mA	2
Power Consumption	P_{CC}	-	1.1	1.3	W	2
Power Supply Inrush Current	I_{CC_P}	-	-	1500	mA	3
Differential Impedance	Z_m	90	100	110	Ω	4
BACKLIGHT : (with LED Driver)						
LED Power Input Voltage	V_{LED}	6.0	12.0	21.0	V	5
LED Power Input Current	I_{LED}	-	380	390	mA	6
LED Power Consumption	P_{LED}	-	4.5	4.6	W	6
LED Power Inrush Current	I_{LED_P}	-	-	1500	mA	7
PWM Duty Ratio		5	-	100	%	8
PWM Jitter	-	0	-	0.2	%	9
PWM Impedance	Z_{PWM}	20	40	60	kΩ	
PWM Frequency	F_{PWM}	200	-	1000	Hz	10
PWM High Level Voltage	V_{PWM_H}	3.0	-	5.3	V	
PWM Low Level Voltage	V_{PWM_L}	0	-	0.3	V	
LED_EN Impedance	Z_{PWM}	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	-	0.3	V	
Life Time		15,000	-	-	Hrs	11

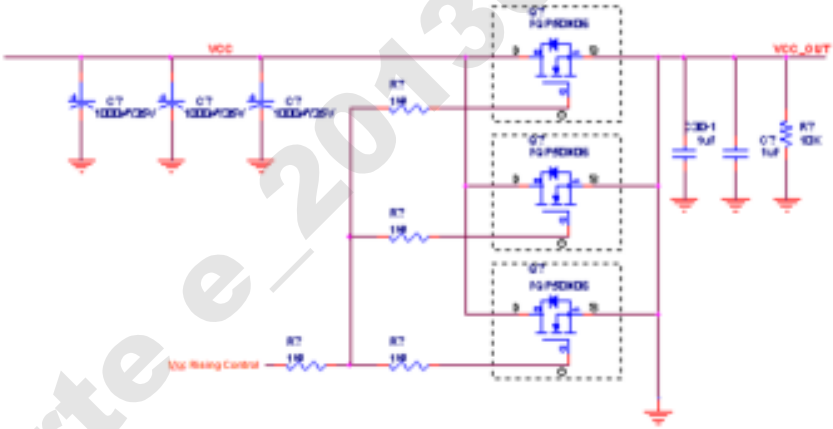
Note)

1. The measuring position is the connector of LCM and the test conditions are under 25℃, fv = 60Hz, Black pattern.
2. The specified Icc current and power consumption are under the Vcc = 3.3V , 25℃, fv = 60Hz condition and Mosaic pattern.

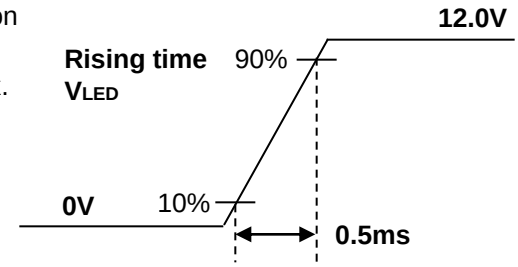


2. This Spec. is the max load condition for the cable impedance designing.
3. The below figures are the measuring Vcc condition and the Vcc control block LGD used. The Vcc condition is same as the minimum of T1 at Power on sequence.





4. This impedance value is needed for proper display and measured form eDP Tx to the mating connector.
5. The measuring position is the connector of LCM and the test conditions are under 25℃.
6. The current and power consumption with LED Driver are under the Vled = 12.0V , 25℃, Dimming of Max luminance and White pattern with the normal frame frequency operated(60Hz).
7. The below figures are the measuring Vled condition and the Vled control block LGD used. VLED control block is same with Vcc control block.

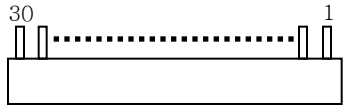


8. The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.
9. If Jitter of PWM is bigger than maximum, it may induce flickering.
10. This Spec. is not effective at 100% dimming ratio as an exception because it has DC level equivalent to 0Hz. In spite of acceptable range as defined, the PWM Frequency should be fixed and stable for more consistent brightness control at any specific level desired.
11. The life time is determined as the time at which brightness of LCD is 50% compare to that of minimum value specified in table 7. under general user condition.

3-2. Interface Connections

This LCD employs two interface connections, a 30 pin connector used for the module electronics interface and the other connector used for the integral backlight system.

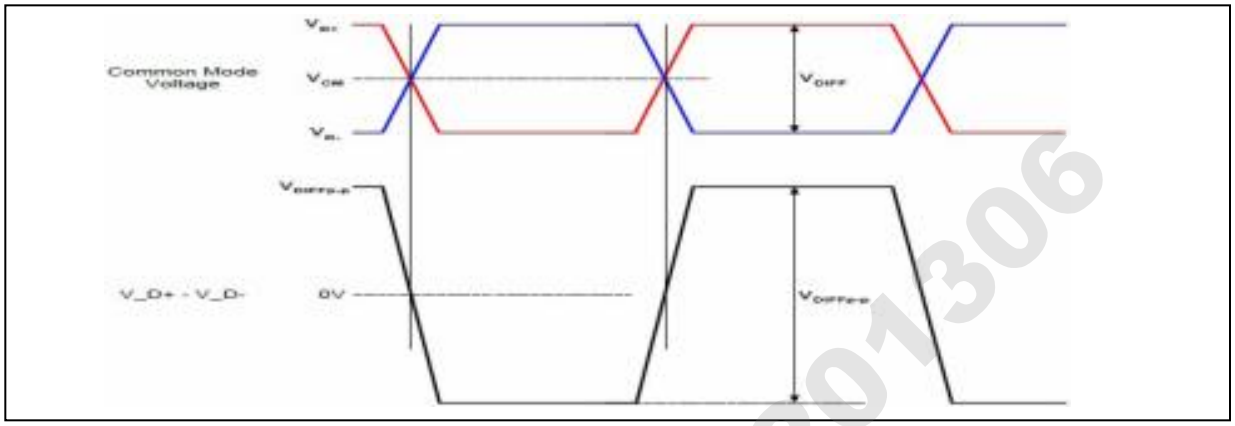
Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin	Symbol	Description	Notes
1	NC	No Connection	**[Interface Chip]** 1. LCD : Analogix, ANX2804 (LCD Controller Including eDP Receiver. 2. System : TBD or equivalent * Pin to Pin compatible with eDP **[Connector]** KN38B-30S-0.5H, HIROSE, 30, 0.5 or its compatibles **[Connector pin arrangement]**  [LCD Module Rear View]
2	GND	High Speed (Main Link) Ground	
3	Lane1_N	Complement Signal-Lane 1	
4	Lane1_p	True Signal-Main Lane 1	
5	GND	High Speed (Main Link) Ground	
6	Lane0_N	Complement Signal-Lane 0	
7	Lane0_p	True Signal-Main Lane 0	
8	GND	High Speed (Main Link) Ground	
9	AUX_P	True Signal-Auxiliary Channel	
10	AUX_N	Complement Signal-Auxiliary Channel	
11	GND	High Speed (Main Link) Ground	
12	VCC	LCD Logic and driver power (3.3V Typ.)	
13	VCC	LCD Logic and driver power (3.3V Typ.)	
14	BIST	LCD Panel Self Test	
15	GND	LCM Ground	
16	GND	LCM Ground	
17	HPD	HPD signal pin	
18	GND	LCM Ground (LED Backlight Ground)	
19	GND	LCM Ground (LED Backlight Ground)	
20	GND	LCM Ground (LED Backlight Ground)	
21	GND	LCM Ground (LED Backlight Ground)	
22	LED_EN	LED Backlight On/Off	
23	PWM	System PWM Signal input for dimming	
24	NC	No Connection	
25	NC	No Connection	
26	VLED	LED Backlight Power (6.0V-21V)	
27	VLED	LED Backlight Power (6.0V-21V)	
28	VLED	LED Backlight Power (6.0V-21V)	
29	VLED	LED Backlight Power (6.0V-21V)	
30	NC	No Connection	

3-3. eDP Signal Timing Specifications

3-3-1. DC Specification

The VESA Display Port related AC specification is compliant with the VESA Display Port Standard v1.1a.



Description	Symbol	Min	Max	Unit	Notes
Differential peak-to-peak Input voltage	VDIFF p-p	120	-	mV	For high bit rate
		40	-		For reduced bit rate
Rx DC common mode voltage	VCM	0	2.0	V	-

3-3-2. AC Specification

The VESA Display Port related AC specification is compliant with the VESA Display Port Standard v1.1a.

Description	Symbol	Min	Typ	Max	Unit	Notes
Unit Interval for high bit rate (2.7Gbps/lane)	UI_High_Rate	-	370	-	ps	Range is nominal ±350ppm. DisplayPort Link Rx does not require local crystal for link clock generation
Unit Interval for high bit rate (1.62Gbps/lane)	UI_Low_Rate	-	617	-	ps	
Lane-to-Lane skew	V Rx-SKEW-INTER_PAIR	-	-	5200	ps	-
Lane intra-pair skew	V Rx-SKEW-INTRA_PAIR	-	-	100	ps	For high bit rate
		-	-	300	ps	For reduced bit rate

3-4. Signal Timing Specifications

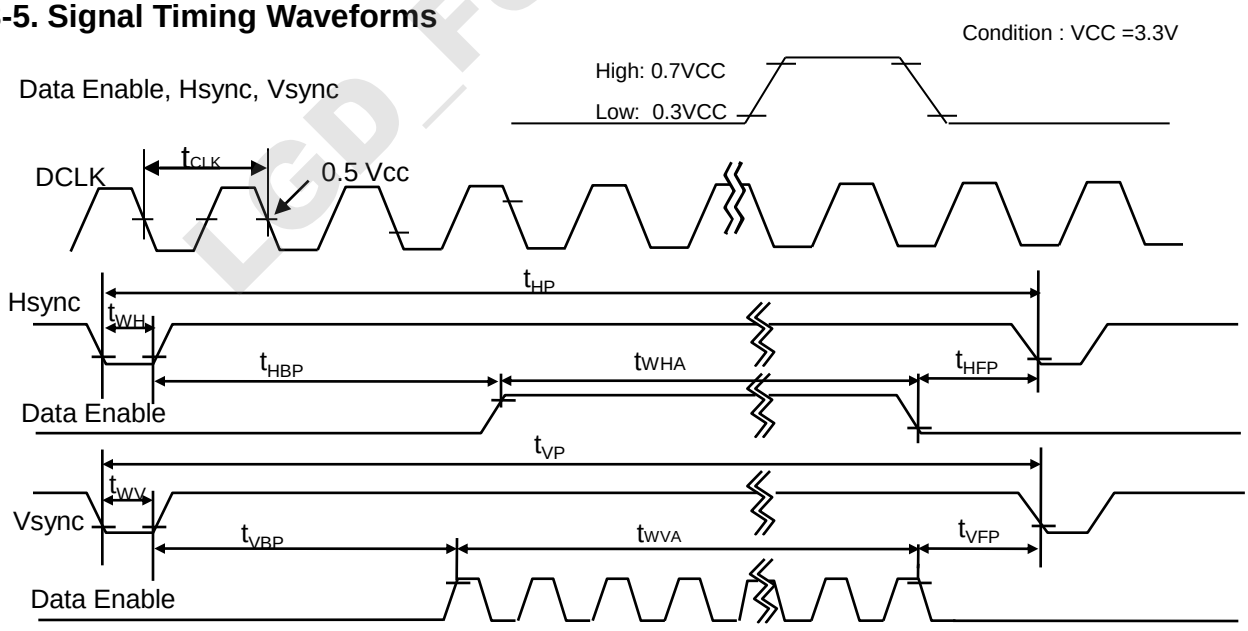
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of eDP Tx/Rx for its proper operation.

Table 6. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	-	138.7	-	MHz	eDP 2 Lane
Hsync	Period	t_{HP}	-	2080	-	tCLK	
	Width	t_{WH}	-	32	-		
	Width-Active	t_{WHA}	-	1920	-		
Vsync	Period	t_{VP}	-	1111	-	tHP	
	Width	t_{WV}	-	5	-		
	Width-Active	t_{WVA}	-	1080	-		
Data Enable	Horizontal back porch	t_{HBP}	-	80	-	tCLK	
	Horizontal front porch	t_{HFP}	-	48	-		
	Vertical back porch	t_{VBP}	-	23	-	tHP	
	Vertical front porch	t_{VFP}	-	3	-		

Appendix) all reliabilities are specified for timing specification based on refresh rate of 60Hz. However, LP156WF4 has a good actual performance even at lower refresh rate (e.g. 40Hz or 50Hz) for power saving mode, whereas LP156WF4 is secured only for function under lower refresh rate. 60Hz at Normal mode, 50Hz, 40Hz at Power save mode. Don't care Flicker level (power save mode).

3-5. Signal Timing Waveforms



3-6. Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color ; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

Table 5. COLOR DATA REFERENCE

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

3-7. Power Sequence

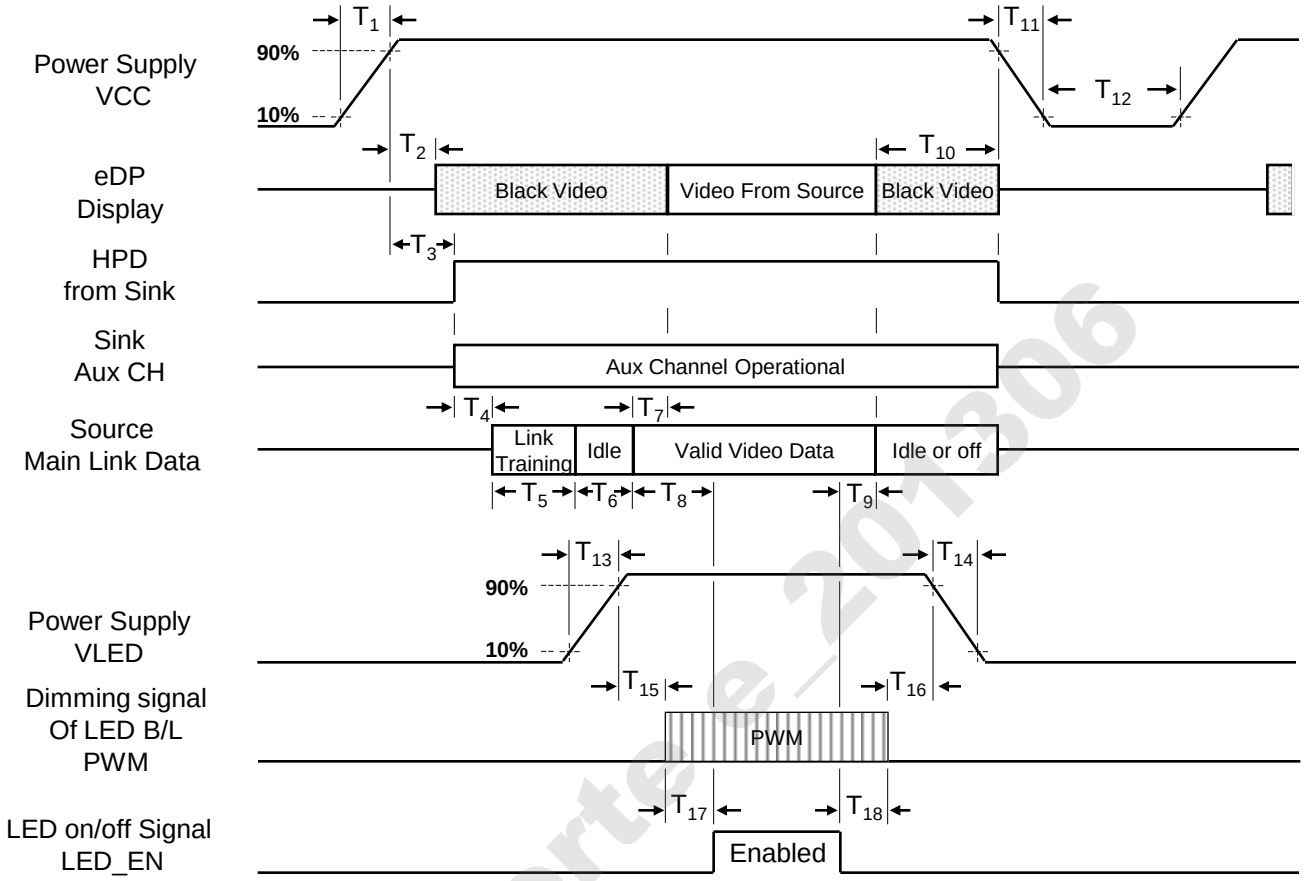


Table 6. POWER SEQUENCE TABLE

Timing	Required By	Limits		Units	Notes
		Min	Max		
T_1	Source	0.5	10	ms	-
T_2	Sink	0	200	ms	-
T_3	Sink	0	200	ms	-
T_4	Source	-	-	ms	-
T_5	Source	-	-	ms	-
T_6	Source	-	-	ms	-
T_7	Sink	0	50	ms	-
T_8	Source	-	-	ms	LGD recommend Min 200ms
T_9	Source	-	-	ms	-

Timing	Required By	Limits		Units	Notes
		Min	Max		
T_{10}	Source	0	500	ms	-
T_{11}	Source	-	10	ms	-
T_{12}	Source	500	-	ms	
T_{13}	Source	0.5	10	ms	-
T_{14}	Source	0.5	10	ms	-
T_{15}	Source	10	-	ms	-
T_{16}	Source	10	-	ms	-
T_{17}	Source	0	-	ms	-
T_{18}	Source	0	-	ms	-

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

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and Θ equal to 0°.
FIG. 1 presents additional information concerning the measurement equipment and method.

FIG. 1 Optical Characteristic Measurement Equipment and Method

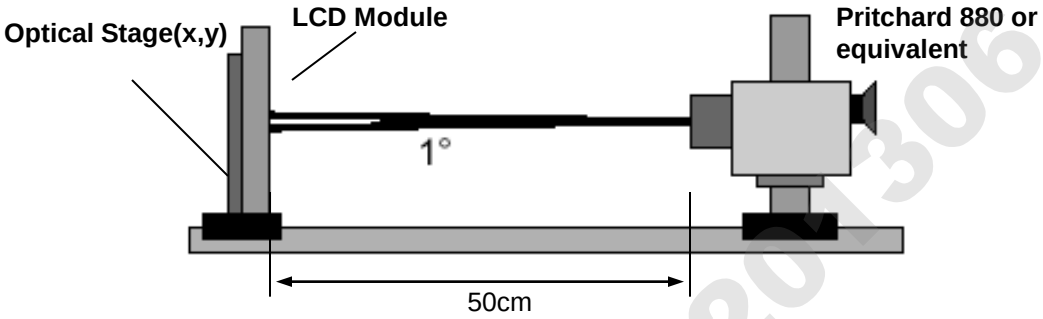


Table 9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 138.7MHz

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	400	700	-		1
Surface Luminance, white	L_{WH}	255	300	-	cd/m^2	2
Luminance Variation	δ_{WHITE}	-	1.4	1.6		3
Response Time	$Tr_R + Tr_D$	-	35	50	ms	4
Color Coordinates						
RED	RX	TBD	TBD	TBD		
	RY	TBD	TBD	TBD		
GREEN	GX	TBD	TBD	TBD		
	GY	TBD	TBD	TBD		
BLUE	BX	TBD	TBD	TBD		
	BY	TBD	TBD	TBD		
WHITE	WX	TBD	TBD	TBD		
	WY	TBD	TBD	TBD		
Viewing Angle						5
x axis, right(Φ=0°)	Θr	80		-	degree	
x axis, left (Φ=180°)	Θl	80		-	degree	
y axis, up (Φ=90°)	Θu	80		-	degree	
y axis, down (Φ=270°)	Θd	80		-	degree	
Gray Scale						6

Note)

1. Contrast Ratio (CR) is defined mathematically as

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is the average of 5 point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see FIG 1.

LWH = Average(L1,L2, … L5)

3. The variation in surface luminance , The panel total variation (δ WHITE) is determined by measuring LN at each test position 1 through 13 and then defined as following numerical formula. For more information see FIG 2.

δ WHITE = Maximum(L1,L2, … L13) / Minimum(L1,L2, … L13)

4. Response time is the time required for the display to transition from white to black (rise time, TrR) and from black to white (Decay Time, TrD). For additional information see FIG 3.

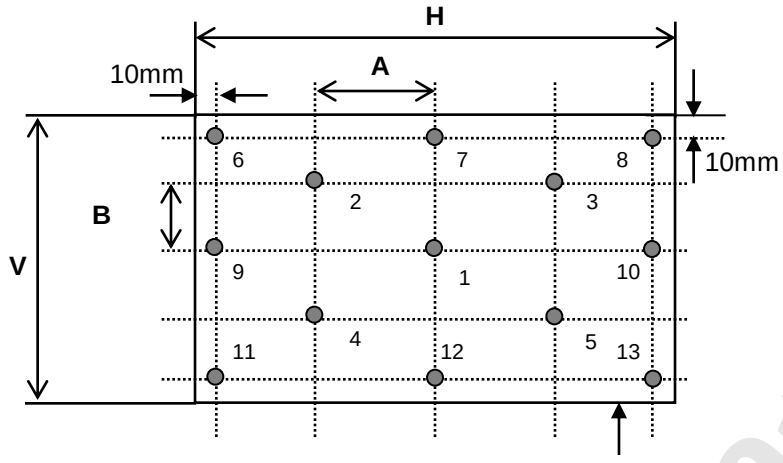
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 4.

6. Gray scale specification * fV = 60Hz

Gray Level	Luminance [%] (Typ)
L0	TBD
L7	TBD
L15	TBD
L23	TBD
L31	TBD
L39	TBD
L47	TBD
L55	TBD
L63	TBD

FIG. 2 Luminance

<Measuring point for Average Luminance & measuring point for Luminance variation>



H,V : ACTIVE AREA
A : H/4 mm
B : V/4 mm
POINTS: 13 POINTS

FIG. 3 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

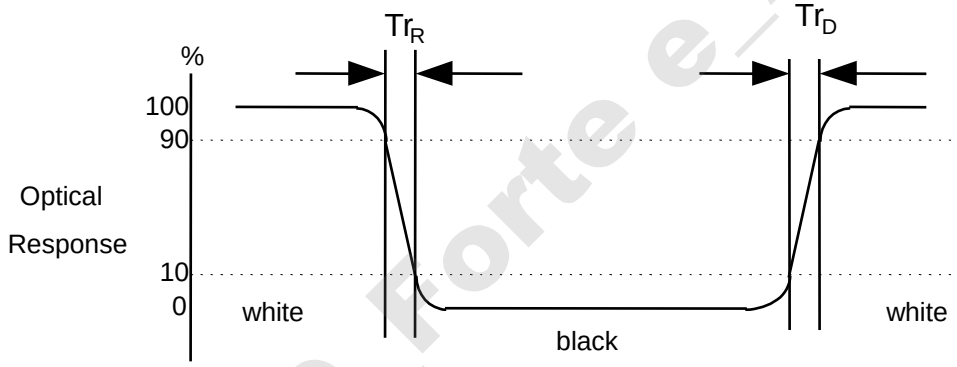
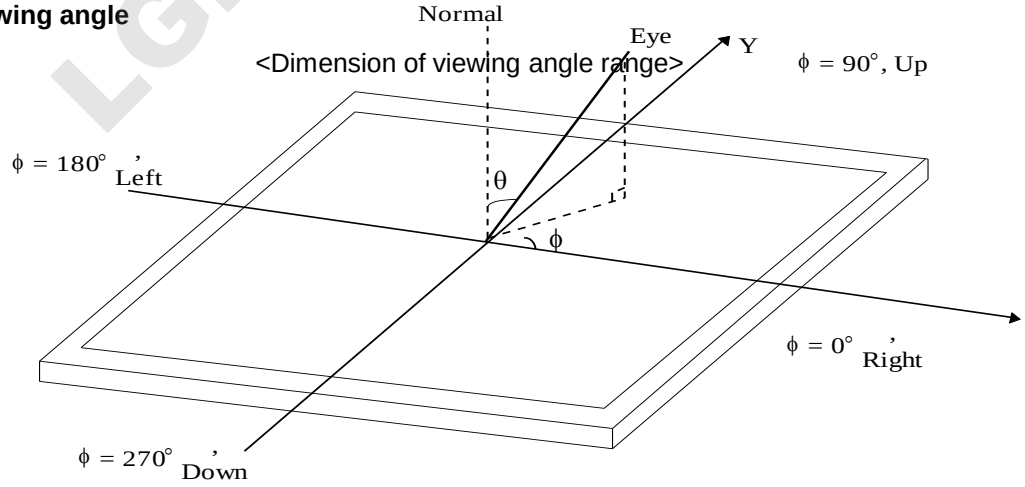


FIG. 4 Viewing angle

<Dimension of viewing angle range>



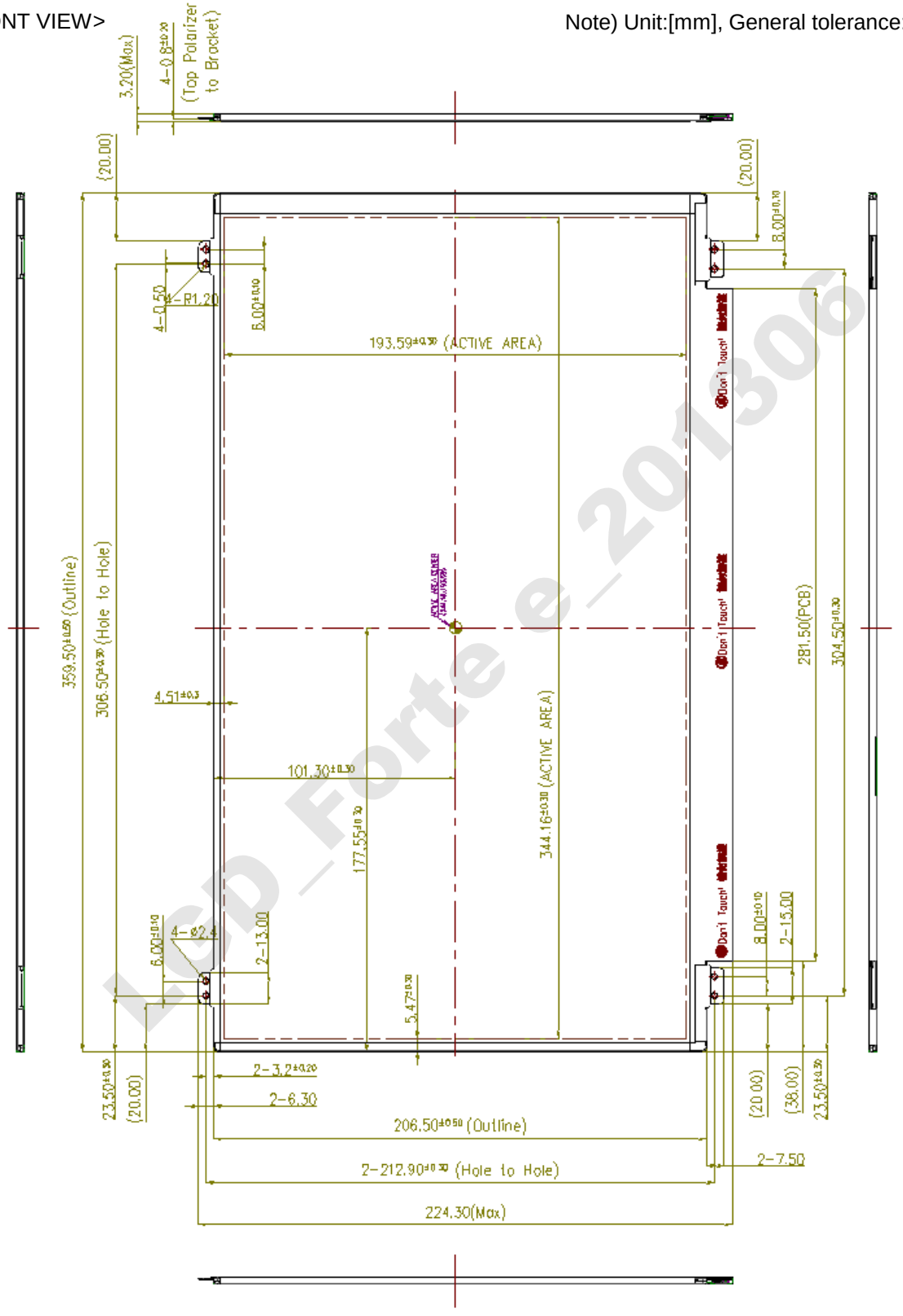
5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP156WF4. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	359.5 ± 0.5mm
	Vertical	223.8 ± 0.5mm (with Bracket & PCB Board)
	Thickness	3.2mm (max.)
Bezel Area	Horizontal	347.6± 0.5mm
	Vertical	196.9± 0.5mm
Active Display Area	Horizontal	344.16±0.3mm
	Vertical	193.59± 0.3mm
Weight	350 g (Max.) / 340 g (Typ.)	
Surface Treatment	Anti-Glare treatment of the front polarizer	

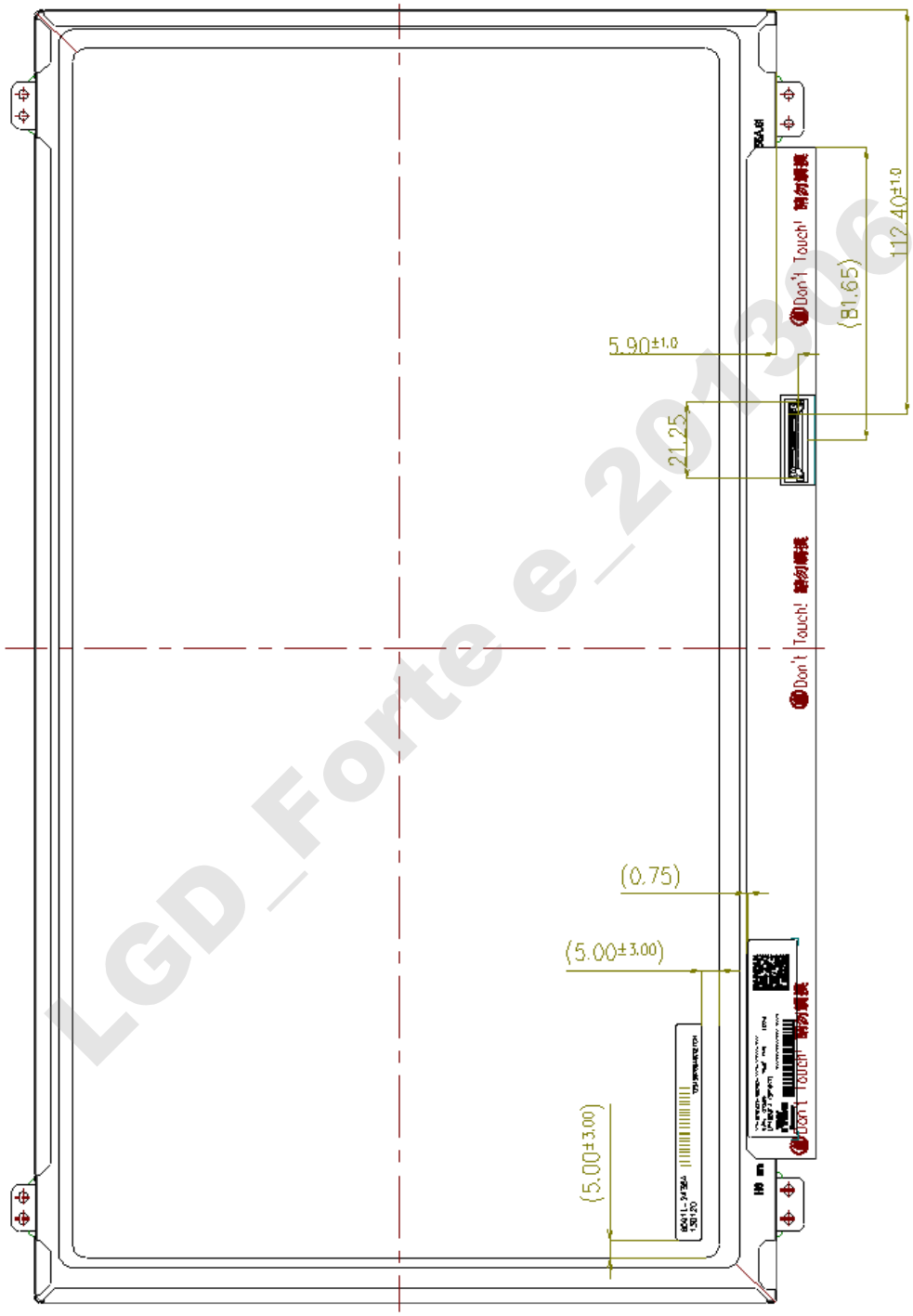
<FRONT VIEW>

Note) Unit:[mm], General tolerance: ± 0.5mm



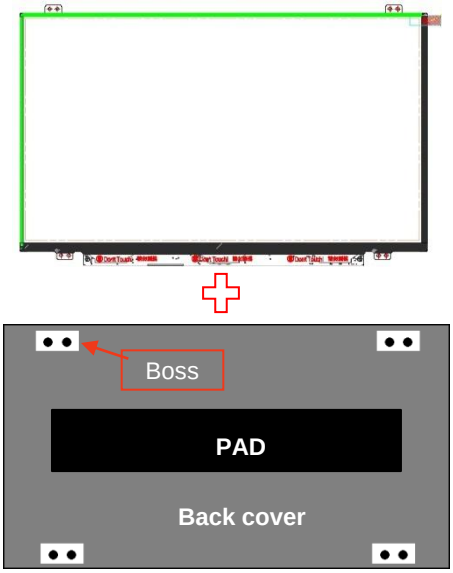
<REAR VIEW>

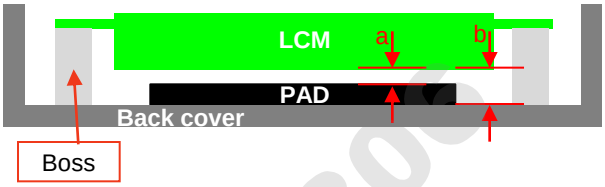
Note) Unit:[mm], General tolerance: ± 0.5mm



LGD Proposal for system cover design.(Appendix)

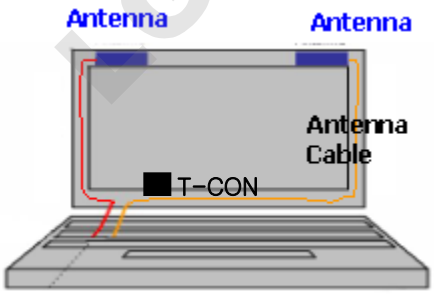
1	**Gap check for securing the enough gap between LCM and System back cover.**



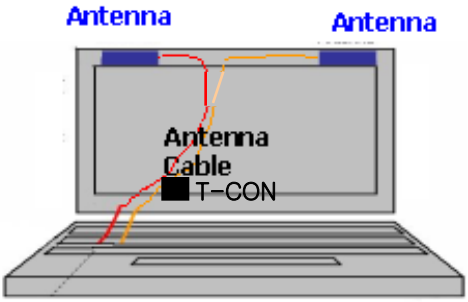


- a : min 0mm
- b : min 0.3mm, Max 1.0mm

Define	1.Rear side of LCM is sensitive against external stress, and previous check about interference is highly needed. 2.In case there is something from system cover comes into the boundary above,mechanical interference may cause the FOS defects. (Eg: Ripple, White spot..)
2	**Check if antenna cable is sufficiently apart from T-CON of LCD Module.**



OK

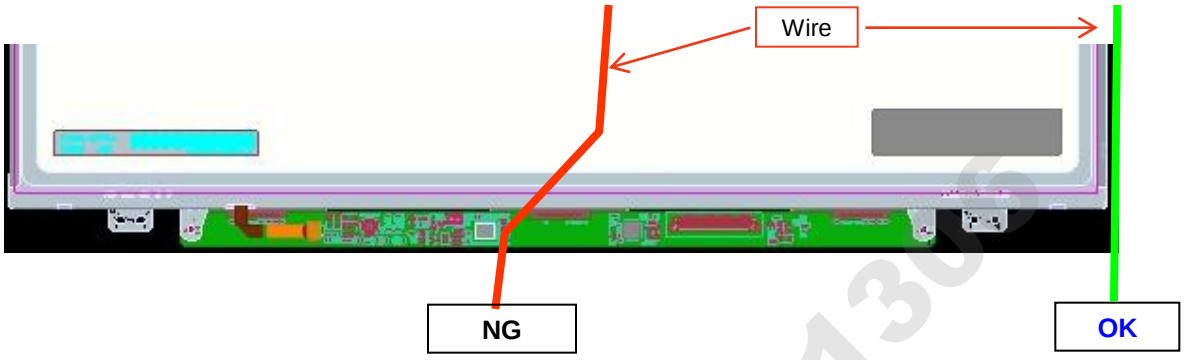


NG

Define	1.If system antenna is overlapped with T-CON,it might be cause the noise

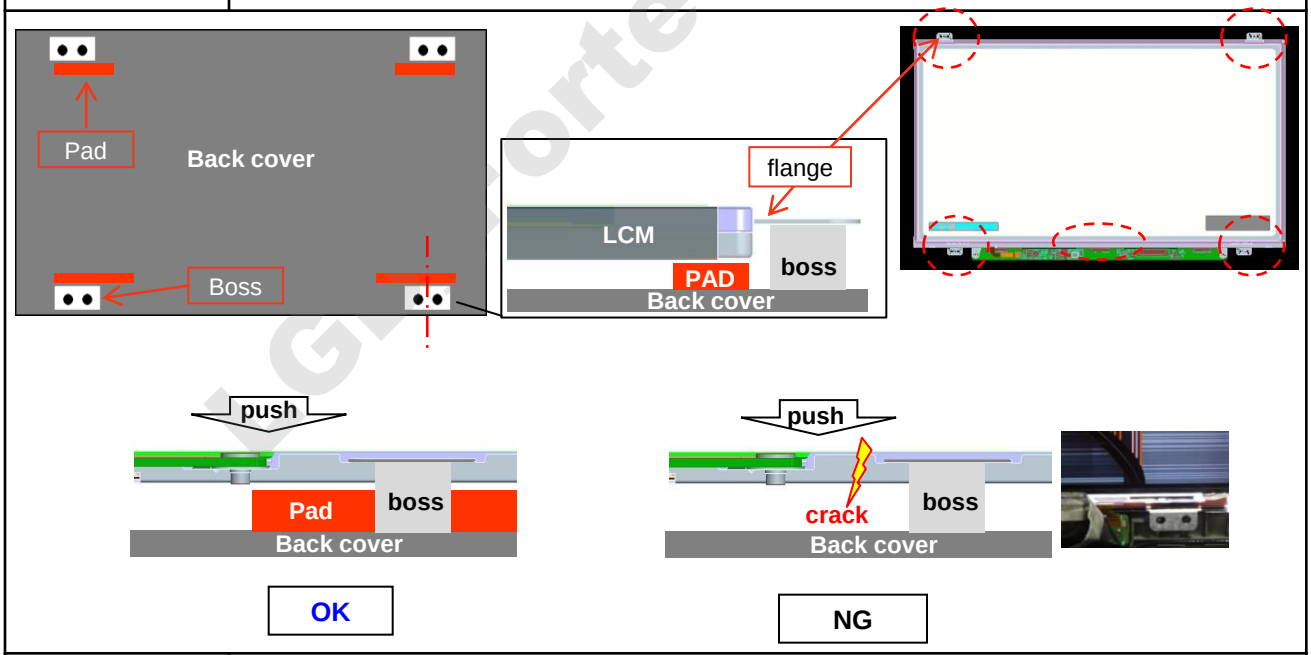
LGD Proposal for system cover design.(Appendix)

3	Checking the path of the System wire



Define	1.If Wire path overlapped with LCM, it is happened white spot, COF problem, etc. 2.OK ➔ Wire path design to system side. NG ➔ Wire path overlapped with LCM.

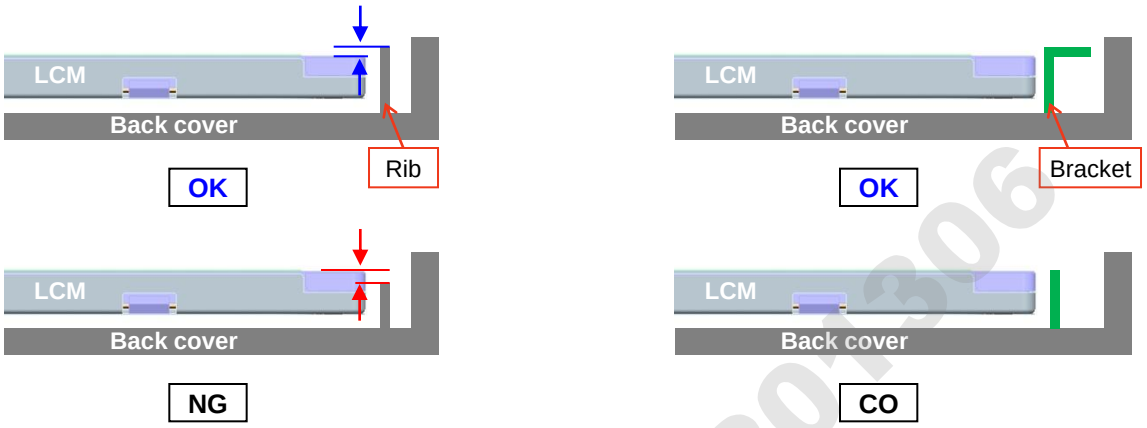
4	Add pad to Prevent panel crack against external load (push)



Define	1. At flat type LCM, panel is easily cracked at flange area during push, assemble. 2. Add pad, it prevent panel crack

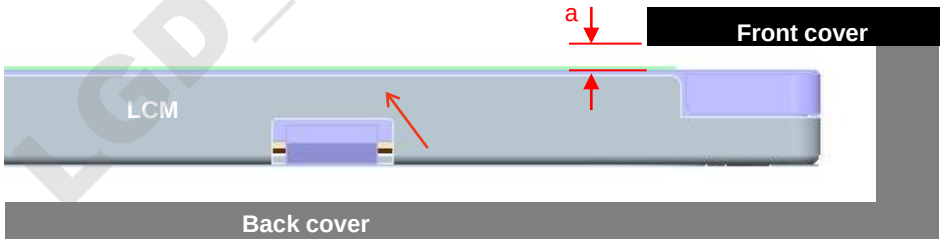
LGD Proposal for system cover design.(Appendix)

5	**Check the rib or Bracket on back cover**



Define	1.It is necessary that the height of back cover rib or bracket is higher than LCM height. It can prevent direct compression of panel at LCM edge. 2.”ㄱ” shape bracket is stronger than “I” shape one.

6	**Check the gap between front cover and LCM(glass)**

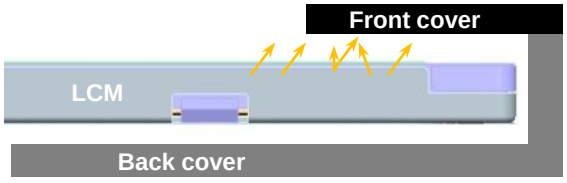


[OK] a ≥ 0.3mm
[CO] 0.3mm ≥ a ≥ 0.1mm
[NG] a ≤ 0.1mm

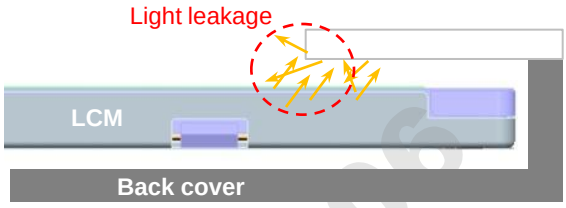
Define	1. Ripple can be happened by little gap between glass and front cover.

LGD Proposal for system cover design.(Appendix)

7	Check the rib or Bracket on back cover



OK



NG

Define	1.If it is possible, shrink to apply front cover of white color. 2. White color can caused light leakage

8	Check the wire position(path)

OK

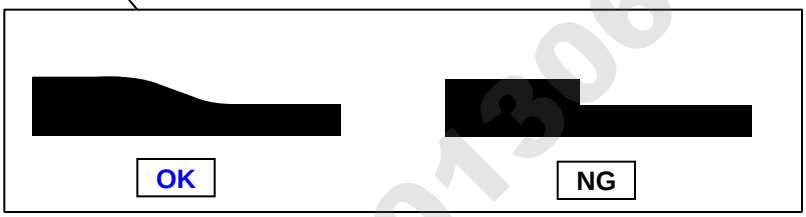
NG

Define	1. It is necessary that wire is posited out of hook, not posited near hook,. 2. If wire is posited near hook, it can be happened assemble error and panel crack during assemble front cover

LGD Proposal for system cover design.(Appendix)

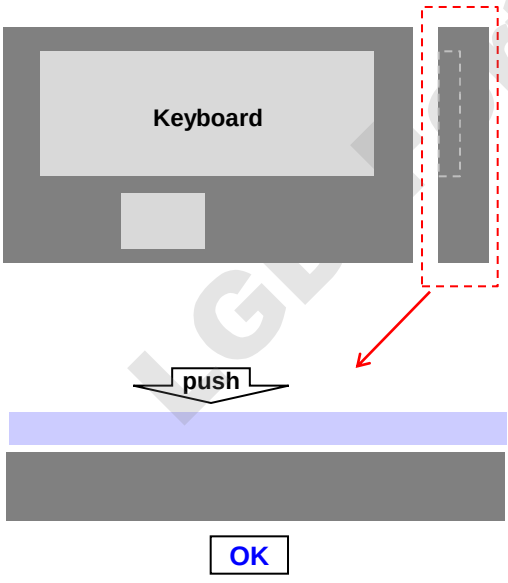
9	Check mouse pad (touch pad) depth and shape of edge

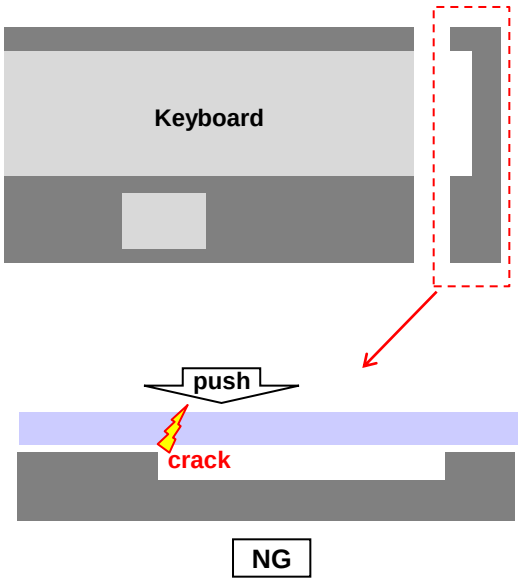
[OK] a ≤ 0.3mm
[CO] 0.5mm ≥ a ≥ 0.3mm
[NG] a ≥ 0.5mm



Define	1.Mouse pad step is deep, it is caused panel crack by external load. 2. The edge shape must be smooth.

10	Check the step of keyboard area





Define	1. The step of keyboard at the side edge of main body, it is caused panel crack

6. Reliability

Environment test condition

No.	Test Item	Conditions
1	High temperature storage test	Ta= 60°C, 240h
2	Low temperature storage test	Ta= -20°C, 240h
3	High temperature operation test	Ta= 50°C, 50%RH, 240h
4	Low temperature operation test	Ta= 0°C, 240h
5	Vibration test (non-operating)	Sine wave, 5 ~ 150Hz, 1.5G, 0.37oct/min 3 axis, 30min/axis
6	Shock test (non-operating)	- No functional or cosmetic defects following a shock to all 6 sides delivering at least 180 G in a half sine pulse no longer than 2 ms to the display module - No functional defects following a shock delivering at least 200 g in a half sine pulse no longer than 2 ms to each of 6 sides. Each of the 6 sides will be shock tested with one each display, for a total of 6 displays
7	Altitude operating storage / shipment	0 ~ 10,000 feet (3,048m) 24Hr 0 ~ 40,000 feet (12,192m) 24Hr

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

7. International Standards

7-1. Safety

a) UL 60950-1, Underwriters Laboratories Inc.
Information Technology Equipment - Safety - Part 1 : General Requirements.
b) CAN/CSA-C22.2 No. 60950-1-07, Canadian Standards Association.
Information Technology Equipment - Safety - Part 1 : General Requirements.
c) EN 60950-1, European Committee for Electrotechnical Standardization (CENELEC).
Information Technology Equipment - Safety - Part 1 : General Requirements.
d) IEC 60950-1, The International Electrotechnical Commission (IEC).
Information Technology Equipment - Safety - Part 1 : General Requirements

7-2. Environment

a) RoHS, Directive 2011/65/EU of the European Parliament and of the council of 8 June 2011

8. Packing

8-1. Designation of Lot Mark

a) Lot Mark

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

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

Note

1. YEAR

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mark	A	B	C	D	E	F	G	H	J	K

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.

8-2. Packing Form

a) Package quantity in one box : 20pcs

b) Box Size : 355 X 468 X 310

9. PRECAUTIONS

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

9-1. 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 the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.
(4) You should adopt radiation structure to satisfy the temperature specification.
(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
(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 soaks 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.
(10) When handling the LCD module, it needs to handle with care not to give mechanical stress to the PCB and Mounting Hole area."

9-2. OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=± 200mV(Over and under shoot voltage)

(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

9-3. ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5. STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.

9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

(1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
(2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.
Please carefully peel off the protection film without rubbing it against the polarizer.
(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

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

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
Header	0	**00**	Header	**00**	00000000
	1	**01**	Header	**FF**	11111111
	2	**02**	Header	**FF**	11111111
	3	**03**	Header	**FF**	11111111
	4	**04**	Header	**FF**	11111111
	5	**05**	Header	**FF**	11111111
	6	**06**	Header	**FF**	11111111
	7	**07**	Header	**00**	00000000
Vendor / Product EDID Version	8	**08**	ID Manufacture Name LGD	**30**	00110000
	9	**09**	ID Manufacture Name	**E4**	11100100
	10	**0A**	ID Product Code 040Eh	**0E**	00001110
	11	**0B**	(Hex. LSB first)	**04**	00000100
	12	**0C**	ID Serial No. - Optional ("00h" If not used, Number Only and LSB First)	**00**	00000000
	13	**0D**	ID Serial No. - Optional ("00h" If not used, Number Only and LSB First)	**00**	00000000
	14	**0E**	ID Serial No. - Optional ("00h" If not used, Number Only and LSB First)	**00**	00000000
	15	**0F**	ID Serial No. - Optional ("00h" If not used, Number Only and LSB First)	**00**	00000000
	16	**10**	Week of Manufacture - Optinal 00 weeks	**00**	00000000
	17	**11**	Year of Manufacture 2013 years	**17**	00010111
	18	**12**	EDID structure version # = 1	**01**	00000001
	19	**13**	EDID revision # = 4	**04**	00000100
Display Parameters	20	**14**	Video input Definition = Input is a Digital Video signal Interface , Colo Bit Depth : 6 Bits per Primary Color , Digital Video Interface Standard Supported: DisplayPort is supported	**95**	10010101
	21	**15**	Horizontal Screen Size (Rounded cm) = 35 cm	**23**	00100011
	22	**16**	Vertical Screen Size (Rounded cm) = 19 cm	**13**	00010011
	23	**17**	Display Transfer Characteristic (Gamma) = (gamma*100)-100 = Example:(2.2*100)-100=120	**78**	01111000
	24	**18**	Feature Support [Display Power Management(DPM) : Standby Mode is supported, Suspend Mode is not supported, Active Off = Very Low Power is supported ,Supportted Color Encoding Formats : RGB 4:4:4 & YCrCb 4:4:4 ,Other Feature Support Flags : No_sRGB, Preferred Timing Mode, No_Display is continuous frequency (Multi-mode_Base EDID and Extension Block).]	**EA**	11101010
Panel Color Coordinates	25	**19**	Red/Green Low Bits (RxRy/GxGy)	**86**	10000110
	26	**1A**	Blue/White Low Bits (BxBy/WxWy)	**25**	00100101
	27	**1B**	Red X Rx = 0.635	**A2**	10100010
	28	**1C**	Red Y Ry = 0.352	**5A**	01011010
	29	**1D**	Green X Gx = 0.333	**55**	01010101
	30	**1E**	Green Y Gy = 0.631	**A1**	10100001
	31	**1F**	Blue X Bx = 0.156	**28**	00101000
	32	**20**	Blue Y By = 0.045	**0B**	00001011
	33	**21**	White X Wx = 0.313	**50**	01010000
	34	**22**	White Y Wy = 0.329	**54**	01010100
Established Timing	35	**23**	Established timing 1 (Optional_00h if not used)	**00**	00000000
	36	**24**	Established timing 2 (Optional_00h if not used)	**00**	00000000
	37	**25**	Manufacturer's timings (Optional_00h if not used)	**00**	00000000
Standard Timing ID	38	**26**	Standard timing ID1 (Optional_01h if not used)	**01**	00000001
	39	**27**	Standard timing ID1 (Optional_01h if not used)	**01**	00000001
	40	**28**	Standard timing ID2 (Optional_01h if not used)	**01**	00000001
	41	**29**	Standard timing ID2 (Optional_01h if not used)	**01**	00000001
	42	**2A**	Standard timing ID3 (Optional_01h if not used)	**01**	00000001
	43	**2B**	Standard timing ID3 (Optional_01h if not used)	**01**	00000001
	44	**2C**	Standard timing ID4 (Optional_01h if not used)	**01**	00000001
	45	**2D**	Standard timing ID4 (Optional_01h if not used)	**01**	00000001
	46	**2E**	Standard timing ID5 (Optional_01h if not used)	**01**	00000001
	47	**2F**	Standard timing ID5 (Optional_01h if not used)	**01**	00000001
	48	**30**	Standard timing ID6 (Optional_01h if not used)	**01**	00000001
	49	**31**	Standard timing ID6 (Optional_01h if not used)	**01**	00000001
	50	**32**	Standard timing ID7 (Optional_01h if not used)	**01**	00000001
	51	**33**	Standard timing ID7 (Optional_01h if not used)	**01**	00000001
	52	**34**	Standard timing ID8 (Optional_01h if not used)	**01**	00000001
	53	**35**	Standard timing ID8 (Optional_01h if not used)	**01**	00000001

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

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
Timing Descriptor #1	54	**36**	Pixel Clock/10,000 (LSB) 138.7 MHz @ 60 Hz	**2E**	00101110
	55	**37**	Pixel Clock/10,000 (MSB)	**36**	00110110
	56	**38**	Horizontal Active (HA) (lower 8 bits) 1920 pixels	**80**	10000000
	57	**39**	Horizontal Blanking (HB) (lower 8 bits) 160 pixels	**A0**	10100000
	58	**3A**	Horizontal Active (HA) / Horizontal Blanking (HB) (upper 4:4bits)	**70**	01110000
	59	**3B**	Vertical Avtive (VA) 1080 lines	**38**	00111000
	60	**3C**	Vertical Blanking (VB) (DE Blanking typ.for DE only panels) 31 lines	**1F**	00011111
	61	**3D**	Vertical Active (VA) / Vertical Blanking (VB) (upper 4:4bits)	**40**	01000000
	62	**3E**	Horizontal Front Porch in pixels (HF) (lower 8 bits) 48 pixels	**30**	00110000
	63	**3F**	Horizontal Sync Pulse Width in pixels (HS) (lower 8 bits) 32 pixels	**20**	00100000
	64	**40**	Vertical Front Porch in lines (VF) : Vertical Sync Pluse Width in lines (VS) (lower 4 bits) 3 lines : 5 lines	**35**	00110101
	65	**41**	Horizontal Front Porch/ Sync Pulse Width/ Vertical Front Porch/ Sync Pulse Width (upper 2bits)	**00**	00000000
	66	**42**	Horizontal Vedio Image Size (mm) (lower 8 bits) 345 mm	**59**	01011001
	67	**43**	Vertical Vedio Image Size (mm) (lower 8 bits) 194 mm	**C2**	11000010
	68	**44**	Horizontal Image Size / Vertical Image Size (upper 4 bits)	**10**	00010000
	69	**45**	Horizontal Border = 0 (Zero for Notebook LCD)	**00**	00000000
	70	**46**	Vertical Border = 0 (Zero for Notebook LCD)	**00**	00000000
	71	**47**	Non-Interlace, Normal display, no stereo, Digital Separate [Vsync_NEG, Hsync_POS (outside of V-sync)]	**1A**	00011010
Timing Descriptor #2	72	**48**	Flag	**00**	00000000
	73	**49**	Flag	**00**	00000000
	74	**4A**	Flag	**00**	00000000
	75	**4B**	Data Type Tag (Descriptor Defined by manufacturer)	**00**	00000000
	76	**4C**	Flag	**00**	00000000
	77	**4D**	Descriptor Defined by manufacturer	**00**	00000000
	78	**4E**	Descriptor Defined by manufacturer	**00**	00000000
	79	**4F**	Descriptor Defined by manufacturer	**00**	00000000
	80	**50**	Descriptor Defined by manufacturer	**00**	00000000
	81	**51**	Descriptor Defined by manufacturer	**00**	00000000
	82	**52**	Descriptor Defined by manufacturer	**00**	00000000
	83	**53**	Descriptor Defined by manufacturer	**00**	00000000
	84	**54**	Descriptor Defined by manufacturer	**00**	00000000
	85	**55**	Descriptor Defined by manufacturer	**00**	00000000
	86	**56**	Descriptor Defined by manufacturer	**00**	00000000
	87	**57**	Descriptor Defined by manufacturer	**00**	00000000
	88	**58**	Descriptor Defined by manufacturer	**00**	00000000
	89	**59**	Descriptor Defined by manufacturer	**00**	00000000
Timing Descriptor #3	90	**5A**	Flag	**00**	00000000
	91	**5B**	Flag	**00**	00000000
	92	**5C**	Flag	**00**	00000000
	93	**5D**	Data Type Tag : Alphanumeric Data String (ASCII String)	**FE**	11111110
	94	**5E**	Flag	**00**	00000000
	95	**5F**	Dell P/N 1st Character = 8	**38**	00111000
	96	**60**	Dell P/N 2nd Character = 9	**39**	00111001
	97	**61**	Dell P/N 3rd Character = 0	**30**	00110000
	98	**62**	Dell P/N 4th Character = N	**4E**	01001110
	99	**63**	Dell P/N 5th Character = 5	**35**	00110101
	100	**64**	EDID Revision Build Name = ST (CS) , Revision # = X20	**14**	00010100
	101	**65**	Manufacturer P/N = 1	**31**	00110001
	102	**66**	Manufacturer P/N = 5	**35**	00110101
	103	**67**	Manufacturer P/N = 6	**36**	00110110
	104	**68**	Manufacturer P/N = W	**57**	01010111
	105	**69**	Manufacturer P/N = F	**46**	01000110
	106	**6A**	Manufacturer P/N = 4	**34**	00110100
	107	**6B**	Manufacturer P/N (If < 13 char, then terminate with ASCII code 0Ah,set remaining char = 20h)	**0A**	00001010

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

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
Timing Descriptor #4	108	**6C**	Flag	**00**	00000000
	109	**6D**	Flag	**00**	00000000
	110	**6E**	Flag	**00**	00000000
	111	**6F**	Data Type Tag : Descriptor Defined by manufacturer	**00**	00000000
	112	**70**	Flag	**00**	00000000
	113	**71**	Color Management [No +2 FRC Support, True Color Depth : 6 bit]	**00**	00000000
	114	**72**	Panel Type [WLED] , Configuration [Single light bar], Number Lamp or LED Light Bar [one]	**41**	01000001
	115	**73**	Frame Rate Details [Minimum Frame Rate : 40Hz, Maximum Frame Rate : 65Hz , Tcon provides native Intel DRRS / sDRRS support]	**31**	00110001
	116	**74**	Controller Interface and Maximum Luminance [PWM type, 300 nit]	**9E**	10011110
	117	**75**	Front Surface / Polarizer [Anti-Glare, No Transflective] , Pixel Structure [RGB v-stripe]	**00**	00000000
	118	**76**	Multi-Media Features [Color Management : NTSC, Dynamic Backlight Control : Type 1]	**10**	00010000
	119	**77**	Multi-Media Features [Motion Blur : No support , Active Gamma Control : No support]	**00**	00000000
	120	**78**	Special Features [Wireless Enhancement Hardware : No support , In-Cell Scanner : No support]	**00**	00000000
	121	**79**	Special Features [Number of LVDS channels or eDP lanes : two , Overdrive : No ,Interface : eDP , In-Cell Touch Support : No]	**0A**	00001010
	122	**7A**	Special Features [BIST Support : yes , Electronic Privacy : No electronic privacy hardware support , 3-D Support : No]	**01**	00000001
	123	**7B**	(If<13 char--> 0Ah, then terminate with ASCⅡ code 0Ah,set remaining char = 20h)	**0A**	00001010
	124	**7C**	(If<13 char--> 0Ah, then terminate with ASCⅡ code 0Ah,set remaining char = 20h)	**20**	00100000
	125	**7D**	(If<13 char--> 0Ah, then terminate with ASCⅡ code 0Ah,set remaining char = 20h)	**20**	00100000
Checksum	126	**7E**	Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0)	**00**	00000000
	127	**7F**	Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)	**9C**	01101000