

# SPECIFICATION FOR APPROVAL

( ) Preliminary Specification

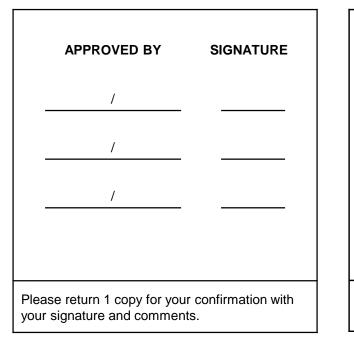
( ◆ ) Final Specification

Title			15.6" HD TFT L	CD
Customer	Customer ASUS		SUPPLIER	LG Display Co., Ltd.
MODEL			*MODEL	LP156WH4

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

TLN2

Suffix



APPROVED BY	SIGNATURE
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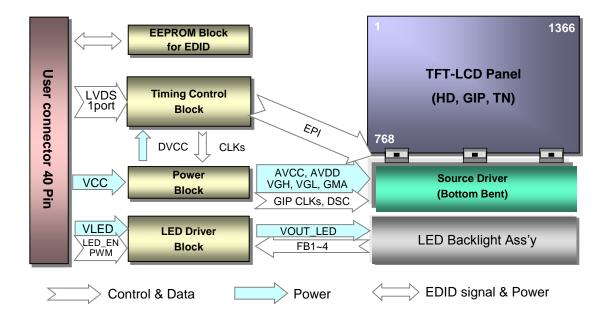
# **RECORD OF REVISIONS**

Revision N o	Revision Date	Page	Description	EDID ver
0.0	Mar. 05, 2012	-	First Draft (Preliminary Specification)	
0.1	May. 23, 2012	14	Update Optical Characteristics	0.1
		15	Update Gray Scale	
		19	Mechanical Characteristics Update (Drawing)	
		29~31	EDID Update	
1.0	Jun. 25, 2012	-	Final Draft	1.0



## 1. General Description

The LP156WH4 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 white mode. This TFT-LCD has 15.6 inches diagonally measured active display area with HD r esolution (1366 horizontal by 768 vertical pixel array). Each pixel is divided into Red, Green and Blue sub-pi xels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is deter mined with a 6-bit gray scale signal for each dot, thus, presenting a palette of more than 262,144 colors. Th e LP156WH4 has been designed to apply the interface method that enables low power, high speed, low EM I. The LP156WH4 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 LP156W H4 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	359.3(H, typ) × 209.5(V, typ) × 5.5(D,max) [mm]
Pixel Pitch	0.252 × 0.252 mm
Pixel Format	1366 horiz. By 768 vert. Pixels RGB strip arrangement
Color Depth	6-bit, 262,144 colors
Luminance, White	220 cd/m <sup>2</sup> (Typ.5 point @ PWM Duty = 100%)
Power Consumption	Total 4.3 W(Typ.) Logic : 0.7W (Typ.@ Mosaic), B/L : 3.6W (Typ.@ VLED 12V )
Weight	420g (Max.)
Display Operating Mode	Transmissive mode, normally white
Surface Treatment	Glare treatment (3H) of the front Polarizer
RoHS Comply	Yes
BFR / PVC / As Free	Yes for all



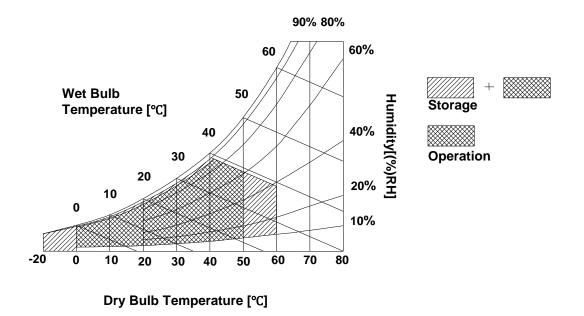
#### 2. Absolute Maximum Ratings

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

Parameter	Symbol	Val	ues	Units	Notes		
Falameter	Symbol	Min	Max	Units	Notes		
Power Input Voltage	VCC	-0.3	4.0	Vdc	at 25 ± 5°C		
Operating Temperature	Тор	0	50	°C	1		
Storage Temperature	Нѕт	-20	60	°C	1		
Operating Ambient Humidity	Нор	10	90	%RH	1		
Storage Humidity	Нѕт	10	90	%RH	1		

#### Table 1. ABSOLUTE MAXIMUM RATINGS

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.



# 3. Electrical Specifications

#### **3-1. Electrical Characteristics**

The LP156WH4 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.

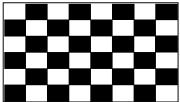
Deremeter	Symbol		Values	Unit	Nataa		
Parameter	Symbol	Min	Тур	Max		Notes	
LOGIC :							
Power Supply Input Voltage		Vcc	3.0	3.3	3.6	v	1
Power Supply Input Curre nt	wer Supply Input Curre Mosaic		-	220	260	mA	2
Power Consumption		Рсс	-	0.7	0.9	w	2
Power Supply Inrush Curre	nt	ICC_P	-	-	1500	mA	3
LVDS Impedance		ZLVDS	90	100	110	Ω	4
BACKLIGHT : ( with LED Driv	ver)						
LED Power Input Voltage		VLED	7.0	12.0	21.0	v	5
LED Power Input Current		ILED	-	300	335	mA	6
LED Power Consumption		PLED	-	3.6	4.0	w	6
LED Power Inrush Current		ILED_P	-	-	1500	mA	7
PWM Duty Ratio			5	-	100	%	8
PWM Jitter		-	0	-	0.2	%	9
PWM Impedance		Zрwм	20	40	60	kΩ	
PWM Frequency		Fрwм	200	-	1000	Hz	10
PWM High Level Voltage		V <sub>PWM_H</sub>	3.0	-	5.3	V	
PWM Low Level Voltage		V <sub>PWM_L</sub>	0	-	0.3	V	
LED_EN Impedance		Zрwm	20	40	60	kΩ	
LED_EN High Voltage		Vled_en_ H	3.0	-	5.3	v	
LED_EN Low Voltage		VLED_EN_L	0	-	0.3	v	
Life Time			12,000	-	-	Hrs	11

#### Table 2. ELECTRICAL CHARACTERISTICS

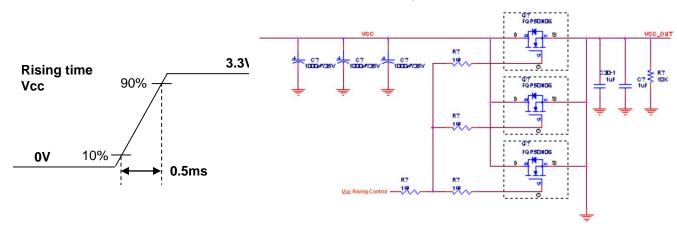


#### Note)

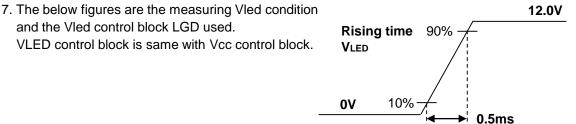
- 1. The measuring position is the connector of LCM and the test conditions are under 25°C, fv = 60Hz, Black pattern.
- 2. The specified lcc current and power consumption are under the Vcc = 3.3V , 25°C, fv = 60Hz condition and Mosaic pattern.



3. This Spec. is the max load condition for the cable impedance designing. 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 LVDS Tx to the mating connector.
- 5. The measuring position is the connector of LCM and the test conditions are under 25°C.
- The current and power consumption with LED Driver are under the Vled = 12.0V, 25°C, Dimming of Max luminance and White pattern with the normal frame frequency operated(60Hz).



- 8. The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.
- 9. If Jitter of  $\ensuremath{\mathsf{PWM}}$  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 40 pin connector used for the module electronics interface and t he other connector used for the integral backlight system.

#### Pin Symbol Description Notes NC 1 No Connection. [Interface Chip] 2 vcc LCD Logic and driver power (3.3V Typ.) 1. LCD : SiW, SW0645 (LCD Controller) 3 vcc LCD Logic and driver power (3.3V Typ.) including LVDS Receiver V EEDID DDC Power (3.3V) 4 2. System : THC63LVDF823A 5 NC No Connection. or equivalent DDC Clock 6 **CIk EEDID** \* Pin to Pin compatible with LVDS 7 DATA EEDID DDC Data ORX0-8 Negative LVDS differential data input [Connector] 9 Positive LVDS differential data input ORX0+ LSMtron GT05Q-40S-H10-M or HD1S040HA2, JAE 10 GND LCM Ground ORX1-Negative LVDS differential data input 11 [Mating Connector] 12 ORX1+ Positive LVDS differential data input 20453-040T-0x, I-PEX or equivalent GND LCM Ground 13 Negative LVDS differential data input 14 ORX2-[Connector pin arrangement] Positive LVDS differential data input ORX2+ 15 GND LCM Ground 16 17 ORXC-Negative LVDS differential clock input Positive LVDS differential clock input 18 ORXC+ 19 GND LCM Ground [LCD Module Rear View] NC No Connection 20 21 NC No Connection GND LCM Ground 22 23 No Connection NC No Connection 24 NC 25 GND LCM Ground NC No Connection 26 NC No Connection 27 28 GND LCM Ground NC No Connection 29 30 NC No Connection GND LCM Ground (LED Backlight Ground) 31 LCM Ground (LED Backlight Ground) 32 GND GND LCM Ground (LED Backlight Ground) 33 NC No Connection. 34 System PWM Signal input for dimming 35 PWM 36 LED EN LED Backlight On/Off

#### Table 3. MODULE CONNECTOR PIN CONFIGURATION (CN1)

NC

VLED

VLED

No Connection

LED Backlight Power (7V-21V)

LED Backlight Power (7V-21V)

LED Backlight Power (7V-21V)

37

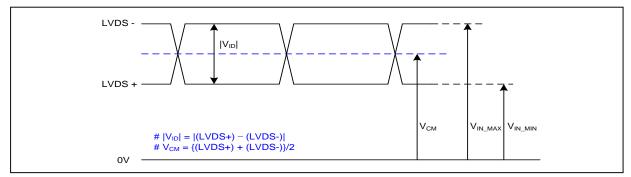
38

39

40

# 3-3. LVDS Signal Timing Specifications

# 3-3-1. DC Specification

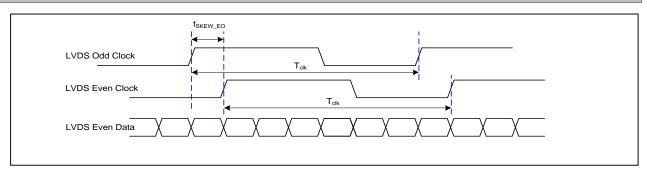


Description	Symb ol	Min	Мах	Unit	Notes
LVDS Differential Voltage	V <sub>ID</sub>	100	600	mV	-
LVDS Common mode Voltage	V <sub>CM</sub>	0.6	1.8	V	-
LVDS Input Voltage Range	V <sub>IN</sub>	0.3	2.1	V	-

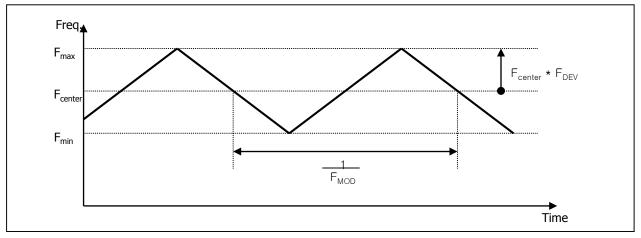
# 3-3-2. AC Specification

LVDS Clock $LVDS Data$ $UVDS Data$ $UVDS Data$ $UVDS Data$ $UVDS Data$ $UVDS Data$ $UVDS Data$ $USKEW$ $USK$										
Description	Symbol	Min	Max	Unit	Notes					
LVDS Clock to Data Skow Margin	t <sub>skew</sub>	- 400	+ 400	ps	85MHz > Fclk ≥ 65MH z					
LVDS Clock to Data Skew Margin	t <sub>skew</sub>	- 600	+ 600	ps	65MHz > Fclk ≥ 25MH z					
LVDS Clock to Clock Skew Margin (Ev en to Odd)	t <sub>skew_eo</sub>	- 1/7	+ 1/7	T <sub>clk</sub>	-					
Maximum deviation of input clock frequency during SSC	F <sub>DEV</sub>	-	± 3	%	-					
Maximum modulation frequency of input clock during SSC	F <sub>MOD</sub>	-	200	KHz	-					



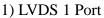


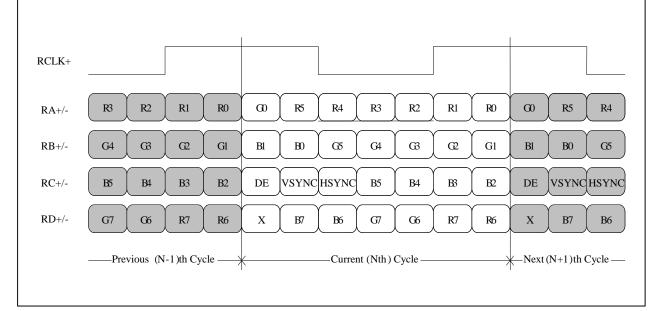
< Clock skew margin between channel >



< Spread Spectrum >

# 3-3-3. Data Format





< LVDS Data Format >

# 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 LVDS Tx/Rx for its proper operation.

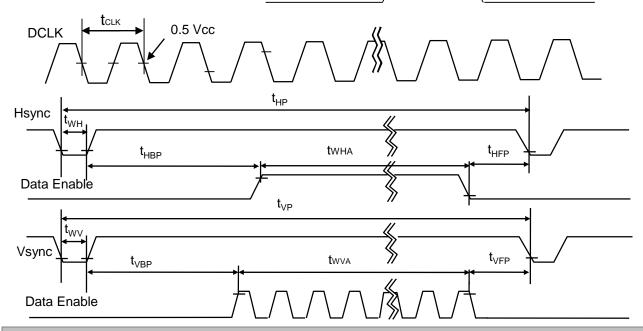
ITEM	Symbol		Min	Тур	Max	Unit	Note
DCLK	Frequency	f <sub>clk</sub>	-	70.0	-	MHz	
	Period	t <sub>HP</sub>	1464	1492	1528		
Hsync	Width	t <sub>wH</sub>	32	48	62	tCLK	
	Width-Active	t <sub>wha</sub>	1366	1366	1366		
	Period	t <sub>vp</sub>	776	782	792		
Vsync	Width	t <sub>wv</sub>	2	5	8	tHP	
	Width-Active	t <sub>wva</sub>	768	768	768		
	Horizontal back porch	t <sub>HBP</sub>	34	42	60		
Data	Horizontal front porch	t <sub>HFP</sub>	32	36	40	tCLK	
Enable	Vertical back porch	t <sub>vBP</sub>	4	6	12		
	Vertical front porch	porch t <sub>vFP</sub>		3	4	tHP	
- Cianal	Timing Wayafarma	-	-	-		Condition · \	/CC =3.3V

#### Table 4. TIMING TABLE

#### 3-5. Signal Timing Waveforms

Data Enable, Hsync, Vsync

High: 0.7VCC Low: 0.3VCC Condition : VCC = 3.3V



# 3-6. Color Input Data Reference

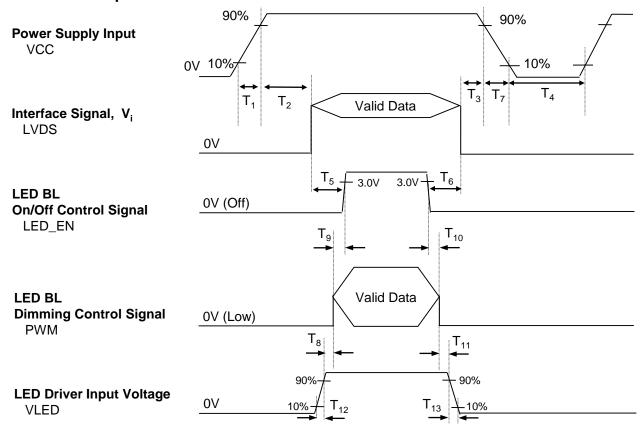
The brightness of each primary color (red,green and blue) is based on the 6-bit gray scale data input for the color ; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

-			Input Color Data																
	Color			RI	ED					GRI	EEN					BL	UE		
		MSE	В				LSB						LSB		3				LSB
	1	R 5	R 4	R 3	R 2	R 1	R 0	G 5	G 4	G 3	G 2	G 1	G 0	B 5	B 4	B 3	B 2	B 1	B 0
	Black		0		<b>0</b>	<b>.</b> 0	<b>0</b>	<b>0</b> 		<b>0</b>		0	0	<b>0</b> 	<b>.</b>	0	<b>0</b>	<b>0</b>	0
	Red	1	1	1	1	1 1	1 1	0	. <b>0</b>		0	0	0	0	0	0	0	<b>0</b>	0
	Green	0	0	0	0	0	<b>0</b>	1	1	1	1	1	1	0	0	0	0	<b>0</b>	0
Basic	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Color	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 (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				•															
	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
	<b>GREEN (00)</b>	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				•••••						•••••							 		
	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 (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					 					•••••	 			••••			 		
	BLUE (62)	0	0	0	0	0	0	 0	0	0	0	0	0	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

#### Table 5. COLOR DATA REFERENCE



#### 3-7. Power Sequence



#### Table 6. POWER SEQUENCE TABLE

Logic		Value		Units	LED		Units		
Parameter	Min.	Тур.	Max.	Units	Parameter	Min.	Тур.	Max.	Units
T <sub>1</sub>	0.5	-	10	ms	Т <sub>8</sub>	10	-	-	ms
T <sub>2</sub>	0	-	50	ms	T <sub>9</sub>	0	-	-	ms
T <sub>3</sub>	0	-	50	ms	T <sub>10</sub>	0	-	-	ms
T <sub>4</sub>	400	-	-	ms	T <sub>11</sub>	10	-	-	ms
T <sub>5</sub>	200	-	-	ms	T <sub>12</sub>	0.5	-	-	ms
T <sub>6</sub>	200	-	-	ms	T <sub>13</sub>	0	-	5000	ms
T <sub>7</sub>	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 be on pull-down condition on invalid status.
- 4. LGD recommend the rising sequence of VLED after the Vcc and valid status of LVDS 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  $\Phi$  and  $\Theta$  equal to 0°.

FIG. 1 presents additional information concerning the measurement equipment and method.

Optical Stage(x,y)

Table 9. OPTICAL CHARACTERISTICS

#### Table 7. OPTICAL CHARACTERISTICS

Ta=25°C, Vcc=3.3V, fv=60Hz, f<sub>CLK</sub>= 70.0MHz

Deveneter	Symbo			Nataa		
Parameter	î   [	Min Typ		Max	Units	Notes
Contrast Ratio	CR	400	-	-		1
Surface Luminance, white	L <sub>WH</sub>	185	220	-	cd/m <sup>2</sup>	2
Luminance Variation	δ <sub>WHITE</sub>	-	1.4	1.6	1	3
Response Time	Tr <sub>R</sub> + Tr	-	16	-	ms	4
Color Coordinates	[]			[		
RED	RX	0.579	0.609	0.639		
	RY	0.318	0.348	0.378		
GREEN	GX	0.322	0.352	0.382		
	GY	0.576	0.606	0.636		
BLUE	BX	0.120	0.150	0.180		
	BY	0.066	0.096	0.126		
WHITE	WX	0.283	0.313	0.343		
	WY	0.299	0.329	0.359		
Viewing Angle	[]					5
x axis, right(Φ=0°)	Θr	40	45	-	degree	
x axis, left (Φ=180°)	ΘΙ	40	45		degree	
y axis, up (Φ=90°)	Θu	10	15		degree	
y axis, down (Φ=270° )	Θd	30	35	-	degree	
Gray Scale					· [· · · · · ]	6

FIG. 1 Optical Characteristic Measurement Equipment and Method



Note)

1. Contrast Ratio(CR) is defined mathematically as

Surface Luminance with all white pixels

Contrast Ratio =

Surface Luminance with all black pixels

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.

 $L_{WH} = Average(L_1, L_2, \dots, L_5)$ 

3. The variation in surface luminance , The panel total variation ( $\delta_{WHITE}$ ) is determined by measuring L<sub>N</sub> at each test position 1 through 13 and then defined as followed numerical formula. For more information see FIG 2.

 $\delta_{\text{WHITE}} = \frac{Maximum(L_1, L_2, \dots L_{13})}{Minimum(L_1, L_2, \dots L_{13})}$ 

- 4. Response time is the time required for the display to transition from white to black (rise time, Tr<sub>R</sub>) and from black to white(Decay Time, Tr<sub>D</sub>). 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

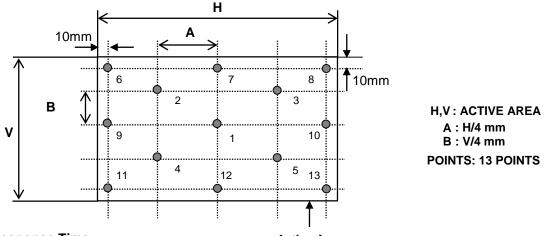
\*  $f_{V} = 60Hz$ 

Gray Level	Luminance [%] (Typ)
LO	0.16
L7	1.48
L15	5.57
L23	12.0
L31	20.8
L39	35.3
L47	55.5
L55	79.1
L63	100



#### FIG. 2 Luminance

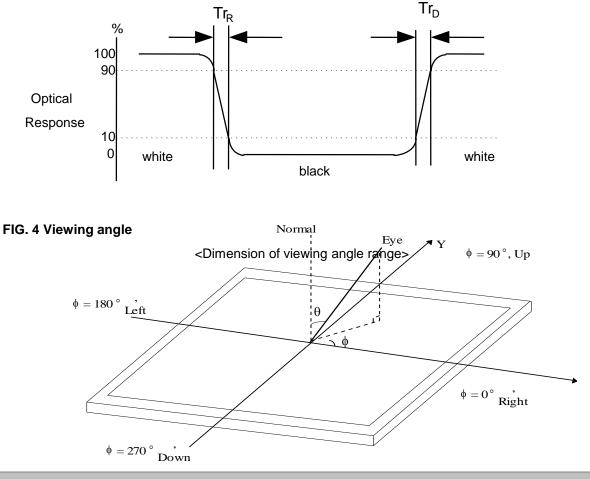
<Measuring point for Average Luminance & measuring point for Luminance variation>



#### FIG. 3 Response Time

**Active Area** 

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





#### **5. Mechanical Characteristics**

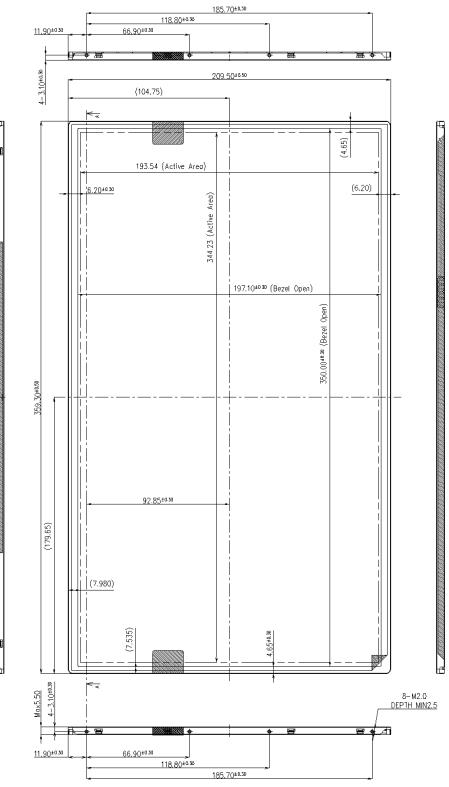
The contents provide general mechanical characteristics for the model LP156WH4. In addition the figures in the next page are detailed mechanical drawing of the LCD.

	Horizontal	359.3 ± 0.5mm			
Outline Dimension	Vertical	209.5 ± 0.5mm			
	Thickness	5.5mm (max)			
Bezel Area	Horizontal	350.0 ± 0.5mm			
Bezel Alea	Vertical	197.1 ± 0.5mm			
Active Display Area	Horizontal	344.232 mm			
Active Display Area	Vertical	193.536 mm			
Weight	420g (Max.)				
Surface Treatment	Glare treatment(3H) of the front polarizer				



#### <FRONT VIEW>

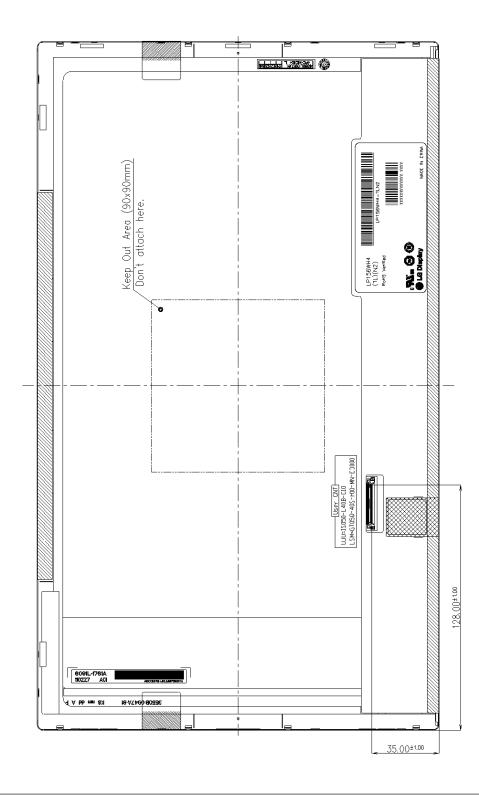
#### Note) Unit:[mm], General tolerance: ± 0.5mm





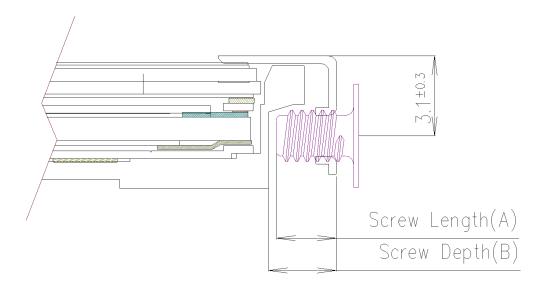
#### <REAR VIEW>

#### Note) Unit:[mm], General tolerance: $\pm$ 0.5mm



Ver. 1.0

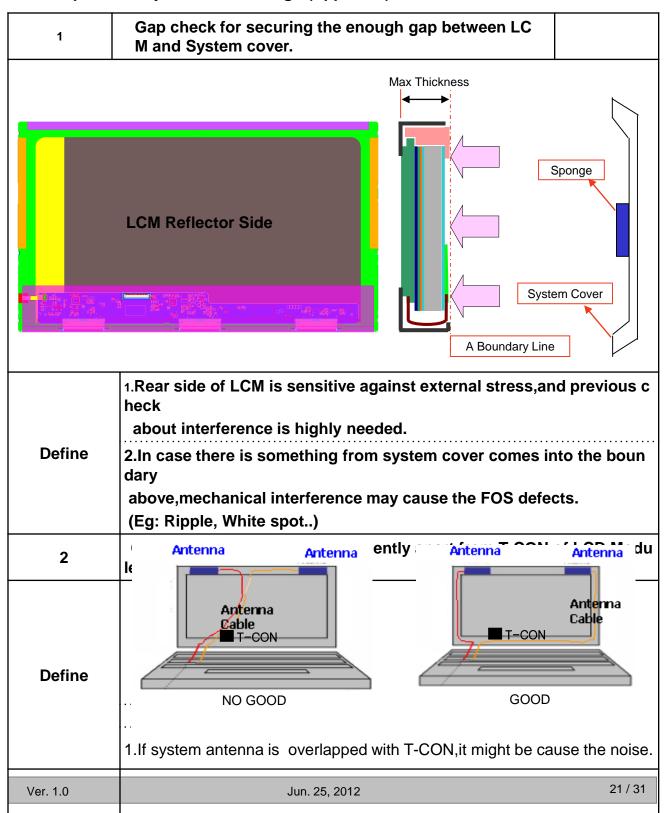
# [ DETAIL DESCRIPTION OF SIDE MOUNTING SCREW ]



- \* Mounting Screw Length (A) = 2.0(Min) / 2.5(Max)
- \* Mounting Screw Hole Depth (B) = 2.5(Min)
- \* Mounting hole location : 3.1(Typ)
- \* Torque : 2.0 kgf.cm(Max) (Measurement gauge : torque meter)
- 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.

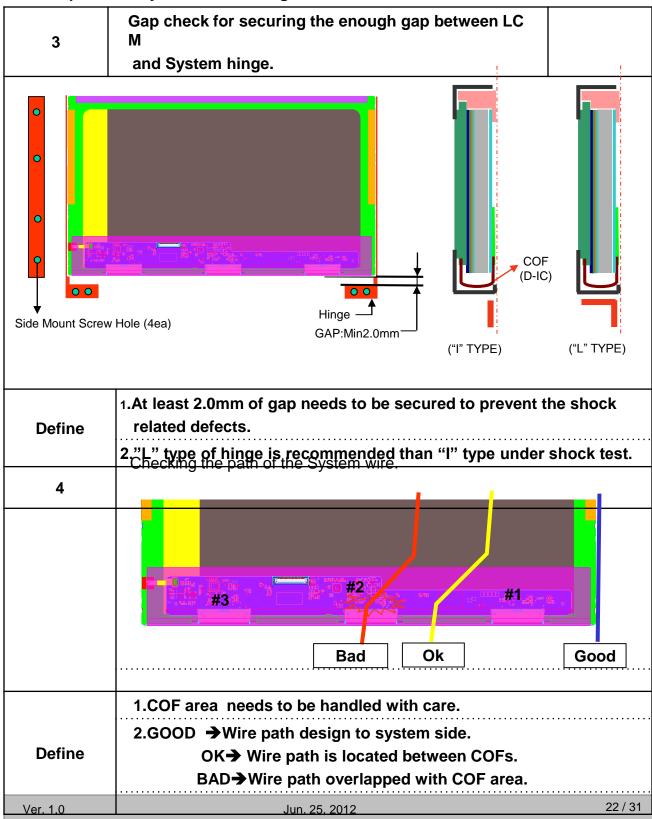


# LGD Proposal for system cover design.(Appendix)



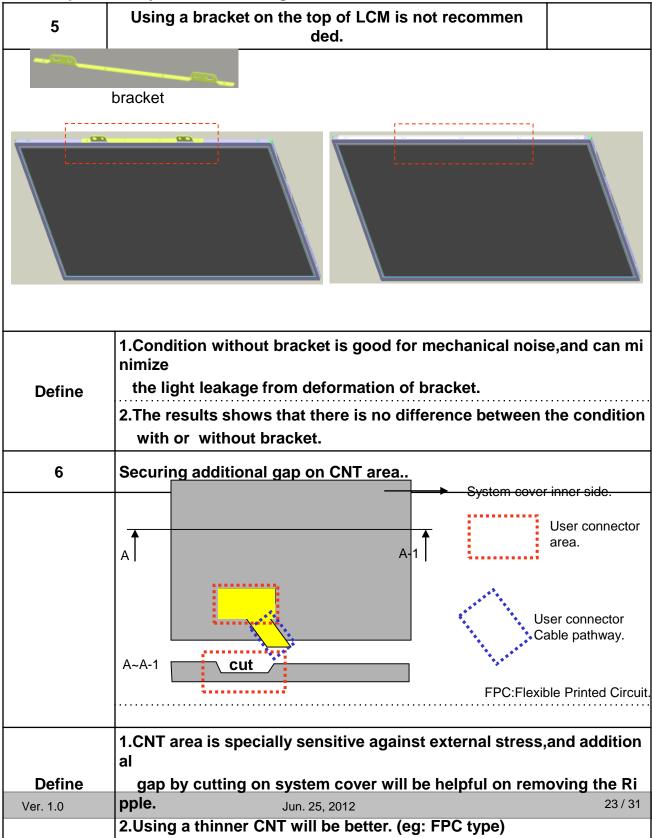


# LGD Proposal for system cover design.





# LGD Proposal for system cover design.





# 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, 10 ~ 500 ~ 10Hz, 1.5G, 0.37oct/min 3 axis, 1hour/axis				
6	Shock test (non-operating)	Half sine wave, 180G, 2ms one shock of each six faces(I.e. run 180G 2ms for all six faces)				
7	Altitude operati	0 ~ 10,000 feet (3,048m) 24Hr				
	ng	0 ~ 40,000 feet (12,192m) 24Hr				
{ Res	ult Evaluation Criteria					
The	e Should be no change which might affe	ct 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, Second Edition, Underwriters Laboratories Inc.
   Information Technology Equipment Safety Part 1 : General Requirements.
- b) CAN/CSA C22.2 No.60950-1-07, Second Edition, Canadian Standards Association. Information Technology Equipment - Safety - Part 1 : General Requirements.
- c) EN 60950-1:2006 + A11:2009, European Committee for Electrotechnical Standardization (CENELEC). Information Technology Equipment - Safety - Part 1 : General Requirements.
- d) IEC 60950-1:2005, Second Edition, The International Electrotechnical Commission (IEC). Information Technology Equipment - Safety - Part 1 : General Requirements.

# 7-2. EMC

- a) ANSI C63.4 "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." American National Standards Institute (ANSI), 2003.
- b) CISPR 22 "Information technology equipment Radio disturbance characteristics Limit and methods of measurement." International Special Committee on Radio Interference (CISPR), 2005.
- c) CISPR 13 "Sound and television broadcast receivers and associated equipment Radio disturbance characteristics – Limits and method of measurement." International Special Committee on Radio Interference (CISPR), 2006.

# 7-3. Environment

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



### 8. Packing

# 8-1. Designation of Lot Mark

a) Lot Mark



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	А	В	С	D	Е	F	G	Н	J	К

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	А	В	С

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 : 22 pcs

b) Box Size : 478x365x288mm



#### 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 th

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.

#### 9-2. OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :  $V=\pm 200 \text{mV}(\text{Over and under shoot voltage})$
- (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<sup>™</sup>) 1/3

	Byte	Byte	Field Name and Comments	Value	Value
	(Dec)	(Hex)		(Hex)	(Bin) 00000000
	0	00	Header Header	00 FF	11111111
	2	01	Header	FF	11111111
ler	3	03	Header	FF	11111111
Header	4	04	Header	FF	11111111
Η	5	05	Header	FF	11111111
	6	06	Header	FF	11111111
	7	07	Header	00	00000000
	8	08	EISA manufacture code ( 3 Character ID ) LGD	30	00110000
	9	09	EISA manufacture code (Compressed ASC II )	E4	11100100
r ct	10	0A 0D	Panel Supplier Reserved - Product Code 038Eh	8E	10001110
Vendor / Product EDID Version	11 12	0B	( Hex. LSB first ) LCD Module Serial No - Preferred but Optional ("0" If not used)	03	00000011 00000000
ro	12	0C 0D	LCD Module Serial No - Preferred but Optional ("0" If not used)	00	00000000
$V_{\ell}$	13	0D 0E	LCD Module Serial No - Preferred but Optional ("0" If not used)	00	00000000
Da	15	0E 0F	LCD Module Serial No - Preferred but Optional ("0" If not used)	00	00000000
IQ.	16	10	Week of Manufacture 00 weeks	00	00000000
Ve. E	17	11	Year of Manufacture 2012 years	16	00010110
	18	12	EDID structure version # = 1	01	00000001
	19	13	EDID revision $\# = 3$	03	00000011
	20	14	Video input Definition = Digital signal	80	1000000
rs		14			
Display Parameters	21		Max H image size (Rounded cm) = $34$ cm	22	00100010
e me	22	16	Max V image size (Rounded cm) = 19 cm	13	00010011
Di	23	17	Display gamma = (gamma*100)-100 = Example:(2.2*100)-100=120 = 2.2 Gamma	78	01111000
Pa	24	18	Feature Support (no_DPMS, no_Active Off/Very Low Power, RGB color display, Timing BLK 1,no_GTF)	<b>0</b> A	00001010
s	25	19	Red/Green Low Bits (RxRy/GxGy)	01	00000001
ute	26	1A	Blue/White Low Bits (BxBy/WxWy)	A5	10100101
Panel Color Coordinates	27	1B	Red X $Rx = 0.609$	9C	10011100
rd	28	1C	Red Y $Ry = 0.348$	59	01011001
200	29	1D	Green X $Gx = 0.352$	5A	01011010
r (	30	1E	Green Y $Gy = 0.606$	9B	10011011
olo	31	1F	Blue X $Bx = 0.150$	26	00100110
C	32	20	Blue Y $By = 0.096$	18	00011000
ləı	33	20	White X $Wx = 0.313$	50	01010000
an					
	34	22	White Y $Wy = 0.329$	54	01010100
Established Timings	35	23	Established timing 1 (00h if not used)	00	00000000
Istablishe Timings	36	24	Established timing 2 (00h if not used)	00	00000000
Est T	37	25	Manufacturer's timings (00h if not used)	00	00000000
	38		Standard timing ID1 (01h if not used)	01	00000001
	39	27	Standard timing ID1 (01h if not used)	01	00000001
	40	28	Standard timing ID2 (01h if not used)	01	00000001
9	41	29	Standard timing ID2 (01h if not used)	01	00000001
	42	2A 2B	Standard timing ID3 (01h if not used)	01	00000001
ing	43 44	2B 2C	Standard timing ID3 (01h if not used) Standard timing ID4 (01h if not used)	01 01	00000001 00000001
Standard Timing ID	44	2C 2D	Standard timing ID4 (01h if not used)	01	00000001
L	46	2D 2E	Standard timing ID5 (01h if not used)	01	00000001
ura	47	2E 2F	Standard timing ID5 (01h if not used)	01	00000001
ıpı	48	30	Standard timing ID6 (01h if not used)	01	00000001
tar	49	31	Standard timing ID6 (01h if not used)	01	00000001
S	50	32	Standard timing ID7 (01h if not used)	01	00000001
	51	33	Standard timing ID7 (01h if not used)	01	00000001
	52	34	Standard timing ID8 (01h if not used)	01	00000001
	53	35	Standard timing ID8 (01h if not used)	01	00000001



# APPENDIX A. Enhanced Extended Display Identification Data (EEDID<sup>™</sup>) 2/3

	Byte (Data)	Byte	Field Name and Comments	Value	Value (Pir)
	(Dec) 54	(Hex) 36	Pixel Clock/10,000 (LSB) 70 MHz @ 60Hz	(Hex) 58	(Bin) 01011000
	55	37	Pixel Clock/10,000 (LSB)	1B	00011011
	56	38	Horizontal Active (lower 8 bits) 1366 Pixels	56	01010110
	57	39	Horizontal Blanking(Thp-HA) (lower 8 bits) 126 Pixels	7E	01111110
	58	3A	Horizontal Active / Horizontal Blanking(Thp-HA) (upper 4:4bits)	50	01010000
	59	3B	Vertical Avtive 768 Lines	00	00000000
ſ#•	60	3C	Vertical Blanking (Tvp-HA) (DE Blanking typ.for DE only panels) 14 Lines	0E	00001110
Timing Descriptor #1	61	3D	Vertical Active : Vertical Blanking (Tvp-HA) (upper 4:4bits)	30	00110000
rip	62	3E	Horizontal Sync. Offset (Thfp) 36 Pixels	24	00100100
esc	63	3F	Horizontal Sync Pulse Width (HSPW) 48 Pixels	30	00110000
D	64	40	Vertical Sync Offset(Tvfp) : Sync Width (VSPW) 3 Lines : 5 Lines	35	00110101
ing	65	41	Horizontal Vertical Sync Offset/Width (upper 2bits)	00	00000000
imi	66	42	Horizontal Image Size (mm) 344 mm	58	01011000
T	67	43	Vertical Image Size (mm) 194 mm	C2	11000010
	68	44	Horizontal Image Size / Vertical Image Size	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_NEG), DE only note : LSB is set to '1' if panel is DE-timing only. H/V can be ignored.	19	00011001
	72	48	Flag	00	00000000
	73	49	Flag	00	00000000
	74	<b>4</b> A	Flag	00	00000000
	75	<b>4B</b>	Data Type Tag (Descriptor Defined by manufacturer)	00	00000000
	76	4C	Flag	00	00000000
#2	77	4D	Descriptor Defined by manufacturer	00	00000000
r#	78	<b>4</b> E	Descriptor Defined by manufacturer	00	00000000
iptc	79	4F	Descriptor Defined by manufacturer	00	00000000
Timing Descriptor #2	80	50	Descriptor Defined by manufacturer	00	00000000
Des	81	51	Descriptor Defined by manufacturer	00	00000000
g I	82	52	Descriptor Defined by manufacturer	00	00000000
nin	83	53	Descriptor Defined by manufacturer	00	00000000
Tin	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
	90	5A	Flag	00	00000000
	91	5B	Flag	00	00000000
	92	5C	Flag	00	00000000
	93	5D	Data Type Tag ( ASCII String )	FE	11111110
	94	5E	Flag	00	00000000
#3	95	5F	ASCII String L	<b>4</b> C	01001100
tor	96	60	ASCII String G	47	01000111
ripi	97	61	ASCII String	20	00100000
isci	98	62	ASCII String D	44	01000100
Dέ	99	63	ASCII String i	69	01101001
Bu	100	64	ASCII String s	73	01110011
Timing Descriptor #3	101	65	ASCII String p	70	01110000
Ti	102	66	ASCII String 1	6C	01101100
	103	67 68	ASCII String a	61	01100001
	104	68	ASCII String y	79	01111001
	105	69	Manufacturer P/N(If<13 char-> 0Ah, then terminate with ASC II code 0Ah, set remaining char = 20		00001010
	106	6A	Manufacturer P/N(If<13 char-> 0Ah, then terminate with ASC II code 0Ah, set remaining char = 20		00100000
	107	6B	Manufacturer P/N(If<13 char> 0Ah, then terminate with ASC $\square$ code 0Ah,set remaining char = 20	<b>b</b> 20	00100000



# APPENDIX A. Enhanced Extended Display Identification Data (EEDID<sup>™</sup>) 3/3

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
	108		Flag	00	00000000
	109	6D	Flag	00	00000000
	110	6E	Flag	00	00000000
	111	6F	Data Type Tag ( ASCII String )	FE	11111110
	112	70	Flag	00	00000000
#4	113	71	ASCII String L	<b>4</b> C	01001100
Timing Descriptor #4	114	72	ASCII String P	50	01010000
pta	115	73	ASCII String 1	31	00110001
cri	116	74	ASCII String 5	35	00110101
SəC	117	75	ASCII String 6	36	00110110
g l	118	76	ASCII String W	57	01010111
nin	119	77	ASCII String H	48	01001000
Tim	120	78	ASCII String 4	34	00110100
	121	79	ASCII String -	2D	00101101
	122	7A	ASCII String T	54	01010100
	123	7B	ASCII String L	<b>4</b> C	01001100
	124	7C	ASCII String N	<b>4</b> E	01001110
	125	7D	ASCII String 2	32	00110010
ksum	126	<b>7</b> E	Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0)	00	00000000
Checksum	127	<b>7</b> F	Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)	C6	11000110