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SPECIFICATION
FOR
APPROVAL

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

Title	17.0” QHD+ TFT LCD

Customer	
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LP170WQ1
Suffix	SPE1

*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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Products Engineering Dept.
LG Display Co., Ltd

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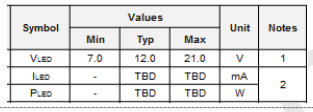
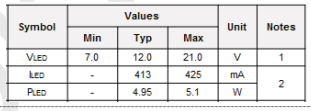
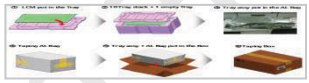
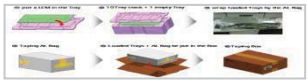
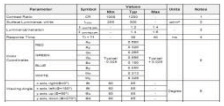
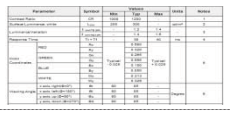
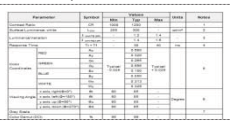
Record of Revisions

Revision No	Revision Date	Page	Before	After	EDID version
0.0	Feb. 14. 2020	All	First Draft (Preliminary Specification)	-	-
0.1	May. 19. 2020	5	eDP version(Tcon): eDP1.3 DPCD version: 1.2 PSR: Support PSR1 sDRRS: Support	eDP version(Tcon): eDP1.4b DPCD version: 1.4 PSR: Support PSR2 sDRRS: Not Support	-
0.2	Jul. 13. 2020	5	Total TBDW (Typ.) Logic : 0.9W (Typ. @ Mosaic), B/L : TBDW (Typ.) 268g (Max.) / 258g (Typ.)	Total 5.85W (Typ.) Logic : 0.9W (Typ. @ Mosaic), B/L : 4.95W (Typ.) 262g (Max.) / 252g (Typ.)	0.0
		8			
		23	-	Update Drawing	
		26	TBD		
		27			
		29	-	Add Precautions for unpacking the Box	
		30	-	Add Precautions for Handling tray	
		53~55	-	Update APPENDIX D	
1.0	Sep. 25. 2020	17	-	Update Power Sequence	
		18			
		21	Active area tolerance: ±0.3	Active area tolerance: ±0.15	
1.1	Oct. 22. 2020	5	Power Consumption : typ. DCI 99% typ.	Power Consumption : Typ. / Max. Supporting DCI Typ. 99%, Min 95% (Cover Ratio)	
		18			
		19	Gray scale: TBD 색좌표 측정 장비 제한	Update Gray scale 색좌표 측정 장비 제한 문구 삭제	
		53~58	-	Update APPENDIX D	

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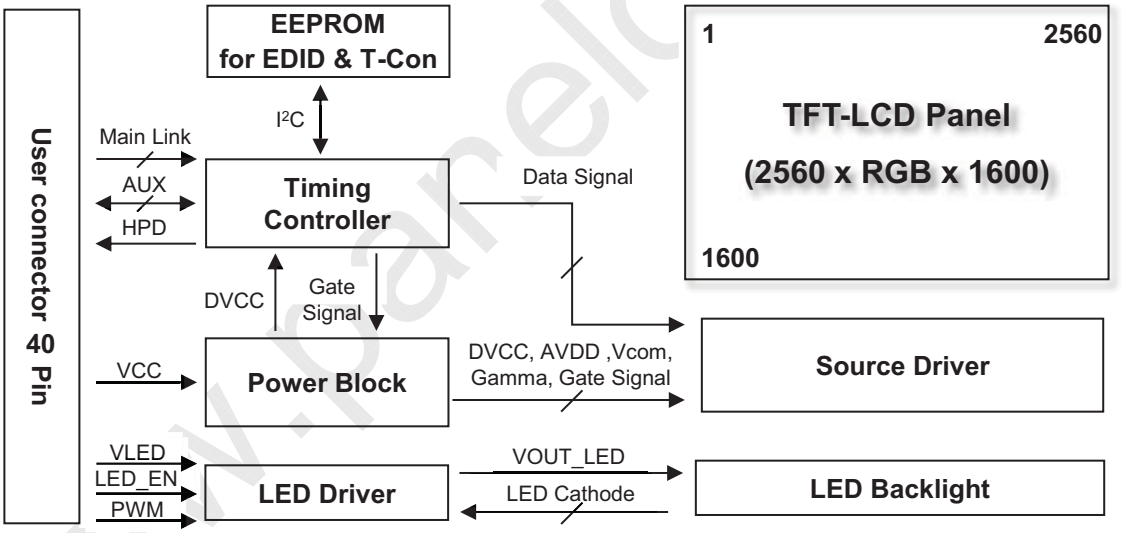
1. General Description

1-1. Introduction

The LP170WQ1 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 17.0 inches diagonally measured active display area with WQXGA resolution (2560 horizontal by 1600 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 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16,177,216 colors. The LP170WQ1 has been designed to apply the interface method that enables low power, high speed, low EMI. The LP170WQ1 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 LP170WQ1 characteristics provide an excellent flat display for office automation products such as Notebook PC.



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1-2. General Feature

Active Screen Size		17.0 inches diagonal
Outline Dimension		372.84(H, Typ.) × 242.17(V, Typ.) × 4.50 (D, Max.) [mm] with PCBA
Pixel Pitch		0.1431 mm X 0.1431 mm
Pixel Format		2560 horiz. by 1600 vert. Pixels RGB strip arrangement
Color Depth		8-bit, 16,177,216 colors
Luminance, White		300 cd/m^2(Typ.)
Power Consumption		Total 5.85W (Typ.) Logic : 0.9W (Typ. @ Mosaic), B/L : 4.95W (Typ.) 6.10W (Max.) Logic : 1.0W (Max. @ Mosaic), B/L : 5.1W (Max.)
Weight		262g (Max.) / 252g (Typ.)
Display Operating Mode		Normally black
Surface Treatment		Glare treatment (3H) of the front Polarizer
Color Gamut		Supporting DCI Typ. 99%, Min 95% (Cover Ratio)
LED Dimming Control mode		DC Dimming
RoHS Compliance		Yes
BFR / PVC / As Free		Yes for all
eDP version(Tcon)		eDP1.4b
DPCD version		Ver1.4
Function	PSR	Support PSR2
	sDRRS	Not support
	DMRRS	Not support
	Adaptive sync	Not support
	NVSR	Not support
	SSC	Down spread 0.5%

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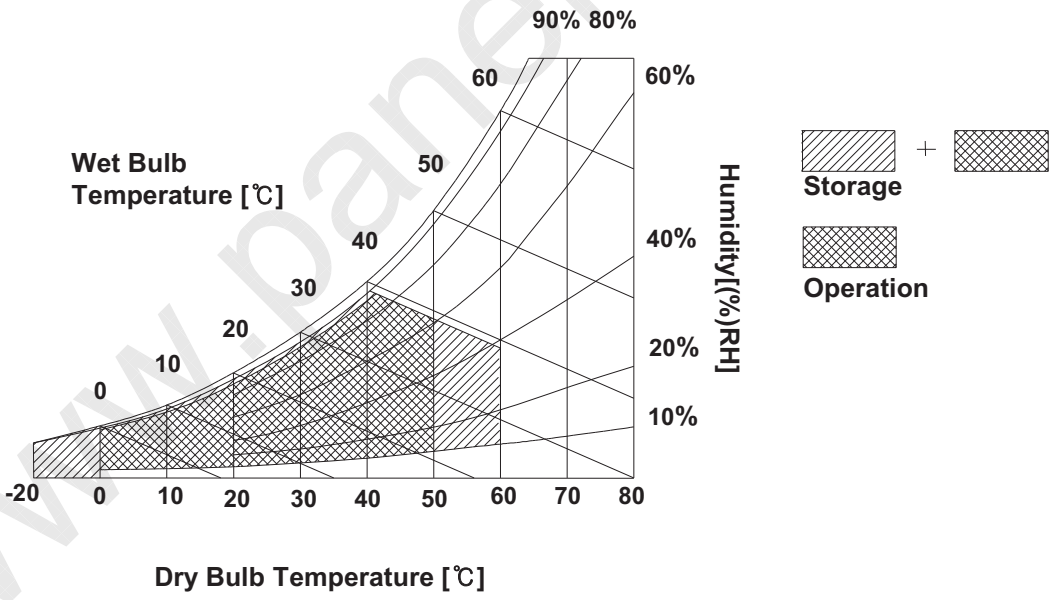
2. Absolute Maximum Ratings

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	V_{DC}	at 25 ± 2°C
Operating Temperature	TOP	0	50	°C	1
Storage Temperature	TST	-20	60	°C	1,2
Operating Ambient Humidity	HOP	10	90	%RH	1
Storage Humidity	HST	10	90	%RH	1,2

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.



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3. Electrical Specifications

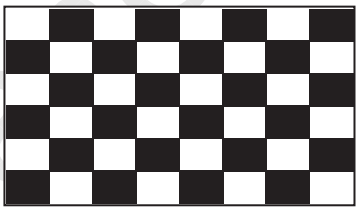
3-1. LCD Electrical Characteristics

Table 2. LCD ELECTRICAL CHARACTERISTICS

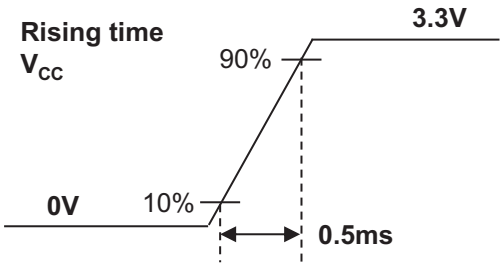
Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Power Supply Input Voltage		V_{CC}	3.0	3.3	3.6	V	1
Permissive Power Supply Input Ripple		V_{CCrp}	-	-	100	mV_{p-p}	
Power Supply Input Current	Mosaic	I_{CC}	-	273	303	mA	2
Power Consumption		P_{CC}	-	0.9	1.0	W	
Power Supply Inrush Current		I_{CC_P}	-	-	1.5	A	3
Differential Impedance		Z_{eDP}	90	100	110	Ω	

Note)

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



3. The V_{CC} rising time is same as the minimum of T1 at Power on sequence.



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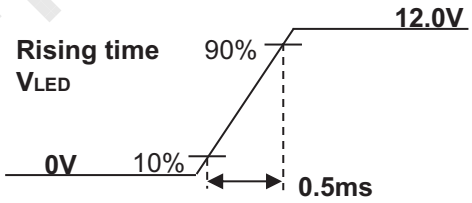
3-2. LED Backlight Electrical Characteristics

Table 3. LED B/L ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
LED Power Input Voltage		V_{LED}	7.0	12.0	21.0	V	1
LED Power Input Current		I_{LED}	-	413	425	mA	2
LED Power Consumption		P_{LED}	-	4.95	5.1	W	
LED Power Inrush Current		I_{LED_P}	-	-	1.5	A	3
PWM Duty Ratio			5	-	100	%	4
PWM Resolution				10		Bit	5
PWM Jitter			0	-	0.05	%	6
PWM Frequency		F_{PWM}	200	-	2000	Hz	7
PWM	High Level Voltage	V_{PWM_H}	2.5	-	3.6	V	
	Low Level Voltage	V_{PWM_L}	0	-	0.3	V	
	Rising Time	Tr_{PWM}	-	-	500	ns	
	Falling Time	Tf_{PWM}	-	-	500	ns	
LED_EN	High Voltage	$V_{LED\_EN\_H}$	2.5	-	3.6	V	
	Low Voltage	$V_{LED\_EN\_L}$	0	-	0.3	V	
Life Time			15,000	-	-	Hrs	8

Note)

1. The measuring position is the connector of LCM and the test conditions are under 25℃.
2. The current and power consumption with LED Driver are under the V_{LED} = 12.0V , 25℃, PWM Duty 100% and White pattern with the normal frame frequency operated(60Hz).
3. The V_{LED} rising time is same as the minimum of T13 at Power on sequence.



4. The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.
5. 10bit resolution means it's possible to change PWM duty by 0.1% step. (8bit operated by 0.4% step)
6. If Jitter of PWM is bigger than maximum, it may induce flickering.
7. 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.
8. 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.

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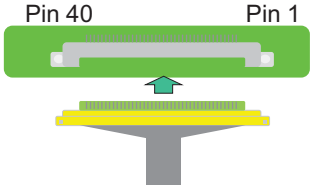
3-3. Interface Connections

Table 4. MODULE CONNECTOR PIN CONFIGURATION (CN1)

Pin	Symbol	Description	Notes
1	NC Reserved	Reserved for LCD manufacturer's use	
2	GND	High Speed Ground	
3	Lane3_N	Complement Signal Link Lane 3	
4	Lane3_P	True Signal Link Lane 3	
5	GND	High Speed Ground	
6	Lane2_N	Complement Signal Link Lane 2	
7	Lane2_P	True Signal Link Lane 2	
8	GND	High Speed Ground	
9	Lane1_N	Complement Signal Link Lane 1	
10	Lane1_P	True Signal Link Lane 1	
11	GND	High Speed Ground	
12	Lane0_N	Complement Signal Link Lane 0	[Connector]
13	Lane0_P	True Signal Link Lane 0	I-PEX, 20474-040E-12R
14	GND	High Speed Ground	(40pin , 0.4pitch)
15	AUX_CH_P	True Signal Auxiliary Channel	
16	AUX_CH_N	Complement Signal Auxiliary Channel	
17	GND	High Speed Ground	
18	VCC	LCD logic and driver power	[Connector pin arrangement]
19	VCC	LCD logic and driver power	Pin 40 Pin 1
20	VCC	LCD logic and driver power	
21	VCC	LCD logic and driver power	
22	LCD Self Test or NC	LCD Panel Self Test Enable (Optional)	
23	GND	LCD logic and driver ground	
24	GND	LCD logic and driver ground	
25	GND	LCD logic and driver ground	
26	GND	LCD logic and driver ground	
27	HPD	HPD signal pin	[LGD P-Vcom using information]
28	BL_GND	LED Backlight ground	1. Pin for P-Vcom : #34, #35
29	BL_GND	LED Backlight ground	2. P-Vcom Address : 0101000x
30	BL_GND	LED Backlight ground	
31	BL_GND	LED Backlight ground	
32	BL ENABLE	LED Backlight control on/off control	
33	BL PWM	System PWM signal input for dimming	
34	NC Reserved	Reserved for LCD manufacture's use	
35	NC Reserved	Reserved for LCD manufacture's use	
36	VLED	LED Backlight power (12V Typical)	
37	VLED	LED Backlight power (12V Typical)	
38	VLED	LED Backlight power (12V Typical)	
39	VLED	LED Backlight power (12V Typical)	
40	NC Reserved	Reserved for LCD manufacture's use	

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3-3-1. Input/output signal circuit

Figure1.HPD Output circuit is as below

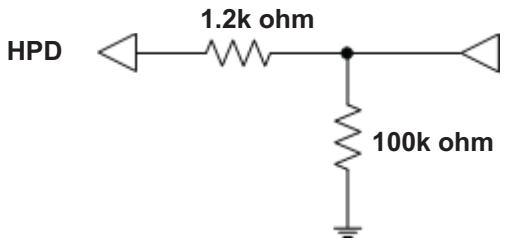


Figure2.BL PWM input circuit is as below

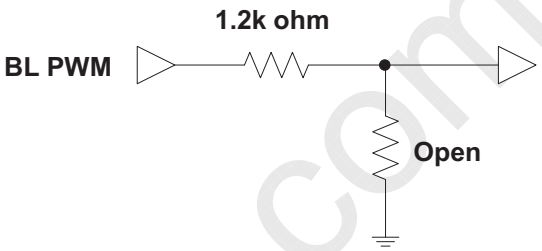


Figure3.BL Enable input circuit is as below

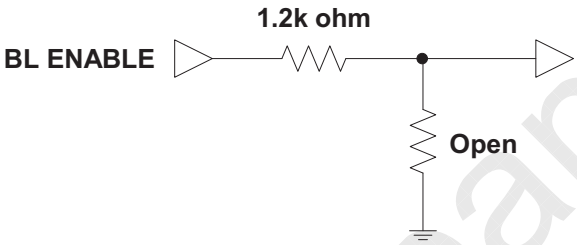
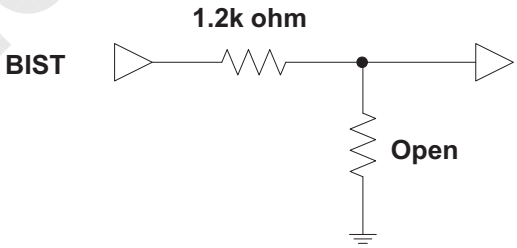


Figure4.BIST input circuit is as below



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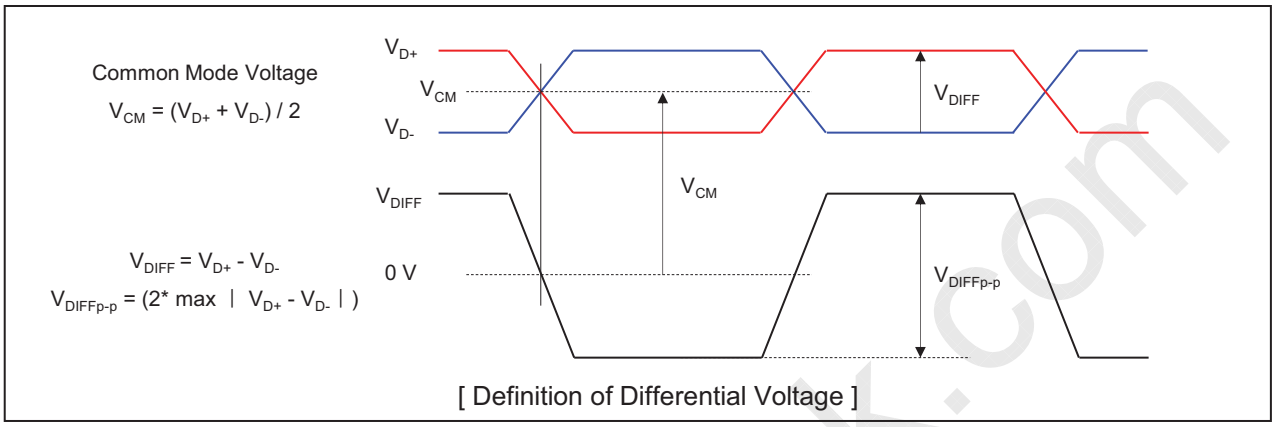
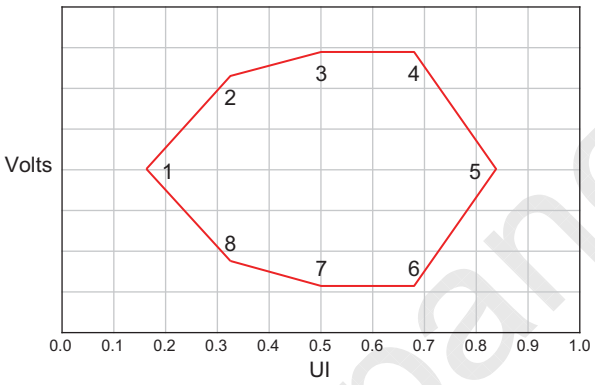
3-4. eDP Signal Timing Specifications

3-4-1. Definition of Differential Voltage

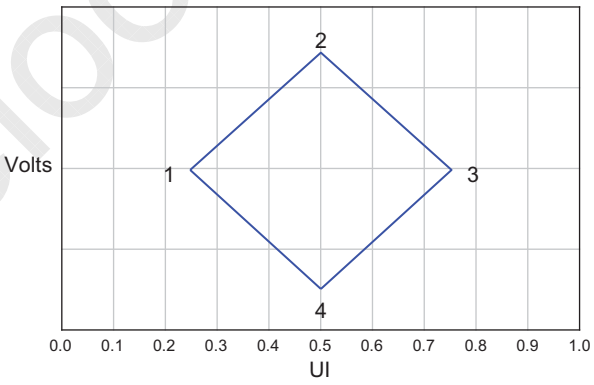


[Definition of Differential Voltage]

3-4-2. Main Link EYE Diagram



[EYE Mask at Source Connector Pins]



[EYE Mask at Sink Connector Pins]

Point	Reduced Bit Rate		High Bit Rate	
	Time(UI)	Voltage(V)	Time(UI)	Voltage(V)
1	0.127	0.000	0.210	0.000
2	0.291	0.160	0.355	0.140
3	0.500	0.200	0.500	0.175
4	0.709	0.200	0.645	0.175
5	0.873	0.000	0.790	0.000
6	0.709	-0.200	0.645	-0.175
7	0.500	-0.200	0.500	-0.175
8	0.291	-0.160	0.355	-0.140

[EYE Mask Vertices at Source Connector Pins]

Point	Reduced Bit Rate		High Bit Rate	
	Time(UI)	Voltage(V)	Time(UI)	Voltage(V)
1	0.375	0.000	0.246	0.000
2	0.500	0.023	0.500	0.075
3	0.625	0.000	0.755	0.000
4	0.500	-0.023	0.500	-0.075

[EYE Mask Vertices at Sink Connector Pins]

Point	Reduced Bit Rate		High Bit Rate	
	Time(UI)	Voltage(V)	Time(UI)	Voltage(V)
1	0.270	0.000	0.246	0.000
2	0.500	0.068	0.500	0.075
3	0.731	0.000	0.755	0.000
4	0.500	-0.068	0.500	-0.075

[EYE Mask Vertices at embedded DP Sink Connector Pins]

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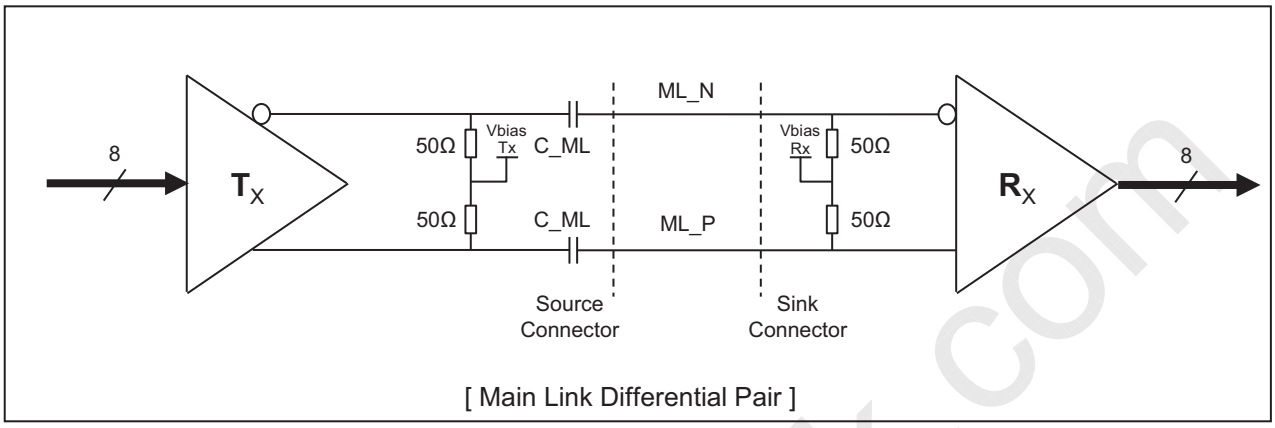
3-4-3. eDP Main Link Signal



[Main Link Differential Pair]

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Unit Interval for high bit rate (2.7Gbps / lane)	UI_HBR	-	370	-	ps	
Unit Interval for reduced bit rate (1.62Gbps / lane)	UI_RBR	-	617	-	ps	
Link Clock Down Spreading	Amplitude	0	-	0.5	%	
	Frequency	30		33	kHz	
Differential peak-to-peak voltage at Source side connector	$V_{TX-DIFFp-p}$	350	-	-	mV	For HBR(2.7Gbps)
		400	-	-		For RBR(1.62Gbps)
EYE width at Source side connector	$T_{TX-EYE-CONN}$	0.58	-	-	UI	For HBR(2.7Gbps)
		0.75	-	-	UI	For RBR(1.62Gbps)
Differential peak-to-peak voltage at Sink side connector	$V_{RX-DIFFp-p}$	150	-	-	mV	For HBR(2.7Gbps)
		136	-	-		For RBR(1.62Gbps)
EYE width at Sink side connector	$T_{RX-EYE-CONN}$	0.51	-	-	UI	For HBR(2.7Gbps)
		0.46	-	-	UI	For RBR(1.62Gbps)
Rx DC common mode voltage	$V_{RX\ CM}$	0	-	1.0	V	
AC Coupling Capacitor	C_{SOURCE_ML}	75		200	nF	Source side

Note)
1. Termination resistor is typically integrated into the transmitter and receiver implementations.
2. AC Coupling Capacitor is not placed at the sink side.
3. In cabled embedded system, it is recommended the system designer ensure that EYE width and voltage are met at the sink side connector pins.

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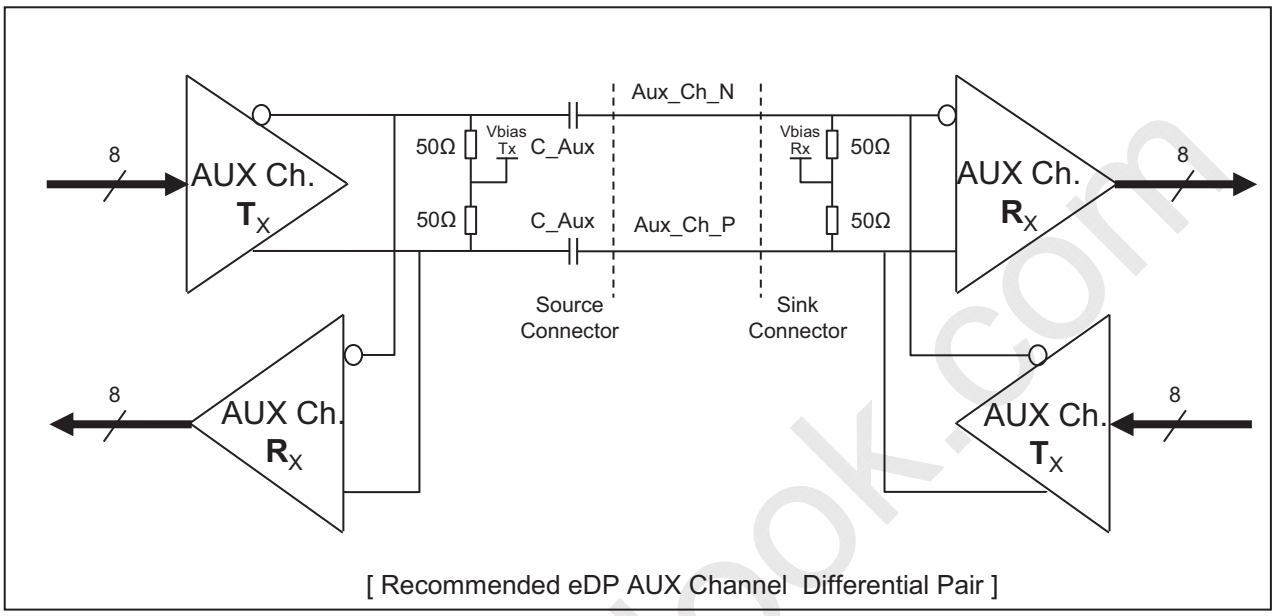
3-4-4. eDP AUX Channel Signal



[Recommended eDP AUX Channel Differential Pair]

Parameter	Symbol	Min	Typ	Max	Unit	Notes
AUX Unit Interval	UI	0.4	-	0.6	us	
AUX Jitter at Tx IC Package Pins	T_{jitter}	-	-	0.04	UI	Equal to 24ns
AUX Jitter at Rx IC Package Pins		-	-	0.05	UI	Equal to 30ns
AUX Peak-to-peak voltage at Connector Pins of Receiving	$V_{AUX-DIFFp-p}$	0.39	-	1.38	V	
AUX Peak-to-peak voltage at Connector Pins of Transmitting		0.36	-	1.36	V	
AUX EYE width at Connector Pins of Tx and Rx		0.98	-	-	UI	
AUX DC common mode voltage	V_{AUX-CM}	0	-	1.0	V	
AUX AC Coupling Capacitor	$C_{SOURCE-AUX}$	75		200	nF	Source side

Note)
1. Termination resistor is typically integrated into the transmitter and receiver implementations.
2. AC Coupling Capacitor is not placed at the sink side.
3. $V_{AUX-DIFFp-p} = 2^* | V_{AUXP}-V_{AUXN} |$

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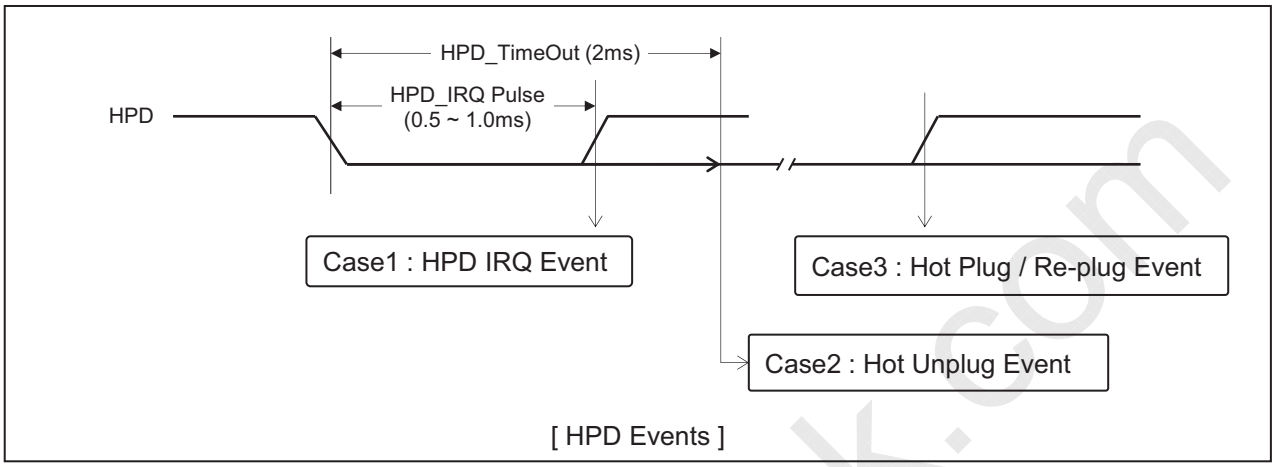
3-4-5. eDP HPD Signal



[HPD Events]

Parameter	Symbol	Min	Typ	Max	Unit	Notes
HPD Voltage	HPD	2.25	-	3.6	V	Sink side Driving
Hot Plug Detection Threshold		2.0	-	-	V	Source side Detecting
Hot Unplug Detection Threshold		-	-	0.8	V	
HPD_IRQ Pulse Width	HPD_IRQ	0.5	-	1.0	ms	
HPD_TimeOut		2.0	-	-	ms	HPD Unplug Event

Note)
1. HPD IRQ : Sink device wants to notify the Source device that Sink's status has changed so it toggles HPD line, forcing the Source device to read its Link / Sink Receiver DPCD field via the AUX-CH
2. HPD Unplug : The Sink device is no longer attached to the Source device and the Source device may then disable its Main Link as a power saving mode
3. Plug / Re-plug : The Sink device is now attached to the Source device, forcing the Source device to read its Receiver capabilities and Link / Sink status Receiver DPCD fields via the AUX-CH

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3-5. Signal Timing Specifications

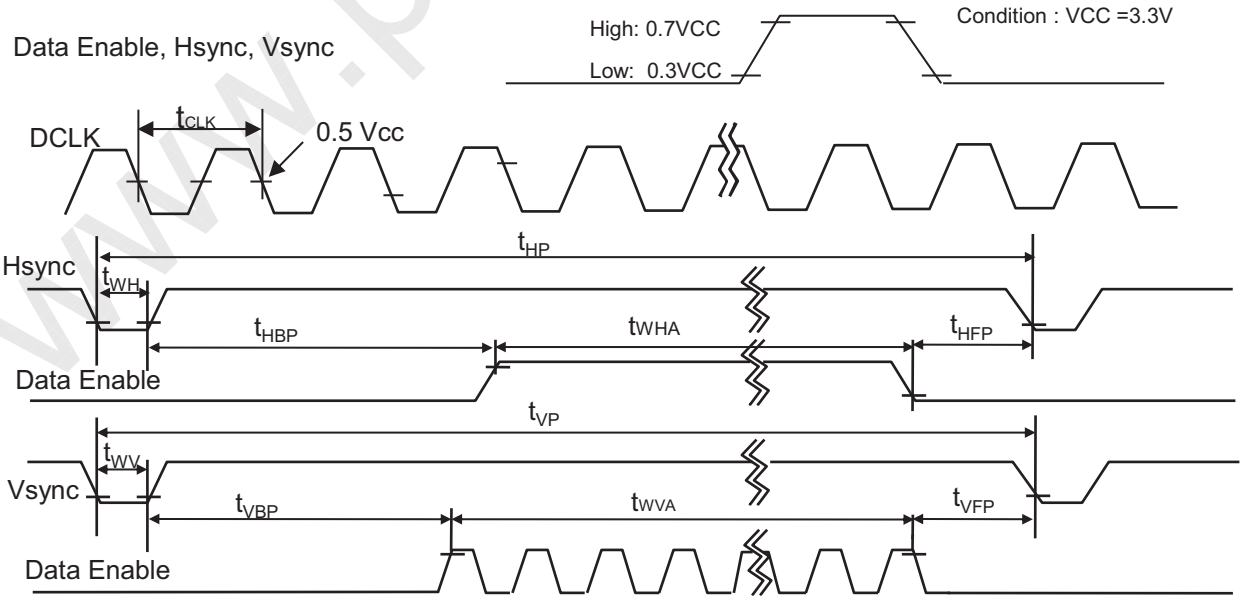
This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications and specifications of eDP Tx/Rx for its proper operation.

Table 4. TIMING TABLE

ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Frequency	f_{CLK}	-	268.6	-	MHz	
Hsync	Period	t_{HP}	2712	2720	2728	t_{CLK}	
	Width	t_{WH}	28	32	36		
	Width-Active	t_{WHA}	2560				
Vsync	Period	t_{VP}	1645	1646	1647	t_{HP}	
	Width	t_{WV}	6	6	6		
	Width-Active	t_{WVA}	1600				
Data Enable	Horizontal back porch	t_{HBP}	78	80	82	t_{CLK}	
	Horizontal front porch	t_{HFP}	46	48	50		
	Vertical back porch	t_{VBP}	36	37	38	t_{HP}	
	Vertical front porch	t_{VFP}	3	3	3		

Notice. all reliabilities are specified for timing specification based on refresh rate of 60Hz. However, LP170WQ1 has a good actual performance even at lower refresh rate (e.g. 40Hz or 50Hz) for power saving Mode, whereas LP170WQ1 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).

3-6. Signal Timing Waveforms



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3-7. Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 8-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
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
RED	RED (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	…					…								…								…			
	RED (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	...					...								...								...			
	GREEN (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	…					…								…								…			
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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3-8. Power Sequence

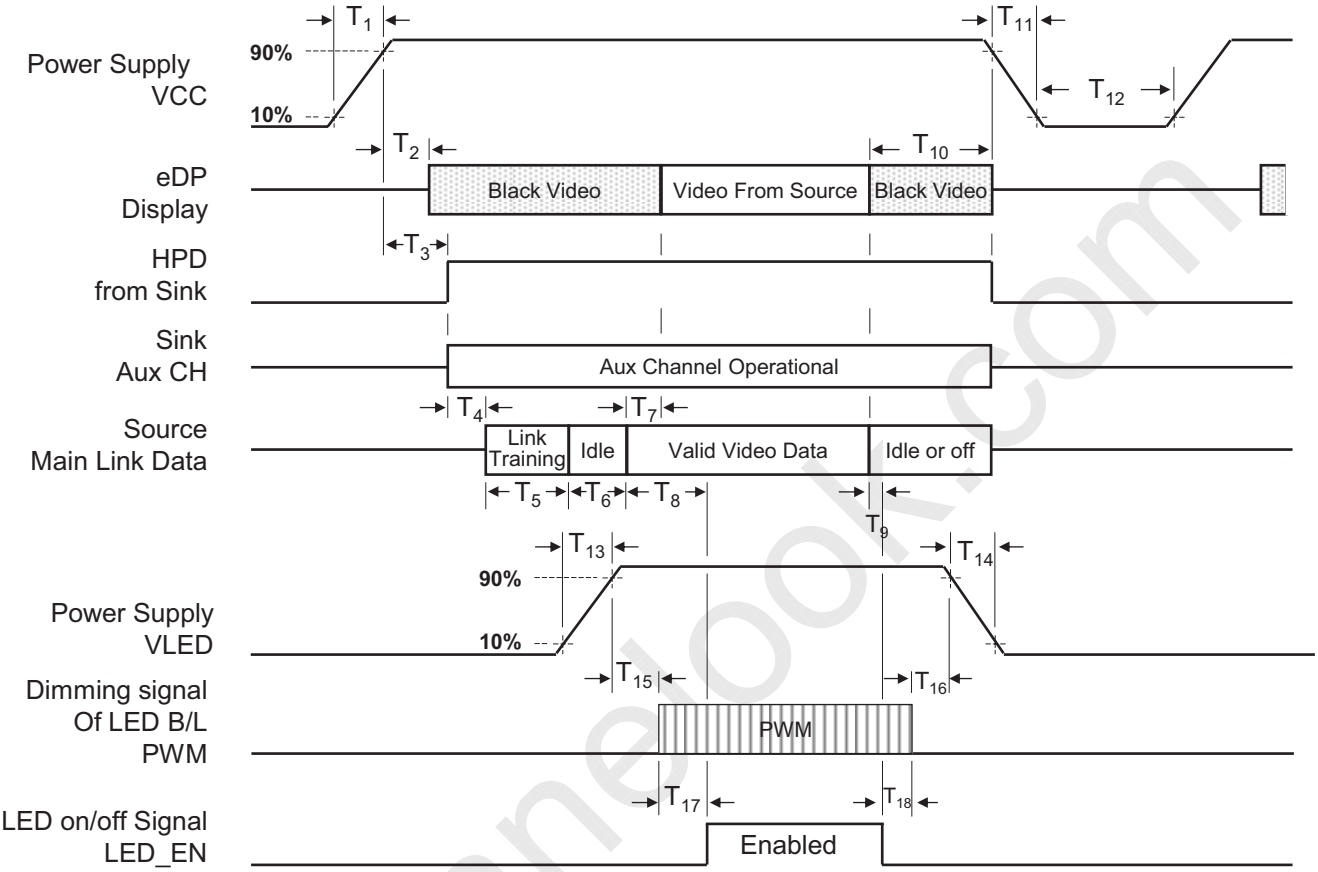

Table 6. POWER SEQUENCE TABLE

Symbol	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	5
T_9	Source	50	100	ms	6

Symbol	Required By	Limits		Units	Notes
		Min	Max		
T_{10}	Source	100	500	ms	7
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.
5. Driving signal of B/L must be "On" after normal video signal (Normal operating data from source) input.
6. When VCC off, LED EN must be dropped to low level within black video data.
7. For stable operation of BL, Black video data have to meet min 100ms.

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4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 20 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

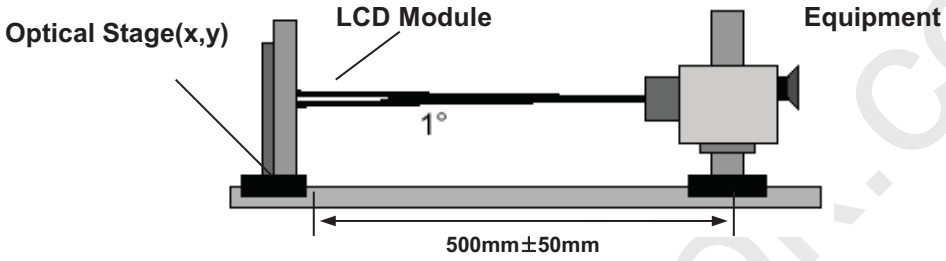

Table 7. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, fv=60Hz

Parameter		Symbol	Values			Units	Notes
			Min	Typ	Max		
Contrast Ratio		CR	1000	1200	-		1
Surface Luminance, white		L_{WH}	255	300	-	cd/m^2	2
Luminance Variation		$\delta_{WHITE\ (5P)}$	-	1.2	1.4	-	3
		$\delta_{WHITE(13P)}$	-	1.4	1.6		
Response Time		Tr + Tf	-	30	40	ms	4
Color Coordinates	RED	Rx	Typical - 0.25	0.680	Typical + 0.25		5
		Ry		0.320			
	GREEN	Gx		0.265			
		Gy		0.700			
	BLUE	Bx		0.150			
		By		0.050			
	WHITE	Wx		0.313			
		Wy		0.329			
Viewing Angle	x axis, right(Φ=0°)	Θr	80	85	-	Degree	6
	x axis, left (Φ=180°)	Θl	80	85	-		
	y axis, up (Φ=90°)	Θu	80	85	-		
	y axis, down (Φ=270°)	Θd	80	85	-		
Gray Scale							7
Color Gamut (DCI)		%	95	99	-		

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Note)

1. It should be measured in the center of screen(1 Point). Contrast Ratio(CR) is defined mathematically as

$$\text{Contrast Ratio(1 Point)} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

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 2.

$$L_{WH} = \text{Average(1,2, … 5 Point)}$$

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

$$\delta \text{ WHITE (5P)} = \frac{\text{Maximum (1,2, … 5 Point)}}{\text{Minimum (1,2, … 5 Point)}} \qquad \delta \text{ WHITE (13P)} = \frac{\text{Maximum (1,2, … 13 Point)}}{\text{Minimum (1,2, … 13 Point)}}$$

4. Response time is the time required for the display to transition from black to white (rise time, Tr) and from white to black (falling time, Tf). For additional information see FIG 3.

5. It should be measured in the center of screen (1Point).

6. 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.

7. Gray scale specification

Gray Level	Luminance [%] (Typ)
L0	0.06
L31	0.83
L63	4.8
L95	11.97
L127	23.16
L159	37.48
L191	54.23
L223	75.16
L255	100

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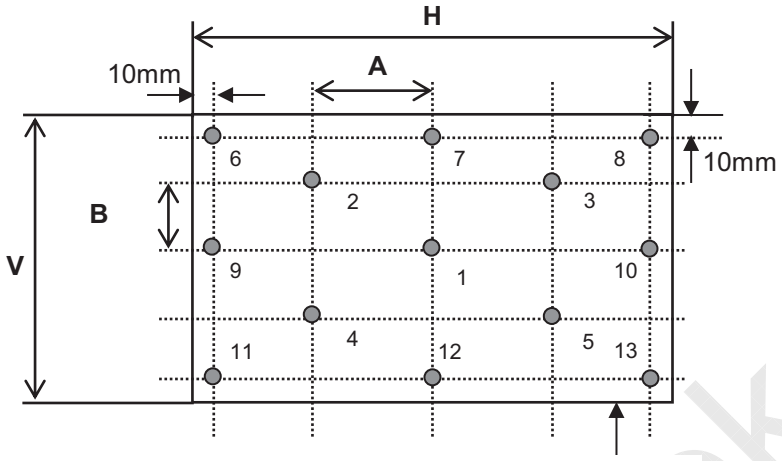
FIG. 2 Luminance

<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”.

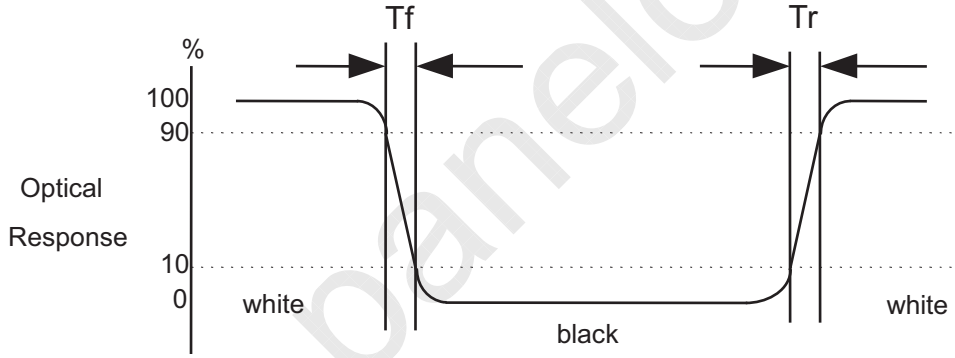
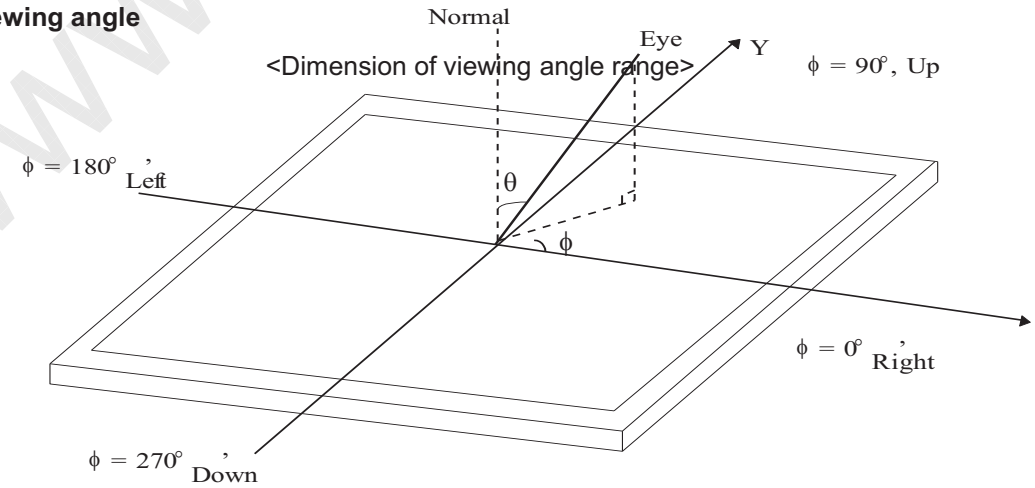


FIG. 4 Viewing angle



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5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model LP170WQ1. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	372.84 ± 0.3 mm
	Vertical	242.47 Max. mm
	Thickness	2.20mm (w/o PCB, D, Max.) 2.35mm (w/o PCB, w/AL Plate, D, Max.) 4.50mm (w/PCB, D, Max.)
Upper Polarizer Dimension	Horizontal	369.14 ± 0.2 mm
	Vertical	231.86 ± 0.2 mm
Active Display Area	Horizontal	366.34 mm
	Vertical	228.96 mm
Weight	262g (Max.) / 252g (Typ.)	
Surface Treatment	Hard Coating(3H), Glare treatment of the front polarizer	

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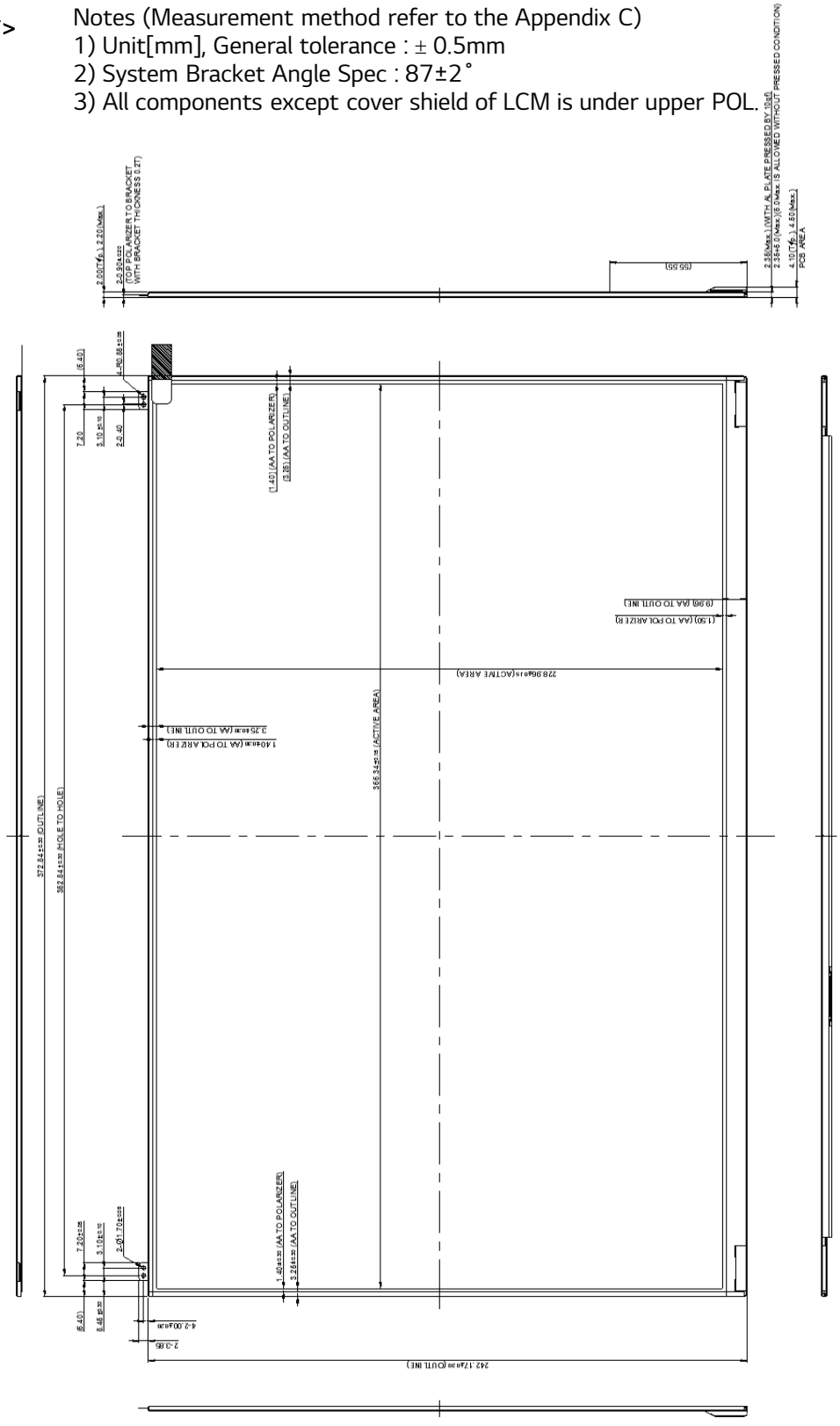
<FRONT VIEW>

Notes (Measurement method refer to the Appendix C)
1) Unit[mm], General tolerance : ± 0.5mm
2) System Bracket Angle Spec : 87±2°
3) All components except cover shield of LCM is under upper POL.



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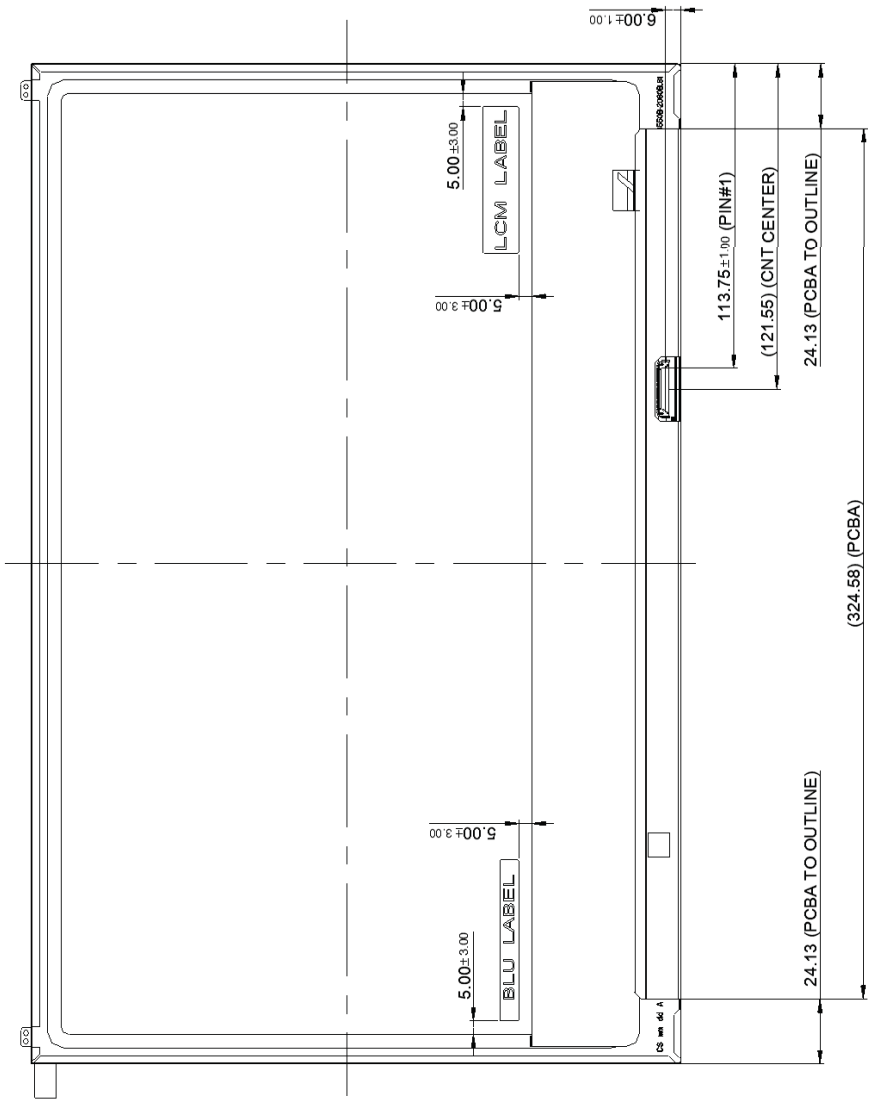
<REAR VIEW>

Notes
1) Unit[mm], General tolerance : ± 0.5mm
2) LCM Label Information refer to the page 25.



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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)	Random, 1.0Grms, 10 ~ 300Hz(PSD 0.0035) 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
8	ESD	± 8kV for contact discharge ± 15kV for air discharge

[Result Evaluation Criteria]

1. Comparing the initial functional FOS status, there should be no major change which might affect the practical display function when the display reliability test is conducted.

2. After conduct reliability tests, LGD guarantees only functional FOS quality.

3. In the Reliability Test, Confirm performance after leaving in room temp.

4. In the standard condition, there shall be no practical problems that may affect the display function 24 hours later after reliability test. After the reliability test, we can guarantee the product only when the corrosion is causing its malfunction. The corrosion causing no functional defect can not be guaranteed.

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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 Electro technical Standardization (CENELEC).
Information Technology Equipment - Safety - Part 1 : General Requirements.
d) IEC 60950-1, The International Electro technical 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

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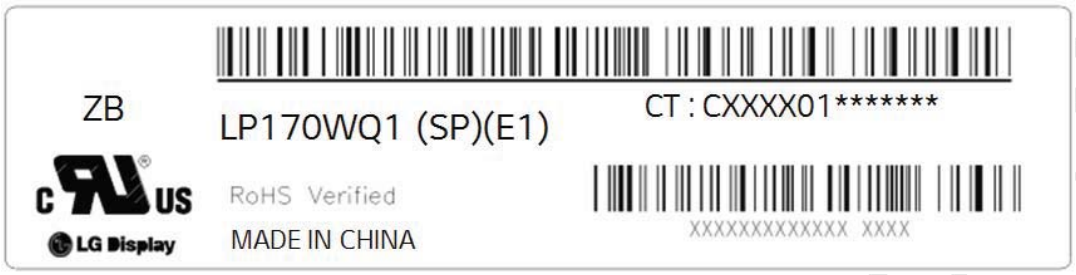
8. Packing

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)
D : YEAR
E : MONTH
F ~ M : SERIAL NO.

Note
1. YEAR

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Mark	K	L	M	N	P	R	S	T	U	V

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 : 10 pcs

b) Box Size : 478 x 365 x 244

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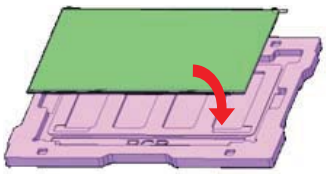
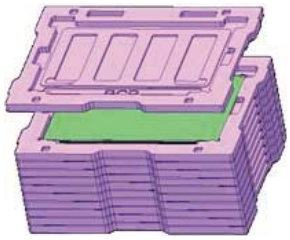
8-3. Packing Assembly

① put a LCM in the Tray

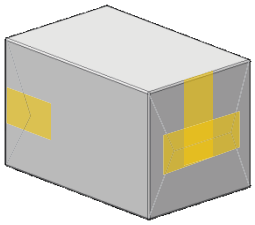


② 10Tray stack + 1 empty Tray

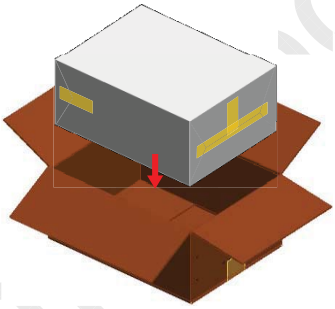


③ wrap Loaded Trays by the AL Bag

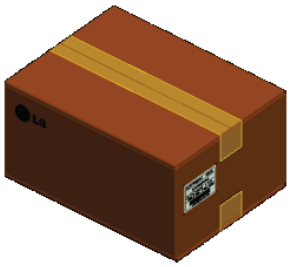
④ Taping AL Bag



⑤ Loaded Trays + AL Bag be put in the Box



⑥Taping Box



NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	AL
3	TAPE	MASKING 20MMX50M
4	PACKING, Tray	EP0
5	Desiccant	PowerDry
6	BOX	SWR4
7	TAPE	OPP 70MMX300M
8	LABEL	ART 100X70

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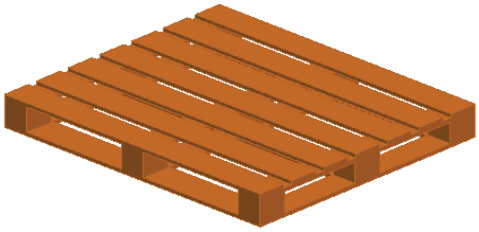
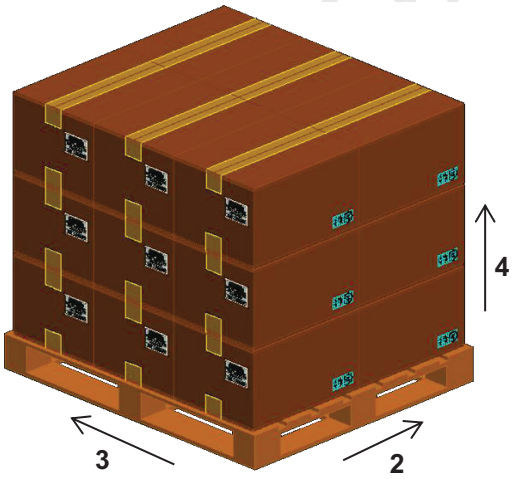
8-4. Pallet Assembly

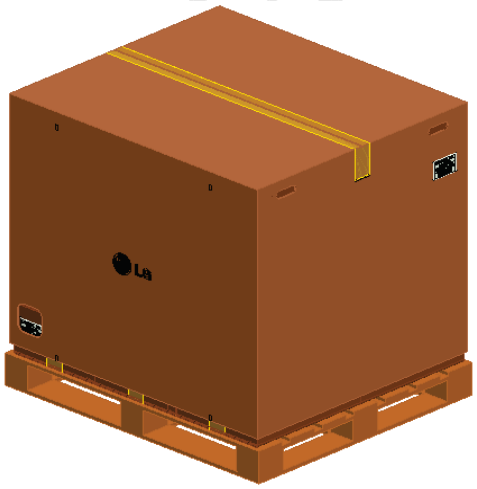
1. Pallet Ready



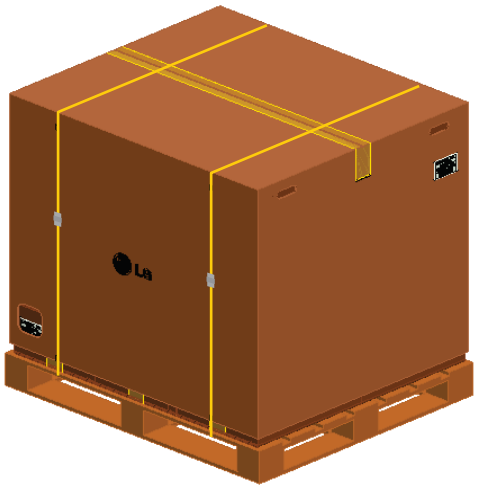
2. 2 x 3 x 4 Box Pattern



3. Angle Packing & Taping



4. Banding



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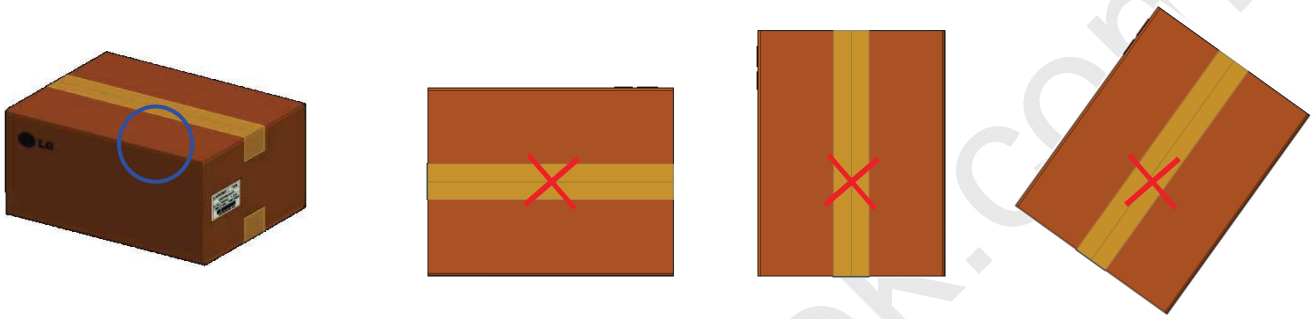
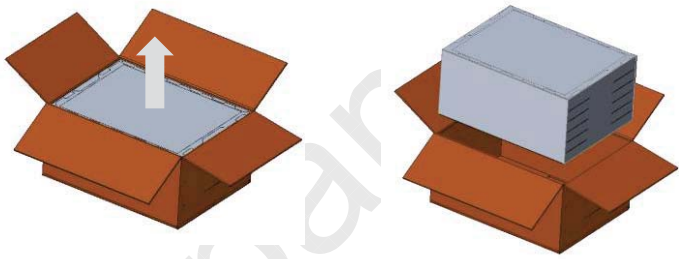
8-5. Precautions for unpacking the Box

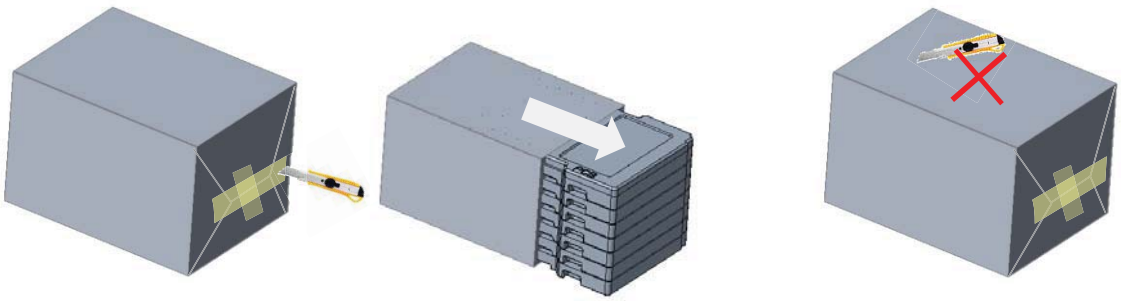
a.) Don't throw or tilt the box and put it on a flat surface.



b.) Place the box on a flat floor and Take out the AL bag vertically.



c.) Cut the tape on the side of the bag with a knife and Take out the tray horizontally.



Caution : Do not cut the top of the bag with a knife.
(The Knife can damage product)

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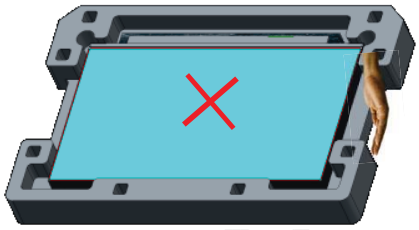
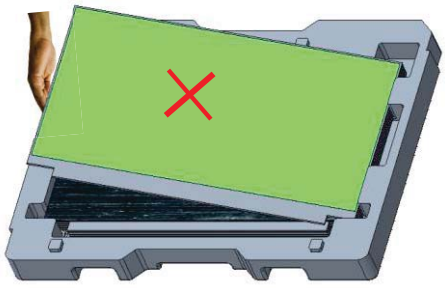
8-6. Precautions for Handling tray

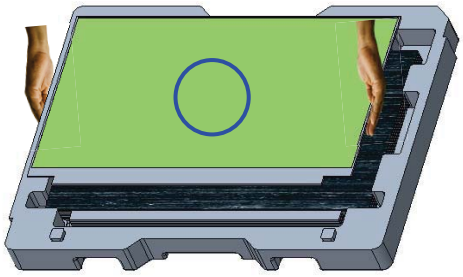
a.) Hold center of short or long side of the tray with both hands when handling one or more trays.



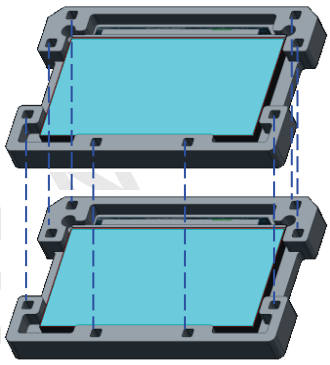
Caution : Do not handle with only one hand.

b.) Always place tray on flat surface and Don't tilt with one hand to take out.





c.) When stacking trays, Please align same position of the hollows of each tray.
- Two corner is Chamfer corner



If not Aligned,
The tray may slip without being loaded.

d.) The maximum stacking quantity is equal to the number of loads per box.
- Recommended as above because heavier weight can cause muscular skeletal disease and operator handling errors.

※The packaging type may be different from the Image.

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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.

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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.

9-7. THE LGD QA RESPONSIBILITY WILL BE AVOIDED IN CASE OF BELOW

(1) When the customer attaches TSM(Touch Sensor Module) on LCM without Supplier's approval.
(2) When the customer attaches cover glass on LCM without Supplier's approval.
(3) When the LCMs were repaired by 3rd party without Supplier's approval.
(4) When the LCMs were treated like Disassemble and Rework by the Customer and/or Customer's representatives without supplier's approval.

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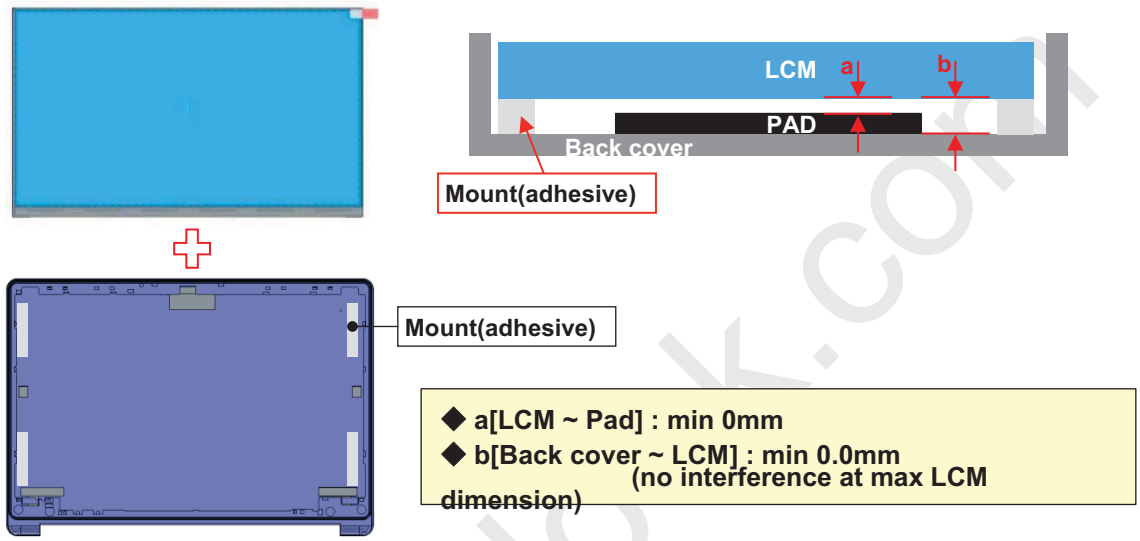
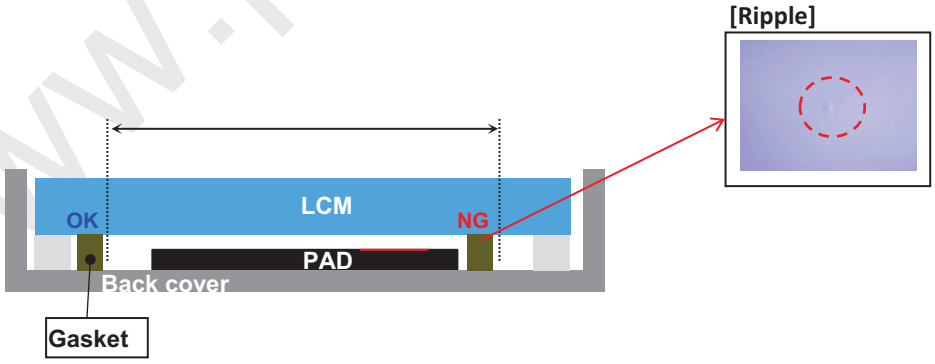
APPENDIX A. LGD Proposal for system cover design

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



Risk point	Rear side of LCM is sensitive against external stress, and previous check about interference is highly needed.
Suggestion	In case there is something from system cover comes into the boundary above,mechanical interference may cause the FOS defects. (ex: Ripple, White spot..)

2	Gasket position



Risk point	Ripple or white spot can be happened by interference between pad and LCM when gap is not enough.
Suggestion	It is recommended that gasket is posited out of active area .

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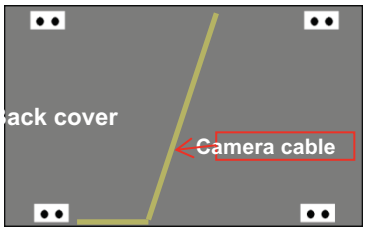
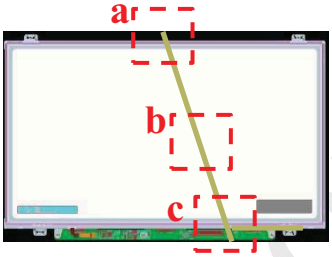
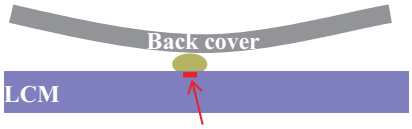
APPENDIX A. LGD Proposal for system cover design

3	Checking the path of the System cables

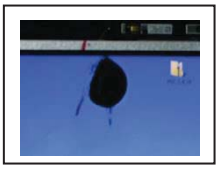


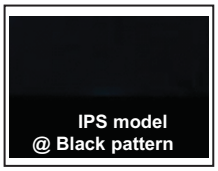


[Panel crack at "a"] [White spot at "b"] [Light leakage at "c"]



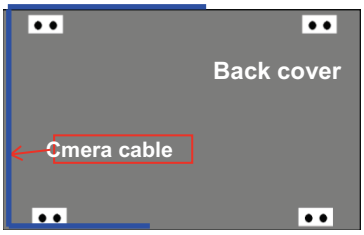
There is concentrated stress

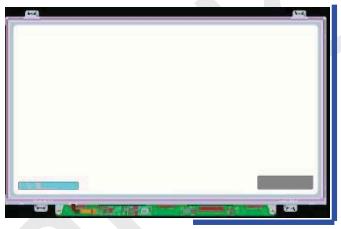




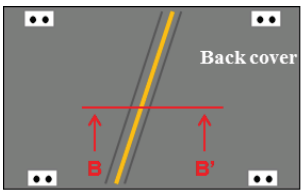
[Suggestion]

[Cable path]

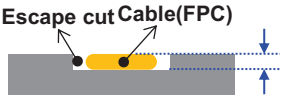




[Add cut]



<Secton B-B'>



Escape cut depth = Cable thickness

[Add pad]

Risk point	LCM is easily damage by camera cable when cable is protruded from back cover. It is caused panel crack or white spot by concentrated stress and light leakage by panel bending at IPS model.
Suggestion	It is recommended that camera cable path put outside of LCM. It is recommended that pad is added at both side of cable. If cable path must be cross middle area of system,@slim & narrow bezel 1) Cable type is recommended to use flexible (Use FPC type). 2) Add escape cut on back cover and add round at the edge of cut Depth of escape cut recommended to set the same as FPC thickness.

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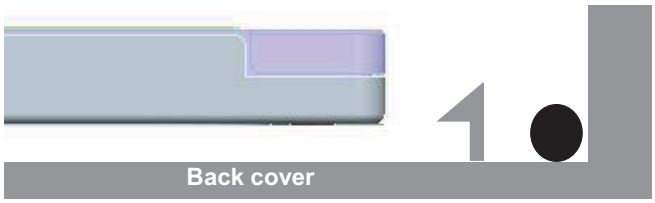
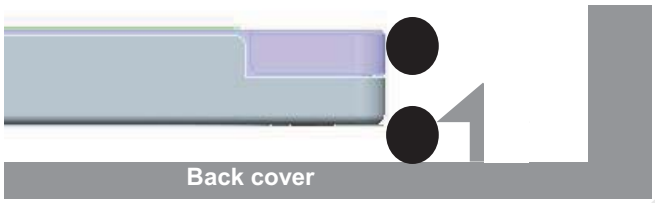
APPENDIX A. LGD Proposal for system cover design

4	Check the wire position(path)



OK



NG

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

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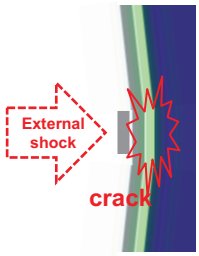
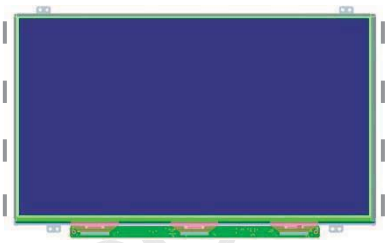
APPENDIX A. LGD Proposal for system cover design

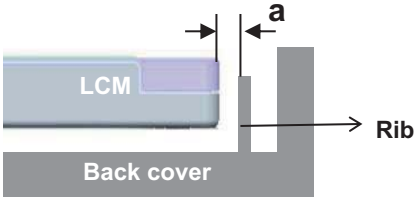
5	Back cover rib / wall (path & gap)

OK





NG



a ≥ 0.5mm [at max dimension of design]
a ≥ 1.0mm [at typical dimension of design]

Risk point	Gap is too small and rib is too short, panel is easily cracked by external stress.
Suggestion	Gap is must be kept more than 0.5mm(max dim.) and 1.0mm(typ dim.) . The figure of rib is continuous or fully long. “a” is not enough as narrow bezel type, add damper between LCM and system rib/wall

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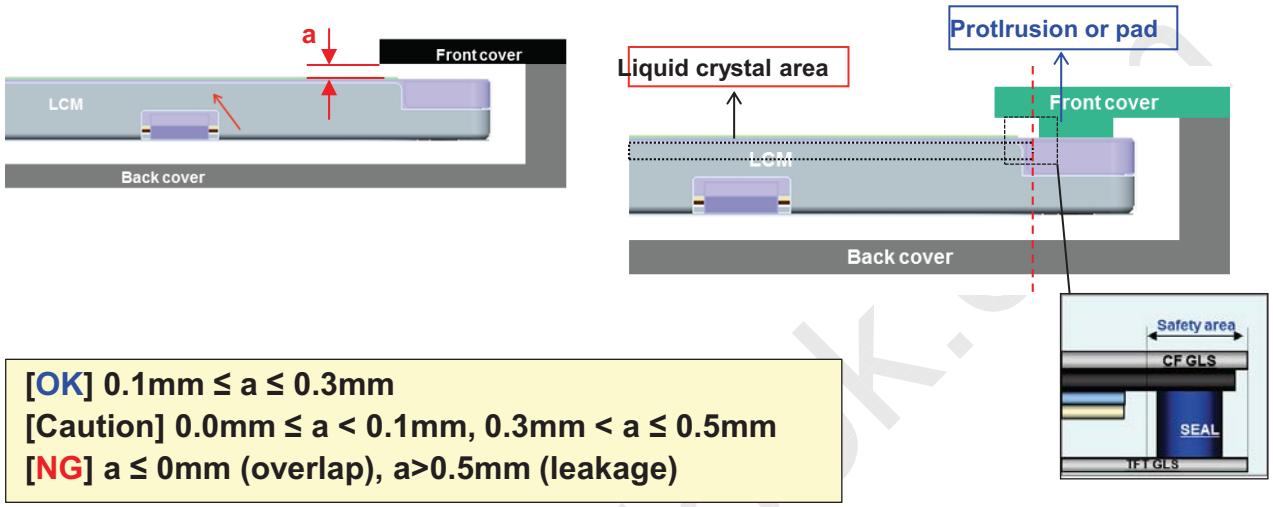
APPENDIX A. LGD Proposal for system cover design

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



[OK] 0.1mm ≤ a ≤ 0.3mm
[Caution] 0.0mm ≤ a < 0.1mm, 0.3mm < a ≤ 0.5mm
[NG] a ≤ 0mm (overlap), a>0.5mm (leakage)

Risk point	Ripple can be happened by little gap between glass and front cover.
Suggestion	Keep the gap between front cover and LCM from 0.1 to 0.3mm Ripple is prevented by add protrusion shape at the back side of front cover. In this case, protrusion must be created outside of liquid crystal area

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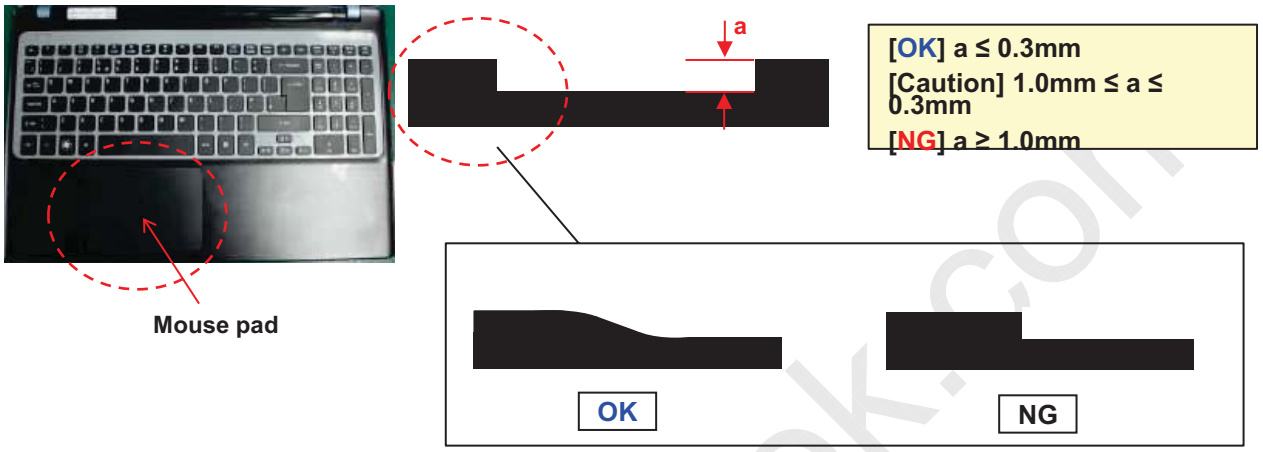
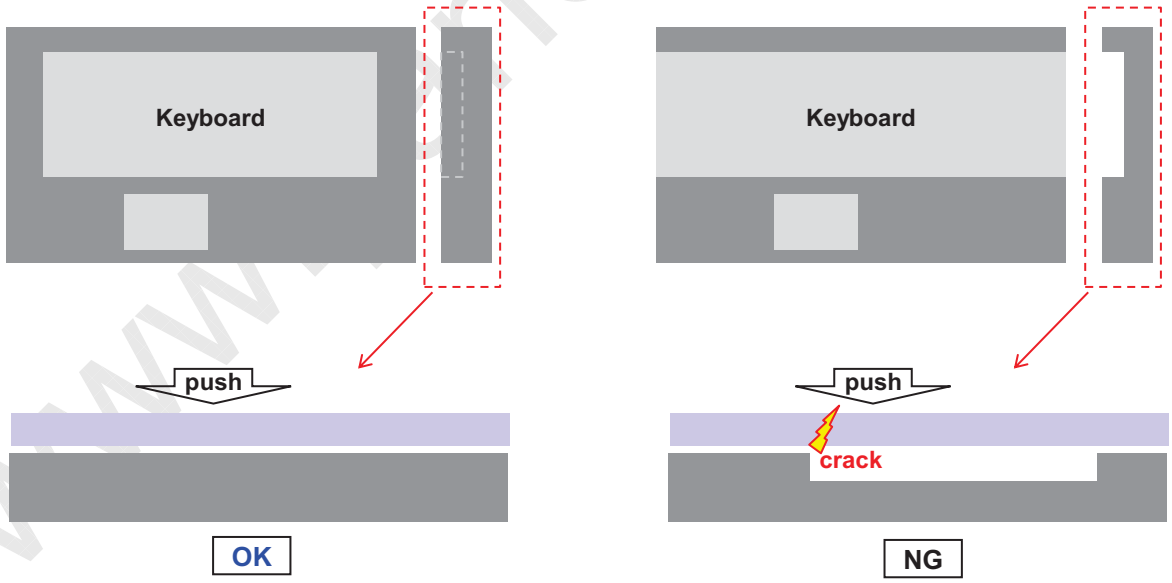
APPENDIX A. LGD Proposal for system cover design

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



Risk point	Mouse pad step is deep, it is caused panel crack by external load.
Suggestion	The edge shape must be smooth.

8	Check the step of keyboard area



Risk point	The step of keyboard at the side edge of main body, it is caused panel crack
Suggestion	Keep to flat out side of keyboard.

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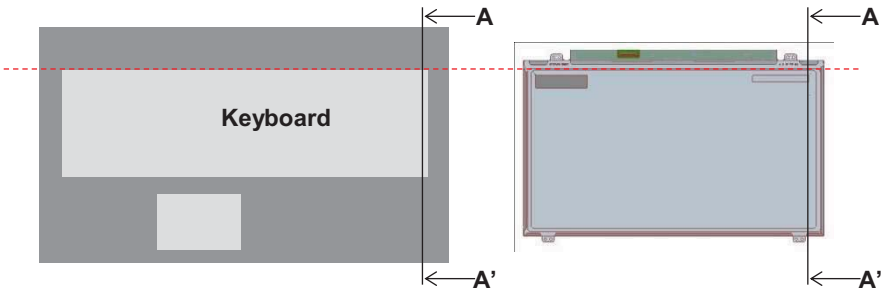
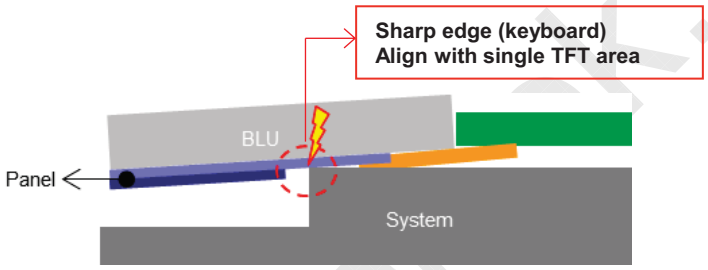
APPENDIX A. LGD Proposal for system cover design

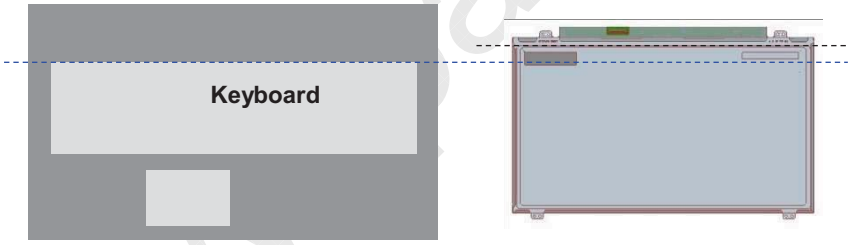
9	The position and shape of keyboard step





<Section A-A'>

[Suggestion]



<Section A-A'>

Risk point	Keyboard edge is sharp (a right angle), panel is get concentrated stress, by external force at this edge. Especially, keyboard edge is aligned with panel edge (single-TFT area), crack risk is seriously increase.
Suggestion	It is recommended that keyboard edge is posited to avoid single-TFT area. It is recommended that edge shape of touch pad is rounded.

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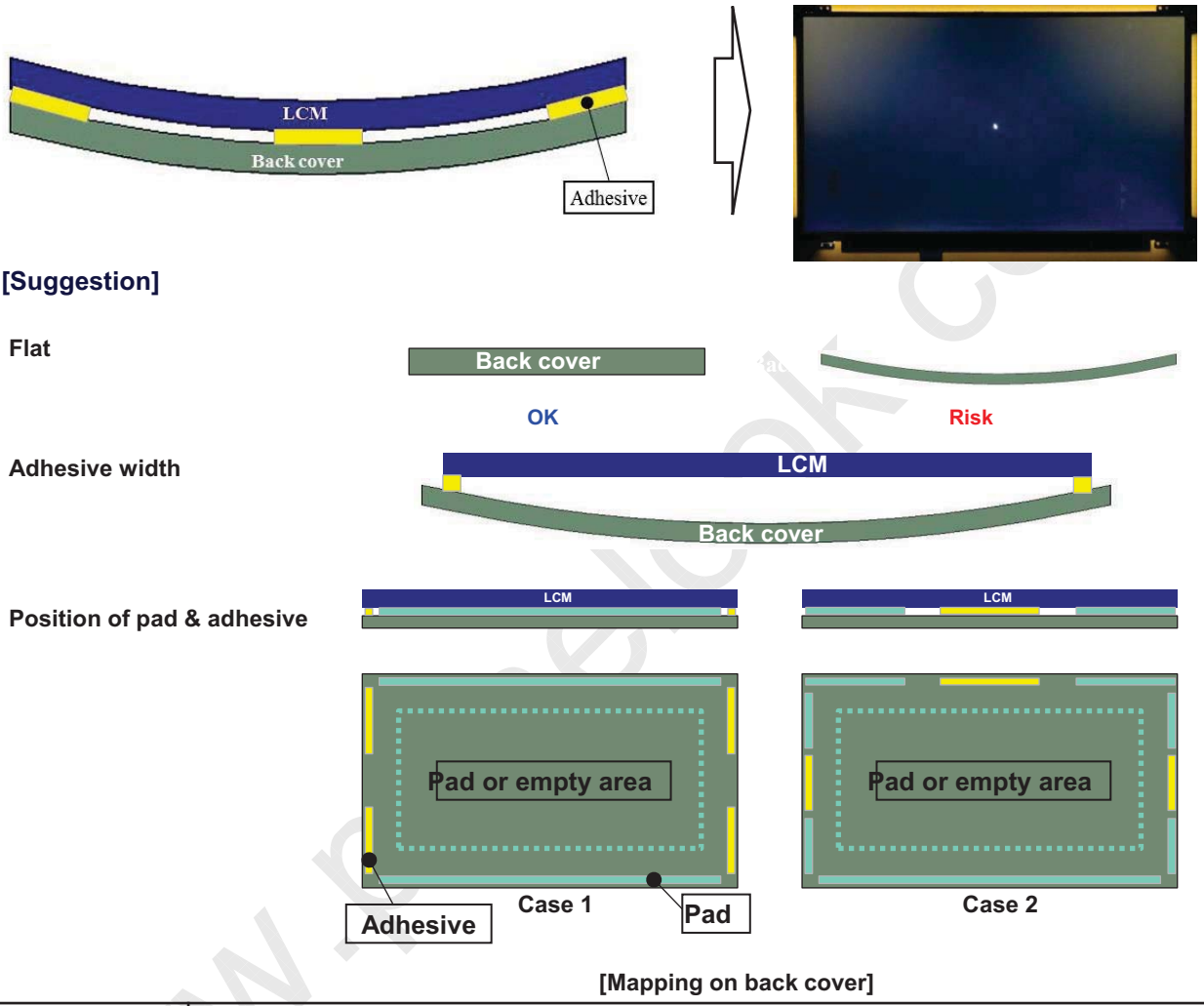
APPENDIX A. LGD Proposal for system cover design

10-1	LCM fixing (no flange model)



[Mapping on back cover]

Risk point	In IPS model, bended LCM, light leakage of IPS (mura) is happened. LCM is bended by below condition. 1. Back cover is not flat or distorted. 2. LCM is fixed by adhesive at center area. 3. Adhesive width is too large.
Suggestion	It is recommended that back cover is flat type. Adhesive width need to be minimized if adhesive strength is enough. It is recommended that adhesive is posited at outside on back-cover. Pad is recommended to apply at other area.

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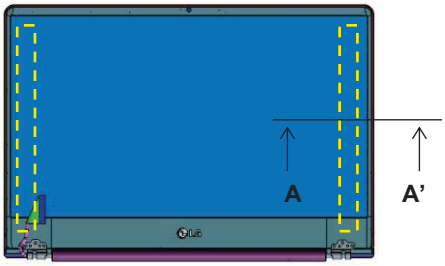
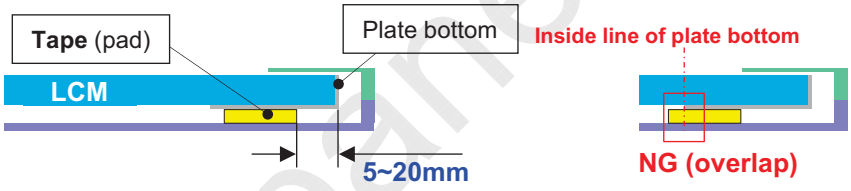
APPENDIX A. LGD Proposal for system cover design

10-2	LCM fixing (no flange model)

[Suggestion]





Risk point	In IPS model, bended LCM, light leakage of IPS (mura) is happened. LCM is bended by below condition. 1. Back cover is not flat or distorted. 2. LCM is fixed by adhesive at center area. 3. Adhesive width is too large.
Suggestion	It is recommended to attach LCM fixing tape to the inside with reference to the outside (5~20mm). But do not overlap the pad with the inside line of the plate bottom

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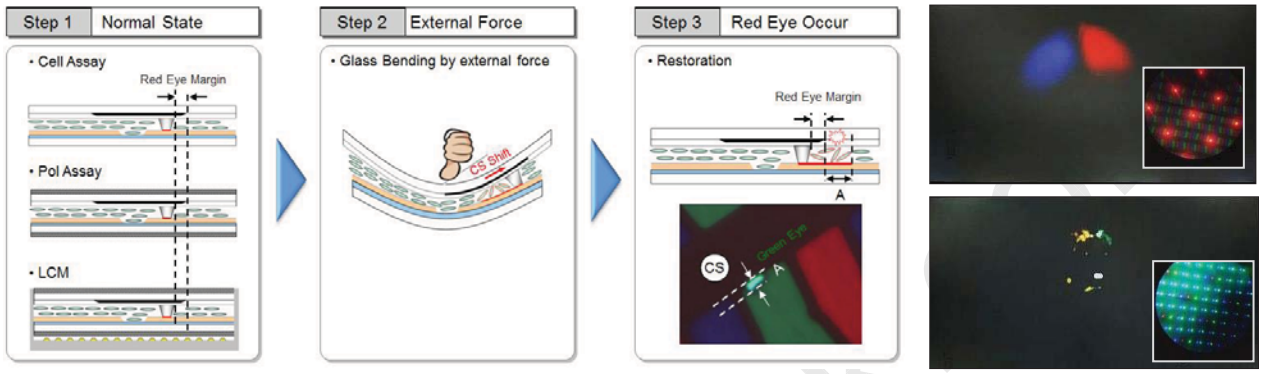
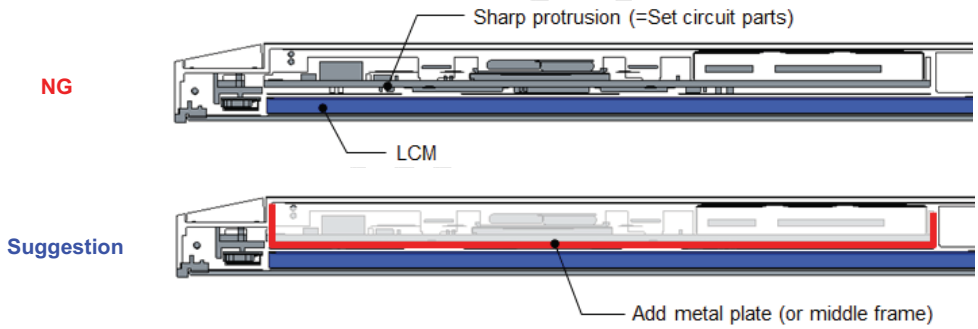
APPENDIX A. LGD Proposal for system cover design

11	System protrusion and step for RGB eye

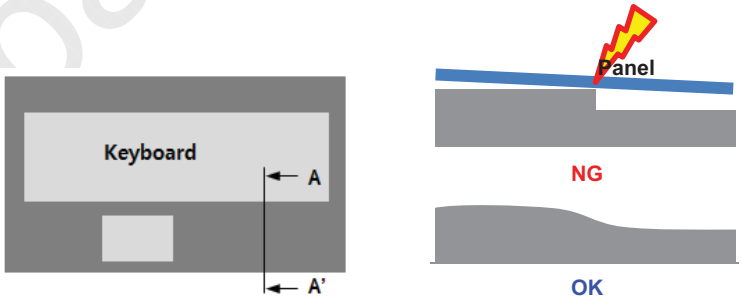


[Suggestion]

Middle frame



Keyboard step



Risk point	When abnormally strong external force is given to LCM, CF CS push the PI and make a scratch, which have the light leak happen. This light leak comes out as Red Eye.
Suggestion	Minimize the height of protrusion and add metal plate on main board. (Tablet type) It is recommended to make a round edge at keyboard step area to prevent stress concentration by external force.

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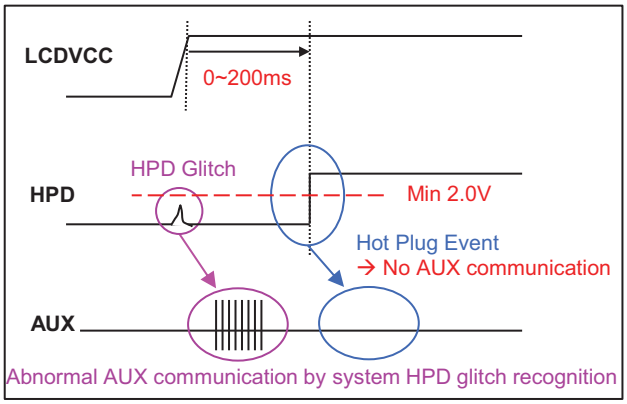
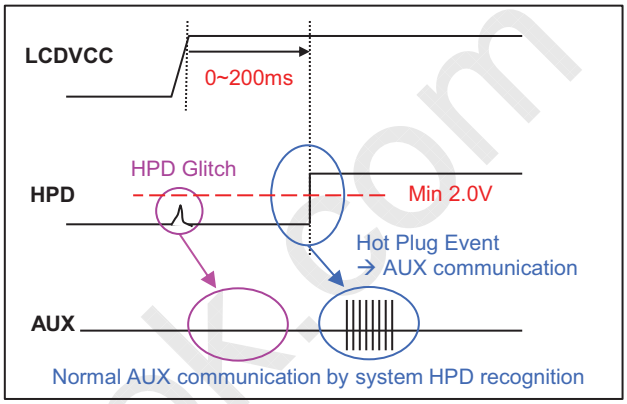
APPENDIX B. LGD Proposal for eDP Interface Design Guide

1	HPD Signal recognition



[Abnormal Communication By HPD Glitch]

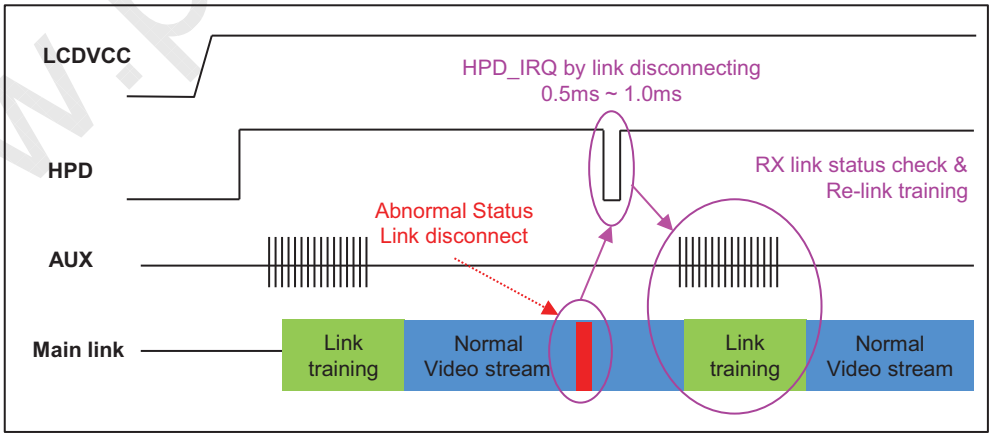


[Normal Communication By HPD Signal]

Define	1. Hot Plug Detection (HPD) Threshold level of Source Device is minimum 2.0V
	2. HPD Unplug : HPD pulse stays low longer than 2ms. DP Tx shall wait for HPD signal to go high again.
	3. "HPD High" is confirmed only after HPD has been asserted continuously for 100msec.

2	IRQ (Interrupt Request) HPD Pulse Definition

Ex) HPD Pulse



Define	Upon detection this "HPD IRQ Event"(0.5ms ~ 1ms) ,the source device must read the link / sink status field of the DPCD and take corrective action.

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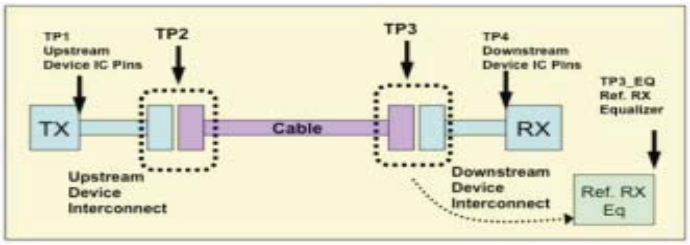
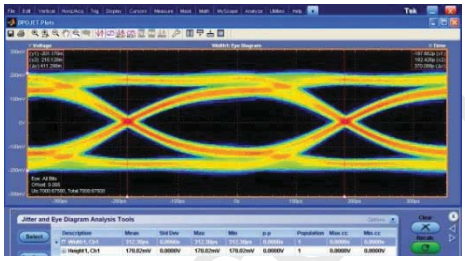
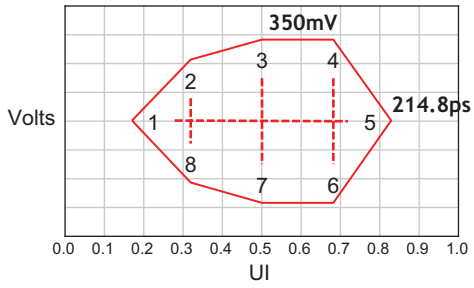
APPENDIX B. LGD Proposal for eDP Interface Design Guide

3 Main Link EYE Diagram



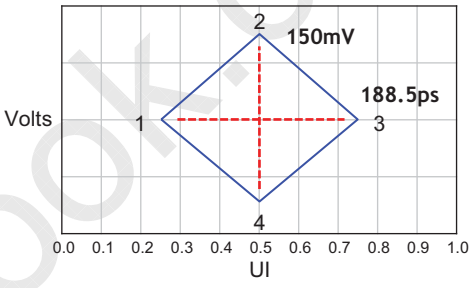


[EYE Diagram]



Point	UI	Voltage (Volts)
1	0.210	0.000
2	0.355	0.140
3	0.500	0.175
4	0.645	0.175
5	0.790	0.000
6	0.645	-0.175
7	0.500	-0.175
8	0.355	-0.140

[EYE Vertices for TP2 at HBR]

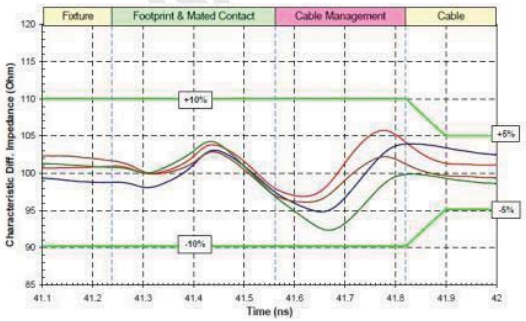


Point	UI	Voltage (Volts)
1	0.246	0.000
2	0.500	0.075
3	0.755	0.000
4	0.500	-0.075

[EYE Vertices for TP3 at HBR]

Define	Main Link EYE Diagram should meet TP2 and TP3 point

4 Cable Impedance management



Segment	Differential Impedance	Maximum Tolerance
Fixture	100 Ω	+/- 10%
Connector	100 Ω	
Wire management	100 Ω	
Cable	100 Ω	+/- 5%

Define	Cable Impedance 100 Ω +/- 5% (95Ω ~ 105Ω)

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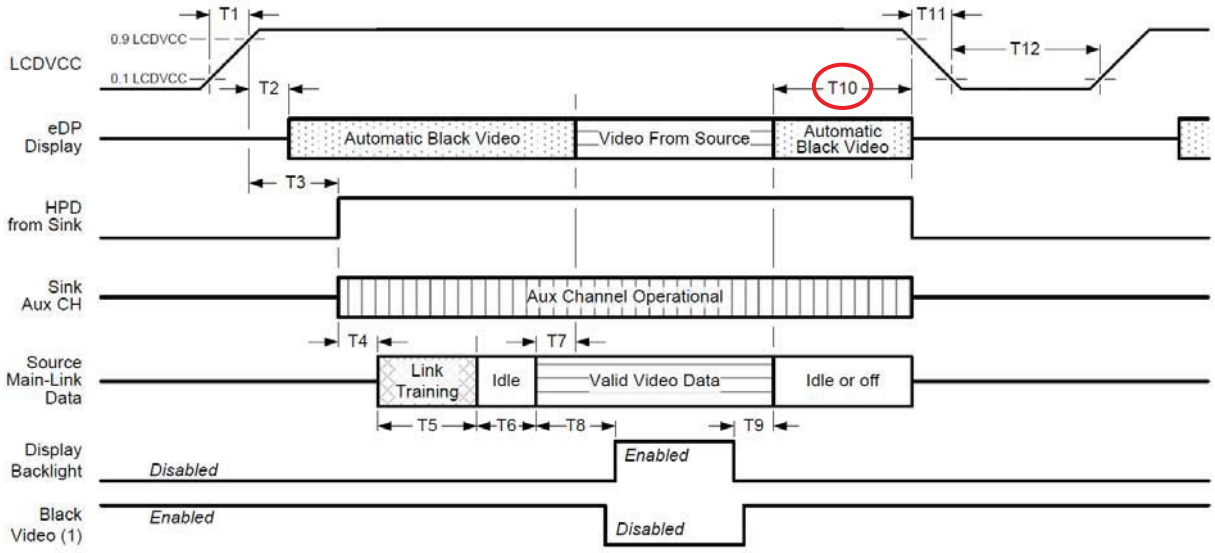
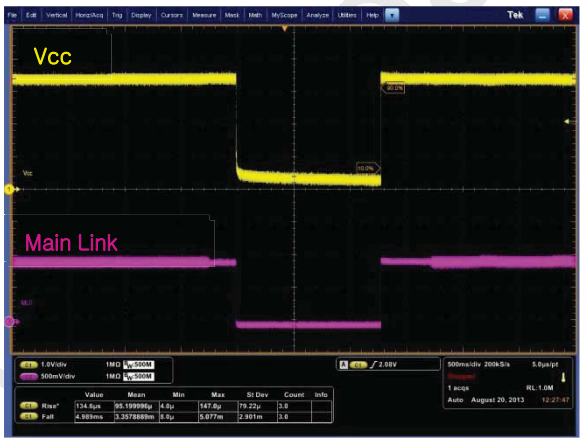
APPENDIX B. LGD Proposal for eDP Interface Design Guide

5	Main Link Off vs. LCD Power Off at Non-PSR

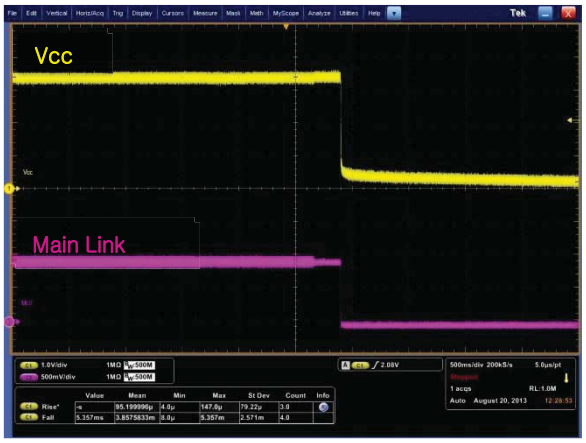


Timing Parameter	Description	Required By	Min	Max
T10	Delay from end of valid video from Source to Power Off	Source	0ms	500ms

* LGD recommend that Source must power off the LCDVCC if Main Link off like below.



[Case1. Resolution Change]



[Case2. Close the Lid]

Define	If Main Link off signal from Source, then LCDVCC must be Power Off within T10 period at Non-PSR mode

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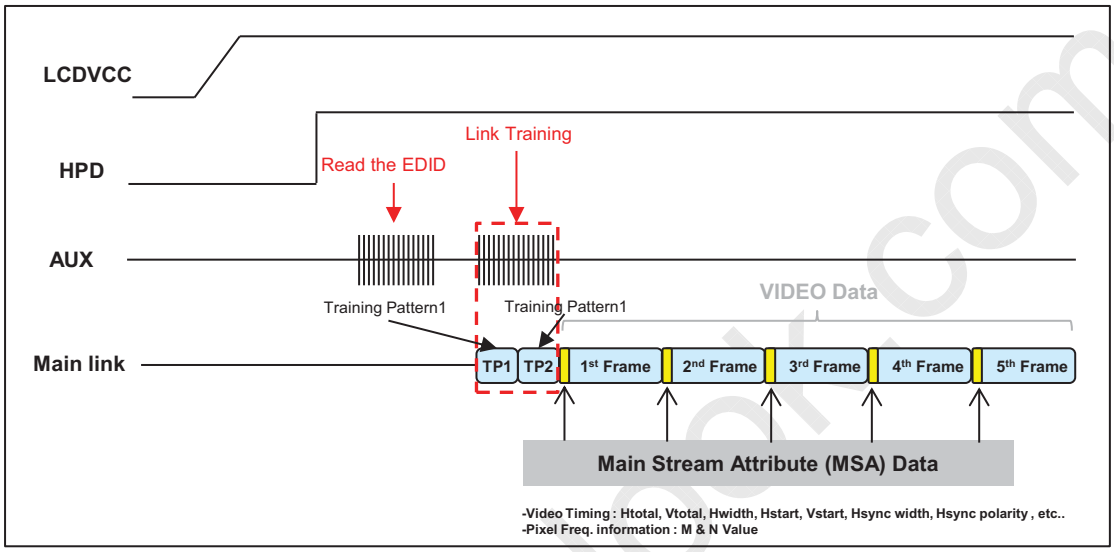
APPENDIX B. LGD Proposal for eDP Interface Design Guide

6	Main Link M & N value of MSA data



Define	It need to fix M& N value of MSA data output to prevent the initial abnormal M& N Value from incoming after power on.

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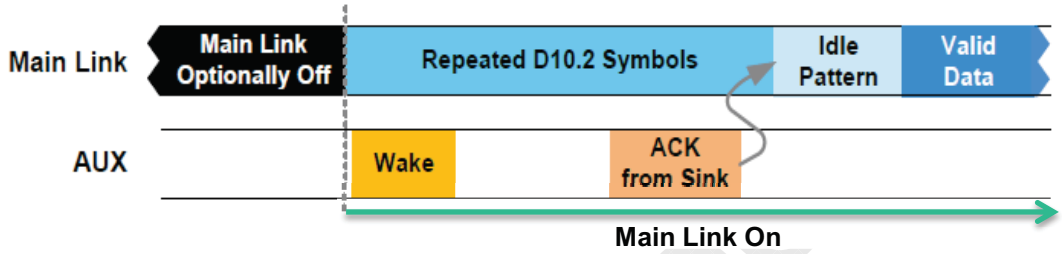
APPENDIX B. LGD Proposal for eDP Interface Design Guide

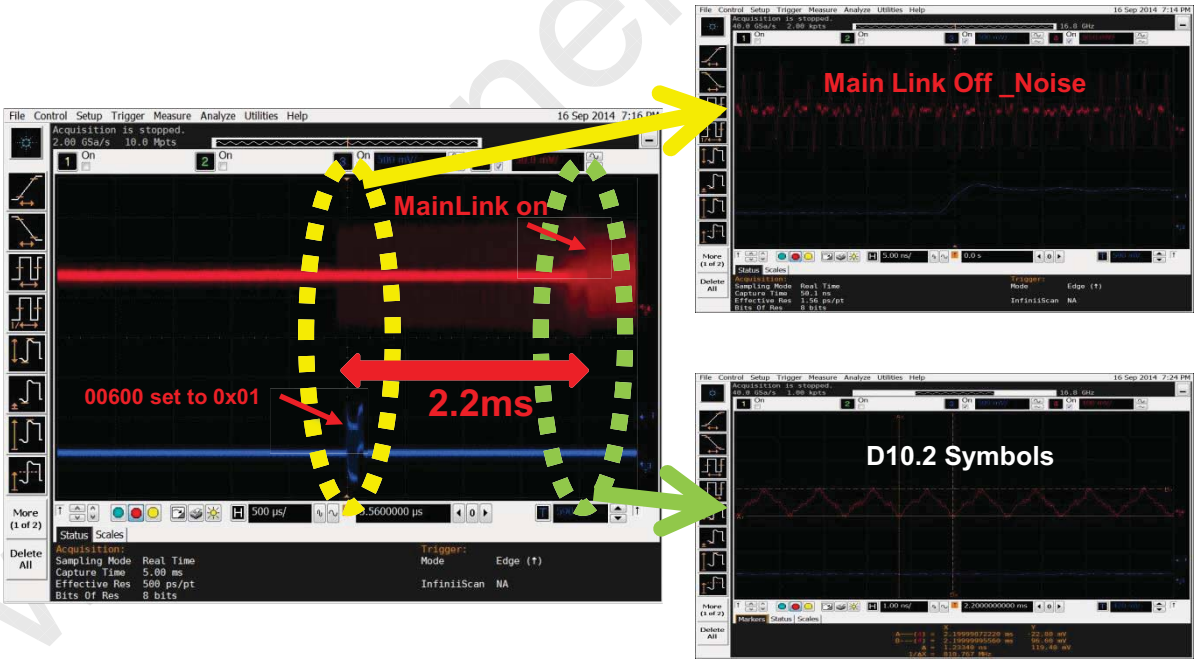
7	PSR Exit

If link training is not required, the Source must begin transmitting data on the Main Link prior to the wake AUX command which occurs through writing 01h to the SET_POWER & SET_DP_PWR_VOLTAGE register (DPCD Address 00600h; see *DP v1.2a*), as illustrated in the upper portion of Figure 6-9. This transmitted data must be a repetition of D10.2 symbols (which is the same as Link Training Pattern 1). Note the requirement above to transmit five repeats of the Idle Pattern after receiving ACK from the Sink.

PSR Exit Link Management with No Link Training



-. The below waveform is the issued case.



Define	If link training is not required, the source must begin transmitting data on the ML prior to the wake AUX wake-up command.

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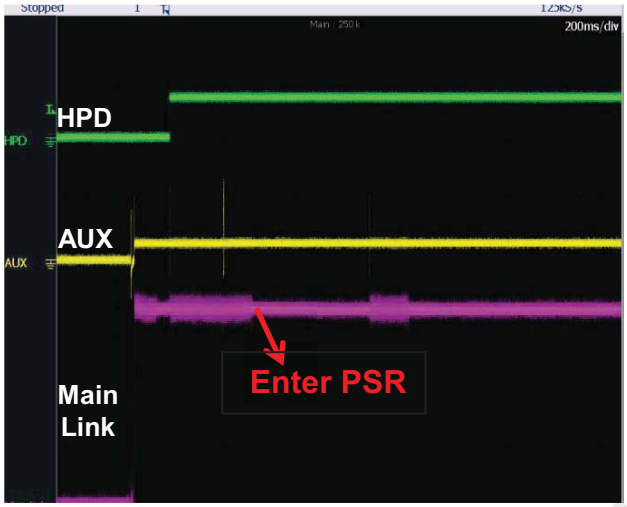
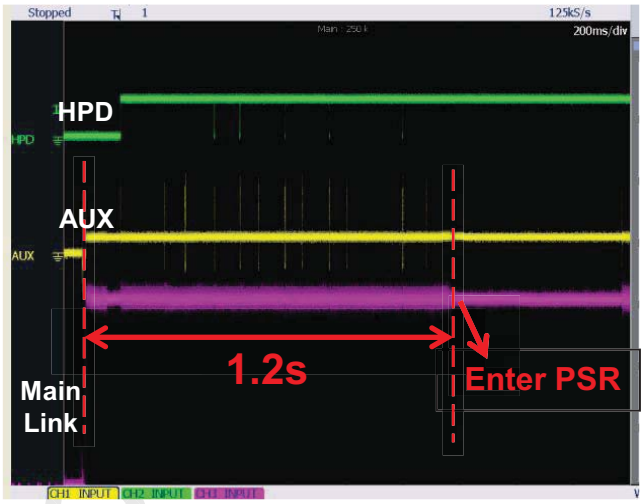
APPENDIX B. LGD Proposal for eDP Interface Design Guide

8	1st time PSR Entry after Power on



< Issue waveform >



< solution waveform >

1. It is found that with solution , the TCON enter the PSR timing is 1.2s delay from VCC on which avoid TCON capture the wrong data from DP link(poor link quality) and enter the BIST mode + PSR mode(black screen).
2. **According to test, link is stable 800ms after VCC on.**

Define	After power(Vcc) on, the DP link is not stable, so the source try to PSR entry at 800ms after Power(Vcc) on..

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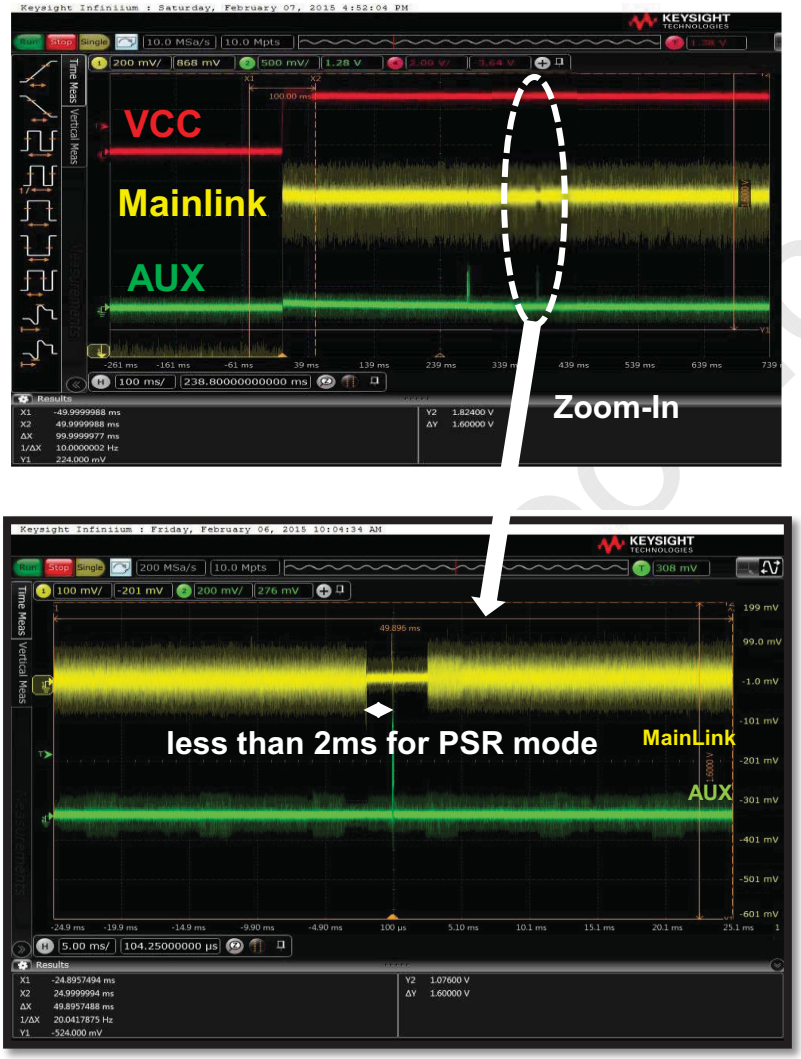
APPENDIX B. LGD Proposal for eDP Interface Design Guide

9	PSR Period Issue



1. When issue is happened, system go to PSR mode for very short time.
2. If PSR active period is shorter than 1frame(16.67ms), T-Con can not go to the standby mode for PSR exit.

Define	When GPU go to the PSR mode, the source must hold the main link off over than 1frame.

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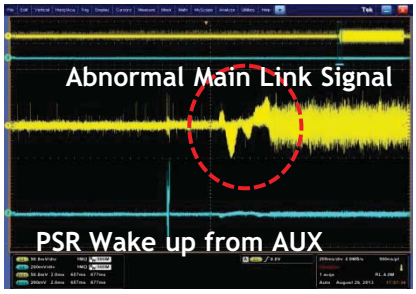
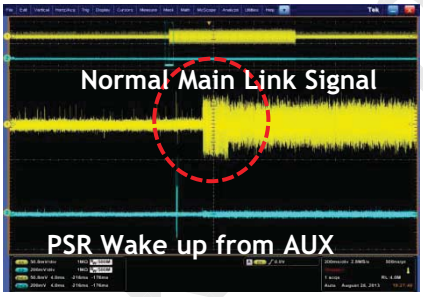
APPENDIX B. LGD Proposal for eDP Interface Design Guide

10	Main Link Noise at PSR Exit



[Abnormal Main Link Noise]



[Normal Main Link Signal]

Define	Main Link Noise at PSR Exit mode can be a cause abnormal display.

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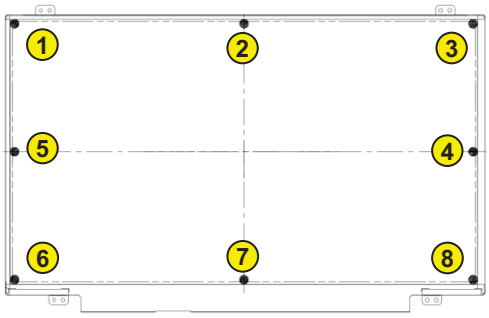
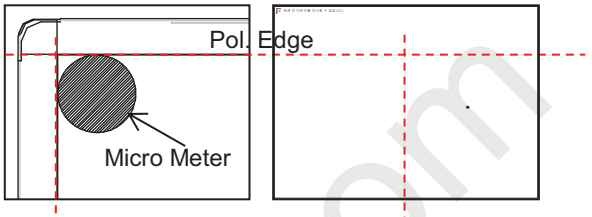
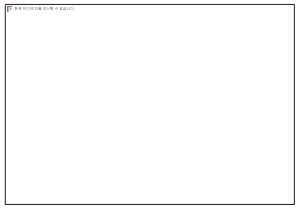
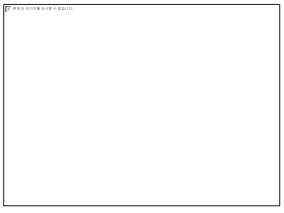
APPENDIX C. LGD Proposal for Measurement Method

1	LCM Thickness
Point	  Pol. Edge (①,③,⑥,⑧) LCM Center (②,④,⑤,⑦)
Measure Tool	Micro Meter  
Guide	✓ Measure the thickness between Polarizer surface and M-Chassis on the rear of LCM ✓ Subtract Pol. protect film thickness from LCM thickness

2	Dimension Between Upper Polarizer to Bottom surface of Bracket
Point	 [Height gauge with load cell]  [Height gauge with weight 400g]
Measure Tool	Height Gauge (With Force 400gf)  or 
Guide	✓ Measure the thickness between Polarizer surface and Bracket top surface. ✓ Measure the thickness include force(400gf) on the Panel surface. ✓ The CAS Spec. : Height from Pol. to Bracket top surface + Material Thickness

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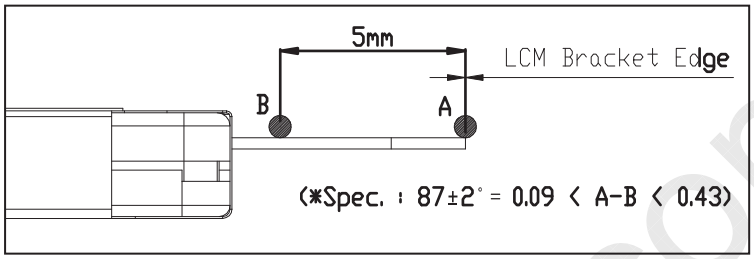
APPENDIX C. LGD Proposal for Measurement Method

3	System Bracket Angle Management
Point	
Measure Tool	Height Gauge 
Guide	✓ Measure the Height point “A” and “B” at all system bracket in LCM ✓ The CAS Spec. : 87˚±2˚ → 0.09 <A-B <0.43 ✓“A-B” spec. could be changed, if bracket dimension is not over than 5mm .

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APPENDIX D. Enhanced Extended Display Identification Data (EEDID™) 1/6

	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 0695h	95	10010101
	11	0B	(Hex. LSB first)	06	00000110
	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 2020 years	1E	00011110
	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 : 8 Bits per Primary Color , Digital Video Interface Standard Supported: DisplayPort is supported	A5	10100101
	21	15	Horizontal Screen Size (Rounded cm) = 37 cm	25	00100101
	22	16	Vertical Screen Size (Rounded cm) = 23 cm	17	00010111
	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 not supported, Suspend Mode is not supported, Active Off = Very Low Power is not supported ,Supportted Color Encoding Formats : RGB 4:4:4 ,Other Feature Support Flags : No_sRGB, Preferred Timing Mode, Display is continuous frequency (Display Range Limits Descriptor is required).]	03	00000011
Panel Color Coordinates	25	19	Red/Green Low Bits (RxRy/GxGy)	0D	00001101
	26	1A	Blue/White Low Bits (BxBy/WxWy)	B5	10110101
	27	1B	Red X Rx = 0.680	AE	10101110
	28	1C	Red Y Ry = 0.320	52	01010010
	29	1D	Green X Gx = 0.265	43	01000011
	30	1E	Green Y Gy = 0.70	B3	10110011
	31	1F	Blue X Bx = 0.150	26	00100110
	32	20	Blue Y By = 0.050	0C	00001100
	33	21	White X Wx = 0.313	50	01010000
	34	22	White Y Wy = 0.329	54	01010100
Established Timin	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

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APPENDIX D. Enhanced Extended Display Identification Data (EEDID™) 2/6

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
Timing Descriptor #1	54	36	Pixel Clock/10,000 (LSB) 268.6 MHz @ 60 Hz	F0	11110000
	55	37	Pixel Clock/10,000 (MSB)	68	01101000
	56	38	Horizontal Active (HA) (lower 8 bits) 2560 pixels	00	00000000
	57	39	Horizontal Blanking (HB) (lower 8 bits) 160 pixels	A0	10100000
	58	3A	Horizontal Active (HA) / Horizontal Blanking (HB) (upper 4:4bits)	A0	10100000
	59	3B	Vertical Avtive (VA) 1600 lines	40	01000000
	60	3C	Vertical Blanking (VB) (DE Blanking typ.for DE only panels) 46 lines	2E	00101110
	61	3D	Vertical Active (VA) / Vertical Blanking (VB) (upper 4:4bits)	60	01100000
	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 : 6 lines	36	00110110
	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) 366 mm	6E	01101110
	67	43	Vertical Vedio Image Size (mm) (lower 8 bits) 229 mm	E5	11100101
	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	Alphanumeric Data String (ASCII String) L	4C	01001100
	96	60	Alphanumeric Data String (ASCII String) G	47	01000111
	97	61	Alphanumeric Data String (ASCII String)	20	00100000
	98	62	Alphanumeric Data String (ASCII String) D	44	01000100
	99	63	Alphanumeric Data String (ASCII String) i	69	01101001
	100	64	Alphanumeric Data String (ASCII String) s	73	01110011
	101	65	Alphanumeric Data String (ASCII String) p	70	01110000
	102	66	Alphanumeric Data String (ASCII String) l	6C	01101100
	103	67	Alphanumeric Data String (ASCII String) a	61	01100001
	104	68	Alphanumeric Data String (ASCII String) y	79	01111001
	105	69	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASC Ⅱ code 0Ah,set remaining char = 20h)	0A	00001010
	106	6A	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASC Ⅱ code 0Ah,set remaining char = 20h)	20	00100000
	107	6B	Manufacturer P/N(If<13 char--> 0Ah, then terminate with ASC Ⅱ code 0Ah,set remaining char = 20h)	20	00100000

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APPENDIX D. Enhanced Extended Display Identification Data (EEDID™) 3/6

	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 (Alphanumeric Data String (ASCII String))		FE	11111110
	112	70	Flag		00	00000000
	113	71	Alphanumeric Data String (ASCII String)	L	4C	01001100
	114	72	Alphanumeric Data String (ASCII String)	P	50	01010000
	115	73	Alphanumeric Data String (ASCII String)	1	31	00110001
	116	74	Alphanumeric Data String (ASCII String)	7	37	00110111
	117	75	Alphanumeric Data String (ASCII String)	0	30	00110000
	118	76	Alphanumeric Data String (ASCII String)	W	57	01010111
	119	77	Alphanumeric Data String (ASCII String)	Q	51	01010001
	120	78	Alphanumeric Data String (ASCII String)	1	31	00110001
	121	79	Alphanumeric Data String (ASCII String)	-	2D	00101101
	122	7A	Alphanumeric Data String (ASCII String)	S	53	01010011
	123	7B	Alphanumeric Data String (ASCII String)	P	50	01010000
	124	7C	Alphanumeric Data String (ASCII String)	E	45	01000101
	125	7D	Alphanumeric Data String (ASCII String)	1	31	00110001
Check	126	7E	Extension flag (# of optional 128 panel ID extension block to follow, Typ = 0)		01	00000001
	127	7F	Check Sum (The 1-byte sum of all 128 bytes in this panel ID block shall = 0)		AE	10101110

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APPENDIX D. Enhanced Extended Display Identification Data (EEDID™) 4/6

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
CEA Extension Header	128	80	CEA Extension header	02	00000010
	129	81	Revision number	03	00000011
	130	82	Reserved	0F	00001111
	131	83	Reserved	00	00000000
CEA Datea Block1	132	84	tag code [0 x 07] , length of following data block = 3bytes	E3	11100011
	133	85	Colorimetry data Block	05	00000101
	134	86	Colorimetry support:BT2020RGB	80	10000000
	135	87	Reserved	00	00000000
CEA Data Block2	136	88	tag code [0 x 07], length of following data block =6bytes	E6	11100110
	137	89	HDR Static Metadata Block	06	00000110
	138	8A	EOTF support =SMPTE ST 2084, Tranditional gamma-SDR Luminance Range	05	00000101
	139	8B	Static Metadata type1	01	00000001
	140	8C	Desired content Max Luminance= 300nit	53	01010011
	141	8D	Desired Content Max Frame-average Luminance = 300nit	53	01010011
	142	8E	Desired Content Min Luminance = 0.075nit	28	00101000

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APPENDIX D. Enhanced Extended Display Identification Data (EEDID™) 5/6

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
	143	8F	Not use	00	00000000
	144	90	Not use	00	00000000
	145	91	Not use	00	00000000
	146	92	Not use	00	00000000
	147	93	Not use	00	00000000
	148	94	Not use	00	00000000
	149	95	Not use	00	00000000
	150	96	Not use	00	00000000
	151	97	Not use	00	00000000
	152	98	Not use	00	00000000
	153	99	Not use	00	00000000
	154	9A	Not use	00	00000000
	155	9B	Not use	00	00000000
	156	9C	Not use	00	00000000
	157	9D	Not use	00	00000000
	158	9E	Not use	00	00000000
	159	9F	Not use	00	00000000
	160	A0	Not use	00	00000000
	161	A1	Not use	00	00000000
	162	A2	Not use	00	00000000
	163	A3	Not use	00	00000000
	164	A4	Not use	00	00000000
	165	A5	Not use	00	00000000
	166	A6	Not use	00	00000000
	167	A7	Not use	00	00000000
	168	A8	Not use	00	00000000
	169	A9	Not use	00	00000000
	170	AA	Not use	00	00000000
	171	AB	Not use	00	00000000
	172	AC	Not use	00	00000000
	173	AD	Not use	00	00000000
	174	AE	Not use	00	00000000
	175	AF	Not use	00	00000000
	176	B0	Not use	00	00000000
	177	B1	Not use	00	00000000
	178	B2	Not use	00	00000000
	179	B3	Not use	00	00000000
	180	B4	Not use	00	00000000
	181	B5	Not use	00	00000000
	182	B6	Not use	00	00000000
	183	B7	Not use	00	00000000
	184	B8	Not use	00	00000000
	185	B9	Not use	00	00000000
	186	BA	Not use	00	00000000
	187	BB	Not use	00	00000000
	188	BC	Not use	00	00000000
	189	BD	Not use	00	00000000
	190	BE	Not use	00	00000000
	191	BF	Not use	00	00000000
	192	C0	Not use	00	00000000
	193	C1	Not use	00	00000000
	194	C2	Not use	00	00000000
	195	C3	Not use	00	00000000
	196	C4	Not use	00	00000000
	197	C5	Not use	00	00000000
	198	C6	Not use	00	00000000
	199	C7	Not use	00	00000000
	200	C8	Not use	00	00000000

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APPENDIX D. Enhanced Extended Display Identification Data (EEDID™) 6/6

	Byte (Dec)	Byte (Hex)	Field Name and Comments	Value (Hex)	Value (Bin)
	201	C9	Not use	00	00000000
	202	CA	Not use	00	00000000
	203	CB	Not use	00	00000000
	204	CC	Not use	00	00000000
	205	CD	Not use	00	00000000
	206	CE	Not use	00	00000000
	207	CF	Not use	00	00000000
	208	D0	Not use	00	00000000
	209	D1	Not use	00	00000000
	210	D2	Not use	00	00000000
	211	D3	Not use	00	00000000
	212	D4	Not use	00	00000000
	213	D5	Not use	00	00000000
	214	D6	Not use	00	00000000
	215	D7	Not use	00	00000000
	216	D8	Not use	00	00000000
	217	D9	Not use	00	00000000
	218	DA	Not use	00	00000000
	219	DB	Not use	00	00000000
	220	DC	Not use	00	00000000
	221	DD	Not use	00	00000000
	222	DE	Not use	00	00000000
	223	DF	Not use	00	00000000
	224	E0	Not use	00	00000000
	225	E1	Not use	00	00000000
	226	E2	Not use	00	00000000
	227	E3	Not use	00	00000000
	228	E4	Not use	00	00000000
	229	E5	Not use	00	00000000
	230	E6	Not use	00	00000000
	231	E7	Not use	00	00000000
	232	E8	Not use	00	00000000
	233	E9	Not use	00	00000000
	234	EA	Not use	00	00000000
	235	EB	Not use	00	00000000
	236	EC	Not use	00	00000000
	237	ED	Not use	00	00000000
	238	EE	Not use	00	00000000
	239	EF	Not use	00	00000000
	240	F0	Not use	00	00000000
	241	F1	Not use	00	00000000
	242	F2	Not use	00	00000000
	243	F3	Not use	00	00000000
	244	F4	Not use	00	00000000
	245	F5	Not use	00	00000000
	246	F6	Not use	00	00000000
	247	F7	Not use	00	00000000
	248	F8	Not use	00	00000000
	249	F9	Not use	00	00000000
	250	FA	Not use	00	00000000
	251	FB	Not use	00	00000000
	252	FC	Not use	00	00000000
	253	FD	Not use	00	00000000
	254	FE	Not use	00	00000000
checksum	255	FF	Extended block checksum	C4	11000100

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