Product Specification

(   ) Preliminary Specification
(√) Approval Specification

Any modification of Spec is not allowed without SDC's permission

CUSTOMER	HP
DATE OF ISSUE	2013.09.23

MODEL NO.	LTN133HL01
EXTENSION CODE	-301

Customer Approval & Feedback

Approved by	*H.D. Lee* 13/09/23
Prepared by	*Kay Song* 13/09/23
LCD Sales & Marketing Team **Samsung Display Co., Ltd**	

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SAMSUNG DISPLAY

REVISION HISTORY

Date.	Rev.No.	Page	Revision Description
13/09/23	A00	All	Initial Release

1. GENERAL DESCRIPTION

DESCRIPTION

The LTN133HL01-301 uses a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFTs as switching components. This model is composed of a TFT LCD panel, a driver circuit, and a backlight unit. This 13.3″ model has a resolution of 1920 x 1080 pixels and can display up to 262,144 colors.

FEATURES

High contrast ratio
FHD(1920 x 1080 pixels) resolution
Low power consumption
Fast Response
LED back light with an embedded LED driver
eDP Interface

APPLICATIONS

Notebook PC
If the intent to use this product is for other purpose, please contact Samsung Display.

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	293.472 (H) x 165.078 (V) (13.3″diagonal)	mm	
Driver Element	a-Si TFT active matrix		
Display colors	262,144 (6bit FRC)		
Number of pixel	1920*1080 (FHD)	Pixel	16:9
Pixel Arrangement	RGB vertical stripe		
Pixel pitch	0.15285 (H) x 0.15285 (V) (TYP.)	mm	
Display Mode	Normally Black, PLS mode		
Thickness of glass	0.5	mm	
Surface treatment	Haze 25%, Hardness 3H		AG
Environmental safe regulation	Pb Free, Halogen Free		

MECHANICAL INFORMATION

	Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	305.8	306.3	306.8	mm	w/o flange
		316.7	317.2	317.7	mm	with flange
	Vertical (V)	177.2	177.7	178.2	mm	-
	Depth (D)	-	-	3.0	mm	(1) w/o PCB
		-	-	5.4	mm	(1) /w PCB
Weight		-	-	330	g	

NOTE (1) Measuring method for thickness

Force to be applied for measurement : The 200gf when using the height gauge.

SAMSUNG DISPLAY

2. ABSOLUTE MAXIMUM RATINGS

2.1 ENVIRONMENTAL ABSOLTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperature (Temperature of glass surface)	TOPR	0	50	°C	(1)
Shock (non-operating)	Snop	-	240	G	(2), (4)
Vibration (non-operating)	Vnop	-	2.41	G	(3), (4)

Note (1) The range of temperature and relative humidity are shown in the graph below 90% RH Max. .
   (39℃ ≥ Ta) If the temperature is higher than 40 ℃, the maximum temperature of wet–bulb shall be less than 39℃. No condensation
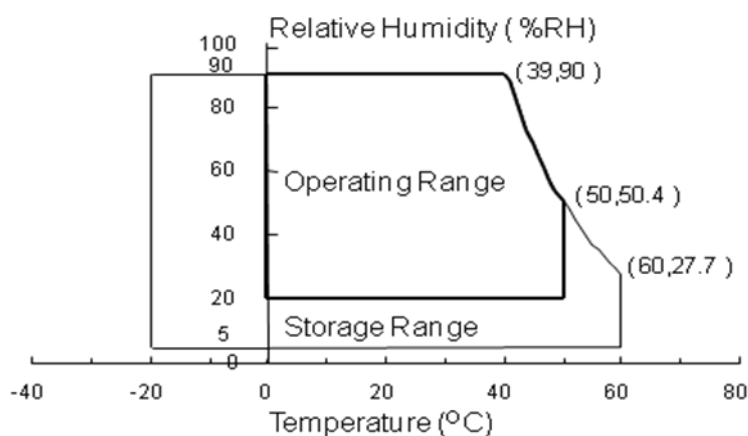
(2) Vibrate ±X, ±Y, and ± Z axis in the shape of the half sine wave one time for 2ms .
(3) Vibrate the X, Y, and Z randomly within a 5 - 500 Hz range for 30min.
(4) When testing a vibration and a shock, the fixture, which holds the module to be tested shall be hard and rigid in order for the the module not to be twisted or bent by the fixture.

2.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

V_{LCD_VCC} =3.3V, V_{SS} = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{LCD_VCC}	V_{SS} - 0.3	4.0	V	(1),(2)
LVDS Input Voltage	V_{LVDS}	V_{SS} - 0.3	2.2		

Note (1) Within Ta (25 ± 2 °C)
(2) Permanent damage to the device may occur if exceed maximum values.

(2) BACKLIGHT UNIT

VSS = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
BLU Supply Voltage	V_{BL_PWR}	V_{SS} - 0.3	28	V	(1), (2)
BLU Supply Current	I_{BL_PWR}	-	1.1	A	(1), (2) Vin=12V Duty 100%

Note (1) Within Ta (25 ± 2 °C)
(2) Permanent damage to the device may occur if exceed maximum values

2.3 THE OTHERS

(1) STATIC ELECTRICITY PRESSURE RESISTANCE

| Item	Test Conditions	Remark
CONTACT DISCHARGE	150pF, 330Ω, ± 8kV, 200points, 1 time/point	Operating
AIR DISCHARGE	150pF, 330Ω, ± 15kV, 200points, 1 time/point	Operating

3. OPTICAL CHARACTERISTICS

The following items are measured under the stable conditions.* The optical characteristics should be measured in the dark room or the equivalent environment by the methods shown in the Note (5).
Measuring equipment : TOPCON SR-3

Ta = 25 ± 2 °C, V_{LCD_VCC} =3.3V, fv= 60Hz, fDCLK = 71.45Mhz , IF = 100% duty

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		500	800	-	-	(1),(2),(5)
Response time (Rising + Falling)		T_{RT}		-	30	-	msec	(1),(3)
Average Luminance of White (5 Points)		$Y_{L,AVE}$	Normal Viewing Angle $\phi = 0$ $\theta = 0$	340	400	-	cd/m^2	IF=100% Duty (1),(4)
Color Chromaticity (CIE)	Red	R_X		-0.03	0.640	+0.03		(1),(5)
		R_Y			0.330			
	Green	G_X			0.300			
		G_Y			0.600			
	Blue	B_X			0.150			
		B_Y			0.060			
	White	W_X			0.313			
		W_Y			0.329			
Viewing Angle	Hor.	θ_L	CR ≥ 10 At center	80	85	-	Degrees	(1),(5)
		θ_H		80	85	-		
	Ver.	ϕ_H		80	85	-		
		ϕ_L		80	85	-		
Color Gamut		CG		-	72	-	%	
White variation (13P)		δ_L		-	-	1.6		(6)

Note (1) The definition of viewing angle : The range of viewing angle ($10 \leq C/R$)
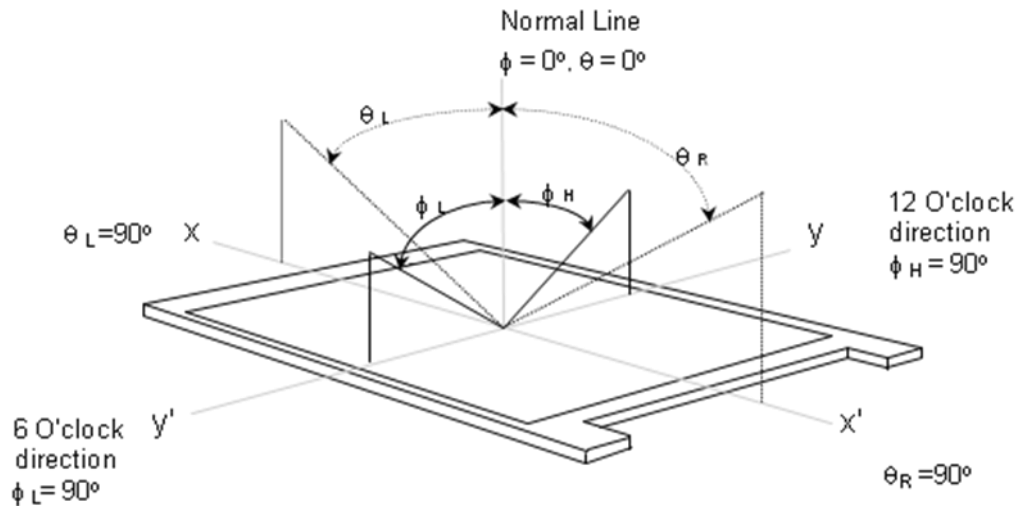
Note (2) The definition of contrast ratio (CR) : The ratio of max. gray and min gray at 5 points
(4, 5, 7, 9, and10)

$$CR = \frac{CR(4) + CR(5) + CR(7) + CR(9) + CR(10)}{5}$$
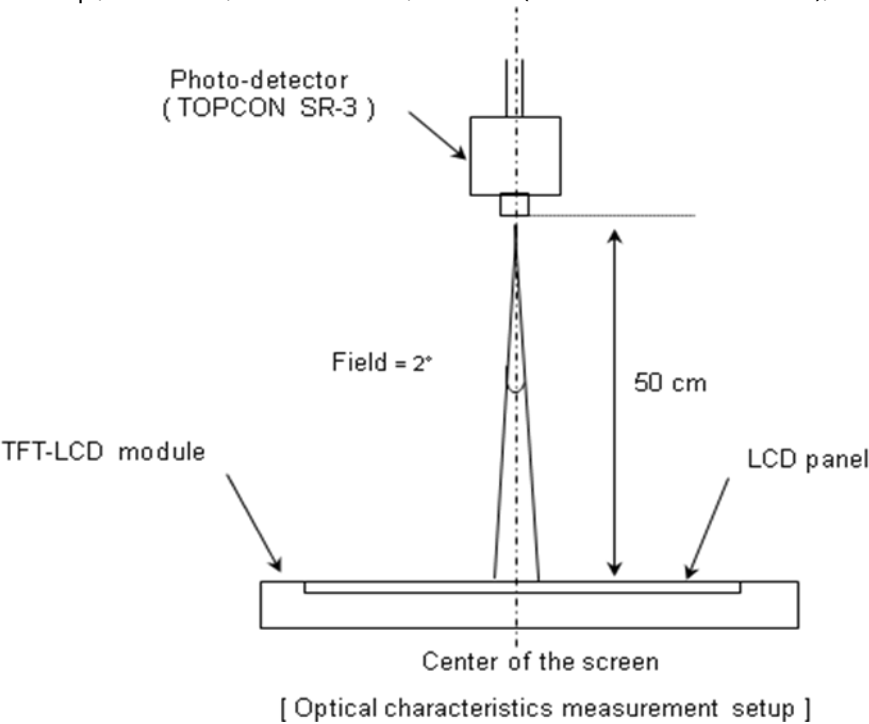
Points = ④ ⑤ ⑦ ⑨ ⑩ at the figure of Note(6).

Note (3) The definition of Response time : Subtotal of the time, during which the transmission changes from 10% to 90% when the TFT turns on and off.
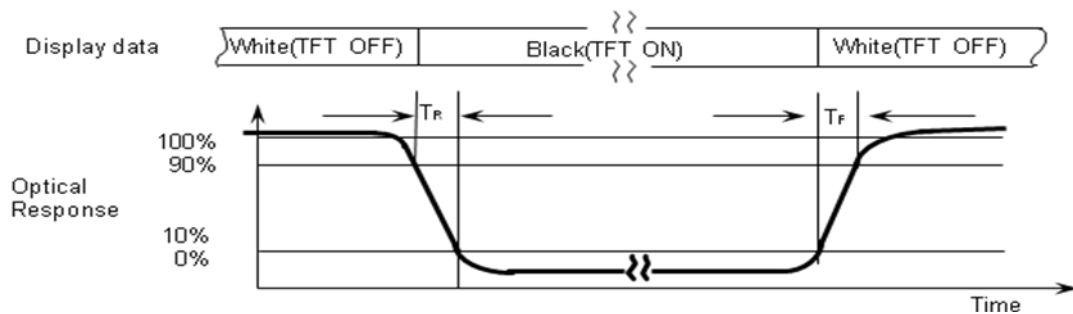
Note (4) The definition of average luminance of white : Measure the luminance of white at 5 points.

Average Luminance of White (Y_{LAVE})

$$Y_{LAVE} = \frac{Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}}{5}$$
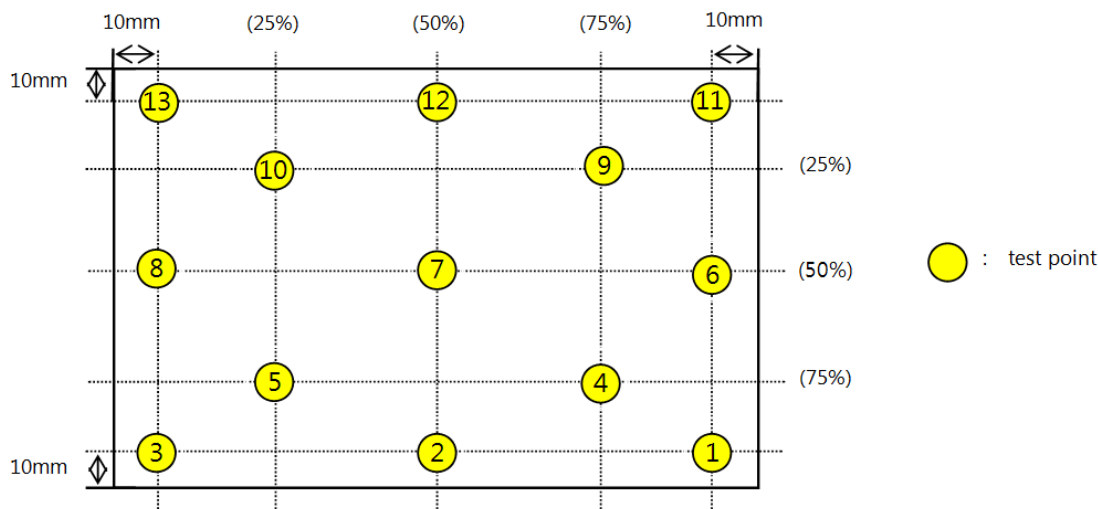

: test point
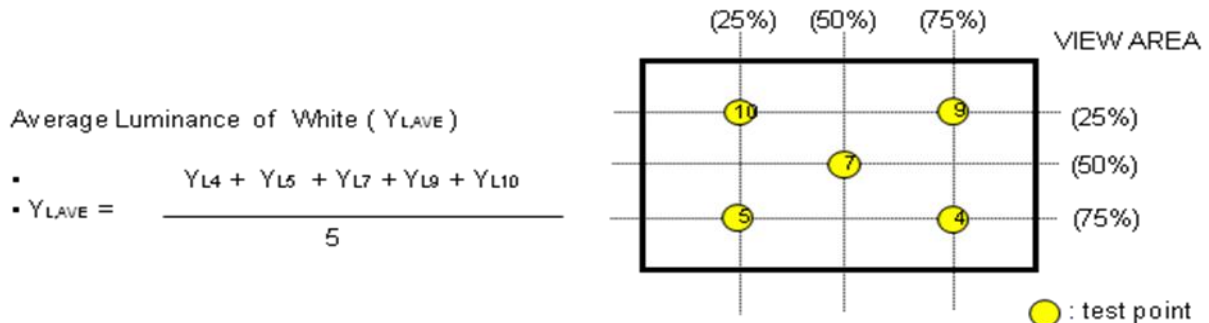
Note (5) Measure the panel, which is left for 30 min. at the normal temp. after leaving it for 30 min with turning the back light on at the rating. The measurement should be executed under the condition including the ambient temp., 25℃±2℃, the dark room, windless(removed the direct wind), and no vibration.

Photo-detector
(TOPCON SR-3)

Field = 2°

50 cm

TFT-LCD module

LCD panel

Center of the screen

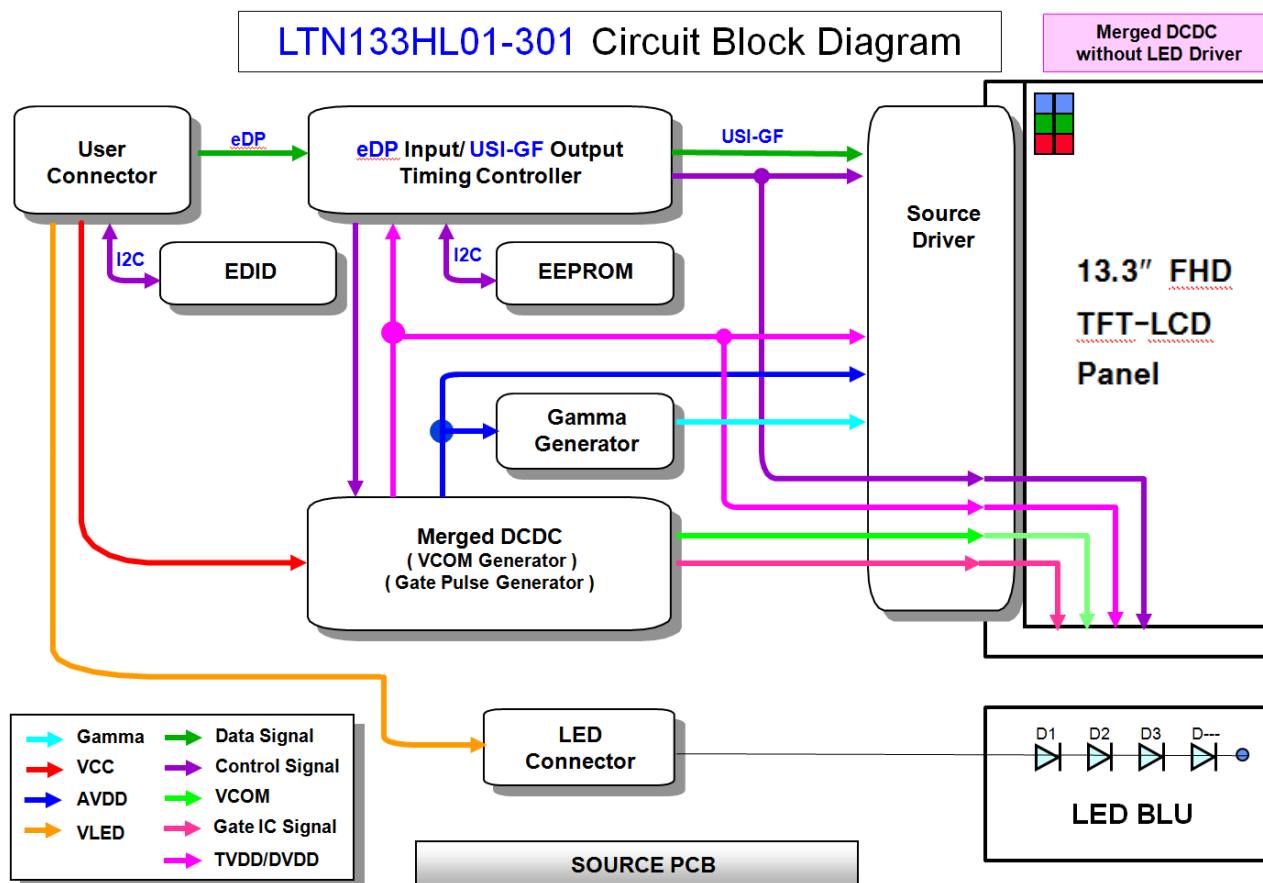[Optical characteristics measurement setup]

Note (6) The definition of white variation at 13 points (δ L)

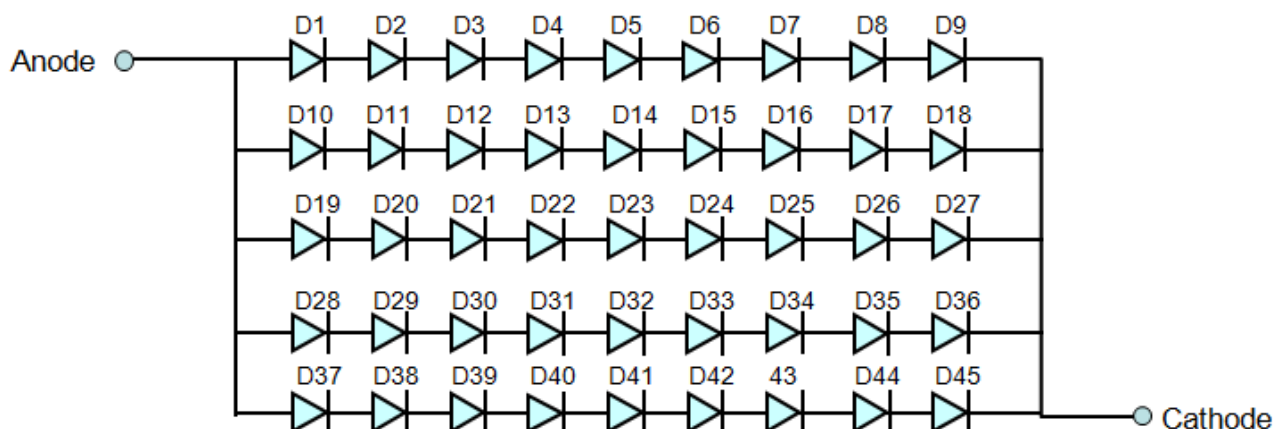$$\delta L \ = \ \frac{\text{Maximum luminance of 13 points}}{\text{Minimum luminance of 13 points}}$$

10mm (25%) (50%) (75%) 10mm

10mm

13   12   11

10   9   (25%)

8   7   6   (50%)

○ : test point

5   4   (75%)

3   2   1

10mm

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE

LTN133HL01-301 Circuit Block Diagram

4.2 THE STRUCTURE OF LED PLACEMENT

(5channels x 9ea = 45ea)

5. ELECTRICAL CHARACTERISTICS

5.1 TFT LCD MODULE

* Ta = 25 ± 2 °C

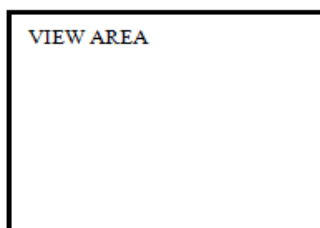| Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage		VLCD_VCC	3.0	3.3	3.6	V	
T-CON TTL Input Voltage	High	VTH	0.7 V_{LCD_VCC}	-	-	V	(1)
	Low	VTL	-	-	0.3 V_{LCD_VCC}	V	
Vsync	60Hz	fv	-	60	-	Hz	
	40Hz	fv	-	40	-	Hz	(3)
Hsync	60Hz	fh	66.84	68.64	70.44	kHz	
Main Frequency	60Hz	fDCLK	66.23	71.45	76.85	MHz	
	40Hz	fDCLK	-	47.63	-	MHz	(3)
Rush Current		IRUSH	-	-	1.5	A	(6)
Input Current	White	ILCD_VCC	-	230	-	mA	(2), (5)
	Mosaic	ILCD_VCC	-	230	394	mA	
	Black	ILCD_VCC	-	230		mA	
	V.Stripe	ILCD_VCC	-	350	-	mA	

Note (1) The data pins for display and signal pins for timing should be connected.(GND= 0V)

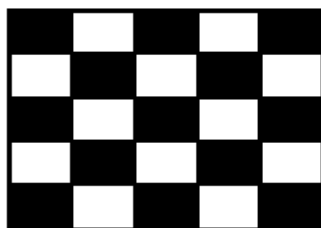(2) fV = 60Hz, fDCLK = 71.45 MHZ, V_{LCD_VCC} = 3.3V , DC Current.

(3) Only 60Hz, FOS, Flicker and Brightness are guaranteed.
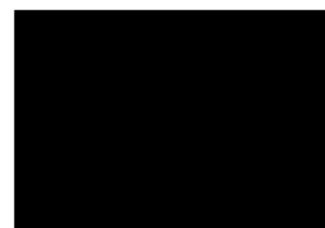
Note (5) The dissipation pattern for power

*a) White Pattern
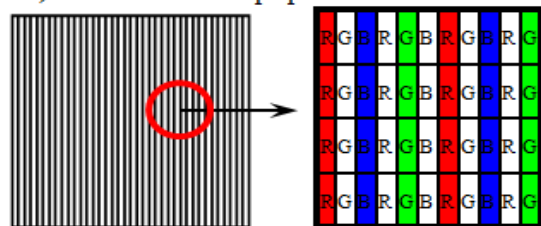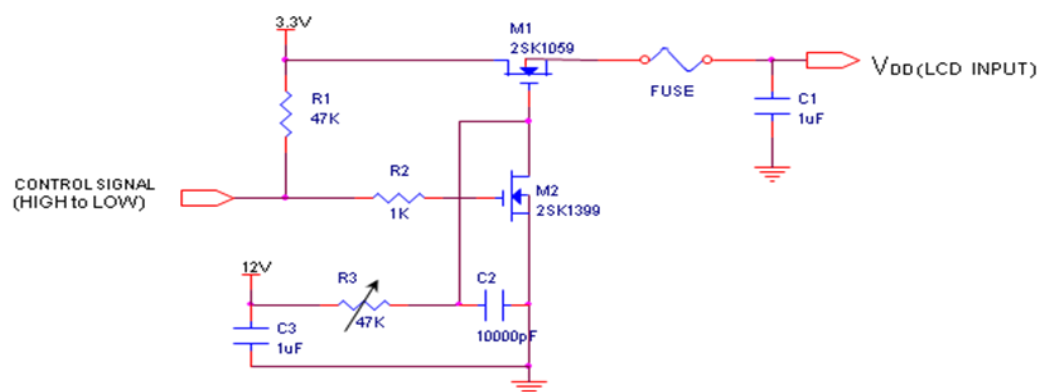
VIEW AREA

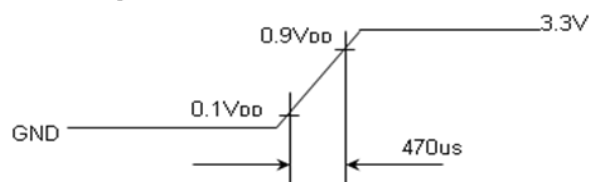*b) Mosaic Pattern

*c) Black Pattern

*d) 1dot Vertical stripe pattern

Note (6) The condition for measurement for rush current

V_{DD} rising time is 470us

5.2 BACK LIGHT UNIT

Ta = 25 ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	26	-	mA	
LED Forward Voltage	VF	2.7	2.9	3.1	V	IF = 20mA
LED Array Voltage	VP	-	26.1	-	V	
LED Power Consumption	P	-	3.9	4.0	W	
LED Life time	Hr	15,000	-	-	Hours	(1)
LED Counts	Q	-	45	-	EA	

Note (1) The life time (Hr) of LEDs can be defined as the time during which it continues to operate under the condition, which the Ta is 25 ± 2 °C and IF=26 mArms until the one of the following events occurs when the brightness becomes 50% or lower than the original..

5.3 LED DRIVER

The manufacturer of LED driver : Richtek RT8561   Ta= 25 ± 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage		V_{BL_PWR}	5	12	20	V	
Input Current		I_{BL_PWR}	-	325	333	mA	Vin=12V Duty 100%
PWM duty Ratio		$D_{BL\_PWM\_DIM}$	5	-	100	%	PWM : 200Hz~2kHz
External PWM Frequency		$F_{BL\_PWM\_DIM}$	0.2	-	2	kHz	
PWM Resolution		$R_{BL\_PWM\_DIM}$	0.8	-	-	%	
In-Rush Current		$I_{RUSH\_BL\_PWR}$	-	-	1.5	A	(1)
EN Control Level	High	V_{BL_ENABLE}	2.0	-	5.0	V	
	Low		0.0	-	0.8	V	
PWM Control Level	High	$V_{BL\_PWM\_DIM}$	2.0	-	5.0	V	
	Low		0.0	-	0.8	V	

Note (1) Rush current measurement condition
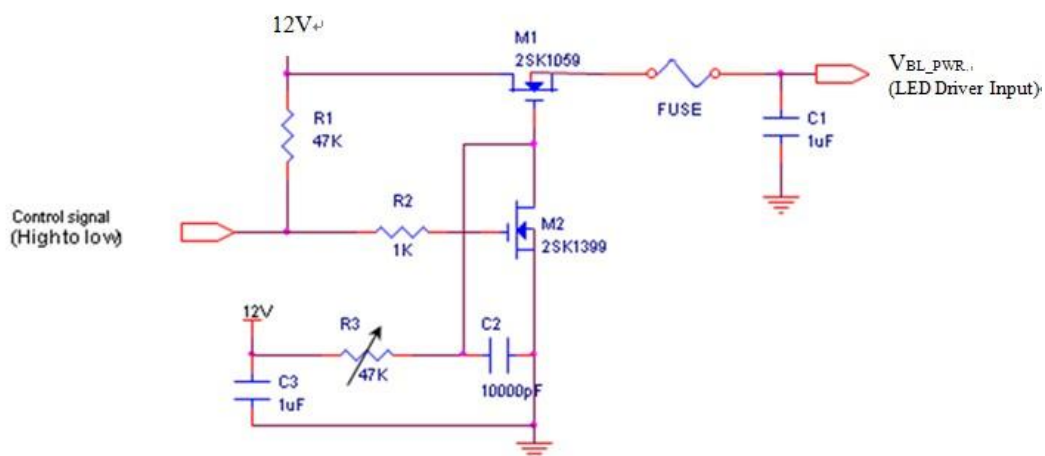
The V$_{BL\_PWR}$ rising time is 470us.
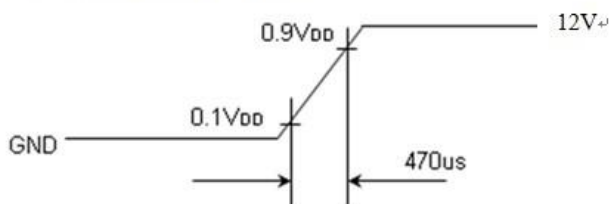
5.4 eDP INTERFACE

5.4.1 HPD Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
HPD voltage	V_{OH_HPD}	2.25	-	3.63	V	
HPD_IRQ pulse width	T_{HPD_IRQ}	0.5	-	1	V	IOH=0mA VDD33=2.25~3.63V

5.4.3 AUX Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
AUX unit interval	UI_{AUX}	0.4	0.5	0.6	us	
Number of pre-charge pulse	$N_{precharge}$	10	-	16	times	
AUX CH bus park time	$T_{AUX-BUS-PARK}$	10	-	-	Ns	
Max cycle-to-cycle output jitter within a single transaction	$T_{AUX-TX-JITTER}$	-	-	0.04	UI	
Max allowable cycle-to-cycle input jitter within a single transaction	$T_{AUX-RX-JITTER}$	-	-	0.05	UI	
AUX peak-to-peak output differential voltage	$V_{AUX-TX-DIFFp-p}$	0.39	-	1.38	V	(1)
AUX peak-to-peak input differential voltage	$V_{AUX-RX-DIFFp-p}$	0.32	-	1.36	V	(1)
AUX CH termination DC resistance	$R_{AUX-TERM}$	-	100	-	Ohm	
AUX DC common mode voltage	$V_{AUX-DC-CM}$	0	-	2	V	
AUX turn around common mode voltage	$V_{AUX-TURN-CM}$	-	-	0.4	V	(2)
AUX short circuit current limit	$I_{AUX-SHORT}$	-	-	90	mA	(3)

Note(1) $V_{AUX-DIFFp-p} = 2 \times |V_{DP\_AUX\_P} - V_{DP\_AUX\_N}|$
Note(2) Stable state common mode voltage shifts between transmit and receive mode
Note(3) Total drive current of the transmitter when it is shorted to its ground.

5.4.3 Main Link Characteristics

| Item	Symbol	Min.	Typ.	Max.	Unit	Note
Unit interval for HBR (2.7Gbps/lane)	UIHBR	-	370	-		
Unit interval for RBR (1.62Gbps/lane)	UIRBR	-	617	-	Ps	(1)
RX DC Common mode voltage	VRX-DC-CM	0	-	2	Ps	(1)
RX short circuit current limit	IRX-SHORT	-	-	50	V	

Note (1) Frequency high limit = +300ppm, Frequency low limit = -5300ppm. Modulation frequency range of 30kHz to 33kHz is supported.

5.5 INTERFACE TIMING

5.5.1 TIMING PARAMETERS

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	T_V	1114	1144	1174	Lines	
Vertical active in the display term	Display Period	T_{VD}	-	1080	-	Lines	
Scanning time in one line	Cycle	T_H	991	1041	1091	Clocks	
Horizontal active in the display term	Display Period	T_{HD}	-	920	-	Clocks	

5.5.2 TIMING DIAGRAMS OF INTERFACE SIGNAL
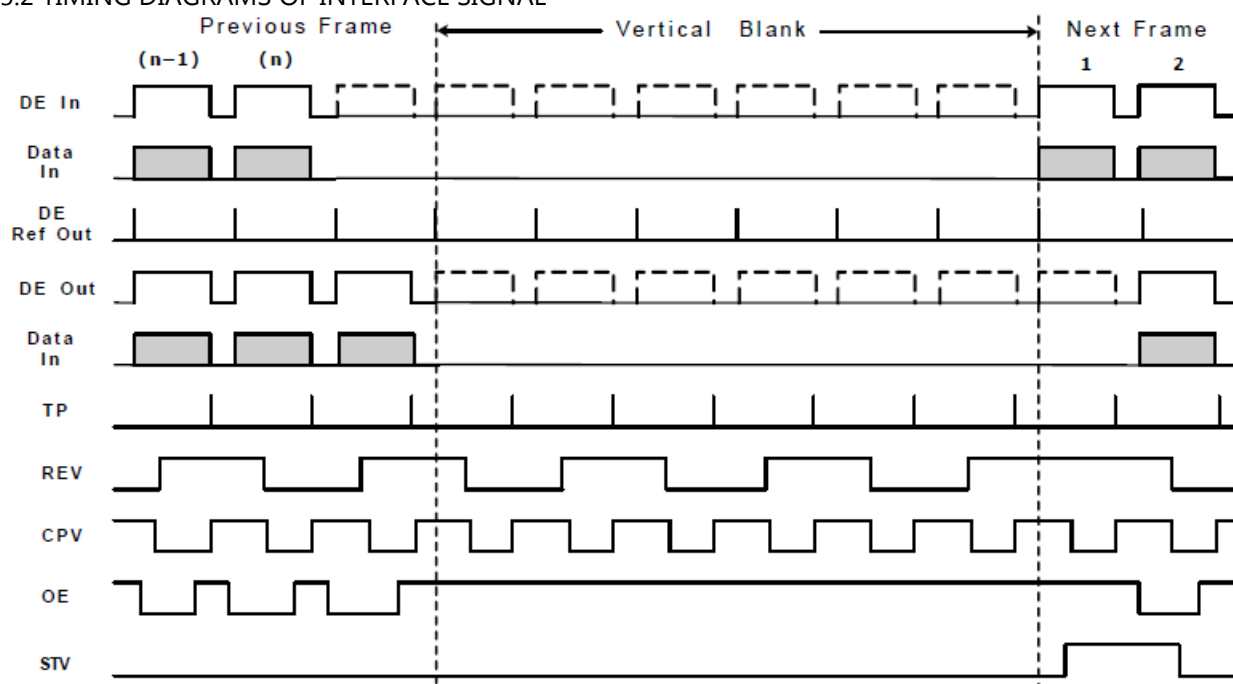
5.6 POWER ON/OFF SEQUENCE

To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.
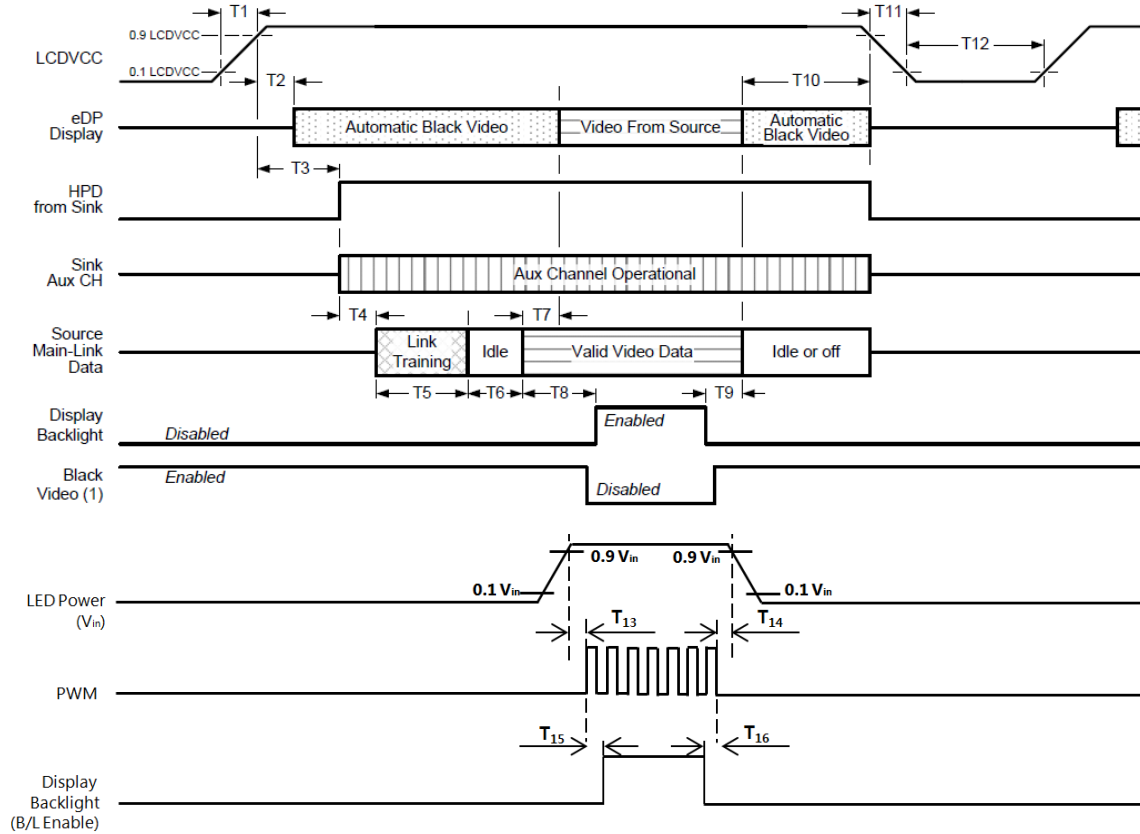
Timing (ms)	Remarks	Note
$0.5 < T_1 \leq 10$	Power rail rise time, 10% to 90%	
$0 < T_2 \leq 200$	Delay from LCDVCC to automatic Black Video generation	(1)(2)
$0 < T_3 \leq 200$	Delay from LCDVCC to HPD high	(3)
$0 \leq T_4$	Delay from HPD high to link training initialization	
$0 \leq T_5$	Link training duration	
$0 \leq T_6$	Link idle	
$0 < T_7 \leq 50$	Delay from valid video data from Source to video on display	
$50 < T_8$	Delay from valid video data from Source to backlight enable	
$0 < T_9$	Delay from backlight disable to end of valid video data	(1)(2)
$0 < T_{10} \leq 500$	Delay from end of valid video data from Source to power off	
$0 < T_{11} \leq 10$	Power rail fall time, 90% to 10%	
$150 < T_{12}$	Power off time	
$0 < T_{13}$	Interval from LED driver Vin rising time 90% to PWM ON	
$0 < T_{14}$	Interval from PWM Off to LED driver Vin falling time 90%	
$0 \leq T_{15}$	Interval from PWM ON to B/L Enable ON	
$0 \leq T_{16}$	Interval from B/L Enable Off to PWM Off	

The backlight may be flashed if the interface signal remains floated when the above-mentioned signal becomes invalid.

Note (1) The Sink must include the ability to automatically generate Black Video autonomously. The Sink must automatically enable Black Video under the following conditions:
Upon LCDVCC power-on (within T2 max)
When the "NoVideoStream_Flag" (VB-ID Bit 3) is received from the Source (at the end of T9)
When no Main Link data, or invalid video data, is received from the Source. Black Video must be displayed within 50ms (max) from the start of either condition. Video data can be deemed invalid based on MSA and timing information, for example.
(2) The Sink may implement the ability to disable the automatic Black Video function, as described in Note 1, above, for system development and debugging purposes.
(3) The Sink must support AUX Channel polling by the Source immediately following LCDVCC power-on without causing damage to the Sink device (the Source can re-try if the Sink is not ready). The Sink must be able to respond to an AUX Channel transaction with the time specified within T3 max.

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5.7 INPUT TERMINAL PIN ASSIGNMENT

5.7.1 INPUT SIGNAL & POWER

(eDP, Connector : 20455-030E-0* , IPEX or the equipment with the equivalent capability)

Pin	Symbol	Function
1	NC	APS on/off or No connection(optional)
2	H_GND	High Speed Ground
3	Lane1_N	Complement Signal Link Lane 1
4	Lane1_P	True Signal Link Lane 1
5	H_GND	High Speed Ground
6	Lane0_N	Complement Signal Link Lane 0
7	Lane0_P	True Signal Link Lane 0
8	H_GND	High Speed Ground
9	AUX_CH_P	True Signal Auxiliary Channel
10	AUX_CH_N	Complement Signal Auxiliary Channel
11	H_GND	High Speed Ground
12	LCD_VCC	LCD logic and driver power
13	LCD_VCC	LCD logic and driver power
14	BIST_EN	BIST on/off or No connection(optional)
15	LCD_GND	LCD logic and driver ground
16	LCD_GND	LCD logic and driver ground
17	HPD	Hot Plug Detect
18	BL_GND	Backlight Ground
19	BL_GND	Backlight Ground
20	BL_GND	Backlight Ground
21	BL_GND	Backlight Ground
22	BL_ENABLE	Backlight on/off
23	BL_PWM_DIM	System PWM signal input for dimming
24	WPN	Reserved for LCD manufacturer's use(WPN)
25	NC	No connection
26	BL_PWR	Backlight power
27	BL_PWR	Backlight power
28	BL_PWR	Backlight power
29	BL_PWR	Backlight power
30	NC	Reserved for LCD manufacturer's use(CE_DVR)

6. PIXEL FORMAT
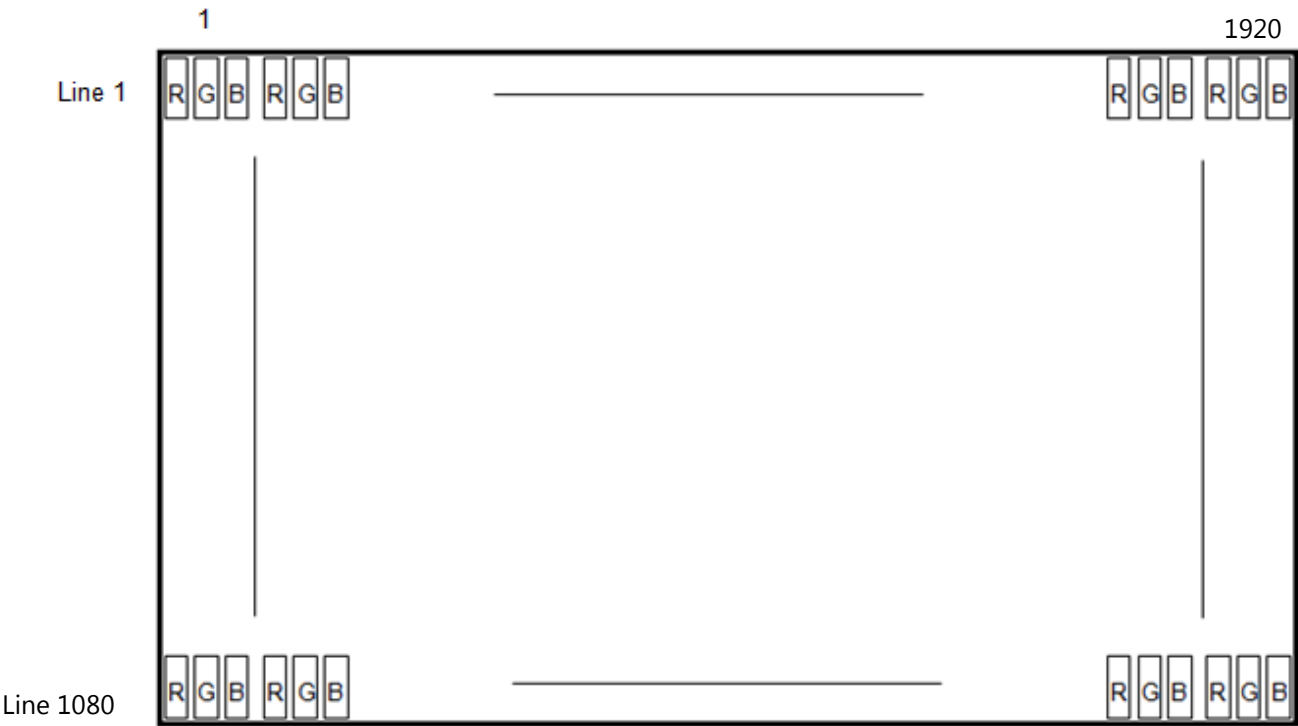
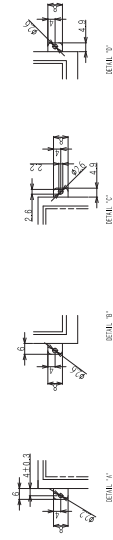## 7. OUTLINE DIMENSION

Refer to the next page
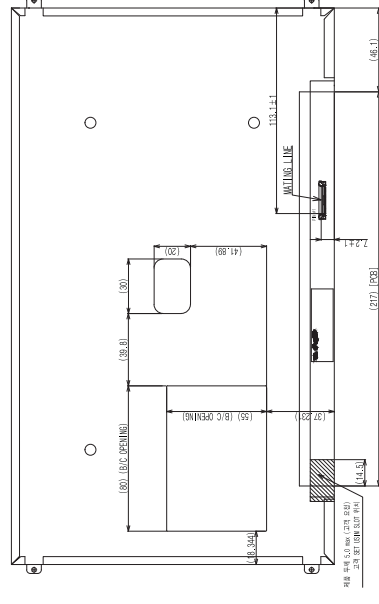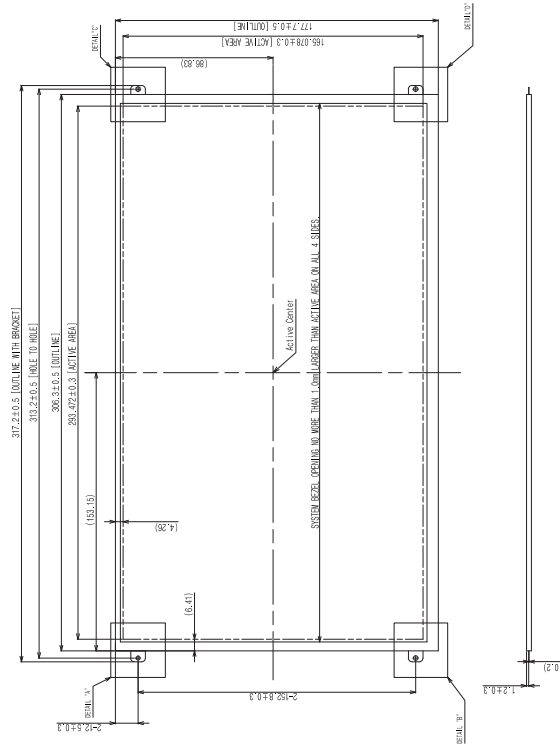
LTN133HL01-301

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* NOTE
1. INPUT SIGNAL CONNECTOR TO BE SPECIFIED AS BELOW.
   -MAKER / PART NO. : I-PEX 20455-030E-0* or equivalent
2. MEASURING FORCE : 200 gf
3. WEIGHT : 330g Max
4. IN ORDER TO AVOID IC DAMAGE, IT IS NOT ALLOW THAT OVERLAPPING OF CABLES
   OR ANTENNAS, CAMERA, WLAN, WWAN, OVER THESE COF LOCATION.

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LTN133HL01-301

04

8. RELIABILITY TEST

Item		Condition	Time/Cycle
HTOL		55 ℃	500 hrs
LTOL		-5 ℃	250 hrs
HTS		70 ℃	500 hrs
LTS		-25 ℃	500 hrs
THB		50 ℃, 90%	500 hrs
WHTS		60 ℃, 75%	250 hrs
T/C		-40 ℃/30min ~ 65 ℃/30min	50 cycles
ESD	Operating	Contact : 150 pF, 330Ω, 100point, once/point	±8kV
		Air(non-contact) : 150pF, 330Ω, 100point, once/point	±15kV
Box Vibration (Non-operating)		5~200Hz, 1.05Grms, 2hr/Y	1time
Shock (Non-operating)		240G, 2msec, ±XYZ	30min/axis
HINGE		10~170˚, Open/Close 2sec, Pause1sec	30Kcycle
Altitude		-40~50℃, 0~45,000ft	72.5Hr

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state,
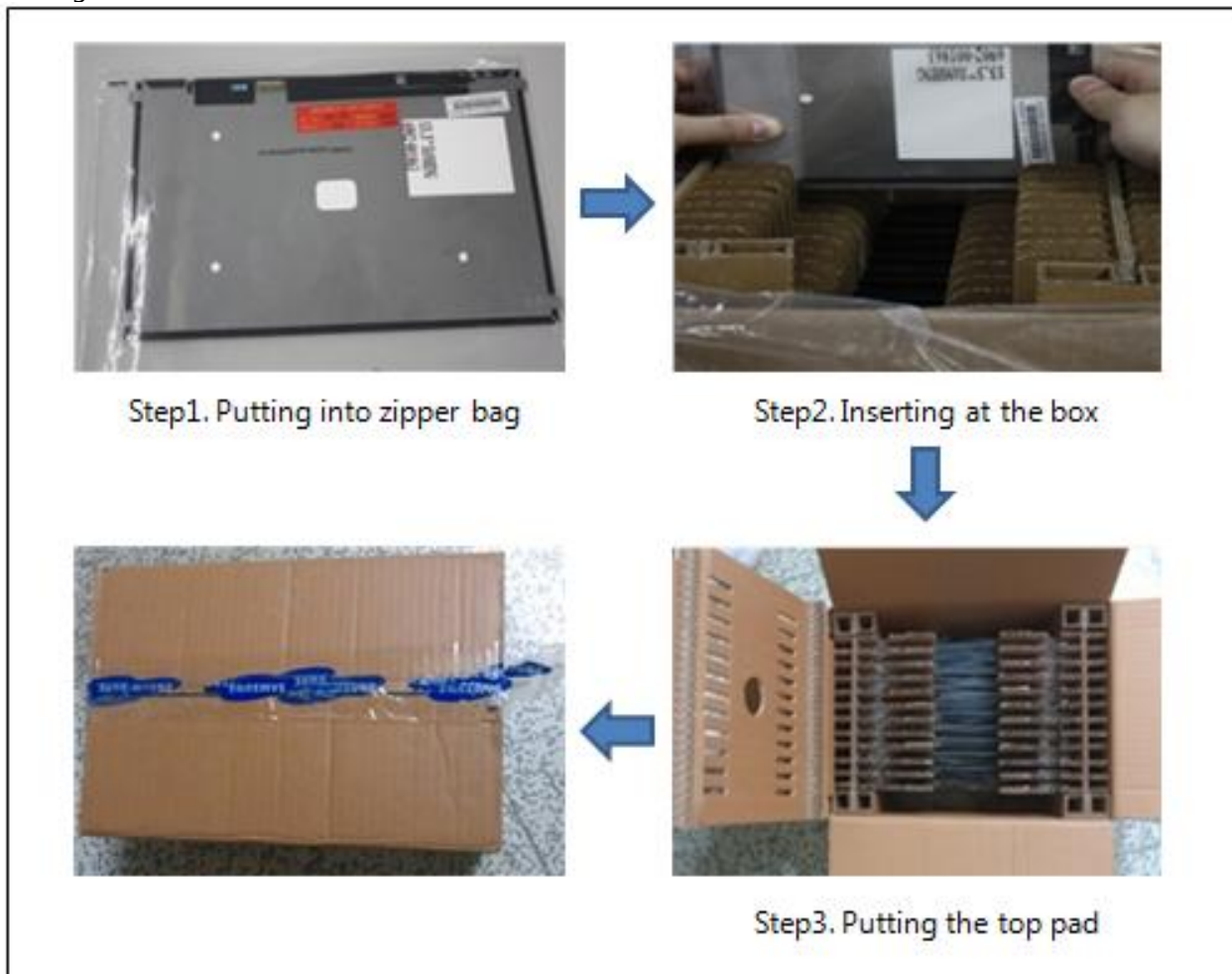these should be no change which may affect practical display functions.

9. PACKING

9.1 CARTON

(1) Packing Form
     Corrugated Cardboard box and Corrupad form as shock absorber.
(2) Packing Method

Step1. Putting into zipper bag

Step2. Inserting at the box

Step3. Putting the top pad

Note (1) Total Weight : Approximately 13.0 Kg
         (2) Acceptance number of piling : 32 sets
         (3) Carton size : 411(W) × 272(D) × 415(H)

(3) Packing Material

No	Part name	Quantity
1	Static electric protective sack	32 pcs
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2
4	Carton	1 set

9.2 MARKING

A nameplate is affixed to the specified location on each product.

(1)Parts number   : LTN133HL01-301
(2)Revision code : 3 letters
(3)Lot number   : X X X X XXX XX   X   301

```
                        Samsung Revision Code
                        Panel number
                        Cell ID
                        Lot  ID
                        Month
                        Year
                        Product Code
                        Line
```
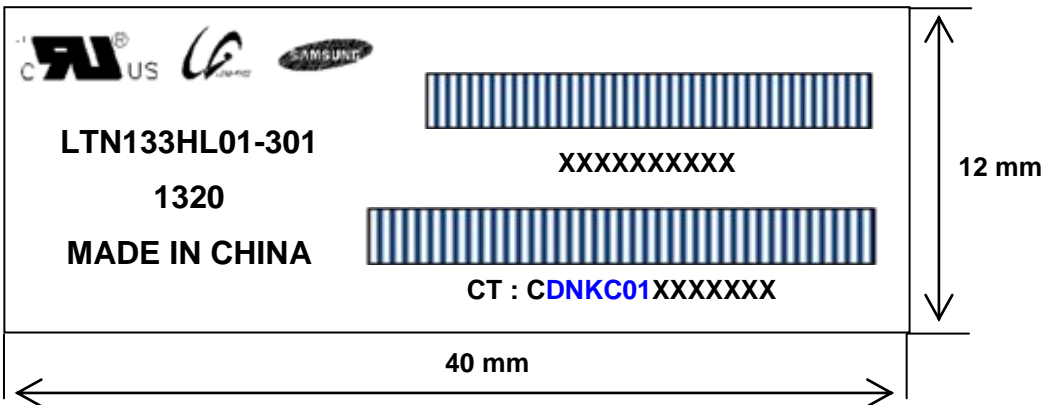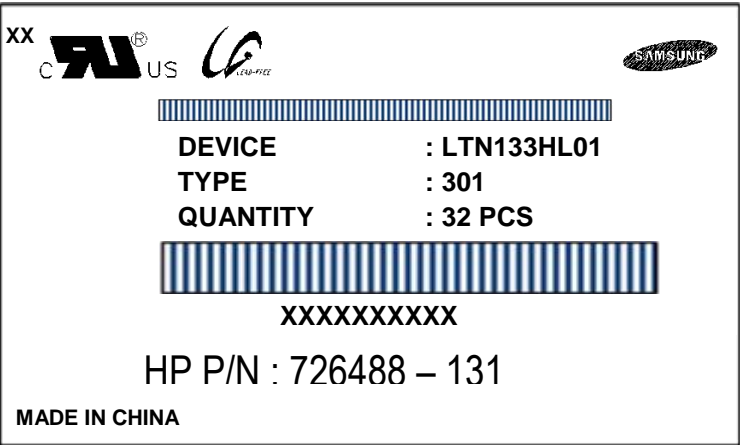
(4) Nameplate Indication

LTN133HL01-301
1320
MADE IN CHINA

XXXXXXXXX

CT : CDNKC01XXXXXXX

12 mm

40 mm

Parts name   : LTN133HL01
Lot number   : XXXXXXXXXX
Inspected work week   : 1320 (2013 year 20th week)
Product Revision Code : 301
CT code : CDNKC01XXXXXXX (Released after HP's approval)

(5) Packing small box attach


```
XX
 C  [UL] US   [LEAD-FREE]                        SAMSUNG

        ||||||||||||||||||||||||||||||||||||||
        DEVICE          : LTN133HL01
        TYPE            : 301
        QUANTITY        : 32 PCS
        |||||||||||||||||||||||||||||||||||
              XXXXXXXXXX
     HP P/N : 726488 – 131
MADE IN CHINA
```

10. GENERAL PRECAUTIONS

10.1 HANDLING

(a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT back-light.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth .In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

(h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

(i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the LED FPC.

(l) Do not touch any component which is located on the back side.

(m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(n) Pins of I/F connector shall not be touched directly with bare hands.

10.2 STORAGE

We highly recommend to comply with the criteria in the table below.

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage Life	12 months		
Storage Condition	- The storage room should be equipped with a good ventilation facility, which has a temperature controlling system. - Products should be placed on the pallet, which is away from the wall not on the floor. - Prevent products from being exposed to the direct sunlight, moisture, and water.; Be cautious not to pile the products up. - Avoid storing products in the environment, which other hazardous material is placed. - If products are delivered or kept in the storage facility more than 3 months,we recommend you to leave products under the condition including a 20℃ temperature and a humidity of 50% for 24 hours. - If you store semi-manufactured products for more than 3 months, bake the products under the condition including the 50℃ temp. and the 10% humidity for 24hrs after being used.		

10.3 OPERATION

(a) Do not connect, disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3 " Power on/off sequence ".

(c) 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 minimize the interference.

(d) The FPC cable between the LED chips and its converter power supply shall be a minimized length and be connected directly .The longer cable between the back-light and the converter may cause lower luminance of light source (LED).

(e) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

10.4 OTHERS

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, Variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time, it can be the situation when The image "sticks" to the screen.

(e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.
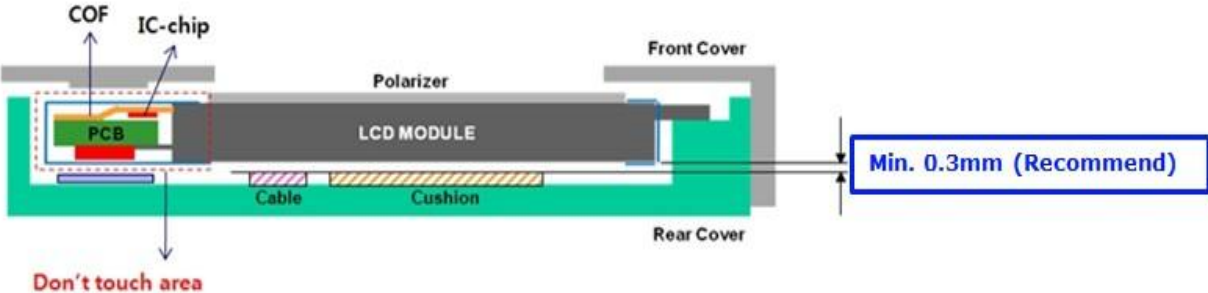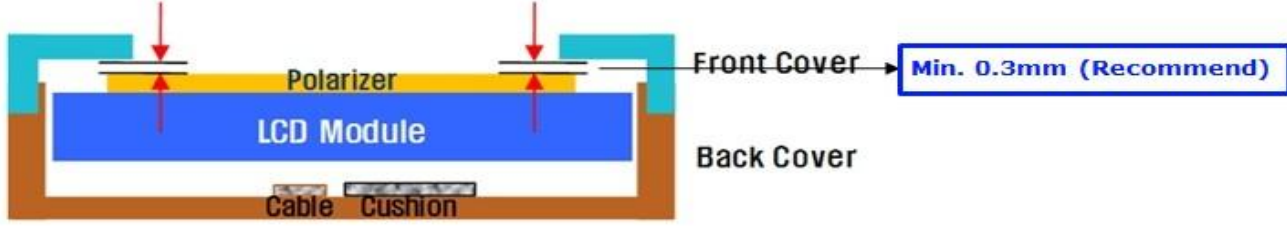
11. EDID

Address (HEX)	FUNCTION	Value HEX	BIN	DEC	ASCII or Data	Notes
00	Header	00	00000000	0		EDID Header
01		FF	11111111	255		
02		FF	11111111	255		
03		FF	11111111	255		
04		FF	11111111	255		
05		FF	11111111	255		
06		FF	11111111	255		
07		00	00000000	0		
08	ID Manufacturer Name	4C	01001100	76	S D	3 character ID
09		83	10000011	131	C	"SDC"
0A	ID Product Code	59	01011001	89	[Y]	
0B		39	00111001	57	[9]	
0C	32-bit serial no.	00	00000000	0		
0D		00	00000000	0		
0E		00	00000000	0		
0F		00	00000000	0		
10	Week of manufacture	00	00000000	0		
11	Year of manufacture	17	00010111	23	2013	2013
12	EDID Structure Ver.	01	00000001	1	1	EDID Ver. 1.0
13	EDID revision #	04	00000100	4	4	EDID Rev. 4
14	Video input definition	95	10010101	149		6 bits, DisplayPort is supported
15	Max H image size	1D	00011101	29	29	29cm (approx)
16	Max V image size	11	00010001	17	17	17cm (approx)
17	Display Gamma	78	01111000	120	2.2	Gamma 2.2
18	Feature support	0A	00001010	10		
19	Red/green low bits	CD	11001101	205		10000111
1A	Blue/white low bits	B5	10110101	181		11111110
1B	Red x/ high bits	A3	10100011	163	0.640	Red x 0.640= 10010011
1C	Red y	57	01010111	87	0.340	Red y 0.340= 01010110
1D	Green x	4C	01001100	76	0.300	Green x 0.300= 01010101
1E	Green y	9C	10011100	156	0.610	Green y 0.610= 10010011
1F	Blue x	26	00100110	38	0.150	Blue x 0.150= 00101001
20	Blue y	0C	00001100	12	0.050	Blue y 0.050= 00011101
21	White x	50	01010000	80	0.313	White x 0.313= 01010000
22	White y	54	01010100	84	0.329	White y 0.329= 01010100
23	Established timing 1	00	00000000	0		
24	Established timing 2	00	00000000	0		
25	Established timing 3	00	00000000	0		
26	Standard timing #1	01	00000001	1		not used
27		01	00000001	1		
28	Standard timing #2	01	00000001	1		not used
29		01	00000001	1		
2A	Standard timing #3	01	00000001	1		not used
2B		01	00000001	1		
2C	Standard timing #4	01	00000001	1		not used
2D		01	00000001	1		
2E	Standard timing #5	01	00000001	1		not used
2F		01	00000001	1		
30	Standard timing #6	01	00000001	1		not used
31		01	00000001	1		
32	Standard timing #7	01	00000001	1		not used
33		01	00000001	1		
34	Standard timing #8	01	00000001	1		not used
35		01	00000001	1		
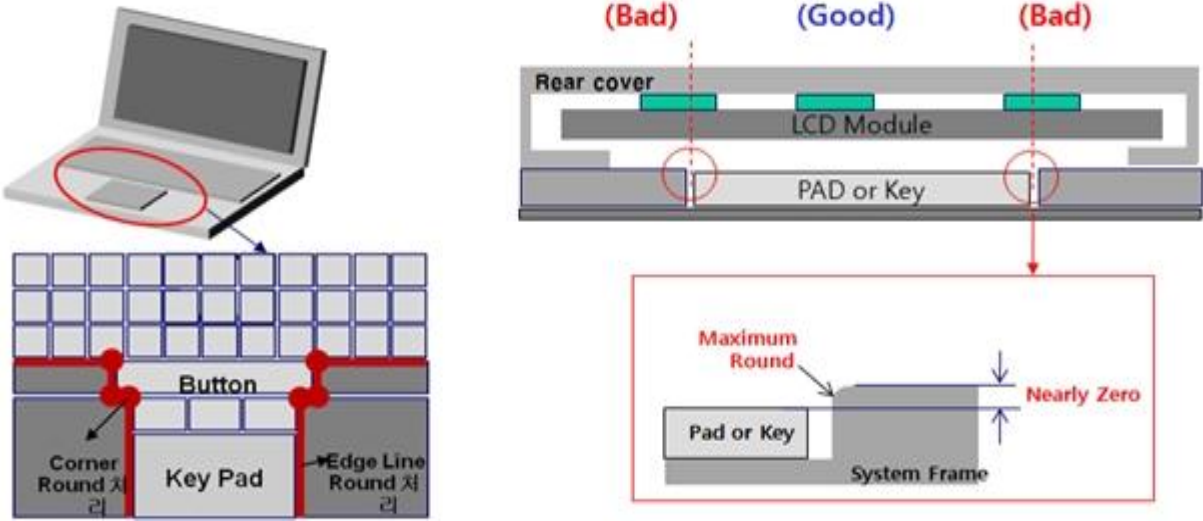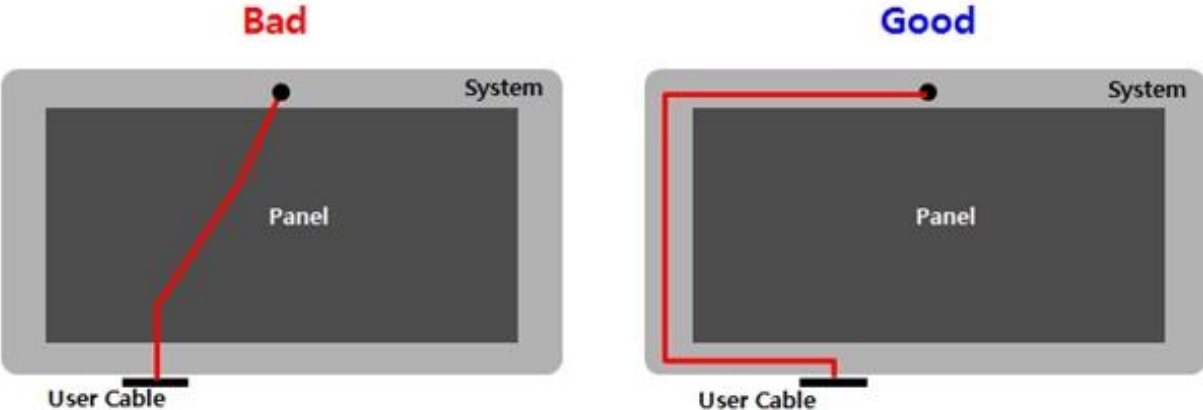
Address (HEX)	FUNCTION	Value HEX	BIN	DEC	ASCII or Data	Notes
36		D2	11010010	210	142.9	Main clock= 142.9 MHz
37		37	00110111	55		
38		80	10000000	128	1920	Hor active=1920 pixels
39		A2	10100010	162	162	Hor blanking=162 pixels
3A		70	01110000	112		4bit : 4bit
3B		38	00111000	56	1080	Vertcal active=1080 lines
3C		40	01000000	64	64	Vertical blanking=64 lines
3D		40	01000000	64		4bit : 4bit
3E		30	00110000	48	48	H sync. Offset=48 pixels
3F	Detailed timing/monitor descriptor #1	20	00100000	32	32	H sync. Width=32 pixels
40		25	00100101	37	2 / 5	V sync. Offset=2 lines / V sync. Width=5 lines
41		00	00000000	0		2bit : 2bit :2bit :2bit
42		25	00100101	37	293	H image size= 293 mm(approx)
43		A5	10100101	165	165	V image size = 165 mm(approx)
44		10	00010000	16		
45		00	00000000	0		No Horizontal Border
46		00	00000000	0		No Vertical Border
47		19	00011001	25		
48		37	00110111	55	95.27	Main clock= 95.27 MHz
49		25	00100101	37		
4A		80	10000000	128	1920	Hor active=1920 pixels
4B		A2	10100010	162	162	Hor blanking=162 pixels
4C		70	01110000	112		4bit : 4bit
4D		38	00111000	56	1080	Vertcal active=1080 lines
4E		40	01000000	64	64	Vertical blanking=64 lines
4F	Detailed timing/monitor	40	01000000	64		4bit : 4bit
50	descriptor #2	30	00110000	48	48	H sync. Offset=48 pixels
51	(sDRRS 40Hz)	20	00100000	32	32	H sync. Width=32 pixels
52		25	00100101	37	2 / 5	V sync. Offset=2 lines / V sync. Width=5 lines
53		00	00000000	0		2bit : 2bit :2bit :2bit
54		25	00100101	37	293	H image size= 293 mm(approx)
55		A5	10100101	165	165	V image size = 165 mm(approx)
56		10	00010000	16		
57		00	00000000	0		No Horizontal Border
58		00	00000000	0		No Vertical Border
59		19	00011001	25		
5A		00	00000000	0		
5B		00	00000000	0		
5C		00	00000000	0		
5D		00	00000000	0		
5E		00	00000000	0		
5F		00	00000000	0		
60		00	00000000	0		
61	Detailed timing/monitor	00	00000000	0		
62	descriptor #3 (None)	00	00000000	0		
63		00	00000000	0		
64		00	00000000	0		
65		00	00000000	0		
66		00	00000000	0		
67		00	00000000	0		
68		00	00000000	0		
69		00	00000000	0		
6A		00	00000000	0		
6B		00	00000000	0		
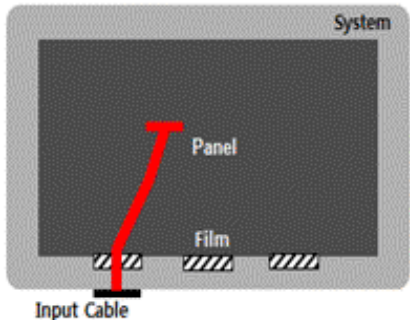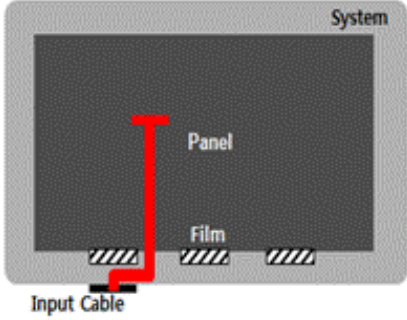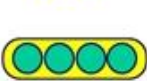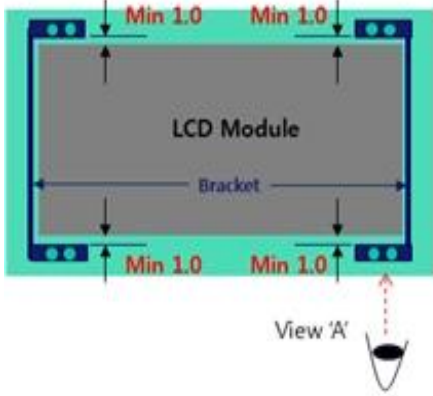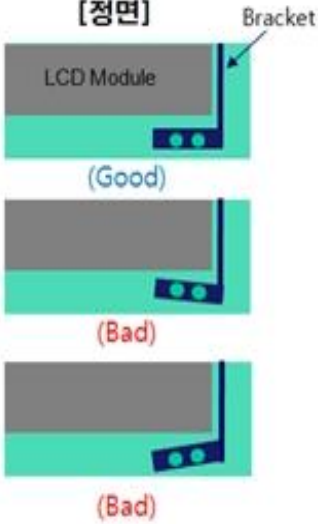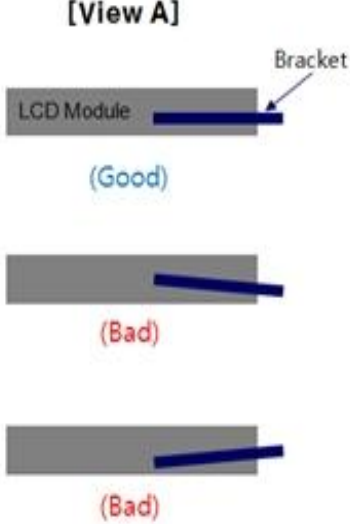
Address (HEX)	FUNCTION	Value HEX	BIN	DEC	ASCII or Data	Notes
6C	Header	00	00000000	0		Detailed Timing Description#4
6D		00	00000000	0		Flag
6E		00	00000000	0		Reserved
6F		02	00000010	2		For Brightness Table and Power consumption
70		00	00000000	0		Flag
71	Brightness Table	0C	00001100	12		Step 0 = 5%, 20nits
72		26	00100110	38		Step 5 = 15%, 60nits
73		FF	11111111	255		Step 10 = 100%, 400nits
74		14	00010100	20		
75		3C	00111100	60		
76		C8	11001000	200		
77	Power Consumption	20	00100000	32		1300mW
78		0F	00001111	15		600mW
79		32	00110010	50		4000mW
7A		C8	11001000	200		400nits
7B	Flags	00	00000000	0		
7C	Flags	00	00000000	0		
7D	Flags	00	00000000	0		
7E	Extension Flag	00	00000000	0		
7F	Checksum	BD	10111101	189		
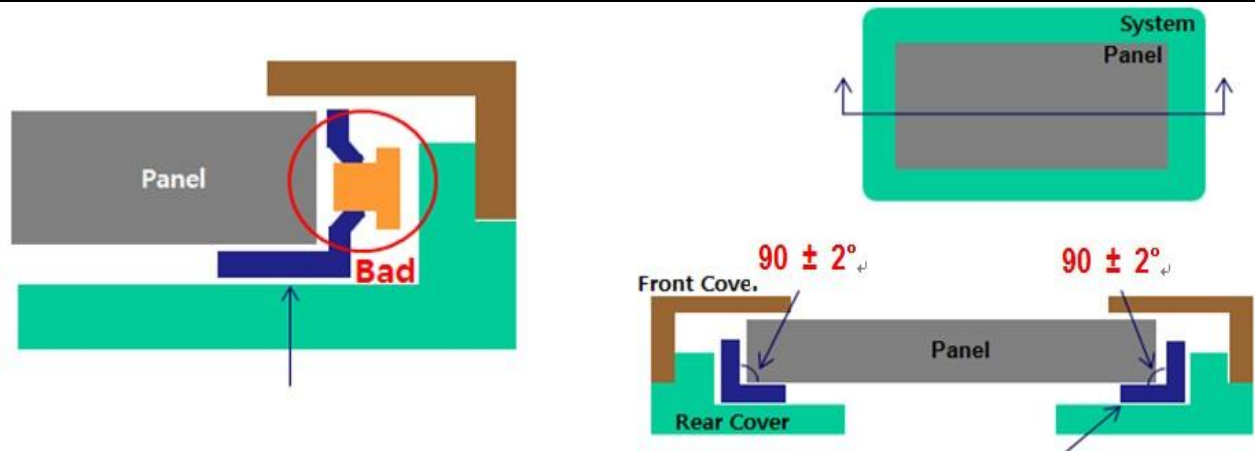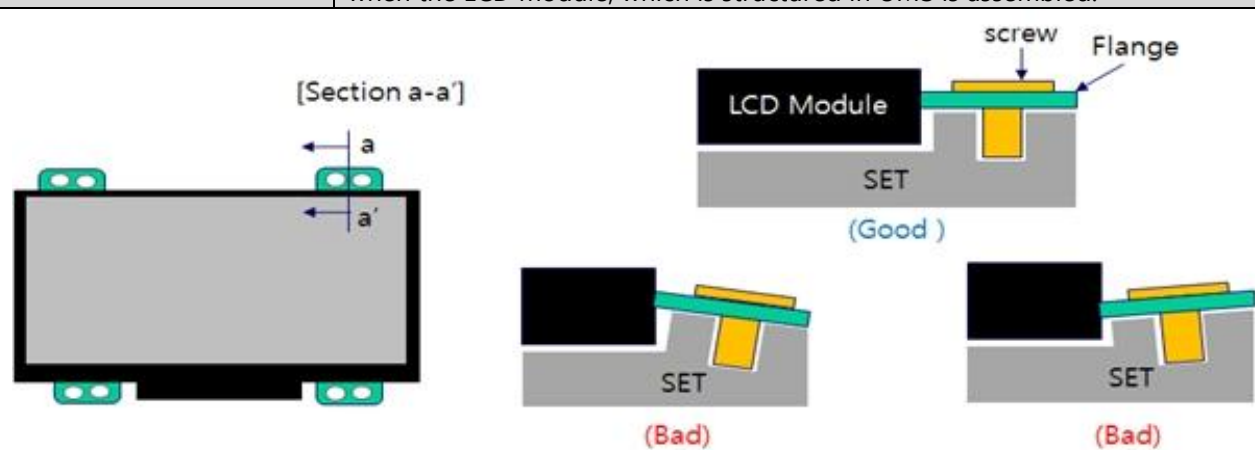
12. APPENDIX

12.1 SYSTEM DESIGN GUIDE

	[Common]Gap in the rear of display
1	Prevent the product from being defected resulted from the interference and the lack of gap between the rear cover of system and the LCD module.

Recommendation	A. The gap between the rear cover of system and the rear of LCD module. : Min. 0.3mm (Recommend) B. Based on the size of part in a maximum size between the rear cover of system and the LCD module. : Min. 0.3mm (Recommend) (※ Based on the maximum thickness of module, which the tolerance is considered.)
Risk factor	Pooling / White Spot / Being divided
	Gap in the front of display
2	Prevent the product from being defected resulted from the interference and the lack of gap between the front cover of system and the LCD module.

Recommendation	Th gap between the front cover of system and the front of LCD module. : Min. 0.3mm (Recommend) (※ Based on the maximum thickness of module, which the tolerance is considered.)
Risk factor	Pooling

	[Common] The shape of key pad of system
3	Prevent the product from being defected resulted from the shape of key pad in the system.
Recommendation	A. Make the shape of frame, which surrounds the key pad as round as possible. B. Prevent the product from being defected resulted from the pressurization by attaching the sponge on the cover of system not to be overlapped with the position of the frame around key pad. C. Prevent the product from being defected, which is resulted from the pressurization from outside by eliminating the difference in height between the key pad and the frame around key pad.
Risk factor	White Spot / Black Spot / Being broken in glass.
4	[Common] The arrangement of user cable (Camera, Antenna)
	Prevent the product from being defected resulted from the user cable arranged on the rear of module.
Recommendation	A. Arrange the user cable in the side not in the rear(the active area) of LCD module.
Risk factor	Pooling / White Spot

| 5 | [Common] The arrangement of input cable |
| | Prevent the product from being defected resulted from the overlapping between the input cable and the film of LCD module . |

| Recommendation | A. Arrange the input cable not to be overlapped with the COF film.
B. Minimization of the height of input cable and making the COF film flat. |
| Risk factor | A/D (The damaged COF film is cracked., The chip is broken.) |

| 6 | [ELS] Gap between the bracket and the LCD Module |
| | Prevent the LCD module from being interfered when testing the product in terms of the performance of hinge and the occurrence of twist. |

| Recommendation | A. Secure the min. 1.0mm distance between the bracket and the LCD module at 4 corners of screen respectively.
B. Control the angle of bracket on the system. |

7	[ELS] Suggestion on the angle of bracket
	Prevent the product from being defected resulted from the changed top chassis by the angle and the shape of bracket on the system.

Recommendation	A. Don't form the bracket hole. B. Control the angle in the event that the bracket, which has L-shape is applied. (90 ± 2˚)
Risk factor	Pooling / Light leakage

8	[UMS] Control the angle of the connected part on the user flange
	Prevent the user flange from not being placed horizontally, which is caused when the LCD module, which is structured in UMS is assembled.

Recommendation	A. Prevent the product from being pooled resulted from the changed user flange created when assembling the LCD module to the system. B. Insert the screw to the hole of flange vertically when LCD module is assembled to the system.
Risk factor	Pooling