

**Product Specification**

# SPECIFICATION FOR APPROVAL

- ( ● ) Preliminary Specification  
 (   ) Final Specification

<b>Title</b>	<b>12.3”FHD (1920 X RGB X 720) TFT- LCD</b>
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BUYER	Continental
MODEL	

SUPPLIER	LG Display Co.,Ltd.
MODEL	LA123WF4
SUFFIX	SR08

SIGNATURE	DATE
/	_____
/	_____
/	_____

APPROVED BY	DATE
S.G.Kim / Chief Engineer	_____
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**Product Engineering Dept.  
 LG Display Co., Ltd**



## Product Specification

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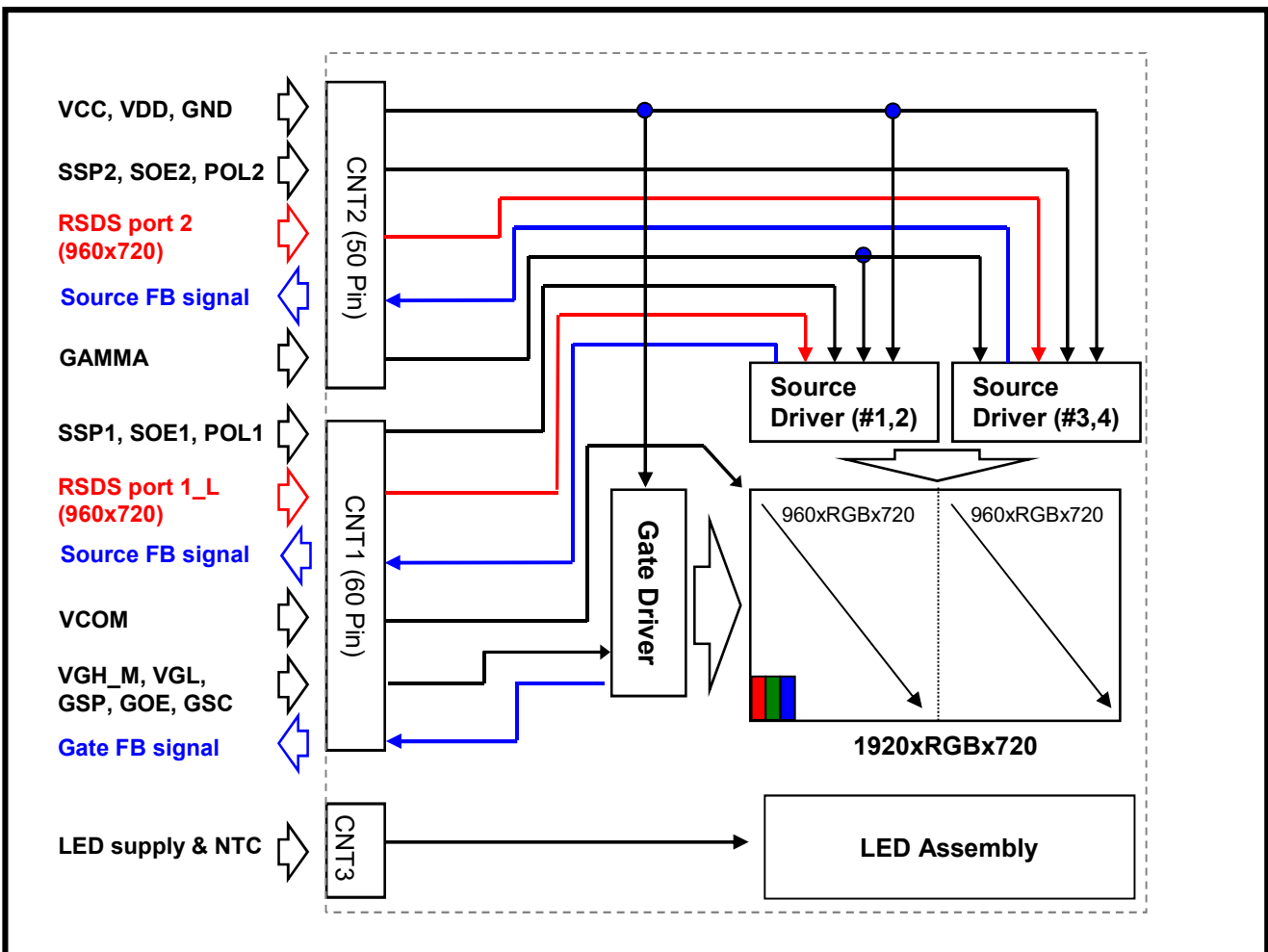
**Product Specification**

## 1. Summary

This module utilizes amorphous silicon thin film transistors and a 8:3 aspect ratio. A 12.3" active matrix liquid crystal display allows 16,777,216 colors to be displayed.  
 The applications are Cluster/CID (Center Information Display) and others AV system.

## 2. Features

- Utilizes a panel with a 8:3 aspect ratio, which makes the module suitable for use in wide-screen systems.
- The " screen produces a high resolution image that is composed of 4,147,200 pixel elements in a stripe arrangement.
- Wide viewing angle technology is employed.
- By adopting an active matrix drive, a picture with high contrast is realized.
- A thin, light and compact module is accomplished through the use of COG mounting technology.
- By adopting a high aperture panel, high transmittance color filter and high transmission polarizing plates, transmittance ratio is realized.
- Gray scale or the brightness of the sub-pixel color is determined with a 8bit gray scale signal.



**Product Specification**
**3. General Specification**

Characteristic Item	Specification
Interface	RSDS 2port
Display Mode	Normally Black, Transmitting Type
Screen Size (Diagonal)	12.3"(312.42mm)
Aspect Ratio	8:3
Outline Dimension (W x H x D)	310.0mm (H) X 128.0mm (V) X 8.2mm (T)
Active Area	292.032(H) [mm] X 109.512 (V) [mm]
Display Area	292.032(H) [mm] X 109.512 (V) [mm]
Number of dots	1920(H) X 3(R, G, B) X 720(V)
Color Depth	8 Bit, 16.7M Colors
Pixel Pitch	0.1521mm(H) × 0.1521mm(V)
Color Filter Array	RGB vertical stripes
Weight	T.B.Dg (Typ.), T.B.Dg ( Max.)
Backlight	White LED
Surface Treatment	Hard Coating treatment of the front polarizer

## Product Specification

### 4. Pin Configuration

#### 4-1. 60 Pin FPC Pin Configuration

Pin No.	Pin name	Function	Notes
1	VGL	Low level power supply for gate	
2	NC	not connected	
3	VGH	High level power supply for gate	
4	NC	not connected	
5	SCAN1	U/D Scan direction	
6	GSP_FB1	Gate synchronisation signal feedback	
7	GND	Ground	
8	VDD1	Power supply for logic	
9	GND	Ground	
10	D23P_L	RSDS input data (Red, left side)	
11	D23N_L	RSDS input data (Red, left side)	
12	D22P_L	RSDS input data (Red, left side)	
13	D22N_L	RSDS input data (Red, left side)	
14	D21P_L	RSDS input data (Red, left side)	
15	D21N_L	RSDS input data (Red, left side)	
16	D20P_L	RSDS input data (Red, left side)	
17	D20N_L	RSDS input data (Red, left side)	
18	GND	Ground	
19	D13P_L	RSDS input data (Green, left side)	
20	D13N_L	RSDS input data (Green, left side)	
21	D12P_L	RSDS input data (Green, left side)	
22	D12N_L	RSDS input data (Green, left side)	
23	D11P_L	RSDS input data (Green, left side)	
24	D11N_L	RSDS input data (Green, left side)	
25	D10P_L	RSDS input data (Green, left side)	
26	D10N_L	RSDS input data (Green, left side)	
27	GND	Ground	
28	D03P_L	RSDS input data (Blue, left side)	
29	D03N_L	RSDS input data (Blue, left side)	
30	D02P_L	RSDS input data (Blue, left side)	
31	D02N_L	RSDS input data (Blue, left side)	
32	D01P_L	RSDS input data (Blue, left side)	
33	D01N_L	RSDS input data (Blue, left side)	
34	D00P_L	RSDS input data (Blue, left side)	
35	D20N_L	RSDS input data (Blue, left side)	
36	GND	Ground	
37	CLKP_L	RSDS input clock (left side)	
38	CLKN_L	RSDS input clock (left side)	
39	GSP_1	Gate start pulse	
40	GSC_1	Gate shift clock	

## Product Specification

### 4-1. 60 Pin FPC Pin Configuration

Pin No.	Pin name	Function	Notes
41	GOE_1	Gate output enable	
42	SSP_1	Source start pulse	
43	SOE_1	Source on enable	
44	POL_1	Polarity signal	
45	SCAN2	L/R Scan direction	
46	SSP_FB1	Source synchronisation signal feedback	
47	GND	Ground	
48	VCOM	Common electrode power supply	
49	VCOM	Common electrode power supply	
50	VDD2	Power supply for source	
51	VDD2	Power supply for source	
52	V0	Gamma reference voltage (highest voltage)	
53	V1	Gamma reference voltage	
54	V2	Gamma reference voltage	
55	V3	Gamma reference voltage	
56	V4	Gamma reference voltage	
57	V5	Gamma reference voltage	
58	V6	Gamma reference voltage	
59	V7	Gamma reference voltage	
60	V8	Gamma reference voltage	

[ Connector ] Kyocera 6288 060

**Product Specification**
**4-2. 50 Pin FPC Pin Configuration**

Pin No.	Pin name	Function	Notes
1	V9	Gamma reference voltage	
2	V10	Gamma reference voltage	
3	V11	Gamma reference voltage	
4	V12	Gamma reference voltage	
5	V13	Gamma reference voltage	
6	V14	Gamma reference voltage	
7	V15	Gamma reference voltage	
8	V16	Gamma reference voltage	
9	V17	Gamma reference voltage (lowest voltage)	
10	GND	Ground	
11	SSP_2	Source start pulse	
12	SOE_2	Source on enable	
13	POL_2	Polarity signal	
14	SCAN2	L/R Scan direction	
15	SSP_FB2	Source synchronisation signal feedback	
16	GND	Ground	
17	D23P_R	RSDS input data (Red, left side)	
18	D23N_R	RSDS input data (Red, left side)	
19	D22P_R	RSDS input data (Red, left side)	
20	D22N_R	RSDS input data (Red, left side)	
21	D21P_R	RSDS input data (Red, left side)	
22	D21N_R	RSDS input data (Red, left side)	
23	D20P_R	RSDS input data (Red, left side)	
24	D20N_R	RSDS input data (Red, left side)	
25	GND	Ground	
26	D13P_R	RSDS input data (Green, left side)	
27	D13N_R	RSDS input data (Green, left side)	
28	D12P_R	RSDS input data (Green, left side)	
29	D12N_R	RSDS input data (Green, left side)	
30	D11P_R	RSDS input data (Green, left side)	
31	D11N_R	RSDS input data (Green, left side)	
32	D10P_R	RSDS input data (Green, left side)	
33	D10N_R	RSDS input data (Green, left side)	
34	GND	Ground	
35	D03P_R	RSDS input data (Blue, left side)	
36	D03N_R	RSDS input data (Blue, left side)	
37	D02P_R	RSDS input data (Blue, left side)	
38	D02N_R	RSDS input data (Blue, left side)	
39	D01P_R	RSDS input data (Blue, left side)	
40	D01N_R	RSDS input data (Blue, left side)	



## Product Specification

### 4-2. 50 Pin FPC Pin Configuration

Pin No.	Pin name	Function	Notes
41	D00P_R	RSDS input data (Blue, left side)	
42	D20N_R	RSDS input data (Blue, left side)	
43	GND	Ground	
44	CLKP_R	RSDS input clock (left side)	
45	CLKN_R	RSDS input clock (left side)	
46	VDD1	Power supply for logic	
47	GND	Ground	
48	VGL	Low level power supply for gate	
49	NC	not connected	
50	VGH	High level power supply for gate	

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**Product Specification**
**4-3. Backlight LED FPC Pin Configuration**

Pin No.	Pin name	Function	Notes
1	NTC_A	Thermal Sensor	
2	NTC_B	Thermal Sensor	
3	VC6	LED Cathode Terminal 6	
4	NC	-	
5	VA6	LED Anode Terminal 6	
6	VA5	LED Anode Terminal 5	
7	NC	-	
8	VC5	LED Cathode Terminal 5	
9	VC4	LED Cathode Terminal 4	
10	NC	-	
11	VA4	LED Anode Terminal 4	
12	VA3	LED Anode Terminal 3	
13	NC	-	
14	VC3	LED Cathode Terminal 3	
15	VC2	LED Cathode Terminal 2	
16	NC	-	
17	VA2	LED Anode Terminal 2	
18	VA1	LED Anode Terminal 1	
19	NC	-	
20	VC1	LED Cathode Terminal 1	

[ Connector ] Kyocera 6288 020

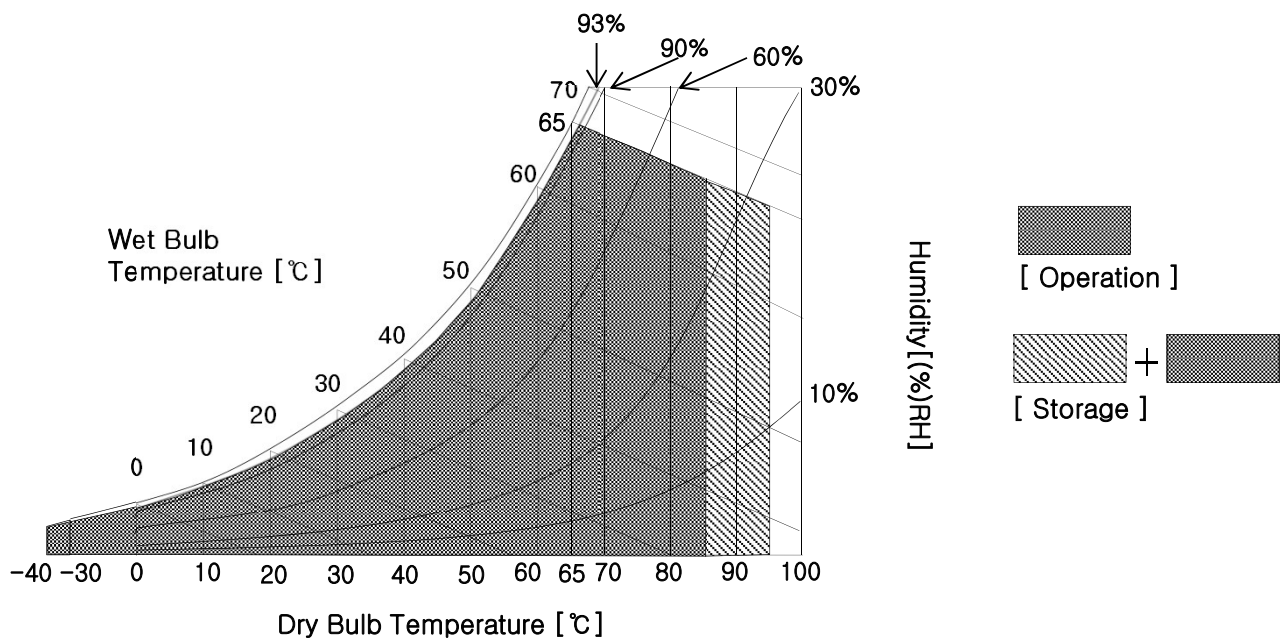
**Product Specification**
**5. Absolute Maximum Ratings**

Parameter	Symbol	Min.	Max.	Unit	Notes
Digital Supply Voltage	VDD1	-0.5	4	V	
Gamma Reference Voltage	$V_{GMA}$ (GMA 0~17)	GND+0.2	VDD-0.2	V	
Source Driver Analog Voltage	VDD2	-0.5	14	V	
Gate Driver Voltage	VGH-VGL	-0.3	39.0	V	
	VGL	-12.0	0.3	V	
Storage Temperature	Ta	-40	95	°C	5-1,2
Operating Temperature	Ta	-40	85	°C	5-1,2,3

[Note 5-1] This rating applies to all parts of the module and should not be exceeded.

[Note 5-2] Maximum wet-bulb temperature is 65°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

[Note 5-3] The operating temperature only guarantees operation of the LCM and doesn't guarantee all the contents of Electro-optical specification.



**Product Specification**
**6. Electrical Specification**
**6-1. Electrical Characteristics (Typical value is only reference)**

Ta=25°C

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes	
Source Driver	Digital Supply Voltage	VCC	3.0	3.3	3.6	V		
	Supply Voltage	VDD2	12.75	13 (Reference)	13.5	V		
	Gamma Reference Voltage	VGMA (GMA0~17)	GND+0.2	-	VDD-0.2	V	6-1.1	
Gate Driver	TFT	Hi	VGH	16	20 (Reference)	22	V	6-1.2
		Low	VGL	-10	-7.5 (Reference)	-5	V	
		Modulation Voltage	VDD_M	12.6	13 (Reference)	16	V	6-1.2
		Voltage Difference	VGH-VGL	17	-	32	V	
	Logic Supply Voltage	VDD1	3.0	3.3	3.6	V		
Common Voltage		VCOM	5.0	-	7.0	V	6-1.3	
Digital Supply Voltage Current		I <sub>VDD1</sub>	-	-	130	mA	6-1.4	
VDD1 Inrush current		I <sub>VDD1_Inrush</sub>	-	-	200	mA	6-1.4	
Source Driver Analog Voltage Current		I <sub>VDD2</sub>	-	-	130	mA	6-1.4	
VDD2 Inrush current		I <sub>VDD2_Inrush</sub>	-	-	200	mA	6-1.4	
VDD2 Current ripple		I <sub>VDD2_Ripple</sub>	-	-	600	mA	6-1.4	
Common Voltage Current		I <sub>VCOM</sub>	-	-	1	mA	6-1.4	
VCOM Inrush current		I <sub>VCOM_Inrush</sub>	-	-	1	mA	6-1.4	
Gate High Voltage Current		I <sub>VGH</sub>	-	-	3	mA	6-1.4	
Gate Low Voltage Current		I <sub>VGL</sub>	-	-	3	mA	6-1.4	

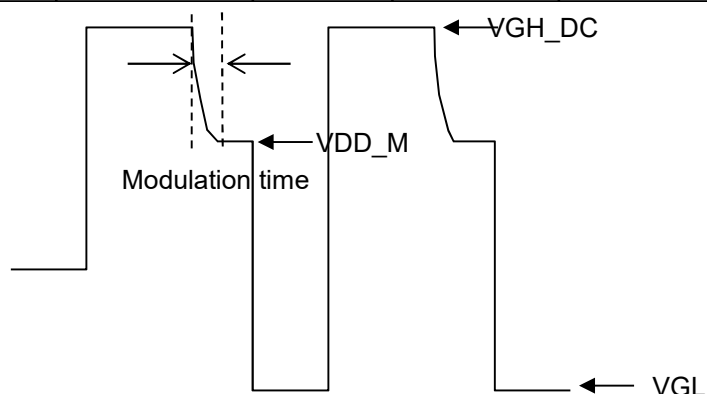
**Product Specification**

[Note 6-1.1] Recommended Gamma Correction Voltage [Reference Only, GMA0 to GMA17]

Symbol	Min.	Typ.	Max.	Unit
GMA0	12.42	12.47	12.52	V
GMA1	12.15	12.2	12.25	V
GMA2	10.82	10.87	10.92	V
GMA3	10.27	10.32	10.37	V
GMA4	9.59	9.64	9.69	V
GMA5	8.94	8.99	9.04	V
GMA6	8.36	8.41	8.46	V
GMA7	7.25	7.3	7.35	V
GMA8	6.73	6.78	6.83	V
GMA9	6.33	6.38	6.43	V
GMA10	5.77	5.82	5.87	V
GMA11	4.67	4.72	4.77	V
GMA12	4.07	4.12	4.17	V
GMA13	3.46	3.51	3.56	V
GMA14	2.75	2.8	2.85	V
GMA15	2.22	2.27	2.32	V
GMA16	0.91	0.96	1.01	V
GMA17	0.61	0.66	0.71	V

[Note 6-1.2] VGH Modulation Method (Frame Rate 60Hz)

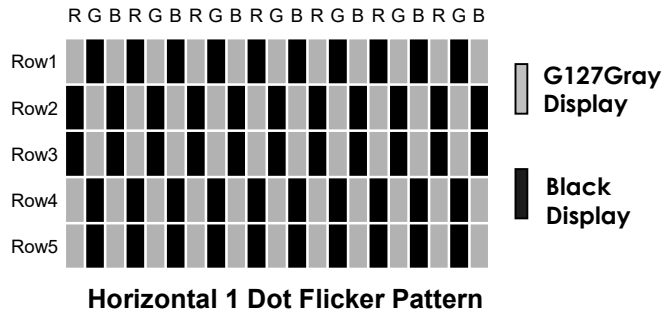
Parameter	Min.	Typ.	Max.	Unit	Notes
VGH_DC	16	20 (Reference)	22	V	
VDD_M	12.6		16	V	
Modulation time	5.3	6.3	7.3	us	Slew rate : 1.1 V/us (Typ.)
VGH_DC Time	12.1	13.1	14.1	us	



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[Note 6-1.3] VCOM adjustment method.

- \* Pattern : Flicker pattern (Horizontal 1dot Vertical 2dot)
- \* Method : Adjust the VCOM Voltage to the minimum flicker phenomenon.  
(adjustment must be finished within 30 sec)



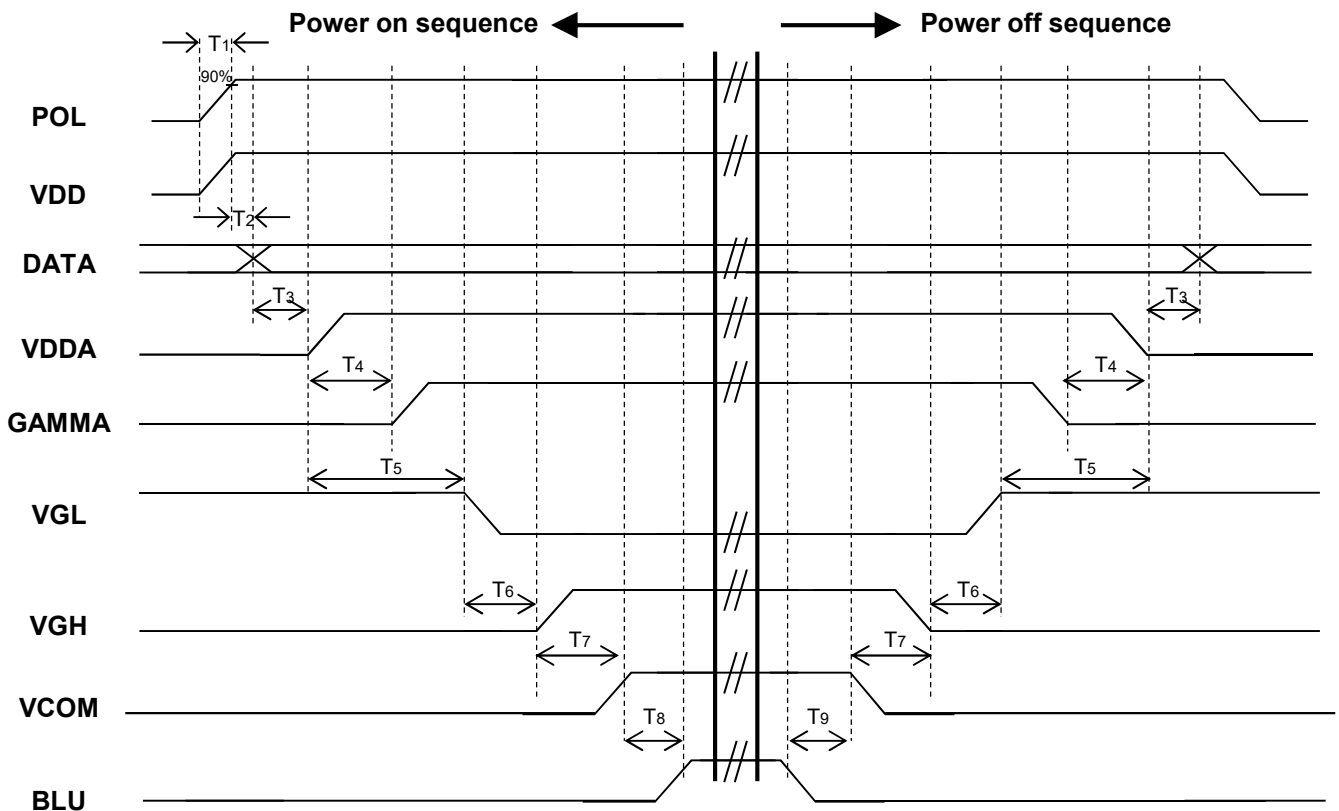
[Note 6-1.4]  $f_{CLK} = 44.7\text{MHz}$ ,  $VCC = 3.3\text{V}$ ,  $VDD = 12.9\text{V}$ ,  $GMA0 = 12.75\text{V}$  /  $GMA17 = 0.67\text{V}$ ,  $VGH = 21\text{V}$ ,  
 $VGL = -8\text{V}$  with Probe Load.

- \* Test pattern : White (256 Gray)

**Product Specification**

**6-2. Power On/Off Sequence**

Parameter		Timing				Notes
		Min.	Typ.	Max.	Unit	
<b>Power On/off</b>	<b>T1</b>	<b>0</b>	<b>-</b>	<b>20</b>	<b>ms</b>	
	<b>T2</b>	<b>20</b>	<b>-</b>	<b>-</b>		
	<b>T3</b>	<b>5</b>	<b>-</b>	<b>-</b>		
	<b>T4</b>	<b>0.2</b>	<b>-</b>	<b>-</b>		
	<b>T5</b>	<b>5</b>	<b>-</b>	<b>-</b>		
	<b>T6</b>	<b>5</b>	<b>-</b>	<b>-</b>		
	<b>T7</b>	<b>5</b>	<b>-</b>	<b>-</b>		
	<b>T8</b>	<b>200</b>				
	<b>T9</b>	<b>200</b>				



Note : This document is preliminary version. The latest version must be checked from LG Display before detail design.

**Product Specification**

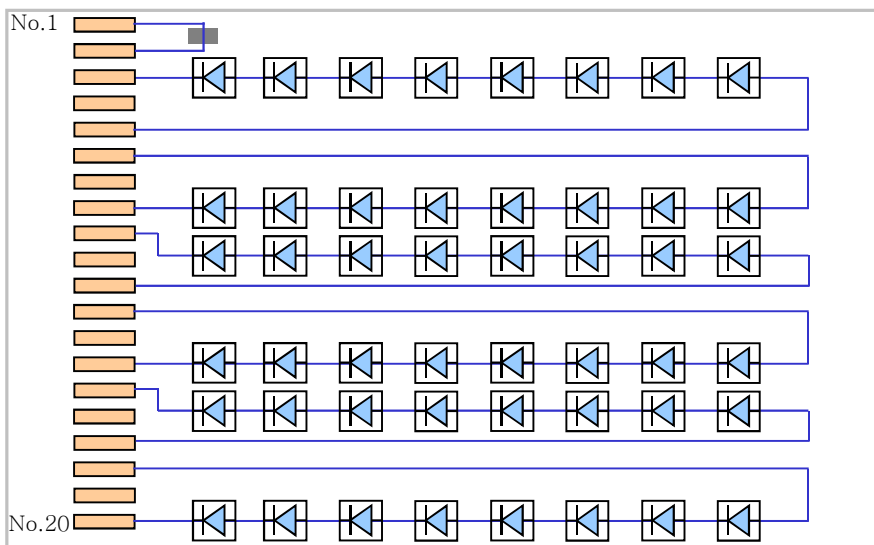
**6-3. LED Backlight Characteristics**

**6-3-1. LED Backlight Characteristics**

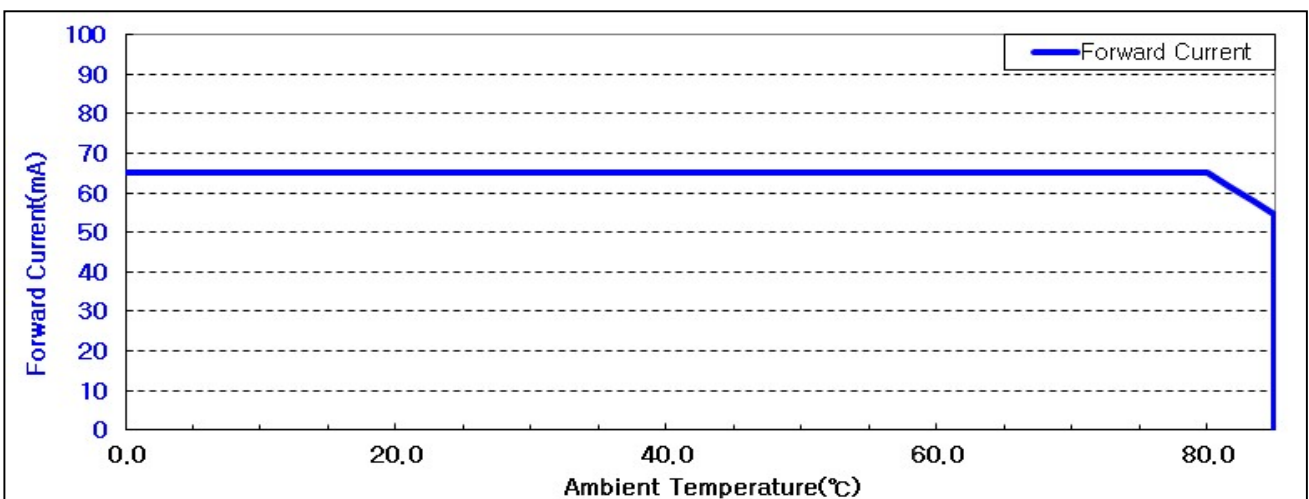
T<sub>a</sub>=25°C

Parameter	Symbol	Values			Unit	Notes	
		Min.	Typ.	Max.			
LED Current	I <sub>LED</sub>	60	65	70	mA	Per LED	
LED Voltage	V <sub>LED</sub>	-30°C	21.3	24.5	27.7	V	Per chain
		+25°C	20.5	23.6	26.7		
		+85°C	20.0	23.0	26.0		
LED Power	P <sub>LED</sub>	7.20	9.20	11.63	W		
LED chain		-	6	-		6-3.1	
LED Quantity		-	48	-	EA		

[Note 6-3.1] LED PCB chain



Thermistor P/N: NCP15XH103F0SRC



Note : This document is preliminary version. The latest version must be checked from LG Display before detail design.



## Product Specification

### 6-4. Timing Characteristics

#### 6-4-1. Input Signals Timing

This is the signal timing required at the input of the RSDS Transmitter. All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

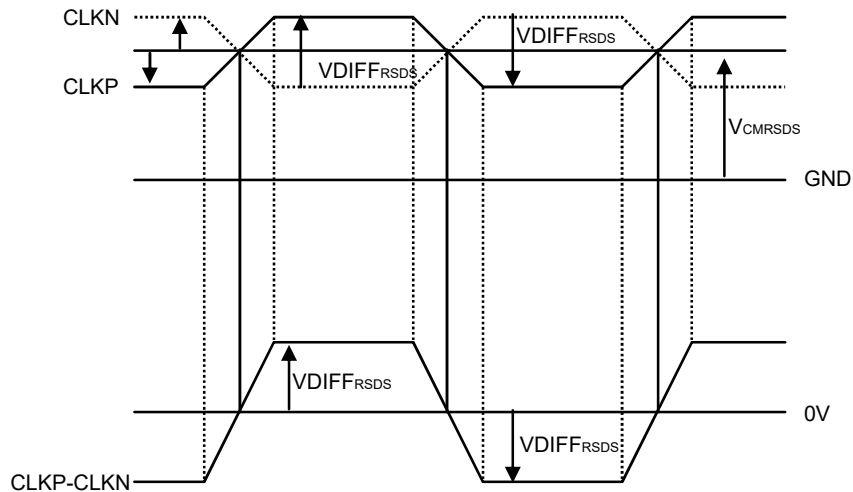
Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK frequency	Fclk	44.4	44.7	56	MHz
Horizontal display area	THD	960			CLK
HS period time	TH	1020	1024	1120	CLK
HS blanking	THBW + THBP	60	64	160	CLK
Vertical display area	TVD	720			H
VS period time	TV	726	728	810	H
VS blanking	TVBW + TVBP	6	8	90	H

**Product Specification**
**6-5. RSDS Input characteristics**
**6-5-1. DC Specification**

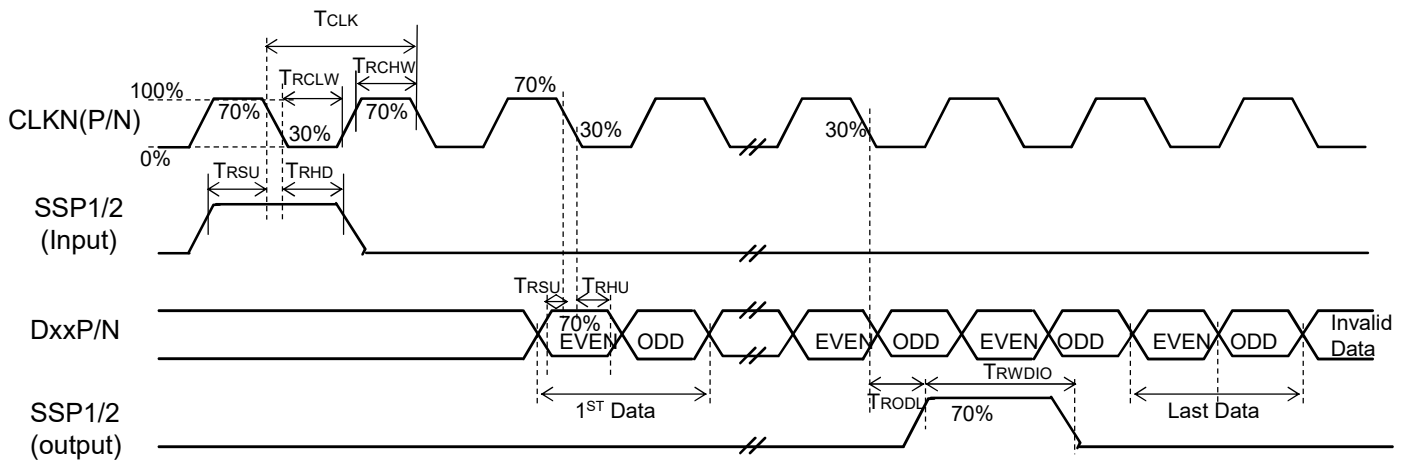
(VDD\_IF=VDD=3.0V to 3.6V, VDDA = 8V to 13.5V, GND\_IF=GND=GNDA=0V, TA=-40°C to 85°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
RSDS Low Level Input Voltage	VILRSDS	-	-150	-100	mV	
RSDS High Level Input Voltage	VIHRSDS	100	150	-	mV	
RSDS Differential Input Voltage	VDIFFRSDS	200	300	600	mV	
RSDS Common Voltage	VCMRSDS	0.5	1.2	VCC-1.6	V	
RSDS input Leakage Current	ILRSDS	-	-	±1	uA	Other input pins
RSDS Digital Stand-by Current	ISTRSDS	-	-	TBD	uA	CLK is stopped, Inputs are default, VDD_IF=3.3V
RSDS Operating Current	IVDDRSDS	-	-	TBD	mA	Fclk = 80MHz, FLD=60KHz, VDD_IF=3.3V, Input pattern: Data Pattern='101010...'



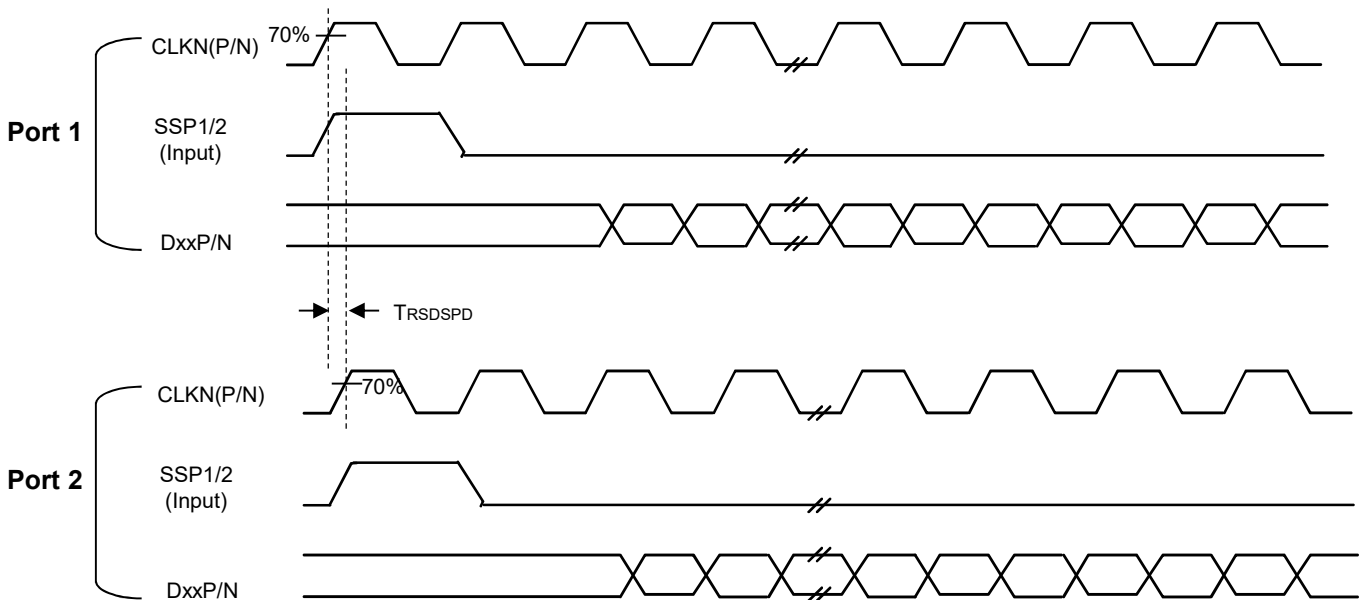
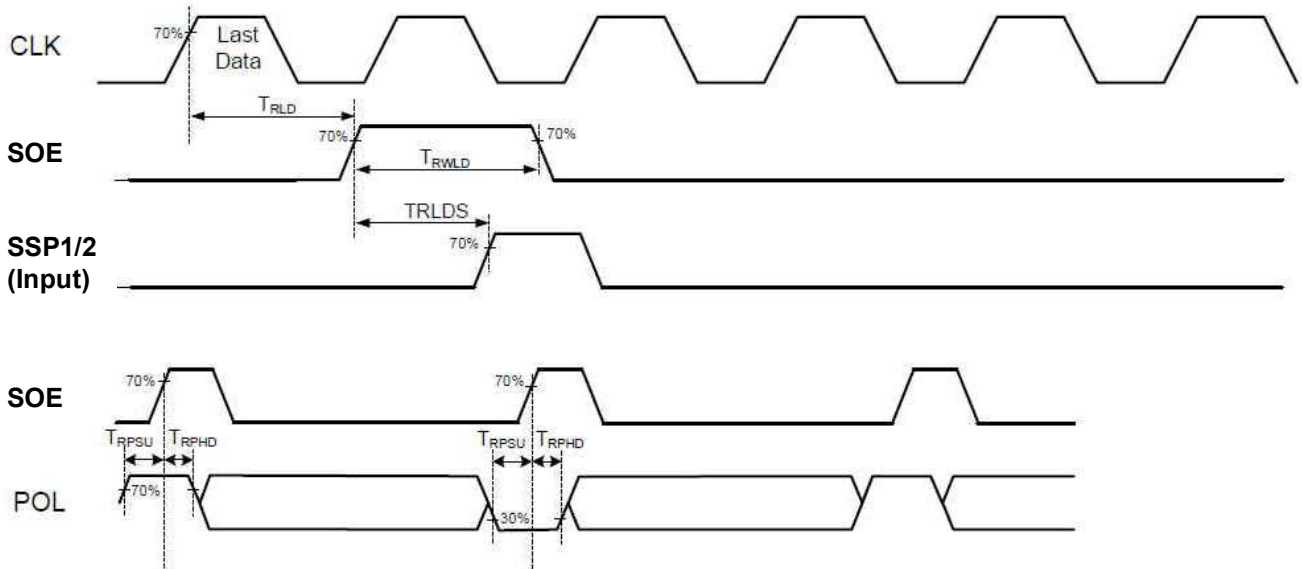
**Product Specification**
**6-5-2. AC Specification for Source D-IC**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Frequency	FCLK	44.4	-	56	MHz	
CLK Period	TCLK		-	-	ns	
CLK High Width	TRCHW	40%		60%	TCLK	
CLK Low Width	TRCLW	40%		60%	TCLK	
Data setup time	TRSU	3	-	-	ns	
Data hold time	TRHD	3.5	-	-	ns	
Output Delay of SSP2/1	TRDL	-	-	15	TCLK	CL=25pF (Output)
Last data to SOE	TRLD	16	-	-	TCLK	
Pulse width of SOE	TRWLD	16	-	-	TCLK	
Pulse width of SSP	TRWDIO	-	1	-	TCLK	
Time that SOE to SSP1/2	TRLDS	16	-	-	TCLK	
POL set-up time	TRPSU	6	-	-	TCLK	POL to SOE
POL hold time	TRPHD	6	-	-	TCLK	POL to SOE
2 PORT Delay	TRSDSPD	-	-	50	ns	



**Product Specification**

**6-5-2. AC Specification for Source D-IC**

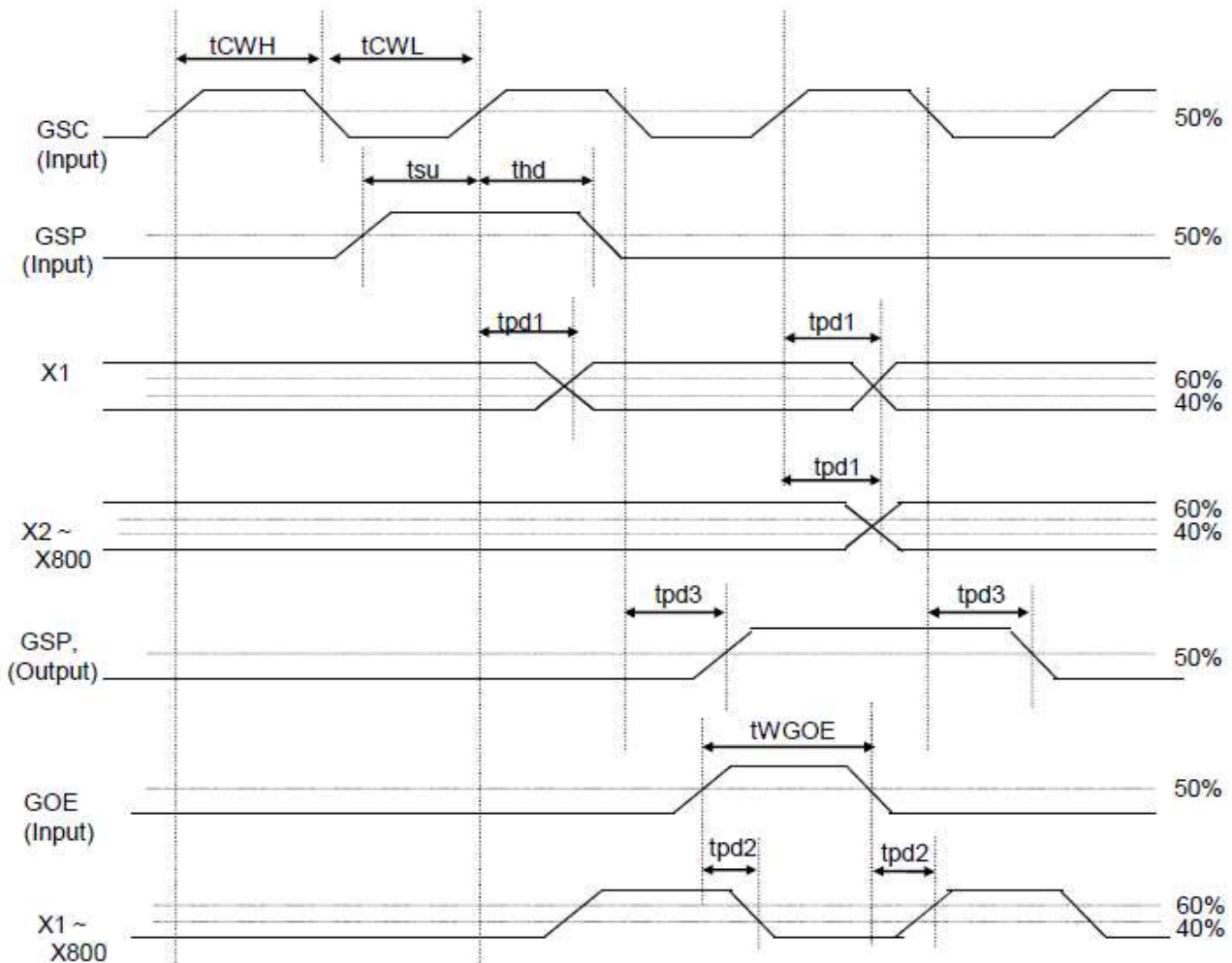


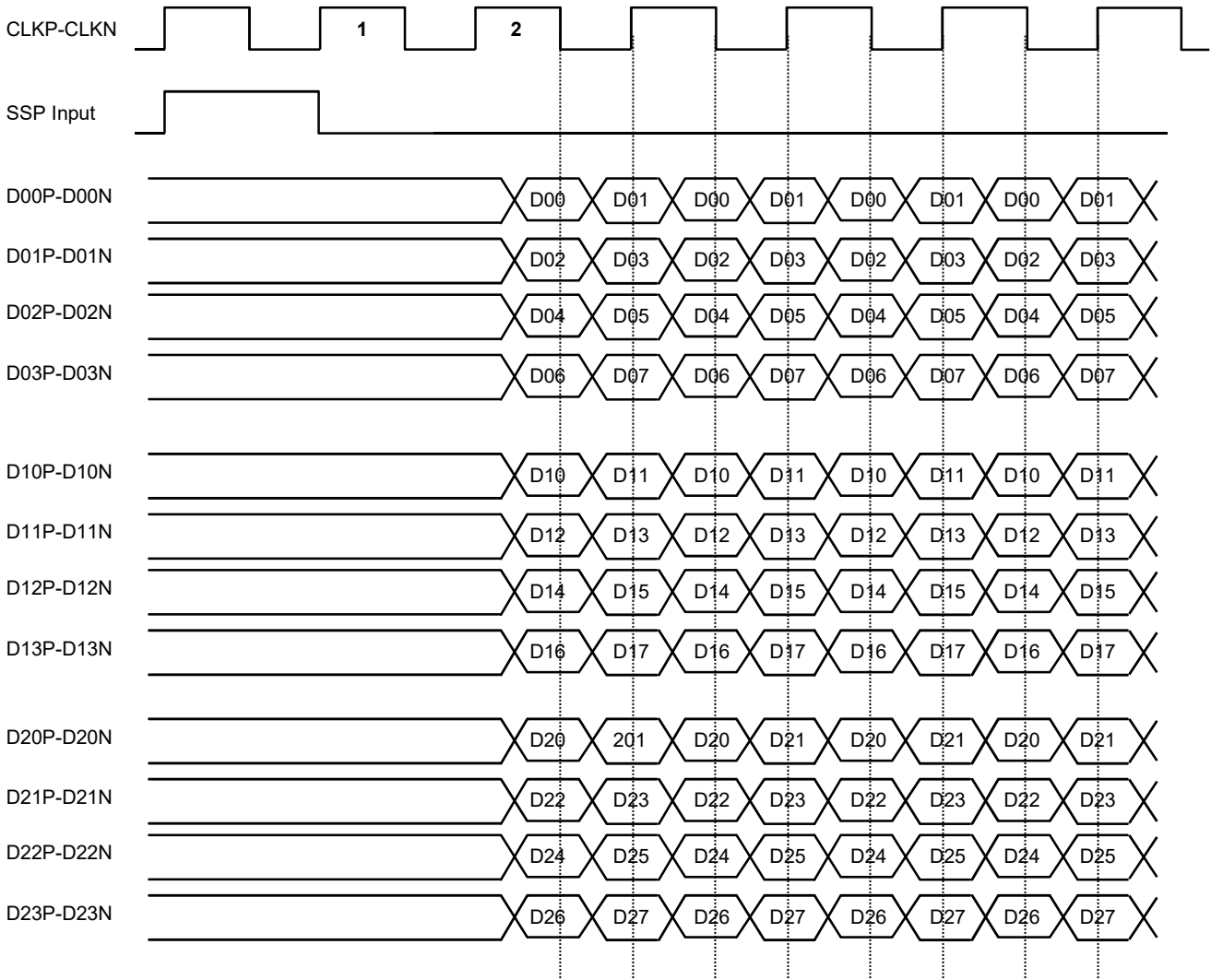
**Product Specification**
**6-5-3. AC Specification for Gate D-IC**

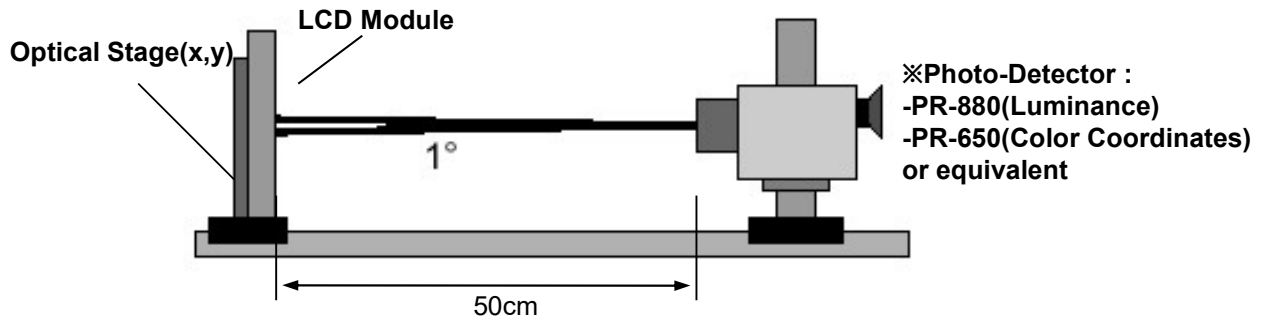
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
GSC Clock Frequency	tGSC	-	-	200	KHz	
GSC Clock Pulse Width	tCWH	2	-	-	us	
	tCWL	2	-	-	us	
Input signal Rising Time	tr <sub>in</sub>	-	-	100	ns	
Input signal Falling Time	t <sub>fin</sub>	-	-	100	ns	
GOE Enable Time	tWG <sub>OE</sub>	1	-	-	us	
Data Setup Time	t <sub>su</sub>	500	-	-	ns	
Data Hold Time	t <sub>hd</sub>	500	-	-	ns	
Output Delay to GSC	t <sub>pd1</sub>	-	500	1000	ns	CL=300pF
Output Delay to GOE	t <sub>pd2</sub>	-	500	1000	ns	CL=300pF
Data Output Delay Time	t <sub>pd3</sub>	-	500	1000	ns	CL=30pF

Note:

- Rising Time and Falling Time is measured between 20% to 80% of the signal.



**Product Specification**
**6-5-4. RSDS Data input format (8bit)**


**Product Specification**
**7. Electro-optical Characteristics**
**7-1. Electro-optical Characteristics**
**Optical Characteristic Measurement Equipment and Method**


Measuring Condition ;

-Measuring surroundings : Dark Room

 -Measuring temperature :  $T_a=25^{\circ}\text{C}$ 

-Adjust operating voltage to get optimum contrast at the center of the display.

-Measured value at the center point of LCD panel after more than 30 minutes while backlight turning on.

 $VCC=3.3\text{V}$ ,  $VDD=12.9\text{V}$ ,  $f_v=60\text{Hz}$ ,  $f_{clk}=44.7\text{MHz}$ ,  $I_{LED}=65\text{mA}$ 

Parameter	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Contrast Ratio	CR	Optimal	800	-	-	-	7-1.1
Viewing Angle	CR	Area A+	800	900		-	7-1.2
		Area A	500	700	-		
		Area B	100	300			
Response Time ( $T_a$ , MPRT)	$T_{rR} + T_{rD}$	+25°C	-	25	30	ms	7-1.3
		-20°C	-	175	250		
		-30°C	-	350	600		
Response Time ( $T_a$ , G2G)	$T_{rR} + T_{rD}$	+25°C	-	-	30	ms	7-1.3
		-20°C	-	-	250		
		-30°C	-	-	600		
Luminance	L	Area A+	600	-	-	cd/m <sup>2</sup>	
White Uniformity	$\delta_{\text{WHITE}}$	Area scan	80	-	-	%	7-1.4
Black Uniformity	$\delta_{\text{BLACK}}$	Area scan	50	-	-	%	7-1.4
Color Coordinates [CIE1931]	RED	$\lambda_R$	616	623	630	nm	
		Sat._R	80	-	-	%	
	GREEN	$\lambda_G$	544	549	554	nm	
		Sat._G	75	-	-	%	
	BLUE	$\lambda_B$	464	469	474	nm	
		Sat._B	90	-	-	%	
	WHITE	$W_x$	0.288	0.313	0.338		
		$W_y$	0.304	0.329	0.354		
LED Life Time	Hrs		10,000	-	-	-	7-1.5

**Product Specification**

[Note 7-1.1]

Contrast Ratio

$$CR = \frac{\text{Gray 255 [ White ]}}{\text{Gray 0 [ Black ]}}$$

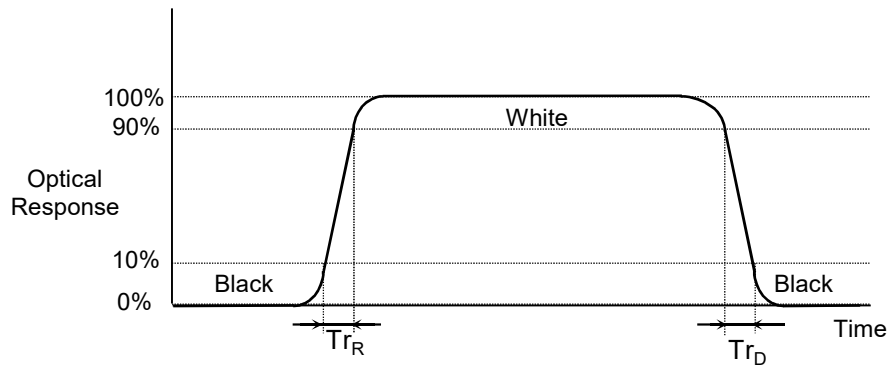
[Note 7-1.2]

Definition of Viewing angle

- Area A+ : Horizontal : +/- 10°, Vertical : +8° / -4°
- Area A : Horizontal : +/- 40°, Vertical : +20° / -10°
- Area B : Horizontal : +/- 50°, Vertical : +20° / -10°

[Note 7-1.3]

Definition of Response time



[Note 7-1.4]

Area scan uniformity measurement according “BlackMURA\_Display\_V100a.doc from 29.01.2010, ©OEM Work group displays”

[Note 7-1.5]

The life time is determined as the time at which brightness of LED is 80% compare to that of initial value at the typical LED current.



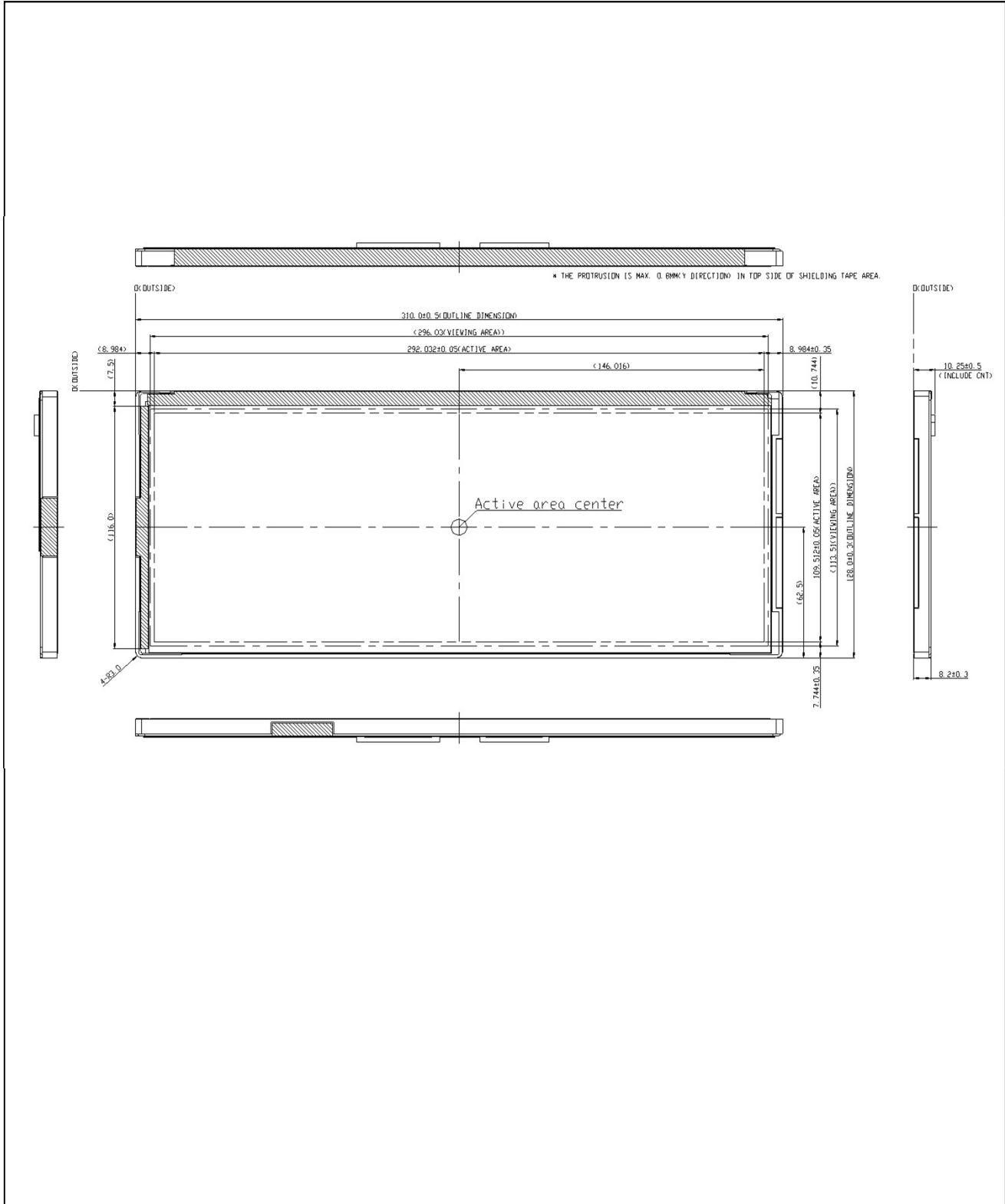
**Product Specification**
**8. Mechanical Characteristics**

Parameter	Specification		Unit
Outline Dimension	Width	310.0 ±0.5	mm
	Height	128.0 ±0.3	mm
	Depth	8.2 ±0.3	mm
Active Display Area	Width	292.032	mm
	Height	109.512	mm
Weight	T.B.Dg(Typ.), T.B.Dg(Max.)		G
Rattle Noise	30		dB

**Product Specification**

<FRONT VIEW>

Unit:[mm], General tolerance:  $\pm 0.3\text{mm}$

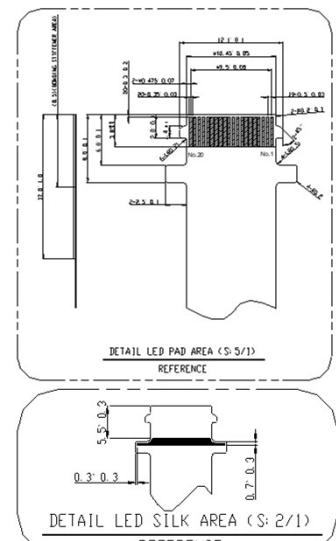
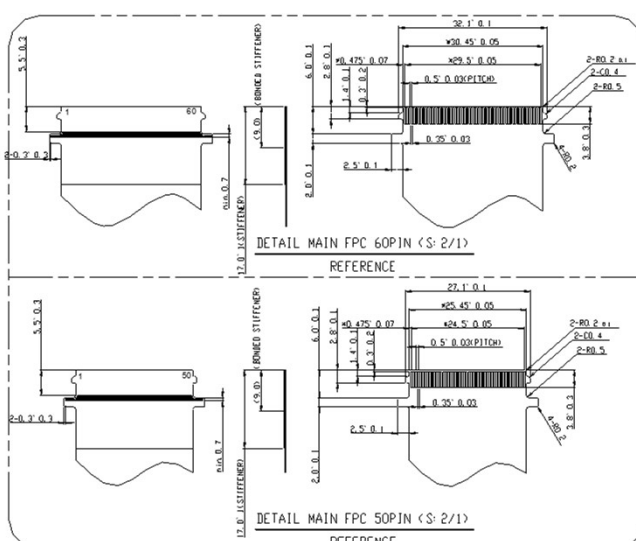
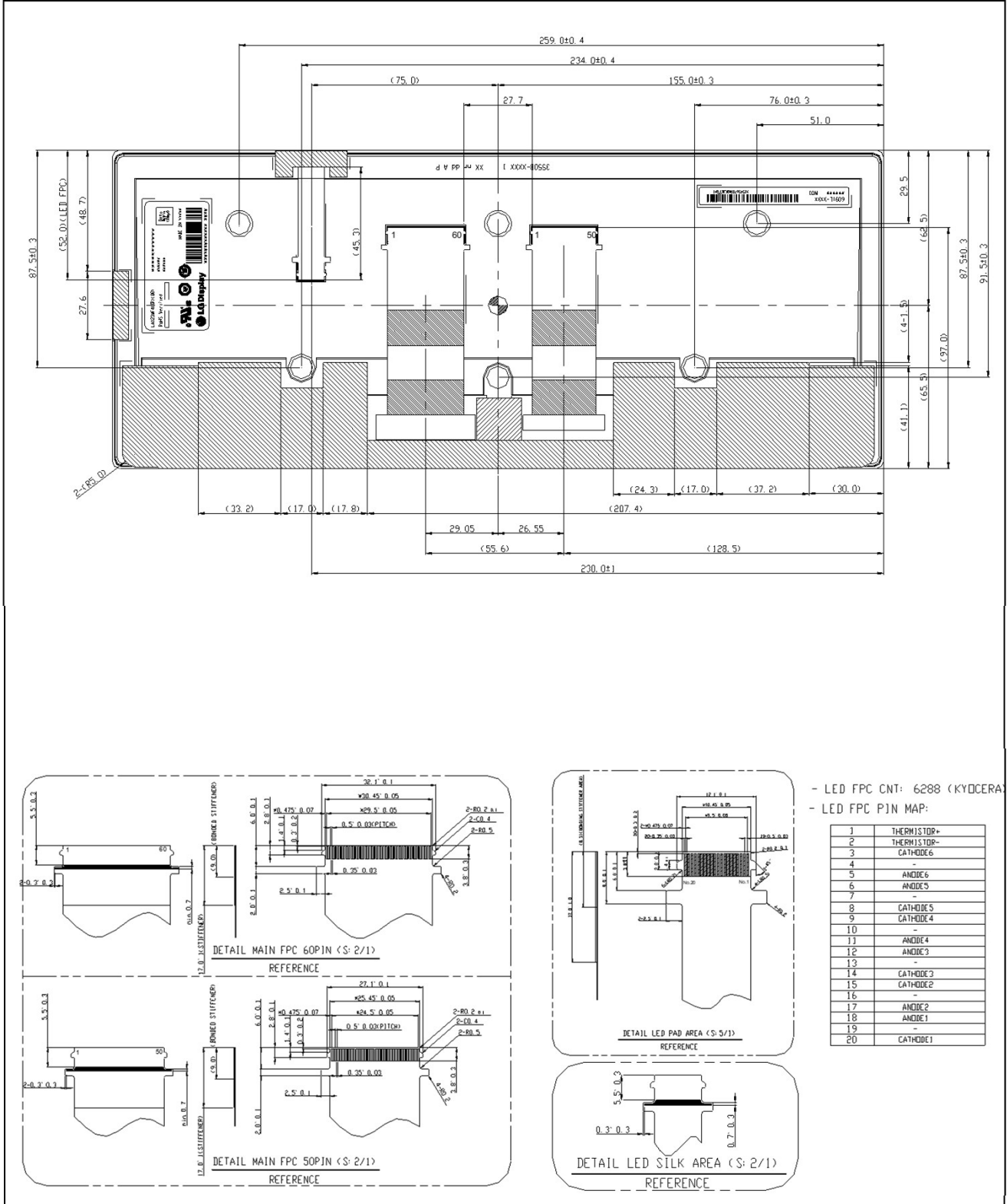


Note : This document is preliminary version. The latest version must be checked from LG Display before detail design.

**Product Specification**

<REAR VIEW>

Unit:[mm], General tolerance: ± 0.3mm



- LED FPC CNT: 6288 (KYOCERA)  
- LED FPC PIN MAP:

1	THERMISTOP-
2	THERMISTOP-
3	CATHODE6
4	-
5	ANODE6
6	ANODE5
7	-
8	CATHODE5
9	CATHODE4
10	-
11	ANODE4
12	ANODE3
13	-
14	CATHODE3
15	CATHODE2
16	-
17	ANODE2
18	ANODE1
19	-
20	CATHODE1

**Product Specification**
**9. Reliability Test**

No.	Test Items	Test Condition	Notes
1	High Temperature Endurance Lifetime	$T_a = 85^\circ\text{C}$ 240h (1000h Reference)	Note 2
2	Temperature Cycle Endurance Lifetime	Chamber Transition time = 1K/1 min , 170 cycles (reference)	Note 1
3	Damp heat steady state	$T_a = 65^\circ\text{C}$ 93%RH 500h (1000h Reference)	Note 2
4	Temperature step	1cycle, step of 10K/hold time 10min/Transition time $1^\circ\text{C}/\text{min}(T_{RT} \rightarrow T_{A.min} \rightarrow T_{A.max} \rightarrow T_{RT})$	Note 3 Note 5
5	Low Temperature Operating	$T_a = -40^\circ\text{C}$ 100h	Note 2
6	Temperature shock I	100 Cycle, $T_{st min.} \leftrightarrow T_{st max}$ Soak time 2h, time for chage < 30s	Note 2 Note 4
7	Temperature humidity cycle	$25^\circ\text{C} \leftrightarrow 55^\circ\text{C}$ 90 $\leftrightarrow$ 98% 6 Cycle	Note 2
8	Mechanical shock	3 shocks in each direction Peak acceleration: $981 \text{ m/s}^2$ Duration of nominal shock: 6 ms Waveform: saw-tooth with slow rise (2,94 m/s) or half-sine	Note 2
9	Vibration	10~30Hz : $\pm 0.75\text{mm}$ , 30~500Hz : sinusoidal 3G, 1 oct/min, Random : 3Grms 3 X (16h sinusoidal and 8h random) in X, Y and Z	Note 1
10	Solar Radiation	1,000W/m <sup>2</sup> , $42^\circ\text{C}$ , <30%RH, 300h	Note 2
11	ESD	Panel I, Panel II : $\pm 15\text{kV}$ (Operation, 330 $\Omega$ , 150pF) User FPC : HBM $\pm 2\text{kV}$ (Non-operation, 1.5k $\Omega$ , 100pF) MM $\pm 0.2\text{kV}$ (Non-operation, 200pF, 0 $\Omega$ )	Note 6

**Note 1. Full specification after testing**

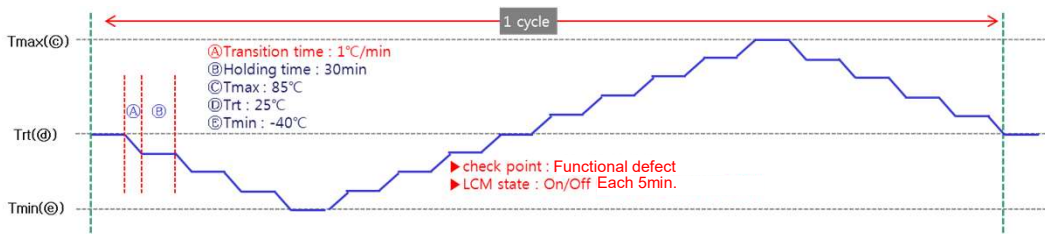
- Electro-optical characteristics
- Cosmetic requirements
- Important dimensions
- Audible noise
- Function and defects at TRT, Top. Min, and Top. Max
- TFT-LCD panels should take place at room temperature for 24 hours after the reliability tests finish

**Note 2. Reduced specification after testing**

- Optical and electrical defects
- Exceeding specified switching times
- Decrease of original perpendicular contrast ratio by more than 30%
- Increase of current consumption by more than 100%
- Decrease of backlight brightness by more than 50%
- TFT-LCD panels should take place at room temperature for 24 hours after the reliability tests finish

**Note 3. Function after testing**
**Note 4. Temperature shock II : Only for PPAP**

(300cycle, Soak time 2h, time for chage &lt; 10s)

**Note 5. Temperature step**


- Test repetition : 1cycle
- Display function & Display abnormality will be checked during the test.  
 → By doing repetition of ON (5min)  $\leftrightarrow$  OFF (5min)
- Temperature transition time is  $1^\circ\text{C}/\text{min}$  (Max value that can be supported by LGD current equipment)

**Note 6. ESD criteria : Level B**

Level	Description	Hardware Damage
A	Normal operating	No Damage
B	Temporary abnormal display but recover within 3 seconds	No Damage
C	Temporary abnormal display. It takes longer to recover or after On/Off.	No Damage
D	Display is not recovered even after long time passed or after On/Off.	Damage

**Product Specification****10. International Standards****10-1. Safety**

- a) UL 60950-1, Second Edition, Underwriters Laboratories Inc.  
Information Technology Equipment - Safety - Part 1 : General Requirements.
- b) CAN/CSA C22.2 No.60950-1-07, Second Edition, Canadian Standards Association.  
Information Technology Equipment - Safety - Part 1 : General Requirements.
- c) EN 60950-1:2006 + A11:2009, European Committee for Electro technical Standardization (CENELEC).  
Information Technology Equipment - Safety - Part 1 : General Requirements.

**10-2. EMC**

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9KHz to 40GHz. "American National Standards Institute(ANSI), 1992
- b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electro technical Standardization.(CENELEC), 1998 ( Including A1: 2000 )

**10-3. Environment**

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

**Product Specification**

## 11. Packing

### 11-1. Designation of Lot Mark

a) Lot Mark

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

A,B,C : SIZE(INCH)  
 E : MONTH

D : YEAR  
 F ~ M : SERIAL NO.

Note

1. YEAR

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

2. MONTH

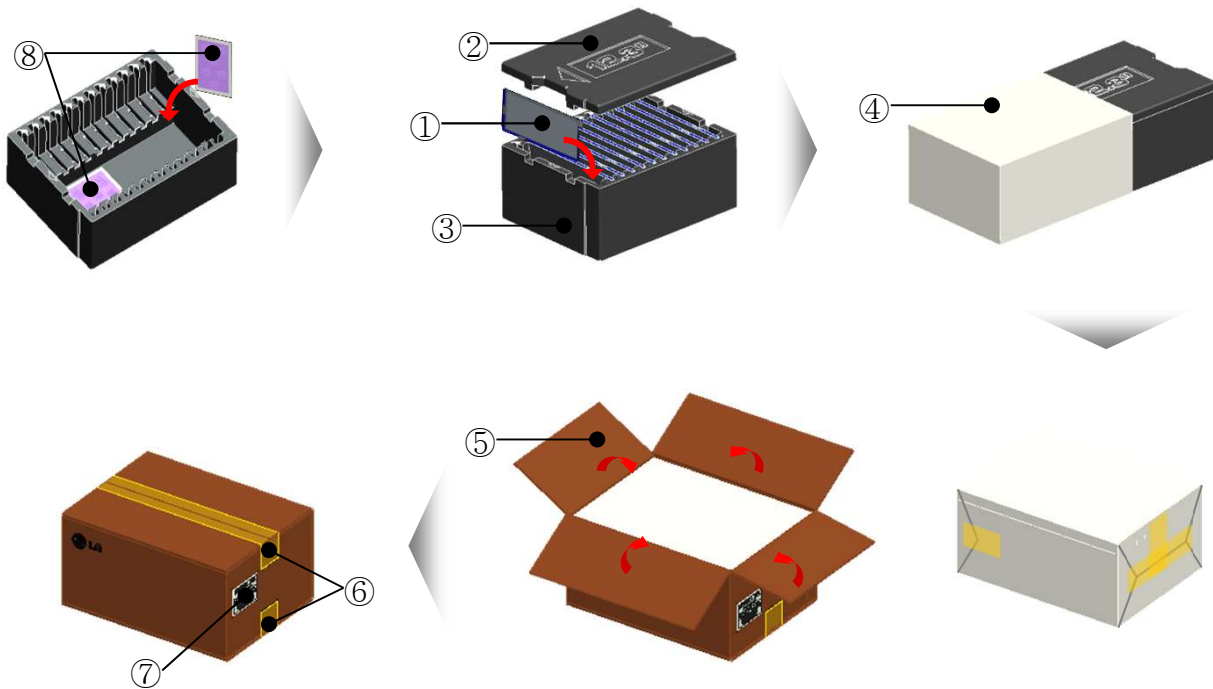
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.  
 This is subject to change without prior notice.

**Product Specification**
**11-2. Packing Form**

- a) Package quantity in one box : 12pcs
- b) Box Size : 478 mm × 365 mm × 195 mm



NO.	Description	Material
1	Module	
2	Packing Top	EPP
3	Packing Bottom	EPP
4	Bag	AL
5	Box	Corrugated board
6	Tape	OPP
7	Label	YUPO 100X70
8	Desiccant	POWER DRY, 60G, UX

**Product Specification****12. PRECAUTIONS**

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

**12-1. MOUNTING PRECAUTIONS**

- (1) Please attach a transparent protective plate to the surface in order to protect the polarizer.  
Transparent protective plate should have sufficient strength in order to resist external force.
- (2) You should adopt radiation structure to satisfy the temperature specification.
- (3) 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.
- (4) 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 deteriorate the polarizer.)
- (5) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzine. 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.
- (6) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (7) Do not open the case because inside circuits do not have sufficient strength.
- (8) The metal case of a module should be contacted to electrical ground of your system.

**12-2. OPERATING PRECAUTIONS**

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :  
 $V = \pm 200\text{mV}$  (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 higher temperature, it becomes lower.)
- (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 minimize the interference.



## Product Specification

### 12-3. ELECTROSTATIC DISCHARGE CONTROL

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

### 12-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

### 12-5. STORAGE

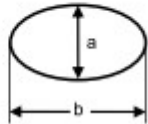
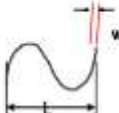
When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°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.

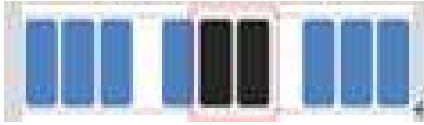
### 12-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

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

**Product Specification**
**13. Cosmetic Specification**

No	Cosmetic defect	Spec
1	<p><b>Weak bright dot</b></p> <p>■ Definition of Weak bright dots</p> <ul style="list-style-type: none"> <li>- Weak bright dots are bright dots that are not visible during inspection</li> <li>- using a 31 gray pattern for 8bit / color. (Minimum distance between two weak bright dots is 10mm)</li> </ul> <p>■ Inspection conditions: (visual inspection)</p> <ul style="list-style-type: none"> <li>- Viewing distance: 60cm</li> <li>- Ambient illumination: 30lux</li> <li>- Ambient temperature: 20 °C...25°C (during aging &gt; 60°C)</li> <li>- Light source condition: based on specification</li> <li>- Viewing angle: Area A</li> <li>- Pattern: 31grey (8bit/color)</li> <li>- Less than half sub-pixel size is not counted as a defect.</li> </ul> <p>■ Inspection sequence.</p> <ol style="list-style-type: none"> <li>1. Inspection for bright dots using black pattern.</li> <li>2. Judgment according to inspection condition.</li> <li>3. Inspection for weak bright dots using 31 grey pattern 8bit/color)</li> <li>4. Judgment according to accumulation of weak bright dots (Minimum distance between two weak bright dot is 10mm)</li> </ol>	Weak bright dot should be invisible at 31 gray (8bit)
2	<p><b>Extraneous substances / Black spots</b></p> <p>Black spots which appear when B/L or frontal lightning is operating</p> <p><i>N: quantity      D: average diameter [mm]</i></p> $D = \frac{a+b}{2}$ 	N≤2 for 0.15mm ≤ D ≤ 0.2mm N=0 for D>0.2mm (0.15mm is the perception threshold)
3	<p><b>Extraneous substances / Lints</b></p> <p>Lints which appear when B/L or frontal lightning is operating.</p> <p><i>N: quantity,      L:Length (longest point) [mm]</i></p> <p>Width: w (mm)                  Length: L (mm)                  L = longest point</p> 	Module operating (Black picture position) N≤2 for L≤2mm; W≤50μm N=0 for L>2mm or W>50μm

**Product Specification**

No	Cosmetic defect	Spec
4	<b>Scratches on the polarizer.</b>	$L \leq 5, w \leq 0.05: N \leq 2, L > 5 \text{ or } w > 0.05: N=0$
5	<b>Dents</b>	$N \leq 3$ for $0.15\text{mm} < D \leq 0.2\text{mm}$ $N=0$ for $D > 0.2\text{mm}$
6	<b>Bright Dot Defects</b> ■ Bright dot: Dot appears bright in display at black picture position  ■ Inspection conditions: (visual inspection) - Viewing distance: 60cm - Ambient illumination: 100lux - Ambient temperature: 20 °C...25 °C (during aging > 60 °C) - Light source condition: based on specification - Viewing angle: Area A - Zone: Visible area	0
7	<b>Black Dot Defects</b> ■ Dot appears dark in display at white, red, green or blue picture position  ■ <b>Adjacent dark dot: 1 adjacent dark dot is allowed within 5cm</b> - Minimum distance between two single dark dots is 10mm.   ■ Inspection conditions: (visual inspection) - Viewing distance: 60cm - Ambient illumination: 100lux - Ambient temperature: 20 °C...25 °C (during aging > 60 °C) - Light source condition: based on specification - Viewing angle: Area A - Zone: Visible area	4
8	<b>Mura</b>	According to a agreed limit sample and level
9	<b>Extraneous substances on polarizer</b>	Extraneous substance which can be wiped out, as finger print, particles, are not considered as a defect.