

10.25 寸 LED 模组规格书

SPECIFICATION

承 认 印 Approved by	
审核:	确认:
客户确认结果:	

Customer

客 户: _____

Product

品 名: _____ 10.25 寸 LED 模组 (LG FOG 1920*720)

Part NO.

产品料号: _____ LCDDT10256003

DATE

日 期: _____ 2019/11/24

Approved 核 准	Checked 审 核	Prepared 制 作

Product Specification	
Model	Model X-2000
Color	White
Material	Stainless Steel
Weight	150g
Dimensions	10cm x 5cm x 2cm
Power Source	Battery
Warranty	1 Year
Price	\$120

Record of Revisions

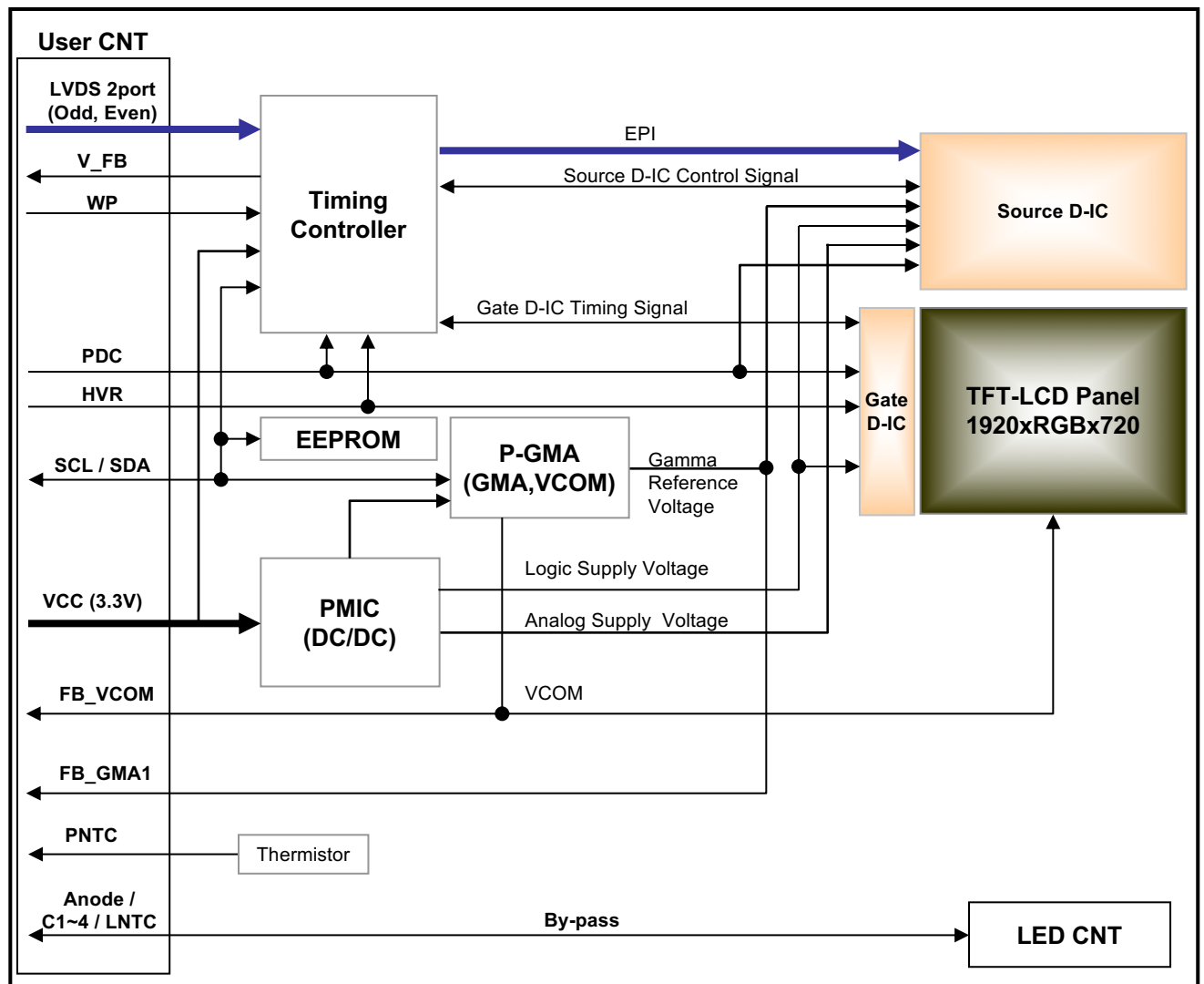
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1. Summary

This LCD panel utilizes amorphous silicon thin film transistors and a 8:3 aspect ratio. The 10.25" active matrix liquid crystal display allows 16,777,216 colors to be displayed by LVDS interface is available. The applications are CID(Center Information Display), RSE(Rear Seat Entertainment) and Instrument Cluster for a vehicle.

2. Features

- Utilizes a panel with a 8:3 aspect ratio.
- The 10.25" screen produces a high resolution image that is composed of 1,382,400 pixel elements in a stripe arrangement.
- By adopting In Plane Switching (IPS) technology, provide a wide viewing angle.
- By adopting an active matrix drive, a picture with high contrast is realized.
- 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 8-bit gray scale signal.
- This LCD panel does not include the backlight unit.



Product Specification

3. General Description

Active Screen Size	10.25 inches(260.2mm) diagonal
Outline Dimension	265.20mm (H) × 109.85mm (V) X 9.91mm (D) (Typ.)
Pixel Pitch	0.1269mm x 0.1269mm (1Dot: 0.0423mm x 0.1269mm)
Pixel Format	1920 horiz. by 720 vert. Pixels, RGB stripe arrangement
Color Depth	8bit(D), 16,777,216 colors
Transmittance	2.58% (Center 1point, Min.)
Weight	63g (Typ.), 68g (Max.)
Display Mode	Transmissive mode, Normally Black
Surface Treatment	Hard coating (3H)

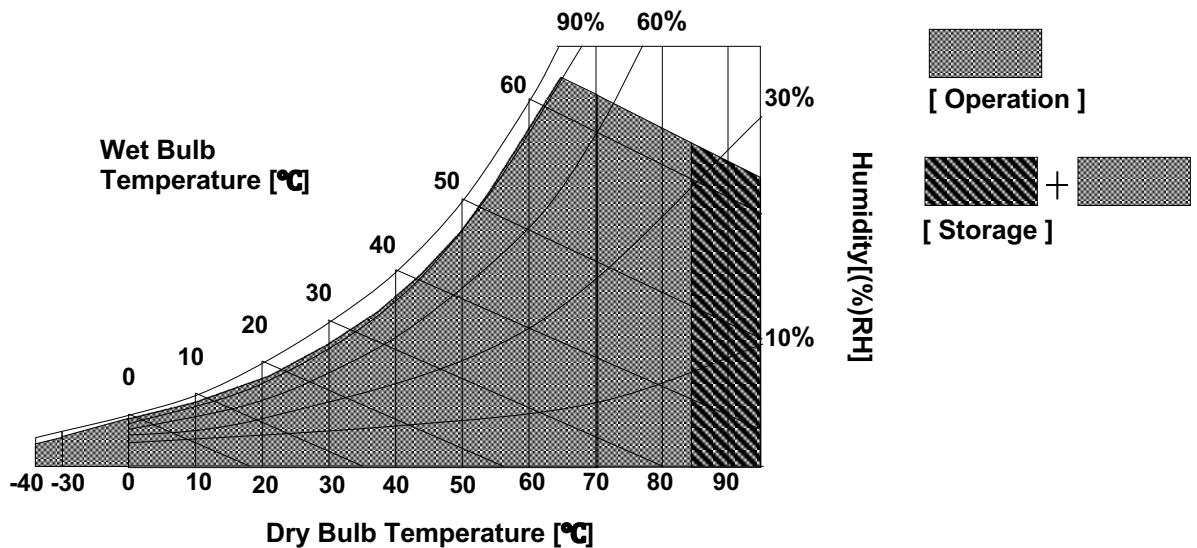
4. Absolute Maximum Ratings

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value		Unit	Note
		Min	Max		
Power Supply Voltage	VCC	-0.3	3.9	V	1
Input Signal Voltage	V _{LVDS}	-0.3	2.5	V	2
	V _{CTRL}	-0.3	3.6	V	
Storage Temperature	T _{ST}	-40	95	°C	3
Operating Temperature	T _{OP}	-40	85	°C	3,4,5

- Note 1. The system should supply enough current for TFT LCD's stable operation at -40 ~ +85°C.
2. V_{LVDS}: LVDS input signal (RAM/P_O/E, RBM/P_O/E, RCM/P_O/E, RCLKM/P_O/E, RDM/P_O/E)
V_{CTRL}: HVR, PDC, SCL, SDA, WP
3. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be Max. 62°C. Condensation of dew must be avoided, because it may cause electrical current leakage, and deterioration of performance and quality.
4. The operating temperature means that LCD panel guarantees operation of the circuit.
All the contents of Electro-optical specifications are guaranteed under the room temperature condition.
5. This temperature is ambient temperature with regard to the heat which is generated under operation of circuit and backlight on. (reference value)



5. Electrical Specifications

5-1. Electrical Characteristics

Table 2. LCD DRIVING CIRCUIT ELECTRICAL CHARACTERISTICS

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
Power Supply Voltage		VCC	3.0	3.3	3.6	V	
Power Supply Current		I _{VCC}	-	250	300	mA	1, 3
Power Consumption		P _{VCC}	-	0.83	1.0	W	1, 2
Permissive input ripple		V _{RF}	-	-	200	mV _{PP}	
Input Signal Voltage		V _H	0.8*VCC	-	VCC	V	4, 5
		V _L	0	-	0.2*VCC	V	
Input Signal Current		I _H	-	-	±4	mA	
		I _L	-	-	±4	mA	
Output Signal Voltage	V _{FB}	V _H	0.7*VCC	-	VCC	V	
		V _L	0	-	0.3*VCC	V	
	FB_GMA1	V	1.5	2.4	3.3	V	
	FB_VCOM	V	1.0	1.7	3.3	V	

Note 1. The specified current and power consumption are under the VCC = 3.3V, Ta=25 ± 2°C, fv=60Hz condition whereas White pattern is displayed and fv is the frame frequency.

2. P_{VCC}(Typ) = I_{VCC}(Typ)*VCC(Typ), P_{VCC}(Max) = I_{VCC}(Max)*VCC(Typ) @ White pattern.

3. (Reference) The rush current is Max 1.5A.

- Condition: The duration of rush current is about 2ms and rising time of power input is 0.5ms.
(VCC = 3.3V, Ta=25±2°C, fv=60Hz)

4. HVR, PDC, SCL, SDA, WP

5. The recommended operating conditions show the ranges in which the device can operate normally. Operation beyond the limit of the recommended operation conditions is not assured, even though operating conditions are within the limit of the maximum ratings.

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5-2. Interface Connections

5-2-1. User Connector Pin Configuration

The electronics interface connector is a model TF45-60S-0.5SH manufactured by HIROSE or equivalent

Table 3. USER CONNECTOR PIN CONFIGURATION

Pin No	Name	I/O	Description	Note
1	GND	I	Ground	
2	V_FB	O	Feedback Signal of LCD Operation	3
3	GND	I	Ground	
4	HVR	I	Horizontal and Vertical Reverse	2
5	GND	I	Ground	
6	RDP_E	I	LVDS Even Data 3+	
7	RDM_E	I	LVDS Even Data 3-	
8	GND	I	Ground	
9	RCLKP_E	I	LVDS Even Clock+	
10	RCLKM_E	I	LVDS Even Clock -	
11	GND	I	Ground	
12	RCP_E	I	LVDS Even Data 2+	
13	RCM_E	I	LVDS Even Data 2-	
14	GND	I	Ground	
15	RBP_E	I	LVDS Even Data 1+	
16	RBM_E	I	LVDS Even Data 1-	
17	GND	I	Ground	
18	RAP_E	I	LVDS Even Data 0+	
19	RAM_E	I	LVDS Even Data 0-	
20	GND	I	Ground	
21	RDP_O	I	LVDS Odd Data 3+	
22	RDM_O	I	LVDS Odd Data 3-	
23	GND	I	Ground	
24	RCLKP_O	I	LVDS Odd Clock+	
25	RCLKM_O	I	LVDS Odd Clock -	
26	GND	I	Ground	
27	RCP_O	I	LVDS Odd Data 2+	
28	RCM_O	I	LVDS Odd Data 2-	
29	GND	I	Ground	
30	RBP_O	I	LVDS Odd Data 1+	
31	RBM_O	I	LVDS Odd Data 1-	
32	GND	I	Ground	
33	RAP_O	I	LVDS Odd Data 0+	
34	RAM_O	I	LVDS Odd Data 0-	
35	GND	I	Ground	
36	PNTC	O	Temperature Sensor on PCB	9
37	FB_GMA1	O	Feedback of Gamma Highest Voltage	
38	SDA	I/O	I2C Data Signal	4
39	SCL	I/O	I2C Clock Signal	
40	WP	I	I2C Write Protect (H: protect, L: write)	

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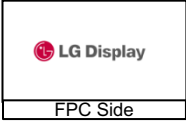
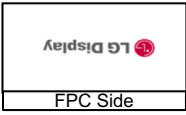
Table 3. USER CONNECTOR PIN CONFIGURATION (Continue)

Pin No	Name	I/O	Description	Note
41	VCC	I	Power supply (3.3V)	7
42	VCC	I	Power supply (3.3V)	
43	VCC	I	Power supply (3.3V)	
44	NC	-	No Connection. (LCD_TEST pin)	6
45	PDC	I	Panel Discharging Control Signal	5
46	GND	I	Ground	
47	LNTC	O	Temperature Sensor on LED array	8
48	FB_VCOM	O	VCOM Voltage Feedback	
49	NC	-	No Connection	
50	NC	-	No Connection	
51	C4	O	Backlight Cathode 4	8
52	C3	O	Backlight Cathode 3	
53	C2	O	Backlight Cathode 2	
54	C1	O	Backlight Cathode 1	
55	NC	-	No Connection	6
56	Anode	I	Backlight Anode	8
57	Anode	I	Backlight Anode	
58	Anode	I	Backlight Anode	
59	NC	-	No Connection	6
60	GND	I	Ground	

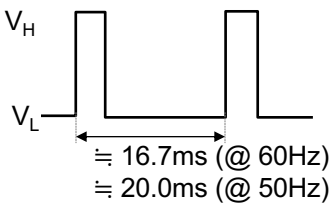
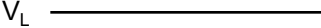
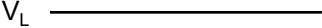
Note 1. All GND pins should be connected together.

2. Display Direction as following pictures.

HVR is pulled-up to high internally. Do not control HVR during LCD operation to avoid abnormal display.

HVR	Display Image
GND (Regular Display)	
Hi-Z (Horizontal and Vertical Inverted Display)	

3. V_{FB} is feedback signal of LCD operation status. (LVDS Detection status and Gate D-IC status)

Normal Operation	No Signal Status (Black Display)	Gate D-IC abnormal status
		

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Note 4. I2C communication signals for gamma control and white calibration.

5. Please see the 2-6. Power Sequence.

6. Make sure that NC pins should be floated.

7. All VCC pins should be connected together.

8. By-Pass signals of Customer's LED FPC.

9. Please see the Appendix-I for more information about Thermistor(PNTC) Characteristics.

10. Please see the Appendix-II for more information about Equivalent Circuits.

5-2-2. LED Connector Pin Configuration

The electronics interface connector is a model 04-6288-012-000-846+ manufactured by Kyocera.

Table 4. LED CONNECTOR PIN CONFIGURATION

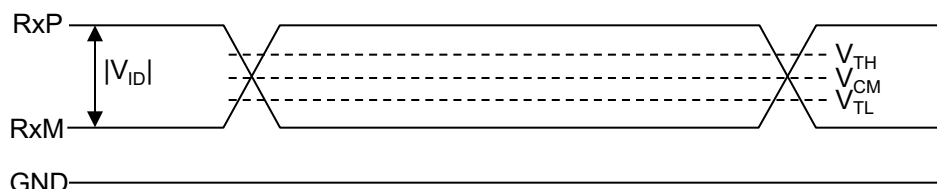
Pin No	Name	I/O	Description	Note
1	LNTC-	I	Temperature Sensor on LED array (LNTC-)	1
2	LNTC	I	Temperature Sensor on LED array	
3	NC	-	No Connection	
4	NC	-	No Connection	
5	NC	-	No Connection	
6	C4	I	Backlight Cathode 4	
7	C3	I	Backlight Cathode 3	
8	C2	I	Backlight Cathode 2	
9	C1	I	Backlight Cathode 1	
10	NC	-	No Connection	
11	Anode	O	Backlight Anode	
12	Anode	O	Backlight Anode	

Note 1. LNTC- signal is tied to ground at LCD PCB.

5-3. LVDS Signal Specifications

5-3-1. DC Characteristics

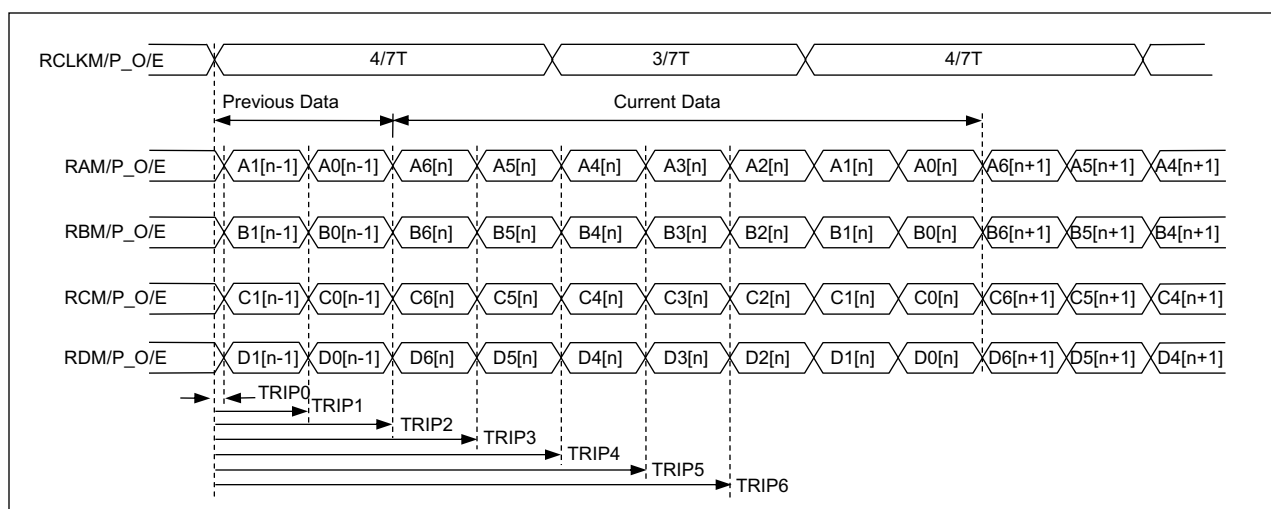
Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Differential Voltage	$ V_{ID} $	200	350	500	mV	1
LVDS Input Common Mode Voltage	V_{CM}	1.0	1.2	1.4	V	
Positive-going Input Threshold Voltage	V_{TH}	-	-	100	mV	
Negative-going Input Threshold Voltage	V_{TL}	-100	-	-	mV	



Note 1. All LVDS Rx termination resistor($100\Omega \pm 20\Omega$) is integrated on the chip.(T-Con)

5-3-2. AC Characteristics (1/2)

Parameter	Symbol	Min	Typ	Max	Unit
Input Data Position for Bit0	T_{RIP0}	-	0	-	ns
Input Data Position for Bit1	T_{RIP1}	-	$T/7$	-	ns
Input Data Position for Bit2	T_{RIP2}	-	$2T/7$	-	ns
Input Data Position for Bit3	T_{RIP3}	-	$3T/7$	-	ns
Input Data Position for Bit4	T_{RIP4}	-	$4T/7$	-	ns
Input Data Position for Bit5	T_{RIP5}	-	$5T/7$	-	ns
Input Data Position for Bit6	T_{RIP6}	-	$6T/7$	-	ns

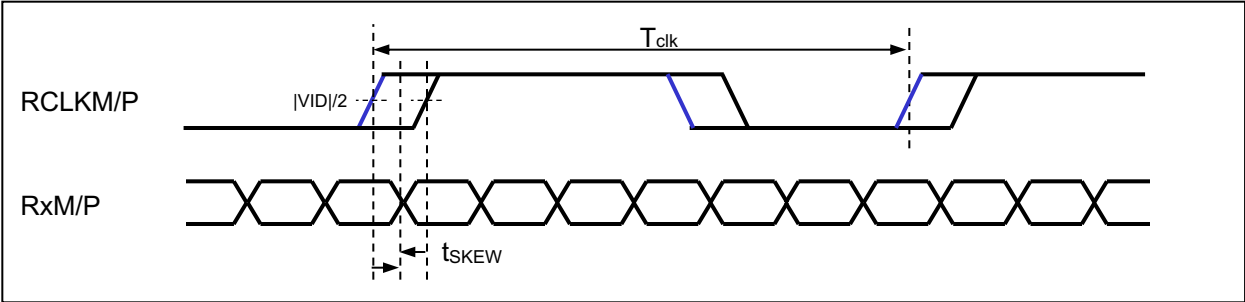


5-3-3. AC Characteristics (2/2)

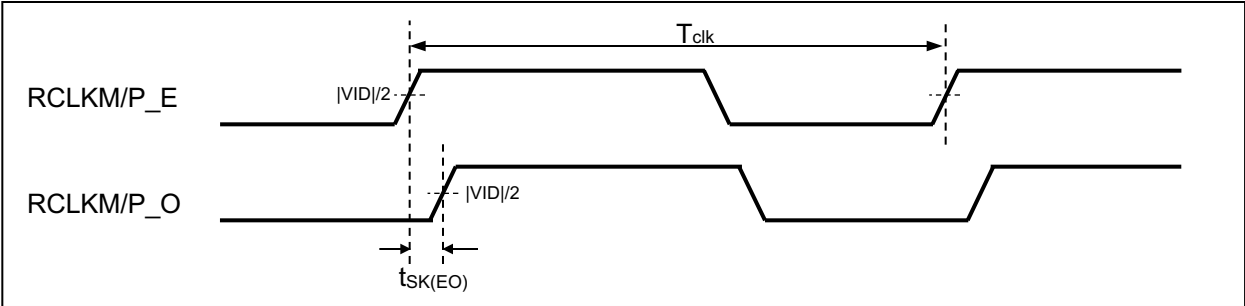
Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Clock to Data Skew Margin	t_{SKEW}	-300	-	+300	ps	1
Skew Even to Odd port	$t_{\text{SK(EO)}}$	-1/7	-	1/7	Tclk	2
Maximum deviation of input clock frequency during SSC	F_{DEV}	-	-	± 3.0	%	3
Maximum modulation frequency of input clock during SSC	F_{MOD}		-	150	KHz	

Note:

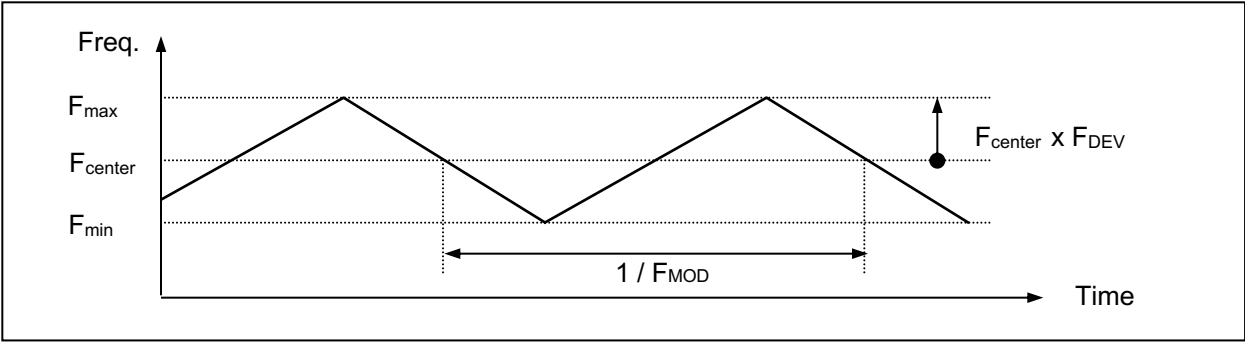
1. LVDS Clock to Data Skew Margin.



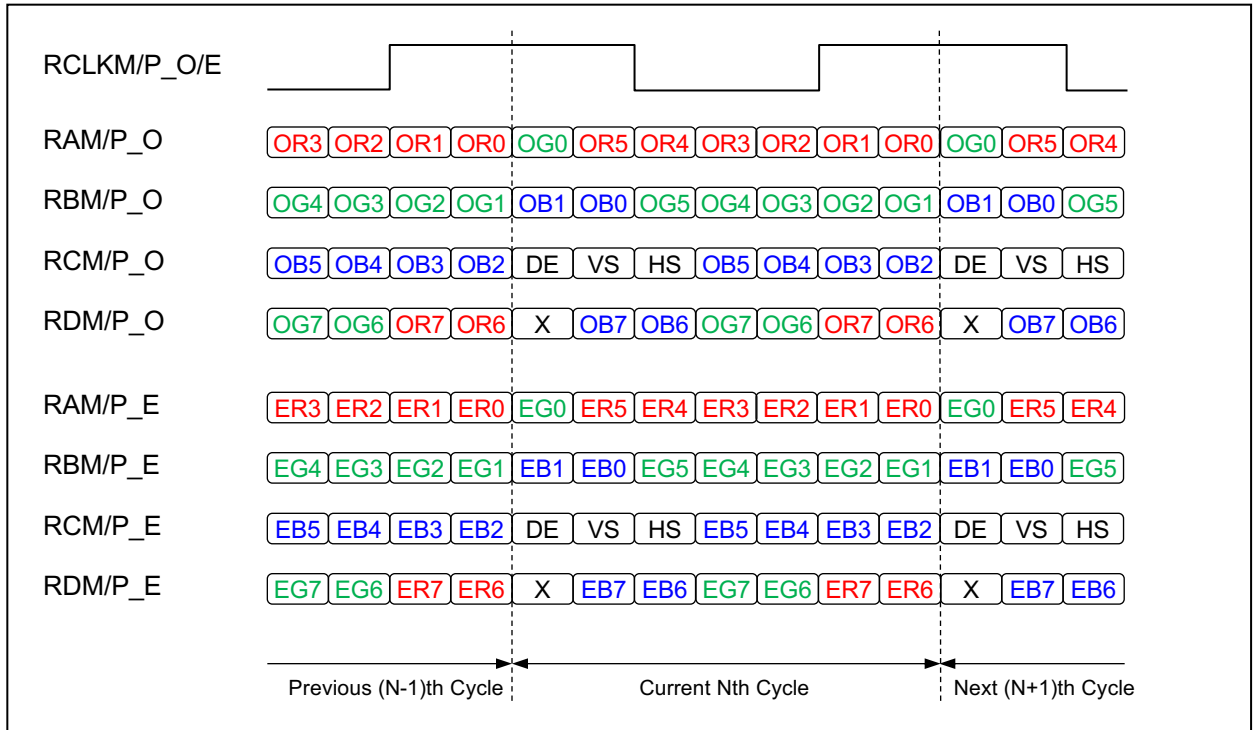
2. LVDS Clock Even to Odd Skew Margin.



3. Spread spectrum



5-3-4. LVDS Bit assignment (LVDS VESA Format)



Product Specification

5-4. Signal Timing Specifications

Table 5 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

Table 5. SIGNAL TIMING CHARACTERISTICS

($f_V=60\text{Hz}$)

Parameter		Symbol	Min	Typ	Max	Unit	Note
DCLK	Frequency	f _{CLK}	44.5	44.8	45.1	MHz	2port
	Period	t _{CLK}	22.17	22.32	22.47	ns	
HSYNC	Period	t _{HP}	1020	1024 (2048)	1028	t _{CLK}	() 1port
	Width	t _{WH}	16	-	-		
	Horizontal Valid	t _{HV}	960 (1920)				() 1port
	Horizontal Back Porch	t _{HBP}	16	-	-		
	Horizontal Front Porch	t _{HFP}	16	-	-		
VSYNC	Period	t _{VP}	727	729	732	t _{HP}	
	Width	t _{WV}	2	-	-		
	Vertical Valid	t _{VV}	720				
	Vertical Back Porch	t _{VBP}	2	-	-		
	Vertical Front Porch	t _{VFP}	3	-	-		

($f_V=50\text{Hz}$)

Parameter		Symbol	Min	Typ	Max	Unit	Note
DCLK	Frequency	f _{CLK}	44.5	44.8	45.1	MHz	2port
	Period	t _{CLK}	22.17	22.32	22.47	ns	
HSYNC	Period	t _{HP}	1109	1113 (2226)	1117	t _{CLK}	() 1port
	Width	t _{WH}	16	-	-		
	Horizontal Valid	t _{HV}	960 (1920)				() 1port
	Horizontal Back Porch	t _{HBP}	16	-	-		
	Horizontal Front Porch	t _{HFP}	16	-	-		
VSYNC	Period	t _{VP}	802	805	808	t _{HP}	
	Width	t _{WV}	2	-	-		
	Vertical Valid	t _{VV}	720				
	Vertical Back Porch	t _{VBP}	2	-	-		
	Vertical Front Porch	t _{VFP}	3	-	-		

Note 1. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rates.

5-5. Color Data Reference

The brightness of each primary color(red, green, blue) is based on the 8bit gray scale data input for the color. The higher binary input, the brighter the color. Table 6 provides a reference for color versus data input.

Table 6. 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 (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 (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 (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
	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 (00)	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 (01)	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 (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 (00)	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 (01)	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	0	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 (00)	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 (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	...	...								...								...							
	BLUE (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	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

5-6. Power Sequence

For LCD's normal operation, it is recommended to keep below power supply sequence.

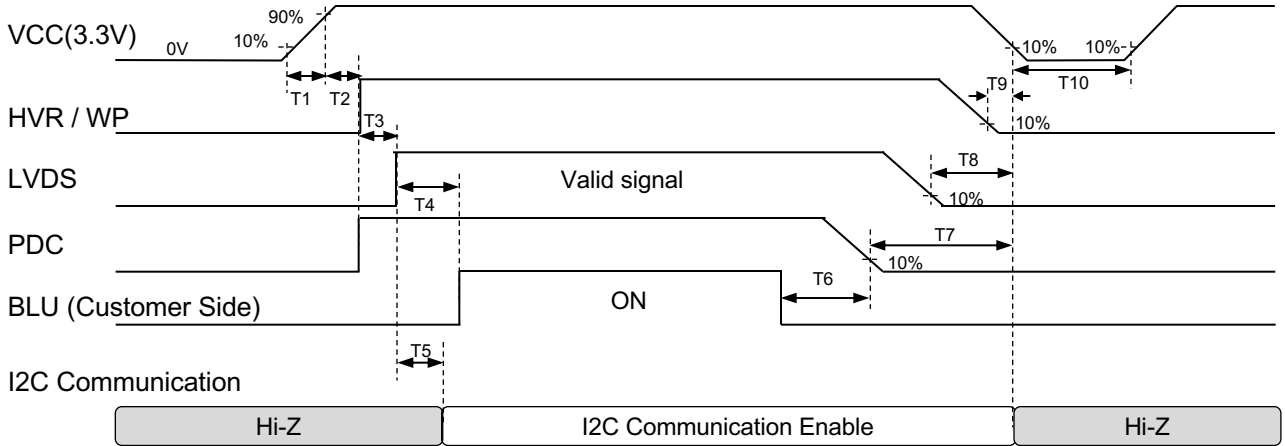


Table 7. POWER SEQUENCE

Parameter	Value			Unit	Note
	Min	Typ	Max		
T1	0.05	-	10	ms	
T2	0	-	10	ms	1
T3	100	-	-	ms	
T4	150	-	-	ms	5
T5	0	-	-	ms	6
T6	0	-	-	ms	
T7	0	5	-	ms	7
T8	0	-	-	ms	
T9	0	-	-	ms	
T10	400	-	-	ms	

Note 1. Do not change HVR status to avoid abnormal display during LCD operation.

2. Power deep time. If it is longer than the T10 maximum value, LCD would be abnormal state.

In this case, you must re-initialize the LCD in accordance with "Power Supply Sequence".

3. Please avoid floating state of interface signal at invalid period.

4. When the interface signal is invalid, be sure to pull down the power supply for VCC to 0V.

5. Backlight must be turn on after power supply for LCD and interface signal are valid.

6. The external I2C Master can control LCD's TCON/PGMA IC after LCD Initialization.

During LCD Initialization time, below condition must be kept. (WP = High, SDA/SCL = Hi-Z[floating])

7. In the Power Off sequence, It is recommended to apply Typ. value of T7 for the stable operation of the Panel discharge.

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6. Electro-optical Characteristics

Electro-optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at $25\pm2^{\circ}\text{C}$. The values are specified at an approximate distance 50cm from the LCD surface at a viewing angle of and equal to 0° . Measured value at the center point of LCD panel after more than 15 minutes while backlight turning on.

It is presented additional information concerning the measurement equipment and method in FIG. 1.

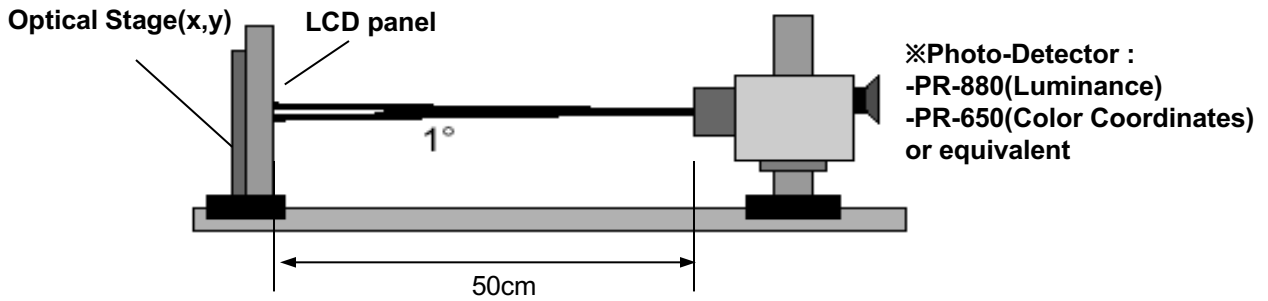


FIG. 1 Electro-optical Characteristic Measurement Equipment and Method

Table 8. ELECTRO-OPTICAL CHARACTERISTICS

Ta=25±2°C, VCC = 3.3V, fv=60Hz

Parameter		Symbol	Value			Unit	Note
			Min	Typ	Max		
Contrast Ratio	Area A+	CR	800	-	-		1
	Area A		500	-	-		
	Area B		100	-	-		
Transmittance, white			2.58	-	-	%	2
Uniformity (Area scan)	White	δ_{WHITE}	75	-	-	%	3
	Black	δ_{Black}	60	-	-	%	
Response Time	+25°C	TG2G	-	-	25	ms	4, 5
	-20°C		-	-	200		
	-30°C		-	-	500		
Color Coordinates [CIE1931]	RED	λ_{dom}	616	623	630	nm	7
		Sat.	80	-	-	%	
	GREEN	λ_{dom}	544	549	554	nm	
		Sat.	75	-	-	%	
	BLUE	λ_{dom}	464	469	474	nm	
		Sat.	90	-	-	%	
	WHITE	Wx	(0.292)	(0.307)	(0.322)	-	
		Wy	(0.306)	(0.321)	(0.336)	-	
Gamma			2.0	2.2	2.4	-	6

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Note 1. Contrast Ratio(CR) is defined mathematically as :

Measured area is defined as below. For more information see the FIG. 3, 4.

- Measurement Equipment: EZ-Contrast

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

2. Panel Transmittance is determined after the unit has been 'ON' and More than 15 Minute after lighting the backlight in a dark environment at $25 \pm 2^\circ\text{C}$. Panel Transmittance is the transmittance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white.

- Measurement Equipment: PR-880

3. Based on the Display specification for automotive applications V4.5.1, Black and White uniformity is measured and evaluated according to "Uniformity measurement standard for displays" Version 1.15, 2011-06-14, Copyright: "German automotive OEM working group displays"

- White Uniformity : Measurement with LGE standard BLU(BLU WU is min. 83%)

- Black uniformity : 55% based on BU measurement data by LG Display Nanjing Production Line.

- Measurement Equipment: LMK-5

4. Response time is obtained by measuring the transition time of photo detector output, when input signals are applied to make center point "Gray(i)" and "Gray(j)".

(7Step at 8bit: Gray0, Gray43, Gray85, Gray128, Gray170, Gray212, Gray255)

For more information, see the FIG. 2

- Measurement Equipment: PR-880

5. Low temperature response time measure method.

: The LCD Panel has remained at low temperature(-20°C or -30°C) for 30 minutes and then kept turning on for 30 minutes before measured.

This is a part of design warranty. No additional management will be fulfilled for this in Mass Production.

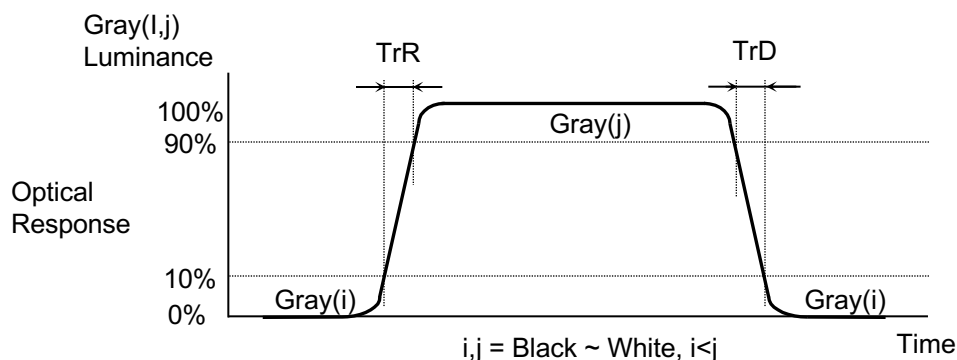


FIG. 2 Response Time

Product Specification

Note 6. Gamma is measured and evaluated according to "Information Display Measurements Standard"

Version 1.03, 2012-07-01

- Measurements 33point: 255, 248, 240, 232, 224, 216, 208, 200, 192, 184, 176, 168, 160, 152, 144, 136, 128, 120, 112, 104, 96, 88, 80, 72, 64, 56, 48, 40, 32, 24, 16, 8, 0Gray

7. All of Electro-optical characteristics are measured by Standard Backlight unit.

Please see the Appendix-III for Standard Backlight Unit Specifications.

Area A+ : $H = \pm 10^\circ$, $V = +8^\circ / -4^\circ$

$[(\Theta, \Phi) = (12.7^\circ, 38.6^\circ), (12.7^\circ, 141.4^\circ), (10.7^\circ, 201.6^\circ), (10.7^\circ, 338.4^\circ)]$

Area A : $H = \pm 40^\circ$, $V = +20^\circ / -10^\circ$

$[(\Theta, \Phi) = (42.4^\circ, 23.4^\circ), (42.4^\circ, 156.6^\circ), (40.6^\circ, 191.9^\circ), (40.6^\circ, 348.1^\circ)]$

Area B : $H = \pm 50^\circ$, $V = +20^\circ / -10^\circ$

$[(\Theta, \Phi) = (51.3^\circ, 17.0^\circ), (51.3^\circ, 163.0^\circ), (50.3^\circ, 188.4^\circ), (50.3^\circ, 351.6^\circ)]$

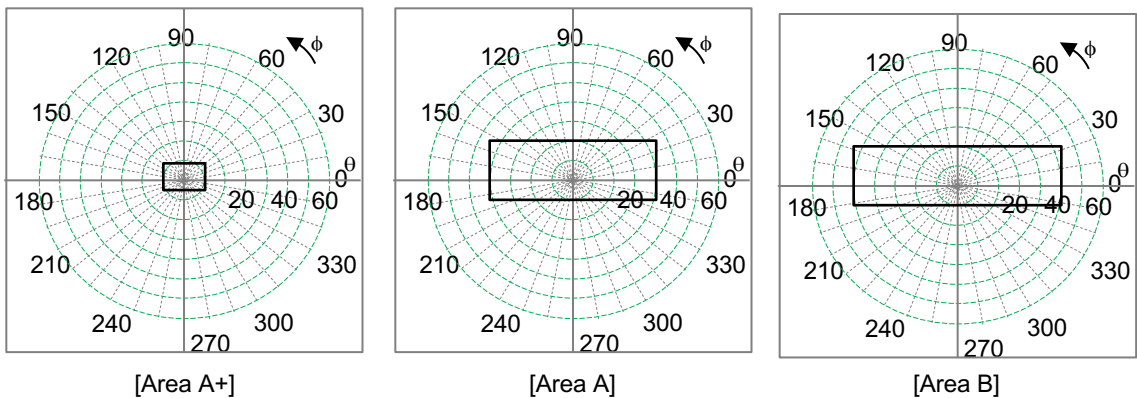


FIG. 3 Area A+, Area A & Area B

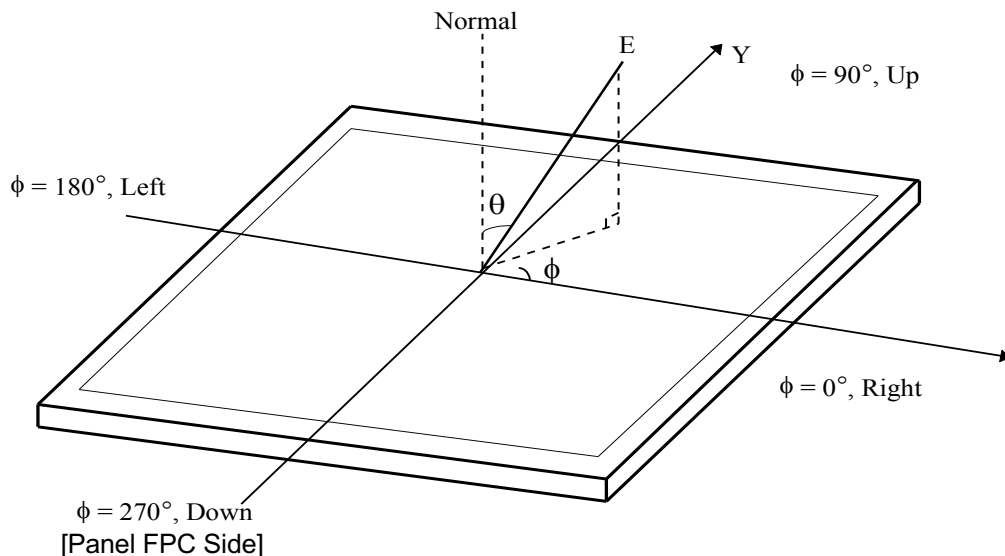


FIG. 4 LCD viewing direction of defined angle θ , Φ

7. Mechanical Characteristics

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

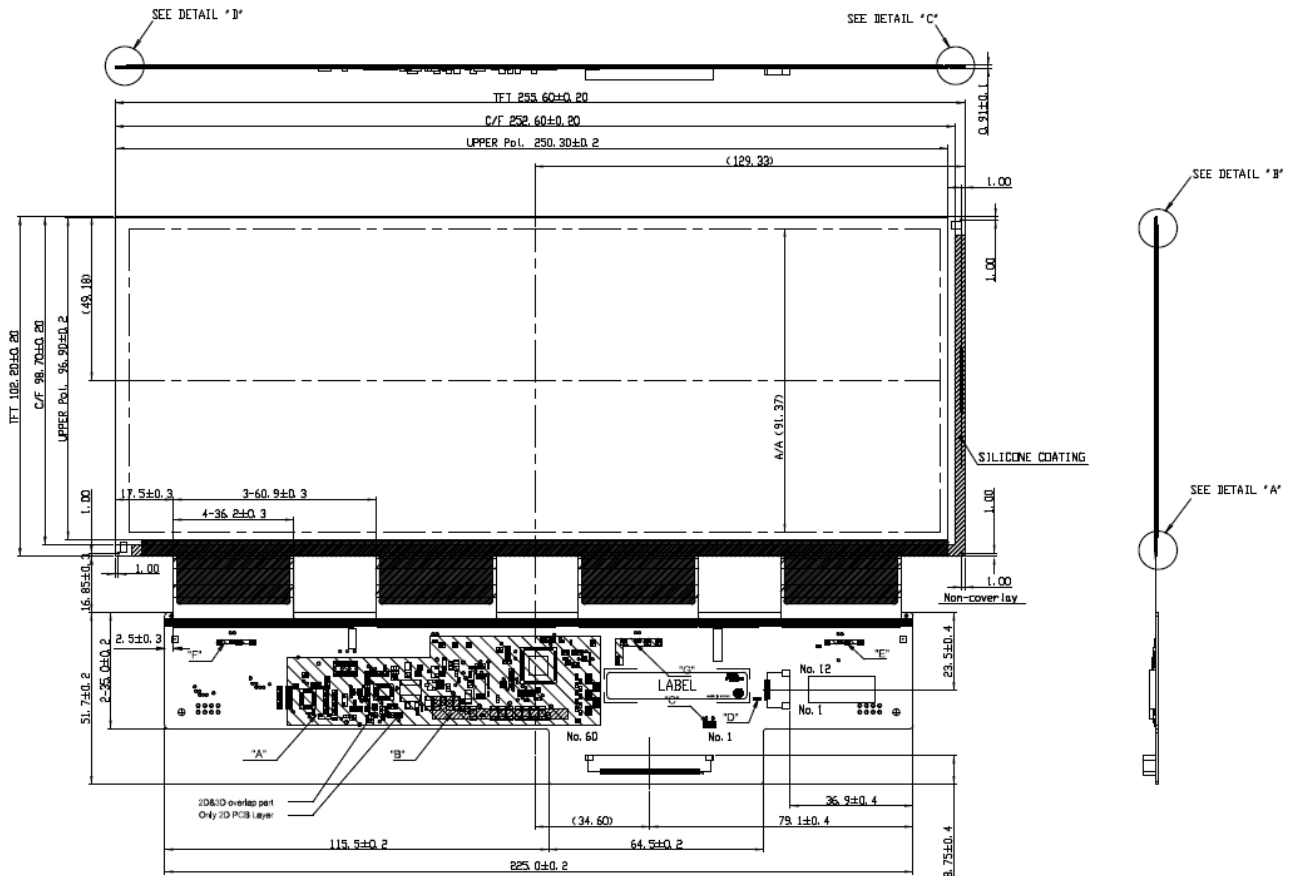
Table 9. MECHANICAL CHARACTERISTICS

Parameter	Value	
Outline Dimension	Horizontal	255.60 ± 0.3 mm
	Vertical	102.20 ± 0.3 mm
	Depth	0.91 ± 0.3 mm
Active Display Area	Horizontal	243.648 mm
	Vertical	91.368 mm
Weight	63g (Typ.), 68g (Max.)	

Product Specification	
Model	Model X-2000
Color	White
Material	Stainless Steel
Weight	150g
Dimensions	10cm x 5cm x 2cm
Features	Waterproof, Shockproof, Dustproof
Warranty	1 Year
Price	\$120

<FRONT VIEW>

Note. Unit:[mm], General tolerance: ± 0.3mm



NOTES

1. THIS MODEL IS BEZEL CLOSE TYPE AND APPLY UV COATING.
(REFER TO STANDARD TABLE ABOUT UV SPREAD)

ITEMS	SIZE(L)	SIZE(W)	THICKNESS(T)
COLOR-FILTER GLASS	252.6	98.7	0.25
TFT GLASS	255.6	102.2	0.25
UPPER POLARIZER	250.3	96.9	0.122
LOWER POLARIZER	245.65	93.8	0.283

- ## 2. MAX HEIGHT OF COMPONENTS

$$\begin{aligned} a' &= 1.8 \\ b' &= 1.8 \\ c', e' \sim g' &= 0.6 \\ d' &= 0.5 \end{aligned}$$

< SILICONE (UV) COATING STANDARD>

ITEMS	MAINTENANCE METHOD AND STANDARD
CONTING AREA	Gate, Source Pad AREA  ■ MAX. OPEN CLOSE TYPE: LOWER THAN C/P - REZEL TYPE: LOWER THAN UPPER FILM ■ MIN. AS C/H HEIGHT FROM GLASS SURFACE: APPE: MORE THAN 1/2 OF FRAME'S HEIGHT.
COATING HEIGHT	 ■ MAX. : DON'T OVER THE EDGE OF BOND GLASS. MIN. : COVER WITH FPC BONDING START AREA.
COATING WIDTH	

- * MATTERS THAT REQUIRE ATTENTION FOR SILICONE COATING.
1. REMOVE SUBSTANCES IN THE COATING AREA FOR EYES (INSPECTION).
 2. DON'T OPEN THE PATTERN OF DOWN GLASS.

模组成品图

The architectural drawings include a floor plan, a side elevation, and a section view of the 1920*720 LG room.

- Floor Plan:** Shows the room layout with dimensions: 1920 (width) and 720 (depth). The room is labeled "1920*720 LG". The floor is marked with a grid pattern. The room is divided into two main sections by a wall. The left section contains a large rectangular area with a grid pattern, and the right section contains a smaller rectangular area with a grid pattern. The room is labeled "1920*720 LG".
- Side Elevation:** Shows the side profile of the room with dimensions: 1920 (width) and 720 (depth). The room is labeled "1920*720 LG".
- Section View:** Shows a cross-section of the room with dimensions: 1920 (width) and 720 (depth). The room is labeled "1920*720 LG".

Product Specification

8. Reliability

Table 10. ENVIRONMENT TEST CONDITION

No.	Test Item	Test Condition	Note
1	High Temperature Storage Test	Ta = 95°C 240h	
2	Low Temperature Storage Test	Ta = -40°C 240h	
3	High Temperature Operation Test	Ta = 85°C 500h	
4	Low Temperature Operation Test	Ta = -40°C 240h	
5	High Humidity Operation Test	Ta = 40°C / 93%RH 504h	
6	Humid Heat Cyclic Test	Ta = 25°C~55°C / 90%RH 144h	
7	Thermal Shock Test (non-operating)	- 1cycle : Ta = -40°C(0.5h) ~ 85°C(0.5h) - 240Cycles - Temperature Transition Time : ≤ 150sec	
8	Sun Radiation	1000W/m2, 300h	
9	Electro Static Discharge Test	- Panel Surface : ±15kV, Air, Power On - User FPC pin : ±0.2kV, Direct, Power Off (Air : 150pF,330Ω / Direct : 150pF,2kΩ / 3 times)	4

Note. Result Evaluation Criteria:

1. There should be no particular problems that may affect the display function at room temperature after 2 hours from the reliability tests finish.
2. TFT-LCD panels should take place at room temperature for 24 hours after the reliability tests finish. Then, all of optical and electrical test should be performed.
3. Display performance quality is monitored before, in the middle of, and after the test, and will be verified after turning into room temperature. (No abnormal display found)
4. ESD should be tested with customer's system level. (with Cover Glass, BLU)

11. PRECAUTIONS

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

11-1. MOUNTING PRECAUTIONS

- (1) You should consider the assembling structure so that uneven force(ex. Twisted stress) is not applied to the LCD panel.
- (2) 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 the resist external force.
- (3) You should adopt radiation structure to satisfy the temperature specification.
- (4) Acetic acid type and chlorine type materials 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.
- (5) 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.)
- (6) 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.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (8) Do not touch, push the circuit component on PCB.
- (9) The ground of a PCB should be contacted to electrical ground of your system.

11-2. 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) 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.
- (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (5) LCD panel 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.

11-3. ELECTROSTATIC DISCHARGE CONTROL

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

11-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

11-5. STORAGE

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

- (1) Store them in a dark place. Do not expose the LCD panel 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.

11-6. HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) The protection film is attached to the bezel with a small masking tape or a double side tape.
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) When the LCD panel with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

APPENDIX- I

■ Thermistor(PNTC) Characteristics

Note 1. Thermistor type is NCP15XH103F0SRC

The LCD panel shall incorporate a NTC thermistor surface mounted to the display circuit board.

The user of LCD panel can utilize this thermistor for some special purpose.

For example, the user can measure display temperature from the thermistor and then turn off backlight when LCD panel temperature exceeds maximum rating.

2. Rthermistor tolerance is $\pm 1\%$ at 25°C.

3. Rthermistor is value of resistance between PTNC & GND.

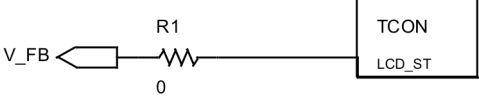
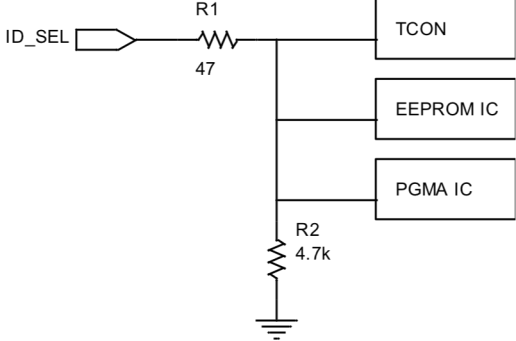
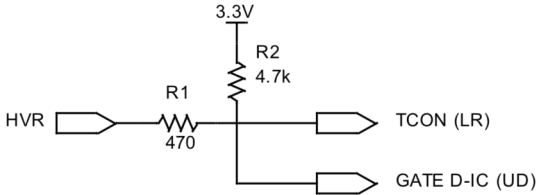
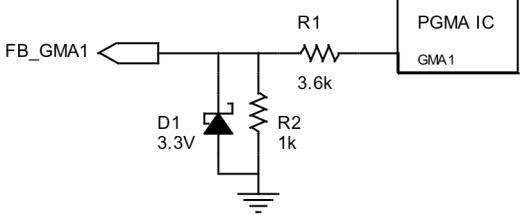
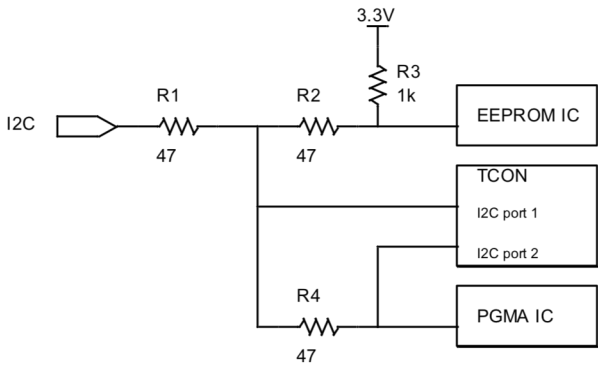
Please see the Equivalent Circuits of Thermistor on Appendix-II.

°C (Ta)	R _{thermistor} [kΩ] (Thermistor)
-40	195.65
-35	141.17
-30	113.35
-25	87.56
-20	68.24
-15	53.65
-10	42.51
-5	33.89
0	27.22
5	22.02
10	17.93
15	14.67
20	12.08
25	10
30	8.31
35	6.95
40	5.83
45	4.92
50	4.16
55	3.54
60	3.01
65	2.59
70	2.23
75	1.93
80	1.67
85	1.45

Product Specification

APPENDIX- II

■ I/O Equivalent Circuits (1/2)

Pin No	Symbol	I/O	Description	Note
2	V_FB	O		
3	ID_SEL	I		
4	HVR	I		
36	PNTC	O		
37	FB_GMA1	O		
38, 39	SDA, SCL	I/O		

Product Specification

APPENDIX- II

■ I/O Equivalent Circuits (2/2)

Pin No	Symbol	I/O	Description	Note
40	WP	I		
44	NC (LCD_TEST)	-		
45	PDC	I		
48	FB_VCOM	O		

APPENDIX- III

■ Standard Backlight Unit Specifications

- Detail specifications will be updated from Customer's Spec.