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TO :

Date : Dec., 26, 2021

(Formal Specification)

Model: FB088DXP613-A

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1.0 GENERAL DESCRIPTION

1.1 Introduction

Display model FB088DXP613-A is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 8.8 (1:4) inch diagonally measured active display area with (480 horizontal by 1920 vertical pixel) resolution.

1.2 Features

- 8.8 inch (1:4 diagonal) configuration
- 16.7M color
- RoHS/ Halogen Free Compliance

1.3 Applications

- Automotive

1.4 TFT LCD General information

Item		Specification	Unit
Outline Dimension		64.3 x 231.3 (typ)	mm
Display area		54.72(H) x 218.88(V)	mm
Number of Pixel		480 RGB (H) x 1920(V)	pixels
Pixel pitch		0.114(H) x 0.114(V)	mm
Pixel arrangement		RGB Vertical stripe	
Display mode		Normally Black	
NTSC		50 (typ.)	%
Surface treatment		HC	
Weight		100g (Typ.)	g
Back-light		White LED	
Power Consumption	Logic	0.65 (Max) @ White pattern 、 Frame rate 60Hz	W
	BL System	2.8 (Max) @ Black pattern w/o LED driver	W

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	64.0	64.3	64.6	mm
	Vertical (V)	231.0	231.3	231.6	mm
	Depth (D)	—	4.8	5.1	mm
Weight		—	100	—	g

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2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	V _{DD}	-0.5	4.0	V	
	V _{GH}	15	26	V	
	V _{GL}	-11.5	-4	V	
	AV _{DD}	7	12.5	V	
Logic Signal Input Level	V _{DD}	-0.5	4.0	V	

2.1.2 Backlight unit

Item	Symbol	Typ.	Max.	Unit	Note
LED current	I _L	160	-	mA	(1) (2)(3)
LED voltage	V _L	16	17.5	V	(1) (2)(3)
LED reverse voltage	V _R	--	5	V	
LED forward current	I _F		80	mA	

Note:

- (1) Permanent damage may occur to the LCD module if beyond this specification.
Functional operation should be restricted to the conditions described under normal operating conditions.
- (2) Ta =25±2℃
- (3) Test Condition: LED current 160 mA. The LED lifetime could be decreased if operating IL is larger than 160mA.

2.1.3 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T _{opa}	-20	70	℃	
Storage Temperature	T _{stg}	-30	80	℃	

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3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal viewing angle	600	800	—		(1)(2)(4)
Response time		Tr+Tf		—	30	40	msec	(1)(3)
White luminance (Center)		Y _L		480	600	—	cd/m ²	(1)(4) (I _L =160mA)
Color chromaticity (CIE1931)	Red	R _x		0.576	0.626	0.676		(1)(4)
		R _Y		0.295	0.345	0.395		
	Green	G _x		0.262	0.312	0.362		
		G _Y		0.493	0.543	0.593		
	Blue	B _x		0.097	0.147	0.197		
		B _Y		0.059	0.109	0.159		
	White	W _x		0.250	0.300	0.350		
		W _y	0.272	0.322	0.372			
Viewing angle	Hor.	Θ _L	CR>10	75	85	—		(1)(4)
		Θ _R		75	85	—		
	Ver.	Θ _U		75	85	—		
		Θ _D		75	85	—		
Brightness uniformity		B _{UNI}	Θ=0 (9point)	70	80	—		(5)
View Direction		ALL						(6)

3.2 Measuring Condition

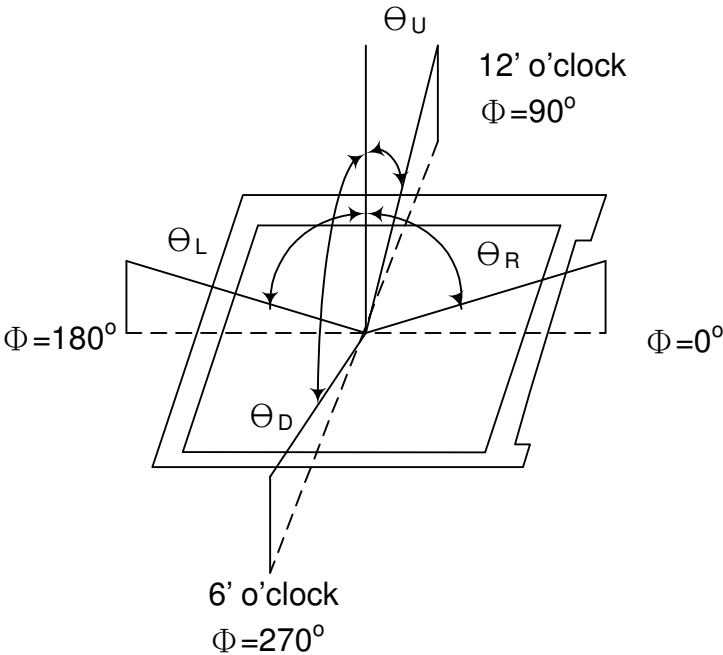
- Measuring surrounding : dark room
- LED current I_L : 160mA
- Ambient temperature : 25±2°C
- 15min. warm-up time.

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3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size : 20 ~ 21 mm

Note (1) Definition of Viewing Angle:

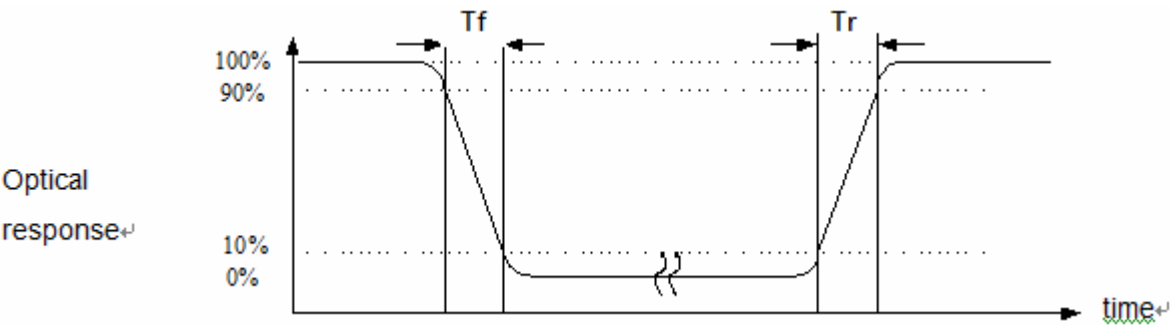


Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

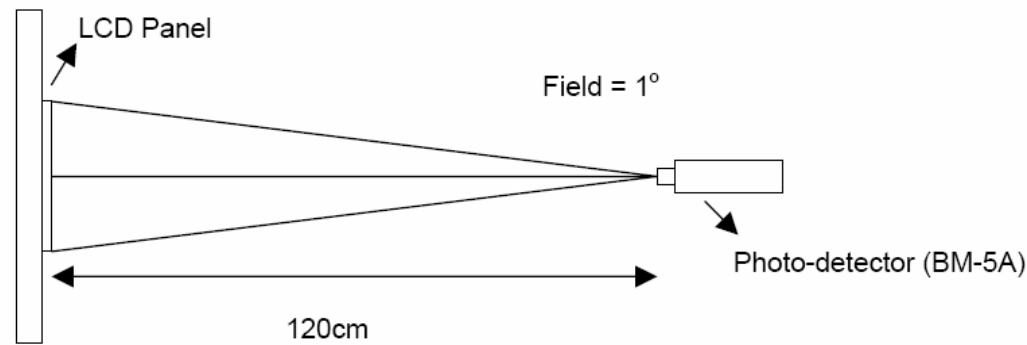
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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Note (3) Definition of Response Time : Sum of T_R and T_F

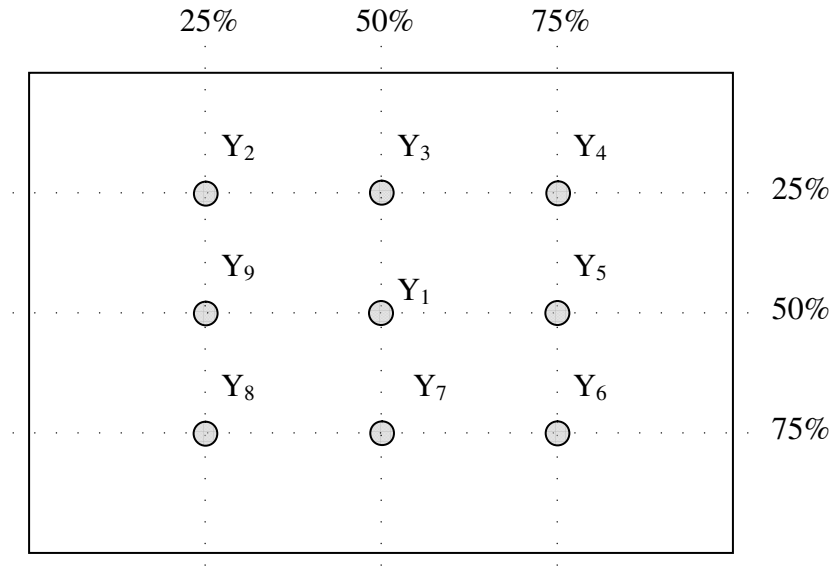


Note (4) Definition of optical measurement setup



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Note (5) Definition of Average Luminance Uniformity of White (Center)
Definition of brightness uniformity

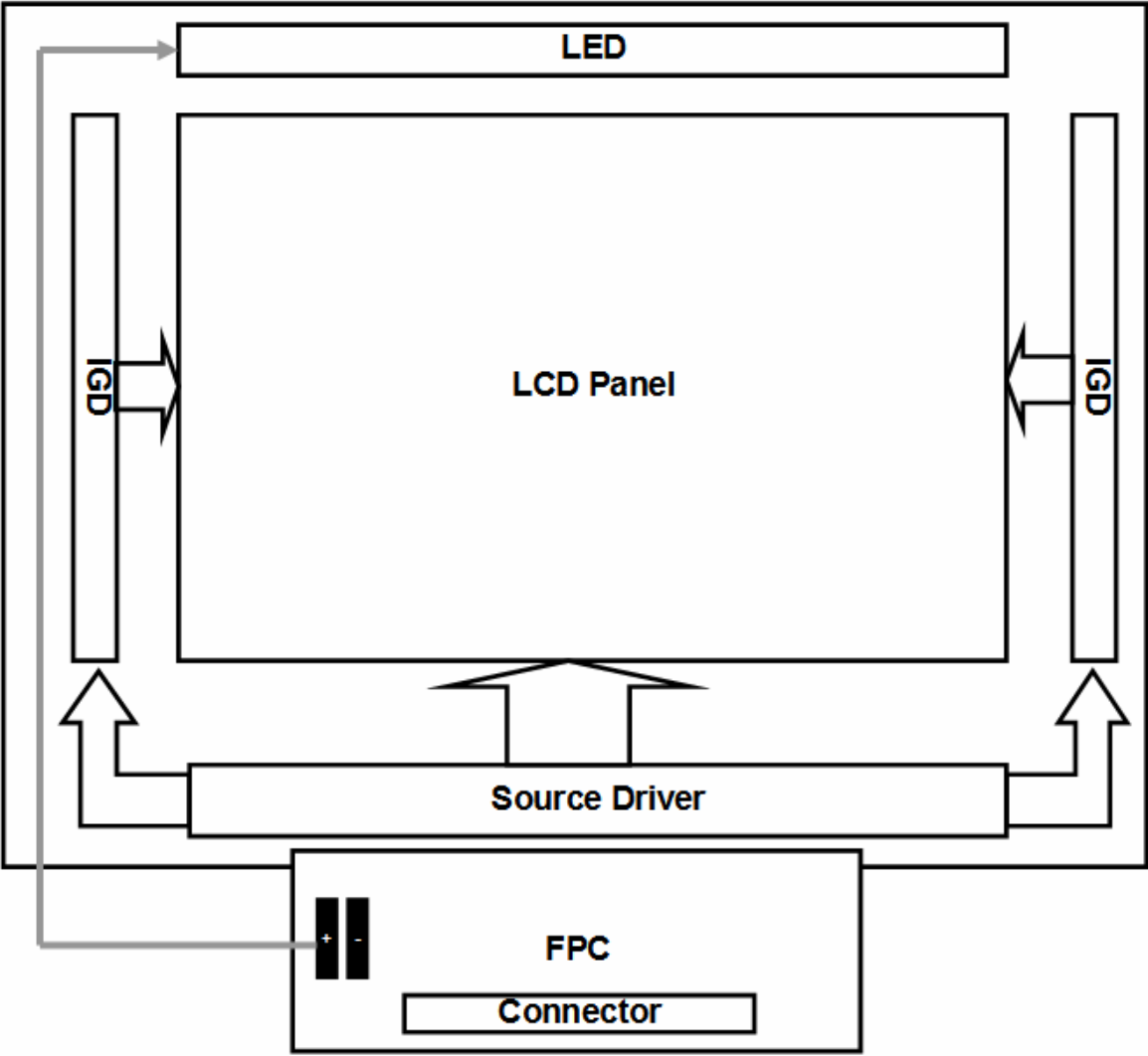


$$\text{Luminance uniformity} = \frac{(\text{Min Luminance of 9 points})}{(\text{Max Luminance of 9 points})} \times 100\%$$

Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.)

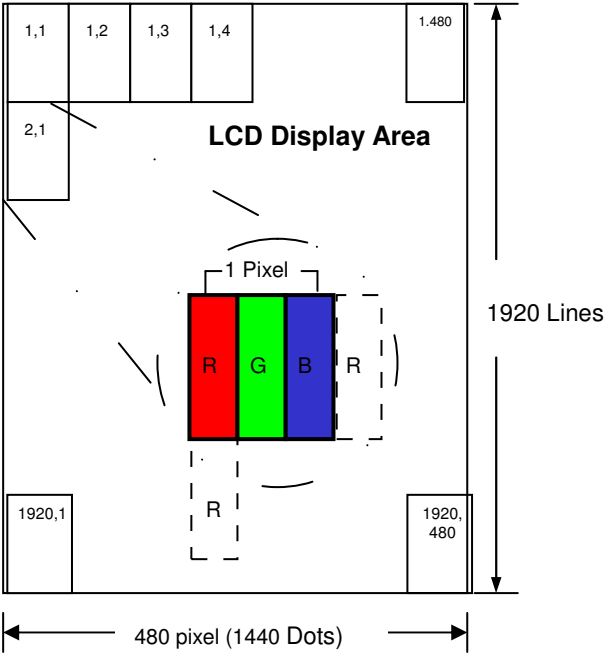
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4.0 BLOCK DIAGRAM
4.1 TFT LCD Module



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4.2 Pixel Format



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5.0 INTERFACE PIN CONNECTION

Pin No.	Symbol	I/O	Function
1	GND	P	Ground
2	NC	---	No connection
3	LED+	P	LED Anode
4	LED+	P	LED Anode
5	NC	---	No connection
6	LED-	P	LED Cathode
7	LED-	P	LED Cathode
8	NC	---	No connection
9	GND	P	Ground
10	NC	---	No connection
11	AVDD	P	Power supply for analog circuit
12	NC	---	No connection
13	VGH	P	Power supply for analog circuit
14	NC	---	No connection
15	VGL	P	Power supply for analog circuit
16	NC	---	No connection
17	GND	P	Ground
18	VCOM	P	Power supply for common voltage
19	GND	P	Ground
20	GND	P	Ground
21	RESET	I	Global reset
22	VDD	P	Power supply for digital circuits
23	STBYB	I	Standby mode
24	TP_Sync	O	Sync signal for touch panel
25	GND	P	Ground
26	D0P	I	MIPI Data Input Lane0 positive-end
27	D0N	I	MIPI Data Input Lane0 negative-end
28	GND	P	Ground
29	D1P	I	MIPI Data Input Lane1 positive-end
30	D1N	I	MIPI Data Input Lane1 negative-end
31	GND	P	Ground
32	CLKP	I	MIPI Clock Input positive-end
33	CLKN	I	MIPI Clock Input negative-end
34	GND	P	Ground
35	D2P	I	MIPI Data Input Lane2 positive-end
36	D2N	I	MIPI Data Input Lane2 negative-end
37	GND	P	Ground
38	D3P	I	MIPI Data Input Lane3 positive-end
39	D3N	I	MIPI Data Input Lane3 negative-end
40	GND	P	Ground

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6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VDD	3.0	3.3	3.6	V	
	VGH	17.0	18.0	19.0	V	
	VGL	-11	-10	-9	V	
	AVDD	11.8	12	12.2	V	
VCOM	VCOM	4.5	4.88	5.2	V	Note (1)
Input signal voltage	ViH	0.7 VDD	-	VDD	V	Note (2)
	ViL	0	-	0.3 VDD	V	
Current of power supply	IDD	-	-	35	mA	VDD =3.3V
	IADD	-	-	30	mA	AVDD=12V
	IGH	-	-	5	mA	VGH=18V
	IGL	-	-	-5	mA	VGL= -10V
	Ivcom	-	-	0.1	mA	Vcom= 4.88V

Note (1): Please adjust VCOM to make the flicker level minimum.

Note (2) :RESET 、STBYB 、TP_Sync

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6.2 MIPI DC Characteristics

6.2.1 HS Receiver DC Specification

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Operation Voltage	VDD	1.5-10%	1.5	1.5+10%	mV	
Differential Input Voltage	VID	70	200	260	mV	
Common Mode Voltage	V _{CMRX(DC)}	70	-	330	mV	
Differential Input High Threshold Voltage	VTH	-	-	70	mV	
Differential Input Low Threshold Voltage	VTL	-70	-	-	mV	
Singled-ended input high voltage	V _{IHS}	-	-	460	mV	
Singled-ended input low voltage	V _{ILHS}	-40	-	-	mV	
Singled-ended threshold for HS termination enable	V _{TERM-EN}	-	-	450	mV	
Differential input impedance	Z _{ID}	80	100	125	ohm	
Pin leakage current	I _{LEAK}	-10	-	10	uA	
Common-mode interference beyond 450MHz	ΔV _{CMRX(HF)}	-	-	100	mV	
Common-mode interference 50MHz - 450MHz	ΔV _{CMRX(LF)}	-50	-	50	mV	
Common-mode termination	C _{CM}	-	-	60	pF	
Embedded Termination	R _T	90	100	110	ohm	2bits RT_SEL[1: 0] for termination resistor selection 00 → 200ohm 10 , 01 → 150ohm 11 → 100ohm (default) 1bit ERMEN for termination resistor enable TERM_EN=0, termr disable R=(OPEN) TERM_EN=1, termr enable

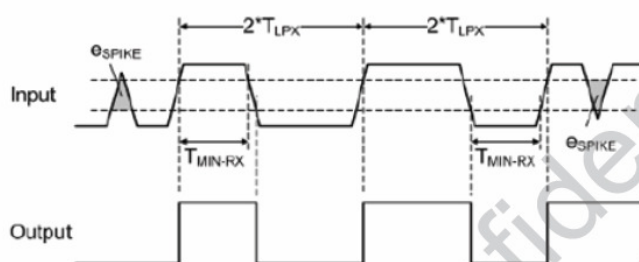
Note:

- (1) Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.
- (2) This table value includes a ground difference of 50mV between the transmitter and the receiver, the static common-mode level tolerance and variations below 450MHz.

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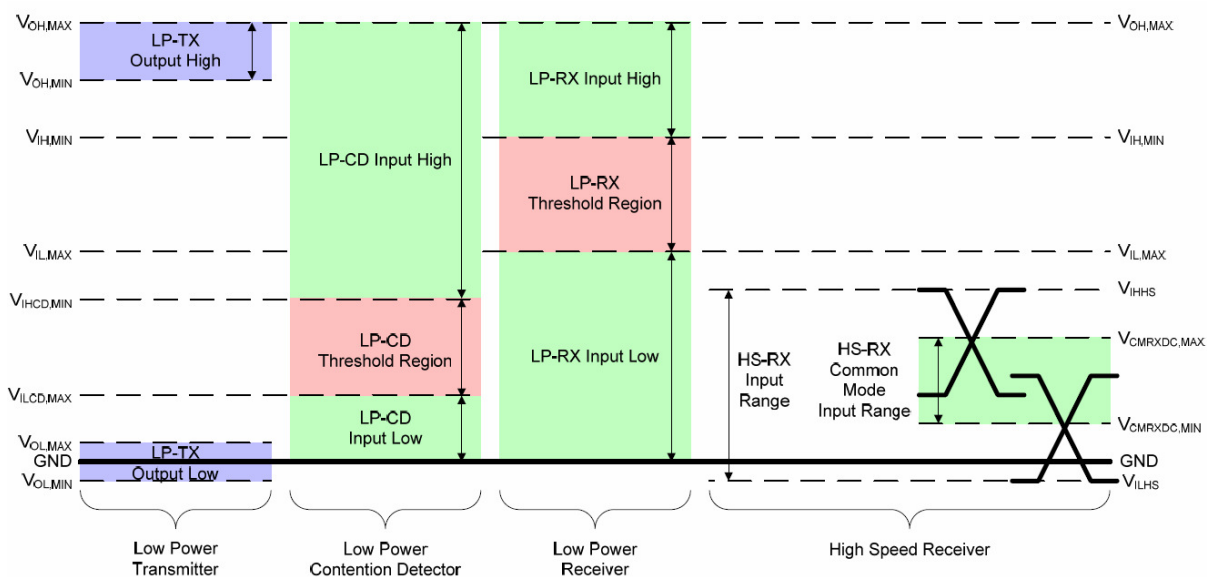
6.2.2 LP Receiver DC Specification

		Rating				
Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Logic 1 input voltage	V _{IH}	880	-	-	mV	
Logic 0 input voltage, not in ULP State	V _{IL}	-	-	550	mV	
Input hysteresis	V _{HYST}	25	-	-	mV	



6.2.3 Line Contention Detection

Parameter	Symbol	Min	Rating		Unit	Note
			Typ	Max		
Logic 1 contention threshold	V_{IHCD}	450	-	-	mV	
Logic 0 contention threshold	V_{ILCD}	-	-	200	mV	



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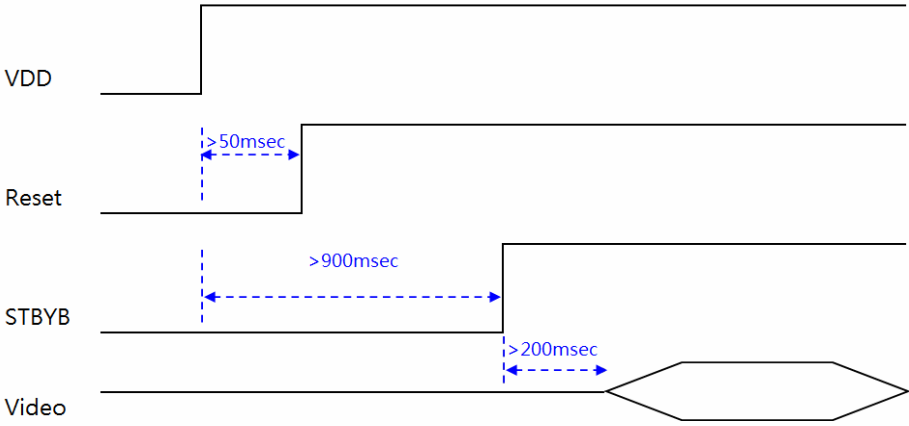
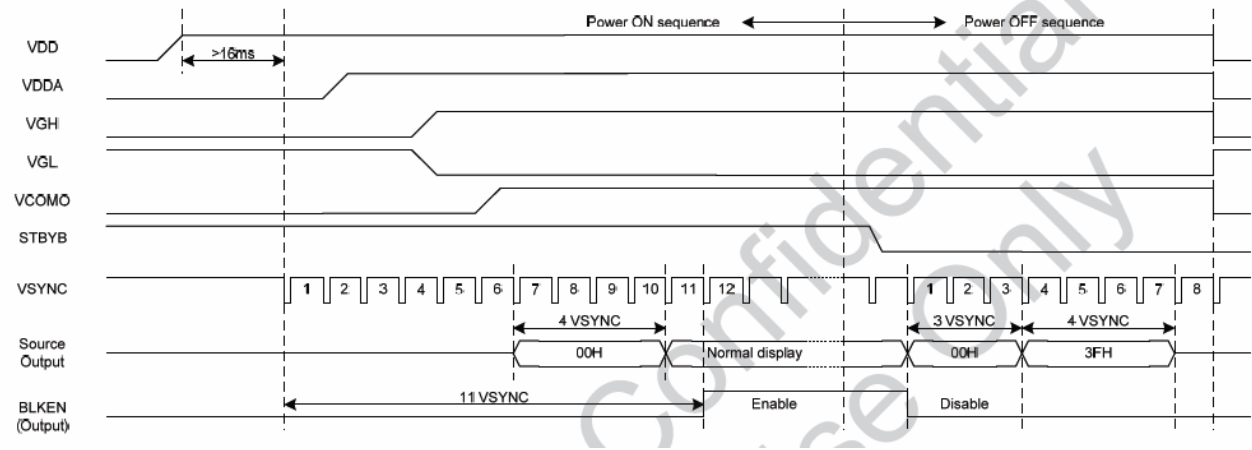
6.3 Interface Timing

Item	Symbol	Min.	Typ.	Max.	Unit
MIPI Video data rate(4 lane)	-	-	397.7	-	Mbps
PCLK Frequency	FPCLK	-	66.3	-	MHz
Horizontal Synchronization	Hsync	-	30	-	PCLK
Horizontal Back Porch	HBP	-	30	-	PCLK
Horizontal Front Porch	HFP	-	30	-	PCLK
Hsync+HBP+HFP	-	75	90	-	PCLK
HorizontalAddress(Display Area)	Hadr	-	480	-	PCLK
Horizontal cycle	-	555	570	-	PCLK
Vertical Synchronization	Vsync	-	6	-	Line
Vertical Back Porch	VBP	-	6	-	Line
Vertical Front Porch	VFP	-	6	-	Line
Vsync+VBP+VFP	-	15	18	-	Line
Vertical Address(Display Area)	Vadr	-	1920	-	Line
Vertical cycle	-	1935	1938	-	Line
Frame Rate	-	-	60	-	Hz

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6.4 Power On / Off Sequence

Power-On/Off Timing Sequence:



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6.5 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Current	I_F	--	160	--	mA	Ta=25°C
LED Voltage	V_F	--	--	17.5	Volt	Ta=25°C
LED Life-Time	N/A	--	30,000	--	Hour	Ta=25°C $I_F=160\text{mA}$ Note (2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=160mA. The LED lifetime could be decreased if operating IL is larger than 160mA. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit

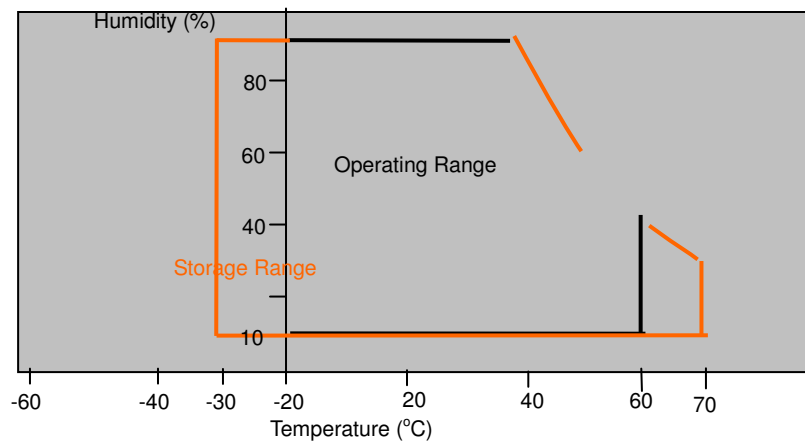
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7.0 Reliability test items

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80°C, 240hrs	
2	Low Temperature Storage	Ta=-30°C, 240hrs	
3	High Temperature Operation	Ta=+70°C, 240hrs	
4	Low Temperature Operation	Ta=-20°C, 240hrs	
5	Thermal Cycling Test (non operation)	-20°C(30min)→+70°C(30min),100 cycles	
6	Vibration	Sine Wave 1.5G, 5~500Hz, XYZ 30min/each direction	
7	Shock	Half-Sine, 200G, 2ms, ±XYZ, 1time	

Note: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

Storage / Operating temperature



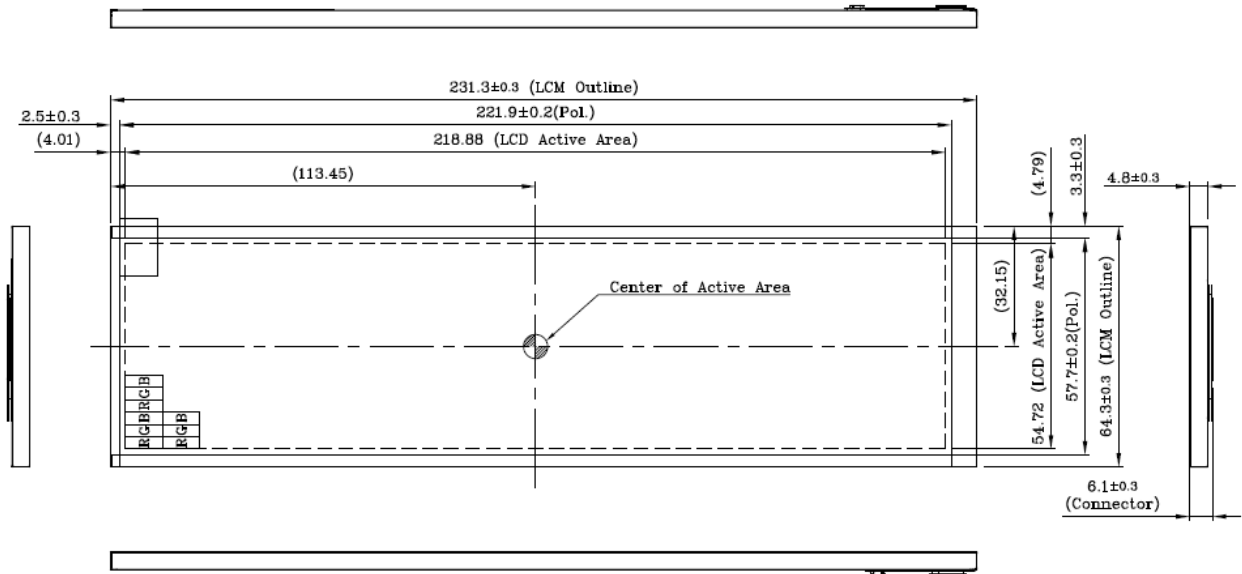
Note .Max wet bulb temp.=39°C

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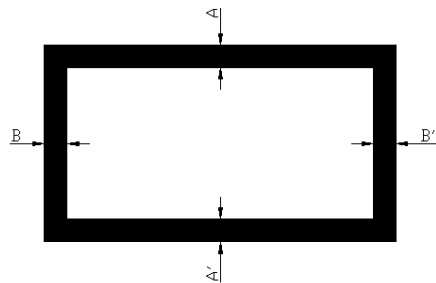
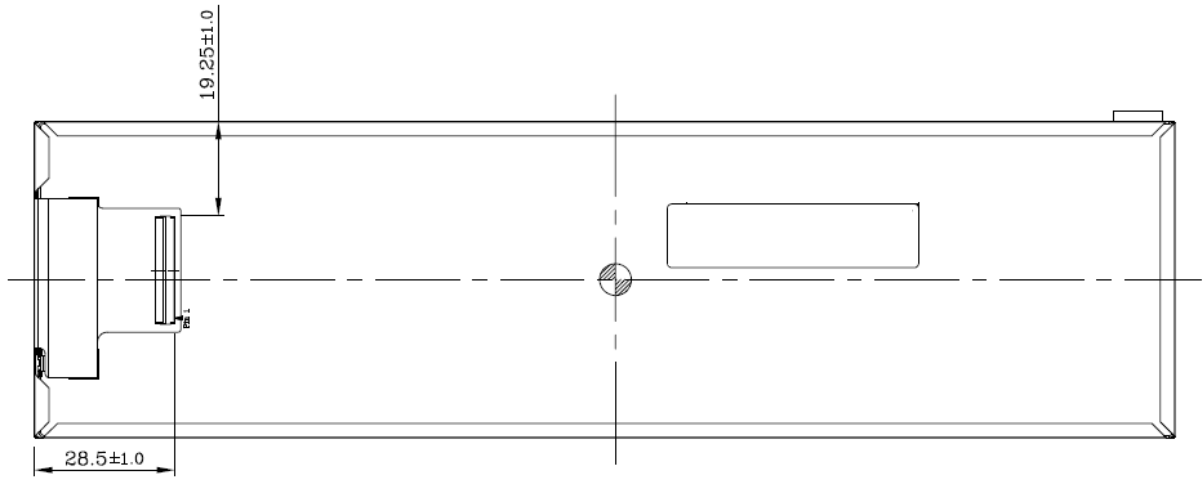
8.0 OUTLINE DIMENSION

8.1 Front View Outline Dimension

Unit : mm



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BM Assembly Tolerance:

$$| A - A' | \leq 1 \text{ (mm)}$$

$$| B - B' | \leq 1 \text{ (mm)}$$

Note:
General Tolerance $\pm 0.3 \text{ mm}$