

Document Title		Page No.	1 / 21
Document No.		Revision	1.0

TO :

Date : Dec., 26, 2021

(Formal Specification)

Model: RV088Z9M-600-40

Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Dec, 26, 2021		Formal Product Specification was first released.

Document Title		Page No.	3 / 21
Document No.		Revision	1.0

Contents

1.0	General description	p.4
2.0	Absolute maximum ratings.....	p.5
3.0	Optical characteristics.....	p.6
4.0	Block diagram	p.10
5.0	Interface pin connection	p.13
6.0	Electrical characteristics	p.16
7.0	Reliability test items	p.21
8.0	Outline dimension	p.22
9.0	Lot mark	p.24
10.0	Package specification	p.25
11.0	General precaution	p.26

Document Title		Page No.	4 / 21
Document No.		Revision	1.0

1.0 GENERAL DESCRIPTION

1.1 Introduction

Display model RV088Z9M-600-40 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

Document Title		Page No.	5 / 21
Document No.		Revision	1.0

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) $T_a = 25 \pm 2^\circ\text{C}$
- (3) Test Condition: LED current 160 mA. The LED lifetime could be decreased if operating I_L is larger than 160mA.

2.1.3 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	$^\circ\text{C}$	
Storage Temperature	T_{stg}	-30	80	$^\circ\text{C}$	

Document Title		Page No.	6 / 21
Document No.		Revision	1.0

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

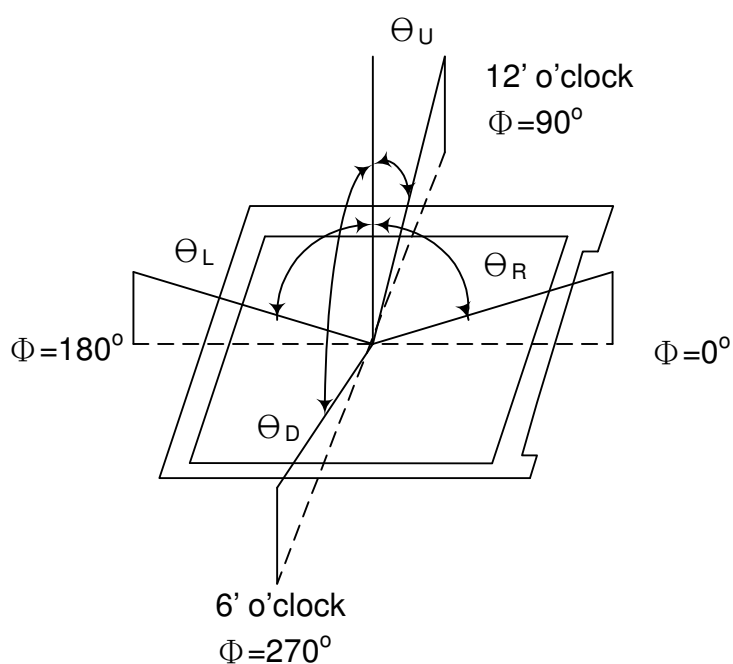
- Measuring surrounding : dark room
- LED current I_L : 160mA
- Ambient temperature : 25±2°C
- 15min. warm-up time.

Document Title		Page No.	7 / 21
Document No.		Revision	1.0

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:

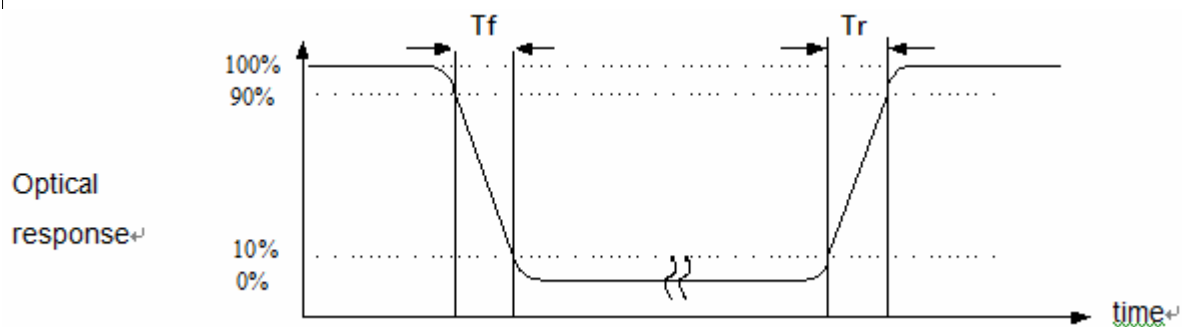


Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

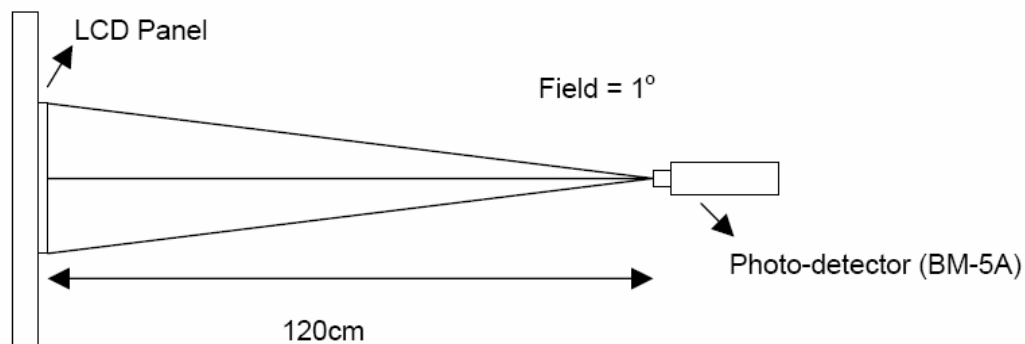
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Document Title		Page No.	8 / 21
Document No.		Revision	1.0

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

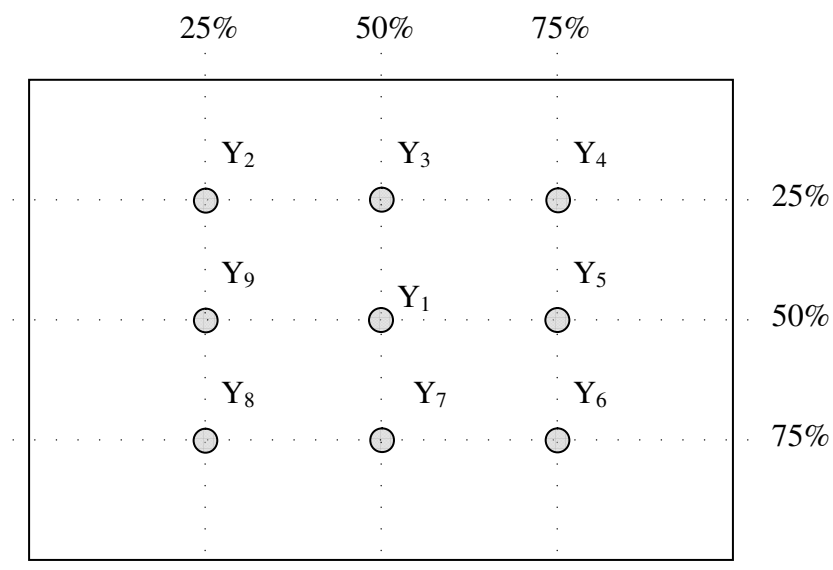


Note (4) Definition of optical measurement setup



Document Title		Page No.	9 / 21
Document No.		Revision	1.0

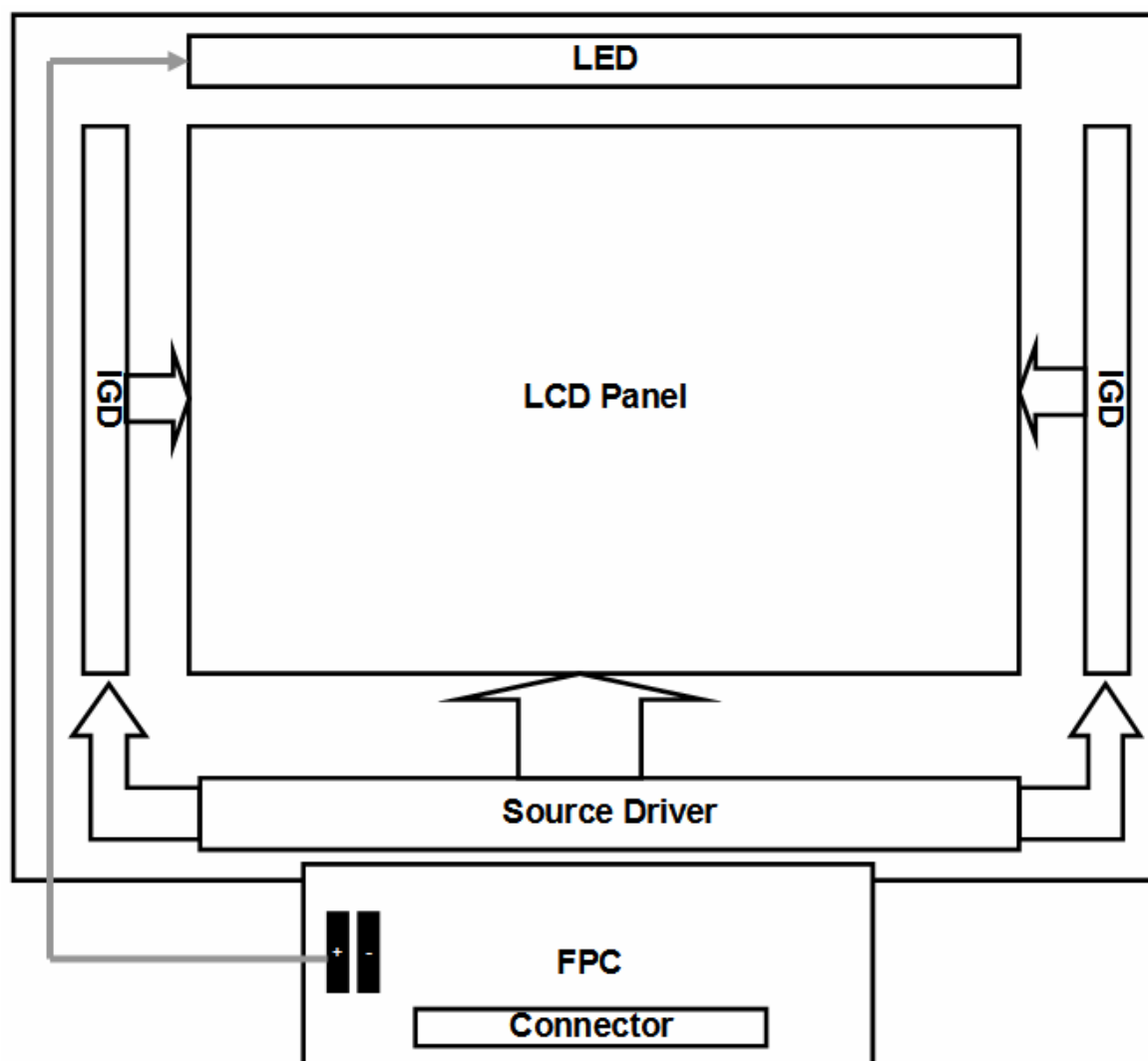
Note (5) Definition of Average Luminance Uniformity of White (Center)
Definition of brightness uniformity



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

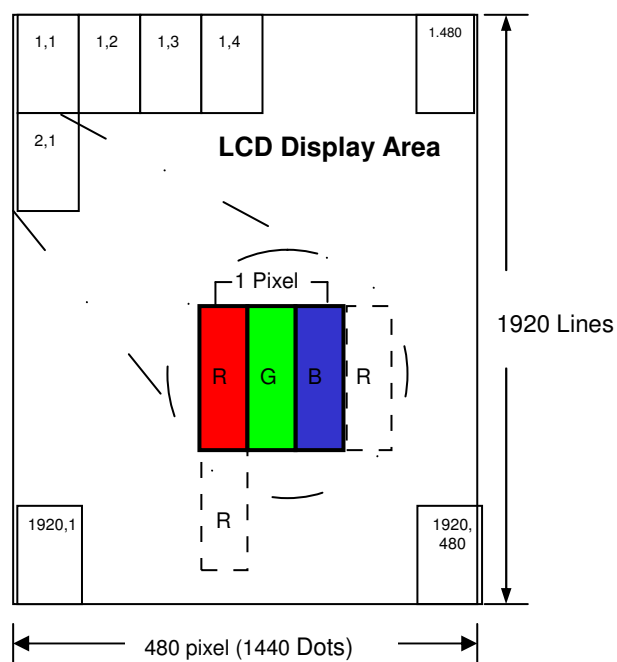
Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optimal view direction.)

4.1 TFT LCD Module



Document Title		Page No.	11 / 21
Document No.		Revision	1.0

4.2 Pixel Format



Document Title		Page No.	12 / 21
Document No.		Revision	1.0

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

Document Title		Page No.	13 / 21
Document No.		Revision	1.0

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

Document Title		Page No.	14 / 21
Document No.		Revision	1.0

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	V _{TH}	-	-	70	mV	
Differential Input Low Threshold Voltage	V _{TL}	-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

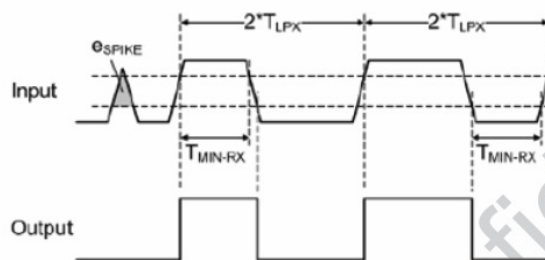
Note:

- (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.

Document Title		Page No.	15 / 21
Document No.		Revision	1.0

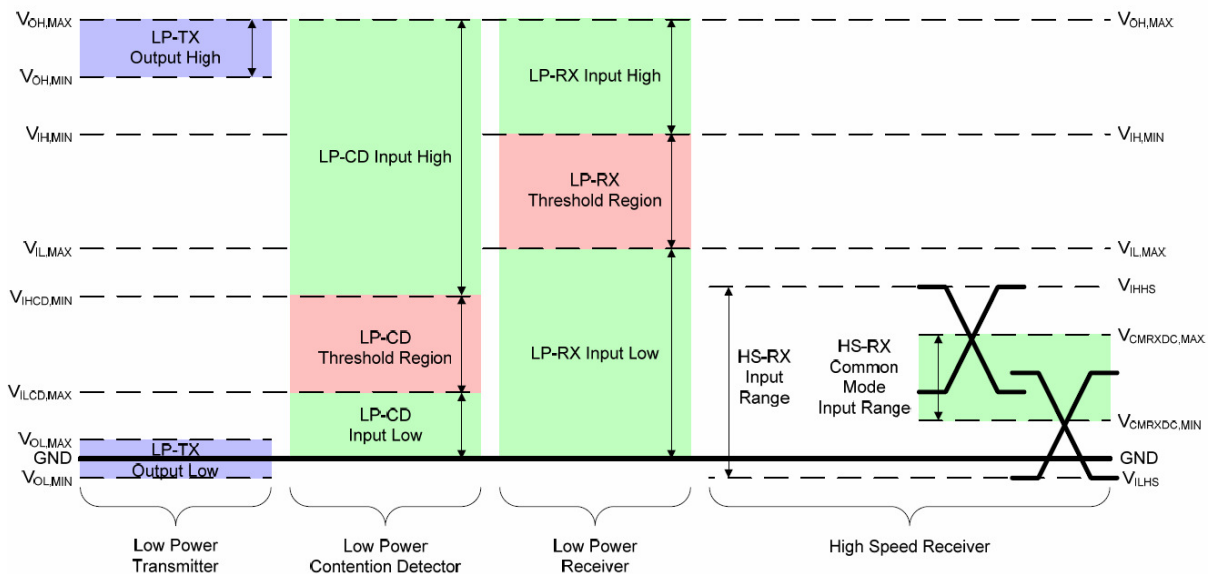
6.2.2 LP Receiver DC Specification

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



Document Title		Page No.	16 / 21
Document No.		Revision	1.0

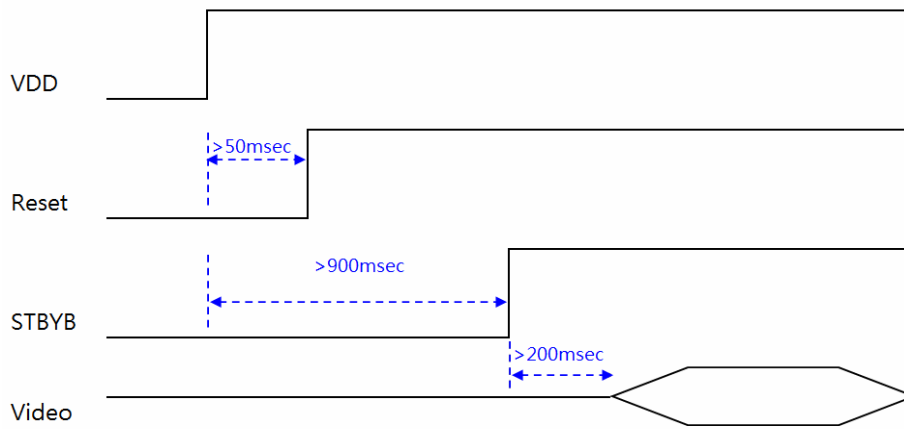
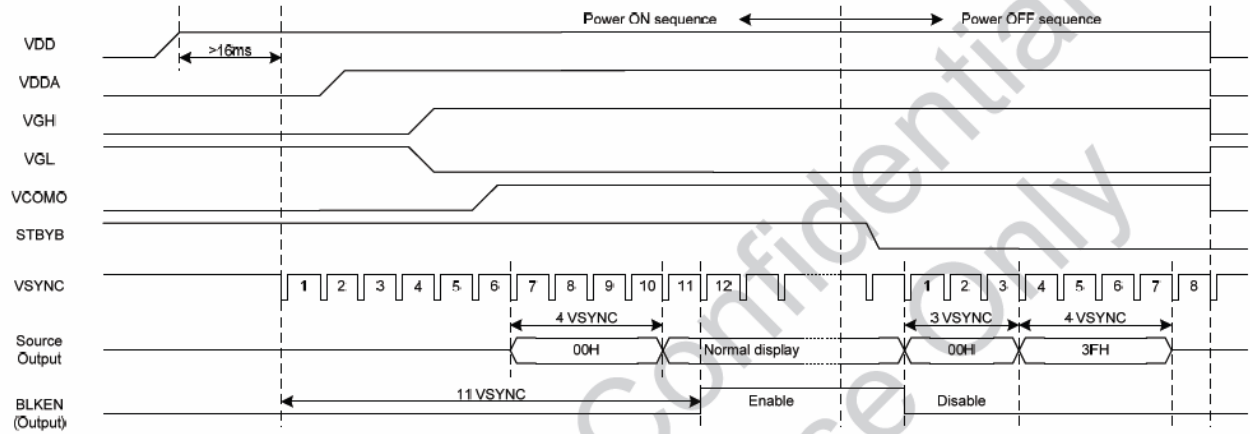
6.3 Interface Timing

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

Document Title		Page No.	17 / 21
Document No.		Revision	1.0

6.4 Power On / Off Sequence

Power-On/Off Timing Sequence:



Document Title		Page No.	18 / 21
Document No.		Revision	1.0

6.5 Backlight Unit

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

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm3^{\circ}\text{C}$, 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 $T_a=25^{\circ}\text{C}$ and $I_L=160\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 160mA. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit

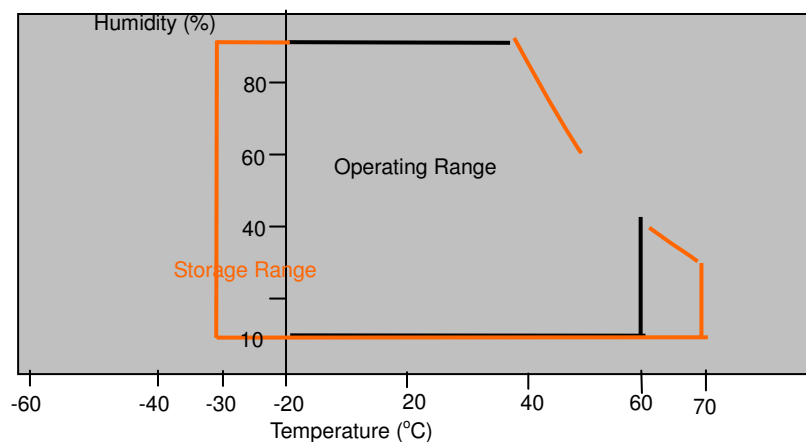
Document Title		Page No.	19 / 21
Document No.		Revision	1.0

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.

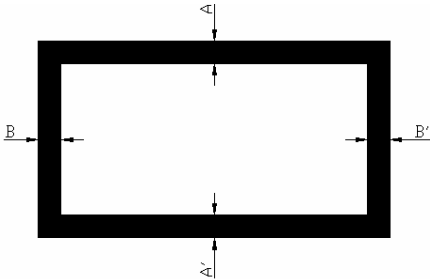
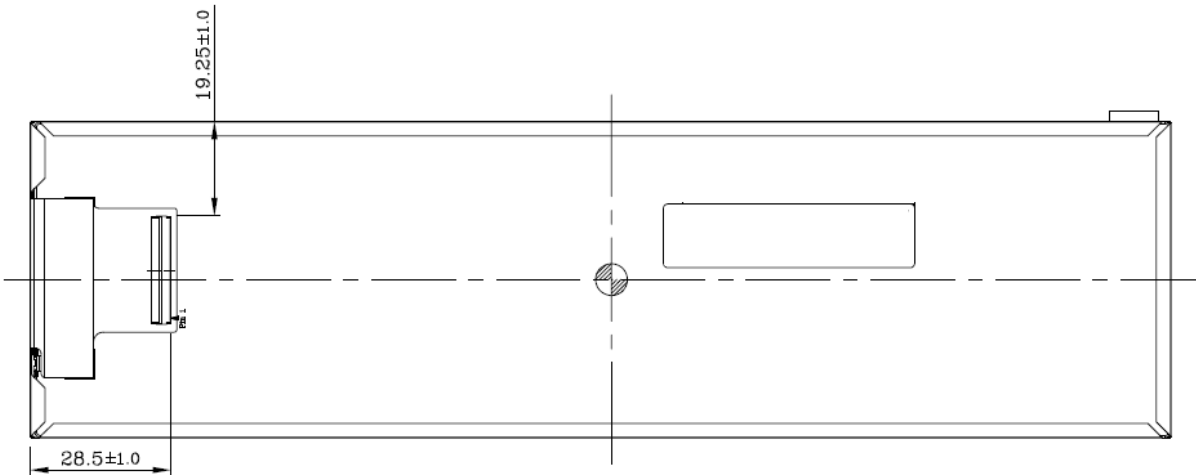
Storage / Operating temperature



Note .Max wet bulb temp.=39°C

[illegible]

Document Title		Page No.	21 / 21
Document No.		Revision	1.0



BM Assembly Tolerance

| A - A' | ≤ 1 (mm)

| B - B' | ≤ 1 (mm)

Note:

General Tolerance ±0.3mm