

	PRODUCTION SPECIFICATION OF TFT LCD MODULE	Model No: M215MXN02-LS300
		OC PN: SG215HB07-1

**PRODUCTION SPECIFICATION
OF TFT LCD MODULE**

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CUSTOMER	
CONFIRMED BY	
APPROVED BY	

PREPARED BY	
CONFIRMED BY	

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

This is a TFT LCD module which used CSOT SG215HB07-1 open cell. This is a diagonal 21.5" color active matrix LCD open cell with 2Channel LVDS interface. This open cell is a transmissive type display operating in the normally black mode. It supports 1920*1080 FHD resolution and can display up to 16.7M colors (6bits+FRC). Each pixel is divided into Red, Green and Blue sub-pixels which are arranged in vertical stripe. There is no backlight built-in.

This open cell dedicates for LCD Monitor products and provides excellent performance which includes high transmittance, ultra wide viewing angle and high color depth. CSOT open cell comply with RoHS for identification.

1.2 General Specifications

Item	Specification	Unit	Note
Active Area	476.064 (H) * 267.786 (V)	mm	
Driving Scheme	a-Si TFT Active Matrix	-	
Number of Pixels	1920 * 1080	pixel	
Pixel Pitch (Sub Pixel)	0.08265*0.24795	mm	
Pixel Arrangement	RGB Vertical Stripe	-	
Display Colors	16.7 M	color	8bit
Display Mode	Transmissive Mode, Normally Black		
Module Brightness	300	Cd/m ²	Typical value measured at BLU
Contrast Ratio	1300:1(Typ.)		
View Angle (CR>10)	+89/-89 (H), +89/-89 (V) (Typ.)		
Surface Treatment	Anti-glare, Haze 25%, Hard Coating (3H)		

1.3 Mechanical Specification

Item		Min	Typ	Max	Unit	Note
Weight		-200	TBD	+200	g	-
Module Size	Horizontal(H)	(TYP)-0.5	496.00	(TYP)+0.5	mm	1
	Vertical (V)		292.50		mm	
	Depth(D)		9.50		mm	

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2. Absolute Maximum Ratings

2.1 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 3
Glass surface temperature (operation)	TGS	0	+65	[°C]	Note 3, Note 4
Operation Humidity	HOP	5	90	[%RH]	Note 3
Storage Temperature	TST	-20	+60	[°C]	
Storage Humidity	HST	5	90	[%RH]	

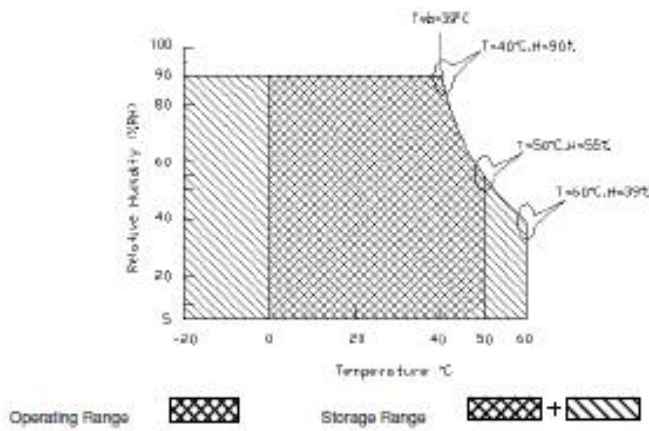
Note 1: With in Ta (25°C)

Note 2: Permanent damage to the device may occur if exceeding maximum values.

Note 3: Temperature and relative humidity range are shown as the below figure.

1. 90% RH Max
2. Max wet-bulb temperature at 39

Note 4: Function Judged only



2.2 Electrical Absolute Ratings

The followings are maximum values which, if exceeded, may cause damage to the unit.

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	5.75	V	Ta=25°C
Input Signal Voltage	VIN	-0.3	3.6	V	

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3. ELECTRICAL CHARACTERISTICS

3.1 Open Cell Power Consumption (TA = 25 ± 2 °C)

Parameter		Symbol	Value			Unit	Note	
			Min.	Typ.	Max.			
Power Supply Voltage		V _{CC}	4.5	5	5.5	Vdc	-	
Permissive Input Ripple Voltage		V _{RIPPLE}	-	-	500	mVp-p	(1)	
Rush Current		I _{RUSH}	-	-	3	A	(2)	
Power Supply Current	White Pattern	I _{CC}	-	0.45	0.54	A	60 Hz	(3)
	Horizontal Stripe		-	0.64	0.77	A		
	Black Pattern		-	0.45	0.54	A		
	Mosaic Pattern(8*8)		-	0.45	0.54	A		
	White Pattern		-	0.60	0.72	A	100 Hz	
	Horizontal Stripe		-	0.78	0.94	A		
	Black Pattern		-	0.60	0.72	A		
	Mosaic Pattern(8*8)		-	0.60	0.72	A		
Power Consumption	Horizontal Stripe	P _{CC}	-	3.20	3.85	Watt	60 Hz	
			-	3.90	4.70	Watt	100 Hz	

Note:

(1) The ripple voltage should be controlled less than 10% of VCC.

FR =Max.(Frame Rate)condition and at that time, we recommend the bandwidth configuration of oscilloscope is to be under 20MHz.

(2) Measurement condition: VCC =5V, Rising time = 470μs.

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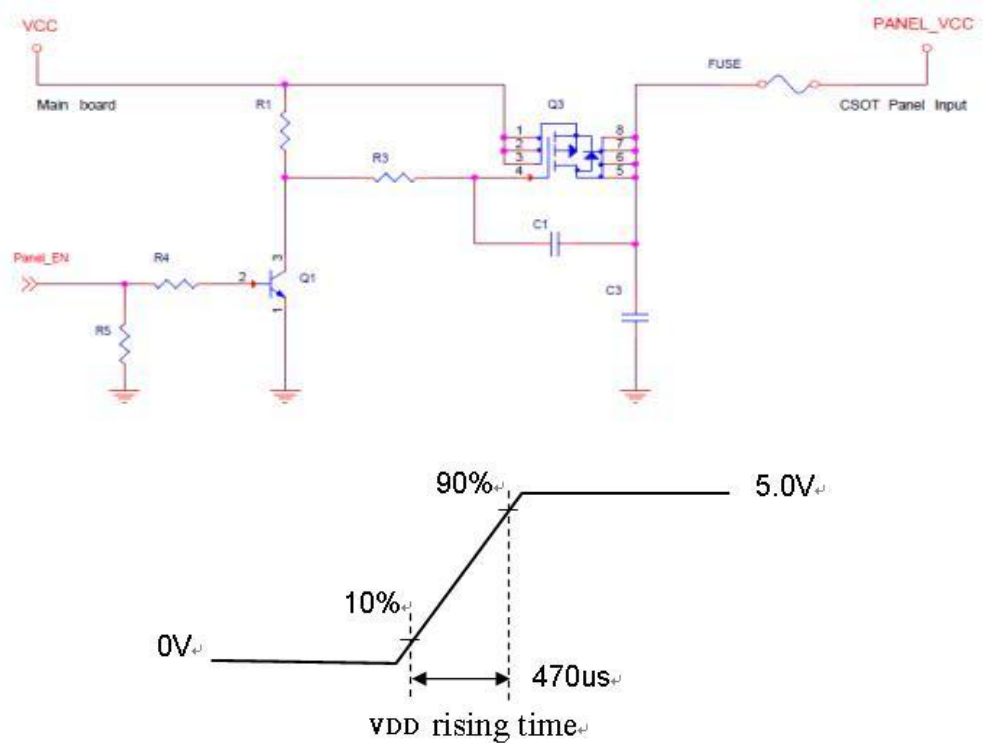
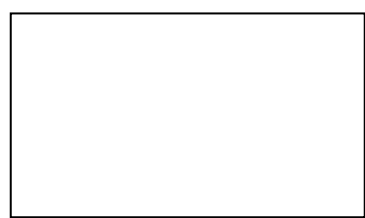


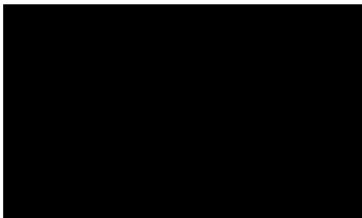
Fig. 3.1 VCC rising time condition

(3) Measurement condition: VCC = 5V, Ta = 25 ± 2°C, F = 60 Hz. The test patterns are shown as below.

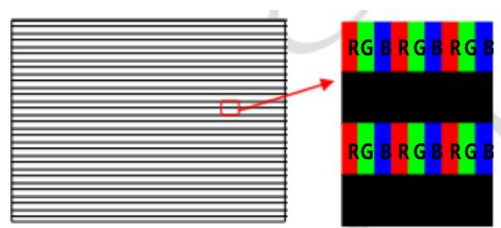
A. White Pattern



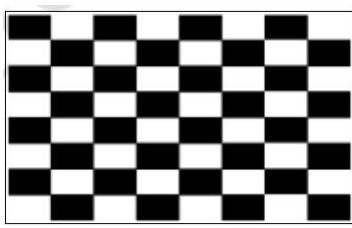
B.Black Pattern



C .Horizontal Stripe Pattern



D. Mosaic Pattern(8*8)



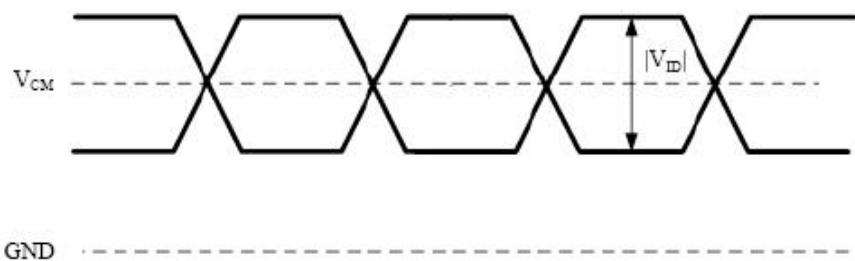
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3.2 LVDS Characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
LVDS Interface	Differential Input High Threshold Voltage	V_{TH}	+100	-	-	mV	(1)
	Differential Input Low Threshold Voltage	V_{TL}	-	-	-100	mV	(1)
	Common Input Voltage	V_{cm}	1.0	1.2	1.5	V	(2)
	Differential Input Voltage	$ V_{ID} $	100	-	600	mV	(3)
	Terminating Resistor	R_t	87.5	100	112.5	ohm	

- Note:
- (1) Condition: $V_{cm}=1.2\text{ V}$
 - (2) The product should be always operated within above ranges.
 - (3) The LVDS input signal has been defined as follows:

Single end Signals



Differential Signal

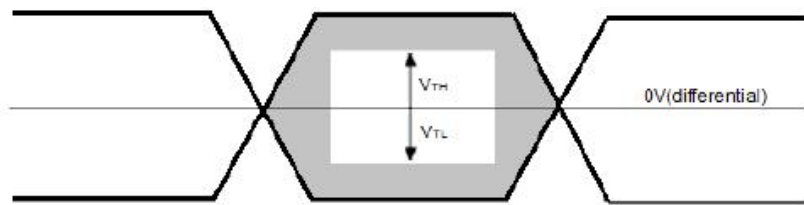


Fig. 3.3 LVDS input signal

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3.3 Temperature Specifications

Parameter	Symbol	Specification			Unit	Recommend test pattern	Note
		Min.	Typ.	Max.			
Surface Temperature	TTCN	-	-	100	°C	Horizontal Pattern	(1)
	TDriver	-	-	100		Horizontal Pattern	(1)
	TPmic	-	-	115		Horizontal Pattern	(1)

Note:

- (1) Any point on the IC surface must be less than Max. specification under any condition ,If the surface temperature is out of the specification, thermal solutions should be applied to avoid be damaged;The IC surface temperature is measured at room temperature of 25°C.

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4. Input Terminal Pin Assignment

4.1 Interface Pin Assignment

CN1: 1-301223-0 (XINDAYITONG) or equivalent (see Note (1))

Pin No.	Symbol	Description	Note
1	LV1N0	Odd LVDS Signal -	
2	LV1P0	Odd LVDS Signal +	
3	LV1N1	Odd LVDS Signal -	
4	LV1P1	Odd LVDS Signal +	
5	LV1N2	Odd LVDS Signal -	
6	LV1P2	Odd LVDS Signal +	
7	GND	Ground	
8	LVCK1N	Odd LVDS Clock -	
9	LVCK1P	Odd LVDS Clock +	
10	LV1N3	Odd LVDS Signal -	
11	LV1P3	Odd LVDS Signal +	
12	LV2N0	Even LVDS Signal -	
13	LV2P0	Even LVDS Signal +	
14	GND	Ground	
15	LV2N1	Even LVDS Signal -	
16	LV2P1	Even LVDS Signal +	
17	GND	Ground	
18	LV2N2	Even LVDS Signal -	
19	LV2P2	Even LVDS Signal +	
20	LVCK2N	Even LVDS Clock -	
21	LVCK2P	Even LVDS Clock +	
22	LV2N3	Even LVDS Signal -	
23	LV2P3	Even LVDS Signal +	
24	GND	Ground	
25	NC	No connection , please let it open.	
26	NC	No connection , please let it open.	
27	NC	No connection , please let it open.	
28	VCC	DC power supply +5V	
29	VCC	DC power supply +5V	
30	VCC	DC power supply +5V	

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Note:

- (1) The direction of pin assignment is shown as below:

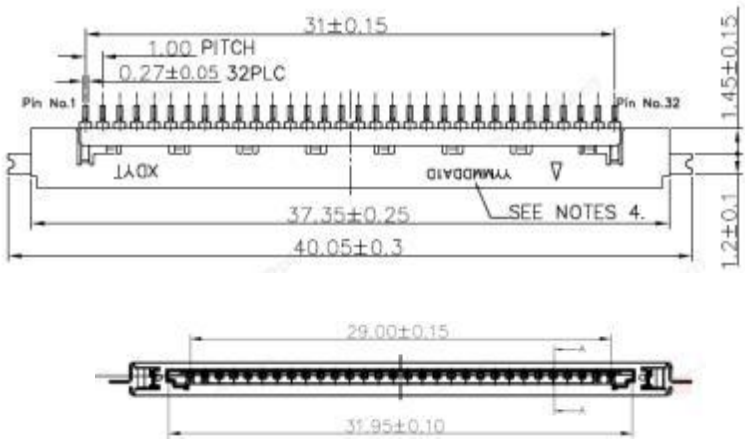
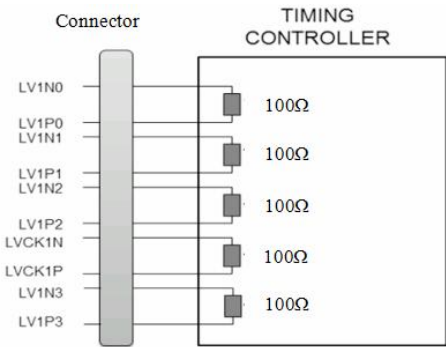


Fig. 4.1 LVDS connector direction sketch map

4.2 Block Diagram of Interface

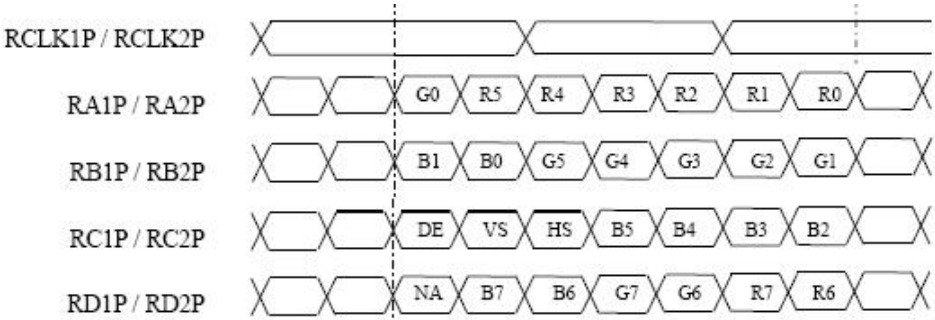


Attention:

- (1) This open cell uses a 100 ohms (Ω) resistor between positive and negative lines of each receiver input.
- (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line respectively.

4.3 LVDS Interface

4.3.1 VESA Format



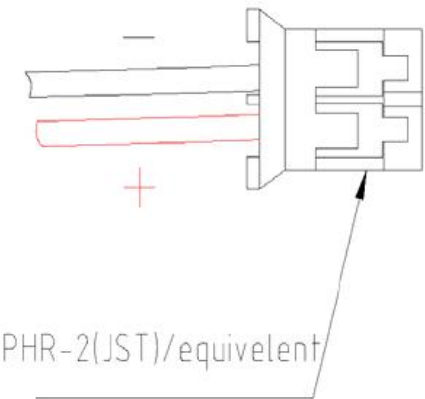
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4.5 Backlight Electrical / Optical Characteristics

4.5.1 backlight connector

"CN2 : PH2.0-2PIN

Pin#	Signal Name
1	VDD- Black)
2	VDD+ (Red)



4.5.2 Backlight Unit

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
LED operation Voltage	V_{led}	50	-	58	V_{led}	(1)
LED operation Current	I_{led}	-	240	280	mA	(1)
BackLight Power	P_{BL}	-	12.96	-	W	(2)
Lift time	Lt	30000	-	-	Hrs	(3)

Note 1: The LED LightBar connector part No: PHR-2 (JST) or equivalent, as shown next page.

Note 2: $P_{BL} = V_L \times I_L$, The LED LightBar circuit is 18 Series, 4 Parallel. Number Of LED is 72Pcs.

Note 3: The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and $I = 60\text{mA}$ (per chip) until the brightness becomes $\leq 50\%$ of its original value.

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5. Interface Timing

5.1 Timing Table (DE Only Mode)

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frequency		DCLK	TBD	TBD	TBD	MHz	(1)
Frame Rate		FR	48	100	100	Hz	
Vertical Term	Total	Tv	TBD	TBD	TBD	Line	$Tv = TVD + TVB$ (2)
	Active Display	TVD	1080			Line	
	Blank	TVB	TBD	TBD	TBD	Line	
Horizontal Term	Total	TH	TBD	TBD	TBD	Pixel	$TH = THD + THB$
	Active Display	THD	960			Pixel	
	Blank	THB	TBD	TBD	TBD	Pixel	
LVDS Receiver Clock	Input cycle to cycle jitter	Trcl	-	-	200	ps	(3)
	Spread spectrum modulation range	Fclkin_mod	- 2 %	-	+ 2 %	MHz	(4)
	Spread spectrum modulation frequency	FSSM	30	-	200	KHz	
LVDS Receiver Data	Receiver Skew Margin	TRSM	- 400	-	400	ps	(5)

Note:

(1) The TFT LCD open cell is operated in DE only mode, H sync and V sync input signal have no effect on normal operation.

(2) Please make sure the range of pixel clock follows the following equations:

$$F_{clkin}(\max) \geq F_{\max} \times Tv \times Th \quad F_{\min} \times Tv \times Th \geq F_{clkin}(\min)$$

Main frequency Max is 96Mhz without spread spectrum

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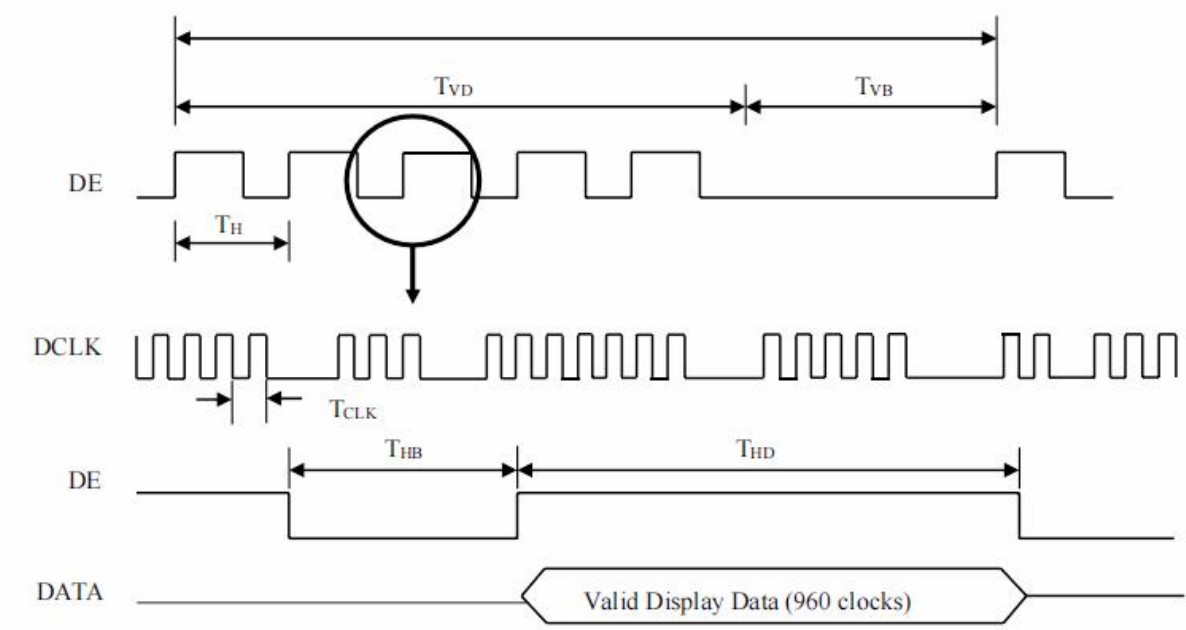


Fig. 5.1 Interface signal timing diagram

(3) The input clock cycle-to-cycle is defined as below figures.

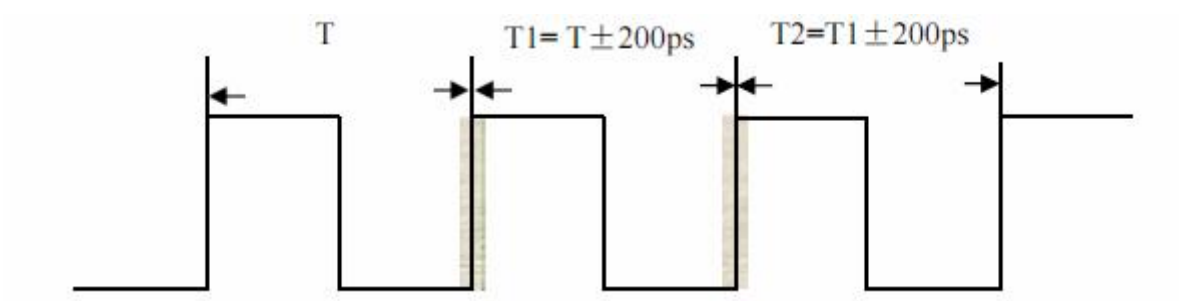


Fig. 5.2 Jitter

(4) The SSCG (Spread Spectrum Clock Generator) is defined as the following figure. The LVDS SSM's suggestion is off by default, SOC board must test all validation if SOC board open the LVDS SSM.

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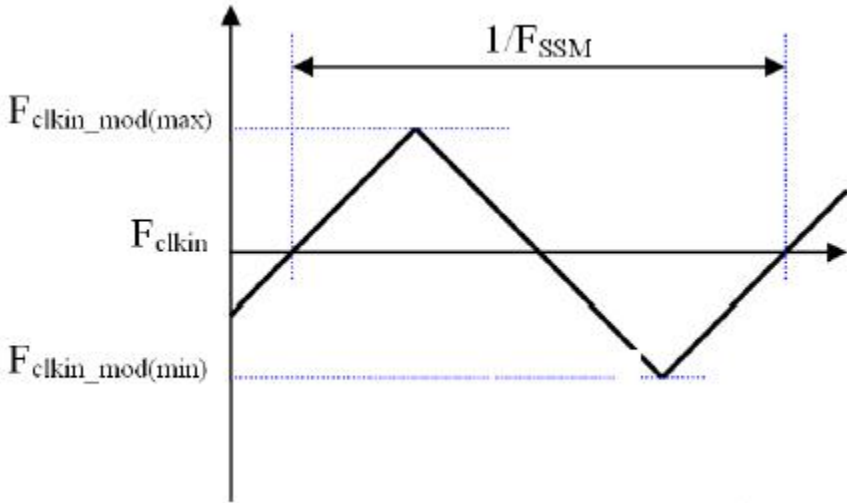


Fig. 5.3 SSM

(5) The LVDS timing diagram and setup/hold time is defined and showed as the following figure.

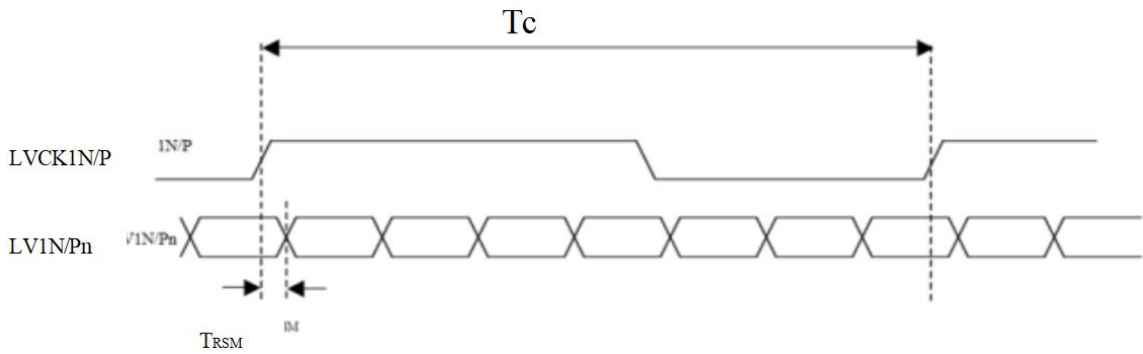


Fig.5.4 LVDS receive interface timing diagram

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5.2 Power On/Off Sequence

To prevent a latch-up or DC operation of the Open cell, the power on/off sequence should be as the diagram below.

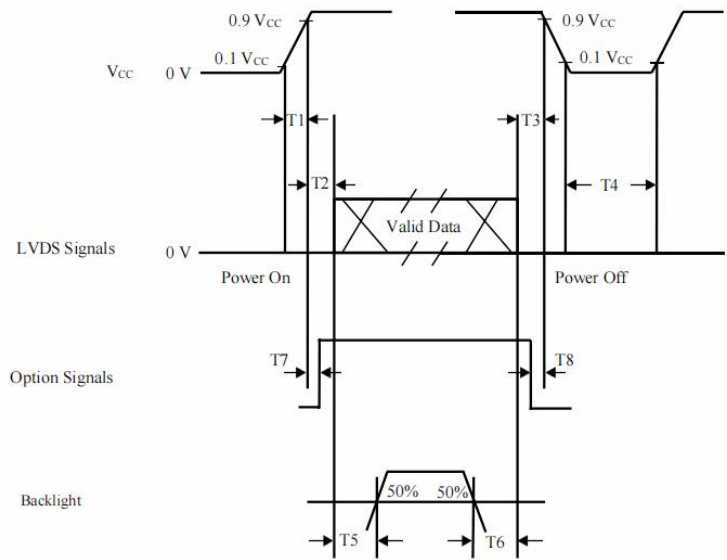


Fig.5.5 Power on/off sequence

Parameter				Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	1000	-	-	ms
T5	500	-	-	ms
T6	100	-	-	ms

Attention:

- (1) The supplied voltage of the external system for the open cell input should follow the definition of VCC.
- (2) When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.
- (3) In case that VCC is in off level, keep the level of input signals on the low or high impedance. If T2 < 0, that may cause electrical overstress.
- (4) T4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.
- (6) The open cell is initializing and loading code during T7. Please don't operate with other function except normal data (Auto swing, IIC, etc.).

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6 Optical Characteristics

6.1 Test Condition

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25 ± 2	°C
Ambient Humidity	Ha	50 ± 10	%RH
Supply Voltage	Vcc	5	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Input Voltage	V _{LED}	53.0	V
LED Input Current	I _{LED}	240	mA
Power Consumption	Pw	12.7	W

6.2 Optical Characteristics

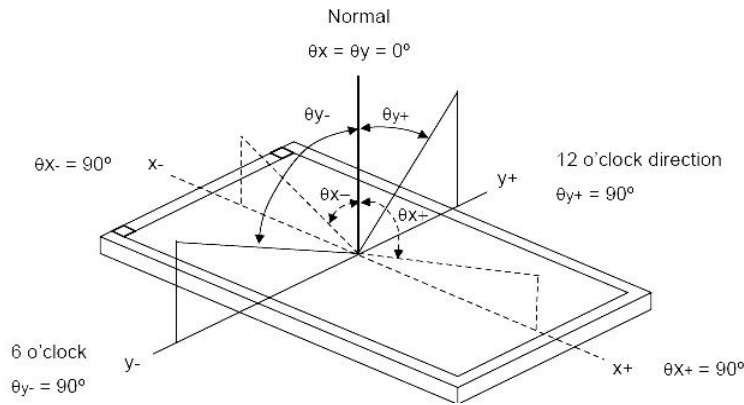
The relative measurement methods of optical characteristics are shown as below.

The following items should be measured under the test conditions described in 6.1

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0, \theta_y=0$, viewing normal angle	910	1300	—	—	—
Response Time		TL		—	14	20	ms	Note 3
Brightness uniformity		BU		70	75	—	—	Note 2
Center Luminance of White		Lc		250	300	—	cd/m2	—
The color chromatic	Red	Rx		Typ. -0.03	0.650	Typ. +0.03	—	—
		Ry			0.341		—	—
	Green	Gx			0.320		—	—
		Gy			0.626		—	—
	Blue	Bx			0.148		—	—
		By			0.070		—	—
	White	Wx			0.300		—	—
		Wy			0.330		—	—
Viewing Angle	Horizontal	θ_{x+}	CR ≥ 10	80	89	—	Deg	Note 1
		θ_{x-}		80	89	—		
	Vertical	θ_{y+}		80	89	—		
		θ_{y-}		80	89	—		

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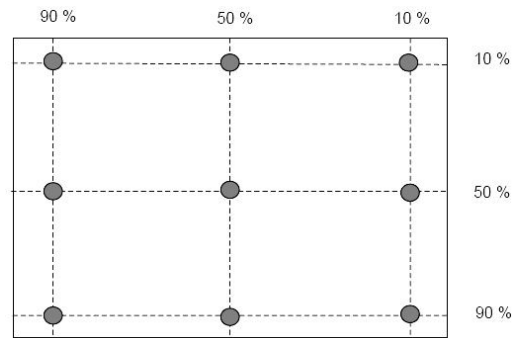
Note 1: The definition of viewing angle



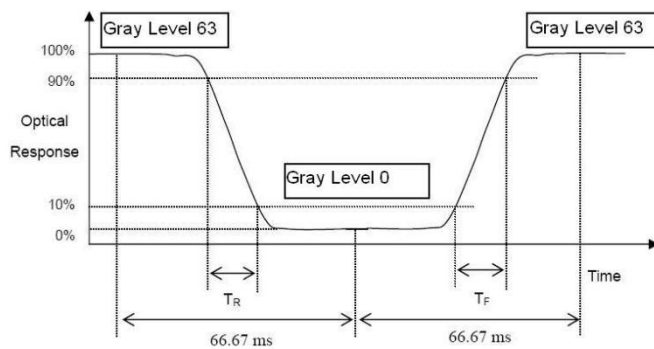
Note 2: Definition of luminance , CR measured positions and brightness uniformity

- (a) Measure White luminance on the below 9 points and take the average value .
- (b) CR : measures the same 9 points and take the average value .The Definition of Contrast Ratio is as follows :
- CR = ON(white L63)Luminance / OFF (Black L0)Luminance
- (c) The definition of White Vibration

$$\frac{\text{The minimum brightness of 9 dot}}{\text{The maximum brightness of 9 dot}} \times 100\%$$

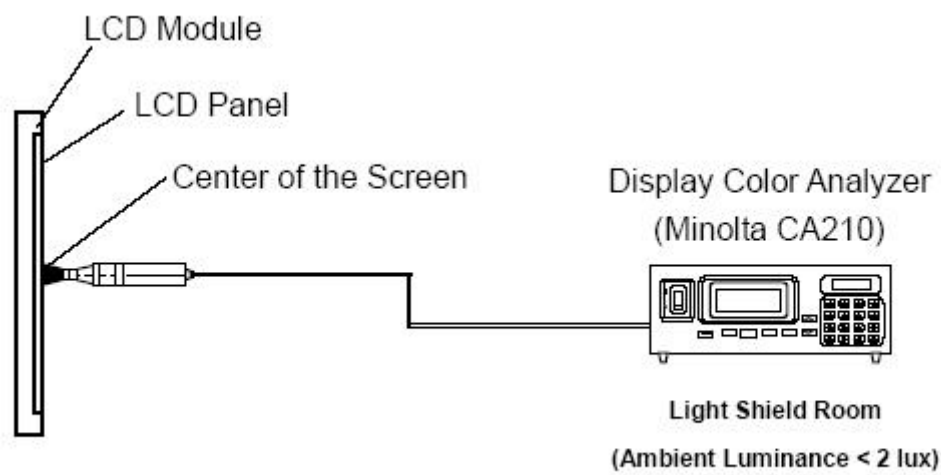


Note 3:Definition of Response Time (TR, TF):



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Note 4: The measure method



- (a) : The measurement point is the center of the active area except for the measurement of Luminance Uniformity
- (b) : Photometer :CA-210

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7.0 Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃ , 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50℃ , 50%RH, 300hours	
Low Temperature Operation (LTO)	Ta= 0℃ , 300hours	
High Temperature Storage (HTS)	Ta= 60℃ , 300hours	
Low Temperature Storage (LTS)	Ta= -20℃ , 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Random Frequency: 10 - 200 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20℃ to 60℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

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8.0 Shipping Label

8.1Panel Label



8.2 Carton Label

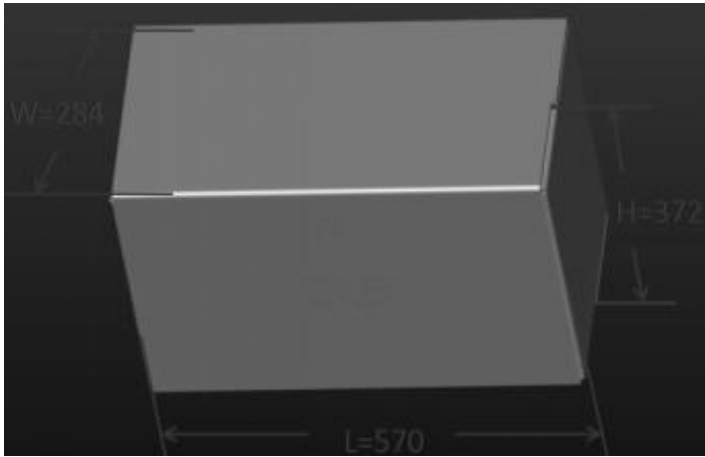
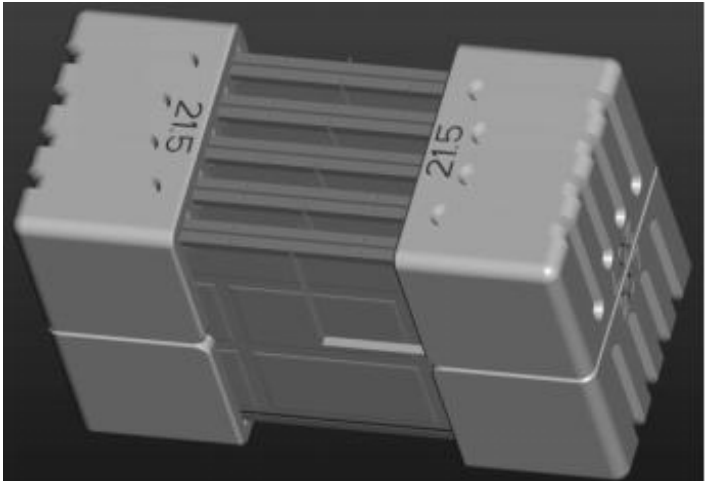


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9. Packaging

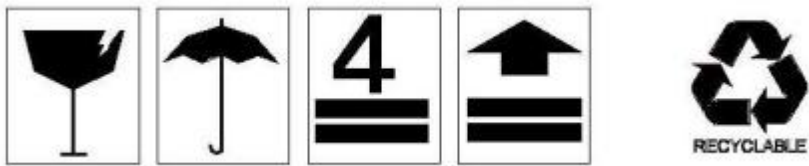
9.1 Carton(internal package)

- (1)Packaging Form
- (2) Packaging Method



Note 1) Acceptable number of piling : 10 sets

9.2 Packing Mark



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10. PRECAUTION

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- 1 Do not apply rough force such as bending or twisting to the module during assembly.
- 2 To assemble or install module into user's system can be in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- 3 It's not permitted to have pressure or impulse on the module because the LED panel and Backlight will be damaged.
- 4 Always follow the correct power sequence when LED module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
- 5 Do not pull the I/F connector in or out while the module is operating .
- 6 Do not disassemble the module.
Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very
- 7 soft and easily scratched.
- 8 It is dangerous that moisture come into or contacted the LED module, because moisture may damage LED module when it is operating.
- 9 High temperature or humidity may reduce the performance of module. Please store LED module within the specified storage conditions.
- 10 When ambient temperature is lower than 10 °C may reduce the display quality. For example, the response time will become slowly.

10.2 SAFETY PRECAUTIONS

- 1 It is dangerous that moisture come into or contacted the LED module, because the moisture may damage LED module when it is operating.
- 2 If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth, in case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- 3 After the module's end of life, it is not harmful in case of normal operation and storage.

