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San Technology (Zhuhai) Co., Ltd.

SPECIFICATION FOR LCD Module

Customer P/N:

Santek P/N: ST0500O1-RSLW-C

DOC. Revision: RS01

Customer Approval:

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	SIGNATURE	DATE
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Document Revision History

Version	Revise Date	Description	Changed by
RS01	2023-10-27	First issue	Jerry Yang

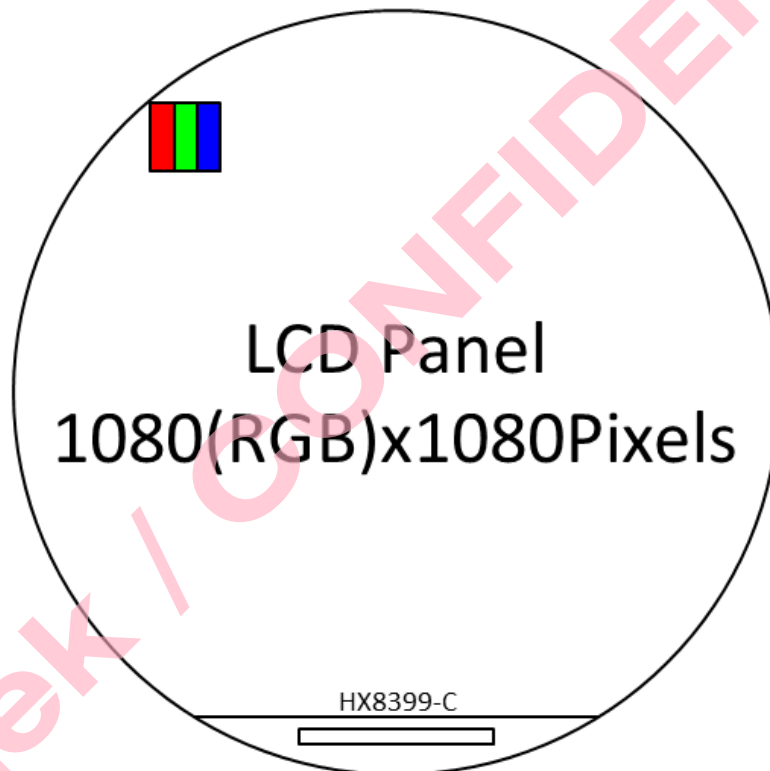
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1.GENERAL DESCRIPTION

1.1 Introduction

ST0500O1-RSLW-C is a color active matrix TFT-LCD Panel using LTPS TFT's (Thin Film Transistors) as an active switching devices. This model is composed of a TFT-LCD Panel, a driving circuit and a back light system. It is a transmissive type display operating in the normal black. This TFT-LCD has a 5.0 inch diagonally measured active area with FHD resolutions (1080 horizontal by 1080 vertical pixel array). Each pixel is divided into Red, Green, Blue dots which are arranged in 1pixel 2 domain and this panel can display 16.7M colors.



1.2 Features

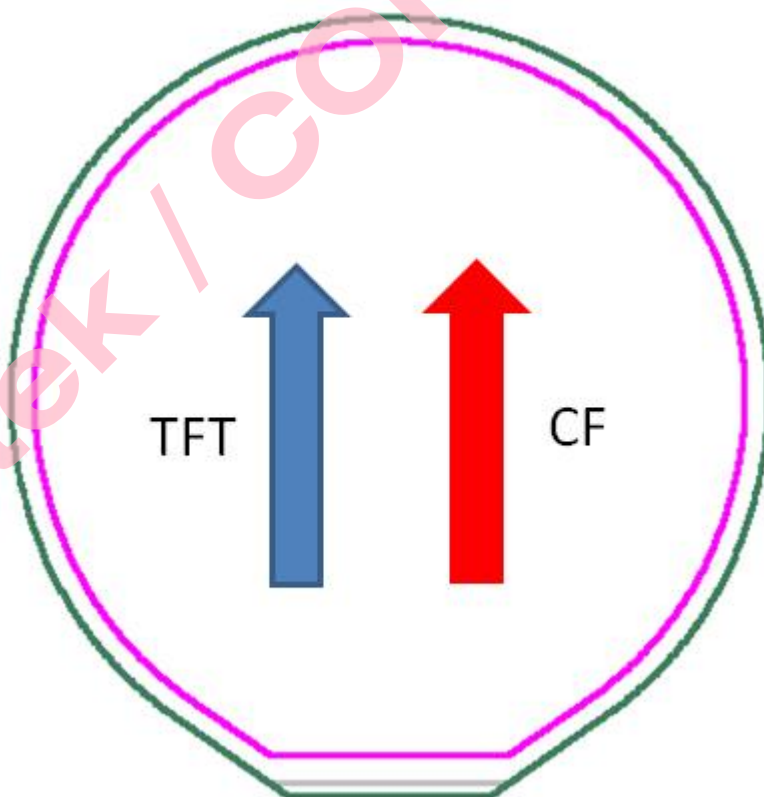
- 0.2t Glass (Single)
- High contrast ratio and wide viewing angle
- Module Design
- RoHS Compliant

1.3 General Specifications (H: horizontal length, V: vertical length)

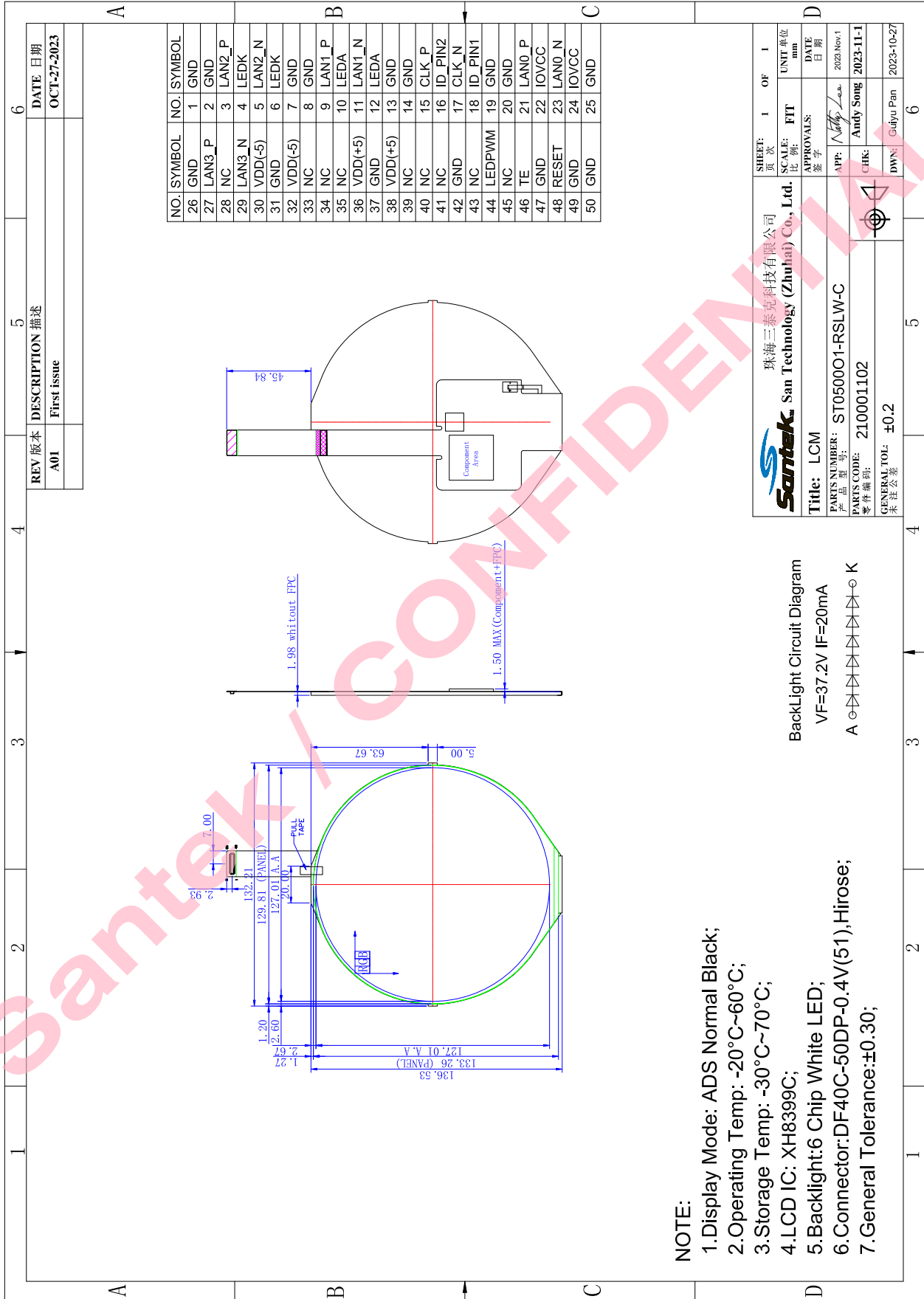
Parameter	Specification	Unit	Remark
Active Area	127.008 (H) ×127.008 (V)	mm	circle
Number of Pixels	1080(H) RGB × 1080(V)	pixels	
Pixel Pitch	0.1176 (H) ×0.1176 (V)	mm	
Pixel Arrangement	1pixel 2domain		
Display Colors	16.7 M	colors	
Color Gamut	65%(Min.) 70%(typ.)		
Display Mode	Normally Black, Transmissive mode		
Dimensional Outline	136.531x132.208x1.98	mm	
Viewing Direction (Human Eye)	U/D/L/R free viewing direction		Note 1,2

Note:

1. At the U/D/L/R direction, the viewing angle is same;
2. The TFT and CF LC Algin Direction;



2.MECHANICAL DRAWING



3.ABSOLUTE MAXIMUM RATINGS

The absolute maximum ratings are list on table as follows. When used out of the absolute maximum ratings, the LSI may be permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LSI will malfunction and cause poor reliability.

Parameter	Symbol	Spec			Unit
		Min.	Typ.	Max.	
Logic Power Supply Voltage	IOVCC	-0.3		+3.6	V
Analog Positive Power Supply	VSP	-0.3		+6.6	V
Analog Negative Power Supply	VSN	0		-6.6	V
Back-light Power Supply Voltage	V _{LED}		37.2	38.4	V
Back-light LED Current	I _{LED}		20		mA
Operating Temperature	T _{OT}	-20		60	℃
Storage Temperature	T _{ST}	-30		75	℃

Note:

If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

4.ELECTRICAL SPECIFICATIONS

4.1 TFT LCD Module DC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Power Supply Input Voltage	IOVCC	1.65	1.8	3.3	V	-
Analog Positive Power Supply	VSP	4.8	5	6	V	
Analog Negative Power Supply	VSN	-6	-5	-4.8	V	
Low Level Input Voltage	VIL	0		0.3* IOVCC	V	
High Level Input Voltage	V _{IH}	0.7* IOVCC		IOVCC	V	
Power Consumption	P _D	-	-	-	W	Note
	PBL	-	0.744	0.768	W	
	P _{Total}	-		-	W	

Note:

Frame rate=60HZ, Typ. Pattern White pattern, worst case pattern 1×1 checker 25°C.

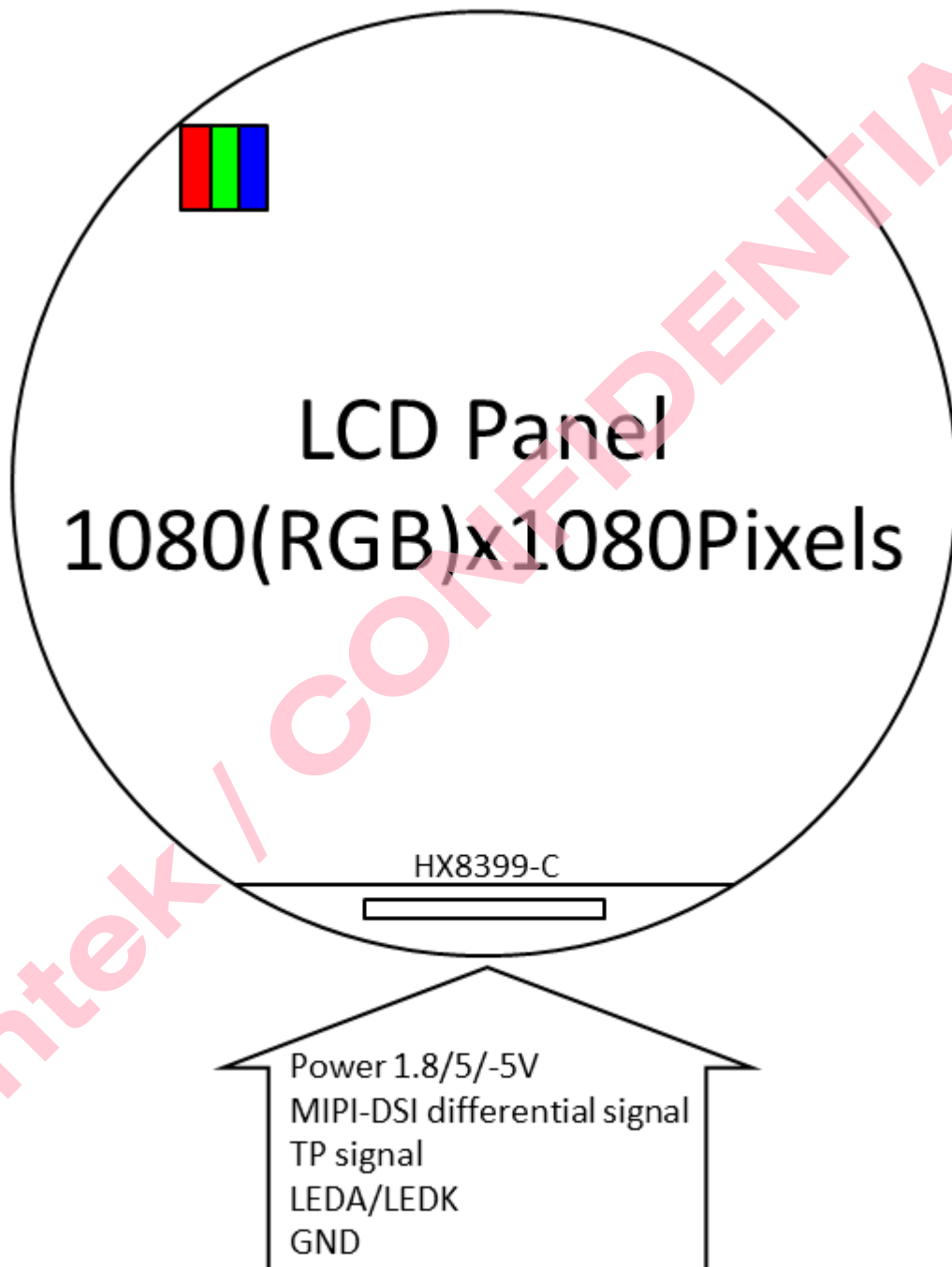
4.2 Backlight Driving Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Remark
LED Forward Voltage	V _F		37.2	38.4	V	-
LED Forward Current	I _F		25		mA	-
LED Power Consumption	P _{LED}		0.93	0.96	W	Note 1

Notes:

1. Calculate Value for reference $I_{LED} \times V_{LED} \times \text{LED Quantity} = P_{LED}$
2. The LED Life-time define as t estimated time to 50% 30000hrs degradation of initial luminous.

4.3 Block Diagram



5. INTERFACE CONNECTION

5.1 Connector Part Number

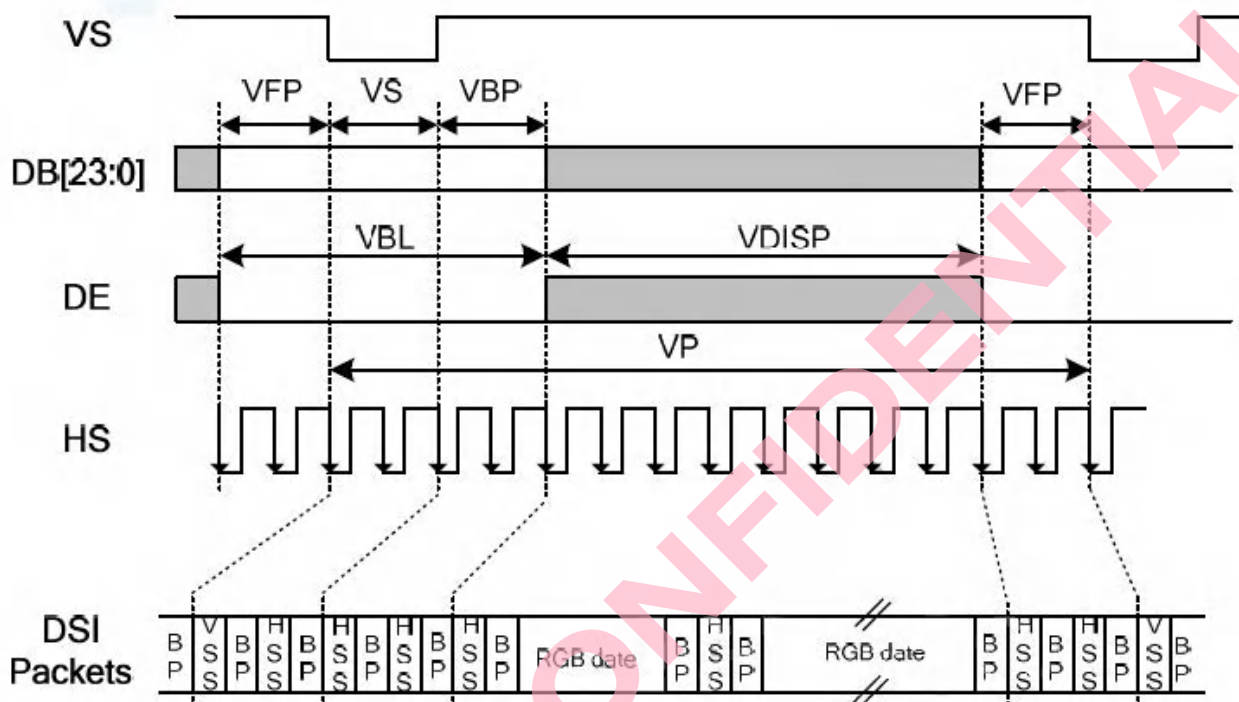
Connector Name / Designation	Signal Connector
Manufacturer	Hirose
Connector Model Number	DF40C-50DP-0.4V

5.2 Electrical Interface Connection

Pin NO.	Pin name	Function	Pin NO.	Pin name	Function
49	GND	Ground	50	GND	Ground
47	GND	Ground	48	RESET	Disp reset
45	NC	NC	46	TE	Disp tearing effect out
43	NC	NC	44	LEDPWM	Backlight pwm output
41	NC	NC	42	GND	Ground
39	NC	NC	40	NC	NC
37	GND	Ground	38	VDD(+5)	Disp +5V analog rail
35	NC	NC	36	VDD(+5)	Disp +5V analog rail
33	NC	NC	34	NC	NC
31	GND	Ground	32	VDD(-5)	Display-5V analog rail
29	LAN3_N	Disp MIPI lane 3-	30	VDD(-5)	Display-5V analog rail
27	LAN3_P	Disp MIPI lane 3+	28	NC	NC
25	GND	Ground	26	GND	Ground
23	LAN0_N	Disp MIPI lane 0-	24	IOVCC	Disp digital power
21	LAN0_P	Disp MIPI lane 0+	22	IOVCC	Disp digital power
19	GND	Ground	20	GND	Ground
17	CLK_N	Disp MIPI CLK -	18	ID_PIN1	ID pd to GND (BOE)
15	CLK_P	Disp MIPI CLK+	16	ID_PIN2	ID pu to 1.8V (BOE)
13	GND	Ground	14	GND	Ground
11	LAN1_N	Disp MIPI lane 1-	12	LEDA	LED Anode
9	LAN1_P	Disp MIPI lane 1+	10	LEDA	LED Anode
7	GND	Ground	8	GND	Ground
5	LAN2_N	Disp MIPI lane 2-	6	LEDK	LED cathode
3	LAN2_P	Disp MIPI lane 2+	4	LEDK	LED cathode
1	GND	Ground	2	GND	Ground

6.SIGNAL TIMING SPECIFICATION

Vertical Timing

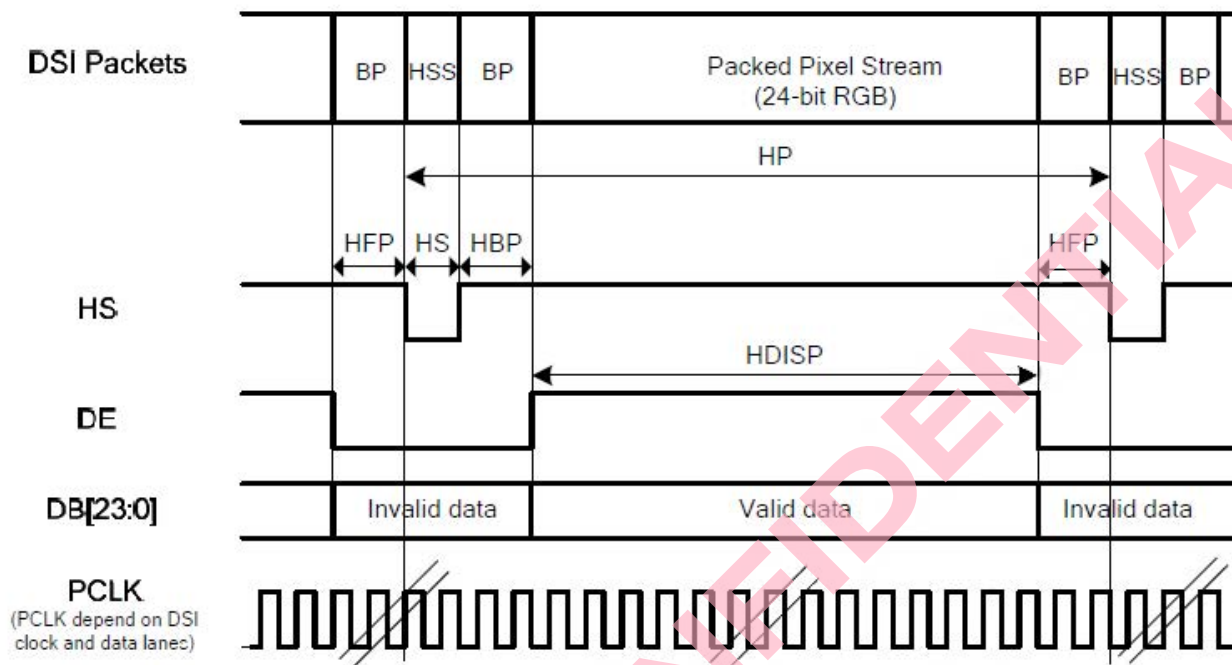


Vertical Resolution=528+8xNL (VSSA=0V, VDD1=1.8V, VDD3=2.8V, T_A=25°C)

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Vertical cycle	VP	-	534+8xNL	-	-	Line
Vertical low pulse width	VS	-	2	-	Note ⁽¹⁾	Line
Vertical front porch	VFP	-	2	-	-	Line
Vertical back porch	VBP	-	2	-	Note ⁽¹⁾	Line
Vertical data start point	-	VS+VBP	4	-	Note ⁽¹⁾	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	-	Line
Vertical active area	-	VDISP	-	528+8xNL	-	Line
Vertical Refresh rate	VRR	-	-	60	-	Hz

Note: (1) The VS and VBP pulse width are related to GSP and GCK timing. The GSP and GCK must be set at corresponding position for LCD normal display.

Horizontal Timing



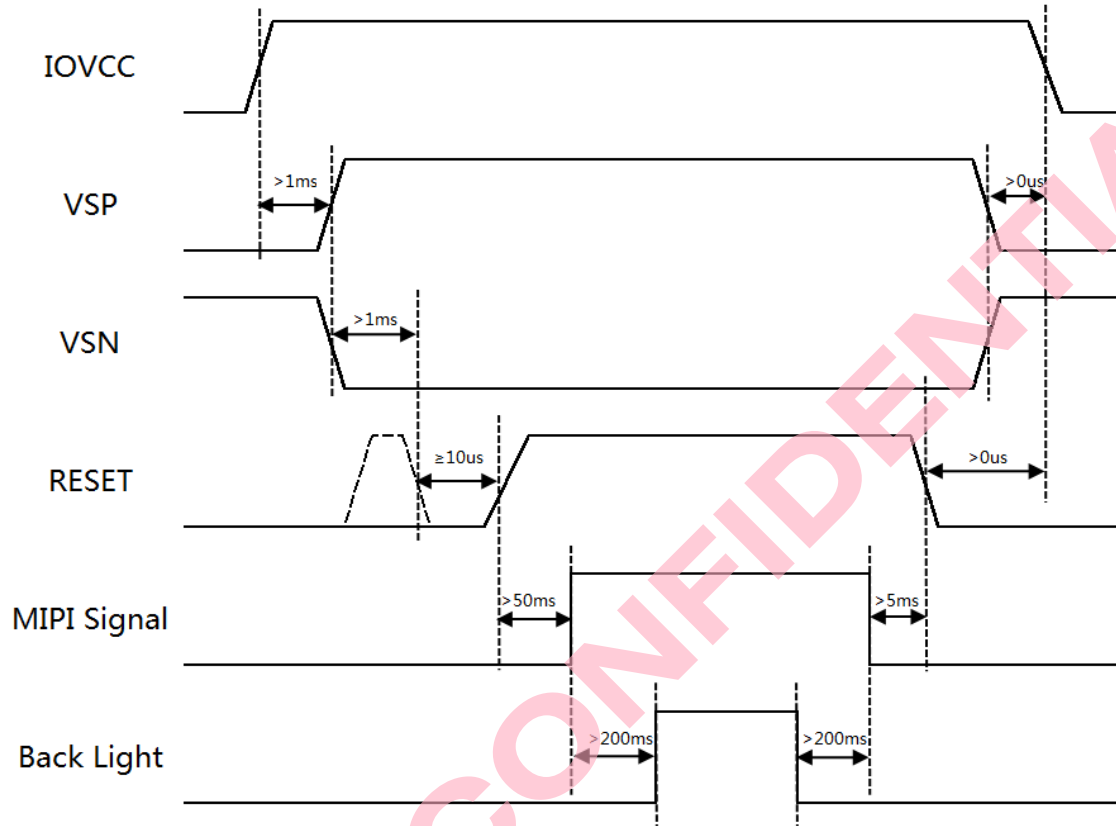
Horizontal Resolution=H_RES(1080/1024/960/900/800/720) (VSSA=0V, VDD1=1.8V, VDD3 = HS_VCC =2.8V, T_A=25°C)

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
HS cycle	HP	-	H_RES+66	-	-	DCK
HS low pulse width	HS	-	25	-	-	DCK
Horizontal back porch	HBP	-	25	-	-	DCK
Horizontal front porch	HFP	-	16	-	-	DCK
Horizontal data start point	-	HS+HBP	50 Note ⁽¹⁾	-	-	DCK
Horizontal blanking period	HBLK	HS+HBP+HFP	66	-	-	DCK
Horizontal active area	HDISP	-	-	H_RES	-	DCK

Note: (1) HS+HBP must larger than 50 PCLK.

7.POWER ON/OFF SEQUENCE

Power on/off Sequence



8.OPTICAL SPECIFICATIONS

8.1 Overview

The test of Optical specifications shall be measured in a dark room(ambient luminance $\leq$ 1 lux and temperature = $25\pm 2^{\circ}\text{C}$) with the equipment of Luminance meter system (Topcon SR-UL1R and Westar TRD-100A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° .The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.

8.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ3	CR>10	70	80		°	Note 1
		Θ9		70	80		°	
	Vertical	Θ12		70	80		°	
		Θ6		70	80		°	
Contrast Ratio		CR	Θ= 0°	800	1300			Note 2
Luminance		cd/m²	Θ= 0°	300	350		nit	Note 3
White Uniformity		%	Θ= 0°	70				Note 4
NTSC		%	Θ= 0°	65	70			
Reproduction Of color	Red	Rx	Θ= 0°	0.656	0.686	0.716		Note 5 * Module
		Ry		0.274	0.304	0.334		
	Green	Gx		0.234	0.264	0.294		
		Gy		0.599	0.629	0.659		
	Blue	Bx		0.117	0.147	0.177		
		By		0.017	0.047	0.077		
White		Wx	Θ= 0°	0.276	0.306	0.336		
		Wy		0.288	0.318	0.348		
Response Time		Tr+Tf Θ= 0°	Ta=+25°C			40	ms	Note 6

Note:

- Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.1).
- Contrast measurements shall be made at viewing angle of $\Theta = 0^{\circ}$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIG. 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$\text{CR} = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. This measurement shall be taken at the locations shown in FIG. 1.

4. Uniformity measurement shall be taken at the locations shown in FIG. 2, for a total of the measurements per display, measure surface luminance of these nine points across the LCD surface 50cm from the surface with all pixels displaying white.

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

5. The color chromaticity coordinates specified in Table1 shall be calculated from The spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the Module.

6. The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Tf.

Figure 1. Measurement Set Up

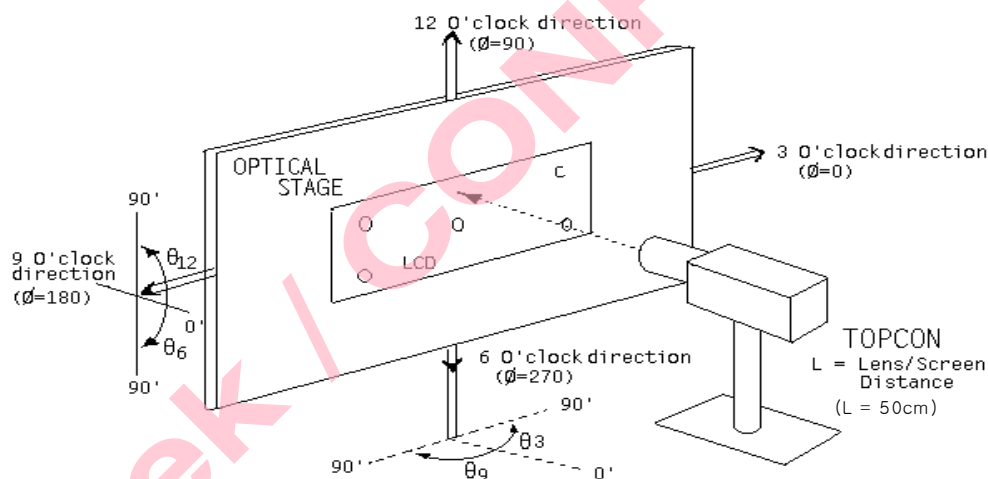
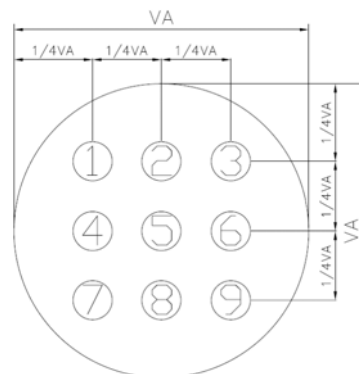
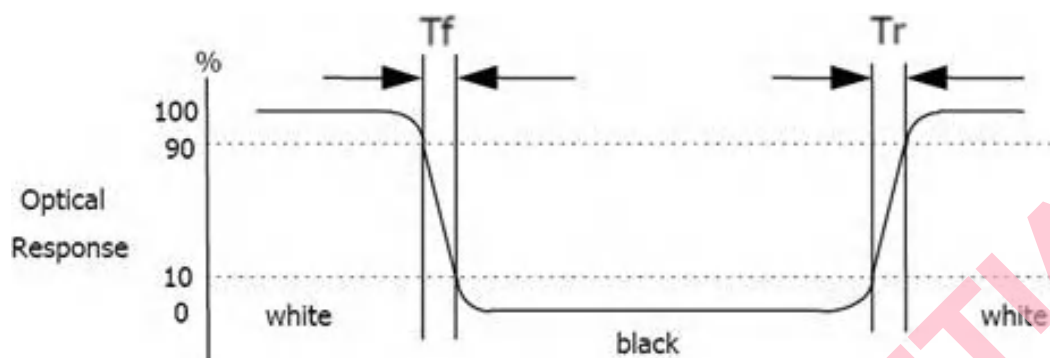


Figure 2. Uniformity Measurement Locations





9.MECHANICAL CHARACTERISTICS

9.1 Dimension Requirements for LCD Part

Mechanical outlines for the panel (H: horizontal length, V: Vertical length)

Parameter	Specification	Unit	Remark
Panel size	129.808(H) × 133.258(V)	mm	
CF size	129.808(H) × 130.908(V)	mm	
Active area	127.008(H) × 127.008(V)	mm	circle
Number of pixels	1080(H)RGB × 1080(V)	pixels	
	(1 pixel = R + G + B dots)		
Pixel pitch	0.1176(H) × 0.1176(V)	mm	
Pixel arrangement	1pixel 2domain		
Dimensional outline	136.531x132.208x1.98		circle
Display mode	Normally Black		