

LCD MODULE SPECIFICATION

Model:	UE016WV-RB14-L005A
Version:	V1.0
Date:	2023-10-9

Customer Confirmation 客户确认

Approved by	Notes

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Prepared by	Reviewed by	Approved by

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1. GENERAL INFORMATION

1.1 Features

- 1) Pixel Arrangement: RGB Vertical Stripe
- 2) Interface Mode: QSPI
- 3) Driver IC: ST77903
- 4) Operation Temperature: -20~70℃
- 5) Storage Temperature: -30~80℃
- 6) Backlight Type: White LED
- 7) Display mode: Normally Black
- 8) Pixel Density: 255 PPI
- 9) LED life time: 30,000 Hours

1.2 Mechanical Specification

Item 项目	Specification 规格	Unit 单位	Remark 备注
Pixel Driving element	IPS, TFT	-	-
Screen Size	1.6	Inch	Diagonal
Resolution	400(W)*3(RGB)*400(H)	Dots	-
Interface	QSPI	-	40PIN
Module Power Consumption	0.246	Watt	Typ.
Active Area	39.84 (∅)	mm	-
Pixel pitch (W*H)	33.2(W)*99.6(H)	um	-
Module Size (W*H*D)	42.04(W)*44.34(H)*1.93(D)	mm	-
Luminance	300	cd/m ²	Typ.
Viewing Direction	ALL	O'clock	-
Display Color	16M	Colors	24bits

2. ABSOLUTE MAXIMUM RATINGS

Item 项目	Symbol 符号	Min. 最小值	Max. 最大值	Unit 单位	Remark 备注
Power supply voltage1	VCC3.3V	-0.5	3.6	V	Note1
LED forward current	I _F	-0.001	60	mA	For each led,Note1
LED Reverse Voltage	V _R	-	3.3	V	For each led,Note1
Operating temperature	T _{op}	-20	70	°C	Note1,2
Storage temperature	T _{st}	-30	80	°C	Note1,2
Humidity	H _{st}	10	90	%RH	Note1,3

(Ta=+25°C,GND=0V)

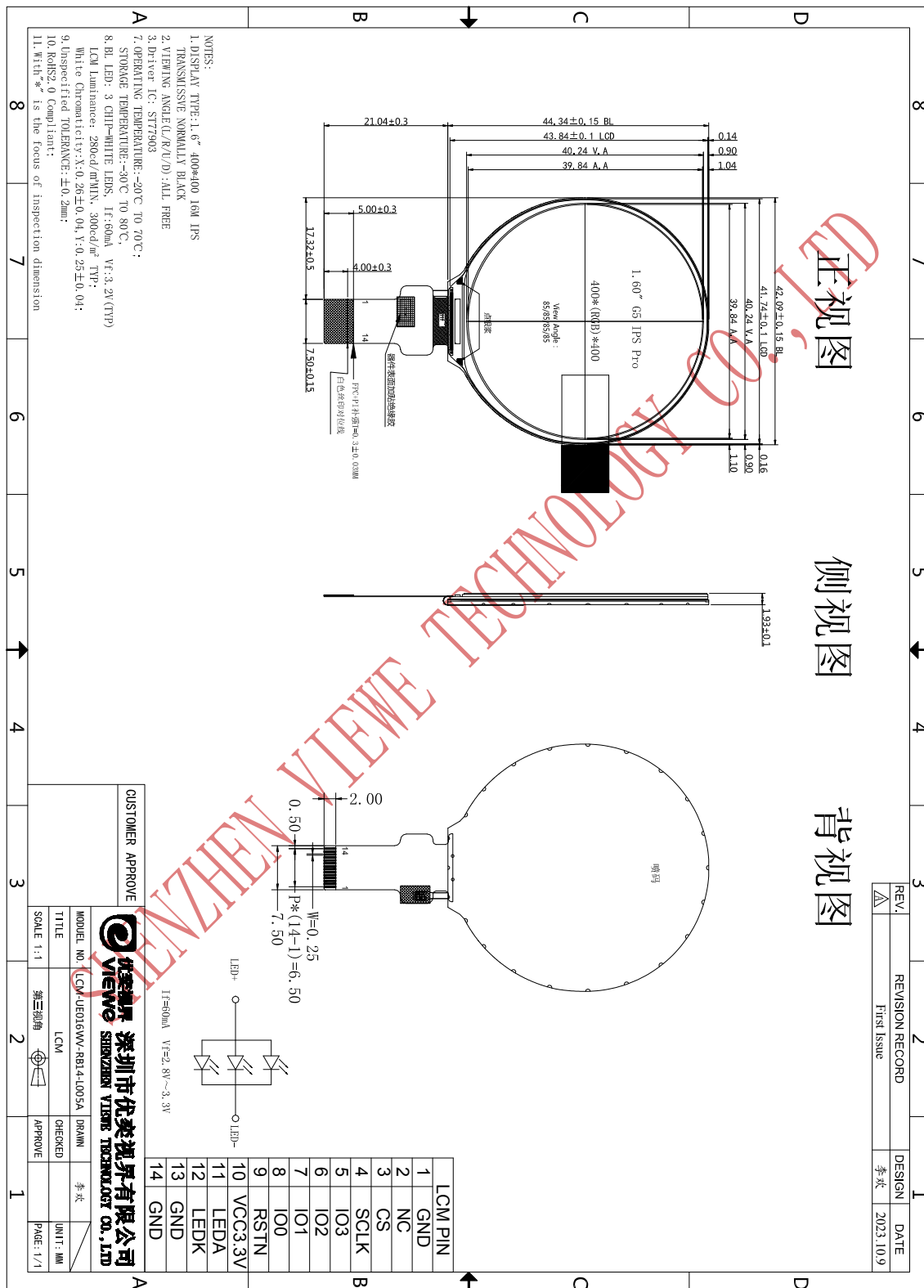
Note1:If the module exceeds the absolute maximum ratings, it may be damaged permanently. Also if the module operates with the absolute maximum ratings for a long time, the reliability may drop.

Note2: In case of temperature below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel darker than normal one.

Note3: Temp. ≤ 60°C , 90% RH MAX.

Temp. > 60°C , Absolute humidity shall be less than 90% RH.

3. MECHANICAL DRAWING



4. Input Terminal Pin Assignment

I: Input; O: Output; P: Power

Pin No.	Symbol 符号	I/O	Description 描述
1	GND	P	Power Ground
2	NC	-	Dummy
3	CS	I	Chip selection pin. Low-active
4	SCLK	I	The serial input in serial interface mode
5-8	IO3-IO0	I	Q SPI Data PIN
9	RSTN	I	The signal will reset the LCM, Signal is active low.
10	VCC3.3	P	Power supply for analog and booster circuits. Power supply for I/O system.
11	LED A	P	Power supply for backlight anode
12	LED K	P	Power supply for backlight cathode
13-14	GND	P	Power Ground

I: Input; O: Output; P: Power

5. ELECTRICAL CHARACTERISTICS

5.1 TFT-LCD Panel Driving Section

Item 项目	Symbol 符号	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Power Supply Voltage ²	VCC	2.8	3	3.3	V	-
Power Supply Current ²	Ivcc	-	20	-	mA	Note1
Logic Input High Voltage	V _{IH}	0.7VDD	-	VDD	V	-
Logic Input Low Voltage	V _{IL}	0	-	0.3VDD	V	-
Panel Power Consumption	P _{VDD}	-	0.06	-	Watt	Note1
Module Power Consumption	P _{LCM}	-	0.246	-	Watt	Note1,2

(Ta=+25°C, GND=0V)

Note1: Measurement Conditions (Video Mode): Full Screen Red Pattern, VDD=3.3V, 60Hz Refresh.

Note2: $P_{LCM} = P_{VDD} + P_{BL}$, About P_{BL} information, inference to 5.2 Back Light Driving Section.

5.2 Back Light Driving Section

Item 项目	Symbol 符号	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Forward Voltage	-	-	3.1	-	V	Note1
Forward Current	I _F	-	60	-	mA	Note1
Backlight Power consumption	P _{BL}	-	0.186	-	Watt	Note1
LED life time	-	30000	-	-	Hrs	Note2
LED Quantity			3		PCS	

(Ta=+25°C, GND=0V)

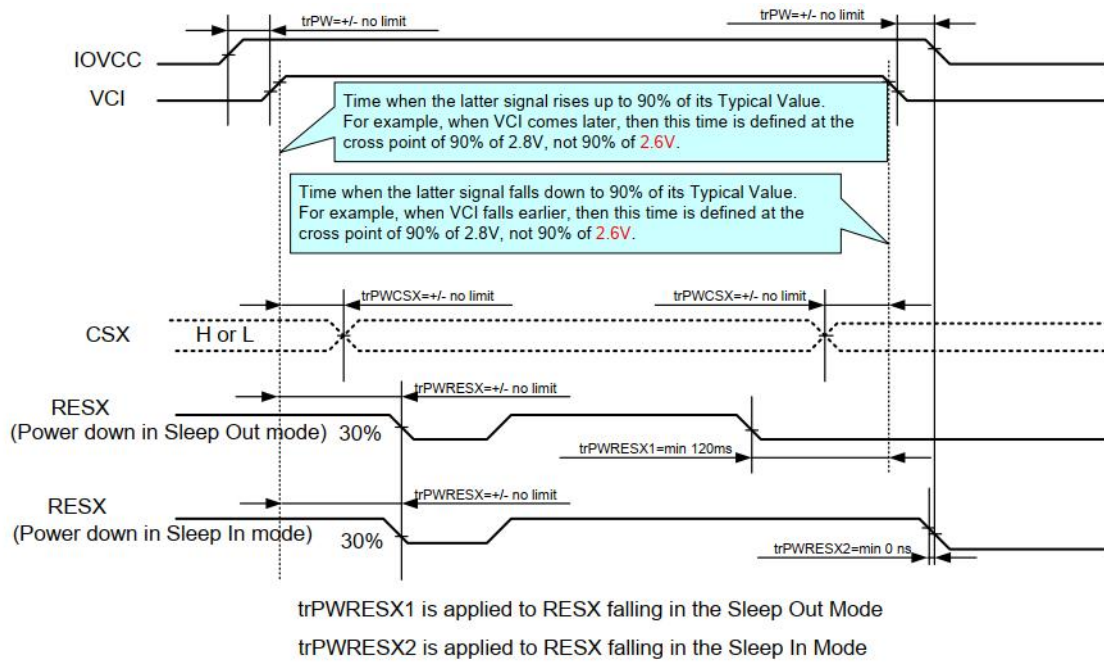
Note1: The LED driving condition is defined for each LED module

Note2: The "LED life time" is defined as the module brightness decrease to 50% of original brightness at I_{LED}=20mA (Per Led). The LED life time could be decreased if operating I_{LED} is larger than 20mA.

5.3 Power On/Off

5.3.1 Case 1 - RESX Line is Held High or Unstable by Host at Power ON

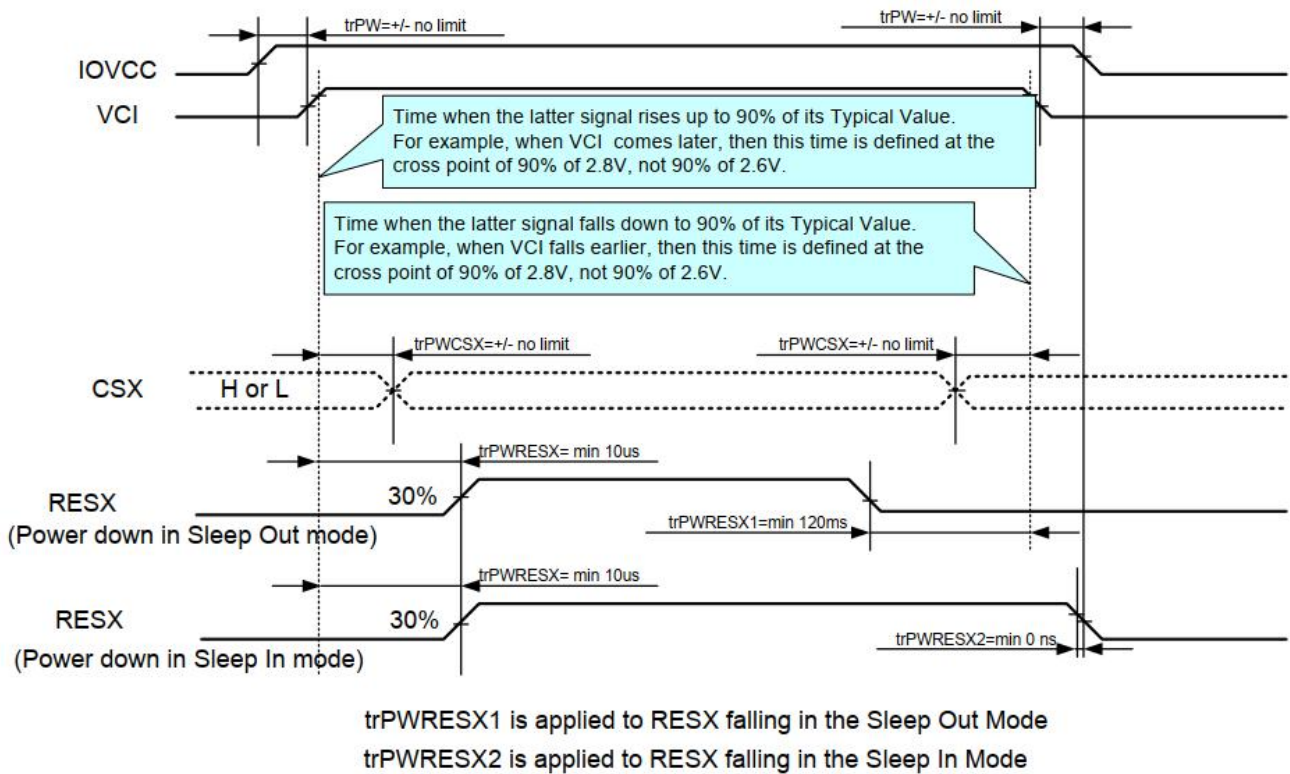
If the RESX line is held High or unstable by the host during Power On, then Hardware Reset must be applied after both VCI and IOVCC have been applied. Otherwise, the correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.



Note: Unless otherwise specified, timings herein show the cross point at 50% of the signal power level.

5.3.2 Case 2 - RESX Line is Held Low by Host at Power ON

If the RESX line is held Low (and stable) by the host during Power On, then the RESX must be held low for a minimum of 10μsec after both VCI and IOVCC have been applied.

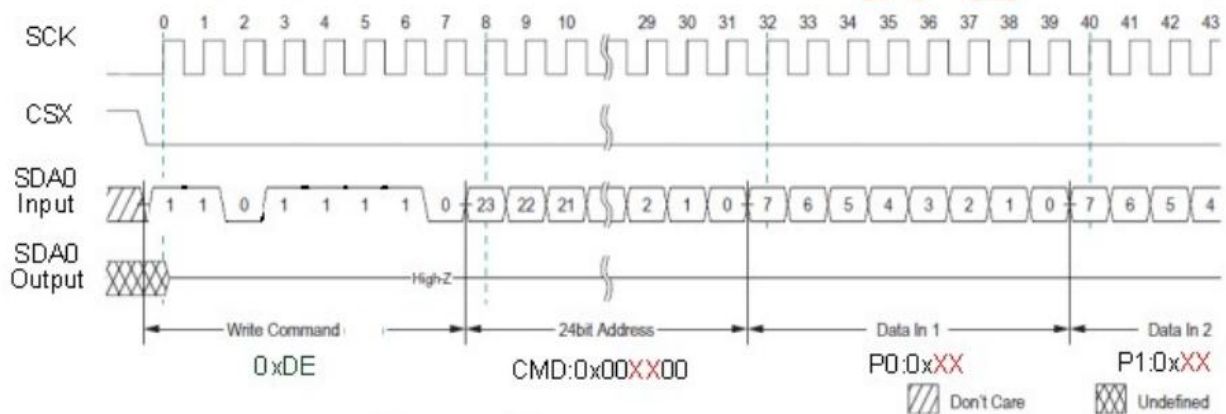


5.4 Timing Characteristics

Pin Name	Description
SCKP	Clock signal (Max=50MHz)
DA0	Serial input data lane 0
DA1	Serial input data lane 1
DA2	Serial input data lane 2
DA3	Serial input data lane 3

Write command mode

When host writes commands or parameter to ST77903, host needs to send 1 byte of write command instruction (0xDE). Then host sends 3 bytes of AD[23:0] which is composed of 1 byte of 0x00, 1 byte of command address and 1 byte of 0x00. After host sending instruction and AD[23:0], the following data is parameter (are parameters). When the last bit of parameter has been sent, CSX pin should be returned "H" level.

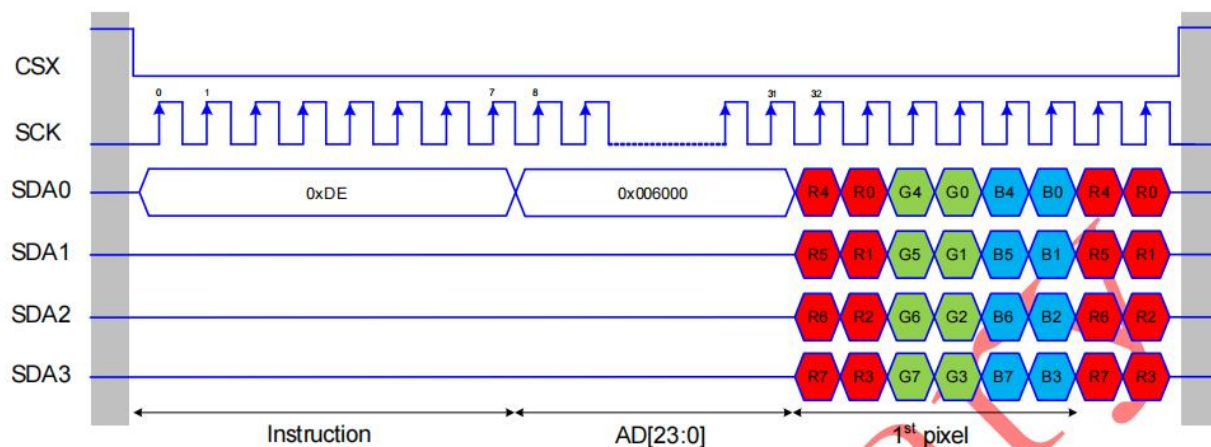


Write pixel data

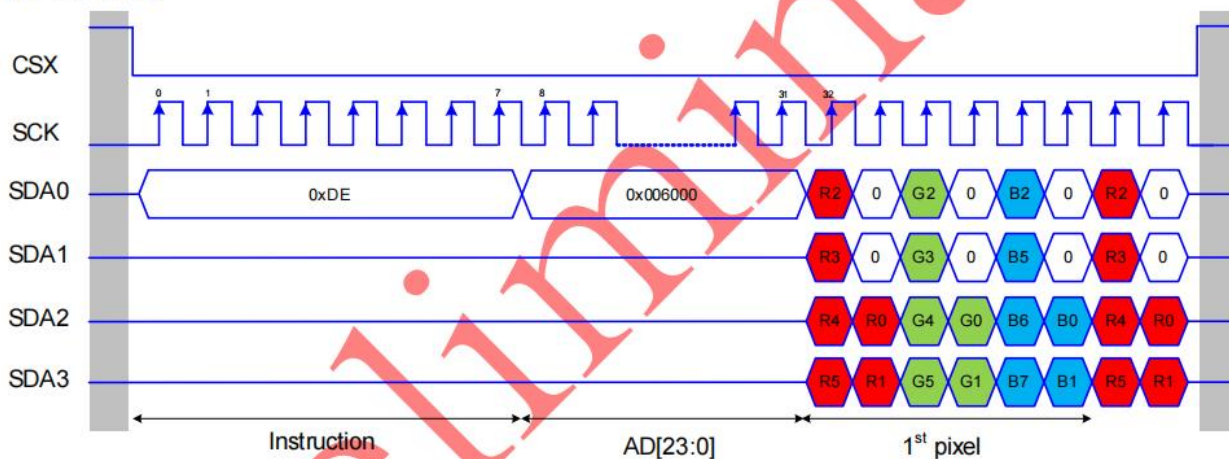
In write pixel data mode, the host sends one byte of instruction, 3 byte of AD[23:0] and pixel data. The instruction is transferred only by one lane of DA0, and data can be transferred 4 DA lanes.

The 0xDE+0x006100 must be issued at the beginning of each frame. The 0xDE+0x006000 must be issued at the beginning of each line.

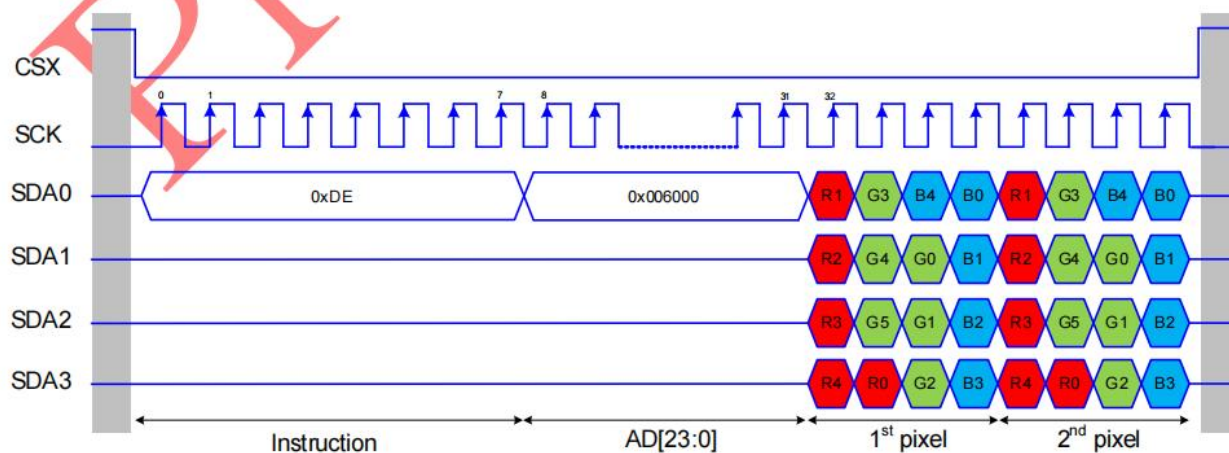
QSPI RGB888



QSPI RGB666



QSPI RGB565



5.5 Display Serial Interface (QSPI)Timing Characteristics

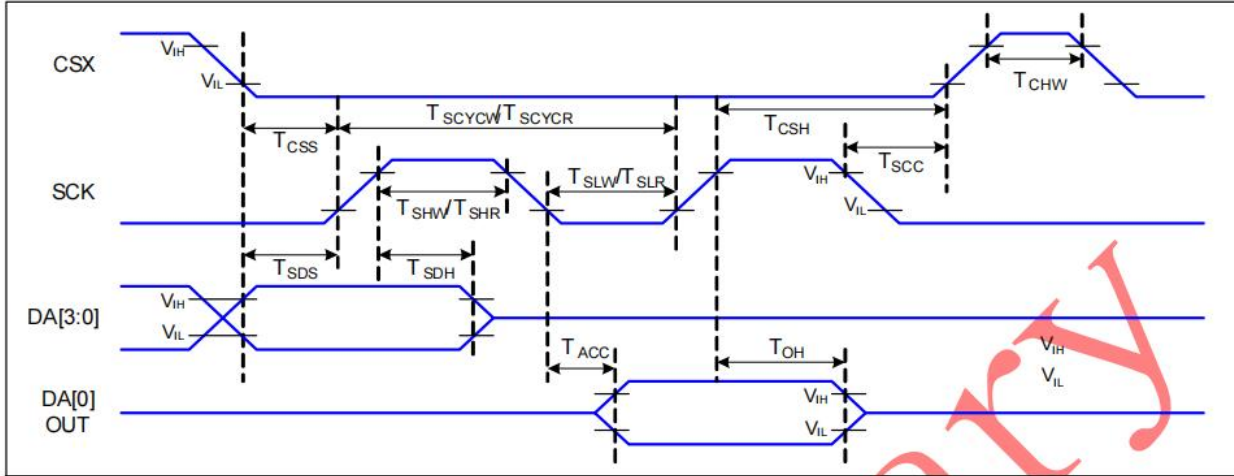


Figure 1 QSPI Interface Timing Characteristics

Figure 1 QSPI Interface Timing Characteristics

$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=25^{\circ}C$

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	19		ns	
	T_{CSH}	Chip select hold time (write)	19		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
			500		ns	Note 1
SCL	T_{SCYCW}	Serial clock cycle (Write)	20		ns	
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	TBD	TBD	ns	For minimum CL=8pF

Table 1 QSPI Interface Characteristics

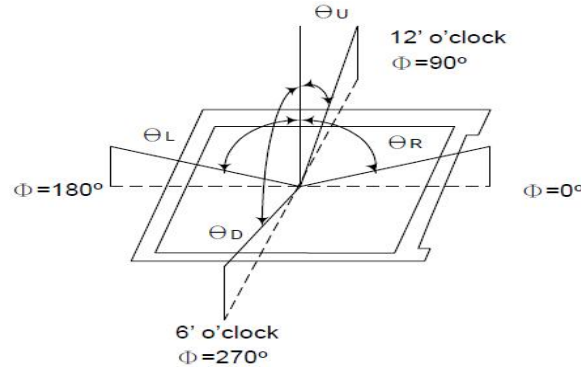
6.OPTICAL CHARACTERISTICS

Parameter 参数	Symbol 符号	Condition 条件	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Contrast Ratio	C/R	$\theta = 0^\circ$	1000	1200	-	-	Note(4)
NTSC Ratio	S	$\theta = 0^\circ$	65	65	-	%	Note(7)
Luminance	L	$\theta = 0^\circ$	-	300	-	cd/m ²	Note(5)
Luminance uniformity	U _w	$\theta = 0^\circ$	70	80	-	%	Note(3)
Response Time	T _R + T _F	25 °C	-	25	35	ms	Note(2)
Color Coordination	W _X	$\theta = 0^\circ$ (Center) Normal viewing angle B/L On	-	0.294	-	NTSC (x,y)	Note(6)
	W _Y		-	0.335	-		
	R _X		-	0.660	-		
	R _Y		-	0.323	-		
	G _X		-	0.280	-		
	G _Y		-	0.571	-		
	B _X		-	0.134	-		
	B _Y		-	0.132	-		
Viewing Angle	θ_L	C/R>10	80	85	-	Degree	Note(1)
	θ_R		80	85	-		
	θ_U		80	85	-		
	θ_D		80	85	-		

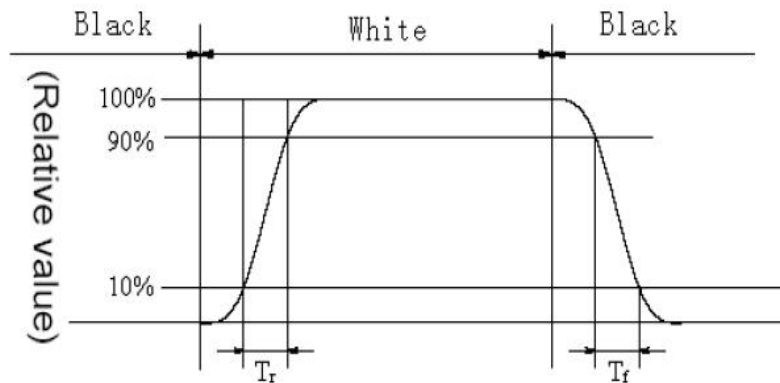
Test Conditions:

1. VDD=3.3V, I_F=20mA (Backlight current), the ambient temperature is +25°C.
2. The test systems refer to Note 8.

Note1: Definition of Viewing Angle: The viewing angle range that the CR>10

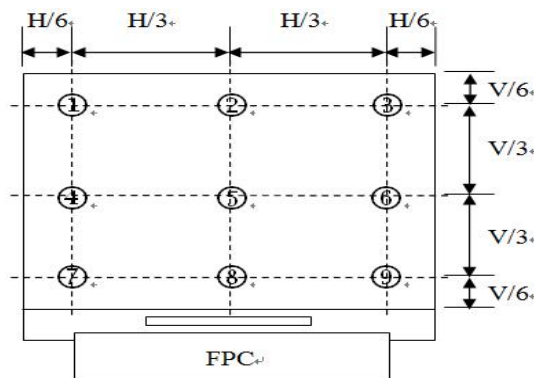


Note2: Definition of Response time: Sum of T_R and T_F



Note 3: Definition of Luminance Uniformity: Active area is divided into 9 measuring areas, every measuring point is placed at the center of each measuring area.

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



Note4: Definition of Contrast Ratio (CR): measured at the center point of panel

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

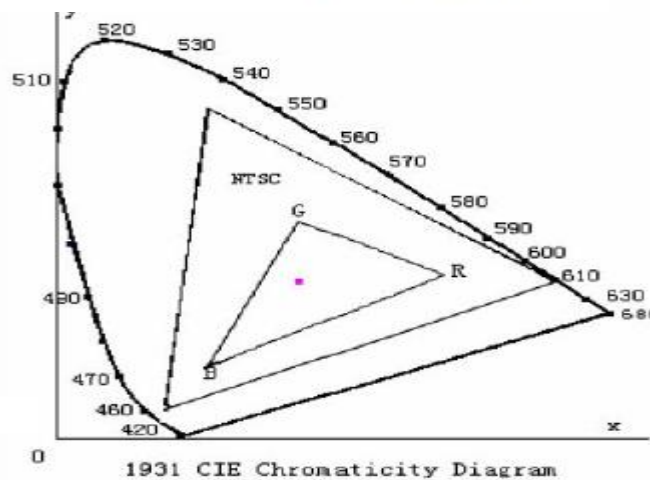
Note 5: Definition of Luminance: Center Luminance of white is defined as luminance values of 1 point average across the LCD surface.

Note 6: Definition of Color Chromaticity (CIE 1931)

Color coordinates of white & red, green, blue measured at center point of LCD.

Note 7: Definition of NTSC ratio:

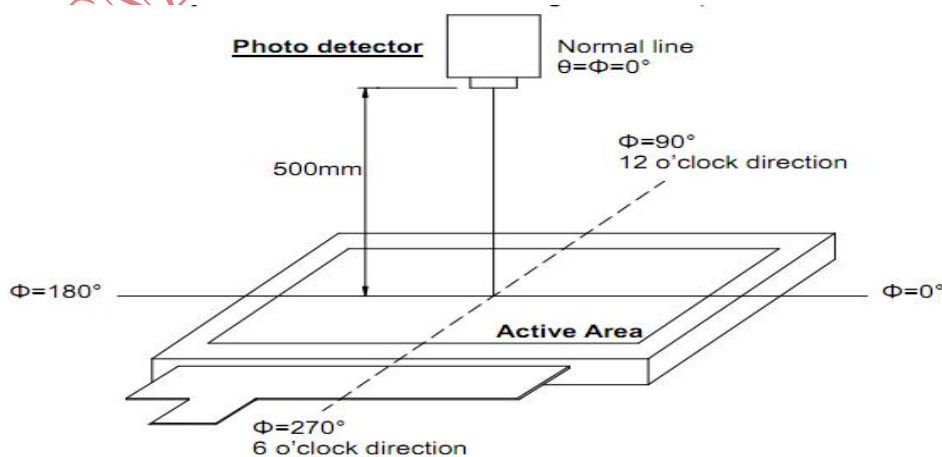
$$\text{NTSC ratio} = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}}$$



Note 8: Definition of measurement system.

optical

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, Field of view: 1°/Height: 500mm.)



7.RELIABILITY

Item 项目	Test Condition 测试条件	Remark 备注
High Temperature Storage	Ta =+80°C / 96Hours	Note1,2,3
Low Temperature Storage	Ta =-30°C / 96Hours	Note1,2,3
High Temperature Operating	Ta =+70°C / 96Hours	Note1,2,3
Low Temperature Operating	Ta =-20°C / 96Hours	Note1,2,3
Temperature Cycle storage Test	-10°C/30min ↔ +60°C /30min for 30cycles, Transfer time less than 5min	Note2,3
Thermal humidity storage Test	50°C x 90%RH / 96Hours	Note2,3
Package Vibration Test	Frequency: 10Hz~55Hz, Amplitude:1.5mm, 1 hrs for each direction of X, Y, Z	Note2
Packing shock test	Drop to the ground from 60cm height, 1 corner, 3 edges, 6 surfaces.	Note2

Inspection after Test:

Note1: Ta is the ambient temperature of samples.

Note 2: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 3: Before cosmetic and function tests, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.



8. PACKAGE DRAWING

