

LCD MODULE SPECIFICATION

Model:	UE029WV-RB31-L001A
Version:	V1.0
Date:	2020.11.12

Customer Confirmation 客户确认

Approved by	Notes

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Prepared by	Reviewed by	Approved by

REVISION HISTORY

Revision 版本号	Date 日期	Contents of Revision Change 修改内容	Remark 备注
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1. GENERAL INFORMATION

1.1 Features

- 1) Pixel Arrangement: RGB Vertical Stripe
- 2) Interface Mode: 3 Wire + RGB 16 Bit
- 3) Driver IC: ST7701S
- 4) Operation Temperature: -20~70℃
- 5) Storage Temperature: -30~80℃
- 6) Backlight Type: White LED
- 7) Display mode: Normally Black
- 8) Pixel Density: 360 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	2.86	Inch	Diagonal
Resolution	376(W)*3(RGB)*960(H)	Dots	-
Interface	3 wire + RGB	-	16Bit
Module Power Consumption	0.336	Watt	Typ.
Active Area	26.51(W)*67.68(H)	mm	-
Pixel pitch (W*H)	0.0825(W)*0.0825(H)	mm	-
Module Size (W*H*D)	29.90(W)*75.55(H)*2.21(D)	mm	Typ
Luminance	230	cd/m ²	Typ.
Viewing Direction	ALL	O'clock	
Display Color	262K	Colors	16bits

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 supply1 voltage	VCC	-0.3	4.6	V	Note1
Power supply2 voltage	IOVCC	-0.3	4.6	V	Note1
LED forward current	I _F	-0.001	20	mA	For each led,Note1
LED Reverse Voltage	V _R	-	5	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 at 60°C.

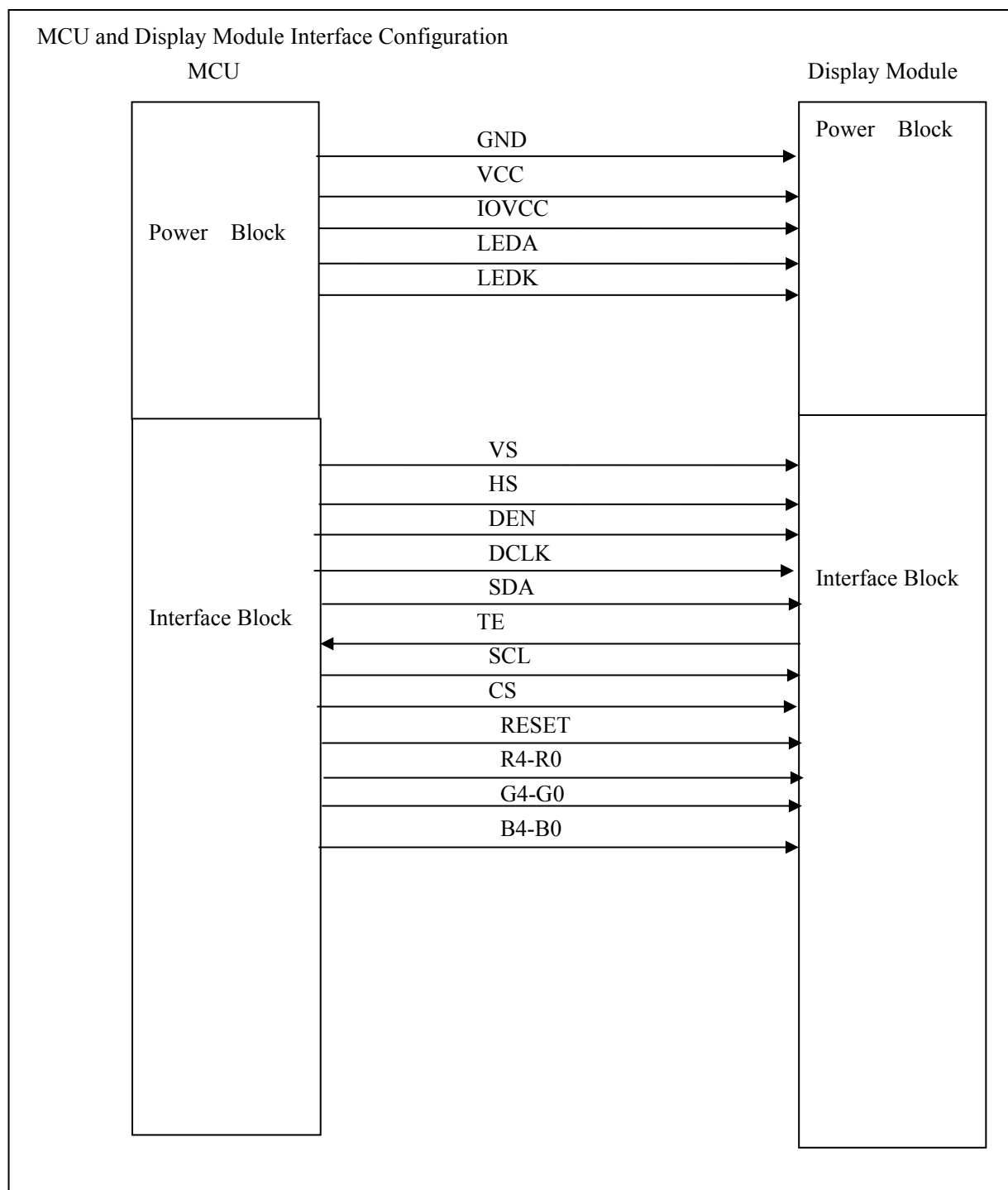
4. I/O CONNECTION & BLOCK DIAGRAM

4.1 I/O Connection

Pin No. 序号	Symbol 符号	I/O	Description 描述
1	VS	I	Frame synchronizing signal
2	HS	I	Line synchronizing signal.
3	DEN	I	A data ENABLE input signal.
4	DCLK	I	Dot clock signal.
5	GND	P	Ground pin for analog circuits.
6	SDA	I/O	The data is applied on the rising edge of the SCL signal.
7	TE	O	Tearing effect outputsignal. If not used, please let this pin
8	SCL	I	Serial interface clock.
9	CS	I	A chip select signal.
10	RESET	I	This signal will reset the device and must be applied
11-15	R4-R0	I	Data Pin
16-21	G5-G0	I	Data Pin
22-26	B4-B0	I	Data Pin
27	VCC	P	Power supply for interface logic circuit. 2.8V
28	IOVCC	P	Power supply for interface logic circuit..
29	GND	P	Ground pin for analog circuits.
30	LEDA	P	LED power anode.
31	LEDK	P	LED power anode.

I: Input; O: Output; P: Power

4.2 Block Diagram



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 Supply1 Voltage	VCC	2.5	2.8	3.6	V	-
Power Supply2 Voltage	IOVCC	1.65	1.8	3.3	V	-
Logic Input High Voltage	V _{IH}	0.7IOVCC	-	IOVCC	V	-
Logic Input Low Voltage	V _{IL}	0	-	0.3IOVCC	V	-
Panel Power Consumption	P _D	-	0.08	-	Watt	Note1
Module Power Consumption	P _{ALL}	-	0.336	-	Watt	Note1,2

(Ta=+25°C,GND=0V)

Note1:Measurement Conditions (Video Mode): Full Screen Red Pattern,VDD=1.8V,60Hz Refresh.

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

5.2 Back Light Driving Section

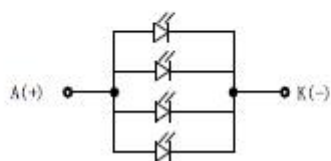
Item 项目	Symbol 符号	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Forward Voltage	V _F	3	3.2	3.3	V	Note1
Forward Current	I _F	-	80	-	mA	Note1
Backlight Power consumption	P _{B/L}	-	0.256	-	Watt	Note1
LED life time	-	30000	-	-	Hours	Note2
LED Quantity	-	4			PCS	

(Ta=+25°C,GND=0V)

Note1: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.

LED CIRCUIT DIAGRAM:

V_F=3.2V, I_F=80mA



5.3 Power On/Off Sequence

5.3.1 Power On/Off Timing

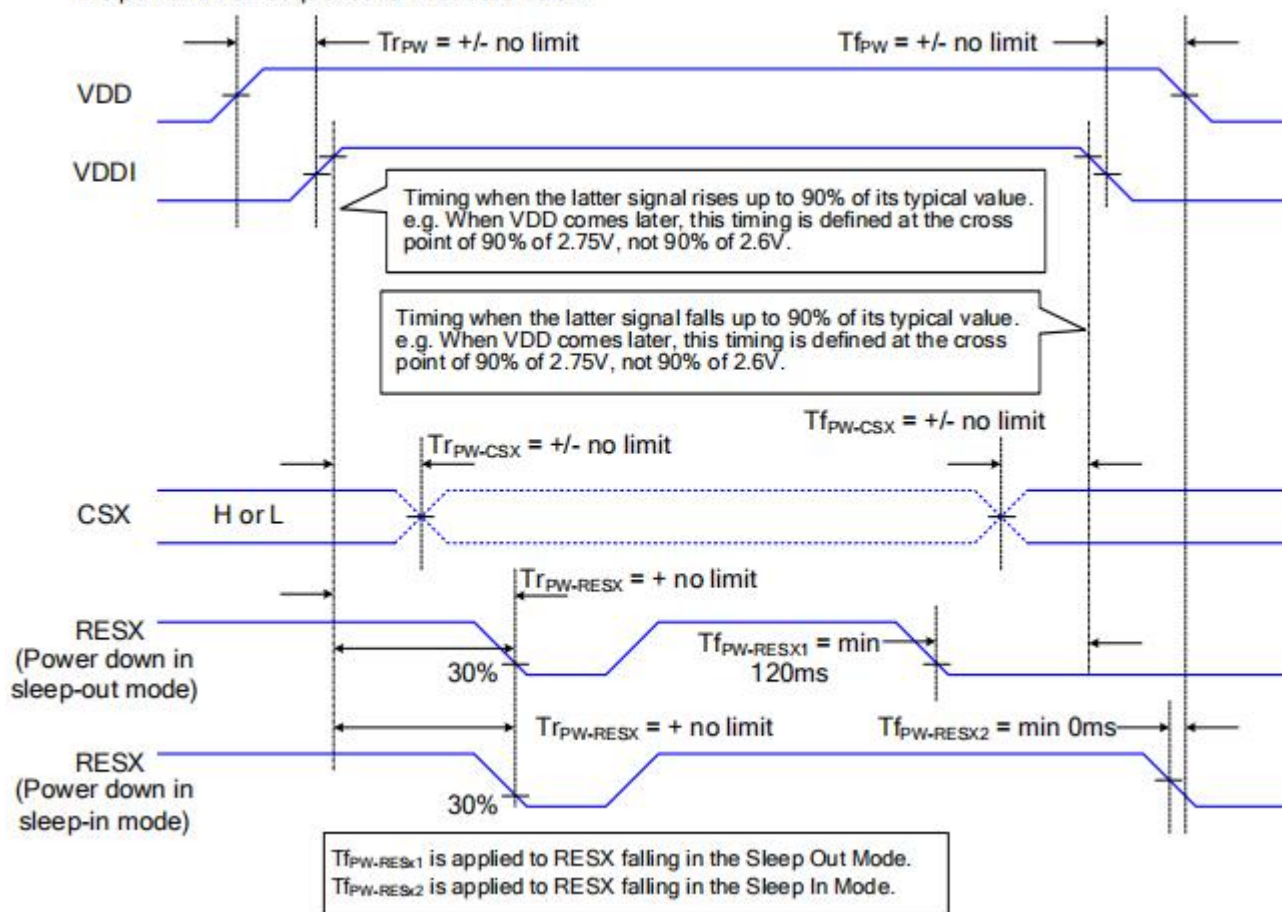
VDDI and VDDA can be applied or powered down in any order. During the Power Off sequence, if the LCD is in the Sleep Out mode, VDDA and VDDI must be powered down with minimum 120msec. If the LCD is in the Sleep In mode, VDDA and VDDI can be powered down with minimum 0msec after the RESX is released.

CSX can be applied at any timing or can be permanently grounded. RESX has high priority over CSX.

Notes:

1. There will be no damage to the ST7701S if the power sequences are not met.
2. There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
3. There will be no abnormal visible effects on the display between the end of Power On Sequence and before receiving the Sleep Out command, and also between receiving the Sleep In command and the Power Off Sequence.
4. If the RESX line is not steadily held by the host during the Power On Sequence as defined in Sections 9.1 and 9.2, then it will be necessary to apply the Hardware Reset (RESX) after the completion of the Host Power On Sequence to ensure correct operations. Otherwise, all the functions are not guaranteed.

The power on/off sequence is illustrated below



Uncontrolled Power Off

The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

If uncontrolled power-off happened, the display will go blank and there will not any visible effect on the display (blank display) and remains blank until "Power On Sequence" powers it up.

5.4.1 DC Characteristics

Ta=25℃, Frame rate = 60Hz, Registers setting are IC default setting.

Operation Mode	Image	Current Consumption			
		Typical		Maximum	
		IDD1 (uA)	IDD (uA)	IDD1 (uA)	IDD (uA)
Sleep-in mode	--	5	45	10	60

5.4.2 AC Characteristics

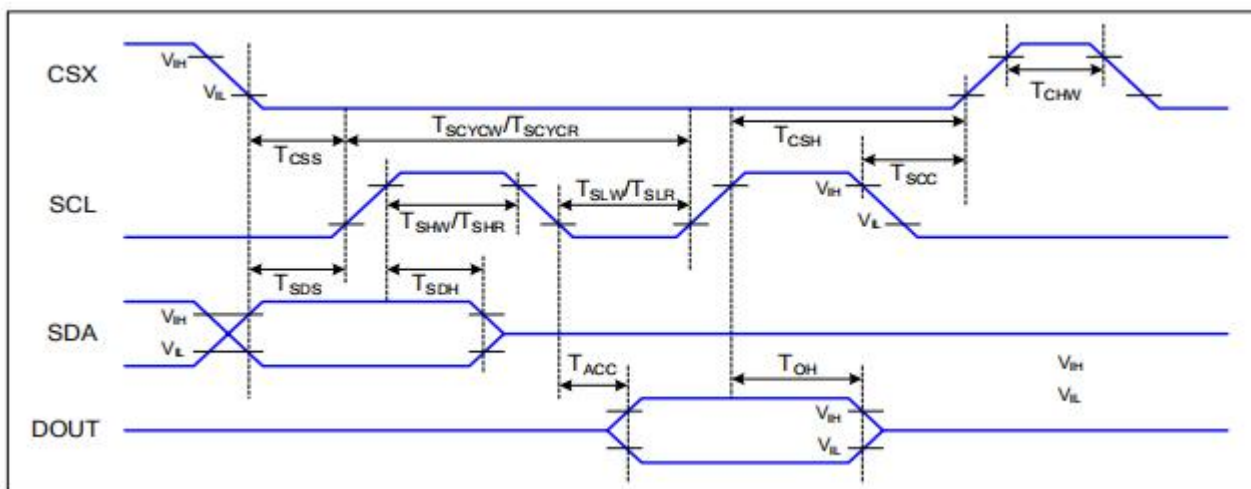


Figure 1 3-line serial Interface Timing Characteristics

$V_{DDI}=1.8, V_{DD}=2.8, A_{GND}=D_{GND}=0V, T_a=25^{\circ}C$

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SOC}	Chip select hold time (read)	60		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		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	10		ns	
	T_{SDH}	Data hold time	10		ns	

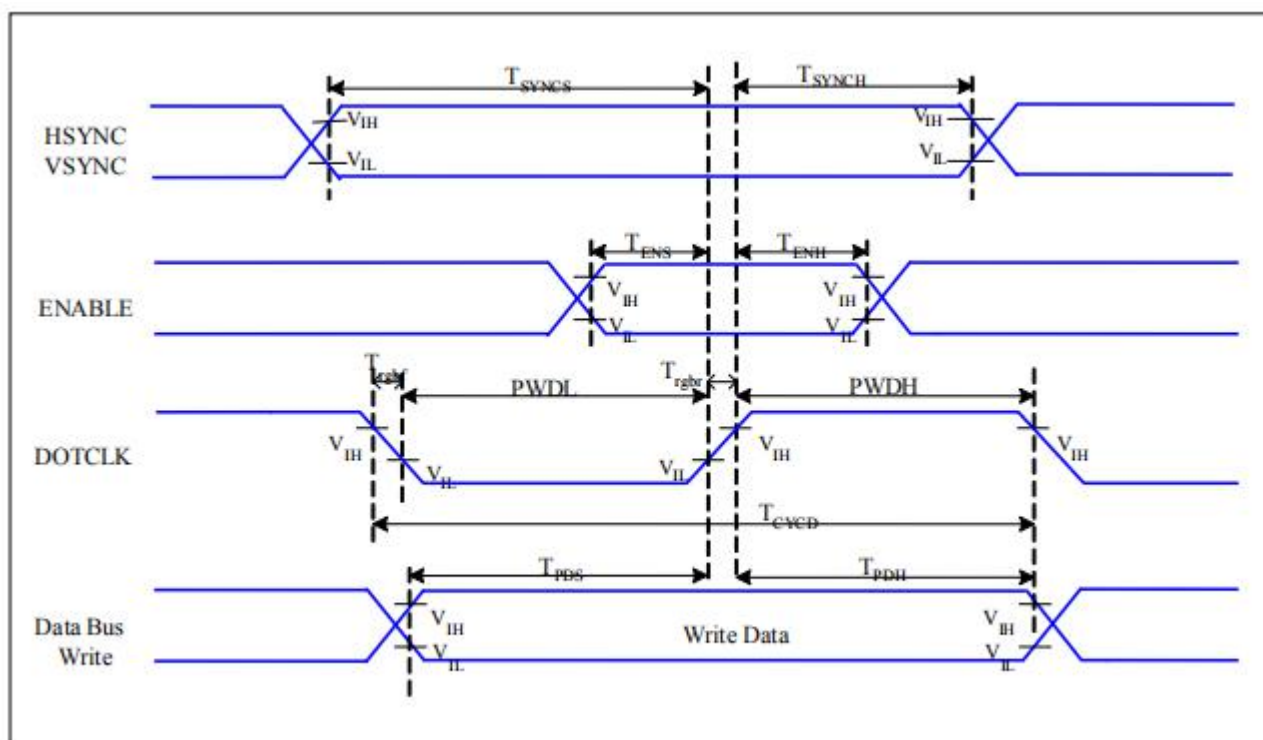


Figure 3 RGB Interface Timing Characteristics

VDD1=1.8, VDD=2.8, AGND=DGND=0V, Ta=25 °C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYSN, HSYN Setup Time	5	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	5	-	ns	
	T_{ENH}	Enable Hold Time	5	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	15	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	15	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	33	-	ns	
	T_{rghr}, T_{rghf}	DOTCLK Rise/Fall time	-	15	ns	
DB	T_{PDS}	PD Data Setup Time	5	-	ns	
	T_{PDH}	PD Data Hold Time	5	-	ns	

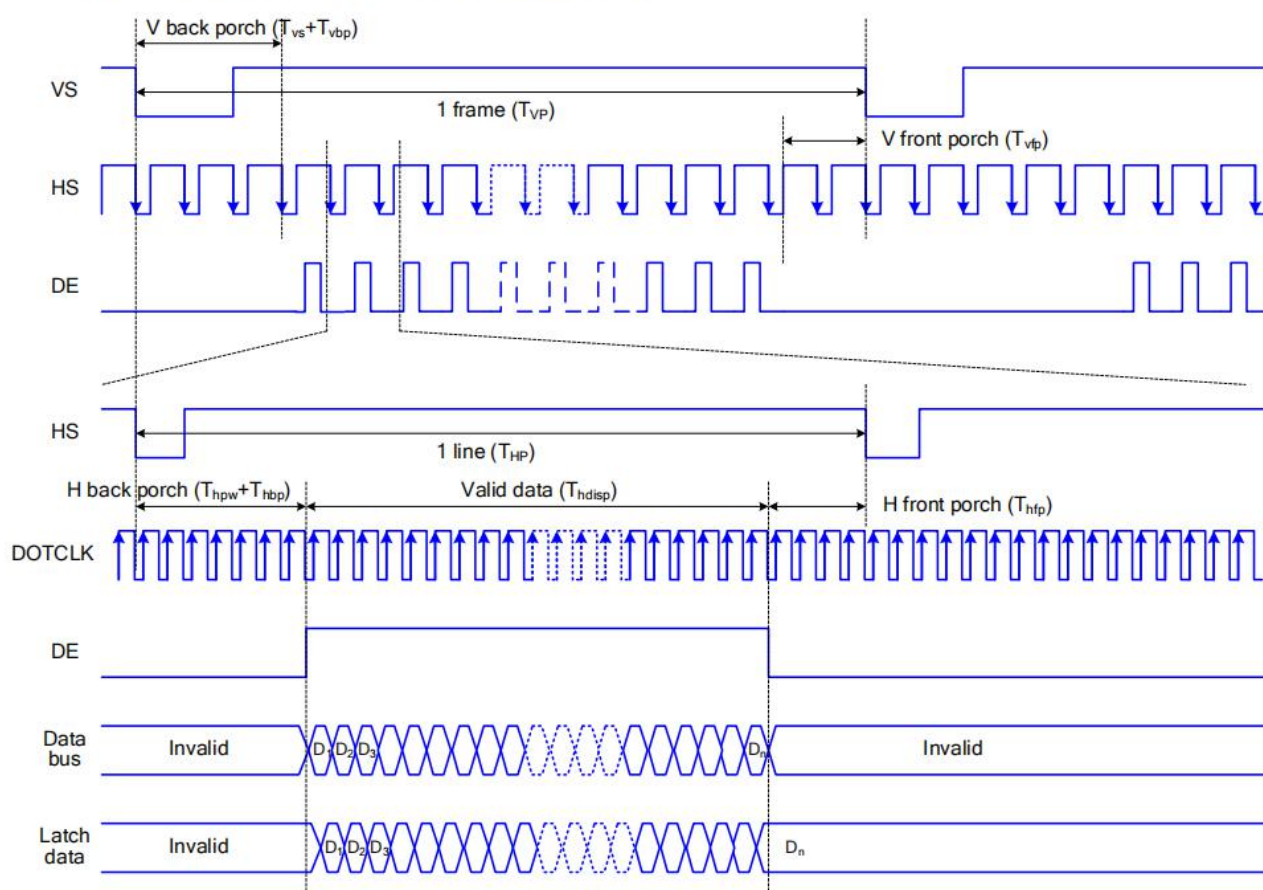
Table 6 18/16 Bits RGB Interface Timing Characteristics

5.5 Timing Diagram

ST7701S supports two kinds of RGB interface, DE mode and HV mode. The table shown below uses command C3h to select RGB interface mode.

DE/Sync	RGB Mode
0	DE mode
1	HV mode

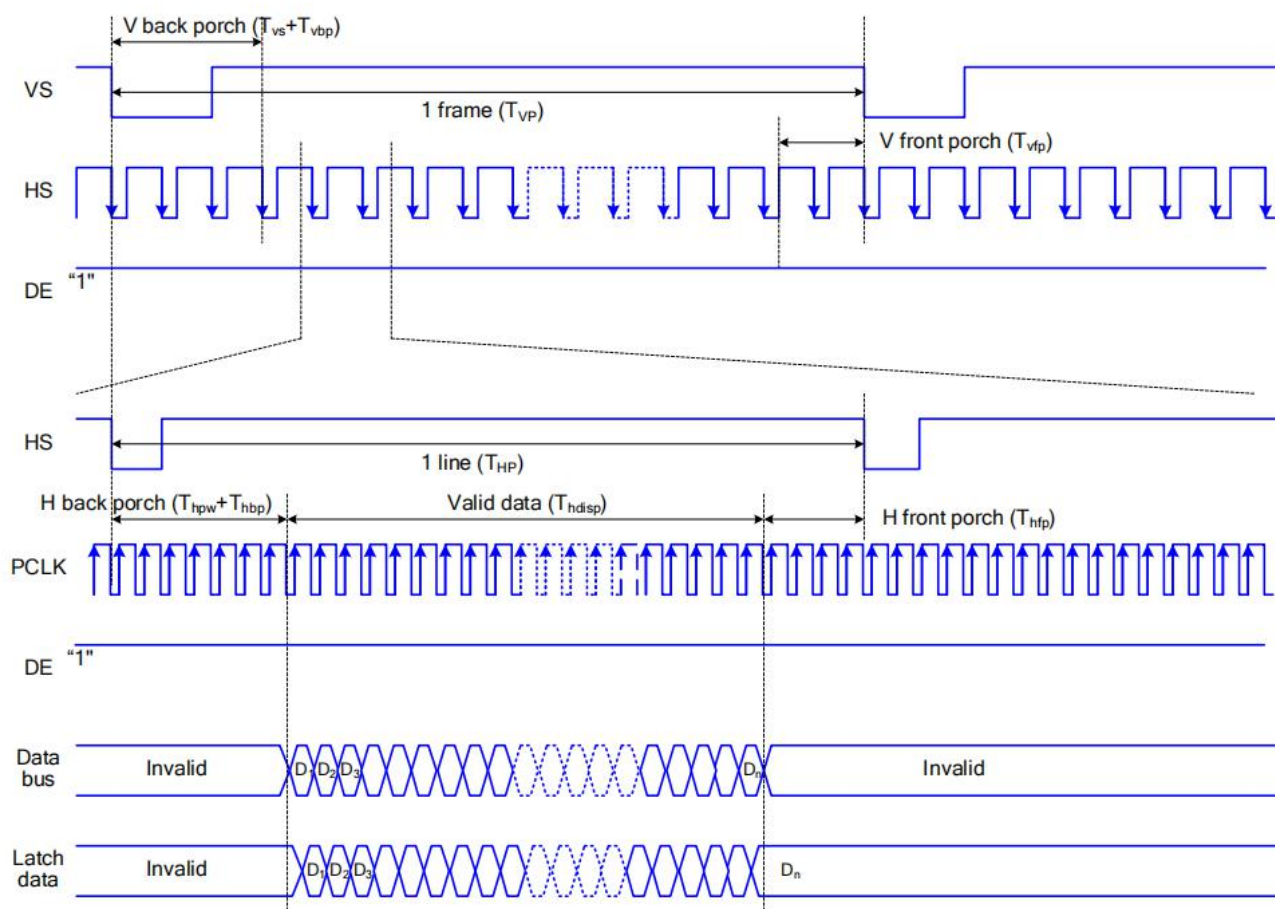
The timing chart of RGB interface DE mode is shown as follows.



Note: The setting of front porch and back porch in host must match that in IC as this mode.

Figure 23 Timing Chart of Signals in RGB Interface DE Mode

The timing chart of RGB interface HV mode is shown as follows.



5.5.1 Timing Parameters

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Vertical low pulse width	VS	-	-	2	-	Line
Vertical front porch	VFP	-	-	16	-	Line
Vertical back porch	VBP	-	-	16	-	Line
Vertical active area	-	VDISP	-	376	-	Line
Vertical Refresh rate	VRR	-	-	60	-	Hz
HS low pulse width	HS	-	-	10	-	DCK
Horizontal back porch	HBP	-	-	10	-	DCK
Horizontal front porch	HFP	-	-	10	-	DCK
Horizontal active area	HDISP	-	-	960	-	DCK

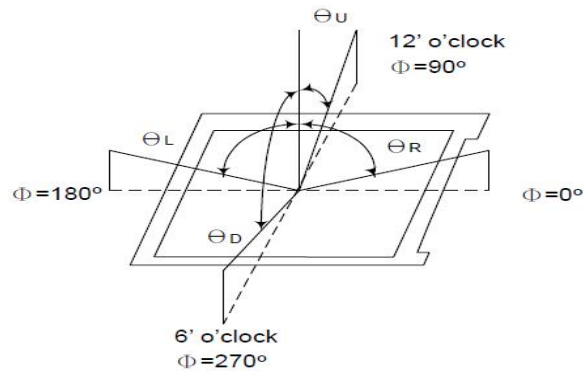
6. OPTICAL CHARACTERISTICS

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	$\theta = 0^\circ$	600	800	-	-	Note(4)
NTSC Ratio	S	$\theta = 0^\circ$	54	60		%	Note(7)
Luminance	L	$\theta = 0^\circ$	-	230	-	cd/m ²	Note(5)
Luminance uniformity	U _w	$\theta = 0^\circ$	75	-	-	%	Note(3)
Response Time	T _R + T _F	25 °C	-	30	45	ms	Note(2)
Color Coordination	W _X	$\theta = 0^\circ$ (Center) Normal viewing angle B/L On	-+0.04	0.296	+0.04	NTSC (x,y)	Note(6)
	W _Y			0.325			
	R _X			0.647			
	R _Y			0.329			
	G _X			0.279			
	G _Y			0.550			
	B _X			0.134			
	B _Y			0.123			
Viewing Angle	θ_L	C/R>10	-	80	-	Degree	Note(1)
	θ_R		-	80	-		
	θ_U		-	80	-		
	θ_D		-	80	-		

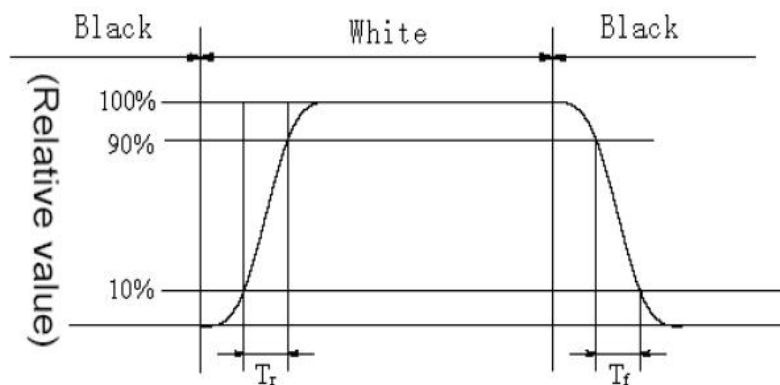
Test Conditions:

1. 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

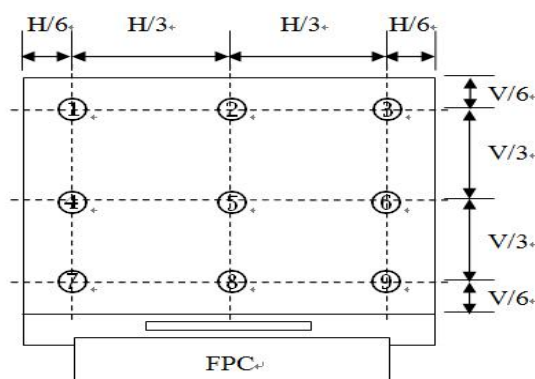


Note2: Definition of Response time: Sum of T_R and T_F



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

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

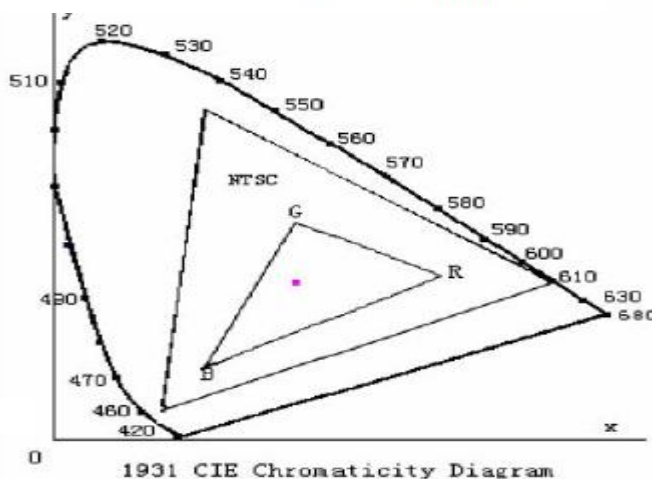
Note 5: Definition of Luminance: Center Luminance of white is defined as luminance values of 1 point average across the LCD surface.

Note 6: Definition of Color Chromaticity (CIE 1931)

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

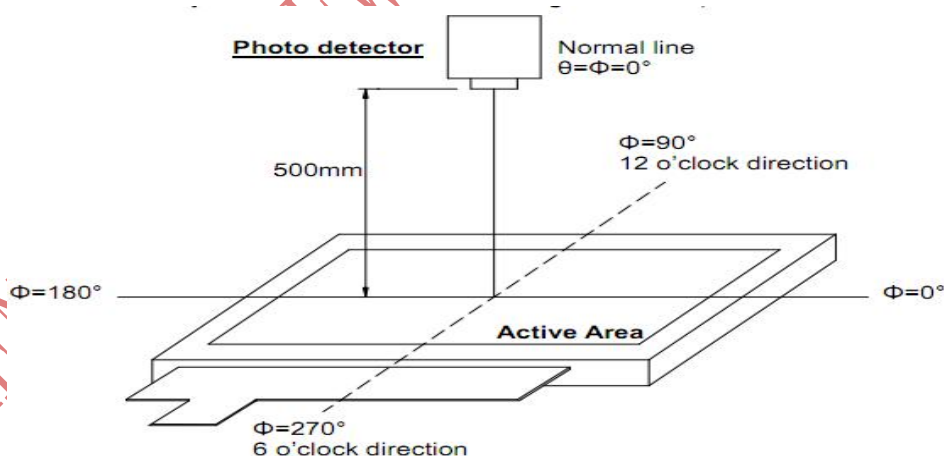
Note 7: Definition of NTSC ratio:

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



Note 8: Definition of measurement system.

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 /48Hours	Note1,2,3
Low Temperature Storage	Ta =-30°C / 240Hours/ -40°C / 8Hours	Note1,2,3
High Temperature Operating	Ta =+70°C / 48Hours	Note1,2,3
Low Temperature Operating	Ta =-20°C / 48Hours	Note1,2,3
Temperature Cycle storage Test	-40°C/30min ↔+80°C /30min for 48cycles,Transfer time less than 5min	Note2,3
Thermal humidity storage Test	60°C x 90%RH / 96Hours	Note2,3

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.



8. PACKAGE DRAWING

