

## LCD MODULE SPECIFICATION

<b>Model:</b>	UE039HV-RB40-L009A
<b>Version:</b>	V1.0
<b>Date:</b>	20230823

### Customer Confirmation 客户确认

Approved by	Notes

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### VIEWE Confirmation 优奕确认

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
V1.0	2023.08.23	Preliminary release	

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## 1. GENERAL INFORMATION

### 1.1 Features

- 1) Pixel Arrangement: RGB Vertical Stripe
- 2) Interface Mode: MCU 8/16BIT/SPI/DSPI/QSPI
- 3) Driver IC: NV3041A-01

- 4) Operation Temperature: -20~70°C  
 5) Storage Temperature: -30~80°C  
 6) Backlight Type: White LED  
 7) Display mode: Normally Black,  
 8) Pixel Density: 128 PPI  
 9) LED life time: 30,000 Hours

## 1.2 Mechanical Specification

Item 项目	Specification 规格	Unit 单位	Remark 备注
<b>Pixel Driving element</b>	IPS TFT	-	-
<b>Screen Size</b>	3.9	Inch	Diagonal
<b>Resolution</b>	480(W)*3(RGB)*128(H)	Dots	-
<b>Interface</b>	MCU 8/16BIT/SPI/DSPI/QSPI	-	40PIN
<b>Module Power Consumption</b>	0.64	Watt	
<b>Active Area</b>	95.04(W)*25.34(H)	mm	-
<b>Pixel pitch (W*H)</b>	0.198(W)*0.198(H)	mm	-
<b>Module Size (W*H*D)</b>	103.2(W)*34.85(H)*2.46(D)	mm	
<b>Luminance</b>	350	cd/m <sup>2</sup>	Typ.
<b>Viewing Direction</b>	ALL	O'clock	-
<b>Display Color</b>	262K	Colors	18bits

## 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	IOVCC	-0.5	3.6	V	Note1

Power supply voltage <sup>2</sup>	V <sub>CI</sub>	-0.5	3.6	V	Note1
LED forward current	I <sub>F</sub>	-0.001	180	mA	For each led,Note1
LED Reverse Voltage	V <sub>R</sub>	-	5	V	For each led,Note1
Operating temperature	T <sub>op</sub>	-20	70	°C	Note1,2
Storage temperature	T <sub>st</sub>	-30	80	°C	Note1,2
Humidity	H <sub>st</sub>	10	90	%RH	Note1,3

(T<sub>a</sub>=+25°C,GND=0V)

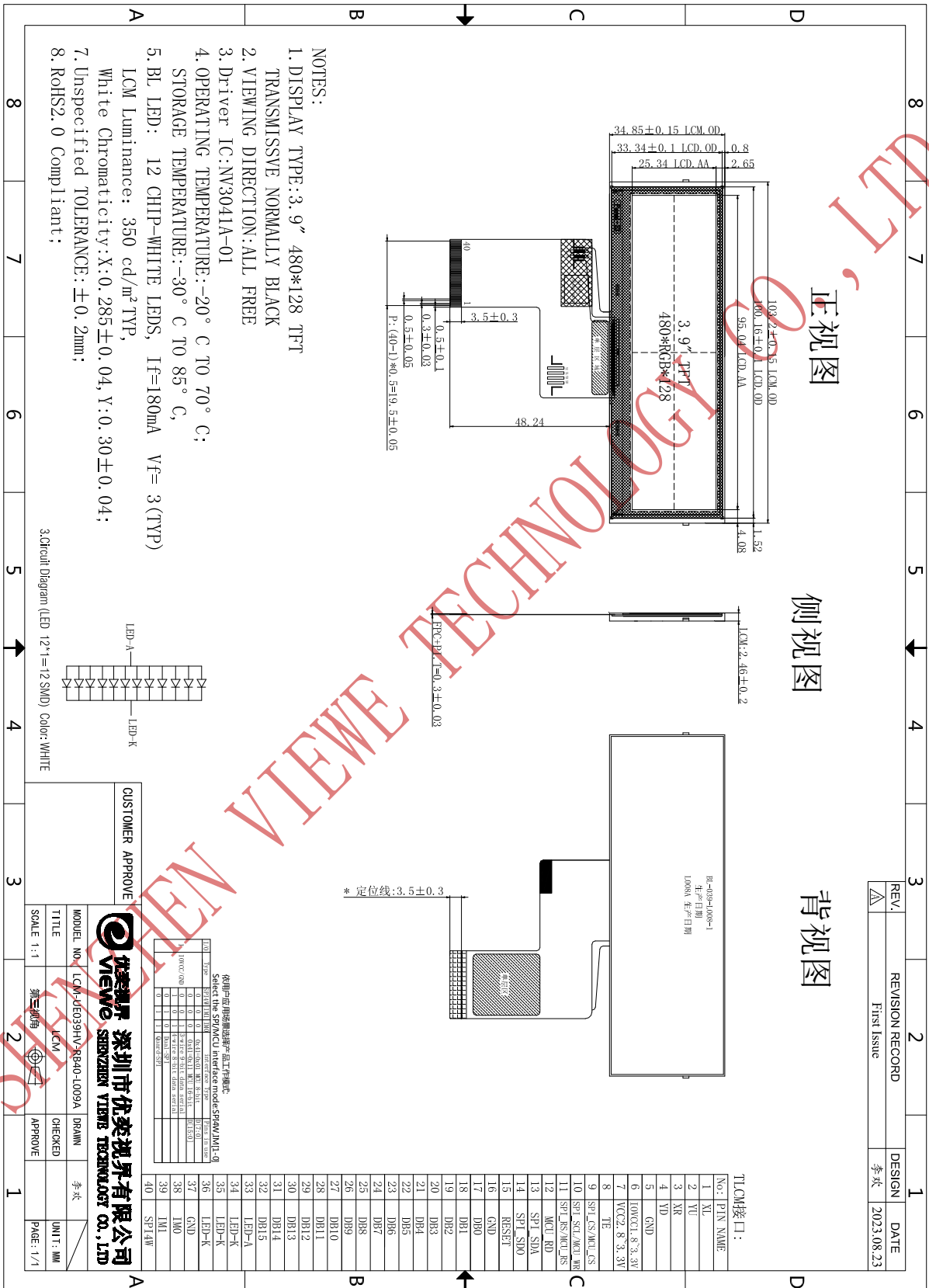
Note1:If the module exceeds the absolute maximum ratings, it may be damaged permanently. Also if the module operates with the absolute maximum ratings for a long time, the reliability may drop.

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. I/O CONNECTION & BLOCK DIAGRAM

### 4.1 I/O Connection

Pin No.	Symbol 符号	I/O	Description 描述
1	<b>XL</b> <b>/CTP-SCL</b>	I	I2C clock signals for CTP; Option XL for RTP
2	<b>YU</b> <b>/CTP-SDA</b>	I	I2C data signal for CTP, Option YU for RTP
3	<b>XR</b> <b>/CTP-RST</b>	I	The signal will reset the CTP,Signal is active low, Option XR for RTP
4	<b>YD</b> <b>/CTP-INT</b>	I/O	Interrupt signals for CTP, Option YD for RTP
5	<b>GND</b>	P	Power Ground
6	<b>IOVCC</b>	P	Power supply for I/O system
7	<b>VCI</b>	P	Power supply for analog circuits
8	<b>TE</b>	O	Tearing effect signal is used to synchronize MCU to frame memory
9	<b>SPI_CS</b> <b>/MCU_CS</b>	I	Chip selection pin. Low-active
10	<b>SPI_SCL</b> <b>/MCU_WR</b>	I	Write enable in MCU parallel interface In SPI mode, this pin is used as SCL
11	<b>SPI_RS</b> <b>/MCU_RS</b>	I	Display data/command selection pin in MCU interface RS=1 display data or parameter;RS=0 register index / command
12	<b>MCU_RD</b>	I	Read enable in 8080 MCU parallel interface. Low-active.
13	<b>SPI_SDA</b>	I/O	Serial communication data input and output, internal pull low.
14	<b>SPI_SDO</b>	O	SPI interface output pin
15	<b>RESET</b>	I	The signal will reset the LCM, Signal is active low.
16	<b>GND</b>	P	Power Ground
17-32	<b>DB0-DB15</b>	I/O	data bus for MCU
33	<b>LED-A</b>	P	Power supply for backlight anode
34-36	<b>LED-K</b>	P	Power supply for backlight cathode
37	<b>GND</b>	P	Power Ground
38	<b>IM0</b>	I	The MCU interface mode select.
39	<b>IM1</b>	I	The MCU interface mode select.
40	<b>SPI4W</b>	I	Std SPI 3/4 wire selection. SPI4W="H", 4 wire SPI; SPI4W="L", 3wire SPI.

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 Voltage1	IOVCC	3.0	3.3	3.6	V	-
Power Supply Voltage2	VCC	3.0	3.3	3.6	V	-
Power Supply Current1	I <sub>iovcc</sub>	-	0.5	-	mA	Note1
Power Supply Current2	I <sub>vcc</sub>	-	30	-	mA	Note1
Logic Input High Voltage	V <sub>IH</sub>	0.7VDD	-	VDD	V	-
Logic Input Low Voltage	V <sub>IL</sub>	0	-	0.3VDD	V	-
Panel Power Consumption	P <sub>VDD</sub>	-	0.1	-	Watt	Note1
Module Power Consumption	P <sub>LCM</sub>	-	0.64	-	Watt	Note1,2

(Ta=+25°C,GND=0V)

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

Note2: P<sub>LCM</sub>= P<sub>VDD</sub>+ P<sub>B/L</sub>, About P<sub>B/L</sub> 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 <sub>F</sub>	-	3	-	V	Note1
Forward Current	I <sub>F</sub>	-	180	-	mA	Note1
Backlight Power consumption	P <sub>B/L</sub>	-	0.54	-	Watt	Note1
LED life time	-	30000	-	-	Hrs	Note2
LED Quantity			12		PCS	

(Ta=+25°C,GND=0V)

Note1: The LED driving condition is defined for each LED module (12 LED Parallel).

For each LED : I<sub>F</sub>=20mA, V<sub>F</sub>=3V(Typ.)/3.3V(Max.), Ta=25°C。

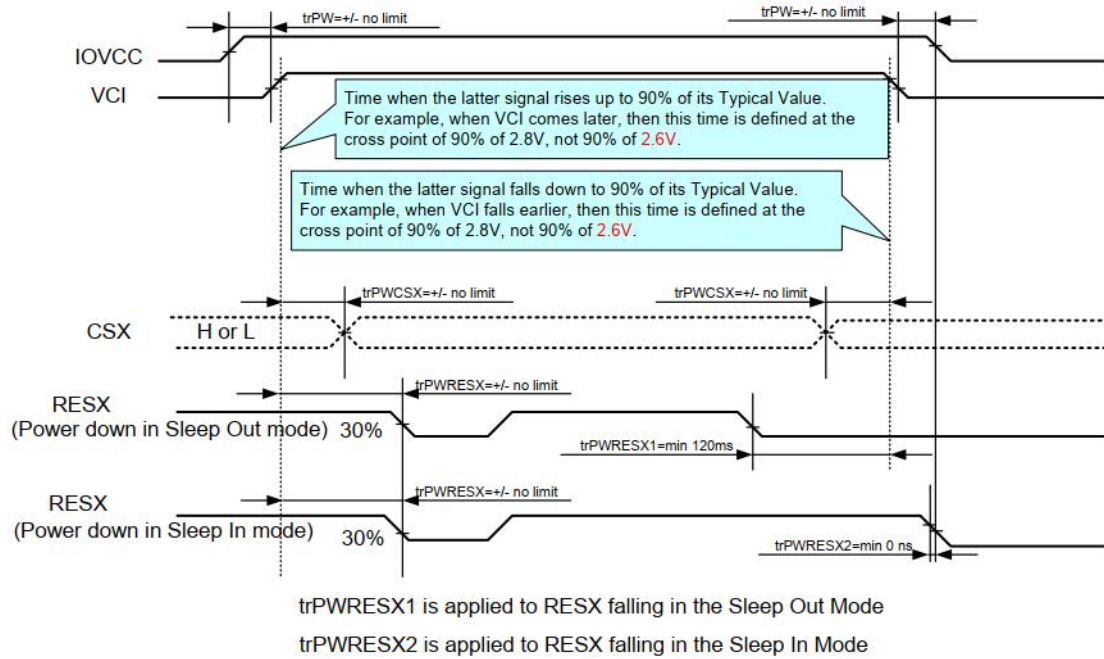
Note2: The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I<sub>LED</sub>=20mA(Per Led). The LED life time could be decreased if operating I<sub>LED</sub> is larger than 20mA.



## 5.3 Power On/Off Sequence

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

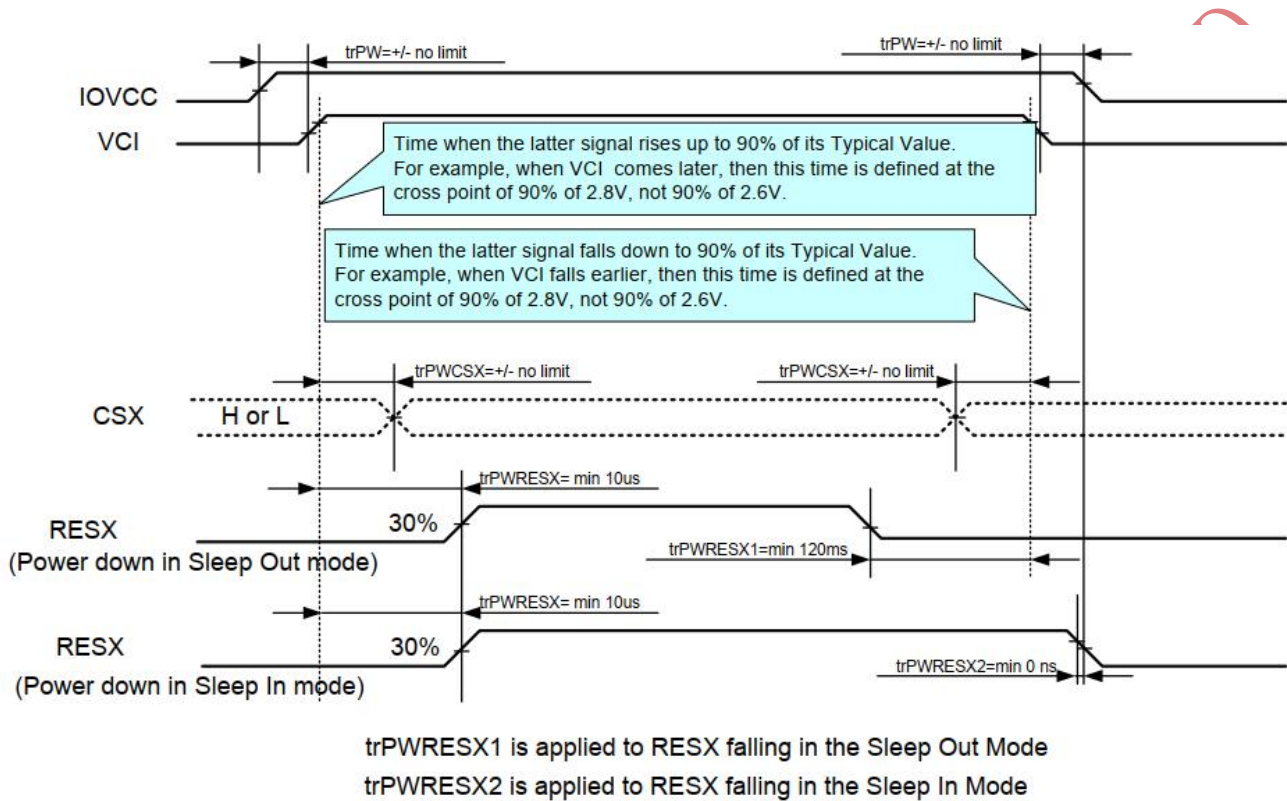
If the RESX line is held High or unstable by the host during Power On, then Hardware Reset must be applied after both VCI and IOVCC have been applied. Otherwise, the correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.



**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

( $T_a = +25^\circ\text{C}$ ,  $GND = 0\text{V}$ )

### 8080 Series MCU Parallel Interface Timing Characteristics: 16/8-bit Bus

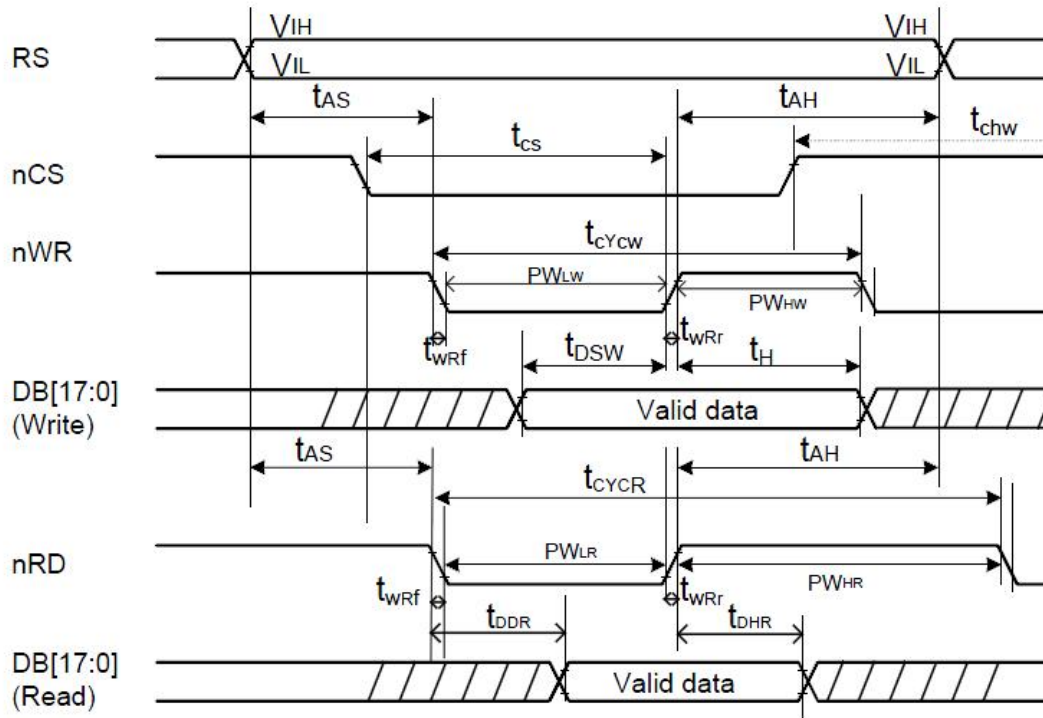
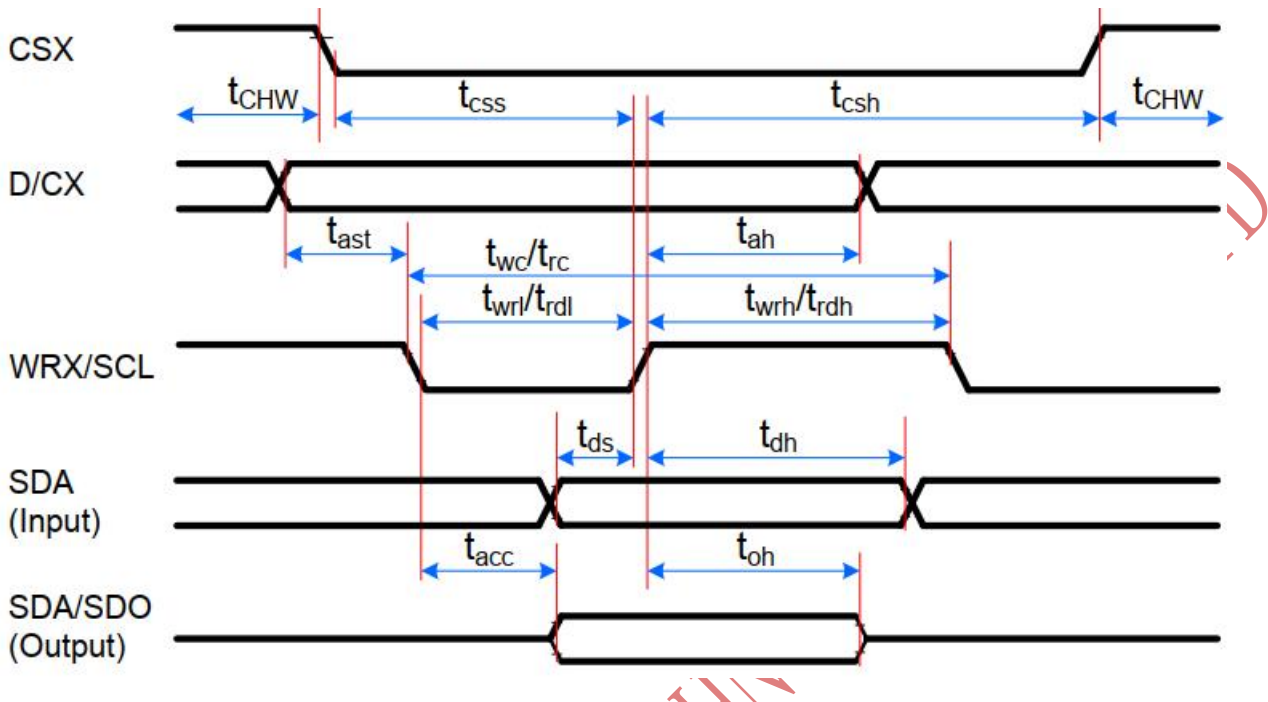


Figure 48 i80-System Bus Timing

Normal Write Mode ( $IOVCC = 1.65\sim 3.3\text{V}$ )

Item	Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	$t_{CYCW}$	ns	TBD	-	-
	Read	$t_{CYCR}$	ns	300	-	-
Write low-level pulse width	$PW_{LW}$	ns	TBD	-	500	-
Write high-level pulse width	$PW_{HW}$	ns	TBD	-	-	-
Read low-level pulse width	$PW_{LR}$	ns	150	-	-	-
Read high-level pulse width	$PW_{HR}$	ns	150	-	-	-
Write / Read rise / fall time	$t_{WR}/t_{WRF}$	ns	-	-	25	-
Setup time	Write (RS to nCS, E/nWR)	$t_{AS}$	ns	10	-	-
	Read (RS to nCS, RW/nRD)			5	-	-
Address hold time	$t_{AH}$	ns	5	-	-	-
Write data set up time	$t_{DSW}$	ns	10	-	-	-
Write data hold time	$t_H$	ns	15	-	-	-
Read data delay time	$t_{DDR}$	ns	-	-	100	-
Read data hold time	$t_{DHR}$	ns	5	-	-	-

## 5.5 Display Serial Interface Timing Characteristics ( SPI system )



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	$t_{css}$	Chip select time (Write)	15	-	ns	
	$t_{csh}$	Chip select hold time (Read)	15	-	ns	
	$t_{CHW}$	CS H pulse width	40	-	ns	
SCL	$t_{wc}$	Serial clock cycle (Write)	50	-	ns	
	$t_{wrh}$	SCL H pulse width (Write)	10	-	ns	
	$t_{wrl}$	SCL L pulse width (Write)	10	-	ns	
	$t_{rc}$	Serial clock cycle (Read)	150	-	ns	
	$t_{rdh}$	SCL H pulse width (Read)	60	-	ns	
	$t_{rdl}$	SCL L pulse width (Read)	60	-	ns	
D/CX	$t_{as}$	D/CX setup time	10	-	ns	
	$t_{ah}$	D/CX hold time (Write/Read)	10	-	ns	
SDA (Input)	$t_{ds}$	Data setup time (Write)	10	-	ns	
	$t_{dh}$	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	$t_{acc}$	Access time (Read)	10	50	ns	For maximum CL=30pF
	$t_{od}$	Output disable time (Read)	15	50	ns	For minimum CL=8pF

### Notes:

1.  $T_a = -30$  to  $70$  °C,  $IOVCC = 1.65V$  to  $3.3V$ ,  $VCI = 2.5V$  to  $3.3V$ ,  $AGND = DGND = 0V$ ,  $T = 10 \pm 0.5ns$ .
2. Does not include signal rising and falling times.

## 6. OPTICAL CHARACTERISTICS

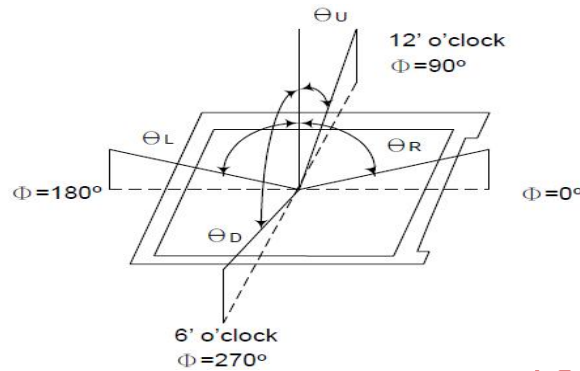
Parameter 参数	Symbol 符号	Condition 条件	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Contrast Ratio	C/R	$\theta = 0^\circ$	1000	1200	-	-	Note(4)
NTSC Ratio	S	$\theta = 0^\circ$	45	50	-	%	Note(7)
Luminance	L	$\theta = 0^\circ$	-	350	-	cd/m <sup>2</sup>	Note(5)
Luminance uniformity	U <sub>w</sub>	$\theta = 0^\circ$	75	80	-	%	Note(3)
Response Time	T <sub>R</sub> + T <sub>F</sub>	25 °C	-	30	40	ms	Note(2)
Color Coordination	W <sub>X</sub>	$\theta = 0^\circ$ (Center) Normal viewing angle B/L On	-0.03	0.307	+0.03	NTSC (x,y)	Note(6)
	W <sub>Y</sub>			0.339			
	R <sub>X</sub>			0.618			
	R <sub>Y</sub>			0.334			
	G <sub>X</sub>			0.287			
	G <sub>Y</sub>			0.547			
	B <sub>X</sub>			0.141			
	B <sub>Y</sub>			0.164			
Viewing Angle	$\theta_L$	C/R>10	80	85	-	Degree	Note(1)
	$\theta_R$		80	85	-		
	$\theta_U$		80	85	-		
	$\theta_D$		80	85	-		



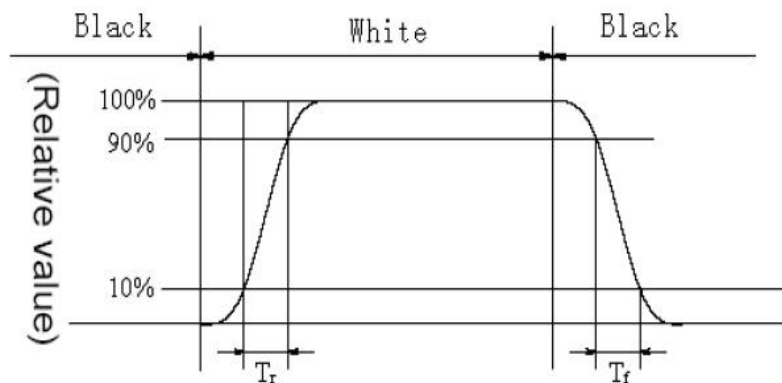
Test Conditions:

1. VDD=3.3V, I<sub>F</sub>=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

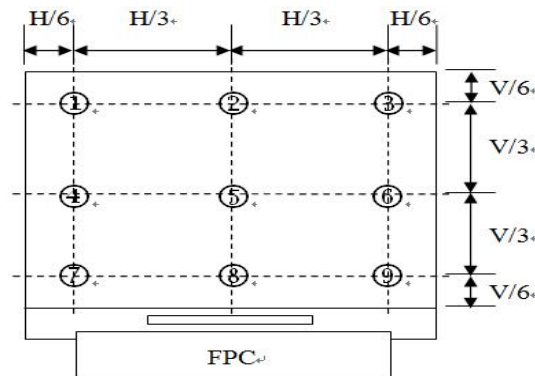


**Note2:** Definition of Response time: Sum of  $T_R$  and  $T_F$



**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

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

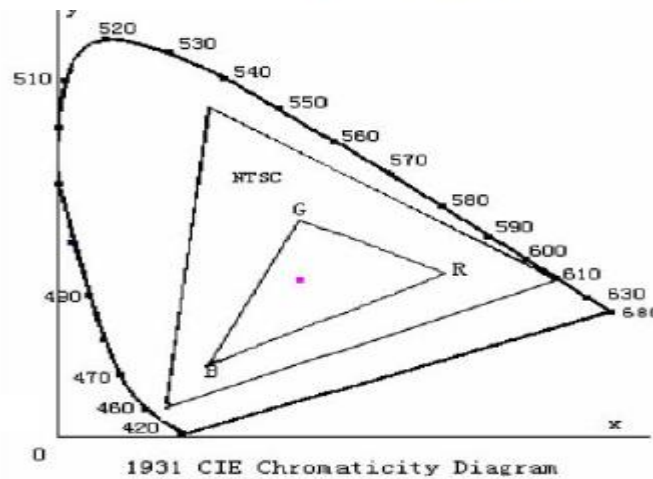
**Note 5:** Definition of Luminance: Center Luminance of white is defined as luminance values of 1point average across the LCD surface.

**Note 6:** Definition of Color Chromaticity (CIE 1931)

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

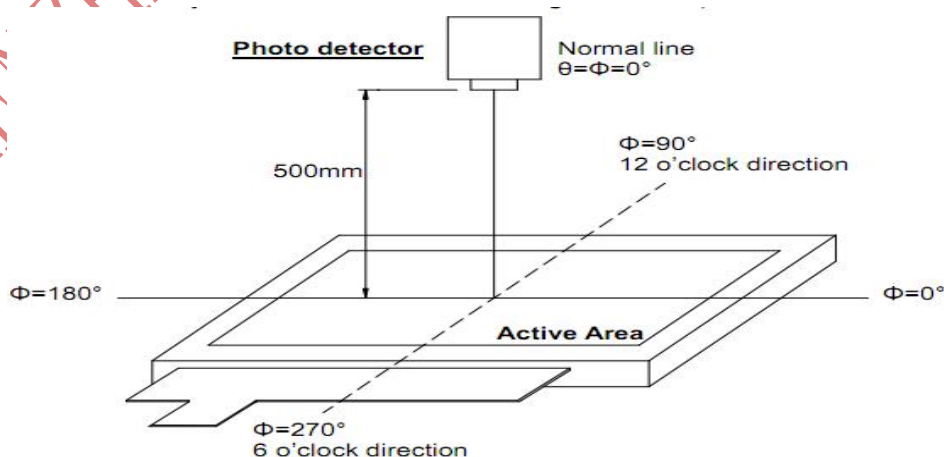
**Note 7:** Definition of NTSC ratio:

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



**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 / 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	-20°C/30min ↔+70°C /30min for 30cycles, Transfer time less than 5min	Note2,3
Thermal humidity storage Test	60°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
<p><b>Inspection after Test:</b></p> <p>Note1: Ta is the ambient temperature of samples.</p> <p>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.</p> <p>Note 3: Before cosmetic and function tests, the product must have enough recovery time, at least 2 hours at room temperature.</p> <p>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.</p>		





## 8. PACKAGE DRAWING

