LCD MODULE

SPECIFICATION

Model:	UE028QV-RB40-A058A
Version:	V1.0
Date:	2023-10-17

Customer Confirmation

Approved by	Notes

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document. If it is not returned, we will assume that you agree to the entire contents of this specification document.

VIEWE Confirmation

Prepared by	Reviewed by	Approved by

REVISION HISTORY

Revision	Date	Contents of Revision Change	Remark
V1.0	2023-10-17	Preliminary release	

TABLE of CONTENTS

1. GENERAL INFORMATION

1.1 Features

1) Pixel Arrangement：RGB Vertical Stripe
2) Interface Mode：MCU 8/16BIT/SPI
3) Driver IC： GC9307/CHSC6540
4) Operation Temperature：-20~70℃
5) Storage Temperature：-30~80℃
6) Backlight Type：White LED
7) Display mode：Normally Black,
8) Pixel Density：167 PPI
9) LED life time：30,000 Hours

1.2 Mechanical Specification

Item	Specification	Unit	Remark
Pixel Driving element	IPS TFT	-	
Screen Size	2.8	Inch	-
Resolution	240(W)*3(RGB)*320(H)	Dots	-
Interface	MCU 8/16BIT/SPI	-	-
Module Power Consumption	0.367	Watt	Typ.
Active Area	43.2(W)*57.6(H)	mm	Typ.
Pixel pitch (W*H)	0.18(W)*0.18(H)	mm	Typ.
Module Size (W*H*D)	56.9(W)*74.1(H)*2.45(D)	mm	Typ.
Luminance	340	cd/m^2	Typ.
Viewing Direction	ALL	O'clock	-
Display Color	262K	Colors	18bits

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remark
Power supply voltage1	IOVCC	-0.5	3.6	V	Note1
Power supply voltage2	VCI	-0.5	3.6	V	Note1
LED forward current	I_F	-0.001	40	mA	For each led,Note1
LED Reverse Voltage	V_R	-	2.9	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

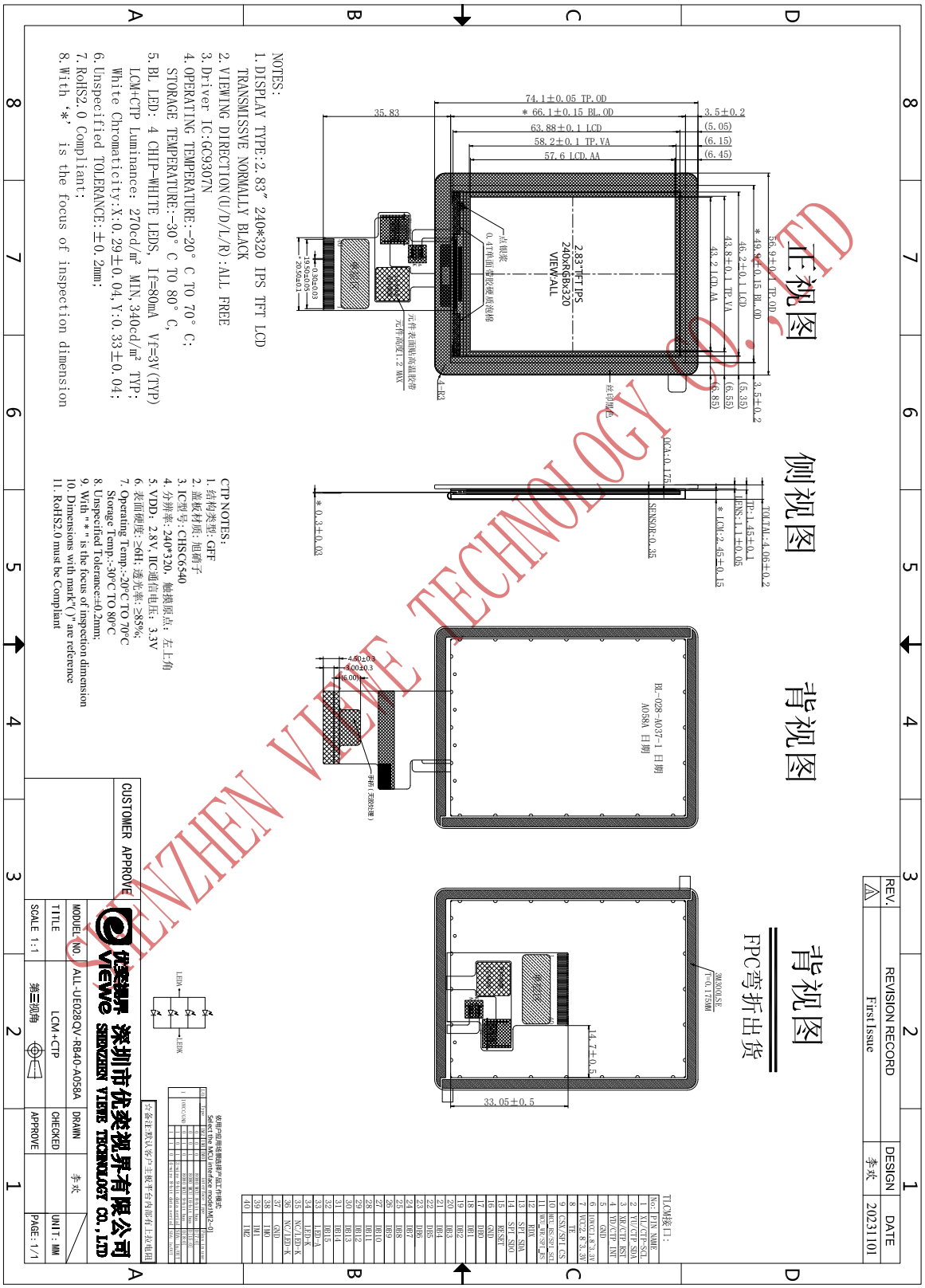
(Ta=+25°C,GND=0V)

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℃,the response time of liquid crystal (LC) becomes slower and the color of panel darker than normal one.

Note3: Temp. ≤ 60℃ , 90% RH MAX.
Temp. ＞60℃ , 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	I/O	Description
1	XL /CTP-SCL	I	I2C clock signals for CTP; Option XL for RTP
2	YU /CTP-SDA	I	I2C data signal for CTP, Option YU for RTP
3	XR /CTP-RST	I	The signal will reset the CTP,Signal is active low, Option XR for RTP
4	YD /CTP-INT	I/O	Interrupt signals for CTP, Option YD for RTP
5	GND	P	Power Ground
6	IOVCC	P	Power supply for I/O system
7	VCI	P	Power supply for analog circuits
8	TE	O	Tearing effect signal is used to synchronize MCU to frame memory
9	SPI_CS /MCU_CS	I	Chip selection pin. Low-active
10	SPI_SCL /MCU_RS	I	Display data/command selection pin in MCU interface In SPI mode, this pin is used as SCL
11	SPI_RS /MCU_WR	I	Write enable in MCU parallel interface RS=1 display data or parameter;RS=0 register index / command
12	MCU_RD	I	Read enable in 8080 MCU parallel interface. Low-active.
13	SPI_SDA	I/O	Serial communication data input and output, internal pull low.
14	SPI_SDO	O	SPI interface output pin
15	RESET	I	The signal will reset the LCM, Signal is active low.
16	GND	P	Power Ground
17-32	DB0-DB15	I/O	data bus for MCU
33	LED-A	P	Power supply for backlight anode
34-36	LED-K	P	Power supply for backlight cathode
37	GND	P	Power Ground
38	IM0	I	The MCU interface mode select.
39	IM1	I	The MCU interface mode select.
40	IM2	I	The MCU interface mode select.

I：Input；O：Output；P：Power

5. ELECTRICAL CHARACTERISTICS

5.1 TFT-LCD Panel Driving Section

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
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_{iovcc}	-	0.5	-	mA	Note1
Power Supply Current2	Ivcc	-	40	-	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}	-	0.135	-	Watt	Note1
Module Power Consumption	P_{LCM}	-	0.367	-	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	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	-		2.9	-	V	Note1
Forward Current	I_F	-	80	-	mA	Note1
Backlight Power consumption	P_{BL}	-	0.232	-	Watt	Note1
LED life time	-	30000	-	-	Hrs	Note2
LED Quantity			4		PCS	

(Ta=+25°C,GND=0V)

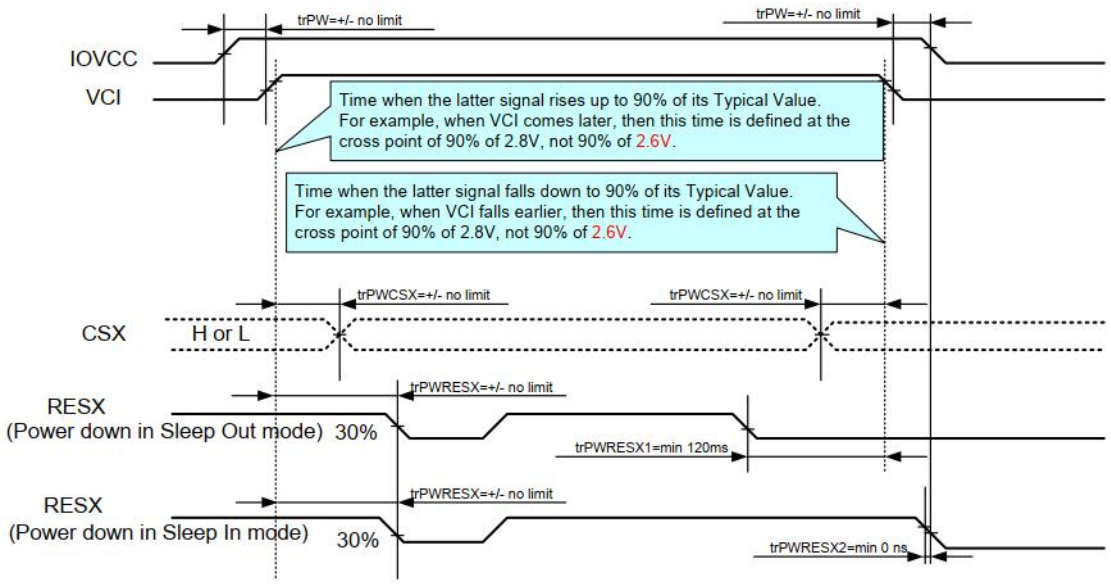
Note1: The LED driving condition is defined for each LED module

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.



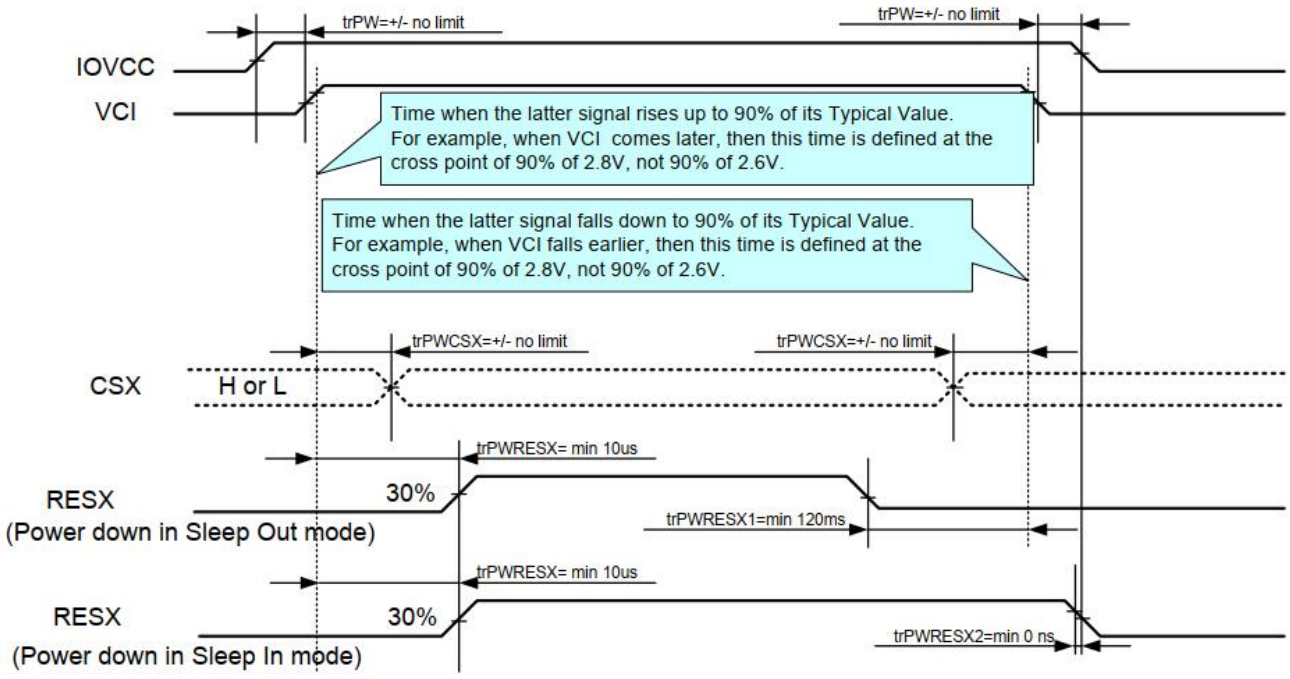
trPWRESX1 is applied to RESX falling in the Sleep Out Mode

trPWRESX2 is applied to RESX falling in the Sleep In Mode

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

5.3.1.2 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.



trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode

5.4 Timing Characteristics

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

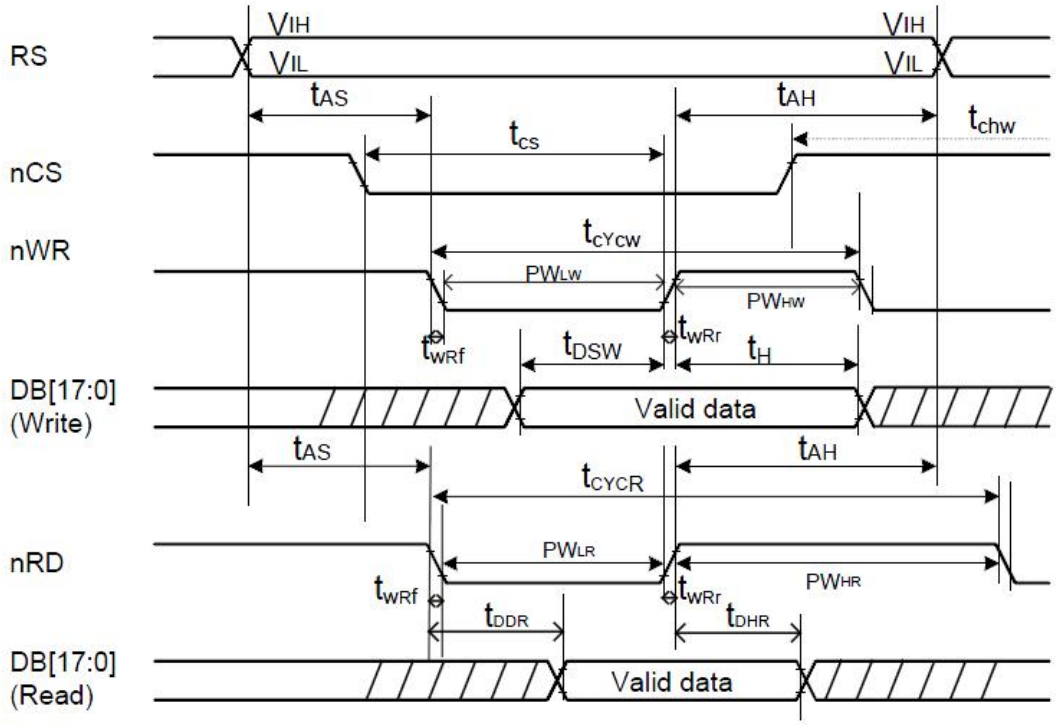
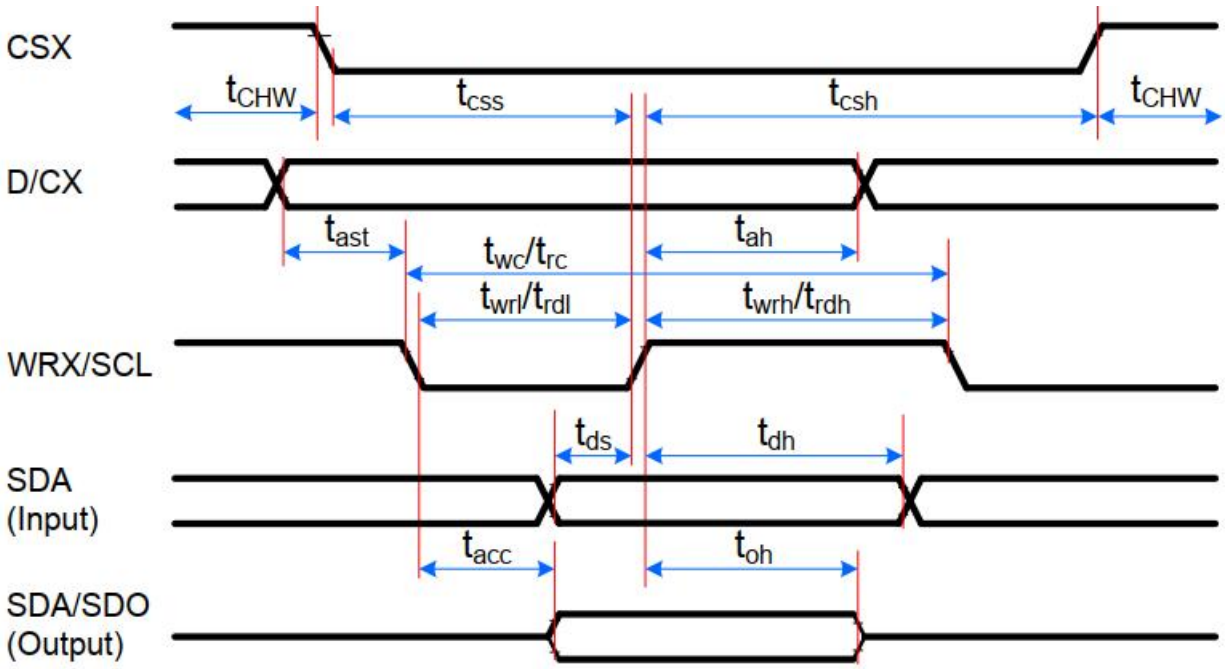


Figure 48 i80-System Bus Timing

Normal Write Mode (IOVCC = 1.65~3.3V)

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_{WRr}/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	tcss	Chip select time (Write)	15	-	ns	
	tcsh	Chip select hold time (Read)	15	-	ns	
	tCHW	CS H pulse width	40	-	ns	
SCL	twc	Serial clock cycle (Write)	50	-	ns	
	twrh	SCL H pulse width (Write)	10	-	ns	
	twrl	SCL L pulse width (Write)	10	-	ns	
	trc	Serial clock cycle (Read)	150	-	ns	
	trdh	SCL H pulse width (Read)	60	-	ns	
	trdl	SCL L pulse width (Read)	60	-	ns	
D/CX	tas	D/CX setup time	10	-	ns	
	tah	D/CX hold time (Write/Read)	10	-	ns	
SDA (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	tacc	Access time (Read)	10	50	ns	For maximum CL=30pF For minimum CL=8pF
	tod	Output disable time (Read)	15	50	ns	

Notes:

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

6.OPTICAL CHARACTERISTICS

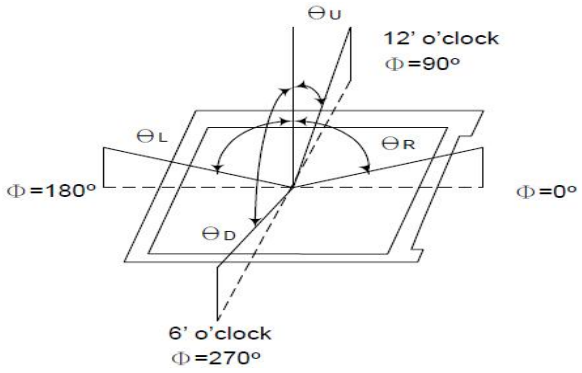
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Contrast Ratio	C/R	θ = 0°	900	1200	-	-	Note(4)
NTSC Ratio	S	θ =0°	65	70	-	%	Note(7)
Luminance	L	θ =0°	-	400	-	cd/m2	Note(5)
Luminance uniformity	U_W	θ =0°	-	80	-	%	Note(3)
Response Time	T_R+ T_F	25 °C	-	30	40	ms	Note(2)
Color Coordination	W_X	θ = 0° (Center) Normal viewing angle B/L On	-	0.30	-	NTSC (x,y)	Note(6)
	W_Y		-	0.33	-		
	R_X		-	0.658	-		
	R_Y		-	0.338	-		
	G_X		-	0.262	-		
	G_y		-	0.6	-		
	B_X		-	0.134	-		
	B_Y		-	0.137	-		
Viewing Angle	θ_L	C/R>10	75	80	-	Degree	Note(1)
	θ_R		75	80	-		
	θ_U		75	80	-		
	θ_D		75	80	-		

Test Conditions:

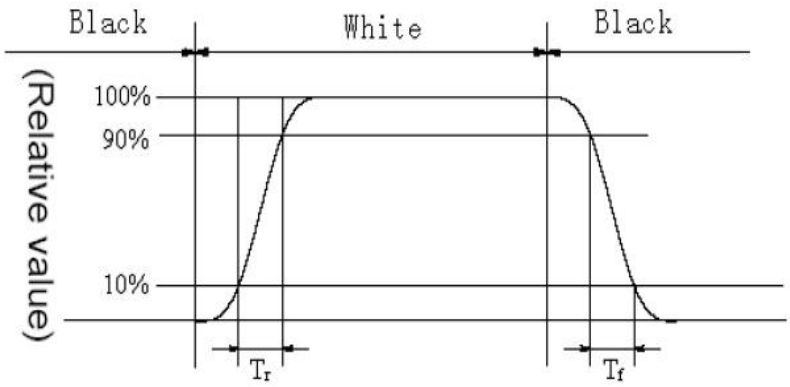
1. VDD=3.3V, I_F=20mA (Backlight current), the ambient temperature is+25℃.

2. The test systems refer to Note 8.

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

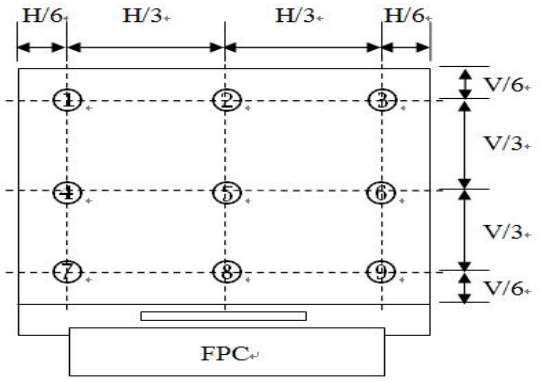


Note2: Definition of Response time: Sum of T_R and T_F



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

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

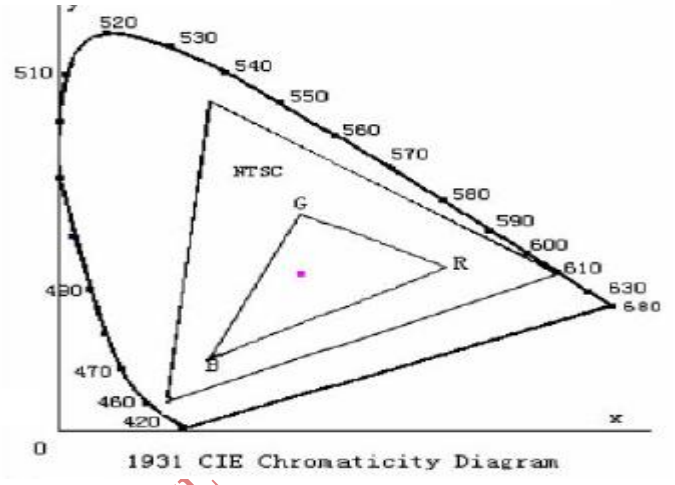
Note 5: Definition of Luminance: Center Luminance of white is defined as luminance values of 1point average across the LCD surface.

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:

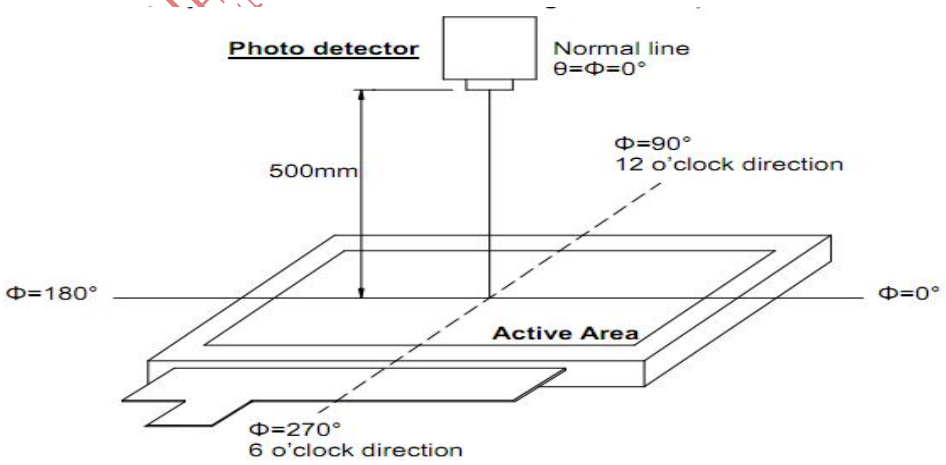
$$\text{NTSC ratio} = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}}$$



1931 CIE Chromaticity Diagram

Note 8: Definition of optical 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	Test Condition	Remark
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 Δ+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