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MODEL NO : ET019QV01-T

MODEL VERSION: 01

SPEC VERSION : 1.0

ISSUED DATE: 2022-12-28

□Preliminary Specification

■Final Product Specification

Customer :_____

Approved by	Notes

Youri Confirmation

Prepared by	Reviewed by	Approved by
John	Johnny	Wang

1. Introduction

1.1 Scope of application

LCD specification: Dots 170xRGBx320.
As to basic specification of the driver IC, refer to the IC (ST7789V2-G4-A) specification and data book.
All material & processing of the LCD module should be Lead Free.

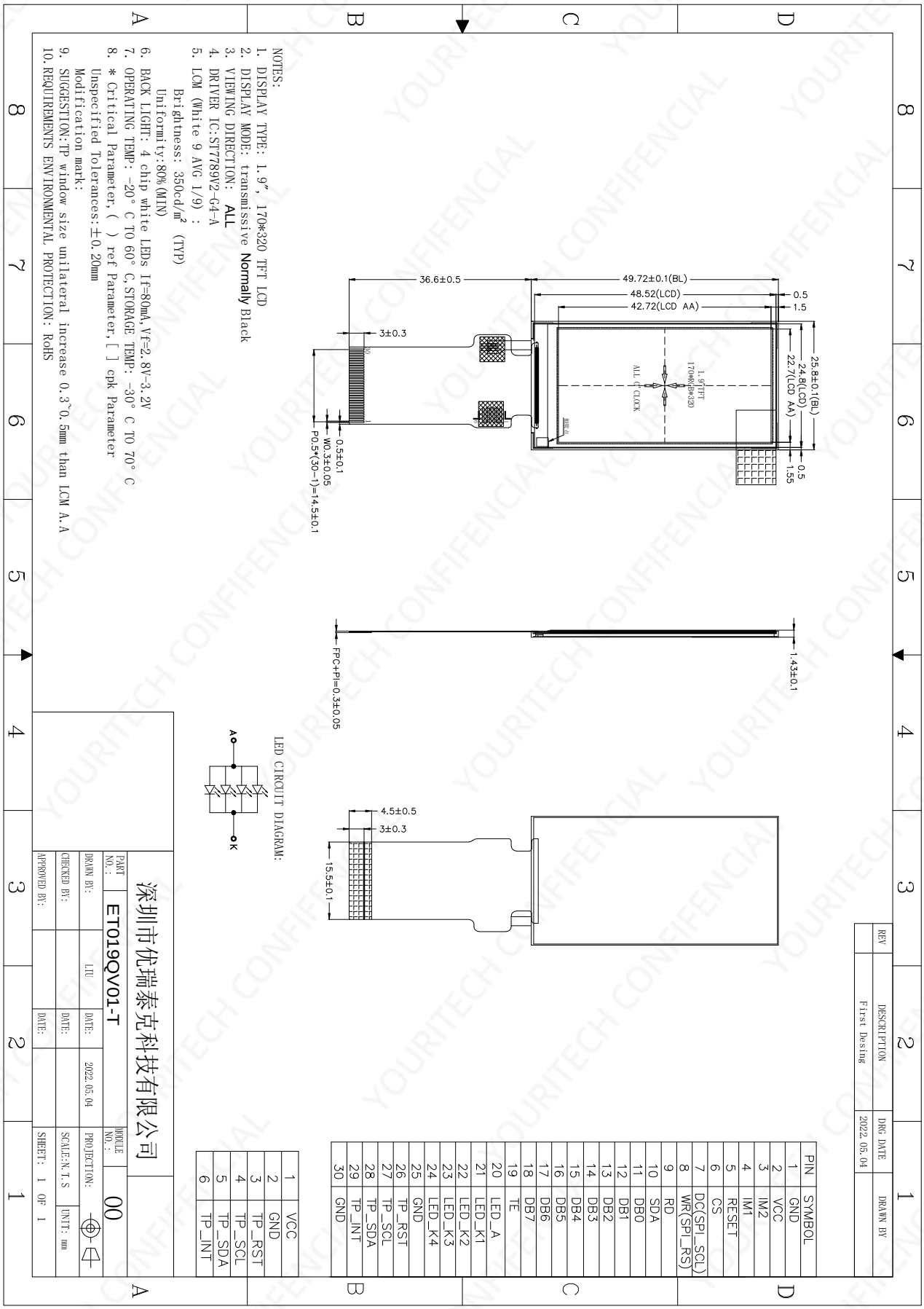
1.2 TFT features:

Structure: TFT PANNEL+IC +FPC+BL;
IPS Type LCD
170dot-segment and 320 dot-common outputs;
65K/262K Color can be selected by software;
White LED back light;
4line SPI+8bit MCU interface

1.3 Applications:

2. LCM General specification

ITEM	Sandard value	Unit
LCD Type	Normally Black	--
Drive element	TFT active matrix	--
Number of pixels	170(H) RGB×320(V)	Dots
Pixel arrangement	RGB Vertical stripe	--
Pixel Pitch (W*H)	0.1335(H) x0.1335 (V)	mm
Active area	22.7(W) ×42.72 (H)	mm
Viewing direction	ALL O'CLOCK	-
TFT Driver IC	ST7789V2-G4-A	
TFT interface	4line SPI+8bit MCU interface	-
Approx. Weight	TBD	g
LCM Size(W*H*T)	25.80(W) ×49.72(H) ×1.43(T)	mm
Touch structure	--	
Touch Driver IC	--	-
Touch Interface	--	



NOTES:

1. DISPLAY TYPE: 1.9", 170*320 TFT LCD
2. DISPLAY MODE: transmissive Normally Black
3. VIEWING DIRECTION: ALL
4. DRIVER IC:ST7789V2-G4-A
5. LCM (White 9 AVG 1/9) :
   Brightness: 350cd/m^2 (TYP)
   Uniformity:80%(MIN)
6. BACK LIGHT: 4 chip white LEDs If=80mA, Vf=2.8V-3.2V
7. OPERATING TEMP: -20° C TO 60° C, STORAGE TEMP: -30° C TO 70° C
8. * Critical Parameter, ( ) ref Parameter, [ ] cpk Parameter
   Unspecified Tolerances:±0.20mm
   Modification mark:
9. SUGGESTION:TP window size unilateral increase 0.3~0.5mm than LCM A.A
10. REQUIREMENTS ENVIRONMENTAL PROTECTION: RoHS

REV	DESCRIPTION	DRG DATE	DRAWN BY
	First Desing	2022.05.04	

PIN	SYMBOL
1	GND
2	VCC
3	IM2
4	IM1
5	RESET
6	CS
7	DC(SPI_SCL)
8	WR(SPI_RS)
9	RD
10	SDA
11	DB0
12	DB1
13	DB2
14	DB3
15	DB4
16	DB5
17	DB6
18	DB7
19	TE
20	LED_A
21	LED_K1
22	LED_K2
23	LED_K3
24	LED_K4
25	GND
26	TP_RST
27	TP_SCL
28	TP_SDA
29	TP_INT
30	GND

1	VCC
2	GND
3	TP_RST
4	TP_SCL
5	TP_SDA
6	TP_INT

深圳市优瑞泰克科技有限公司

PART NO.:	ET019QV01-T	MODULE NO.:	00
DRAWN BY:	LIU	DATE: 2022.05.04	PROJECTION:
CHECKED BY:		DATE:	SCALE:N.T.S
APPROVED BY:		DATE:	UNIT: mm
			SHEET: 1 OF 1

3.Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit
LCM Operating Temperature	T_{OPR}	-20	+60	°C
LCM Storage Temperature	T_{STG}	-30	+70	°C
Humidity	RH	-	90	%

4.Electrical Characteristics

4.1 TFT DC Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage for I/O	I/O	--	--	--	V
Supply Voltage for(DC/DC)	VDD	2.5	2.8	3.6	V
Supply Voltage for(DC/DC)	AVDD				V
Supply Voltage for(DC/DC)	AVEE				V

4.2 Back-Light Unit Characeristics

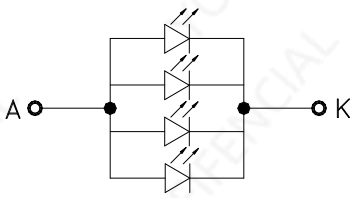
The back-light system is an edge-lighting type with 4 white LEDs. The characteristics of the back-light are shown in the following tables.

Characteristics	Symbol	Min.	Type	Max.	Unit	Notes
Forward Voltage	V_F	2.8	--	3.2	V	-
Forward current	I_F	--	80	-	mA	-
Luminance(With LCD)	Lv		350	--	cd/m^2	-
LED life time	N/A	----	30,000	--	Hr	Note 1

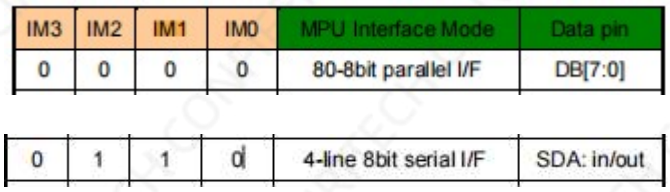
Note:

(1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_L=20mA/LED. The LED life time could be decreased if operating I_L is larger than 25mA/LED.

Backlight circuit diagram shown in below:

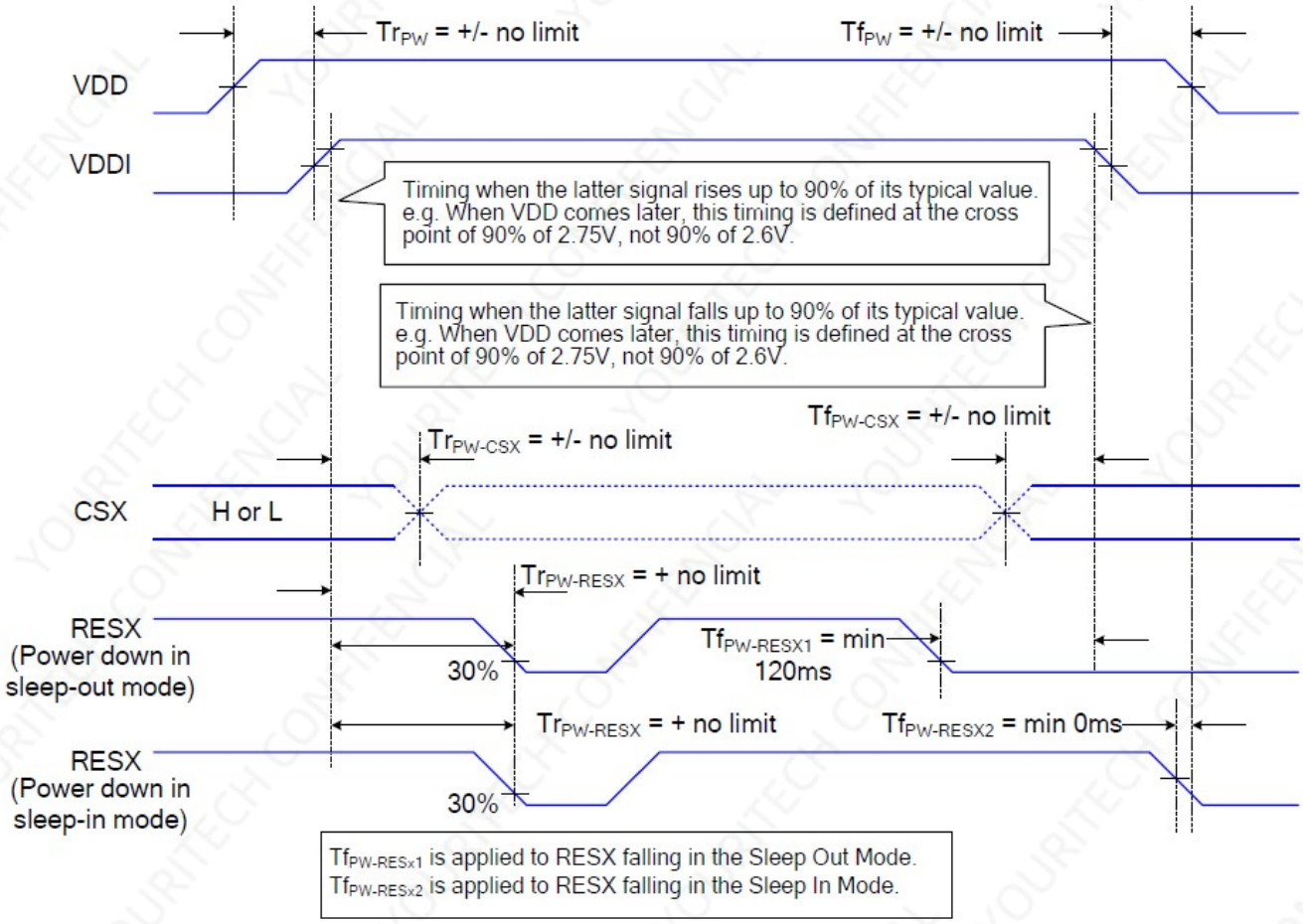


5. Module Function Description

Pin No.	Symbol	LCM Description
1	GND	Ground.
2	VCC	Power Supply For LCD.
3~4	IM2-IM1	
5	RESET	Reset Signal input pin.
6	CS	Chip selection signal.
7	DC(SPI-SCL)	Register selection signal.
8	WR(SPI-RS)	Write strobe signal.
9	RD	Read strobe signal.
10	SDA	Serial data input/output pin.
11-18	DB0-DB7	MCU parallel interface data bus.
19	TE	Frame head pulse for tearing effect.
20	LED_A	Power Supply For LED Backlight Anode Input.
21-24	LED_K1-LED_K4	Power supply for backlight cathode input terminal.
25	GND	Ground.
26	CTP_RST	Touch panel reset
27	CTP_SCL	Touch panel I2C clock
28	CTP_SDA	Touch panel I2C data
29	CTP_INT	Touch panel interrupt output
30	GND	Ground.

6. Timing Characteristics

The power on/off sequence is illustrated below



Serial Interface Characteristics (4-line serial):

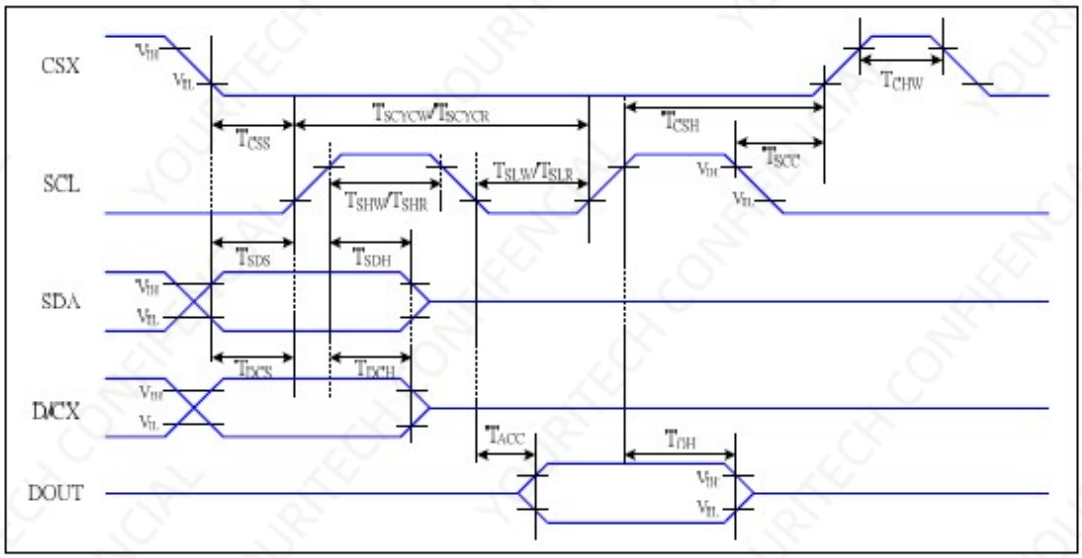


Figure 5 4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25℃

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_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	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	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

Table 6 4-line serial Interface Characteristics

Note : The rising time and falling time (Tr, Tf) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus

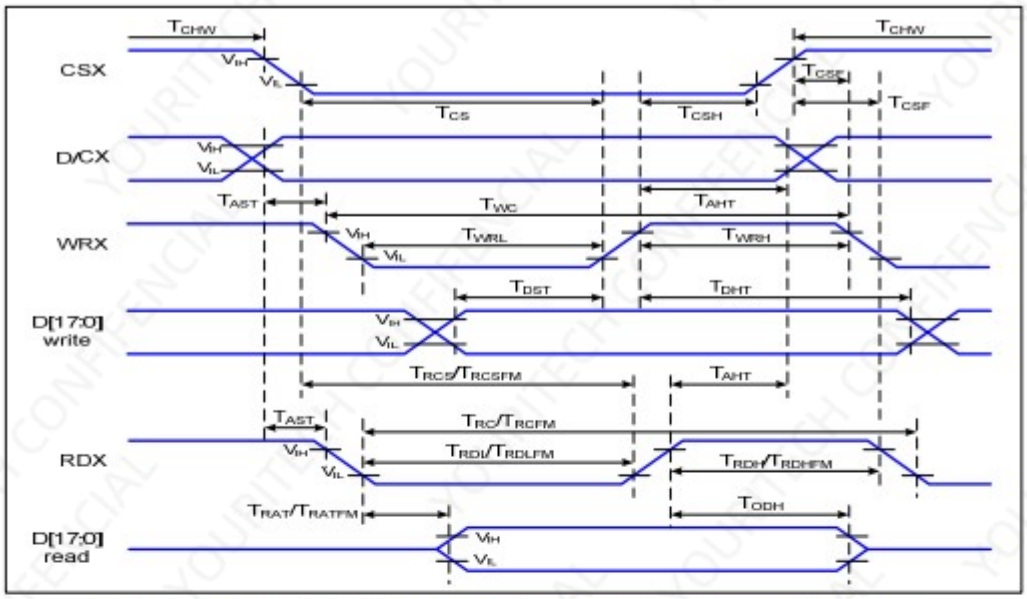


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF

	T_{DHT}	Data hold time	10		ns	
	T_{RAT}	Read access time (ID)		40	ns	
	T_{RATFM}	Read access time (FM)		340	ns	
	T_{ODH}	Output disable time	20	80	ns	

Table 4 8080 Parallel Interface Characteristics

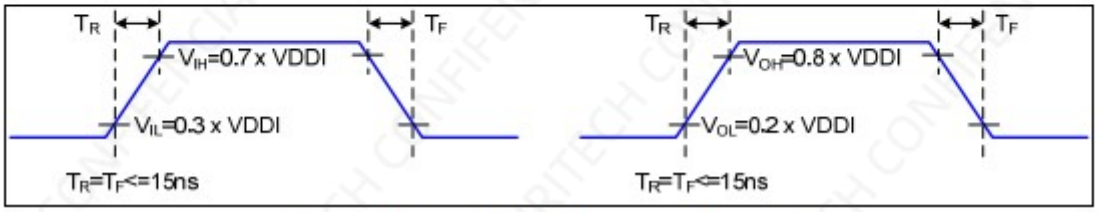


Figure 2 Rising and Falling Timing for I/O Signal

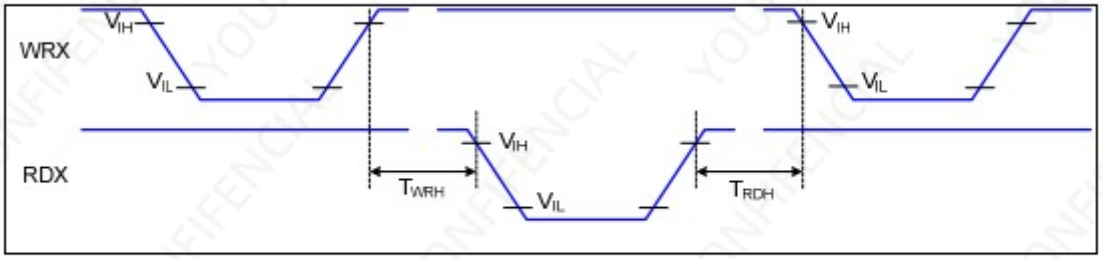


Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Reset Timing:

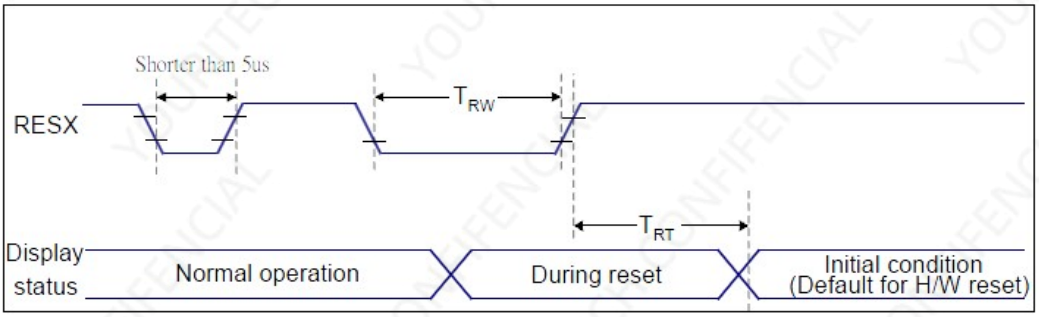


Figure 7 Reset Timing

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

Table 9 Reset Timing

Notes:

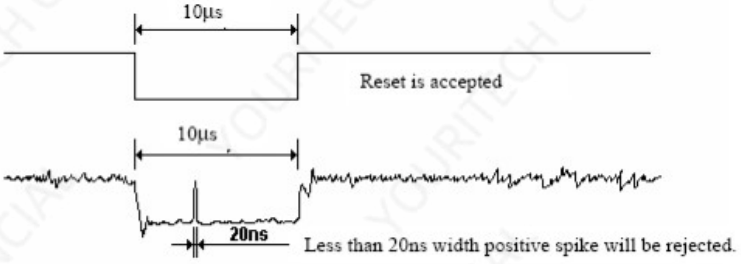
1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.

7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

7.Optical Characteristics

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ3	CR>10	80			°	Note 1
		Θ9		80			°	
	Vertical	Θ12		80			°	
		Θ6		80			°	
Contrast Ratio		CR	Θ= 0°	700	900			Note 2
Transmittance		T(%)	Θ= 0°	3.9	4.3			Note 3
NTSC		%	Θ= 0°	60	65			
Reproduction Of color	Red	Rx	Θ= 0°	0.632	0.647	0.662		Note 4 *Color filter Glass W OC
		Ry		0.311	0.326	0.341		
	Green	Gx		0.276	0.291	0.306		
		Gy		0.571	0.586	0.601		
	Blue	Bx		0.124	0.139	0.154		
		By		0.100	0.115	0.13		
White		Wx	Θ= 0°	0.286	0.301	0.316		
		Wy		0.313	0.328	0.343		
Response Time		Tr+Tf	Θ= 0°		30	35	ms	Note 5

Note:

1. 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.2).
2. Contrast measurements shall be made at viewing angle of Θ= 0° 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. 2) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. Transmittance is the value without APF Pol.
4. 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 C/F.

Measurement condition is C - light source & Halogen Lamp

5. 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

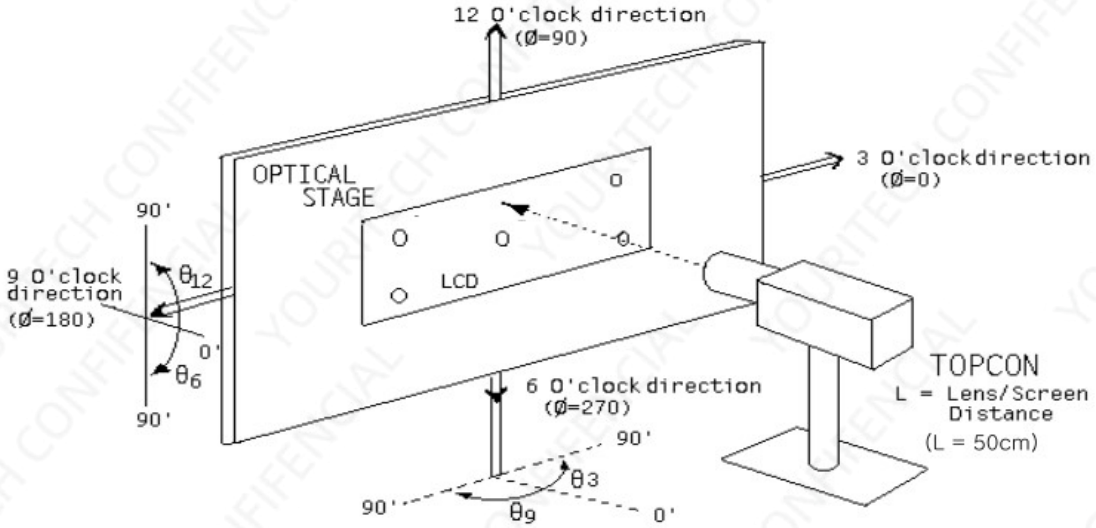
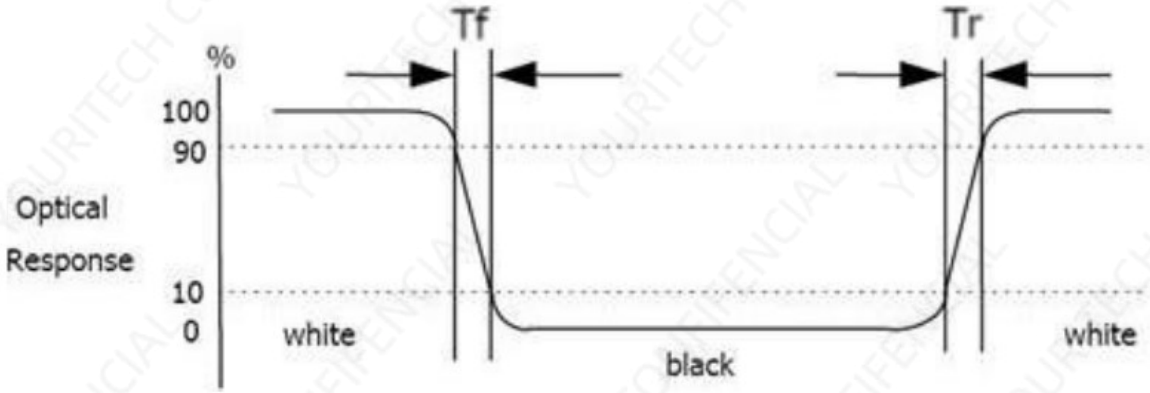


Figure 2. Response Time Testing



8. Reliability Test Item

No.	Test Item	Test Condition	Notes
1	High Temp. Storage	+70°C / 96H	1. Functional test isOK. Missing Segment,short, unclear segment non-display,display abnormally and liquid crystal leakare un-allowed. 2. No low temperature bubbles,end seal loose andfall, frame rainbow.
2	Low Temp. Storage	-30°C / 96H	
3	High Tempe. Operating	+60°C / 96H	
4	Low Tempe. Operating	-20°C / 96H	
5	High Temperature /Humidity storage	50°C x 90%RH /96H	
6	Thermal and cold shock	Static state， -20℃（30min） ~60℃（30min），50 cycles	

9. Packing Method----TBD

- END -