



深圳市福瑞达显示技术有限公司
SHENZHEN FRIDA LCD CO.,LTD

Doc.No.: FRD280V50100-F-RT

REV : A

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SPEC TITLE
DOCUMENT CONTROL SPECIFICATION

EFFECTIVE DATE : 2019-02-23

PRODUCT SPECIFICATION

TFT-LCD MODULE

Model No: FRD280V50100-F-RT

For Customer's Acceptance	
Approved by	Comment

	Signature	Date
Prepared by		2019.2.23
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1. Document Revision History :

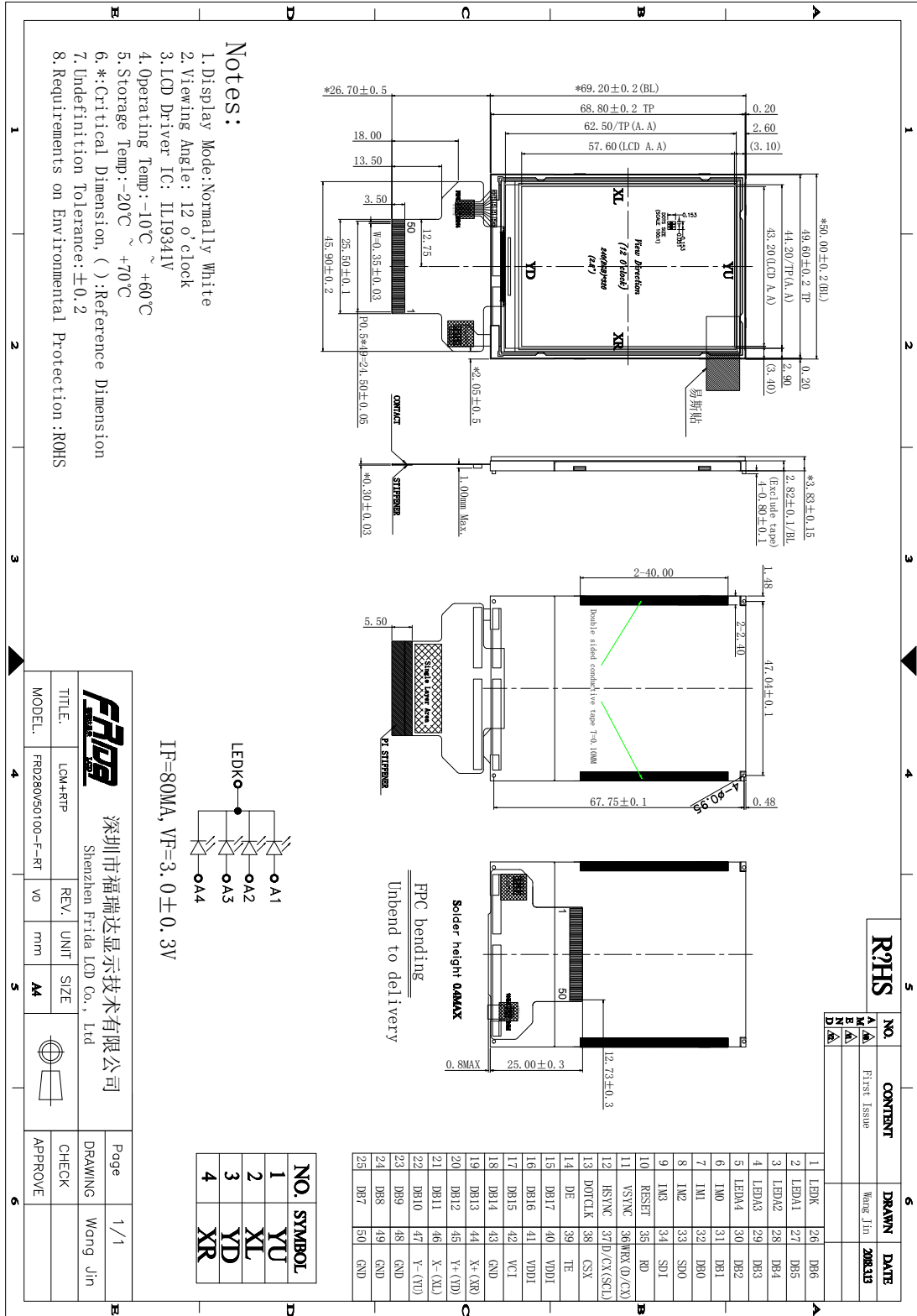
DOCUMENT REVISION	DATE	DESCRIPTION	PREPARED BY
A	2019-02-23	First Release.	

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2. General Description

No	Item	Specification	Remark
1	Screen Size	2.8 inch	
2	Display Mode	Normally White	
3	Resolution	240 × RGB × 320	
4	Active Area	43.2*57.6	mm
5	Outline Dimension	50.0*69.2*3.83	mm
6	Viewing Direction	12 o' clock	
7	Driver IC	ILI9341V	
8	Interface	MCU/SPI/RGB	
9	Back Light	White Led*4	
10	Touch Panel	With RTP	

3. Outline Dimension





4. Interface Specification

Pin No	Symbol	Description	Note
1	LEDK	Power supply Cathode input for backlight	
2	LEDA1~LEDA4	Power supply Anode input for backlight	
6~9	IM0~IM3	Select the interface mode	NOTE1
10	RESET	Reset signal input Pin	
11	VSYNC	Frame synchronous signal for RGB interface operation.	
12	HSYNC	Line synchronous signal for RGB interface operation.	
13	DOTCLK	Dot clock signal for RGB interface operation..	
14	DE	Data enable signal for RGB interface operation.	
15-32	DB17-DB0	Data bus pin	
33	SDO	Serial data output pin.	
34	SDI	Serial data input pin.	
35	RD	Read strobe signal.	
36	WRX/ (D/CX)	MCU : Write strobe signal. 4SPI : Data / Command Selection pin.	
37	D/CX (SCL)	MCU: Data / Command Selection pin. 4SPI/3SPI :Serial clock signal pin.	
38	CSX	Chip select input signal	
39	TE	Frame head pulse for tearing effect.	
40~41	VDDI	Power supply input for I/O	
42	VCI	Power supply input for LCD	
43	GND	Ground	
44	X+ (XR)	Touch panel. RIGHT	
45	Y+(YD)	Touch panel. DOWN	
46	X-(XL)	Touch panel. RIGHT	
47	Y-(YU)	Touch panel.UP	
48~50	GND	Ground	


4.1 TP Interface Specification

1	YU	Touch panel.UP
2	XL	Touch panel. RIGHT
3	YD	Touch panel. DOWN
4	XR	Touch panel. RIGHT

NOTE1

IM3	IM2	IM1	IM0	Interface	Using function pins
0	0	0	0	MCU 8bit	CSX, D/CX, WRX, RD, RESET, DB0-DB7
0	0	0	1	MCU 16bit	CSX, D/CX, WRX, RD, RESET, DB0-DB15
0	0	1	0	MCU 9bit	CSX, D/CX, WRX, RD, RESET, DB0-DB8
0	0	1	1	MCU 18bit	CSX, D/CX, WRX, RD, RESET, DB0-DB17
0	1	0	1	3SPI+RGB	CSX, SCL, SDI, RESET, VSYNC, HSYNC, DE, DOTCLK, DB0-DB17
0	1	1	0	4SPI+RGB	CSX, SCL, D/CX, SDI, RESET, VSYNC, HSYNC, DE, DOTCLK, DB0-DB17
1	0	0	0	MCU 16bit	CSX, D/CX, WRX, RD, RESET, DB1-DB8, DB10~DB17
1	0	0	1	MCU 8bit	CSX, D/CX, WRX, RD, RESET, DB10~DB17
1	0	1	0	MCU 18bit	CSX, D/CX, WRX, RD, RESET, DB0~DB17
1	0	1	1	MCU 9bit	CSX, D/CX, WRX, RD, RESET, DB9~DB17
1	1	0	1	3SPI+RGB	CSX, SCL, SDI, SDO, RESET, VSYNC, HSYNC, DE, DOTCLK, DB0-DB17
1	1	1	0	4SPI+RGB	CSX, SCL, D/CX, SDI, SDO, RESET, VSYNC, HSYNC, DE, DOTCLK, DB0-DB17

1: IOVCC
0: GND

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5. Absolute Maximum Ratings

Electrical Maximum Ratings – for IC Only

Parameter	Symbol	Min.	Max.	Unit	Note
Power supply voltage (VCI)	VCI	-0.3	+4.6	V	1
Power supply voltage (VDDI)	VDDI	-0.3	+4.6	V	1

Note:

- 1.VDDI,VCI, GND must be maintained.
- 2.The modules may be destroyed if they are used beyond the absolute maximum ratings.

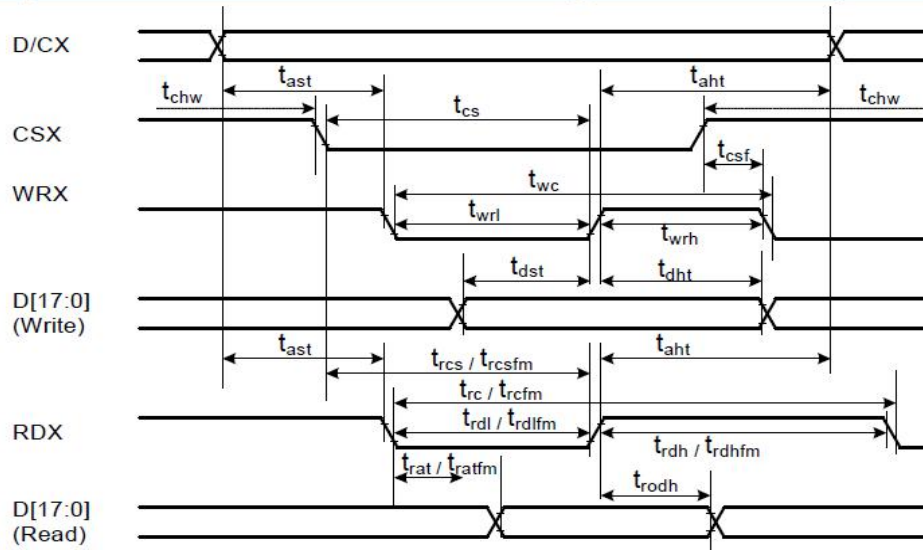
6. Electrical Specifications

At Ta = 25 °C, VCI = 2.5V to 3.3V, VDDI= 1.65V to 3.3V, GND=0V.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (analog)	VCI-GND		2.5	2.8	3.3	V
Supply voltage (logic)	VDDI-GND		1.65	1.8	3.3	V
Supply current (Logic & LCD)	ICC		-	-	-	mA
Supply voltage of white LED backlight	VLED	Forward current =80mA Number of LED = 4	2.7	3.0	3.3	V

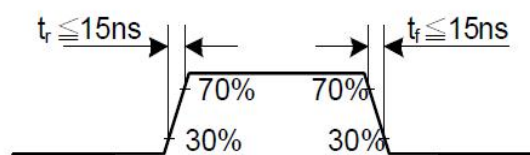
7. Timing Characteristics

7.1 Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- I system)

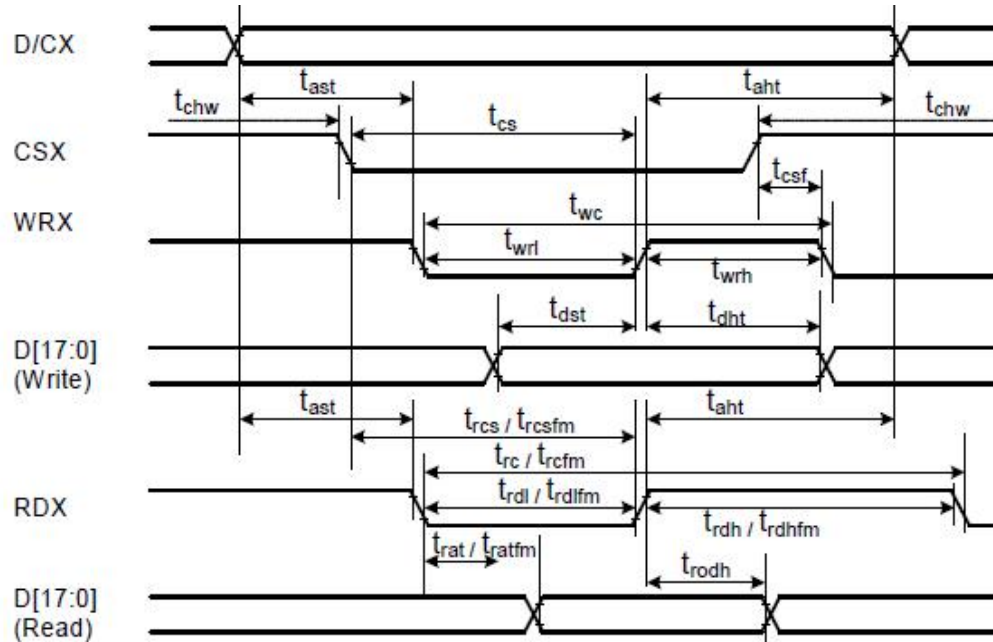


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Note: $T_a = -30$ to 70 °C, $V_{DDI}=1.65V$ to $3.3V$, $V_{CI}=2.5V$ to $3.3V$, $V_{SS}=0V$

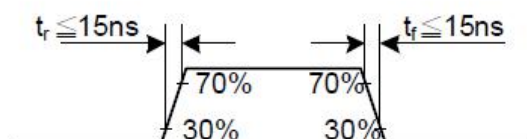


7.2 Display Parallel 18/16/9/8-bit Interface Timing Characteristics(8080- II system)

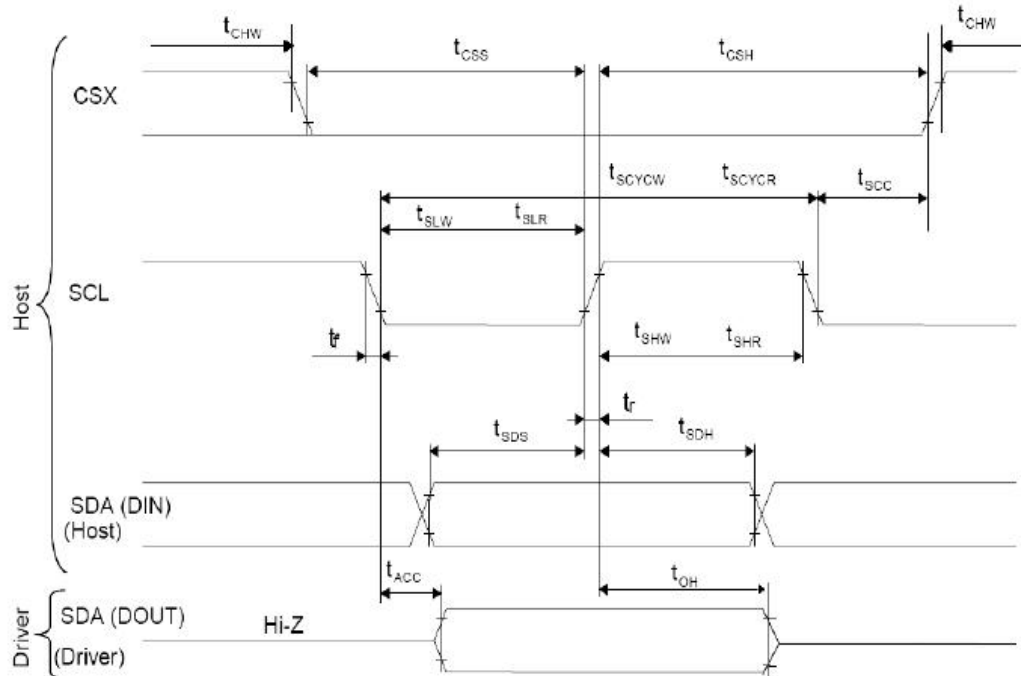


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t _{ast}	Address setup time	0	-	ns	
	t _{aht}	Address hold time (Write/Read)	0	-	ns	
CSX	t _{chw}	CSX "H" pulse width	0	-	ns	
	t _{cs}	Chip Select setup time (Write)	15	-	ns	
	t _{rcs}	Chip Select setup time (Read ID)	45	-	ns	
	t _{rcsfm}	Chip Select setup time (Read FM)	355	-	ns	
	t _{csf}	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	t _{wc}	Write cycle	66	-	ns	
	t _{wrh}	Write Control pulse H duration	15	-	ns	
	t _{wrl}	Write Control pulse L duration	15	-	ns	
RDX (FM)	t _{rcfm}	Read Cycle (FM)	450	-	ns	
	t _{rdhfm}	Read Control H duration (FM)	90	-	ns	
	t _{rdlfm}	Read Control L duration (FM)	355	-	ns	
RDX (ID)	t _{rc}	Read cycle (ID)	160	-	ns	
	t _{rdh}	Read Control pulse H duration	90	-	ns	
	t _{rdl}	Read Control pulse L duration	45	-	ns	
D[17:0], D[17:10]&D[8:1], D[17:10], D[17:9]	t _{dst}	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	t _{dht}	Write data hold time	10	-	ns	
	t _{rat}	Read access time	-	40	ns	
	t _{ratfm}	Read access time	-	340	ns	
	t _{rodh}	Read output disable time	20	80	ns	

Note: T_a = -30 to 70 °C, V_{DDI}=1.65V to 3.3V, V_{CI}=2.5V to 3.3V, V_{SS}=0V.

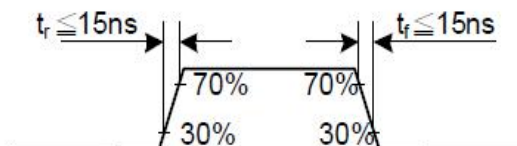


7.3 Display Serial Interface Timing Characteristics (3-line SPI system)

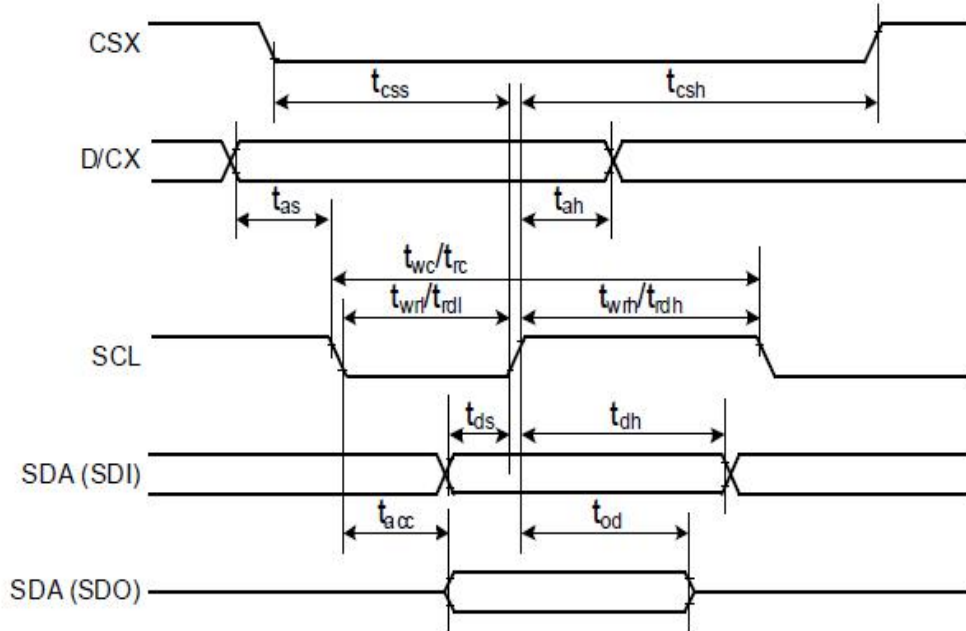


Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tsc	SCL-CSX	20	-	ns	
	tch	CSX "H" Pulse Width	40	-	ns	
	tc	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	

Note: $T_a = 25\text{ }^\circ\text{C}$, $V_{DDI}=1.65\text{V to }3.3\text{V}$, $V_{CI}=2.5\text{V to }3.3\text{V}$, $AGND=VSS=0\text{V}$

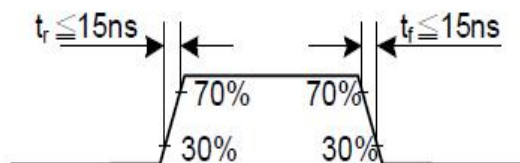


7.4 Display Serial Interface Timing Characteristics (4-line SPI system)

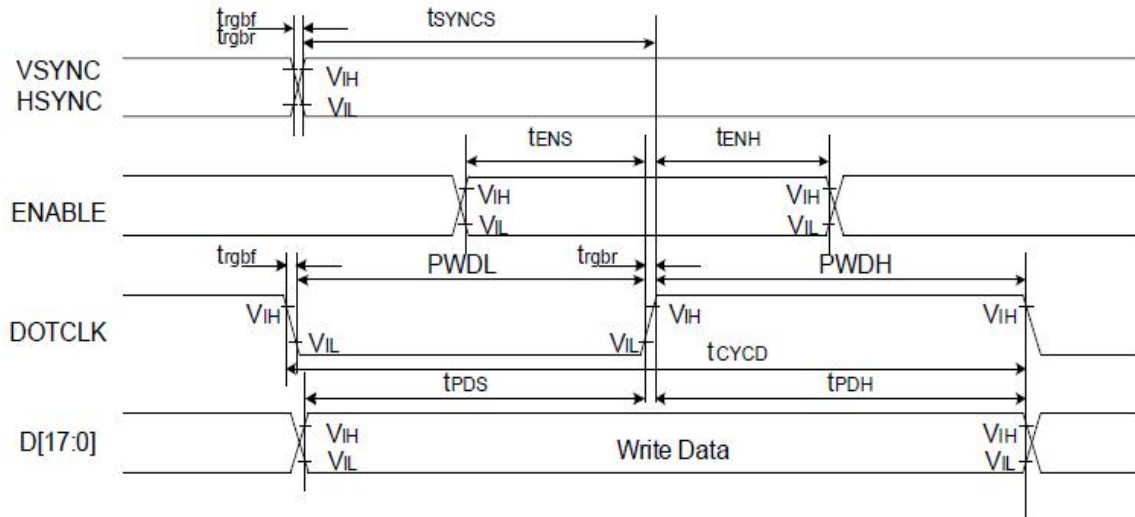


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	t_{css}	Chip select time (Write)	40	-	ns	
	t_{csh}	Chip select hold time (Read)	40	-	ns	
SCL	t_{wc}	Serial clock cycle (Write)	100	-	ns	
	t_{wrh}	SCL "H" pulse width (Write)	40	-	ns	
	t_{wrl}	SCL "L" pulse width (Write)	40	-	ns	
	t_{rc}	Serial clock 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	-		
	t_{ah}	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	t_{ds}	Data setup time (Write)	30	-	ns	
	t_{dh}	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	t_{acc}	Access time (Read)	10	-	ns	For maximum CL=30pF
	t_{od}	Output disable time (Read)	10	50	ns	For minimum CL=8pF

Note: $T_a = 25^\circ\text{C}$, $V_{DDI}=1.65\text{V to }3.3\text{V}$, $V_{CI}=2.5\text{V to }3.3\text{V}$, $AGND=VSS=0\text{V}$



7.5 Parallel 18/16/6-bit RGB Interface Timing Characteristics



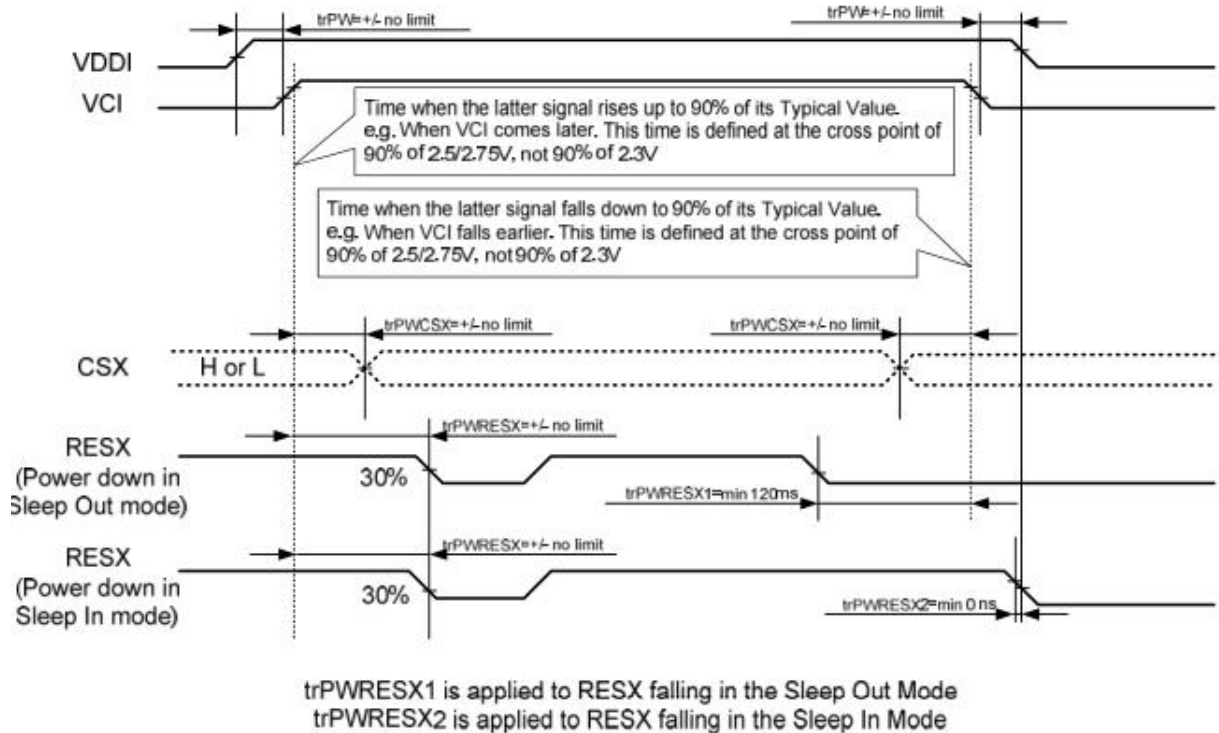
Signal	Symbol	Parameter	min	max	Unit	Description	
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode	
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns		
DE	t_{ENS}	DE setup time	15	-	ns		
	t_{ENH}	DE hold time	15	-	ns		
D[17:0]	t_{POS}	Data setup time	15	-	ns		
	t_{PDH}	Data hold time	15	-	ns		
DOTCLK	$PWDH$	DOTCLK high-level period	15	-	ns		
	$PWDL$	DOTCLK low-level period	15	-	ns		
	t_{CYCD}	DOTCLK cycle time	100	-	ns		
	t_{RGBR}, t_{RGBF}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns		6-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns		
DE	t_{ENS}	DE setup time	15	-	ns		
	t_{ENH}	DE hold time	15	-	ns		
D[17:0]	t_{POS}	Data setup time	15	-	ns		
	t_{PDH}	Data hold time	15	-	ns		
DOTCLK	$PWDH$	DOTCLK high-level pulse period	15	-	ns		
	$PWDL$	DOTCLK low-level pulse period	15	-	ns		
	t_{CYCD}	DOTCLK cycle time	50	-	ns		
	t_{RGBR}, t_{RGBF}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		

Note: $T_a = -30$ to 70 °C, $V_{DDI} = 1.65V$ to $3.3V$, $V_{CI} = 2.5V$ to $3.3V$, $AGND = VSS = 0V$

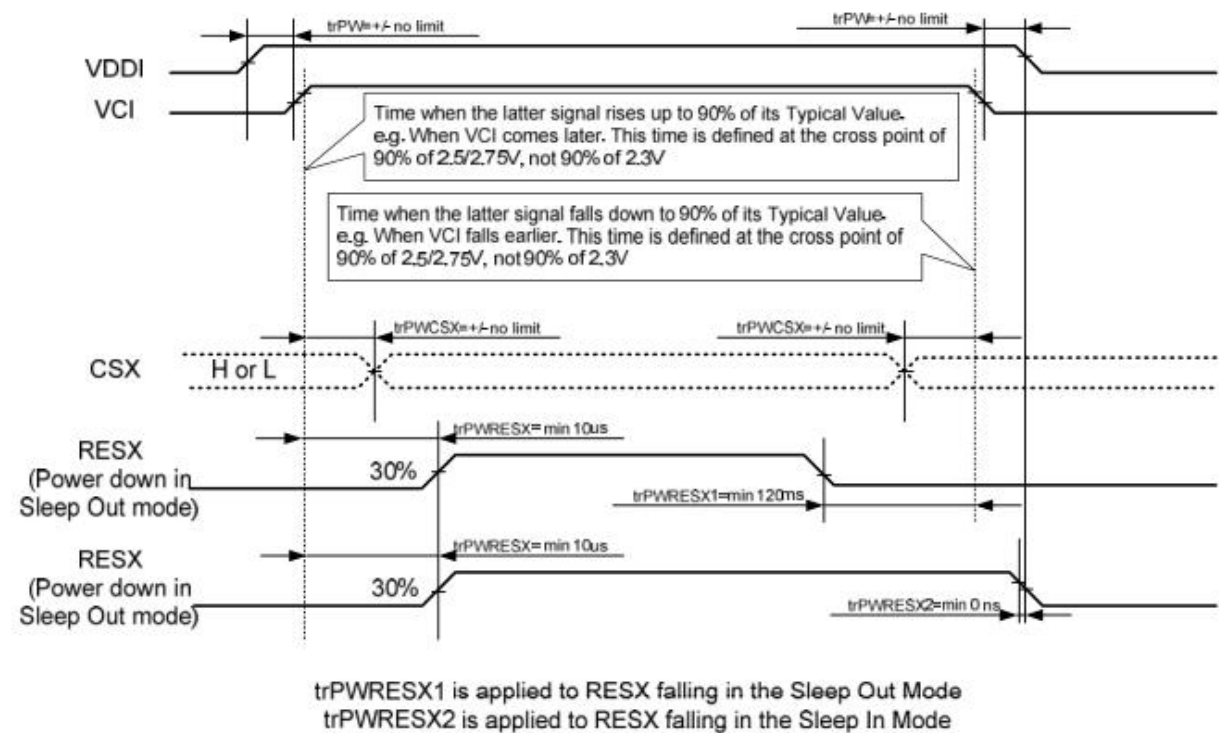



8.Power Supply Configuration

Case 1 - RESX line is held High or Unstable by Host at Power ON



Case 2 - RESX line is held Low by Host at Power ON



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9.Optical Specification

Item 项目	Symbol 符号	Condition 条件	Min 最小值	Typ 典型值	Max 最大值	Unit 单位	Note 备注
Response time 响应时间	Tr+Tf	$\Theta=0^{\circ}$ $\emptyset=0^{\circ}$ Ta=25°C	-	16	-	ms	1
Contrast ratio 对比度	Cr		-	500	-	-	2
Color gamut 饱和度	S(%)		-	55	-	%	-
Luminance uniformity 均匀度	δ WHITE		80	-	-	%	3
Viewing angle range 视角范围	Θ_{x+}	CR \geq 10 Ta=25°C	-	60	-	deg	4
	Θ_{x-}		-	60	-	deg	
	Θ_{y+}		-	70	-	deg	
	Θ_{y-}		-	40	-	deg	
LCM Luminance LCM 亮度	Lv	$\Theta=0^{\circ}$ $\emptyset=0^{\circ}$ Ta=25°C	-	180	-	Cd/m ²	5
CIE (X,Y) Chromaticity 色度坐标	White(X)		0.25	0.28	0.31	-	6
	White(Y)		0.29	0.32	0.35	-	


Note1.Response time is the time required for the display to transition from White to black(Rise Time,Tr)and from black to white(Decay Time,Tf).For additional information see FIG1...

Note2.contrast Ratio(CR) is defined mathematically by the following formula ,For more information see FIG2.

Contrast Ratio(CR)=Average Surface Luminance with all white pixels/ Average Surface Luminance with all black pixels

Note3.The uniformity in surface luminance(WHITE) is determined by measuring luminance at each test position,and then dividing the maximum luminance of all white pixels by minimum luminance of all white pixels,For more information seeFIG2.

WHITE=Minimum Surface Luminance with all white pixels(P1,P2,.....)/Maximum Surface Luminance with all white pixels(P1,P2,.....)

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Note4. Viewing angle is the angel at which contrast ratio is greater than a specific value. For TET module, the specific value of contrast ratio is 10. For monochrome and color stn module, the specific value of contrast ratio is 2. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG3

Note5. Surface luminance is the LCD surface luminance with all white pixels, For more information see FIG2.

LV=Average Surface Luminance with all white pixels(P1,P2,.....)

Note6. CIE(X,Y)chromaticity is the Center point value. For more information see FIG2.

Note7. For Viewing angle and response time testing, the testing date is base on Autronic-Melchers' s ConScope. Series instruments. For contrast ratio, Surface Luminance, Luminance uniformity and CIE, the testing date is base on CS-2000 photo detector.

Note8. For TN type TFT transmissive module, Gray scale reverse occurs in the direction of panel viewing angle

FIG1. The definition of Response time

响应时间定义



FIG2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE(X,Y)chromaticity.

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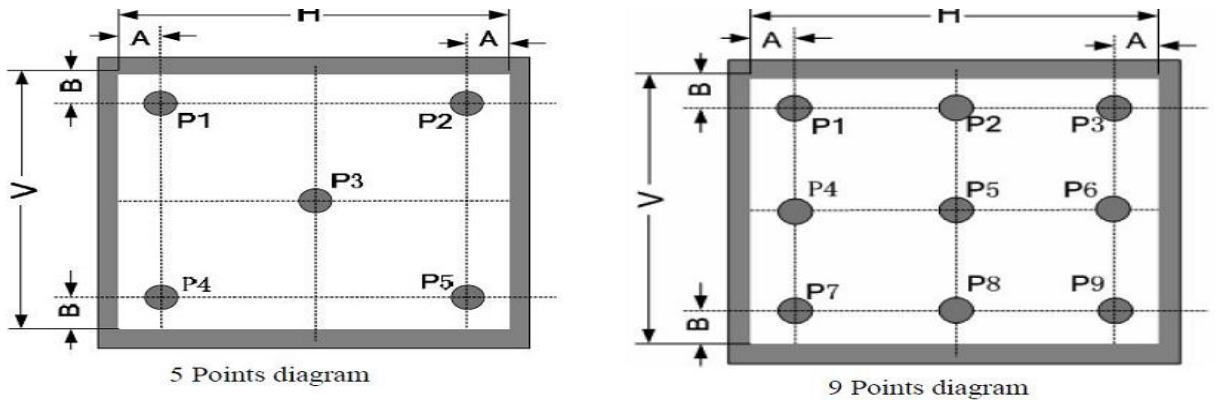
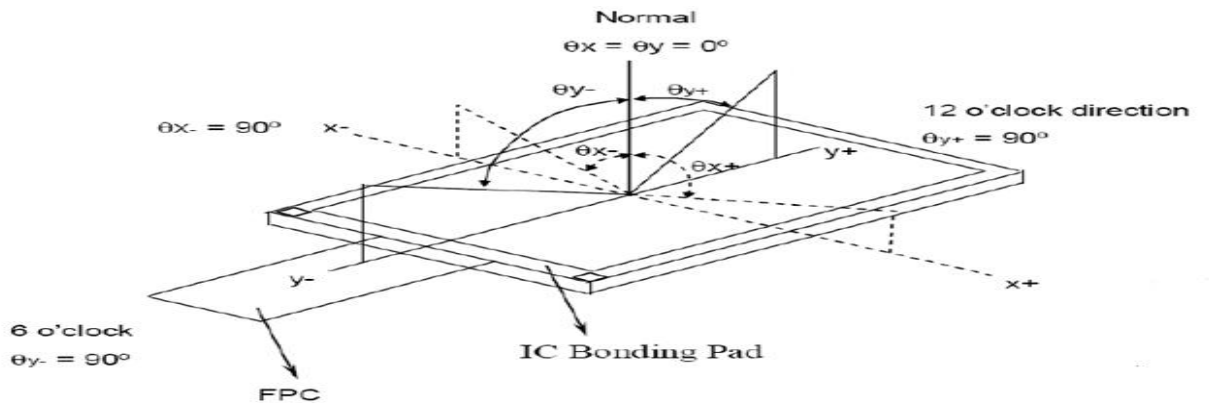



FIG3 The definition of viewing angle 视角定义



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10. Reliability Test Items

Item	Test Condition	Criterion
High Temperature Storage	70 °C, 48 hrs	Note1,Note2
Low Temperature Storage	-20 °C, 48 hrs	
High Temp. & High Humidity Storage	40 °C, 80% RH, 48hrs	
Thermal Shock (Static)	-20°C, 30 min /70°C, 30 min, 20 cycles	
High Temperature Operation	60 °C, 48 hrs	
Low temperature Operation	-10 °C, 48 hrs	

Note1: Evaluation should be tested after storage at room temperature for two hours.

Note2:

Pass: Normal display image no line defect.

Fail: No display image, or line defects.


Partial transformation of the module parts should be ignored.

11. Precautions

Please pay attentions to the followings as using the LCD module.

Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride

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to clean the display surface. It might damage the touch panel surface permanently. The recommended solvents are water and Isopropyl alcohol.


- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (i) Do not disassemble the LCD module.
- (j) Do not lift the FPC of Touch Panel.

Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

Operation

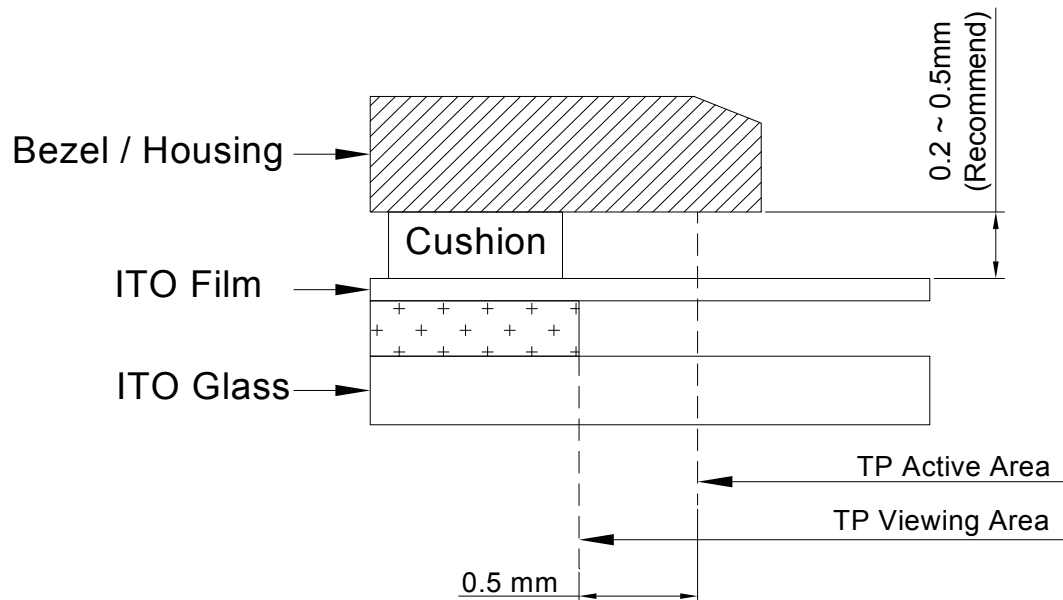
- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms stated above should always obeyed to avoid damaging the LSI and electronic circuit.
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.
- (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
- (f) When a static image is displayed for a long time, remnant image is likely to occur.
- (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.
- (h) Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent.

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- (i) For the fragility of ITO film, it should avoid to use too tapering pen as the input material.

Touch Panel Mounting Notes

- (a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb the expansion and contraction to avoid the distortion of film.
- (b) The cushion must be placed out of the Viewing Area.
- (c) Bezel/Housing edge must be posited between Key Area and Viewing Area. The edge enters the Key Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between Bezel/Housing and ITO film.
- (d) Mounting example:



The corner part has conductivity. Do not touch any metal part after mounting.

Others

- a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.