



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, TD.

TFT-LCD Module Specification

Module NO.: TST024QVHI-17P

Version: V1.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

For Customer' s Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

Version No.	Date	Content	Remark
V1.0	2018-11-7	Initial Release	

CONTENTS

1 GENERAL CHARACTERISTICS..... - 3 -

2 PRODUCT DRAWINGS..... - 4 -

3 INTERFACE DESCRIPTION..... - 5 -

4 LCM INTERFACE TIMING..... - 6 -

 4.1 RESET TIMING..... - 6 -

 4.2 DISPLAY PARALLEL 18/16/9/8-BIT INTERFACE TIMING CHARACTERISTICS(8080- I SYSTEM)..... - 7 -

 4.3 DISPLAY PARALLEL 18/16/9/8-BIT INTERFACE TIMING CHARACTERISTICS (8080- II SYSTEM)..... - 9 -

 4.4 DISPLAY SERIAL INTERFACE TIMING CHARACTERISTICS (3-LINE SPI SYSTEM)..... - 11 -

 4.5 DISPLAY SERIAL INTERFACE TIMING CHARACTERISTICS (4-LINE SPI SYSTEM)..... - 12 -

 4.6 PARALLEL 18/16/6-BIT RGB INTERFACE TIMING CHARACTERISTICS..... - 13 -

5 ABSOLUTE MAXIMUM RATINGS..... - 14 -

6 ELECTRICAL CHARACTERISTICS..... - 14 -

7 BACKLIGHT CHARACTERISTICS..... - 14 -

8 LCD OPTICAL SPECIFICATIONS..... - 15 -

9 TOUCH PANEL SPECIFICATIONS..... - 17 -

10 RELIABILITY TEST..... - 17 -

 10.1 OTHERS..... - 17 -

11 SUGGESTIONS FOR USING LCD MODULES..... - 18 -

 11.1 HANDLING OF LCM..... - 18 -

 11.2 STORAGE..... - 18 -

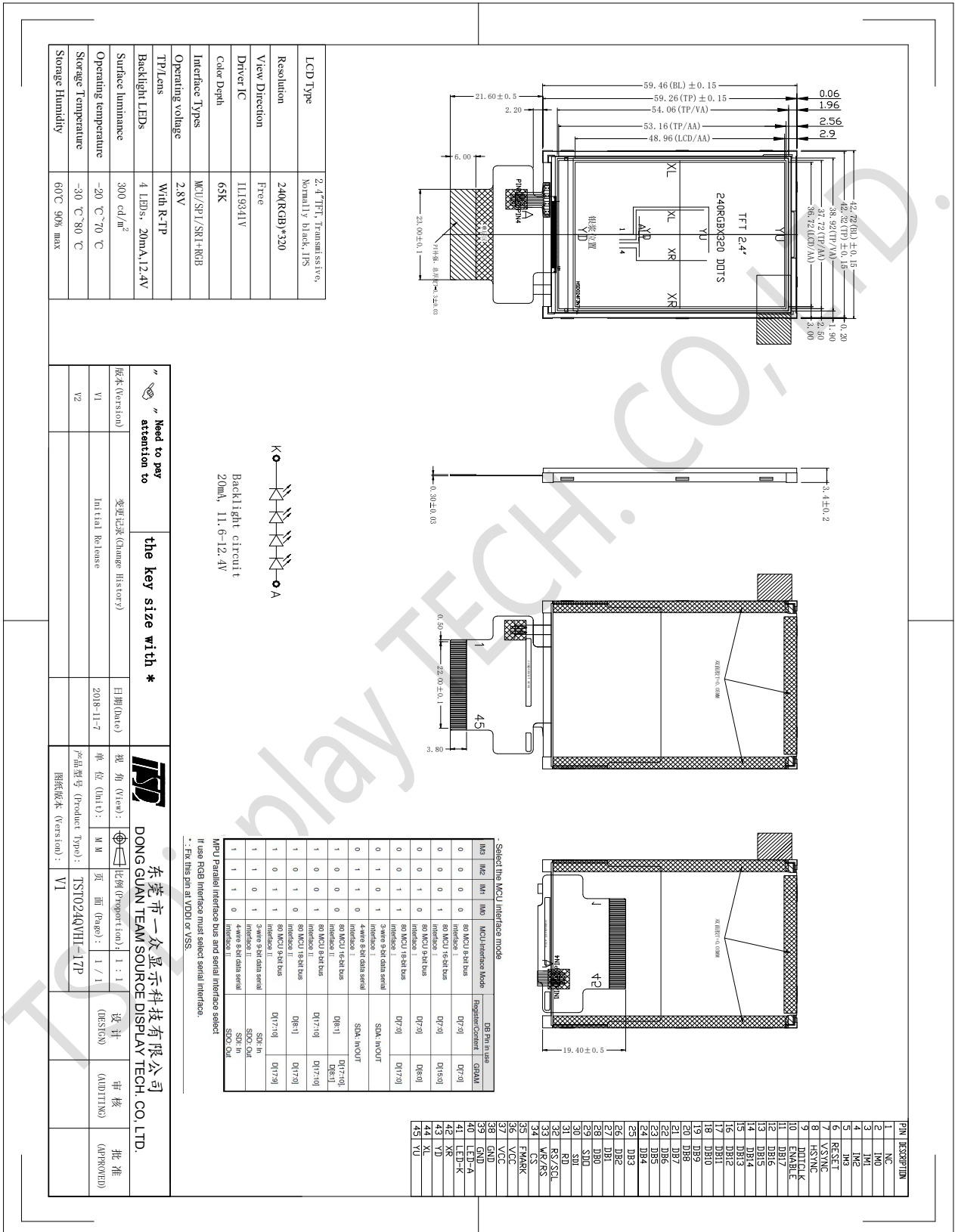
1 General Characteristics

ITEM	Specification	Unit
LCD Type	a-Si TFT, Transmissive, Normally black, IPS	-
LCD Size	2.4	inch
Resolution (W x H)	240 x (RGB) x 320	pixel
LCM (W x H x D)	42.72(W) x 60.26(H) x 3.4(D)	mm
Active Area (W x H)	36.72 (W) x 48.96 (H)	mm
Dot Pitch (W x H)	0.051 (W) x 0.153 (H)	mm
Viewing Direction	Free	-
Color Depth	65K/262K	-
Pixel Arrangement	RGB Vertical stripe	-
Backlight Type	4 LEDs	-
Surface Luminance	Typ 300	cd/m ²
Surface Treatment	Anti-glare	-
Driver IC	ILI9341V	-
Interface Type	MCU/SPI/SRI+RGB	-
Input Voltage	2.8	V
With/Without TP	With RTP	-
Weight	TBD.	g

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

2 Product drawings



3 Interface description

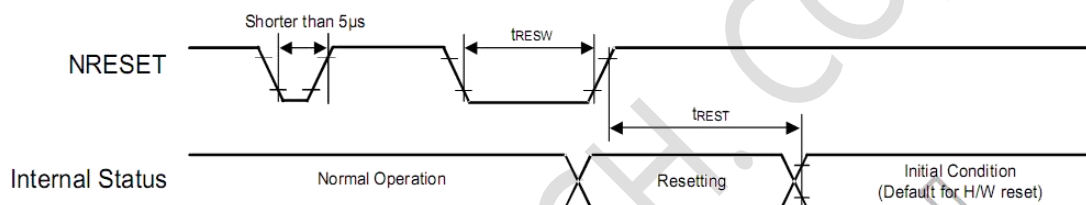
PIN NO.	Symbol	description
1	NC	No Connect
2-5	IM0-IM3	Interface select
6	RESET	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.
7	VSYNC	Frame synchronizing signal for RGB interface operation.
8	HSYNC	Line synchronizing signal for RGB interface operation.
9	DOTCLK	Dot clock signal for RGB interface operation.
10	ENABLE	Data enable signal for RGB interface operation.
11-28	DB17-DB0	18-bit parallel bi-directional data bus for MCU system and RGB interface mode
29	SDO	Serial output signal. The data is outputted on the falling edge of the SCL signal.
30	SDI	When IM[3] : Low, Serial in/out signal. When IM[3] : High, Serial input signal. The data is applied on the rising edge of the SCL signal
31	RD	8080-I/8080-II system (RD): Serves as a read signal and MCU read data at the rising edge.
32	RS/SCL	This pin is used to select "Data or Command" in the parallel interface or 4-wire 8-bit serial data interface. When RS = '1', data is selected. When RS = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface.
33	WR/RS	8080-I/8080-II system(WR):Serves as a write signal and writes data at the rising edge 4-line system(RS):Serves as command or parameter select
34	CS	Chip select signal
35	FMARK	Tearing effect output pin to synchronize MPU to frame writing, activated by S/W command. When this pin is not activated, this pin is low.
36-37	VCC	Power supply +2.8V
38-39	GND	System Ground
40	LED-A	Backlight A Anode input pin

41	LED-K	Backlight K Cathode input pin
42	XR	The touch panel X Right pin
43	YD	The touch panel Y Down pin
44	XL	The touch panel X Left pin
45	YU	The touch panel Y Up pin

Note: “0”connect to GND; “1”connect to IOVCC.

4 LCM Interface Timing

4.1 Reset Timing

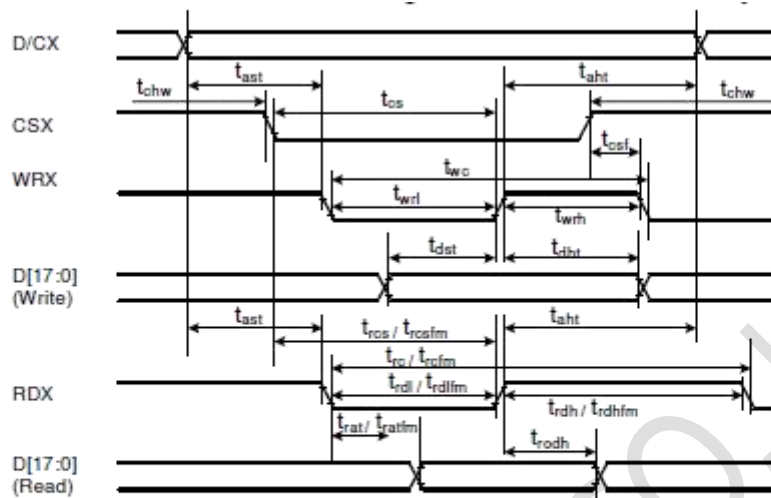


Signal	Symbol	Parameter	Min	Max	Unit
NRESET	tRESW	Reset low pulse width	10	-	us
	tREST	Reset complete time	5 (note 1)	-	ms
			120(note 2)	-	ms

Note: (1) When reset applied during SLPIN mode;

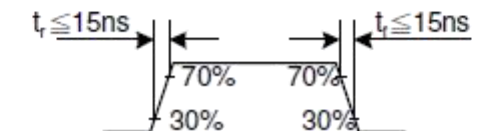
(2) When reset applied during SLPOUT mode.

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

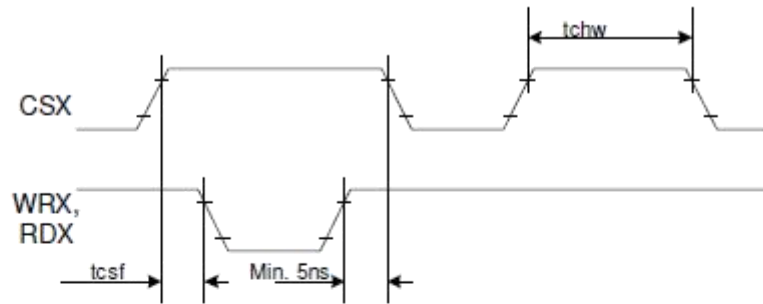


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t _{ast}	Address setup time	0	-	ns	
	t _{ah}	Address hold time (Write/Read)	0	-	ns	
CSX	t _{chw}	CSX "H" pulse width	0	-	ns	
	t _{cs}	Chip Select setup time (Write)	15	-	ns	
	t _{rcs}	Chip Select setup time (Read ID)	45	-	ns	
	t _{rcsfm}	Chip Select setup time (Read FM)	355	-	ns	
WRX	t _{csf}	Chip Select Wait time (Write/Read)	10	-	ns	
	t _{wc}	Write cycle	66	-	ns	
	t _{wrl}	Write Control pulse L duration	15	-	ns	
RDX (FM)	t _{wrh}	Write Control pulse H duration	15	-	ns	
	t _{rcfm}	Read Cycle (FM)	450	-	ns	
	t _{rdhfm}	Read Control H duration (FM)	90	-	ns	
RDX (ID)	t _{rdlfm}	Read Control L duration (FM)	355	-	ns	
	t _{rdh}	Read Control pulse H duration	90	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	t _{rdl}	Read Control pulse L duration	45	-	ns	
	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: Ta = -30 to 70 °C, VDDI= 1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V

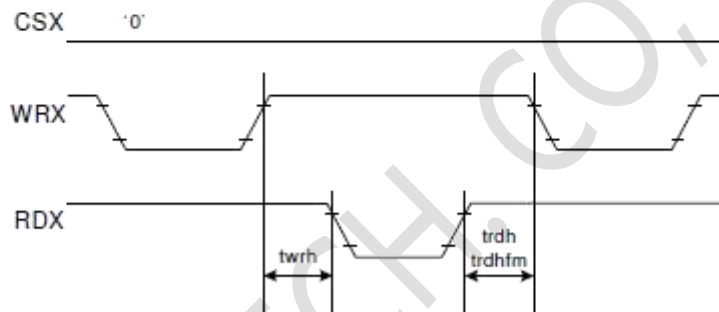


CSX timings :



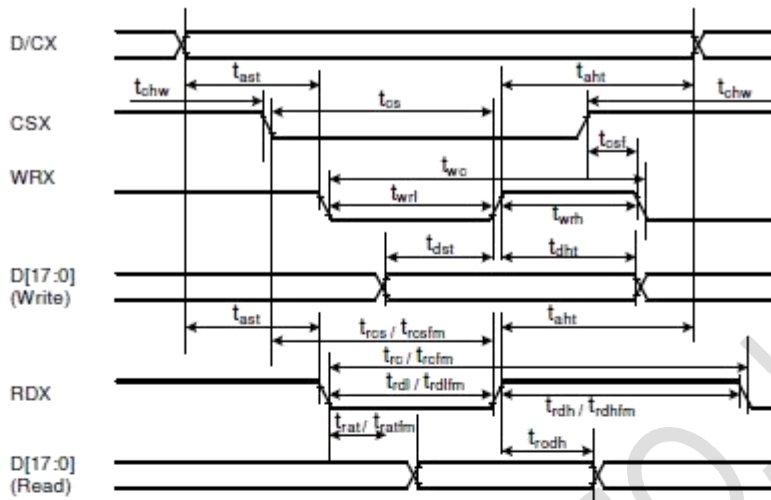
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Write to read or read to write timings:



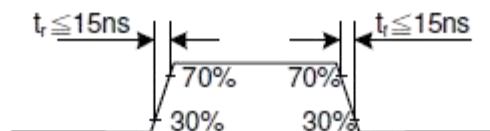
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

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

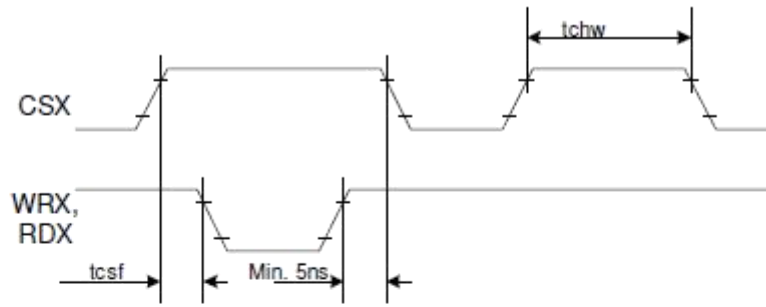


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t _{ast}	Address setup time	0	-	ns	
	t _{ahd}	Address hold time (Write/Read)	0	-	ns	
CSX	t _{chw}	CSX "H" pulse width	0	-	ns	
	t _{cs}	Chip Select setup time (Write)	15	-	ns	
	t _{rcs}	Chip Select setup time (Read ID)	45	-	ns	
	t _{rcsfm}	Chip Select 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 _{rcid}	Read cycle (ID)	160	-	ns	
	t _{rdhid}	Read Control pulse H duration	90	-	ns	
	t _{rdlid}	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 _{ldht}	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.

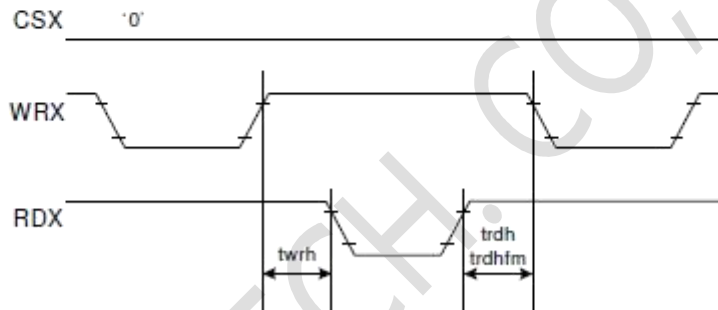


CSX timings :



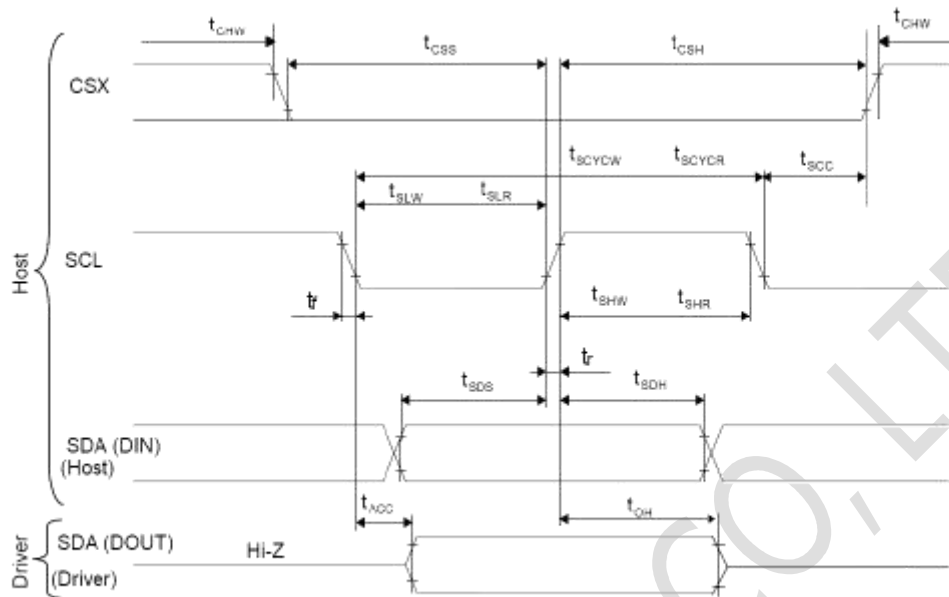
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Write to read or read to write timings:



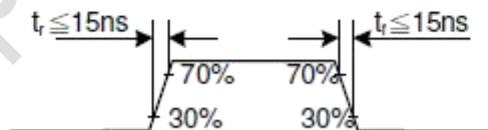
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

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

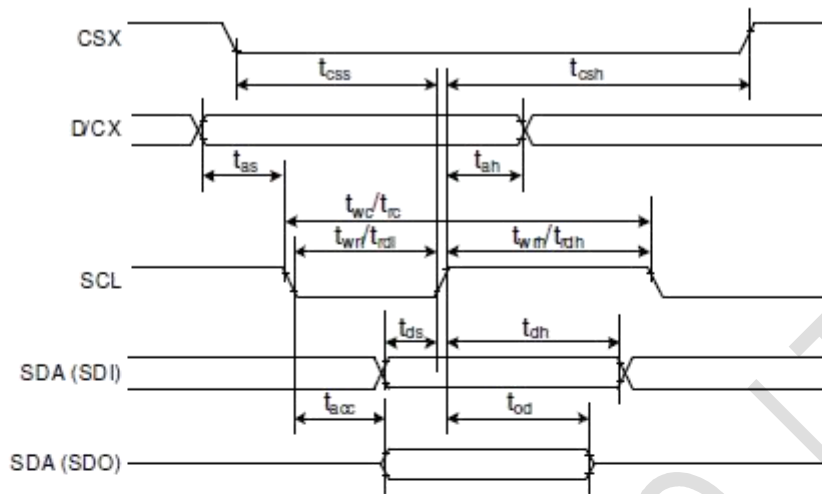


Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscyrcr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	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	tscc	SCL-CSX	20	-	ns	
	tchw	CSX "H" Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	

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

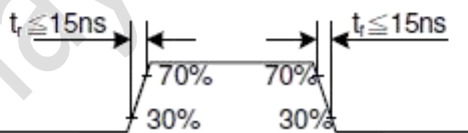


4.5 Display Serial Interface Timing Characteristics (4-line SPI system)

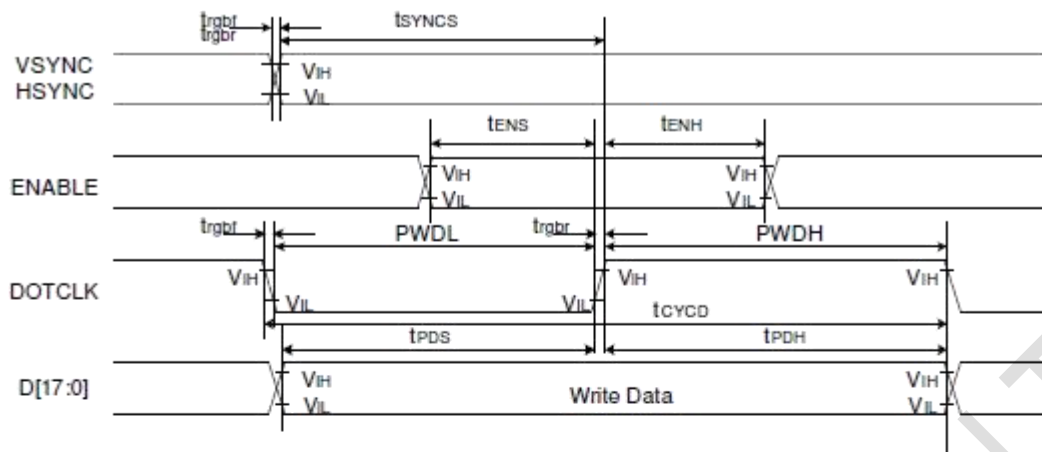


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	t_{css}	Chip select time (Write)	40	-	ns	
	t_{csh}	Chip select hold time (Read)	40	-	ns	
SCL	t_{wc}	Serial clock cycle (Write)	100	-	ns	
	t_{wrh}	SCL "H" pulse width (Write)	40	-	ns	
	t_{wrl}	SCL "L" pulse width (Write)	40	-	ns	
	t_{rc}	Serial clock 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 $C_L=30pF$
	t_{od}	Output disable time (Read)	10	50	ns	For minimum $C_L=8pF$

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

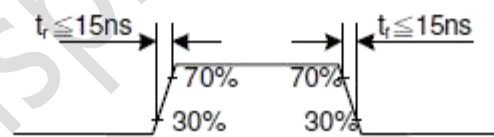


4.6 Parallel 18/16/6-bit RGB Interface Timing Characteristics



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_{POH}	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_{RGB}, t_{RGB}	-	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_{POH}	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	100	-	ns	
		t_{RGB}, t_{RGB}	-	15	ns	

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



5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VCC~GND	-0.3	3.3	V
Logic signal voltage(I/O)	IOVCC~GND	-0.3	3.3	V
Operating Temperature	TOP	-20	70	° C
Storage Temperature	TST	-30	80	° C
Humidity	RH	-	90%(Max 60° C)	RH

6 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analog operating voltage	VCC	2.5	2.8	3.3	V
Logic operating voltage	IOVCC	1.65	1.8	3.3	V
Input Current	IDD	-	TBD	-	mA
Input Voltage ' H ' level	VIH	0.7IOVCC	-	IOVCC	V
Input Voltage ' L ' level	VIL	GND	-	0.3IOVCC	
Output Voltage ' H ' level	VOH	0.8IOVCC	-	IOVCC	
Output Voltage ' L ' level	VOL	GND	-	0.2IOVCC	

7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V _f	-	12	12.4	V
Current for LED backlight	I _f	-	20	-	mA
Power consumption	W _{bl}	-	240	-	mW
Uniformity	Avg	80	-	-	%
LED Life Time	-	30000	40000	-	Hrs

Note:

1. The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.
2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.
3. Typical operating life time is an estimated data.
4. Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
Response time (By Quick)	Tr+Tf	$\theta = 0^\circ$	-	35	-	ms	Note 5
Contrast ratio	CR	$\theta = 0^\circ$	-	800	-		Note 2,6
Viewing angle	Top	$CR \geq 10$	-	80	-	Deg.	Note 2,6,7
	Bottom	$CR \geq 10$	-	80	-		
	Left	$CR \geq 10$	-	80	-		
	Right	$CR \geq 10$	-	80	-		
Color chromaticity (CF only with ITO, light source is C light, CIE 1931)	Wx	$\theta = 0^\circ$	0.290	0.310	0.330		Note 3
	Wy		0.316	0.336	0.356		
	Rx		0.627	0.647	0.667		
	Ry		0.297	0.317	0.337		
	Gx		0.255	0.275	0.295		
	Gy		0.562	0.582	0.602		
	Bx		0.120	0.140	0.160		
	By		0.068	0.088	0.108		
NTSC				60%			Note 3
Transmittance (with Polarizer)	T(%)	$\theta = 0^\circ$	-	4.65	-	%	

Note 1: Ambient temperature = 25°C.

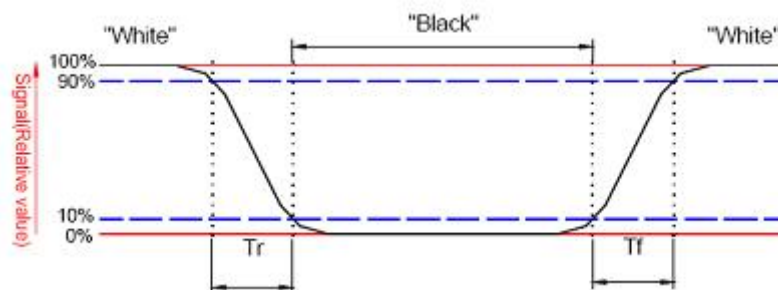
Note 2: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer. The tolerance of Transmittance is ±10%.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to “White” (falling time) and from “White” to “Black” (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

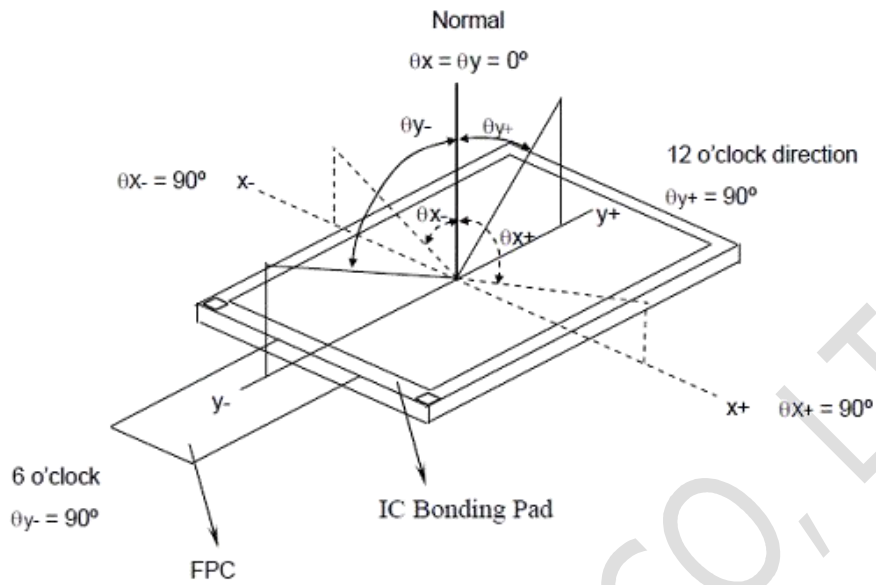


Note 6: Definition of contrast ratio:

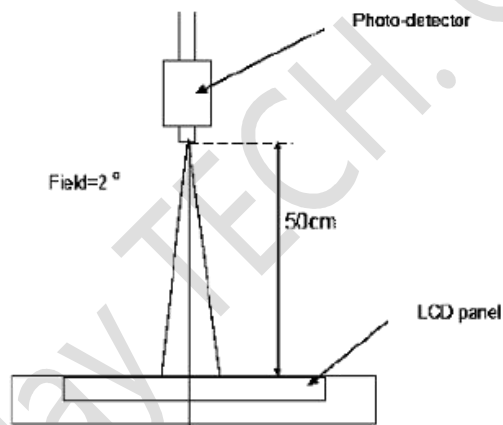
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

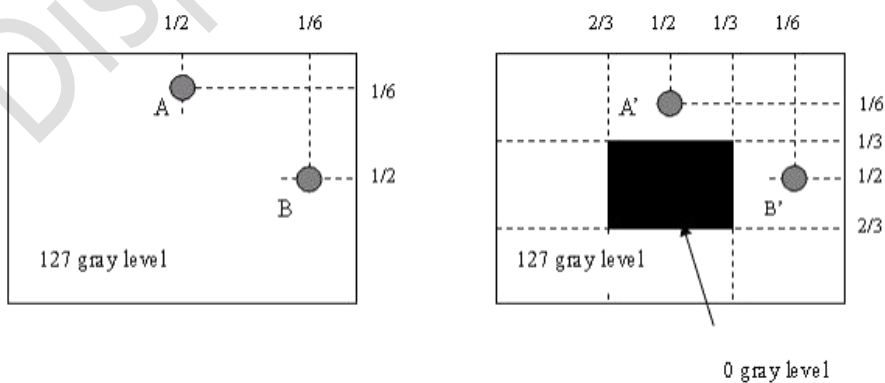
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



$1 \frac{LA-LA'}{LA} \times 100\% = 2\% \text{ max.}$, LA and LA' are brightness at location A and A'.

$1 \frac{LB-LB'}{LB} \times 100\% = 2\% \text{ max.}$, LB and LB' are brightness at location B and B'.

9 Touch Panel specifications

ITEM	VALUE			UNIT	REMARK
	Min	Typ	Max		
Linearity	-	-	1.5	%	Analog X and Y directions
Terminal Resistance	350	-	1050	Ω	x
	100	-	500		y
Insulation Resistance	20	-	-	MΩ	DC 25V
Voltage	-	5	-	V	DC
Transparency	78	-	-	%	-
Operation Force	70	-	120	g	-
Endurance	1,000,000	-	-	Touches	100g Operation Force
	-	-	30,000	Slides	
Surface Hardness	3	-	-	H	-

10 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	80±2°C/96 hours	Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. The sample shall be free from defects: 1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 5. Glass crack
2	Low Temperature Storage	-30±2°C/96 hours	
3	High Temperature Operating	70±2°C/96 hours	
4	Low Temperature Operating	-20±2°C/96 hours	
5	Temperature Cycle	-30±2°C ~ 25~ 80± 2°C × 10 cycles (30 min.) (5min.) (30min.)	
6	Damp Proof Test	60°C ±5°C × 90%RH/96 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z	
8	Shock Test	Half-sine, wave, 300m/s	
9	Packing Drop Test	Height: 80 cm 1 corner, concrete floor	
10	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 30 times Contact: ±4KV,20 times	

10.1 Others

- Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
- Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

11 Suggestions for using LCD modules

11.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don't disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD modules.
 - Tools required for assembling, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

11.2 Storage

1. Store in an ambient temperature of 5 to 45 C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

