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PRODUCT SPECIFICATION

VXT350QHI-37C

☐Preliminary Specification

☐Final Specification

CUSTOMER:

Made By: **Checked By:** **Approved By:** **Quality:** **Date:** **Note:**	**Approved By:** **Date:** **Note:**

2. Revision Record

Date	Rev.No.	Page	Revision Items	Prepared
2023-03-25	V00		The first release	SolonZhang

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3. General Specifications

VXT350QHI-37C is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit . The 3.5′′ display area contains 320 x480 pixels and can display up to 16.7M colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	16.7M	-	1
Viewing Direction	ALL	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Module size	Refer to outline drawing	mm	2
Active Area(W×H)	48.96X73.44	mm	
Number of Dots	*320 x480*	dots	
TFT Controller	ILI9488	-	
CTP Controller	GT911	-	
Power Supply Voltage	2.8	V	
Backlight	6S-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB888&SPI&MCU	-	

Note 1: Color tune is slightly changed by temperature and driving voltage.

Note 2: Without FPC and Solder.

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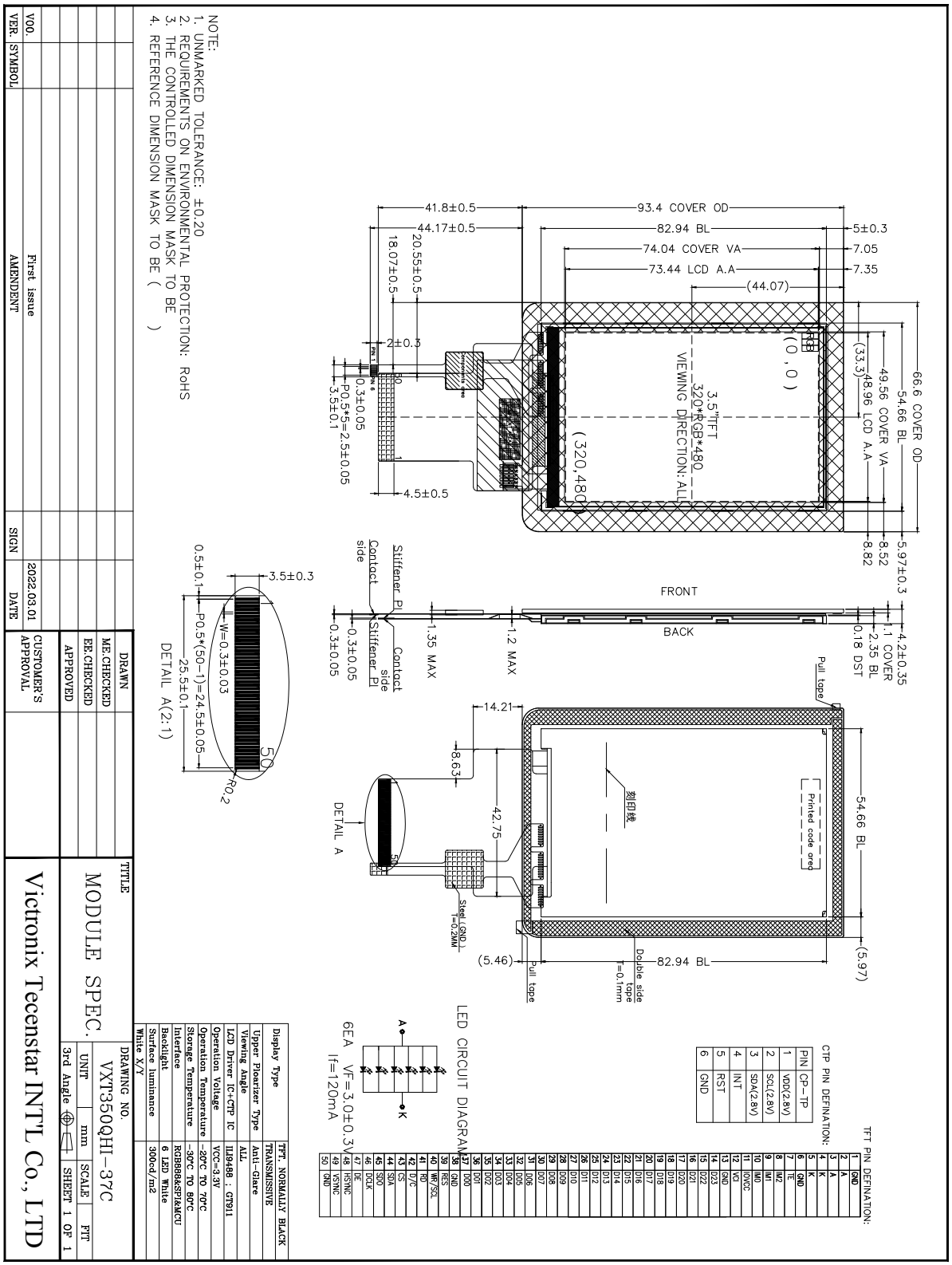
4.Outline Drawing



5. Absolute Maximum Ratings(Ta=25℃)

5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VCC	-0.3	3.3	V	1，2
	IOVCC	-0.3	3.3	V	1，2

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.
2. V_{CC} >V_{SS} must be maintained.

5.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30℃	80℃	-20℃	70℃	1,2
Humidity	-	-	-	-	3

Notes:

1. The response time will become lower when operated at low temperature.
2. Background color changes slightly depending on ambient temperature.
   The phenomenon is reversible.
3. Ta<=40℃:85%RH MAX.
   Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

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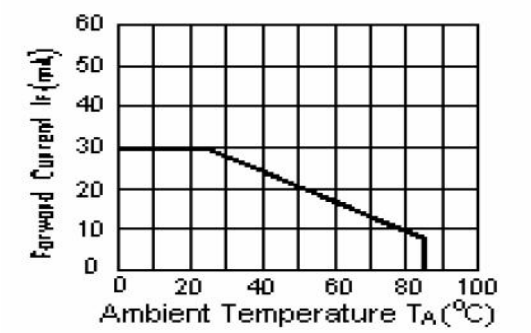
6. Electrical Specifications

6.1 Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VCC	Ta=25℃	2.5	2.8	3.3	V	
		IOVCC	Ta=25℃	1.65	1.8	3.3	V	
Input voltage	'H'	V_{IH}	Ta=25℃	0.7IOVCC	-	IOVCC	V	
	'L'	V_{IL}	Ta=25℃	-0.3	-	0.3IOVCC	V	

6.2 LED backlight specification(VSS=0V ,Ta=25℃)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	Vf	If=20mA	-	3.0	-	V	
Uniformity	ΔBp	If=20mA	80	-	-	%	
Life Time	time	If=20mA	20K	-	-	hours	1



Note 1: Brightness to be decreased to 50% of the initial value at ambient temperature TA=25℃

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6.3.1 TFT Interface signal

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>I/O</th><th>Function</th></tr>
<tr><td>1</td><td>GND</td><td>P</td><td>Ground.</td></tr>
<tr><td>2-3</td><td>LEDA</td><td>P</td><td>LED back light(Anode).</td></tr>
<tr><td>4-5</td><td>LEDK</td><td>P</td><td>LED back light(Cathode).</td></tr>
<tr><td>6</td><td>GND</td><td>P</td><td>Ground.</td></tr>
<tr><td>7</td><td>TE</td><td>O</td><td>Tearing effect output.</td></tr>
<tr><td>8</td><td>IM2</td><td>I</td><td rowspan="3"><table><tr><th>IM2</th><th>IM1</th><th>IM0</th><th>Interface</th></tr><tr><td>0</td><td>0</td><td>0</td><td>MIPI-DBI Type B 24-bit bus (DB_EN = 1)</td></tr><tr><td>0</td><td>0</td><td>0</td><td>MIPI-DBI Type B 18-bit bus (DB_EN = 0)</td></tr><tr><td>0</td><td>0</td><td>1</td><td>MIPI-DBI Type B 9-bit bus</td></tr><tr><td>0</td><td>1</td><td>0</td><td>MIPI-DBI Type B 16-bit bus</td></tr><tr><td>0</td><td>1</td><td>1</td><td>MIPI-DBI Type B 8-bit bus</td></tr><tr><td>1</td><td>0</td><td>1</td><td>MIPI-DBI Type C Option 1 (3-line SPI)</td></tr><tr><td>1</td><td>1</td><td>0</td><td>MIPI DSI</td></tr><tr><td>1</td><td>1</td><td>1</td><td>MIPI-DBI Type C Option 3 (4-line SPI)</td></tr></table></td></tr>
<tr><td>9</td><td>IM1</td><td>I</td></tr>
<tr><td>10</td><td>IM0</td><td>I</td></tr>
<tr><td>11</td><td>IOVCC</td><td>P</td><td>Power for IO voltage.</td></tr>
<tr><td>12</td><td>VCC</td><td>P</td><td>Power supply for Analog voltage.</td></tr>
<tr><td>13</td><td>GND</td><td>P</td><td>Ground.</td></tr>
<tr><td>14-37</td><td>D23-D00</td><td>I</td><td>Data input.</td></tr>
<tr><td>38</td><td>GND</td><td>P</td><td>Ground.</td></tr>
<tr><td>39</td><td>RESET</td><td>I</td><td>Reset pin</td></tr>
<tr><td>40</td><td>WR/SCL</td><td>I</td><td>Clock pin of serial interface.</td></tr>
<tr><td>41</td><td>RD</td><td>I</td><td>Read enable in 8080 MCU parallel interface.</td></tr>
<tr><td>42</td><td>D/C</td><td>I</td><td>Display data/command selection (RS) pin in MCU interface.</td></tr>
<tr><td>43</td><td>CS</td><td>I</td><td>Chip select pin of serial.</td></tr>
<tr><td>44</td><td>SDI</td><td>I</td><td>Data input pin in serial mode.</td></tr>
<tr><td>45</td><td>SDO</td><td>O</td><td>Serial output data bus.</td></tr>
<tr><td>46</td><td>PCLK</td><td>I</td><td>Data clock.</td></tr>
<tr><td>47</td><td>DE</td><td>I</td><td>Data enable pin.</td></tr>
<tr><td>48</td><td>HSYNC</td><td>I</td><td>Horizontal sync input in RGB mode.</td></tr>
<tr><td>49</td><td>VSYNC</td><td>I</td><td>Vertical sync input in RGB mode.</td></tr>
<tr><td>50</td><td>GND</td><td>P</td><td>Ground.</td></tr>
</table>

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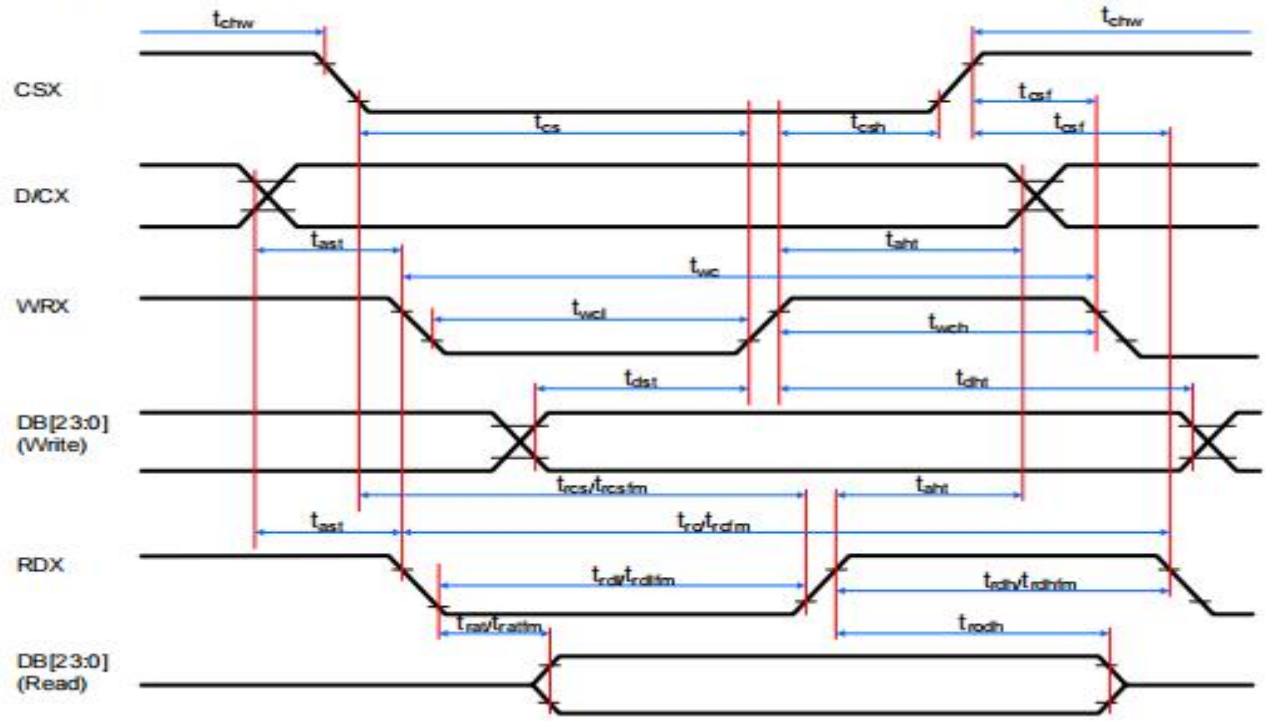
6.3.2 CTP Interface signals

Pin No.	Symbol	I/O	Function
1	VDD	P	CTP Power supply.
2	SCL	I	CTP serial clock signal.
3	SDA	I	CTP serial Input/output data bus.
4	INT	I	external Interrupt to the IC of CTP.
5	RST	I	CTP Global reset signal input pin.
6	GND	P	CTP Ground.

6.4 AC Characteristics

DBI Type B Timing Characteristics



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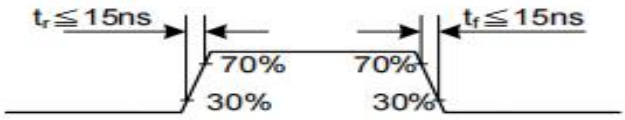
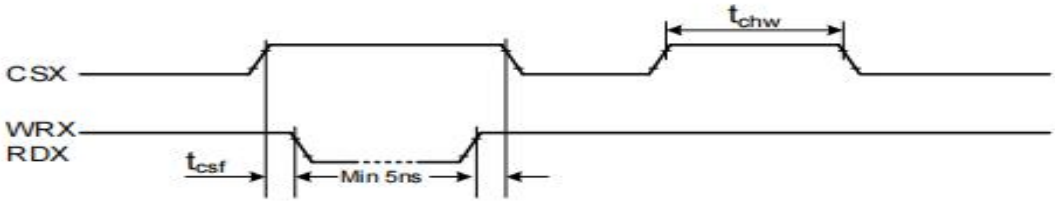
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	taht	Address hold time (Write/Read)	0	-	ns	-
CSX	tchw	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	15	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	-
	tcsf	Chip Select Wait time (Write/Read)	0	-	ns	-
WRX	twc	Write cycle	40	-	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	When read from Frame Memory
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB [23:0], DB [17:0], DB [15:0], DB [8:0], DB [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	

Notes:

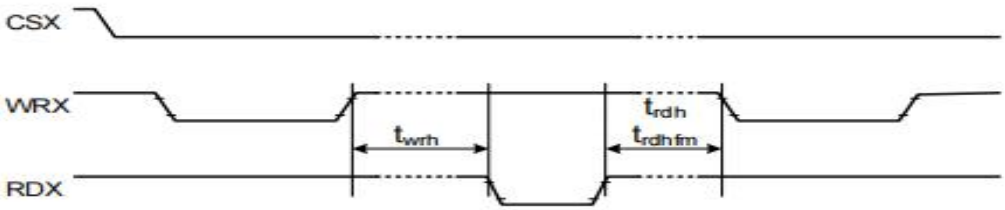
1. Ta = -40 to 85 °C, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V
2. Logic high and low levels are specified as 30% and 70% of IOVCC for input signals.
3. Input signal rising time and falling time:



7. The CSX timing:



8. The Write to Read or the Read to Write timing:



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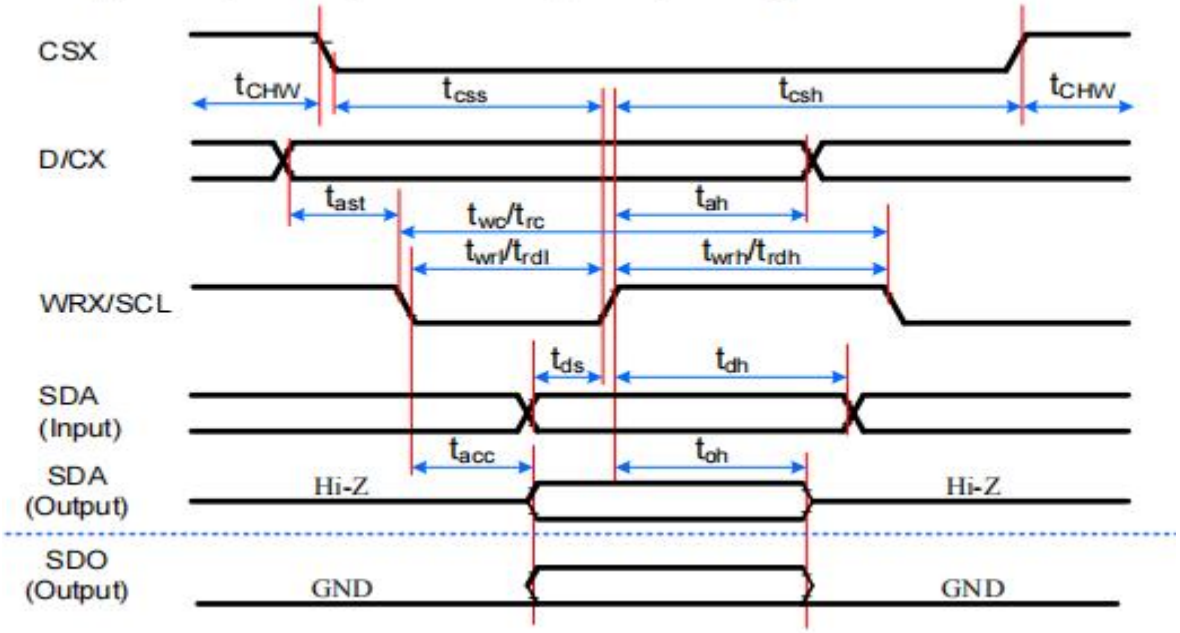
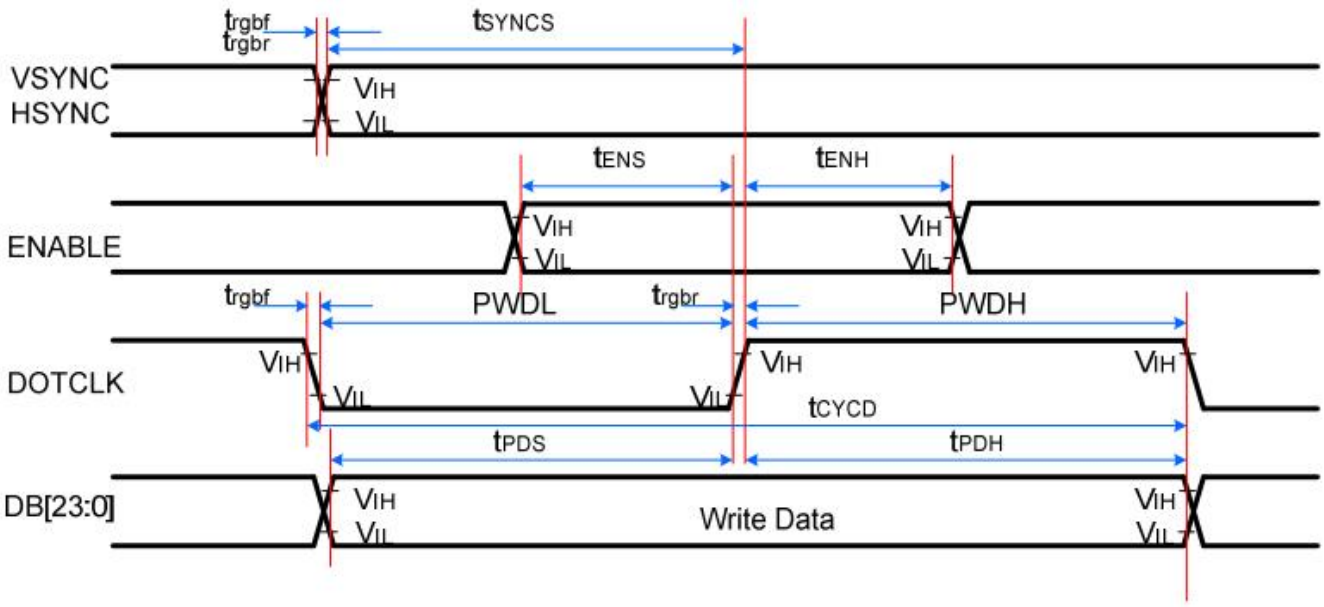
DBI Type C Option 3 (4-Line SPI System) Timing Characteristics

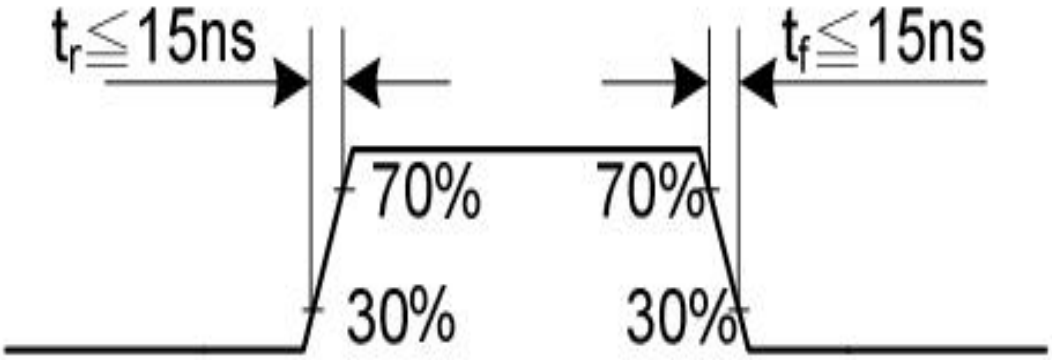


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	15	-	ns	
	tcsh	Chip select hold time (Read)	15	-	ns	
	tCHW	CS H pulse width	40	-	ns	
SCL	twc	Serial clock cycle (Write)	50	-	ns	
	twrh	SCL H pulse width (Write)	10	-	ns	
	twrl	SCL L pulse width (Write)	10	-	ns	
	trc	Serial 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
	tod	Output disable time (Read)	15	50	ns	For minimum CL=8pF

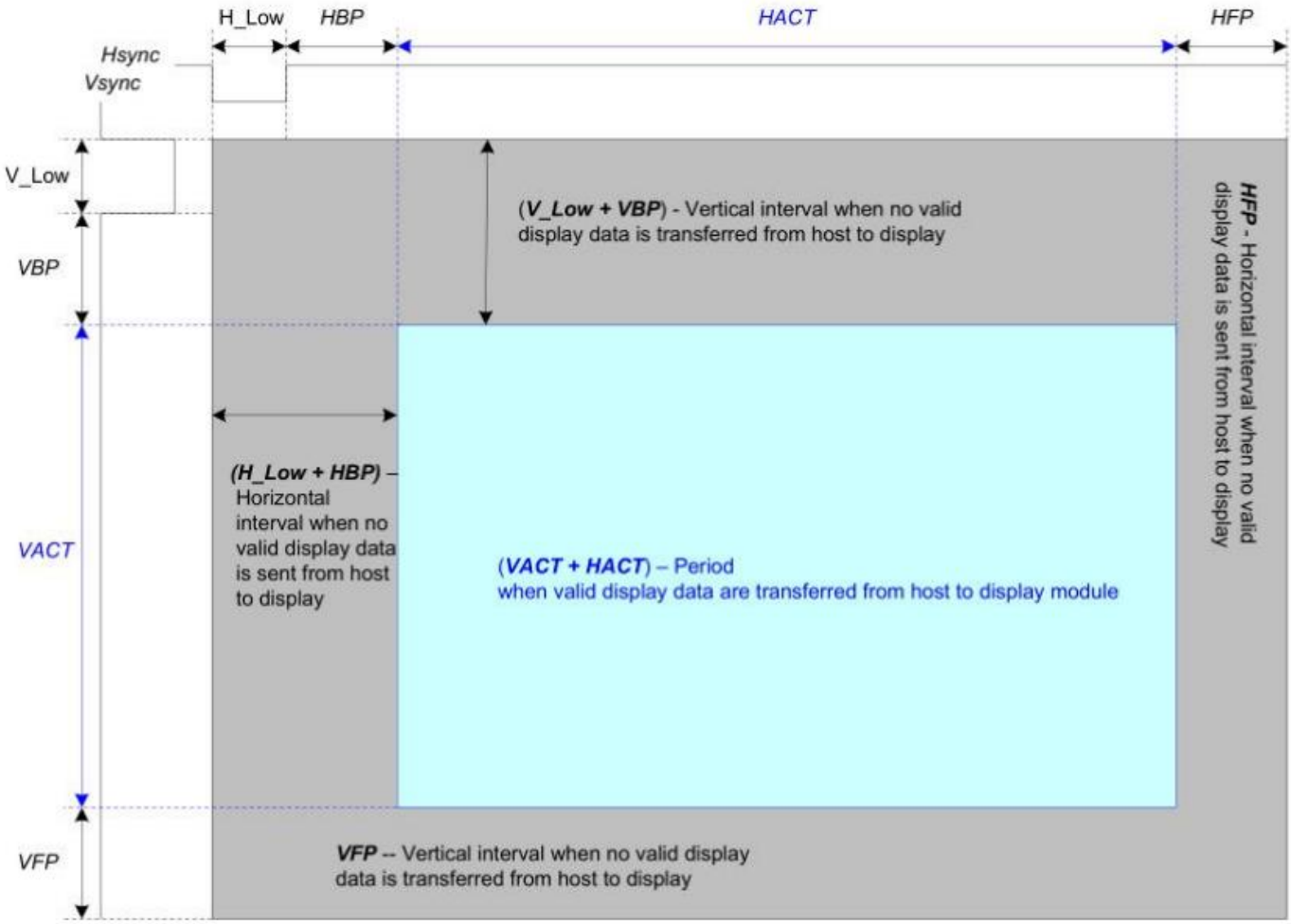
Parallel 24/18/16-bit RGB Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/ HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
DB [23:0]	t_{POS}	Data setup time	15	-	ns	16-/18-/24-bit bus RGB interface mode
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	20	-	ns	
	PWDL	DOTCLK low-level period	20	-	ns	
	t_{CYCD}	DOTCLK cycle time	50	-	ns	
	t_{rgbr} , t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	



6.5 General Timing Diagram



Parameters	Symbols	Min.	Typ.	Max.	Units
Horizontal Synchronization	H_Low	3	-	H_Low+HBP <192	DOTCLK
Horizontal Back Porch	HBP	3	-		DOTCLK
Horizontal Front Porch	HFP	3	-	255	DOTCLK
Horizontal Address	HACT	-	320	-	DOTCLK
Horizontal Frequency		-	-	33	KHz
Vertical Synchronization	V_Low	1	-	V_Low+VBP+VFP < 32	Line
Vertical Back Porch	VBP	2	-		Line
Vertical Front Porch	VFP	2	-		Line
Vertical Address	VACT	-	480	-	Line
Vertical Frequency		60	-	70	Hz
DOTCLK cycle		100	-	50	ns
DOTCLK Frequency		10	-	20	MHz

Example：DOTCLK = 20Mhz, TE=70Hz, V_Low+VBP=2, VFP=2, H_Low+HBP=100, HFP=170.

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7. Optical Characteristics

Item	Symbol		**Condition**	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		θ=0° Φ=0°	-	300	-	Cd/m^2	1
Uniformity	⊿Bp			80	-	-	%	1,2
Viewing Angle	3:00		Cr≥10	-	80	-	Deg	3
	6:00			-	80	-		
	9:00			-	80	-		
	12:00			-	80	-		
Contrast Ratio	Cr		θ=0° Φ=0°	-	700	-	-	4
Response Time	$T_{r+}T_f$			-	30	-	ms	5
Color of CIE Coordinate	W	x	θ=0° Φ=0°	Typ. -0.05	0.309	Typ. +0.05	-	1,6
		y			0.332		-	
	R	x			0.660		-	
		y			0.325		-	
	G	x			0.277		-	
		y			0.568		-	
	B	x			0.145		-	
		y			0.072		-	
NTSC Ratio	S			50	60	-	%	

Note: The parameter is slightly changed by temperature, driving voltage and materiel

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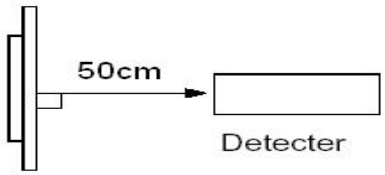
Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ5mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.

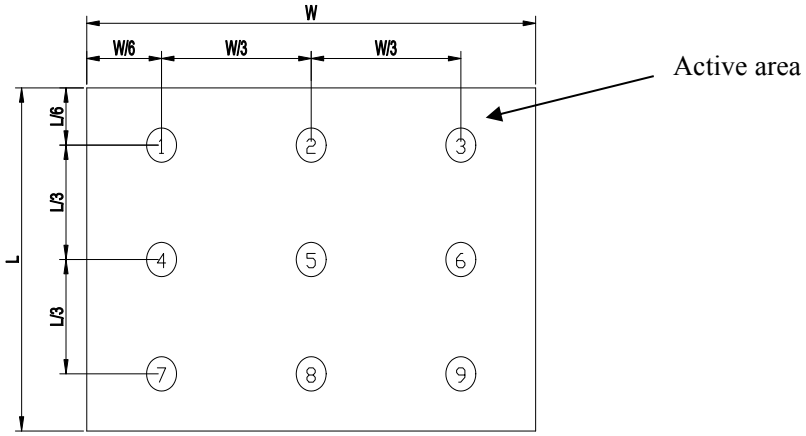


Note 2: The luminance uniformity is calculated by using following formula.

⊿Bp = Bp (Min.) / Bp (Max.)×100 (%)

Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.



Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ

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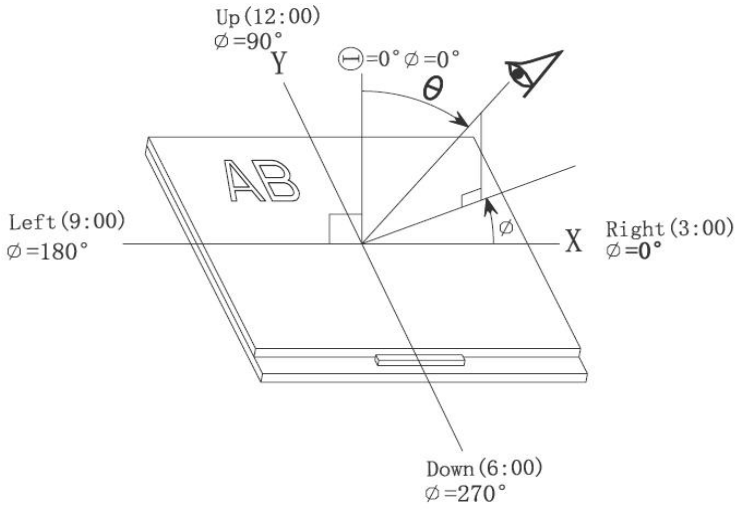
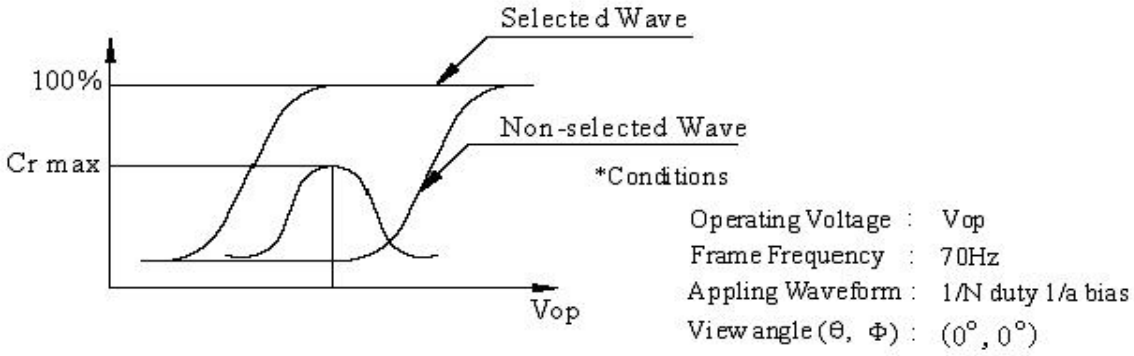


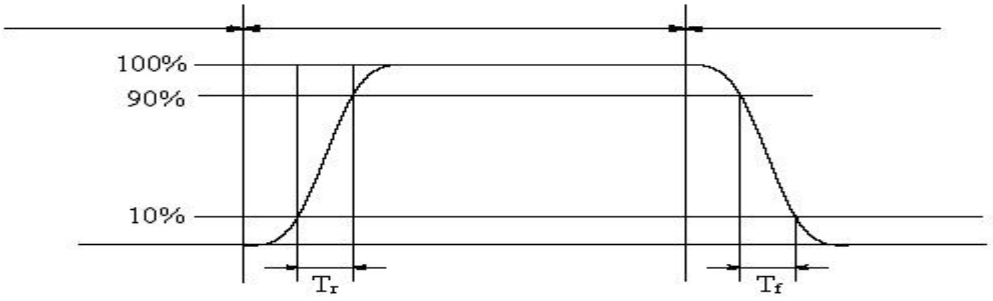
Note 4: Definition of contrast ratio.(Test LCD using DMS501)



$$Contrast\ ratio(Cr) = \frac{Brightness\ of\ selected\ dots}{Brightness\ of\ non-selected\ dots}$$

Note 5: Definition of Response time. (Test LCD using DMS501):

TThe output signals of photo detector are measured when the input signals are changed from“black”to“white”(falling time) and from“ white”to “black”(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.



The definition of response time

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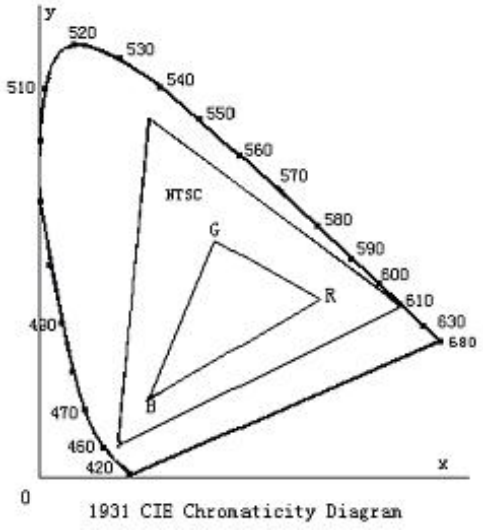
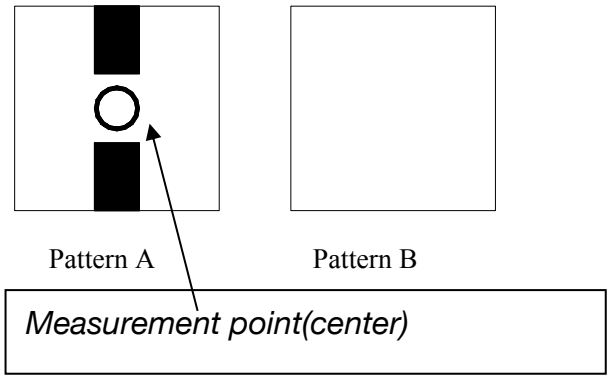
Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.



Color gamut:

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 7: Definition of cross talk.
Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100



Electric volume value=3F+/-3Hex

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8. Reliability Test Items and Criteria

Test Item	Test condition	Remark
High Temperature Storage	Ta = 80℃ 96hrs	Note1,Note3, 4
Low Temperature Storage	Ta = -30℃ 96hrs	Note1,Note3, 4
High Temperature Operation	Ta = 70℃ 96hrs	Note2,Note3, 4
Low Temperature Operation	Ta = -20℃ 96hrs	Note1,Note3, 4
Operation at High Temperature/Humidity	+60℃, 90%RH 96hrs	Note3, 4
Thermal Shock	-30℃/30 min ~ +80℃/30 min for a total 10 cycles, Start with cold temperature and end with high temperature.	Note3, 4
Package Drop Test	Height:60cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	±2KV, Human Body Mode, 100pF/1500Ω	

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: 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 don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time,at least 2 hours at room temperature

9. Precautions for Use of LCD Modules

9.1 Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping

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it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol — Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water — Ketone — Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

9.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD

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modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ~ 40℃

Relatively humidity: ≤80%

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

END

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