XIAMEN OCULAR

GDT-M320240A-5.7

SPECIFICATIONS OF LCD MODULE

1. Features

a) 5.7 inch, 320 x 240 dots, transflective, monochrome TFT module

b) 6 O'clock view direction

c) Driving scheme 1/240 duty

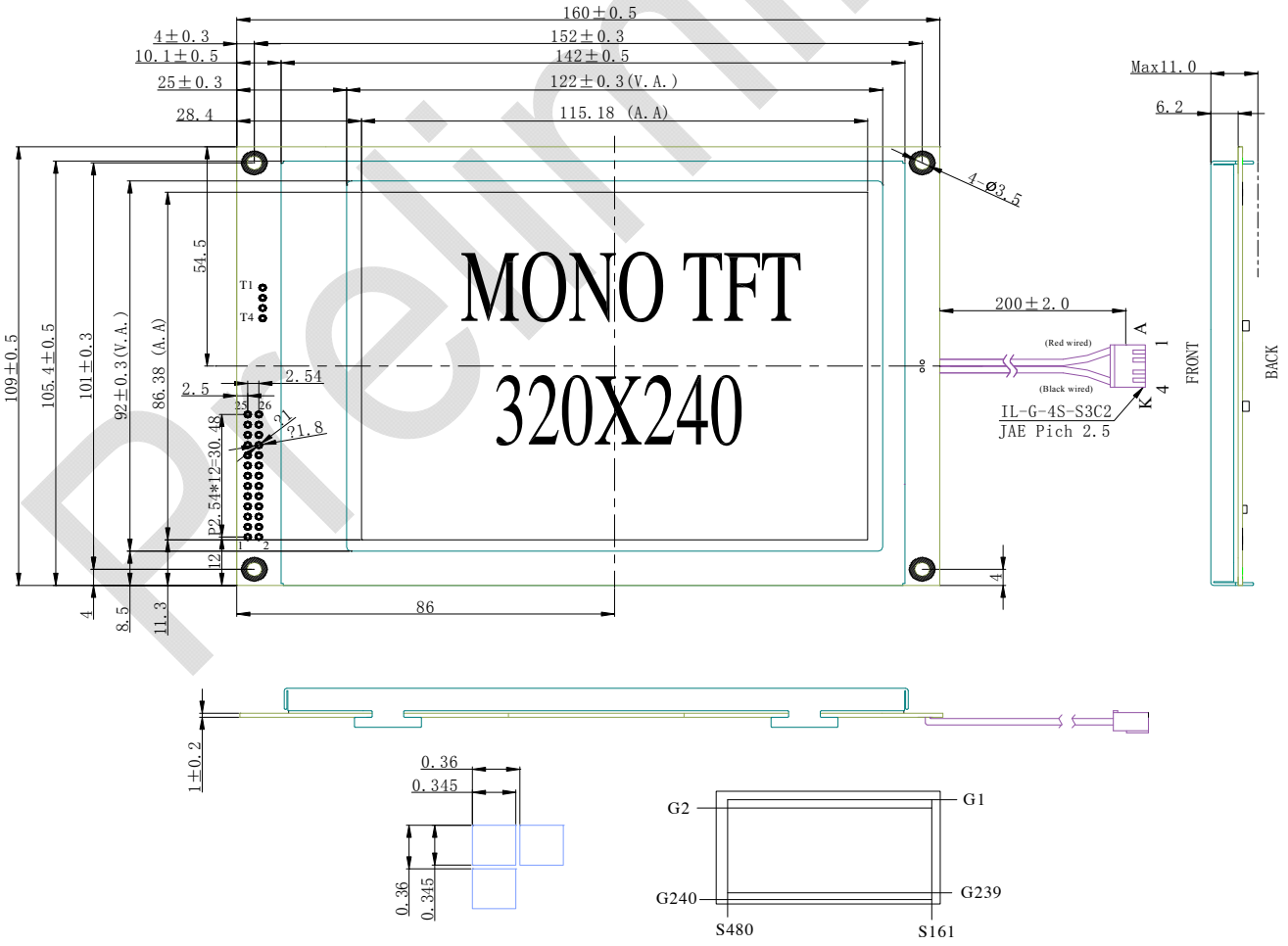
d) Built-in driver ST7511

e) 8-bit parallel/ 4-line & 3-line serial interface

f) Logic voltage V_{DD}=3.3V/5.0V (Default 5.0V)

g) LED side backlight, white color

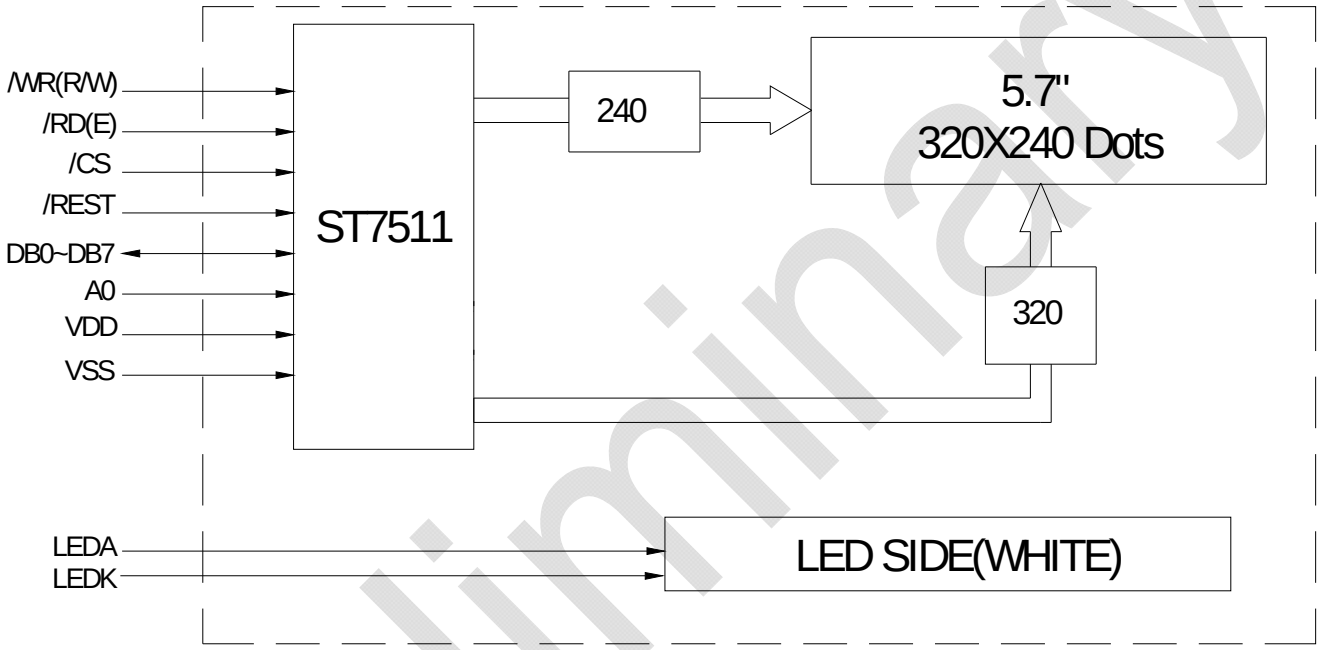
3. Outline dimension



3. Absolute maximum ratings

Item	Symbol	Min.	Typ.	Max.	Unit
Power voltage	V_{DD}-V_{SS}	-0.3	-	6.0	V
Input voltage	V_{IN}	V_{SS}	-	7.0	
Operating temperature range	T_{OP}	-20	-	+70	℃
Storage temperature range	T_{ST}	-30	-	+80	

4. Block diagram



Interface mode select:

Close J2\J4: 8-bit 8080 parallel interface

Close J2\J3: 8-bit 6800 parallel interface

Close J1\J4: 3-line serial interface

Close J1\J3: 4-line serial interface

5. Environmental requirements

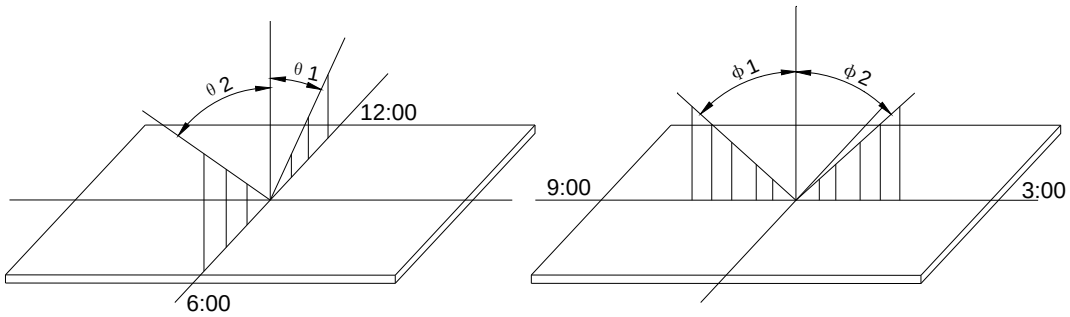
1. Operating Temperature -20°C to +70°C
2. Storage Temperature -30°C to +80°C
3. Operating Humidity 5% ~ 95%RH
4. Cycle Test 0 °C/30 min to 50 °C/30min for 1 cycle run for 10 cycles
5. Lifetime 50000 HOURS (excluding backlight)

*Note: The background color and contrast ratio of LCD will vary throughout operating temperature range.

6. Interface pin description

Pin	Symbol	External connection	Function
1	V_{SS}	Power supply	Signal ground for LCM (GND)
2	V_{DD}(V_{DDI})		Power supply for logic for LCM
3	NC		
4	A0	MCU	Data/Command identification pin. A0=Hi: Display data or parameter A0=Low: Command When using 3-line serial interface:A0=Hi
5	/WR(R/W)	MCU	6800 series, Read/Write control input pin. R/W="H": read; R/W="L": write. 8080 series, Write enable input pin. Signals on D [7:0] will be latched at the rising edge of /WR signal.
6	/RD(E)	MCU	6800 series, Read/Write control input pin. R/W="H": When E is "H", D [7:0] are in output mode. R/W="L": Signals on D [7:0] are latched at the falling edge of E signal. 8080 series, Read enable input pin. When /RD is "L", D [7:0] are in output mode.
7~14	DB0~DB7	MCU	Data bus line When using serial interface: 3-line or 4-line D7: Serial input clock (SCL). D0: Serial data (SDA), D [6:1]: fix to "H" by VDD. When chip select pin (/CS) is not active, D [7:0] are high impedance.
15	/CS	MCU	Chip select input pin. Interface access is enabled when /CS is "L" in parallel, SPI interface. When /CS is non-active (/CS="H"), D [7:0] pins are high impedance.
16	/RST	MCU	Reset input pin. Active when it is low. Initialization is executed when this pin is set to Low. SWRESET command must be required after initialization.
17	NC	-	No Connection
18	NC	-	No Connection
19	NC	-	No Connection
20	NC	-	No Connection
21	NC	-	No Connection
22	NC	-	No Connection
23	NC	-	No Connection
24	NC	-	No Connection
25	NC	-	No Connection
26	NC	-	No Connection

7. Optical characteristics



STN type display module (Ta=25℃, V_{DDI}=3.3V~5.0V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing angle	θ1	Cr≥250	-	50	-	deg
	θ2		-	65	-	
	Φ1			65		
	Φ2			65		
Contrast ratio	Cr	θ=0	300	600	-	-
Response time (rise)	Tr	-	-	15	30	ms
Response time (fall)	T_f	-	-	20	40	

8. Electrical characteristics

8.1 LED backlight

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward current	I_F	-	-	150	-	mA
Forward voltage	V_F	-	2.9	3.0	3.2	V
Luminance (on TFT surface)		-	800	-	-	Cd/m^2

8.2 Typical Electrical Characteristics

At Ta = 25 °C, V_{SS}=0V

Parameter	Symbol	Conditions	Min.	Tpy.	Max.	Unit
Operating voltage	V_{DDI},V_{DDA},V_{DDP}	External power supply	2.7	-	5.5	V
Operating voltage	V_{GH}	Built-in power supply	8.0	-	19.0	V
Operating voltage	V_{GL}	Built-in power supply	-15.0	-	-5.0	V
Operating voltage	V_{com}	Built-in power supply	-1.9	-	-0.3	V
Input high level voltage	V_{IH}		0.8V_{DDI}	-	V_{DDI}	V
Input low level voltage	V_{IL}		V_{SS}	-	0.2V_{DDI}	V
Output high level voltage	V_{OH}		0.8V_{DDI}	-	V_{DDI}	V
Output low level voltage	V_{OL}		V_{SS}	-	0.2V_{DDI}	V

Note 1: There is tolerance in optimum LCD driving voltage during production. Minimum and maximum LCD driving voltages indicate the range of optimum LCD driving voltage shift due to production tolerance. Please adjust LCD driving voltage manually to obtain the best module performance.

Note 2: Do not display a fixed pattern for more than 30 min. because it may cause image sticking due to LCD characteristics. It is recommended to change display pattern frequently. If customer must fix display pattern on the screen, please consider to activate screen saver.

8.3 Timing Specifications

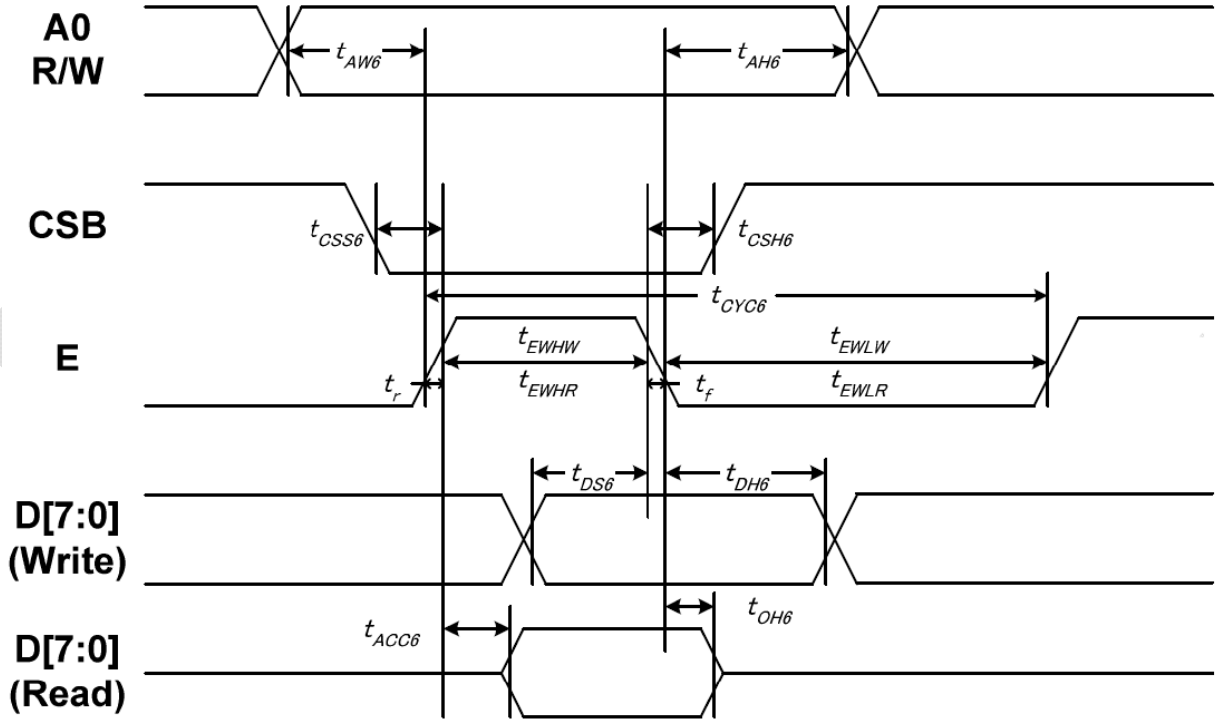
System Bus Timing for 6800 Series MPU

At Ta =25°C, V_{DDI}=3.3V~5.0V, V_{SS}= 0V

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	t_{AW6}		10	-	ns
Address hold time		t_{AH6}		0		
System cycle time	E	t_{CYC6}		1100		
Enable L pulse width (WRITE)		t_{EWLW}		500		
Enable H pulse width (WRITE)		t_{EWHW}		500		
Enable L pulse width (READ)		t_{EWLR}		500		
Enable H pulse width (READ)		T_{EWHR}		500		
CSB setup time	CSB	t_{CSS6}		100		
CSB hold time		t_{CSH6}		100		
Write date setup time	D[7:0]	t_{DS6}		200		
Write data hold time		t_{DH6}		60		
Read data access time		t_{ACC6}	CL=100pF	-	950	
Read data output disable time		t_{OH6}	CL=100pF	5	200	

Note:

1. The input signal rise time and fall time (t_r, t_f) is specified at 15 ns or less. When the system cycle time is extremely fast, ($t_r + t_f$) ≦ ($t_{CYC8} - t_{CCLW} - t_{CCHW}$) for ($t_r + t_f$) ≦ ($t_{CYC8} - t_{CCLR} - t_{CCHR}$) are specified.
2. All timing is specified using 20% and 80% of V_{DDI} as the reference.
3. t_{CCLW} and t_{CCLR} are specified as the overlap between CSB being “L” and /WR and /RD being at the “L” level. CSB and /WR (or /RD) cannot act at the same time and CSB should be 100ns wider than /WR (or /RD).



System Bus Timing for 6800 Series MPU

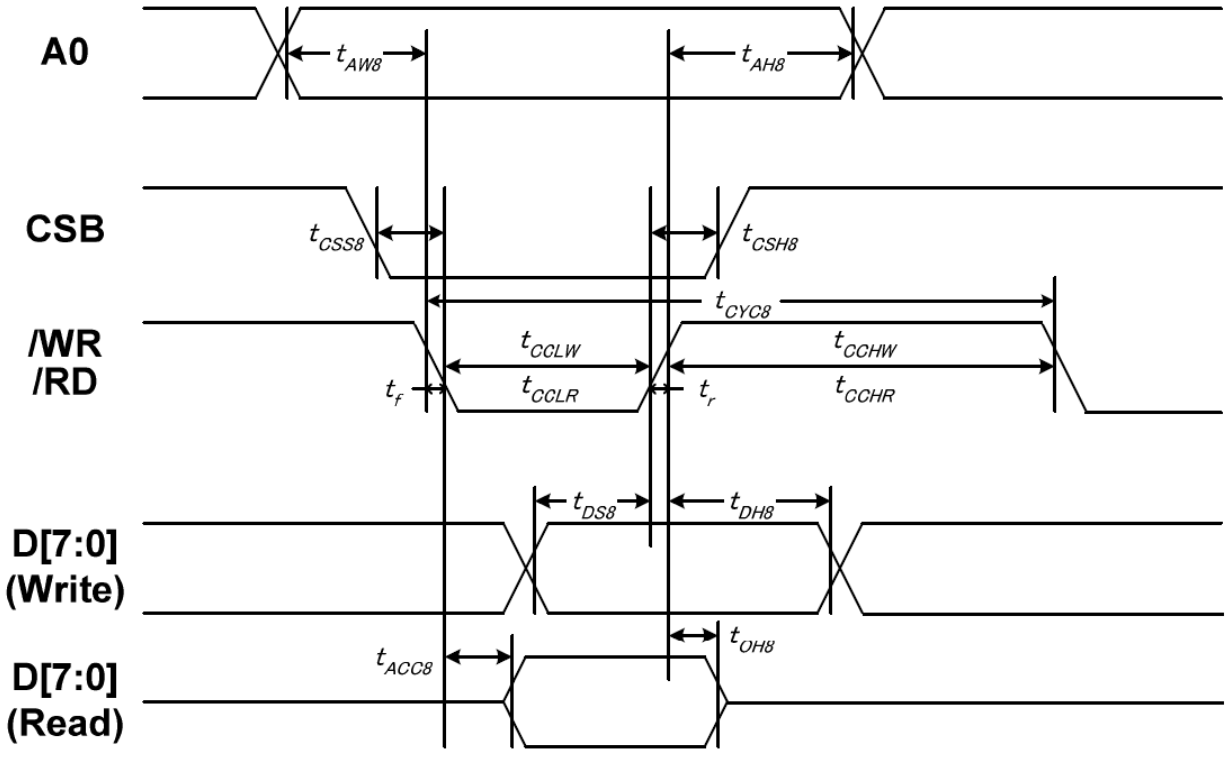
System Bus Timing for 8080 Series MPU

At Ta =25°C, V_{DDI}=3.3V~5.0V, V_{SS}= 0V

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	t_{AW8}		10	-	ns
Address hold time		t_{AH8}		0		
System cycle time	E	t_{CYC8}		1100		
Enable L pulse width (WRITE)		t_{CCLW}		500		
Enable H pulse width (WRITE)		t_{CCHW}		500		
Enable L pulse width (READ)		T_{CCLR}		950		
Enable H pulse width (READ)		T_{CCHR}		500		
CSB setup time	CSB	t_{CSS8}		100		
CSB hold time		t_{CSH8}		100		
Write date setup time	D[7:0]	t_{DS8}		200		
Write data hold time		t_{DH8}		50		
Read data access time		t_{ACC8}	CL=100pF	-	950	
Read data output disable time		t_{OH8}	CL=100pF	5	200	

Note:

1. The input signal rise time and fall time (t_r, t_f) is specified at 15 ns or less. When the system cycle time is extremely fast, ($t_r + t_f$) ≦ ($t_{CYC8} - t_{CCLW} - t_{CCHW}$) for ($t_r + t_f$) ≦ ($t_{CYC8} - t_{CCLR} - t_{CCHR}$) are specified.
2. All timing is specified using 20% and 80% of V_{DDI} as reference.
3. t_{CCLW} and t_{CCLR} are specified as the overlap between CSB being "L" and /WR and /RD being at the "L" level. CSB and /WR (or /RD) cannot act at the same time and CSB should be 100ns wider than /WR (or /RD).



System Bus Timing for 8080 Series MPU

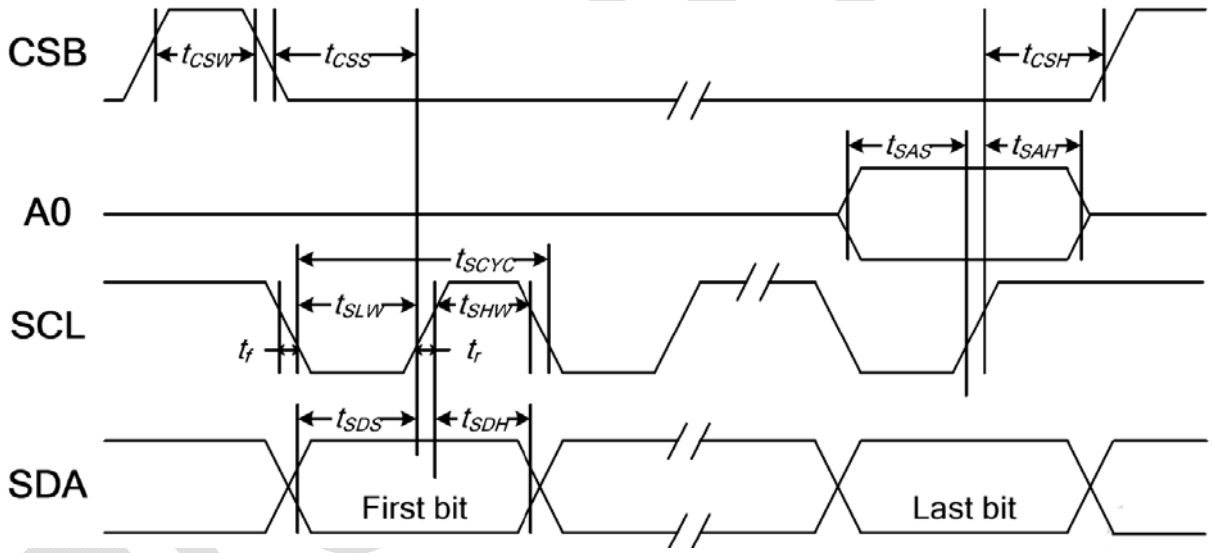
System Bus Timing for 4-Line Serial Interface

At Ta =25°C, V_{DDI}=3.3V~5.0V, V_{SS}= 0V

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCL	T_{SCYC}		300	-	ns
SCL “H” pulse width		T_{SHW}		100		
SCL “L” pulse width		t_{SLW}		100		
Address setup time	A0	t_{SAS}		150		
Address hold time		T_{SAH}		150		
Data setup time	SDA	T_{SDS}		100		
Data hold time		T_{SDH}		100		
CSB-SCL setup time	CSB	t_{CSS}		150		
CSB-SCL hold time		t_{CSH}		150		
CSB “H” pulse width		T_{CSW}		25		

Note:

1. The input signal rise and fall time (t_r, t_f) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of V_{DDI} as the standard.

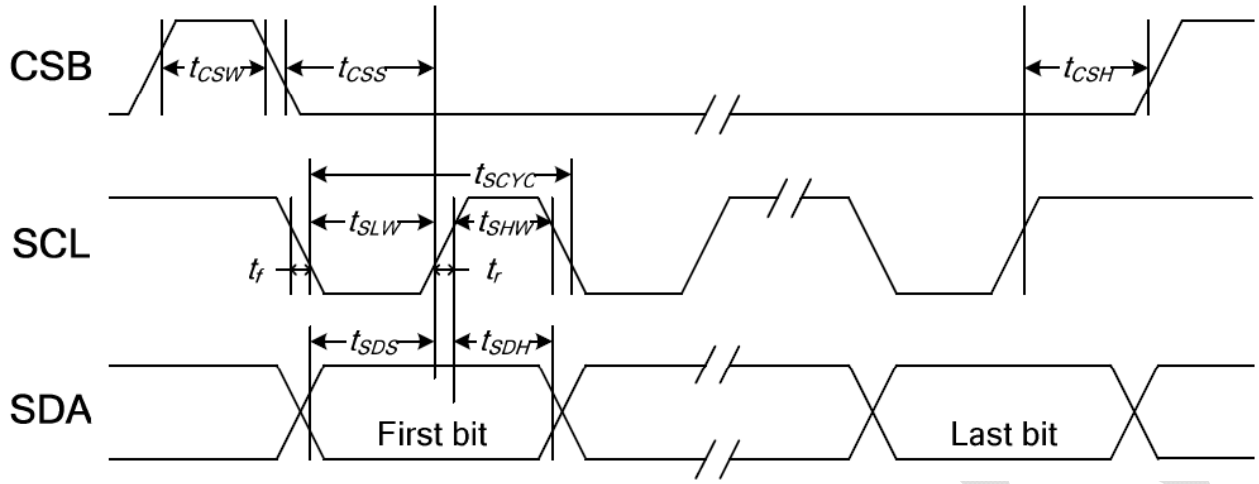


System Bus Timing for 4-Line Serial Interface

System Bus Timing for 3-Line Serial Interface

At Ta = 25°C, V_{DDI}=3.3V~5.0V, V_{SS}= 0V

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCL	T_{SCYC}		250	-	ns
SCL “H” pulse width		T_{SHW}		100		
SCL “L” pulse width		t_{SLW}		100		
Data setup time	SDA	T_{SDS}		100		
Data hold time		T_{SDH}		100		
CSB-SCL time	CSB	t_{CSS}		150		
CSB-SCL time		t_{CSH}		150		
CSB “H” pulse width		T_{CSW}		10		



System Bus Timing for 3-Line Serial Interface

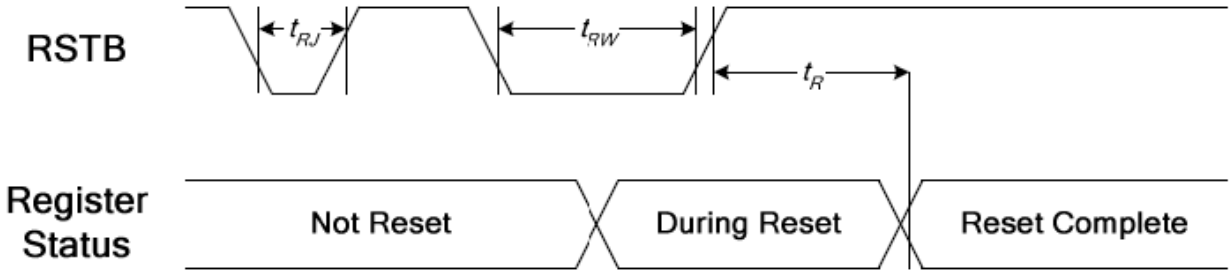
Hardware Reset Timing

At Ta = 25°C, V_{DDI}=3.3V~5.0V, V_{SS}= 0V

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Reset time	RSTB	t_R		-	5	us
Reset "L" pulse width		T_{RW}		15	-	
Reset rejection		T_{RJ}		-	5	
Reset rejection (for noise spike)		T_{RJS}		-	10	ns

Note:

1. For PROM related operation, it takes 50ms at least for PROM Registers to load PROM contents. Do not use any PROM related command during this period.
2. When the system issues a RSTB LOW pulse, the reset procedure of IC will start if the LOW pulse is longer than t_{RW} specified above. If the LOW pulse is less than t_{RJ} specified above, the reset procedure of IC will not start. If the LOW pulse is longer than t_{RJ} and less than t_{RW}, the reset procedure of IC is not guaranteed.



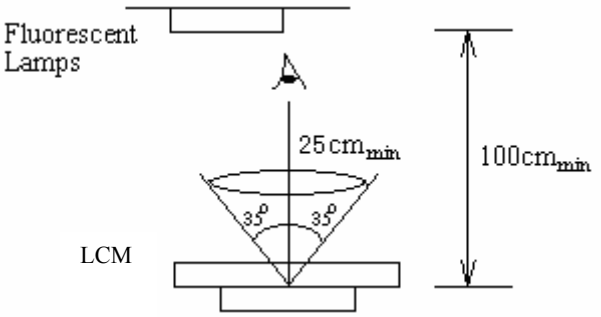
Hardware Reset Timing

9. Specification of Quality Assurance

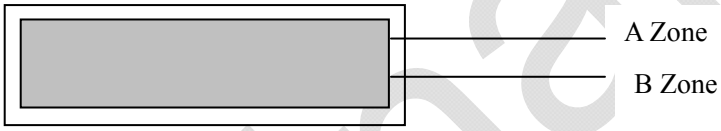
9.1 Standard of the product appearance test

The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 25cm or more.

Viewing direction for inspection is 35° from vertical against LCM.



Definition of zone:



A Zone: Active display area (minimum viewing area).

B Zone: Non-active display area (outside viewing area).

9.2 Specification of quality assurance

AQL inspection standard

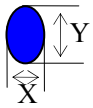
Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

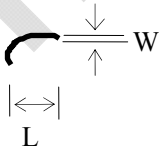
Classify		Item	Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Backlight	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

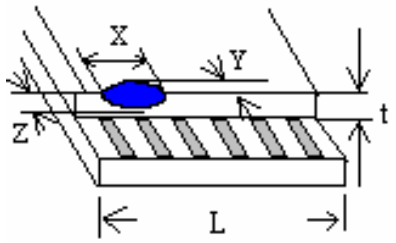
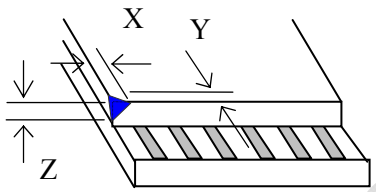
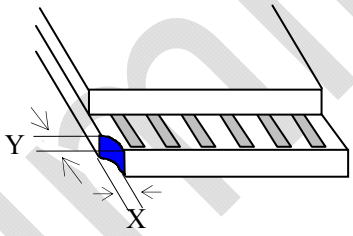
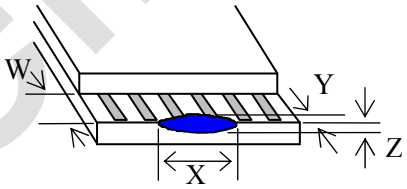
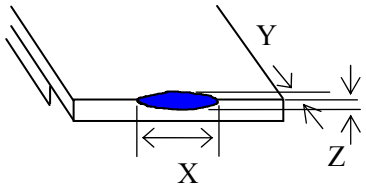
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td></td><td>LC leakage</td></tr>
<tr><td></td><td>Flickering</td></tr>
<tr><td></td><td>No display</td></tr>
<tr><td></td><td>Wrong viewing direction</td></tr>
<tr><td></td><td>Wrong Back-light</td></tr>
<tr><td>2</td><td>Contrast defect</td><td rowspan="2">Refer to approval sample</td></tr>
<tr><td></td><td>Background color deviation</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(including Polarizer)

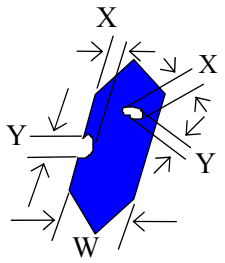
ϕ = (X+Y)/2</td><td> 

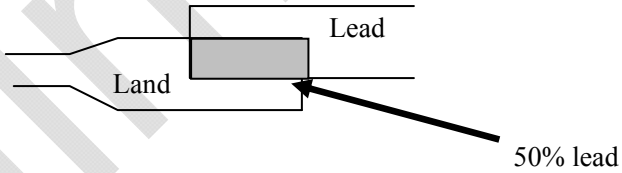
<table>
<tr><th>Point Size</th><th>Acceptable Qty.</th></tr>
<tr><td>ϕ≤0.10</td><td>Disregard</td></tr>
<tr><td>0.10<ϕ≤0.15</td><td>2</td></tr>
<tr><td>0.15<ϕ≤0.25</td><td>1</td></tr>
<tr><td>ϕ>0.25</td><td>0</td></tr>
</table>
Unit：Inch^2</td></tr>
<tr><td>4</td><td>Line defect,

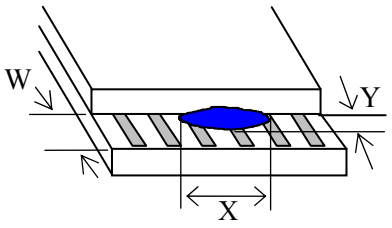
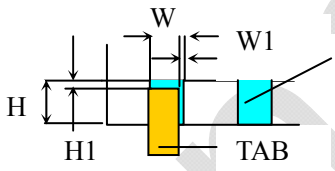
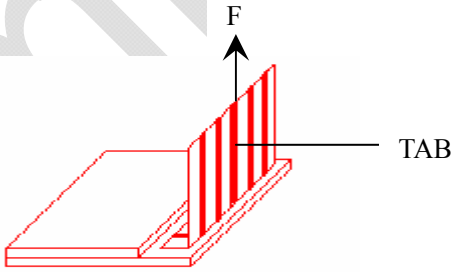
Scratch</td><td> 

<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.05>W</td><td rowspan="3">Disregard</td></tr>
<tr><td>3.0>L</td><td>0.1>W>0.05</td></tr>
<tr><td>2.0>L</td><td>0.15≥W>0.1</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

No	Item	Criterion
6	Chip Remark: X: Length Y: Width Z: Thickness t: Glass thickness W: Terminal width L: Glass length	 Acceptable criterion X: < L /8; Y: 0.5mm; Z: ≤t/2  Acceptable criterion X: ≤2; Y: 0.5mm; Z: ≤t  Acceptable criterion X: ≤3; Y: ≤2; Z: ≤t shall not reach to ITO  Acceptable criterion X: Disregard; Y: ≤0.2; Z: ≤t  Acceptable criterion X: ≤5; Y: ≤2; Z: ≤t/3

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>7</td><td>Segment
pattern
W = Segment width
ϕ = (X+Y)/2</td><td>(1) Pin hole
ϕ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>ϕ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W< ϕ≤1/2W</td><td>1</td></tr>
<tr><td>ϕ>1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Backlight</td><td>(1) The color of backlight should be in match with the specification.
(2) Not allow flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(1) Not allow heavy dirty and solder ball on PCB.
(The size of dirty refer to point and dust defect)
(2) Over 50% of lead should be soldered on Land.
 
</td></tr>
<tr><td>10</td><td>Wire</td><td>(1) Copper wire should not be rusted
(2) Not allow crack on copper wire connection.
(3) Not allow reversing the position of the flat cable.
(4) Not allow exposed copper wire inside the flat cable.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: Y ≤ 0.4
13	TAB	1.Position  W1≤1/3W H1≤1/3H 2.TAB bonding strength test  P (=F/TAB bonding width) ≥650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

9.3 Reliability

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	0°C ← 25°C →50°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

9.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

GENERAL PRECAUTIONS:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting XIAMEM OCULAR
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal spreads to skin or clothes, wash it off immediately with soap and water.

STATIC ELECTRICITY PRECAUTIONS:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.

4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

SOLDERING PRECAUTIONS:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C±10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

OPERATION PRECAUTIONS:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.