

Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 320432A VTX-PW

2,6“ transfl. TFT

Product Specification

Version: 1

07.02.2025

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*** Description**

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a transmissive type TFT-LCD Panel, driver circuit, backlight unit. The resolution of a 2.6" TFT-LCD contains 320xRGBx432 Pixels, and can display up to 65k/262k/16.7Million colors.

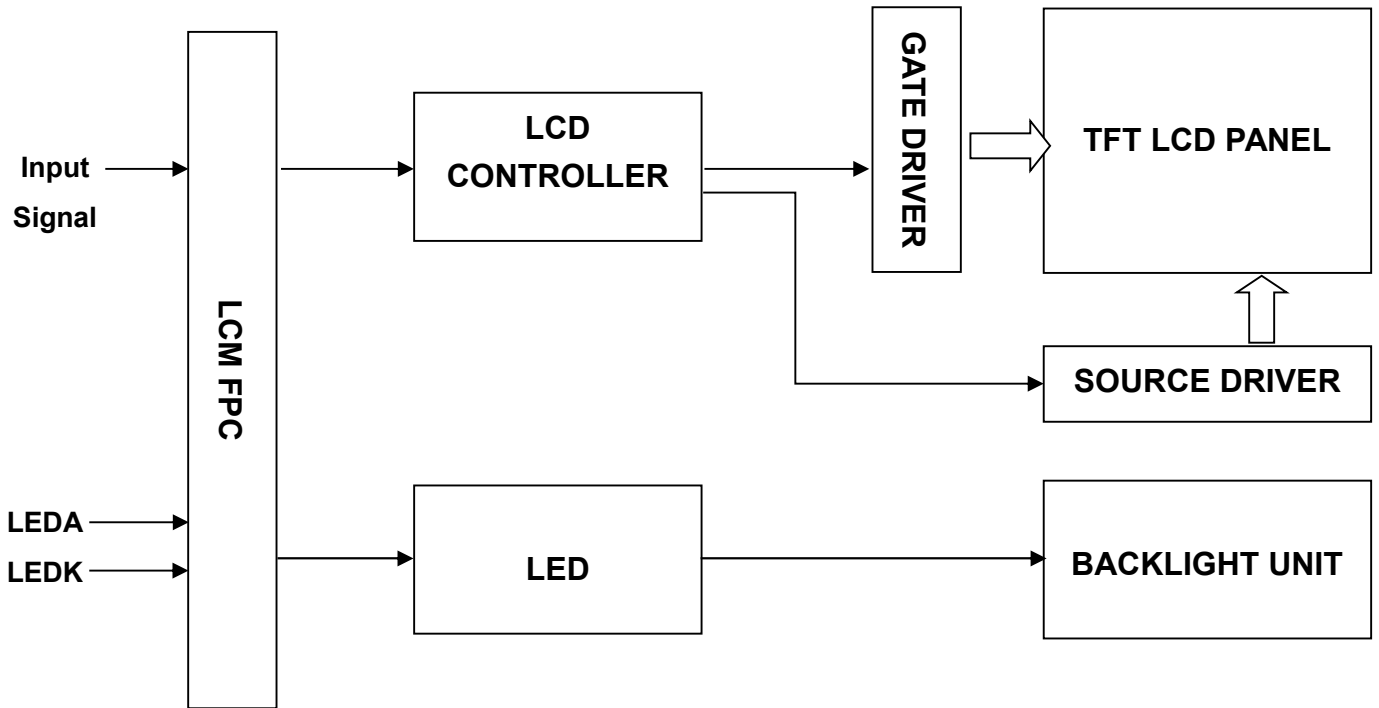
*** Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Display Area (AA)	39.84 x 53.78 (2.6 Inch)	mm	-
Driver Element	TFT active matrix	-	-
Display Colors	65k / 262k / 16.7Million	colors	-
Number of Pixels	320 x RGB x 432	dots	-
TFT Pixel Arrangement	RGB Vertical Stripe	-	-
Pixel Pitch	0.1245 x 0.1245	mm	-
Viewing Angle	WIDE VIEWING	o'clock	-
TFT Controller IC	ILI9488 (Ilitek)	-	-
LCM Interface	8/9/16/18-Bit-MCU 3/4 SPI + 16/18/24-Bit-RGB-Interface 3-line / 4-line Serial	-	-
Display Mode	Transmissive / Normally Black	-	-
Operating Temperature	-30°C ~ +85°C	°C	-
Storage Temperature	-40°C ~ +85°C	°C	-

*** Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	46.76	-	mm	-
	Vertical(V)	-	65.85	-	mm	-
	Depth(D)	-	2.6	-	mm	-
Weight		-	14	-	g	-

1. Block Diagram



2. Outline Dimension

No.	TFT Pin
1	GND
2	LEDA
3	LEDK
4	NC
5	CSX
6	DCX
7	WRX_SCL
8	RDX
9	SDA
10	SOD
11	DBAN0/LSb
12	DB01/1B1
13	DB02/1B2
14	DB03/1B3
15	DB04/1B4
16	DB06/1B5
17	DB06/1B6
18	DB07/1B7
19	DB08/1B8
20	DB09/1C1
21	DB10/1C2
22	DB11/1G3
23	DB12/1G4
24	DB13/1G5
25	DB14/1G6
26	DB15/1G7
27	DB16/1R0
28	DB17/1R1
29	DB18/1R2
30	DB19/1R3
31	DB20/1R4
32	DB21/1R5
33	DB22/1R6
34	DB23/1R7
35	DE
36	PCLK
37	HSYNC
38	VSYNC
39	RESX
40	IM2
41	IM1
42	IM0/ID
43	VCI
44	VCI
45	IDVCC
46	IDVCC
47	YU
48	XL
49	YD
50	XR
51	GND

3. Input Terminal Pin Assignment

NO	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	LEDA	Anode pin of backlight.	P
3	LEDK	Cathode pin OF backlight	P
4	NC	--	P
5	CSX	Chip select input pin ("Low" enable). fix this pin at VCI or GND when not in use.	I
6	DCX	Display data/command selection pin	I
7	WR(SPI-SCL)	DBI Type B: WRX pin, serves as a write signal DBI Type C: SCL pin as Serial Clock when operates in the serial interface	I
8	RDX	Serves as a read signal and MCU read data at the rising edge. Fix this pin at VCI or GND when not in use.	I
9	SDA	Serial input signal.The data is applied on the rising edge of the SCL signal. If not used, fix this pin at VCI or GND.	I/O
10	SDO	Serial data output pin in serial bus system interface. If not used, please open this pin.	O
11-34	DB0-DB23	24-bit parallel bi-directional data bus for MCU system and RGB interface mode. Fix to GND level when not in use	I/O
35	DE	Data enable signal for RGB interface operation. Fix this pin at VCI or GND when not in use.	I
36	PCLK	Dot clock signal for RGB interface operation Fix this pin at VCI or GND when not in use.	I
37	HSYNC	Line synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use	I
38	VSYNC	Frame synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
39	RESX	This signal will reset the device and must be applied to properly initialize the chip.	I

40	IM2	MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at VCI and GND.	I
41	IM1		
42	IM0		
43	VCI	Supply voltage(3.3V).	P
44	VCI		
45	IOVCC	Supply voltage For IO(1.8-3.3V)	P
46	IOVCC		
47	YU	Touch panel Top Film Terminal	A/D
48	XL	Touch panel LEFT Glass Terminal	A/D
49	YD	Touch panel Bottom Film Terminal	A/D
50	XR	Touch panel Right Glass Terminal	A/D
51	GND	Ground.	P

4. LCD Optical Characteristics

4.1 Optical Specification

4.1.1 Transmissive Mode

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$	400	500	--		Note1
Response Time	Rising	T_{R+T_F}	Normal Viewing Angle	--	25	50	msec	Note1
	Falling							
Color gamut		S(%)	-	--	50	--	%	
Color Filter Chromacity	White	W_X	-	0.2405	0.2805	0.3205		
		W_Y	-	0.2717	0.3117	0.3517		
	Red	R_X	-	0.5412	0.5812	0.6212		
		R_Y	-	0.2999	0.3399	0.3799		
	Green	G_X	-	0.2919	0.3319	0.3719		
		G_Y	-	0.5311	0.5711	0.6111		
	Blue	B_X	-	0.1152	0.1552	0.1952		
		B_Y	-	0.0478	0.0878	0.1278		
Viewing Angle	Hor.	Θ_{21}	CR>10	60	80	--	deg	Note1
		Θ_{22}		60	80	--		
	Ver.	Θ_{12}		60	80	--		
		Θ_{11}		60	80	--		
Option View Direction		Wide Angle						

4.1.2 Reflective Mode (Not driving the back light condition)

Item	Symbol	Specifications	Unit	Note
------	--------	----------------	------	------

Reflection Ratio (with Polarizer)	R ($\theta = \phi = 0^\circ$)	1	2	-	%	Here the data are design value.
Reflective Contrast Ratio	Cr ($\theta = 0^\circ$)	-	5	-	-	Note1
Viewing Angle ($Cr \geq 2$)*	$\ominus 21$	-	45	-	deg	
	$\ominus 22$	-	45	-		
	$\ominus 12$	-	45	-		
	$\ominus 11$	-	45	-		

Note1: The polarizers are SRCG31APN2HC5(Top) and SRCH31APT2(Bottom)

Measuring Condition

Measuring surrounding: dark room

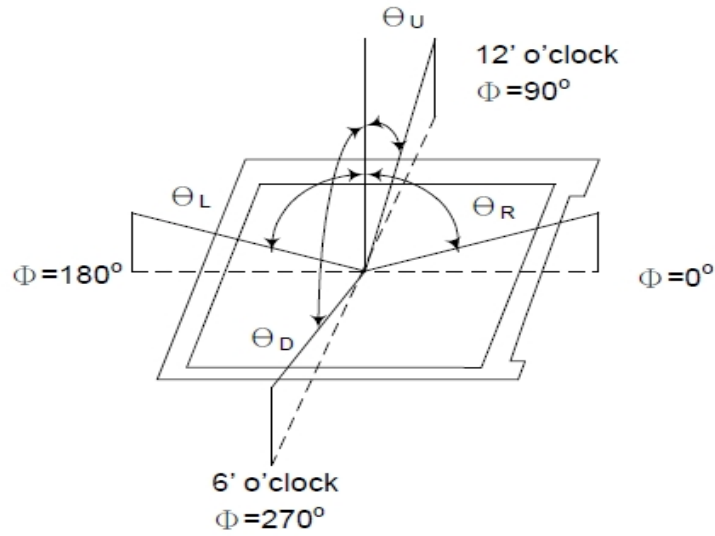
Ambient temperature: $25^\circ\text{C} \pm 2^\circ\text{C}$

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

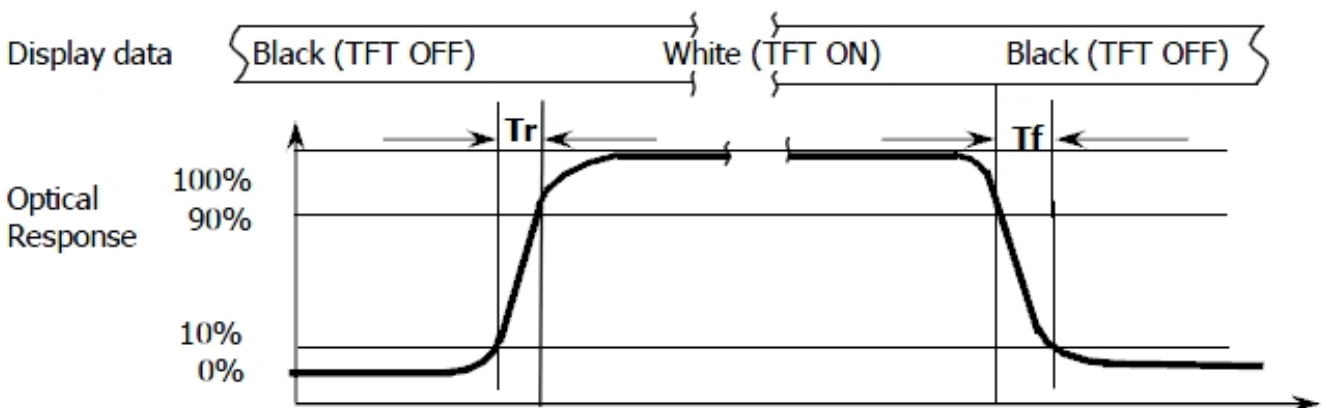
Note (1): Definition of Viewing Angle :



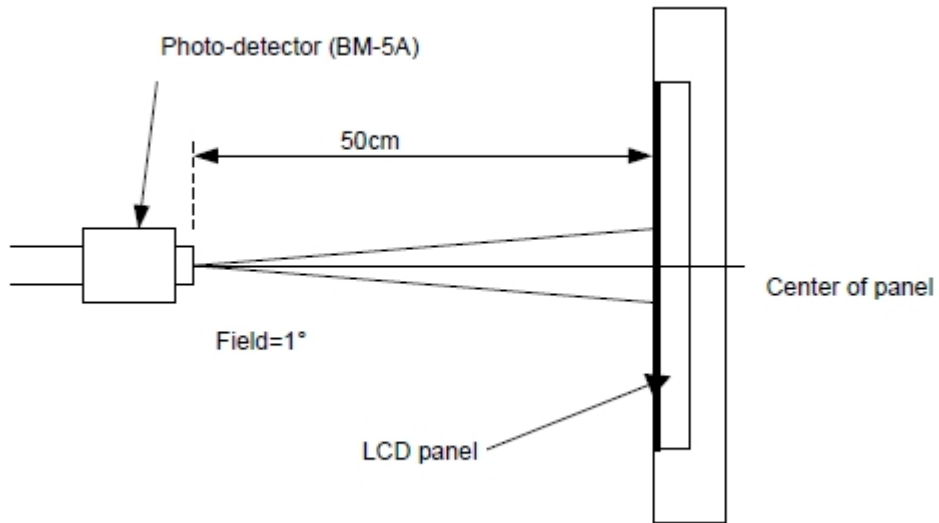
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VCI	-0.3	3.3	V
Digital interface Supply Voltage	IOVCC	-0.3	3.3	V
Operating Temperature	T _{OP}	-30	+85	°C
Storage Temperature	T _{ST}	-40	+85	°C

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VCI	2.5	3.3	--	V	-
Digital interface Supply Voltage	IOVCC	1.65	1.8	3.3	V	-
Normal Mode Current Consumption	IDD	--	14	--	mA	-
Level Input Voltage	V _{IH}	0.7IOVCC		IOVCC	V	-
	V _{IL}	-0.3		0.3IOVCC	V	-
Level Output Voltage	V _{OH}	0.8IOVCC		IOVCC	V	-
	V _{OL}	GND		0.2IOVCC	V	-

5.3 LED Backlight Characteristics

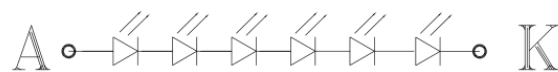
The back-light system is edge-lighting type with 6 chips White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	15	20	--	mA	--
Forward Voltage	V_F	--	19.2	--	V	--
LCM Luminance	LV	450	500	--	cd/m ²	Note3
LED Lifetime	Hr	50000	--	--	Hour	Note1,2
Uniformity	AVg	80	--	--	%	Note3

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25^{\circ}\text{C}\pm 3^{\circ}\text{C}$, typical IL value indicated in the above table until the brightness becomes less than 50%.

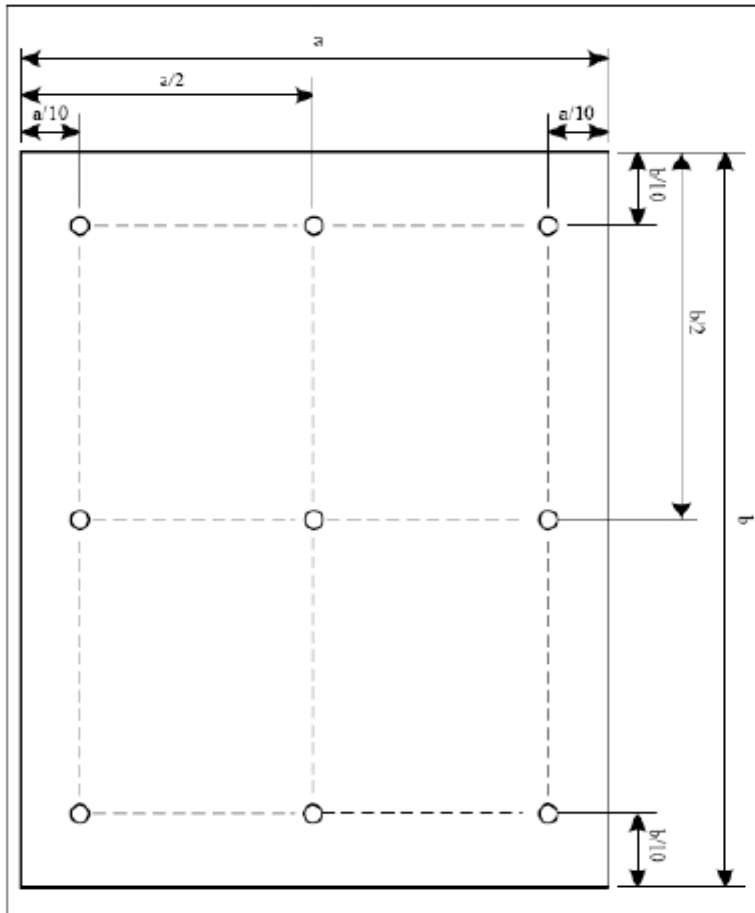
Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=20\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 20mA.

The constant current driving method is suggested.



LED(B/L) CIRCUIT

NOTE 3: Luminance Uniformity of these 9 points is defined as below:

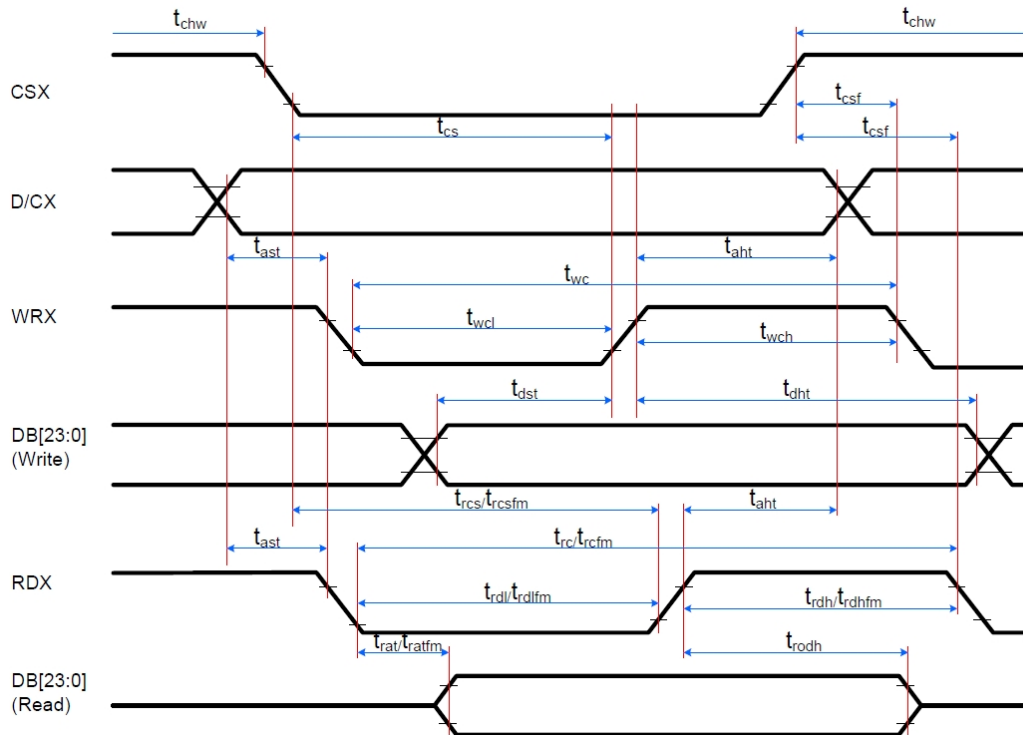


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. AC Characteristic

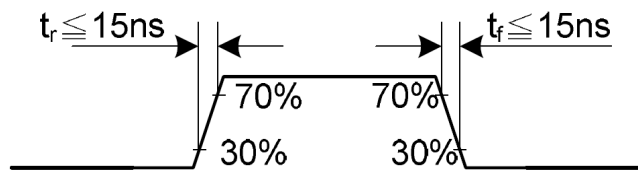
6.1 DBI Type B Timing Characteristics



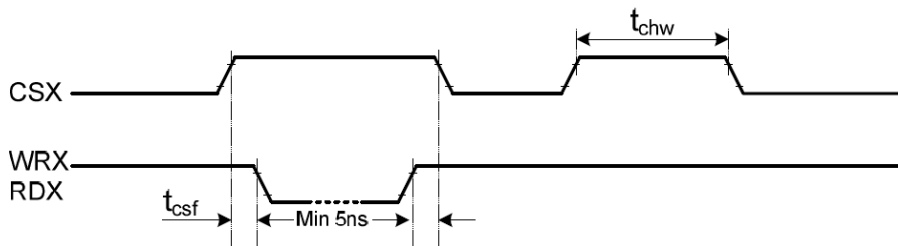
	Symbol	Parameter	Spec		Unit.	Description
			Min.	Max.		
DCX	t_{ast}	Address setup time	0	--	ms	
	t_{hat}	Address hold time (Write/Read)	0	--	us	
CSX	t_{chw}	CSX "H" pulse width	0	--	ns	
	t_{cs}	Chip Select setup time (Write)	15	--	%	
	t_{rcs}	Chip Select setup time (Read ID)	45	--	ns	
	t_{rcsfm}	Chip Select setup time (Read FM)	355	--	ns	
	t_{csf}	Chip Select Wait time (Write/Read)	0	--	ns	
WRX	t_{wc}	Write cycle	40	--	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	When read from Frame Memory
	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	When read ID
	t_{rdh}	Read Control pulse H duration	90	--	ns	
	t_{rdl}	Read Control pulse L duration	45	--	ns	

DB[23:0],	t_{dst}	Write data setup time	10	--	ns	For maximum,
DB[17:0],	t_{dht}	Write data hold time	10	--	ns	
DB[15:0],	t_{rat}	Read access time	--	40	ns	CL=30pF
DB [8:0],	t_{ratfm}	Read access time	--	340	ns	For minimum,
DB [7:0]	t_{rod}	Read output disable time	20	80	ns	CL=8pF

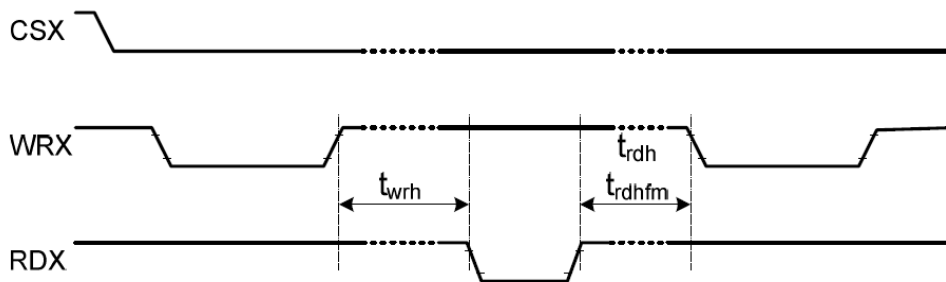
- Note: 1. $T_a = -30$ to 70 °C, $IOVCC = 1.65V$ to $3.3V$, $VCI = 2.5V$ to $3.3V$, $AGND = DGND = 0V$
 2. Logic high and low levels are specified as 30% and 70% of $IOVCC$ for input signals.
 3. Input signal rising time and falling time.:



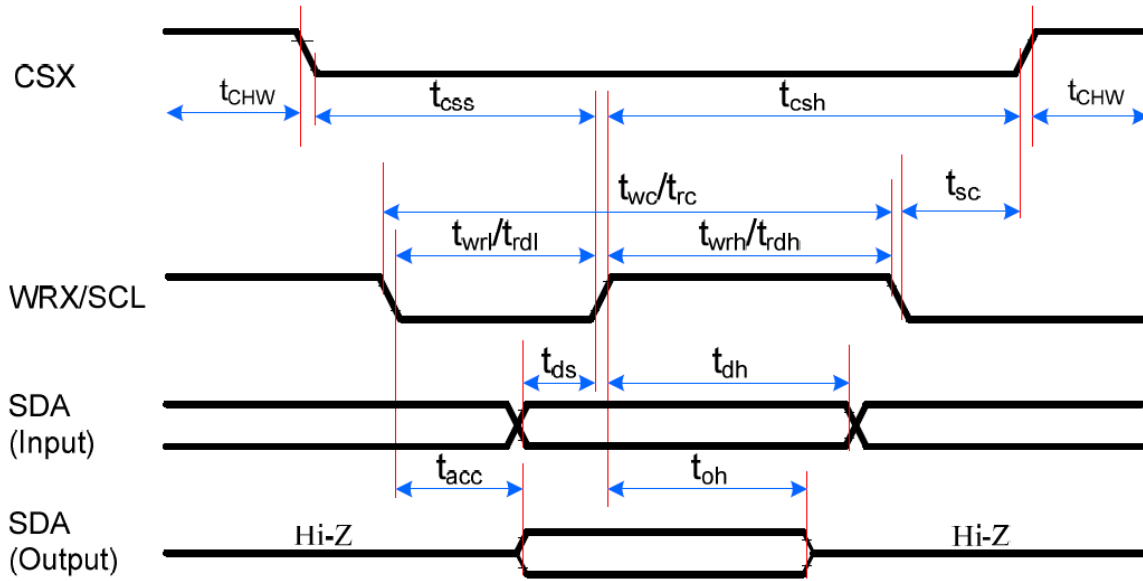
4. The CSX timing:



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

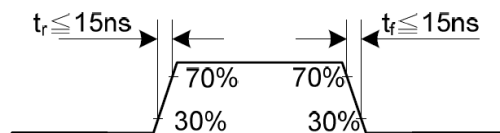


6.2 DBI Type C Option 1 (3-Line SPI System) Timing Characteristics

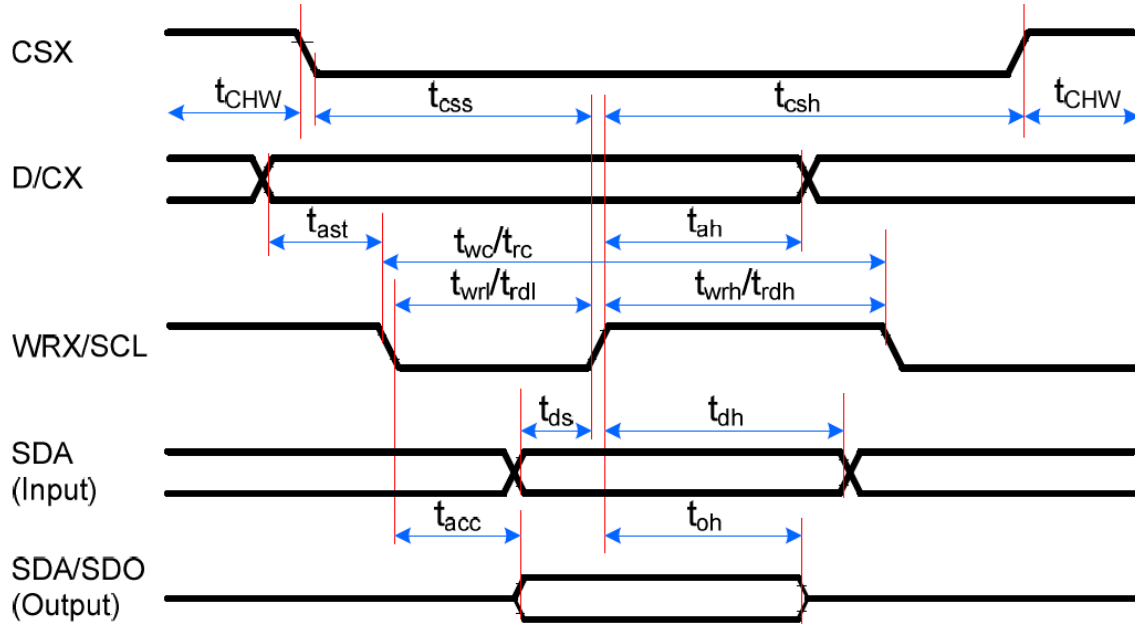


Signal	Symbol	Parameter	Spec		Unit.	Description
			Min.	Max.		
CSX	t_{sc}	SCL-CSX	15	--	ns	
	t_{chw}	CSX H Pulse Width	40	--	ns	
	t_{css}	Chip select time (Write)	60	--	ns	
	t_{csh}	Chip select hold time (Read)	65	--		
SCL	t_{wc}	Serial clock cycle (Write)	66	--	ns	
	t_{wrhf}	SCL H pulse width (Write)	15	--	ns	
	t_{wrl}	SCL L pulse width (Write)	15	--	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	
SDA (Input)	t_{ds}	Read cycle (ID)	10	--	ns	
	t_{dh}	Read Control pulse H duration	10	--	ns	
SDA/SDO (Output)	t_{acc}	Write data setup time	10	50	ns	For maximum CL=30pF
	t_{od}	Write data hold time	15	50	ns	

NOTES: $T_a = -30$ to 70 °C, $IOVCC = 1.65V$ to $3.6V$, $VCI = 2.5V$ to $3.6V$, $AGND = DGND = 0V$, $T = 10 \pm 0.5ns$



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

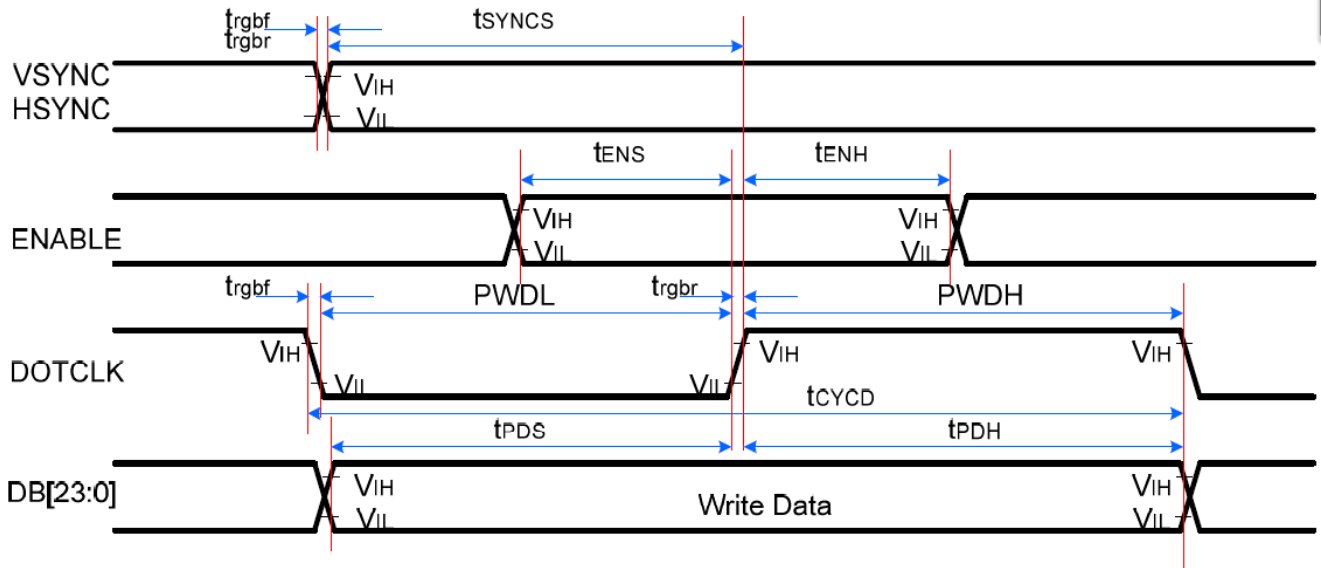


Signal	Symbol	Parameter	Spec		Unit.	Description
			Min.	Max.		
CSX	t_{css}	Chip select time (Write)	15	--	ns	
	t_{csh}	Chip select hold time (Read)	15	--	ns	
	t_{chw}	CS H pulse width	40	--	ns	
SCL	t_{wc}	Serial clock cycle (Write)	50	--	ns	
	t_{wrhf}	SCL H pulse width (Write)	10	--	ns	
	t_{wrl}	SCL L pulse width (Write)	10	--	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	--	ns	
	t_{ah}	D/CX hold time (Write/Read)	10	--	ns	
SDA (Input)	t_{ds}	Read cycle (ID)	10	--	ns	
	t_{dh}	Read Control pulse H	10	--	ns	
SDA/SDO (Output)	t_{acc}	Write data setup time	10	50	ns	For maximum CL=30pF
	t_{od}	Write data hold time	15	50	ns	

1. $T_a = -30$ to $70\text{ }^\circ\text{C}$, $IOVCC = 1.65\text{V}$ to 3.3V , $VCI = 2.5\text{V}$ to 3.3V , $AGND = DGND = 0\text{V}$, $T = 10\pm 0.5\text{ns}$.

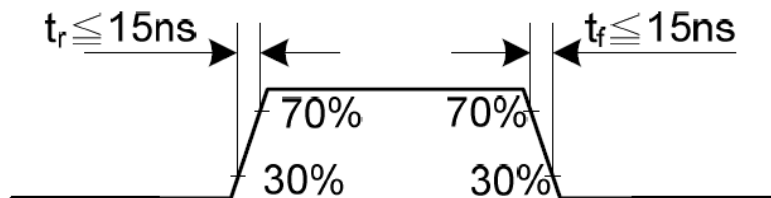
2. Does not include signal rising and falling times.

6.4 DPI (Display Parallel 16-/18-/24-Bit Interface) Timing Characteristics



Signal	Symbol	Parameter	Spec		Unit.	Description
			Min.	Max.		
VSYNC/ HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	--	ns	16-/18-/24-bit bus RGB interface mode
	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	
	t_{POH}	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_{rgbr}	DOTCLK,HSYNC,VSYNC rise/fall	--	15	ns	

NOTES: $T_a = -30$ to 70 °C, $IOVCC = 1.65V$ to $3.6V$, $VCI = 2.5V$ to $3.6V$, $AGND = DGND = 0V$, $T = 10 \pm 0.5ns$



6.8 Reset Input Timing

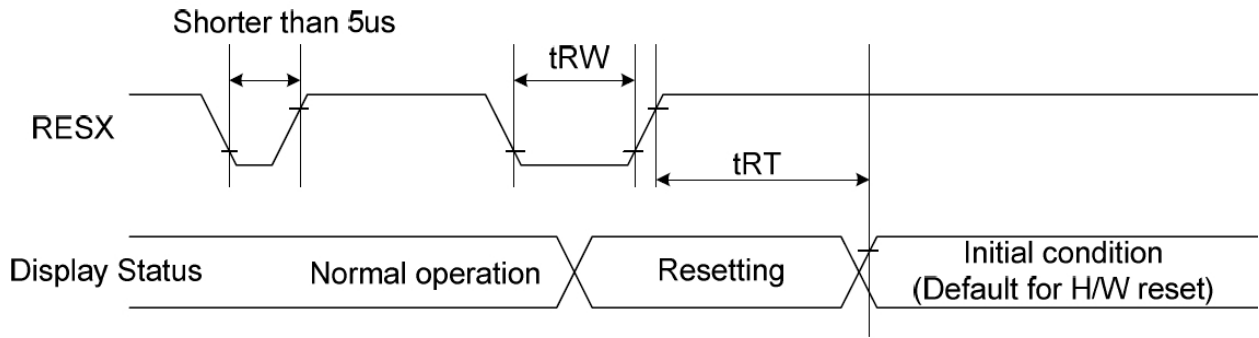


Table 39: Reset Timing

Signal	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	

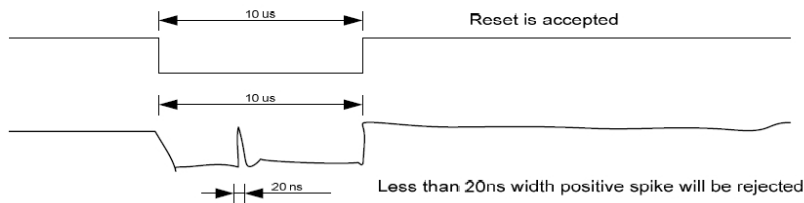
Notes:

1. The reset cancel also includes the required time for loading ID bytes, VCOM setting and other settings from the EEPROM to registers. After a rising edge of RESX, this loading is done within 5 ms after the H/W reset cancel (tRT).
2. According to the Table 40, a spike due to an electrostatic discharge on the RESX line does not cause irregular system reset.

Table 40: Reset Description

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

3. During the Reset period, the display will be blanked (When Reset starts in the Sleep Out mode, the display will enter the blanking sequence in at least 120 ms. The display remains the blank state in the Sleep In mode.) and then return to the default condition for the Hardware Reset.
4. Spike Rejection can also be applied during a valid reset pulse, as shown below:



5. When Reset is applied during the Sleep In Mode.
6. When Reset is applied during the Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. The Sleep Out command also cannot be sent in 120msec.

7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection Conditions

Inspection performed under the following conditions is recommended.

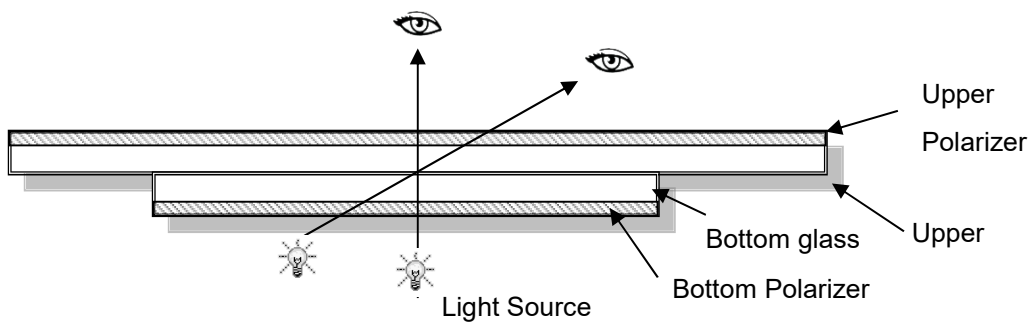
Temperature: 25°C±5°C

Humidity: 65%±10%RH

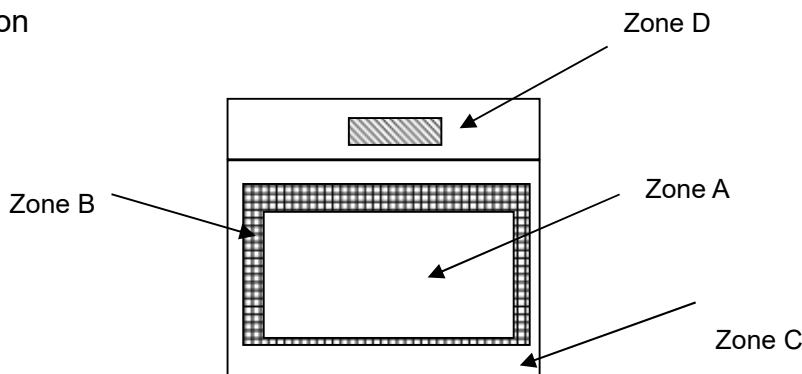
Viewing Angle: Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

7.1.3 Sampling Plan

According to GB/T 2828-2012, normal inspection, Class II

AQL:

Major Defect	Minor Defect
0.65	1.5

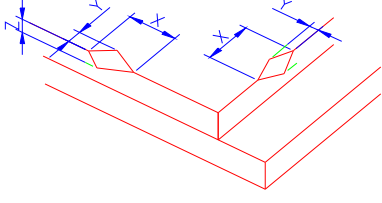
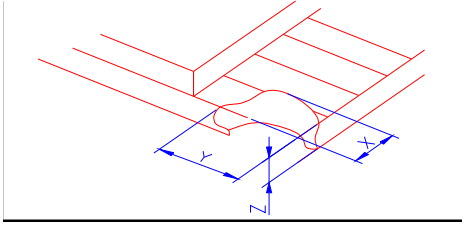
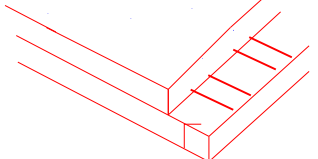
LCD: Liquid Crystal Display, LCM: Liquid Crystal Module,

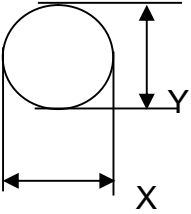
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc...	Major
2	Missing	Missing components and etc...	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed, deformation and etc...	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot, Dim spot, (Note 1) Polarizer Air Bubble, Polarizer accidented spot and etc.	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc.	
7	LCD/Polarizer	Black/White spot/line, scratch, crack, etc.	




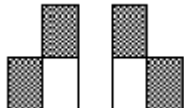
Note: a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.


b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 <table border="1" data-bbox="751 645 1453 792"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td><Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)LCD corner broken	 <table border="1" data-bbox="831 1099 1374 1200"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	 <p style="text-align: center;">Crack Not allowed</p>							

2.0	Spot defect	① light dot (black/white spot , pinhole, stain, etc.)																												
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.15$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.25$</td> <td colspan="3" rowspan="2" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.25 < \Phi \leq 0.4$</td> <td colspan="2" style="text-align: center;">3(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">2(distance ≥ 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table>			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.15$	Ignore			$0.15 < \Phi \leq 0.25$	Ignore			$0.25 < \Phi \leq 0.4$	3(distance ≥ 6 mm)		$\Phi > 0.4$	2(distance ≥ 6 mm)			$\Phi > 0.4$	0		
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$\Phi = (X+Y)/2$	② Dim spot (light leakage, dent, dark spot, etc)																													
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3.0	LCD Pixel defect	Pixel bad points		
		Item	Zone A	Acceptable Qty
		Bright dot	Random	N≤2
			2 dots adjacent	N≤0
			3 dots adjacent	N≤0
		Dark dot	Random	N≤2
			2 dots adjacent	N≤0
			3 dots adjacent	N≤0
		Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm
		Total bright and dark dot		N≤4
<p>Note:</p> <p>A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p>C) 2 dot adjacent = 1 pair = 2 dots</p> <p>Picture:</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 20px;"> <div style="text-align: center;">  <p>2 dot adjacent (vertical)</p> </div> <div style="text-align: center;">  <p>2 dot adjacent (slant)</p> </div> </div>				

4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length N : Count	<table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.03$</td> <td>Ignore</td> <td colspan="2">Ignore</td> <td rowspan="3">Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.04$</td> <td>$L \leq 3.0$</td> <td colspan="2">$N \leq 2$</td> </tr> <tr> <td>$0.04 < W \leq 0.05$</td> <td>$L \leq 2.0$</td> <td colspan="2">$N \leq 1$</td> </tr> <tr> <td>$W > 0.05$</td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Length(m)	Acceptable Qty			A	B	C	$\Phi \leq 0.03$	Ignore	Ignore		Ignore	$0.03 < W \leq 0.04$	$L \leq 3.0$	$N \leq 2$		$0.04 < W \leq 0.05$	$L \leq 2.0$	$N \leq 1$		$W > 0.05$	Define as spot defect			
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$0.04 < W \leq 0.05$	$L \leq 2.0$	$N \leq 1$																										
$W > 0.05$	Define as spot defect																											
5.0	Electronic Components SMT.	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite																										
6.0	Display color & Brightness.	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.																										
7.0	LCD Mura/Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.																										

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed

8. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	+85°C,96h	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Non-display; 3. Missing segments/line; 4. Glass crack; 5. Current IDD is twice higher than initial value.
Low Temperature Operating	-30°C, 96h	
High Temperature Storage	+85°C, 96h	
Low Temperature Storage	-40°C, 96h	
High Temperature & High Humidity Storage	+60°C, 90% RH, 96h	
Thermal Shock (Non-operation)	-30°C, 30 min ↔ 85°C, 30 min, Change time: 5min 20CYC.	
ESD Test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX)	

Remark:

1. The test samples should be applied to only one test item.
2. Sample size for each test item is 5~10pcs.
3. For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.

9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

- (1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
- (2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
- (4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
- (5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static; it may cause damage to the CMOS ICs.
- (9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (10) Do not disassemble the module.
- (11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (12) Pins of I/F connector shall not be touched directly with bare hands.
- (13) Do not connect, disconnect the module in the "Power ON" condition.
- (14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

9.2 Storage and Transportation.

- (1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%
- (2) Do not store the TFT-LCD module in direct sunlight.
- (3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
- (4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
- (5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.