

Display Elektronik GmbH

# DATA SHEET

***TFT MODULE***

**DEM 240320L TMH-PW-N**

**2,8" TFT**

Product Specification

Ver.: 2

04.09.2014

**Revision History**

<b>Revision</b>	<b>Date</b>	<b>Detail</b>	<b>Remarks</b>
0	26.08.2014	Initial Release	-
1	28.08.2014	Modify Module Outline Add LED Lifetime Modify Outline Drawing	P4 P6 P32
2	04.09.2014	Modify Supply Voltage Modify LED Lifetime Modify Viewing Angle Modify Reliability Specification Modify Outline Drawing	P5 P6 P7 P28 P32

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## 1. General Description

The specification is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT-LCD panel, driver Ics, and a backlight unit.

## 2. Module Parameter

Features	Details	Unit
Display Size (Diagonal)	2.8"	-
LCD type	TN TFT	-
Display Mode	Transmissive / Normally White	-
Resolution	240 x RGB x 320	Pixels
View Direction	6:00 O'clock	Best Image
Gray Scale Inversion Direction	12:00 clock	-
Module Outline	50.00 x 69.20 x 2.45 ( Note1 )	mm
Active Area	43.20 x 57.60	mm
Pixel Size	0.180 x .0180	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Colors	262k	-
Interface	9-Bit MCU Interface	-
With or without touch panel	Without	-
Driver IC	ILI9341V (Ilitek)	-
Operating Temperature	-20 to +70	°C
Storage Temperature	-30 to +80	°C
Weight	t.b.d.	g

Note 1: Exclusive hooks, posts, FFC/FPC tail etc.

## 3. Absolute Maximum Ratings

$V_{SS}=0V$ ,  $T_a=25^{\circ}C$

Item	Symbol	Min.	Max.	Unit
Supply Voltage	VDD	-0.3	4.6	V
Storage Temperature	T <sub>STG</sub>	-30	+80	°C
Operating Temperature	T <sub>OP</sub>	-20	+70	°C

Note 1: If  $T_a$  below  $50^{\circ}C$ , the maximal humidity is 90%RH, if  $T_a$  over  $50^{\circ}C$ , absolute humidity should be less than 60%RH.

Note 2: The response time will be extremely slow when the operating temperature is around  $-10^{\circ}C$ , and the back ground will become darker at high temperature operating.

#### 4. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	
Supply Voltage	V <sub>DD</sub>	2.5	3.3	3.3	V	
Logic Low Input Voltage	V <sub>IL</sub>	GND	-	0.3*VDD	V	
Logic High Input Voltage	V <sub>IH</sub>	0.7*VDD	-	VDD	V	
Logic Low Output Voltage	V <sub>OL</sub>	GND	-	0.2*VDD	V	
Logic High Output Voltage	V <sub>OH</sub>	0.8*VDD	-	VDD	V	
Current Consumption All Black	Logic	I <sub>CC+ IIN</sub>	-	10	20	mA
	Analog					

#### 5. Backlight Characteristic

##### 5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	Ta=25 °C, I <sub>F</sub> =20mA/LED	11.6	12.8	13.6	V
Forward Current	I <sub>F</sub>	Ta=25 °C, V <sub>F</sub> =3.2V/LED	-	20	-	mA
Power Dissipation	P <sub>D</sub>		-	256	-	mW
LED Life Time(25 °C)	-	-	-	(20,000)	-	Hrs
Uniformity	Avg		80	-	-	%
Drive Method	Constant Current					
LED Configuration	4 White LEDs in Series					

Note: LED life time defined as follows: The final brightness is at 70% of original brightness.

The environmental conducted under ambient air flow, at Ta=25±2 °C, 60%RH±5%, I<sub>F</sub>=20mA.

##### 5.2 Backlighting Circuit



6. Optical Characteristics

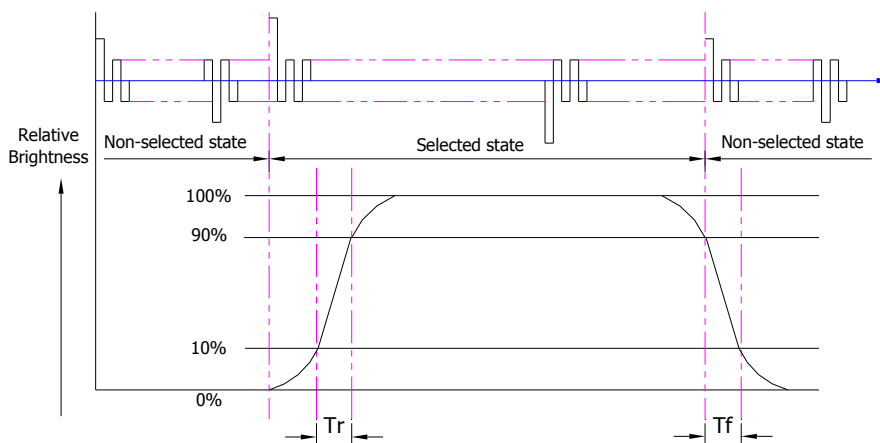
6.1. Optical Characteristics

Ta=25°C, VDD=2.8V, TN LC+ Polarizer

	Item	Symbol	Condition	Specification			Unit
				Min.	Typ.	Max.	
Backlight On (Transmissive Mode)	Luminance on TFT ( $I_f = 20\text{mA/LED}$ )	Lv	Normally viewing angle $\theta_x = \phi_y = 0^\circ$	280	350	-	cd/m <sup>2</sup>
	Contrast Ratio(See 6.3)	CR		400	500	-	
	Response Time (See 6.2)	T <sub>R+T<sub>F</sub></sub>		-	16	32	ms
	Chromaticity Transmissive (See 6.5)	Red	X <sub>R</sub>	(0.562)	(0.612)	(0.662)	
			Y <sub>R</sub>	(0.305)	(0.355)	(0.405)	
		Green	X <sub>G</sub>	(0.247)	(0.297)	(0.347)	
			Y <sub>G</sub>	(0.551)	(0.601)	(0.651)	
		Blue	X <sub>B</sub>	(0.096)	(0.146)	(0.196)	
			Y <sub>B</sub>	(0.038)	(0.088)	(0.138)	
	White	X <sub>W</sub>	(0.229)	(0.279)	(0.329)		
Y <sub>W</sub>		(0.260)	(0.310)	(0.360)			
Viewing Angle (See 6.4)	Horizontal	$\theta_{x+}$	-	70	-	Deg.	
		$\theta_{x-}$	-	70	-		
	Vertical	$\phi_{y+}$	-	55	-		
		$\phi_{y-}$	-	50	-		
NTSC Ratio(Gamut)			-	60	-	%	

6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)

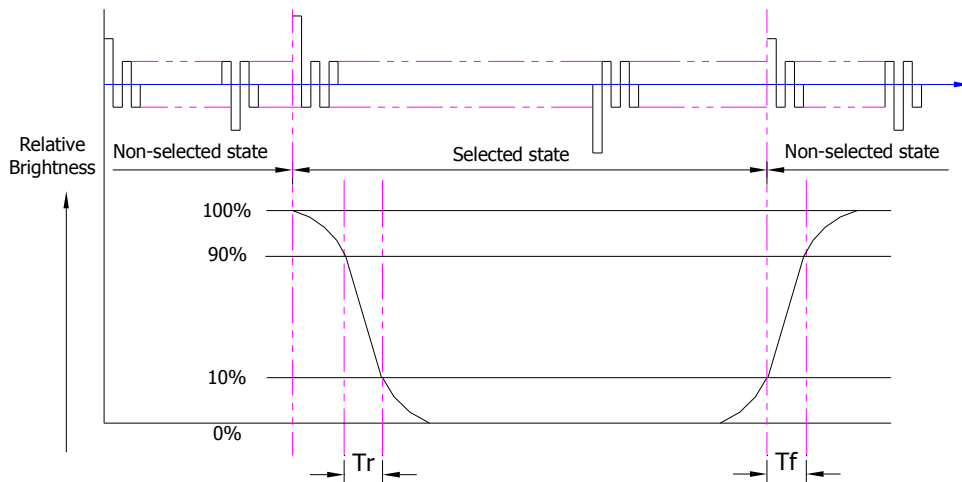


Tr is the time it takes to change from non-selected state with relative luminance 10% to selected state with relative luminance 90%;

Tf is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%.

Note: Measuring machine: LCD-5100

**6.2.2. Normally White Type (Positive)**



Tr is the time it takes to change from non-selected stage with relative luminance 90% to selected state with relative luminance 10%;

Tf is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

Note: Measuring machine: LCD-5100 or EQUI

**6.3. Definition of Contrast Ratio**

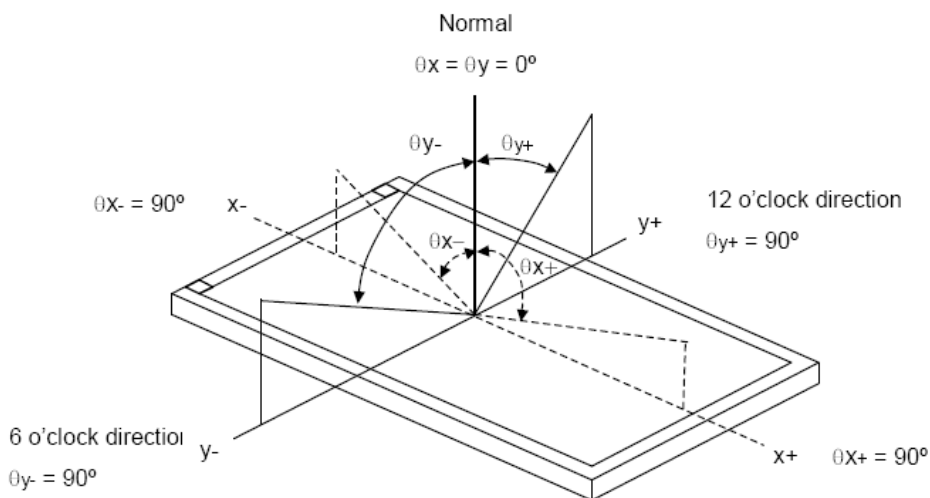
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

The measurement condition is:

Measuring Equipment	Eldim or Equivalent
Measuring Point Diameter	3mm//1mm
Measuring Point Location	Active Area centre point
Test pattern	A: All Pixels white
	B: All Pixel black
Contrast setting	Maximum

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel

**6.4. Definition of Viewing Angles**



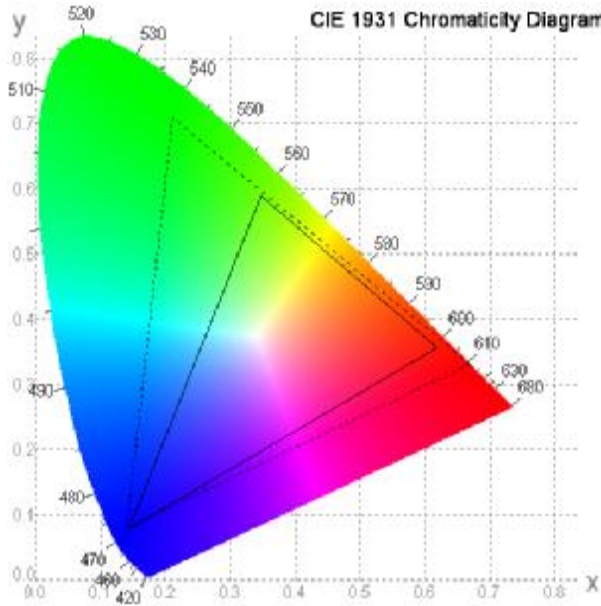
Measuring machine: LCD-5100 or EQUI

**6.5. Definition of Color Appearance**

R, G, B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)



**6.6. Definition of Surface Luminance, Uniformity and Transmittance**

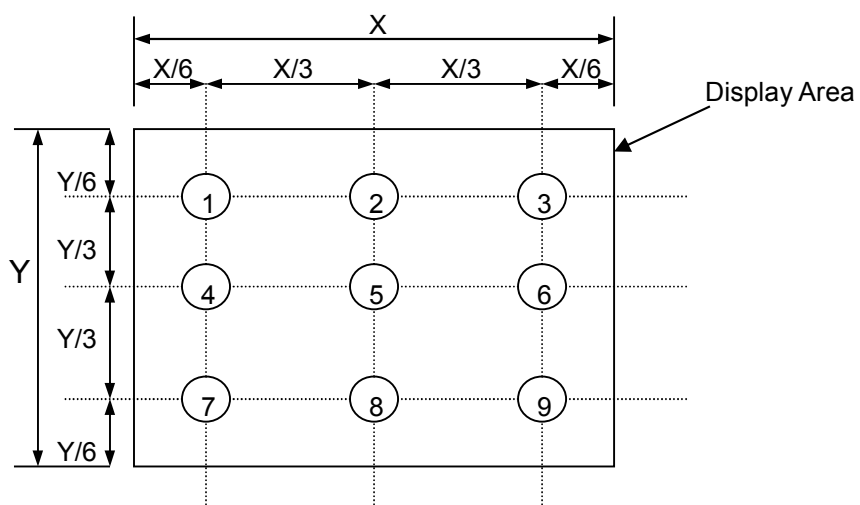
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

6.6.1. Surface Luminance:  $L_v = \text{average} (L_{P1}:L_{P9})$

6.6.2. Uniformity =  $\text{Minimal} (L_{P1}:L_{P9}) / \text{Maximal} (L_{P1}:L_{P9}) * 100\%$

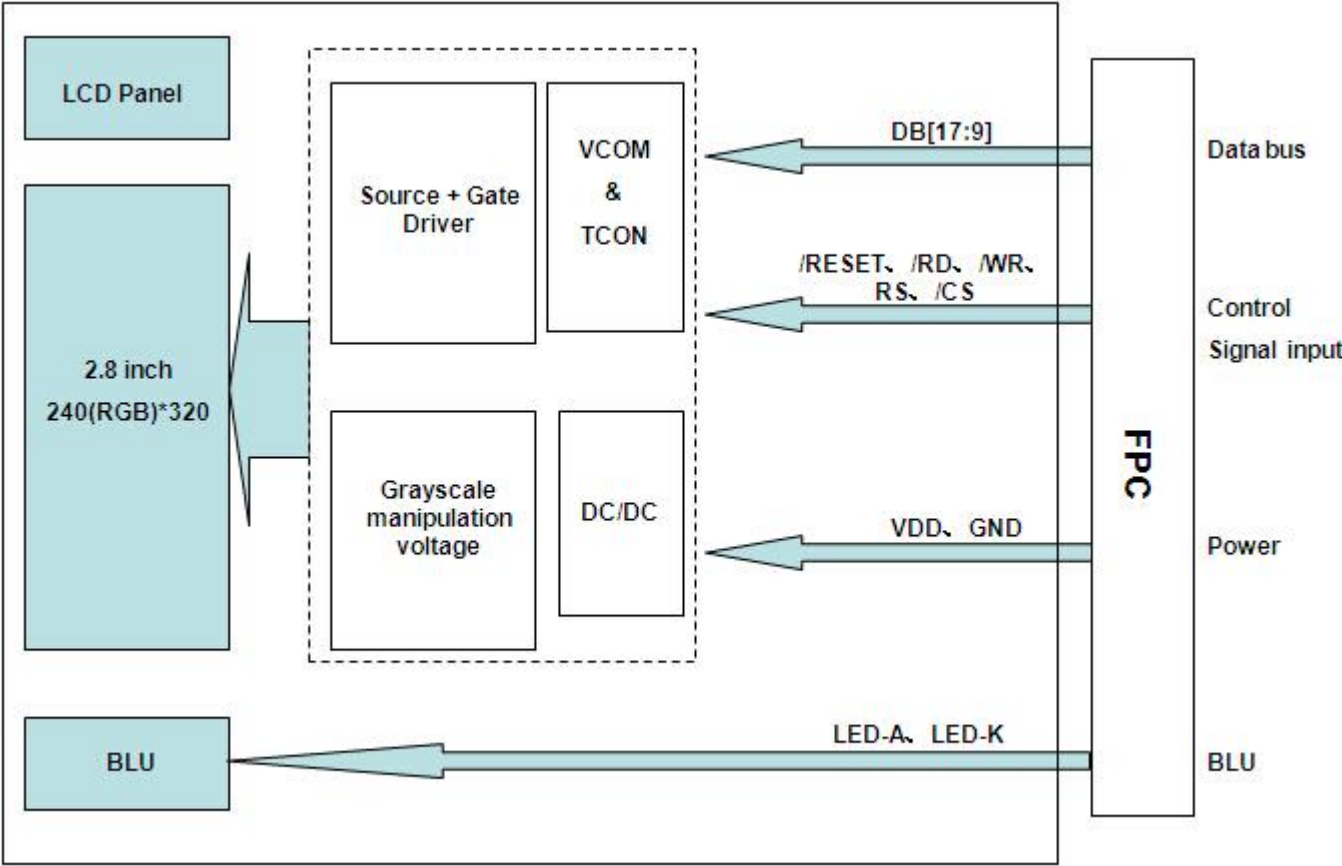
6.6.3. Transmittance =  $L_v \text{ on LCD} / L_v \text{ on Backlight} * 100\%$

Note: Measuring machine: BM-7





7. Block Diagram and Power Supply

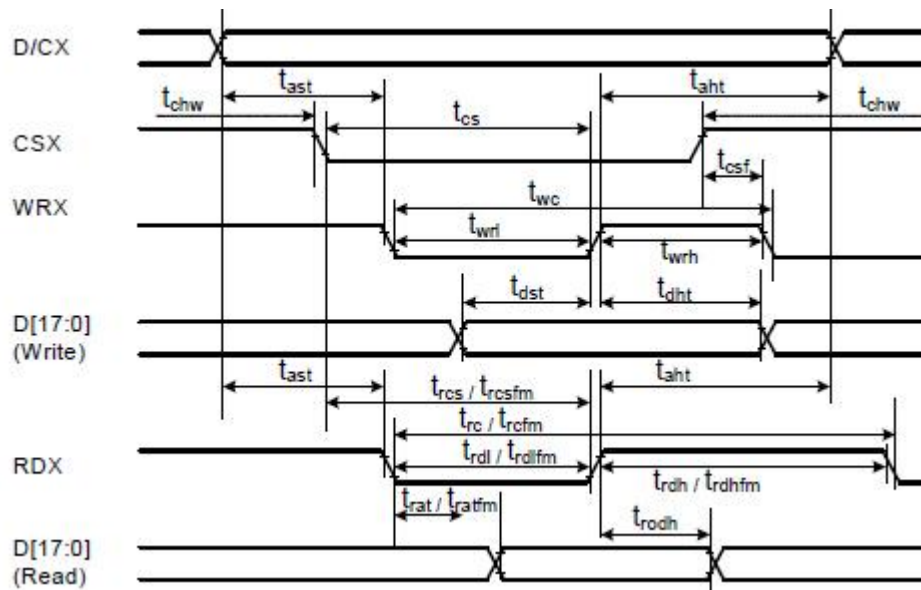


**8. Interface Pins Definition**

No.	Symbol	Function	Remark
1	GND	Ground.	
2	LED-K	LED Cathode.	
3	LED-A	LED Anode.	
4	VDD	Power supply.	
5	DB17	Data bus.	
6	DB16	Data bus.	
7	DB15	Data bus.	
8	DB14	Data bus.	
9	DB13	Data bus.	
10	DB12	Data bus.	
11	DB11	Data bus.	
12	DB10	Data bus.	
13	DB9	Data bus.	
14	VDD	Power supply.	
15	GND	Ground.	
16	FMARK	Tearing effect output pin to synchronize MPU to frame writing, activated by S/W command.	
17	/RESET	Reset signal.	
18	/RD	Read signal.	
19	/WR	Write signal.	
20	RS	Data or Command select.	
21	/CS	Chip select signal.	
22	GND	Ground.	

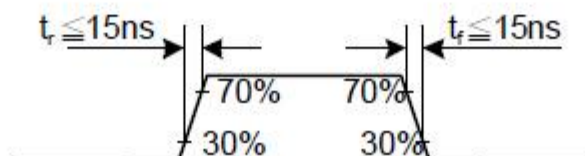
9. AC Characteristics

9.1. Display Parallel 9-bit Interface Timing Characteristics (8080-II system)

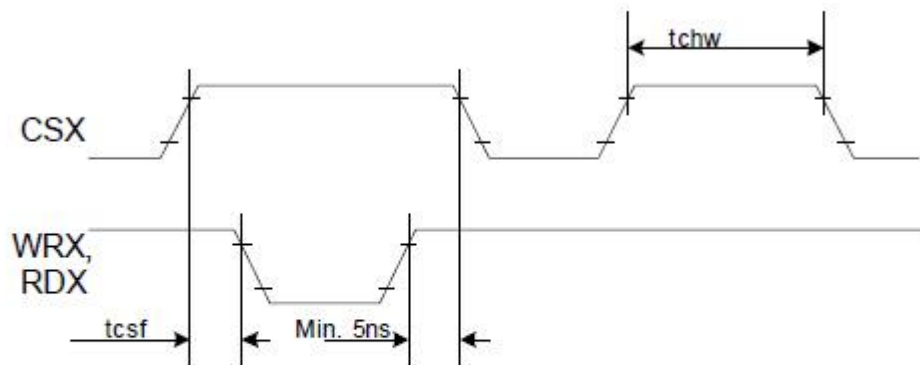


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
WRX	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
RDX (FM)	twrl	Write Control pulse L duration	15	-	ns	
	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
RDX (ID)	trdlfm	Read Control L duration (FM)	355	-	ns	
	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
D[17:0], D[17:10]&D[8:1], D[17:10], D[17:9]	trdl	Read Control pulse L duration	45	-	ns	
	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	
	trafm	Read access time	-	340	ns	
trod	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.

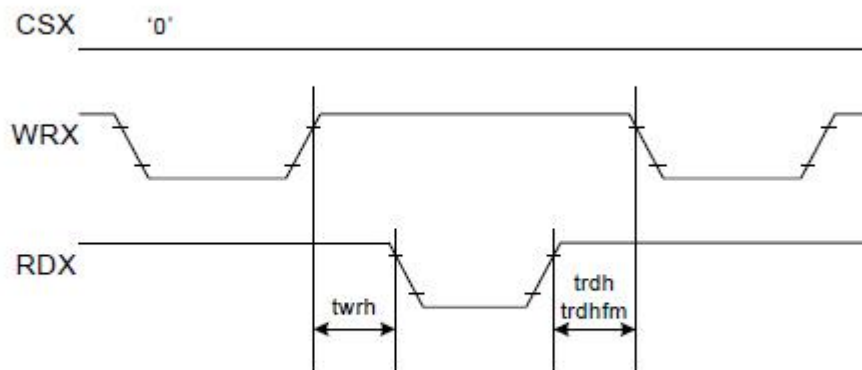


CSX timings :



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.

10. Command Table

Regulative Command Set														
Command Function	D/CX	RDX	WRX	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	Hex	
No Operation	0	1	↑	XX	0	0	0	0	0	0	0	0	00h	
Software Reset	0	1	↑	XX	0	0	0	0	0	0	0	1	01h	
Read Display Identification Information	0	1	↑	XX	0	0	0	0	0	1	0	0	04h	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
	1	↑	1	XX	ID1 [7:0]							XX		
	1	↑	1	XX	ID2 [7:0]							XX		
	1	↑	1	XX	ID3 [7:0]							XX		
Read Display Status	0	1	↑	XX	0	0	0	0	1	0	0	1	09h	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
	1	↑	1	XX	D [31:25]							0	00	
	1	↑	1	XX	0	D [22:20]			D [19:18]				81	
	1	↑	1	XX	D [15]	0	D [13]	0	0	D [10:8]			00	
Read Display Power Mode	1	↑	1	XX	D [7:5]			D [4:1]				0	00	
	0	1	↑	XX	0	0	0	0	1	0	1	0	0Ah	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
Read Display MADCTL	1	↑	1	XX	D [7:2]							0	0	08
	0	1	↑	XX	0	0	0	0	1	0	1	1	0Bh	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
Read Display Pixel Format	1	↑	1	XX	D [7:2]							0	0	00
	0	1	↑	XX	0	0	0	0	1	1	0	0	0Ch	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
Read Display Image Format	1	↑	1	XX	0	DPI [2:0]		0	DBI [2:0]			06		
	0	1	↑	XX	0	0	0	0	1	1	0	1	0Dh	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
Read Display Signal Mode	1	↑	1	XX	0	0	0	0	0	D [2:0]			00	
	0	1	↑	XX	0	0	0	0	1	1	1	0	0Eh	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
Read Display Self-Diagnostic Result	1	↑	1	XX	D [7:2]							0	0	00
	0	1	↑	XX	0	0	0	0	1	1	1	1	0Fh	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
Enter Sleep Mode	1	↑	1	XX	D [7:6]			0	0	0	0	0	0	00
	0	1	↑	XX	0	0	0	1	0	0	0	0	10h	
	0	1	↑	XX	0	0	0	1	0	0	0	1	11h	
Partial Mode ON	0	1	↑	XX	0	0	0	1	0	0	1	0	12h	
Normal Display Mode ON	0	1	↑	XX	0	0	0	1	0	0	1	1	13h	
Display Inversion OFF	0	1	↑	XX	0	0	1	0	0	0	0	0	20h	
Display Inversion ON	0	1	↑	XX	0	0	1	0	0	0	0	1	21h	
Gamma Set	0	1	↑	XX	0	0	1	0	0	1	1	0	26h	
	1	1	↑	XX	GC [7:0]							01		
Display OFF	0	1	↑	XX	0	0	1	0	1	0	0	0	28h	
Display ON	0	1	↑	XX	0	0	1	0	1	0	0	1	29h	
Column Address Set	0	1	↑	XX	0	0	1	0	1	0	1	0	2Ah	
	1	1	↑	XX	SC [15:8]							XX		
	1	1	↑	XX	SC [7:0]							XX		
	1	1	↑	XX	EC [15:8]							XX		
	1	1	↑	XX	EC [7:0]							XX		
Page Address Set	0	1	↑	XX	0	0	1	0	1	0	1	1	2Bh	
	1	1	↑	XX	SP [15:8]							XX		
	1	1	↑	XX	SP [7:0]							XX		
	1	1	↑	XX	EP [15:8]							XX		
	1	1	↑	XX	EP [7:0]							XX		



Memory Write	0	1	↑	XX	0	0	1	0	1	1	0	0	2Ch
	1	1	↑		D [17:0]								XX
Color SET	0	1	↑	XX	0	0	1	0	1	1	0	1	2Dh
	1	1	↑	XX	0	0	R00 [5:0]					XX	
	1	1	↑	XX	0	0	Rnn [5:0]					XX	
	1	1	↑	XX	0	0	R31 [5:0]					XX	
	1	1	↑	XX	0	0	G00 [5:0]					XX	
	1	1	↑	XX	0	0	Gnn [5:0]					XX	
	1	1	↑	XX	0	0	G64 [5:0]					XX	
	1	1	↑	XX	0	0	B00 [5:0]					XX	
	1	1	↑	XX	0	0	Bnn [5:0]					XX	
	1	1	↑	XX	0	0	B31 [5:0]					XX	
Memory Read	0	1	↑	XX	0	0	1	0	1	1	1	0	2Eh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
Partial Area	1	↑	1		D [17:0]								XX
	0	1	↑	XX	0	0	1	1	0	0	0	0	30h
	1	1	↑	XX	SR [15:8]					00			
	1	1	↑	XX	SR [7:0]					00			
	1	1	↑	XX	ER [15:8]					01			
	1	1	↑	XX	ER [7:0]					3F			
	Vertical Scrolling Definition	0	1	↑	XX	0	0	1	1	0	0	1	1
1		1	↑	XX	TFA [15:8]					00			
1		1	↑	XX	TFA [7:0]					00			
1		1	↑	XX	VSA [15:8]					01			
1		1	↑	XX	VSA [7:0]					40			
1		1	↑	XX	BFA [15:8]					00			
1		1	↑	XX	BFA [7:0]					00			
Tearing Effect Line OFF	0	1	↑	XX	0	0	1	1	0	1	0	0	34h
Tearing Effect Line ON	0	1	↑	XX	0	0	1	1	0	1	0	1	35h
Memory Access Control	1	1	↑	XX	0	0	0	0	0	0	0	M	00
	0	1	↑	XX	0	0	1	1	0	1	1	0	36h
Vertical Scrolling Start Address	1	1	↑	XX	MY	MX	MV	ML	BGR	MH	0	0	00
	0	1	↑	XX	0	0	1	1	0	1	1	1	37h
Vertical Scrolling Start Address	1	1	↑	XX	VSP [15:8]					00			
	1	1	↑	XX	VSP [7:0]					00			
Idle Mode OFF	0	1	↑	XX	0	0	1	1	1	0	0	0	38h
Idle Mode ON	0	1	↑	XX	0	0	1	1	1	0	0	1	39h
Pixel Format Set	0	1	↑	XX	0	0	1	1	1	0	1	0	3Ah
	1	1	↑	XX	0	DPI [2:0]			0	DBI [2:0]			66
Write Memory Continue	0	1	↑	XX	0	0	1	1	1	1	0	0	3Ch
	1	1	↑		D [17:0]								XX
Read Memory Continue	0	1	↑	XX	0	0	1	1	1	1	1	0	3Eh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
Set Tear Scanline	1	↑	1		D [17:0]								XX
	0	1	↑	XX	0	1	0	0	0	1	0	0	44h
	1	1	↑	XX	0	0	0	0	0	0	0	STS [8]	XX
Get Scanline	1	1	↑	XX	STS [7:0]					XX			
	0	1	↑	XX	0	1	0	0	0	1	0	1	45h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	0	0	0	0	0	0	GTS [9:8]		XX
Write Display Brightness	1	↑	1	XX	GTS [7:0]					XX			
	0	1	↑	XX	0	1	0	1	0	0	0	1	51h
1	1	↑	XX	DBV [7:0]					00				

Read Display Brightness	0	1	↑	XX	0	1	0	1	0	0	1	0	52h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	DBV [7:0]								00
Write CTRL Display	0	1	↑	XX	0	1	0	1	0	0	1	1	53h
	1	1	↑	XX	0	0	BCTRL	0	DD	BL	0	0	00
Read CTRL Display	0	1	↑	XX	0	1	0	1	0	1	0	0	54h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	0	0	BCTRL	0	DD	BL	0	0	00
Write Content Adaptive Brightness Control	0	1	↑	XX	0	1	0	1	0	1	0	1	55h
	1	1	↑	XX	0	0	0	0	0	0	C [1:0]		00
Read Content Adaptive Brightness Control	0	1	↑	XX	0	1	0	1	0	1	1	0	56h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	0	0	0	0	0	0	C [1:0]		00
Write CAB Minimum Brightness	0	1	↑	XX	0	1	0	1	1	1	1	0	5Eh
	1	1	↑	XX	CMB [7:0]								00
Read CAB Minimum Brightness	0	1	↑	XX	0	1	0	1	1	1	1	1	5Fh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	CMB [7:0]								00
Read ID1	0	1	↑	XX	1	1	0	1	1	0	1	0	DAh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	Module's Manufacture [7:0]								XX
Read ID2	0	1	↑	XX	1	1	0	1	1	0	1	1	DBh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	LCD Module / Driver Version [7:0]								XX
Read ID3	0	1	↑	XX	1	1	0	1	1	1	0	0	DCh
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	LCD Module / Driver ID [7:0]								XX

Extended Command Set													
Command Function	D/CX	RDX	WRX	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	Hex
RGB Interface	0	1	↑	XX	1	0	1	1	0	0	0	0	B0h
Signal Control	1	1	↑	XX	ByPass MODE	RCM [1:0]	0	VSPL	HSPL	DPL	EPL		00
Frame Control (In Normal Mode)	0	1	↑	XX	1	0	1	1	0	0	0	1	B1h
	1	1	↑	XX	0	0	0	0	0	0	DIVA [1:0]		00
	1	1	↑	XX	0	0	0	RTNA [4:0]					1B
Frame Control (In Idle Mode)	0	1	↑	XX	1	0	1	1	0	0	1	0	B2h
	1	1	↑	XX	0	0	0	0	0	0	DIVB [1:0]		00
	1	1	↑	XX	0	0	0	RTNB [4:0]					1B
Frame Control (In Partial Mode)	0	1	↑	XX	1	0	1	1	0	0	1	1	B3h
	1	1	↑	XX	0	0	0	0	0	0	DIVC [1:0]		00
	1	1	↑	XX	0	0	0	RTNC [4:0]					1B
Display Inversion Control	0	1	↑	XX	1	0	1	1	0	1	0	0	B4h
	1	1	↑	XX	0	0	0	0	0	NLA	NLB	NLC	02
Blanking Porch Control	0	1	↑	XX	1	0	1	1	0	1	0	1	B5h
	1	1	↑	XX	0	VFP [6:0]						02	
	1	1	↑	XX	0	VBP [6:0]						02	
	1	1	↑	XX	0	0	0	HFP [4:0]					0A
	1	1	↑	XX	0	0	0	HBP [4:0]					14

Display Function Control	0	1	↑	XX	1	0	1	1	0	1	1	0	B6h	
	1	1	↑	XX	0	0	0	0	PTG [1:0]		PT [1:0]		0A	
	1	1	↑	XX	REV	GS	SS	SM	ISC [3:0]				82	
	1	1	↑	XX	0	0	NL [5:0]						27	
	1	1	↑	XX	0	0	PCDIV [5:0]						04	
Entry Mode Set	0	1	↑	XX	1	0	1	1	0	1	1	1	B7h	
	1	1	↑	XX	0	0	0	0	0	GON	DTE	GAS	08	
Backlight Control 1	0	1	↑	XX	1	0	1	1	1	0	0	0	B8h	
	1	1	↑	XX	0	0	0	0	TH_UI [3:0]				0C	
Backlight Control 2	0	1	↑	XX	1	0	1	1	1	0	0	1	B9h	
	1	1	↑	XX	TH_MV [3:0]				TH_ST [3:0]				CC	
Backlight Control 3	0	1	↑	XX	1	0	1	1	1	0	1	0	BAh	
	1	1	↑	XX	0	0	0	0	DTH_UI [3:0]				04	
Backlight Control 4	0	1	↑	XX	1	0	1	1	1	0	1	1	BBh	
	1	1	↑	XX	DTH_MV [3:0]				DTH_ST [3:0]				65	
Backlight Control 5	0	1	↑	XX	1	0	1	1	1	1	0	0	BCh	
	1	1	↑	XX	DIM2 [3:0]				0	DIM1 [2:0]				44
Backlight Control 7	0	1	↑	XX	1	0	1	1	1	1	1	0	BEh	
	1	1	↑	XX	PWM_DIV [7:0]									
Backlight Control 8	0	1	↑	XX	1	0	1	1	1	1	1	1	BFh	
	1	1	↑	XX	0	0	0	0	0	LEDONR	LEDONPOL	LEDPWMOP	00	
Power Control 1	0	1	↑	XX	1	1	0	0	0	0	0	0	C0h	
	1	1	↑	XX	0	0	VRH [5:0]						21	
Power Control 2	0	1	↑	XX	1	1	0	0	0	0	0	1	C1h	
	1	1	↑	XX	0	0	0	1	0	BT [2:0]			10	
VCOM Control 1	0	1	↑	XX	1	1	0	0	0	1	0	1	C5h	
	1	1	↑	XX	0	VMH [6:0]						31		
	1	1	↑	XX	0	VML [6:0]						3C		
VCOM Control 2	0	1	↑	XX	1	1	0	0	0	1	1	1	C7h	
	1	1	↑	XX	nVM	VMF [6:0]						C0		
NV Memory Write	0	1	↑	XX	1	1	0	1	0	0	0	0	D0h	
	1	1	↑	XX	0	0	0	0	0	PGM_ADR [2:0]			00	
	1	1	↑	XX	PGM_DATA [7:0]									
NV Memory Protection Key	0	1	↑	XX	1	1	0	1	0	0	0	1	D1h	
	1	1	↑	XX	KEY [23:16]								XX	
	1	1	↑	XX	KEY [15:8]								XX	
	1	1	↑	XX	KEY [7:0]								XX	
NV Memory Status Read	0	1	↑	XX	1	1	0	1	0	0	1	0	D2h	
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX	
	1	↑	1	XX	0	ID2_CNT [2:0]			0	ID1_CNT [2:0]			XX	
	1	↑	1	XX	BUSY	VMF_CNT [2:0]			0	ID3_CNT [2:0]			XX	



Read ID4	0	1	↑	XX	1	1	0	1	0	0	1	1	D3h
	1	↑	1	XX	X	X	X	X	X	X	X	X	XX
	1	↑	1	XX	0	0	0	0	0	0	0	0	00
	1	↑	1	XX	1	0	0	1	0	0	1	1	93
	1	↑	1	XX	0	1	0	0	0	0	0	1	41
Positive Gamma Correction	0	1	↑	XX	1	1	1	0	0	0	0	0	E0h
	1	1	↑	XX	0	0	0	0	VP0 [3:0]			0F	
	1	1	↑	XX	0	0	VP1 [5:0]			18			
	1	1	↑	XX	0	0	VP2 [5:0]			14			
	1	1	↑	XX	0	0	0	0	VP4 [3:0]			0A	
	1	1	↑	XX	0	0	0	VP6 [4:0]			0D		
	1	1	↑	XX	0	0	0	0	VP13 [3:0]			06	
	1	1	↑	XX	0	VP20 [6:0]			43				
	1	1	↑	XX	VP36 [3:0]			VP27 [3:0]			75		
	1	1	↑	XX	0	VP43 [6:0]			33				
	1	1	↑	XX	0	0	0	0	VP50 [3:0]			06	
	1	1	↑	XX	0	0	0	VP57 [4:0]			0E		
	1	1	↑	XX	0	0	0	0	VP59 [3:0]			00	
	1	1	↑	XX	0	0	VP61 [5:0]			0C			
	1	1	↑	XX	0	0	VP62 [5:0]			09			
	1	1	↑	XX	0	0	0	0	VP63 [3:0]			08	
Negative Gamma Correction	0	1	↑	XX	1	1	1	0	0	0	0	1	E1h
	1	1	↑	XX	0	0	0	0	VN0 [3:0]			08	
	1	1	↑	XX	0	0	VN1 [5:0]			2B			
	1	1	↑	XX	0	0	VN2 [5:0]			2D			
	1	1	↑	XX	0	0	0	0	VN4 [3:0]			04	
	1	1	↑	XX	0	0	0	VN6 [4:0]			10		
	1	1	↑	XX	0	0	0	0	VN13 [3:0]			04	
	1	1	↑	XX	0	VN20 [6:0]			3E				
	1	1	↑	XX	VN36 [3:0]			VN27 [3:0]			24		
	1	1	↑	XX	0	VN43 [6:0]			4E				
	1	1	↑	XX	0	0	0	0	VN50 [3:0]			04	
	1	1	↑	XX	0	0	0	VN57 [4:0]			0F		
	1	1	↑	XX	0	0	0	0	VN59 [3:0]			0E	
	1	1	↑	XX	0	0	VN61 [5:0]			35			
	1	1	↑	XX	0	0	VN62 [5:0]			38			
	1	1	↑	XX	0	0	0	0	VN63 [3:0]			0F	
Digital Gamma Control 1	0	1	↑	XX	1	1	1	0	0	0	1	0	E2h
1 <sup>st</sup> Parameter	1	1	↑	XX	RCA0 [3:0]			BCA0 [3:0]			XX		
2 <sup>nd</sup> Parameter	1	1	↑	XX	RCA1 [3:0]			BCA1 [3:0]			XX		
3 <sup>rd</sup> Parameter	1	1	↑	XX	RCA2 [3:0]			BCA2 [3:0]			XX		
4 <sup>th</sup> Parameter	1	1	↑	XX	RCA3 [3:0]			BCA3 [3:0]			XX		
5 <sup>th</sup> Parameter	1	1	↑	XX	RCA4 [3:0]			BCA4 [3:0]			XX		
6 <sup>th</sup> Parameter	1	1	↑	XX	RCA5 [3:0]			BCA5 [3:0]			XX		
7 <sup>th</sup> Parameter	1	1	↑	XX	RCA6 [3:0]			BCA6 [3:0]			XX		
8 <sup>th</sup> Parameter	1	1	↑	XX	RCA7 [3:0]			BCA7 [3:0]			XX		
9 <sup>th</sup> Parameter	1	1	↑	XX	RCA8 [3:0]			BCA8 [3:0]			XX		
10 <sup>th</sup> Parameter	1	1	↑	XX	RCA9 [3:0]			BCA9 [3:0]			XX		
11 <sup>th</sup> Parameter	1	1	↑	XX	RCA10 [3:0]			BCA10 [3:0]			XX		
12 <sup>th</sup> Parameter	1	1	↑	XX	RCA11 [3:0]			BCA11 [3:0]			XX		
13 <sup>th</sup> Parameter	1	1	↑	XX	RCA12 [3:0]			BCA12 [3:0]			XX		
14 <sup>th</sup> Parameter	1	1	↑	XX	RCA13 [3:0]			BCA13 [3:0]			XX		
15 <sup>th</sup> Parameter	1	1	↑	XX	RCA14 [3:0]			BCA14 [3:0]			XX		
16 <sup>th</sup> Parameter	1	1	↑	XX	RCA15 [3:0]			BCA15 [3:0]			XX		

Digital Gamma Control 2	0	1	↑	XX	1	1	1	0	0	0	1	1	E3h
1 <sup>st</sup> Parameter	1	1	↑	XX	RFA0 [3:0]			BFA0 [3:0]			XX		
2 <sup>nd</sup> Parameter	1	1	↑	XX	RFA1 [3:0]			BFA1 [3:0]			XX		
3 <sup>rd</sup> Parameter	1	1	↑	XX	RFA2 [3:0]			BFA2 [3:0]			XX		
4 <sup>th</sup> Parameter	1	1	↑	XX	RFA3 [3:0]			BFA3 [3:0]			XX		
5 <sup>th</sup> Parameter	1	1	↑	XX	RFA4 [3:0]			BFA4 [3:0]			XX		
6 <sup>th</sup> Parameter	1	1	↑	XX	RFA5 [3:0]			BFA5 [3:0]			XX		
7 <sup>th</sup> Parameter	1	1	↑	XX	RFA6 [3:0]			BFA6 [3:0]			XX		
8 <sup>th</sup> Parameter	1	1	↑	XX	RFA7 [3:0]			BFA7 [3:0]			XX		
9 <sup>th</sup> Parameter	1	1	↑	XX	RFA8 [3:0]			BFA8 [3:0]			XX		
10 <sup>th</sup> Parameter	1	1	↑	XX	RFA9 [3:0]			BFA9 [3:0]			XX		
11 <sup>th</sup> Parameter	1	1	↑	XX	RFA10 [3:0]			BFA10 [3:0]			XX		
12 <sup>th</sup> Parameter	1	1	↑	XX	RFA11 [3:0]			BFA [3:0]			XX		
13 <sup>th</sup> Parameter	1	1	↑	XX	RFA12 [3:0]			BFA12 [3:0]			XX		
14 <sup>th</sup> Parameter	1	1	↑	XX	RFA13 [3:0]			BFA13 [3:0]			XX		
15 <sup>th</sup> Parameter	1	1	↑	XX	RFA14 [3:0]			BFA14 [3:0]			XX		
16 <sup>th</sup> Parameter	1	1	↑	XX	RFA15 [3:0]			BFA15 [3:0]			XX		
17 <sup>th</sup> Parameter	1	1	↑	XX	RFA16 [3:0]			BFA16 [3:0]			XX		
18 <sup>th</sup> Parameter	1	1	↑	XX	RFA17 [3:0]			BFA17 [3:0]			XX		
19 <sup>th</sup> Parameter	1	1	↑	XX	RFA18 [3:0]			BFA18 [3:0]			XX		
20 <sup>th</sup> Parameter	1	1	↑	XX	RFA19 [3:0]			BFA19 [3:0]			XX		
21 <sup>st</sup> Parameter	1	1	↑	XX	RFA20 [3:0]			BFA20 [3:0]			XX		
22 <sup>nd</sup> Parameter	1	1	↑	XX	RFA21 [3:0]			BFA21 [3:0]			XX		
23 <sup>rd</sup> Parameter	1	1	↑	XX	RFA22 [3:0]			BFA22 [3:0]			XX		
24 <sup>th</sup> Parameter	1	1	↑	XX	RFA23 [3:0]			BFA23 [3:0]			XX		
25 <sup>th</sup> Parameter	1	1	↑	XX	RFA24 [3:0]			BFA24 [3:0]			XX		
26 <sup>th</sup> Parameter	1	1	↑	XX	RFA25 [3:0]			BFA25 [3:0]			XX		
27 <sup>th</sup> Parameter	1	1	↑	XX	RFA26 [3:0]			BFA26 [3:0]			XX		
28 <sup>th</sup> Parameter	1	1	↑	XX	RFA27 [3:0]			BFA27 [3:0]			XX		
29 <sup>th</sup> Parameter	1	1	↑	XX	RFA28 [3:0]			BFA28 [3:0]			XX		
30 <sup>th</sup> Parameter	1	1	↑	XX	RFA29 [3:0]			BFA29 [3:0]			XX		
31 <sup>st</sup> Parameter	1	1	↑	XX	RFA30 [3:0]			BFA30 [3:0]			XX		
32 <sup>nd</sup> Parameter	1	1	↑	XX	RFA31 [3:0]			BFA31 [3:0]			XX		
33 <sup>rd</sup> Parameter	1	1	↑	XX	RFA32 [3:0]			BFA32 [3:0]			XX		
34 <sup>th</sup> Parameter	1	1	↑	XX	RFA33 [3:0]			BFA33 [3:0]			XX		
35 <sup>th</sup> Parameter	1	1	↑	XX	RFA34 [3:0]			BFA34 [3:0]			XX		
36 <sup>th</sup> Parameter	1	1	↑	XX	RFA35 [3:0]			BFA35 [3:0]			XX		
37 <sup>th</sup> Parameter	1	1	↑	XX	RFA36 [3:0]			BFA36 [3:0]			XX		
38 <sup>th</sup> Parameter	1	1	↑	XX	RFA37 [3:0]			BFA37 [3:0]			XX		



39 <sup>th</sup> Parameter	1	1	↑	XX	RFA38 [3:0]	BFA38 [3:0]	XX
40 <sup>th</sup> Parameter	1	1	↑	XX	RFA39 [3:0]	BFA39 [3:0]	XX
41 <sup>st</sup> Parameter	1	1	↑	XX	RFA40 [3:0]	BFA40 [3:0]	XX
42 <sup>nd</sup> Parameter	1	1	↑	XX	RFA41 [3:0]	BFA41 [3:0]	XX
43 <sup>rd</sup> Parameter	1	1	↑	XX	RFA42 [3:0]	BFA42 [3:0]	XX
44 <sup>th</sup> Parameter	1	1	↑	XX	RFA43 [3:0]	BFA43 [3:0]	XX
45 <sup>th</sup> Parameter	1	1	↑	XX	RFA44 [3:0]	BFA44 [3:0]	XX
46 <sup>th</sup> Parameter	1	1	↑	XX	RFA45 [3:0]	BFA45 [3:0]	XX
47 <sup>th</sup> Parameter	1	1	↑	XX	RFA46 [3:0]	BFA46 [3:0]	XX
48 <sup>th</sup> Parameter	1	1	↑	XX	RFA47 [3:0]	BFA47 [3:0]	XX
49 <sup>th</sup> Parameter	1	1	↑	XX	RFA48 [3:0]	BFA48 [3:0]	XX
50 <sup>th</sup> Parameter	1	1	↑	XX	RFA49 [3:0]	BFA49 [3:0]	XX
51 <sup>st</sup> Parameter	1	1	↑	XX	RFA50 [3:0]	BFA50 [3:0]	XX
52 <sup>nd</sup> Parameter	1	1	↑	XX	RFA51 [3:0]	BFA51 [3:0]	XX
53 <sup>rd</sup> Parameter	1	1	↑	XX	RFA52 [3:0]	BFA52 [3:0]	XX
54 <sup>th</sup> Parameter	1	1	↑	XX	RFA53 [3:0]	BFA53 [3:0]	XX
55 <sup>th</sup> Parameter	1	1	↑	XX	RFA54 [3:0]	BFA54 [3:0]	XX
56 <sup>th</sup> Parameter	1	1	↑	XX	RFA55 [3:0]	BFA55 [3:0]	XX
57 <sup>th</sup> Parameter	1	1	↑	XX	RFA56 [3:0]	BFA56 [3:0]	XX
58 <sup>th</sup> Parameter	1	1	↑	XX	RFA57 [3:0]	BFA57 [3:0]	XX
59 <sup>th</sup> Parameter	1	1	↑	XX	RFA58 [3:0]	BFA58 [3:0]	XX
60 <sup>th</sup> Parameter	1	1	↑	XX	RFA59 [3:0]	BFA59 [3:0]	XX
61 <sup>st</sup> Parameter	1	1	↑	XX	RFA60 [3:0]	BFA60 [3:0]	XX
62 <sup>nd</sup> Parameter	1	1	↑	XX	RFA61 [3:0]	BFA61 [3:0]	XX
63 <sup>rd</sup> Parameter	1	1	↑	XX	RFA62 [3:0]	BFA62 [3:0]	XX
64 <sup>th</sup> Parameter	1	1	↑	XX	RFA63 [3:0]	BFA63 [3:0]	XX

Interface Control	0	1	↑	XX	1	1	1	1	0	1	1	0	F8h
	1	1	↑	XX	MY_EOR	MX_EOR	MV_EOR	0	BGR_EOR	0	0	WEMODE	01
	1	1	↑	XX	0	0	EPF [1:0]	0	0	MDT [1:0]			00
	1	1	↑	XX	0	0	ENDIAN	0	DM [1:0]	RM	RIM		00
Power Control A	0	1	↑	XX	1	1	0	0	1	0	1	1	CBh
	1	1	↑	XX	0	0	1	1	1	0	0	1	39
	1	1	↑	XX	0	0	1	0	1	1	0	0	2C
	1	1	↑	XX	0	0	0	0	0	0	0	0	00
	1	1	↑	XX	0	0	1	1	0	REG_VD[2:0]			30
	1	1	↑	XX	0	0	0	0	0	VBC[2:0]			01
Power Control B	0	1	↑	XX	1	1	0	0	1	1	1	1	CFh
	1	1	↑	XX	0	0	0	0	0	0	0	0	00
	1	1	↑	XX	1	PCEQ	DRV_ena	Power control[1:0]	0	0	1		81
	1	1	↑	XX	DRV_vml[2:1]	1	DC_ena	DRV_vm[0]	DRV_vmh[2:0]				30
Driver timing control A	0	1	↑	XX	1	1	1	0	1	0	0	0	E8h
	1	1	↑	XX	CR/EQ/PC	SDT[1:0]	0	0	1	0	NOW		84
	1	1	↑	XX	0	0	EQ[2:0]		CR[2:0]				11

	1	1	↑	XX	0	1	1	1	1	PC[1:0]			7A
	0	1	↑	XX	1	1	1	0	1	0	0	1	E9h
Driver timing control B	1	1	↑	XX	CRE/EQE /PCE	SDT[1:0]		0	0	1	0	NOWE	04
	1	1	↑	XX	0	0	EQ[2:0]		CR[2:0]			11	
	1	1	↑	XX	0	1	1	1	1	PC[1:0]			7A
Driver timing control C	0	1	↑	XX	1	1	1	0	1	0	1	0	EAh
	1	1	↑	XX	VG_SW_T4		VG_SW_T3	VG_SW_T2	VG_SW_T1			66	
Power on sequence control	0	1	↑	XX	1	1	1	0	1	1	0	1	EDh
	1	1	↑	XX	0	1	CP1 soft start		0	1	CP23 soft start		55
	1	1	↑	XX	0	0	En_vcl		0	0	En_ddvdh		01
	1	1	↑	XX	0	0	En_vgh		0	0	En_vgl		23
	1	1	↑	XX	DDVDH_ENH		0	0	0	0	0	1	01
Enable 3G	0	1	↑	XX	1	1	1	1	0	0	1	0	F2h
	1	1	↑	XX	0	0	0	0	0	0	1	3G_enb	02

Note 1: Undefined commands are treated as NOP (00h) command.

Note 2: B0 to D9 and DE to FF are for factory use of display supplier. USER can decide if these commands are available or they are treated as NOP (00h) commands before shipping to USER. Default value is NOP (00h).

Note 3: Commands 10h, 12h, 13h, 26h, 28h, 29h, 30h, 36h (Bit D4 only), 38h and 39h are updated during V-SYNC when ILI9341V is in Sleep OUT mode to avoid abnormal visual effects. During Sleep IN mode, these commands are updated immediately. Read status (09h), Read display power mode (0Ah), Read display MADCTL (0Bh), Read display pixel format (0Ch), Read display image mode (0Dh), Read display signal mode (0Eh) and Read display self diagnostic result (0Fh) of these commands are updated immediately both in Sleep IN mode and Sleep OUT mode.

## **11. Quality Assurance**

### **11.1. Purpose**

This standard for Quality Assurance assures the quality of LCD module products supplied to customer.

### **11.2. Standard for Quality Test**

#### 11.2.1 Sampling Plan:

GB2828.1-2003

Single sampling, general inspection level II

#### 11.2.2 Sampling Criteria:

Visual inspection: AQL 1.5%

Electrical functional: AQL 0.65%.

#### 11.2.3 Reliability Test:

Detailed requirement refer to Reliability Test Specification.

### **11.3. Nonconforming Analysis & Disposition**

#### 11.3.1 Nonconforming analysis:

11.3.1.1 Customer should provide overall information of non-conforming sample for their complaints.

11.3.1.2 After receipt of detailed information from customer, the analysis of nonconforming parts usually should be finished in one week.

11.3.1.3 If cannot finish the analysis on time, customer will be notified with the progress status.

#### 11.3.2 Disposition of nonconforming:

11.3.2.1 Non-conforming product over PPM level will be replaced.

11.3.2.2 The cause of non-conformance will be analyzed. Corrective action will be discussed and implemented.

### **11.4. Agreement Items**

Shall negotiate with customer if the following situation occurs:

11.4.1 There is any discrepancy in standard of quality assurance.

11.4.2 Additional requirement to be added in product specification.

11.4.3 Any other special problem.

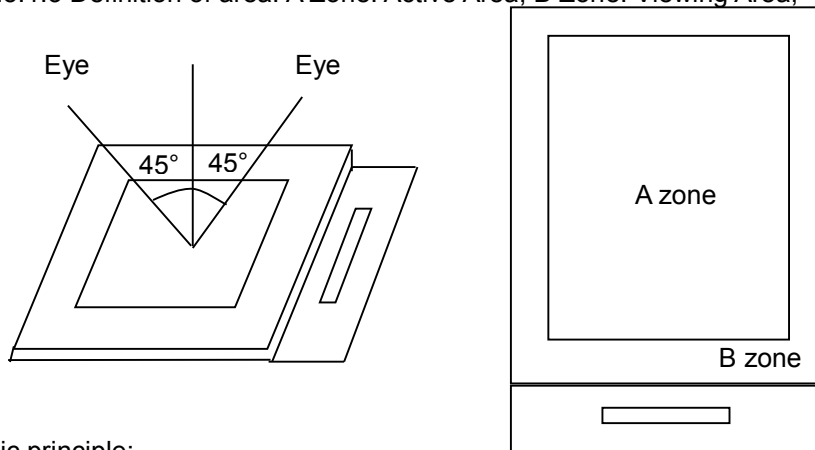
**11.5. Standard of the Product Visual Inspection**

11.5.1 Appearance inspection:

11.5.1.1 The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm ± 2cm.

11.5.1.2 The viewing angle should be 45° from the vertical line without reflection light or follows customer's viewing angle specifications.

11.5.1.3 Definition of area: A Zone: Active Area, B Zone: Viewing Area,



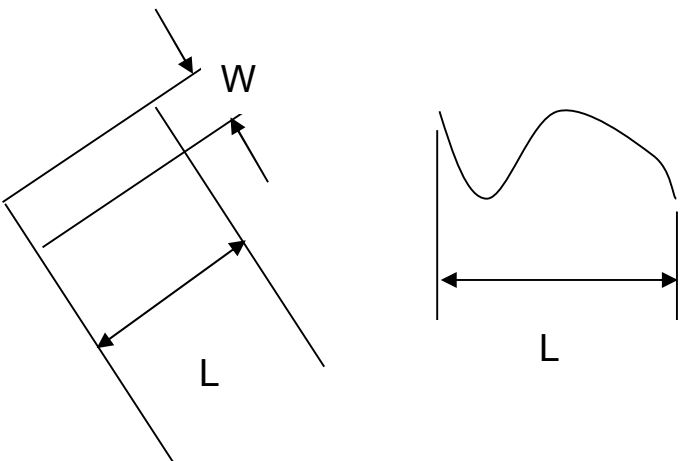
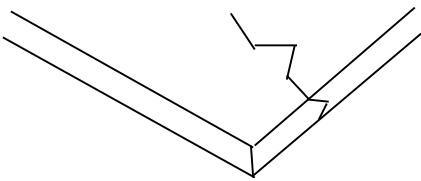
11.5.2 Basic principle:

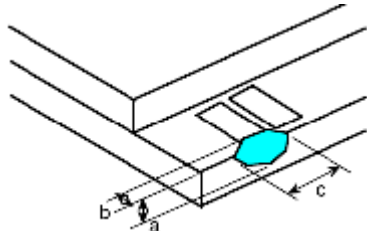
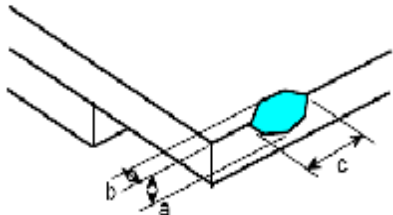
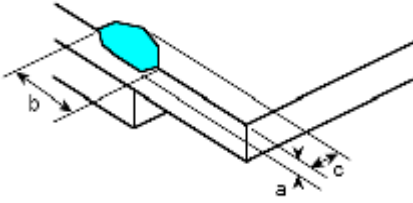
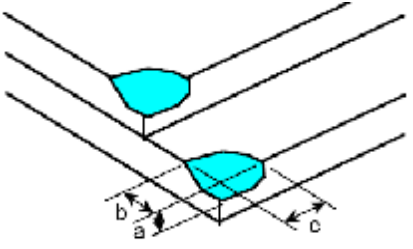
11.5.2.1 A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

11.5.2.2 New item must be added on time when it is necessary.

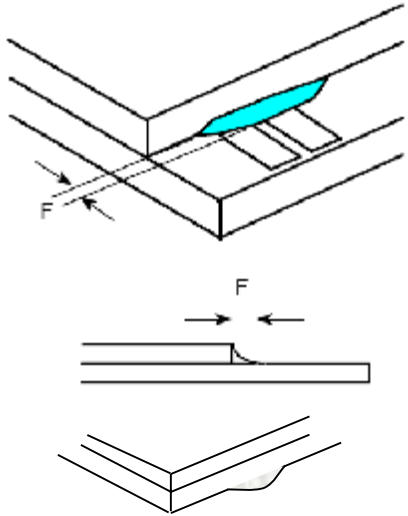
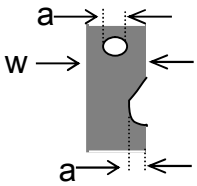
**11.6. Inspection Specification**

No.	Item	Criteria (Unit: mm)																			
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	$\phi = (a + b) / 2$	<table border="1"> <thead> <tr> <th>Size</th> <th>Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.10</math></td> <td></td> <td>Ignore</td> </tr> <tr> <td><math>0.10 &lt; \phi \leq 0.15</math></td> <td></td> <td>2</td> </tr> <tr> <td><math>0.15 &lt; \phi \leq 0.25</math></td> <td></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \phi</math></td> <td></td> <td>0</td> </tr> <tr> <td>Total</td> <td></td> <td>2 no include <math>\phi \leq 0.10</math></td> </tr> </tbody> </table>	Size	Area	Acc. Qty	$\phi \leq 0.10$		Ignore	$0.10 < \phi \leq 0.15$		2	$0.15 < \phi \leq 0.25$		1	$0.25 < \phi$		0	Total		2 no include $\phi \leq 0.10$
			Size	Area	Acc. Qty																
$\phi \leq 0.10$		Ignore																			
$0.10 < \phi \leq 0.15$		2																			
$0.15 < \phi \leq 0.25$		1																			
$0.25 < \phi$		0																			
Total		2 no include $\phi \leq 0.10$																			
Distance between 2 defects should more than 3mm apart.																					

02	Electrical Defect (Minor defect)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 30%;">Display Area</th> <th style="width: 30%;">Total</th> <th rowspan="4" style="width: 10%; text-align: center;">Note1</th> </tr> </thead> <tbody> <tr> <td>Bright dot</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td>Dark dot</td> <td style="text-align: center;"><math>N \leq 2</math></td> <td style="text-align: center;"><math>N \leq 2</math></td> </tr> <tr> <td>Total dot</td> <td style="text-align: center;"><math>N \leq 2</math></td> <td style="text-align: center;"><math>N \leq 2</math></td> </tr> <tr> <td>Mura</td> <td colspan="2" style="text-align: center;">Not visible through 5% ND filters.</td> <td style="text-align: center;">Note 2</td> </tr> </tbody> </table>		Display Area	Total	Note1	Bright dot	0	0	Dark dot	$N \leq 2$	$N \leq 2$	Total dot	$N \leq 2$	$N \leq 2$	Mura	Not visible through 5% ND filters.		Note 2	
			Display Area	Total	Note1															
		Bright dot	0	0																
		Dark dot	$N \leq 2$	$N \leq 2$																
		Total dot	$N \leq 2$	$N \leq 2$																
Mura	Not visible through 5% ND filters.		Note 2																	
Remark:																				
1. Bright dot caused by scratch and foreign object accords to item 1.																				
03	Black and White line Scratch Foreign material (Line type) (Minor defect)																			
		<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 30%;">Length</th> <th style="width: 30%;">Width</th> <th style="width: 30%;">Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td><math>W \leq 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.05 &lt; W \leq 0.10</math></td> <td>2</td> </tr> <tr> <td>/</td> <td><math>0.1 &lt; W</math></td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>3</td> </tr> </tbody> </table>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.10$	2	/	$0.1 < W$	0	Total		3
		Length	Width	Acc. Qty																
/	$W \leq 0.03$	Ignore																		
$L \leq 2.5$	$0.03 < W \leq 0.05$	3																		
$L \leq 2.5$	$0.05 < W \leq 0.10$	2																		
/	$0.1 < W$	0																		
Total		3																		
Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.																				
04	Glass Crack (Minor defect)																			
		Crack is potential to enlarge, any type is not allowed.																		

<p>05</p>	<p>Glass Chipping Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>3</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	3	$a < \text{Glass Thickness}$			
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	3											
$a < \text{Glass Thickness}$												
<p>06</p>	<p>Glass Chipping Rear of Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>07</p>	<p>Glass Chipping Except Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>08</p>	<p>Glass Corner Chipping: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &lt; 3.0, b &lt; 3.0</math></td> <td>Ignore</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c < 3.0, b < 3.0$	Ignore	$a < \text{Glass Thickness}$					
Length and Width	Acc. Qty											
$c < 3.0, b < 3.0$	Ignore											
$a < \text{Glass Thickness}$												



<p>09</p>	<p>Glass Burr: (Minor defect)</p> 	<table border="1" data-bbox="868 264 1339 351"> <thead> <tr> <th>Length</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>F &lt; 1.0</math></td> <td>Ignore</td> </tr> </tbody> </table> <p>Glass burr don't affect assemble and module dimension.</p>	Length	Acc. Qty	$F < 1.0$	Ignore						
Length	Acc. Qty											
$F < 1.0$	Ignore											
<p>10</p>	<p>FPC Defect: (Minor defect)</p> 	<p>10.1 Dent, pinhole width <math>a &lt; w/3</math>. (w: circuitry width.) 10.2 Open circuit is unacceptable. 10.3 No oxidation, contamination and distortion.</p>										
<p>11</p>	<p>Bubble on Polarizer (Minor defect)</p>	<table border="1" data-bbox="743 1296 1214 1512"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi \leq 0.50</math></td> <td>1</td> </tr> <tr> <td><math>0.50 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi \leq 0.50$	1	$0.50 < \varphi$	None
Diameter	Acc. Qty											
$\varphi \leq 0.20$	Ignore											
$0.20 < \varphi \leq 0.30$	4											
$0.30 < \varphi \leq 0.50$	1											
$0.50 < \varphi$	None											
<p>12</p>	<p>Dent on Polarizer (Minor defect)</p>	<table border="1" data-bbox="743 1579 1214 1794"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi \leq 0.50</math></td> <td>1</td> </tr> <tr> <td><math>0.50 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi \leq 0.50$	1	$0.50 < \varphi$	None
Diameter	Acc. Qty											
$\varphi \leq 0.20$	Ignore											
$0.20 < \varphi \leq 0.30$	4											
$0.30 < \varphi \leq 0.50$	1											
$0.50 < \varphi$	None											
<p>13</p>	<p>Bezel</p>	<p>13.1 No rust, distortion on the Bezel. 13.2 No visible fingerprints, stains or other contamination.</p>										

14	Touch Panel	<p>D: Diameter W: width L: length</p> <p>14.1 Spot: <math>D &lt; 0.25</math> is acceptable  <math>0.25 \leq D \leq 0.4</math></p> <p>2dots are acceptable and the distance between defects should more than 10 mm.</p> <p><math>D &gt; 0.4</math> is unacceptable</p> <p>14.2 Dent: <math>D &gt; 0.40</math> is unacceptable</p> <p>14.3 Scratch: <math>W \leq 0.03</math>, <math>L \leq 10</math> is acceptable,  <math>0.03 &lt; W \leq 0.10</math>, <math>L \leq 10</math> is acceptable</p> <p>Distance between 2 defects should more than 10 mm.  <math>W &gt; 0.10</math> is unacceptable.</p>
16	PCB	<p>15.1 No distortion or contamination on PCB terminals.</p> <p>15.2 All components on PCB must same as documented on the BOM/component layout.</p> <p>15.3 Follow IPC-A-600F.</p>
17	Soldering	Follow IPC-A-610C standard
18	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>18.1 Missing vertical / horizontal segment,</p> <p>18.2 Abnormal Display.</p> <p>18.3 No function or no display.</p> <p>18.4 Current exceeds product specifications.</p> <p>18.5 LCD viewing angle defect.</p> <p>18.6 No Backlight.</p> <p>18.7 Dark Backlight.</p> <p>18.8 Touch Panel no function.</p>

Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.

**11.7. Classification of Defects**

11.7.1 Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.

11.7.2 Two minor defects are equal to one major in lot sampling inspection.

**11.8. Identification/marketing criteria**

Any unit with illegible / wrong /double or no marking/ label shall be rejected.

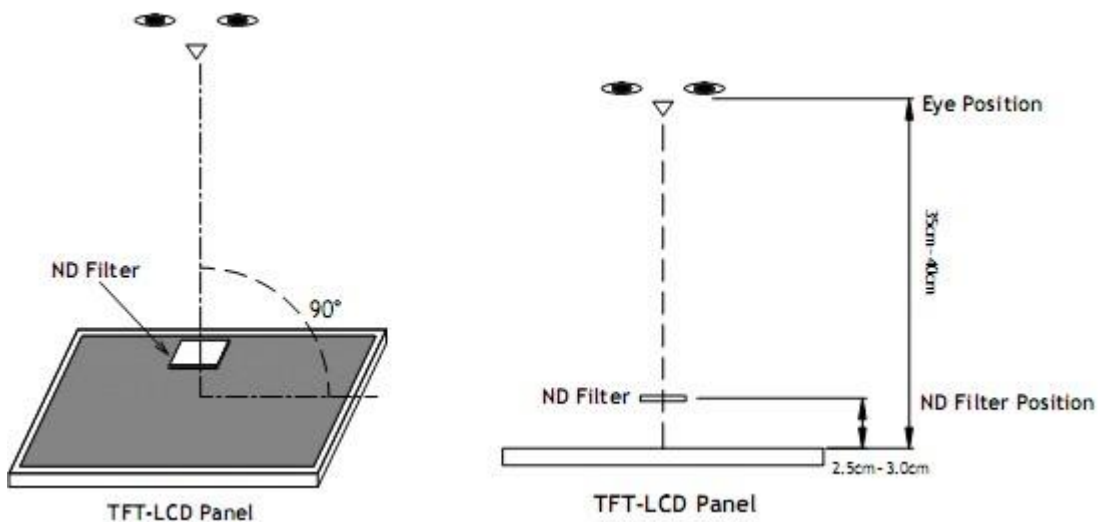
**11.9. Packaging**

11.9.1 There should be no damage of the outside carton box, each packaging box should have one identical label.

11.9.2 Modules inside package box should have compliant mark.

11.9.3 All direct package materials shall offer ESD protection

**Note1:** Bright dot is defined as the defective area of the dot is larger than 50% of one sub-pixel area.



Bright dot: The bright dot size defect at black display pattern. It can be recognized by 2% transparency of filter when the distance between eyes and panel is 350mm±50mm.

Dark dot: Cyan, Magenta or Yellow dot size defect at white display pattern. It can be recognized by 5% transparency of filter when the distance between eyes and panel is 350mm±50mm.

**Note2:** Mura on display which appears darker / brighter against background brightness on parts of display area.

## 12. Reliability Specification

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	70°C, 120Hrs	2	GB/T2423.2-2008
2	Low Temperature Operating	-20°C, 120Hrs	2	GB/T2423.1-2008
3	High Humidity	50°C, 90%RH, 120Hrs	2	GB/T2423.3-2006
4	High Temperature Storage	80°C, 120Hrs	2	GB/T2423.2-2008
5	Low Temperature Storage	-30°C, 120Hrs	2	GB/T2423.1-2008
6	Thermal Cycling Test	-20°C, 60min~70°C, 60min, 20 cycles.	2	GB/T2423.22-2012
7	Packing vibration	Frequency range:10Hz~50Hz Acceleration of gravity:5G X, Y, Z 30 min for each direction.	2	GB/T5170.14-2009
8	Electrical Static Discharge	Air: ±8KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times	2	GB/T17626.2-2006
9	Drop Test (Packaged)	Height:80 cm,1 corner, 3 edges, 6 surfaces.	2	GB/T2423.8-1995

Note1. No deflection cosmetic and operational function allowable.

Note2. Total current Consumption should be below double of initial value

**13. Precautions and Warranty**

**13.1 Safety**

- 13.1.1. The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.
- 13.1.2. Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

**13.2. Handling**

- 13.2.1. Reverse and use within ratings in order to keep performance and prevent damage.
- 13.2.2. Do not wipe the polarizer with dry cloth, as it might cause scratch. If the surface of the LCD needs to be cleaned, wipe it swiftly with cotton or other soft cloth soaked with petroleum IPA, do not use other chemicals.

**13.3. Storage**

- 13.3.1 Do not store the LCD module beyond the specified temperature ranges.

**13.4. Metal Pin (Apply to Products with Metal Pins)**

13.4.1. Pins of LCD and Backlight

- 13.4.1.1. Solder tip can touch and press on the tip of Pin LEAD during the soldering

13.4.1.2. Recommended Soldering Conditions

Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1

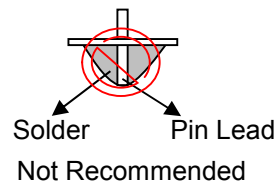
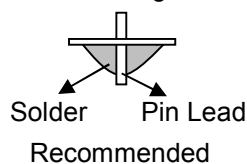
Maximum Solder Temperature: 370℃

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20℃

Typical Soldering Time: ≤3s

13.4.1.3. Solder Wetting



13.4.2. Pins of EL

- 13.4.2.1. Solder tip can touch and press on the tip of EL leads during soldering.

- 13.4.2.2. No Solder Paste on the soldering pad on the motherboard is recommended.

13.4.2.3. Recommended Soldering Conditions

Solder type: Nippon Alimit Leadfree SR-34, size 0.5mm

Recommended Solder Temperature: 270~290℃

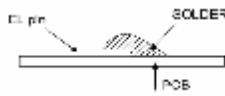
Typical Soldering Time: ≤2s

Minimum solder distance from EL lamp (body):2.0mm

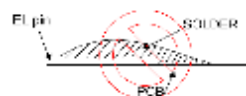
- 13.4.2.4. No horizontal press on the EL leads during soldering.

- 13.4.2.5. 180° bend EL leads three times is not allowed.

13.4.2.6. Solder Wetting

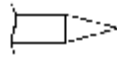


Recommended

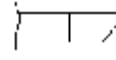


Not Recommended

13.4.2.7. The type of the solder iron:

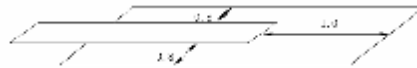


Recommended



Not Recommended

13.4.2.8. Solder Pad



**13.5. Operation**

- 13.5.1. Do not drive LCD with DC voltage
- 13.5.2. Response time will increase below lower temperature
- 13.5.3. Display may change color with different temperature
- 13.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear “fractured”.

**13.6. Static Electricity**

- 13.6.1. CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.
- 13.6.2. The normal static prevention measures should be observed for work clothes and benches.
- 13.6.3. The module should be kept into anti-static bags or other containers resistant to static for storage.

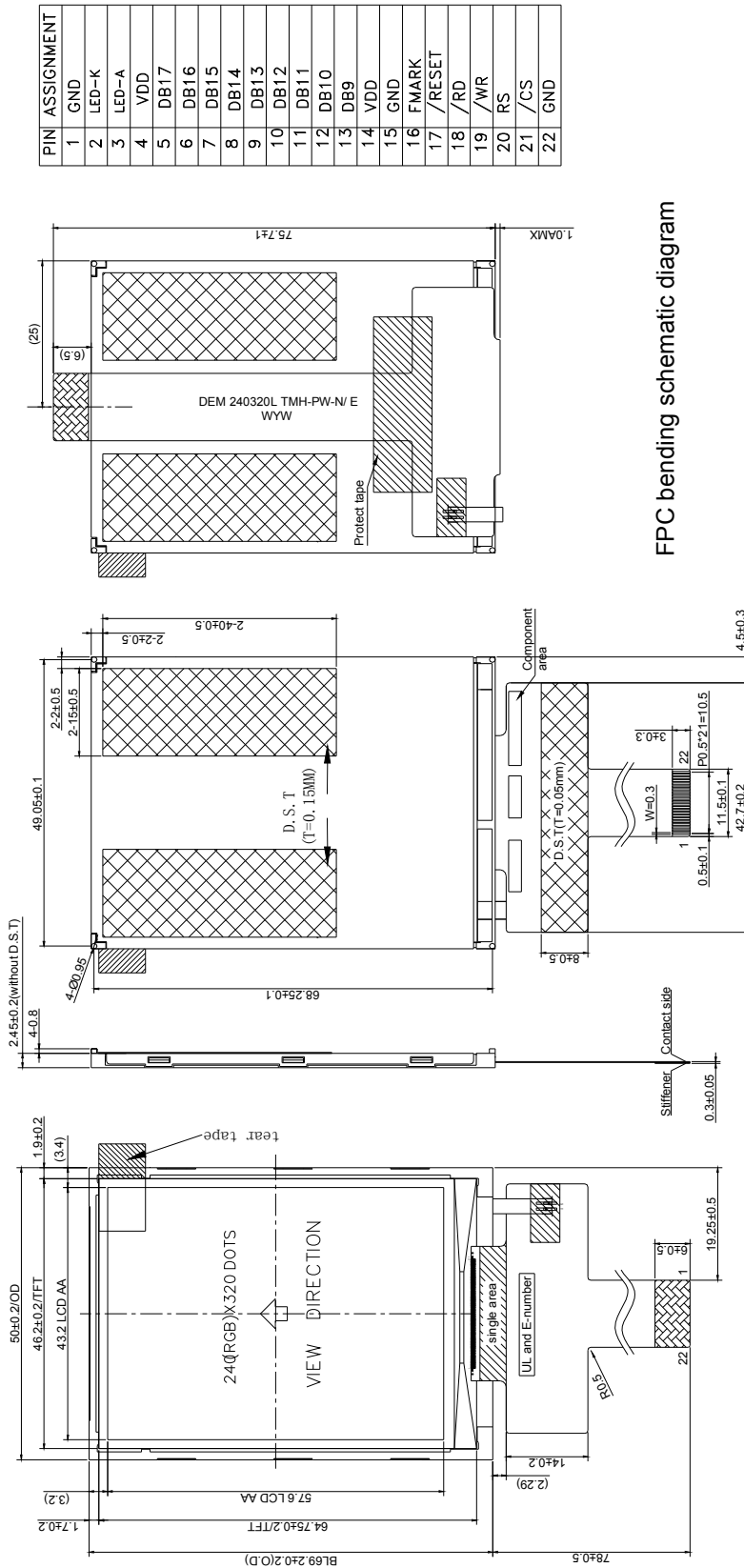
**13.7. Limited Warranty**

- 13.7.1. Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 13.7.2. If possible, we suggest customer to use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used
- 13.7.3. After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.

**14. Packaging**

TBD

15. Outline Drawing



FPC bending schematic diagram

F03	F02	F01	F00	WCL system interface mode	PIN in used
1	0	1	1	80-MCU 9-bit bus interface II	DB17:10, DB17:9

NOTES:

1. Display type: 2.8" TFT
2. Viewing direction: 6 O' CLOCK
3. Gary scale inversion direction: 12 O' CLOCK
4. Polarizer mode: Transmissive/Normally white
5. Operation temperature: -20 ° C ~ +70 ° C
6. Storage temperature: -30 ° C ~ +80 ° C
7. Driver IC: IL19341V
8. Power supply voltage: 3.3V
9. Backlight : White (4 LED) / 12.8 (TYP) V / 20mA
10. LED life: 20000 hrs (MIN)
11. ROHS must be complied

\* Unspecification tolerance are ±0.2mm