

Display Elektronik GmbH

# DATA SHEET

***TFT MODULE***

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

**3,8" TFT**

Product Specification

Ver.: 2

03.12.2015

**Revision History**

<b>Revision</b>	<b>Date</b>	<b>Detail</b>	<b>Remarks</b>
0	11.02.2015	Initial Release	-
1	05.05.2015	Modify Weight Modify Current Consumption Modify Chromacity Transmissive Modify Outline Drawing	P4 P5 P6 P24
2	03.12.2015	Modify Outline Drawing (FPC length)	P24

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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)	3.8"	-
LCD Type	TN TFT	-
Display Mode	Transmissive / Normally White	-
Resolution	240 x RGB x 320	Pixels
View Direction	6 O'CLOCK	Best Image
Gray Scale Inversion Direction	12 O'CLOCK	-
Module Outline	73.00 x 93.30 x 4.70 (Note1 )	mm
Active Area	57.60 x 76.80	mm
Pixel Size	0.240 x 0.240	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Colors	262k	-
Interface	8080 MCU 8-Bit-Parallel-Bus-Interface I	-
Driver IC	ILI9341V (Ilitek)	-
With or Without Touch Panel	without	-
Operating Temperature	-20 to +70	°C
Storage Temperature	-30 to +80	°C
Weight	55	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	$T_{stg}$	-30	+80	°C
Operating Temperature	$T_{op}$	-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	VDD	2.5	3.3	3.3	V	
Logic Low Input Voltage	V <sub>IL</sub>	VSS	-	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>	VSS	-	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+ I<sub>IN</sub></sub>	-	25	30	mA
	Analog					

5. Backlight Characteristic

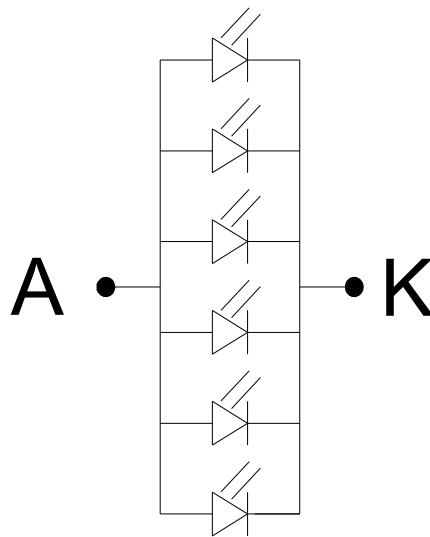
5.1. Backlight Characteristic

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	Ta=25 °C, I <sub>F</sub> =15mA/LED	2.8	3.1	3.3	V
Forward Current	I <sub>F</sub>	Ta=25 °C, V <sub>F</sub> =3.1V/LED	-	15*6	-	mA
Power Dissipation	P <sub>d</sub>		-	-	-	mW
Uniformity	Avg		80	-	-	%
LED Lifetime	30.000 hrs (typ)					
Drive Method	Constant Current					
LED Configuration	6 White LEDs in parallel					

Note: LED life time defined as follows: The final brightness is at 50% of original brightness.

The environmental conducted under ambient air flow, at Ta=25±2 °C, 60%RH±5%, I<sub>F</sub>=15mA.

5.2. Backlighting Circuit



6. Optical Characteristics

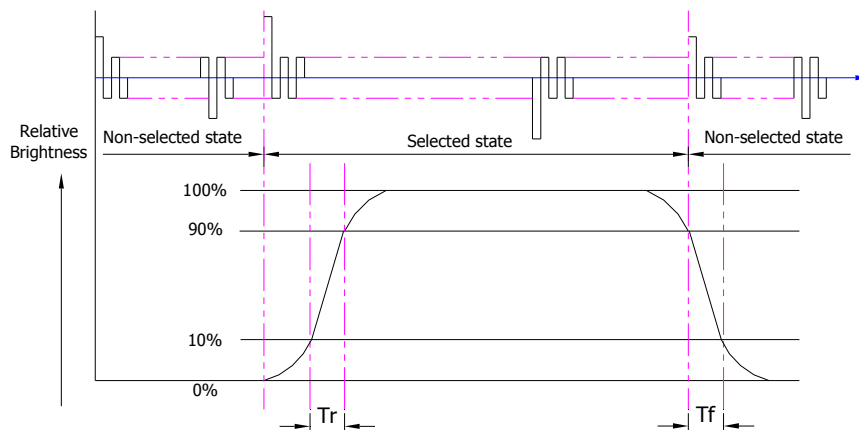
6.1. Optical Characteristics

Ta=25°C, VDD=3.3V

	Item	Symbol	Condition	Specification			Unit	
				Min.	Typ.	Max.		
Backlight On (Transmissive Mode)	Luminance on TFT( $I_f=15\text{mA/LED}$ )	Lv	Normally viewing angle $\theta_x = \phi_y = 0^\circ$	280	350	-	cd/m <sup>2</sup>	
	Contrast Ratio(See 7.4)	CR		250	350	-		
	Response Time (See 7.3)	(Tr+Tf)/2		24	30	-	ms	
	Chromaticity Transmissive (See 7.6)	Red	X <sub>R</sub>	Center CR≥10	0.571	0.621	0.671	
			Y <sub>R</sub>		0.311	0.361	0.411	
		Green	X <sub>G</sub>		0.256	0.306	0.356	
			Y <sub>G</sub>		0.582	0.632	0.682	
		Blue	X <sub>B</sub>		0.095	0.145	0.195	
			Y <sub>B</sub>		0.048	0.098	0.148	
	White	X <sub>W</sub>	0.222	0.272	0.322			
Y <sub>W</sub>		0.282	0.332	0.382				
Viewing Angle (See 7.5)	Horizontal	$\theta_{x+}$	Center CR≥10	-	60	-	Deg.	
		$\theta_{x-}$		-	60	-		
	Vertical	$\phi_{y+}$		-	60	-		
		$\phi_{y-}$		-	40	-		
NTSC Ratio(Gamut)				-	58.2	-	%	

6.2. Definition of Response Time

6.2.1 Normally Black Type (Negative)

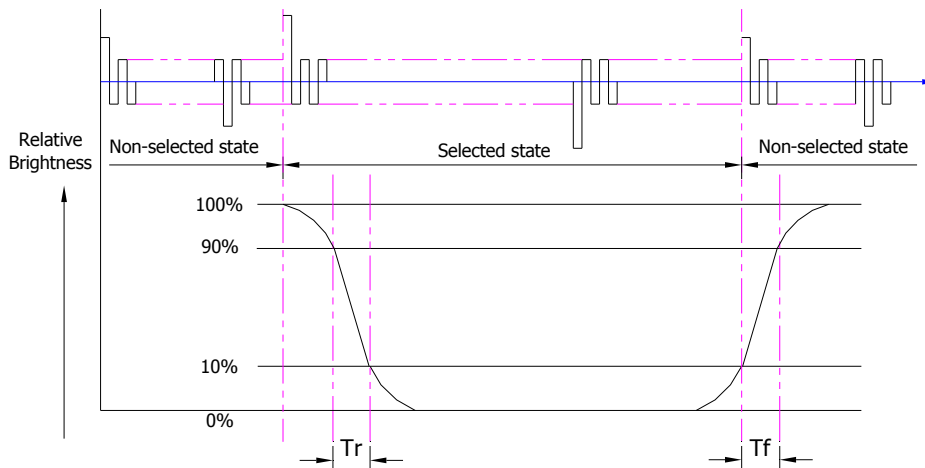


$T_r$  is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

$T_f$  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

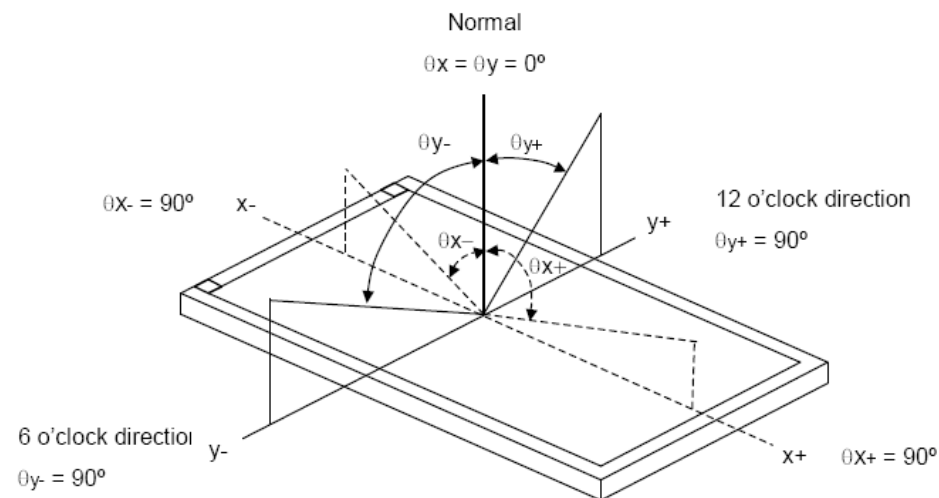
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

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



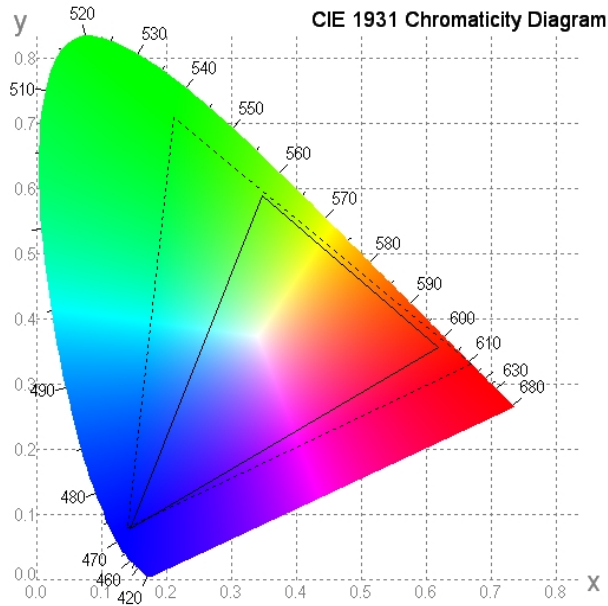
Measuring machine: LCD-5100 or EQUI

**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**

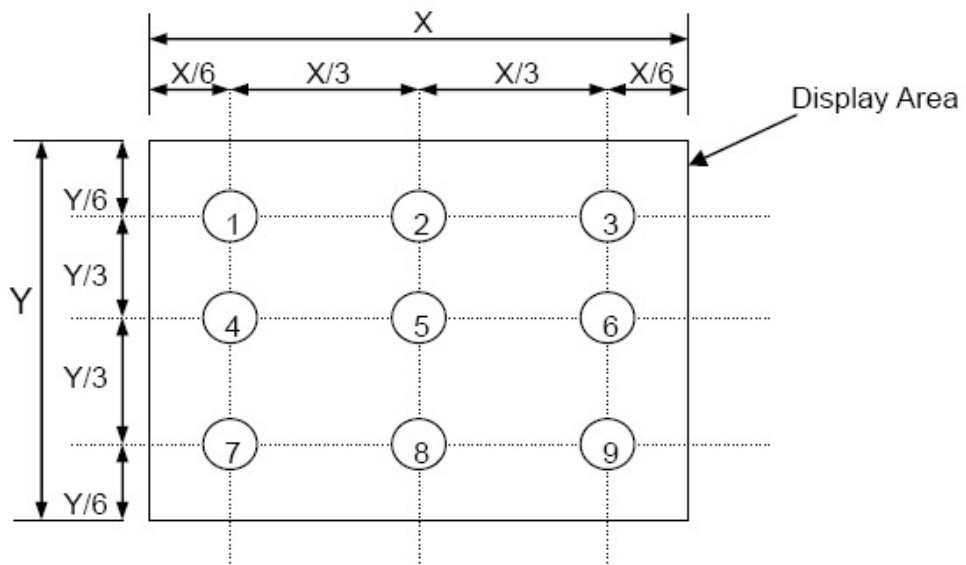
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

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

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

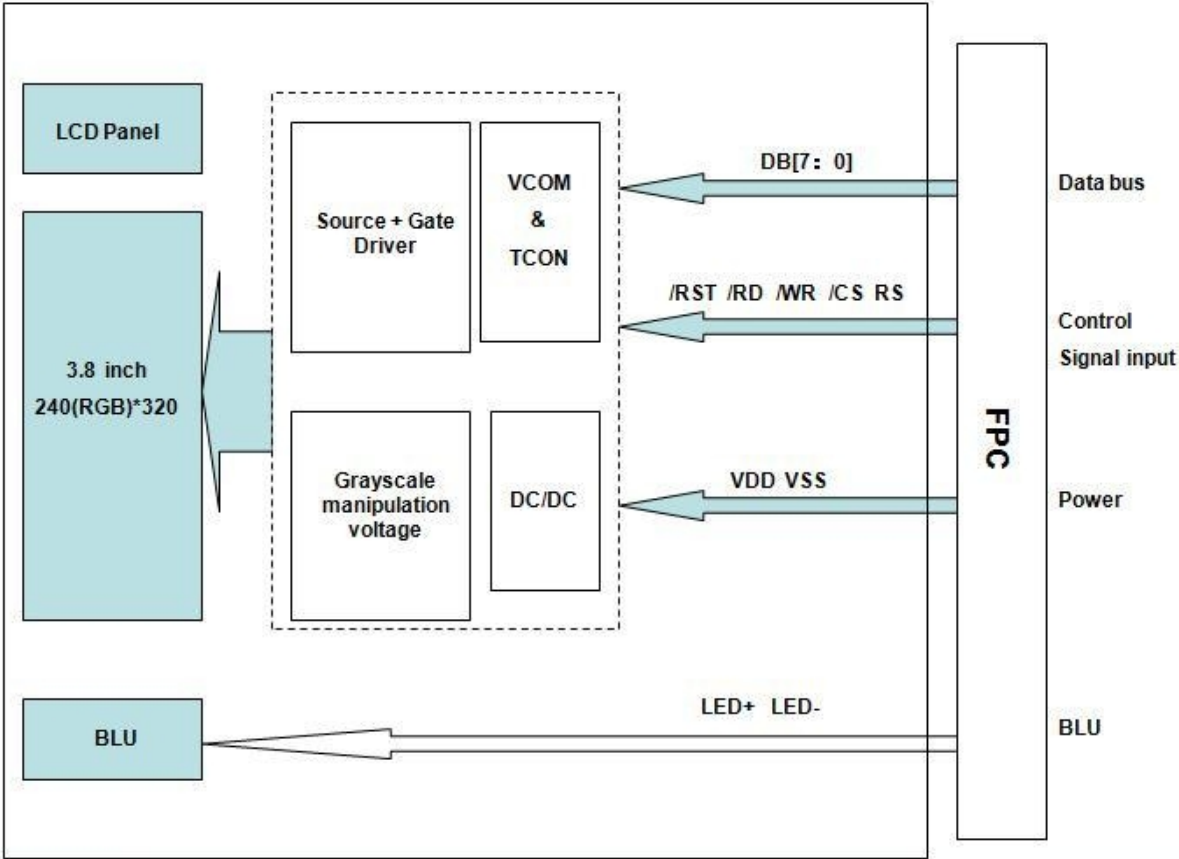
7.7.3 Transmittance =  $L_v \text{ on LCD} / L_v \text{ on Backlight} * 100\%$

Note: Measuring machine: BM-7





7. Block Diagram and Power Supply

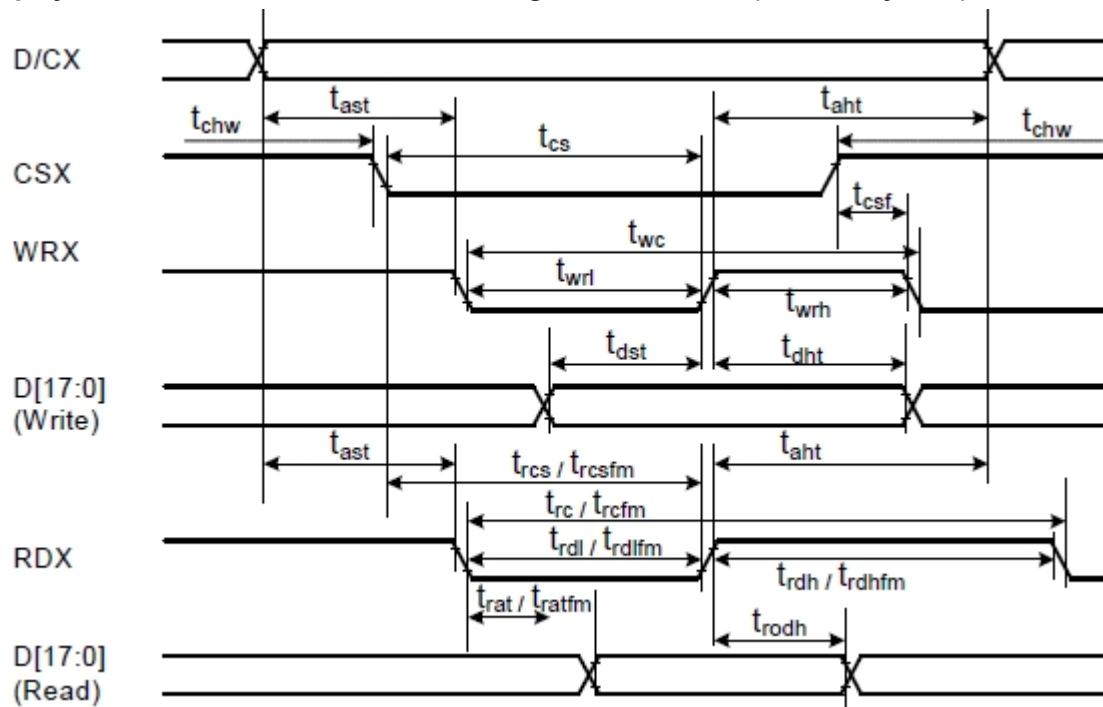


**8. Interface Pins Definition**

<b>No.</b>	<b>Symbol</b>	<b>Function</b>
1	/RST	Reset pin
2	/RD	Serves as a read signal and MCU read data at the rising edge.
3	/WR	Serves as a write signal and writes data at the rising edge.
4	/CS	Chip select input pin ("Low" enable).
5	RS	This pin is used to select "Data or Command" in the parallel interface. "1": data is selected. "0": command is selected.
6   13	DB0   DB7	Data bus
14	VDD	Power supply
15	VSS	Ground.
16   22	NC	No connection.
23	LED+	Backlight LED Anode.
24	LED-	Backlight LED Cathode.

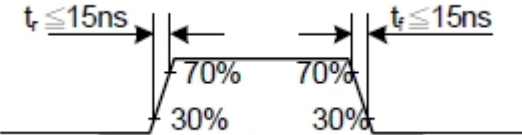
9. AC Timing Diagram

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

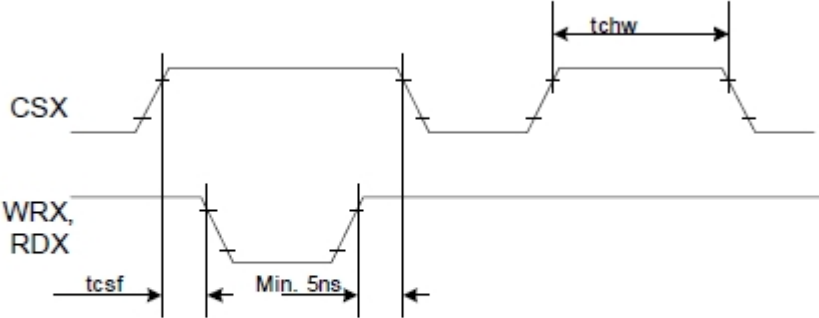


10. AC Characteristics

Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrh	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

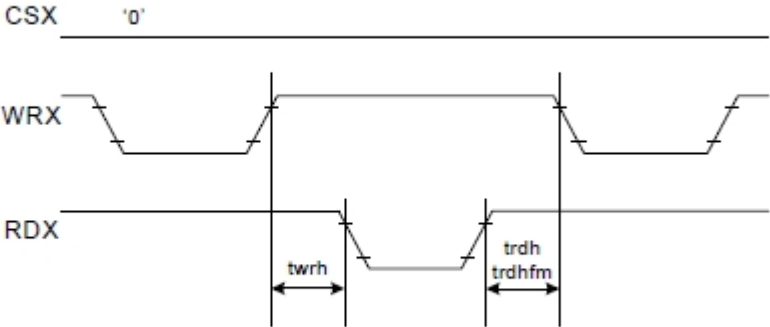


CSX timings :



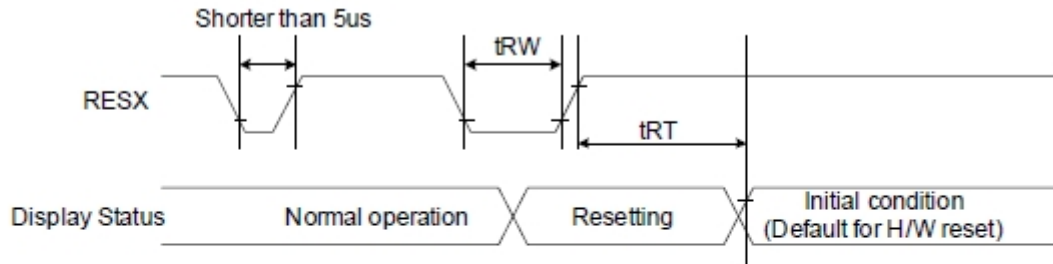
Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

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.

11. 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

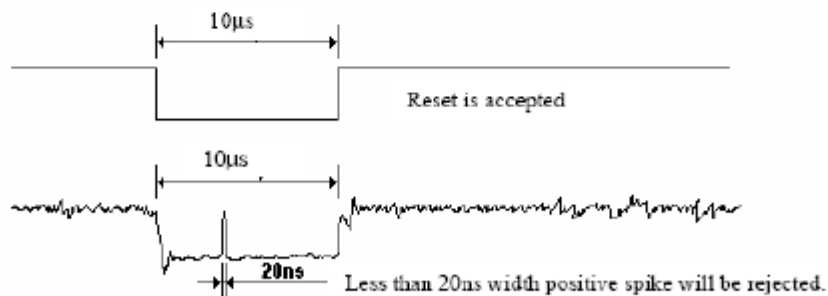
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

## **12. Quality Assurance**

### **12.1 Purpose**

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

### **12.2 Standard for Quality Test**

#### 12.2.1 Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

#### 12.2.2 Sampling Criteria:

Visual inspection: AQL 1.5%

Electrical functional: AQL 0.65%.

#### 12.2.3 Reliability Test:

Detailed requirement refer to Reliability Test Specification.

### **12.3 Nonconforming Analysis & Disposition**

#### 12.3.1 Nonconforming analysis:

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

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

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

#### 12.3.2 Disposition of nonconforming:

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

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

### **12.4 Agreement Items**

Shall negotiate with customer if the following situation occurs:

12.4.1 There is any discrepancy in standard of quality assurance.

12.4.2 Additional requirement to be added in product specification.

12.4.3 Any other special problem.

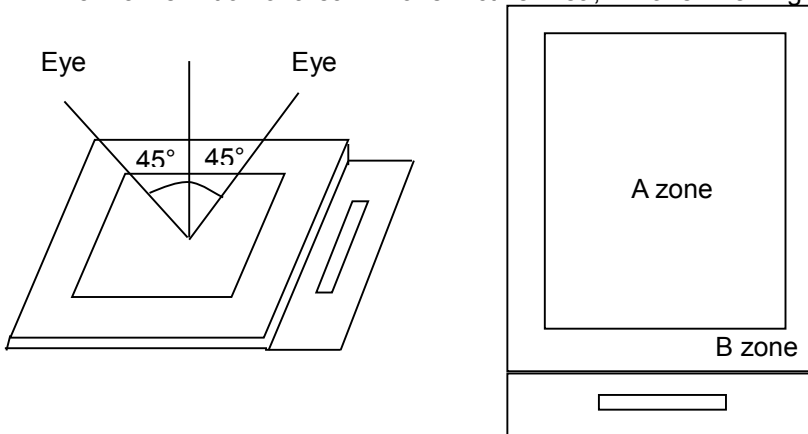
**12.5 Standard of the Product Visual Inspection**

12.5.1 Appearance inspection:

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

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

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



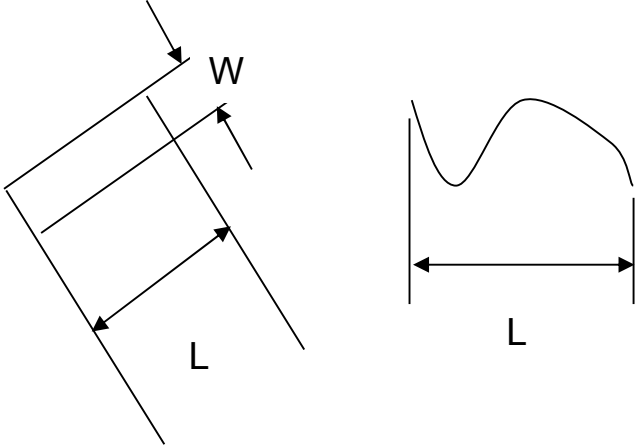
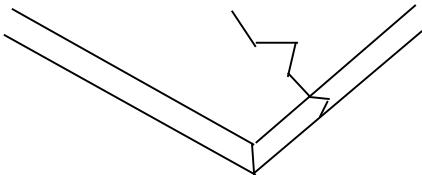
12.5.2 Basic principle:

12.5.2.1 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.

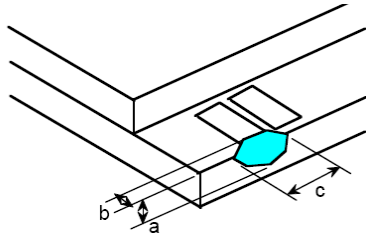
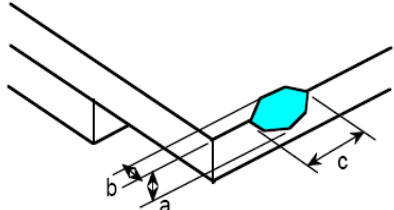
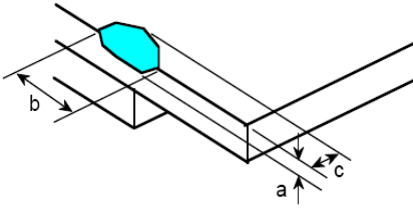
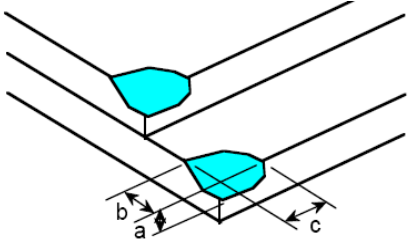
12.5.2.2 New item must be added on time when it is necessary.

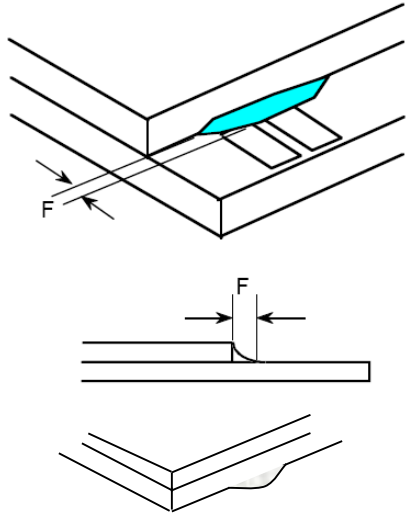
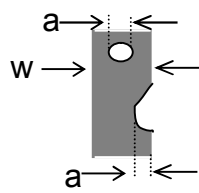
**12.6 Inspection Specification for the TFT module**

No.	Item	Criteria (Unit: mm)																
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	<p><math>\phi = (a + b) / 2</math></p>																
		<table border="1"> <thead> <tr> <th>Size</th> <th>Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.15</math></td> <td></td> <td>Ignore</td> </tr> <tr> <td><math>0.15 &lt; \phi \leq 0.25</math></td> <td></td> <td>2</td> </tr> <tr> <td><math>0.25 &lt; \phi \leq 0.35</math></td> <td></td> <td>1</td> </tr> <tr> <td><math>0.35 &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> <p>Distance between 2 defects should more than 3mm apart.</p>	Size	Area	Acc. Qty	$\phi \leq 0.15$		Ignore	$0.15 < \phi \leq 0.25$		2	$0.25 < \phi \leq 0.35$		1	$0.35 < \phi$		0	Total
Size	Area	Acc. Qty																
$\phi \leq 0.15$		Ignore																
$0.15 < \phi \leq 0.25$		2																
$0.25 < \phi \leq 0.35$		1																
$0.35 < \phi$		0																
Total		2 no include $\phi \leq 0.10$																

02	Electrical Defect (Minor defect)	<table border="1" style="width: 100%; border-collapse: collapse;"> <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> <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> </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 3</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>2</td> </tr> <tr> <td><math>L \leq 1.5</math></td> <td><math>0.05 &lt; W \leq 0.10</math></td> <td>1</td> </tr> <tr> <td>/</td> <td><math>0.1 &lt; W</math></td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>2</td> </tr> </tbody> </table>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 3$	$0.03 < W \leq 0.05$	2	$L \leq 1.5$	$0.05 < W \leq 0.10$	1	/	$0.1 < W$	0	Total		2
		Length	Width	Acc. Qty																
		/	$W \leq 0.03$	Ignore																
		$L \leq 3$	$0.03 < W \leq 0.05$	2																
$L \leq 1.5$	$0.05 < W \leq 0.10$	1																		
/	$0.1 < W$	0																		
Total		2																		
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="853 264 1324 353"> <thead> <tr> <th>Length</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>F &lt; 1.0</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.)</p> <p>10.2 Open circuit is unacceptable.</p> <p>10.3 No oxidation, contamination and distortion.</p>										
<p>11</p>	<p>Bubble on Polarizer (Minor defect)</p>	<table border="1" data-bbox="726 1254 1197 1467"> <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="726 1529 1197 1742"> <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>LCD Ripple</p>	<p>Touch the touch panel, cannot see the LCD ripple. Pen: R 0.8mm silicon rubber. Operation Force(100g)</p>										
<p>14</p>	<p>Bezel</p>	<p>14.1 No rust, distortion on the Bezel. 14.2 No visible fingerprints, stains or other contamination.</p>										

15	PCB	15.1 No distortion or contamination on PCB terminals. 15.2 All components on PCB must same as documented on the BOM/component layout. 15.3 Follow IPC-A-600F.
16	Soldering	Follow IPC-A-610C standard
17	Electrical Defect (Major defect)	The below defects must be rejected. 17.1 Missing vertical / horizontal segment, 17.2 Abnormal Display. 17.3 No function or no display. 17.4 Current exceeds product specifications. 17.5 LCD viewing angle defect. 17.6 No Backlight. 17.7 Dark Backlight.

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

**12.8 Classification of Defects**

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

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

**12.9 Identification/marketing criteria**

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

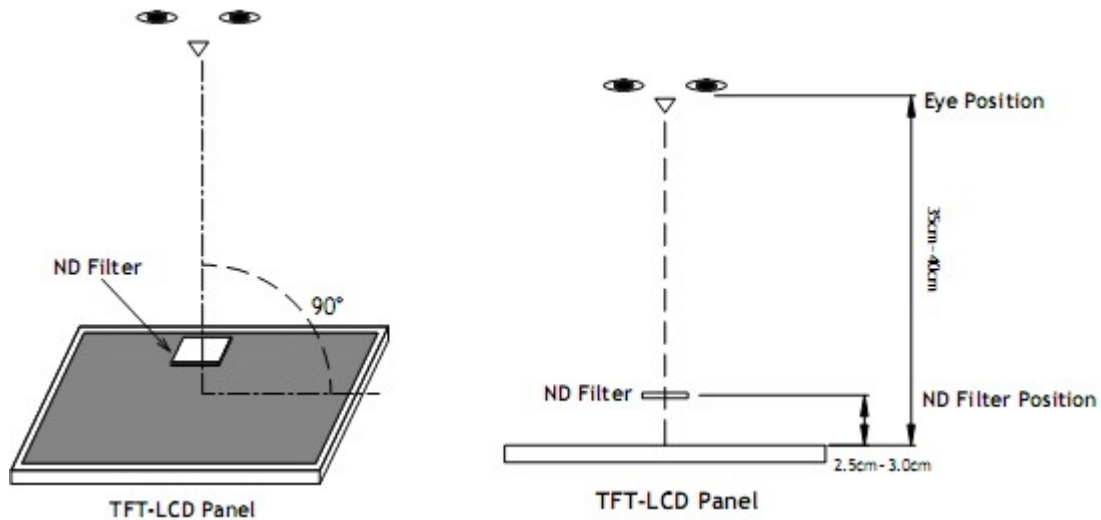
12.10 Packing

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

12.10.2 Modules inside package box should have compliant mark.

12.10.3 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.

**13. Reliability Specification**

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	70°C, 96Hrs	2	GB/T2423.2-2008
2	Low Temperature Operating	-20°C, 96Hrs	2	GB/T2423.1-2008
3	High Humidity	50°C, 90%RH, 96Hrs	2	GB/T2423.3-2006
4	High Temperature Storage	80°C, 96Hrs	2	GB/T2423.2-2008
5	Low Temperature Storage	-30°C, 96Hrs	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	2	GB/T17626.2-2006
		Contact:±4KV 150pF/330Ω 5 times		
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

**14. Precautions and Warranty**

**14.1 Safety**

14.1.1 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.

14.1.2 Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

**14.2 Handling**

14.2.1 Reverse and use within ratings in order to keep performance and prevent damage.

14.2.2 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.

**14.3 Storage**

14.3.1 Do not store the LCD module beyond the specified temperature ranges.

**14.4 Metal Pin (Apply to Products with Metal Pins)**

14.4.1 Pins of LCD and Backlight

14.4.1.1 Solder tip can touch and press on the tip of Pin LEAD during the soldering

14.4.1.2 Recommended Soldering Conditions

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

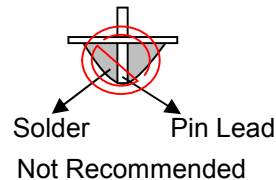
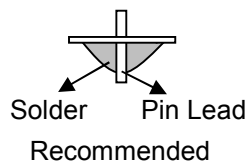
Maximum Solder Temperature: 370°C

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20°C

Typical Soldering Time: ≤3s

14.4.1.3 Solder Wetting



14.4.2 Pins of EL

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

14.4.2.2 No Solder Paste on the soldering pad on the motherboard is recommended.

14.4.2.3 Recommended Soldering Conditions

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

Recommended Solder Temperature: 270~290°C

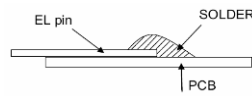
Typical Soldering Time: ≤2s

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

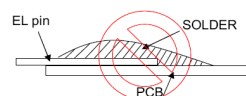
14.4.2.4 No horizontal press on the EL leads during soldering.

14.4.2.5 180° bend EL leads three times is not allowed.

14.4.2.6 Solder Wetting

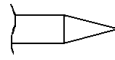


Recommended

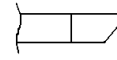


Not Recommended

14.4.2.7 The type of the solder iron:

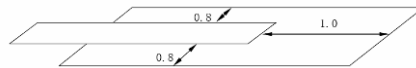


Recommended



Not Recommended

14.4.2.8 Solder Pad



**14.5 Operation**

14.5.1 Do not drive LCD with DC voltage

14.5.2 Response time will increase below lower temperature

14.5.3 Display may change color with different temperature

14.5.4 Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear “fractured”.

**14.6 Static Electricity**

14.6.1 CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.

14.6.2 The normal static prevention measures should be observed for work clothes and benches.

14.6.3 The module should be kept into anti-static bags or other containers resistant to static for storage.

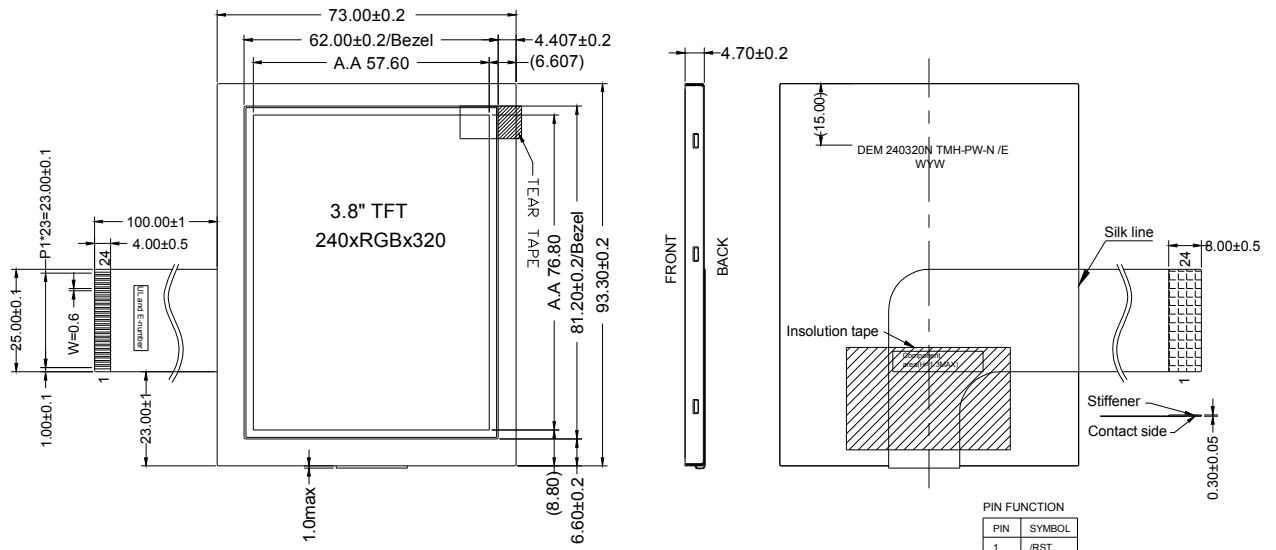
**14.7 Limited Warranty**

14.7.1 Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.

14.7.2 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.

14.7.3 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.

15. Outline Drawing



NOTES:

1. Display Size: 3.8" TFT
  2. Viewing Direction: 6:00
  3. Gray Scale Inversion Direction: 12:00
  3. Display Mode: TN, Transmissive / Normal White / Anti-Glare
  4. Operation Temperature: -20°C to +70°C
  5. Storage Temperature: -30°C to +80°C
  6. Driver IC: ILI9341V (Ilitek)
  7. Logic Power Supply Voltage: 3.3 Volt (typ.)
  8. Backlight: White(6x), 3.1 Volt / 90mA (typ.)  
Brightness: 350 cd/m<sup>2</sup> (typ.)  
LED Lifetime: 30000h (typ.)
  9. ROHS must be complied
- \* Unspecification tolerance are ± 0.2mm

IM3	IM2	IM1	IMO	Interface	PIN IN Used
0	0	0	0	80 MCU 8-bit bus Interface I	DB[7:0]

PIN FUNCTION

PIN	SYMBOL
1	/RST
2	/RD
3	/WR
4	/CS
5	RS
6	DB0
7	DB1
8	DB2
9	DB3
10	DB4
11	DB5
12	DB6
13	DB7
14	VDD
15	VSS
16	NC
17	NC
18	NC
19	NC
20	NC
21	NC
22	NC
23	LED+
24	LED-

