

Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 320240S TMH-PW-N

2,7" TFT

Product Specification

Ver.: 2

10.09.2018

Revision History

Revision	Date	Originator	Detail	Remarks
0	29.06.2018	MH	Initial Release	-
1	27.07.2018	MH	Modify Module Parameter Modify Viewing Angle Modify Outline Drawing	P4 P6 P26-P27
2	10.09.2018	MH	Modify Schematic Drawing Modify Outline Drawing	P11 P26

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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)	2.7"	-
LCD Type	TN TFT	-
Display Mode	Transmissive / Normally White	-
Resolution	320 x RGB x 240	Pixels
View Direction	6 O'clock	Best Image
Gray Scale Inversion Direction	12 O'clock	-
Module Outline	67.50 x 39.10 x 2.40 (Note1)	mm
Active Area	58.80 x 33.06	mm
Pixel Size	0.13775 x 0.18375	mm
Pixel Arrangement	R.G.B.-Delta	-
Display Colors	262k	-
Interface	8-Bit-RGB-Interface + 3-Wire-SPI-Interface	-
With or without touch panel	No Touch	-
Driver IC	ILI8961 (Ilitek)	-
Operating Temperature	-20°C to +70°C	°C
Storage Temperature	-30°C to +80°C	°C
Weight	(10)	g

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

3. Absolute Maximum Ratings

V_{SS}=0V, Ta=25°C

Item	Symbol	Min.	Max.	Unit
Supply Voltage	VDD	-0.3	5.0	V
Storage Temperature	T _{STG}	-30	+80	°C
Operating Temperature	T _{OP}	-20	+70	°C

Note 1: If Ta below 50°C, the maximal humidity is 90%RH, if Ta over 50°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°C, and the back ground will become darker at high temperature operating.

4. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	
Supply Voltage	VDD	2.7	3.3	3.6	V	
Logic Low Input Voltage	V _{IL}	GND	-	0.3*VDDIO	V	
Logic High Input Voltage	V _{IH}	0.7*VDDIO	-	VDDIO	V	
Logic Low Output Voltage	V _{OL}	GND	-	0.2*VDDIO	V	
Logic High Output Voltage	V _{OH}	0.8*VDDIO	-	VDDIO	V	
Current Consumption All Black	Logic	I _{CC+ IIN}	10	20	30	mA
	Analog					

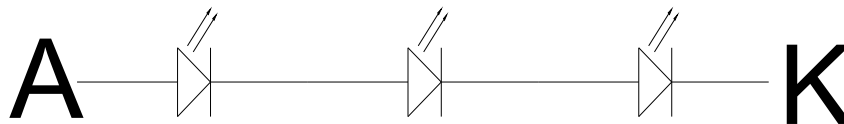
5. Backlight Characteristic

5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V _F	Ta=25 °C, I _F =20mA/LED	8.4	9.6	10.2	V
Forward Current	I _F	Ta=25 °C, V _F =3.2V/LED	-	20	-	mA
Power Dissipation	P _D		-	192	-	mW
Uniformity	Avg		-	80	-	%
LED Lifetime (25° C)	-		20.000	30.000	-	Hrs
Drive Method	Constant Current					
LED Configuration	3 White LEDs in Series					

Note1: LED Lifetime defined as follows: The final brightness is at 50% of original brightness.
 The environmental conducted under ambient air flow, at Ta=25°C±2 °C, 60%RH±5%, I_F=20mA/LED

5.2 Backlighting Circuit



6. Optical Characteristics

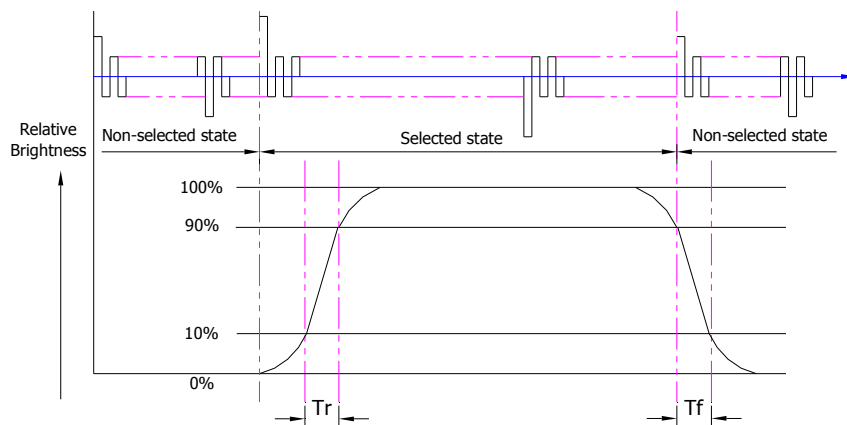
6.1. Optical Characteristics

Ta=25°C, VDD=2.8V

	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 $\theta_x = \phi_y = 0^\circ$	180	230	-	cd/m ²	
	Contrast Ratio(See 6.3)	CR		-	500	-		
	Response Time (See 6.2)	T _R +T _F		-	35	50	ms	
	Chromaticity Transmissive (See 6.5)	Red	X _R	Center CR≥10	(0.483)	(0.533)	(0.583)	
			Y _R		(0.259)	(0.309)	(0.359)	
		Green	X _G		(0.239)	(0.289)	(0.339)	
			Y _G		(0.535)	(0.585)	(0.635)	
		Blue	X _B		(0.096)	(0.146)	(0.196)	
			Y _B		(0.060)	(0.110)	(0.160)	
	White	X _W	(0.206)	(0.256)	(0.306)			
		Y _W	(0.258)	(0.308)	(0.358)			
	Viewing Angle (See 6.4)	Horizontal	θ_{x+}	Center CR≥10	50	60	-	Deg.
			θ_{x-}		50	60	-	
Vertical		ϕ_{y+}	55		65	-		
		ϕ_{y-}	40		50	-		
NTSC Ratio(Gamut)				-	60	-	%	

6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)

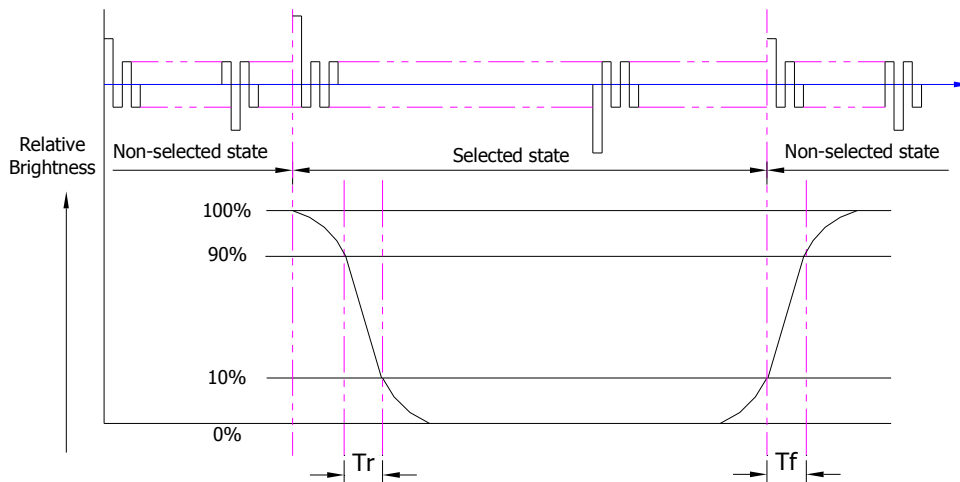


Tr is the time it takes to change from non-selected state with relative luminance 10% to selected state with relative luminance 90%;

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

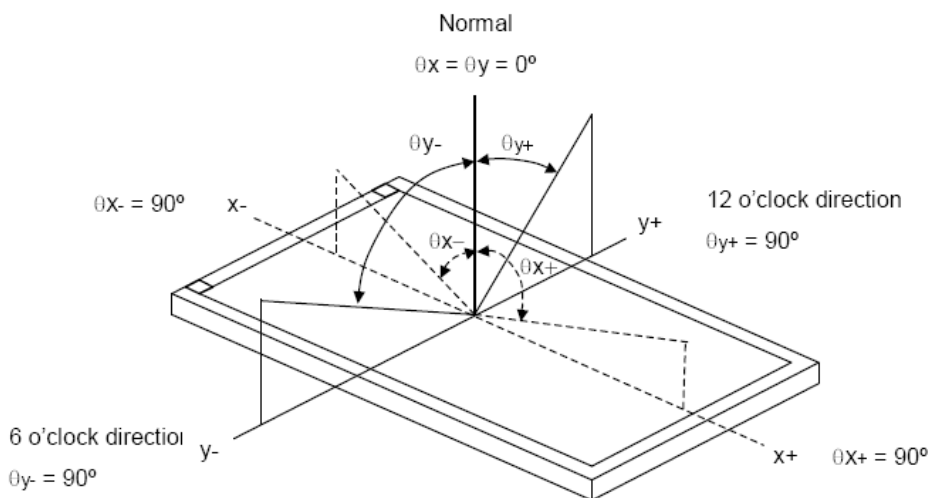
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

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



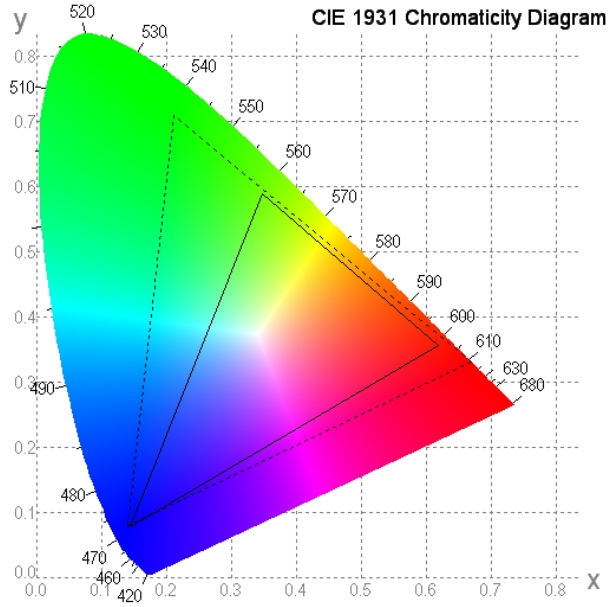
Measuring machine: LCD-5100 or EQUI

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

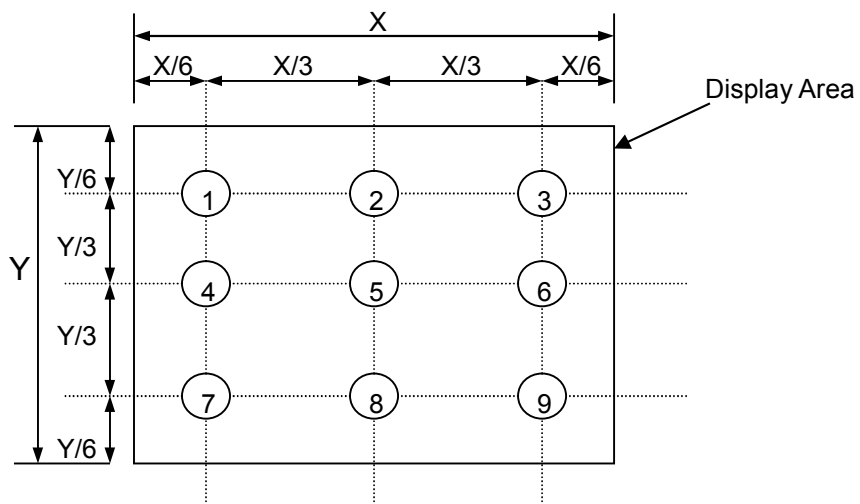
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

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

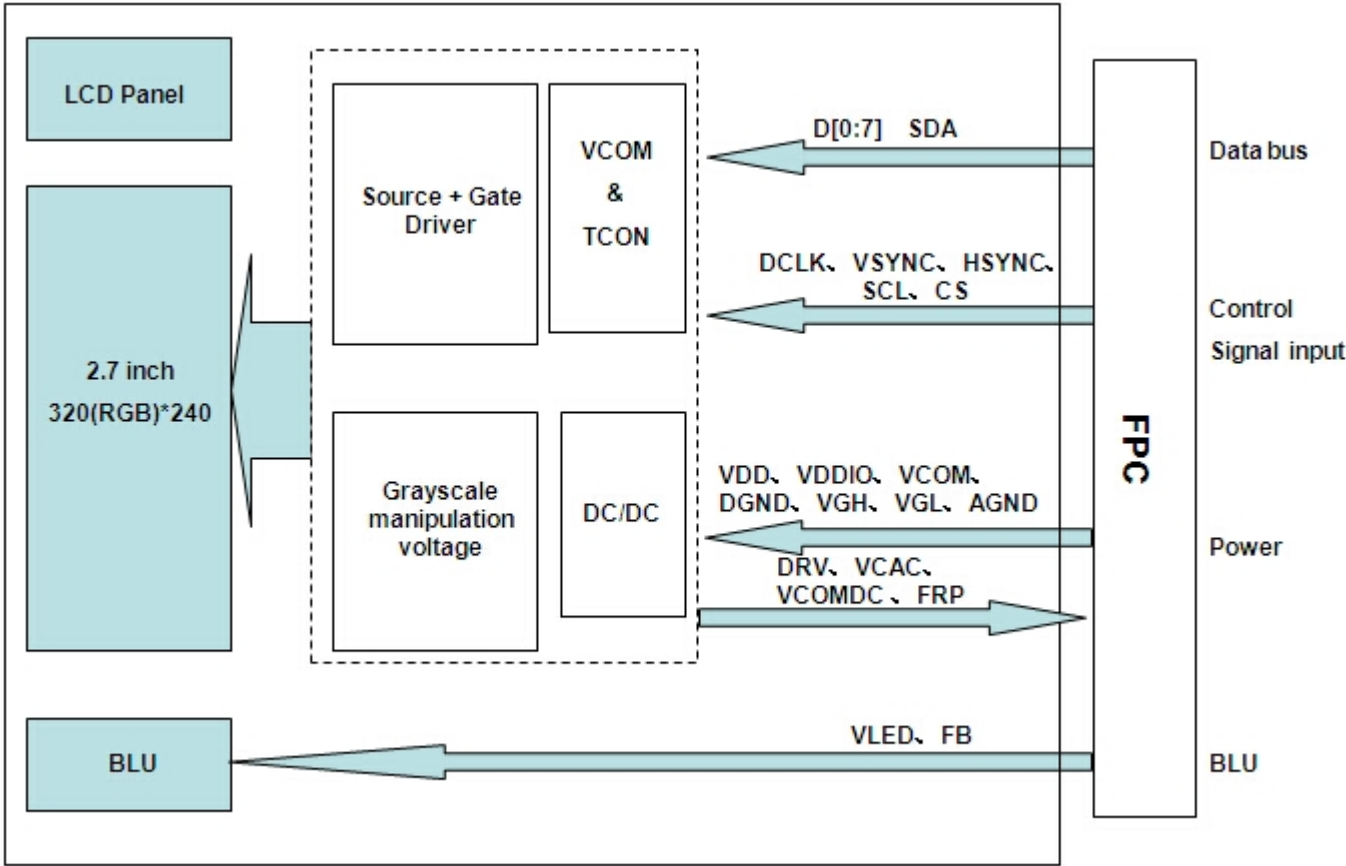
6.6.2. Uniformity = $\text{Minimal} (L_{P1}:L_{P9}) / \text{Maximal} (L_{P1}:L_{P9}) * 100\%$

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

Note: Measuring machine: BM-7

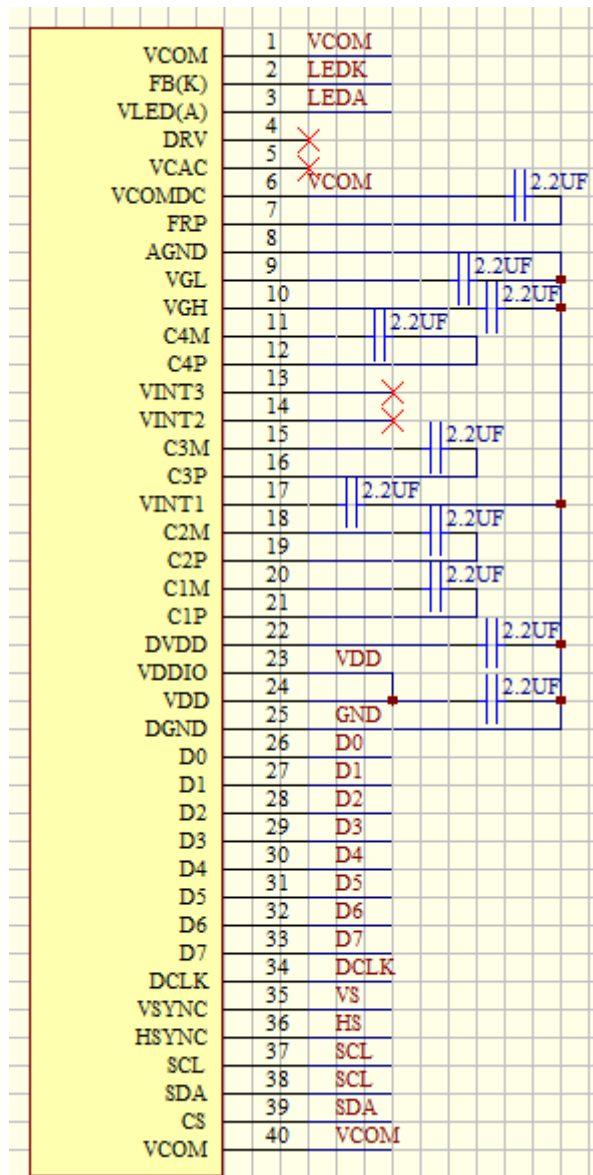


7. Block Diagram and Power Supply



8. Interface Pins Definition

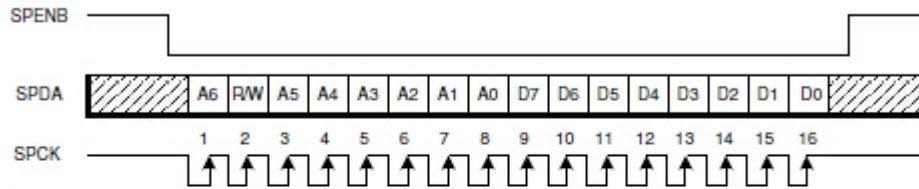
No.	Symbol	Function	Remark
1	VCOM	Vcom voltage.	
2	FB(K)	LED Cathode.	
3	VLED(A)	LED Anode.	
4	DRV	Power transistor signal for back light power boost converter.	Output
5	VCAC	Power setting capacitor for VCOM AC.	Output
6	VCOMDC	VCOM DC output.	Output
7	FRP	Frame polarity output for panel VCOM	Output
8	AGND	Ground for analog circuit.	Power
9	VGL	Power setting capacitor connect pin.	Capacitor PIN
10	VGH	Power setting capacitor connect pin.	Capacitor PIN
11	C4M	Capacitor connect pin for internal charge pump.	Capacitor PIN
12	C4P	Capacitor connect pin for internal charge pump.	Capacitor PIN
13	VINT3	Floating this pin.	Capacitor PIN
14	VINT2	Floating this pin.	Capacitor PIN
15	C3M	Capacitor connect pin for internal charge pump.	Capacitor PIN
16	C3P	Capacitor connect pin for internal charge pump.	Capacitor PIN
17	VINT1	Power setting capacitor connect pin.	Capacitor PIN
18	C2M	Capacitor connect pin for internal charge pump.	Capacitor PIN
19	C2P	Capacitor connect pin for internal charge pump.	Capacitor PIN
20	C1M	Capacitor connect pin for internal charge pump.	Capacitor PIN
21	C1P	Capacitor connect pin for internal charge pump.	Capacitor PIN
22	DVDD	Power setting capacitor connecting pins.(internal core use, typical 1.8 V)	Capacitor PIN
23	VDDIO	Power supply for digital interface.	Power
24	VDD	Power supply for charge pump circuits.	Power
25	DGND	Ground for digital circuits.	Power
26	D0	Data bus.	Input
27	D1	Data bus.	Input
28	D2	Data bus.	Input
29	D3	Data bus.	Input
30	D4	Data bus.	Input
31	D5	Data bus.	Input
32	D6	Data bus.	Input
33	D7	Data bus.	Input
34	DCLK	Clock signal.	
35	VSYNC	Vertical Sync input.	
36	HSYNC	Horizontal Sync input.	
37	SCL	Serial clock signal.	
38	SDA	Serial data.	
39	CS	Chip select signal.	
40	VCOM	Vcom voltage.	



9. AC Characteristics

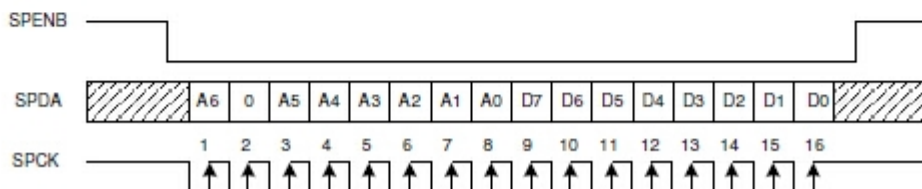
9.1. 3-Wire Serial Interface

3-Wire Serial command format

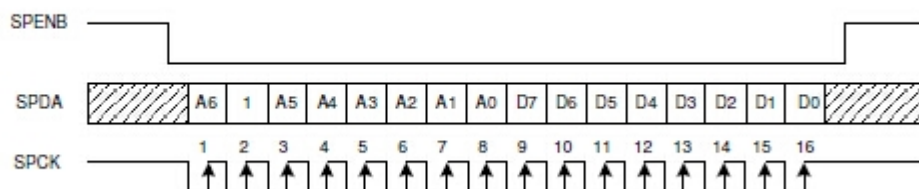


- Each serial command consists of 16 bits of data that is loaded one bit a time at the rising edge of serial clock SPCK. Command loading operation starts from the falling edge of SPENB and is completed at the next rising edge of SPENB.
- The serial control block is operational after power on reset, but commands are established by the VSD signal. If command is transferred multiple times for the same register, the last command before the VSD signal is valid.
- If less than 16 bits of SPCK are input while SPENB is low, the transferred data is ignored.
- If 16 bits or more of SPCK are input while SPENB is low, the first 16 bits of transferred data before the rising edge of SPENB pulse are valid data.
- Serial block operates with the SPCK clock.
- Serial data can be accepted in the power save modes.

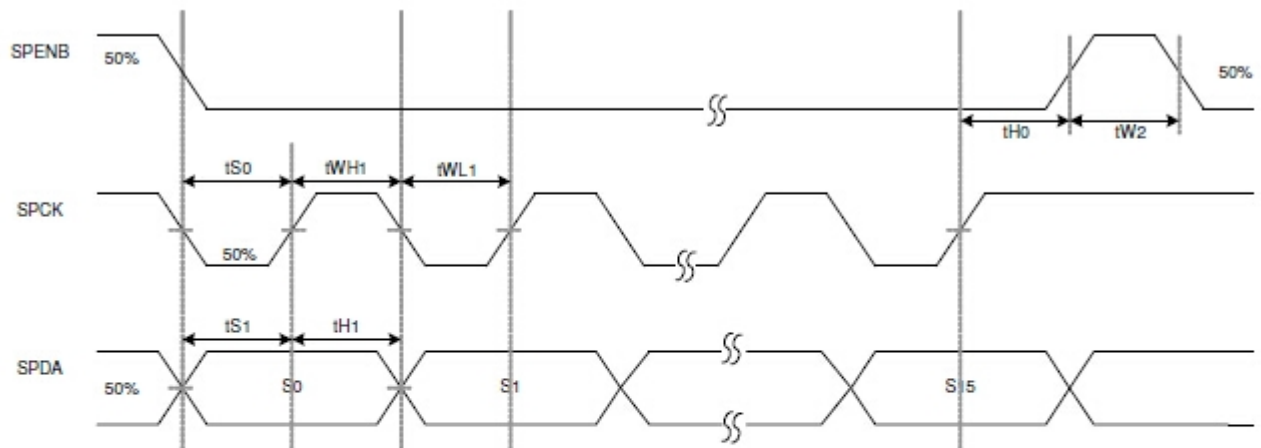
Serial Interface Write Sequence



Serial Interface Read Sequence



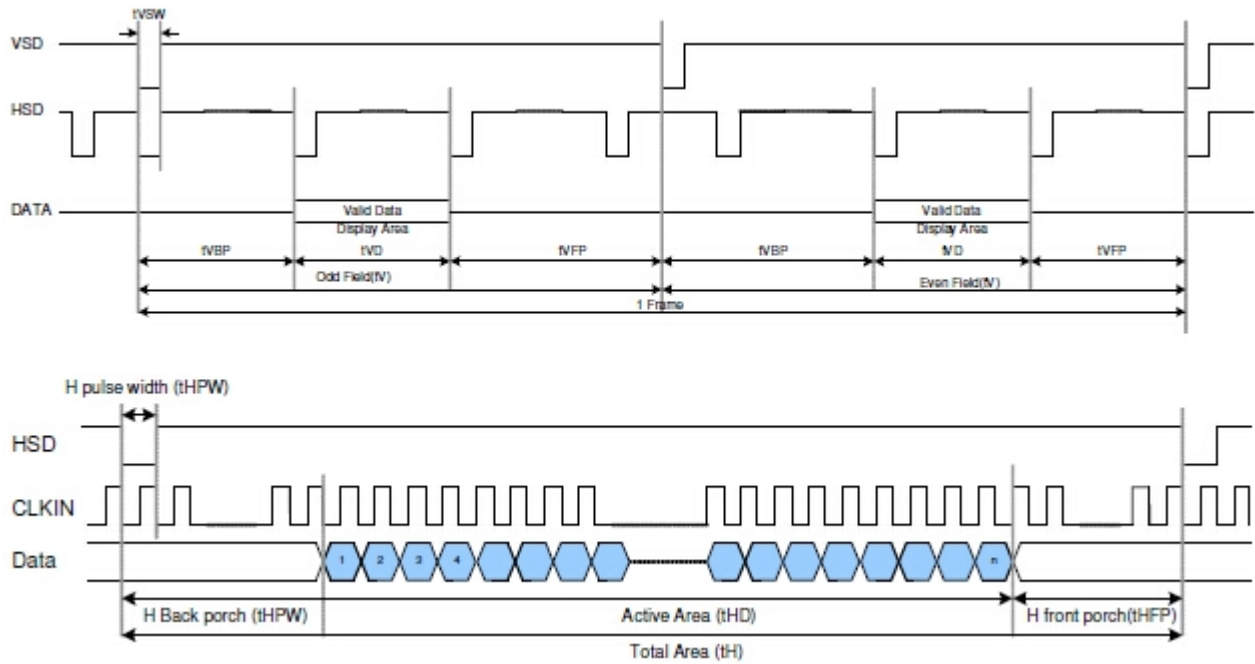
Serial Control Timing



Item	symbol	Min.	Typ.	Max.	Unit
SPENB input setup time	tS0	50			ns
Serial data input setup time	tS1	50			ns
SPENB input hold time	tH0	50			ns
Serial Data Input hold time	tH1	50			ns
SPCK pulse high width	tWH1	50			ns
SPCK pulse low width	tWL1	50			ns
SPENB pulse high width	tW2	400			ns

9.2. Input Timing Chart

8-Bit RGB Input Timing Chart

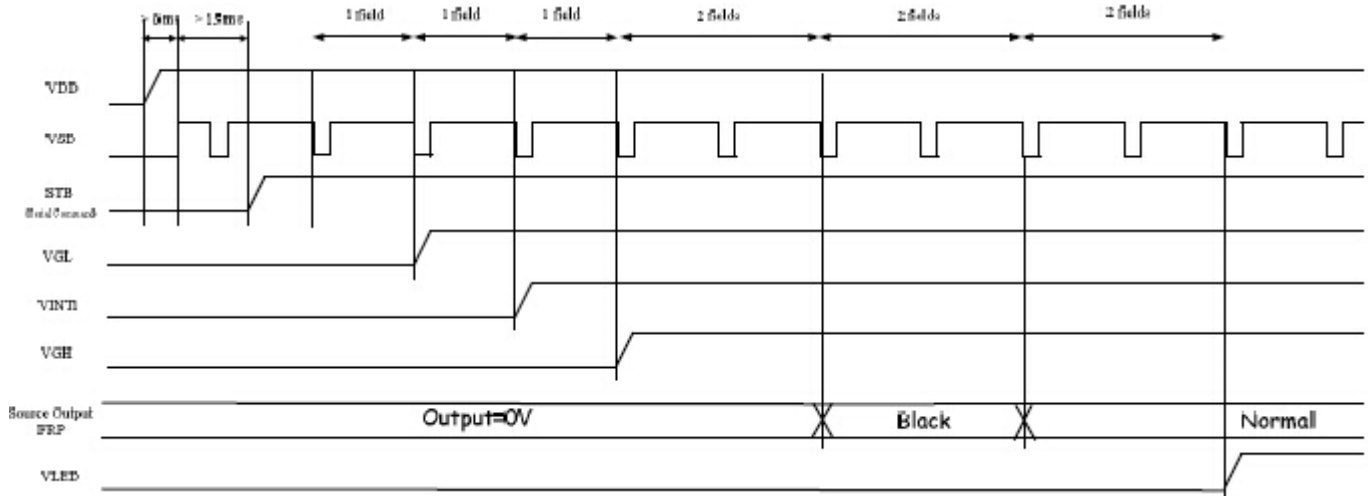


Parallel RGB Input Timing

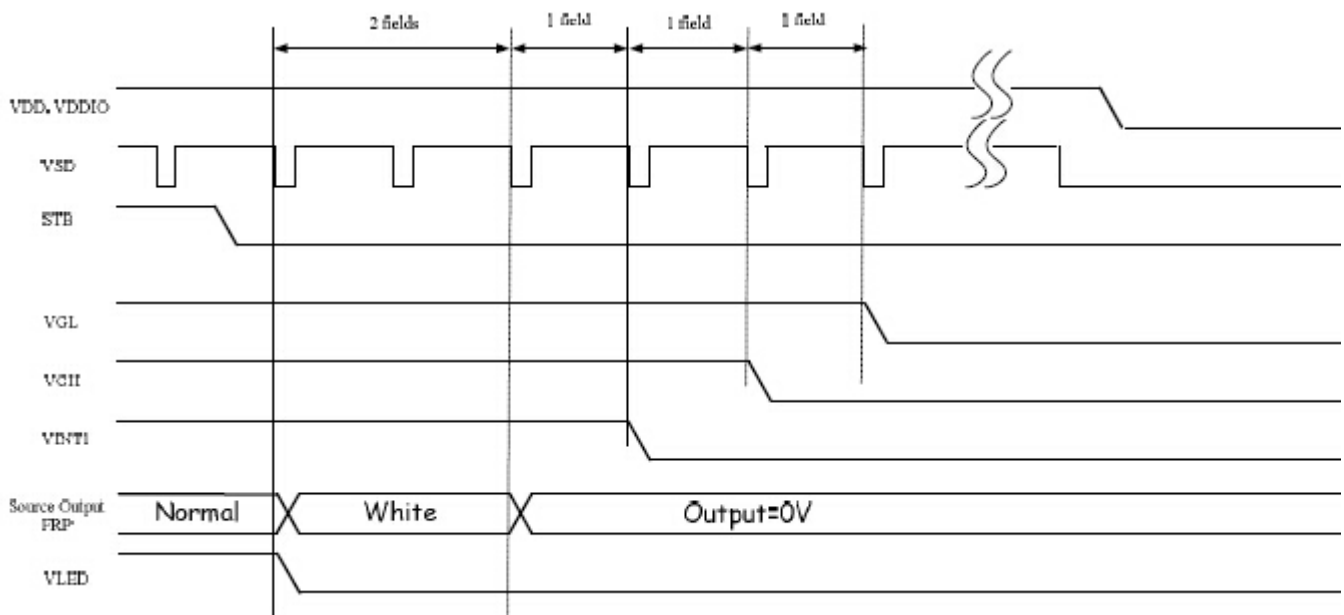
Parameter	Symbol	Interface			Unit
		Min.	Typ.	Max.	
CLKIN frequency	fCLKIN	-	6.2	7.5	MHz
HSD period	tH	-	390	-	CLKIN
HSD display period	tHD	-	320	-	CLKIN
HSD back porch	tHBP	40	61	-	CLKIN
HSD front porch	tHFP	-	9	-	CLKIN
HSD pulse width	tHSW	-	1	-	CLKIN
VSD period time	tV	-	262.5	-	H
Vertical display area	tVD	-	240	-	H
VSD back porch	tVBP	Odd field	-	21	H
		Even field	-	21.5	
VSD front porch	tVFP	Odd field	-	1.5	H
		Even field	-	1	
VSD pulse width	tVSW	-	1	-	CLKIN
1 Frame		-	525	-	H

9.3. Power On/Off Sequence

9.3.1 Power On Sequence



9.3.2 Power Off Sequence



10. Quality Assurance

10.1.Purpose

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

10.2.Standard for Quality Test

10.2.1. Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

10.2.2. Sampling Criteria:

Visual inspection: AQL 1.5%

Electrical functional: AQL 0.65%.

10.2.3. Reliability Test:

Detailed requirement refer to Reliability Test Specification.

10.3.Nonconforming Analysis & Disposition

10.3.1. Nonconforming analysis:

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

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

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

10.3.2. Disposition of nonconforming:

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

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

10.4.Agreement Items

Shall negotiate with customer if the following situation occurs:

10.4.1. There is any discrepancy in standard of quality assurance.

10.4.2. Additional requirement to be added in product specification.

10.4.3. Any other special problem.

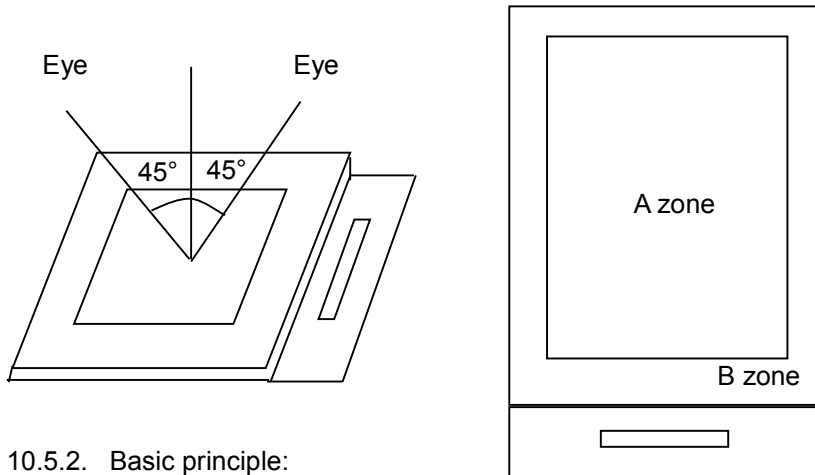
10.5. Standard of the Product Visual Inspection

10.5.1. Appearance inspection:

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

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

10.5.1.3. Definition of area: A Zone: Active Area, B Zone: Viewing Area,



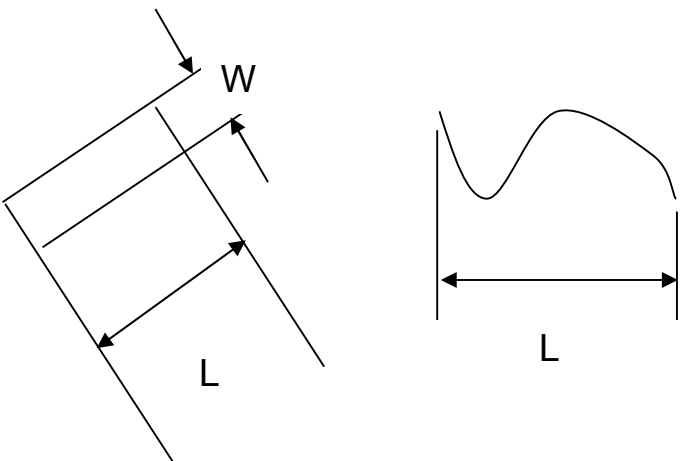
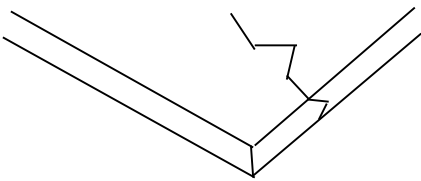
10.5.2. Basic principle:

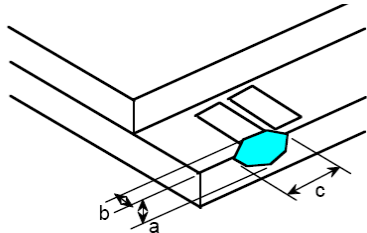
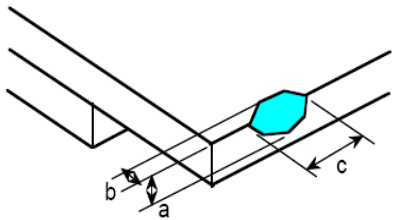
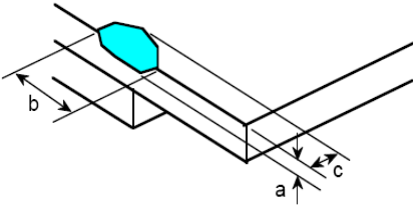
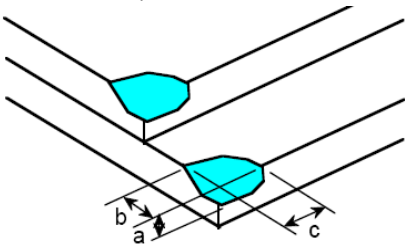
10.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

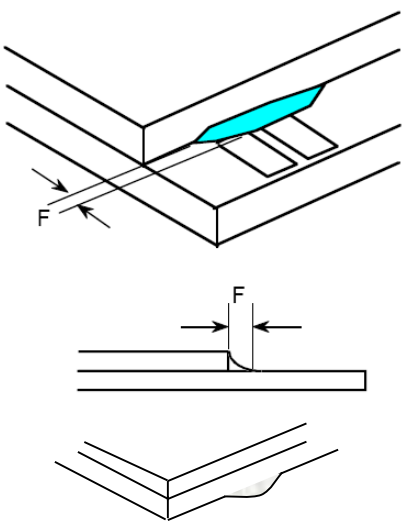
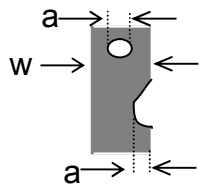
10.5.2.2. New item must be added on time when it is necessary.

10.6. Inspection Specification

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

02	Electrical Defect (Minor defect)	<table border="1"> <tr> <td></td> <td>Display Area</td> <td>Total</td> <td rowspan="4">Note1</td> </tr> <tr> <td>Bright dot</td> <td>0</td> <td>0</td> </tr> <tr> <td>Dark dot</td> <td>$N \leq 2$</td> <td>$N \leq 2$</td> </tr> <tr> <td>Total dot</td> <td>$N \leq 2$</td> <td>$N \leq 2$</td> </tr> <tr> <td>Mura</td> <td colspan="2">Not visible through 5% ND filters.</td> <td>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"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td>$W \leq 0.03$</td> <td>Ignore</td> </tr> <tr> <td>$L \leq 2.5$</td> <td>$0.03 < W \leq 0.05$</td> <td>3</td> </tr> <tr> <td>$L \leq 2.5$</td> <td>$0.05 < W \leq 0.10$</td> <td>2</td> </tr> <tr> <td>/</td> <td>$0.1 < W$</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>$c > 3.0, b < 1.0$</td> <td>1</td> </tr> <tr> <td>$c < 3.0, b < 1.0$</td> <td>3</td> </tr> <tr> <td colspan="2">$a < \text{Glass Thickness}$</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>$c > 3.0, b < 1.0$</td> <td>1</td> </tr> <tr> <td>$c < 3.0, b < 1.0$</td> <td>2</td> </tr> <tr> <td>$c < 3.0, b < 0.5$</td> <td>4</td> </tr> <tr> <td colspan="2">$a < \text{Glass Thickness}$</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>$c > 3.0, b < 1.0$</td> <td>1</td> </tr> <tr> <td>$c < 3.0, b < 1.0$</td> <td>2</td> </tr> <tr> <td>$c < 3.0, b < 0.5$</td> <td>4</td> </tr> <tr> <td colspan="2">$a < \text{Glass Thickness}$</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>$c < 3.0, b < 3.0$</td> <td>Ignore</td> </tr> <tr> <td colspan="2">$a < \text{Glass Thickness}$</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="869 257 1340 347"> <thead> <tr> <th>Length</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$F < 1.0$</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 $a < w/3$. (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="742 1299 1212 1512"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$\varphi \leq 0.20$</td> <td>Ignore</td> </tr> <tr> <td>$0.20 < \varphi \leq 0.30$</td> <td>4</td> </tr> <tr> <td>$0.30 < \varphi \leq 0.50$</td> <td>1</td> </tr> <tr> <td>$0.50 < \varphi$</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="742 1579 1212 1792"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$\varphi \leq 0.20$</td> <td>Ignore</td> </tr> <tr> <td>$0.20 < \varphi \leq 0.30$</td> <td>4</td> </tr> <tr> <td>$0.30 < \varphi \leq 0.50$</td> <td>1</td> </tr> <tr> <td>$0.50 < \varphi$</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: $D < 0.25$ is acceptable $0.25 \leq D \leq 0.4$</p> <p>2dots are acceptable and the distance between defects should more than 10 mm.</p> <p>$D > 0.4$ is unacceptable</p> <p>14.2 Dent: $D > 0.40$ is unacceptable</p> <p>14.3 Scratch: $W \leq 0.03$, $L \leq 10$ is acceptable, $0.03 < W \leq 0.10$, $L \leq 10$ is acceptable</p> <p>Distance between 2 defects should more than 10 mm. $W > 0.10$ is unacceptable.</p>
15	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>
16	Soldering	Follow IPC-A-610C standard
17	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>17.1 Missing vertical / horizontal segment,</p> <p>17.2 Abnormal Display.</p> <p>17.3 No function or no display.</p> <p>17.4 Current exceeds product specifications.</p> <p>17.5 LCD viewing angle defect.</p> <p>17.6 No Backlight.</p> <p>17.7 Dark Backlight.</p> <p>17.8 Touch Panel no function.</p>

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

10.7. Classification of Defects

- 10.7.1. Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.
- 10.7.2. Two minor defects are equal to one major in lot sampling inspection.

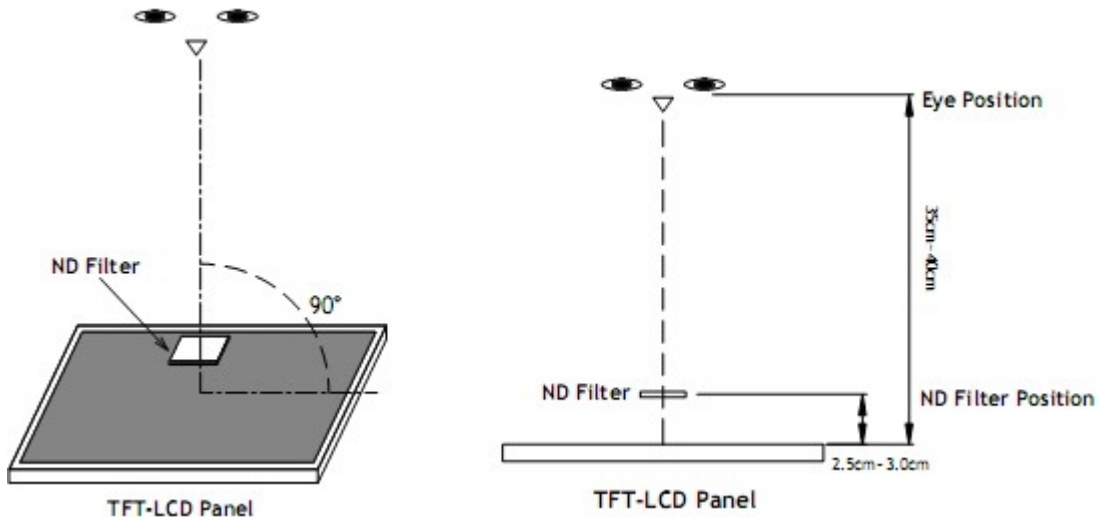
10.8. Identification/marketing criteria

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

10.9.Packing

- 10.9.1. There should be no damage of the outside carton box, each packaging box should have one identical label.
- 10.9.2. Modules inside package box should have compliant mark.
- 10.9.3. 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.

11. 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/330 Ω 5 times Contact: ±4kV 150pF/330 Ω 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

12. Precautions and Warranty

12.1. Safety

- 12.1.1. 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.
- 12.1.2. Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

12.2. Handling

- 12.2.1. Reverse and use within ratings in order to keep performance and prevent damage.
- 12.2.2. 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.

12.3. Storage

- 12.3.1. Do not store the LCD module beyond the specified temperature ranges.
- 12.3.2. Strong light exposure causes degradation of polarizer and color filter.

12.4. Metal Pin (Apply to Products with Metal Pins)

12.4.1. Pins of LCD and Backlight

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

12.4.1.2. Recommended Soldering Conditions

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

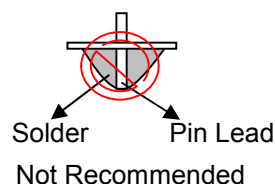
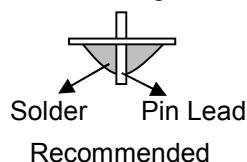
Maximum Solder Temperature: 370°C

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20°C

Typical Soldering Time: ≤3s

12.4.1.3. Solder Wetting



12.4.2. Pins of EL

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

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

12.4.2.3. Recommended Soldering Conditions

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

Recommended Solder Temperature: 270~290°C

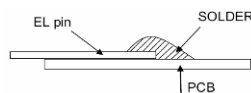
Typical Soldering Time: ≤2s

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

12.4.2.4. No horizontal press on the EL leads during soldering.

12.4.2.5. 180° bend EL leads three times is not allowed.

12.4.2.6. Solder Wetting

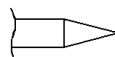


Recommended

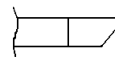


Not Recommended

12.4.2.7. The type of the solder iron:

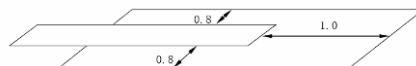


Recommended



Not Recommended

12.4.2.8. Solder Pad



12.5.Operation

- 12.5.1. Do not drive LCD with DC voltage
- 12.5.2. Response time will increase below lower temperature
- 12.5.3. Display may change color with different temperature
- 12.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear “fractured”.
- 12.5.5. Do not connect or disconnect the LCM to or from the system when power is on.
- 12.5.6. Never use the LCM under abnormal condition of high temperature and high humidity.
- 12.5.7. Module has high frequency circuits. Sufficient suppression to the electromagnetic interface shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- 12.5.8. Do not display the fixed pattern for long time(we suggest the time not longer than one hour) because it may develop image sticking due to the TFT structure.

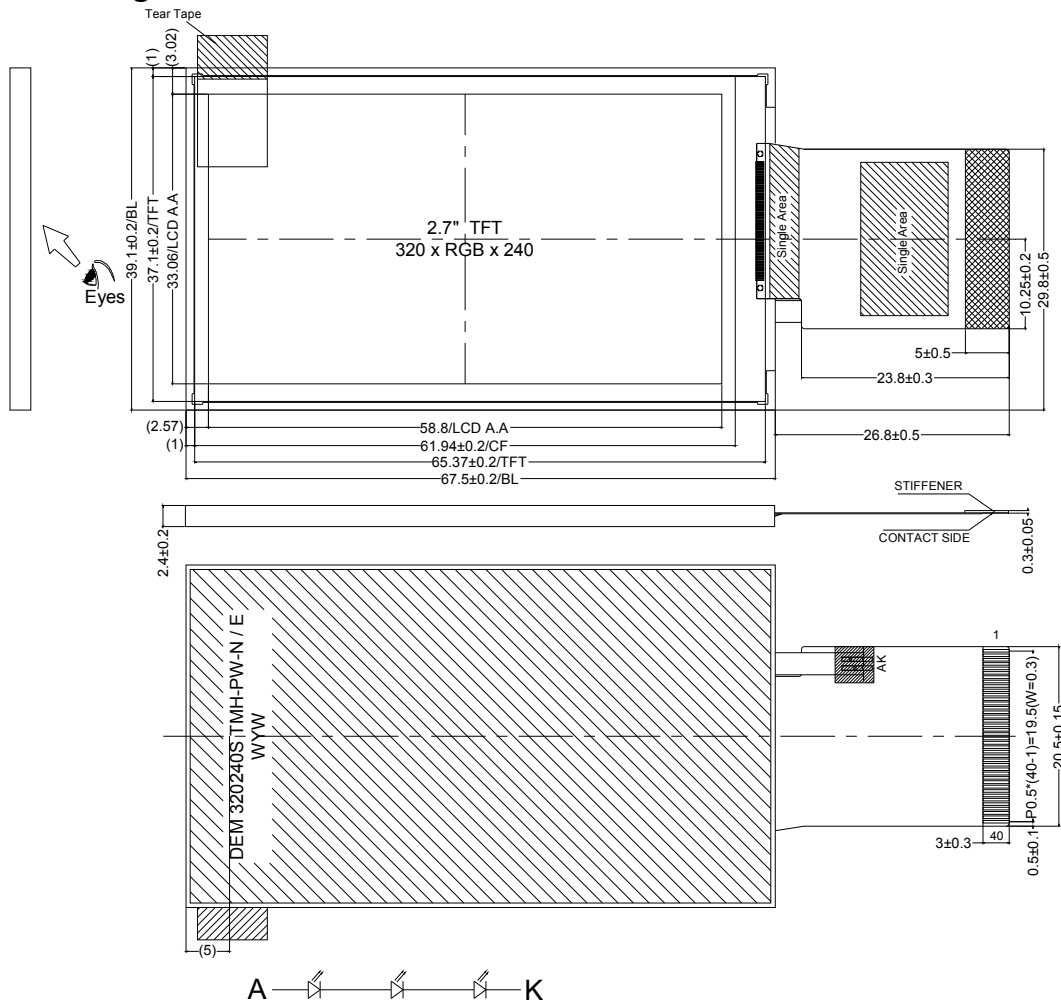
12.6.Static Electricity

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

12.7.Limited Warranty

- 12.7.1. Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 12.7.2. 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.
- 12.7.3. 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.

13. Outline Drawing



NOTES:

1. Display type: 2.7" TFT
 2. Viewing direction: 6 O'CLOCK
 3. Gray Scale Inversion Direction: 12 O'CLOCK
 4. Polarizer mode: Transmissive/Normal white
 5. Operation temperature: -20°C ~ +70°C
 6. Storage temperature: -30°C ~ +80°C
 7. Driver IC: ILI8961
 8. Power supply voltage: 2.8V
 9. Backlight : White (3 LED) 9.6V (TYP) 20mA
Brightness: 230cd/m² (TYP)
 10. ROHS must be complied
- * Unspecification tolerance are ±0.2mm

1	VCOM	21	C1P
2	FB(K)	22	DVDD
3	VLED(A)	23	VDDIO
4	DRV	24	VDD
5	VCAC	25	DGND
6	VCOMDC	26	D0
7	FRP	27	D1
8	AGND	28	D2
9	VGL	29	D3
10	VGH	30	D4
11	C4M	31	D5
12	C4P	32	D6
13	VINT3	33	D7
14	VINT2	34	DCLK
15	C3M	35	VSYNC
16	C3P	36	HSYNC
17	VINT1	37	SCL
18	C2M	38	SDA
19	C2P	39	CS
20	C1M	40	VCOM

