

Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 240320Q VMH-PW-N

**2,8" TFT
(IPS)**

Product Specification

Ver.: 1

23.10.2019

Revision History

Revision	Date	Originator	Detail	Remarks
0	18.10.2019	ZDT	Initial Release	-
1	23.10.2019	ZDT	Add Note	P11

Table of Contents

No.	Item	Page
1.	General Description	4
2.	Module Parameter	4
3.	Absolute Maximum Ratings	4
4.	DC Characteristics	4
5.	Backlight Characteristic	5
5.1.	Backlight Characteristics.....	5
5.2.	Backlighting circuit	5
6.	Optical Characteristics	6
6.1.	Optical Characteristics	6
6.2.	Definition of Response Time	6
6.3.	Definition of Contrast Ratio	7
6.4.	Definition of Viewing Angles.....	7
6.5.	Definition of Color Appearance	8
6.6.	Definition of Surface Luminance, Uniformity and Transmittance.....	8
7.	Block Diagram and Power Supply	9
8.	Interface Pins Definition	10
9.	Characteristics	11
9.1.	Display Serial Interface Timing Characteristics (3-line SPI system).....	11
9.2.	Parallel 18/16/6-bit RGB Interface Timing Characteristics	12
10.	Reset input timing	13
11.	Quality Assurance	14
11.1.	Purpose	14
11.2.	Standard for Quality Test.....	14
11.3.	Nonconforming Analysis & Disposition	14
11.4.	Agreement Items.....	14
11.5.	Standard of the Product Visual Inspection	14
11.6.	Inspection Specification	15
11.7.	Classification of Defects.....	19
11.8.	Identification/marketing criteria	19
11.9.	Packing	19
12.	Reliability Specification	20
13.	Precautions and Warranty	21
13.1.	Safety	21
13.2.	Handling	21
13.3.	Storage.....	21
13.4.	Metal Pin (Apply to Products with Metal Pins)	21
13.5.	Operation	22
13.6.	Static Electricity	22
13.7.	Limited Warranty	22
14.	Outline Drawing	23

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	IPS TFT	-
Display Mode	Transmissive / Normally Black	-
Resolution	240 x RGB x 320	Pixels
View Direction	Full View	Best Image
Module Outline	50.00 x 69.20 x 2.50 (Note 1)	mm
Active Area	43.20 x 57.60	mm
Pixel Size	0.180 x 0.180	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Polarizer Surface Treatment	Anti-Glare	-
Display Colors	262k	-
Interface	3-Wire SPI + 18-Bit RGB interface (default)	-
With or without Touch Panel	Without	-
Driver IC	ILI9341V (Ilitek)	-
Operating Temperature	-20 ~ 70	°C
Storage Temperature	-30 ~ 80	°C
Weight	(14)	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	Logic	-0.3	4.6	V
	Analog	-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	Logic	IOVCC	1.65	2.8	3.3	V
	Analog	VCI	2.5	2.8	3.3	V
Logic Low Input Voltage		V _{IL}	GND	-	0.3*IOVCC	V
Logic High Input Voltage		V _{IH}	0.7*IOVCC	-	IOVCC	V
Logic Low Output Voltage		V _{OL}	GND	-	0.2*IOVCC	V
Logic High Output Voltage		V _{OH}	0.8*IOVCC	-	IOVCC	V
Current Consumption All White	Logic	I _{CC+ IIN}	-	(15)	-	mA
	Analog					

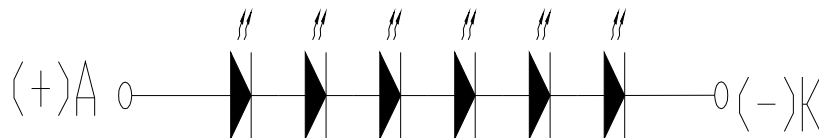
5. Backlight Characteristic

5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V _F	T _a =25 °C, I _F =20mA/LED	16.8	18	20.4	V
Forward Current	I _F	T _a =25 °C, V _F =3.2V/LED	-	20	-	mA
Power Dissipation	P _D		-	360	-	mW
Uniformity	Avg		-	80	-	%
LED Lifetime(25°C)	-		20.000	30.000	-	Hrs
Drive Method	Constant Current					
LED Configuration	6 White LEDs in String					

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

5.2. Backlighting Circuit



6. Optical Characteristics

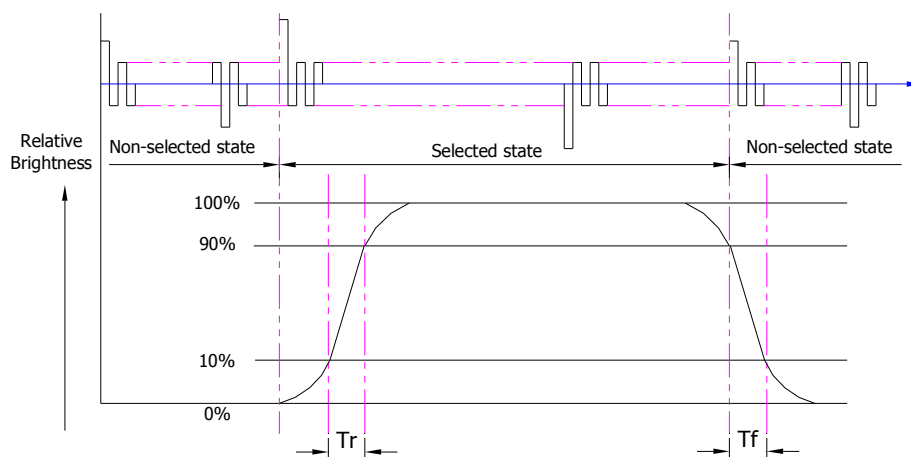
6.1. Optical Characteristics

Ta=25°C, VCI=2.8V

	Item	Symbol	Condition	Specification			Unit
				Min.	Typ.	Max.	
Backlight On (Transmissive Mode)	Luminance On TFT($I_f=20mA/LED$)	Lv	Normally viewing angle $\theta_x = \phi_y = 0^\circ$	400	500	-	cd/m ²
	Contrast Ratio(See 7.3)	CR		600	800	-	
	Response Time (See 7.2)	TR+TF		-	30	40	ms
	Chromaticity Transmissive (See 7.5)	Red	XR	(0.593)	(0.643)	(0.693)	
			YR	(0.281)	(0.331)	(0.381)	
		Green	XG	(0.243)	(0.293)	(0.343)	
			YG	(0.577)	(0.627)	(0.677)	
		Blue	XB	(0.092)	(0.142)	(0.192)	
			YB	(0.006)	(0.056)	(0.106)	
	White	XW	(0.236)	(0.286)	(0.336)		
		YW	(0.279)	(0.329)	(0.379)		
	Viewing Angle (See 7.4)	Horizontal	θ_{x+}	-	80	-	Deg.
			θ_{x-}	-	80	-	
		Vertical	ϕ_{y+}	-	80	-	
ϕ_{y-}			-	80	-		
NTSC Ratio(Gamut)			-	70	-	%	

6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)

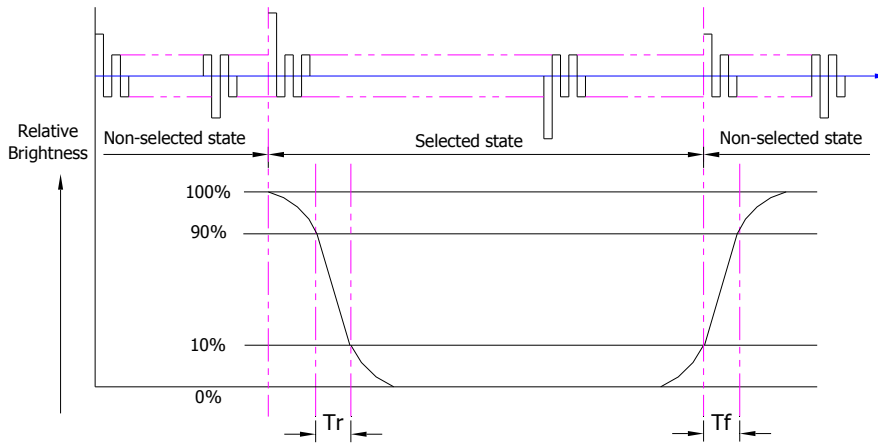


Tr is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

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)



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

T_f 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

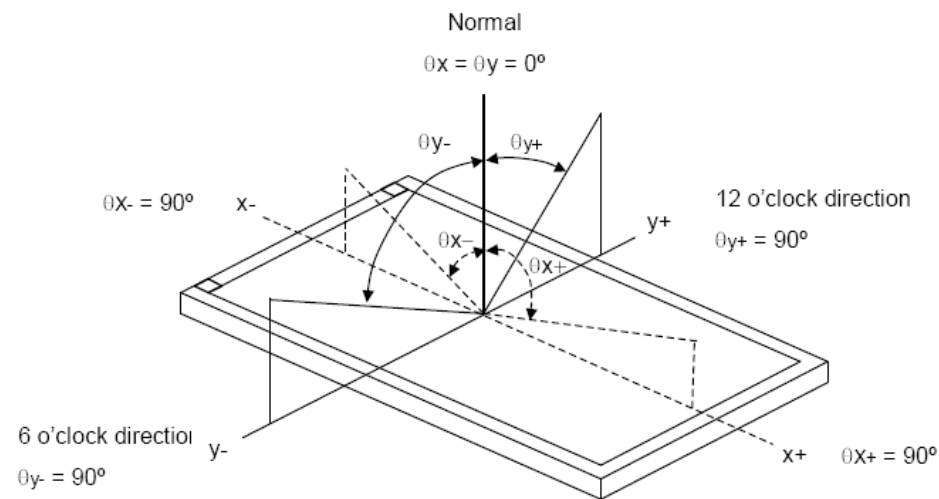
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

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



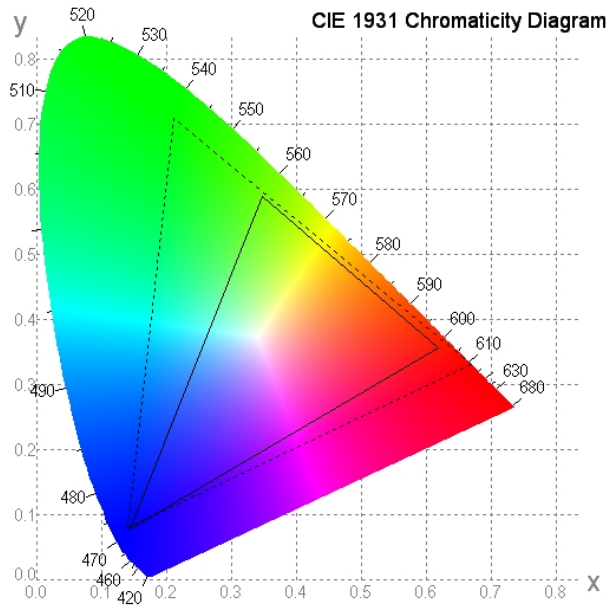
Measuring machine: LCD-5100 or EQUI

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

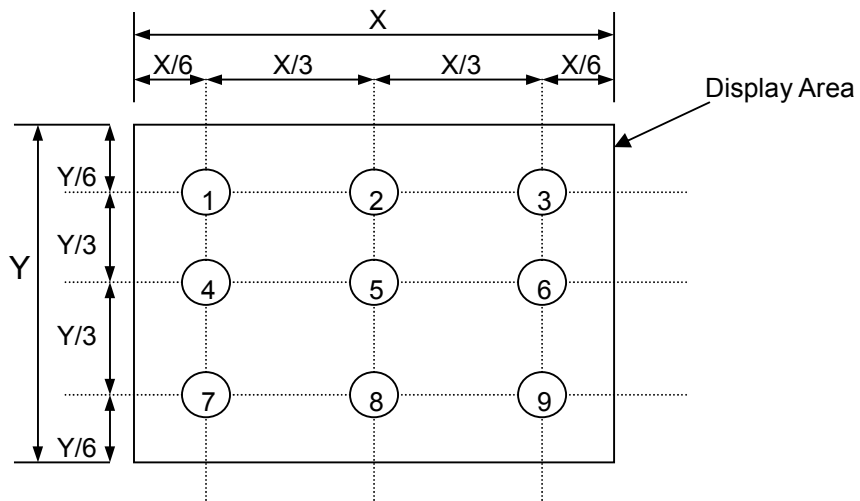
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

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

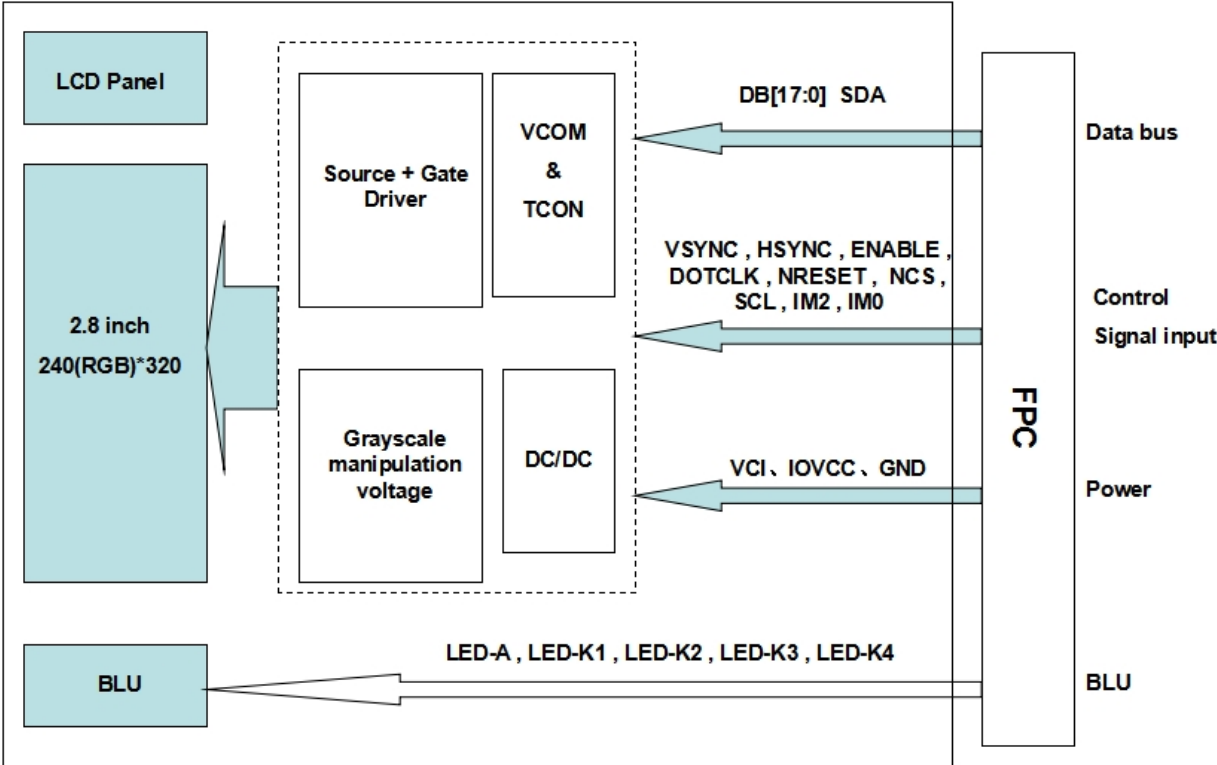
6.6.2. Uniformity = $\text{Minimal} (L_{P1}:L_{P9}) / \text{Maximal} (L_{P1}:L_{P9}) * 100\%$

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

Note: Measuring machine: BM-7



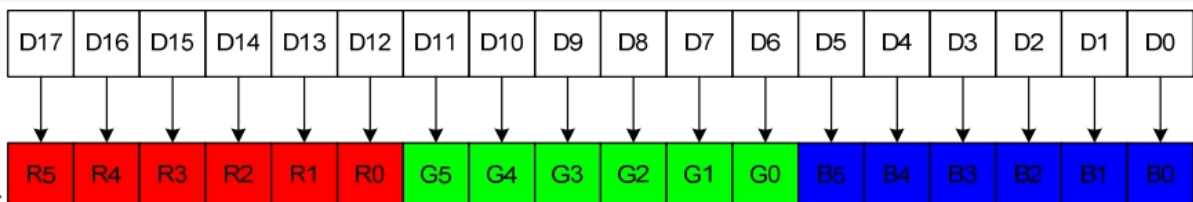
7. Block Diagram and Power Supply



8. Interface Pins Definition

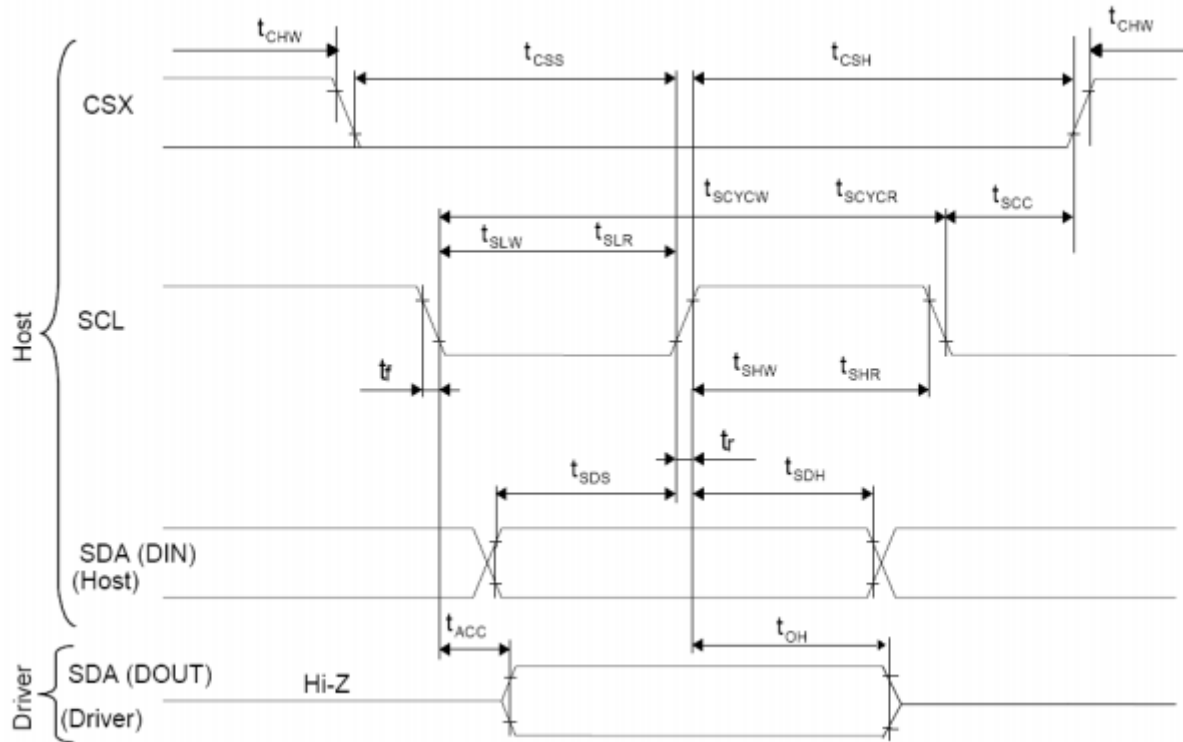
No.	Symbol	Function			
1	LED-A	Anode for back light driver voltage			
2	LED-K1	Cathode for back light driver voltage			
3	LED-K2	Cathode for back light driver voltage			
4	LED-K3	Cathode for back light driver voltage			
5	LED-K4	Cathode for back light driver voltage			
6	SDA	Serial data input pin.			
7	VSYNC	Vertical Sync Signal			
8	HSYNC	Horizontal Sync Signal			
9	IM2	IM2	IM0	Select the MPU system interface mode	PIN in used
10	IM0	1	1	3-wire 9-bit data serial interface I	SDA: In/OUT
11	ENABLE	Data Enable signal.			
12	GND	Ground.			
13	NRESET	Reset pin.			
14	DB17	Data bus.			
15	DB16	Data bus.			
16	DB15	Data bus.			
17	DB14	Data bus.			
18	DB13	Data bus.			
19	DB12	Data bus.			
20	DB11	Data bus.			
21	DB10	Data bus.			
22	DB9	Data bus.			
23	DB8	Data bus.			
24	DB7	Data bus.			
25	DB6	Data bus.			
26	DB5	Data bus.			
27	DB4	Data bus.			
28	DB3	Data bus.			
29	DB2	Data bus.			
30	DB1	Data bus.			
31	DB0	Data bus.			
32	NC	No connection.			
33	NC	No connection.			
34	SCL	Serial Clock			
35	NCS	Chip select signal. Low: chip can be accessed.			
36	DOTCLK	Pixel clock signal			
37	GND	Ground.			
38	VCI	Analog power supply.			
39	IOVCC	Digital IO Pad power supply.			
40	NC	No connection.			

Note:



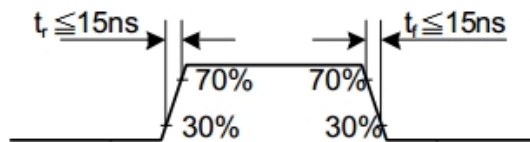
9. Characteristics

9.1. Display Serial Interface Timing Characteristics (3-Line SPI System)

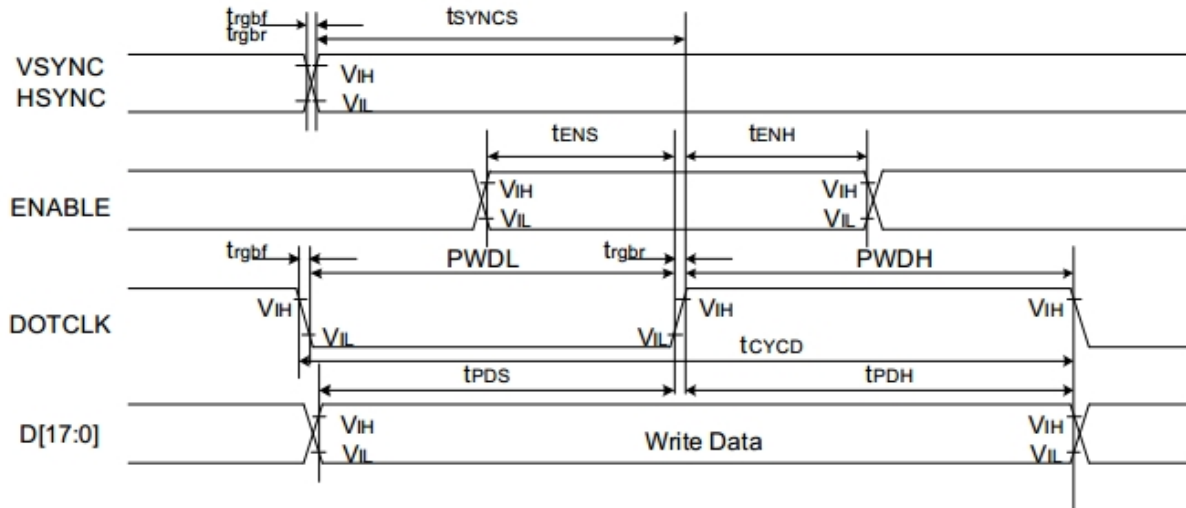


Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tsc	SCL-CSX	20	-	ns	
	tch	CSX "H" Pulse Width	40	-	ns	
	tc	CSX-SCL Time	60	-	ns	
	cs		65	-	ns	

Note: $T_a = 25\text{ }^\circ\text{C}$, $V_{DDI}=1.65\text{V to }3.3\text{V}$, $V_{CI}=2.5\text{V to }3.3\text{V}$, $AGND=V_{SS}=0\text{V}$

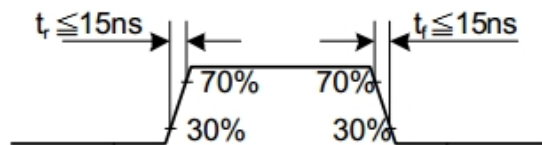


9.2. Parallel 18/16/6-Bit RGB Interface Timing Characteristics

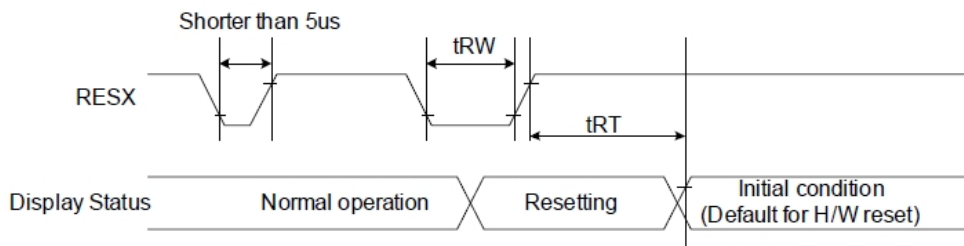


Signal	Symbol	Parameter	min	max	Unit	Description	
VSYNC / HSYNC	tSYNCS	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode	
	tSYNCH	VSYNC/HSYNC hold time	15	-	ns		
DE	tENS	DE setup time	15	-	ns		
	tENH	DE hold time	15	-	ns		
D[17:0]	tPOS	Data setup time	15	-	ns		
	tPDH	Data hold time	15	-	ns		
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns		
	PWDL	DOTCLK low-level period	15	-	ns		
	tCYCD	DOTCLK cycle time	100	-	ns		
	trgbr, trgbf	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		
VSYNC / HSYNC	tSYNCS	VSYNC/HSYNC setup time	15	-	ns		6-bit bus RGB interface mode
	tSYNCH	VSYNC/HSYNC hold time	15	-	ns		
DE	tENS	DE setup time	15	-	ns		
	tENH	DE hold time	15	-	ns		
D[17:0]	tPOS	Data setup time	15	-	ns		
	tPDH	Data hold time	15	-	ns		
DOTCLK	PWDH	DOTCLK high-level pulse period	15	-	ns		
	PWDL	DOTCLK low-level pulse period	15	-	ns		
	tCYCD	DOTCLK cycle time	50	-	ns		
	trgbr, trgbf	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		

Note: Ta = -30 to 70 °C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, AGND=VSS=0V



10. Reset Input 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

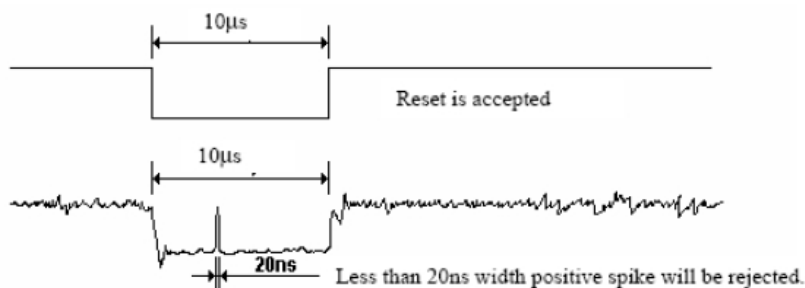
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

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.

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:

GB2828.1-2012

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.

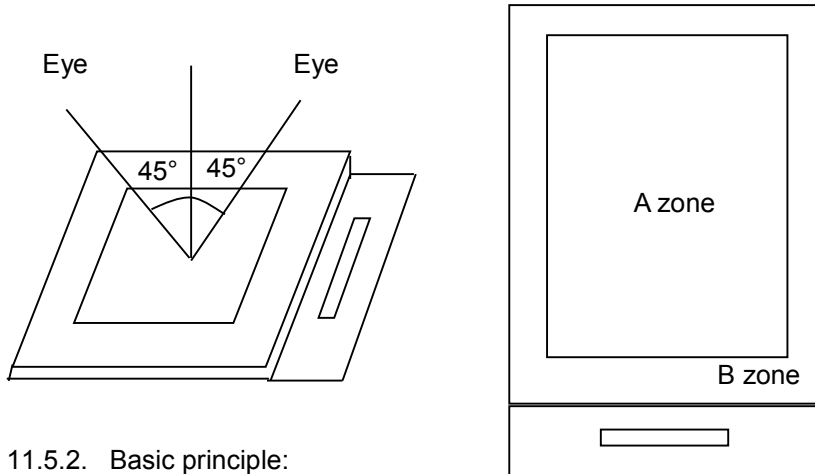
11.5.Standard of the Product Visual Inspection

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,



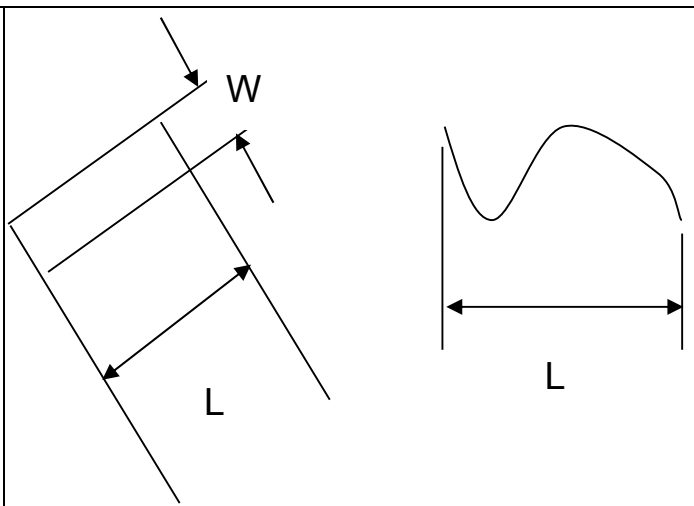
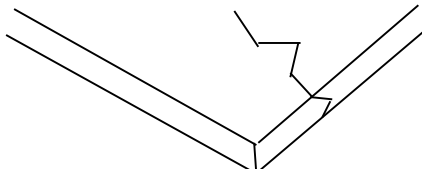
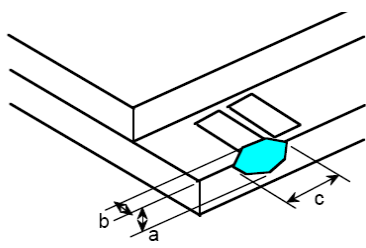
11.5.2. Basic principle:

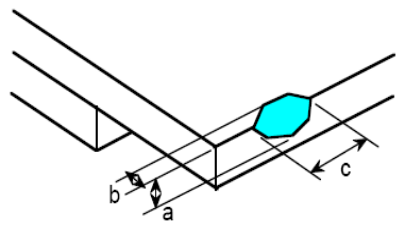
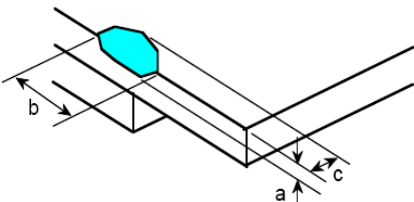
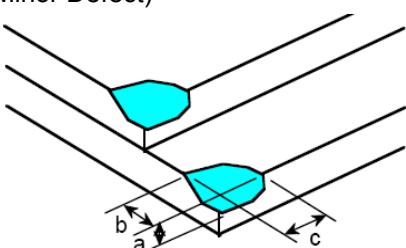
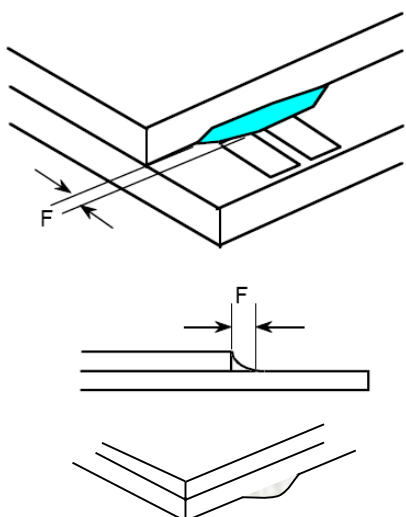
11.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

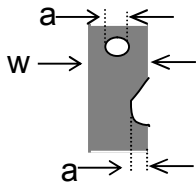
11.5.2.2. New item must be added on time when it is necessary.

11.6. Inspection Specification

No.	Item	Criteria (Unit: mm)																	
01	Black / White Spot Foreign Material (Round Type) Pinholes Stain Particles Inside Cell. (Minor Defect)	<p>$\phi = (a + b) / 2$</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	
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"> <thead> <tr> <th></th> <th>Display Area</th> <th>Total</th> <th rowspan="4">Note1</th> </tr> </thead> <tbody> <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> </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.																			

<p>03</p>	<p>Black and White Line Scratch Foreign Material (Line Type) (Minor Defect)</p>	 <table border="1" data-bbox="523 689 1152 996"> <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>$L \leq .5$</td> <td>$0.03 < W \leq 0.5$</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> <p>Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.</p>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq .5$	$0.03 < W \leq 0.5$	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																		
$L \leq .5$	$0.03 < W \leq 0.5$	3																		
$L \leq 2.5$	$0.05 < W \leq 0.10$	2																		
/	$0.1 < W$	0																		
Total		3																		
<p>04</p>	<p>Glass Crack (Minor Defect)</p>	 <p>Crack is potential to enlarge, any type is not allowed.</p>																		
<p>05</p>	<p>Glass Chipping Pad Area: (Minor Defect)</p> 	<table border="1" data-bbox="853 1579 1324 1758"> <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" style="text-align: center;">$a < \text{Glass Thickness}$</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" style="text-align: center;">$a < \text{Glass Thickness}$</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" style="text-align: center;">$a < \text{Glass Thickness}$</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"> <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											

10	<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>										
11	Bubble on Polarizer (Minor Defect)	<table border="1" data-bbox="730 521 1198 734"> <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											
12	Dent on Polarizer (Minor Defect)	<table border="1" data-bbox="730 784 1198 996"> <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											
13	Bezel	<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 14.1 Spot: $D < 0.25$ is acceptable $0.25 \leq D \leq 0.4$ 2dots are acceptable and the distance between defects should more than 10 mm. $D > 0.4$ is unacceptable 14.2 Dent: $D > 0.40$ is unacceptable 14.3 Scratch: $W \leq 0.03$, $L \leq 10$ is acceptable, $0.03 < W \leq 0.10$, $L \leq 10$ is acceptable 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. 15.2 All components on PCB must same as documented on the BOM/component layout. 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, 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. 17.8 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.

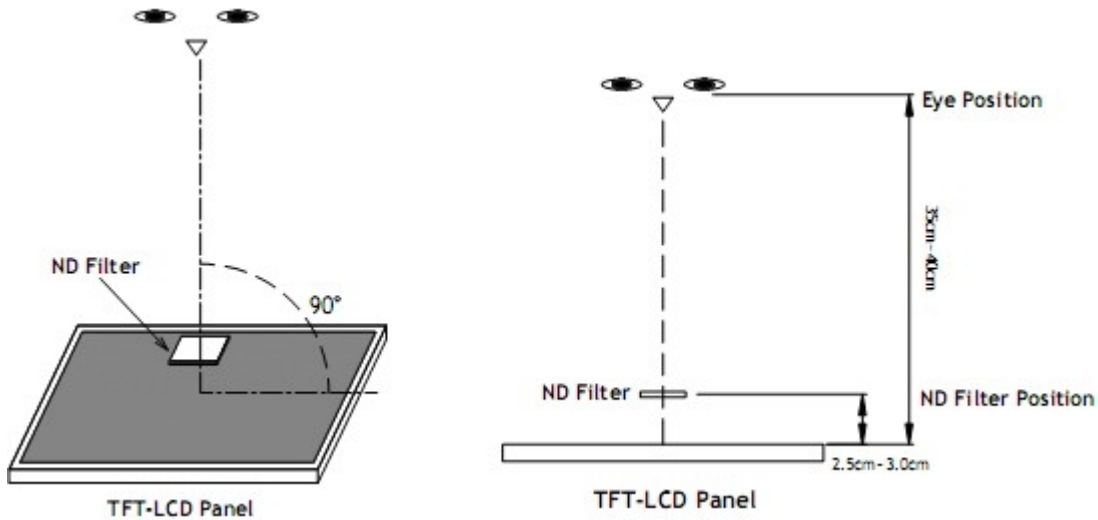
11.8. Identification/marketing criteria

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

11.9. Packing

- 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, 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/T2423.3-2016
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: ±4kV 150pF/330 Ω 5 times Contact: ±2kV 150pF/330 Ω 5 times	2	GB/T17626.2-2018
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.

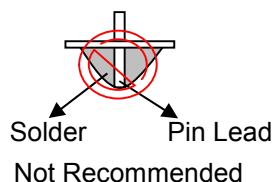
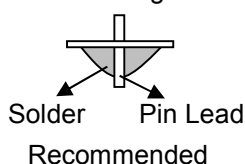
13.3. Storage

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

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

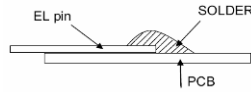
- 13.4.1. Pins of LCD and Backlight
 - 13.4.1.1. Solder tip can touch and press on the tip of Pin LEAD during the soldering
 - 13.4.1.2. Recommended Soldering Conditions
 - Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1
 - Maximum Solder Temperature: 370℃
 - Maximum Solder Time: 3s at the maximum temperature
 - Recommended Soldering Temp: 350±20℃
 - Typical Soldering Time: ≤3s

13.4.1.3. Solder Wetting

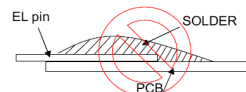


- 13.4.2. Pins of EL
 - 13.4.2.1. Solder tip can touch and press on the tip of EL leads during soldering.
 - 13.4.2.2. No Solder Paste on the soldering pad on the motherboard is recommended.
 - 13.4.2.3. Recommended Soldering Conditions
 - Solder type: Nippon Alimit Leadfree SR-34, size 0.5mm
 - Recommended 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

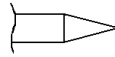


Recommended

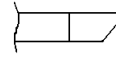


Not Recommended

13.4.2.7. The type of the solder iron:

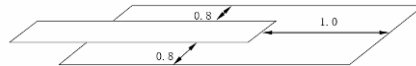


Recommended



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”.
- 13.5.5. Do not connect or disconnect the LCM to or from the system when power is on.
- 13.5.6. Never use the LCM under abnormal condition of high temperature and high humidity.
- 13.5.7. 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.
- 13.5.8. 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.

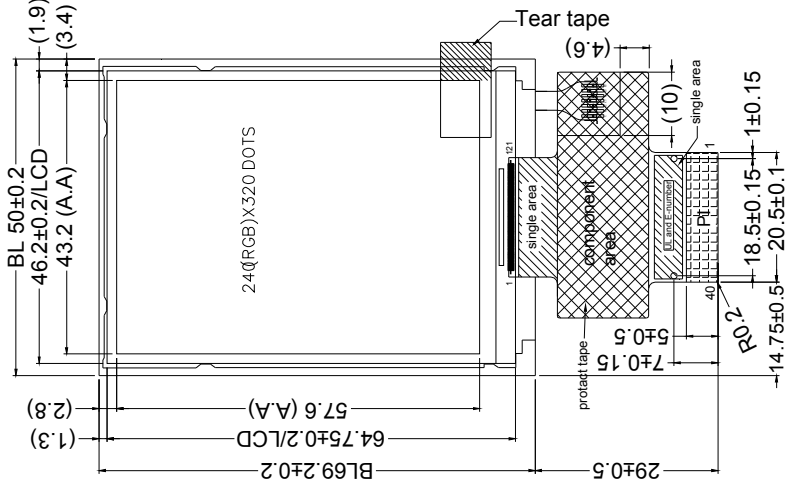
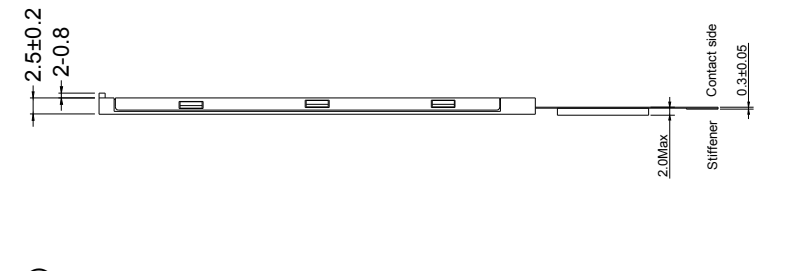
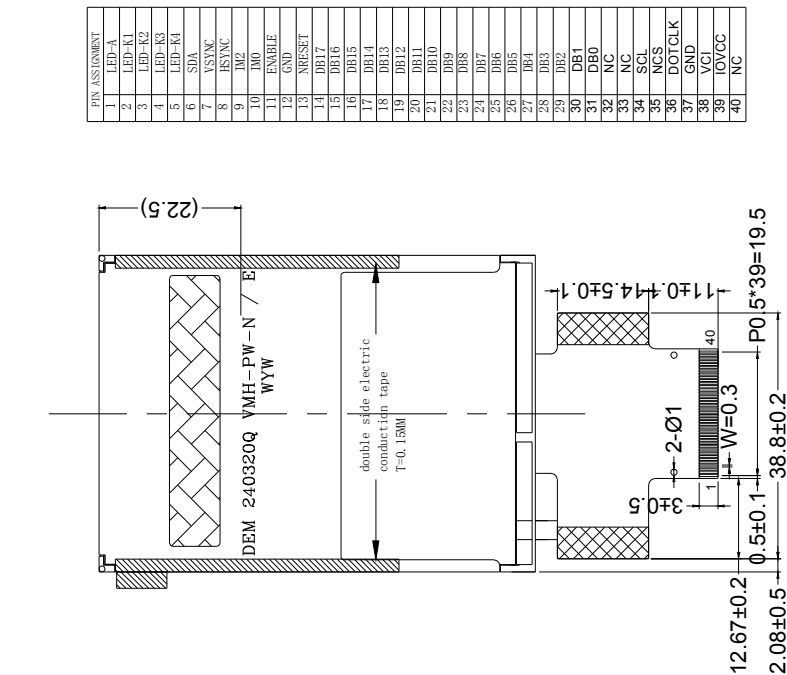
13.6.Static Electricity

- 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. Outline Drawing



(+)>A ○ (-)>K

NOTES:

1. Display type: 2.8" TFT
 2. Viewing direction: FULL VIEW
 4. Polarizer mode: Transmissive/Normally Black
 5. Operation temperature: -20 °C~+70 °C
 6. Storage temperature: -30 °C~+80 °C
 7. Driver IC: ILI9341V
 8. Power supply voltage: 2.8V
 9. Backlight : White(6 LED)/18V(typ)/20mA
Brightness: 500(TYP)cd/m²
 10. ROHS must be complied
- * Unspecification tolerance are ±0.2mm
* The dimension with mark brackets "()" just for reference