

Display Elektronik GmbH

# DATA SHEET

***TFT MODULE***

**DEM 480480B VMH-PW-N**

**2,5" TFT  
(8-Corner-Design)**

Product Specification

Ver.: 1

17.07.2019

**Revision History**

<b>Revision</b>	<b>Date</b>	<b>Originator</b>	<b>Detail</b>	<b>Remarks</b>
0	13.05.2019	MHI	Initial Release	-
1	17.07.2019	MH	Add Weight Add Current Consumption Add Chromacity Transmissive Modify Reliability Specification	P4 P5 P6 P21

**Table of Contents**

No.	Item	Page
1.	General Description .....	4
2.	Module Parameter .....	4
3.	Absolute Maximum Ratings .....	4
4.	DC Characteristics .....	5
5.	Backlight Characteristic .....	5
5.1.	Backlight Characteristic .....	5
5.2.	Backlight Characteristic .....	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.	AC Characteristics .....	11
10.	Reset timing characteristic .....	14
11.	Quality Assurance .....	15
11.1.	Purpose .....	15
11.2.	Standard for Quality Test .....	15
11.3.	Nonconforming Analysis & Disposition .....	15
11.4.	Agreement Items .....	15
11.5.	Standard of the Product Visual Inspection .....	16
11.6.	Inspection Specification .....	16
11.7.	Classification of Defects .....	20
11.8.	Identification/marketing criteria .....	20
11.9.	Packing .....	20
12.	Reliability Specification .....	21
13.	Precautions and Warranty .....	22
13.1.	Safety .....	22
13.2.	Handling .....	22
13.3.	Storage .....	22
13.4.	Metal Pin (Apply to Products with Metal Pins) .....	22
13.5.	Operation .....	23
13.6.	Static Electricity .....	23
13.7.	Limited Warranty .....	23
14.	Outline Drawing .....	24

## 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 IC and a Backlight unit.

## 2. Module Parameter

Features	Details	Unit
Display Size (Diagonal)	2.47"	-
LCD Type	IPS TFT	-
Display Mode	Transmissive / Normally Black	-
Resolution	480 x RGB x 480	Pixels
View Direction	FULL VIEW	Best Image
Module Outline	70.79 x 73.34 x 2.40 (Note1 )	mm
Active Area	62.64 x 62.64	mm
Pixel Size	0.1305 x 0.1305	mm
Pixel Arrangement	RGB Stripe	-
Display Colors	16.7 Million	-
Interface	MIPI	-
With or without Touch Panel	without	-
Driver IC	HX8379-C (Himax)	-
Operating Temperature	-20°C to +70°C	°C
Storage Temperature	-30°C to +80°C	°C
Weight	22	g

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

## 3. Absolute Maximum Ratings

V<sub>SS</sub>=0V, Ta=25°C

Item	Symbol	Min.	Max.	Unit
Supply Voltage	V <sub>CI</sub>	-0.3	3.6	V
	IOVCC	-0.3	3.6	V
Storage Temperature	T <sub>STG</sub>	-30	+80	°C
Operating Temperature	T <sub>OP</sub>	-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	V <sub>CI</sub>	2.5	3.3	3.6	V	
	IOVCC	1.65	1.8	3.3	V	
Logic Low Input Voltage	V <sub>IL</sub>	0	-	0.3*IOVCC	V	
Logic High Input Voltage	V <sub>IH</sub>	0.7*IOVCC	-	IOVCC	V	
Logic Low Output Voltage	V <sub>OL</sub>	0	-	0.2*IOVCC	V	
Logic High Output Voltage	V <sub>OH</sub>	0.8*IOVCC	-	IOVCC	V	
Current Consumption All White	Logic	I <sub>CC</sub> + I <sub>IN</sub>	-	20	-	mA
	Analog					

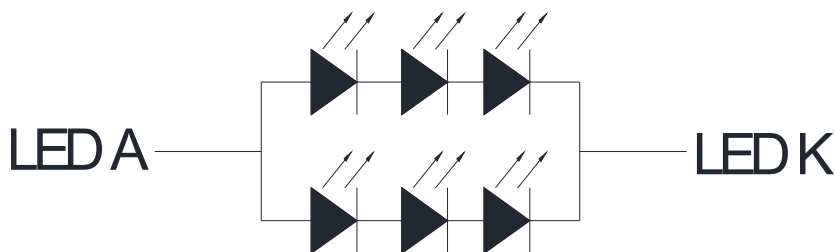
5. Backlight Characteristic

5.1. Backlight Characteristic

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	T <sub>a</sub> =25 °C, I <sub>F</sub> =20mA/LED	8.4	9.6	10.2	V
Forward Current	I <sub>F</sub>	T <sub>a</sub> =25 °C, V <sub>F</sub> =3.2V/LED	-	40	-	mA
Power Dissipation	P <sub>D</sub>		-	384	-	mW
Uniformity	Avg		-	80	-	%
LED Lifetime (25 °C)	-		20,000	30,000	-	Hrs
Drive Method	Constant current					
LED Configuration	6 White LEDs (3 LEDs in one string and 2 groups in parallel)					

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

5.2. Backlight Characteristic



6. Optical Characteristics

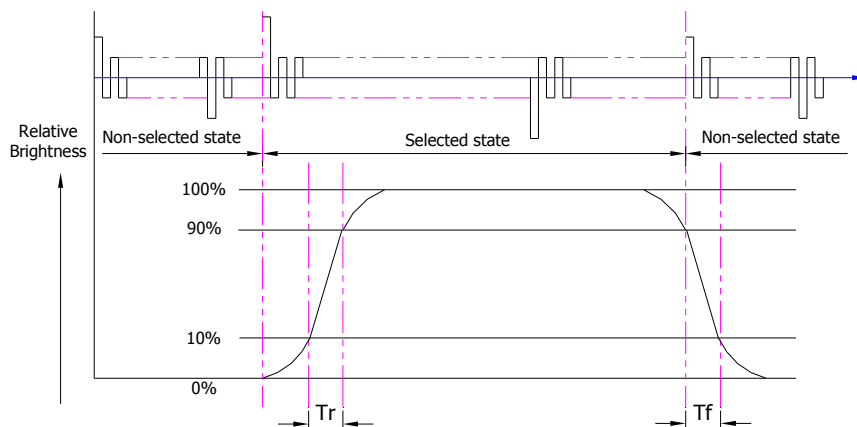
6.1. Optical Characteristics

Ta=25°C, VCI=3.3V

	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 $\theta_x = \phi_y = 0^\circ$	320	400	-	cd/m <sup>2</sup>	
	Contrast Ratio(See 6.3)	CR		-	900	-		
	Response Time (See 6.2)	TR+TF		-	30	-	ms	
	Chromaticity Transmissive (See 6.5)	Red	XR	Center CR≥10	0.576	0.626	0.676	
			YR		0.295	0.345	0.395	
		Green	XG		0.244	0.294	0.344	
			YG		0.580	0.630	0.680	
		Blue	XB		0.092	0.142	0.192	
			YB		0.004	0.054	0.104	
	White	XW	0.221	0.271	0.321			
YW		0.270	0.320	0.370				
Viewing Angle (See 6.4)	Horizontal	$\theta_{x+}$	Center CR≥10	-	80	-	Deg.	
		$\theta_{x-}$		-	80	-		
	Vertical	$\phi_{y+}$		-	80	-		
		$\phi_{y-}$		-	80	-		
NTSC Ratio(Gamut)				-	65	-	%	

6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)

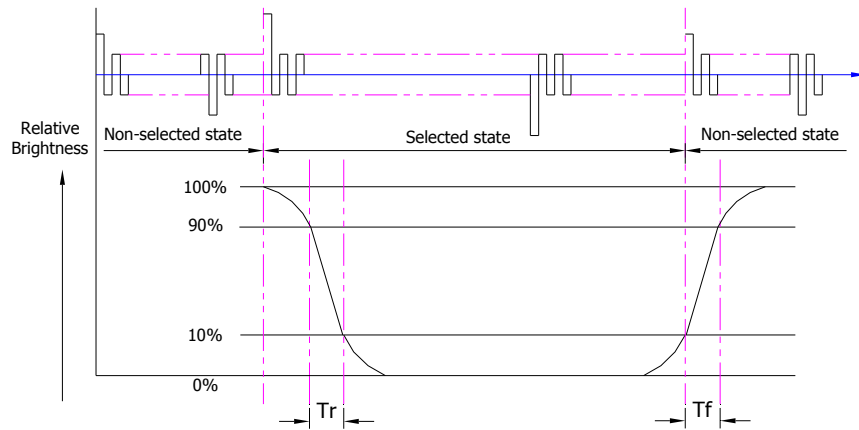


Tr is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

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)



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

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

Note: Measuring machine: LCD-5100 or EQUI

6.3. Definition of Contrast Ratio

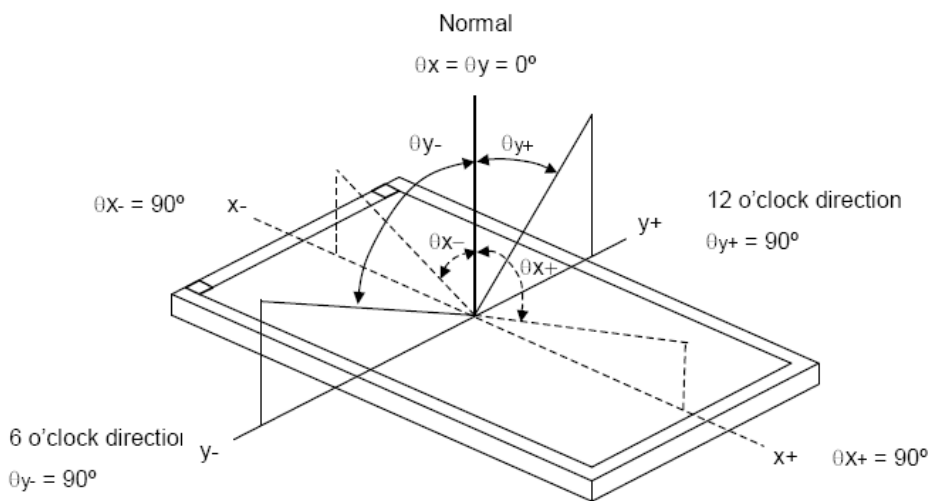
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

The measurement condition is:

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

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

6.4. Definition of Viewing Angles



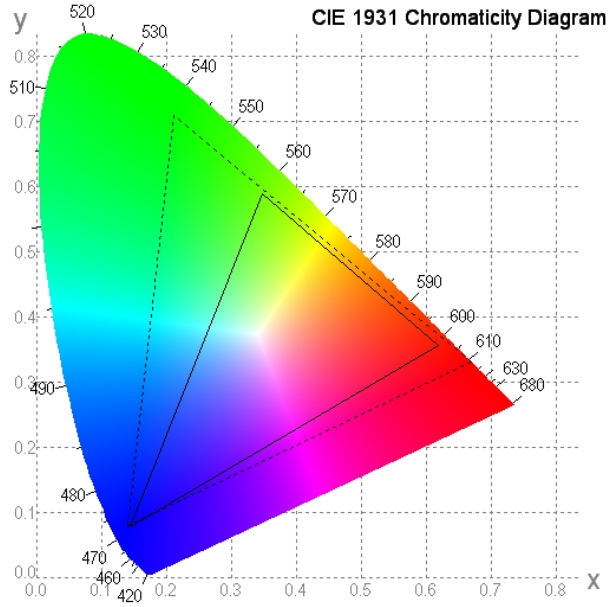
Measuring machine: LCD-5100 or EQUI

**6.5. Definition of Color Appearance**

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

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

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



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

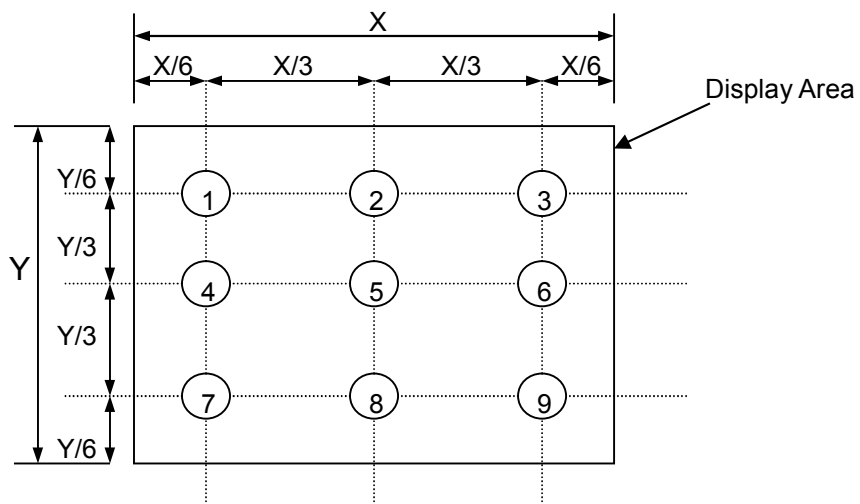
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

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

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

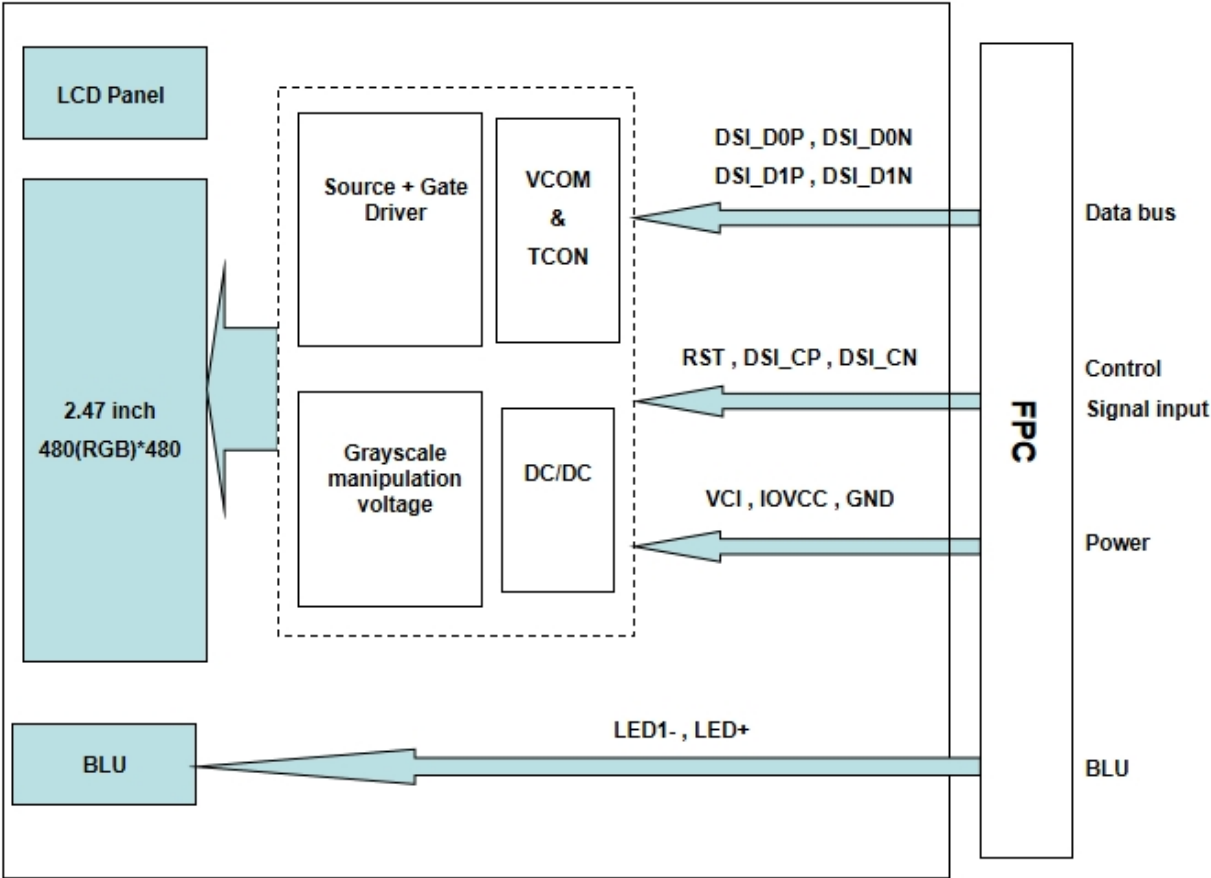
6.6.3. Transmittance =  $L_v \text{ on LCD} / L_v \text{ on Backlight} * 100\%$

Note: Measuring machine: BM-7





7. Block Diagram and Power Supply



## 8. Interface Pins Definition

No.	Symbol	Function	Remark
1	GND	Ground	
2	DSI_D1P	MIPI DSI : Data differential signal input pins. (Data lane 1 positive)	
3	NC	No connection	
4	DSI_D1N	MIPI DSI : Data differential signal input pins. (Data lane 1 negative)	
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	DSI_CP	MIPI DSI : clock differential signal input pins. (Clock lane positive)	
9	NC	No connection	
10	DSI_CN	MIPI DSI : clock differential signal input pins. (Clock lane negative)	
11	GND	Ground	
12	GND	Ground	
13	GND	Ground	
14	DSI_D0P	MIPI DSI : Data differential signal input pins. (Data lane 0 positive)	
15	NC	No connection	
16	DSI_D0N	MIPI DSI : Data differential signal input pins. (Data lane 0 negative)	
17	GND	Ground	
18	GND	Ground	
19	ID0	Display ID0 (0V/ 1.8V) - Add pull up/down Resistor	
20	ID1	Display ID1 (0V/ 1.8V) - Add pull up/down Resistor	
21	RST	Display Reset	
22	NC	No connection	
23	THERM	Thermistor Readout	
24	IOVCC	1.8V, Power supply for logic and I/O circuits	
25	GND	Ground	
26	VCI	3.3V, Power supply for analog circuits	
27	VCI	3.3V, Power supply for analog circuits	
28	GND	Ground	
29	LED-	Led cathode	
30	LED-	Led cathode	
31	NC	No connection	
32	LED+	Led anode	
33	LED+	Led anode	
34	NC	No connection	
35	GND	Ground	

## 9. AC Characteristics

### 1) Electrical characteristics of low-power transmitter

The Low-Power transmitter shall be a slew-rate controlled push-pull driver. It is used for driving the Lines in all Low-Power operating modes. It is therefore important that the static power consumption of a LP transmitter be as low as possible. Under tables list DC and AC characteristic for LP-TX.

#### LP Transmitter DC Specifications

Parameter	Description	Min.	Typ.	Max.	Unit	Note
V <sub>OL</sub>	Thevenin output low level	-50	-	50	mV	-
V <sub>OH</sub>	Thevenin output high level	1.1	1.2	1.3	V	-
Z <sub>OLP</sub>	Output impedance of LP-TX	110	-	-	Ω	(1)

**Note:** (1) Though no maximum value for Z<sub>OLP</sub> is specified, the LP transmitter output impedance shall ensure the t<sub>RLP</sub>/t<sub>FLP</sub> specification is met.

#### LP Transmitter DC Specifications

Parameter	Description	Min.	Typ.	Max.	Unit	Note
t <sub>RLP</sub> /t <sub>FLP</sub>	15%-85% rise time and fall time	-	-	25	ns	(1)
T <sub>LFX</sub>	Transmitted length of any Low-Power state period	50	-	-	ns	TX_OSC=0 (10)
		100	-	-	ns	TX_OSC=1 (10)
δV/δt <sub>SR</sub>	Slew rate @ C <sub>LOAD</sub> = 0pF	-	-	500	mV/ns	(1),(3),(5),(6)
	Slew rate @ C <sub>LOAD</sub> = 5pF	-	-	300	mV/ns	(1),(3),(5),(6)
	Slew rate @ C <sub>LOAD</sub> = 20pF	-	-	250	mV/ns	(1),(3),(5),(6)
	Slew rate @ C <sub>LOAD</sub> = 70pF	-	-	150	mV/ns	(1),(3),(5),(6)
	Slew rate @ C <sub>LOAD</sub> = 0 to 70pF (Falling Edge Only)	30	-	-	mV/ns	(1),(2),(3)
	Slew rate @ C <sub>LOAD</sub> = 0 to 70pF (Rising Edge Only)	30	-	-	mV/ns	(1),(3),(7)
C <sub>LOAD</sub>	Load capacitance	30 – 0.075 * (VO,INST - 700)	-	-	mV/ns	(1),(8),(9)
		0	-	70	pF	-

**Note:** (1) C<sub>LOAD</sub> includes the low-frequency equivalent transmission line capacitance. The capacitance of TX and RX are assumed to always be <10pF. The distributed line capacitance can be up to 50pF for a transmission line with 2ns delay.

(2) When the output voltage is between 400 mV and 930 mV.

(3) Measured as average across any 50 mV segment of the output signal transition.

(4) This parameter value can be lower than TLPX due to differences in rise vs. fall signal slopes and trip levels and mismatches between Dp and Dn LP transmitters.

(5) This value represents a corner point in a piecewise linear curve.

(6) When the output voltage is in the range specified by VPIN(abs-max).

(7) When the output voltage is between 400 mV and 700 mV.

(8) Where VO,INST is the instantaneous output voltage, VDP or VDN, in mini-volts.

(9) When the output voltage is between 700 mV and 930 mV.

(10) TX\_OSC is internal register setting.

#### LP Transmitter AC Specifications

### 2) High-speed receiver

The HS receiver is a differential line receiver. It contains a switch-able parallel input termination, Z<sub>ID</sub>, between the positive input pin Dp and the negative input pin Dn. Under Tables list DC and AC characteristic for HS-RX.

Parameter	Description	Min.	Typ.	Max.	Unit	Note
V <sub>IDTH</sub>	Differential input high threshold	-	-	70	mV	-
V <sub>IDTL</sub>	Differential input low threshold	-70	-	-	mV	-
V <sub>ILHS</sub>	Single-ended input low voltage	-40	-	-	mV	(1)
V <sub>IHHS</sub>	Single-ended input high voltage	-	-	460	mV	(1)
V <sub>CMRXDC</sub>	Common-mode voltage HS receive mode	70	-	330	mV	(1),(2)
Z <sub>ID</sub>	Differential input impedance	80	100	125	Ω	-

**Note:** (1) Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.

(2) This table value includes a ground difference of 50mV between the transmitter and the receiver, the static common-mode level tolerance and variations below 450MHz

#### HS Receiver DC Specifications

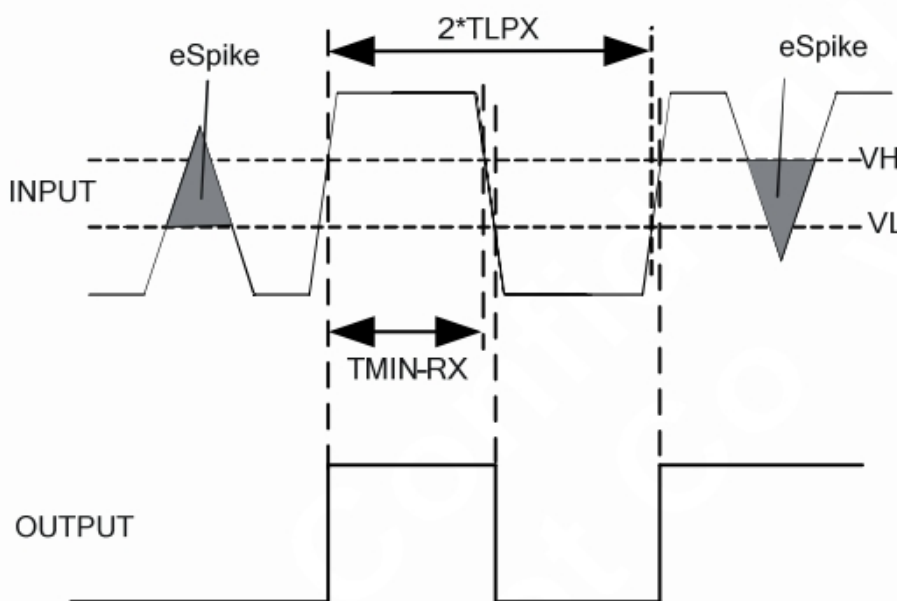
Parameter	Description	Min.	Typ.	Max.	Unit	Note
$\Delta V_{CMRX(HF)}$	Common mode interference beyond 450 MHz	-	-	100	mV <sub>PP</sub>	(1)
$C_{CM}$	Common mode termination	-	-	60	pF	(2)

Note: (1)  $\Delta V_{CMRX(HF)}$  is the peak amplitude of a sine wave superimposed on the receiver inputs.  
 (2) For higher bit rates a 14pF capacitor will be needed to meet the common-mode return loss specification.

HS Receiver AC Specifications

3) Low-power receiver

The low power receiver is an un-terminated, single-ended receiver circuit. The LP receiver is used to detect the Low-Power state on each pin. For high robustness, the LP receiver shall filter out noise pulses and RF interference. It is recommended the implementer optimize the LP receiver design for low power. The LP receiver shall reject any input glitch when the glitch is smaller than eSpike. The filter shall allow pulses wider than TMIN to propagate through the LP receiver. The related diagram shows as Figure 8.8 Input Glitch Rejection of Low-Power Receivers. Besides, under tables list DC and AC characteristic for LP-RX.



Input Glitch Rejections of Low-power Receivers

Parameter	Description	Min.	Typ.	Max.	Unit	Note
$V_{IL}$	Logic 0 input threshold	-	-	550	mV	-
$V_{IH}$	Logic 1 input threshold	880	-	-	mV	-

LP receiver DC specifications

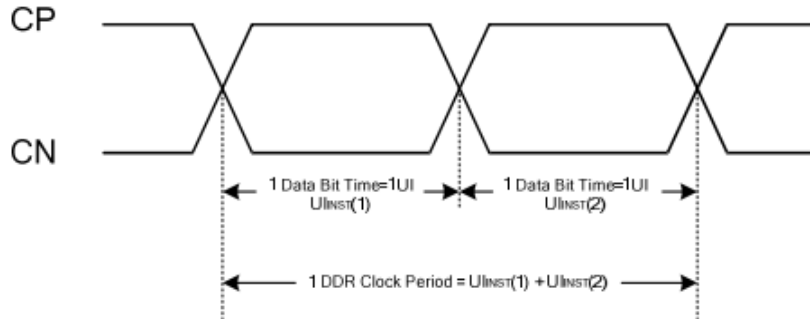
Parameter	Description	Min.	Typ.	Max.	Unit	Note
$e_{SPIKE}$	Input pulse rejection	-	-	300	V.ps	(1),(2), (3)
$T_{MIN-RX}$	Minimum pulse width response	20	-	-	ns	(4)
$V_{INT}$	Peak-to-peak interference voltage	-	-	200	mV	-
$f_{INT}$	Interference frequency	450	-	-	MHz	-

Note: (1) Time-voltage integration of a spike above  $V_{IL}$  when being in LP-0 state or below  $V_{IH}$  when being in LP-1 state  
 (2) An impulse less than this will not change the receiver state.  
 (3) In addition to the required glitch rejection, implementers shall ensure rejection of known RF-interferers.  
 (4) An input pulse greater than this shall toggle the output.

LP Receiver AC Specifications

4) High-speed data-clock timing

The DDR clock signal shall maintain a quadrature phase relationship to the data signal. Data shall be sampled on both the rising and falling edges of the Clock signal. The term “rising edge” means “rising edge of the differential signal, i.e. CP – CN, and similarly for “falling edge”. Therefore, the period of the Clock signal shall be the sum of two successive instantaneous data bit times.



DDR Clock Definition

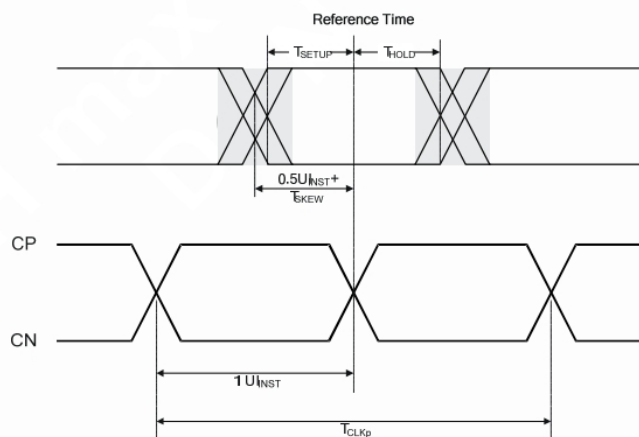
The same clock source is used to generate the DDR Clock and launch the serial data. Since the Clock and Data signals propagate together over a channel of specified skew, the Clock may be used directly to sample the Data lines in the receiver. Such a system can accommodate large instantaneous variations in UI.

The allowed instantaneous UI variation can cause large, instantaneous data rate variations. Therefore, devices shall either accommodate these instantaneous variations with appropriate FIFO logic outside of the PHY or provide an accurate clock source to the Lane Module to eliminate these instantaneous variations.

DSI Mode	Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
550Mbps @ 2-lane	UI instantaneous	$UI_{INST}$	1.82	-	12.5	ns	(1) (2)

Note: (1) This value 1.82ns corresponds to a maximum 550 Mbps data rate, 12.5ns corresponds to a minimum 80 Mbps data rate  
 (2) This value 1.82ns spec is base on 24bpp format.

Reverse HS Data Transmission Timing Parameters



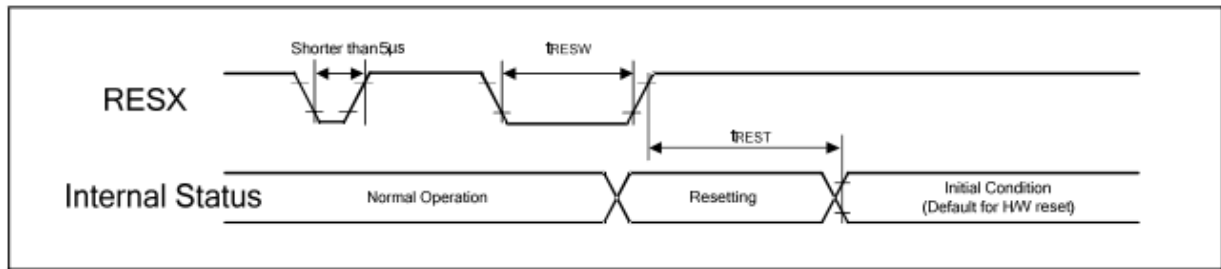
Data to Clock Timing Definition

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Data to Clock Setup Time [Receiver]	$T_{SETUP[RX]}$	0.15	-	-	$UI_{INST}$	1
Clock to Data Hold Time [Receiver]	$T_{HOLD[RX]}$	0.15	-	-	$UI_{INST}$	1

Note: (1) Total setup and hold window for receiver of  $0.3 * UI_{INST}$ .

Data-clock timing specifications

10. Reset Timing Characteristic

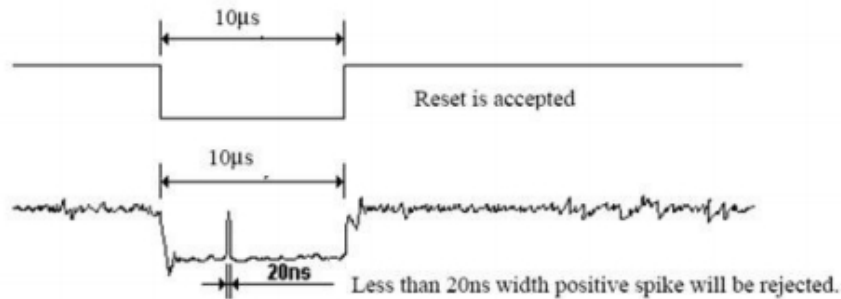


Symbol	Parameter	Related pins	Min.	Typ.	Max.	Note	Unit
$t_{RESW}$	Reset low pulse width <sup>(1)</sup>	RESX	10	-	-	-	$\mu s$
$t_{REST}$	Reset complete time <sup>(2)</sup>	-	5	-	-	When reset is applied during Sleep In mode	ms
		-	120	-	-	When reset is applied during Sleep Out mode	ms

Note: (1) 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 5 $\mu s$	Reset Rejected
Longer than 10 $\mu s$	Reset
Between 5 $\mu s$ and 10 $\mu s$	Reset Start

- (2) 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 returns to Default condition for H/W reset.
- (3) During Reset Complete Time, ID2 value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time ( $t_{REST}$ ) within 5ms after a rising edge of RESX.
- (4) Spike Rejection also applies during a valid reset pulse as shown below:



- (5) When Reset is applied during Sleep In Mode.
- (6) When Reset is applied during Sleep Out Mode.
- (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.



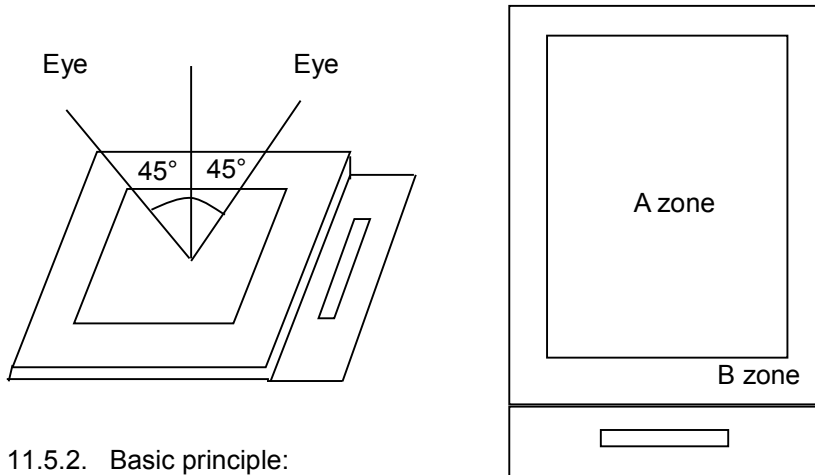
**11.5. Standard of the Product Visual Inspection**

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:

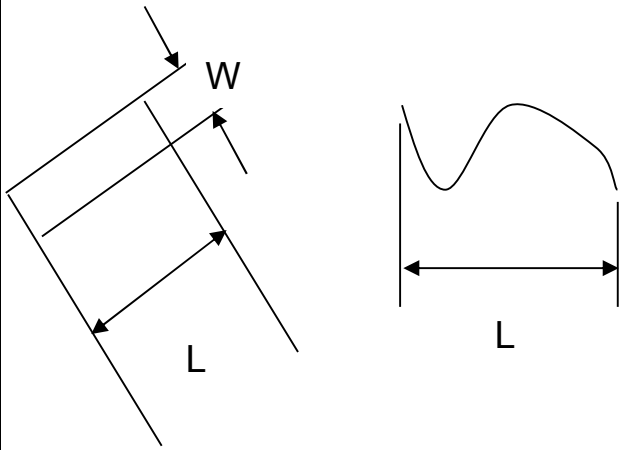
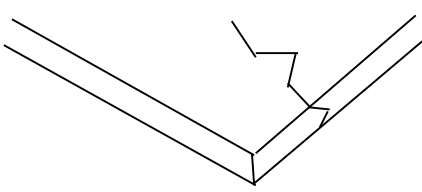
11.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

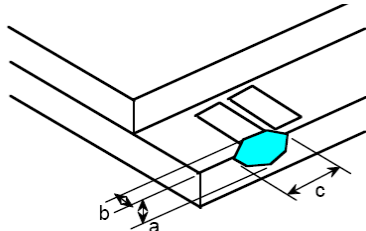
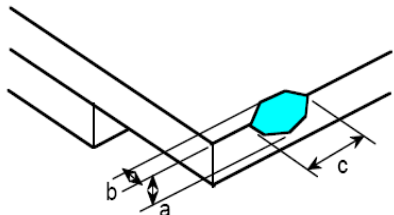
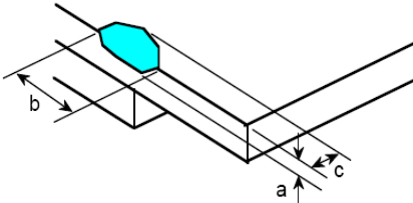
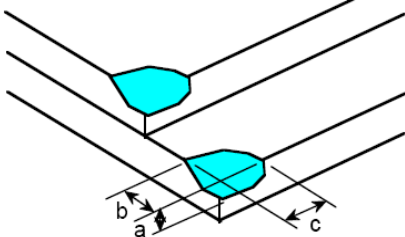
11.5.2.2. New item must be added on time when it is necessary.

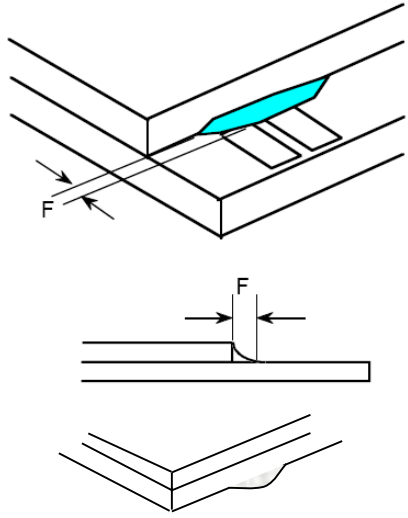
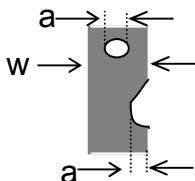
**11.6. Inspection Specification**

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



02	Electrical Defect (Minor defect)	<table border="1"> <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><math>N \leq 2</math></td> <td><math>N \leq 2</math></td> </tr> <tr> <td>Total dot</td> <td><math>N \leq 2</math></td> <td><math>N \leq 2</math></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.																			
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><math>W \leq 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.05 &lt; W \leq 0.10</math></td> <td>2</td> </tr> <tr> <td>/</td> <td><math>0.1 &lt; W</math></td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>3</td> </tr> </tbody> </table>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.10$	2	/	$0.1 < W$	0	Total	
Length	Width	Acc. Qty																	
/	$W \leq 0.03$	Ignore																	
$L \leq 2.5$	$0.03 < W \leq 0.05$	3																	
$L \leq 2.5$	$0.05 < W \leq 0.10$	2																	
/	$0.1 < W$	0																	
Total		3																	
Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.																			
04	Glass Crack (Minor defect)																		
		Crack is potential to enlarge, any type is not allowed.																	

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

<p>09</p>	<p>Glass Burr: (Minor defect)</p> 	<table border="1" data-bbox="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.) 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="726 1339 1200 1554"> <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 1615 1200 1830"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi \leq 0.50</math></td> <td>1</td> </tr> <tr> <td><math>0.50 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi \leq 0.50$	1	$0.50 < \varphi$	None
Diameter	Acc. Qty											
$\varphi \leq 0.20$	Ignore											
$0.20 < \varphi \leq 0.30$	4											
$0.30 < \varphi \leq 0.50$	1											
$0.50 < \varphi$	None											
<p>13</p>	<p>Bezel</p>	<p>13.1 No rust, distortion on the Bezel. 13.2 No visible fingerprints, stains or other contamination.</p>										

14	Touch Panel	<p>D: Diameter W: width L: length</p> <p>14.1 Spot: <math>D &lt; 0.25</math> is acceptable  <math>0.25 \leq D \leq 0.4</math></p> <p>2dots are acceptable and the distance between defects should more than 10 mm.</p> <p><math>D &gt; 0.4</math> is unacceptable</p> <p>14.2 Dent: <math>D &gt; 0.40</math> is unacceptable</p> <p>14.3 Scratch: <math>W \leq 0.03</math>, <math>L \leq 10</math> is acceptable,  <math>0.03 &lt; W \leq 0.10</math>, <math>L \leq 10</math> is acceptable</p> <p>Distance between 2 defects should more than 10 mm.  <math>W &gt; 0.10</math> is unacceptable.</p>
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.

**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.

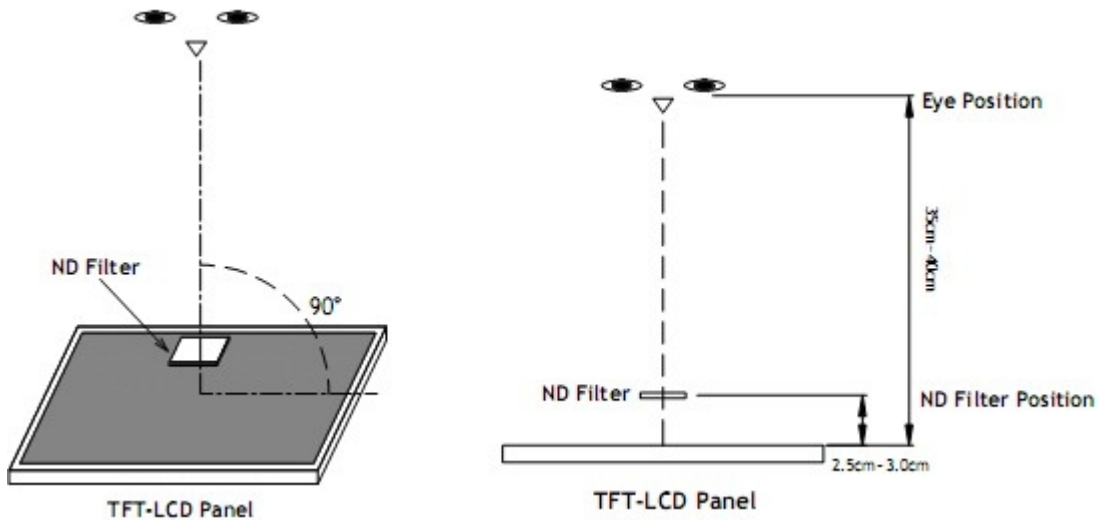
**11.8. Identification/marketing criteria**

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  $350\text{mm} \pm 50\text{mm}$ .

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  $350\text{mm} \pm 50\text{mm}$ .

**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: $\pm 4\text{kV } 150\text{pF}/330 \Omega$ 5 times Contact: $\pm 2\text{kV } 150\text{pF}/330 \Omega$ 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.

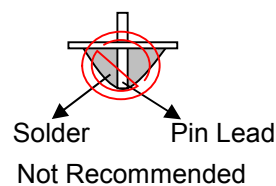
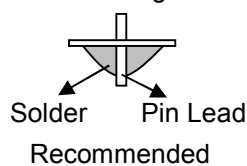
**13.3. Storage**

- 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)**

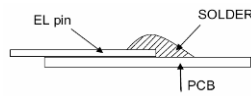
- 13.4.1. Pins of LCD and Backlight
  - 13.4.1.1. Solder tip can touch and press on the tip of Pin LEAD during the soldering
  - 13.4.1.2. Recommended Soldering Conditions
    - Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1
    - Maximum Solder Temperature: 370°C
    - Maximum Solder Time: 3s at the maximum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

13.4.1.3. Solder Wetting

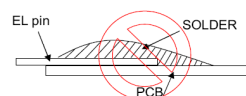


- 13.4.2. Pins of EL
  - 13.4.2.1. Solder tip can touch and press on the tip of EL leads during soldering.
  - 13.4.2.2. No Solder Paste on the soldering pad on the motherboard is recommended.
  - 13.4.2.3. Recommended Soldering Conditions
    - Solder type: Nippon Alimit Leadfree SR-34, size 0.5mm
    - Recommended Solder Temperature: 270~290°C
    - 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

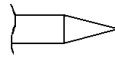


Recommended

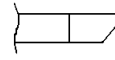


Not Recommended

13.4.2.7. The type of the solder iron:

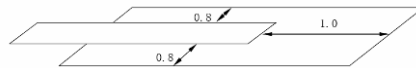


Recommended



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.

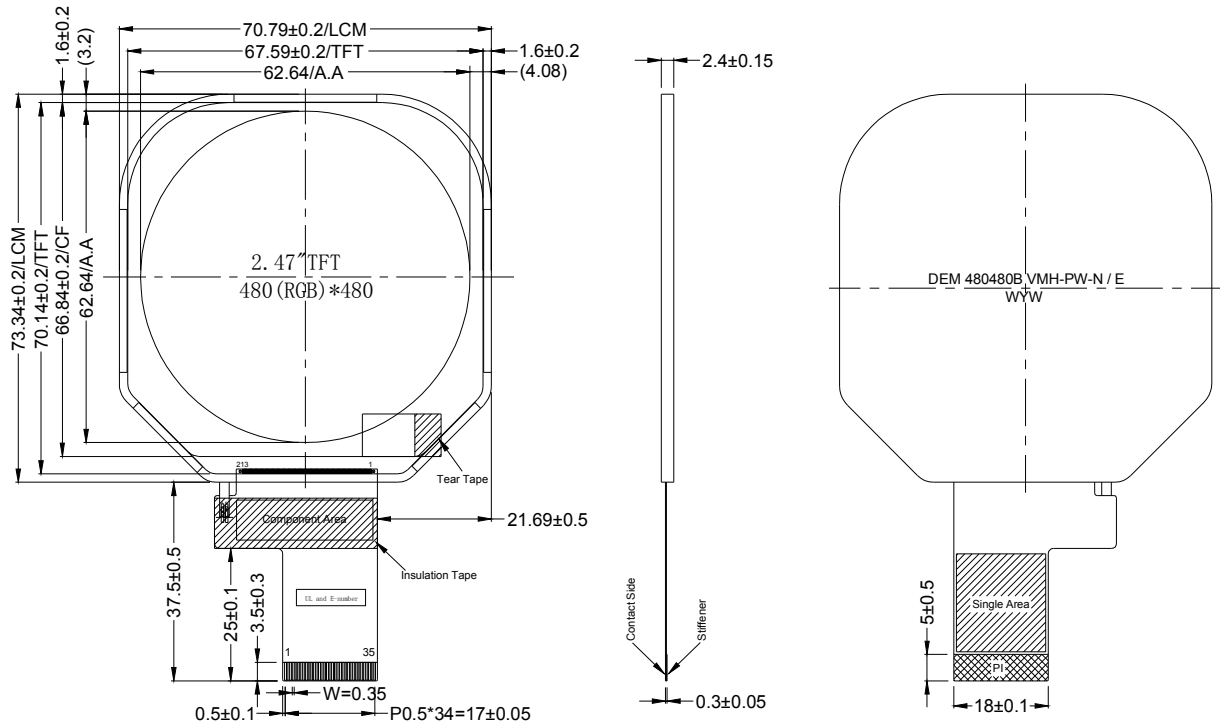
**13.6.Static Electricity**

- 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.

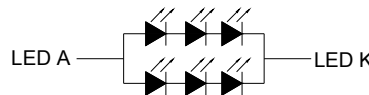
14. Outline Drawing



NOTES:

1. Display Size: 2.47" TFT
2. Viewing Direction: FULL VIEW
3. Display Mode: Transmissive / Normal Black / Anti-Glare
4. Operation Temperature: -20°C to +70°C
5. Storage Temperature: -30°C to +80°C
6. Driver IC: HX8379-C (Himax)
7. Logic Power Supply Voltage: 3.3V (typ.)
8. Brightness: 400cd/m<sup>2</sup> (typ.)
9. Backlight: White(6xLEDs) 9.6V/40mA (typ.)

\* Unspecification tolerance are ±0.2mm  
 \* The dimension with mark brackets "(") just for reference



Pin assignment	
PIN	SYMBOL
1	GND
2	DSI_D1P
3	NC
4	DSI_D1N
5	GND
6	GND
7	GND
8	DSI_CP
9	NC
10	DSI_CN
11	GND
12	GND
13	GND
14	DSI_D0P
15	NC
16	DSI_D0N
17	GND
18	GND
19	ID0
20	ID1
21	RST
22	NC
23	THERM
24	IOVCC
25	GND
26	VCI
27	VCI
28	GND
29	LED-
30	LED-
31	NC
32	LED+
33	LED+
34	NC
35	GND