

Display Elektronik GmbH

# DATA SHEET

*TFT MODULE*

**DEM 1280400B VM-PW-N**

**13,9“ TFT**

Product Specification

Version: 0

26.12.2024

**Revision History**

Date	Rev. No.	Page	Summary
26.12.2024	0	ALL	FIRST ISSUE

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**\* Description**

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Panel, driver circuit, Backlight unit. The resolution of a 13.9" TFT-LCD contains 1280x398 pixels, and can display up to 16.7Million colors.

**\* Features**

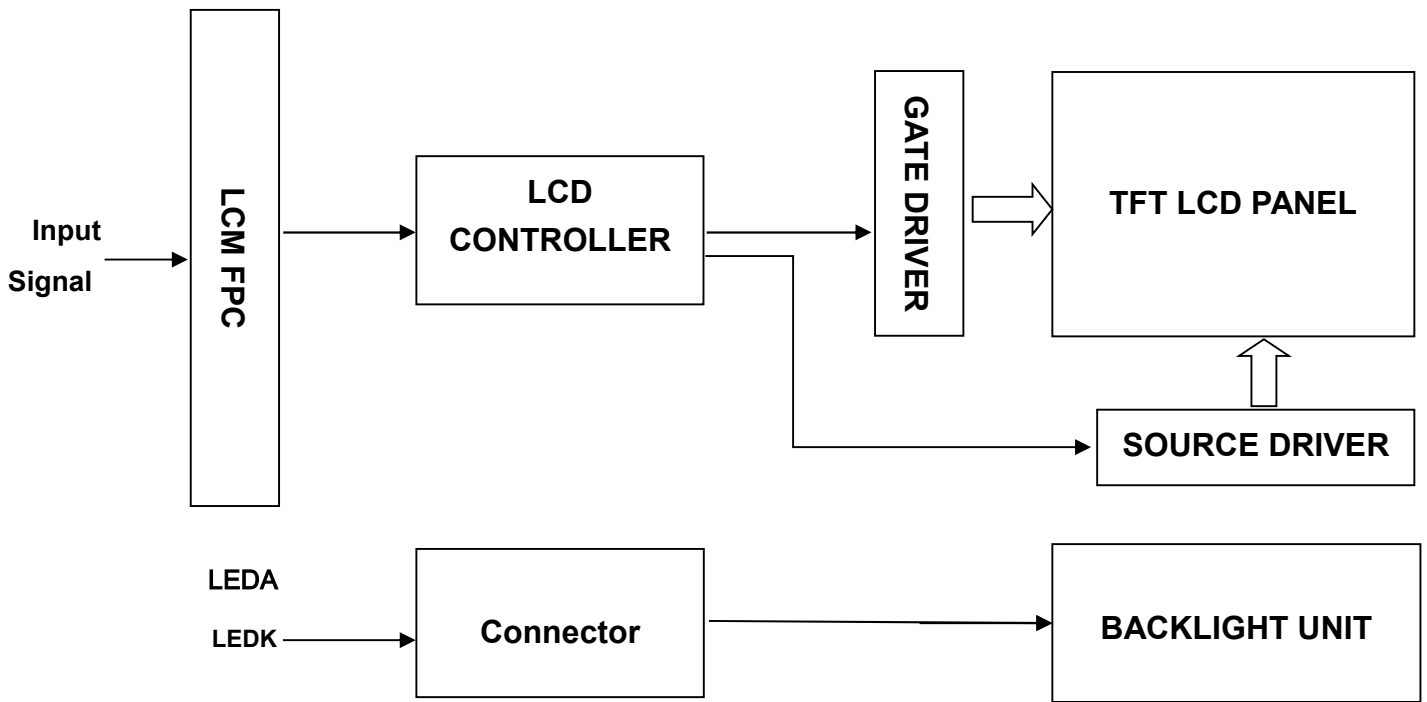
- Low Input Voltage: 3.3V (TYP)

General Information Items	Specification	Unit	Note
	Main Panel		
Display Area(AA)	337.92 x 105.10 (13.9inch )	mm	-
Driver Element	TFT Active Matrix	-	-
Display Colors	16.7 Million	colors	-
Number of Pixels	1280 x RGB x 398	dots	-
TFT Pixel Arrangement	RGB Vertical Stripe	-	-
Pixel Pitch	0.264 x 0.264	mm	-
Viewing Angle	ALL	o'clock	-
LCM Driver IC	HX8249 / HX8678 (HIMAX)	-	-
LCM Interface	2-Port LVDS	-	-
Display Mode	IPS, Transmissive / Normally Black	-	-
Operating Temperature	0°C ~ +50°C	°C	-
Storage Temperature	-20°C ~ +60°C	°C	-

**\* Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	358.5	-	mm	-
	Vertical(V)	-	135	-	mm	-
	Depth(D)	-	13.3	-	mm	-
Weight		-	t.b.d.	-	g	-

1. Block Diagram

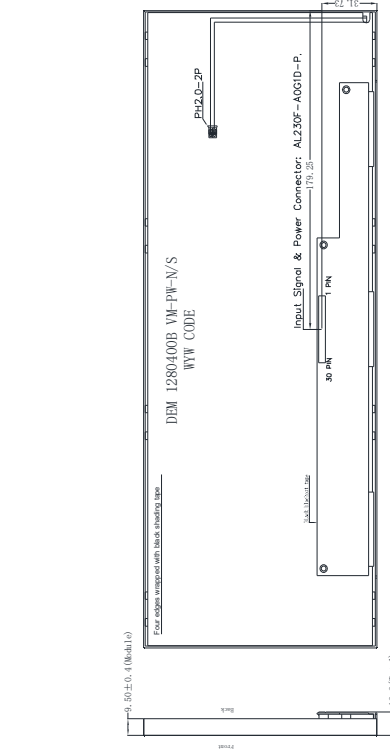


2. Outline Dimension

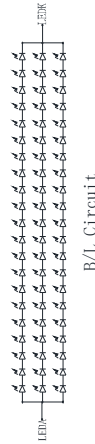
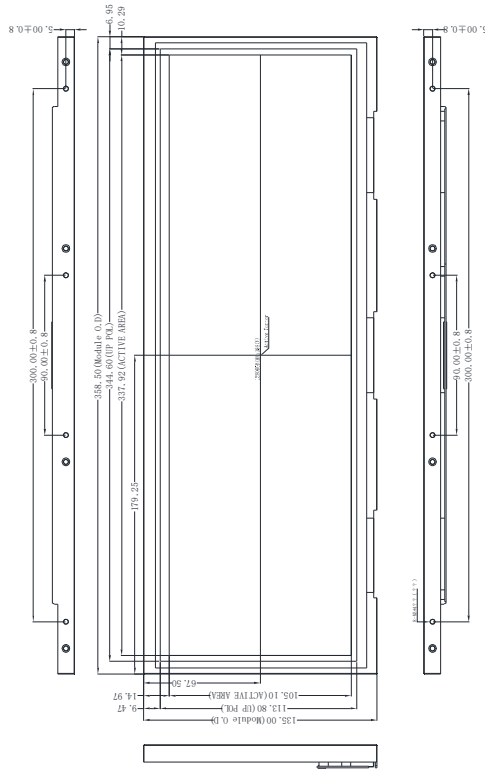
Bottom View

Pin	Name
1	RxOIN0-
2	RxOIN0+
3	RxOIN1-
4	RxOIN1+
5	RxOIN2-
6	RxOIN2+
7	GND
8	RxOCLK-
9	RxOCLK+
10	RxO3-
11	RxO3+
12	RxE0-
13	RxE0+
14	GND
15	RxE1-
16	RxE1+
17	GND
18	RxE2-
19	RxE2+
20	RxECLK-
21	RxECLK+
22	RxE3-
23	RxE3+
24	GND
25	NC
26	NC
27	NC
28	VDD
29	VDD
30	VDD

Side View



Front View



- NOTE:
1. DISPLAY TYPE: 13.9", TFT-LCD, 16.7M COLORS
  2. DISPLAY MODE: NORMALLY BLACK/TIPS
  3. VIEWING DIRECTION: ALL
  4. LCM Interface: 2-Port LVDS
  5. VDD: 3.3V (TYP.)
  6. OPERATING TEMP: 0° C TO 50° C  
STORAGE TEMP: -20° C TO 60° C
  7. BACK LIGHT: LED WHITE, 63 LED (4014), 180-270mA, 55-68V
  8. RoHS COMPLIANT.

### 3. Input Terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	RxOIN0-	Negative LVDS differential data input (Odd data)	I
2	RxOIN0+	Positive LVDS differential data input (Odd data)	I
3	RxOIN1-	Negative LVDS differential data input (Odd data)	I
4	RxOIN1+	Positive LVDS differential data input (Odd data)	I
5	RxOIN2-	Negative LVDS differential data input (Odd data,DSPTMG)	I
6	RxOIN2+	Positive LVDS differential data input (Odd data,DSPTMG)	I
7	GND	Power Ground	P
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)	I
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)	I
10	RxOIN3-	Negative LVDS differential data input (Odd data)	I
11	RxOIN3+	Positive LVDS differential data input (Odd data)	I
12	RxEIN0-	Negative LVDS differential data input (Even data)	I
13	RxEIN0+	Positive LVDS differential data input (Even data)	I
14	GND	Power Ground	P
15	RxEIN1-	Positive LVDS differential data input (Even data)	I
16	RxEIN1+	Negative LVDS differential data input (Even data)	I
17	GND	Power Ground	P
18	RxEIN2-	Negative LVDS differential data input (Even data)	I
19	RxEIN2+	Positive LVDS differential data input (Even data)	I
20	RxECLK-	Negative LVDS differential clock input (Even clock)	I
21	RxECLK+	Positive LVDS differential clock input (Even clock)	I
22	RxEIN3-	Negative LVDS differential data input (Even data)	I
23	RxEIN3+	Positive LVDS differential data input (Even data)	I
24	GND	Power Ground	P
25	NC	No contact	-
26	NC	No contact	-
27	NC	No contact	-
28	VDD	+5V power supply	P
29	VDD	+5V power supply	P
30	VDD	+5V power supply	P

**4. LCD Optical Characteristics**

**4.1 Optical Specification**

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$	600	700	--		(1)(2)
Response Time	Rising	$T_{R+T_F}$	Normal viewing angle	--	5	8	msec	(1)(3)
	Falling							
Color Gamut		S(%)		--	72	--	%	
Color Filter Chromaticity	White	$W_X$			0.322			(1)(4) CA-310
		$W_Y$			0.355			
	Red	$R_X$			0.620			
		$R_Y$			0.361			
	Green	$G_X$			0.323			
		$G_Y$			0.597			
	Blue	$B_X$			0.147			
		$B_Y$			0.057			
Viewing Angle	Hor.	$\Theta_L$	CR>10	--	85	--		(1)(4)
		$\Theta_R$		--	85	--		
	Ver.	$\Theta_U$		--	80	--		
		$\Theta_D$		--	80	--		
Option View Direction		ALL						

\*The data comes from the LCD specification.

**Measuring Condition**

Measuring surrounding: dark room

Ambient temperature: 25°C ± 2°C

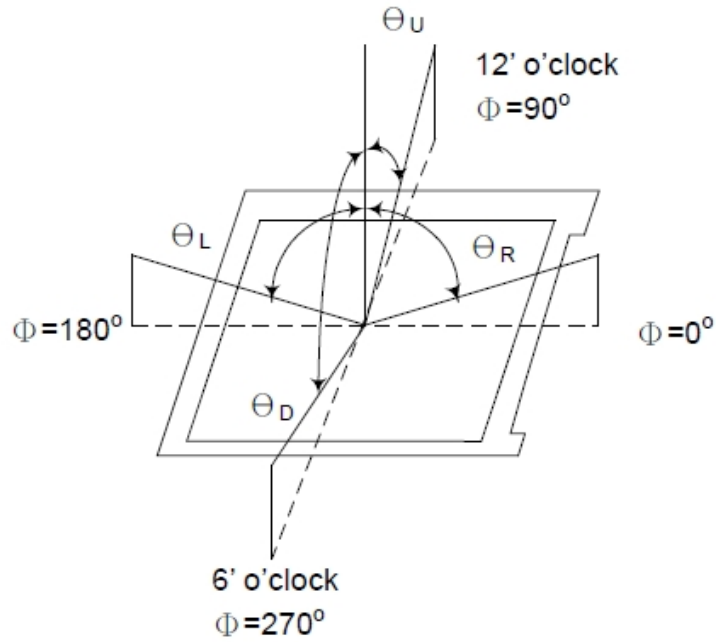
15min. warm-up time.

**Measuring Equipment**

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.



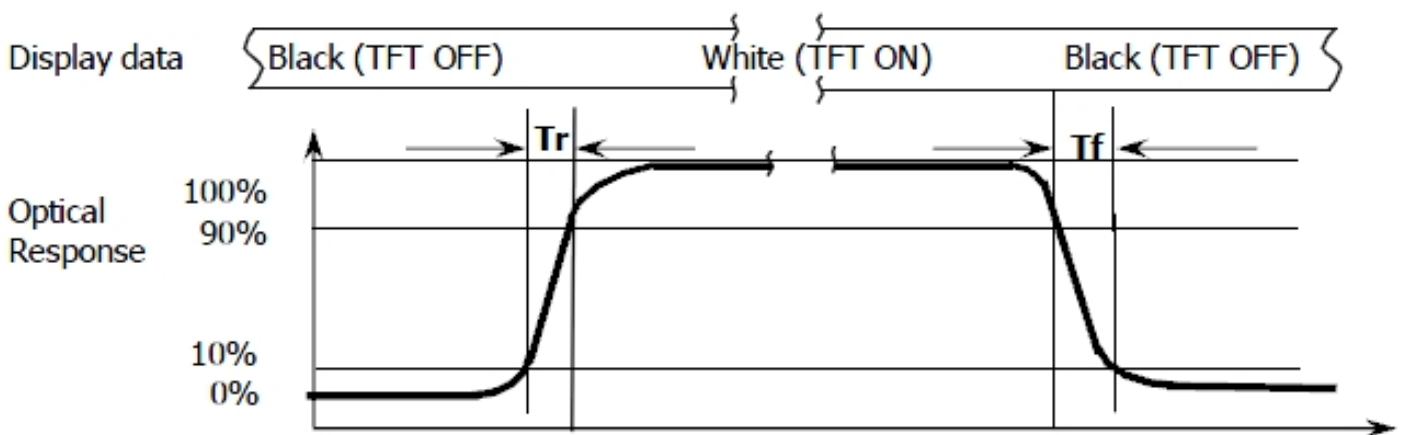
**Note (1):** Definition of Viewing Angle :



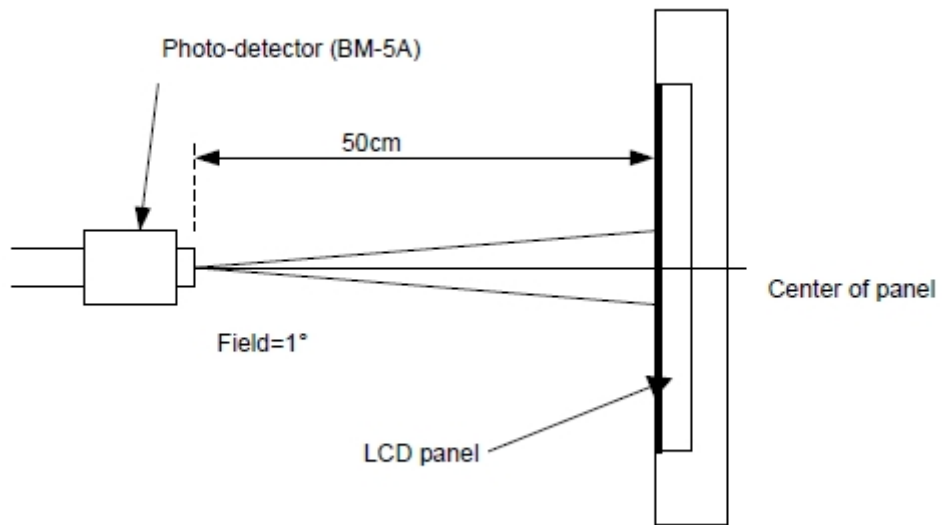
**Note (2):** Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

**Note (3):** Response Time



**Note (4):** Definition of optical measurement setup



## 5. Electrical Characteristics

### 5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	DVDD	-0.3	5.5	V
Operating temperature	T <sub>OP</sub>	0	+50	°C
Storage temperature	T <sub>ST</sub>	-20	+60	°C

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged.  
Be sure to use the product within the range of the absolute maximum ratings.

### 5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	4.5	5	5.5	V	-
Digital Supply Current	IDD	-	800	1600	mA	-
Level Input Voltage	V <sub>IH</sub>	0.7DVDD	-	DVDD	V	-
	V <sub>IL</sub>	GND	-	0.3DVDD	V	-
Level Output Voltage	V <sub>OH</sub>	DVDD	-	--	V	-
	V <sub>OL</sub>	GND	-	GND	V	-

**5.3 LED Backlight Characteristics**

The Backlight system is edge-lighting type with 63 chips White LED

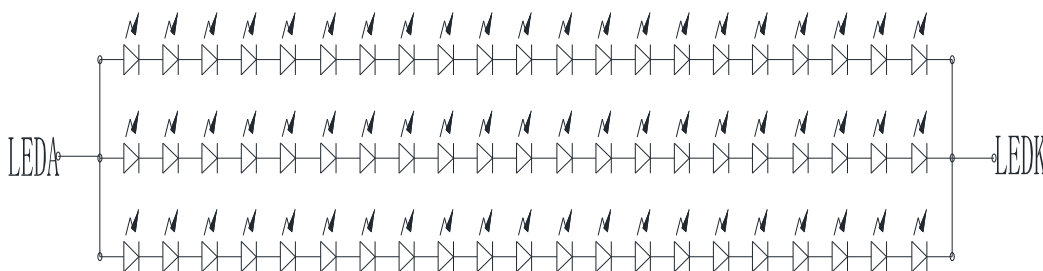
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I <sub>F</sub>	-	180	270	mA	
Forward Voltage	V <sub>F</sub>	-	55	68	V	
LCM Luminance	L <sub>v</sub>	1200	1400		cd/m <sup>2</sup>	Note3
LED life time	Hr	50000	--	--	Hour	Note1,2
Uniformity	AVg	80	--	--	%	Note3

Note (1) LED Lifetime (hr) can be defined as the time in which it continues to operate under the condition: Ta=25°C ± 3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED Lifetime” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=270mA.

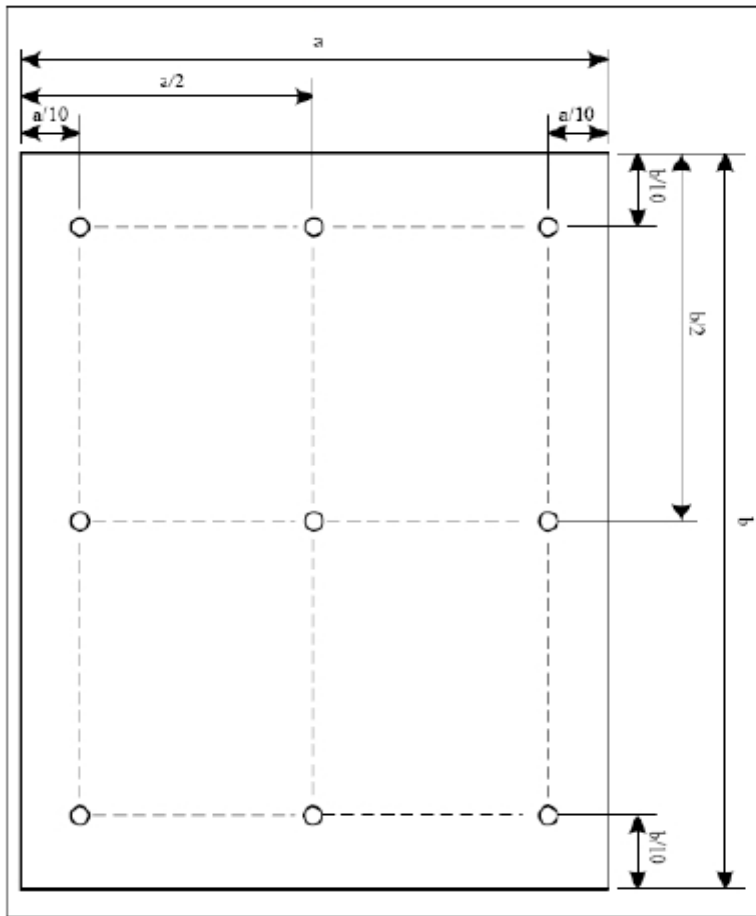
The LED lifetime could be decreased if operating IL is larger than 270mA.

The constant current driving method is suggested.



B/L Circuit

NOTE 3: Luminance Uniformity of these 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

## 6. AC Characteristic

### 6.1 LVDS interface

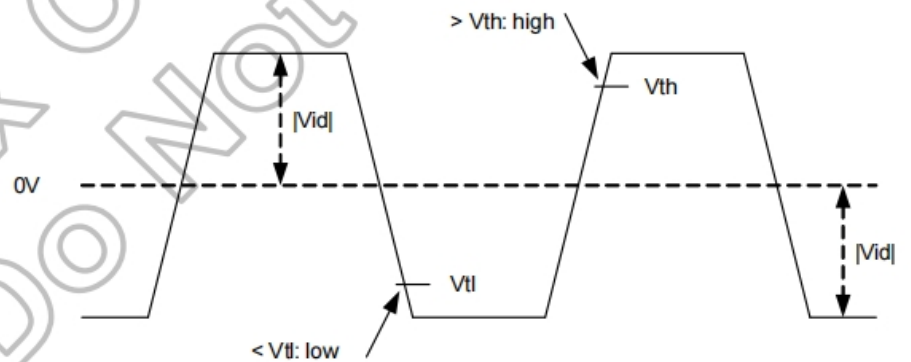
(VDD1=VDD2=2.7 to 3.6V, VSS1=VSS2=VSSA=0V, T<sub>OP</sub> = 25°C)

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Differential input high Threshold voltage	V <sub>th</sub>	V <sub>cm</sub> =1.2V	-	-	+0.1	V
Differential input low threshold voltage	V <sub>tl</sub>		-0.1	-	-	V
Differential input common Mode voltage	V <sub>cm</sub>	-	1	1.2	1.8- V <sub>id</sub>  /2	V
LVDS input voltage	V <sub>INLV</sub>		0.7		1.8	V
Differential input voltage	V <sub>id</sub>	-	0.1	-	0.6	V
Differential input leakage Current	I <sub>lvleak</sub>	-	-10	-	+10	μA
Termination Resistor	Z <sub>id</sub>	-	80	100	120	Ω

**Single-ended:**  
 LVCLKP (R),  
 LVCLKN (R),  
 LVD [3:0]P(R),  
 LVD [3:0]N(R)



**Differential:**  
 LVCLKP (R)-LVCLKN (R),  
 LVD [3:0]P(R)-  
 LVD [3:0]N(R)



## 6.2 Analog circuit

(VDD1=VDD2=2.7 to 3.6V, VSS1=VSS2=VSSA=0V, T<sub>A</sub>=25°C)

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
Analog positive supply voltage	AVDDP	AVDDP is generated by PFM, AVDDPS[3:0]=Dh, with proper settings and components.	6.15	6.3	6.45	V
Analog negative supply voltage	AVDDN	AVDDN is generated by PFM, AVDDNS[3:0]=Dh, with proper settings and components.	-6.45	-6.3	-6.15	V
Source driver positive supply voltage	VSDP	AVDDP=6.3V, VSDPS[3:0]=Fh, loading current=0	5.95	6.1	6.25	V
Source driver negative supply voltage	VSDN	AVDDN= -6.3V, VSDNS[3:0]=Fh, loading current=0	-6.25	-6.1	-5.95	V
Output for positive gamma reference high voltage	VGMPHO	VSDP ≥ 6V, VGMPHS[4:0]=12h, connected to VGMPHI.	5.75	5.9	6.05	V
Output for positive gamma reference low voltage	VGMPLO	VGMPLS[3:0]=0h, connected to VGMPLI.	0.15	0.2	0.25	V
Output for negative gamma reference high voltage	VGMNHO	VSDN ≤ -6V, VGMNHS[4:0]=12h, connected to VGMNHI.	-6.05	-5.9	-5.75	V
Output for negative gamma reference low voltage	VGMNLO	VGMNLS[3:0]=0h, connected to VGMNLI.	-0.25	-0.2	-0.15	V
VCOM voltage	VCOM	VCOMS[7:0]=80h	-1.768	-1.728	-1.688	V
OTP programming voltage	VDDOTP	OTP program sequence < 60sec.	7.4	7.5	7.7	V
Internal digital operating voltage	DVDD	-	1.4	1.5	1.6	V
Internal regulator output for negative level shifter	VCL	-	-2.65	-2.5	-2.35	V
Source output voltage, positive polarity	V <sub>SDOP</sub>	-	0.2	-	VSDP-0.2	V
Source output voltage, negative polarity	V <sub>SDON</sub>	-	VSDN+0.2	-	-0.2	V
Output for gate driver positive power supply	VGH	VGH is generated by charge pump, VGHS[2:0]=4h, loading current=0.	14.5	16	17.5	V
Output for gate driver negative power supply	VGL	VGL is generated by charge pump, VGLS[2:0]=3h, loading current=0.	-11	-10	-9	V

Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
Source output voltage deviation	V <sub>OD</sub>	VSO=0.2 to 1V VSO= -1 to -0.2V	-	-	15	mV
		VSO=1V to (VSDP – 1V) VSO=(VSDN+ 1V) to -1V			10	mV
		VSO=(VSDP - 1V) to (VSDP - 0.2V) VSO=(VSDN + 0.2V) to (VSDN + 1V)	-	-	15	mV
Standby current (VDD1 + VDD2)	I <sub>STBVDD</sub>	STBYB=0, stop all input signal and all input signals match internal pull high/low	-	-	150	μA
Standby current (AVDDP)	I <sub>STBAVDDP</sub>	-	-	-	20	μA
Standby current (AVDDN)	I <sub>STBAVDDN</sub>	-	-80	-	-	μA



**6.3 LVDS Timing**

Signal	Item	Symbol	Min	Typ	Max	Unit
Vertical Section	Period	$T_v$	1032	1066	1150	Th
	Active	$T_{disp(v)}$	1024	1024	1024	Th
	Blanking	$T_{bp(v)}+T_{fp(v)}+PW_{vs}$	8	42	126	Th
Horizontal Section	Period	$T_h$	780	844	2048	Tclk
	Active	$T_{disp(h)}$	640	640	640	Tclk
	Blanking	$T_{bp(h)}+T_{fp(h)}+PW_{hs}$	140	204	1408	Tclk
Clock	Period	Tclk	14.81	18.52	25	ns
	Frequency	Freq	40	54	67.5	MHz
Frame rate	Frame rate	F	50	60	75	Hz

## 7. LCD Module Out-Going Quality Level

### 7.1 VISUAL & FUNCTION INSPECTION STANDARD

#### 7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

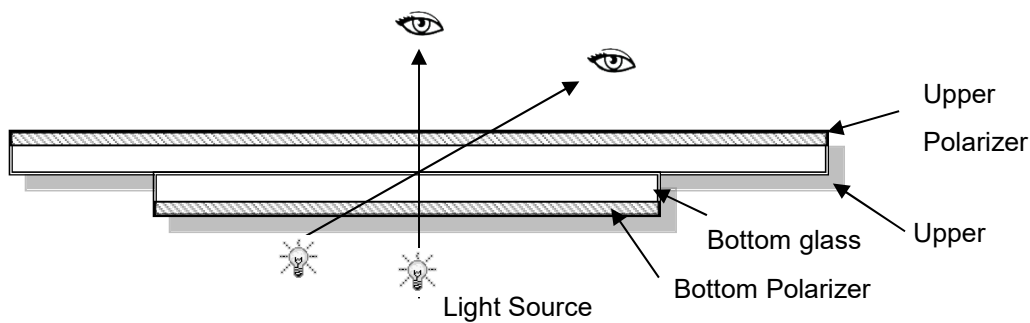
Temperature :  $25\pm 5^{\circ}\text{C}$

Humidity :  $65\%\pm 10\%\text{RH}$

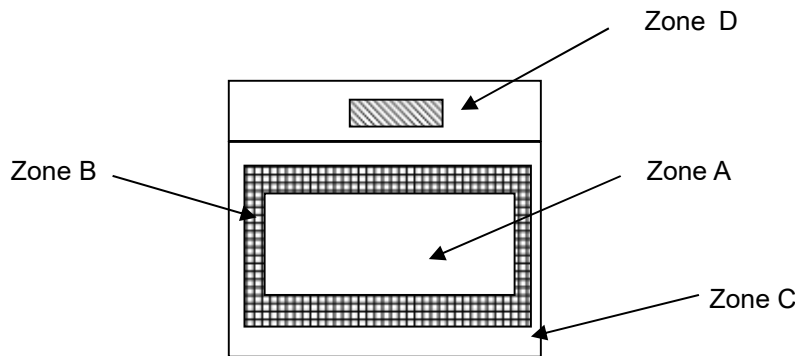
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



#### 7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note: As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

**7.1.3 Sampling Plan**

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

Major defect	Minor defect
0.65	1.5

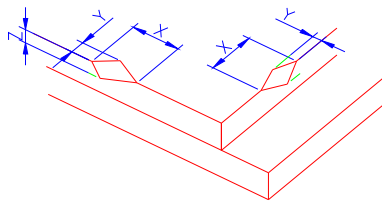
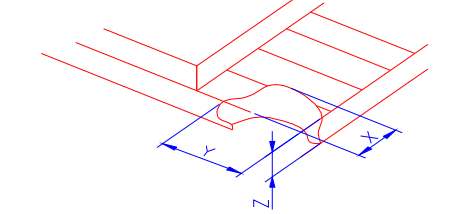
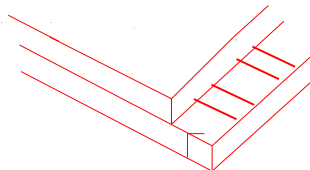
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc...	Major
2	Missing	Missing components and etc...	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed, deformation and etc...	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot, Dim spot, (Note1) Polarizer Air Bubble, Polarizer accidented spot and etc...	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc...	
7	LCD/Polarizer	Black/White spot/line, scratch, crack, etc.	

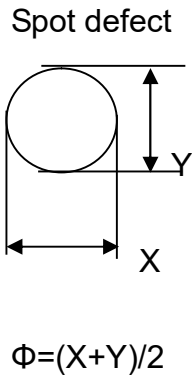
**Note1:** a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 <table border="1" data-bbox="762 611 1465 757"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>&lt;Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2) LCD corner broken	 <table border="1" data-bbox="842 1066 1385 1167"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	 <p style="text-align: center;">Crack Not allowed</p>							

2.0



① light dot ( black/white spot , pinhole, stain, etc. )

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3(distance $\geq 10$ mm)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)		
$\Phi > 0.4$	0		

② Dim spot ( light leakage, dent, dark spot, etc )


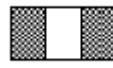

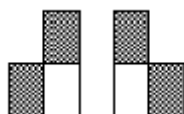
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3( distance $\geq 10$ mm)		
$0.25 < \Phi \leq 0.4$	2( distance $\geq 10$ mm)		
$\Phi > 0.4$	0		


③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.5$	2( distance $\geq 10$ mm)		
$\Phi > 0.5$	0		

④ Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)		
$0.4 < \Phi \leq 0.5$	1		
$\Phi > 0.5$	0		

3.0	LCD Pixel defect	<p>Pixel bad points</p> <table border="1" data-bbox="544 253 1500 1003"> <thead> <tr> <th data-bbox="544 253 738 304">Item</th> <th data-bbox="738 253 1254 304">Zone A</th> <th data-bbox="1254 253 1500 304">Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td data-bbox="544 304 738 465" rowspan="3">Bright dot</td> <td data-bbox="738 304 1254 360">Random</td> <td data-bbox="1254 304 1500 360">N≤2</td> </tr> <tr> <td data-bbox="738 360 1254 416">2 dots adjacent</td> <td data-bbox="1254 360 1500 416">N≤0</td> </tr> <tr> <td data-bbox="738 416 1254 465">3 dots adjacent</td> <td data-bbox="1254 416 1500 465">N≤0</td> </tr> <tr> <td data-bbox="544 465 738 633" rowspan="3">Dark dot</td> <td data-bbox="738 465 1254 521">Random</td> <td data-bbox="1254 465 1500 521">N≤3</td> </tr> <tr> <td data-bbox="738 521 1254 577">2 dots adjacent</td> <td data-bbox="1254 521 1500 577">N≤0</td> </tr> <tr> <td data-bbox="738 577 1254 633">3 dots adjacent</td> <td data-bbox="1254 577 1500 633">N≤0</td> </tr> <tr> <td data-bbox="544 633 738 943">Distance</td> <td data-bbox="738 633 1254 943">                     1. Minimum Distance Between Bright dots.                      2. Minimum Distance Between dark dots                      3. Minimum Distance Between dark and bright dot.                 </td> <td data-bbox="1254 633 1500 943">5mm</td> </tr> <tr> <td colspan="2" data-bbox="544 943 1254 1003">Total bright and dark dot</td> <td data-bbox="1254 943 1500 1003">N≤4</td> </tr> </tbody> </table> <p data-bbox="544 1014 624 1043">Note:</p> <p data-bbox="544 1066 1485 1155">A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p data-bbox="544 1178 1445 1267">B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p data-bbox="544 1312 1038 1357">C) 2 dot adjacent = 1 pair = 2 dots</p> <p data-bbox="544 1368 655 1402">Picture:</p> <div data-bbox="671 1447 751 1514" style="display: inline-block; text-align: center;">  </div> <p data-bbox="592 1559 799 1592">2 dot adjacent</p> <div data-bbox="1078 1447 1190 1514" style="display: inline-block; text-align: center;">  </div> <p data-bbox="1031 1559 1238 1592">2 dot adjacent</p> <div data-bbox="679 1615 719 1727" style="display: inline-block; text-align: center;">  </div> <p data-bbox="544 1749 879 1783">2 dot adjacent (vertical)</p> <div data-bbox="1086 1615 1270 1727" style="display: inline-block; text-align: center;">  </div> <p data-bbox="1023 1749 1326 1783">2 dot adjacent (slant)</p>	Item	Zone A	Acceptable Qty	Bright dot	Random	N≤2	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Dark dot	Random	N≤3	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm	Total bright and dark dot		N≤4
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4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length  N : Count	<table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.05</math></td> <td>Ignore</td> <td colspan="2">Ignore</td> <td rowspan="3">Ignore</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.06</math></td> <td><math>L \leq 5.0</math></td> <td colspan="2">N<math>\leq</math>3</td> </tr> <tr> <td><math>0.06 &lt; W \leq 0.08</math></td> <td><math>L \leq 4.0</math></td> <td colspan="2">N<math>\leq</math>2</td> </tr> <tr> <td><math>W &gt; 0.08</math></td> <td colspan="3">Define as spot defect</td> <td></td> </tr> </tbody> </table>	Width(mm)	Length(m)	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore		Ignore	$0.05 < W \leq 0.06$	$L \leq 5.0$	N $\leq$ 3		$0.06 < W \leq 0.08$	$L \leq 4.0$	N $\leq$ 2		$W > 0.08$	Define as spot defect			
		Width(mm)			Length(m)	Acceptable Qty																						
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$0.06 < W \leq 0.08$	$L \leq 4.0$	N $\leq$ 2																										
$W > 0.08$	Define as spot defect																											
5.0	Electronic Components SMT.	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite																										
6.0	Display color& Brightness.	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.																										
7.0	LCD Mura/Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.																										

Criteria ( functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed

**8. Reliability Test Result**

Remark:

Item	Condition	Inspection after test
High Temperature Operating	50°C,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	0°C, 96HR	
High Temperature Storage	60°C, 96HR	
Low Temperature Storage	-20°C, 96HR	
High Temperature & High Humidity Operating	+50°C, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	0°C,30 min ↔ 50°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(MEDIUM)	

1. The test samples should be applied to only one test item.
2. Sample size for each test item is 5~10pcs.
3. For Damp Proof Test, Pure water (Resistance > 10MΩ) should be used.
4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.



## **9. Cautions and Handling Precautions**

### **9.1 Handling and Operating the Module**

- (1) When the module is assembled, it should be attached to the system firmly.  
Do not warp or twist the module during assembly work.
- (2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and Backlight unit.
- (3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
- (4) Do not allow drops of water or chemicals to remain on the display surface.  
If you have the droplets for a long time, staining and discoloration may occur.
- (5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.  
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride.  
It might permanent damage to the polarizer due to chemical reaction.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth.  
In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static; it may cause damage to the CMOS ICs.
- (9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (10) Do not disassemble the module.
- (11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (12) Pins of I/F connector shall not be touched directly with bare hands.
- (13) Do not connect, disconnect the module in the "Power ON" condition.
- (14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

### **9.2 Storage and Transportation.**

- (1) Do not leave the panel in high temperature, and high humidity for a long time.  
It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%
- (2) Do not store the TFT-LCD module in direct sunlight.
- (3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
- (4) It is recommended that the modules should be stored under a condition where no condensation is allowed.  
Formation of dewdrops may cause an abnormal operation or a failure of the module.  
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
- (5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.