

**DISPLAY Elektronik GmbH**

# DATA SHEET

**TFT MODULE**

**DEM 480128B TMH-PW-N**

**3,9“ TFT**

**Product Specification**

**Version: 3**

**04.01.2019**

## **Revision History**

<b>VERSION</b>	<b>DATE</b>	<b>REVISED PAGE NO.</b>	<b>Note</b>
0	18.12.2017		First issue
1	06.03.2018		Modify Block Diagram
2	31.05.2018		Add TFT Driver IC & TFT Interface
3	04.01.2019		Add Uniformity

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## **1. Summary**

TFT 3.9" is a TN transmissive type color active matrix TFT liquid crystal display that use amorphous silicon TFT as switching devices. This module is a composed of a TFT\_LCD module, It is usually designed for industrial application and this module follows RoHs.

## **2. General Specifications**

- n Size: 3.9 Inch
- n Dot Matrix: 480x128 x RGB (TFT) dots
- n Module dimension: 105.50 x 37.00 x 3.05 mm
- n Active area: 95.04 x 25.34 mm
- n Dot pitch: 0.066 x 0.198 mm
- n LCD type: TFT, Normally White, Transmissive
- n View Direction: 6 o'clock
- n Gray Scale Inversion Direction: 12 o'clock
- n Aspect Ratio: Bar Type
- n Backlight Type: LED, Normally White
- n TFT Driver IC: HX8278-A Or Equal
- n TFT Interface: RGB-24BIT (SYNC mode)
- n With /Without TP: Without TP
- n Surface: Anti-Glare

\*Color tone slight changed by temperature and driving voltage.

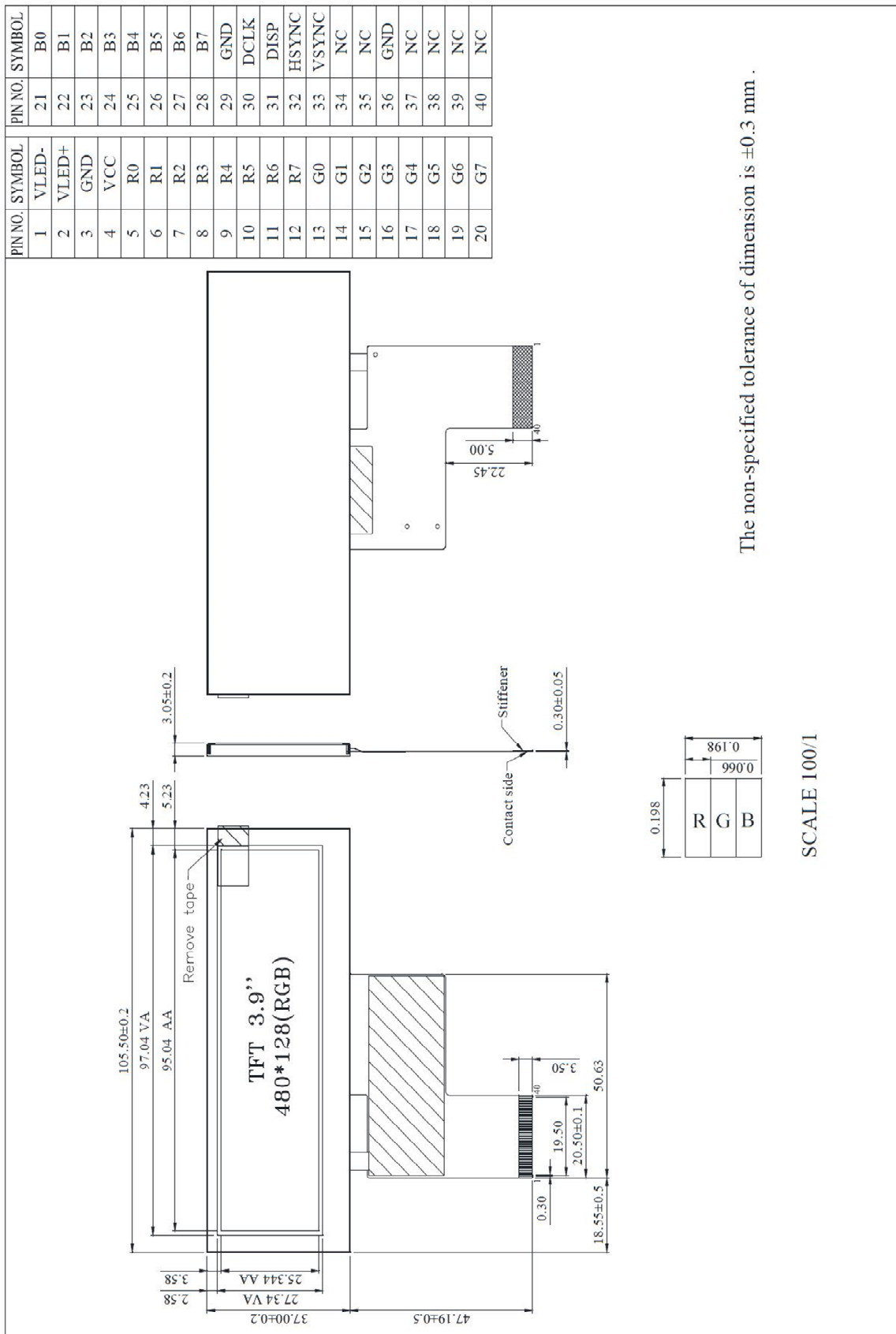
### 3. Interface

#### 3.1. LCM PIN Definition

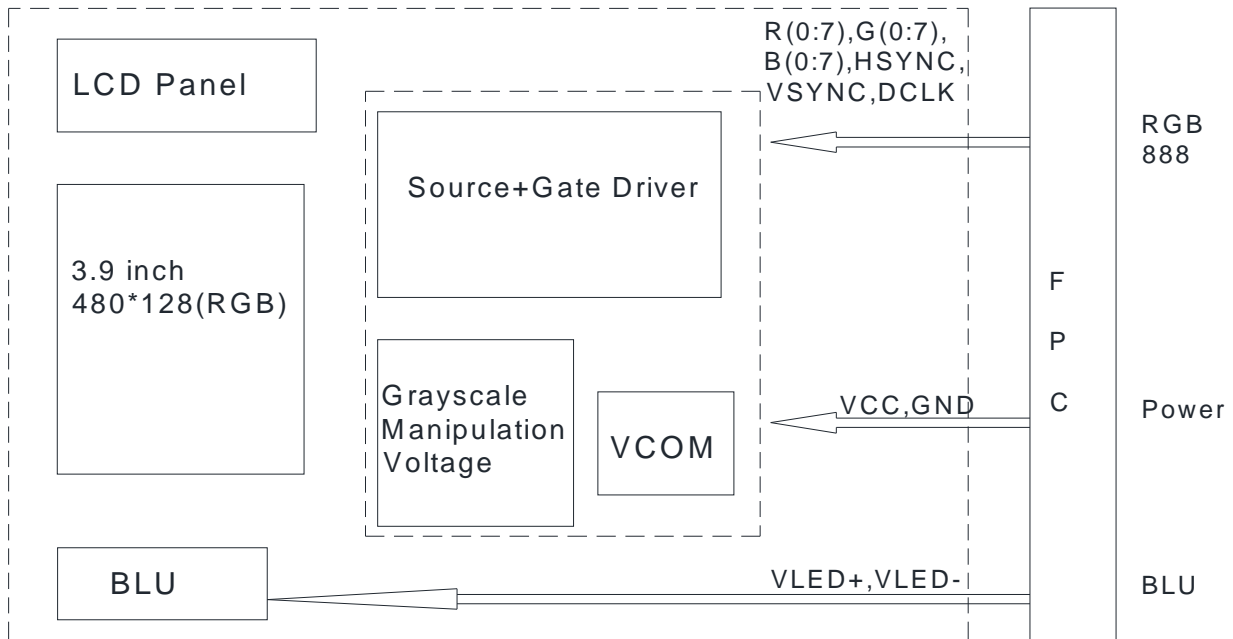
No.	Symbol	Description	Remark
1	VLED-	Backlight LED Cathode	
2	VLED+	Backlight LED Anode.	
3	GND	System Ground	
4	VCC	Power supply for logic operation	
5~12	R0~R7	Data bus	
13~20	G0~G7	Data bus	
21~28	B0~B7	Data bus	
29	GND	System Ground	
30	DCLK	Pixel clock signal	
31	DISP	Display on/off control	
32	HSYNC	Horizontal Sync signal	Note1
33	VSYNC	Vrtical Sync signal	Note1
34	NC	No connection (Option DE)	Note1
35	NC	No connection	
36	GND	System Ground	
37	NC	No connection (Option XR for RTP)	
38	NC	No connection (Option YD for RTP)	
39	NC	No connection (Option XL for RTP)	
40	NC	No connection (Option YU for RTP)	

Note1: This module default function is for SYNC mode, if this module want change to use DE mode , the FPC have to modify resistive jumper

# 4. Contour Drawing



### 5. Block Diagram



## **6. Absolute Maximum Ratings**

<b>Item</b>	<b>Symbol</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Operating Temperature	TOP	-20	-	+70	°C
Storage Temperature	TST	-30	-	+80	°C

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp.  $\leq 60^{\circ}\text{C}$ , 90% RH MAX. Temp.  $> 60^{\circ}\text{C}$ , Absolute humidity shall be less than 90% RH at  $60^{\circ}\text{C}$



## 7. Electrical Characteristics

### 7.1. Operating conditions

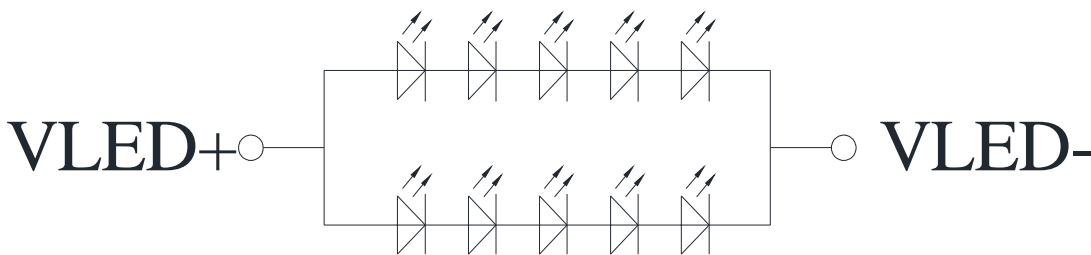
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Supply Voltage For LCM	VCC	-	3.0	3.3	3.6	V	
Supply Current For LCM	ICC	-	—	15	25	mA	Note 1

Note 1 : This value is test for VCC =3.3V , Ta=25°C only

### 7.2. LED driving conditions

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I <sub>LED</sub>		40		mA	Note 1,2,3,4
Forward Voltage	V <sub>LED+</sub>	14	15	17	V	
Backlight Lifetime			50000		hr	

Note 1 : There are 1 Groups LED



Note 2 : Ta = 25°C

Note 3 : Brightness to be decreased to 50% of the initial value

Note 4 : The single LED lamp case

## 8. DC Characteristics

Parameter	Symbol	Rating			Unit	Condition
		Min	Typ	Max		
Low level input voltage	V <sub>IL</sub>	0	-	0.3VCC	V	
High level input voltage	V <sub>IH</sub>	0.7VCC	-	VCC	V	

## 9. Interface Timing

### 9.1. Parallel RGB in SYNC mode

#### 9.1.1 Horizontal

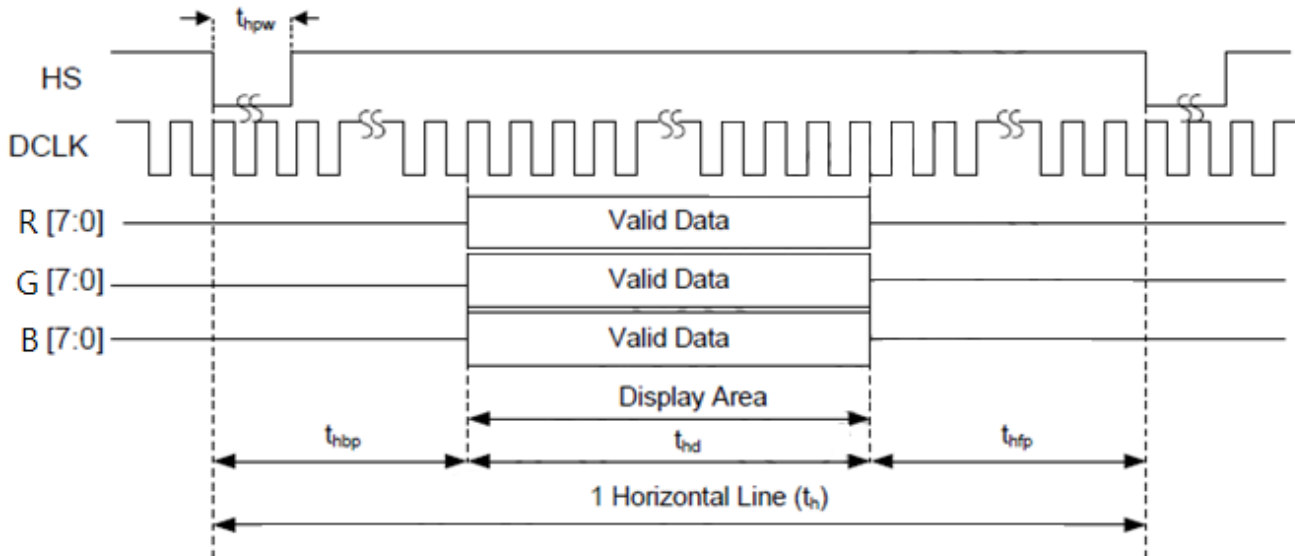


Figure 9.1.1: Horizontal input timing in Sync mode

#### 9.1.2 Horizontal

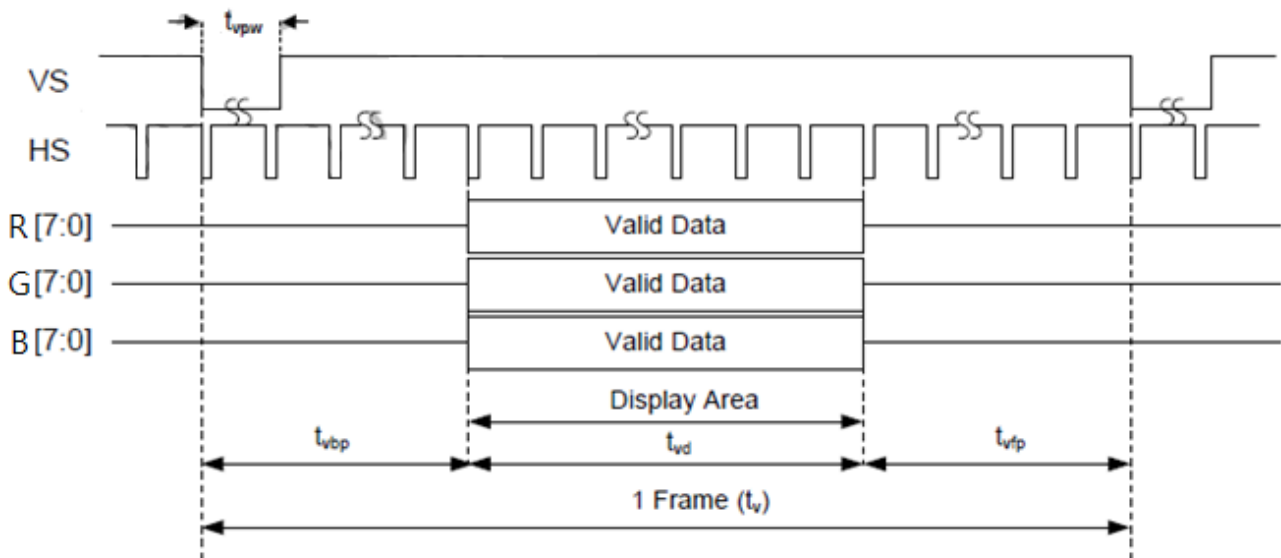


Figure 9.1.2: Vertical input timing in Sync mode

**9.2. Parallel RGB input timing table**

Item		Symbol		Min	Typ	Max	Unit
CLK frequency		Fclk		-	9.05	-	MHz
DCLK Period		Tclk		-	111	-	ns
HSYNC	Period Time	Th		510	524	862	DCLK
	Display Period	Thdisp		-	480	-	DCLK
	Back Porch	Thbp		6	16	127	DCLK
	Front Porch	Thfp		24	28	255-	DCLK
	Pulse Width	Thw		11	16	127	DCLK
VSYNC	Period Time	Tv		280	288	526	H
	Display Period	Tvdisp		-	272	-	H
	Back Porch	Tvbp		4	8	127	H
	Front Porch	Tvfp		4	8	127	H
	Pulse Width	Tvw		1	3	20	H

### 10. Optical Characteristics

Item	Symbol	Condition.	Min	Typ.	Max.	Unit	Remark	
Response Time	Tr	$\theta=0^\circ, \Phi=0^\circ$	-	10	-	ms	Note 3	
	Tf		-	15	-			
Contrast Ratio	CR	At optimized viewing angle	-	500	-	-	Note 4	
Color Chromaticity	White	$\theta=0^\circ, \Phi=0^\circ$	0.269	0.319	0.369	-	Note 2,6,7	
			0.273	0.323	0.373	-		
Viewing Angle (Gray Scale Inversion Direction)	Hor.	$CR \geq 10$	$\Theta_R$	-	65	-	Deg.	Note 1
			$\Theta_L$	-	65	-		
	Ver.		$\Phi_T$	-	65	-		
			$\Phi_B$	-	50	-		
Brightness	-	-	400	500	-	cd/m <sup>2</sup>	Center of display	
Uniformity	(U)	-	75	-	-	%	Note 5	

Ta=25±2°C, ILED=40mA

Note 1: Definition of viewing angle range

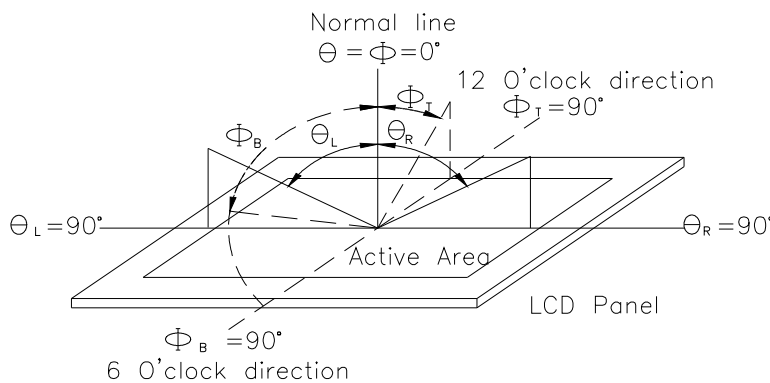


Fig. 11.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

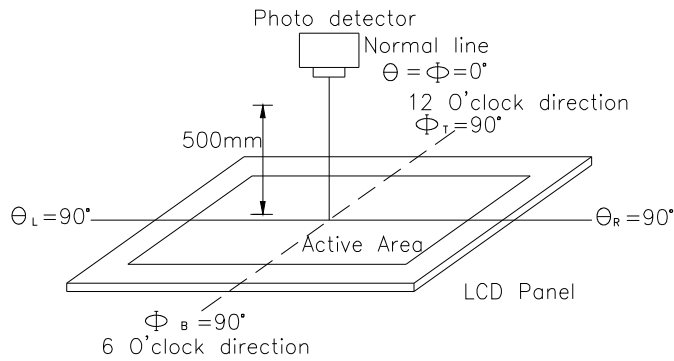
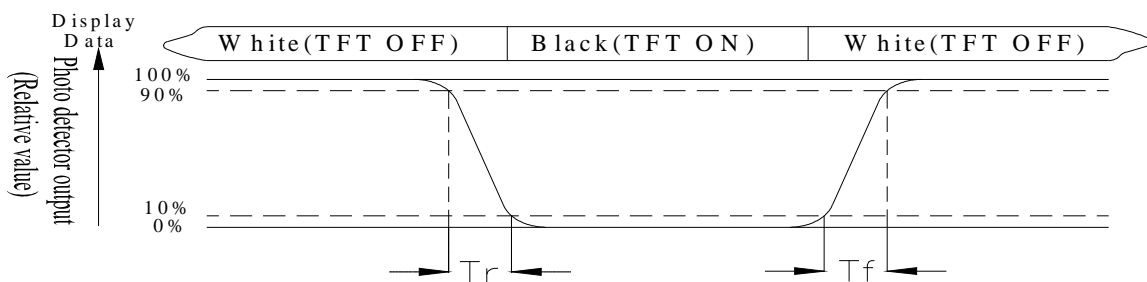


Fig. 11.2. Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time,  $T_r$ , is the time between photo detector output intensity changed from 90% to 10%. And fall time,  $T_f$ , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) =  $L_{min}/L_{max} \times 100\%$

L = Active area length

W = Active area width

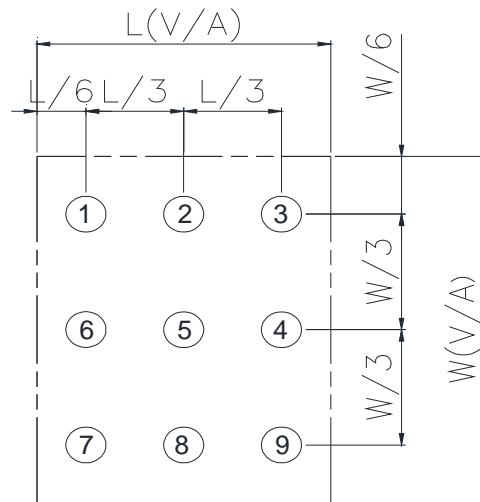


Fig11.3. Definition of uniformity

Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

# 11. Reliability

Content of Reliability Test (Wide temperature, -20°C ~ 70°C)

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature Storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature Storage	Endurance test applying the low storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max	60°C,90%RH 96hrs	1,2
Thermal Shock Resistance	The sample should be allowed stand the following 10 cycles of operation  <div style="text-align: center;"> <p style="margin: 0;">-20°C      25°C      70°C</p> <p style="margin: 0;">←—————→</p> <p style="margin: 0;">30min    5min    30min</p> <p style="margin: 0;">1 cycle</p> </div>	-20°C /70°C 10 cycles	—
Vibration Test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static Electricity Test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact) ,±800v(air), RS=330Ω CS=150pF 10 times	—

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.