



# Customer Approval Specification

**Product: Touch Display Module**

**Model Name: VL101-12880YL-C13**

Approved	Prepared
<i>Kent Wu</i>	<i>Leo Tsao</i>

**Customer:** \_\_\_\_\_

**Project Name:** \_\_\_\_\_

**Part Number:** \_\_\_\_\_

**Approved By:** \_\_\_\_\_

# Content

1	Introduction	.....	3
2	General Description	.....	3
3	Pin Assignment	.....	4
4	Operation Specifications	.....	6
5	Optical Specifications	.....	12
6	Reliability Test Items	.....	15
7	Visual Inspection	.....	17
8	General Precautions	.....	21
9	Mechanical Drawing	.....	22
10	Revision History	.....	23

## 1. Introduction

VL101-12880YL-C13 is a Touch Display Module, composed of a TFT-LCD panel, Timing Controller, Backlight Driving Unit and Projective Capacitive Touch Panel. This Touch Display Module can support high resolution (1280 x (R.G.B) X 800) and can display up to 16.7M colors (RGB 8-bits).

## 2. General Description

No.	Item	Specification	Remark
1	Display size	10.1 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	1280 x 3(RGB) x 800	
4	Display mode	Normally black, Transmissive	
5	Pixel pitch	0.1695 x 0.1695 mm	
6	Active area	216.96 x 135.6 mm	Note1
7	Module size(Outline)	243.16(W) x 161.8(H) x 8.05(D) mm	
8	Surface Hardness	>=7H	
9	Color arrangement	RGB-stripe	
10	LCD Interface	LVDS 8bits	
11	Touch Panel Interface	USB 1.1 & I2C	

Note1: Please refer to mechanical drawing.

## 3. PIN Assignment

### 3.1 LCD LVDS Interface(CN1)

User connector: Starconn / 300E40-0010RA-G3

Pin No.	Symbol	Description	Remark
1	NC	No connection	
2	VDD	Power supply 3.3V	
3	VDD	Power supply 3.3V	
4	NC	No connection	
5	NC	No connection	
6	NC	No connection	
7	NC	No connection	
8	RXIN0+	-LVDS differential data input	
9	RXIN0+	+LVDS differential data input	
10	GND	Power ground	
11	RXIN1-	-LVDS differential data input	
12	RXIN1+	+LVDS differential data input	
13	GND	Power ground	
14	RXIN2-	-LVDS differential data input	
15	RXIN2+	+LVDS differential data input	
16	GND	Power ground	
17	RXCLK-	-LVDS differential clock input	
18	RXCLK+	+LVDS differential clock input	
19	GND	Power ground	
20	RXIN3-	-LVDS differential data input	
21	RXIN3+	+LVDS differential data input	
22	GND	Power ground	
23	LED_GND	Ground for LED Driving	
24	LED_GNG	Ground for LED Driving	
25	LED_GND	Ground for LED Driving	
26	NC	No connection	
27	LED_PWM	PWM Input Signal for LED Driver	
28	LED_EN	LED Enable Pin	
29	NC	No connection	
30	NC	No connection	
31	VLED	Power Supply for LED Driver	
32	VLED	Power Supply for LED Driver	
33	VLED	Power Supply for LED Driver	
34	NC	No connection	
35	NC	No connection	
36	NC	No connection	
37	NC	No connection	
38	NC	No connection	
39	NC	No connection	
40	NC	No connection	

## 3.2 Touch Panel

User Connector: Molex 537800670 or equivalent.

Pin No.	Symbol	Description	Remark
1	GND_E	Shielding Pin	CN2 USB I/F
2	NC	No Connection	
3	D+	Differential "1"	
4	D-	Differential "0"	
5	VDD	Power Supply 5V	
6	GND	Power Ground	
1	GND	Power Ground	CN3 I2C I/F
2	INT	Interruption	
3	NC	No connection	
4	VDD	Power Supply 3.3V ~ 5V	
5	SCL	Serial Clock	
6	SDA	Serial Data	

Note: Please connect GND\_E to system ground or earth ground to obtain better noise resistance.

## 4. Operation Specifications

### 4.1 Absolute Maximum Ratings

Item	Symbol	Values(Note)		Unit	Remark
		Min.	Max.		
Power voltage	V <sub>DD</sub>	-0.3	5.0	V	
	V <sub>LED</sub>	6.5	13.5	V	
	V <sub>TP</sub>	-0.5	6	V	
Operation temp.	T <sub>OP</sub>	-20	70	°C	
Storage temp.	T <sub>ST</sub>	-30	80	°C	

Note: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

#### 4.1.1 Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	V <sub>DD</sub>	3.0	3.3	3.6	V	
	V <sub>TP</sub>	3.3	5	5.5	V	
Current for Panel	I <sub>DD</sub>	-	300	-	mA	
Current for Touch	I <sub>TP</sub>	-	-	100	mA	

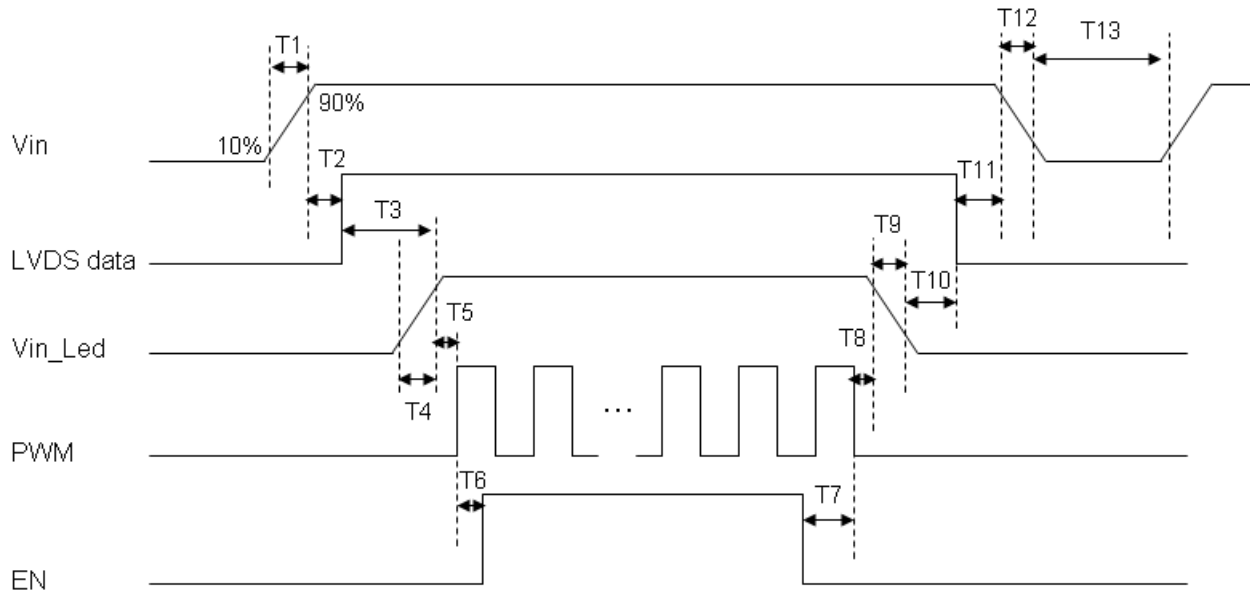
#### 4.1.2 Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	V <sub>LED</sub>	6	12	21	V	
Current for LED backlight	I <sub>LED</sub>	-	200	120	mA	
LED life time	-	-	25,000	-	Hrs	
PWM Frequency	F <sub>PWM</sub>	100	-	20K	Hz	
PWM logic high level	V <sub>IH</sub>	2.4	-	-	V	
PWM logic low level	V <sub>IL</sub>	-	-	0.7	V	
PWM signal voltage	V <sub>PWM</sub>	3.0	-	3.6	V	High
	V <sub>EN</sub>	0	-	0.4		Low
Backlight enable voltage	High	3.0	-	3.6	V	High
	Low	0	-	0.4		Low

## 4.2 Power Sequence

### 4.2.1 LCD Panel Power Sequence

Power on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.

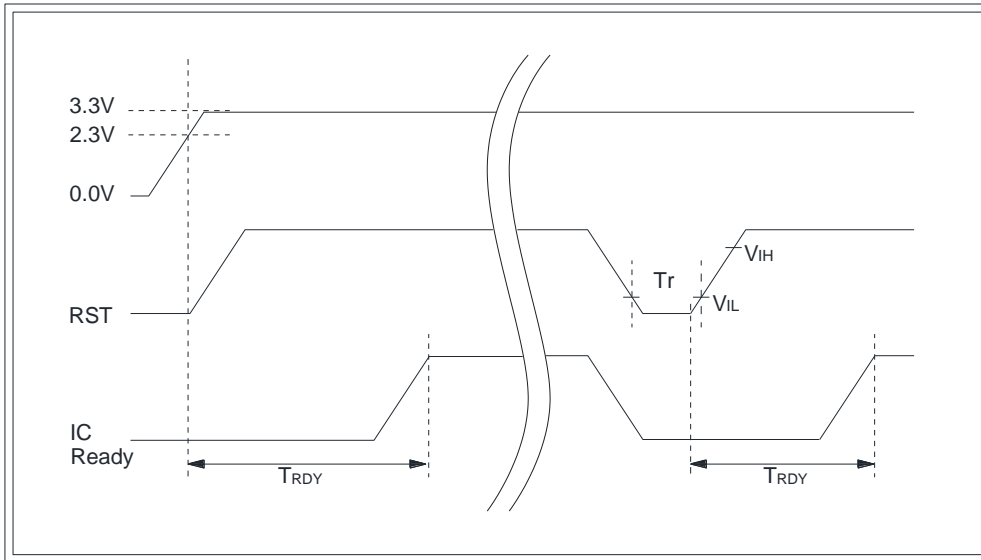


Power Sequencing Requirements

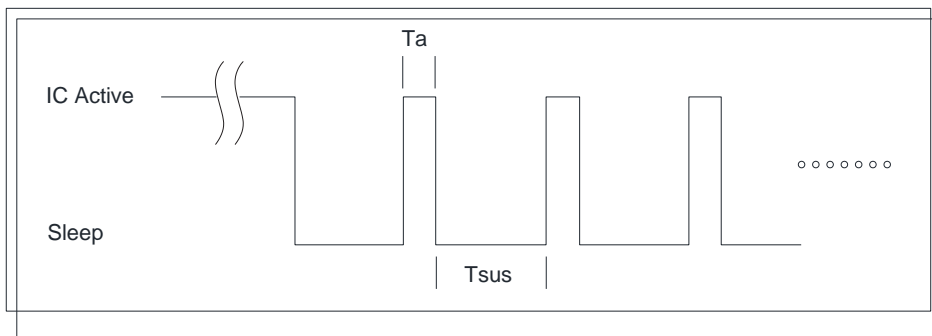
Parameter	Symbol	Unit	Min	Typ.	Max
VIN Rise Time	T1	ms	0.5	--	10
VIN Good to Signal Valid	T2	ms	30	--	90
Signal Valid to Backlight On	T3	ms	200	--	--
Backlight Power On Time	T4	ms	0.5	--	--
Backlight VDD Good to System PWM On	T5	ms	10	--	--
System PWM ON to Backlight Enable ON	T6	ms	10	--	--
Backlight Enable Off to System PWM Off	T7	ms	0	--	--
System PWM Off to B/L Power Disable	T8	ms	10	--	--
Backlight Power Off Time	T9	ms	0.5	10	30
Backlight Off to Signal Disable	T10	ms	200	--	--
Signal Disable to Power Down	T11	ms	0	--	50
VIN Fall Time	T12	ms	0.5	10	30
Power Off	T13	ms	500	--	--

## 4.2.2 Touch Panel Power Sequence

Power On Sequence Diagram



Idle Sequence Diagram





## 4.3 Timing Characteristics

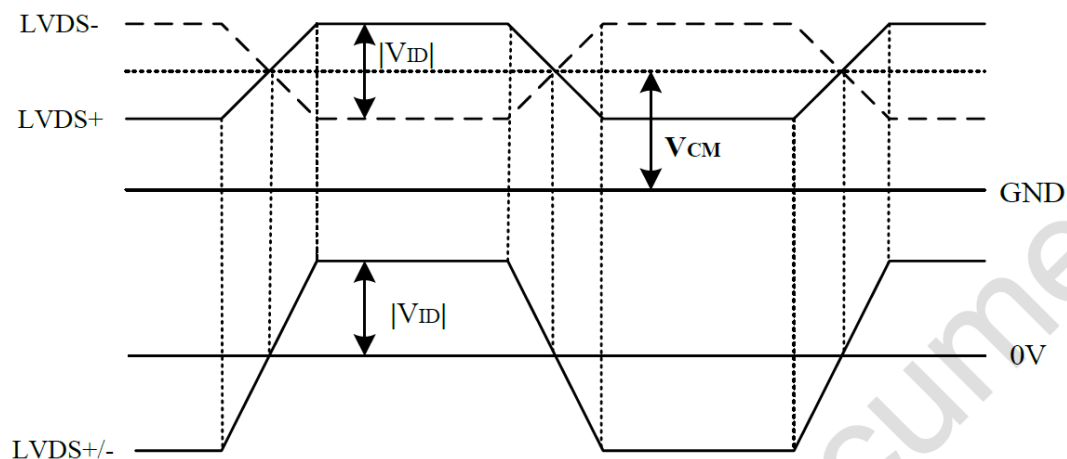
### 4.3.1 LCD LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Differential Input High	$V_{th}$	-	-	+100	mV	$V_{CM}=+1.2V$
Differential Input Low	$V_{tl}$	-100	-	-	mV	$V_{CM}=+1.2V$
Magnitude Differential Input	$ V_{ID} $	200	-	400	mV	-
Common Mode Voltage	$V_{CM}$	$0.3+(V_{ID}/2)$	-	$V_{DD}-1.2-(V_{ID}/2)$	V	-
Common Mode Voltage	$\overline{V}_{CM}$	-	-	50	mV	$V_{CM}=+1.2V$

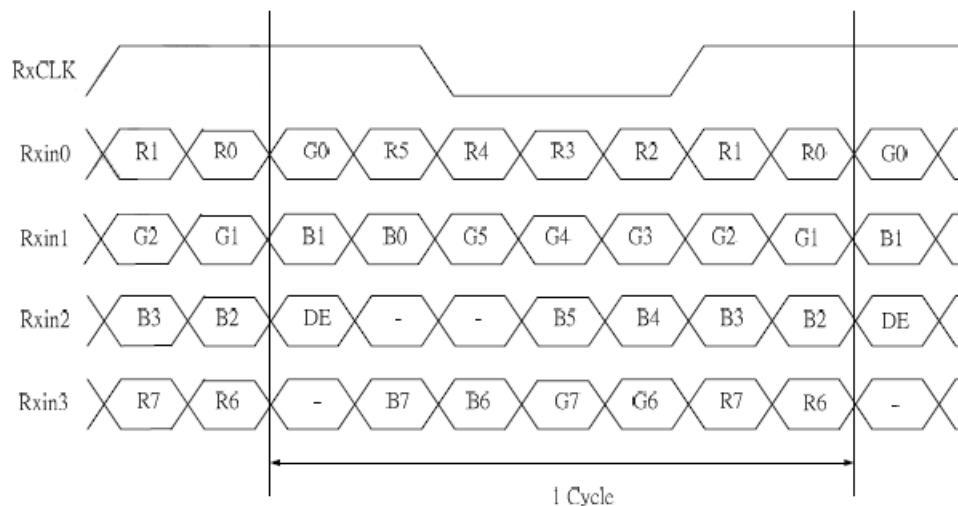
Note1: Input signals shall be low or Hi-Z state when VDD is off.

Note2: All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

#### Voltage Definitions



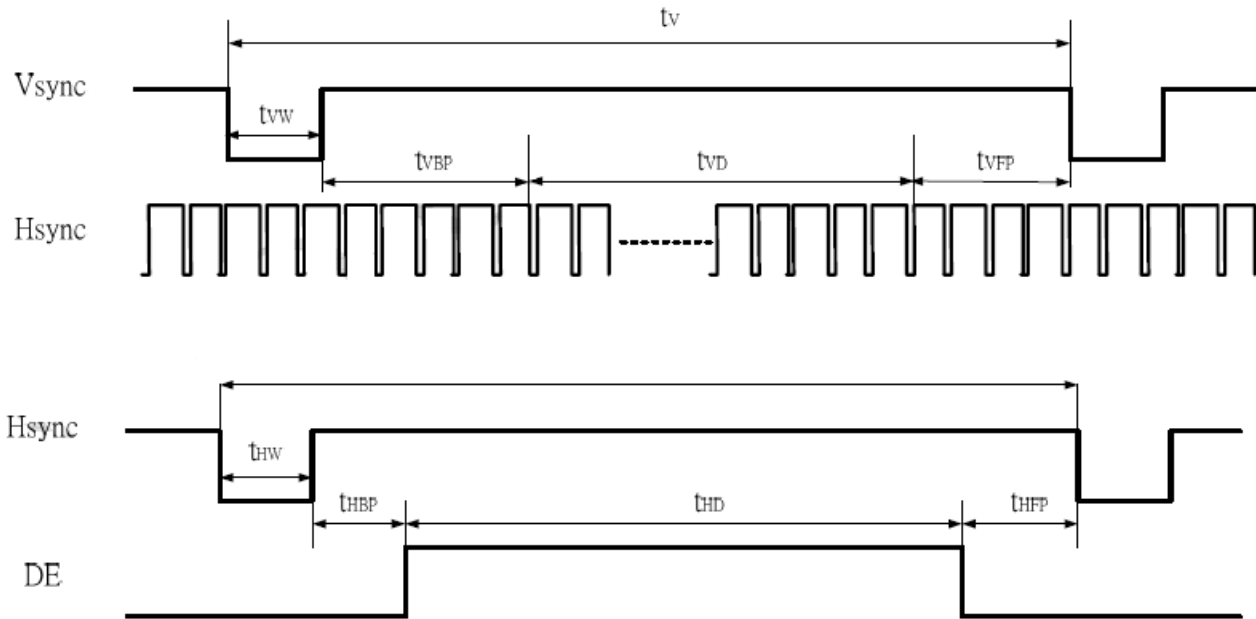
#### LVDS Data Mapping



### 4.3.2 LCD Timing

Parameter	Symbol	Unit	Min.	Typ.	Max.
Frame Rate	--	Hz	-	60	-
Frame Period	$t_v$	line	(815)	(823)	(1023)
Vertical Display Time	$t_{VD}$	line	800		
Vertical Blanking Time	$t_{VW}+t_{VBP}+t_{VFP}$	line	(15)	(23)	(33)
1 Line Scanning Time	$t_H$	clock	(1410)	(1440)	(1470)
Horizontal Display Time	$t_{HD}$	clock	1280		
Horizontal Blanking Time	$t_{HW}+t_{HBP}+t_{HFP}$	clock	(60)	(160)	(190)
Clock Rate	$1/T_C$	MHz	(68.9)	(71.1)	(73.4)

### 4.3.3 Timing Diagram of Interface Signal (DE mode)



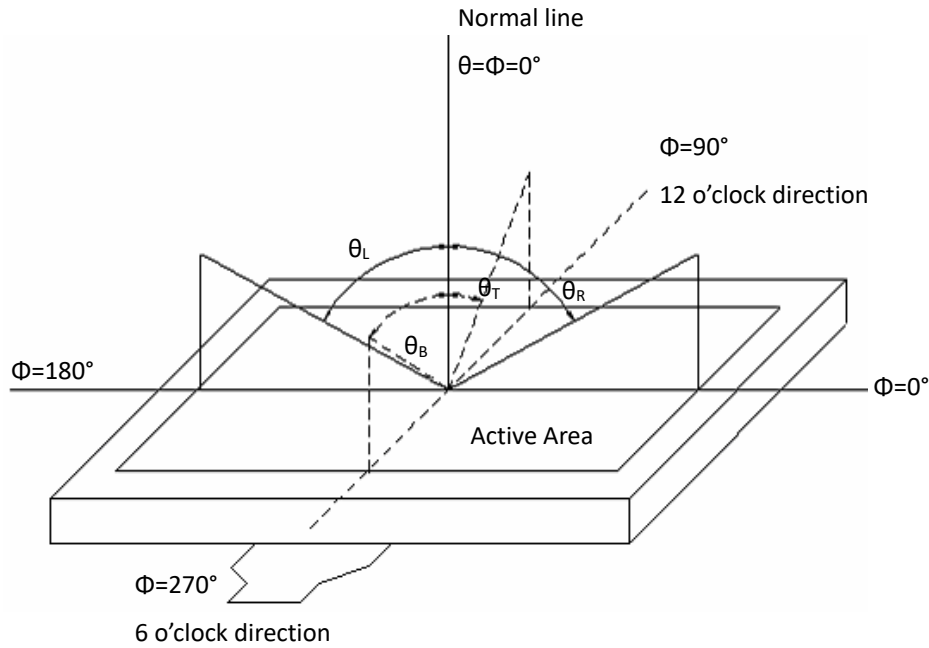
## 5. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max		
LCD Viewing angle (CR $\geq$ 10)	$\theta_L$	$\Phi=180^\circ$ (9 o'clock)	75	85	-	degree	Note1
	$\theta_R$	$\Phi=0^\circ$ (3 o'clock)	75	85	-		
	$\theta_T$	$\Phi=90^\circ$ (12 o'clock)	75	85	-		
	$\theta_B$	$\Phi=270^\circ$ (6 o'clock)	75	85	-		
LCD Response time	T <sub>ON</sub>	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note3
	T <sub>OFF</sub>		-	15	30	msec	Note3
LCD Contrast ratio	CR		600	800	-	-	Note4
LCD Color chromatically	W <sub>X</sub>		0.283	0.313	0.333	-	Note2
	W <sub>Y</sub>		0.299	0.329	0.359	-	Note5 Note6
LCD Luminance	L		250	300	-	cd/m <sup>2</sup>	Note6
Luminance uniformity	Y <sub>u</sub>		70	75	-	%	Note7

Test Conditions:

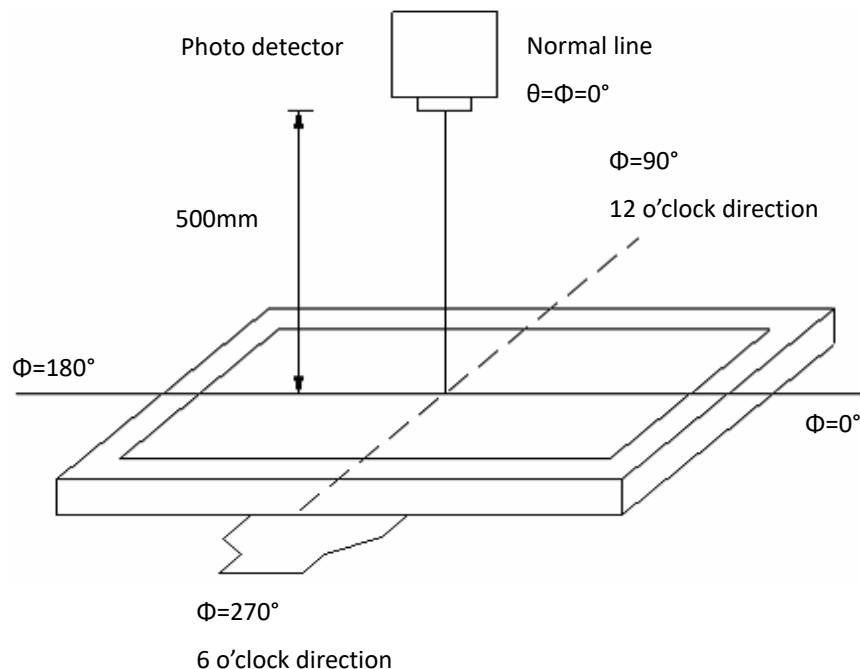
1. The ambient temperature is 25°C.
2. The test systems refer to Note 2.

Note1: Definition of viewing angle



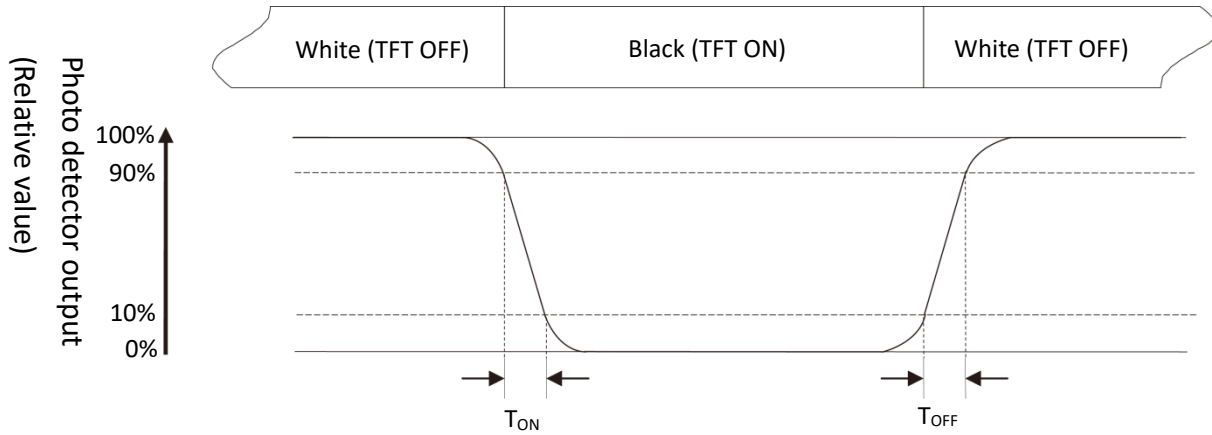
Note2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view:  $1^\circ$  /Height: 500mm.)



Note3: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.



Note4: Definition of contrast ratio

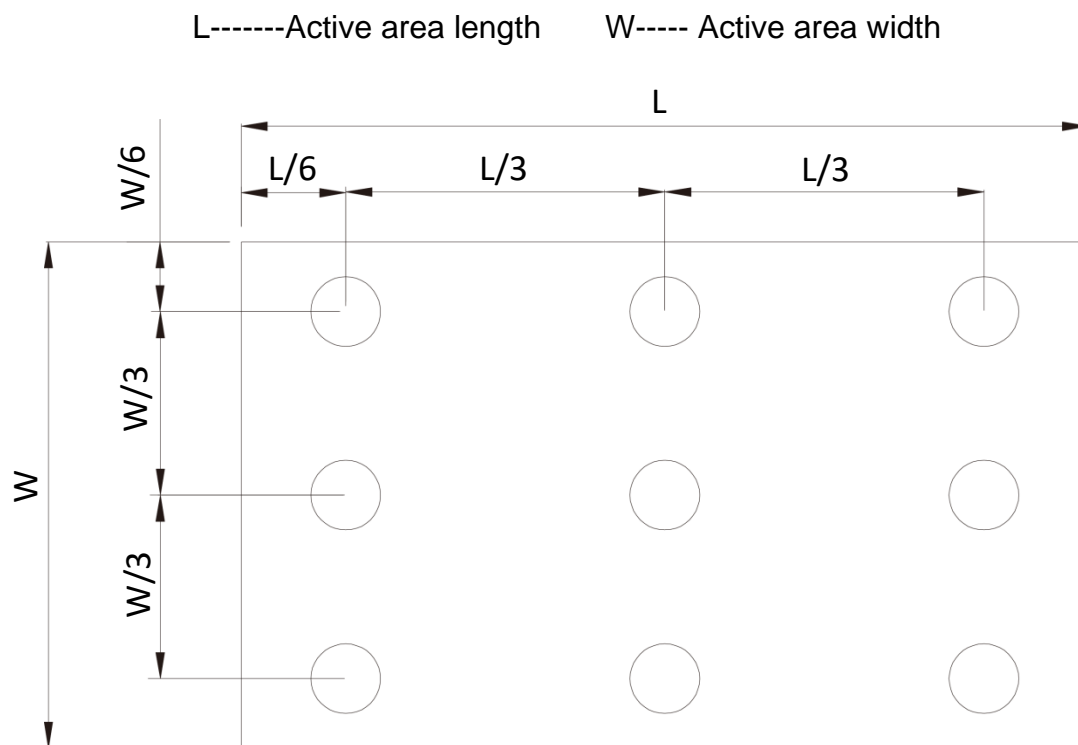
Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. **The brightness is with Touch Panel on LCD Panel.**

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to below graphic).  
Every measuring point is placed at the center of each measuring area.



$B_{\max}$ : The measured maximum luminance of all measurement position.

$B_{\min}$ : The measured minimum luminance of all measurement position.

## 6. Reliability Test Items

### 6.1 LCD Panel Reliability

Item	Test Conditions (Note3)	Remark
High Temperature Storage	Ta = 80°C, 240hrs	Note1, Note4
Low Temperature Storage	Ta = -30°C, 240hrs	Note1, Note4
High Temperature Operation	Ts = 70°C, 240hrs	Note2, Note4
Low Temperature Operation	Ta = -20°C, 240hrs	Note1, Note4
Operate at High Temperature and Humidity	+60°C, 90%RH, 240hrs	Note4
Thermal Shock	-30°C/30 min ~ +80°C/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	Note4
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	

Note1: Ta is the ambient temperature of samples.

Note2: Ts is the temperature of panel's surface.

Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

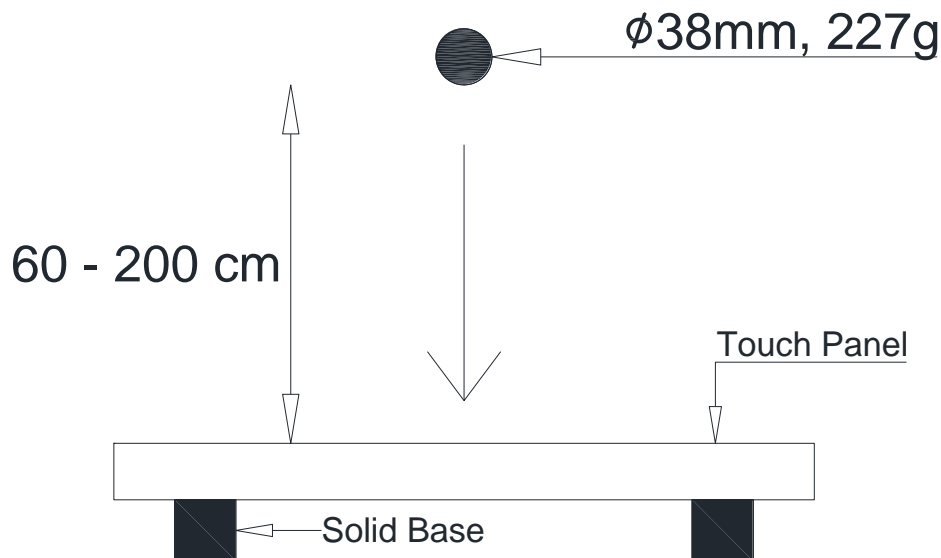
Note4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

## 6.2 Touch Panel Reliability

### 6.2.1 Impact Test

Cover Glass Thickness	Test Condition	Testing Height	Remark
1.1 mm	Steel ball 227g, Diameter 38mm, One-time Impact at Center	60cm	No Damage

7.



### 6.2.2 Environmental Test

No	Item	Specification	Remark
1	High temperature storage	70°C, 240 hr (Confirm after 4hr room temp.)	No condensation.
2	Low temperature storage	-20°C, 240 hr (Confirm after 4hr room temp.)	
3	High temperature high humidity storage	50°C, 80%RH, 240 hr (Confirm after 24hr room temp.)	
4	Thermal Cycling	-20°C ~+70°C (30min each), 10cycles (Confirm after 24hr room temp.)	



## 7. Visual Inspection

### 7.1 Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.

**6.1.1 Lot size:** Quantity per shipment as one lot (different model as different lot).

**6.1.2 Sampling type:** Normal inspection, single sampling.

**6.1.3 Sampling level:** Level II.

**6.1.4 AQL:** Major defect: AQL=0.65

Minor defect: AQL=1.0

### 7.2 LCD Panel Inspection Condition

**7.2.1 Environment:** Room Temperature: 25±5°C.

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

**7.2.2 Inspection Distance:** 35±5 cm

**7.2.3 Inspection Angle:**

The vision of inspector should be perpendicular to the surface of the Module.

**7.2.4 Inspection time:** Perceptibility Test Time: 20 seconds max.

### 7.3 LCD Panel Quality

**7.3.1 Function Related:**

The function defects of line defect, abnormal display, and no display are considered Major defects.

**7.3.2 Bright/Dark Dots:**

Defect Type	Specification	Major	Minor
Bright Dots	$N \leq 2$		V
Dark Dots	$N \leq 3$		V
Total	$N \leq 4$		V

Note: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

The bright dot defect must be visible through 2% ND filter

Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

### 7.3.3 Pixel Definition

R	G	B	R	G	B	R	G	B			Dot Defect
R	G	B	R	G	B	R	G	B			Adjacent Dot Defect
R	G	B	R	G	B	R	G	B			Cluster

Note1: If pixel or partial sub-pixel defects exceed 50% of the affected pixel or sub-pixel area, it shall be considered as 1 defect.

Note 2: There should be no distinct non-uniformity visible through 2% ND Filter within 2 sec inspection times.

### 7.3.4 Visual Inspection Specifications

Defect Type	Specification	Count	Major	Minor
Dot Shape (Particle, Scratch, Bubble in Active area)	$D \leq 0.25 \text{ mm}$	Ignored		V
	$0.25 < D \leq 0.5\text{mm}$	$N \leq 5$		
	$D > 0.5\text{mm}$	$N = 0$		
Line Shape (Particles、Scratch、Lint, Bubbles in Active area)	$W \leq 0.03 \text{ mm}$	Ignored		V
	$0.03 < W \leq 0.05\text{mm}, L \leq 10\text{mm}$	$N \leq 3$		
	$0.05 < W \leq 0.1\text{mm}, L \leq 5\text{mm}$			
	$W > 0.1\text{mm}$ or $L > 10 \text{ mm}$	$N = 0$		

Note: Extraneous substance and scratch not affecting the display of image, for instance, extraneous substance under polarizer film but outside the display area, or scratch on metal bezel and backlight module or polarizer film outside the display area, shall not be considered as defective or non-conforming.

## 7.4 Touch Panel Inspection

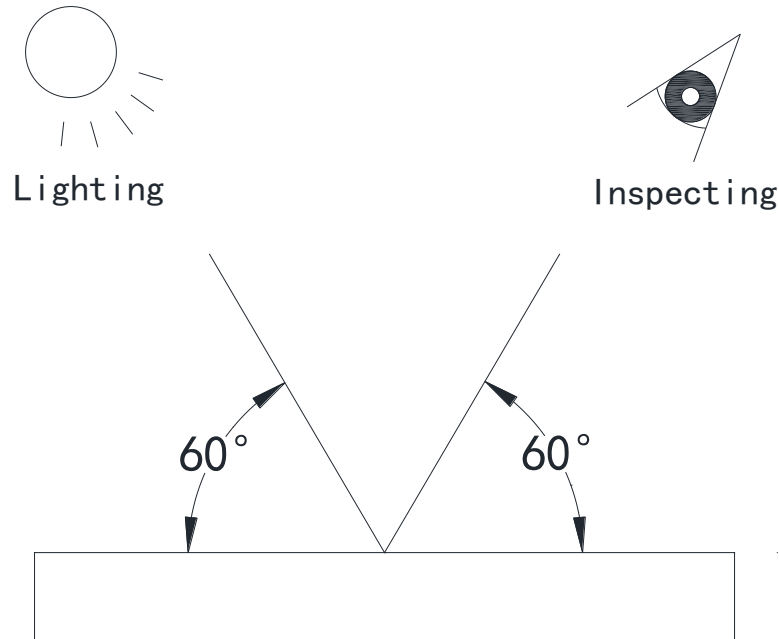
### 7.4.1 Inspection Method

(A)The lightness of place: 500~800 LUX

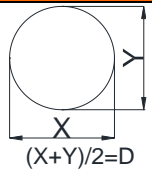
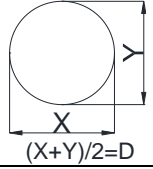
(B)The distance of eyeshot: 30 CM

(C)The angle of eyeshot:  $>60^{\circ}$

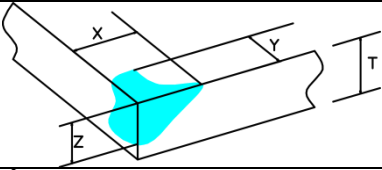
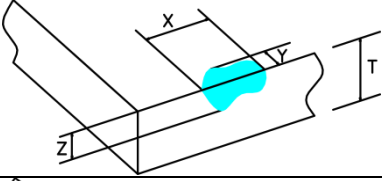
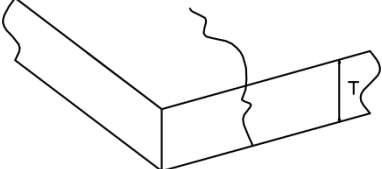
(D)Inspection time: 10 sec



### 7.4.2 Inspection Standard

No	Item	Specification	Allowance	Remark
1	Granular foreign object	$D > 0.5\text{mm}$	0	 $(X+Y)/2=D$
		$0.2 < D \leq 0.5\text{mm}$	3	
		$D < 0.2\text{mm}$	Ignore	
2	Linear foreign matter	$W > 0.2\text{mm}, L > 15\text{mm}$	0	$W = \text{Width}$ $L = \text{Length}$
		$0.1 < W \leq 0.2\text{mm}, L \leq 215\text{mm}$	5	
		$W < 0.1\text{mm}$	Ignore	
3	Scratch	$W > 0.2\text{mm}, L > 15\text{mm}$	0	
		$0.1 < W \leq 0.2\text{mm}, L \leq 15\text{mm}$	5	
		$W < 0.1\text{mm}$	Ignore	
4	Bubble	$D > 0.5\text{mm}$	0	 $(X+Y)/2=D$
		$0.2 < D \leq 0.5\text{mm}$	3	
		$D < 0.2\text{mm}$	Ignore	

### 7.4.3 Glass Chip

No	Item	Description	Allowance	Remark
1	Corner Judgement		$X \leq 3.0\text{mm}$ $Y \leq 3.0\text{mm}$ $Z \leq T$	
2	Edge Judgement		$X \leq 3.0\text{mm}$ $Y \leq 3.0\text{mm}$ $Z \leq T$	
3	Progressive Judgement		Not Allowed	

## 8. General Precautions

### 8.1 Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

### 8.2 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

### 8.3 Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

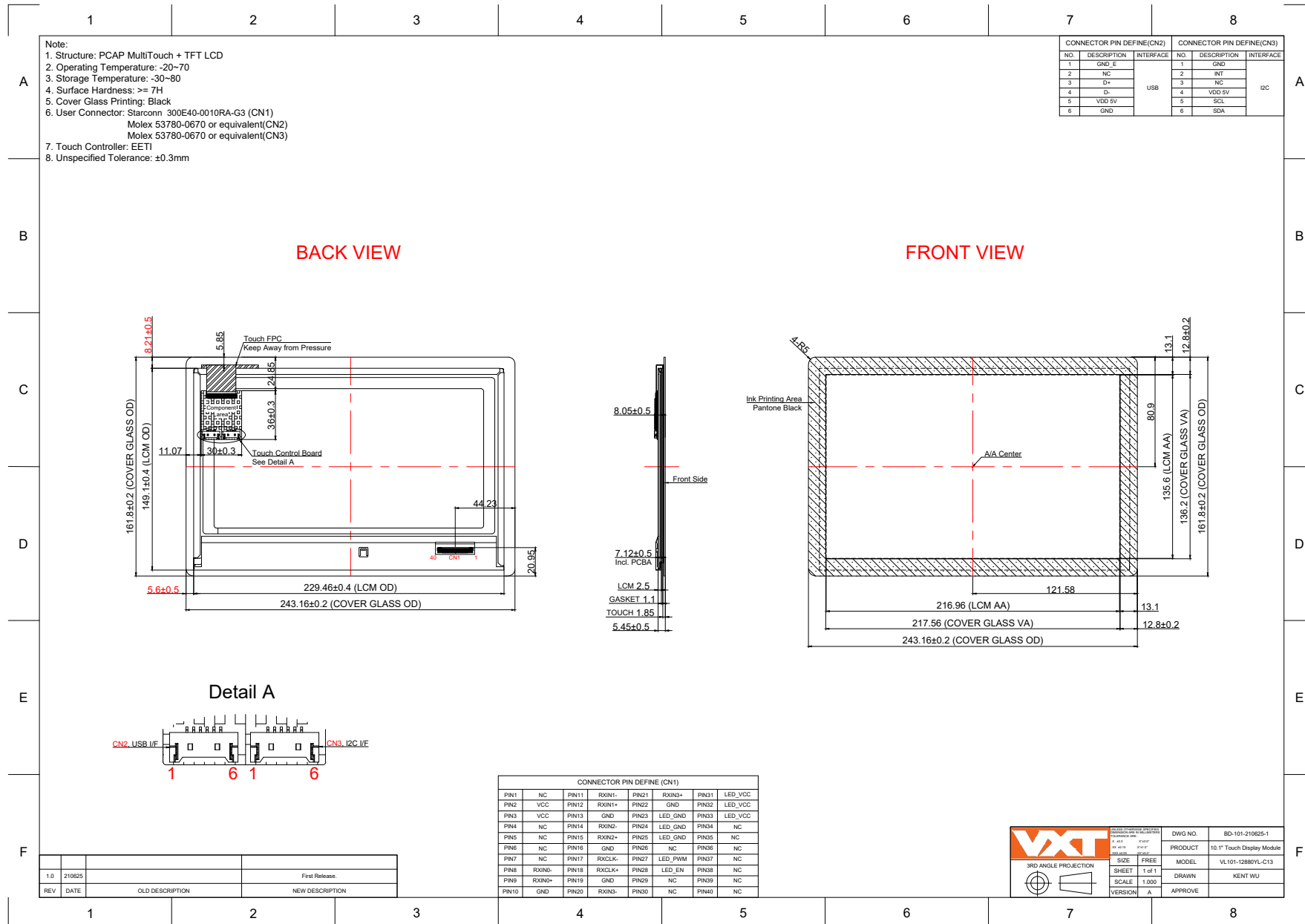
### 8.4 Storage

1. Store the module in a dark room where must keep at  $25\pm 10^{\circ}\text{C}$  and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

### 8.5 Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

## 9. Mechanical Drawing



Revision History			
Date	Version	Description	Remark
2021/06/28	1.0	First release	
2021/08/18	1.1	Pin 35 No connection. Add PWM voltage,	P4, P6

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