

SPECIFICATION

Customer: _____
Model Name: TI035AI310
SPEC NO.: _____
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Version: V01

- Preliminary Specification**
 Final Specification

For Customer's Acceptance

Approved by	Comment

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Record of Revision

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1. General Specifications

No.	Item	Specification	Unit
1	LCD size	3.5	inch
2	Pixel pitch	0.073(H)X 0.219(V)	mm
3	Active area	70.08(H) x 52.56(V)	mm
4	Module size(FOG)	76.9 (H)X 63.9(V)X 3.3(T)	mm
5	Number of pixel	320 RGB(H)X 240 (V)	pixels
6	Number of colors	16.7M	colors
7	Interface	RGB	
8	Display mode	Normally Black	
9	Pixel arrangement	RGB Vertical stripe	
10	Surface Treatment	AG	
11	NTSC	60	%
12	Brightness	350	cd/m2
13	Backlight power consumption	375	mW
14	Panel power consumption	TBD	W
15	Module Weight	TBD	g

Note 1: Refer to Mechanical Drawing.

2..Pin Assignment

Pin No.	Symbol	Description	Remark
1	LEDK	LED cathode	
2	LEDK	LED cathode	
3	LEDA	LED anode	
4	LEDA	LED anode	
5	GND	Ground	
6	RESB	Global reset pin.(H=3.3V)	
7	GND	Ground	
8	Y1	TP-Y1	
9	X1	TP-X1	
10	Y2	TP-Y2	
11	X2	TP-X2	
12	B0	Blue data	
13	B1	Blue data	
14	B2	Blue data	
15	B3	Blue data	
16	B4	Blue data	
17	B5	Blue data	
18	B6	Blue data	
19	B7	Blue data	
20	G0	Green data	
21	G1	Green data	
22	G2	Green data	
23	G3	Green data	
24	G4	Green data	
25	G5	Green data	
26	G6	Green data	
27	G7	Green data	
28	R0	Red data	
29	R1	Red data	
30	R2	Red data	
31	R3	Red data	
32	R4	Red data	
33	R5	Red data	
34	R6	Red data	
35	R7	Red data	
36	HSYNC	Horizontal Sync Input	
37	VSYNC	Vertical Sync Input	
38	DOTCLK	Sample clock	
39	NC	No connection	
40	NC	No connection	
41	VCC	Power for Digital Circuit(3.3V)	
42	VCC	Power for Digital Circuit(3.3V)	
43	CS	Serial communication chip selection	
44	GND	Ground	

45	NC	No connection	
46	GND	Ground	
47	NC	No connection	
48	NC	No connection	
49	SCK	Serial communication clock	
50	SDI	serial communication data	
51	NC	No connection	
52	DE	Data Input Enable	
53	GND	Ground	
54	GND	Ground	

3. Operation Specifications

3.1.1. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Item	Symbol	Values		Unit
		Min.	Max.	
Power Voltage	VDD	-0.3	5.0	V
Input Signal Voltage	V _I	-0.3	VDD	V
Operation Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{ST}	-30	80	°C

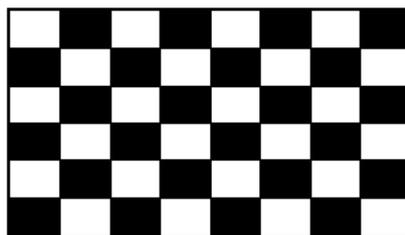
Note: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed. There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

3.1.2. Typical Operation Conditions

Item	Symbol	Values			Unit
		Min.	Typ.	Max.	
Power Voltage	VDD	3.0	3.3	3.6	V
Current Consumption	I _{VDD}	-	TBD	-	mA
Power Consumption	P _{VDD}	-	TBD	-	W
Power Consumption	P _{LED}	-	N/A	-	W

Note :1. The measuring position is the connector of LCM and the test conditions are under 25°C, Frame Rate=60Hz

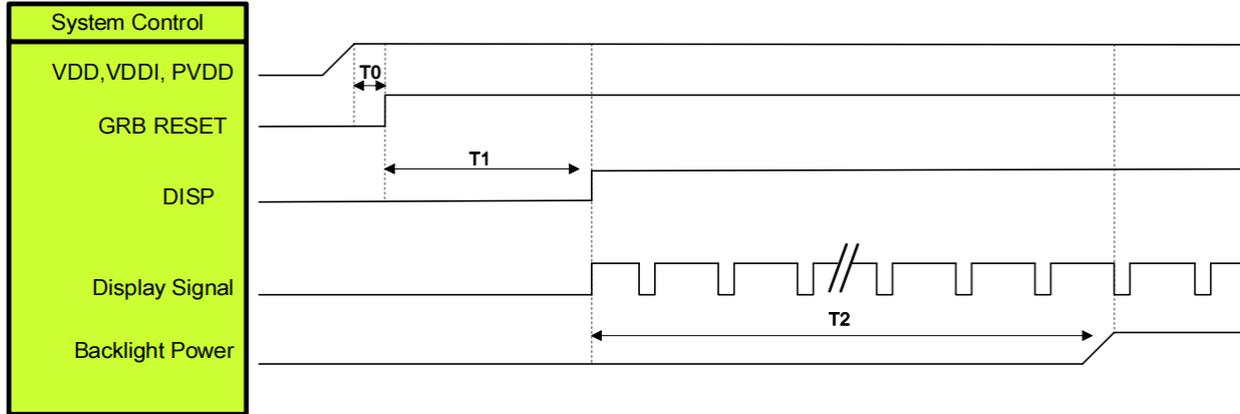
2. The specified current and power consumption are under the VCC = 3.3V , 25°C, Frame Rate=60Hz condition and Mosaic pattern



3.2. Power On/Off Sequence

To prevent the device damage from latch up, the power on/off sequence shown below must be followed.

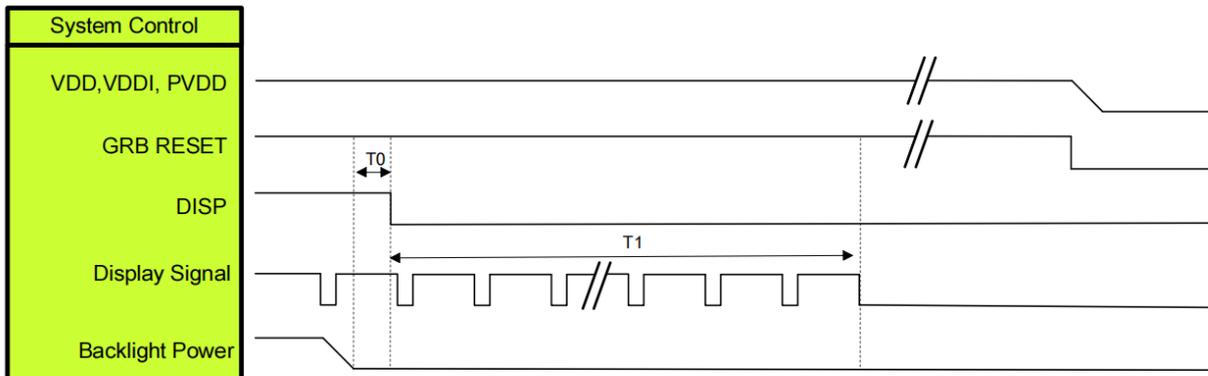
a. Power on



Symbol	Description	Min. Time	Unit
T0	System power stability to GRB RESET signal	0	ms
T1	GRB RESET= "High" to DISP="High"	10	ms
T2	Display Signal output to Backlight Power on	250	ms

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

b. Power off



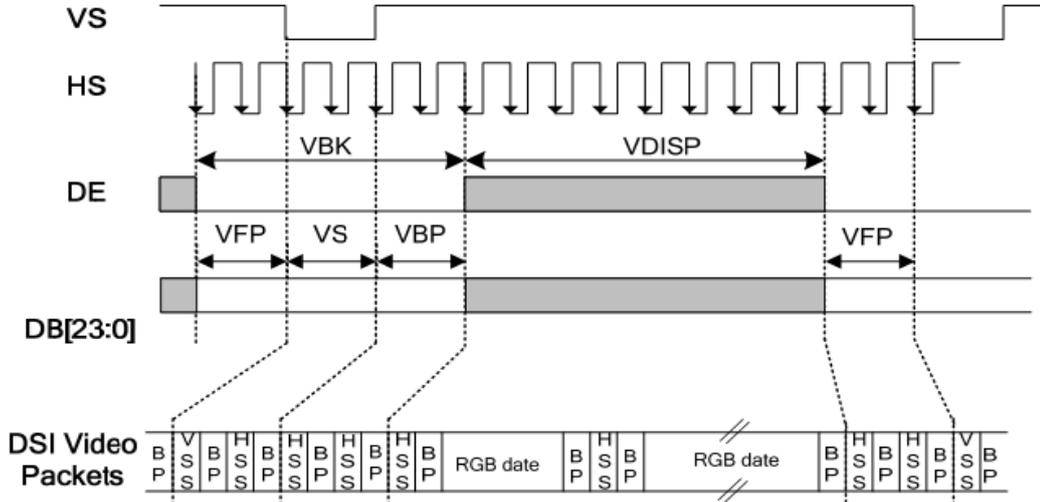
Symbol	Description	Min. Time	Unit
T0	Backlight Power off to DISP="Low"	5	ms
T1	DISP="Low" to IC internal voltage discharge complete	80	ms

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

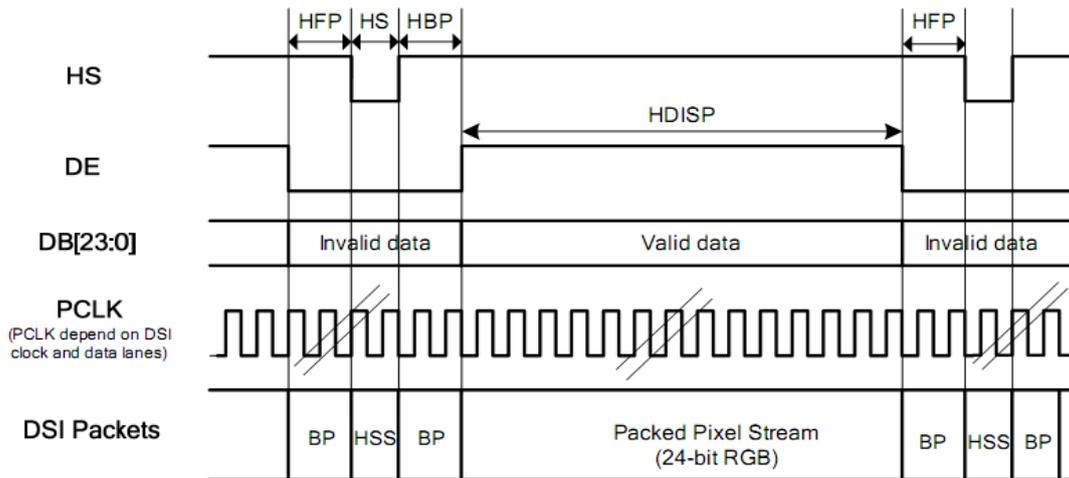
3.3 Timing Characteristics

3.3.1. Signal Electrical Characteristics

Vertical Timings



Horizontal Timings



3.3.2 Timing Setting Table

Parallel 24-bit RGB Input Timing Table							
Item	Symbol	Min.	Typ.	Max.	Unit	Note	
DCLK Frequency	Fclk	5	6	8	MHz		
DCLK Period	Tclk	125	167	200	ns		
HSYNC	Period Time	Th	325	371	438	DCLK	
	Display Period	Thdisp	-	320	-	DCLK	
	Back Porch	Thbp	3	43	43	DCLK	Thbp of SYNC mode set by H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	43	DCLK	
VSYNC	Period Time	Tv	244	260	289	HSYNC	
	Display Period	Tvdisp	-	240	-	HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	Tvbp of SYNC mode set by V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	12	HSYNC	

Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

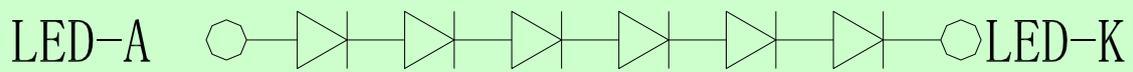
4 Backlight Characteristic

4.1 Backlight Characteristic

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V _F	Ta=25 °C, I _F =20mA/LED	16.8	18.6	20.4	V
Forward Current	I _F	Ta=25 °C, V _F =3.0 V/LED	-	20		mA
Power dissipation	P _D		-	372		mW
Uniformity	Avg		-	80	-	%
LED working life(25°C)	-		-	20,000	-	Hrs
Drive method	Constant current					
LED Configuration	6 White LEDs in parallel					

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

4.2 Backlighting circuit



5. Optical specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	70	80	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	70	80	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	70	80	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	70	80	-		
Response time Rise+Fall	T_{RT}	Normal $\theta=\Phi=0^\circ$	-	25	35	msec	Note 3
Contrast ratio	CR		640	800	-	-	Note 4
Color chromaticity	W_X		0.297	0.317	0.337	-	Note 2
	W_Y		0.308	0.328	0.348	-	Note 5
NTSC	Ratio		-	60	-	%	Note 6
Luminance	L		280	350	-	cd/m ²	Note 6
Luminance uniformity	Y_U		9 AVG	-	N/A	-	%

Note 1: Definition of viewing angle range

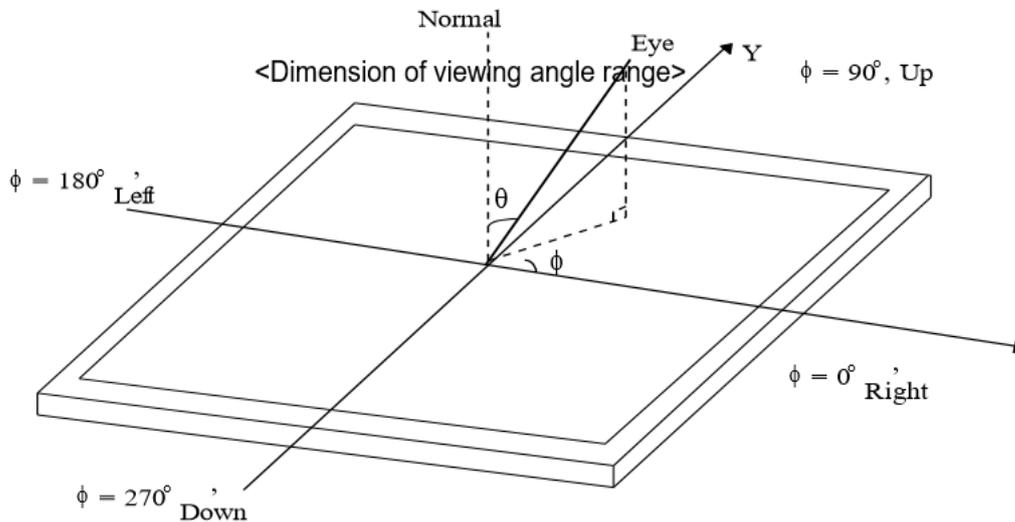


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm ,Response time is measured by Photo detector TOPCON BM-5A, other items are measured by BM-7A/Field of view: 1° /Height: 500mm.)

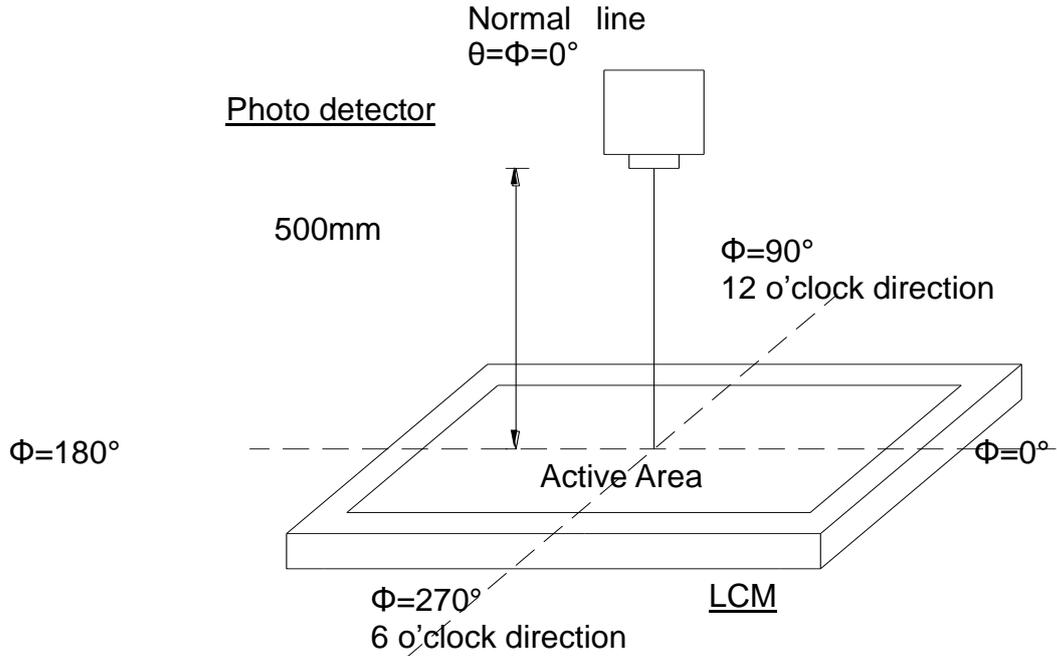


Fig. 4-2 Optical measurement system setup

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_{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%.

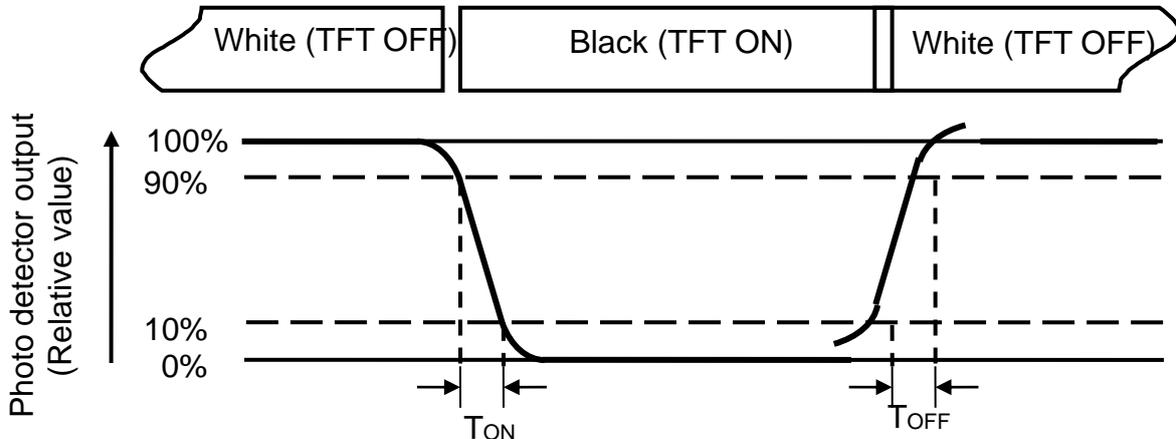


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

L-----Active area length W----- Active area width

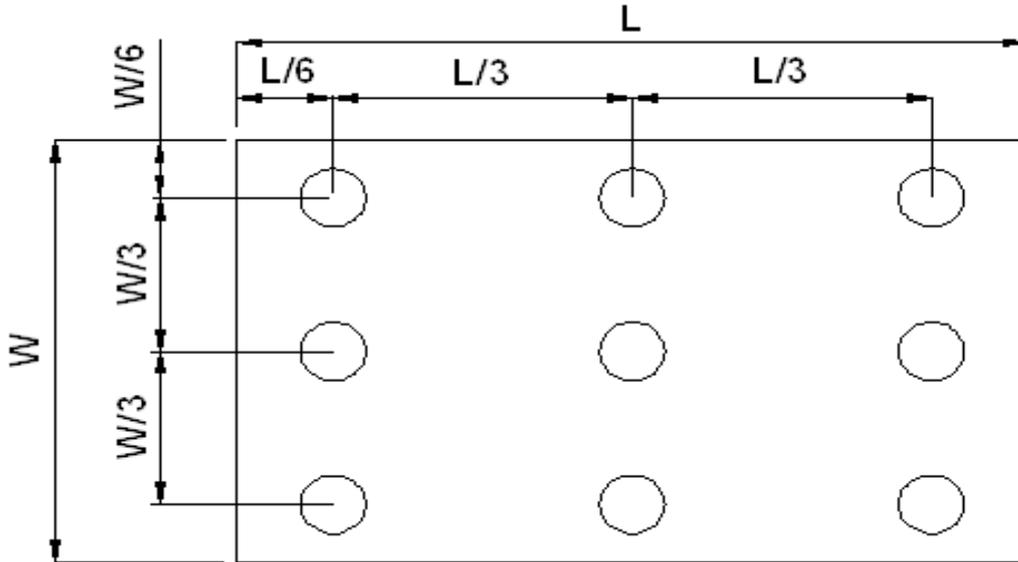


Fig. 4-4 Definition of measuring points

B_{max} : The measured maximum luminance of all measurement position.
 B_{min} : The measured minimum luminance of all measurement position.

6. Reliability Test Items

Item	Test Conditions	Remark
High Temperature Storage	Ta =80℃ 240hrs	
Low Temperature Storage	Ta = -30℃ 240hrs	
High Temperature Operation	Ts = 70℃ 240hrs	
Low Temperature Operation	Ta =-20℃ 240hrs	
Operate at High Temperature and Humidity	60℃, 90%RH max. 240hrs	Operation
Thermal Shock	-20℃~+70℃ 100cycles 0.5Hrs/cycle	Non-operation
Electrostatic Discharge	Contact=±4KV, class B Air=±8KV, class B	

Note1: 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.

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

7. General Precautions

7.1. 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.

7.2. 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 lcs.

7.3. 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.

7.4. 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

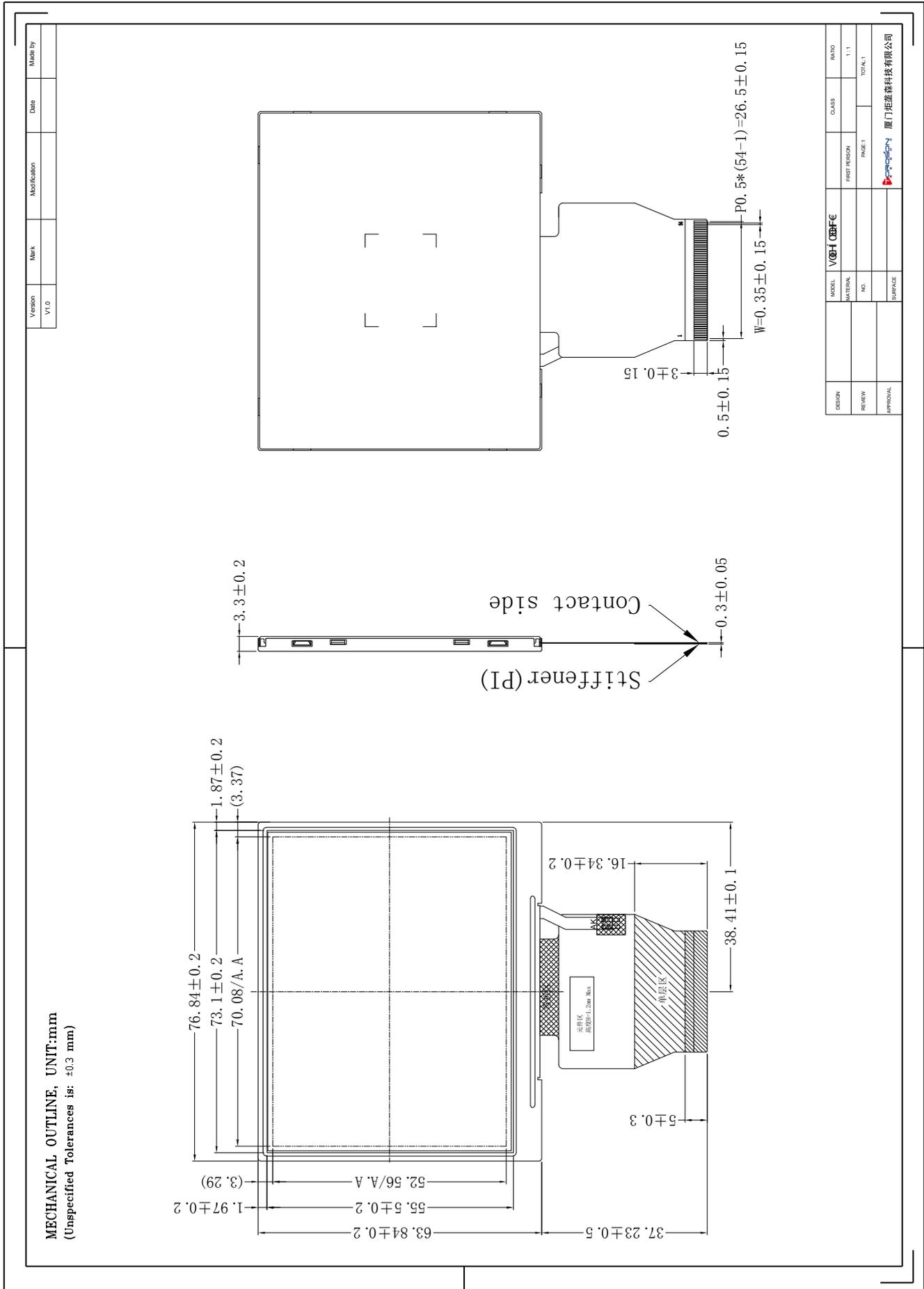
3. Store the module in an anti-electrostatic container or bag.

7.5. 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.

8. Mechanical Drawing



9. Packing and Label Format

TBD