

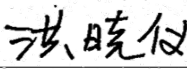
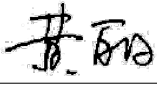
PRODUCT SPECIFICATION

CDTECH Model: **S156KWU09NP-FC13-GF**

CUSTOMER Model: **-**

Description: **15.6 " TFT-LCD Module with CTP**

Version: **1.0**

CDTECH	PREPARED BY	CHECKED BY	APPROVED BY
SIGNATURE			
DATE	2024.7.23	2024.7.23	2024.7.23

CUSTOMER APPROVAL	SIGNATURE	DATE



Record of Revisions

[illegible]



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1. General Specifications

1.1 LCM General Information

Item	Specification	Unit
LCD Size	15.6	inch
Number of Pixels	1920 (H) RGB x 1080 (V)	pixels
Display Mode	Normally Black	-
Viewing Direction	Free	o' clock
Interface	EDP	-
Display Colors	16.7M	colors
Outline Dimension	384.2 (H) x 266.6 (V) x 7.1 (D)	mm
Active Area	344.16 (H) x 193.59 (V)	mm
Pixel Pitch	0.1792 (H) x 0.1792 (V)	mm
Driver IC	-	-
Operation Temperature	0~50	°C
Storage Temperature	-20~60	°C

1.2 Touch Panel Information

Item	Specification
Touch Structure	G+G
Bonding Type with LCM	OCA Optical Bonding
Driver IC	ILI2511 (COB)
Interface	USB
Touch Count Max	-
Surface treatment	AG+AF
Surface hardness	6H
I2C slave address	0x82
Origin of coordinate	Top Left Corner

Note1: Requirements on environmental protection RoHS compliant.

2. Absolute Maximum Ratings

Item	Symbol	MIN.	MAX.	Unit	Note
Analog Supply voltage	LCD_VCC	-0.3	3.6	V	Note 1

Note 1: Permanent damage may occur to the LCD module if beyond this specification.

Functional operation should be restricted to the conditions described under normal operating conditions.

3. Electrical Characteristics

3.1 Recommended Operating Condition for TFT LCD

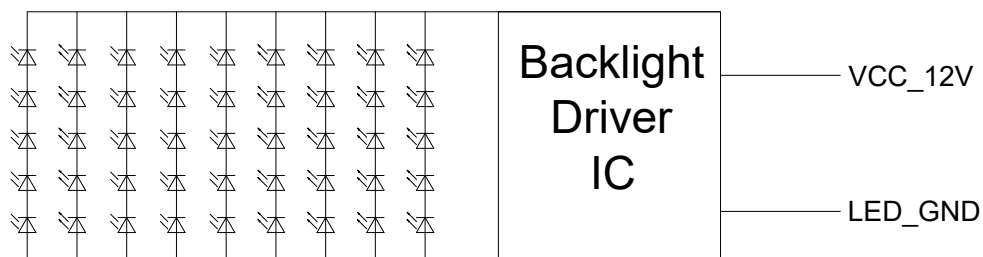
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Analog Supply voltage	LCD_VCC	3.0	3.3	3.6	V	
Analog supply current	I_{LCD_VCC}	-	233	-	mA	LCD_VCC=3.3V
Logic input voltage	V _{IH}	0.7*LCD_VCC	-	LCD_VCC	V	
	V _{IL}	GND	-	0.3*LCD_VCC	V	

3.2 Recommended Driving Condition for Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Driving Current	I_{BLU}	-	300	-	mA	
Driving Voltage	V_{BLU}	-	12	-	V	
Power consumption	W_{BLU}	-	3.6	-	W	
LED Life-Time	N/A	-	30,000	-	Hours	Ta=25°C Note 1

Note 1: LED lifetime is defined as the module brightness decay 50% of original brightness at Ta=25 degree, typical current.

Note 2:LED circuit :



CIRCUIT DIAGRAM

45 CHIP WHITE LED, 5S9P,
VF =27~29V; IF=100mA

3.3 Touch Panel

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply voltage	VBUSIN	-	5.0	-	V	
Analog supply current	I _{VBUSIN}	-	TBD	-	mA	VBUSIN=5.0V
Input high-level voltage	VIH	0.7*VBUSIN	-	VBUSIN	V	
Input low -level voltage	VIL	GND	-	0.3*VBUSIN	V	

4. Interface Pin Assignment

4.1 LCM Pin Assignment

No.	Symbol	Description
1	NC	No Connection
2	H_GND	Ground
3	LANE1_N	eDP RX Channel 1 Negative
4	LANE1_P	eDP RX Channel 1 Positive
5	H_GND	Ground
6	LANE0_N	eDP RX Channel 0 Negative
7	LANE0_P	eDP RX Channel 0 Positive
8	H_GND	Ground
9	AUX_CH_P	eDP AUX CH Positive
10	AUX_CH_N	eDP AUX CH Negative
11	H_GND	Ground
12	LCD_VCC	Power Supply, 3.3V (typ.)
13	LCD_VCC	Power Supply, 3.3V (typ.)
14	BIST	Self Test(BIST) prohibit pull up resistor on LCD side
15	GND	Ground
16	GND	Ground
17	HPD	Hot Plug Detect Output
18	BL_GND	LED Ground
19	BL_GND	LED Ground
20	BL_GND	LED Ground
21	BL_GND	LED Ground
22	BL_ENABLE	LED Enable Pin
23	BL_PWM	System PWM Signal Input
24	NC	No Connection
25	NC	No Connection
26	BL_POWER	LED Power Supply
27	BL_POWER	LED Power Supply
28	BL_POWER	LED Power Supply
29	BL_POWER	LED Power Supply
30	NC	No Connection

4.2 USB Pin Assignment

No.	Symbol	Description
1	VBUSIN	Power supply
2	DN	Data- input
3	DP	Data+ input
4	GNDIN	Ground

5. Interface Characteristics

5.1 Signal Electrical Characteristics

Table 5. Display Port Main Link

Parameter	Description	Min.	Typ.	Max.	Unit
V_{CM}	Differential Common Mode Voltage	-	0	-	V
$V_{Diff P-P}$ Level	Differential Peak to Peak Voltage Level 1	0.4	-	1.3	V

Note:

- (1) Input signals shall be low or Hi- resistance state when VCC is off.
- (2) It is recommended to refer the specifications of VESA Display Port Standard.

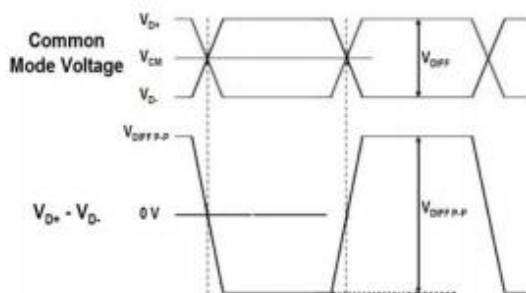


Figure 4. Display Port Main Link Signal

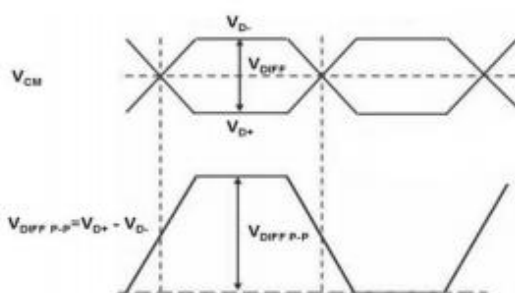


Figure 5. Display Port AUX_CH Signal

Table 6. Display Port AUX_CH

Parameter	Description	Min.	Typ.	Max.	Unit
V_{CM}	Common Mode Voltage When receiving	0	-	2.0	V
	Common Mode Voltage When transmitting	-	0.15	-	V
$V_{Diff P-P}$	Differential Peak to Peak Voltage	0.4	-	0.8	V

Note: Follow as VESA Display Port standard.

Table 7. Display Port V_{HPD}

Parameter	Description	Min.	Typ.	Max.	Unit
V_{HPD}	HPD Voltage	2.25	-	3.6	V

Note: Follow as VESA Display Port standard.

5.2 Interface Timings

Table 8. Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Frequency	Fclk	111.0	138.8	150.3	MHz
H Total Time	HT	2,040	2,080	2,120	Clocks
H Active Time	HA	1,920			Clocks
V Total Time	VT	1,104	1,112	1,120	Lines
V Active Time	VA	1,080			Lines
Frame Rate	Fv	48	60	65	Hz

Note1: $HT * VT * \text{Frame Frequency} \leq 150.3 \text{ MHz}$

Note2: All reliabilities are specified for timing specification based on refresh rate of 60Hz.

5.3 Input Power Specifications

Input power specifications are as follows.

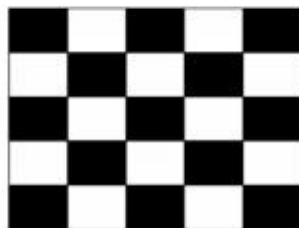
Table 9. Input Power Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
System Power Supply						
LCD Drive Voltage (Logic)	V _{CC}	3.0	3.3	3.6	V	(1),(2)
V _{CC} Current	I _{VCC}	-	0.233	-	A	(1),(3)
V _{CC} Power Consumption	P _{VCC}	-	-	0.75	W	
Rush Current	I _{rush}	-	-	1.5	A	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage	V _{VCC-RP}	-	-	200	mV	(1)
LED Power Supply						
LED Driver Input Voltage	V _{LED}	5	12	21	V	(1),(2)
PWM Signal Voltage	High	2.5	-	V _{CC}	V	(1),(2)
	Low	-	-	0.4		
LED Enable Voltage	High	2.5	-	V _{CC}	V	
	Low	-	-	0.4		
Input PWM Frequency	F _{PWM}	200	-	2000	Hz	(1),(2),(6)
Duty Ratio	PWM	1	-	100	%	(1),(7)

Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25°C, Humidity: 50± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified V_{CC} current and power consumption are measured under the $V_{CC} = 3.3V$, $F_V = 60Hz$ condition and 5*5 mosaic Pattern.



Note (4) The figures below is the measuring condition of V_{CC} Rush current can be measured when T_{rush} is 0.5ms.

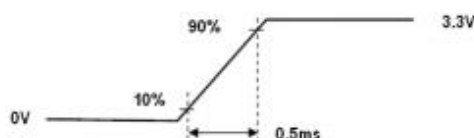


Figure 6. V_{CC} Rising Time

Note (5) The power consumption of LED Driver are under the $V_{LED} = 12V$, Dimming of Max luminance.

Note (6) Although acceptable range as defined, the dimming ratio is not effective at all conditions. The PWM frequency should be fixed and stable for more consistent luminance control at any specific level desired.

Note (7) The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.

Note (9) Because there are voltage dividers on some control signal lines of the connector, please pay special attention when using it.

5.4 Power ON/OFF Sequence

Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when V_{CC} voltage is off.

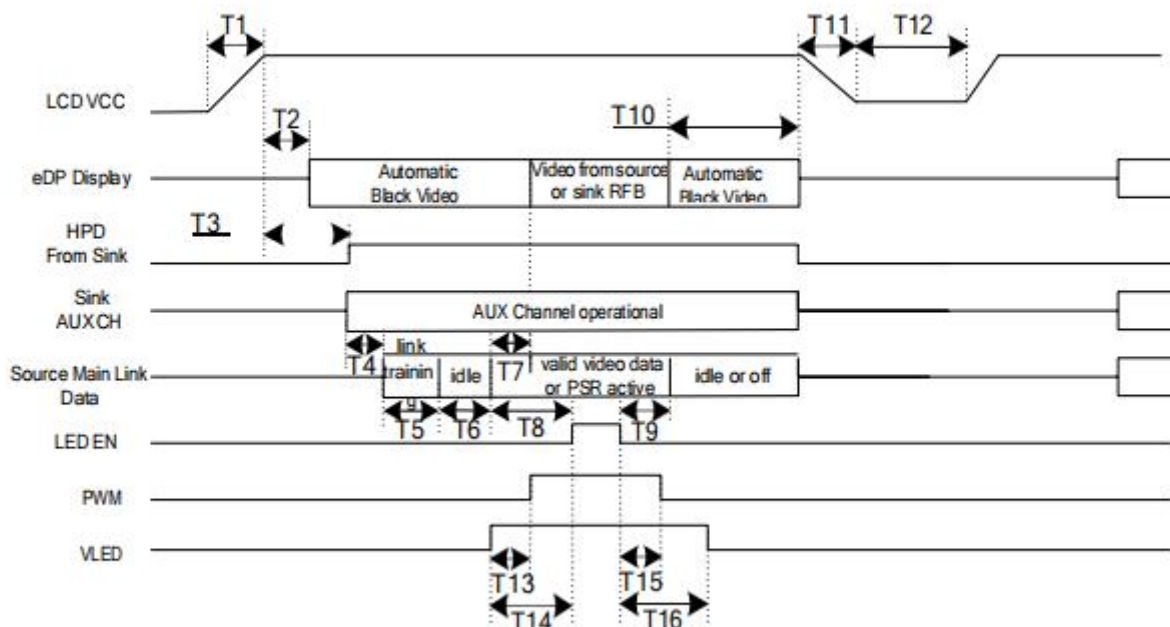


Figure 7. Power Sequence

Table 10. Power Sequencing Requirements

Parameter	Symbol	Min.	Typ.	Max.	Unit
V _{CC} Rise Time (10% to 90%)	T1	(0.5)	-	(10)	ms
Delay from V _{CC} to automatic Black Video generation	T2	(0)	-	(200)	ms
Delay from V _{CC} to HPD high	T3	(0)	-	(200)	ms
Delay from HPD high to link training initialization	T4	-	-	-	ms
Link training duration	T5	-	-	-	ms
Link idle	T6	-	-	-	ms
Delay from valid video data from Source to video on display	T7	(0)	-	(50)	ms
Delay from valid video data from Source to backlight enable	T8	(200)	-	-	ms
Delay from backlight disable to end of valid video data	T9	-	-	-	ms
Delay from end of valid video data from Source to V _{CC} off	T10	(0)	-	(500)	ms
V _{CC} fall time (90% to 10%)	T11	(0.5)	-	(10)	ms
V _{CC} off time	T12	(500)	-	-	ms
Delay from V _{LED} to PWM	T13	0	-	-	ms
Delay from V _{LED} to backlight enable	T14	0	-	-	ms
Delay from backlight disable to V _{LED} off	T15	0	-	-	ms
Delay from PWM off to V _{LED} off	T16	0	-	-	ms

6. Optical Specifications

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR≥10) B/L ON	θ_T	$\Phi=90^\circ$ (12 o'clock)	80	85	-	deg	Note2
	θ_B	$\Phi=270^\circ$ (6 o'clock)	80	85	-	deg	Note2
	θ_L	$\Phi=180^\circ$ (9 o'clock)	80	85	-	deg	Note2
	θ_R	$\Phi=0^\circ$ (3 o'clock)	80	85	-	deg	Note2
Response Time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	12	15	msec	Note4
	T_{OFF}		-	12	15	msec	Note4
Contrast Ratio	CR		(600:1)	(800:1)	-	-	Note1 Note3
Color Chromaticity	W_X		0.2966	0.3266	0.3566	-	Note1 Note5
	W_Y		0.3159	0.3459	0.3759	-	Note1 Note5
Luminance	L		350	400	-	cd/m ²	Note1 Note7
Luminance Uniformity	Y_U		70	80	-	%	Note1 Note6
NTSC	-		42	45	-	%	-

Note 1: 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. All input terminals LCD panel must be ground when measuring the center area of the panel.

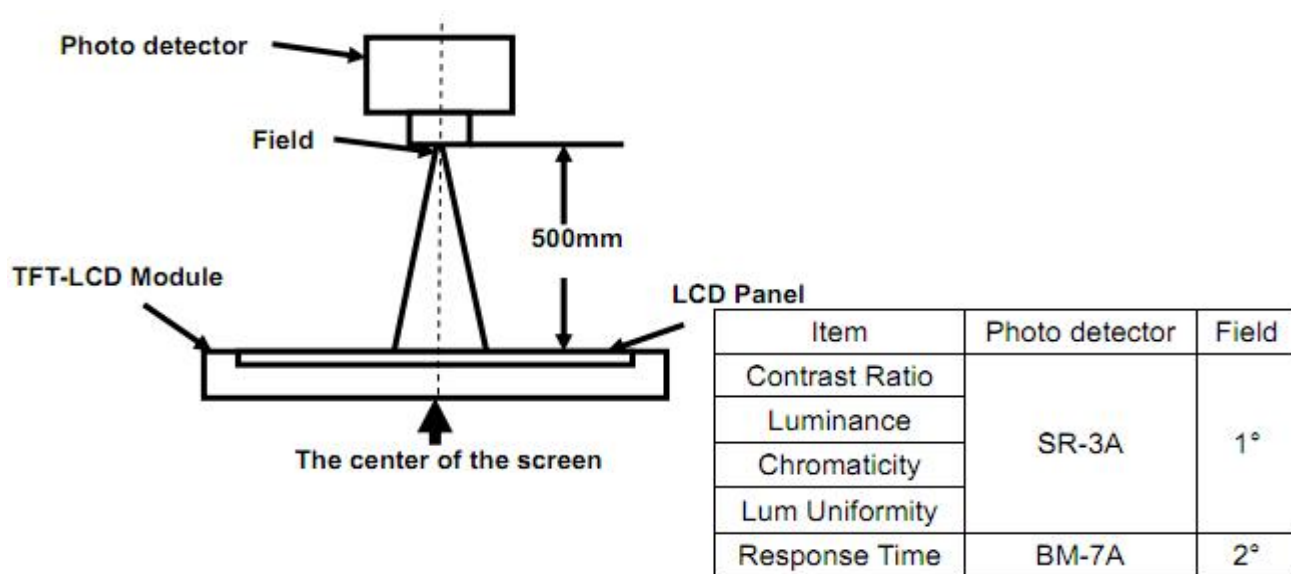


Fig 1

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

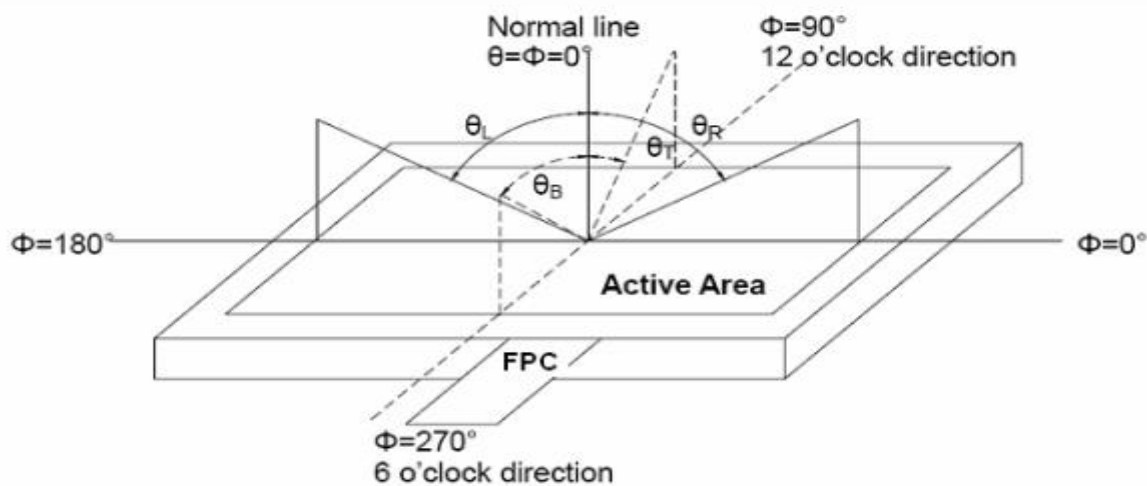


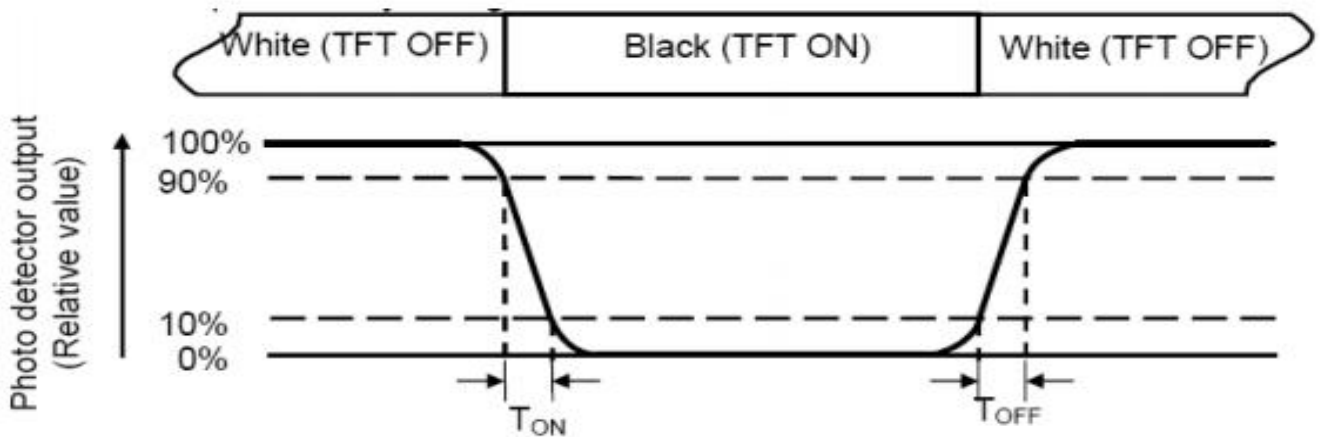
Fig 2 Definition of viewing angle

Note 3: Definition of contrast ratio

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

Note 4: Definition of Response time

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



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.3-a/b

Note 7: Surface luminance is the luminance with all pixels displaying white.

L_v = Average Surface Luminance with all white pixels ($P_1, P_2, P_3, \dots, P_n$)

For more information see FIG.3-a/b

Note 8: Size : $S \leq 5"$ (see Figure a) H,V : Active area

Light spot size $\varnothing = 5\text{mm}$ (BM-5) or $\varnothing = 7.7\text{mm}$ (BM-7) 50cm distance or test spot position : see Figure a.

measurement instrument : TOPCON's luminance meter SR-3A or BM-7 or compatible (see Figure 1).

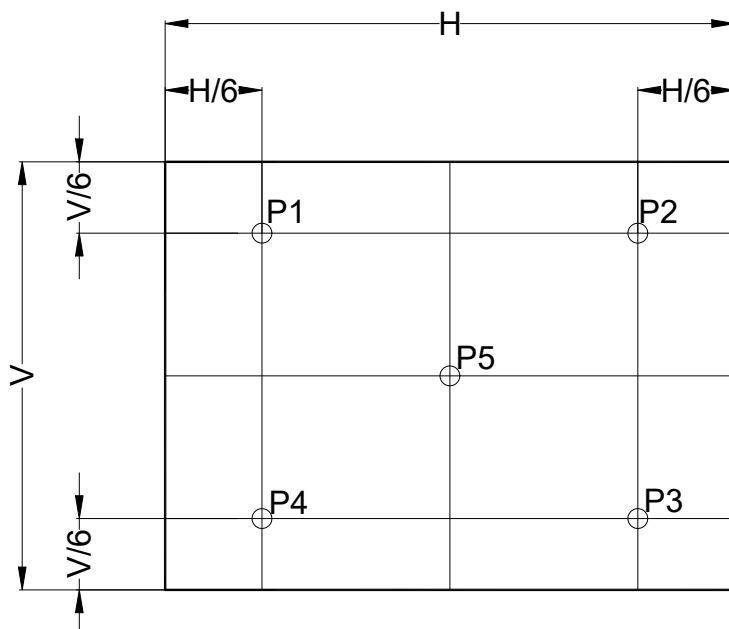


Fig. 3-a Definition of points

$5" < S \leq 12.3"$ (see Figure b) . H,V : Active area

Light spot size $\varnothing = 5\text{mm}$ (BM-5) or $\varnothing = 7.7\text{mm}$ (BM-7) 50cm distance or compatible distance from the LCD surface to detector lens. test spot position : see Figure b.

measurement instrument : TOPCON's luminance meter SR-3A or BM-7 or compatible (see Figure 1).

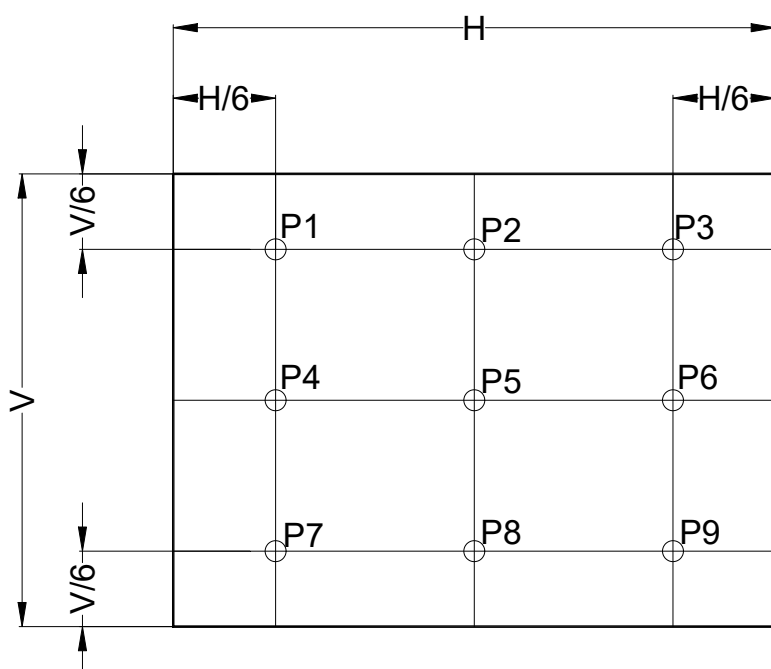


Fig. 3-b Definition of points

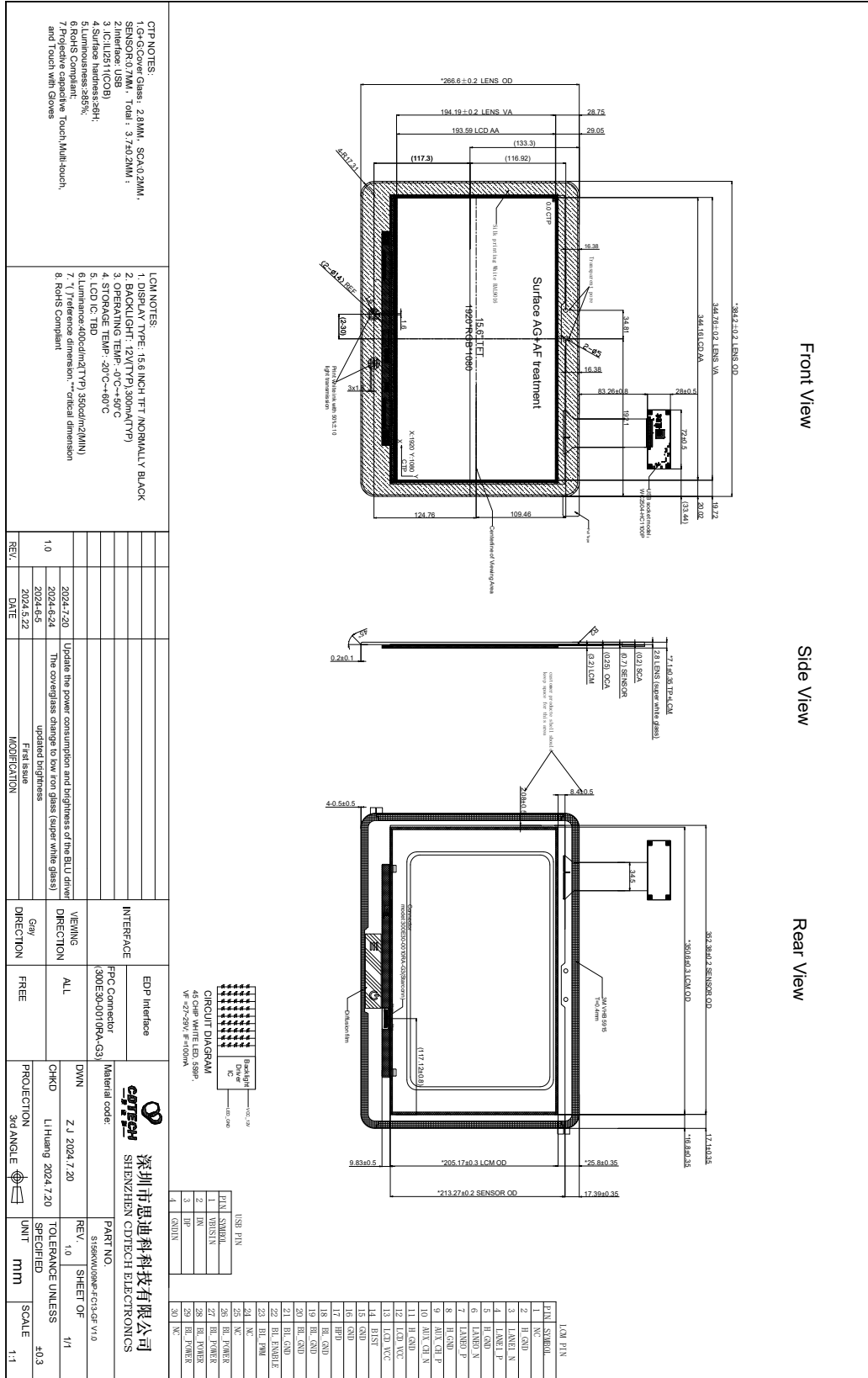
7. Reliability Test Items

Test Item	Test Conditions
High Temperature Storage	Ta= +60℃ 96hrs
Low Temperature Storage	Ta= -20℃ 96hrs
High Temperature Operation	Ta= +50℃ 96hrs
Low Temperature Operation	Ta= 0℃ 96hrs
High Temperature and Humidity Storage	Ta= +60℃, 90% RH 96hrs
Thermal Shock (Non-operation)	-20℃/30 min ~ +60℃/30 min for 20 cycles Start with cold temperature end with high temperature
Electro Static Discharge	Contact = ± 4 kV, class B Air = ± 8 kV, class B R=330Ω,C=150pF
Vibration	Sweep: 10Hz~55Hz~10Hz Stroke: 1.5mm 2 hrs for each direction of X .Y. Z.
Mechanical Shock	60G 6ms,±X,±Y,±Z 3 times for each direction
Package Drop Test	Height: 60 cm 1 corner, 3 edges, 6 surfaces

Notes: The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

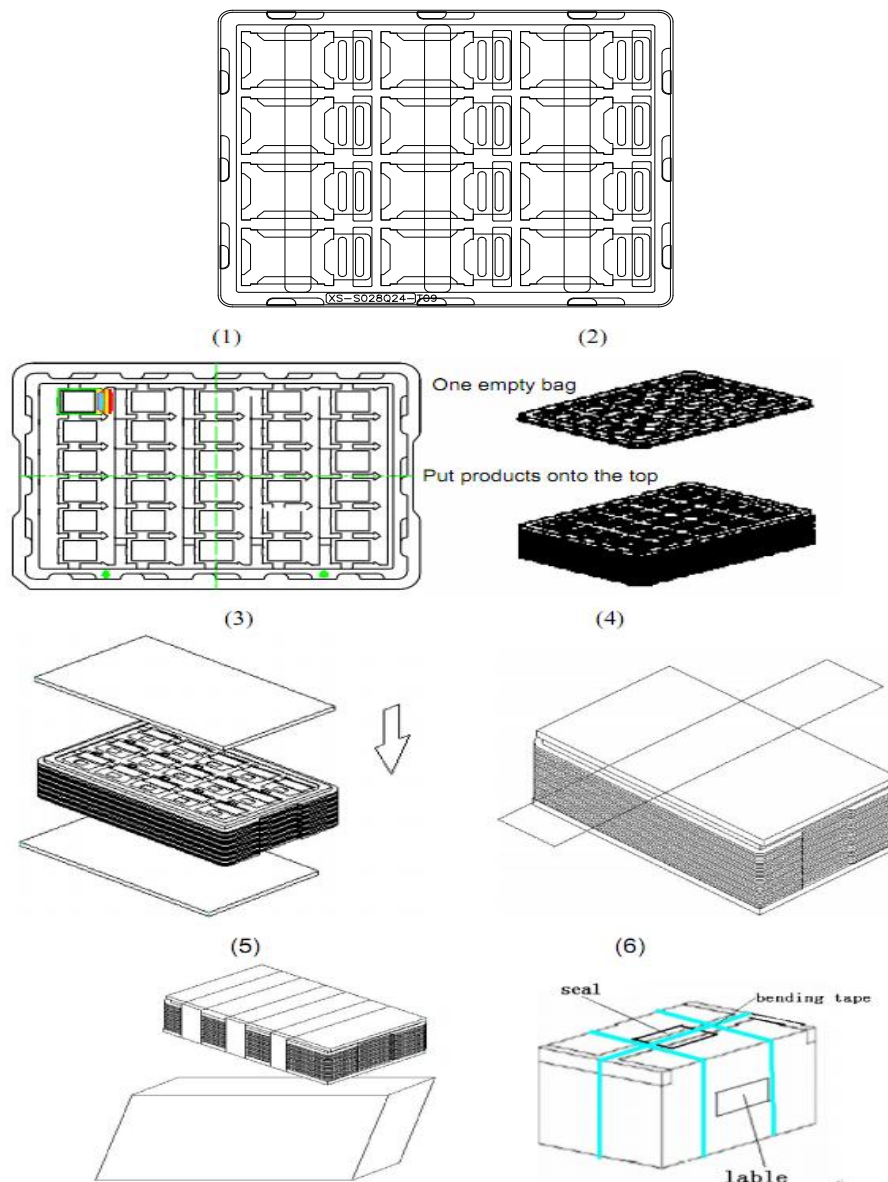
- 1). Air bubble in the LCD
- 2). Seal leak or Glass crack
- 3). Non display or abnormal display
- 4). Brightness reduction >50%

8. Mechanical Drawing



9. Packing

Packing Method



Steps:

1. Put module into tray cavity
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above
4. Fix the cardboard to the tray stack with adhesive tape
5. Put the tray stack into carton
6. Carton sealing with adhesive tape

10. Precautions for Use of LCD modules

10.1 Handling Precautions

10.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketene
- Aromatic solvents

10.1.6. Do not attempt to disassemble the LCD Module.

10.1.7. If the logic circuit power is off, do not apply the input signals.

10.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1. Be sure to ground the body when handling the LCD Modules.

10.1.8.2. Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage Precautions

10.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2. The LCD modules should be stored under the storage temperature range if the LCD modules will be stored for a long time, the recommend condition is :

Temperature : 0℃ ~40℃ Relatively humidity: ≤80%

10.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.