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**DV650QUM-N00**

**Product Preliminary Specification**

**Rev. O**

**Hefei BOE Display Technology Co.,Ltd**

SPEC. NUMBER

S8-65-AA-149

PRODUCT GROUP

TFT-LCD

Rev. O

ISSUE DATE

2022/5/9

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REVISION HISTORY

(√) preliminary specification

( ) Final specification

Revision No.	Page	Description of changes	Date	Prepared
O	-	Initial Release	2022/5/9	Xianan

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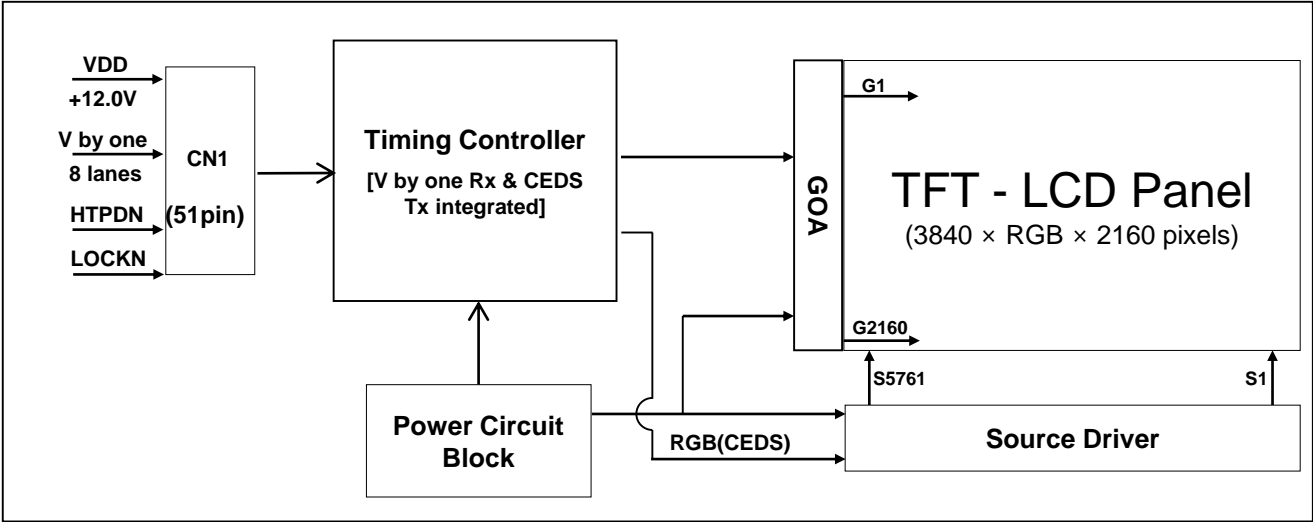
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## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

DV650QUM-N00 is a color active matrix TFT LCD MDL using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This MDL has a 64.5 inch diagonally measured active display area with UHD resolutions (3840 horizontal by 2160 vertical pixel array)).Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this open cell can display 1.07G colors. The TFT-LCD panel is adapted for a low reflection and higher color type.



### 1.2 Features

- V by one interface with 8 lanes
- High-speed response
- Low color shift image quality
- 8-bit + FRC color depth, display 1.07G colors
- High luminance and contrast ratio, low reflection and wide viewing angle
- Gate driver use GOA mode
- DE (Data Enable) only mode
- ADS technology is applied for high display quality
- RoHS compliant
- Landscape and Portrait Display
- 7\*24hrs in auto aging status

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1.3 Application

- Commercial Digital Display
- Display Terminals for Control System
- Landscape and Portrait Display

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	1428.48(H) × 803.52(V)	mm	
Number of pixels	3840(H) × 2160(V)	pixels	
Pixel pitch	0.372(H) × 0.372(V)	um	
Pixel arrangement	Pixels RGB Vertical stripe		
Display colors	8bit+FRC	colors	8bits True
Display mode	Normally Black		
Dimensional outline	1450.38(H) × 825.47(V) × 32.05(Body) /50.9(Converter Cover)	mm	Detail refer to drawing
Weight	Typ. 20.29	Kg	
Power Consumption	229.6	Watt	Typ.
Surface Treatment	Haze 1%		
Back-light	D-LED Backlight		
Possible display type	Landscape and Portrait Enabled		

## 2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

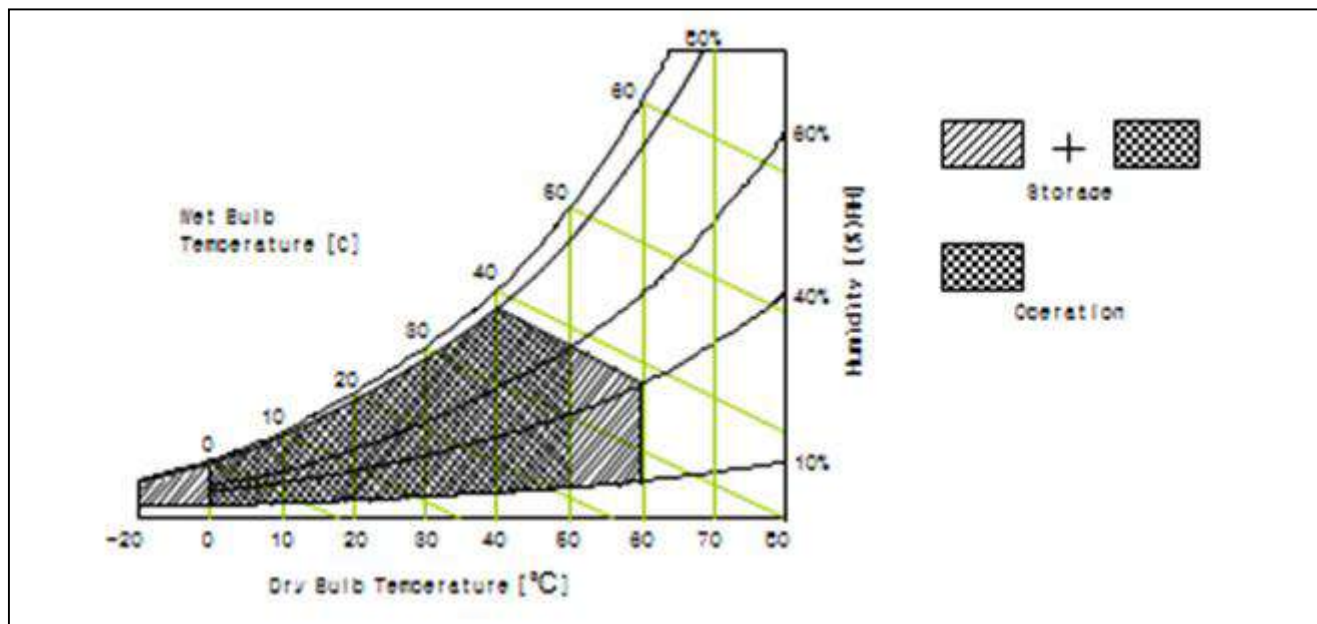
< Table 2. Open Cell Electrical Specifications >

[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	VSS-0.3	13.2	V	Ta = 25 °C
Operating Temperature	T <sub>OP</sub>	0	+50	°C	Note 1
Storage Temperature	T <sub>SUR</sub>	-20	+60	°C	
	T <sub>ST</sub>	-20	+60	°C	
Operating Ambient Humidity	Hop	10	80	%RH	
Storage Humidity	Hst	10	80	%RH	

Note 1 : Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 °C max. and no condensation of water.



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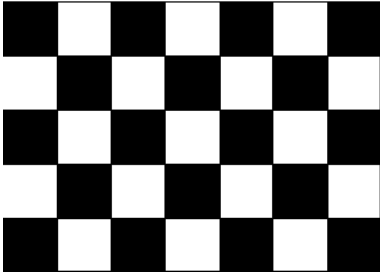
3.0 ELECTRICAL SPECIFICATIONS


3.1 TFT LCD Open Cell

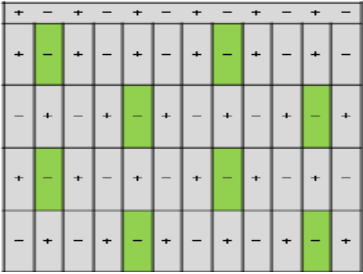
< Table 3. Open Cell Electrical Specifications > [Ta =25±2 °C]

Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	Vdc	
Power Supply Ripple Voltage		VRP	-	-	600	mV	
Power Supply Current		IDD	-	0.76	2.2	A	Note 1
Power Consumption		PDD	-	9.1	26.4	Watt	
Rush current		IRUSH	-	-	10	A	Note 2
V by One Interface	Differential Input High Threshold Voltage	VLVTH	-	-	+50	mV	
	Differential Input Low Threshold Voltage	VLVTL	-50	-	-	mV	
	Common Input Voltage	VLVC	-	-	-	V	
	Terminating Resistor	Rt	90	100	110	ohm	
CEDS Interface	Transmission Line Impedance	Z0	-	50	-	ohm	
	Input termination Resistance	Ri	90	100	110	ohm	
CMOS Interface	Input High Threshold Voltage	VIH	2.0	-	3.3	V	
	Input Low Threshold Voltage	VIL	0	-	0.8	V	

Note 1 : The supply voltage is measured and specified at the interface connector of LCM.  
The current draw and power consumption specified is for VDD=12.0V,  
Frame rate f<sub>v</sub>=60Hz and Clock frequency = 74.25MHz.  
Test Pattern of power supply current

a) Typ : Mosaic 7X5 (L0/L255)


b) Max : Horizontal 1 Line (L0/L255)


c) Flicker Pattern


Note 2 : The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

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3.2 LED Constant current source LED

3.2.1 Input Electrical Characteristics

输入电压 Input voltage	22Vdc to 26Vdc
输入电流 Input current	Max.12A at 24Vdc input and full load

3.2.2 Output Electrical Characteristics

(LED DRIVER(DC/DC)ELECTRICAL REQUIREMENTS)

输出功率(Output Power)

输出功率 Output Power	Max. 244.8W
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恒流输出特性(Constant Current Output Characteristics)

输出通道 Output Channel	最低电压 Min Voltage	典型电压 Type Voltage	最高电压 Max. Voltage	输出电流 Output current
LED	98.6V	108.8V	122.4V	400mA*5

背光控制(The Backlight On/Off Control)

BL Signal	Remark	Outputs
BL-High	≥2.5V	Output
BL-Low	≤0.5V	X
BL-Open	--	X

备注：恒流源输出受控于一个 TTL 电平兼容的信号（BL），此信号电平需在 0-5V 之间  
Remark: The Constant Current Source DC outputs current shall be enable with an active-TT L-compatible signal (BL). The signal level must be between 0-5V.

- BL 高电平，打开输出。  
When BL is pulled to TTL high, the DC current outputs are to be enabled.
- BL 低电平或悬空，关闭输出。  
When BL is pulled to TTL low or open circuit, the DC outputs are to be disabled.

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调光(Adjust Backlight Brightness)

PWM Signal	Remark
PWM-High	≥2.5V
PWM-Low	≤0.5V
PWM-Duty	10%-99%
PWM-Frequency	150-300Hz

DC Signal	Remark
DC-Voltage	0V-5V

备注(Remark):  
I ADJ 脚接 PWM 信号,此 PWM 信号能调节背光亮度, PWM 信号占空比越宽, 背光越亮,此信号电平需在2.5V-5V 之间。  
The ADJ pin must be connected to a PWM signal. The PWM signal can adjust the backlight brightness, the wider the duty cycle, the brighter the backlighting. The signal level must be between 2.5V-5V.  
I ADJ脚接DC信号。此DC信号能调节背光亮度, 电压越高, 背光越暗, 此信号电平需在0V-5V之间。  
The ADJ pin must be connected to a DC signal. The DC signal can adjust the backlight brightness, the higher the voltage, the darker the backlighting. The signal level must be between 0-5V.  
I 调光方式: ☐ PWM调光 ☒ DC调光 ☐ Other

3.2.3 Interface Connections

CON1(Type : Pitch 2.0)    Connect(XH2.5-14aW)

PIN号(Pin Number)	符号(Symbol)	功能(Function)	
1. 2. 3. 4. 5	+24V	INPUT VOLTAGE	
6. 7. 8. 9. 10	GND	Ground	
11. 14	NC	NC	
12	BL-ON	LED ON/OFF CONTROL(ON≥2.5)	
13	ADJ	Dimming control	0V=Brightness Max
			5V=Brightness Min

CON2(Type : Pitch 2.0mm)

PIN号(Pin Number)	符号(Symbol)	功能(Function)
1	LED1+	LED+ OUTPUT
2	LED1-	LED- OUTPUT

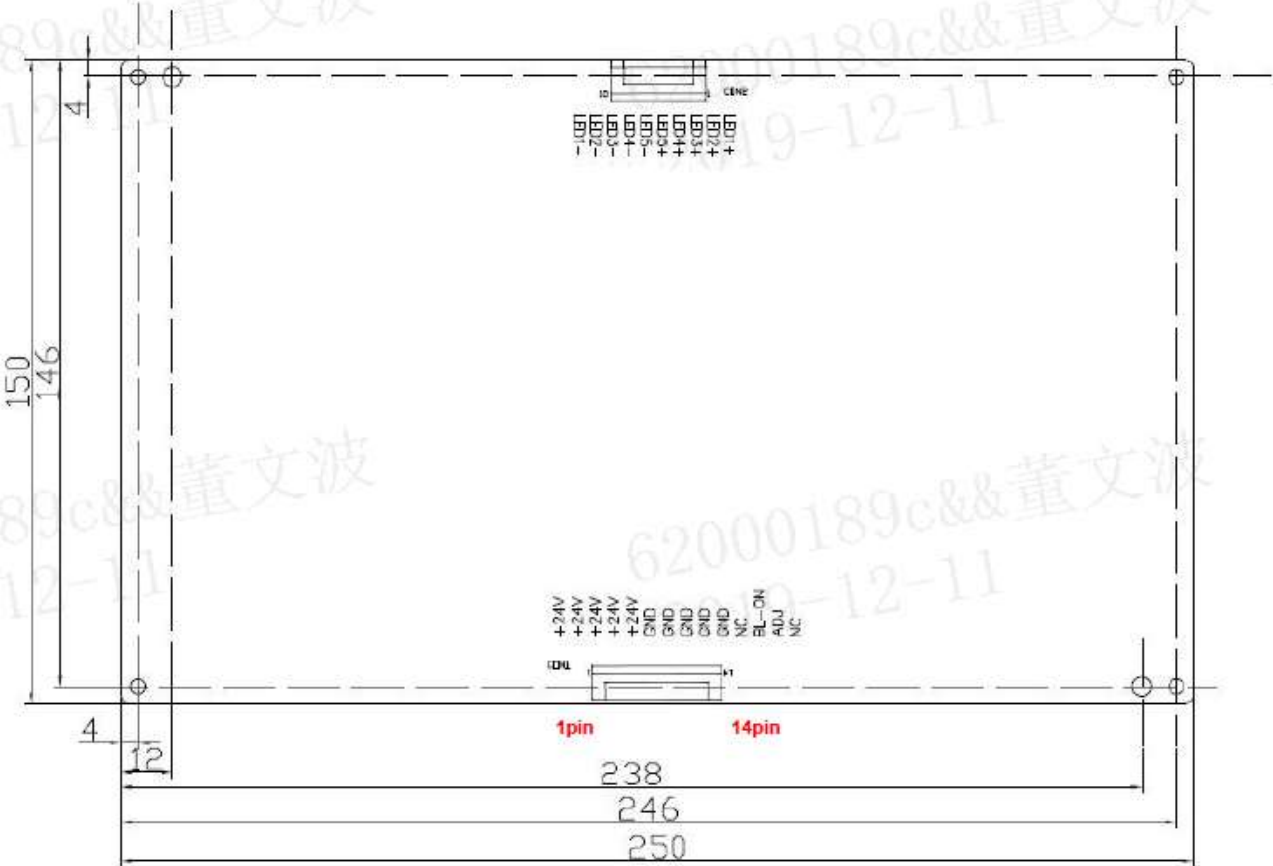
Notice: 1. PIN 13:External ADJ Control

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### 3.2.4 Mechanical Characteristics

Outline Dimension  
250(L)\*150(W)\*12(H) mm

(Mounting)



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4.0 INTERFACE CONNECTION

4.1 Open Cell Input Signal & Power

- V by one Connector: F05035-51P-H(昶通) or Equivalent.

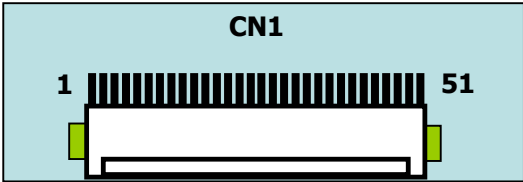
< Table 4. Open Cell Input Connector Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	VDD	Power Supply +12.0V	27	GND	Ground
2	VDD	Power Supply +12.0V	28	Rx0n	V-by-One HS Data Lane 0
3	VDD	Power Supply +12.0V	29	Rx0p	V-by-One HS Data Lane 0
4	VDD	Power Supply +12.0V	30	GND	Ground
5	VDD	Power Supply +12.0V	31	Rx1n	V-by-One HS Data Lane 1
6	VDD	Power Supply +12.0V	32	Rx1p	V-by-One HS Data Lane 1
7	VDD	Power Supply +12.0V	33	GND	Ground
8	VDD	Power Supply +12.0V	34	Rx2n	V-by-One HS Data Lane 2
9	NC	No Connection	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	GND	Ground	40	Rx4n	V-by-One HS Data Lane 4
15	NC	No Connection	41	Rx4p	V-by-One HS Data Lane 4
16	NC	No Connection	42	GND	Ground
17	NC	No Connection	43	Rx5n	V-by-One HS Data Lane 5
18	SDA	SDA	44	Rx5p	V-by-One HS Data Lane 5
19	SCL	SCL	45	GND	Ground
20	NC	No Connection	46	Rx6n	V-by-One HS Data Lane 6
21	NC	No Connection	47	Rx6p	V-by-One HS Data Lane 6
22	SEL_SECTI ON	Low or NC: 1 section(default) High: 2 section	48	GND	Ground
23	NC	No Connection	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	HTPDN	Hot plug detect	51	GND	Ground
26	LOCKN	Lock detect			






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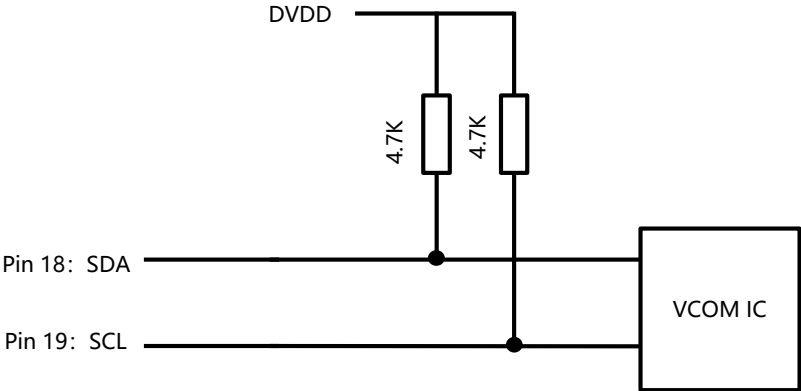
- Notes :
1. NC (Not Connected) : These pins show status of T/con board and are only used for BOE internal operations.
  2. Input pins assignments on T/con board refer to the below diagram.



3. If T/con board can't receive correct V-by-One signals, T/con will run BIST pattern as bellow.

PT1:Black (2 sec)	PT2:White (2 sec)	PT3:Red (2 sec)	PT4:Green (2 sec)	PT5:Blue (2 sec)
				

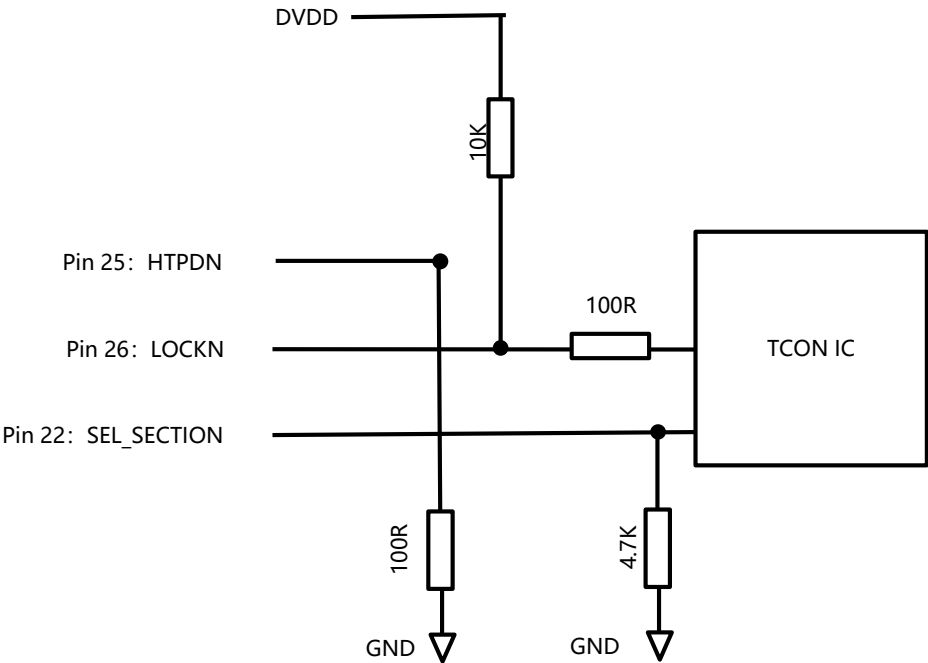
4. Circuit Block Diagram pin of SDA/SCL on Tcon board. They are used for flicker adjustment only.



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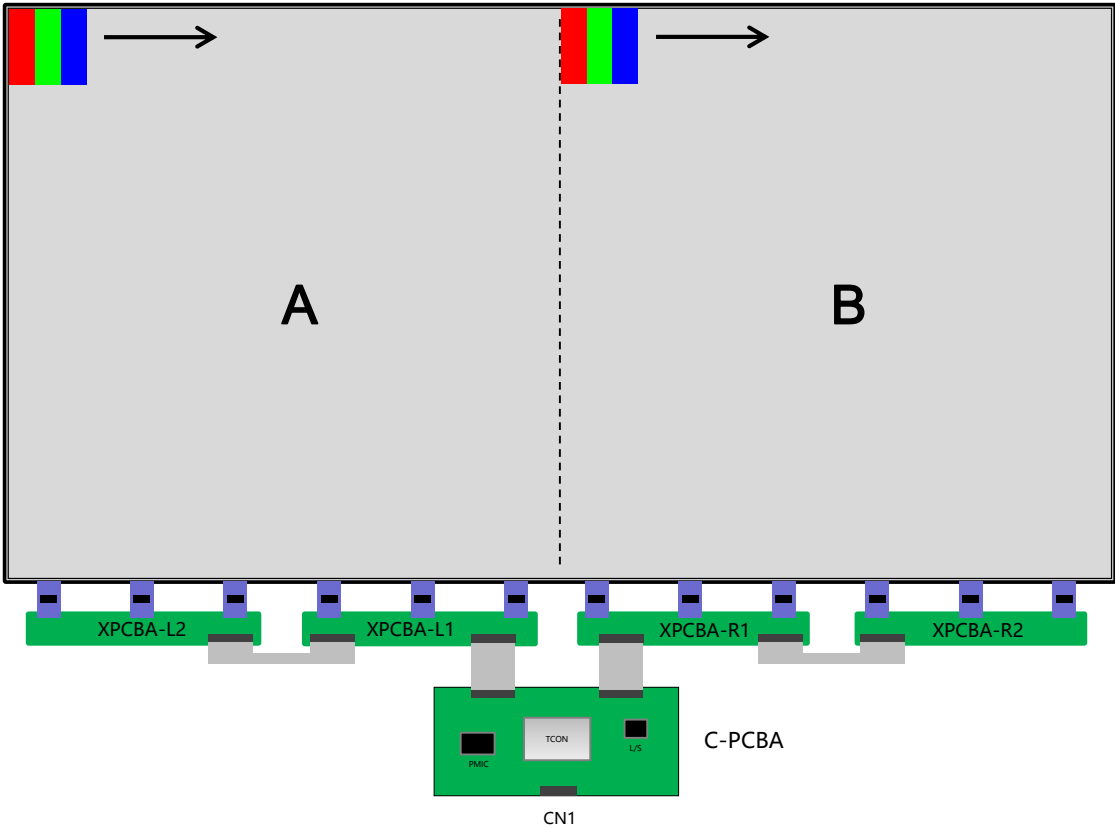
Notes :  
5. Circuit Block Diagram of HTPDN/LOCKN/SEL\_SECTION on Tcon board.



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### 4.2 V by One Data Mapping Setting

< Table5. V By One Mapping Diagram >



Connector	V-by-One
CN1	Lane 0 – Lane 7

< Table 6. V By One Data Mapping Setting Table >

1 Section					
Area	Lane	Input Data Stream			
		1st	2nd	.....	480th
A+B	Lane 0	Pixel 1	Pixel 9	.....	Pixel 3833
	Lane 1	Pixel 2	Pixel 10	.....	Pixel 3834
	Lane 2	Pixel 3	Pixel 11	.....	Pixel 3835
	Lane 3	Pixel 4	Pixel 12	.....	Pixel 3836
	Lane 4	Pixel 5	Pixel 13	.....	Pixel 3837
	Lane 5	Pixel 6	Pixel 14	.....	Pixel 3838
	Lane 6	Pixel 7	Pixel 15	.....	Pixel 3839
	Lane 7	Pixel 8	Pixel 16	.....	Pixel 3840

2 Section					
Area	Lane	Input Data Stream			
		1st	2nd	.....	480th
A	Lane 0	Pixel 1	Pixel 5	.....	Pixel 1917
	Lane 1	Pixel 2	Pixel 6	.....	Pixel 1918
	Lane 2	Pixel 3	Pixel 7	.....	Pixel 1919
	Lane 3	Pixel 4	Pixel 7	.....	Pixel 1920
B	Lane 4	Pixel 1921	Pixel 1925	.....	Pixel 3837
	Lane 5	Pixel 1922	Pixel 1926	.....	Pixel 3838
	Lane 6	Pixel 1923	Pixel 1927	.....	Pixel 3839
	Lane 7	Pixel 1924	Pixel 1928	.....	Pixel 3840

Note: T/con board supports two kinds of sections. System board output can choose either of them.



5.0 SIGNAL TIMING SPECIFICATION

5.1 Timing Parameters

< Table 7. Timing Table >

Item		Symbols	Min	Typ	Max	Unit
Frequency		1/Tc	69	74.25	77	MHz
Vertical	Frame Rate	F	57	60	62	Hz
	Total	T <sub>V</sub>	2180	2250	2450	T <sub>H</sub>
	Display	T <sub>VD</sub>	2160			T <sub>H</sub>
	Blank	T <sub>VB</sub>	20	90	290	T <sub>H</sub>
Horizontal	Total	T <sub>H</sub>	530	550	570	T <sub>CLK</sub>
	Display	T <sub>HD</sub>	-	480	-	T <sub>CLK</sub>
	Blank	T <sub>HB</sub>	50	70	90	T <sub>CLK</sub>

Item		Symbols	Min	Typ	Max	Unit
Frequency		1/Tc	69	74.25	77	MHz
Vertical	Frame Rate	F	47	50	51	Hz
	Total	T <sub>V</sub>	2180	2700	2715	T <sub>H</sub>
	Display	T <sub>VD</sub>	2160			T <sub>H</sub>
	Blank	T <sub>VB</sub>	20	540	555	T <sub>H</sub>
Horizontal	Total	T <sub>H</sub>	530	550	570	T <sub>CLK</sub>
	Display	T <sub>HD</sub>	-	480	-	T <sub>CLK</sub>
	Blank	T <sub>HB</sub>	50	70	90	T <sub>CLK</sub>

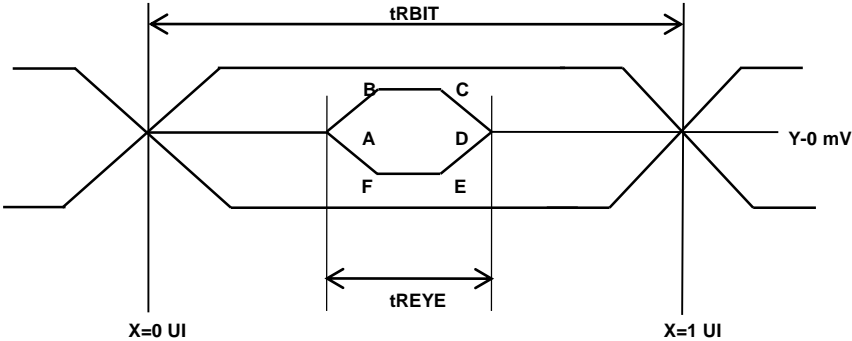
- Notes:
- 1.This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.
  2. This product should keep clock frequency and Horizontal value fixed when adjusting frame rate.

# 5.0 SIGNAL TIMING SPECIFICATION

## 5.2 V by one Input Signal Timing

< Table 8. Signal Timing Table >

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Unit Interval(VBO Operation Bit Rate)	tRBIT	3-byte	266	tTCIP/30	1667	PS
		4-byte	266	tTCIP/40	1667	PS
		5-byte	266	tTCIP/50	1667	PS
Eye Width at Package Pin	tREYE	-	-	0.5	-	UI
Eye Width Position A at Package Pin	tA	-	-	0.25	-	UI
Eye Width Position B at Package Pin	tB	-	-	0.3	-	UI
Eye Width Position Cat Package Pin	tC	-	-	0.7	-	UI
Eye Width Position D at Package Pin	tD	-	-	0.75	-	UI
Eye Width Position E at Package Pin	tE	-	-	0.7	-	UI
Eye Width Position F at Package Pin	tF	-	-	0.3	-	UI
Effective Veye level	Veye	-	-	50	-	mv
Intra – pair Skew	TTOSK_intra	-	-0.3	-	0.3	UI
Inter – pair Skew	TTOSK_inter	-	-5	-	5	UI
SSCG	-	30KHz modulation	-0.5		0.5	%



	Y[mV]
A	0
B	50
C	50
D	0
E	-50
F	-50

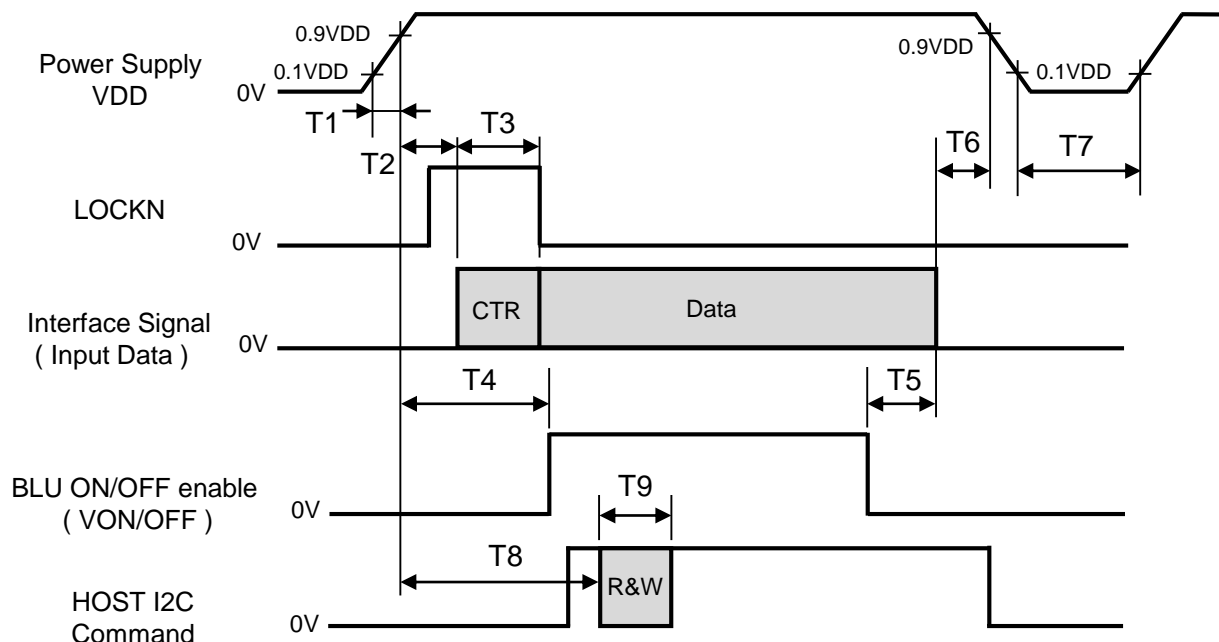
## 5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

&lt; Table 9. Input Signal and Display Color Table &gt;

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

## 5.4 Power Sequence

In order to get a normal display of the Open Cell, the power on/off sequence shall be as shown in below.



Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	-	ms
T3	0	-	500	ms
T4	T2+T3	-	-	-
T5	100	-	-	ms
T6	0	-	-	ms
T7	1	-	-	s
T8	T4	-	-	-
T9	Depends on I2C command			ms

### Notes:

- Even though T1 is out of SPEC, it is still ok if the inrush current of VDD is below the limit.
- Back Light enable must after power ready for logic and interface signal are valid.
- All input signals should set to 0 volt before VDD rising edge ready.
- If possible, T4 should not less than hundreds of milliseconds, so do T2+T3.
- HOST I2C should operate after BLU enable. It's used for flicker tuning. If customer does not need adjust panel flicker, ignoring T8 & T9.
- VDD should rise and fall smoothly. If there is rebounding voltage when falling stage, it must smaller than 5 volts.

## 6.0 OPTICAL SPECIFICATIONS

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at  $25\pm2^{\circ}\text{C}$ . The values are specified at an approximate distance 50cm from the LCD surface at a viewing angle of  $\Phi$  and  $\theta$  equal to  $0^{\circ}$ . It is presented additional information concerning the measurement equipment and method in FIG. 1.

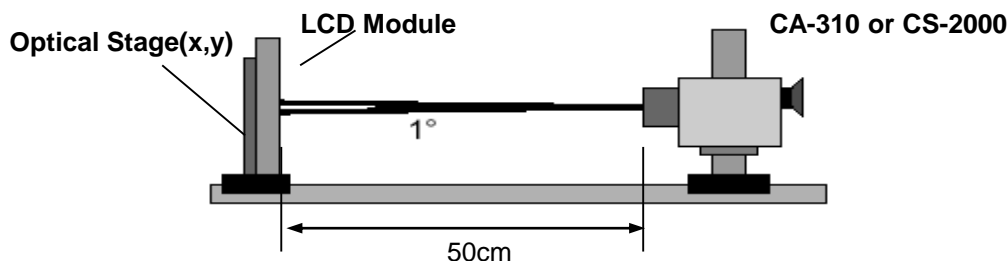


FIG. 1 Optical Characteristic Measurement Equipment and Method

< Table 12. Optical Table >

[VDD = 12.0V, Frame rate = 60Hz, Ta =  $25\pm2^{\circ}\text{C}$ ]

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		800	1200	-		1
Surface Luminance, white		L <sub>WH</sub>		450	500	-	cd/m <sup>2</sup>	2
Luminance Variation		δ <sub>WHITE</sub>	9P	75	-	-	%	3
Response Time	Gray-to-Gray	G to G		-	8	10	ms	4
Color Coordinates [CIE1931]	RED	Rx		Typ -0.03	0.63	Typ +0.03		
		Ry			0.33			
	GREEN	Gx			0.29			
		Gy			0.61			
	BLUE	Bx			0.15			
		By			0.06			
	WHITE	Wx			0.28			
		Wy			0.29			
Color Gamut					72		%	NTSC
Color Temperature				8000	-	12000	K	
Viewing Angle (CR>10)								
	x axis, right(φ=0°)	θr		-	89	-	degree	5
	x axis, left (φ=180°)	θl		-	89	-		
	y axis, up (φ=90°)	θu		-	89	-		
	y axis, down (φ=270°)	θd		-	89	-		
Gray Scale				-	-	-		6

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Note : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

It is measured at center 1-point.

2. Surface luminance are determined after the unit has been 'ON' and 1 Hour after lighting the backlight in a dark environment at 25±2°C. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2.

3. The variation in surface luminance , δ WHITE is defined as :

$$\delta \text{ WHITE(9P)} = \text{Minimum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on0}) / \text{Maximum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on9})$$

Where  $L_{on1}$  to  $L_{on9}$  are the luminance with all pixels displaying white at 9 locations .  
For more information, see the FIG. 2.

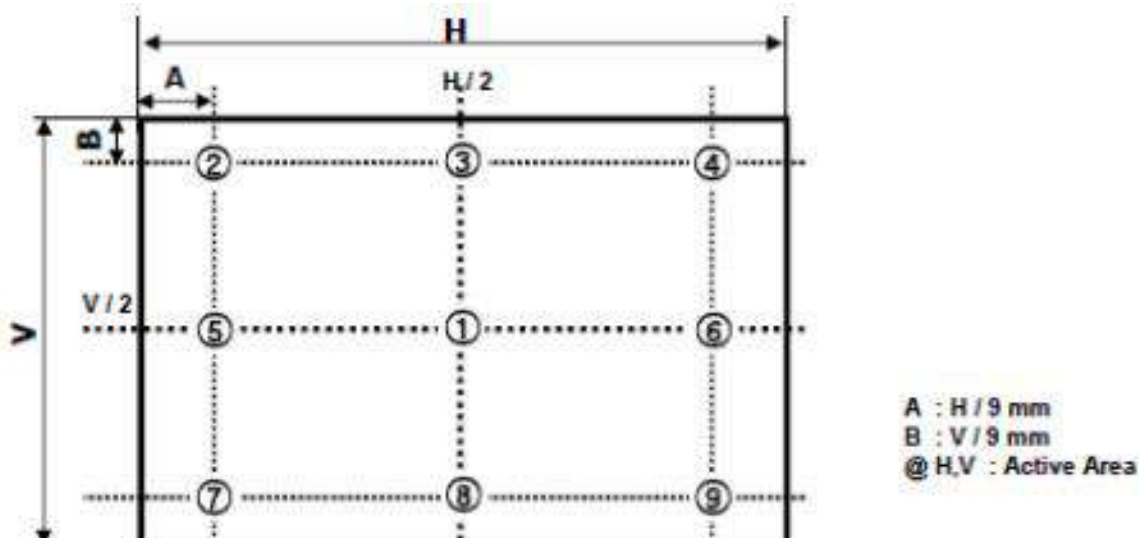
4. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.

5. Gray scale specification  
Gamma Value is approximately 2.2.

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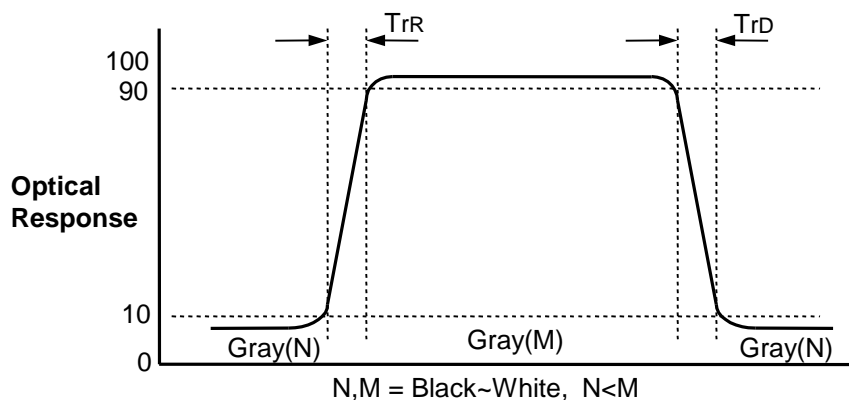
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### Measuring point for surface luminance & luminance variation **CA-310 ,Contact method)**



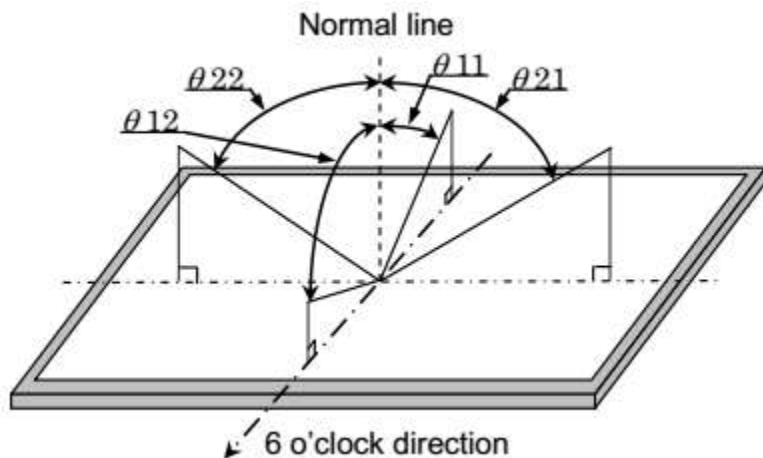
### FIG. 2 9 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for “Gray(N)” and “Gray(M)”.



### FIG. 3 Response Time

Definitions of viewing angle range



**FIG. 4 Viewing Angle**



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## 7.0 MECHANICAL CHARACTERISTICS

### 7.1 Dimensional Requirements

Figure 5 (located in Appendix) shows mechanical outlines for the model DV65QUM-N00. Other parameters are shown in Table 13.

< Table 13. Dimensional Parameters >

Parameter	Specification	Unit
Dimensional outline	1450.38(H) × 825.47(V) × 32.05(Body) /50.9(Converter Cover)	mm
Weight	Typ. 20.29	Kg
Active area	1428.48(H) × 803.52(V)	mm
Pixel pitch	0.372(H) × 0.372(V)	mm
Number of pixels	3840(H) ×2160(V) (1 pixel = R + G + B dots)	pixels
Back-light	D-LED Backlight	

### 7.2 Mounting

See Figure 6. (Shown in Appendix)

### 7.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an low haze coating to reduce scratching. Front Polarizer hardness is at less 3H.

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8.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

No	Test Items	Conditions
1	Low temperature storage test	Ta = -20 °C, 240hrs
2	High temperature & high humidity storage test	Ta = 60 °C, 90%RH,240hrs
3	High temperature & high humidity operation test	Ta = 50 °C,80%RH, 240hrs
4	Low temperature operation test	Ta = -5°C, 240hrs
5	Thermal shock	Ta = -20 °C ↔ 60 °C (per 30min), 10 cycle
6	Vibration test (non-operating)	Frequency 1~ 200 Hz, Random Gravity / AMP 0.82 Grms Period Z 2Hr

This test condition is based on BOE module.

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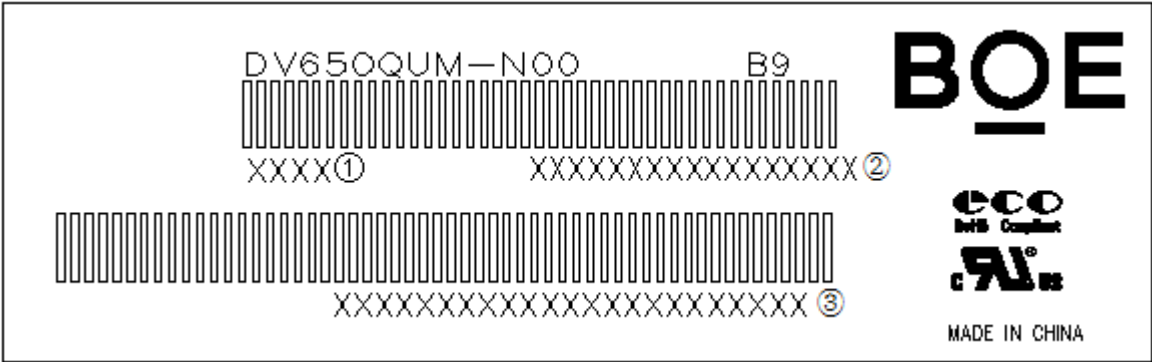
## 9.0 DEFINITION OF LABELS

### MDL Label

He bar code nameplate is pasted on each module as illustration, and its definitions are as following explanation.

Label Size: 80mm (L) ×25mm (W)

Label Picture:



①生产年份+生产周别；②MDL ID；③PPID

MDL ID Naming Rule:

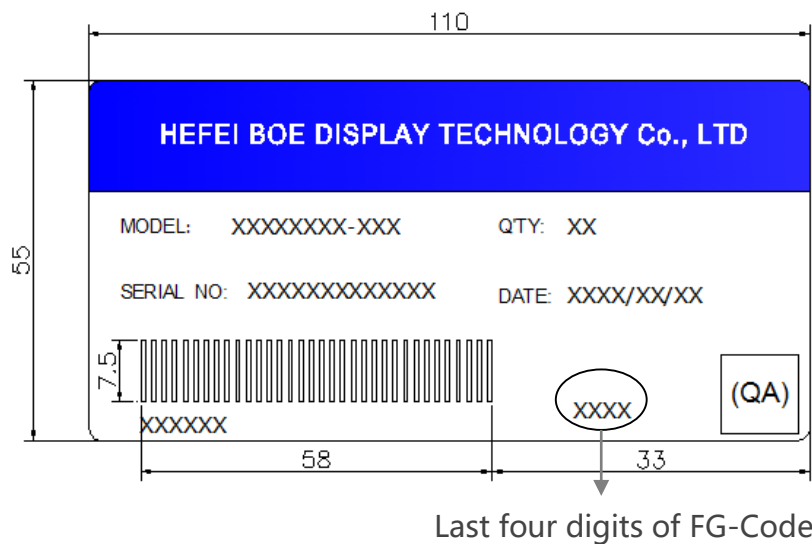
Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	S	L	S	9	1	6	3	5	9	4	2	0	A	A	0	0	0
Description	Model Code /GBN		Gr ad e	Lin e	Year		M on th	Model Extension Code (Last 4 Digits Of FG-CODE)				Serial No 00001-ZZZZZZ					

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BOX Label

- Label Size : 110 mm (L) × 55 mm (W)
- Contents
  - Model : DV650QUM-N00-DWK0 (FG-Code)
  - Q`ty : 6 LCM in one box.
  - Serial No. : Box Serial No.
  - Date : Packing Date
  - FG Code : FG Code of Product



Box ID Naming Rule:

Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	S	L	S	9	1	6	3	5	9	4	2	0	0
Description	Products GBN		Grade	Line	Year		Mon th	Revision Code	Serial No 00001-ZZZZZZ				

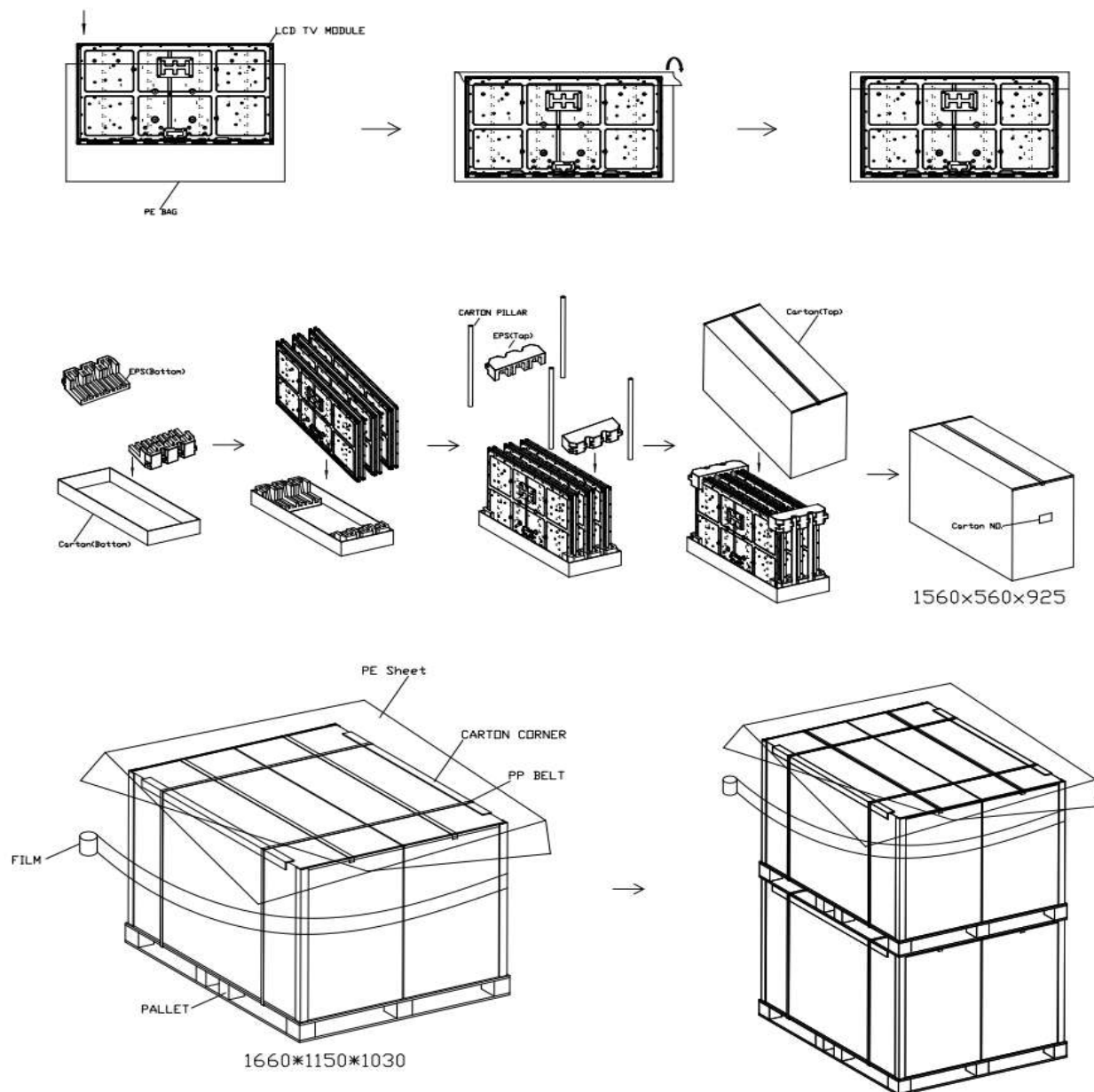
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## 10.0 PACKING INFORMATION

### 10.1 PACKING SPECIFICATIONS

- (1) 6LCD TV modules / 1 Box
- (2) Box dimensions: 1560(L) x560(W) x925(H)mm
- (3) Weight: approximately 121.745Kg (6 modules per box)

### 10.2 PACKING METHOD



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## 11.0 PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD Module.

### 11.1 Mounting Precautions

- Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- You must mount a module using specified mounting holes (Details refer to the drawings)
- You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress)is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- Do not apply mechanical stress or static pressure on module; Abnormal display cause by pressing some parts of module during assembly process , do not belong to product failure, the press should be agreed by two sides.
- Determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Do not apply mechanical stress or static pressure on module , and avoid impact, vibration and falling.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Protection film for polarizer on the module should be slowly peeled off before display.
- Be careful to prevent water & chemicals contact the module surface.
- You should adopt radiation structure to satisfy the temperature specification.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane & alcohol is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene , because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading..

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- This module has its circuitry PCB’s on the rear side and Driver IC, should be handled carefully in order not to be stressed.
- Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package & wire
- Do not disassemble the module.

### 11.2 Operating Precautions

- Do not connector or disconnect the cable to/from the Module at the “Power On” Condition.
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the module would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- Do not allow to adjust the adjustable resistance or switch.
- The electrochemical reaction caused by DC voltage will lead to LCD module degradation, so DC drive should be avoided.
- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipment to protect against static electricity.
- Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- Design the length of cable to connect between the connector for back-light and the converter as shorter as possible and the shorter cable shall be connected directly , The long cable between back-light and Converter may cause the Luminance of LED to lower and need a higher startup voltage.
- The cables should be as short as possible between System Board and PCB interface.
- Connectors are precision devices to transmit electrical signals, and operators should plug in parallel.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

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### 11.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc.
- Do not close to static electricity to avoid product damage.
- Do not touch interface pin directly.

### 11.4 Precautions for Strong Light Exposure

- Do not leave the module operation or storage in Strong light . Strong light exposure causes degradation of polarizer and color filter.

### 11.5 Precautions for Storage

#### A. Atmosphere Requirement

ITEM	UNIT	MIN	MAX
Storage Temperature	(°C)	5	40
Storage Humidity	(%rH)	40	75
Storage Life	6 months		
Storage Condition	<ul style="list-style-type: none"> <li>• The storage room should be equipped with a dark and good ventilation facility.</li> <li>• Prevent products from being exposed to the direct sunlight, moisture and water.</li> <li>• The product need to keep away from organic solvent and corrosive gas.</li> <li>• Be careful for condensation at sudden temperature change.</li> <li>• Storage condition is guaranteed under packing conditions.</li> </ul>		

#### B. Package Requirement

- The product should be placed in a sealed polythene bag.
- Product Should be placed on the pallet, Which is away from the floor, Be cautions not to pile the product up.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
- As the original protective film, do not use the adhesive protective film to avoid change of Pol color and characteristic.

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### 11.6 Precautions for protection film

- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- People who peeled off the protection film should wear anti-static strap and grounded well.

### 11.7 Appropriate Condition for Commercial Display

-Generally large-sized LCD modules are designed for consumer applications . Accordingly, long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize module's lifetime and function, several operating usages are required.

#### 1. Normal operating condition

- Temperature:  $20\pm15^{\circ}\text{C}$
- Operating Ambient Humidity :  $55\pm20\%$
- Display pattern: dynamic pattern (Real display)
- Well-ventilated place is recommended to set up Commercial Display system

#### 2. Special operating condition

##### a. Ambient condition

- Well-ventilated place is recommended to set up Commercial Display system.

##### b. Power and screen save

- Periodical power-off or screen save is needed after long-term display.

c. As the low temperature, the response time is greatly delayed. As the high temperatures (higher than the operating temperature) the LCD module may turn black screen. The above phenomenon cannot explain the failure of the display. When the temperature returns to the normal operating temperature, the LCD module will return to normal display.

d. When expose to drastic fluctuation of temperature (hot to cold or cold to hot ) ,the LCD module may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD module 's surface which may affect the operation of the polarizer and LCD module

e. Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.

f. Products exposed to low temperature environment for a long time, need to carry out necessary protection , low temperature environment is usually refrigerators , vending machine Etc...

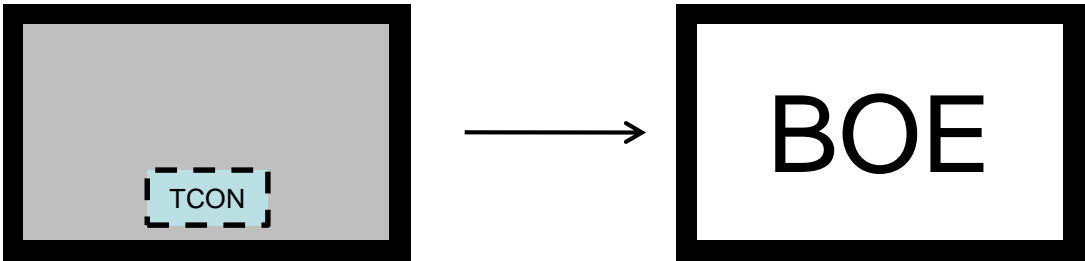
g. Long time and large angle forward use or unconventional use , It is strongly recommended to contact BOE for filed application engineering advice

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- f. Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions such as high temperature, high humidity, high altitude, special display images, running time, long time operation, outdoor operation, etc. It is strongly recommended to contact BOE for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.
3. Operating usages to protect against image sticking due to long-term static display.
- a. Suitable operating time: under 20 hours a day.
  - b. Static information display recommended to use with moving image.
    - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
  - c. Background and character (image) color change
    - Use different colors for background and character, respectively.
    - Change colors themselves periodically.
  - d. Avoid combination of background and character with large different luminance.
    - 1) Abnormal condition just means conditions except normal condition.
    - 2) Black image or moving image is strongly recommended as a screen save
4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.
5. Module should be turned clockwise based on front view when used in portrait mode.
- Landscape Mode
 

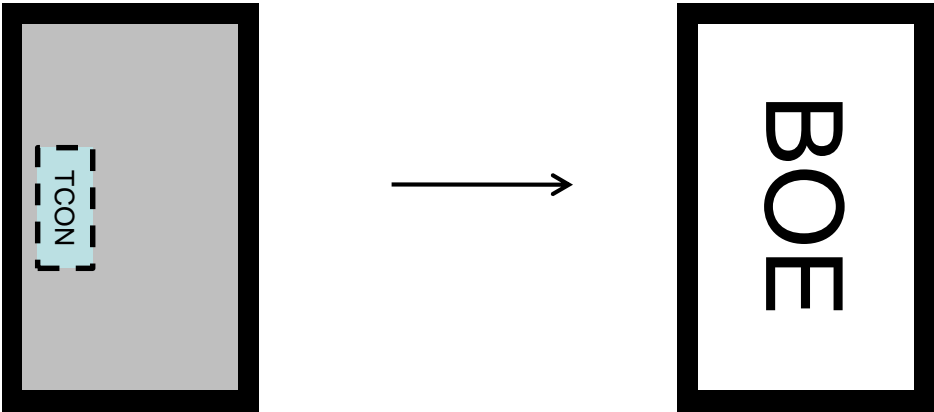
The default placement is TCON side on the lower side and the image is shown upright via viewing from the front.



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- Portrait Mode  
The default placement is that TCON side has to be placed on the left side via viewing from the front



11.8 Other Precautions

A. LC Leak

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- 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, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

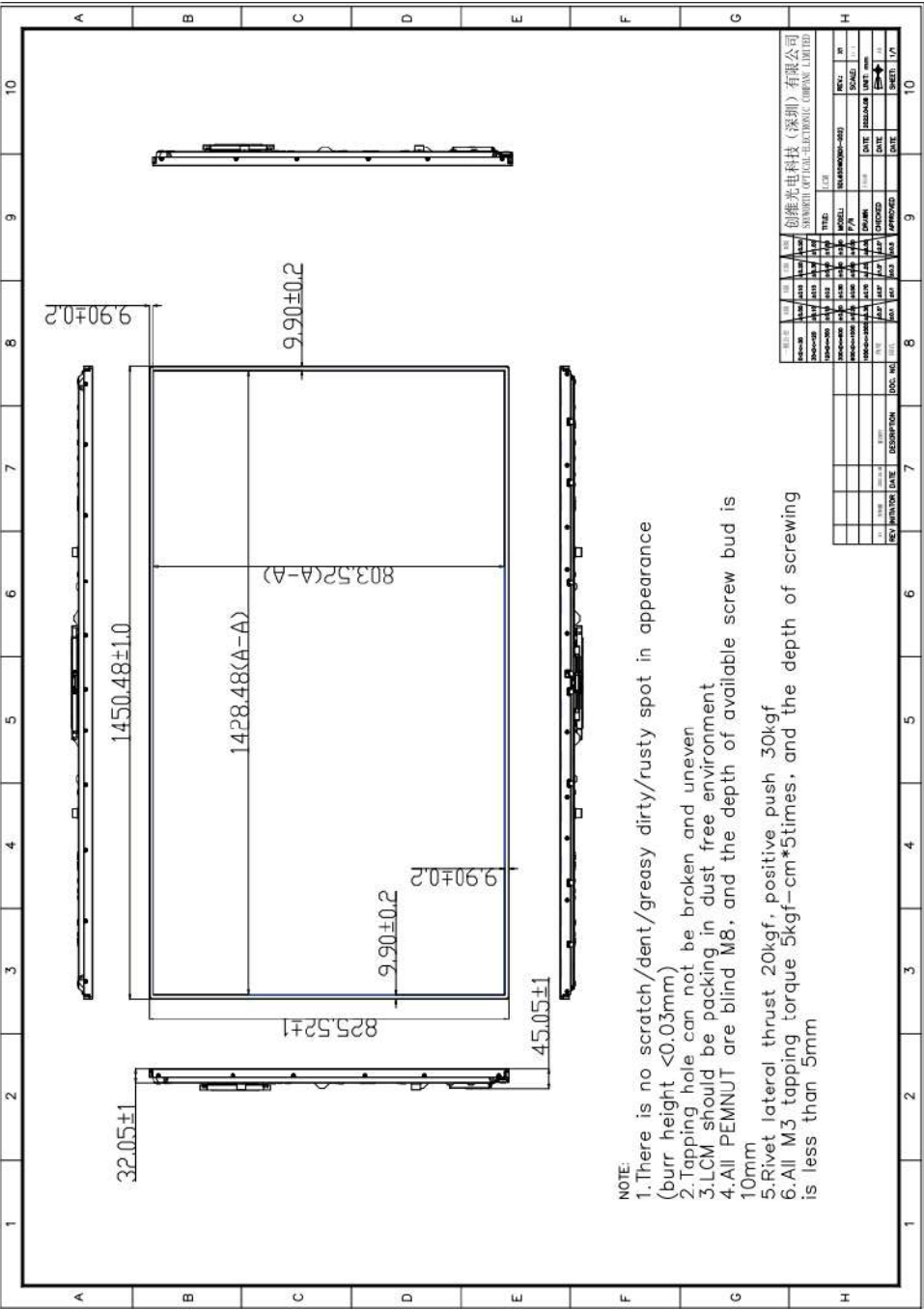
B. Rework

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

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12.0 APPENDIX

< Figure 5. TFT-LCD Module Outline Dimensions (Front View) >



< Figure 6. TFT-LCD Module Outline Dimensions (Rear View) >

