



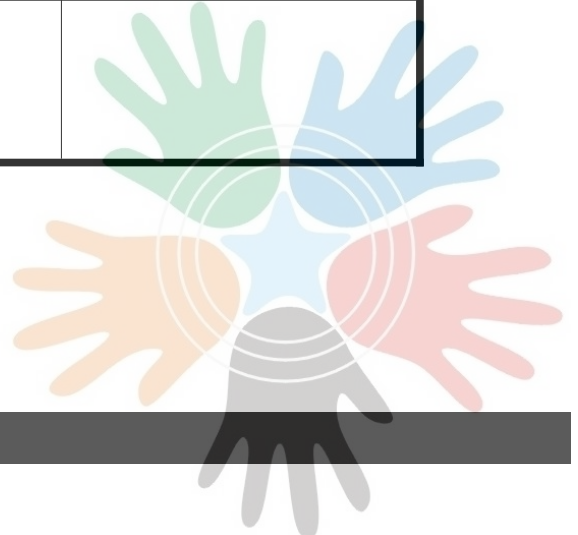
- Preliminary Specification
- Approval Specification

## TFT-LCD Module

### MODEL NO. BTP-OGF-MV-21.5-S01

<p><b>Customer:</b></p> <p><b>Model NO: BTP-OGF-MV-21.5-S01</b></p> <p><b>Part NO:</b></p> <p><b>APPROVED BY</b>      <b>SIGNATURE</b></p> <p><small>*Please return 1 copy for your confirmation with your signature and comments.</small></p>
--

Approved By	Checked By	Prepared By



## -CONTENTS-

REVISION HISTORY .....	3
1. GENERAL DESCRIPTION.....	4
1.1 OVERVIEW .....	4
1.2 CHARACTERISTICS .....	4
1.3 MECHANICAL SPECIFICATIONS .....	4
2. ABSOLUTE MAXIMUM RATINGS OF ENVIRONMENT.....	4
3. ELECTRICAL CHARACTERISTIC.....	5
3.1 Absolute Maximum Rating .....	5
3.2 Recommended Operating Condition .....	5
3.3 Input control signal threshold voltage definition .....	6
3.4 Write Protection mode selection .....	6
3.5 Input equivalent impedance .....	6
3.6 LED LIGHTBAR SPECIFICATION FOR BACKLIGHT .....	7
4. INTERFACE CONNECTION.....	8
4.1 TFT LCD MODULE.....	8
4.2 BACKLIGHT INTERFACE CONNECTION.....	9
5. SIGNAL CHARACTERISTICS.....	9
5.1 Lcd pixel Format .....	9
5.2 LVDS Data Format .....	10
5.3 Color versus Input Data .....	11
5.4 LVDS Specification .....	11
5.5 Input Timing Specification .....	13
6. POWER ON/OFF SEQUENCE.....	14
7. OPTICAL CHARACTERISTICS.....	15
7.1 Optical specification.....	15

www.sinotelectronics.com





## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

The specification is applied to 21.5" model (SN215CS01-1) TFT Liquid Crystal Display open cell and it supports 1920 x 1080 FHD mode with 16.7M colors. This product is with data driver ICs and a 30-pins connector with LVDS interface and built in without backlight unit.

### 1.2 CHARACTERISTICS

CHARACTERISTICS ITEMS	SPECIFICATIONS
Screen Diagonal [in]	21.5"
Pixels [lines]	1920(x3) × 1080
Active Area [mm]	476.064(H) × 267.786(V)
Pixel Pitch [mm]	0.24795(H) x 0.24795(V)
Pixel Arrangement	RGB vertical stripe
Open Cell Transmittance	5.6(Typ.)
Power Consumption	LCD module : PDD (Typ.)=3.2 W@ White pattern,Fv=60Hz
Display Mode	HIS Normally Black
Surface treatment	Anti-glare, 3H,Haze: 25%

### 1.3 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Remark
Module Size	Horizontal (H)	-	484.5	-	mm [Note 1]
	Vertical (V)	-	284.4	-	mm [Note 1]
	Depth (D)	-	8.55	-	mm [Note 1]
Weight		1634		g	

## 2. ABSOLUTE MAXIMUM RATINGS OF ENVIRONMENT

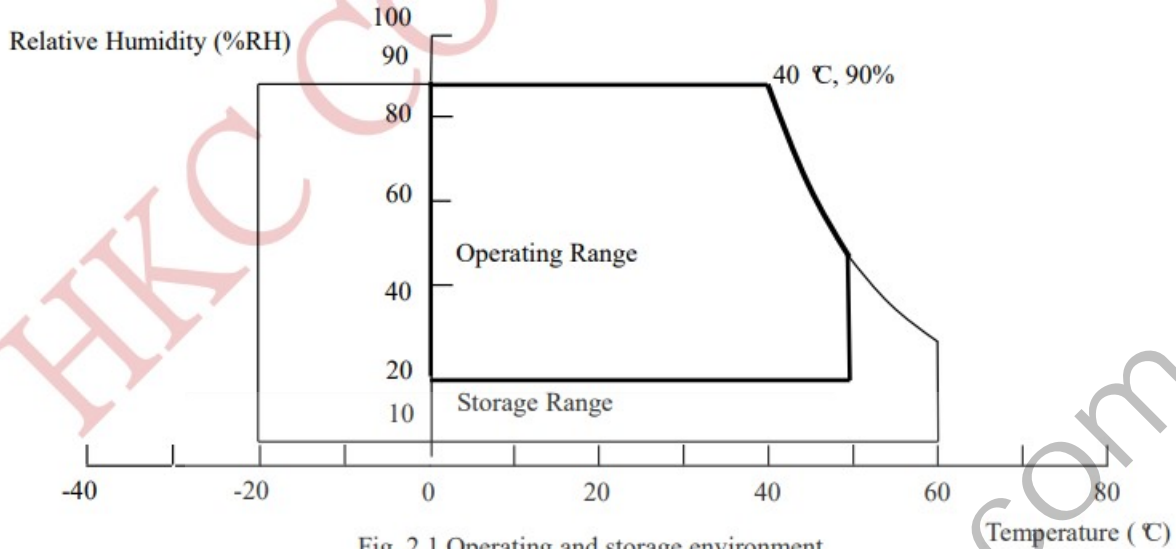
Permanent damage may occur if exceeding the following maximum rating.

Temperature and relative humidity range are shown as below.

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	60	°C	(1)
Operating Temperature	TOP	0	50	°C	(1), (2)
Panel Surface Temperature of Display Area	PST	-	65	°C	(3)

Note:

- (1) a. 90 % RH Max. ( $T_a \leq 40^\circ\text{C}$ ).  
 b. Web-bulb temperature should be  $39^\circ\text{C}$  Max. ( $T_a > 40^\circ\text{C}$ )  
 c. No condensation  
 d. Operating condition with a assemble module
- (2) Any point on the Driver surface must be less than  $120^\circ\text{C}$  under any condition ,If the surface temperature is out of the spec, thermal solutions should be applied to avoid be damaged.
- (3) Surface temperature of display area is measured at  $50^\circ\text{C}$  dry condition



## 3. ELECTRICAL CHARACTERISTICS

### 3.1 Electrical Characteristics

#### 3.1.1 Power Consumption

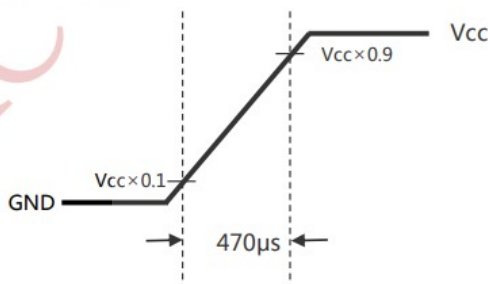
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	VCC	4.5	5.0	5.5	V	-
Ripple Voltage	VRP	-	-	500	mV	(2)
Power Consumption	PLCD	-	3.5	5.5	W	(3)
Rush Current	IRUSH	-	-	3	A	(4)
Power Supply Current	White Pattern	-	0.38	0.5	A	(3)
	Horizontal Stripe	-	0.92	1.1	A	
	8 Color Bar H	-	0.56	0.7	A	

Note :

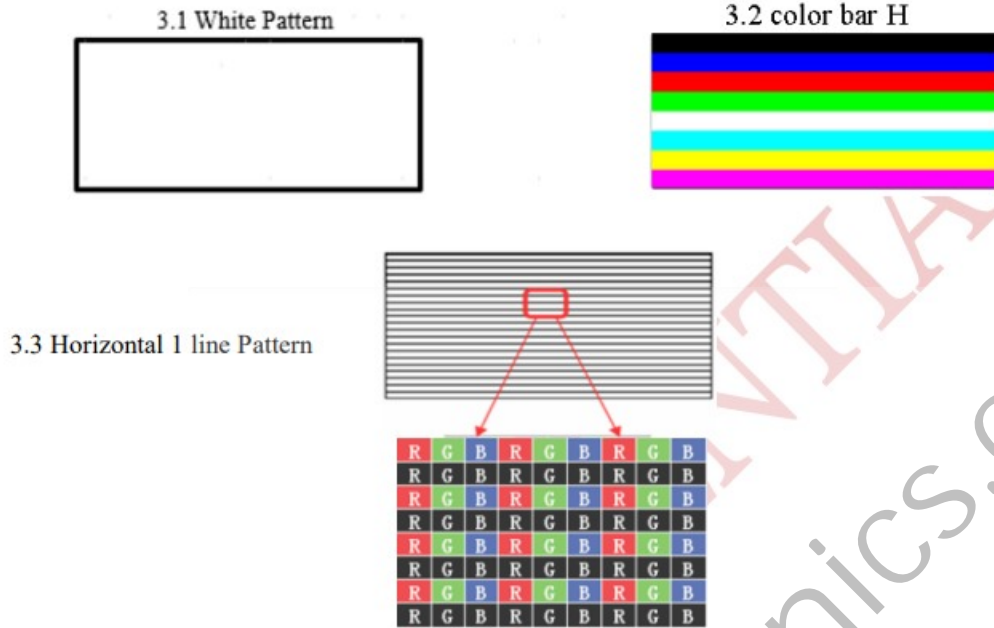
(1) Measurement Conditions

Item	Symbol	Value	Unit
Temperature	T <sub>A</sub>	25±2	°C
Humidity	H <sub>A</sub>	50±10	%RH

(2) Measurement Conditions: VCC rising time=470μs.



(3) Measurement Conditions:  $V_{cc} = 5V$ ,  $T_a = 25 \pm 2^\circ C$ . whereas the test pattern is shown as below.



(4) The typical power consumption is specified at the pattern with the color bar H, refresh rate is 60Hz,  $V_{IN}$  is 5V. The max power consumption is specified at the pattern with the Horizontal 1 line, refresh rate is 75Hz,  $V_{IN}$  is 5V.

### 3.1.2 LVDS characteristics

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LVDS interface	Differential Input High Threshold Voltage	$V_{TH}$	-	-	+100	(1)
	Differential Input Low Threshold Voltage	$V_{TL}$	-100	-	-	
	Common Input Voltage	$V_{CM}$	1.0	1.2	1.4	
	Differential input voltage	$ V_{ID} $	100	-	600	
	Terminating Resistor	RT	90	100	110	

Note:

(1) The LVDS input signal has been defined as follows:

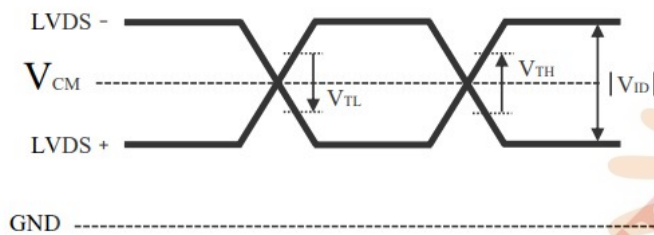


Fig 3.4 LVDS input signal

### 3.1.3 LVDS format

VESA Format

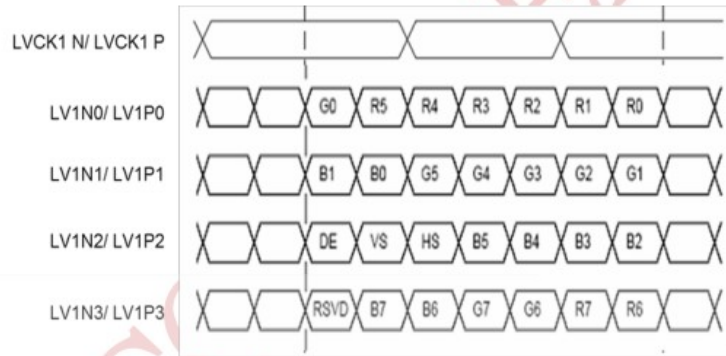
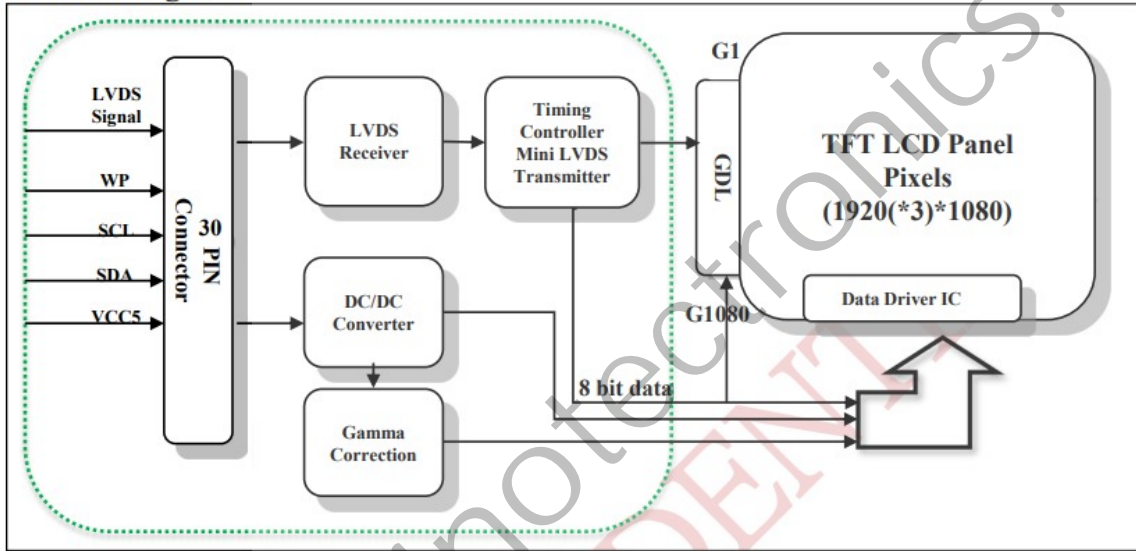


Fig 3.5 VESA format

### 3.2 Block diagram



### 3.3 Interface Connections

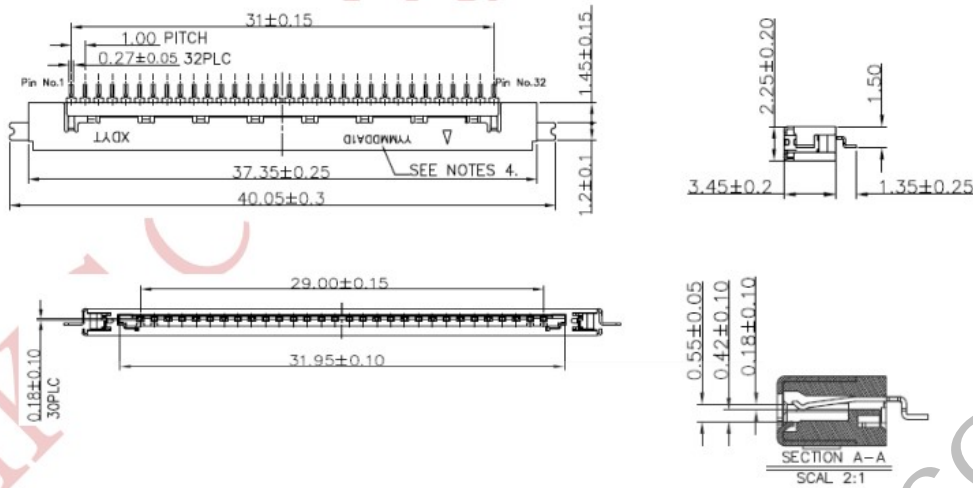
#### 3.3.1 Interface Pin Assignment

CNN: 3-10522317-0 1mm 30P SMT

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	RXO0-	LVDS Odd Data (-)	16	RXE1+	LVDS Even Data (+)
2	RXO0+	LVDS Odd Data (+)	17	GND	Power Ground
3	RXO1-	LVDS Odd Data (-)	18	RXE2-	LVDS Even Data (-)
4	RXO1+	LVDS Odd Data (+)	19	RXE2+	LVDS Even Data (+)
5	RXO2-	LVDS Odd Data (-)	20	RXECLK-	LVDS Even Clock (-)
6	RXO2+	LVDS Odd Data (+)	21	RXECLK+	LVDS Even Clock (+)
7	GND	Power Ground	22	RXE3-	LVDS Even Data (-)
8	RXOCLK-	LVDS Odd Clock (-)	23	RXE3+	LVDS Even Data (+)
9	RXOCLK+	LVDS Odd Clock (+)	24	NC	For HKC test only, WP
10	RXO3-	LVDS Odd Data (-)	25	NC	For HKC test only, SCL
11	RXO3+	LVDS Odd Data (+)	26	NC	For HKC test only, SDA
12	RXE0-	LVDS Even Data (-)	27	NC	For HKC test only, Bist
13	RXE0+	LVDS Even Data (+)	28	V <sub>cc</sub>	Power supply +5.0V
14	GND	Power Ground	29	V <sub>cc</sub>	Power supply +5.0V
15	RXE1-	LVDS Even Data (-)	30	V <sub>cc</sub>	Power supply +5.0V

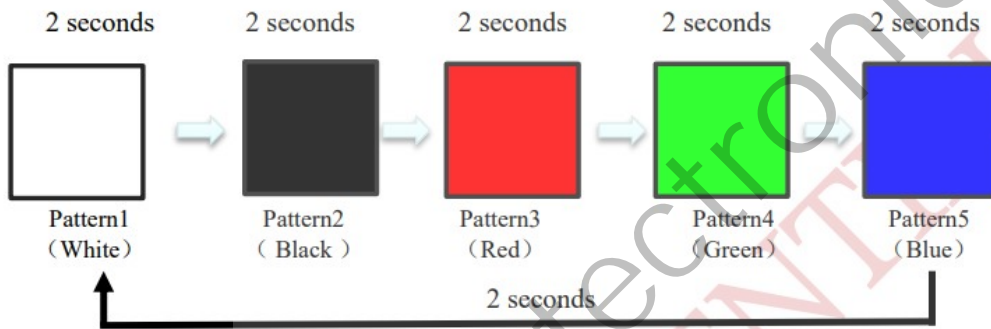
Note:

(1) Interface Connector Information



3.3.2 Built-in Self Test Patterns

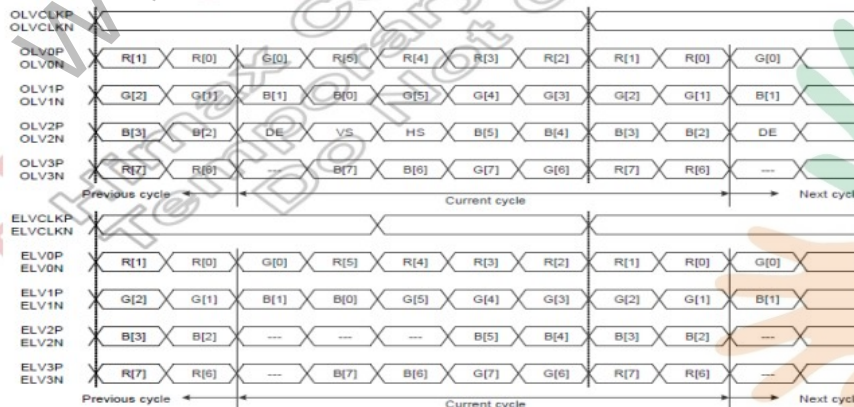
The TCON is built in variable test patterns. The sequence and display time of test patterns could be set by EEPROM code. An example BIST pattern is as the following table.



**Note:** BIST\_MODE pull high/low setting Figure 3.7 BIST patterns  
 L = Connect to GND, H = Connect to +3.3V

BIST_MODE	Note
L or Open	Available LVDS Signal input: Display LVDS Input Pattern No LVDS-Signal or unavailable LVDS Signal input: Display Black Pattern
H	Available LVDS Signal input: Display LVDS Input Pattern No LVDS Signal or unavailable LVDS Signal input: Display Bist Pattern

3.3.3 LVDS data mapping type could be set by internal registers, and 8-bit data sequence is shown as following table.



## 3.4 Timing Spec.

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fclk	45	74.25	95	MHz	(1)
	Input cycle to cycle jitter	Trcl		-	200	ps	(2)
	Spread spectrum modulation range	Fclk_mod	Fclk-2%	-	Fclk+2%	MHz	(3)
	Spread spectrum modulation frequency	FSSM	30	-	200	KHz	
LVDS Receiver Data	Receiver Skew Margin	TRSM	-380	-	380	ps	(4)
Vertical Term	Frame Rate	F	48	60	75	Hz	-
	Total	TV	1110	1125	1836	TH	TV = TVD + TVB
	Active Display	TVD	1080			TH	-
	Blank	TVB	30	45	756	TH	-
Horizontal Term	Total	TH	1050	1100	1250	TCLK	TH = THD + THB
	Active Display	THD	960			TCLK	-
	Blank	THB	90	140	290	TCLK	-

Attention:

The module is operated in DE only mode, H sync and V sync input signal have no effect on normal operation.

Note:

(1) Please make sure the range of pixel clock follows the following equations:

$$F_{CLK}(\max) \geq F_{max} \times T_V \times T_H \quad F_{CLK}(\min) \leq F_{min} \times T_V \times T_H$$

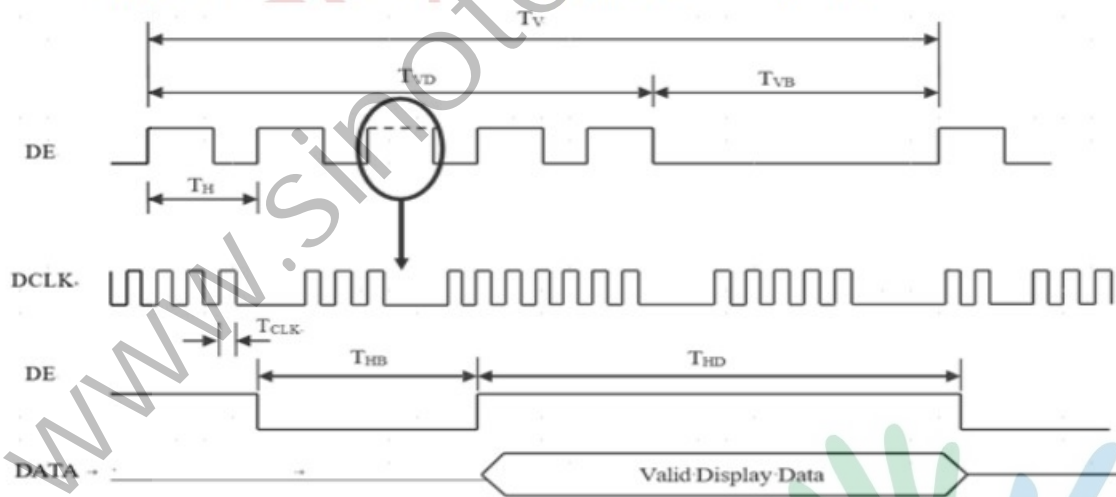


Fig 3.8 Signal timing diagram

## 3.5 Power On/Off Sequence

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.

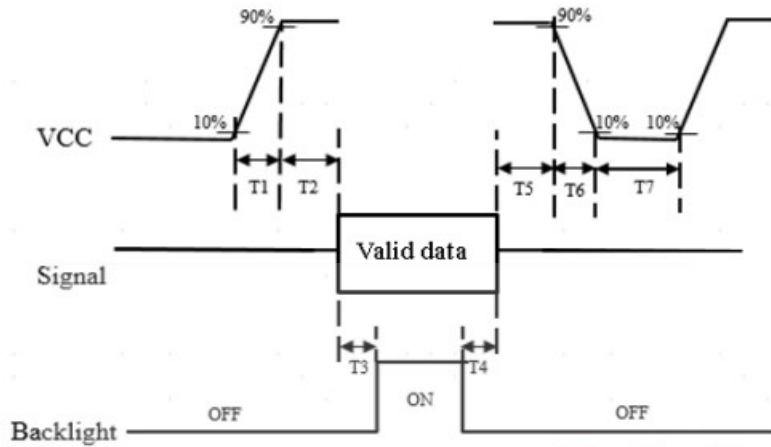


Fig 3.9 Power on/off signal sequence

Item	Values			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	ms
T2	0	30	50	ms
T3	450	-	-	ms
T4	100	250	-	ms
T5	0	20	50	ms
T6	0.1	-	100	ms
T7	1000	-	-	ms

Note:

Attention:

- (1) Apply the light bar voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.
- (2) In case that VCC is in off level, please keep the level of input signals on the low or high impedance.
- (3) T4 should be measured after the module has been fully discharged between power off and on period.
- (4) Interface signal shall not be kept at high impedance when the power is on.
- (5) To avoid some abnormal display noise, we suggest "Vcc falling time" to follow "T6" definition.

## 3.6 LED LIGHTBAR SPECIFICATION FOR BACKLIGHT

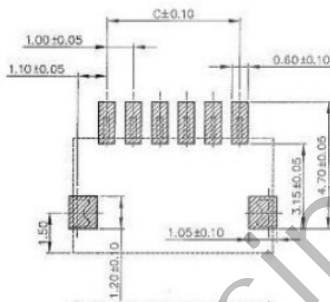
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max		
Input Voltage	$V_{pin}$	<b>46.4</b>	-	<b>51.2</b>	VDC	Duty 100% [Note 1]
Input Current	$I_{pin}$	—	<b>240</b>	—	mADC	Duty 100% Per string [Note 1]
LEDLifeTime	LT	<b>(30,000)</b>			Hrs	[Note 2]
Power Consumption	PBL	11.14	-	<b>12.28</b>	W	
Dimming Duty Ratio		<b>20</b>		<b>100</b>	%	

[Note1] Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

[Note2] The lifetime of LED is defined as the time when it continues to operate under the condition at  $T_a=25\pm 2^\circ\text{C}$  And  $I_{pin}=60\text{mA}(\text{Per EA})\times 4$  until the brightness becomes  $\leq 50\%$  of its original value.

## 3.7 BACKLIGHT INTERFACE CONNECTION

a、Output Connector: PH1.0 (6pin), 捷士泰 (A1010AWRR)



Pin No.	Symbol
1	LED-
2	LED-
3	LED+
4	LED+
5	LED-
6	LED-

## 4. OPTICAL CHARACTERISTICS

### 4.1 Measurement Conditions

The table below is the test condition of optical measurement.

Item	Symbol	Value	Unit
Ambient Temperature	$T_A$	25±2	°C
Ambient Humidity	$H_A$	50±10	% RH
Supply Voltage	$V_{CC}$	5	V
Driving Signal	Refer to the typical value in Chapter 3: Electrical Specification		
Vertical Refresh Rate	$F_v$	60	Hz
Light source	HKC BLU		
Warm up time	$T_{warm}$	> 30	min
Dark room	ED	< 1	lux

To avoid abrupt temperature change during optical measurement, the measurement should be executed in a stable, windless, in dark room after lighting the light source.

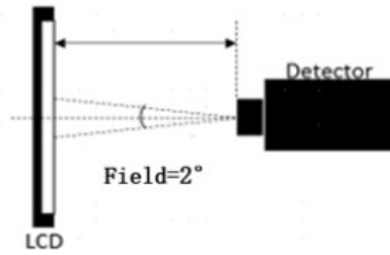


Fig 4.1 Measurement equipment.

## 4.2 Optical Specifications

The relative measurement methods of optical characteristics are shown in 4.2. The following items should be measured under the test conditions described in 4.1 and stable environment shown in 4.1.

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Color Chromaticity (CIE1931)	Red	Rx	Viewing Angle at Normal Direction at center point of panel Light Source is HKC BLU $\theta_x=0^\circ, \theta_y=0^\circ$	Typ. - 0.03	0.655	Typ. + 0.03	--	Design data HKC BLU, center point
		Ry			0.337			
	Green	Gx			0.307			
		Gy			0.617			
	Blue	Bx			0.145			
		By			0.065			
	White	Wx			0.313			
		Wy			0.329			
Color Gamut	SRGB		95	99	-	%	绝对面积比	
Transmittance	T%		4.9	5.6	-	%	(3)	
Contrast Ratio	CR		700	1000	-	-	(4)	
Response Time	Tg	$\theta_x=0^\circ, \theta_y=0^\circ$	-	14	25	ms	(5)	
Viewing Angle	Horizontal	$\theta_{x+}$	-	89	-	Deg.	(6)	
		$\theta_{x-}$	-	89	-			
	Vertical	$\theta_{y+}$	-	89	-			
		$\theta_{y-}$	-	89	-			
Cross talk (2D)	CT		-	-	2	%	(7)	
Gamma	$\gamma$		2.0	2.2	2.4	-	(8)	

Note:

(1) Each chromaticity coordinates (x, y) are measured in CIE1931 color space when full-screen displaying (Red, Green, Blue, White) and light source is defined by HKC BLU, measurements shall be made at the center of the panel, and setup of measurement is shown in Fig 4.1.

(2) The color gamut is defined as the fraction in percent of the area of the triangle bounded by R, G, B coordinates and the area is defined by sRGB 1931 color standard in the CIE color space. Chromaticity coordinates are measured by SRUL2 and the standard setup of measurement is shown in Fig 4.1.

(3) Definition of Transmittance (T%):

The transmittance is measured with full white pattern (Lmax) at the center of the LCD pane

$$\text{Transmittance (T\%)} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}}$$

(4) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression,

$$\text{Contrast Ratio (CR): } CR = \frac{CR_w}{CR_D}$$

CRW : Luminance of LCD module with full screen white pattern (255,255, 255) at center point.

CRD : Luminance of LCD module with full screen Dark pattern (0, 0, 0) at center point.

Where the measure point of to the Contrast Ratio is the center of the panel

(5) Definition of Response time (Tg):

Average of gray to gray response time (Tg) means the average switching time of luminance ratios among 0%,25%,50%,75%, and 100% to each other and is optimized on frame rate =60Hz ( Max 75Hz ) .

Measured Response time		To				
		0%	25%	50%	75%	100%
From	0%		T <sub>0%to25%</sub>	T <sub>0% to 50%</sub>	T <sub>0% to 75%</sub>	T <sub>0% to 100%</sub>
	25%	T <sub>25% to 0%</sub>		T <sub>25% to 50%</sub>	T <sub>25% to 75%</sub>	T <sub>25% to 100%</sub>
	50%	T <sub>50% to 0%</sub>	T <sub>50% to 25%</sub>		T <sub>50% to 75%</sub>	T <sub>50% to 100%</sub>
	75%	T <sub>75% to 0%</sub>	T <sub>75% to 25%</sub>	T <sub>75% to 50%</sub>		T <sub>75% to 100%</sub>
	100%	T <sub>100% to 0%</sub>	T <sub>100% to 0%</sub>	T <sub>100% to 50%</sub>	T <sub>100% to 75%</sub>	

Fig 4.3 Switching time of luminance ratios matrix



(6) Definition of Viewing angle:

As Note (4) the static contrast ratio definition, the viewing angles are defined at the angle that the contrast ratio is larger than 10 at four directions relative to the perpendicular direction of the HKC's module (two vertical angles: up  $\theta_{y+}$  and down  $\theta_{y-}$ ; and two horizontal angles: right  $\theta_{x+}$  and left  $\theta_{x-}$ ). The standard setup of measurement is shown in Fig 4.1 & 4.4

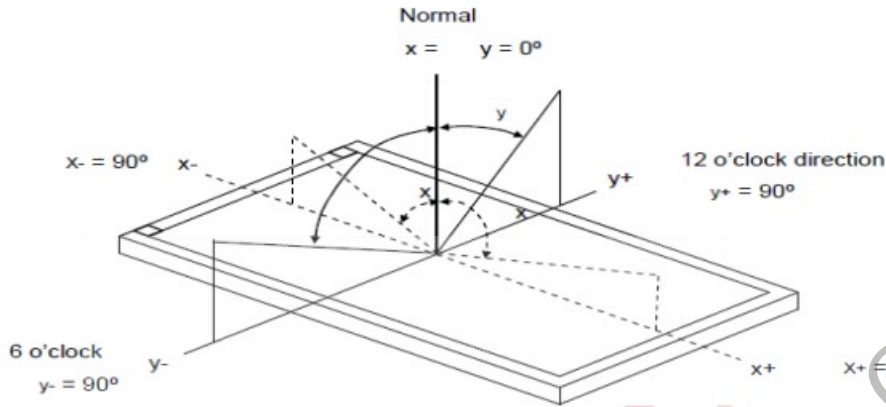


Fig 4.4 Definition of Viewing angle

(7) Definition of Crosstalk (2D)

Crosstalk of one area of the LCD surface by another shall be measured by comparing the luminance (A), with all display pixels set to a gray level, to the luminance (B) of that same area when any adjacent area is driven full white pattern which shown in Fig. 4.5. The gray level of background is set to 25% full gray pattern.

Crosstalk(%) =  $\text{Max.} \left( \frac{|L_B(X) - L_A(X)|}{L_A(X)} \times 100\% \right)$ , Where the X is point 1 to 4 shown in Fig.4.5

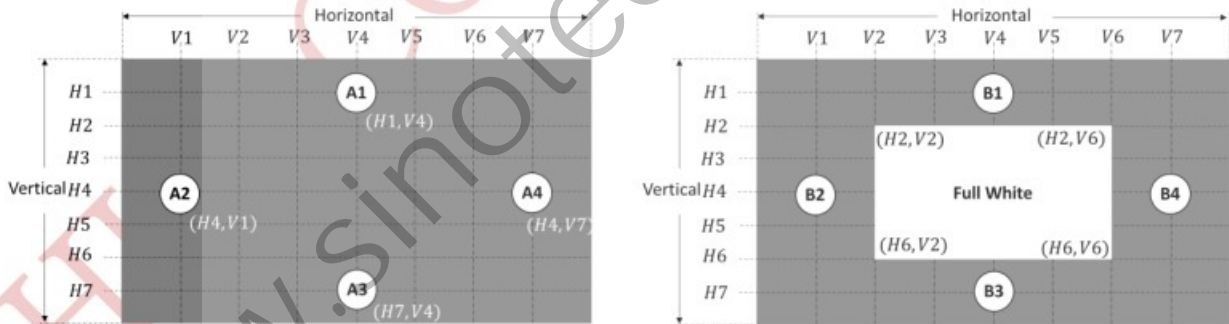


Fig 4.5 Definition of Crosstalk (2D)

(8) gamma scale is calculated by the average between gray level 50 and 128.



## 4.3 OPTICAL SPECIFICATION

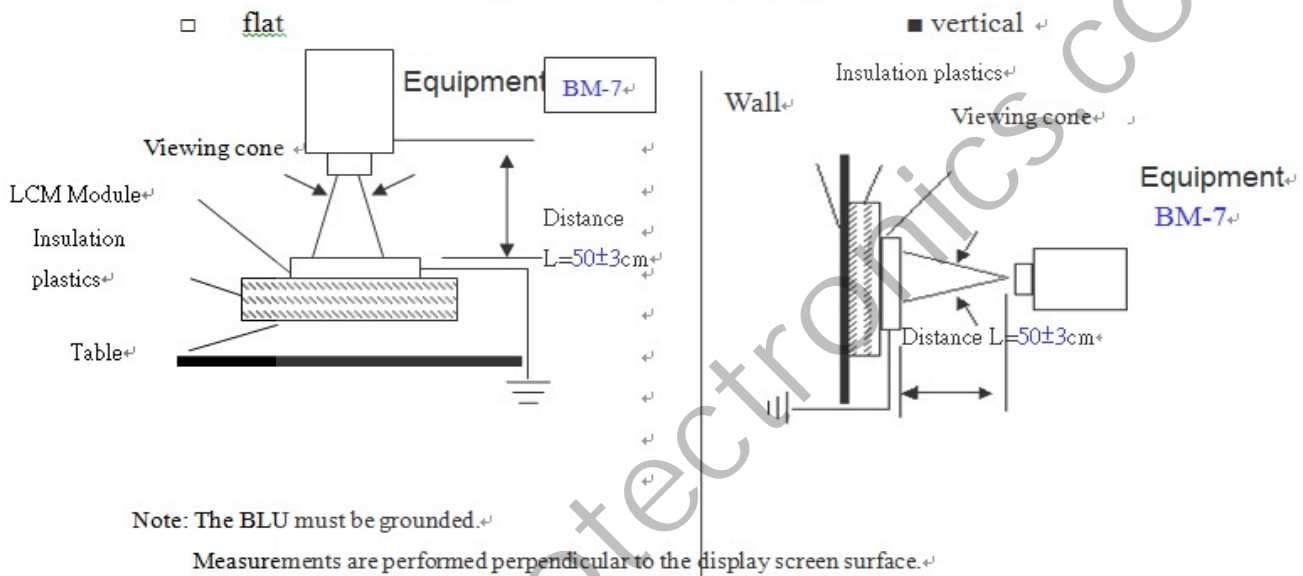
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Luminance	Central Luminance	Lwc	$\theta = 0\text{deg.}$	250	300	---	nit	[Note1,4]
	Uniformity	$\Delta Lw$	$\theta = 0\text{deg.}$	75		---	%	[Note1,5]

\*The measurement shall be executed 30 minutes after lighting at rating.

\*These values are measured with CPL standard back light unit.

\*The optical characteristics are measured using the following equipment.

Figure 10 Measurement Setup



Note (1) : Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255.

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

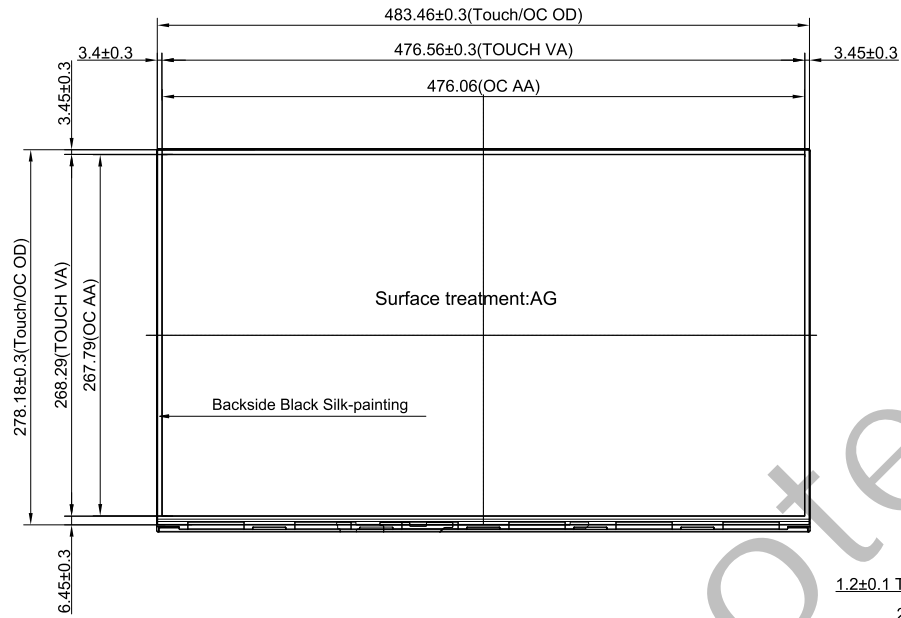
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (8).

Note (2) Definition of Response Time (TR, TF):





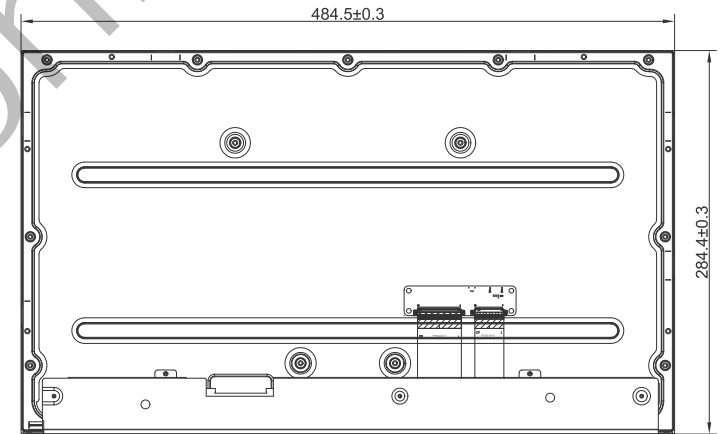
### Front View



### Side View



### Back View



**Technical Datasheet:**

1. Structure: OGF
2. TP Controller IC: SIS9515 (Interface: USB)
6. Surface Hardness: ≥6H
7. Light Transmittance: ≥85%
8. Working Temperature: -20℃~+60℃, ≤85%RH;
9. Storage Temperature: -30℃~+75℃, ≤85%RH;
10. Unmarked Tolerance: ±0.5mm
11. All materials used conform to RoHS standards

TOP	ITO CLASS (T=0.7/60-80Ω)
	OCA (T=0.175mm)
	ITO Film (T=0.125/25Ω)
	OCA (T=0.25mm)
	LCM (T=8.74mm)
BOTTOM	

Designed by:	Curry.Wang
Checked by:	Jimmy.Lu
Approved by:	Cale.Chen
Workmanship:	
Standardization:	Link.Chen
Released by:	Rocky.Liu

Part No.	BTP-OGF-MV-21.5-S01		
Product Name:	21.5 inch Touch Display (TP+LCM Optical Bonding)	Drawing No.	OGF215250715S01
		Project Code.	OGF215S01
Business Unit:	SNT-BTP	Period Mark	View Angle
		A	
BOM Code	2.03.215.01.0000	Page 1	Total 1 Page
Product Series	BTP-OGF	<b>SINOTECHNICS</b> Interactivity Changes the World	