Product Specification Sheet

Customer: **TCS**

Model Name: **MNG007DA5-2**

Date: **2024/03/28**

Version： **V01**

Customer's Approval		**CSOT**	
Signature	Date	Approved By	Date
		Reviewed By	Date
		Prepared By:	Date

Record of Revision

Version	Revise Date	Page	Content
V01	2024/02/18	All	initial Specification
V02	2024/03/27	Page 26-35	Update EDID table
		Page 10	Update OD Circuit
		Page 24	Update Reliability Test Items
		Page 5	Update Specifications Summary table
		Page 17	Update table
		Page 27-36	Update EDID table
		Page 5	Update Display Colors
		Page 21	Update Luminace of White

Contents

1. General Description

1.1 Overview

MNG007DA5-2 is a 16” TFT Liquid Crystal Display Low blue light module with LED Backlight unit and 40 pins eDP 1.4 interface. This module supports 2560 x 1600 mode and can display 16.7M colors.

1.2 Specifications Summary

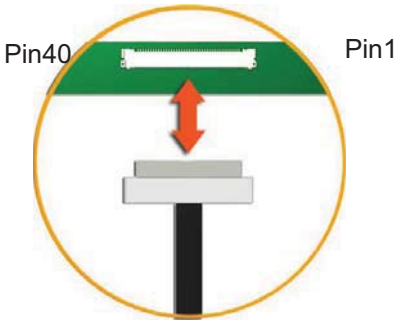
No.	Item	Specification	Unit	Note
1	LCD size	16.0	inch	
2	Resolution	2560 x RGB x 1600		
3	Pixel Arrangement	RGB		
4	Model Type	LCM		
5	TFT Technology	LTPS		
6	Display mode	FFS, Normally Black		
7	Active Area	344.6784 (H) × 215.4240(V)	mm	
8	pixel pitch	134.64(H)×134.64(V)	um	
9	Display Colors	10/3.7M		@true 10bit
10	Contrast Ratio	1200:1(Typ)		
11	Color Gamut	SRGB 100% (typ) / 95% (min)	CIE1976	SRGB
12	LCM Outline Dimension	349.68×224.42×2.45	mm	Typical
13	Luminance	500(Typ)	nits	5 Points Average
14	Low blue light ratio	50	%	Max
15	Surface treatment(UP)	Anti-Glare	--	Pol.
16	Interface	eDP 1.4		
17	Refresh rate	165	Hz	
18	HDR function	/		
19	Method of Inversion	Column Inversion		
20	Power consumption of Panel	1.9(Max)	W	3.3V@Mosaic 165Hz
	Power consumption of Backlight	4.98	W	Max
21	Weight	325	g	Max

Note (1) The specified power consumption (with converter efficiency) is under the conditions at VCCS =3.3 V, LED_VCCS = Typ, fPWM = 200 Hz, Duty=100% and Ta = 25 ± 2 ºC, whereas mosaic pattern is displayed.

2. Mechanical Specifications

Parameter		Min.	Typ.	Max.	Unit	Note
Unit outline dimensions	Width	349.38	349.68	349.98	mm	
	Height	223.92	224.42	224.92	mm	
	Depth	2.3	2.45	2.6	mm	
Weight		-	-	325	g	

2.1 Interface Connection



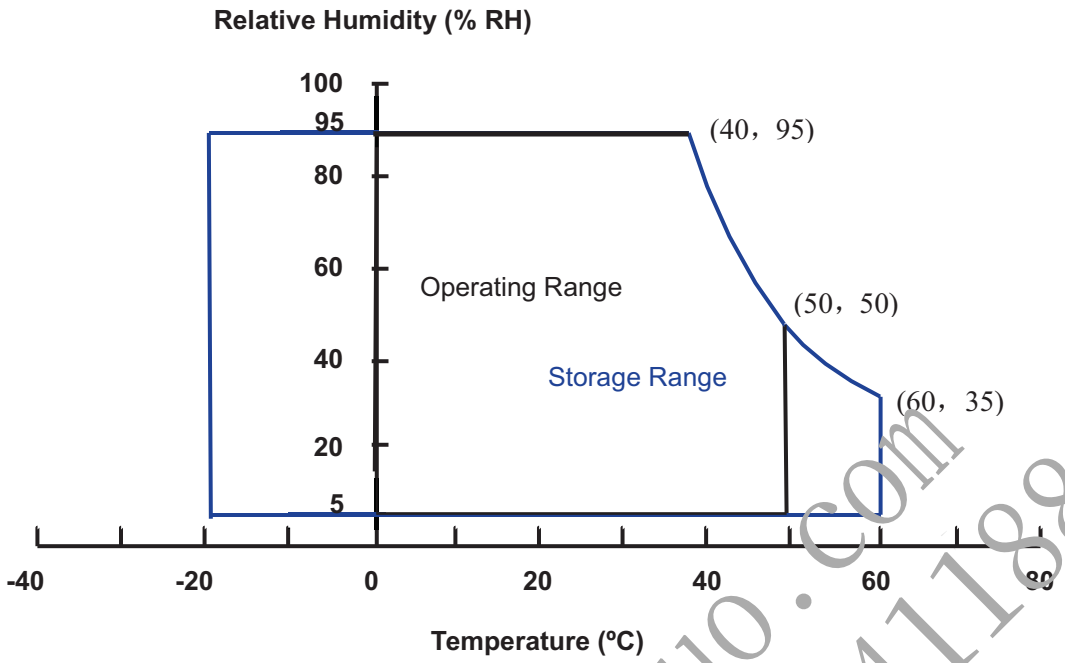
Please refer Appendix Outline Drawing for detail design.

Connector Part No.: IPEX-20455-040E-66

3. Absolute Maximum Ratings

3.1 Absolute Ratings of Environment

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)



Note (1)

(a) 95% RH Max. (Ta <= 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 ºC min. and 60 ºC max.

3.2 Electrical Absolute Ratings

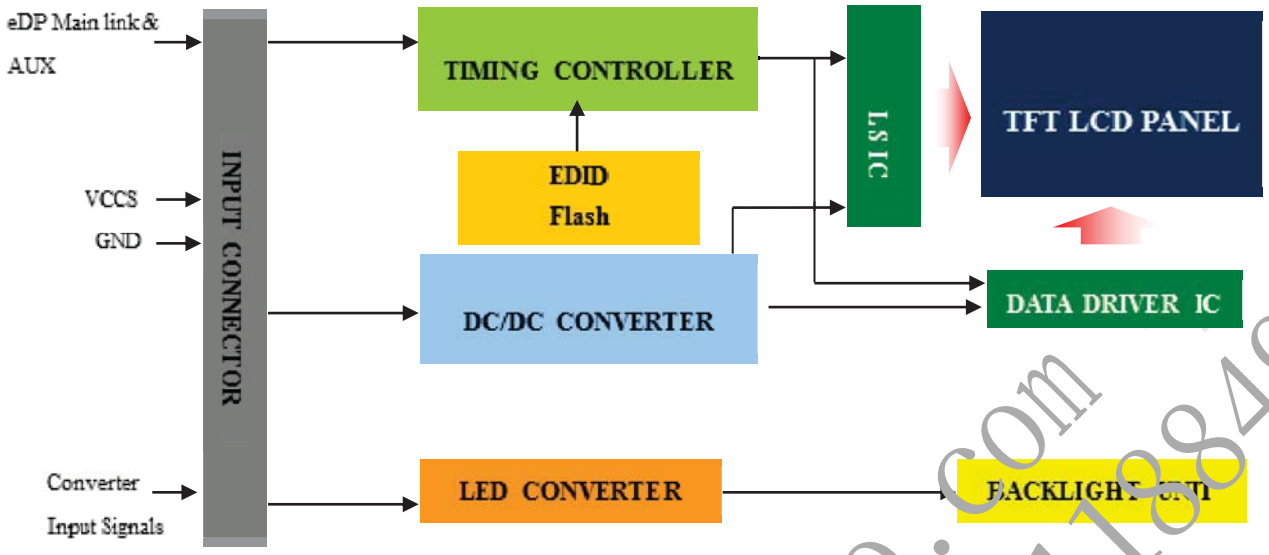
3.2.1 TFT LCD Module

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	+4	V	(1)
Logic Input Voltage	V_{IN}	-0.3	+3.6	V	
Converter Input Voltage	LED_VCCS	-0.3	26	V	(1)
Converter Control Signal Voltage	LED_PWM,	-0.3	+3.6	V	(1)
Converter Control Signal Voltage	LED_EN	-0.3	+3.6	V	(1)

Note (1) Stresses beyond those listed in above “ELECTRICAL ABSOLUTE RATINGS” may cause permanent damage to the device. Normal operation should be restricted to the conditions described in “ELECTRICAL CHARACTERISTICS”.

4. Electrical Specifications

4.1 Function Block Diagram



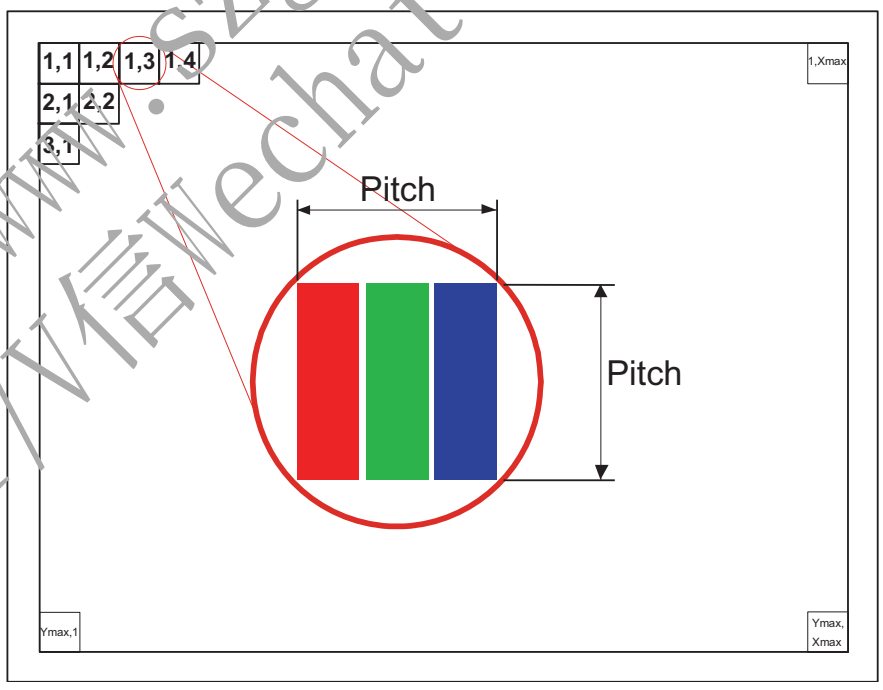
4.2 Interface Connections

PIN Assignment

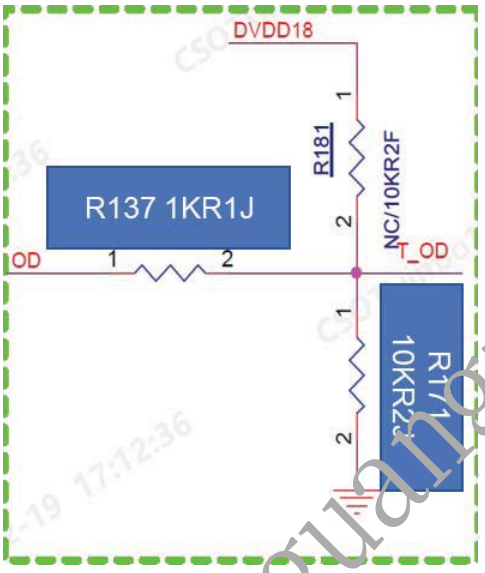
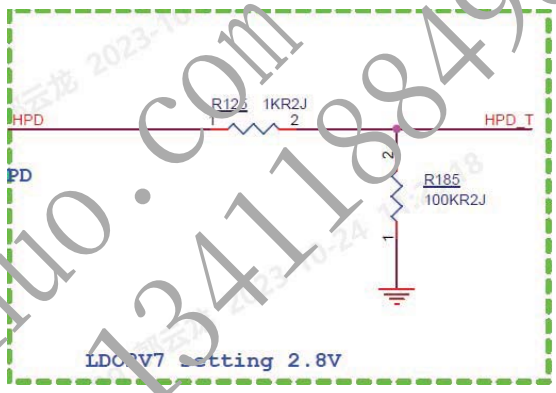
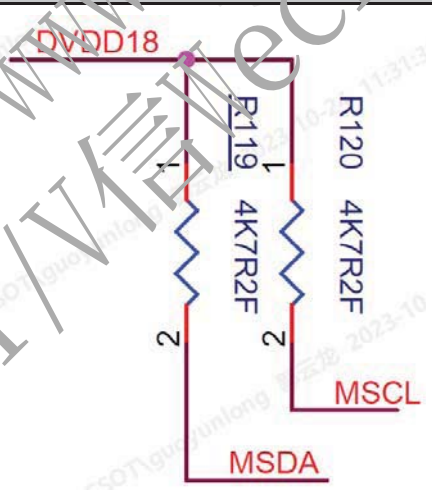
Pin	Symbol	Description	Note
1	I2C SCL	I2C SCL (Reserve)	High level:1.8V
2	H_GND	High Speed Ground	
3	Lane3_N	Complement Signal-Lane 3	
4	Lane3_P	True Signal-Main Lane 3	
5	H_GND	High Speed Ground	
6	Lane2_N	Complement Signal-Lane 2	
7	Lane2_P	True Signal-Main Lane 2	
8	H_GND	High Speed Ground	
9	Lane1_N	Complement Signal-Lane 1	
10	Lane1_P	True Signal-Main Lane 1	
11	H_GND	High Speed Ground	
12	Lane0_N	Complement Signal-Lane 0	
13	Lane0_P	True Signal-Main Lane 0	
14	H_GND	High Speed Ground	
15	AUX_CH_P	True Signal-Auxiliary Channel	
16	AUX_CH_N	Complement Signal-Auxiliary Channel	
17	H_GND	High Speed Ground	
18	LCD_VCC	Power Supply +3.3V (typical)	
19	LCD_VCC	Power Supply +3.3V (typical)	

20	LCD_VCC	Power Supply +3.3V (typical)	
21	LCD_VCC	Power Supply +3.3V (typical)	
22	BIST	Built-In Self Test (active high)	
23	LCD_GND	Ground	
24	LCD_GND	Ground	
25	LCD_GND	Ground	
26	LCD_GND	Ground	
27	HPD	Hot Plug Detect	
28	BL_GND	BL Ground	
29	BL_GND	BL Ground	
30	BL_GND	BL Ground	
31	BL_GND	BL Ground	
32	BL_EN	BL_Enable Signal of LED Converter	
33	BL_PWM_DIM	PWM Dimming Control Signal of LED Converter	
34	I2C_SDA	I2C SDA(Reserve)	High level:1.8V
35	DDS_CNT	DDS	For CSOT use (customer must NC)
36	BL_PWR	LED Power Supply	
37	BL_PWR	LED Power Supply	
38	BL_PWR	LED Power Supply	
39	BL_PWR	LED Power Supply	
40	OD	Over Drive enable Pull high(1): OD on; Pull low(0): OD off	High level:3.3V

Note (1) The pixel is shown in the following figure.



Note2 ： function pin feature

Vendor/Model name			
Pin No.		40	27
Symbol		OD_EN	HPD
I/O		Input	Output
Input status	High	enable	
	Floating	Disable	
	Low	Disable	
Circuit			
Pin No.		1 &34	
Symbol		I2C	
I/O		Input/Output	
CircuitS			

4.3 Electrical Characteristics

4.3.1 LCD Electronics Specification

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		LCD_VCC	3.0	3.3	3.6	V	(1)
BIST Control Level		BIST on	2.2	3.3	3.6	V	(1)
		BIST off	0	-	0.5	V	(1)
I2C(SDA/SCL)		on	1.65	1.8	2.2	V	(1)
		off	0	-	0.5	V	(1)
OD(Over Driver)		on	2.2	3.3	3.6	V	(1)
		off	0	-	0.5	V	(1)
Ripple Voltage		V_{RP}	-	-	100	mV	(1)
Inrush Current		I_{RUSH}	-	-	1.5	A	(1)(2)
Power Supply Current	Mosaic	I_{LCD}	-	545	576	mA	(3)
Power Consumption	Mosaic	P_{LCD}	-	1.8	1.9	W	(3)

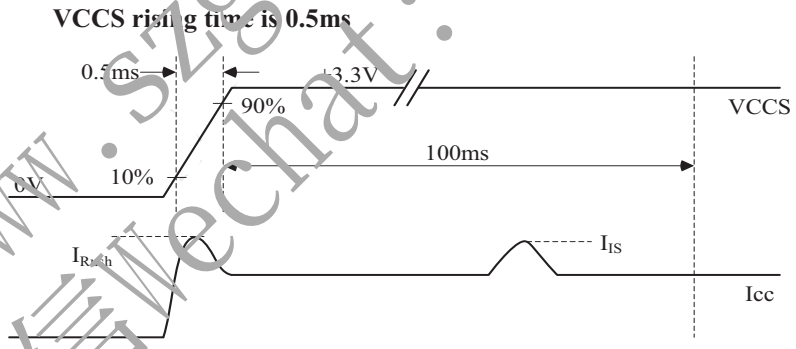
Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

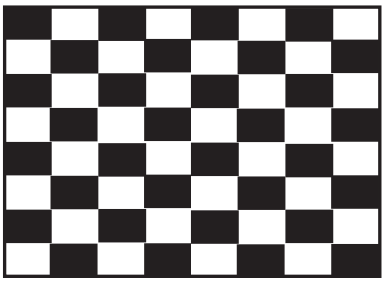
Measurement Conditions: Shown as the following figure.

Test pattern: Mosaic



Note (3) The specified power supply current is under the conditions at VCCS = 3.3 V, Ta = 25 ± 2 ºC, DC Current and f_v = 180 Hz, whereas a power dissipation check pattern below is displayed.

Mosaic Pattern



Active Area

LED CONVERTER SPECIFICATION

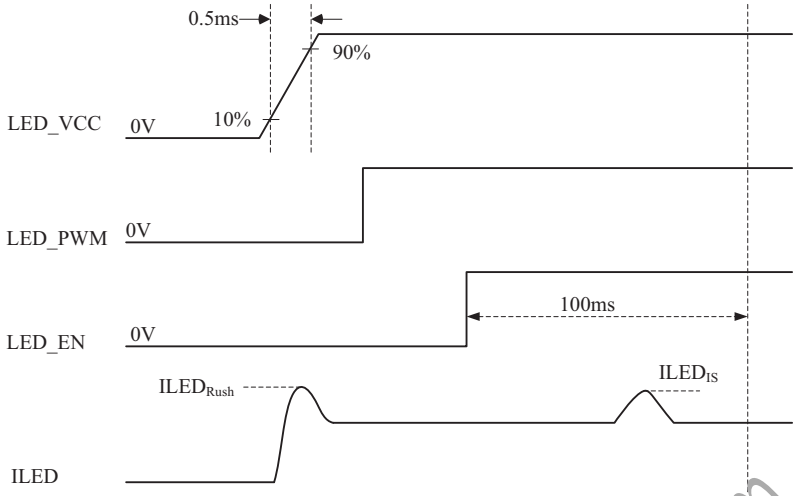
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input power supply voltage		LED_Vccs	5.0	12.0	21.0	V	
Converter Inrush Current		$ILED_{RUSH}$	-	-	1.5	A	(1)
EN Control Level	Backlight On		1.5	-	3.6	V	
	Backlight Off		0	-	0.5	V	
PWM Control Level	PWM High Level		1.5	-	3.6	V	
	PWM Low Level		0	-	0.5	V	
PWM Control Duty Ratio			1	-	100	%	
PWM Control Permissive Ripple Voltage		V_{PWM_pp}	-	-	100	mV	
PWM Control Frequency		f_{PWM}	200	-	2000	Hz	
LED Power consumption		P_L	-	4.27	4.63	W	(2)
LED Power Current	LED_VCCS = Typ.	-	-	356	386	mA	(3)

Note (1) $ILED_{RUSH}$: the maximum current when LED_VCCS is rising,

$ILED_{IS}$: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 ºC, f_{PWM} = 200 Hz, Duty=100%.

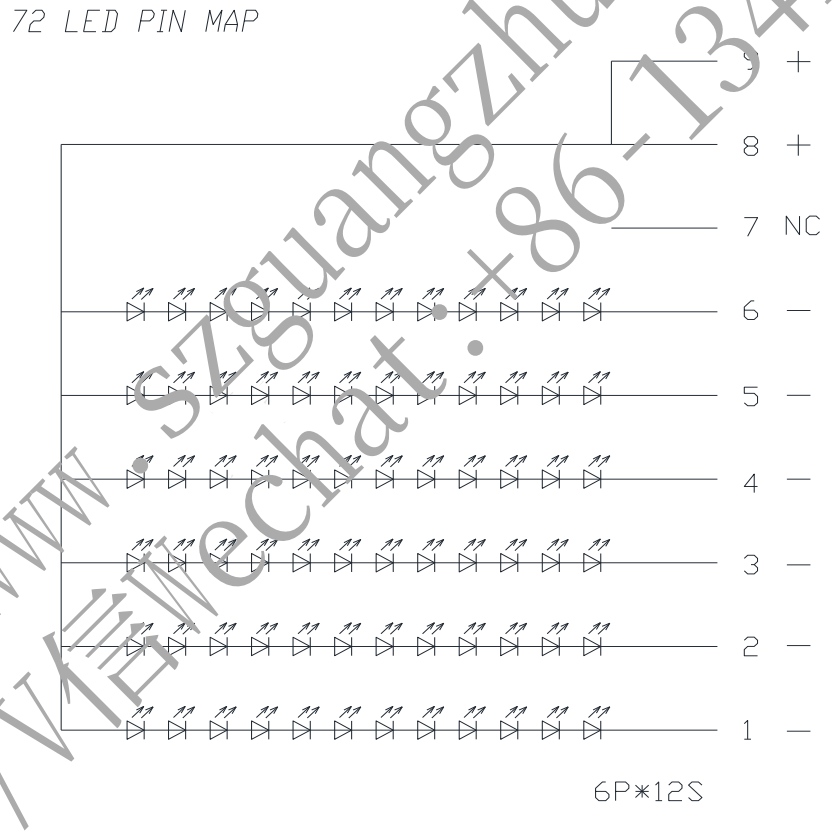
VLED rising time is 0.5ms



Note(2) $P_L = I_L \times V_L$ (With LED converter transfer efficiency);

Note (3) The specified LED power supply current is under the conditions at "LED_VCCS = Typ.", Ta = 25 ± 2 ºC, fPWM = 200 Hz, Duty=100%。

4.3.2 Backlight Unit



Ta = 25 ± 2 °C

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		Min.

LED Light Bar Power Supply Voltage	VL	-	-	33.72	VL	-
LED Light Bar Power Supply Current	IL	-	126	-	IL	-
Power Consumption	PL	-	-	4.96	PL	-
LED Life Time	L_{BL}	15000	-	-	L_{BL}	15000

Note (1) LED current is measured by utilizing a high frequency current meter :

Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at T_a = 25 ±2 °C and I_L = 20 mA(Per EA) until the brightness becomes ≦ 50% of its original value.

4.4 Input Signal Timing Specification

4.4.1 eDP AUX Channel Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Unit Interval for AUX channel	UI_{AUX}	0.4	-	0.6	μS	
Peak-to-peak voltage at TP1	$V_{AUX-DIFF-pp}$	0.18	0.2	1.38	V	
AUX DC Common mode Voltage	$V_{AUX-DC-CM}$	0	-	1.2	V	
AUX Short current limit	I_{AUX_SHORT}	-	-	90	mA	
AUX CH termination DC resistor	R_{AUX_TERM}	80	100	100	Ω	Differential input
AUX AC coupling capacitor	C_{AUX}	75	-	200	nF	
Number of pre-charge pulses	Pre-charge pulses	10	-	16		

4.4.2 eDP Main Link Receiver Characteristics

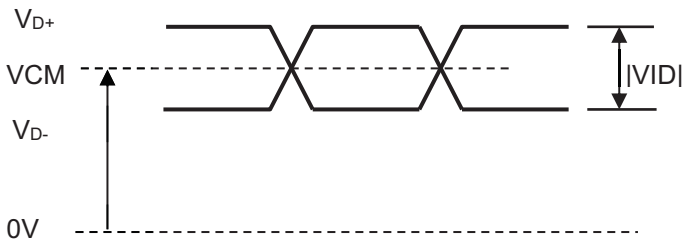
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Link clock down spreading	Down_Spread_Amplitude	0		0.5	%	
Differential Peak-to-peak Input Voltage at Rx package pins	$V_{RX-DIFFp-p}$	100	-	1320	mV	
Differential termination resistance	$R_{RX-TERM}$	80	90	120	Ω	
RX short circuit Current Limit	$I_{RX-SHORT}$	-	-	50	mA	
Lane Intra-pair Skew at RX package pins	$T_{RX-SKEW-INTRA-PAIR-High-Bit-Rate}$	-	-	50	ps	

4.4.3 eDP AUX Channel CharacteristicsS

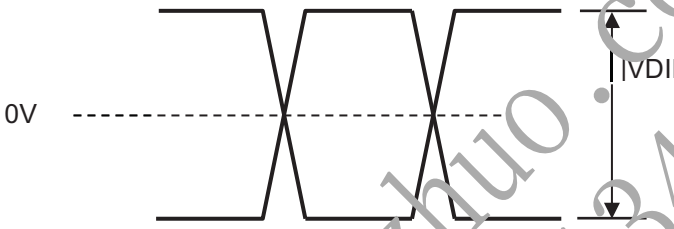
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Hot plug Detect	VHPD	2.5	-	3.3	V	

Note (1) Display port interface related AC coupled signals are following VESA Display Port Standard V1.4b.

Single Ended



Differential



4.4.4 Color Data Input Assignment

The brightness of each primary color (red, green and blue) based on the 10-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																													
		Red										Green										Blue									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	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	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	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	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	1	1	1	1	1	1

Gray Scale Of Red	Red(0)/Dark	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
	Red(1)	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	0	0	0	0
	Red(2)	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	0	0	0	0	0
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	Red(1021)	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	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
	Green(1)	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
	Green(2)	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
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	Green(1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	Green(1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	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
	Blue(1)	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
	Blue(2)	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
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	Blue(1021)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1
	Blue(1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

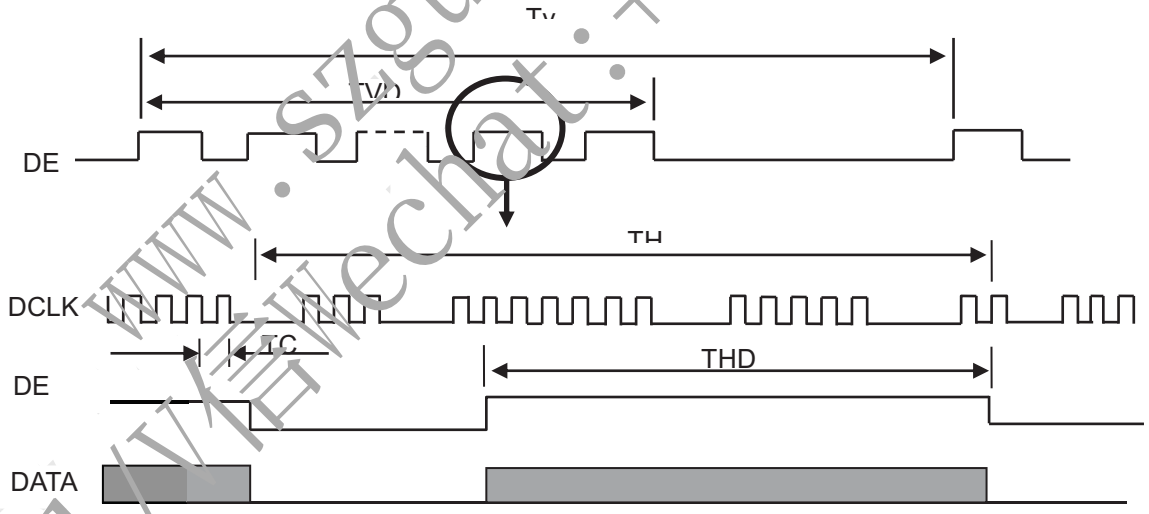
Note (1) 0: Low Level Voltage, 1: High Level Voltage

4.5 Display Timing Specifications

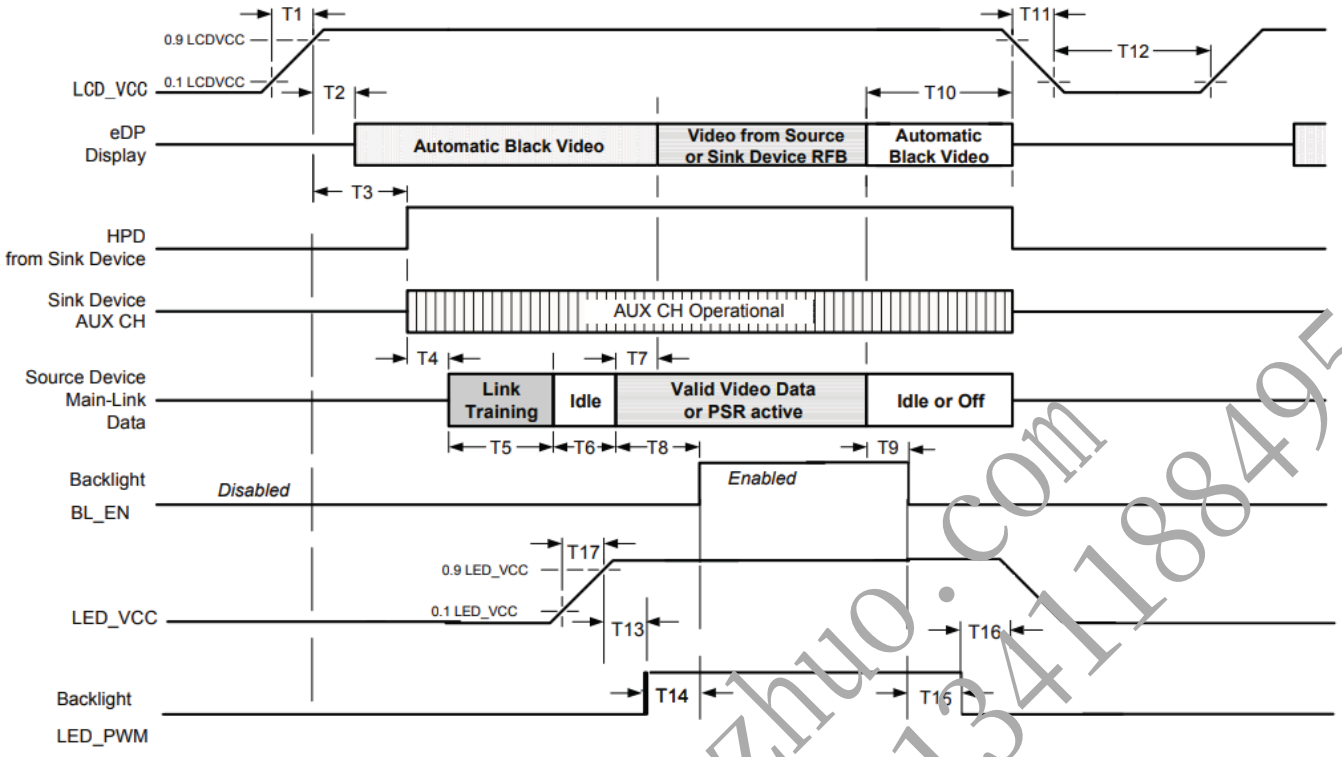
The input signal timing specification is showed as the following table and timing diagram.

Item		Min.	Typ.	Max.	Unit
H-Active			2560		Line
V-Active			1600		Line
Switching RR by Varying PCLK	RR Range(f_v)	60	-	165	Hz
	PCLK	277.44	-	762.96	MHz
	H-Total		2720		TH
	V-Total		1700		Line
Switching RR by Varying V-Blank	RR Range(f_v)	48	-	165	Hz
	PCLK		762.96		MHz
	H-Total		2720		TH
	V-Total	5844	-	1700	Line

Note (1) Display timing signal should be contained and transferred by Display Port Main Link stream data packing described in VESA Display Port Standard V1.4b.



4.6 Power ON/OFF Sequence



Symbol	Description	Min.	Typ.	Max.	Unit	Note
t1	Power rail rise time,10% to 90%	0.5		10	ms	
t2	Delay from LCD_VCC to eDP Display	0		80	ms	Note(5)
t3	Delay from LCD_VCC to HPD High	0		80	ms	
t4	Delay from Sink AUX to link training initialization	-		-	ms	
t5	Link training duration	-		-	ms	
t6	Link idle	-		-	ms	
t7	Delay from valid video Data from Source to video on display	0		50	ms	
t8	Delay from valid video Data from Source to backlight on	-		-	ms	
t9	Delay from Backlight off to end of valid video Data	0		T10-50	ms	
t10	Delay from end of valid video Data from Source to Power off	50		500	ms	
t11	LCD_VCC Power rail fall time,90% to 10%	-		10	ms	Note(1)
t12	LCD_VCC Power off time	500		-	ms	

t13	Delay from LCD_VCC to LED_PWM	0		-	ms	
t14	Delay from LED_PWM to BL_EN	0		-	ms	
t15	Delay from BL_EN to LED_PWM Disable	0		-	ms	
t16	Delay from LED_PWM Disable to LED_VCC 90%	0		-	ms	
t17	Delay from LED_VCC 10% to LED_VCC 90%	0		-	ms	

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might abnormal display or be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD VCCS to 0 V.

Note (3) The backlight must be turned on after the power supply for the logic and the interface signal is valid.

The backlight must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Please follow the LED backlight power sequence as above. If the customer could not follow, it might cause backlight flash issue during display ON/OFF or damage the LED backlight controller.

5. Optical characteristics

Ta=25°C

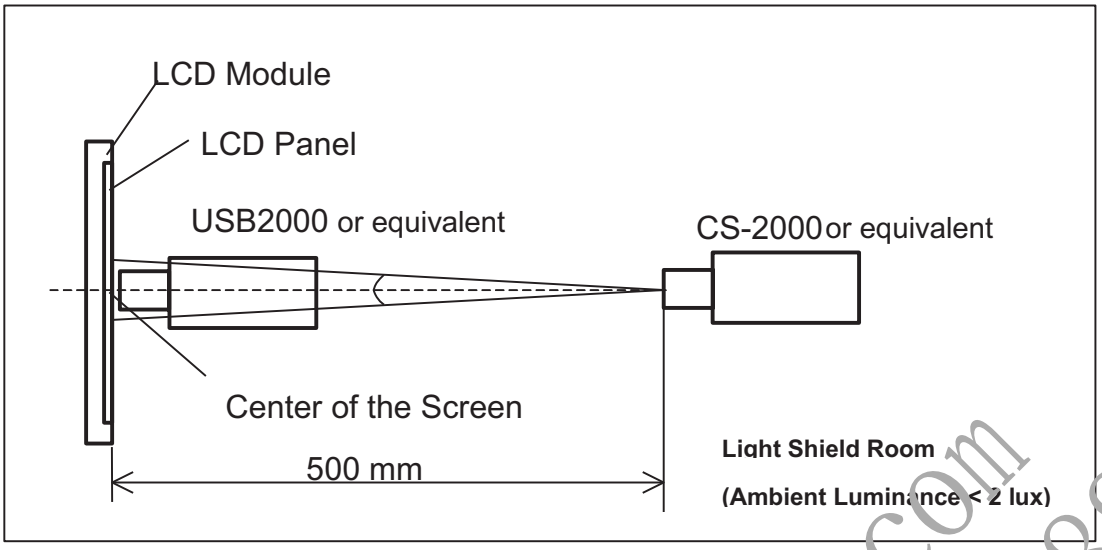
	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing angle range	Left/Right	CR＞10	-	89	-	Deg.	(1), (3), (4), (6)
	Upper/Low		-	89	-		
	Left/Right	CR＞100	-	80	-	Deg.	
	Upper/Low		-	80	-	Deg.	
Contrast ratio	CR	θ=0 deg.	1000	1200	-	-	(2), (4), (6)
Response time	GTG wi OD		-	4	4.3	ms	(5)
	GTG wo		-	6	7	ms	
	Tr+Tf		-	9	-	ms	
Chromaticity of white	x		Typ. -0.025	0.313	Typ. +0.025	-	(2), (6) Normal operation
	y			0.329		-	
Chromaticity of red	x			0.647		-	
	y			0.328		-	
Chromaticity of green	x			0.301		-	
	y			0.603		-	
Chromaticity of blue	x			0.142		-	
	y			0.054		-	
CT	K		5500	-	7000	--	
Gamut	%		95%	100%.		sRGB	
Luminance of White	Y_{LI}		425	500	-	cd/m^2	(7)
Half brigthness viewing	--		-	25/25	-	[deg]	(3)
Half brigthness viewing	-	-	-	25/25	-	[deg]	(3)
gamma	-	-	-	2.2	-	-	-
Surface hardness	[H]	-	-	3	-	H	-
White uniformity 5pt	δW	θ=0 deg.	80	-	-	%	(8)
White uniformity 13pt	δW	θ=0 deg.	60	-	-	%	(2), (8)
Low blue light ratio	%	(415nm~455nm)/(400nm~500nm)	-	-	50	%	-
Reflection ratio	%	-	-	-	6.5	%	-

※The measurement shall be taken 5 minutes after lighting the LCM at the following rating.

※The optical characteristics shall be measured in a dark room or equivalent.

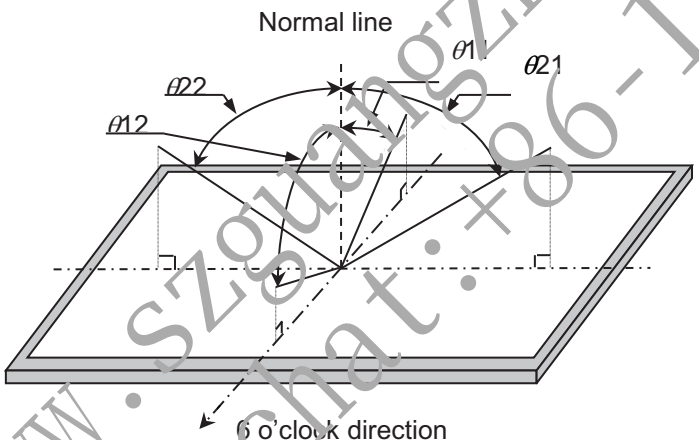
Note (1) Measurement of viewing angle range

Note (2) Measurement of luminance and Chromaticity and Contrast.



Measurement of Contrast, Luminance, Chromaticity, White variation, Crosstalk and Color temperature variation

Note (3) Definitions of viewing angle range:

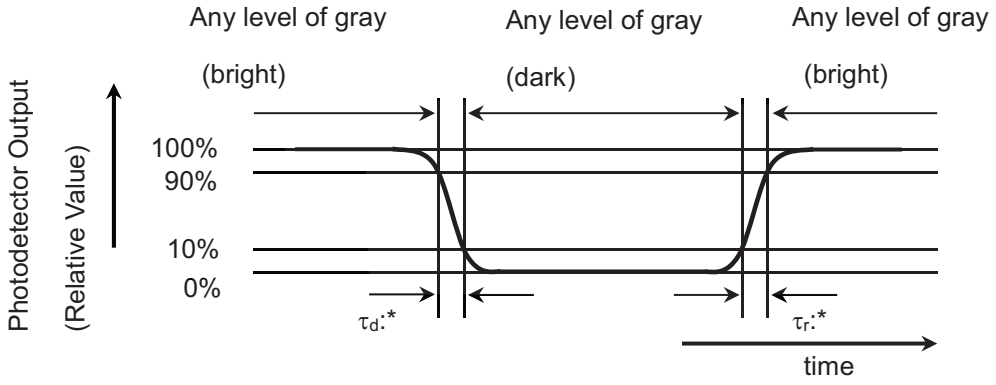


Viewing angle

Note (4) Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance(Brightness) with all pixels white}}{\text{Luminance(Brightness) with all pixels Black}}$$



		Start Gray								
		0	31	63	95	127	159	191	223	255
End Gray	0	■								
	31		■							
	63			■						
	95				■					
	127					■				
	159						■			
	191							■		
	223								■	
	255									■

Response time

Note (5) Definition of response time:

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" ,

$$GTG\ ave = \frac{t_{0-31} + t_{31-0} + t_{0-63} + t_{63-0} + \cdots + t_{223-255} + t_{255-223}}{8 * 9}$$

Note (6) This shall be measured at center of the screen.

Note (7) The Luminance of White is the average of 5 points measurements (4,5,7,9,10) showing in the Fig.9-5.

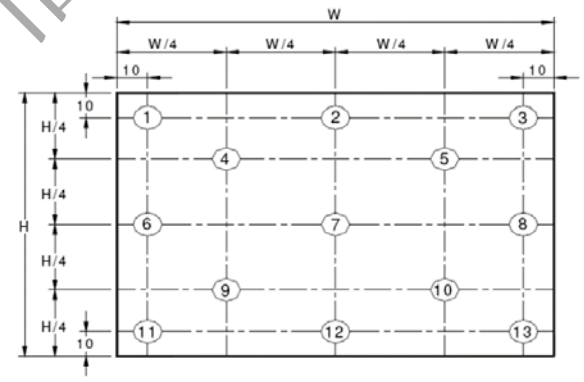


Fig.9-5

Note (8) Definition of white uniformity:

White uniformity of 5 points is defined as the

following with 5 measurements(4,5,7,9,10).

$$\delta_{W1} = \frac{\text{Maximum Luminance of 5 Points(Brightness)}}{\text{Minimum Luminance of 5 Points(Brightness)}}$$

White uniformity of 13 points is defined as the following with 13 measurements(1~13).

$$\delta_{W2} = \frac{\text{Maximum Luminance of 13 Points(Brightness)}}{\text{Minimum Luminance of 13 Points(Brightness)}}$$

6. Reliability Test Items

No.	Test Item	Conditions
1	IS	常温，0~500lux，30~50cm，检查角度：0° 5*5 棋盘格，在室温（23℃）下点亮 4H，切换为 L128，并静置 30min，之后 2s 检查是否有残像（用 ND 卡）
2	ESD	150 pF, 330Ω, Air/contact 放电 10 times/point,1 times/sec; Air :15 KV,9Point @AA Area(垂直距离屏表面 1~2mm) Contact： 8 KV,8Point @metal fram/2side I/O pin contact:5 times/pin,1times/sec
3	HTHHO	50℃±2℃/80%RH，240hrs±48hrs； 2、检查时间点：T0, T240±8
4	LTO	-10℃，240hrs±48hrs； 2、检查时间点：T0,T240±8,
5	ON/OFF Test （OnOff）	1、室温 (25±3℃), 500 hours (30sec. On / 30sec. Off, 30,000 cycles)； 2、测试画面无要求；3、检查时间点：T240±8, T500; 4、以上时间点分别进行外观，画面，光学测试（白画面中心点亮度、Wx、Wy、Contrast）
6	HTS	1、60±2℃, 240±8 hours；2、检查时间点：T0,T240±8,
7	LTS	1、-20±2℃, 240±8 hours; 2、检查时间点：T0,T240±8,
8	TST	1、-20±2℃/30minutes±5%、60±2℃/30minutes±5% 100cycles
9	Vibration	1、1.5G, 10 ~ 200Hz, for x, y, z axis. 30minutes for each axis 2、试验前后进行外观、功能、显示屏质量检查
10	Shock	1、(1) 50G 18msec. trapezoidal (2) 210G 3msec. half-sine 1 for each ± x, y, z direction, total 6 times for (1),(2) 2、试验前后进行外观、功能、显示屏质量检查

[Result Evaluation Criteria] Under the display quality test condition with normal operation state.

Do not change these condition as such changes may affect practical display function.

[Normal operation state] Temperature：＋15℃~＋35℃，Humidity：45~75%，Atmospheric pressure：86~106kPa

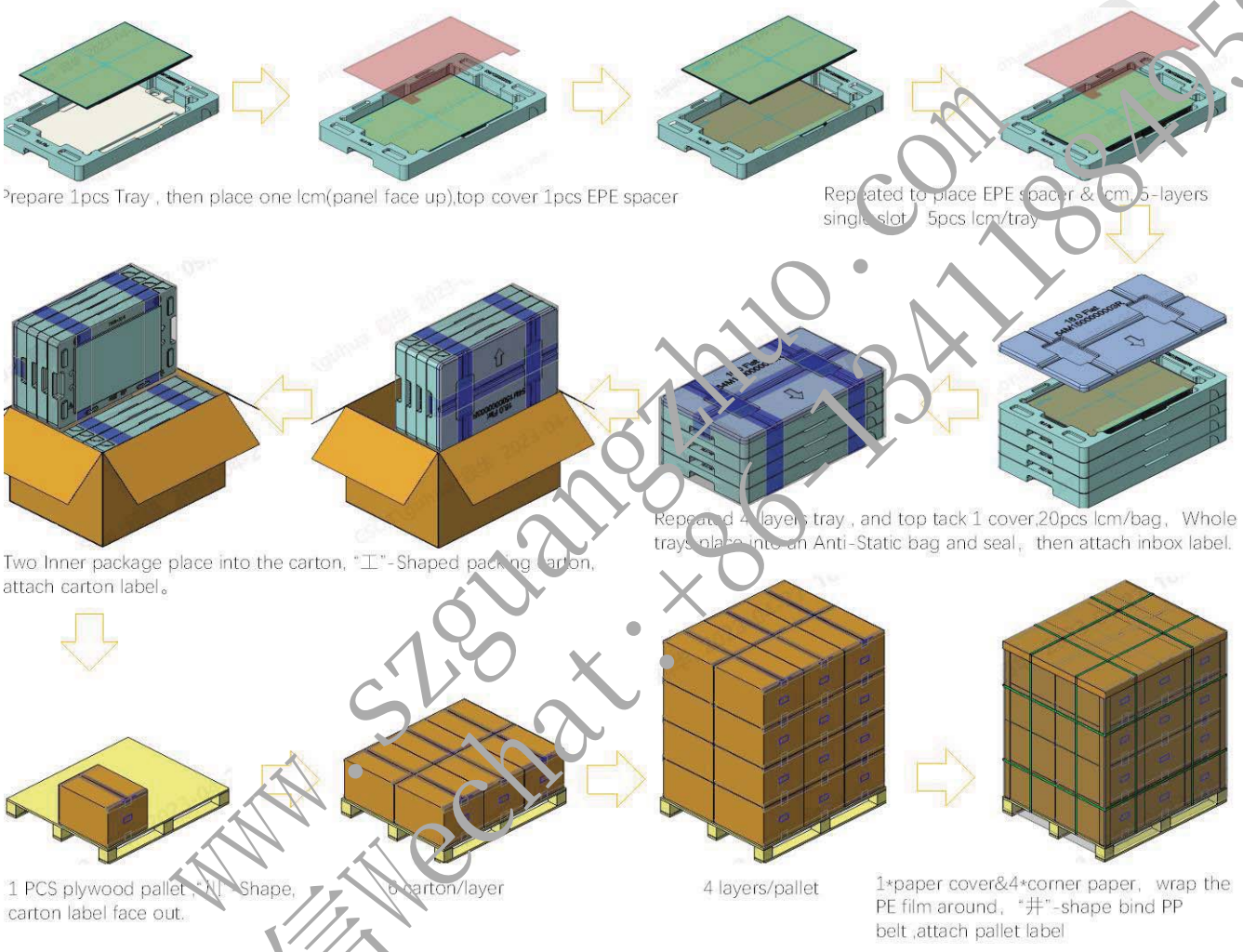
7. Display Quality

The display quality of the color TFT-LCD Module shall be in compliance with the Incoming Inspection Standard.

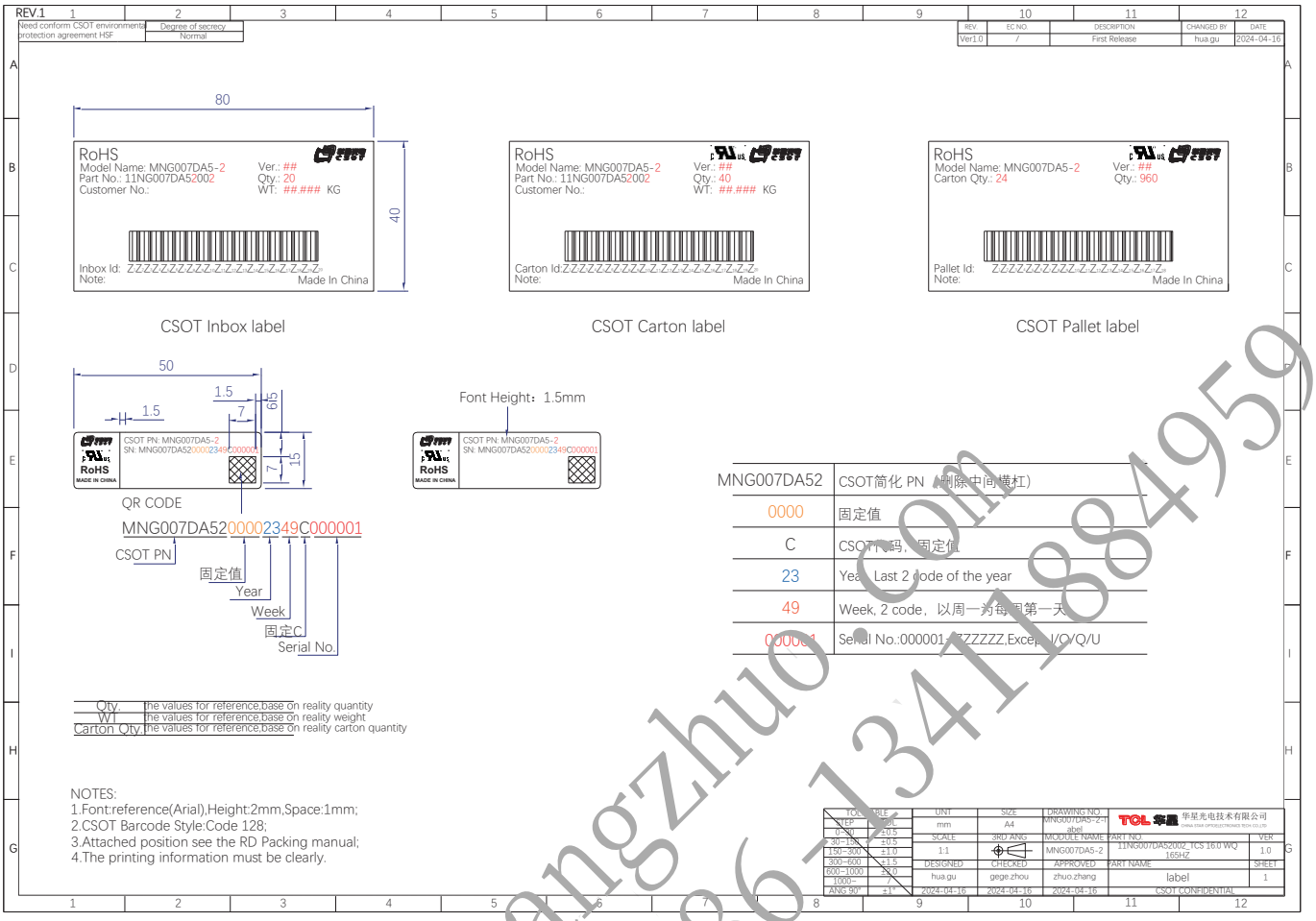
8. Packaging Condition

Item	Specification	Remark
Carton(Box) Packing	40 PCS/Carton(Box)	5 PCS/Tray,（4+1）*2
Carton(Box) Packing Size	490mm(L)x392mm(W)x310mm(H)	Length x Width x Height
Pallet Packing	24 Carton(Box)/Pallet	6*4
Pallet Packing Size	1200mm(L)x1000mm(W)x1360mm(H)	Length x Width x Height

8.1 Packing Method



8.2 Label ：



9. RoHS Directive

This LCD Module is compliant with RoHS Directive.

10. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable .Please insert for too much stress not to join a connector in the case of insertion of a connector.

b) Be sure to design the cabinet so that the Module can be installed without any extra stress such as warp or twist.

c) Since the front polarizer is easily damaged, pay attention not to scratch it.

d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

g) Since CMOS LSI is used in this Module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.

h) This Open-cell has its circuitry PCBs on the side and should be handled carefully in order not to be stressed.

i) Laminate film is attached to the Module surface to prevent it from being scratched. Peel the laminate film off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc. Working under the following environments is desirable.

- All workers wear conductive shoes, conductive clothes, conductive fingerstalls and grounding belts without fail.
- Use Ionized blower for electrostatic removal, and peel of the laminate film with a constant speed. (Peeling of it at over 2 seconds)

j) The polarizer surface on the panel is treated with Anti Glare . In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.

k) Do not expose the LCD Module to a direct sunlight, for a long period of time to protect the Module from the ultra violet ray.

l) When handling LCD Modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the Modules.

m) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.

n) Disassembling the Module can cause permanent damage and should be strictly avoided.(Except for protection film of the panel.)

o) Be careful when using it for long time with fixed pattern display as it may cause afterimage.(Please use a screen saver etc., in order to avoid an afterimage.)

p) If a minute particle enters in the Module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.

q) Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series), tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with polarizer film deterioration regardless of contact or noncontact to polarizer film.Be sure to confirm the component of them.

r) Do not use polychloroprene. If you use it, there is some possibility of generating Cl2 gas that influences the reliability of the connection between LCD panel and driver IC.

s) Do not put a laminate film on LCD Module, after peeling of the original one. If you put on it, it may cause discoloration or spots because of the occurrence of air gaps between the polarizer and the film.

t) Ground module bezel to stabilize against EMI and external noise.

Appendix. EDID Data Structure：

EDID structure	Address (HEX)	Field Name & Comments	Requirements	Hex
Header	00	Header	"00h" fixed	00
	01		"FFh" fixed	FF
	02		"FFh" fixed	FF
	03		"FFh" fixed	FF
	04		"FFh" fixed	FF
	05		"FFh" fixed	FF
	06		"FFh" fixed	FF
	07		"00h" fixed	00
Vendor & Product Identification	08	ID Manufacturer Name	"0Eh" fixed	0E
	09		"77h" fixed	77
	0A	ID Product Code	Pls Check "CSOT ID table"	52
	0B			16
	0C	32-bit serial No.	Basically "00h"	00
	0D		Basically "00h"	00
	0E		Basically "00h"	00
	0F		Basically "00h"	00
	10	Week of manufacture	Basically "00h"	00
	11	Year of Manufacture	2024	22
EDID Version & Revision	12	EDID Structure ver.	"01h" fixed	01
	13	EDID revision #	"04h" fixed	04
Basic Display Parameters & Features	14	Video input definition		B5
	15	Max H image size		22
	16	Max V image size		16
	17	Display Gamma		78
	18	Feature support		03
Color Characteristics	19	Red/Green low bits	Pls input values in cell D3~D10 of	C1
	1A	Blue/White low bits		75

	1B	Red x high bits	sheet "Coordinates"	A5
	1C	Red y high bits		54
	1D	Green x high bits		4D
	1E	Green y high bits		9A
	1F	Blue x high bits		24
	20	Bue y high bits		0D
	21	White x high bits		50
	22	White y high bits		54
Established Timings	23	Established timing 1	"00h" fixed	00
	24	Established timing 2	"00h" fixed	00
	25	Established timing 3	"00h" fixed	00
Standard Timings: Identification 1 → 8	26	Standard timing #1	"01h" fixed	01
	27		"01h" fixed	01
	28	Standard timing #2	"01h" fixed	01
	29		"01h" fixed	01
	2A	Standard timing #3	"01h" fixed	01
	2B		"01h" fixed	01
	2C	Standard timing #4	"01h" fixed	01
	2D		"01h" fixed	01
	2E	Standard timing #5	"01h" fixed	01
	2F		"01h" fixed	01
	30	Standard timing #6	"01h" fixed	01
	31		"01h" fixed	01
	32	Standard timing #7	"01h" fixed	01
	33		"01h" fixed	01
	34	Standard timing #8	"01h" fixed	01
	35		"01h" fixed	01
Preferred Timing Mode	36	Pixel Clock/10,000 (LSB)	Preferred Timing Mode	60
	37	Pixel Clock/10,000 (MSB) /		6C
	38	Horizontal Active		00

	39	Horizontal Blanking		A0
	3A	Horizontal Active : Horizontal Blanking		A0
	3B	Vertical Active		40
	3C	Vertical Blanking		64
	3D	Vertical Active : Vertical Blanking		60
	3E	Horizontal Sync. Offset		30
	3F	Horizontal Sync Pulse Width		20
	40	Vertical Sync Offset : Sync Width		36
	41	Horizontal Vertical Sync Offset/Width		00
	42	Horizontal Image Size		63
	43	Vertical Image Size		D7
	44	Horizontal & Vertical Image Size		10
	45	Horizontal Border		00
	46	Vertical Border		00
	47	Signal Interface Type		18
Detailed Timing # 2	48	Pixel Clock/10,000 (LSB) (Slow Refresh rate)	【LRR 2.5(PSR2, VRR)】: MRL 【Not LRR】: All "00h" or Timing MRL (Monitor Range Limits) 48h -> "00h" fixed 49h -> "00h" fixed 4Ah -> "00h" fixed 4Bh -> "FDh" fixed 52h -> "01h" fixed 53h -> "0Ah" fixed 54h -> "20h" fixed 55h -> "20h" fixed 56h -> "20h" fixed 57h -> "20h" fixed 58h -> "20h" fixed	00
	49	Pixel Clock/10,000 (MSB) / (Slow Refresh rate)		00
	4A	Horizontal Active		00
	4B	Horizontal Blanking		FD
	4C	Horizontal Active : Horizontal Blanking		0C
	4D	Vertical Active		3C
	4E	Vertical Blanking		A5
	4F	Vertical Active : Vertical Blanking		1A
	50	Horizontal Sync. Offset		1A
	51	Horizontal Sync Pulse Width		4D
	52	Vertical Sync Offset : Sync Width		01
	53	Horizontal Vertical Sync Offset/Width		0A
	54	Horizontal Image Size		20
	55	Vertical Image Size		20

	56	Horizontal & Vertical Image Size	59h -> "20h" fixed	20
	57	Horizontal Border		20
	58	Vertical Border		20
	59	Signal Interface Type		20
Display Descriptor # 3	5A	Flag	Model Name : MNH301CA3-1 5Ah -> "00h" fixed 5Bh -> "00h" fixed 5Ch -> "00h" fixed 5Dh -> "FEh" fixed 5Eh -> "00h" fixed	00
	5B	Flag		00
	5C	Flag		00
	5D	Data Type Tag		FC
	5E	Reserved		00
	5F	ASCII		4D
	60	ASCII		4E
	61	ASCII		47
	62	ASCII		30
	63	ASCII		30
	64	ASCII		37
	65	ASCII		44
	66	ASCII		41
	67	ASCII		35
	68	ASCII		2D
	69	ASCII		32
	6A	ASCII		0A
	6B	ASCII		20
Display Descriptor # 4	6C	Flag	【ASCII】Display Product 6Ch -> "00h" fixed 6Dh -> "00h" fixed 6Eh -> "00h" fixed 6Fh -> "FEh" fixed 70h -> "00h" fixed	00
	6D	Flag		00
	6E	Flag		00
	6F	Data Type Tag		FE
	70	Flag		00
	71	Model Name		43
	72	Model Name		53
	73	Model Name		4F

	74	Model Name		54
	75	Model Name		20
	76	Model Name		54
	77	Model Name		33
	78	Model Name		0A
	79	Model Name		20
	7A	Model Name		20
	7B	Model Name		20
	7C	Model Name		20
	7D			20
Extension Block Count N	7E	Extension flag		01
Checksum	7F	Checksum		2B
DID 2.0	80	EDID Extension Tags		70
	81	Display ID version		20
	82	section size		79
	83	product Type identifier		02
DID Block #1 Header	84	extension count		00
	85	block tag		21
	86	block revision and other data		00
	87	payload		1D
First Timing	88	Horizontal Image Size		77
	89			0D
	8A	Vertical Image Size		6A
	8B			08
	8C	Horizontal Pixel Count		00
	8D			0A
	8E	Vertical Pixel Count		40
	8F			06
	90	Feature Support Flags		00

	91	Native Color Chromaticity (Red Chromaticity)		5A
	92			3A
	93			53
	94	Native Color Chromaticity (Green Chromaticity)		D1
	95			64
	96	Native Color Chromaticity (Blue Chromaticity)		9A
	97			46
	98			D2
	99			0D
	9A	Native Color Chromaticity (White Chromaticity)		02
	9B			45
adaptive sync data block	9C			54
	9D	Native Maximum Luminance (Full Coverage)		00
	9E			80
	9F	Native Maximum Luminance (10% Coverage)		00
	A0			80
	A1	Native Minimum Luminance		00
	A2	Native Color Depth and Display Device Technology		80
	A3			12
	A4	Native Gamma EOTF		78
DTD1: Native RR	A5	block tag		22
	A6	block rev		00
	A7	Payload		14
	A8	Pixel Clock		4F
	A9			A4
	AA			0B
	AB	timing options		85

	AC	H-Active		FF
	AD			09
	AE	H-Blanking		9F
	AF			00
	B0	H-offset		2F
	B1			00
	B2	H-sync pulse width		1F
	B3			00
	B4	V-Active		3F
	B5			06
	B6	V-Blanking		00
	B7			00
	B8	V-offset		02
	B9			00
	BA	V-sync pulse width		05
	BB			00
adaptive sync data block 60-48HZ	BC	Adaptive-Sync Data Block		2B
	BD	Block revision = 0		00
	BE	Number of Payload Bytes in block= 6 byte		0C
	BF	FAVT and AVT Supported,Native panel range,successive frame duration Decrease met with in RR Range.		27
	C0	00h = Flicker performance is met in any duration increase within the refresh rate range without jitter impact.		00
	C1	Minimum Refresh Rate(60/1.001)Hz		30
	C2	Maximum Refresh Rate(165x1.00035)Hz		3B
	C3			00
	C4	00h = Flicker performance is met in any duration decrease within the refresh rate range		00
	C5	FAVT and AVT Supported,Native panel range,successive frame duration Decrease		27

		met with in RR Range.		
	C6	00h = Flicker performance is met in any duration increase within the refresh rate range without jitter impact.		00
	C7	Minimum Refresh Rate(48/1.001)Hz		3C
	C8	Maximum Refresh Rate(60x1.00035)Hz		A4
	C9			00
	CA	00h = Flicker performance is met in any duration decrease within the refresh rate range		00
CTA AMD VSDB3 (Fresync Range : Native rr ~48HZ)	CB	DID2.0 Data block tag[81h] = CTA DisplayID		81
	CC	Block revision		00
	CD	Number of Payload Bytes in block=		14
	CE	CTA Block1 Tag Code and Block1 Length = Vendor Specific Data Block(03h) +Length of following data block (in bytes)		74
	CF	AMD IEEE OUI value (0x00001A)		1A
	D0	(Hex. LSB first)		00
	D1	(Hex. LSB first)		00
	D2	AMD VSDB Version 3		03
	D3	Freesync Capability : Seamless Local Dimming Disable Control Not Supported , Seamless Native Color Space & Transfer Switching Curve Not Supported , Seamless Variable Frame Rate Switching Supported		01
	D4	Min Refresh Rate =		3C
	D5	Max Refresh Rate =		A5
	D6	Freesync MCCS VCP Code		00
	D7	Support WCG and HDR features : Seamless Gamma 2.2 EOTF Not Supported , Seamless PQ EOTF Not Supported		04
	D8	Max Luminance 1 (for HDR) =		00
	D9	Min Luminance 1 (for HDR) =		00

	DA	Max Luminance 2 (for HDR) =		00
	DB	Min Luminance 2 (for HDR) =		00
	DC	Freesync Maximum Refresh Rate (LSB) : (Range : 0Hz (000h) ~ 1023Hz (3FFh), for VSDB v3)		A5
	DD	Freesync Maximum Refresh Rate (MSB)		00
	DE	Maximum Fast Transport Input Pixel Rate [kHz] - bits 7:0		8D
	DF	Maximum Fast Transport Input Pixel Rate [kHz] - bits 15:8		36
	E0	Maximum Fast Transport Input Pixel Rate [kHz] - bits 23:16		0E
Unused	E1	Additional Sink information offset DP/eDP Port: offset from DPCD 0x403		00
	E2	eDP Display Features Handshake DPCD offset eDP Port: offset from DPCD 0x380		00
	E3			00
	E4			00
	E5			00
	E6			00
	E7			00
	E8			00
	E9			00
	EA			00
	EB			00
	EC			00
	ED			00
	EE			00
	EF			00
	F0			00
	F1			00

	F2			00
	F3			00
	F4			00
	F5			00
	F6			00
	F7			00
	F8			00
	F9			00
	FA			00
	FB			00
	FC			00
	FD			00
Checksum1	FE			B2
Checksum2	FF	Checksum(80h~FEh)		90

Appendix. Outline Drawing