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MODEL NO : ET101WS02-DMODEL VERSION: 01SPEC VERSION : 1.0ISSUED DATE: 2018-01-11☒ Preliminary Specification☐ Final Product Specification

Customer : _____

Approved by	Notes

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Record of Revision

[illegible]

1 General Specifications

Feature		Spec
Display Spec.	Size	10.1 inch
	Resolution	1024(RGB) X 600
	Technology Type	a-Si
	Pixel Configuration	RGB Vertical Stripe
	Pixel pitch(mm)	0.2175(V)*0.2088(V)
	Display Mode	Normally white
	Viewing Direction	6 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	235.00(H)*143.00(V)*5.2(D)
	Active Area(mm)	222.72(H)*125.28 (V)
	With /Without TSP	Without TSP
	Weight (g)	TBD
Electrical Characteristics	Interface	24bit-RGB
	Color Depth	16.7M

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

Note 2: Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance: $\pm 5\%$

2 Input/Output Terminals

FPC Connector is used for the module electronics interface. The recommended model is FH12A-50S-0.5SH manufactured by Hirose.

No.	Symbol	Function	Remark
1	LED+	Power for LED backlight (Anode)	
2	LED+	Power for LED backlight (Anode)	
3	LED-	Power for LED backlight (Cathode)	
4	LED-	Power for LED backlight (Cathode)	
5	GND	Power ground	
6	VCOM	Common voltage	
7	VDD	Digital Power	
8	MODE	DE/SYNC mode select	Note1
9	DE	Data Input Enable	
10	VSD	Vertical sync input. Negative polarity	
11	HSD	Horizontal sync input. Negative polarity	
12	B7	Blue data(MSB)	
13	B6	Blue data	
14	B5	Blue data	
15	B4	Blue data	
16	B3	Blue data	
17	B2	Blue data	
18	B1	Blue data	
19	B0	Blue data(LSB)	
20	G7	Green data(MSB)	
21	G6	Green data	
22	G5	Green data	
23	G4	Green data	
24	G3	Green data	
25	G2	Green data	
26	G1	Green data	
27	G0	Green data(LSB)	
28	R7	Red data(MSB)	
29	R6	Red data	
30	R5	Red data	
31	R4	Red data	
32	R3	Red data	
33	R2	Red data	
34	R1	Red data	
35	R0	Red data(LSB)	
36	GND	Power Ground	
37	DCLK	Clock input	
38	GND	Power Ground	
39	L/R	Left or Right Display Control	Note2
40	U/D	Up / Down Display Control	Note3
41	VGH	Positive Power for TFT	
42	VGL	Negative Power for TFT	

43	AVDD	Analog Power	
44	RESET	Global reset pin	Note4
45	NC	No connection	
46	VCOM	Common Voltage	
47	DITH	Dithering setting	Note5
48	GND	Power Ground	
49	NC	No connection	
50	NC	No connection	

Note1: DE/SYNC mode select . Normally pull high.

When MODE = H , DE mode

When MODE = L , SYNC mode

Note2: Source Driver internal shift register is controlled by this pin as shown below: Normally pull high.

SHLR=H: SO1→ SO2→ SO3→ ...→SO1536 (Default)

SHLR=L: SO1536→ SO1535→ SO1534→...→SO1

Note3: Gate Driver Up/down scan setting. Normally pull low.

When UPDN=H, reverse scan.

STV1 output vertical start pulse and UD pin output "H" to Gate driver

When UPDN=L, normal scan. (Default)

STV2 output vertical start pulse and UD pin output "L" to Gate driver

Note4: Global reset pin. Active low to enter reset state.

Suggest to connecting with an RC reset circuit for stability. Normally pull high.

(R=10KΩ , C=1μF)

Note5: Dithering setting DITH=" H" 8bit resolution (default setting)

DITH=" L" 6bit resolution (last 2 bit of input data truncated)

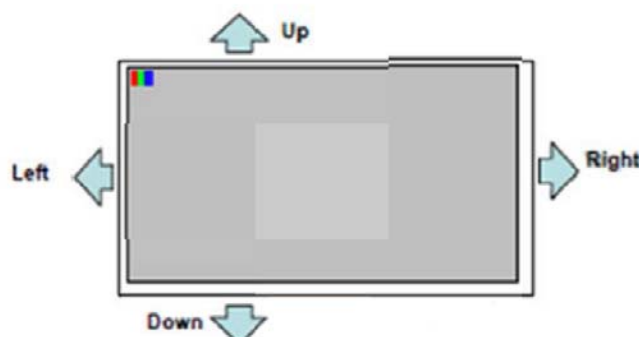
Note6: SHLR: left or right setting

UPDN: up or down setting

SHLR	UPDN	Data shifting
VDD	GND	left to right ,Up to down(default)
GND	GND	right to left,Up to down
VDD	VDD	left to right ,Down to up
GND	VDD	right to left ,Down to up

Note7: Definition of scanning direction.

Refer to the figure as below:



3 Absolute Maximum Ratings

Parameter of absolute maximum ratings 参数	Symbol 符号	Min 最小值	Max 最大值	Unit 单位
Power supply voltage1	DVDD	-0.5	5.0	V
Power supply voltage2	AVDD	-0.5	15	V
Power supply voltage3	VGH	-0.5	22	V
Power supply voltage4	VGL	-13	0	V
Power supply voltage5	VCOM	0	4.8	V
Backlight forward current	ILED	-0.001	30	mA(For each led)
Reverse Voltage	VR	-	5	V
Operating temperature	Top	-10	50	°C
Storage temperature	Tst	-20	60	°C
Humidity	RH	-	90%(Max)/60°C	RH

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

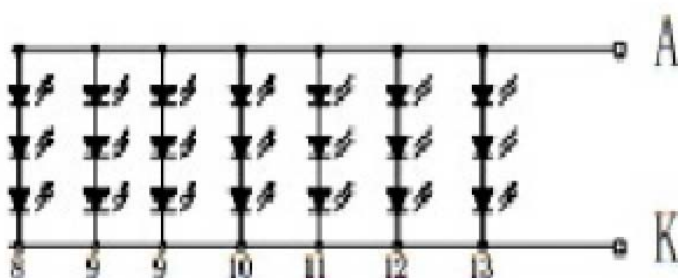
Item	Symbol	Values			Unit	Remarks
		Min.	Typ.	Max.		
Power Voltage Supply1	DVDD	3.0	3.3	3.96	V	-
Power Voltage Supply2	AVDD	0.5	10.85	13.85	V	
Power Voltage Supply3	VGH	-0.5	21	22	V	
Power Voltage Supply4	VGL	-13	-8	0	V	
Power Voltage Supply5	VCOM	0	3.8	4.8	V	

4.2 Backlight Unit

The backlight system is an edge-lighting type with 21 LED. The characteristics of the LED are shown in the following tables.

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Backlight forward voltage	V_F	-	9.6	10.6	V	21 LEDs
Backlight forward current	I_F	--	140	--	mA	
LED life time	--	20000	--	--	Hrs	

Note 1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25\pm3\text{ }^{\circ}\text{C}$, typical IL value indicated in the above table and the $f_L=50\text{k Hz}$ until the brightness becomes less than 50%.



3X7PCS = 21 LED

5 Timing Chart

5.1 AC Electrical Characteristics

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
HS setup time	Thst	8	-	-	ns	
HS hold time	Thhd	8	-	-	ns	
VS setup time	Tvst	8	-	-	ns	
VS hold time	Tvhd	8	-	-	ns	
Data setup time	Tdsu	8	-	-	ns	
Data hole time	Tdhd	8	-	-	ns	
DE setup time	Tesu	8	-	-	ns	
DE hole time	Tehd	8	-	-	ns	
DVDD Power On Slew rate	TPOR	-	-	20	ms	From 0 to 90% DVDD
RESET pulse width	TRst	1	-	-	ms	
DCLK cycle time	Tcoh	20	-	-	ns	
DCLK pulse duty	Tcwh	40	50	60	%	

5.2 Interface Timing

Vertical timing

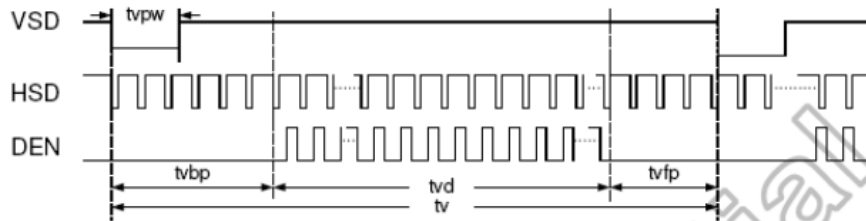
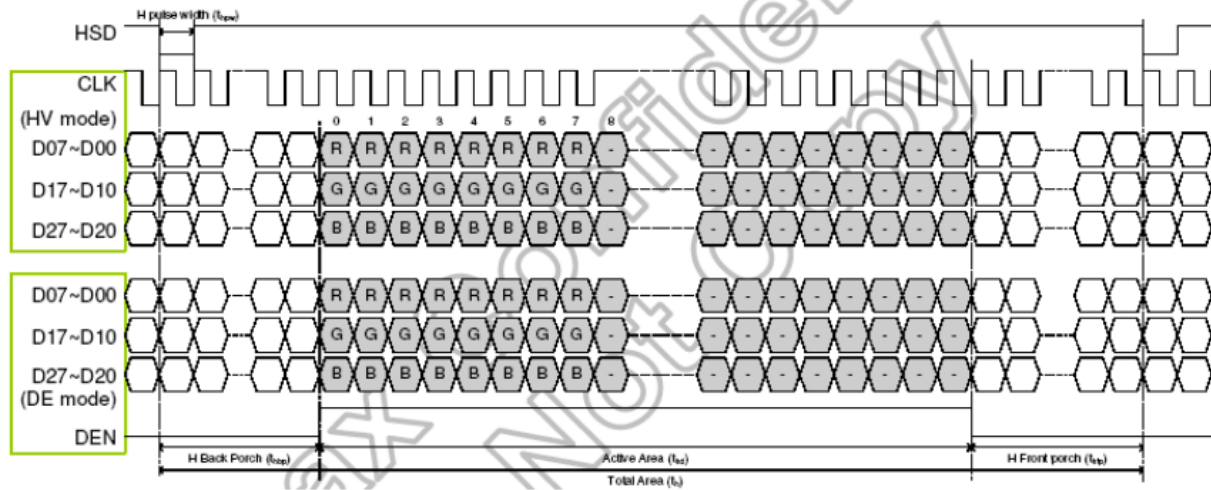


Figure 10.2: Vertical input timing diagram

Horizontal timing



DE mode

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd	1024			DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd	600			T _H
VSD Period	tvbp	610	635	800	T _H
VSD Blanking	tvbp+ tvfp	10	35	200	T _H

HV mode

Horizontal timing

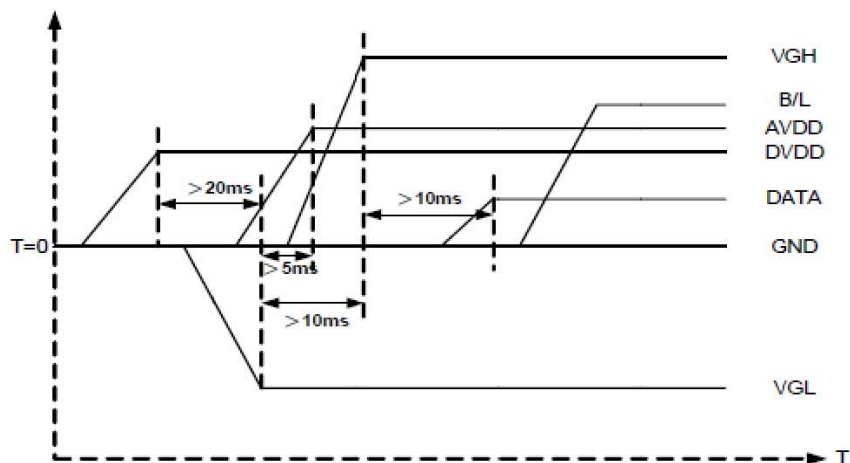
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1		140	DCLK
HSD Back Porch	thbp		160		DCLK
HSD Front Porch	thfp	16	160	216	DCLK

Vertical Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		600		T _H
VSD Period	tv	624	635	750	T _H
VSD Pulse Width	tvpw	1	-	20	T _H
VSD Back Porch	tvbp		23		T _H
VSD Front Porch	tvfp	1	12	127	T _H

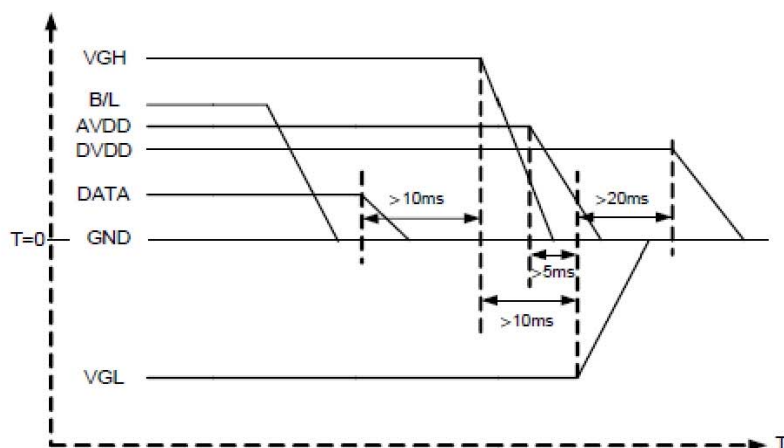
5.3 Power On / Off Sequence

a. Power on:



DV_{nn}→VGL→AVDD→VGh→Data→B/L

b. Power off:



B/L→Data→VGh→AVDD→VGL→DV_{nn}

Note: Data include R0~R7, B0~B7, GO~G7, U/D, L/R, DCLK, HS, VS, DE.

6 Optical Characteristics

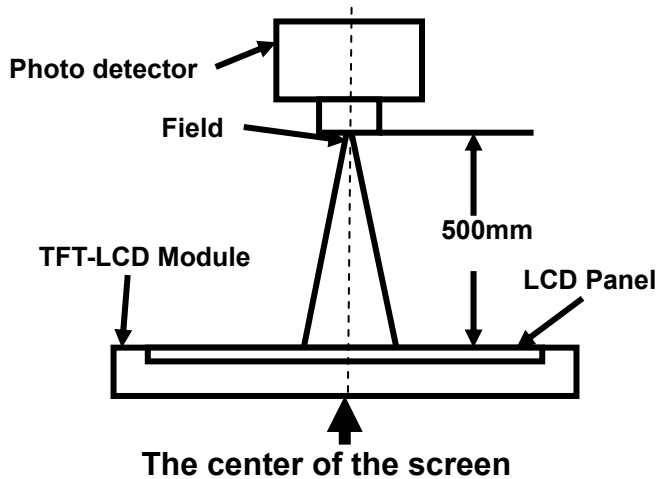
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	-	60	-	Degree	Note2,3
		θB		-	70	-		
		θL		-	70	-		
		θR		-	70	-		
Contrast Ratio		CR	θ=0°	-	500	-		Note 3
Response Time		T _{ON}	25℃	-	30	-	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.260	0.310	0.360		Note 1,5
		y		0.286	0.336	0.386		
	Red	x						Note 1,5
		y						
	Green	x						Note 1,5
		y						
	Blue	x						Note 1,5
		y						
Uniformity		U		75	80	--	%	Note 6
Luminance		L		230	280	-	cd/m ²	Note 7

Test Conditions:

1. $I_F = 20$ mA, and the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

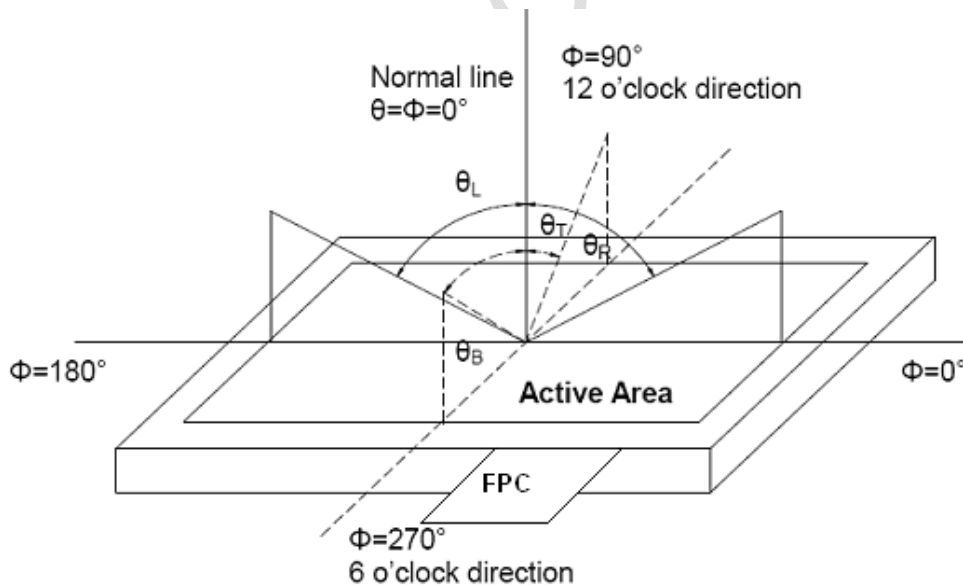
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



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

viewing angle is measured at the center point of the LCD.



Note 3: Definition of contrast ratio

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

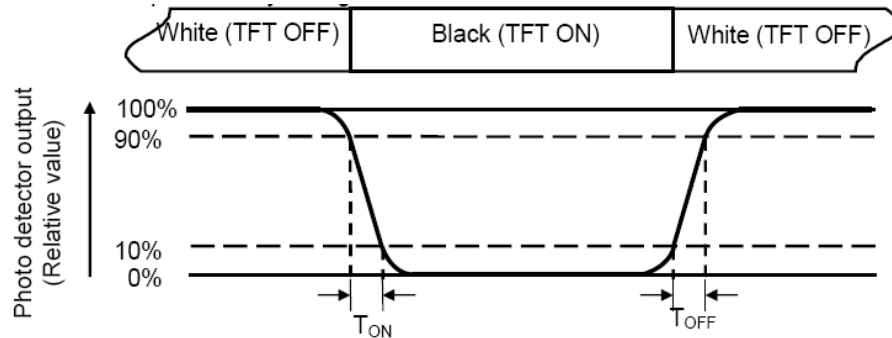
"White state ": The state is that the LCD should drive by V_{white} .

"Black state": The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note 4: Definition of Response time

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



Note 5: Definition of color chromaticity (CIE1931)

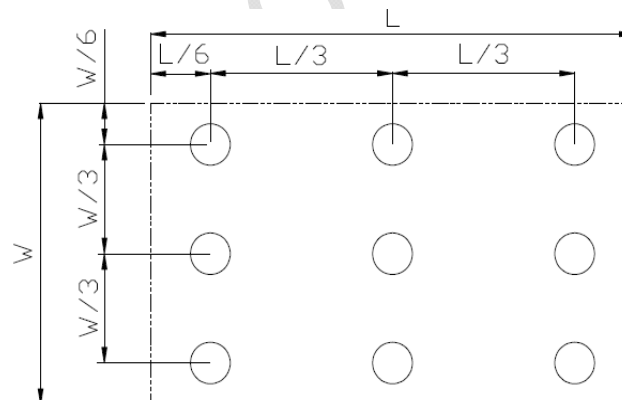
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

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



$L_{\max}$: The measured Maximum luminance of all measurement position.

$L_{\min}$: The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	70℃, 96Hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20℃, 96 Hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	80℃, 96Hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30℃, 96 Hours	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity	40℃, 90%RH, 96 Hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-20℃(30min)→+70℃(30min), 100 cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, G B2423.22-2002
7	ESD	Contact: ±4KV Air: ±8KV 150PF/330Ω, 5Points/panel, 5times	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm, 2 hours for each direction of X, Y, Z	IEC60068-2-6:1982 GB/T2423.10—1995
10	Package Drop Test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	IEC60068-2-32:1990 GB/T2423.8—1995

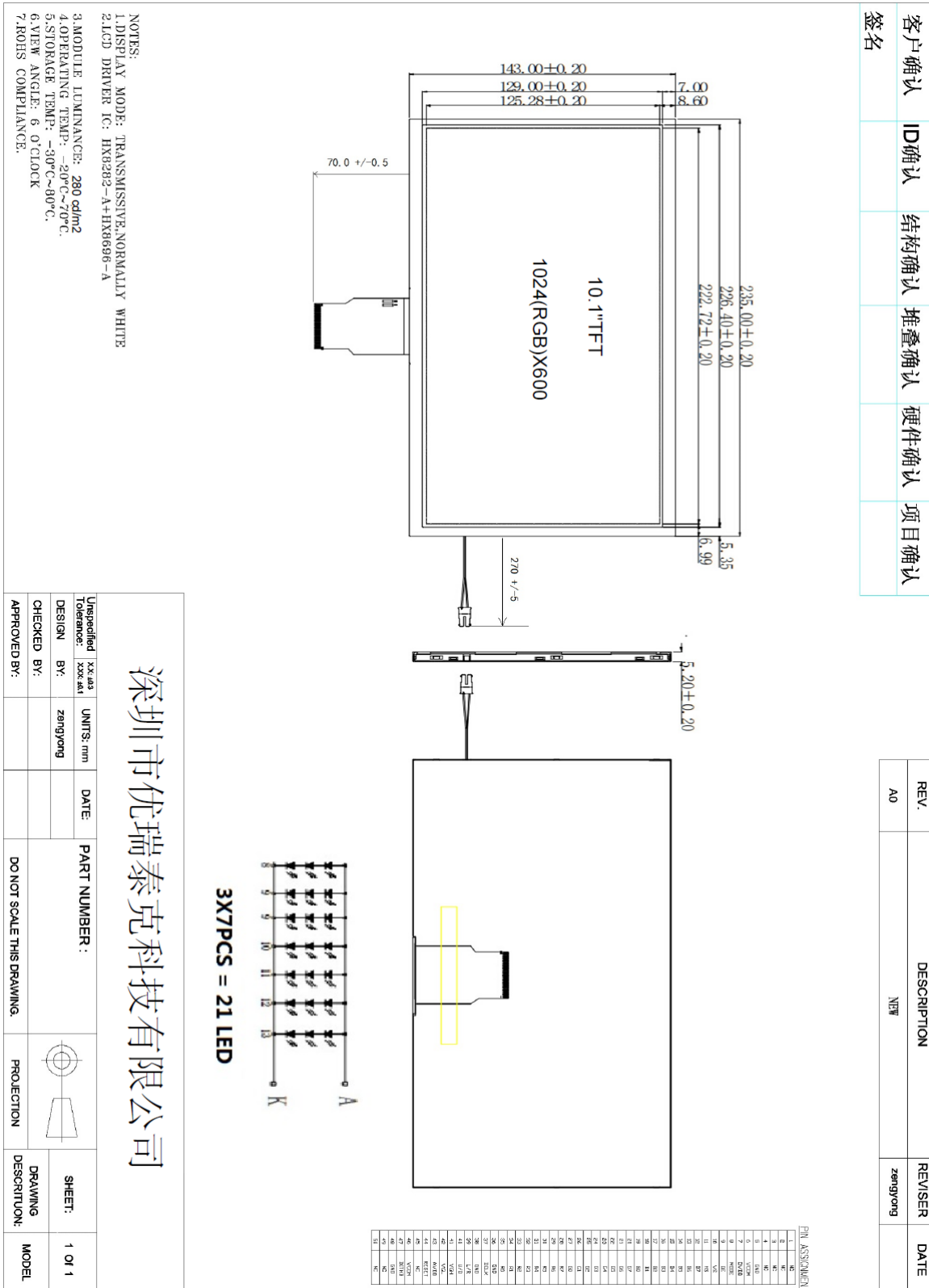
Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

8. Outline Dimension



9 Packing Drawing

TBD

10 Precautions for Use of LCD Modules

a) Handling Precautions

- i. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- ii. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- iii. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- iv. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- v. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcohol

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

- Water
 - Ketone
 - Aromatic solvents
- vi. Do not attempt to disassemble the LCD Module.
 - vii. If the logic circuit power is off, do not apply the input signals.
 - viii. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

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

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

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

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

b) Storage precautions

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

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

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

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

c) Transportation Precautions

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