Specifications Approval Sheet

Product Description: 1.6” Transmissive TFT Color Module	
Customer Part No:	
	Approved By: 謝宗宏 Simon Hsieh
	Reviewed By: 謝宗宏 Simon Hsieh
	Prepared By: 詹琇蓉 Vita Chan

Please return one copy with your signature and comments for our confirmation.

AU Optronics Corporation

Tel: +886-3-500-8899

Fax: +886-3-564-5785

Doc. version	1
Total pages	14
(Not include this cover page)	

Product Specification

1.6″ COLOR TFT-LCD

(◆) Preliminary Specification
( ) Final Specification

Note: The content of this specification is subject to change.

Record of Revision

Version	Revise Date	Page	Content
0			First draft
1		4	Unify pin assignment definition
		9	Modified Optical specification
		14	Modified Outline dimensions of TFT LCD drawing

Contents:

Appendix:

A. General Specification

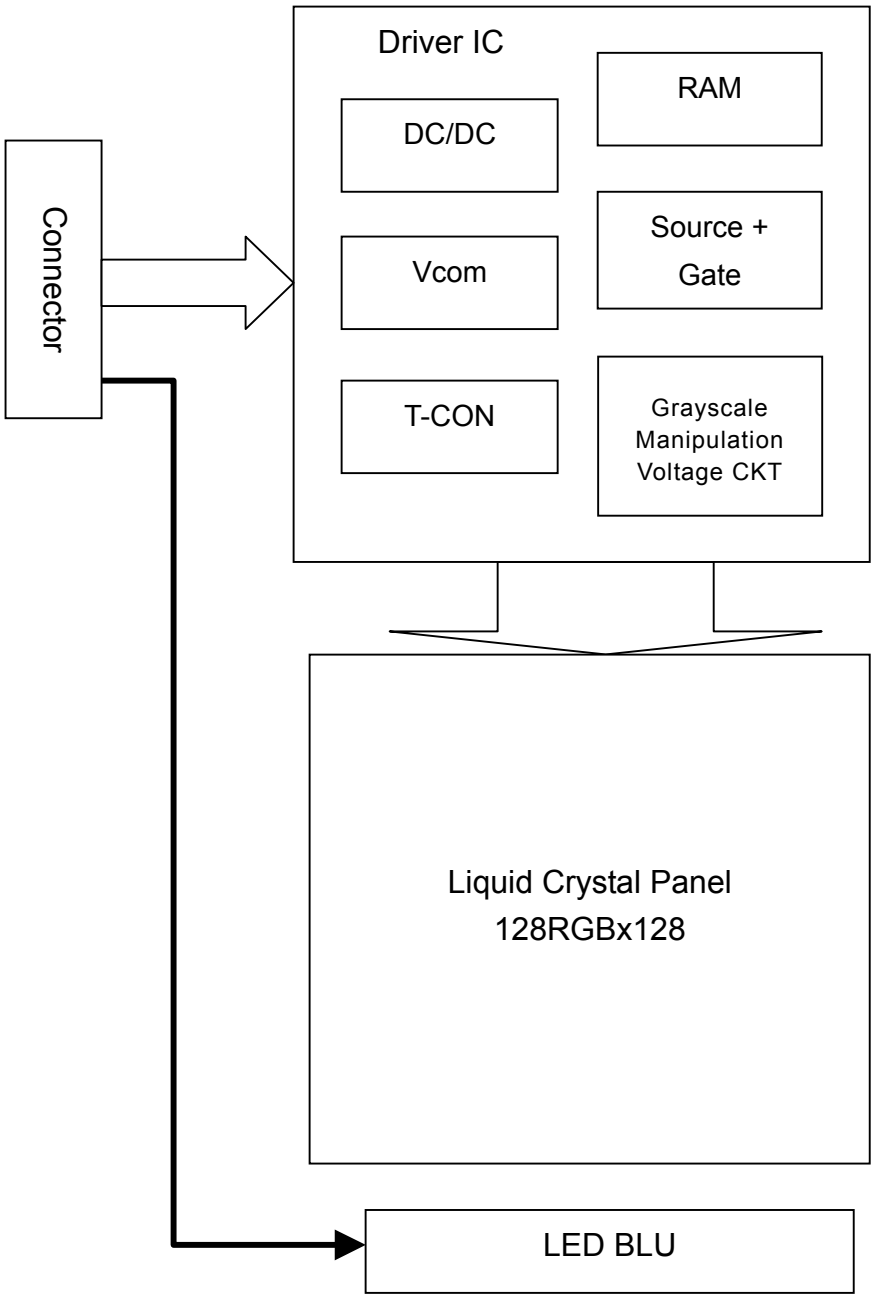
1.Physical specifications

NO.	Item	Specification	Remark
1	Display method	Active matrix TFT	
2	Display mode	Transmissive type	
3	Display resolution (dot)	128 X RGB (V) X 128(H)	
4	Active area (mm)	28.032(V) X 28.032(H)	
5	Screen size (inch)	1.6 (Diagonal)	
6	Pixel pitch (mm)	0.219(V) X 0.219(H)	
7	Color configuration	R. G. B. stripe	
8	Display color	8/9/16/18 bits CPU I/F	
9	Surface treatment	3H Hard Coating	
10	Light technology	Backlight with high brightness LED	
11	Overall dimension (mm)	34.67(W)×39.78(H)×2.88(D)	
12	View Direction	6 o'clock	
13	Weight (g)	5.6 ± 1.0	

Key features

a. Allows direct RAM data display (RAM is included in the source driver):
A single pixel consists of three dots (RGB), and a single dot consists of 6 bits data (64 gray-scale). Built-in RAM capacity are 132x3x132x6=313,632 bits
b. Can display moving pictures up to 30 FPS, and support area scrolling and partial display
c. Can support 8/9/16/18 bits parallel i80 series CPU interface
d. Reserve the flexibility for making dual-display module
e. Low power consumption and single chip driver solution

2. Block diagram



B. Electrical specifications

1. Pin assignment (Pin1-31):

No	Pin name	I/O	Description	Remark
1	VDD	I	2.7~3.3V(Interface voltage)	
2	VCI	I	2.7~3.3V(Power supply voltage)	
3	IM0	I	Pins to select interfacing mode with MPU When IM3="L"; IM0="L" is i80-system 16 bits (DB17-10,DB8-1) When IM3="L"; IM0="H" is i80-system 8 bits (DB17-10)	
4	IM3	I	Pins to select interfacing mode with MPU When IM3= "H"; IM0="L" is i80-system 18 bits (DB17-0) When IM3= "H"; IM0="H" is i80-system 9 bits (DB17-9)	
5	/RD	I	80-system Read strobe signal input pin. Read out data at the low level.	
6	DB17	I/O	Data bus	
7	DB16	I/O	Data bus	
8	DB15	I/O	Data bus	
9	DB14	I/O	Data bus	
10	DB13	I/O	Data bus	
11	DB12	I/O	Data bus	
12	DB11	I/O	Data bus	
13	DB10	I/O	Data bus	
14	DB9	I/O	Data bus	
15	DB8	I/O	Data bus	
16	DB7	I/O	Data bus	
17	DB6	I/O	Data bus	
18	DB5	I/O	Data bus	
19	DB4	I/O	Data bus	
20	DB3	I/O	Data bus	
21	DB2	I/O	Data bus	
22	DB1	I/O	Data bus	
23	DB0	I/O	Data bus	
24	/CS	I	Chip select signal input pin (low active).	
25	RS	I	Register select pin. Low: Index/status, High: Control	
26	RESET	I	Reset pin. Initializes the IC when low. Must be reset after power-on.	
27	/WR	I	80-system Write strobe signal input pin. Data is fetched at the "low" level.	
28	VSS	I	System ground.	
29	LED_GND	I	LED Cathode	
30	LED_VCC	I	LED Anode	
31	NC	-	No connection	

2. Description of function

Data /Command selection : RS

RS	Interface
Low	Indicates that data from DB0~D17 is command
High	Indicates that data from DB0~D17 is display data

3. Absolute maximum ratings (V_{SS}=0V) (Note 1)

Item	Symbol	Condition	Min.	Max.	Unit	Remark
System power supply	V_{DD}		-0.3	5.0	V	
An internal reference power supply	V_{CI}		-0.3	5.0	V	
LCD supply voltage range	IV_{GH} -V_{GL}I			33	V	
Logic input voltage range	V_i		-0.3	V_{DD} +0.5	V	Note 2
Operating temperature (Ambient)	T_{OPA}		-20	70	℃	
Storage temperature (Ambient)	T_{STG}		-30	80	℃	

Note 1: If the module exceeds the absolute maximum ratings, it may be damaged permanently. Also, if the module operated with the absolute maximum ratings for a long time, its reliability may drop.

Note 2: DB0 ~DB17, /CS, *RS, /WR, /RD, RESET*

4. Electrical characteristics

a. Typical operating conditions

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
System power supply		V_{DD}	2.7	2.8	3.3	V	Note 1
An internal reference power supply		V_{CI}	2.7	2.8	3.3	V	
Input Signal Voltage	H Level	V_{IH}	0.7 x V_{DD}	-	V_{DD}	V	Note 2
	L Level	V_{IL}	0	-	0.3 x V_{DD}	V	
Output signal voltage	H Level	V_{OH}	V_{DD} - 0.5	-	V_{DD}	V	
	L Level	V_{OL}	0	-	0.5	V	

Note 1: The operations are guaranteed under the recommended operating conditions only. These operations are not guaranteed if a quick voltage change occurs during operation. To prevent noise, a bypass capacitor must be inserted into the line close to power pin.

Note 2:/CS, *RS, DB0 ~ DB17, /WR , /RD , RESET*

b. Power consumption (Note 1)

Mode	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Stand-by	P_S	V_{DD} = 2.8V		0.025		mW	Note 2
Partial display	P_P		-	1.27		mW	Note 3
Still	P_g		-	4.41		mW	Note 4
Video	P_V		-	TBD	TBD	mW	Note 5

Note 1: No backlight is driven

Note 2: Display off

Note 3: 20 black display lines

Note 4: Full screen with Black pattern (Line inversion)

Note 5: Full screen with 65K colors under 60 frames per second

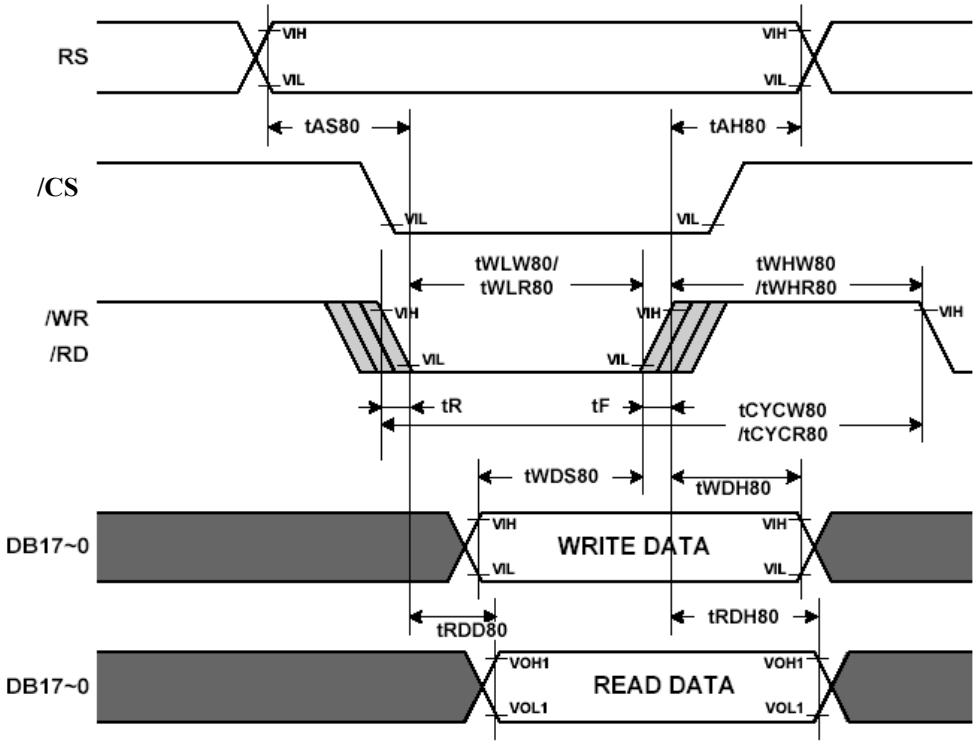
c. Backlight driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Remark
LED voltage	V_L	-	9.6	-	V	
LED current	I_L	-	15	-	mA	
Power consumption	W_L	-	144	-	mW	Note 1
LED life time	T_L		10000	-	hr	Note 2

Note 1: Ambient temperature Ta = 25℃, with I_L =15mA LED circuit

Note 2: Brightness (I_L=15mA) to be decreased to 50% of the initial value.

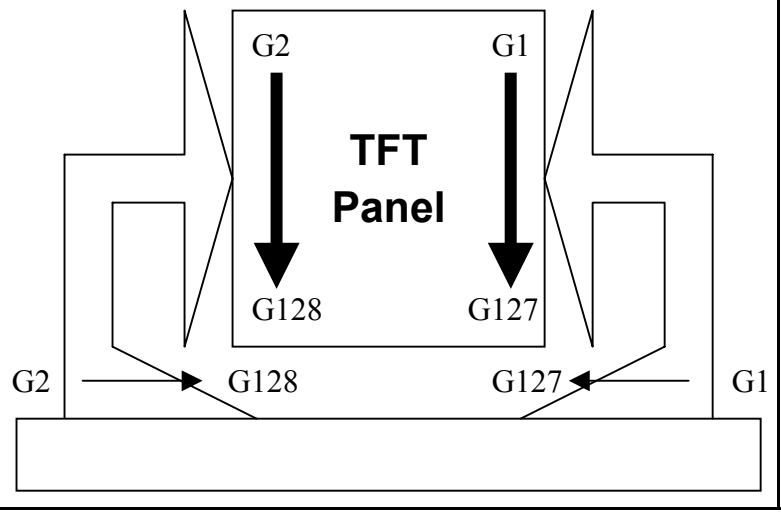
5. AC Characteristics-18/16 bit 80-system



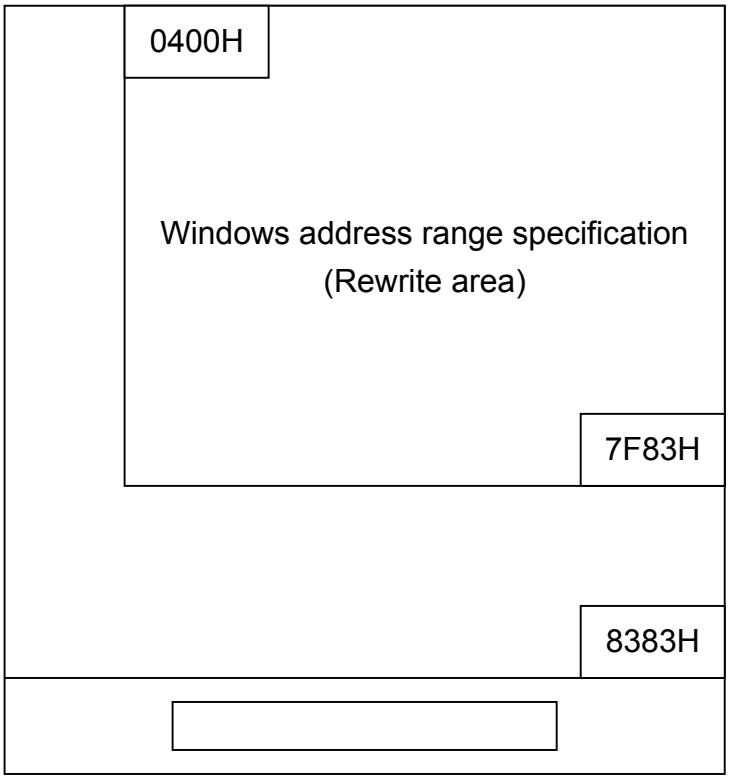
Conditions (V_{DD}=2.7V to 3.3V, V_{CI}=2.7V to 3.3V)

Characteristic		Symbol	Specification		Unit
			Min	Max	
Cycle time	Write	tCYCW80	100	-	ns
	Read	tCYCR80	500	-	
Pulse rise / fall time		t_R , t_F	-	25	
Pulse width low	Write	tWLW80	40	-	
	Read	tWLR80	250	-	
Pulse width high	Write	tWHW80	40	-	
	Read	tWHR80	200	-	
/WR , RS and /CS setup time		tAS80	10	-	
/WR , RS and /CS hold time		tAH80	2	-	
Write data setup time		tWDS80	60	-	
Write data hold time		tWDH80	15	-	
Read data delay time		tRDD80	-	200	
Read data hold time		tRDH80	5	-	

6. Gate driver scan mode

Scan Mode	
	G1 → G2 → G3 → G4 → G5 →……→ G126 →G127 → G128

7. Gram address map:



Window address-range setting
HAS=h04. HEA=h83
VSA=h00. VEA=h7F

C. Optical specification (Note 1,Note 2, Note 3)

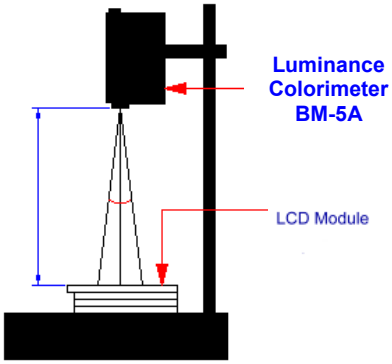
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time	Rise	Tr	θ =0°	-	12	20	ms	Note 3-1,4
	Fall	Tf		-	18	25	ms	
Contrast ratio		CR	Optimize Viewing angle	150	200	-	-	Note 3-1,5
Viewing angle	Top	-	CR≧5	10	15	-	deg.	Note 3-1, 6
	Bottom			45	55	-		
	Left			30	40	-		
	Right			30	40	-		
Brightness uniformity		-	θ =0°	70	80		%	Note 3-1, 7
Brightness		Y_L	θ =0°	(180)	(230)	-	cd/m^2	Note 3-1
Color Tone	White	Wx	θ =0°	0.27	0.31	0.35	-	Note 3-1
		Wy		0.30	0.34	0.38		
	Red	Rx		0.55	0.60	0.65		
		Ry		0.30	0.35	0.40		
	Green	Gx		0.26	0.31	0.36		
		Gy		0.52	0.57	0.62		
	Blue	Bx		0.09	0.14	0.19		
		By		0.10	0.15	0.20		

Note 1: Ta =25℃±2℃.

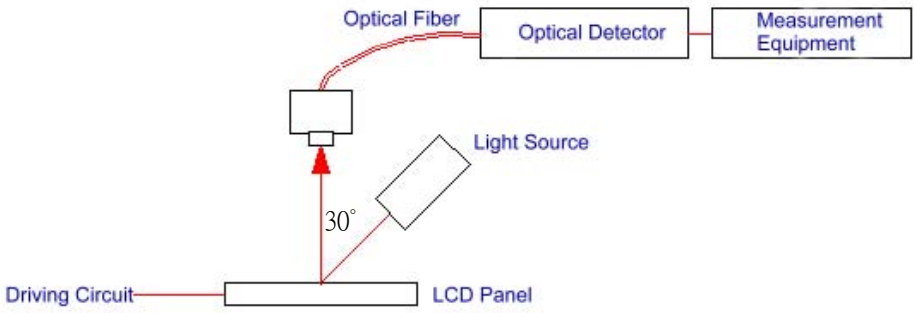
Note 2: To be measured in the dark room.

Note 3: To be measured at the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-5A and LCD-7000, after 10 minutes module operation with I_L=15mA

3-1. Measurement system 1: BM-5A

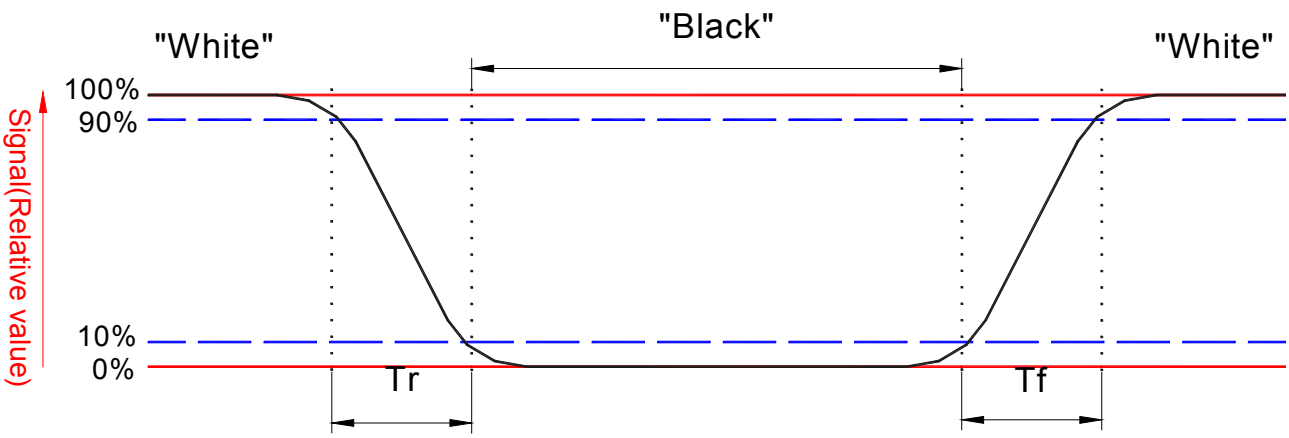


3-2. Measurement system 2: LCD-7000



Note 4: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white” (falling time) and from “white” to “black” (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below:



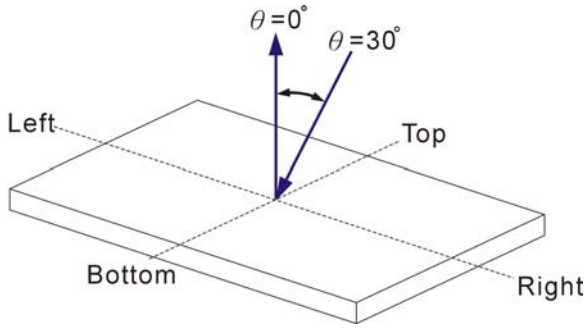
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at “White” state}}{\text{Photo detector output when LCD is at “Black” state}}$$

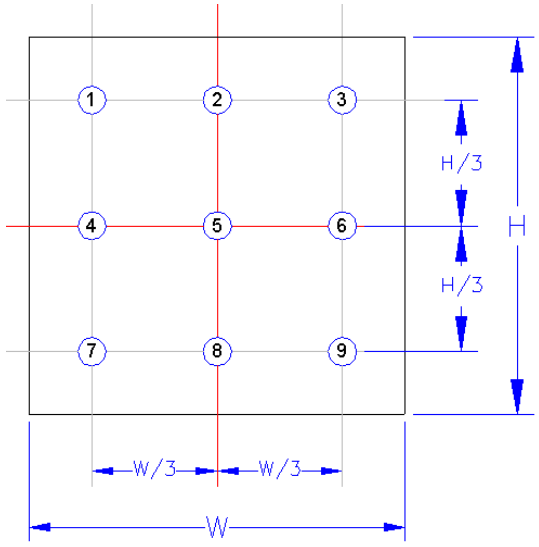
Note 6. Definition of viewing angle:

Refer to the figure as below.



Note 7. Definition of the brightness uniformity

$$= \frac{\text{Minimum Brightness}}{\text{Maximum Brightness}} \times 100\%$$



D. Reliability test items:

1. Test items and conditions:

No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 80℃ 240H	
2	Low temperature storage	Ta= -30℃ 240H	
3	High temperature operation	Ta= 70℃ 240H	
4	Low temperature operation	Ta= -20℃ 240H	
5	High temperature and high humidity	Ta= 60℃. 90% RH 240H	Operation
6	Heat shock	-30℃~80℃/50 cycles 2H/cycle	Non-operation
7	Electrostatic discharge	±200V, 200pF(0Ω), once for each terminal	Non-operation
8	Drop (with carton)	Height: 80cm 1 corner, 3 edges, 6 surfaces	

Note: After finishing the test, leave the samples under room temperature and normal humidity for 2 hours, and then this module should work normally.

2. Failure Judgment Criterion:

a. Neither abnormality nor significant visible deterioration should be found on display quality and appearance.

b. There should be no functions abnormalities on display quality.

E. Packing form (TBD)

Appendix: Outline dimensions of TFT LCD drawing