TFT DISPLAY SPECIFICATION

WINSTAR Display Co.,Ltd.
華凌光電股份有限公司

Winstar Display Co., LTD
華凌光電股份有限公司
WEB: https://www.winstar.com.tw E-mail: sales@winstar.com.tw

SPECIFICATION

CUSTOMER : _____

MODULE NO.: WF70C9SYAB4MNN0#

APPROVED BY: **(FOR CUSTOMER USE ONLY)**	**PCB VERSION: DATA:**

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY
			葉虹蘭
ISSUED DATE: 2024/03/28			

TFT Display Inspection Specification: https://www.winstar.com.tw/technology/download.html
Precaution in use of TFT module: https://www.winstar.com.tw/technology/download/declaration.html

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MODLE NO：

RECORDS OF REVISION			DOC. FIRST ISSUE
VERSION	DATE	REVISED PAGE NO.	**SUMMARY**
0	2024/03/28		First issue

Contents

1.Module Classification Information

W	F	70	C9	S	Y	A	B4	M	N	N	0	#
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬

①	Brand：WINSTAR DISPLAY CORPORATION		
②	Display Type：F→TFT Type, J→Custom TFT		
③	Display Size：7.0” TFT		
④	Model serials no.		
⑤	Backlight Type：	F→CCFL, White S→LED, High Light White	T→LED, White Z→Nichia LED, White
⑥	LCD Polarize Type/ Temperature range/ Gray Scale Inversion Direction	A→Transmissive, N.T, IPS TFT C→Transmissive, N. T, 6:00 ; F→Transmissive, N.T,12:00 ; I→Transmissive, W. T, 6:00 K→Transflective, W.T,12:00 L→Transmissive, W.T,12:00 N→Transmissive, Super W.T, 6:00	Q→Transmissive, Super W.T, 12:00 R→Transmissive, Super W.T, O-TFT V→Transmissive, Super W.T, VA TFT W→Transmissive, Super W.T, IPS TFT X→Transmissive, W.T, VA TFT Y→Transmissive, W.T, IPS TFT Z→Transmissive, W.T, O-TFT
⑦	A：TFT LCD B：TFT+SCREW HOLES+CONTROL BOARD C：TFT+ SCREW HOLES +A/D BOARD D：TFT+ SCREW HOLES +A/D BOARD+CONTROL BOARD E：TFT+ SCREW HOLES +POWER BOARD		F：TFT+CONTROL BOARD G：TFT+ SCREW HOLES H：TFT+D/V BOARD I：TFT+ SCREW HOLES +D/V BOARD J：TFT+POWER BD

⑧ Resolution:

M	1024768	N	128128	P	1280800	Q	480800	R	640320	S	480128
T	800320	U	8001280	V	176220	W	1280398	X	1024250	Y	1920720
A5	19201080	A6	480480	A7	10801920	A8	135240	A9	480640	B2	122250
B3	340800	B4	2801424	B5	12001920	B6	4801280	B7	800800	B8	40160

⑨				
	D: Digital	L:LVDS	M:MIPI	E:eDP

⑩ Interface:

N	Without control board	A	8Bit	B	16Bit	E	eDP	H	HDMI
I	I2C Interface	R	RS232	S	SPI Interface	U	USB		

⑪ TS:

N	Without TS	T	Resistive touch panel	C	Capacitive touch panel (G-F-F)
G	Capacitive touch panel (G-G)	C1	Capacitive touch panel (G-F-F)+OCA		
C2	Capacitive touch panel (G-F-F)+OCR	G1	Capacitive touch panel (G-G)+OCA		
G2	Capacitive touch panel (G-G)+OCR	B	CTP+GG+USB		

⑫			
	Version:	X:Raspberry pi	V: Raspberry pi 3B+

⑬		
	Special Code	#:Fit in with ROHS directive regulations

2.Summary

TFT 7.0 is a color active matrix thin film transistor (TFT)liquid crystal display(LCD) that uses amorphous silicon TFT as a switching device. This TFT LCD has a 7(1:5) inch diagonally measured active display area with 280x1424 (1424 horizontal by 280 vertical pixel) resolution.

3.General Specification

Item	Dimension	Unit
Size	7.0	inch
Dot Matrix	280 x RGBx1424(TFT)	dots
Module dimension	38.2(H) x 186.62 (V) x 4.03 (D)	mm
Active area	33.60 (H) x170.88(V)	mm
Pixel pitch	0.12(H) x 0.12(V)	mm
LCD type	TFT, Normally Black, Transmissive	
Viewing Angle	80/80/80/80	
Aspect Ratio	1:5	
TFT Driver IC	OTA7290N-C or equivalent	
TFT Interface	4-Lanes MIPI	
Backlight Type	LED, Normally White	
With /Without TP	Without TP	
Surface	Anti-Glare	

*Color tone slight changed by temperature and driving voltage.

4.Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	—	+70	℃
Storage Temperature	TST	-30	—	+80	℃

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp. 60℃, 90% RH MAX. Temp.＞60℃, Absolute humidity shall be less than 90% RH at 60℃

5.Electrical Characteristics

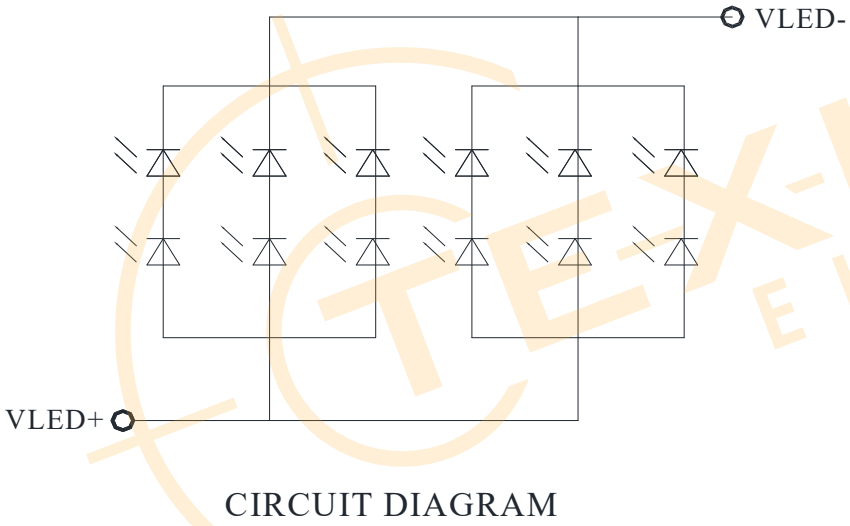
5.1. TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Analog Supply voltage	VCC	3.0	3.3	3.6	V	
Analog supply current	I_{CC}	-	115	175	mA	VCC=3.3V
Logic input voltage	VIH	0.7*VCC	-	VCC	V	
	VIL	GND	-	0.3*VCC	V	

5.3. 5.2. Backlight Driving Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current	-	-	240	-	mA	-
LED voltage	VLED+	5.5	6.0	6.8	V	Note 1
LED Life Time	-	-	50,000	-	Hr	Note 2,3,4

Note 1 : There are 1 Groups LED



CIRCUIT DIAGRAM

Note 2 : Ta = 25 ℃

Note 3 : Brightness to be decreased to 50% of the initial value

Note 4 : The single LED lamp case

6.MIPI DC Characteristics

6.1. HS Receiver DC Specification

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Operation Voltage	VDD	1.5-10%	1.5	1.5+10%	mV	
Differential Input Voltage	|VID|	70	200	260	mV	
Common Mode Voltage	$V_{CMRX(DC)}$	70	-	330	mV	
Differential Input High Threshold Voltage	VTH	-	-	70	mV	
Differential Input Low Threshold Voltage	VTL	-70	-	-	mV	
Singled-ended input high voltage	V_{IHHS}	-	-	460	mV	
Singled-ended input low voltage	V_{ILHS}	-40	-	-	mV	
Singled-ended threshold for HS termination enable	$V_{TERM-EN}$	-	-	450	mV	
Differential input impedance	Z_{ID}	80	100	125	ohm	
Pin leakage current	I_{LEAK}	-10	-	10	uA	
Common-mode interference beyond 450MHz	$\Delta V_{CMRX(HF)}$	-	-	100	mV	
Common-mode interference 50MHz - 450MHz	$\Delta V_{CMRX(LF)}$	-50	-	50	mV	
Common-mode termination	C_{CM}	-	-	60	pF	
Embedded Termination	R_T	90	100	110	ohm	

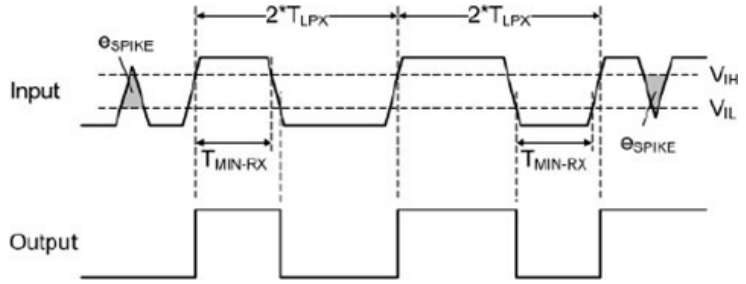
Note:

(1) Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.

(2) This table value includes a ground difference of 50mV between the transmitter and the receiver, the static common-mode level tolerance and variations below 450MHz.

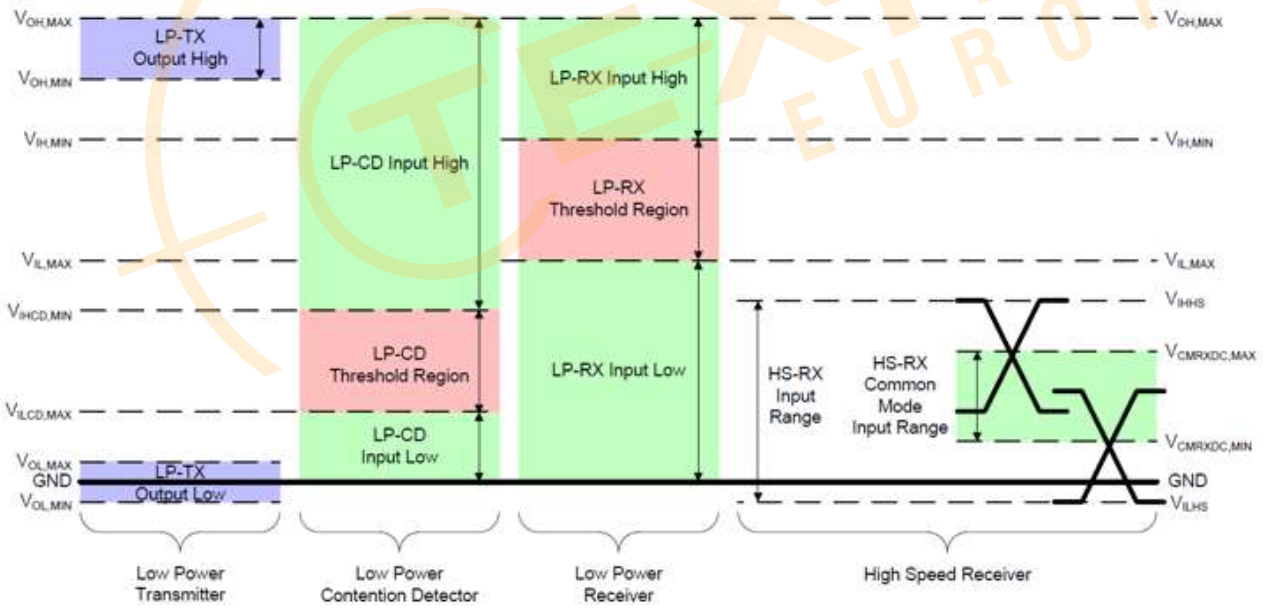
LP Receiver DC Specification

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Logic 1 input voltage	V_{IH}	880	-	-	mV	
Logic 0 input voltage, not in ULP State	V_{IL}	-	-	550	mV	
Input hysteresis	V_{HYST}	25	-	-	mV	



Line Contention Detection

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Logic 1 contention threshold	V_{IHCD}	450	-	-	mV	
Logic 0 contention threshold	VILCD	-	-	200	mV	



Input Characteristics

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Pin signal voltage range	V_{PIN}	-50		1350	mV	
Pin leakage current	I_{LEAK}	-10		10	uA	
Ground shift	V_{GNDSH}	-50		50	mV	
Transient pin voltage level	$V_{PIN(absmax)}$	-0.15		1.45	V	
Maximum transient time above $V_{PIN(max)}$ or below $V_{PIN(min)}$	$TV_{PIN(absmax)}$			20	ns	

Note:

(1) When the pad voltage is in the signal voltage range from VGNDSH, MIN to VOH + VGNDSH, MAX and the Lane Module is in LP receive mode.

(2) The voltage overshoot and undershoot beyond the VPIN is only allowed during a single 20ns window after any LP-0 to LP-1 transition or vice versa. For all other situations it must stay within the VPIN range.

(3) This value includes ground shift.

7.AC Characteristics

7.1. System AC Characteristics

(VDD=3.3V,AVDD=12V, VSS=VSSA=0V, TA=-20 to +70℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
VDD Power On Slew rate	T	-	-	20	ms	From VSS to 90% VDD
RSTB pulse width	T	10	-	-	us	

7.2. TCON OSC AC Characteristics

(VDD=3.3V,AVDD=12V, VSS=VSSA=0V, TA=-20 to +70℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
TCON OSC tolerance	△OSC	-3%	-	+3%	Hz	Ta = 25℃
TCON OSC tolerance	△OSC	-5%	-	+5%	Hz	Ta = -20℃ ~ 70℃

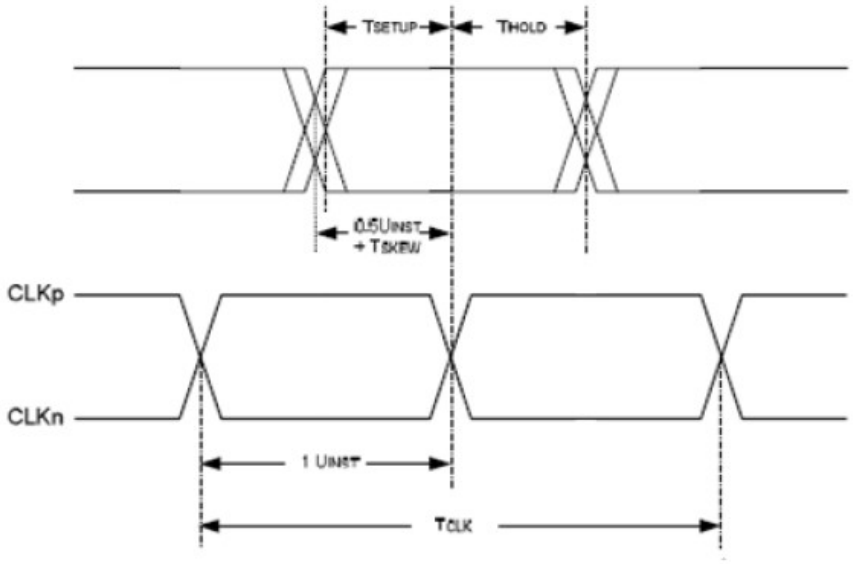
Note: Typical TCON OSC frequency is 33.5Mhz.

7.3. MIPI AC Characteristics

HS Receiver AC Timing Characteristics

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Bandwidth per lane	-	-	-	1000	Mbps	Bandwidth selected by register 'speedup' Speedup=0 → Max=550Mbps Speedup=1 → Max=1000Mbps
Operation frequency	-	-	-	500	MHz	
UI instantaneous	UI_{INST}	1	-	12.5	ns	1
Data to Clock Skew	Tskew	-0.15	-	0.15	UI_{INST}	
Inter-lane static skew	Tskew-lane	-	-	$UI_{INST/50}$	UI_{INST}	
Data to Clock Setup Time	T_{SETUP}	0.25	-	-	UI_{INST}	2
Data to Clock Hold Time	T_{HOLD}	0.25	-	-	UI_{INST}	
Common-mode interference beyond 450MHz	$\Delta V_{CMRX(HF)}$	-	-	100	mV	4
Common-mode interference 50MHz- 450MHz	$\Delta V_{CMRX(LF)}$	-50	-	50	mV	3,6
Common-mode termination	C_{CM}	-	-	60	pF	5

Note:
(1) Total silicon and package delay budget of 0.3*UINST
(2) Total setup and hold window for receiver of 0.3*UINST
(3) Excluding 'static' ground shift of 50mV
(4) =VCMRX (HF) is the peak amplitude of a sine wave superimposed on the receiver input
(5) For higher bit rates a 14pF capacitor will be needed to meet the common-mode return loss specification.
(6) Voltage difference compared to the DC average common-mode potential.



LP Receiver AC Timing Characteristics

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
Input pulse rejection	e_{SPIKE}	-	-	300	V·ps	1,2,3
Minimum pulse width response	T_{MIN-RX}	20	-	-	ns	
Peak interference amplitude	V_{INT}	-	-	200	mV	
Interference frequency	f_{INT}	450	-	-	MHz	
Logic 1 input voltage	V_{IH}	880	-	-	mV	
Logic 0 input voltage, not in ULP State	V_{IL}	-	-	550	mV	
Logic 0 input voltage, ULP State	$V_{IL-ULPS}$	-	-	300	mV	
Input Hysteresis	V_{HYST}	25	-	-	mV	
Logic 1 contention threshold	V_{IHCD}	450	-	-	mV	
Logic 0 contention threshold	V_{ILCD}	-	-	200	mV	

Note:

(1) Time-voltage integration of a spike above VIL when being in LP-0 state or below VIH when being in LP-1state.

(2) An impulse less than this will not change the receiver state.

(3) In addition to the required glitch rejection, implementers shall ensure rejection of known RF-interferers.

7.4. Input timings for interface

Item	Symbol	Value			Unit
		Min.	Typ.	Max.	
HS low pulse width	HS	-	24	-	DCK
Horizontal back porch	HBP	-	40	-	DCK
Horizontal front porch	HFP	-	150	-	DCK
Horizontal blanking period	HBLK	-	NA	-	DCK
Horizontal active area	HDISP	-	280	-	DCK
Pixel Clock	PCLK	-	43	-	MHz
Vertical low pulse width	VS	-	6	-	Line
Vertical back porch	VBP	-	10	-	Line
Vertical front porch	VFP	-	12	-	Line
Vertical blanking period	VBK	-	NA	-	Line
Vertical active area	-	-	1424	-	Line
Vertical Refresh rate	VRR	-	60	-	Hz

8.Optical Characteristics

Item		Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time		Tr+Tf	θ=0°、Φ=0°	-	30	40	.ms	Note 3
Contrast ratio		CR	At optimized viewing angle	800	1000	-	-	Note 4
Color Chromaticity	White	Wx	θ=0°、Φ=0	0.269	0.319	0.369	-	Note 2,5,6
		Wy		0.293	0.343	0.393	-	
Viewing angle	Hor.	ΘR	CR≧10	75	80	-	Deg.	Note 1
		ΘL		75	80	-		
	Ver.	ΦT		75	80	-		
		ΦB		75	80	-		
Brightness		-	-	900	1000	-	cd/m2	Center of display
Uniformity		(U)	-	75	-	-	%	Note 5

Ta=25±2℃,

Note 1: Definition of viewing angle range

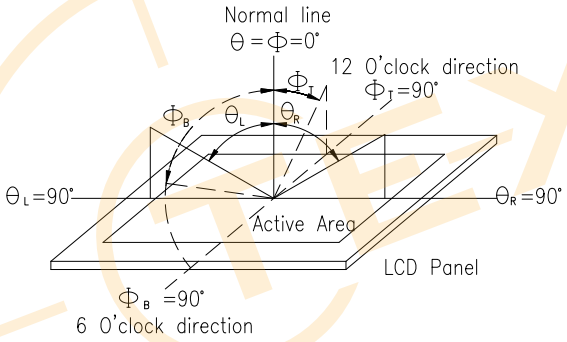


Fig. 8.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

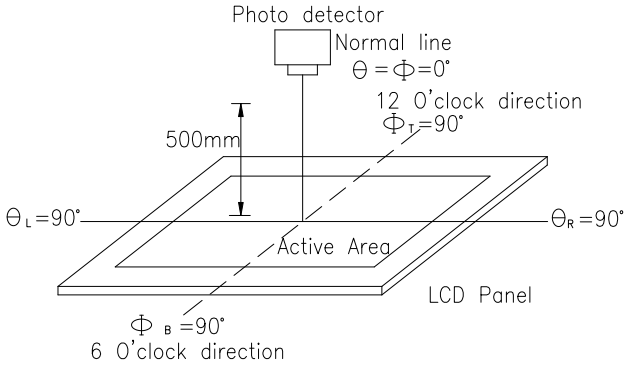
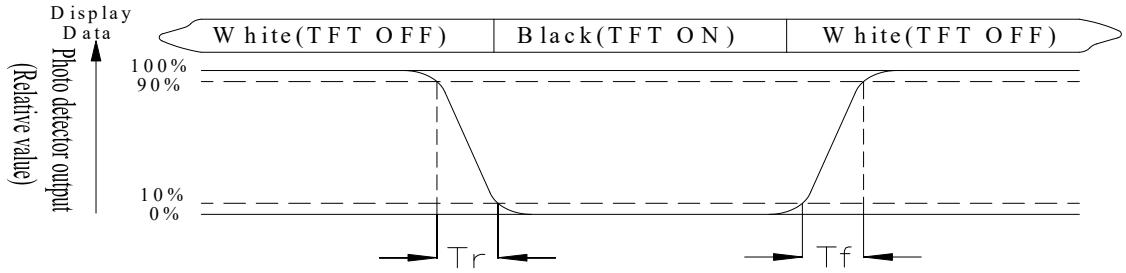


Fig. 8.2. Optical measurement system setup

Note 3: Definition of Response time:
The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time, Tr, is the time between photo detector output intensity changed from 90%to 10%. And fall time, Tf, is the time between photo detector output intensity changed from 10%to 90%



Note 4: Definition of contrast ratio:
The contrast ratio is defined as the following expression.

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

Note 5: Definition of Luminance Uniformity
Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.
Luminance Uniformity (U) = Lmin/Lmax x100%
L = Active area length
W = Active area width

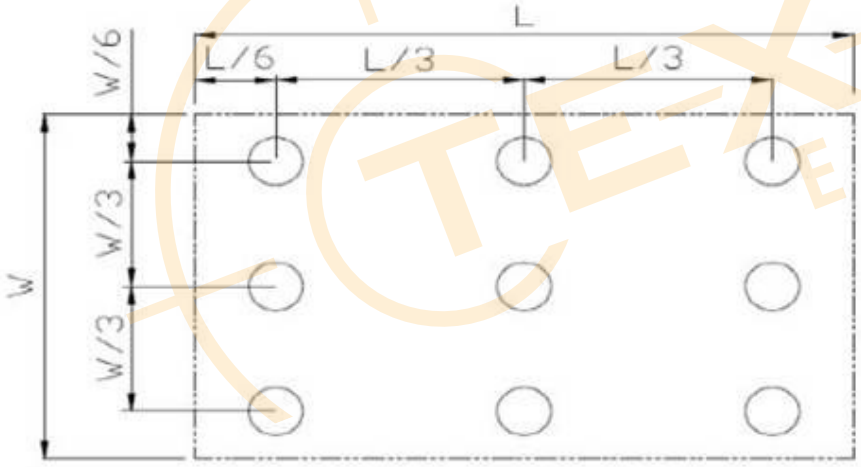


Fig 8.3. Definition of uniformity

Note 6: Definition of color chromaticity (CIE 1931)
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

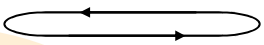
9.Interface

9.1. LCM PIN Definition

Pin No.	Symbol	Description
1	GND	Ground.
2	D3N	MIPI data input pins
3	D3P	
4	GND	Ground.
5	D2N	MIPI data input pins
6	D2P	
7	GND	Ground.
8	CLKN	MIPI clock input pins.
9	CLKP	
10	GND	Ground.
11	D1N	MIPI data input pins
12	D1P	
13	GND	Ground.
14	D0N	MIPI data input pins
15	D0P	
16	GND	Ground.
17	GND	Ground.
18	TE	Tearing effect output pin to synchronize to frame writing. If not used, open this pin
19	RESET	Reset signal pin
20	GND	Ground.
21-23	VCC	Power supply
24	GND	Ground.
25-26	NC	Not connect
27-28	VLED-	LED cathode
29-30	VLED+	LED anode

10.Reliability

Content of Reliability Test (Wide temperature, -20℃~70℃)

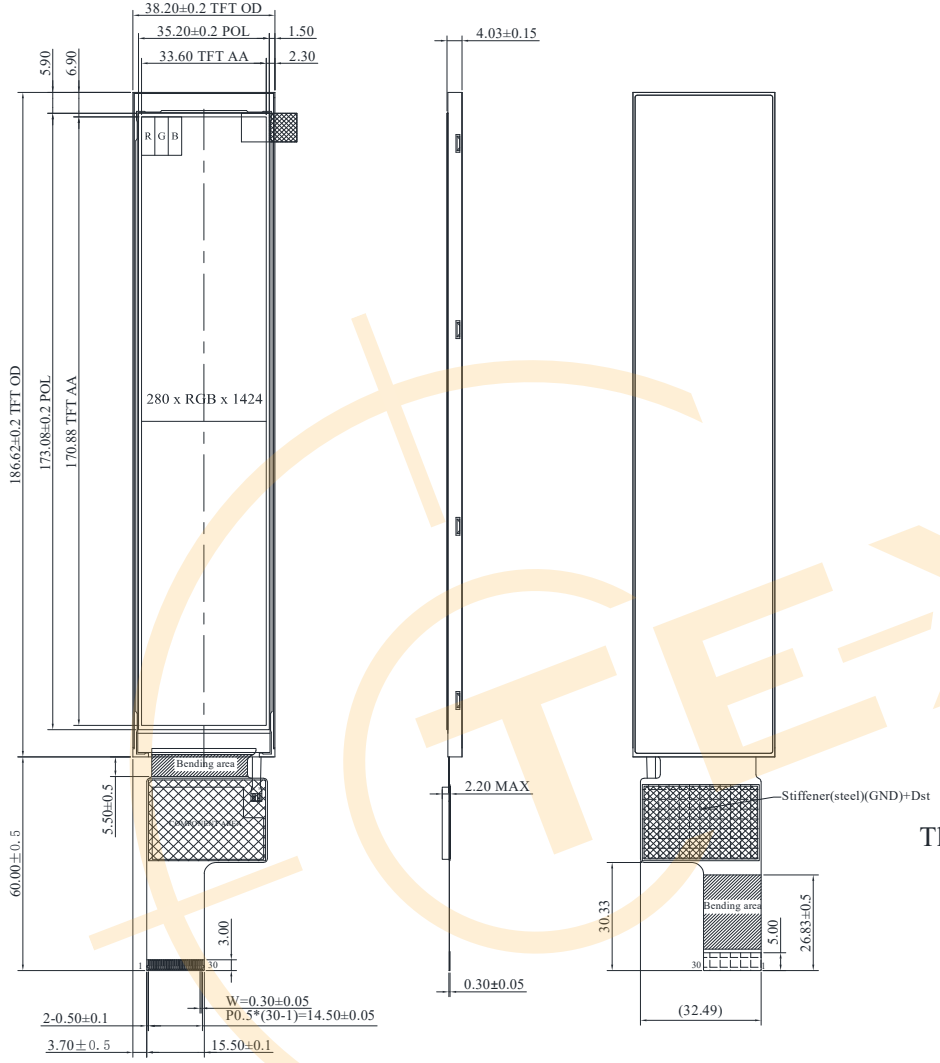
Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max	60℃,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20℃ 25℃ 70℃  30min 5min 30min 1 cycle	-20℃/70℃ 10 cycles	——
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±2KV(contact), ±8KV(air), RS=330Ω CS=150pF 10 times	——

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

11.Contour Drawing



TFT FPC

PIN No.	SYMBOL	PIN No.	SYMBOL
1	GND	16	GND
2	D3N	17	GND
3	D3P	18	TE
4	GND	19	RESET
5	D2N	20	GND
6	D2P	21	VCC
7	GND	22	VCC
8	CLKN	23	VCC
9	CLKP	24	GND
10	GND	25	NC
11	D1N	26	NC
12	D1P	27	VLED-
13	GND	28	VLED-
14	D0N	29	VLED+
15	D0P	30	VLED+

The non-specified tolerance of dimension is ±0.3 mm .

winstar

LCM Sample Estimate Feedback Sheet

Module Number： _____

1、Panel Specification：

1.	Panel Type：	□ Pass	□ NG , _____
2.	View Direction：	□ Pass	□ NG , _____
3.	Numbers of Dots：	□ Pass	□ NG , _____
4.	View Area：	□ Pass	□ NG , _____
5.	Active Area：	□ Pass	□ NG , _____
6.	Operating Temperature：	□ Pass	□ NG , _____
7.	Storage Temperature：	□ Pass	□ NG , _____
8.	Others： _____		

2、Mechanical

1.	PCB Size：	□ Pass	□ NG , _____
2.	Frame Size：	□ Pass	□ NG , _____
3.	Material of Frame：	□ Pass	□ NG , _____
4.	Connector Position：	□ Pass	□ NG , _____
5.	Fix Hole Position：	□ Pass	□ NG , _____
6.	Backlight Position：	□ Pass	□ NG , _____
7.	Thickness of PCB：	□ Pass	□ NG , _____
8.	Height of Frame to PCB：	□ Pass	□ NG , _____
9.	Height of Module：	□ Pass	□ NG , _____
10.	Others：	□ Pass	□ NG , _____

3、Relative Hole Size：

1.	Pitch of Connector：	□ Pass	□ NG , _____
2.	Hole size of Connector：	□ Pass	□ NG , _____
3.	Mounting Hole size：	□ Pass	□ NG , _____
4.	Mounting Hole Type：	□ Pass	□ NG , _____
5.	Others：	□ Pass	□ NG , _____

4、Backlight Specification：

1.	B/L Type：	□ Pass	□ NG , _____
2.	B/L Color：	□ Pass	□ NG , _____
3.	B/L Driving Voltage (Reference for LED Type)：	□ Pass	□ NG , _____
4.	B/L Driving Current：	□ Pass	□ NG , _____
5.	Brightness of B/L：	□ Pass	□ NG , _____
6.	B/L Solder Method：	□ Pass	□ NG , _____
7.	Others：	□ Pass	□ NG , _____

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5、Electronic Characteristics of Module：

1.	Input Voltage：	□ Pass	□ NG ,_____
2.	Supply Current：	□ Pass	□ NG ,_____
3.	Driving Voltage for LCD：	□ Pass	□ NG ,_____
4.	Contrast for LCD：	□ Pass	□ NG ,_____
5.	B/L Driving Method：	□ Pass	□ NG ,_____
6.	Negative Voltage Output：	□ Pass	□ NG ,_____
7.	Interface Function：	□ Pass	□ NG ,_____
8.	LCD Uniformity：	□ Pass	□ NG ,_____
9.	ESD test：	□ Pass	□ NG ,_____
10.	Others：	□ Pass	□ NG ,_____

6、Summary：

Sales signature：_____

Customer Signature：_____ **Date**：____/____/____

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