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SPECIFICATION

☐ Preliminary Specification
☒ Final Specification

Description **4.3" 480xRGBx272 TFT-LCD Module**
Part Number **P0430WQF1ME00**

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REVISION HISTORY

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CONTENTS

1. SUMMARY.....	1
1.1 General Description.....	1
1.2 Features	1
2. GENERAL SPECIFICATIONS.....	2
3. INPUT / OUTPUT TERMINALS.....	3
3.1 CN1 Pin assignment (LCD Interface)	3
4. ABSOLUTE MAXIMUM RATINGS	5
5. ELECTRICAL CHARACTERISTICS	6
5.1 DC Characteristics for Panel Driving.....	6
5.2 DC Characteristics for Backlight Driving.....	6
5.3 Recommended Power ON/OFF Sequence.....	6
5.4 LCD Module Block Diagram	8
6. INTERFACE TIMING CHARACTERISTICS.....	9
6.1 AC characteristics	9
6.2 Data Input Timing Parameter Setting	10
6.3 SYNC Mode Timing Diagram.....	10
6.4 SYNC-DE Mode Timing Diagram.....	11
6.5 DE Mode Timing Diagram	11
6.6 RGB Mode Selection Table	12
7. OPTICAL CHARACTERISTICS	12
8. RELIABILITY TEST.....	15
9. MECHANICAL DRAWING	16
10. PACKING INSTRUCTION.....	17
11. PRECAUTIONS FOR USE OF LCD MODULES.....	18
11.1 Handling Precautions.....	18
11.2 Storage precautions.....	18
11.3 Transportation Precautions	18
11.4 Screen saver Precautions.....	18
11.5 Safety Precautions	18

1. Summary

1.1 General Description

This is a 4.3 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle (Super Fine TFT (SFT))
- Interface: RGB 24 bits.
- Acquisition product for UL62368-1/CSA C22.2 No.62368-1-03 (File number: E170632)
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

2. General Specifications

Feature		Spec	Unit
Display Spec	Size	4.3 inches	
	Resolution	480(RGB)x272	
	Pixel Pitch	0.198x0.198	mm
	TFT Active Area	95.04x53.856	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT, Normally Black	
	Surface Treatment	Anti-Glare	
	Viewing Direction	All	
	Gray Scale Inversion Direction	NA	
Mechanical Characteristics	LCM (W x H x D)	105.50x67.20x2.90	mm
	Weight	44.5	g
Optical Characteristics	Luminance	400	cd/m ²
	Contrast Ratio	800:1	
	NTSC	50	%
	Viewing Angle	88/88/88/88(SFT)	degree
Electrical Characteristics	Interface	RGB 24 bits	
	Color Depth	16.7 Million	color
	Power Consumption	LCD:80; Backlight:640;	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
Matching connector	FH19SC-40S-0.5SH (HIROSE) or equivalent

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	VLED-	P	Back light cathode	
2	VLED+	P	Back light anode	
3	GND	P	Ground	
4	VDD	P	Power supply +3.3V	
5	R0	I	Red Data input	
6	R1	I	Red Data input	
7	R2	I	Red Data input	
8	R3	I	Red Data input	
9	R4	I	Red Data input	
10	R5	I	Red Data input	
11	R6	I	Red Data input	
12	R7	I	Red Data input	
13	G0	I	Green Data input	
14	G1	I	Green Data input	
15	G2	I	Green Data input	
16	G3	I	Green Data input	
17	G4	I	Green Data input	
18	G5	I	Green Data input	
19	G6	I	Green Data input	
20	G7	I	Green Data input	
21	B0	I	Blue Data input	
22	B1	I	Blue Data input	
23	B2	I	Blue Data input	
24	B3	I	Blue Data input	
25	B4	I	Blue Data input	
26	B5	I	Blue Data input	
27	B6	I	Blue Data input	
28	B7	I	Blue Data input	
29	GND	P	Ground	
30	DCLK	I	Clock signal; latching data at the rising edge.	
31	DISP	I	Display control / standby mode selection, Internal pull low. DISP = "Low" : Standby; DISP = "High" : Normal display	

Industrial Display Module

32	HSYNC	I	Horizontal sync signal; negative polarity. Pull “low” when not used in DE mode.	Note1
33	VSYNC	I	Vertical sync signal; negative polarity. Pull “low” when not used in DE mode.	Note1
34	DE	I	Data input enable. Active High to enable the data input Pull “low” when not used in SYNC mode.	Note1
35	NC(EXTC)	N	No connection OTP trim function control. Please keep this pin in floating.	
36	GND	P	Ground.	
37	NC(CS)	N	No connection. Serial communication chip select, Please keep this pin in floating.	
38	NC(SCL)	N	No connection. Serial communication clock input, Please keep this pin in floating.	
39	NC(SDA)	N	No connection. Serial communication data input and output, Please keep this pin in floating.	
40	NC(VPP)	N	No connection. For OTP, Please keep this pin in floating.	

Table 3.1.2 Pin Assignment for LCD Interface

Note1: I/O definition: I---Input, O---Output, P---Power/Ground, N---No connection

Note2: All of the GND pins should be connected to the system ground.

4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	-0.3	4.0	V	Note1
Input voltage	V _{IN}	-0.3	3.6	V	
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40°C
		--	≤85	%	40°C < Ta≤50°C
		--	≤55	%	50°C < Ta≤60°C
		--	≤36	%	60°C < Ta≤70°C
		--	≤24	%	70°C < Ta≤80°C
Absolute Humidity	AH	--	≤70	g/m ³	Ta>70°C

Table 4.1 Absolute Maximum Ratings

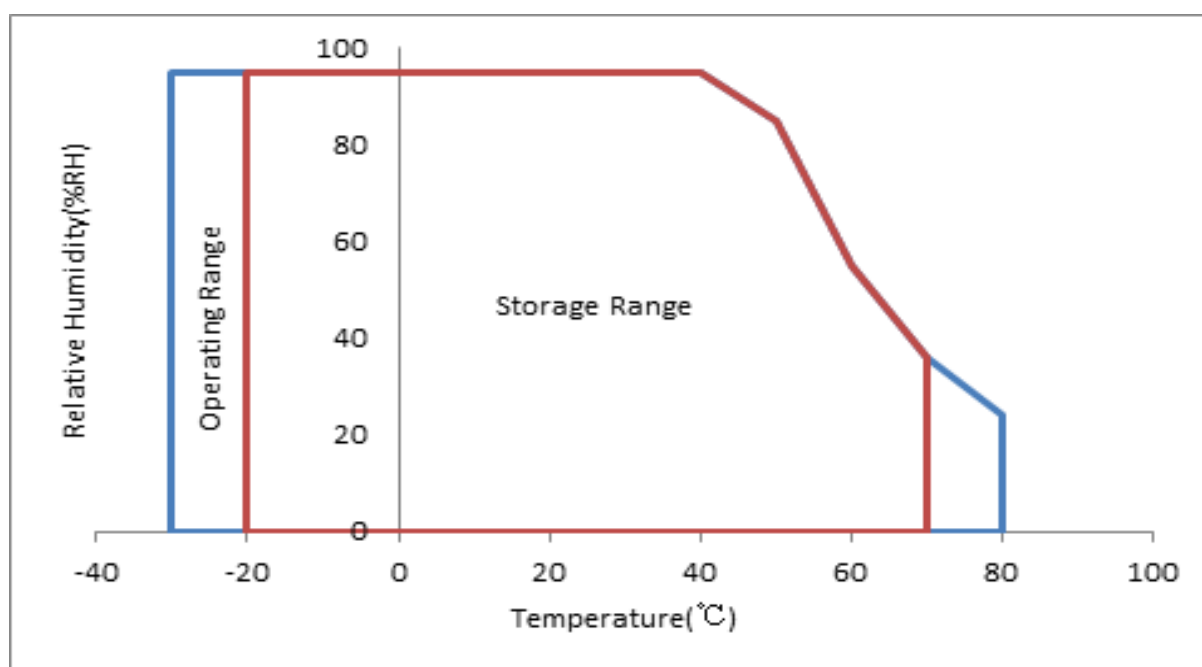


Table 4.2 Absolute Maximum Ratings chart

Note1: Input voltage include R0~R7, G0~G7, B0~B7, DCLK, HSYNC, VSYNC, DISP, DE.

Note2: Ta means the ambient temperature. It is necessary to limit the relative humidity to the specified temperature range. Condensation on the module is not allowed.

Note3: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage	VDD	3.0	3.3	3.6	V	
Input Signal Voltage	Low Level	VIL	DGND	--	0.3×VDD	V
	High Level	VIH	0.7×VDD	--	VDD	V
Power Consumption	60Hz	P	--	80	--	mW
						Black pattern

Table 5.1.1 Operating Voltages

Note1: The proposed supply voltage is $3.3 \pm 0.1V$, the typical voltage 3.3V is applied in the test in Chapter 7 and Chapter 8.

Note2: Input signal include R0~R7, G0~G7, B0~B7, DCLK, HSYNC, VSYNC, DISP, DE

5.2 DC Characteristics for Backlight Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	--	40	50	mA	10 LEDs (2 LED Serial, 5 LED Parallel)
Forward Current Voltage	VF	15	16	18	V	
Backlight Power Consumption	WBL	--	640	—	mW	
LED life time	--	20000	30000	-	Hrs	

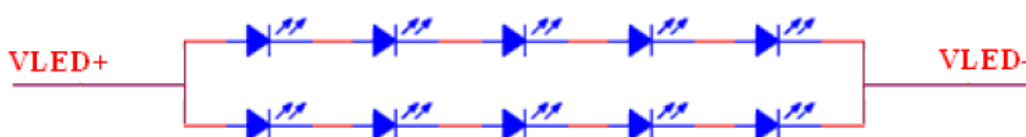
Table 5.2.1 LED Backlight Characteristics

Note1: I_F is defined for each channel.

Note2: Optical performance should be evaluated at $T_a = 25^\circ C$ only.

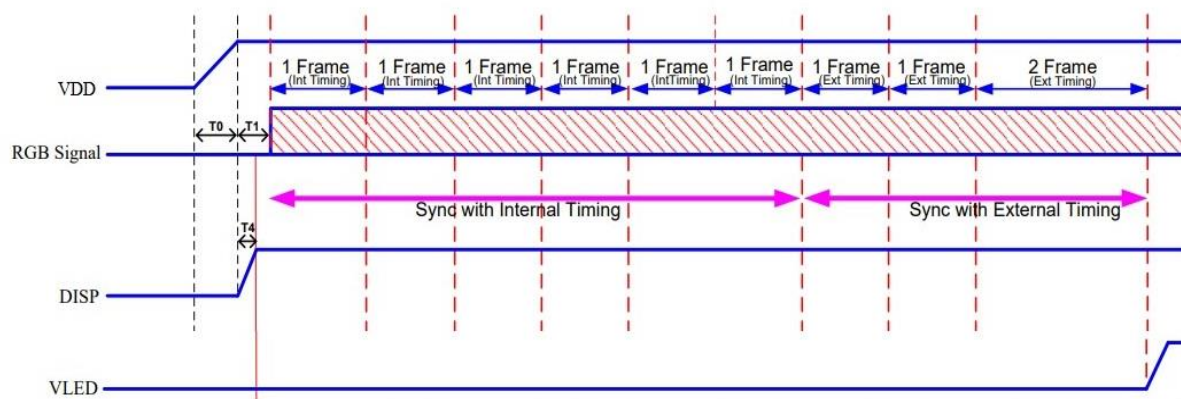
Note3: If LED is driven by high current, high ambient temperature & humidity condition, The life time of LED will be reduced.

Note4: Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.



5.3 Recommended Power ON/OFF Sequence

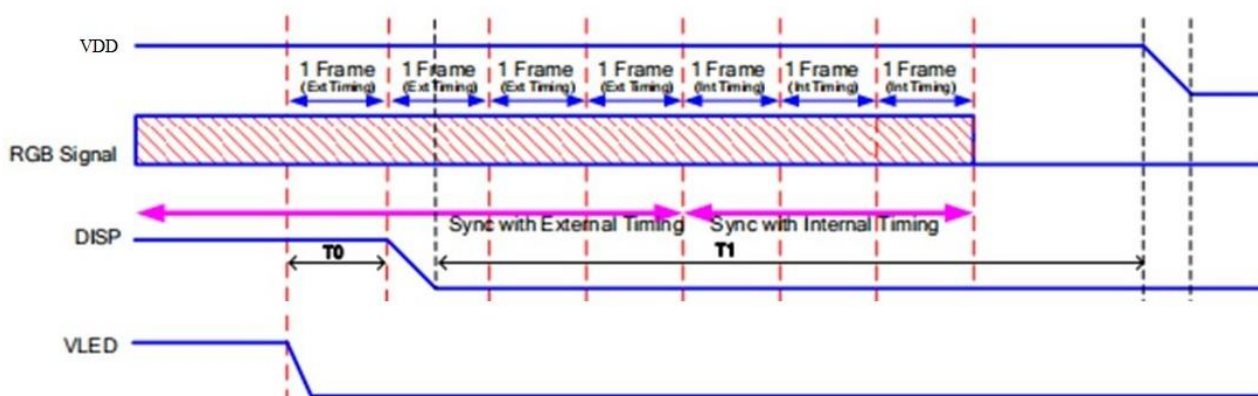
Power ON Sequence



Item	Description	Min. Time
T0	Determined by the external power.	$470\mu s \leq T0 \leq 1ms$
T1	Time from stable VDD set-up to the first frame.	T1=0
T4	Time from stable VDD set-up to DISP asserted.	T4=0

Figure 5.4.1 Power on sequence

Power OFF Sequence



Item	Description	Min. Time
T0	Time from backlight power off to DISP="L".	1*Frame
T1	Time from DISP="L" to LCM Power off.	5*Frame

Figure 5.4.2 Power off sequence

Note1: The low level of these signals and analog powers are GND level.

Note2: All of the power and signals should be kept at GND level before power on. If there are residual voltages on them, the LCD might not work properly.

Note3: during power on/off, please input signal according timing chart to avoid shake of screen or else.

Note4: Frame=60Hz

5.4 LCD Module Block Diagram

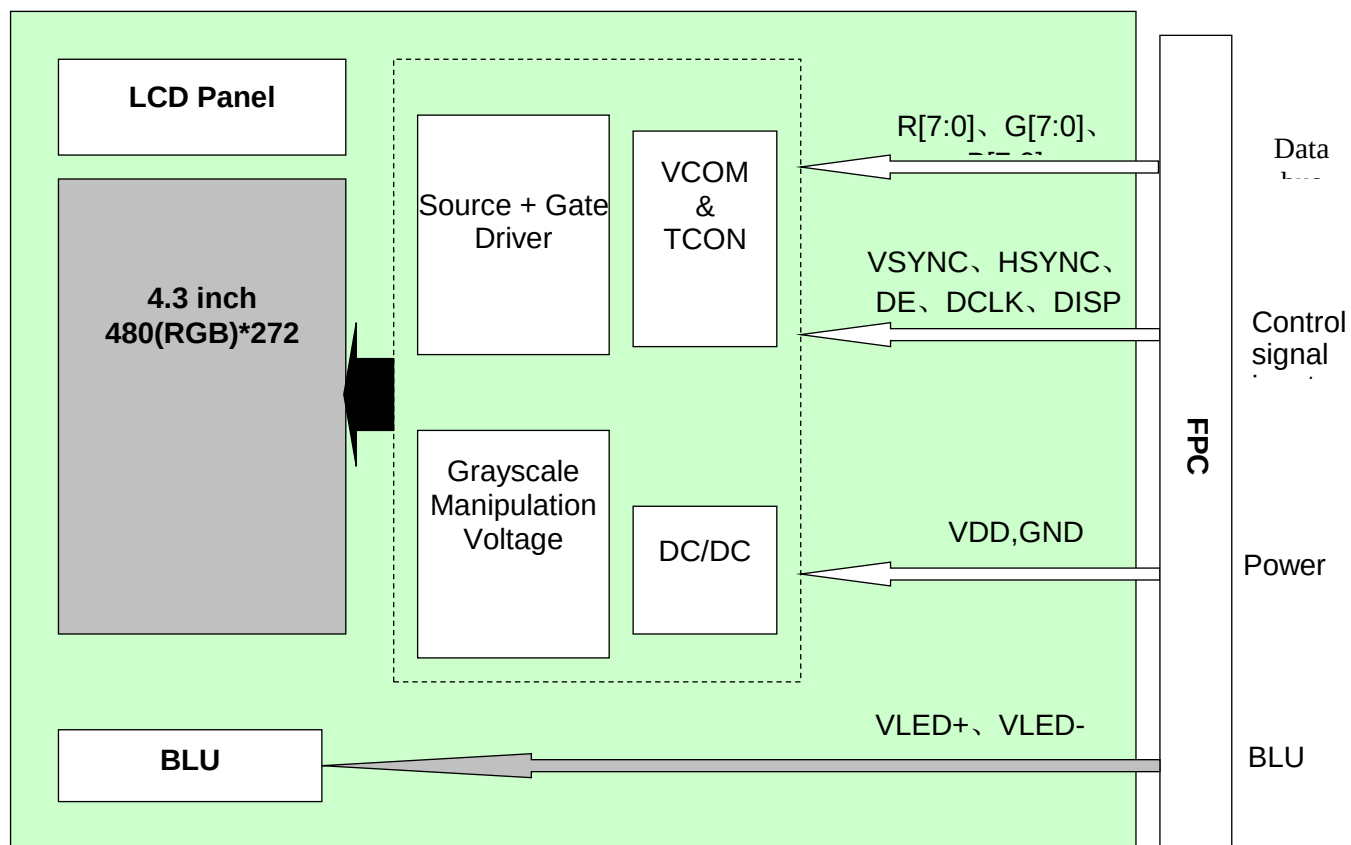


Figure 5.5.1 LCD Module Block Diagram

6. Interface Timing Characteristics

6.1 AC characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Remark
System operation timing						
VDD power source slew time	TPOR	-	-	20	ms	From 0V to 99% VDD
Input/ Output timing						
DCLK pulse duty	T _{cw}	40	50	60	%	
HSYNC Width	T _{hw}	2	-	-	DCLK	
HSYNC Period	T _h	55	60	65	us	
DE Setup Time	T _{dest}	10	-	-	ns	
DE Hold Time	T _{dehd}	10	-	-	ns	
HSYNC Setup Time	T _{hst}	12	-	-	ns	
HSYNC Hold Time	T _{hhd}	12	-	-	ns	
VSYNC Setup Time	T _{vst}	12	-	-	ns	
VSYNC Hold Time	T _{vhd}	12	-	-	ns	
Data Setup Time	T _{dsu}	12	-	-	ns	
Data Hold Time	T _{dhd}	12	-	-	ns	

Table 6.1.1 Input Setup Timing Parameters Requirement

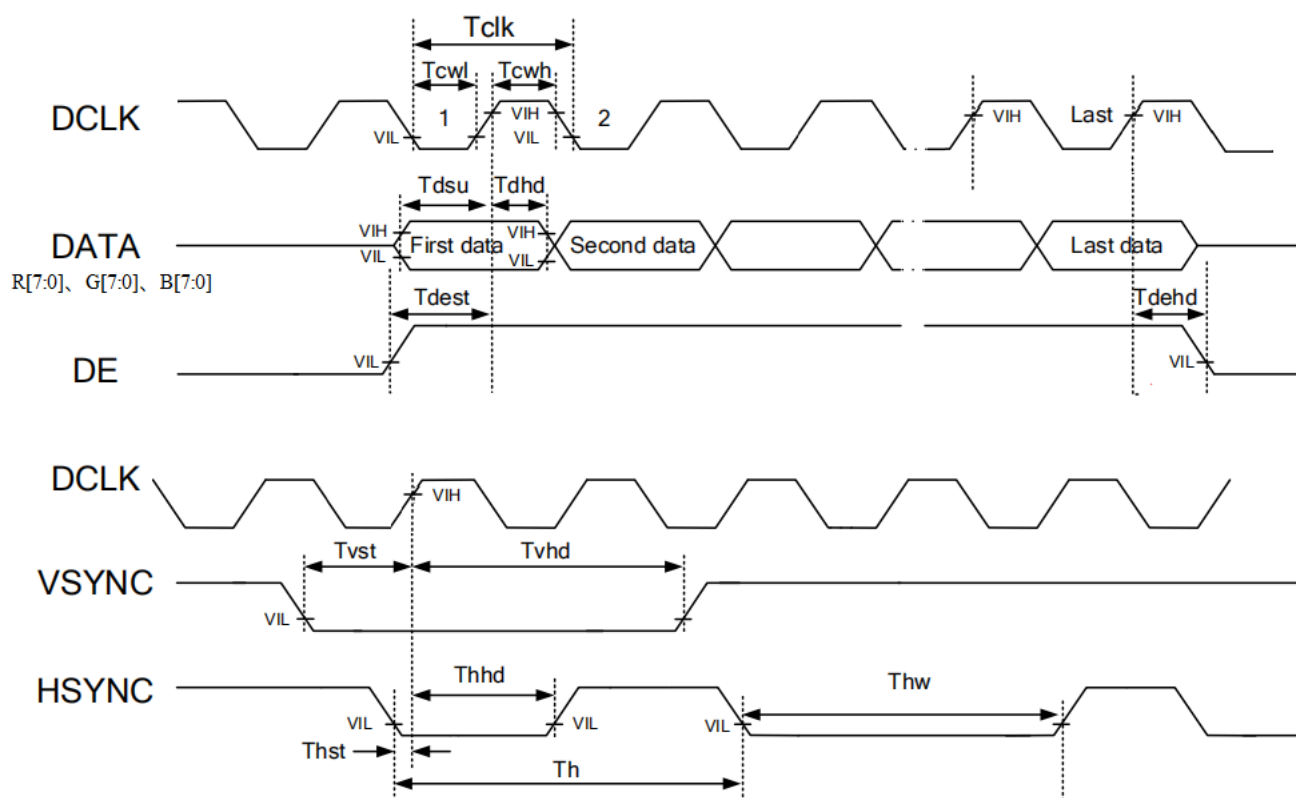


Figure 6.1.1 Clock and Data Input Timing Diagram

6.2 Data Input Timing Parameter Setting

Item	Symbol	Min	Typ	Max	Unit	Remark
DCLK Frequency	Fclk	8.67	9.30	10.36	MHz	
DCLK Period	Tclk	97	108	115	ns	
HSYNC	Period Time	Th	531	564	DCLK	
	Display Period	Thdisp	480		DCLK	
	Back Porch	Thbp	23	43	DCLK	By H_Blanking setting
	Front Porch	Thfp	6	41	DCLK	
	Pulse Width	Thw	3	39	DCLK	
VSYNC	Period Time	Tv	292	306	H	
	Display Period	Tvdisp	272		H	
	Back Porch	Tvbp	7	12	H	By V_Blanking setting
	Front Porch	Tvfp	5	22	H	
	Pulse Width	Tvw	3	20	H	
Frame	Fr	60			Hz	

Table 6.2.1 Data Input Timing Parameters

Note1: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

6.3 SYNC Mode Timing Diagram

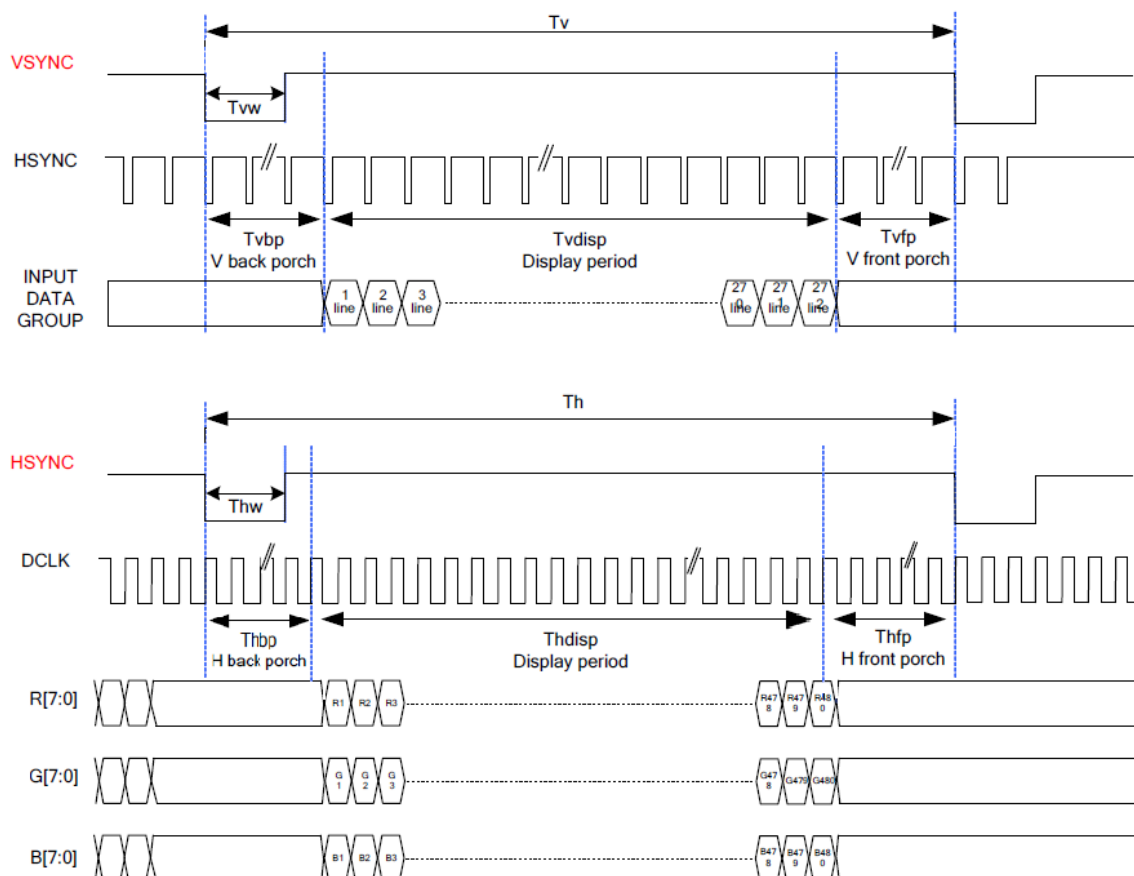


Figure 6.3.1 Data Input Timing Diagram In SYNC Mode

6.4 SYNC-DE Mode Timing Diagram

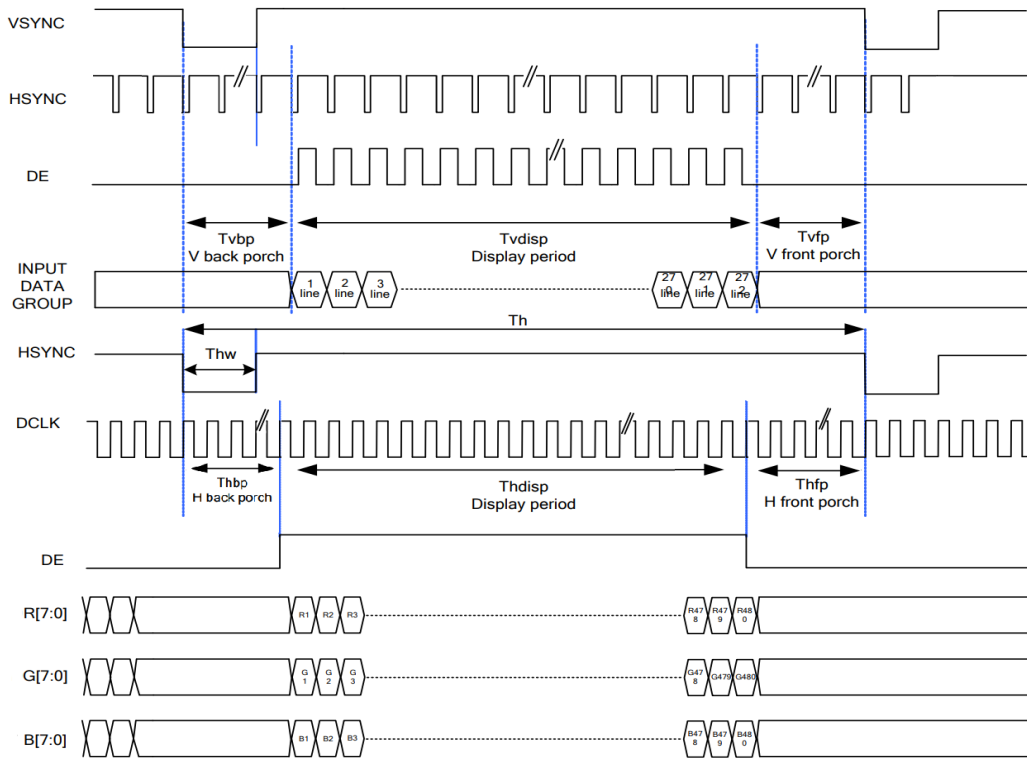


Figure 6.4.1 Data Input Timing Diagram In SYNC-DE Mode

6.5 DE Mode Timing Diagram

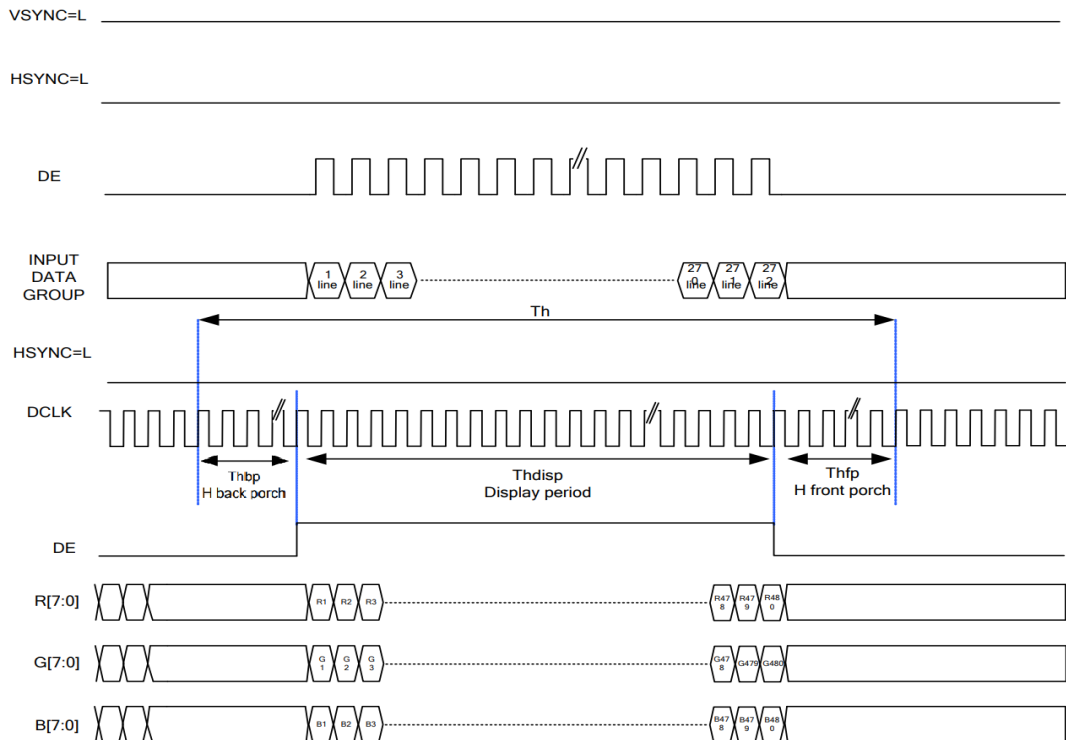


Figure 6.5.1 Data Input Timing Diagram In DE Mode

6.6 RGB Mode Selection Table

RGB Mode	DCLK	HSYNC	VSYNC	DE	R[0:7]	G[0:7]	B[0:7]
Parallel RGB SYNC-DE Mode	Input	Input	Input	Input	Input	Input	Input
Parallel RGB SYNC Mode	Input	Input	Input	VSSD	Input	Input	Input
Parallel RGB DE Mode	Input	VSSD	VSSD	Input	Input	Input	Input

Table 6.6.1 RGB Mode Selection

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR ≧ 10	70	88	--	degree	Note2,3
		θB		70	88	--		
		θL		70	88	--		
		θR		70	88	--		
Contrast Ratio		CR	θ=0°	600	800			Note 3
Response Time		T _{ON}	25℃	--	20	30	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.253	0.303	0.353		Note 1,5
		y		0.270	0.320	0.370		
	Red	x		0.538	0.588	0.638		Note 1,5
		y		0.304	0.354	0.404		
	Green	x		0.288	0.338	0.388		Note 1,5
		y		0.533	0.583	0.633		
	Blue	x		0.102	0.152	0.202		Note 1,5
		y		0.042	0.092	0.142		
Uniformity		U			75	80	%	Note 6
NTSC		-			45	50	%	Note 5
Luminance		L			350	400	cd/m ²	Note 7

Table 7.1 Optical Parameters

Test Conditions:

1. $I_F = 40$ mA, and the ambient temperature is 25℃.
2. The test systems refer to Note1 and Note2.

Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical characteristics are measured at the center point of the LCD screen.

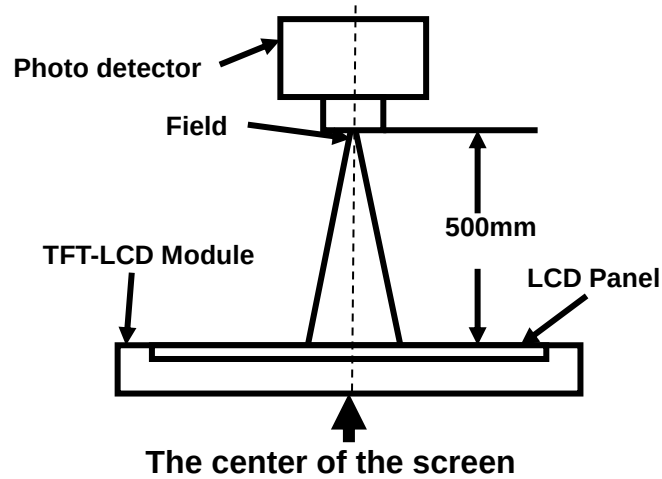


Fig1.Measurement Set Up

Note2: Definition of viewing angle range and measurement system. Viewing angle is measured at the center point of the LCD .

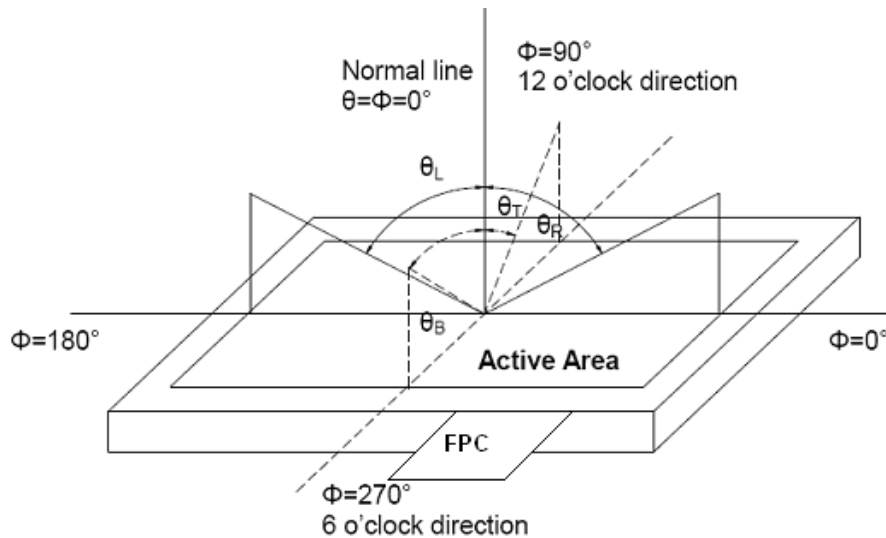


Fig2. Measurement viewing angle

Note3: Definition of contrast ratio

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

Note4: Definition of Response time

For TN LCM, the response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_r) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_f) is the time between photo detector output intensity changed from 10% to 90%.

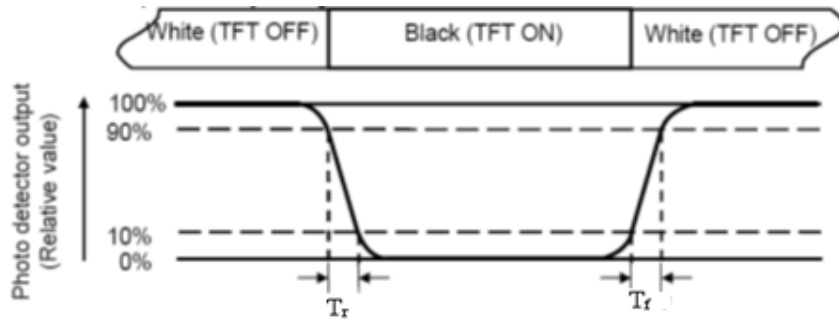


Fig3. Response Time Testing(TN)

For SFT LCM, the response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_r) is the time between photo detector output intensity changed from 10% to 90%. And fall time (T_f) is the time between photo detector output intensity changed from 90% to 10%.

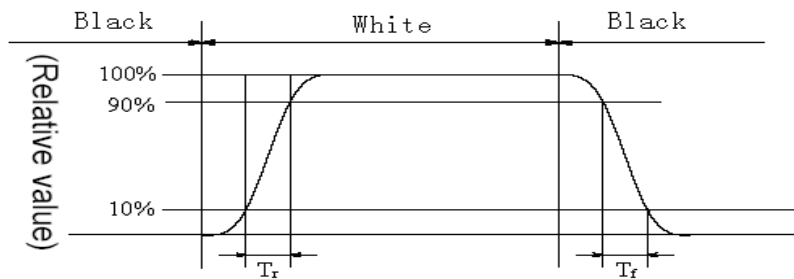


Fig4. Response Time Testing(SFT)

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig.5). Every measuring point is placed at the center of each measuring area.

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

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

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

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

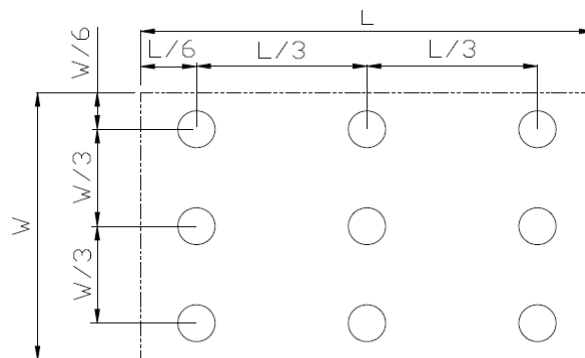


Fig5. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	+70℃ , 240H	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20℃ , 240H	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	+80℃ , 240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30℃ , 240H	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity(non-operation)	+60℃ , 90%RH , 240H	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃ , 30min~80℃ , 30min , change time : 5min , 100cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
7	ESD	C=150pF , R=330Ω , 5point/panel Air : ±8kv , 5times ; Contact : ±4kv , 5times ; (Environment : 15℃~35℃ , 30%~60% , 86Kpa~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Package Vibration	5-20-200HZ , PSD : 0.01-0.01-0.001 Total: 0.781g2/HZ, x/y/z 30min	
9	Package Drop Test	Height: 60 cm,1 corner, 3edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

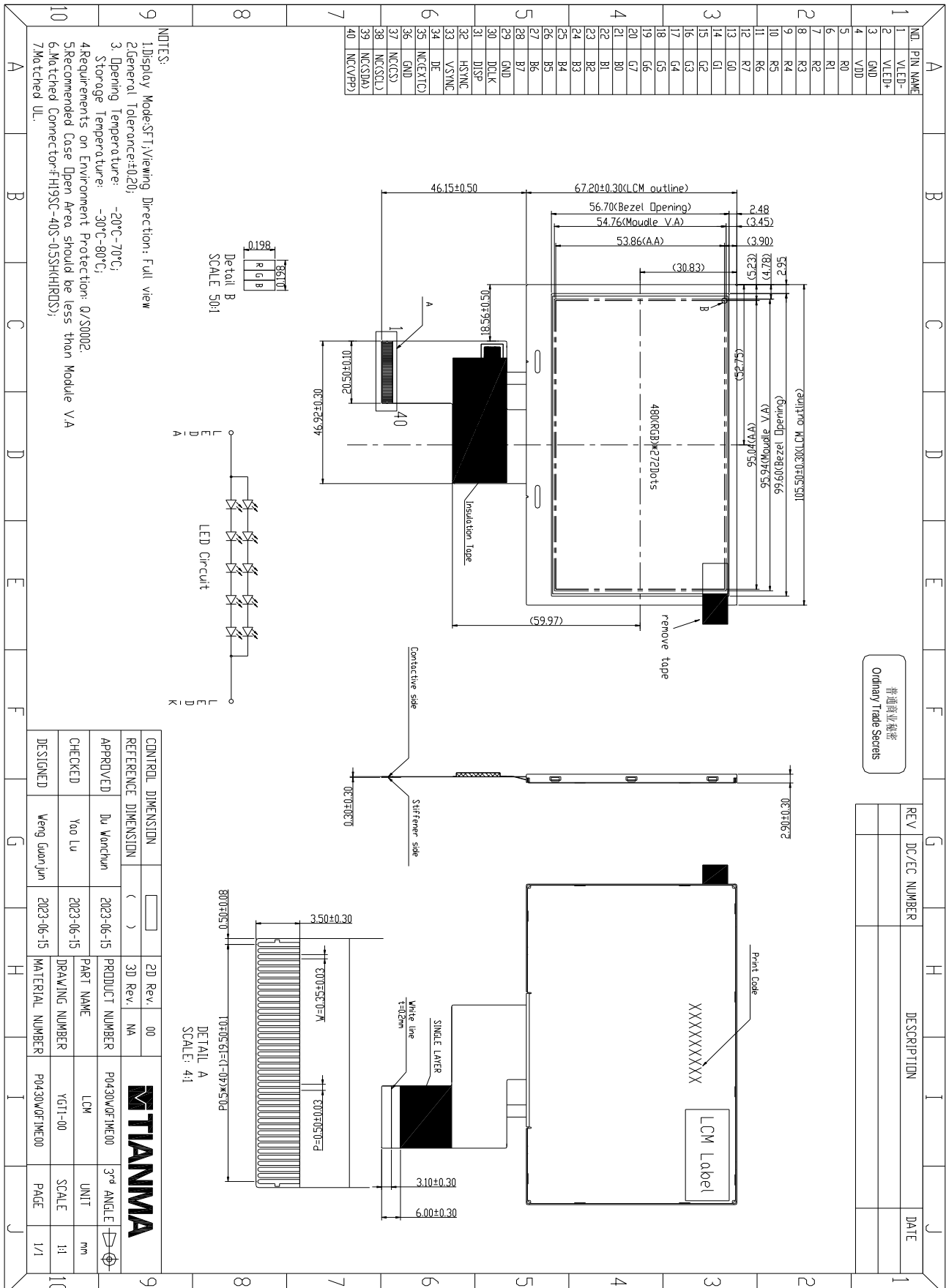
Table 8.1 RA test condition

Note1: Temperature is the ambient temperature of sample

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

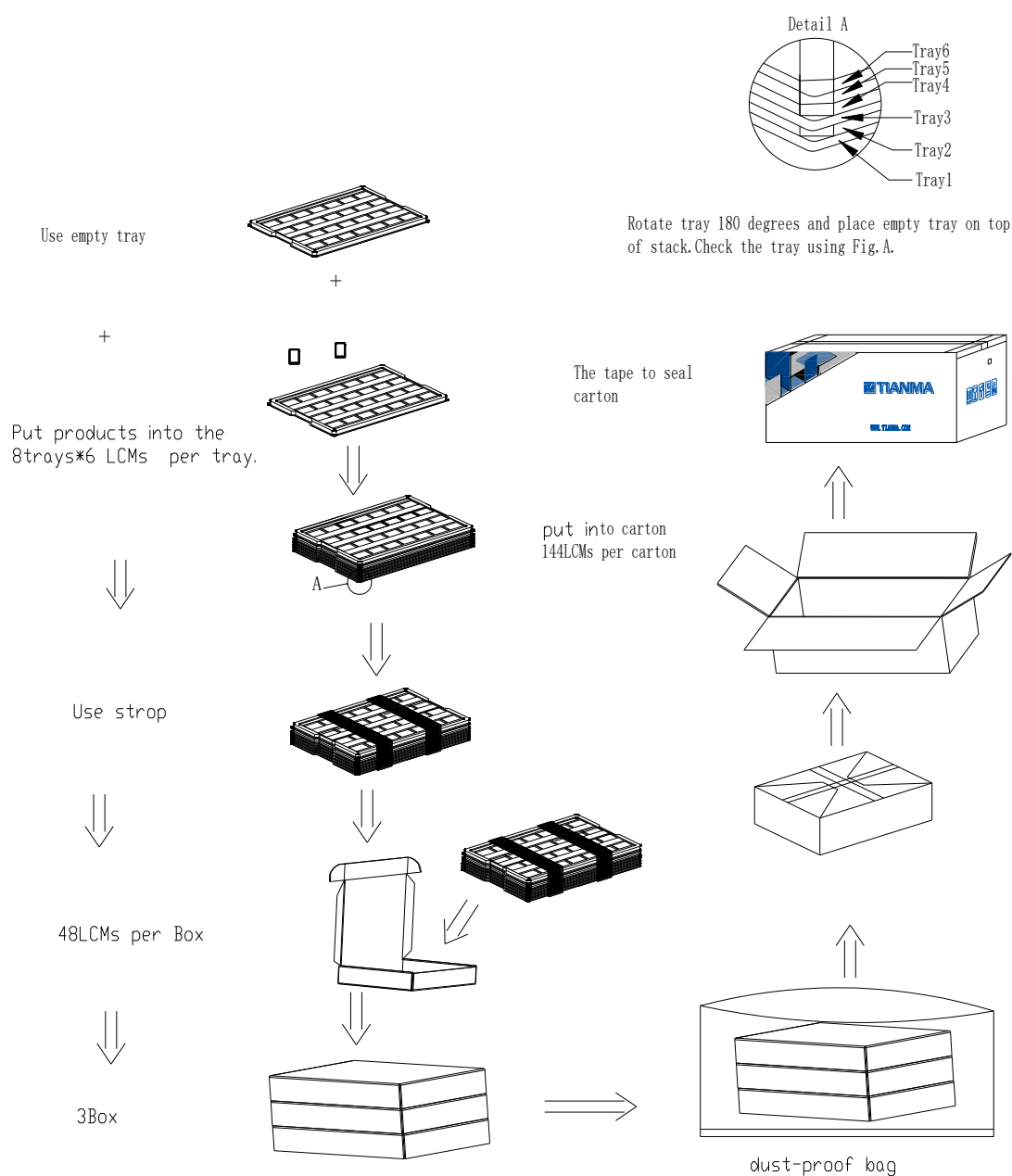
Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product's function only be guaranteed, but not for all of the cosmetic specification.

9. Mechanical Drawing



10. Packing Instruction

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Q'ty	Remark
1	LCM module	P0430WQF1ME00	105.5×67.20×2.90	0.0445	144	
2	Tray	PET (Transmit)	485×330×13.8	0.172	27	
3	Dust Proof Bag	PE	700×545mm	0.050	1	
4	BOX	CORRUGATED PAPER	520*345*74	0.38	3	
5	Carton	CORRUGATED PAPER	544×365×250	1.01	1	
6	Label	Paper	100×52	0.001	1	
7	Total weight	13.253 Kg ± 10%				



11. Precautions for Use of LCD Modules

11.1 Handling Precautions

- (1) The display panel is made of glass. Do not subject it to mechanical shock by dropping it, etc.
- (2) If the display panel is damaged and the liquid crystal fluid inside it leaks out be sure not to get any in your mouth. If the fluid comes into contact with your skin or clothes promptly wash it off using soap and water.
- (3) Do not apply excessive force to the display surface or the bezel since this may cause the color tone to vary.
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
- (5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear use a moist cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcohol

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

- Water
 - Ketone
 - Aromatic solvents
- (6) Do not disassemble the LCD Module.
 - (7) If powered off, do not apply the input signals.
 - (8) To prevent destruction of the module by static electricity, be careful to maintain an optimum work environment.
 - (9) Be sure to ground your body when handling the LCD Modules.
 - (10) Tools used for assembly, must be properly grounded.
 - (11) To reduce the amount of static electricity generated, do not conduct assembly or other work under very low humidity conditions.
 - (12) The LCD Module is covered with a film to protect the display surface, remove film slowly under the ionizer.

11.2 Storage precautions

- (1) When storing the LCD modules avoid exposure to direct sunlight or to the light of fluorescent lamps.
- (2) The LCD modules should be stored within the rated storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is: Temperature: 0 ~ 35 °C at normal humidity.
- (3) The LCD modules should be stored in a room without acid, alkali or other harmful gas.

11.3 Transportation Precautions

The LCD modules should not be dropped or subject to violent mechanical shock during transportation. Also they should avoid excessive pressure, water, high humidity and direct sunlight.

11.4 Screen saver Precautions

Not display the fixed pattern for a long time. Use a screen saver, if the fixed pattern is displayed on the screen

11.5 Safety Precautions

- (1) When you waste damaged or unnecessary LCDs, it is recommended to crush LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned
- (2) Be sure to turn off the power supply when inserting or disconnecting the LED backlight cable.

- (3) LED driver should be designed to limit or stop its function when over current is detected on the LED.