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SPECIFICATION

[◉] Preliminary Specification
[ ] Final Specification

Description 8.4” 640xRGBx480 TFT-LCD Module
Part Number P0840VGF1MA00

Customer		Product Dept, PDBU Tianma Microelectronics Co., Ltd.	
Signatures	Date	Approved By	Date
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REVISION HISTORY

Rev	Date	Page	Revision Items	Editor
1.0	2023/11/15		Preliminary spec	Tingting Hou
1.1	2023/12/08		Add matching connector in page 3 Add Backlight Forward Current in page 5 Update Absolute Humidity Remark in page 5 Update backlight driving figure in page 6 Add chapter 5.3&5.4 in page 7 Delete repeat notes in page 7 Update CN1+CN2 in page 8 Update AC characteristics in page 9 Update Data Input Timing Parameter Setting in page 10 Update Chromaticity Condition in page 13	Tingting Hou
1.2	2023/12/15		Delete chapter 5.1&5.3&5.5 “VCC=5V” in page 6	Tingting Hou

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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
3.2 CN2 Pin assignment (Back Light) 4
4. ABSOLUTE MAXIMUM RATINGS 5
5. ELECTRICAL CHARACTERISTICS 6
5.1 DC Characteristics for Panel Driving 6
5.2 Characteristics for Backlight Driving 6
5.3 Power supply voltage ripple 7
5.4 Fuse 7
5.5 Power ON/OFF Sequence 7
5.6 LCD Module Block Diagram 8
6. TIMING CHARACTERISTICS 9
6.1 AC characteristics 9
6.2 Data Input Timing Parameter Setting 10
6.3 SYNC Mode Timing Diagram 11
6.4 DE Mode Timing Diagram 12
6.5 Initial Code 12
7. OPTICAL CHARACTERISTICS 13
8. RELIABILITY TEST 16
9. MECHANICAL DRAWING 17
10. PACKING INSTRUCTION 18
11. PRECAUTIONS FOR USE OF LCD MODULES 20
11.1 Handling Precautions 20
11.2 Storage precautions 20
11.3 Transportation Precautions 20
11.4 Screen saver Precautions 20
11.5 Safety Precautions 20

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1. Summary

1.1 General Description

This is a 8.4 inch a-Si TFT-LCD module with Normal- Black technology. It is composed of a TFT-LCD panel, a driver circuit, a PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle
- High luminance
- Long LED life time
- Wide temperature range
- Interface: RGB 6bits
- Anti- glare Surface treatment
- Acquisition product for UL62368-1/CSA C22.2 No.62368-1-03 (File number: TBD)
- Compliant with the European RoHS Directive (2011/65/EU) and Delegated Directive (2015/863/EU, Amending Annex II of 2011/65/EU)

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2. General Specifications

Feature		Spec	Unit
Display Spec	Size	8.4 inches	
	Resolution	640(RGB)x480	
	Pixel Pitch	0.267*0.267	mm
	TFT Active Area	170.88*128.16	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT	
	Surface Treatment	Anti-Glare	
	Viewing Direction	ALL	
	Gray Scale Inversion Direction	No Gray Scale Inversion Direction	
Mechanical Characteristics	LCM (W x H x D)	200*152*8.8	mm
	Weight	TBD	g
Optical Characteristics	Luminance	900	cd/m^2
	Contrast Ratio	1000	
	NTSC	50	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	RGB 6 bits	
	Color Depth	262K	color
	Power Consumption	LCD:TBD Backlight:4060	mW

Table 2.1 General TFT Specifications

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3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	MSAK24025P40 (TBD)
Matching connector	20453-240T-03 or equivalent

Table 3.1.1 Connector information

No	Symbol	I/O	Description	Comment
1	GND	P	Ground	-
2	CLK	I	Dot clock	-
3	Hsync	I	Horizontal synchronous signal	-
4	Vsync	I	Vertical synchronous signal	
5	GND	P	Ground	
6	R0	I	Red data	
7	R1	I	Red data	
8	R2	I	Red data	
9	R3	I	Red data	
10	R4	I	Red data	
11	R5	I	Red data	
12	GND	P	Ground	
13	G0	I	Green data	
14	G1	I	Green data	
15	G2	I	Green data	
16	G3	I	Green data	
17	G4	I	Green data	
18	G5	I	Green data	
19	GND	P	Ground	
20	B0	I	Blue data	
21	B1	I	Blue data	
22	B2	I	Blue data	
23	B3	I	Blue data	
24	B4	I	Blue data	
25	B5	I	Blue data	
26	GND	P	Ground	
27	DE	I	Selection of DE / Fixed mode	
28	VCC	P	Power supply	
29	VCC	P	Power supply	
30	MODE	-	Select DE or SYNC mode	High: SYNC Mode Low or

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				Open: DE Mode
31	DPS	I	DPS = “Low” or “Open” : Normal scan; DPS = “High” : Reverse scan	
32	NC		Not Connect	
33	NC		Not Connect	
34	NC		Not Connect	
35	NC		Not Connect	
36	NC		Not Connect	
37	NC		Not Connect	
38	NC		Not Connect	
39	NC		Not Connect	
40	NC		Not Connect	

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.
Note3: This LCD module supports SYNC & SYNC-DE & DE mode, the pin setting is different from each other. Please refer to the descriptions.

3.2 CN2 Pin assignment (Back Light)

Connector Information	
LCD Module connector	MS24011P8RA (TBD)
Matching connector	P24011P8 or equivalent

Table 3.2.1 Connector information

No	Symbol	I/O	Description
1	LEDA1	P	LED driving anode (high voltage)
2	LEDK1	P	LED driving cathode (low voltage)
3	LEDA2	P	LED driving anode (high voltage)
4	LEDK2	P	LED driving cathode (low voltage)
5	LEDA3	P	LED driving anode (high voltage)
6	LEDK3	P	LED driving cathode (low voltage)
7	LEDA4	P	LED driving anode (high voltage)
8	LEDK4	P	LED driving cathode (low voltage)

Table 3.2.2 Pin Assignment for Back Light 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.

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4. Absolute Maximum Ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.5	6.0	V	Note1
Input voltage for signals	V_{IN}	-0.5	4.0	V	
Backlight Forward Current	IL	--	50	mA	Per one circuit
Operating Temperature	Top	-30	80	℃	
Storage Temperature	Tst	-35	85	℃	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40℃
		--	≤85	%	40℃＜Ta≤50℃
		--	≤55	%	50℃＜Ta≤60℃
		--	≤36	%	60℃＜Ta≤70℃
		--	≤24	%	70℃＜Ta≤80℃
Absolute Humidity	AH	--	≤70	g/m³	Ta＞80℃

Table 4.1 Absolute Maximum Ratings

Note1: Input voltage include all in put data.
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

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5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Supply Voltage		VCC	(3.2)	3.3	(3.4)	V	
Supply Current		ICC		TBD		mA	VCC=3.3V
Display and function signals	Low Level	VIL	GND	--	0.2×VCC	V	
	High Level	VIH	0.8×VCC	--	VCC	V	
Power Consumption	60Hz	P	--	TBD	--	mW	White pattern

Table 5.1.1 Operating Voltages

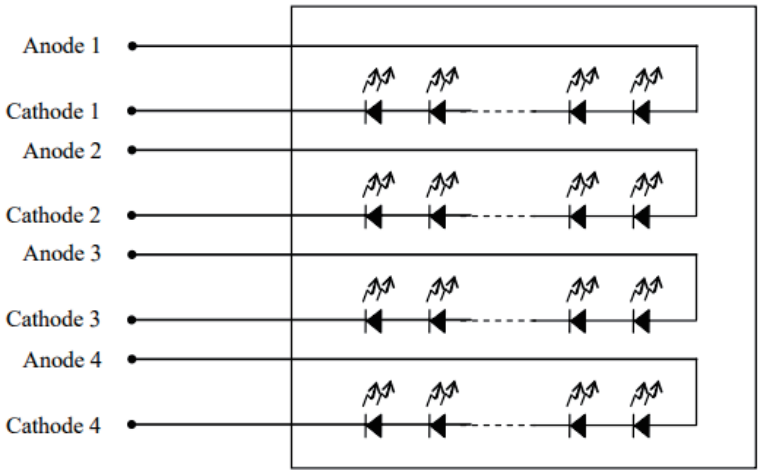
Note1: Indicated the subsequent version may be updated.

5.2 Characteristics for Backlight Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	--	50	55	mA	28 LEDs (4 LED Parallel,7 LED Serial)
Forward Current Voltage	VF	18	20.3	22.5	V	
Backlight Power Consumption	WBL	--	4060	—	mW	
LED life time	--	--	70000	-	Hrs	

Table 5.2.1 LED Backlight Characteristics

Note1: I_F is defined for each channel.
Note2: Optical performance should be evaluated at Ta=25℃ 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.



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5.3 Power supply voltage ripple

Power supply voltage		MIN	Remark
VCC	3.3 V	≤ 100	mVp-p

Note1: The permissible ripple voltage includes spike noise.

5.4 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	TBD	TBD	TBD TBD	TBD	Note1

Note1: The power supply's rated current must be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.

5.5 Power ON/OFF Sequence

5.5.1 LCD power on/off

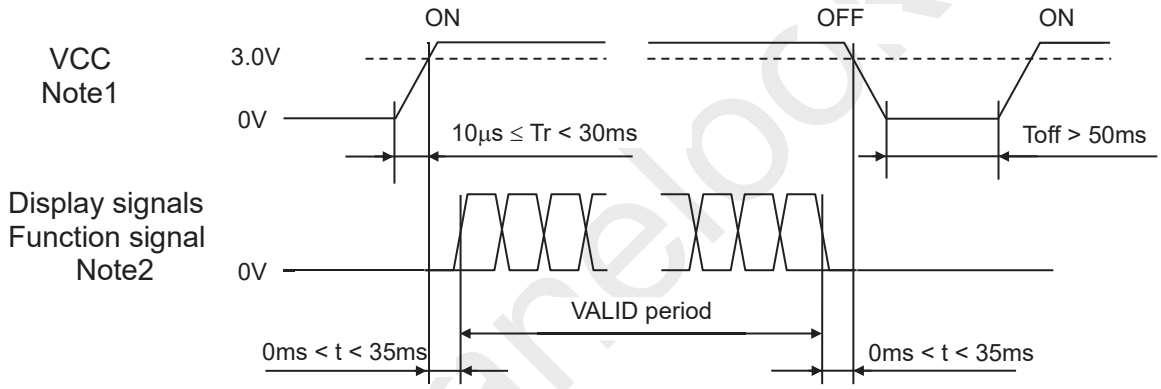


Figure 5.5.1 Backlight on/off

Note1: If there is a voltage variation (voltage drop) at the rising edge of VCC below 3.0V, there is a possibility that a product does not work due to a protection circuit.

Note2: Display signals (CLK, Hsync, Vsync, DE, DATA (R0 to R5, G0 to G5, B0 to B5)) and function signal (DPS) must be set to Low or High-impedance, except the VALID period (See above sequence diagram), in order to avoid the circuitry damage.
If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If a customer stops the display and function signals, VCC also must be shut down.

5.5.2 Backlight on/off

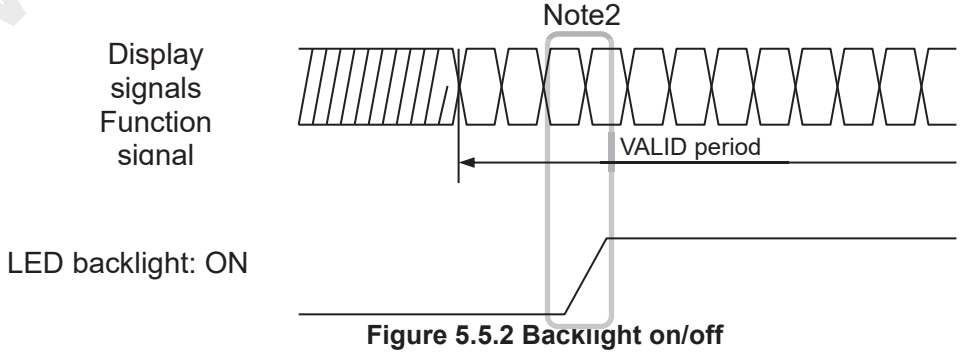


Figure 5.5.2 Backlight on/off

Note1: These are the display and function signals for LCD panel signal processing board.

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Note2: The backlight should be turned on within the VALID period of display and function signals, in order to avoid unstable data display.

5.6 LCD Module Block Diagram

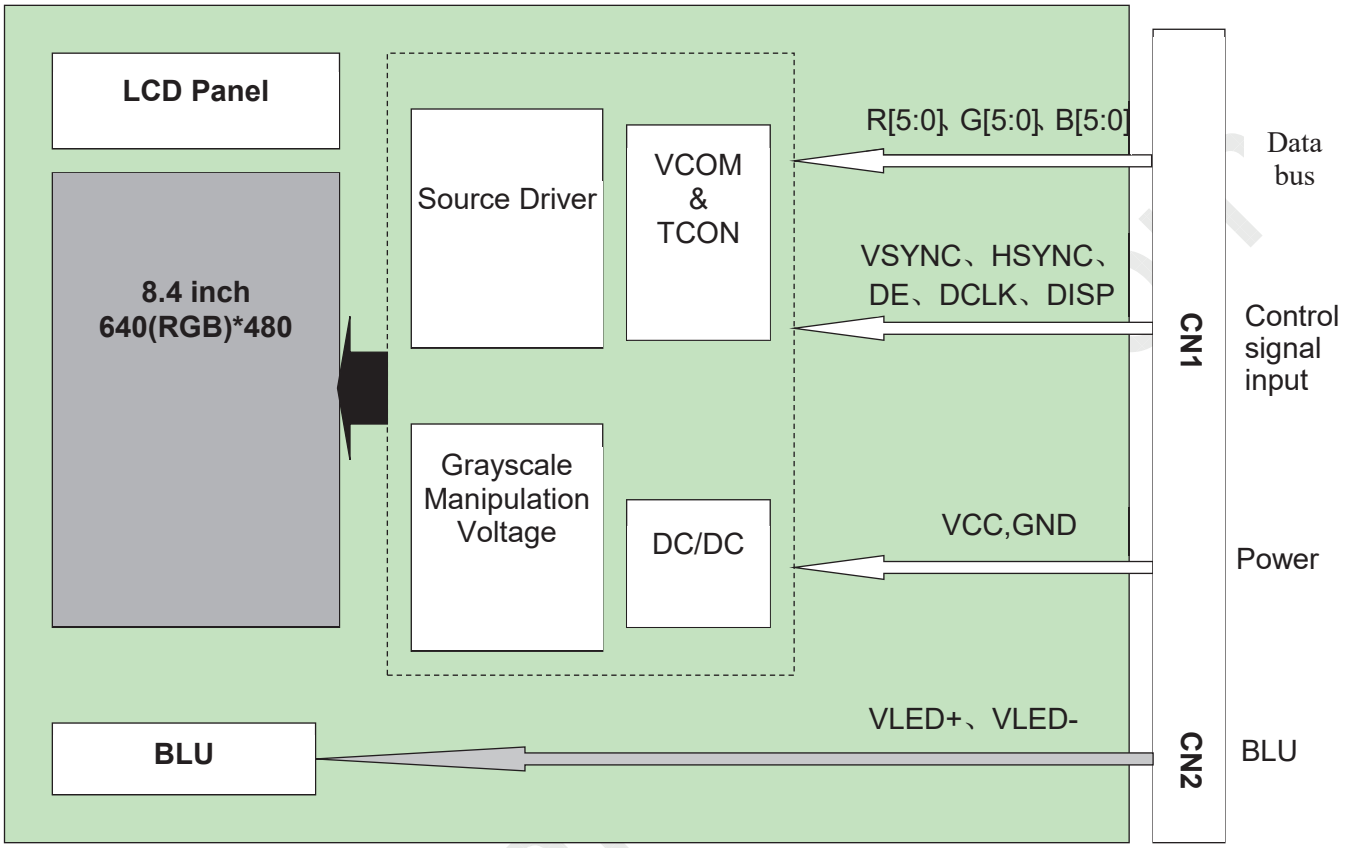


Figure 5.6.1 LCD Module Block Diagram

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6. Timing Characteristics

6.1 AC characteristics

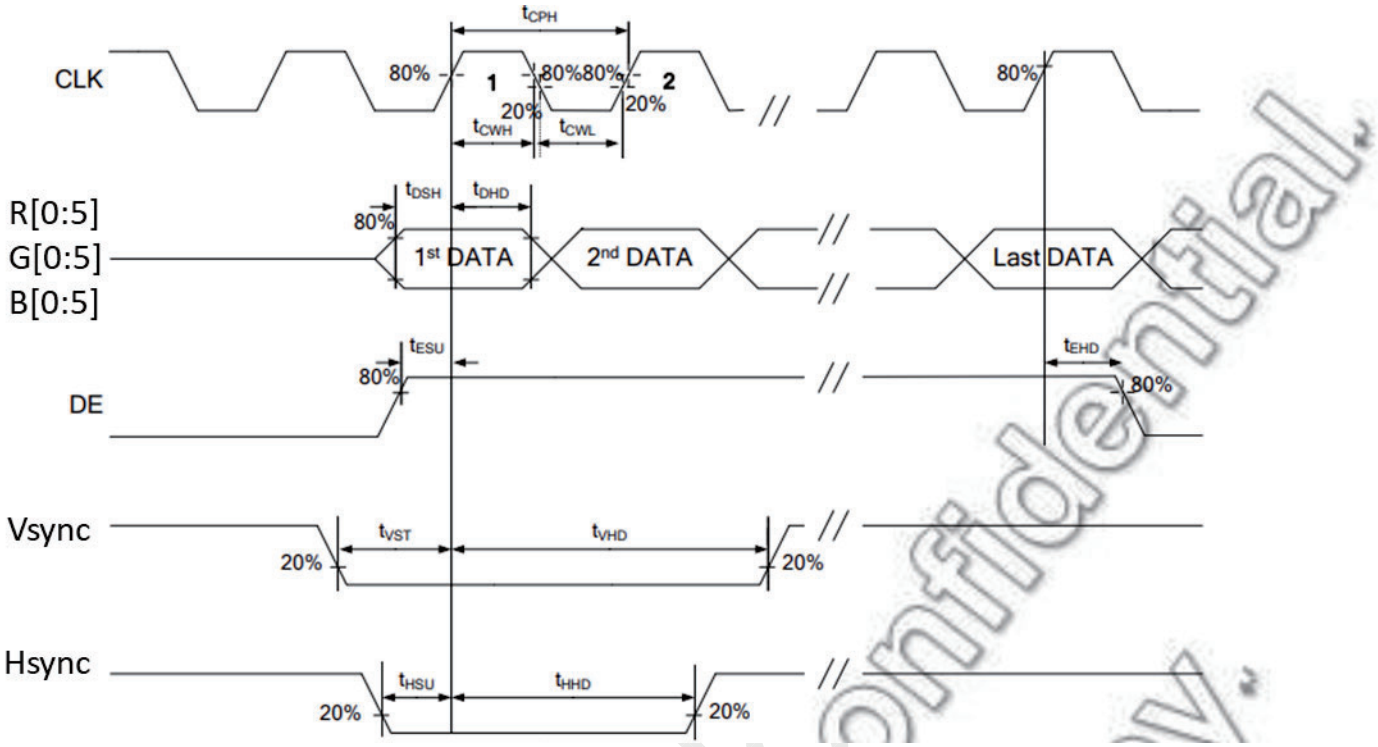


Figure 6.1.1 Clock and Data Input Timing Diagram

Item	Signal	Symbol	Condition	Rating	
				Min.	Max.
CLK cycle time	CLK	t_{CPH}		42.3	46.3
CLK pulse high duty		t_{CWH}		40	60
CLK pulse low duty		t_{CWL}		40	60
Vsync setup time	Vsync	t_{VST}		4	-
Vsync hold time		t_{VHD}		2	-
Hsync setup time	Hsync	t_{HST}		4	-
Hsync hold time		t_{HHD}		2	-
Data setup time	R[0:5] G[0:5] B[0:5]	t_{DSH}		4	-
Data hold time		t_{DHD}		2	-

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DE setup time	DE	t_{ESU}		4	-
DE hold time		t_{EHD}		2	-

Table 6.1.1 Input Timing Chart

6.2 Data Input Timing Parameter Setting

6.2.1 SYNC MODE

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency	1/tc	23.1	25.2	27.1	MHz	Note1
Hsync	Cycle	t_H	744	800	840	CLK	
	Display period	t_{HD}		640		CLK	
	Front-porch	t_{HFP}	80	136	176	CLK	
	Pulse width	t_{HPW}	2	2	5	CLK	
	Back-porch	t_{HBP}	24	24	24	CLK	Note2 Register HBP
Vsync	Cycle	t_V	517	525	537	H	
	Display period	t_{VD}		480		H	
	Front-porch	t_{VFP}	17	25	37	H	
	Pulse width	t_{VPW}	2	2	5	H	
	Back-porch	t_{VBP}	20	20	20	H	Note2 Register VBP
FR	Frame Rate	FR		60		Hz	

Table 6.2.1 Input Timing Parameters on Fixed Mode

Note1: Definition of parameters is as follows.
tc= 1CLK, th= 1H
Note2: Need to be consistent with the register settings.

6.2.2 DE MODE

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	23.1	25.2	27.1	MHz	Note1
DE	Horizontal	Cycle	t_H	744	800	840	CLK	
		Display period	t_{HD}		640		CLK	Note2
	Vertical (One frame)	Cycle	t_V	517	525	537	H	Note3
		Display period	t_{VD}		480		H	
FR	Frame Rate		FR		60		Hz	

Table 6.2.2 Input Timing Parameters on DE Mode

Note1: Definition of parameters is as follows.
tc= 1CLK, th= 1H
Note2: Hsync signal (Pin No.3 of CN1) and Vsync signal (Pin No.4 of CN1) are not used inside the product at DE mode.
Do not keep pin open to avoid noise problem.
Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

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6.3 SYNC Mode Timing Diagram

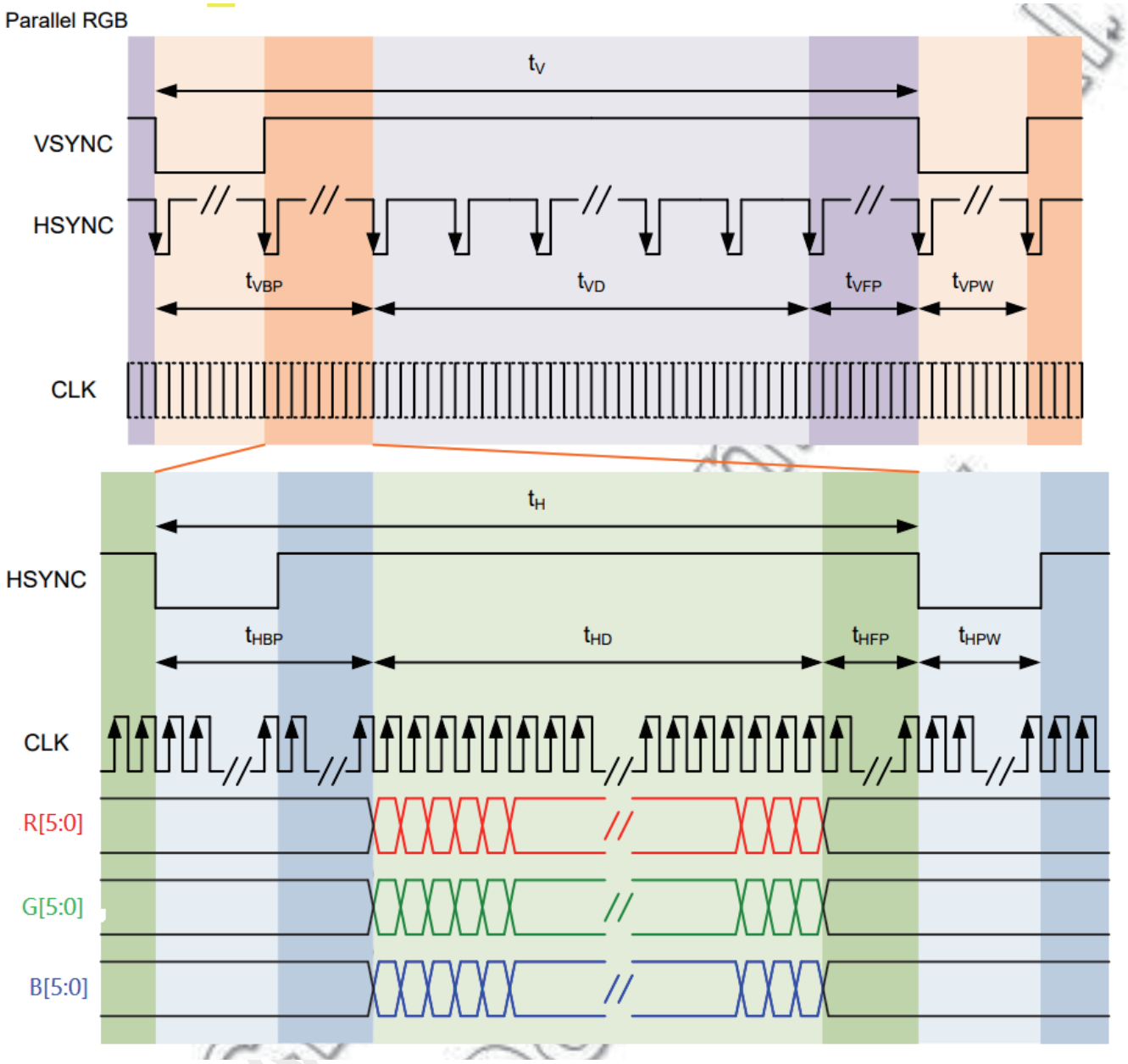


Figure 6.3.1 Data Input Timing Diagram Under SYNC Mode

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6.4 DE Mode Timing Diagram

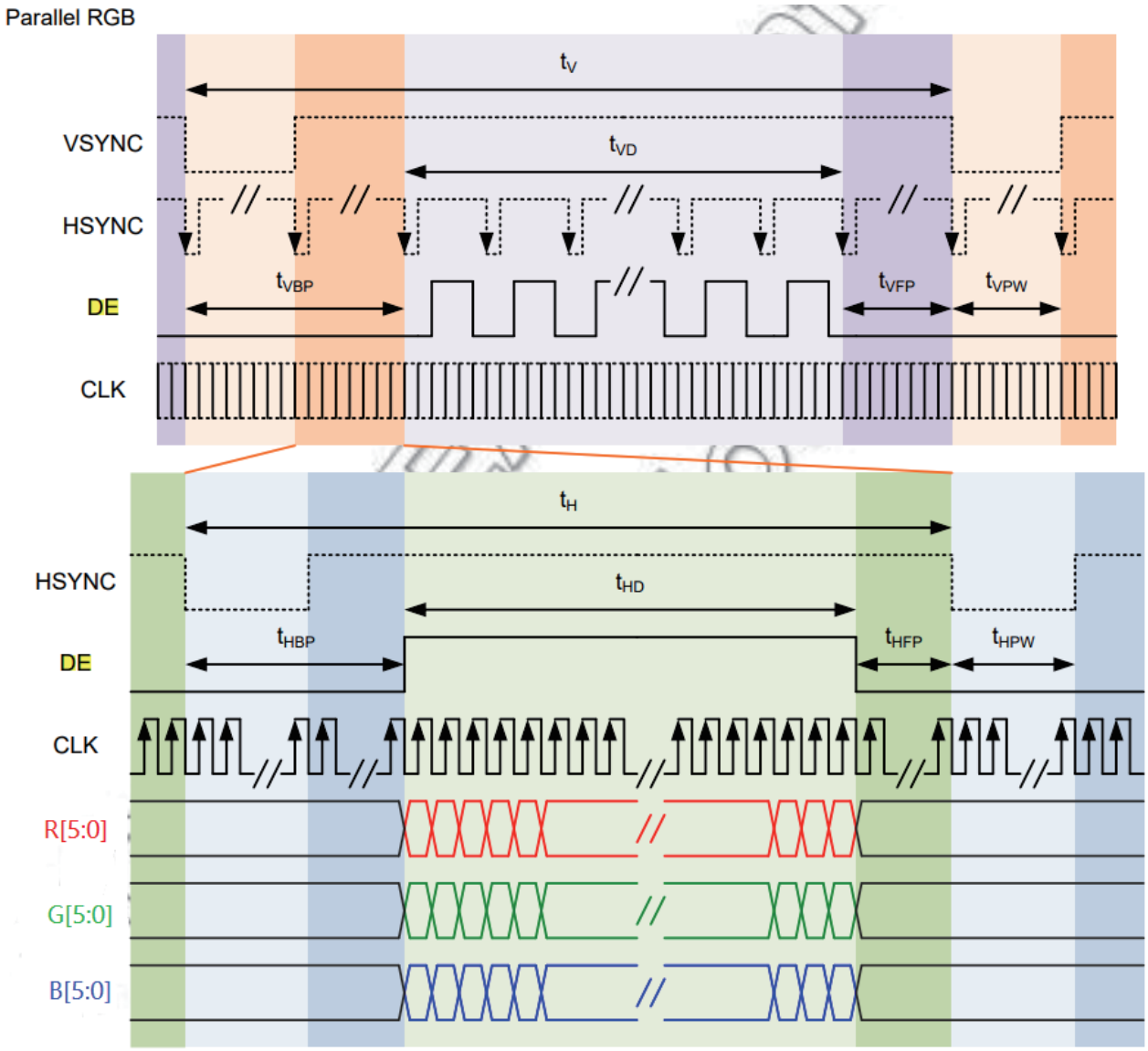


Figure 6.4.1 Data Input Timing Diagram Under DE Mode

6.5 Initial Code

TBD

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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°	800	1000			Note 3
Response Time		T_r	25℃		30	40	ms	Note 4
		T_f						
Chromaticity	White	x		TBD	TBD	TBD		Note 1,5
		y		TBD	TBD	TBD		
	Red	x		TBD	TBD	TBD		Note 1,5
		y		TBD	TBD	TBD		
	Green	x		TBD	TBD	TBD		Note 1,5
		y		TBD	TBD	TBD		
	Blue	x		TBD	TBD	TBD		Note 1,5
		y		TBD	TBD	TBD		
Uniformity		U		TBD	80		%	Note 6
NTSC		-		45	50		%	Note 5
Luminance		L		540	900		cd/m^2	Note 7

Table 7.1 Optical Parameters

Test Conditions:

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

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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.

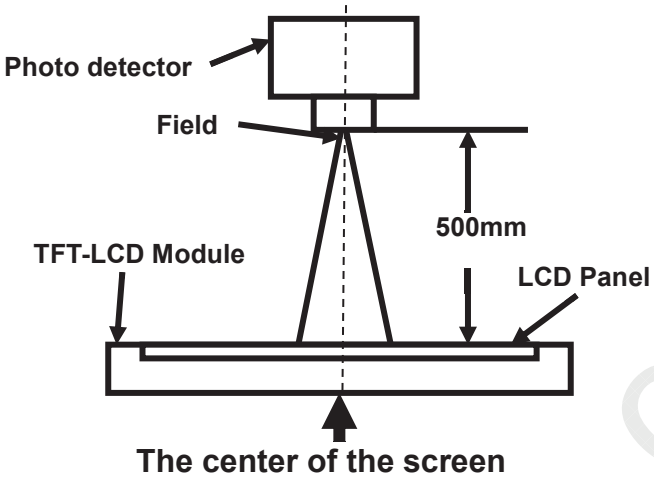


Fig1. Measurement Set Up

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

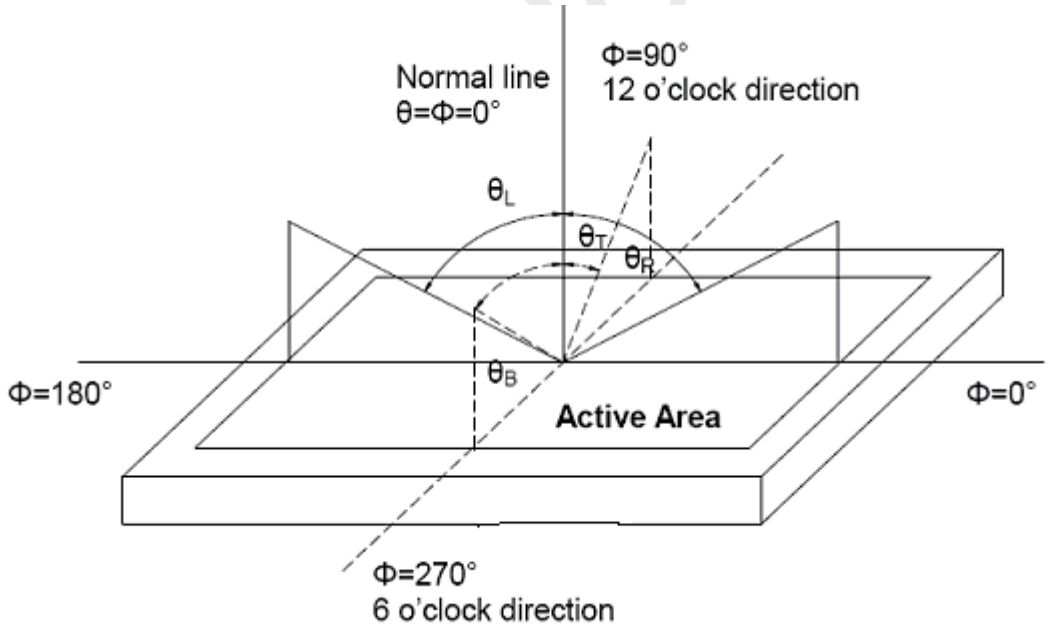


Fig2. Measurement viewing angle

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 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%.

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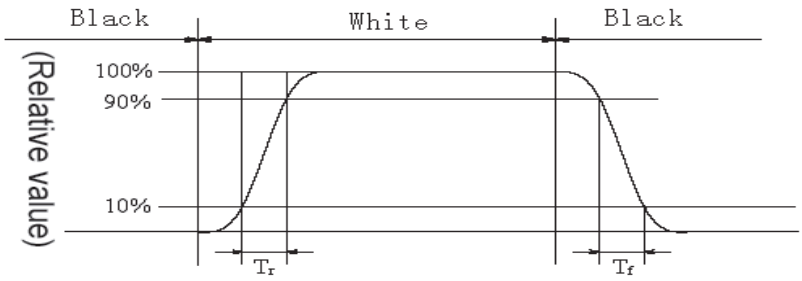


Fig3. Response Time Testing(SFT)

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) = Lmin/ Lmax

Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

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

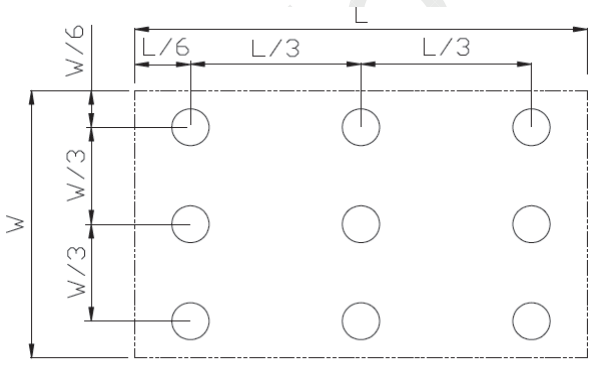


Fig4. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

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8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +80±3℃, 240 hours Display data is white	IEC60068-2-1:2007 GB2423.2-2008
2	High Temperature and Humidity(operation)	Ta = 60±2℃, 90% RH,240hours Display data is white	IEC60068-2-78 GB/T2423.3
3	Heat Cycle (operation)	-30±3℃,1 hour 80±3℃,1 hour 50cycles,4 hours/cycle Display data is white	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
4	Thermal Shock (non-operation)	-30±3℃,30minutes 80±3℃,30minutes 100cycles,1hours/cycle temperature transition time is within 5 mimutes	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
5	ESD	C=150pF,R=150Ω,±10Kv 9 point/panel 10 times each place at 1 sec interval	IEC61000-4-2:2001 GB/T17626.2-2006
6	Vibration (Non-operation)	5~100Hz 19.6m/s² 1 minute/cycle X 、Y 、Z 120 times each direction	IEC60068-2-6 GB/T17626.6
7	Mechanical shock (Non-operation)	539m/s²,11 ms ±X 、±Y 、±Z 5 times each direction	IEC60068-2-27 GB/T2423.5

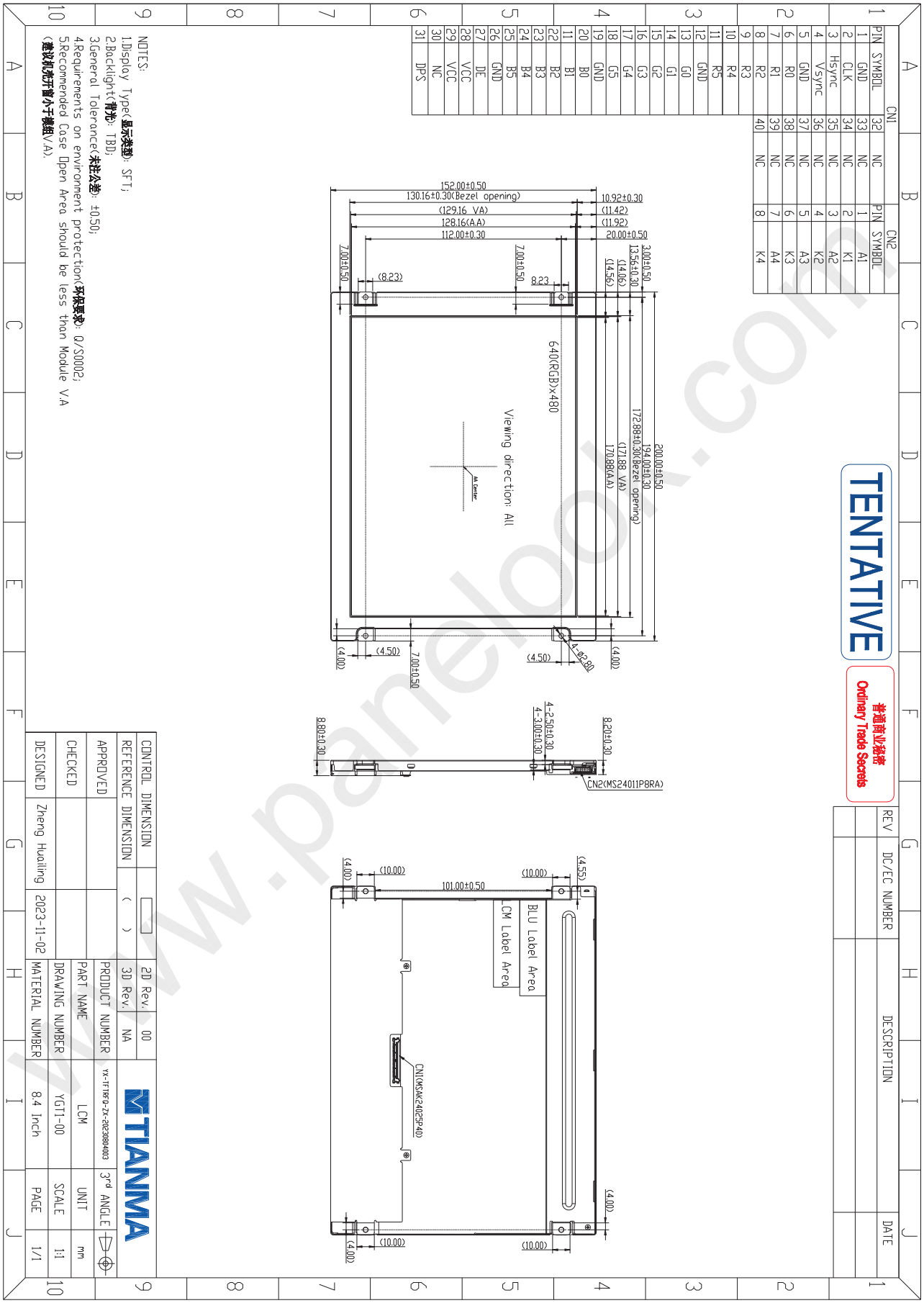
Table 8.1 RA test condition

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.

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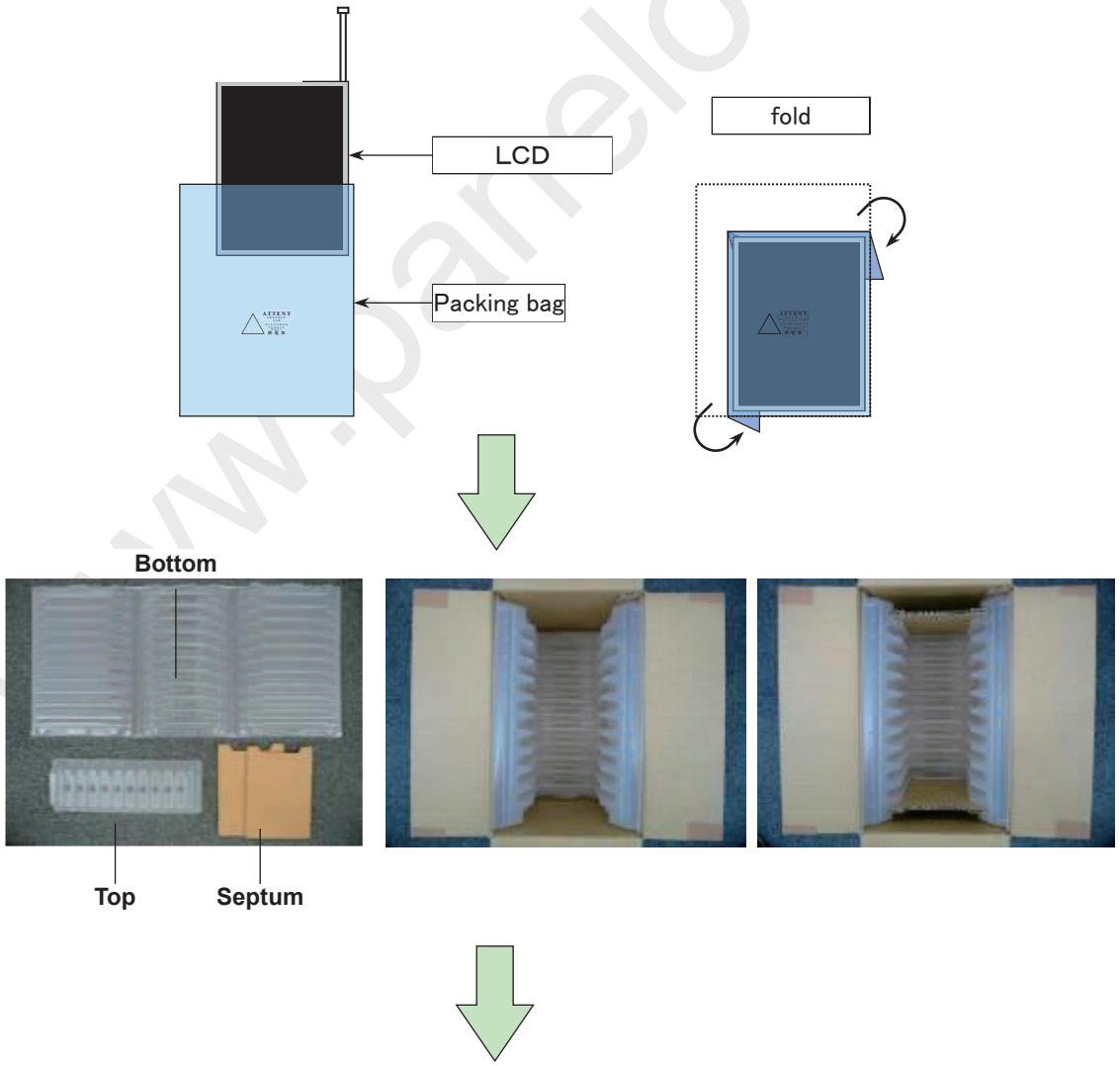
9. Mechanical Drawing



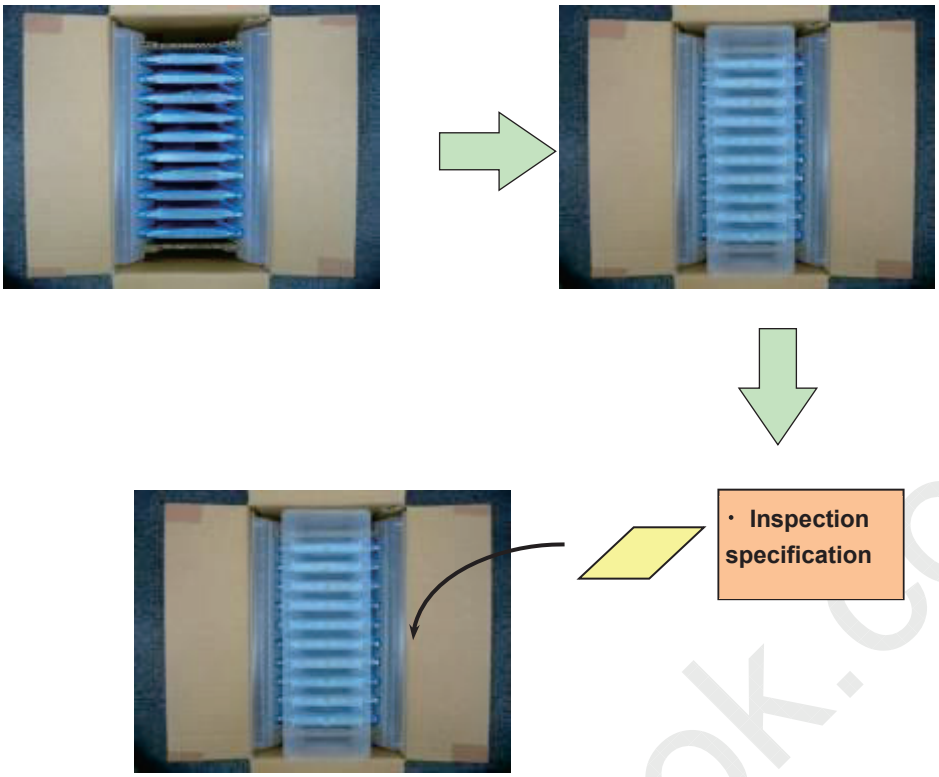
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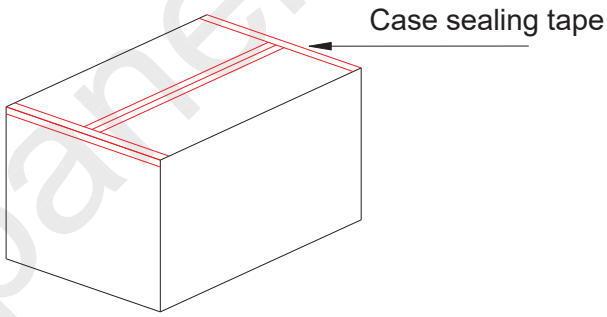
10. Packing Instruction

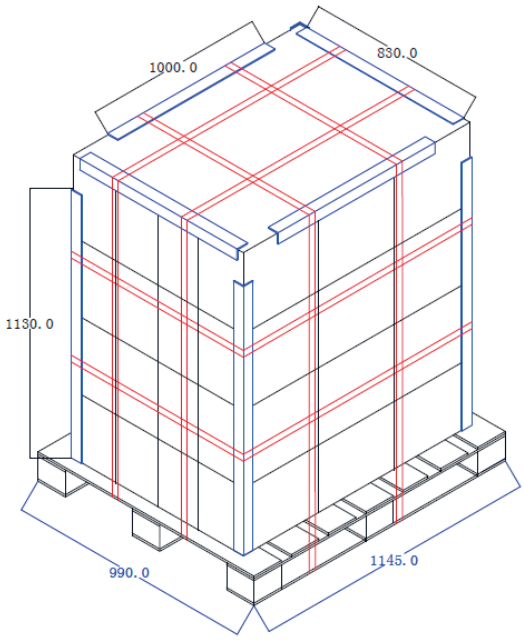
No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	P0840VGF1MB00	200x152x8.8		10	---
2	Partition broad	Corrugated paper	216×152		2	1687003450
3	Anti-static Bag	LD-PE	270×210		10	1687003440
4	Base Pad	PP	753×357×55		1	1687003430
5	Top Pad	PP	355×128×45		1	1687003420
6	Carton-inside	Corrugated paper	360x220x265		1	1687003461
7	Barcode Label	Paper	76x104		1	1697000140
8	Total weight					



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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. The recommend condition is: Temperature: 0 ~ 35 ℃ 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.

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