SPECIFICATION

[√] Preliminary Specification
[ ] Final Specification

Description **6.5” 640xRGBx480 TFT-LCD Module**

Part Number **P0650VGF2MA20**

Customer		Industrial Product Dept, PDBU Tianma Microelectronics Co., Ltd.	
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Comments:			

* This cover page is for your Comments and Signatures back to TIANMA.

REVISION HISTORY

Rev	Date	Page	Revision Items	Editor
1.0	2023/12/14	-	Preliminary Specification Released.	Ao_Chen
1.1	2024/1/26	-	Luminance to 950nits typ, Chromaticity(Wx,Wy) is target value	Ao_Chen
1.2	2024/4/9	-	Add packing instruction	Ao_Chen
1.3	2024/7/5	-	Change luminance typ 950nits to 900nits, 6-bit PIN18 is updated from High to Low or Open	Ao_Chen

CONTENTS

1. Summary

1.1 General Description

This is a 6.5 inch a-Si TFT-LCD module with Normal- black technology. It is composed of a TFT-LCD panel, a driver circuit, PCB, and a LED backlight unit.

1.2 Features

- Ultra-wide viewing angle (Super Fine TFT (SFT))
- 40Khrs Long LED life time
- Interface: 1 port LVDS
- Without LED driver
- 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	6.5 inches	
	Resolution	640(RGB)x480	
	Pixel Pitch	0.207 (H) x 0.207(V)	mm
	TFT Active Area	132.48×99.36	mm
	Technology Type	a-Si	
	Pixel Configuration	R.G.B Vertical Stripe	
	Display Mode	SFT Normally black	
	Surface Treatment	AG	
	Viewing Direction	ALL	
Mechanical Characteristics	LCM (W x H x D)	153W* 118H * 9.0D(typ)	mm
	Weight	(170)	g
Optical Characteristics	Luminance	900	cd/m^2
	Contrast Ratio	800:1	TYP
	NTSC	36	%
	Viewing Angle	88/88/88/88	degree
Electrical Characteristics	Interface	1 port LVDS	
	Color Depth	262K/16.7 M	color
	Power Consumption	LCD:TBD Backlight: 1470	mW

Table 2.1 General TFT Specifications

3. Input / Output Terminals

3.1 CN1 Pin assignment (LCD Interface)

Connector Information	
LCD Module connector	DF19K-20P-1H（HIROSE）
Matching connector	DF19-20S-1C（HIROSE）or equivalent

Table 3.1.1 Connector information

PIN		Symbol	I/O	Signal	Input data signal:8-bit			Input data signal:6-bit	Remark
					MAP A	MAP B			
1	A	D3+	I	Pixel data	R0-R1,G0-G1,B0-B1	R6-R7,G6-G7,B6-B7		-	Note3,4
	B	GND	P	Ground	-	-		Ground	
2	A	D3-	I	Pixel data	R0-R1,G0-G1,B0-B1	R6-R7,G6-G7,B6-B7		-	Note3,4
	B	GND	P	Ground	-	-		Ground	
3		DPS	I	Selection of scan direction	High: Reverse scan Low or Open: Normal scan				Note5
4		FRC	I	Selection of the number of colors	High			Low or open	
5		GND	P	Ground	Ground				
6		CLK+	I	Pixel clock	Pixel clock				Note3
7		CLK-	I						
8		GND	P	Ground	Ground				
9		D2+	I	Pixel data	B4-B7,DE	B2-B5,DE			Note3
10		D2-	I						
11		GND	P	Ground	Ground				
12		D1+	I	Pixel data	G3-G7,B2-B3	G1-G5,B0-B1			Note3
13		D1-	I						
14		GND	P	Ground	Ground				
15		D0+	I	Pixel data	R2-R7,G2	R0-R5,G0			Note3
16		D0-	I						
17		GND	P	Ground	Ground				
18		MSL	I	Selection of LVDS input map	Low or Open	High	Low or Open		
19		VCC	P	Power supply	Power supply				
20		VCC							

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: See “6.5 Display Colors and Input Data Signals”
Note4: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.
Note5: See “6.7 SCANNING DIRECTIONS”

3.2 CN2 Pin assignment (Back Light)

Connector Information	
LCD Module connector	DF14A-15P-1.25H(52)（HIROSE）
Matching connector	DF14-15S-1.25C（HIROSE）or equivalent

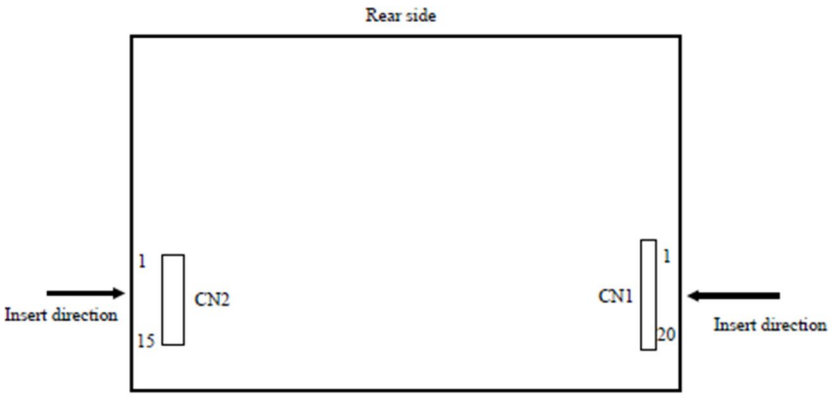
Table 3.2.1 Connector information

No	Symbol	I/O	Description	Remark
1	A1	P	Anode1	-
2	K1	P	Cathode1	-
3	A2	P	Anode2	-
4	K2	P	Cathode2	-
5	A3	P	Anode3	-
6	K3	P	Cathode3	-
7	A4	P	Anode4	-
8	K4	P	Cathode4	-
9	A5	P	Anode5	-
10	K5	P	Cathode5	-
11	A6	P	Anode6	-
12	K6	P	Cathode6	-
13	N.C.	-	-	Keep this pin open
14	N.C.	-	-	Keep this pin open
15	N.C.	-	-	Keep this pin open

Table 3.2.2 Pin Assignment for Back Light Interface

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

3.3 Positions of socket



4. Absolute Maximum Ratings

GND=0V

Item		Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	LCD panel signal processing board	VCC	-0.3	5.0	V	
Digital Input Voltage	Display signals	VD	-0.3	5.0	V	Note1
	Function signal	VF	-0.3	VCC+0.3	V	Note2
Storage temperature	Tst	-30 to +80			℃	
Operating temperature	TopF	-20 to +70			℃	Note3
	TopR	-20 to +70			℃	Note4
Relative Humidity Note5	RH	--		≤95	%	Ta≤40℃
		--		≤85	%	40℃＜Ta≤50℃
		--		≤55	%	50℃＜Ta≤60℃
		--		≤36	%	60℃＜Ta≤70℃
		--		≤24	%	70℃＜Ta≤80℃
Absolute Humidity Note5	AH	--		≤70 Note6	g/m³	Ta＞80℃

Table 4.1 Absolute Maximum Ratings

Note1: D0+/-, D1+/-, D2+/-, D3+/-, CLK+/-
Note2: Digital input voltage includes DPS, FRC, MSL.
Note3: Measured at LCD panel surface (including self-heat)
Note4: Measured at LCD module's rear shield surface (including self-heat)
Note5: No condensation
Note6: Water amount at Ta= 80°C and RH= 24%

5. Electrical Characteristics

5.1 DC Characteristics for Panel Driving

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power supply Voltage		VCC	3.0	3.3	3.6	V	include ripple
Power supply current		IVCC	-	TBD Note1	TBD Note2	mA	at VCC=3.3V
Power supply ripple		Vp-p	-	-	100	mV	for VCC
Digital input voltage	Low Level	VIL	GND	-	0.3*VCC	V	Note3
	High Level	VIH	0.7*VCC	-	VCC	V	

Table 5.1.1 DC characteristics

Note1: Checkered flag pattern [by IEC 61747-6]
Note2: Pattern for maximum current
Note3: Digital input voltage includes DPS, FRC, MSL

5.2 Fuse

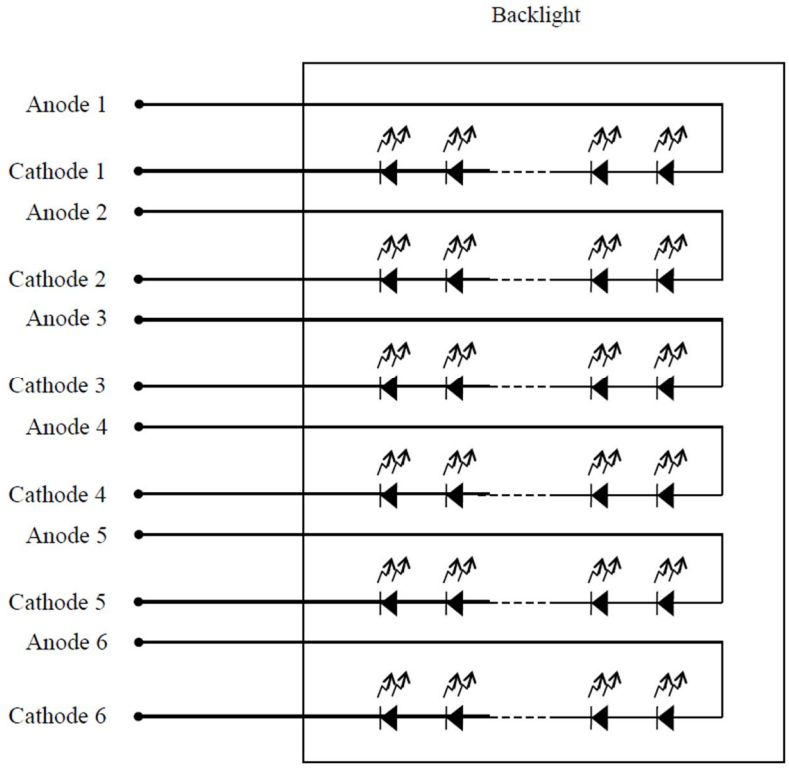
Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	(F0603HI2000V032T)	(AEM)	2.0A 32V	TBD	

5.3 DC Characteristics for Backlight Driving

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	10	-	mA	Note 1;54 LEDs (9S3P*2)
Forward Current Voltage	V_F	-	24.5	25.8	V	
Backlight Power Consumption	W_{BL}	-	1470	-	mW	
Operating Life Time	--	-	40000	-	hrs	Note 2 Note3

Table 5.3.1 LED Backlight Characteristics

Note1: IF is defined for Current value of one LED circuit
Note2: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced.
Note3: Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is estimated data.



5.4 Recommended Power ON/OFF Sequence

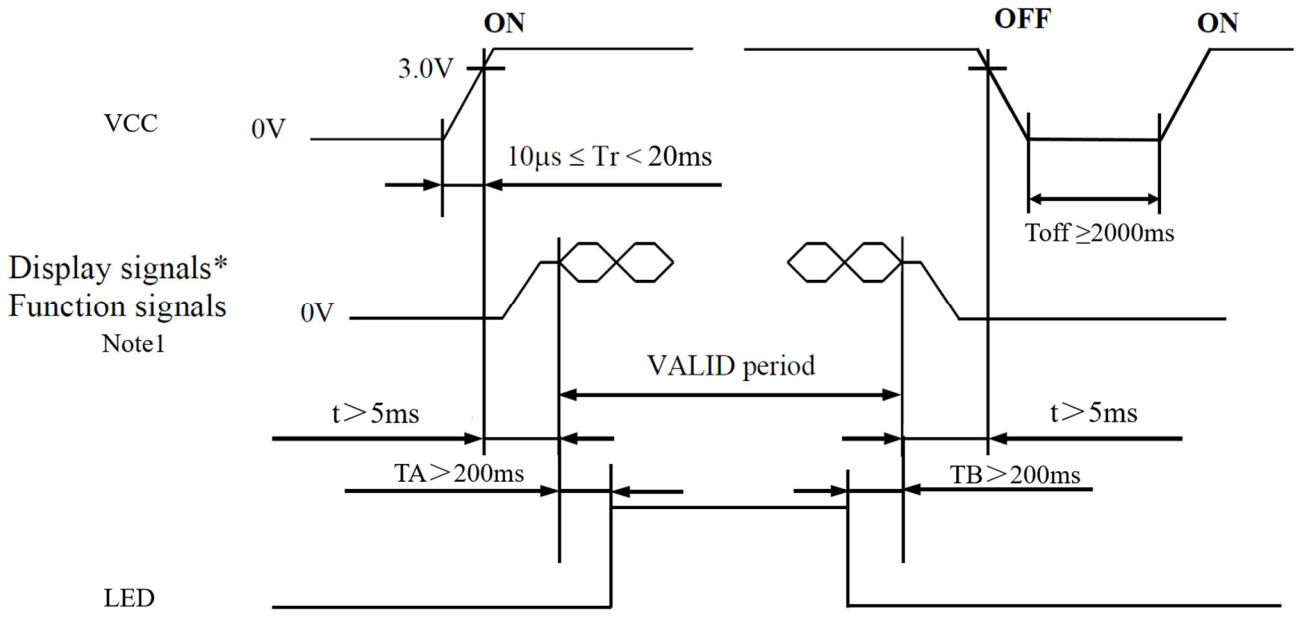


Figure 5.4Power on/off sequence

Note1: Display signals (D0+/-,D1+/-,D2+/-,D3+/-,CLK+/-) and function signal (DPS,FRC,MSL) 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.
Note2: Keep backlight turned off until the display has stabilized.

5.5 LCD Module Block Diagram

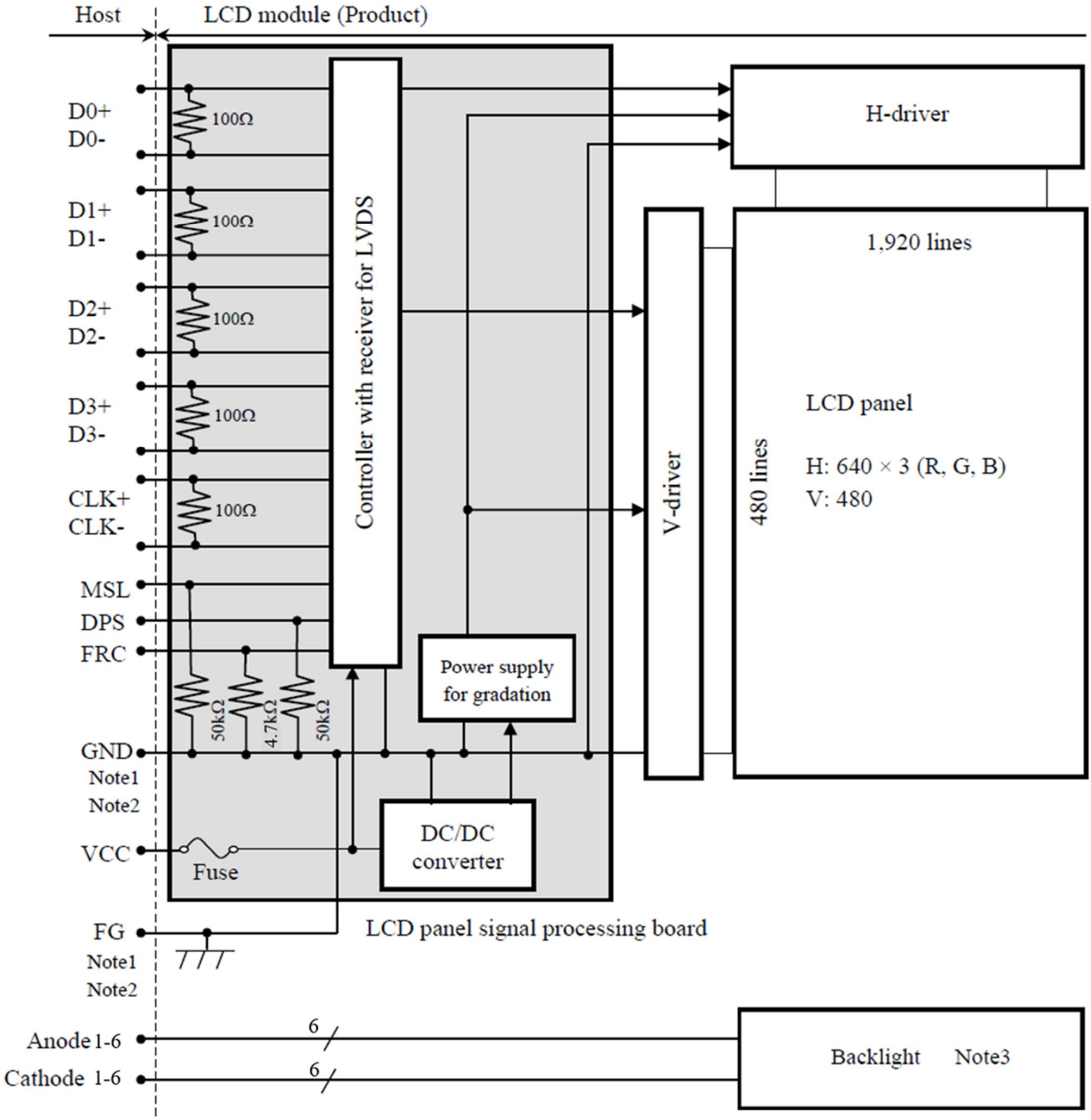


Figure 5.5 LCD Module Block Diagram

Note1: Relation between GND (Signal ground) and FG (Frame ground) in the LCD module is as follows.

GND - FG	Connected

Note2: GND and FG must be connected to customer equipment's ground, and it is recommended that these grounds to be connected together in customer equipment.

Note3: See 5.3 for details

6. Timing Characteristics

6.1 Data Input Timing Parameter Setting

TCON (Embedded In Source IC) Input Timing (DCLK, HSYNC, VSYNC, DE)

VCC=3.3V, GND=0V, Ta=25℃

Parameter			Symbol	Min	Typ	Max	Unit	Remark
CLK	Frequency		1/tc	21	25.2	29	MHz	
DE	Horizontal	Cycle	t_h	706	800	871	CLK	
		Display period	t_{hd}		640		CLK	
	Vertical (One frame)	Cycle	t_V	496	525	555	H	
		Display period	t_{vd}		480		H	
FR	Frame Rate		FR		60		Hz	

Table 6.1.1 Data Input Timing Parameters

Note1: Definition of parameters is as follows.

tc=1CLK , t_h= 1H

Note2: See the data sheet of LVDS transmitter

Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

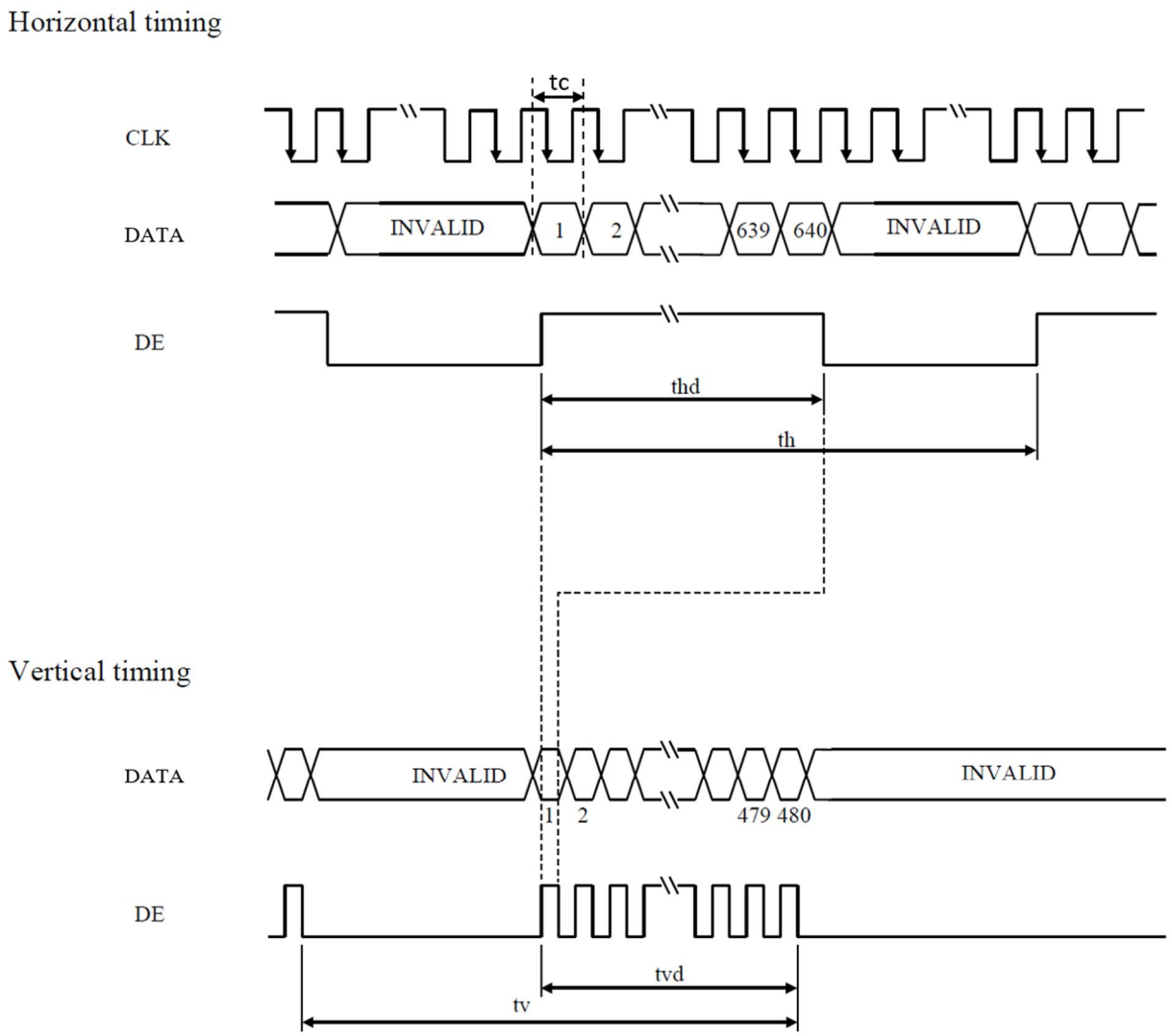


Figure 6.1.1 Data Input Timing

6.2 LVDS DC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Differential input high Threshold voltage	R_{XVTH}	-	-	0.1	V	R_{XVCM}=1.2V
Differential input Low Threshold voltage	R_{XVTL}	-0.1	-	-	V	
Input voltage range(single-end)	R_{XVIN}	0	-	VCC-1.0	V	
Differential input common Mode voltage	R_{XVCM}	0.6	1.2	2.4-$\|V_{ID}\|$/2	V	
Differential input voltage	$\|V_{ID}\|$	0.2	0.4	0.6	V	

Table 6.2.1 LVDS DC Electrical Characteristics

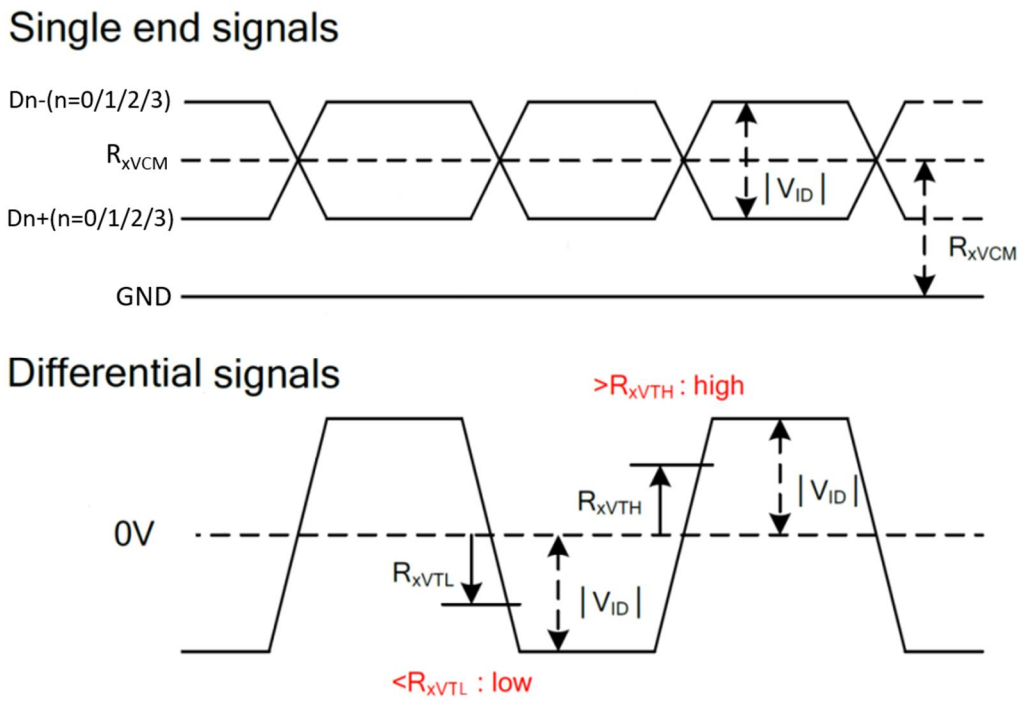


Figure 6.2.1 LVDS DC Electrical Characteristics

6.3 LVDS AC characteristics

VCC=3.3V, GND=0V, Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Clock Frequency	R_{xFCLK}	21	-	29	MHz	
Clock Period	R_{xTCLK}	34.4	-	47.6	ns	
1 data bit time	UI	-	1/7	-	R_{xTCLK}	
Clock high time	T_{LVCH}	-	4	-	UI	
Clock low time	T_{LVCL}	-	3	-	UI	
Position 1	T_{POS1}	-0.25	0	0.25	UI	
Position 2	T_{POS2}	0.75	-	1.25	UI	
Position 3	T_{POS3}	0.75	1	1.25	UI	
Position 4	T_{POS4}	1.75	-	2.25	UI	
Position 5	T_{POS5}	1.75	2	2.25	UI	
Position 6	T_{POS6}	2.75	-	3.25	UI	
Position 7	T_{POS7}	2.75	3	3.25	UI	
Position 8	T_{POS8}	3.75	-	4.25	UI	
Position 9	T_{POS9}	3.75	4	4.25	UI	
Position 10	T_{POS10}	4.75	-	5.25	UI	
Position 11	T_{POS11}	4.75	5	5.25	UI	
Position 12	T_{POS12}	5.75	-	6.25	UI	
Position 13	T_{POS13}	5.75	6	6.25	UI	
Position 14	T_{POS14}	6.75	-	7.25	UI	
Input eye width	T_{EYEW}	0.5	-	-	UI	
Input eye border	T_{EX}	-	-	0.25	UI	

Table 6.3.1 LVDS AC characteristics

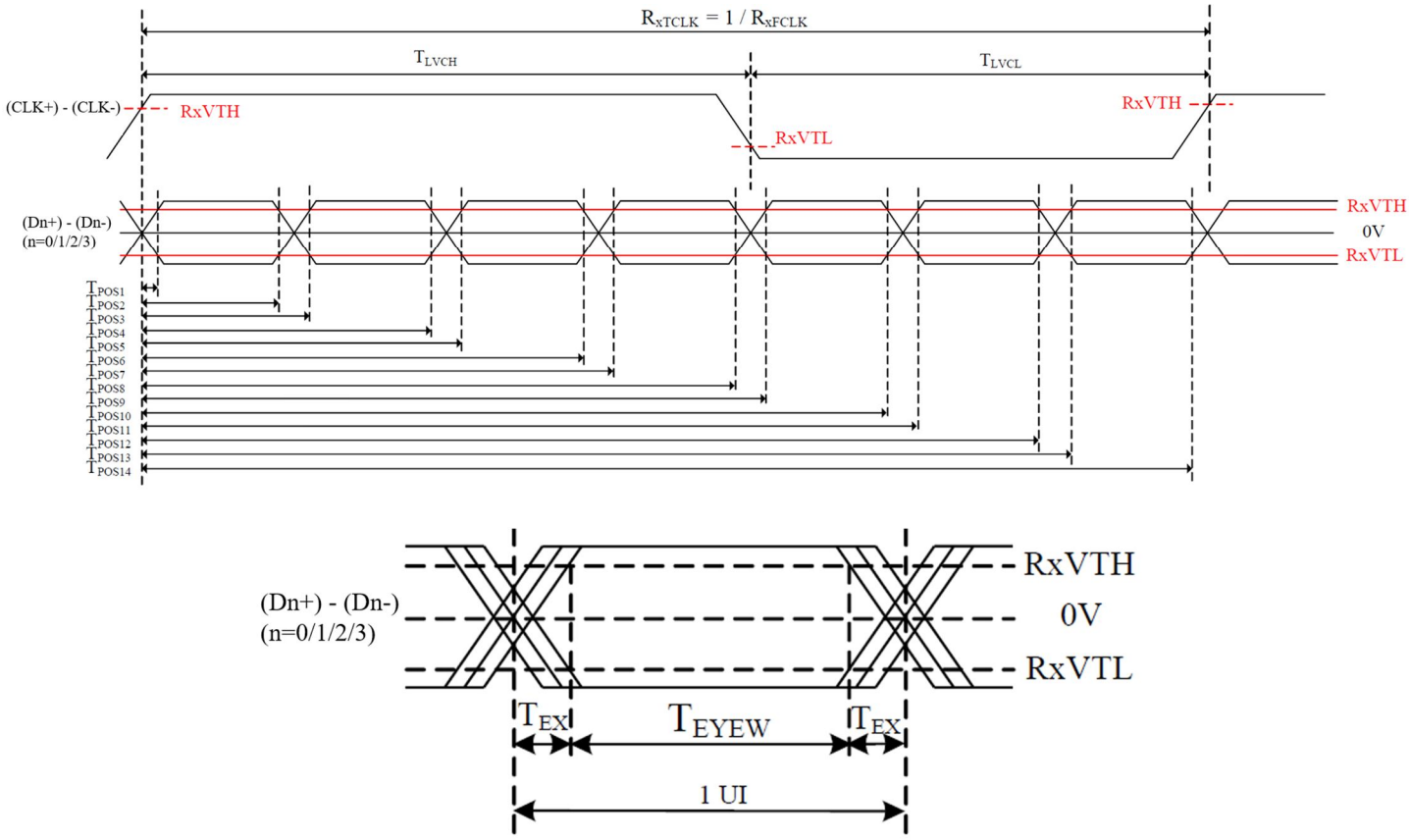
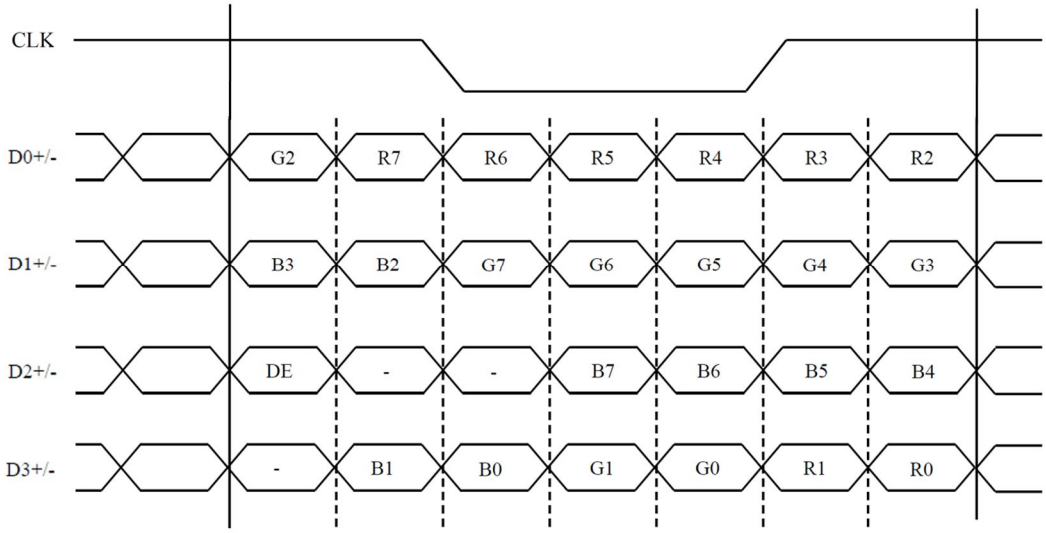


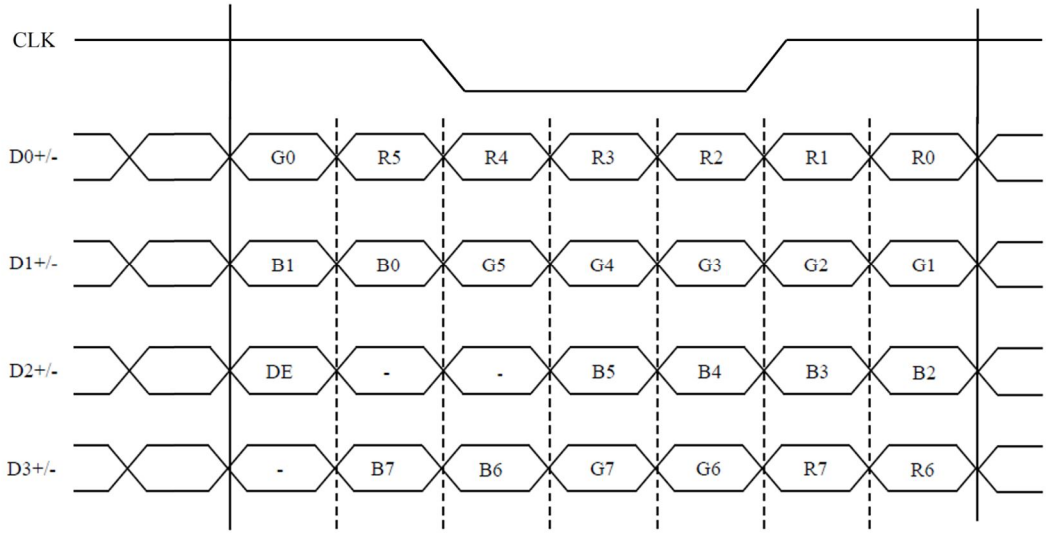
Figure 6.3.1 LVDS AC Electrical Characteristics

6.4 LVDS data mapping

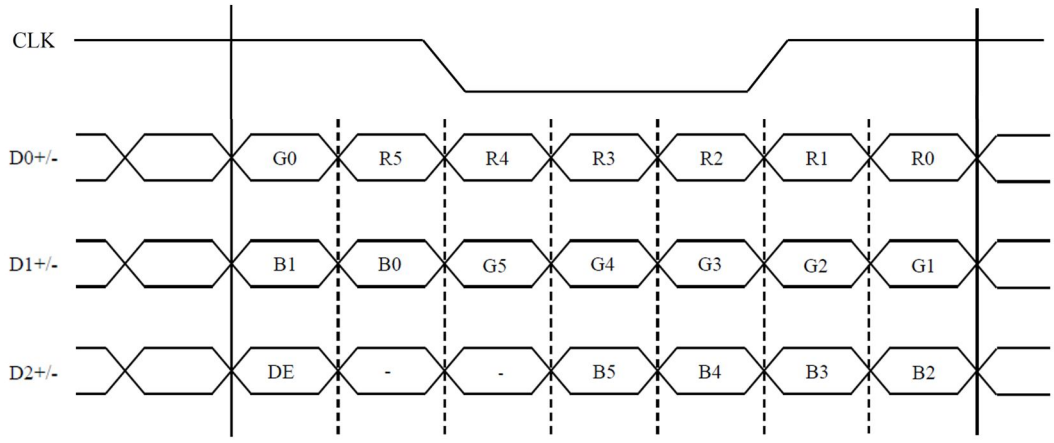
（1）Input data signal：8-bit, MAP A



（2）Input data signal：8-bit, MAP B



（3）Input data signal：6-bit



6.5 Display Colors and Input Data Signals

6.5.1 Combinations between input data signals, FRC signal and MSL signal

This product can display equivalent of 16,777,216 colors and 262,144 colors by combination between input data signals, FRC signal and MSL signal. See following table.

Combination	Input data signals	Input data mapping	CN1- Pin No.1 and 2	FRC terminal	MSL terminal	Display colors	Remarks	
①	8-bit	Map A	D3+/-	High	Low or Open	16,777,216	Note1	☆
②	8-bit	Map B	D3+/-	High	High	16,777,216	Note1	
③	6-bit	-	GND	Low or Open	Low or Open	262,144	Note2	☆

Note1: See"6.5.2 16,777,216 colors"
Note2: See"6.5.3 262,144 colors".

6.5.2 16,777,216

This product can display equivalent of 16,777,216 colors in 256 gray scales by combination ① and ②.
(See "6.5.1 Combinations between input data signals, FRC signal and MSL signal")
Also the relation between display colors and input data signals is as the following table.

Display colors		Data signal (0: Low level, 1: High level)																			
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑					:								:								:			
	↓					:								:								:			
	bright	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↑					:								:								:			
	↓					:								:								:			
	bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑					:								:								:			
	↓					:								:								:			
	bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

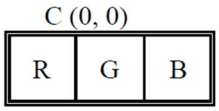
6.5.3 262.144 colors

This product can display equivalent of 16,777,216 colors in 256 gray scales by combination ③. (See "6.5.1 Combinations between input data signals, FRC signal and MSL signal")
Also the relation between display colors and input data signals is as the following table.

Display colors		Data signal (0: Low level, 1: High level)																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	dark	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑				:						:						:		
	↓				:						:						:		
	bright	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↑				:						:						:		
	↓				:						:						:		
	bright	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑				:						:						:		
	↓				:						:						:		
	bright	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

6.6 DISPLAY POSITIONS

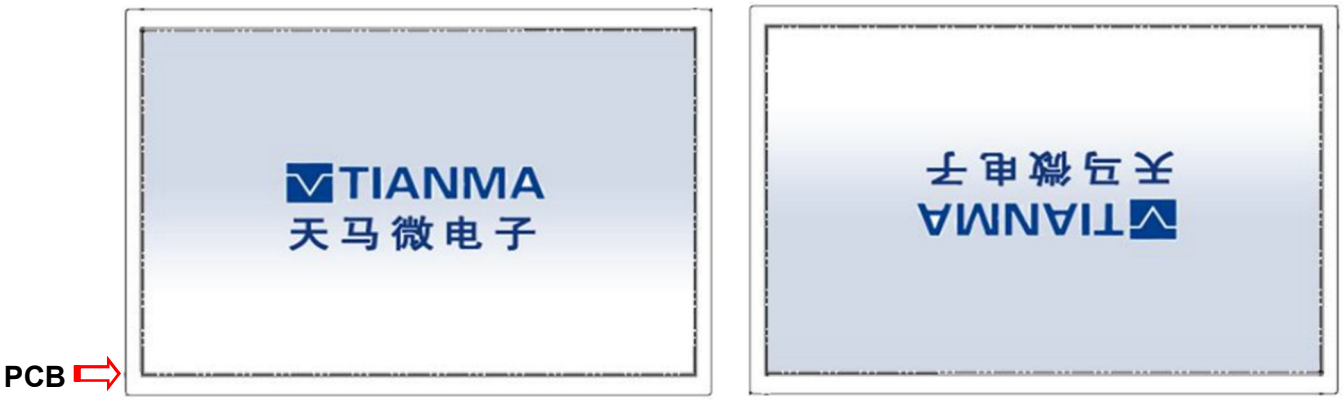
The following tables is the coordinates per pixel (See"6.7 SCANNING DIRECTIONS".)



C(0, 0)	C(1, 0)	· · ·	C(X, 0)	· · ·	C(638, 0)	C(639, 0)
C(0, 1)	C(1, 1)	· · ·	C(X, 1)	· · ·	C(638, 1)	C(639, 1)
· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·
C(0, Y)	C(1, Y)	· · ·	C(X, Y)	· · ·	C(638, Y)	C(639, Y)
· · ·	· · ·	· · ·	· · ·	· · ·	· · ·	· · ·
C(0, 478)	C(1, 478)	· · ·	C(X, 478)	· · ·	C(638, 478)	C(639, 478)
C(0, 479)	C(1, 479)	· · ·	C(X, 479)	· · ·	C(638, 479)	C(639, 479)

6.7 SCANNING DIRECTIONS

The following figures are figures are seen from a front view. Also the arrow show the direction of scan.



Normal scan (DPS: Low or Open)

Reverse scan (DPS: High)

7. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θU	CR≧10	70	88	-	Degree	Note 2
		θD		70	88	-		
		θL		70	88	-		
		θR		70	88	-		
Contrast Ratio		CR	θ=0°	600	800	-		Note1 Note3
Response Time		T_{ON}	25℃		25	35	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	TBD	(0.313)	TBD		Note1 Note5
		y		TBD	(0.329)	TBD		
	Red	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
	Green	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
	Blue	x		TBD	TBD	TBD		
		y		TBD	TBD	TBD		
Uniformity		U		72	80	-	%	Note1 Note6
NTSC				33	36	-	%	Note 5
Luminance (Without TP)		L		740	900	-	cd/m^2	Note1 Note7

Table 7.1 Optical Parameters

Test Conditions:
1. I_F= 10mA, and the ambient temperature is 25℃.

2. The test systems refer to Note1 ~ Note7.

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.

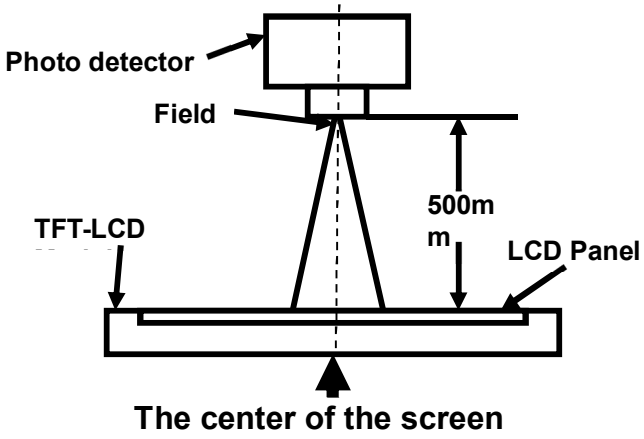


Fig1. Measurement Set Up

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

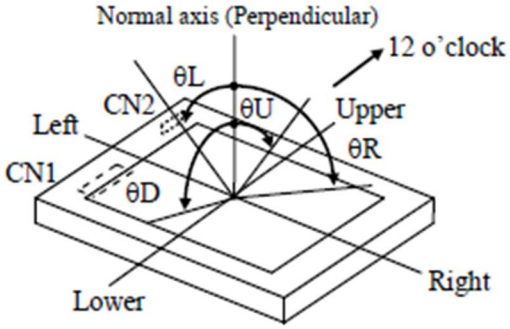


Fig2. Measurement viewing angle

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%.

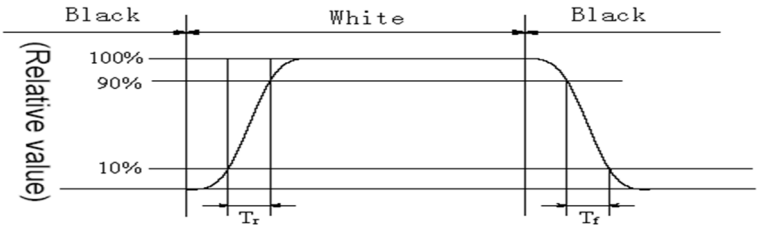


Fig3. Response Time Testing(SFT)

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

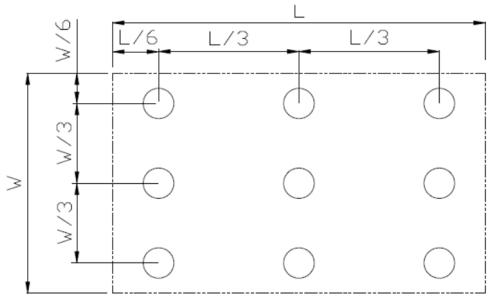


Fig4. Luminance Uniformity Measurement Locations(9 points)

Note7: Definition of Luminance:

Measure the luminance of white state at center point.

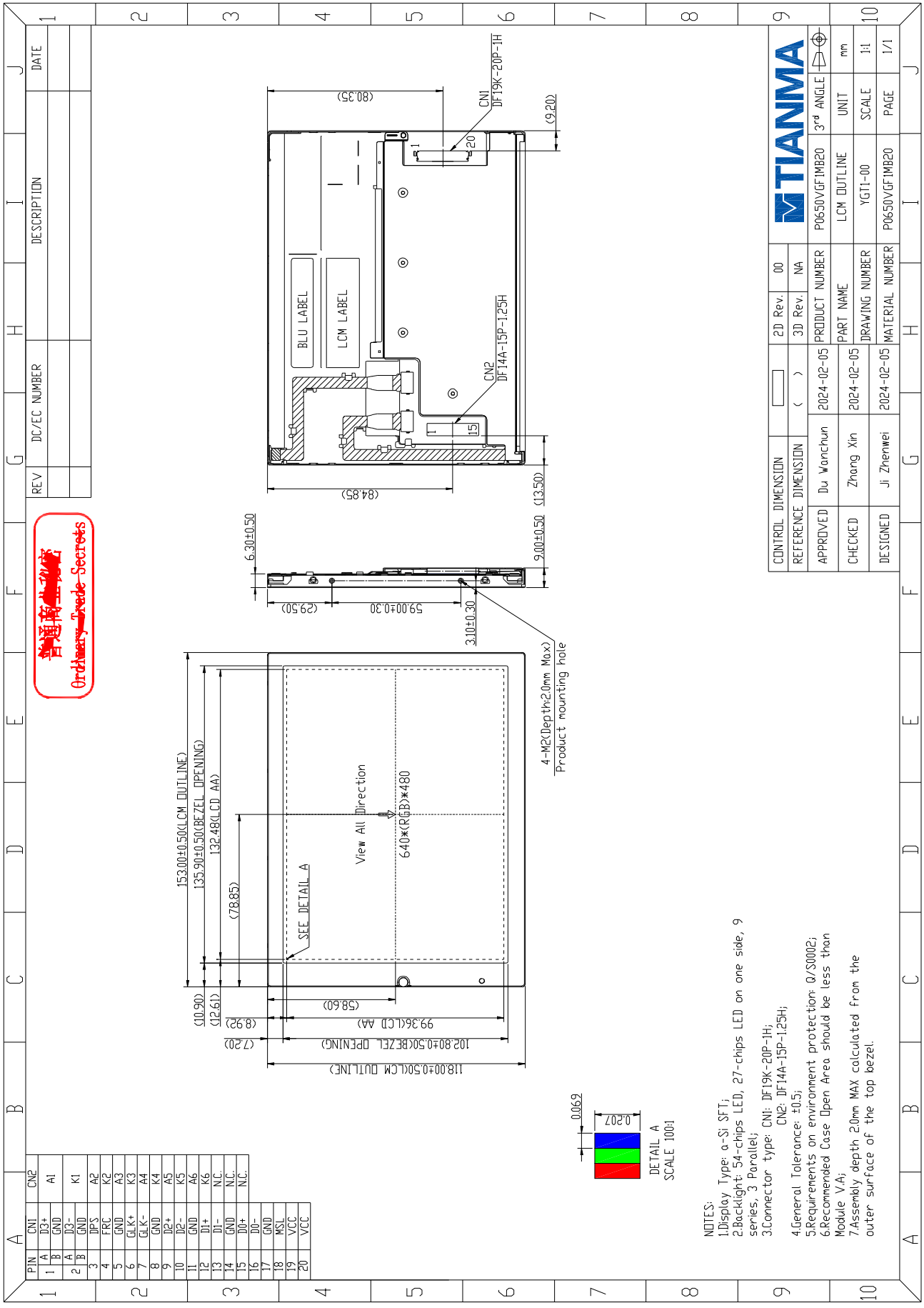
8. Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +70℃, 240 hours	IEC60068-2-2:2007 GB2423.2-2008
2	Low Temperature Operation	Ta = -20℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +80℃, 240hours	IEC60068-2-2:2007 GB2423.2-2008
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature and Humidity Operation	Ta = +60℃, 90% RH max,240hours	IEC60068-2-78 :2012 GB/T2423.3—2016
6	Thermal Shock (non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 100 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:2009,GB2423.22-2012
7	ESD	C=150pF,R=150Ω,9point/panel Contact:±10Kv,10times;	IEC61000-4-2:2008 GB/T17626.2-2018
8	Vibration Test (non-operation)	5~100HZ ，19.60m/s2 1min/cycle 120times Per X\Y\Z	IEC60068-2-6:2007 GB/T2423.10—2019
9	Shock Test (non-operation)	539m/s2, 11ms 5times ±X、±Y、±Z	GB/T 2423.5-1995
10	Package Drop Test	Height:60cm, 1corner,3edges,6surfaces	GB/T 4857.5-1995
11	Package Vibration	Frequency：5-20-200HZ，PSD： 0.01-0.01-0.001 Total:0.781g2/HZ, x/y/z axis per 30min ）	GB/T 4857.23-2021

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 24 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)	Quantity	Remark
1	LCM	P0650VGF2MA20	153.0×118.0×9.0	(0.170)	24	
2	Tray	PET	356×256×19.7	0.125	15	1150379740
3	Dust-proof Bag	PE	680×520	0.042	1	1680399440
4	EPE1	EPE	336×246×6	0.01	6	680402130
5	EPE 2	EPE	375×275×10	0.014	4	1680402140
6	EPE 3	EPE	250×280×12	0.015	2	680402150
7	Carton	CORRUGATED PAPER	398×290×315	0.58	1	680346281
8	Lable	tagboard	100×52	0.002	1	690000280
9	Total weight	(6.725) Kg				

Table 10.1 Packing Instruction

Packaging Specification and Quantity

(1) LCM quantity per tray:2
(2) Total LCM quantity per group:8(4 trays+1 tray)
(2) Total LCM quantity in Carton: Number of PET trays 12× quantity per tray 2= 24
Note: Please refer to the data from “estimated report about the dimension and stack of Carton ”about stacking carton

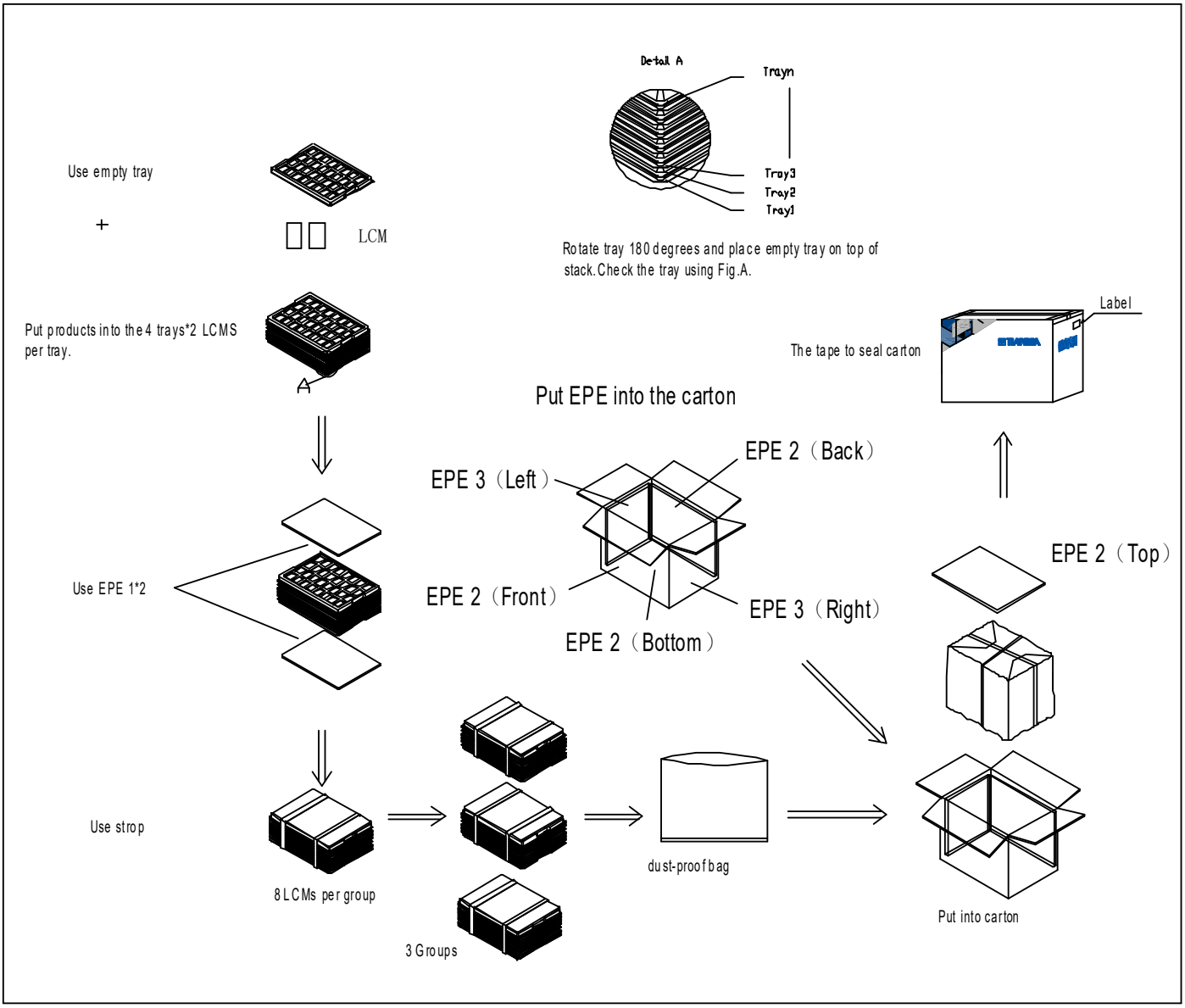
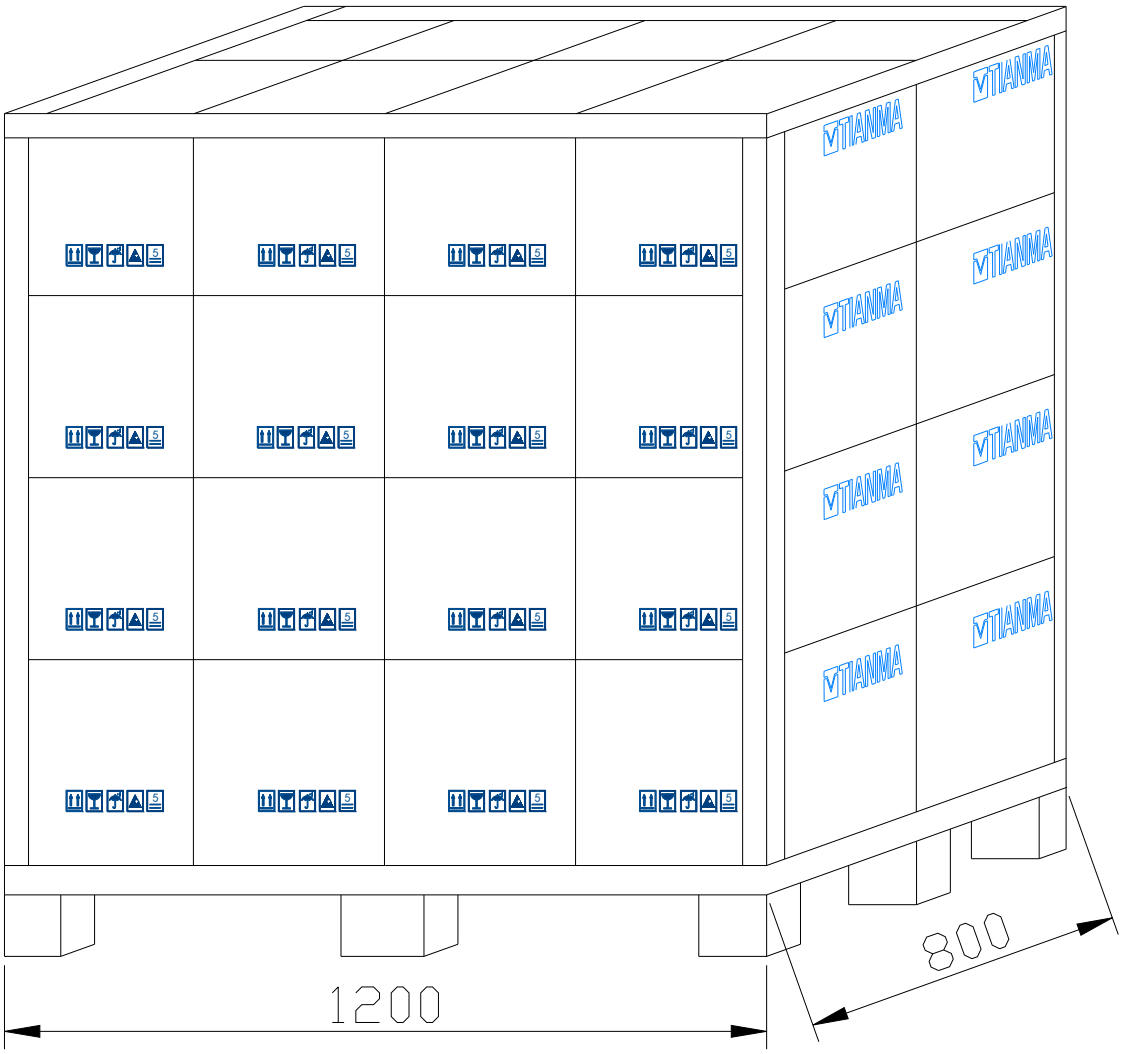


Figure 10.1 Packing Instruction

Stack placement

The number of cartons stacked is 2 x 4/ each layer x 4 layers in total



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 t hem 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.