

MODEL NO. : P0650VGF1MA10**Module version** A**VERSION :** Ver 1.0**ISSUED DATE:** 2021-03-25☒ **Preliminary Specification**☐ **Final Product Specification****Customer :** _____

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by
Chunhui Yang		

This technical specification is subjected to change without prior notice.

Table of Contents

Table of Contents	2
Record of Revision.....	3
1 General Specifications.....	4
2 Input/Output Terminals	5
3 Absolute Maximum Ratings.....	6
4 Electrical Characteristics	7
5 Timing Chart.....	10
6 Optical Characteristics	13
7 Environmental / Reliability Test.....	16
8 Mechanical Drawing	17
9 Packing drawing.....	18
10 Precautions for Use of LCD Modules	19

Record of Revision

[illegible]

1 General Specifications

Feature		Spec
Display Spec.	Size	6.5 inch
	Resolution	640(RGB) x 480
	Technology Type	a-Si TFT
	Pixel Pitch (mm)	0.207 (H) x 0.207(V)
	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) (mm)	153.00x 118.00 x 10.9
	Active Area(mm)	132.48×99.36
	With /Without TSP	Without Touch Screen
	Weight (g)	TBD
	Matching Connection Type	CN1: P24013P20 CN2: STM P24016
Electrical Characteristics	Interface	LVDS
	Color Depth	16.7M/262K

Note 1: Requirements on Environmental Protection: Q/S0002

Note 2: LCM weight tolerance: +/- 5%

2 Input/Output Terminals

2.1 CN1(LCD)

Connector type: MSB24013P20

Matching connector: P24013P20 or DF19-20S-1C

PIN	Symbol	I/O	Description	Remark
1	VCC	P	Power supply,+3.3V(typical)	
2	VCC	P	Power supply,+3.3V(typical)	
3	GND	P	Ground	
4	Mode	I	L: 6bit H: 8bit	
5	Link 0-	I	LVDS Receiver Signal(-)	
6	Link 0+	I	LVDS Receiver Signal(+)	
7	GND	P	Ground	
8	Link 1-	I	LVDS Receiver Signal(-)	
9	Link 1+	I	LVDS Receiver Signal(+)	
10	GND	P	Ground	
11	Link 2-	I	LVDS Receiver Signal(-)	
12	Link 2+	I	LVDS Receiver Signal(+)	
13	GND	P	Ground	
14	CLKIN-	I	LVDS Receiver Clock Signal(-)	
15	CLKIN+	I	LVDS Receiver Clock Signal(+)	
16	NC	I	Not connected	
17	U/D	I	Vertical reverse (H: up to down scan L: down to up scan)	
18	R/L	I	Horizontal reverse (H: left to right scan L : right to left scan)	
19	Link 3-	I	LVDS Receiver Signal(-)	
20	Link 3+	I	LVDS Receiver Signal(+)	

I---Input, O---Output, P--- Power/Ground

Table 2.1 terminal pin assignments

Note 1: Scan direction is shown as below(PCB at down side):

PCB →



SC=0



SC=1

2.2 CN2(Backlight)

Connector type: MS24016RHD

Matching connector: STM P24016

No	Symbol	I/O	Description	Remark
1	VLED	I	12V Input	
2	VLED	I	12V Input	
3	GND	P	Ground	
4	GND	P	Ground	
5	LED On/Off	I	3.3V On; GND Off	
6	PWM DIM	I	Dimming signal	

Table2.2 Backlight pin assignment

3 Absolute Maximum Ratings

 $T_a = 25^{\circ}\text{C}$

Item	Symbol	Min	Max	Unit	Remark
Power Voltage for LCD	VCC	-0.5	5.0	V	Note1
Input voltage for LCD	Vin	-0.5	5.0	V	
Operating Temperature	TOPR	-30	+80	$^{\circ}\text{C}$	Note2
Storage Temperature	TSTG	-40	+90	$^{\circ}\text{C}$	
Relative Humidity Note2	RH	--	≤ 95	%	$T_a \leq 40^{\circ}\text{C}$
		--	≤ 85	%	$40^{\circ}\text{C} < T_a \leq 50^{\circ}\text{C}$
		--	≤ 55	%	$50^{\circ}\text{C} < T_a \leq 60^{\circ}\text{C}$
		--	≤ 36	%	$60^{\circ}\text{C} < T_a \leq 70^{\circ}\text{C}$
		--	≤ 24	%	$70^{\circ}\text{C} < T_a \leq 80^{\circ}\text{C}$
Absolute Humidity	AH	--	≤ 70	g/m^3	$T_a > 70^{\circ}\text{C}$

Table 3.1 absolute maximum rating

Note1: V_{IN} represents Mode,SC,LVDS data etc..

Note2: T_a means the ambient temperature.

It is necessary to limit the relative humidity to the specified temperature range.
Condensation on the module is not allowed.

4 Electrical Characteristics

4.1 Recommended Operating Condition

VCC=3.3V, GND=0V, Ta = 25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power supply Voltage	VCC	(3.00)	3.30	(3.60)	V	
Power supply ripple	Vp-p	-	-	TBD	mV	
Power supply current	IDD	-	TBD	-	mA	
Power consumption	P	-	TBD	-	mW	Note1
Input voltage threshold	Low level	VIL	0	-	0.3VCC	V
	High level	VIH	0.7VCC	-	VCC	V
Inrush current	Irush	-	-	1.5	A	Note2

Table 4.1 LCD module electrical characteristics

Note1: To test the current dissipation, using the “white” testing pattern.

Vcc rising time is 470μs

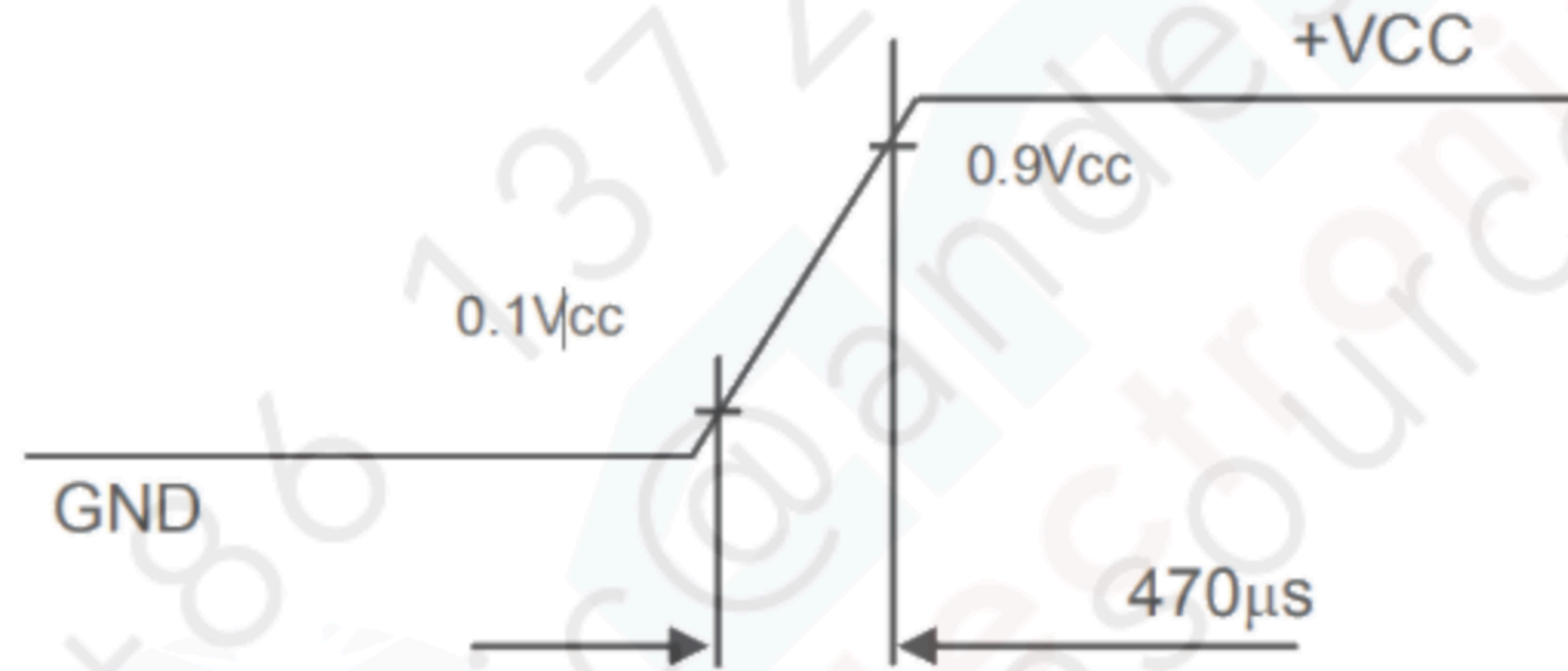


Figure4.1 Inrush current test condition

4.2 Backlight Unit Driving Condition

(GND=0V, Ta=25°C)

Item	Symbol	MIN	TYP	MAX	Unit	Remark
LED driver input voltage	VLED	9	12	13	V	100% Duty
LED driver input current	ILED	—	TBD	—	mA	100% Duty
Backlight Power Consumption	W _{BL}	—	TBD	—	mW	100% Duty
VLED On/Off	on	TBD	3.3	—	V	
	off	—	0	TBD	V	
PWM voltage	High	TBD	3.3	—	V	
	Low	—	0	TBD	V	
Dimming Frequency	Fpwm	TBD	—	TBD	HZ	
Dimming Duty	Dpwm	TBD	—	100	%	
Life Time	Lf	50000	70000	—	hrs	Note

Table 4.2 Backlight Unit Driving Condition

Note1: The LED driving condition is defined for total LED module.

Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: Optical performance should be evaluated at Ta=25°C only If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note4: The LED driving condition is defined for each LED module.



4.3 BLOCK DIAGRAM

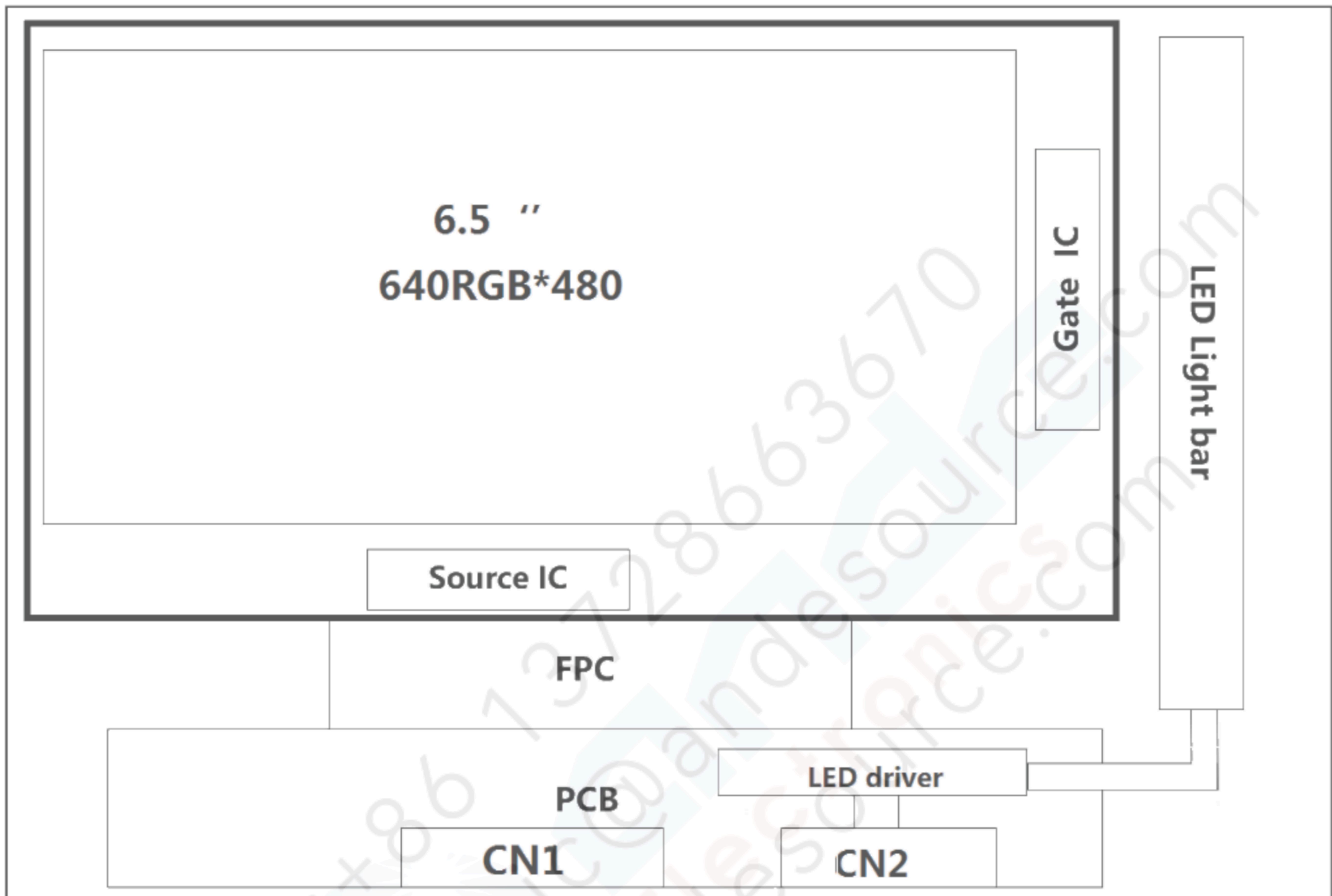


Figure4.3 Block diagram

5 Timing Chart

5.1 Input Timing

VCC=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
CLK frequency	F _{clk}	19.7	20.7	47.2	MHz	
Horizontal blanking time	t _{HBT}	26	34	506	t _{clk}	
Horizontal display area	t _{HD}	-	640	-	t _{clk}	
Horizontal period	t _H	666	674	1146	t _{clk}	
Vertical blanking time	t _{VBT}	13	32	206	t _H	
Vertical display area	t _{VD}	-	480	-	t _H	
Vertical period	t _V	493	512	686	t _H	
Frame Rate	F	-	60	-	HZ	

Note: DE mode, HSYNC&VSYNC is unnecessary.

Table 5.1 Timing table

5.2 Timing Diagram

Horizontal input timing

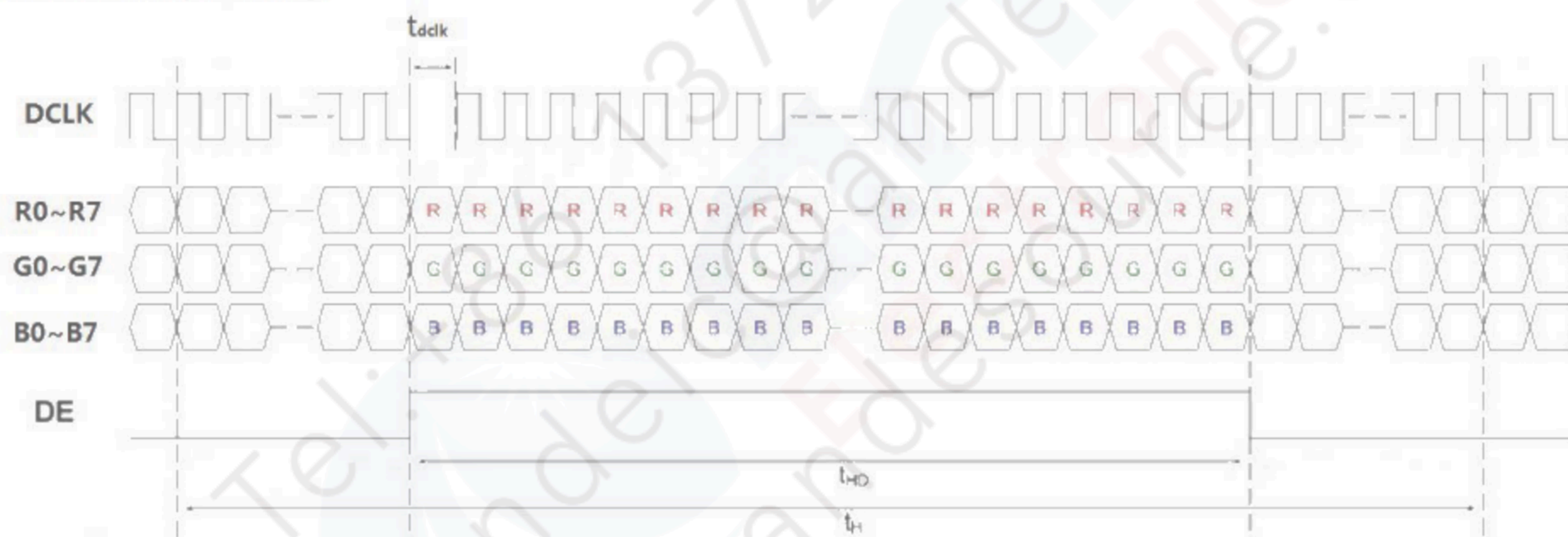


Figure 5.2.1 Horizontal input timing

Vertical input timing

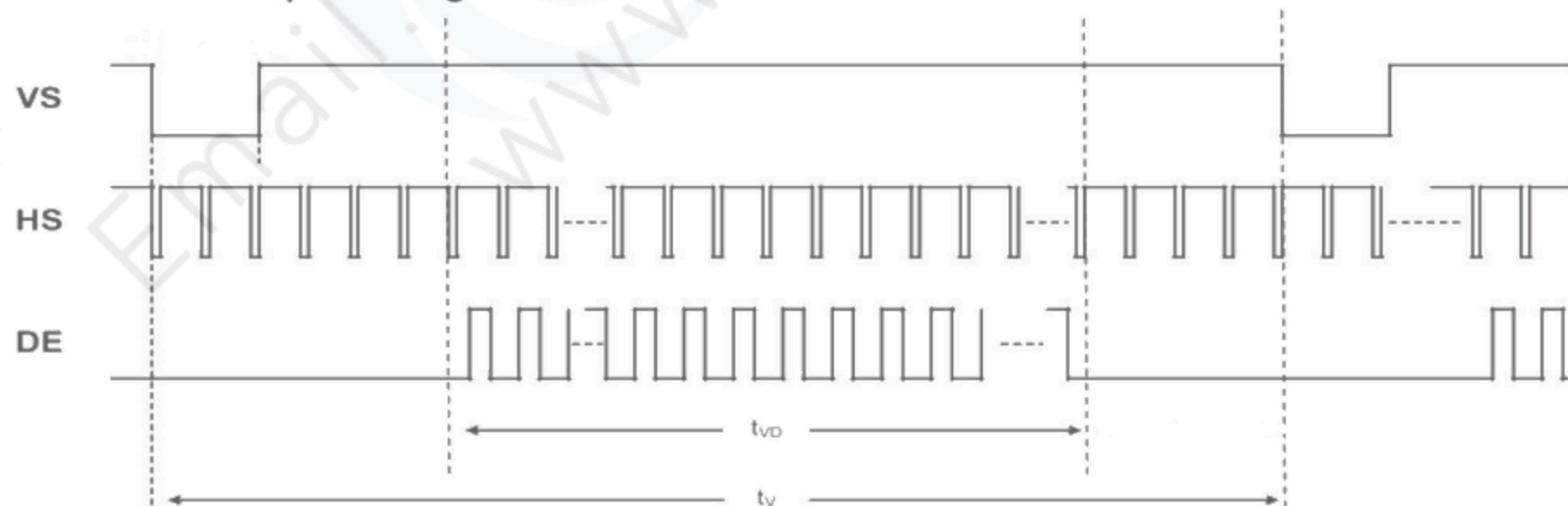


Figure 5.2.2 Vertical input timing

Note: HS/VS waveform is for reference only.

The information contained herein is the exclusive property of TIANMA MICRO-ELECTRONICS Corporation and shall not be distributed, reproduced, or disclosed in whole or in part without prior written permission of TIANMA MICRO-ELECTRONICS Corporation.

5.3 LVDS data mapping

8-bit mode data input

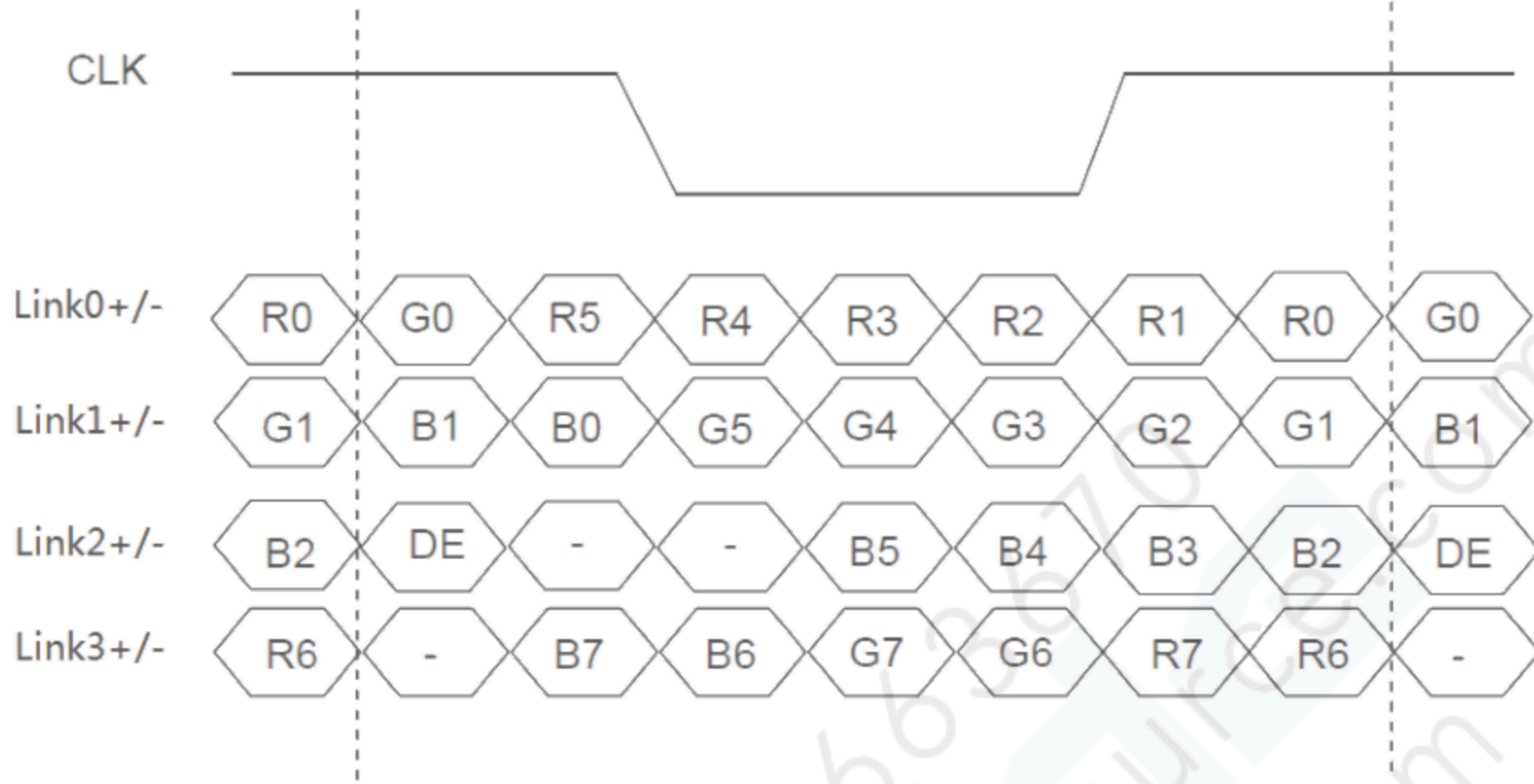


Figure 5.3.1 LVDS 8bit(Mode=H)

6-bit mode data input

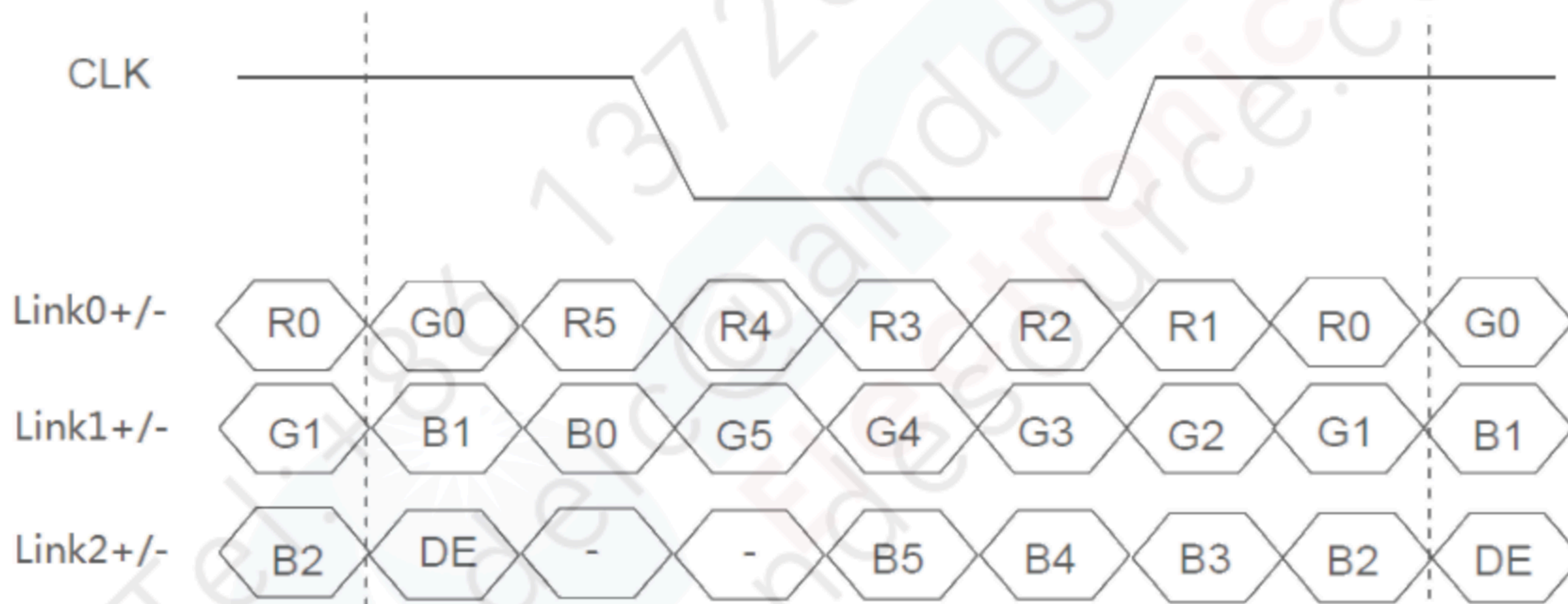


Figure 5.3.2 LVDS 6bit(Mode=L)

5.4 POWER ON/OFF SEQUENCE

Item	Symbol	Min	Typ	Max	Unit	Remark
VCC on to VCC stable	TP1	0.5	-	3	ms	
VCC stable to signal on	TP2	1	-	-	ms	
Signal on to LED on	TP3	200	-	-	ms	
VDD off time	TP4	0	-	10	ms	
VDD off to next VDD on	TP5	500	-	-	ms	
Signal off before VDD off	TP6	1	-	-	ms	
LED off before signal off	TP7	200	-	-	ms	

Table 5.4 Power on/off sequence

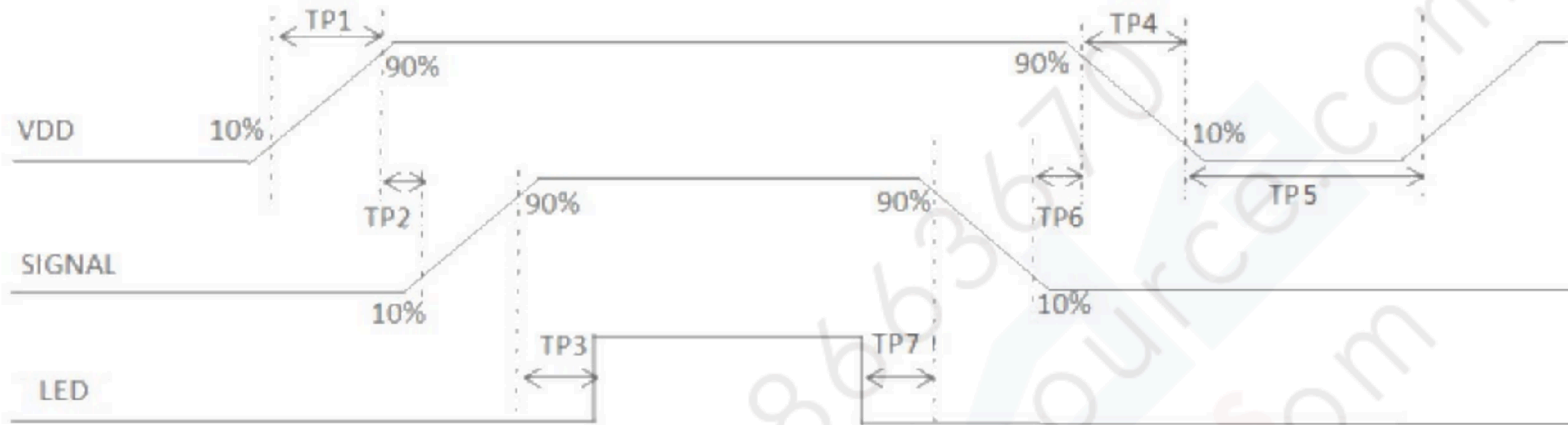


Figure 5.4 Power on/off sequence

6 Optical Characteristics

Ta=25℃

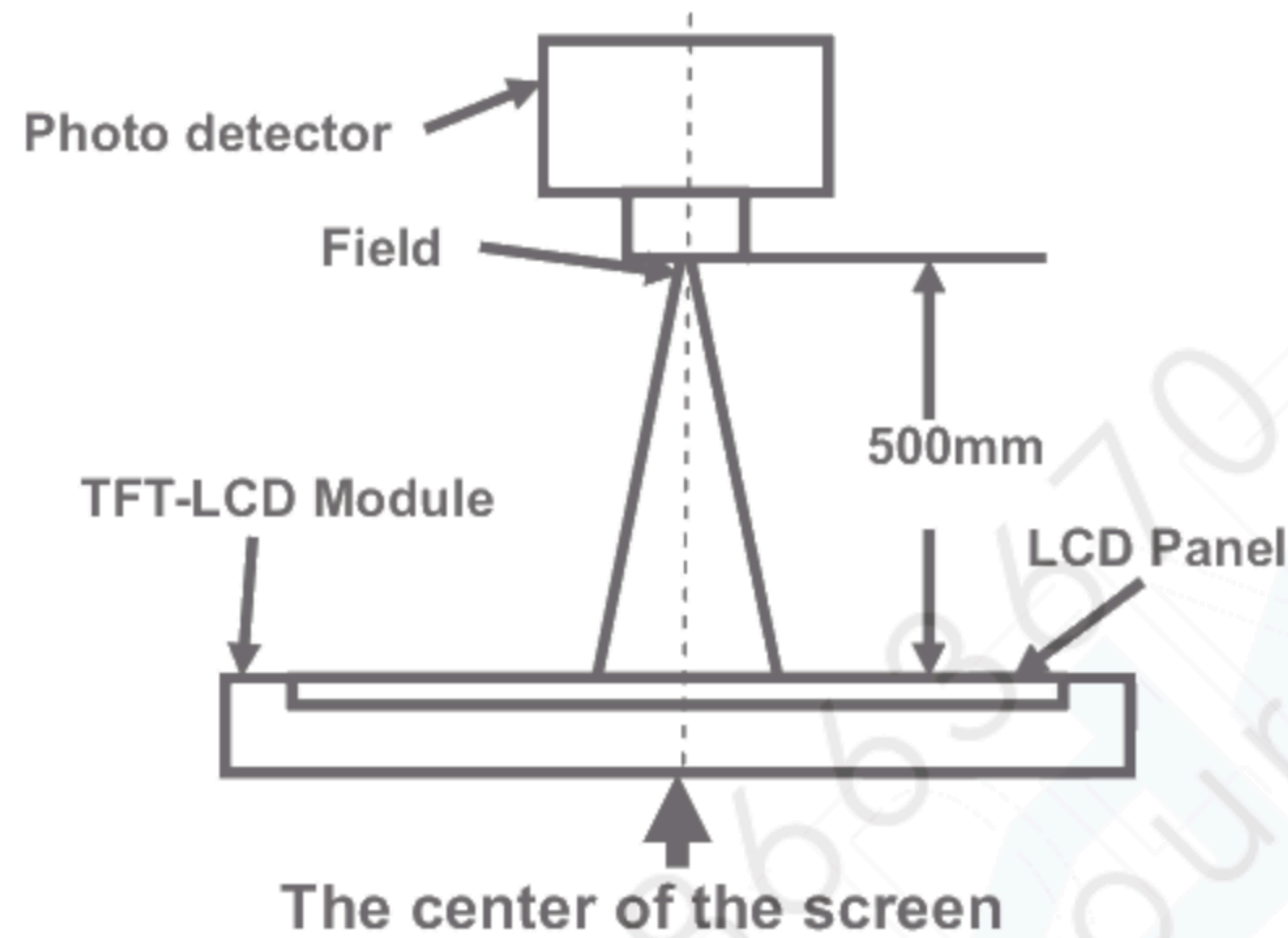
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧ 10	75	88	-	Degree	Note 2
		θB		75	88	-		
		θL		75	88	-		
		θR		75	88	-		
Contrast Ratio		CR	θ=0°	700	900	-		Note1 Note3
Response Time		T _{ON}	25℃	-	30	35	ms	Note1 Note4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.263	0.313	0.363		Note1 Note5
		y		0.279	0.329	0.379		
	Red	x		-	-	-		
		y		-	-	-		
	Green	x		-	-	-		
		y		-	-	-		
	Blue	x		-	-	-		
		y		-	-	-		
Uniformity		U		75	80	-	%	Note1 Note6
NTSC				65	70	-	%	Note 5
Luminance (Without TP)		L		600	800	-	cd/m ²	Note1 Note7

Test Conditions:

1. $I_F = 120$ mA, and the ambient temperature is $25 \pm 2^\circ\text{C}$. humidity is $65 \pm 7\%$
2. The test systems refer to Note 1 and Note 2.

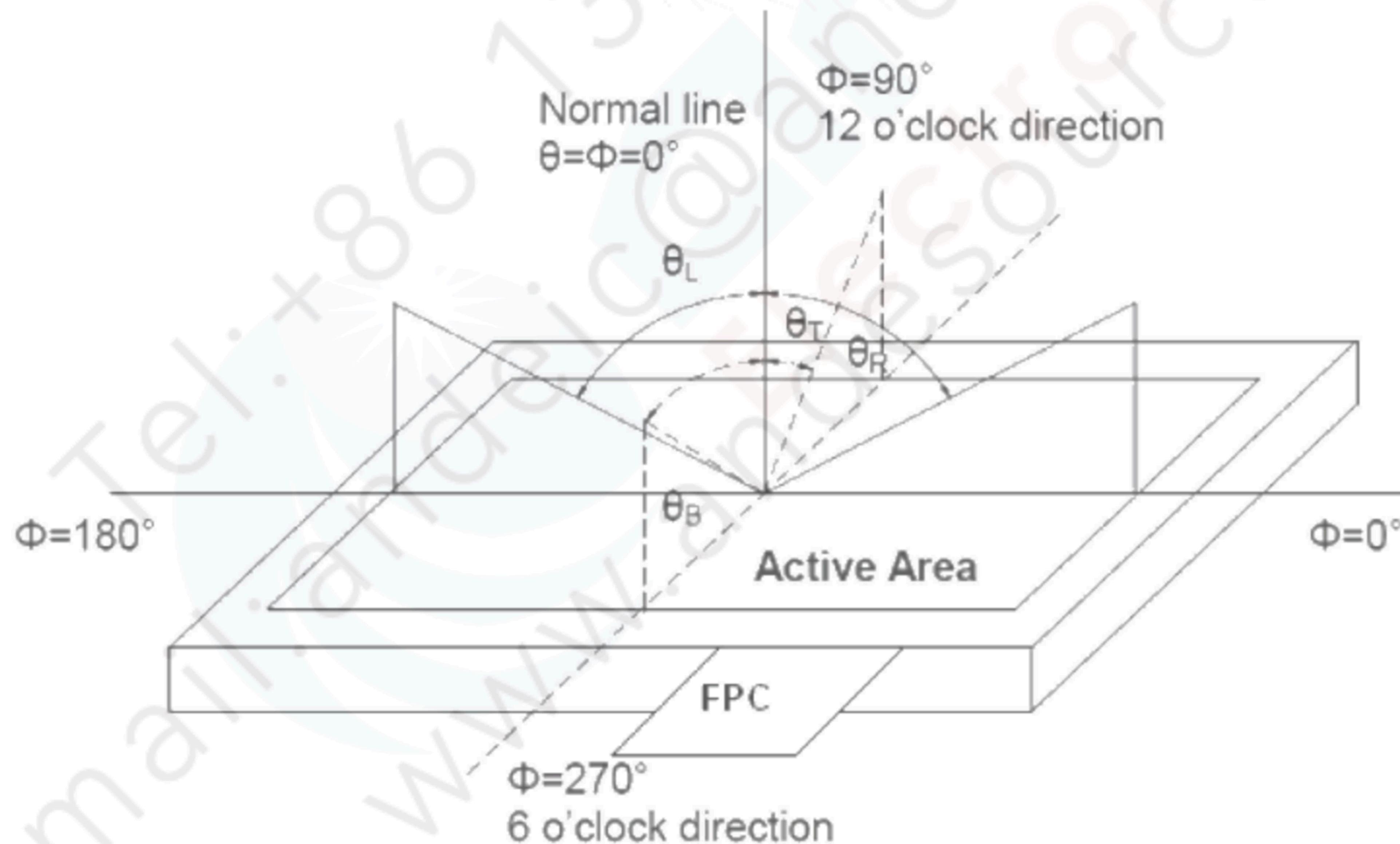
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).



Note 3: Definition of contrast ratio

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

"White state ": The state is that the LCD should drive by V_{white} .

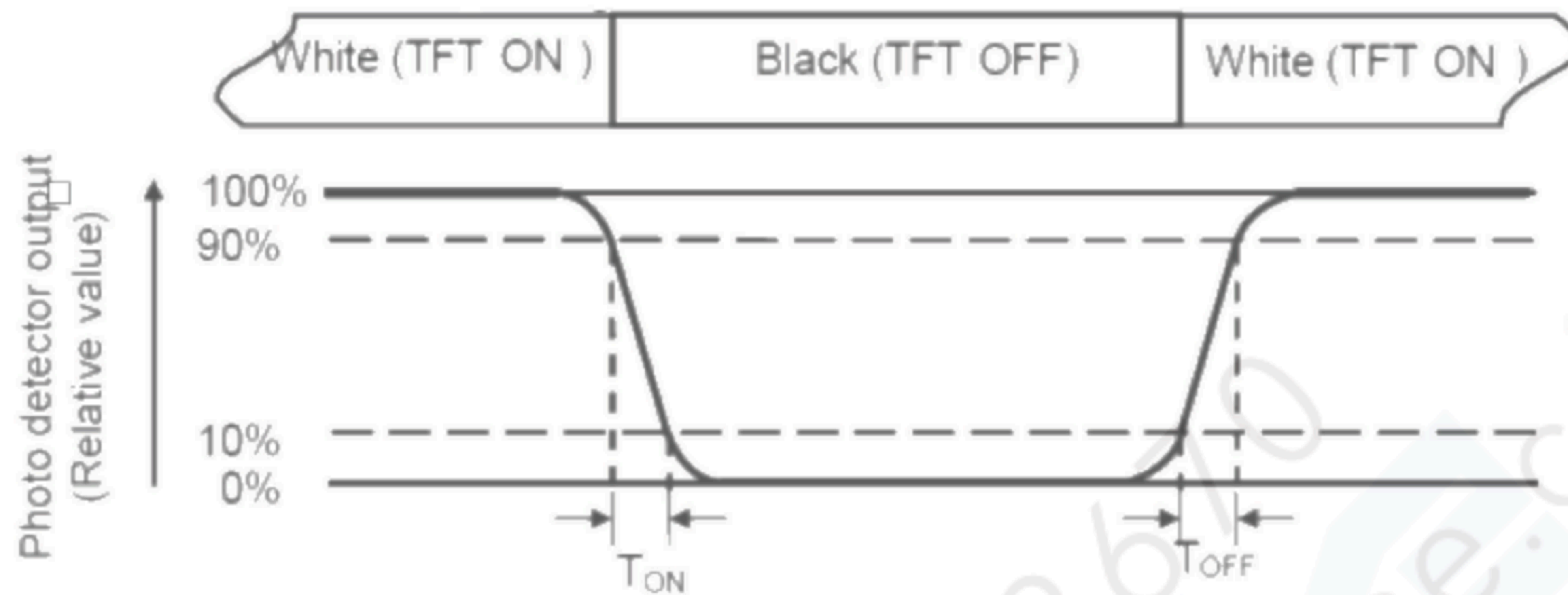
"Black state": The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

The information contained herein is the exclusive property of TIANMA MICRO-ELECTRONICS Corporation and shall not be distributed, reproduced, or disclosed in whole or in part without prior written permission of TIANMA MICRO-ELECTRONICS Corporation.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

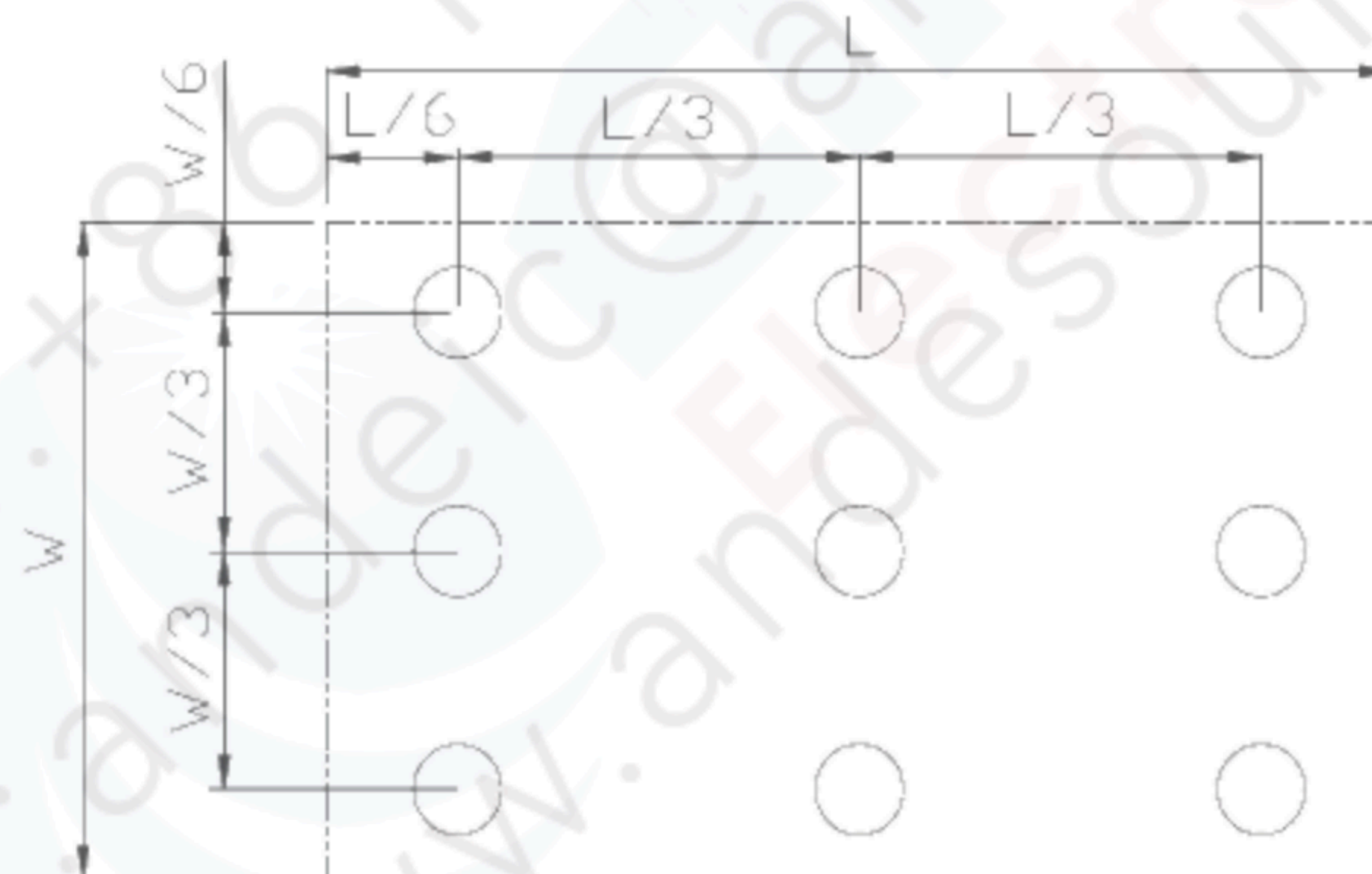
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

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

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



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

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

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +80℃, 300 hours	IEC60068-2-1 GB2423.2
2	Low Temperature Operation	Ta = -30℃, 300 hours	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +90℃, 300 hours	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -40℃, 300 hours	IEC60068-2-1 GB2423.1
5	High Temperature and Humidity Operation	Ta = +60℃, 90% RH max,300hours	IEC60068-2-78 GB/T2423.3
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,GB2423.22
7	ESD	C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2
8	Vibration Test (Non Op)	5~100HZ , 19.60m/s ² 1min/cycle 120times Per X\Y\Z	IEC60068-2-6 GB/T17626.6
9	Mechanical Shock (Non Op)	539m/s ² , 11ms 5times ±X、±Y、±Z	IEC60068-2-27 GB/T2423.5
10	Package Drop Test	Height:60cm, 1corner,3edges,6surfaces	GB/T 4857.5-1992
11	Package Vibration	Frequency : 5-20-200HZ , PSD : 0.01-0.01-0.001 Total:0.781g ² /HZ,x/y/z axis per 30min)	GB/T 4857.23-2012

Note1: Ta is the ambient temperature of samples.

8 Mechanical Drawing

9 Packing drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM	P0650VGF1MA10	153.00x 118.00 x 10.9	TBD	TBD	
2						
3						
4						
5						
6						
7	Total weight	TBD±5% Kg				

10 Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

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

- Water ,Ketone ,Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ~ 40℃ Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

10.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.