

**MODEL NO :** TM097TDHG04**MODEL VERSION:** 02**SPEC VERSION :** 2.0**ISSUED DATE:** 2016-07-28

- ☐ Preliminary Specification
☒ Final Product Specification

Customer : _____

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by
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This technical specification is subjected to change without notice



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1 General Specifications

Feature		Spec
Display Spec.	Size	9.7 inch
	Resolution	1024 (RGB) x 768
	Technology Type	a-Si
	Pixel Configuration	R.G.B. Vertical Stripe
	Pixel pitch(mm)	0.192 (H) x 0.192 (V)
	Display Mode	TM with Normally White
	Surface Treatment	Clear
	Viewing Direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	210.20 (W) x166.30(H)x3.28(D)
	Active Area(mm)	196.61 (W) x 147.46 (H)
	With /Without TSP	Without TSP
	LVDS Connector Type	I-PEX 20474-0-30E
	Suggested Connector Type	I-PEX 20472-0-30T
	LED Numbers	36 LEDs
	Weight (g)	200
Electrical Characteristics	Interface	LVDS 6-bit
	Color Depth	262K
	Driver IC	NT51008H-D+NT39212FH-D

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

Note 2: Requirements on Environmental Protection: ROHS

Note 3: LCM weight tolerance: $\pm 5\%$



2 Input/Output Terminals

LVDS Connector Type: I-PEX 20474-0-30E

Suggested Connector Type: I-PEX 20472-0-30T

Pin No.	Symbol	I/O	Function	Remarks
1	GND	P	Ground	-
2	VCC	P	Power supply 3.3V	-
3	VCC	P	Power supply 3.3V	-
4	V EEDID	P	DDC 3.3V	-
5	GSP	-	No connection	-
6	Clk EEDID	I	DDC clock	-
7	Data EEDID	I	DDC data	-
8	R _{IN} 0-	I	Negative LVDS differential data input	-
9	R _{IN} 0+	I	Positive LVDS differential data input	-
10	GND	P	Ground	-
11	R _{IN} 1-	I	Negative LVDS differential data input	-
12	R _{IN} 1+	I	Positive LVDS differential data input	-
13	GND	P	Ground	-
14	R _{IN} 2-	I	Negative LVDS differential data input	-
15	R _{IN} 2+	I	Positive LVDS differential data input	-
16	GND	P	Ground	-
17	Clk _{IN} -	I	Negative LVDS differential data input	-
18	Clk _{IN} +	I	Positive LVDS differential data input	-
19	GND	P	Ground	-
20	NC	-	No connection	-
21	Vdc	P	LED Anode (positive)	-
22	Vdc	P	LED Anode (positive)	-
23	NC	-	No connection	-
24	Vdc 1	P	LED Cathode (Negative)	-
25	Vdc 2	P	LED Cathode (Negative)	-
26	Vdc 3	P	LED Cathode (Negative)	-
27	Vdc 4	P	LED Cathode (Negative)	-
28	Vdc 5	P	LED Cathode (Negative)	-
29	Vdc 6	P	LED Cathode (Negative)	-
30	NC	-	No connection	-

Note: I/O definition.

I---Input pin, O---Output pin, P--- Power/Ground, N--- No Connection



3 Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.5	5.0	V	Note1
Input voltage	V _{IN}	-0.5	5.0	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 3 Absolute Maximum Ratings

Note1: Input voltage include R_{IN} 0-/ R_{IN} 0+, R_{IN} 1-/ R_{IN} 1+, R_{IN} 2-/ R_{IN} 2+, Clk_{IN} -/ Clk_{IN} + .

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.



4 Electrical Characteristics

4.1 Recommended Operating Condition

AGND=GND=0V, Ta = 25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Digital Supply Voltage	VCC	3.0	3.3	3.6	V	



4.2 Recommended Driving Condition for Backlight

Ta=25°C

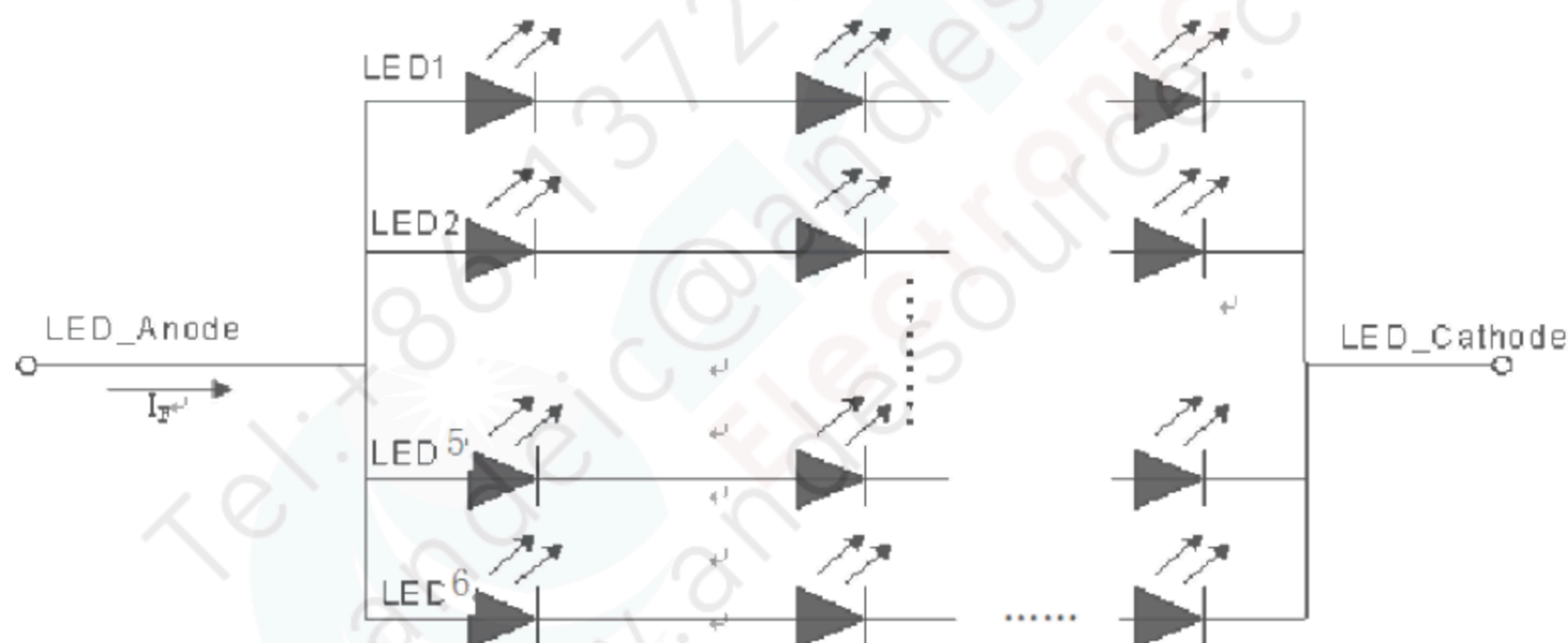
Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	120	150	mA	36 LEDs (6 LED Serial, 6 LED Parallel)
Forward Voltage	V_F	18	19.2	21.6	V	
Operating Life Time	-	20000	30000	--	Hrs	

Note1: For each LED: $I_F (1/6) = 20\text{mA}$, $V_F (1/6) = 3.2\text{V}$.

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

Note3: I_F is defined for one channel LED. 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 Power Consumption

AGND=GND=0V, Ta = 25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Power Supply Current	I_{DVDD}	VCC=3.3V	-	271	-	mA	
Power Consumption	Panel&Gamma		-	894.3	-	mW	
	Backlight		-	2.304	-	W	
	Total		-	3.198	-	W	

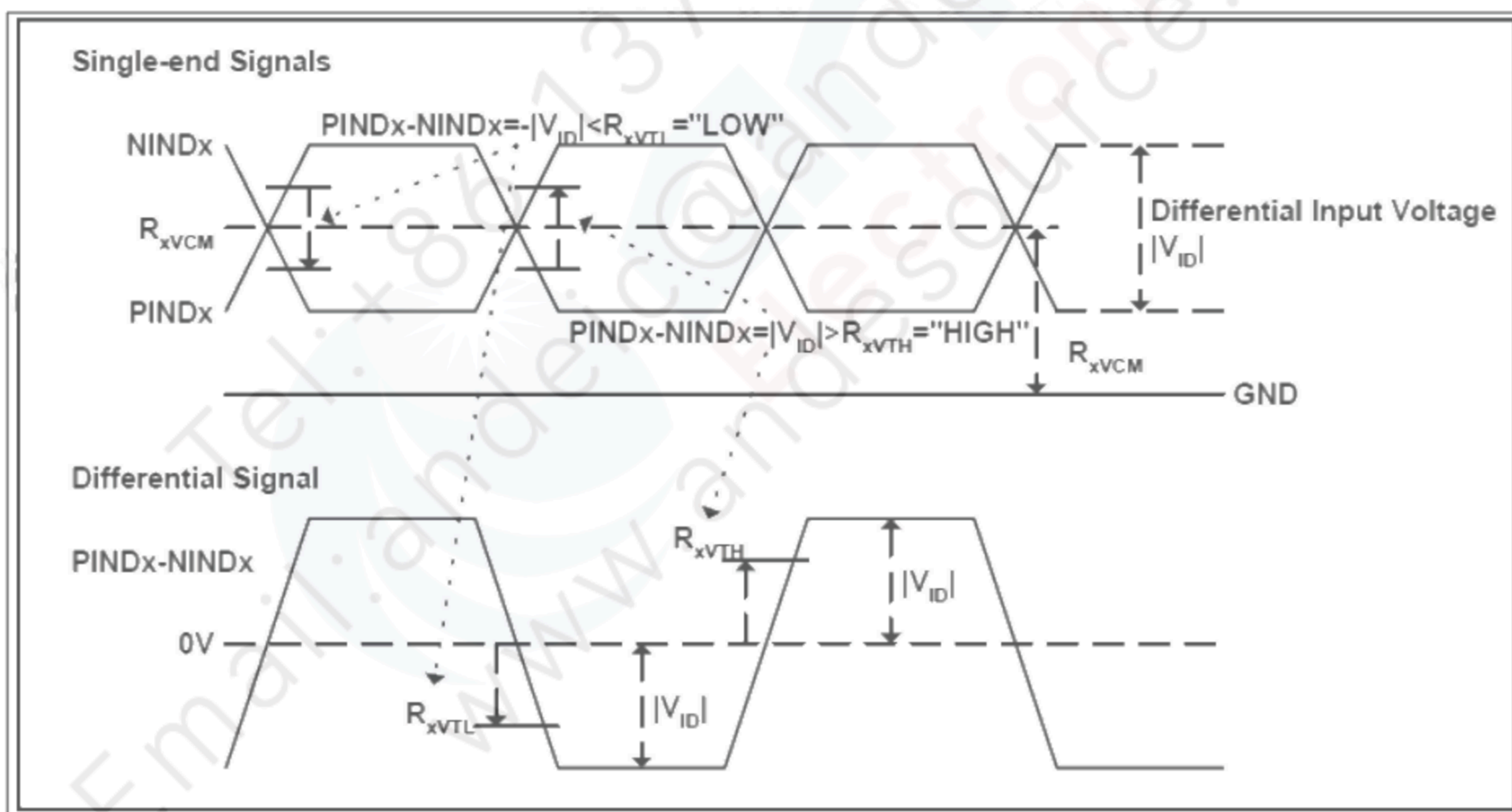


5 Timing Chart

5.1 TFT-LCD Input Timing

DC specification

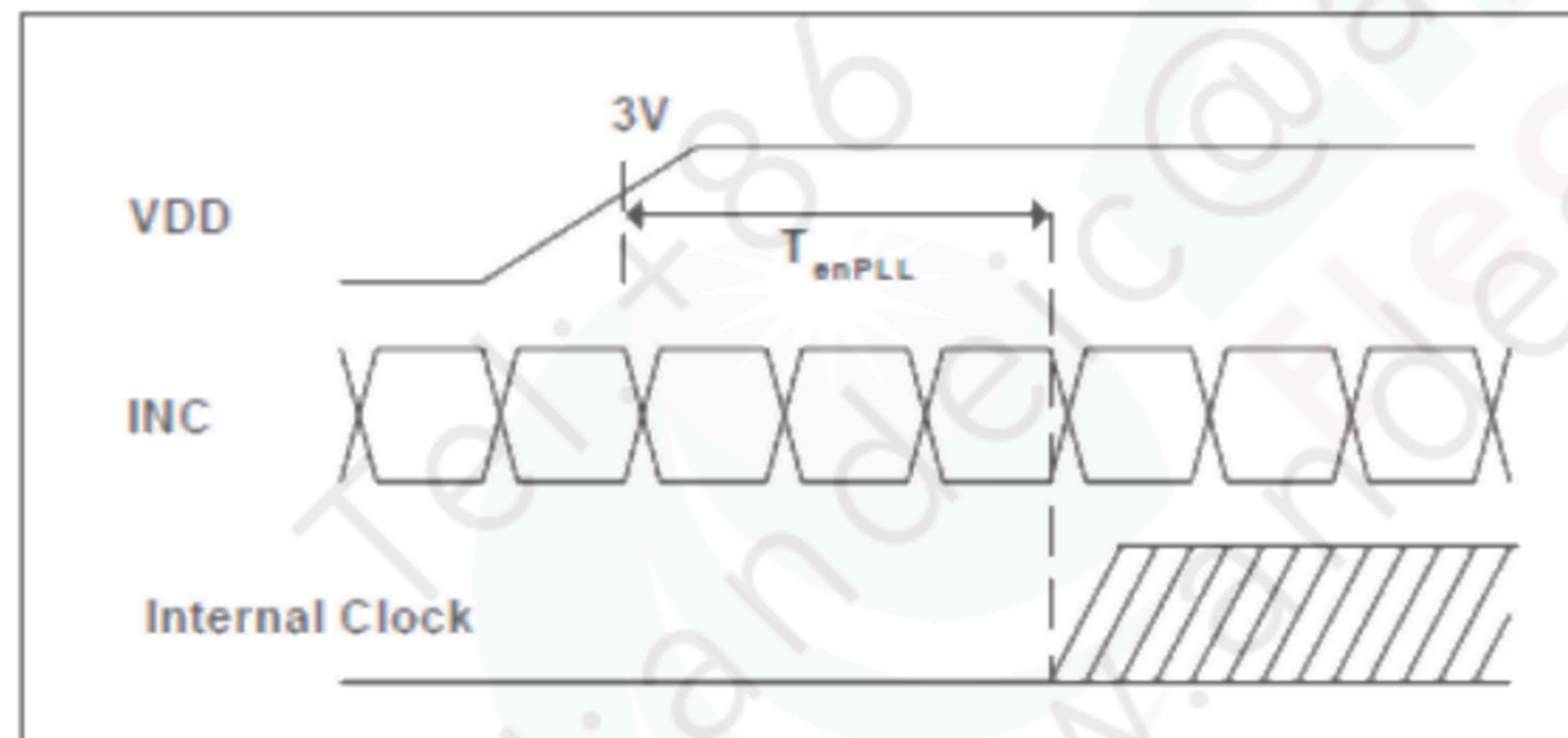
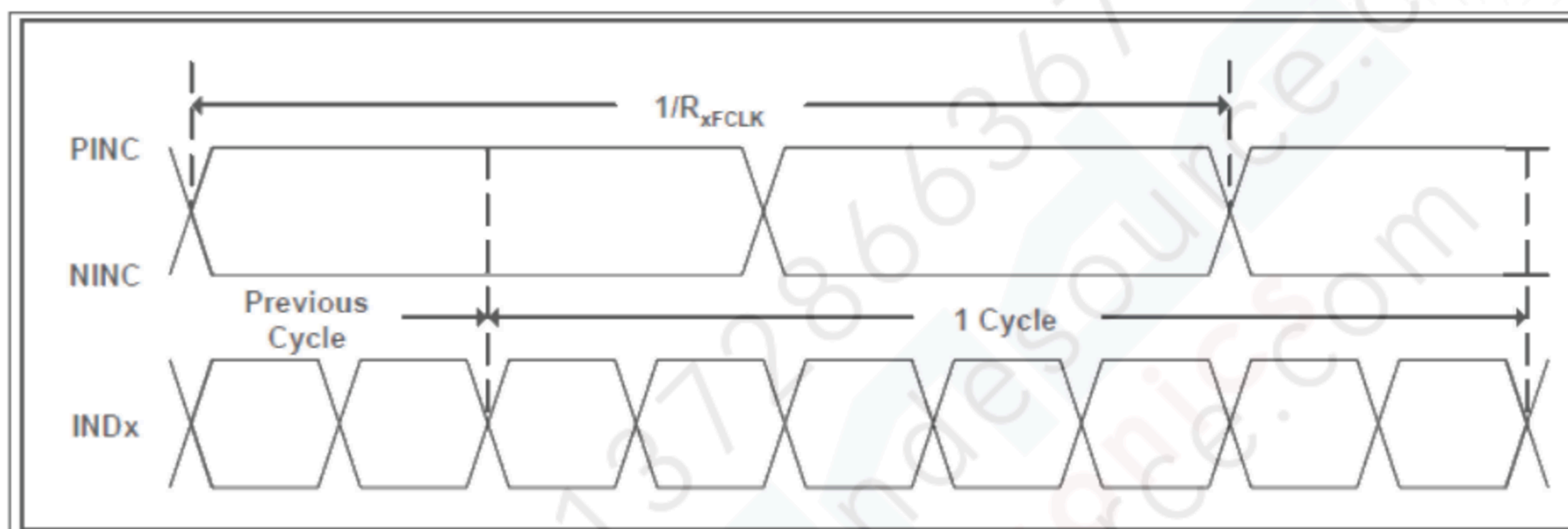
Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Differential input high threshold voltage	R_{xVTH}			+0.1	V	$R_{xVCM} = 1.2V$
Differential input low threshold voltage	R_{xVTL}	-0.1			V	
Input voltage range (singled-end)	R_{xVIN}	0		2.4	V	
Differential input common mode voltage	R_{xVCM}	$ V_{ID} /2$		$2.4 - V_{ID} /2$	V	
Differential input voltage	$ V_{ID} $	0.2		0.6	V	
Differential input leakage current	RV_{xIIZ}	-10		+10	μA	
LVDS Digital Operating Current	I_{ddLVDS}	-	40	50	mA	$F_{clk}=65\text{ MHz}$, $V_{DD}=3.3V$
LVDS Digital Stand-by Current	I_{stLVDS}	-	10	50	μA	Clock & all Functions are stopped

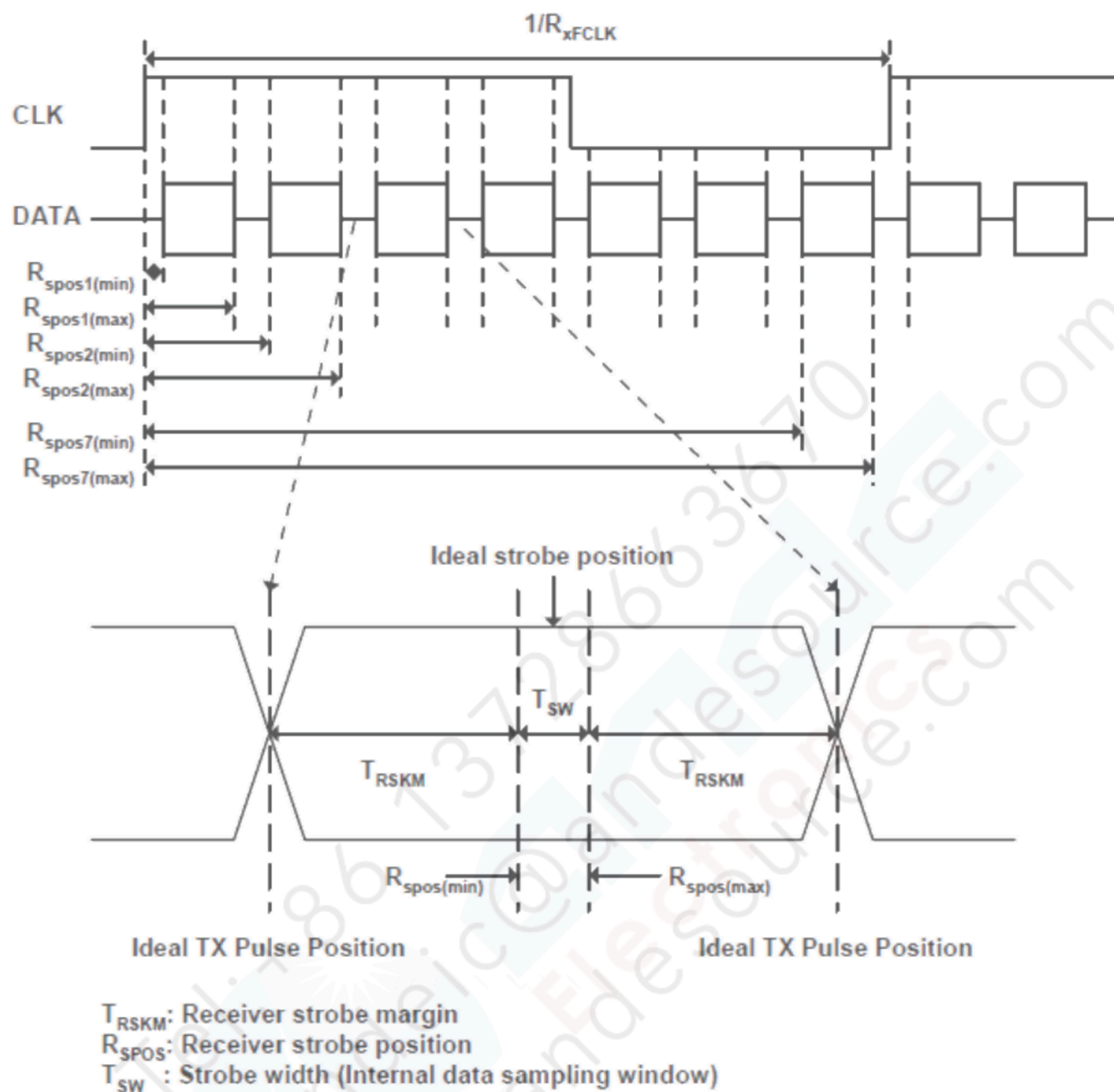




AC specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency	R_{xFCLK}	20		71	MHz	
Input data skew margin	T_{RSKM}	500			pS	$ V_{ID} = 400\text{mV}$ $R_{xVCM} = 1.2\text{V}$ $R_{xFCLK} = 71\text{ MHz}$
Clock high time	T_{LVCH}		$4/(7 * R_{xFCLK})$		ns	
Clock low time	T_{LVCL}		$3/(7 * R_{xFCLK})$		ns	
PLL wake-up time	T_{enPLL}			150	uS	





SSC tolerance of LVDS receiver						
Symbol	parameter	condition	Min.	Typ.	Max.	Units
SSCMF	Modulation Frequency		23		93	KHz
SSCMR	Modulation Rate	LVDS clock = 71MHz center spread			± 3	%



5.2 Timing Setting Of Signal

Input Timing Of Connector

DE mode

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency @ Frame rate = 60Hz	fclk	52	65	71	MHz
Horizontal display area	thd	1024			DCLK
HSYNC period time	th	1114	1344	1400	DCLK
HSYNC blanking	thb+thfp	90	320	376	DCLK
Vertical display area	tvd	768			H
VSYNC period time	tv	778	806	845	H
VSYNC blanking	tvb+tvfp	10	38	77	H

HV mode

Horizontal Input timing

Parameter		Symbol	Value			Unit
Horizontal display area		thd	1024			DCLK
DCLK frequency @ Frame rate = 60Hz		fclk	Min.	Typ.	Max.	MHz
			57	65	70.5	
1 Horizontal Line		th	1200	1344	1400	DCLK
HSYNC pulse width	Min.	thpw	1			
	Typ.		-			
	Max.		140			
HSYNC blanking		thb	160	160	160	
HSYNC front porch		thfp	16	160	216	

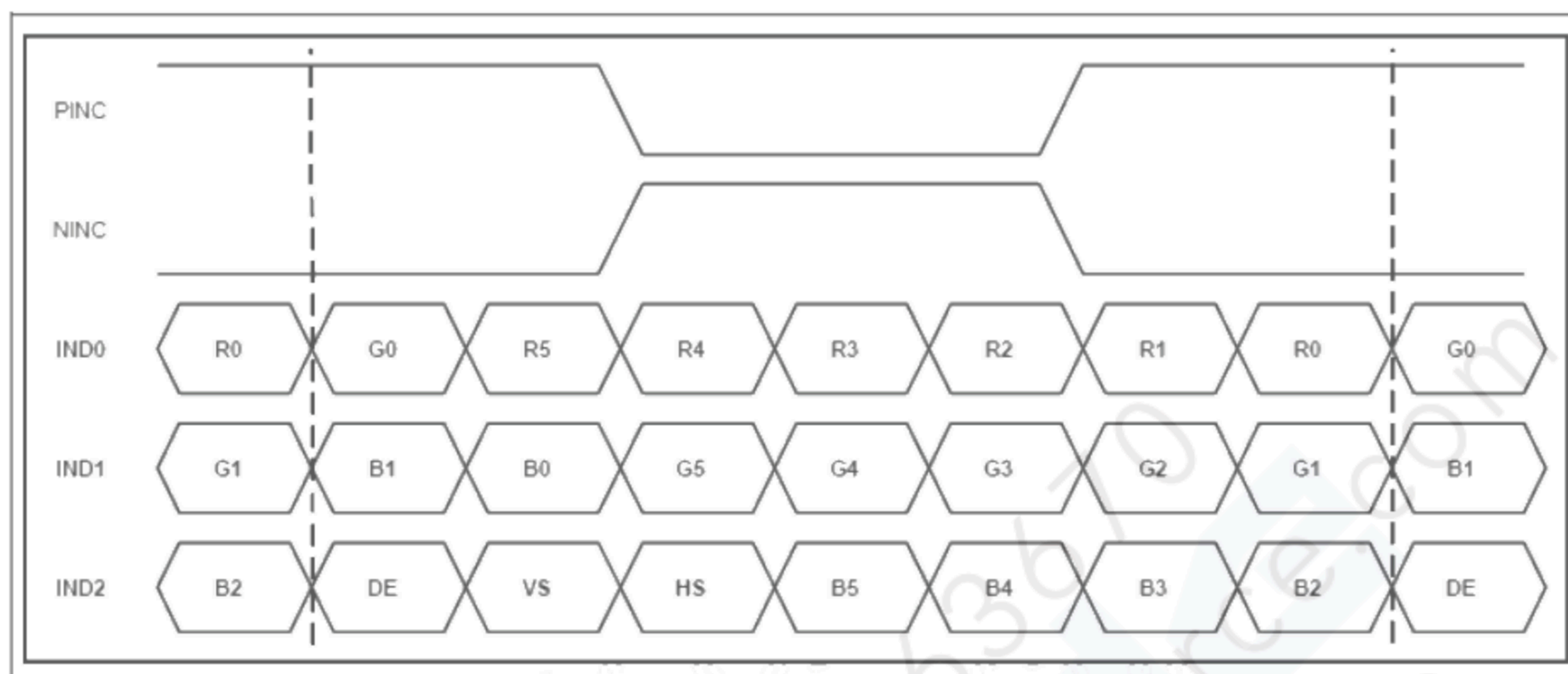
Vertical Input timing

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	tvd	768			H
VSYNC period time	tv	792	806	840	H
VSYNC pulse width	tvpw	1	-	20	H
VSYNC Blanking (tvb)	tvb	23	23	23	H
VSYNC Front porch (tvfp)	tvfp	1	15	49	H

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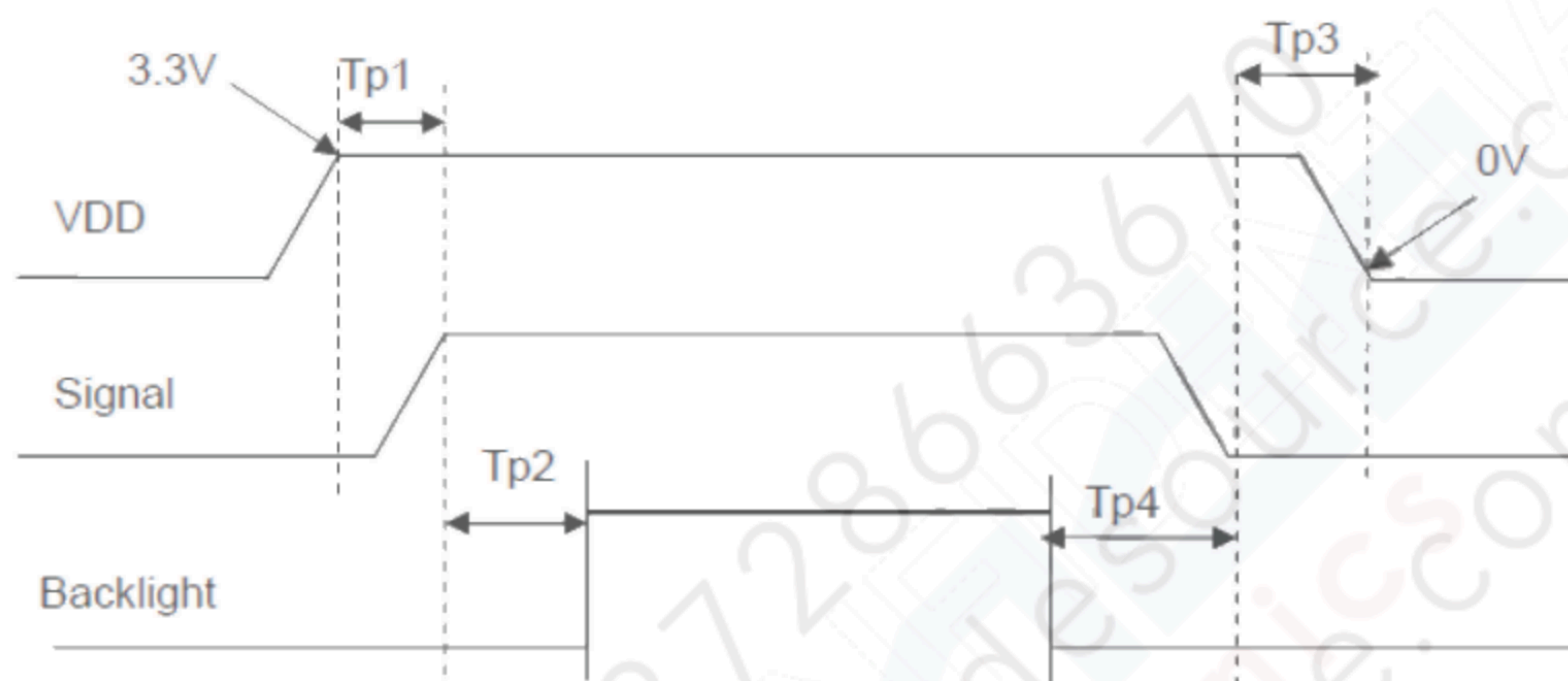
Date input:



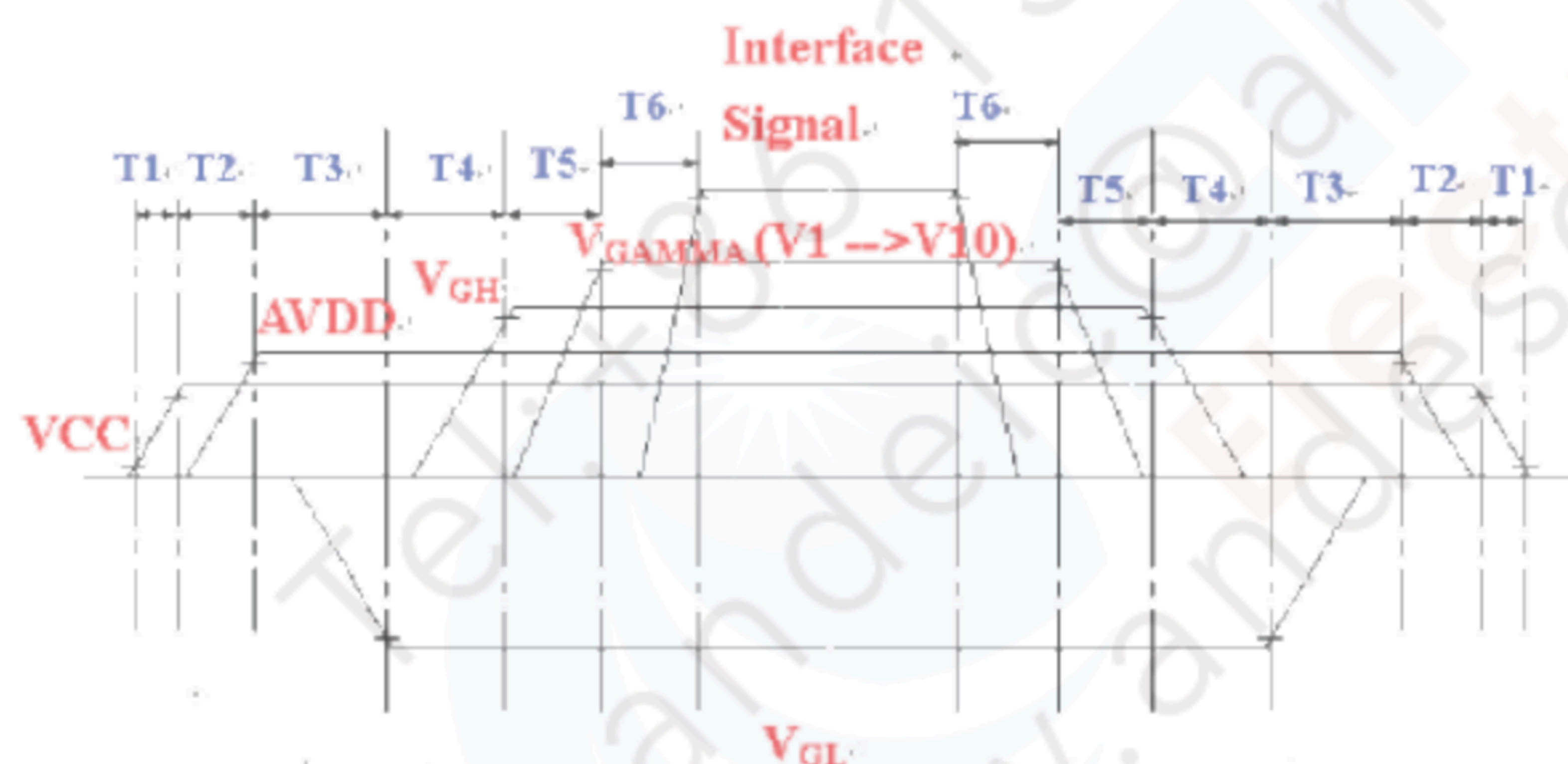


5.3 POWER ON/OFF SEQUENCE

Item	Symbol	Min	Typ	Max	Unit	Remark
VDD to signal starting	Tp1	5	-	50	ms	
Signal starting to backlight on	Tp2	150	-	-	ms	
Signal off to VDD 3.0V	Tp3	5	-	50	ms	
Backlight off to signal off	Tp4	150	-	-	ms	



5.4 System power ON/OFF sequence



	Min.	Typ.	Max.	Unit
T1	-	-	20	ms
T2	16	-	-	ms
T3	> 0			ms
T4	> 0			ms
T5	> 0			ms
T6	> 0			ms



6 Optical Characteristics

Ta=25°C

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥ 10	50	60	-	Degree	Note 2
		θB		60	70	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	400	500	-		Note1 Note3
Response Time		T _{ON}	25℃	-	20	25	ms	Note1 Note4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.258	0.308	0.358		Note1 Note5
		y		0.269	0.319	0.369		
	Red	x		0.539	0.589	0.639		
		y		0.301	0.351	0.401		
	Green	x		0.299	0.349	0.399		
		y		0.519	0.569	0.619		
	Blue	x		0.104	0.154	0.204		
		y		0.033	0.083	0.133		
Uniformity		U			75	--	%	Note1 Note6
NTSC				45	50	-	%	Note 5
Luminance		L		280	350	-	cd/m ²	Note1 Note7

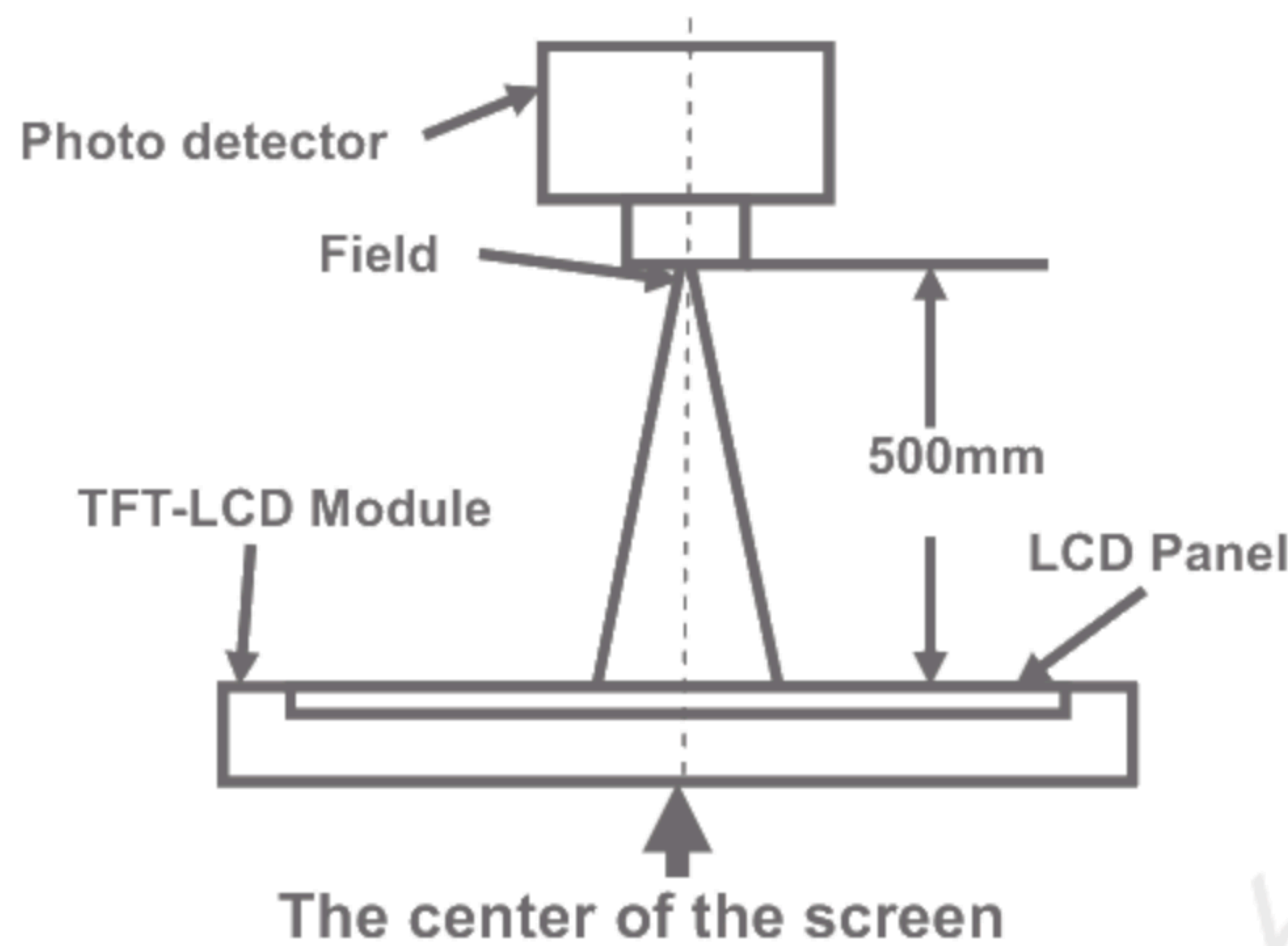
Test Conditions:

1. $I_F = 120 \text{ mA}$, $V_F = 19.2 \text{ V}$ and the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.



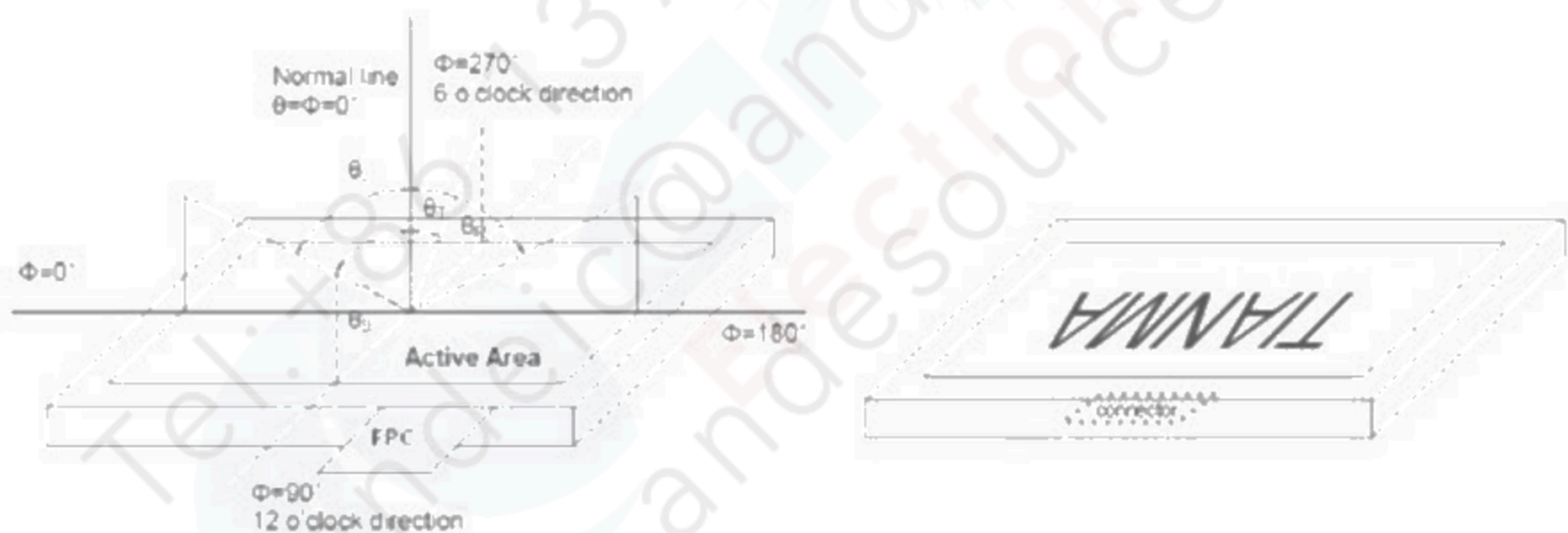
Note 1: Definition of optical measurement system.

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.

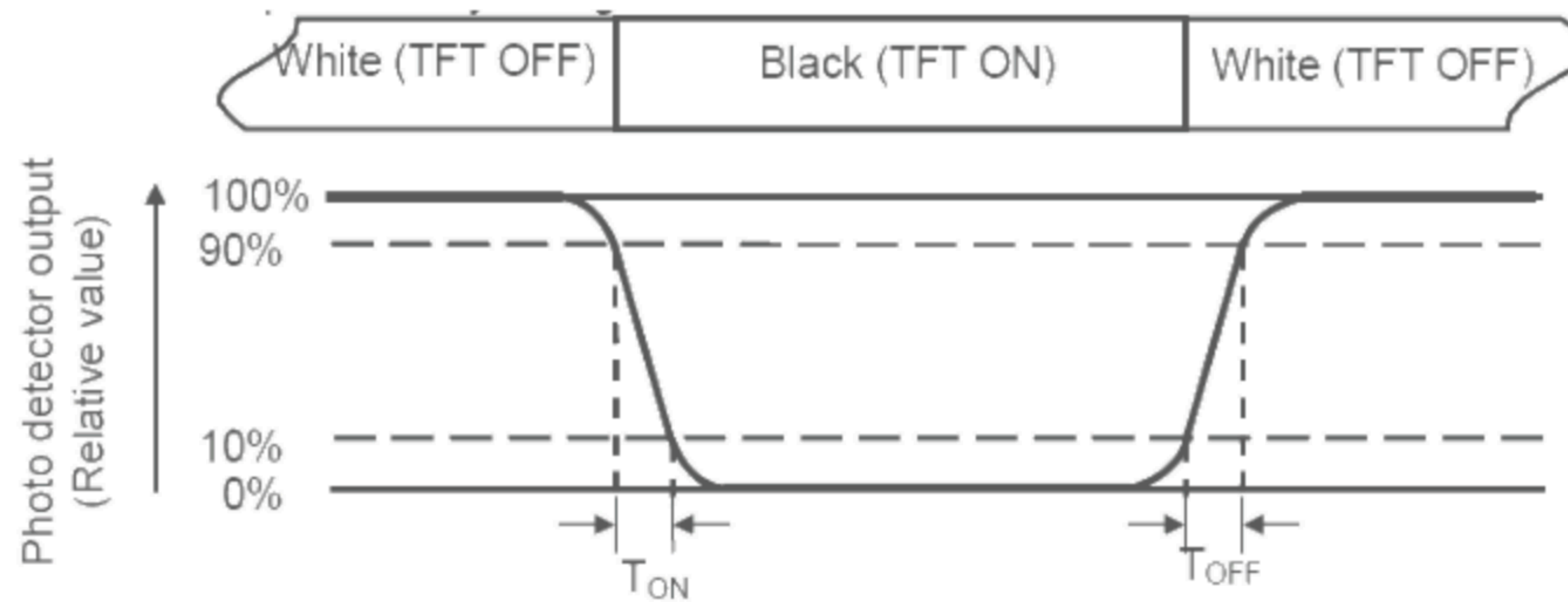
Note 4: Definition of Response time

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%

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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)

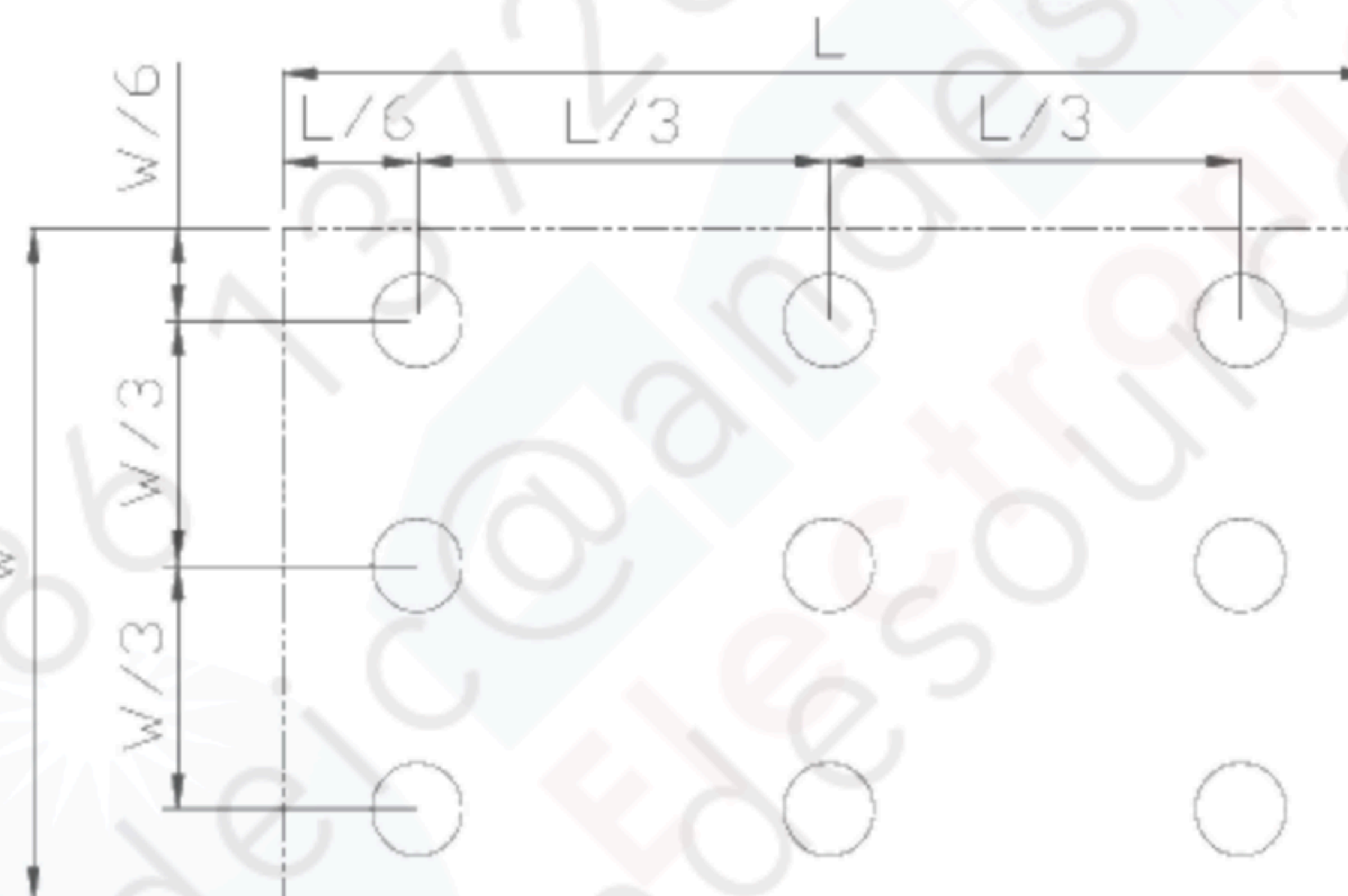
Color coordinates measured at center point of LCD.

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	Ts = +70℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ta = -20℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +80℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity	Ta = +60℃, 90% RH max, 240 hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-20℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,G B2423.22-2002
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	Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)	IEC60068-2-6:1982 GB/T2423.10—1995
9	Mechanical Shock (Non Op)	Half Sine Wave 60G 6ms, ±X,±Y,±Z 3times for each direction	IEC60068-2-27:1987 GB/T2423.5—1995
10	Package Drop Test	Height:50cm, 1corner,3edges,6surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

Note1: Ts is the temperature of panel's surface.

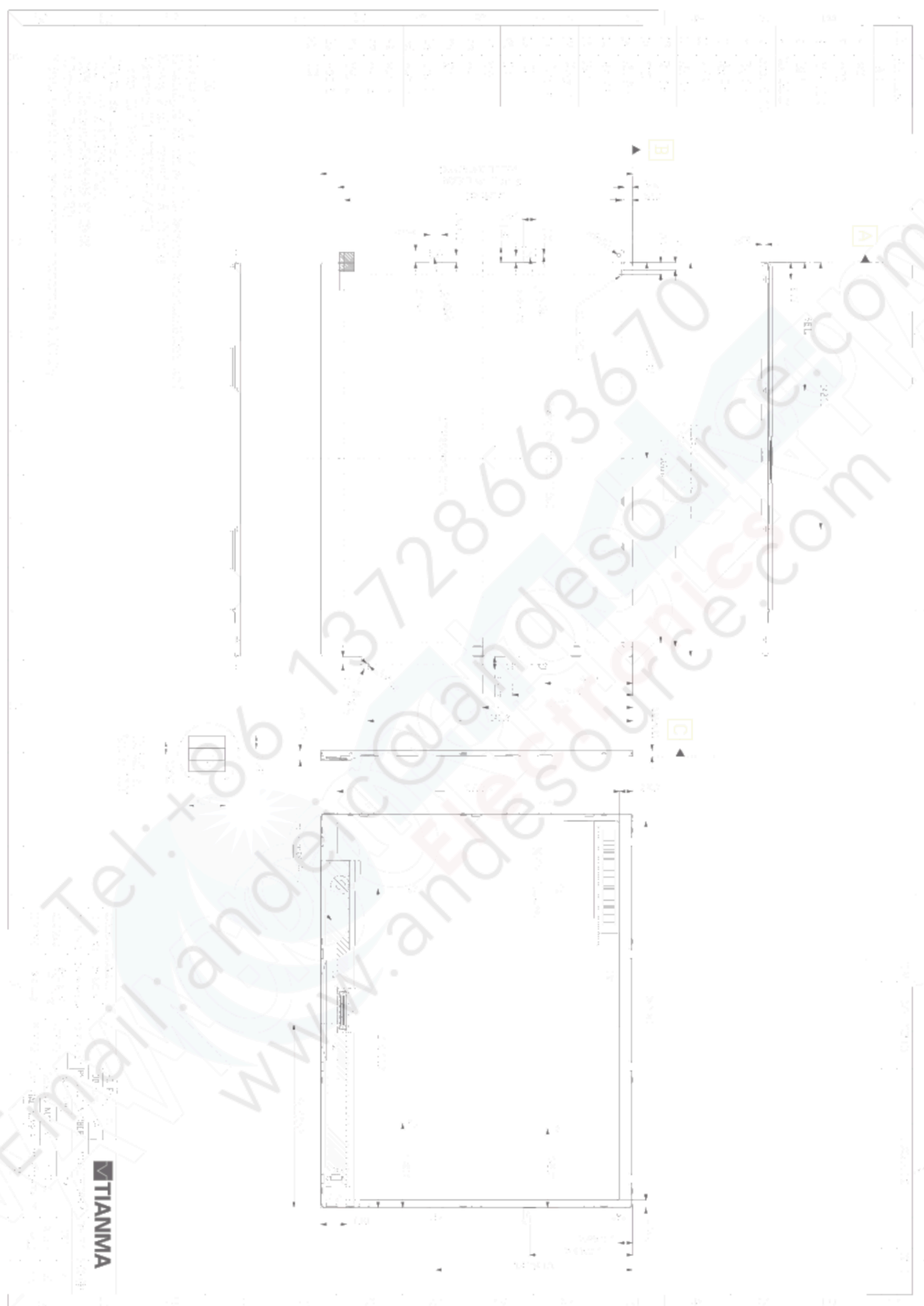
Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.



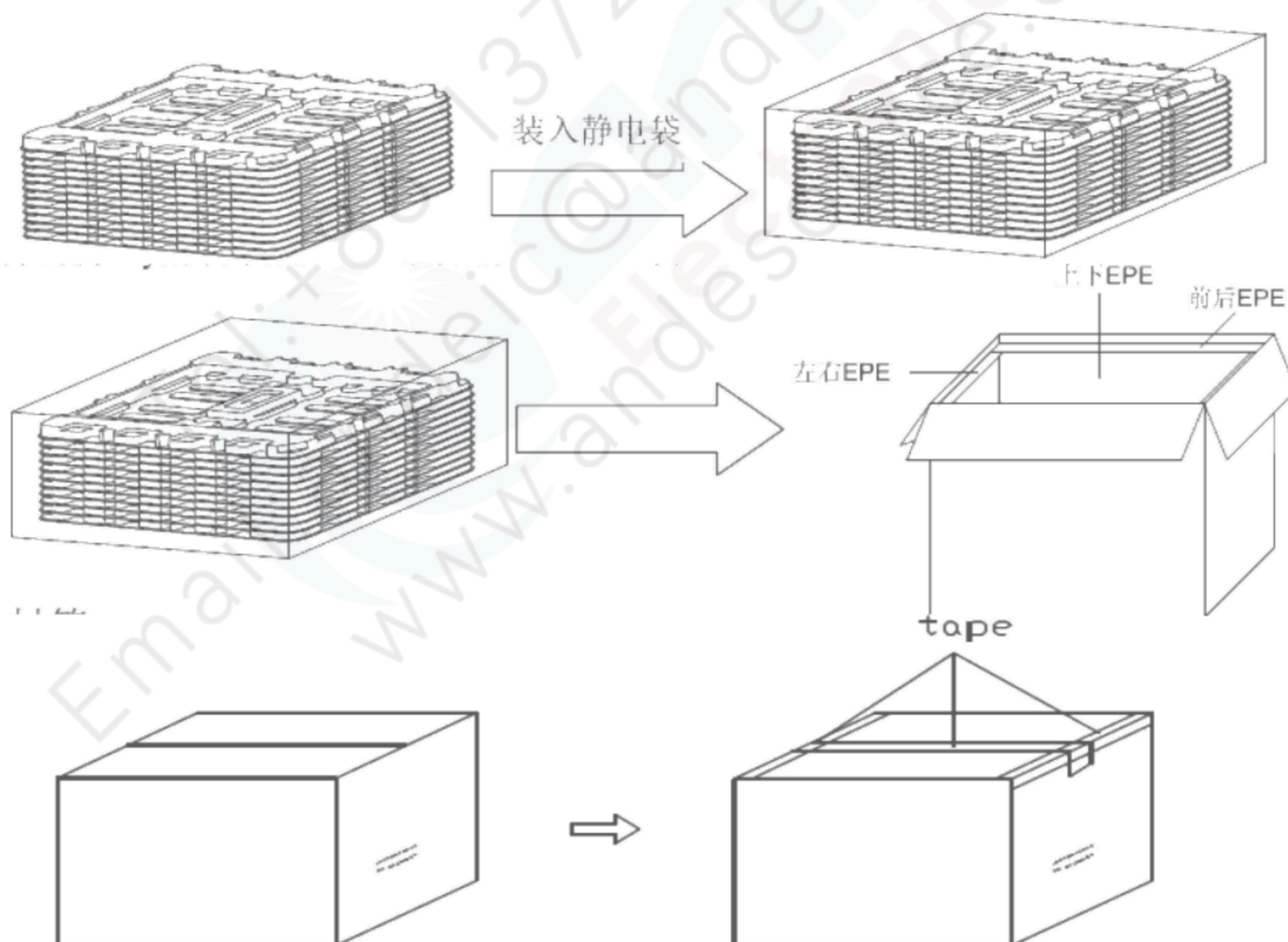
8 Mechanical Drawing





9 Packing drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM097TDHG04	210.2X166.3X3.55	0.2	60	
2	Tray	PET	519 X437 X20	0.295	16	
3	Dust-Proof Bag	PE	830 X 525 X 0.09	0.05	1	
4	EPE Spacer	EPE	544 X426 X15	0.2	2	
5	EPE Spacer	EPE	462 X246 X15	0.1	2	
6	EPE Spacer	EPE	514 X246 X15	0.1	2	
7	EPE Spacer	EPE	451 X368 X1	0.02	15	
8	Carton	Corrugated paper	565 X 483 X 312	1.4	1	
9	Total weight	19.27kg±5%				





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°C ~ 40°C 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.



11 Incoming Inspection Standard

11.1 Scope

The incoming inspection standard shall be applied to TFT-LCD module (hereinafter called "module") that is supplied by shanghai AVIC OPTOELECTRONICS Co., Ltd. (hereinafter called "AVIC").

11.2 Incoming Inspection Right

The buyer (customer) shall inspect the modules within twenty working days since the delivery date. The results of the inspection (acceptance or rejection) shall be recorded in writing, and a copy of this writing will be promptly sent to the AVIC.

If the samples of module within a lot show a number of unacceptable defects in accordance with this incoming inspection standard, the buyer must promptly notify AVIC in writing within three business days at the end of the inspection period. If does not notify AVIC within the inspection period, the modules shall be deemed to have been accepted by buyer.

11.3 Inspection Sampling Methods

11.3.1 Lot size: Quantity per shipment lot.

11.3.2 Sampling type: Normal inspection, single sampling.

11.3.3 Inspection level: Level II.

11.3.4 Sampling table: MIL-STD-105D.

11.3.5 Acceptable quality level (AQL)

Major defect: AQL=0.65

Minor defect: AQL=1.00

11.4 Inspection Methods

11.4.1 Ambient conditions:

a. Temperature: Room temperature $23\pm 2^{\circ}\text{C}$

b. Humidity: $(60\pm 10)\% \text{RH}$

c. Illumination: Single fluorescent lamp non-directive (800 to 1200 Lum)

11.4.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be at least $35\pm 5 \text{ cm}$.

11.4.3 Viewing Angle

The inspection shall be conducted within normal viewing angle range.

U/D: $45^{\circ}/45^{\circ}$, L/R: $45^{\circ}/45^{\circ}$

11.5 Inspection Criteria

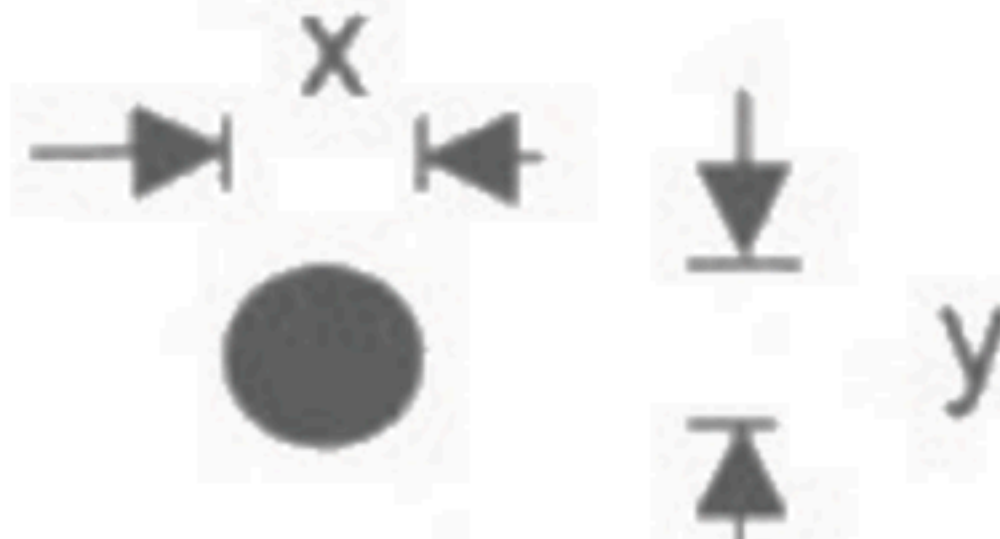
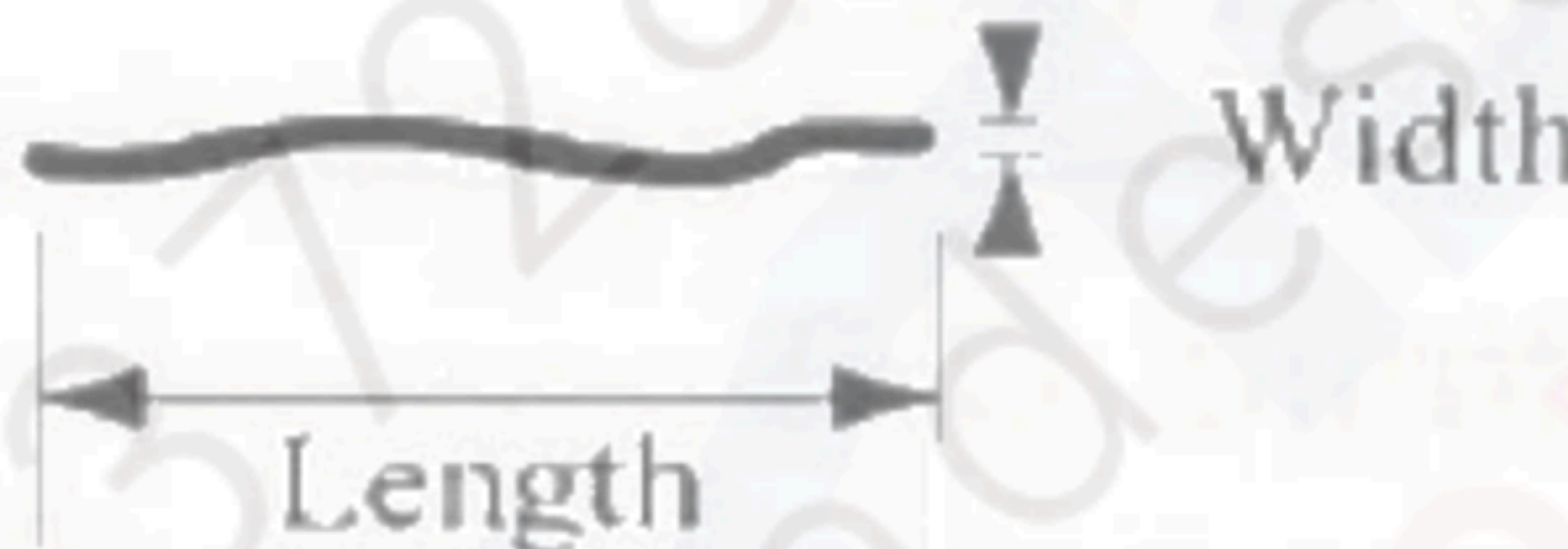

11.5.1 Major Defect

Item No.	Items to be Inspected	Inspection Standard	Defect Type
11.5.1.1	All Functional Defects	1) No display 2) Display abnormally 3) Short circuit 4) Excess power consumption 5) Back-light no lighting, flickering and abnormal lighting.	Major
11.5.1.2	Missing	Missing component	



11.5.1.3	Outline Dimension	Overall outline dimension beyond the drawing is not allowed	
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11.5.2 Minor Defect

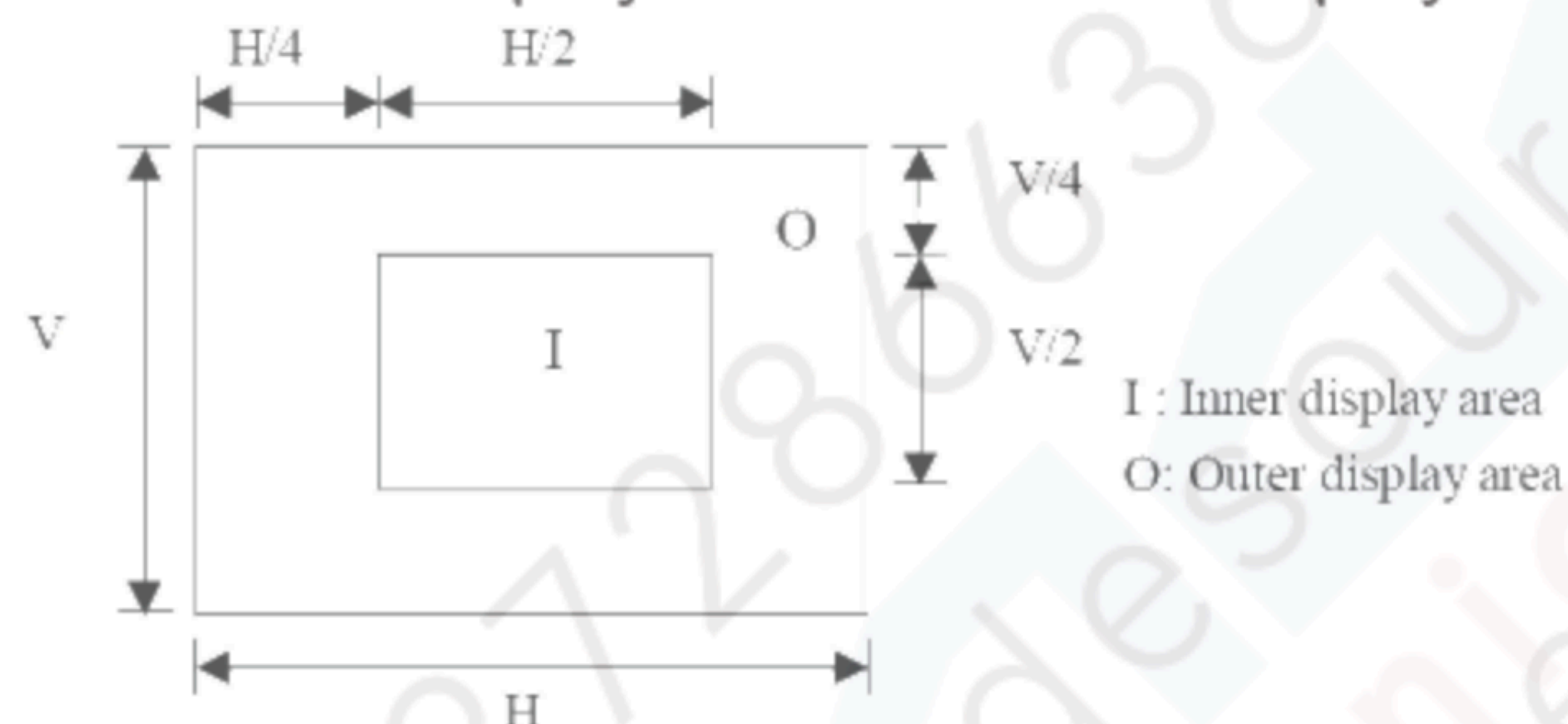
Item No.	Items to be Inspected	Inspection Standard			
11.5.2.1	Spot Defect Including: black spot, white spot, pinhole, foreign particle, polarizer dirt, abnormal colour spot	for dark/white spot is defined: $\varphi = (x + y) / 2$			
					
		Size φ (mm)	Acceptable Quantity		
		$\varphi \leq 0.20$	Ignore		
		$0.20 < \varphi \leq 0.5$	$N \leq 3$		
		$0.5 < \varphi$	Not allowed		
11.5.2.2	Line Defect Including: black line, white line, scratch	for line defect is defined:			
					
		Length/Width (mm)	Acceptable Quantity		
		$W \leq 0.03$	Ignore		
		$0.03 < W \leq 0.04, L \leq 5.0$	$N \leq 4$		
		$0.04 < W, L > 5.0$	Not Allowed		
11.5.2.3	Polarizer Dent	Size φ (mm)	Acceptable Quantity		
		$\varphi \leq 0.25$	Ignore		
		$0.25 < \varphi \leq 0.5$	$N \leq 3$		
		$0.5 < \varphi$	Not Allowed		
	Polarizer Protective Film Bubble	bubble area over 1/3 module	Not Allowed		
11.5.2.4	Electrical Dot Defect (single sub-pixel)	bright and black dot defect: single sub-pixel			
					
		inspection pattern: full white, full black, red, green and blue screens			
		Item	Acceptable Quantity		
			I Area	O Area	Total
	Black Dot Defect	2	3	4	



		Black Dot Pitch (mm)	≥ 5	≥ 5	-
		Bright Dot Defect	0	0	0
		Bright Dot Pitch (mm)	-	-	-
		Total Dot	2	3	4
11.5.2.5	Product surface dirt including: dirt, particle, fingerprints	Not Allowed			
11.5.2.6	Mura	not accepted under 5% ND filter, but a limits sample will be allowed			

Note1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area. Bright dot should be detected under 5% ND filter.

Note2. The definitions of the inner display area and outer display area:



Note3. Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on outside of active display area.

11.6 Inspection Judgment

11.6.1 If the number of defects is more than the applicable acceptance level, the lot shall be rejected and the buyer should inform the seller of the result of incoming inspection in writing.

11.6.2 Issue which is not defined in this criteria shall be discussed by both parties, customer and supplier, for better solutions.

11.7 Precaution

Please pay attention to the following items when you use the module.

11.7.1 Do not twist or bend the module and also avoid any inappropriate external force on display surface during assembly.

11.7.2 Adopt good ventilation measures. Be sure to use the module within the specified temperature range.

11.7.3 Avoid dust or oil mist during assembly.

11.7.4 Follow the correct power sequence while operating. Do not apply the invalid signal otherwise it will cause unexpected shutdown that damages the module.

11.7.5 The response time & brightness might vary at different temperature.

11.7.6 Avoid displaying at certain pattern (e.g. the white pattern) for a long time otherwise it might cause image sticking.

11.7.7 Be sure to turn off the power while connecting or disconnecting the circuit.

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11.7.8 Display surface Polarizer scratches easily, please avoid dirt or stain on it and handle with care.

11.7.9 A dew drop may cause malfunction or worse situation. Wipe off any dew drop before using the module.

11.7.10 Sudden temperature change might cause condensation of materials and possible Polarizer damage.

11.7.11 High temperature and high humidity might undermine the performance. Do not expose the module to the direct sunlight and so on.

11.7.12 Avoid any acetic acid or chlorine compounds, which are harmful to the module.

11.7.13 Static electricity might damage the module. Avoid direct touch of the module without any grounded device connected.

11.7.14 Do not disassemble and reassemble the module by yourself.

11.7.15 Avoid any strong vibration or shock, which might cause a broken module.

11.7.16 Store the modules in appropriate environment with regular packing.

11.7.17 Be careful of possible injury caused by a broken module. Also avoid the pressure added onto the (front or rear) surface of modules, which might cause non-uniformity or other function issue to display.