Product Specification

Part Name: 10.10 inch TFT Display Module
Customer Part ID:
Topovision Part ID: TVT1010D9E2
Ver: A

Customer:
Approved by

From: Topovision Technology Co.,Ltd.
Approved by

Notes:

1. Please contact Topovision Technology Co., Ltd. before assigning your product based on this module specification
2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Topovision Technology Co., Ltd. for any intellectual property claims or other problems that may result from application based on the module described herein.

Record of Revision			
Version	Revise Date	Page	Content
A	2025/01/20	ALL	First Release

Contents

1. General Specifications

No.	Item	Specification	Remark
1	LCD size	10.1 inch	
2	Driver element	a-Si TFT active matrix	
3	Resolution	1024(W) RGB x 600(H)	
4	Display mode	Normally White, Transmissive	
5	Dot pitch	0.2175 (w)x 0.2088(H)	
6	Active area	222.72(W) x 125.28(H) mm	
7	Module size	235(W) ×143(H) ×2.9(D) mm	Note 1
8	View direction	12	O' clock
9	Surface treatment	Anti-Glare	
10	Color arrangement	RGB-stripe	
11	Display colors	16.7M	colors
12	Color gamut (C light)	48.5%	
13	Interface	LVDS	
14	Lcm power consumption	(2.9 W)	TYP.
15	Driver IC	HX8282-A14&HX8696-A01	

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

FPC Connector is used for the module electronics interface. The recommended model is FH12A-40S-0.5SH manufactured by Hirose.

Pin No	Symbol	I/O	Function	Remark
1	VCOM	P	Common Voltage	
2	VDD	P	Power Supply	
3	VDD	p	Power Supply	
4	NC	-	No connection	
5	GRB	I	Global reset pin.	
6	STBYB	I	Standby mode control. Normally pull High.	
7	GND	P	Ground	
8	NIND0	I	-LVDS Differential Data Input	
9	PIND0	I	+LVDS Differential Data Input	
10	GND	P	Ground	
11	NIND1	I	-LVDS Differential Data Input	
12	PIND1	I	+LVDS Differential Data Input	
13	GND	P	Ground	
14	NIND2	I	-LVDS Differential Data Input	
15	PIND2	I	+LVDS Differential Data Input	
16	GND	P	Ground	
17	NINC	I	-LVDS Differential Clock Input	
18	PINC	I	+LVDS Differential Clock Input	
19	GND	P	Ground	
20	NIND3	I	-LVDS Differential Data Input	
21	PIND3	I	+LVDS Differential Data Input	
22	GND	p	Ground	
23	NC	-	No connection	
24	NC	-	No connection	
25	GND	P	Ground	
26	NC	-	No connection	
27	NC	-	No connection	
28	MODE	I	DE / SYNC mode select. Normally pull high. When MODE=H, DE mode. When MODE=L, SYNC mode	
29	AVDD	P	Power for Analog Circuit	

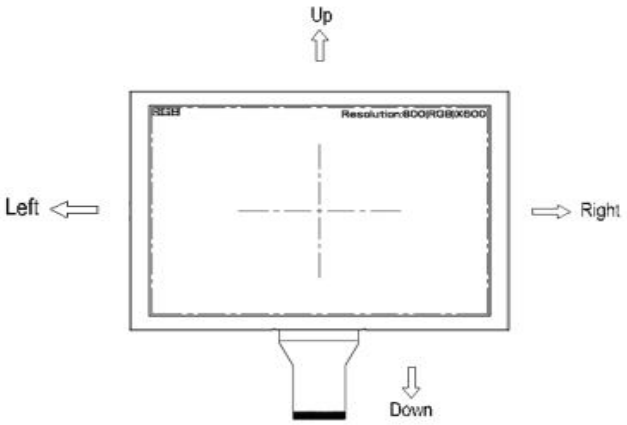
30	GND	P	Ground	
31	LED-	P	LED Cathode	
32	LED-	P	LED Cathode	
33	L/R	I	Left/right selection	Note 1
34	U/D	I	Up/down selection	Note 1
35	VGL	P	Gate OFF Voltage	
36	NC	-	No connection	
37	NC	-	No connection	
38	VGH	P	Gate ON Voltage	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

Note I: input; O: output; P: Power or Ground(0V).

Note 1: Selection of scanning mod

Setting of scan control input		Scanning direction
U/D	L/R	
GND	VDD	Up to down, left to right
VDD	GND	Down to up, right to left
GND	GND	Up to down, right to left
VDD	VDD	Down to up, left to right

Note 2: Definition of scanning direction.Refer to the figure as below:



3. Operation Specifications

3.1. Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	VDD	-0.3	5.0	V	TA=25℃
	AVDD	6.5	15	V	
	VGL	-20	0.3	V	
	VGH	-0.3	40	V	
Operation Temperature	T_{OP}	-20	70	℃	
Storage Temperature	T_{ST}	-30	80	℃	

Note1 : The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

3.2. Typical Operation Conditions

Test condition: GND=0V, T_A=25 °C

Note1

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	VDD	3.0	3.3	3.6	V	
	AVDD	8	13	15	V	
	VGH	-	21	-	V	
	VGL	-	-8	-	V	
Input signal voltage	VCOM	3.0	4.6	5.0	V	
Input logic high voltage	V_{IH}	0.9 V_{DD}	-	V_{DD}	V	
Input logic low voltage	V_{IL}	0	-	0.1 V_{DD}	V	

3.3. Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED Backlight	V_L	8.1	9.6	10.2	V	Note 1
Crrent for LED Backlight	I_L	-	240	-	mA	
LED life time	-	20,000	-	-	Hr	Note 2

Note1: V_L=9.6V, I_L=240mA (Backlight circuit: 3 series connection, 12 parallel connection), the ambient temperature is 25℃.

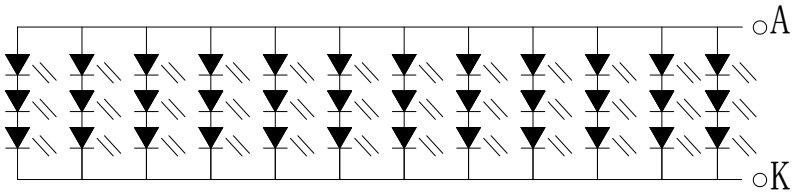
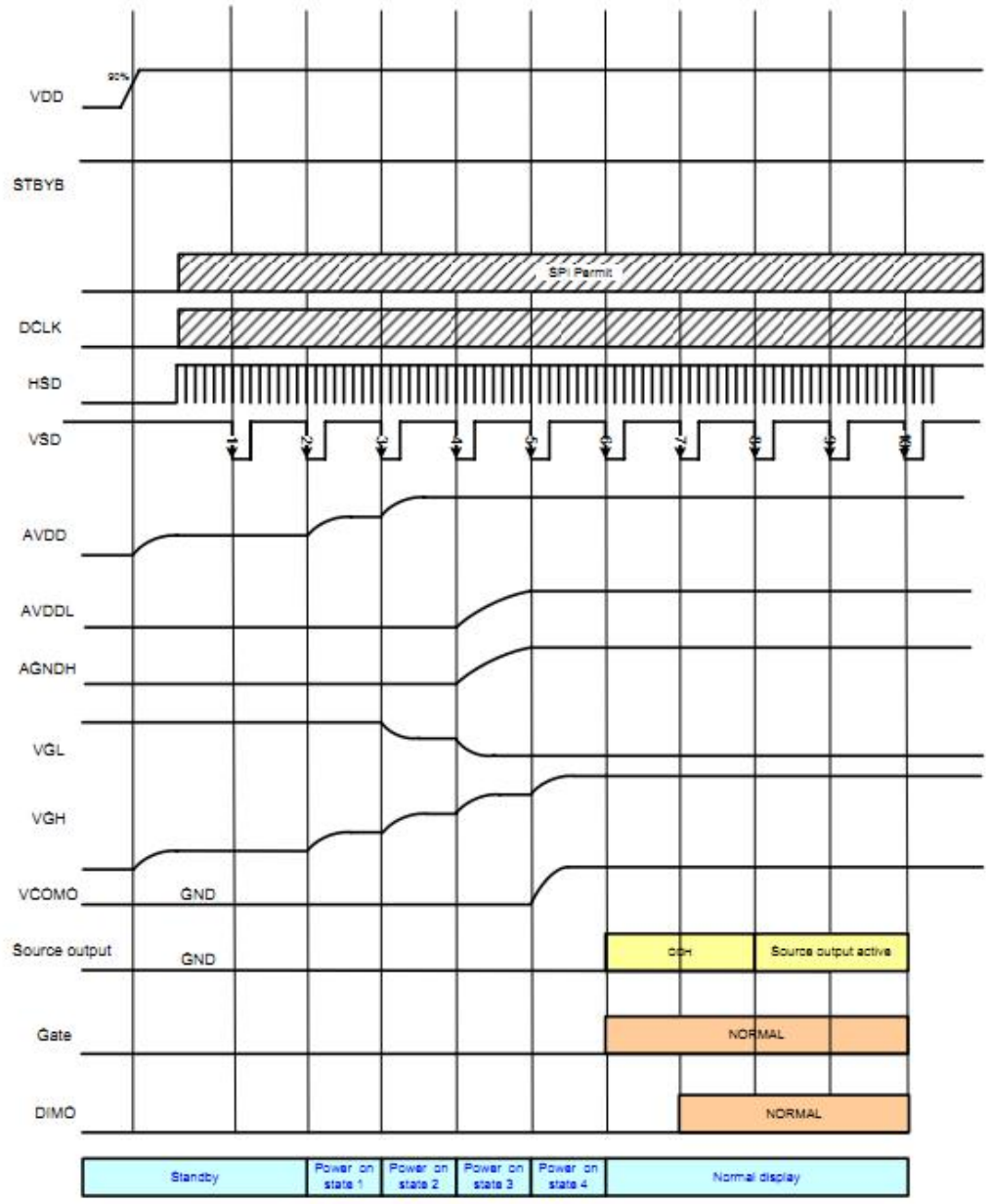


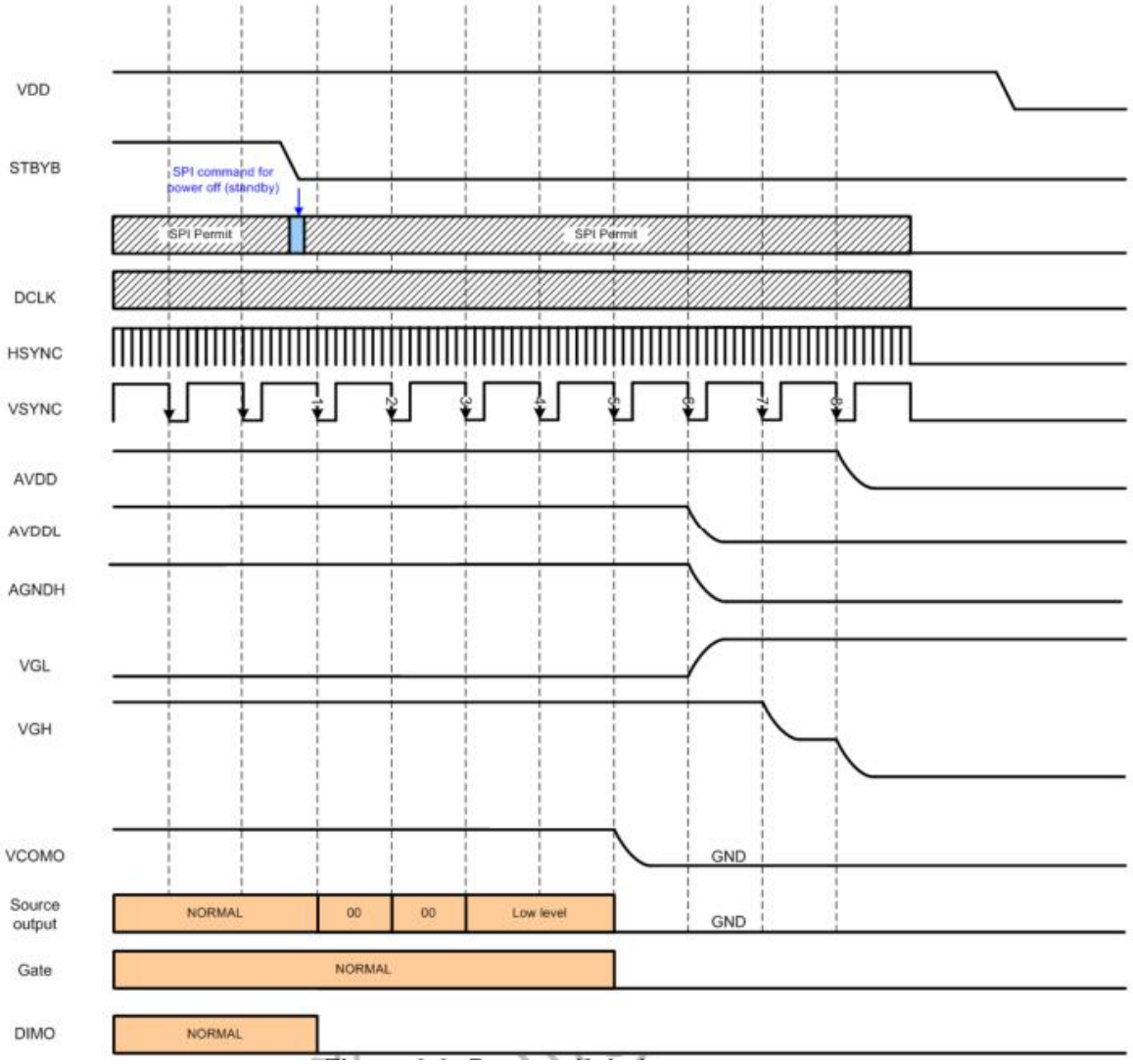
Fig. 3-1 LED test circuit diagram

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and 1/2 rated current . The LED lifetime could be decreased if operating I_L is larger than 240 mA.

3.4. Power Sequence



Power on timing sequence



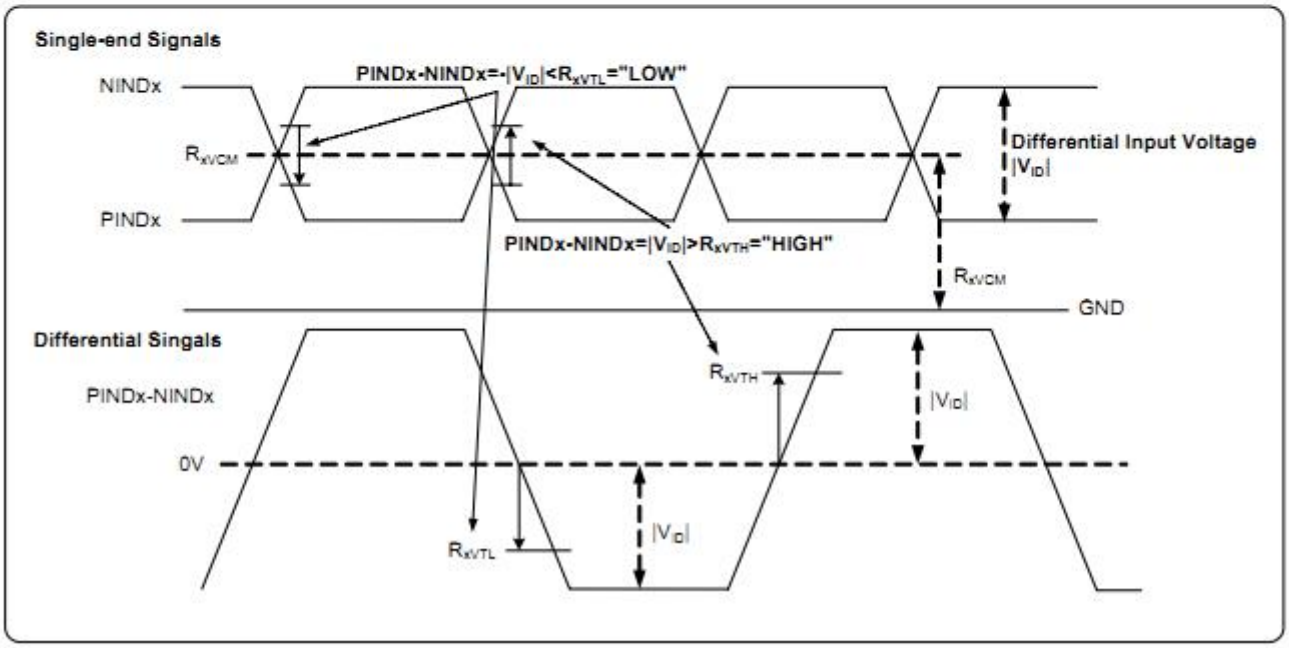
Power off timing sequence

3.5. LVDS Signal Timing Characteristics

LVDS mode DC electrical characteristics

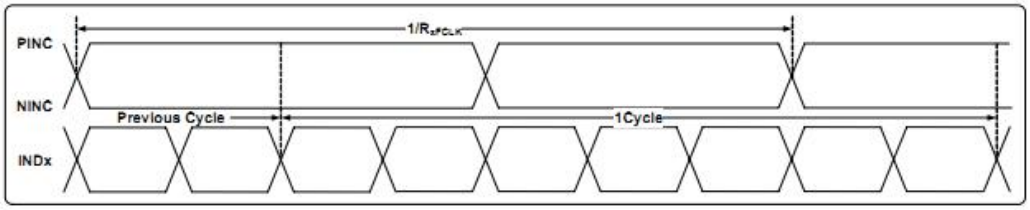
Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Differential input high Threshold voltage	R_{XVTH}	-	-	+0.1	V	R_{XVCM}=1.2V
Differential input low threshold voltage	R_{XVTL}	-0.1	-	-	V	
Input voltage range (singled-end)	R_{XVIN}	0	-	VDD-1.2+ $\|V_{ID}\|/2$	V	-
Differential input common Mode voltage	R_{XVCM}	$\|V_{ID}\|/2$	-	VDD-1.2	V	-
Differential input voltage	$\| V_{ID} \|$	0.2	-	0.6	V	-
Differential input leakage Current	RV_{Xliz}	-10	-	+10	μA	-
LVDS Digital Operating Current	Iddlvds	-	15	30	mA	Fclk=65MHz, VDD=3.3V
LVDS Digital Stand-by Current	Istlvds	-	10	50	μA	Clock & all Functions are stopped

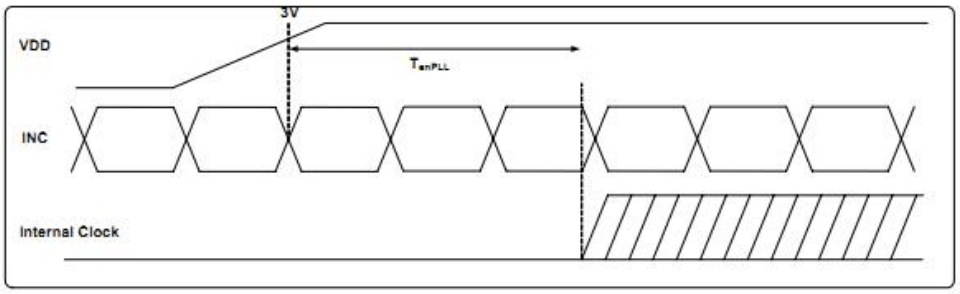
Table 9.3: LVDS mode DC electrical characteristics

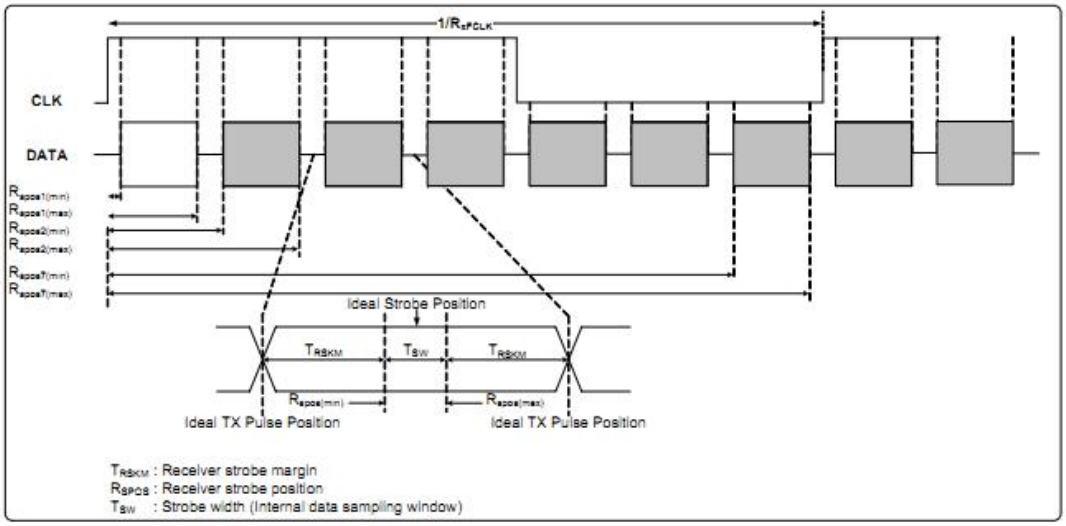


LVDS mode AC electrical characteristics

Parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	Unit	Condition
Clock frequency	R_{XFCLK}	20	-	71	MHz	-
Input data skew margin	T_{RSKM}	500	-	-	pS	| V_{ID} |=400mV R_{XVCM} =1.2V R_{XFCLK} =71MHz
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_{emPLL}	-	-	150	µs	-







Parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	Unit	Condition
Modulation Frequency	SSC_{MF}	23	-	93	KHz	-
Modulation Rate	SSC_{MR}	-	-	±3	%	LVDS clock =71MHz center spread

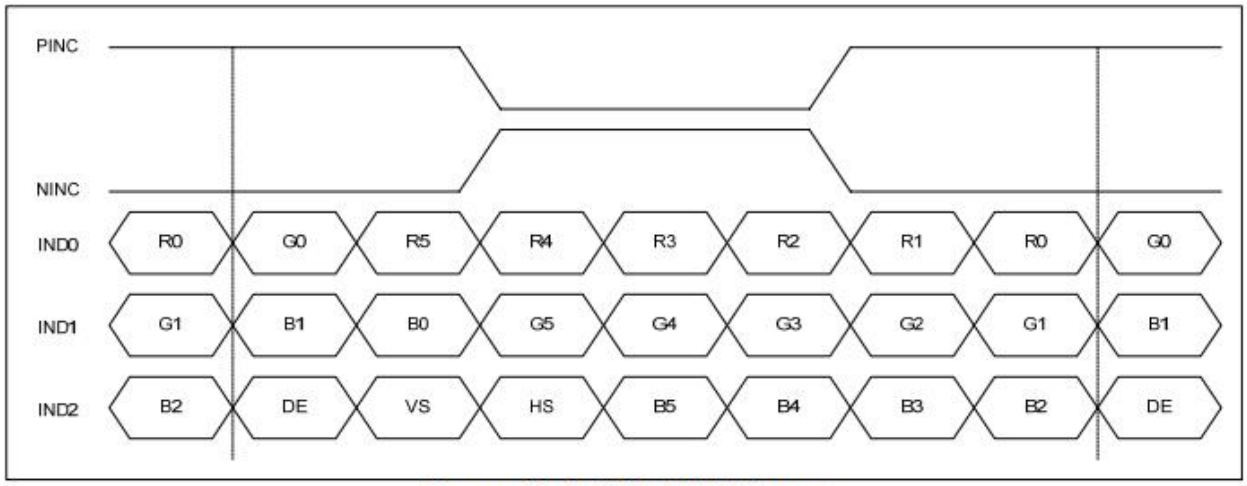


Figure 10.4: 6-bit LVDS input

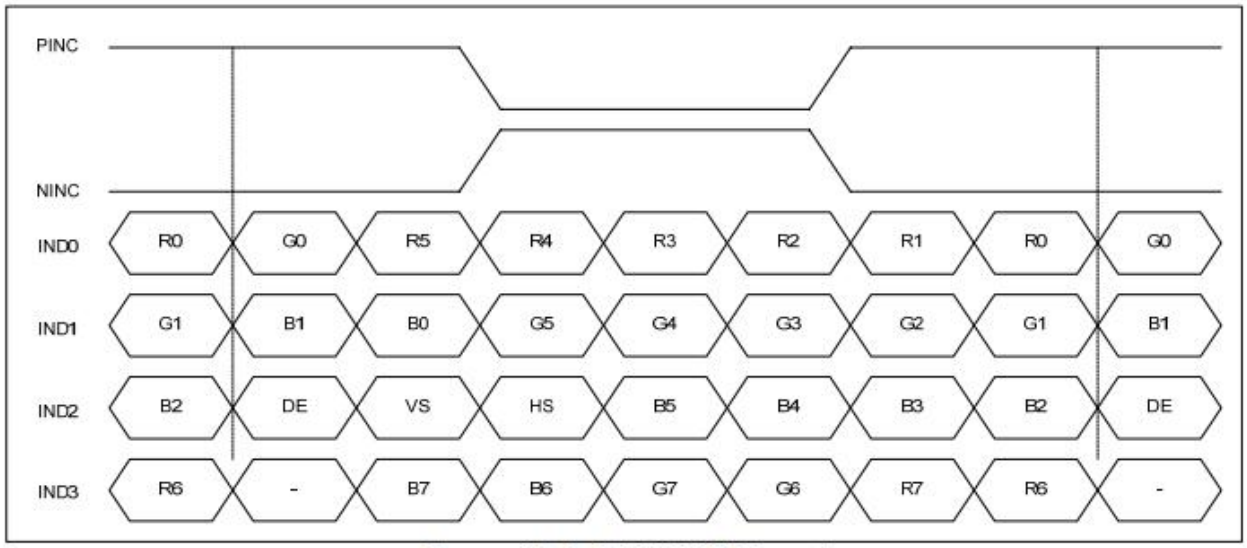


Figure 10.5: 8-bit LVDS Input

Interface timing Parameter

Item		Symbol	min	typ	max	UNIT
DCLK	Frequency	Fclk	40.8	51.2	67.2	MHz
Horizontal	Horizontal display area	Thd		1024		DCLK
	Horizontal period time	Th	1114	1344	1400	DCLK
	Horizontal blanking	Thb+Thfp	90	320	376	DCLK
Vertical	Vertical display area	Tvd		600		H
	Vertical period time	Tv	610	635	800	H
	Vertical blanking	Tvb+Tvfp	10	35	200	H

< DE mode>

Item	Symbol	min	typ	max	UNIT
Horizontal display area	thd		1024		DCLK
DCLK frequency	fclk	44.9	51.2	63	MHz
1 Horizontal Line	th	1200	1344	1400	DCLK
HSYNC pulse width	Thpw	1	-	140	DCLK
HSYNC back porch	Thbp	160	160	160	DCLK
HSYNC front porck	thfp	16	160	216	DCLK

< HV mode Horizontal input timing>

Item	Symbol	min	typ	max	UNIT
Vertical display area	Tvd		600		H
VSYNC period time	Tv	624	635	750	H
VSYNC pulse width	Tvpw	1	-	20	H
VSYNC back porch	Tvbp	23	23	23	H
VSYNC front porck	tvfp	1	12	127	H

< HV mode Vertical input timing>

4. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θL	Φ=180° (9 o'clock)	60	70	-	degree	Note 1
	θR	Φ=0°(3 o'clock)	60	70	-		
	θT	Φ=90° (12 o'clock)	50	60	-		
	θB	Φ=270° (6 o'clock)	60	70	-		
Response time	TON+ TOFF	Normal $\theta = \Phi = 0^{\circ}$	-	25	50	msec	Note 2
Contrast ratio	CR		400	600	-	-	Note 3
Color chromaticity	WX		0.26	0.31	0.36	-	Note 4 Note 5 Note 6
	WY		0.30	0.35	0.40	-	
Luminance	L		250	300	-	cd/m^2	Note 6
Luminance uniformity	YU		70	75	-	%	Note 7
Color Gamut	%		47	50	-		

The test systems refer to Note 2.

Note 1: Definition of viewing angle range

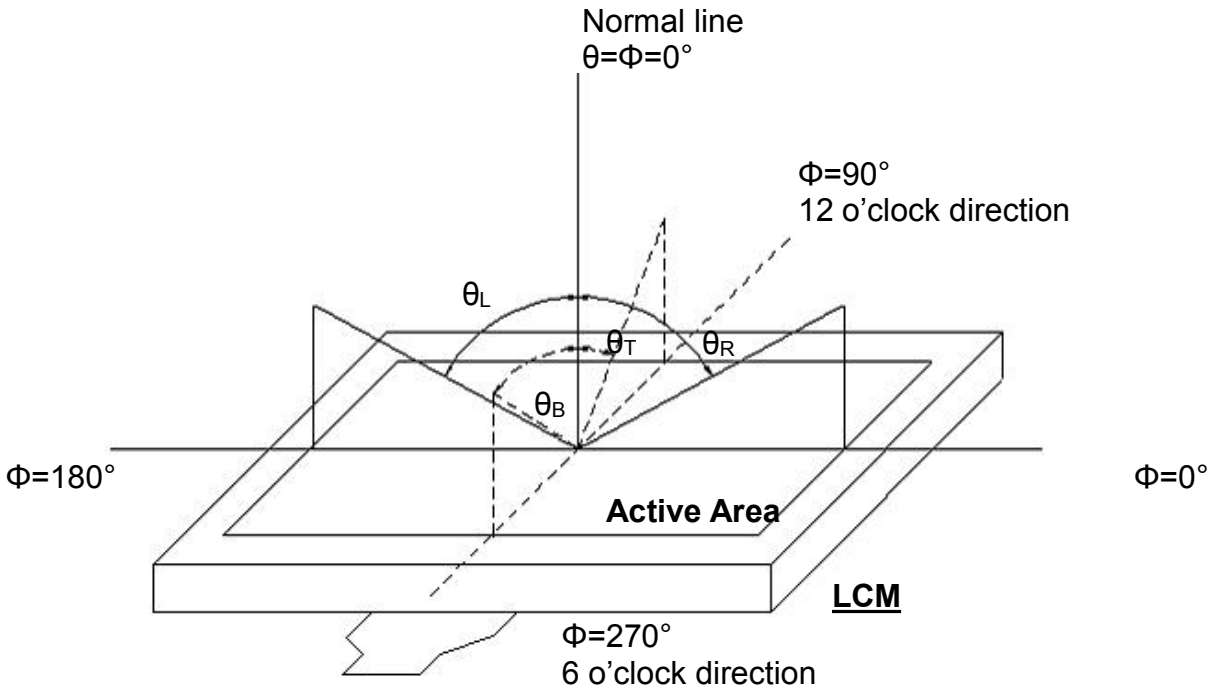


Fig. 4-2 Definition of viewing angle

Note 2: 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%.

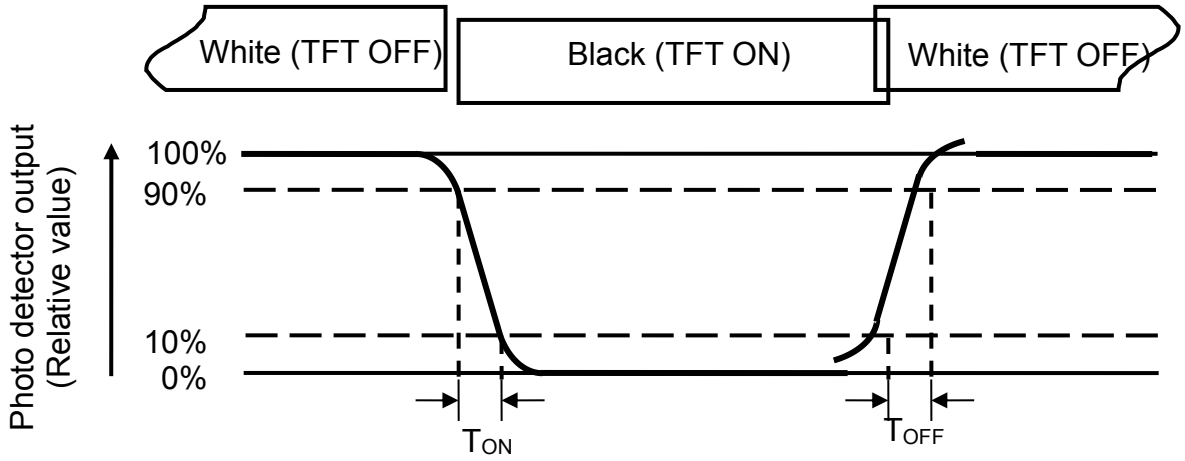


Fig. 4- 3 Definition of response time

Note 3: Definition of contrast ratio

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

Note 4: Definition of optical measurement system.
The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm, Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/ Field of view: 1° /Height: 500mm.) or CA-210.

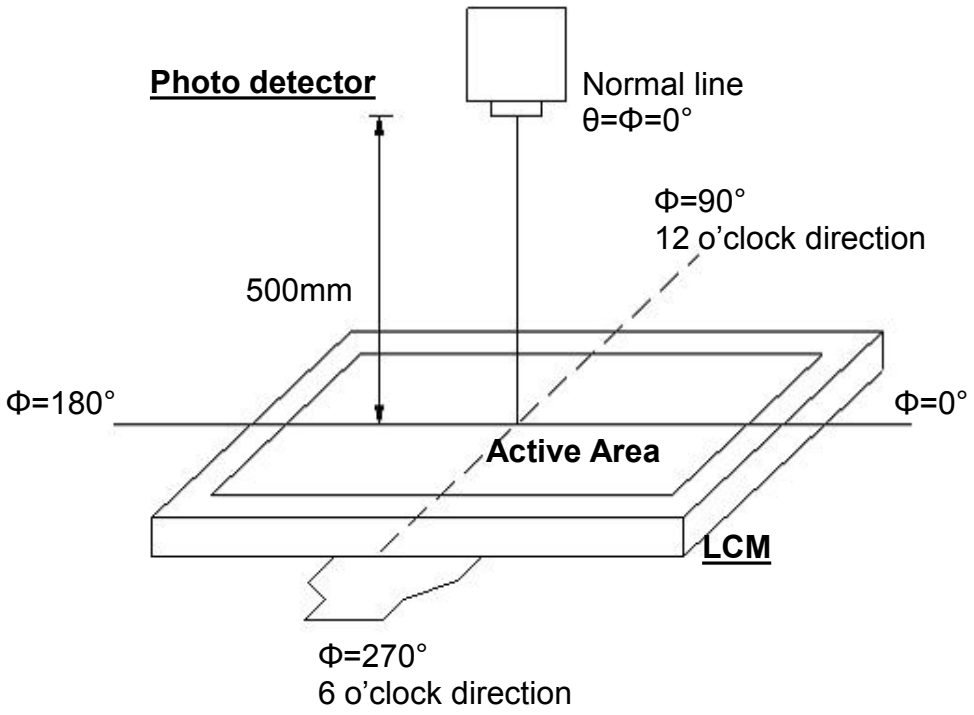


Fig. 4-4 Optical measurement system setup

Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is I_L=240mA .

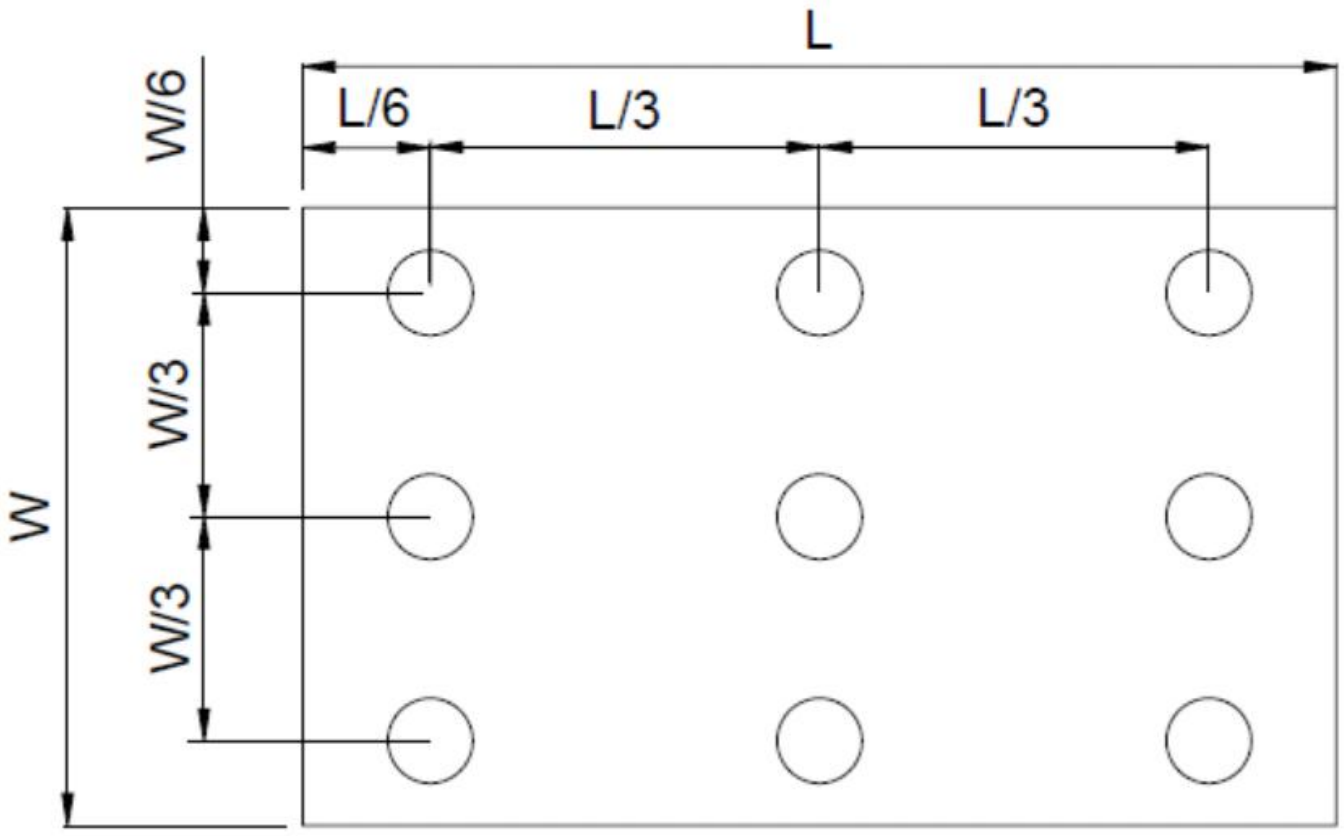
Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas(Refer to Fig. 4-5).

Every measuring point is placed at the center of each measuring area.

$$Luminance\ \ Uniformity\ (Yu) = \frac{B_{min}}{B_{max}}$$

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



B_{MAX}: The measured maximum luminance of all measurement position.

B_{MIN}: The measured minimum luminance of all measurement position.

5. Reliability Test Items

Item	Test Conditions	Criterion
High Temperature Storage	Ta = 80℃ 240hrs	Note 1，Note3，Note 4 ,Note5
Low Temperature Storage	Ta = -30℃ 240hrs	Note 1，Note3，Note 4
High Temperature Operation	Ts = 70℃ 240hrs	Note 2，Note3，Note 4 , Note5
Low Temperature Operation	Ta =-20℃ 240hrs	Note 1，Note3，Note 4
Operate at High Temperature and Humidity	+60℃, 90%RH 240hrs	Note3，Note 4 Note5
Thermal Shock(non operation)	-30℃/30 min ~ +80℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.	Note3，Note 4 Note5
Vibration Test	Sweep:10Hz~55Hz~10Hz 2G 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	
Electro Static Discharge	Contact=+/-4KV, Air=+/-8KV,(R=330R,C=150pF), 1 sec,9point,10times/point;	

※Criterion:

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

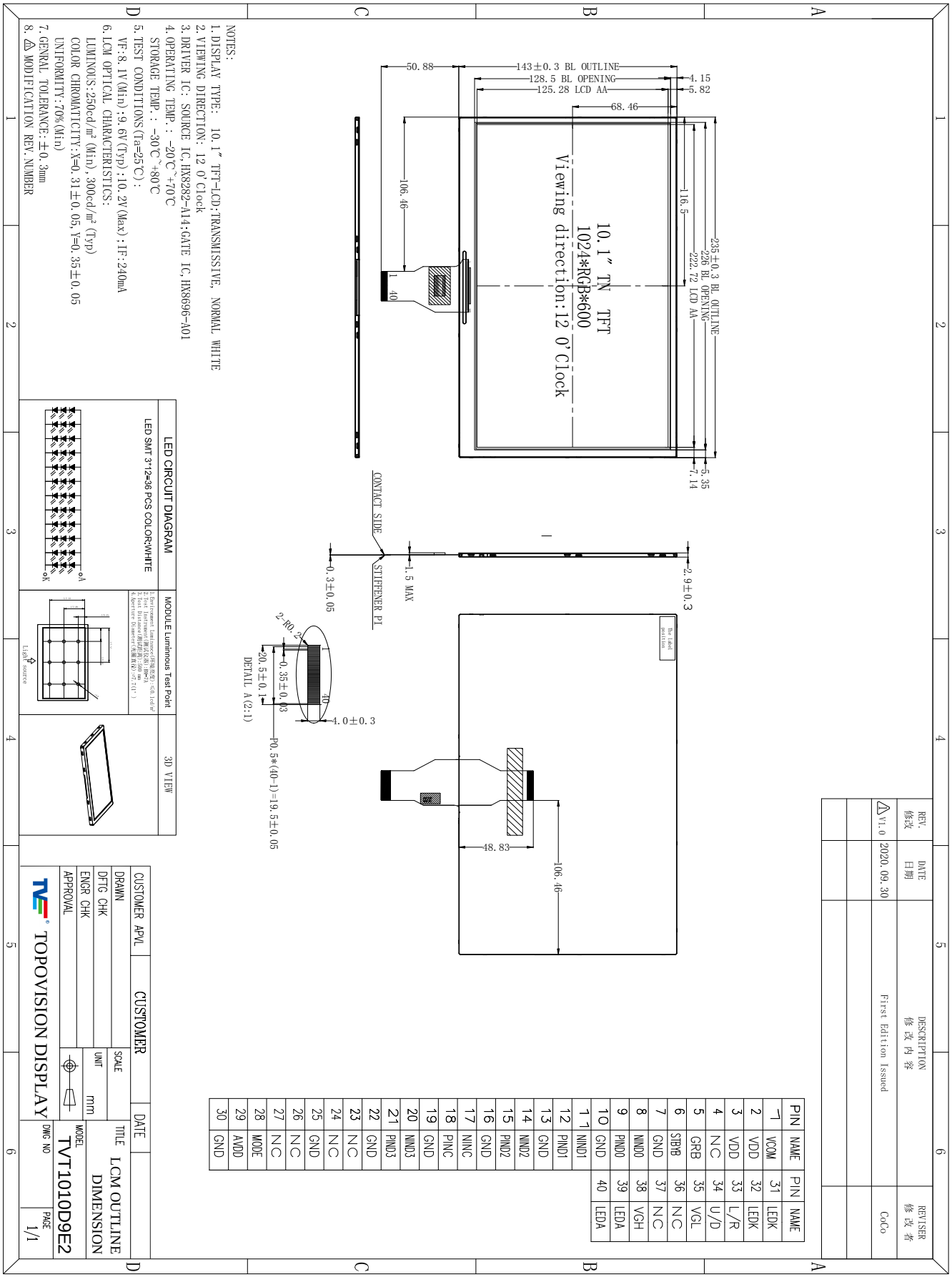
Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 5: A certain level of Mura (non-uniformity) of dark / black image will happen several days after high temperature testing (H.T.T.). There is a slowly part recovery over a long time (several months). Such a long exposure time like in H.T.T. will normally not happen in a real application. Therefore the test H.T.T. was introduced to simulate cycles with normal conditions in-between but with the same total exposure time what show a significant reduced Mura.

The root cause is related to tension generated due to different amount of shrinking in the stack of layers in the polarizer sheet. The effect is more significant on larger displays like this size. An investigation into alternative polarizer material showed that there is no better alternative currently available.

6. Mechanical Drawing



7. Package Drawing

TBD

8. General Precautions

8.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

8.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

8.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

8.4. Storage

1. Store the module in a dark room where must keep at 25±10℃ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

8.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.