Product Specification

Part Name: 10.1 inch TFT Display Module(IPS)

Customer Part ID:

Topovision Part ID: TVT1010D10F-CP

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.

Revision History

Rev.	Date	Contents	Written	Approved
A	2023/03/17	Preliminary Specification	ZHENG	YUAN

Special Notes

Note1.	

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 Black, Transmissive	
5	Pixel pitch	0.2175 (w)x 0.2088(H) mm	
6	Active area	222.72(W) x 125.28(H) mm	
7	Module size	248.3(W) ×150.2(H) ×7(D) mm	Note 1
8	View direction	ALL	O'Clock
9	Surface treatment	Anti-Glare	
10	Color arrangement	RGB-stripe	
11	Interface	LVDS	
12	Lcm power consumption	3.5W	TYP
13	Driver IC	HX8282-A11+HX8696-A01	
14	Touch IC	GT9271	
15	Weight	TBD	TYP
16	Operating Mode	IPS	
17	Color Depth	16.7M	

Note 1: Refer to Mechanical Drawing.

2. Block Diagram
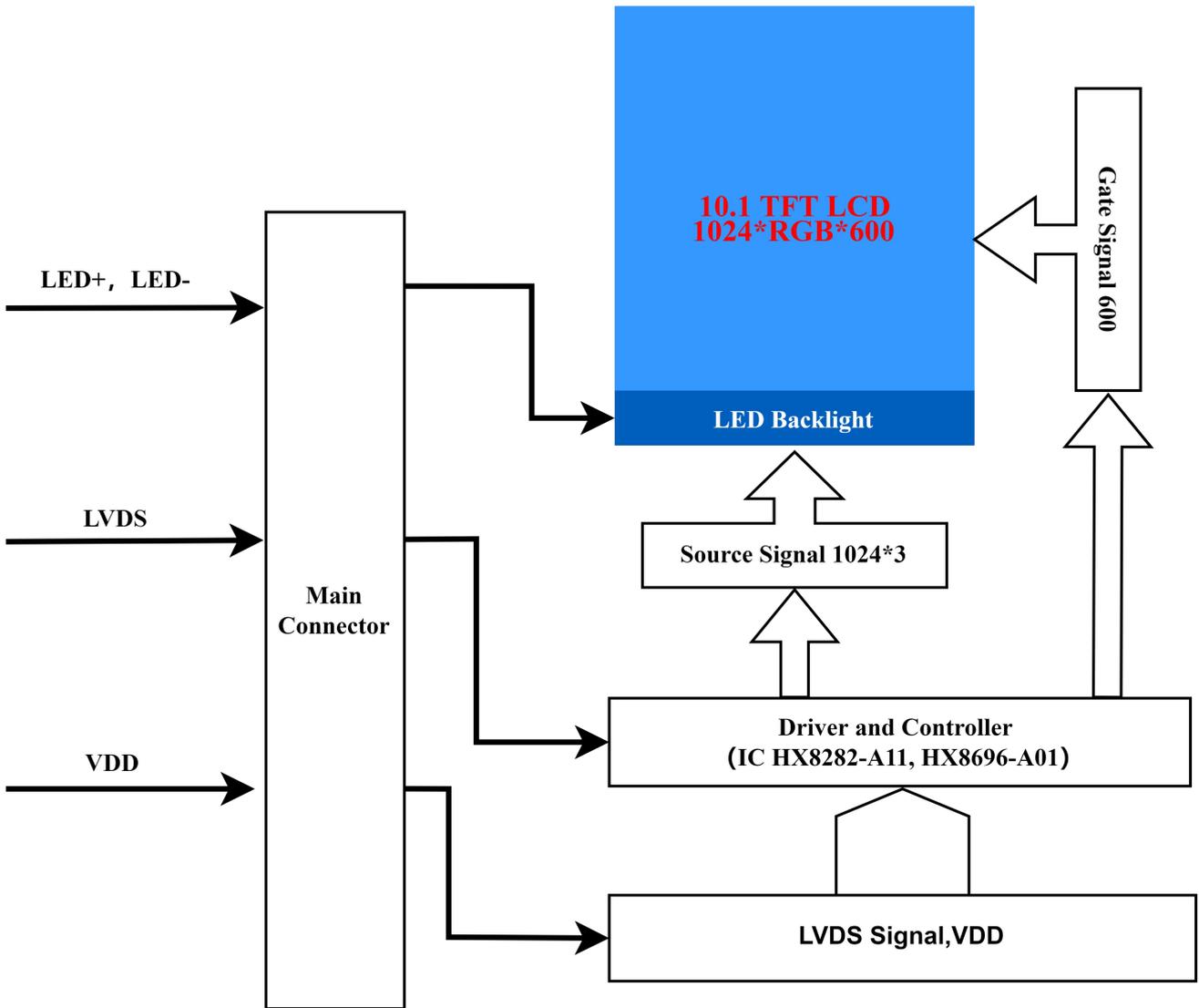
3. Pin Assignment

FPC Connector is used for the module electronics interface.The recommended model is FH12-40S-0.5SH manufactured by Hirose.

Pin No.	Symbol	I/O	Function	Remark
1	NC	-	No connect	
2-3	VDD	P	Power Supply	
4	NC	-	No connect	
5	RESET	I	Reset signal input Pin	
6	STBYB	I	Standby mode. STBYB = ”H”,normal operation(default) 　STBYB = ”L”, timing controller, source driver will 　turn off, all output are High-Z	
7	GND	P	Ground	
8	RXIN0-	I	-LVDS Differential Data Input	
9	RXIN0+	I	+LVDS Differential Data Input	
10	GND	P	Ground	
11	RXIN1-	I	-LVDS Differential Data Input	
12	RXIN1+	I	+LVDS Differential Data Input	
13	GND	P	Ground	
14	RXIN2-	I	-LVDS Differential Data Input	
15	RXIN2+	I	+LVDS Differential Data Input	
16	GND	P	Ground	
17	RXCLKIN-	I	-LVDS Differential Clock Input	
18	RXCLKIN+	I	+LVDS Differential Clock Input	
19	GND	P	Ground	
20	RXIN3-	I	-LVDS Differential Data Input	
21	RXIN3+	I	+LVDS Differential Data Input	
22	GND	P	Ground	
23-24	NC	-	No connect	
25	GND	P	Ground	
26-27	NC	-	No connect	
28	SELB	I	6bit/8bit . mode select. SELB=”0”, LVDS input data is 8bit SELB=”1”, LVDS input data is 6bit	
29	NC	-	No connect	
30	GND	P	Ground	

31-32	LED-	P	LED Cathode	
33	L/R	I	Up/down selections	Note 1
34	U/D	I	Left/right selection	Note 1
35	NC	-	No connect	
36-37	GND	P	Ground	
38	NC	-	No connect	
39-40	LED+	P	LED Anode	

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

Note 1: Selection of scanning mode

Setting of scan control input		Scanning direction
UP/DN	SHLR	
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:

TOP

Left

1024(RGB)×600

Right

Bottom
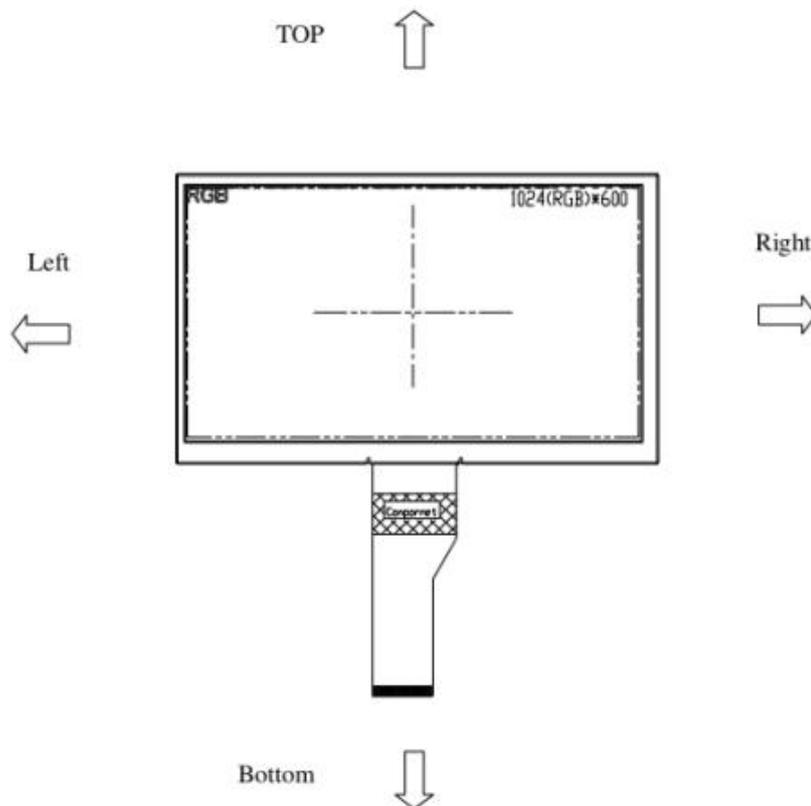
3.1. TP Pin Assignment

FPC Connector is used for the module electronics interface. The recommended model is FH12-6S-0.5SH manufactured by Hirose.

Pin No	Symbol	I/O	Function	Remark
1	INT 3.3V	O	TP Interrupt	
2	SDA 3.3V	I/O	TP serial data input/output bi-direction pin	
3	SCK 3.3V	I	TP High speed interface CLOCK signal input pins.	
4	RST 3.3V	I	TP Reset pin	
5	VCC 3.3V	P	Power for TP	
6	GND	P	Ground	

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

4. Operation Specifications

4.1. Absolute Maximum Ratings

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	VDD	-0.3	4.0	V	TA=25℃
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.

4.2. Typical Operation Conditions

Test condition: GND=0V, TA=25 ºC

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	VDD	3	3.3	3.6	V	
Input logic high voltage	V_{IH}	0.7 V_{DD}	-	V_{DD}	V	Note 2
Input logic low voltage	V_{IL}	0		0.3 V_{DD}	V	

Note1：Please adjust VCOM to make the flicker level be minimum.
Note 2 :DCLK,HS,VS,RESET,U/D,L/R,DE,R0-R7,G0-G7,B0-B7,MODE,DITHB.

4.3. Current Consumption

4.3.1.   Current for LCD Driver

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
	Ivdd	-	60	-	mA	VDD=3.3V

4.3.2.   Current for LED Drive

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED Backlight	V_L	18.6	21.5	23.8	V	Note 1
Crrent for LED Backlight	I_L	-	161	-	mA	
LED life time	-	30,000	-	-	Hrs	Note 2

Note1: V_L=21.5V, I_L=161mA (Backlight circuit:7 series connection, 7 parallel connection), the ambient temperature is 25℃.
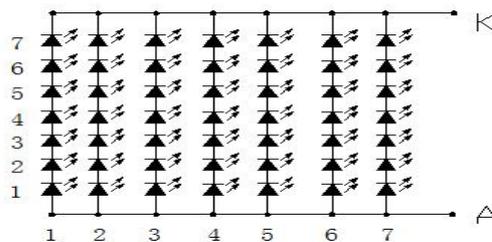

Fig. 3-1 LED test circuit diagram

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 161 mA.

4.4. Power Sequence

a.   Power on:

b. Power off

Figure 3.2 Power off timing
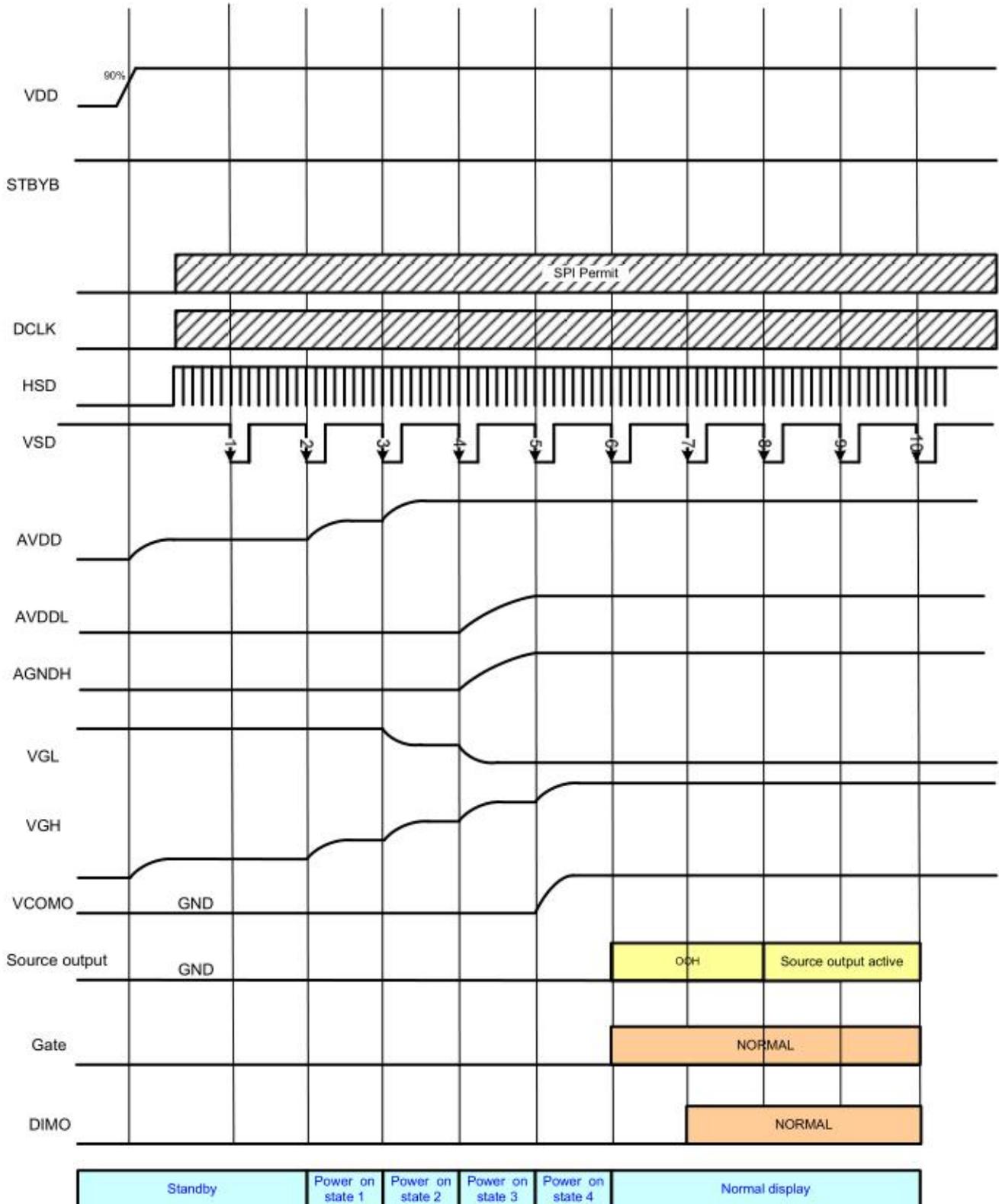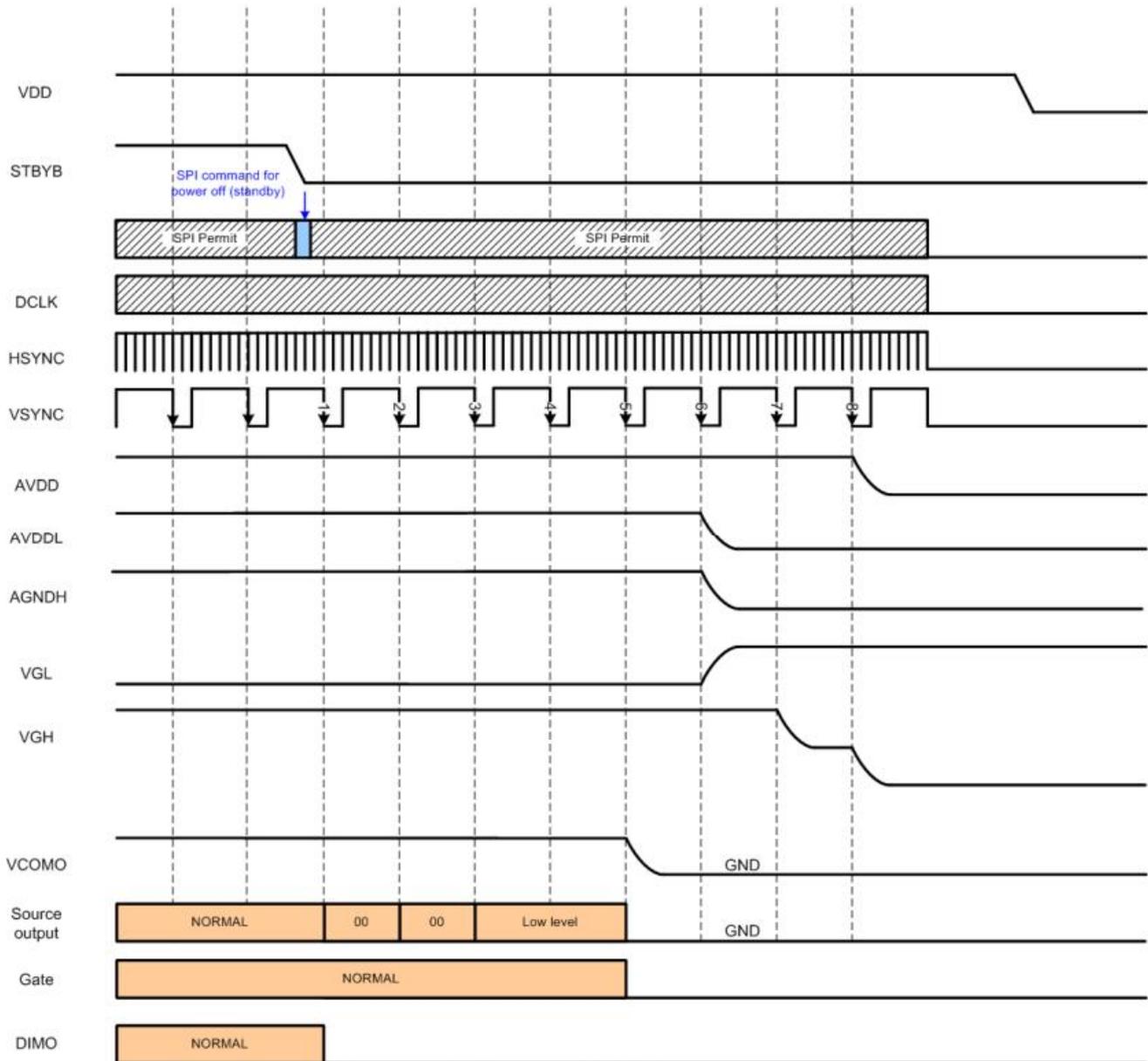
4.5. LVDS Signal Timing Characteristics

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

Single-end signals
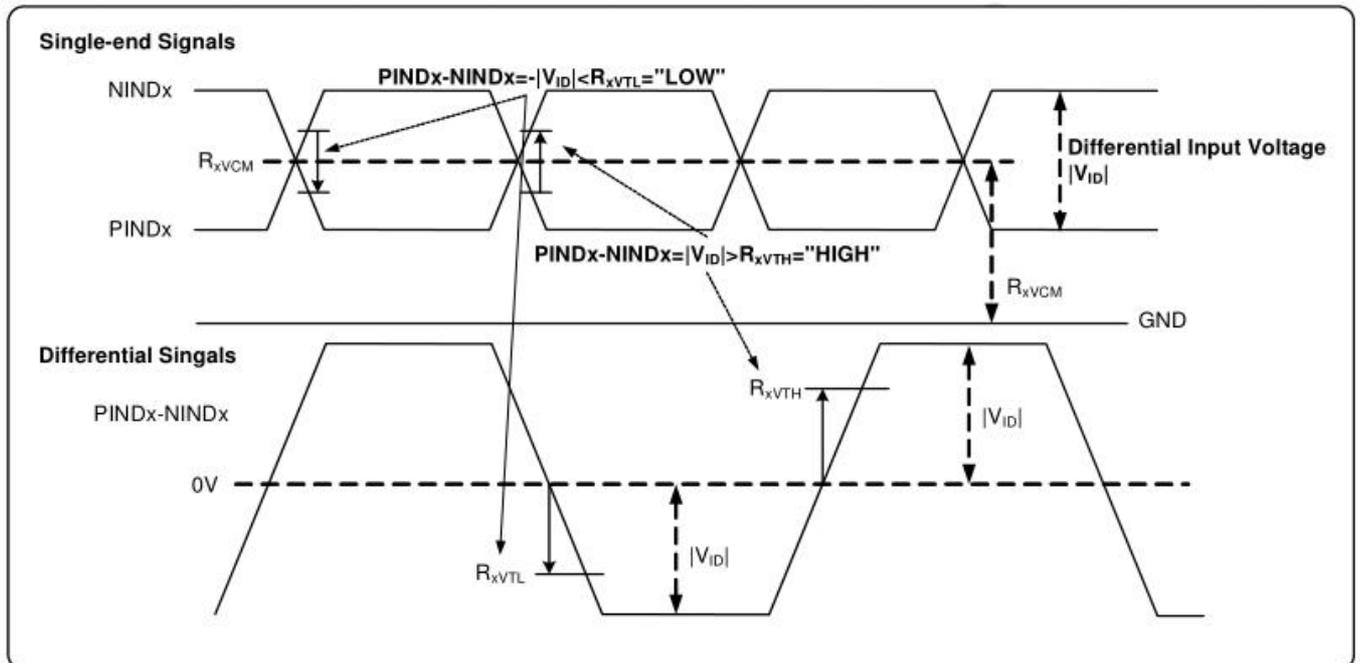
LVDS mode AC electrical characteristics

| Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R_{XFCLK}	20	-	71	MHz	-
Input data skew margin	T_{RSKM}	500	-	-	pS	$\lvert V_{ID} \rvert$=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	-

LVDS figure
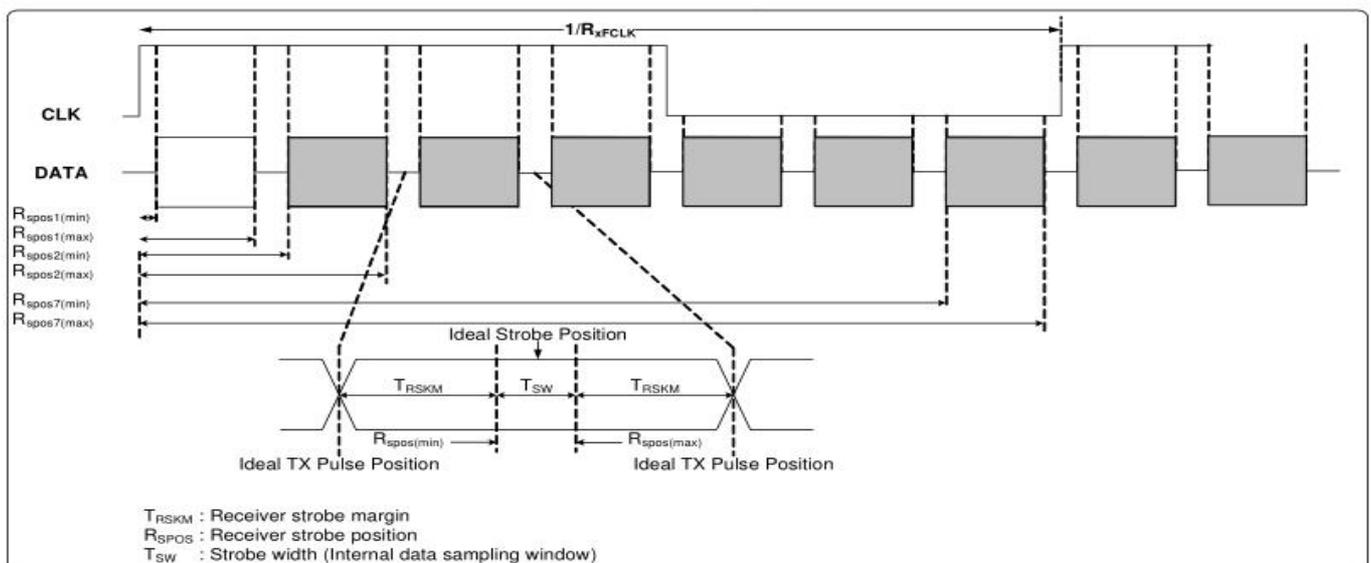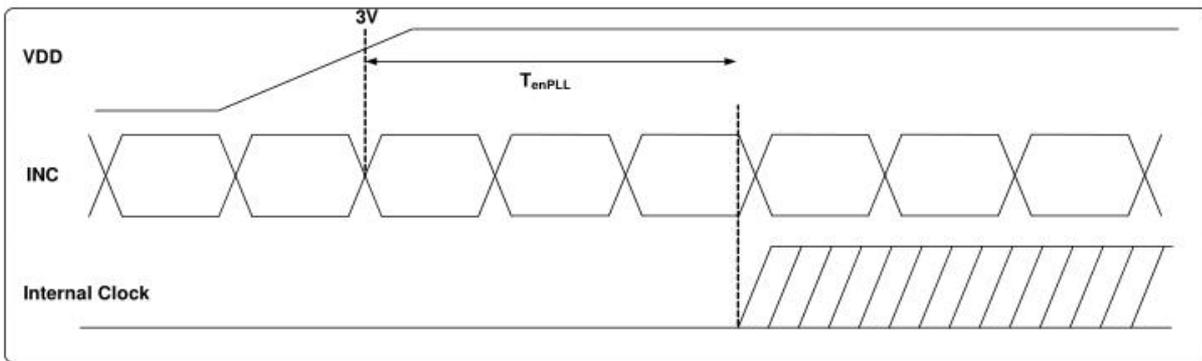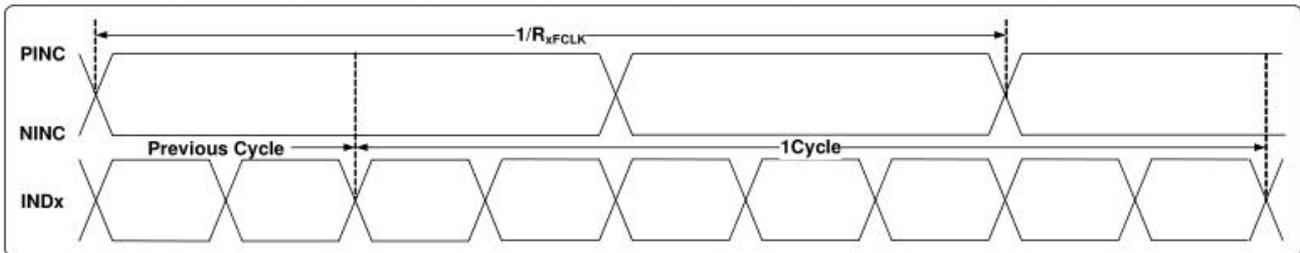
4.6. LVDS mode data input format
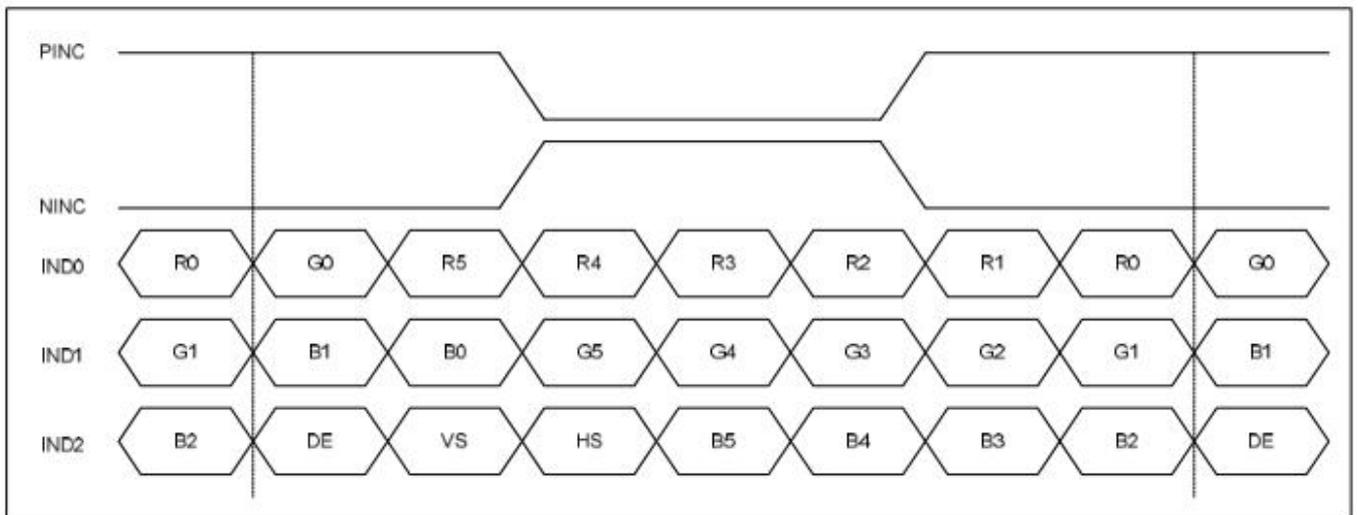
6-bit LVDS input
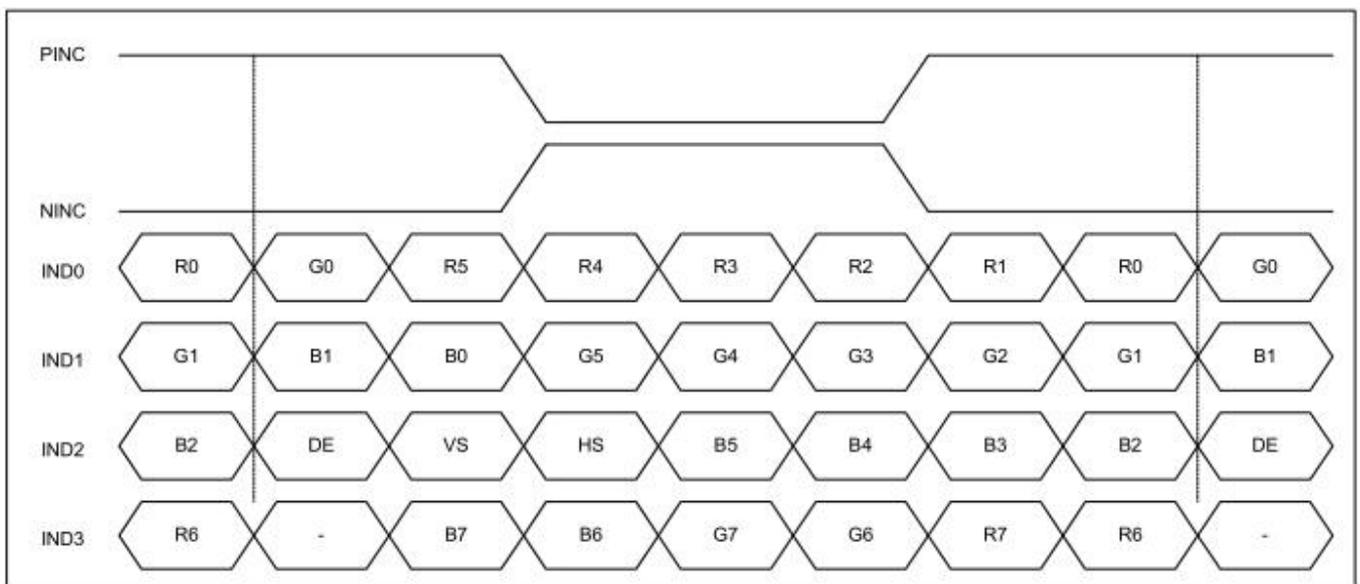
8-bit LVDS Input

4.7. Timing Characteristics of input signals

● DE mode

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd		600		T_H
VSD Period	tv	610	635	800	T_H
VSD Blanking	tvbp+ tvfp	10	35	200	T_H

Table 10.4: DE mode (1024x600)

● HV mode

Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1	-	140	DCLK
HSD Back Porch	thbp		160		DCLK
HSD Front Porch	thfp	16	160	216	DCLK

Table 10.5: HV mode horizontal timing (1024x600)

Vertical Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		600		T_H
VSD Period	tv	624	635	750	T_H
VSD Pulse Width	tvpw	1	-	20	T_H
VSD Back Porch	tvbp		23		T_H
VSD Front Porch	tvfp	1	12	127	T_H

Table 10.6: HV Mode Vertical Timing (1024x600)

5. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	Φ=180°(9 o'clock)	80	-	-	degree	Note 1
	θ_R	Φ=0°(3 o'clock)	80	-	-		
	θ_T	Φ=90°(12 o'clock)	80	-	-		
	θ_B	Φ=270°(6 o'clock)	80	-	-		
Response time	T_{ON+} T_{OFF}		-	25	35	msec	Note 2
Contrast ratio	CR		800	1000	-	-	Note 3
Color chromaticity	W_X	Normal θ=Φ=0°	0.27	0.32	0.37	-	Note 4 Note 5 Note 6
	W_Y		0.30	0.35	0.40	-	
Luminance	L		580	630	-	cd/m²	Note 6
Luminance uniformity	Y_U		70	75	-	%	Note 7

The test systems refer to Note 2.

Note 1: Definition of viewing angle range
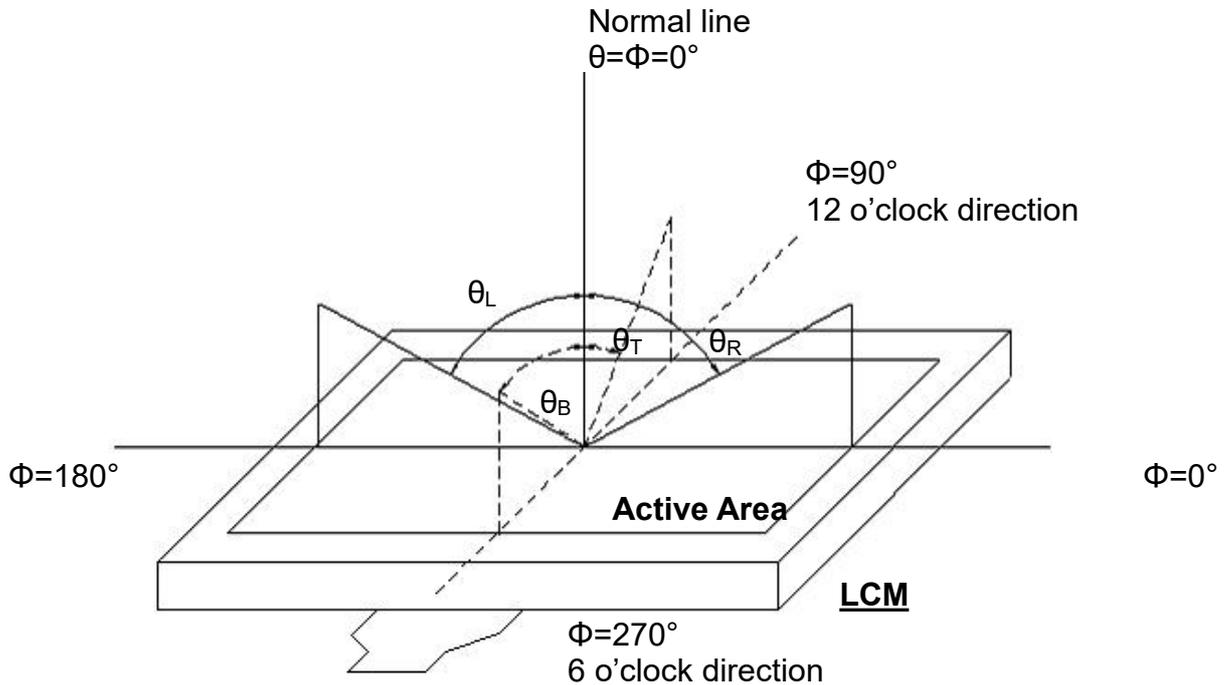
Fig. 4-2 Definition of viewing angle

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%.
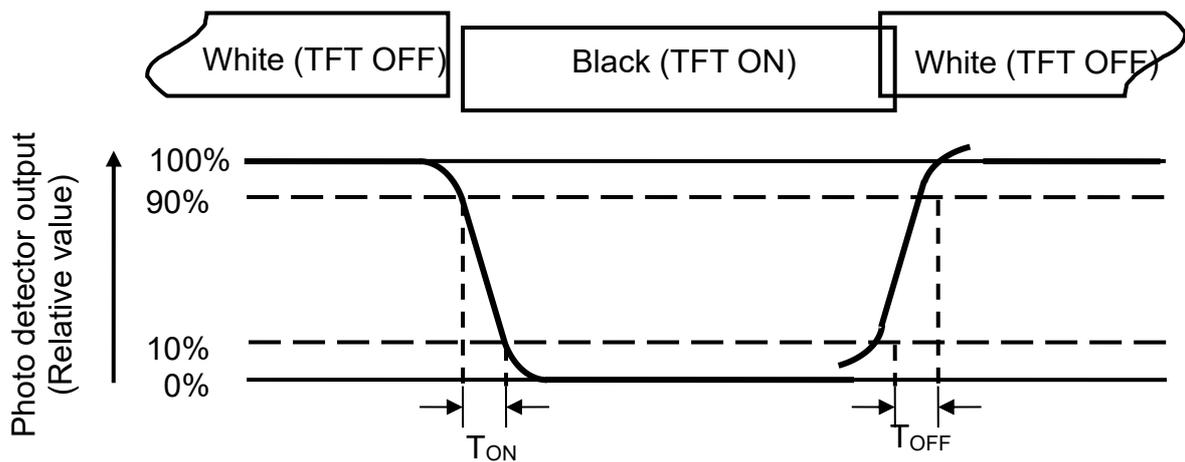

Fig. 4- 3 Definition of response time

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.

Photo detector

Normal line
θ=Φ=0°

Φ=90°
12 o'clock direction

500mm

Φ=180°

Φ=0°

Active Area

LCM

Φ=270°
6 o'clock direction
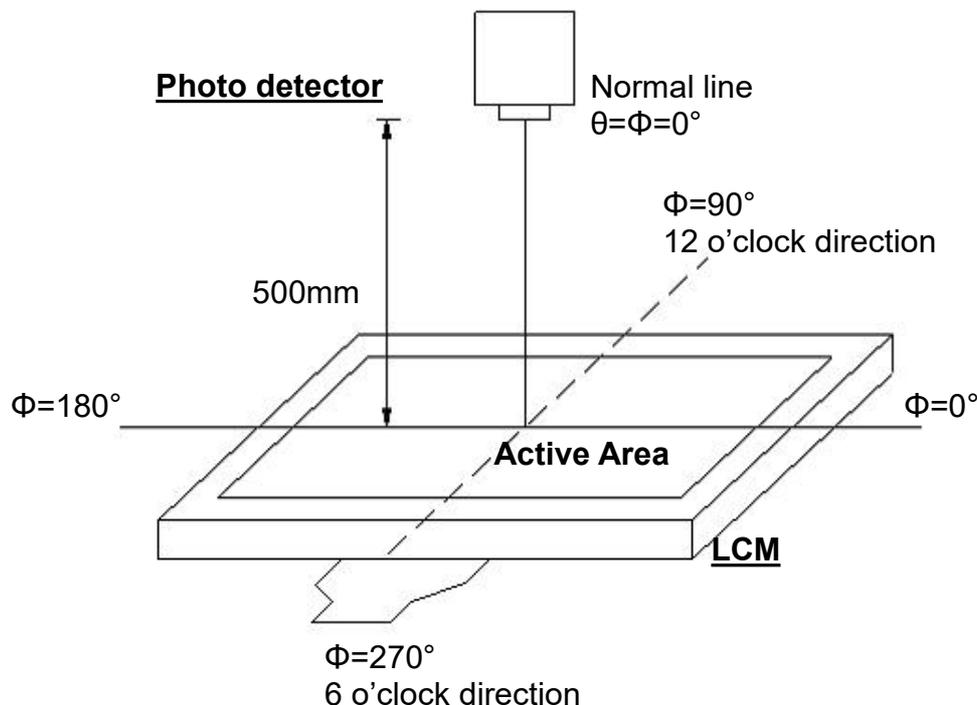
Fig. 4-4 Optical measurement system setup

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=161mA .

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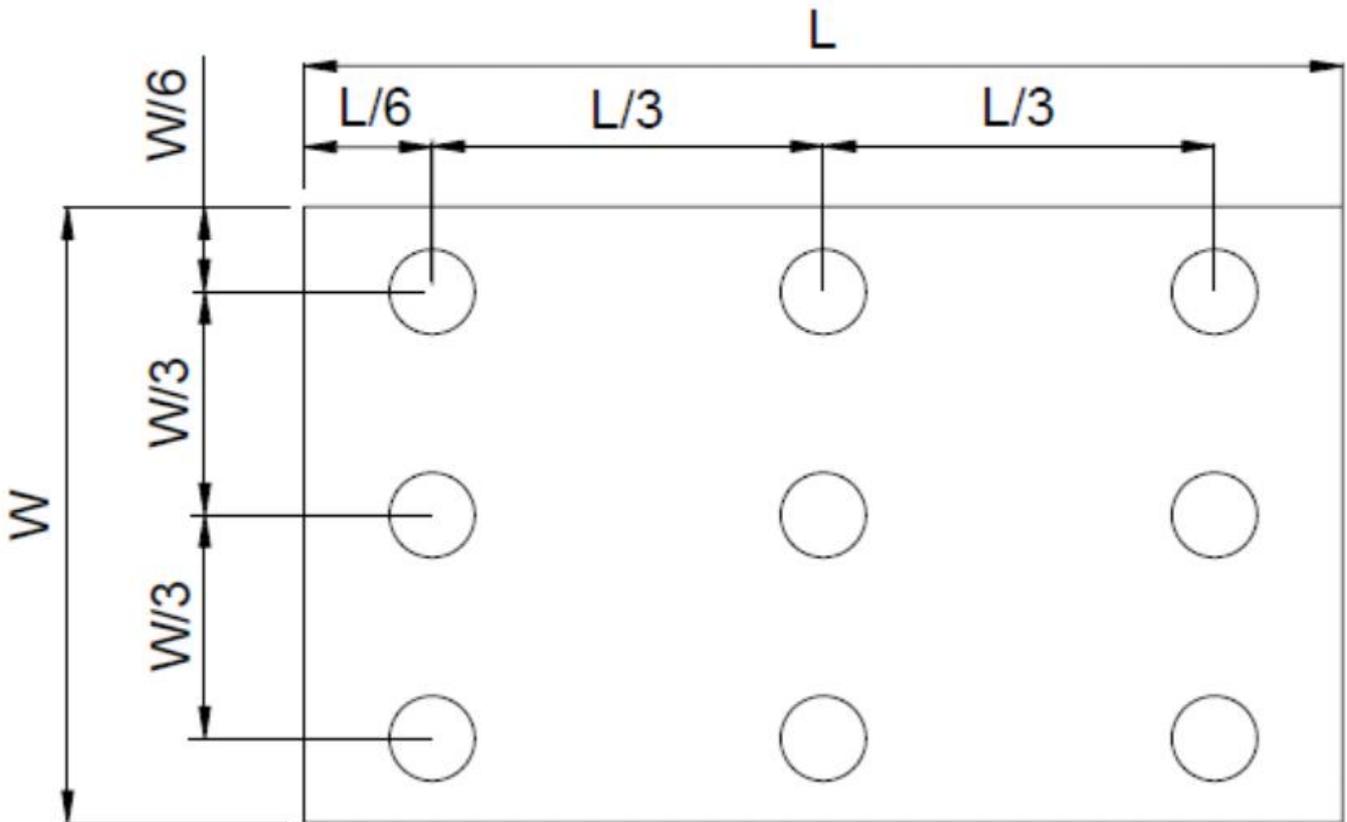
B_{MAX}: The measured maximum luminance of all measurement position.
B_{MIN}: The measured minimum luminance of all measurement position.

6. 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	Ta = 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)	-20℃/30 min ~ +70℃/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.

Note 6: The test samples should be applied to only one test item.

7. Mechanical Drawing

1.基本规格 General Specification

Item		
DISPLAY TYPE	10.1"IPS TFT	
	NORMALLY BLACK	
RESOLUTION	1024*(RGB)*600	
LCD Driver IC	HX8282-A11+HX8696-A01	
TRANSMISSIVE		
Viewing Angle(U/D/L/R)	ALL(80/80/80/80) TYP	
TFT POWER SUPPLY(VDD)	MIN 3.0 TYP 3.3 MAX 3.6	
TP Transmittance	≥85%	
TP Driver IC	GT9271(32*18)	
Interface	LVDS	
OPERATING TEMP	-20℃~+70℃	
STORAGE TEMP	-30℃~+80℃	
FLATNESS	≤0.40	

2.光学要求 Optical Requirements

3.电性要求 Electronic Requirement(Ta=25℃)

Item	Min	Typ	Max	Unit
Luminance(LCM)	580	630	—	cd/m²
Uniformity %	70	75	—	%
颜色中心色度 (Center Chromatis X)	0.27	0.32	0.37	
Y颜色中心色度 (Center Chromatis Y)	0.30	0.35	0.40	
LED driver current	—	161	—	mA
LED driver voltage	18.6	21.5	23.8	V

4.LED电路图 LED CIRCUIT DIAGRAM

5.Notes:
1. Unit:mm
2. Do not scale drawing
3. All radii without dimension R0.20mm
4. ▲ Modification rev. number
5. "▲" FOR SAFETY CHARACTERISTIC(安全特性).
   "●" FOR SPECIAL DIMENSION,CPK≥1.33
   "O" FOR REFERENCE DIMENSION(参考尺寸)
   "※" FOR CRITICAL DIMENSION(重要管控尺寸)
6. General Tolerance:±0.30mm
7. Mark mold cavity indentification in recess approximately where indicated
8. Rohs must be complied.

REV 修改	DATE 日期	DESCRIPTION 修改内容	REVISER 修改者
△ V1.0	23/03/18	First Edition Issued	PNW

6.CTP Technical parameters
1. TP Structure: G+G;
2. TP Type: COF;IC controller: GT9271;
   Working voltage: 2.8V~3.3V;I/O voltage:2.8V
3. Light transmittance: ≥85%
4. Surface hardness: more than 3H
5. Surface treatment:antiglare
6. Working environment: -20℃~+70℃,≤85%RH
7. Storage environment: -30℃~+80℃, ≤85%RH
8. Products comply with RoHS standard.

7.MODULE Luminous Test Point

PIN NO.	Dinfination
1	INT(3.3V)
2	SDA(3.3V)
3	SCK(3.3V)
4	RST(3.3V)
5	VCC(3.3V)
6	GND

No.	PIN NAME	No.	PIN NAME
1	NC	21	RXIN3+
2	VDD	22	GND
3	VDD	23	NC
4	NC	24	NC
5	RESET	25	GND
6	STBYB	26	NC
7	GND	27	NC
8	RXCLKIN-	28	SELB
9	RXIN0+	29	NC
10	GND	30	GND
11	RXIN1-	31	NC
12	RXIN1+	32	LED-
13	GND	33	L/R
14	RXIN2-	34	U/D
15	RXIN2+	35	NC
16	GND	36	GND
17	RXCLKIN+	37	GND
18	RXCLKIN-	38	NC
19	GND	39	LED+
20	RXIN3-	40	LED+

TOPOVISION DISPLAY

MODEL	TVT1010D10F-CP
TITLE	LCM OUTLINE DIMENSION

CUSTOMER APVL		CUSTOMER
DRAWN		
DFTG CHK		
ENGR CHK		
APPROVAL		

10.1"TFT 1024*(RGB)*600

Open Shipment

8. Inspection Standards for LCD Modules

8.1. Acceptable Criteria

Unless there is other agreement, the sampling plan for incoming inspection shall follow GB2828.1-2012

(1) Lot size: Quantity per shipment as one lot (different model as different lot).

(2) Sampling type: Normal inspection, single sampling.

(3) Sampling level: Level II.

(4) AQL: Acceptable Quality Level

Major defect: AQL=0.65

Minor defect: AQL=1.0

8.2. Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of defects is classified as below.

(1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

The criteria on major or minor judgment will be according with the classification of defects.

8.3. The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

(1) Ambient temperature：25±5 ℃

(2) Humidity：25~75 % RH

(3) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30~40cm or more between the LCD module and eyes of inspector.

Ambient Illumination：500~600Lux for external appearance inspection

Ambient Illumination：200~500 Lux for light on inspection

(4) The viewing angle：

a）±45 degree to the front surface of display panel in vertical direction.

b）±45 degree to the front surface of display panel in horizontal direction.

(5) Display panel shall be conducted at the distance 35~40cm between the LCD

module and eyes of inspector (Fig. 1)

Fig. 1
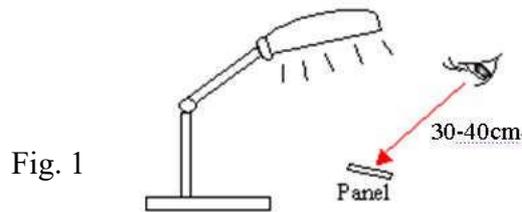
8.4. Inspection CriteriaSafety

（1）Definition of dot defect induced from the panel inside

　a）Bright dot：Dots appear bright and unchanged in size in which LCD panel is

　　displaying under black pattern.

　b）Dark dot：Dots appear dark and unchanged in size in which LCD panel is displaying
　　under pure red, green, blue picture.

　c) 2 dot adjacent = 1 pair = 2 dots
　　Picture:

2 dot adjacent　2 dot adjacent　2 dot adjacent (vertical)　2 dot adjacent (slant)
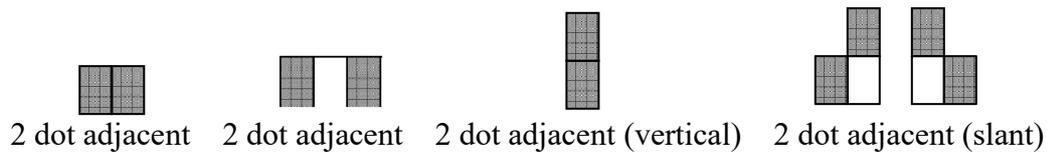
(2)Display Inspection

| Items		Acceptable count
Bright dot	Random	N ≦ 1
	2 dots adjacent	N ≦ 0
	3 dots adjacent	N ≦ 0
Distance	Minimum Distance Between Bright dots	5mm
Dark dot	Random	N ≦ 2
	2 dots adjacent	N ≦ 0
	3 dots adjacent	N ≦ 0
Total bright and dark dot		N ≦ 2
Distance	Minimum Distance Between dark dots Minimum Distance Between dark and bright dot.	5mm
Tiny bright dot		visible through 5% ND filter D≦0.15mm，Ignore 0.15mm ＜ D≦0.3mm，N≦3 Distance≧5mm
Display failure (V-line/H-line/Cross line etc.)		Not allowable
Mura/ Waving/ Hot spot	Not visible through 5% ND filter	

*Note: Defect which is on the Black Matrix(outside of Active Area) are not considered as a defect.

(3)Appearance & Display inspection

Item	Standards
Foreign Black/White/Bright Spot (Display & Appearance)	D≦0.15mm，Ignore 0.15mm＜D≦0.4mm，N≦2 Distance≧5mm It is shown in Fig. 2.
Foreign Black/White/Bright Line (Display & Appearance)	W≦0.05 mm，Ignore 0.05＜W≦0.1 mm L≦3.0 mm，N≦2 It is shown in Fig. 3.
Polarizer Dent/Air Bubble	D≦0.15mm，Ignore 0.15mm＜D≦0.4mm，N≦2 Distance≧5mm
Polarizer Scratches	W≦0.05 mm，Ignore 0.05＜W≦0.1 mm L≦3.0 mm，N≦2

Notes: If any specific defect is not included in the above defect table, this defect should be judged by   customer discussion.

1. W：Width
2. L：Length
3. D：Average Diameter
4. N：Count

D=(a+b)/2

Fig. 2

W: width, L：length

Fig. 3
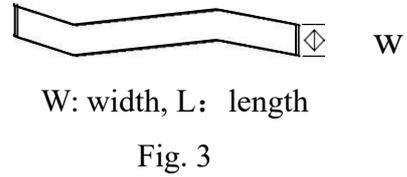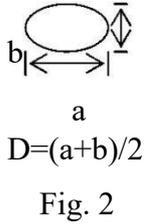
8.5. External Appearance Inspection Criteria

Item	Contents	
FPC cable	Cable not continuous、Break-off Connector Burn-off /Break-off are not permitted.	
Metal frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Stain on Polarizer	The stain, which can't be wiped off, is not permitted.	
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Assembly NG or Function fail caused by deformation is not permitted	
Outline size	Spec. out is not permitted.	

9.　General Precautions

10.1.　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.

10.2.　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.

10.3.　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.

10.4.　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.

10.5.　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.