TFT DISPLAY SPECIFICATION

RAYSTAR Optronics, Inc.
曜凌光電股份有限公司

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RFM1040G-AWW-LNN

SPECIFICATION

CUSTOMER:

APPROVED BY	
PCB VERSION	
DATE	

FOR CUSTOMER USE ONLY

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

Release DATE:

TFT Display Inspection Specification: https://www.raystar-optronics.com/download/products.htm
Precaution in use of TFT module: https://www.raystar-optronics.com/download/declaration.htm

Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2022/02/14		First issue

Contents

1.Module Classification Information

R	F	M	104	0G	-	A	W	W	-	L	N	N
1	2	3	4	5	-	6	7	8	-	9	10	11

Item	Description		
1	R：Raystar Optronics Inc.		
2	Display Type：F→TFT Type, J→ Custom TFT		
3	Solution: A: 128x160 B:320x234 C:320x240 D:480x234 E:480x272 F:800x480 G:640x480 H:1024x600 I:320x480 J:240x320 K:1280x800 L:240x400 M:1024x768 N:128x128 O:480x800 P:640x320 Q:800x600 S:480x128 T:800x320		
4	Display Size：10.4” TFT		
5	Version Code.		
6	Model Type: A：TFT LCD E：TFT+FR+CONTROL BOARD J：TFT+FR+A/D BOARD N：TFT+FR+A/D BOARD+CONTROL BOARD S：TFT+FR+POWER BOARD (DC TO DC) 1：TFT+CONTROL BOARD		6：TFT+FR H：TFT+D/V BOARD I：TFT+FR+D/V BOARD B：TFT+POWER BD
7	Polarizer Type, Temperature range, View direction	I→Transmissive, W. T, 6:00 ; C→Transmissive, N. T, 6:00 L→Transmissive, W.T,12:00 ; F→Transmissive, N.T,12:00 Y→Transmissive,W.T, IPS TFT ; A→Transmissive, N.T, IPS TFT Z→Transmissive, W.T, O-TFT R→Transmissive, Super W.T, O-TFT N→Transmissive, Super W.T, 6:00; Q→Transmissive, Super W.T, 12:00 V→Transmissive, Super W.T, VA TFT	
8	Backlight	W：LED, White	H：LED, High Light White
		F：CCFL, White	
9	Driver Method	D: Digital A: Analog L：LVDS M:MIPI	
10	Interface	N：without control board A：8Bit B：16Bit S:SPI Interface R: RS232 U:USB I: I2C	
11	TS	N：Without TS S：resistive touch panel C：capacitive touch panel capacitive touch panel (G-F-F) G：capacitive touch panel(G-G)	

2.Summary

TFT 10.4 ” is a transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This panel has a 10.4 inches diagonally measured active display area with resolution 1024 x 768. This product is composed of a TFT LCD panel, polarizers, driver ICs, FPC and PCBA.

Note: Air-Bonding is recommended.

3.General Specifications

- Size: 10.4 inch
- Dot Matrix: 1024 x RGB x 768 (TFT) dots
- Module dimension: 230 x 180.2 x 12.4 mm
- Active area: 210.432 x 157.824 mm
- Pixel pitch: 0.2055 X 0.2055 mm
- LCD type: TFT, Normally Black, Transmissive
- Viewing Angle: 80/80/80/80 min
- Aspect Ratio: 4:3
- TFT Interface: LVDS
- Backlight Type: LED ,Normally White
- With /Without TP: Without TP
- Surface: Anti-Glare
- Side screw torque : TBD
- Assembly Instructions:Need to use edge measuring keyholes to perform fixing and support

*Color tone slight changed by temperature and driving voltage.

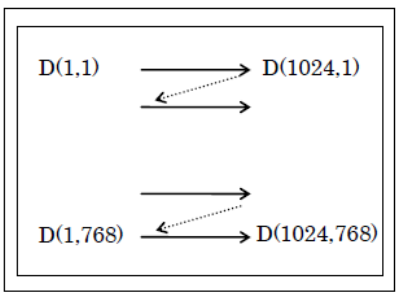
4.Interface

4.1. LCM PIN Definition (CON1)

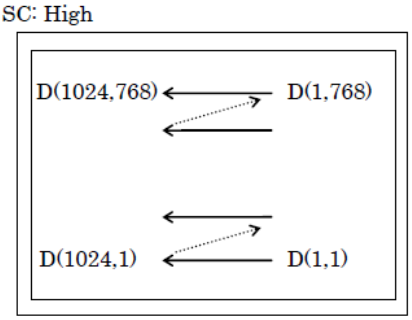
Pin	Symbol	Function	Remark
1-2	VDD	Power supply: + 3.3V	
3-4	GND	Ground	
5	Link0-	0- LVDS differential data input	
6	Link0+	0+ LVDS differential data input	
7	GND	Ground	
8	Link1-	1- LVDS differential data input	
9	Link1+	1+ LVDS differential data input	
10	GND	Ground	
11	Link2-	2- LVDS differential data input	
12	Link2+	2+ LVDS differential data input	
13	GND	Ground	
14	CLKIN-	- LVDS differential clock input	
15	CLKIN+	+ LVDS differential clock input	
16	GND	Ground	
17	Link3-	3- LVDS differential data input	
18	Link3+	3+ LVDS differential data input	
19	MODE	Bit 6:High(6 Bit);Low(8 Bit)	
20	SC	Scan direction selector (Low: Normal ;High: Reverse)	

(1) Display Position and Scan Direction
D(X,Y) shows the data number of input signal.

SC: Low



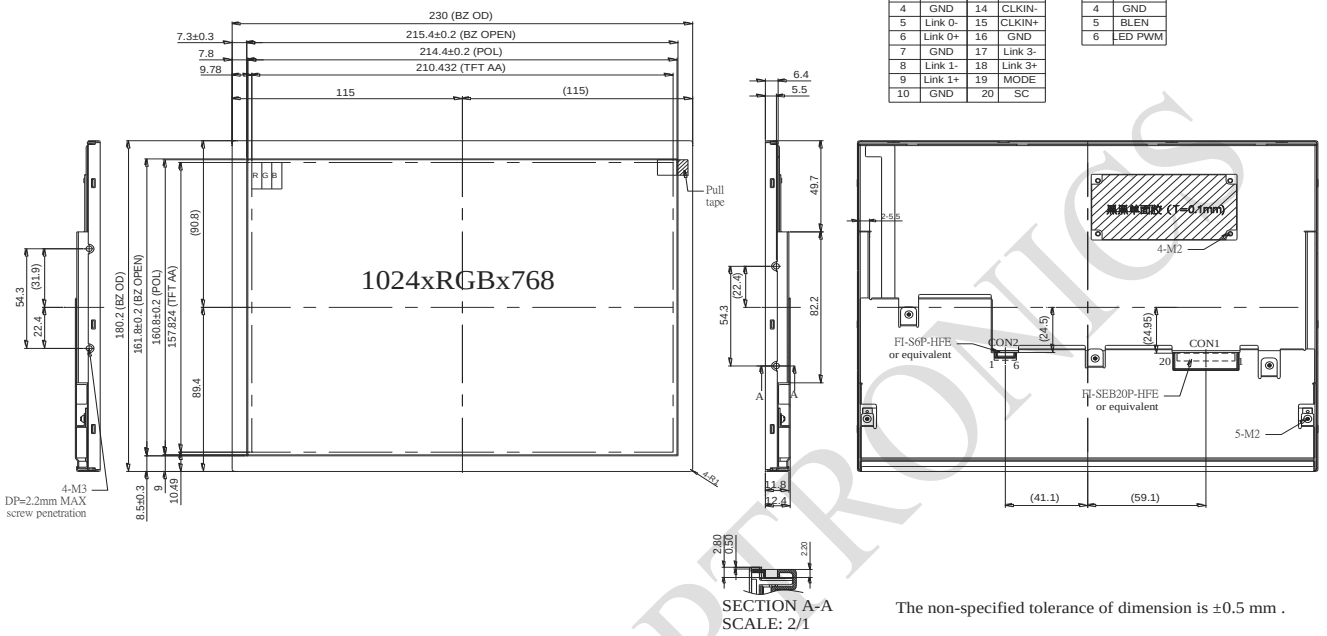
SC: High



4.2. CON2

Pin	Symbol	Function	Remark
1-2	VLED 12V	12V input	
3-4	GND	Ground	
5	BLEN	Backlight ON-OFF	
6	LED PWM	Light Dimming Control (PWM) Input Voltage (Low active)	

5.Contour Drawing



CON1

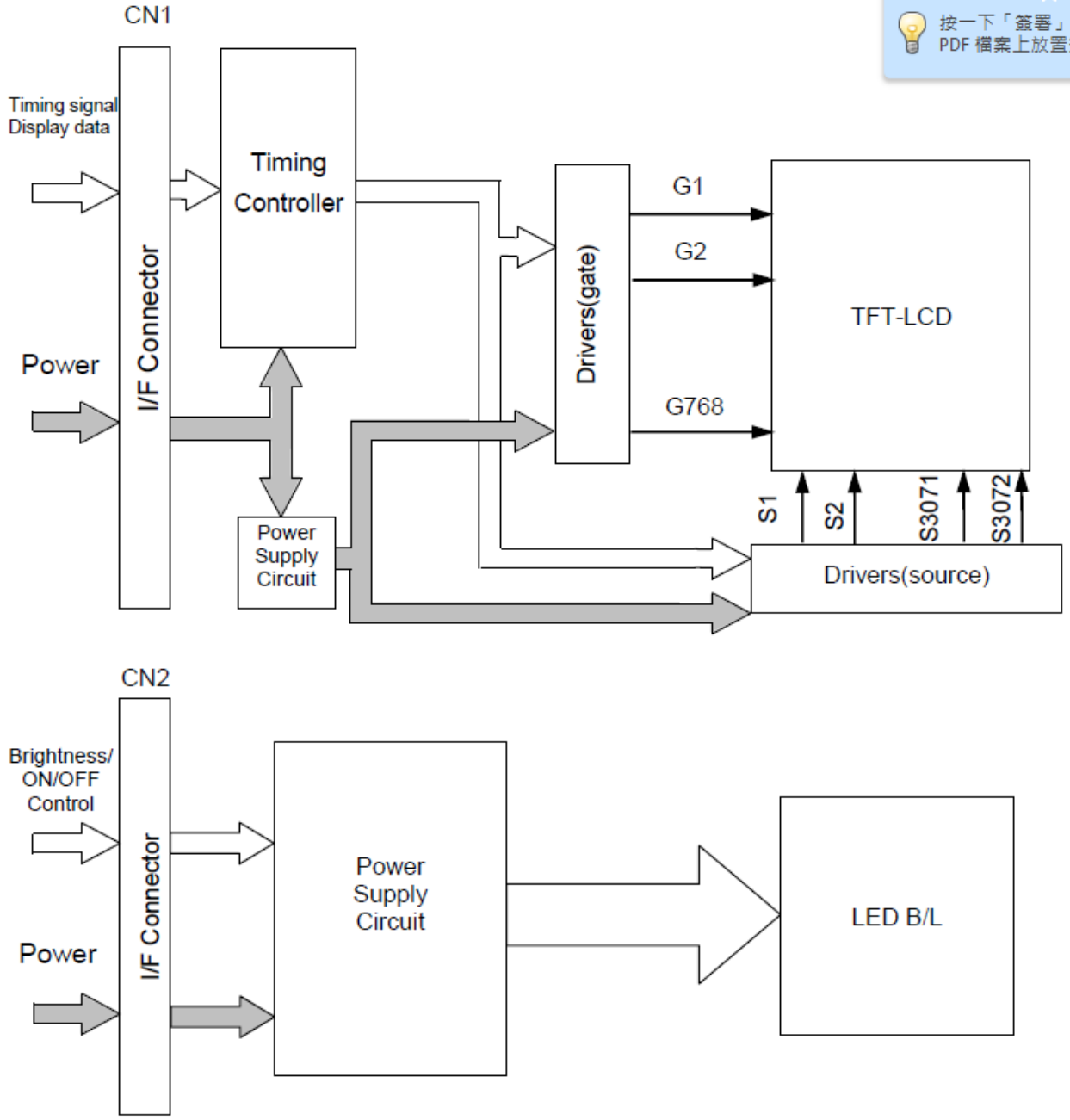
PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	VDD	11	Link 2-
2	VDD	12	Link 2+
3	GND	13	GND
4	GND	14	CLKIN-
5	Link 0-	15	CLKIN+
6	Link 0+	16	GND
7	GND	17	Link 3-
8	Link 1-	18	Link 3+
9	Link 1+	19	MODE
10	GND	20	SC

CON2

PIN NO.	SYMBOL
1	VLED 12V
2	VLED 12V
3	GND
4	GND
5	BLEN
6	LED PWM

The non-specified tolerance of dimension is ±0.5 mm .

6.Block Diagram



7.Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-30	—	+80	□
Storage Temperature	TST	-30	—	+80	□

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp. □60□, 90% RH MAX. Temp.＞60□, Absolute humidity shall be less than 90% RH at 60□

8.Electrical Characteristics

8.1. Operating conditions

Item	Symbol	Standard Value			Unit
		Min	Typ	Max	
Power voltage	V_{DD}	3.0	3.3	3.6	V
Input logic high voltage	V_{IH}	0.7 V_{DD}	-	V_{DD}	V
Input logic low voltage	V_{IL}	0	-	0.3 V_{DD}	V
Current for Power	I_{VDD}		385	424	mA

8.2. LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Backlight Enable(BLEN)	High Level	1.3	3.3	-	V	Note 2
	Low Level	-	0.8	1.0	V	
PWM Control Level (PWM)	High Level	-	3.3	-	V	Note 3
	Low Level	-	0	-	V	
PWM Control Duty Ratio	-	0	-	100	%	
PWM Control Frequency	-	-	10K	-	Hz	Note 4
LED Life Time	-	-	100,000	-	Hr	Note 1

Note 1 : Ta = 25 ℃

Note 2 : Turn ON the backlight when BLEN =High, Turn OFF when BLEN =Low

Note 3 : PWM High Active Control from lowest brightness to highest brightness

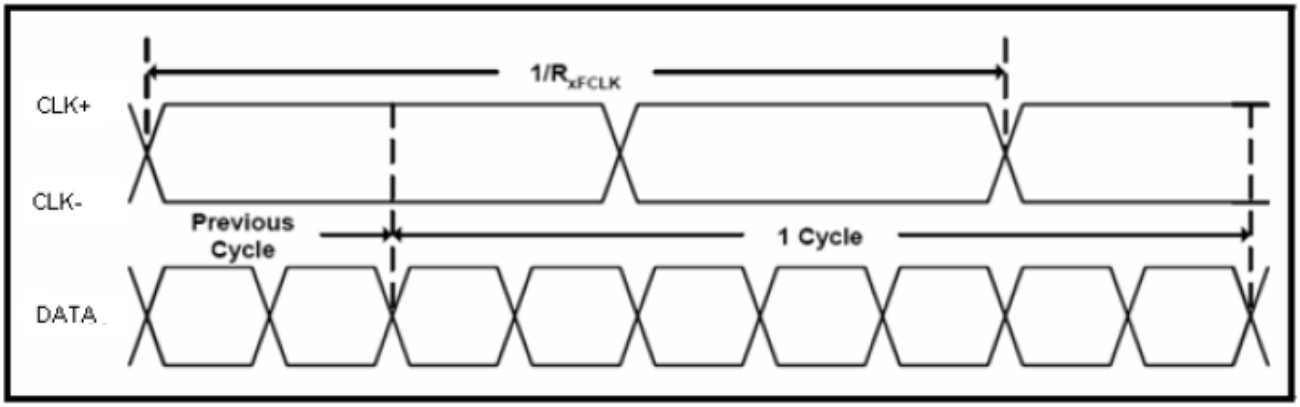
Note 4 : Lower frequency causes the flicker or the image breaking of motion picture. Depending on the PWM signal integrity (jitter etc.), the flicker may be visible. Please evaluate in advance

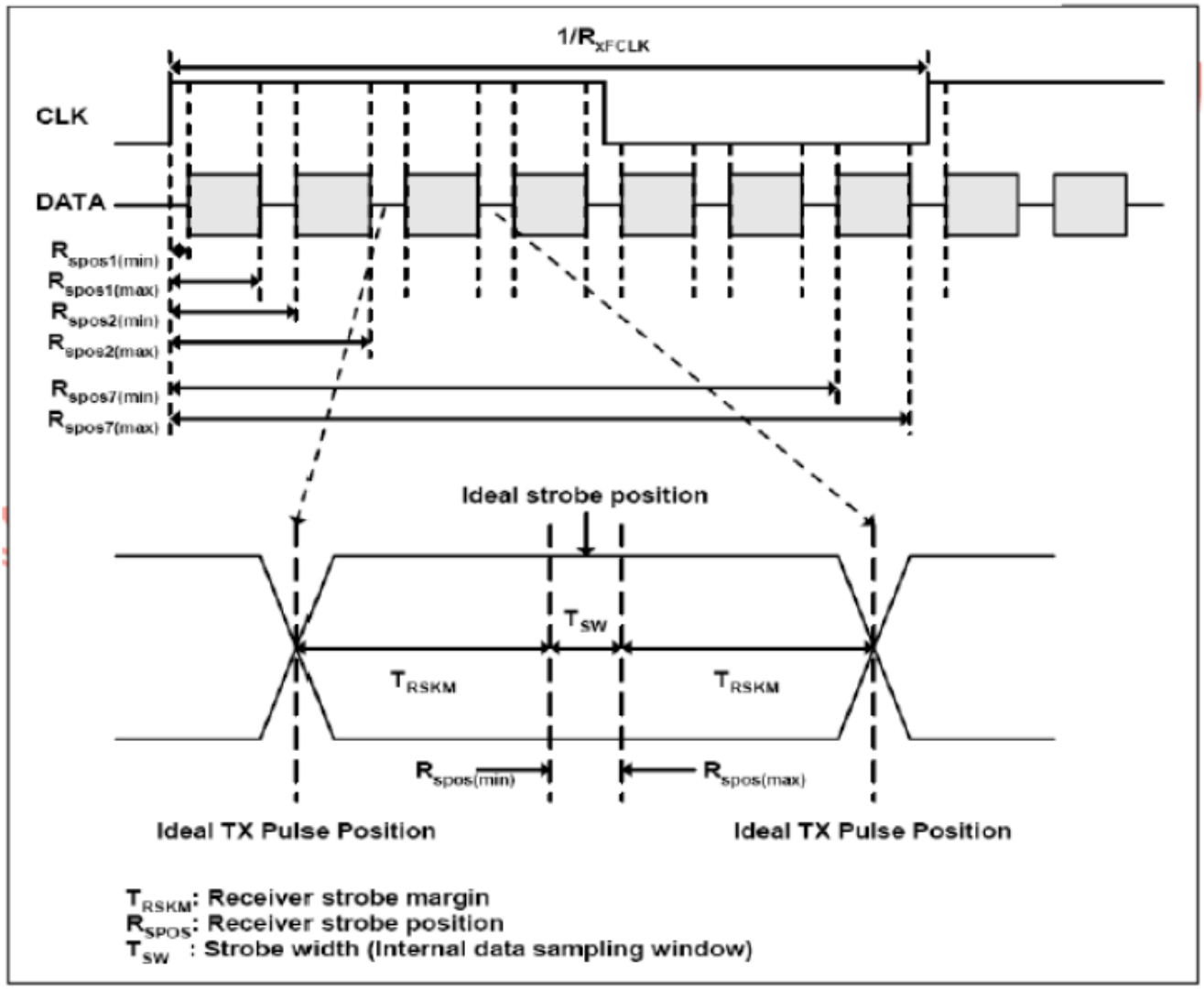
9.LVDS Signal Timing Characteristics

9.1. AC Electrical characteristics

Parameter	Symbol	Min	Typ	Max	Units	Condition
Clock frequency	RxFCLK	26.2	51.2	71	MHz	
Input data skew margin	TRSKM	500	500	1/(2*RxFCLK)	ps	Typical value for 1024*600 resolution
Clock high time	TLVCH		4/(7xRxFCLK)		ns	|VID|=400mv RxVCM=1.2V RxFCLK=71MHz VDD_LVDS=3.3V
Clock low time	TLVCL		3/(7xRxFCLK)		ns	
VSD setup time	TenPLL	0	TenPLL	150	us	

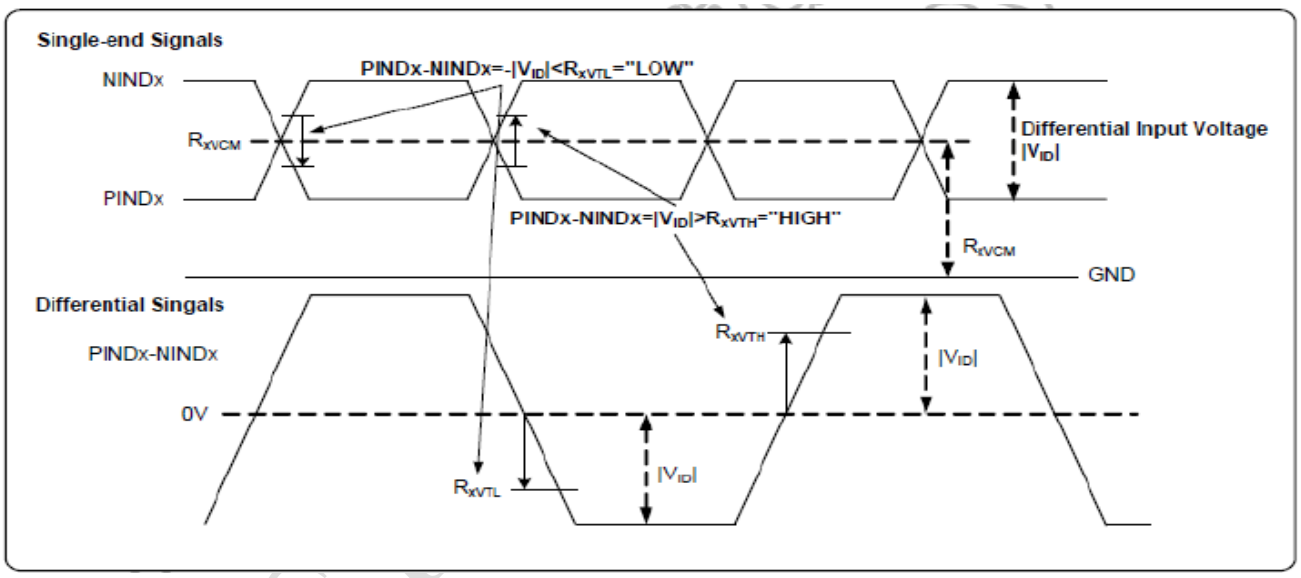
9.2. Input clock and data timing diagram




1/RxFCLK
CLK
DATA
Rspos1(min)
Rspos1(max)
Rspos2(min)
Rspos2(max)
Rspos7(min)
Rspos7(max)
Ideal strobe position
TSW
TRSKM
TRSKM
Rspos(min)
Rspos(max)
Ideal TX Pulse Position
Ideal TX Pulse Position
TRSKM: Receiver strobe margin
RSPOS: Receiver strobe position
TSW : Strobe width (Internal data sampling window)

9.3. DC electrical characteristics

Parameter	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LVDS Differential input high Threshold voltage	R_{xVTH}	-	-	+100	mV	R_{XVCM}=1.2V
LVDS Differential input low Threshold voltage	R_{xVTL}	-100	-	-	mV	
Input Voltage range (Singled-end)	R_{xVIN}	0	-	VDD-1.2+ $\|V_{ID}\|/2$	V	
LVDS Differential input common mode voltage	R_{xVCM}	$\|V_{ID}\|/2$	-	VDD-1.2	V	
LVDS Differential voltage	$\|V_{ID}\|$	0.2	-	0.6	V	

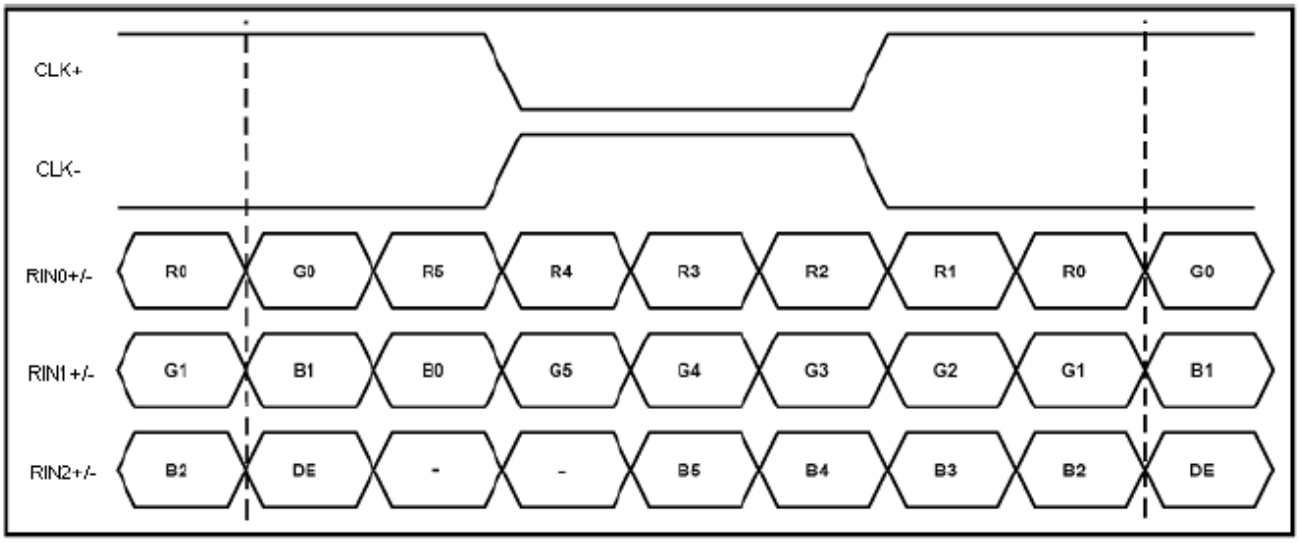


9.4. Data timing

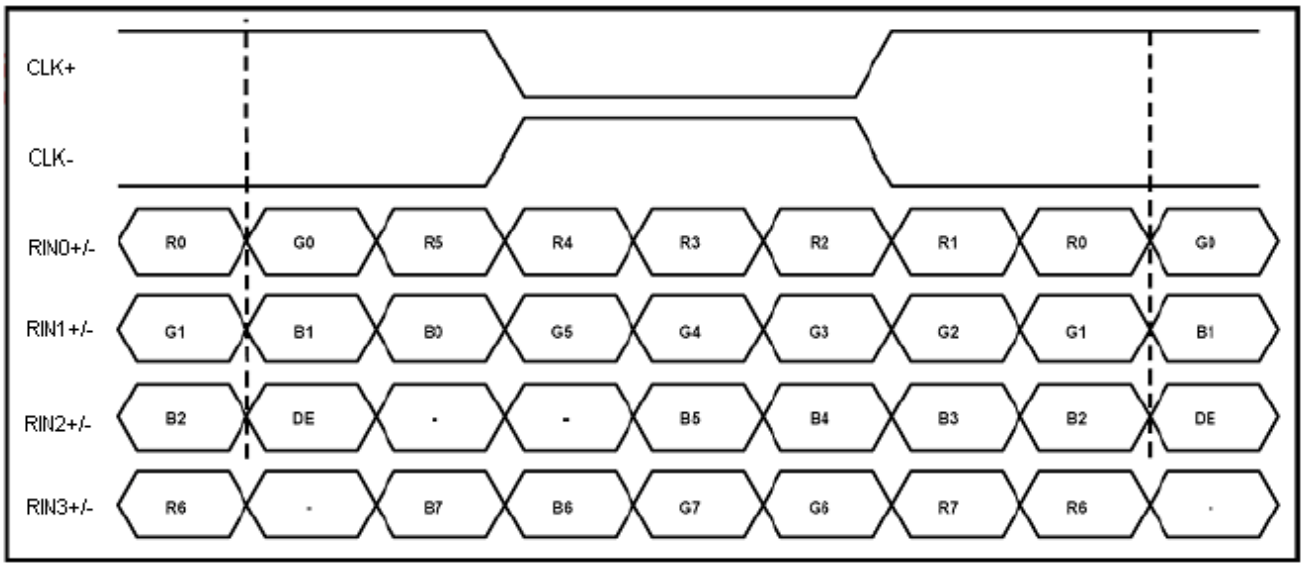
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK frequency	fclk	52	65	71	MHz
Horizontal display area	thd		1024		DCLK
HSD period	th	1114	1344	1400	DCLK
HSD blanking	thb+thfp	90	320	376	DCLK
Vertical display area	tvd		768		T_H
VSD period	tv	778	806	845	T_H
VSD blanking	tvbp+tvfp	10	38	77	T_H

9.5. LVDS data input format

SEL6/8 = “High” for 6 bits LVDS Input



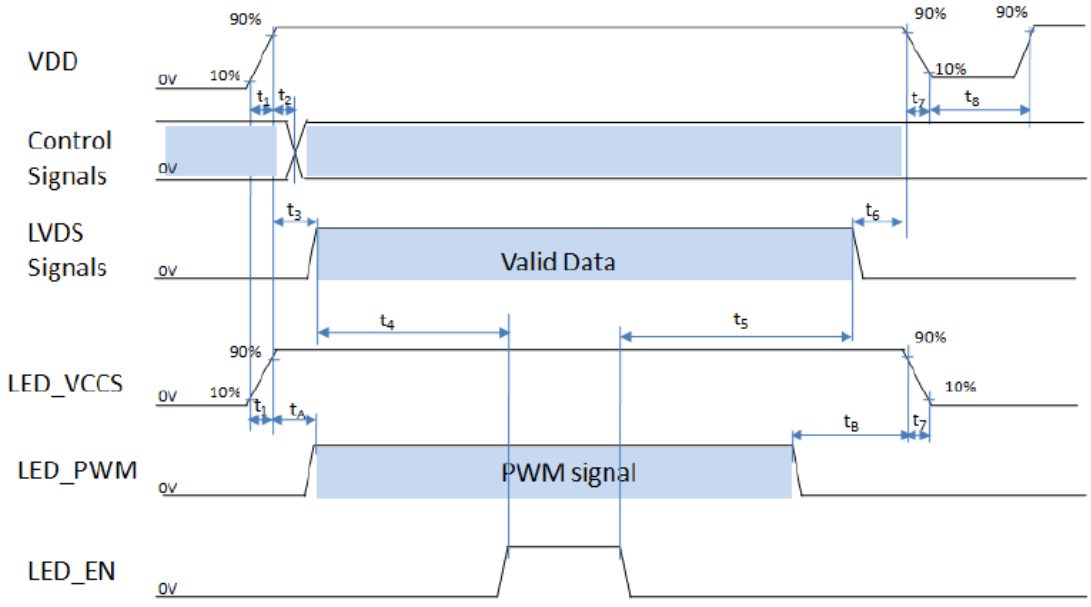
SEL6/8 = “Low” or “NC” for 8 bits LVDS Input



10.Power sequence

The power sequence specifications are shown as the following table and diagram.

Symbol	Value		Unit
	Min.	Max.	
t_1	1	20	ms
t_2	1	5	ms
t_3	10	50	ms
t_4	200	500	ms
t_5	200	500	ms
t_6	50	200	ms
t_7	0	20	ms
t_8	500	-	ms
t_A	0	50	ms
t_B	0	50	ms



Note 1: Please don't plug the interface cable of on when system is turned on.
Note 2: Please avoid floating state of the interface signal during signal invalid period.
Note 3: It is recommended that the backlight power must be turned on after the power supply for LCD and the interface signal is valid.
Note 4: Control signals include SEL6/8 & Reverse.

11.Optical Characteristics

Item		Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time		Tr+ Tf	θ=0°、Φ=0°	-	25	35	.ms	Note 3
Contrast ratio		CR	At optimized viewing angle	800	1000	-	-	Note 4
Color Chromaticity	White	Wx	θ=0°、Φ=0	0.269	0.319	0.369	-	Note 2,5,6
		Wy		0.319	0.369	0.419	-	
Viewing angle (Gray Scale Inversion Direction)	Hor.	ΘR	CR≧10	80	-	-	Deg.	Note 1
		ΘL		80	-	-		
	Ver.	ΦT		80	-	-		
		ΦB		80	-	-		
Brightness		-	-	400	500	-	cd/m2	Center of display
Uniformity		(U)	-	70	-	-	%	Note 5

Ta=25±2℃,

Note 1: Definition of viewing angle range

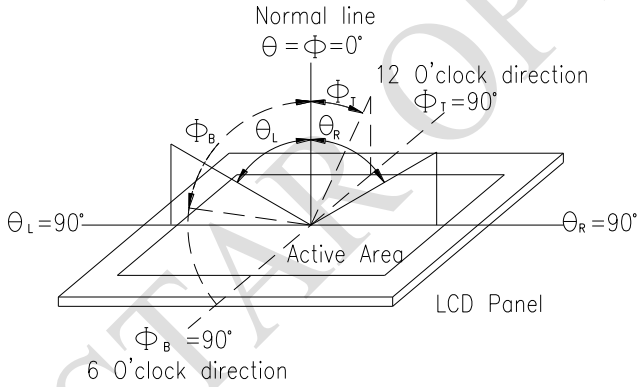


Fig. 11.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

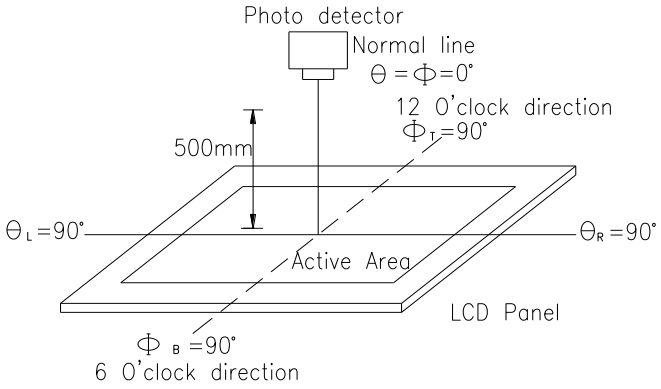
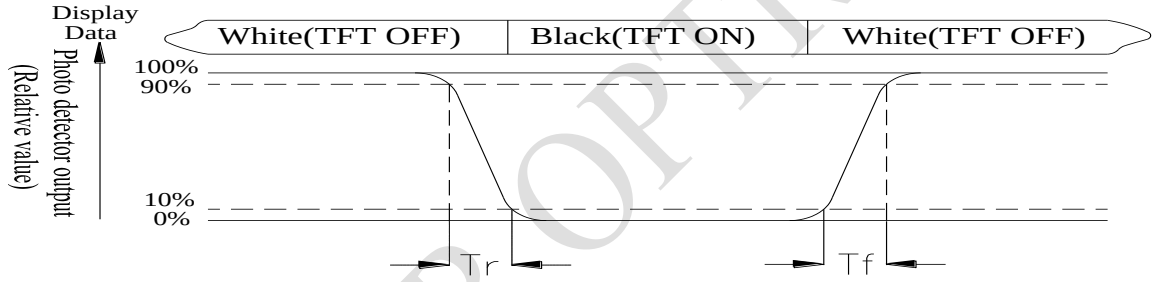


Fig. 11.2. Optical measurement system setup

Note 3: Definition of Response time:
The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time, Tr, is the time between photo detector output intensity changed from 90%to 10%. And fall time, Tf, is the time between photo detector output intensity changed from 10%to 90%



Note 4: Definition of contrast ratio:
The contrast ratio is defined as the following expression.

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

Note 5: Definition of Luminance Uniformity
Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.
Luminance Uniformity (U) = Lmin/Lmax x100%
L = Active area length
W = Active area width

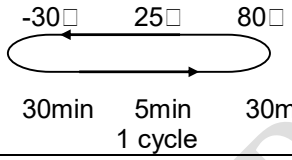
Fig11.3. Definition of uniformity

Note 6: Definition of color chromaticity (CIE 1931)
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

12.Reliability

Content of Reliability Test (Super Wide temperature, -30□~80□)

Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80□ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30□ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80□ 200hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-30□ 200hrs	1
High Temperature/ Humidity storage	The module should be allowed to stand at 60□,90%RH max	60□,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation  	-30□/80□ 10 cycles	——
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	**3**
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact) ,±800v(air), RS=330Ω CS=150pF 10 times	——

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

LCM Sample Estimate Feedback Sheet		
Module Number：_____		
1、Panel Specification：		
1. Panel Type：	□ Pass	□ NG ,_____
2. View Direction：	□ Pass	□ NG ,_____
3. Numbers of Dots：	□ Pass	□ NG ,_____
4. View Area：	□ Pass	□ NG ,_____
5. Active Area：	□ Pass	□ NG ,_____
6.Operating Temperature：	□ Pass	□ NG ,_____
7.Storage Temperature：	□ Pass	□ NG ,_____
8.Others：_____		
2、Mechanical Specification：		
1. PCB Size：	□ Pass	□ NG ,_____
2.Frame Size：	□ Pass	□ NG ,_____
3.Materal of Frame：	□ Pass	□ NG ,_____
4.Connector Position：	□ Pass	□ NG ,_____
5.Fix Hole Position：	□ Pass	□ NG ,_____
6.Backlight Position：	□ Pass	□ NG ,_____
7. Thickness of PCB：	□ Pass	□ NG ,_____
8. Height of Frame to PCB：	□ Pass	□ NG ,_____
9.Height of Module：	□ Pass	□ NG ,_____
10.Others：	□ Pass	□ NG ,_____
3、Relative Hole Size：		
1.Pitch of Connector：	□ Pass	□ NG ,_____
2.Hole size of Connector：	□ Pass	□ NG ,_____
3.Mounting Hole size：	□ Pass	□ NG ,_____
4.Mounting Hole Type：	□ Pass	□ NG ,_____
5.Others：	□ Pass	□ NG ,_____
4、Backlight Specification：		
1.B/L Type：	□ Pass	□ NG ,_____
2.B/L Color：	□ Pass	□ NG ,_____
3.B/L Driving Voltage (Reference for LED Type)：□ Pass □ NG ,_____		
4.B/L Driving Current：	□ Pass	□ NG ,_____
5.Brightness of B/L：	□ Pass	□ NG ,_____
6.B/L Solder Method：	□ Pass	□ NG ,_____
7.Others：	□ Pass	□ NG ,_____

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Module Number：_____		
5、Electronic Characteristics of Module：		
1.Input Voltage：	□ Pass	□ NG ,_____
2.Supply Current：	□ Pass	□ NG ,_____
3.Driving Voltage for LCD：	□ Pass	□ NG ,_____
4.Contrast for LCD：	□ Pass	□ NG ,_____
5.B/L Driving Method：	□ Pass	□ NG ,_____
6.Negative Voltage Output：	□ Pass	□ NG ,_____
7.Interface Function：	□ Pass	□ NG ,_____
8.LCD Uniformity：	□ Pass	□ NG ,_____
9.ESD test：	□ Pass	□ NG ,_____
10.Others：	□ Pass	□ NG ,_____

6、Summary：

Sales signature：_____

Customer Signature：_____ **Date**： / /