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RFH700A7-AIW-LNG

SPECIFICATION

CUSTOMER:

APPROVED BY	
PCB VERSION	
DATE	

FOR CUSTOMER USE ONLY

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

Release DATE:

Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2019/05/06		First issue

RAYSTAR OPTRONICS

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1.Module Classification Information

R	F	H	70	0A7	-	A	I	W	-	L	N	G
1	2	3	4	5	-	6	7	8	-	9	10	11

Item	Description	
1	R : Raystar Optonics 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 : 7.0" 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 7.0" is a TN transmissive type color active matrix TFT liquid crystal display that uses amorphous silicon TFT as switching devices. This module is composed of a TFT_LCD module. It is usually designed for industrial application and this module follows RoHS.

RAYSTAR OPTRONICS

3.General Specifications

- Size: 7.0 inch
- Dot Matrix: 1024 x RGBx600(TFT) dots
- Module dimension: 164.8(W) x 99.8(H) x 7.325(D) mm
- Active area: 154.2144 x 85.92 mm
- Dot pitch: 0.1506 x 0.1432 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- Aspect Ratio: 16:9
- Control IC: NA
- TFT Driver IC: EK79001HE + EK73215BCGA
- TFT Interface: LVDS
- Backlight Type: LED, Normally White
- CTP IC: FT5426 or Equivalent
- CTP Interface: I2C
- CTP FW Version: V03
- With /Without TP: With CTP
- Surface: Glare

*Color tone slight changed by temperature and driving voltage.

4.Interface

4.1. LCM PIN Definition

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	Digital circuit	
3	VDD	P	Digital circuit	
4	NC	---	No connection	
5	Reset	I	Global reset pin	
6	STBYB	I	Standby mode, Normally pulled high STBYB = "1", normal operation STBYB = "0", timing controller, source driver will turn off, all output are High-Z	
7	GND	P	Ground	
8	RXIN0-	I	Negative LVDS differential data input	
9	RXIN0+	I	Positive LVDS differential data input	
10	GND	P	Ground	
11	RXIN1-	I	Negative LVDS differential data input	
12	RXIN1+	I	Positive LVDS differential data input	
13	GND	P	Ground	
14	RXIN2-	I	Negative LVDS differential data input	
15	RXIN2+	I	Positive LVDS differential data input	
16	GND	P	Ground	
17	RXCLKIN-	I	Negative LVDS differential clock input	
18	RXCLKIN+	I	Positive LVDS differential clock input	
19	GND	P	Ground	
20	RXIN3-	I	Negative LVDS differential data input	
21	RXIN3+	I	Positive 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	DIMO	O	Backlight CABC controller signal output	
28	SELB	I	6bit/8bit mode select H:6bit / L:8bit	
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	Horizontal inversion	
34	U/D	I	Vertical inversion	
35	VGL	P	Negative power for TFT	
36	GND	P	Ground	
37	GND	P	Ground	
38	VGH	P	Positive power for TFT	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

I:input ,O:output,P:power

Note

When L/R="0",set right to left scan direction.

When L/R="1",set left to right scan direction.

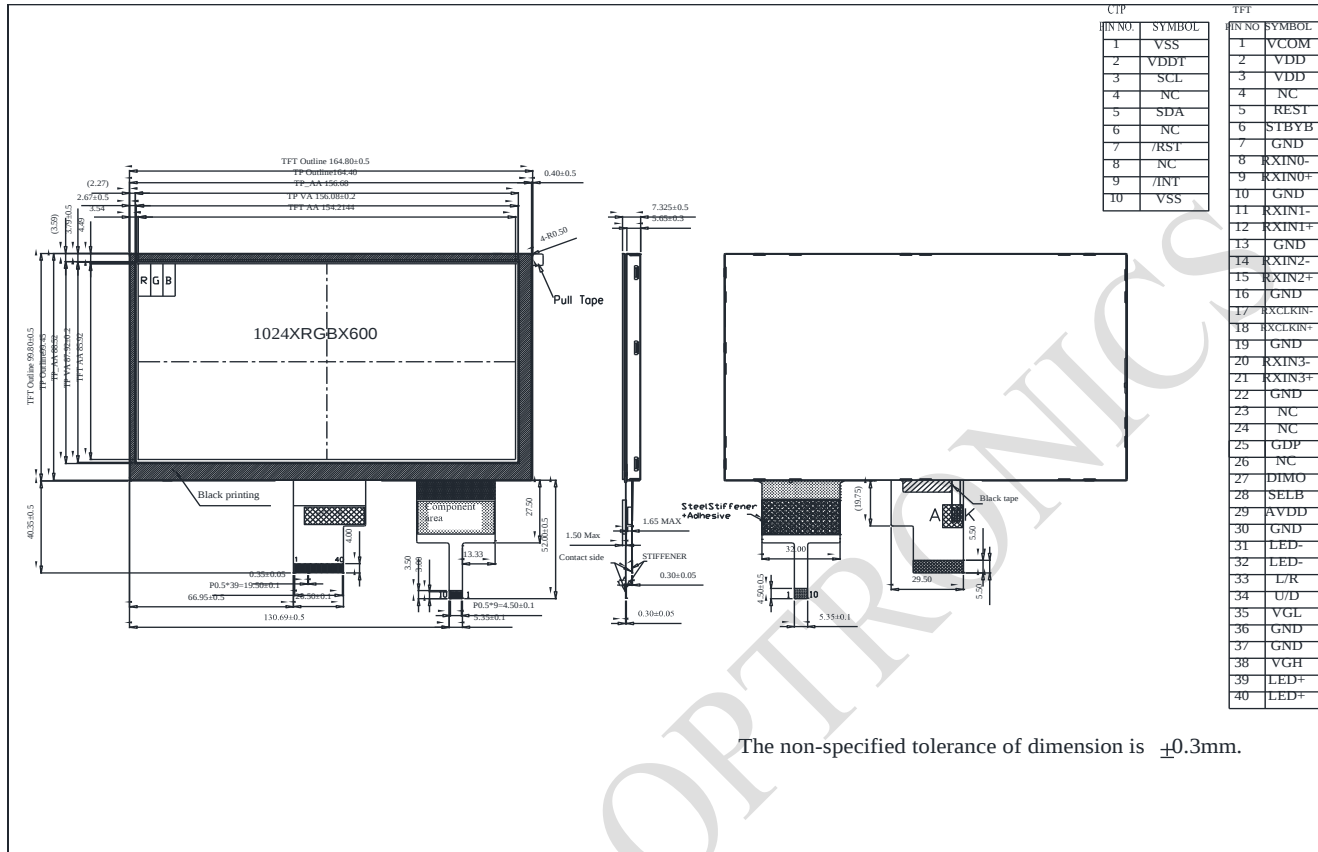
When U/D="0",set top to bottom scan direction.

When U/D="1",set bottom to top scan direction.

CTP PIN Definition

Pin	Symbol	Function	Remark
1	VSS	Ground for analog circuit	
2	VDDT	Power Supply : +3.0V	
3	SCL	I2C clock input	
4	NC	No connect	
5	SDA	I2C data input and output	
6	NC	No connect	
7	/RST	External Reset, Low is active	
8	NC	No connect	
9	/INT	External interrupt to the host	
10	VSS	Ground for analog circuit	

5. Contour Drawing



6. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	—	+70	°C
Storage Temperature	TST	-30	—	+80	°C

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

1. Temp. $\leq 60^{\circ}\text{C}$, 90% RH MAX. Temp. $> 60^{\circ}\text{C}$, Absolute humidity shall be less than 90% RH at 60°C

7. Electrical Characteristics

7.1. Typical Operation Conditions

(Note 1)

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	DVDD	3.0	3.3	3.6	V	Note 2
	AVDD	9.4	9.6	9.8	V	
	VGH	17	18	19	V	
	VGL	-6.6	-6.0	-5.4	V	
Supply Voltage For Touch Logic	VDDT	4.4	5.0	5.5	V	USB TYPE
Input signal voltage	VCOM	3.1	3.3	3.6	V	
Input logic high voltage	VIH	0.7 DVDD	-	DVDD	V	Note 3
Input logic low voltage	VIL	0	-	0.3 DVDD	V	

Note 1: Be sure to apply DVDD and VGL to the LCD first, and then apply VGH.

Note 2: DVDD setting should match the signals output voltage (refer to Note 3) of customer's system board.

Note 3: DCLK, HS, VS, RESET, U/D, L/R, DE, R0~R7, G0~G7, B0~B7, MODE, DITHB.

7.2. Current Consumption

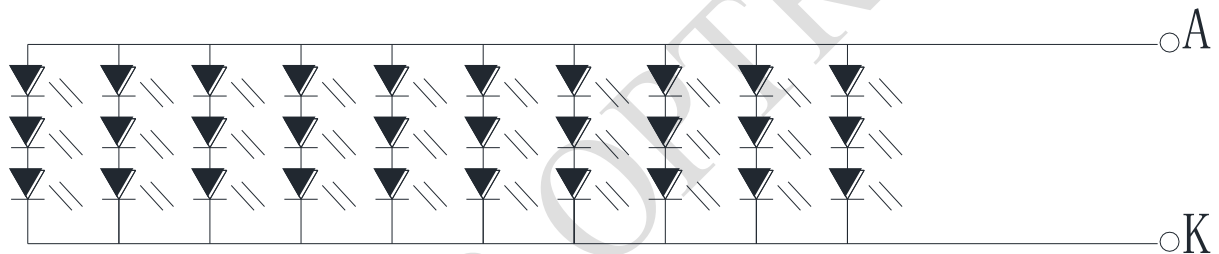
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	IGH	-	0.2	1.0	mA	VGH = 18.0V
	IGL	-	0.2	1.0	mA	VGL = -6.0V
	IDVDD	-	4.0	10	mA	DVDD = 3.3V
	IAVDD	-	20	50	mA	AVDD = 9.6V

7.3. Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED backlight	VL	8.4	9.8	10.8	V	Note 1
Current for LED backlight	IL	--	300	--	mA	
LED life time	-	-	50,000	-	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at $T_a=25^{\circ}\text{C}$ and $I_L=300\text{mA}$.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=300\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 300mA.

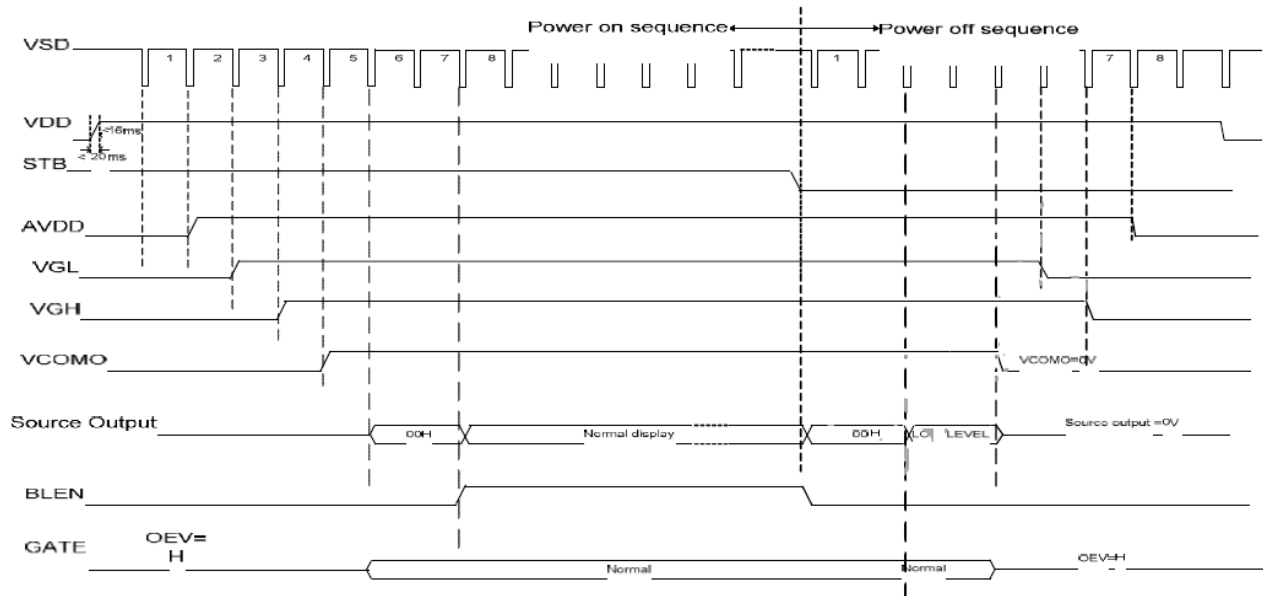


Backlight 30LED Circuit

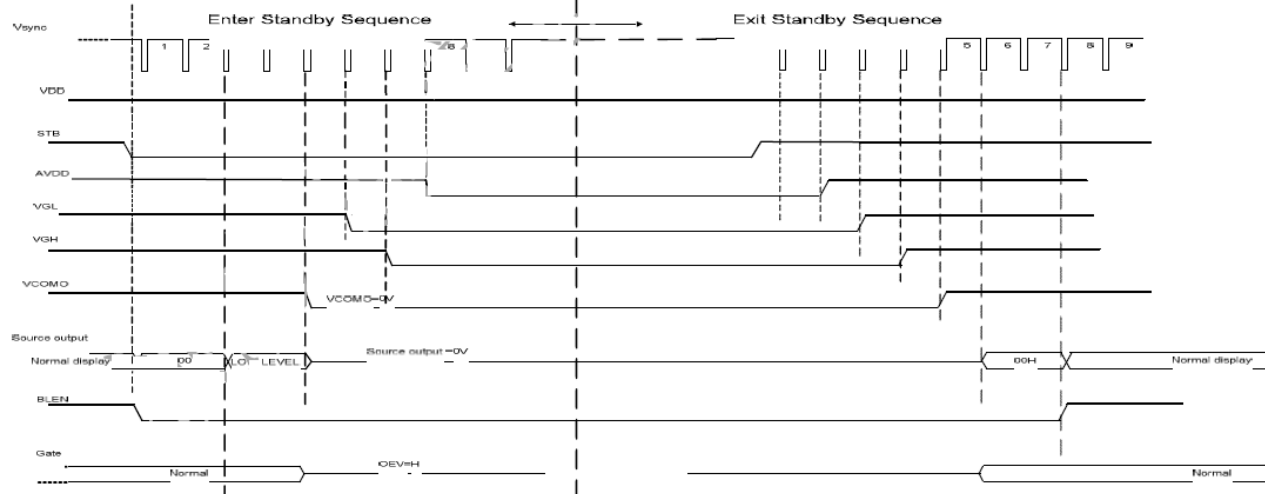
8.Operation Sequence

8.1. Power Sequence

In order to prevent IC from power on reset fail, the time (TPOR) of the digital power supply VDD should be maintained within the given specifications. Refer to “AC characteristics” for more detail on timing.



Power on/off timing chart



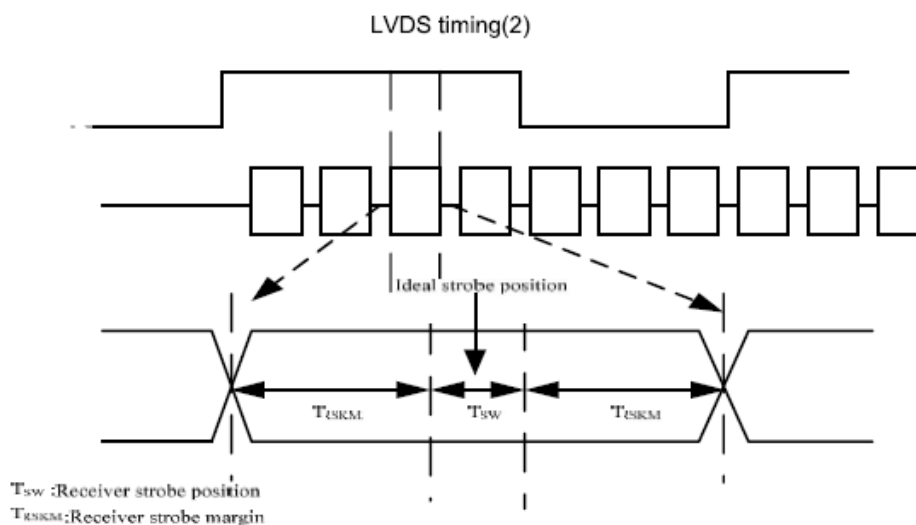
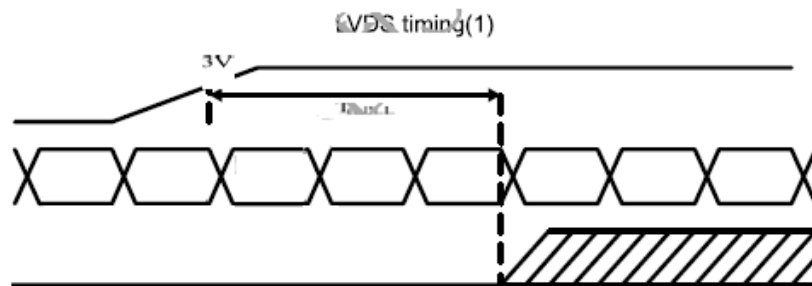
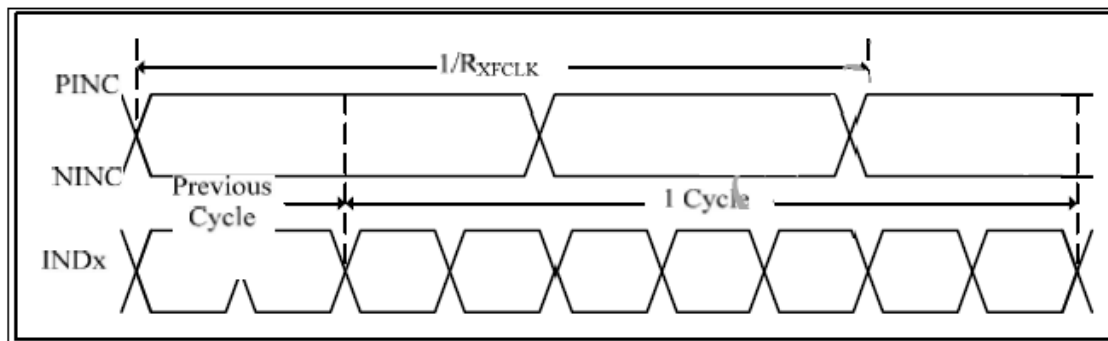
Enter and Exit standby Mode timing chart

Note : Low level=3Fh, when NBW=L (normally white)
Low level=00h, when NBW=H (normally black)

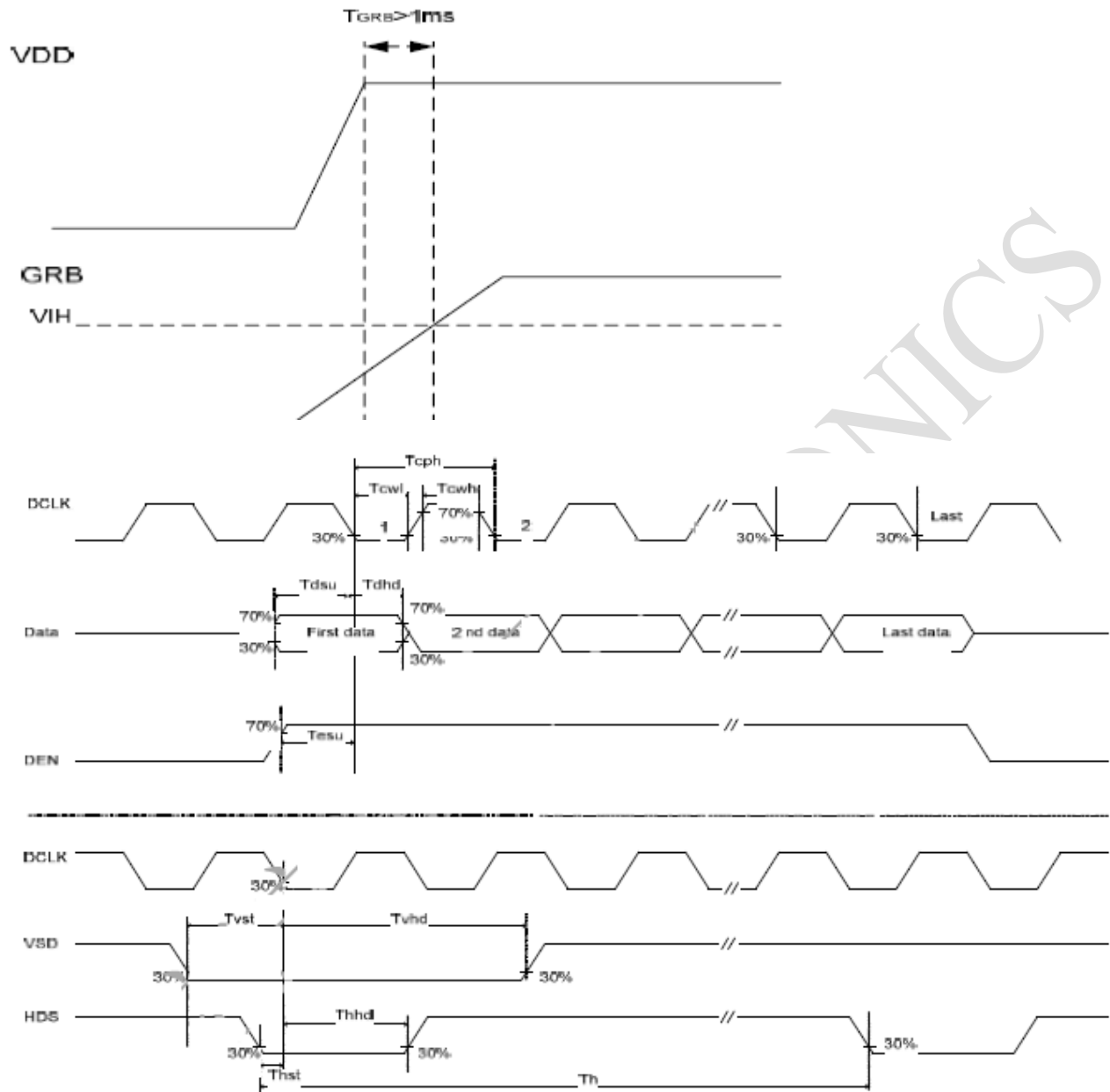
8.2. Timing Characteristics

AC Electrical Characteristics

Parameter	Symbol	condition	Min.	Typ.	Max.	Unit
Clock frequency	RxFCLK		20	-	71	MHz
Input data skew margin	TRSKM	VID =400mV RxVCM=1.2V RxFCLK=71MHz	500	-	-	ps
Clock high time	TLVCH		-	4/(7* RxFCLK)	-	ns
Clock low time	TLVCL		-	3/(7* RxFCLK)	-	ns
PLL wake-up-time	TenPLL				150	us



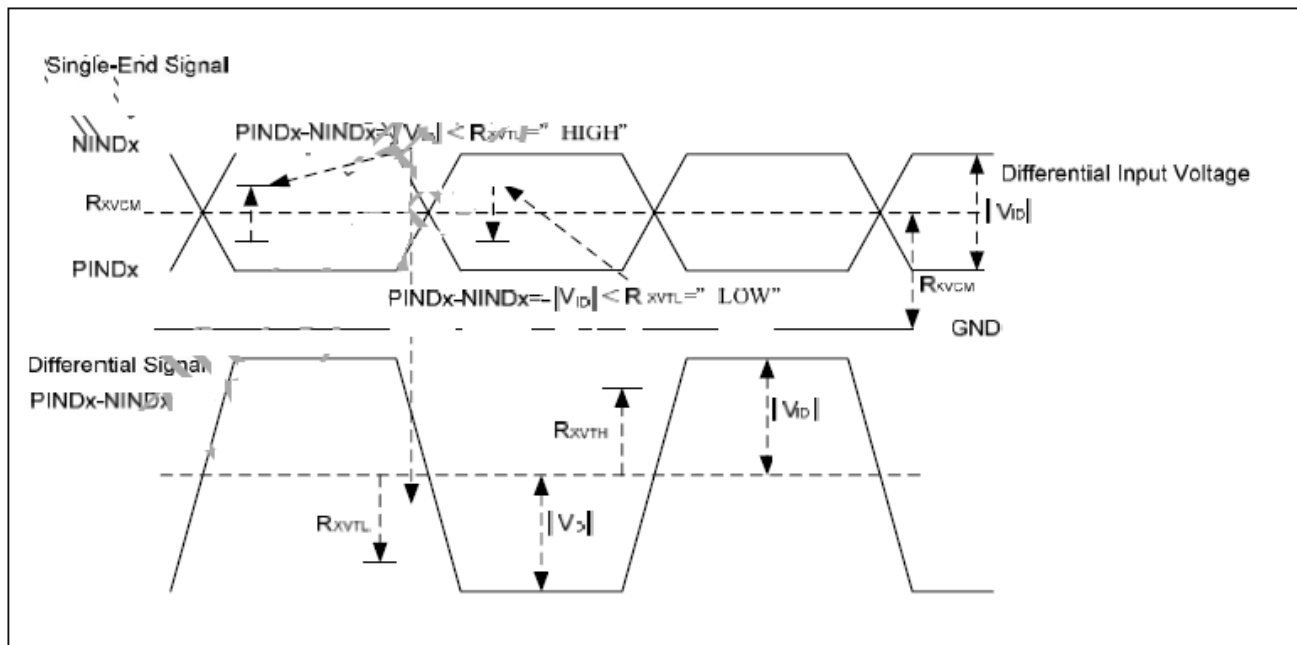
LVDS timing(3)



Parallel Input Clock and Data timing

8.3. LVDS DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Differential input high Threshold voltage	RxVTH	-	-	+0.1		
Differential input low Threshold voltage	RxVTL	-0.1	-	-	V	
Input voltage range (singled-end)	RxVIN	0	-	2.4	V	
Differential input common mode voltage	RxVCM	$ VID /2$	-	$2.4- VID /2$	V	
Differential input voltage	$ VID $	0.2	-	0.6	V	
Differential input leakage current	RVxliz	-10	-	+10	uA	
LVDS Digital operating Current	Iddlvds	-	40(TBD)	50	mA	Fclk=65Mhz VDD=3.3V
LVDS Digital Standby Current	Istlvds	--	10(TBD)	50	uA	Clock & all Functions are



LVDS DC Characteristics

HV mode(1)

HV mode

Horizontal input timing

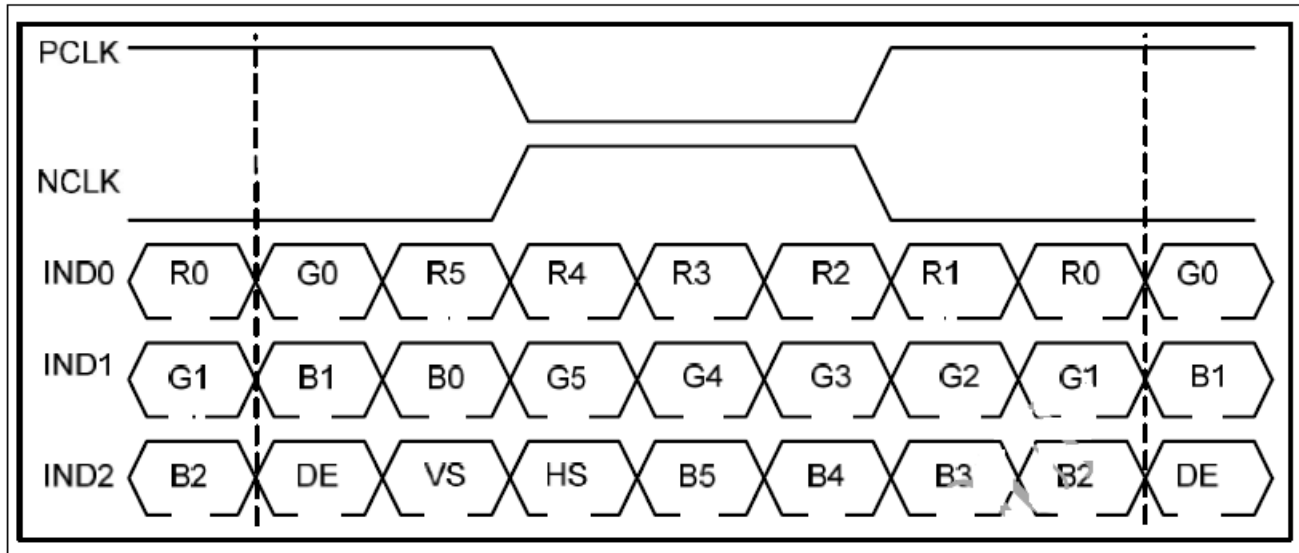
Parameter		Symbol	Value			Unit
Horizontal display area		thn	1024			DCLK
DCLK frequency @ Frame rate=60hz		fclk	Min.	Typ.	Max.	Mhz
			44.9	51.2	63	
1 Horizontal Line		Th	1200	1344	1400	DCLK
HSYNC pulse width	Min.	thpw	1			
	Typ.		-			
	Max.		140			
HSYNC back porch		thbp	160	160	160	DCLK
HSYNC front porch		thfp	16	160	216	

HV mode(2)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	tvd	600			H
VSYNC period time	tv	624	635	750	H
VSYNC pulse width	tvpw	1	-	20	H
VSYNC back porch	tvb	23	23	23	H
VSYNC front porch	tvfp	1	12	127	H

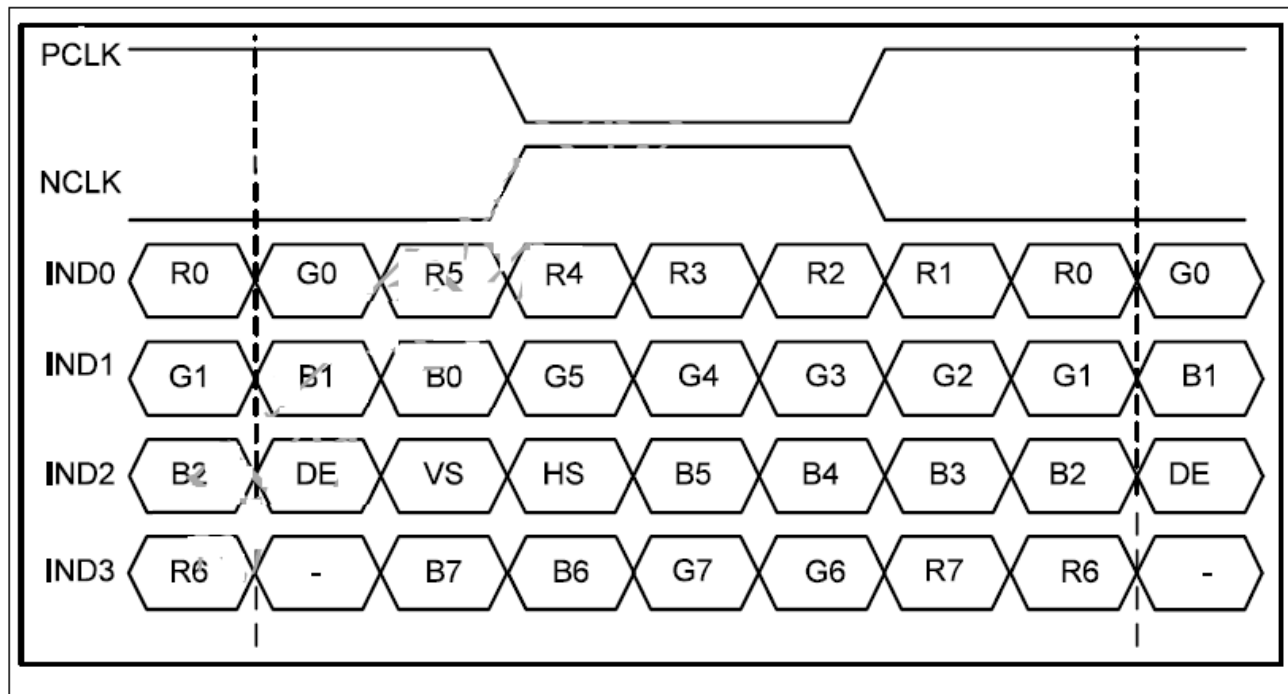
Data Input Format

6bit LVDS input(HSD="H")



6-bit LVDS input timing chart

8bit LVDS input(HSD="L")



8-bit LVDS input timing chart

9. Optical Characteristics

Item		Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time		Tr	$\theta=0^{\circ}$ 、 $\Phi=0^{\circ}$	-	25	40	.ms	Note 3
		Tf						
Contrast ratio		CR	At optimized viewing angle	600	800	-	-	Note 4
Color Chromaticity	White	Wx	$\theta=0^{\circ}$ 、 $\Phi=0$	0.26	0.31	0.36	-	Note 2,5,6
		Wy		0.28	0.33	0.38	-	
Viewing angle (Gray Scale Inversion Direction)	Hor.	Θ_R	$CR \geq 10$	70	80	-	Deg.	Note 1
		Θ_L		70	80	-		
	Ver.	Φ_T		50	60	-		
		Φ_B		60	70	-		
Brightness		-	-	400	450	-	cd/m ²	Center of display
Uniformity		(U)	-	70	-	-	%	Note 5

Ta=25±2℃,

Note 1: Definition of viewing angle range

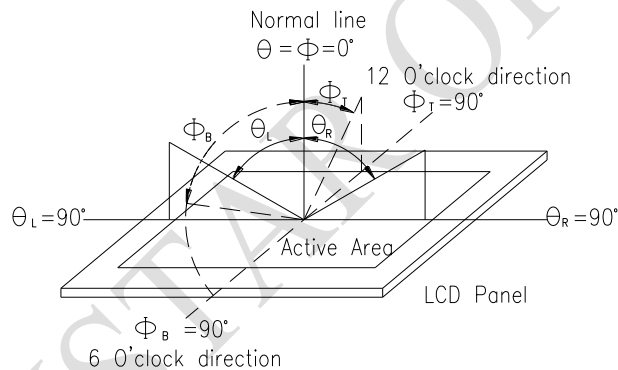


Fig. 9.1. Definition of viewing angle

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-7 or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

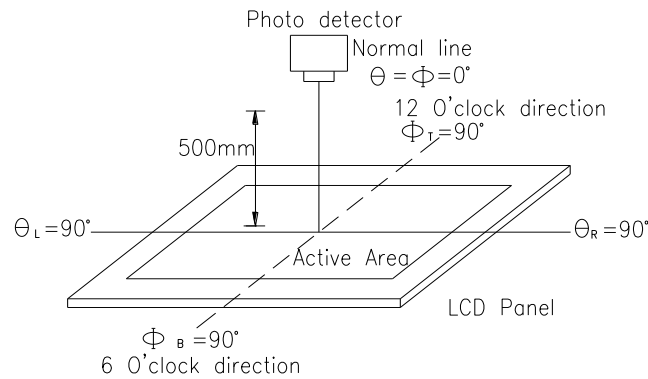
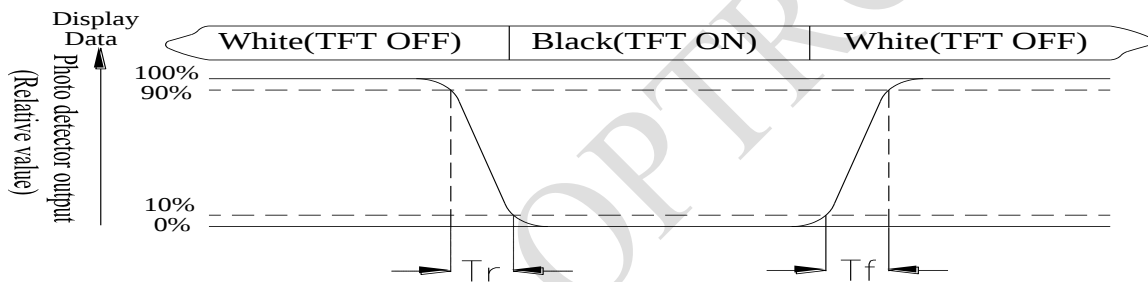


Fig. 9.2. Optical measurement system setup

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, T_r , is the time between photo detector output intensity changed from 90% to 10%. And fall time, T_f , 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) = $L_{min}/L_{max} \times 100\%$

L = Active area length

W = Active area width

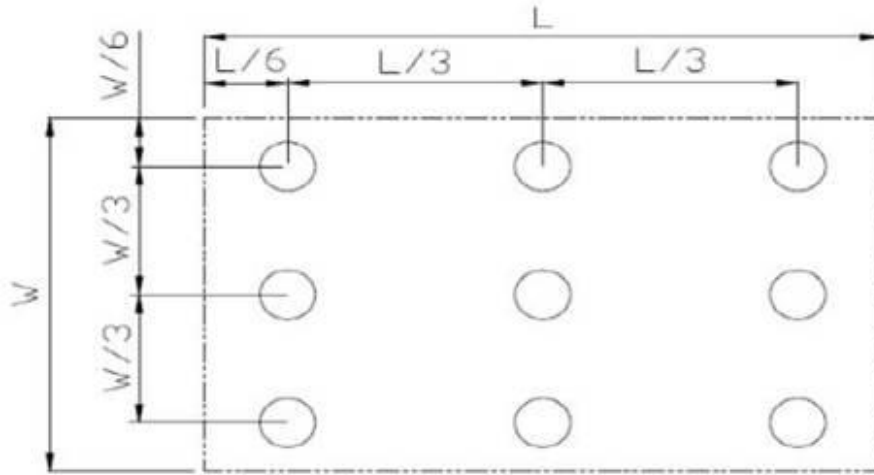


Fig 9.3. Definition of uniformity

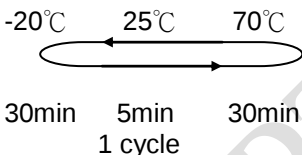
Note 6: Definition of color chromaticity (CIE 1931)

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.

10. Reliability

Content of Reliability Test (Wide temperature, -20°C~70°C)

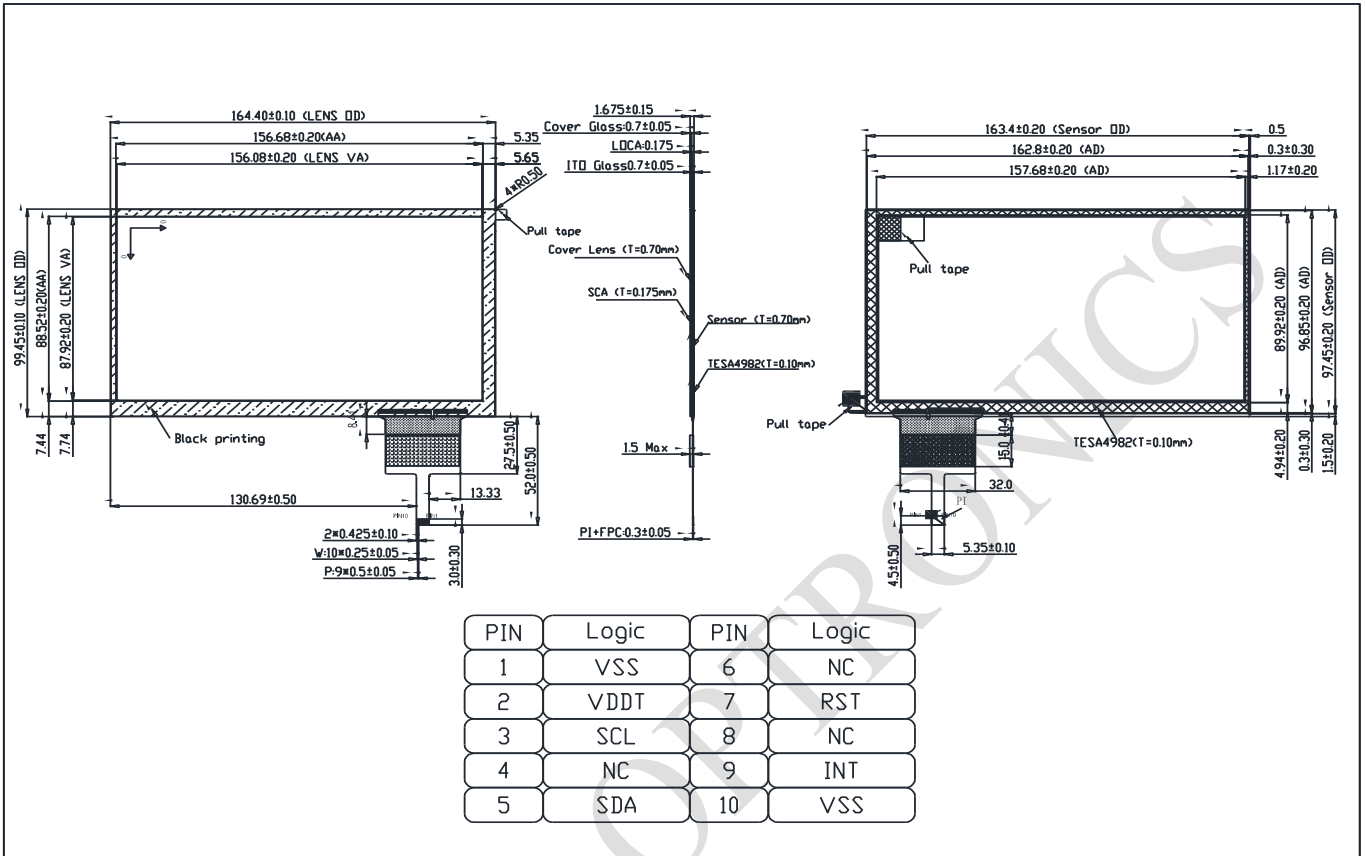
Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max	60°C,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation 	-20°C/70°C 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 3 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.

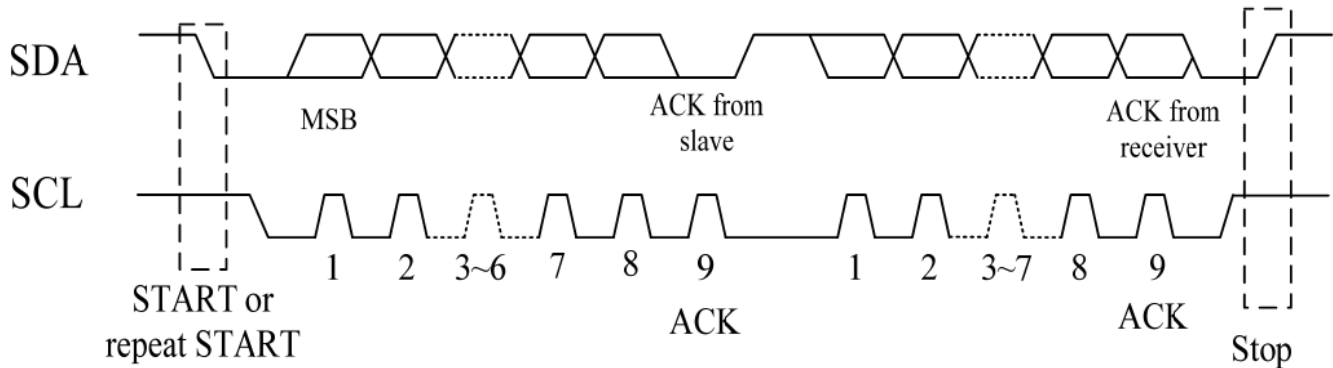
Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

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

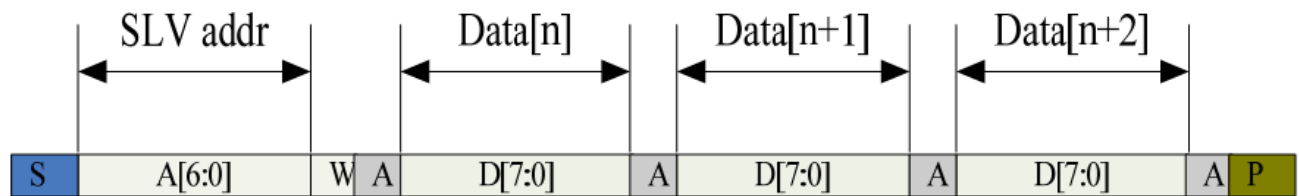
11.Touch Panel Information



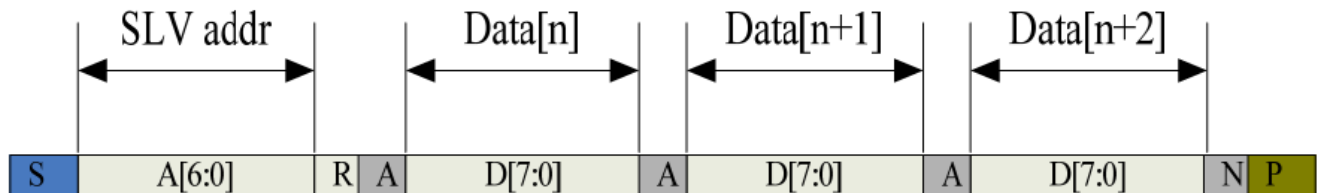
11.1. CTP I2C Timing:



I2C Serial Data Transfer Format



I2C master write, slave read



I2C master read, slave write

Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address
R/W	READ/WRITE bit, '1' for read, '0' for write
A(N)	ACK(NACK) bit
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

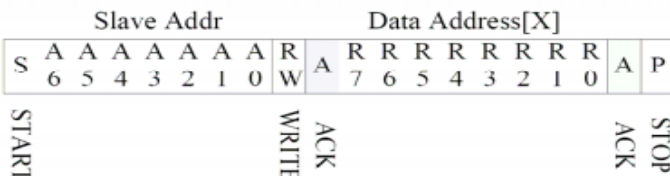
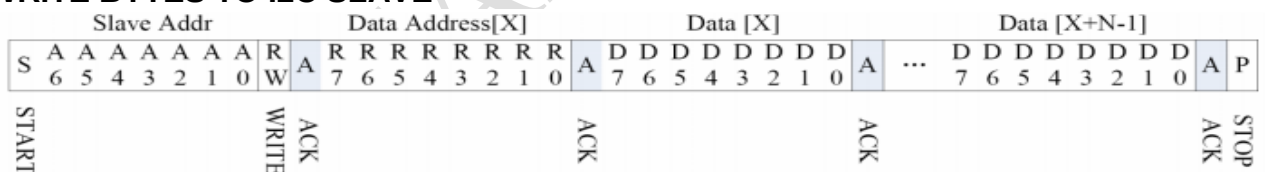
Lists the meanings of the mnemonics used in the above figures

Parameter	Unit	Min	Max
SCL frequency	KHz	0	400
Bus free time between a STOP and START condition	us	1.3	\
Hold time (repeated) START condition	us	0.6	\
Data setup time	ns	100	\
Setup time for a repeated START condition	us	0.6	\
Setup time for STOP condition	us	0.6	\

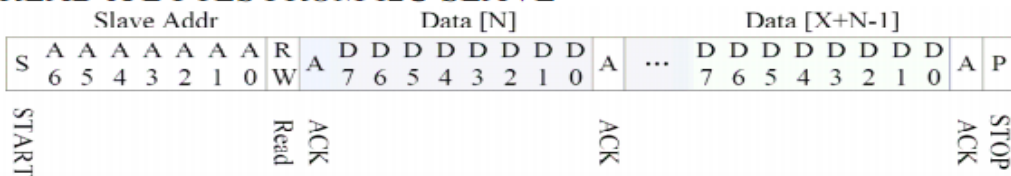
Interface Timing Characteristics

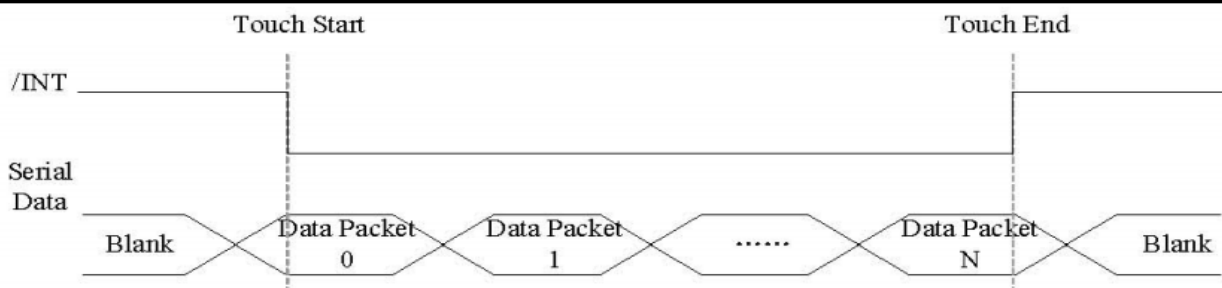
AS FOR STANDARD CTPM, HOST NEED TO USE BOTH INTERRUPT CONTROL SIGNAL AND SERIAL DATA INTERFACE TO GET THE TOUCH DATA. HERE IS THE TIMING TO GET TOUCH DATA.

WRITE BYTES TO I2C SLAVE



READ X BYTES FROM I2C SLAVE





Address: 0X38

TOUCH DATA READ PROTOCOL

NAME	VALUE	DESCRIPTION
START CH	0X00	START COMMAND FOR CTPM TOUCH DATA PACKET,HOST MUST SEND CTPM A START CH COMMAND BEFORE READ TOUCH DATA
Lst READ BYTE~ LAST READ BYTE		TOUCH DATA PACKET SENT BY CTPM,EACH BYTE HAS 8-BIT DATA ,A TOUCH DATA PACKET CONSISTS OF N BYTE

Address	Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Host Access
00h	Devide__Mode	—	Device Model[2:0]			—				RW
01h	Gest__ID	Gesture ID[7:0]								R
02h	TD__Status	—				Number of touch points[3:0]				R
03h	Touch1__XH	1 st Event Flag		—		1 st Touch X Position[11:8]				R
04h	Touch1__XL	1 st Touch X Position[7:0]								R
05h	Touch1__YH	1 st Touch ID[3:0]				1 st Touch Y Position[11:8]				R
06h	Touch1__YL	1 st Touch Y Position[7:0]								R
09h	Touch2__XH	2 nd Event Flag		—		2 nd Touch X Position[11:8]				R
0Ah	Touch2__XL	2 nd Touch X Position[7:0]								R
0Bh	Touch2__YH	2nd Touch ID[3:0]				2ndTouch Y Position[11:8]				R
0Ch	Touch2__YL	2nd Touch Y Position[7:0]								R
0Fh	Touch3__XH	3rdEvent Flag		—		3rdTouch X Position[11:8]				R

10h	Touch3__XL	3rd Touch X Position[7:0]			R
11h	Touch3__YH	3rdTouch ID[3:0]	3rdTouch Y Position[11:8]		R
12h	Touch3__YL	3rd Touch Y Position[7:0]			R
15h	Touch4__XH	4thEvent Flag	—	4thTouch X Position[11:8]	R
16h	Touch4__XL	4th Touch X Position[7:0]			R
17h	Touch4__YH	4thTouch ID[3:0]	4thTouch Y Position[11:8]		R
18h	Touch4__YL	4th Touch Y Position[7:0]			R
1Bh	Touch5__XH	5thEvent Flag	—	5thTouch X Position[11:8]	R
1Ch	Touch5__XL	5th Touch X Position[7:0]			R
1Dh	Touch5__YH	5thTouch ID[3:0]	5thTouch Y Position[11:8]		R
1Eh	Touch5__YL	5th Touch Y Position[7:0]			R

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. Material 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 , _____

>> Go to page 2 <<

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 : / /