Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 19201080E VM-PW-N

(C-TOUCH)

15,6“ TFT

Product Specification

Version: 0

13.12.2024

Revision History

Date	Rev. No.	Page	Summary
13.12.2024	0	ALL	FIRST ISSUE

Contents

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel,driver circuit , capacitance touch panel , back-light unit. The resolution of a 15.6' TFT-LCD contains 1920X1080 pixels, and can displayup to 16.7M colors.

* Features

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	344.16(H)*193.59(V) (15.6inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	1920(RGB)*1080	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.05975(H)*0.17925(V)	mm	
Viewing angle	Supper wide angle	o'clock	
LCM Interface	Dual 8 BIT LVDS	-	
Display mode	Normally Black	-	
Operating temperature	0～+50	℃	
Storage temperature	-20～+60	℃	

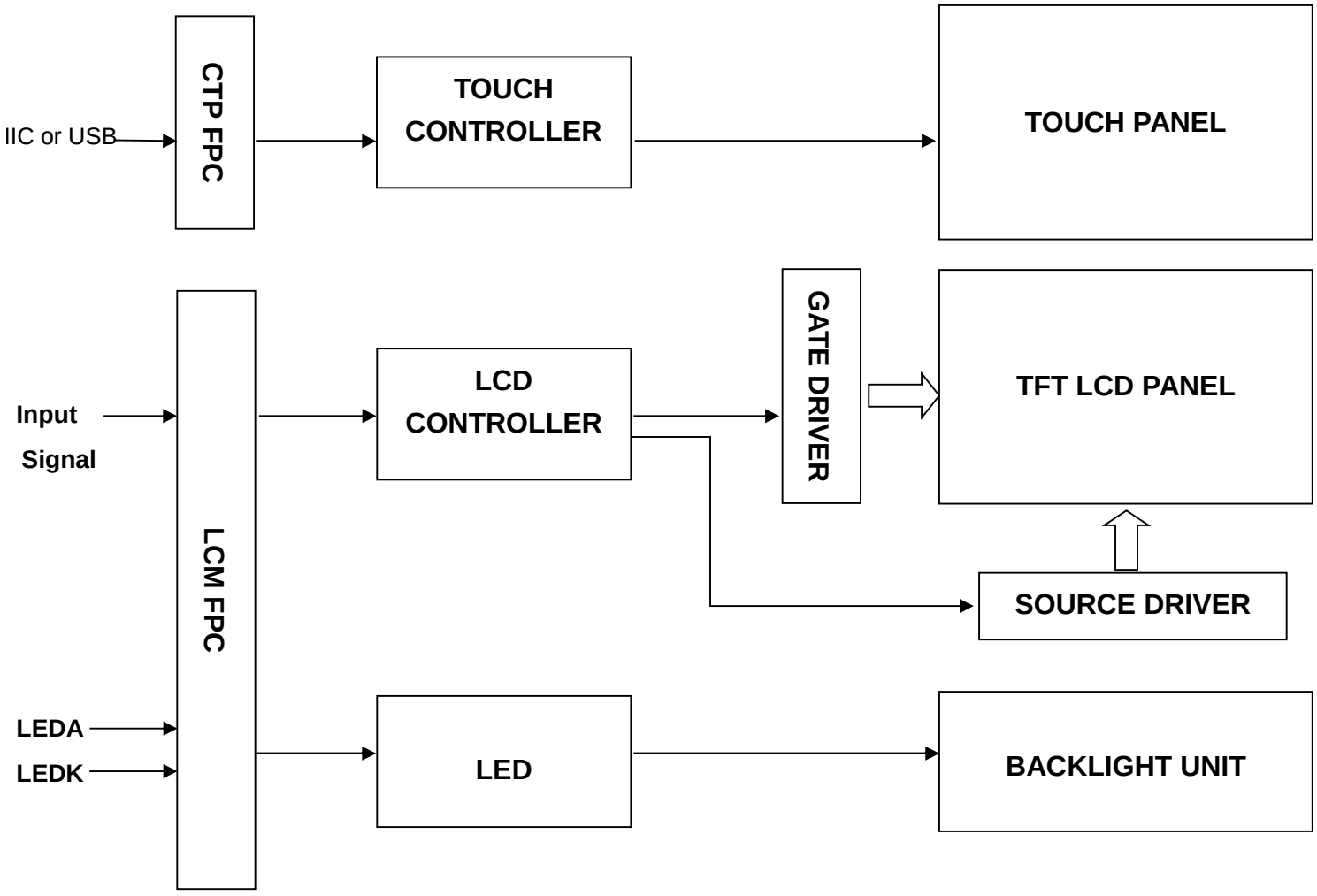
***CTP Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Structure	G+G	-	
Controller IC	ILI2511	-	
Interface	USB/I2C	-	
Slave Adress	0x41(7bit)	-	
Touch mode	ten points	-	-
Logic level	3.3	V	

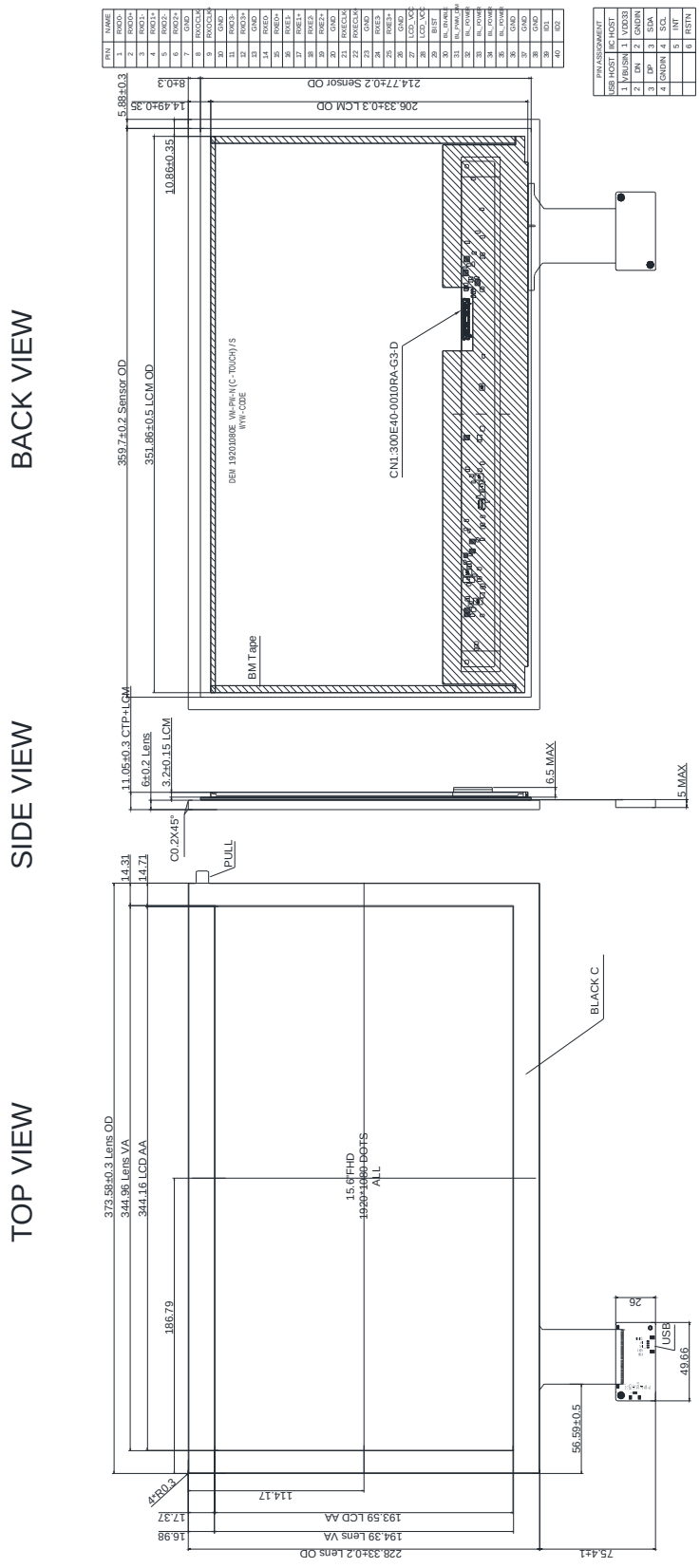
*** Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	373.58	-	mm	
	Vertical(V)	-	228.33	-	mm	
	Depth(D)	-	11.05	-	mm	
Weight		-	200	-	g	

1. Block Diagram



2. Outline dimension



PIN	NAME
1	RXO0-
2	RXO0+
3	RXO1-
4	RXO1+
5	RXO2-
6	RXO2+
7	GND
8	RXOCLK-
9	RXOCLK+
10	GND
11	RXO3-
12	RXO3+
13	GND
14	RXE0-
15	RXE0+
16	RXE1-
17	RXE1+
18	RXE2-
19	RXE2+
20	GND
21	RXECLK-
22	RXECLK+
23	RXE3-
24	RXE3+
25	RXE3+
26	LCD_VCC
27	LCD_VCC
28	BLEN
29	BL_PWM
30	BL_PWM_EN
31	BL_POWER
32	BL_POWER
33	BL_POWER
34	BL_POWER
35	GND
36	GND
37	GND
38	GND
39	ID1
40	ID2

PIN ASSIGNMENT		
USB HOST		I²C HOST
1	VBUSIN	1 VDD33
2	DN	2 GNDIN
3	DP	3 SDA
4	GNDIN	4 SCL
		5 INT
		6 RSTN

NOTES:
1. DISPLAY TYPE:15.6" TFT-LCD,16.2M COLORS.
2. DISPLAY MODE: IPS,NORMALLY BLACK.
3. VIEWING DIRECTION: FREE
4. TFT DRIVER IC:NA
   CTP DRIVER IC: IL2511
5. TOUCH Type:CTP
6. TFT Interface: Dual 8 BIT LVDS
7. CTP Interface: USB&I2C
8. Touch and LCM Bonding technology: Optical Bonding
9. VCC:12V
10. OPERATING TEMP:0°C TO 50°C
    STORAGE TEMP:-20°C TO 60°C
11. RoHS and COMPLIANT

3. Input terminal Pin Assignment

The electronics interface connectoris 300E40-0010RA-G3-D(CT)

NO.	SYMBOL	DISCRIPTION	I/O
1	RxO0-	Negative LVDS differential data input(Odd data)	I
2	RxO0+	Positive LVDS differential data input(Odd data)	I
3	RxO1-	Negative LVDS differential data input(Odd data)	I
4	RxO1+	Positive LVDS differential data input(Odd data)	I
5	RxO2-	Negative LVDS differential data input(Odd data)	I
6	RxO2+	Positive LVDS differential data input(Odd data)	I
7	GND	Ground	P
8	RxOCLK-	Negative LVDS differential clock input(Odd data)	I
9	RxOCLK+	Positive LVDS differential clock input(Odd data)	I
10	GND	Ground	P
11	RxO3-	Negative LVDS differential data input(Odd data)	I
12	RxO3+	Positive LVDS differential data input(Odd data)	I
13	GND	Ground	P
14	RxE0-	Negative LVDS differential data input(Even data)	I
15	RxE0+	Positive LVDS differential data input(Even data)	I
16	RxE1-	Negative LVDS differential data input(Even data)	P
17	RxE1+	Positive LVDS differential data input(Even data)	I
18	RxE2-	Negative LVDS differential data input(Even data)	I
19	RxE2+	Positive LVDS differential data input(Even data)	I
20	GND	Ground	P
21	RxECLK-	Negative LVDS differential clock input(Even data)	I
22	RxECLK+	Positive LVDS differential clock input(Even data)	I
23	GND	Ground	P
24	RxE3-	Negative LVDS differential data input(Even data)	I
25	RxE3+	Positive LVDS differential data input(Even data)	I
26	GND	Ground	P
27	LCD_VCC	LCD VCC(12V)	P

28	LCD_VCC	LCD VCC(12V)	P
29	BIST	LCD self-test(Normal mode:NC or pull L;BIST mode:pull H)	P
30	BL_ENABLE	Backlight on/off（3.3V input）	P
31	BL_PWM_DIM	System PWM	P
32	BL_POWER	LED Power Supply Input Voltage(12V)	P
33	BL_POWER	LED Power Supply Input Voltage(12V)	P
34	BL_POWER	LED Power Supply Input Voltage(12V)	P
35	BL_POWER	LED Power Supply Input Voltage(12V)	P
36	GND	Ground	P
37	GND	Ground	P
38	GND	Ground	P
39	ID1	Reserved PIN,Default"H",Recommend NC	I
40	ID2	Reserved PIN,Default"L",Recommend NC	I

***CTP PIN Definition（USB）**

NO.	SYMBOL	DISCRIPTION	I/O
1	VBUSIN	Power supply for USB (5V).	P
2	DN	USB interface, D- signal.	I
3	DP	USB interface, D+ signal.	I
4	GNDIN	Ground.	P

***CTP PIN Definition（IIC）**

NO.	SYMBOL	DISCRIPTION	I/O
1	VDD33	Supply voltage.	P
2	GNDIN	Ground.	P
3	SDA	I2C data input and output	I/O
4	SCL	I2C clock input.	I
5	INT	External interrupt to the host.	I
6	RSTN	External Reset, Low is active.	I

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	1500	2500	--		(1)(2)
Response time	Rising	T_R		--	30	35	msec	
	Falling	T_F		--	30	35		(1)(3)
LCM Luminance				250	280		cd/m2	
Color Gamut		S(%)		--	66	--	%	
Color Filter Chromacicity	White	W_X		-0.04	0.3044	+0.04		(1)(4) CA310
		W_Y			0.3313			
	Red	R_X			0.6400			
		R_Y			0.3475			
	Green	G_X			0.3124			
		G_Y			0.5893			
	Blue	B_X			0.1489			
		B_Y			0.0717			
Viewing angle	Hor.	ΘL	CR>10	80	89	--		
		ΘR		80	89	--		
	Ver.	ΘU		80	89	--		
		ΘD		80	89	--		
Option View Direction		SUPPER WIDE ANGLIE						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

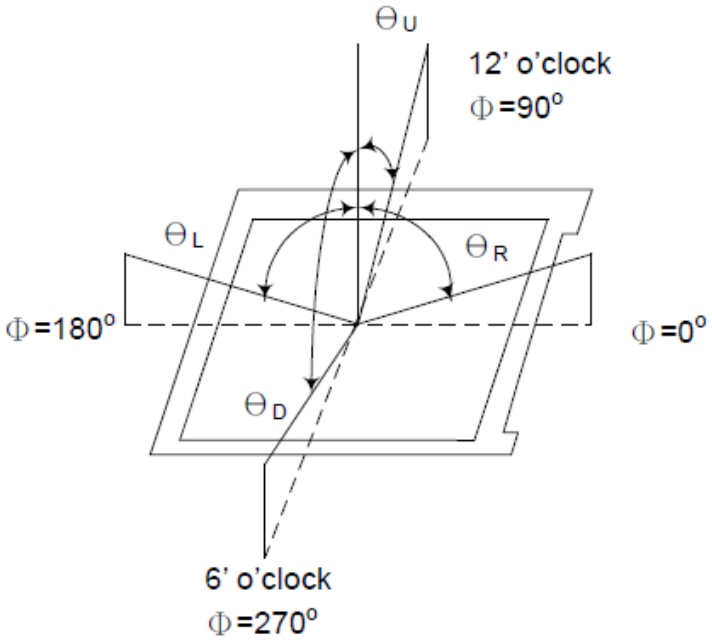
Ambient temperature : 25±2oC

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

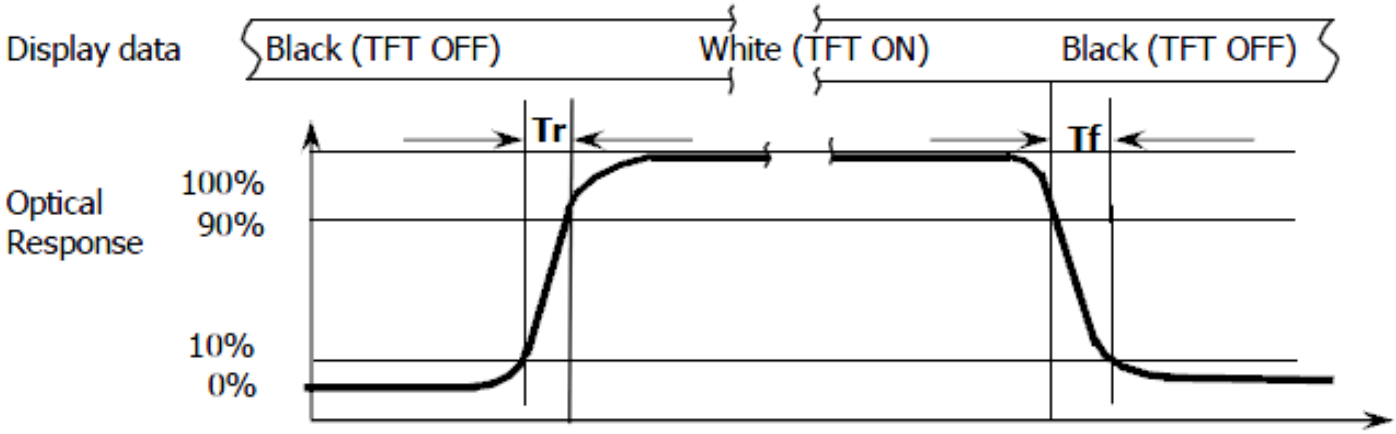
Note (1): Definition of Viewing Angle :



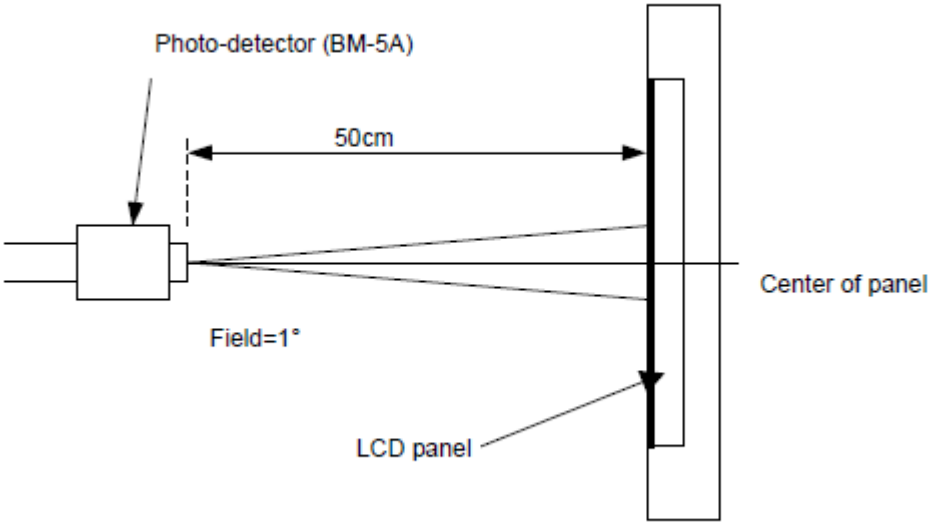
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	LCD_VCC	-0.3	13.2	V	Note1
Operating temperature	T_{OP}	0	+50	℃	
Storage temperature	T_{ST}	-20	+60	℃	

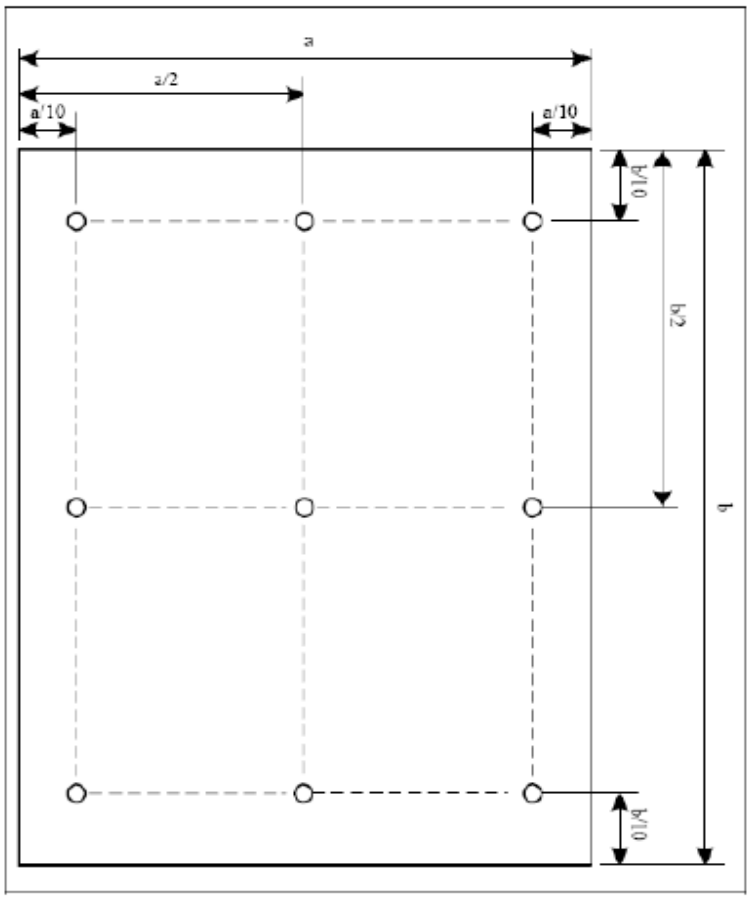
NOTE1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	LCD_VCC	10.8	12	13.2	V	
Normal mode Current	IDD	--	100	--	mA	
Level input voltage	V_{IH}	0.7LCD_VCC		LCD_VCC	V	
	V_{IL}	GND		0.3 LCD_VCC	V	
Level output voltage	V_{OH}	LCDVCC-0.4		--	V	
	V_{OL}	GND		GND+0.4	V	

5.3 LED Backlight Characteristics

Note (1) Luminance Uniformity of these 9 points is defined as below:

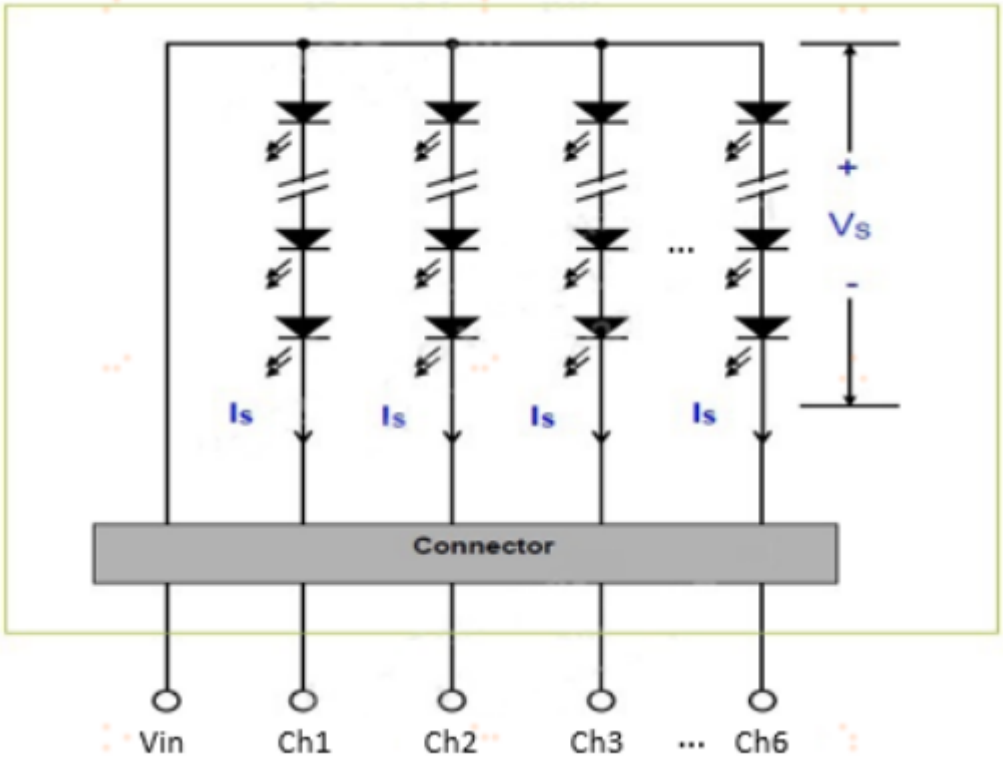


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

BACK-Light&lcm Interface Connection

The back-light system is edge-lighting type with 54 chips White LED (6strings and 9PCS LED in one string).



Pin#	Symbol	Description	Remark
1	Vout	LED anode connection	
2	Vout	LED anode connection	
3	Vout	LED anode connection	
4	NC	NC	
5	LED	LED Cathode connection	
6	LED	LED Cathode connection	
7	LED	LED Cathode connection	
8	LED	LED Cathode connection	
9	LED	LED Cathode connection	
10	LED	LED Cathode connection	

6. Electrical Specifications

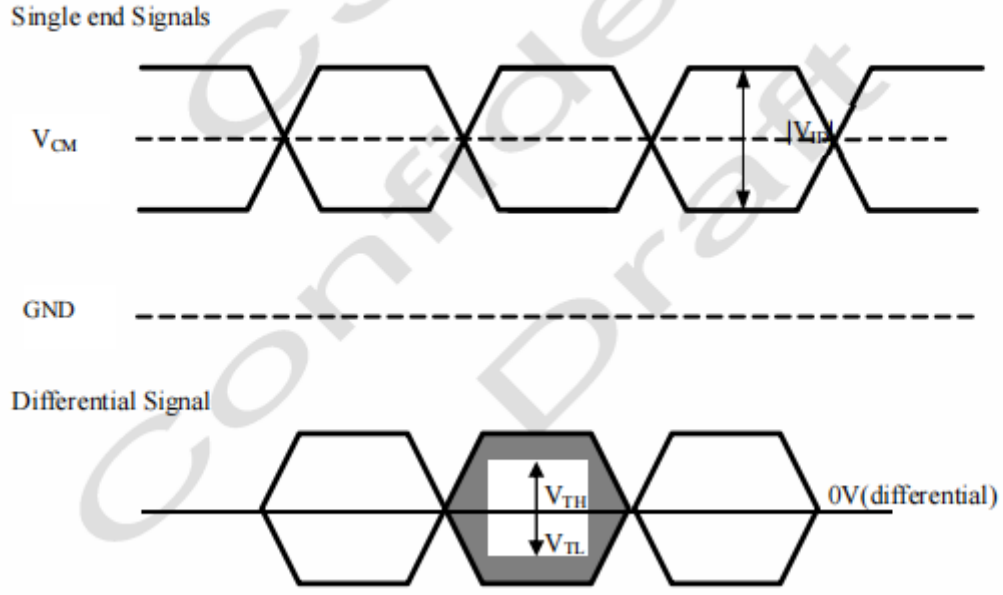
6.1 LVDS Characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
LVDS Interface	Differential Input High Threshold Voltage	VTH	+100	-	-	mV	(1)
	Differential Input Low Threshold Voltage	VTL	-	-	-100	mV	
	Common Input Voltage	VCM	1.0	1.2	1.4	V	
	Differential Input Voltage	|VID|	100	-	600	mV	
	Terminating Resistor	RT	87.5	100	112.5	ohm	
CMOS Interface	Input High Threshold Voltage	VIH	2.7	-	3.3	V	
	Input Low Threshold Voltage	VIL	0	-	0.7	V	

Note:

(1) The product should be always operated within above ranges.

(2) The LVDS input signal has been defined as follows:



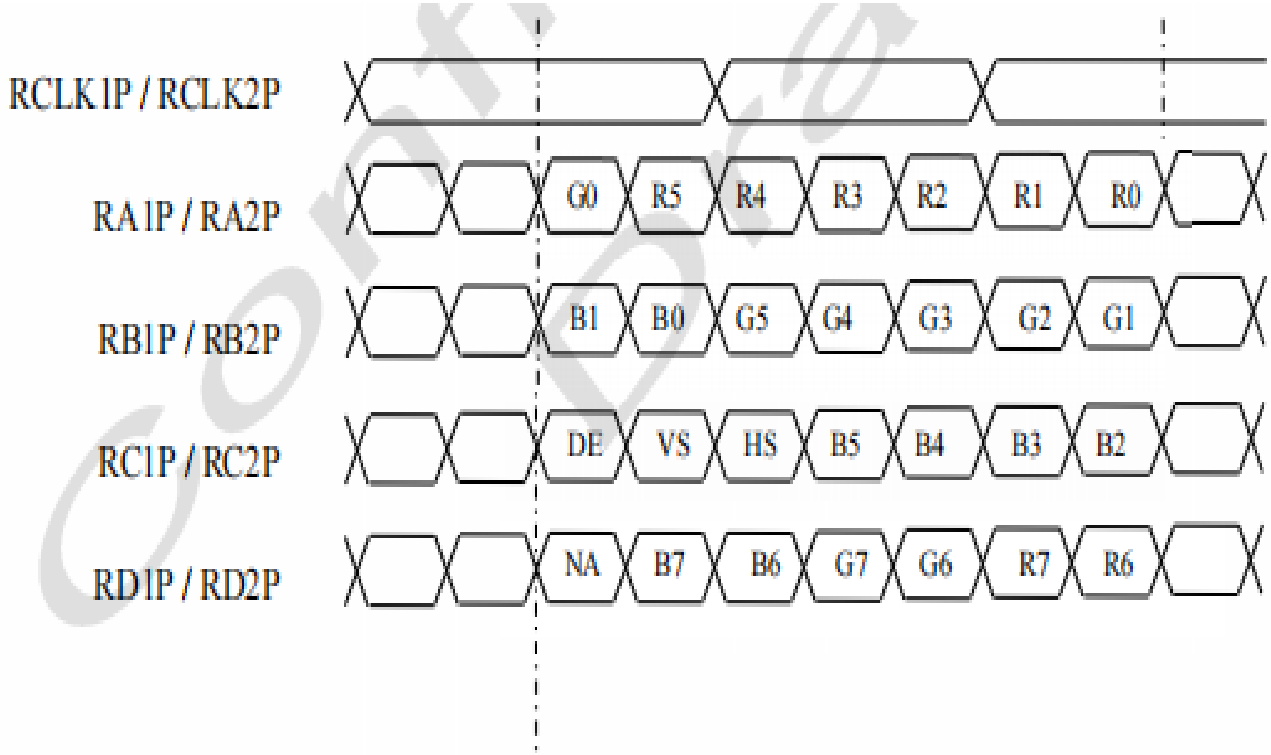
6.2 Temperature Specifications

Parameter	Symbol	Spec			Unit	Note
		Min.	Typ.	Max.		
Source driver	T_{DRIVER}	-	-	115	℃	(1)
PMIC	T_{PMIC}	-	-	100	℃	(1)
TCON	T_{TCON}	-	-	105	℃	(1)

Note:

(1) Any point on the IC surface must be less than Max. specification under any condition ,If the surface temperature is out of the specification, thermal solutions should be applied to avoid to be damaged.

6.3 LVDS Interface



6.4 Interface Timing

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	Fclkin (=1/TClk)	64	74.25	96	MHz	(1) (2)
	Input cycle to cycle jitter	Trcl	–	–	200	ps	(3)
	Spread spectrum modulation range	Fclkin_mod	Fclkin-2%	–	Fclkin+2%	MHz	(4)
	Spread spectrum modulation frequency	FSSM	60	–	200	KHz	
LVDS Receiver Data	Receiver Skew Margin	TRSM	-400	–	400	ps	(5)
Vertical Active Display Term	Frame Rate	F	48	60	75	Hz	
	Total	TV	1092	1125	1380	TH	TV = TVD +TVB
	Display	TVD	1080				
	Blank	TVB	12	45	300	TH	
Horizontal Active Display Term	Total	TH	1046	1100	1174	TCLK	TH = THD + THB
	Display	THD	960				
	Blank	THB	86	140	214	TCLK	

Note:

(1) The TFT LCD open cell is operated in DE only mode, H sync and V sync input signal have no effect on normal operation.

(2) Please make sure the range of pixel clock follows the following equations:

$Fclkin(max) \geq Fmax \times Tv \times Th$ $Fmin \times Tv \times Th \geq Fclkin(min)$

Main frequency Max is 96Mhz without spread spectrum

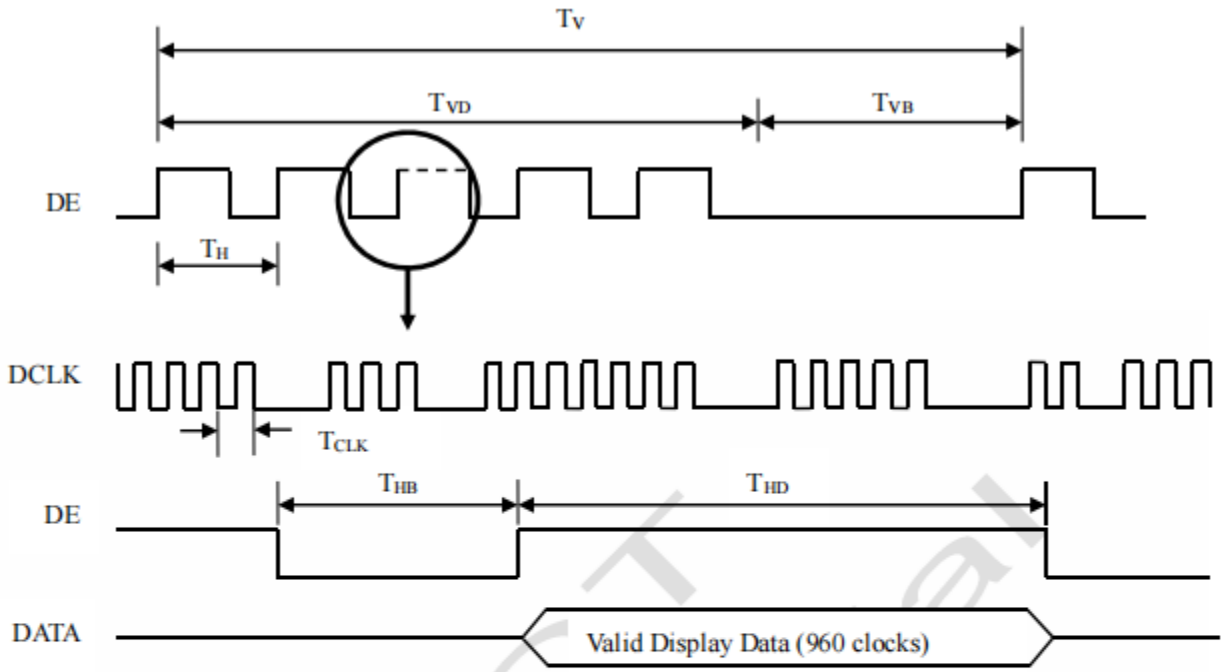
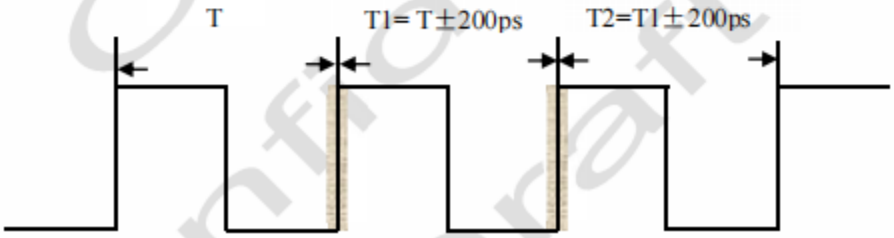


Fig. 5.1 Interface signal timing diagram

(3)The input clock cycle-to-cycle is defined as below figures.



(4) The SSCG (Spread Spectrum Clock Generator) is defined as the following figure.

The LVDS SSCG 's suggestion is off by default, SOC board must test all validation if SOC board open the LVDS SSCG.

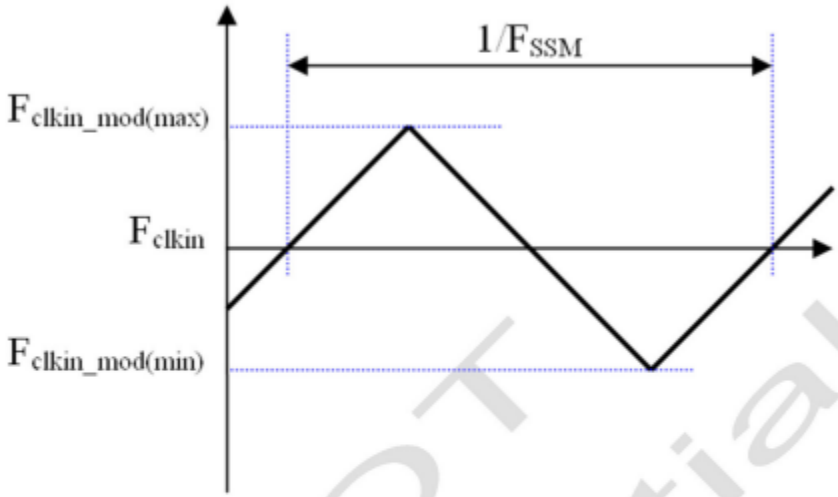
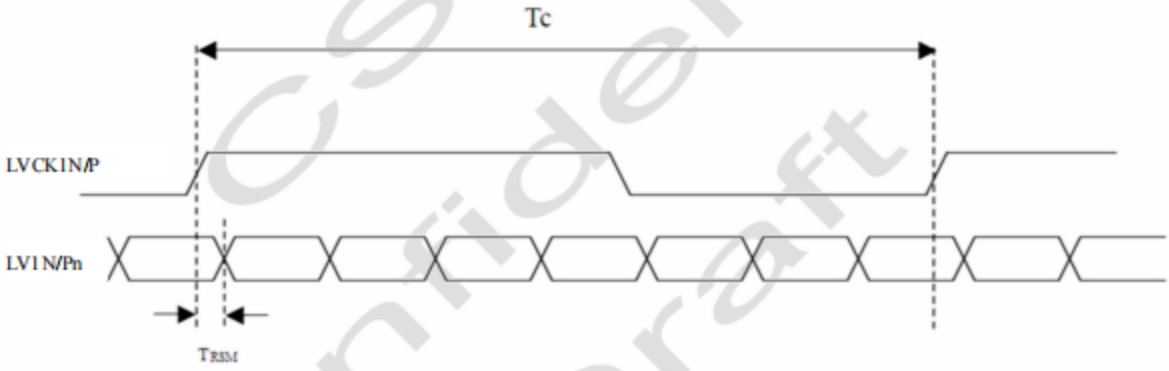


Fig. 5.3 SSCG

(5) The LVDS timing diagram and setup/hold time is defined and showed as the following figure.



6.5 Power On/Off Sequence

To prevent a latch-up or DC operation of the Open cell, the power on/off sequence should be as the diagram below.

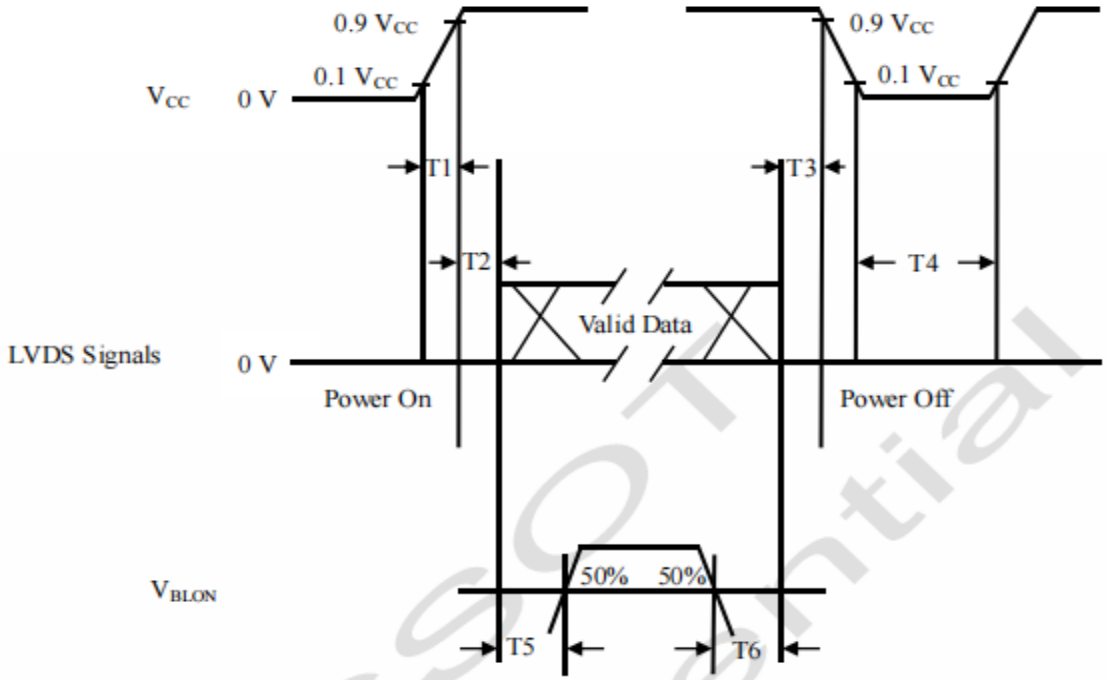


Fig.5.5 Power on/off sequence

Parameter	Values			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10.0	ms
T2	0.0	-	50	ms
T3	0.0	-	50	ms
T4	1000.0	-	-	ms
T5	500.0	-	-	ms
T6	100.0	-	-	ms

Attention:

(1) The supply voltage of the external system for the open cell input should follow the definition of VCC.

(2) When the customer's backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

(3) In case that VCC is in off level, please keep the level of input signals on the low or high impedance. If T2 < 0, that may cause electrical overstress.

(4) T4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

7. CTP Specification

7.1.1 Electrical Characteristics

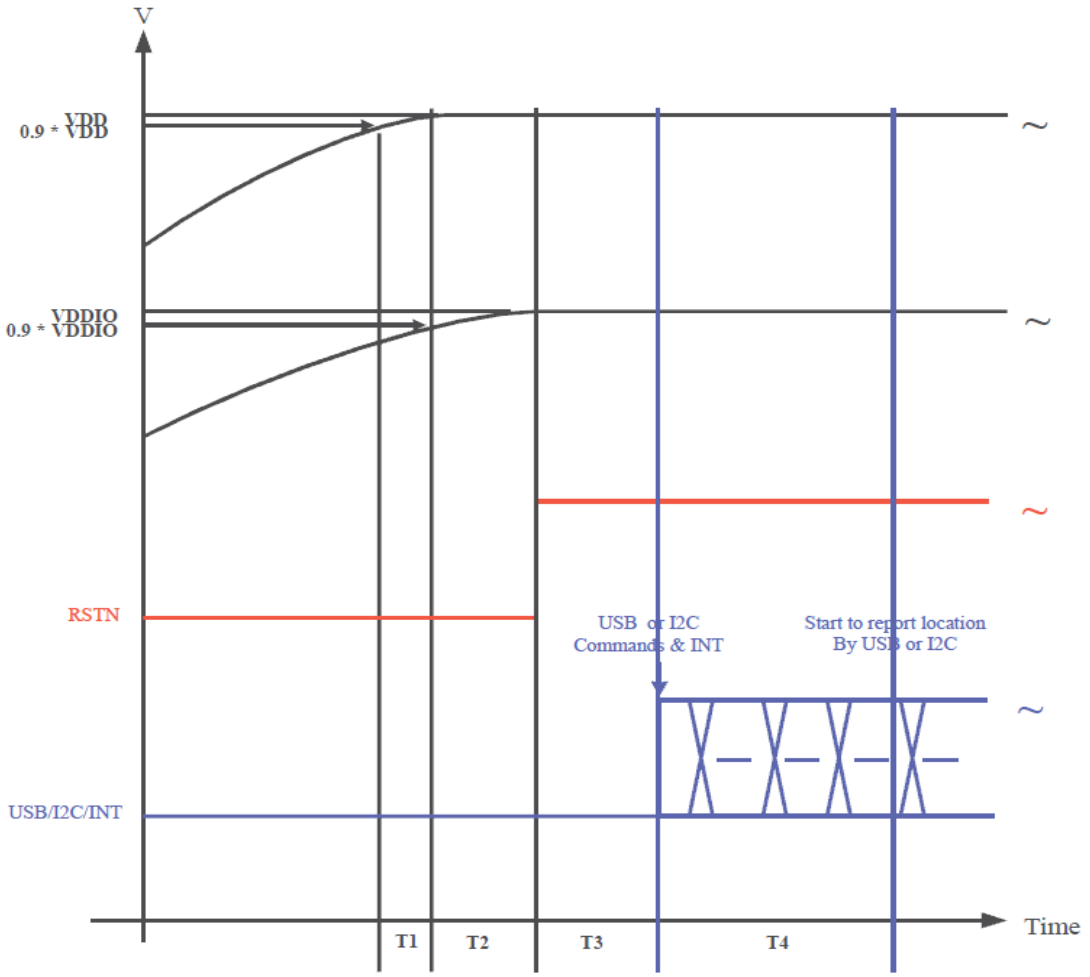
7.1.1 Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage for I2C	VDD	-0.3	3.6	V	
Power Supply Voltage for USB	VBUS	2.2	6	V	
Operating temperature	T_{OP}	-20	+70	℃	
Storage temperature	T_{ST}	-30	+80	℃	

7.1.2 DC Electrical Characteristics (Ta=25℃)

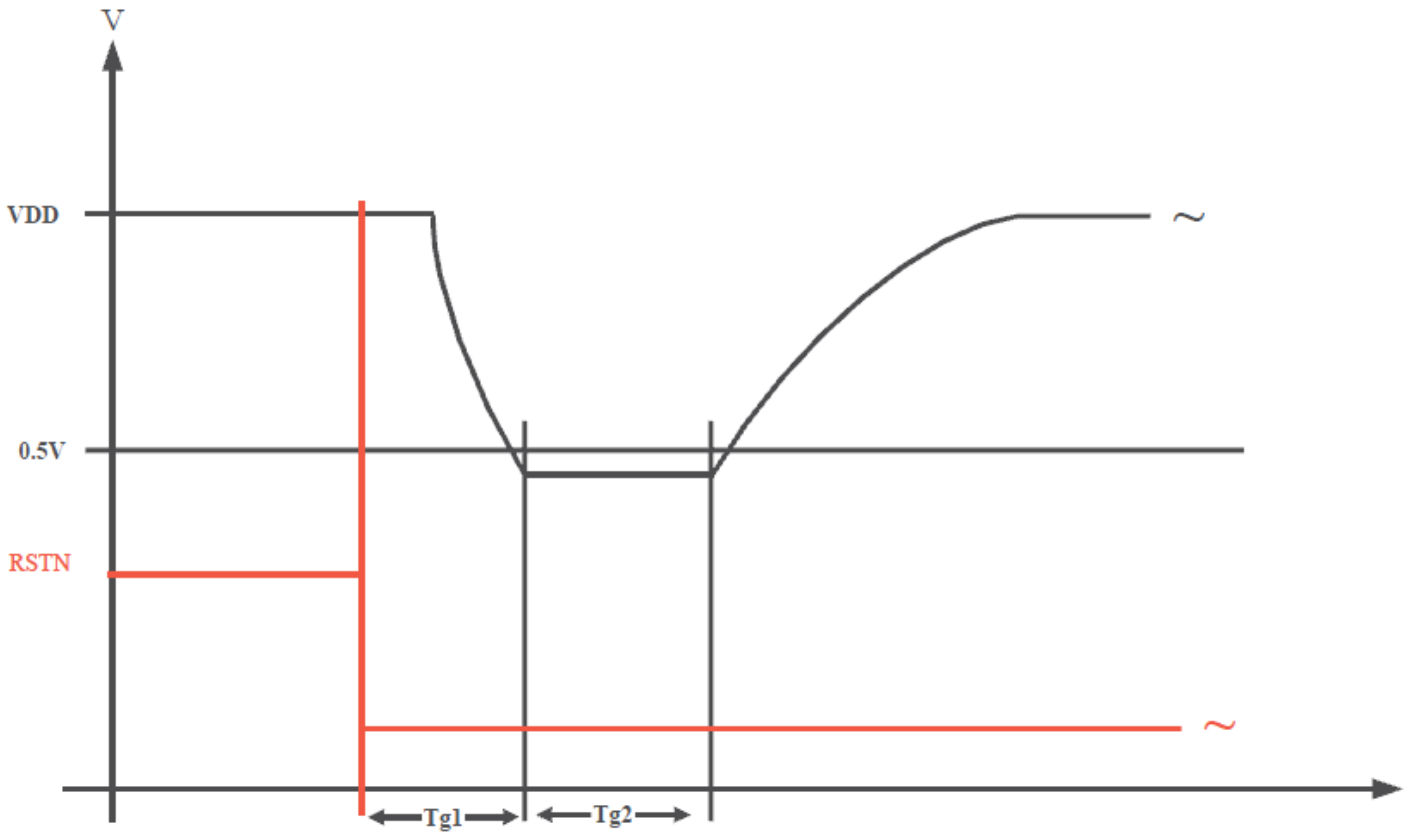
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	3.0	3.3	3.6	V	
Operation current	Iop		100		mA	Active Mode
Input Low Voltage	VIL1	0		0.3VDD	mA	
Input High Voltage	VIH1	0.6VDD		VDD+0.5	mA	
Hysteresis voltage	VHY		0.2VDD		uA	
Input Low Voltage, XT_In	VIL2	0		0.6	mA	
Input High Voltage, XT_In	VIH2	2.6		VDD+0.2	V	
Negative going threshold, /Reset	VILS	0		0.2VDD	V	
Positive going threshold, /Reset	VIHS	0.6VDD		VDD+0.5	V	
Output High Voltage	VOH	0.7VDD			V	VDD =3.3V, IOH=8mA
Output Low Voltage	VOL			0.3VDD		VDD =3.3V, IOL=10mA

7.1.3 Power up Sequence



1. T1: the time difference between 0.9*VDD and 0.9*VDDIO. T1 must be ≥ 0 sec.
2. T2: the time difference between 0.9*VDDIO and RSTN. T2 must be ≥ 200 us.
3. T3: the time difference between RSTN and Commands.T3 must be ≥ 150 ms.
4. T4: IC start to report point location to host. T4 must be ≥ 300 ms.

7.1.4 Power-off to Power-on Sequence



Tg1 : the time difference between power-off and power-on. Tg1 must be > 10us.

Tg2 : the time difference between power-off and power-on. Tg2 must be > 10us.

Note. During the power off time, the VDD must be lower than 0.5V that make sure the touch controll have been correctly reset.

7.1.5 AC Characteristics

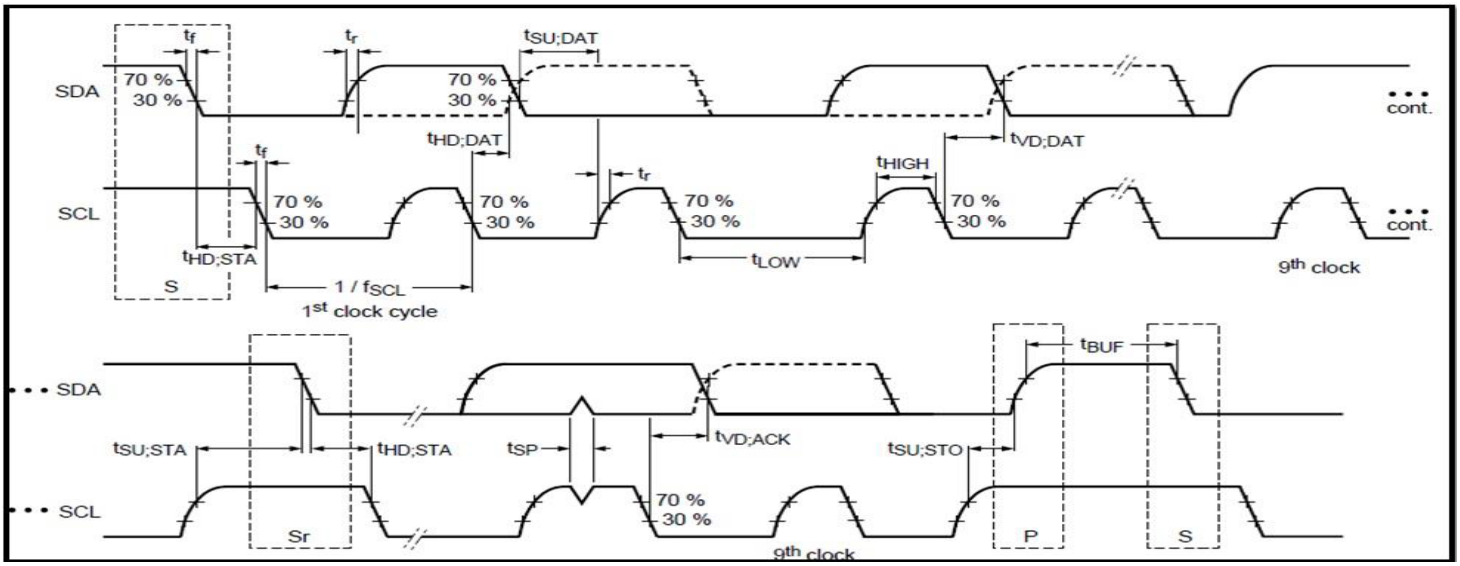


Table 5-7: I2C AC Characteristics

Parameter	Symbol	Standard-mode		Fast-mode		Unit
		Min	Max	Min	Max	
SCL clock frequency	f_{SCL}	0	100	0	400	kHz
Hold time START condition	$t_{HD;STA}$	4.0	-	0.6	-	us
LOW period of the SCL clock	t_{Low}	4.7	-	1.3	-	us
HIGH period of the SCL clock	t_{High}	4.0	-	0.6	-	us
Set-up time for a repeated START condition	$t_{SU:STA}$	4.7	-	0.6	-	us
Data hold time	$t_{HD;DAT}$	300	-	300	-	ns
Data set-up time	$t_{SU;DAT}$	250	-	100	-	ns
Rise time of both SDA and SCL signals (30% to 70%)	t_r	-	1000	20	300	ns
Fall time of both SDA and SCL signals (70% to 30%)	t_f	-	300	20	300	ns
Set-up time for STOP condition	$t_{SU;STO}$	4.0	-	0.6	-	us
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	1.3	-	us
Capacitive load for each bus line	C_b	-	400	-	400	pF
Noise margin at the LOW level for each connected device	V_{nL}	$0.1V_{DD}$	-	$0.1V_{DD}$	-	V
Noise margin at the HIGH level for each connected device	V_{nH}	$0.2V_{DD}$	-	$0.2V_{DD}$	-	V

7.2 I2C Timing

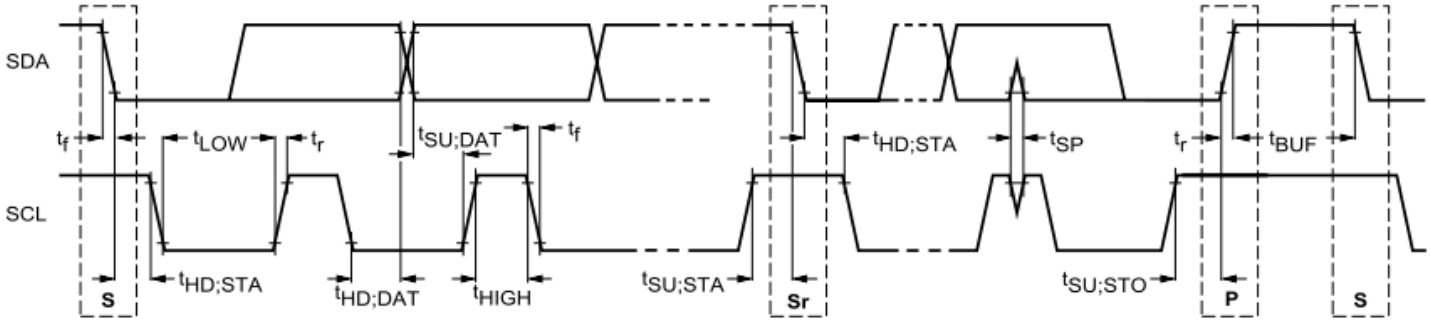


Fig 2: The timing of I²C Interface

Characteristics of the SDA and SCL bus lines

Symbol	Parameter	Standard mode			Fast Mode		
		Min	Max	Unit	Min	Max	Unit
f_{SCL}	SCL clock frequency	0	100	kHz	0	400	kHz
$t_{HD;STA}$	Hold time (repeated) START condition. After this period, the first clock pulse is generated	4.0	–	µs	0.6	–	µs
t_{LOW}	LOW period of the SCL clock	4.7	–	µs	1.3	–	µs
t_{HIGH}	HIGH period of the SCL clock	4.0	–	µs	0.6	–	µs
$t_{SU;STA}$	Set-up time for a repeated START condition	4.7	–	µs	0.6	–	µs
$t_{HD;DAT}$	Data hold time	5.0	–	µs	0	0.9	µs
$t_{SU;DAT}$	Data set-up time	250	–	ns	100	–	ns
t_r	Rise time of both SDA and SCL signals	–	1000	ns	–	300	ns
t_f	Fall time of both SDA and SCL signals	–	300	ns	–	300	ns
$t_{SU;STO}$	Set-up time for STOP condition	4.0	–	µs	0.6	–	µs
t_{BUF}	Bus free time between a STOP and START condition	4.7	–	µs	1.3	–	µs

7.3 I2C Interface Data Structure

7.3.1 Device Address

The device addresses are 7-binary bits long and are conventionally expressed as 4 bits followed by 3 bits followed by the letter 'b', 1000 001b. These addresses occupy the high seven bits of an eight-bit field on the bus.

MSB							LSB
1	0	0	0	0	0	1	0/1
Device Address							R/W

7-bit Device Address: 0x41

8-bit Device Read Address:0x83

8-bit Device Write Address:0x82

Fig 3: I^2C Device Address

7.3.2 Data Transfer

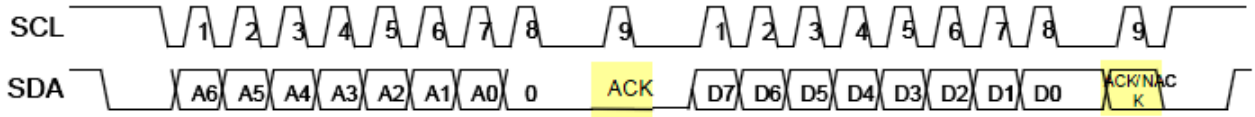
Data is transferred over the I^2C bus with 8-bit address and 8-bit data. The related protocol and timing diagrams are shown as below.

1	7	1	1	8	1	1
S	Slave Address	Wr	A	Data Byte	A	P

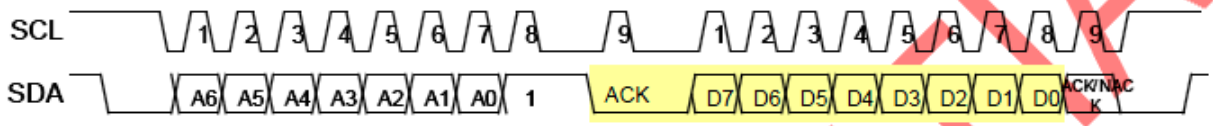
S	Start Condition
Sr	Repeated Start Condition
Rd	Read (bit value of 1)
Wr	Write (bit value of 0)
A/NA	Acknowledge (this bit position may be '0' for an ACK or '1' for a NACK)
P	Stop Condition
	Master-to-Slave
	Slave-to-Master
---	Continue

Fig 4: Generic Transaction Diagram

I2C Write timing



I2C Read timing



Byte Write

S	Slave Address	Wr	A	Command Code	A	Data Byte	A	P

Fig 5: Byte Write

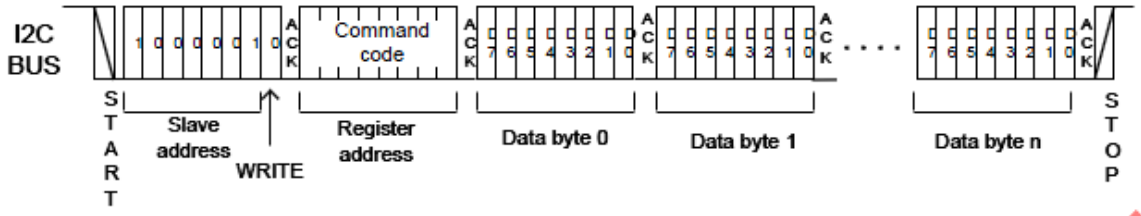
Byte Read

c

S	Slave Address	Wr	A	Command Code	A	Sr	Slave Address	Rd	A	Data Byte	A	P

Fig 6: Byte Read

Multi-Byte Write



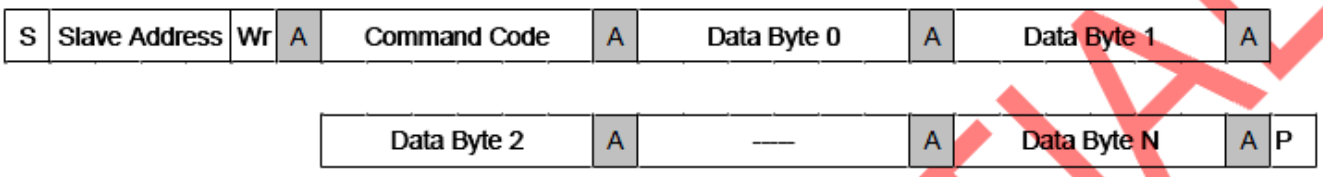
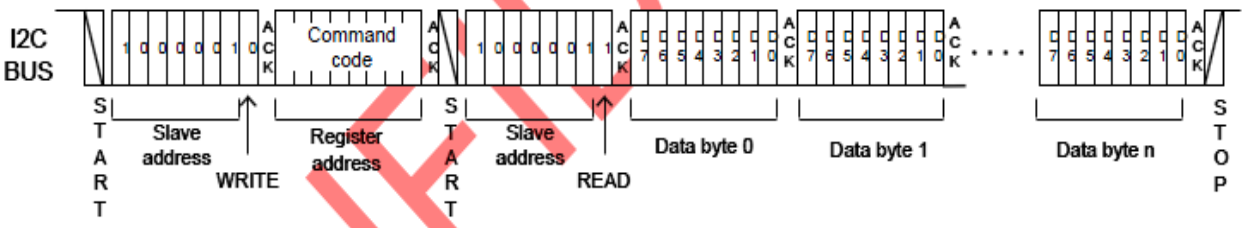


Fig 7: Multi-Byte Write

Multi-Byte Read



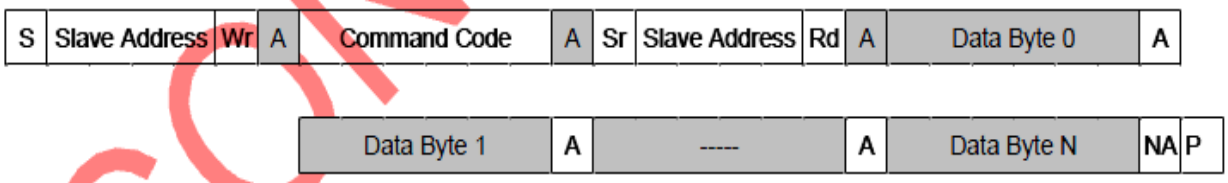


Fig 8: Multi-Byte Read

7.4 Interrupt Pin (INT) Control

ILI Touch device uses interrupt pin to signal the host when detecting touch events on the sensor. When a finger touches on the sensor surface, the $\overline{INT}$ pin will be pull low. ILI Touch device supports two different type control method.

Method 1(Polling): The $\overline{INT}$ will continue to be low until the finger leaves the sensor surface.

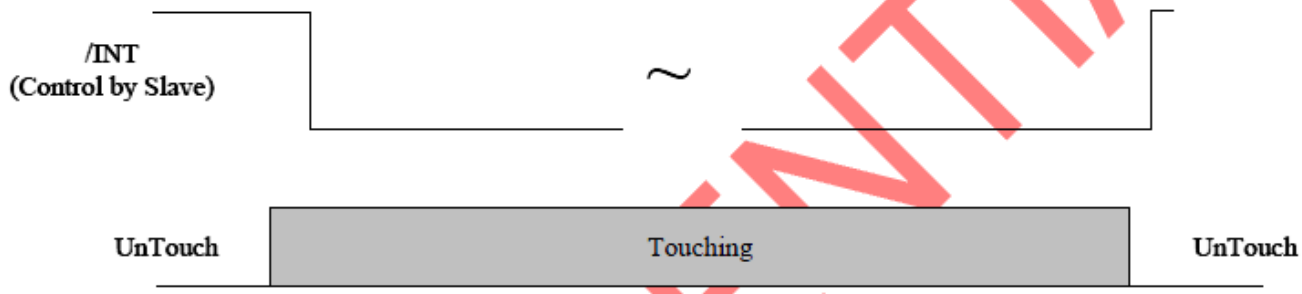


Fig 9: Method 1: $\overline{INT}$ Pin Control Diagram (Finger Touch)

Method 2(Interrupt): The $\overline{INT}$ will continue to be pull low until host read 0x10 command.

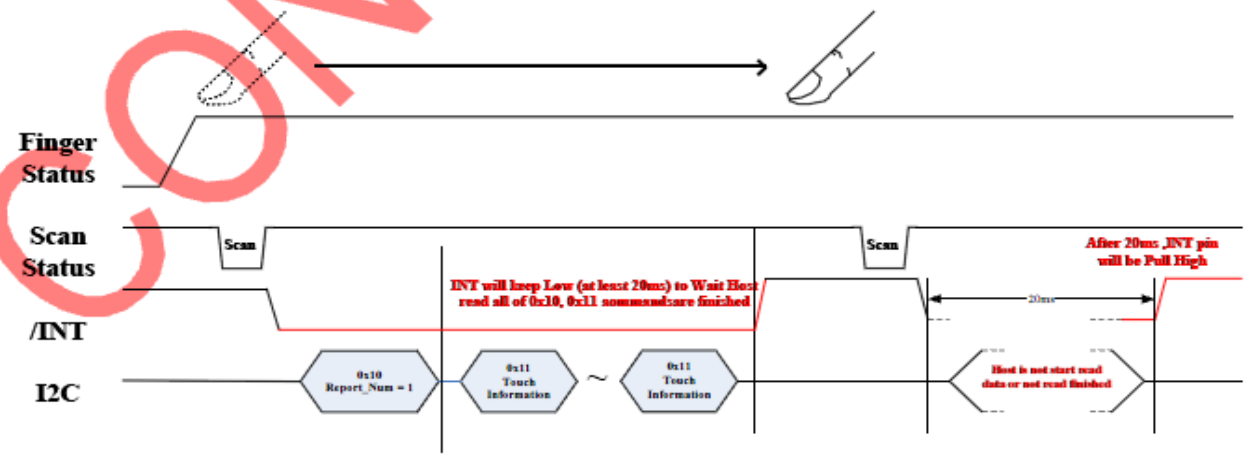


Fig 10: Method 2: $\overline{INT}$ Pin Control Diagram (Finger Touch)

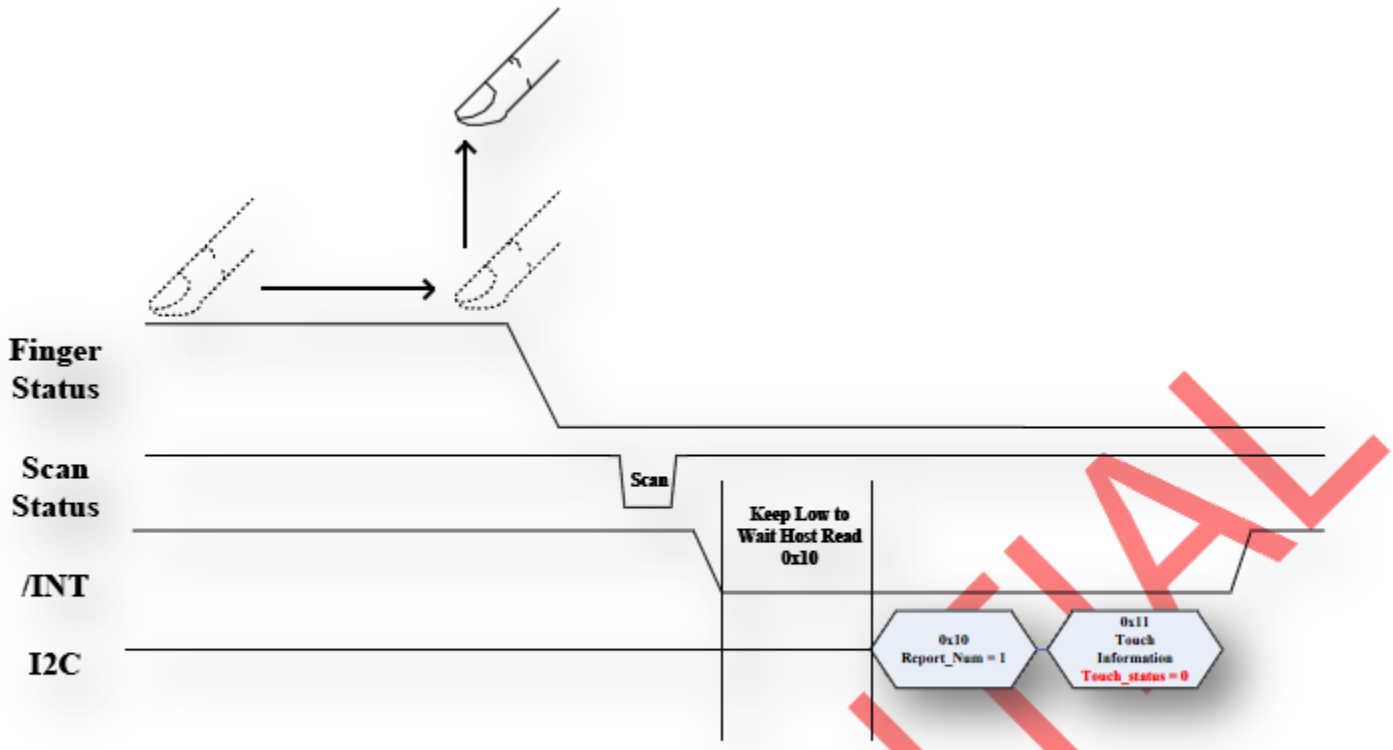


Fig 11: Method 2: $\overline{\text{INT}}$ Pin Control Diagram (Finger Release)

8. LCD Module Out-Going Quality Level

8.1 VISUAL & FUNCTION INSPECTION STANDARD

8.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

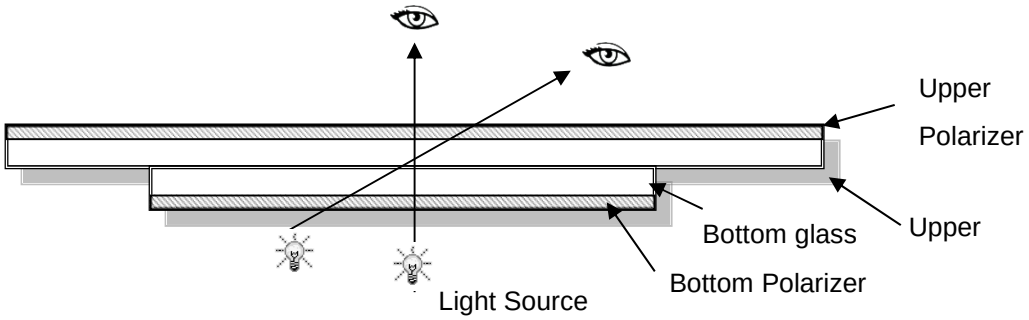
Temperature : 25±5℃

Humidity : 65%±10%RH

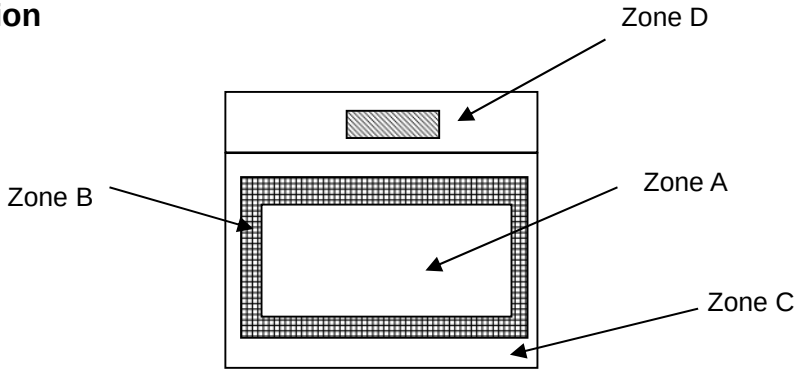
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



8.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

8.1.3 Sampling Plan

According to GB/T 2828.1-2003 ; , normal inspection, Class Ⅱ

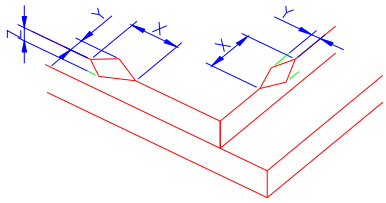
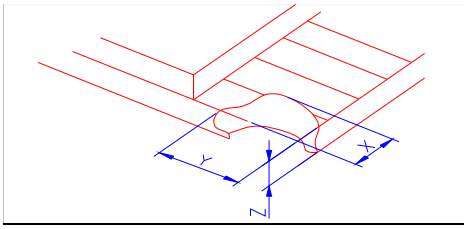
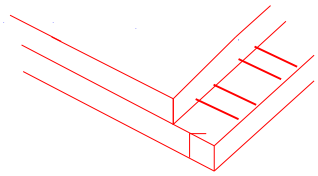
AQL:

Major defect	Minor defect
0.65	1.5

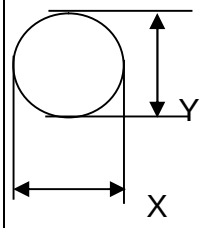
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting.	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot Line defect	Light dot，Dim spot,Polarizer Bubble ; Polarizer accidented spot.	
6	Soldering appearance	Good soldering , Peeling off is not allowed.	
7	LCD/Polarizer/CTP	Black/White spot/line, scratch, crack, etc.	

8.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

2.0 Spot defect



Φ=(X+Y)/2

① light dot（ black/white spot , pinhole, stain，etc.）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

② Dim spot（light leakage、dent、dark spot，etc）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

③ Polarizer accidented spot

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.5	2(distance≧10mm)		
Φ>0.5	0		

④Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

3.0 LCD Pixel defect

Pixel bad points

Item	Zone A	Acceptable Qty
Bright dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Dark dot	Random	N≤3
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm
Total bright and dark dot		N≤4

Note:

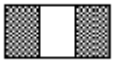
A) Bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

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

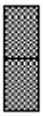
C) 2 dot adjacent = 1 pair = 2 dots

Picture:

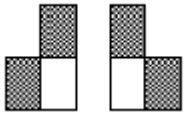
2 dot adjacent



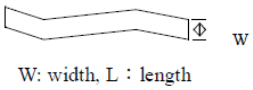
2 dot adjacent



2 dot adjacent (vertical)



2 dot adjacent (slant)

<table>
<tr>
<td>4.0</td>
<td>Line defect (LCD /Polarizer backlight black/white line, scratch, stain)
 

N：Count</td>
<td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤5.0</td><td colspan="2">N≤3</td></tr>
<tr><td>0.06<W≤0.08</td><td>L≤4.0</td><td colspan="2">N≤2</td></tr>
<tr><td>W>0.08</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
<tr>
<td>5.0</td>
<td>Electronic Components SMT.</td>
<td>Not allow missing parts，solderless connection，cold solder joint，mismatch，The positive and negative polarity opposite</td>
</tr>
<tr>
<td>6.0</td>
<td>Display color& Brightness.</td>
<td>1. Color：Measuring the color coordinates, The measurement standard according to the datasheet or samples.
2. Brightness：Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</td>
</tr>
<tr>
<td>7.0</td>
<td>LCD Mura/Waving/ Hot spot</td>
<td>Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.</td>
</tr>
<tr>
<td rowspan="2">8.0</td>
<td rowspan="2">CTP Related</td>
<td>CTP Cover sensor accidented black/white spot</td>
<td>
<table>
<tr><th rowspan="2">Size Φ(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.15</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.15<Φ≤0.25</td><td colspan="2">1 (distance ≥ 10mm)</td></tr>
<tr><td>0.25<Φ≤0.35</td><td colspan="2">2 (distance ≥ 10mm)</td></tr>
<tr><td>Φ>0.35</td><td colspan="2">0</td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>CTP Cover scratch</td>
<td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Ignore(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤4.0</td><td colspan="3">N≤3</td></tr>
<tr><td>0.06<W≤0.08</td><td>L≤3.0</td><td colspan="3">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
</table>

CTP Cover Pinhole/ Lack of ink

Zone / Size (mm)	Acceptable Qty
	C
Φ≤0.2	Ignore
0.2<Φ≤0.3	4(distance≧10mm)
0.3<Φ≤0.4	2(distance≧10mm)
Φ>0.4	0

CTP Bonding bubble/ accidented spot

Size Φ(mm)	Acceptable Qty	
	A	B
Φ≤0.1	Ignore	
0.1<Φ≤0.2	2(distance≧10mm)	
0.2<Φ≤0.3	2(distance≧10mm)	
Φ>0.3	0	

Assembly deflection

beyond the edge of backlight ≤0.2mm

CTP cover broken

X：length

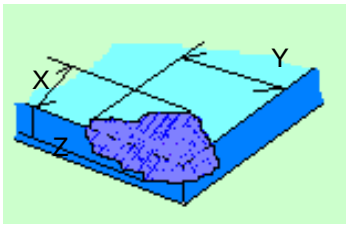
Y：width

Z：height

X	Y	Z
X≤0.5mm	Y≤0.5mm	Z<cover thickness

*

Circuitry broken is not allowed.



CTP cover broken

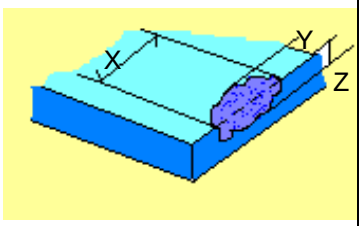
X：length

Y：width

Z：height

X	Y	Z
X≤0.3mm	Y≤0.3mm	Z<cover thickness

* Circuitry broken is not allowed.



Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	CTP no function	Not allowed

9. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	50℃,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	0℃, 96HR	
High Temperature Storage	60℃, 96HR	
Low Temperature Storage	-20℃, 96HR	
High Temperature & High Humidity Operating	60℃, 80% RH ,96hours.	
Thermal Shock (Non-operation)	-20℃,30 min ↔ +60℃,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±15KV, 5times; Contact:±8KV, 5 times; (Environment: 15℃~35℃, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~500Hz, Stroke:1.5mm Sweep:10Hz~500Hz~10Hz 1 hours for each direction of X.Y.Z. (1 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80㎝(MEDIUM BOX)	

Remark:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

10. Cautions and Handling Precautions

10.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.

10.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.