Zeppelinstrasse 19 D-82205 Gilching Fon +49-8105-778090 *info@lcd-module.de* http://www.lcd-module.de

SPECIFICATION

CUSTOMER : _____

MODULE NO.: **EA TFT035-32BTS**

APPROVED BY: **(FOR CUSTOMER USE ONLY)**	**PCB VERSION:** **DATA:**

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY
ISSUED DATE: 2021/10/19			

Content

1.Summary

This technical specification applies to 3.5” color TFT-LCD panel. The 3.5” color TFT-LCD panel is designed for camcorder, digital camera application and other electronic products which require high quality flat panel displays. This module follows RoHS.

1.1. Accessories

ZIF connector for display, bottom contact	**EA WF050-40S**
ZIF connector for display, top contact	**EA WF050-40ST**
ZIF connector for touch panel, top contact	**EA WF050-10T**

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2.General Specifications

Item	Dimension	Unit
Size	3.5	inch
Dot Matrix	320 x RGBx240(TFT)	dots
Module dimension	76.9x 63.9x 4.52	mm
Active area	70.08 x 52.56	mm
Dot pitch	0.073 x 0.219	mm
LCD type	TFT, Normally White, Transmissive	
View Direction	12o'clock	
Gray Scale Inversion Direction	6 o'clock	
Backlight Type	LED white	
TFT Driver IC	HX8238 or equivalent	
TFT Interface	24-bit RGB	
PCAP IC	ILI2130 or equivalent	
PCAP Interface	I²C 7-bit Device Address: 0x41 8-bit Device Address: 0x82/0x83	
PCAP FW Version	0x07.0x00.0x00.0x00.0x00.0x35.0x5A.0x01	
With /Without TP	With PCAP	
Surface	Glare	

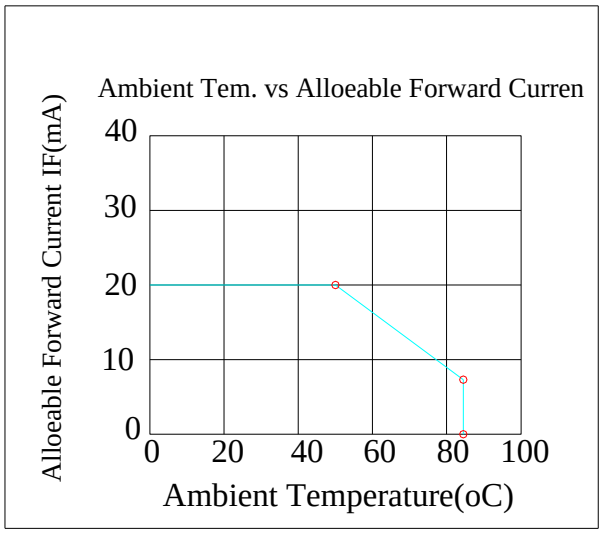
*Color tone slight changed by temperature and driving voltage.

3.Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	—	+70	℃
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℃



4.Electrical Characteristics

4.1. Operating conditions:

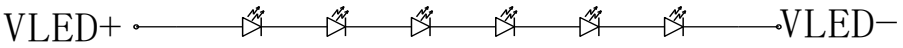
Item	Symbol	Min	Typ	Max	Unit	Remark
Supply Voltage For LCM	VCC	3.0	3.3	3.6	V	
Supply Current For LCM	ICC	—	12	18	mA	Note 1
Supply CTP	VDDT	3.0	3.3	3.6	V	
	ICTP	—	45	68	mA	

Note 1 : This value is test for VCC =3.3V , Ta=25 ℃ only

4.2. LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		-	20	-	mA	
Power Consumption		336	384	408	mW	
LED voltage	LED+	16.8	19.2	20.4	V	Note 1
LED Life Time		-	50,000	-	Hr	Note 2,3,4

Note 1 : There is 1 LED path



CIRCUIT DIAGRAM

Note 2 : Ta = 25 ℃
Note 3 : Brightness to be decreased to 50% of the initial value
Note 4 : The single LED lamp case

5.DC CHARATERISTICS

Parameter	Symbol	Rating			Unit	Condition
		Min	Typ	Max		
Low level input voltage	V_{IL}	0	-	0.3VCC	V	
High level input voltage	V_{IH}	0.7VCC	-	VCC	V	

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6.AC Characteristics

Digital Parallel RGB interface

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Tosc	-	6.5	10	MHz
	High Time	Tch	-	77	-	ns
	Low Time	Tcl	-	77	-	ns
Data	Setup Time	Tsu	12	-	-	ns
	Hold Time	Thd	12	-	-	ns
Hsync	Period	TH	-	408		Tosc
	Pulse Width	THS	5	30	-	Tosc
	Back-Porch	Thb	-	38	-	Tosc
	Display Period	TEP	-	320	-	Tosc
	Hsync-den time	THE	36	68	88	-
	Front-Porch	Thf	-	20	-	Tosc
Vsync	Period	Tv	-	262	-	TH
	Pulse Width	Tvs	1	3	5	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-Porch	Tvf	2	4	-	TH

Note:

1. Thp + Thb = 68, the user is make up by yourself.

2. Tv = Tvs + Tvb + Tvd + Tvf , the user is make up by yourself.

3.When SYNC mode is used,1st data start from 68th Dclk after Hsync falling

6.1. Waveform

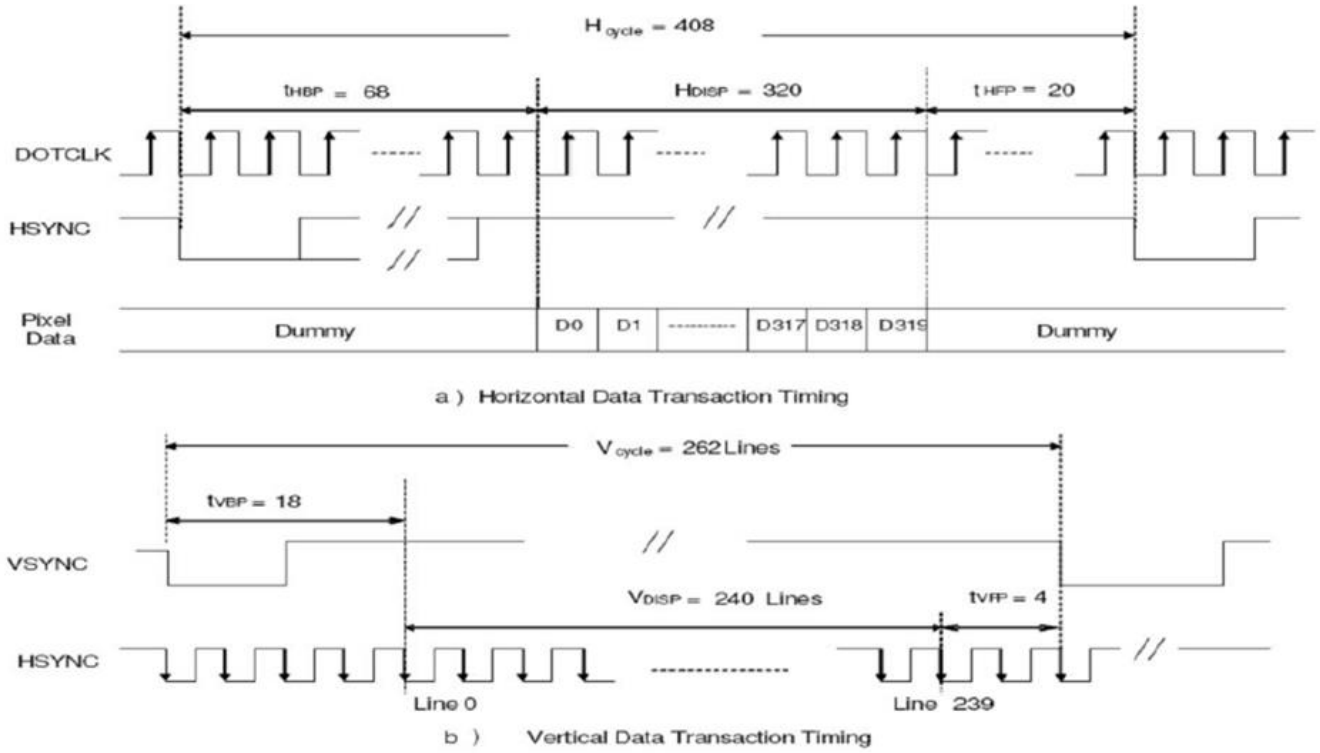


Figure 6.1.1 Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)

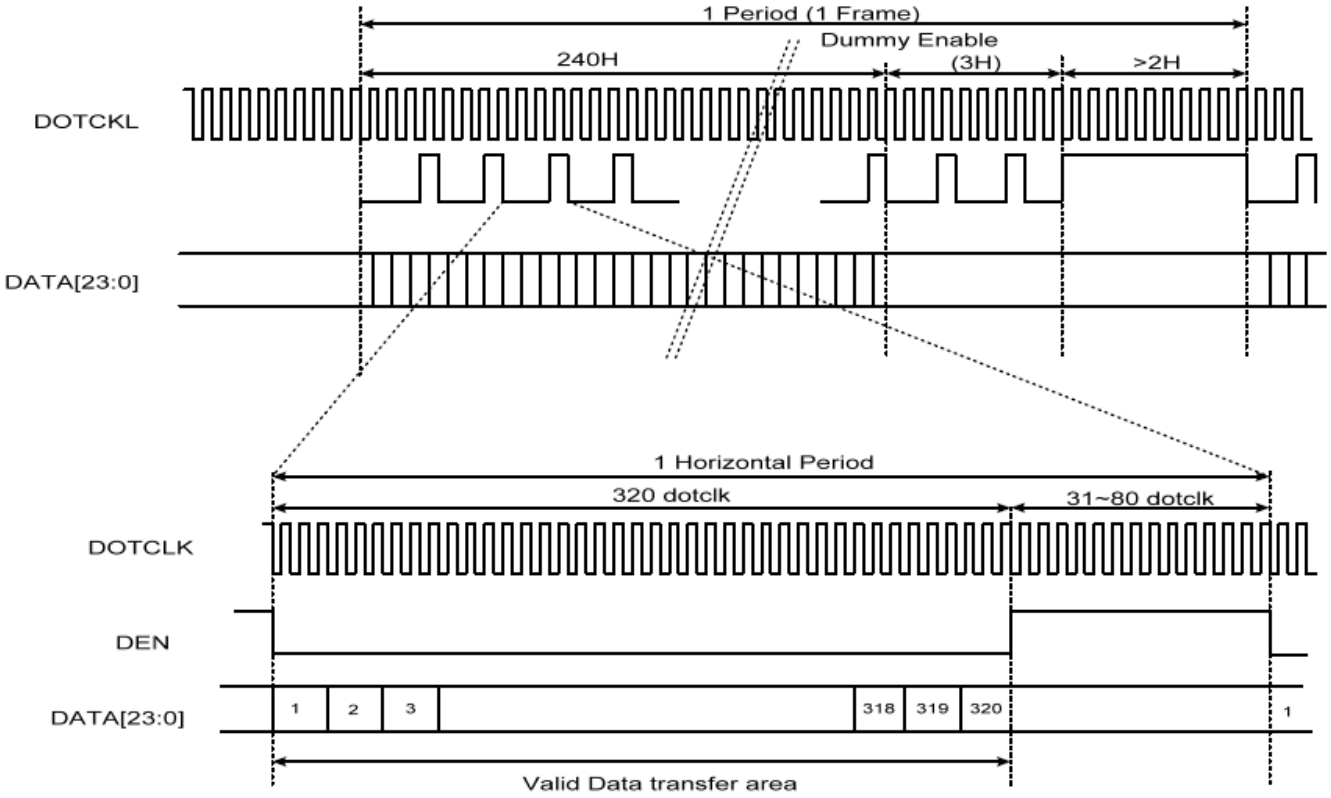


Figure 6.1.2 Data Transaction Timing in Parallel RGB (24 bit) Interface (DE Mode)

6.2. Clock and Sync waveforms

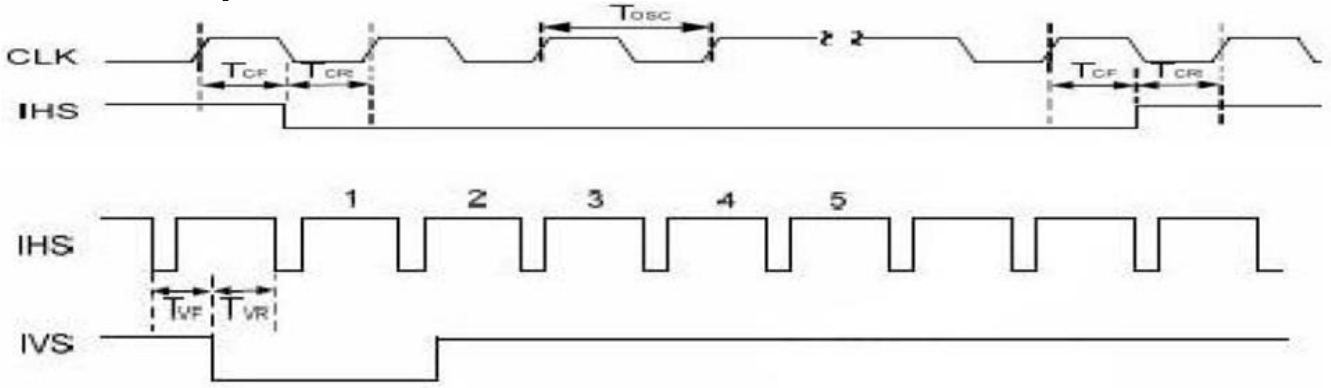
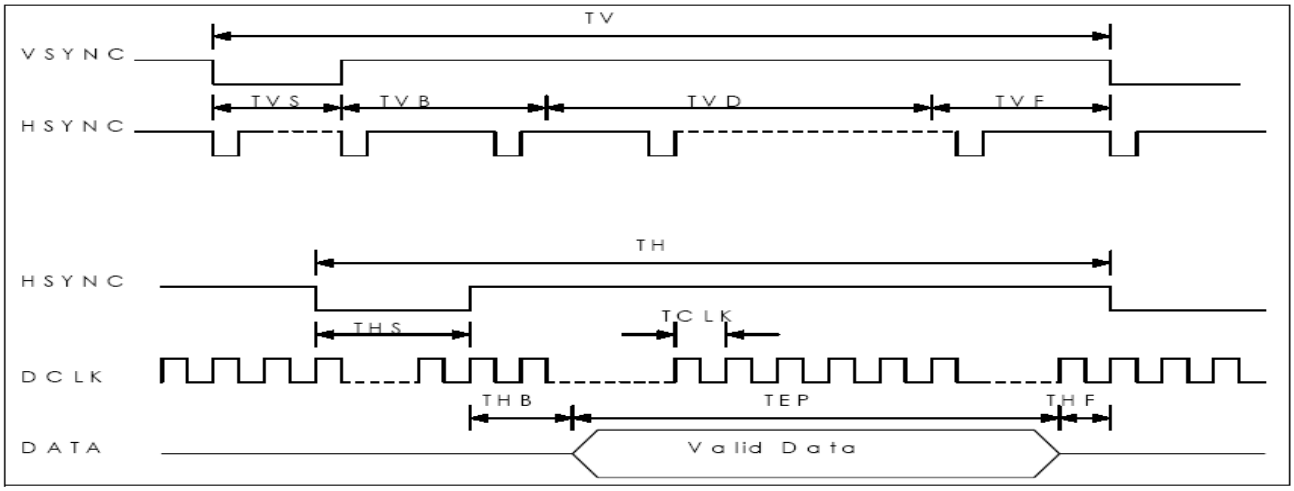


Figure 6.2.1 IHS and IVS timing waveforms



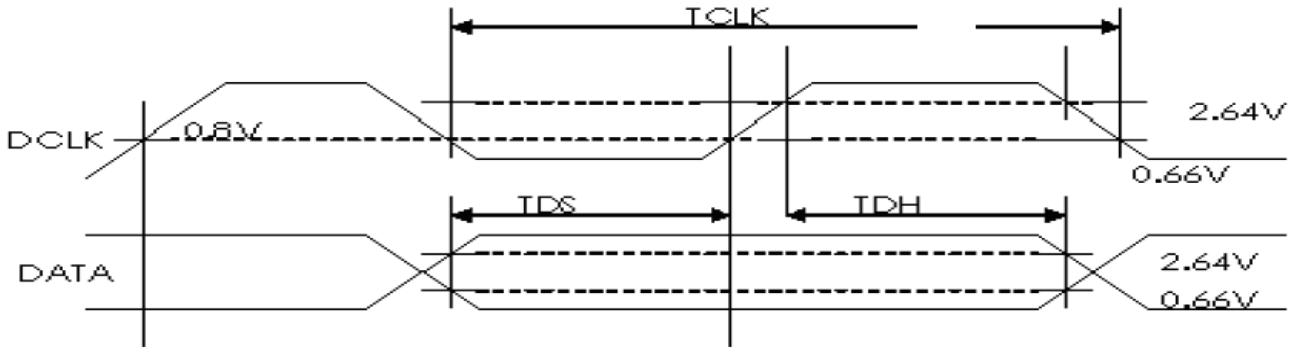
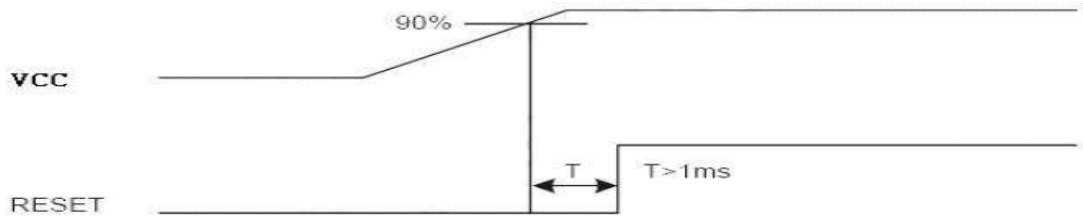


Figure 6.2.2 TV and TH timing waveforms

6.3. Reset Timing Chart

The RESET input must be held at least 1ms after power is stable



Reset timing

7.Optical Characteristics

Item		Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time		Tr	θ =0°、Φ=0°	-	10	-	ms	Note 3,5
		Tf		-	15	-	ms	
Contrast ratio		CR	At optimized viewing angle	300	350	-	-	Note 4,5
Color Chromaticity	White	Wx	θ =0°、Φ=0	0.26	0.31	0.36	-	Note 2,6,7
		Wy		0.28	0.33	0.38	-	
Viewing angle (Gray Scale Inversion Direction)	Hor.	ΘR	CR≧10	-	55	-	Deg.	Note 1
		ΘL		-	55	-		
	Ver.	ΦT		-	45	-		
		ΦB		-	50	-		
Brightness		-	-	280	340	-	cd/m^2	Center of display
Uniformity		-	-	75	-	-	%	Note 5

Ta=25±2℃, IL=20mA

Note 1: Definition of viewing angle range

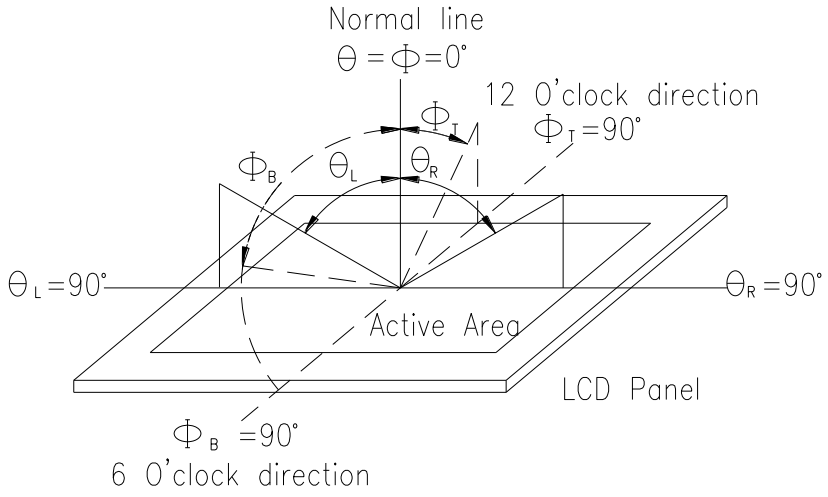


Fig. 8.1. Definition of viewing angle

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.

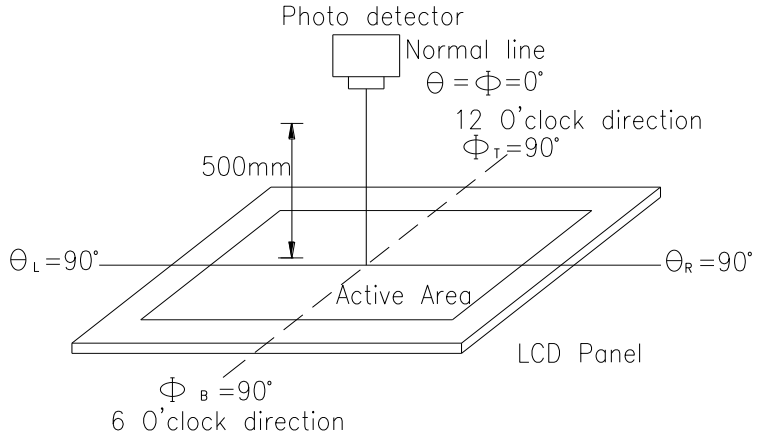
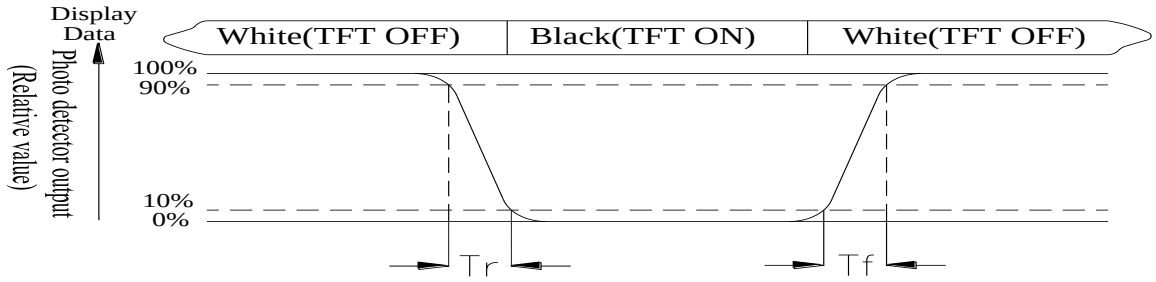


Fig. 8.2. Optical measurement system setup

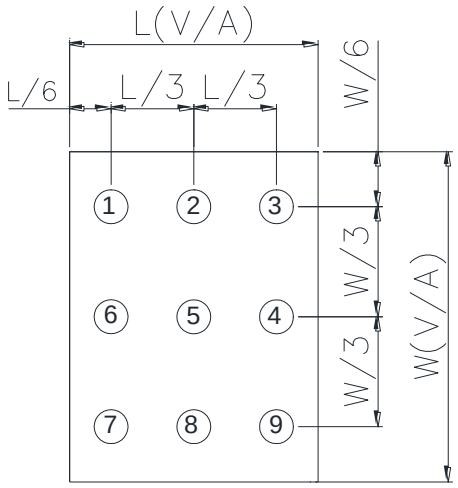
Note 3: Definition of Response time:
The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time, Tr, is the time between photo detector output intensity changed from 90%to 10%. And fall time, Tf, is the time between photo detector output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



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.

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8.Interface

8.1. LCM PIN Definition

Pin	Symbol	Function	Remark
1	VLED-	Power for LED backlight cathode	
2	VLED+	Power for LED backlight anode	
3	DGND	System ground pin of the IC. Connect to system ground.	
4	VCC	Power Supply	
5	R0	Red Data bit(LSB)	
6	R1	Red Data bit	
7	R2	Red Data bit	
8	R3	Red Data bit	
9	R4	Red Data bit	
10	R5	Red Data bit	
11	R6	Red Data bit	
12	R7	Red Data bit (MSB)	
13	G0	Green Data bit(LSB)	
14	G1	Green Data bit	
15	G2	Green Data bit	
16	G3	Green Data bit	
17	G4	Green Data bit	
18	G5	Green Data bit	
19	G6	Green Data bit	
20	G7	Green Data bit (MSB)	
21	B0	Blue Data bit(LSB)	
22	B1	Blue Data bit	
23	B2	Blue Data bit	
24	B3	Blue Data bit	
25	B4	Blue Data bit	
26	B5	Blue Data bit	
27	B6	Blue Data bit	
28	B7	Blue Data bit (MSB)	
29	AVSS	Grounding for analog circuit Connect to system ground	
30	CLK	Dot-clock signal and oscillator source	
31	NC	No connect	
32	HSYNC	Horizontal sync signal	Note1
33	VSYNC	Vertical sync signal	Note1
34	DE	Data Enable signal	Note1
35	NC	No connect	
36	RESET	Hardware reset	
37	NC	No connect	
38	NC	No connect	
39	NC	No connect	
40	NC	No connect	

Note1:
For digital 24Bit RGB input data format, both SYNC mode and DE mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise,DE mode is used. Suggest used SYNC mode!!

Mode	D[23:16]	D[15:8]	D[7:0]	IHS	IVS	DEN
24 bit RGB	R[7:0]	G[7:0]	B[7:0]	HSYNC	VSYNC	DE signal is fixed low for SYNC mode
				Floating if not used	Floating if not used	DE for DE Mode

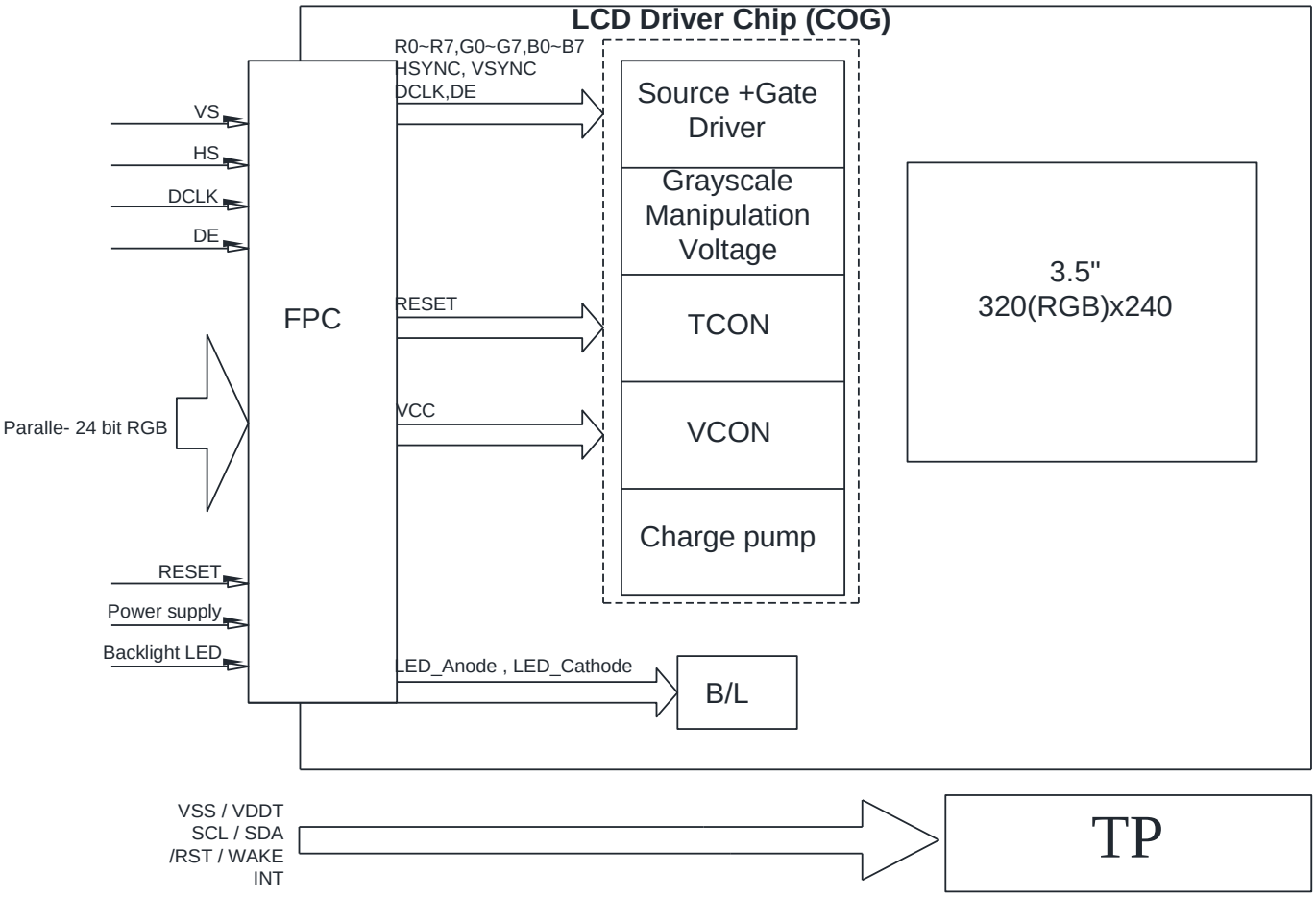
8.2. Basic Display Color and Gray Scale

Color		Input Color Data																							
		Red								Green								Blue							
		MSB							LSB	MSB							LSB	MSB							LSB
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) Bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

8.3. PCAP PIN Definition

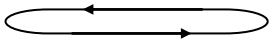
Pin	Symbol	Function	Remark
1	VSS	System ground.	
2	VDDT	Power Supply : +3.3V	
3	SCL	I2C clock input	
4	NC	No connect	
5	SDA	I2C data input and output	
6	NC	No connect	
7	/RST	External Reset, Low is active	
8	NC	No connect	
9	/INT	Interrupt output to the host	
10	VSS	System ground.	

9.Block Diagram



10.Reliability

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

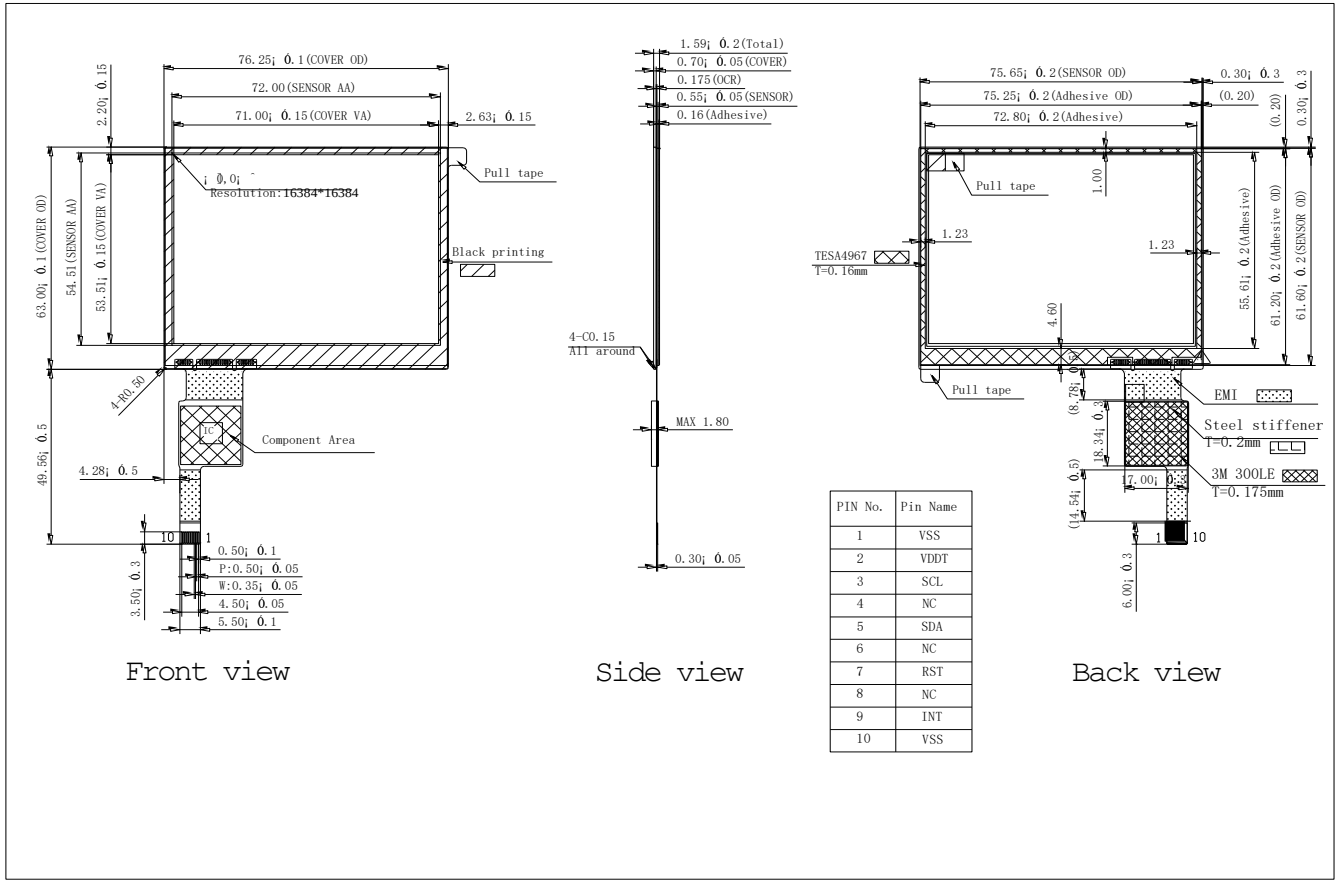
Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	1
High Temperature/ Humidity Operation	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 -20℃ 25℃ 70℃  30min 5min 30min 1 cycle	-20℃/70℃ 10 cycles	——
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 15mm 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



PIN No.	Pin Name
1	VSS
2	VDDT
3	SCL
4	NC
5	SDA
6	NC
7	RST
8	NC
9	INT
10	VSS

11.1 PCAP controller ILI2130

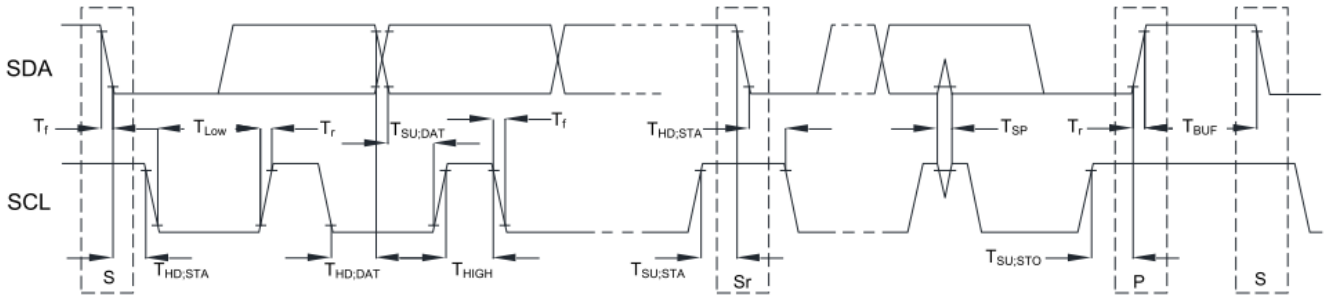
11.1.1 Device address

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
7-bit Device Address							R/W

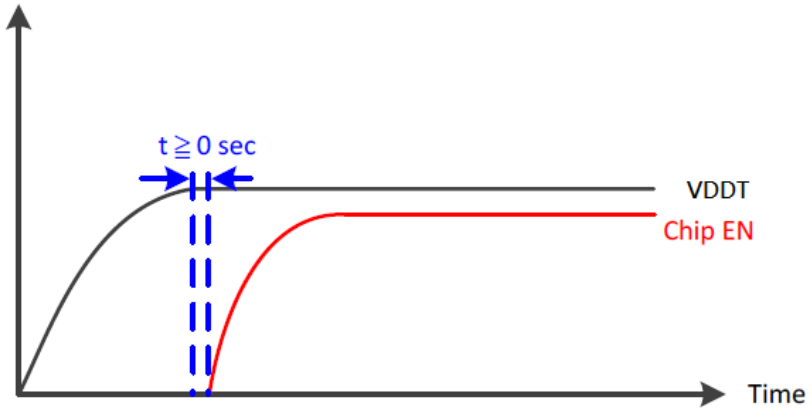
7-bit Device Address: 0x41
8-bit Device Address Read: 0x83
8-bit Device Address Write :0x82

11.1.2 I²C AC Characteristics

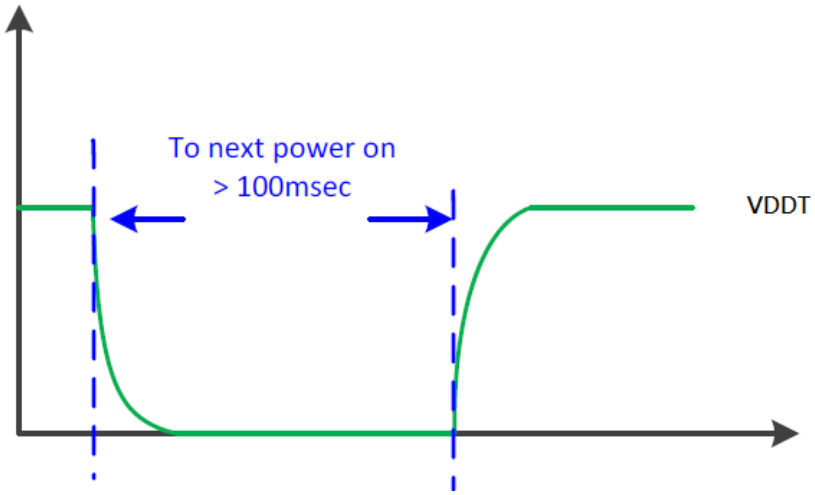


Item	Symbol	100kHz		400kHz		Unit
		Min.	Max.	Min.	Max.	
SCL standard mode clock frequency	FSCL	0	100	0	400	kHz
Hold time (repeated) START condition. After this period, the first clock is generated.	THD;STA	4	--	0.6	--	us
LOW period of the SCL clock	TLOW	4.7	--	1.3	--	us
HIGH period of the SCL clock	THIGH	4	--	0.6	--	us
Setup time for a repeat START condition.	TSU;STA	4.7	--	0.6	--	us
Data hold time	THD;DAT	0	3.45	0	0.9	us
Data setup time	TSU;DAT	250	--	100	--	ns
Rising time of both SDA and SCL signals	Tr	--	1000	--	300	ns
Falling time of both SDA and SCL signals	Tf	--	300	--	300	ns
Setup time for STOP condition.	TSU;STO	4	--	0.6	--	us
Free time between STOP and START condition	TBUF	4.7	--	1.3	--	us
Pulse width of spikes which must be suppressed by input filter	TSP	--	--	0	50	ns

11.2. Power On Sequence



11.3. Power Off to Power On Sequence



11.4 Code example for PCAP

```
#include "main.h"
//================= By IC ===========
unsigned char ILI2130_buf[11];
/***************************************
 * if touch point add 3~10 finger
 * u can add buf size for add finegr
 * 1 finger point add bufsize[5]
 * finger 1 buf[2~5]
 * finger 2 buf[7-10]
 * finger 3 buf[12~15]
 * finger 4 buf[17~20]
 * finger 5 buf[22~25]
 * finger 6 buf[27~30]
 * finger 7 buf[32~35]
 * finger 8 buf[37~40]
 * finger 9 buf[42~45]
 * finger 10 buf[47~50]
 * 10 finger total 51 buf
***************************************/

void CTP_initial_ILI2130(void)
{
     TRISCbits.TRISC4 = 0;     //CTP_SCL
     TRISGbits.TRISG7 = 0;     //CTP_SDA
     TRISAbits.TRISA2 = 1;     //CTP_INT
     CNPU3bits.CN35PUE = 1;  //INT_Internal Pull High
}

void I2C_SrCondition(void)
{
    CTP_SCL = 0;
     delay(T4);
    CTP_SDA = 1;
    delay(T4);

     CTP_SCL = 1;
     delay(T4);
     CTP_SDA = 0;
     delay(T4);
}

void I2C_CLK_ILI2130(void)// I2C SCL Timing
{
      CTP_SCL = 1;  //SCL High
      delay(T4);    //delay(4)

      CTP_SCL = 0;  //SCL Low
      delay(T4);    //delay(4)
}
//=============================================
unsigned char ILI2130_DataRead(void)
{
     unsigned char Data;

     Data = LCD_GetData_I2C();

     return Data ;
}
```

```
//=============================================
void ILI2130_received_data(void)
{
     unsigned int i;

    //TOUCH DATA
     for(i=0;i<11;i++)
     {
          ILI2130_buf[i]=ILI2130_DataRead();
          CTP_SDA = 0;
          delay(T4);
          I2C_CLK_ILI2130();
     }
     I2C_StopCondition();
}

//=============================================
unsigned int ILI2130_Get_X1_Value_16bit(void)
{
   unsigned int temp,temp1;

   temp=0;
   if(ILI2130_buf[1]==0x40)
   {
        temp|=ILI2130_buf[3];
        temp1=(temp<<8);
        temp= temp1|ILI2130_buf[2];
   }
   return temp;
}

unsigned int ILI2130_Get_Y1_Value_16bit(void)
{
   unsigned int temp2,temp3;

   temp2=0;
   if(ILI2130_buf[1]==0x40)
   {
        temp2|=ILI2130_buf[5];
        temp3=(temp2<<8);
        temp2= temp3|ILI2130_buf[4];
   }
   return temp2;
}

unsigned int ILI2130_Get_X2_Value_16bit(void)
{
   unsigned int temp,temp1;
   temp=0;
   if(ILI2130_buf[6]==0x41)
   {
        temp|=ILI2130_buf[8];
        temp1=(temp<<8);
        temp= temp1|ILI2130_buf[7];
   }
   return temp;
}

unsigned int ILI2130_Get_Y2_Value_16bit(void)
{
   unsigned int temp2,temp3;

   temp2=0;
   if(ILI2130_buf[6]==0x41)
   {
        temp2|=ILI2130_buf[10];
        temp3=(temp2<<8);
        temp2= temp3|ILI2130_buf[9];
   }
```

```
   return temp2;
}

void ILI2130_Communication(void)
{
     I2C_StartCondition();              //s
     LCD_SendAddress(0x82);              //A            write to slave 8
     Slave_ack();//1

     LCD_SendAddress(0x10); //8
     Slave_ack();//1
     //I2C_StopCondition();

     I2C_SrCondition();
     LCD_SendAddress(0x83);              //   read slave data
     Slave_ack();
}
//=========================================================
```

11.5 Programming guide for PCAP

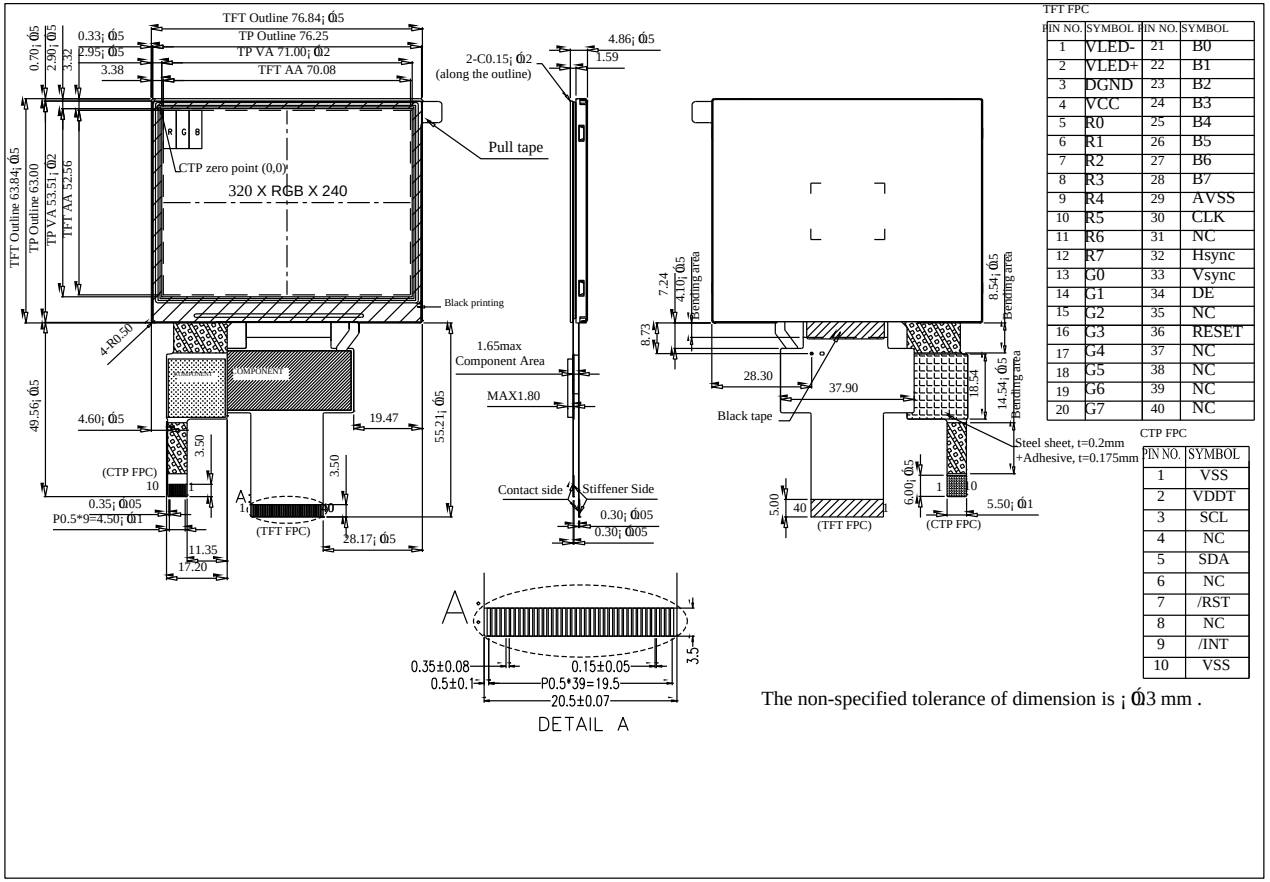
More information on getting touch data and programming is written here:
https://www.lcd-module.de/eng/pdf/zubehoer/ILI2130_Programming_Guide_V1_50.pdf

11.6 Comparsion between ILI2130 and FT5426 (EA TFT035-32BTS)

https://www.lcd-module.de/eng/pdf/zubehoer/ILI2130_comparsion_FT5426.pdf

Zeppelinstrasse 19 D-82205 Gilching Fon +49-8105-778090 info@lcd-module.de http://www.lcd-module.de

12.Contour Drawing



TFT FPC

PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	VLED-	21	B0
2	VLED+	22	B1
3	DGND	23	B2
4	VCC	24	B3
5	R0	25	B4
6	R1	26	B5
7	R2	27	B6
8	R3	28	B7
9	R4	29	AVSS
10	R5	30	CLK
11	R6	31	NC
12	R7	32	Hsync
13	G0	33	Vsync
14	G1	34	DE
15	G2	35	NC
16	G3	36	RESET
17	G4	37	NC
18	G5	38	NC
19	G6	39	NC
20	G7	40	NC

CTP FPC

PIN NO.	SYMBOL
1	VSS
2	VDDT
3	SCL
4	NC
5	SDA
6	NC
7	/RST
8	NC
9	/INT
10	VSS

The non-specified tolerance of dimension is ¡ Ó3 mm .