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TFT | CHARACTER | UWVD | FSC | SEGMENT | CUSTOM | REPLACEMENT

TFT Display Module

Part Number

E50RG68048LW2M350-C

Overview:

- 5.0-inch TFT (132.72x87.8mm)
- 16/18/24-bit RGB Interface
- 800x480 pixels
- 3.3V
- White LED back-light
- Transmissive/ Normally Black
- Capacitive Touch Screen
- 350 NITS
- Controller: ILI5960/ILI6122
- RoHS Compliant

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 and backlight unit. The resolution of a 5.0" TFT-LCD contains 800x480 pixels and can display up to 65K/262K/16.7M colors.

Features

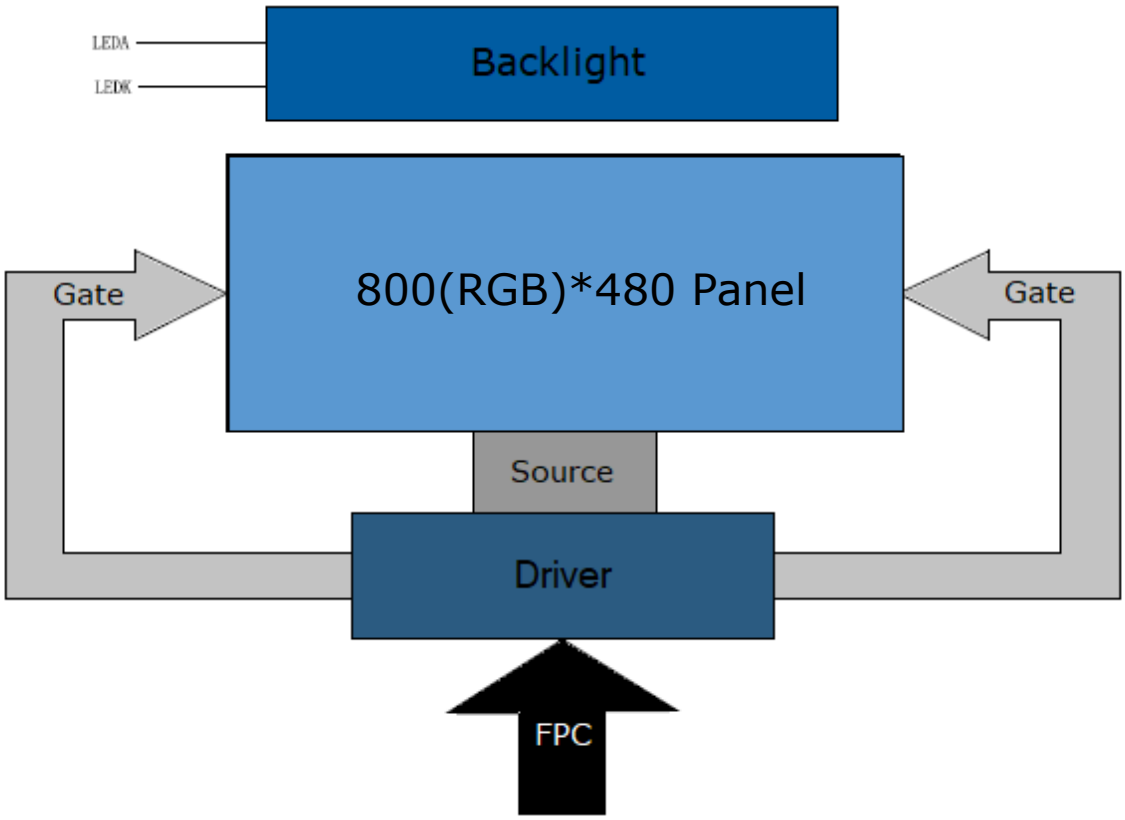
Low Input Voltage: 3.3V (TYP)
Display Colors of TFT LCD: 65K/262K/16.7M colors
TFT Interface: 16/18/24-bit RGB
CTP Interface: I2C

General Information Items	Specification Main Panel	Unit	Note
TFT Display area (AA)	108.00(H) * 64.80(V) (5.0 inch)	mm	-
CTP View Area	109.00(H)*65.80(V)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65K/262K/16.7M	colors	-
Number of pixels	800(RGB)*480	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.198 (H) x 0.198 (V)	mm	-
Viewing angle	12:00	o'clock	-
TFT Controller IC	ILI5960/ILI6122	-	-
CTP Driver IC	GT911	-	-
Simultaneous Touch Points	5	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

Mechanical Information

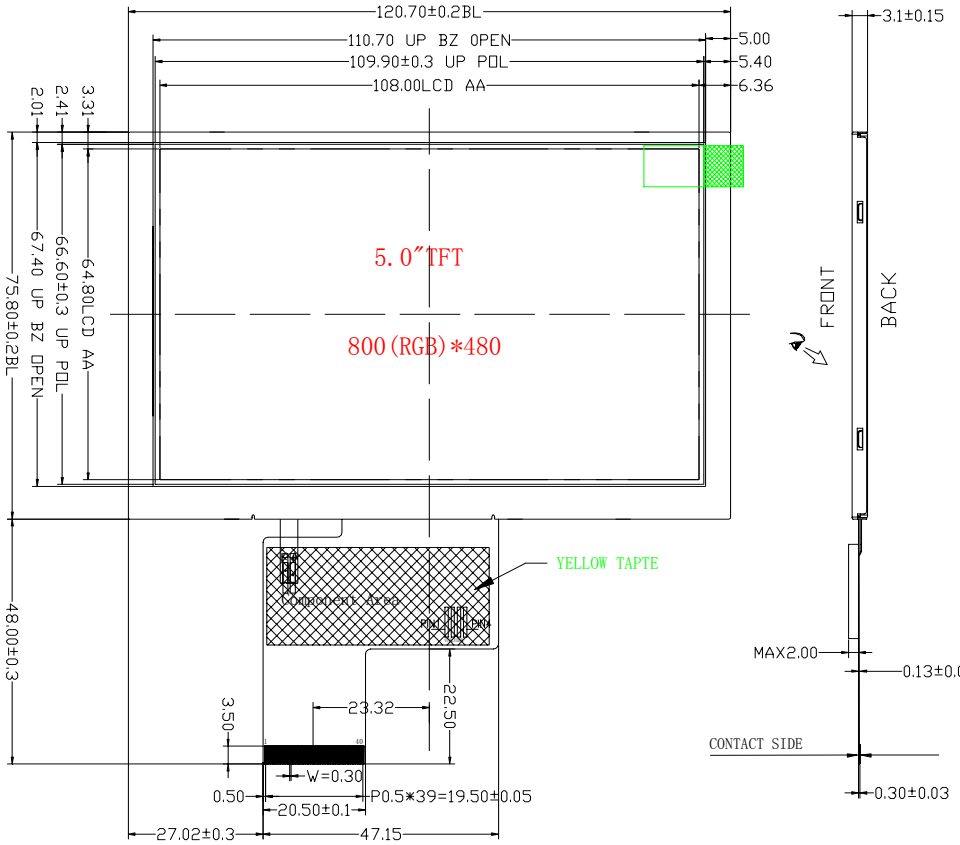
Item		Min	Typ.	Max	Unit	Note
Module size	Horizontal(H)		132.72		mm	-
	Vertical(V)		87.80		mm	-
	Depth(D)		4.13		mm	-
Weight			TBD		g	-

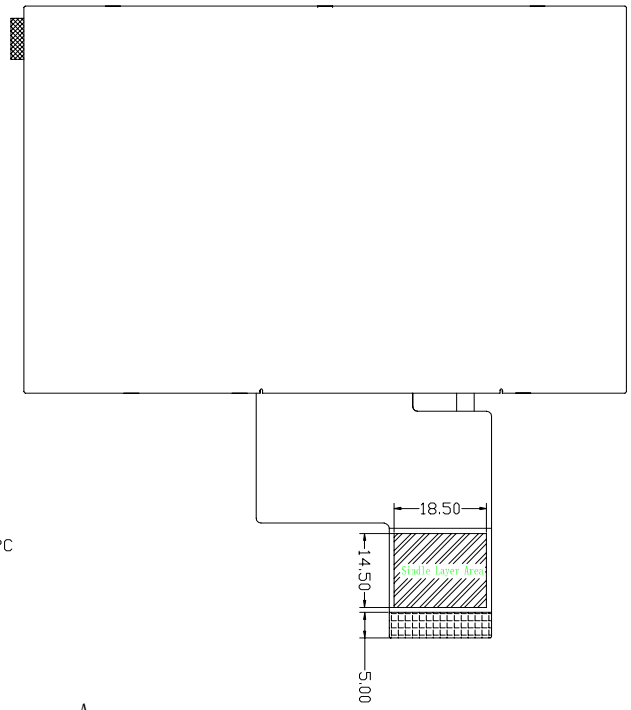
1. Block Diagram



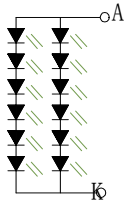
2. Outline dimensions

2.1 LCM





Pin	Name
1	VIED-
2	VLED+
3	GND
4	VDD
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	B0
22	B1
23	B2
24	B3
25	B4
26	B5
27	B6
28	B7
29	GND
30	PCLK
31	DISP
32	HSYNC
33	VSYNC
34	DE
35	NC
36	GND
37	XR(NC)
38	YD(NC)
39	XL(NC)
40	YU(NC)



Backlight LED Circuit

Display type:TFT/Normally white
color depth:16.7M Colors
Interface Type: 16/18/24 BIT R.G.B
Wide viewing: 12'clock
Backlight: White Backlight 12 LED
TYP:Vf=19.2V If=40mA
Operating temprature: -10° C ~ +60° C
Storage temprature: -20° C ~ +70° C
ROHS COMPLIANT PRODUCT

RoV.	Revision content description	Date

Part No.	E50RG68048LW2M350-C	
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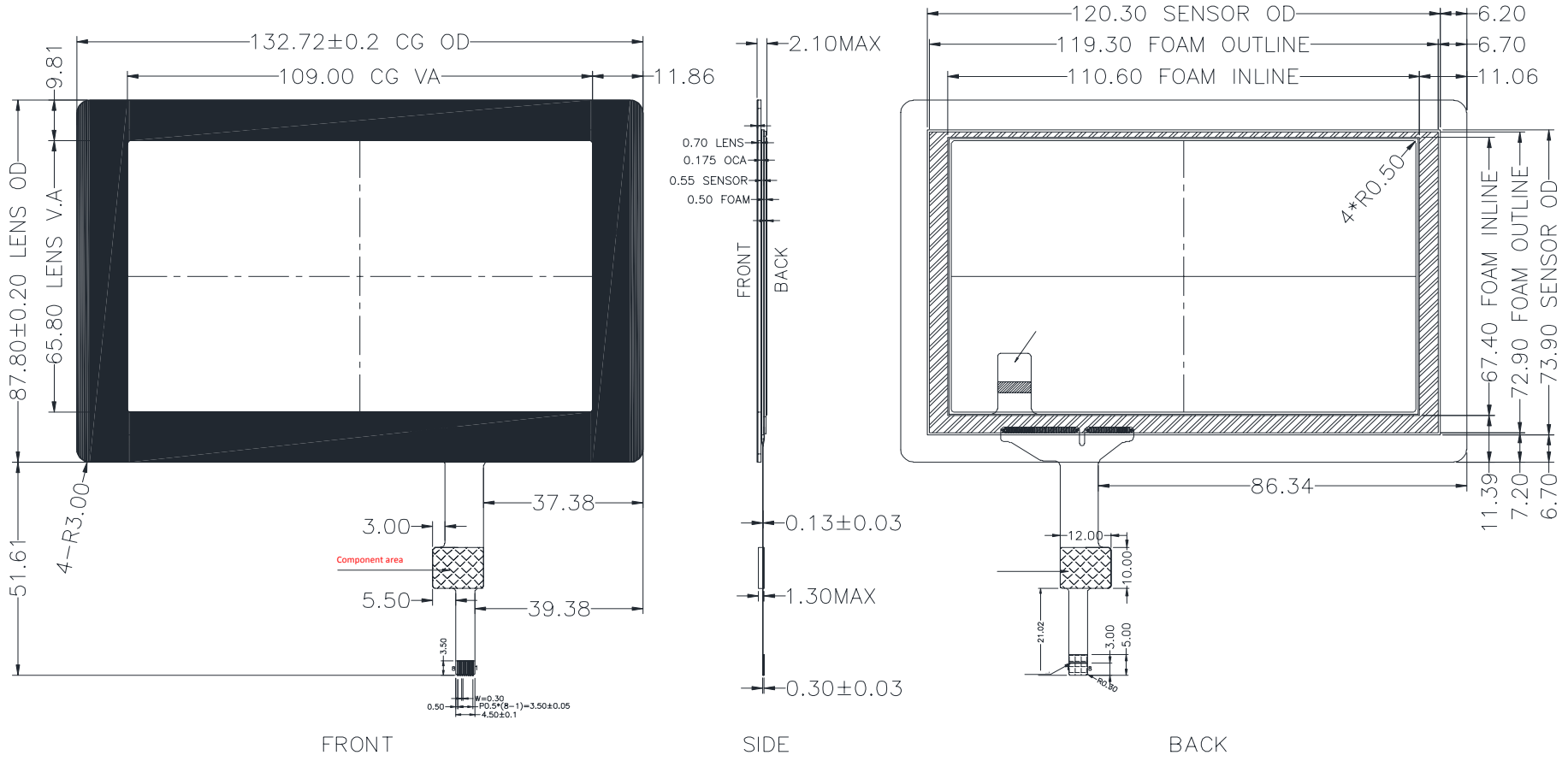
2.2 CTP



NOTES:
1.DRIVER IC: GT911
2.WORKING VOLTAGE: 3.3V
3.LIGHT TRANSMISSION: ≥8%
4.SURFACE HARDNESS: 6H
5.OPERATING TEMP: -20℃~+70℃, ≤90%RH
6.STORAGE TEMP: -30℃~+80℃, ≤90%RH
7.UNMARKED TOLERANCE±0.2mm
8.PRECISE DIMENSION IN<>

NO.	PinName
1	GND
2	VDDIO
3	VDD
4	SCL
5	SDA
6	INT
7	RST
8	GND

ReV.	Revision content description	Date
A	FIRST	2015/05/29

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TOLERANCE

TOLERANCE UNLESS OTHERWISE SPECIFIED: X.X±0.3, X.XX±0.2

DRAWING NAME: E50RG68048LW2M350-C

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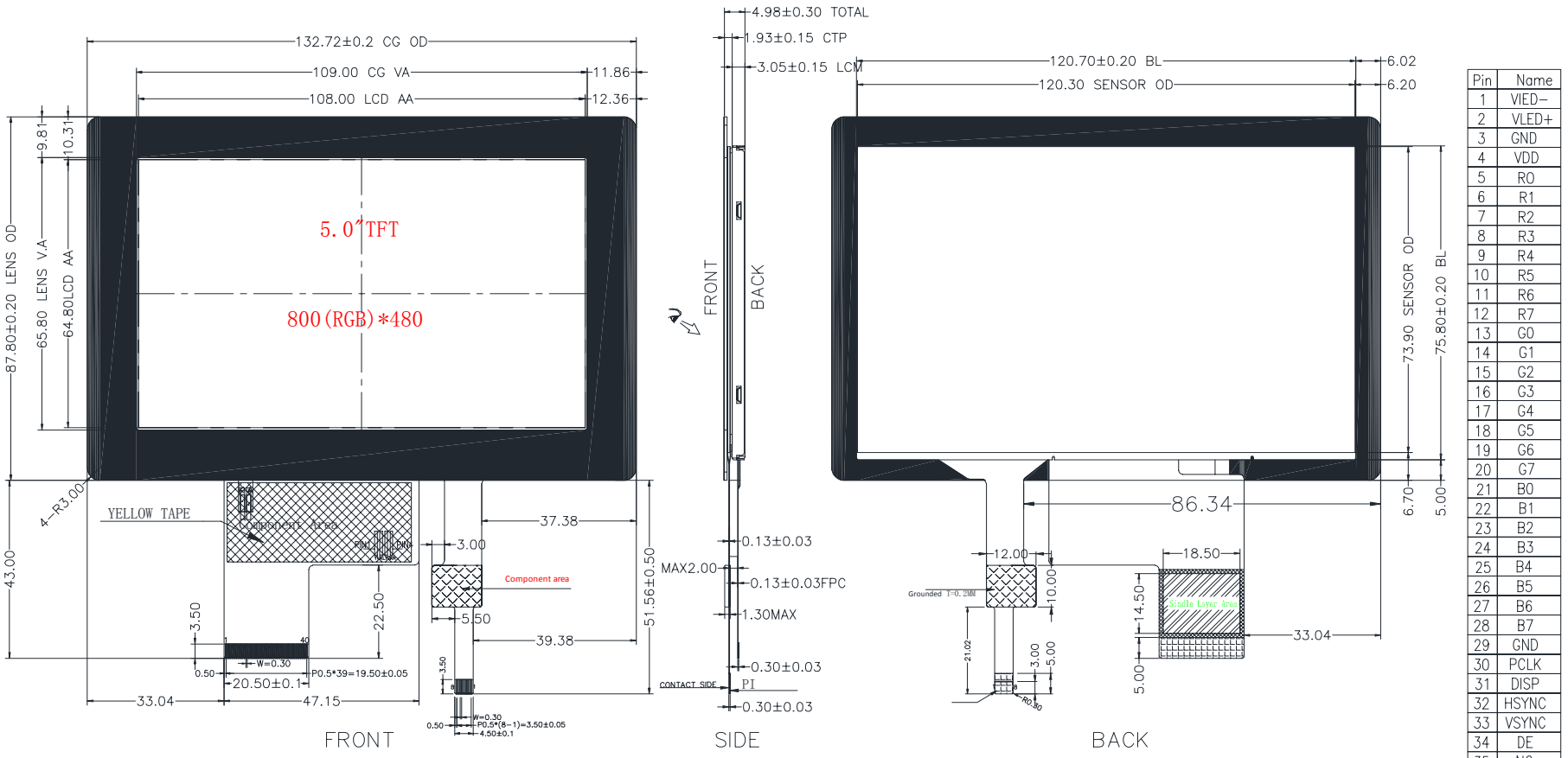
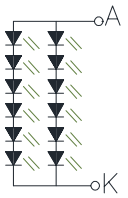
2.3 LCM+CTP



Pin	Name
1	VIED−
2	VLED+
3	GND
4	VDD
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	B0
22	B1
23	B2
24	B3
25	B4
26	B5
27	B6
28	B7
29	GND
30	PCLK
31	DISP
32	HSYNC
33	VSYNC
34	DE
35	NC
36	GND
37	XR(NC)
38	YD(NC)
39	XL(NC)
40	YU(NC)

NOTES:

1. DISPLAY TYPE: 5.0", TFT-LCD, 16.7M COLORS
2. DISPLAY MODE: T/N NORMALLY WHITE
3. VIEWING DIRECTION: 12:00
4. TFT DRIVER IC: ILI5960/ILI6122 (COG)
   CTP DRIVER IC: GT911
5. VCI: 3.3V(TFT)
   VDD: 3.3V(CTP)
6. CTP SURFACE HARDNESS: 6H
7. OPERATING TEMP: −20°C TO 70°C
   STORAGE TEMP: −30°C TO 80°C
8. TFT BACK LIGHT: LED WHITE, 12 LED, 40mA, 19.2±0.3V
9. RoHS COMPLIANT.



Backlight LED Circuit

NO	PinName
1	GND
2	VDDIO
3	VDD
4	SCL
5	SDA
6	INT
7	RST
8	GND

ReV.	Revision content description	Date
A	FIRST	2015/05/29

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TOLERANCE	DRAWING NAME	E50RG68048LW2M350-C
TOLERANCE UNLESS OTHERWISE SPECIFIED	X.X±0.3 X.XX±0.2	

3. Input Terminal Pin Assignment

Recommended TFT Connector: FH33-40S-0.5SH(99) | Recommended CTP Connector: FH12-8S-0.5SH(55)

NO.	Symbol	Description	I/O
1	LEDK	Cathode pin of backlight	P
2	LEDA	Anode pin of backlight	P
3	GND	Ground	P
4	VDD	Supply voltage (3.3V)	P
5	R0	Red data input	I
6	R1	Red data input	I
7	R2	Red data input	I
8	R3	Red data input	I
9	R4	Red data input	I
10	R5	Red data input	I
11	R6	Red data input	I
12	R7	Red data input	I
13	G0	Green data input	I
14	G1	Green data input	I
15	G2	Green data input	I
16	G3	Green data input	I
17	G4	Green data input	I
18	G5	Green data input	I
19	G6	Green data input	I
20	G7	Green data input	I
21	B0	Blue data input	I
22	B1	Blue data input	I
23	B2	Blue data input	I
24	B3	Blue data input	I
25	B4	Blue data input	I
26	B5	Blue data input	I
27	B6	Blue data input	I
28	B7	Blue data input	I
29	GND	Ground	P
30	PCLK	Clock signal for RGB interface operation. Latching data at the rising edge.	I
31	DISP	Standby setting for testing. Should be connected to VDDIO in normal operation mode. If connected to GND the IC is in standby mode.	I
32	HSYNC	Horizontal sync input. Negative polarity.	I
33	VSYNC	Vertical sync input. Negative polarity.	I
34	DE	Data input enable. Active high to enable the data input bus under “DE mode”	I
35	NC	NC	
36	GND	Ground	P
37	XR(NC)	Touch panel right glass terminal	
38	YD(NC)	Touch panel bottom film terminal	
39	XL(NC)	Touch panel left glass terminal	
40	YU(NC)	Touch panel top film terminal	

4. LCD Optical Characteristics

4.1 Optical Specifications

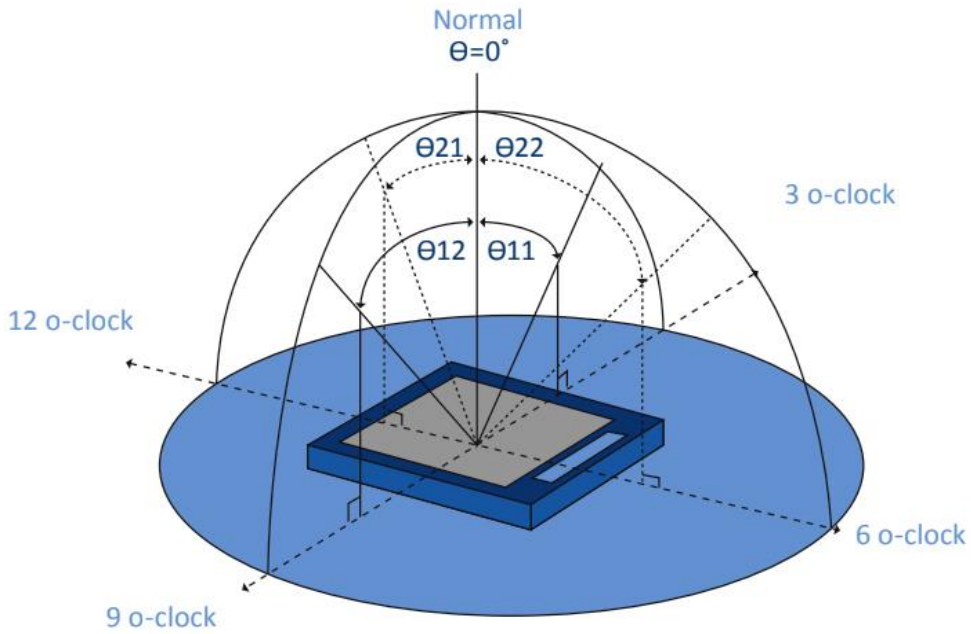
Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Contrast Ratio		CR	Θ = ϕ = 0 Normal viewing angle	560	700	--		(2)
Response time	Rising	TR		--	4	8	msec	(4)
	Falling	TF		--	12	24		
Transmittance (with polarizer)		T(%)		--	4.29	--	%	(3)
Transmittance (without polarizer)		T(%)		--	12.16	--	%	(3)
Color Gamut		S(%)		--	62	--	%	(5)
Color Filter Chromaticity	White	W_X		0.283	0.303	0.323		(5)(6)
		W_Y		0.305	0.325	0.345		
	Red	R_X		0.606	0.626	0.646		
		R_Y		0.314	0.334	0.354		
	Green	G_X		0.257	0.277	0.297		
		G_Y		0.529	0.549	0.569		
	Blue	B_X		0.122	0.142	0.162		
		B_Y		0.102	0.122	0.142		
Viewing angle	Hor.	ΘL	CR>10	60	70	--		(1)(6)
		ΘR		60	70	--		
	Ver.	ΘU		60	70	--		
		ΘD		40	60	--		
Option View Direction		12 o'clock						(1)

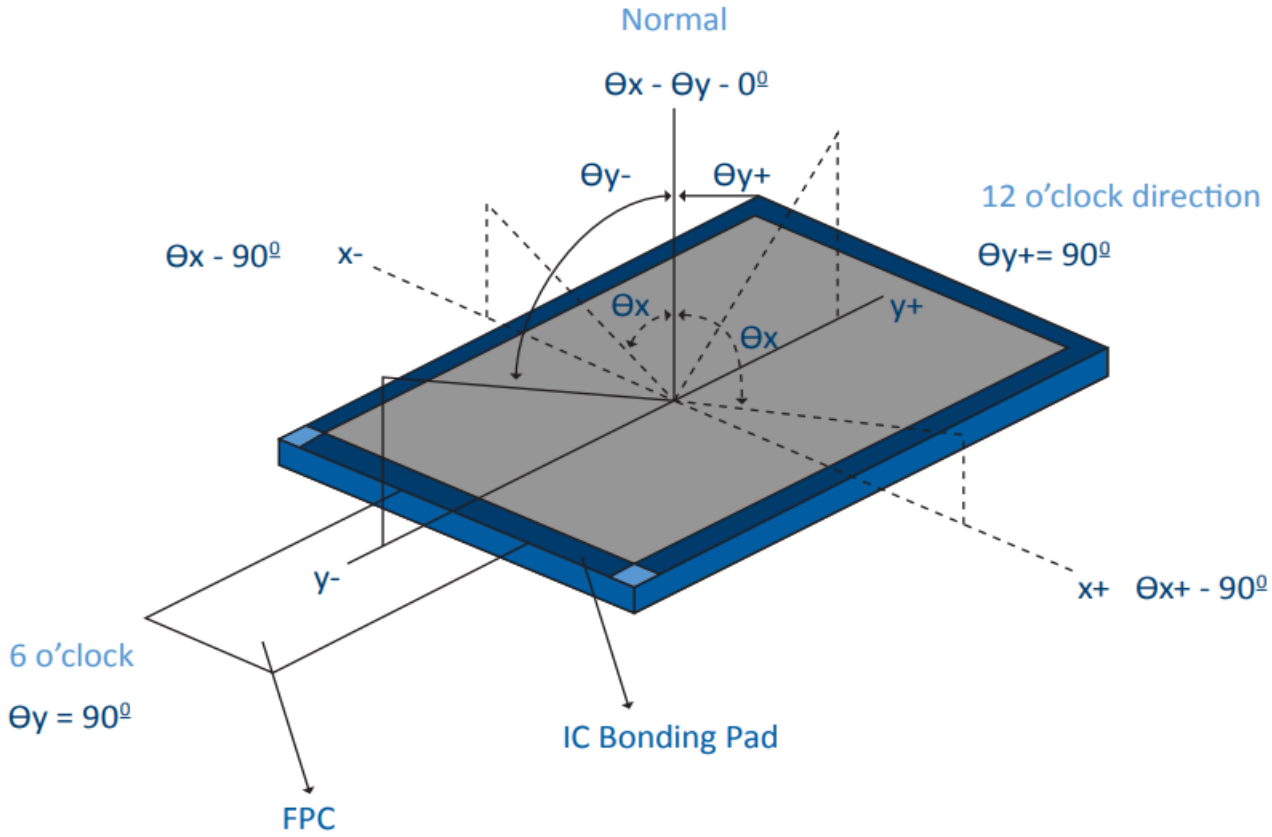
4.2 Measuring Condition

VDD = 3.3V, IL = 20mA (Backlight current)
Ambient temperature: 25 ± 2℃
15min. warm-up time

Optical Specification Reference Notes:

(1) Definition of Viewing Angle: The viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3,9 o'clock direction and the vertical or 6,12 o'clock direction with respect to the optical axis which is normal to the LCD surface.

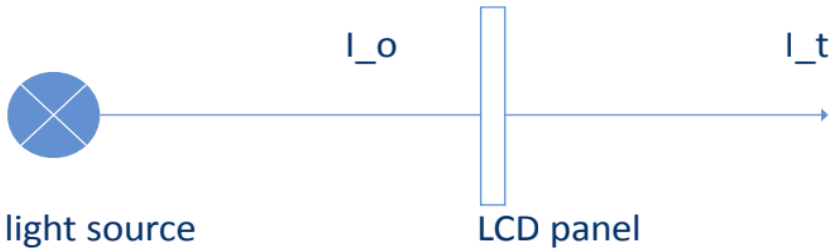




(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

$$Cr = \frac{Lw}{Ld}$$

(3) Definition of transmittance (T%): The transmittance of the panel including the polarizers is measured with electrical driving.

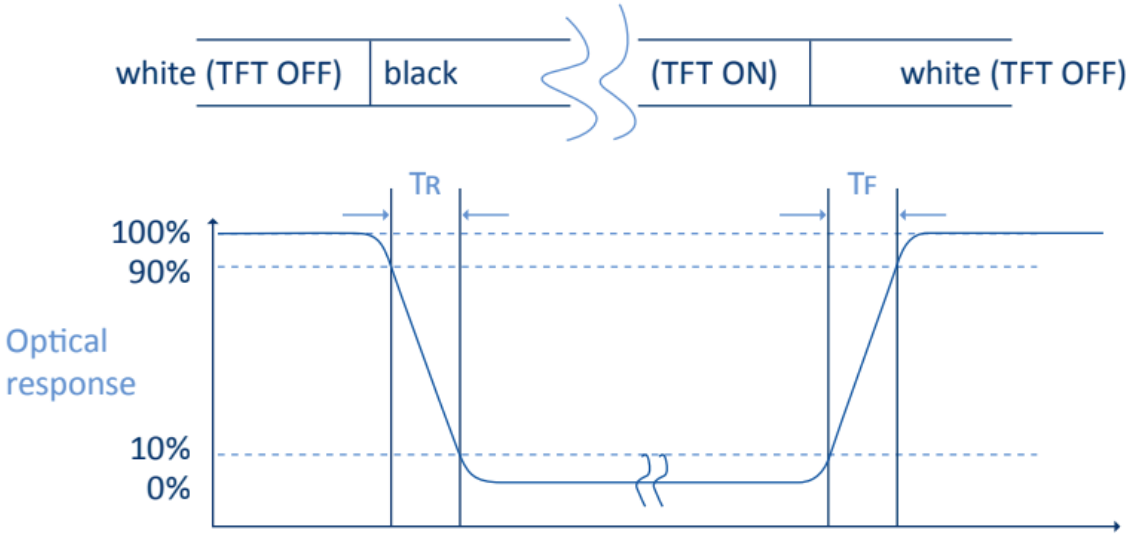


The transmittance is defined as:

$$Tr = \frac{It}{Io}\ x\ 100\%$$

Io = the brightness of the light source.
It = the brightness after panel transmission

(4) Definition of Response Time (Tr, Tf): The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.



(5) Definition of Color Gamut: Measuring machine CFT-01. NTSC's Primaries: R(x,y,Y),G(x,y,Y), B(x,y,Y). FPM520 of Westar Display Technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. The color chromaticity shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

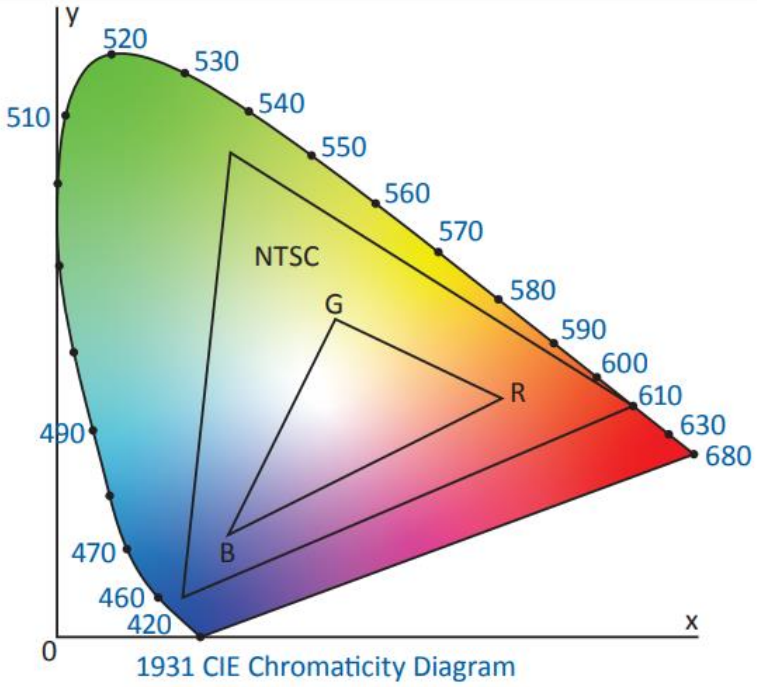
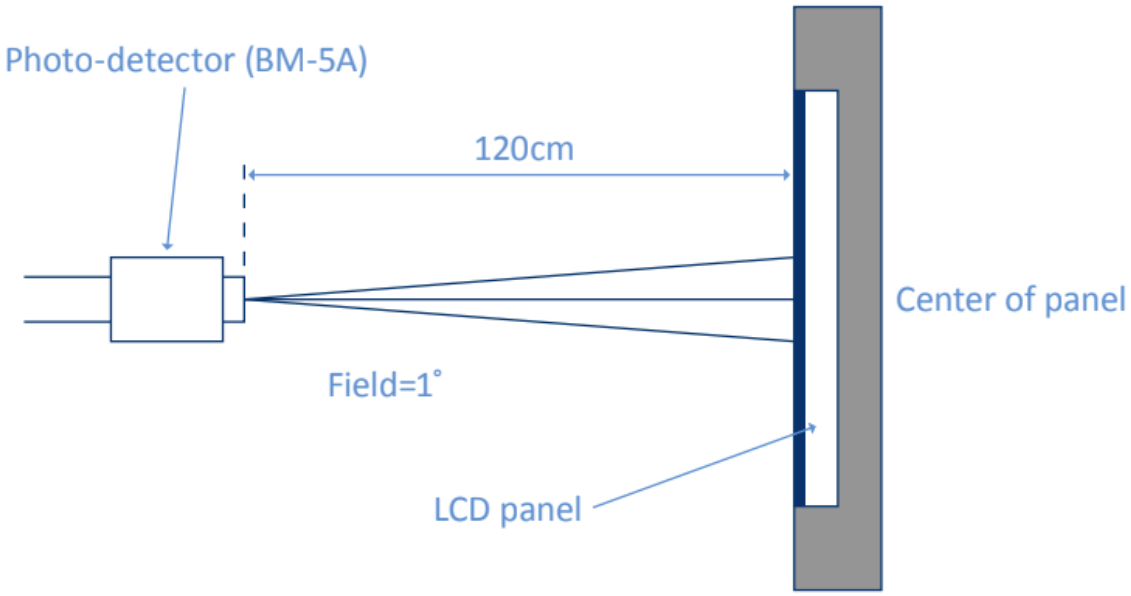


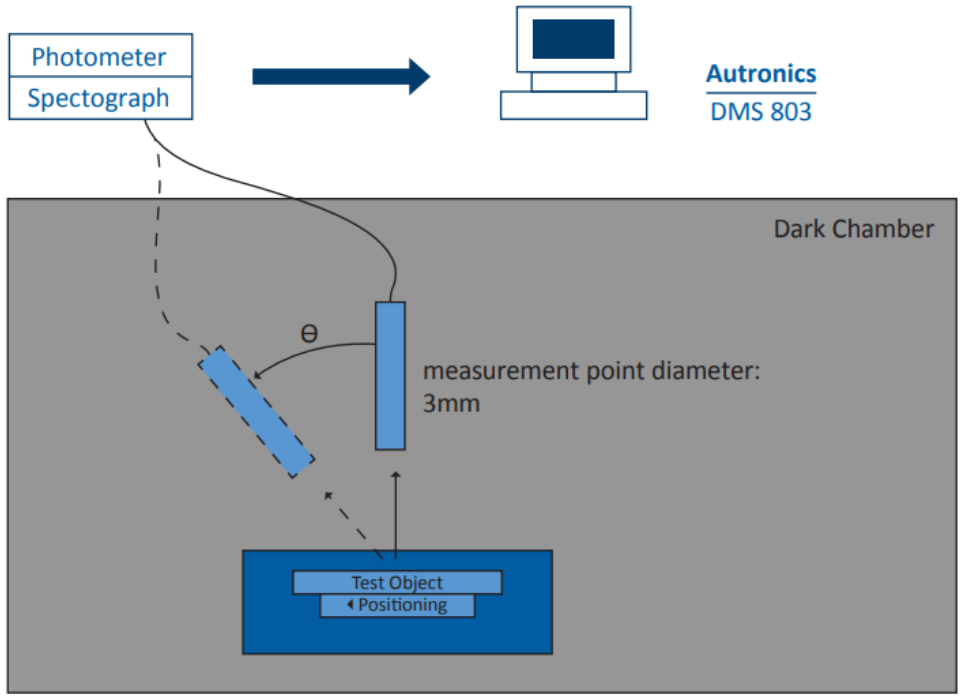
Fig. 1931 CIE chromacity diagram

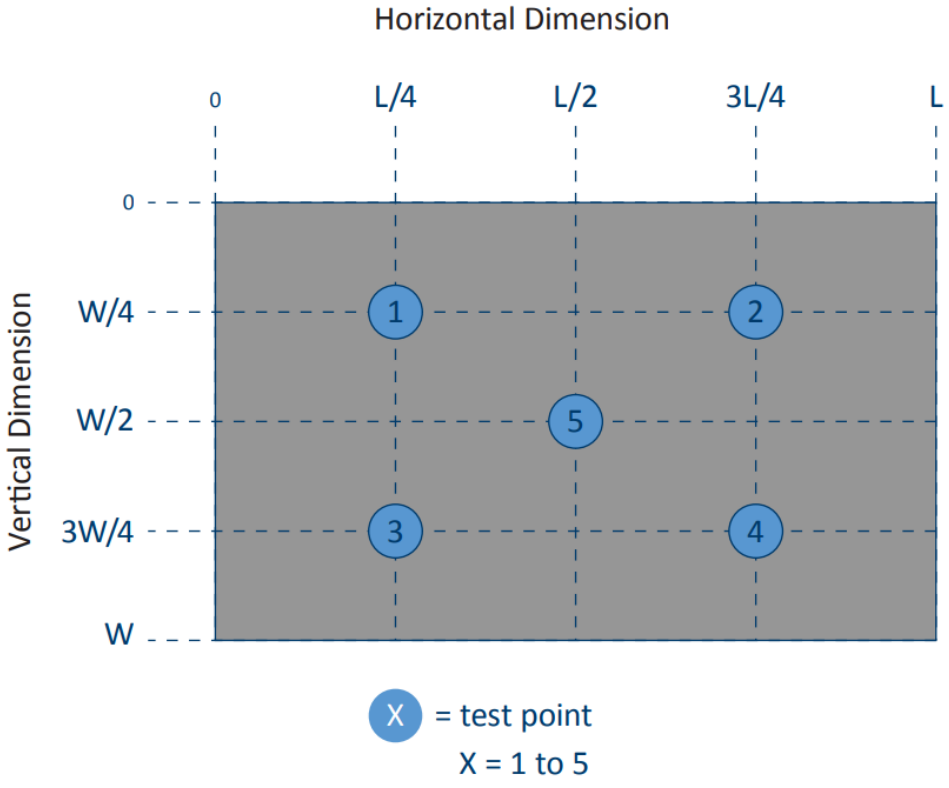
$$\text{Color gamut: } S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$

(6) Definition of Optical Measurement Setup:



(6) Optical Measurement Setup Continued:
The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 20 minutes.





5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min	Max	Unit
Digital Supply Voltage	VDD	-0.3	4.6	V
Digital Interface Supply Voltage	VDDIO	1.8	VDD	V
Operating temperature	T_{OP}	-20	+70	℃
Storage temperature	T_{ST}	-30	+80	℃

NOTE: 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	VDD	3.0	3.3	4.2	V	
Digital Interface Supply Voltage	VDDIO	1.8	3.3	4.2	V	
Normal Mode Current Consumption	IDD	--	200	--	mA	
Level input voltage	VIH	0.7VDDIO	--	VDDIO	V	
	VIL	GND	--	0.3VDDIO	V	
Level output voltage	VOH	VDDIO-04	--	--	V	
	VOL	GND	--	GND+0.4	V	

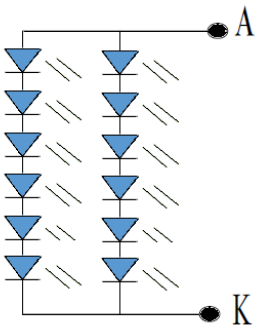
5.3 LED Backlight Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	IF	30	40	--	mA	
Forward Voltage	VF	--	19.2	--	V	
LCM Luminance	LV	350	--	--	cd/m2	Note 3
LED lifetime	Hr	50000	--	--	hour	Note1 & 2
Uniformity	AVg	80	--	--	%	Note 3

The back-light system is edge-lighting type with 12 chips White LED

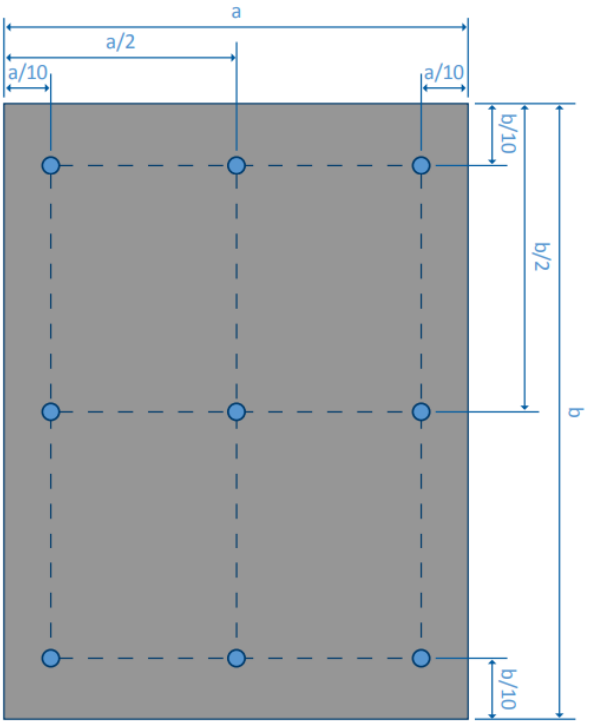
Note 1: LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25 ±3 ℃, typical IF value indicated in the above table until the brightness becomes less than 50%.

Note 2: The "LED lifetime" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IF = 40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.



Backlight LED Circuit

Note 3: Luminance Uniformity of these 9 points is defined as below:



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

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

6. AC Characteristic

For further details and configurations, please see the spec for IC ILI6122 and ILI5960.

6.1 Input Signal Characteristics

Parameters	Symbol	Min	Typ.	Max	Unit	Condition
VDD power source slew time	TPOR	--	--	20	ms	From 0V to 99%VDD
GRB pulse width	tRSTW	10	50	--	us	R=10kΩ, C=1uF
DCLK clock time	Tclk	33.3	--	--	ns	DCLK=30MHz
DCLK clock low period	Tcwl	40	--	60	%	
DCLK clock high period	Tcwh	40	--	60	%	
Clock rising time	Trck	9	--	--	ns	
Clock falling time	Tfck	9	--	--	ns	
HSD width	Thwh	1	--	--	DCLK	
HSD period time	Th	55	60	65	us	
HSD setup time	Thsu	12	--	--	ns	
HSD hold time	Thhd	12	--	--	ns	
VSD width	Tvwh	1	--	--	Th	
VSD setup time	Tvsu	12	--	--	ns	
VSD hold time	Tvhd	12	--	--	ns	
Data setup time	Tdasu	12	--	--	ns	
Data hold time	Tdahd	12	--	--	ns	
DE setup time	Tdesu	12	--	--	ns	
DE hold time	Tdehd	12	--	--	ns	
Source output setting time	Tssf	--	--	TBD	us	10% to 90% CL=60pF, RL=2kΩ
Gate output setting time	Tgst	--	--	TBD	ns	10% to 90% CL=60pF
VCOM output setting time	Tcst	--	--	TBD	us	10% to 90% CL=40nF, RL=50Ω
Time from VSD to 1st line data input	Tvs	3	8	31	Th	HV mode By HDL[4:0] setting

Table 6.1: AC Input Signal Timing Characteristics

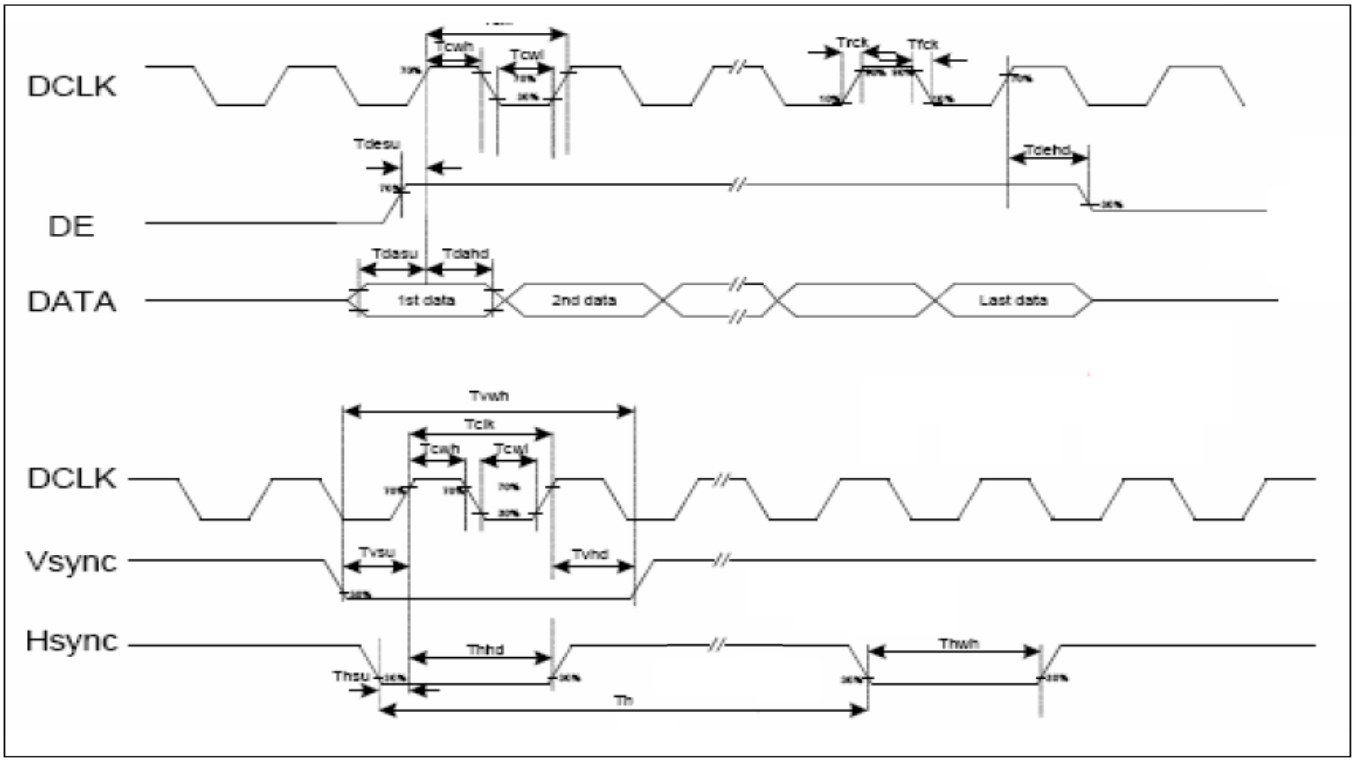


Figure 6.1: Clock and Data Input Waveforms

6.2 Data Input Format

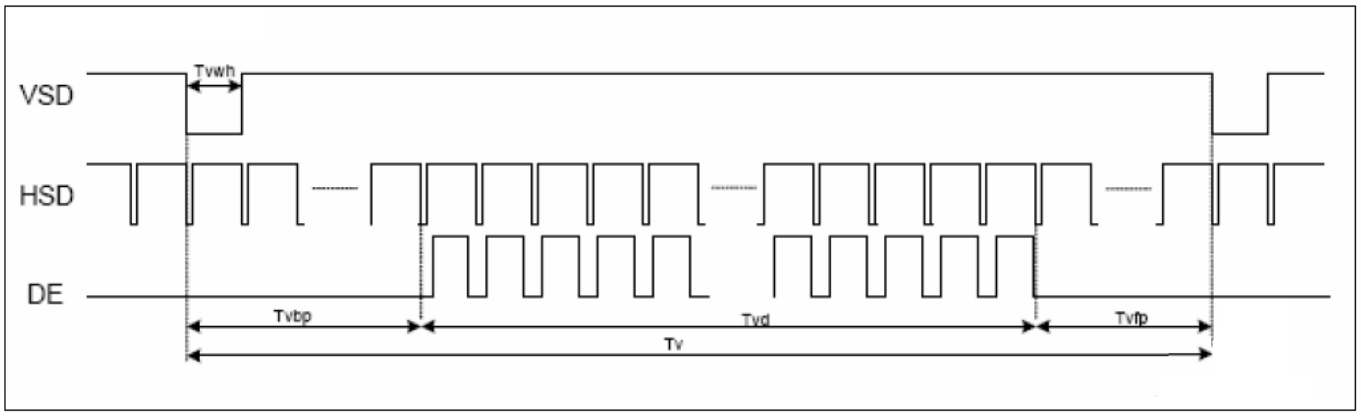


Figure 6.2: Vertical Input Timing Diagram

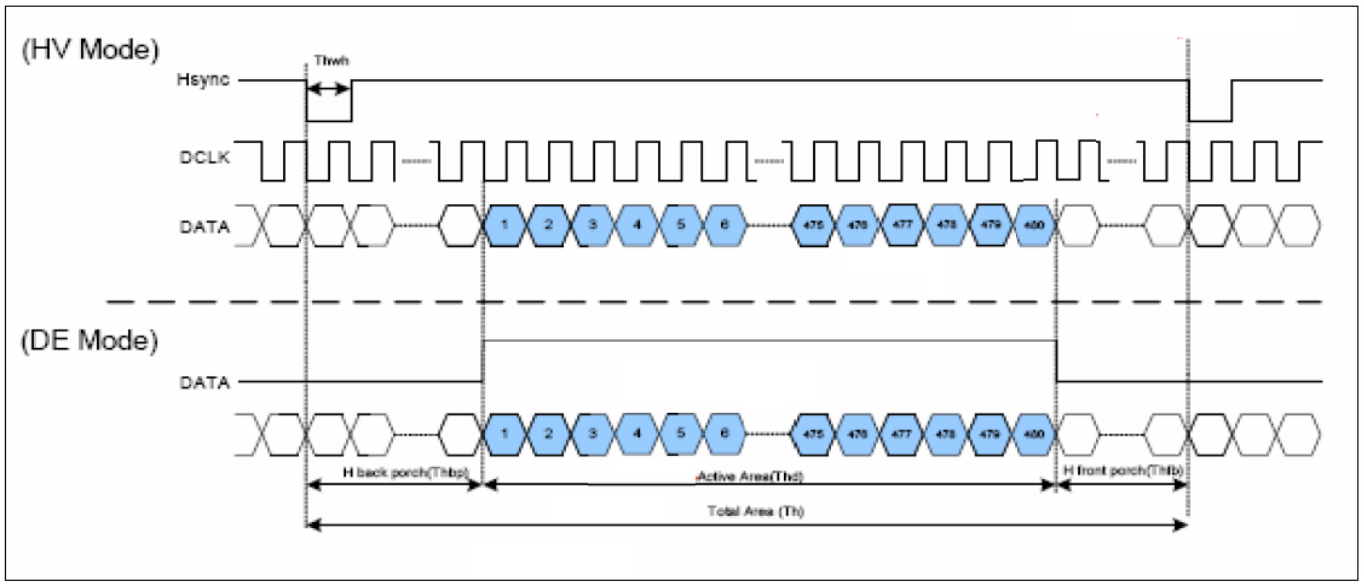


Figure 6.3: Serial 8-bit RGB Mode Timing Diagram

Parameters	Symbol	Min	Typ.	Max	Unit	Condition
DCLK frequency	Fclk	24	27	30	MHz	
DCLK cycle time	Tclk	83	110	200	ns	
DCLK pulse duty	Tcwh	40	50	60	%	
Time from HSD to source output	Thso	--	13	--	DCLK	
Time from HSD to gate output	Thgo	--	27	--	DCLK	
Time from HSD to gate output off	Thgz	--	3	--	DCLK	
Time from HSD to VCOM	Thvc	--	12	--	DCLK	

Table 6.2: Horizontal and Vertical Input Timing Characteristics

6.3 Parallel RGB Mode Data Format

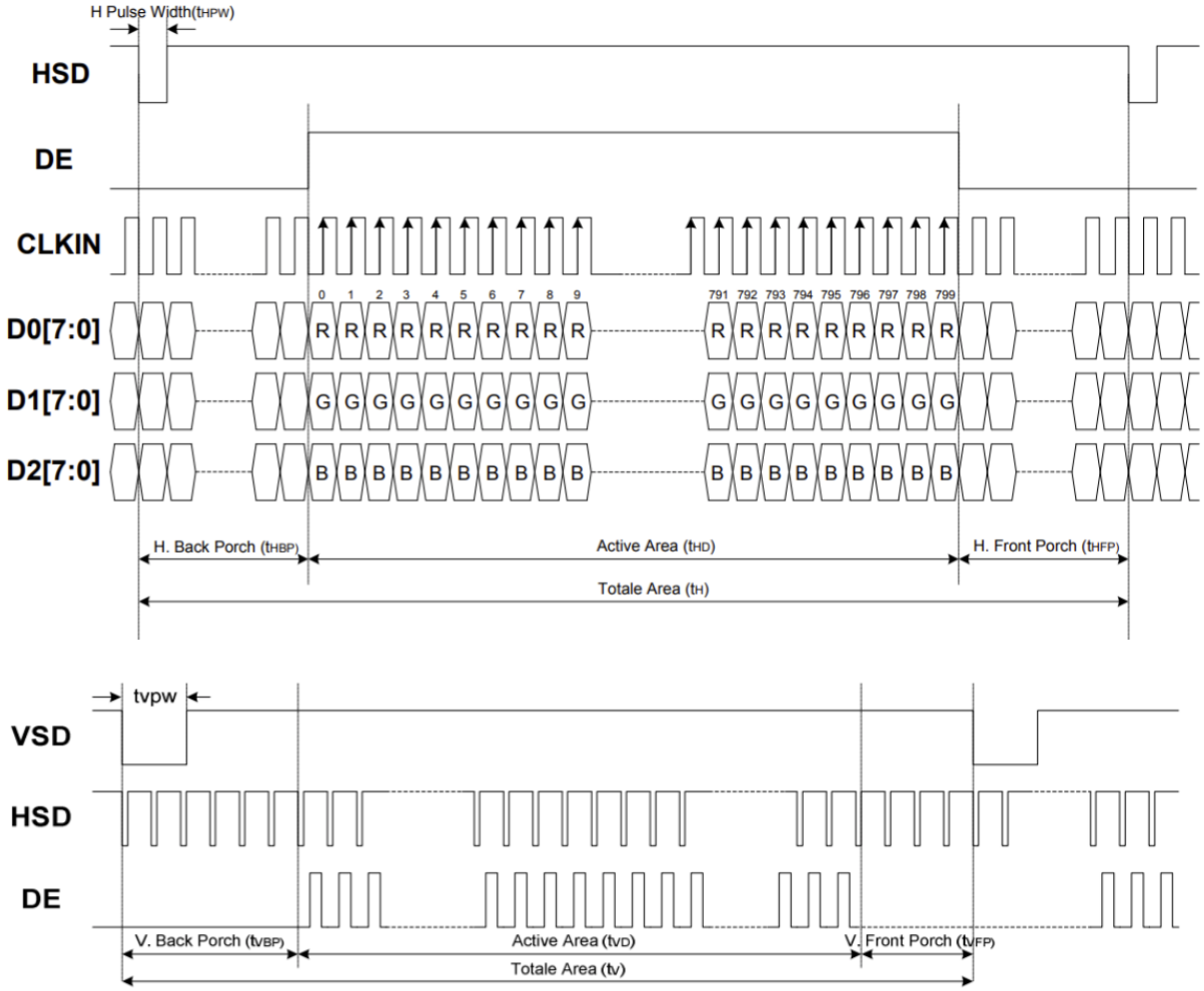


Figure 6.4: Parallel RGB Input Timing Diagram

Parameters	Symbol	Min	Typ.	Max	Unit	Condition
CLKIN frequency	Fclk	--	33.3	50	MHz	
VSD period time	Tv	510	525	650	HSD	
VSD display area	Tvd	--	480	--	HSD	
VSD back porch	Tvbp	23	23	23	HSD	
VSD front porch	Tvfp	7	22	147	HSD	
HSD period time	Th	862	1056	1200	CLKIN	
HSD display area	Thd	--	800	--	CLKIN	
HSD back porch	Thbp	46	46	46	CLKIN	
HSD front porch	Thfp	16	210	354	CLKIN	

Table 6.3: Parallel RGB Input Timing Characteristics

7. CTP Specification

7.1 Electrical Characteristics

7.1.1 Absolute Maximum Rating

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	VDD	-0.3	3.47	V	1
I/O Digital Voltage	VDDIO	-0.3	3.47	V	1
Operating Temperature	T	-20	+70	℃	-
Storage Temperature	T_{ST}	-30	+80	℃	-

Table 7.1: CTP Absolute Maximum Rating Characteristics

Note: If used beyond the absolute maximum ratings, GT911 may permanently damage. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.

7.1.2 DC Electrical Characteristics (Ta=25℃)

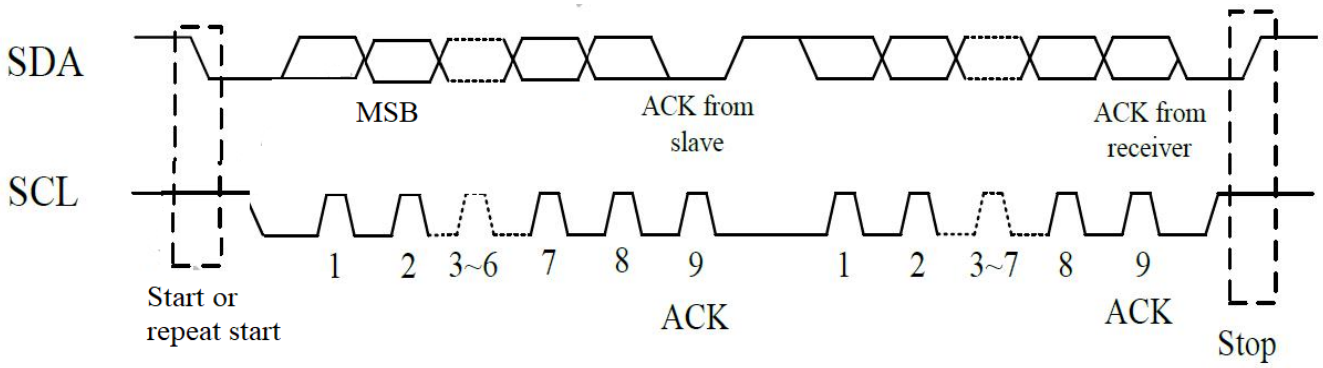
Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Digital supply voltage	VDD		2.8		3.3	V	
I/O Digital supply voltage	VDDIO		1.8		3.3	V	
Normal operation mode current consumption	I_{OPr}	VDD=2.8V Ta=25℃ MCLK=17.5 MHz		8	14.5	mA	
Monitor mode current consumption	I_{mon}			3.3		mA	
Sleep mode current consumption	I_{sip}		70		120	uA	
Level input voltage	V_{IH}		0.75VDDIO		VDDIO+0.3	V	
	V_{IL}		-0.3		0.25VDDIO	V	
Level output voltage	V_{OH}	I_{OH}=-0.1mA	0.85VDDIO			V	
	V_{OL}	I_{OL}=0.1mA			0.15VDDIO	V	

Table 7.2: CTP DC Electrical Characteristics

7.2 AC Characteristics

7.2.1 I2C Interface Characteristics

GT911 provides a standard I2C interface for SCL and SDA to communicate with the host. GT911 always serves as slave device in the system with all communication being initialized by the host. It is recommended that transmission rate be kept at or below 400kbps. The figure shown below is the I2C timing:



Parameter	Symbols	Condition	Min	Max	Units
SCL low period	t_{lo}		1.3		us
SCL high period	t_{hi}		0.6		us
SCL setup time for start condition	t_{st1}		0.6		us
SCL setup time for stop condition	t_{st3}		0.6		us
SCL hold time for start condition	t_{hd1}		0.6		us
SDA setup time	t_{st2}		0.1		us
SDA hold time	t_{hd2}		0		us

Table 7.3: I2C AC Characteristics, 1.8V interface voltage, 400kbps transmission rate, 2k pull-up resistor

Parameter	Symbols	Condition	Min	Max	Units
SCL low period	t_{lo}		1.3		us
SCL high period	t_{hi}		0.6		us
SCL setup time for start condition	t_{st1}		0.6		us
SCL setup time for stop condition	t_{st3}		0.6		us
SCL hold time for start condition	t_{hd1}		0.6		us
SDA setup time	t_{st2}		0.1		us
SDA hold time	t_{hd2}		0		us

Table 7.4: I2C AC Characteristics, 3.3V interface voltage, 400kbps transmission rate, 2k pull-up resistor

GT911 supports two I2C slave addresses: 0xBA/0xBB and 0x28/0x29. The host can select the address by changing the status of Reset and INT pins during the power-on initialization phase. The configuration methods and timings are shown below:

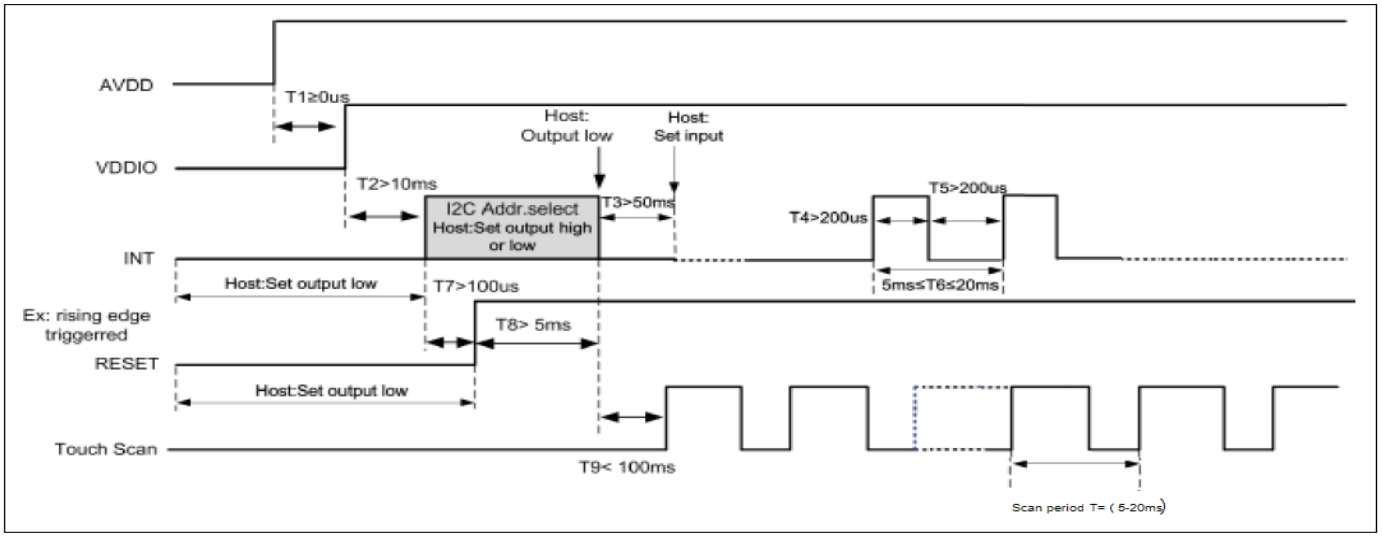


Figure 7.1: I2C Power on Timing

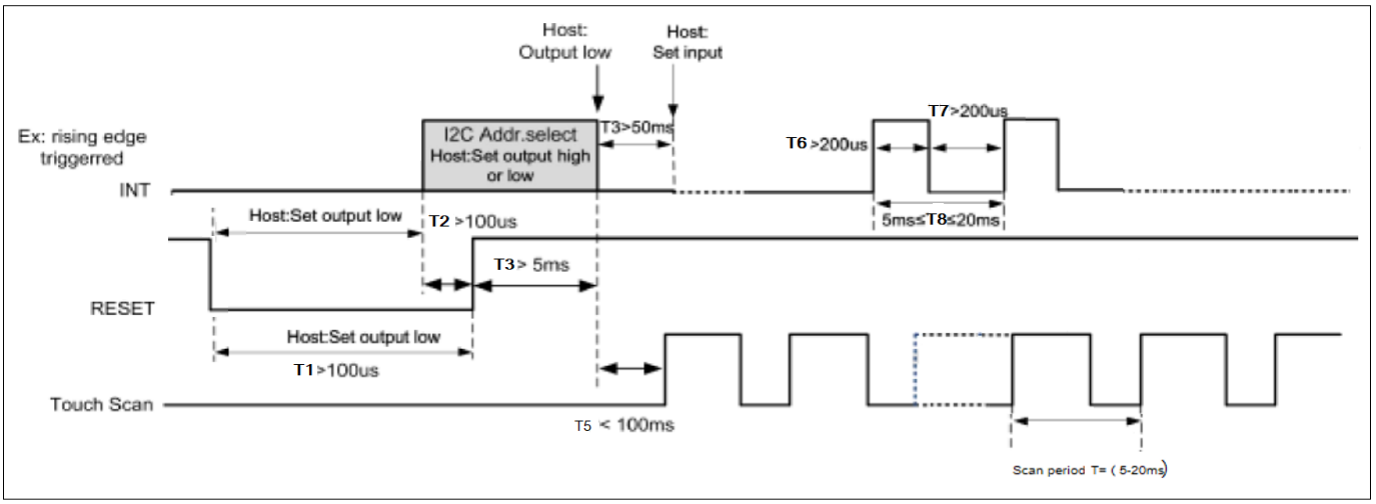


Figure 7.2: I2C Host Resetting Timing

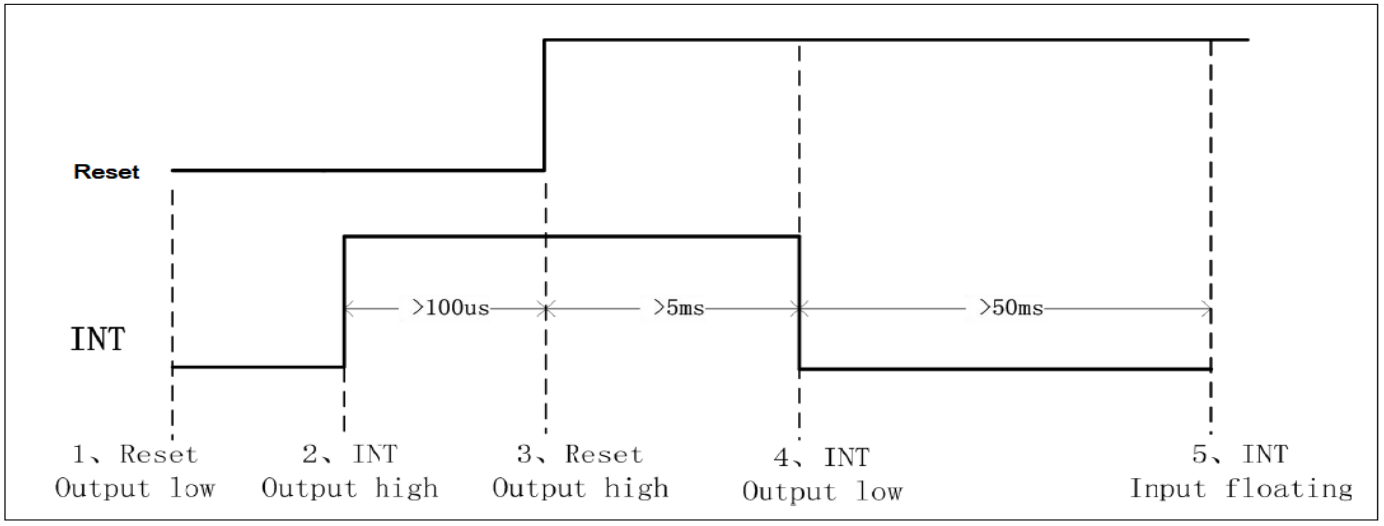


Figure 7.3: Setting Slave Address to 0x28/0x29 Timing

6.0 TFT AC Characteristics

6.1 Input Signal Characteristics

For the interface timing diagram, see diagram on page 61 of the data sheet for controller IC ST7282. The data sheet can be found here: https://focuslcds.com/content/ST7282.pdf

6.2 Data Input Format

For the vertical input timing diagram, see diagram

6.3 Parallel RGB Mode Data Format

For the parallel RGB Input timing diagrams and tables, see diagrams and tables on pages 45-46 of the datasheet for IC ILI5960. The datasheet can be found here: https://focuslcds.com/content/ILI5960.pdf

7.0 Quality Inspection Standards

For TFT quality inspection standards, please see the following link: https://focuslcds.com/tft-quality-inspection-standards/

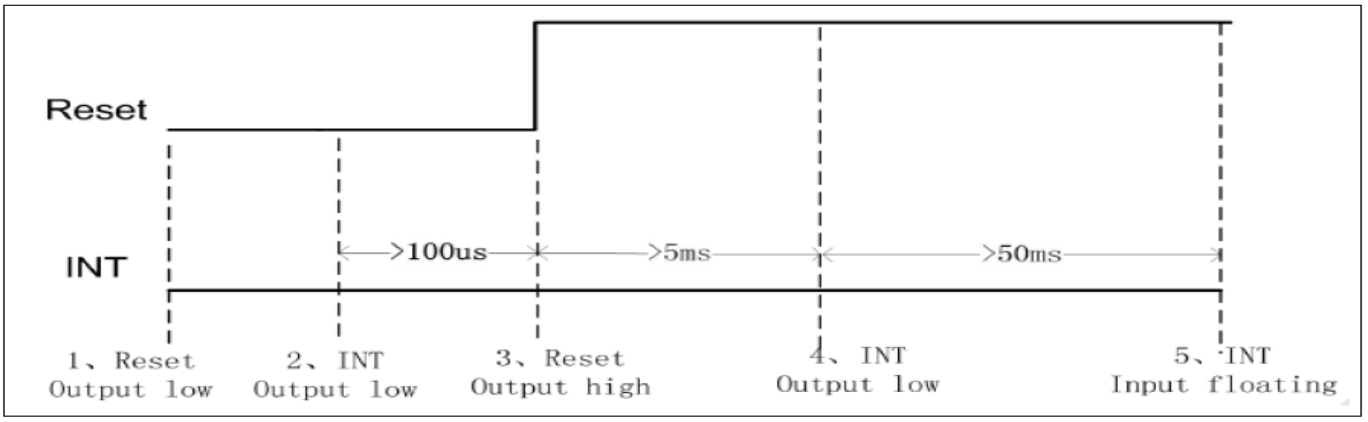


Figure 7.4: Setting Slave Address to 0xBA/0xBB Timing

Data Transmission *(ex. 0xBA/0xBB)*

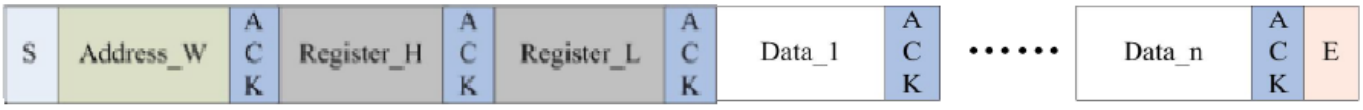
Communication is always initiated by the host. Valid start condition is signaled by pulling SDA line from high to low when SCL is high. Data flow or address is transmitted after the start condition.

All slave devices connected to I2C bus should detect the 8-bit address issued after start condition and send the correct ACK. After receiving matching address, GT911 acknowledges by configuring SDA line as output port and pulling SDA line low during the ninth SCL cycle. When receiving unmatched address, namely not 0xBA or 0xBB, GT911 will stay in an idle state.

For data bytes on SDA, each of the 9 serial bits will be sent on nine SCL cycles. Each data byte consists of 8 valid data bits and one ACK or NACK bit sent by the recipient. The data transmission is valid when SCL line is high. When communication is completed the host will issue the stop condition. Stop condition implies the transition of SDA line from low to high when SCL is high.

Writing Data to GT911

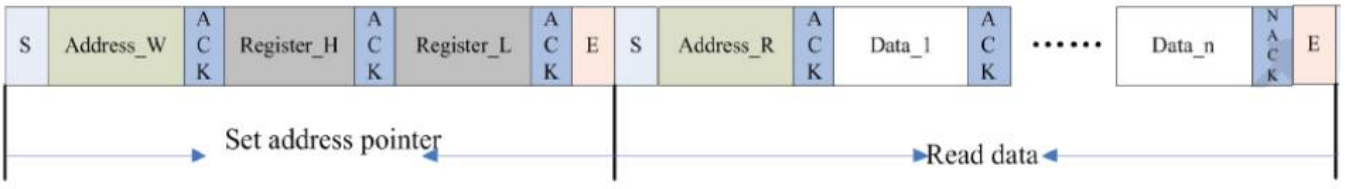
The diagram displays the timing sequence of the host writing data onto GT911. First the host issues a start condition. The host sends 0xBA (address bits and R/W bit; R/W bit as 0 indicates write operation) to the slave device. After receiving ACK, the host sends the 16-bit register address (where writing starts) and the 8-bit data bytes (to be written onto the register)



The location of the register address pointer will automatically add 1 every write operation. When the host needs to perform write operations on a group of registers of continuous addresses it can write continuously. The write operation is terminated when the host issues the stop condition.

Reading Data from GT911

The diagram below is the timing sequence of the host reading data from GT911. The host issues the start condition and sends 0xBA (Address bits and R/W bit, R/W bit as 0 indicates write operation) to the slave device. After receiving ACK, the host sends the 16-bit register address (where reading starts) to the slave device. Then the host sets register addresses which need to be read.



The host issues the start condition once again and sends 0xBB (read operation). After receiving ACK, the host starts to read the data. GT911 also supports continuous read operation. When receiving a byte of data, the host sends an ACK signal indicating successful reception. After receiving the last byte of data, the host sends a NACK signal followed by a STOP condition which terminates communication.

8. Cautions and Handling Precautions

8.1 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 fingerstalls 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.
14. Power supply should always be turned on/off by the item Power On Sequence & Power Off Sequence

8.2 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.