



**DM-TFT50-429**  
**5" IPS 720x1280 FULL VIEW**  
**DISPLAY PANEL WITH**  
**CAPACITIVE TOUCH - MIPI**

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## 1 Revision History

Date	Changes
2022-5-10	First release

## 2 Main Features

Item	Specification	Unit
Size	5	Inch
Resolution	720(RGB) x 1280	pixel
Display area	62.10(H)*110.40(V)	mm
Module Dimension	67.56 x 122.35 x 4.03	mm
TFT Controller IC	ILI9881C	-
CTP Driver IC	GT911	
Interface	4 Lane MIPI	-
Display Color	65K/262K/16.7M	colors
Pixel pitch	0.08625(H)*0.08625(V)	mm
View Direction	All	
Touch mode	5- points and Gestures	
Backlight Type	Transmissive/ Normally black	-
Weight	TBD	g

## 3 Pin Description

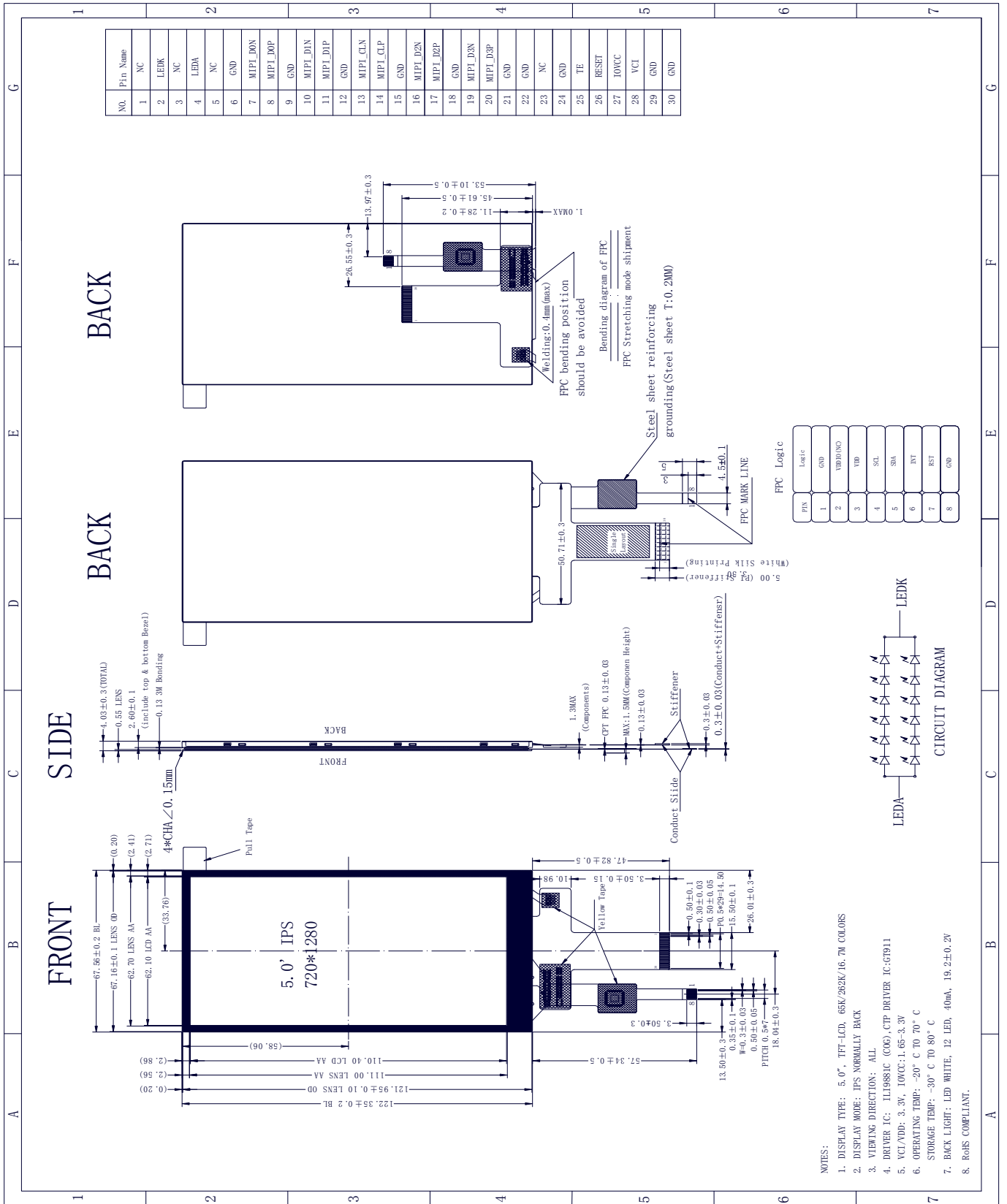
### 3.1 CTP

No.	Symbol	Description
1	GND	Ground
2	NC	
3	VDD	Supply voltage
4	SCL	I2C clock input
5	SDA	I2C data input and output
6	INT	External interrupt to the host
7	RST	External Reset, Low is active
8	GND	Ground

### 3.2 TFT

No.	Symbol	Description
1	NC	
2	LEDK	Cathode pin of backlight
3	NC	
4	LEDA	Anode pin of backlight
5	NC	
6	GND	Ground
7	MIPI_D0N	-MIPI DSI differential data pair.(Data lane 0)
8	MIPI_D0P	Leave it open or fix to GND level when not in use
9	GND	Ground
10	MIPI_D1N	-MIPI DSI differential data pair.(Data lane 1)
11	MIPI_D1P	Leave it open or fix to GND level when not in use
12	GND	Ground
13	MIPI_CLN	-MIPI DSI differential clock pair
14	MIPI_CLP	Leave it open or fix to GND level when not in use
15	GND	Ground
16	MIPI_D2N	-MIPI DSI differential data pair.(Data lane 2)
17	MIPI_D2P	Leave it open or fix to GND level when not in use
18	GND	Ground
19	MIPI_D3N	-MIPI DSI differential data pair.(Data lane 3)
20	MIPI_D3P	Leave it open or fix to GND level when not in use
21	GND	Ground
22	GND	Ground
23	NC	
24	GND	Ground
25	TE	-Tearing effect output pin Leave it open or fix to GND level when not in use
26	RESET	-The external reset pin Initializes the chip with a low input. Be sure to execute a power-on reset after supplying power. Fix to IOVCC level when not in use
27	IOVCC	-Power supply for internal logic regulator. Connect to an external power supply of 1.65V to 3.3V
28	VCI	-Power supply for analog circuits. Connect to an external power supply of 2.5V to 3.3V
29	GND	Ground
30	GND	Ground

# 4 Mechanical Drawing



## 5 Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Digital Supply Voltage	VCC		2.5	3.3	6.0	V
I/O Digital Voltage	IOVCC		1.65	1.8	3.3	V
Normal mode Current	IDD			40		mA
Low Level Input Voltage	V <sub>IL</sub>		-0.3		0.3 IOVCC	V
High Level Input Voltage	V <sub>IH</sub>		0.7 IOVCC		IOVCC	V
Low Level Output Voltage	V <sub>OL</sub>		GND		0.2 IOVCC	V
High Level Output Voltage	V <sub>OH</sub>		0.8 IOVCC		IOVCC	V
Operating Temperature	TOP	Absolute Max	-20	-	+70	°C
Storage Temperature	TST	Absolute Max	-30	-	+80	°C
Display Supply Voltage	VCI	Absolute Max	-0.3	-	6.5	°C
Digital interface supply Voltage	IOVCC	Absolute Max	-0.3	-	3.3	°C

## 6 Optical Characteristics

### 6.1 Optical specification

Item	Symbol	Min	Typ	Max	Unit
View Angles TOP	AV	-	80	-	deg
View Angles Bottom	AV	-	80	-	deg
View Angles Right	AH	-	80	-	deg
View Angles Left	AH	-	80	-	deg
Response Time	Tr +Tf		30	40	ms
Contrast Ratio	CR	640	800	-	--
Color Filter Chromacity	White	W <sub>X</sub>	0.276	0.316	0.356
		W <sub>Y</sub>	0.296	0.336	0.367
	Red	R <sub>X</sub>	0.611	0.631	0.651
		R <sub>Y</sub>	0.319	0.339	0.359
	Green	G <sub>X</sub>	0.300	0.320	0.340
		G <sub>Y</sub>	0.587	0.607	0.627
Blue	B <sub>X</sub>	0.131	0.151	0.171	
	B <sub>Y</sub>	0.025	0.045	0.065	
Option View Direction	Free				

### 6.2 LED Backlight Characteristics

Item	Symbol	Min	Typ	Max	Unit
Forward Current	I <sub>F</sub>	30	40	-	mA
Forward Voltage	V <sub>F</sub>	-	19.2	-	V
LED Life Time	Hr	50000	-	-	Hour
Uniformity	AVg	80	-	-	%
LCM Luminance	L <sub>v</sub>	380	420	-	cd/m <sup>2</sup>

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

## 7 MIPI Interface Characteristics

### 7.1 High Speed Mode-Clock Channel Timing

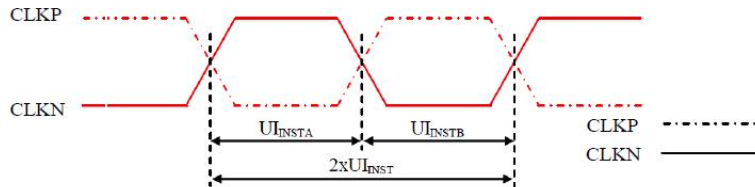


Figure 118: DSI Clock Channel Timing

Table 38: DSI Clock Channel Timing

Signal	Symbol	Parameter	Min	Max	Unit
CLKP/N	$2xUI_{INST}$	Double UI instantaneous	4	25	ns
CLKP/N	$UI_{INSTA}, UI_{INSTB}$ (Note 1)	UI instantaneous Half	2 (Note 2)	12.5	ns

**Notes:**

- $UI = UI_{INSTA} = UI_{INSTB}$
- Define the minimum value of 24 UI per Pixel, see Table 39.

Table 39: Limited Clock Channel Speed

Data type	Two Lanes speed	Three Lanes speed	Four Lanes speed
Data Type = 00 1110 (0Eh), RGB 565, 16 UI per Pixel	566 Mbps	433 Mbps	366 Mbps
Data Type = 01 1110 (1Eh), RGB 666, 18 UI per Pixel	637 Mbps	487 Mbps	412 Mbps
Data Type = 10 1110 (2Eh), RGB 666 Loosely, 24 UI per Pixel	850 Mbps	650 Mbps	550 Mbps
Data Type = 11 1110 (3Eh), RGB 888, 24 UI per Pixel	850 Mbps	650 Mbps	550 Mbps

### 7.2 High Speed Mode – Data Clock Channel Timing

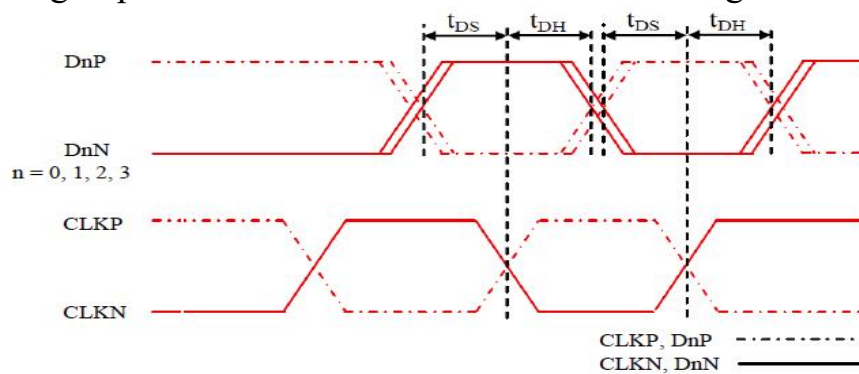


Figure 119: DSI Data to Clock Channel Timings

Table 40: DSI Data to Clock Channel Timings

Signal	Symbol	Parameter	Min	Max
DnP/N, n=0 and 1	$t_{DS}$	Data to Clock Setup time	$0.15xUI$	-
	$t_{DH}$	Clock to Data Hold Time	$0.15xUI$	-

### 7.3 High Speed Mode – Rising and Fall Timings

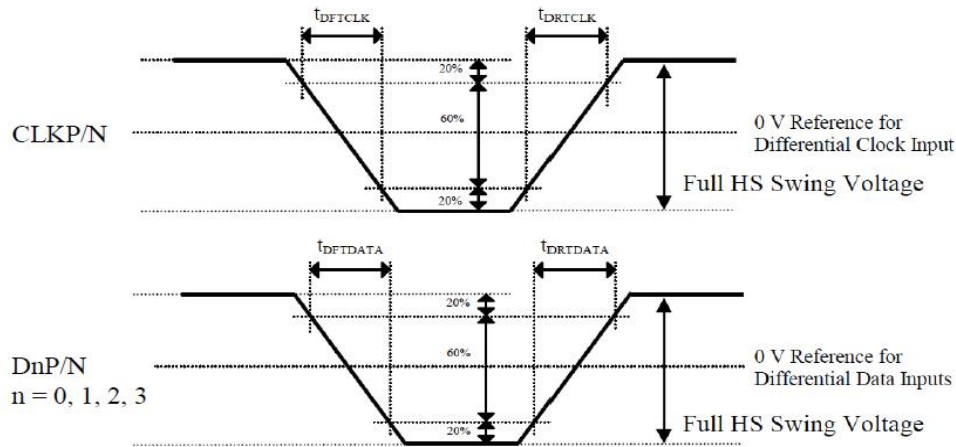


Figure 120: Rising and Falling Timings on Clock and Data Channels

Table 41: Rise and Fall Timings on Clock and Data Channels

Parameter	Symbol	Condition	Specification		
			Min	Typ	Max
Differential Rise Time for Clock	$t_{DRTCLK}$	CLKP/N	150 ps	-	0.3UI (Note)
Differential Rise Time for Data	$t_{DRTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)
Differential Fall Time for Clock	$t_{DFTCLK}$	CLKP/N	150 ps	-	0.3UI (Note)
Differential Fall Time for Data	$t_{DFTDATA}$	DnP/N n=0 and 1	150 ps	-	0.3UI (Note)

**Note:** The display module has to meet timing requirements, which are defined for the transmitter (MCU) on MIPI D-Phy standard.



## 7.4 Low Speed Mode – Bus Turn Around

Lower Power Mode and its State Periods on the Bus Turnaround (BTA) from the MCU to the Display Module (ILI9881C) are illustrated for reference purposes below.

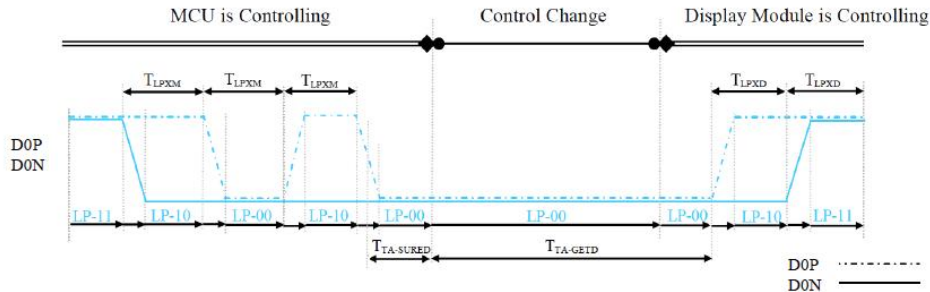


Figure 121: BTA from the MCU to the Display Module

Lower Power Mode and its State Periods on the Bus Turnaround (BTA) from the Display Module (ILI9881C) to the MCU are illustrated for reference purposes below.

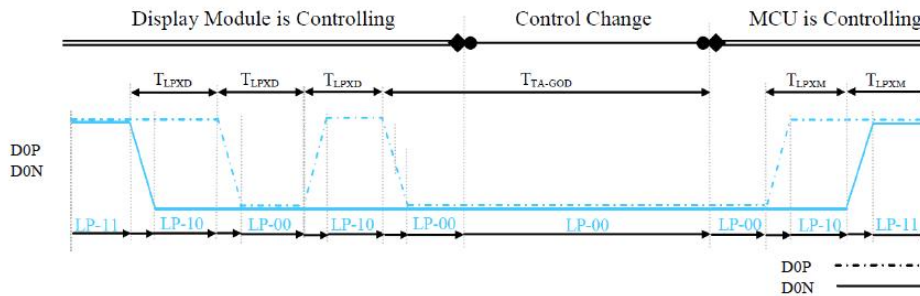


Figure 122: BTA from the Display Module to the MCU

Table 42: Low Power State Period Timings – A

Signal	Symbol	Description	Min	Max	Unit
D0P/N	$T_{LPXM}$	Length of LP-00, LP-01, LP-10 or LP-11 periods MCU → Display Module (ILI9881C)	50	75	ns
D0P/N	$T_{LPXD}$	Length of LP-00, LP-01, LP-10 or LP-11 periods Display Module (ILI9881C) → MCU	50	75	ns
D0P/N	$T_{TA-SURED}$	Time-out before the Display Module (ILI9881C) starts driving	$T_{LPXD}$	$2 \times T_{LPXD}$	ns

Table 43: Low Power State Period Timings – B

Signal	Symbol	Description	Time	Unit
D0P/N	$T_{TA-GETD}$	Time to drive LP-00 by Display Module (ILI9881C)	$5 \times T_{LPXD}$	ns
D0P/N	$T_{TA-GOD}$	Time to drive LP-00 after turnaround request - MCU	$4 \times T_{LPXD}$	ns

## 7.5 Data Lanes from Low Power Mode to High Speed Mode

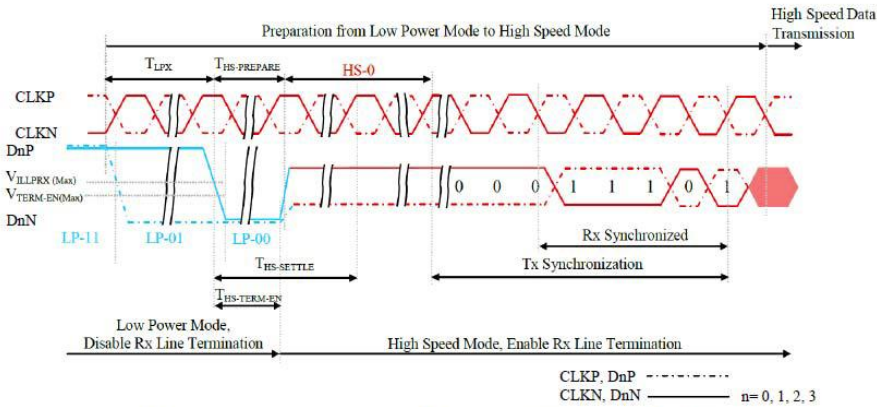


Figure 123: Data Lanes - Low Power Mode to High Speed Mode Timings

Table 44: Data Lanes - Low Power Mode to High Speed Mode Timings

Signal	Symbol	Description	Min	Max	Unit
DnP/N, n = 0 and 1	$T_{LPX}$	Length of any Low Power State Period	50	-	ns
DnP/N, n = 0 and 1	$T_{HS-PREPARE}$	Time to drive LP-00 to prepare for HS Transmission	$40+4xUI$	$85+6xUI$	ns
DnP/N, n = 0 and 1	$T_{HS-TERM-EN}$	Time to enable Data Lane Receiver line termination measured from when Dn crosses $V_{ILMAX}$	-	$35+4xUI$	ns

## 7.6 Data Lanes from High Power Mode to High Speed Mode

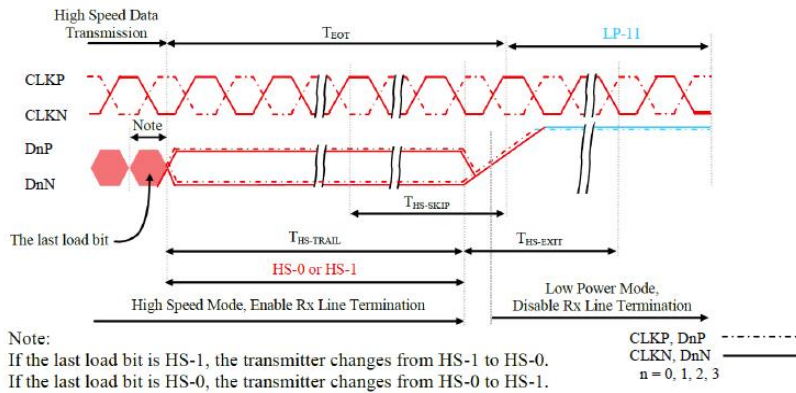


Figure 124: Data Lanes - High Speed Mode to Low Power Mode Timings

Table 45: Data Lanes - High Speed Mode to Low Power Mode Timings

Signal	Symbol	Description	Min	Max	Unit
DnP/N, n = 0 and 1	$T_{HS-SKIP}$	Time-Out at Display Module (ILI9881C) to ignore transition period of EoT	40	$55+4xUI$	ns
DnP/N, n = 0 and 1	$T_{HS-EXIT}$	Time to driver LP-11 after HS burst	100	-	ns

### 7.7 DSI Clock Burst – High Speed Mode to/from Low Power Mode

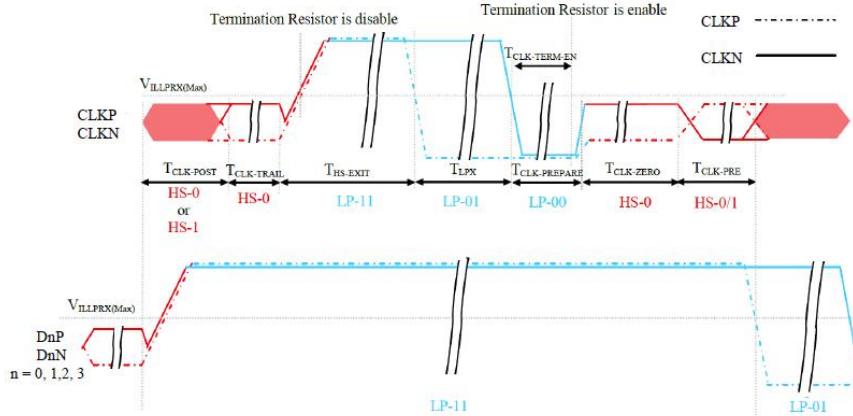
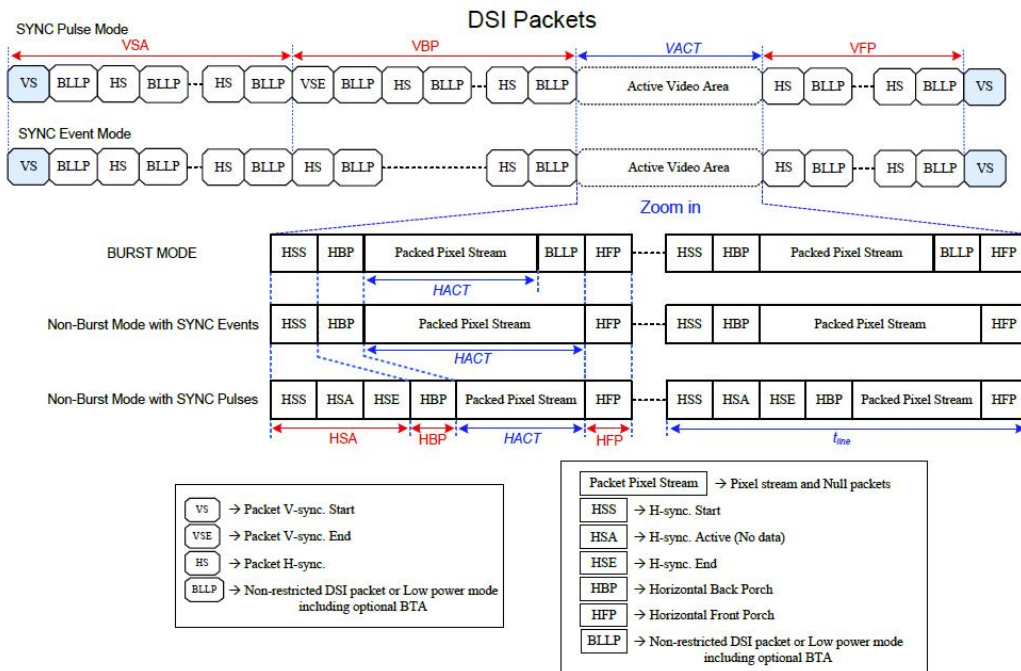


Figure 125: Clock Lanes - High Speed Mode to/from Low Power Mode Timings

Table 46: Clock Lanes - High Speed Mode to/from Low Power Mode Timings

Signal	Symbol	Description	Min	Max	Unit
CLKP/N	$T_{CLK-POST}$	Time that the MCU shall continue sending HS clock after the last associated Data Lanes has transitioned to LP mode	$60+52xUI$	-	ns
CLKP/N	$T_{CLK-TRAIL}$	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	ns
CLKP/N	$T_{HS-EXIT}$	Time to drive LP-11 after HS burst	100	-	ns
CLKP/N	$T_{CLK-PREPARE}$	Time to drive LP-00 to prepare for HS transmission	38	95	ns
CLKP/N	$T_{CLK-TERM-EN}$	Time-out at Clock Lane to enable HS termination	-	38	ns
CLKP/N	$T_{CLK-PREPARE} + T_{CLK-ZERO}$	Minimum lead HS-0 drive period before starting Clock	300	-	ns
CLKP/N	$T_{CLK-PRE}$	Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode	$8xUI$	-	ns

### 7.8 Timing for DSI video mode



Parameters	Symbols	Min.	Typ.	Max.	Units
Vertical sync. active	VSA	TBD	TBD	-	Line
Vertical Back Porch	VBP	TBD	TBD	-	Line
Vertical Front Porch	VFP	TBD	TBD	-	Line
Active lines per frame	VACT	-	1280	-	Line
Horizontal sync. active	HSA	TBD	TBD	-	Pixel
Horizontal Back Porch	HBP	TBD	TBD	-	Pixel
Horizontal Front Porch	HFP	TBD	TBD	-	Pixel
Active pixels per line	HACT	-	800	-	Pixel
Line time	$t_{line}$	TBD		-	bps/lane
Bit rate	$BR_{bps}$	200		Note 5	Line

1 UI=1/Bit rate

$HAS(pixel) = (tHSA * lane\ number) / (UI * pixel\ format)$

$HBP(pixel) = (tHBP * lane\ number) / (UI * pixel\ format)$

$HFP(pixel) = (tHFP * lane\ number) / (UI * pixel\ format)$

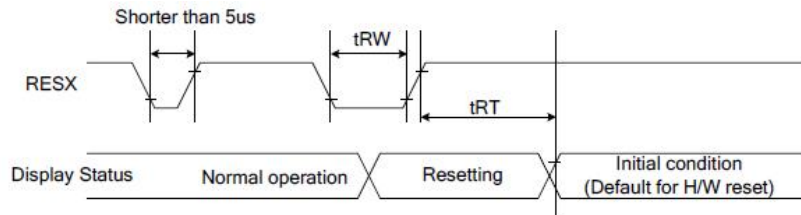
$$\text{Frame Rate} = \frac{BR_{bps} \times Lane_{num}}{(VACT+VSA+VBP+VFP) \times (HACT+HSA+HBP+HFP) \times \text{Pixel Format}}$$

Example :  $BR_{bps} = 457\text{Mbps/lane}$ ,  $1UI=2.1883\text{ns}$ , Frame rate=60Hz, VACT=1280, VSA=2, VBP=30, VFP=20, HACT=720, HSA=33, HBP=100, HFP=100,  $Lane_{num}=4(\text{lane})$ , Pixel Format=24(bit).

**Note:**

1.  $Lane_{num}$ : Data lane of MIPI-DSI.
2. Pixel Format: Please reference to "4.1DSI System Interface".
3. The formula exists slightly error because of the host-transmission way.
4. The best frame rate setting : 2 data lanes : 50~60 Hz / 3 data lanes : 50~70 Hz / 4 data lanes : 50~70 Hz.
5. Please reference to "Table 39: Limited Clock Channel Speed"

## 7.9 Reset input timing



**Figure 126: Reset Timing**

**Table 47: Reset Timing**

Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5) 120 (note 1,6,7)	mS

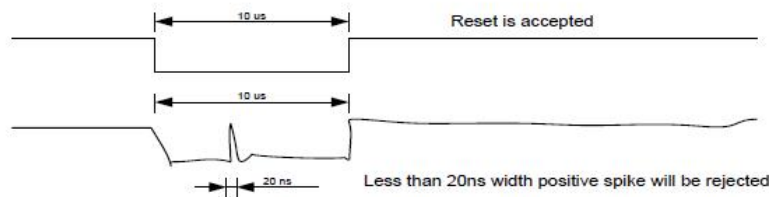
**Notes:**

1. The reset cancel also includes required time for loading ID bytes, VCOM setting and other settings from EEPROM to registers. This loading is done every time when there is H/W reset cancel time (tRT) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the Table 48.

**Table 48: Reset Descript**

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

3. During the Resetting period, the display will be blanked (The display enters the blanking sequence, which maximum time is 120 ms, when Reset Starts in the Sleep Out mode. The display remains the blank state in the Sleep In mode.) and then return to Default condition for Hardware Reset.
4. Spike Rejection can also be applied during a valid reset pulse, as shown below:



**Figure 127: Positive Noise Pulse during Reset Low**

5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

## 8 CTP Specification

### 8.1 Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage	VDD	Absolute Max	2.66	-	3.47	V
Operating Temperature	TOP	Absolute Max	-20	-	+70	°C
Storage Temperature	TST	Absolute Max	-30	-	+80	°C
Normal mode Current			-	8	14.5	mA
Green mode operating current			-	3.3	-	mA
Sleep mode operating current			70	-	120	uA
Doze mode operating current			-	0.78	-	mA
Digital Input low voltage/VIL			-0.3	-	0.25*VDD	V
Digital Input high voltage/VIH			0.75*VDD	-	VDD+0.3	V
Digital Output low voltage/VOL			-		0.15*VDD	V
Digital Output high voltage/VOH			0.85*VDD			V

### 8.2 AC Characteristics

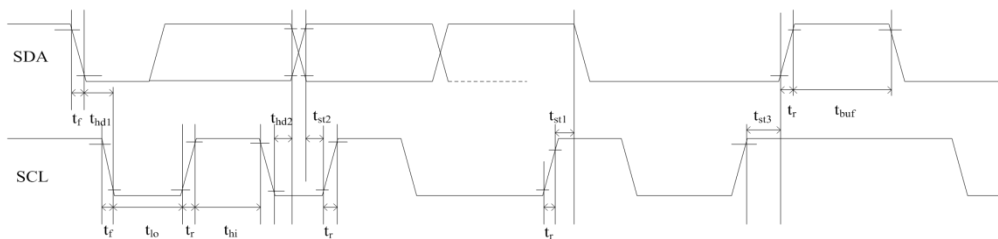
(Ambient temperature:25°C, AVDD=2.8V, VDDIO=1.8V)

Item	Min	Typ	Max	Unit
OSC oscillation frequency	59	60	61	MHz
I/O output rise time,low to high	-	14	-	ns
I/O output rfall time,high to low	-	14	-	ns

### 8.3 I2C interface

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 strongly recommended that transmission rate be kept at or below 400Kbps. The I2C timing is shown below:



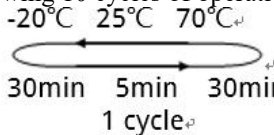
**Test condition 1: 1.8V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor**

Parameter	Symbol	Min.	Max.	Unit
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

**Test condition 2: 3.3V host interface voltage, 400Kbps transmission rate, 2K pull-up resistor**

Parameter	Symbol	Min.	Max.	Unit
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

## 9 Reliability

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 high 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, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature.	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: 15mm; Vibration: 10~55Hz; One cycle 60 seconds to 3 directions of X, Y, Z, for each 16 minutes.	3
Static Electricity Test	Endurance test apply the electric stress to the terminal.	VS=800V, RS=1.5kΩ, CS=100pF, 1 time.	-

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 rest chamber.

Note3: Test performed on product itself, not inside a container

## 10 Warranty and Conditions

<http://www.displaymodule.com/pages/faq>