

**Product Specification**

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# NHD-3.5-640480EF-MSXP-CTP

## TFT Liquid Crystal Display

<b>NHD-</b>	Newhaven Display
<b>3.5-</b>	3.5" Diagonal
<b>640480-</b>	640 x 480 Pixels
<b>EF-</b>	Model
<b>M-</b>	MIPI Interface
<b>S-</b>	High Brightness, White LED Backlight
<b>X-</b>	TFT
<b>P-</b>	IPS, Wide Temperature
<b>CTP-</b>	Capacitive Touch Panel

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## Additional Resources

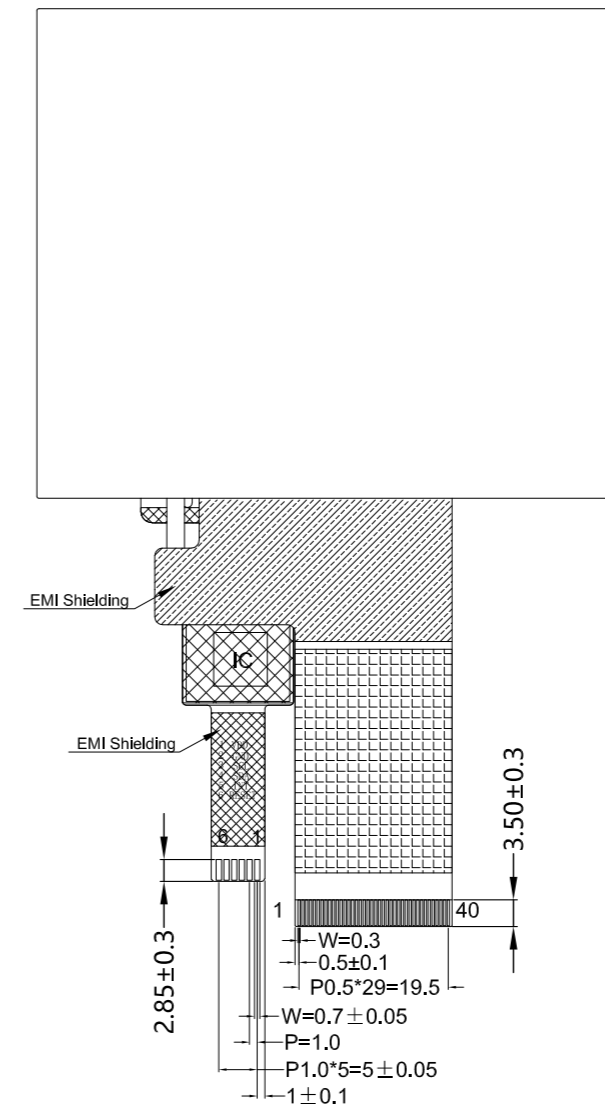
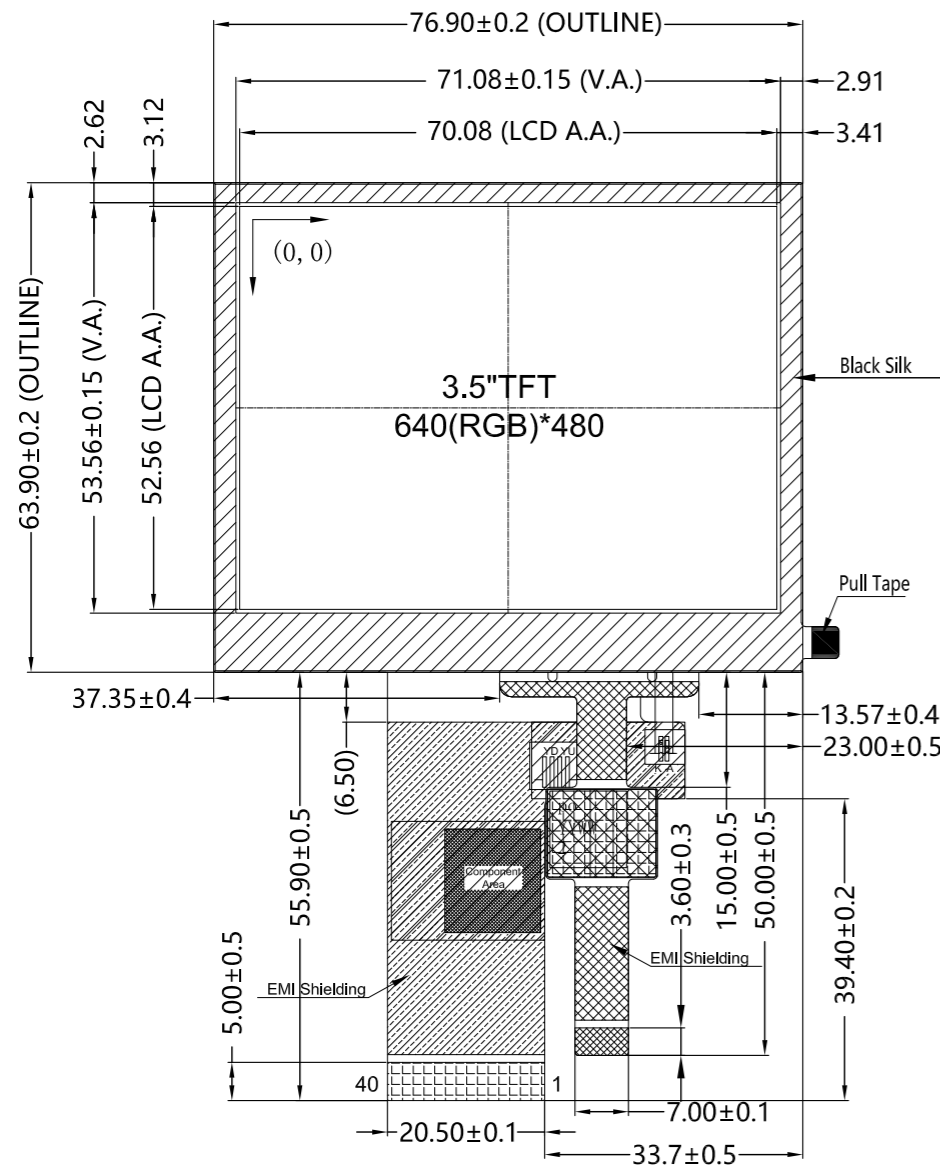
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** [https://www.newhavendisplay.com/knowledge\\_center.html](https://www.newhavendisplay.com/knowledge_center.html)
- **Quality Center:** [https://www.newhavendisplay.com/quality\\_center.html](https://www.newhavendisplay.com/quality_center.html)
- **Precautions for using LCDs/LCMs:** <https://www.newhavendisplay.com/specs/precautions.pdf>
- **Warranty / Terms & Conditions:** <https://www.newhavendisplay.com/terms.html>



## Document Revision History

Revision	Date	Description	Changed By
0	08/24/2023	Initial Release	KL
1	09/15/2023	Pin Description and Interface Information Updated	KL

# Mechanical Drawing



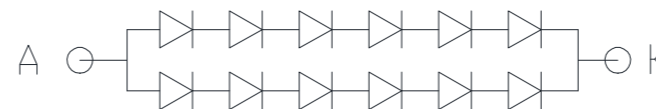
Pin No.	Symbol
1	LED_K
2	LED_A
3	NC
4	VSS
5	VDD
6	NC
7	CSX
8	DCX
9	SCL
10	SDA
11	NC
12	VSS
13	DSI_DOP
14	DSI_DON
15	VSS
16	DSI_D1P
17	DSI_D1N
18	VSS
19	DSI_CP
20	DSI_CN
21	VSS
22	DSI_D2P
23	DSI_D2N
24	VSS
25	DSI_D3P
26	DSI_D3N
27	VSS
28	NC
29	RESX
30	VOUT
31	HOUT
32	T_IM
33	IM1
34	IMO
35	LANSEL
36	NC
37	NC(XR)
38	NC(YD)
39	NC(XL)
40	NC(YU)

CTP

Pin No.	Symbol
1	V <sub>DD</sub>
2	V <sub>SS</sub>
3	SCL
4	SDA
5	/INT
6	/RESET

Product Description: 3.5" 640x480 IPS TFT w/ Capacitive Touch

1. Driver IC: FL7703NI TFT, FT5426-003 CTP
2. Interface: MIPI TFT, I<sup>2</sup>C CTP
3. Power Requirement: 3.0V TFT, 19.2V/40mA Backlight, 3.3V CTP
4. Optical Features: Normally Black, Transmissive, 808cd/m<sup>2</sup>
5. Recommended FFC Connector:
  - TFT: 40pin 0.5mm Pitch
  - CTP: 6pin 1.0mm Pitch; Molex 52271-0679
6. Key Features: EMI Shielded FPC, 10-point Multitouch



<b>Standard Tolerance:</b> (Unless otherwise specified)  Linear: $\pm 0.3\text{mm}$		
	Drawing/Part Number: <b>NHD-3.5-640480EF-MSXP-CTP</b>	Revision: -
<b>Unless otherwise specified:</b> • Dimensions are in Millimeters • Third Angle Projection	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 08/24/2023	Approved Date: 08/24/2023
This drawing is solely the property of Newhaven Display International, Inc. The information it contains is not to be disclosed, reproduced or copied in whole or part without written approval from Newhaven Display.		

## Pin Description

### TFT:

Pin No.	Symbol	External Connection	Function Description
1	LED_K	Power Supply	Backlight Cathode
2	LED_A	Power Supply	Backlight Anode
3	NC	-	No Connect
4	VSS	Power Supply	Ground
5	VDD	Power Supply	Supply Voltage for LCD and logic
6	NC	-	No Connect
7	CSX	MPU	Active LOW Chip Select signal
8	DCX	MPU	Data/Command Selection. Command: 0/LOW; Data: 1/HIGH
9	SCL	MPU	Serial Clock signal
10	SDA	MPU	Serial Data input/output signal
11	NC	-	No Connect
12	VSS	Power Supply	Ground
13	DSI_D0P	MPU	High Speed Interface Data Differential signal
14	DSI_D0N	MPU	High Speed Interface Data Differential signal
15	VSS	Power Supply	Ground
16	DSI_D1P	MPU	High Speed Interface Data Differential signal
17	DSI_D1N	MPU	High Speed Interface Data Differential signal
18	VSS	Power Supply	Ground
19	DSI_CP	MPU	High Speed Interface Clock Differential signal
20	DSI_CN	MPU	High Speed Interface Clock Differential signal
21	VSS	Power Supply	Ground
22	DSI_D2P	MPU	High Speed Interface Data Differential signal
23	DSI_D2N	MPU	High Speed Interface Data Differential signal
24	VSS	Power Supply	Ground
25	DSI_D3P	MPU	High Speed Interface Data Differential signal
26	DSI_D3N	MPU	High Speed Interface Data Differential signal
27	VSS	Power Supply	Ground
28	NC	-	No Connect
29	RESX	MPU	Active LOW Reset signal
30	VOUT	MPU	Vertical Frame Synchronization output signal
31	HOUT	MPU	Horizontal Frame Synchronization output signal
32	T_IM	MPU	Test Mode Enable signal
33	IM1	MPU	Polarity and Data Lane swap signal
34	IM0	MPU	Polarity and Data Lane swap signal
35	LANSEL	MPU	Polarity and Data Lane swap signal
36-40	NC	-	No Connect

**Recommended LCD connector:** 0.5mm pitch 40-Conductor FFC. **Backlight connector:** on LCD connector

### CTP:

Pin No.	Symbol	External Connection	Function Description
1	V <sub>DD</sub>	Power Supply	Supply voltage for Logic (3.3V)
2	V <sub>SS</sub>	Power Supply	Ground
3	SCL	MPU	Serial I2C Clock (Requires 4.7KΩ pull-up resistor)
4	SDA	MPU	Serial I2C Data (Requires 4.7kΩ pull-up resistor)
5	/INT	MPU	Interrupt signal from touch panel module to host
6	/RESET	MPU	Active LOW Reset signal

**Recommended connector:** 6pin, 1.0mm pitch, FFC connector. Molex P/N 52271-0679



T\_IM signal can be used to select between MIPI interface (normal mode) or serial interface (test mode).

T_IM	Interface mode
0	MIPI Interface
1	DPI/DBI type-C Option 1 (9-bit SPI)

The serial interface is used to communicate between the MPU and the LCD driver chip. It uses CSX (chip select), DCX (data/command select), SCL (serial clock), SDA (serial data input/output). Serial clock (SCL) can be stopped when no communication is necessary. CSX, DCX, SCL and SDA signals should be No Connect when test mode is disabled.

See FL7703NI datasheet using the link below for more details.

[https://support.newhavendisplay.com/hc/en-us/article\\_attachments/4688767550359](https://support.newhavendisplay.com/hc/en-us/article_attachments/4688767550359)

## Interface Selection

IM1	IM2	LANSEL	D0P/N	D1P/N	CP/N	D2P/N	D3/PN
0	0	0	D3P/N	D2P/N	CP/N	D1P/N	D0P/N
0	1	0	D3N/P	D2N/P	CN/P	D1N/P	D0N/P
1	0	0	D0P/N	D1P/N	CP/N	D2P/N	D3P/N
1	1	0	D0N/P	D1N/P	CN/P	D2N/P	D3N/P
0	0	1	D2P/N	D1P/N	CP/N	D0P/N	D3P/N
0	1	1	D2N/P	D1N/P	CN/P	D0N/P	D3N/P
1	0	1	D3P/N	D0P/N	CP/N	D1P/N	D2P/N
1	1	1	D3N/P	D0N/P	CN/P	D1N/P	D2N/P

Command **SETMIPI (BAh)** is used to set MIPI related register.

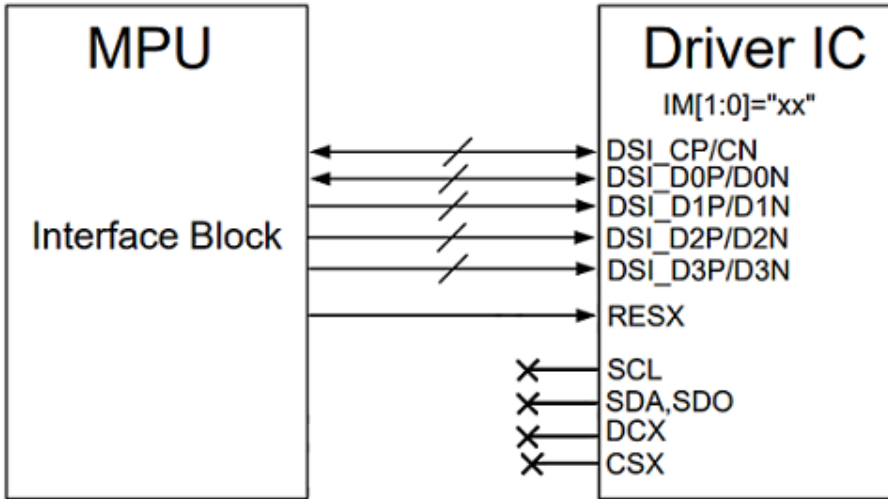
BA H	SETMIPI									HEX
	R/W	D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	1	0	1	1	1	0	1	0	BA
Parameter 1st	R/W	HOSTTY PE	CD_DLY	x	CRC_En able	VC_Main [1]	VC_Main [0]	Lane Number[1]	Lane Number[0]	33
Parameter 2nd	R/W	DSI_LDO_SEL[2]	DSI_LDO_SEL[1]	DSI_LDO_SEL[0]	LPTX_DR[2]	LPTX_DR[1]	LPTX_DR[0]	RTERM[1]	RTERM[0]	61
Parameter 3rd	R/W	x	x	x	X	IHSRX[3]	IHSRX[2]	IHSRX[1]	IHSRX[0]	06
Parameter 4th	R/W	DSI_HFP_OTP	Txs_Wait [2]	Txs_Wait [1]	Txs_Wait [0]	Tx_clk_sel[1]	Tx_clk_sel[0]	VBP_OSC_EN	VFP_OSC_EN	F9
Parameter 5th	R/W	HFP_OSC[7]	HFP_OSC[6]	HFP_OSC[5]	HFP_OSC[4]	HFP_OSC[3]	HFP_OSC[2]	HFP_OSC[1]	HFP_OSC[0]	FF
Parameter 6th	R/W	HBP_OSC[7]	HBP_OSC[6]	HBP_OSC[5]	HBP_OSC[4]	HBP_OSC[3]	HBP_OSC[2]	HBP_OSC[1]	HBP_OSC[0]	0A

**Lane [1:0]:** Specify the lane number selection.

Lane [1:0]	MIPI Lane
0	1 lane
1	2 lanes
2	3 lanes
3	4 lanes



## Wiring Diagram



### Notes:

1. Connect DSI\_D3P/N to VSS in 3 data lanes application.
2. Connect DSI\_D3P/N and DSI\_D2P/N to VSS in 2 data lanes application.

## Electrical Characteristics

### TFT:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	2.5	3.0	3.3	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 3V	38	50	75	mA
"H" Level input	V <sub>IH</sub>	-	0.7 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	GND	-	0.3 * V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	GND	-	0.2 * V <sub>DD</sub>	V
Backlight Supply Current	I <sub>LED</sub>	-	30	40	50	mA
Backlight Supply Voltage	V <sub>LED</sub>	I <sub>LED</sub> = 40mA T <sub>OP</sub> = 25°C	16.8	19.2	20.4	V
Backlight Lifetime*	-		-	30,000	-	Hrs.

\*Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions. The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated.

### Capacitive Touch Panel:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	2.7	3.3	3.6	V
Supply Current – Operating	I <sub>DD</sub>	-	12	12.76	14.5	mA
"H" Level input	V <sub>IH</sub>	-	0.7*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.3*V <sub>DD</sub>	V
"H" Level output	V <sub>OH</sub>	-	0.7*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.3*V <sub>DD</sub>	V

## Optical Characteristics:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	CR ≥ 10	75	85	-	°	
	Bottom		75	85	-	°	
	Left		75	85	-	°	
	Right		75	85	-	°	
Contrast Ratio	CR	-	600	800	-	-	
Luminance	L <sub>V</sub>	I <sub>LED</sub> = 40 mA	646	808	1211	cd/m <sup>2</sup>	
Response Time (Rise + Fall)	T <sub>R</sub> + T <sub>F</sub>	T <sub>OP</sub> = 25°C	-	25	50	ms	
Chromaticity	Red	X <sub>R</sub>	-	.508	.558	.608	-
		Y <sub>R</sub>	-	.273	.323	.373	-
	Green	X <sub>G</sub>	-	.245	.295	.345	-
		Y <sub>G</sub>	-	.547	.597	.647	-
	Blue	X <sub>B</sub>	-	.100	.150	.200	-
		Y <sub>B</sub>	-	.027	.077	.127	-
	White	X <sub>W</sub>	-	.228	.278	.328	-
		Y <sub>W</sub>	-	.284	.334	.360	-

## Driver/Controller Information

Built-in FL7703NI Driver: <https://support.newhavendisplay.com/hc/en-us/articles/4688762082071-FL7703NI>

Built-in FT5426-003 Controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414392845079-FT5x26>





## Capacitive Touch Panel Registers

Register No.	Access	Register Name	Bits	Value	Description
01h	RO	Gesture ID	[7:0]	1Ch	Swipe Up
				14h	Swipe Down
				10	Swipe Left
				18	Swipe Right
				48	Zoom In
				49	Zoom Out
				00	No gesture
02h	RO	Touch Points	[7:0]	0-Ah	0: No touch detected A: 10 touch points detected
03h	RO	TOUCH1_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
03h	RO	TOUCH1_XH	[3:0]	0-1	Upper 4 bits of X touch coordinate
04h	RO	TOUCH1_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
05h	RO	TOUCH1_YH	[3:0]	0-1	Upper 4 bits of Y touch coordinate
06h	RO	TOUCH1_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
07h	RO	TOUCH1_Weight	[7:0]		Touch Weight
08h	RO	TOUCH1_Misc	[3:0]	00-0Fh	Touch Area
09h	RO	TOUCH2_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
09h	RO	TOUCH1_XH	[3:0]	0-1	Upper 4 bits of X touch coordinate
0Ah	RO	TOUCH2_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
0Bh	RO	TOUCH2_YH	[3:0]	0-1	Upper 4 bits of Y touch coordinate
0Ch	RO	TOUCH2_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
0Dh	RO	TOUCH2_Weight	[7:0]		Touch Weight
0Eh	RO	TOUCH2_Misc	[3:0]	00-0Fh	Touch Area
0Fh	RO	TOUCH3_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
0Fh	RO	TOUCH3_XH	[3:0]	0-1	Upper 4 bits of X touch coordinate
10	RO	TOUCH3_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
11h	RO	TOUCH3_YH	[3:0]	0-1	Upper 4 bits of Y touch coordinate
12h	RO	TOUCH3_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
13h	RO	TOUCH3_Weight	[7:0]		Touch Weight
14h	RO	TOUCH3_Misc	[3:0]	00-0Fh	Touch Area
15h	RO	TOUCH4_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
15h	RO	TOUCH4_XH	[3:0]	0-1	Upper 4 bits of X touch coordinate
16h	RO	TOUCH4_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
17h	RO	TOUCH4_YH	[3:0]	0-1	Upper 4 bits of Y touch coordinate
18h	RO	TOUCH4_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
1Ah	RO	TOUCH4_Misc	[3:0]	00-0Fh	Touch Area
1Bh	RO	TOUCH5_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved



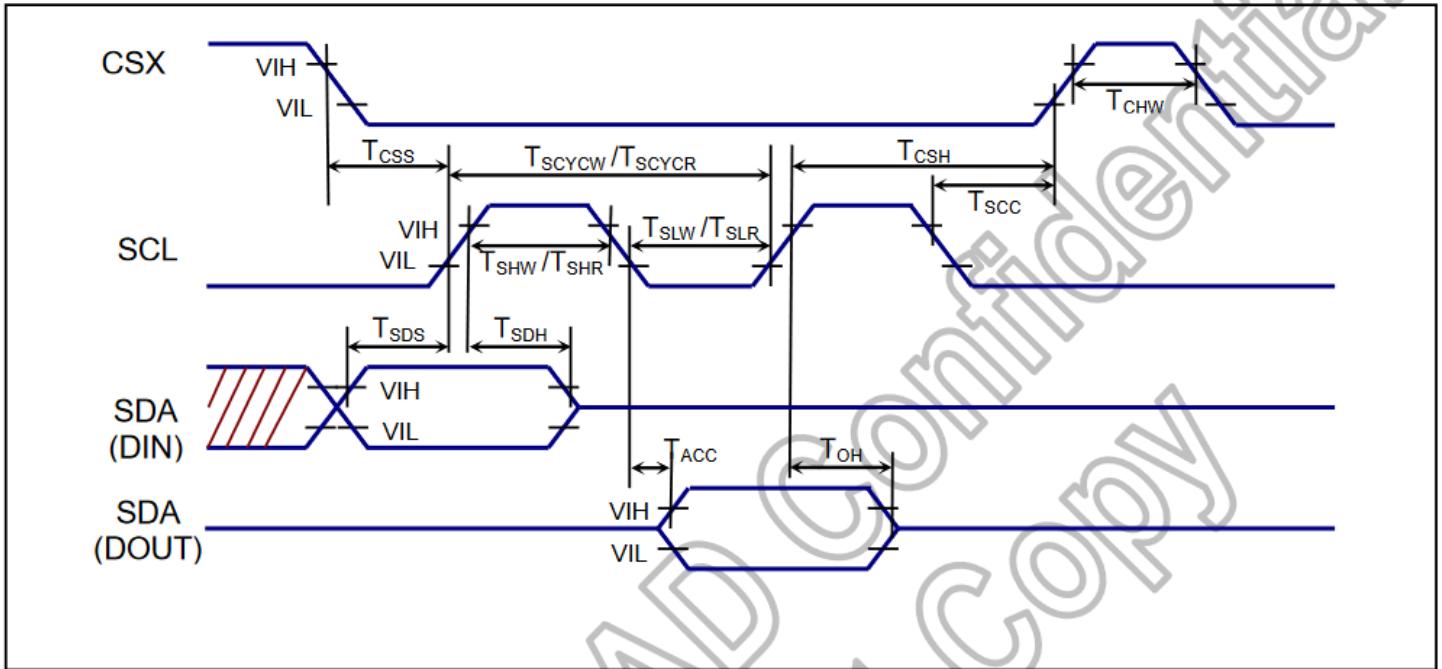
Register No.	Access	Register Name	Bits	Value	Description
1Bh	RO	TOUCH5_XH	[3:0]	0 -1	Upper 4 bits of X touch coordinate
1Ch	RO	TOUCH5_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
1Dh	RO	TOUCH5_YH	[3:0]	0 -1	Upper 4 bits of Y touch coordinate
1Eh	RO	TOUCH5_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
1Fh	RO	TOUCH5_Weight	[7:0]		Touch Weight
20	RO	TOUCH5_Misc	[3:0]	00-0Fh	Touch Area
21h	RO	TOUCH6_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
21h	RO	TOUCH6_XH	[3:0]	0 -1	Upper 4 bits of X touch coordinate
22h	RO	TOUCH6_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
23h	RO	TOUCH6_YH	[3:0]	0 -1	Upper 4 bits of Y touch coordinate
24h	RO	TOUCH6_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
25h	RO	TOUCH6_Weight	[7:0]		Touch Weight
26h	RO	TOUCH6_Misc	[3:0]	00-0Fh	Touch Area
27h	RO	TOUCH7_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
27h	RO	TOUCH7_XH	[3:0]	0 -1	Upper 4 bits of X touch coordinate
28h	RO	TOUCH7_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
29h	RO	TOUCH7_YH	[3:0]	0 – 1	Upper 4 bits of Y touch coordinate
2Ah	RO	TOUCH7_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
2Bh	RO	TOUCH7_Weight	[7:0]		Touch Weight
2Ch	RO	TOUCH7_Misc	[3:0]	00-0Fh	Touch Area
2Dh	RO	TOUCH8_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
2Dh	RO	TOUCH8_XH	[3:0]	0 – 1	Upper 4 bits of X touch coordinate
2Eh	RO	TOUCH8_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
2Fh	RO	TOUCH8_YH	[3:0]	0 – 1	Upper 4 bits of Y touch coordinate
30	RO	TOUCH8_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
31h	RO	TOUCH8_Weight	[7:0]		Touch Weight
32h	RO	TOUCH8_Misc	[3:0]	00-0Fh	Touch Area
33h	RO	TOUCH9_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
33h	RO	TOUCH9_XH	[3:0]	0 – 1	Upper 4 bits of X touch coordinate
34h	RO	TOUCH9_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
35h	RO	TOUCH9_YH	[3:0]	0 – 1	Upper 4 bits of Y touch coordinate
36h	RO	TOUCH9_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
37h	RO	TOUCH9_Weight	[7:0]		Touch Weight
38h	RO	TOUCH9_Misc	[3:0]	00 – 0Fh	Touch Area
39h	RO	TOUCH10_Event_Flag	[7:6]	0	Put Down
				1	Put Up
				2	Contact
				3	Reserved
39h	RO	TOUCH10_XH	[3:0]	0 – 1	Upper 4 bits of X touch coordinate
3Ah	RO	TOUCH10_XL	[7:0]	00 – FFh	Lower 8 bits of X touch coordinate
3Bh	RO	TOUCH10_YH	[3:0]	0 – 1	Upper 4 bits of Y touch coordinate
3Ch	RO	TOUCH10_YL	[7:0]	00 - FFh	Lower 8 bits of Y touch coordinate



Register No.	Access	Register Name	Bits	Value	Description
3Dh	RO	TOUCH10_Weight	[7:0]	00-FFh	Touch Weight
3Eh	RO	TOUCH10_Misc	[3:0]	00-0Fh	Touch Area
A1h	RO	ID_G_LIB_VERSION_H	[7:0]	00-FFh	App library version high-byte Default: 0
A2h	RO	ID_G_LIB_VERSION_L	[7:0]	00-FFh	App library version low-byte Default: 1h
A3h	RO	ID_G_CHIPER_HIGH	[7:0]	00-FFh	Chip Vendor ID Default: 54
A6h	RO	ID_G_FIRMID	[7:0]	00-FFh	Firmware ID Number Default: 2
A8h	RO	ID_G_VENODRID	[7:0]	00-FFh	CTPM Vendor's Chip ID Default: 79h

# Timing Characteristics-TFT

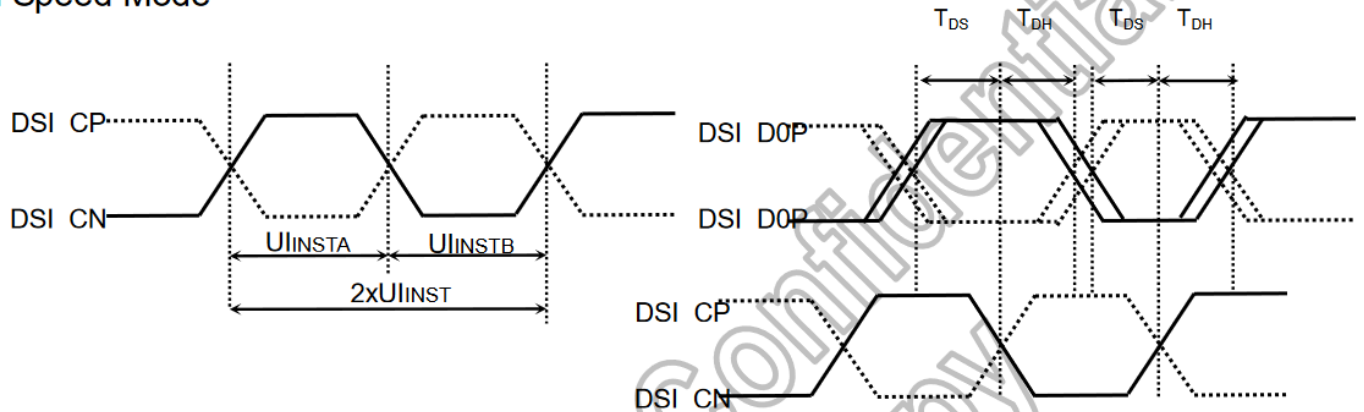
## Serial Interface



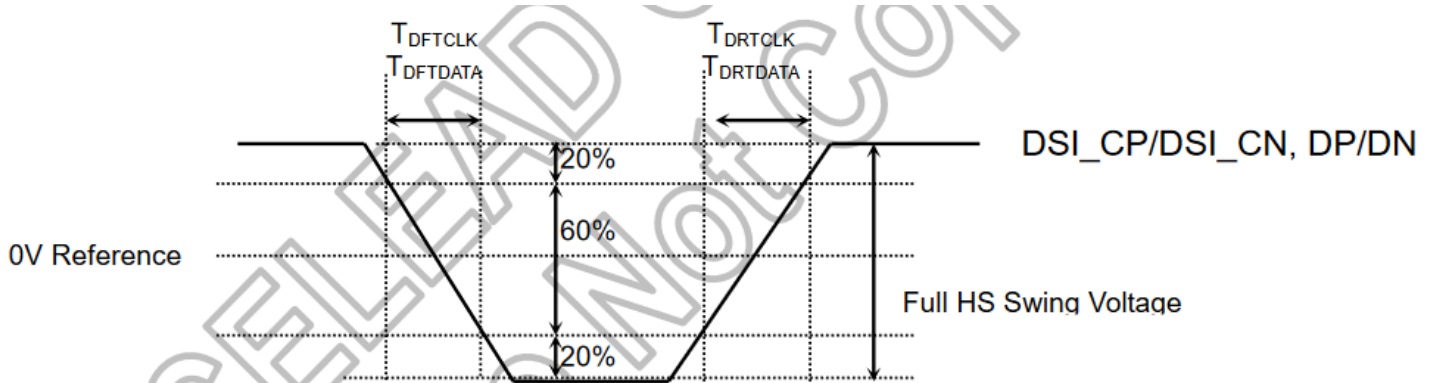
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	$t_{CSS}$	Chip select setup time (Write)	15	-	ns	-
	$t_{CSS}$	Chip select setup time (Read)	60	-		
	$t_{CSH}$	Chip select hold time (Write)	15	-		
	$t_{CSH}$	Chip select hold time (Read)	65	-		
DCX	$t_{AST}$	Address setup time	0	-	ns	-
	$t_{AHT}$	Address hold time (Write/Read)	10	-		
SCL (Write)	$t_{WC}$	Write cycle	66	-	ns	-
	$t_{WRH}$	Control pulse "H" duration	15	-		
	$t_{WRL}$	Control pulse "L" duration	15	-		
SCL (Read)	$t_{RC}$	Read cycle	150	-	ns	-
	$t_{RDH}$	Control pulse "H" duration	60	-		
	$t_{RDL}$	Control pulse "L" duration	60	-		
SDA (Input)	$t_{DS}$	Data setup time	10	-	ns	For maximum $C_L=30pF$ For minimum $C_L=8pF$
	$t_{DH}$	Data hold time	10	-		
SDA (Output)	$t_{ACC}$	Read access time	-	100	ns	
	$t_{OH}$	Output disable time	10	-		

## DSI Interface

### High Speed Mode



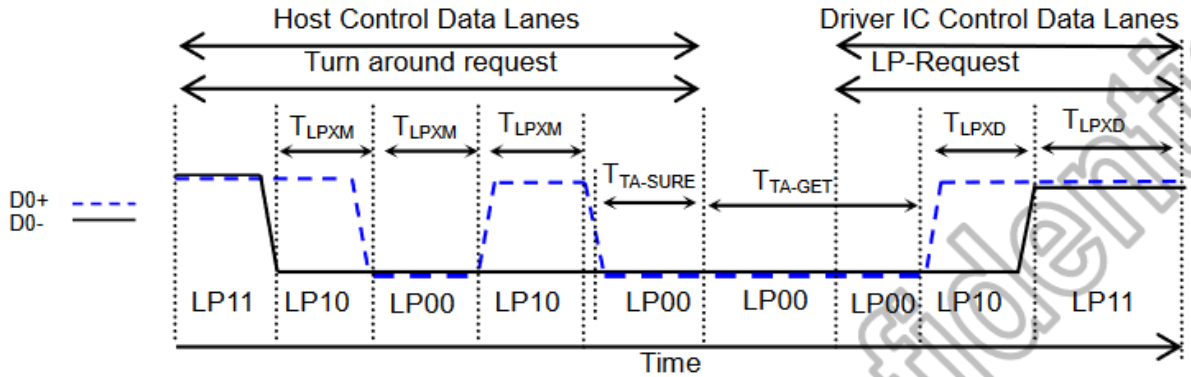
**Figure 7-4: DSI clock timing Characteristics**



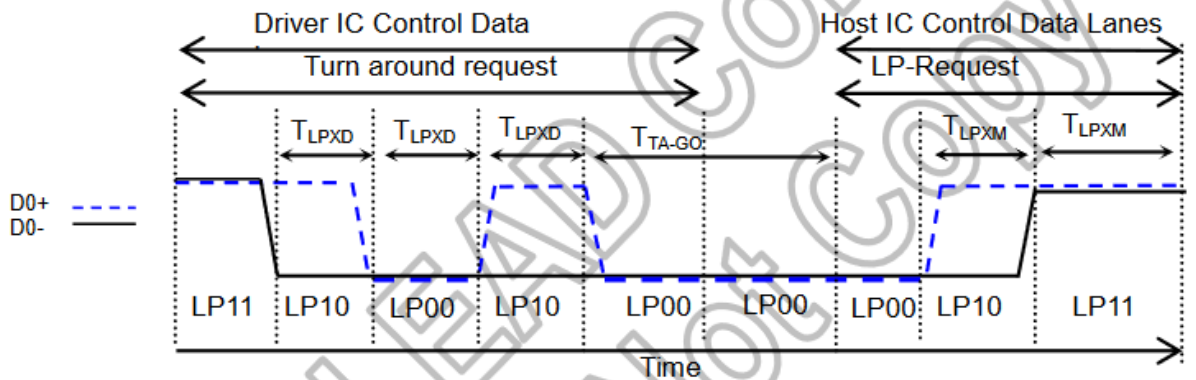
**Figure 7-5: Rising and falling time on clock and data channel**

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Double UI instantaneous	$2xU_{INST}$	4LANE: 3.30 3LANE: 2.85 @ VDDD=1.8V	-	25	ns
	UI instantaneous	$U_{INSTA}$ $U_{INSTB}$	4LANE: 1.67 3LANE: 1.43 @ VDDD=1.8V	-	12.5	ns
DP/DN	Data to clock setup time	$T_{DS}$	$0.15xUI$	-	-	ps
	Data to clock hold time	$T_{DH}$	$0.15xUI$	-	-	ps
DSI_CP/ DSI_CN	Differential rise time for clock	$T_{DRTCLK}$	150	-	$0.3UI$	ps
	Differential fall time for clock	$T_{DFTCLK}$	150	-	$0.3UI$	ps
DP/DN	Differential rise time for data	$T_{DRTDATA}$	150	-	$0.3UI$	ps
	Differential fall time for data	$T_{DFTDATA}$	150	-	$0.3UI$	ps

## Low Power Mode



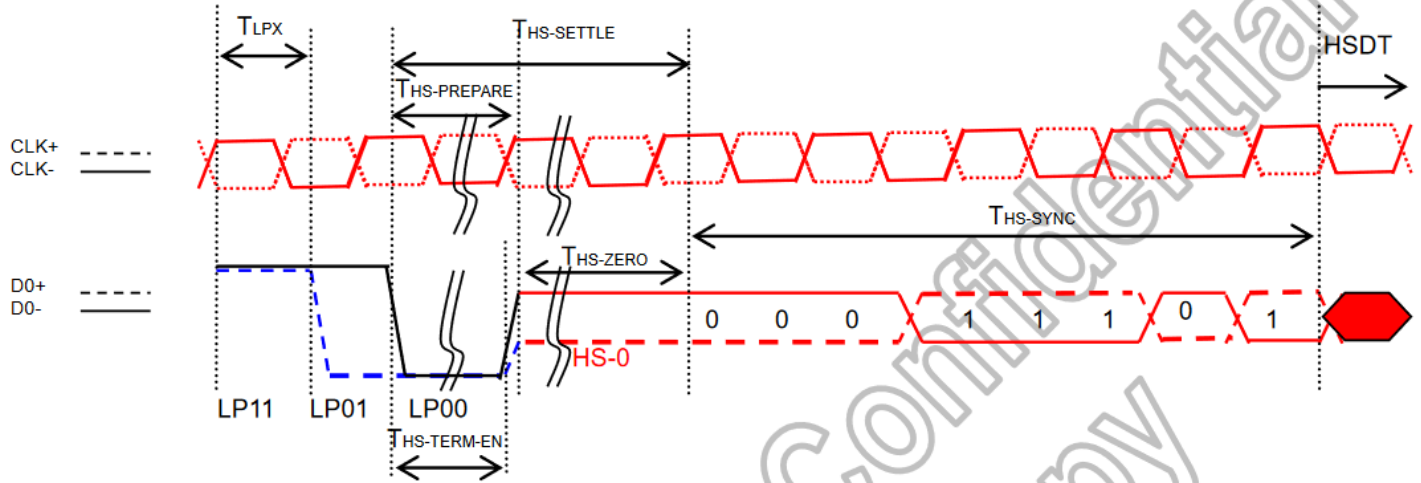
**Figure 7-6: BTA from HOST to Display Module Timing**



**Figure 7-7: BTA from Display Module Timing to HOST**

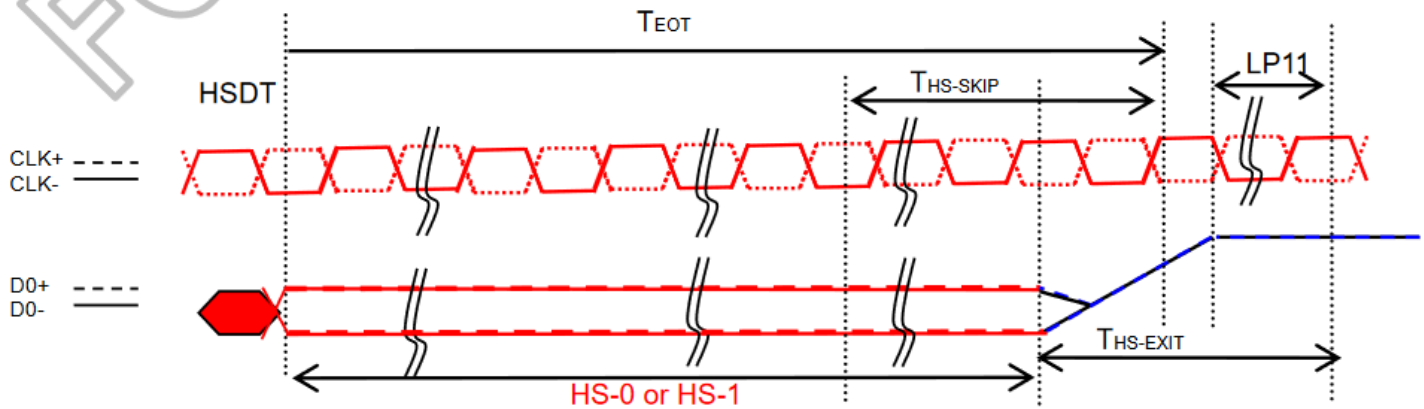
Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11 Host → Display module	$T_{LPXM}$	50	-	-	ns
	Length of LP-00/LP01/LP10/LP11 Display module → Host	$T_{LPXD}$	50	-	-	ns
	Time-out before the MPU start driver	$T_{TA-SURE}$	$T_{LPXD}$	-	$2 \times T_{LPXD}$	ns
	Time to drive LP-00 by display module	$T_{TA-GET}$	$5 \times T_{LPXD}$	-	-	ns
	Time to drive LP-00 after turnaround request Host	$T_{TAGO}$	$4 \times T_{LPXD}$	-	-	ns

## DSI BURSTS



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11	T <sub>LPX</sub>	50	-	-	ns
	Time to Driver LP-00 to prepare for HS transmission	T <sub>HS-PREPARE</sub>	40+4UI	-	85+6UI	ns
	Time to enable data receiver line termination	T <sub>HS-TERM-EN</sub>	-	-	35+4xUI	ns
	Time to drive LP-00 by display module	T <sub>TA-GET</sub>	5xT <sub>LPXD</sub>	-	-	ns
	Time to drive LP-00 after turnaround request Host	T <sub>TAGO</sub>	4xT <sub>LPXD</sub>	-	-	ns

Table 7-5: DSI Low Power Mode to High Speed Mode Timing



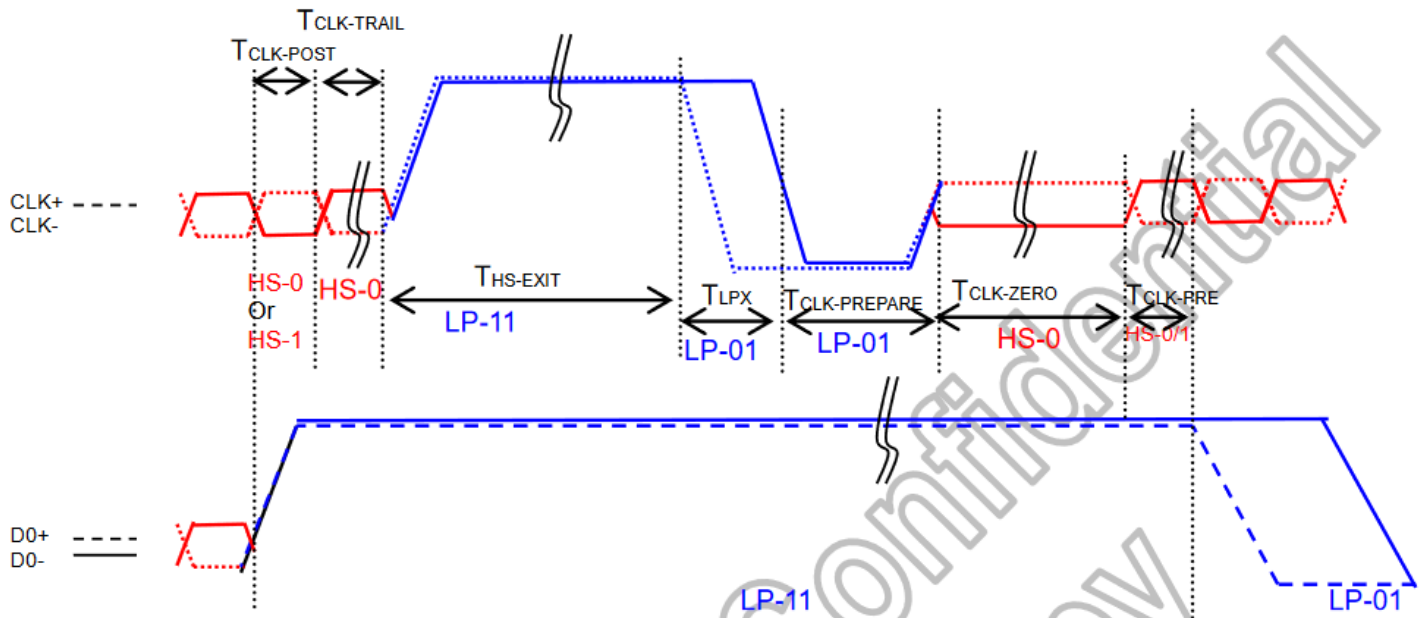
**NOTE:**

If the last bit is HS-0, the transmitter changes from HS-0 to HS-1

If the last bit is HS-0, the transmitter changes from HS-1 to HS-0

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Time-Out at Display Module to Ignore Transition Period of EoT	T <sub>HS-SKIP</sub>	40	-	55+4xUI	ns
	Time to Driver LP-11 after HS Burst	T <sub>HS-EXIT</sub>	100	-	-	ns

Table 7-6: DSI Low Power Mode to High Speed Mode Timing

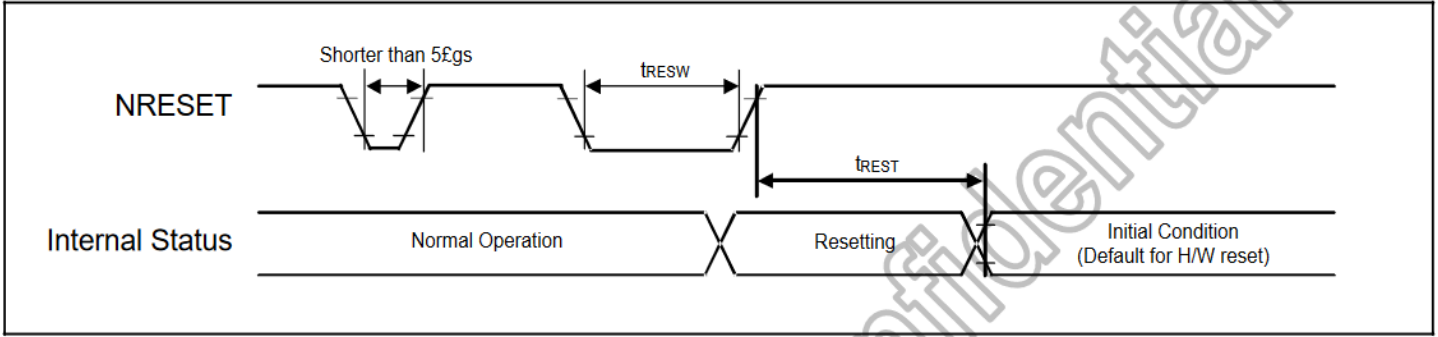


Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Time that the MCU shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	$T_{CLK-POST}$	$60+52xUI$	-	-	ns
	Time to drive HS differential state after last payload clock bit of a HS transmission burst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

**Table 7-7: Clock Lanes High Speed Mode to/from Low Power Mode Timing**



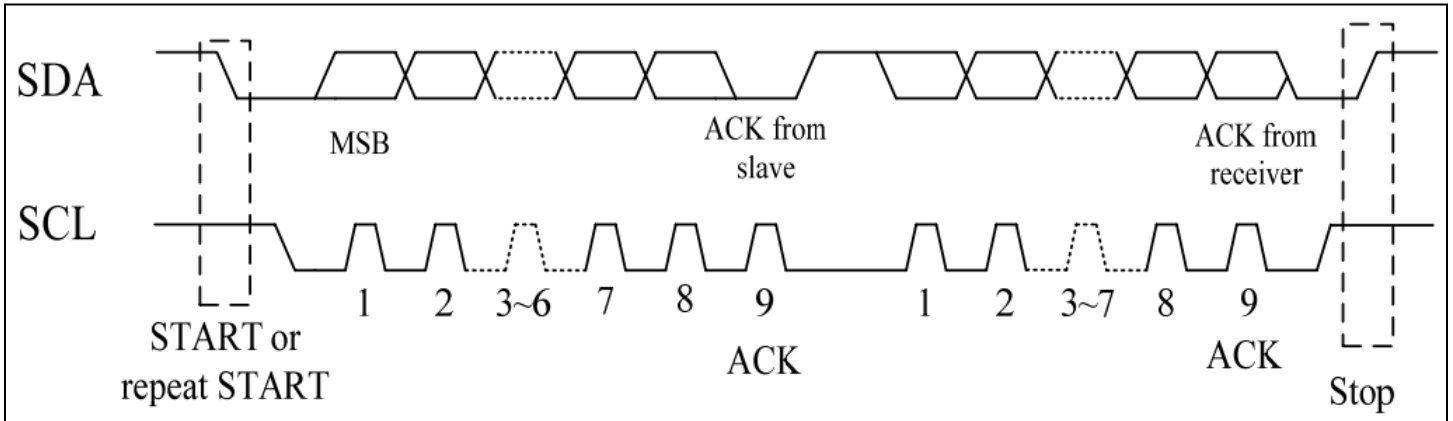
### Reset Input Timing



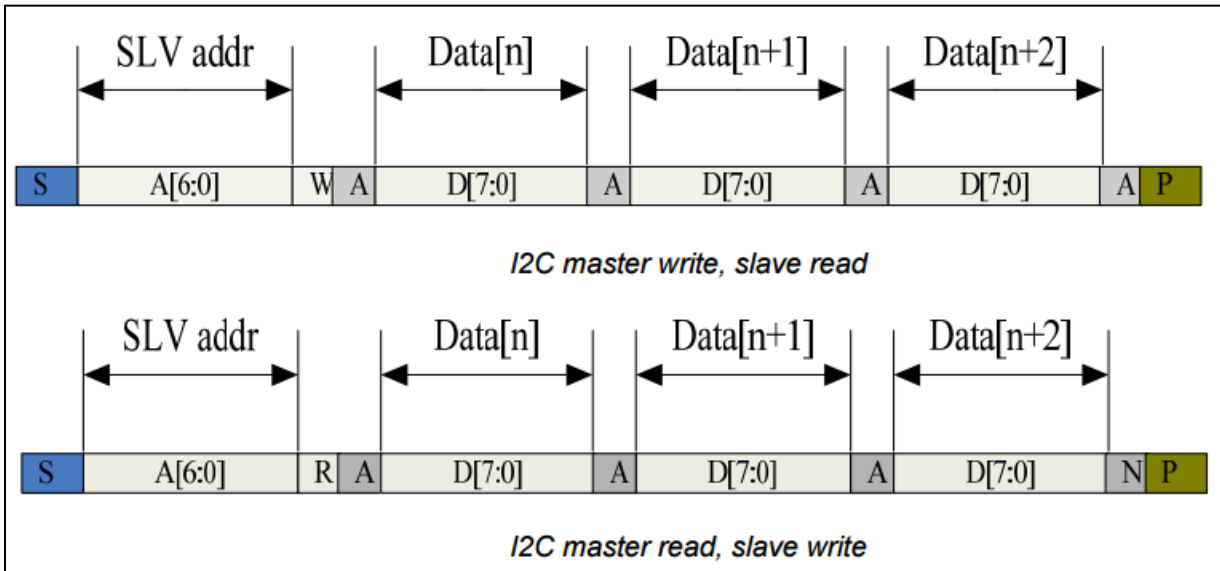
Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width <sup>(1)</sup>	NRESET	10	-	-	-	µs
tREST	Reset complete time <sup>(2)</sup>	-	15	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

## Timing Characteristics – Capacitive Touch Panel

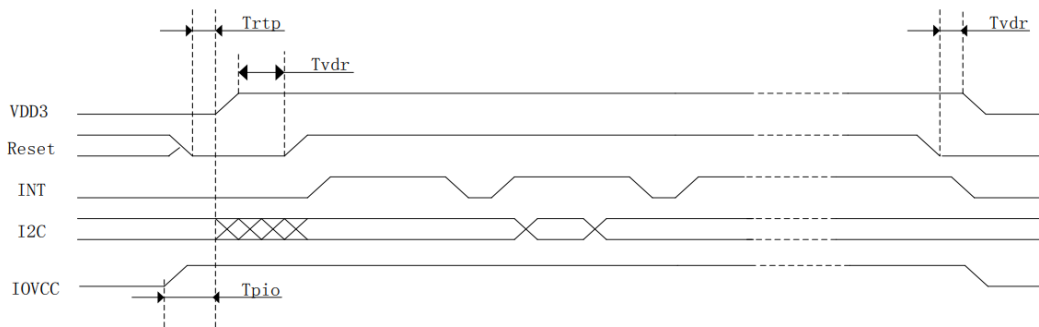
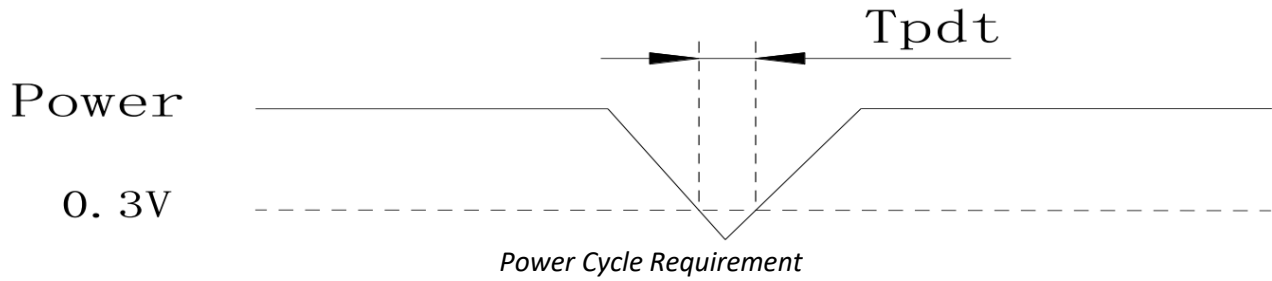
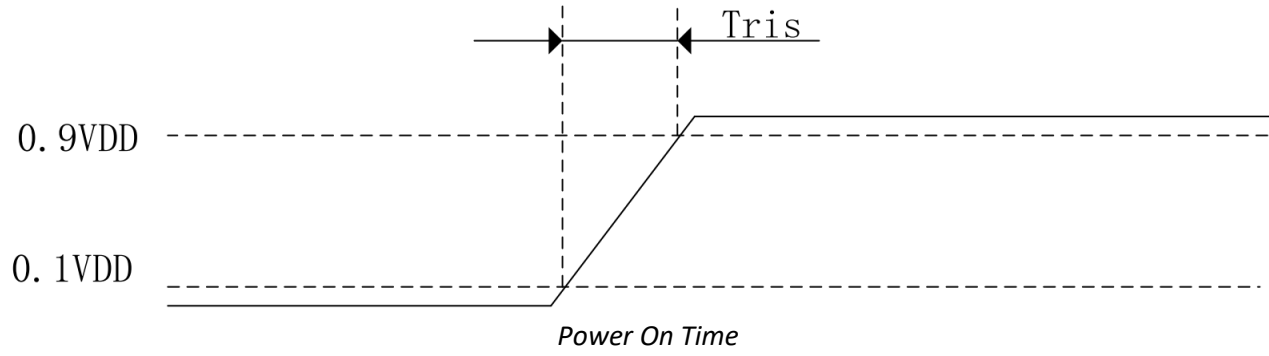
### Data Transfer Format



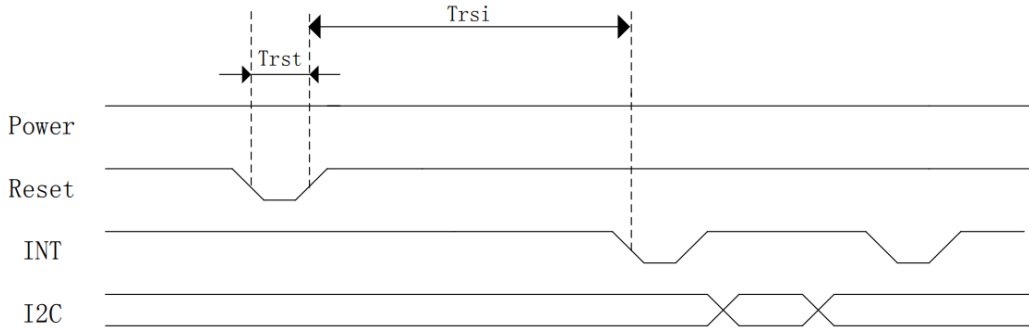
Parameter	Min	Max	Unit
SCL Frequency	0	400	KHz
Bus free time between a STOP & START condition	1.3	-	μs
Hold time Repeated START condition	0.6	-	μs
Data Setup Time	100	-	ns
Setup time for a repeated START condition	0.6	-	μs
Setup time for a STOP condition	0.6	-	μs



**Power ON/Reset Sequence**



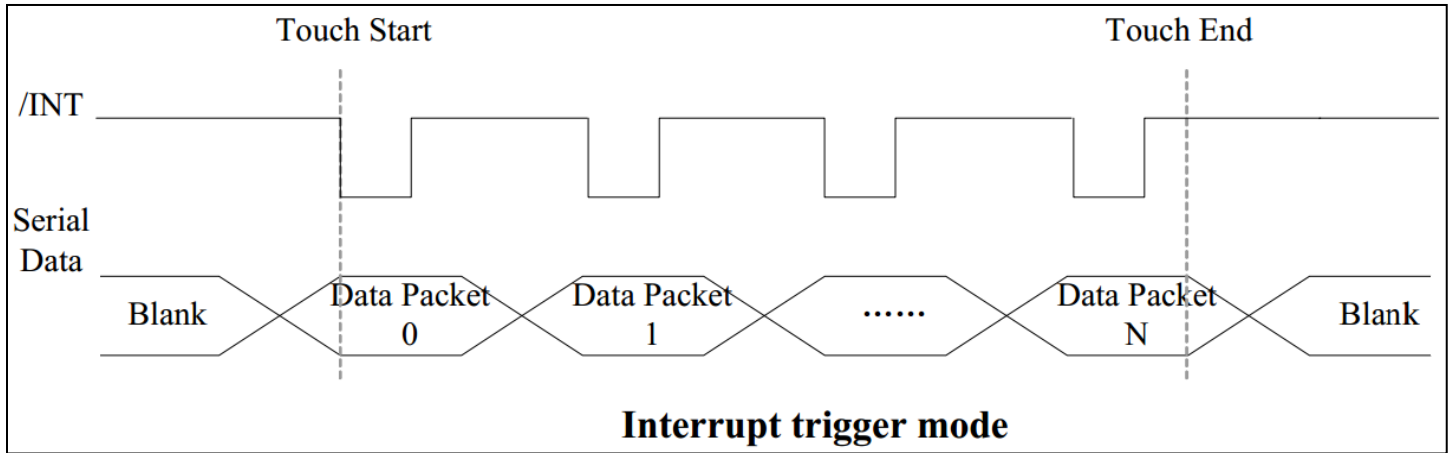
### Power ON Sequence



### Reset sequence

Parameter	Description	Min	Max	Unit
Tris	Rise time from 0.1V <sub>DD</sub> to 0.9V <sub>DD</sub>	-	5	ms
Tpdt	Time of the voltage of supply being below 0.3V	5	-	ms
Trtp	Time of resetting to be low before powering on	100	-	μs
Tpon	Time to start reporting after power on	-	200	ms
Tvdr*	Reset time after applying V <sub>DD</sub>	1	-	ms
Trsi	Time to start reporting after reset	-	200	ms
Trst*	Reset Time	1	-	ms

\*Note: If Reset is tied to V<sub>DD</sub> data corruption can occur



**Sample code to read touch data:**

```
i2c_start();
i2c_tx(0x70);           //Slave Address (Write)
i2c_tx(0x00);          //Start reading address
i2c_stop();

i2c_start();
i2c_tx(0x71);           //Slave Address (Read)
for(i=0x00;i<0x1F;i++)
{touchdata_buffer[i] = i2c_rx(1);}
i2c_stop();
```

**Sample code to overwrite default register values:**

```
i2c_start();
i2c_tx(0x70);           //Slave Address (Write)
i2c_tx(0xA4);           //ID_G_Mode
i2c_tx(0x01);           //Disable interrupt status to host
i2c_stop();
```

## Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C , 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C , 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 96hrs	1,2
High Temperature / Humidity Storage	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+50°C , 90% RH , 96hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-20°C,60min -> 70°C,60min = 1 cycle 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz , 5G Acceleration 60 sec in each of 3 directions (X,Y,Z) For 30 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: ±4kV 150pF/330Ω, 5 Times Contact: ±2kV 150pF/330Ω, 5 Times	

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.