NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD-2.1-480480AF-ASXP-CTP

TFT Liquid Crystal Display

NHD-	Newhaven Display
2.1-	2.1" Diagonal
480480-	480xRGBx480 Pixels
AF-	Model
A-	Built-in Driver / No Controller
S-	High Brightness, White LED Backlight
X-	TFT
P-	IPS, Wide Temperature
CTP-	Capacitive Touch Panel

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REACH Compliant

RoHS Compliant

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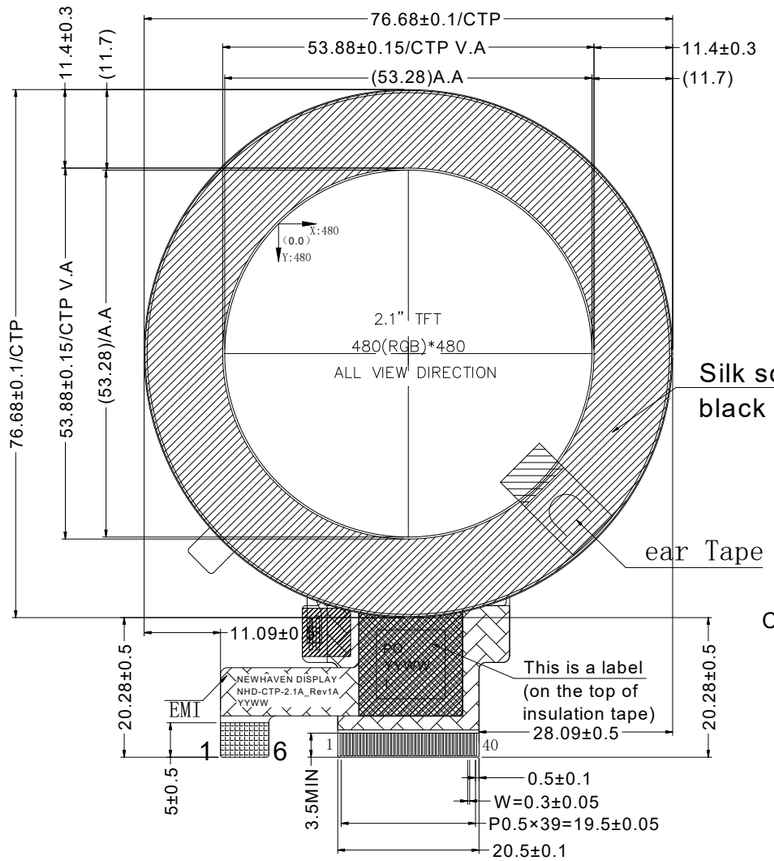
Additional Resources

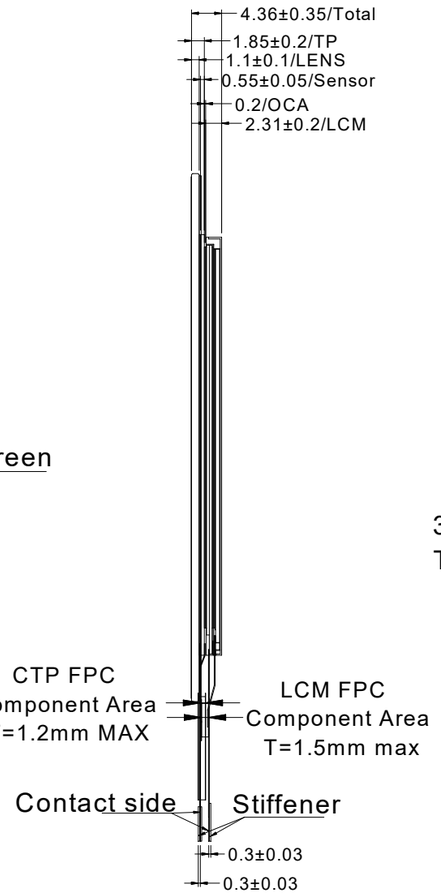
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** 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

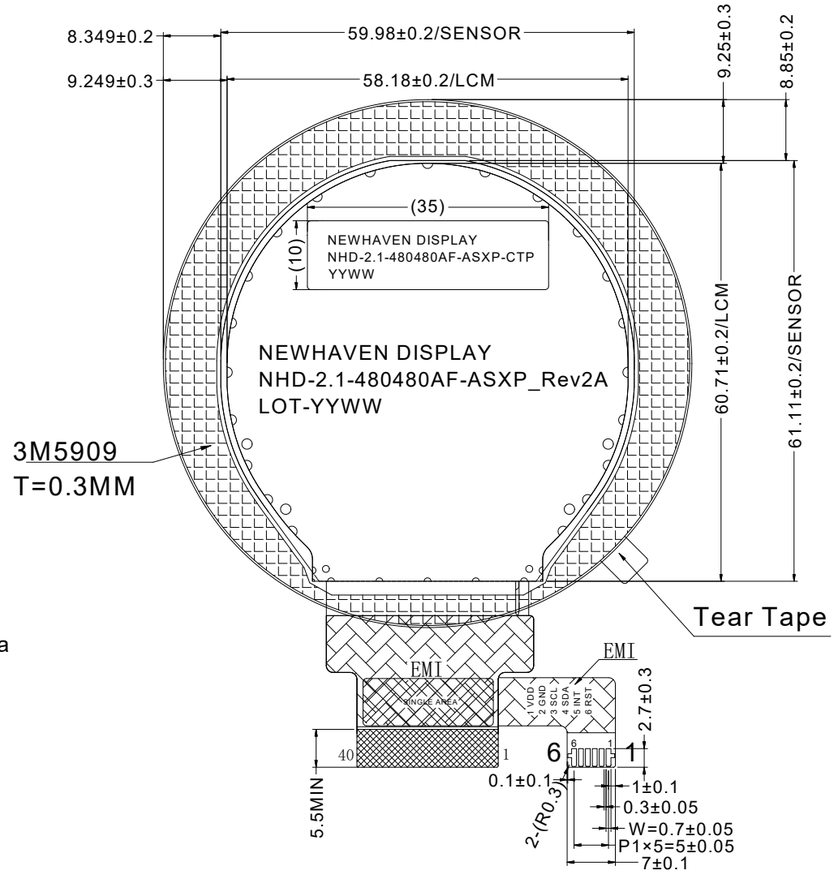
Document Revision History

Revision	Date	Description	Changed By
-	06/14/2026	Initial Release	KL

Mechanical Drawing







TFT

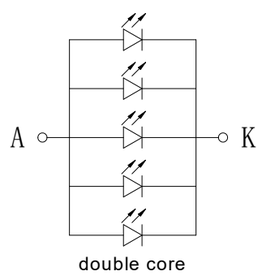
PIN	SYMBOL
1	LED_K
2	LED_A
3	VDD
4	GND
5	DN0
6	DP0
7	GND
8	CN
9	CP
10	GND
11	VS
12	HS
13	PCLK
14	DE
15	DB0(B0)
16	DB1(B1)
17	DB2(B2)
18	DB3(B3)
19	DB4(B4)
20	DB5(B5)
21	DB8(G0)
22	DB9(G1)
23	DB10(G2)
24	DB11(G3)
25	DB12(G4)
26	DB13(G5)
27	DB16(R0)
28	DB17(R1)
29	DB18(R2)
30	DB19(R3)
31	DB20(R4)
32	DB21(R5)
33	RESETX
34	CSX
35	SCL
36	DCX
37	SDA
38	IM0
39	IM1
40	IM2

CTP

1	VDD3.3V
2	GND
3	SCL3.3V
4	SDA3.3V
5	INT3.3V
6	RESET3.3V

Product Description: 2.1” 480x480 IPS TFT w/ Capacitive Touch

1. Driver IC: ST7701S TFT, FT3427 CTP
2. Interface: 18-bit Parallel RGB, 1-lane MIPI DSI TFT, I²C CTP
3. Power Requirement: 3.0V TFT, 6.0V/100mA Backlight, 3.0V CTP
4. Optical Features: Normally Black, Transmissive, 850cd/m²
5. Recommended FFC Connector:
   TFT: 40pin 0.5mm pitch; Ex. Molex 54104-4096
   CTP: 6pin 1.0mm pitch
6. Key Features: Built-in EMI Shielding, 5-point Multitouch



Backlight LED Circuit:1×5=5(LED)
If=100mA;Vf=5.4~6.6V
Lifespan: 30,000 hours

Standard Tolerance:
(Unless otherwise specified)
Linear: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-2.1-480480AF-ASXP-CTP
Revision: -

Unless otherwise specified:
• Dimensions are in Millimeters
• Third Angle Projection

Drawn By: K. Lewis
Approved By: K.. Lewis
Drawn Date: 05/22/2026
Approved Date: 05/22/2026

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Pin Description

TFT

Pin No.	Symbol	External Connection	Function Description
1	LED_K	Power Supply	Backlight Cathode (Ground)
2	LED_A	Power Supply	Backlight Anode (100mA @ 6V)
3	VDD	Power Supply	Supply Voltage for LCD and Logic (3.0V)
4	GND	Power Supply	Ground
5	DN0	MPU	MIPI DSI Differential Data signal
6	DP0	MPU	MIPI DSI Differential Data signal
7	GND	Power Supply	Ground
8	CN	MPU	MIPI DSI Differential Clock signal
9	CP	MPU	MIPI DSI Differential Clock signal
10	GND	Power Supply	Ground
11	VS	MPU	Frame Synchronizing signal for RGB interface
12	HS	MPU	Line Synchronizing signal for RGB interface
13	PCLK	MPU	Dot Clock signal for RGB interface
14	DE	MPU	Data Enable signal for RGB interface
15-20	B0-B5	MPU	Blue Data signals
21-26	G0-G5	MPU	Green Data signals
27-32	R0-R5	MPU	Red Data signals
33	RESETX	MPU	Active LOW Reset signal
34	CSX	MPU	Active LOW Chip Select signal
35	SCL	MPU	Serial Clock signal for SPI interface (rising edge)
36	DCX	MPU	Data/Command selection for SPI: '1' = Data; '0' = Command
37	SDA	MPU	Serial Data Input signal for SPI interface
38	IM0	MPU	Interface Mode Select signal
39	IM1	MPU	Interface Mode Select signal
40	IM2	MPU	Interface Mode Select signal

Recommended LCD connector: 40pin 0.5mm pitch FFC; Ex. Molex 54104-4031

Capacitive Touch Panel

Pin No.	Symbol	External Connection	Function Description
1	V_{DD}	Power Supply	Supply voltage for Logic (3.0V)
2	V_{SS}	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

Interface Selection

Pin Name	RGB + 8b_SPI (rise)	RGB + 9b_SPI (rise)	RGB + 16b_SPI (fall)	MIPI DSI	MIPI + 16b_SPI (fall)
IM0	1	0	1	1	0
IM1	0	1	1	0	1
IM2	0	0	0	1	1

IM3 (not shown) is pulled 'high' internally.

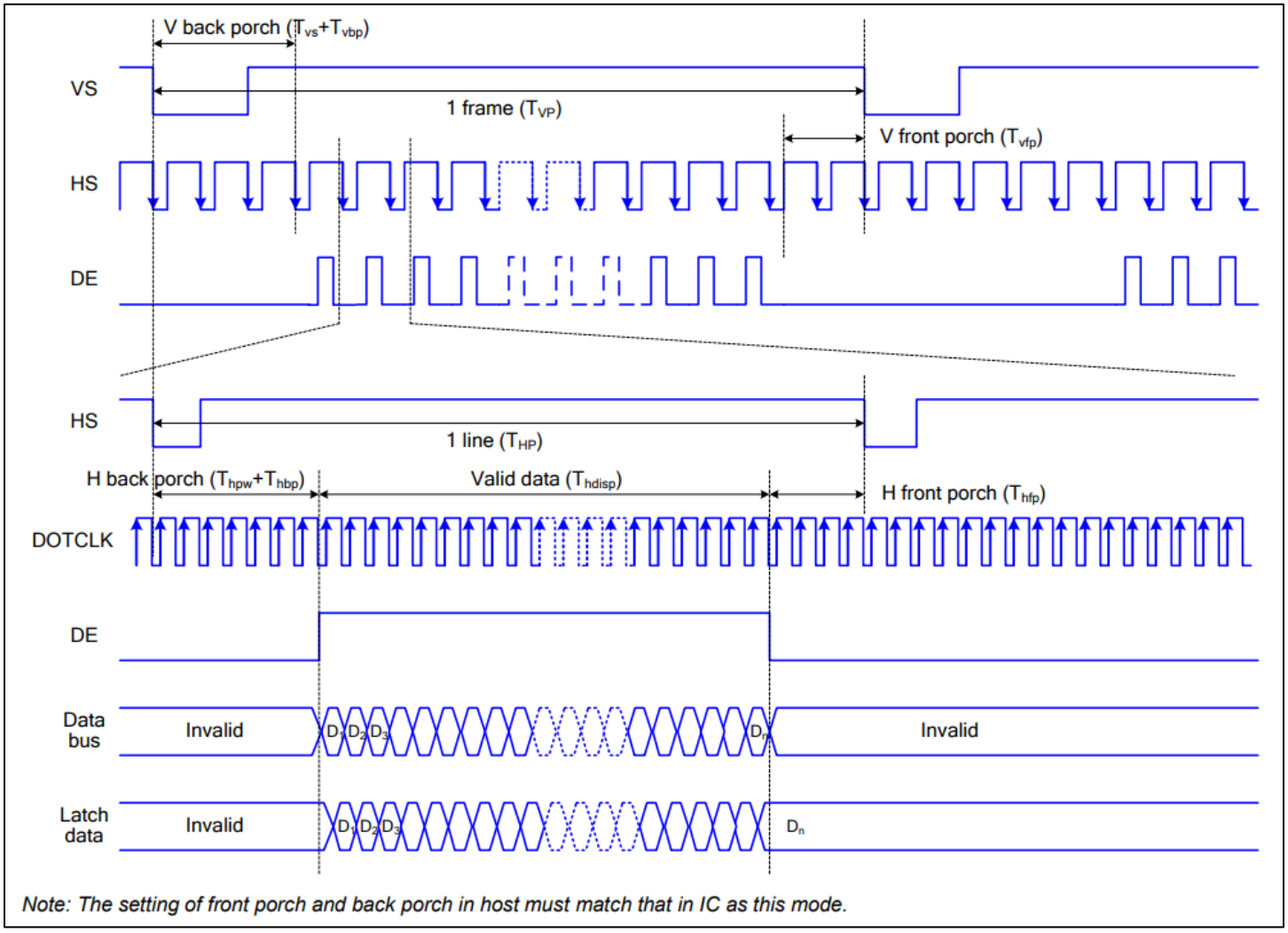
NOTE:
ST7701S requires SPI to initialize the display before sending pixel data over RGB data lines.
SPI cannot be used for sending pixel data.

RGB Interface Mode

The ST7701S driver IC is user configurable for DE Mode (mode 1) and HV Mode (mode 2) RGB interface.

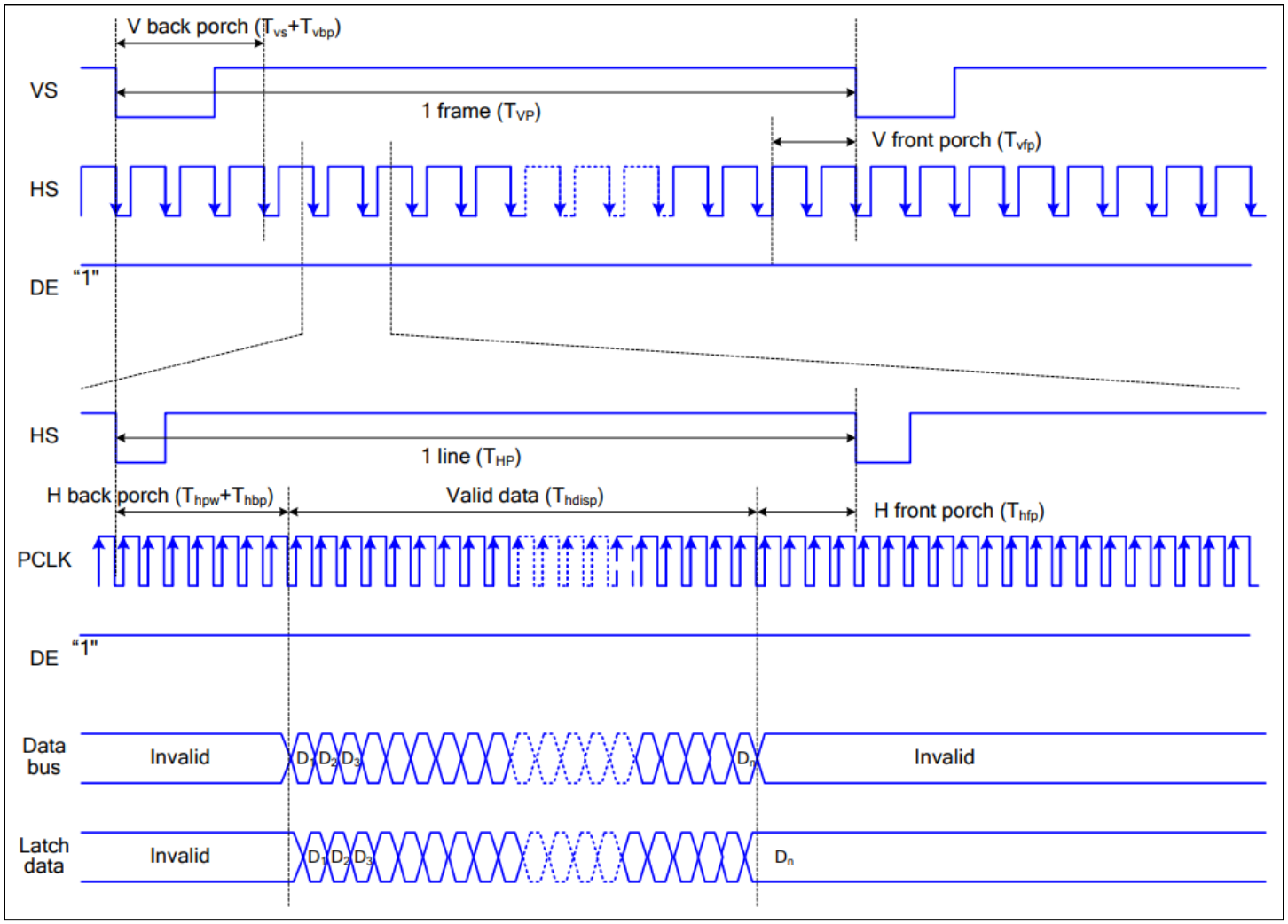
RGB Interface Mode	PCLK	DE	VS	HS	Blanking Porch Setting
DE Mode (mode 1)	Used	Used	Used	Used	Not used
HV Mode (mode 2)	Used	Not used	Used	Used	Used

DE Mode is enabled when the DE/HV bit of RGBCTR (0xC3) command is set to "0", and DE signal is high for valid pixel data. The PCLK, HS, and VS signals are used for clocking the display data and must always be used by host controller.



Note: The setting of front porch and back porch in host must match that in IC as this mode.

HV Mode is enabled when the DE/HV bit of RGBCTR (0xC3) command is set to "1", DE signal is ignored. VS back porch is defined by VBP_HVRGB [7:0] of RGBCTR command, and HS back porch is defined by HBP_HVRGB [7:0] of RGBCTR command. VS front porch is not used in this mode.



RGB Input Timing:

Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	2	-	255	Clock
Horizontal Sync. Back Porch	hbp	2	-	255	Clock
Horizontal Sync. Front Porch	hfp	2	-	-	Clock
Vertical Sync. Width	vs	2	-	255	Line
Vertical Sync. Back Porch	vbp	2	-	255	Line
Vertical Sync. Front Porch	vfp	2	-	-	Line

VIPF[2:0] bits of Interface Pixel Format (0x3A) command can be used to select between 18-bit/pixel and 16-bit/pixel.

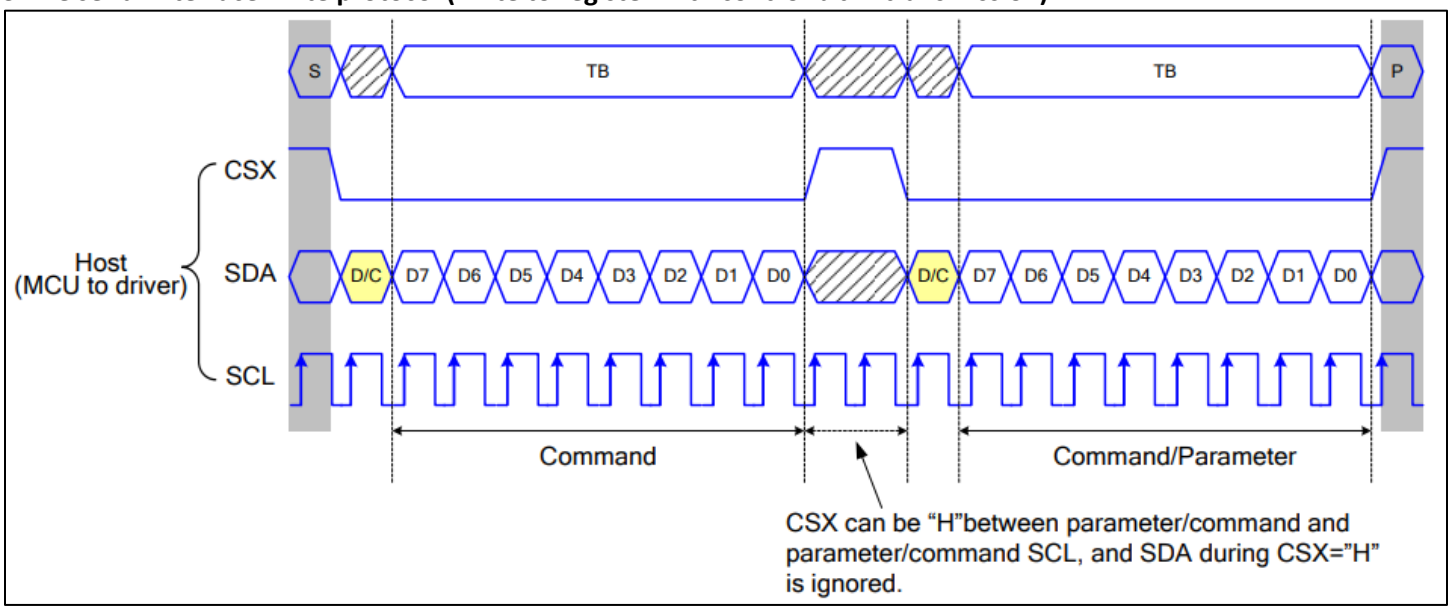
Bit	NAME	DESCRIPTION
VIPF[2:0]	Pixel Format for RGB Interface	"101"=16-bit/pixel "110"=18-bit/pixel "111"=24-bit/pixel The others=not defined

24-bit/pixel not supported in this design.

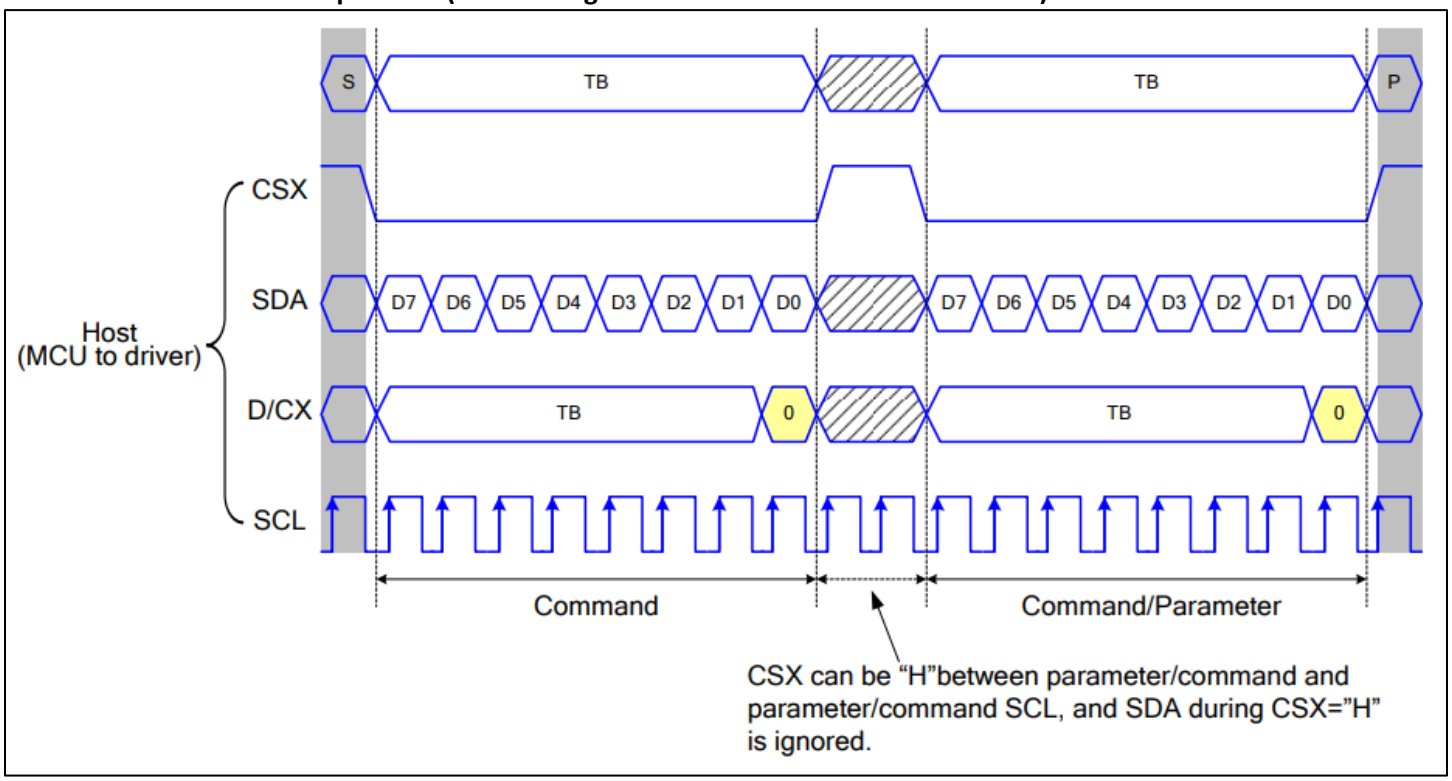
SPI Interface Mode

ST7701S requires SPI to initialize the display before sending pixel data over RGB data lines. SPI cannot be used for sending pixel data.

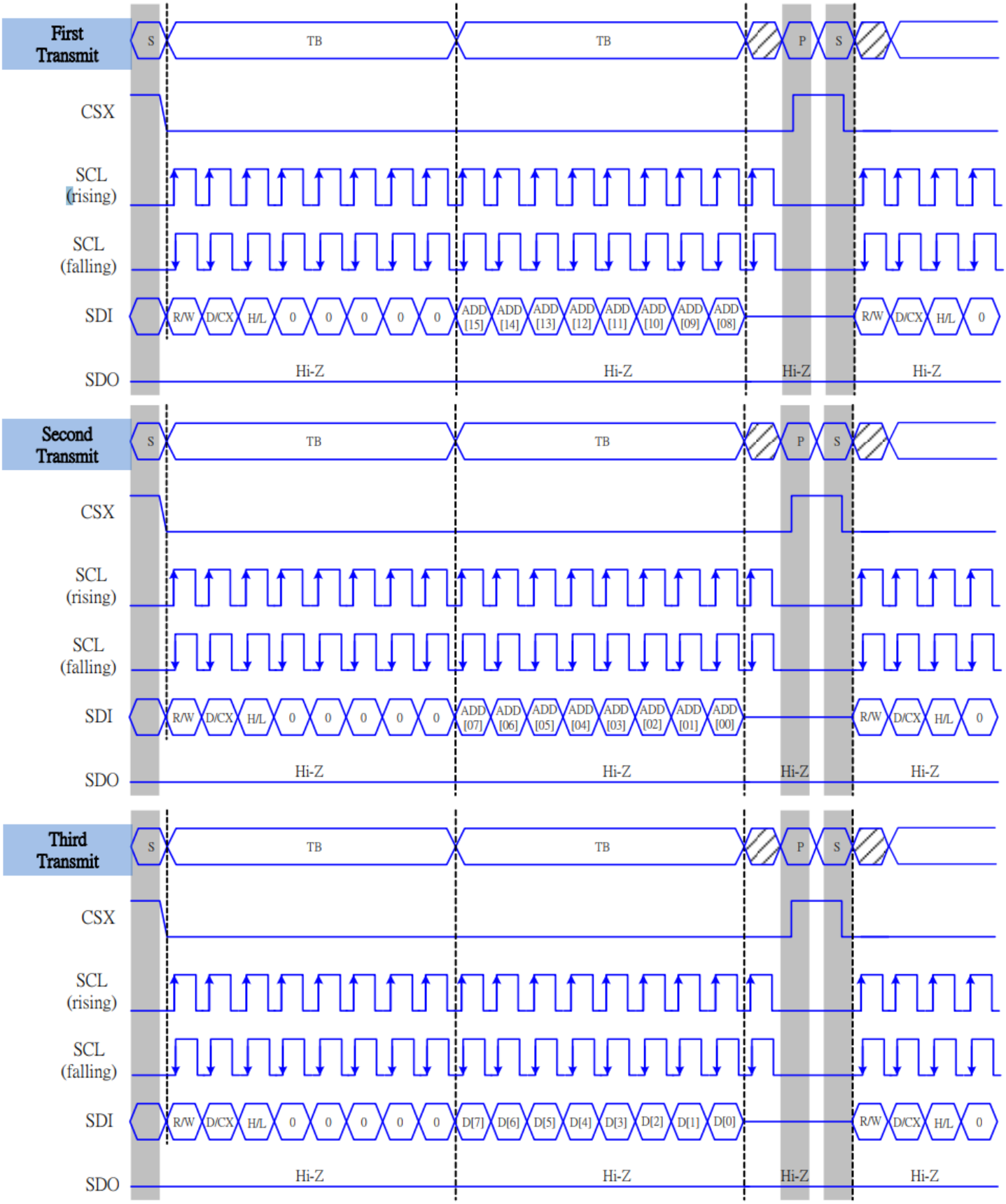
3-line serial interface write protocol (write to register with control bit in transmission)



4-line serial interface write protocol (write to register with control bit in transmission)



Serial 16-bit interface write mode



Electrical Characteristics

TFT

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V_{DD}	-	2.5	3.0	3.3	V
Supply Current	I_{DD}	V_{DD} = 3.0V	12	24	36	mA
"H" Level input	V_{IH}	-	0.7*V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.3*V_{DD}	V
"H" Level output	V_{OH}	-	0.8*V_{DD}	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.2*V_{DD}	V
Backlight Supply Current	I_{LED}	-	75	100	125	mA
Backlight Supply Voltage	V_{LED}	I_{LED} = 100mA T_{OP} = 25°C	5.4	6.0	6.6	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_{OP}	-	-20	-	+70	°C
Storage Temperature Range	T_{ST}	-	-30	-	+80	°C
Supply Voltage	V_{DD}	-	2.8	3.0	3.3	V
Supply Current – Operating	I_{DD}	-	8	12	20	mA
"H" Level input	V_{IH}	-	0.7*V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	-0.3	-	0.3*V_{DD}	V
"H" Level output	V_{OH}	-	0.7*V_{DD}	-	Vss	V
"L" Level output	V_{OL}	-	V_{SS}	-	0.3*V_{DD}	V

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	ϕY+	CR ≥ 10	-	85	-	o
	Bottom	ϕY-		-	85	-	o
	Left	θX-		-	85	-	o
	Right	θX+		-	85	-	o
Contrast Ratio		CR	-	800	1000	-	-
Luminance		L_V	I_{LED} =100mA	680	850	-	cd/m^2
Response Time (Rise + Fall)		$T_R + T_F$	T_{OP} = 25°C	-	30	35	ms
Chromaticity	Red	X_R	-	0.572	0.622	0.672	-
		Y_R	-	0.307	0.357	0.407	-
	Green	X_G	-	0.286	0.336	0.386	-
		Y_G	-	0.566	0.616	0.666	-
	Blue	X_B	-	0.082	0.132	0.182	-
		Y_B	-	0.004	0.054	0.104	-
	White	X_W	-	0.246	0.296	0.346	-
		Y_W	-	0.280	0.330	0.380	-

Driver/Controller Information

Built-in ST7701S Driver: https://support.newhavendisplay.com/hc/en-us/articles/14549586395031-ST7701S

Built-in FT3427 Controller: https://support.newhavendisplay.com/hc/en-us/articles/37060699657879-FT3427

Recommended Timing Values

Recommended RGB Timing Values:

HS Total	HFP	HBP	HS Pulse	VS Total	VFP	VBP	VS Pulse	PCLK Freq
584	50	50	4	582	50	50	2	30 MHz

Recommended MIPI Timing Values:

HSYNC	HFP	HBP	VSYNC	VFP	VBP	PCLK Freq
20	40	60	6	10	10	18.2 MHz

Capacitive Touch Panel Registers

Register No.	Access	Register Name	Bits	Value	Description
01h	RO	Gesture ID	[7:0]	1Ch 14h 10h 18h 48h 49h 00	Swipe Up Swipe Down Swipe Left Swipe Right Zoom In Zoom Out No gesture
02h	RO	Touch Points	[3:0]	0-5h	0: No touch detected 5: 5 touch points detected
03h	RO	TOUCH1_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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	[7:4]	00-0Fh	Touch Area
07h	RO	TOUCH1_Weight	[3:2]	0 1 2 3	UP Down Left Right
07h	RO	TOUCH1_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
08h	RO	TOUCH1_Misc	[7:0]		Touch Weight
09h	RO	TOUCH2_Event_Flag	[7:6]	0 1	Put Down Put Up

				2 3	Contact Reserved
09h	RO	TOUCH2_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	[7:4]	00-0Fh	Touch Area
0Dh	RO	TOUCH2_Weight	[3:2]	0 1 2 3	UP Down Left Right
0Dh	RO	TOUCH2_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
0Eh	RO	TOUCH2_Misc	[7:0]		Touch Weight
0Fh	RO	TOUCH3_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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	[7:4]	00-0Fh	Touch Area
Register No.	Access	Register Name	Bits	Value	Description
13h	RO	TOUCH3_Weight	[3:2]	0 1 2 3	UP Down Left Right
13h	RO	TOUCH3_Weight	[1:0]	0	Static

				1 2	Normal Speed High Speed
14h	RO	TOUCH3_Misc	[7:0]		Touch Weight
15h	RO	TOUCH4_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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
19h	RO	TOUCH4_Weight	[7:4]	00-0Fh	Touch Area
19h	RO	TOUCH4_Weight	[3:2]	0 1 2 3	UP Down Left Right
19h	RO	TOUCH4_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
1Ah	RO	TOUCH4_Misc	[7:0]		Touch Weight
1Bh	RO	TOUCH5_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact Reserved
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	[7:4]	00-0Fh	Touch Area
1Fh	RO	TOUCH5_Weight	[3:2]	0 1	UP Down

				2 3	Left Right
1Fh	RO	TOUCH5_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
20h	RO	TOUCH5_Misc	[7:0]		Touch Weight
21h	RO	TOUCH6_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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	[7:4]	00-0Fh	Touch Area
25h	RO	TOUCH6_Weight	[3:2]	0 1 2 3	UP Down Left Right
Register No.	Access	Register Name	Bits	Value	Description
25h	RO	TOUCH6_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
26h	RO	TOUCH6_Misc	[7:0]		Touch Weight
27h	RO	TOUCH7_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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

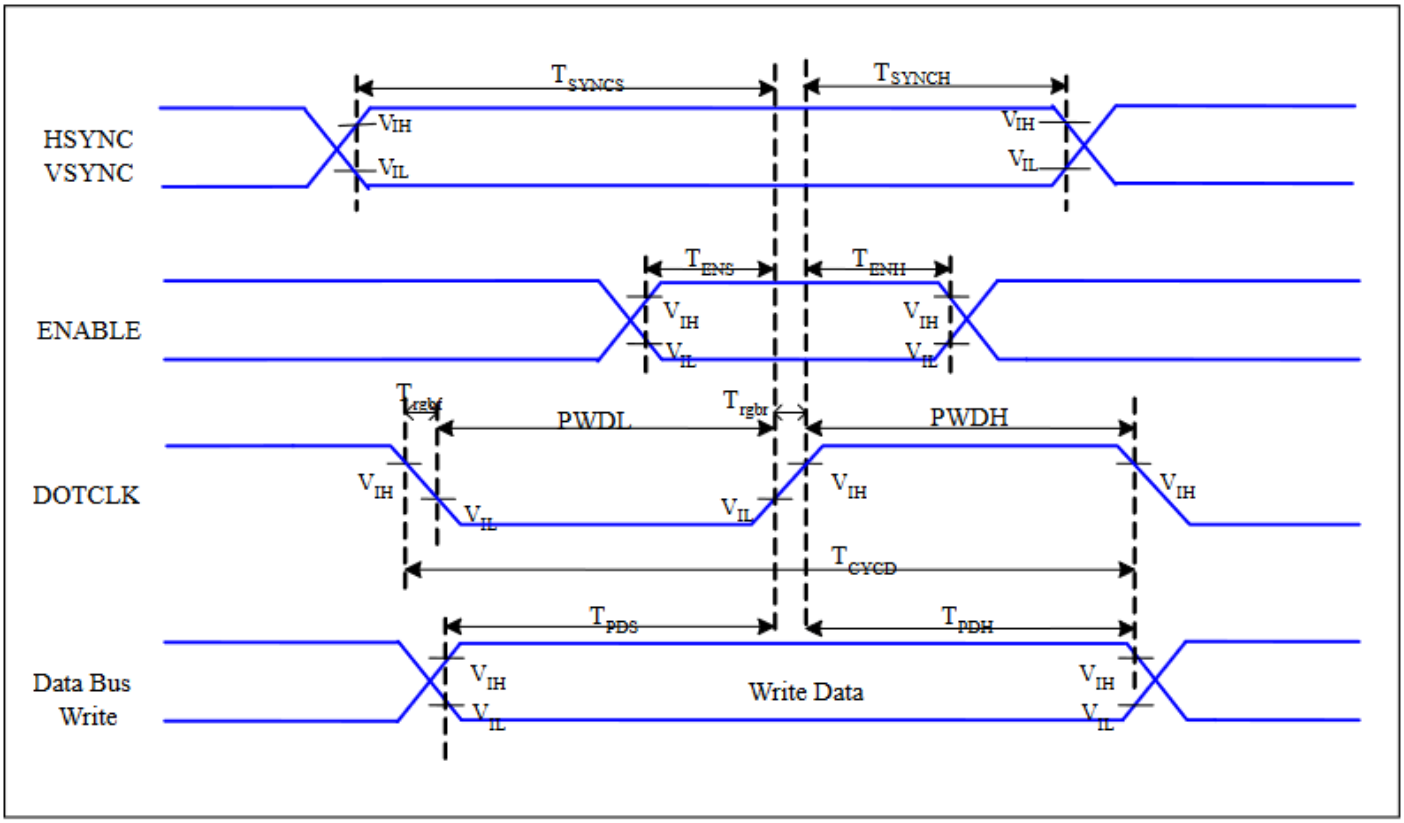
2Ah	RO	TOUCH7_YL	[7:0]	00 – FFh	Lower 8 bits of Y touch coordinate
2Bh	RO	TOUCH7_Weight	[7:4]	00-0Fh	Touch Area
2Bh	RO	TOUCH7_Weight	[3:2]	0 1 2 3	UP Down Left Right
2Bh	RO	TOUCH7_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
2Ch	RO	TOUCH7_Misc	[7:0]		Touch Weight
2Dh	RO	TOUCH8_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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	[7:4]	00-0Fh	Touch Area
31h	RO	TOUCH8_Weight	[3:2]	0 1 2 3	UP Down Left Right
31h	RO	TOUCH8_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
32h	RO	TOUCH8_Misc	[7:0]		Touch Weight
33h	RO	TOUCH9_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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	[7:4]	00-0Fh	Touch Area
37h	RO	TOUCH9_Weight	[3:2]	0 1 2 3	UP Down Left Right
37h	RO	TOUCH9_Weight	[1:0]	0 1 2	Static Normal Speed High Speed
38h	RO	TOUCH9_Misc	[7:0]		Touch Weight
Register No.	Access	Register Name	Bits	Value	Description
39h	RO	TOUCH10_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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
3Dh	RO	TOUCH10_Weight	[7:4]	00-0Fh	Touch Area
3Dh	RO	TOUCH10_Weight	[3:2]	0 1 2 3	UP Down Left Right
3Dh	RO	TOUCH10_Weight	[1:0]	0 1 2	Static Normal Speed High Speed

3Eh	RO	TOUCH10_Misc	[7:0]		Touch Weight
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: 2h
A3h	RO	ID_G_CHIPER_HIGH	[7:0]	00-FFh	Chip Vendor ID Default: 0x54
A6h	RO	ID_G_FIRMID	[7:0]	00-FFh	Firmware ID Number Default: 1
A8h	RO	ID_G_VENODRID	[7:0]	00-FFh	CTPM Vendor's Chip ID Default: 79h

Timing Characteristics- TFT Panel

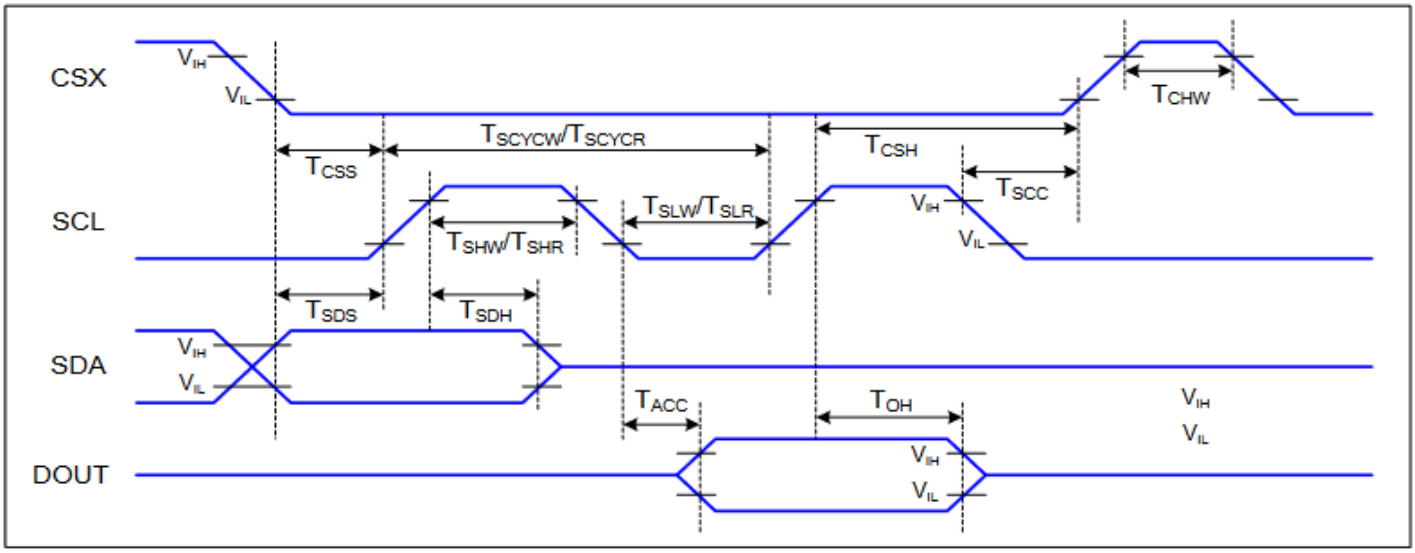
18-bit RGB Interface Characteristics



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	5	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	5	-	ns	
	T_{ENH}	Enable Hold Time	5	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	15	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	15	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	33	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	15	ns	
DB	T_{PDS}	PD Data Setup Time	5	-	ns	
	T_{PDH}	PD Data Hold Time	5	-	ns	

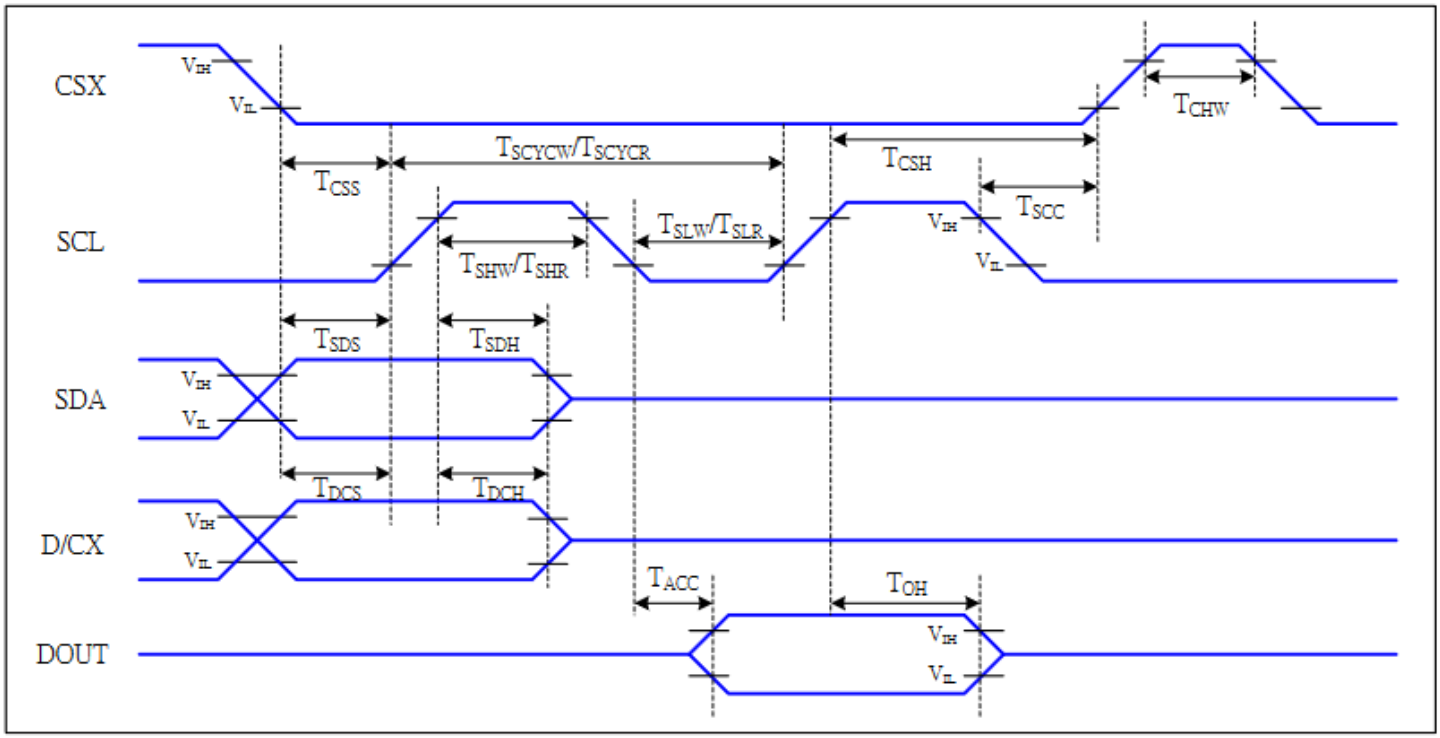
Table 6 18/16 Bits RGB Interface Timing Characteristics

Serial Interface Characteristics (3-line serial)



Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	60		ns	
	T_{CHW}	Chip select “H” pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL “H” pulse width (Write)	15		ns	
	T_{SLW}	SCL “L” pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL “H” pulse width (Read)	60		ns	
	T_{SLR}	SCL “L” pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	

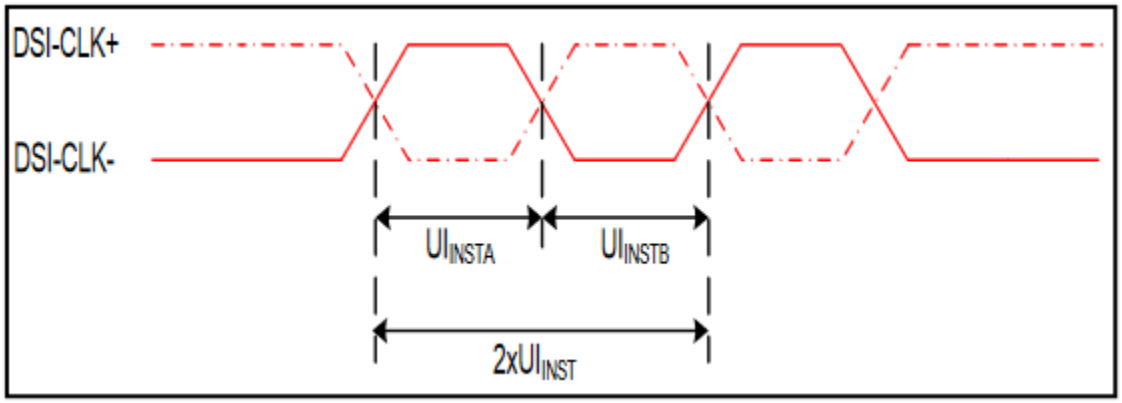
Serial Interface Characteristics (4-line serial)

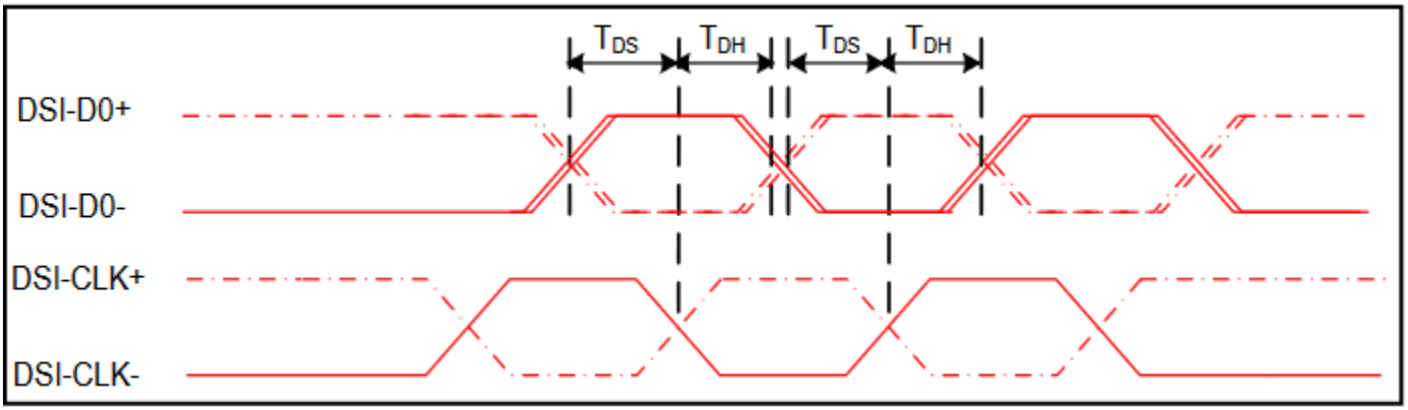


Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select “H” pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL “H” pulse width (Write)	15		ns	
	T_{SLW}	SCL “L” pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL “H” pulse width (Read)	60		ns	
	T_{SLR}	SCL “L” pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	

MIPI DSI Interface Characteristics

High Speed Mode





DSI timing characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xUI_{INSTA}$	Double UI instantaneous	2.5	25	ns	
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halfs	1.25	12.5	ns	UI = UI_{INSTA}= UI_{INSTB}
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

Table 7 Mipi Interface- High Speed Mode Timing Characteristics

Low Power Mode

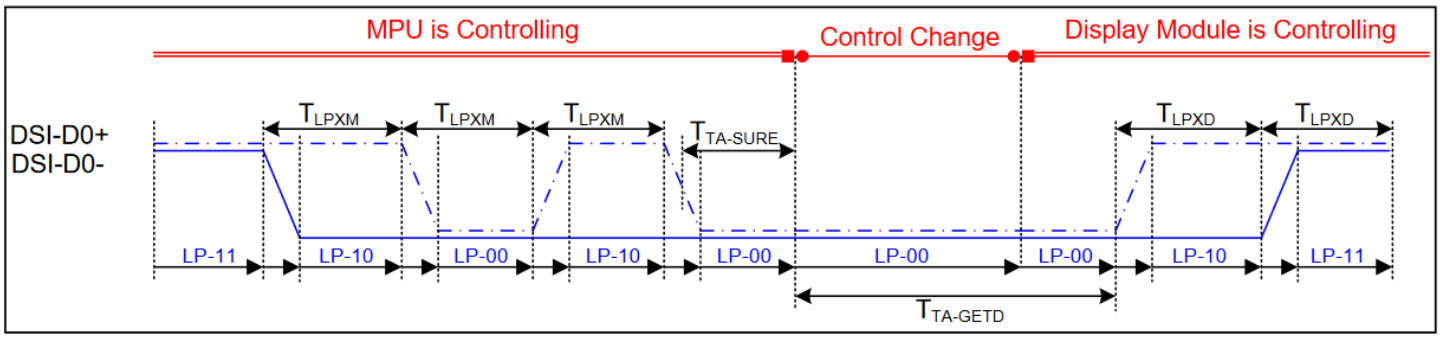


Figure 6 Bus Turnaround (BTA) from display module to MPU Timing

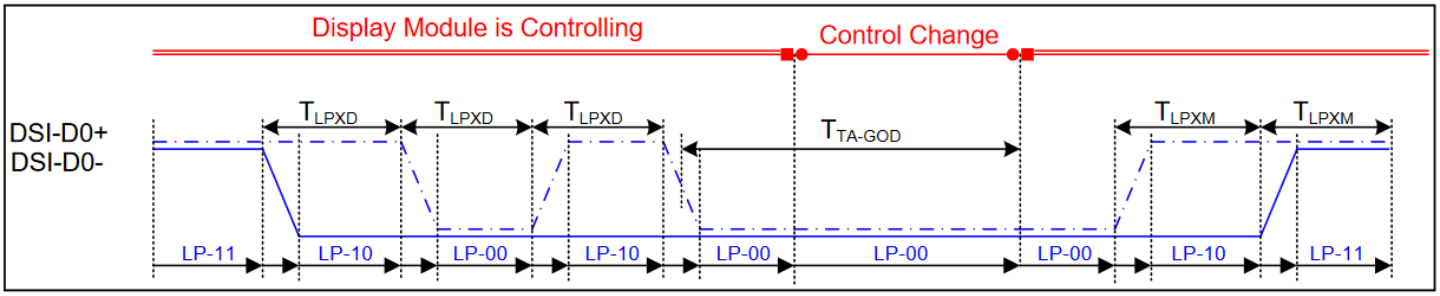


Figure 7 Bus Turnaround (BTA) from MPU to display module Timing

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-D0+/-	TLPXM	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Input
DSI-D0+/-	TLPXD	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Output
DSI-D0+/-	TTA-SURED	Time-out before the MPU start driving	T_{LPXD}	$2xT_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module	$5xT_{LPXD}$		ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU	$4xT_{LPXD}$		ns	Output

Table 8 Mipi Interface Low Power Mode Timing Characteristics

DSI Burst Mode

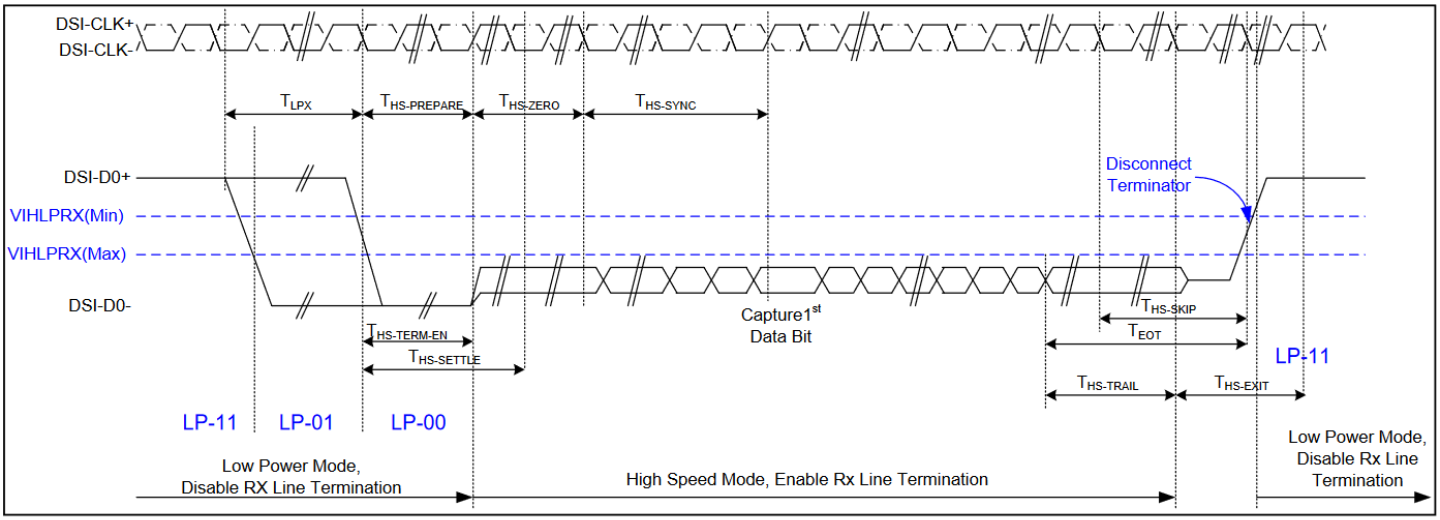


Figure 7 Data lanes-Low Power Mode to/from High Speed Mode Timing

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
Low Power Mode to High Speed Mode Timing						
DSI-Dn+/-	TLPX	Length of any low power state period	50	-	ns	Input
DSI-Dn+/-	THS-PREPARE	Time to drive LP-00 to prepare for HS transmission	40+4 UI	85+6 UI	ns	Input
DSI-Dn+/-	THS-TERM-EN	Time to enable data receiver line termination measured from when Dn crosses VILMAX	-	35+4 UI	ns	Input
DSI-Dn+/-	THS-PREPARE + THS-ZERO	THS-PREPARE + time to drive HS-0 before the sync sequence	140+ 10UI	-	ns	Input

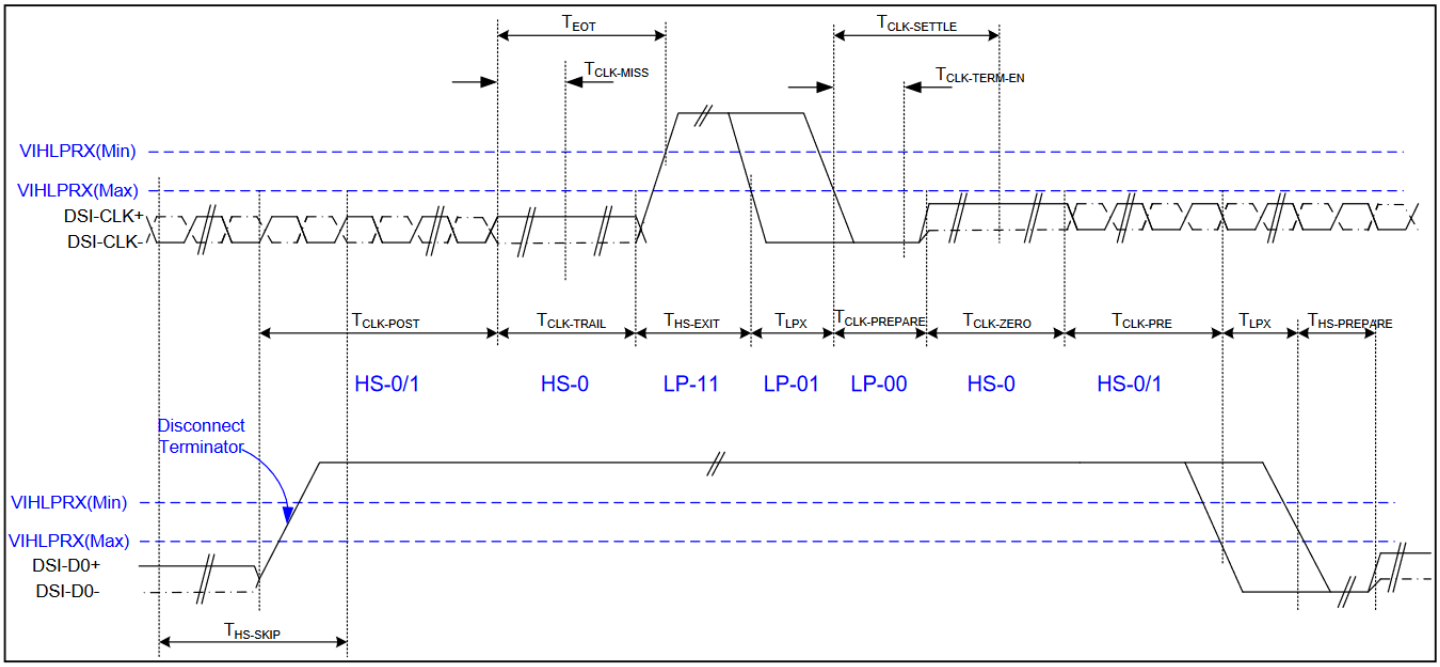
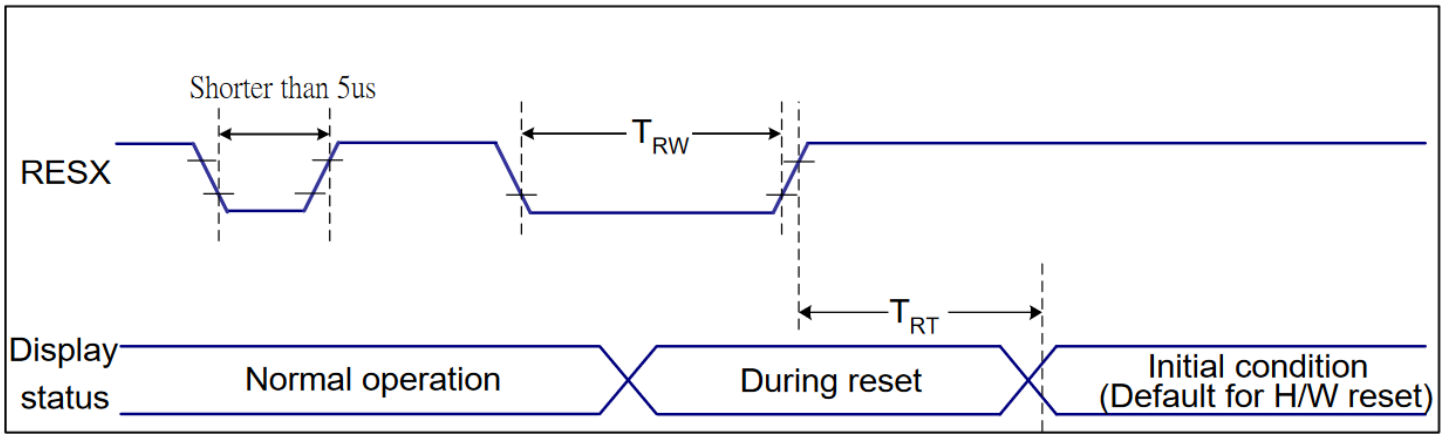


Figure 8 Clock lanes- High Speed Mode to/from Low Power Mode Timing

High Speed Mode to/from Low Power Mode Timing						
DSI-CLK+/-	TCLK-POS	Time that the MPU shall continue sending HS clock after the last associated data lane has transition to LP mode	60+5 2UI	-	ns	Input
DSI-CLK+/-	TCLK-TRAIL	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	ns	Input
DSI-CLK+/-	THS-EXIT	Time to drive LP-11 after HS burst	100	-	ns	Input
DSI-CLK+/-	TCLK-PREPARE	Time to drive LP-00 to prepare for HS transmission	38	95	ns	Input
DSI-CLK+/-	TCLK-TERM-EN	Time-out at clock lan display module to enable HS transmission	--	38	ns	Input
DSI-CLK+/-	TCLK-PREPARE + TCLK-ZERO	Minimum lead HS-0 drive period before starting clock	300	-	ns	Input
DSI-CLK+/-	TCLK-PRE	Time that the HS clock shall be driven prior to any associated data lane beginning the transition from LP to HS mode	8UI	-	ns	Input
DSI-CLK+/-	TEOT	Time form start of TCLK-TRAIL period to start of LP-11 state	-	105n s+12 UI	ns	Input

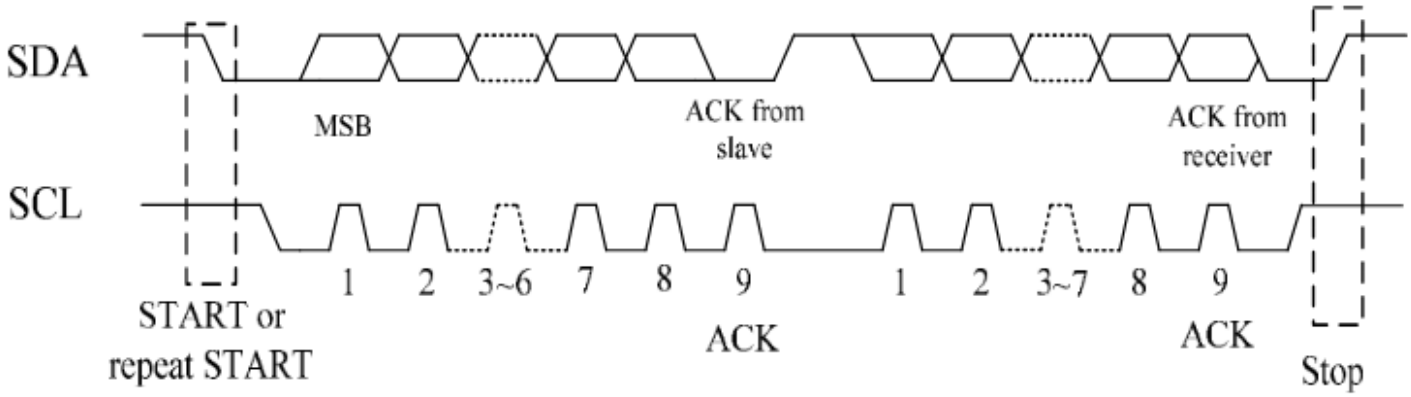
Reset Input Timing



Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120(Note 1, 6, 7)	ms

Timing Characteristics- Capacitive Touch Panel

Data Transfer Format



Parameter	Min	Max	Unit
SCL frequency	0	400	KHz
Bus free time between a STOP and START condition	1.3		us
Hold time (repeated) START condition	0.6		us
Data setup time	100		ns
Setup time for a repeated START condition	0.6		us
Setup time for STOP condition	0.6		us
Rise time of both SDA and SCL signals	20	300	ns
Fall time of both SDA and SCL signals	20x (VDD/5.5V)	300	ns

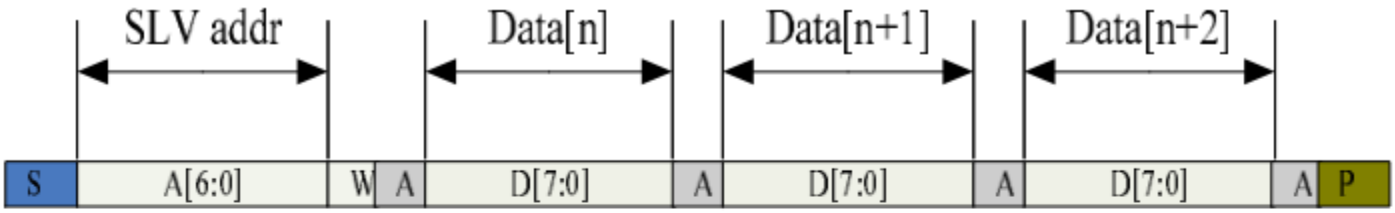


Figure 2-5I2C master write, slave read

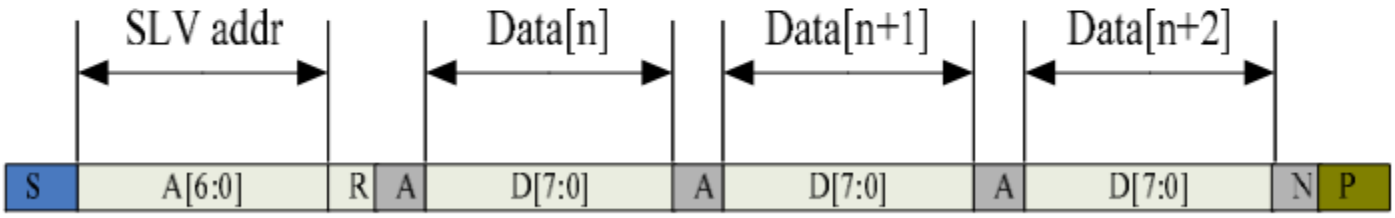
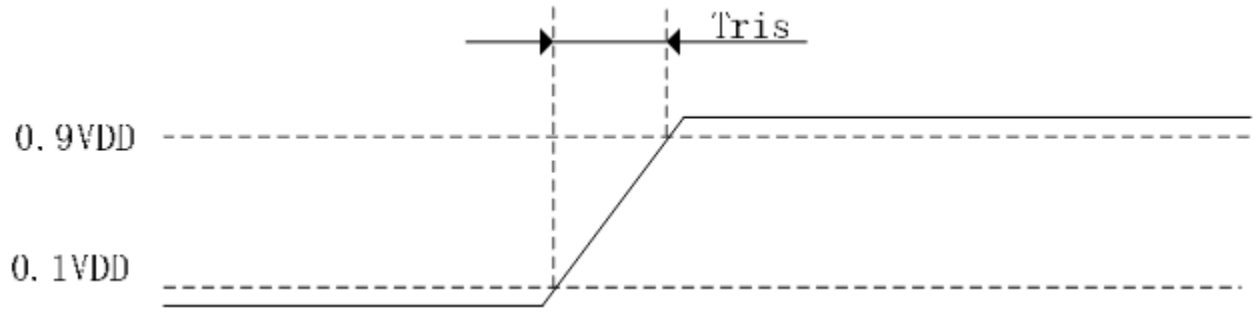
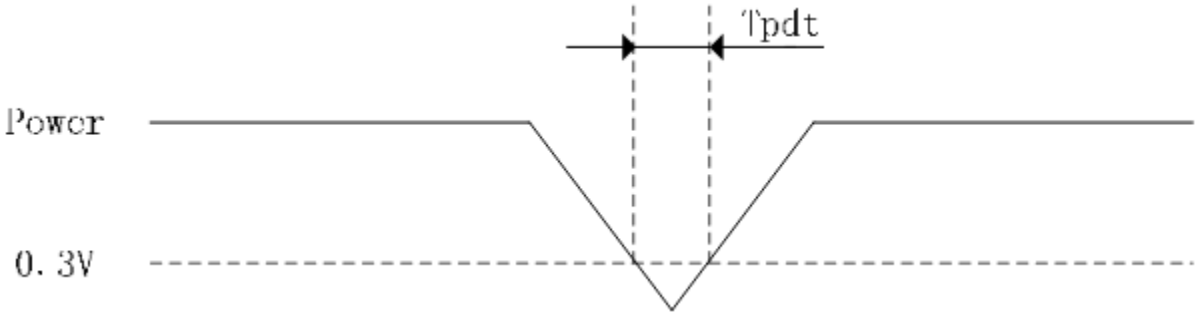


Figure 2-6 I2C master read, slave write

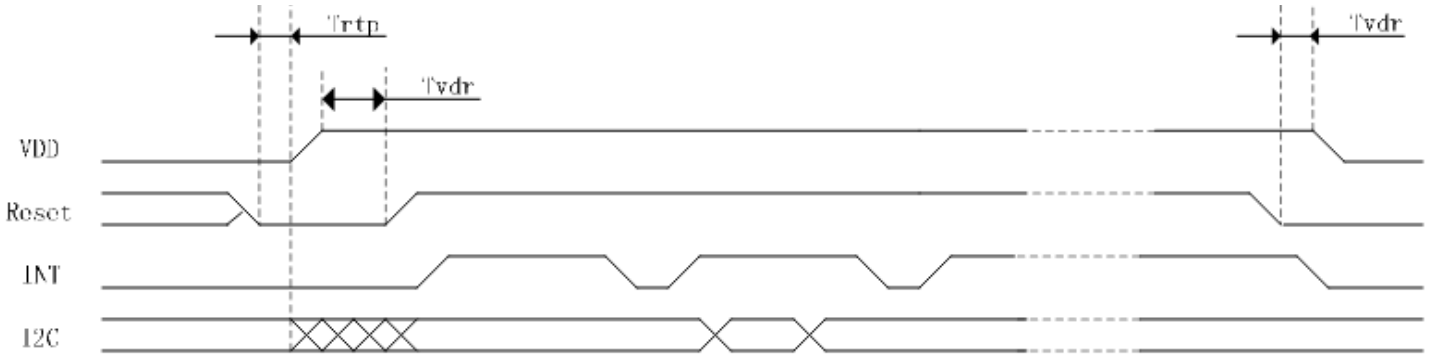
Power ON/Reset Sequence



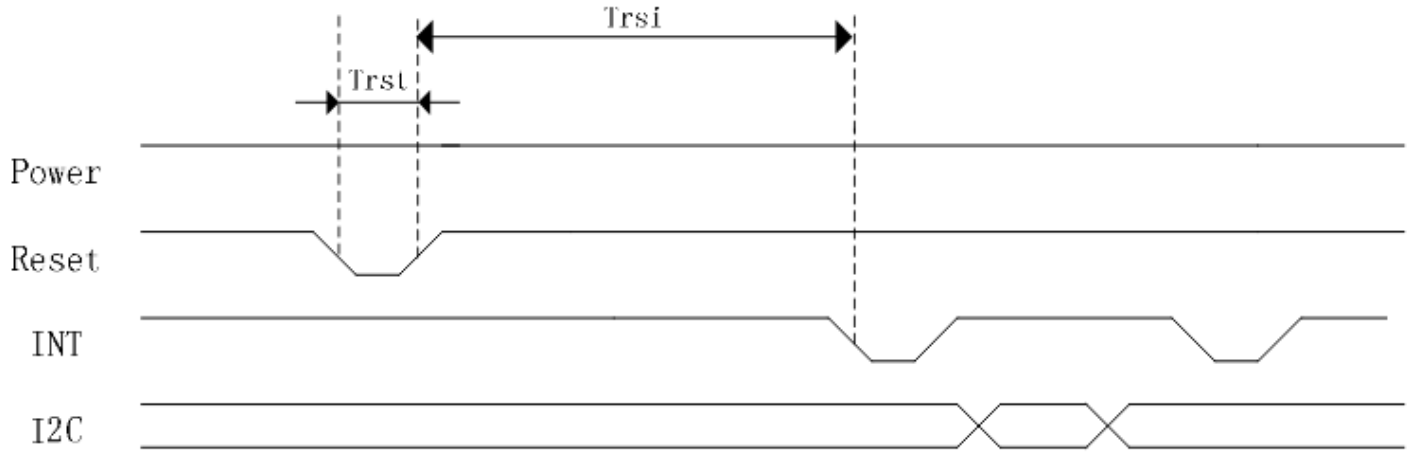
Power on time



Power cycle requirement



Power on sequence



Reset sequence

Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD to 0.9VDD	--	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
Tvdr	Reset time after VDD powering on	1	--	ms
Trsi	Time of starting to report point after resetting	--	200	ms
Trst	Reset time	1	--	ms

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();
```

Example Initialization Code

Please refer to the example code: https://support.newhavendisplay.com/hc/en-us/articles/30069060235927-NHD-2-1-480480AF-ASXP-with-SSD1963-Controller-with-Arduino

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 , 240hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 240hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C , 240hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 240hrs	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 , 120hrs	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.	Frequency range:10Hz~50Hz Acceleration of gravity:5G X, Y, Z 30 min for each direction	3
Static electricity test	Endurance test applying electric static discharge.	Air: Vs=±4kV 150pF/330Ω, 5 Times Contact: Vs= ±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.