

Product Specification

NHD-3.9-480128AF-ASXP-CTP

TFT Liquid Crystal Display

NHD-	Newhaven Display
3.9-	3.9" Diagonal
480128-	480xRGBx128 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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Additional Resources

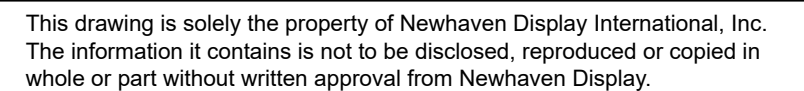
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **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
-	01/16/2025	Initial Release	KL

F



Pin Description

TFT:

Pin No.	Symbol	External Connection	Function Description
1	LED-K	LED Power Supply	Ground for Backlight
2	LED-A	LED Power Supply	Backlight Power Supply (40mA @ 14.8V)
3	GND	Power Supply	Ground
4	V _{DD}	Power Supply	Power supply for LCD and logic (3.3V)
5-12	[R0-R7]	MPU	Red Data signals
13-20	[G0-G7]	MPU	Green Data signals
21-28	[B0-B7]	MPU	Blue Data signals
29	GND	Power Supply	Ground
30	DCLK	MPU	Pixel Clock signal for input data (Falling Edge)
31	DISP	MPU	H: Normal Operation; L: Standby Mode
32	HSYNC	MPU	Horizontal (Line) synchronization signal
33	VS _{YNC}	MPU	Vertical (Frame) synchronization signal
34	DE	MPU	Data Enable signal
35	GRB	MPU	Active LOW Reset signal
36	GND	Power Supply	Ground
37	XR	-	No Connect
38	YD	-	No Connect
39	XL	-	No Connect
40	YU	-	No Connect

Recommended LCD connector: 0.5mm pitch 40-Conductor FFC. Molex p/n: 54104-4031 (top contact)

CTP:

Pin No.	Symbol	External Connection	Function Description
1	V _{DD}	Power Supply	Supply voltage for Logic (3.3V)
2	V _{SS}	Power Supply	Ground
3	SCL	MPU	Serial I2C Clock (Requires 4.7K Ω pull-up resistor)
4	SDA	MPU	Serial I2C Data (Requires 4.7k Ω 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

RGB Interface Mode Selection

The Sitronix ST7282 driver IC is user configurable for DE Mode, SYNC mode, or SYNC-DE mode RGB interface.

DE Mode is enabled when HSYNC and VSYNC signals are set to logic-low state, and DE signal is toggled high for valid pixel data. Data is clocked in using DCLK signal. DE mode is recommended to enable the ST7282 driver IC to synchronize the display image on TFT panel without depending on specific horizontal and vertical sync timing from host controller.

SYNC mode is enabled when the DE signal is set to logic-low state, and HSYNC and VSYNC signals are used to explicitly define the horizontal and vertical sync timing to synchronize the display image on TFT panel. Data is clocked in using DCLK signal. Any change to the HSYNC or VSYNC values may prevent the image from correctly appearing on the display.

SYNC-DE Mode is enabled when HSYNC and VSYNC signals are used to explicitly define the horizontal and vertical sync timing to synchronize the display image on TFT panel. DE signal is used as an additional indicator for transmission of valid pixel data. Data is clocked in using DCLK signal. Any change to the HSYNC or VSYNC values may prevent the image from correctly appearing on the display.

RGB Mode Selection Table	DCLK	HSYNC	VSYNC	DE
SYNC-DE Mode	Input	Input	Input	Input
SYNC Mode	Input	Input	Input	GND
DE Mode	Input	GND	GND	Input

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}	-	3.0	3.3	3.6	V
Supply Current	I _{DD}	V _{DD} = 3.3V	8	16	24	mA
"H" Level input	V _{IH}	-	0.7 * V _{DD}	-	V _{DD}	V
"L" Level input	V _{IL}	-	GND	-	0.3V _{DD}	V
"H" Level output	V _{OH}	-	V _{DD} - 0.4	-	V _{DD}	V
"L" Level output	V _{OL}	-	GND	-	GND + 0.4	V
Backlight Supply Current	I _{LED}	-	30	40	50	mA
Backlight Supply Voltage	V _{LED}	I _{LED} = 40mA T _{OP} = 25°C	13.5	14.8	16.0	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}	Absolute Max	-20	-	+75	°C
Storage Temperature Range	T _{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V _{DD}	-	2.7	3.3	3.6	V
Supply Current – Operating	I _{DD}	-	7	12	21	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}	-	0.7*V _{DD}	-	V _{DD}	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	$\phi Y+$	-	-	85	-	°
	Bottom	$\phi Y-$		-	85	-	°
	Left	$\theta X-$		-	85	-	°
	Right	$\theta X+$		-	85	-	°
Contrast Ratio		CR	-	1000	1200	-	-
Luminance		L_V	$I_{LED} = 40mA$	816	1020	-	cd/m ²
Response Time (Rise + Fall)		$T_R + T_F$	$T_{OP} = 25^\circ C$	-	30	35	ms
Chromaticity	Red	X_R	-	0.552	0.602	0.652	-
		Y_R	-	0.285	0.335	0.385	-
	Green	X_G	-	0.254	0.304	0.354	-
		Y_G	-	0.540	0.590	0.640	-
	Blue	X_B	-	0.076	0.126	0.176	-
		Y_B	-	0.069	0.119	0.169	-
	White	X_W	-	0.214	0.264	0.314	-
		Y_W	-	0.262	0.312	0.35	-

Driver/Controller Information

TFT Display:

Built-in ST7282 Source Driver: <https://support.newhavendisplay.com/hc/en-us/articles/4414848420119-ST7282>

Capacitive Touch Panel:

Built-in FT5426G Controller: <https://support.newhavendisplay.com/hc/en-us/articles/17688730921367-FT5426G>



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: 5 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
18h	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: 1
A8h	RO	ID_G_VENODRID	[7:0]	00-FFh	CTPM Vendor's Chip ID Default: 79h

Timing Characteristics- TFT

Horizontal Input Timing

Parameter	Symbol	Min	Typ	Max	Unit	Note
HSYNC Display period	T_{HDISP}	480			DCLK	
DCLK Frequency	F_{CLK}	8	9	12	MHz	
HSYNC Period Time	T_H	485	531	598	DCLK	
HSYNC Pulse Width	T_{HW}	2	4	75		
HSYNC Back Porch (Blanking)	T_{HBP}	3	43	43		
HSYNC Front Porch	T_{HFP}	2	8	75		

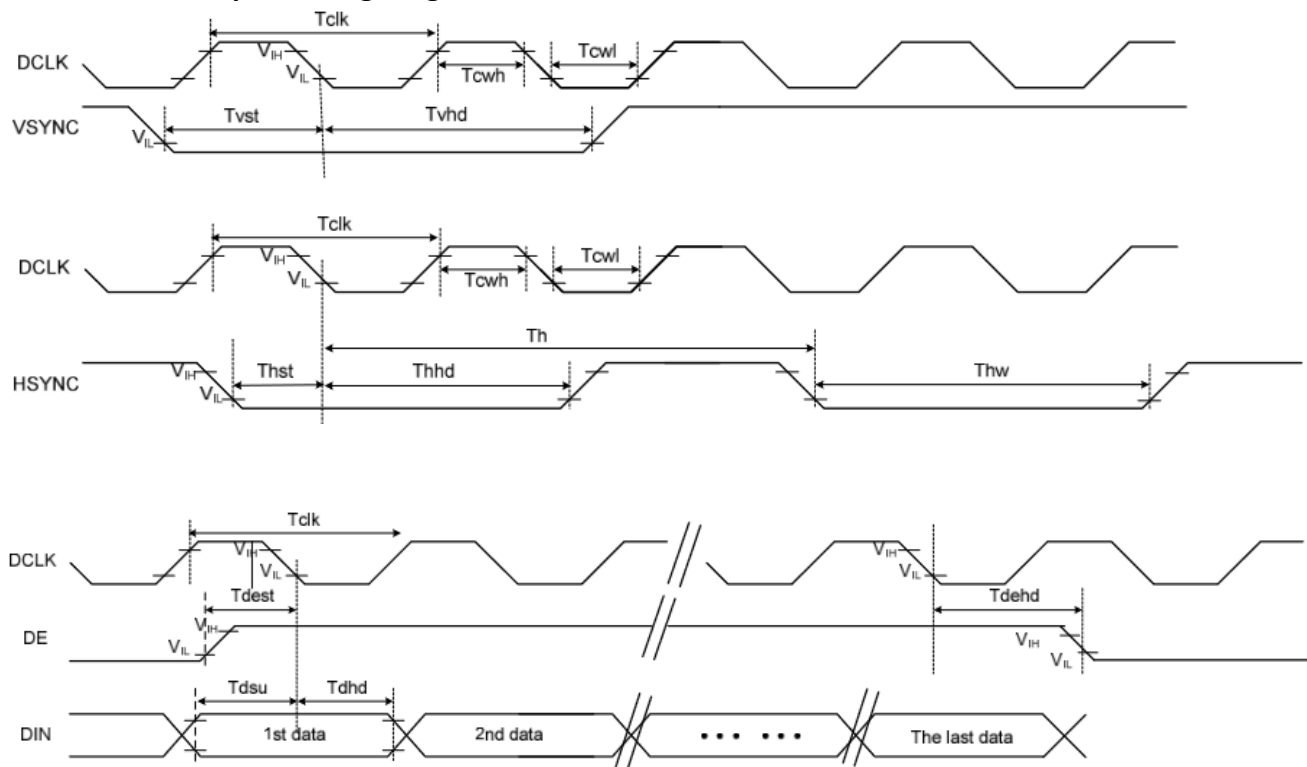
Vertical Input Timing

Parameter	Symbol	Min	Typ	Max	Unit	Note
VSYNC Display period	T_{VDISP}	272			HSYNC	
VSYNC Period Time	T_V	276	292	321		
VSYNC Pulse Width	T_{VW}	2	4	37		
VSYNC Back Porch (Blanking)	T_{VBP}	2	12	12		
VSYNC Front Porch	T_{VFP}	2	8	37		

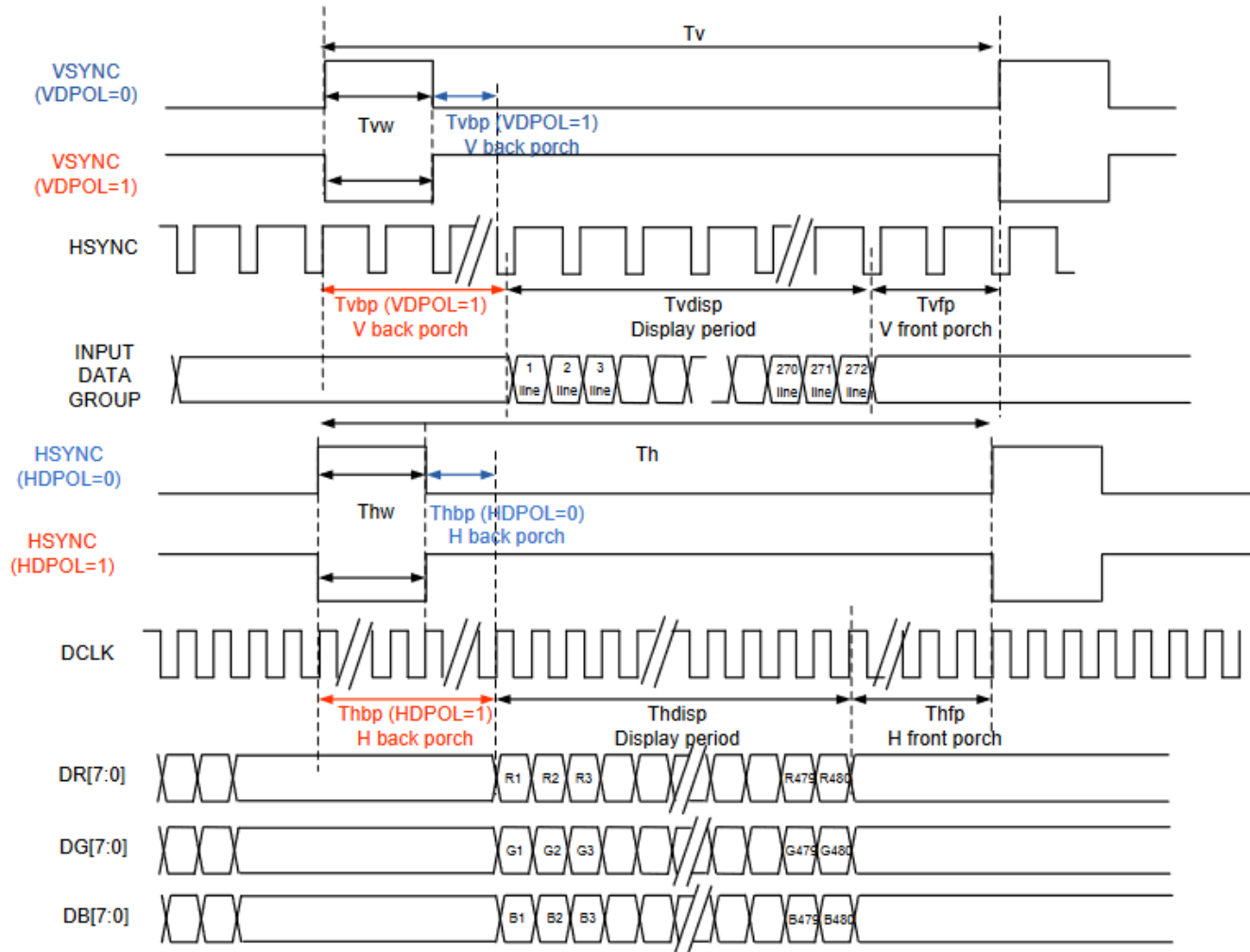
AC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
CLK pulse duty	T_{CW}	40	50	60	%	
VSYNC setup time	T_{VST}	12	-	-	ns	
VSYNC hold time	T_{VHD}	12	-	-	ns	
HSYNC setup time	T_{HST}	12	-	-	ns	
HSYNC hold time	T_{HHD}	12	-	-	ns	
Data set-up time	T_{DSU}	12	-	-	ns	
Data hold time	T_{DHD}	12	-	-	ns	
DE setup time	T_{DEST}	10	-	-	ns	
DE hold time	T_{DHD}	10	-	-	ns	
Output stable time	T_{SST}	-	-	12	μs	

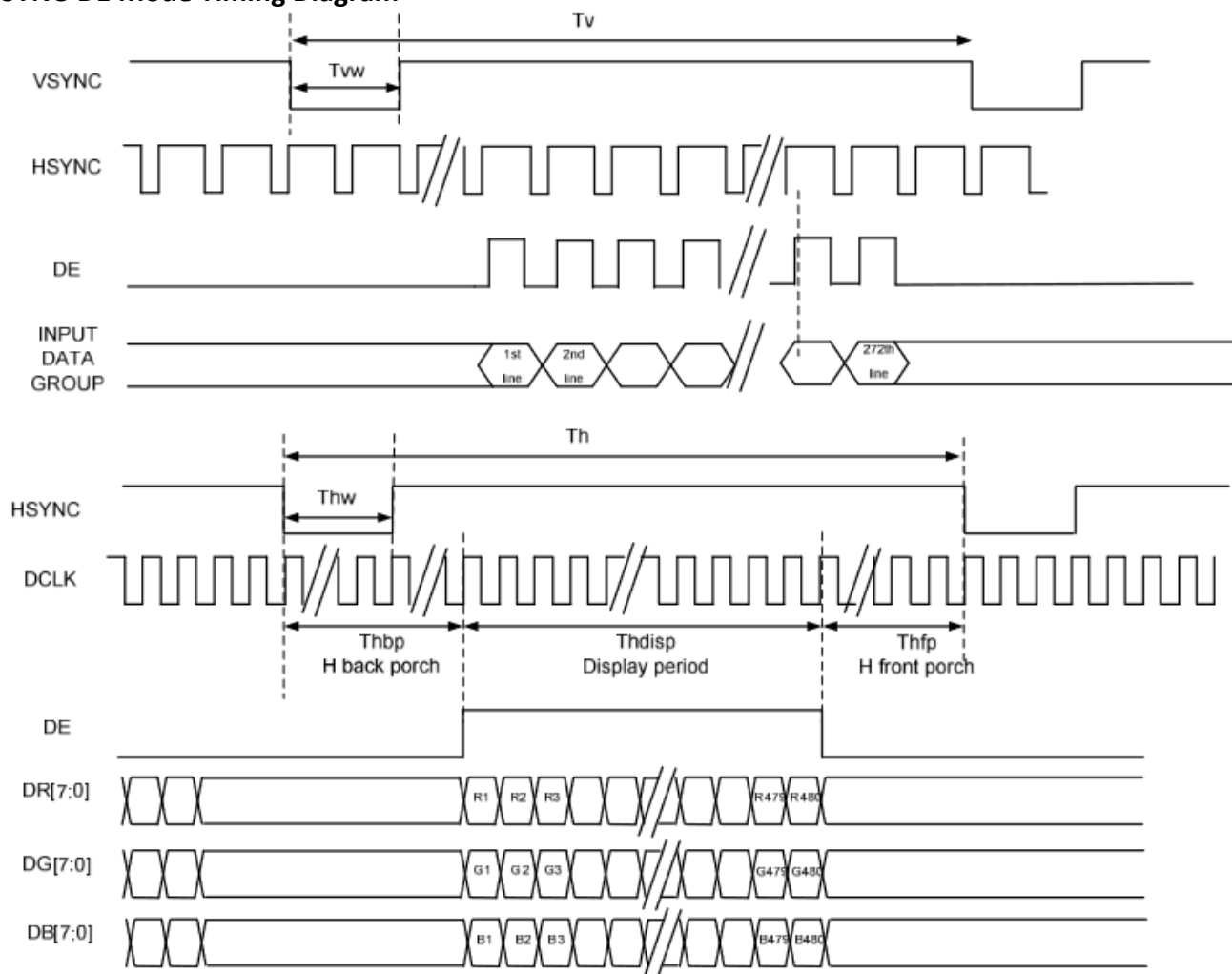
Clock and Data Input Timing Diagram



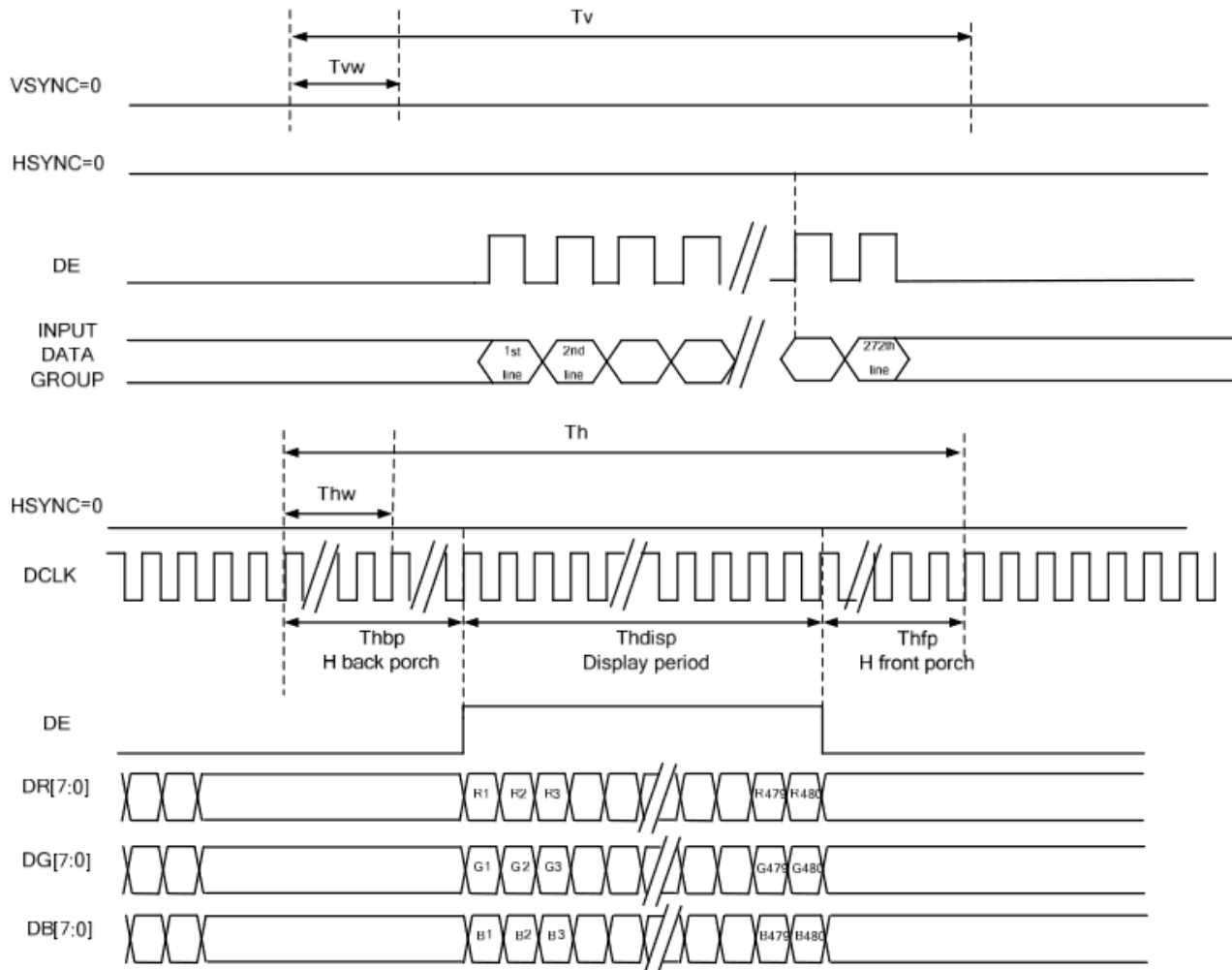
SYNC-Mode Timing Diagram



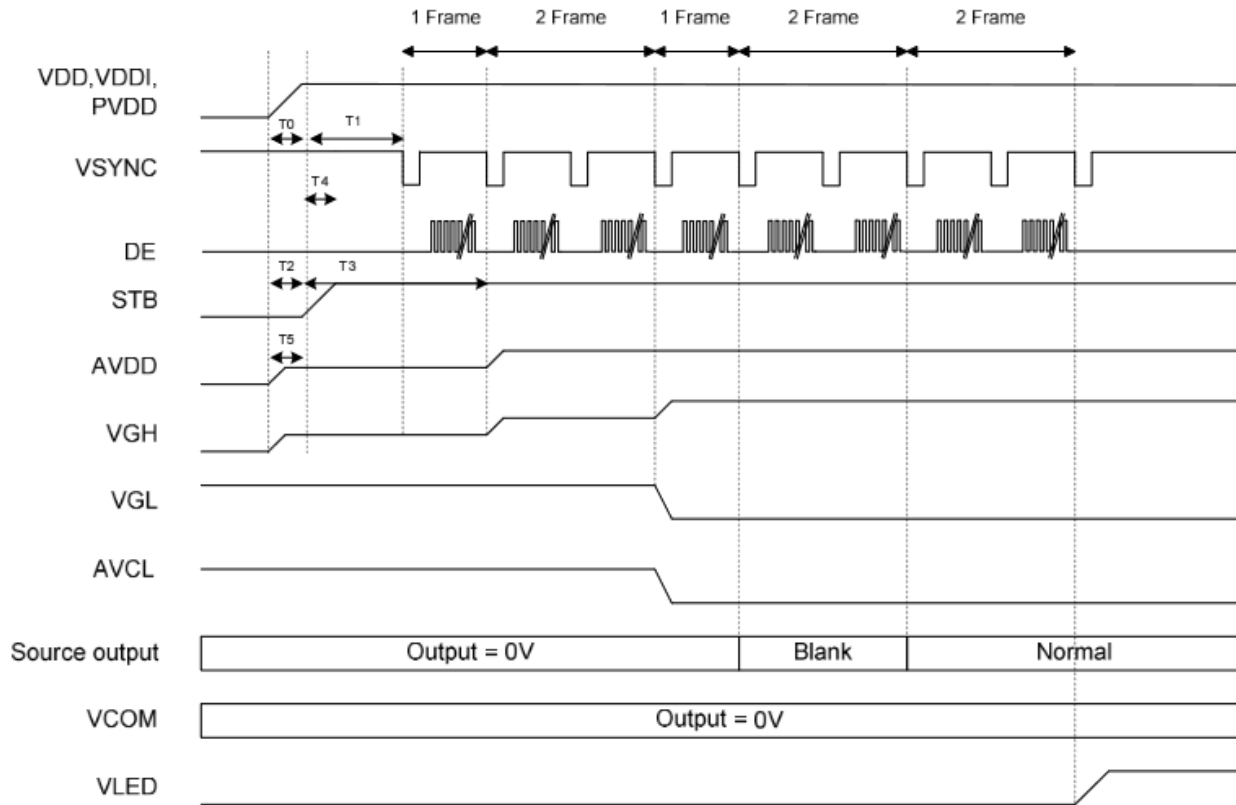
SYNC-DE Mode Timing Diagram



DE Mode Timing Diagram

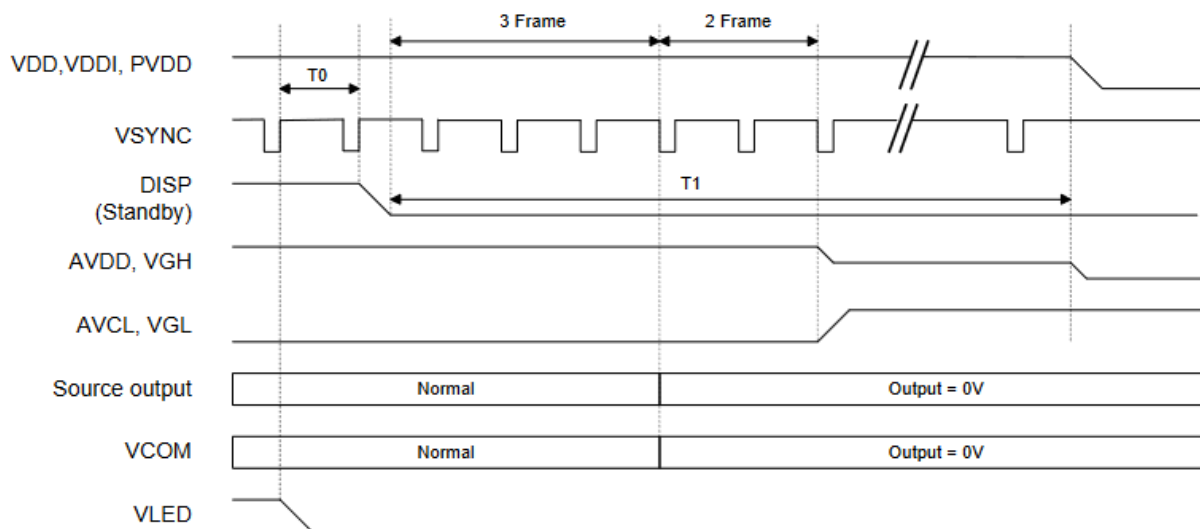


Power On Sequence



	Description	Min. Time
T0	Determined by the external power	
T1	Time from stable VDD, VDDI, PVDD set-up to the first VSYNC	T1=0
T2	Time from AVDD=0V to AVDD=3.3V	T2=T0
T3	Time from AVDD=3.3V to AVDD=6.0V	T3=T1+ (1*Frame)
T4	Time from stable VDD, VDDI, PVDD set-up to DISP asserted	T4=0
T5	Time from VGH=0V to VGH=3.3V	T5=T0

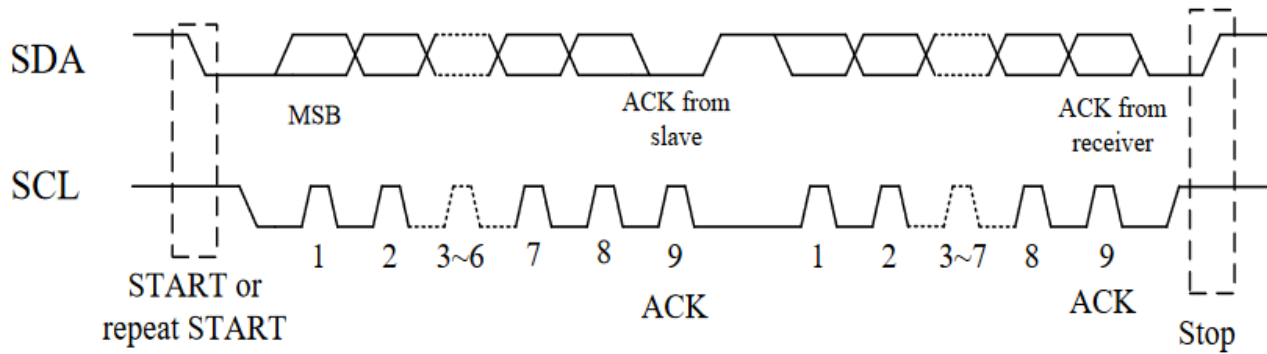
Power Off Sequence



	Description	Min. Time
T0	Time from backlight power off to DISP="L"	1*Frame
T1	Time from DISP="L" to LCM Power off	5*Frame

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

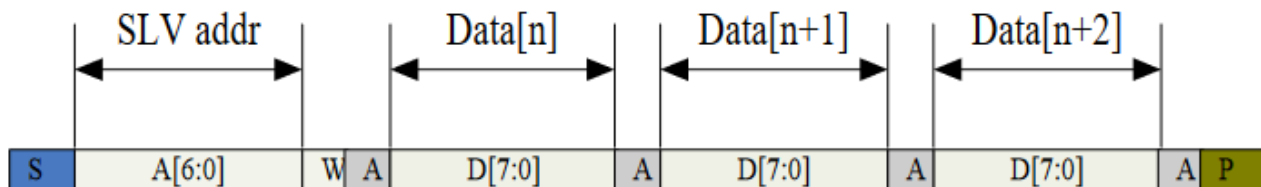


Figure 2-5 I2C master write, slave read

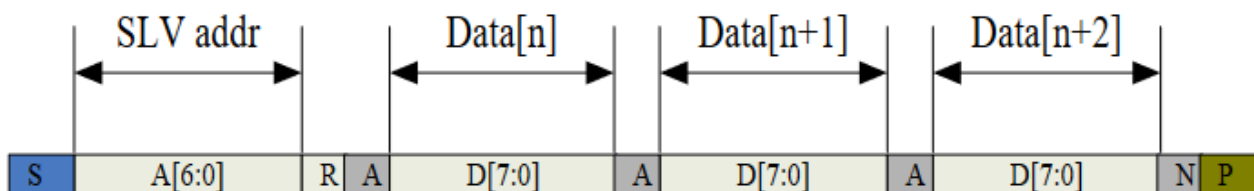


Figure 2-6 I2C master read, slave write

Power ON/Reset Sequence

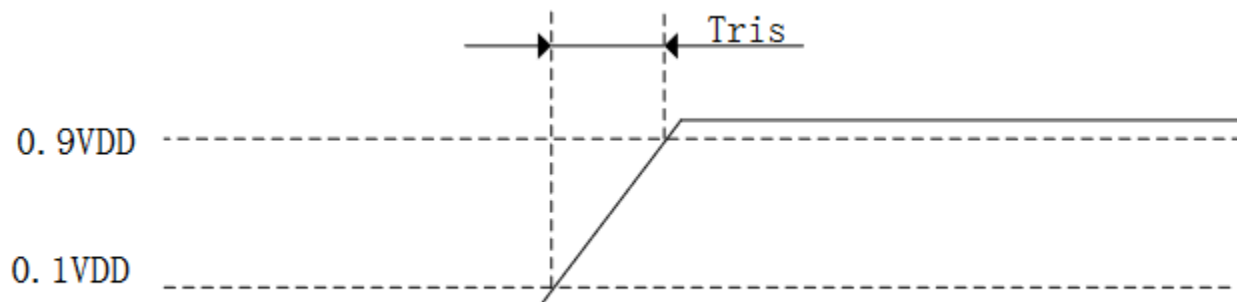
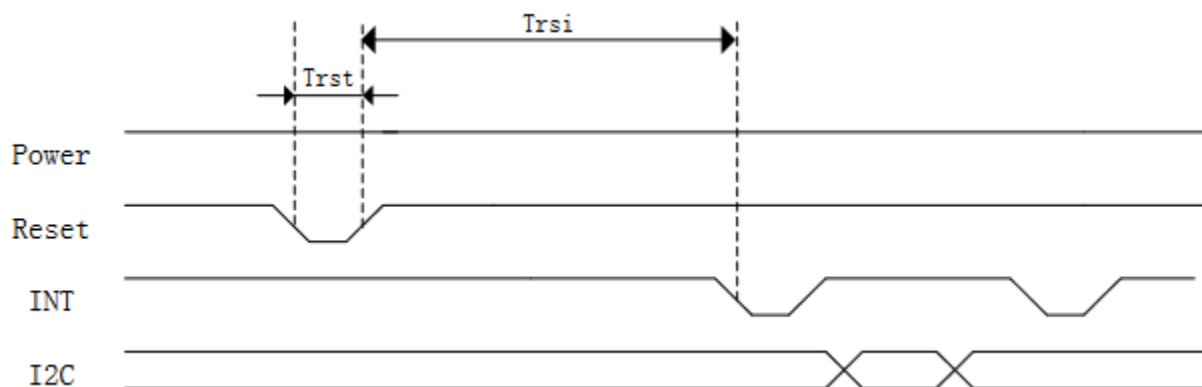
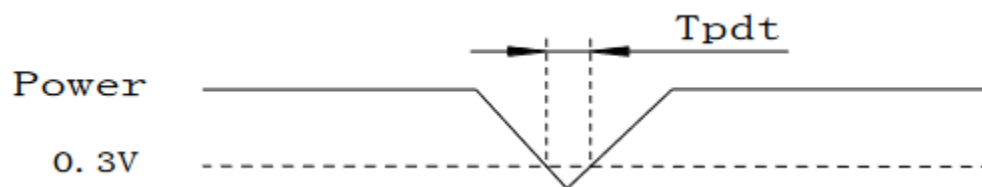


Figure 3-3 Power on time



Parameter	Description	Min	Max	Units
Tris	Rise time from $0.1V_{DD}$ to $0.9V_{DD}$	--	5	ms
Tpd t	Time of the voltage of supply being below $0.3V$	5	--	ms
Trtp	Time of resetting to be low before powering on	100	--	μs
Tivd	Delay time of VDD powering on after IOVCC	10	--	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();
```

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,60 min =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: ±4kV 150pf/330Ω ; Contact: ±2kV 150pF/330Ω For 5 times each.	

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.