NEWHAVEN DISPLAY INTERNATIONAL

Product Specification

NHD-7.0-800480AF-ASXP-CTP

IPS TFT Liquid Crystal Display

NHD-	Newhaven Display
7.0-	7.0" Diagonal
800480-	800xRGBX480 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

Newhaven Display International, Inc.
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REACH Compliant

RoHS Compliant

NEWHAVEN DISPLAY INTERNATIONAL

Table of Contents

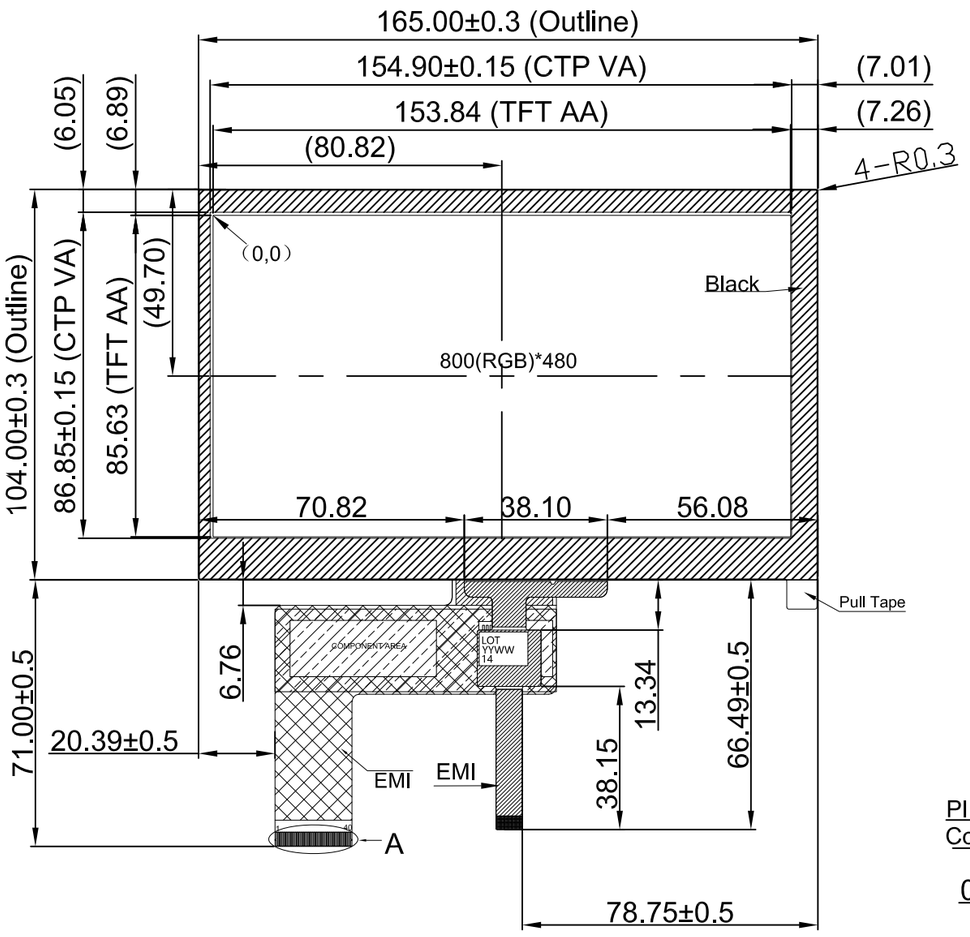
Additional Resources

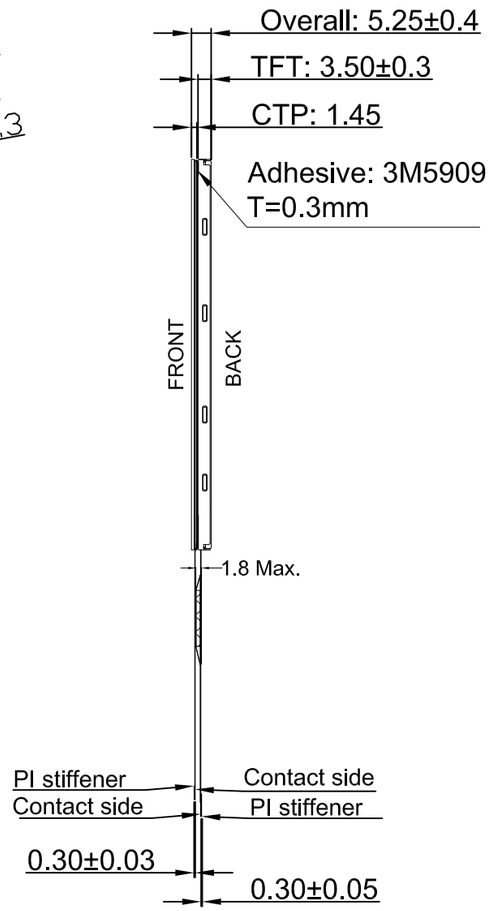
- **Support Forum:** https://support.newhavendisplay.com/hc/en-us/community/topics
- **GitHub:** https://github.com/newhavendisplay
- **Example Code:** https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html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

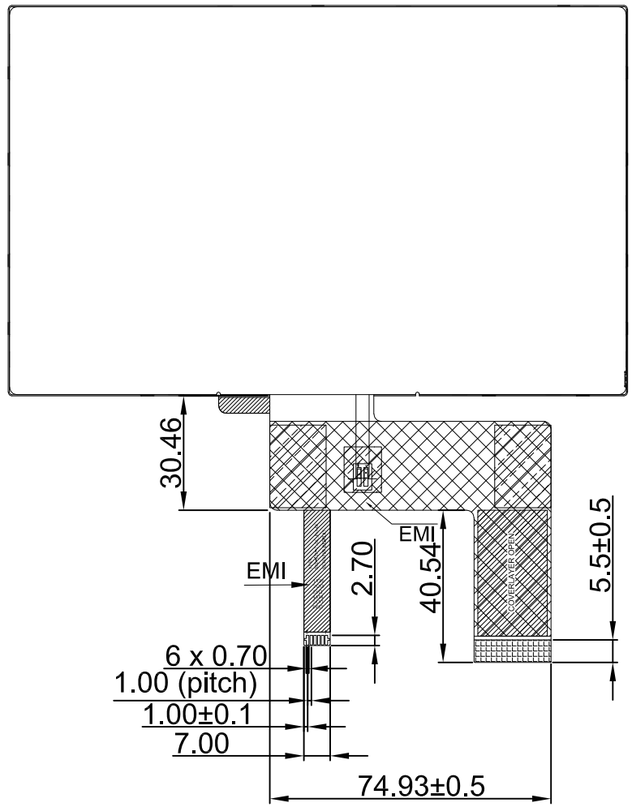
Document Revision History

Revision	Date	Description	Changed By
-	08/26/2024	Initial Release	KL

Mechanical Drawing



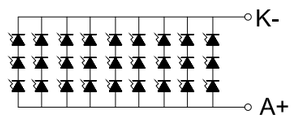




Newhaven Display
NHD-7.0-800480AF-ASXP-CTP
Date Code
Part Label (type/format may vary)

TFT

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



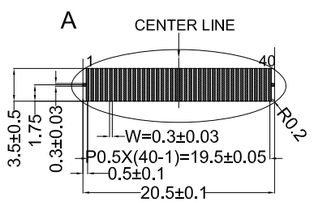
LED CIRCUIT

CTP

PIN	DEFINE
1	VDD 3.3V
2	GND
3	SCL 3.3V
4	SDA 3.3V
5	INT 3.3V
6	RESET 3.3V

Product Description: 7.0” 800x480 IPS TFT w/ Capacitive Touch Panel

1. Driver IC: ST7277 TFT, FT5426G CTP
2. Interface: 24-bit Parallel RGB
3. Power Requirement: 3.3V TFT, 9.3V/180mA Backlight
4. Optical Features: Normally Black, Transmissive, 850cd/m²
5. Recommended FFC Connector:
   TFT: 40pin 0.5mm pitch; Ex. Molex 54104-4031
   CTP: 6pin 1.0mm pitch; Ex. Molex 52271-0679
6. Key Features: EMI Shielded FPC, 10-point Multitouch



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

NEWHAVEN DISPLAY INTERNATIONAL

Drawing/Part Number: NHD-7.0-800480AF-ASXP-CTP
Revision: -

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

Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 08/26/2024
Approved Date: 08/26/2024

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 (180mA @ 9.3V)
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	VSYNC	MPU	Vertical (Frame) synchronization signal
34	DE	MPU	Data Enable signal
35	BIST_EN	MPU	Built in Self-Test BIST_EN=H: Self-Test Enabled BIST_EN-L: Normal Operation (Default)
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)

Capacitive Touch Panel:

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 4.7kΩ 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

RGB Interface Mode Selection

The Sitronix ST7277 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 ST7277 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}	-	3.1	3.3	3.6	V
Supply Current	I_{DD}	V_{DD} = 3.3V	28	55	83	mA
"H" Level input	V_{IH}	-	0.7 * V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	GND	-	0.3 * V_{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}	-	135	180	225	mA
Backlight Supply Voltage	V_{LED}	I_{LED} = 180mA	8.3	9.3	10.2	V
Backlight Lifetime*	-	T_{OP} = 25°C	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	-	+70	°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}	-	10	20.5	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}	-	0.7*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	φY+	-	-	85	-	º
	Bottom	φY-		-	85	-	º
	Left	θX-		-	85	-	º
	Right	θX+		-	85	-	º
Contrast Ratio		CR	-	800	1000	-	-
Luminance		L_V	I_{LED} = 180 mA	680	850	-	cd/m²
Response Time (Rise + Fall)		$T_R + T_F$	T_{OP} = 25°C	-	25	-	ms
Chromaticity	Red	X_R	-	0.569	0.619	0.669	-
		Y_R	-	0.289	0.339	0.389	-
	Green	X_G	-	0.284	0.334	0.384	-
		Y_G	-	0.535	0.585	0.635	-
	Blue	X_B	-	0.077	0.127	0.177	-
		Y_B	-	0.078	0.128	0.178	-
	White	X_W	-	0.246	0.296	0.346	-
		Y_W	-	0.286	0.336	0.36	-

Driver/Controller Information

TFT Display:
Built-in ST7277 Source Driver: https://support.newhavendisplay.com/hc/en-us/articles/22014397027991-ST7277

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]	1C 14 10 18 48 49 00	Swipe Up Swipe Down Swipe Left Swipe Right Zoom In Zoom Out 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 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	[7:0]		Touch Weight
08h	RO	TOUCH1_Misc	[3:0]	00-0Fh	Touch Area
09h	RO	TOUCH2_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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 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	[7:0]		Touch Weight
14h	RO	TOUCH3_Misc	[3:0]	00-0Fh	Touch Area
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
1Ah	RO	TOUCH4_Misc	[3:0]	00-0Fh	Touch Area
1Bh	RO	TOUCH5_Event_Flag	[7:6]	0 1 2 3	Put Down Put Up Contact 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 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	[7:0]		Touch Weight
26h	RO	TOUCH6_Misc	[3:0]	00-0Fh	Touch Area
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	[7:0]		Touch Weight
2Ch	RO	TOUCH7_Misc	[3:0]	00-0Fh	Touch Area
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	[7:0]		Touch Weight
32h	RO	TOUCH8_Misc	[3:0]	00-0Fh	Touch Area
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	[7:0]		Touch Weight
38h	RO	TOUCH9_Misc	[3:0]	00 - 0Fh	Touch Area
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
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: 14
A8h	RO	ID_G_VENODRID	[7:0]	00-FFh	CTPM Vendor's Chip ID Default: 79

Timing Characteristics – TFT Display

Horizontal Input Timing

Parameter	Symbol	Min	Typ	Max	Unit	Note
HSYNC Display period	T_{HDISP}		800		DCLK	
DCLK Frequency	F_{CLK}	23	25	27	MHz	
HSYNC Period Time	T_H	808	816	848	DCLK	
HSYNC Pulse Width	T_{HW}	2	4	8		
HSYNC Back Porch (Blanking)	T_{HBP}	4	8	24		
HSYNC Front Porch	T_{HFP}	4	8	24		

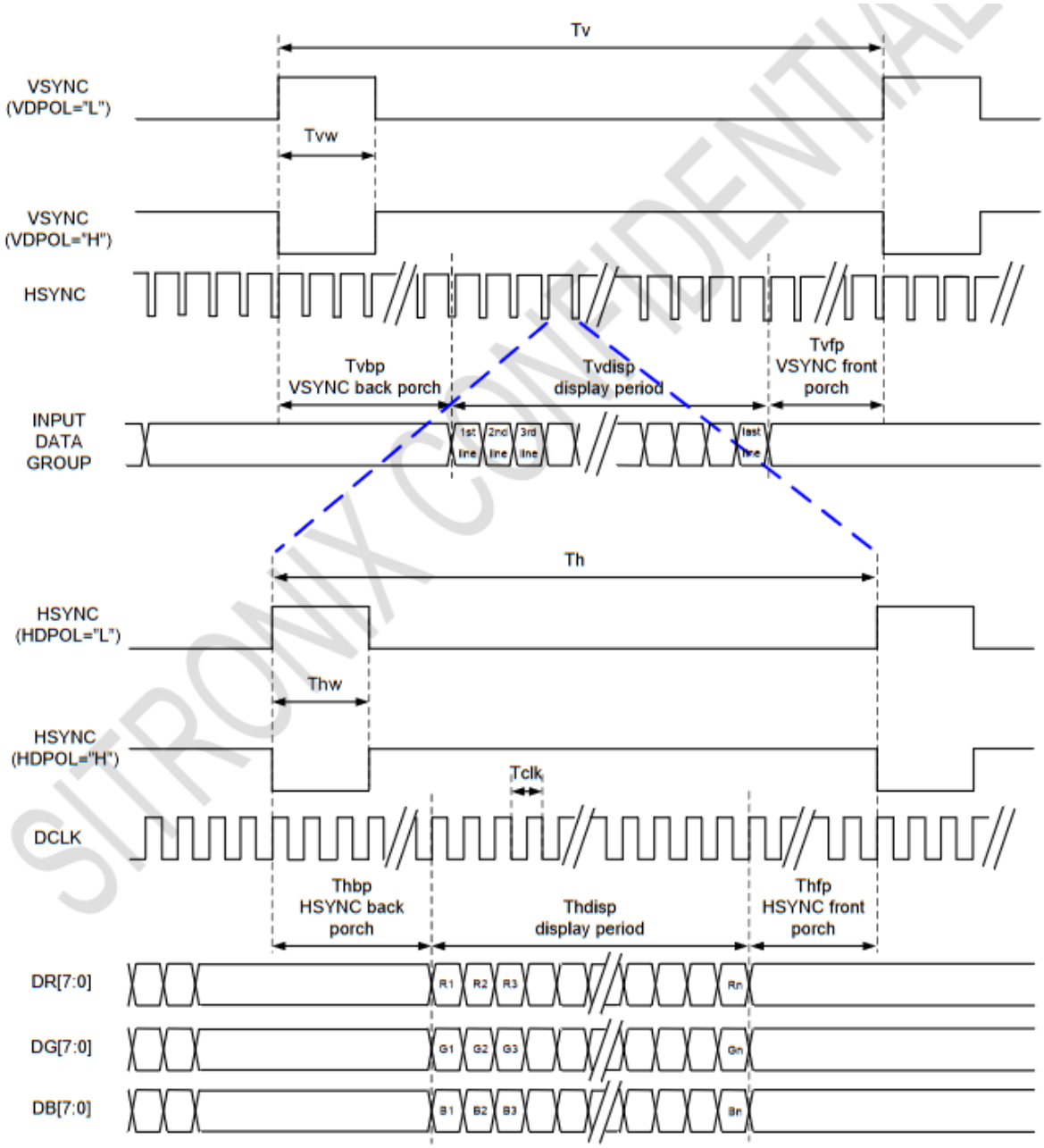
Vertical Input Timing

Parameter	Symbol	Min	Typ	Max	Unit	Note
VSYNC Display period	T_{VDISP}		480		HSYNC	
VSYNC Period Time	T_V	496	512	528		
VSYNC Pulse Width	T_{VW}	2	4	8		
VSYNC Back Porch (Blanking)	T_{VBP}	8	16	24		
VSYNC Front Porch	T_{VFP}	8	16	24		

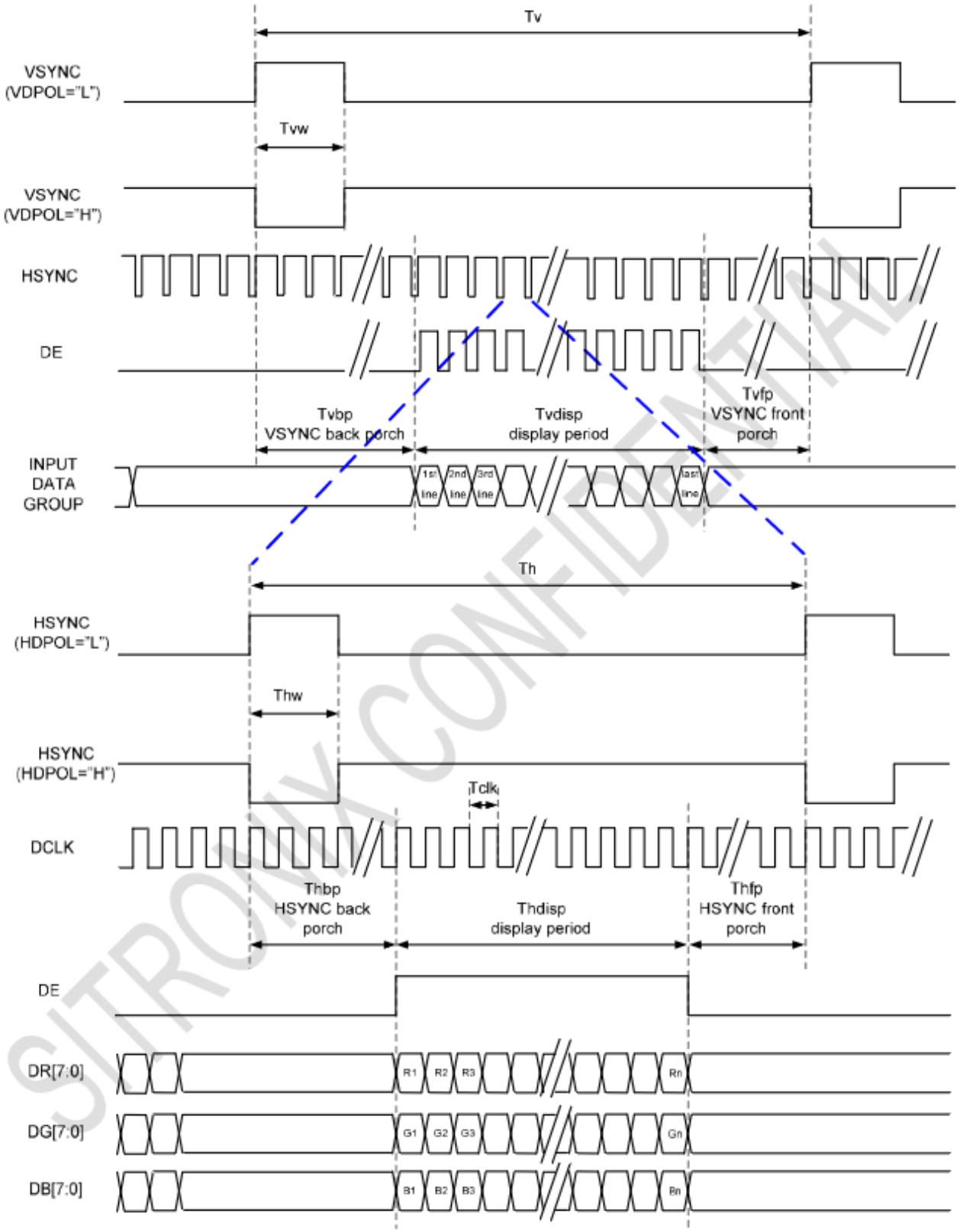
AC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
CLK pulse duty	T_{cw}	40	50	60	%	
VSYNC setup time	T_{vst}	10	-	-	ns	
VSYNC hold time	T_{vhd}	10	-	-	ns	
HSYNC setup time	T_{hst}	10	-	-	ns	
HSYNC hold time	T_{hhd}	10	-	-	ns	
Data set-up time	T_{dsu}	10	-	-	ns	
Data hold time	T_{dhd}	10	-	-	ns	
DE setup time	T_{dest}	10	-	-	ns	
DE hold time	T_{dhd}	10	-	-	ns	
Output stable time	T_{sst}	-	-	TBD	µs	

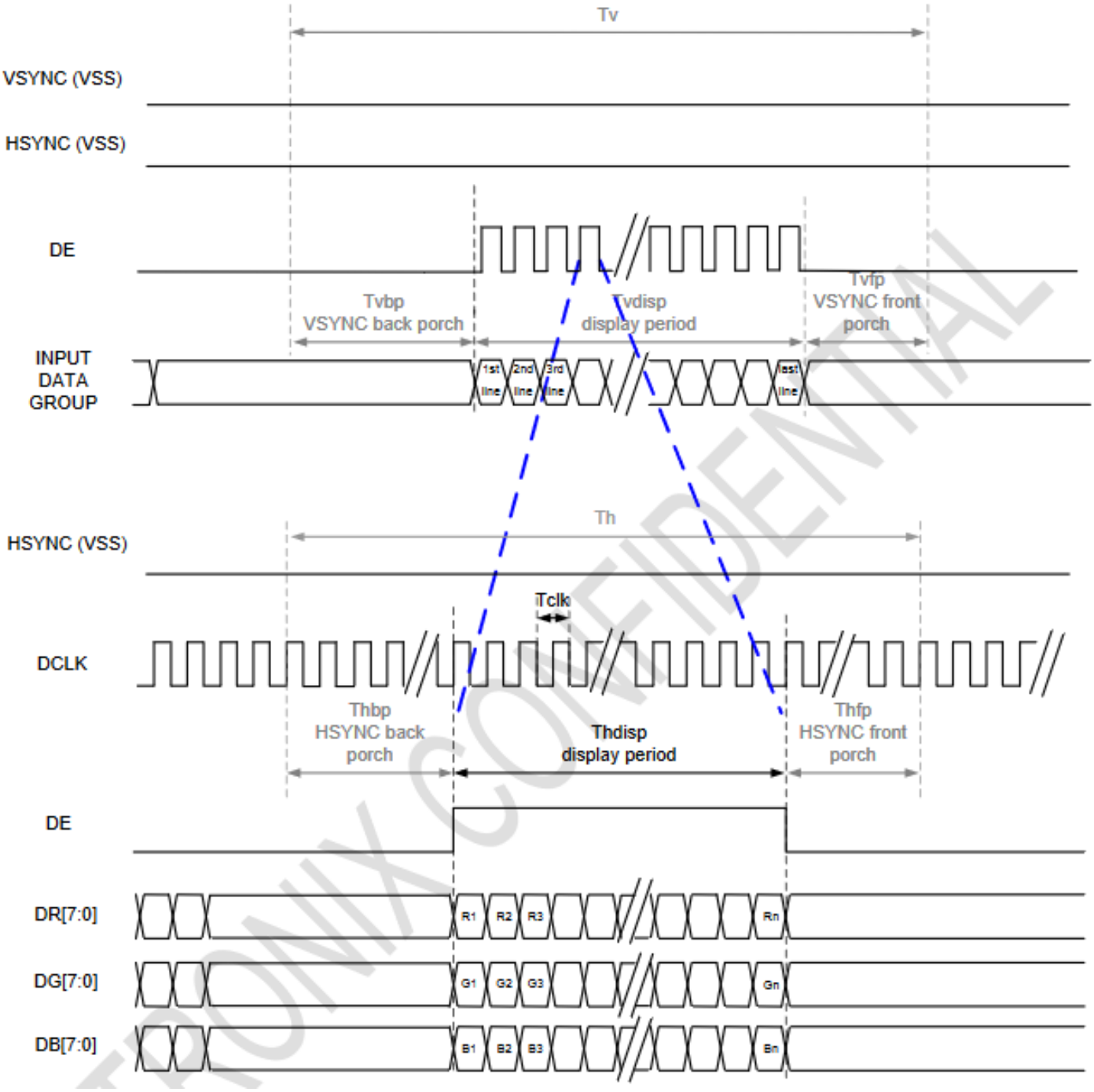
SYNC Mode



SYNC-DE Mode

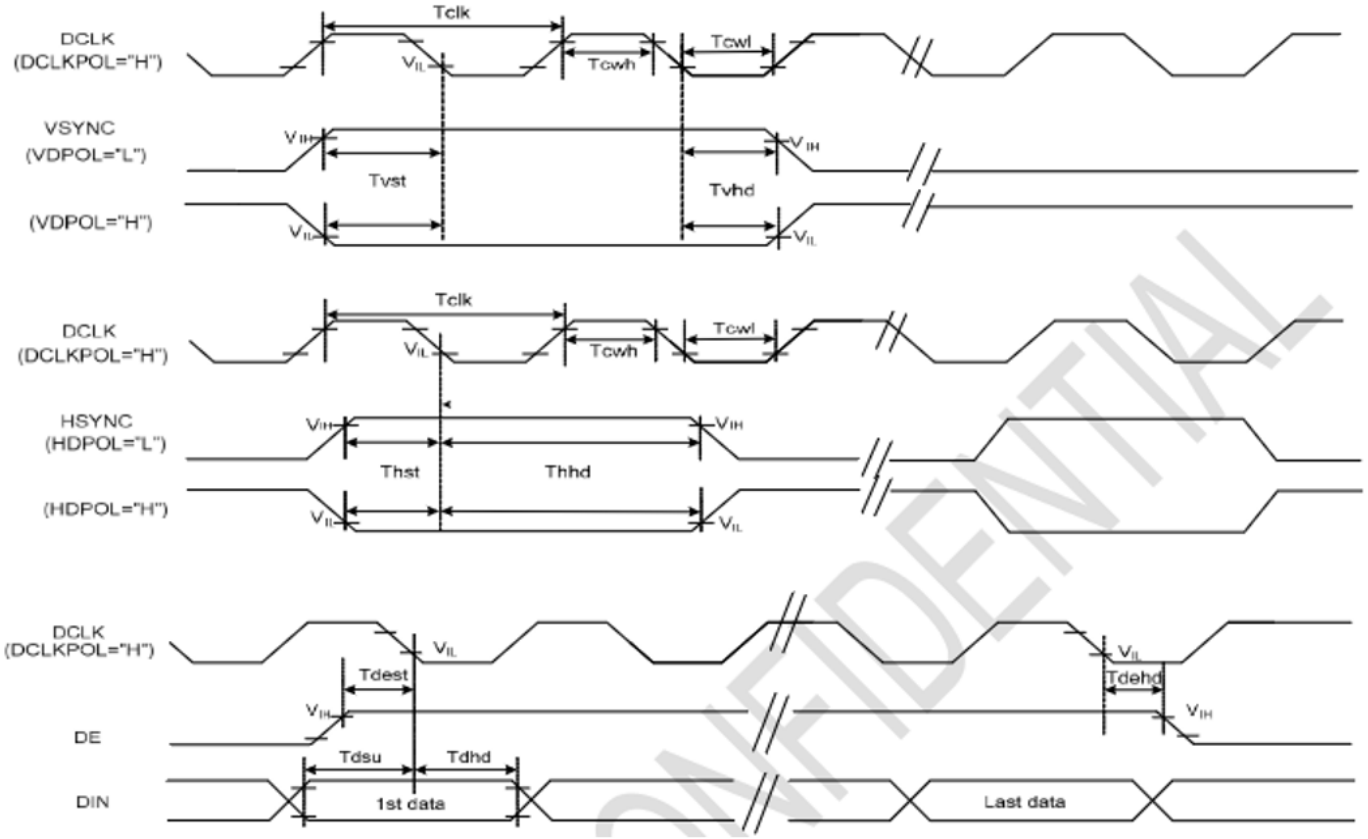


DE Mode

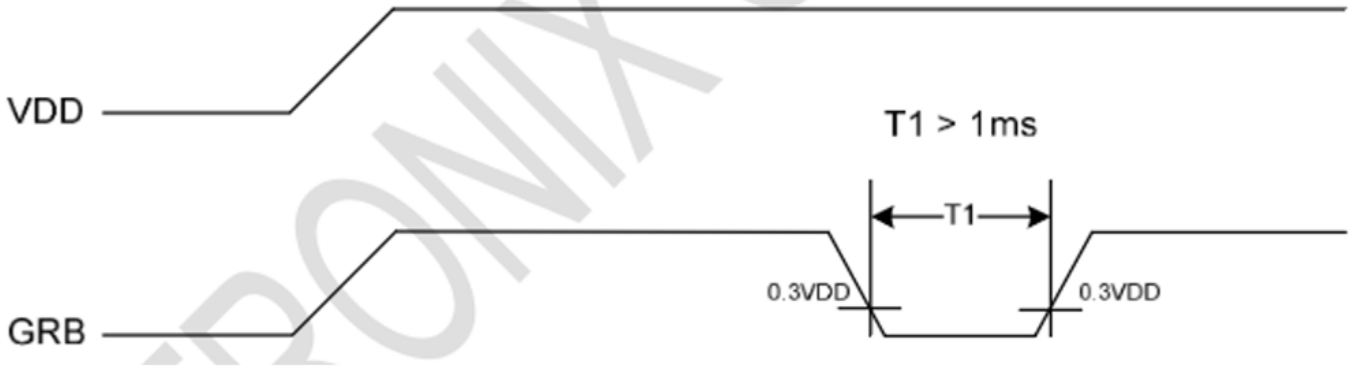


System Bus Timing for RGB Interface

DCLK Negative Polarity (DCLPOL="H")

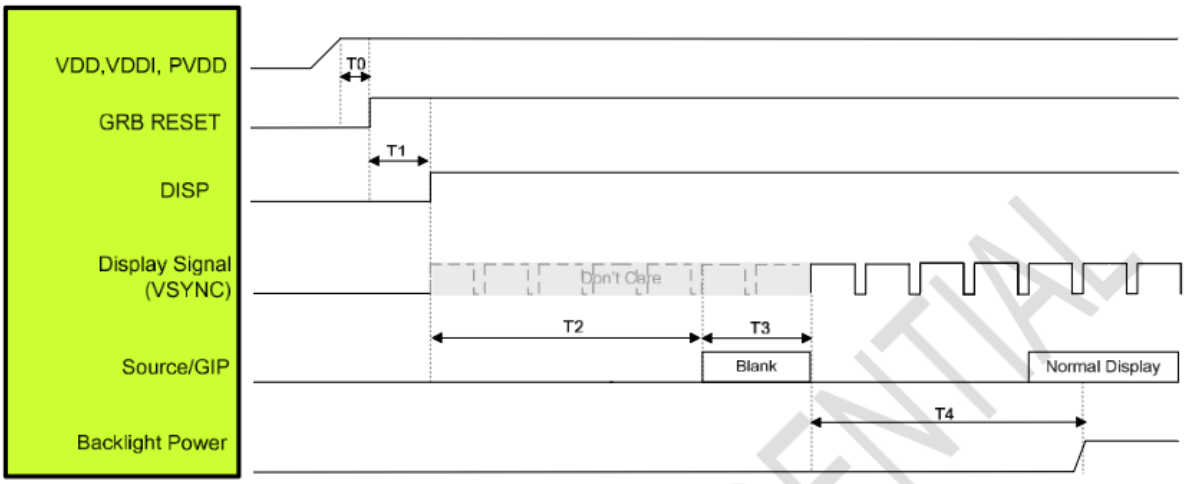


Reset Timing



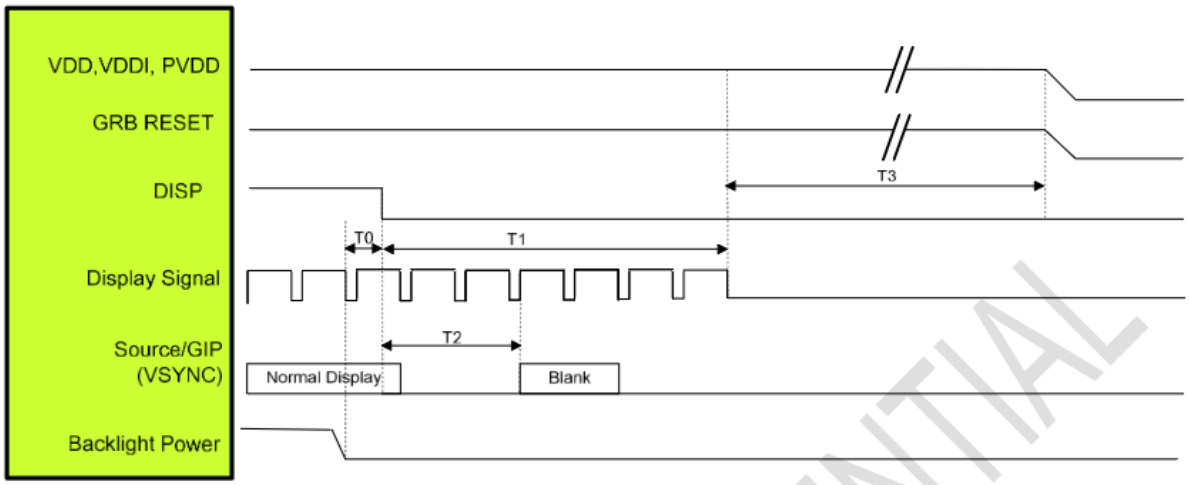
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
VDD Power Source Slew Time	TPOR	-	-	20	ms	From 0V to 99% VDD
GRB Pulse Width	tRSTW	10	50	-	us	R=10Kohm, C=1uF

Power On Sequence



Symbol	Description	Time	Unit
T0	System power stability to GRB RESET signal	≥1	ms
T1	GRB RESET= "High" to DISP="High"	≥10	ms
T2	DISP="High" to Source/GIP scan blank	85	ms
T3	IC scan blanking signal	≥33	ms
T4	Display signal input to Backlight power on (base on Display Signal Frame Rate 60Hz)	≥100	ms

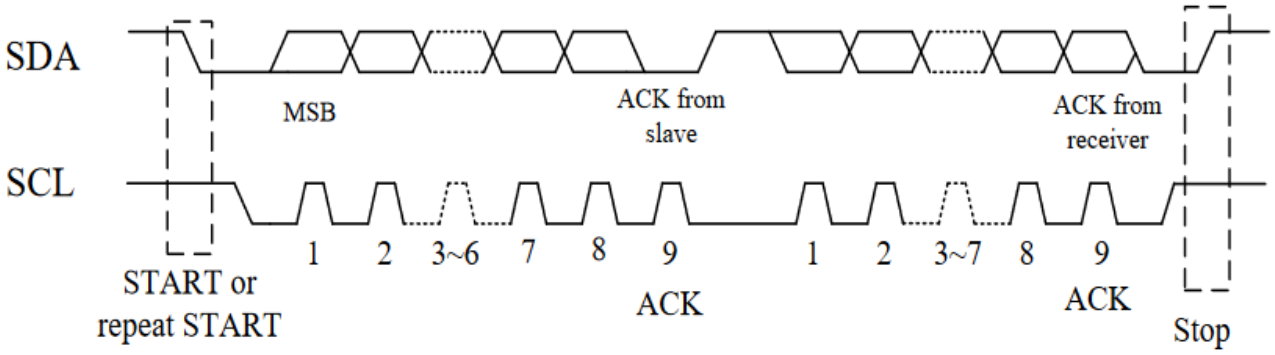
Power Off Sequence



Symbol	Description	Time	Unit
T0	Backlight Power off to DISP="Low"	≥1	ms
T1	DISP="Low" to IC internal voltage discharge complete	≥100	ms
T2	DISP="Low" to Source/GIP scan blank (base on Display Signal Frame Rate 60Hz)	≤50	ms
T3	IC internal voltage discharge is completed to VDD/VDDI/PVDD off	≥0	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

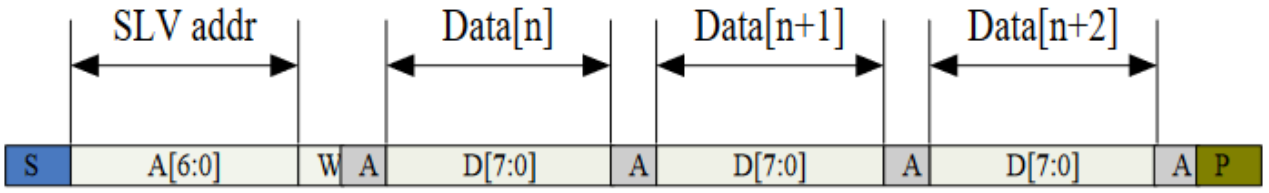


Figure 2-5I2C master write, slave read

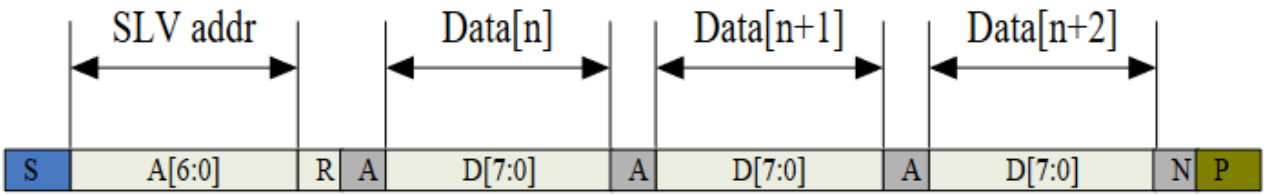


Figure 2-6 I2C master read, slave write

Power ON/Reset Sequence

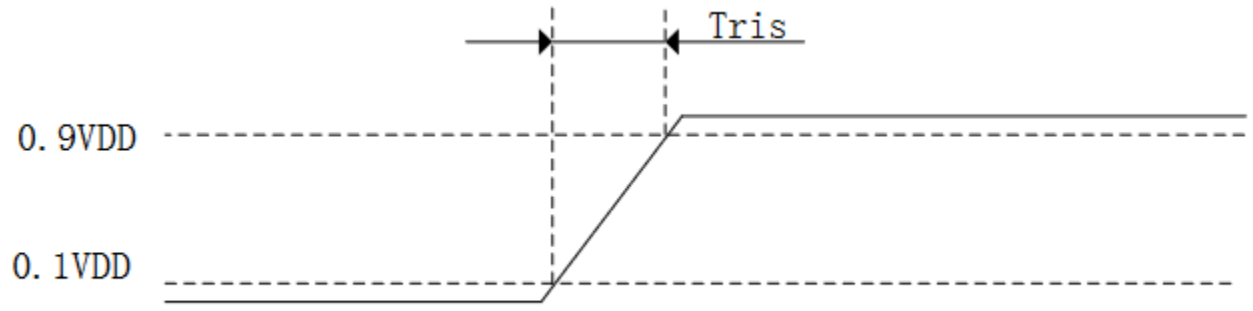
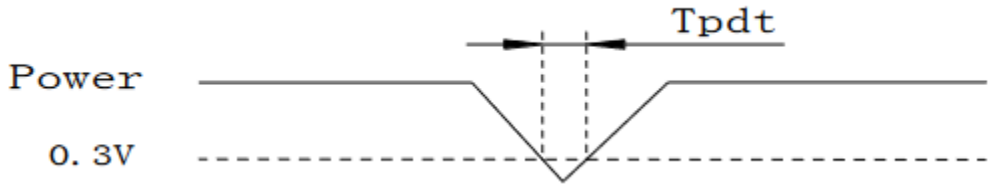
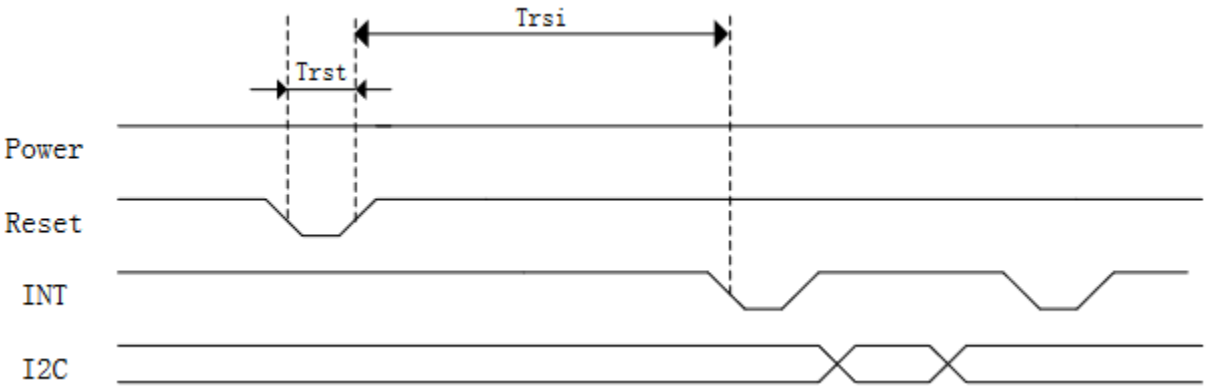


Figure 3-3 Power on time





Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD 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
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: ±8kV ; Contact: ±4kV 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.