

Product Specification

NHD-5.0-800480TF-ATXL#-CTP

TFT Liquid Crystal Display

NHD-	Newhaven Display
5.0-	5.0" Diagonal
800480-	800xRGBx480 Pixels
TF-	Model
A-	Built-in Driver / No Controller
T-	White LED Backlight
X-	TFT
L-	MVA, Enhanced Optical Characteristics, 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
0	03/20/2013	Initial Release	AK
1	08/28/2013	Electrical Characteristics updated	AK
2	09/16/2014	Electrical Characteristics updated	ML
3	04/01/2015	CTP mechanical dimensions updated	AK
4	09/02/2015	Driver, Electrical, Optical characteristics updated	AK
5	10/27/2015	Backlight lifetime rating added	AK
6	10/30/2015	Datasheet Reformat	SB
7	01/18/2016	CTP Controller Updated, Updated Brightness Rating	SB
6	02/23/2016	Corrected Notes on Drawing, Updated CTP Supply Voltage	SB
7	04/05/2016	Updated Brightness Rating	SB
8	07/07/2016	Mechanical Drawing Updated	SB
9	07/22/2016	Electrical Characteristics	TM
10	04/14/2017	Supply Current Updated	SB
11	07/27/2017	CTP Registers updated	SB
12	07/13/2018	Drawing Updated to Show Accurate Thickness	SB
13	08/14/2018	CTP Bonding Tape Thickness Increased to 0.3mm	SB
14	09/21/2018	Updated CTP Driver & Panel	SB
15	10/10/2018	TFT Driver IC Updated	SB
16	05/02/2019	CTP Timing Note Added	SB
17	07/10/2019	Timing Information Updated	SB
18	01/14/2020	Driver Change to ILI6122, Optical Characteristics Updated	SB
19	04/22/2020	Added Information for DE Mode Operation	TM
20	05/06/2020	Production Line Changed: Part Revision Updated from Rev1C to Rev1D	AS
21	03/22/2021	Updated Silkscreen on FPC	AS
22	05/11/2021	Updated Mechanical Drawing	JT
23	10/26/2021	Updated CTP IC	ZP
24	11/19/2021	Removed RW Registers from Register List Updated CTP Register A6h Default Value to 7.	CJ
25	08/04/2022	Updated CTP IC to FT5326DQ8-003, TFT Luminance Updated, CTP Transmittance Updated, Updated Mechanical Drawing	CJ
26	02/13/2024	Mechanical Drawing Updated CTP Controller Upgraded from FT5426 to FT5426G	KL
27	08/14/2024	Firmware ID Updated on Mechanical Drawing and CTP Registers	KL



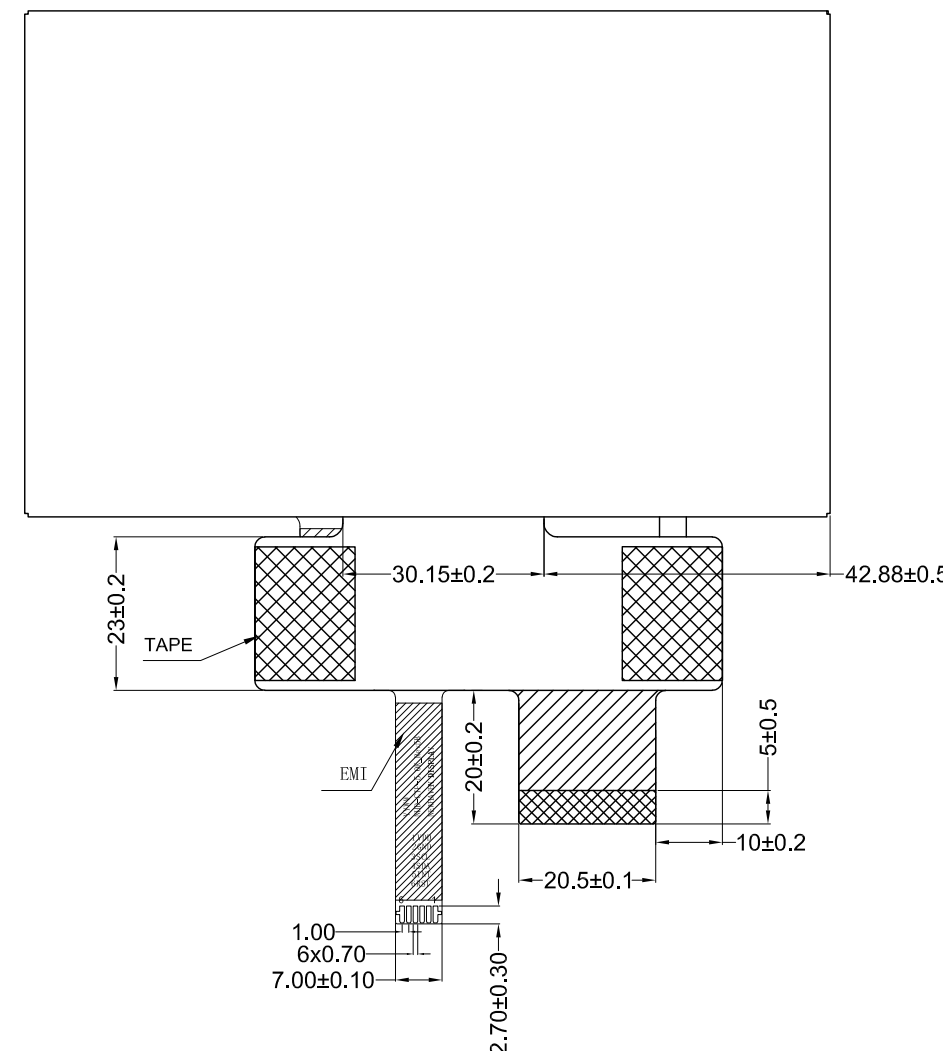
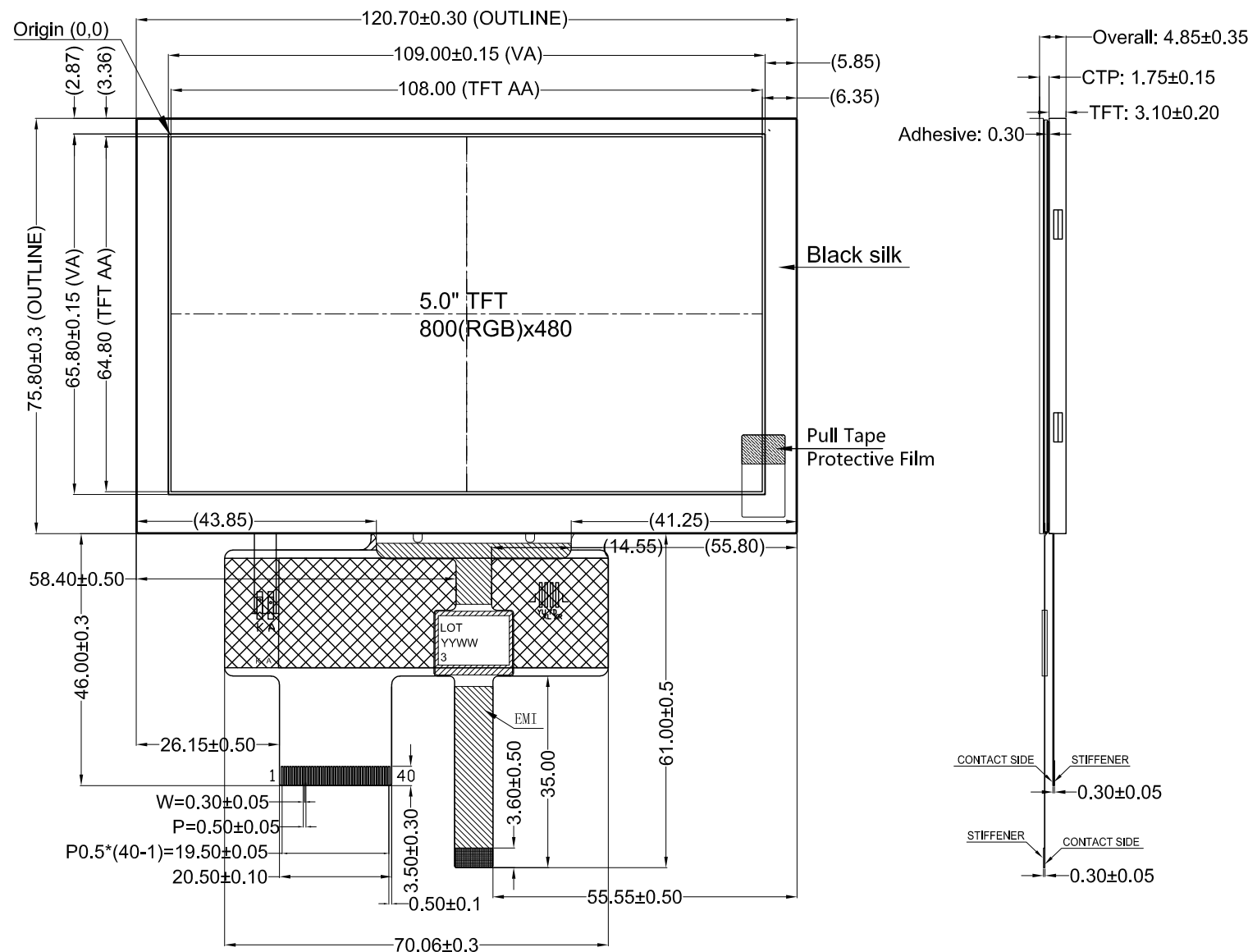
Mechanical Drawing

Newhaven Display

NHD-5.0-800480TF-ATXL#-CTP

Date Code

Part Label (type/format may vary)



TFT Pinout

NO.	PIN	NAME
1	VLED-	
2	VLED+	
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	CLKIN	
31	STBYB	
32	HSD	
33	VSD	
34	DEN	
35	NC	
36	GND	
37	XR	
38	YD	
39	XL	
40	YU	

CTP Pinout

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

Product Description: 5" 800x480 Premium TFT w/ Capacitive Touch

1. Driver IC: ILI6122 TFT, FT5426G CTP

2. Interface: 24-Bit Parallel RGB TFT, I²C CTP

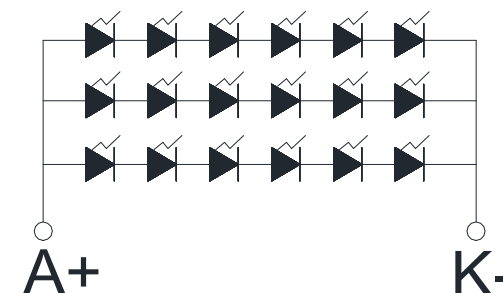
3. Power Requirement: 3.3V TFT, 19.2V/60mA Backlight, 3.3V CTP

4. Optical Features: Normally White, Transmissive, 527cd/m²

TFT: 40pin 0.5mm pitch; Ex. Molex 54104-4031

CTP: 6pin 1.0mm pitch; Ex. Molex 52271-0679

7. Key Features: EMI Shielded FPC, 10-point Multitouch



Standard Tolerance:
(Unless otherwise specified)

Linear: $\pm 0.3\text{mm}$

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

NEWHAVEN DISPLAY
INTERNATIONAL

Drawing/Part Number:
NHD-5.0-800480TF-ATXL#-CTP

Revision:
-

Drawn By: K. Lewis
Approved By: K. Lewis
Drawn Date: 08/14/2024
Approved Date: 08/14/2024

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Pin Description

TFT:

Pin No.	Symbol	External Connection	Function Description
1	LED-	LED Power Supply	Ground for Backlight
2	LED+	LED Power Supply	Backlight Power Supply (60mA @ ~19.2V)
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	CLKIN	MPU	Clock for input data (Rising Edge)
31	STBYB	MPU	1: Normal Operation; 0: Standby Mode
32	HSD	MPU	Line synchronization signal
33	VSD	MPU	Frame synchronization signal
34	DEN	MPU	Data Enable signal; Positive Polarity (Required in DE mode)
35	NC	-	No Connect
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)

Backlight Connector: on LCD connector

Mates with: ---

The ILI6122 driver IC is configured for DE Mode by default which eliminates the need to depend on HSD and VSD timing signals. Using DE mode in place of Sync mode, the display will no longer be affected by changes to the sync timing or porch settings in the event of a driver IC change. This will maintain a consistent display performance for any driver IC changes that may occur in the future.

The ILI6122 driver will treat the data on the Dx[7:0] RGB data bus as active display data while DEN is at "H" level and ignore the data on the Dx[7:0] RGB data bus while DEN is at "L" level.

Sync Mode can still be provided as the default setting but will need to be ordered as a custom option.

Capacitive Touch Panel:

Pin No.	Symbol	External Connection	Function Description
1	V _{CC}	Power Supply	Power supply for logic (3.3V)
2	GND	Power Supply	Ground
3	SCL	MPU	Serial I2C Clock (Requires pull-up resistor)
4	SDA	MPU	Serial I2C Data (Requires pull-up resistor)
5	/INT	MPU	Interrupt signal from touch panel module to host
6	/RESET	MPU	Active LOW Reset signal (Do not tie to V _{CC})

Recommended Connector: 1.0mm pitch 6-Conductor FFC. **Molex P/N:** 52271-0679

Driver/Controller Information

TFT:

Built-in ILI6122 Source Driver: <https://support.newhavendisplay.com/hc/en-us/articles/4414554619671-ILI6122>

Built-in ILI5960D Gate Driver: <https://support.newhavendisplay.com/hc/en-us/articles/4414531730583--ILI5960D>

Capacitive Touch Panel:

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



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	39	78	117	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	-	0.4	V
Backlight Supply Current	I _{LED}	-	-	60	75	mA
Backlight Supply Voltage	V _{LED}	I _{LED} = 60mA T _{OP} = 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 _{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}	1 point input	9	15	24	mA
Supply Current – Hibernate	I _{DD}	-	-	1.0	-	uA
"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}	IOH=-0.1mA	0.7 * V _{DD}	-	V _{DD}	V
"L" Level Output	V _{OL}	IOH=-0.1mA	V _{SS}	-	0.3*V _{DD}	V

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 10	60	70	-	°
	Bottom	φY-		60	70	-	°
	Left	θX-		60	70	-	°
	Right	θX+		60	70	-	°
Contrast Ratio		CR	-	400	500	-	-
Luminance		L _V	I _{LED} = 60 mA	425	527	-	cd/m ²
Response Time		T _R + T _F	T _{OP} = 25°C	-	25	50	ms
Chromaticity	Red	X _R	-	0.499	0.549	0.599	-
		Y _R	-	0.294	0.344	0.394	-
	Green	X _G	-	0.293	0.343	0.393	-
		Y _G	-	0.538	0.588	0.638	-
	Blue	X _B	-	0.085	0.135	0.185	-
		Y _B	-	0.053	0.103	0.153	-
	White	X _W	-	0.254	0.304	0.354	-
		Y _W	-	0.292	0.342	0.392	-



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 Out Zoom In 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	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: 0x54
A6h	RO	ID_G_FIRMID	[7:0]	00-FFh	Firmware ID Number Default: 3h
A8h	RO	ID_G_VENODRID	[7:0]	00-FFh	CTPM Vendor's Chip ID Default: 79h

Timing Characteristics – TFT Display

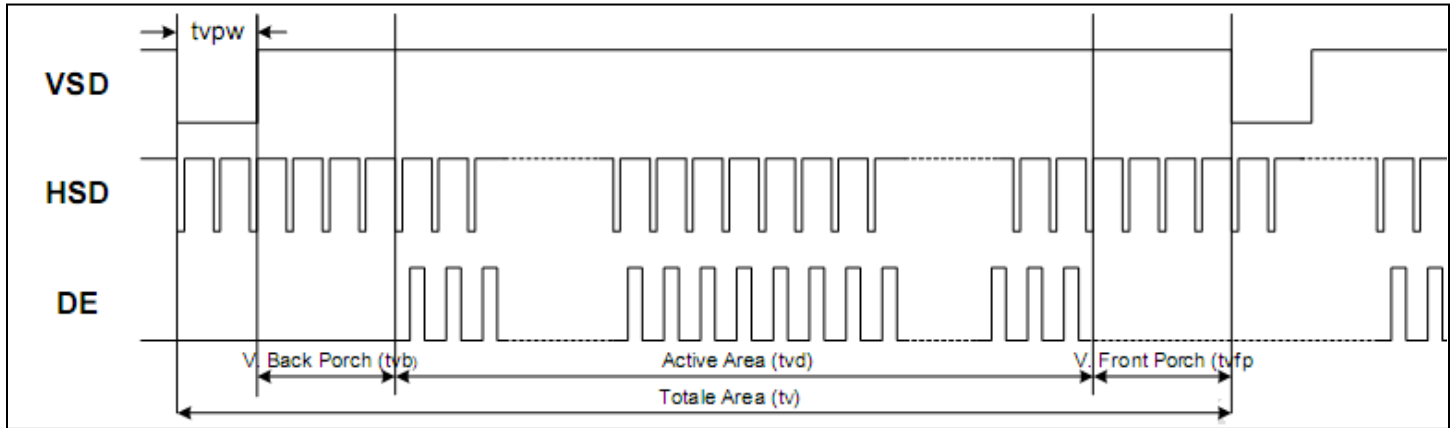
AC Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
V _{DD} Power ON Slew Rate	T _{POR}	-	-	20	ms	From 0V to 90% V _{DD}
RSTB Pulse Width	T _{RST}	10	-	-	μs	CLKIN = 45MHz
CLKIN cycle time	T _{cph}	20	-	-	ns	
CLKIN pulse duty	T _{cwh}	40	50	60	%	
VSD setup time	T _{vst}	8	-	-	ns	
VSD hold time	T _{vhd}	8	-	-	ns	
HSD setup time	T _{hst}	8	-	-	ns	
HSD hold time	T _{hhd}	8	-	-	ns	
Data set-up time	T _{dsu}	8	-	-	ns	D0R[7:0], D1G[7:0], D2B[7:0] to CLKIN
Data hold time	T _{dhd}	8	-	-	ns	D0R[7:0], D1G[7:0], D2B[7:0] to CLKIN
DE setup time	T _{esu}	8	-	-	ns	
DE hold time	T _{ehd}	8	-	-	ns	
Output stable time	T _{sst}	-	-	6	μs	10%-90% target voltage C _L = 120pf, R = 10kΩ

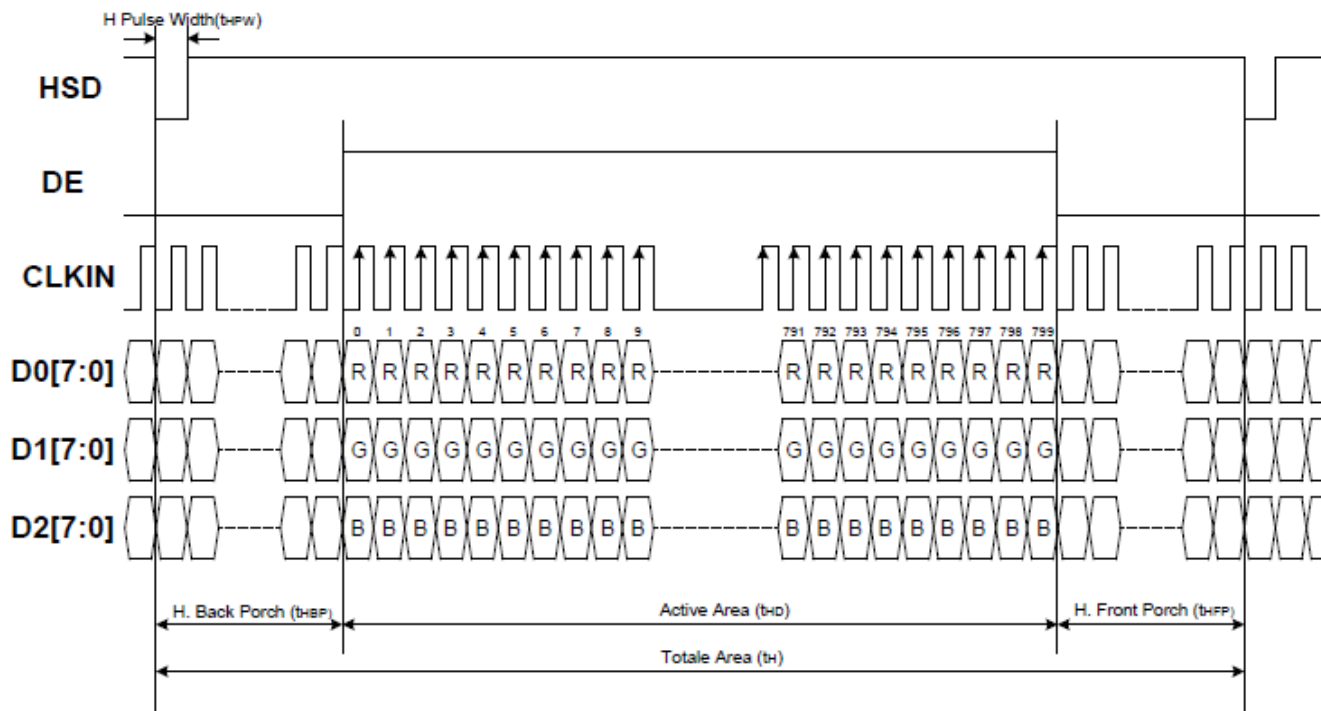
Parallel 24-Bit RGB Mode Timing

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
CLKIN Frequency	F _{clk}	-	40	50	MHz	V _{DD} = 2.7V ~ 3.6V
CLKIN time	T _{clk}	20	25	-	Ns	
CLKIN Pulse Duty	T _{cwh}	40	50	60	%	T _{clk}
Time from HSD to Source Output	T _{hso}	-	20	-	CLKIN	
Time from HSD to LD	T _{hld}	-	20	-	CLKIN	
Time from HSD to STV	T _{hstv}	-	2	-	CLKIN	
Time from HSD to CKV	T _{hckv}	-	20	-	CLKIN	
Time from HSD to OEV	T _{hoev}	-	4	-	CLKIN	
LD Pulse Width	T _{wld}	-	10	-	CLKIN	
CKV Pulse Width	T _{wckv}	-	66	-	CLKIN	
OEV Pulse Width	T _{woev}	-	74	-	CLKIN	

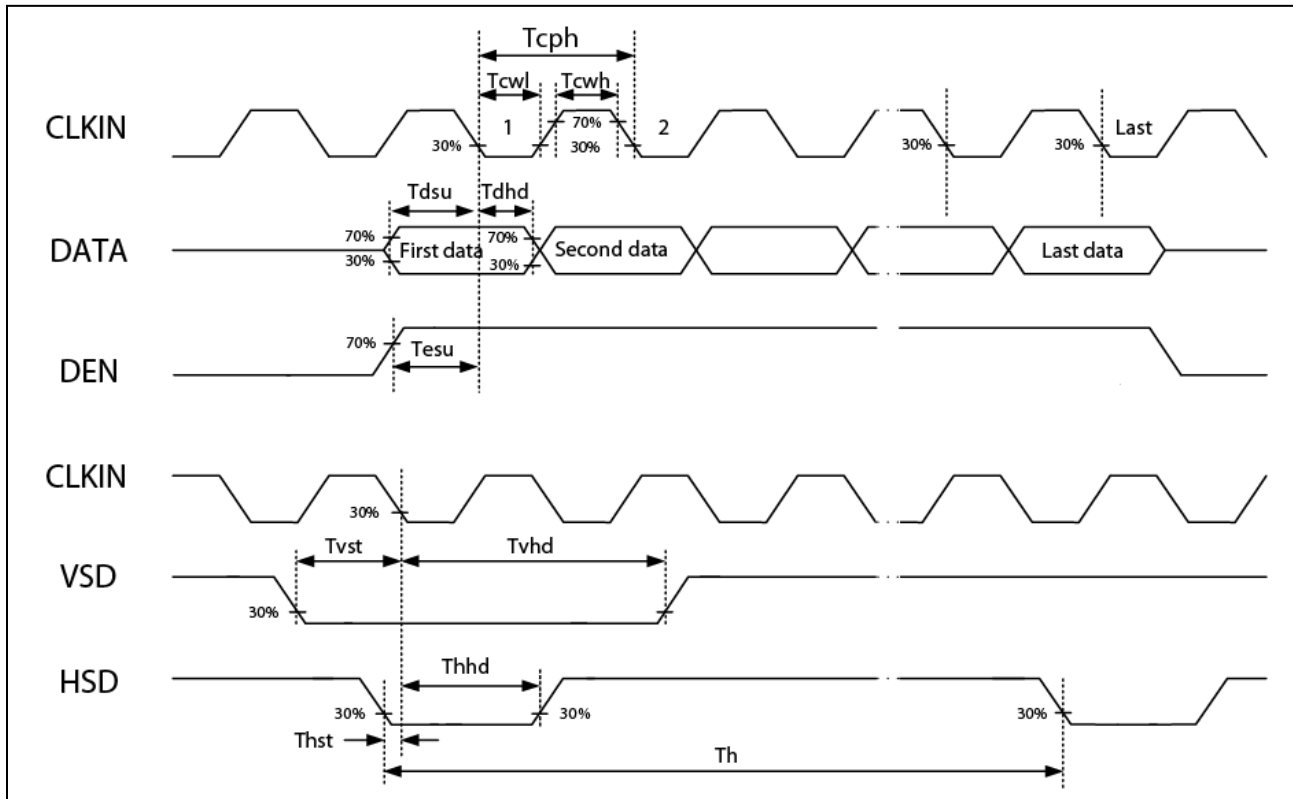
Vertical Input Timing



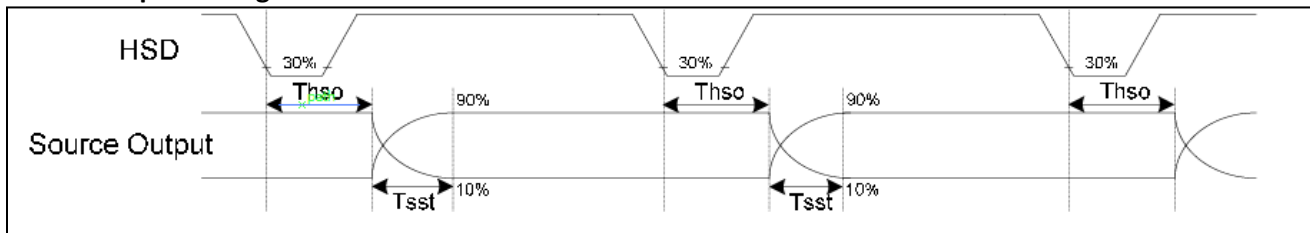
Horizontal Input Timing (DE Mode)



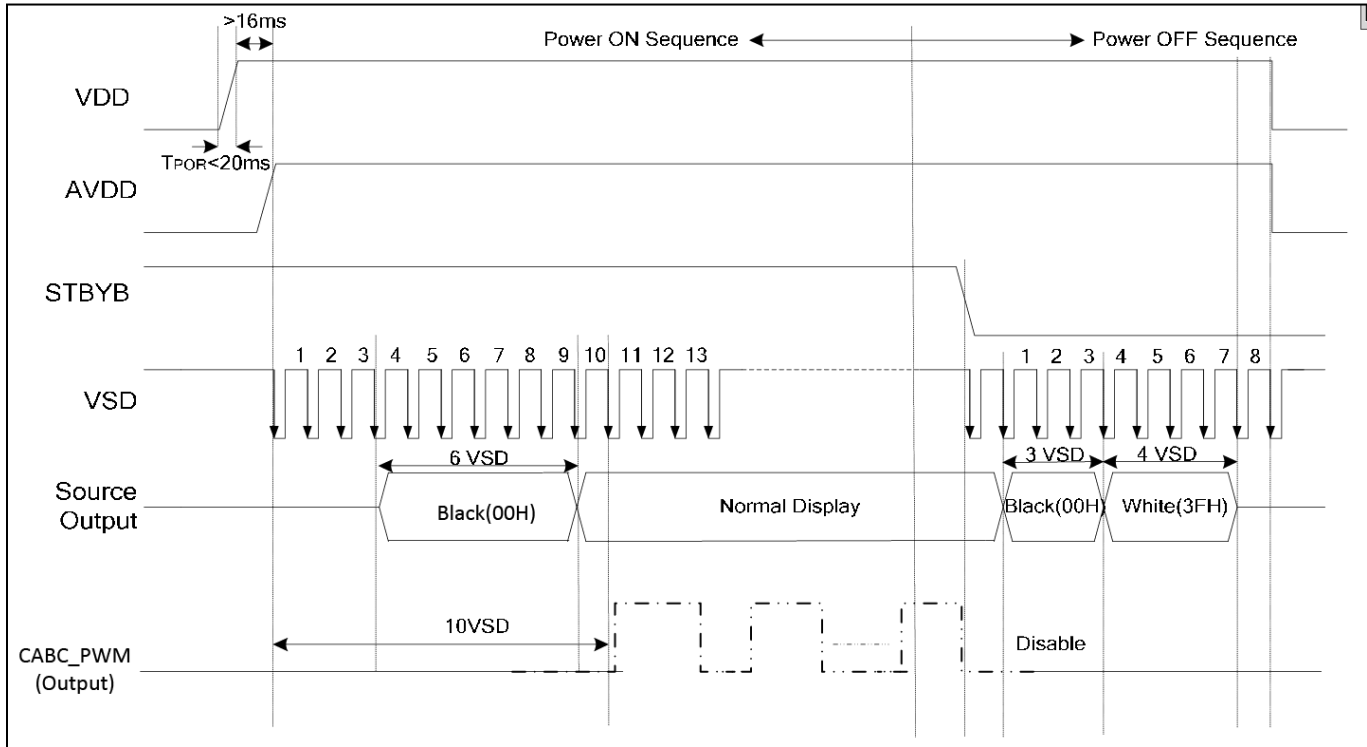
Input Clock and Data Timing



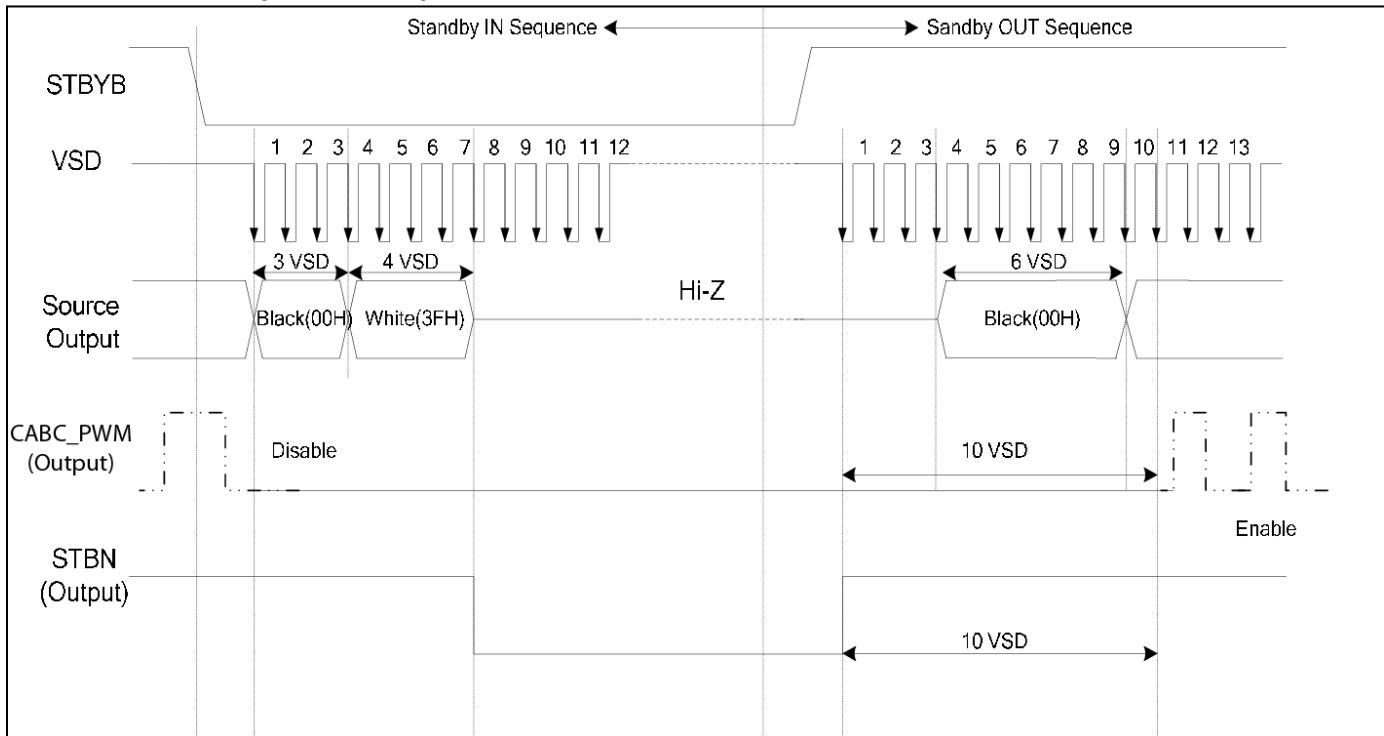
Source Output Timing



Power ON/OFF Sequence

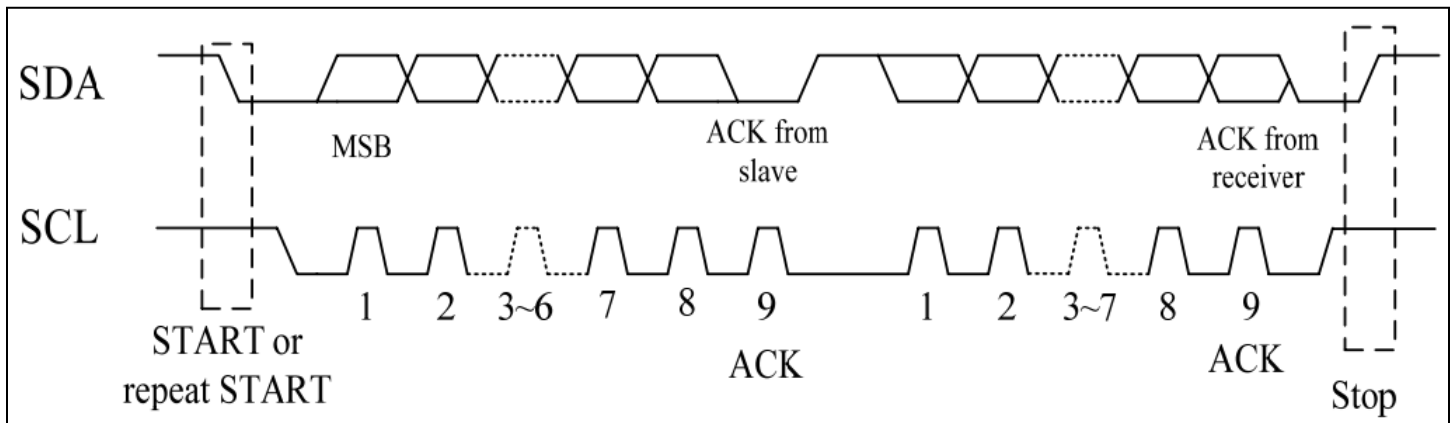


Enter/Exit Standby Mode Sequence

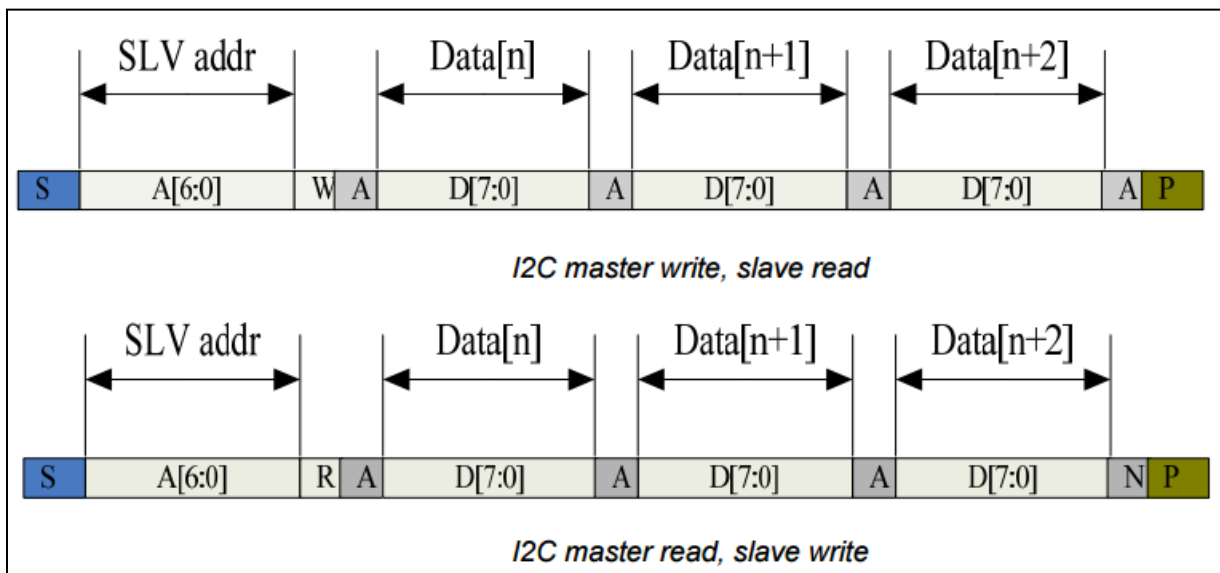


Timing Characteristics – Capacitive Touch Panel

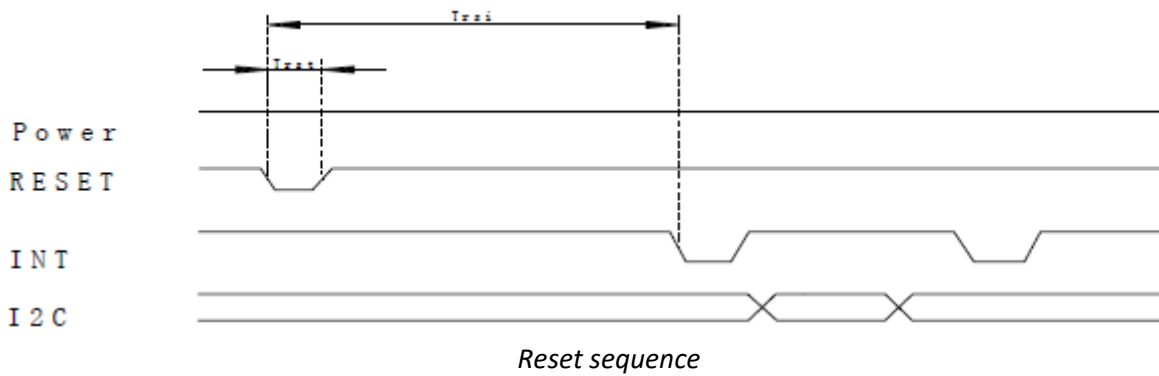
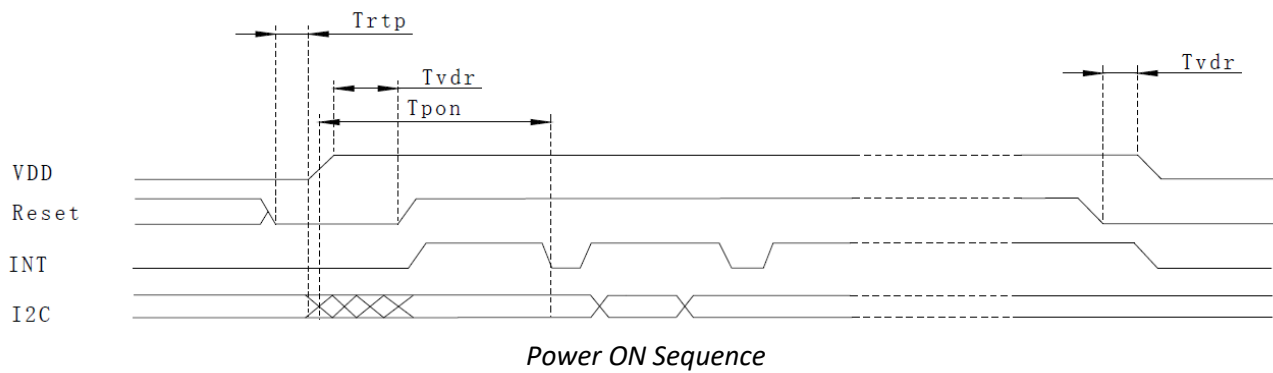
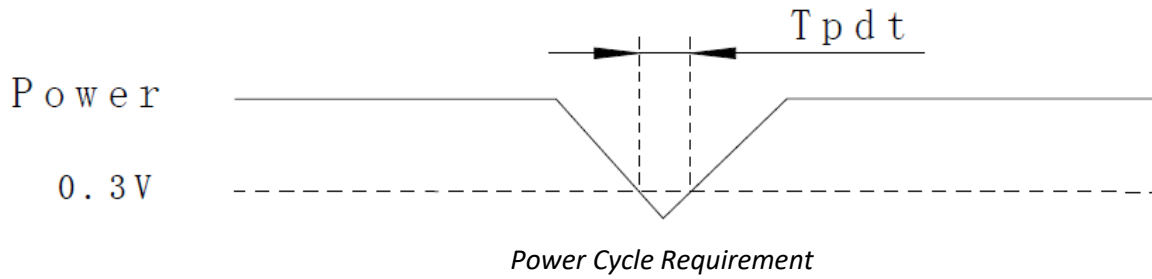
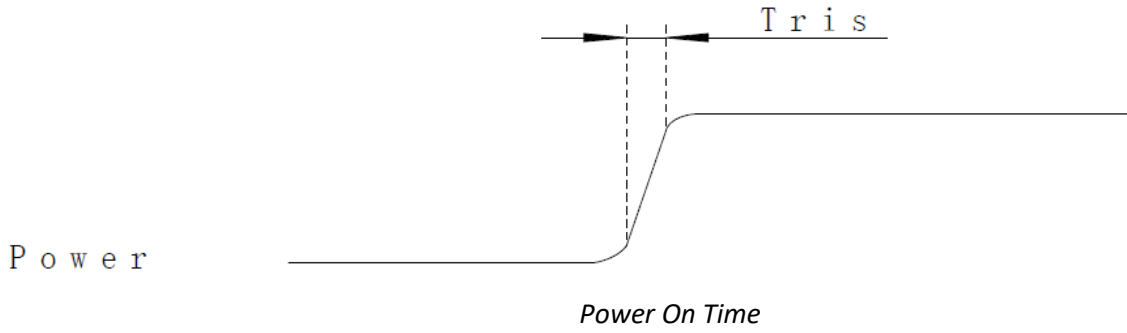
Data Transfer Format



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

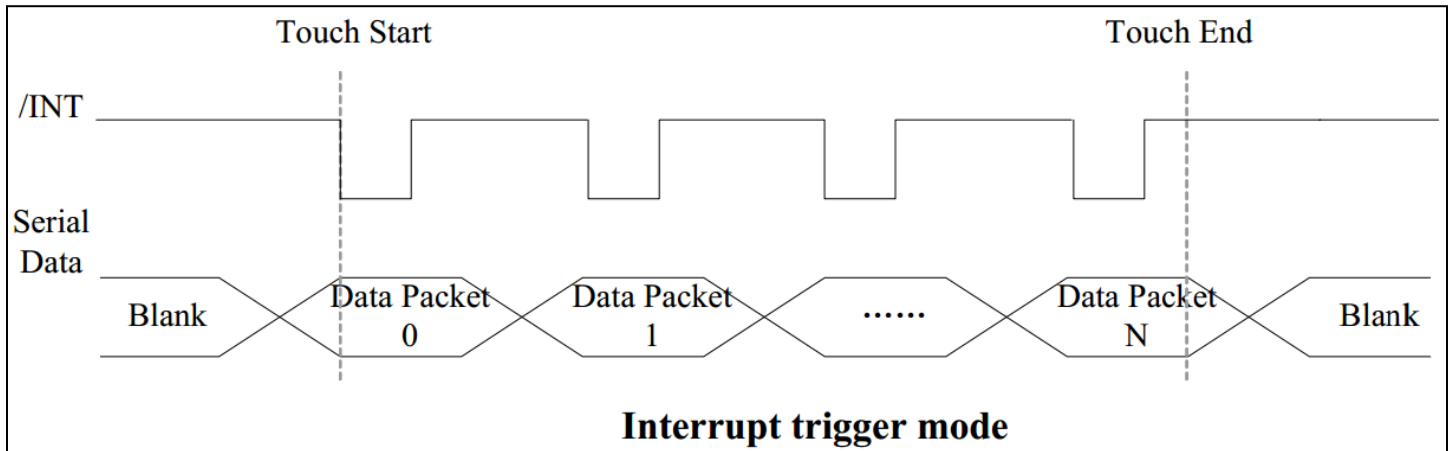


Power ON/Reset Sequence



Parameter	Description	Min	Max	Unit
T_{ris}	Rise time from 0.1V _{DD} to 0.9V _{DD}	-	5	ms
T_{pdt}	Time of the voltage of supply being below 0.3V	5	-	ms
T_{rtp}	Time of resetting to be low before powering on	100	-	μs
T_{pon}	Time to start reporting after power on	-	200	ms
T_{vdr}^*	Reset time after applying V _{DD}	1	-	ms
T_{rsi}	Time to start reporting after reset	-	200	ms
T_{rst}^*	Reset Time	1	-	ms

*If Reset is tied to V_{CC} 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, 96 Hrs.	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C, 96 Hrs.	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 96 Hrs.	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 96 Hrs.	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, 96 Hrs.	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 for 20 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz, 5G in each of 3 directions X, Y, Z For 30 minutes each direction	3
Static electricity test	Endurance test applying electric static discharge.	Air: 8kV, 150pF, 330Ω, 5 times Contact: 4kV, 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.

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