

NHD-5.0-800480TF-ATXL#-CTP

TFT (Thin-Film-Transistor) Color Liquid Crystal Display Module

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
#	RoHS Compliant
CTP	Capacitive Touch Panel with Controller

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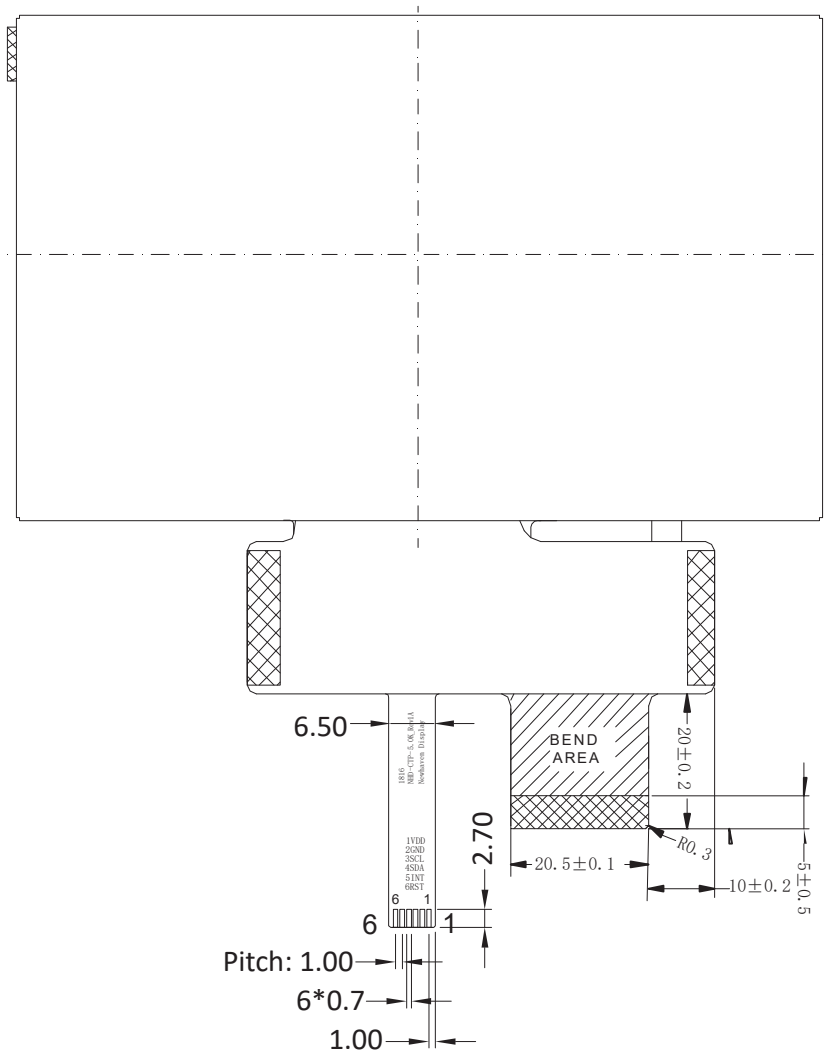
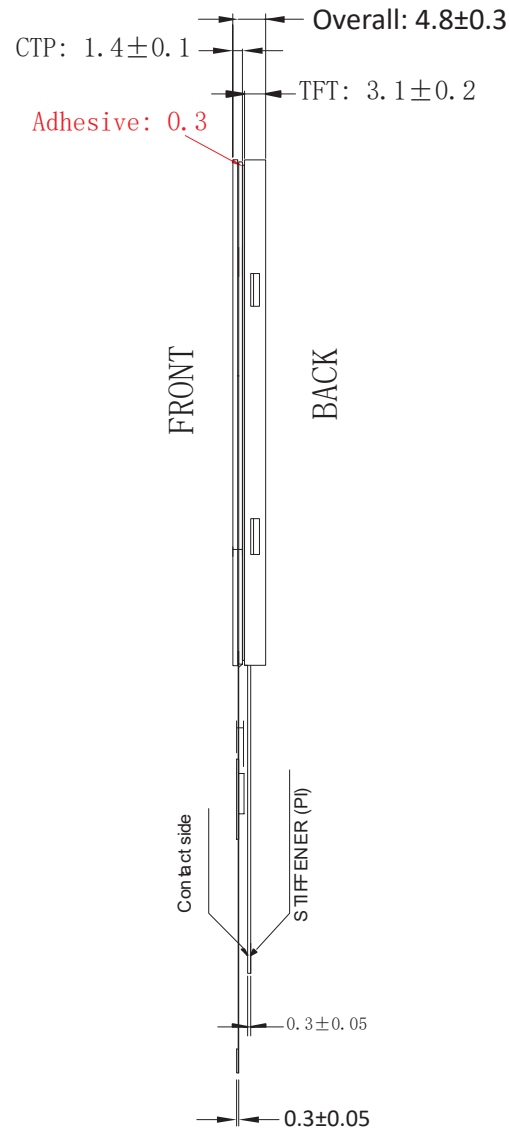
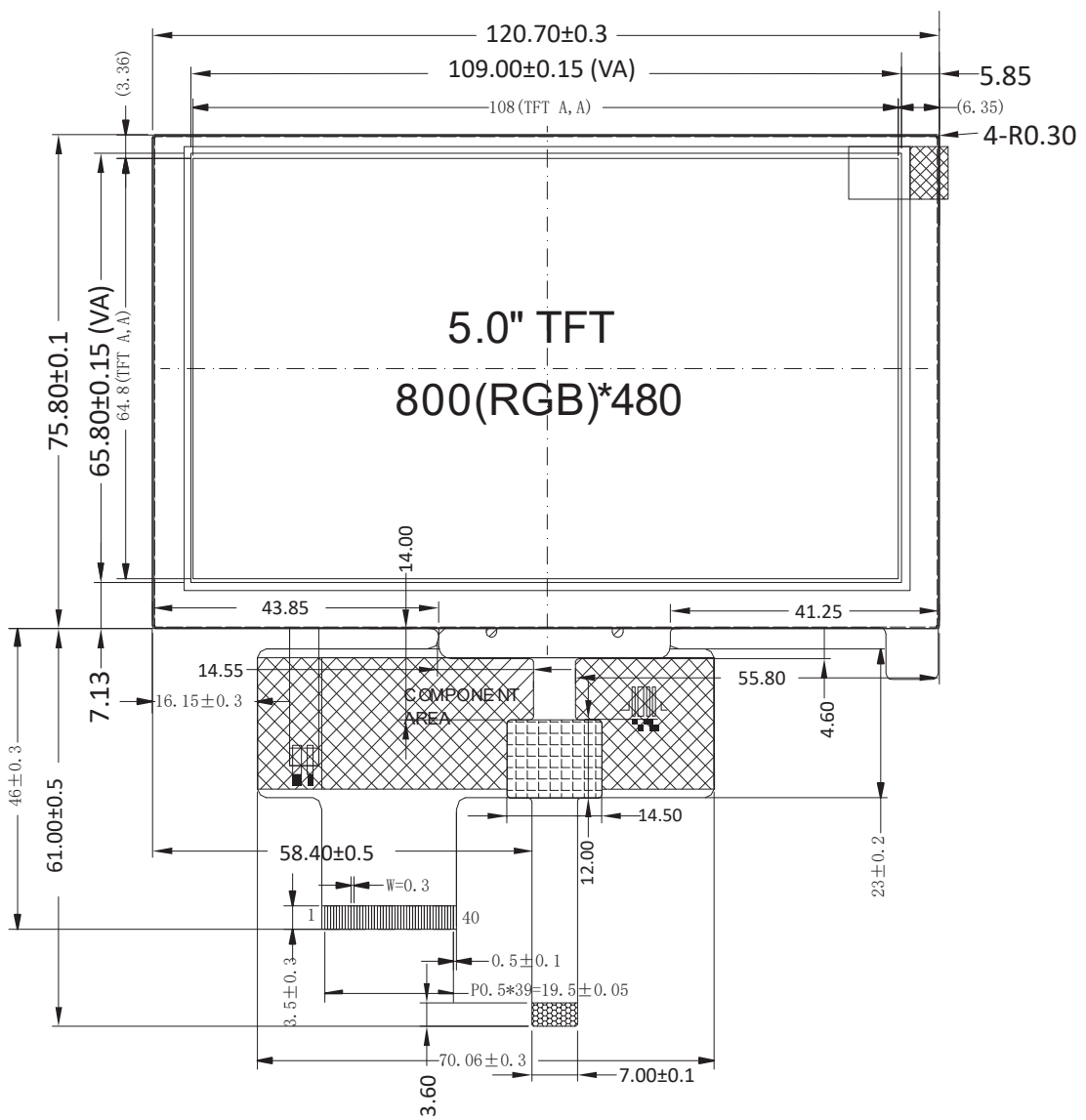
Document Revision History

Revision	Date	Description	Changed by
0	3/20/13	Initial Release	AK
1	8/28/13	Electrical Characteristics updated	AK
2	9/16/14	Electrical Characteristics updated	ML
3	4/1/15	CTP mechanical dimensions updated	AK
4	9/2/15	Driver, Electrical, Optical characteristics updated	AK
5	10/27/15	Backlight lifetime rating added	AK
6	10/30/15	Datasheet Reformat	SB
7	1/18/16	CTP Controller Updated, Updated Brightness Rating	SB
6	2/23/16	Corrected Notes on Drawing, Updated CTP Supply Voltage	SB
7	4/5/16	Updated Brightness Rating	SB
8	7/7/16	Mechanical Drawing Updated	SB
9	7/22/16	Electrical Characteristics	TM
10	4/14/17	Supply Current Updated	SB
11	7/27/17	CTP Registers updated	SB
12	7/13/18	Drawing Updated to Show Accurate Thickness	SB
13	8/14/18	CTP Bonding Tape Thickness Increased to 0.3mm	SB
14	9/21/18	Updated CTP Driver & Panel	SB
15	10/10/18	TFT Driver IC Updated	SB
16	5/2/19	CTP Timing Note Added	SB
17	7/10/19	Timing Information Updated	SB

Functions and Features

- 800xRGBx480 resolution, up to 16.7M colors
- 18-LED backlight
- 24 bit RGB interface
- Enhanced Optical Characteristics
- Wide Viewing Angles
- Capacitive touch panel with controller
 - 10-Point multi-touch input
 - Gesture input
 - Zoom In/Out
 - Swipe Up/Down/Left/Right

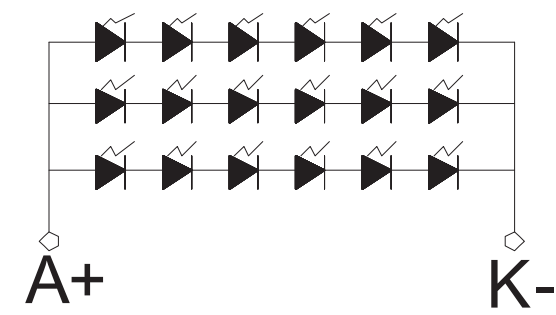
1	2	3	4	5	6	7	8	
				SYMBOL	REVISION			DATE



PIN	Symbol
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	NC{XR
38	NC{YD
39	NC{XL
40	NC{YU

PIN	Symbol
1	VDD
2	GND
3	SCI
4	SDA
5	INT
6	RESET

- Notes:**
1. Display Size: 5.0" TFT
 2. Display Mode: MVA / Transmissive / Normal White / Anti-Glare
 3. Supply Voltage: 3.3V
 4. Driver IC: ILI6126
 5. Backlight: White LED / 19.2V / 60 mA (Typ)
 6. Brightness: 400 cd/m² (Typ)
 7. Touch Panel: PCAP



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)
 LINEAR: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-5.0-800480TF-ATXL#-CTP

REVISION: 1B

SIZE: A3

SCALE: NS

DO NOT SCALE DRAWING

SHEET 1 OF 1

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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
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: ---

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 ILI6126C Source Driver: <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/ILI6126C.pdf>

Built-in ILI5960D Gate Driver: <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/ILI5960D.pdf>

Capacitive Touch Panel:

Built-in FocalTech FT5426 controller.

Please download specification at <http://www.newhavendisplay.com/appnotes/datasheets/touchpanel/FT5x26.pdf>

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	50	100	170	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	17.4	19.2	19.8	V
Backlight Lifetime*	-	T _{OP} = 25°C	20,000	50,000	-	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}	-	2.8	3.3	3.6	V
Supply Current – Operating	I _{DD}	V _{DD} = 3.3V	-	12	20	mA
Supply Current – Hibernate	I _{DD}	T _{OP} = 25°C	-	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}	-	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	CR ≥ 10	-	75	-	°
	Bottom		-	75	-	°
	Left		-	75	-	°
	Right		-	75	-	°
Contrast Ratio	CR	-	350	-	-	
Luminance	L _V	I _{LED} = 60 mA	315	400	-	cd/m ²
Response Time	T _R + T _F	T _{OP} = 25°C	-	20	30	ms

Capacitive Touch Panel Material Characteristics:

Property	Requirement	Unit
IC	FT5426	-
ITO Glass thickness	0.55	mm
Surface Hardness	≥6	H
Light transmission	82%	-
Operating Humidity	20~90	RH
Storage Humidity	20~90	RH

Capacitive Touch Panel Registers

Register No.	Access	Register Name	Bits	Value	Description
01h	RO	Gesture ID	[7:0]	10	Swipe Up
				18h	Swipe Down
				1Ch	Swipe Left
				14h	Swipe Right
				48h	Zoom Out
				49h	Zoom In
				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
80	RW	ID_G_MC_THGROUP	[7:0]	00-FFh	Mutual-Capacitive touch Threshold / 4 Default: 4Bh
81h	RW	ID_G_MC_THPEAK	[7:0]	00-FFh	Mutual-Capacitive Peak Threshold / 4 Default: 46h
85h	RW	ID_G_THDIFF	[7:0]	00-FFh	Points Filtering Range Threshold / 16 Default: A0
86h	RW	ID_G_CTRL	[1:0]	0-1	Allowed to switch to monitor mode or not (1: Allowed, 0: Not Allowed)
88h	RW	ID_G_PERIODACTIVE	[3:0]	3h-Eh	Period of Active Status
89h	RW	ID_G_PERIODMONITOR	[7:0]	1Eh-FFh	Timer to enter "idle" while in Monitor (ms)
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
A4h	RW	ID_G_MODE	[0]	0 1	INT Trigger Mode INT Polling Mode
A5h	RW	ID_G_PMODE	[1:0]	0 1 3	Active Monitor Sleep
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
C0h	RW	ID_G_GLOVE_MODE_EN	[0]	0 1	Glove Mode Switch Disable Glove Mode Switch Enable
C1h	RW	ID_G_COVER_MODE_EN	[0]	0 1	Cover Mode Switch Disable Cover Mode Switch Enable

Timing Characteristics – TFT display

Horizontal Input Timing

Parameter	Symbol	Value			Unit	Note
Horizontal Display Area	thd	800			MHz	
DCLK Frequency	fclk	Min	Typ	Max	MHz	
		-	33.3	50		
1 Horizontal Line	th	908	928	1010	DCLK	thb + thpw = 88 DCLK is fixed
HSD Pulse Width	thpw	4	48	64		
HSD Back Porch (Blanking)	thb	20	40	84		
HSD Front Porch	thfp	20	40	122		

Vertical Input Timing

Parameter	Symbol	Min	Typ	Max	Unit	Note
Vertical Display Area	tvd	480			H	tvpw + tvb = 32H is fixed
VSD Period Tim	tv	515	525	-		
VSD Pulse Width	tvpw	1	3	31		
VSD Back Porch (Blanking)	tvb	1	29	31		
VSD Front Porch	tvfp	3	13	-		

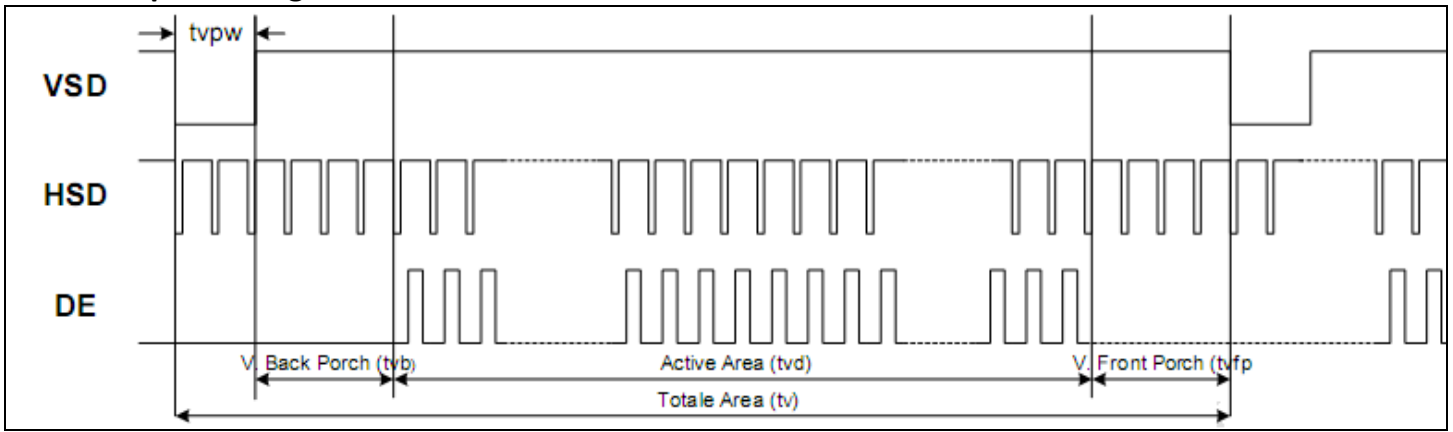
AC Characteristics

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	DOR[7:0], D1G[7:0], D2B[7:0] to CLKIN
Data hold time	T _{dhd}	8	-	-	ns	DOR[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

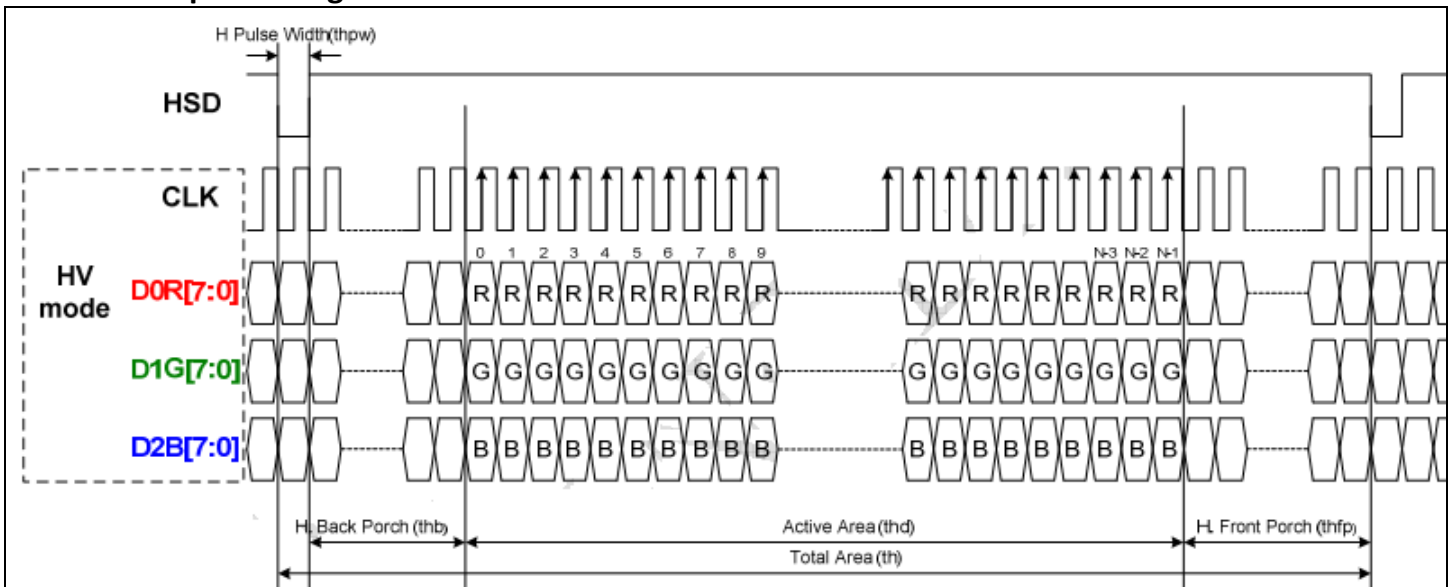
Parallel 24-Bit RGB Mode Timing

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
CLKIN Frequency	F _{clk}	-	33	50	MHz	V _{DD} = 2.7V ~ 3.6V
CLKIN time	T _{clk}	20	30	-	Ns	
CLKIN Pulse Duty	T _{cwh}	40	50	60	%	T _{clk}
Time from HSD to Source Output	T _{hso}	-	64	-	CLKIN	
Time from HSD to LD	T _{hld}	-	64	-	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 Puse Width	T _{woev}	-	92	-	CLKIN	

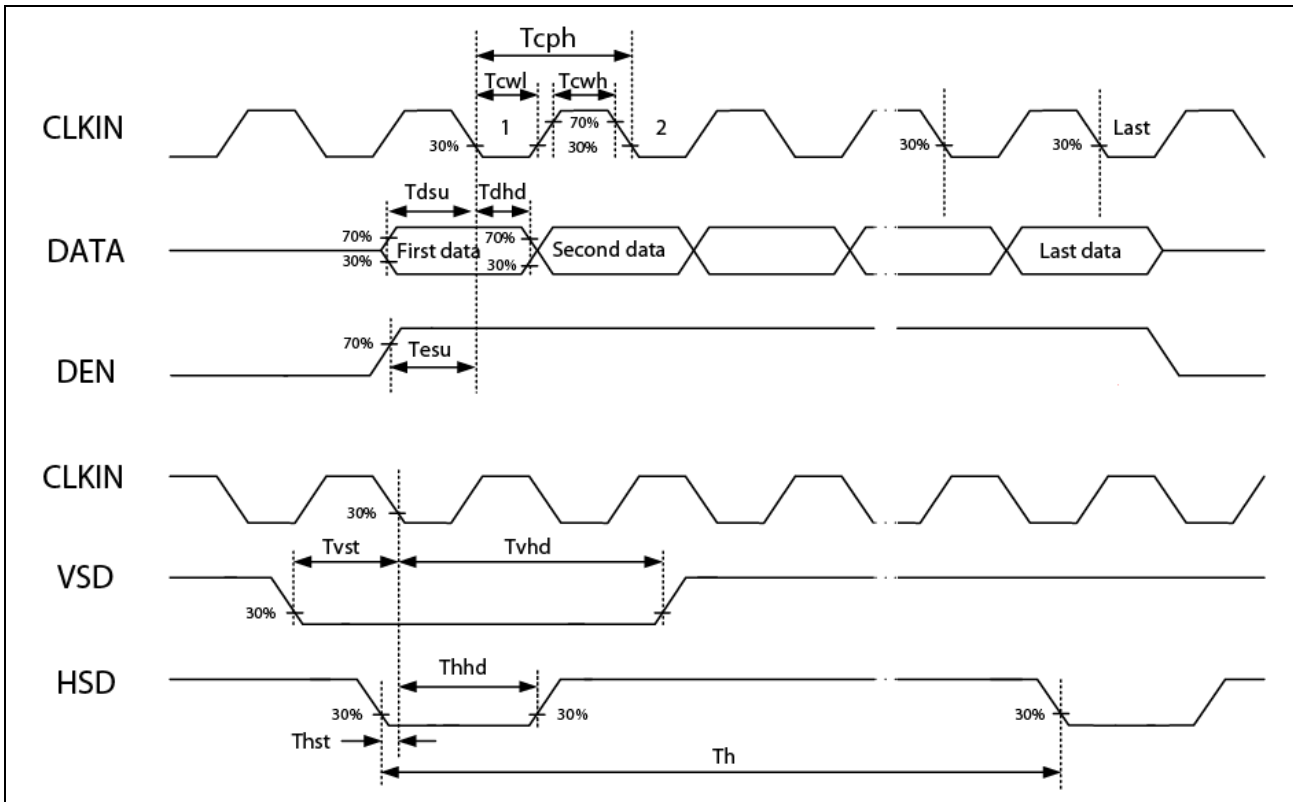
Vertical Input Timing



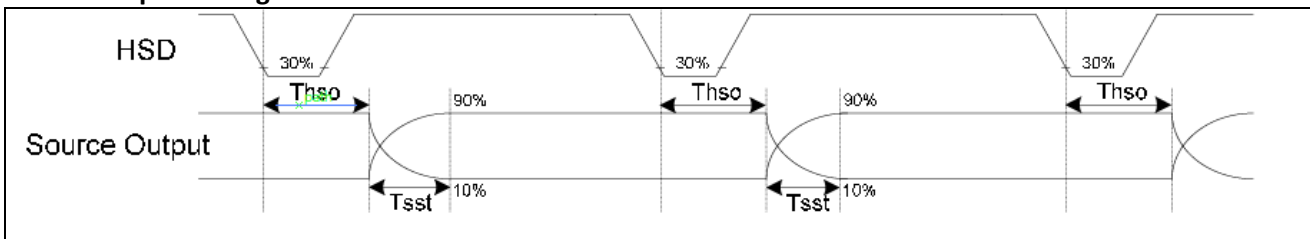
Horizontal Input Timing



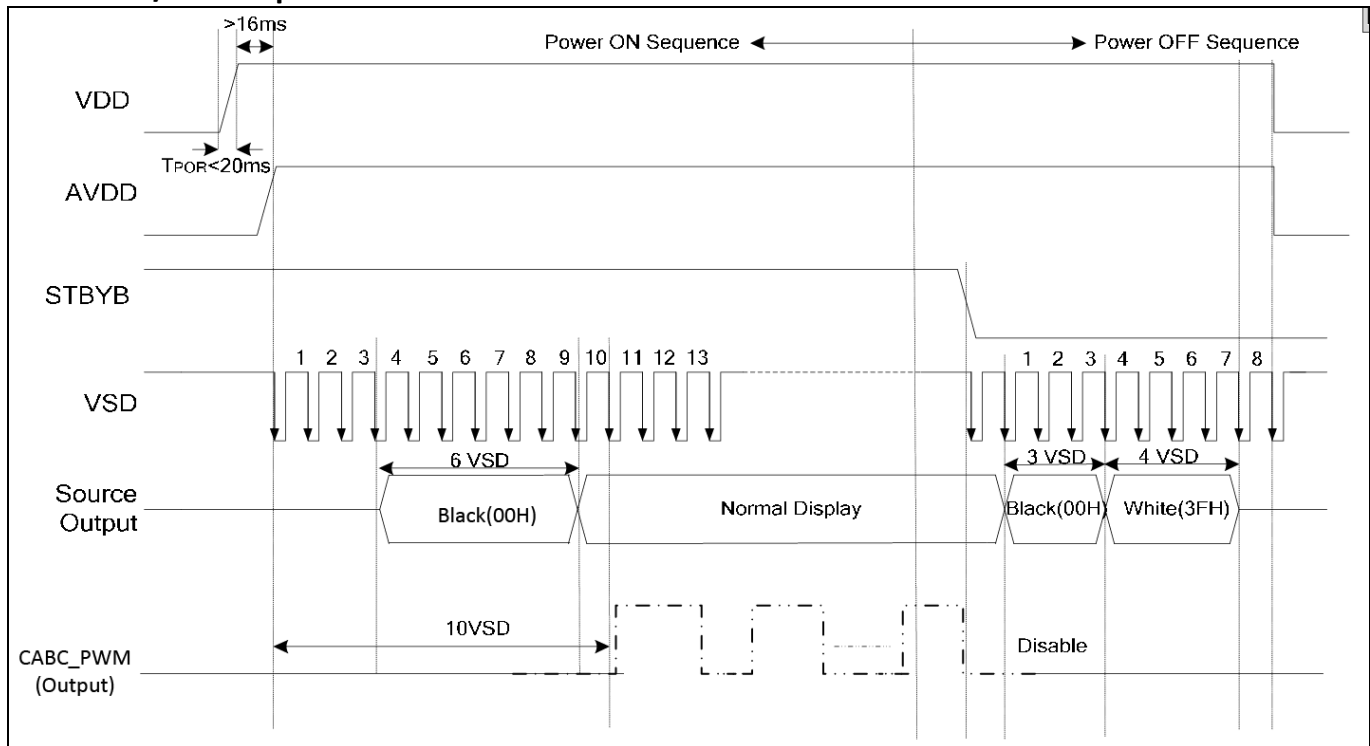
Input Clock and Data Timing



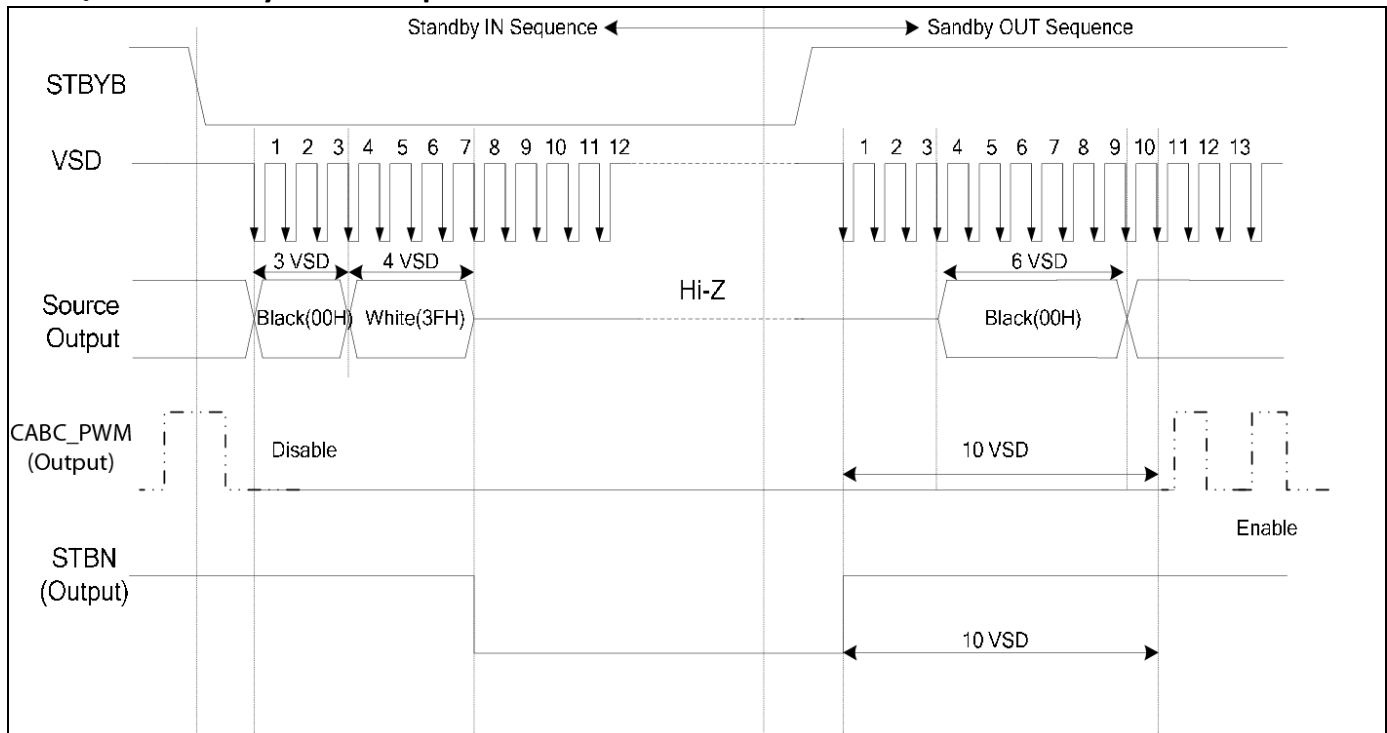
Source Output Timing



Power ON/OFF Sequence

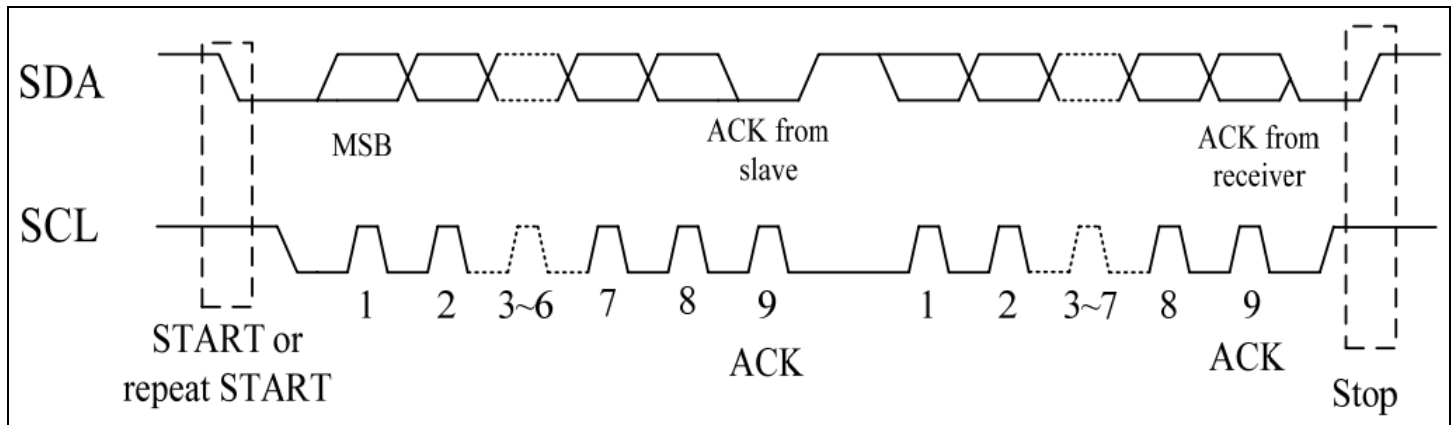


Enter/Exit Standby Mode Sequence

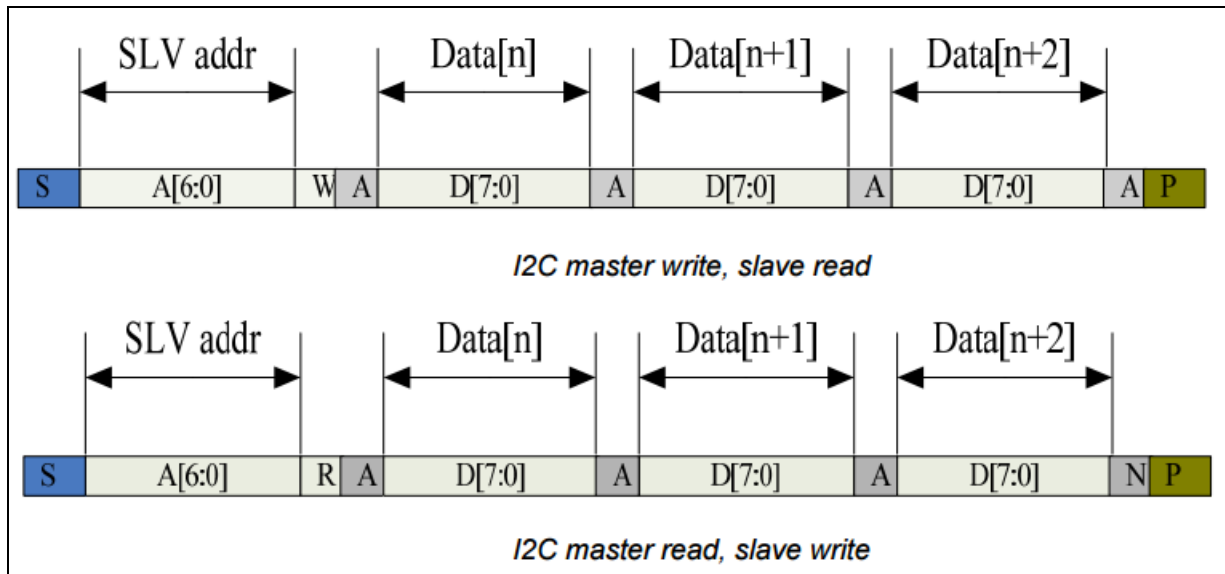


Timing Characteristics – Capacitive Touch Panel

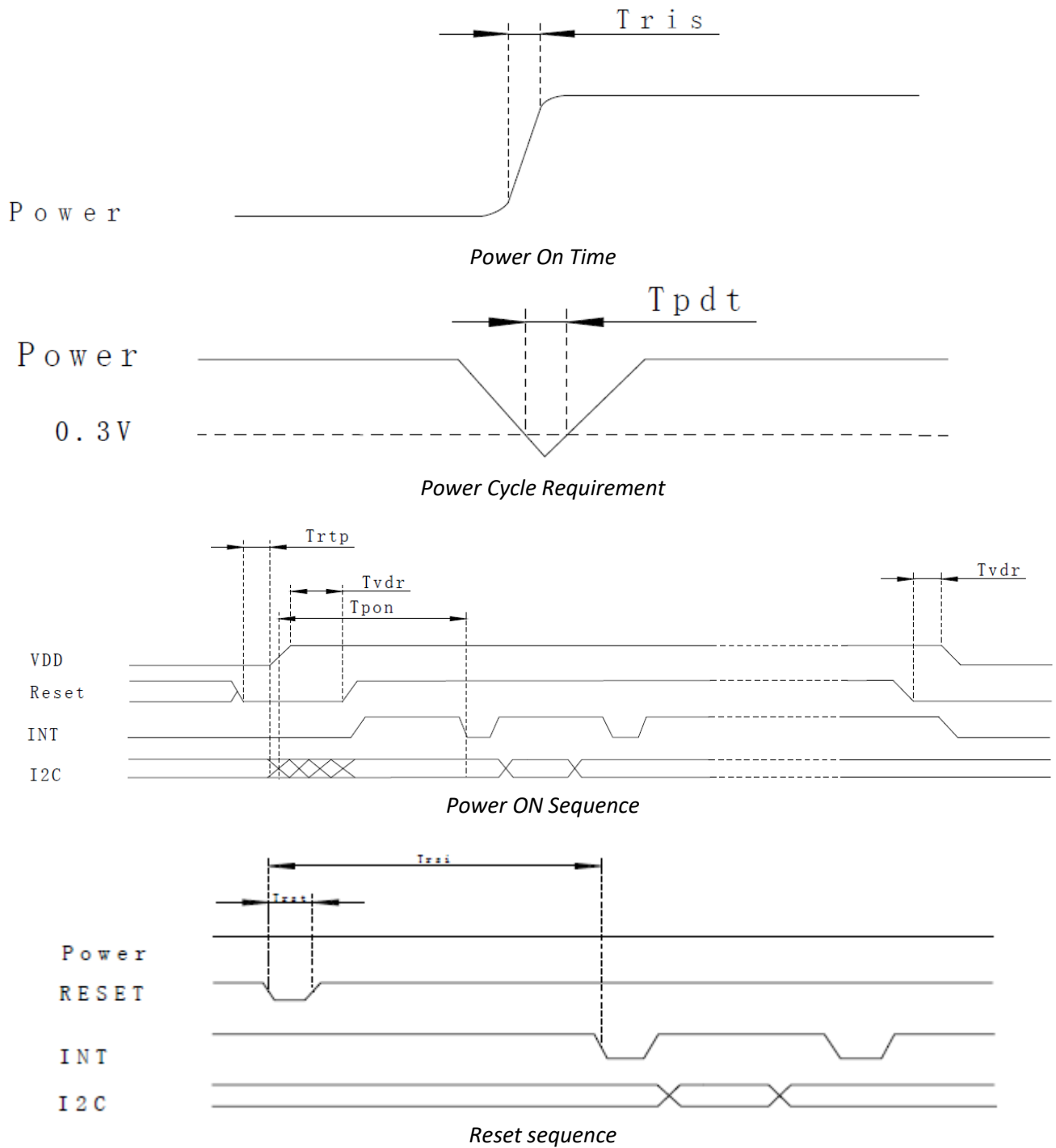
Data Transfer Format



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

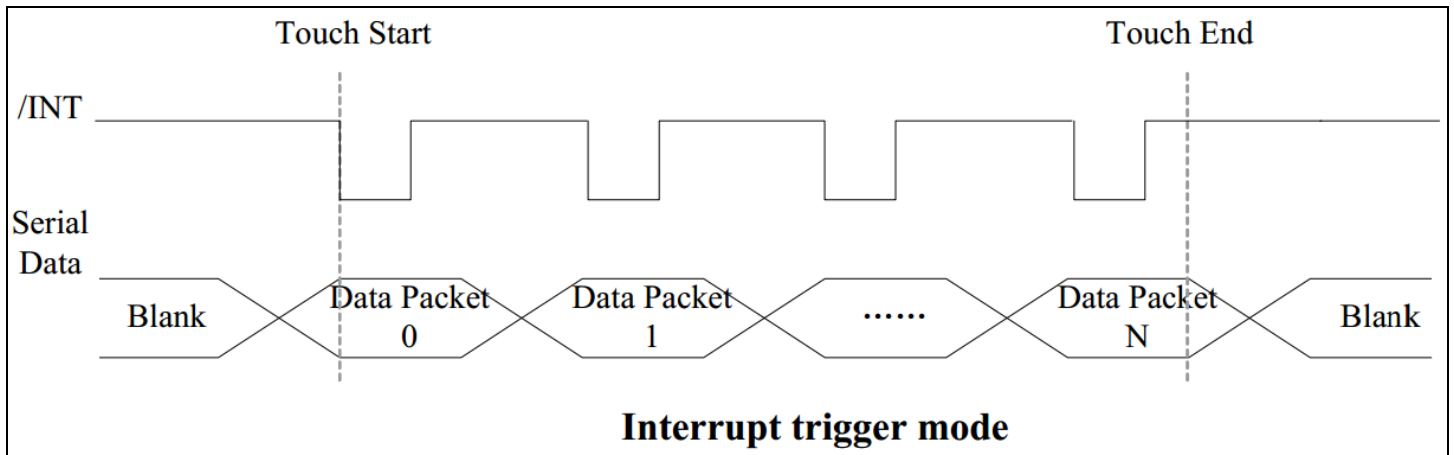


Power ON/Reset Sequence



Parameter	Description	Min	Max	Unit
T_{ris}	Rise time from $0.1V_{DD}$ to $0.9V_{DD}$	-	5	ms
$T_{pd t}$	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 , 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 Operation	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 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.

Precautions for using LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms