

# NHD-7.0-800480EF-ASXV#-CTP

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

NHD-	Newhaven Display
7.0-	7.0" Diagonal
800480-	800xRGBx480 pixels
EF-	Model
A-	Built-in driver / No Controller
S-	High Brightness, White LED backlight
X-	TFT
V-	MVA, Wide Temperature
#-	<b>RoHS Compliant</b>
CTP-	Capacitive Touch Panel with Controller

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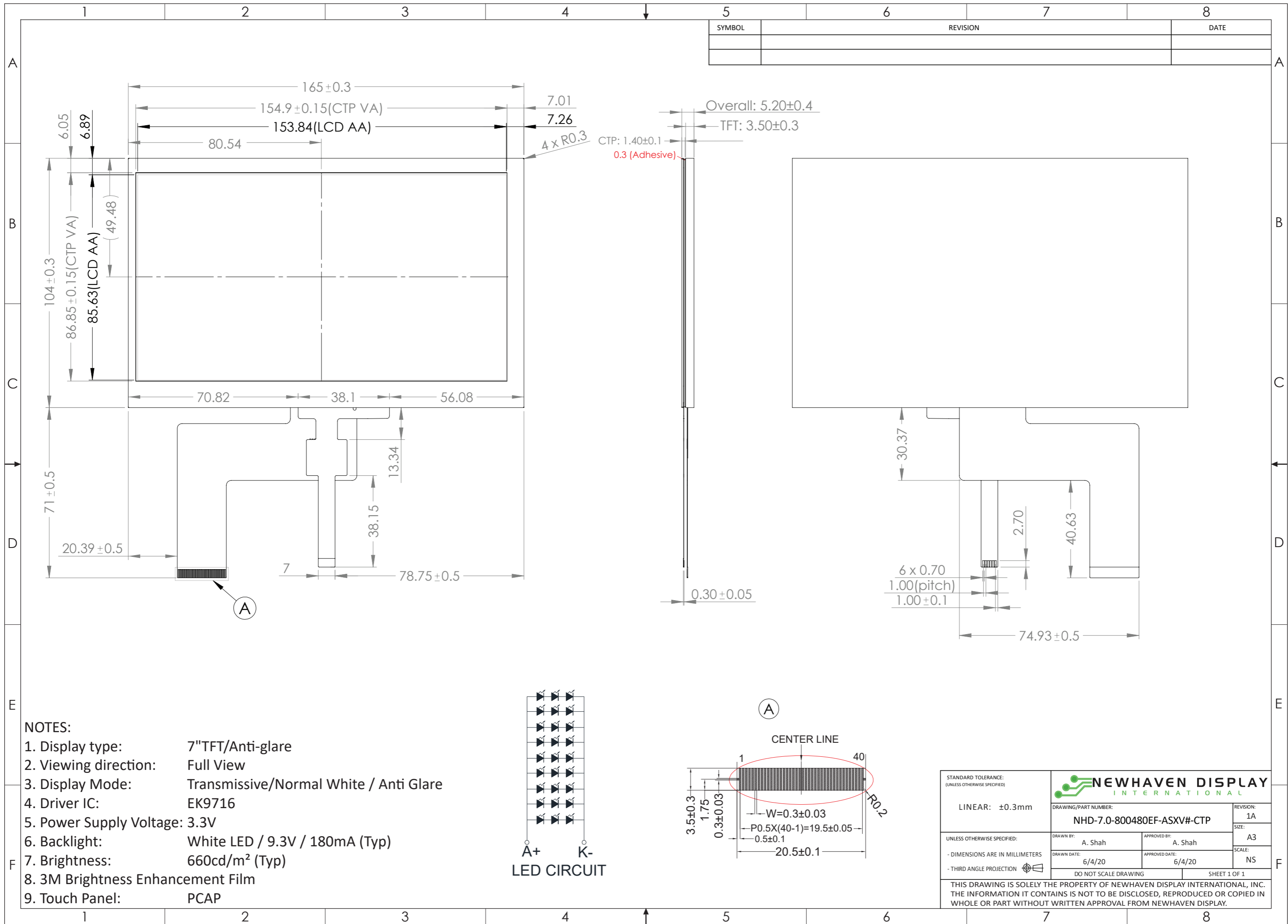
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## Document Revision History

Revision	Date	Description	Changed by
0	3/10/16	Initial Release	SB
1	7/5/16	Chromaticity Added	SB
2	8/2/17	CTP Firmware Updated	SB
3	8/14/18	Updated CTP Driver & Panel	SB
4	12/11/18	Updated Mechanical Drawing	TM
5	5/7/19	CTP Timing Note Added	SB
6	3/9/20	LCD Driver Changed to EK9716	SB
7	6/4/20	Updated 2D Mechanical Drawing, Contrast Ratio, Quality Information	AS

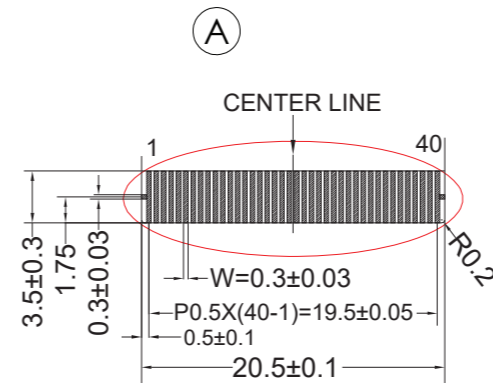
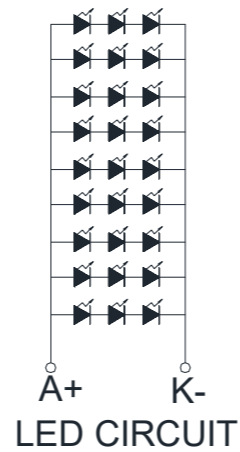
## Functions and Features

- 800xRGBx480 resolution
- LED backlight
- 24-bit digital RGB interface
- 16.7M colors
- Premium high brightness display
- Capacitive touch panel with controller
  - 10-point multi-touch input
  - Gesture input
    - Zoom In/Out
    - Swipe Up/Down/Left/Right



SYMBOL	REVISION	DATE

- NOTES:**
1. Display type: 7" TFT/Anti-glare
  2. Viewing direction: Full View
  3. Display Mode: Transmissive/Normal White / Anti Glare
  4. Driver IC: EK9716
  5. Power Supply Voltage: 3.3V
  6. Backlight: White LED / 9.3V / 180mA (Typ)
  7. Brightness: 660cd/m<sup>2</sup> (Typ)
  8. 3M Brightness Enhancement Film
  9. Touch Panel: PCAP



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)			REVISION:
	DRAWING/PART NUMBER: <b>NHD-7.0-800480EF-ASXV#-CTP</b>		1A
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: A. Shah	APPROVED BY: A. Shah	SIZE: A3
	DRAWN DATE: 6/4/20	APPROVED DATE: 6/4/20	SCALE: NS
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## Pin Description

### TFT:

Pin No.	Symbol	External Connection	Function Description
1	LED-K	Power Supply	Ground for Backlight
2	LED-A	Power Supply	Backlight Power Supply (180mA @ 9.3V)
3	GND	Power Supply	Ground
4	VDD	Power Supply	Power Supply (+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	Dot data Clock
31	DISP	MPU	Display on/off DISP= 1: Display on; DISP=0: Display off
32	HSYNC	MPU	Line synchronization signal
33	VSYNC	MPU	Frame synchronization signal
34	DEN	MPU	Data Enable signal
35	NC	-	No Connect
36	GND	Power Supply	Ground
37	NC(XR)	-	No Connect
38	NC(YD)	-	No Connect
39	NC(XL)	-	No Connect
40	NC(YU)	-	No Connect

**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 <sub>DD</sub>	Power Supply	Power Supply (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 <sub>DD</sub> )

**Recommended connector:** 1.0mm pitch 6-Conductor FFC. Molex p/n: 52271-0679

## Driver/Controller Information

### TFT:

Built-in EK9716B Source Driver: [https://www.newhavendisplay.com/appnotes/datasheets/LCDs/EK9716B\\_v1-1.pdf](https://www.newhavendisplay.com/appnotes/datasheets/LCDs/EK9716B_v1-1.pdf)

Built-in EK73002AB2 Gate Driver: <https://www.newhavendisplay.com/appnotes/datasheets/LCDs/EK73002AB2.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 <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	3.0	3.3	3.6	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> =3.3V, 25°C	45	90	135	mA
"H" Level Input	V <sub>IH</sub>	-	0.7*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level Input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.3*V <sub>DD</sub>	V
"H" Level Output	V <sub>OH</sub>	-	V <sub>DD</sub> -0.4	-	V <sub>DD</sub>	V
"L" Level Output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	V <sub>SS</sub> +0.4	V
Backlight Supply Current	I <sub>LED</sub>	-	-	180	225	mA
Backlight Supply Voltage	V <sub>LED</sub>	I <sub>LED</sub> = 180 mA	8.4	9.3	10.2	V
Backlight Lifetime*	-	T <sub>OP</sub> = 25° C	20,000	50,000	-	mA

\*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 <sub>OP</sub>	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-30	-	+80	°C
Supply Voltage	V <sub>DD</sub>	-	2.8	3.3	3.6	V
Supply Current – Operating	I <sub>DD</sub>	V <sub>DD</sub> =3.3V T <sub>OP</sub> =25°C	-	15.0	-	mA
Supply Current – Hibernate	I <sub>DD</sub>		-	1.0	-	µA
"H" Level Input	V <sub>IH</sub>	-	0.7*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level Input	V <sub>IL</sub>	-	V <sub>SS</sub>	-	0.3*V <sub>DD</sub>	V
"H" Level Output	V <sub>OH</sub>	-	0.7*V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level Output	V <sub>OL</sub>	-	V <sub>SS</sub>	-	0.3*V <sub>DD</sub>	V

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	CR ≥10	-	70	-	°	
	Bottom		-	70	-	°	
	Left		-	70	-	°	
	Right		-	70	-	°	
Contrast Ratio	CR	-	-	500	-	-	
Luminance	L <sub>V</sub>	I <sub>LED</sub> = 180 mA	530	660	-	cd/m <sup>2</sup>	
Response Time	T <sub>R</sub> +T <sub>F</sub>	T <sub>OP</sub> = 25°C	-	25	-	ms	
Chromaticity	Red	X <sub>R</sub>	-	0.532	0.582	0.632	-
		Y <sub>R</sub>	-	0.292	0.342	0.392	-
	Green	X <sub>G</sub>	-	0.285	0.335	0.385	-
		Y <sub>G</sub>	-	0.574	0.624	0.674	-
	Blue	X <sub>B</sub>	-	0.104	0.154	0.204	-
		Y <sub>B</sub>	-	0.092	0.142	0.192	-
	White	X <sub>W</sub>	-	0.257	0.307	0.357	-
		Y <sub>W</sub>	-	0.334	0.384	0.434	-

## 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



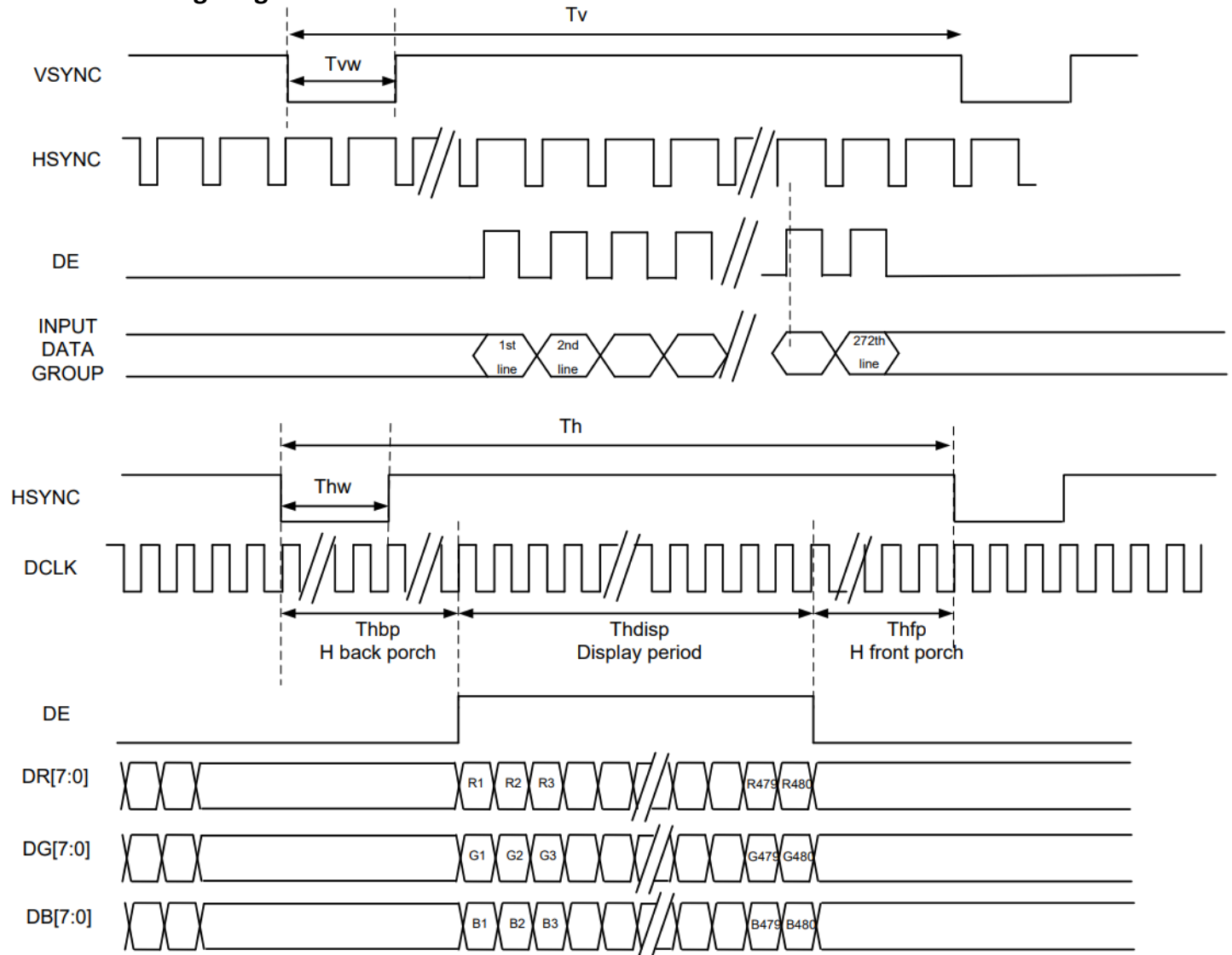
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3Dh	RO	TOUCH10_Weight	[7:0]	00-FFh	Touch Weight
3Eh	RO	TOUCH10_Misc	[3:0]	00-0Fh	Touch Area
80	RW	ID_G_MC_THGROUP	[7:0]	00-FFh	Mutual-Capacitive touch Threshold / 4 Default: 4Bh
81h	RW	ID_G_MC_THPEAK	[7:0]	00-FFh	Mutual-Capacitive Peak Threshold / 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: 8
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

## Parallel RGB Input Timing Requirements

Item	Symbol	Min.	Typ.	Max.	Unit	Remark	
DCLK Frequency	$F_{clk}$	28.2	29.2	40	MHz	-	
DLCK Period	$T_{clk}$	25	34	-	ns	-	
HSYNC	Period Time	$T_h$	908	928	1088	DCLK	Thw + Thbp = 88 DCLK is fixed
	Display Period	$T_{ndisp}$	800			DCLK	
	Pulse Width	$T_{hw}$	1	48	87	DCLK	
	Back Porch	$T_{hbp}$	87	40	1	DCLK	
	Front Porch	$T_{hfp}$	20	40	200	DCLK	
VSYNC	Display Period	$T_{vdisp}$	480			H	Tv + Tvbp = 32 H is fixed
	Period Time	$T_v$	517	525	613	H	
	Pulse Width	$T_{vw}$	1	1	3	H	
	Back Porch	$T_{vbp}$	31	31	29	H	
	Front Porch	$T_{vfp}$	5	13	101	H	

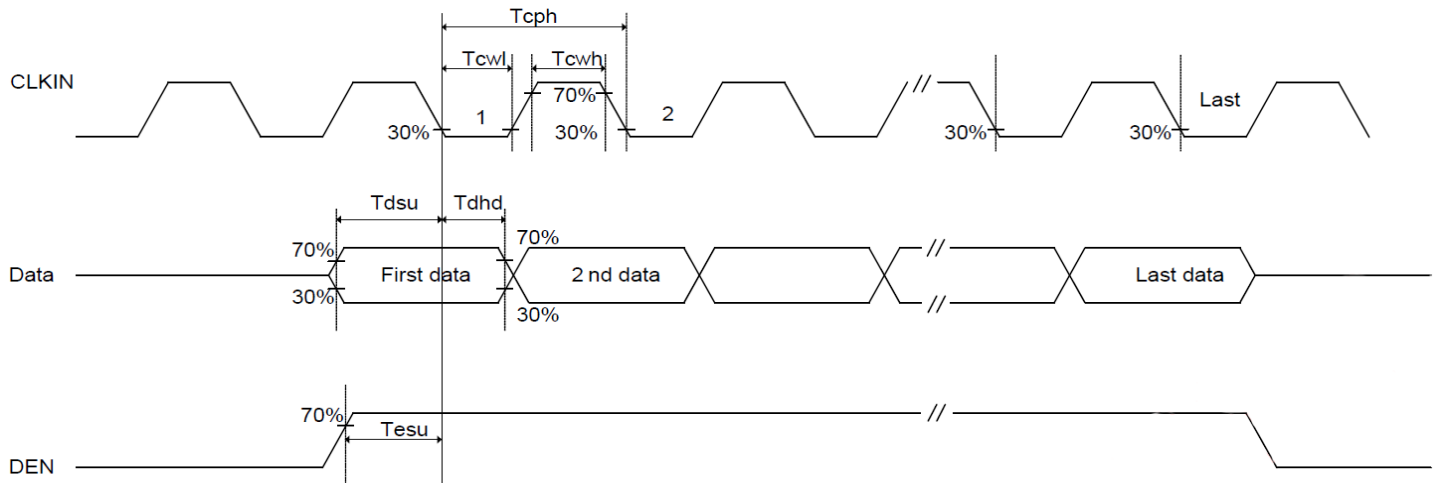
## DE Mode Timing Diagram



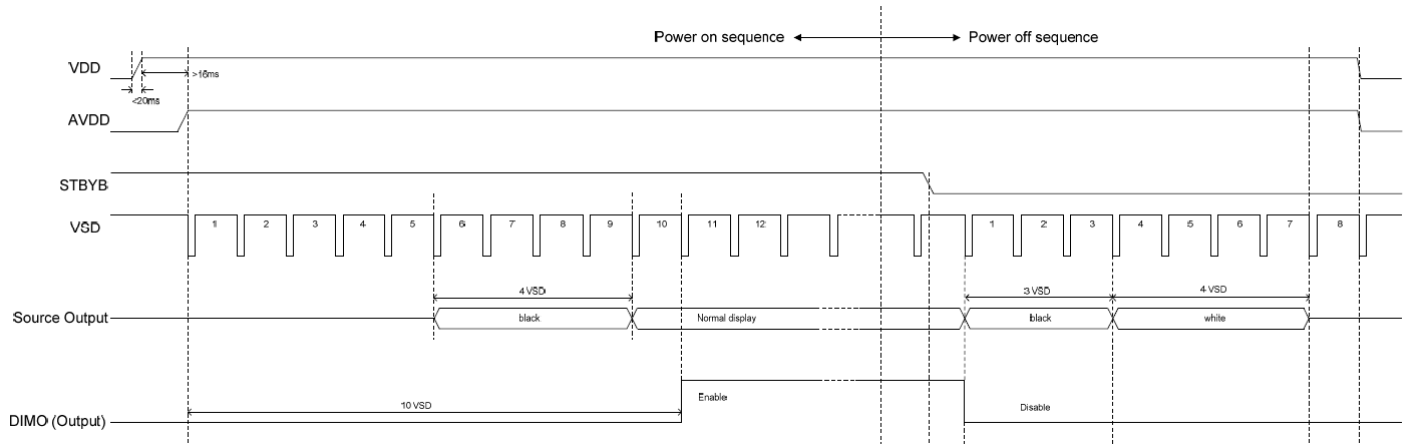
## Input Setup Timing Requirements

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
V <sub>DD</sub> Power Source Slew Time	T <sub>por</sub>	-	-	20	ms	From 0V to 90% V <sub>DD</sub>
CLK cycle time	T <sub>cph</sub>	20	-	-	ns	-
CLK pulse duty	T <sub>cwh</sub>	40	50	60	%	-
Data setup time	T <sub>dsu</sub>	8	-	-	ns	-
Data hold time	T <sub>dhd</sub>	8	-	-	ns	-
DEN setup time	T <sub>esu</sub>	8	-	-	ns	-
DEN hold time	T <sub>ehd</sub>	8	-	-	ns	-

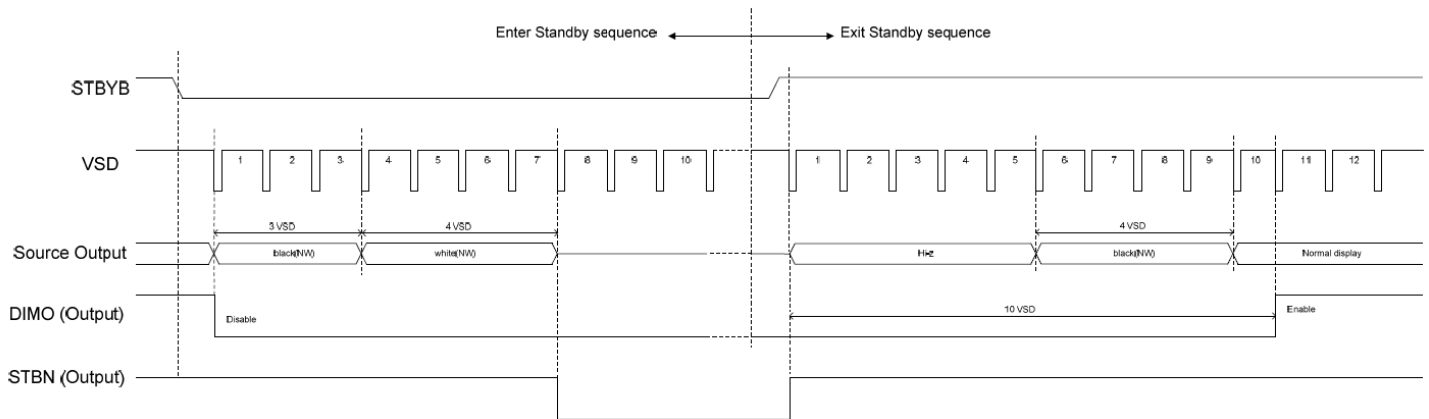
## Input Setup Timing Diagram



# Power ON/OFF Sequence

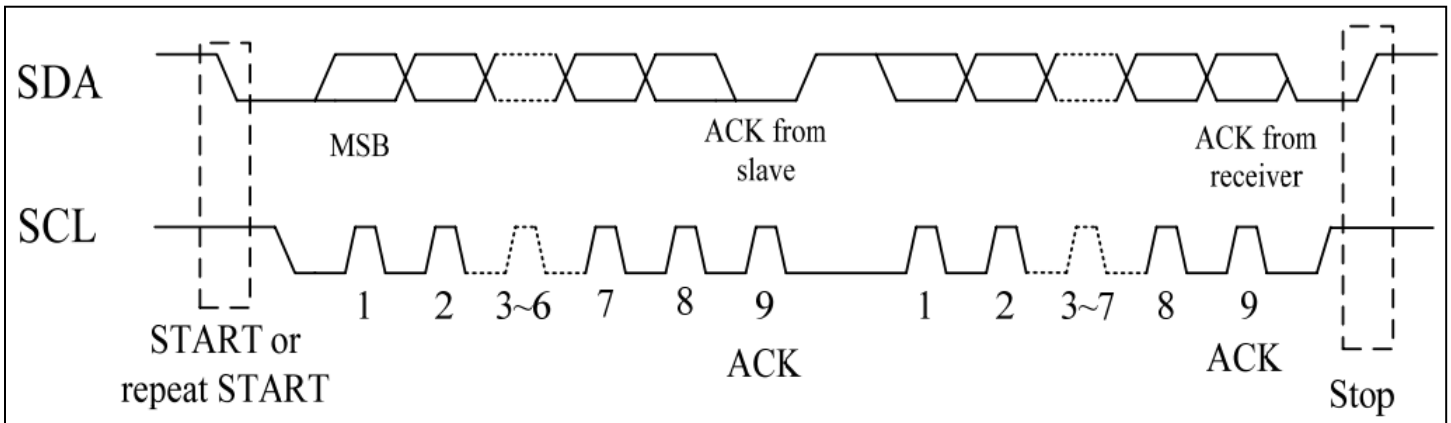


# Enter/Exit Standby Mode Sequence

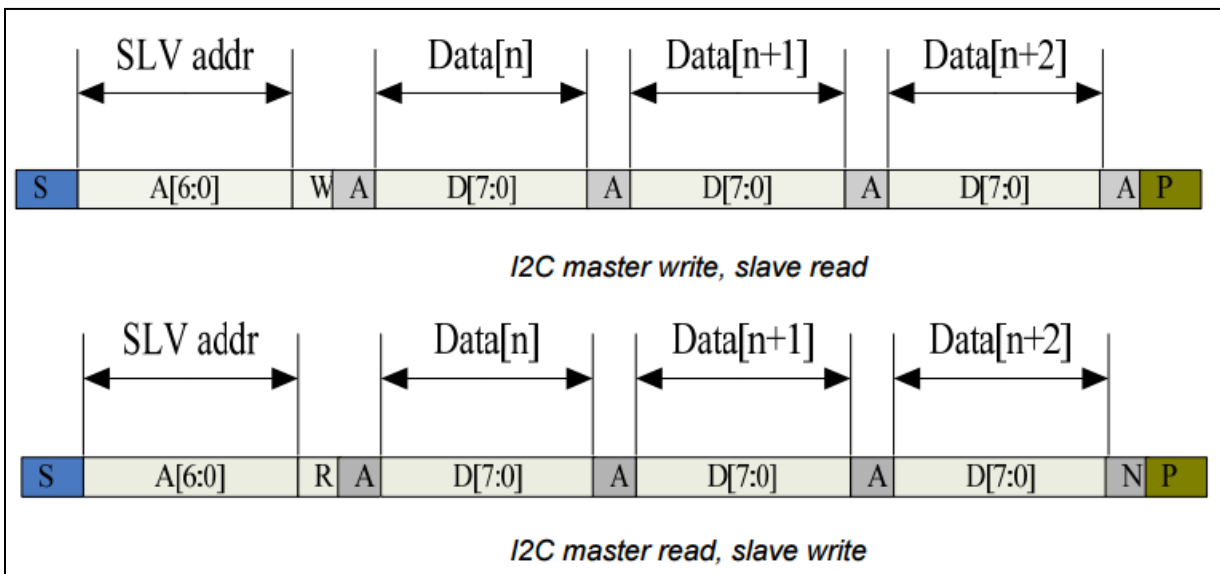


# Timing Characteristics – Capacitive Touch Panel

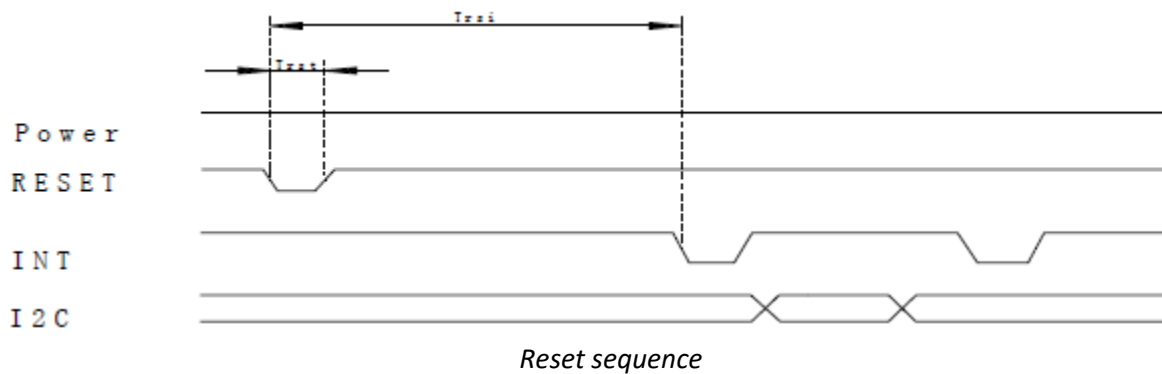
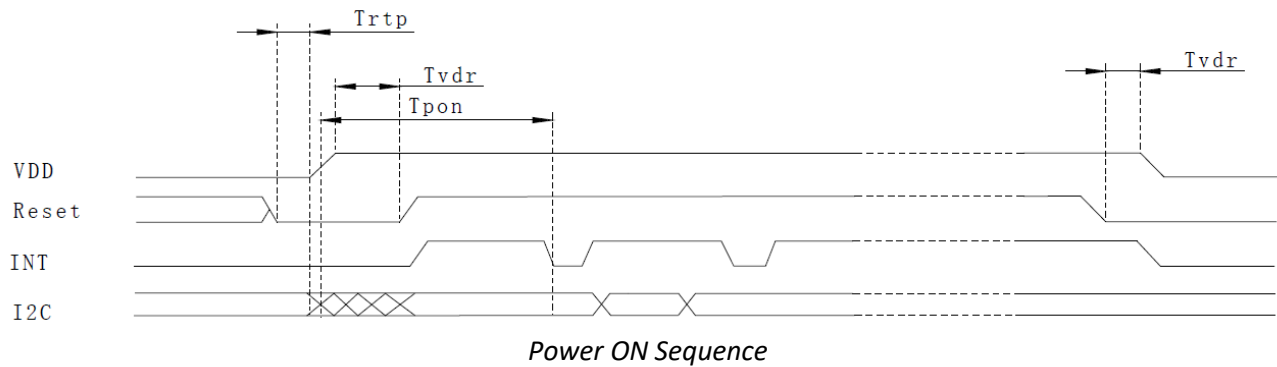
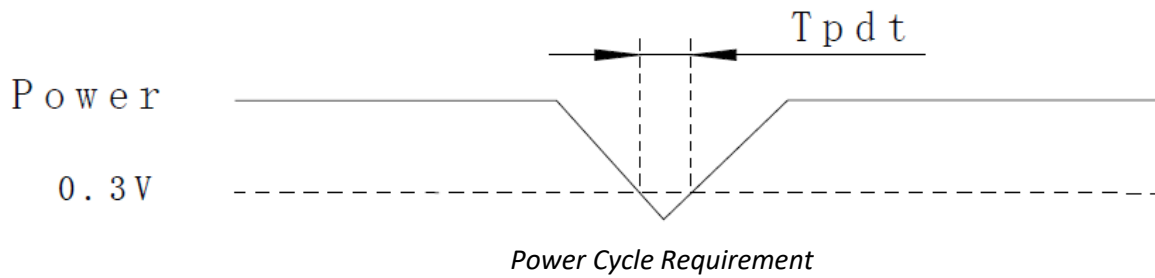
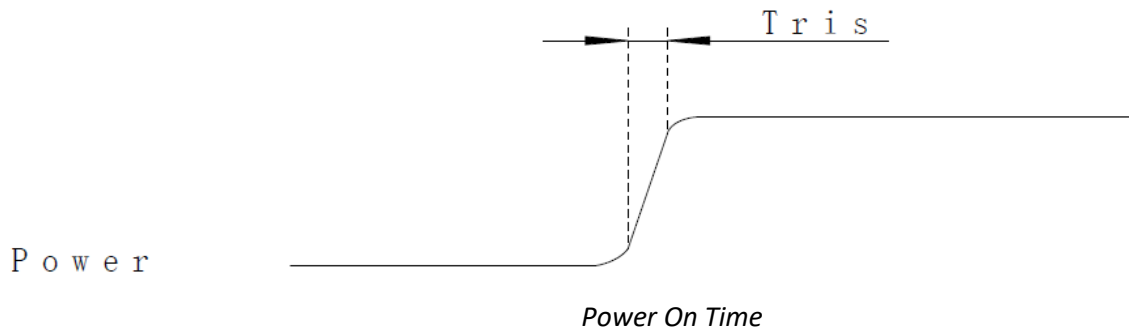
## Data Transfer Format



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

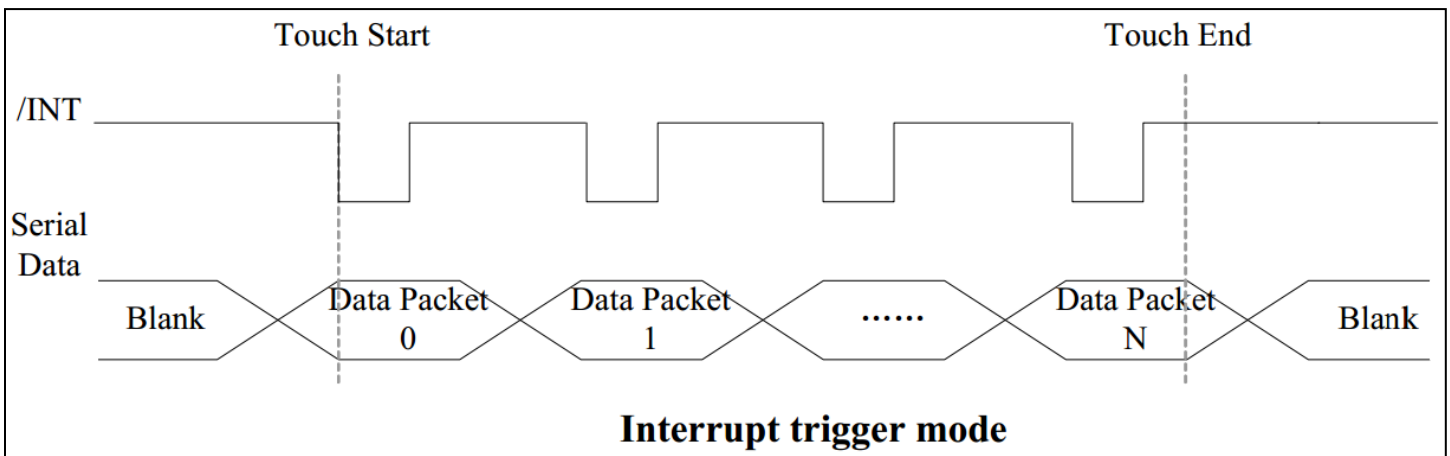


## Power ON/Reset Sequence



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	-	$\mu s$
$T_{pon}$	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

\*Note: If Reset is tied to  $V_{DD}$  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 amplitude. 30min in each of 3 directions: X, Y, Z	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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)