

# NHD-10.1-1024600AF-ASXV#-CTP

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

NHD-	Newhaven Display
10.1-	10.1" Diagonal
1024600-	1024xRGBx600 Pixels
AF-	Model
A-	RGB Interface
S-	High Brightness, White LED Backlight
X-	TFT
V-	MVA, Transmissive, Standard Temperature
#-	<b>RoHS Compliant</b>
CTP-	Capacitive Touch Panel with Controller

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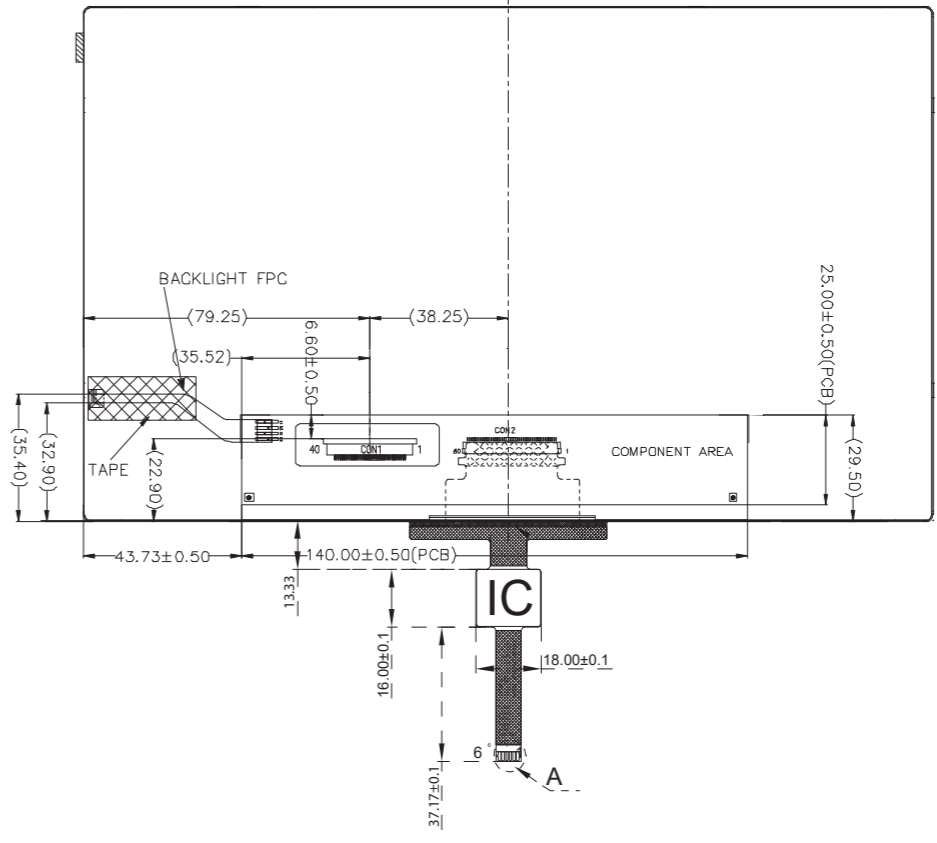
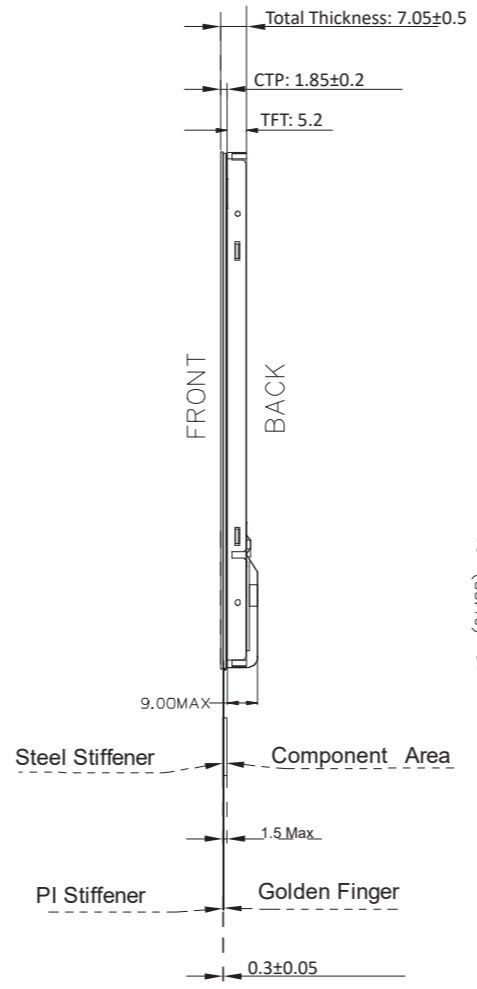
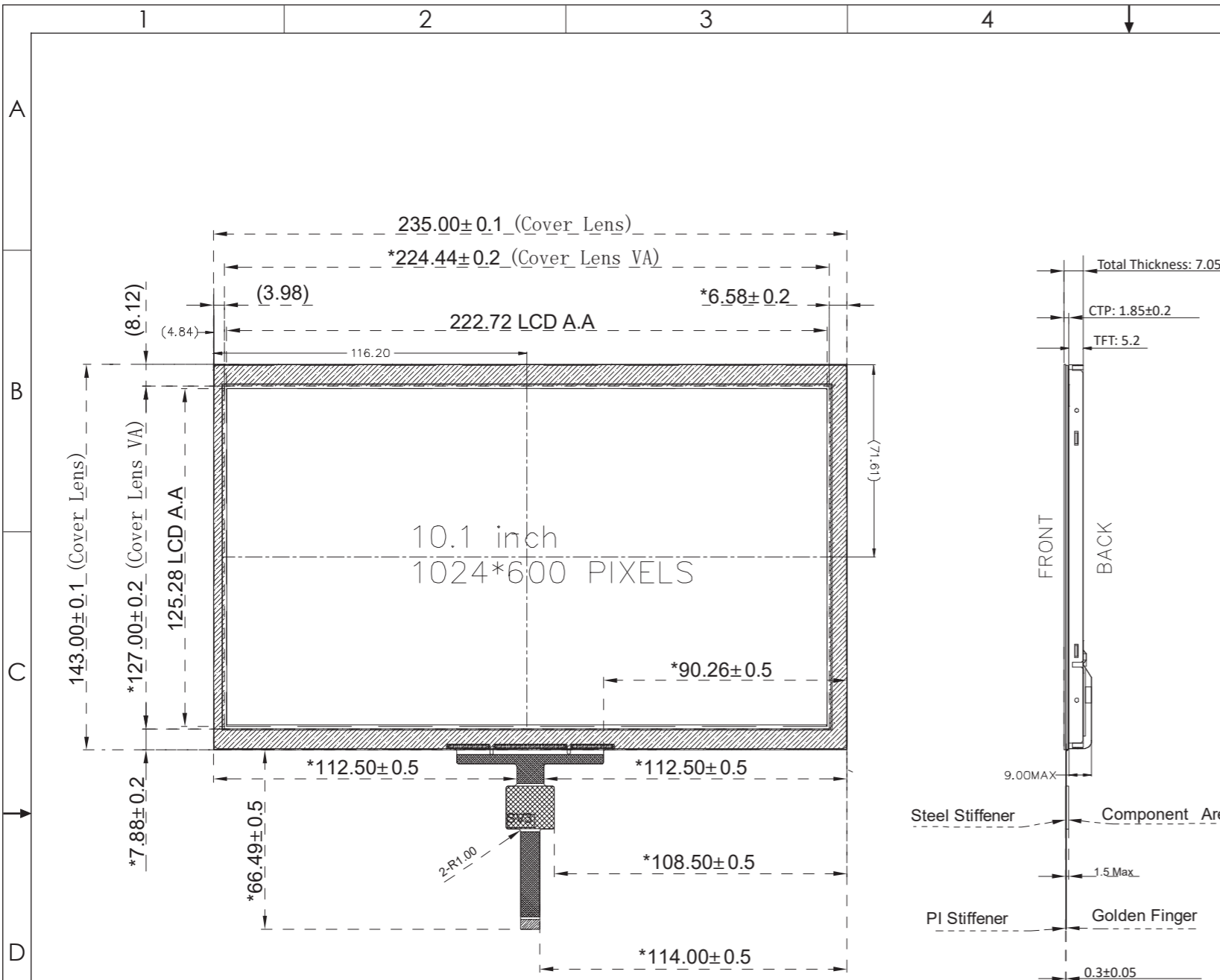
## Document Revision History

Revision	Date	Description	Changed by
-	08/14/18	Initial Release	NP
1	7/10/19	Mechanical Drawing & Backlight Characteristics Updated	SB

## Functions and Features

- 1024xRGBx600 Resolution
- LED Backlight
  - Built In-LED Driver
  - PWM Brightness Control
- RGB Interface
- 262K Colors
- Wide Viewing Angles
- Capacitive touch panel with controller
  - 10-point multi-touch input
  - Gesture input
    - Zoom In/Out
    - Swipe Up/Down/Left/Right

SYMBOL	REVISION	DATE



**Pin Assignment:  
TFT**

PIN No.	SYMBOL
1	LED_GND
2	LED_VDD
3	LED_VDD
4	LED_VDD
5	LED_PWM
6	LED_EN
7	GND
8	VDD
9	R0
10	R1
11	R2
12	R3
13	R4
14	R5
15	R6
16	R7
17	G0
18	G1
19	G2
20	G3
21	G4
22	G5
23	G6
24	G7
25	B0
26	B1
27	B2
28	B3
29	B4
30	B5
31	B6
32	B7
33	GND
34	DCLK
35	HSD
36	VSD
37	DEN
38	MODE
39	RESET
40	STBYB

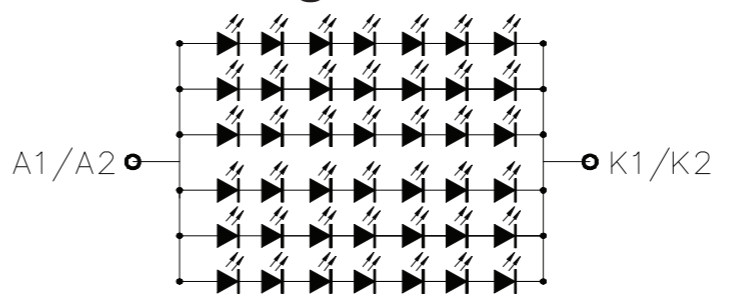
**Pin Assignment:  
CTP:**

PIN	SYMBOL
PIN1	VDD
PIN2	GND
PIN3	SCL
PIN4	SDA
PIN5	INT
PIN6	RESET

**Notes:**

1. Display Size: 10.1" TFT
2. Display Resolution: 1024 x 600 Pixels
3. Display Mode: Transmissive / Normally White / Anti-Glare
4. Optimal View: Full View
5. Driver IC: HX8282 - RGB Interface
6. Power Supply Voltage: 3.3V
7. Backlight: White LED
8. Luminance: 700 cd/m<sup>2</sup> (Typ)
9. Touch Panel: PCAP

**Backlight Circuit**



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)

LINEAR: ±0.3mm

UNLESS OTHERWISE SPECIFIED:  
- DIMENSIONS ARE IN MILLIMETERS  
- THIRD ANGLE PROJECTION

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**NEWHAVEN DISPLAY INTERNATIONAL**

DRAWING/PART NUMBER: NHD-10.1-1024600AF-ASXV#-CTP

REVISION: 1C

SIZE: A3

SCALE: NS

SHEET 1 OF 1

DRAWN BY: S. Baxi  
APPROVED BY: S. Baxi  
DRAWN DATE: 7/10/19  
APPROVED DATE: 7/10/19

## Pin Description

Pin No.	Symbol	Connection	Function Description
1	LED_GND	Power Supply	Ground for Backlight Driver
2-4	LED_VDD	Power Supply	Supply Voltage for Backlight Driver
5	LED_PWM	MPU	Backlight PWM Signal Input (See Table Below)
6	LED_EN	MPU	Backlight Enable H: Backlight On; L: Backlight Off
7	GND	Power Supply	Ground
8	VDD	Power Supply	Supply voltage for LCD (+3.3V)
9-16	[R0-R7]	MPU	Red Data Signals
17-24	[G0-G7]	MPU	Green Data Signals
25-32	[B0-B7]	MPU	Blue Data Signals
33	GND	Power Supply	Ground
34	DCLK	MPU	Dot data Clock
35	HSYNC	MPU	Horizontal sync input
36	VSYNC	MPU	Vertical sync input
37	DEN	MPU	Data Enable signal
38	MODE	MPU	DE/SYNC mode select MODE= H: DE mode MODE= L: SYNC mode
39	/RESET	MPU	Active Low Reset Signal
40	/STBYB	MPU	Active Low Standby Signal

**LCD connector:** 0.5mm pitch 40-Conductor FFC.

**Recommended cable:** 40 POS FFC      **Molex P/N:** 15020-0435

## Capacitive Touch Panel:

Pin No.	Symbol	External Connection	Function Description
1	VDD	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.

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

## Electrical Characteristics (T<sub>OP</sub> = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T <sub>OP</sub>	Absolute Max	0	-	+50	°C
Storage Temperature Range	T <sub>ST</sub>	Absolute Max	-20	-	+60	°C
Supply Voltage for LCD	V <sub>DD</sub>	-	3.0	3.3	3.6	V
Supply Current for LCD	I <sub>DD</sub>	V <sub>DD</sub> = 3.3V	50	120	180	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>	-	GND	-	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>	-	GND	-	GND + 0.4	V
Supply Voltage for Backlight Driver	LED_V <sub>DD</sub>	-	5	12.0	22.4	V
Supply Current for Backlight Driver <sup>1</sup>	LED_I <sub>DD</sub>	-	160	360	1200	mA
Backlight Enable Voltage	LED_EN	-	2.5	3.3	5.5	V
Backlight PWM Voltage	LED_PWM	I <sub>PWM</sub> ≤ 5 mA	2.5	3.3	5.5	V
Backlight Lifetime <sup>2</sup>	-	T <sub>OP</sub> = 25° C	20,000	50,000	-	Hrs.

<sup>1</sup>Minimum supply current occurs when supply voltage is at max; maximum supply current when supply voltage is at minimum.

<sup>2</sup>Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions.

## 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>	-	3.0	3.3	3.6	V
Supply Current – Operating	I <sub>DD</sub>	T <sub>OP</sub> =25°C, V <sub>DD</sub> =3.3V	-	6.0	-	mA
Supply Current – Hibernate	I <sub>DD</sub>		-	1.0	-	μA
"H" Level Input	V <sub>OH</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>OH</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	-	75	-	°	
	Bottom		-	75	-	°	
	Left		-	75	-	°	
	Right		-	75	-	°	
Contrast Ratio	Cr	-	450	750	-	-	
Luminance	L <sub>V</sub>	-	550	700	880	cd/m <sup>2</sup>	
Response Time	Rise + Fall	T <sub>R</sub> + T <sub>F</sub>	T <sub>OP</sub> = 25°C		-	8	ms
Chromaticity	Red	X <sub>R</sub>	-	0.565	0.605	0.635	-
		Y <sub>R</sub>	-	0.309	0.349	0.379	-
	Green	X <sub>G</sub>	-	0.286	0.326	0.356	-
		Y <sub>G</sub>	-	0.565	0.605	0.635	-
	Blue	X <sub>B</sub>	-	0.112	0.152	0.182	-
		Y <sub>B</sub>	-	0.075	0.115	0.145	-
White	X <sub>W</sub>	-	0.257	0.297	0.327	-	
	Y <sub>W</sub>	-	0.283	0.323	0.353	-	

## LED\_PWM Signal Operating Frequency:

PWM Frequency (F)	Duty Cycle (Min.)	Duty Cycle (Max.)
100Hz < F < 500Hz	5%	100%
500Hz < F < 20KHz	10%	100%

## Capacitive Touch Panel Material Characteristics:

Property	Requirement	Unit
Surface Hardness	≥6	H
Light transmission	≥82%	-
Operating Humidity	20~85%	RH
Storage Humidity	20~85%	RH

## Driver Information

Built-in HX8282 Source Driver: <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/HX8282-A01.pdf>

Built-in HX8696 Gate Driver: <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/HX8696-A.pdf>

## Capacitive Touch Panel:

Built-in FocalTech FT5526EEZ controller.

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

## Capacitive Touch Panel Registers

Register No	Register Name	Bits	Value	Description
00h	Device Mode	[2:0]	000b	Normal Operating Mode
			100b	Test Mode - read raw data (reserved)
			001b	System Information Mode (reserved)
01h	Gesture ID	[7:0]	48h	Zoom In
			49h	Zoom Out
			00h	No Gesture
02h	Touch Points	[3:0]	000b	0 touch points detected
			001b	1 touch point detected
			010b	2 touch points detected
			011b	3 touch points detected
			100b	4 touch points detected
			101b	5 touch points detected
03h	Touch 1 Event Flag	[7:6]	00b	Put Down
			01b	Put Up
			10b	Contact
			11b	Reserved
03h	TOUCH1_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
04h	TOUCH1_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
05h	TOUCH1_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
06h	TOUCH1_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
09h	Touch 2 Event Flag	[7:6]	00b	Put Down
			01b	Put Up
			10b	Contact
			11b	Reserved
09h	TOUCH2_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
0Ah	TOUCH2_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
0Bh	TOUCH2_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
0Ch	TOUCH2_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
0Fh	Touch 3 Event Flag	[7:6]	00b	Put Down
			01b	Put Up
			10b	Contact
			11b	Reserved
0Fh	TOUCH3_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
10h	TOUCH3_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
11h	TOUCH3_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
12h	TOUCH3_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
15h	Touch 4 Event Flag	[7:6]	00b	Put Down
			01b	Put Up
			10b	Contact
			11b	Reserved
15h	TOUCH4_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
16h	TOUCH4_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
17h	TOUCH4_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
18h	TOUCH4_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate

Register No	Register Name	Bits	Value	Description
18h	Touch 5 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact Reserved
18h	TOUCH5_XH	[3:0]	0h - 1h	Upper 4 bits of X touch coordinate
1Ch	TOUCH5_XL	[7:0]	00h - FFh	Lower 8 bits of X touch coordinate
1Dh	TOUCH5_YH	[3:0]	0h - 1h	Upper 4 bits of Y touch coordinate
1Eh	TOUCH5_YL	[7:0]	00h - FFh	Lower 8 bits of Y touch coordinate
80h	ID_G_THGROUP	[7:0]	00h - FFh	Valid touching detect threshold Actual value will be 4 times register's value Recommended: 46h
81h	ID_G_THPEAK	[7:0]	00h - FFh	valid touching peak detect threshold Recommended: 3Ch
82h	ID_G_THCAL	[7:0]	00h - FFh	Touch focus threshold Recommended: 1Dh
83h	ID_G_THWATER	[7:0]	00h - FFh	threshold when there is surface water Recommended: D3h
84h	ID_G_THTEMP	[7:0]	00h - FFh	threshold of temperature compensation Recommended: EBh
85h	ID_G_THDIFF	[7:0]	00h - FFh	Touch difference threshold Actual value is 32 times the register's value Recommended: A0h
86h	ID_G_CTRL	[1:0]	00h 01h	Power Control Mode: Not Auto Jump Power Control Mode: Auto Jump
87h	ID_G_TIME_ENTER_MONITOR	[7:0]	00h-FFh	Delay to enter 'Monitor' status (s) Recommended: C8h
88h	ID_G_PERIODACTIVE	[3:0]	3h-Eh	Period of 'Active' status (ms) Recommended: 6h
89h	ID_G_PERIODMONITOR	[7:0]	1Eh-FFh	Timer to enter 'idle' when in 'Monitor' (ms) Recommended: 28h
A0h	ID_G_AUTO_CLB_MODE	[7:0]	00h FFh	Auto calibration mode: Enable auto calibration Auto calibration mode: Disable auto calibration
A1h	ID_G_LIB_VERSION_H	[7:0]	30h	Firmware Library Version H byte
A2h	ID_G_LIB_VERSION_L	[7:0]	01h	Firmware Library Version L byte
A3h	ID_G_CIPHER	[7:0]	54h	Chip vendor ID
A4h	ID_G_MODE	[0:0]	00h 01h	Interrupt status: Enable interrupt to host Interrupt status: Disable interrupt to host
A5h	ID_G_PMODE	[1:0]	00h 01h 03h	'Active' Mode 'Monitor' Mode 'Hibernate' Mode
A6h	ID_G_FIRMID	[7:0]	06h	Firmware ID
A7h	ID_G_STATE	[7:0]	00h 01h 02h 03h 04h	Running State: Configure Running State: Work Running State: Calibration Running State: Factory Running State: Auto-calibration
A8h	ID_G_FT5201ID	[7:0]	79h	CTPM Vendor's Chip ID
A9h	ID_G_ERR	[7:0]	00h 03h 05h 1Ah	Error Code: OK Error Code: Chip register writing inconsistent with reading Error Code: Chip start fail Error Code: Calibration match fail



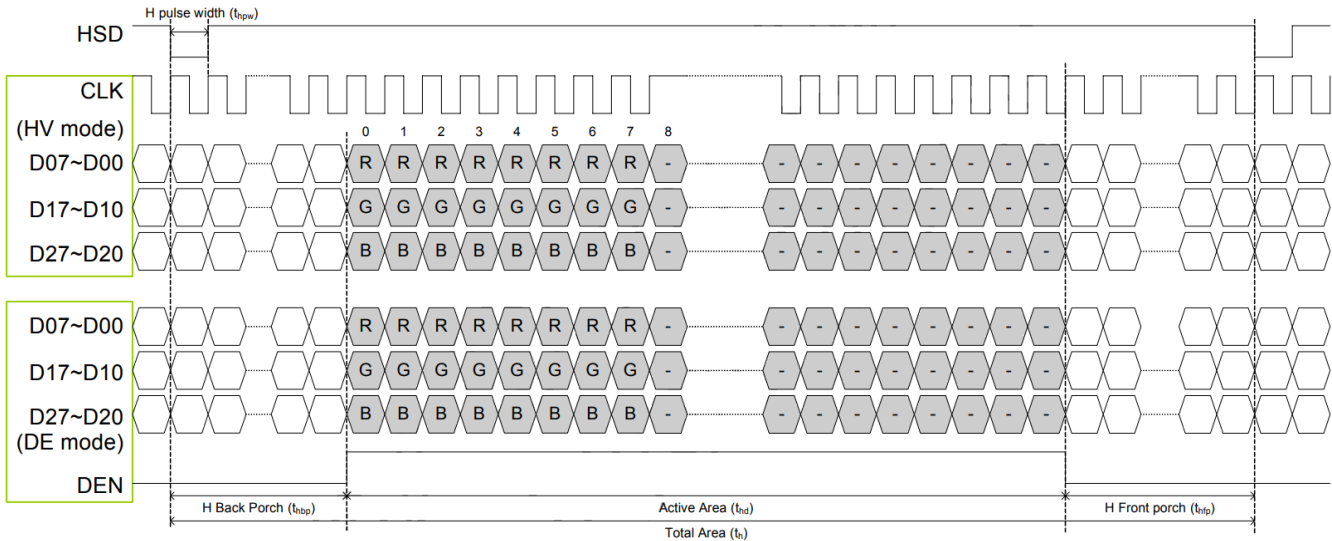
# Timing Characteristics

## DE Mode

Parameter	Symbol	Spec			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	51.2	67.2	MHz
Horizontal Display Area	thd	1024			DCLK
HSD Period	th	1114	1344	1600	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd	600			TH
VSD Period	tv	610	635	800	TH
VSD Blanking	tvbp+ tvfp	10	35	200	TH

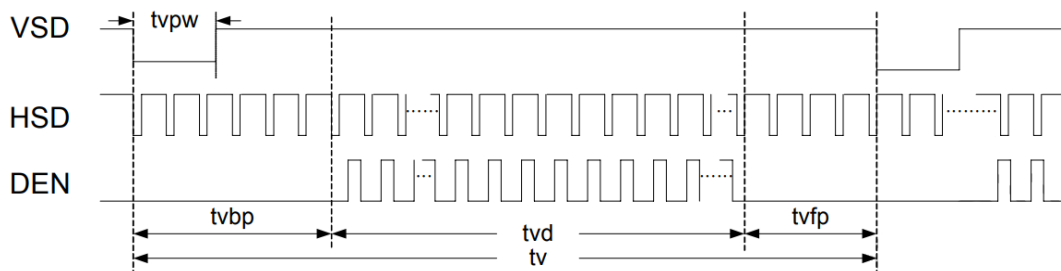
## Horizontal Timing

Parameter	Symbol	Spec			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd	1024			DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1	-	140	DCLK
HSD Back Porch	thbp	160			DCLK
HSD Front Porch	thfp	16	160	216	DCLK



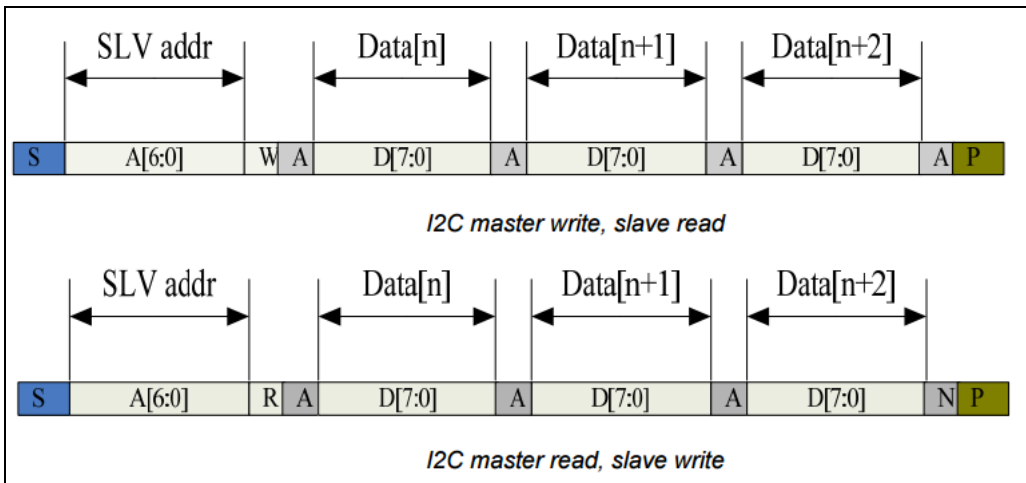
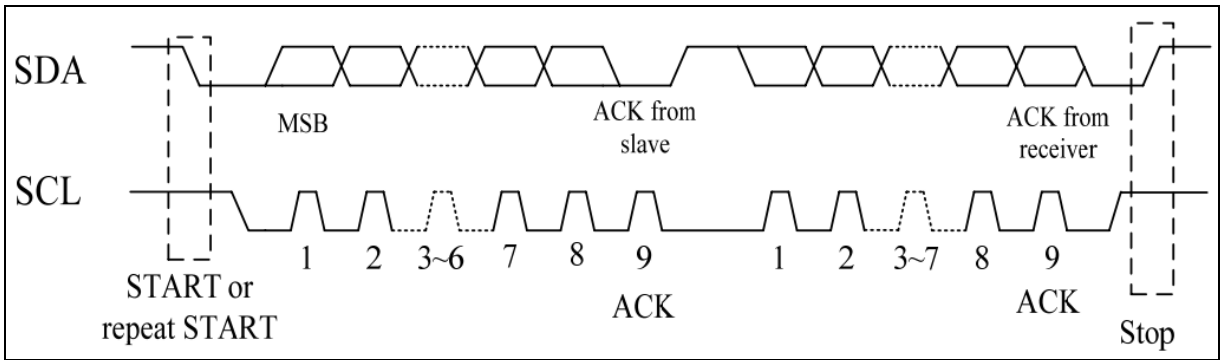
## Vertical Timing

Parameter	Symbol	Spec			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd	600			TH
VSD Period	tv	624	635	750	TH
VSD Pulse Width	tvpw	1	-	20	TH
VSD Back Porch	tvbp	23			TH
VSD Front Porch	tvfp	1	12	127	TH



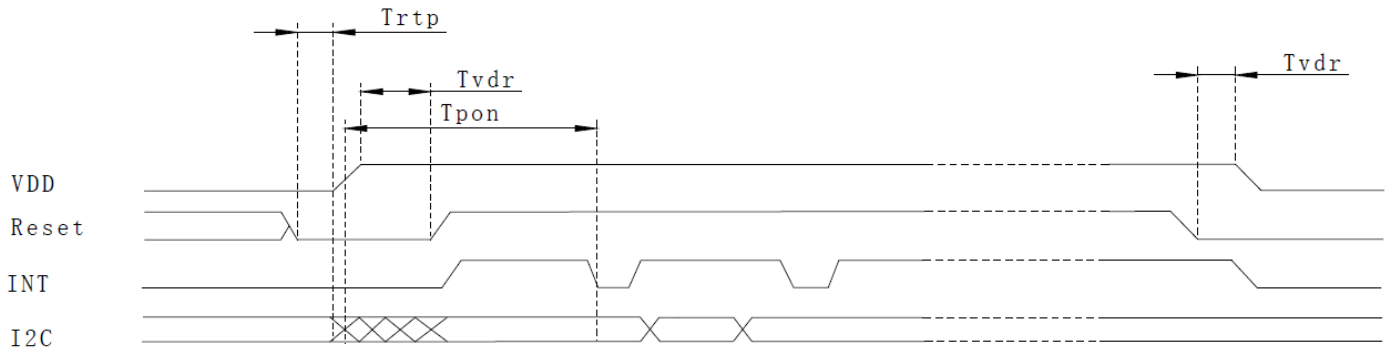
# Timing Characteristics: Capacitive Touch Panel

## Data Transfer Format

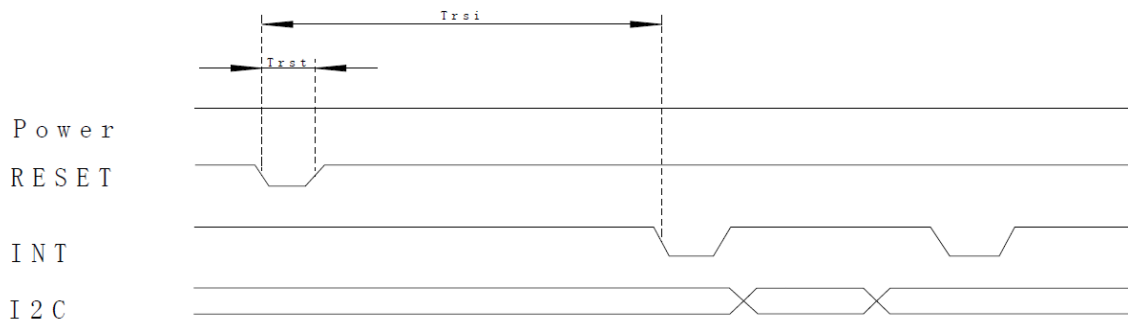


Parameter	Min	Max	Unit
SCL Frequency	0	400	KHz
Bus free time between a STOP and START Condition	1.3	-	μs
Hold Time (repeated) START Condition	0.6	-	μs
Data Setup Time	100	-	ns
Setup Time for a repeated START Condition	0.6	-	μs
Setup Time for STOP Condition	0.6	-	μs

## Power ON Sequence



## Reset Sequence



Parameter	Description	Min	Max	Unit
$T_{ris}$	Rise time from $0.1 \cdot V_{DD}$ to $0.9 \cdot V_{DD}$	-	5	ms
$T_{pdt}$	Time for voltage supply below $0.3 \cdot V_{DD}$	5	-	ms
$T_{rtp}$	Time to hold reset low Before Applying Power	100	-	$\mu s$
$T_{pon}$	Time of starting to report point after powering on	-	200	ms
$T_{vdr}$	Reset time after $V_{DD}$ power on	1	-	ms
$T_{rsi}$	Time of starting to report point after Reset	-	200	ms
$T_{rst}$	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.	+60°C, 240 hrs.	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-20°C, 240 hrs.	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+50°C, 120 hrs.	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	0°C, 120 hrs.	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, 120 hrs.	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	0°C, 30min->25°C, 5min -> 50°C, 30min 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 1.5mm amplitude. 60 sec in each of 3 directions X, Y, Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	Air: V <sub>s</sub> =8KV, Contact: V <sub>s</sub> =4KV 10 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)