

# NHD-4.3-480272EF-ATXL#-CTP

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

NHD-	Newhaven Display
4.3-	4.3" Diagonal
480272-	480xRGBx272 pixels
EF-	Model
A-	Built-in driver / No Controller
T-	White LED backlight
X-	TFT
L-	6:00 optimum view, Wide Temp
#-	<b>RoHS Compliant</b>
CTP-	Capacitive touch panel with controller

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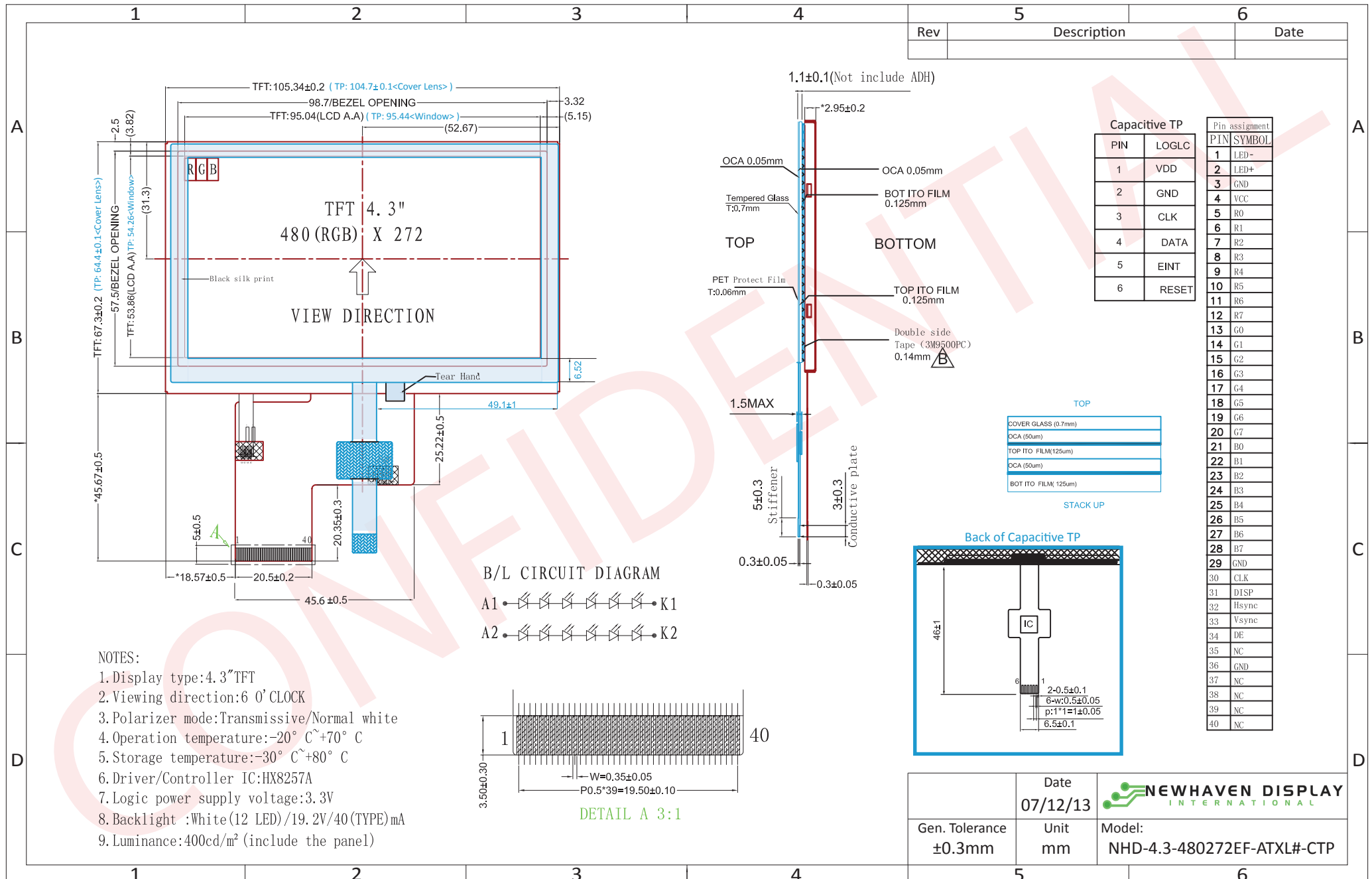
## Document Revision History

Revision	Date	Description	Changed by
0	8/29/2012	Initial Release	AK
1	7/12/2013	Mechanical and Optical characteristics updated	KA

## Functions and Features

- 480xRGBx272 resolution, up to 16.7M colors
- 12-LED backlight
- 24 bit RGB interface
- Capacitive touch panel with controller

# Mechanical Drawing



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## Pin Description

### TFT:

Pin No.	Symbol	External Connection	Function Description
1	LED-	Power Supply	Ground for Backlight
2	LED+	Power Supply	Backlight Power Supply (40mA @ 19.2V)
3	GND	Power Supply	Ground
4	VDD	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	CLK	MPU	Data sample Clock signal
31	DISP	MPU	Display ON/OFF signal
32	HSYNC	MPU	Line synchronization signal
33	VSYNC	MPU	Frame synchronization signal
34	DE	MPU	Data Enable signal
35	NC	-	No Connect
36	GND	Power Supply	Ground
37	NC	-	No Connect
38	NC	-	No Connect
39	NC	-	No Connect
40	NC	-	No Connect

**Recommended LCD connector:** 0.5mm pitch 40-Conductor FFC. Molex p/n: 54132-4097

**Backlight connector:** on LCD connector **Mates with:** ---

### Capacitive Touch Panel:

Pin No.	Symbol	External Connection	Function Description
1	VDD	Power Supply	Power supply for logic (3.0V)
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	/WAKE	MPU	External interrupt signal from host (0: Disable /INT; 1: Enable /INT)

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

## Driver/Controller Information

### TFT:

Built-in Himax HX8257-A

Please download specification at [http://www.newhavendisplay.com/app\\_notes/HX8257.pdf](http://www.newhavendisplay.com/app_notes/HX8257.pdf)

### Capacitive Touch Panel:

Built-in FocalTech FT5x06

Please download specification at [http://www.newhavendisplay.com/app\\_notes/FT5x06.pdf](http://www.newhavendisplay.com/app_notes/FT5x06.pdf)

## Electrical Characteristics

### TFT:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		3.0	3.3	3.6	V
Supply Current (White screen)	IDD		-	24.24	28.78	mA
Supply Current (Black screen)	IDD		-	25.76	30.30	mA
"H" level input	Vih		0.8*VDD	-	VDD	V
"L" level input	Vil		0	-	0.2*VDD	V
Backlight Supply Voltage	VLED		-	19.2	22	V
Backlight Supply Current	ILED		-	40	-	mA
Backlight Power Consumption	PBL		-	768	-	mW

### Capacitive Touch Panel:

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		2.8	-	3.3	V
Supply Current (Operating)	IDD	Ta=25°C, VDD=2.8V	-	6.0	-	mA
Supply Current (Hibernate)	IDD		-	0.03	-	mA
"H" level input	Vih		0.7*VDD	-	VDD	V
"L" level input	Vil		VSS	-	0.3*VDD	V
"H" level output	Voh		0.7*VDD	-	VDD	V
"L" level output	Vol		VSS	-	0.3*VDD	V

## Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top		Cr ≥10	-	50	-	°
Viewing Angle – Bottom			-	70	-	°
Viewing Angle – Left			-	70	-	°
Viewing Angle – Right			-	70	-	°
Contrast Ratio	Cr		400	500	-	
Luminance	YL		-	340	-	cd/m <sup>2</sup>
Response Time	Tr+Tf	-	-	25	30	ms

## Capacitive Touch Panel Material Characteristics

Property	Requirement	Unit
IC	FT5306DE3	-
Glass thickness	0.7	Mm
Top film thickness	0.125	Mm
Surface hardness	6(750)	H(g)
Light transmission	82%	-
Operating humidity	45~85	RH
Storage Humidity	5~95	RH

## Timing Characteristics

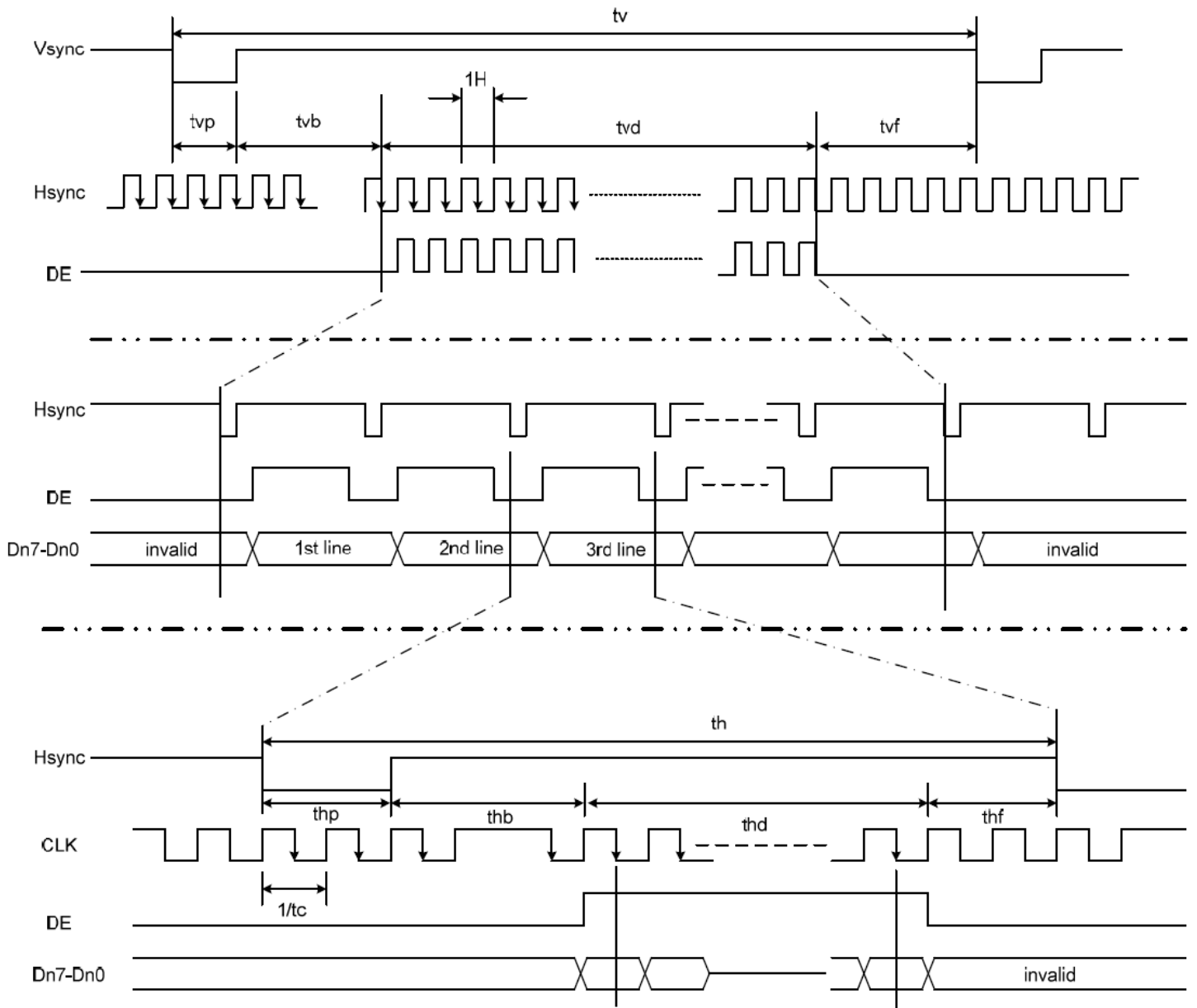
### Parallel RGB input timing requirement

(480R GBx272,  $T_A=25^\circ\text{C}$ ,  $V_{DDIO}=1.8\text{V}$  to  $3.6\text{V}$ ,  $DVSS=0\text{V}$ )

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock cycle	$f_{\text{CLK}}^{(1)}$	-	9	15	MHz
Hsync cycle	$1/\text{th}$	-	17.14	-	KHz
Vsync cycle	$1/\text{tv}$	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	$\text{thp}^{(2)}$	2	41	41	CLK
Horizontal back porch	$\text{thb}^{(2)}$	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	511	$\text{H}^{(1)}$
Vertical display period	tvd	272	272	272	$\text{H}^{(1)}$
Vertical front porch	tvf	1	2	227	$\text{H}^{(1)}$
Vertical pulse width	$\text{tvp}^{(2)}$	1	10	11	$\text{H}^{(1)}$
Vertical back porch	$\text{tvb}^{(2)}$	1	2	11	$\text{H}^{(1)}$

Note: (1) Unit:  $\text{CLK}=1/f_{\text{CLK}}$ ,  $\text{H}=\text{th}$ ,

(2) It is necessary to keep  $\text{tvp}+\text{tvb}=12$  and  $\text{thp}+\text{thb}=43$  in sync mode. DE mode is unnecessary to keep it.



## Input setup timing requirement

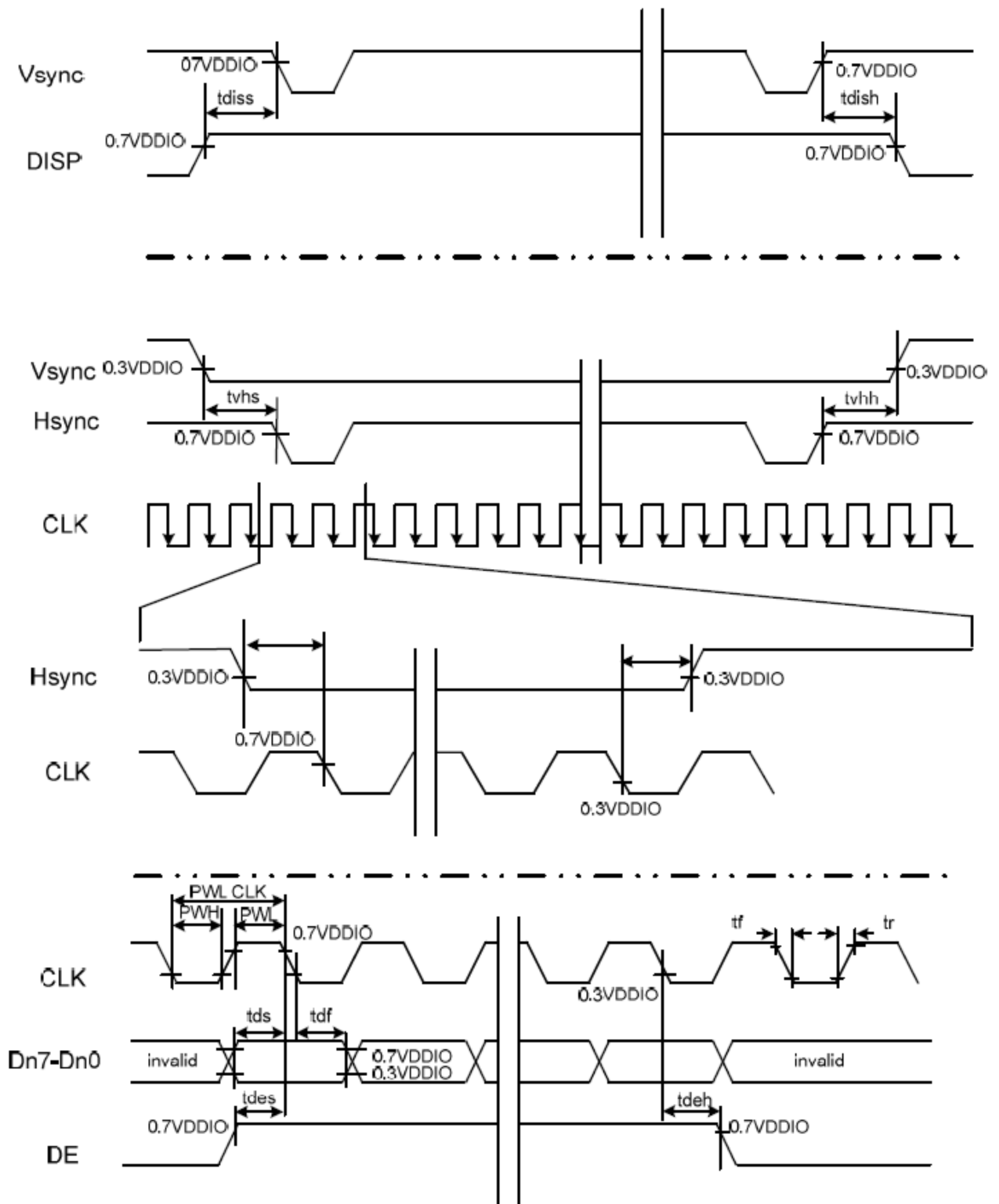
( $T_A=25^\circ\text{C}$ ,  $V_{DDIO}=1.8\text{V}$  to  $3.6\text{V}$ ,  $DVSS=0\text{V}$ ,  $t_r^{(1)}=t_f^{(1)}=2\text{ns}$ )

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DIS P setup time	$t_{diss}$	10	-	-	ns
DIS P hold time	$t_{dish}$	10	-	-	ns
Clock period	$PW_{CLK}^{(2)}$	66.7	-	-	ns
Clock pulse high period	$PWH^{(2)}$	26.7	-	-	ns
Clock pulse low period	$PWL^{(2)}$	26.7	-	-	ns
Hsync setup time	$t_{hs}$	10	-	-	ns
Hsync hold time	$t_{hh}$	10	-	-	ns
Data setup time	$t_{ds}$	10	-	-	ns
Data hold time	$t_{dh}$	10	-	-	ns
DE setup time	$t_{des}$	10	-	-	ns
DE hold time	$t_{deh}$	10	-	-	ns
Vsync setup time	$t_{vhs}$	10	-	-	ns
Vsync hold time	$t_{vhh}$	10	-	-	ns

Note: (1)  $t_r$ ,  $t_f$  is defined 10% to 90% of signal amplitude.

(2) For parallel interface, maximum clock frequency is 15MHz.





# Capacitive Touch Panel Registers

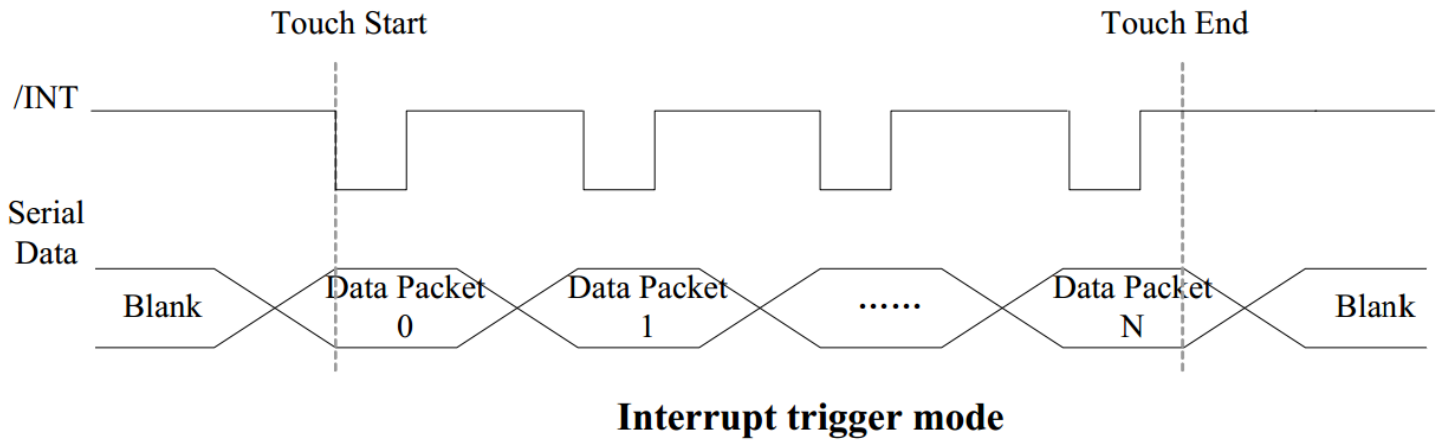
Address	Name	B7	B6	B5	B4	B3	B2	B1	B0	Access	
00h	DEVICE_MODE	Device Mode [2..0]									R/W
01h	GEST_ID	Gesture ID [7..0]									R
02h	TD_STATUS							Touch Points [3..0]			R
03h	TOUCH1_XH	Event Flag			1st Touch X Position MSB [11..8]					R	
04h	TOUCH1_XL	1st Touch X Position LSB [7..0]									R
05h	TOUCH1_YH	Touch ID [3..0]			1st Touch Y Position MSB [11..8]					R	
06h	TOUCH1_YL	1st Touch Y Position LSB [7..0]									R
07h										R	
08h										R	
09h	TOUCH2_XH	Event Flag			2nd Touch X Position MSB [11..8]					R	
0Ah	TOUCH2_XL	2nd Touch X Position LSB [7..0]									R
0Bh	TOUCH2_YH	Touch ID [3..0]			2nd Touch Y Position MSB [11..8]					R	
0Ch	TOUCH2_YL	2nd Touch Y Position LSB [7..0]									R
0Dh										R	
0Eh										R	
0Fh	TOUCH3_XH	Event Flag			3rd Touch X Position MSB [11..8]					R	
10h	TOUCH3_XL	3rd Touch X Position LSB [7..0]									R
11h	TOUCH3_YH	Touch ID [3..0]			3rd Touch Y Position MSB [11..8]					R	
12h	TOUCH3_YL	3rd Touch Y Position LSB [7..0]									R
13h										R	
14h										R	
15h	TOUCH4_XH	Event Flag			4th Touch X Position MSB [11..8]					R	
16h	TOUCH4_XL	4th Touch X Position LSB [7..0]									R
17h	TOUCH4_YH	Touch ID [3..0]			4th Touch Y Position MSB [11..8]					R	
18h	TOUCH4_YL	4th Touch Y Position LSB [7..0]									R
19h										R	
1Ah										R	
1Bh	TOUCH5_XH	Event Flag			5th Touch X Position MSB [11..8]					R	
1Ch	TOUCH5_XL	5th Touch X Position LSB [7..0]									R
1Dh	TOUCH5_YH	Touch ID [3..0]			5th Touch Y Position MSB [11..8]					R	
1Eh	TOUCH5_YL	5th Touch Y Position LSB [7..0]									R
1Fh										R	

Address	Name	B7	B6	B5	B4	B3	B2	B1	B0	Access	
80h	ID_G_THGROUP	valid touching detect threshold								R/W	
81h	ID_G_THPEAK	valid touching peak detect threshold								R/W	
82h	ID_G_THCAL	the threshold when calculating the focus of touching								R/W	
83h	ID_G_THWATER	the threshold when there is surface water								R/W	
84h	ID_G_TEMP	the threshold of temperature compensation								R/W	
85h	ID_G_THDIFF	the threshold whether the coordinate is different from original								R/W	
86h	ID_G_CTRL						Power Control Mode [1..0]				R/W
87h	ID_G_TIME_ENTER_MONITOR	the timer for entering monitor status								R/W	
88h	ID_G_PERIODACTIVE						Period Active [3..0]				R/W
89h	ID_G_PERIODMONITOR	the timer of entering idle when in monitor status								R/W	
A0h	ID_G_AUTO_CLB_MODE	auto calibration mode								R/W	
A1h	ID_G_LIB_VERSION_H	Firmware Library Version H byte								R	
A2h	ID_G_LIB_VERSION_L	Firmware Library Version L byte								R	
A3h	ID_G_CIPHER	Chip vendor ID								R	
A4h	ID_G_MODE	the interrupt status to host								R	
A5h	ID_G_PMODE	Power Consume Mode									
A6h	ID_G_FIRMID	Firmware ID								R	
A7h	ID_G_STATE	Running State									
A8h	ID_G_FT5201ID	CTPM Vendor ID								R	
A9h	ID_G_ERR	Error Code								R	
AAh	ID_G_CLB	Configure TP module during calibration in Test Mode								R/W	
FEh	LOG_MSG_CNT	The log MSG count								R	
FFh	LOG_CUR_CHA	Current character of log message								R	

NOTE: Registers 80h – AFh have been configured for optimum settings and do not need to be modified.

Register No	Register Name	Bits	Value	Description
00h	Device Mode	[2:0]	000b 100b 001b	Normal Operating Mode Test Mode - read raw data (reserved) System Information Mode (reserved)
01h	Gesture ID	[7:0]	48h 49h 00h	Zoom In Zoom Out No Gesture
02h	Touch Points	[3:0]	000b 001b 010b 011b 100b 101b	0 touch points detected 1 touch point detected 2 touch points detected 3 touch points detected 4 touch points detected 5 touch points detected
03h	Touch 1 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact 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 01b 10b 11b	Put Down Put Up Contact 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 01b 10b 11b	Put Down Put Up Contact 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 01b 10b 11b	Put Down Put Up Contact 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
1Bh	Touch 5 Event Flag	[7:6]	00b 01b 10b 11b	Put Down Put Up Contact Reserved
1Bh	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]	55h	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]	05h	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



### 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(0x70);           //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 , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200hrs	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.	+60°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,30min -> 25°C,5min ->70°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

**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)