

# NHD-5.0-800480TF-ATXI#-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
I-	6:00 viewing angle, Wide Temp
#-	<b>RoHS Compliant</b>
CTP-	Capacitive touch panel with controller

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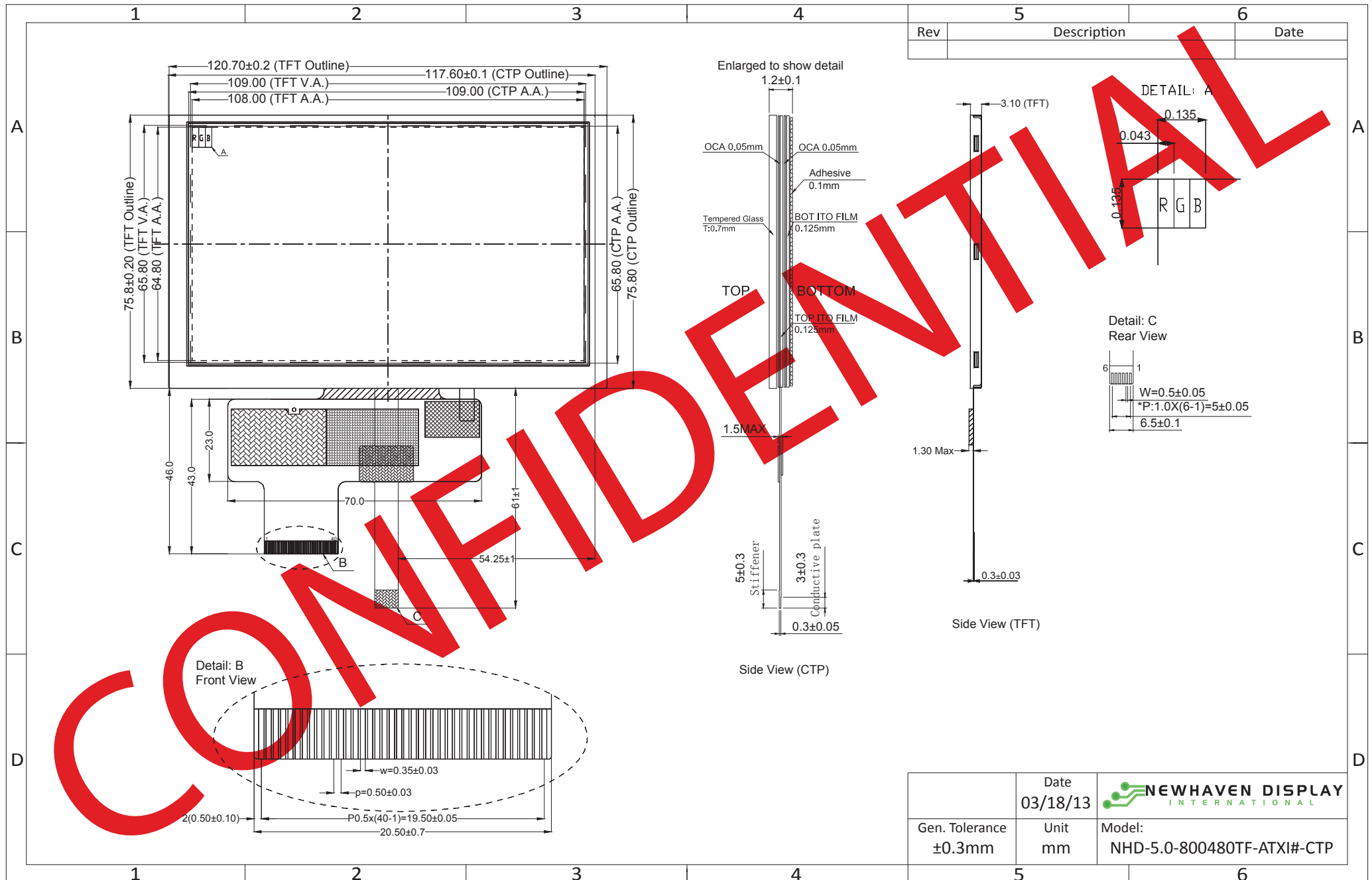
## Document Revision History

Revision	Date	Description	Changed by
0	2/1/2012	Initial Release	SB
1	3/18/2013	Timing Characteristics added	AK
2	8/5/2013	Optical characteristics updated	ML

## Functions and Features

- 800xRGBx480 resolution, up to 16.7M colors
- 14-LED backlight
- 24 bit RGB interface
- Capacitive Touch Panel with Controller

# Mechanical Drawing



Rev	Description	Date

	Date 03/18/13	 <b>NEWHAVEN DISPLAY</b> INTERNATIONAL
Gen. Tolerance ±0.3mm	Unit mm	

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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 (20mA @ 23.1V)
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	CLKIN	MPU	Clock for input data (Rising Edge)
31	STBYB	MPU	1: Normal Operation; 0: Standby Mode
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	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	VCC	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 HX8264-D02 Source Driver: [http://www.newhavendisplay.com/app\\_notes/HX8264-D02.pdf](http://www.newhavendisplay.com/app_notes/HX8264-D02.pdf)

Built in HX8664-B Gate Driver: [http://www.newhavendisplay.com/app\\_notes/HX8664-B.pdf](http://www.newhavendisplay.com/app_notes/HX8664-B.pdf)

### Capacitive Touch Panel:

Built-in FocalTech FT5x06 controller.

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	IDD	VDD=3.3	-	132	-	mA
"H" Level input	Vih		0.7*VDD	-	VDD	V
"L" Level input	Vil		VSS	-	0.3*VDD	V
"H" Level output	Voh		VDD-0.4	-	VDD	V
"L" Level output	Vol		VSS	-	VSS+0.4	V
Backlight Supply Voltage	VLED		-	23.1	-	V
Backlight Supply Current	ILED		-	20	25	mA
Backlight Power Consumption	PBL		-	924	-	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	Ta=25°C, VDD=2.8V	-	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		500	600	-	
Luminance	YL		-	250	-	cd/m <sup>2</sup>
Response Time	Tr+Tf	-	-	20	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

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
HS setup time	$T_{hst}$	8	-	-	ns
HS hold time	$T_{hhd}$	8	-	-	ns
VS setup time	$T_{vst}$	8	-	-	ns
VS hold time	$T_{vhd}$	8	-	-	ns
Data setup time	$T_{dsu}$	8	-	-	ns
Data hold time	$T_{dhd}$	8	-	-	ns
DE setup time	$T_{esu}$	8	-	-	ns
DE hold time	$T_{ehd}$	8	-	-	ns
VDD Power On Slew rate	$T_{POR}$	-	-	20	ms
RSTB pulse width	$T_{Rst}$	10	-	-	us
CLKIN cycle time	$T_{cph}$	20	-	-	ns
CLKIN pulse duty	$T_{cwh}$	40	50	60	%
Output stable time	$T_{sst}$	-	-	6	us

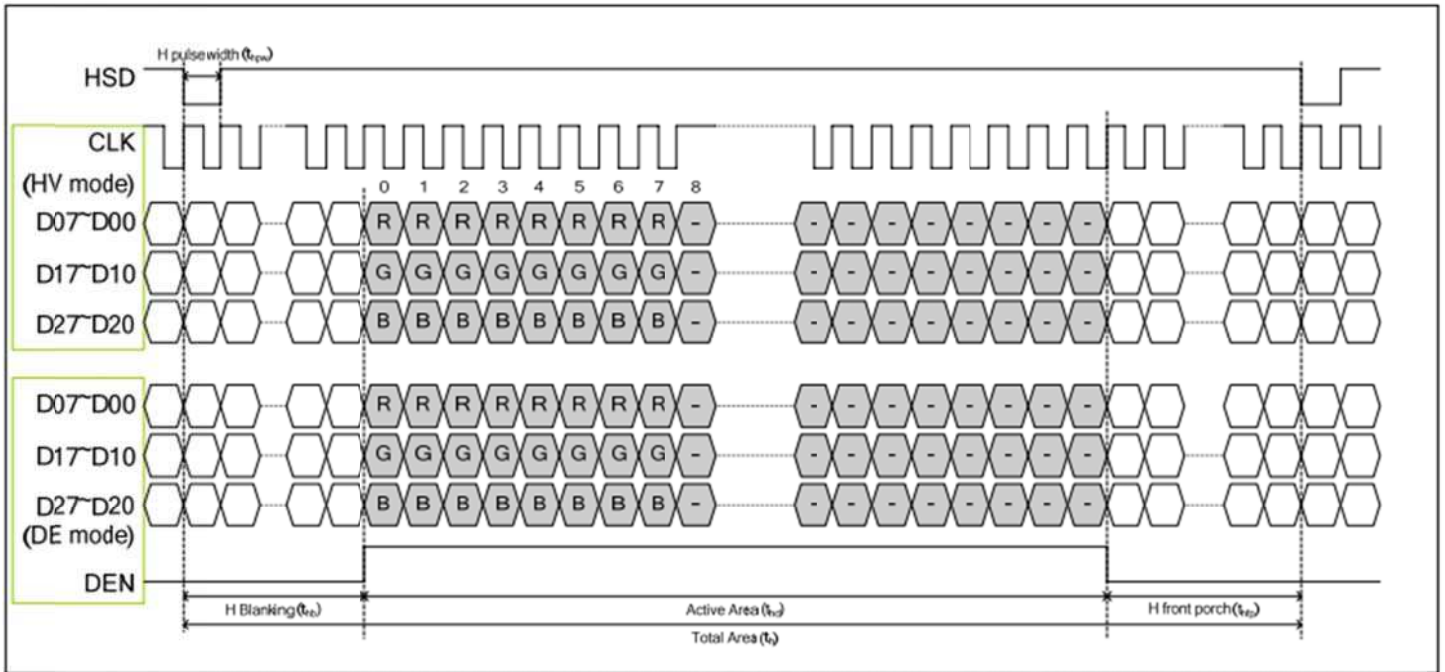
### Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Horizontal Display Area	thd		800		DCLK
DCLK frequency	fclk	-	30	50	MHz
One Horizontal Line	th	889	928	1143	DCLK
HS pulse width	thpw	1	48	255	DCLK
HS Back Porch (Blanking)	thb		88		DCLK
HS Front Porch	thfp	1	40	255	DCLK
DE mode Blanking	th-thd	85	128	512	DCLK

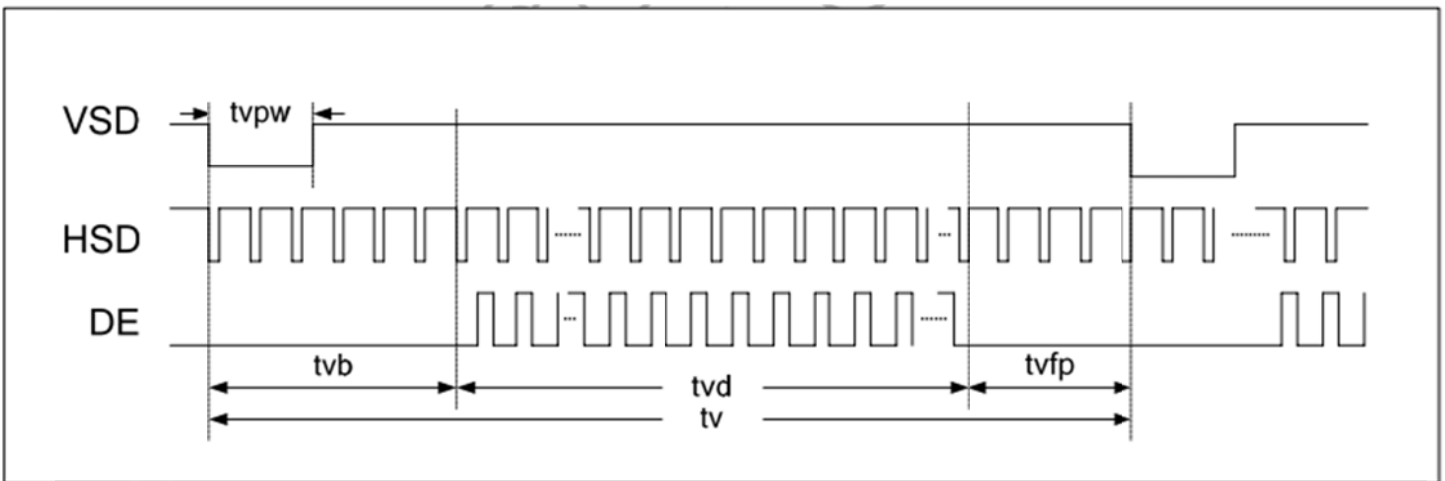
### Vertical timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		480		$T_H$
VS period time	tv	513	525	767	$T_H$
VS pulse width	tvpw	3	3	255	$T_H$
VS Back Porch (Blanking)	tvb		32		$T_H$
VS Front Porch	tvfp	1	13	255	$T_H$
DE mode Blanking	tv-tvd	4	45	255	$T_H$

## Horizontal Timing



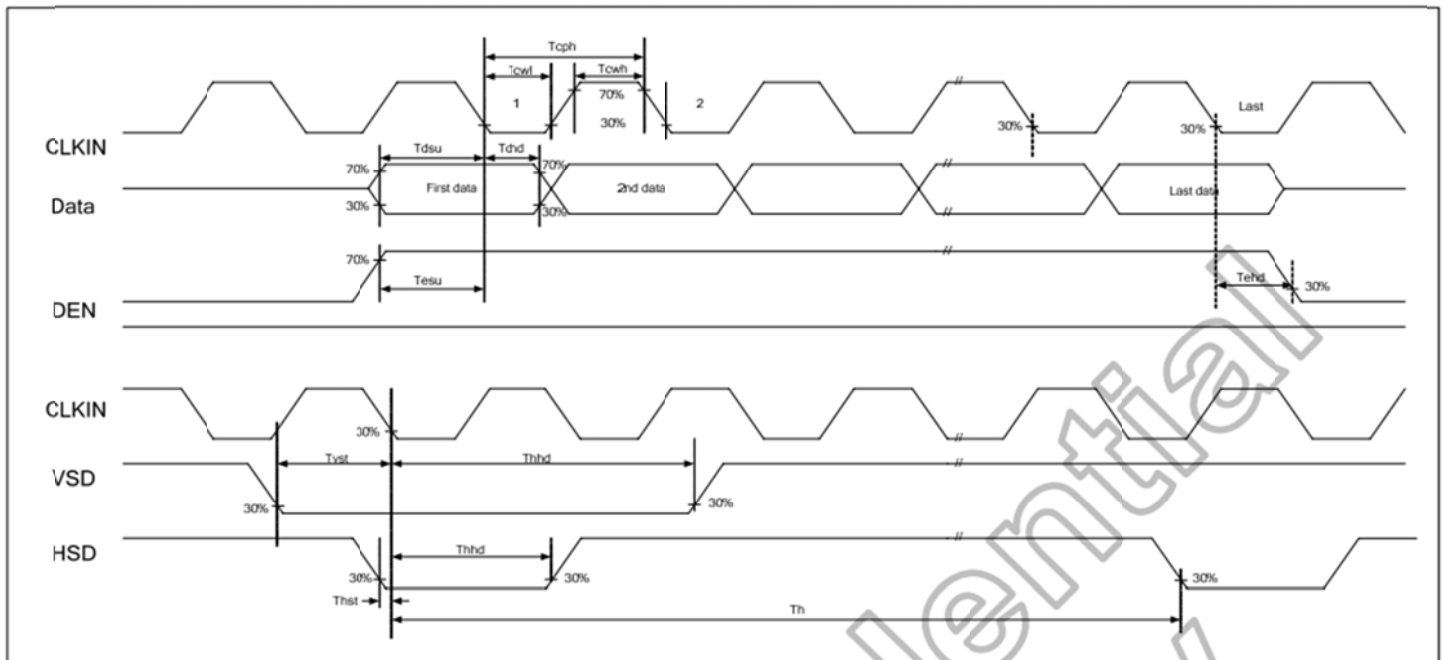
## Vertical Timing



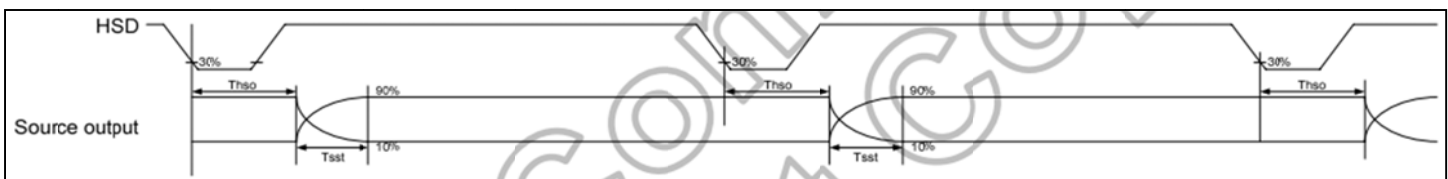
## Parallel 24-bit RGB mode

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN Frequency	Fclk	-	40	50	MHz	VDD=3.0V~3.6V
CLKIN Cycle Time	Tclk	20	25	-	ns	-
CLKIN Pulse Duty	Tcwh	40	50	60	%	Tclk
Time from HSD to Source Output	Thso		64		CLKIN	-
Time from HSD to LD	Thld		64		CLKIN	-
Time from HSD to STV	Thstv		2		CLKIN	-
Time from HSD to CKV	Thckv		20		CLKIN	-
Time from HSD to OEV	Thoev		4		CLKIN	-
LD Pulse Width	Twld		10		CLKIN	-
CKV Pulse Width	Twckv		66		CLKIN	-
OEV Pulse Width	Twoev		74		CLKIN	-

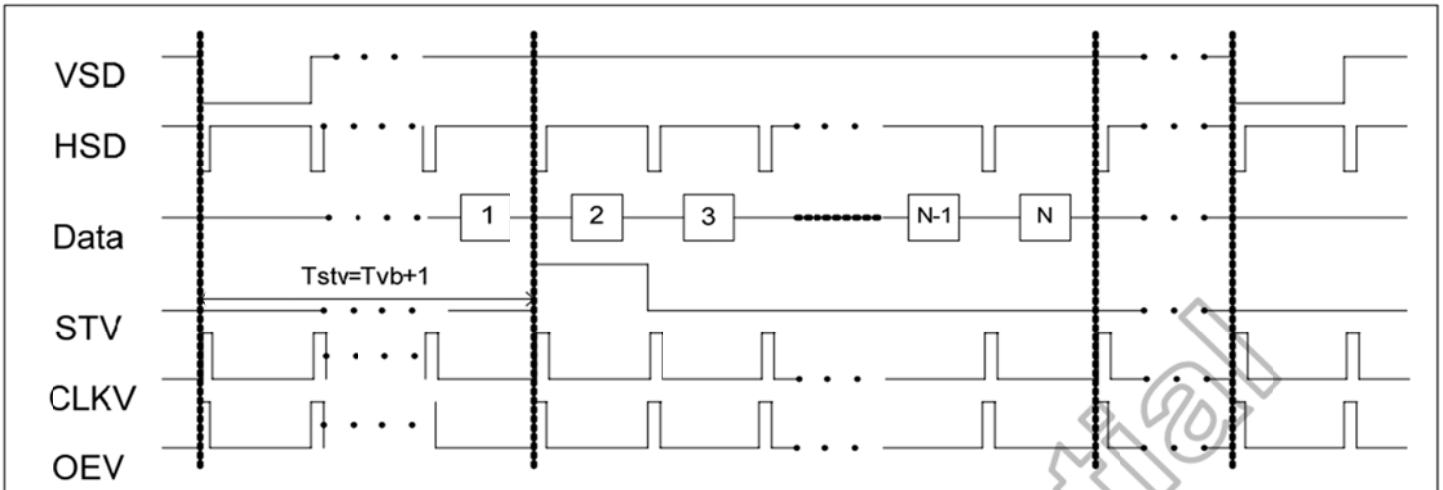
## Input Clock and Data Timing



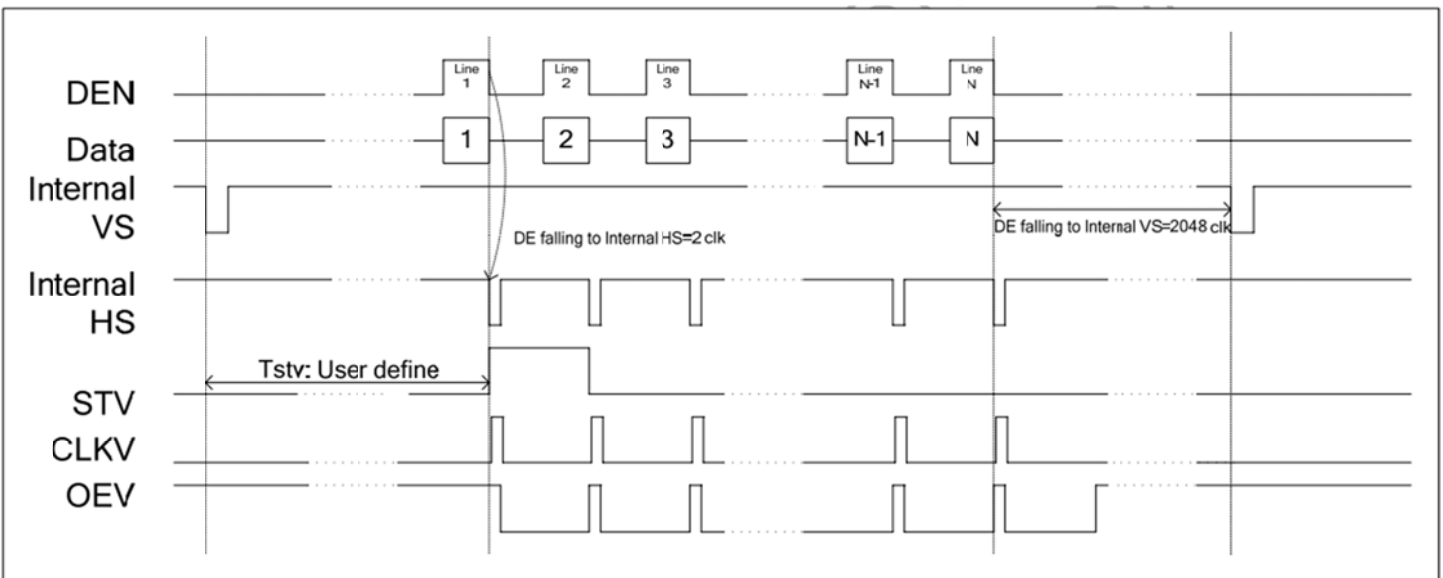
## Source Output Timing



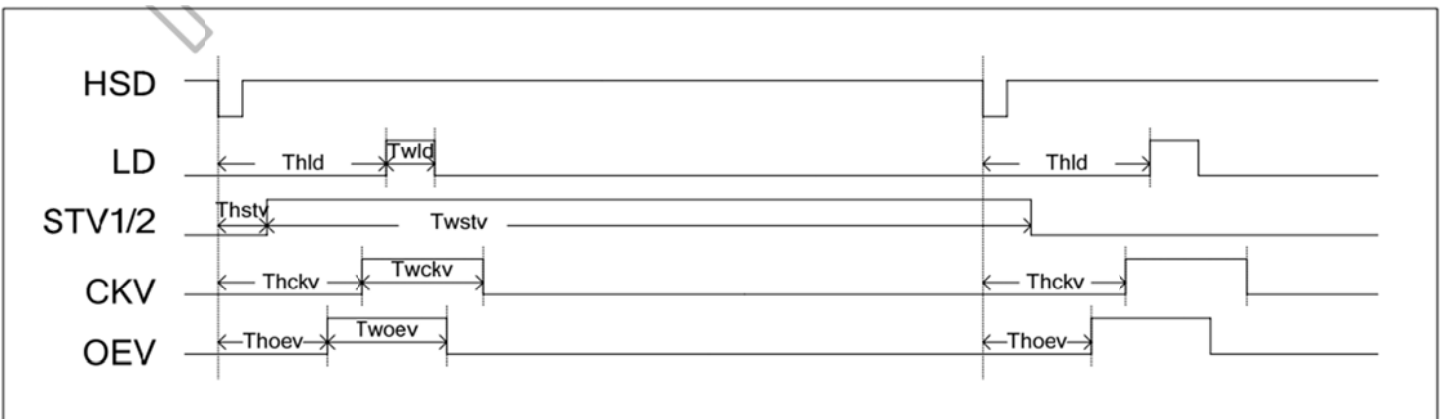
## Vertical Timing HV (Cascade)



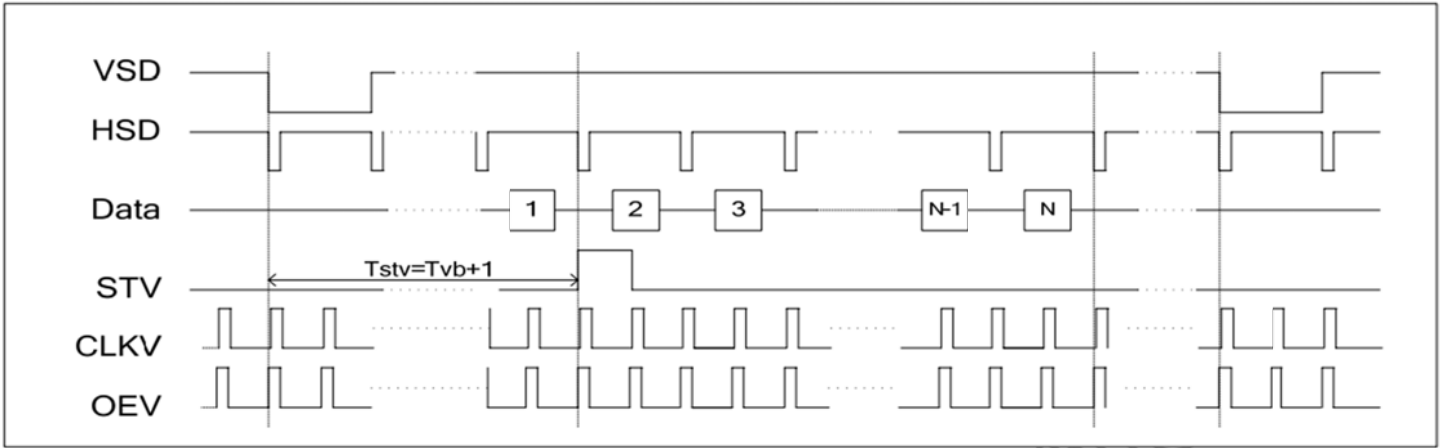
## Vertical Timing DE (Cascade)



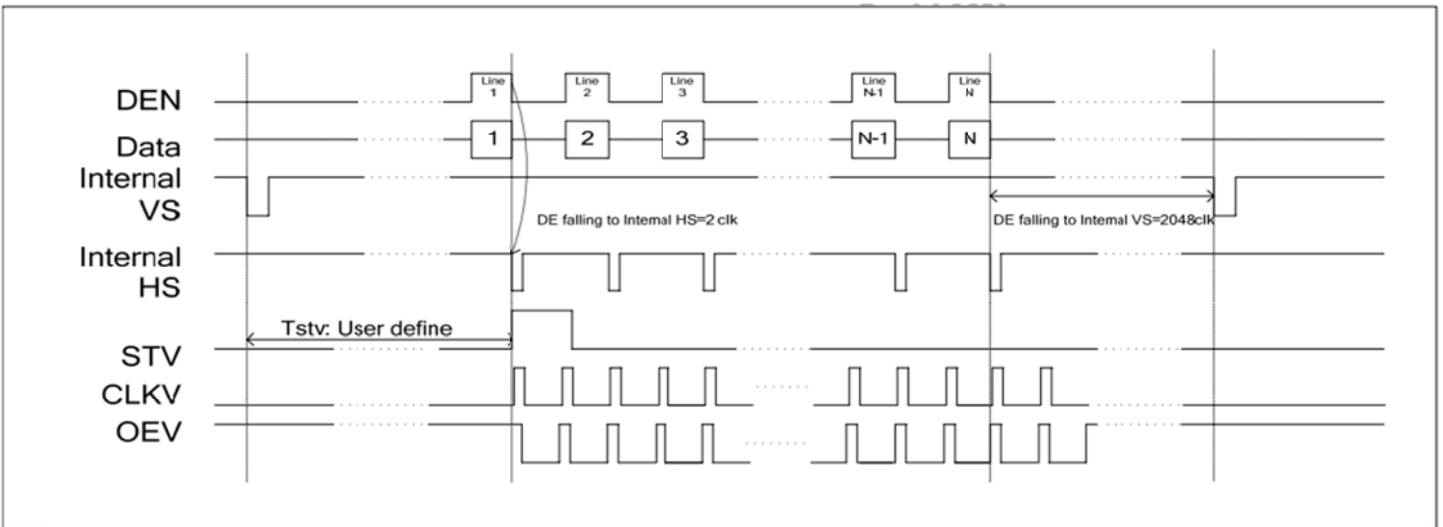
## Gate Output Timing



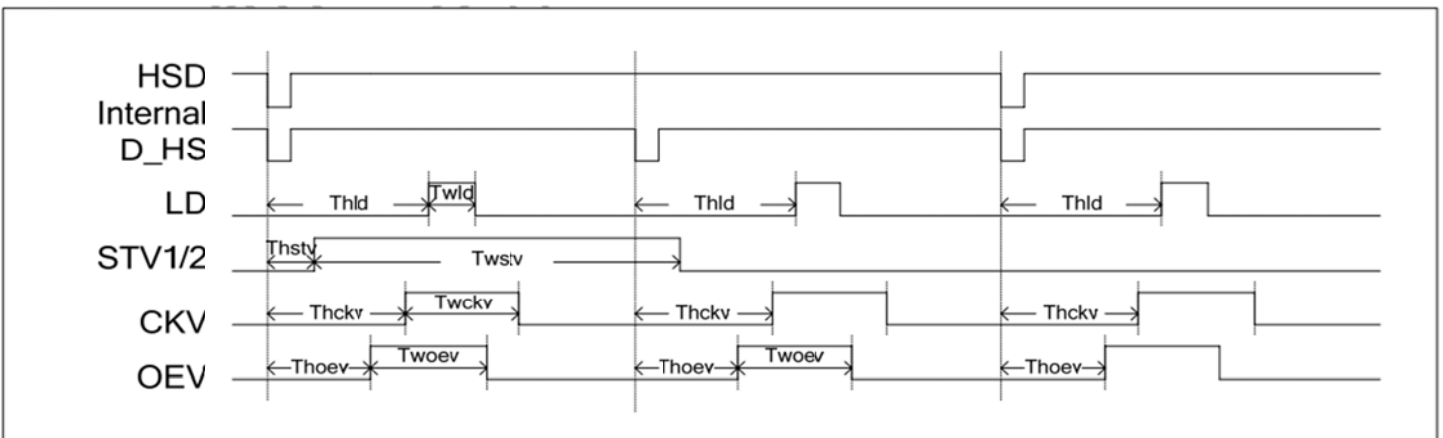
### Vertical Timing HV (Dual Gate)



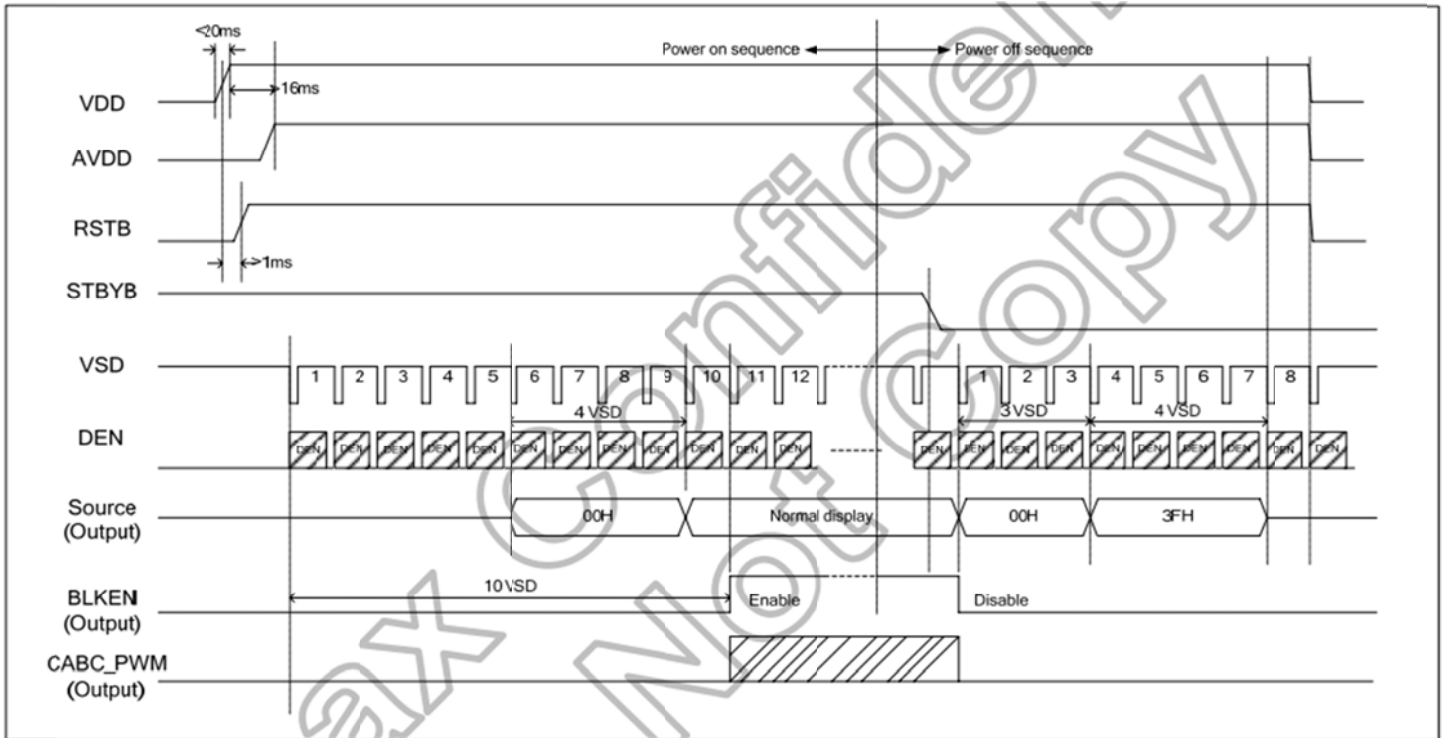
### Vertical Timing DE (Dual Gate)



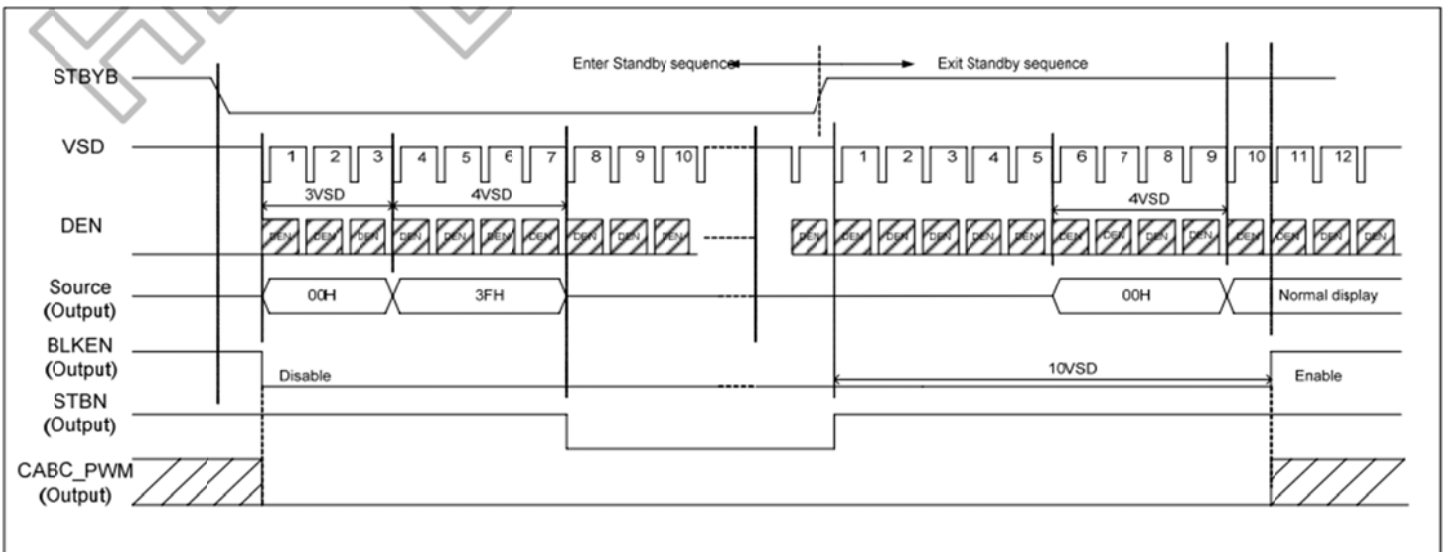
### Gate Output Timing (Dual Gate)



## Power ON/OFF Sequence



## Enter/Exit Standby Mode Sequence



## Capacitive Touch 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

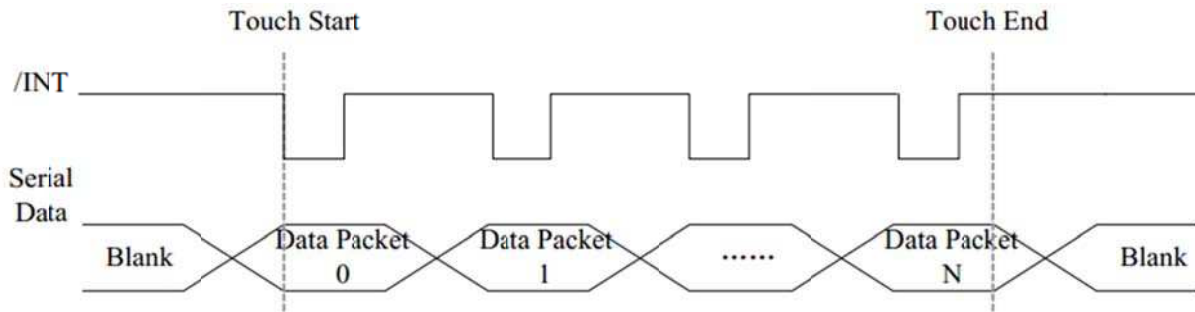
Address	Name	B7	B6	B5	B4	B3	B2	B1	B0	Access	
80h	ID_G_THGROUP	valid touching detect threshold								R/W	
81h	ID_G_THPEAK	valid touching peak detect threshold								R/W	
82h	ID_G_THCAL	the threshold when calculating the focus of touching								R/W	
83h	ID_G_THWATER	the threshold when there is surface 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.

## Capacitive Touch Register Description:

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 - 3h	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 - 3h	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 - 3h	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 - 3h	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 - 3h	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 Default : 1Eh
81h	ID_G_THPEAK	[7:0]	00h - FFh	valid touching peak detect threshold Default : 3Ch
82h	ID_G_THCAL	[7:0]	00h - FFh	Touch focus threshold Default : 14h
83h	ID_G_THWATER	[7:0]	00h - FFh	threshold when there is surface water Default : D0h
84h	ID_G_THTEMP	[7:0]	00h - FFh	threshold of temperature compensation Default : 66h
85h	ID_G_THDIFF	[7:0]	00h - FFh	Touch difference threshold Actual value is 32 times the register's value Default : 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) Default : C8h
88h	ID_G_PERIODACTIVE	[3:0]	3h-Eh	Period of 'Active' status (ms) Default : 6h
89h	ID_G_PERIODMONITOR	[7:0]	1Eh-FFh	Timer to enter 'idle' when in 'Monitor' (ms) Default : 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(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 , 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)