

# NHD-2.8-240320AF-CSXP-FCTP

## IPS TFT Liquid Crystal Display Module

NHD-	Newhaven Display
2.8-	2.8" Diagonal
240320-	240 x 320 Pixels (Portrait Mode)
AF-	Model
C-	Built-in Controller
S-	High Brightness White LED Backlight
X-	TFT
P-	IPS, Wide Temperature
FCTP-	FFC ZIF Connection Style, Capacitive Touch Panel with controller

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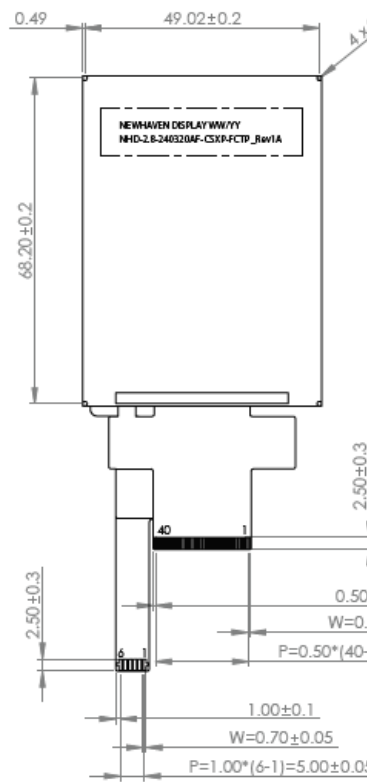
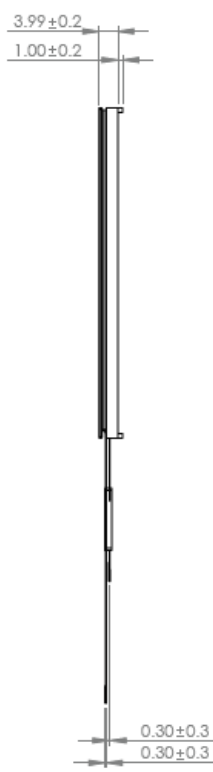
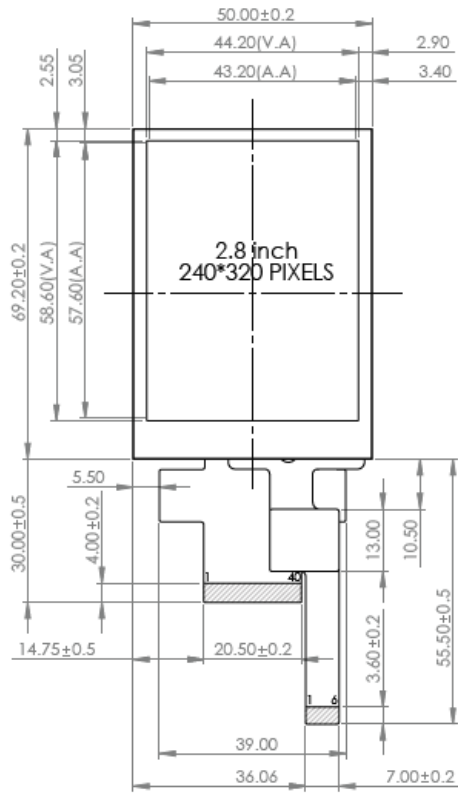
## Document Revision History

Revision	Date	Description	Changed by
-	4/9/19	Initial Release	PK
1	12/9/19	Interface information updated (8080-II)	SM
2	2/12/21	Updated FPC Tolerances On 2D Mechanical Drawing	AS
3	5/25/21	CTP Timing Characteristics Included	ZP

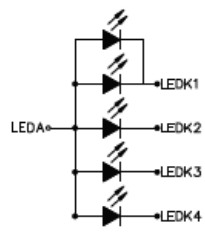
## Functions and Features

- 240 x 320 pixels
- IPS type, full viewing angles
- High brightness LED backlight
- 3.0V power supply
- 8-bit or 16-bit Parallel MPU interface (8080-II Series)
- FFC ZIF I/O connection
- Built-in ST7789Vi controller
- 262K colors
- Capacitive touch panel with controller
  - 5-point multi-touch input
  - Gesture input
    - Zoom In/Out
    - Swipe Up/Down/Left/Right

SYMBOL	REVISION



1. Display Size: 2.8" TFT
2. Optimal View: Full View (IPS)
3. Display Mode: Transmissive / Normally Black / Anti-Glare
4. Driver IC: ST7789Vi: 8/16Bit Parallel Interface
5. Supply Voltage: 2.8V
6. Backlight: White LED / 100 mA (Typ) / 3.1V
7. Brightness: 500 cd/m<sup>2</sup> (Typ)
8. Film: 3M Brightness Enhancement
9. Touch Panel: PCAP



STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED)
LINEAR: ±0.3mm
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION
THIS DRAWING IS SOLELY FOR THE INFORMATION IT CO WHOLE OR PART WITHOU

## Pin Description

### TFT:

Pin No.	Symbol	External Connection	Function Description
1	GND	Power Supply	Ground
2 - 6	NC	-	No Connect
7	V <sub>DD</sub>	Power Supply	Supply Voltage for LCD (2.8V)
8	IOV <sub>DD</sub>	Power Supply	Supply Voltage for Logic (Tie to V <sub>DD</sub> )
9	NC	-	No Connect
10	/CS	MPU	Active LOW Chip Select signal (can tie to GND)
11	D/C	MPU	Data / Command selection: '1' = Data ; '0' = Command
12	/WR	MPU	Active LOW Write signal
13	/RD	MPU	Active LOW Read signal
14 - 29	DB0 – DB15	MPU	Bi-directional data bus, 8-bit:DB8-DB15, 16-bit: DB0-DB15
30	/RES	MPU	Active LOW Reset signal
31	IM0	MPU	IM0=0: 16-bit (8080-II)      IM0=1: 8-bit (8080-II)
32	NC	-	No Connect
33	GND	Power Supply	Ground
34 - 37	LED-K1 – LED-K4	Power Supply	Backlight Cathode (Ground)
38	LED-A	Power Supply	Backlight Anode (100mA @ 3.1V)
39	GND	Power Supply	Ground
40	NC	-	No Connect

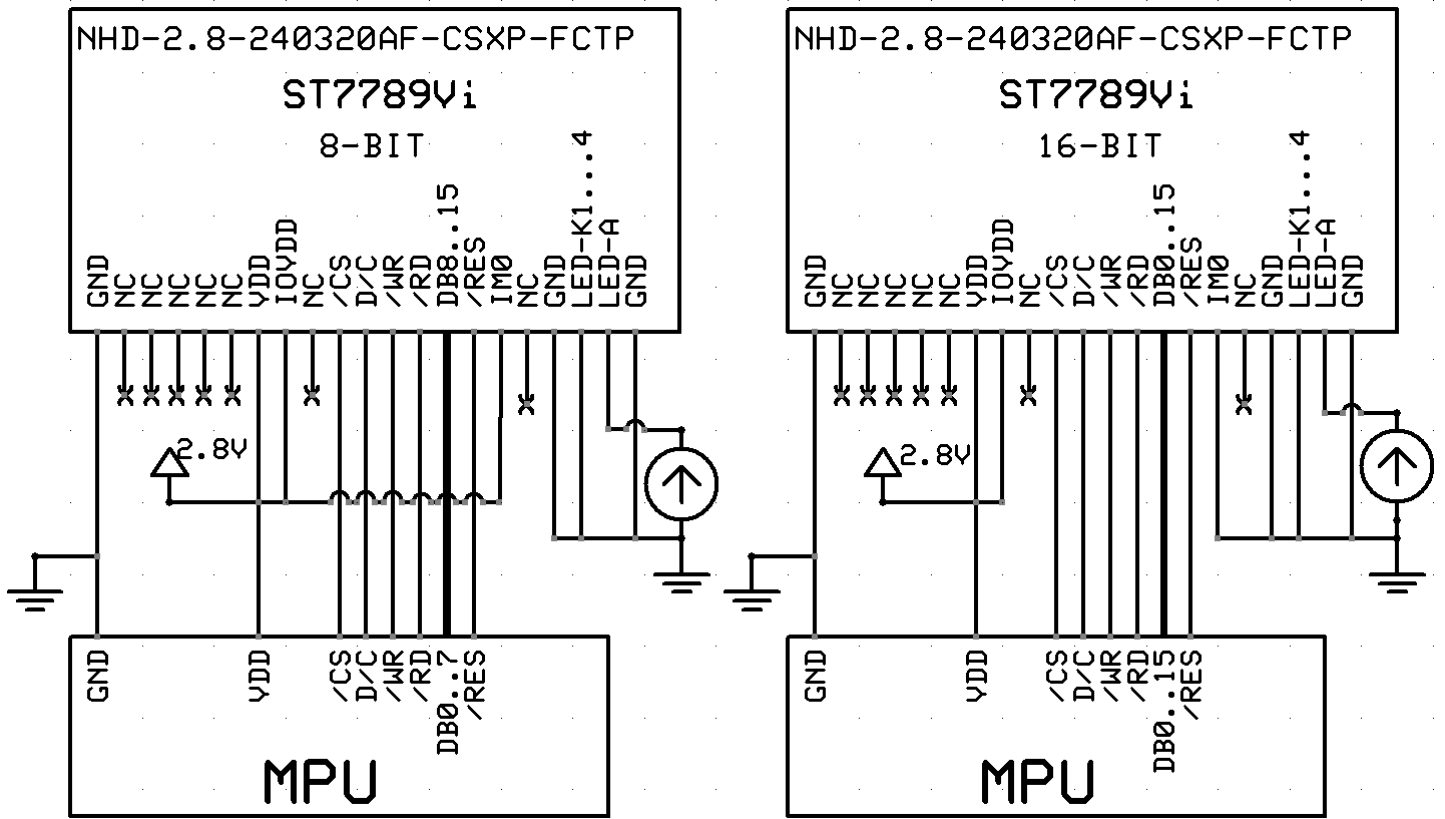
**Recommended LCD connector:** 40-pin, 0.5mm pitch FFC connector      **Molex P/N:** 54132-4062 or similar

### Capacitive Touch Panel:

Pin No.	Symbol	External Connection	Function Description
1	V <sub>DD</sub>	Power Supply	Supply voltage for Logic (3.3V)
2	V <sub>SS</sub>	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:** 6pin, 1.0mm pitch, FFC connector. Molex P/N 52271-0679

# Wiring Diagram



## 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 for LCD	V <sub>DD</sub>	-	2.6	2.8	3.3	V
Supply Voltage for Logic	IOV <sub>DD</sub>	-	1.65	1.8	3.3	V
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> = 2.8	3	9	15	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>	-	0.8 * V <sub>DD</sub>	-	V <sub>DD</sub>	V
"L" Level output	V <sub>OL</sub>	-	GND	-	0.2 * V <sub>DD</sub>	V
Backlight Supply Current	I <sub>LED</sub>	-	80	100	125	mA
Backlight Supply Voltage	V <sub>LED</sub>	I <sub>LED</sub> = 100 mA	2.8	3.1	3.4	V
Backlight Lifetime*	-	I <sub>LED</sub> = 100mA T <sub>OP</sub> = 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 <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	3.3	V
Supply Current – Operating	I <sub>DD</sub>	V <sub>DD</sub> = 3.3V	5.75	11.50	23	mA
Supply Current – Sleep	I <sub>DD</sub>	V <sub>DD</sub> = 3.3V	25	50	100	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	-	80	-	°	
	Bottom		-	80	-	°	
	Left		-	80	-	°	
	Right		-	80	-	°	
Contrast Ratio	CR	-	600	800	-	-	
Luminance	L <sub>V</sub>	I <sub>LED</sub> = 100 mA	410	500	-	cd/m <sup>2</sup>	
Response Time	T <sub>R</sub> + T <sub>F</sub>	T <sub>OP</sub> = 25°C	-	30	40	Ms	
Chromaticity	Red	X <sub>R</sub>	-	0.590	0.630	0.670	-
		Y <sub>R</sub>	-	0.296	0.336	0.376	-
	Green	X <sub>G</sub>	-	0.267	0.607	0.347	-
		Y <sub>G</sub>	-	0.563	0.603	0.643	-
	Blue	X <sub>B</sub>	-	0.107	0.147	0.187	-
		Y <sub>B</sub>	-	0.012	0.052	0.092	-
White	X <sub>W</sub>	-	0.249	0.289	0.329	-	
	Y <sub>W</sub>	-	0.270	0.310	0.350	-	

## Capacitive Touch Panel Material Characteristics:

Property	Requirement	Unit
IC	FT5426	-
ITO Glass thickness	0.55	mm
Surface Hardness	≥6	H
Light transmission	85%	-
Operating Humidity	20~90	RH
Storage Humidity	20~90	RH

## Controller Information

### TFT Display:

Built-in ST7789Vi controller.

Please download specification at <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/ST7789V.pdf>

### Capacitive Touch Panel:

Built-in FT5426 controller.

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

Please download app notes at [FT5x26 App Notes](#)

## TFT Table of Commands

Please download specification at <http://www.newhavendisplay.com/appnotes/datasheets/LCDs/ST7789V.pdf>

## 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]	0-5h	0: No touch detected A: 5 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

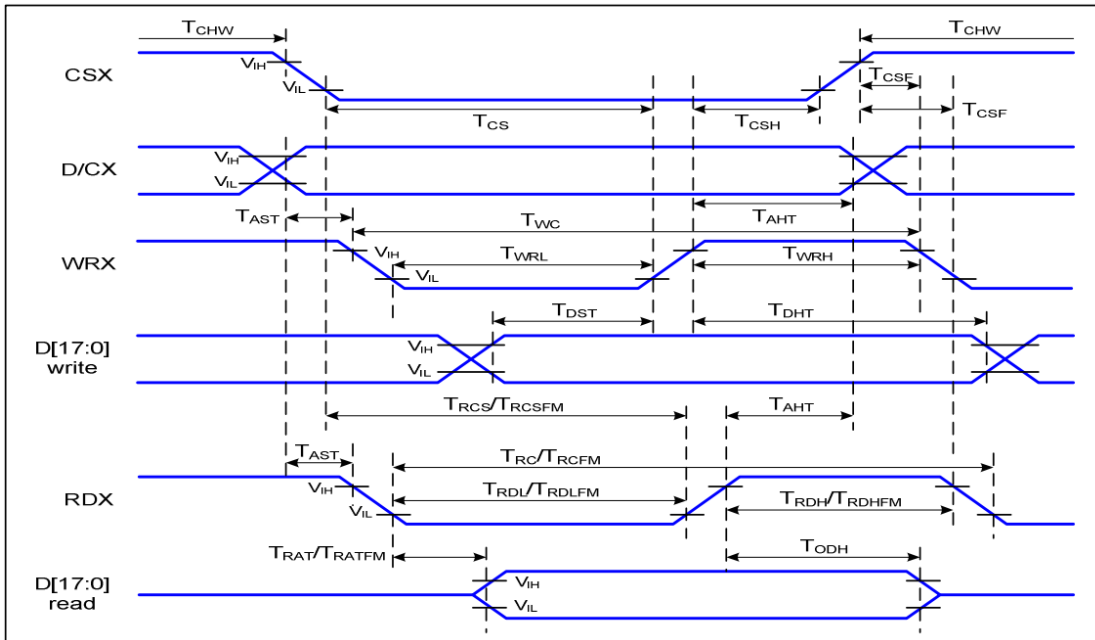


1Bh	RO	TOUCH5_XH	[3:0]	0-1	Upper 4 bits of X touch coordinate
1Ch	RO	TOUCH5_XL	[7:0]	00 - FFh	Lower 8 bits of X touch coordinate
1Dh	RO	TOUCH5_YH	[3:0]	0-1	Upper 4 bits of Y touch coordinate
1Eh	RO	TOUCH5_YL	[7:0]	00 - FFh	Lower 8 bits of Y touch coordinate
1Fh	RO	TOUCH5_Weight	[7:0]		Touch Weight
20h	RO	TOUCH5_Misc	[3:0]	00-0Fh	Touch Area
80h	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: 54h
A4h	RW	ID_G_MODE	[0]	0 1	INT Trigger Mode INT Polling Mode

Register No.	Access	Register Name	Bits	Value	Description
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: 2
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

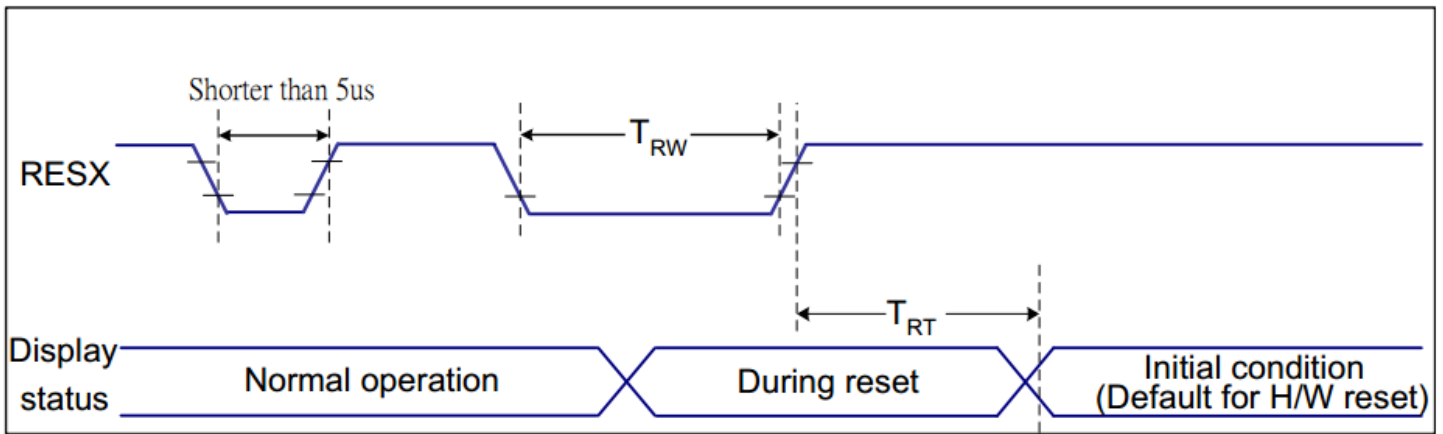
# Timing Characteristics – TFT Display

## Parallel 18/16/9/8-bit Interface Timing Characteristics (8080-II system)



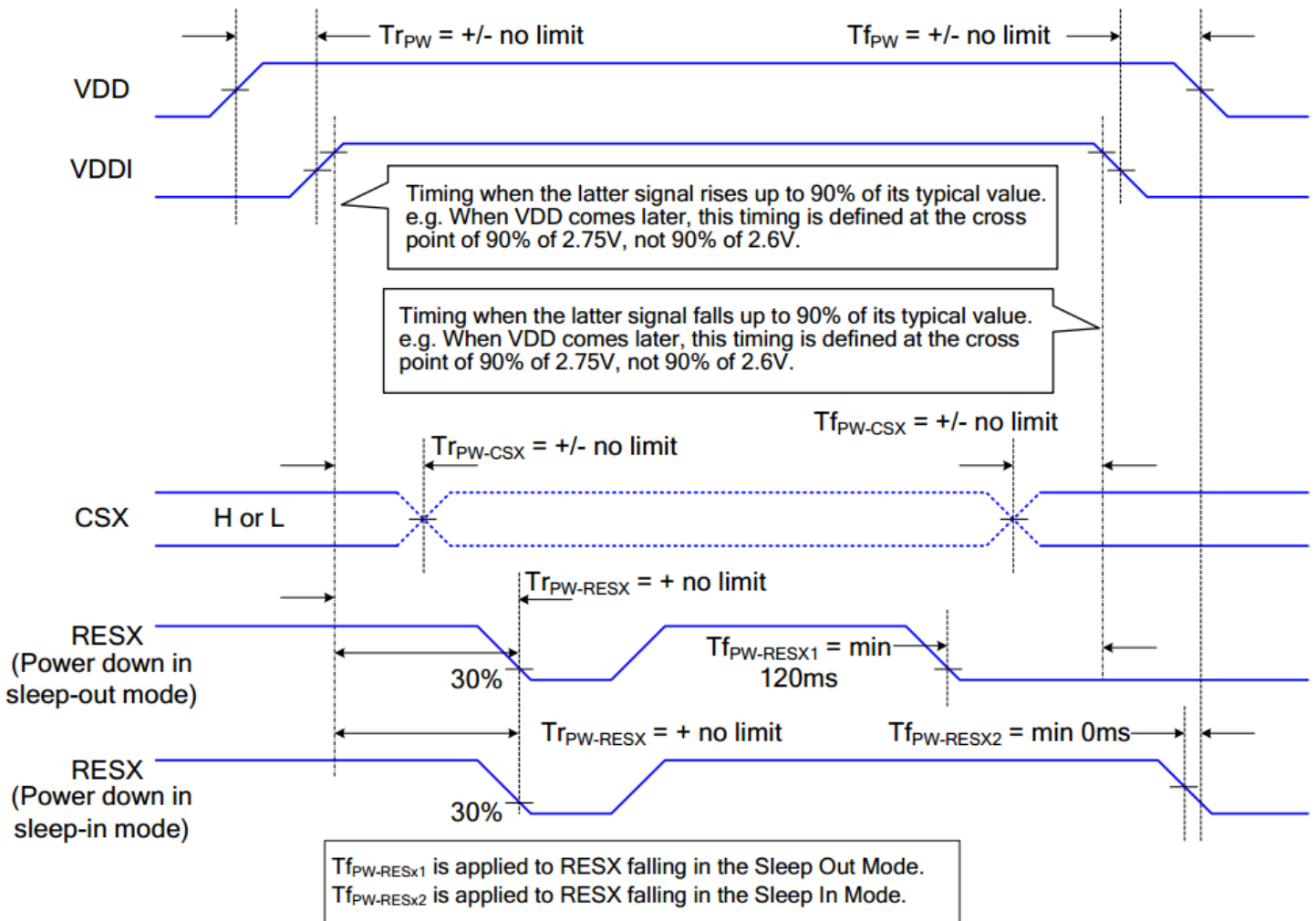
Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	$T_{AST}$	Address setup time	0		ns	-
	$T_{AHT}$	Address hold time (Write/Read)	10		ns	
CSX	$T_{CHW}$	Chip select "H" pulse width	0		ns	-
	$T_{CS}$	Chip select setup time (Write)	15		ns	
	$T_{RCS}$	Chip select setup time (Read ID)	45		ns	
	$T_{RCSFM}$	Chip select setup time (Read FM)	355		ns	
	$T_{CSF}$	Chip select wait time (Write/Read)	10		ns	
	$T_{CSH}$	Chip select hold time	10		ns	
WRX	$T_{WC}$	Write cycle	66		ns	-
	$T_{WRH}$	Control pulse "H" duration	15		ns	
	$T_{WRL}$	Control pulse "L" duration	15		ns	
RDX (ID)	$T_{RC}$	Read cycle (ID)	160		ns	When read ID data
	$T_{RDH}$	Control pulse "H" duration (ID)	90		ns	
	$T_{RDL}$	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	$T_{RCFM}$	Read cycle (FM)	450		ns	When read from frame memory
	$T_{RDHFM}$	Control pulse "H" duration (FM)	90		ns	
	$T_{RDLFM}$	Control pulse "L" duration (FM)	355		ns	
D[17:0]	$T_{DST}$	Data setup time	10		ns	For CL=30pF
	$T_{DHT}$	Data hold time	10		ns	
	$T_{RAT}$	Read access time (ID)		40	ns	
	$T_{RATFM}$	Read access time (FM)		340	ns	
	$T_{ODH}$	Output disable time	20	80	ns	

## Reset Timing



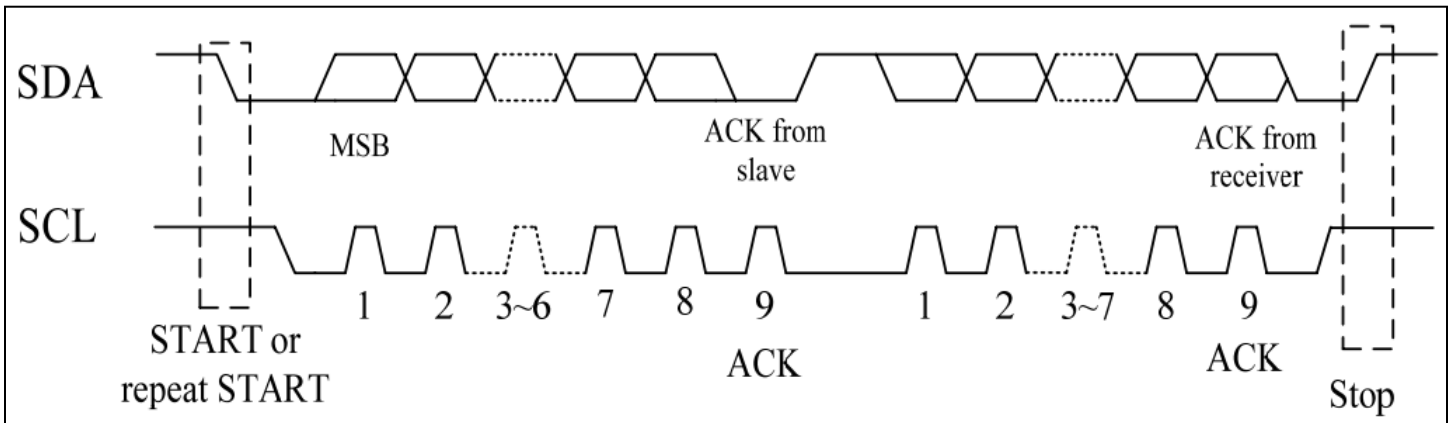
Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

## Power ON/OFF Sequence

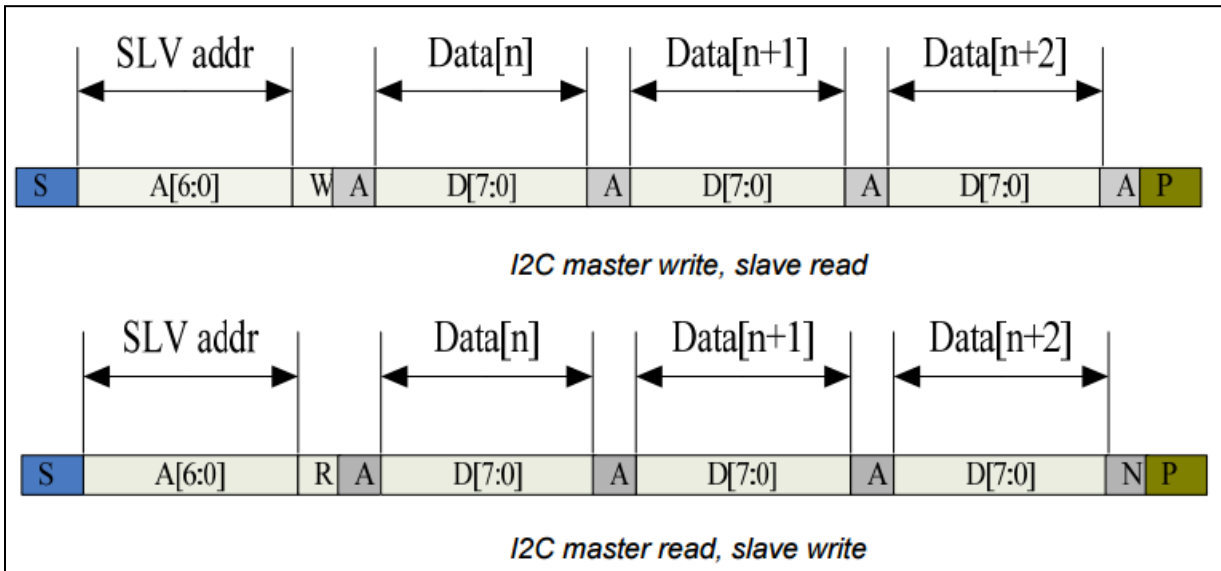


# Timing Characteristics – Capacitive Touch Panel

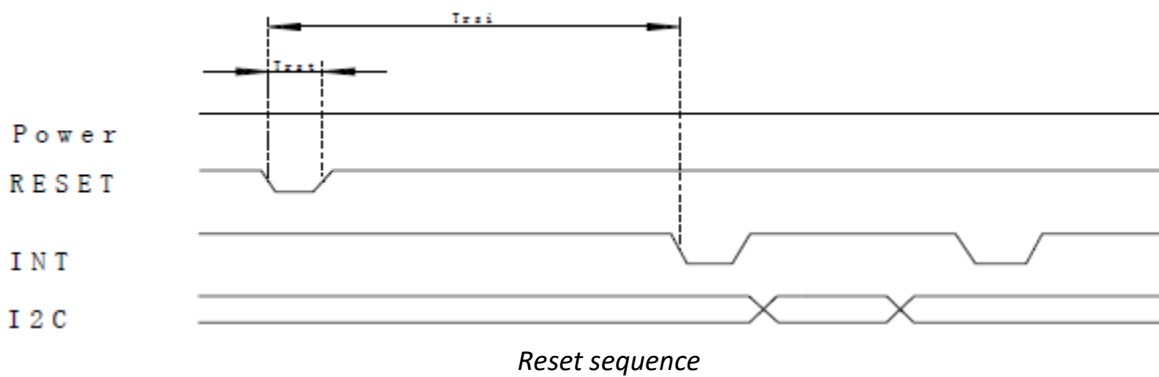
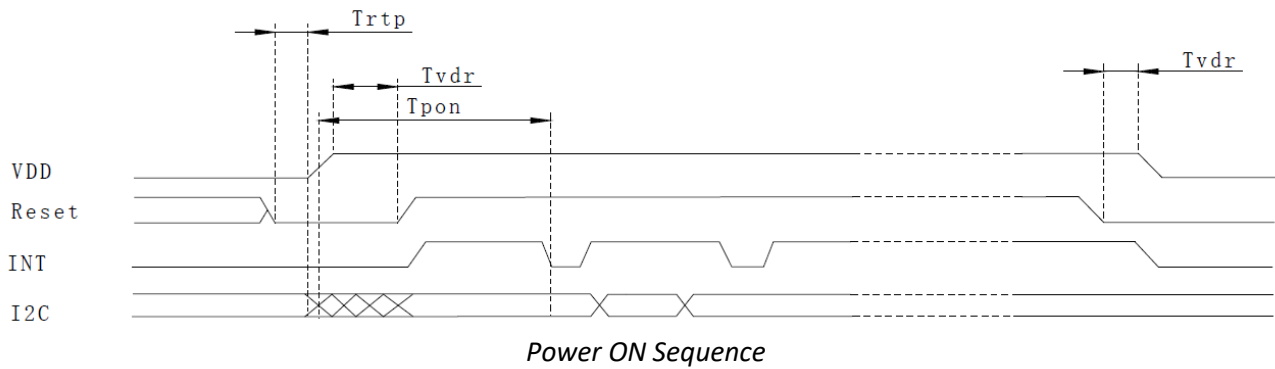
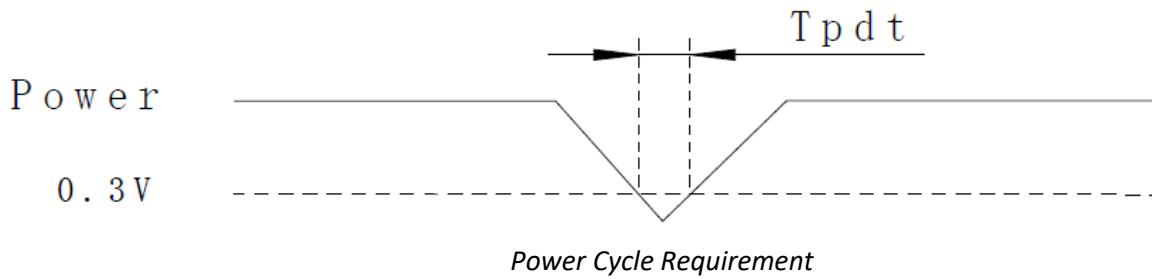
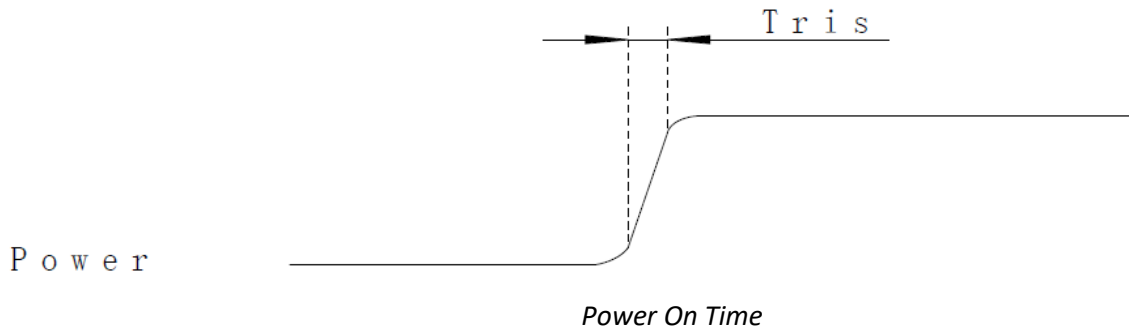
## Data Transfer Format



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

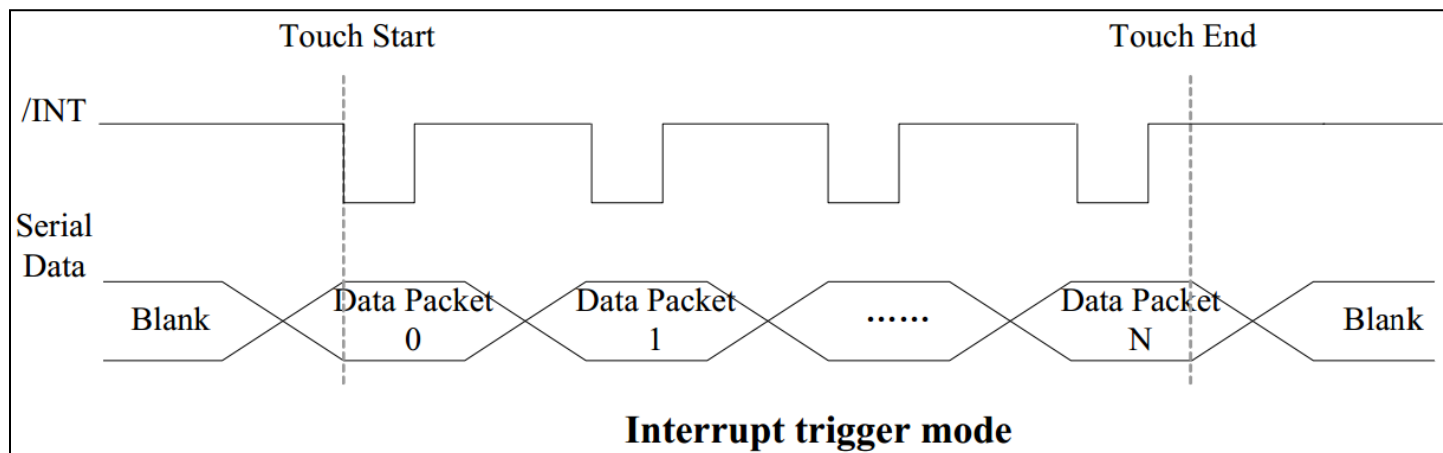


## Power ON/Reset Sequence



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

\*If Reset is tied to V<sub>CC</sub> 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();
```

## Example Initialization Code

```
/*
void TFT_28_7789_Write_Command(unsigned int command)
{
    GPIO_ResetBits(GPIOC, CS1);
    GPIO_ResetBits(GPIOC, RS);
    GPIO_SetBits(GPIOC, nRD);
    GPIO_ResetBits(GPIOC, nWR);
    GPIO_Write(GPIOB, command);
    TFT_delay(10);
    GPIO_SetBits(GPIOC, nWR);
    TFT_delay(1);
}
*/
void TFT_28_7789_Write_Data(unsigned int data1)
{
    GPIO_Write(GPIOB, data1);
    GPIO_SetBits(GPIOC, RS);
    GPIO_ResetBits(GPIOC, nWR);
    TFT_delay(1);
    GPIO_SetBits(GPIOC, nWR);
}
/*
void TFT_28_7789_Init(void)
{
    int n;
    GPIO_ResetBits(GPIOC, CS1);
    GPIO_SetBits(GPIOC, nRD);
    GPIO_ResetBits(GPIOC, nWR);
    GPIO_WriteBit(GPIOC, RES, Bit_RESET);
    TFT_delay(100);
    GPIO_WriteBit(GPIOC, RES, Bit_SET);
    TFT_delay(100);
    TFT_28_7789_Write_Command(0x0011); //exit SLEEP mode
    TFT_delay(100);

    TFT_28_7789_Write_Command(0x0036);
    TFT_28_7789_Write_Data(0x0080); //MADCTL: memory data access control
    TFT_28_7789_Write_Command(0x003A);
    TFT_28_7789_Write_Data(0x0066); //COLMOD: Interface Pixel format
    TFT_28_7789_Write_Command(0x0021); //INVON: Display Inversion ON (setting for IPS)
    TFT_28_7789_Write_Command(0x00B2);
    TFT_28_7789_Write_Data(0x000C);
    TFT_28_7789_Write_Data(0x0C);
    TFT_28_7789_Write_Data(0x00);
    TFT_28_7789_Write_Data(0x33);
    TFT_28_7789_Write_Data(0x33); //PORCTRK: Porch setting
    TFT_28_7789_Write_Command(0x00B7);
    TFT_28_7789_Write_Data(0x0035); //GCTRL: Gate Control
    TFT_28_7789_Write_Command(0x00BB);
    TFT_28_7789_Write_Data(0x002B); //VCOMS: VCOM setting
    TFT_28_7789_Write_Command(0x00C0);
    TFT_28_7789_Write_Data(0x002C); //LCMCTRL: LCM Control
    TFT_28_7789_Write_Command(0x00C2);
    TFT_28_7789_Write_Data(0x0001);
    TFT_28_7789_Write_Data(0xFF); //VDVVRHEN: VDV and VRH Command Enable
    TFT_28_7789_Write_Command(0x00C3);
    TFT_28_7789_Write_Data(0x0011); //VRHS: VRH Set
*/
```

```

TFT_28_7789_Write_Command(0x00C4);
TFT_28_7789_Write_Data(0x0020);//VDVS: VDV Set
TFT_28_7789_Write_Command(0x00C6);
TFT_28_7789_Write_Data(0x000F);//FRCTRL2: Frame Rate control in normal mode
TFT_28_7789_Write_Command(0x00D0);
TFT_28_7789_Write_Data(0x00A4);
TFT_28_7789_Write_Data(0xA1);//PWCTRL1: Power Control 1
TFT_28_7789_Write_Command(0x00E0);
TFT_28_7789_Write_Data(0x00D0);
TFT_28_7789_Write_Data(0x0000);
TFT_28_7789_Write_Data(0x0005);
TFT_28_7789_Write_Data(0x000E);
TFT_28_7789_Write_Data(0x0015);
TFT_28_7789_Write_Data(0x000D);
TFT_28_7789_Write_Data(0x0037);
TFT_28_7789_Write_Data(0x0043);
TFT_28_7789_Write_Data(0x0047);
TFT_28_7789_Write_Data(0x0009);
TFT_28_7789_Write_Data(0x0015);
TFT_28_7789_Write_Data(0x0012);
TFT_28_7789_Write_Data(0x0016);
TFT_28_7789_Write_Data(0x0019);//PVGAMCTRL: Positive Voltage Gamma control
TFT_28_7789_Write_Command(0x00E1);
TFT_28_7789_Write_Data(0x00D0);
TFT_28_7789_Write_Data(0x0000);
TFT_28_7789_Write_Data(0x0005);
TFT_28_7789_Write_Data(0x000D);
TFT_28_7789_Write_Data(0x000C);
TFT_28_7789_Write_Data(0x0006);
TFT_28_7789_Write_Data(0x002D);
TFT_28_7789_Write_Data(0x0044);
TFT_28_7789_Write_Data(0x0040);
TFT_28_7789_Write_Data(0x000E);
TFT_28_7789_Write_Data(0x001C);
TFT_28_7789_Write_Data(0x0018);
TFT_28_7789_Write_Data(0x0016);
TFT_28_7789_Write_Data(0x0019);//NVGAMCTRL: Negative Voltage Gamma control
TFT_28_7789_Write_Command(0x002A);
TFT_28_7789_Write_Data(0x0000);
TFT_28_7789_Write_Data(0x0000);
TFT_28_7789_Write_Data(0x0000);
TFT_28_7789_Write_Data(0x00EF);//X address set
TFT_28_7789_Write_Command(0x002B);
TFT_28_7789_Write_Data(0x0000);
TFT_28_7789_Write_Data(0x0000);
TFT_28_7789_Write_Data(0x0001);
TFT_28_7789_Write_Data(0x003F);//Y address set

TFT_delay(10);
}
/*****/

```



## 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, 240hrs	2
Low Temperature Storage	Endurance test applying the low storage temperature for a long time.	-30°C, 240hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 120hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 120hrs	1,2
High Temperature / Humidity Storage	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+50°C, 90-95% RH, 120hrs	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 -> 25°C 5min = 1 cycle. For 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10Hz-55Hz, 1.5mm amplitude. 2hrs in each of 3 directions X,Y,Z	3
Static electricity test	Endurance test applying electric static discharge.	Air discharge: ±8KV 10 Times Contact discharge: ±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

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

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