

Product Specification

NHD-1.8-128160EF-SSXN-FT

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

NHD-	Newhaven Display
1.8-	1.8" Diagonal Size
128160-	128 x160 Pixels (Portrait Mode)
EF-	Model
S-	Built-in Controller, 3/4-Wire Serial Interface
S-	Sunlight Readable
X-	TFT
N-	TN, 6:00 Optimal View, Wide Temperature
F-	FFC ZIF Connection Style
T-	4-Wire Resistive Touch Panel

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Additional Resources

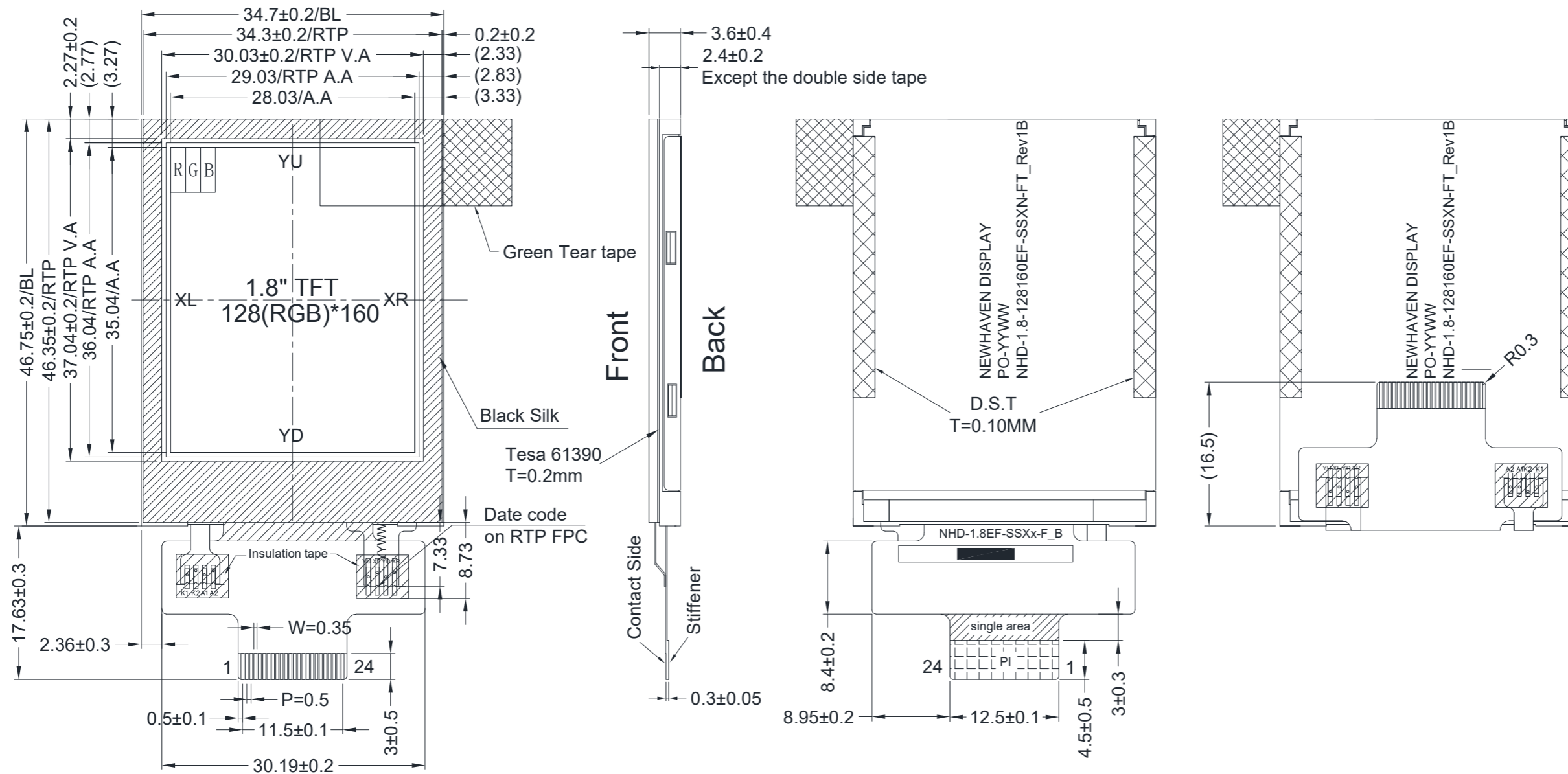
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** https://www.newhavendisplay.com/knowledge_center.html
- **Quality Center:** https://www.newhavendisplay.com/quality_center.html
- **Precautions for using LCDs/LCMs:** <https://www.newhavendisplay.com/specs/precautions.pdf>
- **Warranty / Terms & Conditions:** <https://www.newhavendisplay.com/terms.html>



Document Revision History

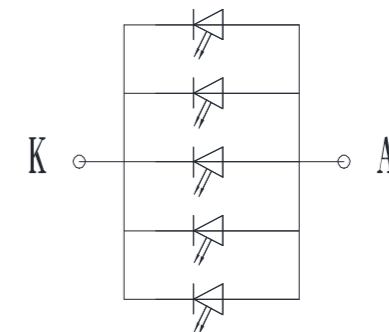
Revision	Date	Description	Changed By
-	08/06/2019	Initial Release	PK
1	10/31/2019	Adjusted Viewing Angles	SB
2	06/26/2020	FPC Redesign: Pin 12 changed from NC to TE. Updated Response Times, Chromaticity Values & Touch Panel Characteristics P/N Upgraded to Rev1B	AS
3	01/13/2021	Updated 2D Mechanical Drawing & Quality Information	AS
4	03/09/2021	2D Mechanical Drawing Redesign	AS
5	08/07/2023	Timing Characteristics, Wiring Diagram and Table of Commands Updated	KL
6	09/05/2023	V _{DD} /IOV _{DD} Supply Voltage Updated from 2.8V to 3.0V (Typ.) Mechanical Drawing Updated	KL
7	10/13/2023	Date Code Format Updated on Mechanical Drawing	KL

Mechanical Drawing



TFT Pinout:

Pin No.	Symbol
1	GND
2	IOVDD
3	VDD
4	/CS
5	/RST
6	SDIO
7	GND
8	D/C
9	SCL
10	GND
11	SPI4W
12	TE
13	NC
14	NC
15	NC
16	NC
17	LED-A
18	LED-K1
19	LED-K2
20	GND
21	YU
22	XL
23	YD
24	XR



Product Description: 1.8" 128x160 Sunlight Readable TFT w/ Resistive Touch

1. Driver IC: ILI9163V
2. Interface: 3/4-wire SPI
3. Power Requirement: 3.0V TFT, 3.2V/100mA Backlight
4. Optical Features: Normally White, Transmissive, Anti-Glare, 850cd/m²
5. Recommended FFC Connector: 24pin 0.5mm pitch; Ex. Molex 52435-2471

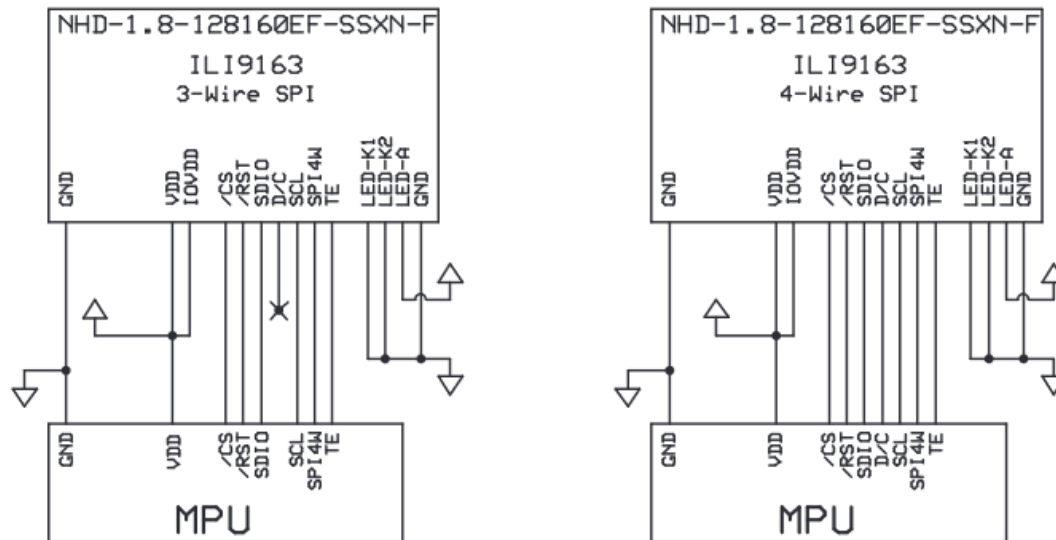
Standard Tolerance: (Unless otherwise specified) Linear: ±0.3mm		
	Drawing/Part Number: NHD-1.8-128160EF-SSXN-FT	Revision: 1B
Unless otherwise specified: • Dimensions are in Millimeters • Third Angle Projection	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 10/13/2023	Approved Date: 10/13/2023
This drawing is solely the property of Newhaven Display International, Inc. The information it contains is not to be disclosed, reproduced or copied in whole or part without written approval from Newhaven Display.		

Pin Description

Pin No.	Symbol	External Connection	Function Description
1	GND	Power Supply	Ground
2	IOV _{DD}	Power Supply	Supply Voltage for Logic (3.0V) – Can be tied to V _{DD}
3	V _{DD}	Power Supply	Supply Voltage for LCD (3.0V)
4	/CS	MPU	Active LOW Chip Select signal
5	/RST	MPU	Active LOW Reset signal
6	SDIO	MPU	Serial Data Input & Output signal
7	GND	Power Supply	Ground
8	D/C	MPU	Data / Command selection 4-wire Serial: '1' = Data; '0' = Command 3-wire Serial: Ground
9	SCL	MPU	Serial Clock signal
10	GND	Power Supply	Ground
11	SPI4W	MPU	SPI4W: '1' = 4-wire SPI; '0' = 3-wire SPI (default)
12	TE	MPU	Tearing Effect output pin to synchronize MCU to frame writing. If not used, leave this pin floating (No Connect)
13-16	NC	-	No Connect
17	LED-A	Power Supply	Backlight Anode (100mA @ 3.2V)
18	LED-K1	Power Supply	Backlight Cathode
19	LED-K2	Power Supply	Backlight Cathode
20	GND	Power Supply	Ground
21	YU	Touch Controller	Touch Panel – Up
22	XL	Touch Controller	Touch Panel – Left
23	YD	Touch Controller	Touch Panel – Down
24	XR	Touch Controller	Touch Panel – Right

Recommended LCD connector: 24pin 0.5mm FFC connector. Molex P/N: 52435-2471

Wiring Diagram



Interface Selection

MPU Interface Pin Assignment Summary

	Pin 4 (/CS)	Pin 6 (SDIO)	Pin 8 (D/C)	Pin 9 (SCL)	Pin 11 (SPI4W)
3-wire SPI (default)	Chip Select	Serial Data I/O	Tie LOW	Serial Clock	0
4-wire SPI	Chip Select	Serial Data I/O	Data/Command	Serial Clock	1

Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T _{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T _{ST}	Absolute Max	-30	-	+80	°C
Supply voltage for LCD	V _{DD}	-	2.5	3.0	3.3	V
Supply voltage for Logic	IOV _{DD}	-	1.65	3.0	3.3	V
Supply Current	I _{DD}	V _{DD} = 3.0V	1	3	5	mA
"H" Level input	V _{IH}	-	0.7*IOV _{DD}	-	IOV _{DD}	V
"L" Level input	V _{IL}	-	GND	-	0.3*IOV _{DD}	V
"H" Level output	V _{OH}	-	0.8*IOV _{DD}	-	IOV _{DD}	V
"L" Level output	V _{OL}	-	GND	-	0.2*IOV _{DD}	V
Backlight Supply Current	I _{LED}	-	75	100	125	mA
Backlight Supply Voltage	V _{LED}	I _{LED} = 100mA T _{OP} = 25°C	2.8	3.2	3.4	V
Backlight Lifetime*	-		20,000	30,000	-	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.

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Optimal Viewing Angles	Top	CR ≥ 10	-	60	-	°	
	Bottom		-	40	-	°	
	Left		-	60	-	°	
	Right		-	60	-	°	
Contrast Ratio	CR	-	400	500	-	-	
Luminance	L _V	I _{LED} =100mA	680	850	-	cd/m ²	
Response Time	Rise + Fall	T _R +T _F	T _{OP} = 25°C	-	8	16	ms
Chromaticity	Red	X _R	-	0.553	0.603	0.653	
		Y _R		0.322	0.372	0.422	
	Green	X _G		0.268	0.318	0.368	
		Y _G		0.544	0.594	0.644	
	Blue	X _B		0.089	0.139	0.189	
		Y _B		0.054	0.104	0.154	
	White	X _W		0.255	0.305	0.355	
		Y _W		0.300	0.350	0.400	

Touch Panel Characteristics

Item	Min.	Typ.	Max.	Unit
Linearity	-1.5	-	1.5	%
Circuit Resistance – X-Axis	150	-	550	Ω
Circuit Resistance – Y-Axis	250	-	800	Ω
Insulation Resistance	20	-	-	MΩ
Operating Voltage	-	-	5	V
Chattering	-	-	15	ms
Activation Force	20	-	80	g
Pen Writing Durability	20,000	-	-	Characters
Pitting Durability	1,000,000	-	-	Touches
Surface Hardness	3	-	-	H

Controller Information

Built-in ILI9163V Controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414575853079--ILI9163V>

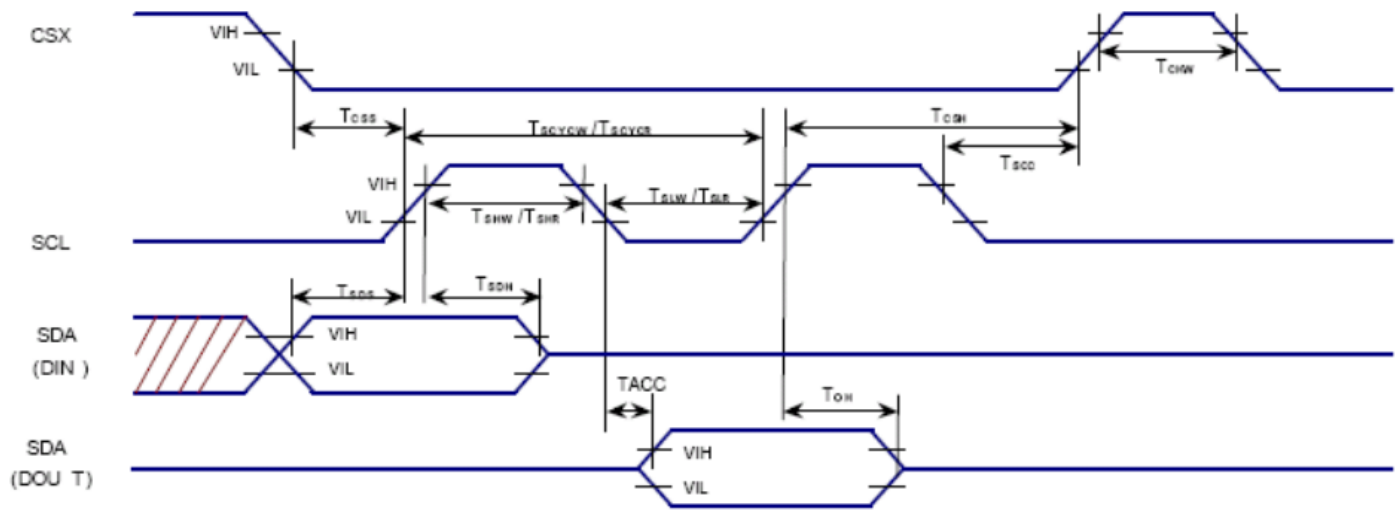
Table of commands

For Command Table and Descriptions, please see:

https://support.newhavendisplay.com/hc/en-us/article_attachments/4414532035607/ILI9163V.pdf

Timing Characteristics

3-wire Serial Interface:



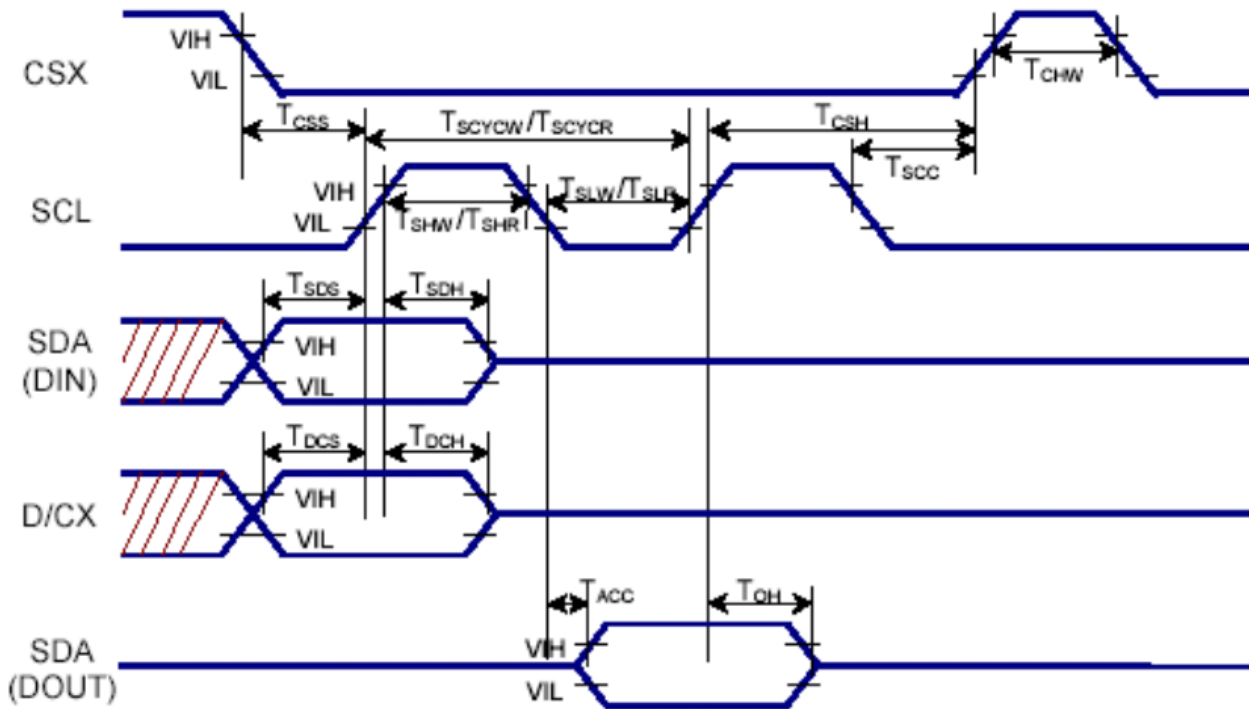
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip select setup time	10		ns	
	TCSH	Chip select hold time	30		ns	
	TCHW	Chip select "H" pulse width	30		ns	
SCL	TSCYCW	Serial clock cycle(Write)	66		ns	
	TSHW	S'L' to 'H' pulse width(Write)	15		ns	
	TSLW	S'L' to 'L' pulse width(Write)	15		ns	
	TSCYCR	Serial clock cycle(Read)	150		ns	
	TSHR	S'L' to 'H' pulse width(Read)	60		ns	
	TSLR	S'L' to 'L' pulse width(Read)	60		ns	
SDA(DIN) (DOU T)	TSDS	Data setup time	5		ns	
	TSDH	Data hold time	5		ns	
	TACC	Access time	5	50	ns	For maximum CL = 30pF
	TOH	Output disable time	10		ns	For minimum CL = 8pF

Note 1: VDDI=1.65 to 3.3V, VCI=2.6 to 3.3V, AGND=GND=0V. Ta=-30 to 70°C (to +85°C no damage)

Note 2: The input signal rise time and fall time(tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 10% and 90% of VDDI for Input signals.

4-wire Serial Interface:



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T _{css}	Chip select setup time	10		ns	
	T _{sch}	Chip select hold time	30		ns	
	T _{chw}	Chip select "H" pulse width	30		ns	
SCL	T _{scycw}	Serial clock cycle(Write)	66		ns	
	T _{shw}	S"L""H" pulse width(Write)	15		ns	
	T _{slw}	S"L""L" pulse width(Write)	15		ns	
	T _{scycr}	Serial clock cycle(Read)	150		ns	
	T _{shr}	S"L""H" pulse width(Read)	60		ns	
	T _{slr}	S"L""L" pulse width(Read)	60		ns	
D/CX	T _{dcs}	D/CX setup time	5		ns	
	T _{dch}	D/CX hold time	5		ns	
SDA(DIN) (DOUT)	T _{sdh}	Data hold time	5		ns	
	T _{sdcs}	Data setup time	5		ns	
	T _{acc}	Access time	5	50	ns	For maximum CL = 30pF
	T _{oh}	Output disable time	10		ns	For minimum CL = 8pF

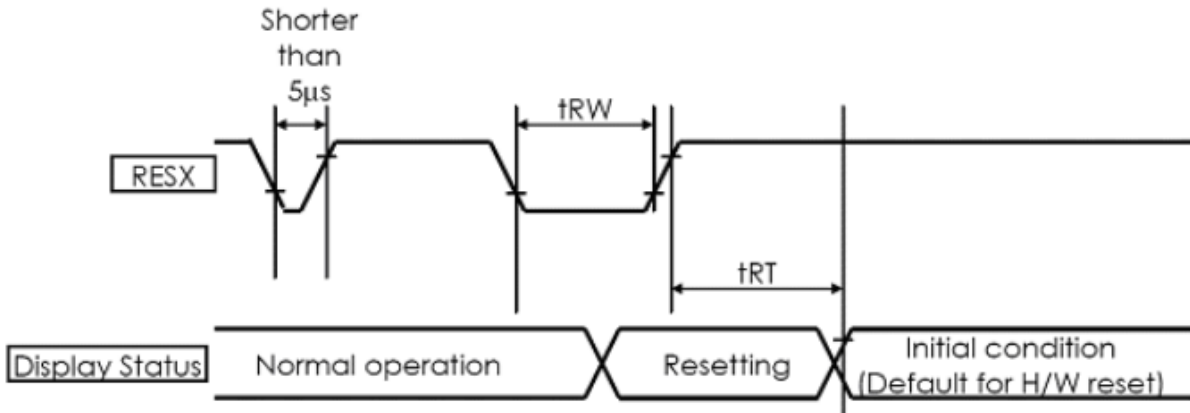
Note 1: VDDI=1.65 to 3.3V, VCI=2.6 to 3.3V, AGND=GND=0V. Ta=-30 to 70°C (to +85°C no damage)

Note 2 : The input signal rise time and fall time(tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 10% and 90% of VDDI for Input signals.



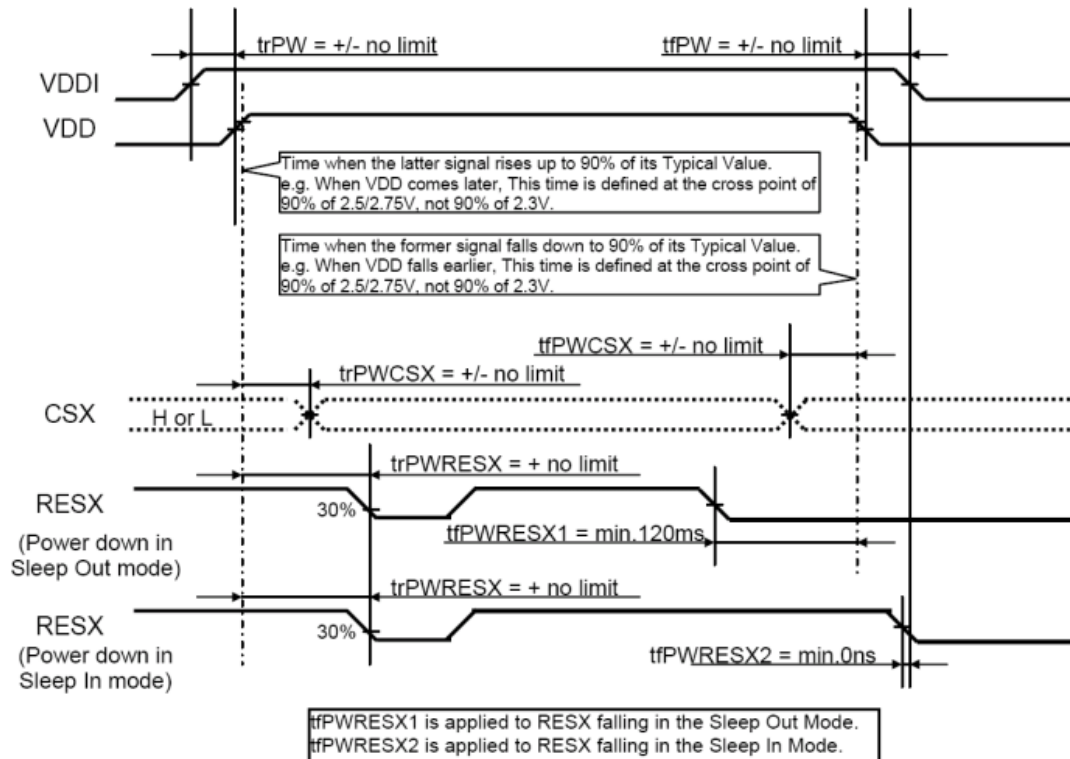
Reset Timing



(VSS=0V, VDDI=1.65V to 1.95V, VCI=2.6V to 2.9V, Ta = -30 to 70°C)

Symbol	Parameter	Related Pins	MIN	TYP	MAX	Note	Unit
tRESW	*1) Reset low pulse width	RESX	10	-	-	-	µs
tREST	*2) Reset complete width	-	-	-	5	When reset applied during Sleep in mode	ms
		-	-	-	120	When reset applied during Sleep out mode	ms

Power ON/OFF Sequence



Note: Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

Example Program Code

```

*****/
*      Initialization and Setup Routine for 3-Line & 4-Line      *
*****/

void setup()
{
  DDRB = 0xFF;           //Enable All outputs on PortB
  PORTB = 0x00;
  DDRD = 0xFF;           //Enable All outputs on PortD
  PORTD = 0x00;
  DDRD |= (1<<DDD6);     //SDIO = 1
  DDRD |= (1<<DDD7);     //SCL = 1
  digitalWrite(RST, LOW);
  delay(150);
  digitalWrite(RST, HIGH);
  delay(150);
  command(0x11);         //exit SLEEP mode
  delay(100);
  command(0x28);         //display off
  command(0x26);         //select gamma curve
  data(0x04);

  command(0xB1);         //frame rate control
  data(0x0A);
  data(0x14);

  command(0xC0);         //power control 1
  data(0x0A);
  data(0x00);

  command(0xC1);         //power control 2
  data(0x02);

  command(0xC5);         //VCOM control 1
  data(0x2F);
  data(0x3E);

  command(0xC7);         //VCOM control 2
  data(0x40);

  command(0x2A);         //column address set
  data(0x00);

  data(0x00);           //start 0x0000
  data(0x00);

  data(0x7F);           //end 0x007F
  command(0x2B);         //page address set
  data(0x00);
  data(0x00);           //start 0x0000
  data(0x00);
  data(0x9F);           //end 0x009F

  command(0x36);         //memory access control
  data(0xC0);           //C0 = RGB; C8 = BGR
  command(0x3A);         //pixel format = 18 bit per pixel
  data(0x06);

  command(0x29);         //display ON
  delay(10);
}

```



3-line Serial Interface

```

/*****
*           Functions           *
*****/

```

```

void command(unsigned char c) //9-bit Transmission
{
  digitalWrite(CS, LOW);          ///CS = 0
  PORTD &= ~(1<<PORTD6);         //SDIO = 0 (Set D/C bit LOW for Command)
  PORTD &= ~(1<<PORTD7);         //SCL = 0
  PORTD |= (1<<PORTD7);          //SCL = 1
  PORTD &= ~(1<<PORTD7);         //SCL = 0
  for (int i=0;i<8;i++)
  {
    if((c & 0x80)== 0x80)        //Send MSB
      PORTD |= (1<<PORTD6);      //SDIO = 1
    else
      PORTD &= ~(1<<PORTD6);     //SDIO = 0
    c = (c<<1);
    PORTD &= ~(1<<PORTD7);       //SCL = 0
    PORTD |= (1<<PORTD7);        //SCL = 1
    PORTD &= ~(1<<PORTD7);       //SCL = 0
  }
  digitalWrite(CS, HIGH);        ///CS = 1
}

```

```

void data(unsigned char d) //9-bit Transmission
{
  digitalWrite(CS, LOW);          ///CS = 0
  PORTD |= (1<<PORTD6);           //SDIO = 1 (Set D/C bit HIGH for Data)
  PORTD &= ~(1<<PORTD7);         //SCL = 0
  PORTD |= (1<<PORTD7);          //SCL = 1
  PORTD &= ~(1<<PORTD7);         //SCL = 0
  for (int i=0;i<8;i++)
  {
    if((d & 0x80)== 0x80)        //Send MSB
      PORTD |= (1<<PORTD6);      //SDIO = 1
    else
      PORTD &= ~(1<<PORTD6);     //SDIO = 0
    d = (d<<1);
    PORTD &= ~(1<<PORTD7);       //SCL = 0
    PORTD |= (1<<PORTD7);        //SCL = 1
    PORTD &= ~(1<<PORTD7);       //SCL = 0
  }
  digitalWrite(CS, HIGH);        ///CS = 1
}

```

4-line Serial Interface

```

/*****
*          Functions          *
*****/

```

```

void command(unsigned char c) //8-bit Transmission
{
  digitalWrite(CS, LOW);          //CS = 0
  digitalWrite(DC, LOW);         //D/C = 0
  for (int i=0;i<8;i++)
  {
    if((c & 0x80)== 0x80)         //Send MSB
      PORTD |= (1<<PORTD6);      //SDIO = 1
    else
      PORTD &= ~(1<<PORTD6);     //SDIO = 0
    c = (c<<1);
    PORTD &= ~(1<<PORTD7);       //SCL = 0
    PORTD |= (1<<PORTD7);        //SCL = 1
    PORTD &= ~(1<<PORTD7);       //SCL = 0
  }
  digitalWrite(CS, HIGH);        //CS = 1
}

```

```

void data(unsigned char d) //8-bit Transmission
{
  digitalWrite(CS, LOW);          //CS = 0
  digitalWrite(DC, HIGH);         //D/C = 1
  for (int i=0;i<8;i++)
  {
    if((d & 0x80)== 0x80)         //Send MSB
      PORTD |= (1<<PORTD6);      //SDIO = 1
    else
      PORTD &= ~(1<<PORTD6);     //SDIO = 0
    d = (d<<1);
    PORTD &= ~(1<<PORTD7);       //SCL = 0
    PORTD |= (1<<PORTD7);        //SCL = 1
    PORTD &= ~(1<<PORTD7);       //SCL = 0
  }
  digitalWrite(CS, HIGH);        //CS = 1
}

```

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 Storage	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, 20 cycles.	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-50Hz , 1.5G 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.