

Product Specification

NHD-2.8-240320DA-CTXN-T

TFT Liquid Crystal Display Module

NHD-	Newhaven Display
2.8-	2.8" Diagonal
240320-	240 x 320 Pixels
DA-	Model
C-	Built-in Controller
T-	White LED Backlight
X-	TFT
N-	TN, 6:00 Optimal View, Wide Temperature
T-	4-Wire Resistive Touch Panel

Table of Contents

Document Revision History.....	2
Mechanical Drawing	3
Pin Description	4
Driver/Controller Information	4
MCU Interface Mode Selection	5
RGB Interface Mode Selection	6
Electrical Characteristics	7
Optical Characteristics	7
Touch Panel Characteristics	7
Timing Characteristics for TFT	8
Example Initialization Code.....	14
Quality Information.....	16

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>

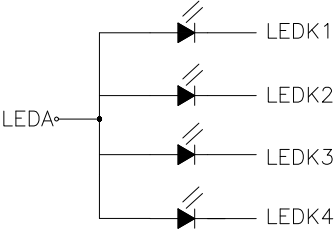


Document Revision History

Revision	Date	Description	Changed By
-	02/04/2025	Initial Release	KL

[illegible]

Pin No.	Symbol
1	LED-A
2	LED-K1
3	LED-K2
4	LED-K3
5	LED-K4
6	IM0
7	IM1
8	IM2
9	IM3
10	TE
11	VSYNC
12	HSYNC
13	DOTCLK
14	DE
15-32	DB17-DB0
33	CSX
34	WRX (D/CX)
35	D/CX (SCL)
36	RDX
37	RESX
38	SDO
39	SDI/SDA
40	VDD
41	GND
42	YD
43	XR
44	YU
45	XL



LED CIRCUIT DIAGRAM

Standard Tolerance: (Unless otherwise specified) Linear: $\pm 0.3\text{mm}$	 NEWHAVEN DISPLAY INTERNATIONAL	
	Drawing/Part Number: NHD-2.8-240320DA-CTXN-T	Revision: 1A
Unless otherwise specified: • Dimensions are in Millimeters • Third Angle Projection 	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 02/04/2025	Approved Date: 02/04/2025
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	LED-A	Power Supply	Backlight Anode (3.0V/80mA)
2	LED-K1	Power Supply	Backlight Cathode (Ground)
3	LED-K2	Power Supply	Backlight Cathode (Ground)
4	LED-K3	Power Supply	Backlight Cathode (Ground)
5	LED-K4	Power Supply	Backlight Cathode (Ground)
6	IM0	MPU	Interface Mode select
7	IM1	MPU	Interface Mode select
8	IM2	MPU	Interface mode select
9	IM3	MPU	Interface mode select
10	TE	MPU	Tearing Effect output signal to synchronize MPU to frame
11	VSYNC	MPU	Vertical (Frame) sync signal for RGB interface
12	HSYNC	MPU	Horizontal (Line) sync signal for RGB interface
13	DOTCLK	MPU	Dot Clock signal for RGB interface (Rising Edge)
14	DE	MPU	Data Enable signal for RGB interface
15-32	DB17-DB0	MPU	Bi-directional data bus
33	CSX	MPU	Active LOW Chip Select signal
34	WRX (D/CX)	MPU	Parallel Interface: Active LOW write signal Serial Interface: Data/command selection: 1 = Data; 0 = Command
35	D/CX (SCL)	MPU	Parallel Interface: Data/command selection: 1 = Data; 0 = Command Serial Interface: Serial Clock signal
36	RDX	MPU	Active LOW Read signal
37	RESX	MPU	Active LOW Reset signal
38	SDO	MPU	Serial Data out
39	SDI/SDA	MPU	Serial Data in
40	VDD	Power Supply	Supply Voltage for LCD (3.0V)
41	GND	Power Supply	Ground
42	YD	Touch Controller	Touch Panel- RIGHT
43	XR	Touch Controller	Touch Panel- DOWN
44	YU	Touch Controller	Touch Panel- LEFT
45	XL	Touch Controller	Touch Panel- UP

Recommended LCD connector: 45-pin, 0.5mm pitch FFC connector

Molex P/N: 0512964594 or similar

Driver/Controller Information

Built-in ILI9341V Controller: <https://support.newhavendisplay.com/hc/en-us/articles/26623027048343-ILI9341V>



MCU Interface Mode Selection

Pin Name	Interface Mode I						Interface Mode II					
	8080 8-bit	8080 16-bit	8080 9-bit	8080 18-bit	3-wire SPI	4-wire SPI	8080 8-bit	8080 16-bit	8080 9-bit	8080 18-bit	3-wire SPI	4-wire SPI
IM0	0	1	0	1	1	0	1	0	1	0	1	0
IM1	0	0	1	1	0	1	0	0	1	1	0	1
IM2	0	0	0	0	1	1	0	0	0	0	1	1
IM3	0	0	0	0	0	0	1	1	1	1	1	1

MPU Interface Pin Assignment Summary

Bus Interface	Data/Command Interface																Control Signals							
	D 17	D 16	D 15	D 14	D 13	D 12	D 11	D 10	D 9	D 8	D 7	D 6	D 5	D 4	D 3	D 2	D 1	D 0	/WRX	/RDX	/CSX	D/CX	SDO	SDI/SDA
Interface Mode I																								
8080 8-bit	Tie LOW										D [7:0]						/WRX	/RDX	/CSX	D/CX	NC	LOW		
8080 16-bit	Tie LOW		D [15:0]												/WRX	/RDX	/CSX	D/CX	NC	LOW				
8080 9-bit	Tie LOW										D [8:0]						/WRX	/RDX	/CSX	D/CX	NC	LOW		
8080 18-bit	D [17:0]																/WRX	/RDX	/CSX	D/CX	NC	LOW		
3-wire SPI	Tie LOW																HIGH	HIGH	/CSX	SCL	NC	SDA		
4-wire SPI	Tie LOW																D/CX	HIGH	/CSX	SCL	NC	SDA		
Interface Mode II																								
8080 8-bit	D [17:10]								Tie LOW						/WRX	/RDX	/CSX	D/CX	NC	LOW				
8080 16-bit	D [17:10]								D [8:1]				LOW		/WRX	/RDX	/CSX	D/CX	NC	LOW				
8080 9-bit	D [17:9]										Tie LOW						/WRX	/RDX	/CSX	D/CX	NC	LOW		
8080 18-bit	D [17:0]																/WRX	/RDX	/CSX	D/CX	NC	LOW		
3-wire SPI	Tie LOW																HIGH	HIGH	/CSX	SCL	SDO	SDI		
4-wire SPI	Tie LOW																D/CX	HIGH	/CSX	SCL	SDO	SDI		

RGB Interface Mode Selection

The Ilitek ILI9341V driver IC is user configurable for DE Mode and SYNC mode RGB interface.

DE Mode is enabled when the RCM [1:0] bits of B0h command are set to “10”, and DE signal is high for valid pixel data. Data is clocked in using rising edge of DOTCLK signal. DE mode is recommended to enable the ILI9341V driver IC to synchronize the display image on TFT panel without depending on specific horizontal and vertical sync timing from host controller.

SYNC mode is enabled when the RCM [1:0] bits of B0h command are set to “11”, DE signal is ignored, and HSYNC and VSYNC signals are used to explicitly define the horizontal and vertical sync timing to synchronize the display image on TFT panel. Data is clocked in using rising edge of DOTCLK signal. Any change to the HSYNC or VSYNC values may prevent the image from correctly appearing on the display.

ILI9341V supports several pixel formats that can be selected by DPI [2:0] bits of “Pixel Format Set (3Ah)” and RIM bit of F6h command.

RCM[1:0]		RIM	DPI[2:0]			RGB Interface Mode	RGB Mode	Used Pins
1	0	0	1	1	0	18-bit RGB interface (262K colors)	DE Mode Valid data is determined by the DE signal	VSYNC, HSYNC, DE, DOTCLK, D[17:0]
1	0	0	1	0	1	16-bit RGB interface (65K colors)		VSYNC, HSYNC, DE, DOTCLK, D[17:13] & D[11:1]
1	0	1	1	1	0	6-bit RGB interface (262K colors)		VSYNC, HSYNC, DE, DOTCLK, D[5:0]
1	0	1	1	0	1	6-bit RGB interface (65K colors)		VSYNC, HSYNC, DE, DOTCLK, D[5:0]
1	1	0	1	1	0	18-bit RGB interface (262K colors)	SYNC Mode In SYNC mode, DE signal is ignored; blanking porch is determined by B5h command.	VSYNC, HSYNC, DOTCLK, D[17:0]
1	1	0	1	0	1	16-bit RGB interface (65K colors)		VSYNC, HSYNC, DOTCLK, D[17:13] & D[11:1]
1	1	1	1	1	0	6-bit RGB interface (262K colors)		VSYNC, HSYNC, DOTCLK, D[5:0]
1	1	1	1	0	1	6-bit RGB interface (65K colors)		VSYNC, HSYNC, DOTCLK, D[5:0]

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 Current	I _{DD}	V _{DD} = 3.0V	5	10	15	mA
"H" Level input	V _{IH}	-	0.7 * V _{DD}	-	V _{DD}	V
"L" Level input	V _{IL}	-	V _{SS}	-	0.3 * V _{DD}	V
"H" Level output	V _{OH}	-	0.8 * V _{DD}	-	V _{DDI}	V
"L" Level output	V _{OL}	-	V _{SS}	-	0.2 * V _{DD}	V
Backlight Supply Current	I _{LED}	-	40	80	100	mA
Backlight Supply Voltage	V _{LED}	I _{LED} = 80mA	2.7	3.0	3.4	V
Backlight Lifetime*	-	I _{LED} = 80mA T _{OP} = 25°C	30,000	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.

Optical Characteristics

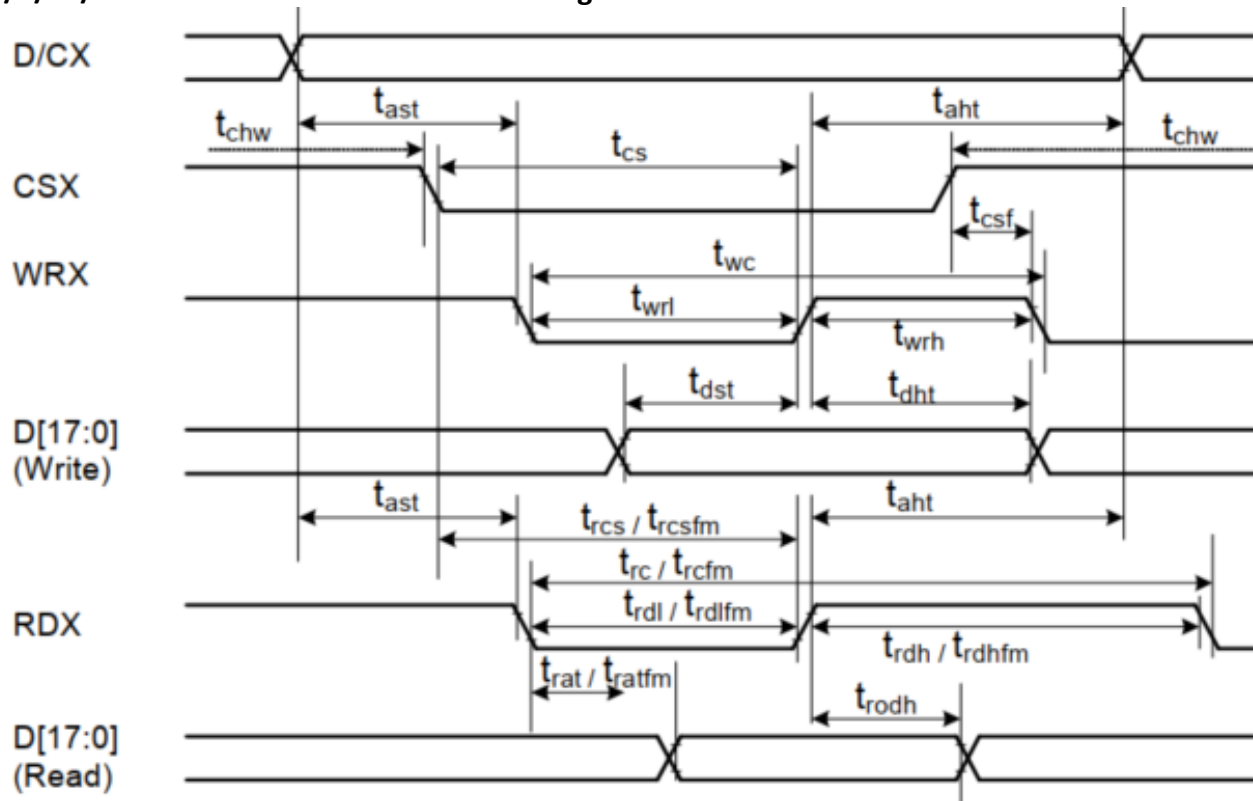
Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 10	-	20	-	°
	Bottom	φY-		-	50	-	°
	Left	θX-		-	45	-	°
	Right	θX+		-	45	-	°
Contrast Ratio		CR	-	-	500	-	-
Luminance		L _V	I _{LED} = 80mA	270	336	-	cd/m ²
Response Time		T _R + T _F	T _{OP} = 25°C	-	16	45	ms
Chromaticity	Red	X _R	-	0.542	0.592	0.642	-
		Y _R	-	0.306	0.356	0.406	-
	Green	X _G	-	0.278	0.328	0.378	-
		Y _G	-	0.574	0.624	0.674	-
	Blue	X _B	-	0.104	0.154	0.204	-
		Y _B	-	0.059	0.109	0.159	-
	White	X _W	-	0.232	0.282	0.332	-
		Y _W	-	0.262	0.312	0.359	-

Touch Panel Characteristics

Item	Min.	Typ.	Max.	Unit
Linearity	-	-	1.5	%
Circuit Resistance – X-Axis	200	-	600	Ω
Circuit Resistance – Y-Axis	250	-	900	Ω
Insulation Resistance	20	-	-	MΩ
Operating Voltage	-	-	5	V
Response Time	-	-	15	ms
Transmittance	80	-	-	%
Activation Force	30	-	-	g
Pitting Durability	1,000,000	-	-	Touches
Surface Hardness	3	-	-	H

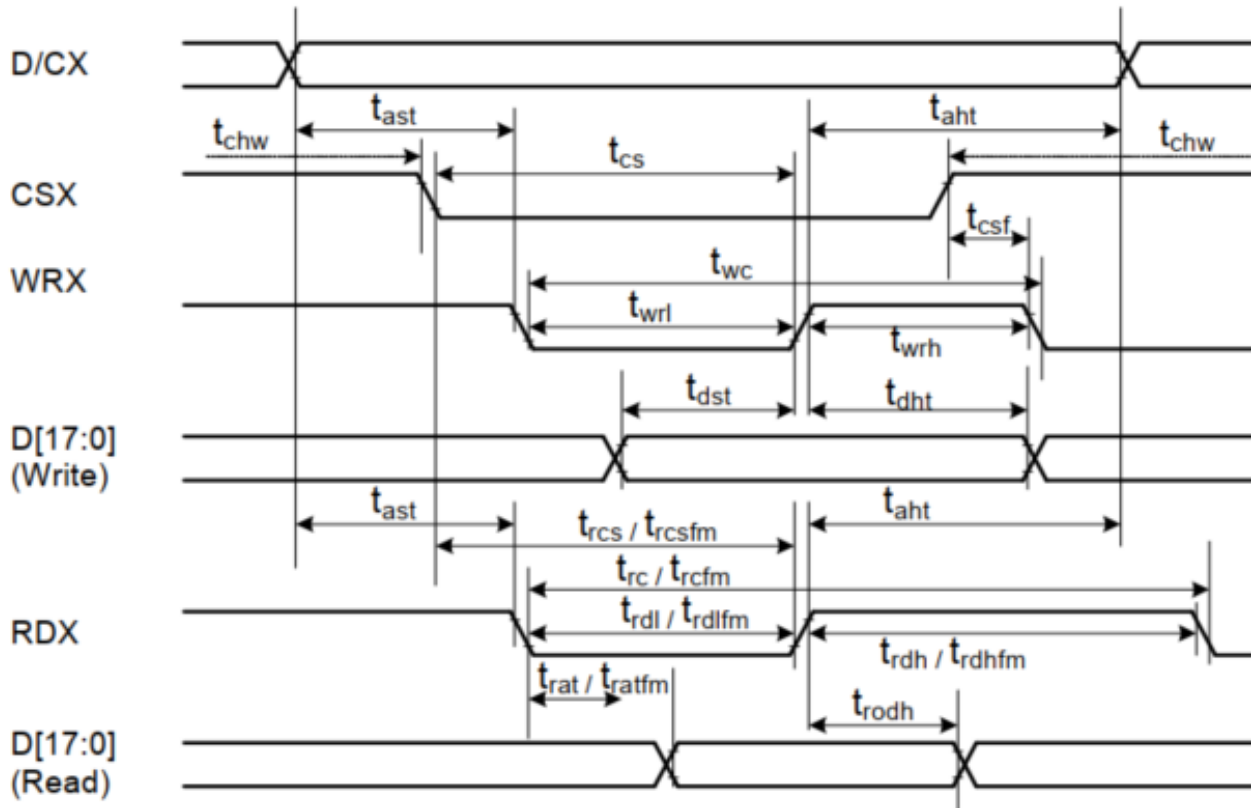
Timing Characteristics for TFT

8/9/16/18-bit Parallel MCU Interface I Timing Characteristics



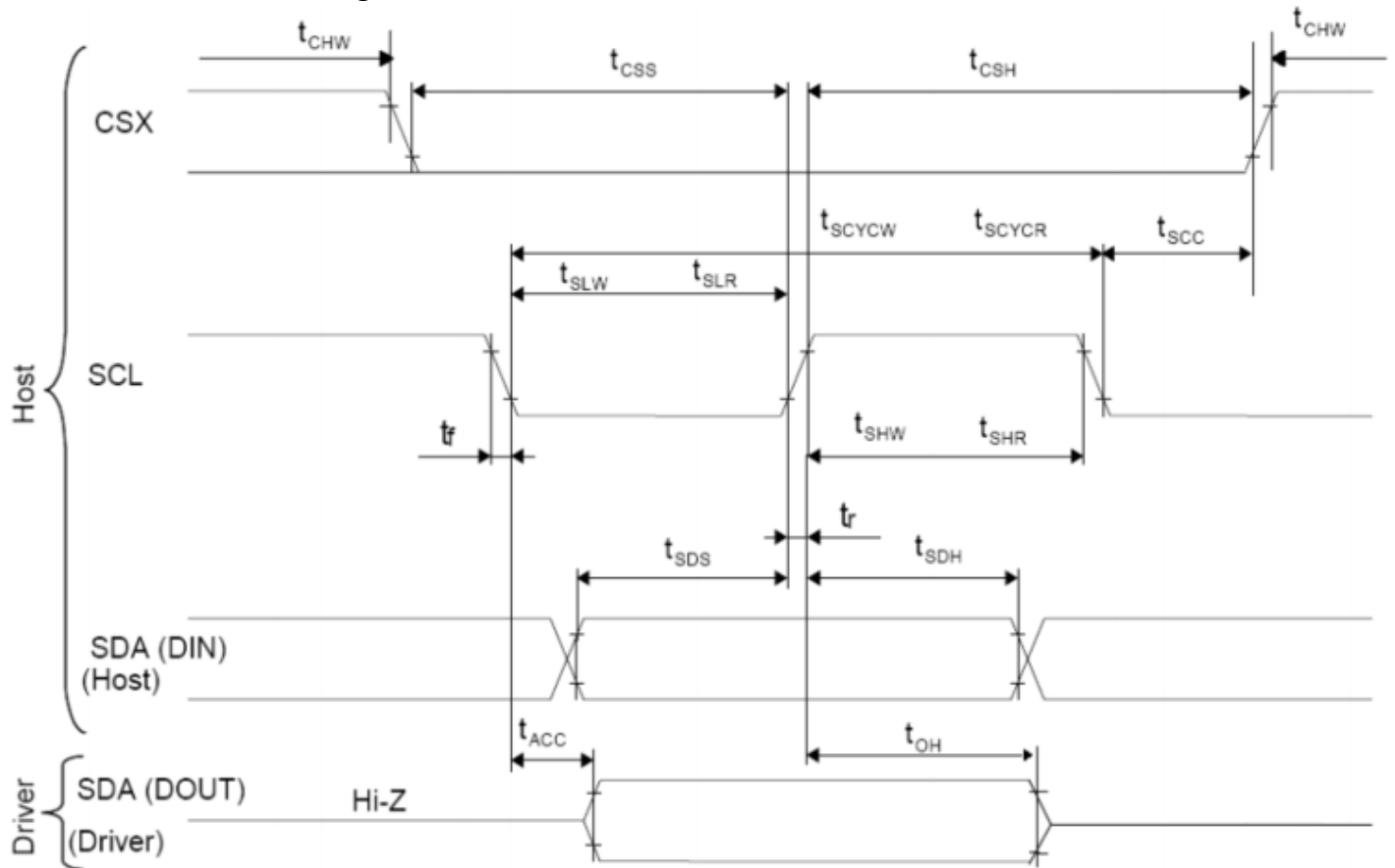
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

8/9/16/18-bit Parallel MCU II Interface Timing Characteristics



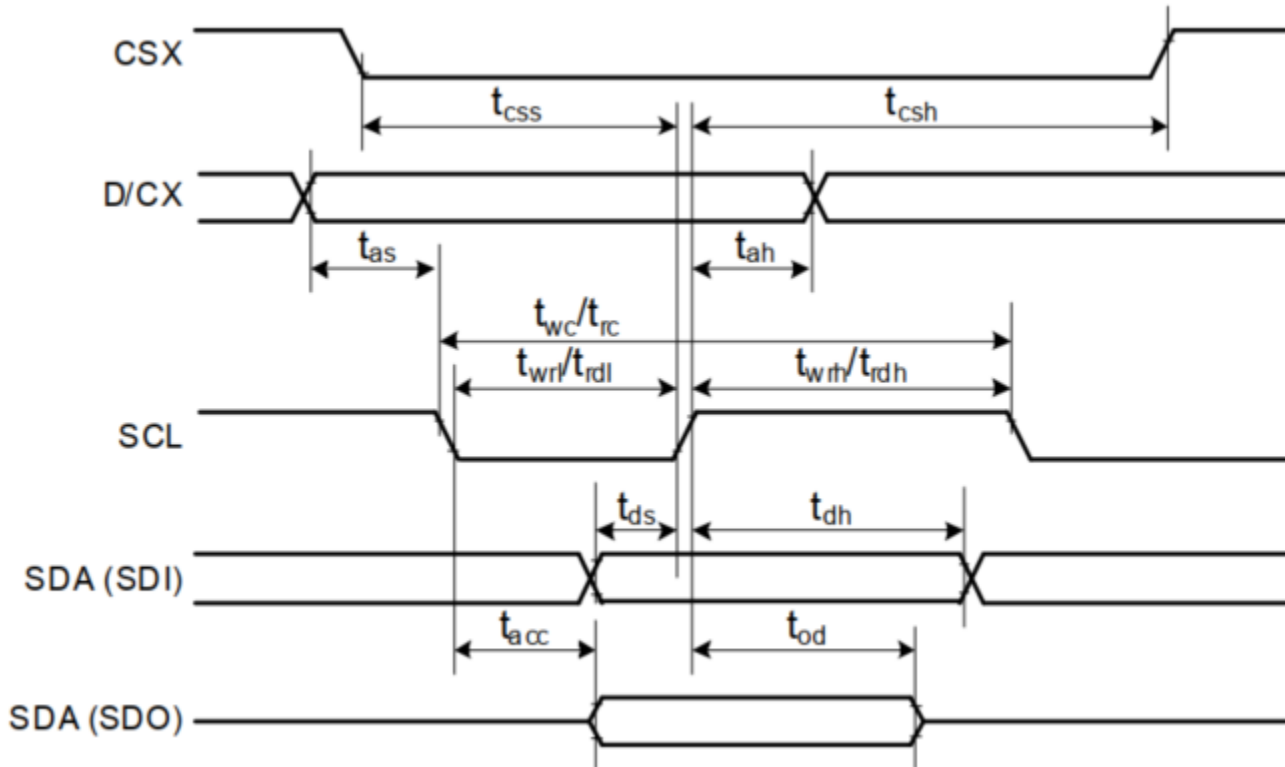
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
WRX	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[17:10]&D[8:1], D[17:10], D[17:9]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trodh	Read output disable time	20	80	ns	

3-wire Serial interface Timing Characteristics



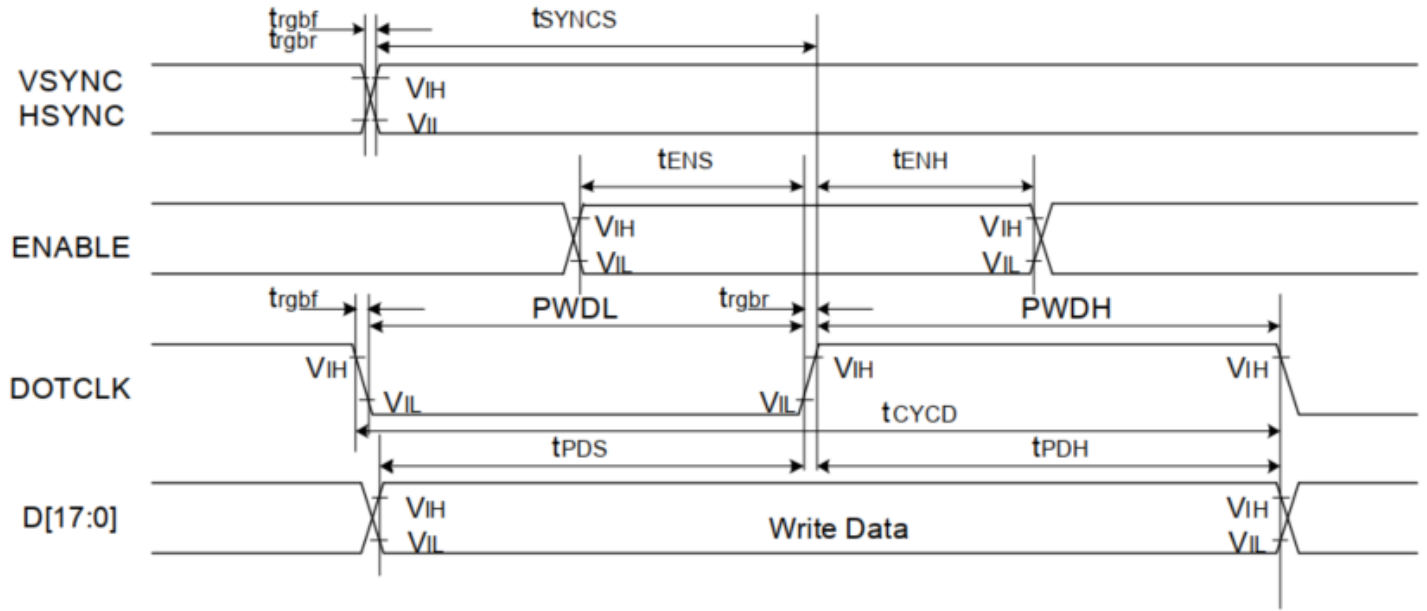
Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tsc	SCL-CSX	20	-	ns	
	tch	CSX "H" Pulse Width	40	-	ns	
	tcs	CSX-SCL Time	60	-	ns	
	tcs		65	-	ns	

4-wire Serial interface Timing Characteristics



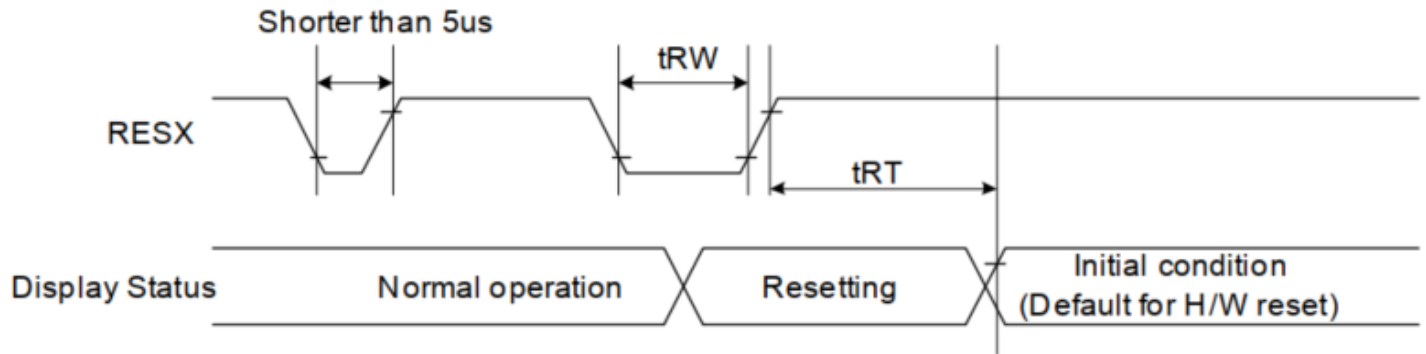
Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tcss	Chip select time (Write)	40	-	ns	
	tcsch	Chip select hold time (Read)	40	-	ns	
SCL	twc	Serial clock cycle (Write)	100	-	ns	
	twrh	SCL "H" pulse width (Write)	40	-	ns	
	twrl	SCL "L" pulse width (Write)	40	-	ns	
	trc	Serial clock cycle (Read)	150	-	ns	
	trdh	SCL "H" pulse width (Read)	60	-	ns	
	trdl	SCL "L" pulse width (Read)	60	-	ns	
	tas	D/CX setup time	10	-		
	tah	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	tds	Data setup time (Write)	30	-	ns	
	tdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	For maximum CL=30pF
	tod	Output disable time (Read)	10	50	ns	For minimum CL=8pF

Parallel 6/16/18-bit RGB Interface Timing Characteristics



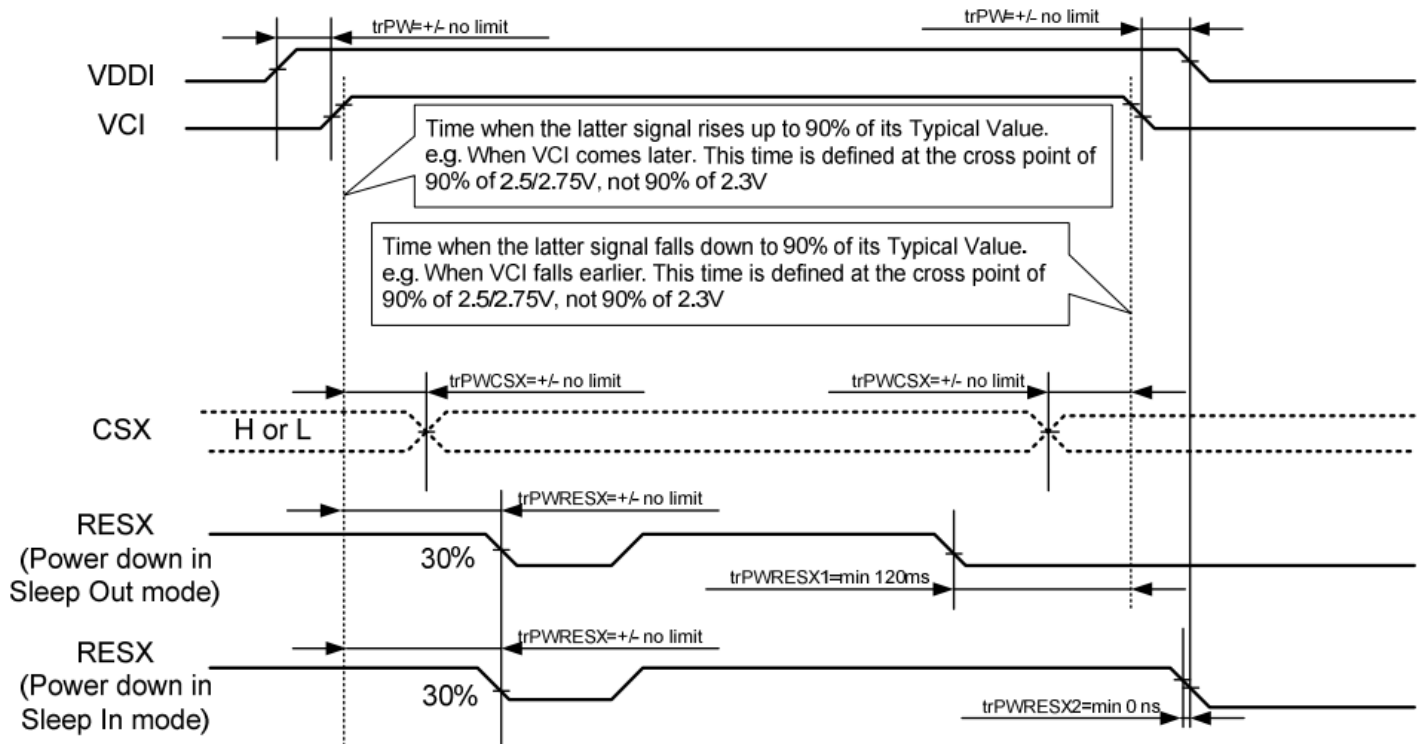
Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	$PWDH$	DOTCLK high-level period	15	-	ns	
	$PWDL$	DOTCLK low-level period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{rgbr}, t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	$PWDH$	DOTCLK high-level pulse period	15	-	ns	
	$PWDL$	DOTCLK low-level pulse period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	50	-	ns	
	t_{rgbr}, t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Reset Timing



Signal	Symbol	Parameter	Min	Max	Unit
RESX	t_{RW}	Reset pulse duration	10		uS
	t_{RT}	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

Power ON/OFF Sequence



$trPWRESX1$ is applied to RESX falling in the Sleep Out Mode
 $trPWRESX2$ is applied to RESX falling in the Sleep In Mode

Example Initialization Code

```
void init() {  
    command(0x28); // Display off  
    command(0x11); // Exit SLEEP mode  
  
    command(0xCB); // Power Control A  
    data(0x39);  
    data(0x2C);  
    data(0x00);  
    data(0x34);  
    data(0x02);  
  
    command(0xCF); // Power Control B  
    data(0x00);  
    data(0x81);  
    data(0x30);  
  
    command(0xC0); // Power Control 1  
    data(0x26);  
    data(0x04);  
  
    command(0xC1); // Power Control 2  
    data(0x11);  
  
    command(0xC5); // VCOM Control 1  
    data(0x35);  
    data(0x3E);  
  
    command(0x36); // Memory Access Control (BGR)  
    data(0x88);  
  
    command(0xB1); // Frame Rate Control  
    data(0x00);  
    data(0x18);  
  
    command(0xB6); // Display Function Control  
    data(0x0A);  
    data(0xA2);  
  
    command(0x21); // Display inversion off  
  
    command(0xC7); // VCOM Control 2  
    data(0xBE);  
  
    command(0x3A); // Pixel Format (16-bit)  
    data(0x55);  
}
```



```
command(0xF2); // 3G Gamma Control (Off)
data(0x02);

command(0x26); // Gamma Curve 3
data(0x01);

command(0x2A); // Column Address Set
data(0x00);
data(0x00);
data(0x00);
data(0xEF);

command(0x2B); // Page Address Set
data(0x00);
data(0x00);
data(0x01);
data(0x3F);

command(0x29); // Display ON
}
```


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, 240hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 240hrs	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, 240hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-30°C 30min -> 25°C 3min -> 80°C 30min = 1 cycle. For 100 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10Hz-55Hz,(1 min) 1.5mm amplitude. Accelerated Velocity:2G 30 min 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 (RS=330kΩ ,CS=150pF)	

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.