

# NHD-3.5-320240MF-20 Controller Board

## TFT Controller Evaluation Board

<b>NHD-</b>	Newhaven Display
<b>3.5-</b>	3.5" Diagonal
<b>320240-</b>	320xRGBx240 pixels
<b>MF-</b>	Model
<b>20-</b>	20-POS FFC interface (8-bit data), SSD1963 Controller

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## Additional Resources

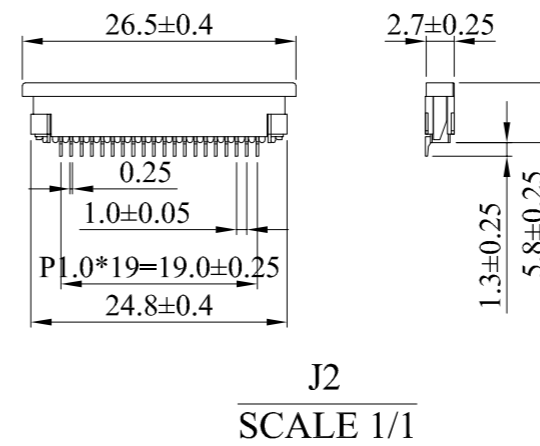
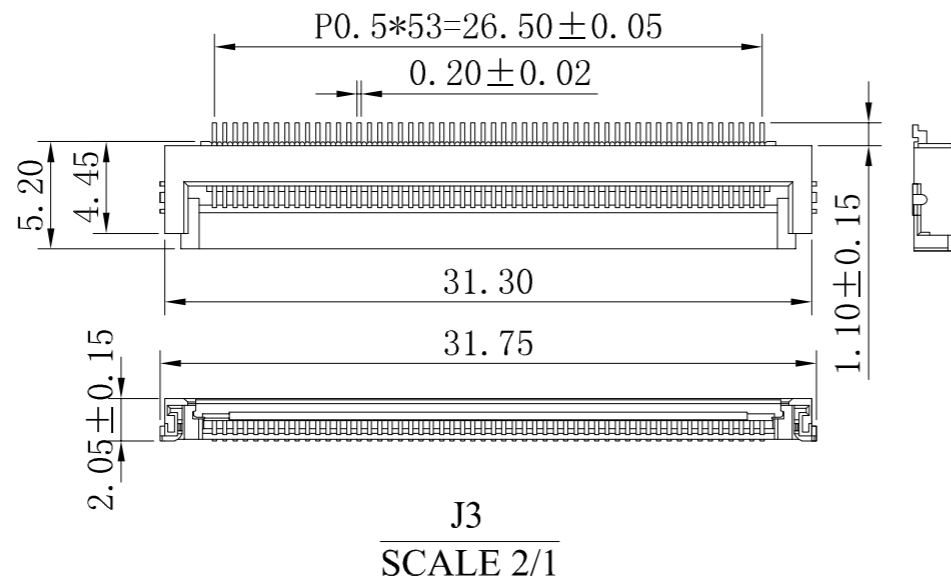
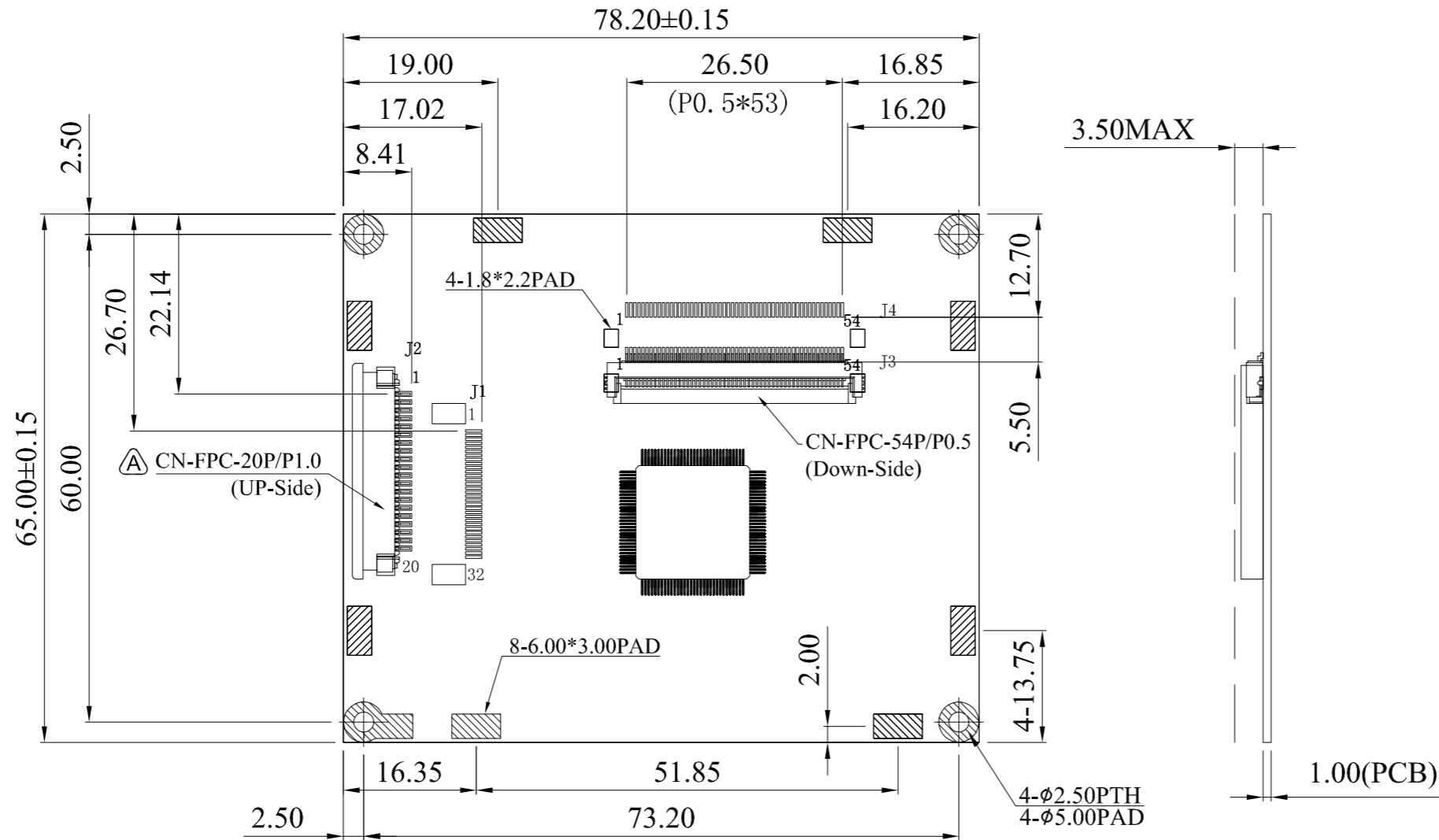
- **Support Forum:** <https://support.newhavendisplay.com/hc/en-us/community/topics>
- **GitHub:** <https://github.com/newhavendisplay>
- **Example Code:** <https://support.newhavendisplay.com/hc/en-us/categories/4409527834135-Example-Code/>
- **Knowledge Center:** [https://www.newhavendisplay.com/knowledge\\_center.html](https://www.newhavendisplay.com/knowledge_center.html)
- **Quality Center:** [https://www.newhavendisplay.com/quality\\_center.html](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
0	05/14/2007	Initial Release	CL
1	04/17/2012	Mechanical drawing updated	AK
2	04/27/2012	J2 Pin description updated	AK
3	01/25/2013	J2 Pin description updated	AK
4	04/26/2016	Mechanical Drawing Updated	SB
5	03/03/2021	2D Mechanical Drawing Redesign; Revised Compatibility to NHD-3.5-320240MF-ATXL# Models	AS
6	09/07/2022	Updated Mechanical Drawing Part Revision Updated to Rev1A	JT
7	03/31/2023	Updated the supply current in Electrical Characteristics	JT
8	08/11/2023	J2/J3 Pin Description, Backlight Voltage/Current Updated	KL

# Mechanical Drawing



## J2

PIN NO.	SYMBOL
1	GND
2	VDD
3	BL_E
4	D/C
5	WR
6	RD
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	CS
16	RES
17	NC
18	NC
19	NC
20	NC

<b>Standard Tolerance:</b> (Unless otherwise specified)  Linear: ±0.3mm		
	Drawing/Part Number: NHD-3.5-320240MF-20 Controller Board	Revision: 1A
<b>Unless otherwise specified:</b> • Dimensions are in Millimeters • Third Angle Projection	Drawn By: K. Lewis	Approved By: K. Lewis
	Drawn Date: 08/11/2023	Approved Date: 08/11/2023
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## Pin Description

### J2 (SSD1963 input from user's MPU):

Pin No.	Symbol	External Connection	Function Description
1	GND	Power Supply	Ground
2	V <sub>DD</sub>	Power Supply	Power supply for LCD and logic (3.3V)
3	BL_E	Power Supply	Backlight Enable and PWM Signal
4	D/C#	MPU	Data/Command Select signal. D/C#=0: Command, D/C#=1: Data
5	WR#	MPU	8080 MPU Write Signal active LOW
6	RD#	MPU	8080 MPU Read Signal active LOW
7-14	DB0-DB7	MPU	8-bit bidirectional data bus
15	CS#	MPU	Active LOW Chip Select signal
16	RESET#	MPU	Active LOW Reset signal
17	NC	-	No Connect
18	NC	-	No Connect
19	NC	-	No Connect
20	NC	-	No Connect

### J3 (SSD1963 output to display panel):

Pin No.	Symbol	External Connection	Function Description
1	LED-	LED Power Supply	Backlight Cathode
2	LED-	LED Power Supply	Backlight Cathode
3	LED+	LED Power Supply	Backlight Anode
4	LED+	LED Power Supply	Backlight Anode
5-7	NC	-	No Connect
8	RESET#	MPU	Active LOW Reset signal
9-11	NC	-	No Connect
12-13	GND	Power Supply	Ground
14-19	[B0-B5]	MPU	Blue Data Signals
20-21	GND	Power Supply	Ground
22-27	[G0-G5]	MPU	Green Data Signals
28-29	GND	Power Supply	Ground
30-35	[R0-R5]	MPU	Red Data Signals
36	HSYNC	MPU	Line synchronization signal
37	VSYNC	MPU	Frame synchronization signal
38	PCLK	MPU	Data sample Clock signal
39-40	NC	-	No Connect
41-42	V <sub>DD</sub>	Power Supply	Power supply for LCD and logic (3.3V)
43-47	NC	-	No Connect
48-50	GND	Power Supply	Ground
51-52	NC	-	No Connect
53-54	GND	Power Supply	Ground



## Electrical Characteristics

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	-	-	390	-	mA
Input High Voltage	VIH	-	0.8*VDD	-	VDD	V
Input Low Voltage	VIL	-	VSS	-	0.2*VDD	V
Backlight Voltage	VLED	ILED=40mA	17.4	18.6	19.8	V
Backlight Current	ILED	-	-	40	50	mA

## Controller Information

Built-in SSD1963 controller: <https://support.newhavendisplay.com/hc/en-us/articles/4414860003351-SSD1963>

## MCU Interface

The controller board operates in 8080 mode. This interface uses /WR to define a write cycle and /RD for read cycle. If /WR goes low when the /CS signal is low, the data or command will be latched into the system at the rising edge of /WR. Similarly, the read cycle will start when /RD goes low and end at the rising edge of /RD.

**Pixel Data Format**

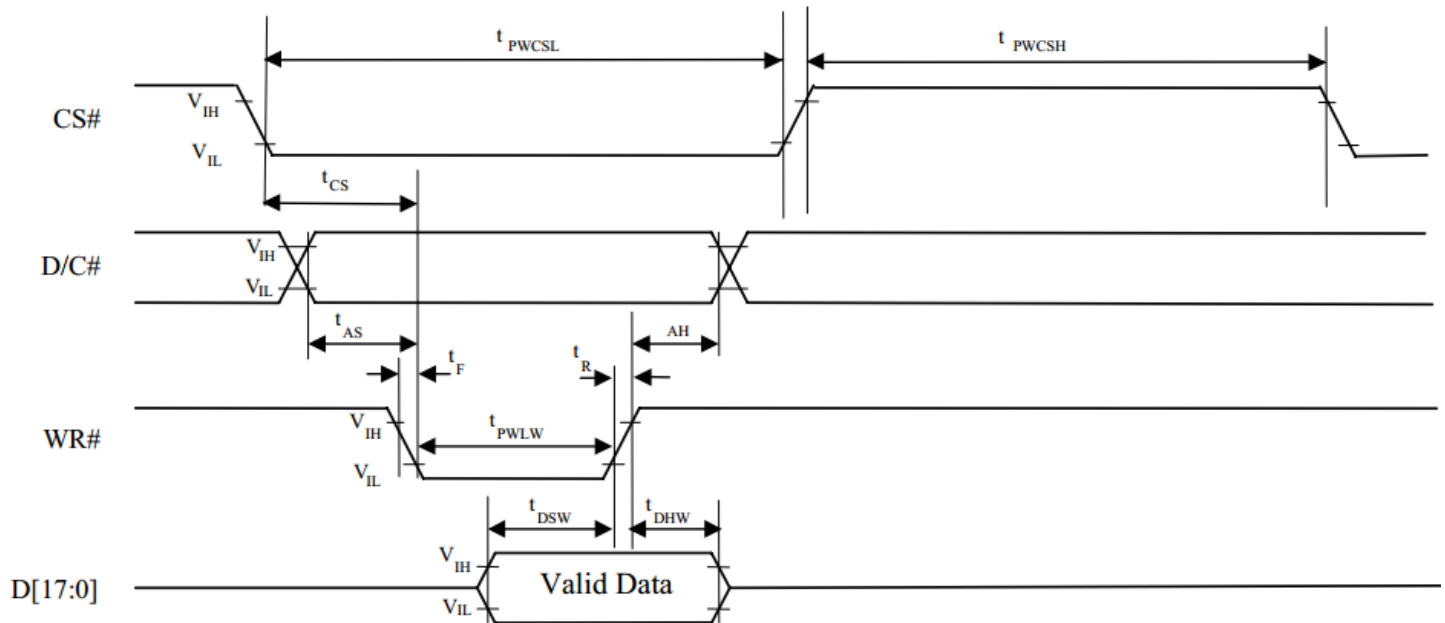
Interface	Cycle	D[23]	D[22]	D[21]	D[20]	D[19]	D[18]	D[17]	D[16]	D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
24 bits	1 <sup>st</sup>	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
18 bits	1 <sup>st</sup>							R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
16 bits (565 format)	1 <sup>st</sup>									R5	R4	R3	R2	R1	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1
16 bits	1 <sup>st</sup>									R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0
	2 <sup>nd</sup>									B7	B6	B5	B4	B3	B2	B1	B0	R7	R6	R5	R4	R3	R2	R1	R0
	3 <sup>rd</sup>									G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
12 bits	1 <sup>st</sup>													R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4
	2 <sup>nd</sup>												G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	
9 bits	1 <sup>st</sup>																R5	R4	R3	R2	R1	R0	G5	G4	G3
	2 <sup>nd</sup>															G2	G1	G0	B5	B4	B3	B2	B1	B0	
8 bits	1 <sup>st</sup>																	R7	R6	R5	R4	R3	R2	R1	R0
	2 <sup>nd</sup>																	G7	G6	G5	G4	G3	G2	G1	G0
	3 <sup>rd</sup>																	B7	B6	B5	B4	B3	B2	B1	B0

# Timing Characteristics

## Parallel 8080-series Interface Timing

Symbol	Parameter	Min	Typ	Max	Unit
$f_{MCLK}$	System Clock Frequency*	1	-	110	MHz
$t_{MCLK}$	System Clock Period*	$1/f_{MCLK}$	-	-	ns
$t_{PWCSL}$	Control Pulse High Width	Write Read	$1.5 * t_{MCLK}$ $3.5 * t_{MCLK}$	-	ns
$t_{PWCSH}$	Control Pulse Low Width	Write (next write cycle) Write (next read cycle) Read	$1.5 * t_{MCLK}$ $9 * t_{MCLK}$ $9 * t_{MCLK}$	-	ns
$t_{AS}$	Address Setup Time	1	-	-	ns
$t_{AH}$	Address Hold Time	2	-	-	ns
$t_{DSW}$	Write Data Setup Time	4	-	-	ns
$t_{DHW}$	Write Data Hold Time	1	-	-	ns
$t_{PWLW}$	Write Low Time	12	-	-	ns
$t_{DHR}$	Read Data Hold Time	1	-	-	ns
$t_{ACC}$	Access Time	32	-	-	ns
$t_{PWLR}$	Read Low Time	36	-	-	ns
$t_R$	Rise Time	-	-	0.5	ns
$t_F$	Fall Time	-	-	0.5	ns
$t_{CS}$	Chip select setup time	2	-	-	ns
$t_{CSH}$	Chip select hold time to read signal	3	-	-	ns

\* System Clock denotes external input clock (PLL-bypass) or internal generated clock (PLL-enabled)



## 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 Storage	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.