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# NHD-3.5-320240MF-34 Controller Board

## TFT Controller Evaluation Board

NHD-	Newhaven Display
3.5-	3.5" Diagonal
320240-	320xRGBx240 pixels
MF-	Model
34-	34-POS FFC interface (16-bit data) SSD1963 Controller

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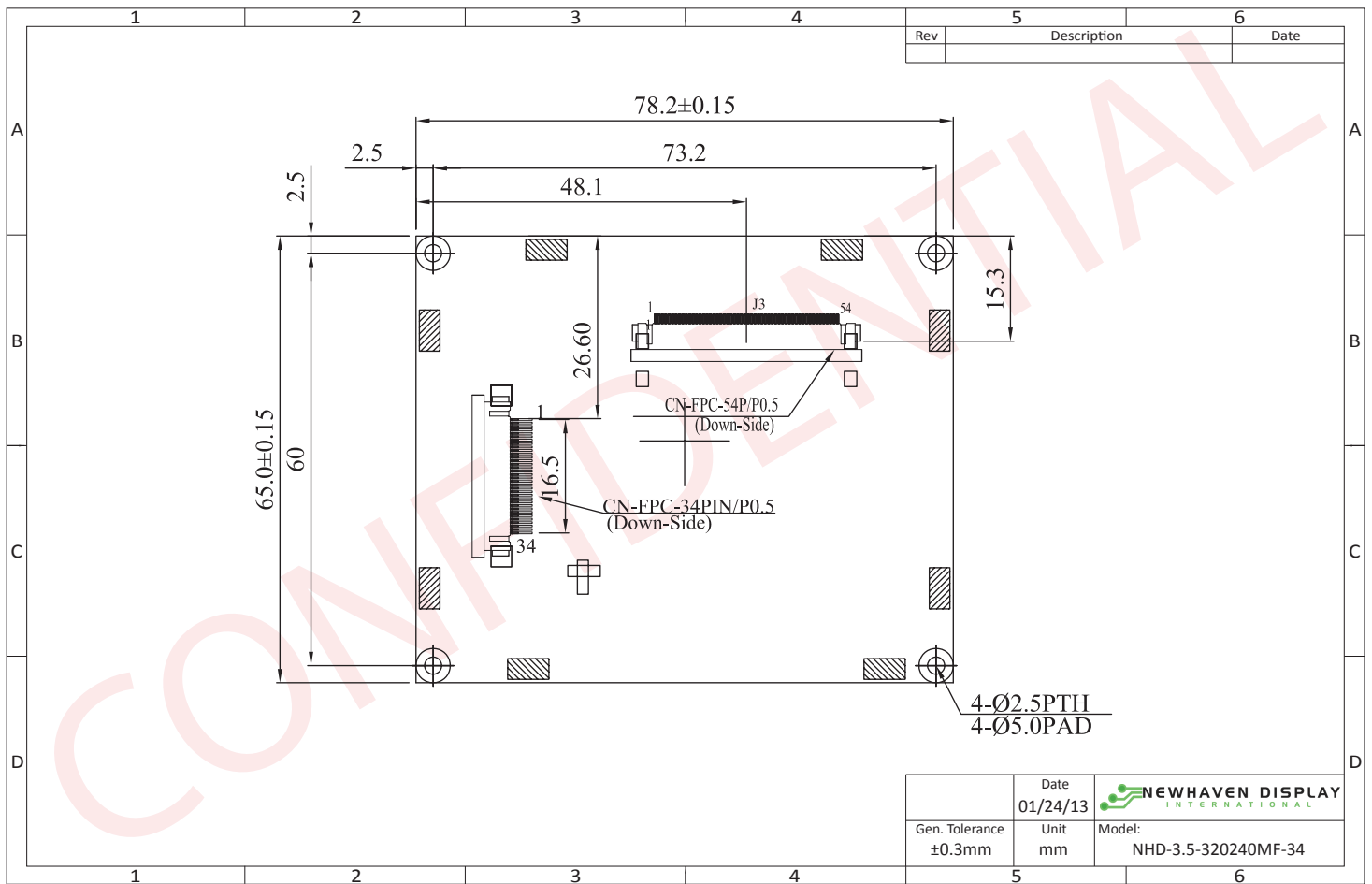
## Document Revision History

Revision	Date	Description	Changed by
0	4/17/2012	Initial Release	-
1	4/27/2012	J2 Pin description updated	AK
2	1/25/2013	J2 Pin description updated	AK

## Functions and Features

- To use for testing, evaluating, or in final production with NHD-3.5-320240MF-A displays.

**Mechanical Drawing**



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## Pin Description

### J1 (SSD1963 input from user's MPU):

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for LCD and logic (3.3V)
3	B/L Enable	Power Supply	Backlight Enable
4	RS	MPU	Register Select. RS=0: Command, RS=1: Data
5	/WR	MPU	8080 mode: Active LOW Write
6	/RD	MPU	8080 mode: Active LOW Read
7-22	DB0-DB15	MPU	8-bit bidirectional data bus
23	NC	-	No Connect
24	NC	-	No Connect
25	/CS	MPU	Active LOW Chip Select
26	/RST	MPU	Active LOW Reset
27-32	NC	-	No Connect

### J3, J4 (SSD1963 output to display panel):

Pin No.	Symbol	External Connection	Function Description
1	LED-	LED Power Supply	Ground for backlight
2	LED-	LED Power Supply	Ground for backlight
3	LED+	LED Power Supply	Power for backlight
4	LED+	LED Power Supply	Power for backlight
5-7	NC	-	No Connect
8	/RST	MPU	Active LOW Reset
9	/CS	-	Active LOW Serial Chip Select (No Connect)
10	SCL	-	Serial Clock (No Connect)
11	SDA	-	Serial Data (No Connect)
12-19	[B0-B7]	MPU	Blue Data
20-27	[G0-G7]	MPU	Green Data
28-35	[R0-R7]	MPU	Red Data
36	HSYNC	MPU	Horizontal (Line) Sync
37	VSYNC	MPU	Vertical (Frame) Sync
38	DCLK	MPU	Dot Clock
39-40	NC	-	No Connect
41	VDD	Power Supply	Power supply for LCD and logic (3.3V)
42	VDD	Power Supply	Power supply for LCD and logic (3.3V)
43-51	NC	-	No Connect
52	DE	-	Data Enable (No Connect)
53	VSS	Power Supply	Ground
54	VSS	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		-	25	-	mA
Input High Voltage	VIH		0.8*VDD	-	VDD	V
Input Low Voltage	VIL		VSS	-	0.2*VDD	V
Backlight Voltage	VLED	ILED=20mA	18	19.2	20.4	V
Backlight Current	ILED		-	18	20	mA

## Controller Information

Built-in SSD1963 controller

Please download specification at [http://www.newhavendisplay.com/app\\_notes/SSD1963.pdf](http://www.newhavendisplay.com/app_notes/SSD1963.pdf)

## 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

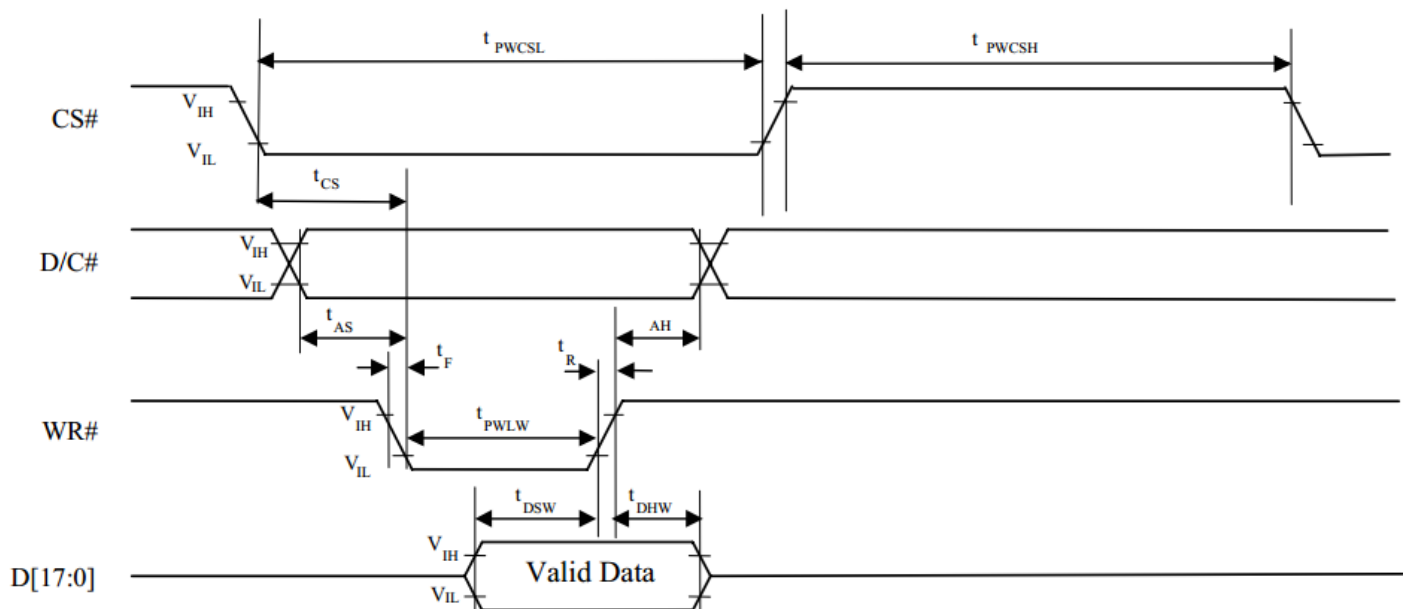
Interface	Cycle	D[23]	D[22]	D[21]	D[20]	D[19]	D[18]	D[17]	D[16]	D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
24 bits	1 <sup>st</sup>	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
18 bits	1 <sup>st</sup>							R5	R4	R3	R2	R1	R0	G5	G4	G3	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	13	$1.5 * t_{MCLK}$	-	ns
	Control Pulse High Width Read	30	$3.5 * t_{MCLK}$	-	ns
$t_{PWCSH}$	Control Pulse Low Width Write (next write cycle)	13	$1.5 * t_{MCLK}$	-	ns
	Control Pulse Low Width Write (next read cycle)	80	$9 * t_{MCLK}$	-	ns
	Control Pulse Low Width Read	80	$9 * t_{MCLK}$	-	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 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)