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NHD-1.27-AU-SHIELD

Graphic Color OLED Display Module + Arduino UNO Shield

NHD-	Newhaven Display
1.27-	1.27” Diagonal Size
AU-	Arduino Uno
SHIELD-	Shield

Newhaven Display International, Inc.

2661 Galvin Ct.

Elgin IL, 60124

Ph: 847-844-8795 Fax: 847-844-8796

www.newhavendisplay.com

nhtech@newhavendisplay.com nhsales@newhavendisplay.com

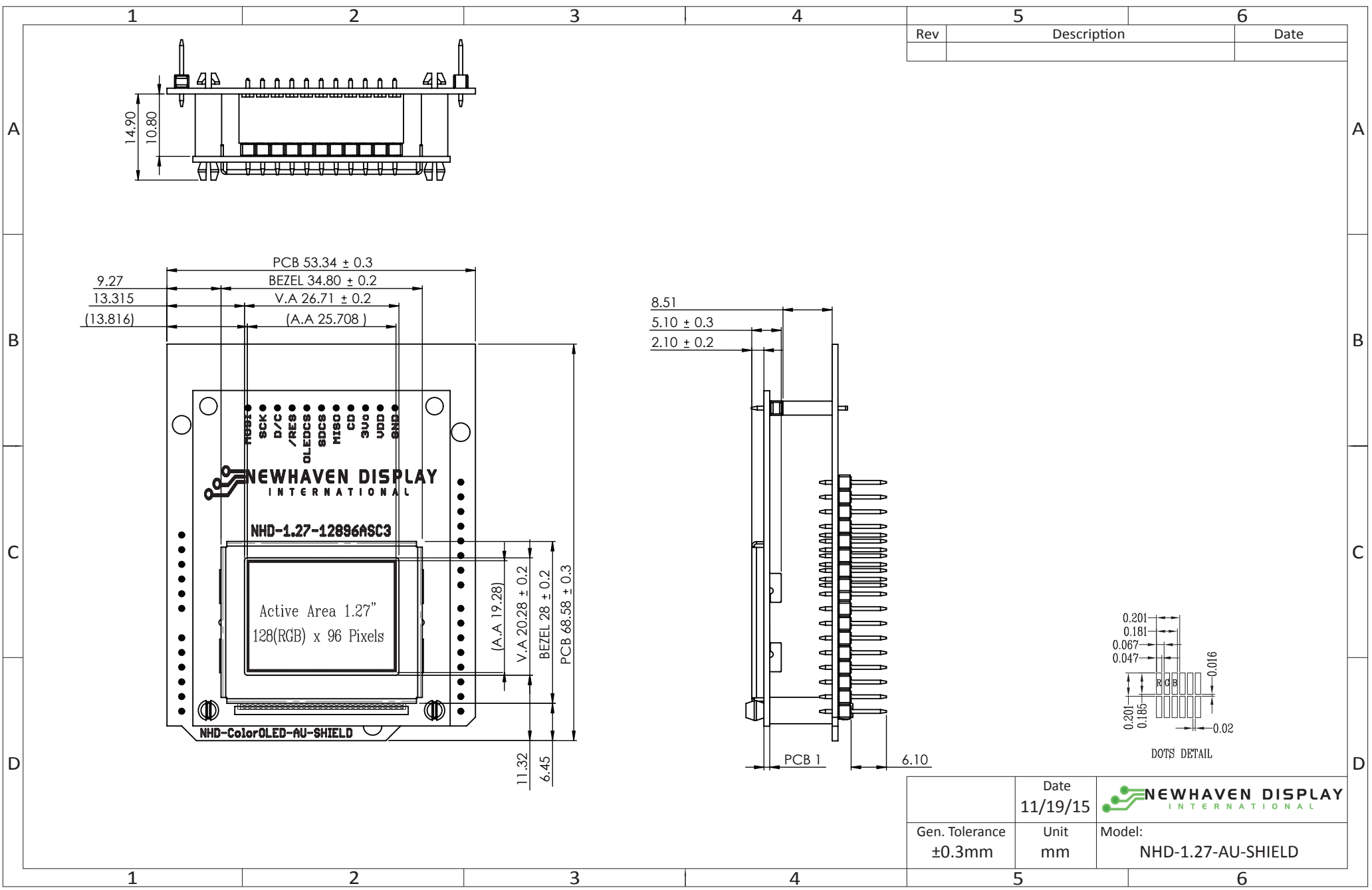
Document Revision History

Revision	Date	Description	Changed by
0	11/19/2015	Initial Release	PB
1	1/11/2016	Functions and Features Updated	PB

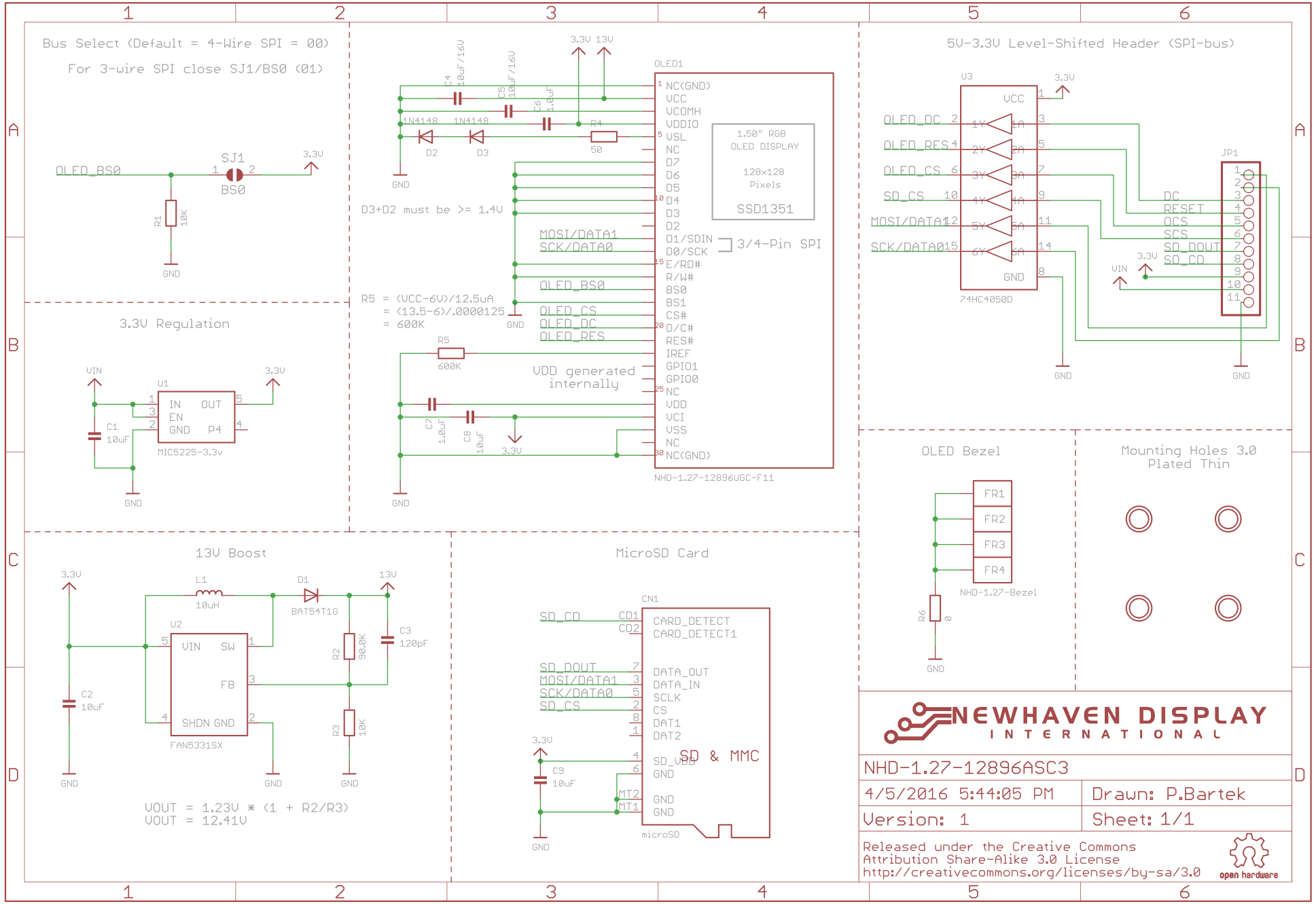
Functions and Features

- **128 x 96 pixel resolution**
- **Built-in SSD1351 controller**
- **SPI MPU interface**
- **RoHS compliant**
- **microSD card reader (microSD card not included)**
- **Built-in logic level shifting for 3.3V ~ 5V operation**

Mechanical Drawing



Schematic


Bus Select (Default = 4-Wire SPI = 00)
For 3-wire SPI close SJ1/BS0 (01)
OLED_BS0
SJ1
BS0
3.3V
R1
10K
GND
3.3V Regulation
VIN
U1
IN
OUT
EN
GND
P4
MIC5225-3.3v
C1
10uF
13V Boost
L1
10uH
D1
BAT54T1G
U2
VIN
SW
FB
SHDN
GND
FAN5331SX
C2
10uF
R2
90.0K
R3
10K
C3
120pF
VOUT = 1.23V * (1 + R2/R3)
VOUT = 12.41V
OLED1
NC(GND)
VCC
VCOMH
VDDIO
VSL
NC
D7
D6
D5
D4
D3
D2
D1/SDIN
D0/SCK
E/RD#
R/W#
BS0
BS1
CS#
D/C#
RES#
IREF
GPIO1
GPIO0
NC
VDD
VCI
VSS
NC
NC(GND)
1.50" RGB
OLED DISPLAY
128x128
Pixels
SSD1351
3/4-Pin SPI
NHD-1.27-12896UGC-F11
C4
10uF/16V
C5
10uF/16V
C6
1.0uF
1N4148
D2
D3
R4
50
D3+D2 must be >= 1.4V
MOSI/DATA1
SCK/DATA0
OLED_BS0
OLED_CS
OLED_DC
OLED_RES
R5 = (VCC-6V)/12.5uA
= (13.5-6)/.0000125
= 600K
R5
600K
VDD generated
internally
C7
1.0uF
C8
10uF
MicroSD Card
CN1
SD_CD
CD1
CD2
CARD_DETECT
CARD_DETECT1
SD_DOUT
MOSI/DATA1
SCK/DATA0
SD_CS
DATA_OUT
DATA_IN
SCLK
CS
DAT1
DAT2
SD_VDD
GND
MT2
MT1
SD & MMC
microSD
C9
10uF
5V-3.3V Level-Shifted Header (SPI-bus)
U3
VCC
OLED_DC
OLED_RES
OLED_CS
SD_CS
MOSI/DATA1
SCK/DATA0
1Y
2Y
3Y
4Y
5Y
6Y
1A
2A
3A
4A
5A
6A
GND
74HC4050D
JP1
DC
RESET
OCS
SCS
SD_DOUT
SD_CD
OLED Bezel
FR1
FR2
FR3
FR4
NHD-1.27-Bezel
R6
0
Mounting Holes 3.0
Plated Thin
NEWHAVEN DISPLAY
INTERNATIONAL
NHD-1.27-12896ASC3
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Version: 1
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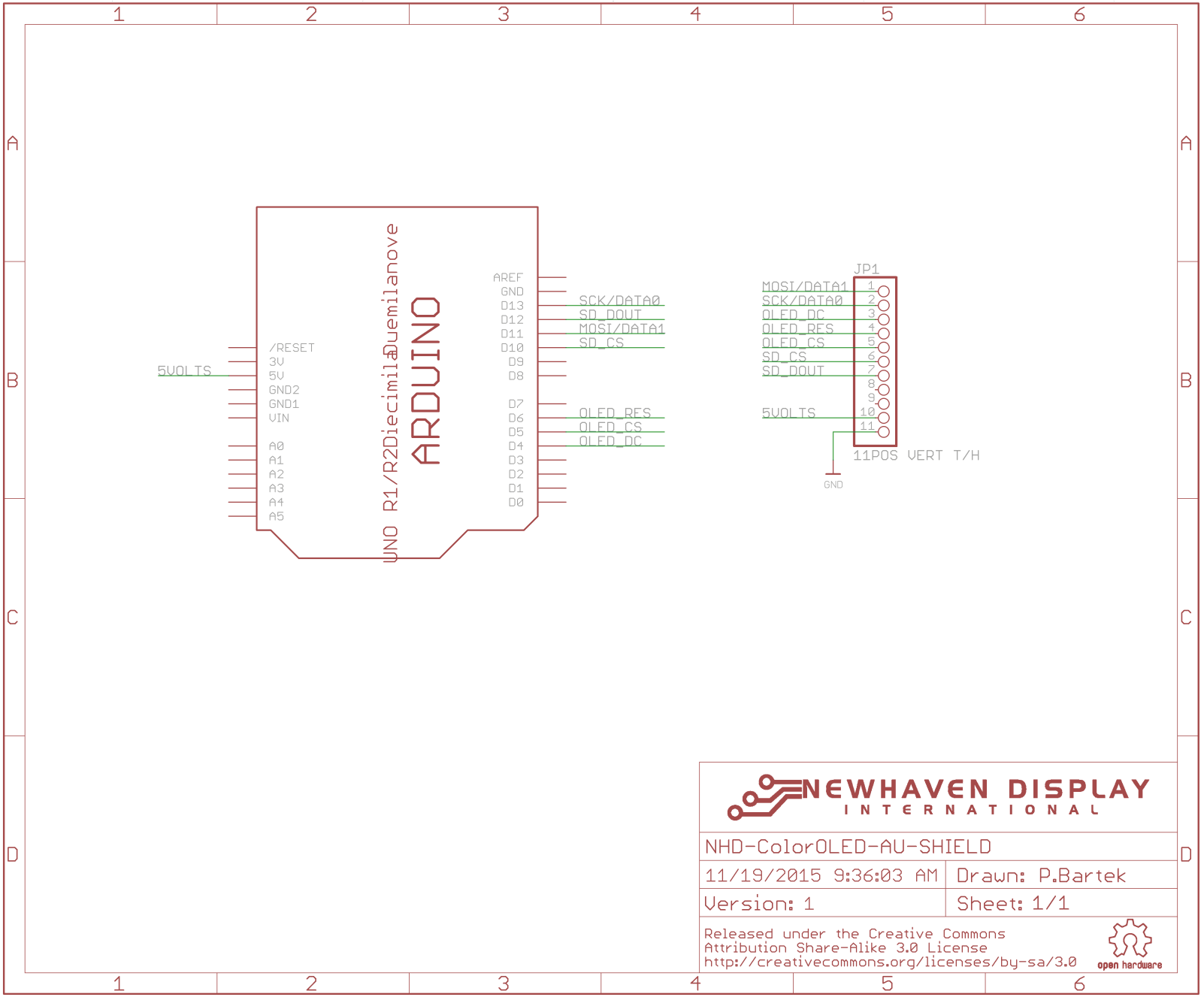
1
2
3
4
5
6
A
B
C
D
ARDUINO
UNO R1/R2Diecimila&Duemilanove
/RESET
3V
5V
GND2
GND1
VIN
A0
A1
A2
A3
A4
A5
5VOLTS
AREF
GND
D13
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1
D0
SCK/DATA0
SD_DOUT
MOSI/DATA1
SD_CS
OLED_RES
OLED_CS
OLED_DC
JP1
MOSI/DATA1
SCK/DATA0
OLED_DC
OLED_RES
OLED_CS
SD_CS
SD_DOUT
5VOLTS
GND
11POS VERT T/H
NEWHAVEN DISPLAY
INTERNATIONAL
NHD-ColorOLED-AU-SHIELD
11/19/2015 9:36:03 AM
Drawn: P.Bartek
Version: 1
Sheet: 1/1
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open hardware

Interface Description

JP1 Interface:

Pin No.	Symbol	External Connection	Function Description
1	MOSI	MPU	Master Out Slave In
2	SCK	MPU	Serial Clock signal
3	D/C	MPU	Register Select signal. D/C=0: Command, D/C=1: Data
4	/RES	MPU	Active LOW Reset signal
5	OLEDCS	MPU	OLED Active LOW Chip Select signal
6	SDCS	MPU	Micro SD Active LOW Chip Select signal
7	MISO	MPU	Master In / Slave Out
8	NC	-	No Connect
9	NC	-	No Connect
10	VDD	Power Supply	Supply Voltage for OLED and logic (3.3V~5V)
11	GND	Power Supply	Ground

JP2 Interface:

Shield Pin Symbol	Arduino UNO Pin Symbol	Function Description
AREF	AREF	No Connect
GND	GND	Ground
Digital 13	13	Serial Clock signal
Digital 12	12	Master In / Slave Out
Digital 11	11	Master Out Slave In
Digital 10	10	Micro SD Active LOW Chip Select signal
Digital 9	9	No Connect
Digital 8	8	No Connect

JP3 Interface:

Shield Pin Symbol	Arduino UNO Pin Symbol	Function Description
Digital 7	7	No Connect
Digital 6	6	Active LOW Reset signal
Digital 5	5	OLED Active LOW Chip Select signal
Digital 4	4	Register Select signal. D/C=0: Command, D/C=1: Data
Digital 3	3	No Connect
Digital 2	2	No Connect
Digital 1	1	No Connect
Digital 0	0	No Connect

JP4 Interface:

Shield Pin Symbol	Arduino UNO Pin Symbol	Function Description
Analog 5	A5	No Connect
Analog 4	A4	No Connect
Analog 3	A3	No Connect
Analog 2	A2	No Connect
Analog 1	A1	No Connect
Analog 0	A0	No Connect

JP5 Interface:

Shield Pin Symbol	Arduino UNO Pin Symbol	Function Description
RST	RESET	No Connect
3V	3.3V	No Connect
5V	5V	Supply Voltage for OLED and logic (5V)
GND	GND	No Connect
GND	GND	No Connect
Vin	Vin	No Connect

Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-30	-	+70	ºC
Storage Temperature Range	Tst	Absolute Max	-40	-	+80	ºC
Supply Voltage	VDD		3.0	3.3	5.5	V
Supply Current	IDD		-	80	200	mA
"H" Level input	Vih		0.8*VDD	-	VDD	V
"L" Level input	Vil		0	-	0.2*VDD	V
"H" Level output	Voh		0.9*VDD	-	VDD	V
"L" Level output	Vol		0	-	0.1*VDD	V

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle – Top			80	-	-	º
Viewing Angle – Bottom			80	-	-	º
Viewing Angle – Left			80	-	-	º
Viewing Angle – Right			80	-	-	º
Contrast Ratio	Cr		-	2000:1	-	-
Response Time (rise)	Tr	-	-	10	-	us
Response Time (fall)	Tf	-	-	10	-	us
Brightness		50% checkerboard	60	75	-	cd/m^2
Lifetime		90 cd/m^2, Ta=25°C, 50% checkerboard	10,000	-	-	Hrs

Note: Lifetime at typical temperature is based on accelerated high-temperature operation. Lifetime is tested at average 50% pixels on and is rated as Hours until **Half-Brightness**. The Display OFF command can be used to extend the lifetime of the display.
Luminance of active pixels will degrade faster than inactive pixels. Residual (burn-in) images may occur. To avoid this, every pixel should be illuminated uniformly.

Controller information

Built-in SSD1351 controller.
Please download specification at www.newhavendisplay.com/app_notes/SSD1351.pdf

Table of Commands

(D/C# = 0, R/W#(WR#)= 0, E(RD#) = 1) unless specific setting is stated
Single byte command (D/C# = 0), Multiple byte command (D/C# = 0 for first byte, D/C# = 1 for other bytes)

Fundamental Command Table											
D/C#	**Hex**	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D2**	**D0**	**Command**	**Description**
0	15	0	0	0	1	0	1	0	1	Set Column Address	A[6:0]: Start Address. [reset=0] B[6:0]: End Address. [reset=127] Range from 0 to 127
1	A[6:0]	*	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
1	B[6:0]	*	B_6	B_5	B_4	B_3	B_2	B_1	B_0		
0	75	0	1	1	1	0	1	0	1	Set Row Address	A[6:0]: Start Address. [reset=0] B[6:0]: End Address. [reset=127] Range from 0 to 127
1	A[6:0]	*	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
1	B[6:0]	*	B_6	B_5	B_4	B_3	B_2	B_1	B_0		
0	5C	0	1	0	1	1	1	0	0	Write RAM Command	Enable MCU to write Data into RAM
0	5D	0	1	0	1	1	1	0	1	Read RAM Command	Enable MCU to read Data from RAM
0	A0	1	0	1	0	0	0	0	0	Set Re-map / Color Depth (Display RAM to Panel)	A[0]=0b, Horizontal address increment [reset] A[0]=1b, Vertical address increment A[1]=0b, Column address 0 is mapped to SEG0 [reset] A[1]=1b, Column address 127 is mapped to SEG0 A[2]=0b, Color sequence: A → B → C [reset] A[2]=1b, Color sequence is swapped: C → B → A A[3]=0b, Reserved A[3]=1b, Reserved A[4]=0b, Scan from COM0 to COM[N –1] [reset] A[4]=1b, Scan from COM[N-1] to COM0. Where N is the Multiplex ratio. A[5]=0b, Disable COM Split Odd Even A[5]=1b, Enable COM Split Odd Even [reset] A[7:6] Set Color Depth, 00b / 01b: 65k color [reset] 10b: 262k color 11b 262k color, 16-bit format 2 Refer to Table 8-8 for details
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		

Fundamental Command Table											
D/C#	Hex	D7	D6	D5	D4	D3	D2	D2	D0	Command	Description
0	A1	1	0	1	0	0	0	0	1	Set Display Start Line	Set vertical scroll by RAM from 0~127. [reset=00h]
1	A[6:0]	*	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
0	A2	1	0	1	0	0	0	1	0	Set Display Offset	Set vertical scroll by Row from 0-127. [reset=60h] Note (1) This command is locked by Command FDh by default. To unlock it, please refer to Command FDh.
1	A[6:0]	*	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
0	A4~A7	1	0	1	0	0	1	X_1	X_0	Set Display Mode	A4h: All OFF A5h: All ON (All pixels have GS63) A6h : Reset to normal display [reset] A7h: Inverse Display (GS0 -> GS63, GS1 -> GS62, ...)
0	AB	1	0	1	0	1	0	1	1	Function Selection	A[0]=0b, Select external V_{DD} A[0]=1b, Enable internal V_{DD} regulator [reset] A[7:6]=00b, Select 8-bit parallel interface [reset] A[7:6]=01b, Select 16-bit parallel interface A[7:6]=11b, Select 18-bit parallel interface
1	A[7:0]	A_7	A_6	0	0	0	0	0	A_0		
0	AD	1	0	1	0	1	1	0	1	NOP	Command for no operation.
0	AE~AF	1	0	1	0	1	1	1	X_0	Set Sleep mode ON/OFF	AEh = Sleep mode On (Display OFF) AFh = Sleep mode OFF (Display ON)
0	B0	1	0	1	1	0	0	0	0	NOP	Command for no operation.
0	B1	1	0	1	1	0	0	0	1	Set Reset (Phase 1) / Pre-charge (Phase 2) period	A[3:0] Phase 1 period of 5~31 DCLK(s) clocks [reset=0010b] A[3:0]: 0-1 invalid 2 = 5 DCLKs 3 = 7 DCLKs : 15 = 31DCLKs A[7:4] Phase 2 period of 3~15 DCLK(s) clocks [reset=1000b] A[7:4]: 0-2 invalid 3 = 3 DCLKs 4 = 4 DCLKs : 15 =15DCLKs Note (1) 0 DCLK is invalid in phase 1 & phase 2 (2) This command is locked by Command FDh by default. To unlock it, please refer to Command FDh.
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		

Fundamental Command Table

D/C#	Hex	D7	D6	D5	D4	D3	D2	D2	D0	Command	Description
0	B2	1	0	1	1	0	0	1	0	Display Enhancement	A[7:0] = 00h, B[7:0] = 00h, C[7:0] = 00h normal [reset] A[7:0] = A4h, B[7:0] = 00h, C[7:0] = 00h enhance display performance
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
1	B[7:0]	0	0	0	0	0	0	0	0		
1	C[7:0]	0	0	0	0	0	0	0	0		
0	B3	1	0	1	1	0	0	1	1	Front Clock Divider (DivSet)/ Oscillator Frequency	A[3:0] [reset=0001], divide by DIVSET where A[7:4] Oscillator frequency, frequency increases as level increases [reset=1101b] **Note** (1) This command is locked by Command FDh by default. To unlock it, please refer to Command FDh.
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
0	B4	1	0	1	1	0	1	0	0	Set Segment Low Voltage (VSL)	A[1:0]=00 External VSL [reset] A[1:0]=01,10,11 are invalid **Note** (1) When external VSL is enabled, in order to avoid distortion in display pattern, an external circuit is needed to connect between VSL and V_{SS} as shown in Figure 14-1
1	A[7:0]	1	0	1	0	0	0	A_1	A_0		
1	B[7:0]	1	0	1	1	0	1	0	1		
1	C[7:0]	0	1	0	1	0	1	0	1		
0	B5	1	0	1	1	0	1	0	1	Set GPIO	A[1:0] GPIO0: 00 pin HiZ, Input disabled 01 pin HiZ, Input enabled 10 pin output LOW [reset] 11 pin output HIGH A[3:2] GPIO1: 00 pin HiZ, Input disabled 01 pin HiZ, Input enabled 10 pin output LOW [reset] 11 pin output HIGH
1	A[3:0]	*	*	*	*	A_3	A_2	A_1	A_0		
0	B6	1	0	1	1	0	1	0	0	Set Second Pre-charge Period	A[3:0] Set Second Pre-charge Period 0000b invalid 0001b 1 DCLKS 0010b 2 DCLKS .... 1000 8 DCLKS [reset] .... 1111 15 DCLKS
1	A[3:0]	*	*	*	*	A_3	A_2	A_1	A_0		

A[3:0]	DIVSET
0000	divide by 1
0001	divide by 2
0010	divide by 4
0011	divide by 8
0100	divide by 16
0101	divide by 32
0110	divide by 64
0111	divide by 128
1000	divide by 256
1001	divide by 512
1010	divide by 1024
>=1011	invalid

Fundamental Command Table

D/C#	Hex	D7	D6	D5	D4	D3	D2	D2	D0	Command	Description
0	B8	1	0	1	1	1	0	0	0	Look Up Table for Gray Scale Pulse width	The next 63 data bytes define Gray Scale (GS) Table by setting the gray scale pulse width in unit of DCLK's (ranges from 0d ~ 180d) A1[7:0]: Gamma Setting for GS1, A2[7:0]: Gamma Setting for GS2, : A62[7:0]: Gamma Setting for GS62, A63[7:0]: Gamma Setting for GS63 **Note** (1) 0 ≤ Setting of GS1 < Setting of GS2 < Setting of GS3..... < Setting of GS62 < Setting of GS63 (2) GS0 has only pre-charge but no current drive stages. (3) GS1 can be set as only pre-charge but no current drive stage by input gamma setting for GS1 equals 0.
1	A1[7:0]	$A1_7$	$A1_6$	$A1_5$	$A1_4$	$A1_3$	$A1_2$	$A1_1$	$A1_0$		
1	A2[7:0]	$A2_7$	$A2_6$	$A2_5$	$A2_4$	$A2_3$	$A2_2$	$A2_1$	$A2_0$		
1	.	.	.	.	.	.	.	.	.		
1	.	.	.	.	.	.	.	.	.		
1	.	.	.	.	.	.	.	.	.		
1	A62[7:0]	$A62_7$	$A62_6$	$A62_5$	$A62_4$	$A62_3$	$A62_2$	$A62_1$	$A62_0$		
1	A63[7:0]	$A63_7$	$A63_6$	$A63_5$	$A63_4$	$A63_3$	$A63_2$	$A63_1$	$A63_0$		
0	B9	1	0	1	1	1	0	0	1	Use Built-in Linear LUT [reset= linear]	Reset to default Look Up Table: GS1 = 0 DCLK GS2 = 2 DCLK GS3 = 4 DCLK GS4 = 6 DCLK ... GS62 = 122 DCLK GS63 = 124 DCLK
0	BB	1	0	1	1	1	0	1	1	Set Pre-charge voltage	Set pre-charge voltage level.[reset = 17h]
1	A[4:0]	0	0	0	A_4	A_3	A_2	A_1	A_0		

A[4:0]	Hex code	pre-charge voltage
00000	00h	0.20 x V_{CC}
:	:	:
11111	1Fh	0.60 x V_{CC}

Note
(1) This command is locked by Command FDh by default. To unlock it, please refer to Command FDh.

0	BE	1	0	1	1	1	1	1	0	Set V_{COMH} Voltage	Set COM deselect voltage level [reset = 05h]
1	A[2:0]	0	0	0	0	0	A_2	A_1	A_0		

A[2:0]	Hex code	V_{COMH}
000	00h	0.72 x V_{CC}
:	:	:
101	05h	0.82 x V_{CC} [reset]
:	:	:
111	07h	0.86 x V_{CC}

Note
(1) This command is locked by Command FDh by default. To unlock it, please refer to Command FDh.

Fundamental Command Table											
D/C#	**Hex**	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D2**	**D0**	**Command**	**Description**
0	C1	1	1	0	0	0	0	0	1	Set Contrast Current for Color A,B,C	A[7:0] Contrast Value Color A [reset=10001010b] B[7:0] Contrast Value Color B [reset=01010001b] C[7:0] Contrast Value Color C [reset=10001010b]
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
1	B[7:0]	B_7	B_6	B_5	B_4	B_3	B_2	B_1	B_0		
1	C[7:0]	C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0		
0	C7	1	1	0	0	0	1	1	1	Master Contrast Current Control	A[3:0] : 0000b reduce output currents for all colors to 1/16 0001b reduce output currents for all colors to 2/16 .... 1110b reduce output currents for all colors to 15/16 1111b no change [reset]
1	A[3:0]	*	*	*	*	A_3	A_2	A_1	A_0		
0	CA	1	1	0	0	1	0	1	0	Set MUX Ratio	A[6:0] MUX ratio 16MUX ~ 128MUX, [reset=127], (Range from 15 to 127)
1	A[6:0]	0	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
0	D1	1	0	1	0	1	1	0	1	NOP	Command for No Operation
0	E3	1	1	1	0	0	0	1	1	NOP	Command for No Operation
0	FD	1	1	1	1	1	1	0	1	Set Command Lock	A[7:0]: MCU protection status [reset = 12h] A[7:0] = 12b, Unlock OLED driver IC MCU interface from entering command [reset] A[7:0] = 16b, Lock OLED driver IC MCU interface from entering command A[7:0] = B0b, Command A2,B1,B3,BB,BE,C1 inaccessible in both lock and unlock state [reset] A[7:0] = B1b, Command A2,B1,B3,BB,BE,C1 accessible if in unlock state **Note** (1) The locked OLED driver IC MCU interface prohibits all commands and memory access except the FDh command.
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		

Note
(1) "*" stands for "Don't care".

Set (GAC) (D/C# = 0, R/W#(WR#)= 0, E(RD#) = 1) unless specific setting is stated
Single byte command (D/C# = 0), Multiple byte command (D/C# = 0 for first byte, D/C# = 1 for other bytes)

Graphic acceleration command											
D/C#	**Hex**	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D2**	**D0**	**Command**	**Description**
0	96	1	0	0	1	0	1	1	0	Horizontal Scroll	A[7:0] = 00000000b No scrolling A[7:0] = 00000001b to 00111111b Scroll towards SEG127 with 1 column offset A[7:0] = 01000000b to 11111111b Scroll towards SEG0 with 1 column offset B[6:0] : start row address C[7:0] : number of rows to be H-scrolled B+C <= 128 D[6:0] : Reserved (reset=00h) E[1:0] : scrolling time interval 00b test mode 01b normal 10b slow 11b slowest **Note** (1) Operates during display ON.
1	A[7:0]	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0		
1	B[6:0]	0	B_6	B_5	B_4	B_3	B_2	B_1	B_0		
1	C[7:0]	C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0		
1	D[6:0]	0	D_6	D_5	D_4	D_3	D_2	D_1	D_0		
1	E[1:0]	0	0	0	0	0	0	E_1	E_0		
0	9E	1	0	0	1	1	1	1	0	Stop Moving	Stop horizontal scroll **Note** (1) After sending 9Eh command to stop the scrolling action, the ram data needs to be rewritten
0	9F	1	0	0	1	1	1	1	1	Start Moving	Start horizontal scroll

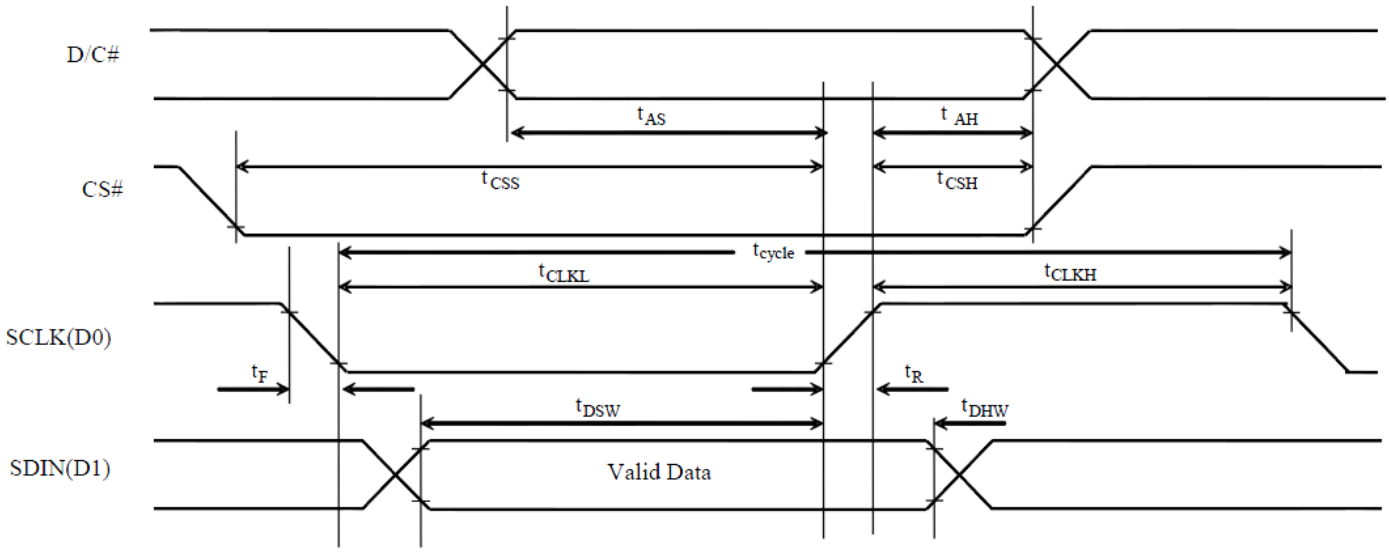
Note
(1) After executed the graphic command, waiting time is required for update GDDRAM content.
V_{CI} =2.4~3.5V, waiting time = 500ns/pixel.

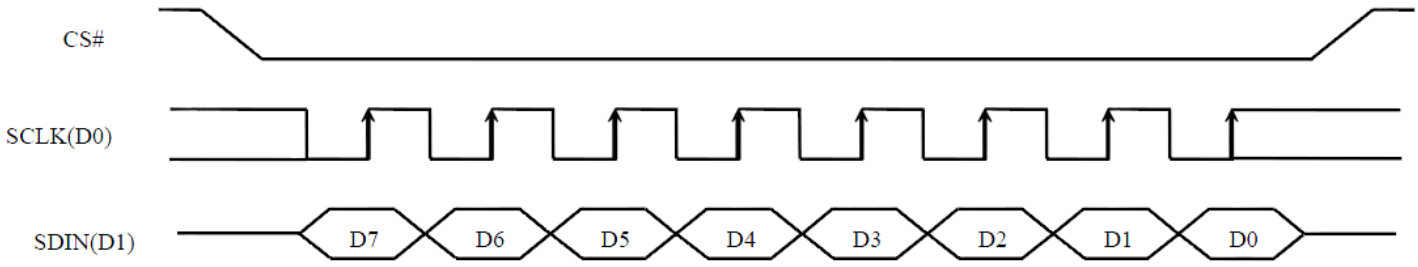
(2) "*" stands for "Don't care".

Timing Characteristics

4-wire SPI:

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	220	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	42	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	10	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	20	-	-	ns
t_{CLKL}	Clock Low Time	20	-	-	ns
t_{CLKH}	Clock High Time	20	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns





Example Initialization Sequence

```
void OLED_Init_12896RGB(void)
{
int i,j;
GPIO_ResetBits(GPIOC, RES);
graphic_delay(500000);
GPIO_SetBits(GPIOC, RES);
graphic_delay(500000);

oled_Command_12896RGB(0xFD);      //Command lock setting
oled_Data_12896RGB(0x12);         //unlock
oled_Command_12896RGB(0xFD);      //Command lock setting
oled_Data_12896RGB(0xB1);         //unlock

oled_Command_12896RGB(0xAE);

oled_Command_12896RGB(0xB3);      //clock & frequency
oled_Data_12896RGB(0xF1);         //clock=Diviser+1 frequency=fh

oled_Command_12896RGB(0xCA);      //Duty
oled_Data_12896RGB(0x7F);         //OLED _END+1

oled_Command_12896RGB(0xA2);      //Display offset
oled_Data_12896RGB(0x00);

oled_Command_12896RGB(0xA1);      //Set display start line
oled_Data_12896RGB(0x00);         //0x00 start line

oled_Command_12896RGB(0xA0);      //Set Re-map, color depth
oled_Data_12896RGB(0xA0);         //8-bit 262K

oled_Command_12896RGB(0xB5);      //set GPIO
oled_Data_12896RGB(0x00);         //disabled

oled_Command_12896RGB(0xAB);      //Function Set
oled_Data_12896RGB(0x01);         //8-bit interface, internal VDD regulator

oled_Command_12896RGB(0xB4);      //set VSL
oled_Data_12896RGB(0xA0);         //external VSL
oled_Data_12896RGB(0xB5);
oled_Data_12896RGB(0x55);

oled_Command_12896RGB(0xC1);      //Set contrast current for A,B,C
oled_Data_12896RGB(0x8a);         //Color A       //8a
oled_Data_12896RGB(0x51);         //Color B       //51
oled_Data_12896RGB(0x8a);         //Color C       //8a

oled_Command_12896RGB(0xC7);      //Set master contrast
oled_Data_12896RGB(0x0F);         //
```

```
oled_Command_12896RGB(0xB9);        //use linear grayscale LUT

oled_Command_12896RGB(0xB1);        //Set pre & dis-charge
oled_Data_12896RGB(0x32);           //pre=1h, dis=1h

oled_Command_12896RGB(0xBB);        //Set precharge voltage of color A,B,C
oled_Data_12896RGB(0x07);           //

oled_Command_12896RGB(0xB2);   //display enhancement
oled_Data_12896RGB(0xa4);
oled_Data_12896RGB(0x00);
oled_Data_12896RGB(0x00);

oled_Command_12896RGB(0xB6);        //precharge period
oled_Data_12896RGB(0x01);

oled_Command_12896RGB(0xBE);        //Set VcomH
oled_Data_12896RGB(0x07);

oled_Command_12896RGB(0xA6);        //Normal display

oled_Command_12896RGB(0x15);        //set column start and end addresses
oled_Data_12896RGB(0x00);     //
oled_Data_12896RGB(0x7F);           //
oled_Command_12896RGB(0x75);        //set row start and end addresses
oled_Data_12896RGB(0x00);           //
oled_Data_12896RGB(0x5F);           //
oled_Command_12896RGB(0x5C);        //write to RAM command

        for(i=0;i<128;i++)
        {
                for(j=0;j<96;j++)
                {
                        oled_Data_12896RGB(0x00);
                        oled_Data_12896RGB(0x00);
                        oled_Data_12896RGB(0x00);
                }
        }
oled_Command_12896RGB(0xAF);        //Display on
}

int oled_12896RGB(void)
{
column = 0x00;
byte1 = 0x00;
byte2 = 0x00;
oled_Command_12896RGB(0x15);        //set column start and end addresses
oled_Data_12896RGB(column);         //
oled_Data_12896RGB(0x7F);           //
```

```
oled_Command_12896RGB(0x75);        //set row start and end addresses
oled_Data_12896RGB(0x00);           //
oled_Data_12896RGB(0x5F);           //
oled_Command_12896RGB(0x5C);        //write to RAM command

for (i=0;i<12288;i++)      //for each 24-bit pixel...128*96=12288
{
        f_read(&File1, &red, 1, &blen);          //read the red 8-bits
        f_read(&File1, &green, 1, &blen);        //read the green 8-bits
        f_read(&File1, &blue, 1, &blen);//read the blue 8-bits

        red = red >> 2;
        green = green >> 2;
        blue = blue >> 2;
        oled_Data_12896RGB(red);
        oled_Data_12896RGB(green);
        oled_Data_12896RGB(blue);

}
//////////////////////////////////////////////////////
```

Example Arduino Code

Please see: https://github.com/NewhavenDisplay/NHD-1.27-12896ASC3_Example

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Test the endurance of the display at high storage temperature.	+80°C , 96hrs	2
Low Temperature storage	Test the endurance of the display at low storage temperature.	-40°C , 96hrs	1,2
High Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature.	+70°C 96hrs	2
Low Temperature Operation	Test the endurance of the display by applying electric stress (voltage & current) at low temperature.	-30°C , 96hrs	1,2
High Temperature / Humidity Operation	Test the endurance of the display by applying electric stress (voltage & current) at high temperature with high humidity.	+60°C , 90% RH , 96hrs	1,2
Thermal Shock resistance	Test the endurance of the display by applying electric stress (voltage & current) during a cycle of low and high temperatures.	-30°C,30min -> 25°C,5min -> 70°C,30min = 1 cycle 100 cycles	
Vibration test	Test the endurance of the display by applying vibration to simulate transportation and use.	10-22Hz , 15mm amplitude. 22-500Hz, 1.5G 30min in each of 3 directions X,Y,Z	3
Atmospheric Pressure test	Test the endurance of the display by applying atmospheric pressure to simulate transportation by air.	115mbar, 40hrs	3
Static electricity test	Test the endurance of the display by applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

Note 1: No condensation to be observed.
Note 2: Conducted after 2 hours of storage at 25°C, 0%RH.
Note 3: Test performed on product itself, not inside a container.
Evaluation Criteria:
1: Display is fully functional during operational tests and after all tests, at room temperature.
2: No observable defects.
3: Luminance >50% of initial value.
4: Current consumption within 50% of initial value

Precautions for using OLEDs/LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms