NHD-1.69-AU-SHIELD

Graphic Color OLED Display Module + Arduino UNO Shield

NHD-	Newhaven Display
1.69-	1.69” Diagonal Size
AU-	Arduino Uno
SHIELD-	Shield

Newhaven Display International, Inc.

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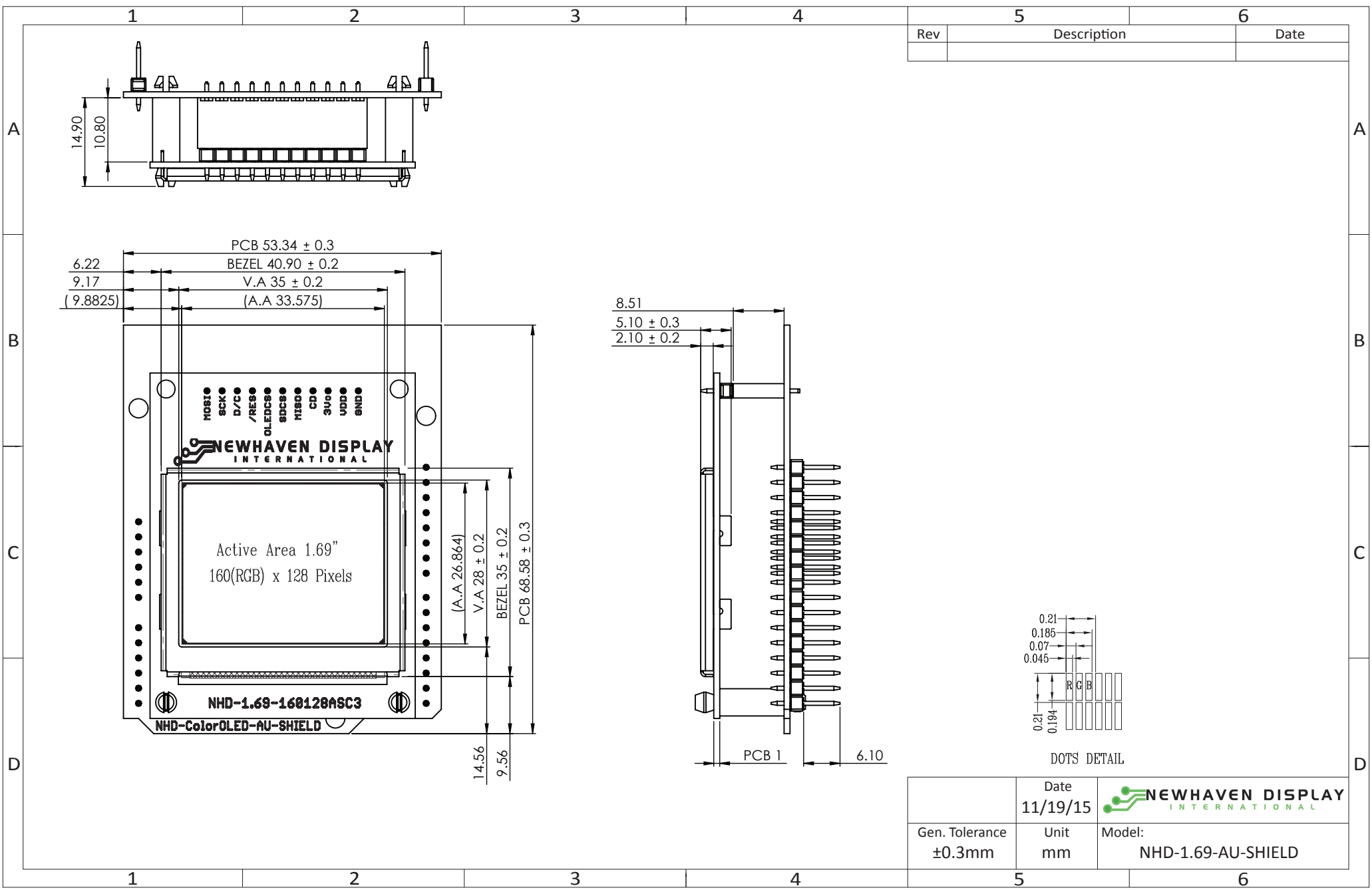
Document Revision History

Revision	Date	Description	Changed by
0	11/19/2015	Initial Release	PB
1	01/11/2016	Functions and Features Updated	PB
2	03/01/2016	Example Initialization Sequence & Schematic Typo Updated	PB

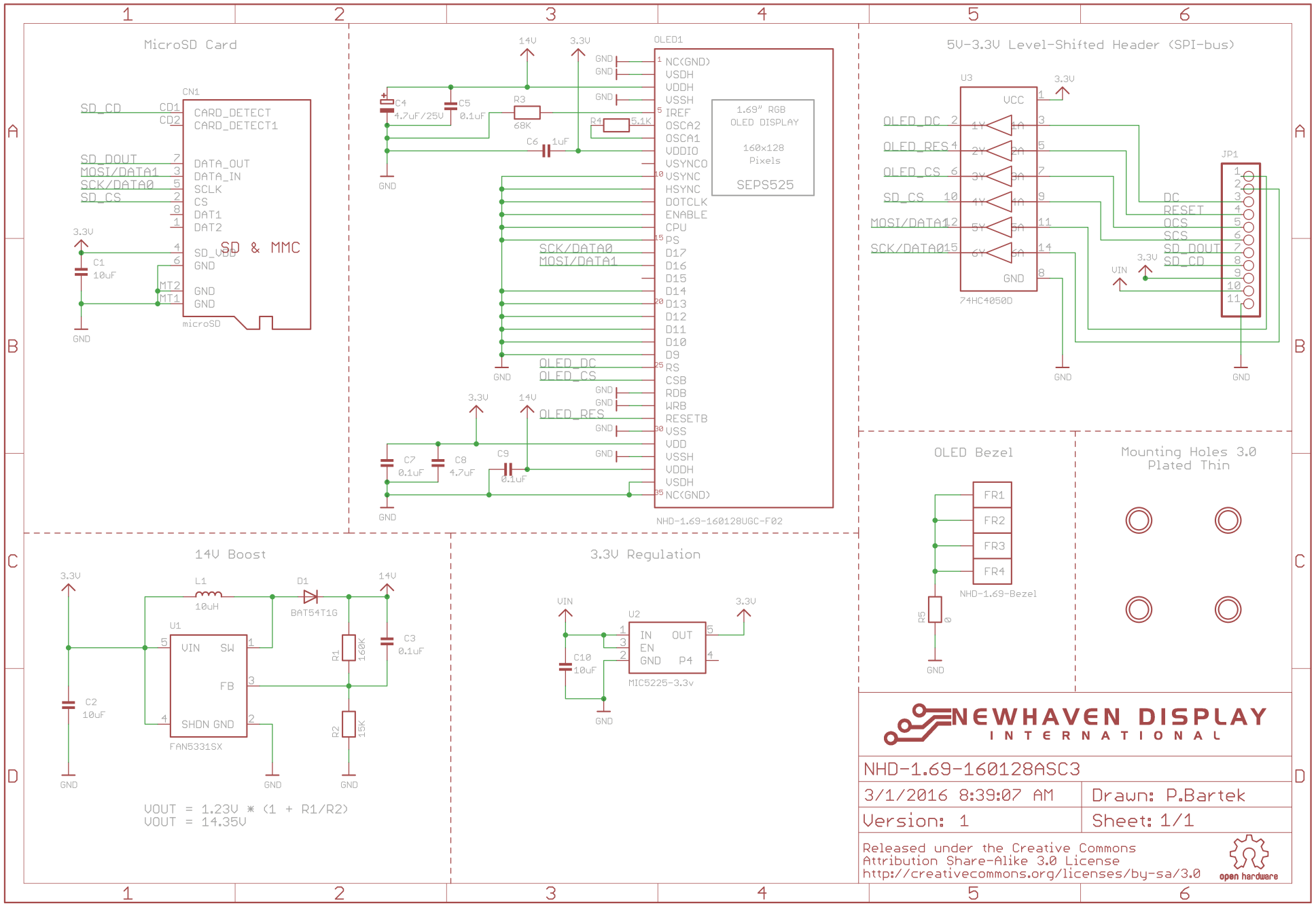
Functions and Features

- **160 x 128 pixel resolution**
- **Built-in SEPS525 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


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 & MMC
SD_VDD
GND
MT2
MT1
microSD
3.3V
C1
10uF
OLED1
NC(GND)
VSDH
VDDH
VSSH
IREF
OSCA2
OSCA1
VDDIO
VSYNCO
VSYNC
HSYNC
DOTCLK
ENABLE
CPU
PS
D17
D16
D15
D14
D13
D12
D11
D10
D9
RS
CSB
RDB
WRB
RESETB
VSS
VDD
VSSH
VDDH
VSDH
NC(GND)
1.69" RGB
OLED DISPLAY
160x128
Pixels
SEPS525
NHD-1.69-160128UGC-F02
14V
C4
4.7uF/25V
C5
0.1uF
R3
68K
R4
5.1K
C6
1uF
SCK/DATA0
MOSI/DATA1
OLED_DC
OLED_CS
OLED_RES
C7
0.1uF
C8
4.7uF
C9
0.1uF
5V-3.3V Level-Shifted Header (SPI-bus)
U3
VCC
74HC4050D
OLED_DC
OLED_RES
OLED_CS
SD_CS
MOSI/DATA1
SCK/DATA0
JP1
DC
RESET
OCS
SCS
SD_DOUT
SD_CD
VIN
OLED Bezel
FR1
FR2
FR3
FR4
NHD-1.69-Bezel
R5
0
Mounting Holes 3.0
Plated Thin
14V Boost
L1
10uH
D1
BAT54T1G
U1
VIN
SW
FB
SHDN
GND
FAN5331SX
R1
160K
R2
15K
C2
10uF
C3
0.1uF
VOUT = 1.23V * (1 + R1/R2)
VOUT = 14.35V
3.3V Regulation
U2
IN
OUT
EN
GND
P4
MIC5225-3.3v
C10
10uF
NEWHAVEN DISPLAY
INTERNATIONAL
NHD-1.69-160128ASC3
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Drawn: P.Bartek
Version: 1
Sheet: 1/1
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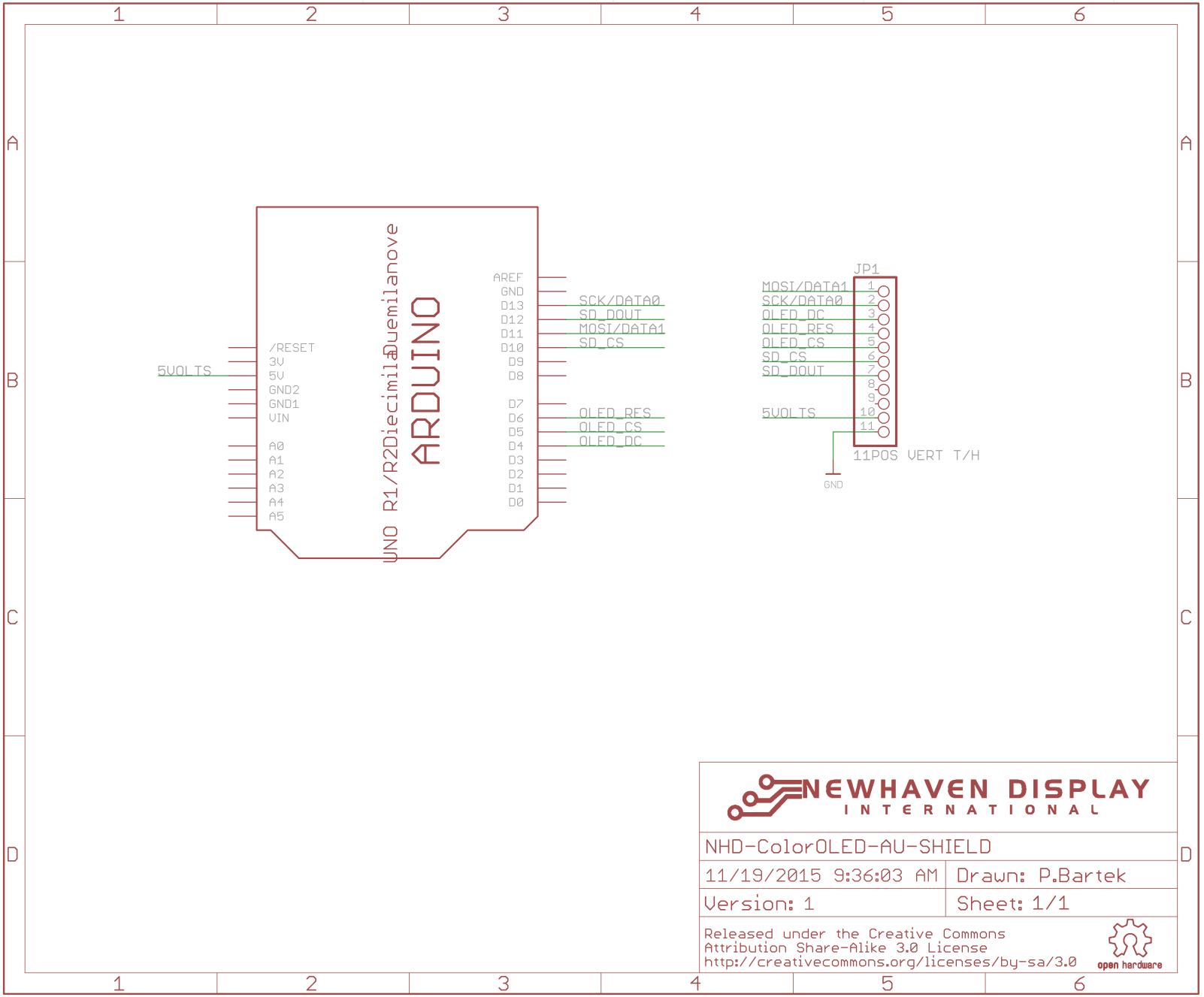
open hardware


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
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Version: 1
Sheet: 1/1
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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		-	95	220	mA
"H" Level input	Vih		0.8*VDD	-	VDD	V
"L" Level input	Vil		0	-	0.4	V
"H" Level output	Voh		VDD-0.4	-	-	V
"L" Level output	Vol		-	-	0.4	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

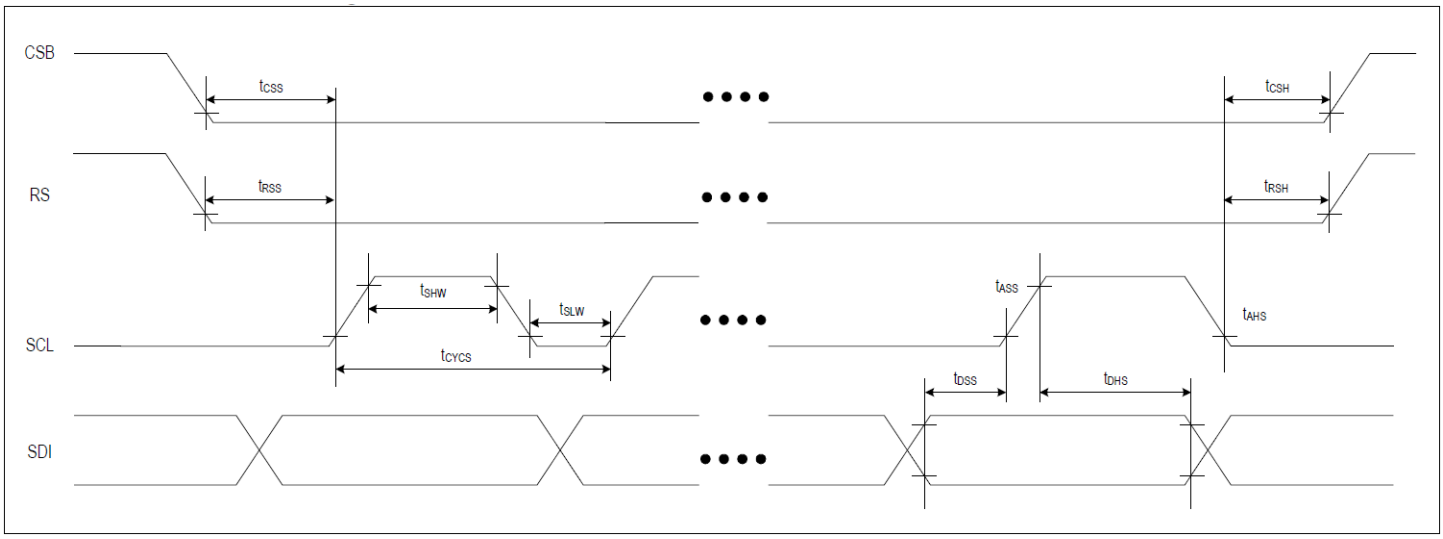
Built-in SEPS525 controller.
Please download specification at www.newhavendisplay.com/app_notes/SEPS525.pdf

Table of Commands

ADDR	RW	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	Description	Default
00h	R	IDX7	IDX6	IDX5	IDX4	IDX3	IDX2	IDX1	IDX0	INDEX	00h
01h	R	HC	VC	HV	SWAP	RD	CD	DC1	DC0	STATUS_RD	C0h
02h	R/W	SELEXP	SELRES	-	-	-	-	SELCLK	OSCDSB	OSC_CTL	C0h
80h	R/W	-	-	-	-	-	-	-	IREF	IREF	00h
03h	R/W	FR3	FR2	FR1	FR0	DFR3	DFR2	DFR1	DFR0	CLOCK_DIV	30h
04h	R/W	-	-	-	-	-	RC	OSCPS	PS	REDUCE_CURRENT	00h
05h	R/W	-	-	-	-	-	-	-	SRN	SOFT_RST	00h
06h	R/W	PREM	-	-	-	-	-	-	DON	DISP_ON_OFF	00h
08h	R/W	-	-	-	-	PTR3	PTR2	PTR1	PTR0	PRECHARGE_TIME_R	00h
09h	R/W	-	-	-	-	PTG3	PTG2	PTG1	PTG0	PRECHARGE_TIME_G	00h
0Ah	R/W	-	-	–	0	PTB3	PTB2	PTB1	PTB0	PRECHARGE_TIME_B	00h
0Bh	R/W	PCR7	PCR6	PCR5	PCR4	PCR3	PCR2	PCR1	PCR0	PRECHARGE_CURRENT_R	00h
0Ch	R/W	PCG7	PCG6	PCG5	PCG4	PCG3	PCG2	PCG1	PCG0	PRECHARGE_CURRENT_G	00h
0Dh	R/W	PCB7	PCB6	PCB5	PCB4	PCB3	PCB2	PCB1	PCB0	PRECHARGE_CURRENT_B	00h
10h	R/W	DCR7	DCR6	DCR5	DCR4	DCR3	DCR2	DCR1	DCR0	DRIVING_CURRENT_R	00h
11h	R/W	DCG7	DCG6	DCG5	DCG4	DCG3	DCG2	DCG1	DCG0	DRIVING_CURRENT_G	00h
12h	R/W	DCB7	DCB6	DCB5	DCB4	DCB3	DCB2	DCB1	DCB0	DRIVING_CURRENT_B	00h
13h	R/W	SWAP	SM	RD	CD	-	SPT	DC1	DC0	DISPLAY_MODE_SET	00h
14h	R/W	-	-	RIM1	RIM0	-	-	-	EIM	RGB_IF	11h
15h	R/W	RES	RES	ENP	DOP	VSYOEN	RES	RES	RES	RGB_POL	00h
16h	R/W	-	DFM1	DFM0	TRI	-	HC	VC	HV	MEMORY_WRITE_MODE	06h
17h	R/W	MX1_7	MX1_6	MX1_5	MX1_4	MX1_3	MX1_2	MX1_1	MX1_0	MX1_ADDR	00h
18h	R/W	MX2_7	MX2_6	MX2_5	MX2_4	MX2_3	MX2_2	MX2_1	MX2_0	MX2_ADDR	9Fh
19h	R/W	MY1_7	MY1_6	MY1_5	MY1_4	MY1_3	MY1_2	MY1_1	MY1_0	MY1_ADDR	00h
1Ah	R/W	MY2_7	MY2_6	MY2_5	MY2_4	MY2_3	MY2_2	MY2_1	MY2_0	MY2_ADDR	7Fh
20h	R/W	MAC7	MAC6	MAC5	MAC4	MAC3	MAC2	MAC1	MAC0	MEMORY_ACCESS_POINTER X	00h
21h	R/W	MAR7	MAR6	MAR5	MAR4	MAR3	MAR2	MAR1	MAR0	MEMORY_ACCESS_POINTER Y	00h
22h		DDRAM[17:0]								DDRAM_DATA_ACCESS_PORT	
50h	R/W	IGAMMA7	IGAMMA6	IGAMMA5	IGAMMA4	IGAMMA3	IGAMMA2	IGAMMA1	IGAMMA0	GRAY_SCALE_TABLE_INDEX	00h
51h	R/W	DGAMMA7	DGAMMA6	DGAMMA5	DGAMMA4	DGAMMA3	DGAMMA2	DGAMMA1	DGAMMA0	GRAY_SCALE_TABLE_DATA	
28h	R/W	DUTY7	DUTY6	DUTY5	DUTY4	DUTY3	DUTY2	DUTY1	DUTY0	DUTY	7Fh
29h	R/W	DSL7	DSL6	DSL5	DSL4	DSL3	DSL2	DSL1	DSL0	DSL	00h
2Eh	R/W	FAC7	FAC6	FAC5	FAC4	FAC3	FAC2	FAC1	FAC0	D1_DDRAM_FAC	00h
2Fh	R/W	FAR7	FAR6	FAR5	FAR4	FAR3	FAR2	FAR1	FAR0	D1_DDRAM_FAR	00h
31h	R/W	SAC7	SAC6	SAC5	SAC4	SAC3	SAC2	SAC1	SAC0	D2_DDRAM_SAC	00h
32h	R/W	SAR7	SAR6	SAR5	SAR4	SAR3	SAR2	SAR1	SAR0	D2_DDRAM_SAR	00h
33h	R/W	FX1_7	FX1_6	FX1_5	FX1_4	FX1_3	FX1_2	FX1_1	FX1_0	SCR1_FX1	00h
34h	R/W	FX2_7	FX2_6	FX2_5	FX2_4	FX2_3	FX2_2	FX2_1	FX2_0	SCR1_FX2	9Fh
35h	R/W	FY1_7	FY1_6	FY1_5	FY1_4	FY1_3	FY1_2	FY1_1	FY1_0	SCR1_FY1	00h
36h	R/W	FY2_7	FY2_6	FY2_5	FY2_4	FY2_3	FY2_2	FY2_1	FY2_0	SCR1_FY2	7Fh
37h	R/W	SX1_7	SX1_6	SX1_5	SX1_4	SX1_3	SX1_2	SX1_1	SX1_0	SCR2_SX1	00h
38h	R/W	SX2_7	SX2_6	SX2_5	SX2_4	SX2_3	SX2_2	SX2_1	SX2_0	SCR2_SX2	9Fh
39h	R/W	SY1_7	SY1_6	SY1_5	SY1_4	SY1_3	SY1_2	SY1_1	SY1_0	SCR2_SY1	00h
3Ah	R/W	SY2_7	SY2_6	SY2_5	SY2_4	SY2_3	SY2_2	SY2_1	SY2_0	SCR2_SY2	7Fh
3Bh	R/W	-	SSA1	SSA0	-	SSC1	SSC0	-	SSM	SCREEN_SAVER_CONTEROL	00h
3Ch	R/W	SST7	SST6	SST5	SST4	SST3	SST2	SST1	SST0	SS_SLEEP_TIMER	00h
3Dh	R/W	-	-	SMS1	SMS0	-	-	SMF1	SMF0	SCREEN_SAVER_MODE	00h
3Eh	R/W	FSUT7	FSUT6	FSUT5	FSUT4	FSUT3	FSUT2	FSUT1	FSUT0	SS_SCR1_FU	00h
3Fh	R/W	-	-	-	-	FSMS3	FSMS2	FSMS1	FSMS0	SS_SCR1_MXY	00h
40h	R/W	SSUT7	SSUT6	SSUT5	SSUT4	SSUT3	SSUT2	SSUT1	SSUT0	SS_SCR2_FU	00h
41h	R/W	SSMS7	SSMS6	SSMS5	SSMS4	SSMS3	SSMS2	SSMS1	SSMS0	SS_SCR2_MXY	00h
42h	R/W	-	-	SSMD1	SSMD0	-	-	-	-	MOVING_DIRECTION	00h
47h	R/W	ISX1_7	ISX1_6	ISX1_5	ISX14	ISX1_3	ISX1_2	ISX1_1	ISX1_0	SS_SCR2_SX1	00h
48h	R/W	ISX2_7	ISX2_6	ISX2_5	ISX2_4	ISX2_3	ISX2_2	ISX2_1	ISX2_0	SS_SCR2_SX2	00h
49h	R/W	ISY1_7	ISY1_6	ISY1_5	ISY1_4	ISY1_3	ISY1_2	ISY1_1	ISY1_0	SS_SCR2_SY1	00h
4Ah	R/W	ISY2_7	ISY2_6	ISY2_5	ISY2_4	ISY2_3	ISY2_2	ISY2_1	ISY2_0	SS_SCR2_SY2	00h

Timing Characteristics

4-wire SPI:



ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Serial clock cycle	t_{CYCS}	-	100	-	ns	SCL
SCL "H" pulse width	t_{SHW}		45		ns	
SCL "L" pulse width	t_{SLW}		45		ns	
Data setup timing	t_{DSS}	-	5	-	ns	SDI
Data hold timing	t_{DHS}		5		ns	
CSB-SCL timing	t_{CSS}	-	5	-	ns	CSB
CSB-hold timing	t_{CSH}		5		ns	
RS-SCL timing	T_{RSS}	-	5	-	ns	RS
RS-hold timing	T_{RSH}		5		ns	

Example Initialization Sequence

```
void OLED_Init_160128RGB(void)
{
   digitalWrite(RES_PIN, LOW);
   delay(2);
   digitalWrite(RES_PIN, HIGH);
   delay(2);

   // display off, analog reset
   OLED_Command_160128RGB(0x04);
   OLED_Data_160128RGB(0x01);
   delay(1);

    // normal mode
   OLED_Command_160128RGB(0x04);
   OLED_Data_160128RGB(0x00);
   delay(1);

   // display off
   OLED_Command_160128RGB(0x06);
   OLED_Data_160128RGB(0x00);
   delay(1);

   // turn on internal oscillator using external resistor
   OLED_Command_160128RGB(0x02);
   OLED_Data_160128RGB(0x01);

   // 90 hz frame rate, divider 0
   OLED_Command_160128RGB(0x03);
   OLED_Data_160128RGB(0x30);

   // duty cycle 127
   OLED_Command_160128RGB(0x28);
   OLED_Data_160128RGB(0x7F);

   // start on line 0
   OLED_Command_160128RGB(0x29);
   OLED_Data_160128RGB(0x00);

   // rgb_if
   OLED_Command_160128RGB(0x14);
   OLED_Data_160128RGB(0x31);

   // Set Memory Write Mode
   OLED_Command_160128RGB(0x16);
   OLED_Data_160128RGB(0x76);
```

```
  // driving current r g b (uA)
  OLED_Command_160128RGB(0x10);
  OLED_Data_160128RGB(0x45);
  OLED_Command_160128RGB(0x11);
  OLED_Data_160128RGB(0x34);
  OLED_Command_160128RGB(0x12);
  OLED_Data_160128RGB(0x33);

  // precharge time r g b
  OLED_Command_160128RGB(0x08);
  OLED_Data_160128RGB(0x04);
  OLED_Command_160128RGB(0x09);
  OLED_Data_160128RGB(0x05);
  OLED_Command_160128RGB(0x0A);
  OLED_Data_160128RGB(0x05);

  // precharge current r g b (uA)
  OLED_Command_160128RGB(0x0B);
  OLED_Data_160128RGB(0x9D);
  OLED_Command_160128RGB(0x0C);
  OLED_Data_160128RGB(0x8C);
  OLED_Command_160128RGB(0x0D);
  OLED_Data_160128RGB(0x57);

  // Set Reference Voltage Controlled by External Resister
  OLED_Command_160128RGB(0x80);
  OLED_Data_160128RGB(0x00);

  // mode set
  OLED_Command_160128RGB(0x13);
  OLED_Data_160128RGB(0xA0);

  OLED_SetColumnAddress_160128RGB(0, 159);
  OLED_SetRowAddress_160128RGB(0, 127);

  // Display On
  OLED_Command_160128RGB(0x06);
  OLED_Data_160128RGB(0x01);
}
```

Example Arduino Code

Please see: https://github.com/NewhavenDisplay/NHD-1.69-160128ASC3_Example

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Test the endurance of the display at high storage temperature.	+800°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

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ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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