BASIC MICRO

TECHNOLOGY AT WORK

BasicATOM Nano Simon Board
Data Sheet

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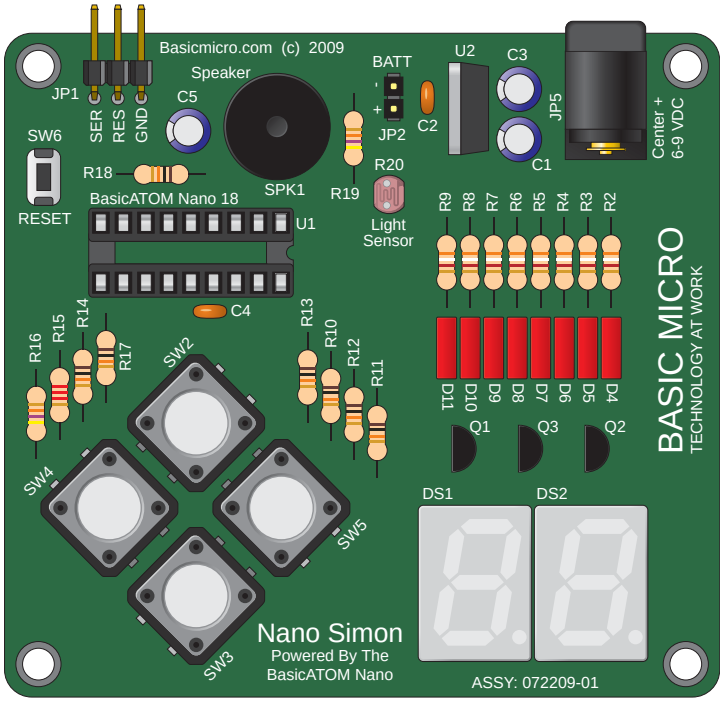
Feature Overview:

- 7 Segment LED Displays
- 1 Speaker
- 4 User Buttons
- 8 LEDs
- Light Sensor
- 2 Pin Battery Connector
- 2.1mm Power Connector
- All Features Pre-wired
- Low Voltage Dropout Regulator
- In-circuit Nano Programming



Basic Description

The BasicATOM Nano Simon is a great platform for beginners or advance users alike. It demonstrates the power of the Nano by controlling several peripherals at once using multiplexed I/O. The Nano Simon makes it easy to experiment with music, light sensing applications, stop watch or even play games as shown in the available demo code.

Nano Simon board is a great way to learn or teach the Nano series by Basic Micro. The Nano Simon demo code has 4 modes built in and demonstrates all the powerful features of the Nano and Nano Simon board.

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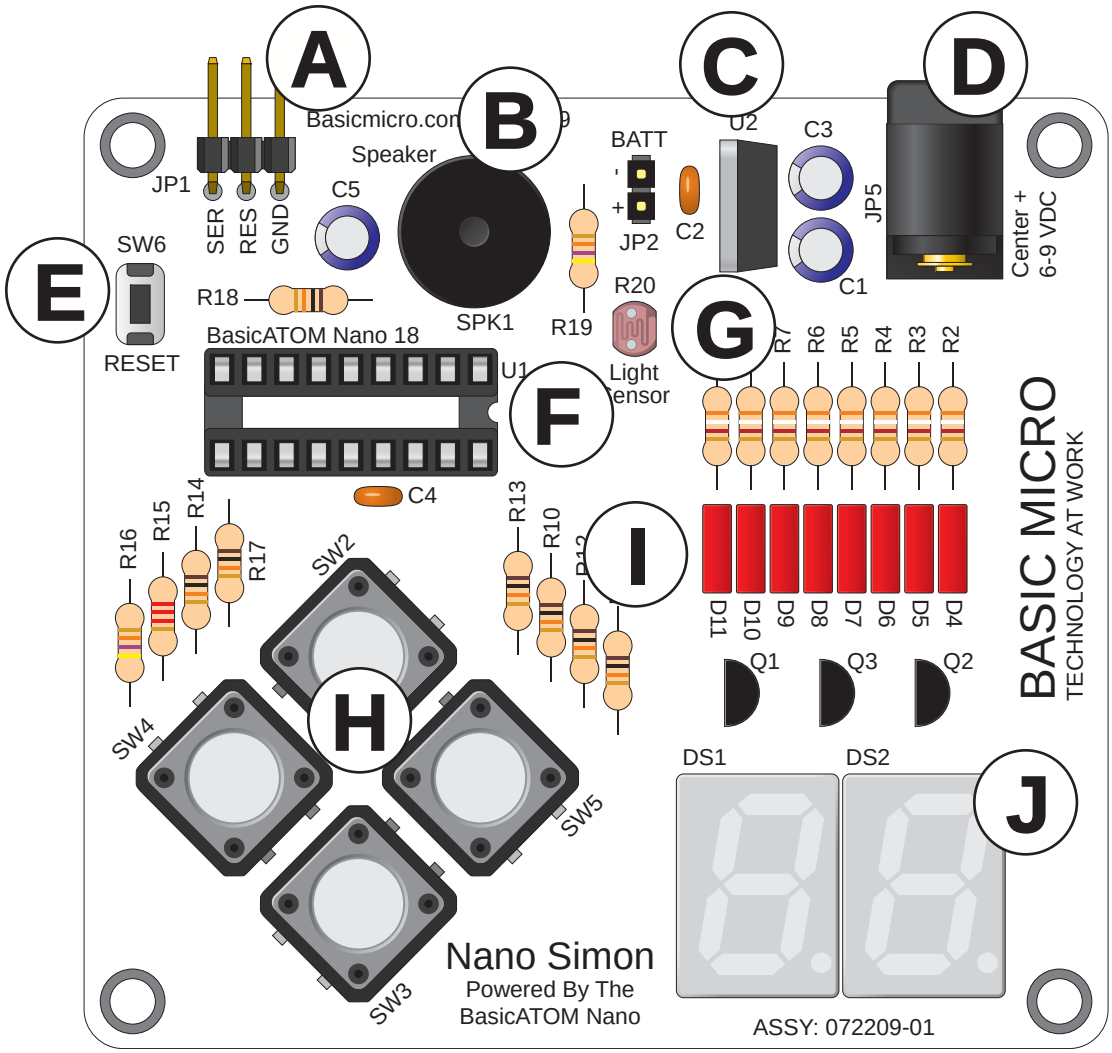
Hardware Overview:



A: 3 Pin in circuit Nano programming header.
B: Speaker.
C: 5VDC Low voltage drop out regulator.
D: 2.1mm center positive power connector.
E: Reset button.
F: 18 Pin Nano socket.
G: Light sensor.
H: 4 user controller buttons.
I: 8 user controlled Red LEDs.
J: 2 Red 7 Segment LEDs.

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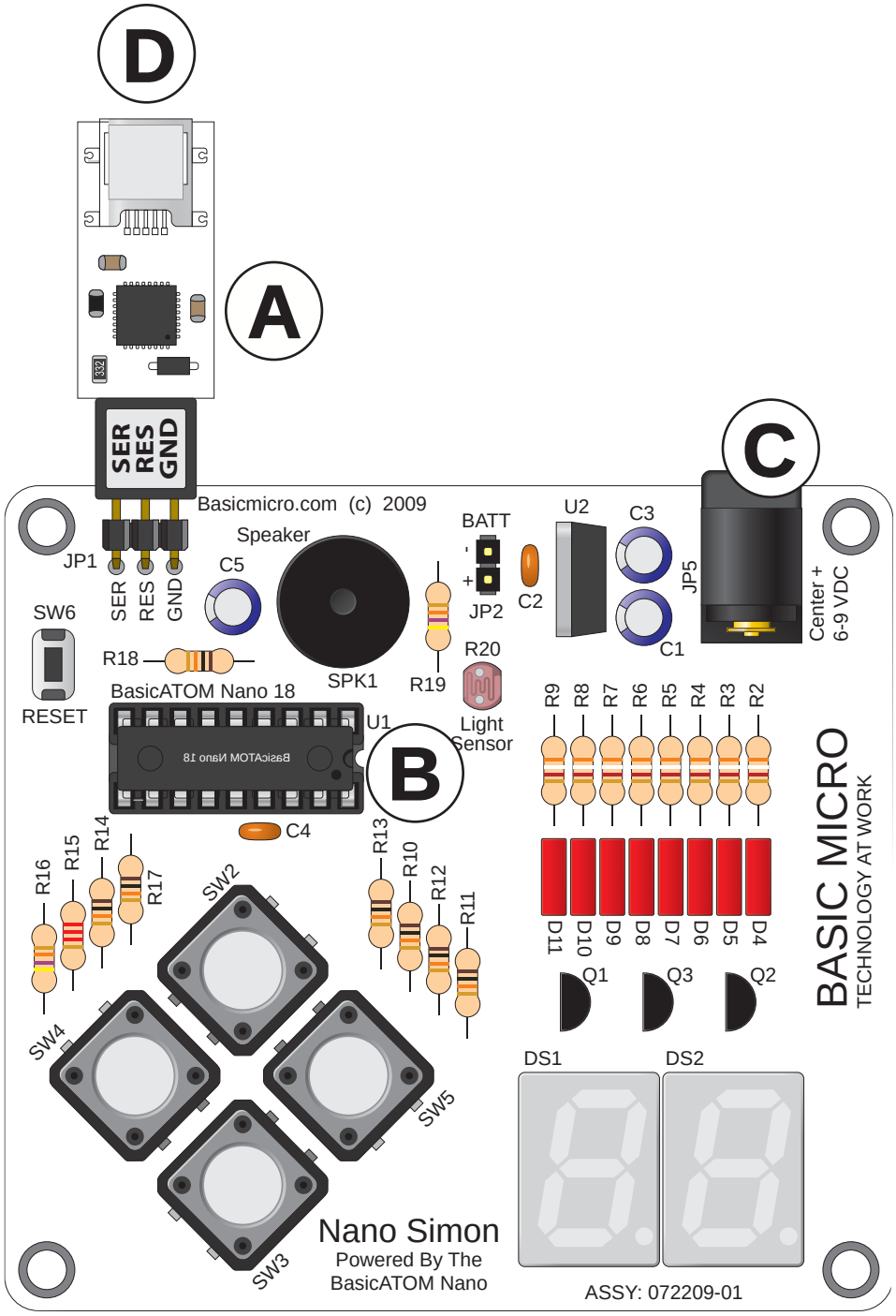
Programming The Nano Simon

Insert a Nano 18 pin chip in the Nano Simon board (B) socket labeled U1. Be careful to note Nano orientation. If Nano is placed in socket backward you will damage it. Insert the USB2Serial adapter as shown (A). Plug power into the 2.1mm power jack (C). Then plug a miniB USB cable (D). Plug the other end of the USB cable into your pc. You will need to download the USB2Serial adapter drivers from the Basic Micro web site. To program the Nano you will need to download Basic Micro Studio software from the Basic Micro web site.



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LEDs

The LEDs are multiplexed with the 7 segment displays. The controlling I/O are shared between the 8 LED bar graph and the 7 segment displays. The commons (GND) are controlled but the transistors Q1, Q2 and Q3. Setting P13 high you can address any of the 8 LEDs. The pin outs for each LED are as follows:

P7 = D4
P6 = D5
P5 = D6
P4 = D7
P3 = D8
P2 = D9
P1 = D10
P0 = D11

The program below shows how to blink one LED. You can change which LED is blinking by replacing P7 with the pin name that points at the LED you want to blink from the list above. More advanced programs are available for download at basicmicro.com.

```
;Start Program

Low P8          ;Disables 7 segment 1
Low P9          ;Disables 7 segment 2
High P13        ;Enables 8 LED Bar Graph

Main
        High P7         ;Turn LED D4 on
        Pause 300       ;Wait here 300 milliseconds
        Low P7          ;Turn LED D4 off
        Pause 300       ;Wait here 300 milliseconds
Goto Main               ;Repeat forever
```

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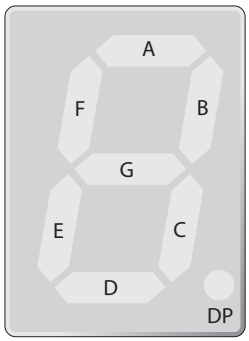
7 Segment LEDs

The 7 segment LEDs are controlled by the same I/O as the standard LEDs on the Nano Simon Board. The commons (GND) of each 7 segments are controlled by P8 for DS1 and P9 for DS2. Each segment of the display is labeled A to G and DP for the decimal point. The table shows what I/O pin is used to control each segment.

DS1:	DS2:
P8 = ON/OFF	P9 = ON/OFF
P7= A	P7 = A
P6 = B	P6 = B
P5 = C	P5 = C
P4 = D	P4 = D
P3 = E	P3 = E
P2 = F	P2 = F
P1 = G	P1 = G
P0 = DP	P0 = DP



To display numbers 0 to 9 on each segment use the following table. Each string represents all 8 pins of the port P7 to P0. The strings are read from left to right. 1's mean the pin is high and 0's mean the pin is low.

```
OUTL = %11111100 ;Display Number 0
OUTL = %01100000 ;Display Number 1
OUTL = %11011010 ;Display Number 2
OUTL = %11110010 ;Display Number 3
OUTL = %01100110 ;Display Number 4
OUTL = %10110110 ;Display Number 5
OUTL = %10111110 ;Display Number 6
OUTL = %11100000 ;Display Number 7
OUTL = %11111110 ;Display Number 8
OUTL = %11100110 ;Display Number 9
OUTL = %00000001 ;Display Decimal Point
```

The following program will display a 0 on each 7 segment display, rotating between the two on board displays.

```
;Start Program

DIRL = 0x00  ;set port pins to outputs
OUTL = 0x00  ;set all pins off

Low P8       ;7 segment 1
Low P9       ;7 segment 2
Low P13      ;8 LED Bar Graph

Main
      High P8                ;Turn ON 7segment DS1
      OUTL = %11111100       ;Display 0
      Pause 300
      Low P8                 ;Turn OFF 7 segment DS1
      High P9                ;Turn ON 7 segment DS2
      OUTL = %11111100       ;Display 0
      Pause 300
      Low P9                 ;Turn OFF 7 segment DS2
Goto Main                    ;Repeat forever
```

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To display a number on both displays at the same time you need to use a technique called persistence of vision. The Nano can only control one display at a time. We can trick your eye into seeing all three displays on at the same time by turning each on for a brief period of time and rotating between all 3 displays very quickly. To achieve this on a microcontroller we need to use interrupts. Interrupts allow the microcontroller to perform multiple tasks by time slicing. Interrupts for the Nano are done in assembly. You can easily modify the available sample code to suit your own needs without touching the Assembly code in the program. The program is available for download at basicmicro.com.

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Tactile Switches

The Nano Simon buttons are read by an analog pin (P10). Each button has a unique value resistor which is part of a resistor divider circuit. When a button is pressed it changes the voltage presented on P10. Each button is identified by the unique voltage generated.

The following program demonstrates how to determine which button was pressed. It use 4 conditional statements. In each conditional statement two comparisons are made for each button. This gives us a range. This is due to resistors having a tolerance of 1% to 5% typically. No two resistors will always be alike. This will cause the voltage to vary slightly for every board. So we compensate in code.

```
;Start Program

Pressed var word      ;Setup a word sized variable

DIRL = 0x00           ;set data port pins as outputs
OUTL = 0x00           ;set all graph LEDs off

High P8               ;Turns Display 1 ON
Low P9                ;Turns Display 2 OFF
low P13               ;Turns all 8 LEDs OFF

OUTL = %11111100 ;Display 0 on DS1

Main
      adin p10,Pressed
            if pressed >= 70 and pressed <=125 then UpBtn        ;Typically 93
            if pressed >= 140 and pressed <=250 then DownBtn     ;Typically 184
            if pressed >= 290 and pressed <=360 then LeftBtn     ;Typically 325
            if pressed >= 450 and pressed <=600 then RightBtn    ;Typically 510
      Goto Main

UpBtn
      OUTL = %01100000 ;Display 1 on DS1
            sound p12,[100\784,100\1047,100\1319,100\1568]
      Goto Main

DownBtn
      OUTL = %11110010 ;Display 3 on DS1
            sound p12,[100\100,100\784,100\510,100\600]
      Goto Main

LeftBtn
      OUTL = %01100110 ;Display 4 on DS1
            sound p12,[100\2000,100\1047,100\700,100\450]
      Goto Main

RightBtn
      OUTL = %11011010 ;Display 2 on DS1
            sound p12,[100\3000,100\2047,100\1319,100\100]
      Goto Main
```

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Light Sensor

The light sensor is read by one of the Nano,s analog pins. The light sensor works by changing resistance based on the amount of light it receives. The light sensor is connected using a resistor divider circuit. As the light increases the voltages changes at the Nano's analog pin.

The following program demonstrates how to read the light sensor.

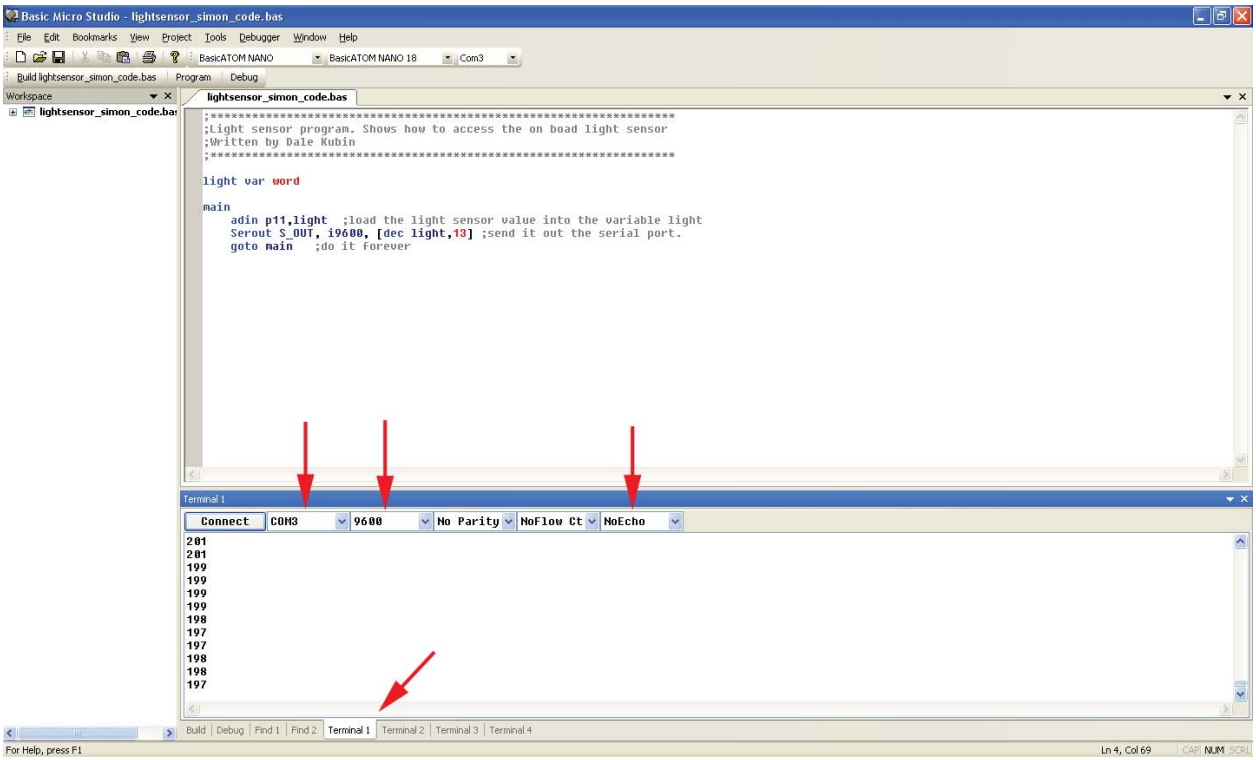
```
;Start Program

light var word

main
        adin p11,light                          ;load the sensor value into the variable light
        Serout S_OUT, i9600, [dec light,13]     ;send it out the serial port.
goto main                                       ;do it forever
```

Terminal Window

After programming the Nano Simon with the code above you can use Studio's built-in terminal window. Select terminal 1 tab at the bottom of the IDE. Set it to the COM port the programmer is connected to. Then select the Baud rate. Set the "Echo" option to "NoEcho"



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Speaker

The Nano Simon's speaker is connected to a Nano hardware pulse width pin. This allows the Nano to create sound in the background while performing other tasks.

Here is a simple program that will play "Mary Had a Little Lamb". The first part of the program sets up the notes. Instead of using raw numbers which would be difficult to remember what number generated a given note, we use a simple constant define list. To play through the notes we use a FOR/NEXT loop and the LOOKUP command to play each note.

```
;Start Program

AH con 440*2        ;assigns a value for the note and octave
AS con 466*2        ;the note is 466*2 = A sharp second octave
BH con 494*2
CH con 523*2
CS con 554*2
DH con 587*2
DS con 622*2
EH con 659*2
FH con 698*2
FS con 740*2
GH con 784*2
GS con 831*2

Position var byte
Note var long

Playsong
      for Position = 0 to 33
            lookup Position,[CS,BH,AH,BH,CS,0,CS,0,CS,BH,0,BH,0,BH,0,CS,|
                        EH, 0, EH,CS,BH,AH,BH,CS,0,CS,0,CS,BH,0,BH,CS,BH,AH],Note
            if Note then
                  sound p12,[350\Note]
            else
                  pause 10
            endif
      next
      pause 5000
      goto playsong
```

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Full Nano Simon Game Program

Download the Nano Simon game code from the Basic Micro web site in the Nano Simon product page. After programming the Nano 18 with the demo code remove the USB2Serial programmer and reset the Simon board by pressing the reset button (SW6). There are 4 modes in the demo code. You can change to a new mode by pressing the reset button and selecting one of the 4 buttons. To start mode 1, press button 1 and so on.

Program Menu

Mode 1 = Simple game called Simon. The 2 displays are broken into 4 parts. Top, Left, Bottom, Right. As each part illuminates press the corresponding button. The 8 LEDs indicate the Level.

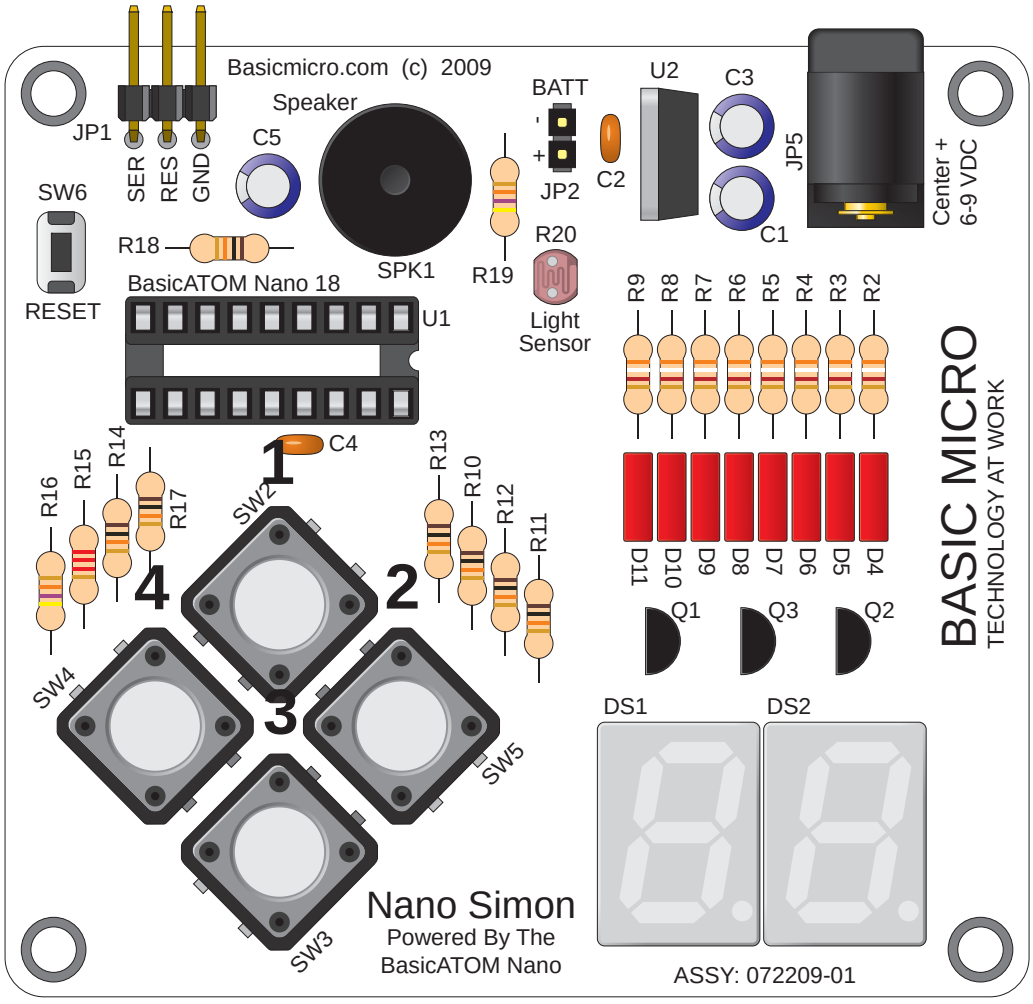
Mode 2 = Demonstrates the light sensor. Cover the light sensor and see the value displayed change.

Mode 3 = Plays a song.

Mode 4 = Knight Rider style led display.

Demo Video

In the Nano Simon product listing at the basicmicro.com website there is a demo video you can watch to discover all the features of the main demo program.



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Electrical Characteristics

Characteristic	Value (Units)
VIN Range (min - max)	6 – 9VDC
Current Draw (Idle)	50 mA
Current Draw (Max)	600 mA

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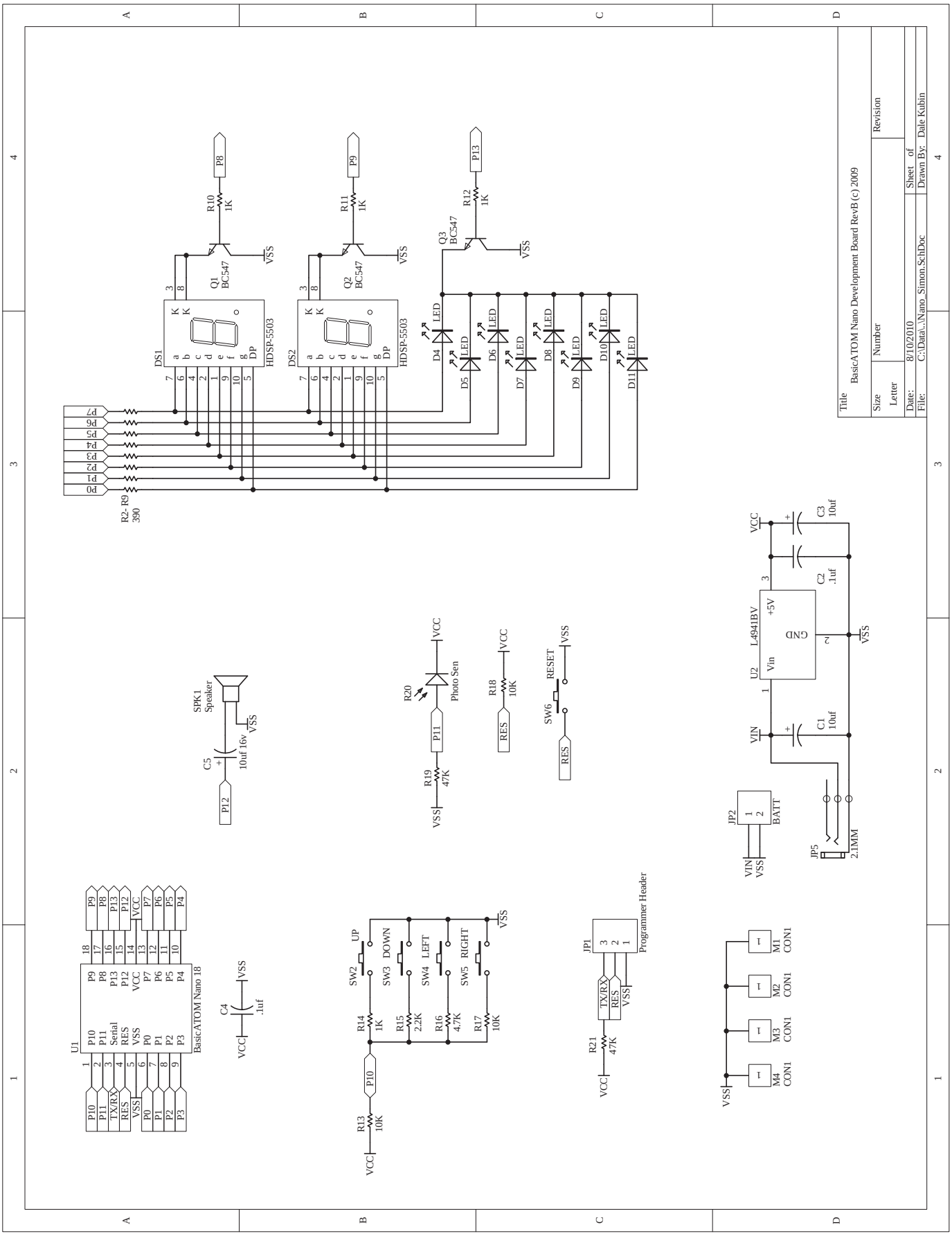

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Contacts

Email: sales@basicmicro.com
Tech support: support@basicmicro.com
Web: http://www.basicmicro.com

Discussion List

A web based discussion board is maintained at http://www.fourms.basicmicro.net.

Technical Support

Technical support is made available by sending an email to support@basicmicro.com. All email will be answered within 48 hours. All general syntax and programming questions, unless deemed to be a software issue, will be referred to the on-line discussion forums.

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