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Development tools - Books - Compilers

EasyAVR3 Users Manual



with on board

USB

2.0 programmer

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Software and Hardware
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October 2005**

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CONNECTING THE SYSTEM

The development system box contains a development system, CD, USB cable and serial cable.

- Step no.1** The first thing to do is to take the system out of a box. Unpack the USB cable and connect it to the PC. Please use USB ports from the back of the PC, with direct contact to the motherboard.
- Step no.2** Connect the USB cable to the EasyAVR3 board.
- Step no.3** The PC will start the procedure for installing the USB driver for the on-board USB 2.0 programmer. Follow the procedure from the document ‘*Installing Driver for USB programmer*’ and install the USB driver.
- Step no.4** Copy AVRprog.exe file to the folder of your choice. You can find this file in the AVRPROG folder on the CD.
- Step no.5** Run and use AVRPROG as explained in the document ‘*AVRprog programmer*’.

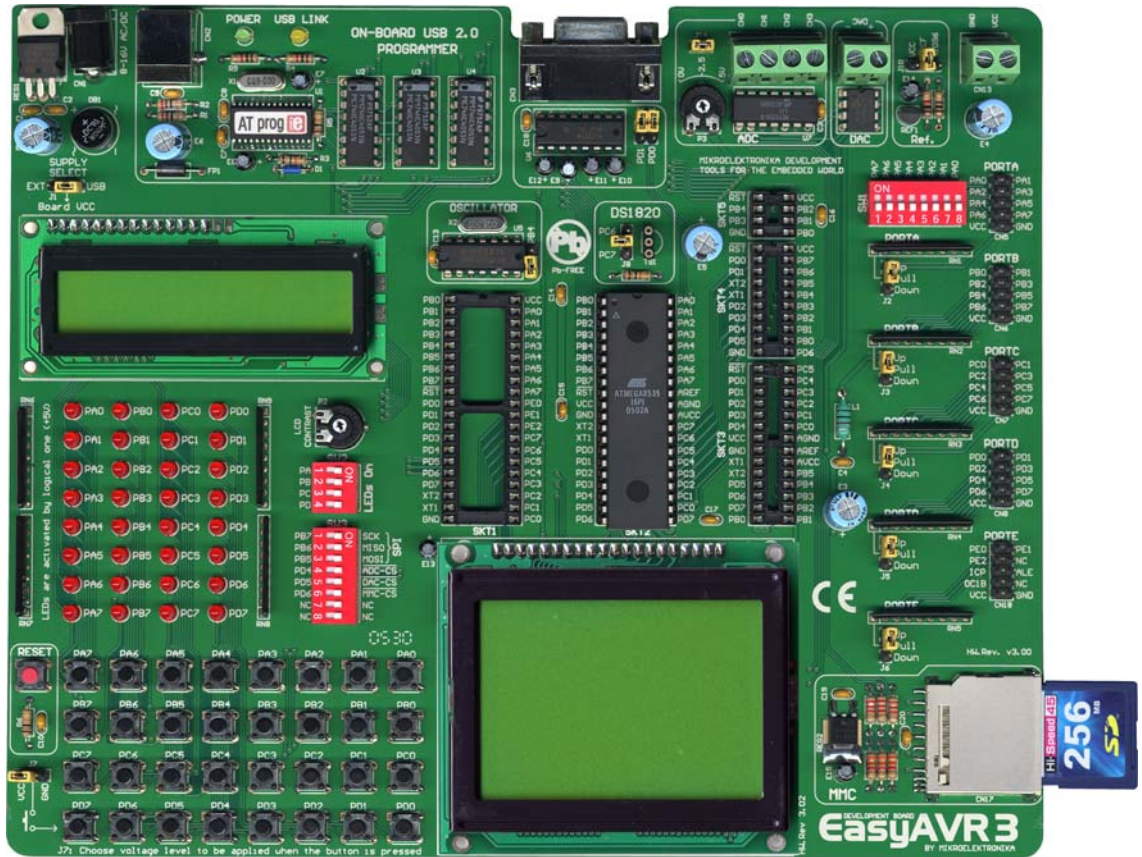
After these 5 steps, your EasyAVR3 is installed and ready for use. You should try to read a program from the chip or to load an example from the examples folder.

INTRODUCTION

The EasyAVR3 development system is a full-featured development board for Atmel AVR microcontrollers. It has been designed to allow students and engineers to easily exercise and explore the capabilities of AVR microcontrollers. It allows AVR microcontrollers to be interfaced with external circuits and a broad range of peripheral devices, allowing the user to concentrate on software development.

Figure 1 illustrates the development board. On a silkscreen, there are identification marks beside each component. These marks describe connections to the microcontroller, operation modes, and provide some useful notes. The need for additional schematics is minimized as all the information is printed on the board.

Figure 1.



SWITCHES

The EasyAVR3 development board features many peripheral devices. In order to enable these devices before programming, you need to check if appropriate jumpers or switches have been properly set.

Switches are devices that have two positions - ON and OFF, which have a role to establish or break a connection between two contacts. The EasyAVR3 development system has three groups of switches.

The first group, **SW1**, enables a connection between the microcontroller ports with external pull-up/down resistors. When port PA pins are used as digital inputs/outputs, the appropriate pull-up/down resistors should be enabled.

The switches of **SW2** are used to enable LEDs connected to ports PA, PB, PC, PD. For example, if switch PB is OFF, all PB LED's will be turned off.

The switches of **SW3**, enables a connection between the microcontroller ports and ADC, DAC, and MMC(SD) via SPI communication. First three switches are used by SPI comm. (SCK, MISO, MOSI), Second three switches are used for CS (chip selection), you can select what chip do you want to use (ADC, DAC, and MMC(SD)). Last two switches are not used.

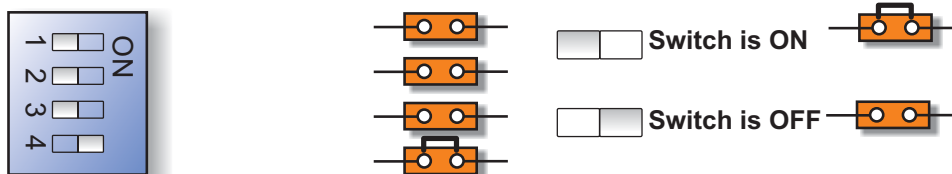


Figure 2. Group of 4 switches

Switch 4 is ON, and other switches are OFF

JUMPERS

Jumpers, like switches, can break or establish a connection between two points. Beneath the plastic cover of the jumper is a metal contact, which makes a connection when the jumper is placed between two disconnected pins.

For example J16 are used to connect or disconnect potentiometer for analog input. Connection is made when the jumper is placed between two contacts.

Figure 3.

Jumper as a switch



Jumper is ON



Jumper is OFF



More often, jumpers are used as a selector between two possible connections using a three pin connector. As illustrated in Fig. 4, middle connector can be connected to the left or right pin, depending on the jumper's position.

Figure 4.

Jumper as a multiplexer



All lines are disconnected



Left line is selected



Right line is selected



MCU SOCKETS

The EasyAVR3 is delivered with a 40-pin microcontroller. Users can remove this, and fit a different microcontroller DIP40, DIP28, DIP20, or DIP8 packages of an adequate pin-out.

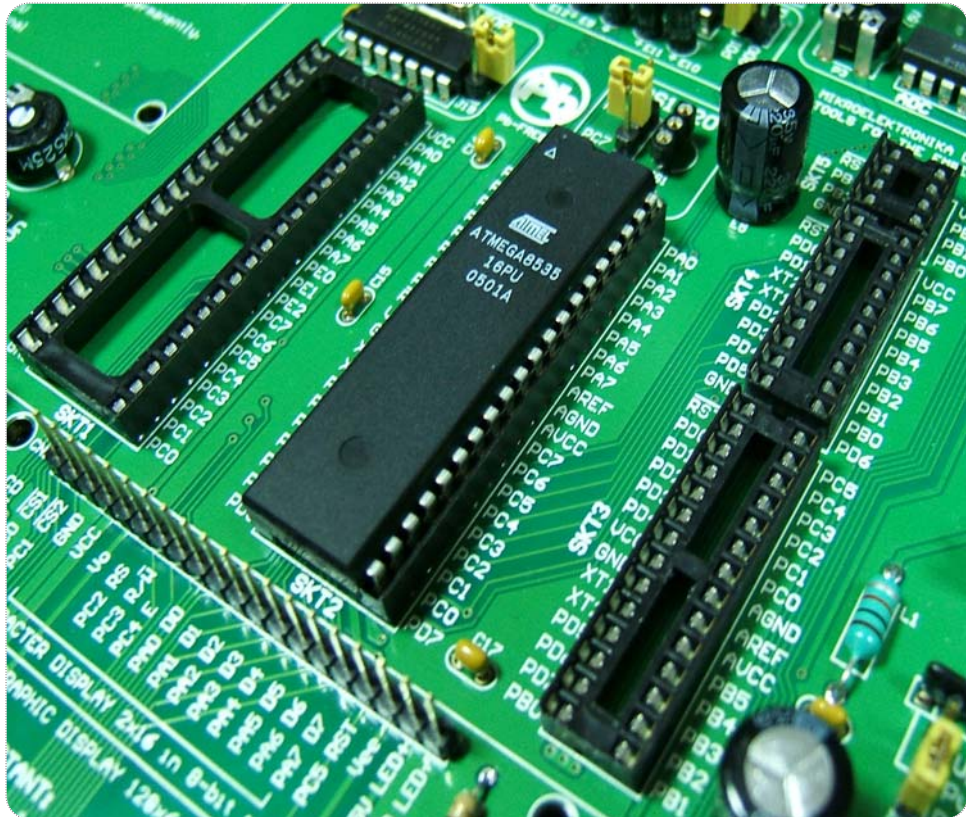


Figure 5.

MCU sockets

NOTE: Since all packages have parallel connections, there must not be more than one microcontroller on the board at a time.

The microcontroller's pins are routed to various peripherals as is illustrated in Fig.6. All ports have direct connections to Direct Port Access connectors. Such connectors are typically used for connecting external peripherals to the board, or for providing useful points for connecting digital logic probes.

All ports are connected to LEDs, pushbutton switches and pull-up/down resistors, which allow for easy digital pin state monitoring and testing.

Some of the pins are connected to other peripherals such as the DS1820 temperature sensor, RS-232 communication, 7-segment displays, LCD, etc.

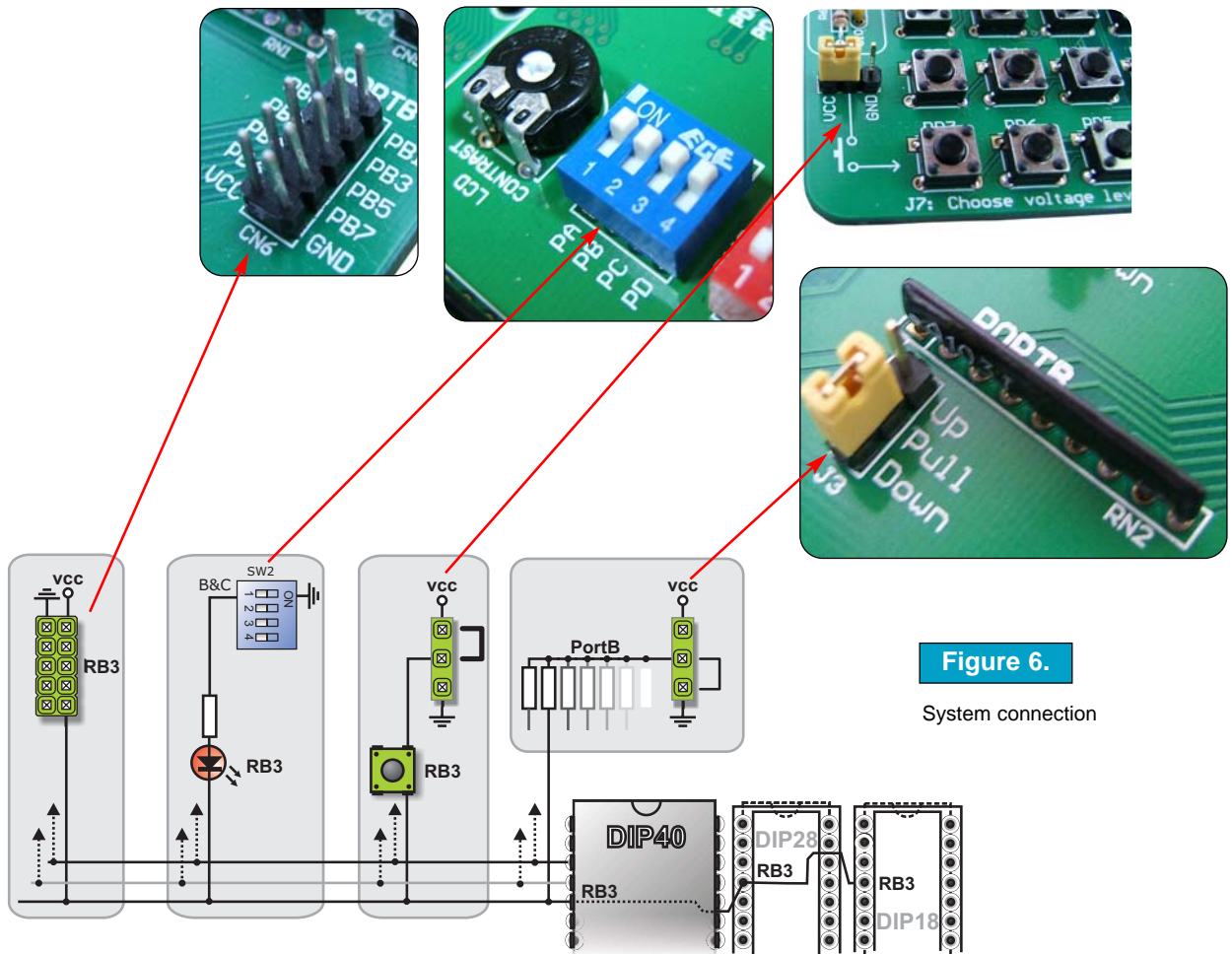


Figure 6.

System connection

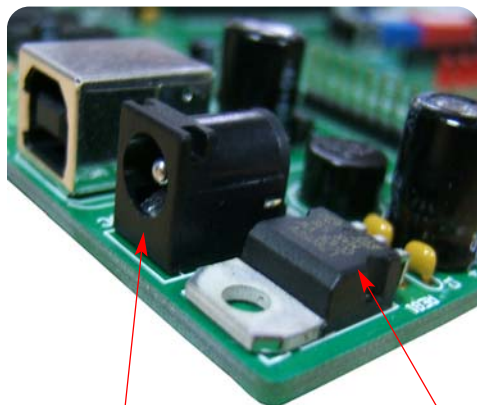
POWER SUPPLY

As a power supply source, users can select either a regulated supply from USB cable (default) or an external non-regulated power supply.

In the case of the USB power supply, the system should be connected to a PC using the USB programming cable and jumper JP1 should be set in the right-hand position.

In case of an external power supply, the EasyAVR3 board produces +5V using an LM7805 voltage regulator. The external power supply can be AC or DC, with a voltage between 9V and 16V, and jumper JP1 should be set in the left-hand position. In Fig. 8 you can see the USB (left) and power supply (right) connectors.

Figure 7. USB and power supply connectors



JP1 in the left position: system will take power from the external AC/DC power adapter.

JP1 in the right position: system will take power from the USB cable.

Figure 8. Power supply select jumper

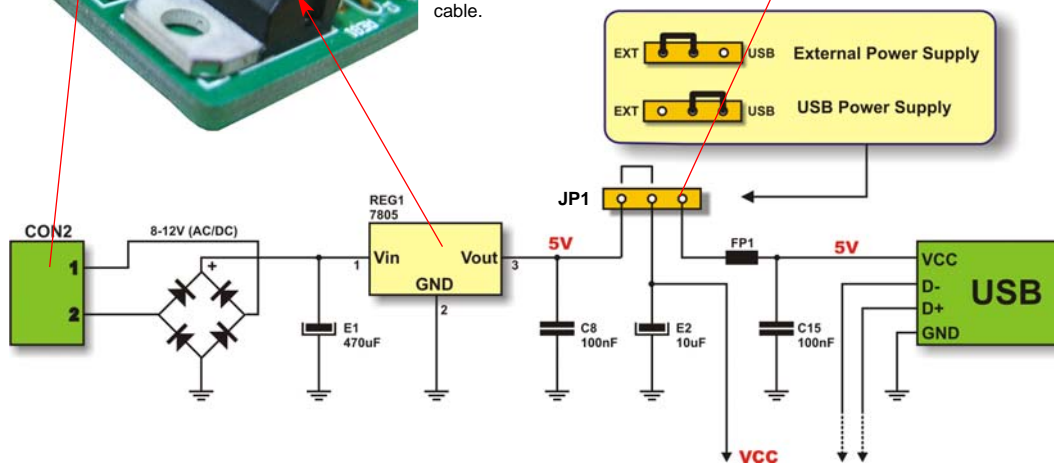
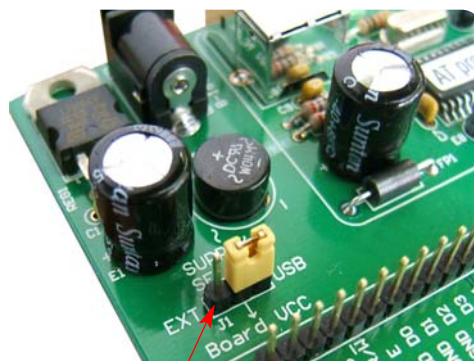


Figure 5. JP1 is set to USB power supply

ON-BOARD USB PROGRAMMER

There is no need for the use of external equipment during programming, as the EasyAVR3 development system has its own on-board USB programmer.

All you need to do is connect the system to a PC using the USB cable. Then, load your program into the microcontroller via the *AVRprog* programming software, which is supplied with the board.

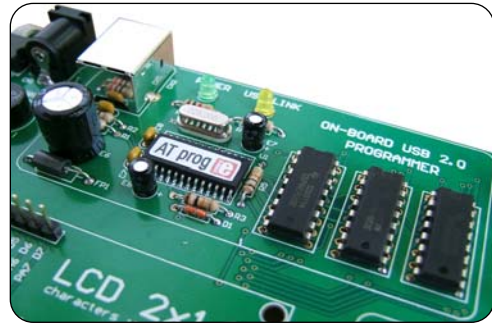


Figure 9. On-Board USB programmer

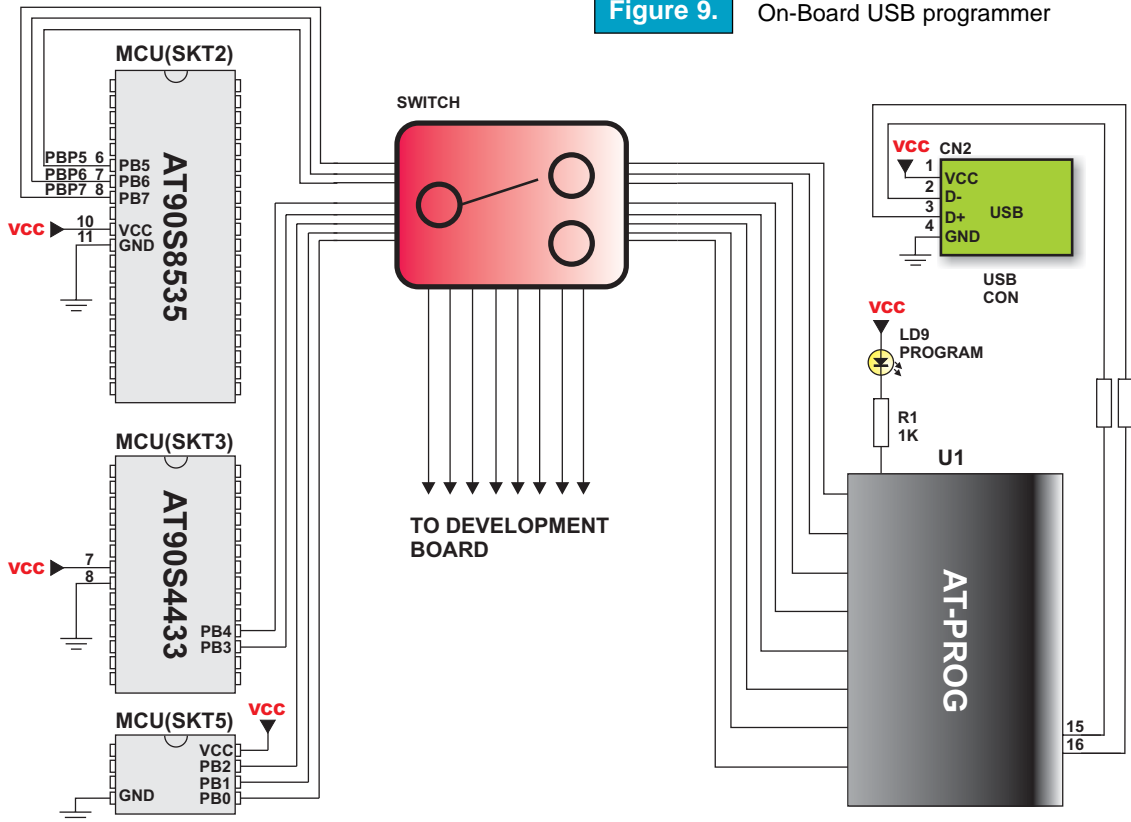
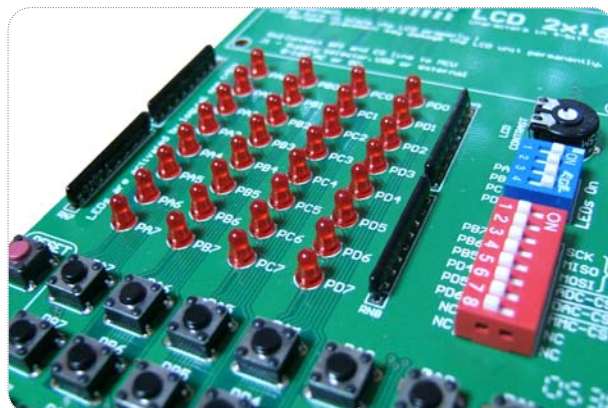


Figure 10. Switch scheme

LIGHT EMITTING DIODES

Light Emitting Diodes (LEDs) are the most commonly used components, usually for displaying pins' digital states. The EasyAVR3 has 32 LEDs that are connected to the microcontroller's ports PA, PB, PC and PD.



Each group of eight LEDs can be enabled or disabled using switch SW2, as shown in Fig. 12.

Figure 11.

Light Emitting Diodes

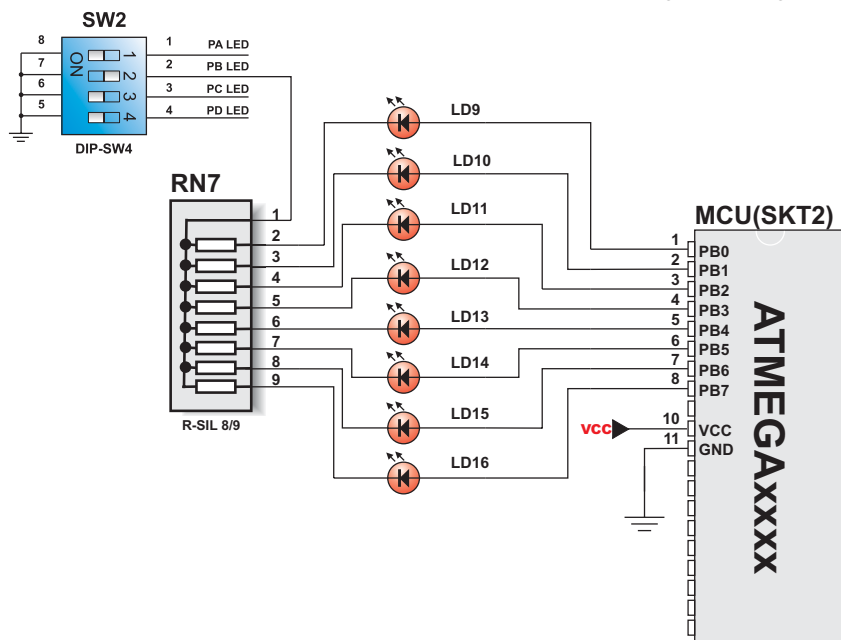


Figure 12. LED schematic

Fig. 12. illustrates the connection of a LEDs to PORTB of the microcontroller. A resistor is used in series with the LED to limit the LED's current (1-10mA). In this case the resistor's value is 1K.

All eight LEDs from one port are connected to a common point through these resistors, which can then be connected or disconnected to ground by the corresponding switch on SW2. The LEDs are enabled when connected to ground and will display the state of the corresponding microcontroller pin; otherwise the LEDs will always be off, no matter what the port state is as no current can flow through it.

PUSHBUTTON SWITCHES

The EasyAVR3 has 32 push button switches, which can be used to provide digital inputs to the microcontroller's ports. There is also one switch that acts as a RESET.

Switch connections to ports PA, PB, PC and PD are shown in Fig. 14. Jumper J7 determines whether a button press will bring logical zero or logical one to the appropriate pin. In the example shown in Fig. 14, the switches are connected to +5V. In order to detect a switch state, pull-up or pull-down resistors should be used. Which is used depends on how J7 is set and is illustrated on the next page. For the example shown in Fig. 14, pull-down resistors would be required.

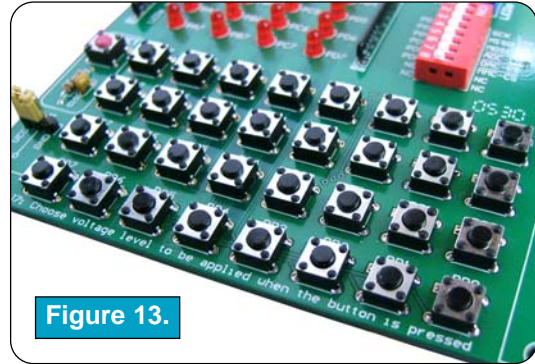


Figure 13.

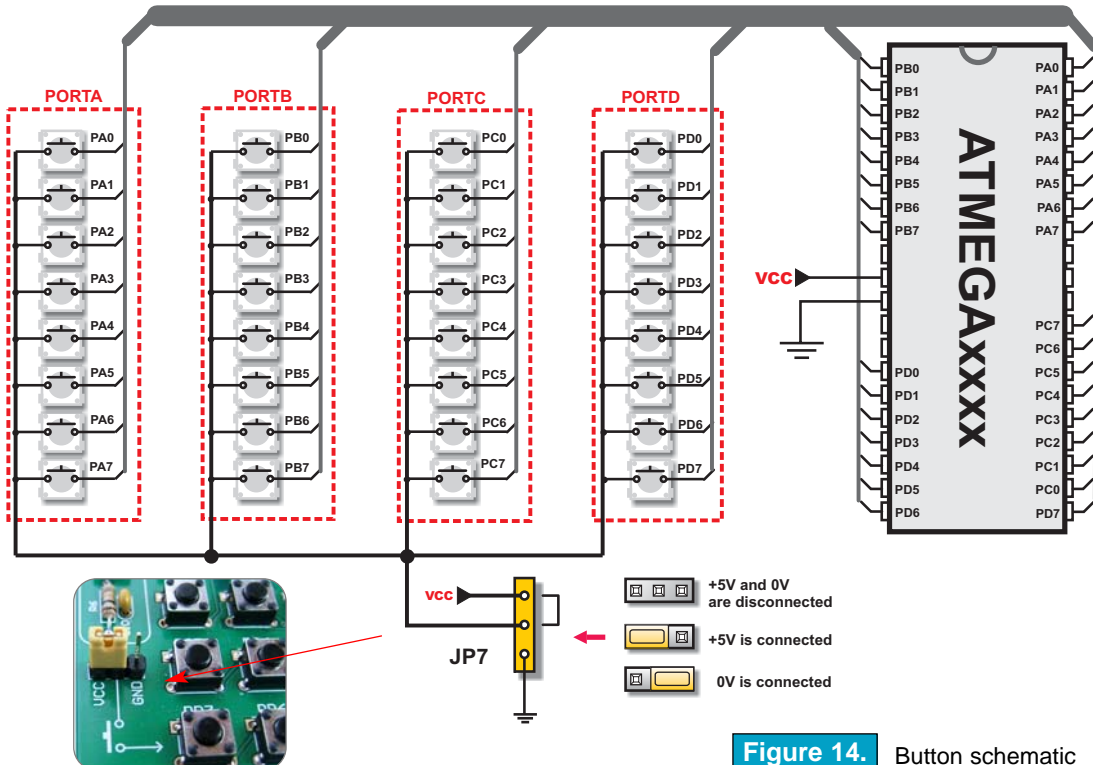


Figure 14. Button schematic

In the case of Fig. 15 the pull-up resistor pulls the microcontroller port pin to +5V when the button is not pressed. A button press causes the port pin to be connected to ground (J7 is in the lower position). Thus, only when the button is pressed will the microcontroller sense a logical ZERO; otherwise the pin state will always be logical ONE.

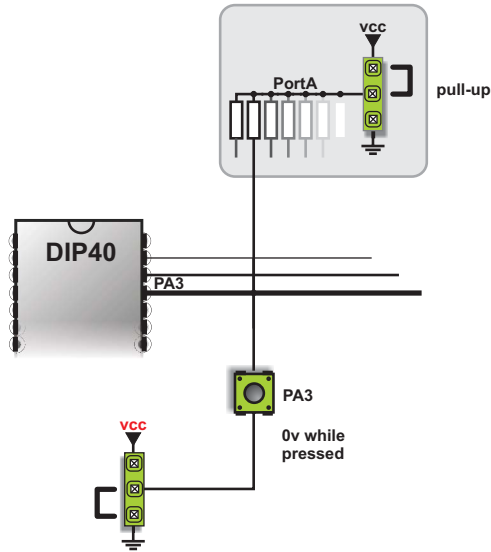


Figure 15. Button with pull-up resistor

In the case of Fig. 16 the pull-down resistor pulls the microcontroller port pin to ground when the button is not pressed. A button press causes the port pin to be connected to +5V (J7 is in the upper position). Thus, only when the button is pressed will the microcontroller sense a logical ONE; otherwise the pin state will always be logical ZERO.

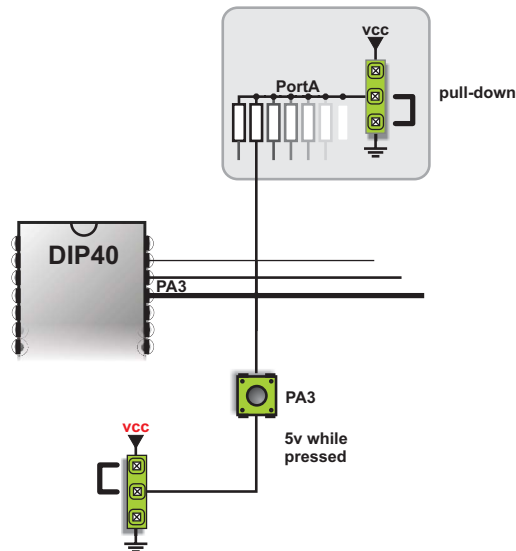


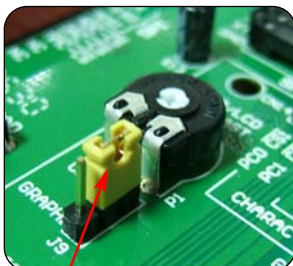
Figure 16. Button with pull-down resistor

GRAPHIC LCD

The Graphic LCD (GLCD) allows advanced visual messages to be displayed. While a character LCD can display only alphanumeric characters, a GLCD can be used to display messages in the form of drawings and bitmaps. The most commonly used graphic LCD has a screen resolution of 128x64 pixels. Before a GLCD is connected, the user needs to set jumper J9 (Fig. 17) to the upper position. The GLCD's contrast can be adjusted using potentiometer P1, which is placed to the left of the GLCD below jumper J9.

Figure 17.

GLCD selection jumper



In order to enable GLCD, jumper JP17 should be set to the upper position, labeled as GRAPH.



GLCD

Figure 18.

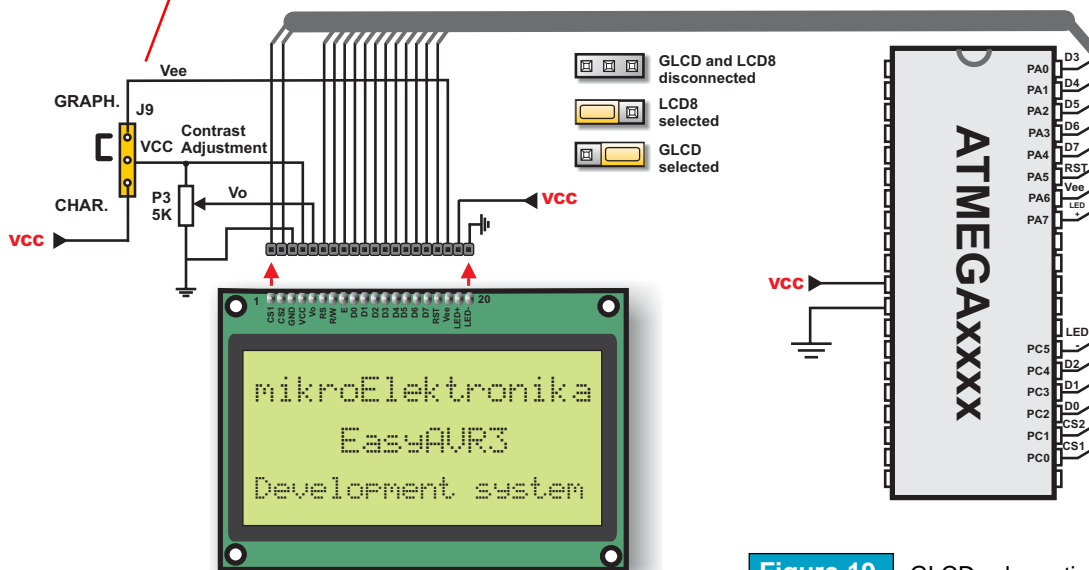


Figure 19. GLCD schematic

LCD 2X16 IN 4-BIT MODE

The standard character LCD is probably the most widely used data visualization component. Normally, it can display two lines of 16 alphanumeric characters, each made up of 5x7 pixels. The character LCD communicates with the microcontroller via a 4-bit or 8-bit data bus, each requiring the use of a different connector on the EasyAVR3. For 4-bit data bus use, the LCD should be placed in the upper left of the board above the LEDs. The connection to the microcontroller is shown in Fig. 21 where there are only four data lines. It is important that the LCD is only added or removed from the EasyAVR3 when the power is off.

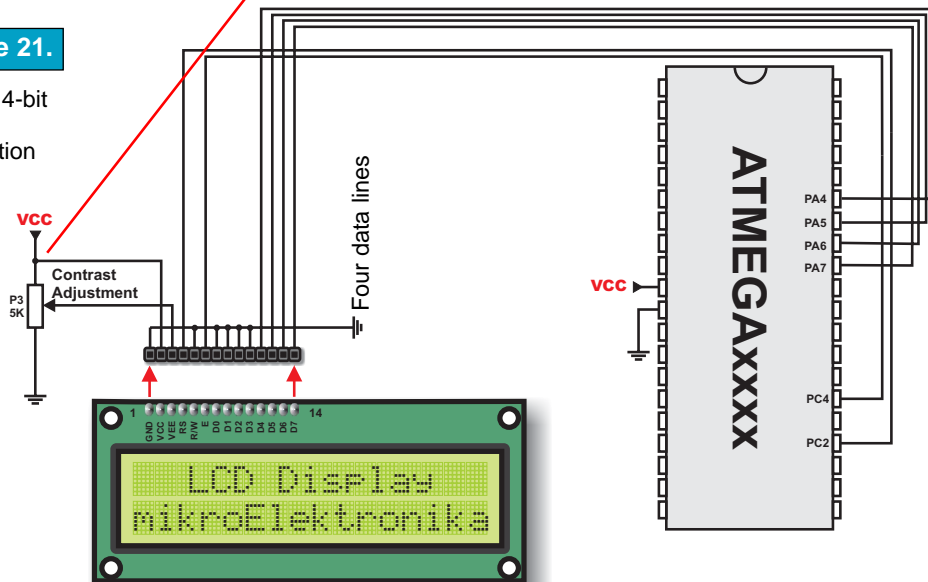


Figure 20.

LCD 2x16 in 4-bit mode connector

Figure 21.

LCD in 4-bit mode connection



LCD 2X16 IN 8-BIT MODE

When using a character LCD in 8-bit mode, the connector that is shared with the GLCD should be used. Since this connector has 20 pins and the character LCD has only 14 pins, special attention is required when placing the LCD. Otherwise the LCD can be permanently damaged. The LCD must be placed in the marked position with two free pins to the left and four free pins to the right. Only add or remove the LCD

from the EasyAVR3 when the power is off. Before adding the LCD, set jumper J9 to the lower position. The LCD's contrast can be adjusted using potentiometer P3, which is located to the left of the GLCD/LCD connector (Fig. 23).

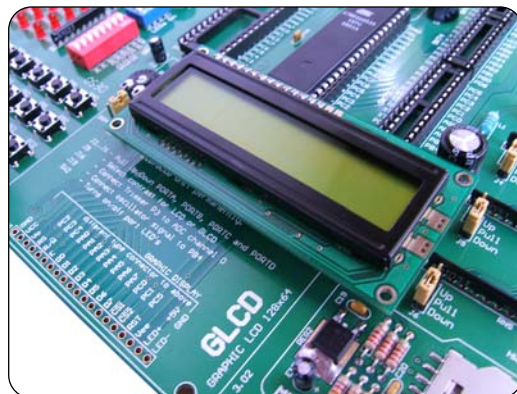


Figure 22.

LCD 2x16 in 8-bit mode

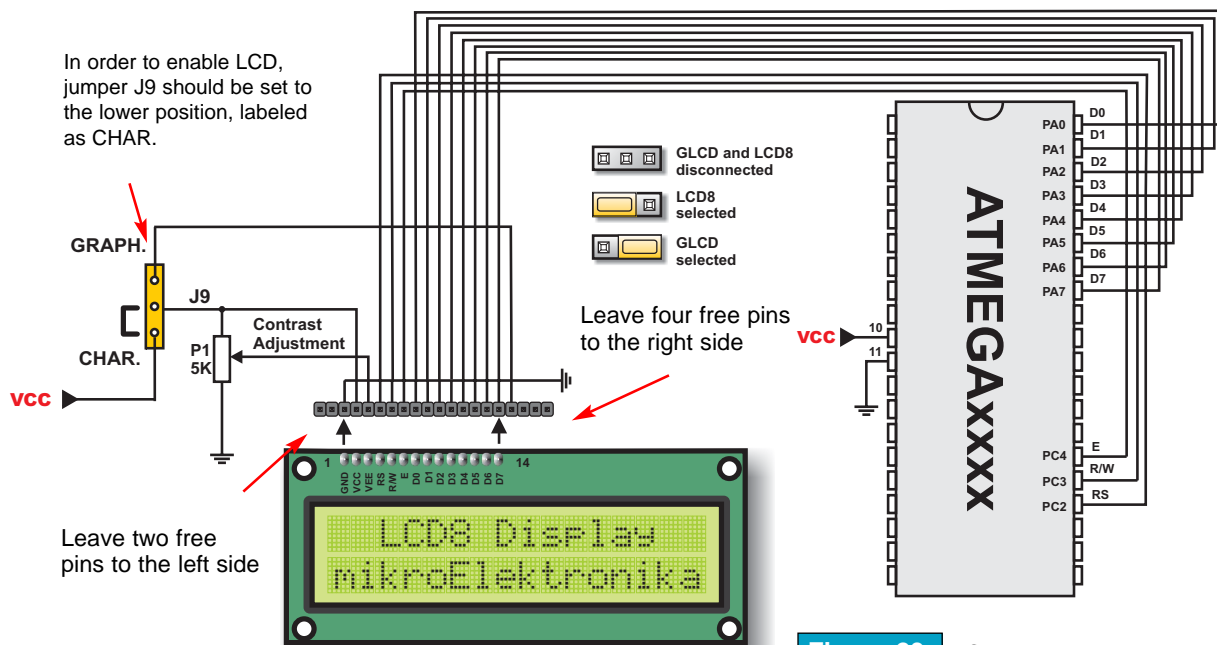


Figure 23. LCD 8-bit mode schematic

RS-232 COMMUNICATION

RS-232 communication enables point-to-point data transfer. It is commonly used in data acquisition applications, for the transfer of data between the microcontroller and a PC. Since the voltage levels of a microcontroller and PC are not directly compatible with those of RS-232, a level transition buffer such as the MAX232 must be used. In order to provide a more flexible system, the microcontroller is connected to the MAX232 through the two jumpers J17 and J18. Jumper J17 is used to connect the Rx line to PD0. Jumper J18 is used to connect the Tx line to PD1.

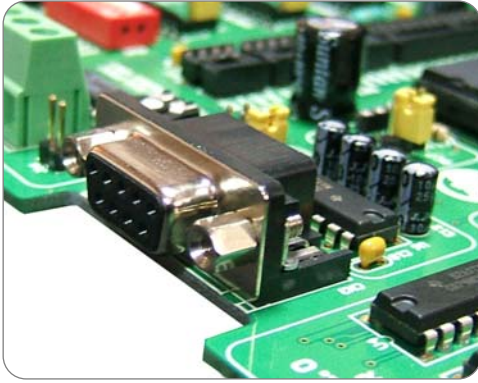
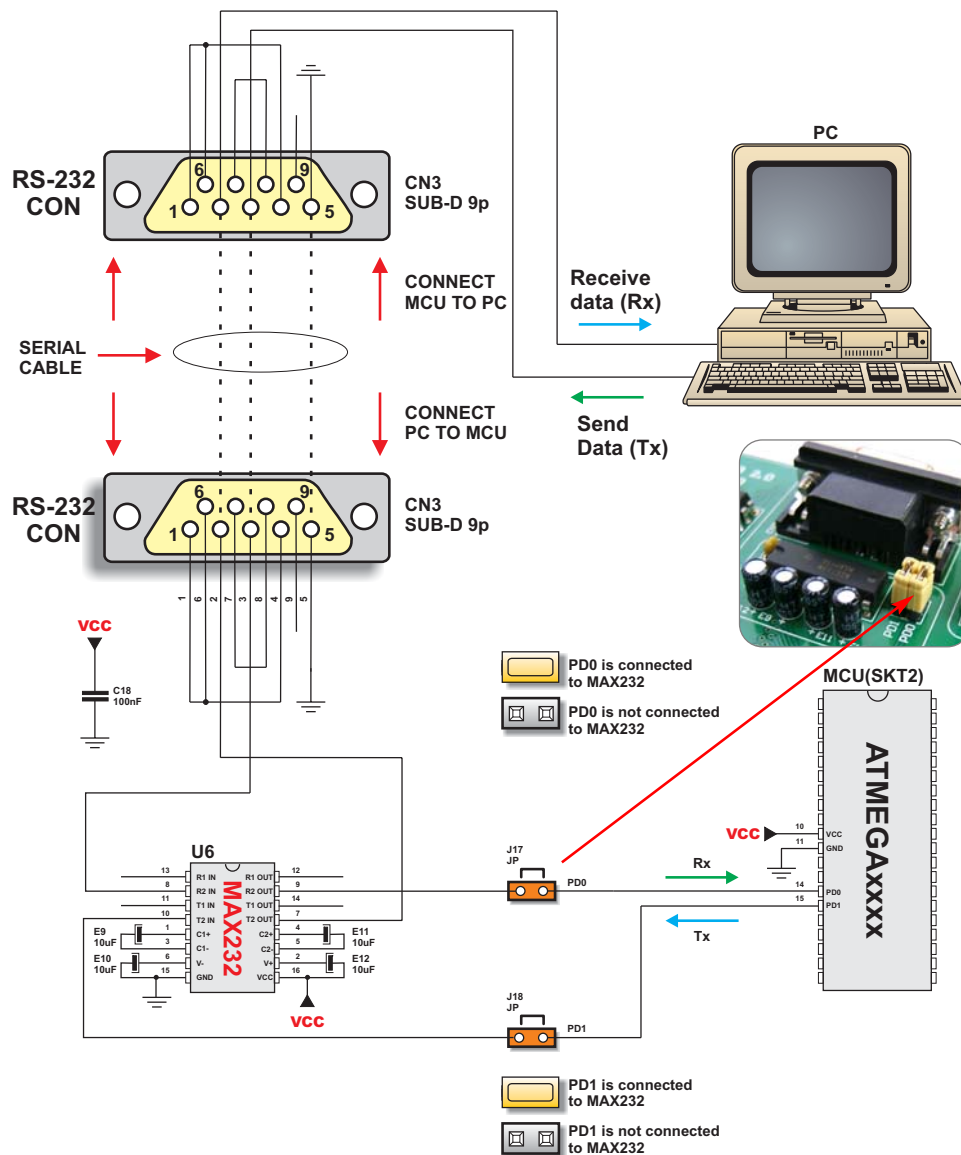


Figure 24. RS232 connector

Figure 25. Connection between microcontroller and a PC



DS1820 DIGITAL THERMOMETER

The DS1820 digital thermometer is well suited to environmental temperature measurement, having a temperature range of -55°C to 125°C and an accuracy of $\pm 0.5^{\circ}\text{C}$. It must be placed correctly in the 3-pin socket provided on the EasyPIC3, with its rounded side to the right, as marked on the board (see below). Otherwise the DS1820 could be permanently damaged. The DS1820's data pin can be connected to either the PC7 or PC6 pin, which is determined by jumper J8.

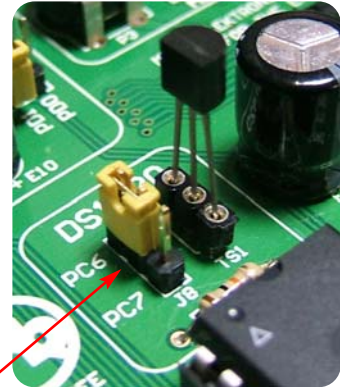


Figure 26. DS1820

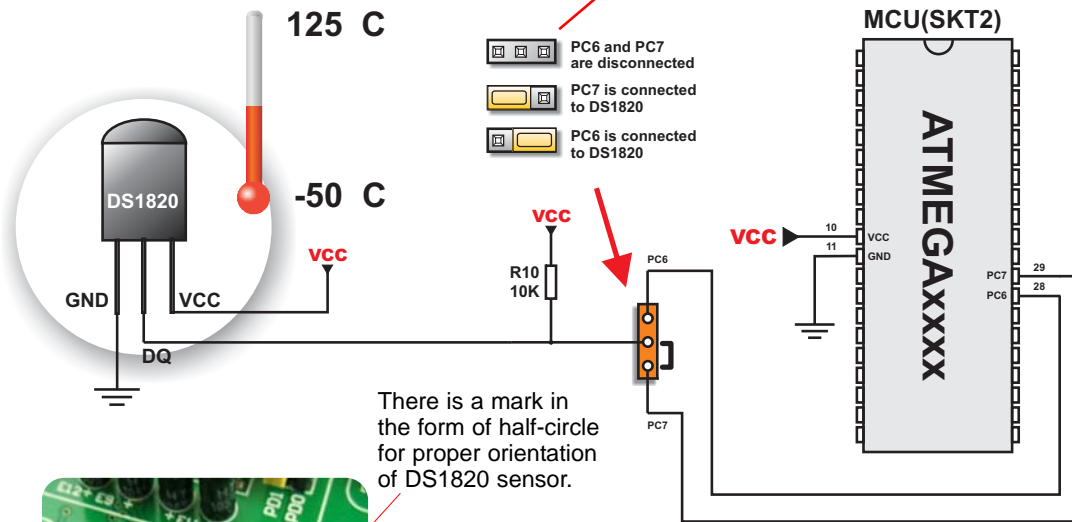


Figure 27. DS1820 Schematic



ADC (ANALOG-DIGITAL CONVERTER)

The EasyAVR3 development system has ADC that can simulate analog input in the range of 0-5V. The potentiometer P3 may be connected to the MCP3204 ADC using jumper J16.

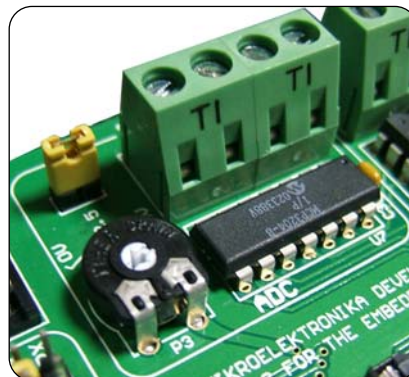


Figure 28. ADC

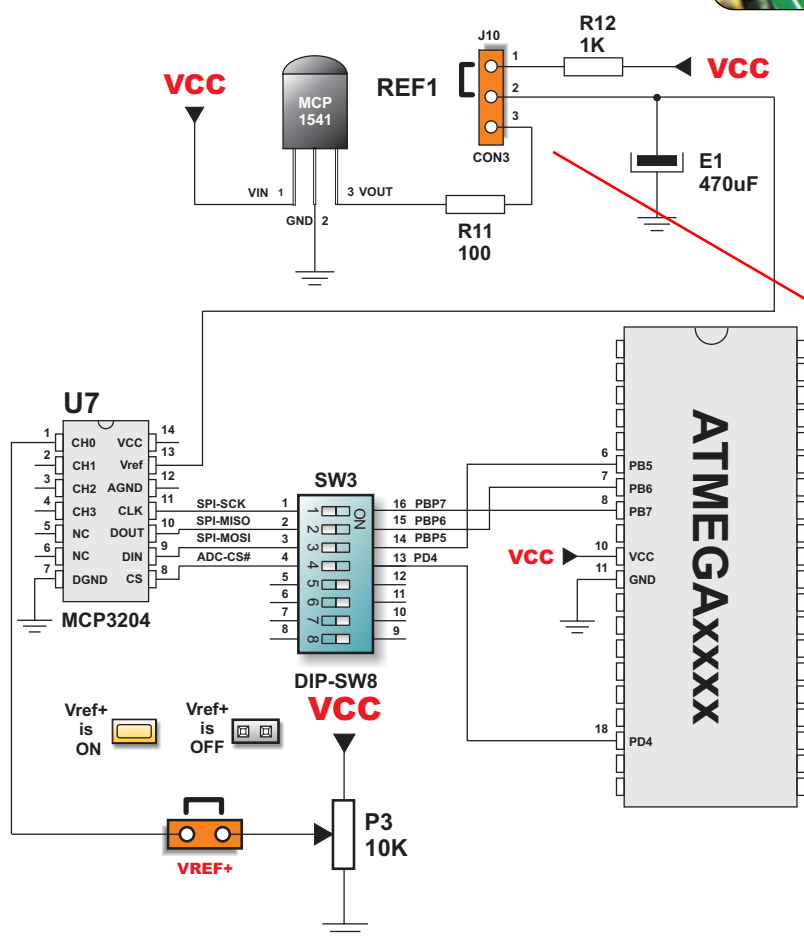


Figure 30. ADC schematics

- All lines are disconnected
- Vref line is connected
- Vcc line is connected



Figure 29. Vref

ADC (ANALOG DIGITAL CONVERTER)

DAC (DIGITAL-ANALOG CONVERTER)

The EasyAVR3 development system has DAC that can simulate analog output in the range of 0-5V.

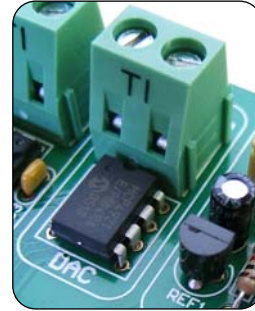





Figure 31. DAC

-  All lines are disconnected
-  Vref line is connected
-  Vcc line is connected

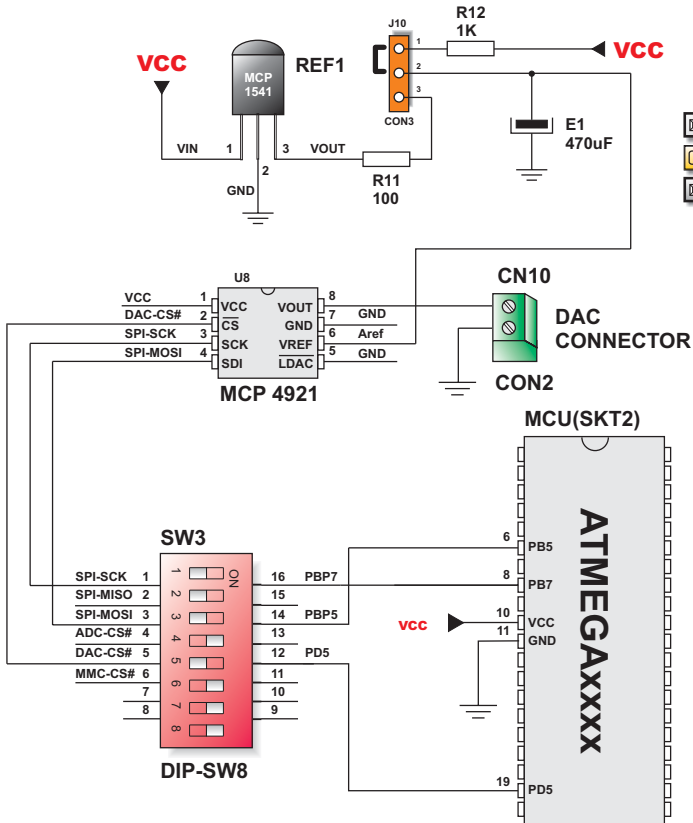


Figure 32. DAC schematics

DAC (DIGITAL ANALOG CONVERTER)

DIRECT PORT ACCESS

All microcontroller input/output pins can be accessed via connectors placed along the right-hand side of the board. For each of the ports PA, PB, PC, PD, there is one 10-pin connector providing Vdd, GND and up to eight port pins.

These connectors can be used for system expansion with external boards such as Compact Flash, CAN, RS-485, etc. Ensure that the on-board peripherals are disconnected from microcontroller by setting the appropriate jumpers, while external peripherals are using the same pins. The connectors can also be used for attaching logic probes or other test equipment.

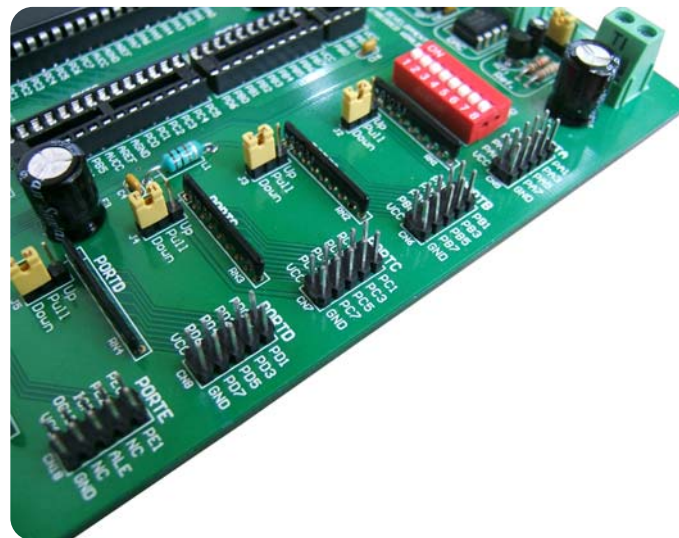
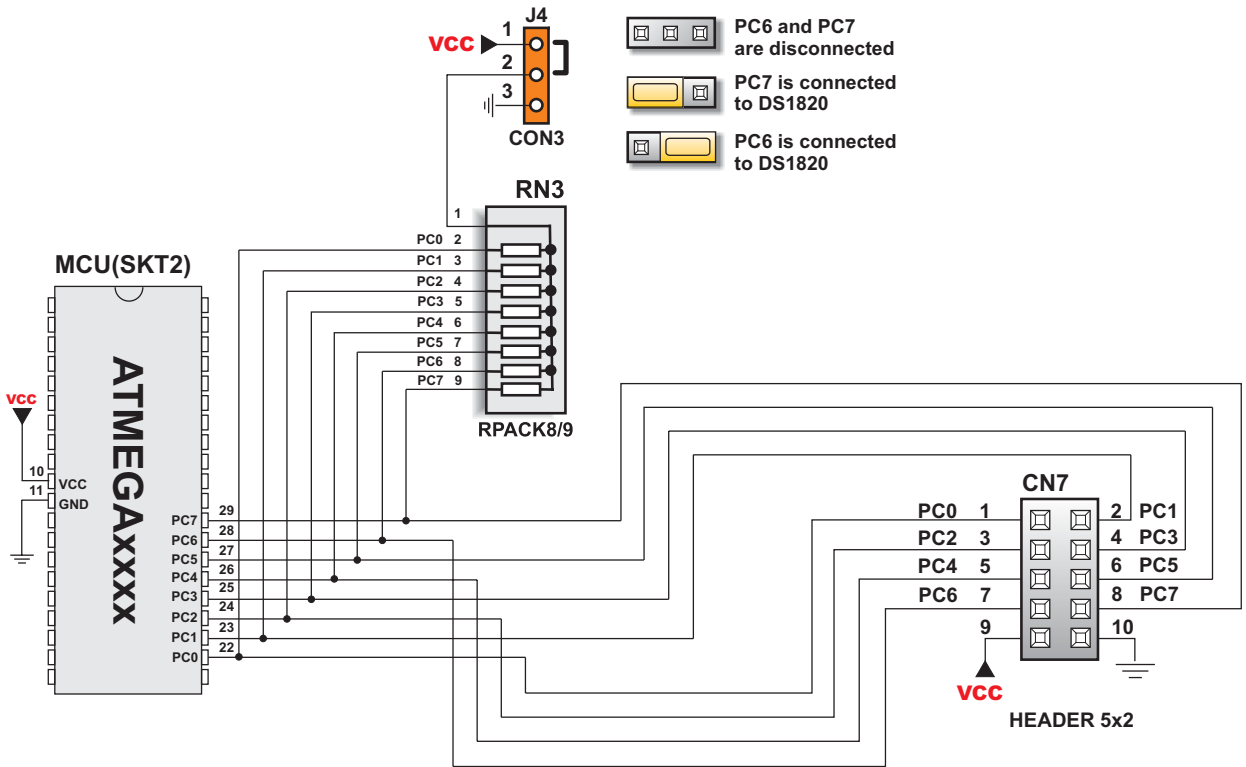


Figure 33. Direct port access connectors



DIRECT PORT ACCESS

Figure 34. Port C connection

MMC \ SD (MULTIMEDIA CARD)

MMC card is used as storage media for a portable device, in a form that can easily be removed for access by a PC. For example, a digital camera would use an MMC card for storing image files. With an MMC reader (typically small box that connects via USB or some other serial connection). communicates with Multi Media Card via SPI communication.

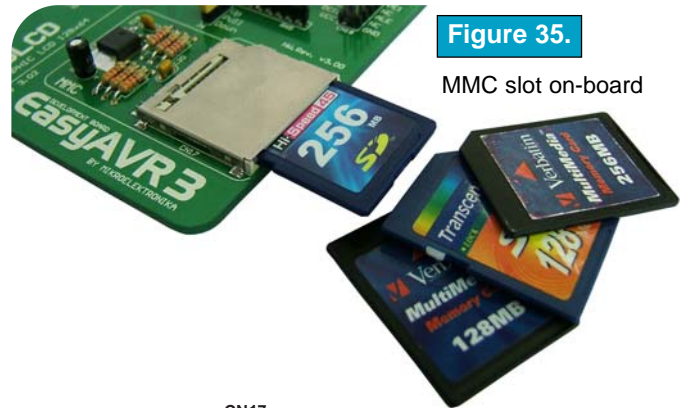


Figure 35.

MMC slot on-board

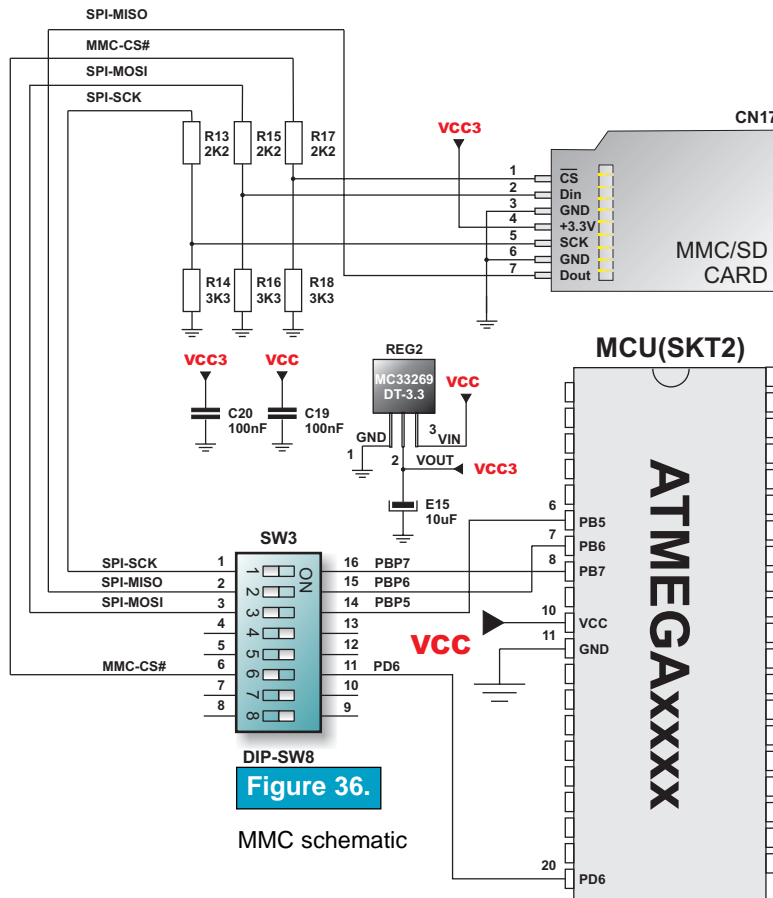


Figure 36.

MMC schematic

Modern computers, both laptops and desktops, often have SD slots, which can read MMC cards.

MCU's on AVR board communicates with Multi Media Card via SPI communication.

If you are experiencing problems with any of our products or you just want additional information, please let us know. We are committed to meet every your need.

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