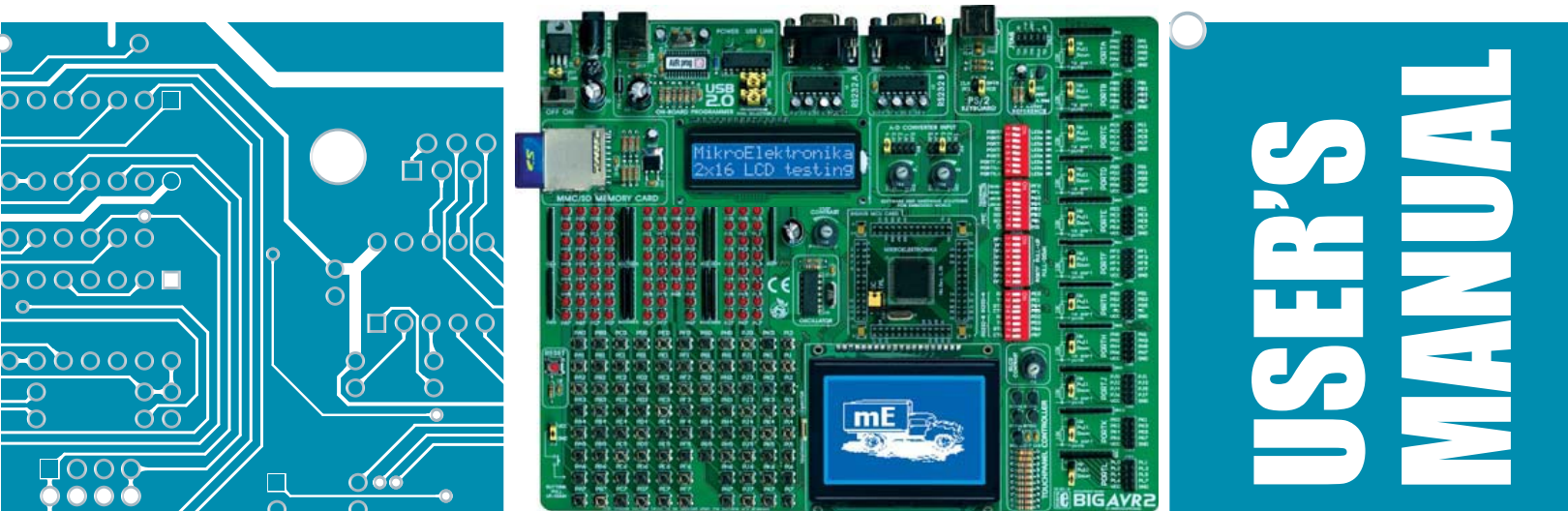
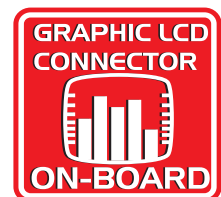
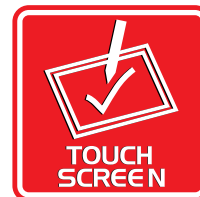
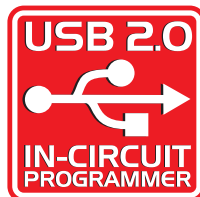


BIGAVR2



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Nebojsa Matic
General Manager

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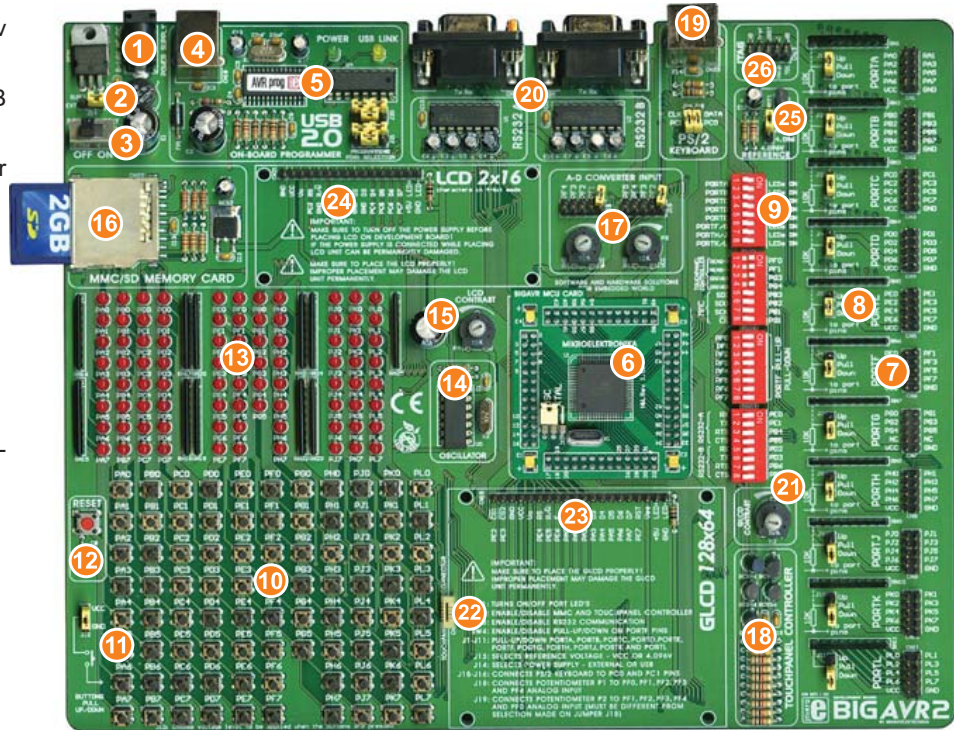
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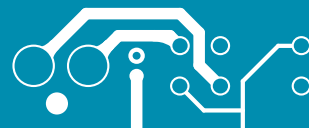


BIGAVR2 KEY FEATURES

1. External power supply of 8v to 16v AC/DC.
2. Selectable external and USB power supply. When using USB port, there is no need for external power supply.
3. Power on/off switch.
4. USB connector.
5. Very fast and flexible on-board USB programmer. By downloading a new software, it will be possible to program new MCUs in coming years.
6. MCU card supports 64-pin microcontrollers such as ATmega128 and 100-pin microcontrollers such as ATmega1280.
7. Direct port access connector.
8. Jumpers to determine input pin performance in idle state (connected to pull-up or pull-down resistor).
9. Switch group SW4 enabling pull-up/pull-down resistors on port pins.
10. 86 push-buttons allowing control of all the microcontroller pins.
11. Jumper to select high or low state of pins on any push-button press.
12. RESET push-button.
13. Each I/O pin corresponds to one LED.
14. On-board clock oscillator.
15. LCD display contrast potentiometer.



16. MMC/SD (MULTIMEDIA CARD) reader.
17. A/D converter test inputs.
18. Touch panel controller.
19. PS/2 keyboard communication port.
20. RS232 communication port.
21. GLCD display contrast potentiometer.
22. Touch panel connector.
23. GLCD connector.
24. LCD connector.
25. On-board reference voltage 4.096V.
26. JTAG connector.



CONNECTING THE SYSTEM

Apart from this manual, the development system box contains development system, product CD, USB cable, RS232 cable and user's manuals for *AVRflash programmer*, *mikroICD Debugger* and *Installing USB drivers*. In order to use BIGAVR2 properly, it is necessary to go through the following steps:

- Step no.1** Take the development system and product CD out of the box. Insert the product CD into CD drive. Please, do not connect the development system to a PC yet.
- Step no.2** Install *AVRflash* programmer software to enable a program to be transferred from PC to the microcontroller chip. Installation instructions are contained in '*AVRflash programmer*' manual.
- Step no.3** Install USB drivers on your PC to enable programmer's hardware to operate properly on BIGAVR2 board. For detailed installation instructions refer to '*Installing USB drivers*' manual.
- Step no.4** Connect BIGAVR2 to PC using USB cable. Please use one of USB ports on the back of the PC because they are directly connected to the computer motherboard.
- The first time you switch the BIGAVR2 on, your PC will automatically detect a new hardware. You will be immediately prompted whether Windows should search for new drivers update or not. Select the option '*No, not this time*' and click '*Next*'. Another window appears, click '*Next*' and the operating system will automatically find the drivers. Click '*Finish*' to complete this process and run *AVRflash* as explained in '*AVRflash programmer*' manual.
- Next time you switch the BIFGAVR2 on, Windows will not ask for new drivers update during driver installation.

After these four steps, your BIGAVR2 is successfully installed and ready for use. You can read a program from the chip or write a new one into it. The product CD provides numerous simple program examples which will make your first steps Easy...



INTRODUCTION

The BIGAVR2 development system is a full-featured development board for Atmel AVR microcontrollers. It is designed to allow students and engineers to easily test and explore the capabilities of these AVR microcontrollers. In addition, it allows AVR microcontrollers to be interfaced with external circuits and a broad range of peripheral devices. The user can therefore concentrate on software development only.

Figure 1 illustrates the development board. There are identification marks beside each component on a silkscreen, both on the top and bottom. These marks describe connections to the microcontroller, operation modes, and provide additional useful information. Since all relevant information is provided on the board, there is almost no need for additional schematics.

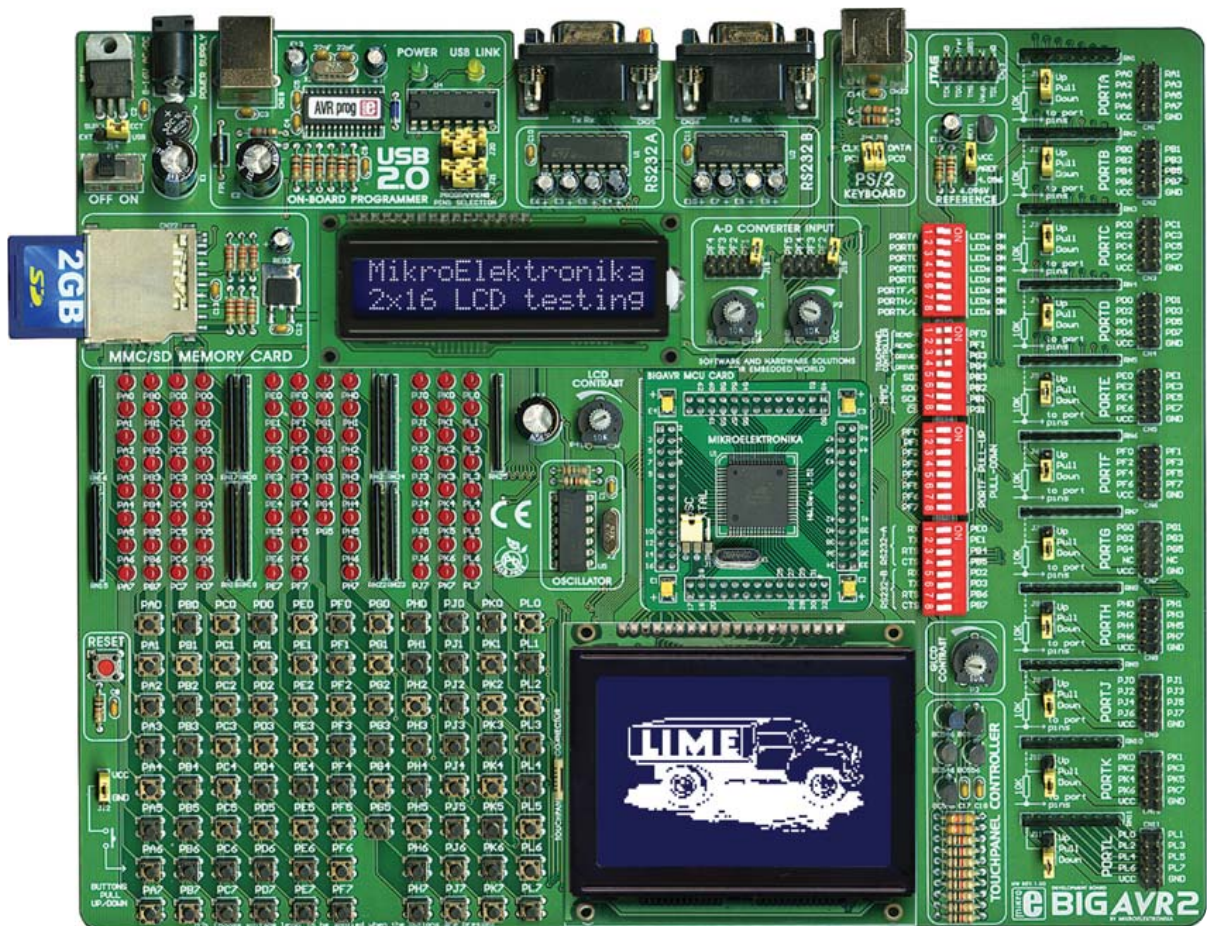
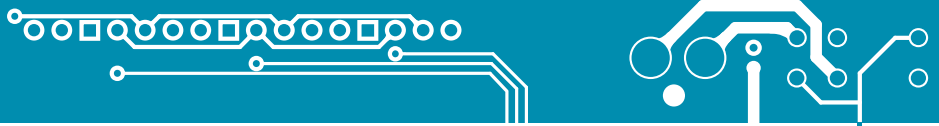


Figure 1 BIGAVR2 development board



SWITCHES

The *BIGAVR2* development board features a number of peripheral devices. In order to enable them before programming, the appropriate jumpers or switches have to be properly set.

Switches are mechanical devices which have two positions - ON and OFF. Their function is to establish or break connection between two contacts. The *BIGAVR2* development board has four groups of switches.

Switch group **SW1** is used to enable/disable LEDs connected to the microcontroller ports. Five out of eleven ports have its own switch, while the ports F, G, H, J, K and C share three lower switches of this group.

Switch group **SW2** is used to enable/disable touch panel and MMC card reader.

Switch group **SW3** is used to enable/disable RS232 communication.

Switch group **SW4** is used to enable/disable external pull-up/pull-down resistors on PORTF pins. Each pull-up/pull-down resistor is individually enabled.

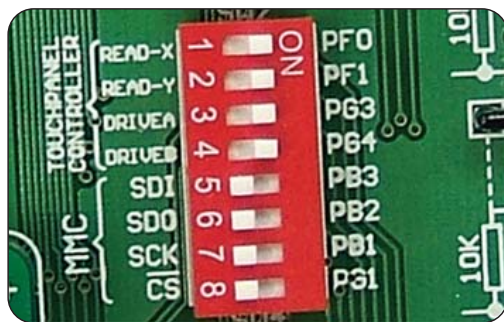
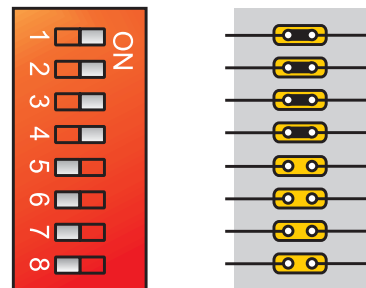
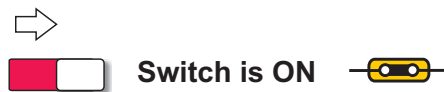


Figure 2 Group of 8 switches

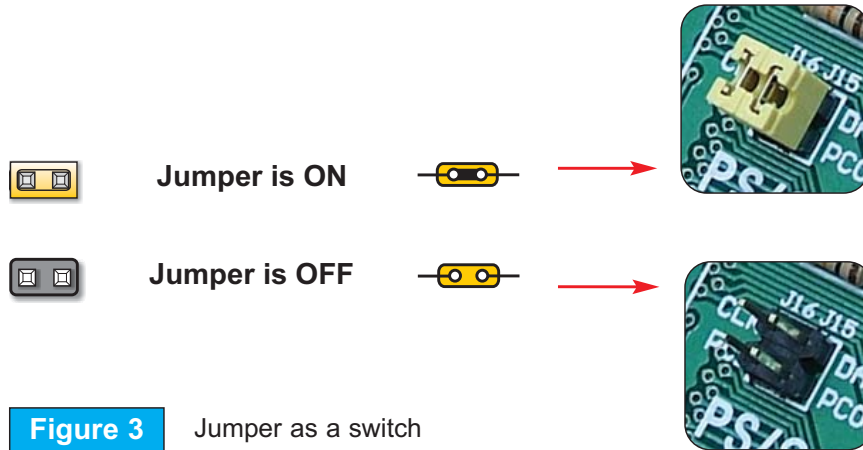


Switches 1,2,3 and 4 are ON,
other switches are OFF

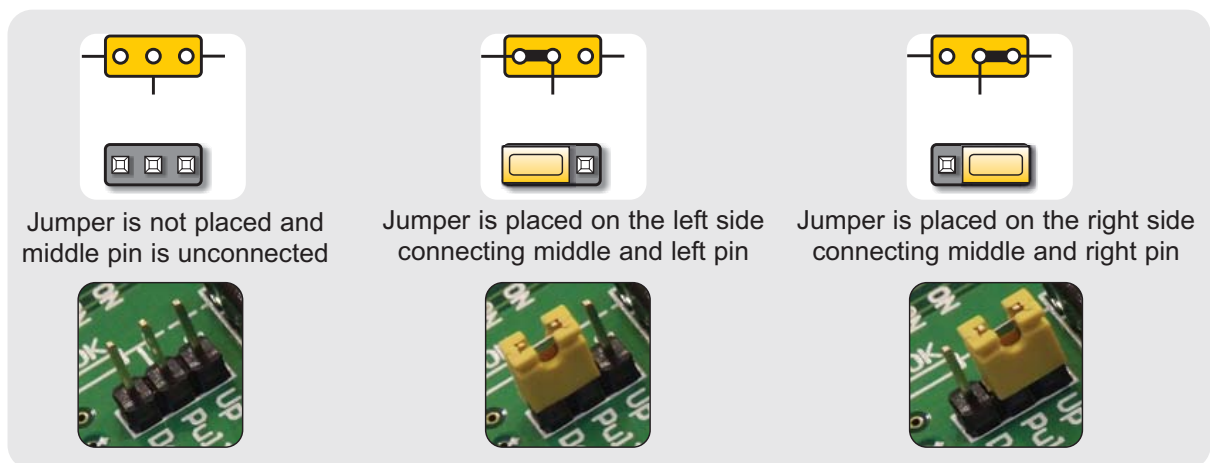


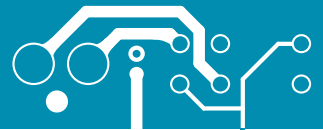
JUMPERS

Jumpers, like switches, are used to break or establish connection between two points. Under the plastic cover of a jumper, there is a metal contact which establishes connection when the jumper is placed over two pins.



Jumpers are commonly used as selectors between two possible connections via 3-pin connector. As illustrated in figure 4, the middle connector pin can be connected to the left or right pin, depending on the jumper's position.





MCU CARD

BIGAVR2 is delivered with the 64-pin microcontroller ATmega128. The user can remove MCU card with this chip and fit another MCU card with another microcontroller such as ATmega1280 (100-pins).

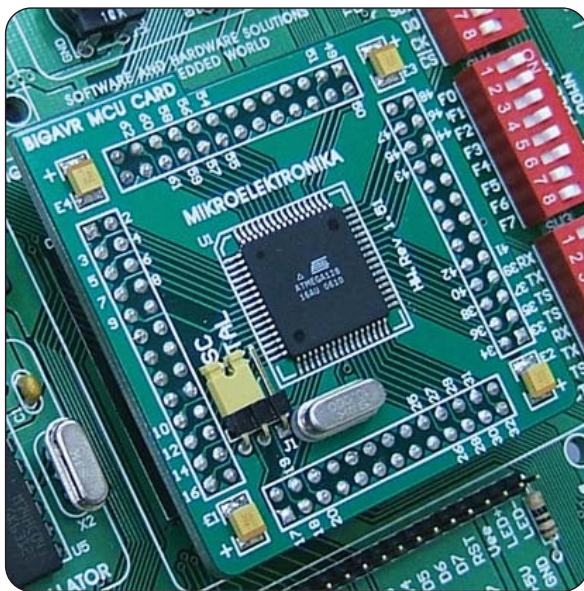
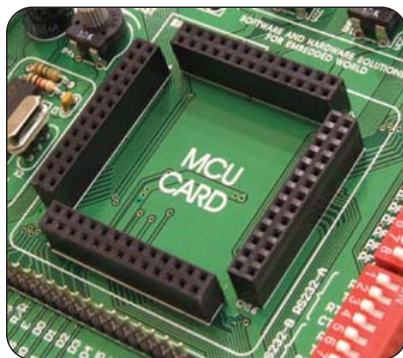


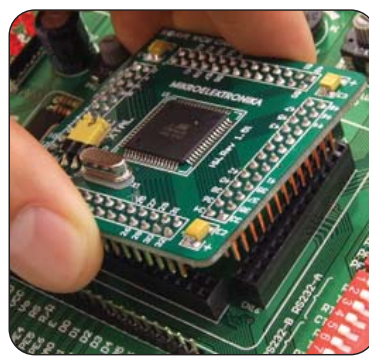
Figure 5 MCU card

When placing MCU card on the BIGAVR2 MCU socket, it is necessary to follow steps below:



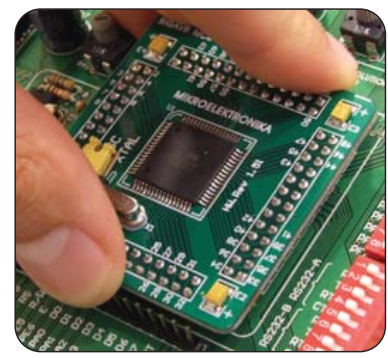
Step no. 1

If MCU card is already placed on BIGAVR2, you should remove it by slowly pulling it up.



Step no. 2

Place another MCU card on the board. Note that label on the MCU card must be in the upper-left corner as it is drawn on the BIGAVR2 board.



Step no. 3

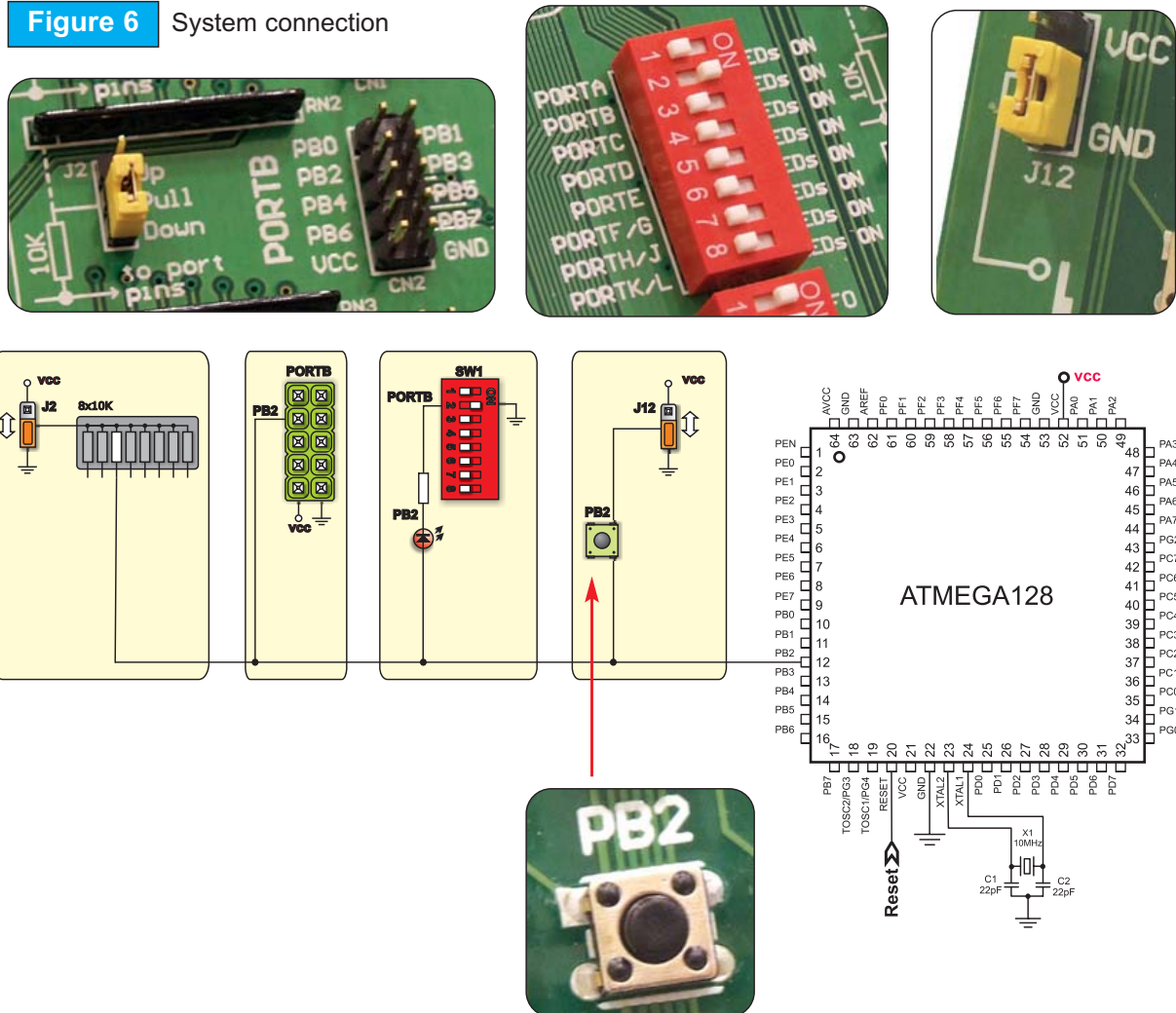
When the MCU card is properly placed, push it down by applying pressure on all edges at the same time.

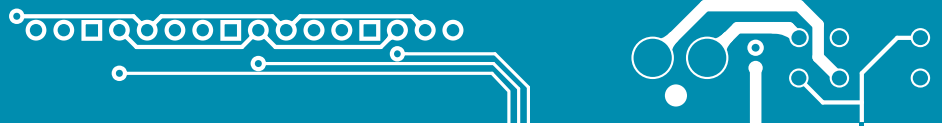
Microcontroller pins are routed to various peripherals as illustrated in figure 6. All the MCU ports are directly connected to 2x5 direct port access connectors placed on the right side of the board. Such connectors are normally used for connecting external peripherals to the board or for digital logic probes for testing and measurement.

All the ports are also connected to LEDs and push-button which allows easy monitoring and testing digital pin state.

Some pins are connected to other peripherals such as RS-232 communication, Precise Voltage Reference, LCD etc. which depends on MCU internal peripheral organization.

Figure 6 System connection





POWER SUPPLY

BIGAVR2 can use on of two power supply sources - PC power supply over USB cable (by default) and external power supply (external AC/DC power adapter). When using power supply over USB, the system should be connected to PC using the USB programming cable, while the jumper J14 should be set in right-hand position.



When using external power supply, the BIGAVR2 board produces +5V using LM7805 voltage regulator. The external power supply can be AC or DC, while power supply voltage ranges from 8V to 16V. The jumper J14 should be set in left-hand position. Figure 8 illustrates USB and external power supply connectors.

Figure 7 Power supply connector

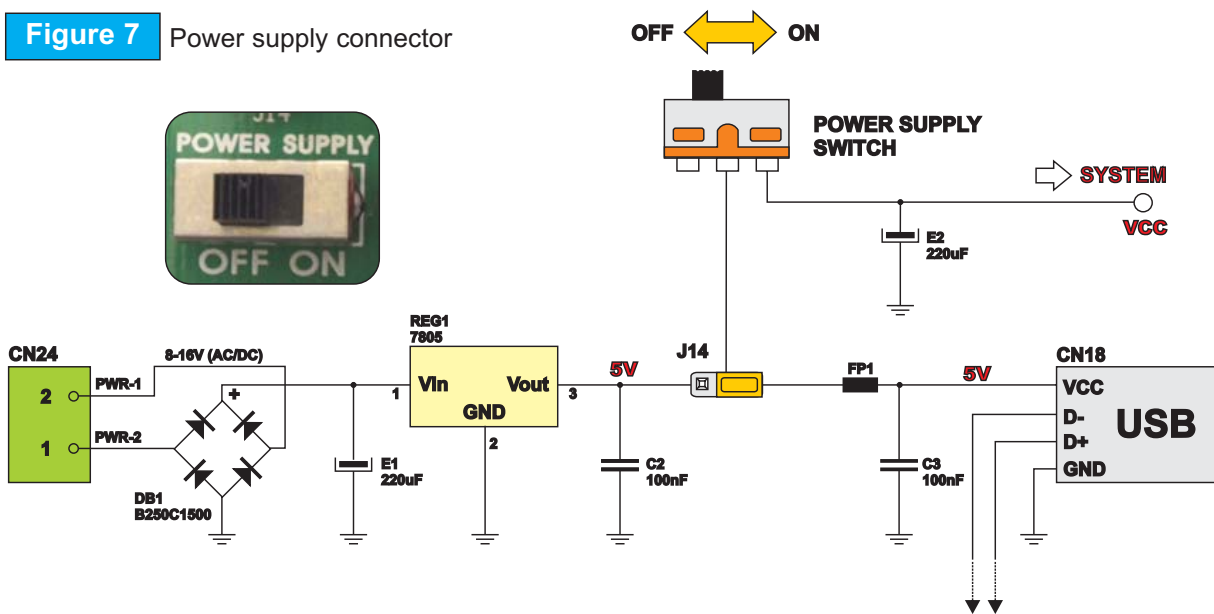


Figure 8 J14 is set to USB power supply



J14 in left-hand position: system is powered from external AC/DC power adapter.



J14 in right-hand position: system is powered from PC via USB cable.



ON-BOARD USB 2.0 PROGRAMMER

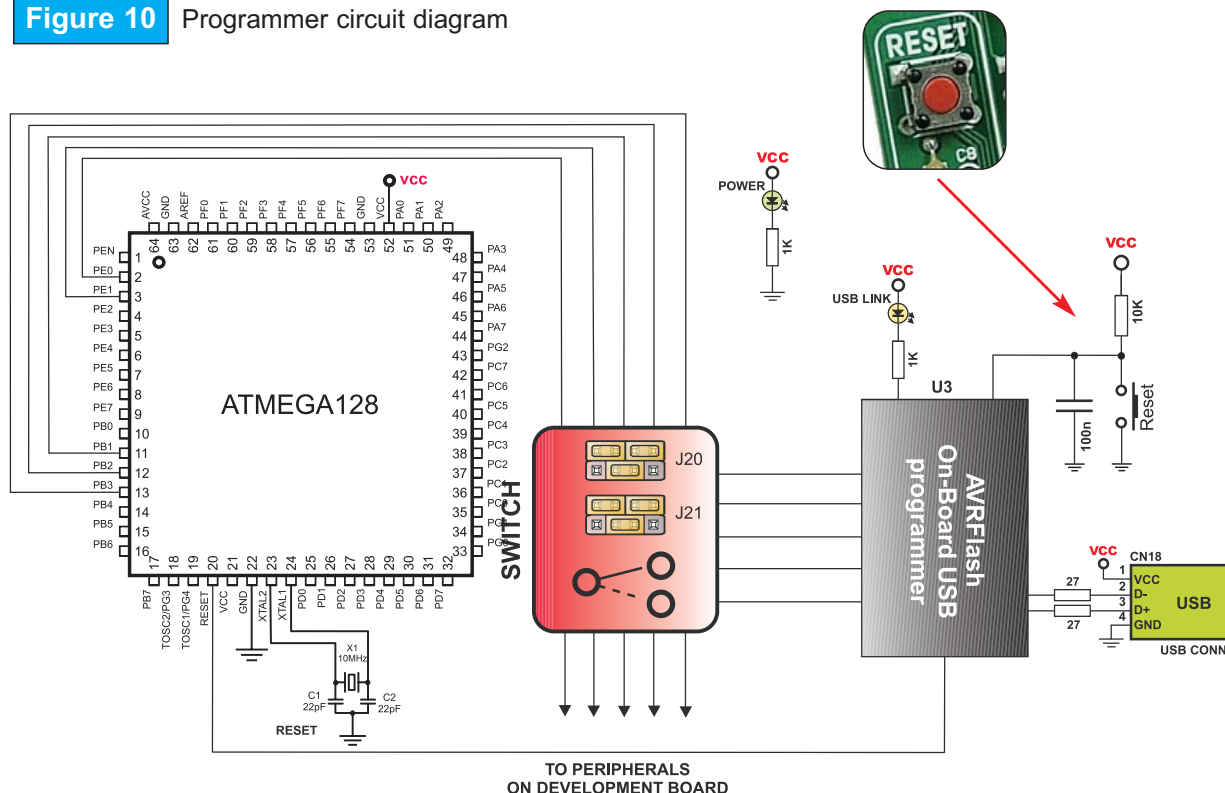
There is no need to use external equipment during programming as the *BIGAVR2* development system has its own on-board USB 2.0 programmer. It is only needed to connect the system to PC using the USB cable. Then, the program should be loaded into the microcontroller using the *AVRflash* programming software supplied with *BIGAVR2*.

Please refer to *AVRflash* documentation for more information.

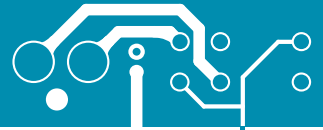
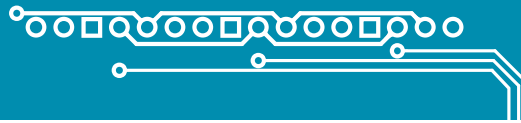


Figure 9 USB 2.0 programmer

Figure 10 Programmer circuit diagram

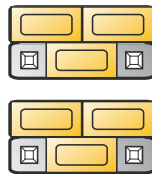
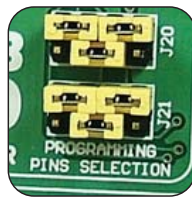


Note: There is no need to reset MCU after programming because the programmer will reset the MCU automatically.



There are two different groups of AVR MCUs (64- and 100-pin microcontrollers). The first group (Default) uses jumper groups J20 and J21 for programming: PDI (PE0 pin), PDO (PE1 pin) and SCK (PB1 pin). See Figure 11.

Another group uses SPI communication lines for programming: MOSI (PB2 pin), MISO (PB3 pin) and SCK (PB1pin). See Figure 12.

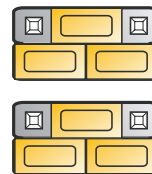


J20

J21

Figure 11

PE0, PE1 and PB1 used as programming lines (Default) for 64-pin MCUs.



J20

J21

Figure 12

PB2, PB3 and PB1 used as programming lines for 100-pin MCUs.



OSCILLATOR

The BIGAVR2 development board has on-board oscillator circuit for generating microcontroller's clock input and crystal oscillator placed on MCU Card as well. The *AVRFlash* programmer enables you to choose between internal RC oscillator, external clock or internal crystal oscillator. By means of jumper J1 (placed on MCU Card) it is possible to choose clock source to drive MCU: external or internal crystal oscillator.



Figure 13 On-board oscillator

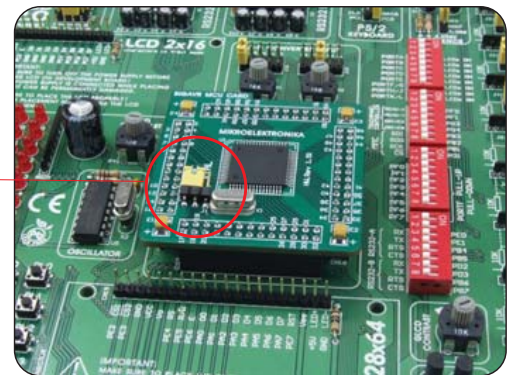
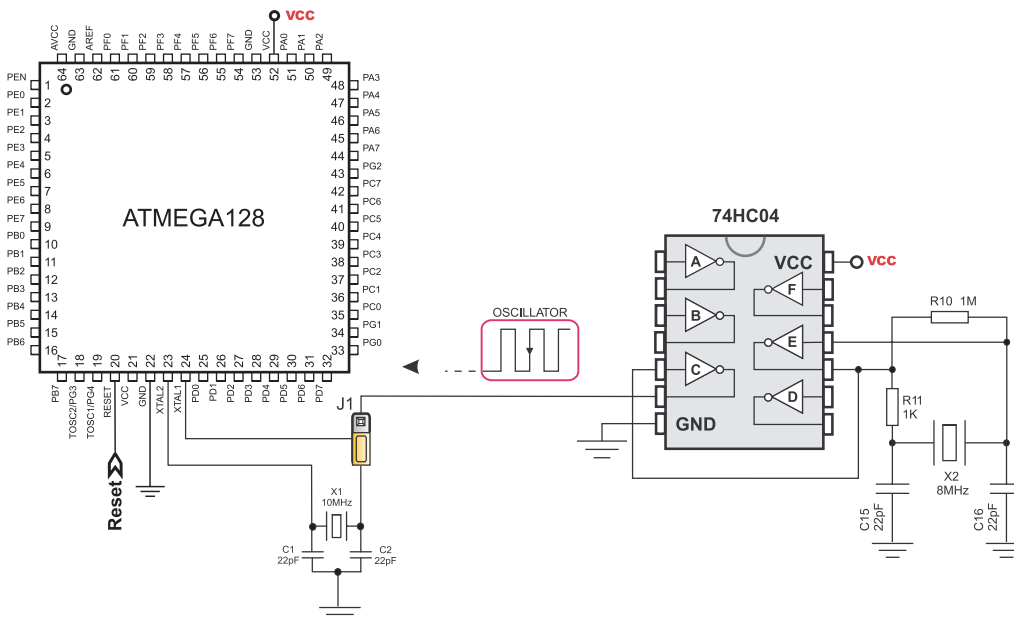
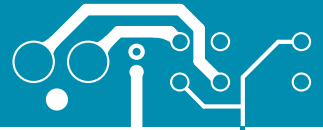
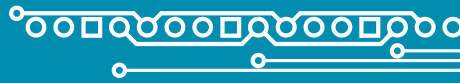


Figure 14 MCU Oscillator

Figure 15 Oscillator circuit diagram





LEDS

Light Emitting Diodes (LEDs) are components most commonly used for displaying pins' digital state. *BIGAVR2* has 86 LEDs connected to the microcontroller ports: PORTA, PORTB, PORTC, PORTD, PORTE, PORTF, PORTG, PORTH, PORTJ, PORTK and PORTL.

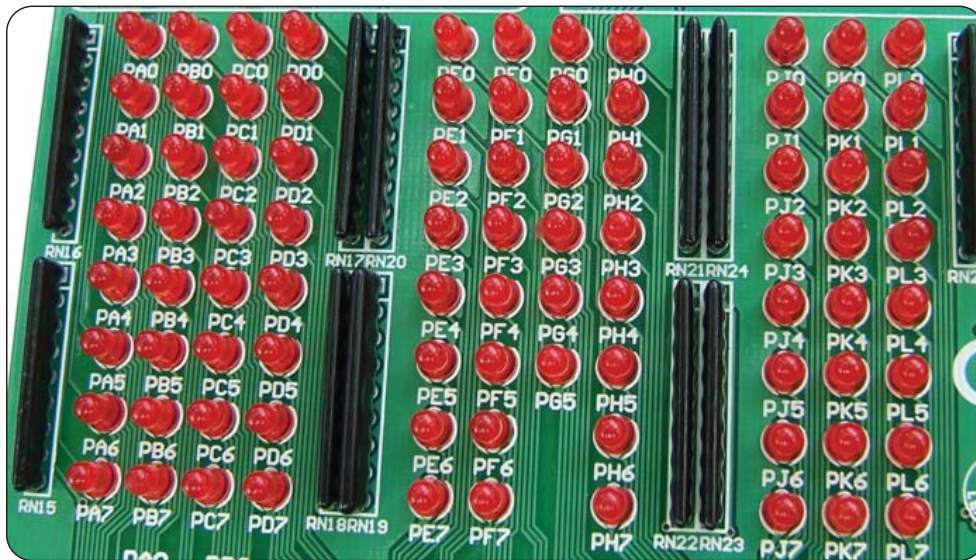


Figure 16 On-board LEDs

The development system is capable of monitoring the state of eleven MCU ports. Each of these ports is connected to eight LEDs which can be enabled or disabled using switches of the switch group SW1. The only exception is port PORTG connected to six LEDs.

LEDs are enabled when the corresponding switch of the SW1 is ON. When enabled, LEDs display the state of the corresponding microcontroller pin. Otherwise, the LEDs are always off, no matter what the port state is, as no current can flow through them.

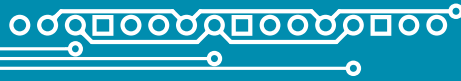
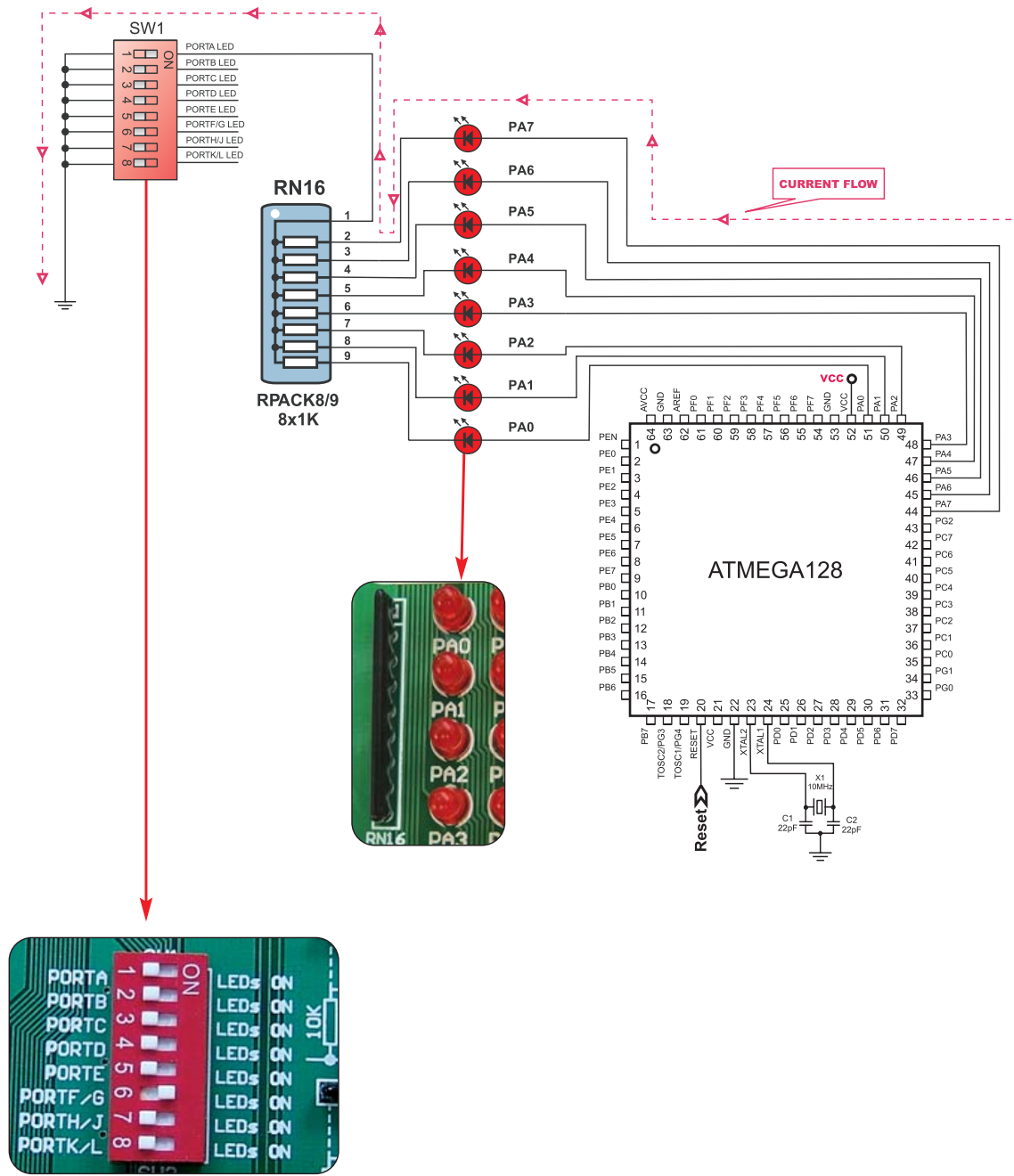
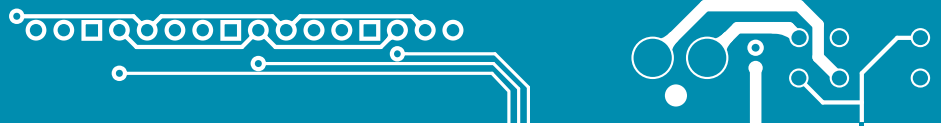


Figure 17 illustrates the connection between PORTF pins and the corresponding LEDs. A resistor is serially connected to LEDs in order to limit their current. In this very case the resistor value is 1K.

Figure 17 LEDs circuit diagram





RESET CIRCUIT

In addition to other push-buttons, there is one red button on the far left portion of the board marked as RESET. It is used for MCU reset.

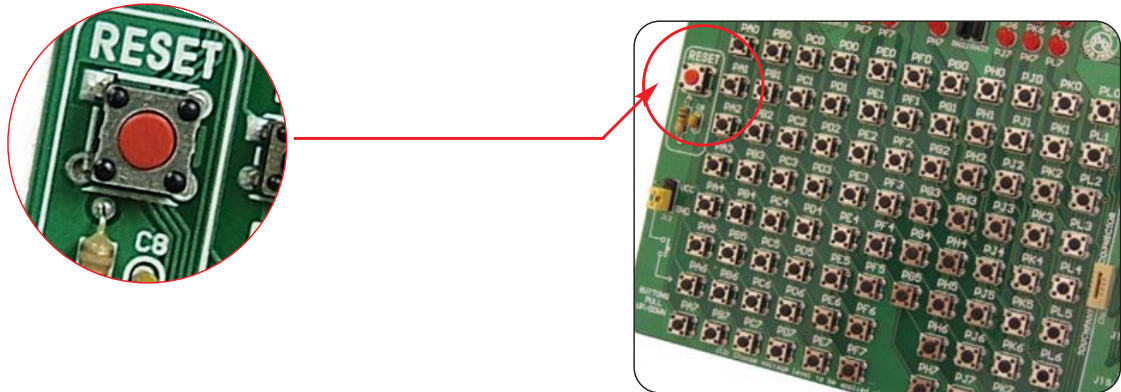


Figure 18 Reset button

As seen in figure below, the microcontroller MCLR pin is connected to programmer circuit instead of being directly connected to RESET button.

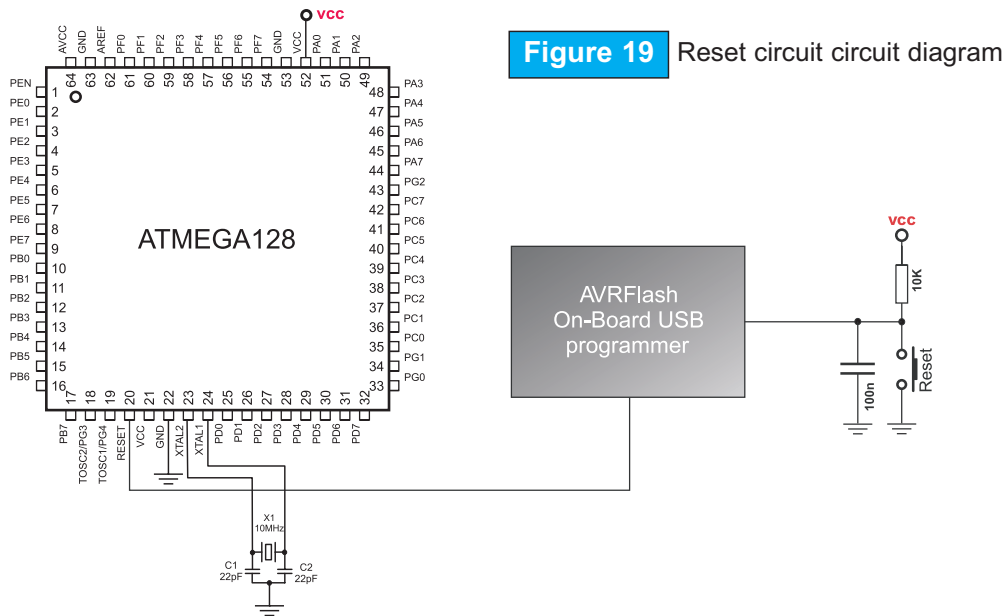


Figure 19 Reset circuit circuit diagram



PUSH-BUTTONS

BIGAVR2 has 86 push-buttons used to change the state of digital inputs on the microcontroller ports. There is also one RED push-button which acts as a RESET.

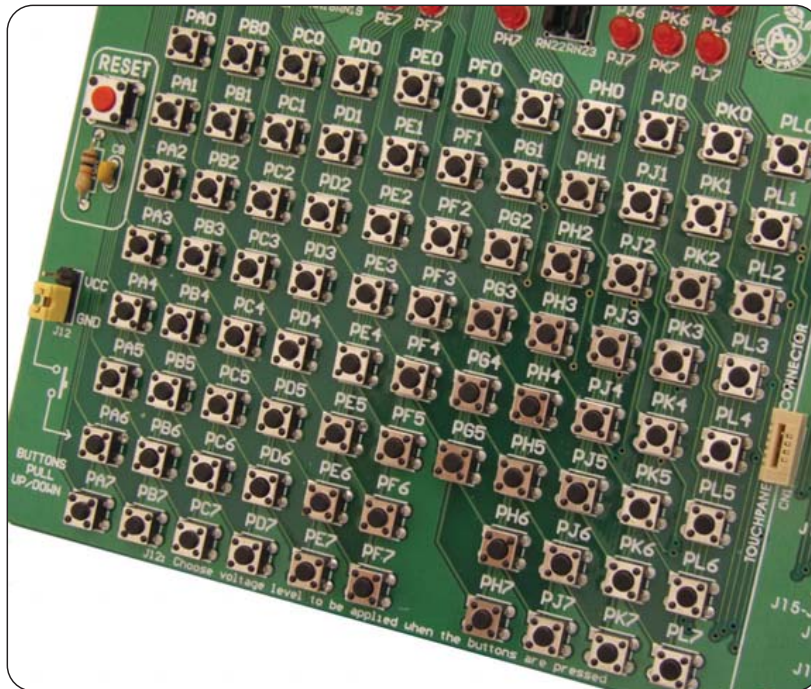


Figure 20 Push-buttons

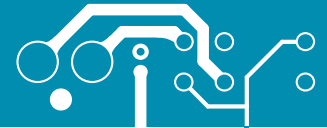
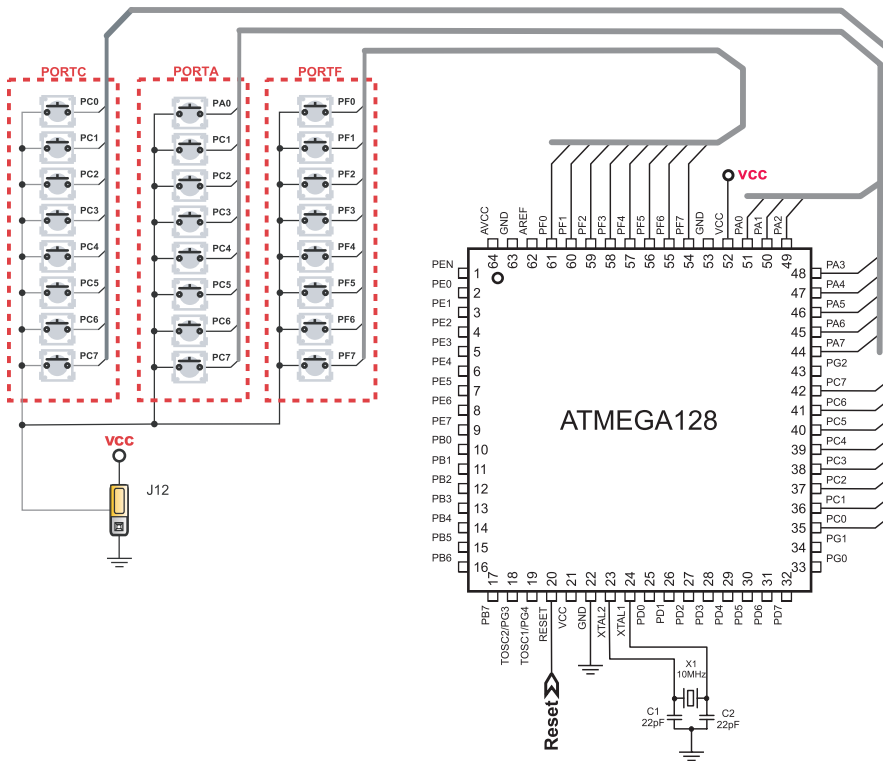


Figure 21 illustrates the connection between push-buttons and the corresponding PORTC, PORTA and PORTF pins. Jumper J12 determines whether a button press will bring logic zero (0) or logic one (1) to the appropriate pin.

When button is released the pin state is determined by pull-up or pull-down resistors.

Referring to Figure 21, J12 is connected to +5V and any button press will therefore bring logic one (1) to the appropriate pin.

Figure 21 Push-button circuit diagram



5V while button is pressed



0V while button is pressed

Referring to figure 22, jumper J3 is set to pull-up position so that pull-up resistor pulls the microcontroller pin PC2 pin to +5V. By pressing the button, the PC2 pin will be connected to ground via J12.

Accordingly, only when the button is pressed the microcontroller senses a logic zero (0). Otherwise, the pin state will always be logic one (1).

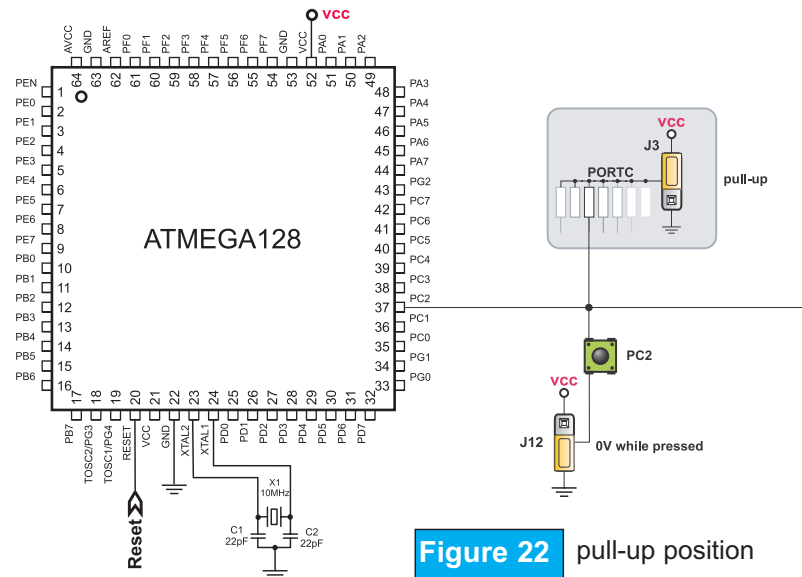


Figure 22 pull-up position

Referring to Figure 23, jumper J3 is set to pull-down position so that pull-down resistor pulls the microcontroller pin PC2 to 0V. By pressing the button, the PC2 pin will be connected to +5V via J12.

Accordingly, only when the button is pressed the microcontroller senses a logic one (1). Otherwise, the pin state will always be logic zero (0).

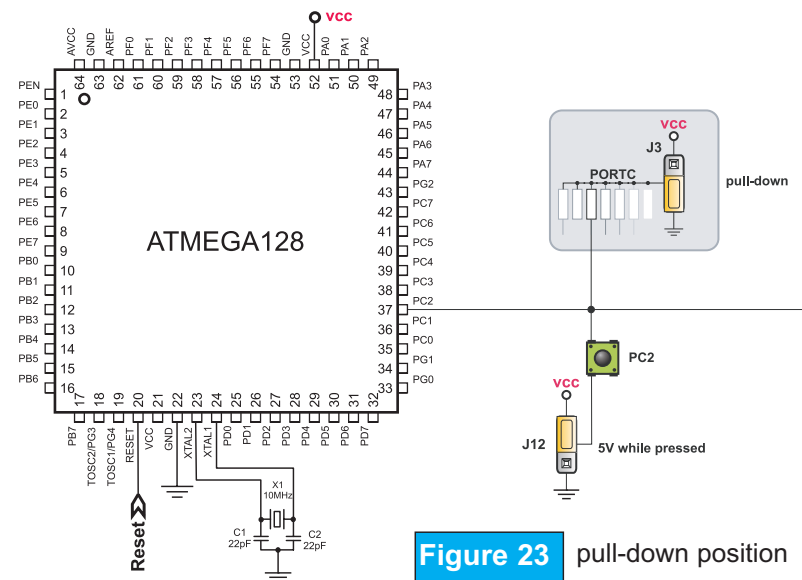
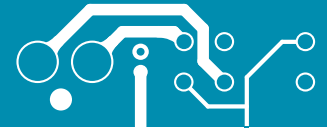


Figure 23 pull-down position



2X16 CHARACTER LCD IN 4-BIT MODE



A standard character LCD is probably the most widely used data visualization component. It normally can display messages in two lines, each containing up to 16 alphanumeric characters. Characters are made up of 5x8 pixels. The character LCD communicates with the microcontroller via 4-bit data bus. Connecting to the microcontroller is shown in figure 25.

Figure 24 2x16 LCD in 4-bit mode

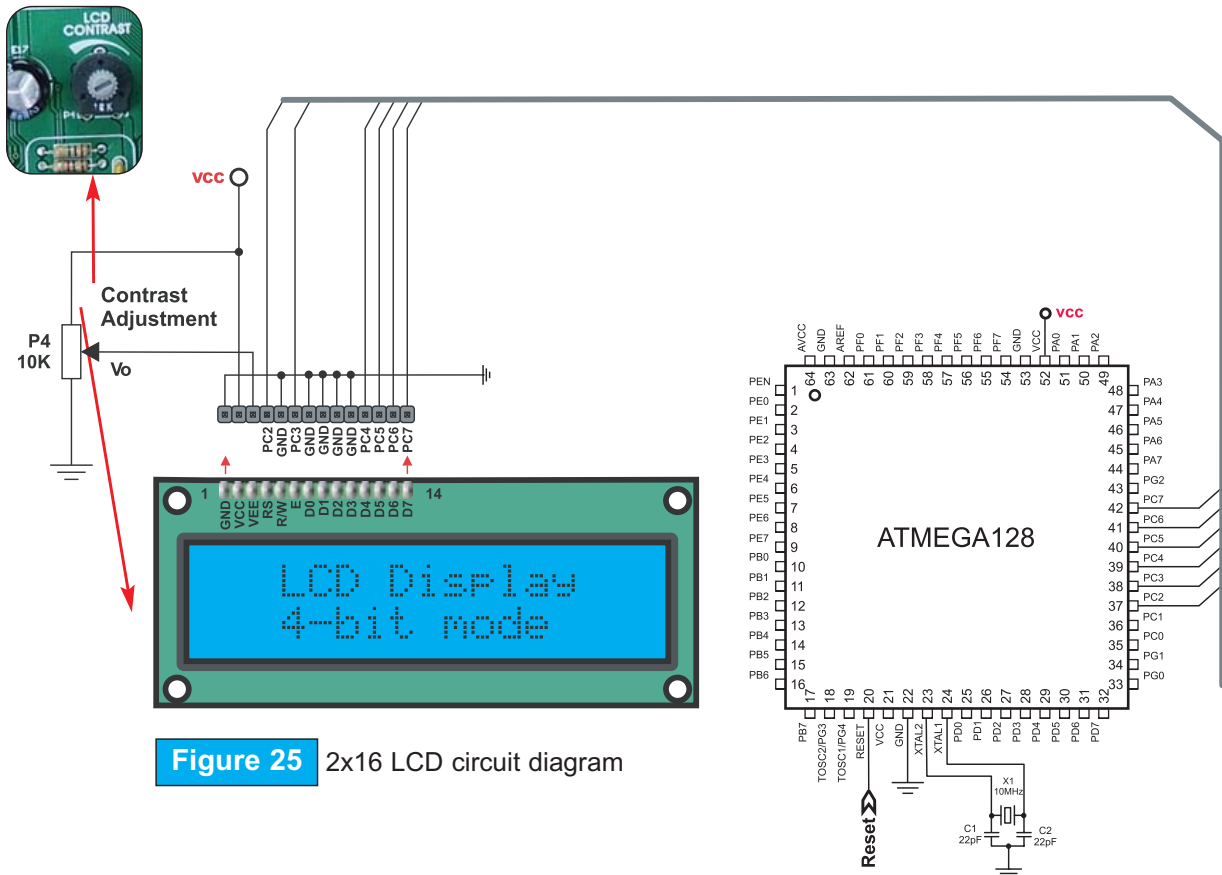


Figure 25 2x16 LCD circuit diagram



Note: It is very important to bear in mind that LCD should be placed on or removed from the BIGAVR2 development board only after the power supply is switched off. Otherwise, it could be permanently damaged.

GRAPHIC LCD

A graphic LCD (GLCD) provides an advanced method for displaying visual messages. 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 128x64 pixels screen resolution. The GLCD contrast can be adjusted using the potentiometer P3 placed right above the touch panel controller.

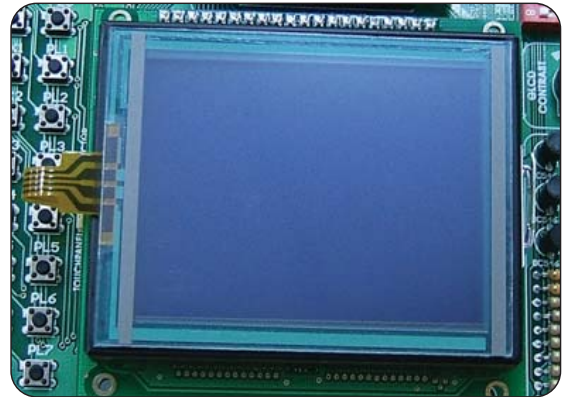


Figure 26 GLCD

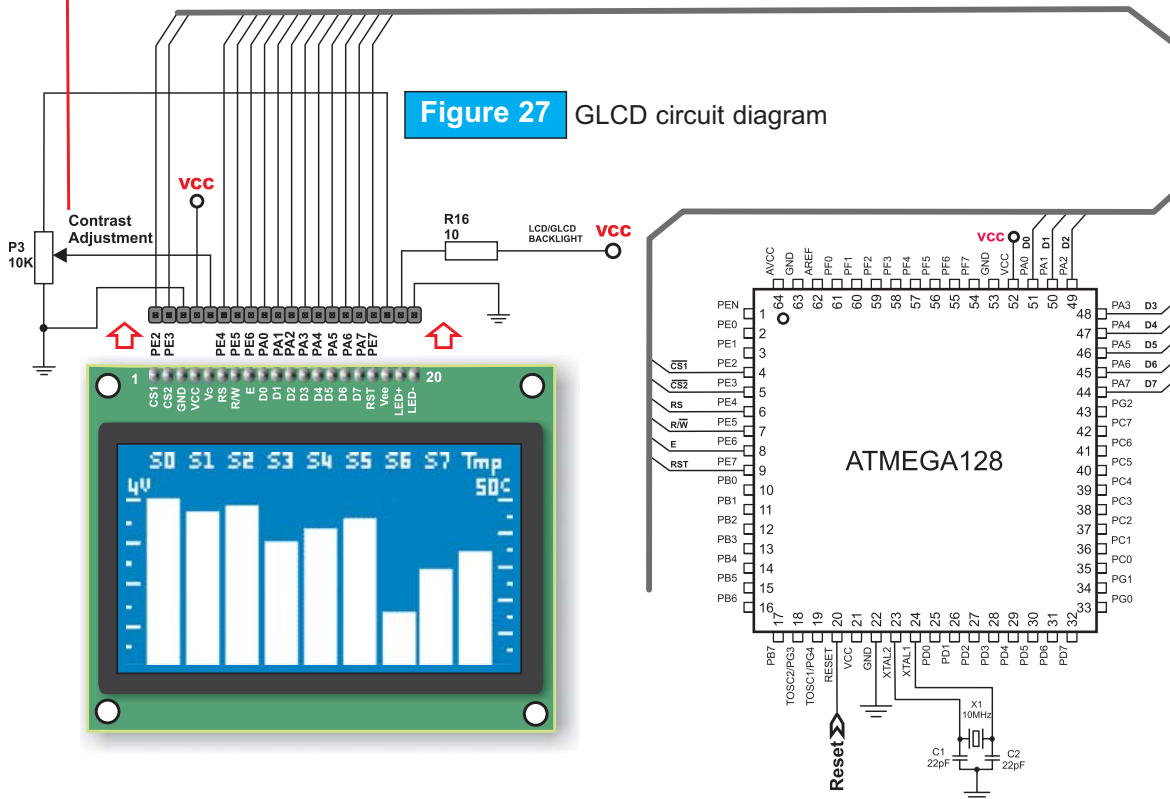
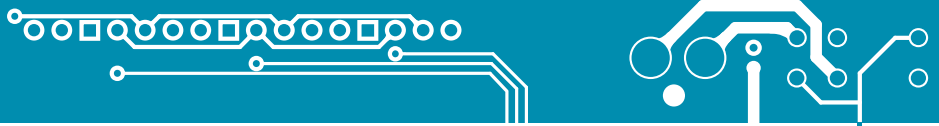


Figure 27 GLCD circuit diagram



Note: It is very important to bear in mind that GLCD should be placed on or removed from the BIGAVR2 development board only after the power supply is switched off. Otherwise, it could be permanently damaged.



TOUCH PANEL

Touch panel is a thin, self-adhesive, transparent panel that could be placed over screen of graphic LCD. It consists of two separate foils which form “sandwich” structure. They are very sensitive to press so that even a soft touch causes some changes on output signal. It is used in various user-friendly devices in combination with graphic LCD. Connector CN12 enables this device to be connected to on-board touch panel controller whose active part consists of 5 discrete transistors. Four switches of the SW2 enable or disable connection between this controller and PF0, PF1, PG3 and PG4 pins.



Figure 28 Touch panel connector

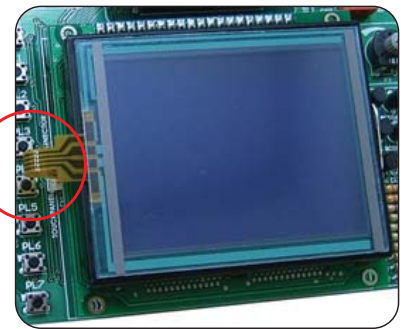
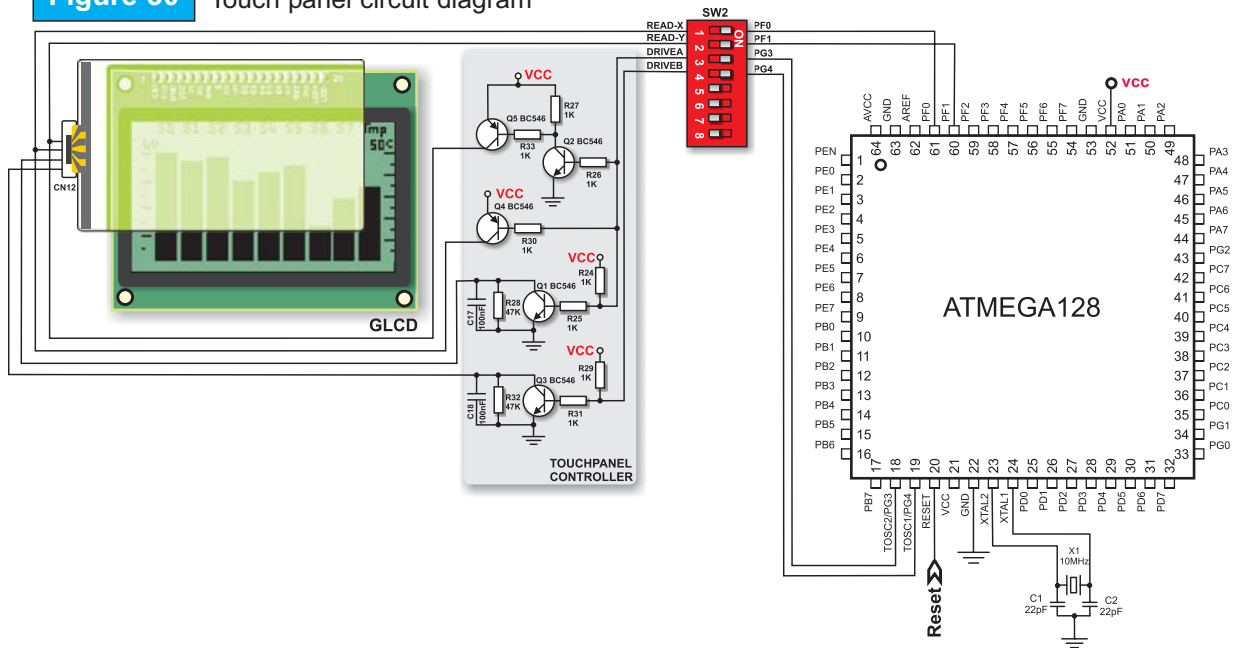
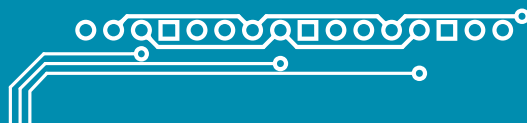
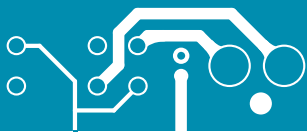


Figure 29 Touch panel

Figure 30 Touch panel circuit diagram



Note: It is very important to bear in mind that touch panel should be placed on or removed from the BIGA/R2 development board only after the power supply is switched off. Otherwise, it could be permanently damaged.



RS-232 COMMUNICATION

RS-232 communication enables point-to-point data transfer. It is commonly used in data acquisition applications to transfer data between the microcontroller and PC. Since the voltage levels of the microcontroller and PC are not directly compatible with those of RS-232, a level transition buffer, such as MAX232, must be used.

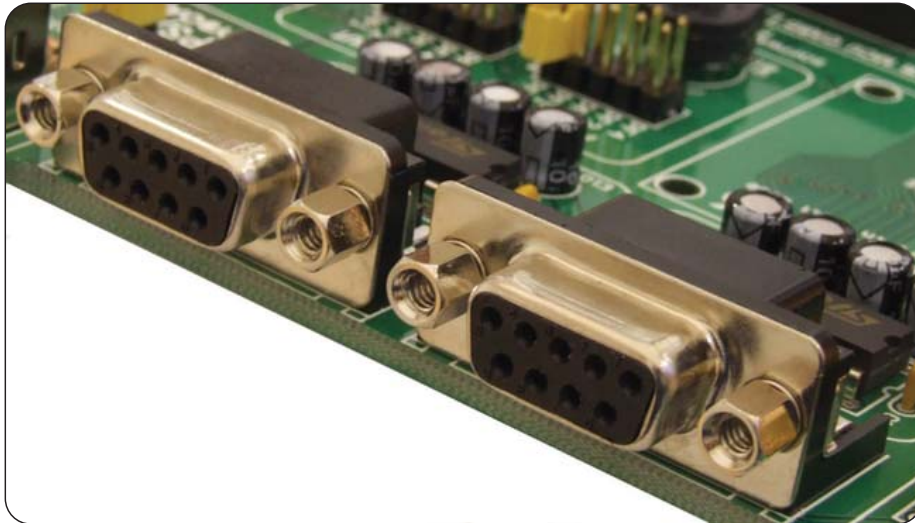


Figure 31 RS232 connector

In order to provide even more flexible system, the microcontroller is connected to two MAX232 chips through switches of the SW3. First two switches (1 and 2) are used to connect MCU pins PE0 and PE1 to the RS232-A port via Rx and Tx lines, respectively. Other two switches (5 and 6) are used to connect MCU pins PD2 and PD3 to the RS232-B port through Rx and Tx lines, respectively. Both RS232 ports have RTS and CTS lines (3 and 4 on RS232-A and 7 and 8 on RS232-B) for implementing hardware handshaking.

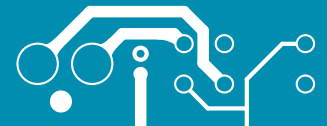


Figure 32 Connection between microcontroller and PC through the RS-232A

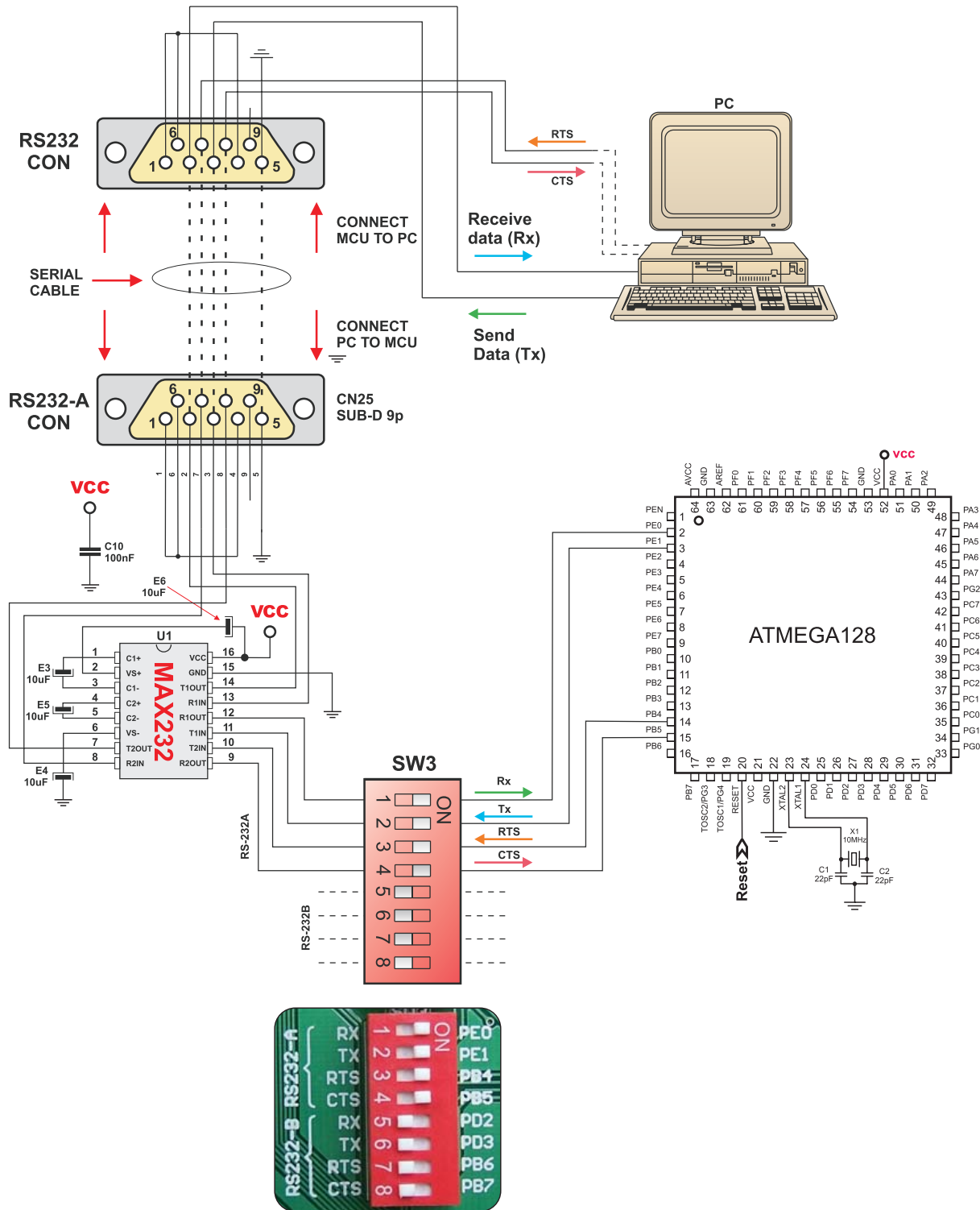
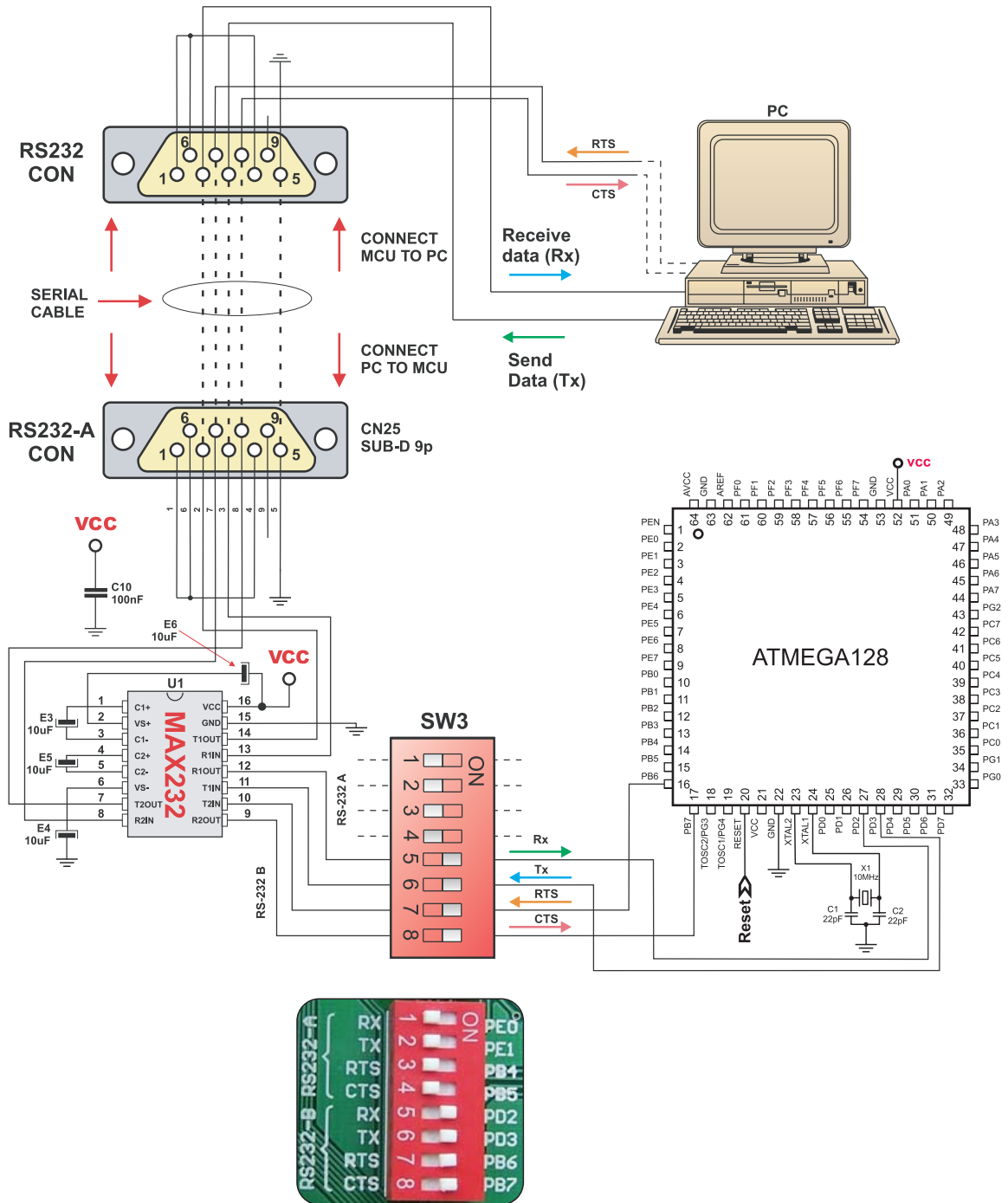
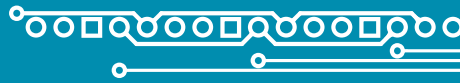




Figure 33 Connection between microcontroller and PC through the RS-232B





A/D CONVERTER TEST INPUTS

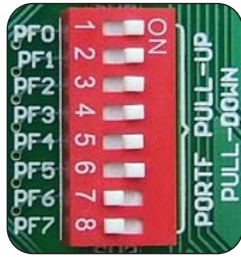
The *BIGAVR2* development board has two potentiometers for demonstrating the operation of analog-to-digital converter (ADC). Both potentiometers outputs are in the range of 0 - 5V. These analog signals can be connected to two different analog input pins at the same time. Jumper group J18 enables connection between potentiometer P1 and one of the following pins: PF0, PF1, PF2, PF3 or PF4. Jumper group J19 enables connection between potentiometer P2 and one of the following pins: PF1, PF2, PF3, PF4 or PF5.



Figure 34 A/D converter inputs

In order to measure analog signal without interference, it is necessary to turn off the corresponding switch of the SW4. This disables connection between PORTF pins and pull-up/down resistors.

A/D converter has a wide range of applications. The microcontroller takes analog signal from its input pin and converts it into digital value. Basically, it is possible to measure any analog signal that fits in the range acceptable by the microcontroller. In case of AVR, that range is 0 - 5V.



Pull-up/down resistors on PORTF analog input pins should be disabled using the SW4

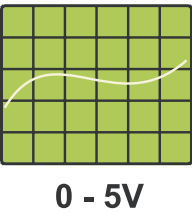
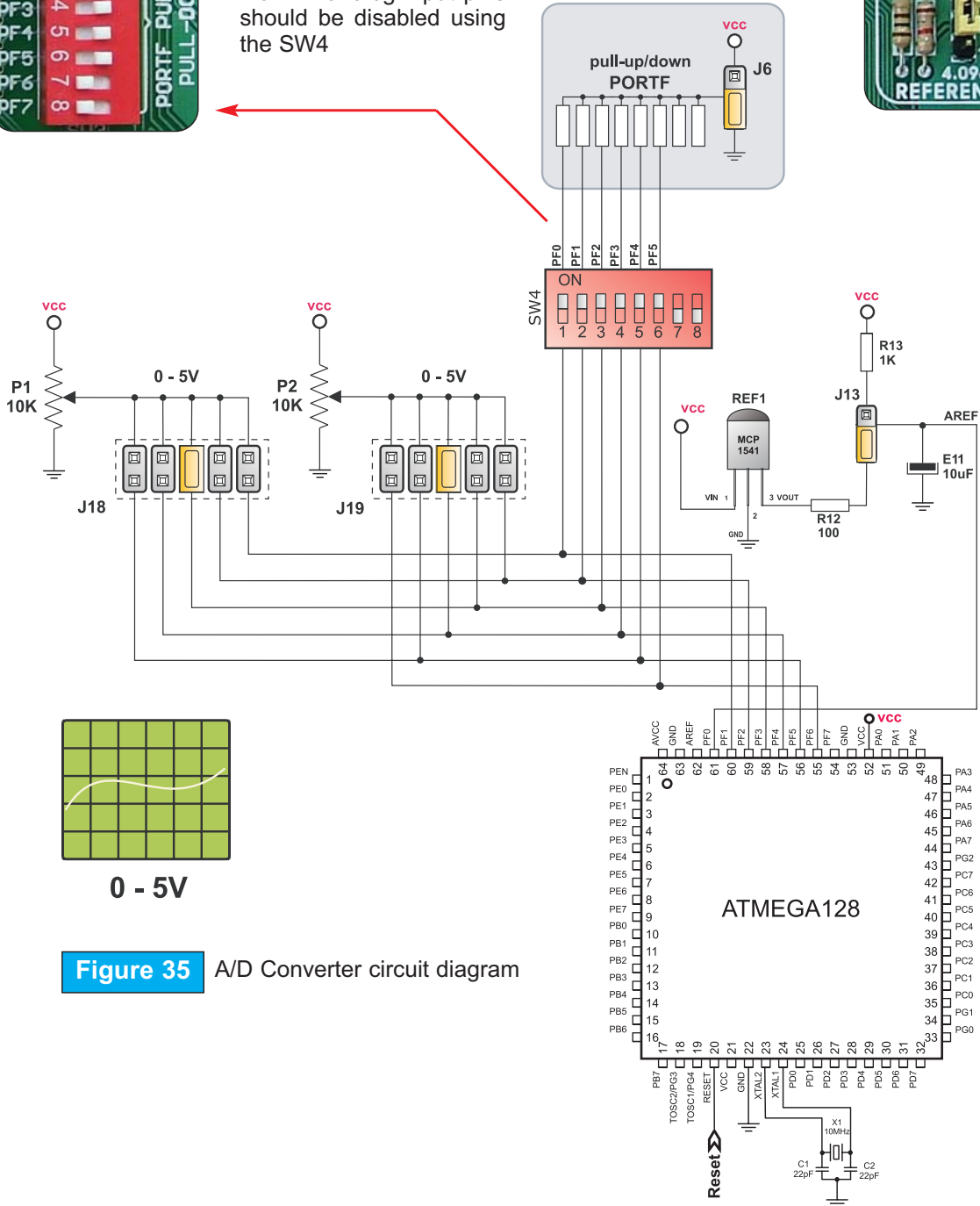
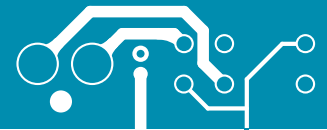


Figure 35 A/D Converter circuit diagram



NOTE: Jumpers J18 and J19 should not connect pins with the same label at the same time.



DIRECT PORT ACCESS

All the microcontroller input/output pins can be accessed via 10-pin connectors (2x5) placed along the right side of the board. For each microcontroller port there is one connector providing eight port pins for data transfer and two additional pins connected to VCC and GND.

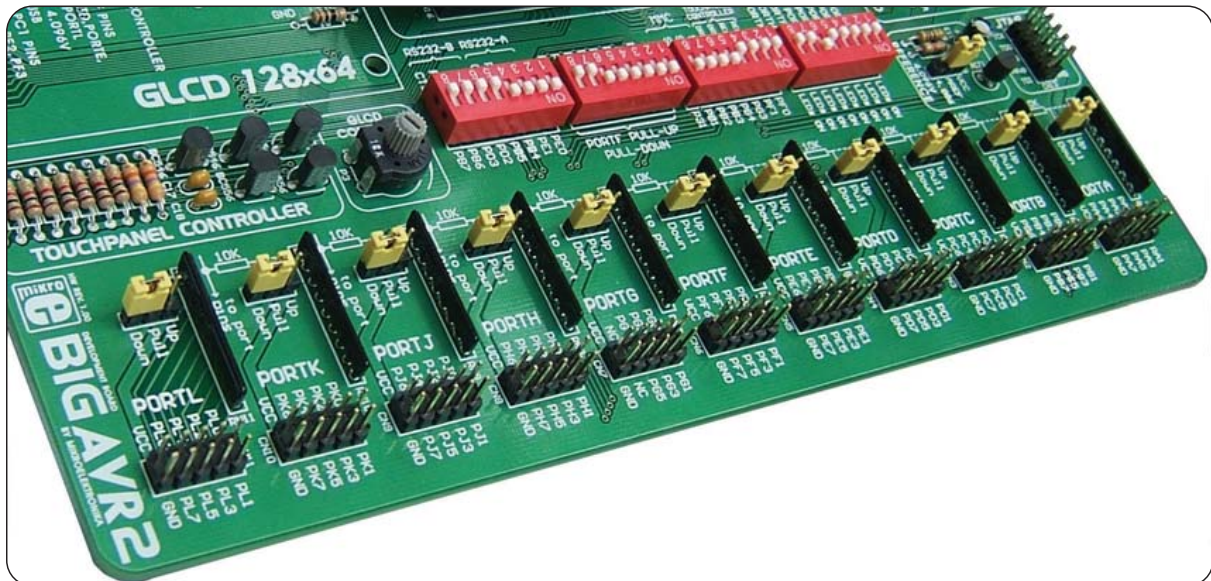


Figure 36 Direct port access connectors

These connectors can be used to connect the system to external devices such as Serial Ethernet, Compact Flash, DAC, CAN, RTC, RS-485 etc. In case on-board and external peripherals use the same pins, then on-board peripherals must be disconnected from the microcontroller by setting the appropriate jumpers. The connectors can be also used for attaching logic probes or other test equipment.

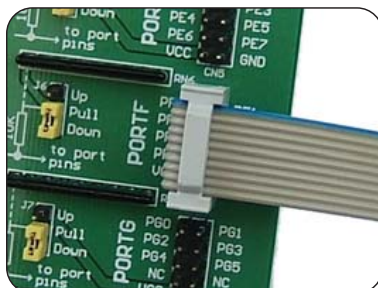


Figure 37 Connecting external peripheral via flat cable

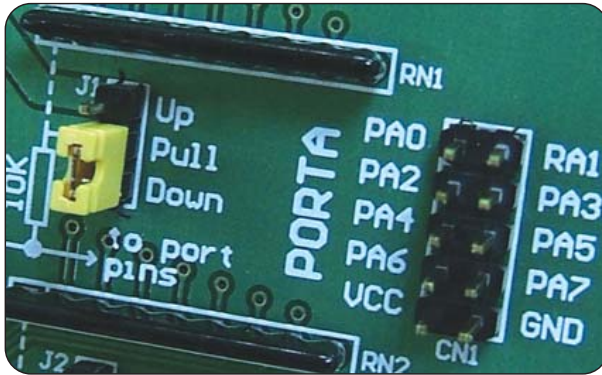


Figure 39 PORTA

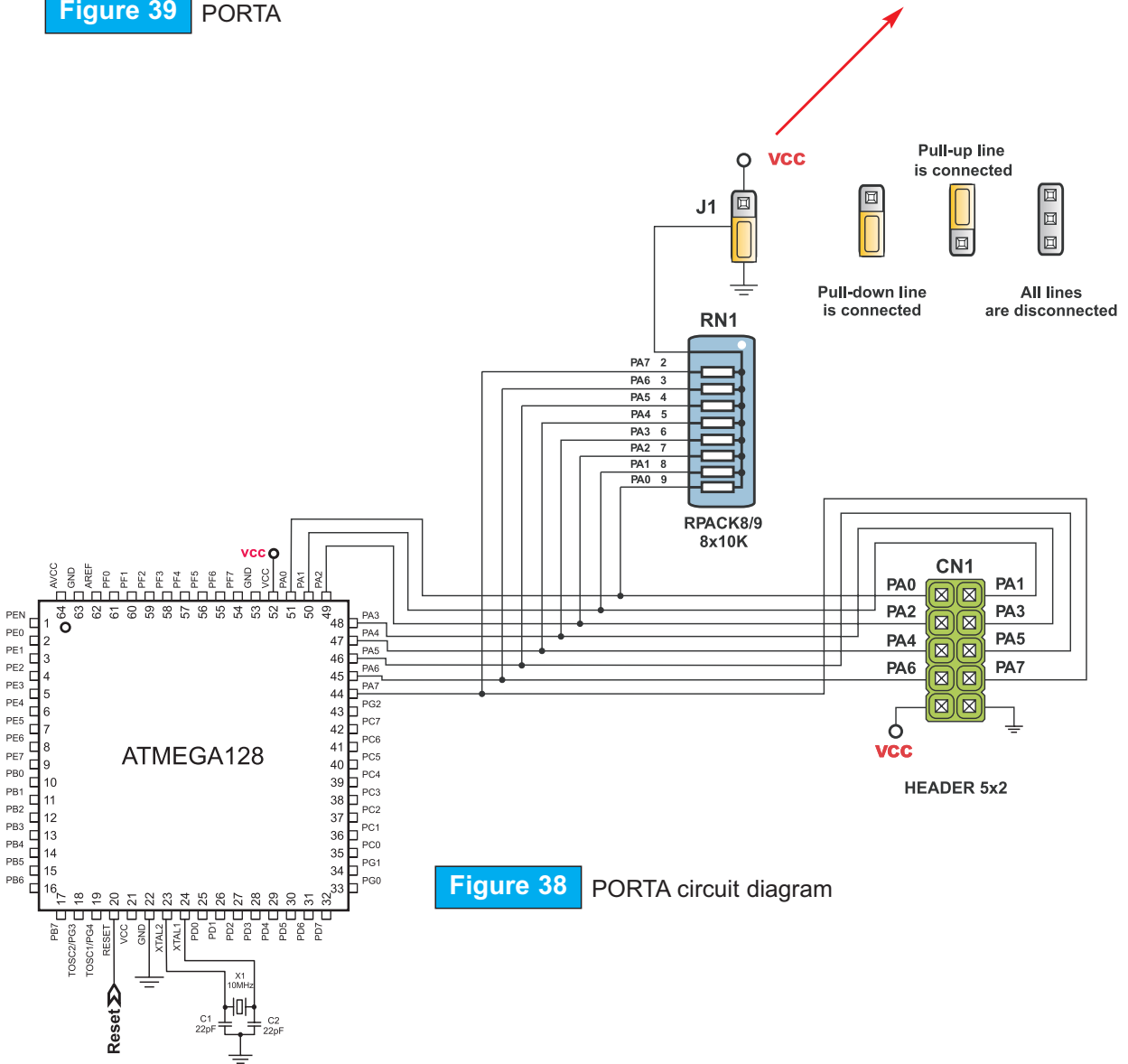
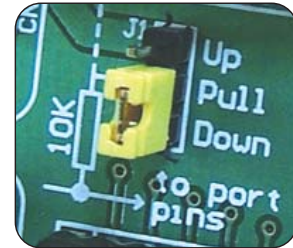
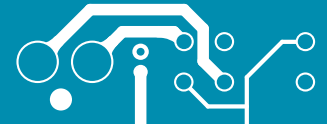
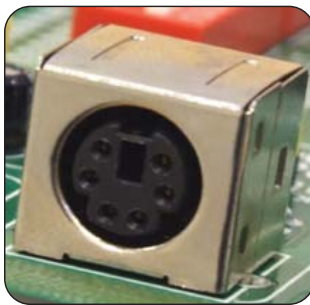


Figure 38 PORTA circuit diagram



PS/2 (KEYBOARD) CONNECTOR

PS/2 connector allows direct connection between BigAVR2 and devices that use PS/2 communication, such as PC, keyboard or mouse. For example, the microcontroller can be connected to a keyboard to capture pressed keys or to a PC to act as a keyboard. CLK and DATA lines are used for data transfer. In this case, they should be connected to pins PC1 and PC0 respectively.



J15 and J16 are in default position (OFF). Connect them in order to use PS/2 connector.

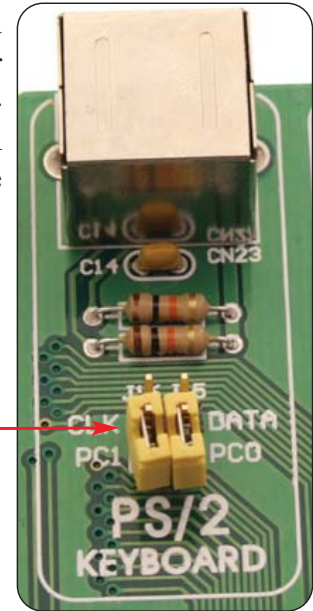


Figure 40 PS/2 connector

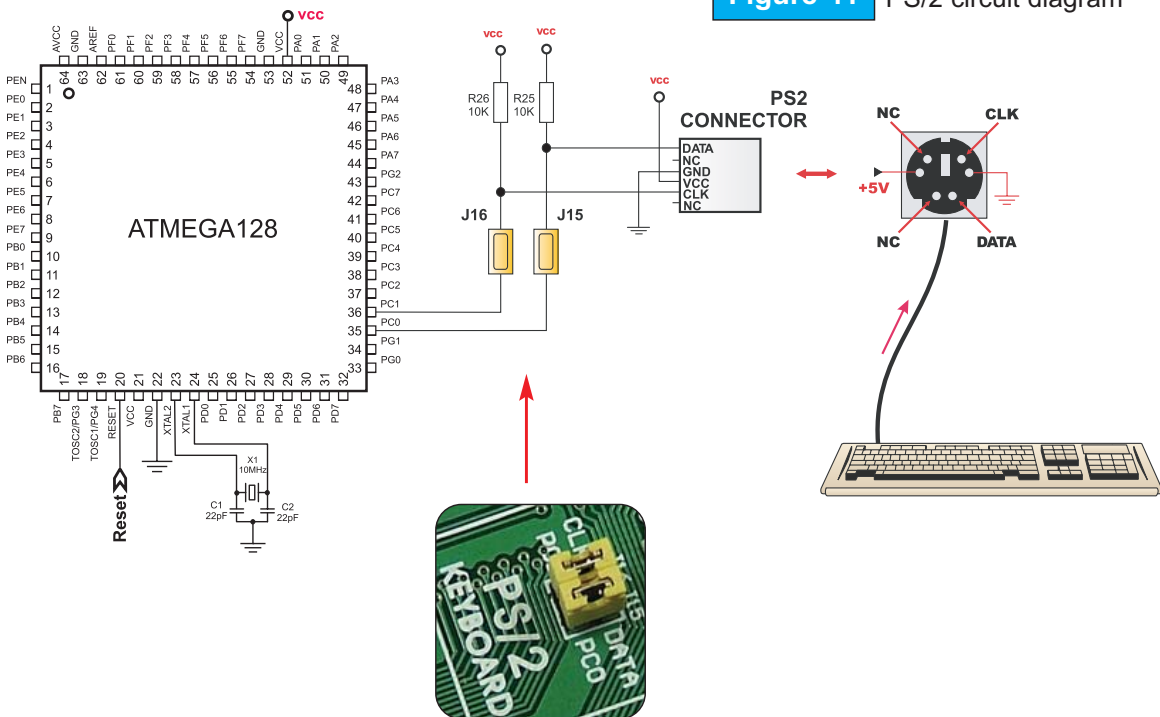


Figure 41 PS/2 circuit diagram

JTAG CONNECTOR

JTAG connector can be used as a serial programming interface or as a part of on-chip debugger. JTAG connector pin marked as nSRST is directly connected to the RESET push-button. In that way, on-chip debugger is able to use the RESET push-button as external reset source. Additionally, the debugger can pull the RESET pin low in order to reset the whole system. The JTAG interface is accessed through the four microcontroller pins:

- TCK:** *Test Clock*
- TDO:** *Test Data Out*
- TMS:** *Test Mode Select*
- TDI:** *Test Data In*

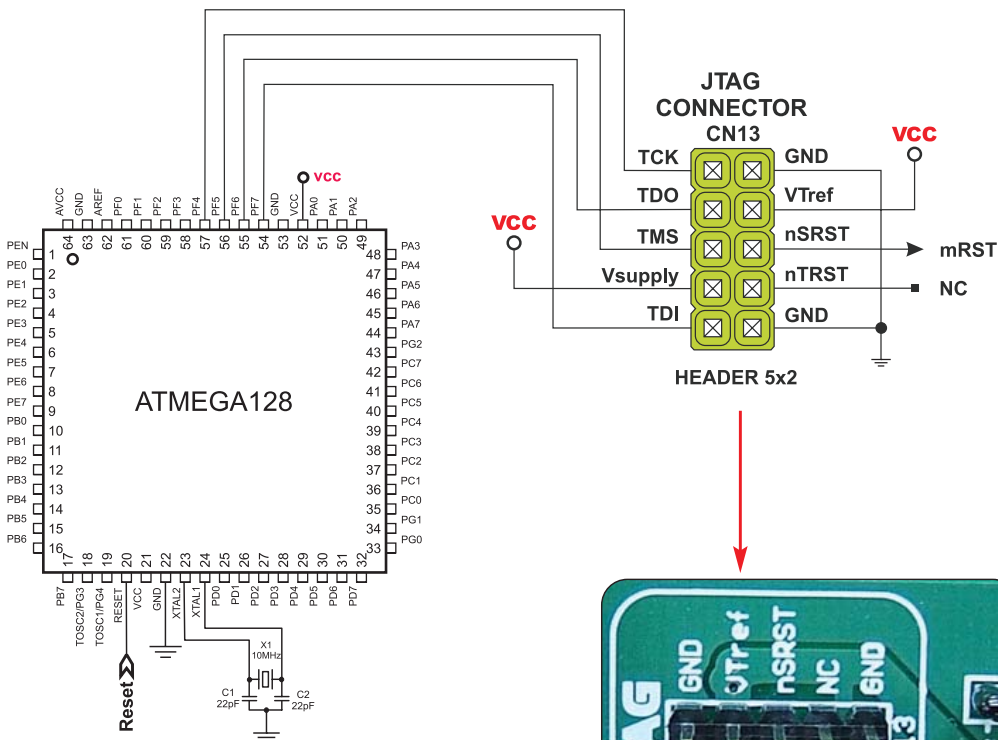


Figure 42 JTAG circuit diagram

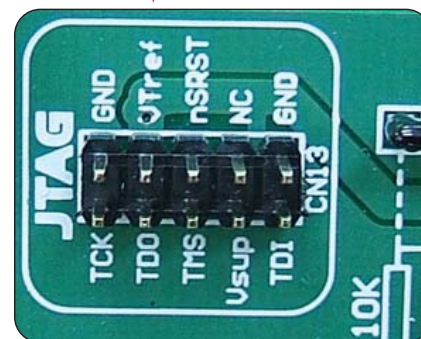
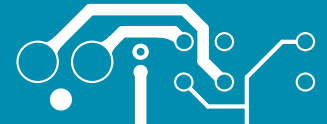


Figure 43 JTAG connection



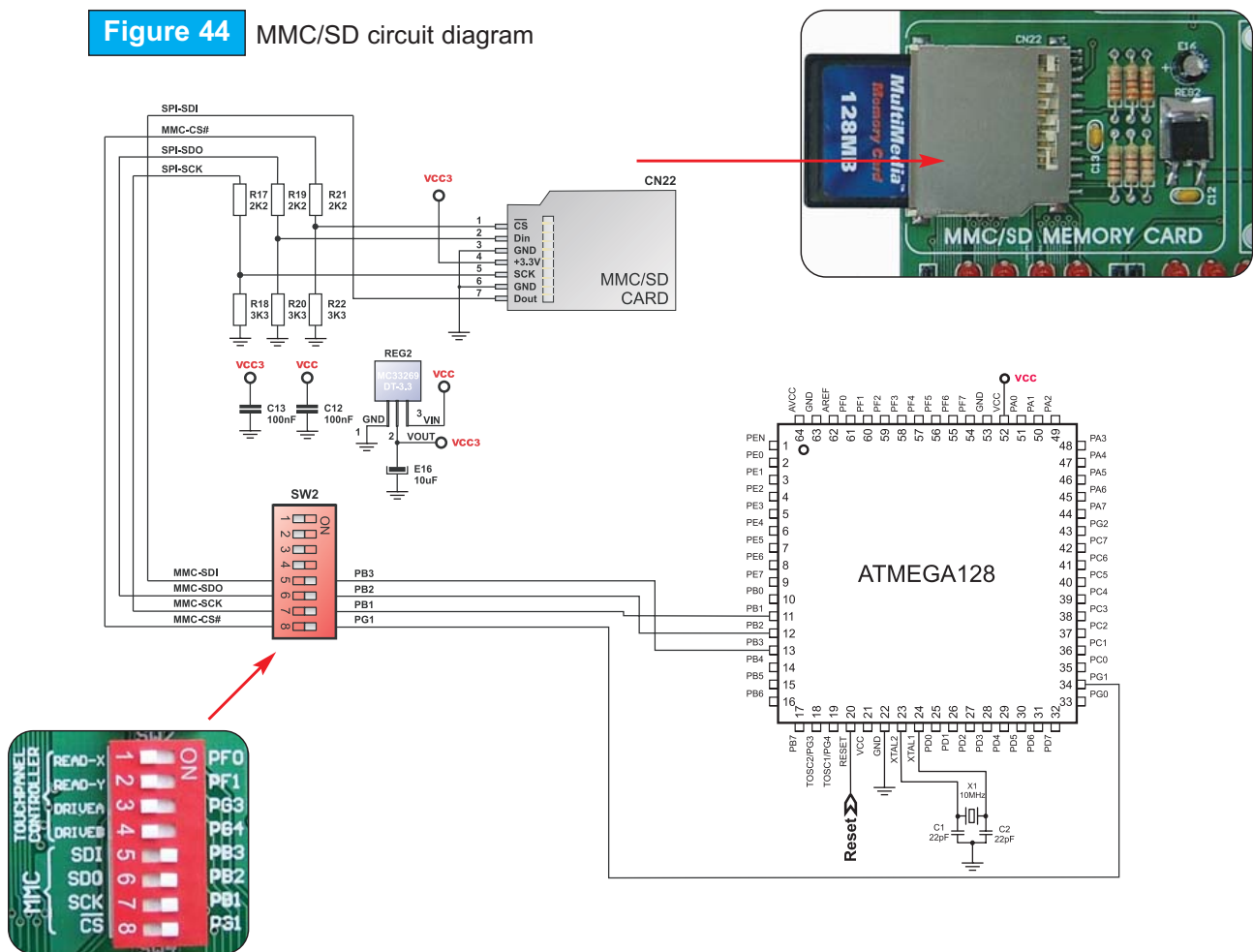
MMC/SD (MULTIMEDIA CARD)

MMC card is used as a storage media for a portable devices from which it can be easily removed to enable data transfer to a PC. For example, a digital camera uses MMC card for storing image files. Data can be easily transferred from MMC card to a PC using MMC reader. Modern computers, laptops and desktops usually have card readers with SD slots for reading MMC cards.

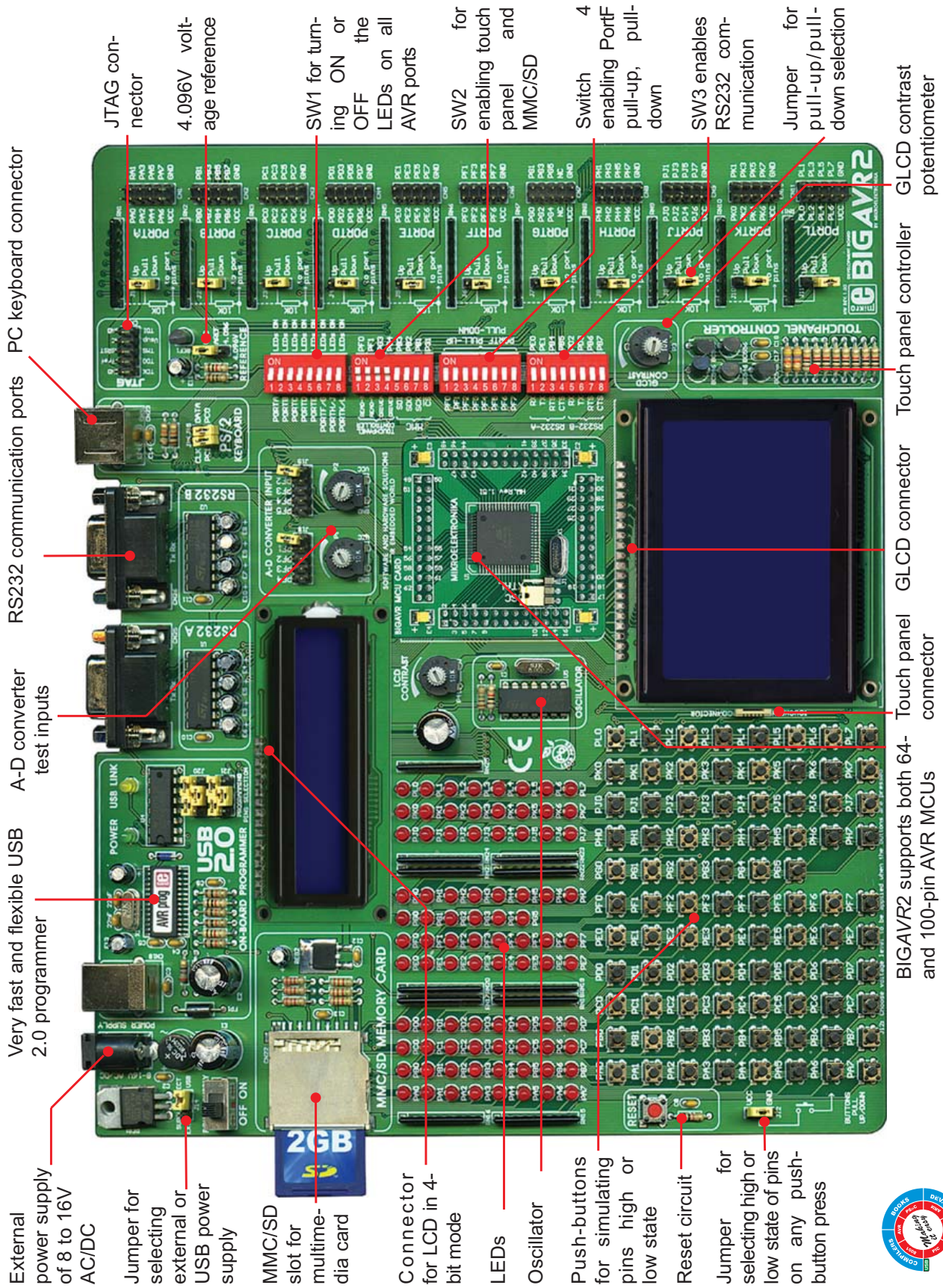
Microcontroller on the *BIGAVR2* development board communicates with MMC card via SPI communication.

In order to enable MMC card, it is necessary to select and turn on switches 5, 6, 7, 8 of the switch group SW2. The *BIGAVR2* power supply voltage is 5V DC, whereas the MMC card power supply voltage is 3.3V DC. Because of that, there is an on-board voltage regulator MC33269DT-3.3. For the same reason voltage level on data lines connecting the microcontroller to MMC card must be limited to 3.3V. It is done by means of resistor voltage dividers as shown in Figure 44.

Figure 44 MMC/SD circuit diagram



BIG AVR2



External power supply of 8 to 16V AC/DC

Jumper for selecting external or USB power supply

MMC/SD slot for multimedia card

Connector for LCD in 4-bit mode

LEDs

Oscillator

Push-buttons for simulating pins high or low state

Reset circuit

Jumper for selecting high or low state of pins on any push-button press

Very fast and flexible USB 2.0 programmer

A-D converter test inputs

RS232 communication ports

PC keyboard connector

JTAG connector

4.096V voltage reference

SW1 for turning ON or OFF the LEDs on all AVR ports

SW2 for enabling touch panel and MMC/SD

Switch enabling PortF pull-up, pull-down

SW3 enables RS232 communication

Jumper for pull-up/pull-down selection

GLCD contrast potentiometer

Touch panel controller

GLCD connector

Touch panel connector

BIG AVR2 supports both 64- and 100-pin AVR MCUs



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