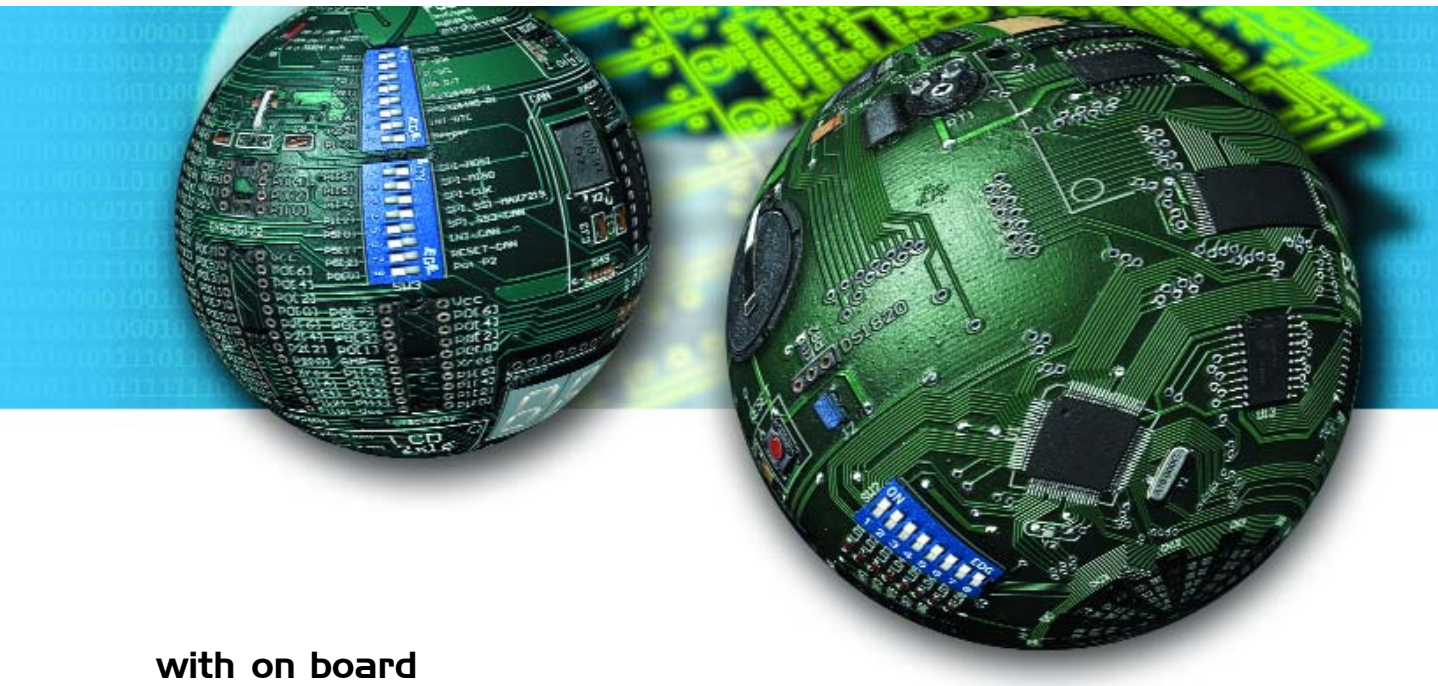
SOFTWARE AND HARDWARE SOLUTIONS FOR THE EMBEDDED WORLD

MikroElektronika
Development tools - Books - Compilers

BIGPIC 3
User's Manual



with on board
USB
2.0 programmer

With useful implemented peripherals, plentiful practical code examples and a broad set of additional add-on boards (ADC potentiometers, two RS-232, MMC / SD Card, Compact Flash, etc.), MikroElektronika development boards make fast and reliable tools that can satisfy the needs of experienced engineers and beginners alike.

Software and Hardware
solutions for Embedded World

First edition
November
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 BIGPIC3 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 PICFLASH2.exe file to the folder of your choice. You can find this file in the PICFLASH folder on the CD.

Step no.5 Run and use PICFLASH2 as explained in the document '*PICflash2 programmer*'.

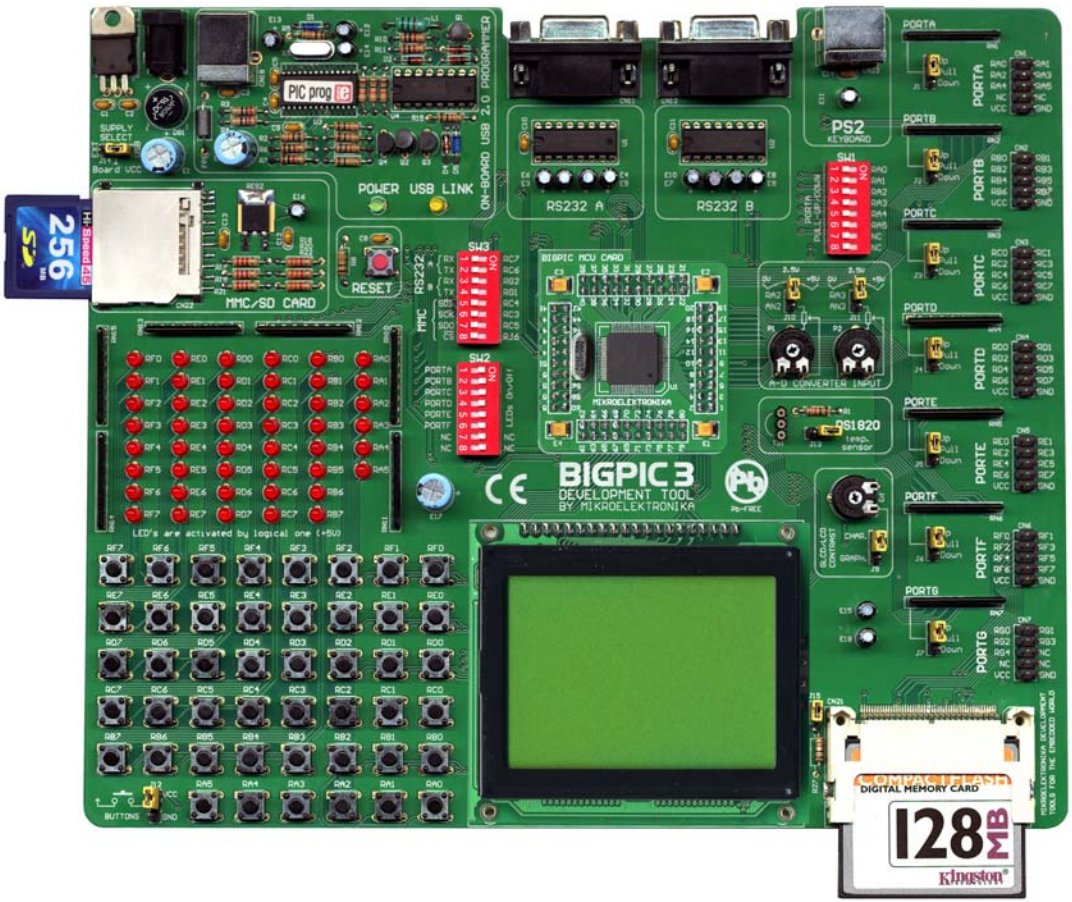
After these 5 steps, your BIGPIC3 is installed and ready for use. You should try to read a program from the chip or to load an example from the examples folder.

INTRODUCTION

The BIGPIC3 development system is a full-featured development board for Microchip PIC microcontrollers. It has been designed to allow students and engineers to easily exercise and explore the capabilities of PIC microcontrollers. It allows PIC 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. BIGPIC3 development board



SWITCHES

The BIGPIC3 development board features many peripherial 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 BIGPIC3 development system has three groups of switches.

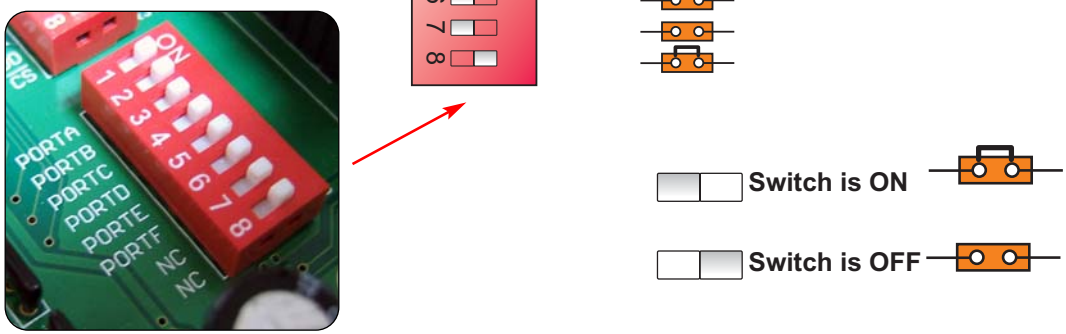
The first group, **SW1,** enables a connection between the microcontroller ports with external pull-up/down resistors. When port RA pins are used as digital inputs/outputs, the appropriate pull-up/down resistors should be enabled.

The switches of **SW2** are used to enable LEDs connected to ports RA, RB, RC, RD, RE and RF. For example, if switch RB is OFF, all RB LED's will be turned off.

The switches of **SW3,** enables a connection between the microcontroller ports and MMC/SD Card via SPI communication and also between the microcontroller ports and both RS232 communication devices. First two switches are used for RS232 A communication lines, second two are used for RS232 B communication lines and last four are used for MMC/SD Card.

Figure 2.

Group of 8 switches



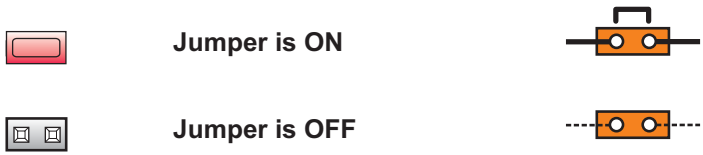
JUMPERS

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 J10 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

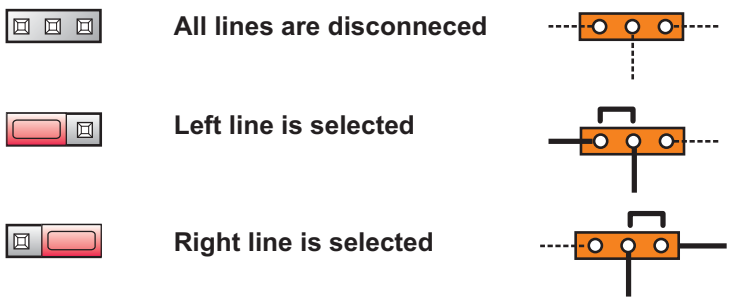


More often, jumpers are used as a selector between two possible connections using a three pin connector. As illustrated in Fig. 4, middle connector can be connected to the left or right pin, depending on the jumper's position.

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Figure 4.

Jumper as a multiplexer



MCU CARD

The BIGPIC3 development board have a 80-pin MCU Card as shown on the following picture:

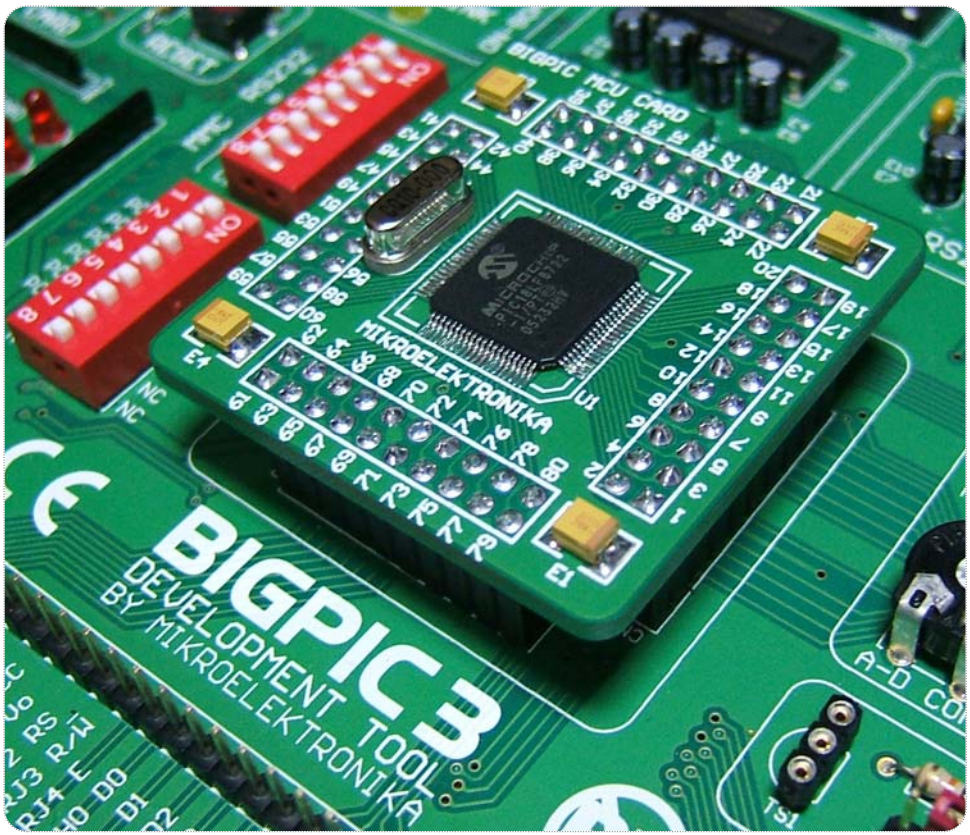
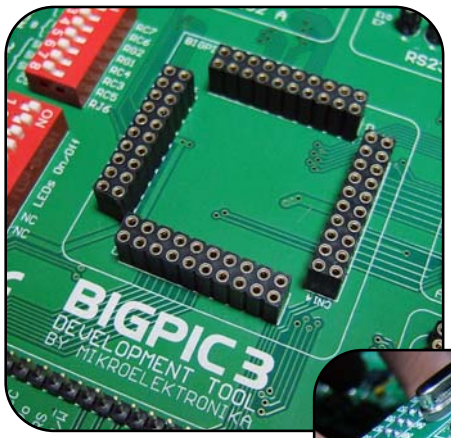


Figure 5. MCU Card

When you are placing MCU Card on the BIGPIC3 MCU socket you must follow these steps:

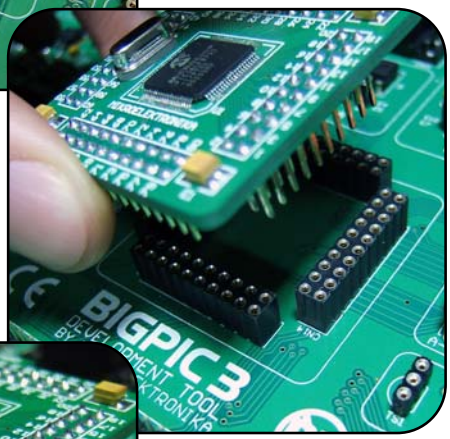


Step no.1

If there is already MCU Card placed on BIGPIC3, you must remove it by slowly pulling it up.

Step no.2

Label on the MCU Card must be at the upper-left corner as it is drawn on the BIGPIC3 board.





Step no.3

When MCU Card is on the place, push it down by applying the pressure on all edges at the same time.

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

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

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

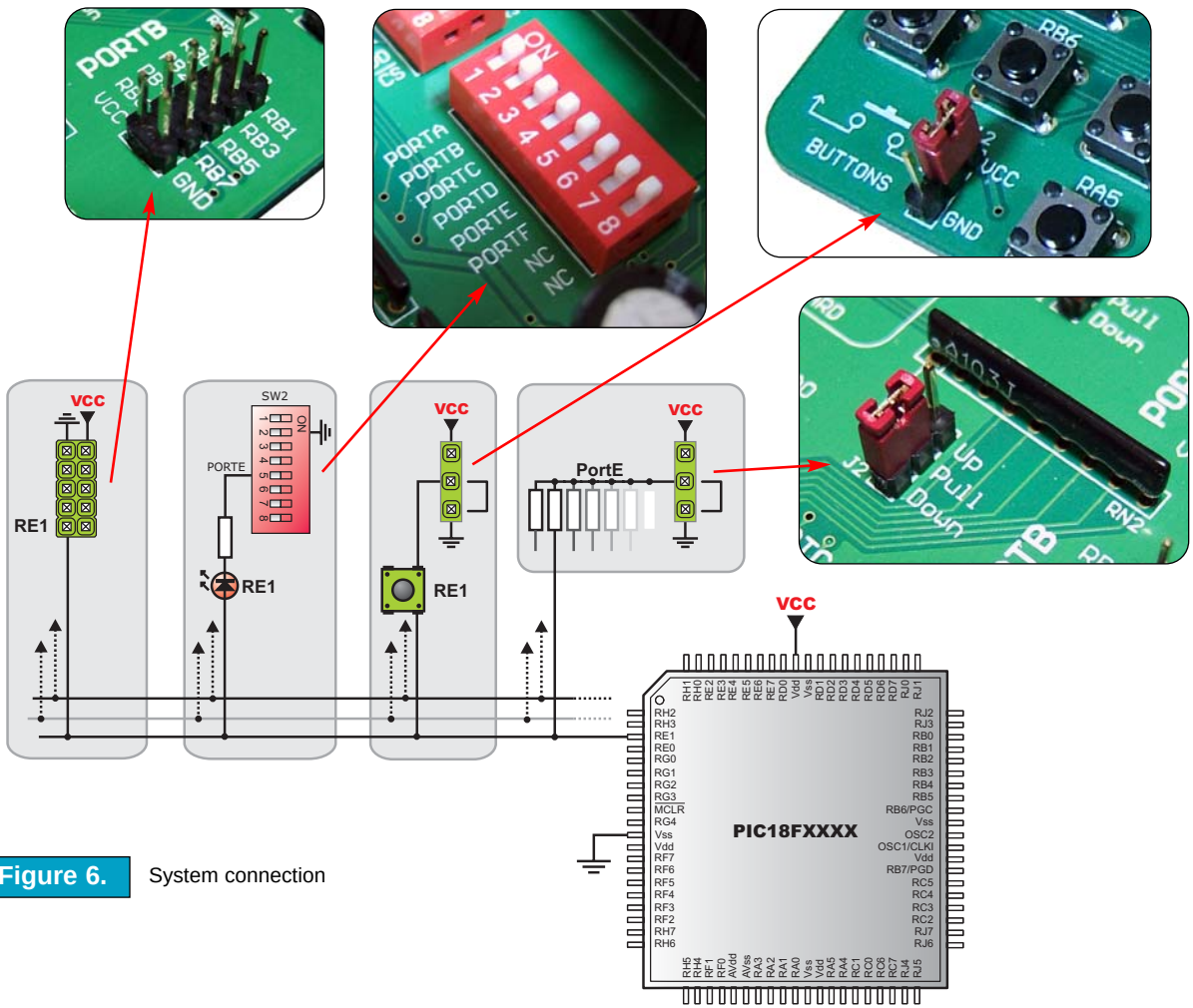


Figure 6. System connection

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 case of the USB power supply, the system sholud be connected to a PC using the USB programming cable and jumper J14 should be set in the right-hand position.

In case of an external power supply, the BIGPIC3 board produces +5V using an LM7805 voltage regulator. The external power supply can be AC or DC, with a voltage between 9V and 16 V, and jumper J14 should be set in the left-hand position. In Fig. 8 you can see the USB (left) and power supply (right) connectors.

Figure 7. Power supply select jumper

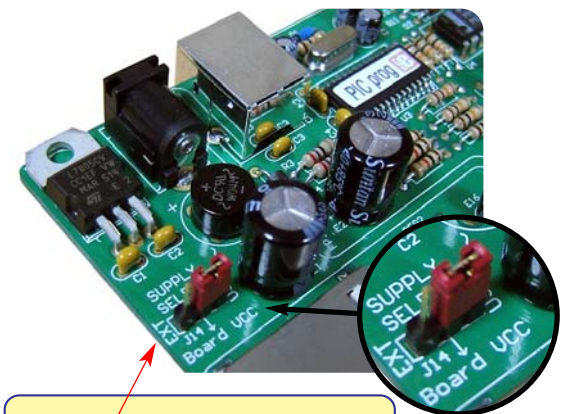
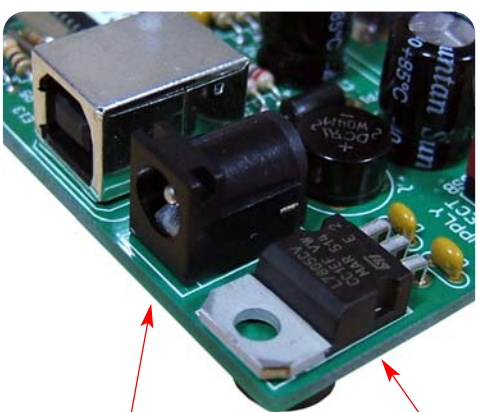
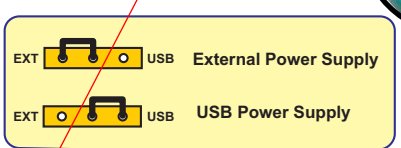


Figure 8. USB and power supply connectors



J14 in the left position: system will take power from the external AC/DC power adapter.

J14 in the right position: system will take power from the USB cable.



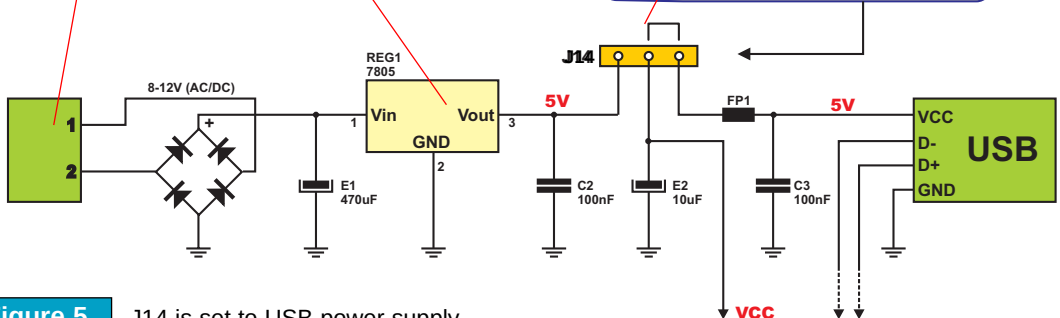


Figure 5. J14 is set to USB power supply

ON-BOARD USB PROGRAMMER

There is no need for the use of external equipment during programming, as the BIGPIC3 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 *PICflash2* programming software, which is supplied with the board.

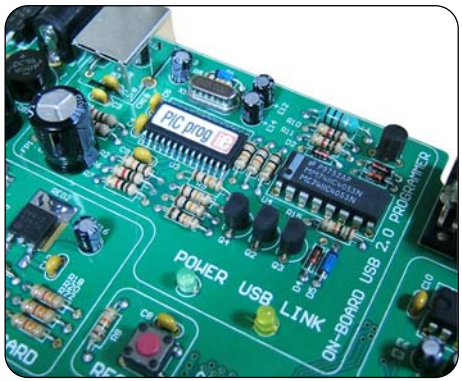


Figure 9. On-Board USB programmer

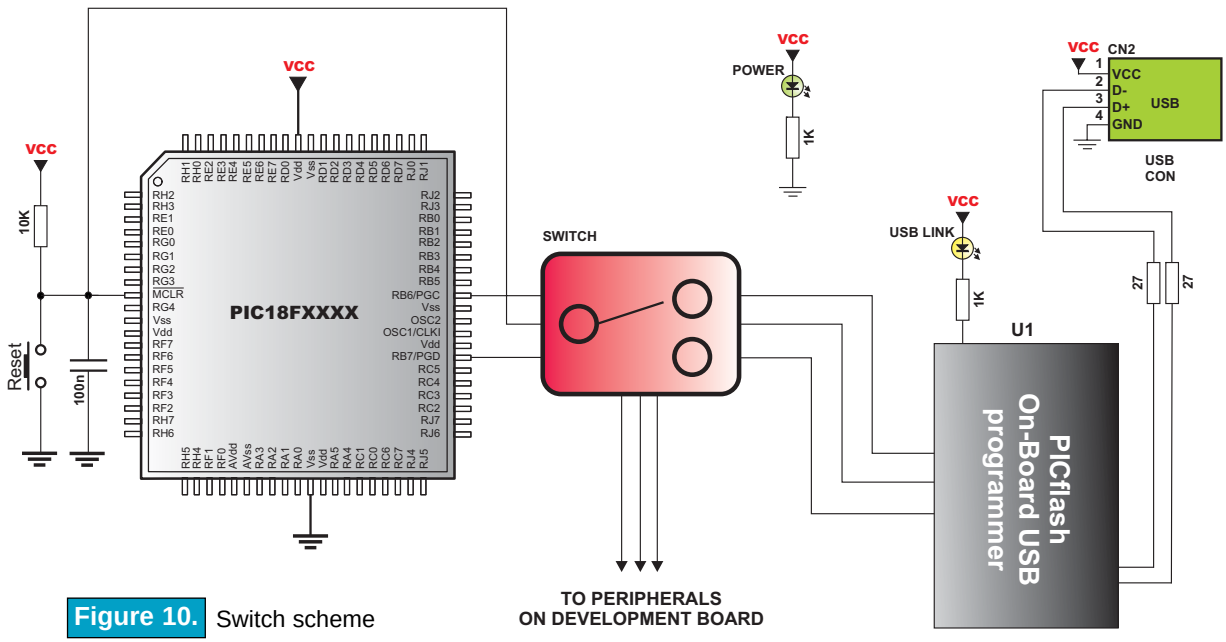


Figure 10. Switch scheme

LIGHT EMITTING DIODES

Light Emitting Diodes (LEDs) are the most commonly used components, usually for displaying pin's digital state. The BIGPIC have 46 LEDs that are connected to the microcontroller's ports RA, RB, RC, RD, RE and RF.

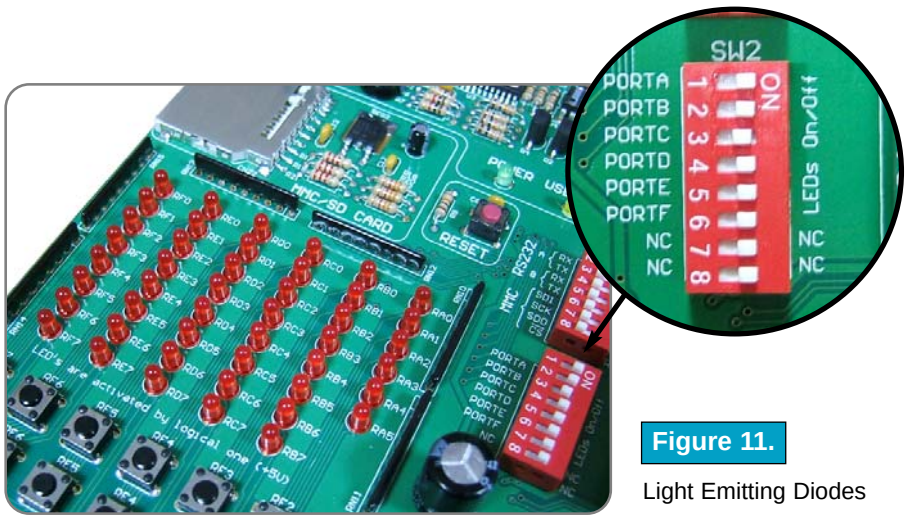


Figure 11.

Light Emitting Diodes

Each group of eight LEDs (except PORTA which have 6 LEDs) can be enabled or disabled using switch SW2, as shown in Fig. 11.

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

All 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 a ground and will display the state of the corresponding microcontroller pin; otherwise the LEDs will always be off, no matter what the pin state is, because no current can flow through it.

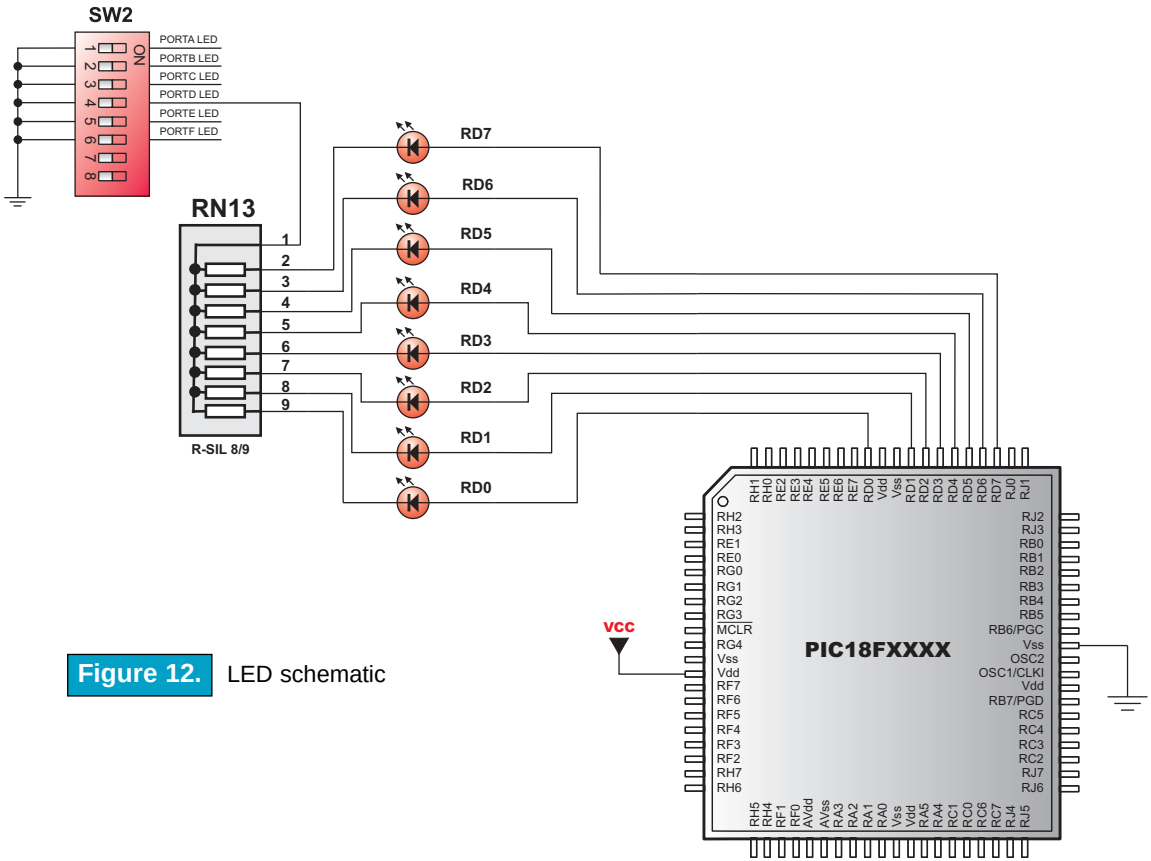


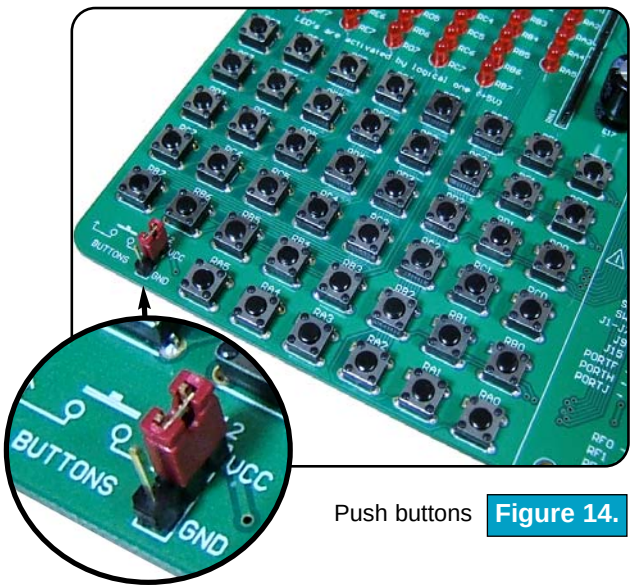
Figure 12. LED schematic

PUSH BUTTONS

The BIGPIC3 has 46 push buttons, which can be used to provide digital inputs to the microcontroller's ports. There is also one push button that acts as a RESET (Figure 13).



Reset button **Figure 13.**



Push buttons **Figure 14.**

Jumper J12 (zoomed on the figure 14) determines whether a button press will bring logical zero or logical one to the appropriate pin.

Buttons connection to ports RA, RB, RC, RD, RE and RF is shown in Fig. 15. In this example, the buttons are connected to +5V. In order to detect a button state, pull-up or pull-down resistors should be used.

Which one of those two, depends on how J12 is set. It is illustrated on the next page. For the example shown in Fig. 15, pull-down resistors would be required.

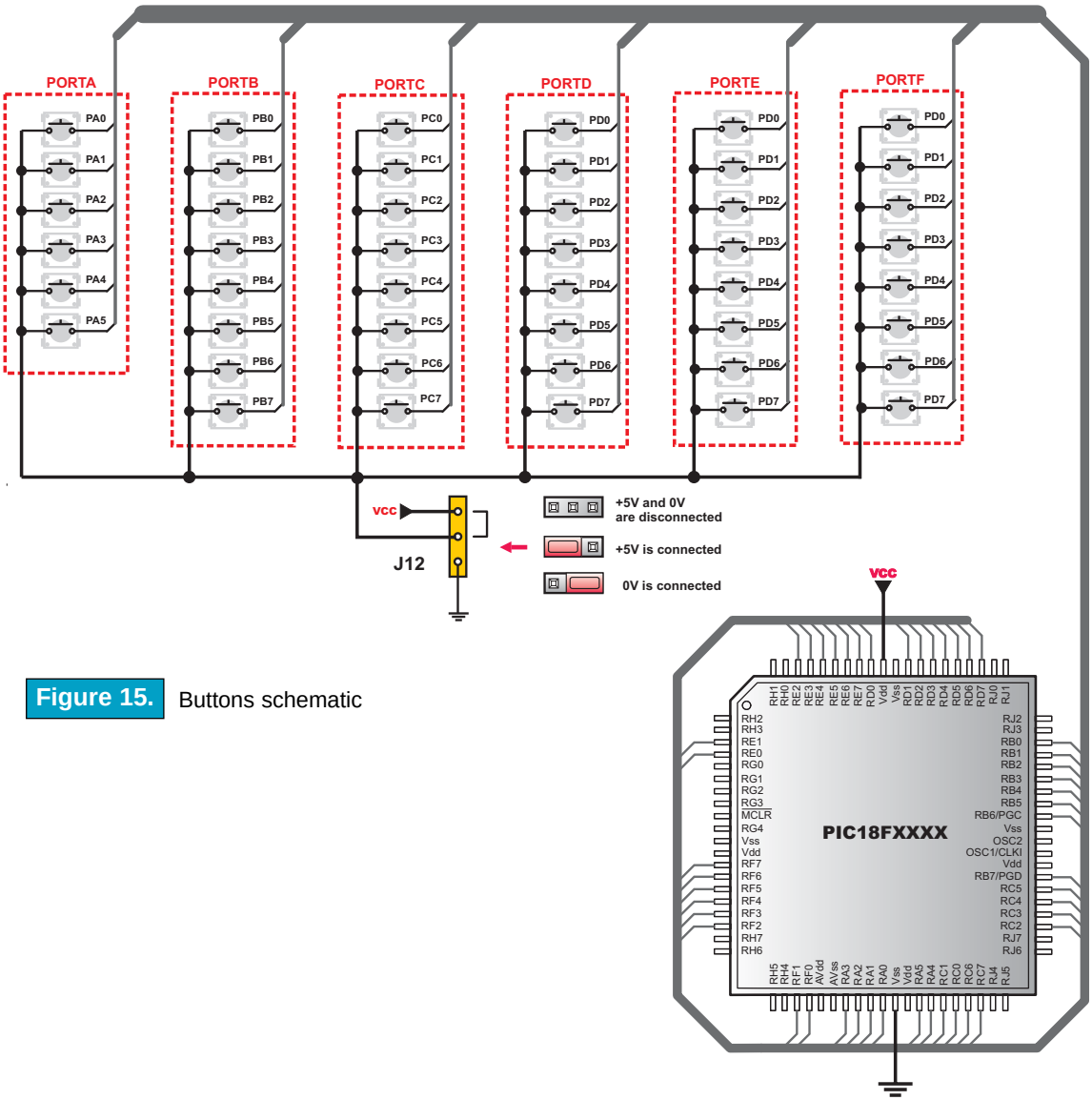


Figure 15. Buttons schematic

In the case of Fig. 16 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 (J12 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.

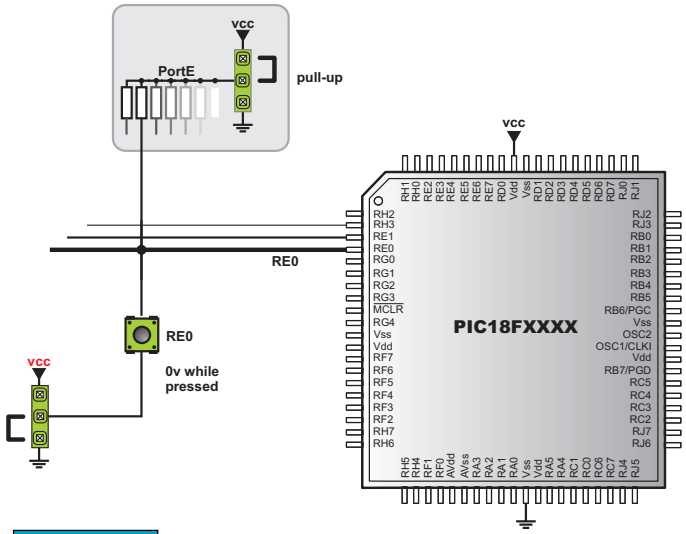


Figure 16. Button with pull-up resistor

In the case of Fig. 17 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 (J12 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.

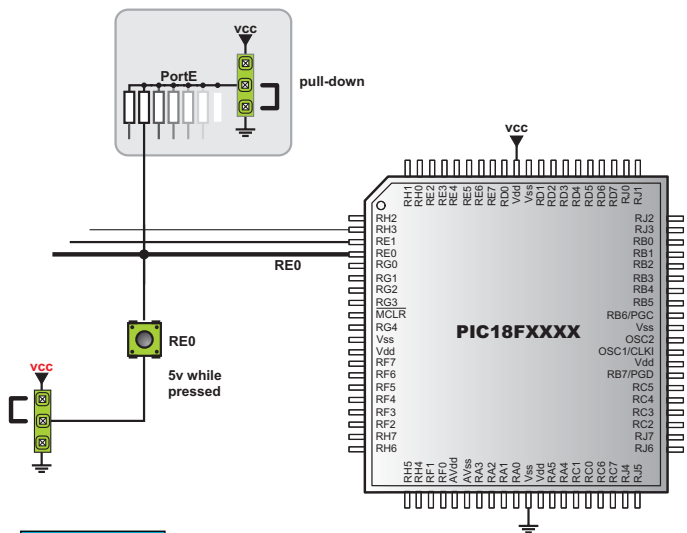
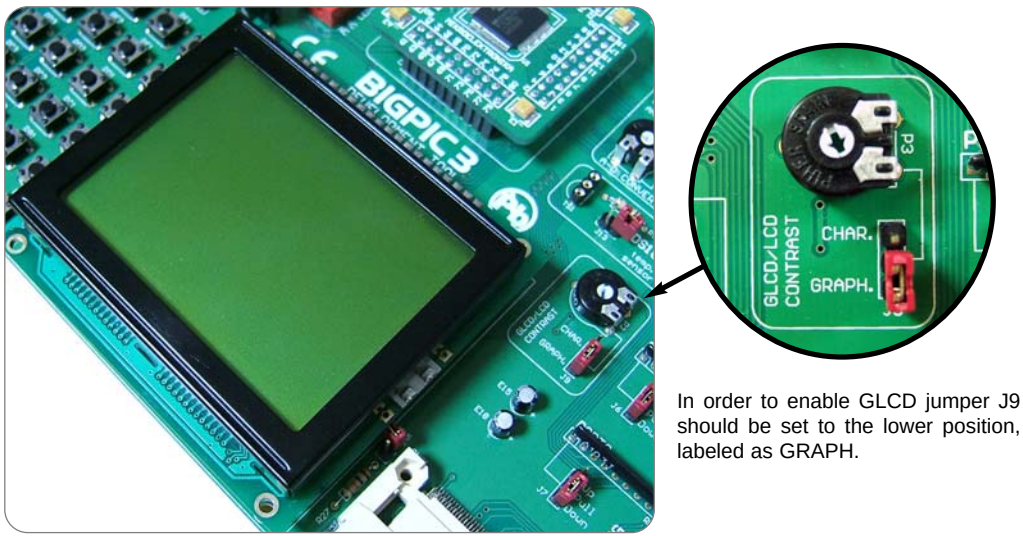


Figure 17. Button with pull-down resistor

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. 18) to the lower position. The GLCD's contrast can be adjusted using potentiometer P3. Jumper J9 and potentiometer P3 are placed to the upper-right of the GLCD.



In order to enable GLCD jumper J9 should be set to the lower position, labeled as GRAPH.

Figure 18. GLCD

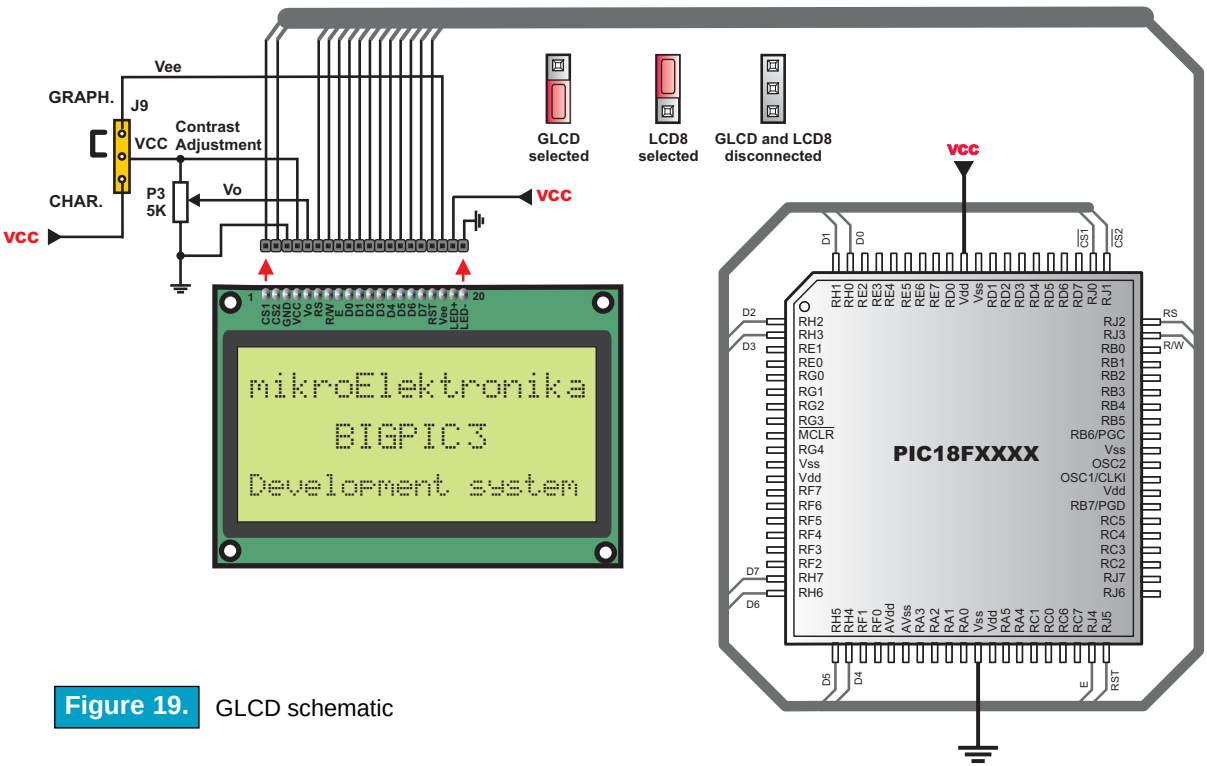


Figure 19. GLCD schematic

LCD 2X16 IN 8-BIT MODE

When using a character LCD in 8-bit mode, it should be placed on the GLCD connector. Since GLCD 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. When you add or remove LCD be sure that the power supply is off.

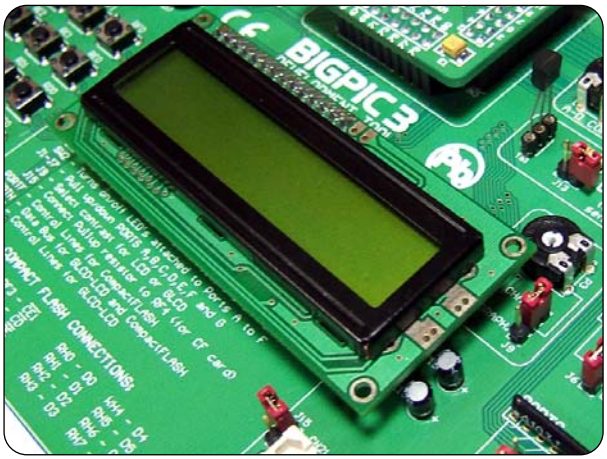


Figure 20.

LCD 2x16 in 8-bit mode

Before adding the LCD, set jumper J9 to the upper position, labeled as CHAR. The LCD's contrast can be adjusted using potentiometer P3, which is located to the upper-right of the GLCD/LCD connector (Fig. 20).

In order to enable LCD, jumper J9 should be set to the position labeled as CHAR.

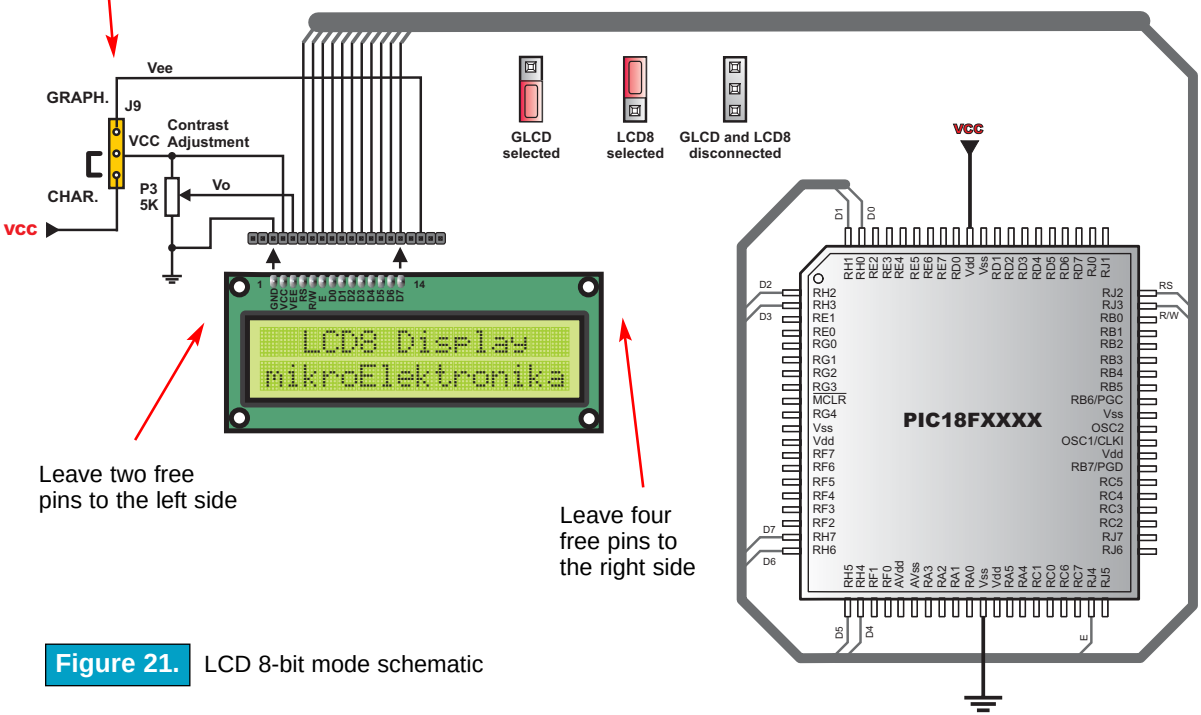


Figure 21. LCD 8-bit mode schematic

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 each other, a level transition buffer such as the MAX232 must be used.

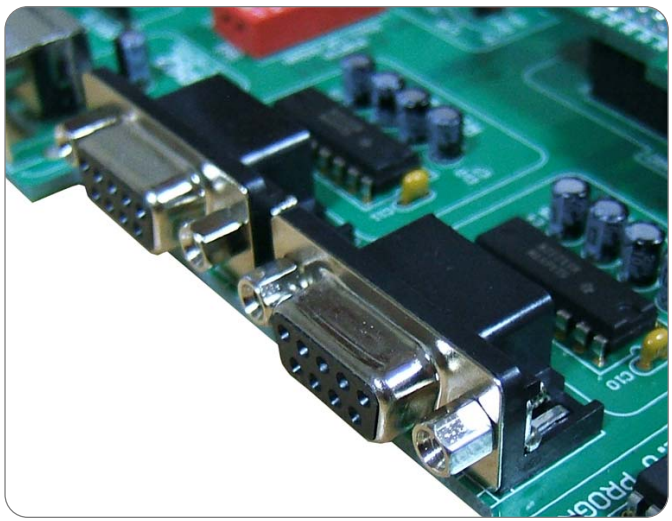


Figure 22.

RS232 connectors

BIGPIC3 development board have two RS-232 communication devices, RS-232 A and RS-232 B. In order to provide a more flexible system, the microcontroller is connected to the MAX232 through DIP-switch SW3. First two switches on SW3 are used to connect Rx and Tx lines from microcontroller to RS-232 A port, and second two for connecting Rx and Tx lines to RS-232 B.

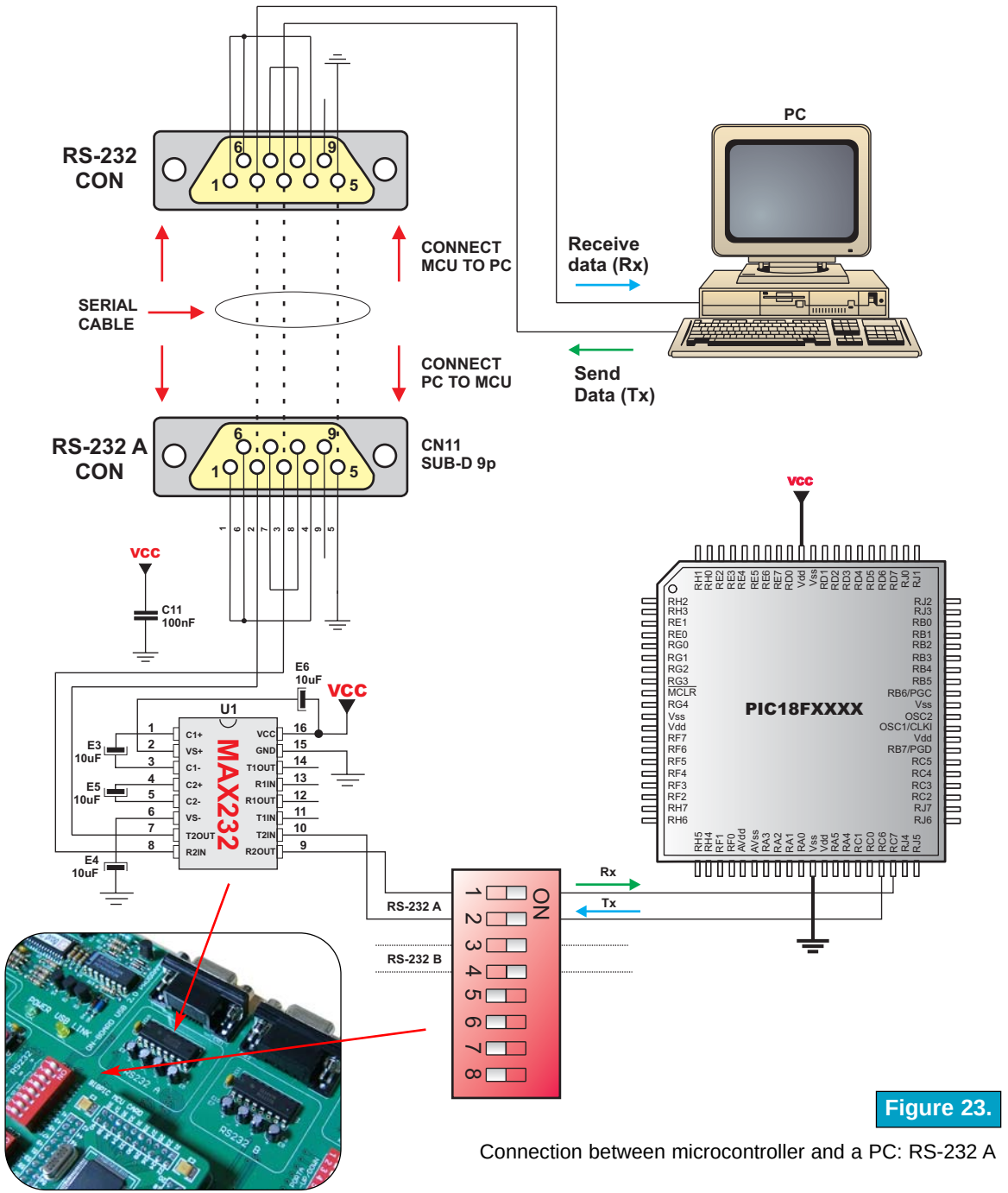


Figure 23.

Connection between microcontroller and a PC: RS-232 A

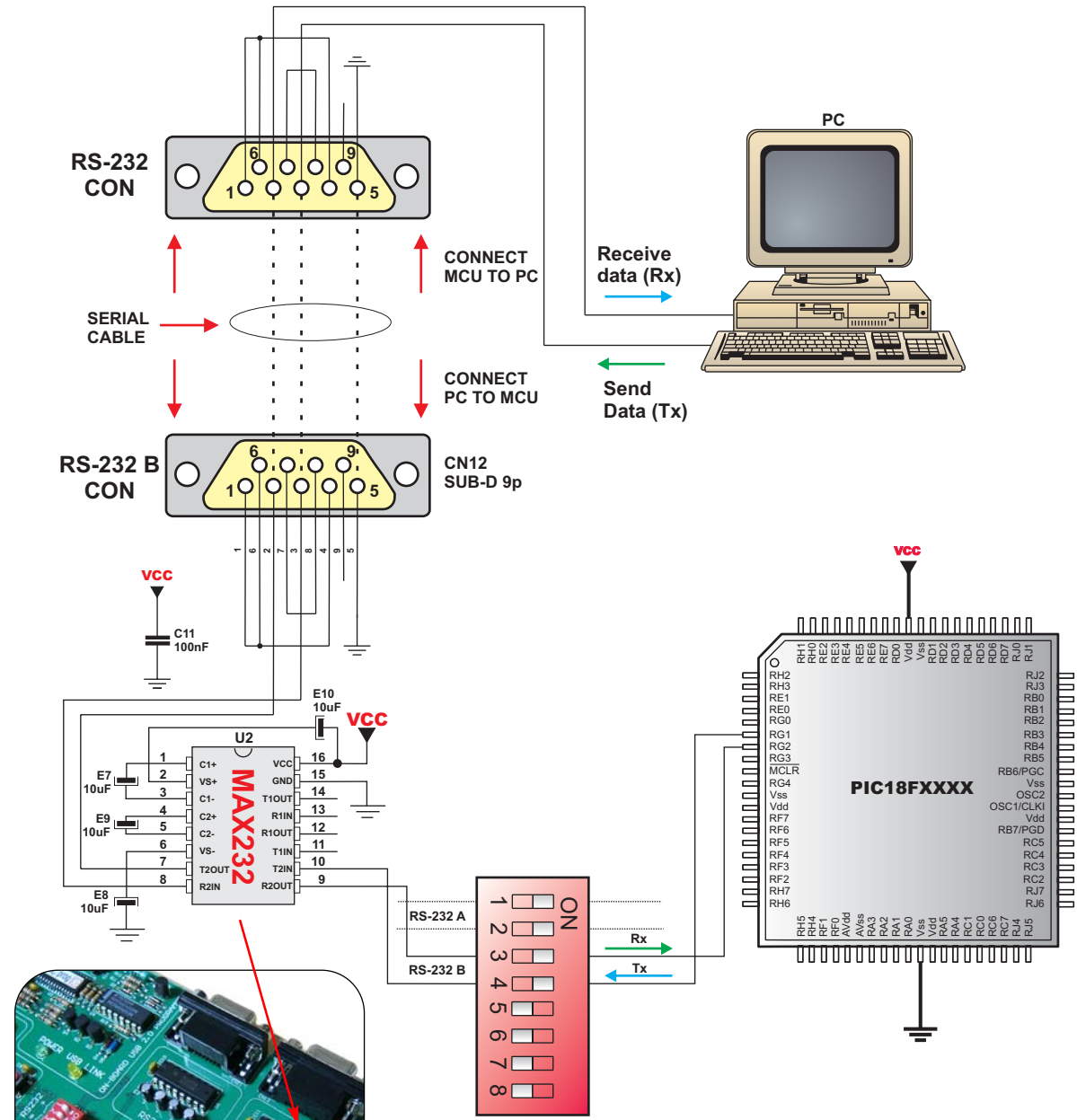


Figure 24.

Connection between microcontroller and a PC: RS-232 B

DS1820 DIGITAL THERMOMETER

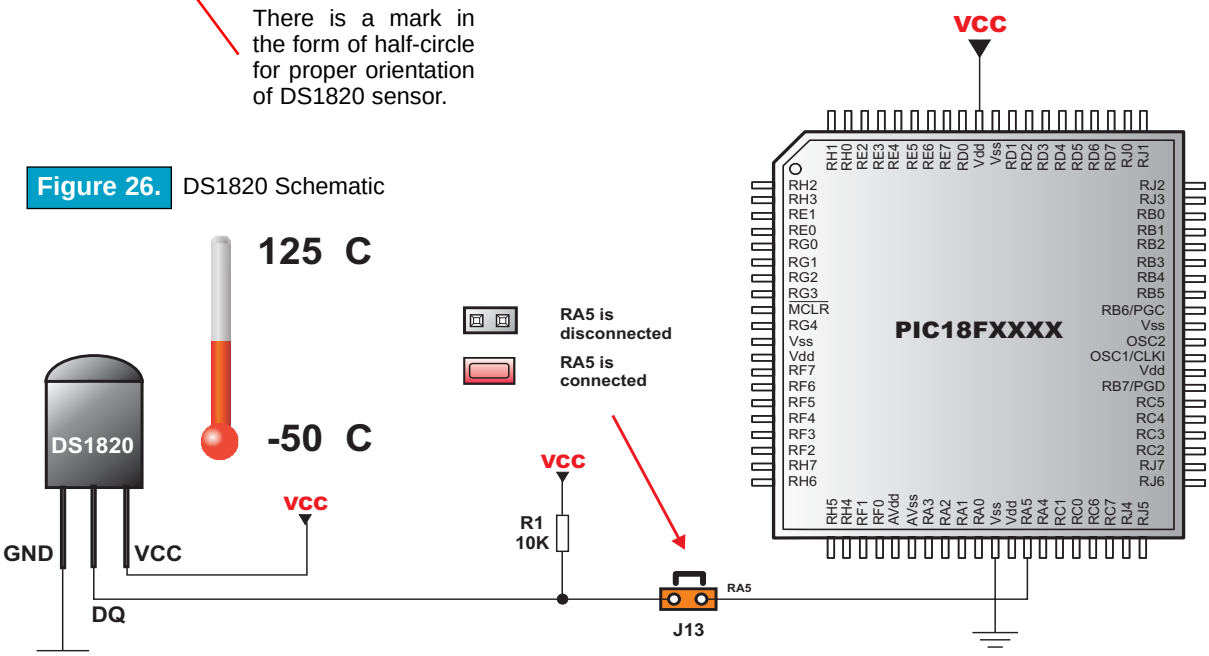


Figure 25. DS1820

There is a mark in the form of half-circle for proper orientation of DS1820 sensor.

The DS1820 digital thermometer is well suited to environmental temperature measurement, having a temperature range of -55C to 125C and an accuracy of +/-0.5C. It must be placed correctly in the 3-pin socket provided on the BIGPIC3, with its rounded side to the right, as marked on the board (see below). Otherwise the DS1820 could be permanently damaged. In order to work, DS1820 must be connected to microcontroller's RA5 pin, by enabling jumper J13.

Figure 26. DS1820 Schematic



A-D CONVERTER INPUT

BIGPIC3 development board have two potentiometers for working with ADC. Potentiometer P1 is active when jumper J10 is enabled and gives analogue signal to microcontroller's RA2 pin. Potentiometer P2 is active when jumper J11 is enabled and gives analogue signal to RA3 pin. Both potentiometers analogue output is in the range of 0V to 5V as drawn on board.

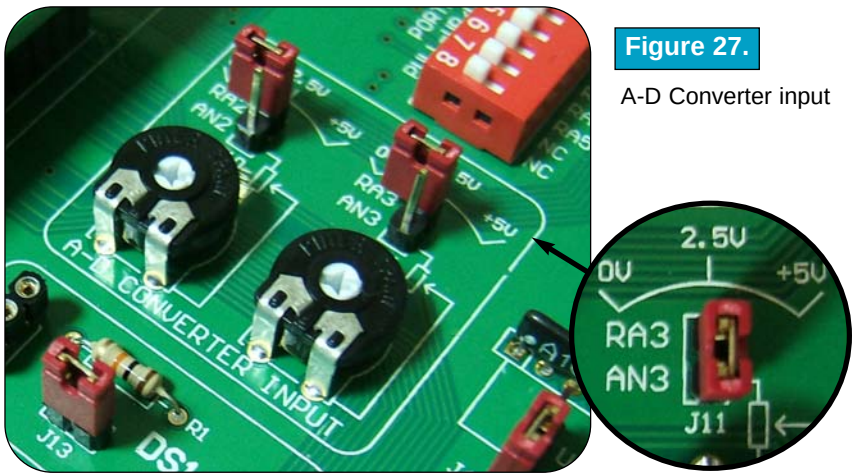


Figure 27.
A-D Converter input

In order to measure analogue signal without interference, the pull-up/down jumper should be removed from PORTA. In this way PORTA pins remain floating.

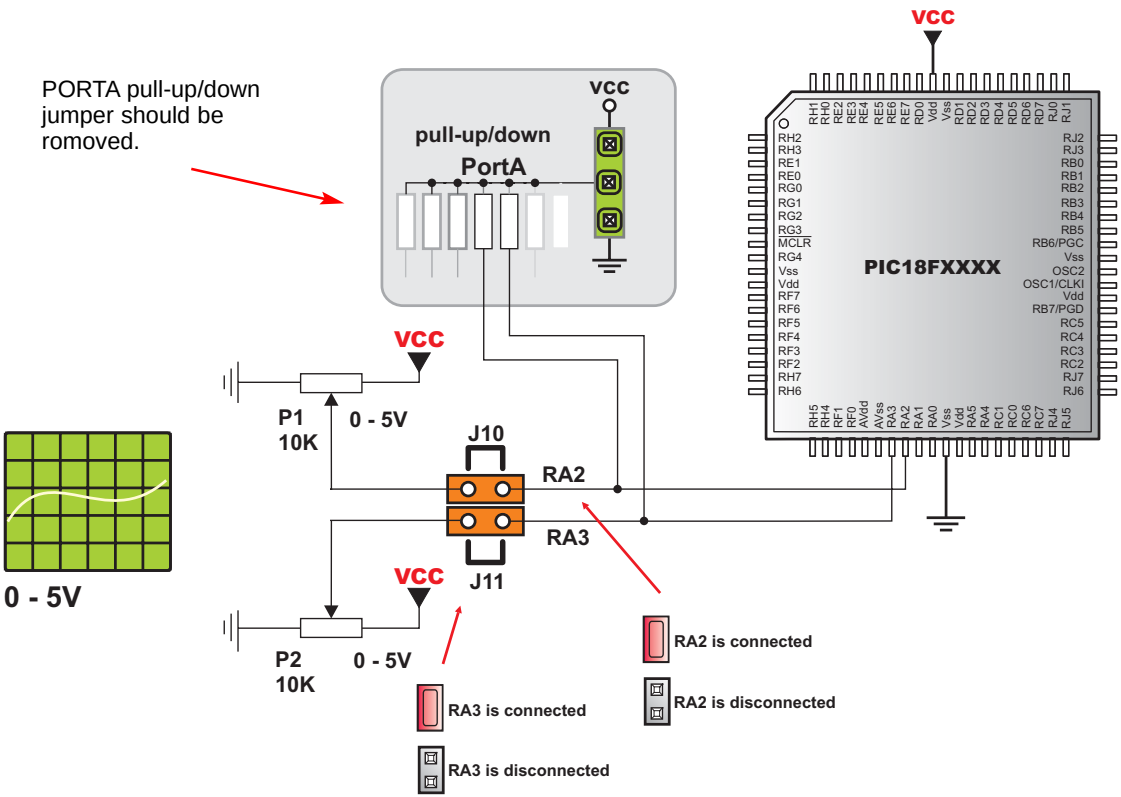


Figure 28.

A-D Converter input schematic

PS/2 (KEYBOARD) CONNECTOR

Keyboards consist of a large matrix of keys, all of which are monitored by an on-board processor (called the "keyboard encoder".) The specific processor varies from keyboard-to-keyboard but they all basically do the same thing: Monitor which key(s) are being pressed/released and send the appropriate data to the MCU. This processor takes care of all the debouncing and buffers any data in its 16-byte buffer, if needed. All communication between the host and the keyboard uses an IBM protocol.

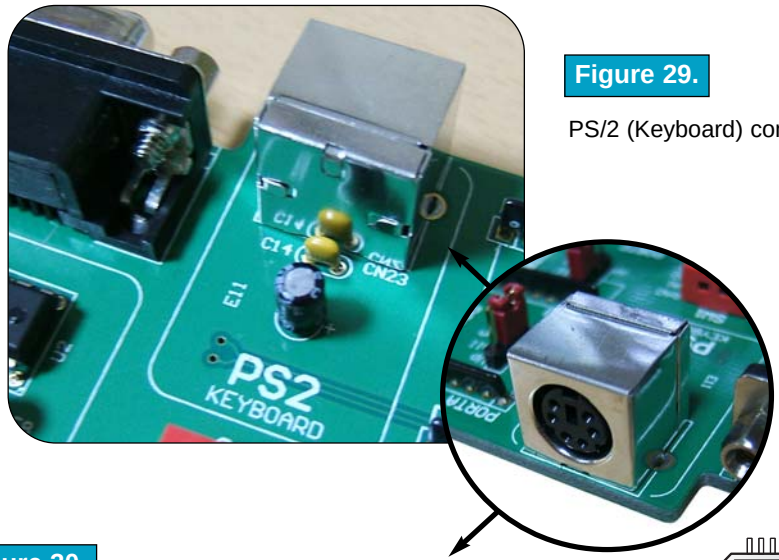
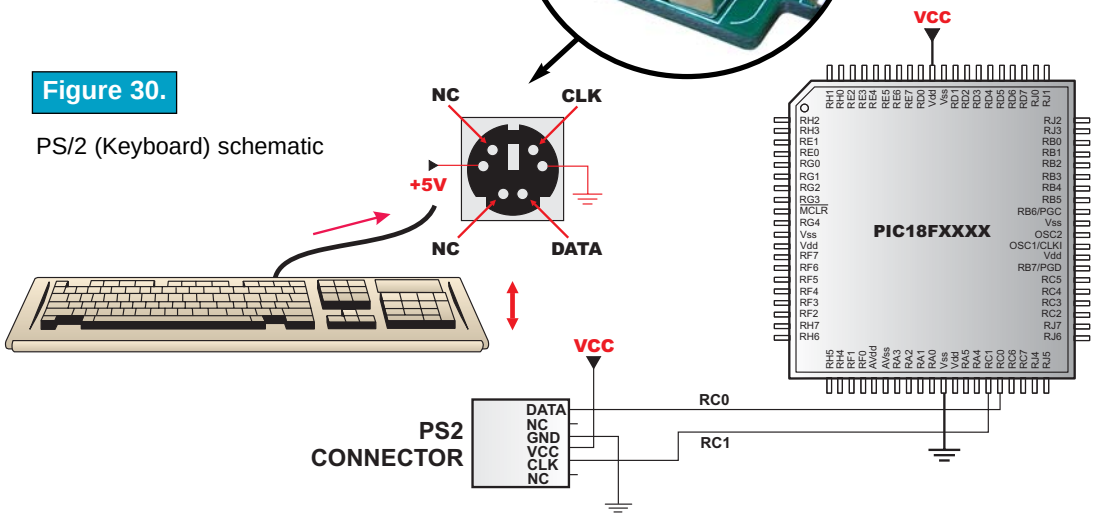


Figure 29.

PS/2 (Keyboard) connector

Figure 30.

PS/2 (Keyboard) schematic



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 RA,RB, RC, RD, RE, RF and RG 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 peripherials are diconnected 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.

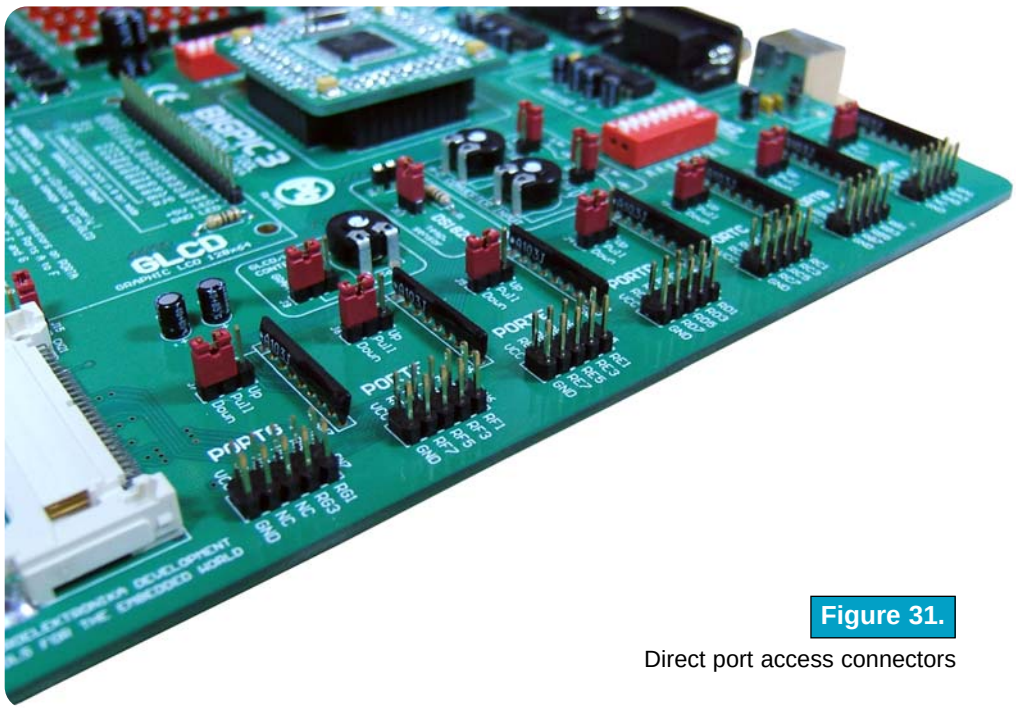
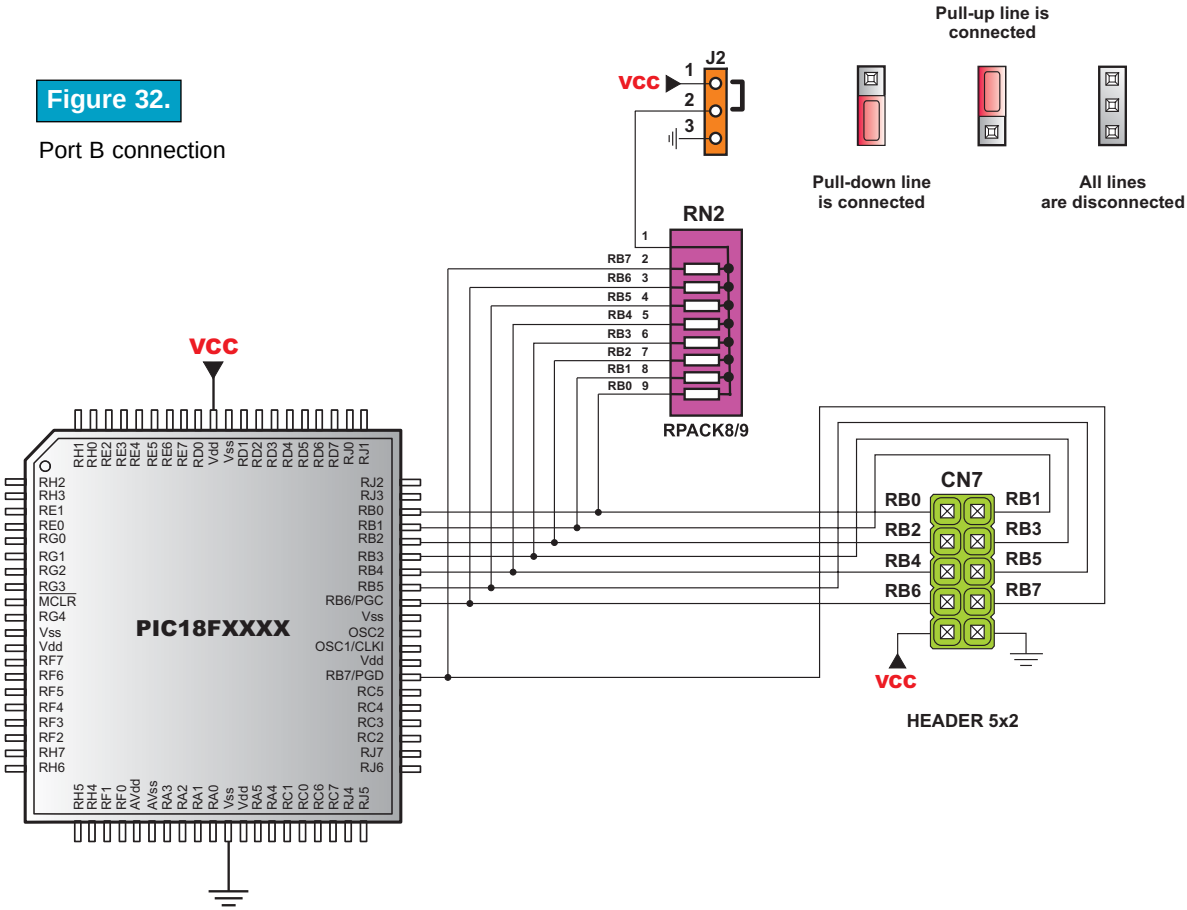


Figure 31.
Direct port access connectors

Figure 32.

Port B connection



MMC / SD (MULTIMEDIA CARD)

MMC card is used as storage media for a portable devices, 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) you can easily transfer data from MMC card to your computer. Microcontroller on BIGPIC3 communicates with Multi Media Card via SPI communication.

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

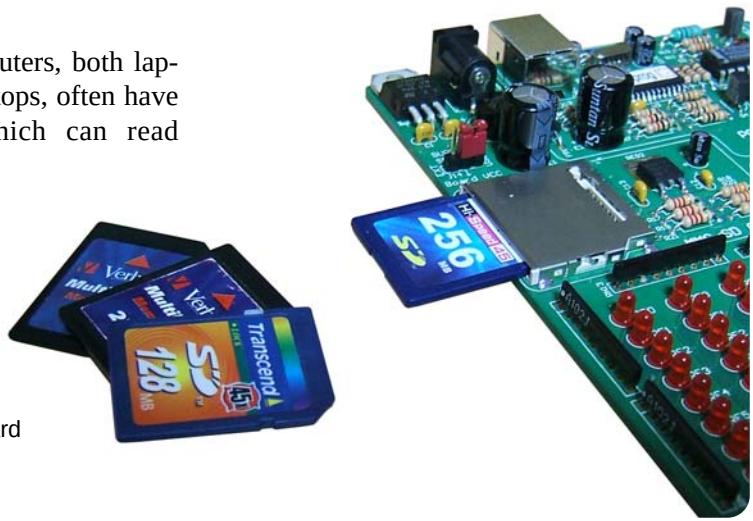


Figure 33.

MMC slot on-board

To enable MMC card you must turn on switches 5, 6, 7 and 8 on SW3. By doing that, microcontrollers's SPI comunnication lines (SDI, SDO and SCK) and Chip Select are connected with MMC. Working voltage of BIGPIC3 is 5V DC, while working voltage of MMC card is 3.3V DC. Because of that, there is a voltage regulator on-board with MMC card (MC33269DT-3.3). Data lines from microcontroller to MMC card must be also adjusted to 3.3V. It is done with resister voltage dividers as shown on Figure 34.

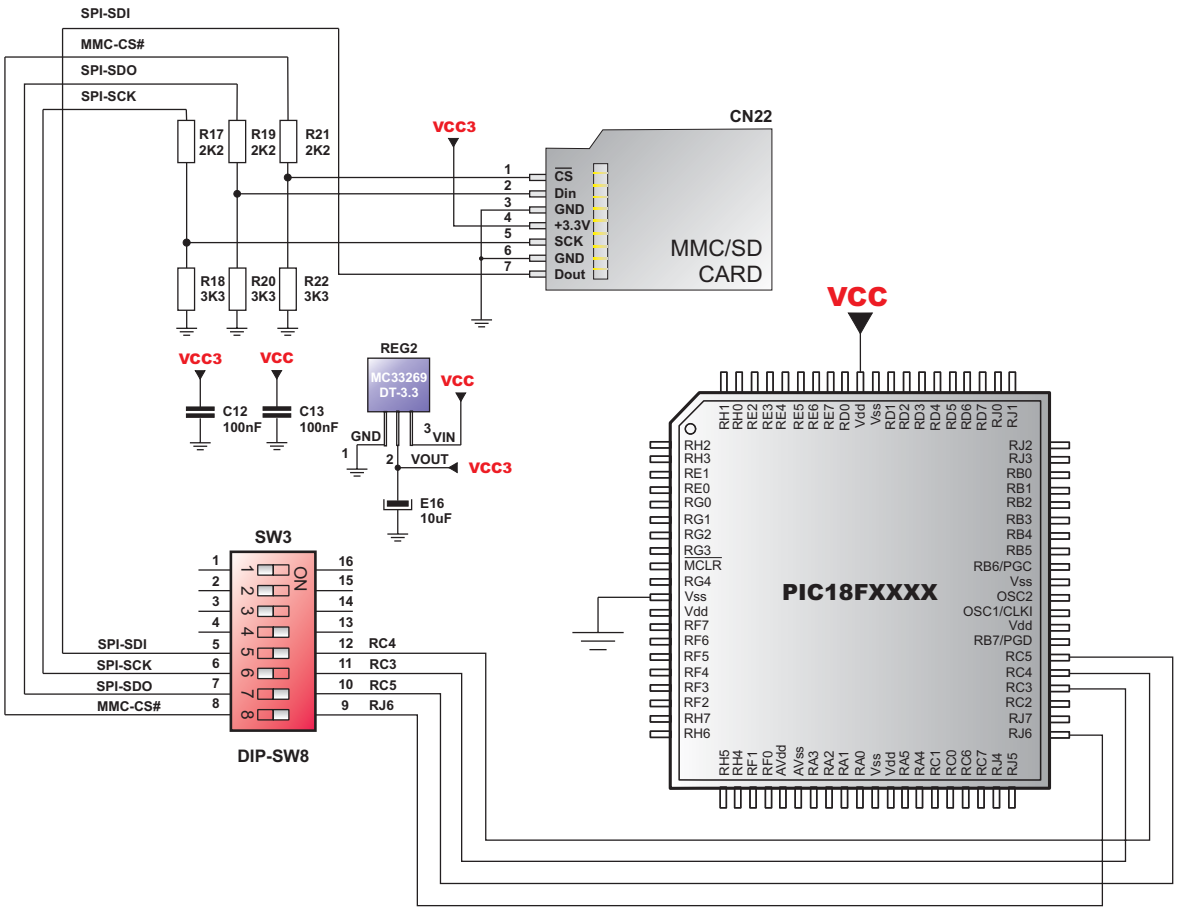


Figure 34. MMC schematic

COMPACT FLASH

Compact Flash is a small removable mass storage device. The application of Compact Flash include digital cameras, digital music players, desktop computers, handheld PCs, personal communicators, Palm PCs, Auto PCs etc. so you can easily exchange data from them and BIGPIC3 development board. Compact Flash have non-volatile storage solution that does not require a battery to retain data indefinitely.

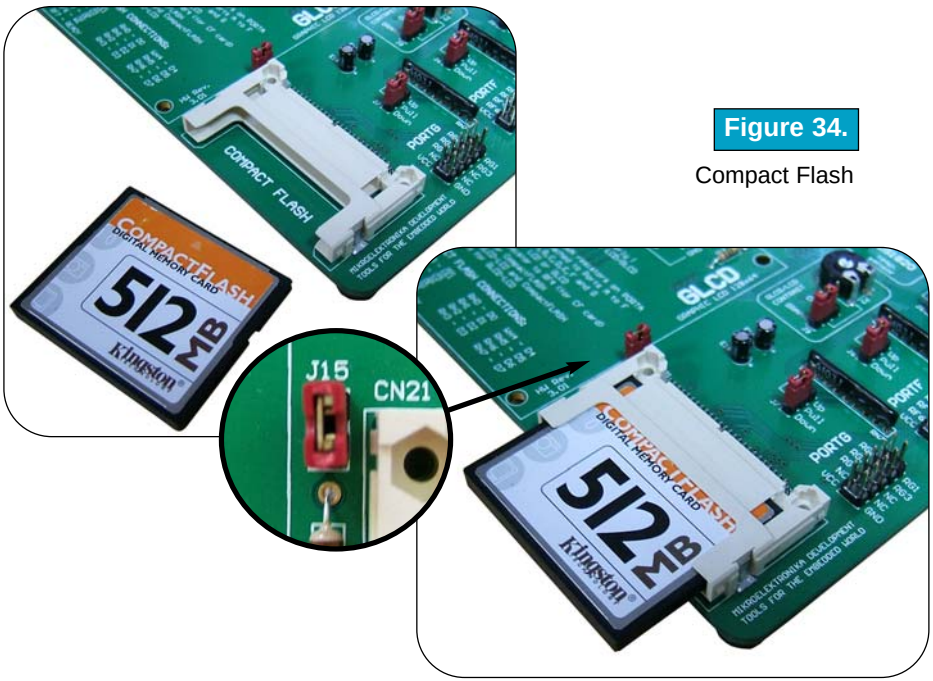
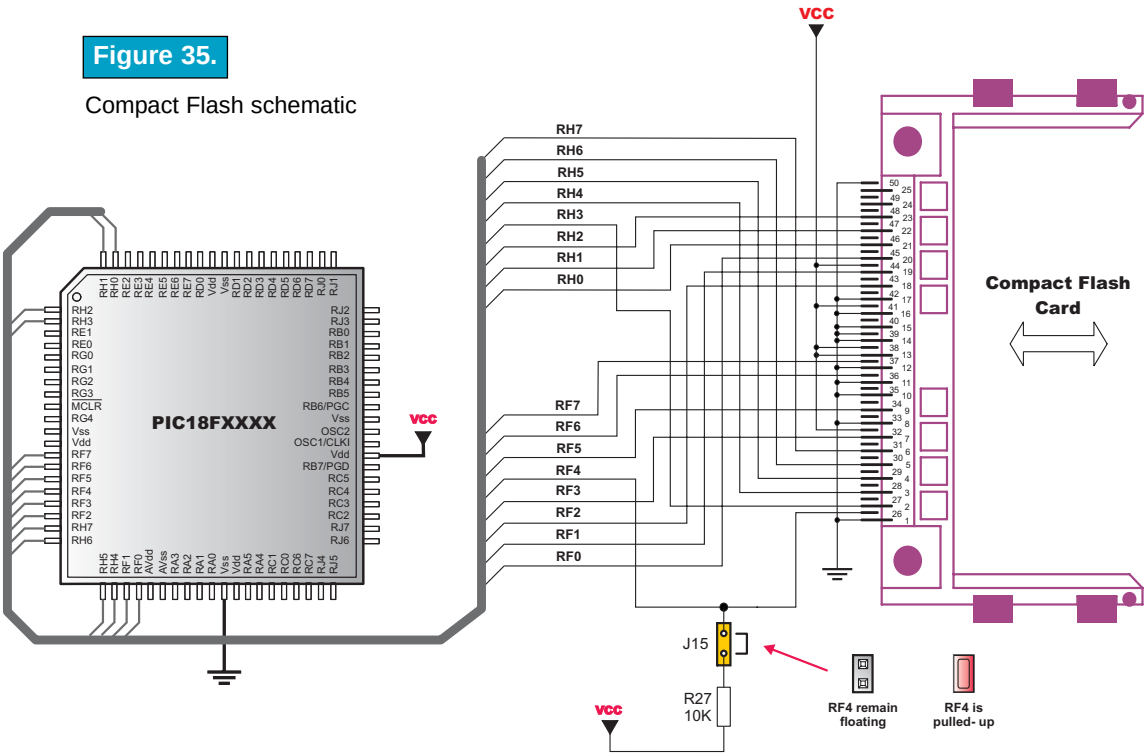


Figure 34.
Compact Flash

In order to detect when Compact Flash card is inserted, there is a jumper J15 on the left side of Compact Flash slot that must be enabled. Enabling this jumper, pin RF4 is pulled high so when Compact Flash card is inserted it drops RF4 level low and it can be detected by microcontroller. Compact Flash schematic is shown on Figure 35.

Figure 35.

Compact Flash schematic



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