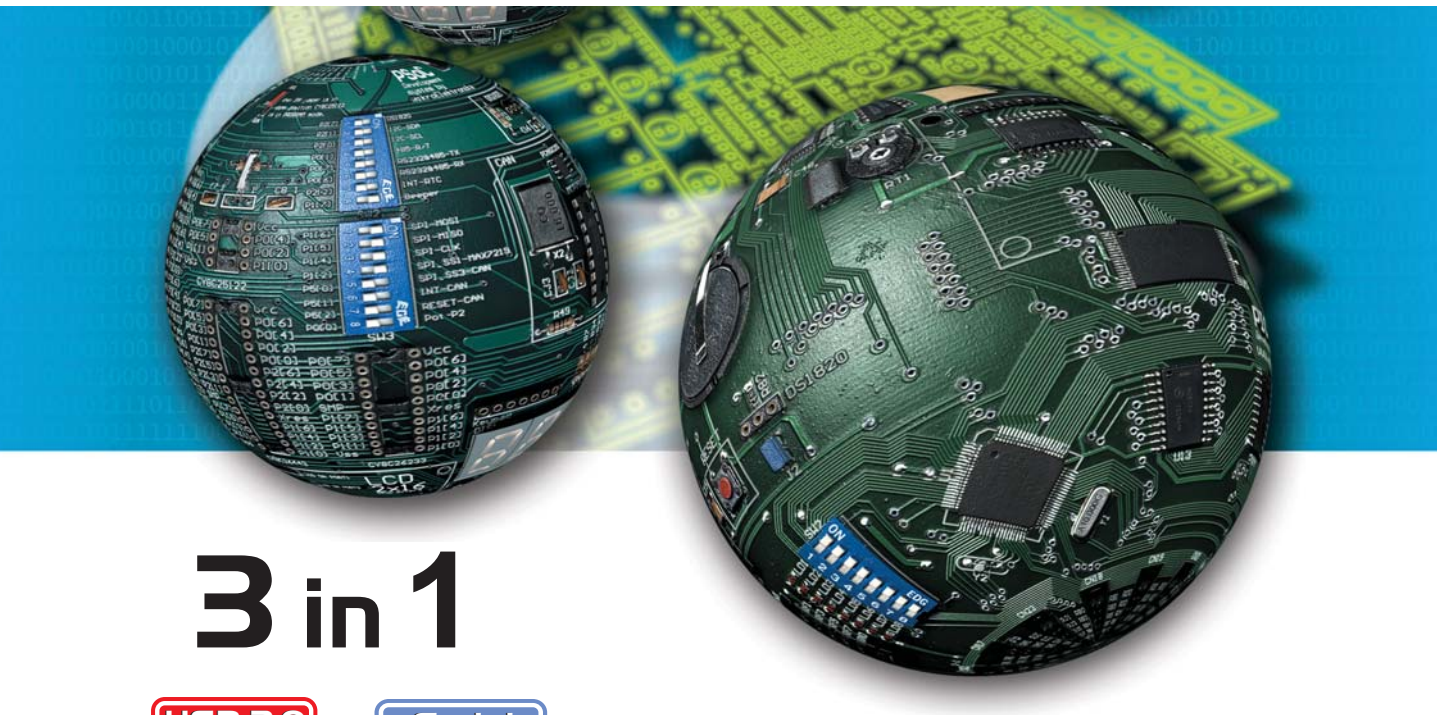
SOFTWARE AND HARDWARE SOLUTIONS FOR THE EMBEDDED WORLD

MikroElektronika
Development tools - Books - Compilers

LV18FJ
User's Manual



3 in 1

USB 2.0 IN-CIRCUIT PROGRAMMER

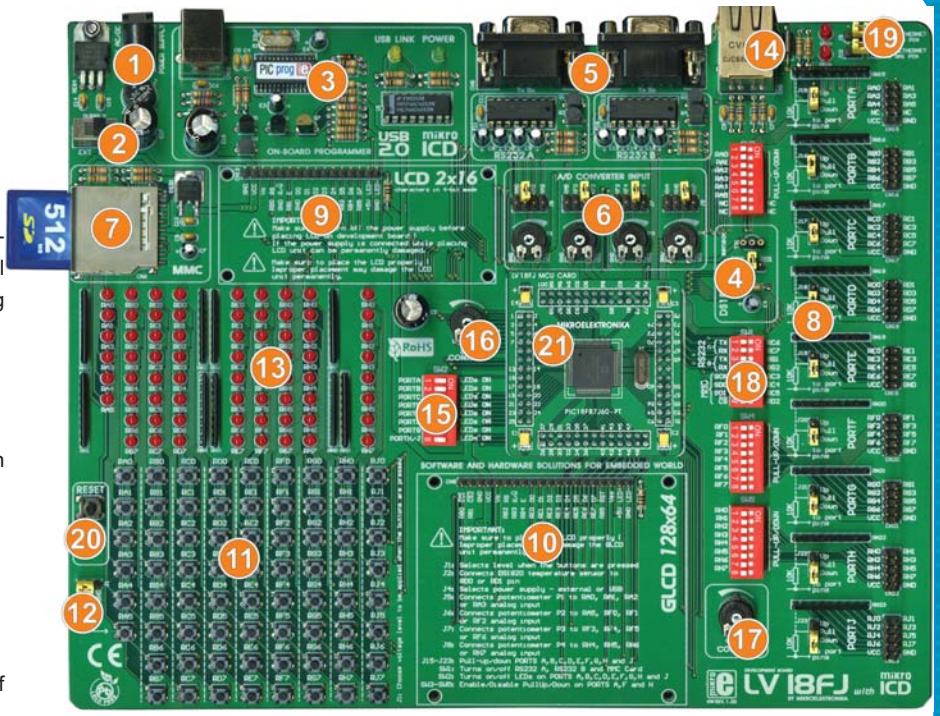
Serial Ethernet SUPPORTED

mikro ICD IN-CIRCUIT DEBUGGER

With useful implemented peripherals, plentiful practical code examples and a broad set of add-on boards (Serial Ethernet, Compact Flash, MMC/SD, ADC, DAC, CAN, RTC, RS-485, 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

LV18FJ
KEY FEATURES



1. External power supply 8-16 V AC/DC.
2. Choose between external and USB power supply.
3. Very fast and flexible on-board USB pro grammer. The key feature is expandability. By downloading new software, you will be able to program new MCUs in coming years.
4. DS1820 temperature sensor allows to measure temperature with 0.5°C accuracy.
5. Two RS232 ports for communication with PC or another microcontroller.
6. 16-channels for MCU Analog-to-Digital Converter.
7. MMC/SD Multimedia card socket.
8. Jumpers to select default logic state of the appropriate pins.
9. LCD connector allows easy connection of LCD in 4-bit mode.
10. Graphic LCD connector allows easy connection of GLCD.
11. 70 buttons allow control of every pin on the microcontroller.
12. Buttons to select high/low state of the pins.
13. See all the signals -each pin has a LED.
14. On-board Ethernet socket.
15. Switches on the SW2 turns on/off the LEDs on ports. Select port to connect LEDs to. These switches are used to disconnect all LEDs from MCU pins.
16. Set LCD contrast according to display characteristics.
17. Set GLCD contrast according to display characteristics.
18. On-Board peripherals are connected to the microcontroller via switches.
19. Enabling/disabling ethernet connection to MCU.
20. Reset circuit - if the reset button is pressed MCU will start executing from the beginning of the program.
21. MikroElektronika's MCU card.

Development board dimensions

Width	250 mm	9.84 Inches
Height	210 mm	8.27 Inches

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CONTENTS

CONNECTING THE SYSTEM

The development system box contains a development system, product CD, USB cable, RS232 cable and this manual.

Step no.1 First of all, take the system out of the box. Unpack the USB cable and connect it to the PC. Do not connect it to LV18FJ yet.

Step no.2 Install the PICFlash programmer. Start the installation from the product CD: CD_Drive:\zip\lv18picflash.zip

Step no.3 Open the folder CD_Drive:\zip\drivers and run installation for the appropriate operating system. Do not connect LV18FJ until the installation is finished.

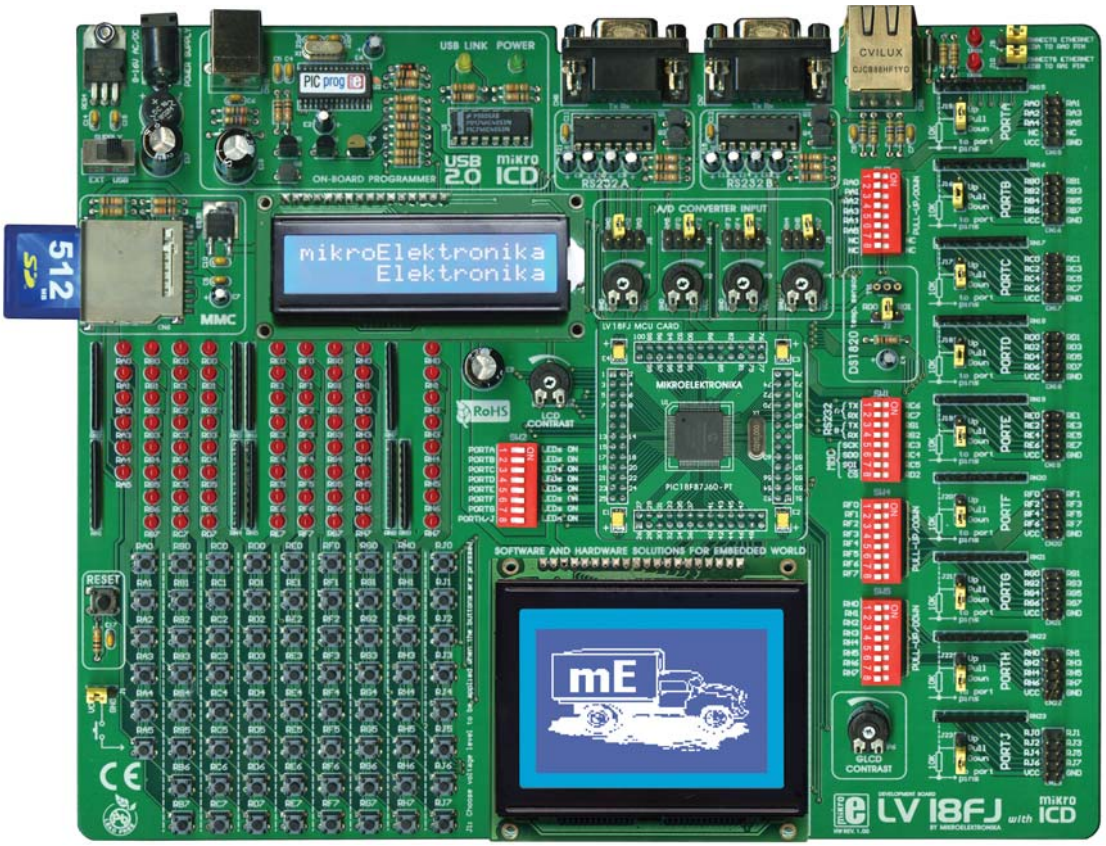
Step no.4 Connect USB cable to LV18FJ. Run and use LV18PICFlash.exe as explained in the document '*lv18PICFlash with mikroICD support*' CD_Drive:\pdf\lv18picflash_manual

After these four steps your LV18FJ is installed and ready for use. You can now read a program from the chip or load an example from the product CD.

INTRODUCTION

The LV18FJ development system is a full-featured development board for Microchip's low voltage microcontrollers. It is designed to allow students and engineers to easily test and explore the capabilities of low-voltage microcontrollers. It also allows low-voltage microcontrollers to be interfaced with external circuits and a broad range of peripheral devices, making it possible for the user to concentrate on software development.
Figure 1 illustrates the development board. There are identification marks beside each component on a silkscreen. These marks describe connections to the microcontroller, operation modes and provide additional information. Since all relevant information is provided on the board there is almost no need for additional schematics.

Figure 1. LV18FJ development board



SWITCHES

The LV18FJ development board features a number of peripherial devices. In order to enable them before programming, the appropriate jumpers or switches have to be properly set. Switches are devices that have two positions - ON and OFF, which having the role to establish or break connection between two contacts. The LV18FJ development board has three groups of switches.

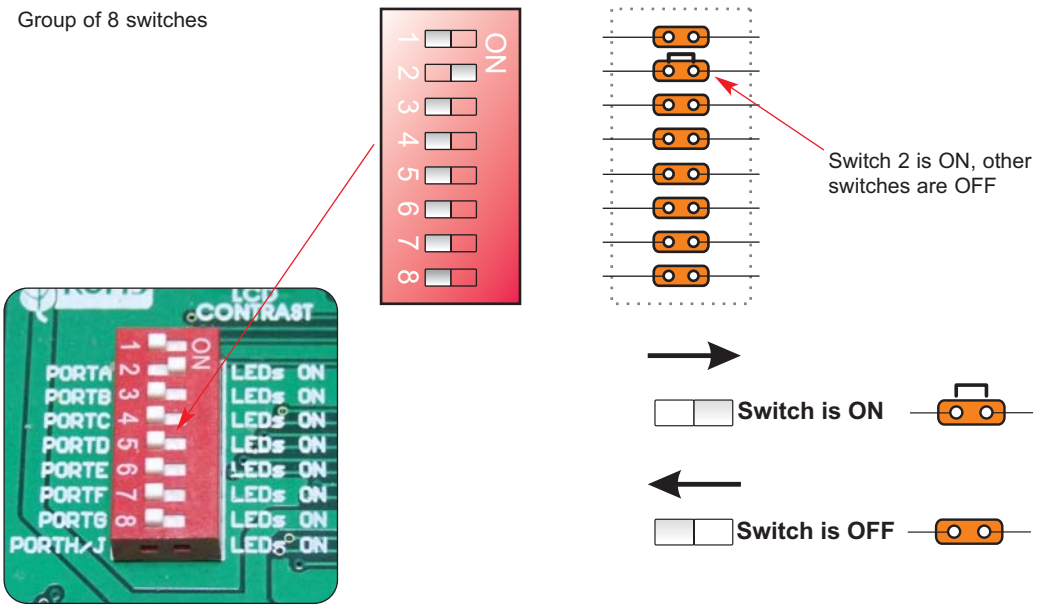
The first group, **SW1**, is used to enable SPI communication for interfacing with MMC/SD multimedia card. It is also used for RS-232 communication.

Switches of the **SW2** are used to enable LEDs connected to ports. For example, if the switch enabling PORTB is OFF, all PORTB LEDs will be turned off.

Switches of the SW3, SW4 and SW5 are used for controlling output port pins by enabling/disabling them.

Figure 2.

Group of 8 switches



JUMPERS

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

For example, the jumpers J9 and J10 are used to connect or disconnect ethernet leds to the RA0 and RA1 pins, respectively. In order to establish a connection, the jumper should be placed over two contacts.

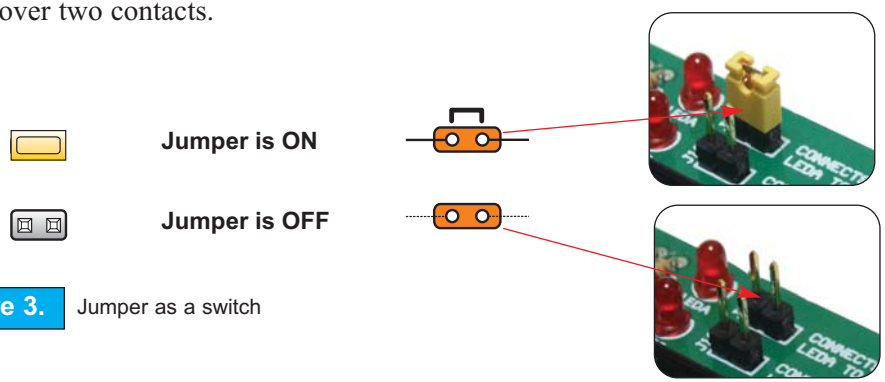


Figure 3. Jumper as a switch

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

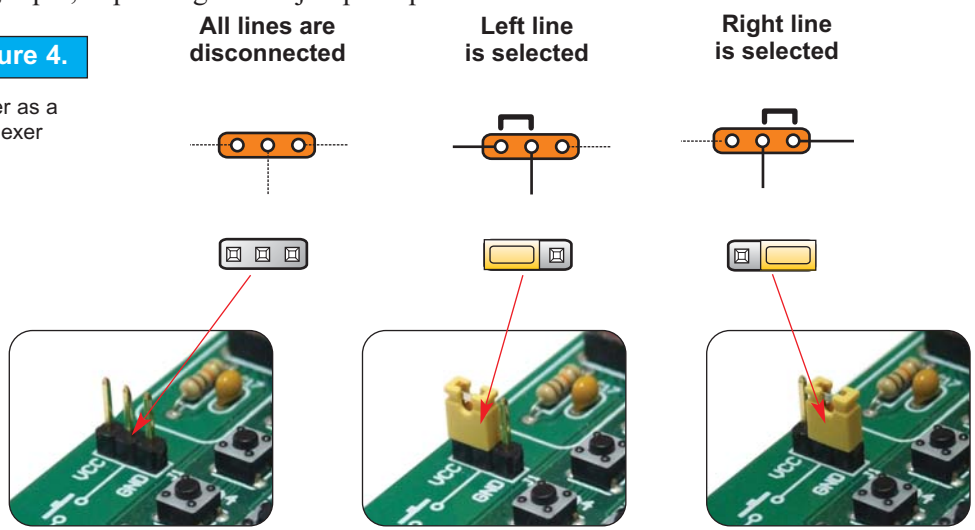
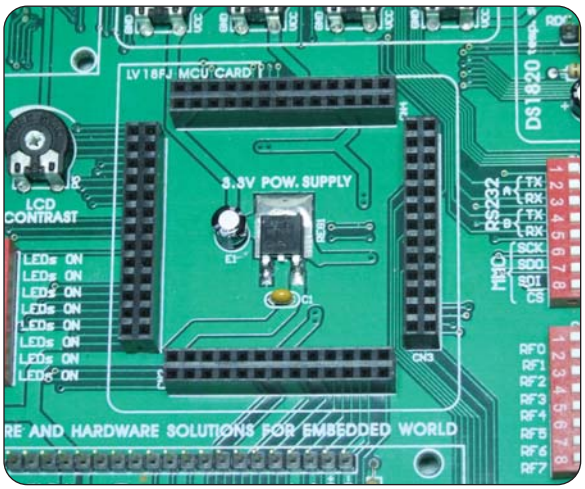


Figure 4. Jumper as a multiplexer

MCU SOCKETS

LV18FJ is delivered with the PIC18F97J60 64-pin microcontroller. User can remove this chip and fit a different microcontroller into MCU socket.

Figure 5. MCU's socket



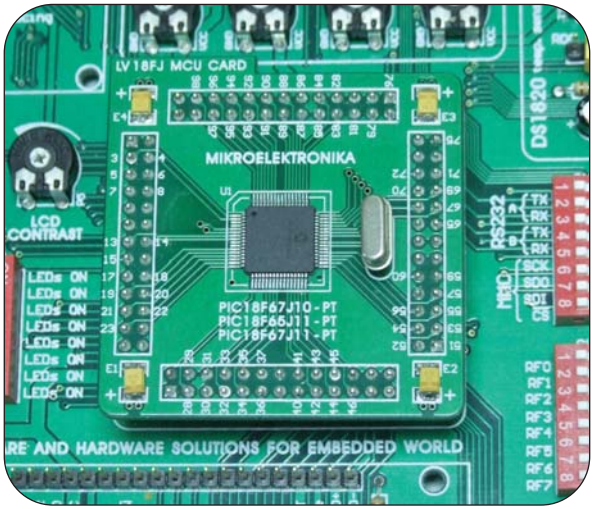
There is a white line around MCU socket which outlines the proper position of the MikroElektronika Card.

Be sure that the upper left corner of the card with label LV18FJ MCU CARD maches the upper left corner of the outlined image with the same label.

Figure above illustrates MCU Socket before placing the MikroElektronika card.

Figure 6 on the right illustrates MCU Socket with properly placed MikroElektronika card.

Figure 6. MCU placed on socket



Microcontroller's pins are routed to various peripherals as illustrated in Figure7. All ports are directly connected to Direct Port Access connectors. Such connectors are normally used for connecting external peripherals to the board or for providing digital logic probes for testing and measuring.

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

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

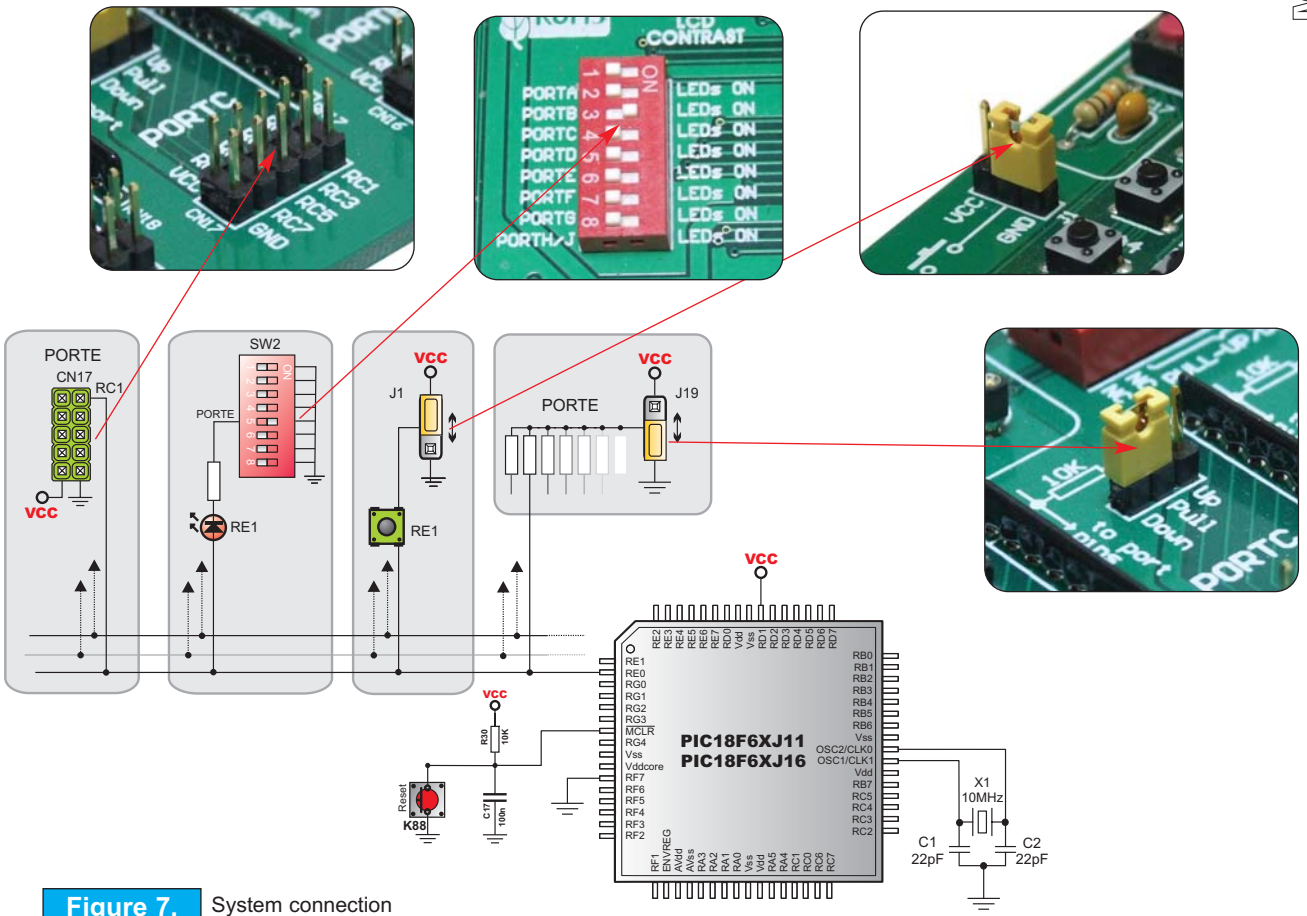


Figure 7. System connection

POWER SUPPLY

LV18FJ has two kinds of power supply- regulated supply from the USB cable (default) or external power supply. In case of the USB power supply, the system should be connected to PC using the USB programming cable, while the power supply selection switch should be set in the right-hand position.

In case of the external power supply, the LV18FJ board produces +5V using an LM7805 voltage regulator. The external power supply can be AC or DC. Power supply voltage can be in the range of 8-16V and the power supply selection switch should be set in the left-hand position. Figure 8 illustrates USB and external power supply connectors.

Figure 8. USB and power supply connectors

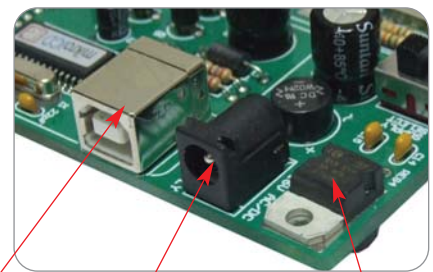
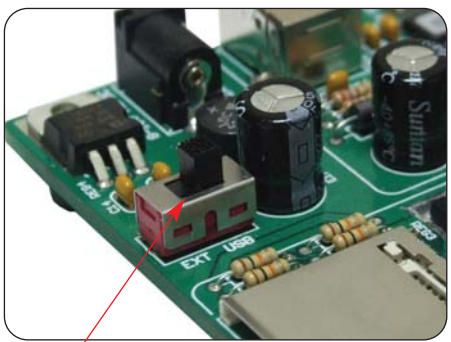


Figure 9. Power supply selection switch



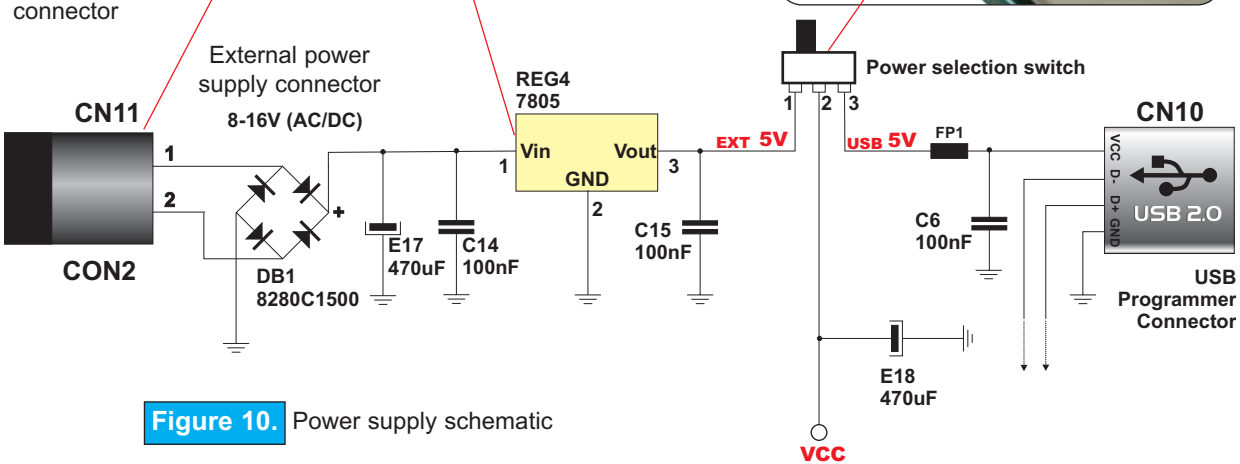


Figure 10. Power supply schematic

ON-BOARD USB 2.0 PROGRAMMER

There is no need to use external equipment during programming, as the LV18FJ development system has its own on-board USB 2.0 programmer.

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

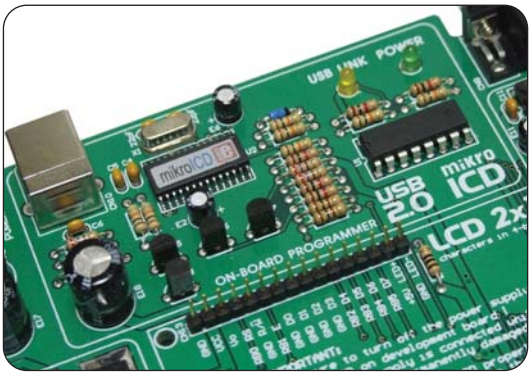
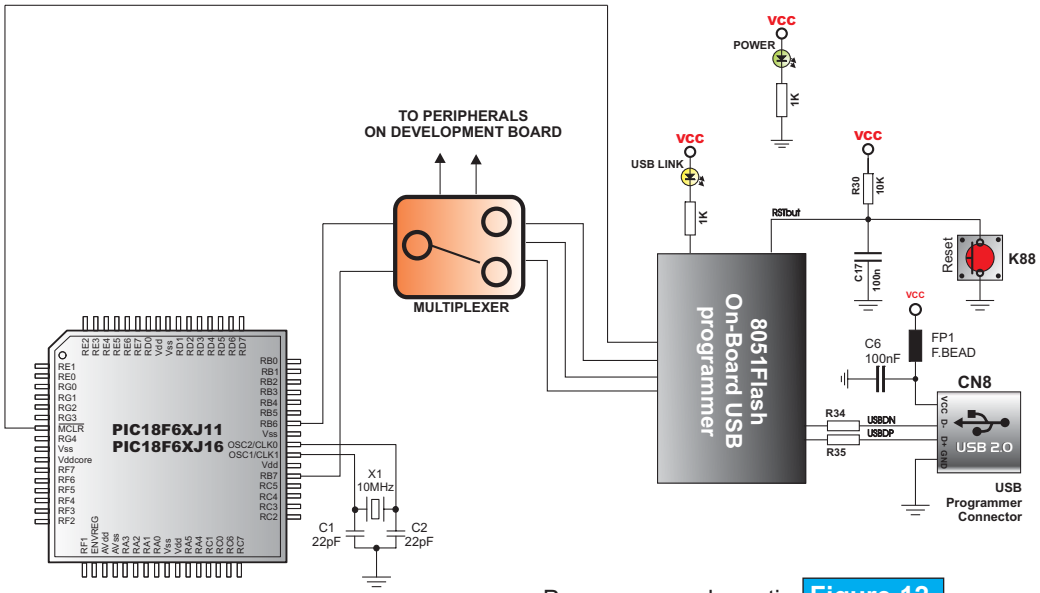


Figure 11. On-Board USB programmer

Note: After programming, the programmer will reset MCU automatically.



Programmer schematic **Figure 12.**

mikroICD (IN CIRCUIT DEBUGGER)

mikroICD is a highly effective tool for Real-Time debugging on hardware level. The mikroICD debugger enables you to execute a program on the LvPIC microcontroller and view variable values, Special Function Registers (SFR) and EEPROM while the program is running.

mikroICD can be used within any of MikroElektronika's compilers for LvPIC (mikroC, mikroBasic or mikroPascal). You just have to select the appropriate build type (Release or ICD Debug), build the project, program the MCU, select the appropriate debugger (mikroICD Debugger) and that's all.

The mikroICD debugger uses the *PICFlash* programmer to communicate with the compiler and supports common debugger commands:

Start Debugger	[F9]
Run/ Pause Debugger	[F6]
Toggle Breakpoint	[F5]
Run to cursor	[F4]
Step Into	[F7]
Step Over	[F8]
Flush RAM	[F2]
Stop Debugger	[Ctrl+F2]

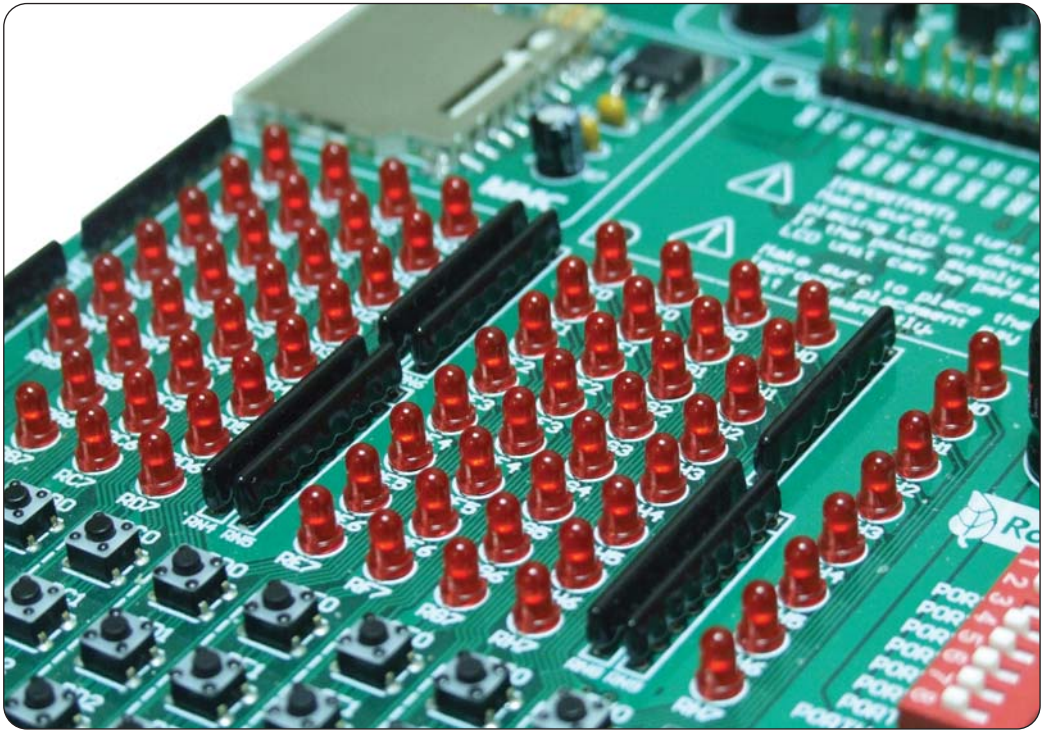
Figure 13. On-Board USB programmer

Note: For more information on how to use mikroICD debugger please refer to the mikroICD documentation *"mikroICD User's Manual"*. You can also find it within the Help documentation inside any of the compilers mentioned above.

LEDs

Light Emitting Diodes (LEDs) are the most commonly used components, usually for displaying pin's digital state. LV18FJ has 70 LEDs connected to the microcontroller's PORTs.

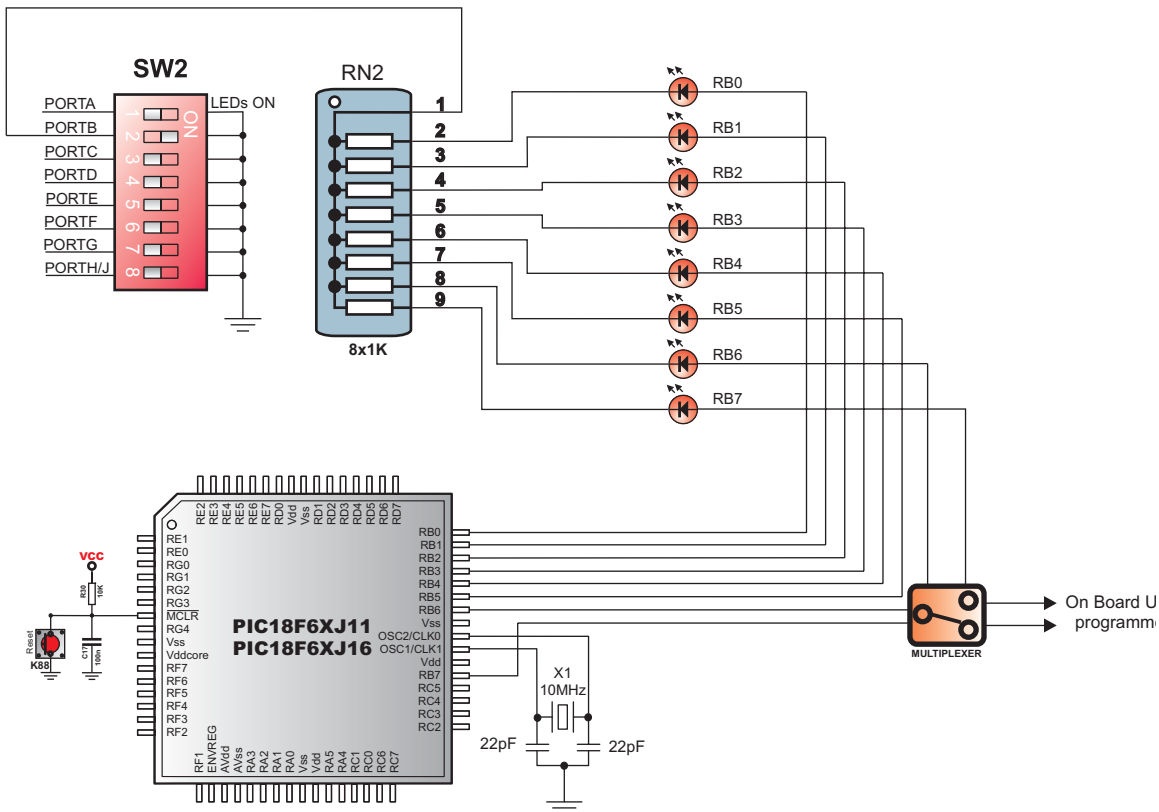
Figure 14. Light Emitting Diodes



Each group of eight LEDs can be enabled or disabled using the SW2. Figure 14 illustrates the connection between LEDs and PORTB on 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.

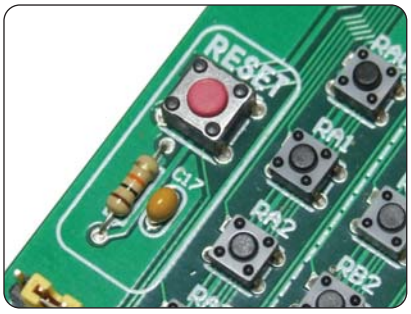
The LEDs are enabled when the corresponding switch on the SW2 is on. When enabled, LEDs will display the state of the corresponding microcontroller pin; otherwise the LEDs are always off, no matter what the port state is, as no current can flow through LED.

Figure 15. LED schematic



PUSHBUTTON SWITCHES

LV18FJ has 70 push buttons which can be used to change states of digital inputs on the microcontroller's ports. There is also one switch that acts as a RESET. Reset switch is shown in Figure 16.



Reset switch **Figure 16.**

Figure 17. Reset switch

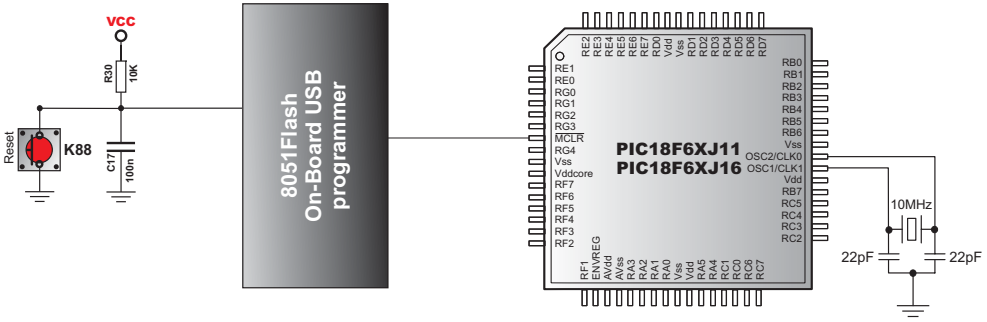
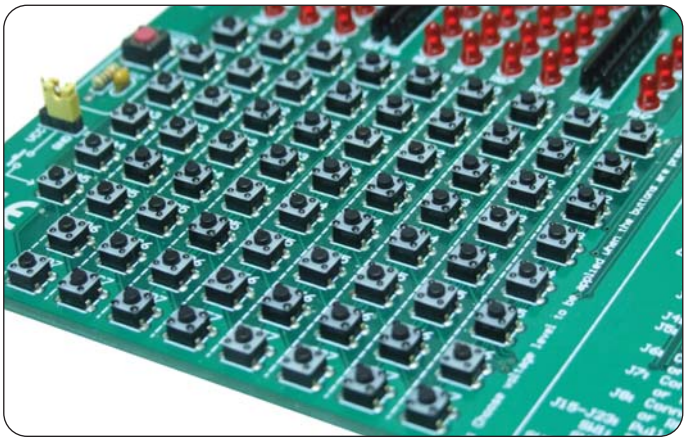


Figure 18. Pushbutton switches



The connection between buttons and PORTA, PORTB, PORTC and PORTD is shown in Figure 19. Jumper J1 determines whether a button press will bring logic zero or logic one to the appropriate pin.

When button is released, pin state is determined by the pull-up or pull-down port jumpers.

In the example shown in Figure 19, J1 is connected to +5V, therefore a button press will bring logic one to the appropriate pins.

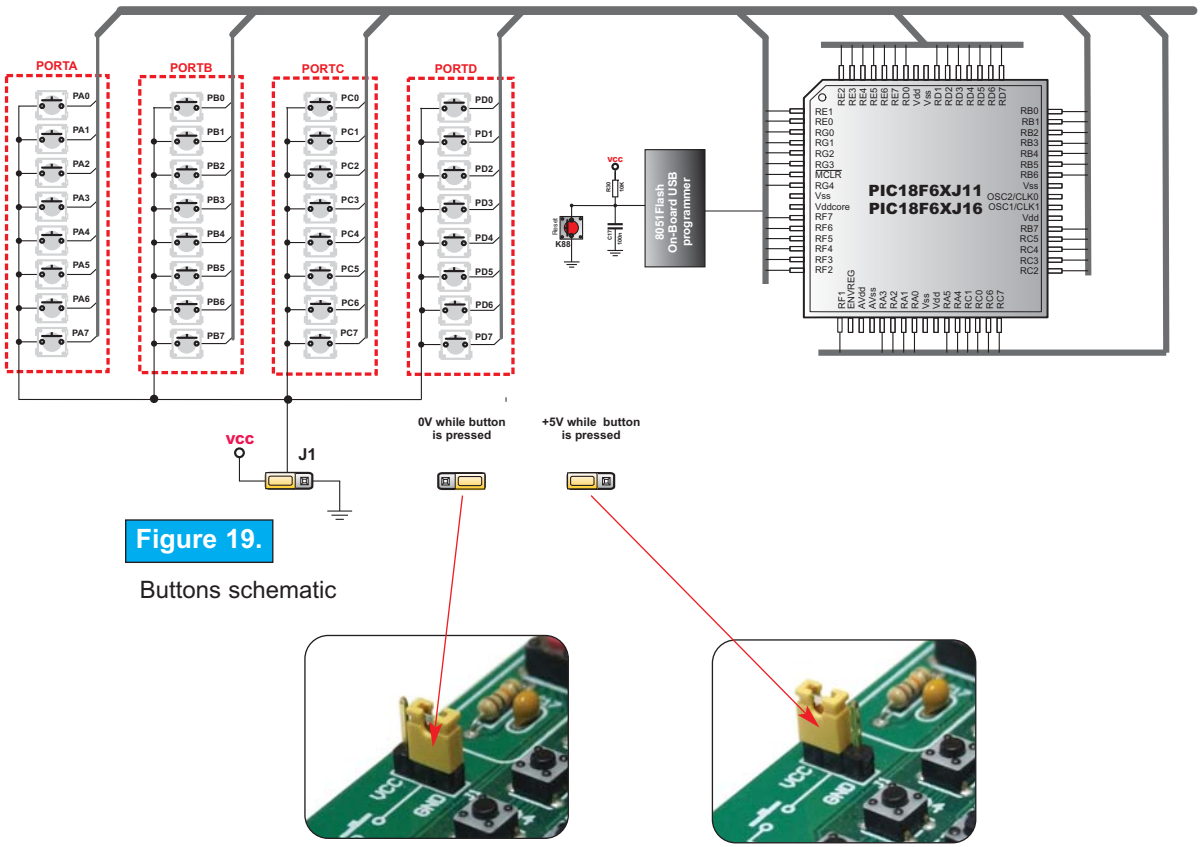


Figure 19.

Buttons schematic

In Figure 20 the J16 jumper is set to pull-up, therefore when the button is released, pull-up resistor pulls the microcontroller's PB5 pin to +5V.

By pressing the button, the port pin is connected to ground (J1 is in the GND position).

Thus, only when the button is pressed the microcontroller will sense a logic zero; otherwise the pin state will always be logic one.

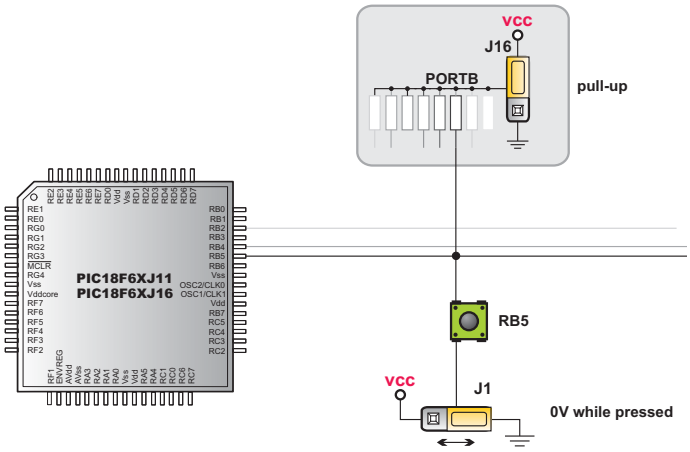


Figure 20. Button with pull-up resistor

In Figure 21 the J16 jumper is set to pull-down, therefore when the button is released, pull-down resistor pulls the microcontroller's RB5 pin to 0V.

By pressing the button, the port pin is connected to +5V (J1 is in the VCC position).

Thus, only when the button is pressed the microcontroller will sense a logic one; otherwise the pin state will always be logic zero.

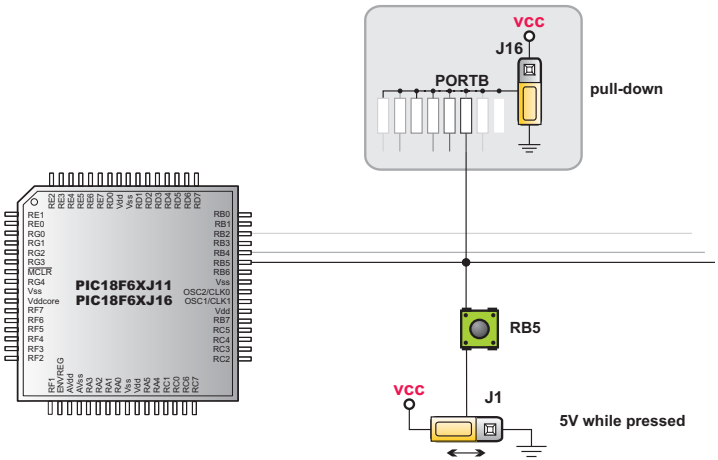


Figure 21. Button with pull-down resistor

GRAPHIC LCD CONNECTOR ON-BOARD

GRAPHIC LCD

A 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 the screen resolution of 128x64 pixels. The GLCD's contrast can be adjusted using the potentiometer P6 placed to the right of the GLCD.

Figure 22. GLCD

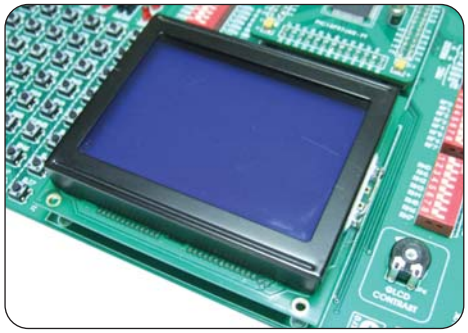
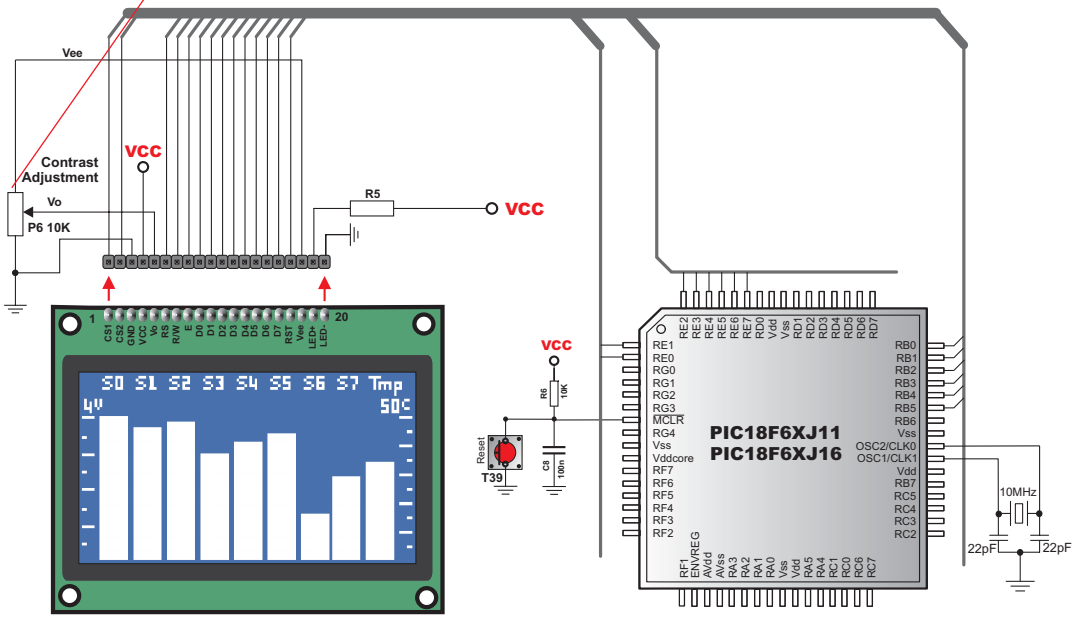


Figure 23. GLCD schematic



Note: Do not connect LCD and GLCD at the same time because they share the same data and control pins.

LCD 2X16 IN 4-BIT MODE

A standard character LCD is probably the most widely used data visualization component. Usually, it can display two lines of 16 alphanumeric characters, each made up of 5x8 pixels. The character LCD communicates with the microcontroller via a 4 bits. The connection to the microcontroller is shown in Figure 25. where there are only four data lines. It is important to know that the LCD should be placed or removed from LV18FJ board only after the power is turned off.

Figure 24.

LCD 2x16 in place

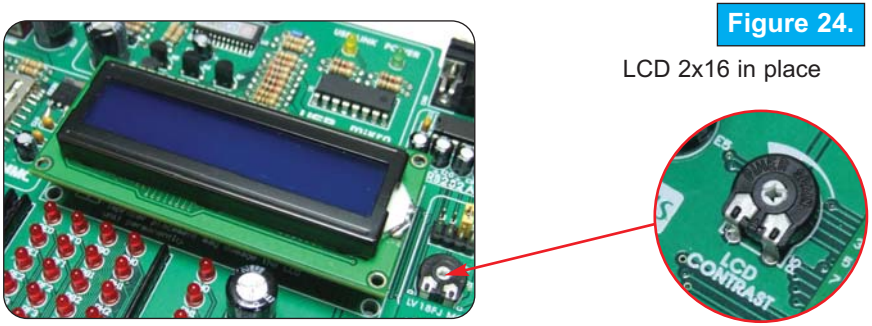
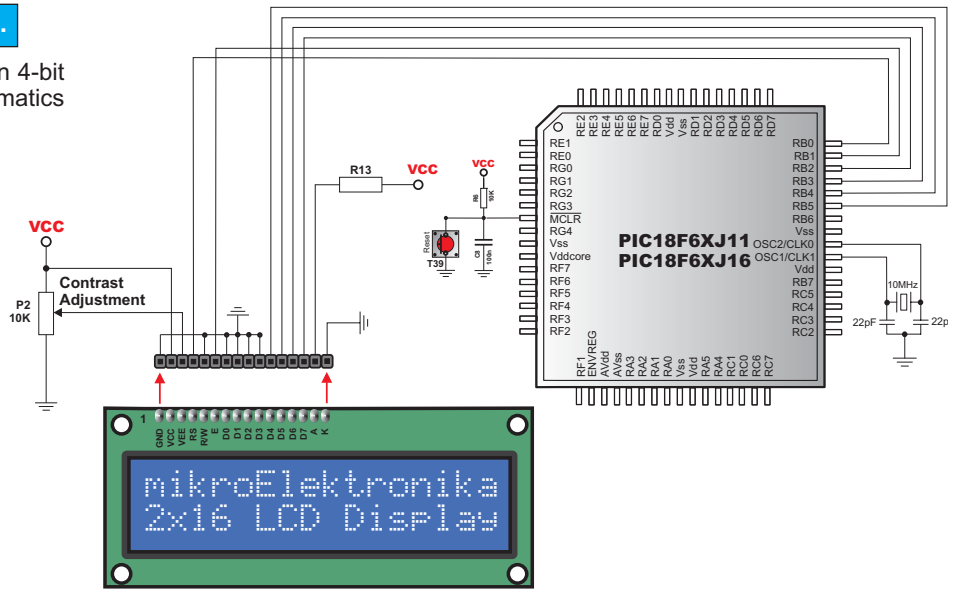


Figure 25.

LCD 2x16 in 4-bit mode schematics

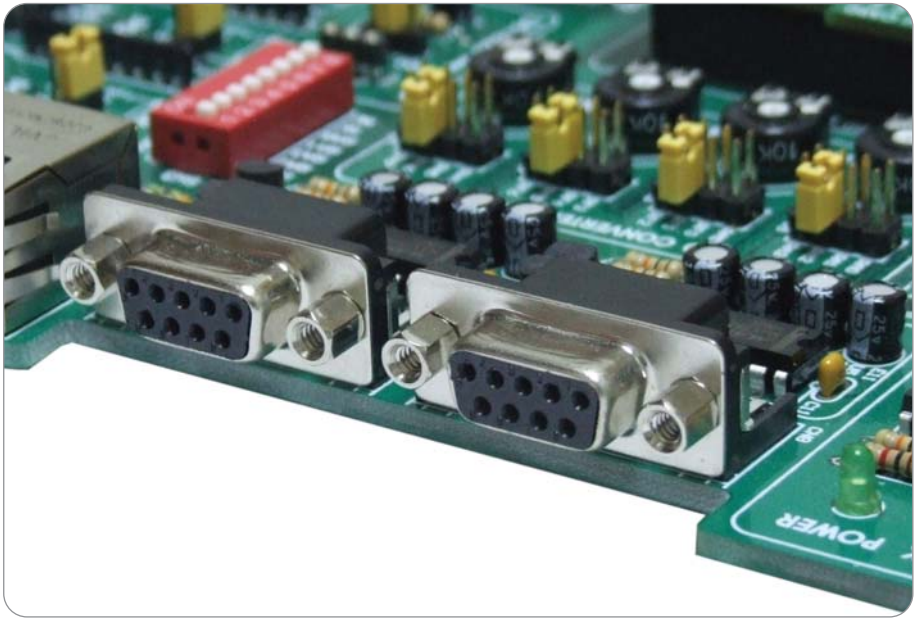


Note: Do not connect LCD and GLCD at the same time because they share same data and control pins.

RS-232 COMMUNICATION

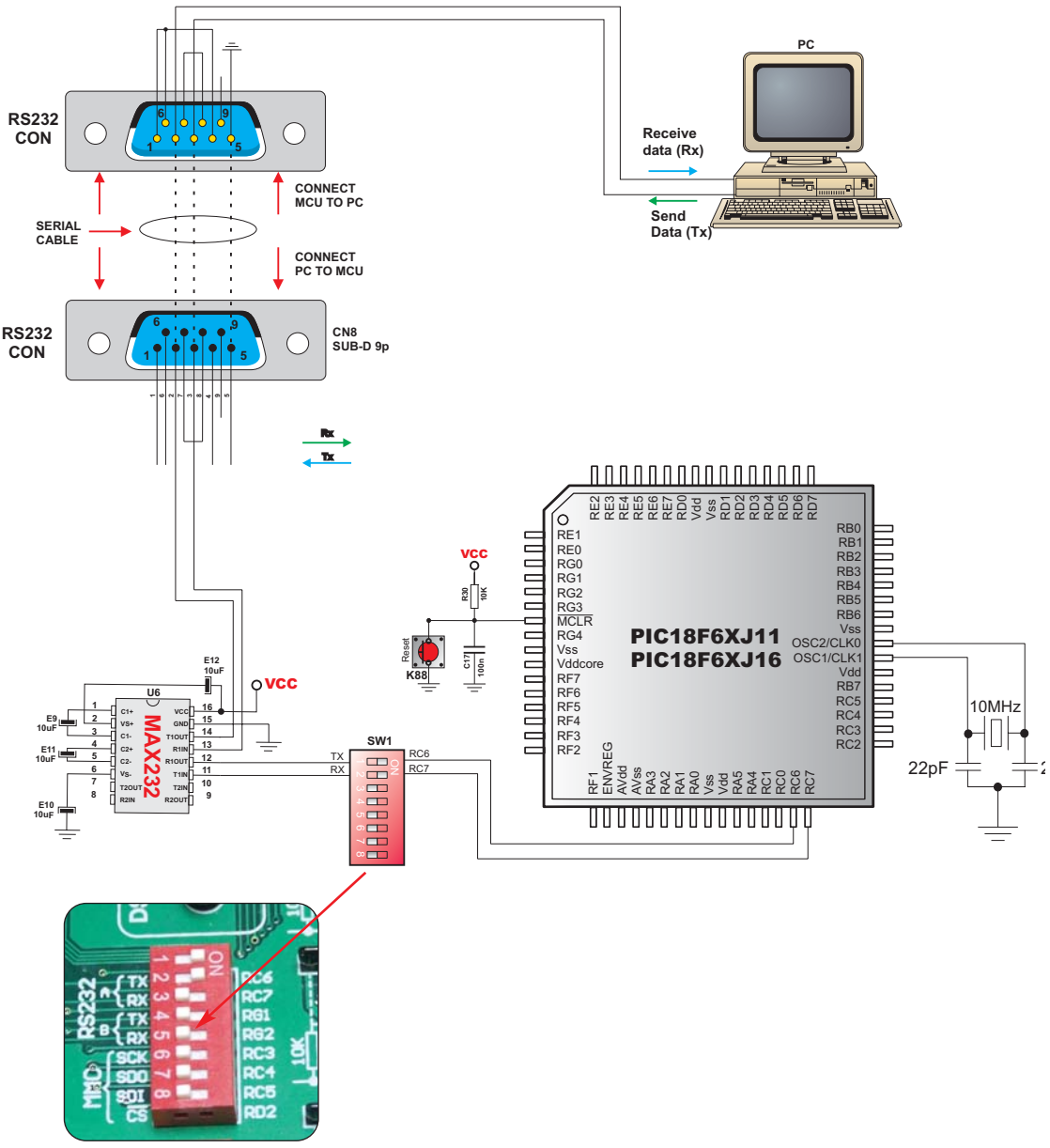
RS-232 communication enables point-to-point data transfer. It is commonly used in data acquisition applications, for the transfer of data between the microcontroller and PC. Since the voltage levels of the microcontroller and PC are not directly compatible with each other, a level transition buffer such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

Figure 26. RS232 connectors



In order to provide a more flexible system, the microcontroller is connected to the MAX232 through switches on the SW1. In order to use it, switches 1 and 2 or 3 and 4 on the SW1 must be enabled. Both RS232 modules can be used at the same time.

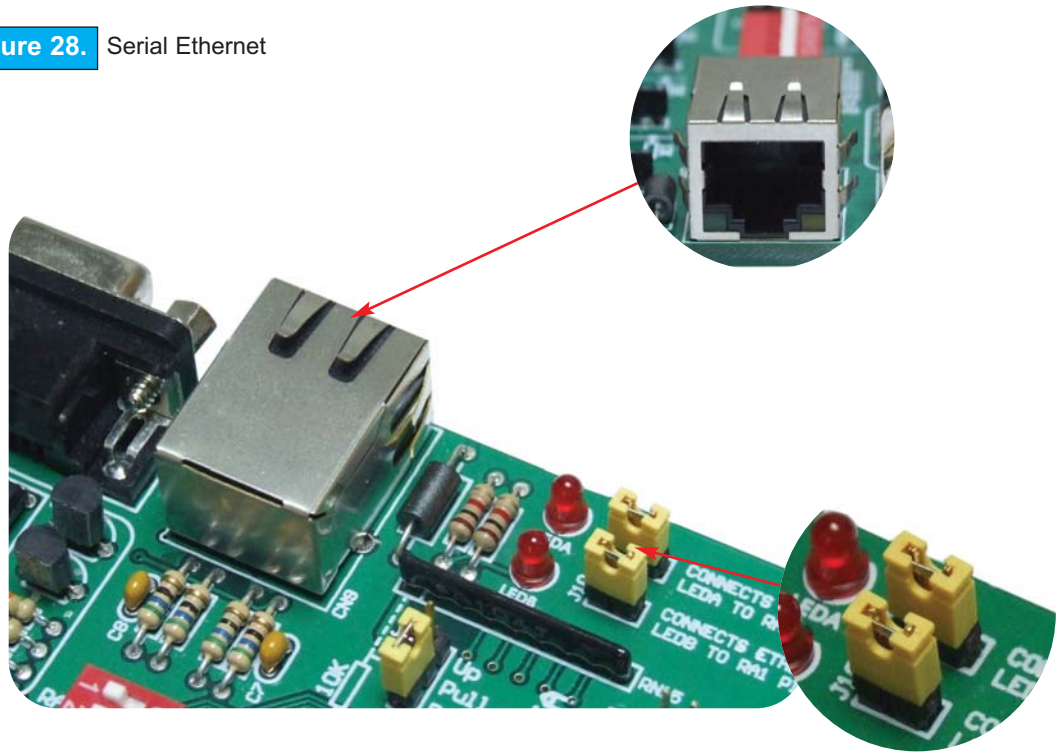
Figure 27. Connection between microcontroller and PC



SERIAL ETHERNET

Ethernet is the most common Local Area Network (LAN) technology in use today.On the top of the physical layer, Ethernet stations mutually communicate by sending data packets to each other. Each Ethernet station is assigned a single 48-bit MAC address used to specify both the destination and the source of each data packet.

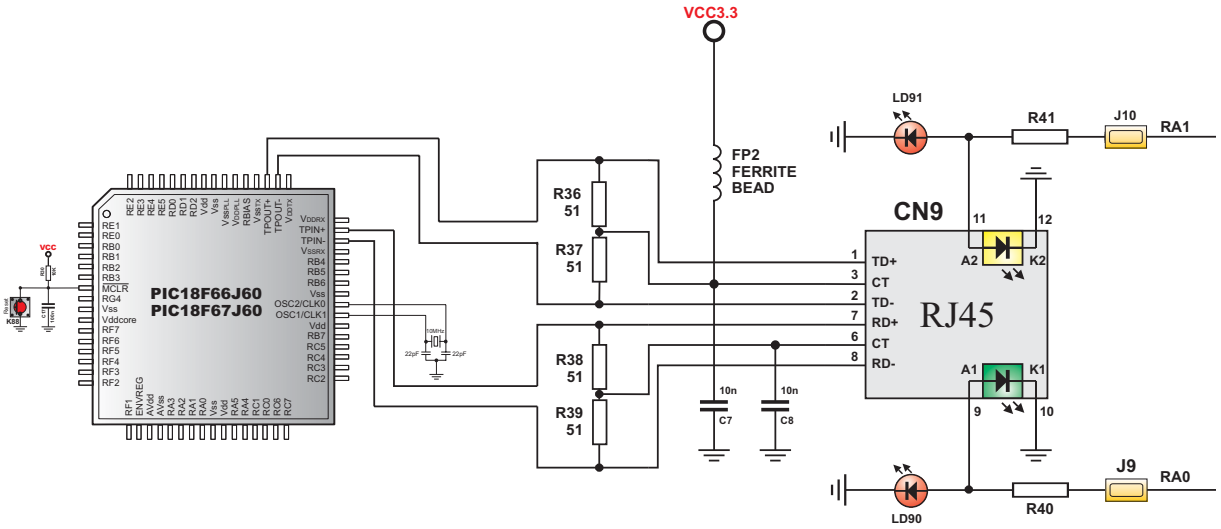
Figure 28. Serial Ethernet



Note: Make sure to select the proper voltage level depending on the MCU Card attached to the LV18FJ development board.
Improper voltage level can damage development system or Serial Ethernet chip!

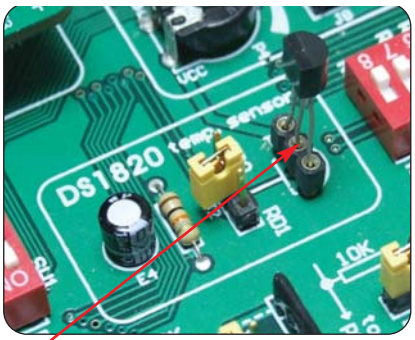
Note: Both jumpers J9 and J10 must be connected.

Figure 29. Serial Ethernet schematic



DS1820 DIGITAL THERMOMETER

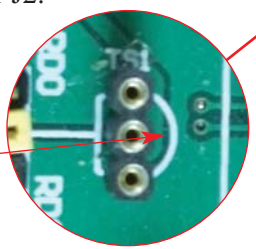
DS1820 digital thermometer is convenient for environmental temperature measurement, having the temperature in the range of -55°C to 125°C with +/-0.5°C accuracy. It must be properly placed in the 3-pin socket provided on LV18FJ, with its rounded side to the right edge of the board (see Fig. 30) otherwise the DS1820 could be permanently damaged. DS1820's data pin can be connected to either RD0 or RD1 pin, which is determined by the jumper J2.

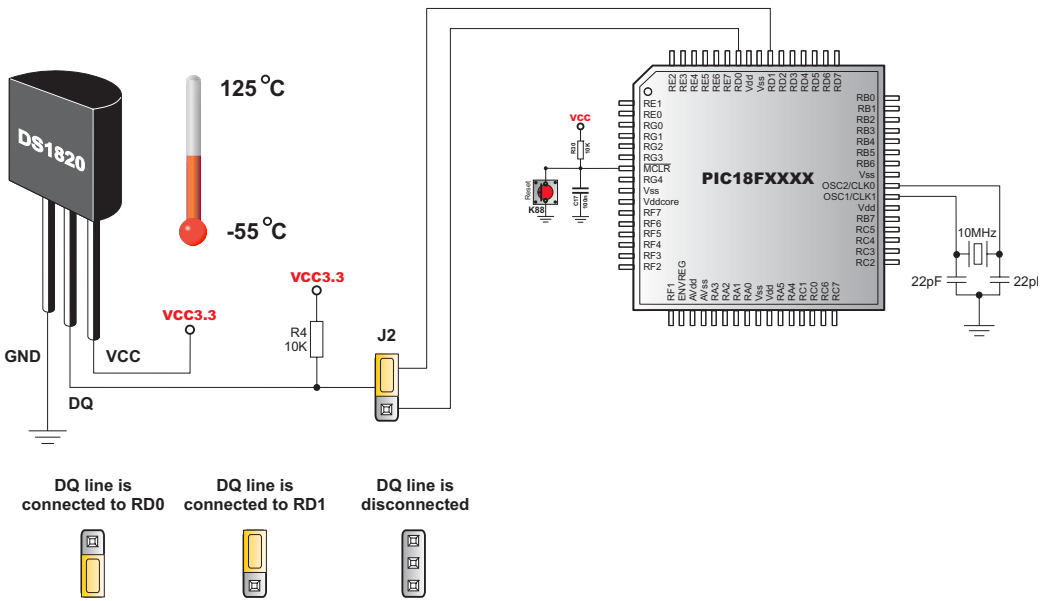


DS1820 **Figure 31.**

Figure 30. DS1820 schematic

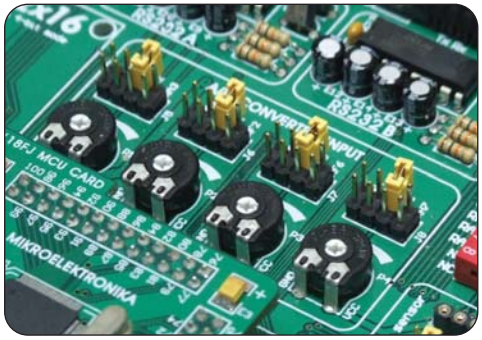
There is a mark in the shape of a half-circle for proper orientation of DS1820 sensor.





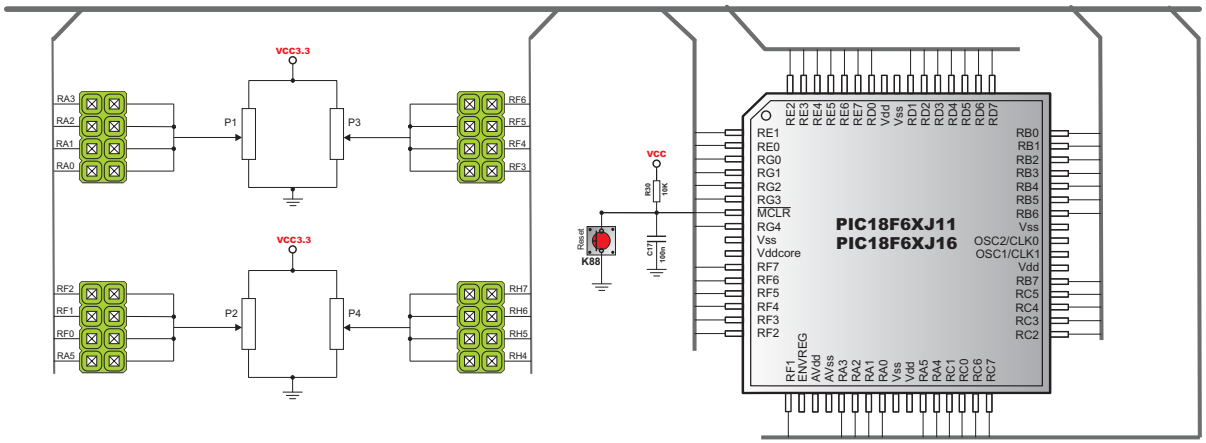
MCU A/D CONVERTER SUPPORT

LV18FJ microcontrollers have built-in A/D Converter. For the purpose of accessing the ADC there are 4 potentiometers available on the development board, each connected to four different A/D inputs. A detailed scheme is shown below.



A/D Converter **Figure 32.**

Figure 33. 4.096 reference voltage schematic

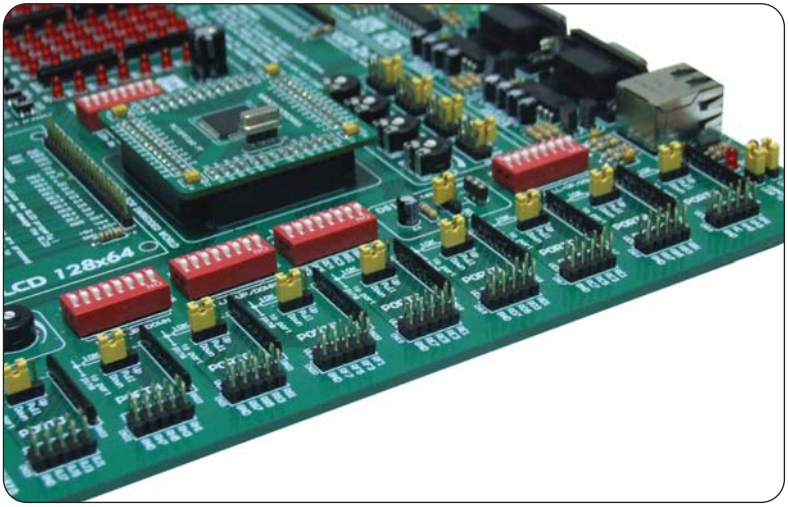


DIRECT PORT ACCESS

All microcontroller input/output pins can be accessed via connectors placed along the right side of the board. For each PORT there is one 10-pin connector providing VCC, GND and eight port pins.

Figure 34.

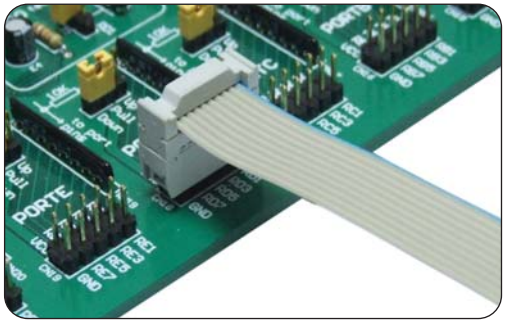
Direct port access connectors



These connectors can be used for system expansion with external boards such as Serial Ethernet, Compact Flash, MMC/SD, ADC, DAC, CAN, RTC, RS-485 etc. Ensure that on-board peripherals are disconnected from the microcontroller when an external peripheral is attached to the board. The appropriate jumpers and switches must be set for this purpose. The connectors can also be used for attaching logic probes or test equipment.

Figure 35.

Example of how to connect external peripheral with flat cable



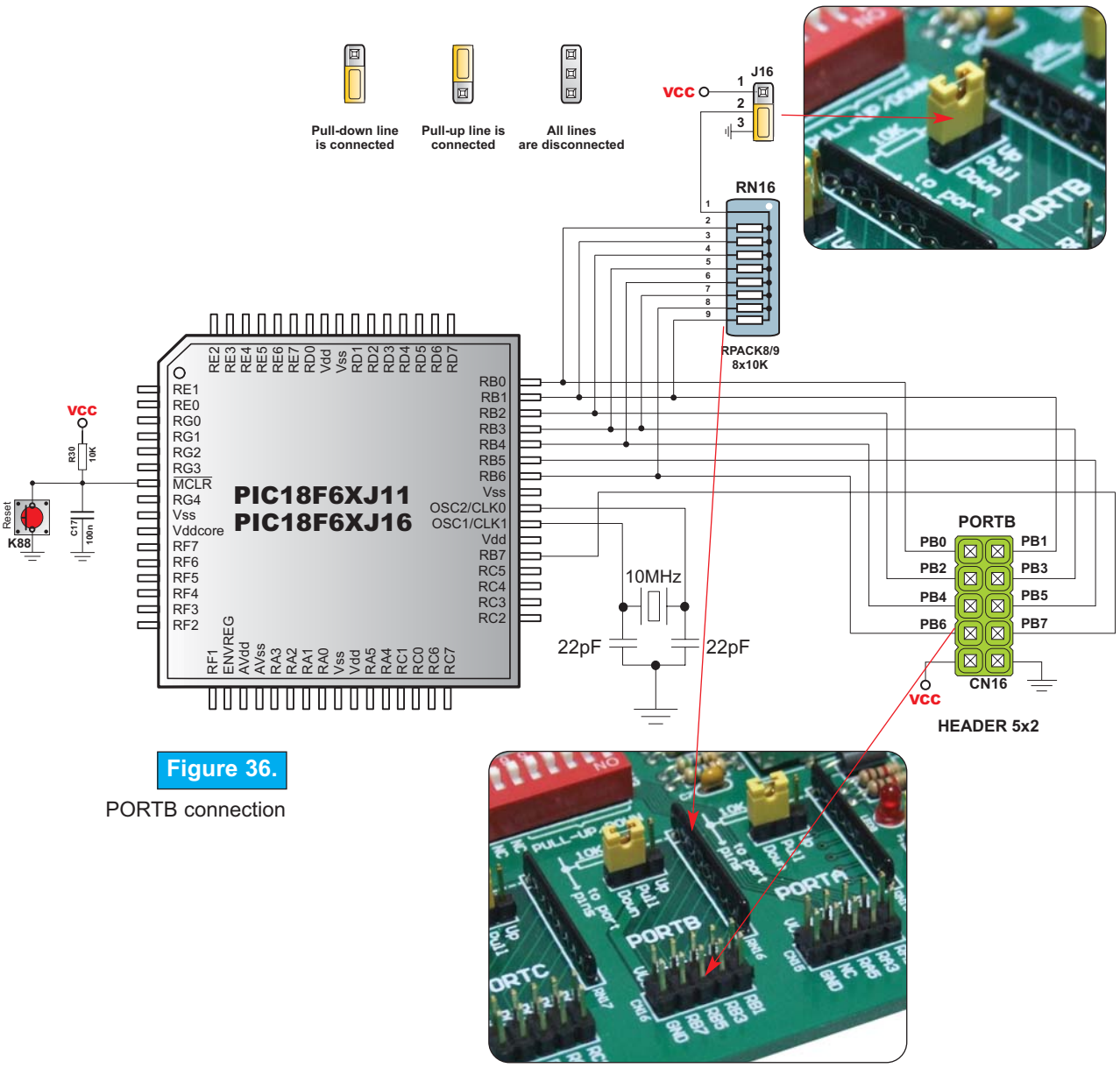


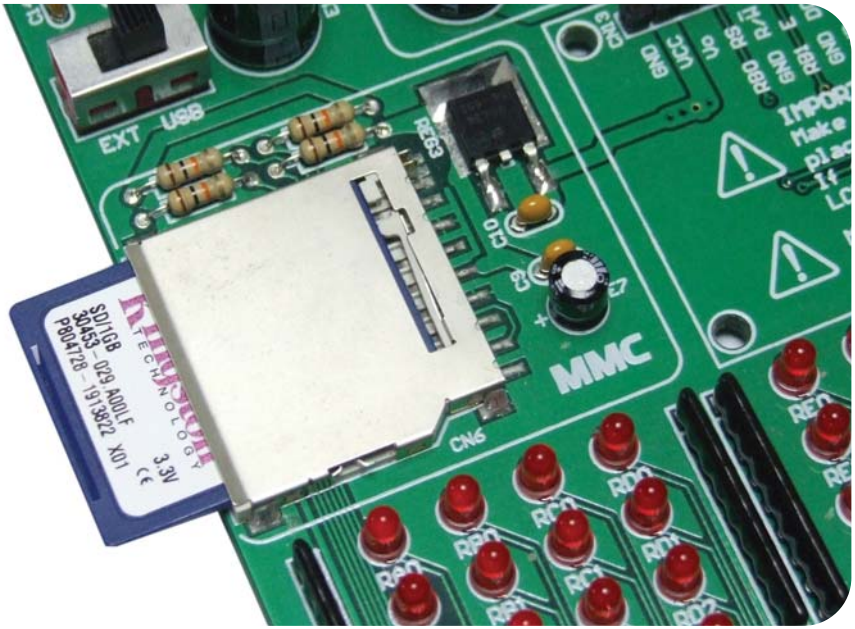
Figure 36.

PORTB connection

MMC/SD (Multimedia Card)

MMC/SD card is used as a storage media for a portable device, in a form that can be easily accessed by PC. For example, a digital camera uses MMC/CD card to store image files. Microcontroller on the LV18FJ development board comunicates with MMC/SD via SPI communication. The on-board connector enables users to easily access MMC/SD card from the microcontroller.

Figure 37. MMC Card



In order to enable MMC card, switches 5, 6, 7 and 8 on the **SW1** must be turned on, as shown at figure 38. By doing that, SPI communication lines (SCK, MISO and MOSI) are connected to the microcontroller and CS line is turned on.

Operating voltage of the MMC Card is 3.3V DC.
3.3V power supply voltage regulator (MC33269DT-3.3) are used for the adjusting MMC card voltage level.

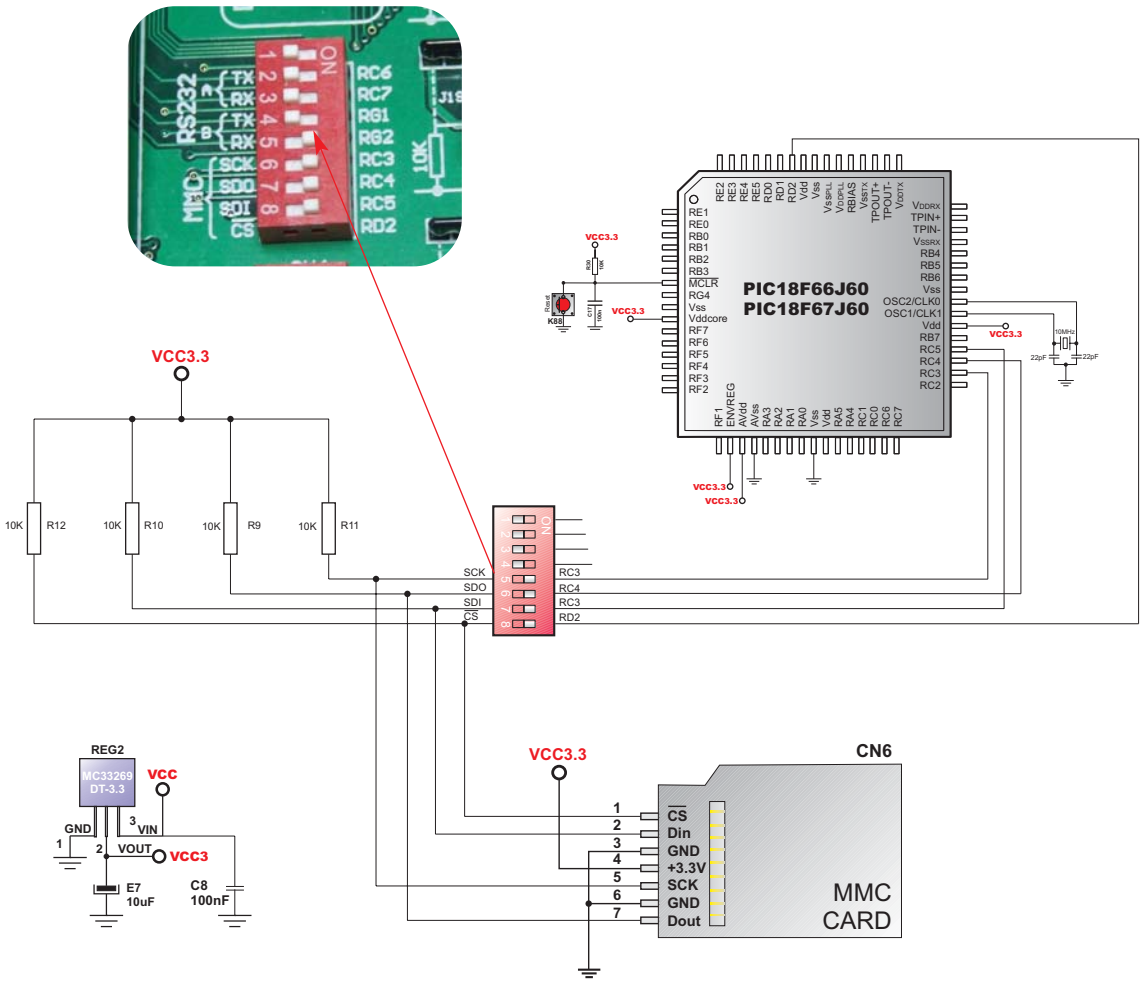


Figure 38. MMC Card schematic

Second edition
October 2007

LV18FJ

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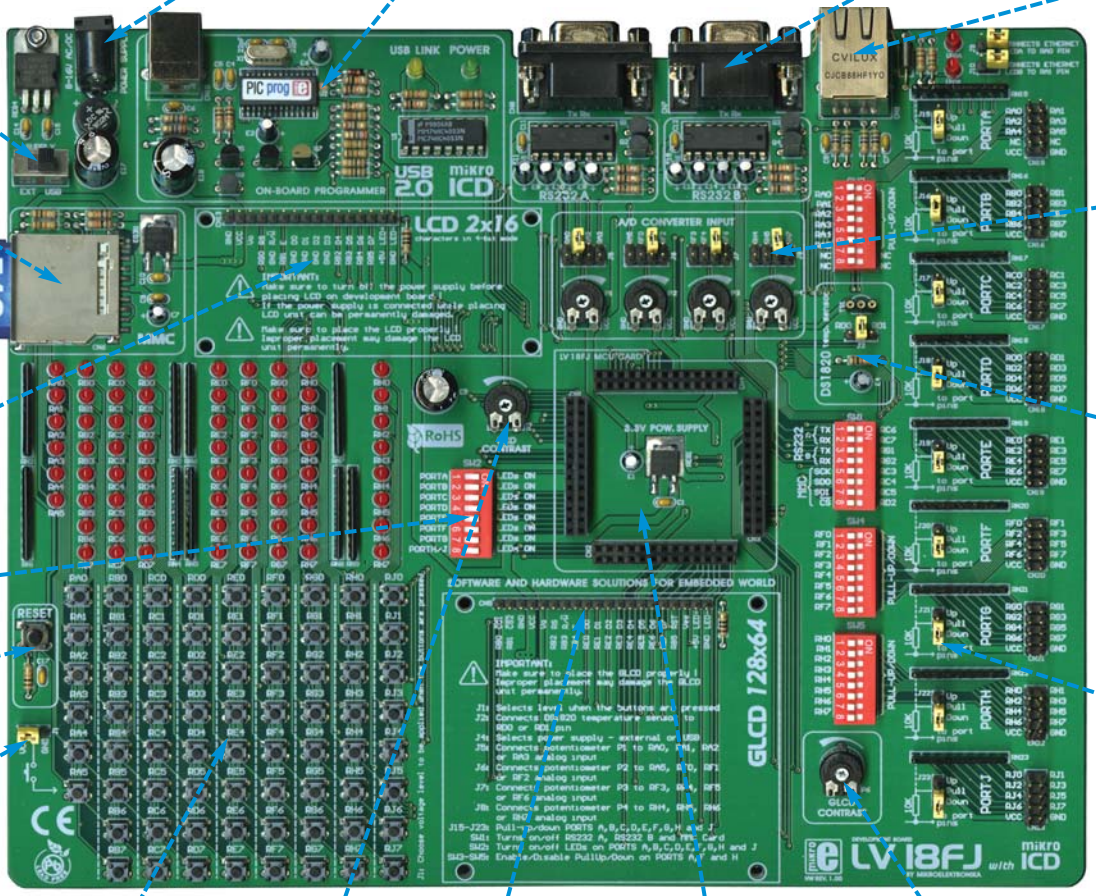

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Very fast and flexible USB 2.0 programmer.

RS232 communication ports.

Serial ethernet socket.

Choose between external or USB power supply.

MMC/SD multimedia card socket.

AD Inputs on pins

LCD connector allows easy connection of LCD in 4-bit mode.

DS1820 temperature sensor can be conneced to PC6 or PC7 pin.

Turns ON or OFF the LEDs on PORTA, PORTB, PORTC etc.

Reset circuit

Jumpers to select default logic state of the appropriate pins.

Buttons to select high/low state of the pins.

Buttons for simulating pins high state or low state

LCD contrast

GLCD connector

Socket for mikroElektronika MCU card

GLCD contrast

MikroElektronika

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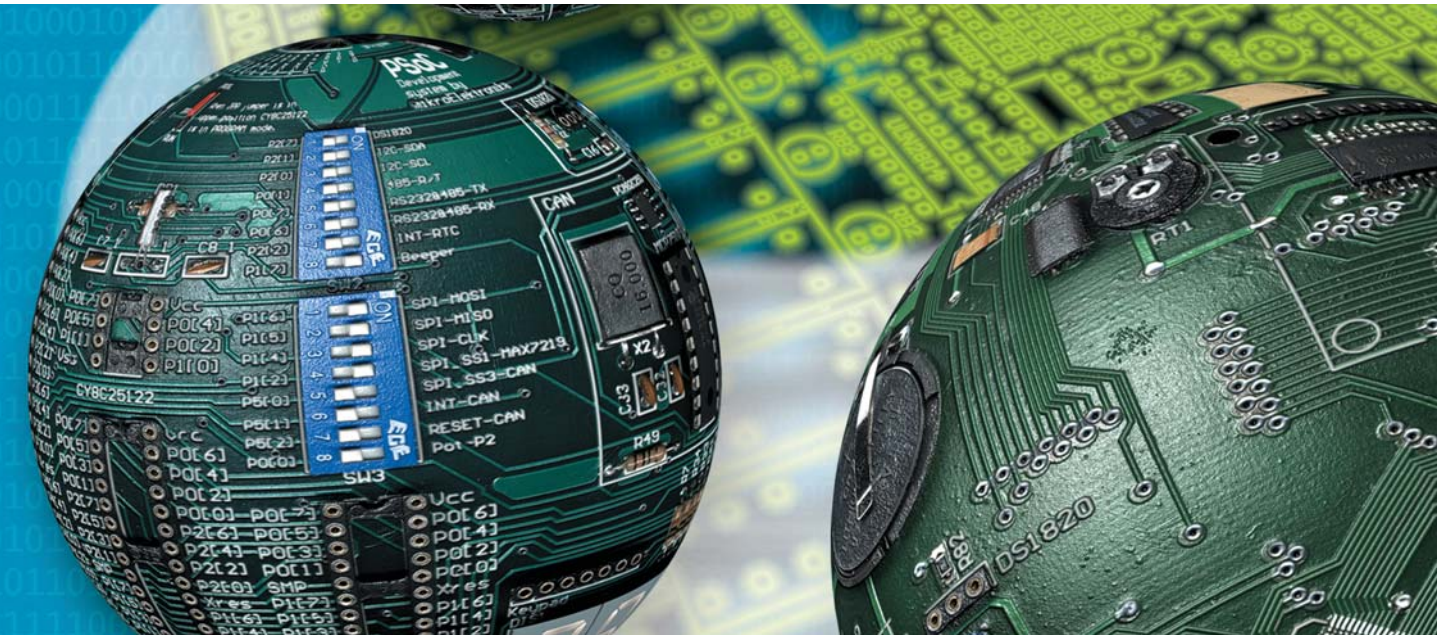

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