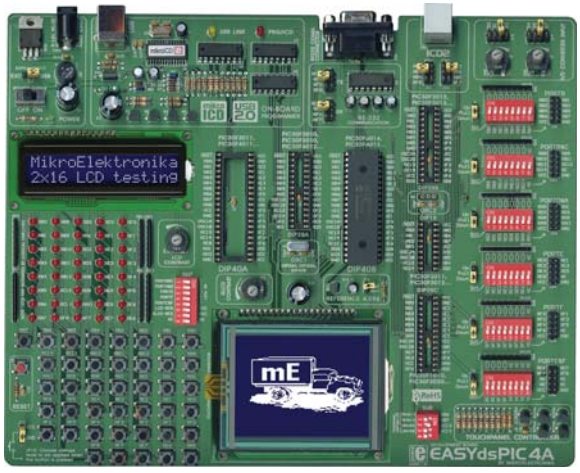
MikroElektronika

SOFTWARE AND HARDWARE SOLUTIONS FOR EMBEDDED WORLD . . . making it simple

EasydsPIC4A



USER MANUAL

A large number of useful peripherals, ready-to-go practical code examples and a broad set of add-on boards make MikroElektronika development systems fast and reliable tools that can satisfy the needs of experienced engineers and beginners alike.

USB 2.0 IN-CIRCUIT PROGRAMMER

TOUCH SCREEN

mikro ICD IN-CIRCUIT DEBUGGER

TO OUR VALUED CUSTOMERS

I want to express my thanks to you for being interested in our products and having confidence in MikroElektronika.
It is our intention to provide you with the best quality products. Furthermore, we will continue to improve our performance to better suit your needs.

Nebojsa Matic
General Manager

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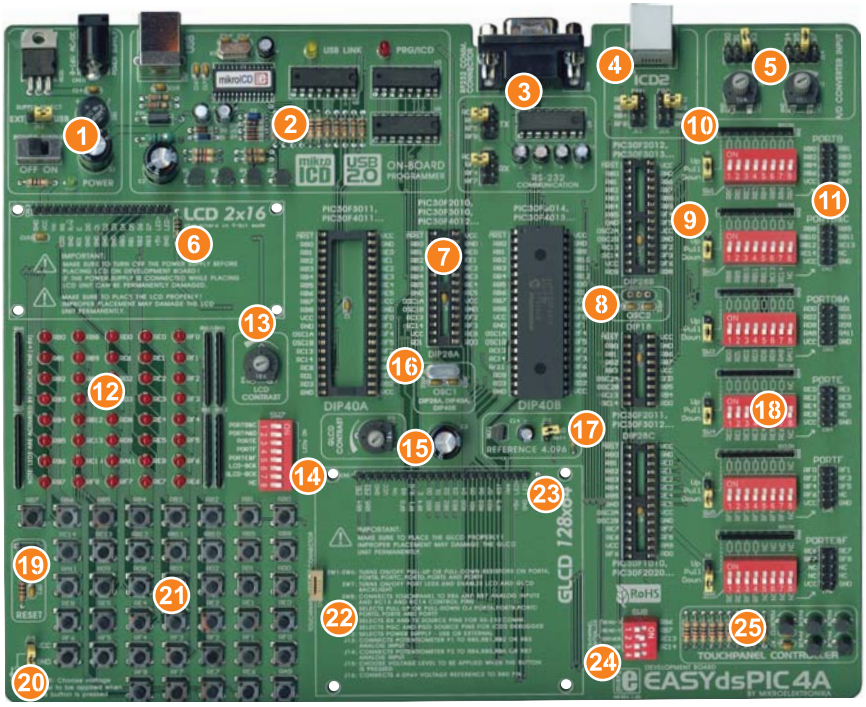
EASYdsPIC4A KEY FEATURES



1. External power supply of 8v to 16v AC/DC;
2. On-Board USB 2.0 programmer with MikroICD (In-Circuit debuger);
3. RS-232 communication port;
4. ICD2 external programmer connector;
5. A/D converter test input potentiometers;
6. 2X16 character LCD display in 4-bit mode conector;
7. EASYdsPIC4A supports microcontrollers in DIP18, DIP28, and DIP40 packages;
8. OSC2 oscillator connector;
9. Jumpers to determine input pin performance in idle state (connected to pull-up/pull-down resistor);
10. Resistor network 8x10K;
11. Direct port access connectors;
12. Each I/O pin corresponds to one LED;
13. LCD contrast potentiometar;
14. Switch group SW7 allowing all LEDs on ports A,B,C,D,E and F to be connected or disconnected from MCU pins. Switches 6 and 7 of the same group enable LCD and GLCD backlight.;
15. GLCD contrast potentiometer;
16. OSC1 crystal (10Mhz);
17. Reference voltage source 4.096V;
18. Switch groups SW1-SW6 enabling pull-up/pull-down resistors on port pins;
19. RESET push-button;
20. Jumper J15 is used to select high or low state of pins on any button press;
21. 41 push-buttons allowing control of all microcontroller pins.
22. CN11 touch panel connector;
23. Graphic LCD display (GLCD) connector;
24. Touch panel switch (SW8) enabling/disabling connection between touch panel and microcontroller; and
25. Touch panel controller;

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 *dsPICflash programmer, mikroICD Debugger* and *Installing USB drivers*. In order to use EASYdsPIC4A 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 development system to a PC yet.

Step no.2 Install PICflash programmer software to enable a program to be transferred from PC to the microcontroller chip. Installation instructions are contained in '*dsPICflash programmer*' manual.

Step no.3 Install USB drivers on your PC to enable programmer's hardware to operate properly on the EASYdsPIC4A board. For detailed installation instructions refer to '*Installing USB drivers*' manual.

Step no.4 Connect the EASYdsPIC4A 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 EASYdsPIC4A 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 dsPICflash as explained in '*dsPICflash programmer*' manual.
Next time you switch the EASYdsPIC4A on, Windows will not ask for new drivers update during driver installation.

After these four steps, your EASYdsPIC4A 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...

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INTRODUCTION

The EASYdsPIC4A development system is a full-featured development board for almost all Microchip dsPIC30 microcontrollers. It is designed to allow students and engineers to easily test and explore the capabilities of these dsPIC microcontrollers. It also allows dsPIC30 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.

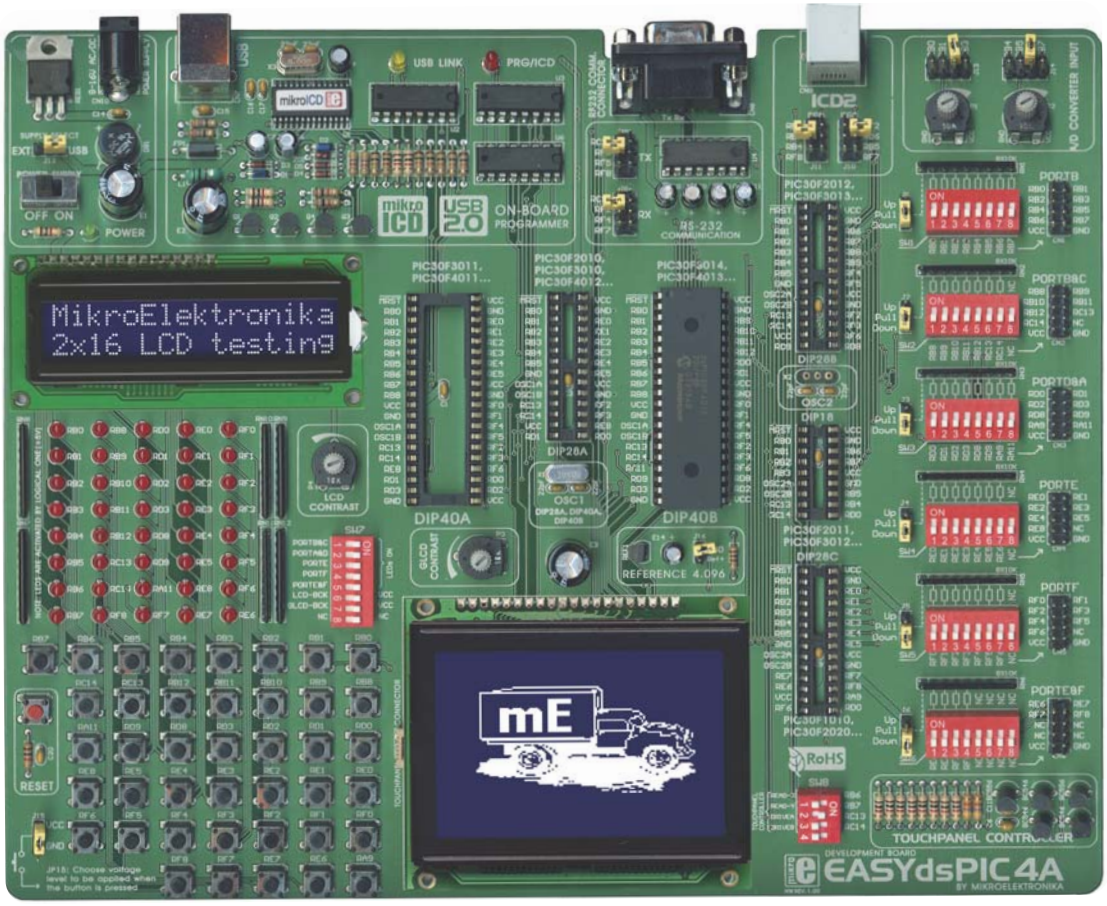


Figure 1 EASYdsPIC4A development board

SWITCHES

The EASYdsPIC4A 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 functon is to establish or break connection between two contacts. The EASYdsPIC4A development board has eight groups of switches.

Switch groups **SW1 - SW6** are used to enable external pull-up/pull-down resistors on port pins. Each pull-up/pull-down resistor is individually enabled.

Switch group **SW7** is used to enable/disable LEDs connected to the microcontroller ports. Each group of 6 port LEDs has its own switch. Two lower switches of this group are used to enable/disable LCD and GLCD backlight. The last switch of this group is not used.

Switch group **SW8** is used to enable touch panel.

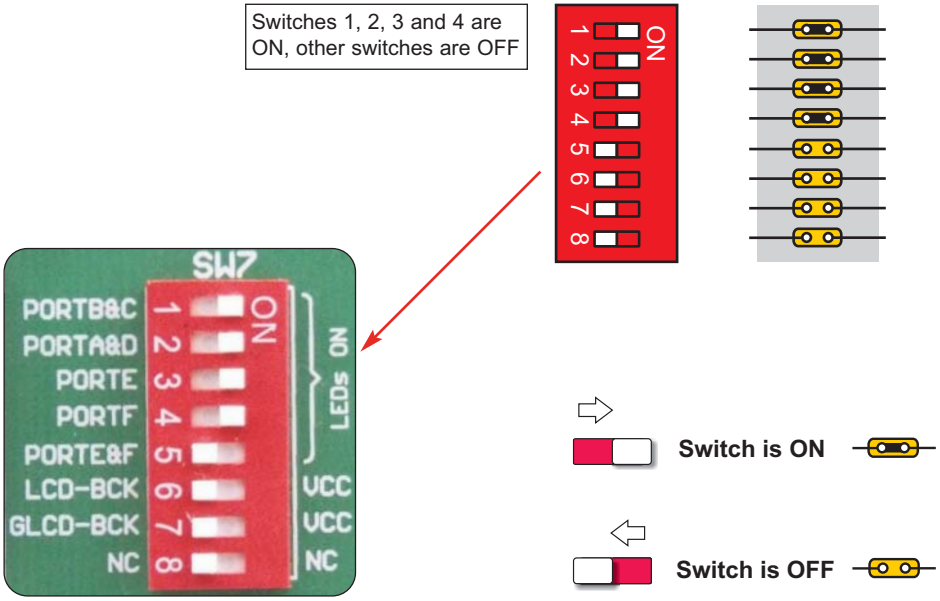
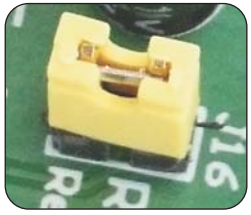


Figure 2 Group of 8 switches

JUMPERS

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

Figure 3 Jumper as a switch

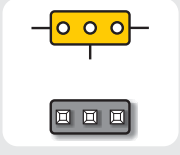


Jumper is ON

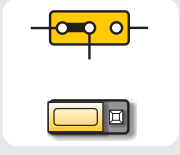
Jumper is OFF

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.

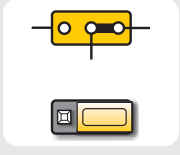
Figure 4 Jumper as a multiplexer



Jumper is not placed and middle pin is unconnected



Jumper is placed on the left side connecting middle and left pin



Jumper is placed on the right side connecting middle and right pin.

MCU SOCKETS

The EASYdsPIC4A is delivered with the 40-pin microcontroller dsPIC30F4013. The user can remove this chip and fit another microcontroller into the MCU socket (DIP40, DIP28, or DIP18 packages).

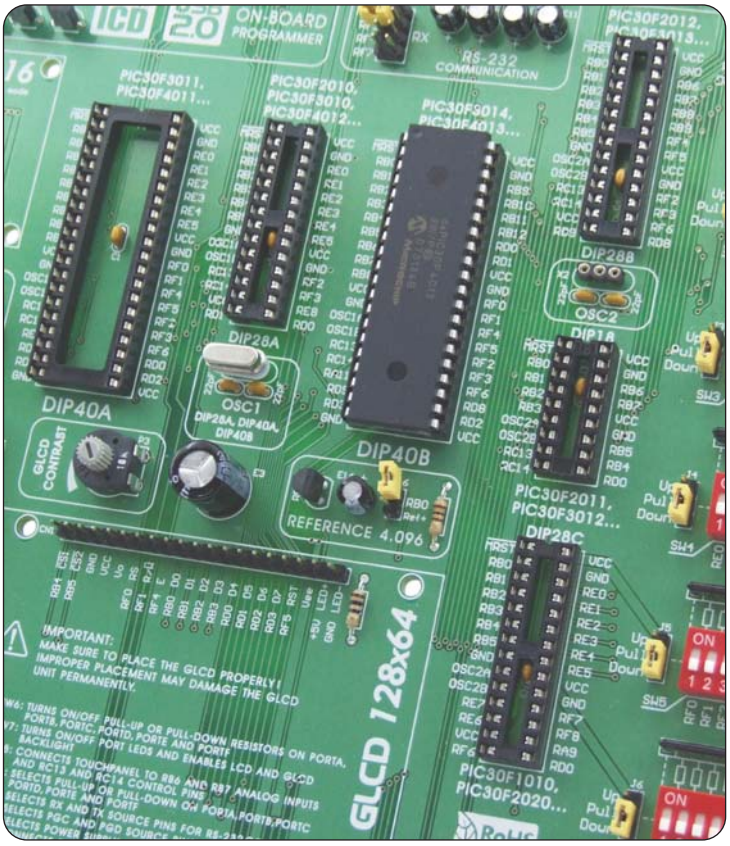


Figure 5 MCU sockets

Note: **There are two DIP40 and three DIP28 sockets with different pinouts (DIP40A, DIP40B, DIP28A, DIP28B and DIP28C). Make sure to select the socket with the appropriate pinout for each microcontroller. For example, the PIC30F2010 uses DIP28A socket, the PIC30F2012 uses DIP28B socket, whereas the PIC30F2011 uses DIP28C socket. The DIP18 socket is used for all 18-pin dsPIC30 microcontrollers.**

Note: **Since all packages have parallel connections, it is not allowed to have more than one microcontroller on the board at a time.**

Microcontroller pins are routed to various peripherals as illustrated in figure 6. All MCU ports are directly connected to 2x5 (10-pins) 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.

Also, all ports are connected to LEDs and push-buttons, 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. depending on MCU internal peripheral organization.

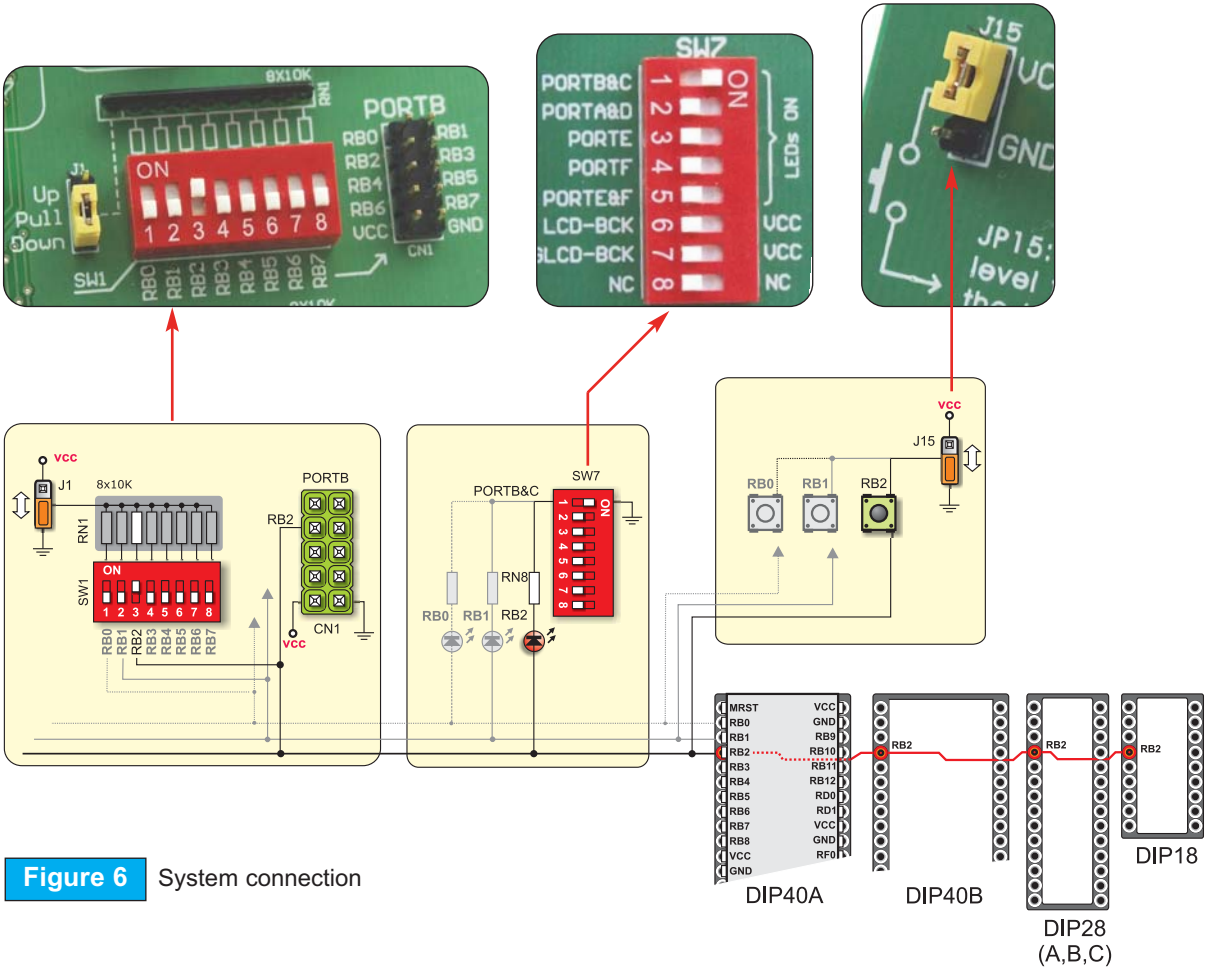


Figure 6 System connection

POWER SUPPLY

The EASYdsPIC4A can use two power supply sources - regulated supply over USB cable (by default) and external power supply (external AC/DC power adapter). When using power supply over USB cable, the system should be connected to PC using the USB programming cable, while the jumper J12 should be set in the right-hand position.

When using external power supply, the EASYdsPIC4A 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 J12 should be set in the left-hand position. Figure 8 illustrates USB and external power supply connectors.

Figure 7 Power supply connector

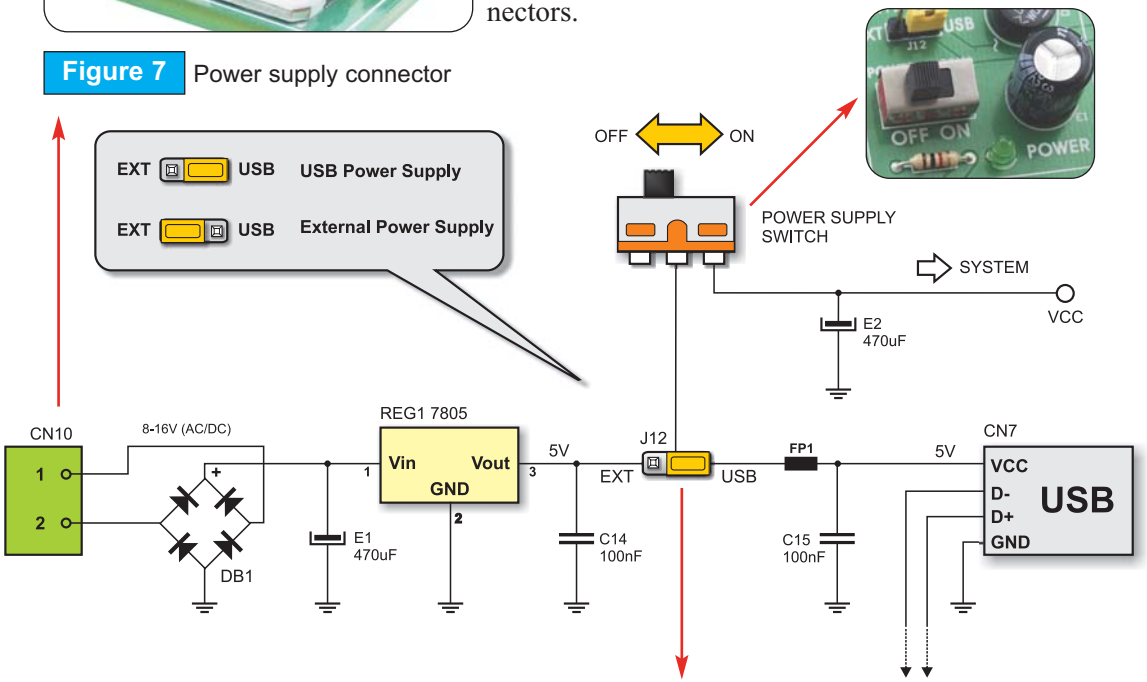


Figure 8 J12 is set to USB power supply

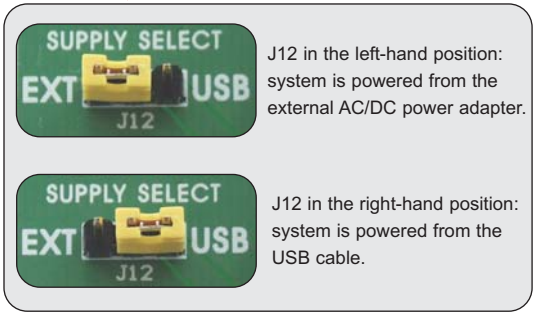


Figure 9 Power supply select jumper

ON-BOARD USB 2.0 PROGRAMMER

There is no need to use external equipment during programming as the EASYdsPIC4A 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 *dsPICflash* programming software supplied with the EASYdsPIC4A.

Please refer to *dsPICflash* documentation for more information.

Figure 10 USB 2.0 programmer

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

OSCILLATOR

Since there are so many sockets on the EASYdsPIC4A board, there are two oscillators connected to two main sections of the MCU sockets. One oscillator, designated as OSC1, is connected to DIP40A, DIP40B and DIP28A socket. Another one, denoted as OSC2, is connected to DIP28B, DIP28C and DIP18 socket.

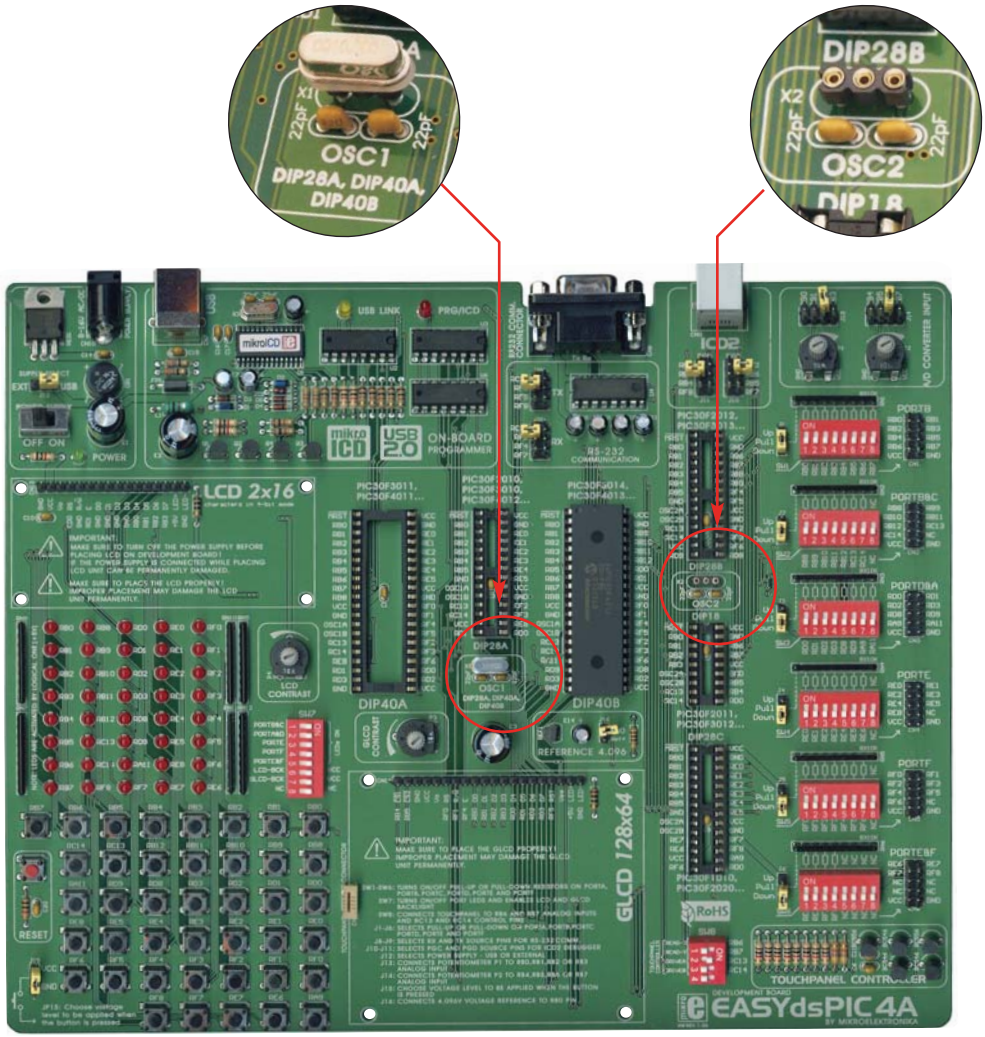


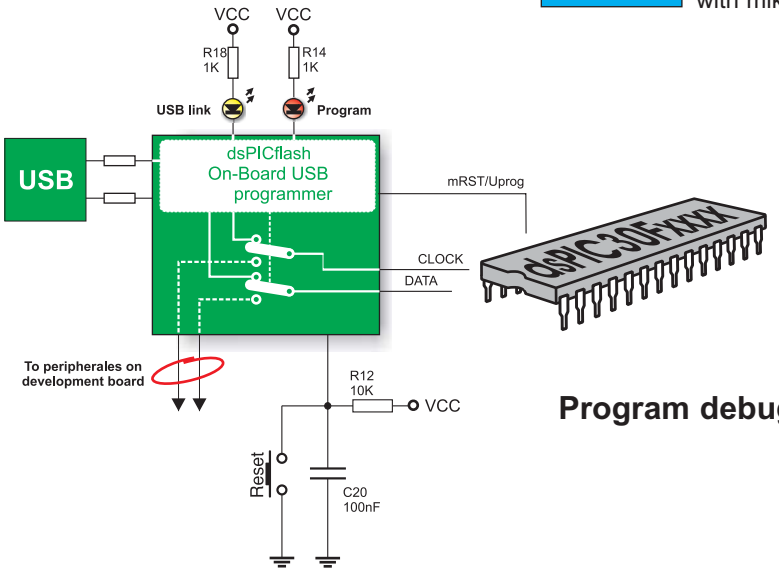
Figure 11 Oscillators

MikroICD (HARDWARE 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 dsPIC microcontroller and view variable values, special function registers (SFRs) and EEPROM while the program is running. MikroICD can be used with any dsPIC compiler manufactured by MikroElektronika (mikroC, mikroBasic or mikroPascal). You just have to select the appropriate build type (Release or ICD Debug), build the project, program the MCU and run debugger.
The mikroICD debugger uses on-board programmer to communicate with the compiler and supports common debugger commands:

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

Figure 12 On-Board USB programmer with mikroICD



Program debugging

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 in Help documentation inside any of the mentioned compilers.**

ICD2

ICD2 connection is used for external (Microchip) programmer. By means of jumper groups J11 and J10 you can choose pins to connect to external Microchip programmer. Pin selection depends on the type of the microcontroller in use.

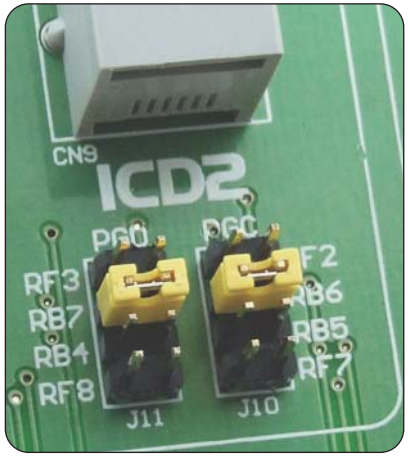


Figure 13 ICD2 Connector

Note: **For more information about ICD2 please look at www.microchip.com**

LEDs

Light Emitting Diodes (LEDs) are components most commonly used for displaying pin digital state. The EASYdsPIC4A has 40 LEDs connected to the microcontroller ports: PORTA, PORTB, PORTC, PORTD, PORTE and PORTF.

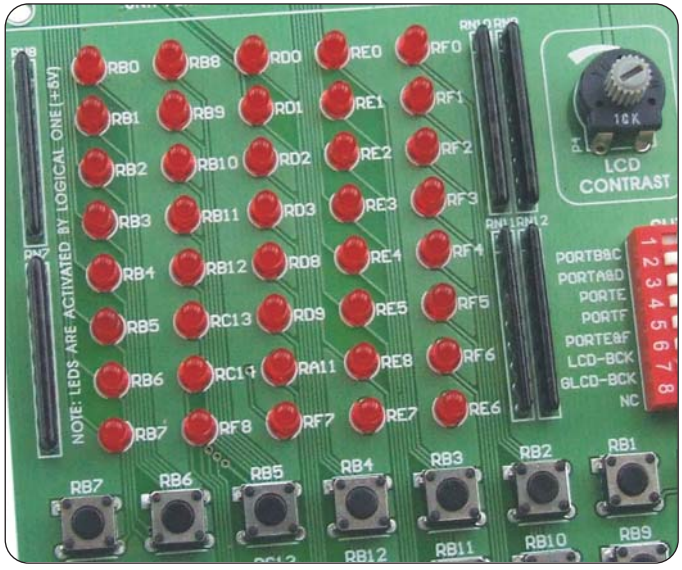


Figure 14 On board LEDs

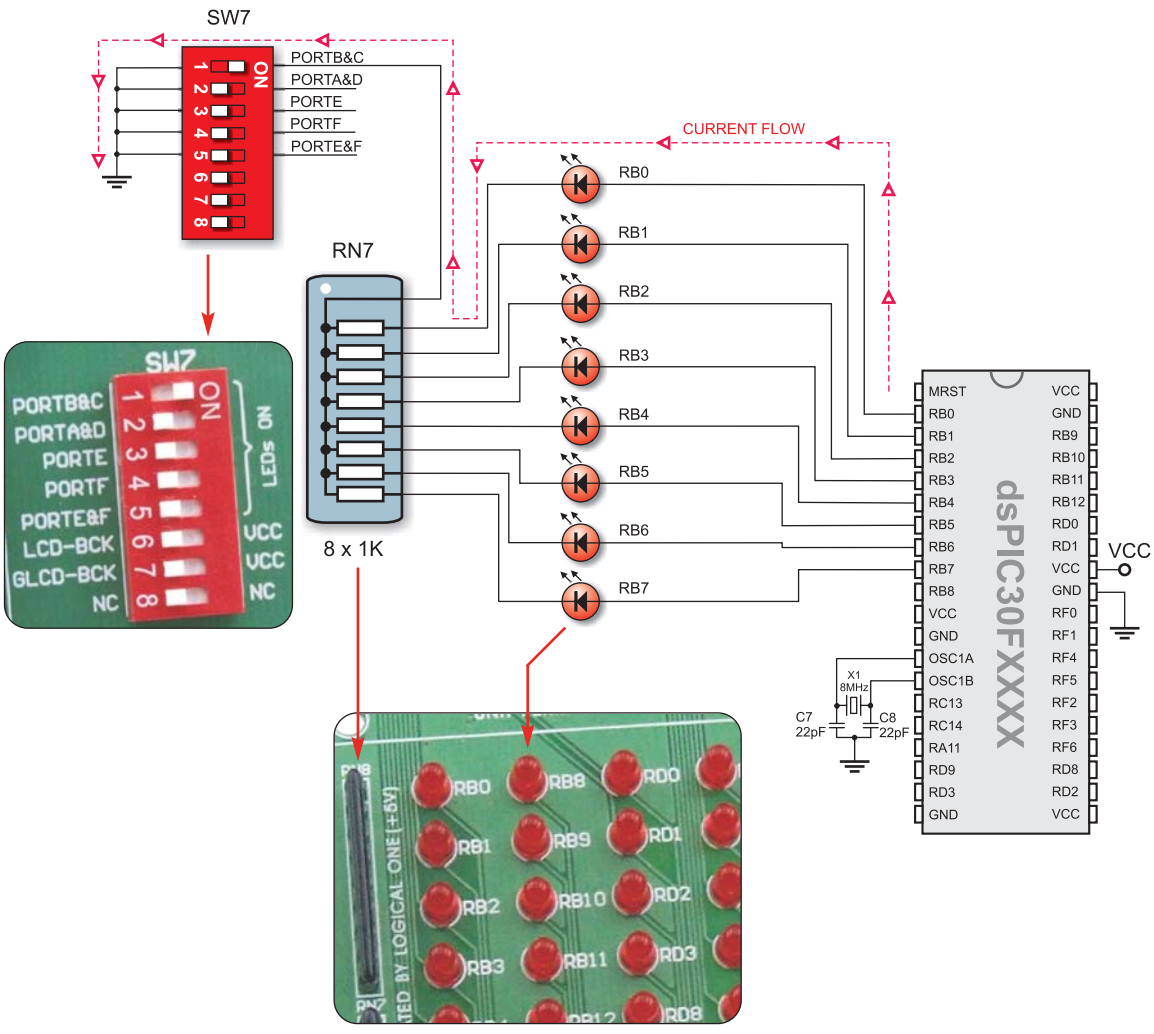
Each port LEDs can be enabled or disabled using switches of the switch group SW7.

Switch 1 of the switch group **SW7** enables/disables LEDs on PORTB (RB0 - RB12) and PORTC (RC13 and RC14);
Switch 2 of the switch group **SW7** enables/disables LEDs on PORTA (RA11) and PORTD (RD0-RD9);
Switch 3 of the switch group **SW7** enables/disables LEDs on PORTE (RE0, RE1, RE2, RE3, RE4, RE5 and RE8);
Switch 4 of the switch group **SW7** enables/disables LEDs on PORTF (RF0-RF6); and
Switch 5 of the switch group **SW7** enables/disables LEDs on PORTE (RE7 and RE6) and PORTF (RF8 and RF7). 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 them.

Note: **There is no corresponding LED for RA9 output.**

Figure 15 illustrates the connection between PORTB pins and the corresponding LEDs. A resistor is serially connected to the LEDs in order to limit their current. In this case the resistor value is 1K.

Figure 15 LEDs



RESET CIRCUIT

Apart from other pushbuttons, there is one red button on the far left position of the board marked as RESET. It is used for MCU reset.

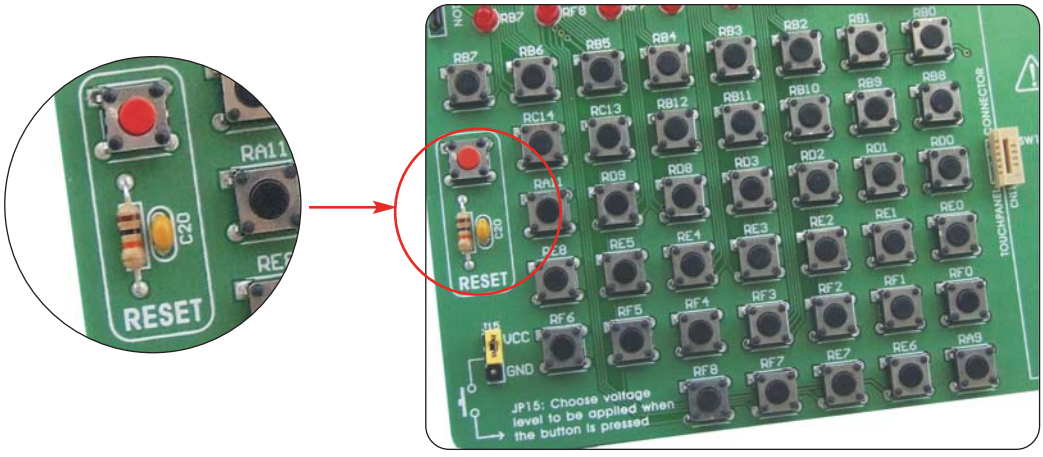


Figure 16 Reset button

As seen in figure 17, the microcontroller pin MCLR is connected to programmer circuit instead of being directly connected to the RESET push button.

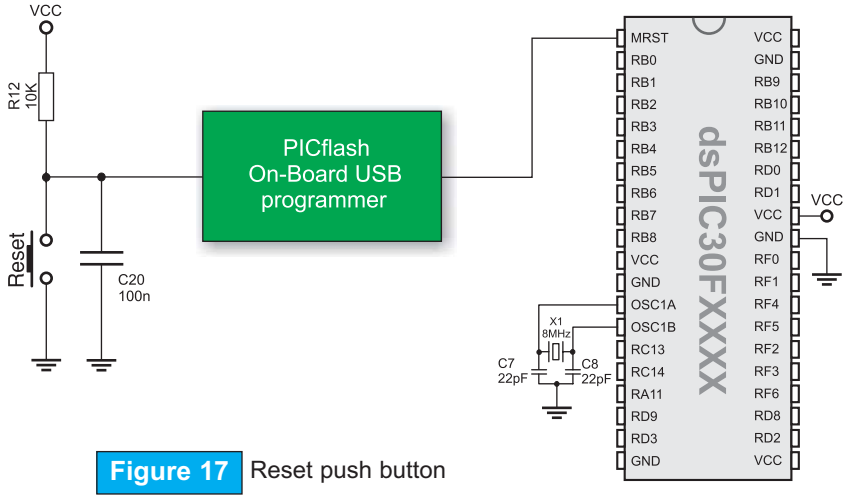


Figure 17 Reset push button

PUSH BUTTONS

The EASYdsPIC4A has 41 push buttons used to change the states of digital inputs on the microcontroller ports. Connection between the push buttons and the following ports PORTA, PORTB, PORTC, PORTD, PORTE and PORTF is shown in figure 18. Jumper J15 determines whether a button press will bring a logic zero (0) or a logic one (1) to the appropriate pin. When button is released, pin state is determined by pull-up or pull-down port jumpers.

Figure 18 Pushbuttons circuit diagram

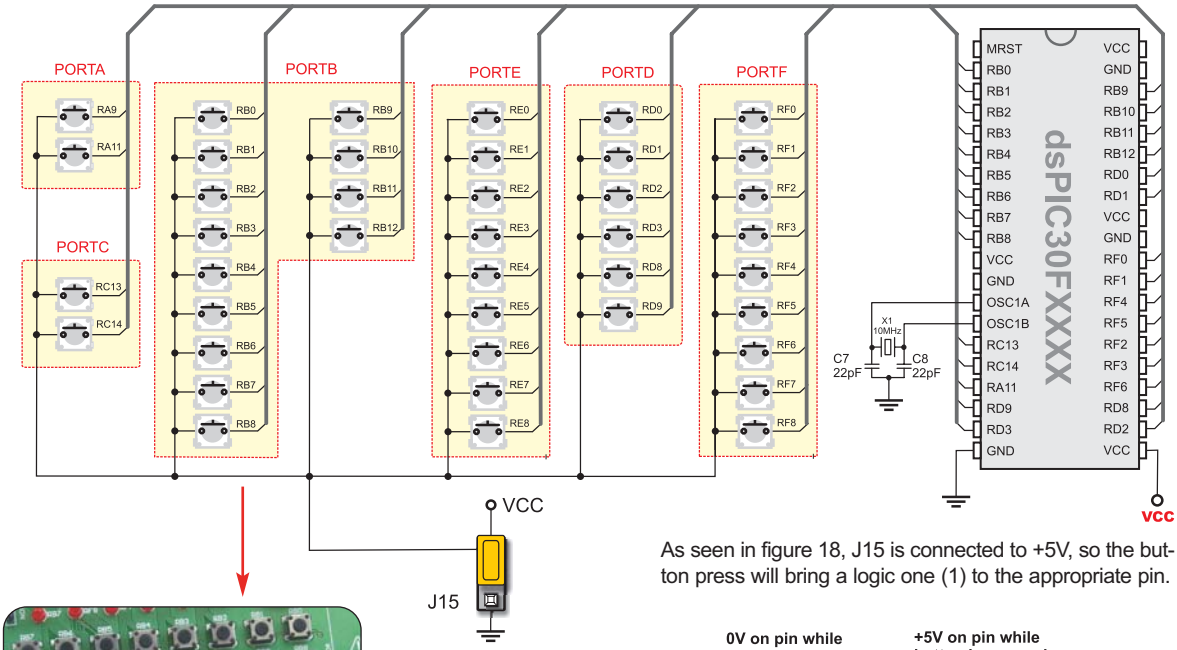
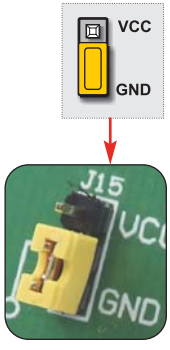


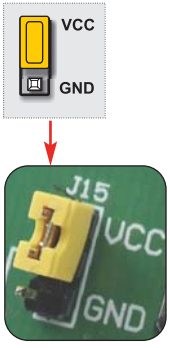
Figure 19 Push buttons

As seen in figure 18, J15 is connected to +5V, so the button press will bring a logic one (1) to the appropriate pin.

0V on pin while button is pressed



+5V on pin while button is pressed



Referring to figure 20, jumper J2 is set to pull-up position, so that pull-up resistor pulls the microcontroller pin RB10 to +5V.

By pressing the button, the RB10 pin is connected to ground via J15.

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

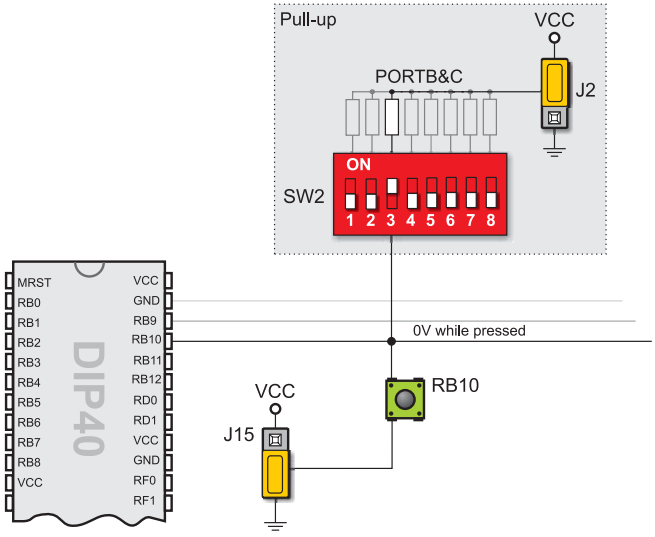


Figure 20 Button with pull-up resistor

Referring to figure 21, switch J2 is set to pull-down position, so that pull-down resistor pulls the microcontroller pin RB10 to 0V.

By pressing the button, the RB10 pin is connected to +5V via J15.

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

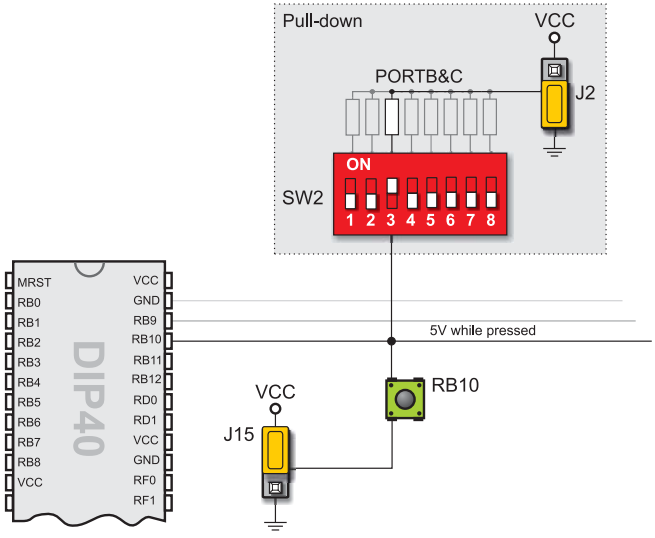


Figure 21 Button with pull-down resistor

2X16 CHARACTER LCD

A standard character LCD is probably the most widely used data visualization component. It can usually display messages in two lines each containing up to 16 alphanumeric characters. These are made up of 5x8 pixels. The character LCD communicates with the microcontroller via 4-bit data bus. Its connection to the microcontroller is shown in figure 23.

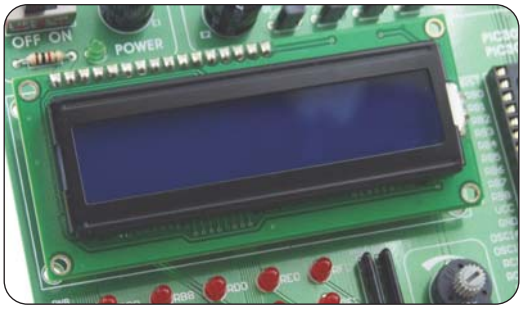


Figure 22 LCD 2x16 in 4-bit mode

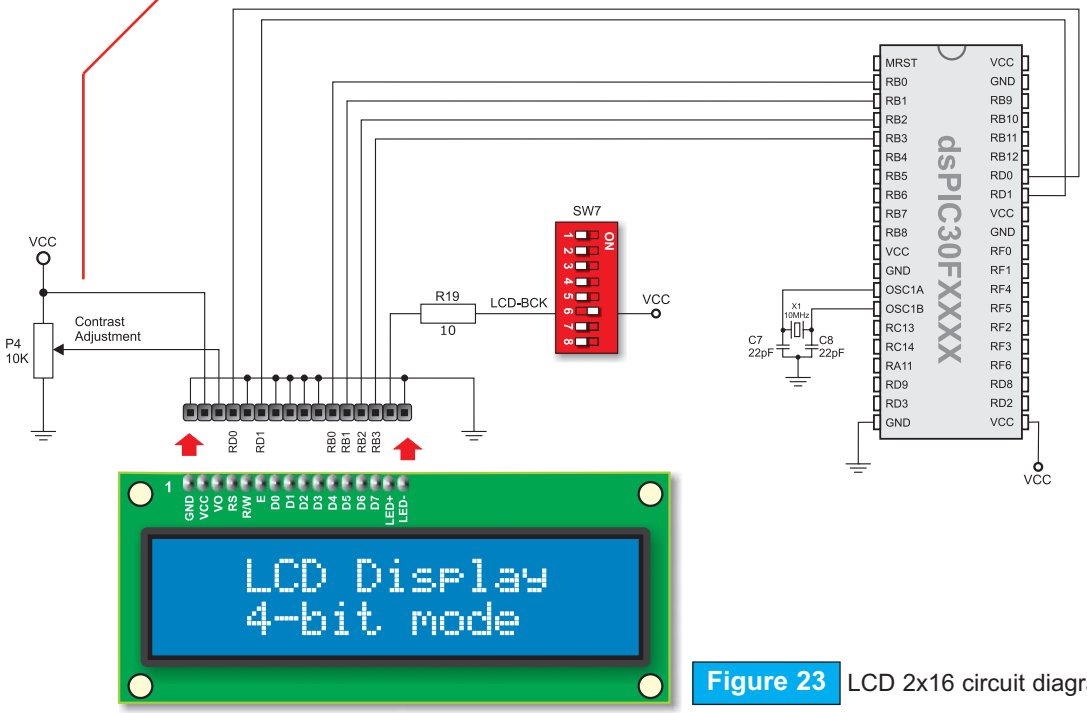


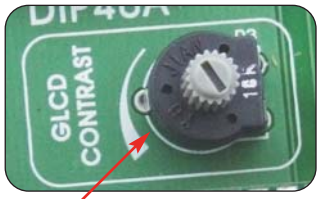
Figure 23 LCD 2x16 circuit diagram

Note: **It is important to understand that LCD should be placed or removed from the EASYdsPIC4A 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 text and graphics. While a character LCD can display only alphanumeric characters, a GLCD can be used to display messages in the form of drawings and graphics. The most commonly used graphic LCD has the screen resolution of 128x64 pixels. The GLCD contrast can be adjusted using the potentiometer P3 placed right above the GLCD.

Figure 24 GLCD contrast adjusment potentiometer



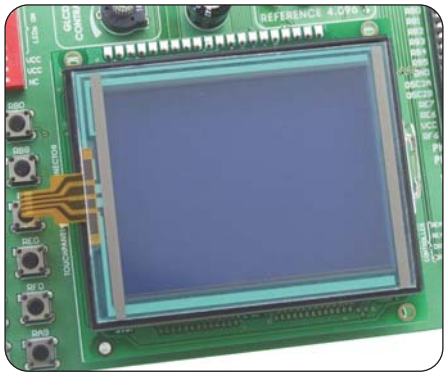


Figure 25 GLCD

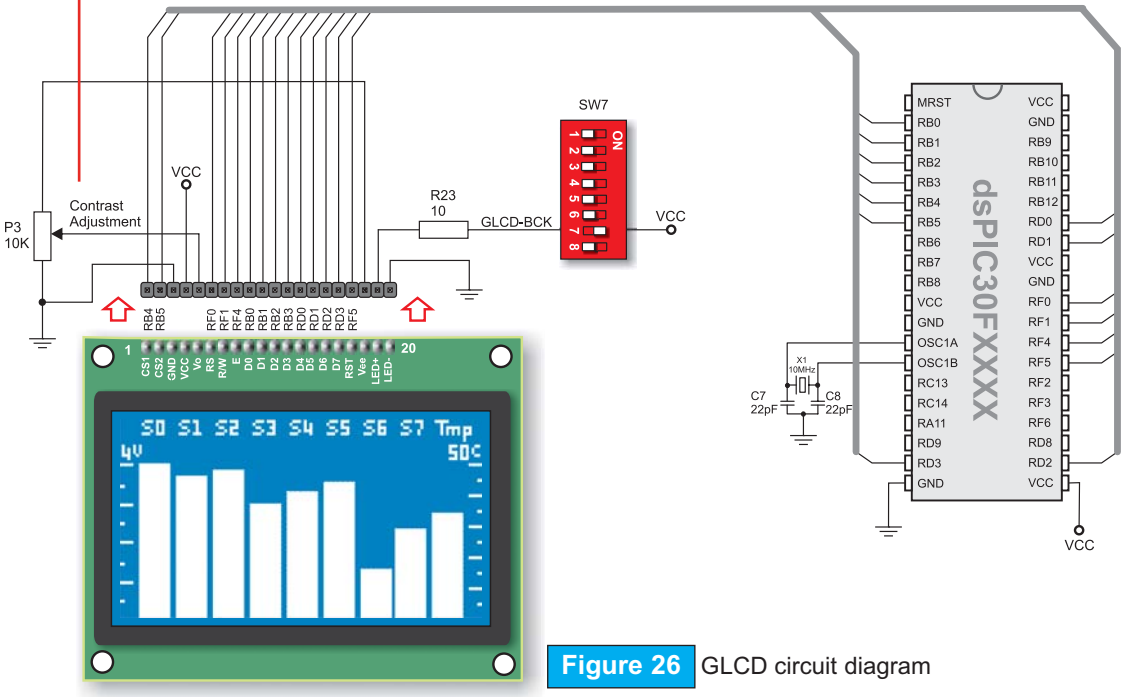


Figure 26 GLCD circuit diagram

Note: **It is very important to understand that GLCD should be placed on or removed from the EASYdsPIC4A development board only after the power supply is switched off. Otherwise, it could be permanently damaged.**

TOUCH PANEL

Touch panel is a self-adhesive, transparent panel that could be placed over the screen of graphic LCD. It consists of two separate foils which form a "sandwich" structure. It is 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 CN11 enables this device to be connected to on-board touch panel controller whose active part consists of 5 discrete transistors. Four switches of the SW8 enable or disable connection between this controller and RB6, RB7, RC13 and RC14 pins.

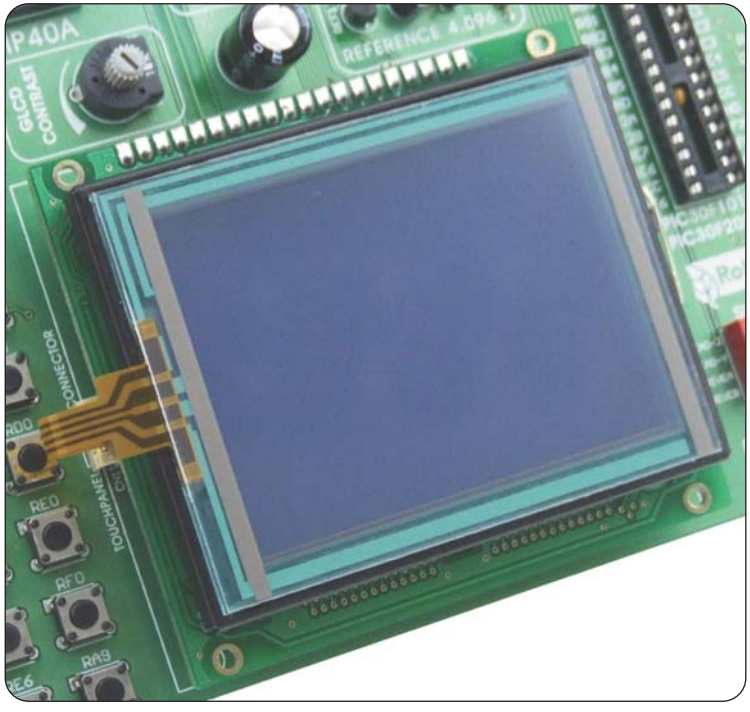


Figure 27 Touch Panel

Figure 28 Touch Panel circuit dagram

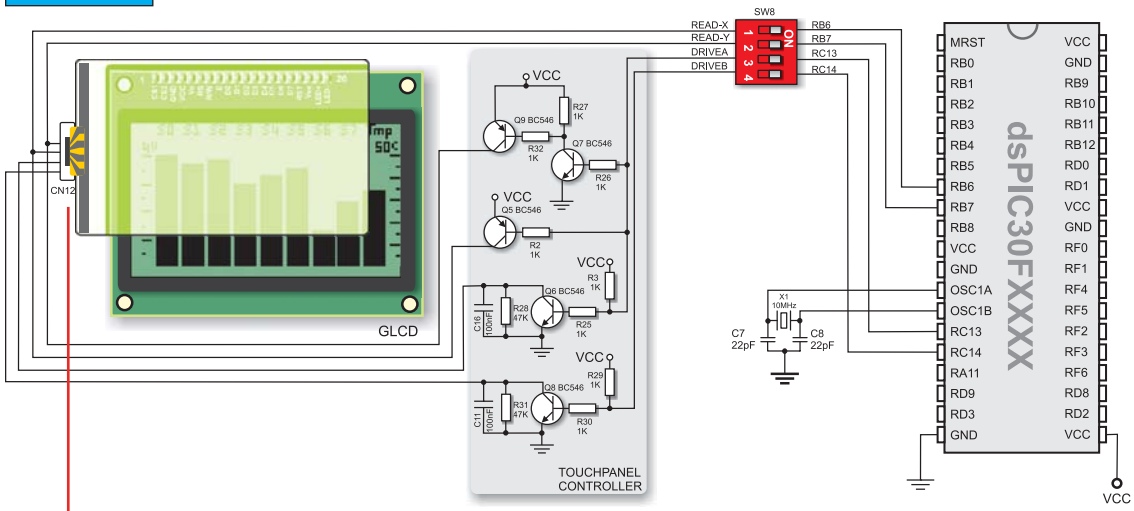


Figure 29 Thin ribbon cable placed in CN11 connector

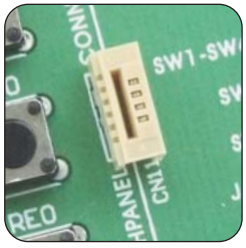


Figure 30 CN11 connector

It is very easy to connect touch panel to the EASYdsPIC4A development system. You just need to place a thin ribbon cable in on-board connector CN11 as shown in figures 29 and 30.

Note: **It is very important to understand that touch panel should be placed on or removed from the EASYdsPIC4A 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. In order to provide a more flexible system, the microcontroller is connected to the MAX232 via the jumper groups J8 and J9. The jumper group J8 is used to connect Rx line to RC14, RF2, RF4 or RF7. The jumper group J9 is used to connect Tx line to RC13, RF3, RF5 or RF8.

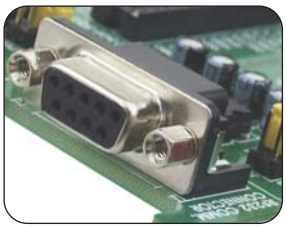


Figure 31 RS232 connector

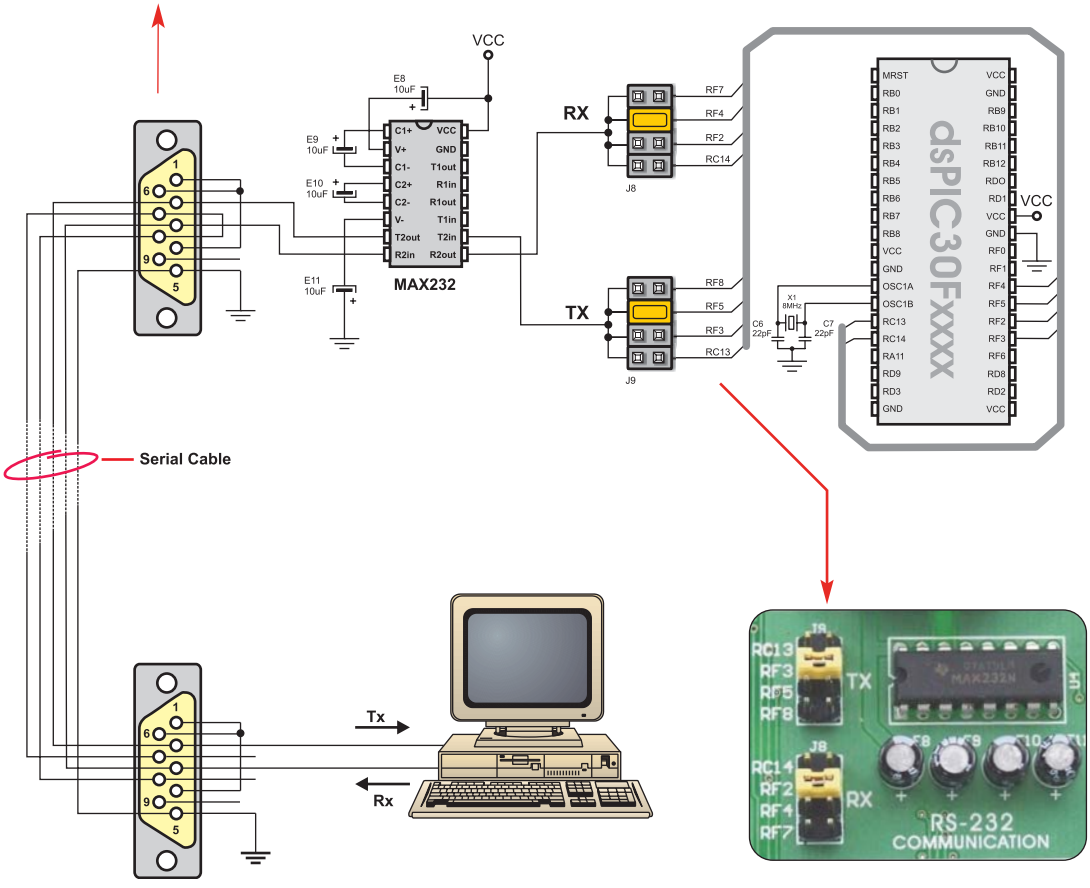


Figure 32 Connection between microcontroller and PC

A/D CONVERTER TEST INPUTS

The EASYdsPIC4A development board has two potentiometers for demostrating the operation of analog-to-digital converter (ADC). Both potentiometers outputs are in the range of 0 - 5V. These analog signals can be brought to two different analog input pins simultaneously. The jumper group J13 enables connection between potentiometer P1 and one of the following pins: RB0, RB1, RB2 or RB3. The jumper group J14 enables connection between potentiometer P2 and one of the following pins: RB4, RB5, RB6 or RB7.

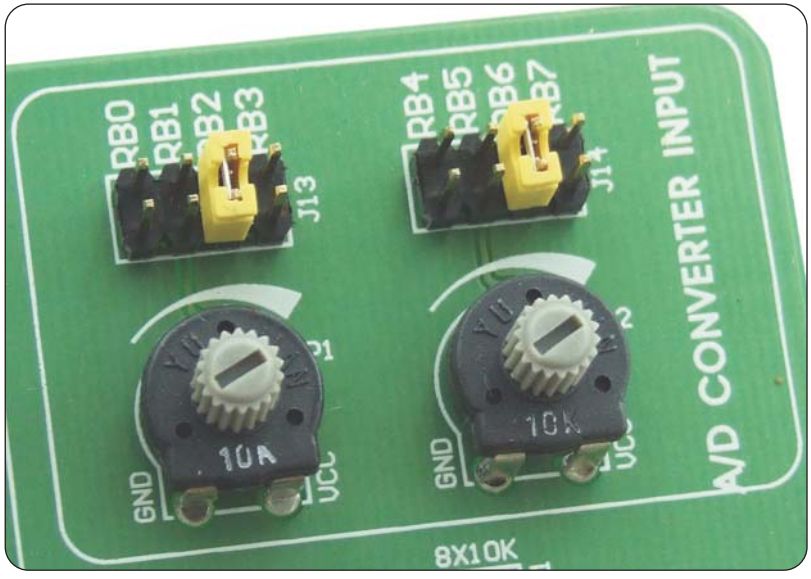


Figure 33 A/D Converter test inputs

A/D conversion has a wide range of applications. The microcontroller takes an analog signal from its input pin and converts it into a digital value. Basically, it is possible to measure any analog signal that fits in the range acceptable by microcontroller. For the EASYdsPIC4A, this range is 0 - 5V.

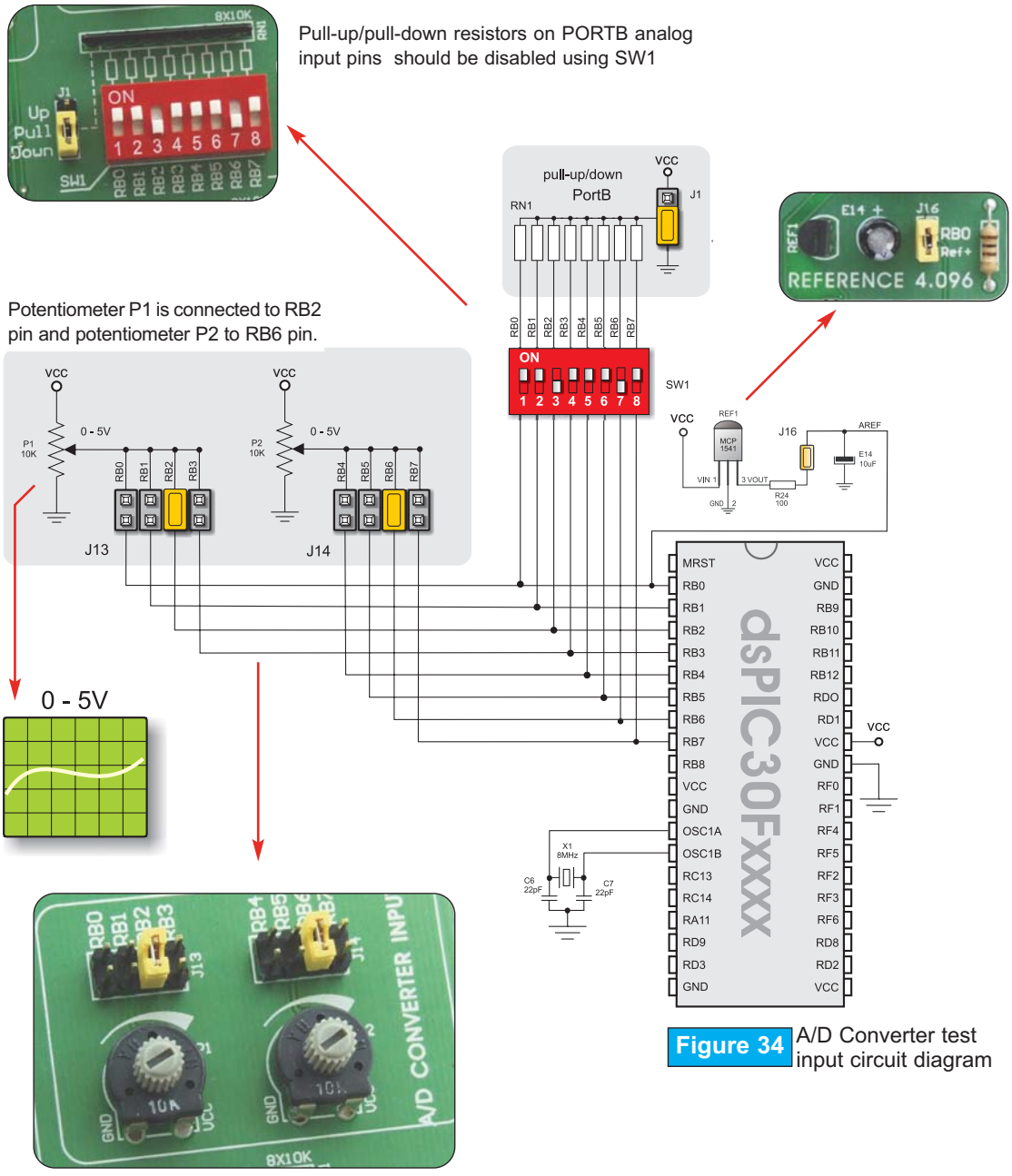


Figure 34 A/D Converter test input circuit diagram

DIRECT PORT ACCESS

All microcontroller input/output pins can be accessed via IDC10 connectors (2 x 5) placed along the right side of the board. For each microcontroller port there is one connector providing up to eight port pins and two additional pins connected to VCC and GND.

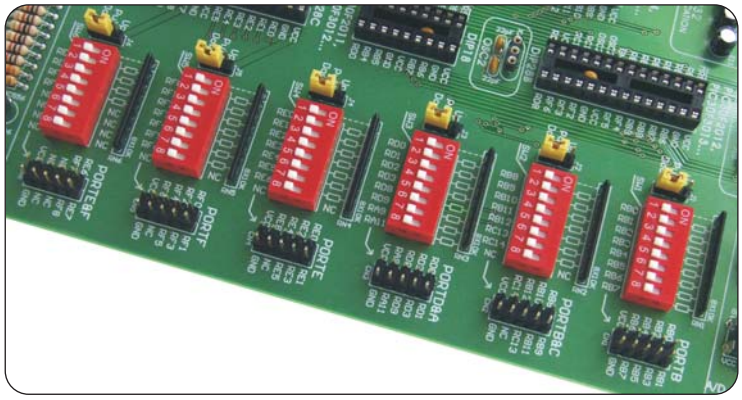
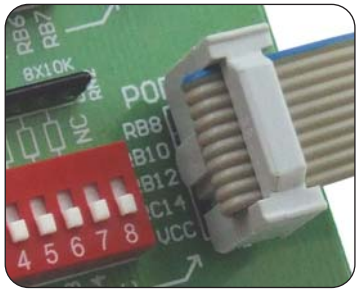


Figure 35 Direct port access connectors



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

Figure 36 Connection of external peripheral via flat cable

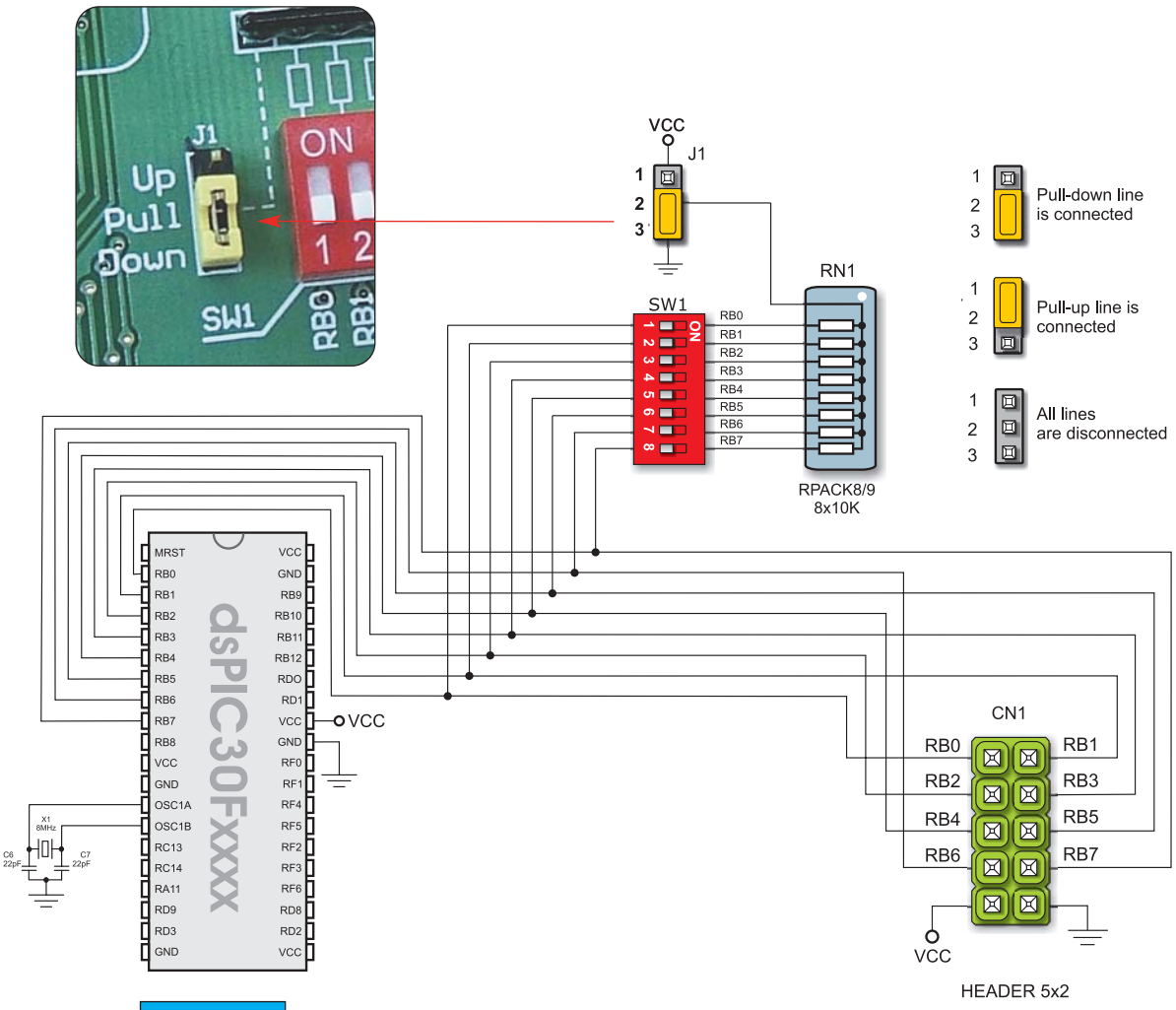
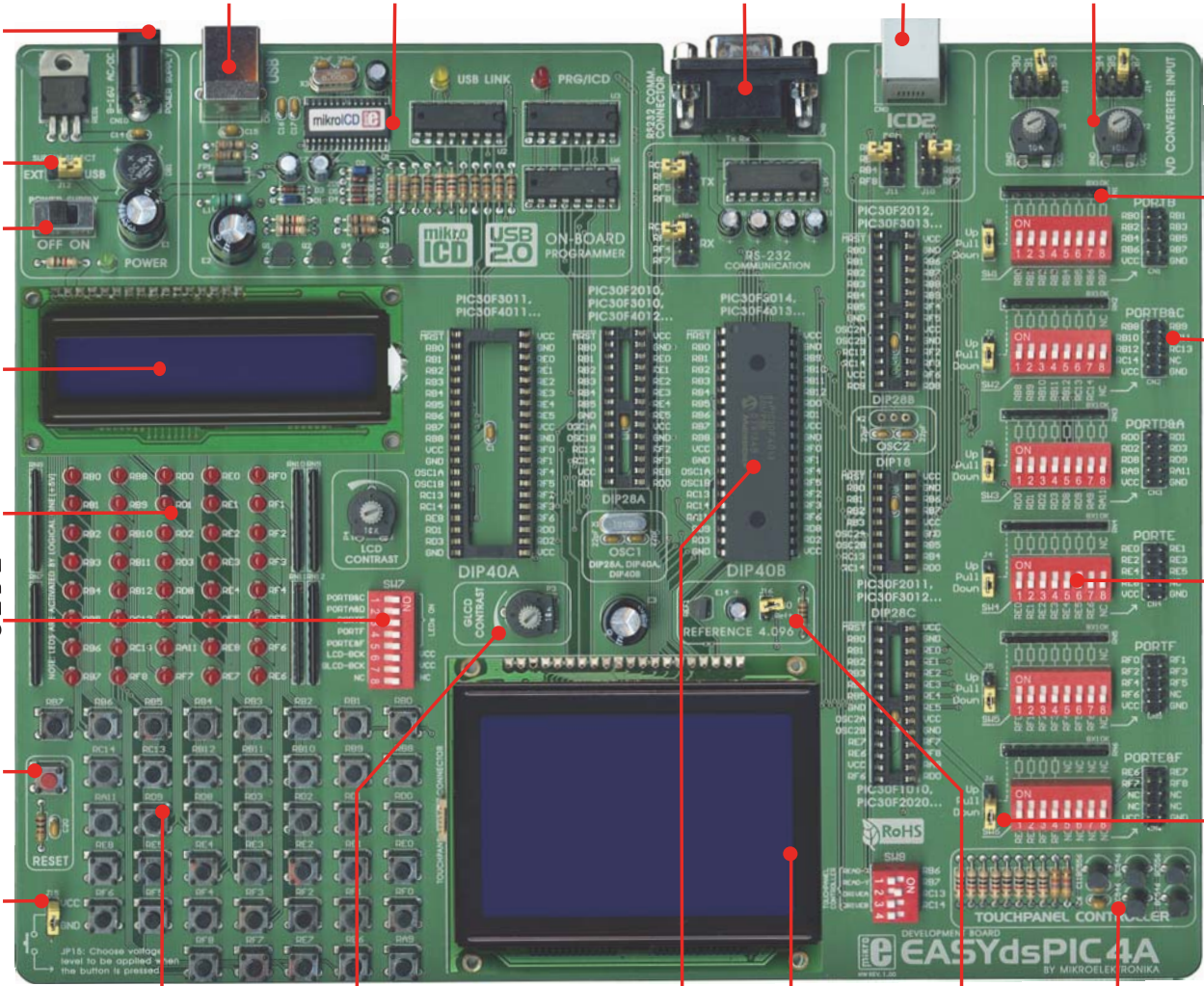


Figure 37 PORTB connection

EASYdsPIC4A



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