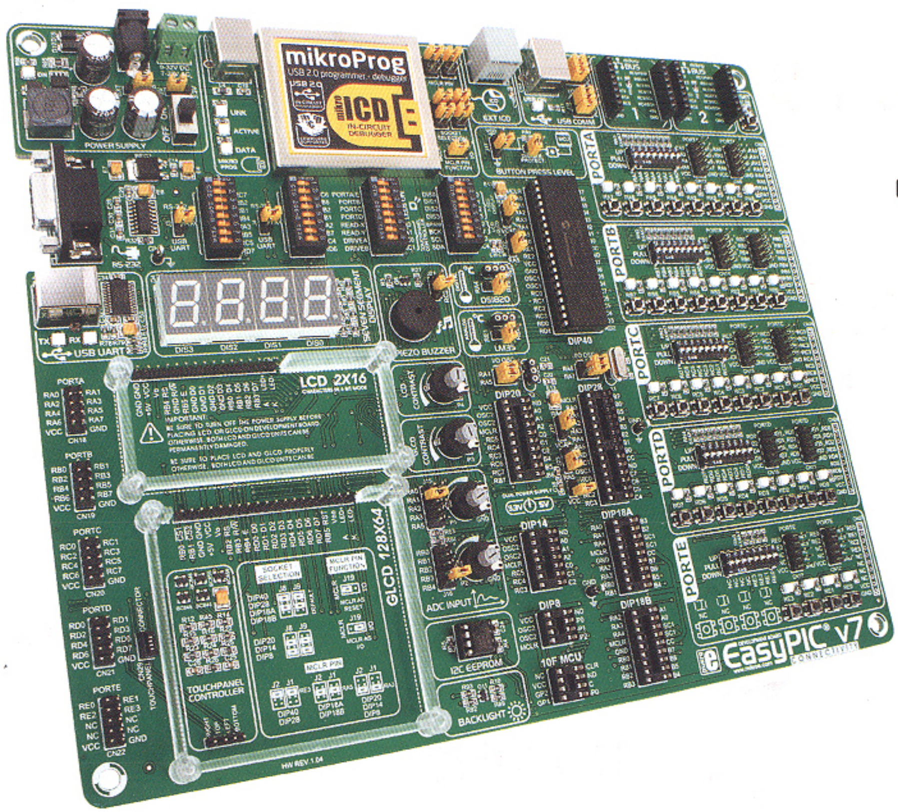


Introduction

EasyPIC™ is an old friend. It has been with us for six generations. Many of us made our first steps in embedded world with EasyPIC™. Today it has thousands of users: students, hobbyists, enthusiasts and professionals. It's used in many schools and other educational institutions across the globe. We may say that it's the most famous PIC development system in the world. We asked ourselves what we can do to make such a great board even greater. And we made some brilliant changes. We focused all of our creativity and knowledge into making a revolutionary new design, unlike any previous version of the board. We now present you with the new version 7 that brings so much more, and we hope that you will be thrilled with your new board, just as we are.

EasyPIC™ development Team

Four Connectors for each port

Amazing connectivity

EasyPIC™ v7 is all about connectivity. Having four different connectors for each port, you can connect accessory boards, sensors and your custom electronics easier then ever before.

Everything is already here

mikroProg™ on board

Powerful on-board mikroProg™ programmer and In-Circuit debugger can program and debug over 250 microcontrollers. You will need it, whether you are a professional or a beginner.

3.3V and 5V power supply

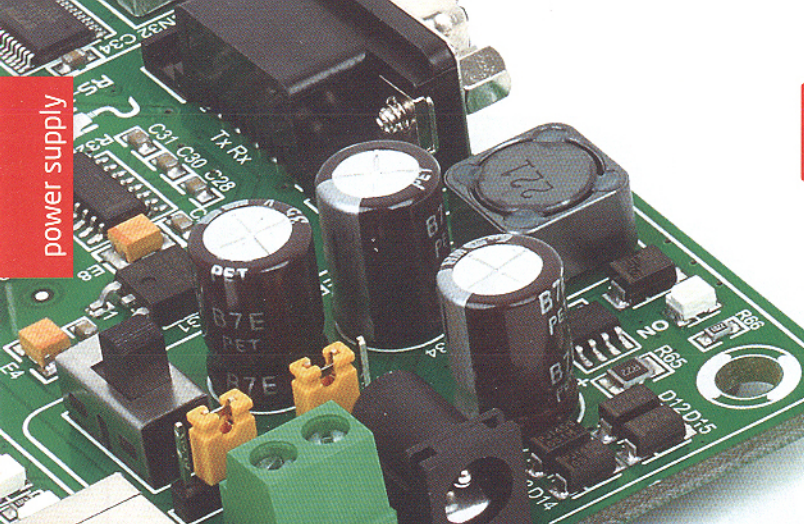
Dual Power Supply

EasyPIC™ v7 is among few development boards which support both 3.3V and 5V microcontrollers. This feature greatly increases the number of supported MCUs. It's like having two boards instead of one!

For easier connections

mikroBUS™ support

Just plug in your Click™ board, and it's ready to work. We picked up a set of the most useful pins you need for development and made a pinout standard you will enjoy using.



Dual power supply

Board contains switching power supply that creates stable voltage and current levels necessary for powering each part of the board. Power supply section contains two power regulators: **MC34063A**, which generates VCC-5V, and **MC33269DT3.3** which creates VCC-3.3V power supply. The board can be powered in three different ways: with **USB power supply (CN2)**, using external adapters via adapter connector **(CN31)** or additional screw terminals **(CN30)**. External adapter voltage levels must be in range of **9-32V DC or 7-23V AC**. Use jumper **J6** to specify which power source you are using and jumper **J5** to specify whether you are using 5V or 3.3V power supply. Upon providing the power using either external adapter or USB power source you can turn on power supply by using **SWITCH 1 (Figure 3-1)**. Power **LED (Green ON)** will indicate the presence of power supply.

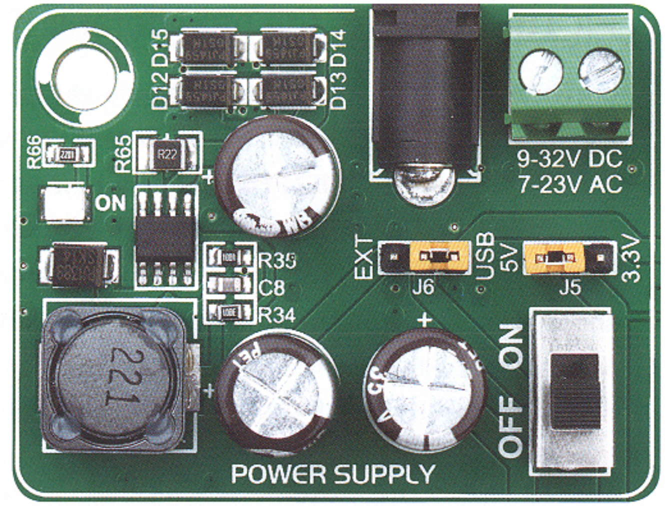


Figure 3-1: Dual power supply unit of EasyPIC™ v7

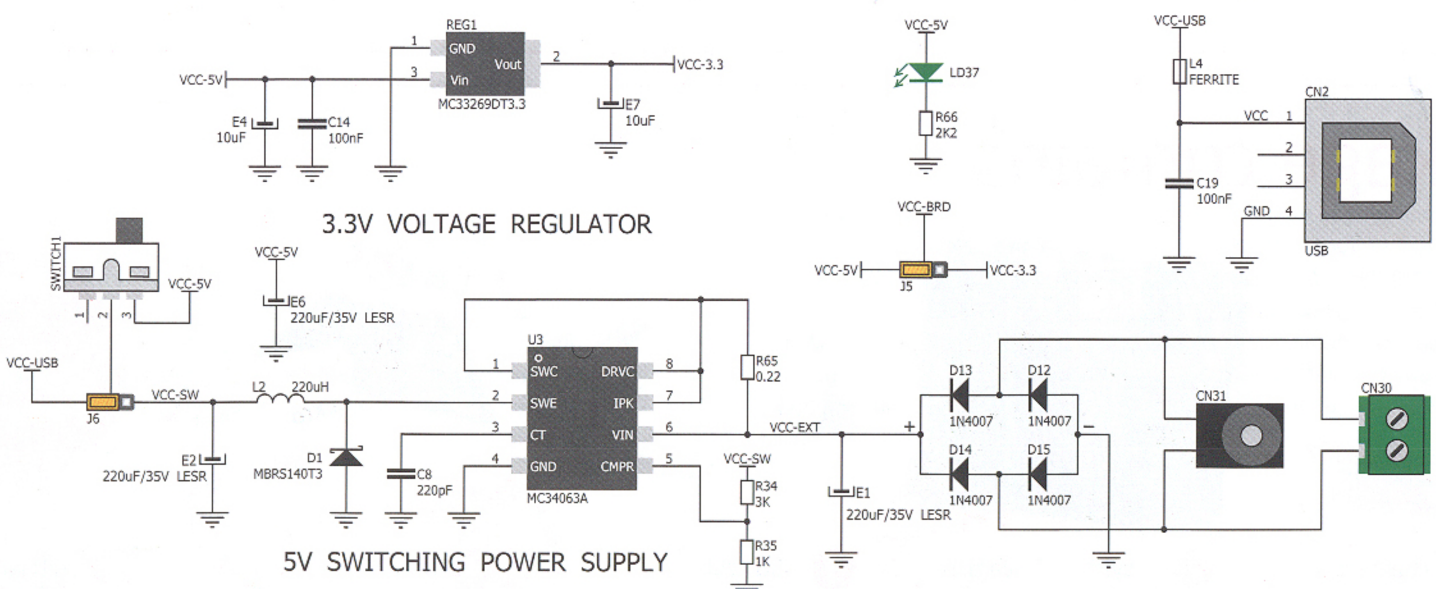


Figure 3-2: Dual power supply unit schematic

DUAL POWER SUPPLY 3.3V 5V

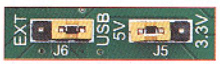
EasyPIC™ v7 development board supports both 3.3V and 5V power supply on a single board. This feature enables you to use wide range of peripheral boards.

Power supply: via DC connector or screw terminals (7V to 23V AC or 9V to 32V DC), or via USB cable (5V DC)

Power capacity: up to 500mA with USB, and up to 600mA with external power supply

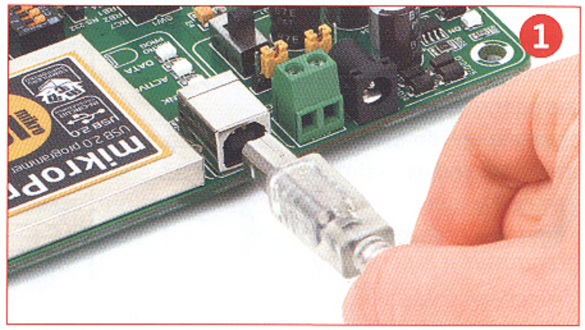
How to power the board?

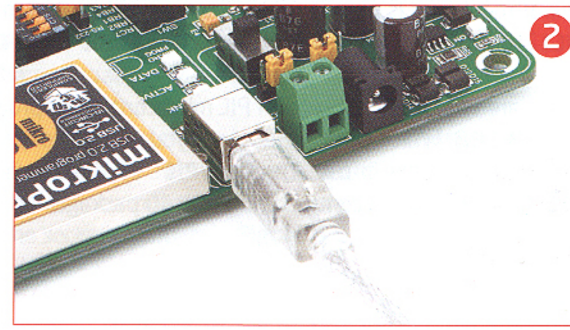
1. With USB cable



Set J6 jumper to USB position

To power the board with USB cable, place jumper **J6** in USB position and place jumper **J5** in 5V or 3.3V position. You can then plug in the USB cable as shown on images 1 and 2, and turn the power switch ON.

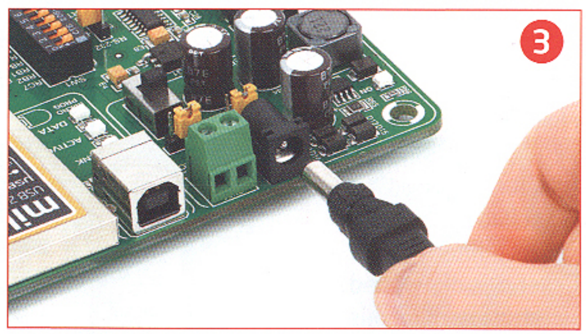


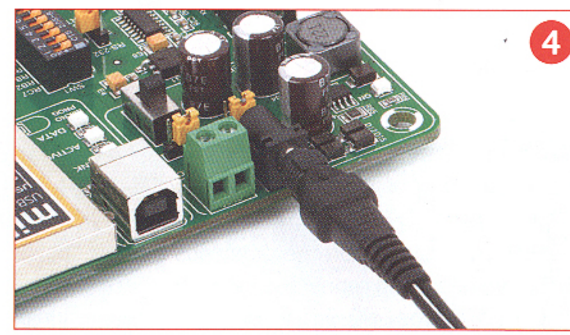


2. Using adapter

Set J6 jumper to EXT position

To power the board via adapter connector, place jumper **J6** in EXT position, and place jumper **J5** in 5V or 3.3V position. You can then plug in the adapter cable as shown on images 3 and 4, and turn the power switch ON.

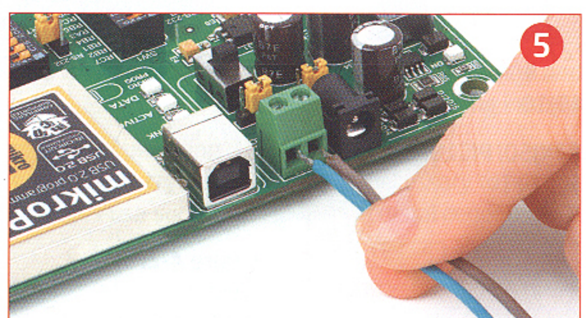


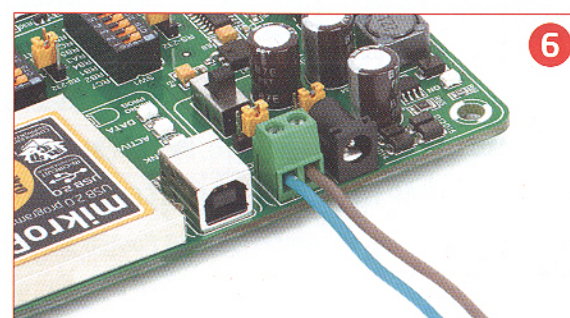


3. With laboratory power supply

Set J6 jumper to EXT position

To power the board using screw terminals, place jumper **J6** in EXT position, and place jumper **J5** in 5V or 3.3V position. You can then screw-on the cables in the screw terminals as shown on images 5 and 6, and turn the power switch ON.





How to properly place your microcontroller into the DIP socket?

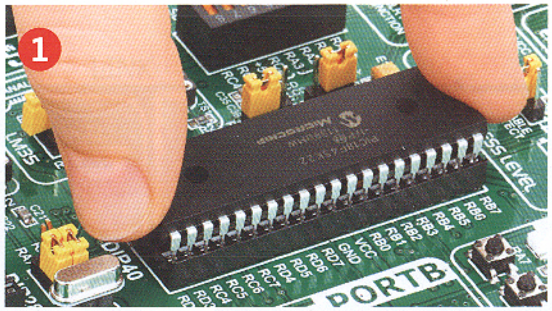


Figure 4-3: Place both ends of microcontroller on the socket so the pins are aligned correctly

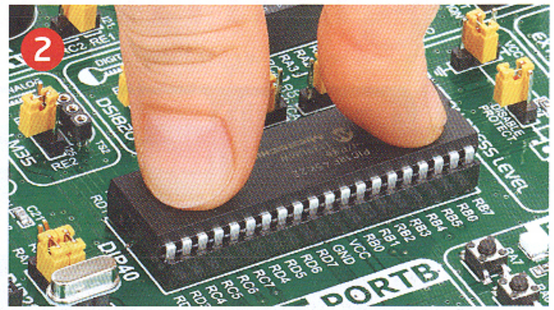


Figure 4-4: with both fingers, evenly distribute the force and press the chip into the socket.

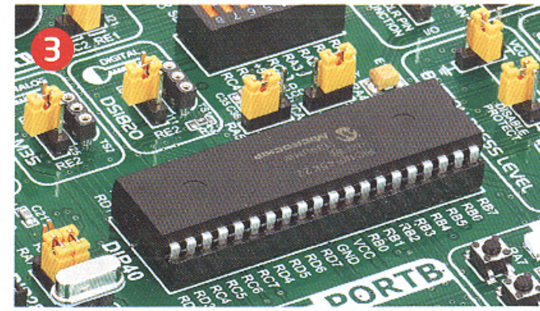


Figure 4-5: Properly placed microcontroller will have equally leveled pins.

Before you plug the microcontroller into the appropriate socket, make sure that the **power supply is turned off.** Images above show how to correctly plug a microcontroller. First make sure that a half circular cut in the microcontroller DIP packaging matches the cut in the DIP socket. Place both ends of the microcontroller into the socket as shown in **Figure 4-3**. Then put the microcontroller slowly down until all the pins match the socket as shown in **Figure 4-4**. Check again if everything is placed correctly and press the microcontroller until it is completely plugged into the socket as shown in **Figure 4-5**.

IMPORTANT: *Only one microcontroller may be plugged into the development board at the same time.*

Using crystal oscillators

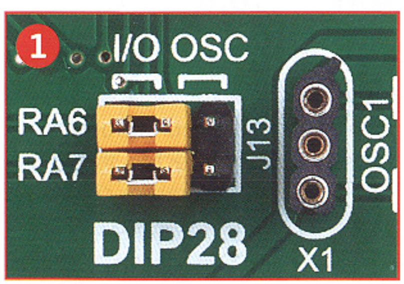


Figure 4-6: RA6 and RA7 as I/O pins (when using internal oscillator)

Figure 4-7: RA6 and RA7 connected to X1 quartz-crystal

PIC microcontrollers normally use a quartz crystal for the purpose of providing clock frequency. The **EasyPIC™ v7** provides two sockets for quartz-crystal. Microcontrollers in **DIP18A**, **DIP18B**, **DIP28** and **DIP40** packages use socket **X1 (OSC1)** for quartz-crystal.

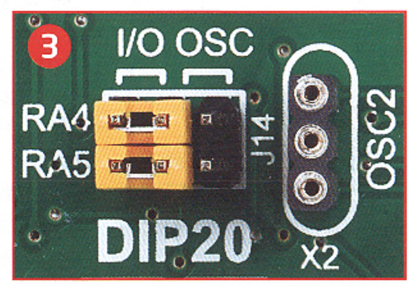


Figure 4-8: RA4 and RA5 as I/O pins (when using internal oscillator)

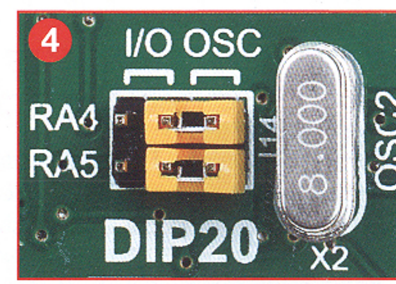
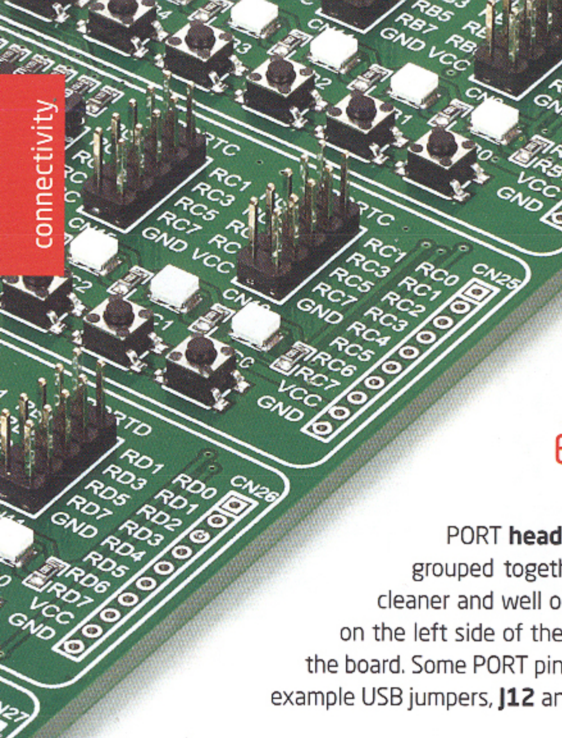


Figure 4-9: RA4 and RA5 connected to X2 quartz-crystal

If you want to use microcontrollers in **DIP8**, **DIP14** and **DIP20** packages, it is necessary to put quartz crystal into socket **X2 (OSC2)**. The value of the quartz-crystal depends on the maximum clock frequency allowed and your application. You can always exchange the default 8MHz crystal with another one.

IMPORTANT: *Microcontrollers which are plugged into socket 10F use their own internal oscillator and are not connected to any of the mentioned quartz-crystal sockets.*



Input/Output Group

One of the most distinctive features of EasyPIC™ v7 are it's Input/Output PORT groups. They add so much to the connectivity potential of the board.

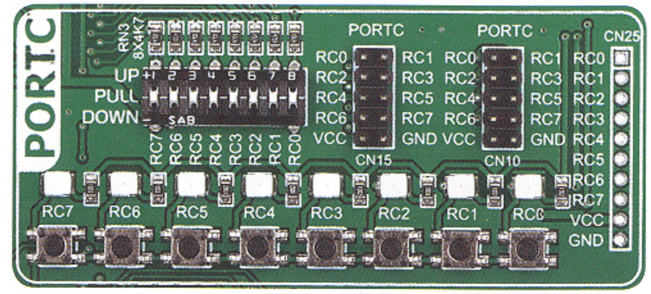


Figure 10-1: I/O group contains PORT headers, tri-state pull up/down DIP switch, buttons and LEDs all in one place

Everything is grouped together

PORT **headers**, PORT **buttons** and PORT **LEDs** are next to each other, and grouped together. It makes development easier, and the entire EasyPIC™ v7 cleaner and well organized. We have also provided an **additional PORT headers** on the left side of the board, so you can access any pin you want from both sides of the board. Some PORT pins are directly connected to the microcontroller, and some that are connected to other on-board modules are enabled via jumpers (for example USB jumpers, **J12** and **J18**).

Tri-state pull-up/down DIP switches

Tri-state DIP switches, like **SW7** on **Figure 10-2**, are used to enable 4K7 pull-up or pull-down resistor on any desired port pin. Each of these switches has three states:

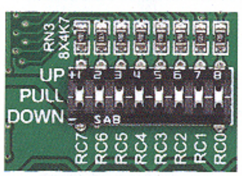
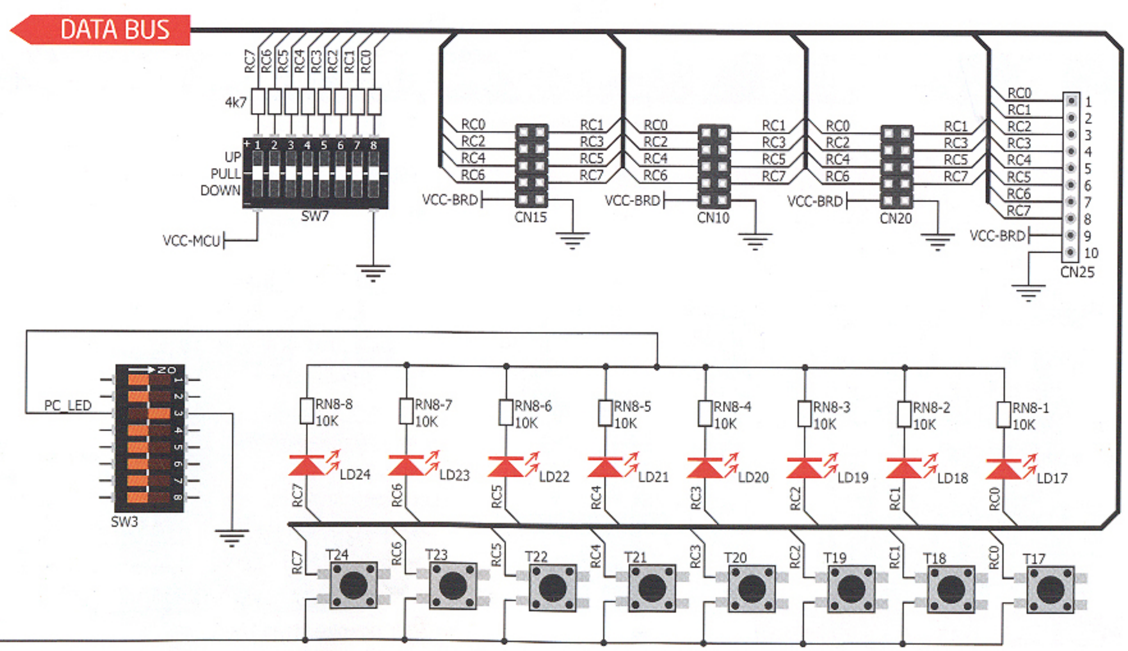


Figure 10-2: Tri-state DIP switch on PORTC

1. **middle position** disables both pull-up and pull-down feature from the PORT pin
2. **up position** connects the resistor in pull-up state to the selected pin
3. **down position** connects the resistor in pull-down state to the selected PORT pin.



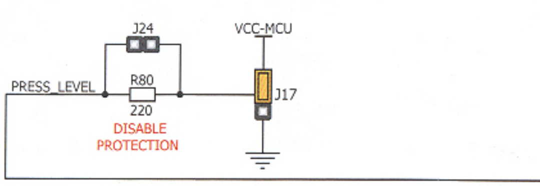
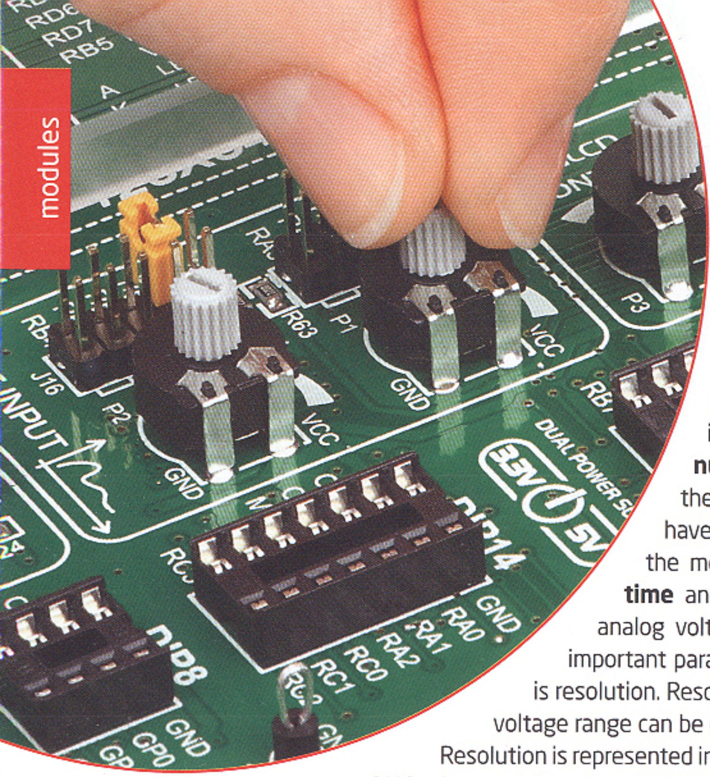


Figure 10-3: Schematic of the single I/O group connected to microcontroller PORTC



ADC inputs

Digital signals have **two discrete states**, which are decoded as **high** and **low**, and interpreted as **logic 1** and **logic 0**. **Analog signals**, on the other hand, are **continuous**, and can have any value within defined range. **A/D converters** are specialized circuits which can convert analog signals (voltages) into a digital representation, usually in form of an **integer number**. The value of this number is **linearly dependent** on the input voltage value. Most microcontrollers nowadays internally have A/D converters connected to one or more input pins. Some of the most important parameters of A/D converters are **conversion time** and **resolution**. Conversion time determines how fast can an analog voltage be represented in form of a digital number. This is an important parameter if you need fast data acquisition. The other parameter is resolution. Resolution represents the number of discrete steps that supported voltage range can be divided into. It determines the sensitivity of the A/D converter. Resolution is represented in maximum number of bits that resulting number occupies. Most PIC® microcontrollers have 10-bit resolution, meaning that maximum value of conversion can be represented with 10 bits, which converted to integer is $2^{10}=1024$. This means that supported voltage range, for example from 0-5V, can be divided into 1024 discrete steps of about 4.88mV.

EasyPIC™ v7 provides an interface in form of two potentiometers for simulating analog input voltages that can be routed to any of the 10 supported analog input pins.

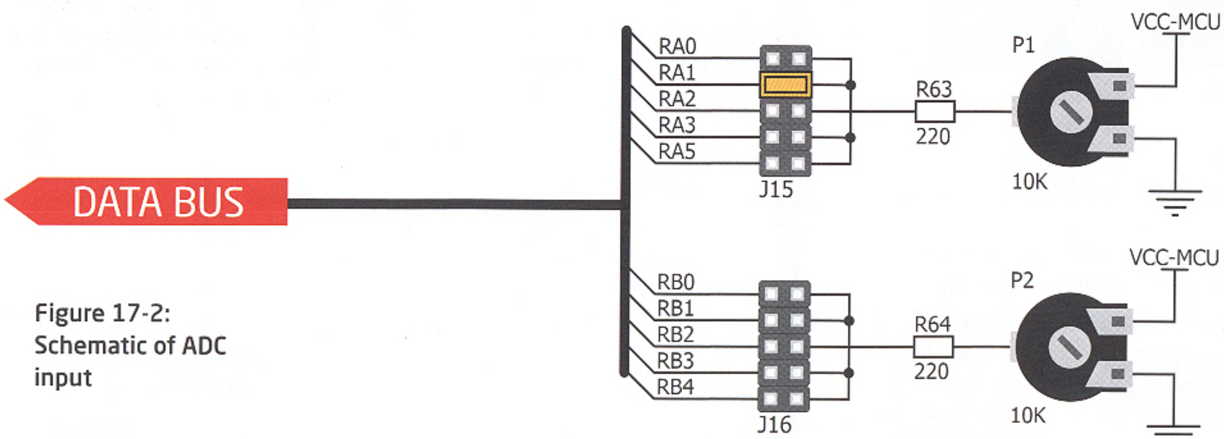


Figure 17-2: Schematic of ADC input

Enabling ADC inputs

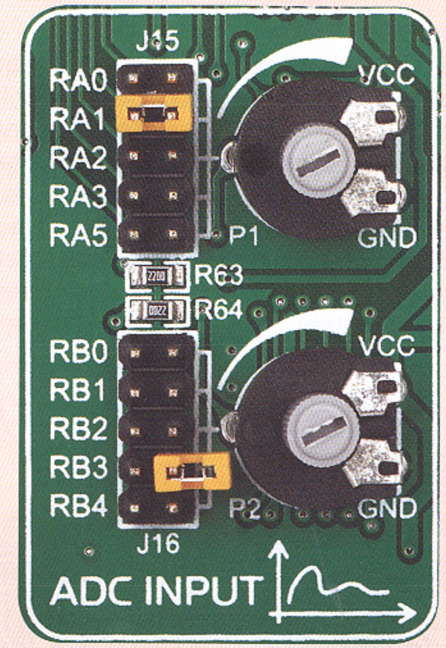
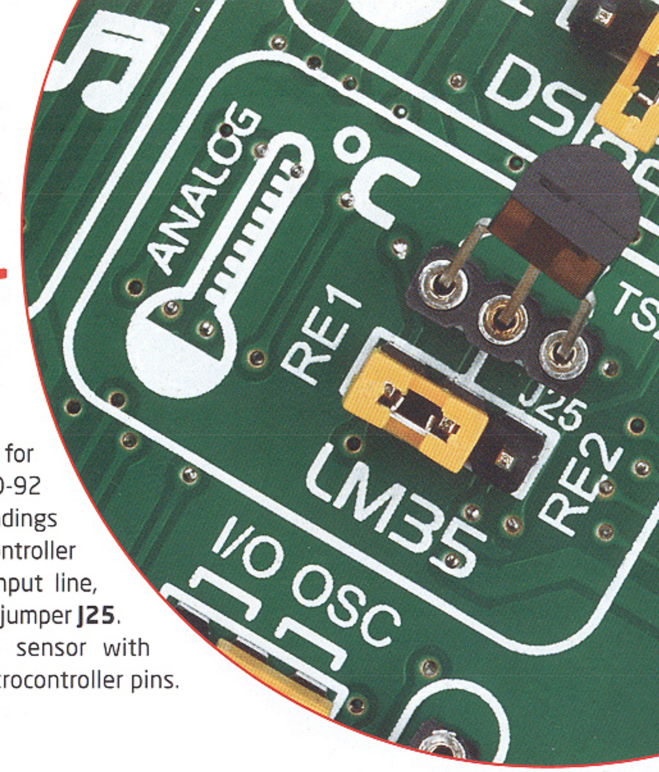


Figure 17-1: use J15 and J16 jumpers to connect analog input lines with potentiometers P1 and P2

In order to connect the output of the potentiometer **P1** to **RA0**, **RA1**, **RA2**, **RA3** or **RA5** analog microcontroller inputs, you have to place the jumper **J15** in the desired position. If you want to connect potentiometer **P2** to any of the **RB0 - RB4** analog microcontroller inputs, place jumper **J16** in the desired position. By moving the potentiometer knob, you can create voltages in range from **GND** to **VCC**.

LM35 - Analog Temperature Sensor



The **LM35** is a low-cost precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. It has a linear +10.0 mV/°C scale factor and less than 60 μA current drain. As it draws only 60 μA from its supply, it has very low self-heating, less than 0.1°C in still air. EasyPIC™ v7 enables you to get analog readings from the LM35 sensor in restricted temperature range from +2°C to +150°C. Board provides a separate socket (**TS2**) for the LM35 sensor in TO-92 plastic packaging. Readings are done with microcontroller using single analog input line, which is selected with jumper **J25**. Jumper connects the sensor with either **RE2** or **RE1** microcontroller pins.

Enabling LM35 Sensor

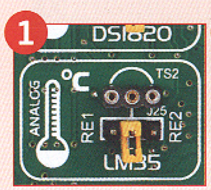


Figure 16-1: LM35 not connected

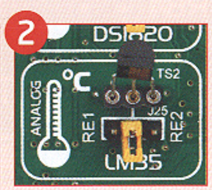


Figure 16-2: LM35 placed in socket

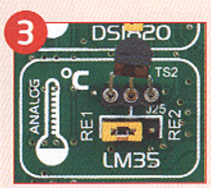


Figure 16-3: LM35 connected to RE1 pin

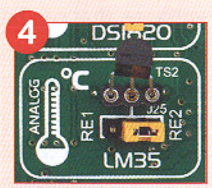


Figure 16-4: LM35 connected to RE2 pin

EasyPIC™ v7 enables you to get analog readings from the LM35 sensor using **RE1** or **RE2** microcontroller pins. The selection of either of those two lines is done using **J25** jumper. When placing the sensor in the socket make sure that half-circle on the board's silkscreen markings matches the rounded part of the LM35 sensor. If you accidentally connect the sensor the other way, it can be permanently damaged and you might need to replace it with another one. During the readings of the sensor, make sure that no other device uses the selected analog line, because it may interfere with the readings.

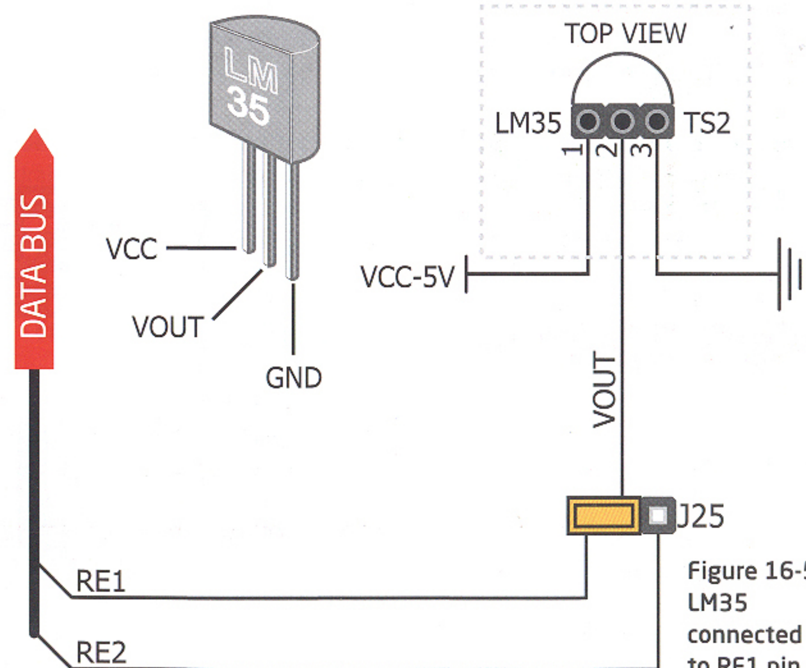
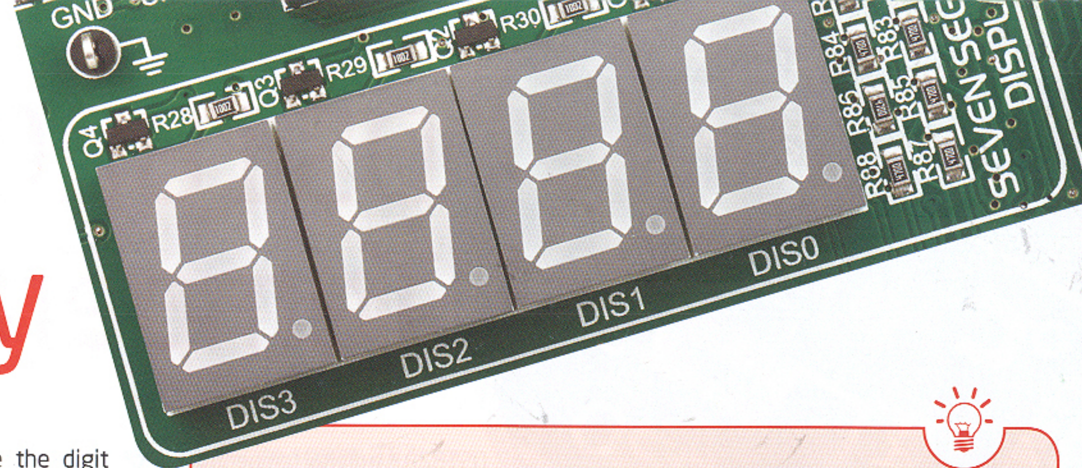


Figure 16-5: LM35 connected to RE1 pin

4 digit 7-seg display



One seven segment digit consist of 7+1 LEDs which are arranged in a specific formation which can be used to represent digits from 0 to 9 and even some letters. One additional LED is used for marking the decimal dot, in case you want to write a decimal point in the desired segment. EasyPIC™ v7 contains four of these digits put together to form 4-digit 7-segment display. Driving such a display is done using **multiplexing techniques.** Data lines are shared between segments, and therefore the same segment LEDs in each digit are connected in parallel. Each digit has it's **unique digit select line**, which is used to enable the digit to which the data is currently being sent. By multiplexing data through all four segments fast enough, you create an illusion that all four segments are in operation simultaneously. This is possible because human eye has a slower reaction time than the mention changes. This way you can represent numbers in decimal or hexadecimal form. Eight data lines that are common for all the digits are connected to PORTD, and digit select lines are connected to RA0-RA3 lines on the microcontroller sockets.

Enabling the display

To enable digit select lines for the 4-digit 7-segment display you have to turn on **SW4.1**, **SW4.2**, **SW4.3** and **SW4.4** switches. Digit select lines are connected to **RA0 - RA3** pins on the microcontroller sockets, while data lines are connected to **RD0 - RD7** pins. Make sure to disconnect other peripherals from the interface lines in order not to interfere with signal/data integrity.

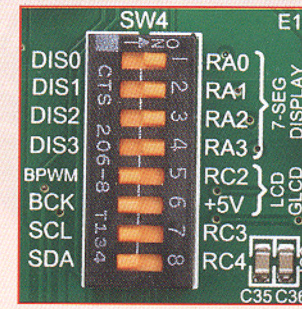


Figure 14-1: Turn on switches 1 through 4 on SW4 to enable 4-digit 7-seg display

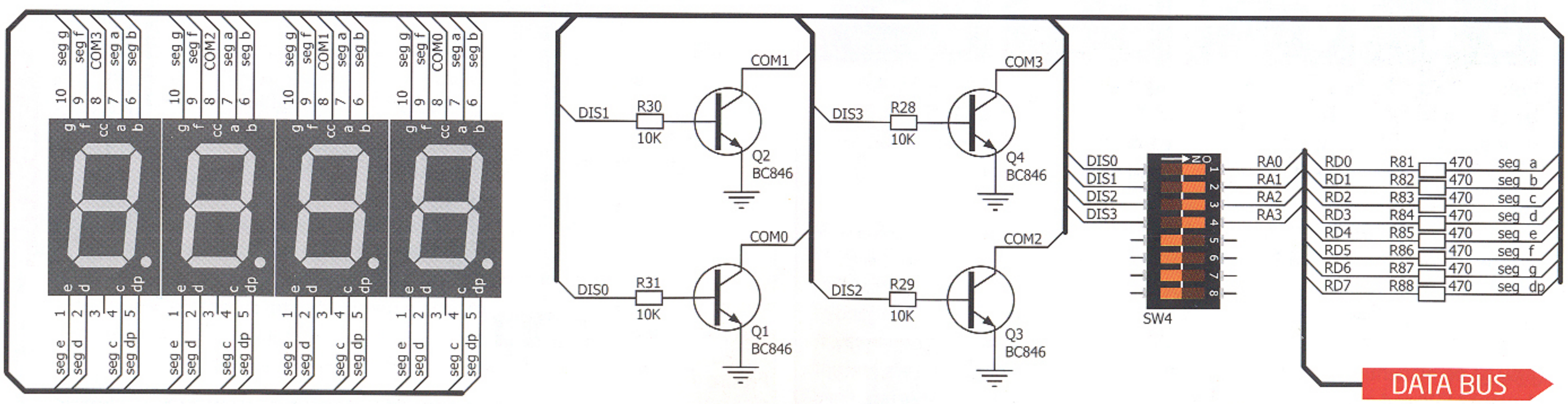
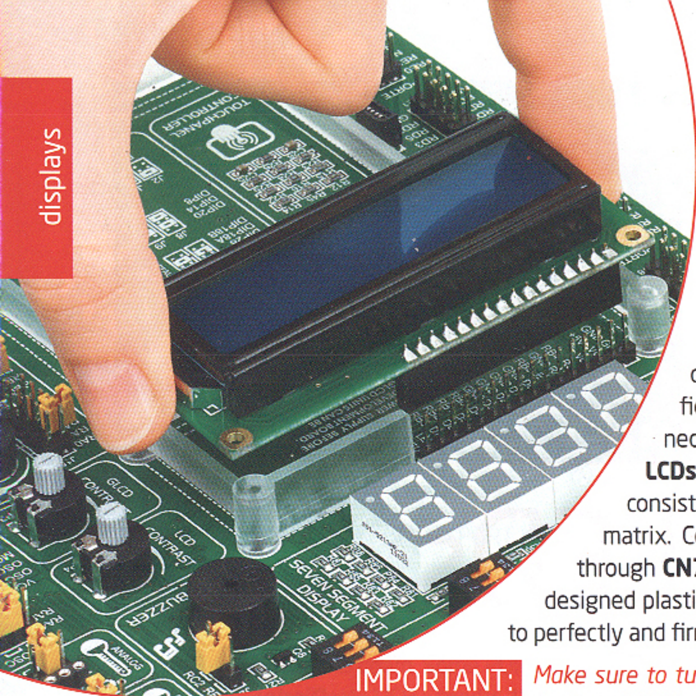


Figure 14-2: 4-digit 7-segment display schematic



LCD 2x16 characters

Liquid Crystal Displays or **LCDs** are cheap and popular way of representing information to the end user of some electronic device. Character LCDs can be used to represent standard and custom characters in the predefined number of fields. EasyPIC™ v7 provides the connector and the necessary interface for supporting **2x16 character LCDs** in 4-bit mode. This type of display has two rows consisted of 16 character fields. Each field is a 7x5 pixel matrix. Communication with the display module is done through **CN7** display connector. Board is fitted with uniquely designed plastic display distancer, which allows the LCD module to perfectly and firmly fit into place.

IMPORTANT: *Make sure to turn off the power supply before placing LCD onto the board. Otherwise your display can be permanently damaged.*

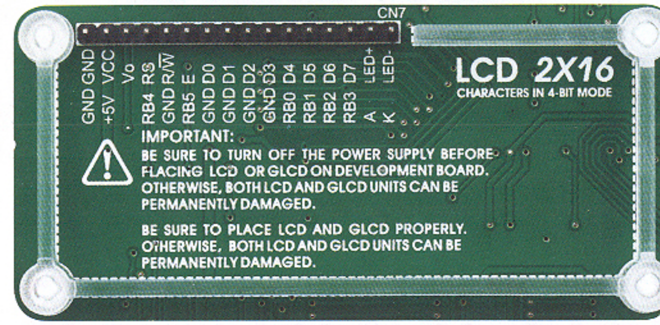


Figure 11-1: On-board LCD 2x16 display connector

Connector pinout explained

GND and VCC - Display power supply lines
Vo - LCD contrast level from potentiometer P4
RS - Register Select Signal line
E - Display Enable line
R/W - Determines whether display is in Read or Write mode. It's always connected to GND, leaving the display in Write mode all the time.
D0-D3 - Display is supported in 4-bit data mode, so lower half of the data byte interface is connected to GND.
D4-D7 - Upper half of the data byte
LED+ - Connection with the back-light LED anode
LED- - Connection with the back-light LED cathode

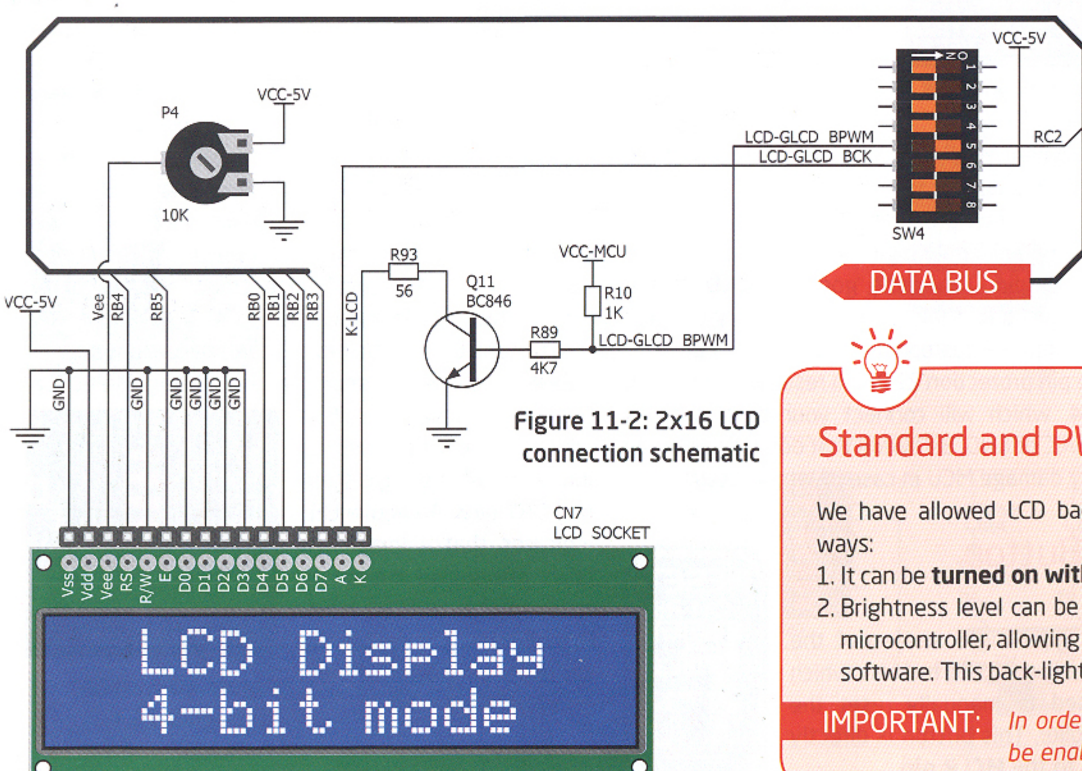
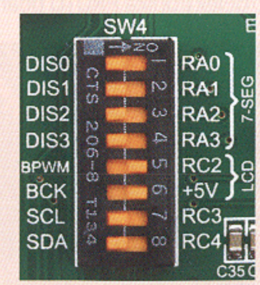


Figure 11-2: 2x16 LCD connection schematic

Standard and PWM-driven back-light

We have allowed LCD back-light to be enabled in two different ways:

1. It can be **turned on with full brightness** using **SW4.6** switch.
2. Brightness level can be determined **with PWM signal** from the microcontroller, allowing you to write custom back-light controlling software. This back-light mode is enabled with **SW4.5** switch.



IMPORTANT: *In order to use PWM back-light both* ***SW4.5*** *and* ***SW4.6*** *switches must be enabled at the same time.*