To our valued customers

I want to express my thanks to you for being interested in our products and for having confidence in **LogiFind Tech CO., Ltd**. The primary aim of our company is to design and produce high quality electronic products and to constantly improve the performance thereof in order to better suit your needs.

Please share your thoughts and feelings regarding our operation so that we can serve you better in the future. I thank you for your continued support and patronage.
Your Dream is our Destination!

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Sincerely,

Jeff·w

Owner and General Manager
Of LogiFind Tech CO., Ltd.

CONTENTS

Chapter 1: Introduction

What is easyPIC Pro?

easyPIC Pro is an old friend. It has been with us for two generations. Many of us made our first steps in embedded world with **easyPIC Pro**. Today it has thousands of users: students, hobbyists, enthusiasts and professionals. It is used in many schools and other educational institutions across the globe. We have sold them over 3000pcs in the world in the past 3 years. It provides a low-cost easy-to-use platform with common modules to bring you into the colorful embedded world.

easyPIC Pro contains motherboard and MCU Card. We have designed three different MCU Card boards to equip **easyPIC Pro**.They are **PIC64-A**, **PIC80-A** and **PIC100-A** which is respectively for **PIC24x**, **dsPIC33x**, **PIC32MX4xx**, **PIC32MX7xx** microcontroller families in **64-pin**, **80-pin** and **100-pin** TQFP packaging. Different microcontrollers are supported using these MCU cards, which are placed into the on-board female MCU socket.

Of course, we are not perfect and we asking ourselves what we can do to make such a board even better, and at the same time, we are looking forward to receiving your valuable suggestions.

System Specifications

	power supply 7-10V DC External or via USB Cable (5V DC)	**power consumption** ~150mA(all Modules are disconnected)	**board dimensions** 14.26*18.99cm (5.6141732*7.476378)	**weight** ~500g (1.102311 lbs)

What's on Board?

1.MCU Card Socket

○The **easyPIC Pro** equips a 100-pin Plug-In Module socket, supporting a wide variety of 16-bit and 32-bit microcontroller families via PICXXX-XXX series MCU Cards. The MCU Cards supported by the **easyPIC Pro** development board are: PIC64-A, PIC64-B, PIC80-A, PIC80-B, and PIC100-A etc. which are respectively for most PIC24,
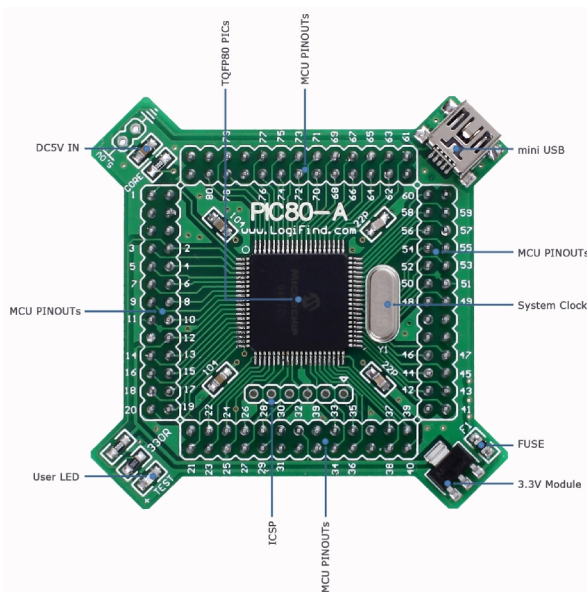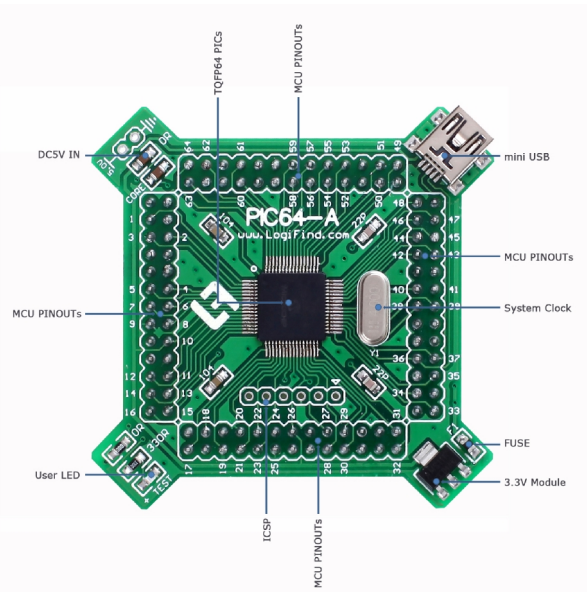
Figure 1-1.What's on board (PIC80-A Card)   **Figure 1-2.What's on board (PIC64-A Card)**
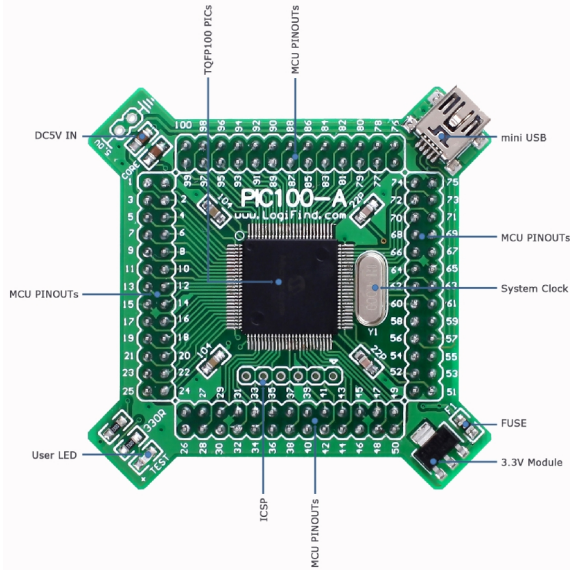
Figure 1-3.What's on board (PIC100-A Card)

dsPIC33, PIC32 microcontroller families in 64-pin, 80-pin and 100-pin TQFP packages. You can use different microcontrollers on the **easyPIC Pro** development board for development, demonstration and testing via using these MCU cards.

2.Interface for Programmer

○Two standard ICSP interfaces (ICSP1 and ICSP2) which allow you to connect PICKIT2, PICKIT3, ICD2 or other
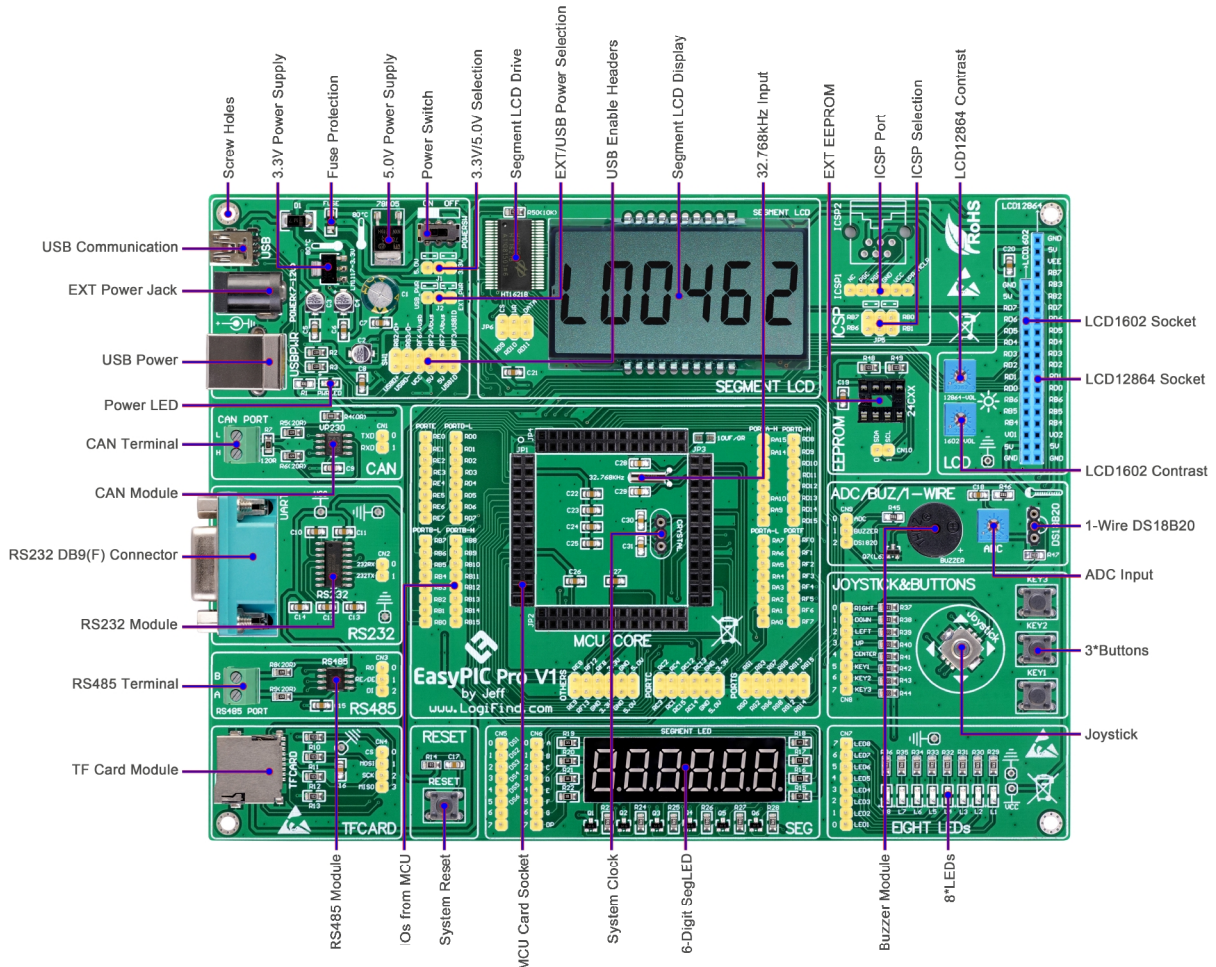

Figure 1-4.What's on board(Motherboard)

Third-party Programmer/debugger directly.

3.Indicator

○"PWRLED"：Power LED Indicator, indicates when power supply is switched on.

○"L1"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

○"L2"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

○"L3"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

○"L4"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

○"L5"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

○"L6"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

○"L7"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

○"L8"：User LED Indicator – useful for indicating the IO state of PIC microcontroller.

4.Button Device

○"RESET"：System Reset Button – for manually resetting the microcontroller.

○"KEY1"：User Button – state readable by the PIC microcontroller.

○"KEY2"：User Button – state readable by the PIC microcontroller.

○"KEY3"：User Button – state readable by the PIC microcontroller.

○"UP"： Direction UP on Jostick – state readable by the PIC microcontroller.

○"DOWN"：Direction DOWN on Jostick – state readable by the PIC microcontroller.

○"LEFT"： Direction LEFT on Jostick – state readable by the PIC microcontroller.

○"RIGHT"： Direction RIGHT on Jostick – state readable by the PIC microcontroller.

○"CENTER"： Direction CENTER on Jostick – state readable by the PIC microcontroller.

5.Power Supply

○The board can be powered in two different ways: with USB power supply (USB) or using external DC 7-12V via adapter connector Jack (POWER(7-12V)).

○5V or 3.3V power supply is optional for the system(But for most PIC24,dsPIC and PIC32 MCUs, the working volage is 3.3V).

6.Communication

○ RS232 Module with interface – useful for transferring data to/from the PIC microcontroller using RS232 communication protocol.

○ RS485 Module with interface – useful for transferring data to/from the PIC microcontroller using RS485 communication protocol.

○CAN Module with interface – useful for transferring data to/from the PIC microcontroller using CAN communication protocol.

○Mini USB connector(**Installed on MCU Cards**) – shares USB signals with the USB connector and is useful for the development of dedicated USB embedded host applications, when used in conjunction with a USB capable.

7.Display

○6 digit Segment LED Display – useful for displaying user application measured value.

○Socket for 16x2 Character LCD Display Module – useful for displaying user application strings/ measured value.

○Socket for 128x64 Graphical Liquid Crystal Display Module – useful for displaying user application strings/ measured value/graphical interface.

○6 digit Segment LCD Display – useful for displaying user application measured value.

8.1-WIRE Bus

○Socket for DS18B20 Temperature Sensor Module – useful for monitoring the ambient temperature.

9.Storage

○TF Card Module – useful to save data.

○IIC External EEPROM Module – useful to save data that should be saved when the power supply goes off.

10.Sound Generator Device

○Buzzer –to generate voice using a voltage signal of specified frequency from the PIC microcontroller.

11.Analog to Digital Conversion

○Potentiometer ADC Input: 10 kΩ Potentiometer – useful as an analog signal source for ADC demonstration or user interface purposes.

12.Motor

○Socket for 28BYJ-48-5V stepmoter with ULN2003A Darlington Array drive.

13.System Clock

○32.768 kHz Low-power Oscillator Crystal Input .

○Socket for System main Oscillator Crystal.

14.External expansion

○All IOs are taken out for DIY.

Power Supply

The board can be powered in two different ways: with USB power supply (**USB**) or using external DC 7-12V via adapter connector Jack (**POWER(7-12V)**).

Programmer/Debugger Requirement

An external PIC programmer or Debugger is required to download code to the DIP-40 PICs on the board.It supports many Programmers or Debuggers like PICKIT2，PICKIT3 or ICD2 etc.

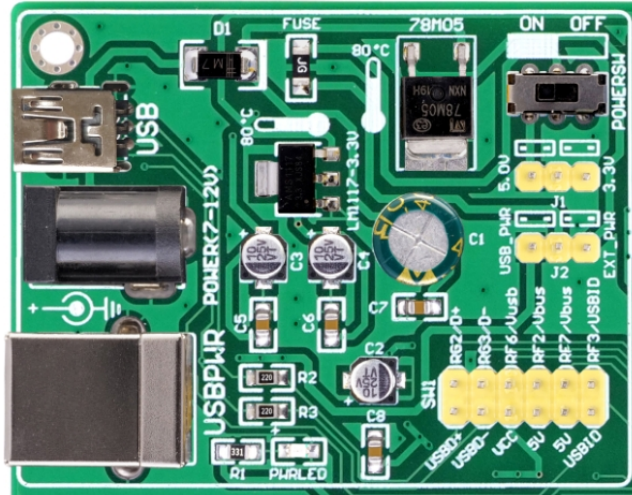# Chapter 2: Hardware Details

1.Power Supply and USB

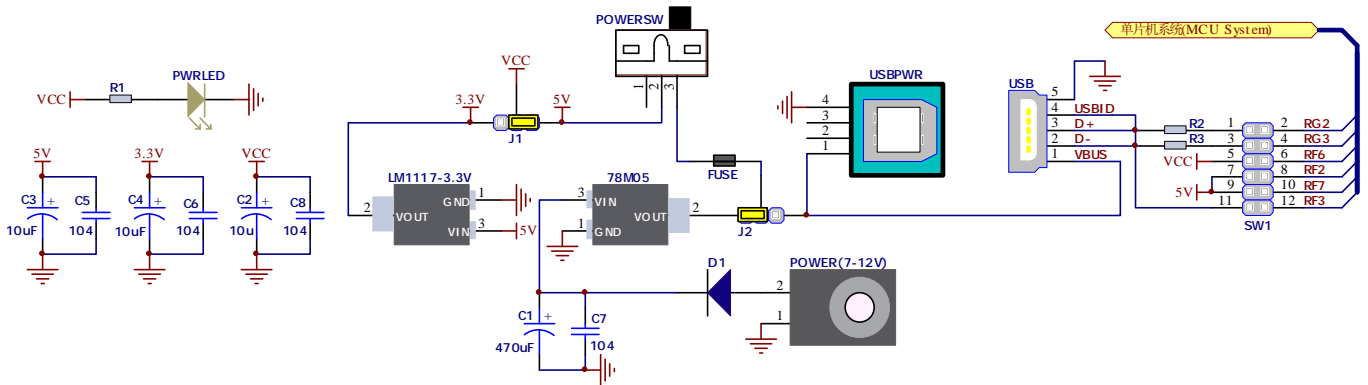**Figure 2-1**: power supply unit



Figure 2-2: schematic of power supply unit

easyPIC pro Board contains power supply that creates stable voltage **5V** and **3.3V** and current levels necessary for powering each part of the board. Power supply section contains two power regulators: **78M05**, which generates **VCC-5V**, and **LM1117-3.3** which creates **VCC-3.3V** power supply. The board can be powered in two different ways: with USB power supply (**USB**) or using external DC 7-12V via adapter connector Jack (**POWER(7-12V)**). External voltage levels must be in range of DC 7-12V. Use **J1** to specify whether you are using 5V or 3.3V power supply for the system. Use **J2** to specify whether you are using USB or External power supply. Upon providing the power using either external or USB power source you can turn on power supply by using switch(**POWERSW**). LED (**PWRLED**) will indicate the presence of power supply.

The **D-** and **D+** lines on USB power supply connector (**USB**) are connected to the Microcontroller socket, which are for creating a USB HID application if you are using a microcontroller with USB module inside like **PIC32MX795F512L**. The USB enable Switch(**SW1**) is used to enable the USB function.

How to power the board?

1.With USB cable

To power the board with USB cable, place jumper J2 in USB position(**USB_PWR**). You can then plug in the USB cable as shown on the right image, and turn the power switch(POWERSW) ON.
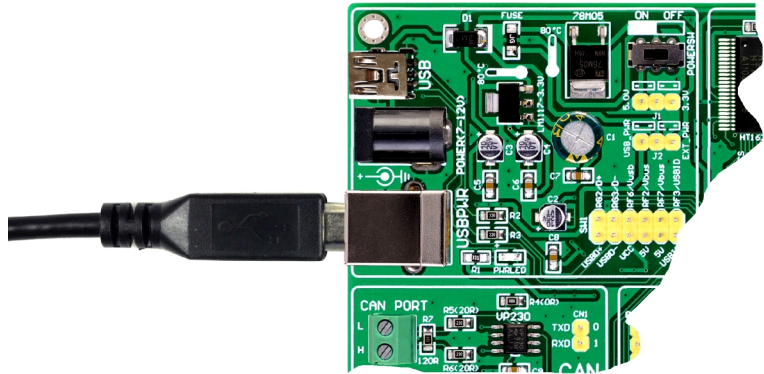
2.With Using adapter

To power the board via adapter connector, place jumper J2 in **EXT_PWR** position. You can then plug in the adapter cable as shown on the right image , and turn the power switch(POWERSW) ON. External voltage levels must be in range of DC 7-12V.
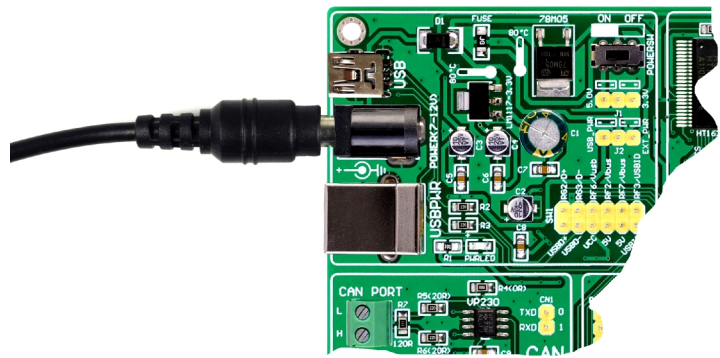
Figure 2-3: How to power the board

2.MCU System

easyPIC Pro contains motherboard and MCU Card. We have designed three different MCU Card boards to equip **easyPIC Pro**.They are **PIC64-A**, **PIC80-A** and **PIC100-A** (as shown on **Figure 1-1, Figure 1-2** and **Figure 1-3**) which is respectively for **PIC24x**, **dsPIC33x**, **PIC32MX4xx**, **PIC32MX7xx** microcontroller families in **64-pin**, **80-pin** and **100-pin**
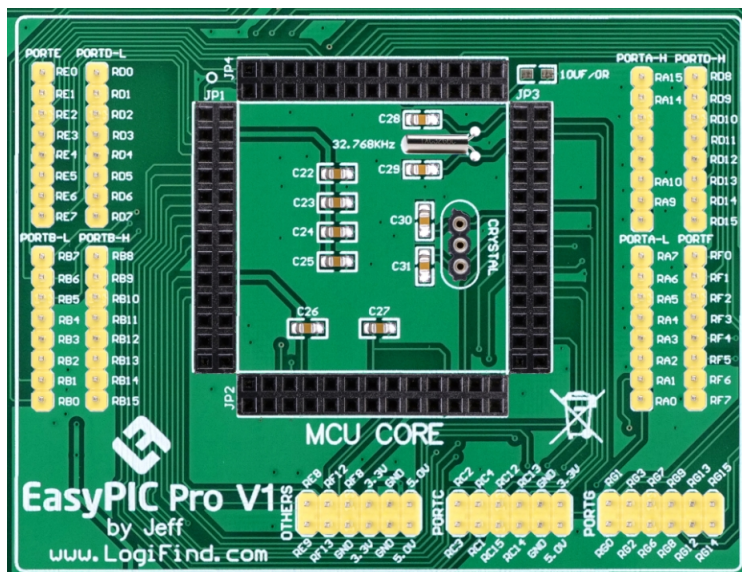
Figure 2-4: MCU System

TQFP packages. Different microcontrollers are supported using these MCU cards, which are placed into the on-board female MCU socket.
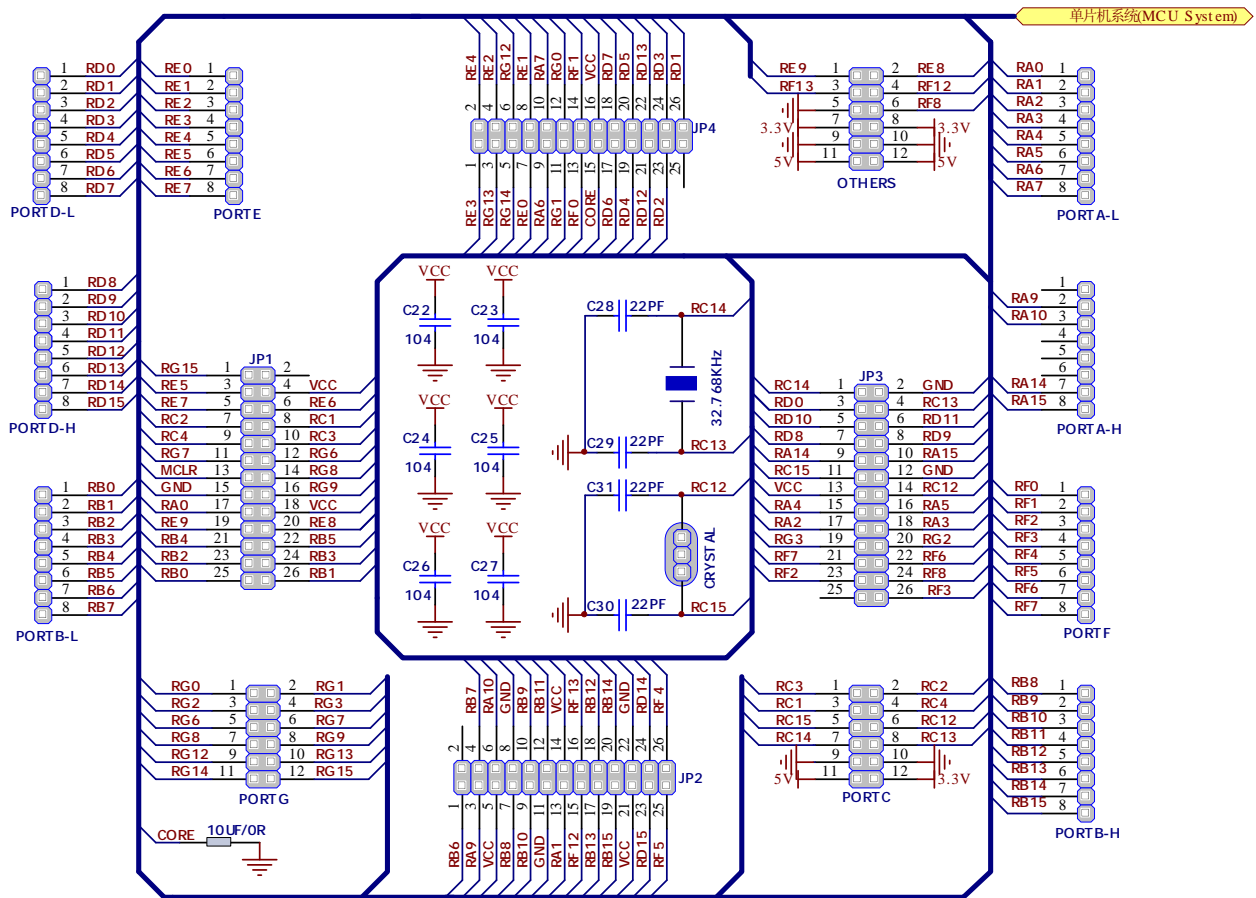

Figure 2-5: schematic of MCU System

3.CAN communication

Controller Area Network (CAN or CAN bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host computer. CAN is a message-based protocol, designed specifically for automotive applications but now also used in other areas such as industrial automation and medical equipment. **easyPIC Pro** is equipped with VP230 – a 3.3V CAN Transceiver and a pair of screw terminals which provide microcontrollers with integrated CAN controller with the necessary physical interface for CAN communication. Make sure to correctly connect negative and positive differential communication lines before using this module. In order to enable CAN communication, you must connect the **CN1** to the TX and RX lines of the microcontroller .See the comments in the source code provided in CD Rom for how to connect the hardware.
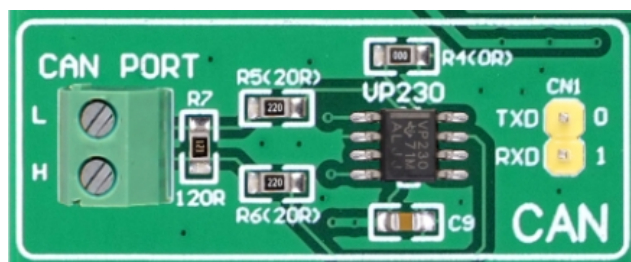

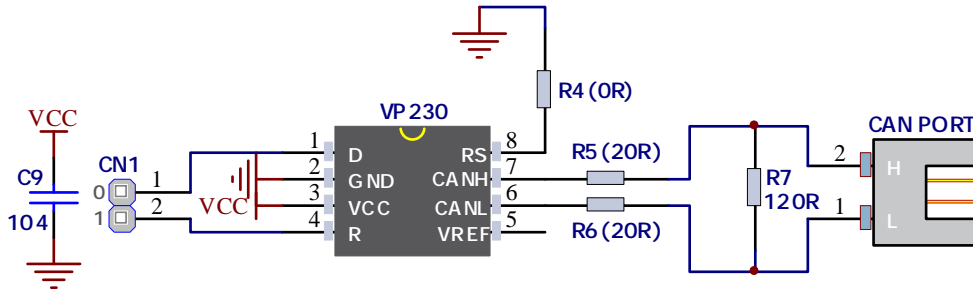**Figure 2-6**: CAN Communication Module

Figure 2-7: schematic of CAN Communication Module

4.6-Digit SEGLED 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. The **easyPIC Pro** contains six of these digits put together to form 6-digit segled 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 six segments fast enough, you create an illusion that all six 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 connector (**CN6**), and digit select lines are connected to connector (**CN5**).The two connectors does not be connected to any IOs, and it makes your experiments more flexible. In order to enable Segled Display, you must connect the **CN5** and **CN6** to the IO lines of the microcontroller .See the comments in the source code provided in CD Rom for how to connect the hardware.
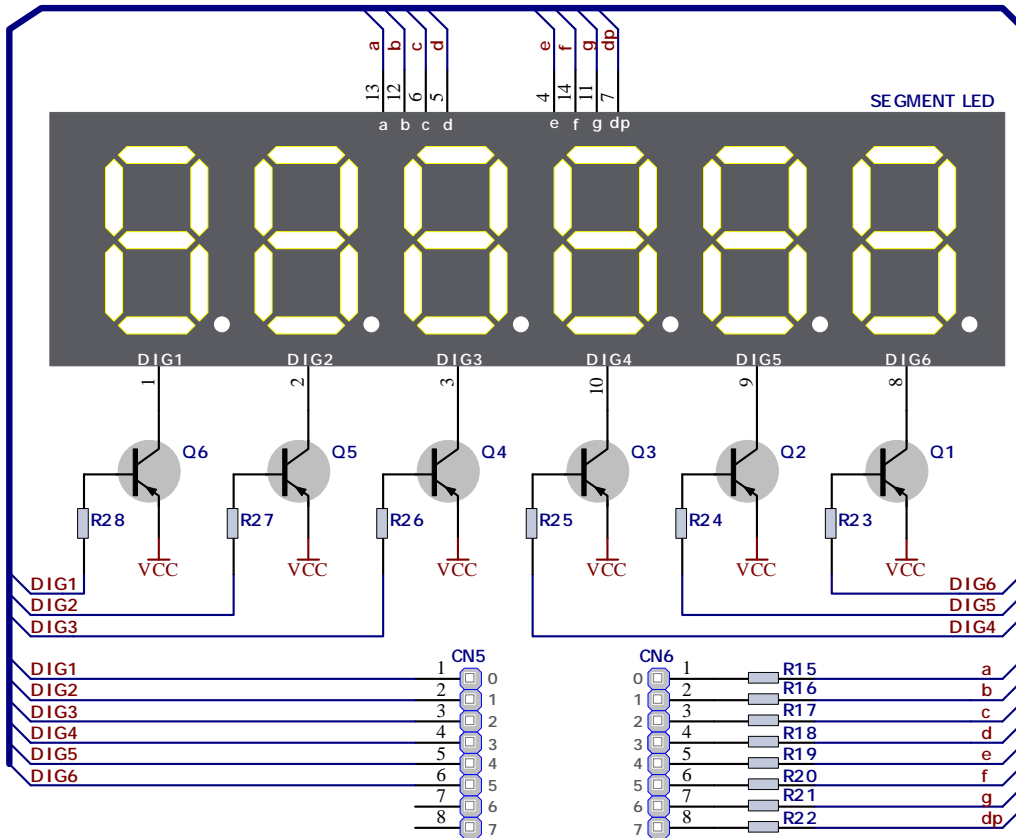

Figure 2-8: 6-Digit segled Display Module

Figure 2-9: schematic of 6-Digit segled Display Module

5.Eight LEDs

LED (Light-Emitting Diode) is a highly efficient electronic light source. When connecting LEDs, it is necessary to place a current limiting resistor in series so that LEDs are provided with the current value specified by the manufacturer. The current varies from 0.2mA to 20mA, depending on the type of the LED and the manufacturer.. The EasyPIC Pro board uses low-current LEDs with typical current consumption of 0.2mA or 0.3mA, depending of VCC voltage selection. Board contains 8 LEDs which can be used for visual indication of the logic state on PORT pins. An active LED indicates that a logic high (1) is present on the pin.

In order to enable LEDs, it is necessary to connected them to the appropriate IOs Port via connector (**CN7**) using dupont wires. See the comments in the source code provided in CD Rom for how to connect the hardware.
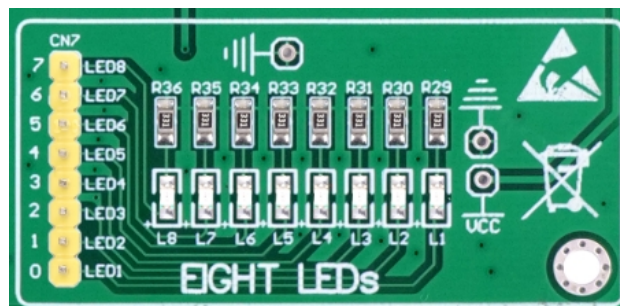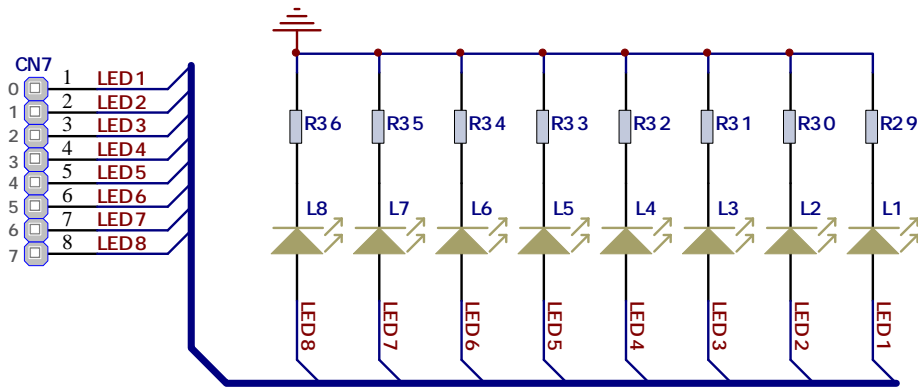

Figure 2-10: 8 LEDs Module

Figure 2-11: schematic of 8 LEDs Module

6.Buttons and Joystick

The logic state of all microcontroller digital inputs may be changed using push buttons. In order to enable three Keys, it is necessary to connected them to the appropriate IOs Port via connector (**CN8.5~7**) using dupont wires. **easyPIC Pro** equips 3 user buttons KEK1~ KEK3. See the comments in the source code provided in CD Rom for how to connect the hardware.
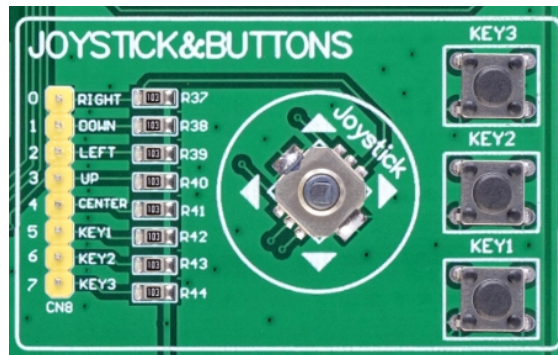

Figure 2-11: Buttons and Joystick Module
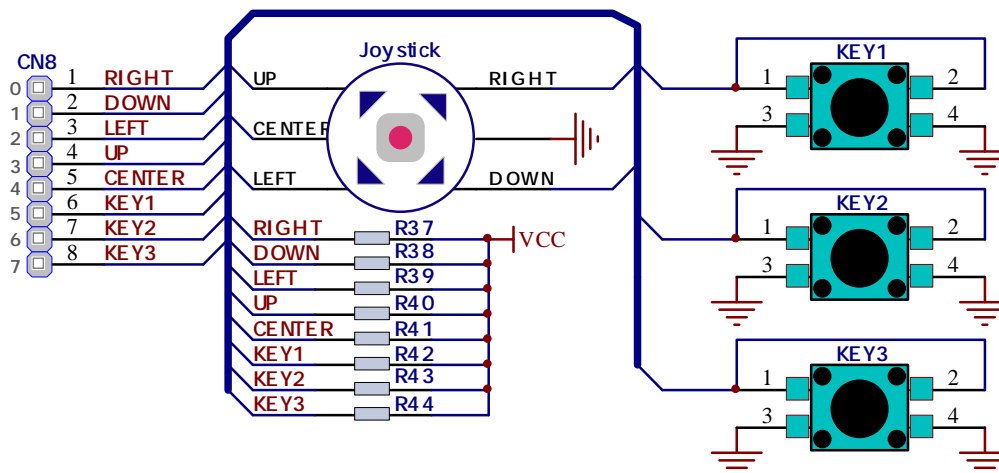
Figure 2-12: schematic of Buttons and Joystick Module

easyPIC Pro also equips a **Joystick** which is a smart navigation key concept based on contactless, magnetic movement

detection. You can think it simply as 5 Tact Switchs installed on one device, and they are **Left**, **Right**, **Up**, **Down** and **Center**. In order to enable the Joystick, it is necessary to connected them to the appropriate IOs Port via connector (**CN8.0~4**) using dupont wires. See the comments in the source code provided in CD Rom for how to connect the hardware.
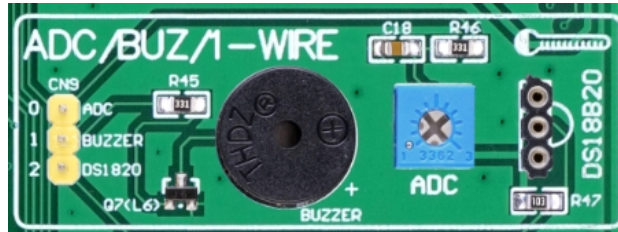
7.ADC input, Buzzer and 1-wire DS18B20

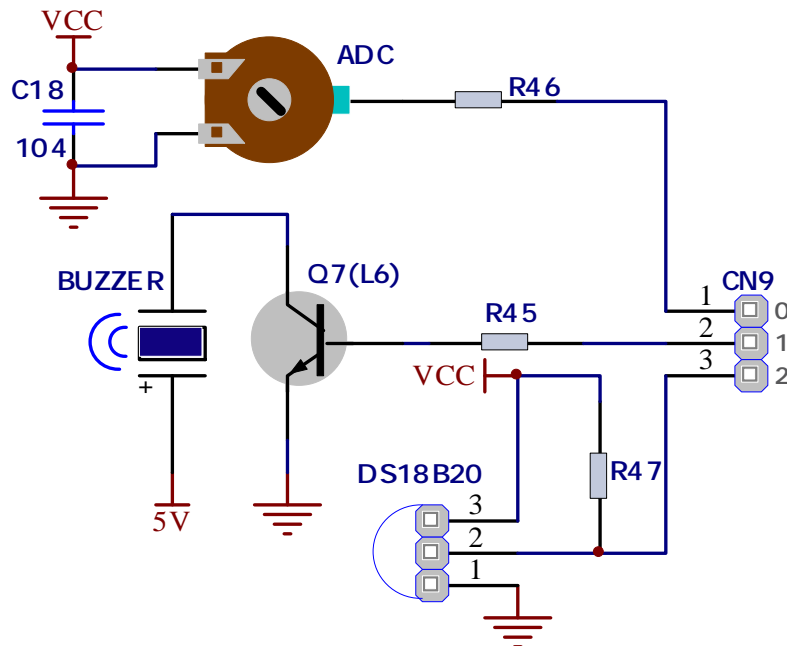**Figure 2-12:** ADC input, Buzzer and 1-wire DS18B20 Module

Figure 2-13: schematic of ADC input, Buzzer and 1-wire DS18B20 Module

1)ADC input

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 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 0-3.3V, can be divided into 1024 discrete steps of about 3.222mV.**easyPIC Pro** provides an interface in form of potentiometer for simulating analog input voltages that can be routed to any of the 5 supported analog input pins.

easyPIC Pro provides an external ADC input which allows you to connect to any ADC pin of the on-board microcontroller. In order to enable the ADC input, it is necessary to connected them to the appropriate ADC input Port via connector (**CN9.0**) using dupont wires.

2) Piezo Buzzer

Piezoelectricity is the charge which accumulates in certain solid materials in response to mechanical pressure,but also providing the charge to the **piezo** electric material causes it to physically deform. One of the most widely used applications of piezoelectricity is the production of sound generators, called piezo buzzers. **Piezo buzzer** is an electric component that comes in different shapes and sizes, which can be used to create sound waves when provided with analog electrical signal.

easyPIC Pro comes with **piezo buzzer** which can be connected to any IO of microcontroller via connector (**CN9.1**). **Buzzer** is driven by transistor **Q7** (**Figure 2-13**). Microcontrollers can create sound by generating a PWM(Pulse Width Modulated) signal – a square wave signal, which is nothing more than a sequence of logic zeros and ones. Frequency of the square signal determines the pitch of the generated sound, and duty cycle of the signal can be used to increase or decrease the volume in the range from 0% to 100% of the duty cycle. You can generate PWM signal using hardware capture-compare module, which is usually available in most microcontrollers, or by writing a custom software which emulates the desired signal waveform.

3) 1-wire DS18B20

DS18B20 is a digital temperature sensor that uses 1-wire® interface for it's operation. It is capable of measuring temperatures within the range of -55 to 128°C, and provides ±0.5°C accuracy for temperatures within the range of -10 to 85°C. It requires 3V to 5.5V power supply for stable operation. It takes maximum of 750ms for the **DS18B20** to calculate temperature with 9-bit resolution. 1-wire® serial communication enables data to be transferred over a single communication line, while the process itself is under the control of the master microcontroller. The advantage of such communication is that only one microcontroller pin is used. Multiple sensors can be connected on the same line. All slave devices by default have a unique ID code, which enables the master device to easily identify all devices sharing the same interface.

easyPIC Pro provides a separate socket for the DS18B20. Communication line with the microcontroller is connected via **CN9.2**.

8.I²C EEPROM

I²C is a multi-master serial single-ended bus that is used to attach low-speed peripherals to computer or embedded systems. **I²C** uses only two open-drain lines, Serial Data Line (**SDA**) and Serial Clock (**SCL**), pulled up with resistors. **SCL** line is driven by a master, while **SDA** is used as bidirectional line either by master or slave device. Up to 112 slave devices can be connected to the same bus. Each slave must have a unique address.

EEPROM is short for Electrically Erasable Programmable Read Only Memory. It is usually a secondary storage memory in devices containing data that is retained even if the device looses power supply. **EEPROMs** come with parallel or serial interface to the master device. Because of the ability to alter single bytes of data, **EEPROM** devices are used to store personal preference and configuration data in a wide spectrum of consumer, automotive, telecommunication, medical, industrial, and PC applications. **easyPIC Pro** supports serial EEPROM which uses I2C communication interface and has
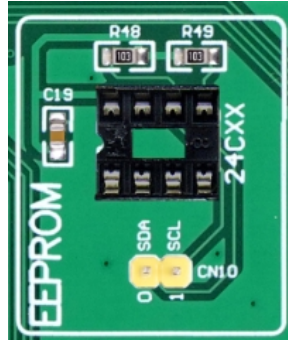
Figure 2-14: I²C EEPROM Module
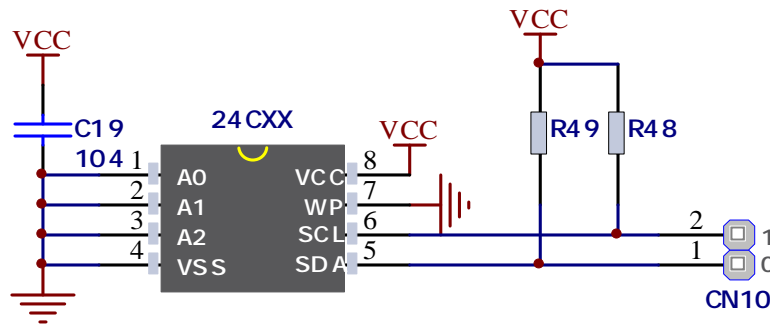
Figure 2-15: schematic of I²C EEPROM Module

1024 bytes of available memory. **EEPROM** itself supports single byte or 16-byte (page) write and read operations. Data rates are dependent of power supply voltage, and go up to 400 kHz for 3.3V power supply.

easyPIC Pro equips an IC socket for **EEPROM IC** with different capacity.

In order to enable the **I²C EEPROM**, it is necessary to connected them to the appropriate microcontroller Pin via connector (**CN10**) using dupont wires.

9.microSD card slot

Secure Digital (SD) is a non-volatile memory card format developed for use in portable devices. It comes in different packages and memory capacities. It is mostly used for storing large amounts of data. **easyPIC Pro** features the **microSD card slot.** The **microSD** form factor is the smallest card format currently available. It uses standard **SPI** user interface with minimum additional electronics, mainly used for stabilizing communication lines which can be significantly distorted at high transfer rates. Special ferrite is also provided to compensate the voltage and current glitch that can occur when pushing-in and pushing-out **microSD** card into the socket.
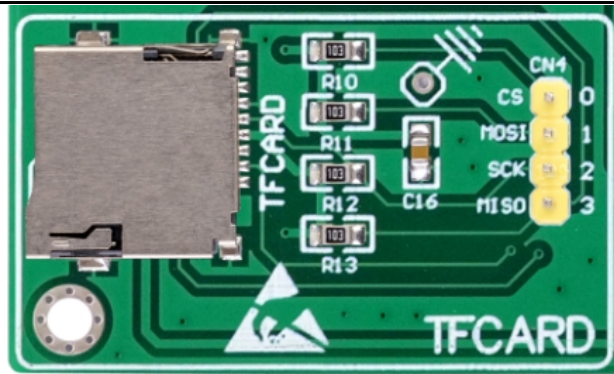
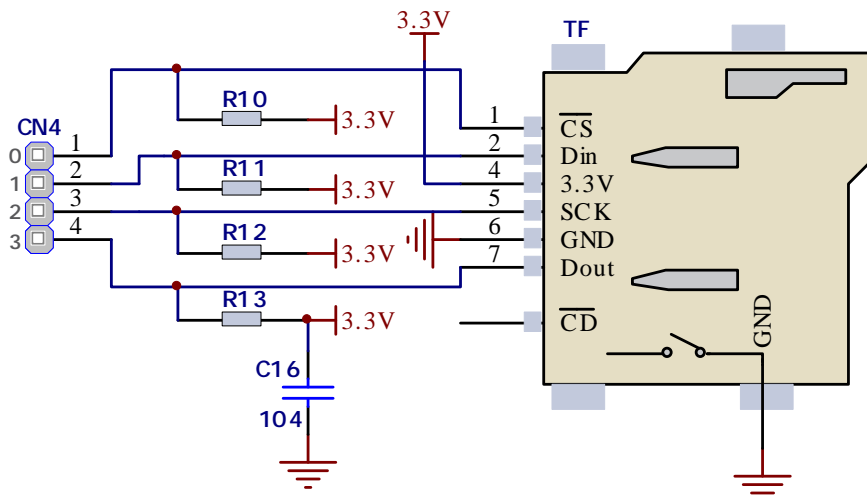**Figure 2-16:** microSD card slot Module

Figure 2-17: schematic of microSD card slot Module

In order to access microSD card, you must enable **SPI** communication lines via connecting the **microSD card** Module to the **SPI** pins of microcontroller via **CN4** using the DIY wires.

10.UART via RS-232

The **UART** (universal asynchronous receiver/transmitter) is one of the most common ways of exchanging data between the MCU and peripheral components. It is a serial protocol with separate transmit and receive lines, and can be used for full-duplex communication. Both sides must be initialized with the same baud rate, otherwise the data will not be received correctly. **RS-232** serial communication is performed through a 9-pin SUB-D connector and the microcontroller **UART** module. In order to enable this communication, it is necessary to establish a connection between RX and TX lines on SUB-D connector and the same pins on the target microcontroller using **CN2**. Since RS-232 communication voltage levels are different than microcontroller logic levels, it is necessary to use a RS-232 Transceiver circuit, such as SP232 as shown on the following Figure.
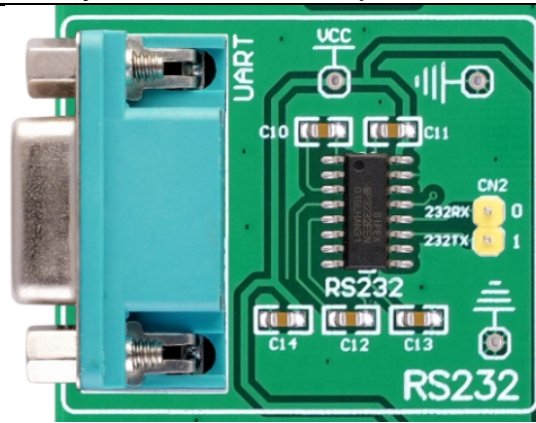
Figure 2-18: RS232 Module
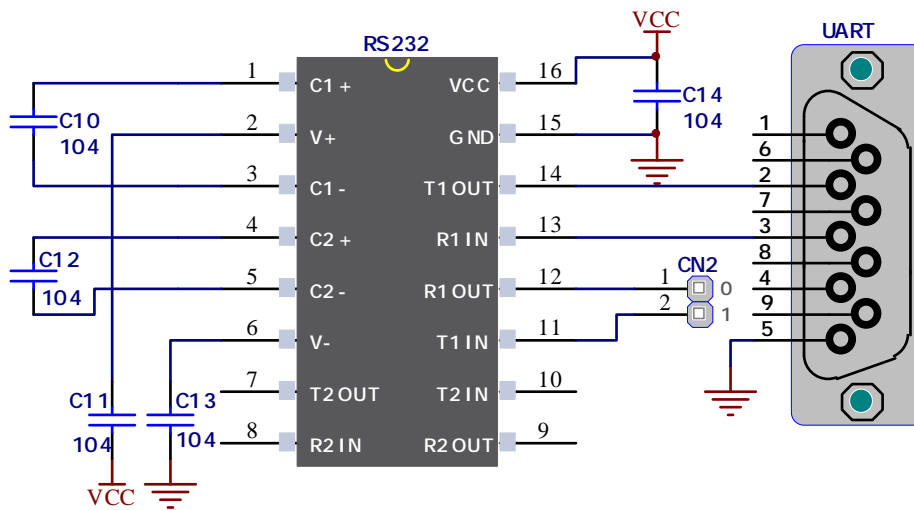
Figure 2-19: schematic of RS232 Module

In order to access **RS232 Module**, you must enable communication lines via connecting the **RS232 Module** to the proper pins of microcontroller via **CN2** using the DIY wires .

11.LCD 2x16 characters (Socket)

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. The **easyPIC Pro** provides the connector and the necessary interface for supporting 2x16 character LCDs. This type of display has two rows consisted of 16 character fields. Each field is a 7x5 pixel matrix. Board equips an universal socket allowing you to install 16x2 LCD very easily.
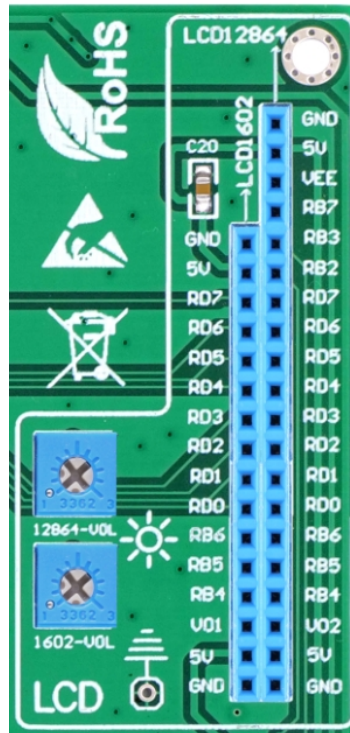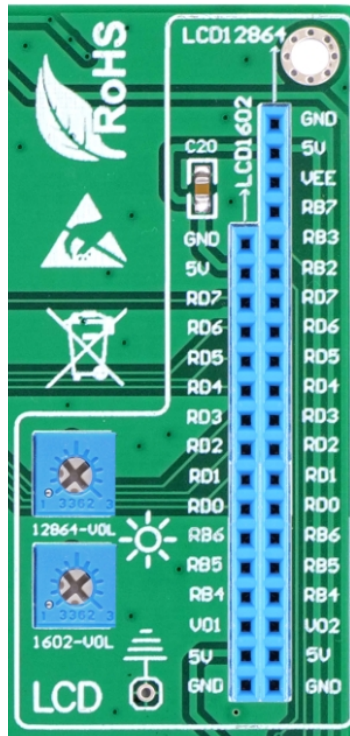
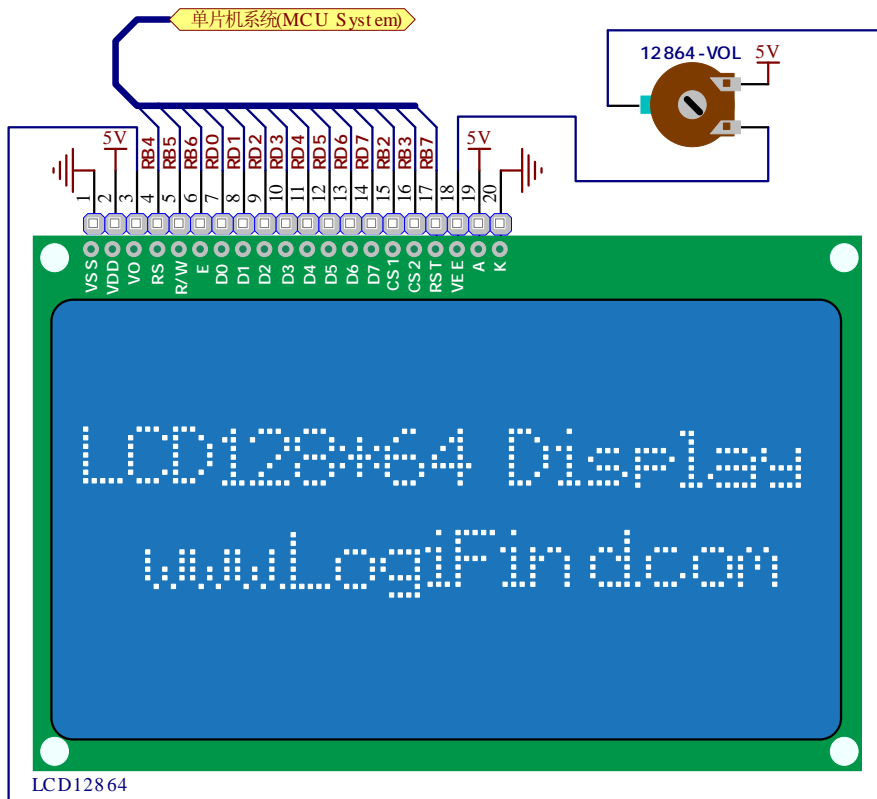**Figure 2-20:** LCD1602 and LCD12864 display Socket
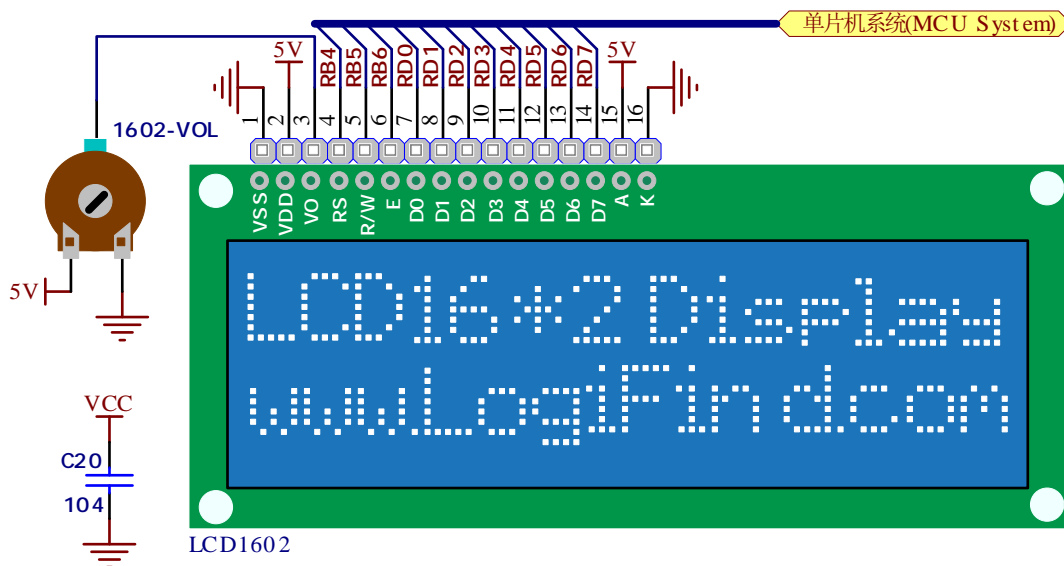
Figure 2-21: schematic of LCD1602 display Socket

Connector pinout explained

1-GND

2-5V

3-Vo,LCD contrast level from potentiometer **1602-VOL**

4-RS,Register Select Signal

5-E,Display Enable

6-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.

7~14-Data Port,Display is supported in 8-bit data mode.

15-LED+,Connection with 5V

16-LED-,Connection with GND

IMPORTANT:

Make sure to Place the LCD1602 in the right direction.

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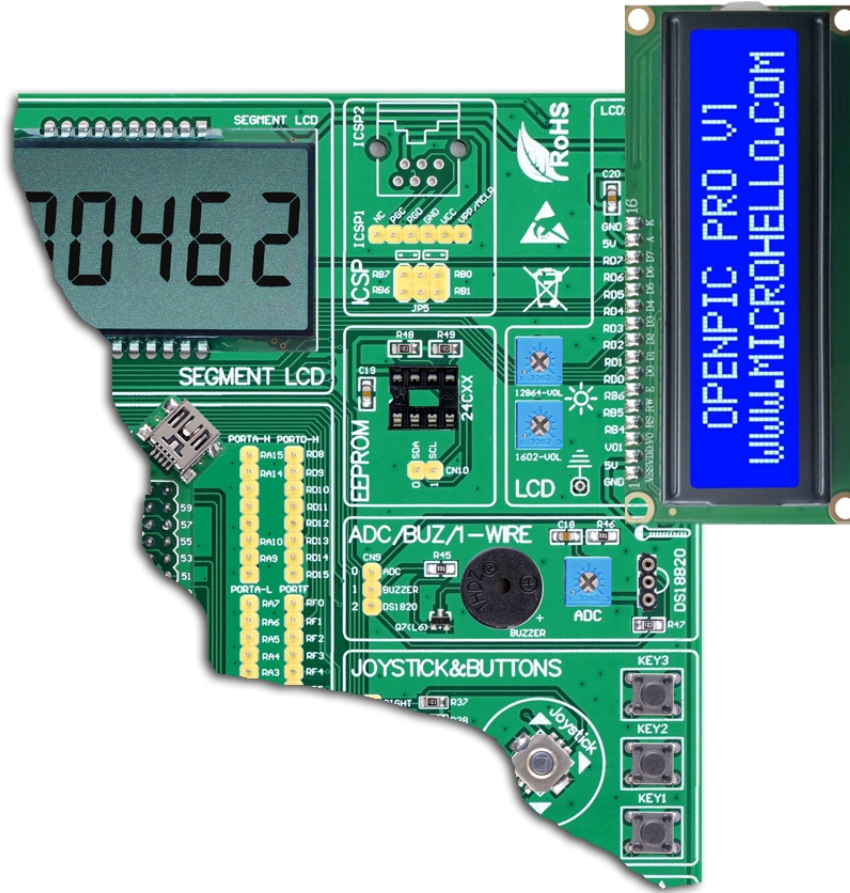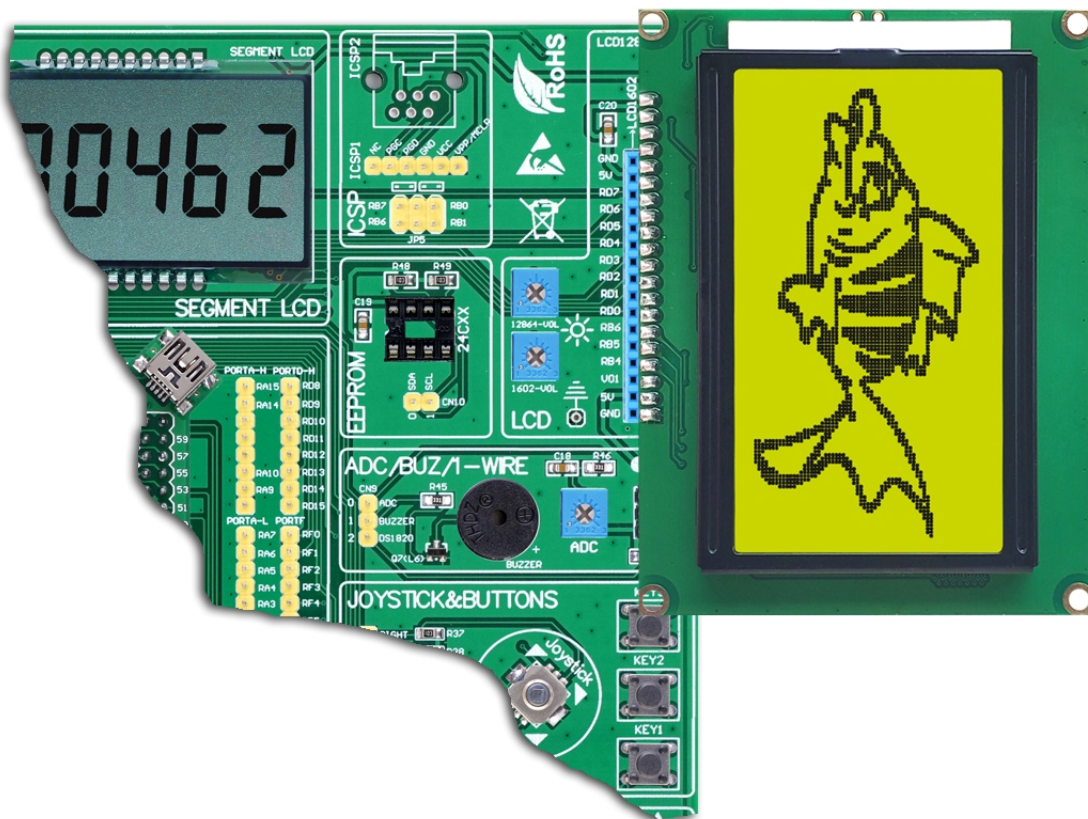

Figure 2-22: Installing direction of LCD1602 display

12.GLCD 128x64(Socket)

Graphical Liquid Crystal Displays, or GLCDs are used to display monochromatic graphical content, such as text, images, human-machine interfaces and other content. **easyPIC Pro** provides the connector and necessary interface for supporting GLCD with resolution of 128x64 pixels and proper PINOUTs.It is compatible with the most popular LCD12864 in the market with KS108 or ST7920 display controller. The example we provide is only for LCD12864 with ST7920 display controller. **easyPIC Pro** equips an universal socket allowing you to install 128*64 Graphical LCD very easily.

Figure 2-23: LCD1602 and LCD12864 display Socket

Figure 2-24: schematic of LCD12864 display Socket

Connector pinout explained:

1-GND

2-VCC

3-Vo,GLCD contrast level from potentiometer **12864-VOL**

4-RS,Data (High), Instruction (Low) selection

5-R/W,Determines whether display is in Read or Write mode.

6-E,Display Enable line

7~14,D0–D7,Data lines

15-PSB,Parallel/Serial Mode Selection

16-NC

17-RST

18-VEE

19-LEDA - 5V

20-LEDK – GND

IMPORTANT:

Make sure to Place the LCD12864 in the right direction.

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

Figure 2-25: Installing direction of LCD12864 display

13.Seglcd Display

easyPIC Pro equips **segment LCD display module** with a driver IC **HT1621.HT1621** is a 128 pattern (32*4), memory

mapping, and multi-function LCD driver. The S/W configuration feature of the **HT1621** makes it suitable for multiple LCD applications including LCD modules and display subsystems.Only three or four lines are required for the interface between the host controller and the **HT1621**.The HT1621 contains a power down command to reduce power consumption. Refer to the PDF datasheet of **HT1621** for more details.
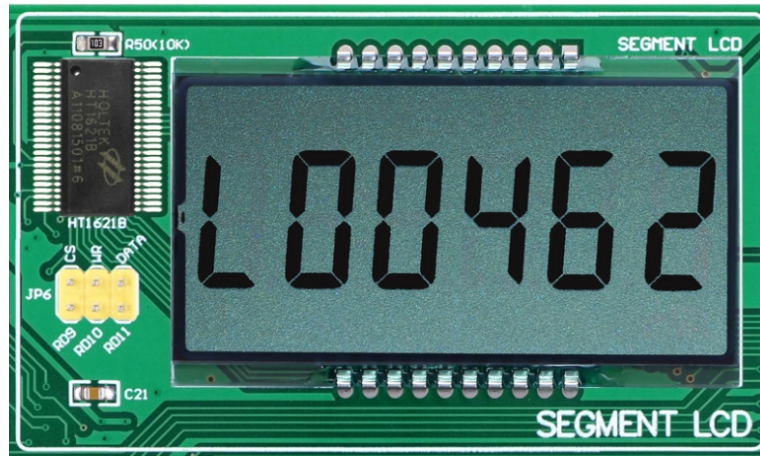
Figure 2-26: Segment LCD display module
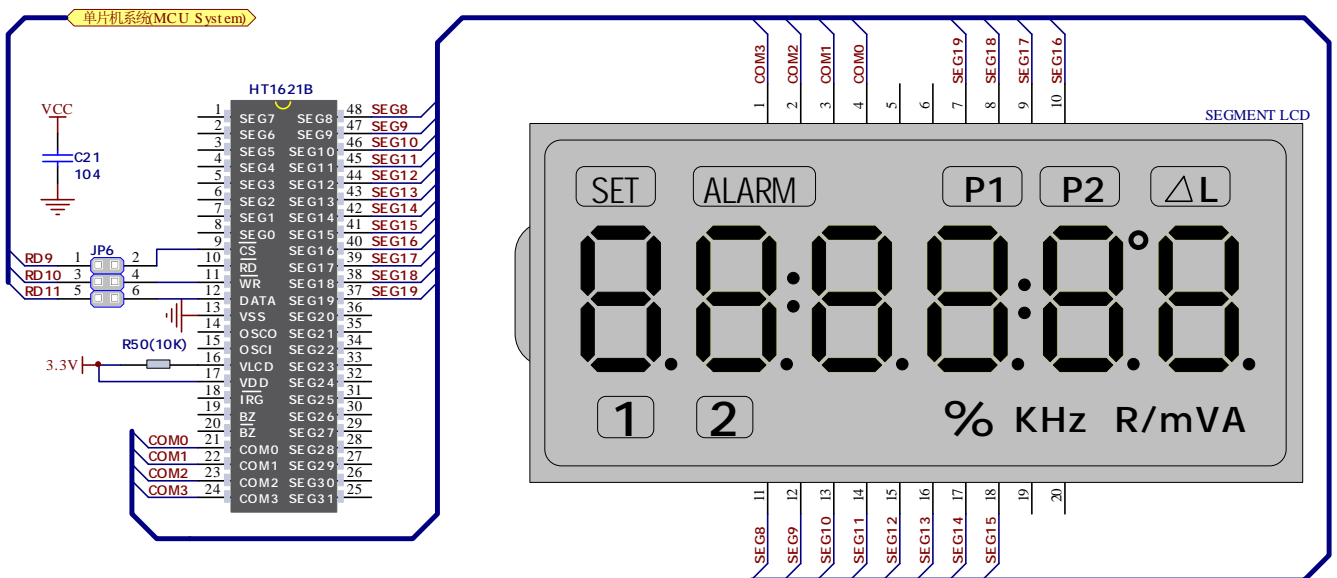
Figure 2-27: schematic of Segment LCD display module

In order to access **segment LCD display module**, you must enable communication lines via connecting the Jumper(**JP6**).

14.RS-485

RS-485 is a standard defining the electrical characteristics of drivers and receivers for use in serial communications systems. Electrical signaling is balanced and multipoint systems are supported. Digital communications networks implementing the standard can be used effectively over long distances and in electrically noisy environments. Multiple receivers may be connected to such a network in a linear, multi-drop configuration. These characteristics make such networks useful in industrial environments and similar applications.

The **RS-485** module enables the development system to communicate to external devices whose operation is in compliance with the **RS-485** standard. The connection between this module and one of these devices is established via a screw connector (**RS485 PORT**).

In order to turn on this module, it is necessary to connect the **CN3** to the PINs of microcontroller using three dupont DIY wire.
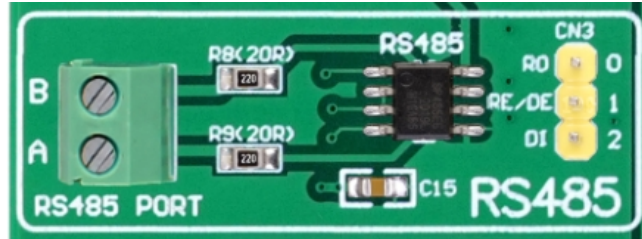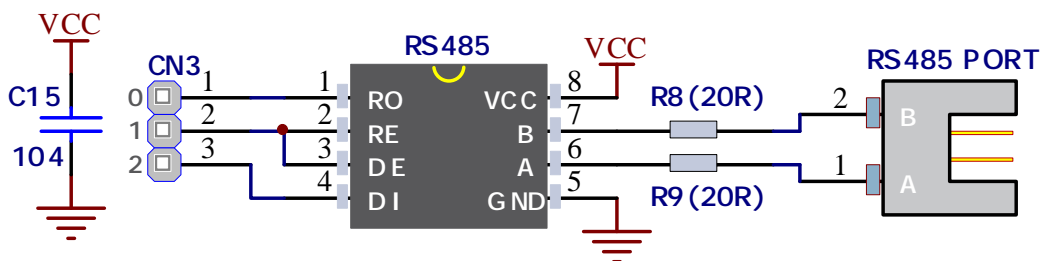

Figure 2-28: RS485 Module

Figure 2-29: schematic of RS485 Module

15.ICSP Programming and Debugging Port

In-Circuit Serial Programming (**ICSP**) is an enhanced ISP technique implemented in Microchip's PICmicro One-Time-Programmable (**OTP**) and FLASH RISC microcontrollers (MCU). Use of only two I/O pins to serially input and output data makes **ICSP** easy to use and less intrusive on the normal operation of the MCU.
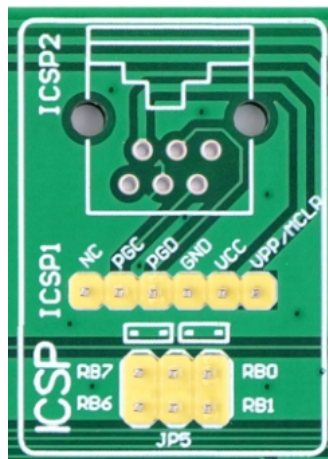
Figure 2-31: ICSP port
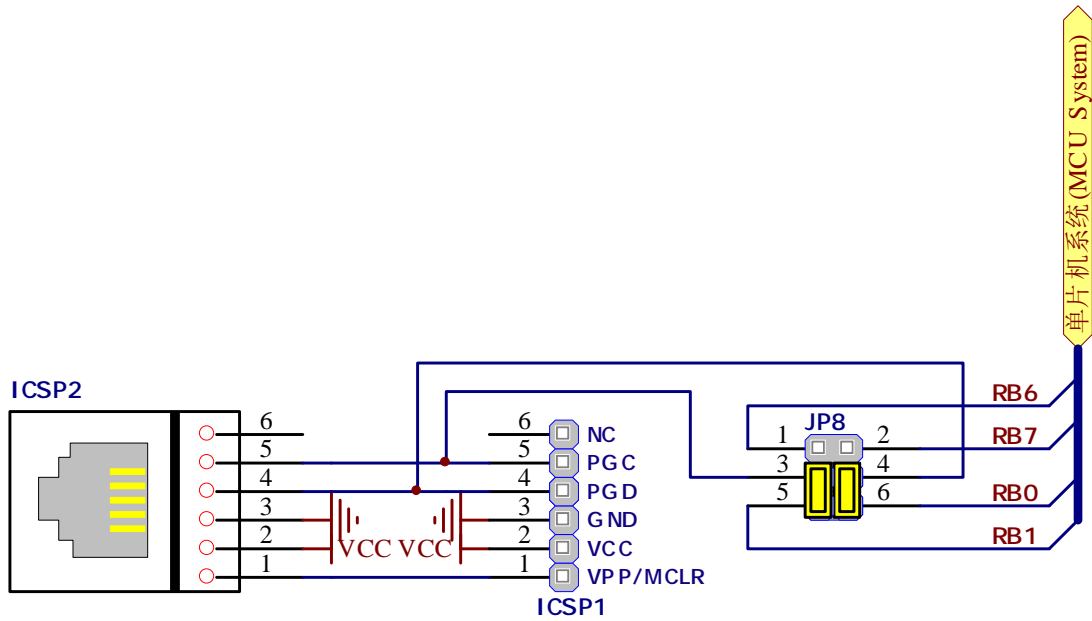
Figure 2-31: schematic of ICSP port

easyPIC Pro has two standard ICSP interfaces (ICSP1 and ICSP2) which allow you to connect PICKIT2, PICKIT3, ICD2 or other Third-party Programmer/debugger directly.

16.System Reset

easyPIC Pro reset circuit is made with 10K pull-up resistor, RESET button connected to GND and a 0.1uF capacitor for filtering.
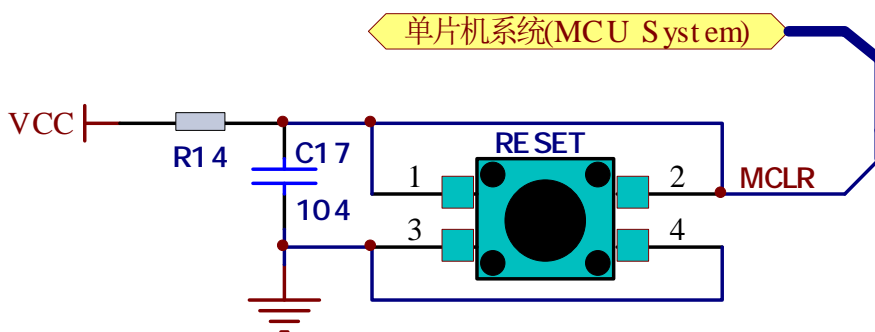

Figure 2-32: System Reset Module

Figure 2-33: schematic of System Reset Module

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