user's guide to

# multimedia
## for PIC32MX7

Compact development system rich with on-board peripherals
for all-round multimedia development on PIC32MX795F512L


MikroElektronika
DEVELOPMENT TOOLS | COMPILERS | BOOKS

# TO OUR VALUED CUSTOMERS

I want to express my thanks to you for being interested in our products and for having confidence in Mikroelektronika.

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.

Nebojsa Matic
General Manager

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# Introduction to MMB for PIC32MX7

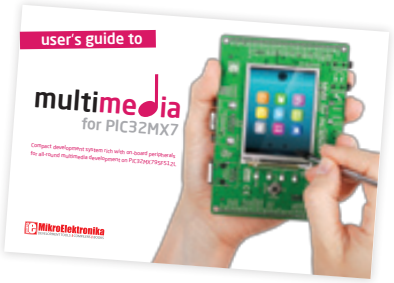
The MMB for PIC32MX7 is a compact development system which provides a convenient platform for development of devices with multimedia contents. The central part of the system is a 32-bit microcontroller **PIC32MX795F512L** that is programmed with bootloader or with external programmer mikroProg (mikroElektronika), or ICD3® (Microchip®). The MMB for PIC32MX7 features integrated modules such as audio module, **TFT 320x240** touch screen display, USB connector for communication with the microcontroller, accelerometer, **RS-232** module, **EEPROM** memory, **FLASH** memory, temperature sensor, joystick and **MMC/SD** card slot.

# Package contains


01 Damage resistant protective box

02 MMB for PIC32MX7 development system


03 CD with documentation and examples

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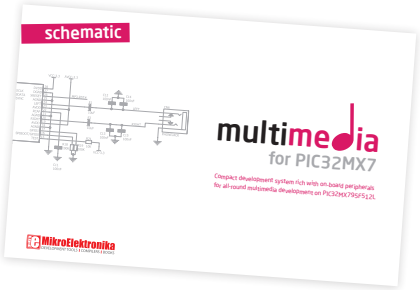
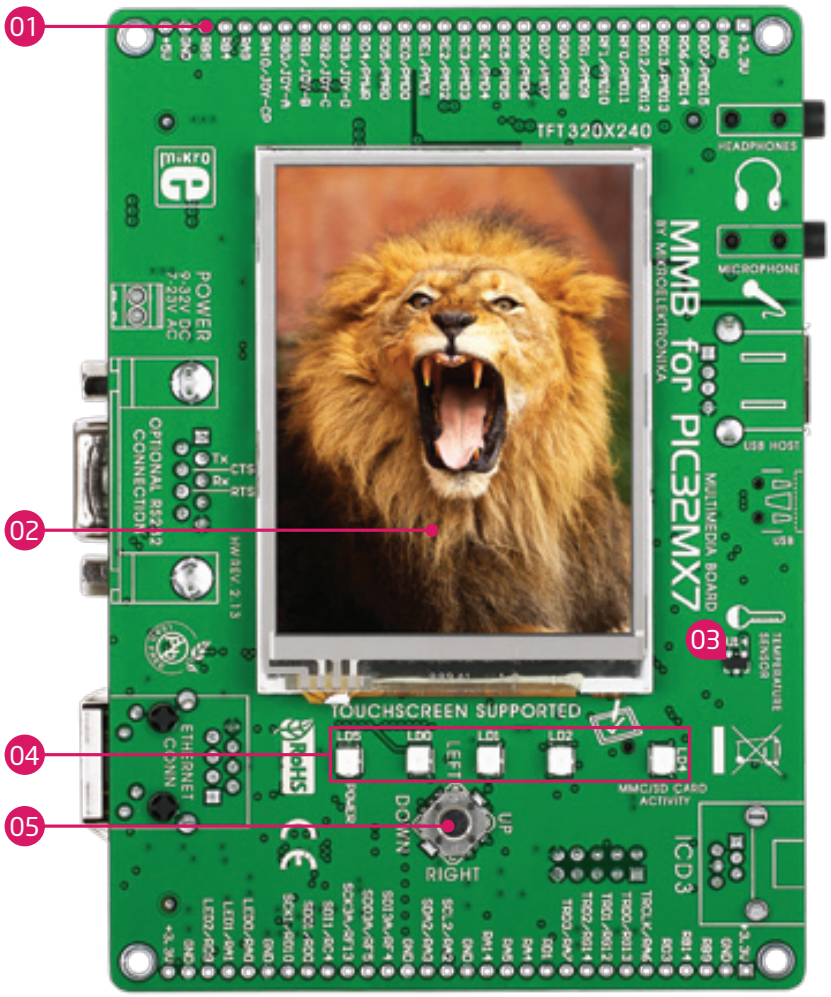


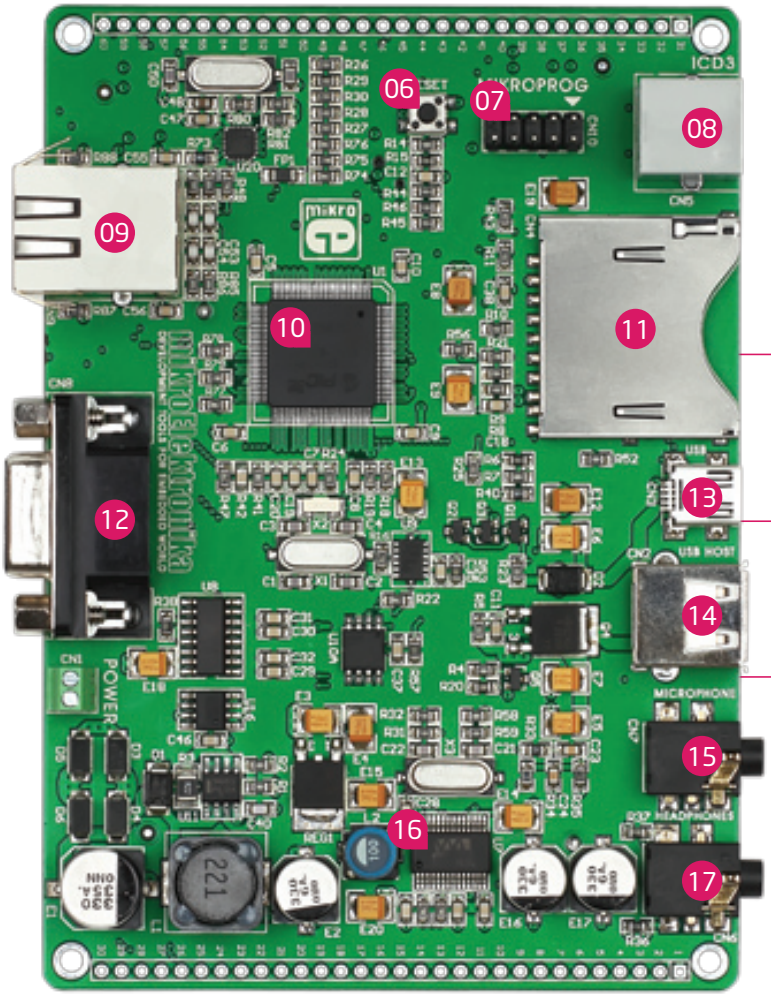

05 MMB for PIC32MX7 schematic

06 USB cable

# Key Features

01 Pads
02 TFT 320x240 display
03 Temperature sensor
04 Indication LEDs
05 Joystick
06 RESET button
07 2x5 male header for mikroProg programmer
08 ICD3 connector
09 Ethernet connector
10 PIC32MX795F512L
11 MicroSD Card Slot
12 RS-232 connector
13 USB MINIB connector
14 USB HOST connector
15 3.5mm microphone connector
16 Audio module
17 3.5mm headphone connector






# System Specification

**power supply**

Over a USB cable (5V DC) or via screw terminal (7-23V AC or 9-32V DC)

**power consumption**

50mA in idle state

(when on-board modules are off)

**board dimensions**

12.6 x 8.9cm (4.9 x 3.5 inch)

**weight**

~200g (0.5 lbs)

# 1. Connecting power supply

## Via USB MINIB connector

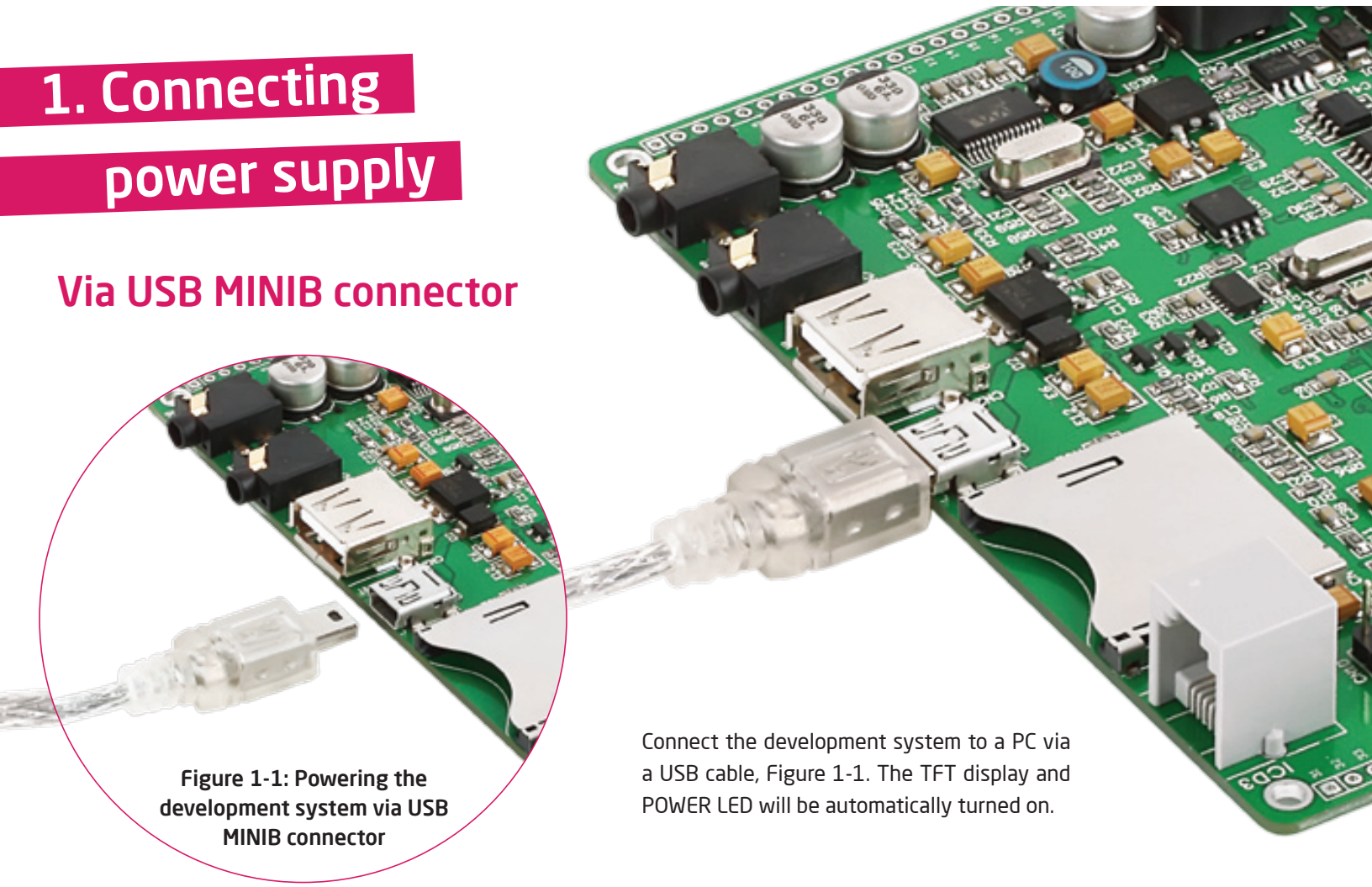


**Figure 1-1: Powering the development system via USB MINIB connector**

Connect the development system to a PC via a USB cable, Figure 1-1. The TFT display and POWER LED will be automatically turned on.

## Via screw terminal

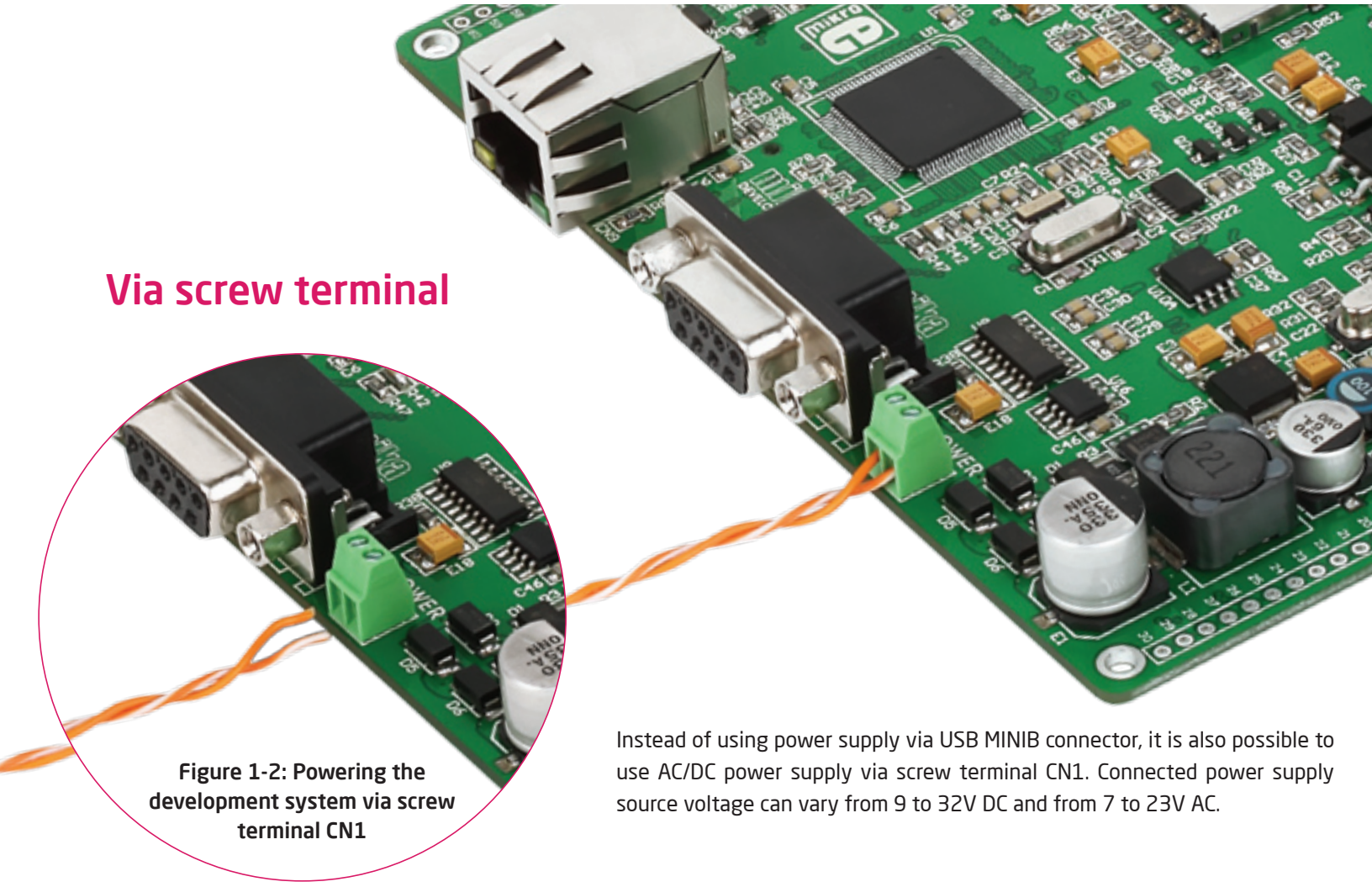


**Figure 1-2: Powering the development system via screw terminal CN1**

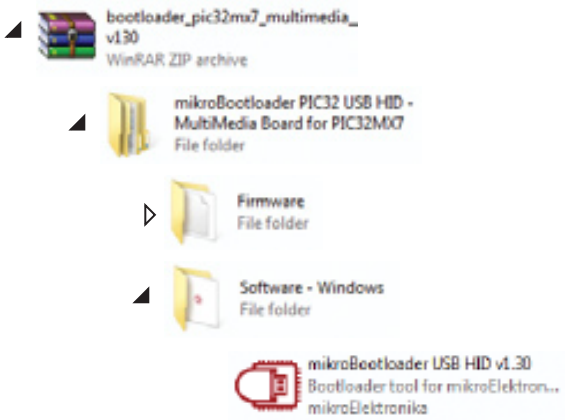
Instead of using power supply via USB MINIB connector, it is also possible to use AC/DC power supply via screw terminal CN1. Connected power supply source voltage can vary from 9 to 32V DC and from 7 to 23V AC.

# 2. Programming with bootloader

For programming, microcontroller use bootloader program which is preinstaled in to MCU memory. To transfer .hex file from a PC to MCU you need bootloader software (**mikroBootloader USB HID**) which can be downloaded from:

http://www.mikroe.com/eng/products/view/573/multimedia-board-for-pic32mx7/

After software is downloaded unzip it to desired location and start mikroBootloader USB HID software.




## step 1 - Connecting PIC32MX7


**Figure 2-1: mikroBootloader USB HID**

01 Connect PIC32MX7 board with a PC via USB cable and USB icon will turn red

02 Whitin 5s click on Connect button

## step 2 - Browsing for .hex file


**Figure 2-2: Browse for HEX**

01 Click on Browse for HEX button

## step 3 - Select .hex file

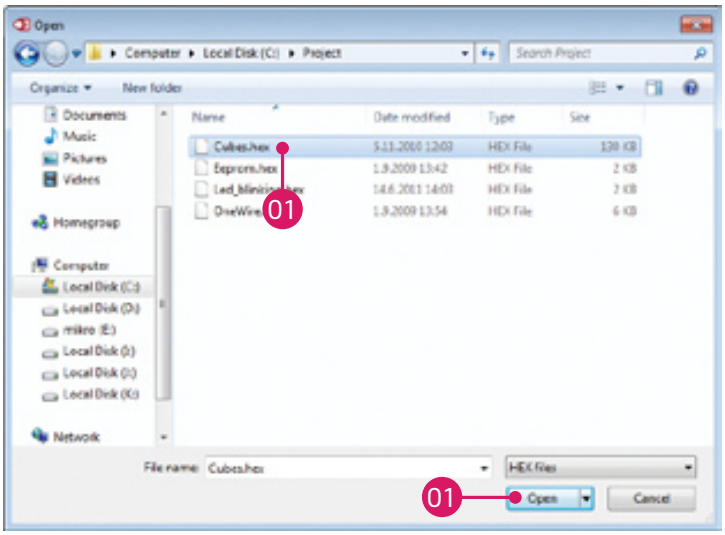



**Figure 2-3: Selecting HEX**

01 Select .hex file via open window

02 Click on Open button

# step 4 - .hex file uploading


**Figure 2-4: Begin uploading**

01 To start .hex file uploading click on Begin uploading button


**Figure 2-5: Progress bar**

01 You can monitor .hex file uploading via progress bar

# step 5 - Finish upload

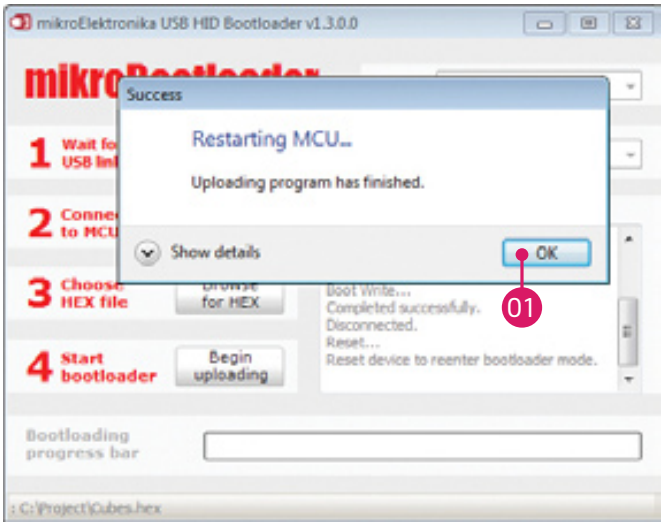



Figure 2-6: Restarting MCU


Figure 2-7: mikroBootloader ready for next job

01 To finish uploading click on OK button

# 3. Programing with mikroProg™ programmer

The microcontroller can be programmed with **mikroProg** programmer. The mikroProg programmer is connected to the development system via the CN10 connector, Figure 3-1.

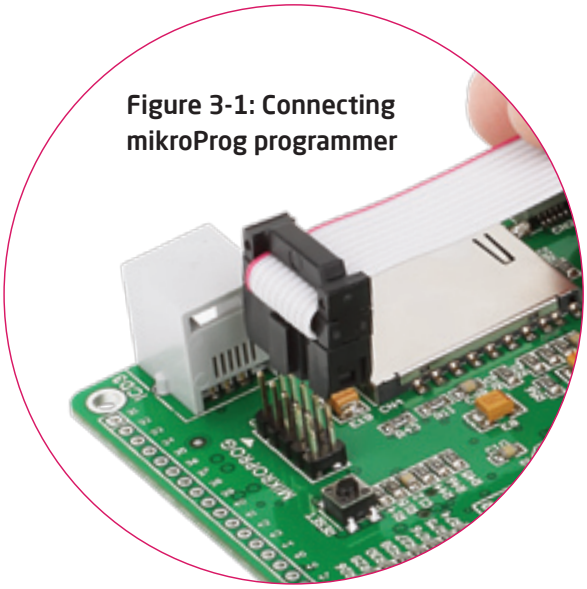
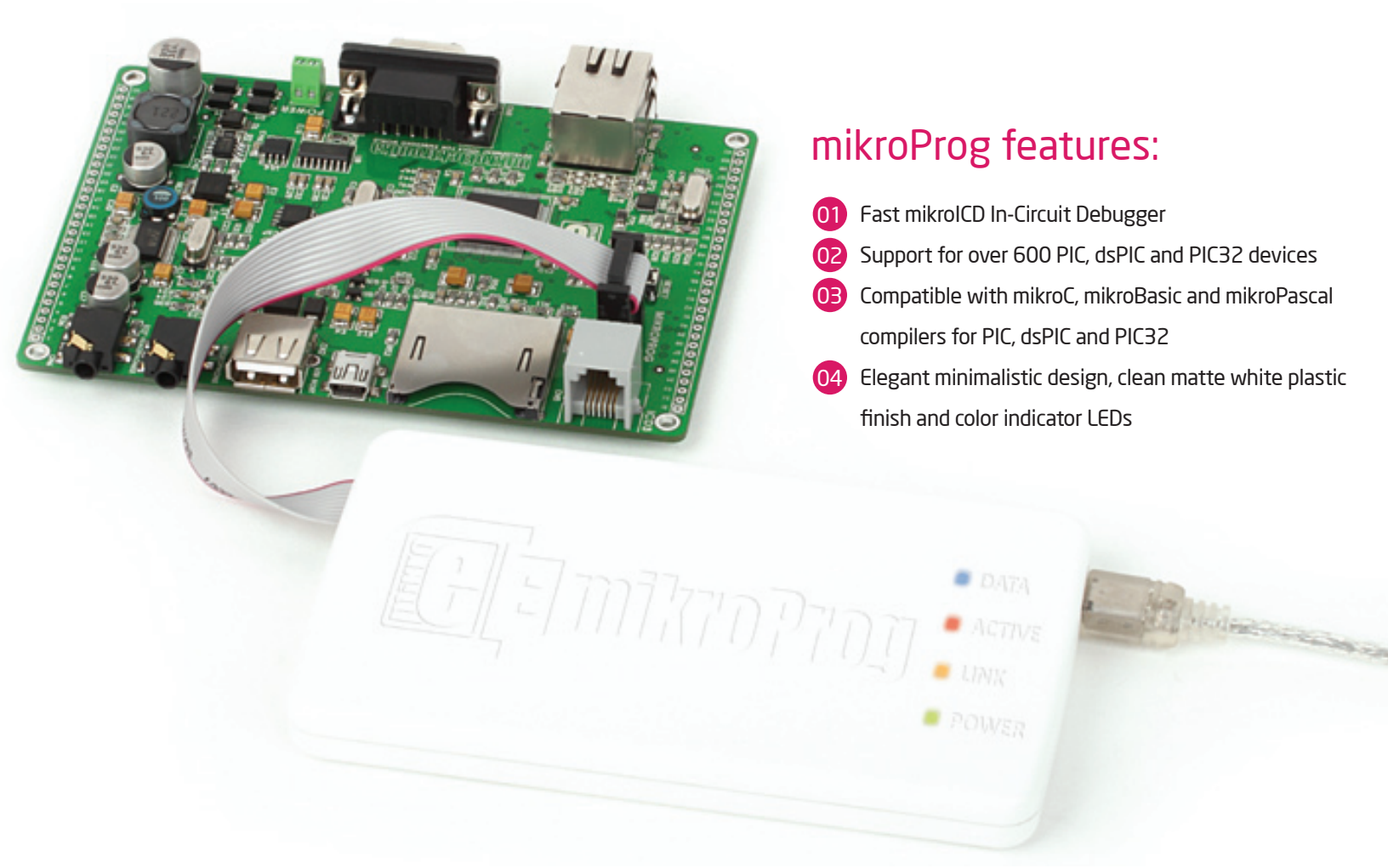


**Figure 3-1: Connecting mikroProg programmer**

In order to connect the **mikroProg** programmer to the development system, it is necessary to place IDC10 connector on 2x5 male header CN10. Make sure that knob on IDC10 connector must be oriented towards mark MIKROPROG, Figure 3-1.




## mikroProg features:

01 Fast mikroICD In-Circuit Debugger
02 Support for over 600 PIC, dsPIC and PIC32 devices
03 Compatible with mikroC, mikroBasic and mikroPascal compilers for PIC, dsPIC and PIC32
04 Elegant minimalistic design, clean matte white plastic finish and color indicator LEDs

# 4. Programing with ICD3 programmer

The microcontroller can be also programmed with **ICD3** programmer. This programmer is connected to PIC32MX7 board via on-board ICD connector CN5.

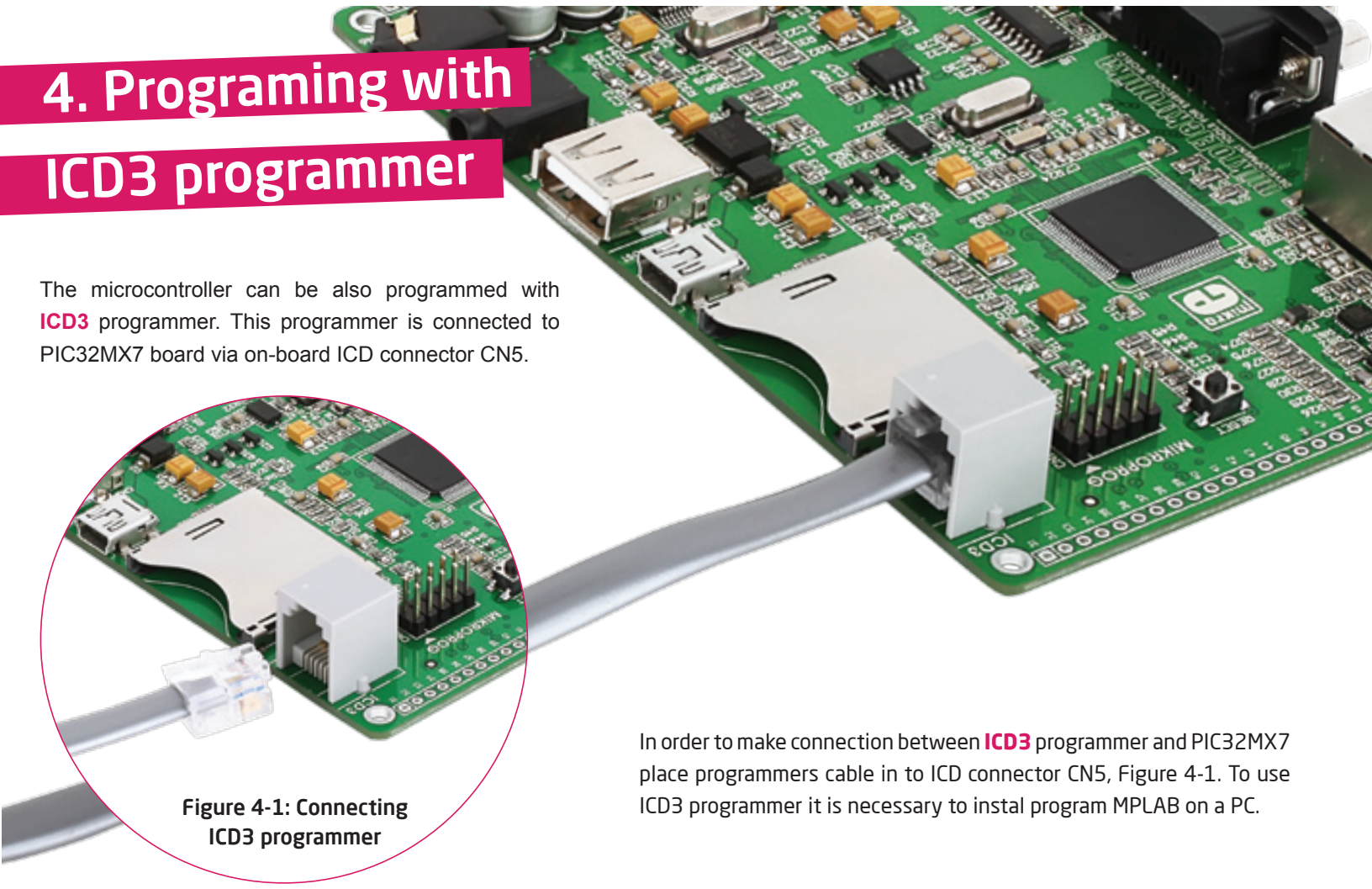


**Figure 4-1: Connecting ICD3 programmer**

In order to make connection between **ICD3** programmer and PIC32MX7 place programmers cable in to ICD connector CN5, Figure 4-1. To use ICD3 programmer it is necessary to instal program MPLAB on a PC.

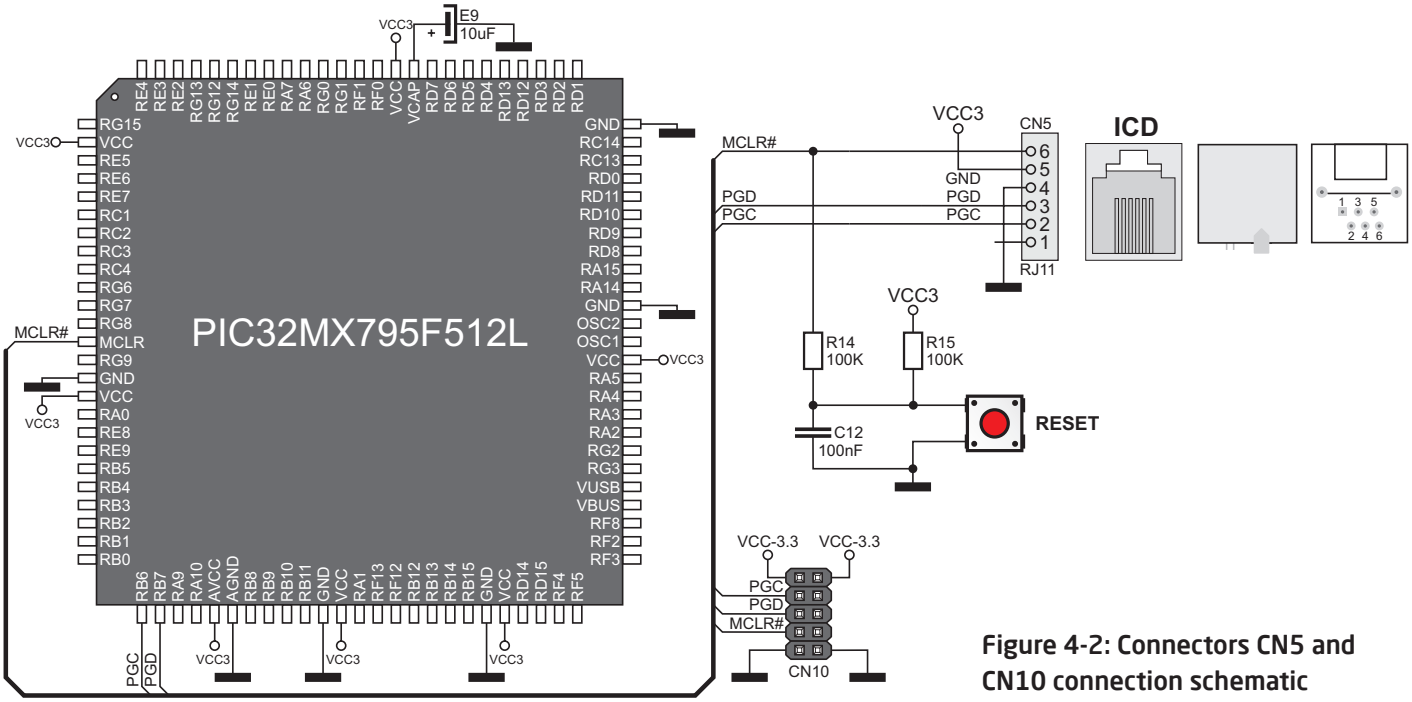
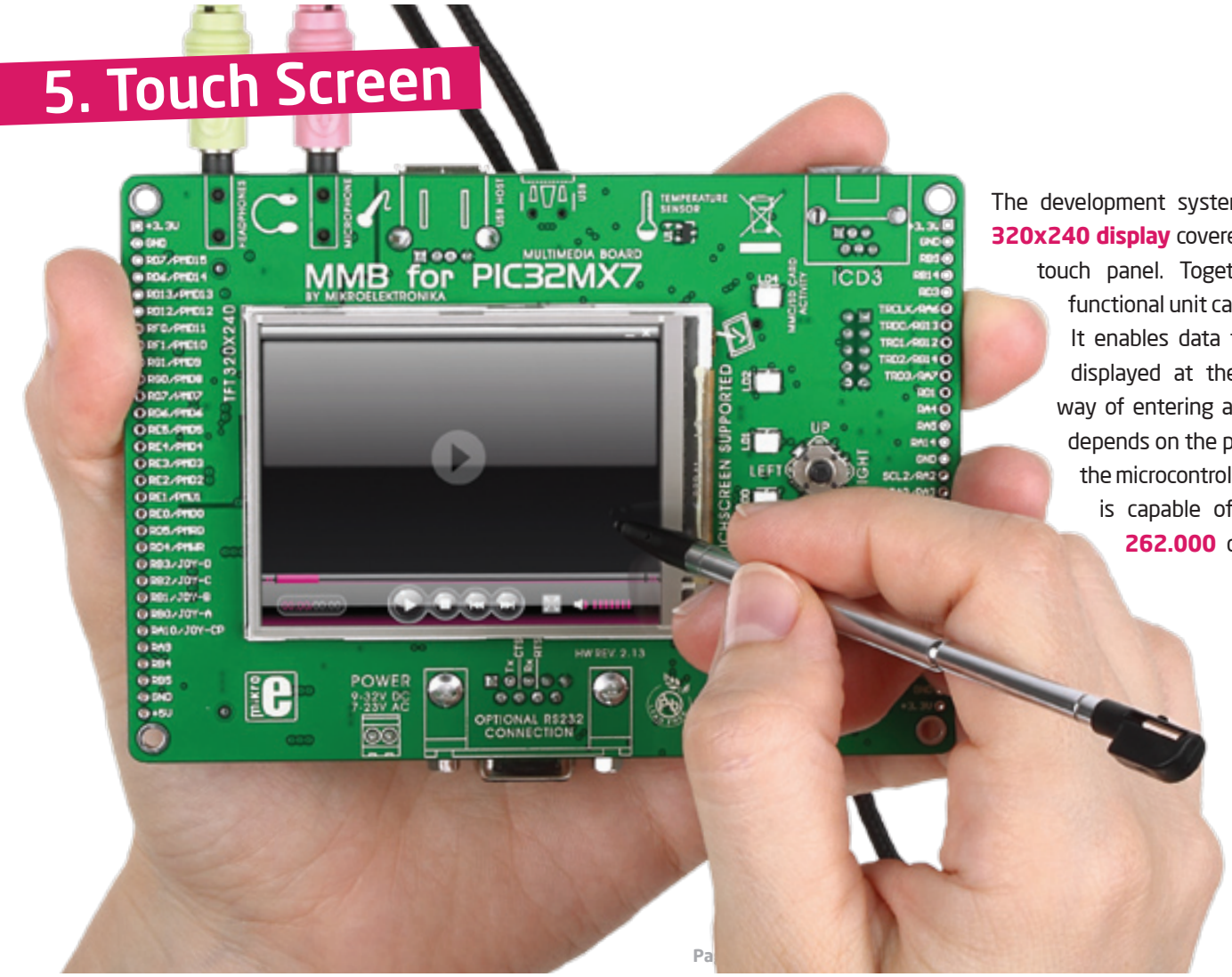



**Figure 4-2: Connectors CN5 and CN10 connection schematic**

**note** *If you accidently erase bootloader program from MCU memory it is possible to load it again with external programer. MMB MX7 USB HID Bootloader v1.10.hex file is located in Firmware sub folder, Page 10.*

# 5. Touch Screen




The development system features a **TFT 320x240 display** covered with a **resistive** touch panel. Together they form a functional unit called a touch screen. It enables data to be entered and displayed at the same time. The way of entering and displaying data depends on the program loaded into the microcontroller. The TFT display is capable of showing data in **262.000** different **colors**.

**Figure 5-1: Touch Screen**

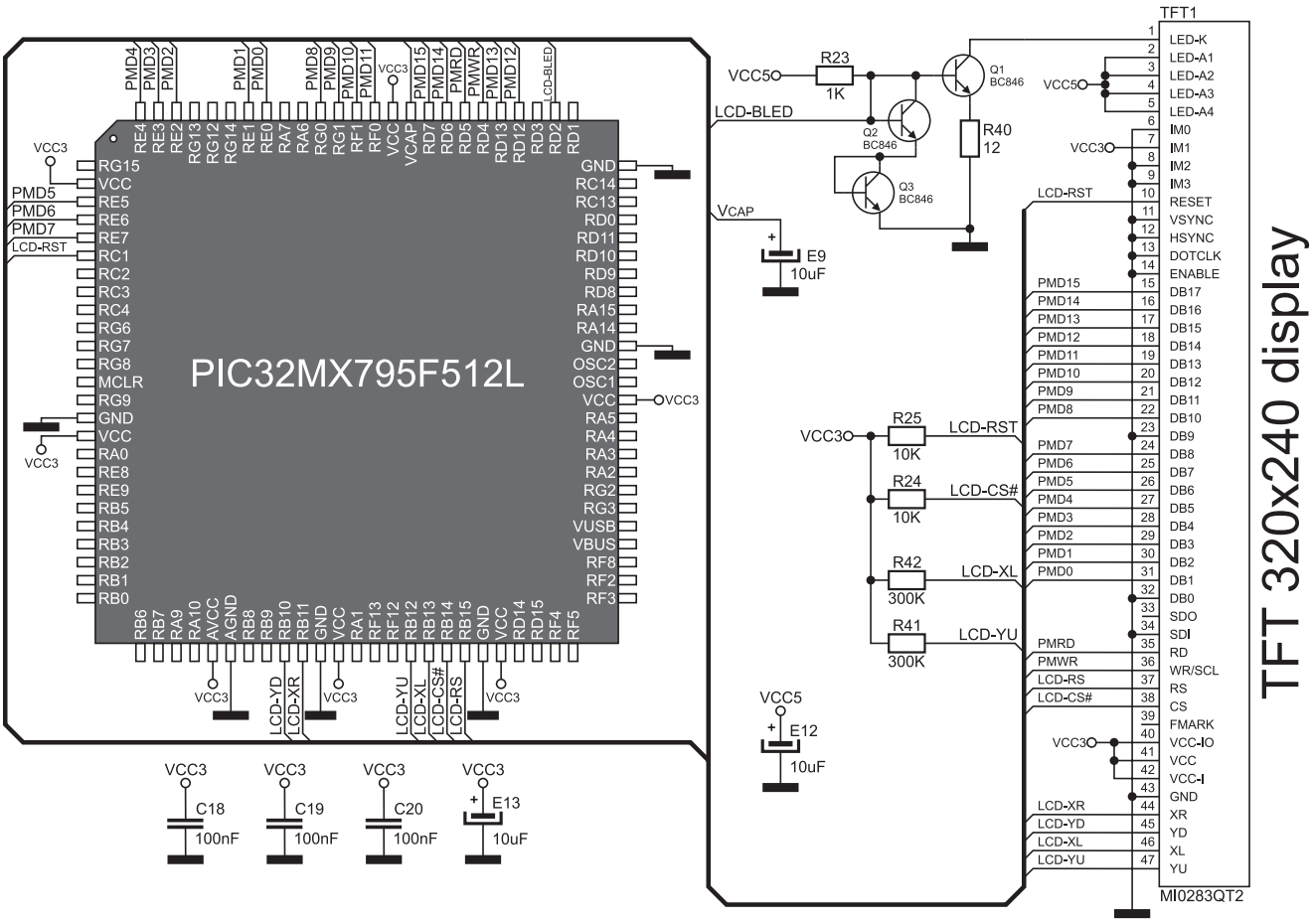



**Figure 5-2: Touch Screen connection schematic**

# 6. Temperature sensor

The built in temperature sensor (MCP9700A) is capable for measuring temperature in range between **-40** and **+125°C** with accuracy of **+/-2°C**. Temperature sensor is attached to MCU via pin **RB8** (TEMP).

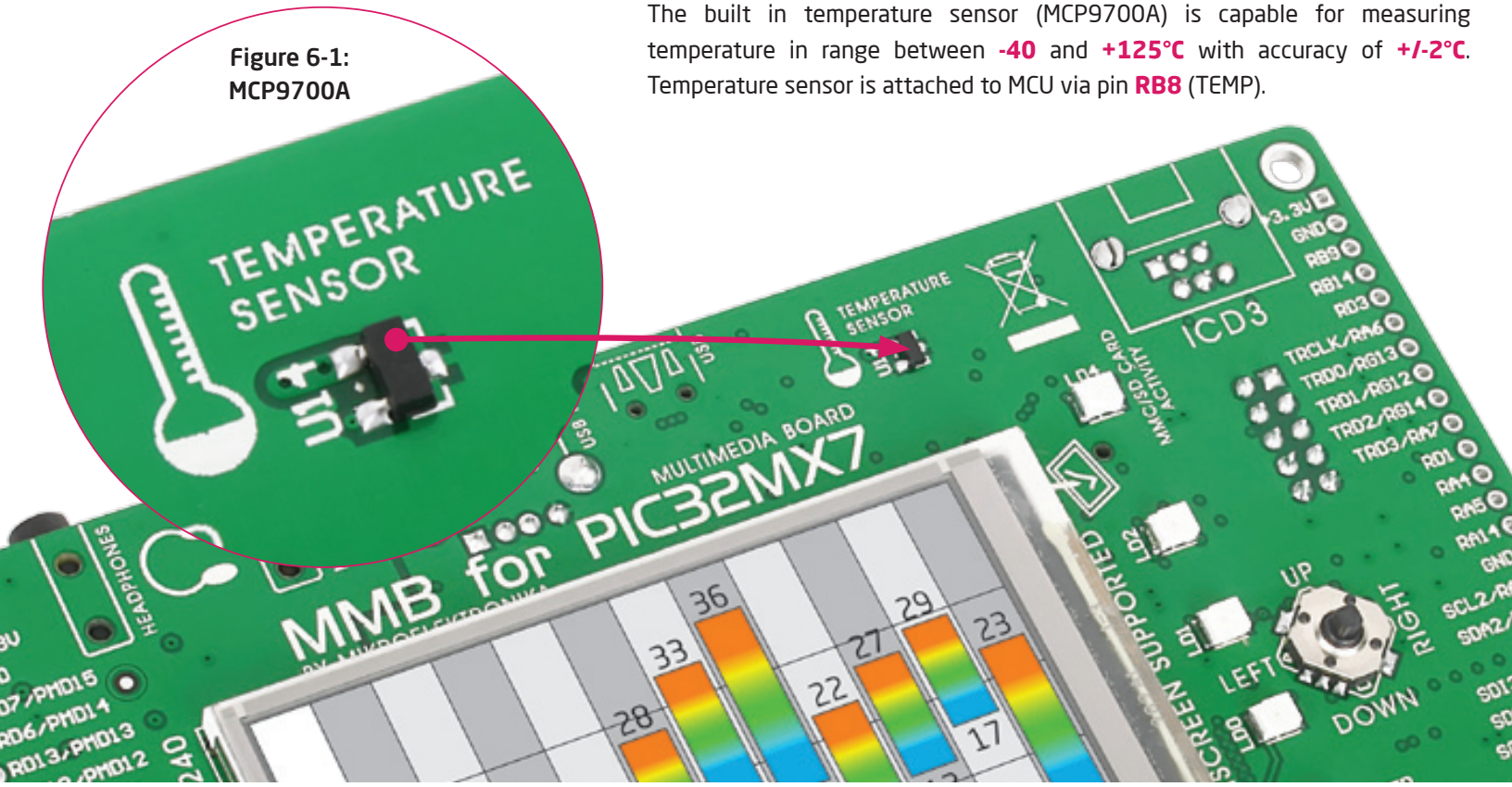



**Figure 6-1: MCP9700A**

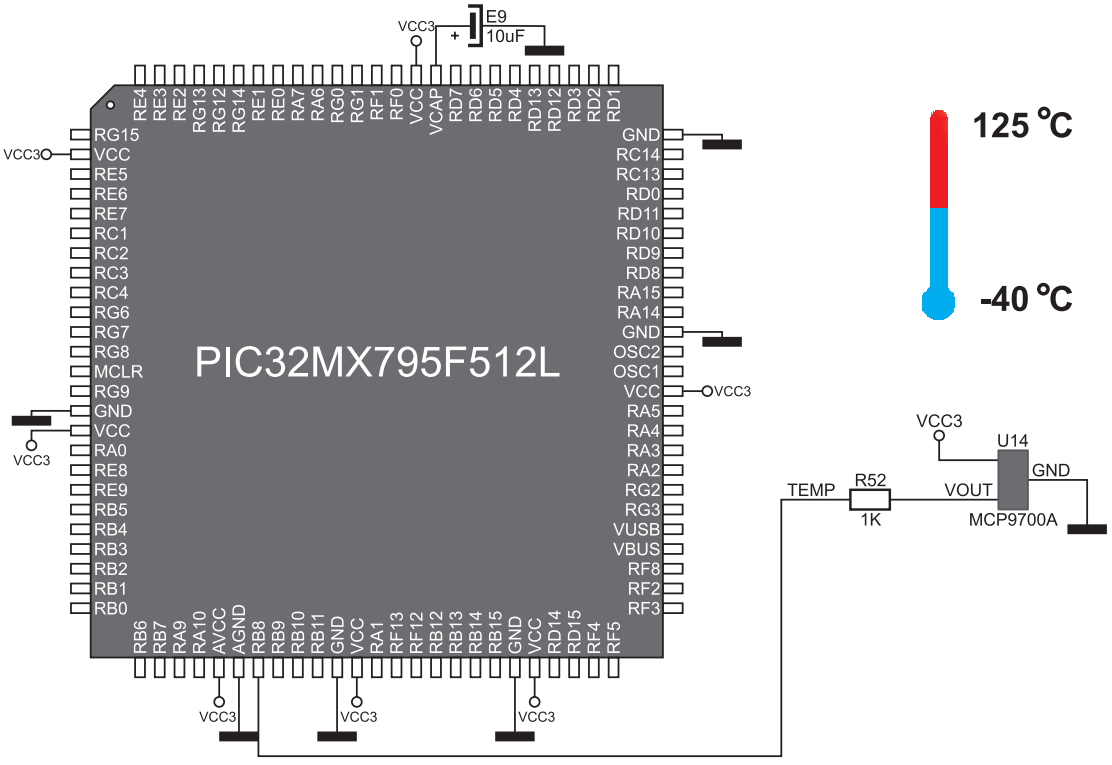



**Figure 6-2: Temperature sensor connection schematic**

# 7. Flash Memory

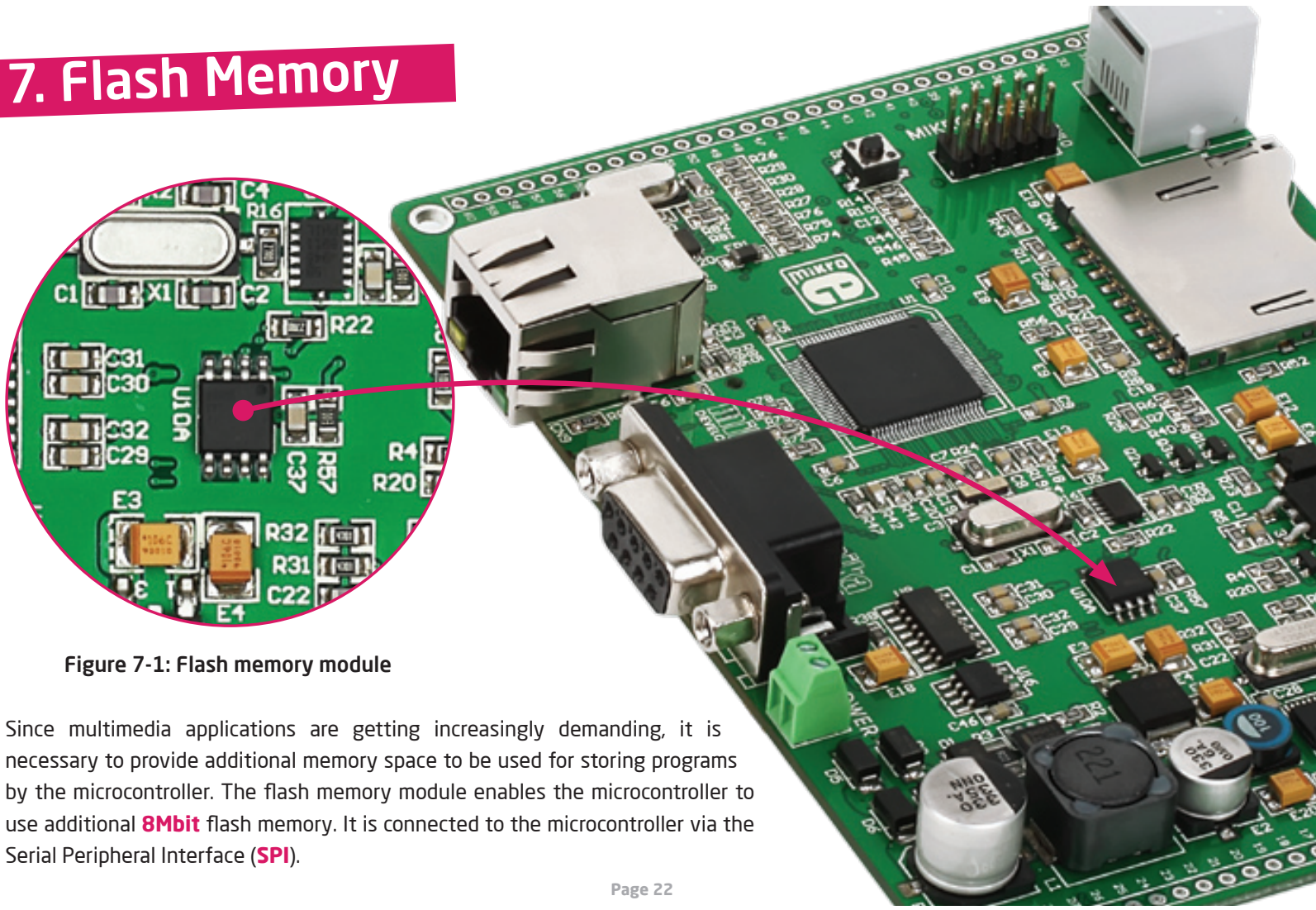



**Figure 7-1: Flash memory module**

Since multimedia applications are getting increasingly demanding, it is necessary to provide additional memory space to be used for storing programs by the microcontroller. The flash memory module enables the microcontroller to use additional **8Mbit** flash memory. It is connected to the microcontroller via the Serial Peripheral Interface (**SPI**).

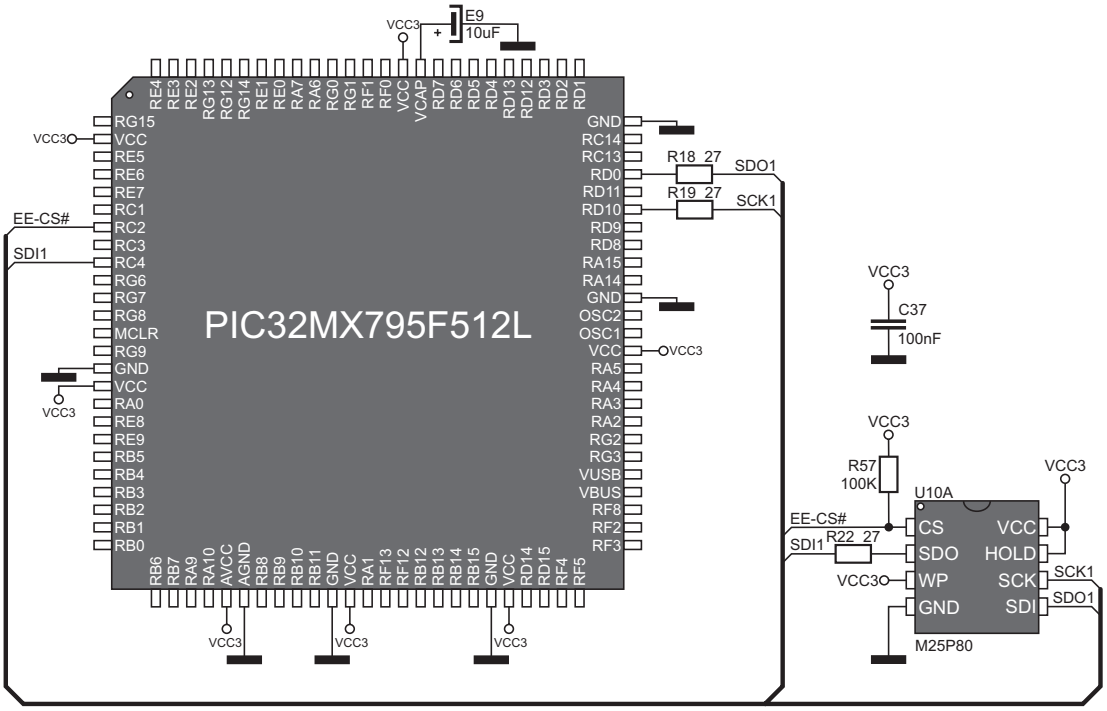



**Figure 7-2: Flash memory module connection schematic**

# 8. EEPROM Memory

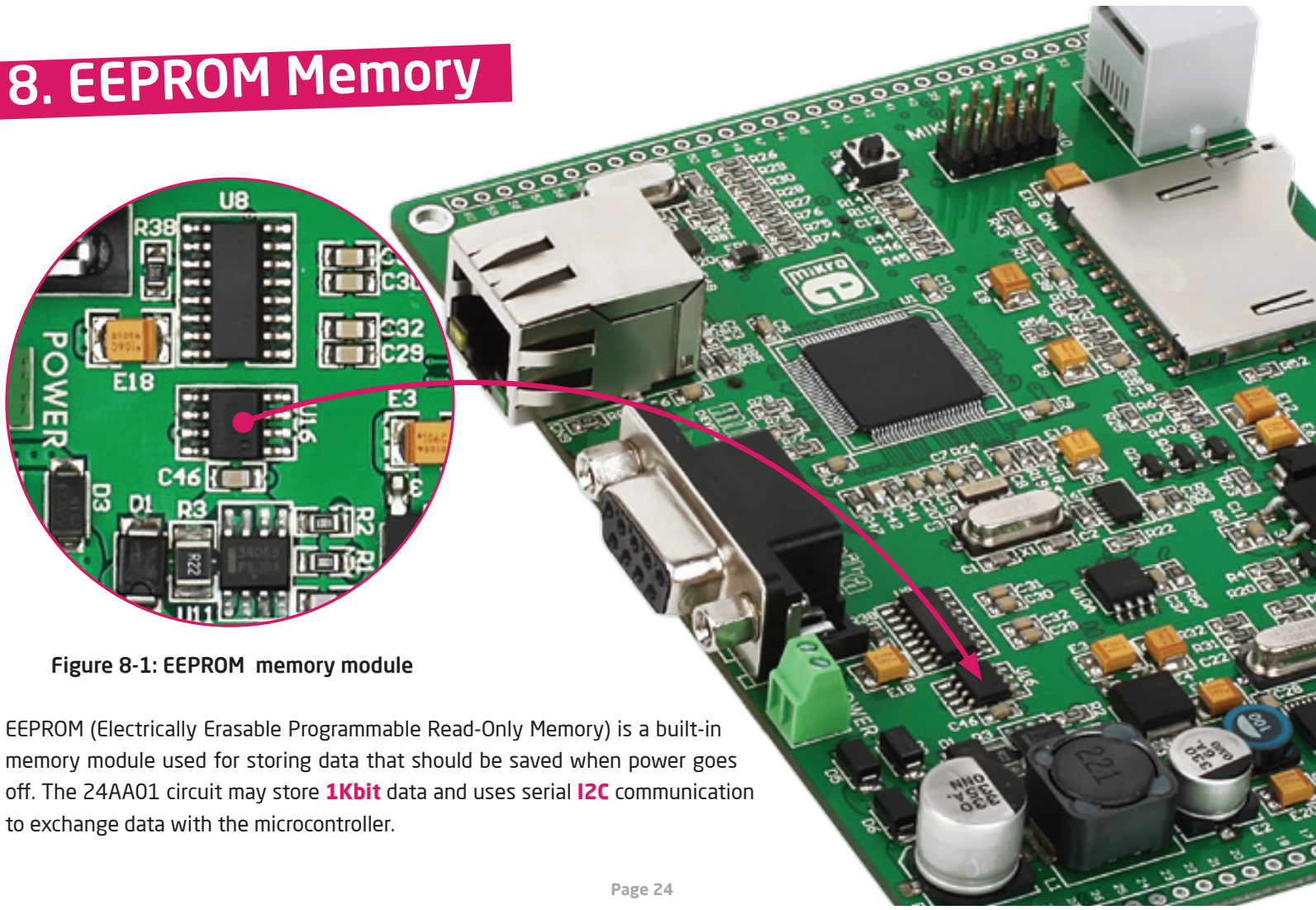



**Figure 8-1: EEPROM memory module**

EEPROM (Electrically Erasable Programmable Read-Only Memory) is a built-in memory module used for storing data that should be saved when power goes off. The 24AA01 circuit may store **1Kbit** data and uses serial **I2C** communication to exchange data with the microcontroller.

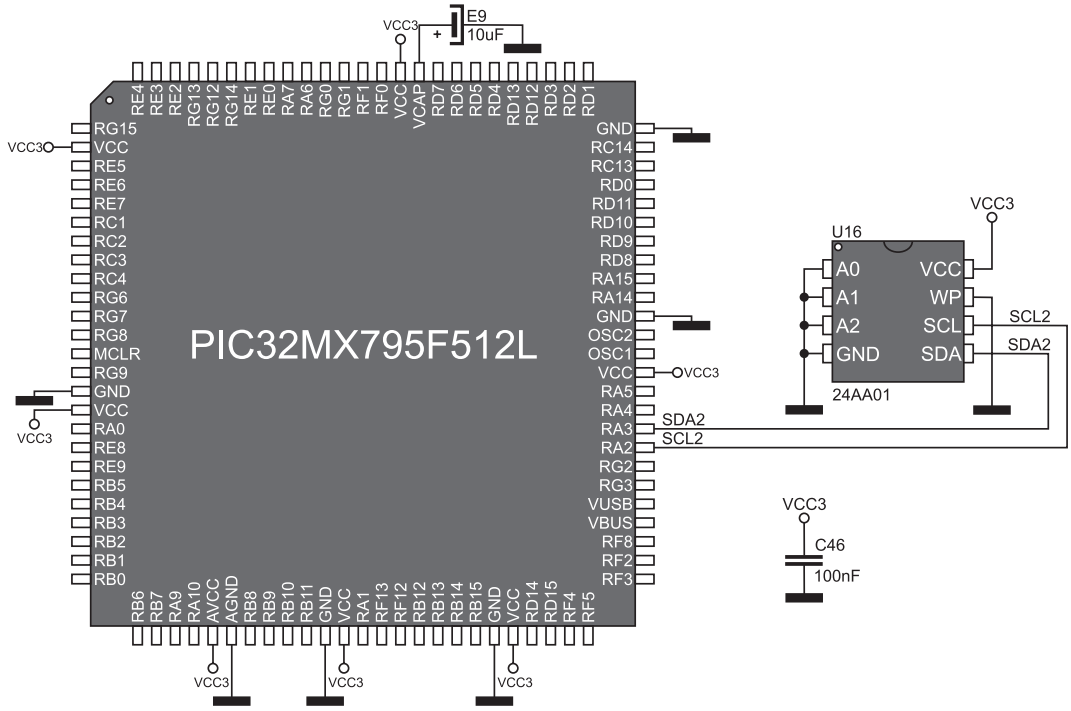



**Figure 8-2: EEPROM memory module connection schematic**

# 9. MMC/SD Card Slot


Figure 9-1: Inserting microSD card

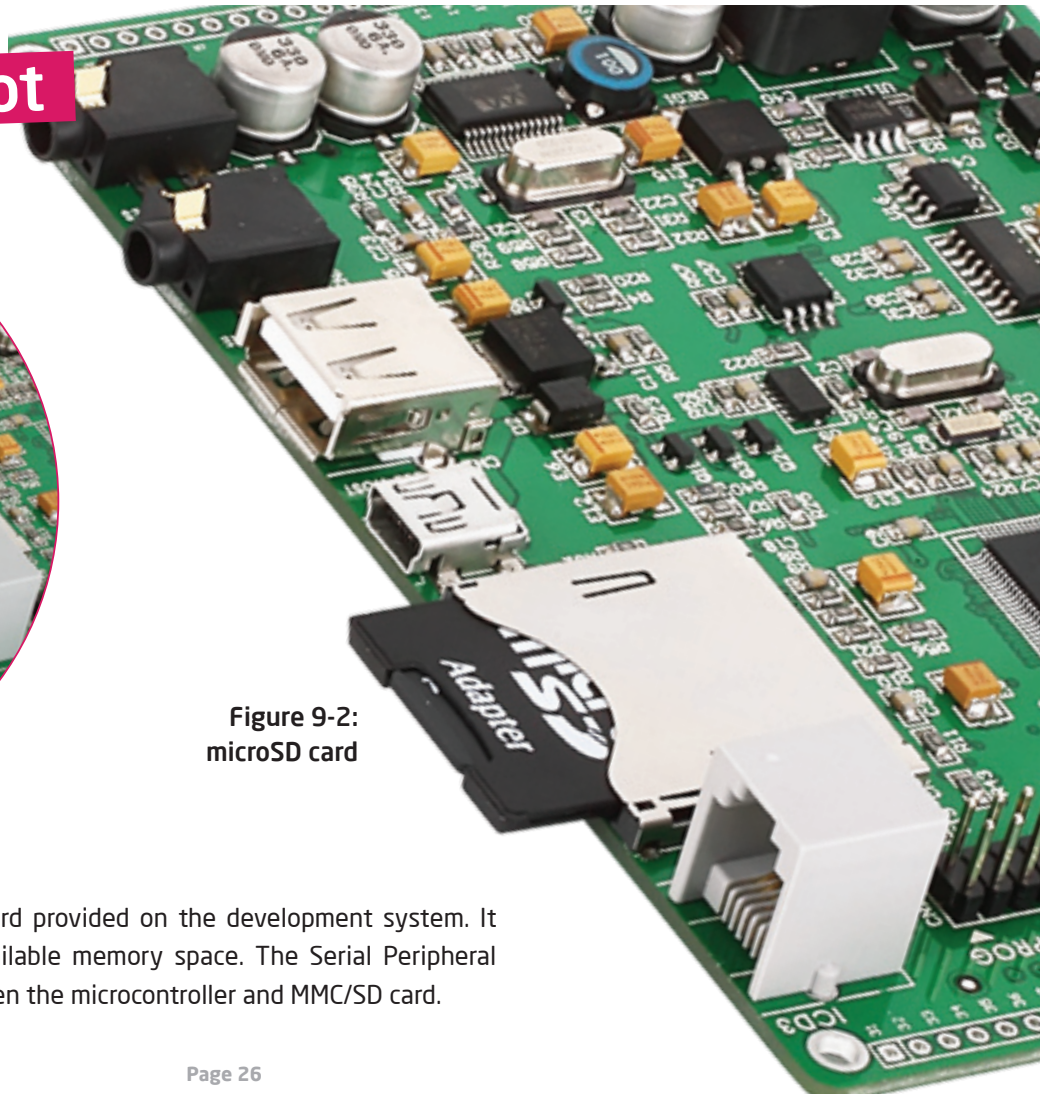



Figure 9-2: microSD card

There is a built-in **MMC/SD** slot for MMC/SD card provided on the development system. It enables the system to additionally expand available memory space. The Serial Peripheral Interface (**SPI**) is used for communication between the microcontroller and MMC/SD card.

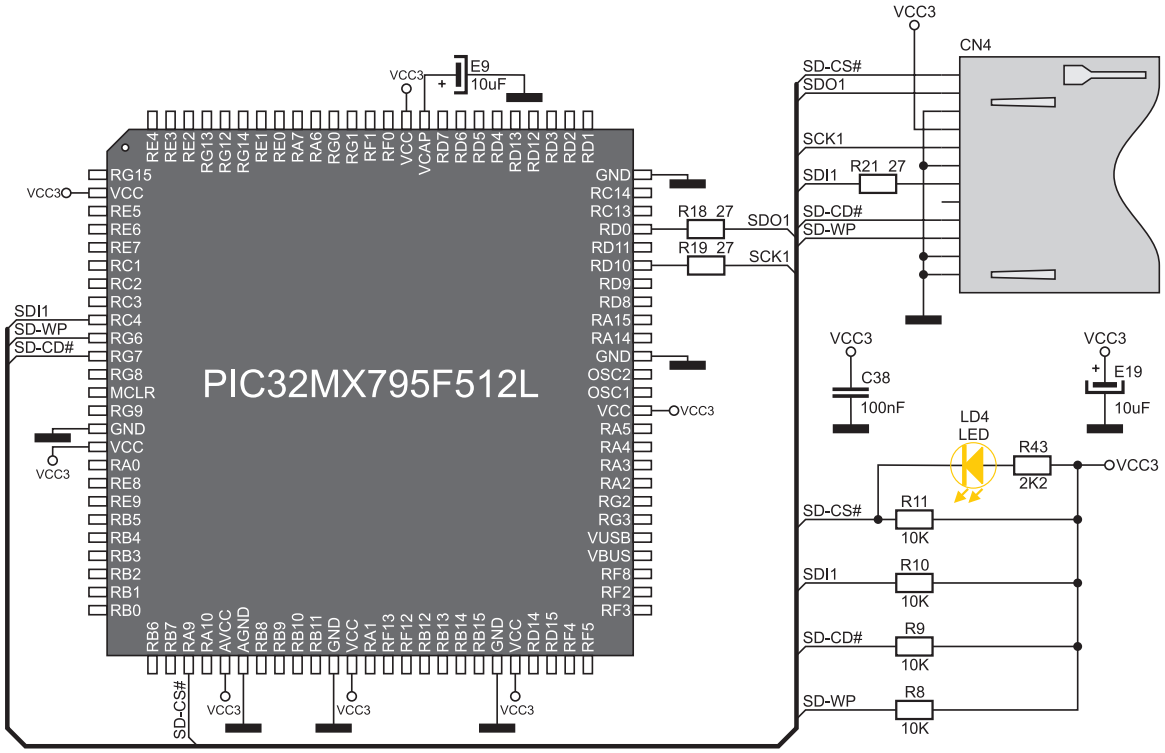



**Figure 9-3: MMC/SD slot connecting schematic**

# 10. Audio Module

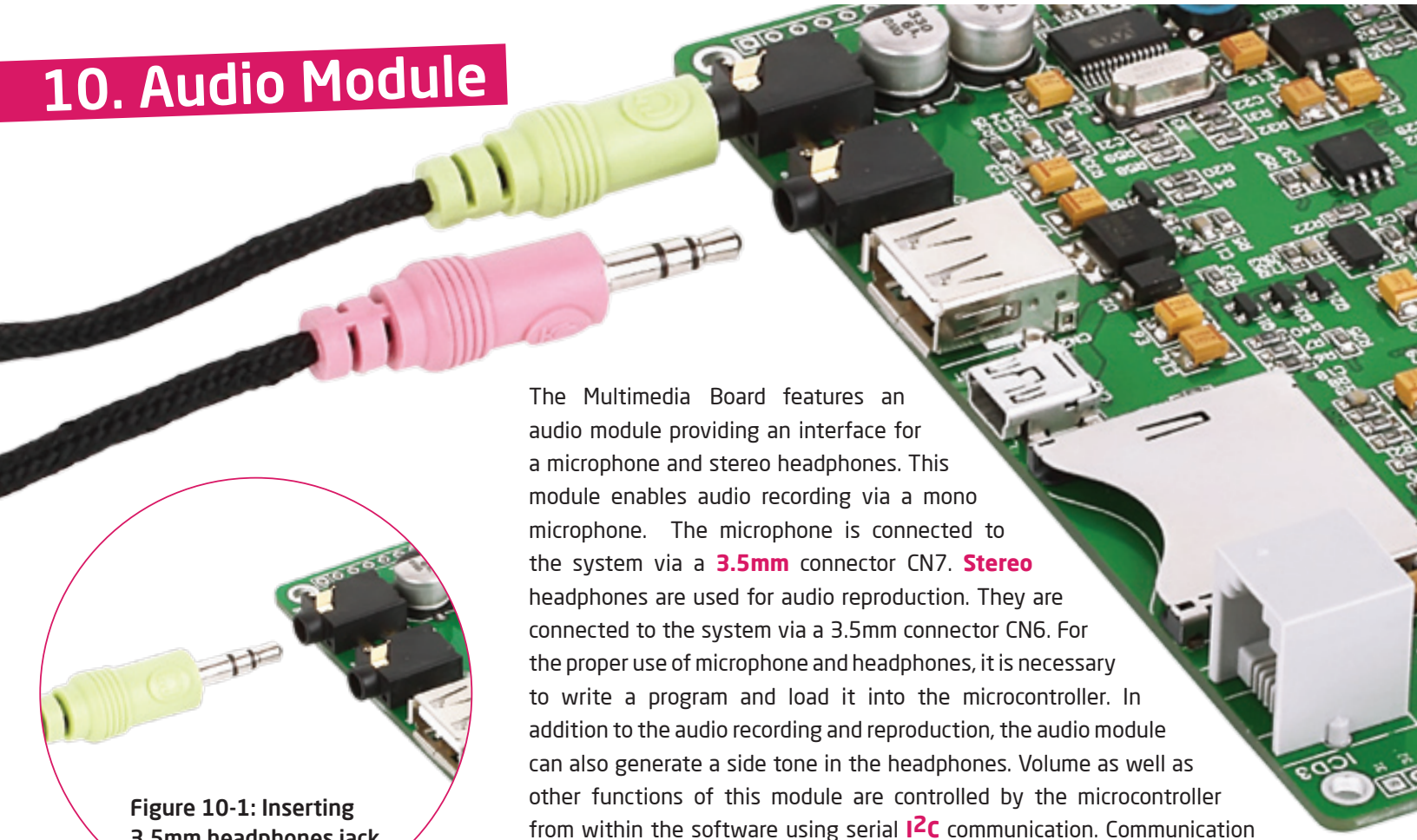




**Figure 10-1: Inserting 3.5mm headphones jack**

The Multimedia Board features an audio module providing an interface for a microphone and stereo headphones. This module enables audio recording via a mono microphone. The microphone is connected to the system via a **3.5mm** connector CN7. **Stereo** headphones are used for audio reproduction. They are connected to the system via a 3.5mm connector CN6. For the proper use of microphone and headphones, it is necessary to write a program and load it into the microcontroller. In addition to the audio recording and reproduction, the audio module can also generate a side tone in the headphones. Volume as well as other functions of this module are controlled by the microcontroller from within the software using serial **I²C** communication. Communication between the audio module and the microcontroller is performed via the Serial Peripheral Interface (**SPI**).

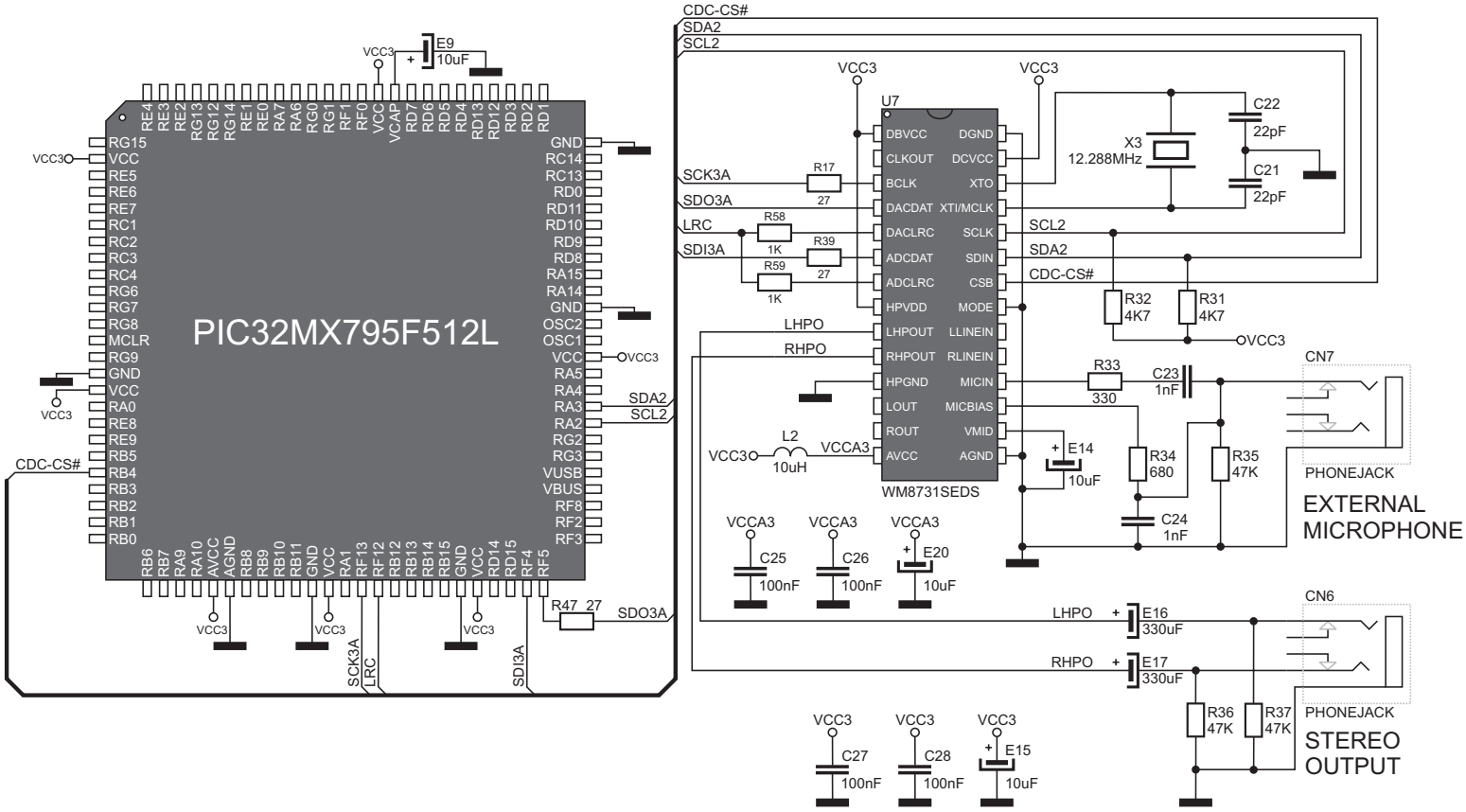



**Figure 10-2: Audio module connecting schematic**

# 11. Joystick

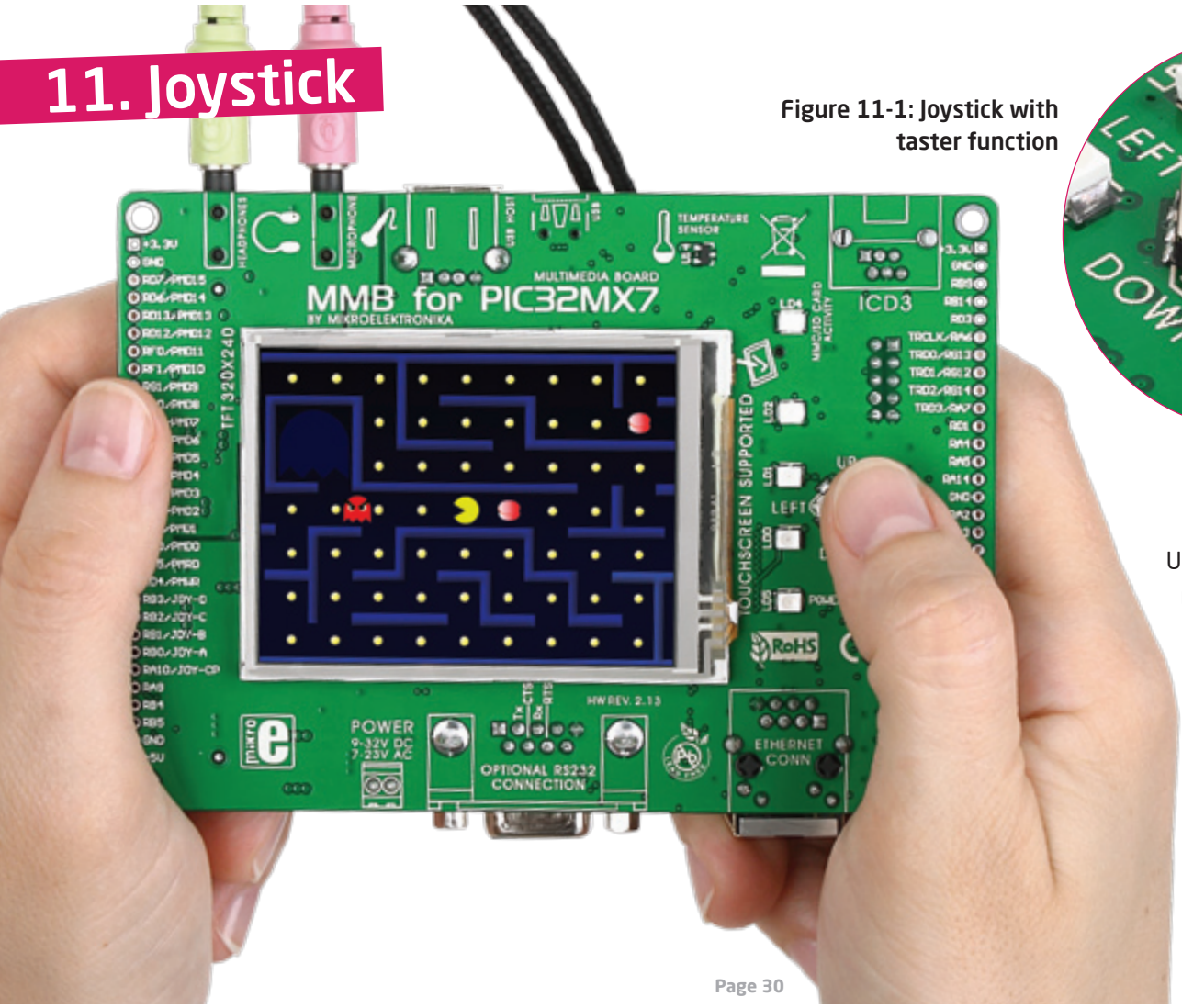
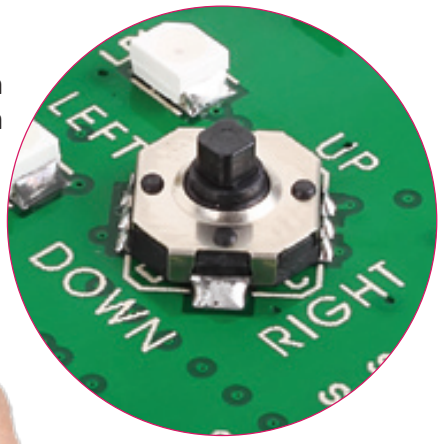



**Figure 11-1: Joystick with taster function**




Use built-in **joystick** to make simple games, menus and other applications that requires movement in four directions with **taster** function (when joystick is pressed).

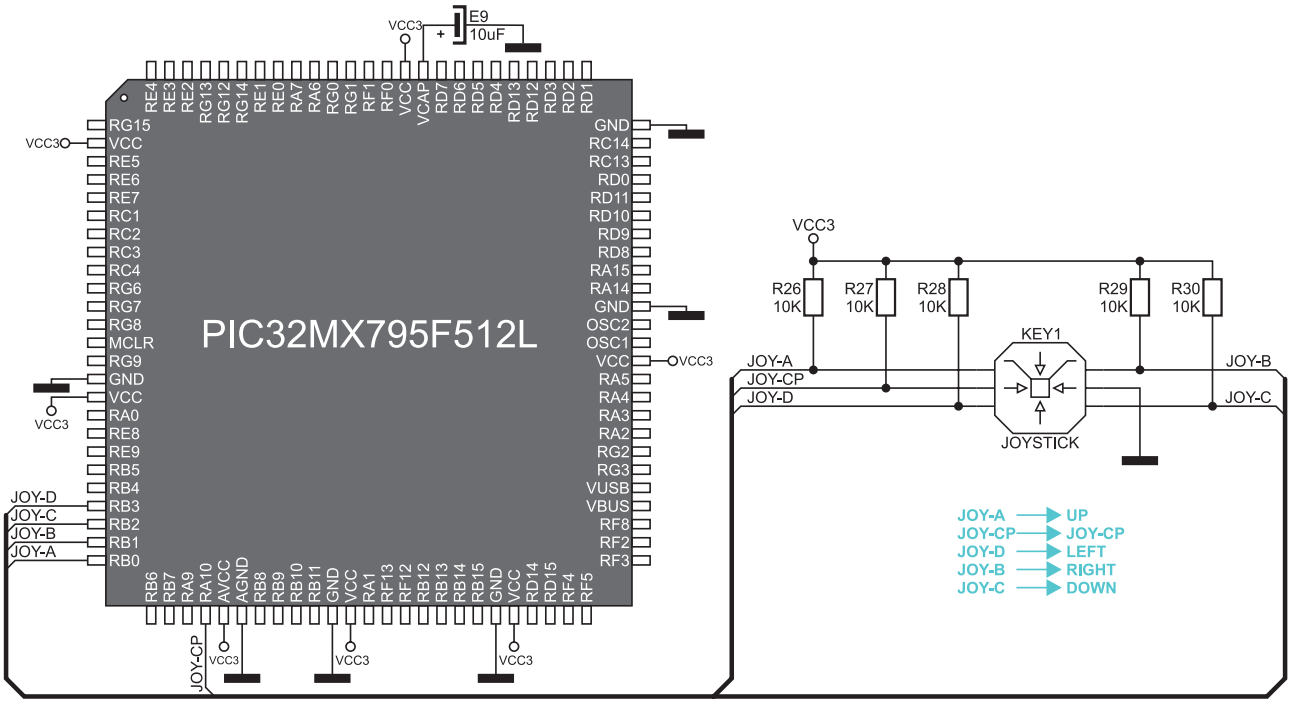



**Figure 11-2: Joystick connecting schematic**

# 12. USB connectors

MultiMedia Board for PIC32MX7 have two USB connectors: USB MINIB and USB HOST.

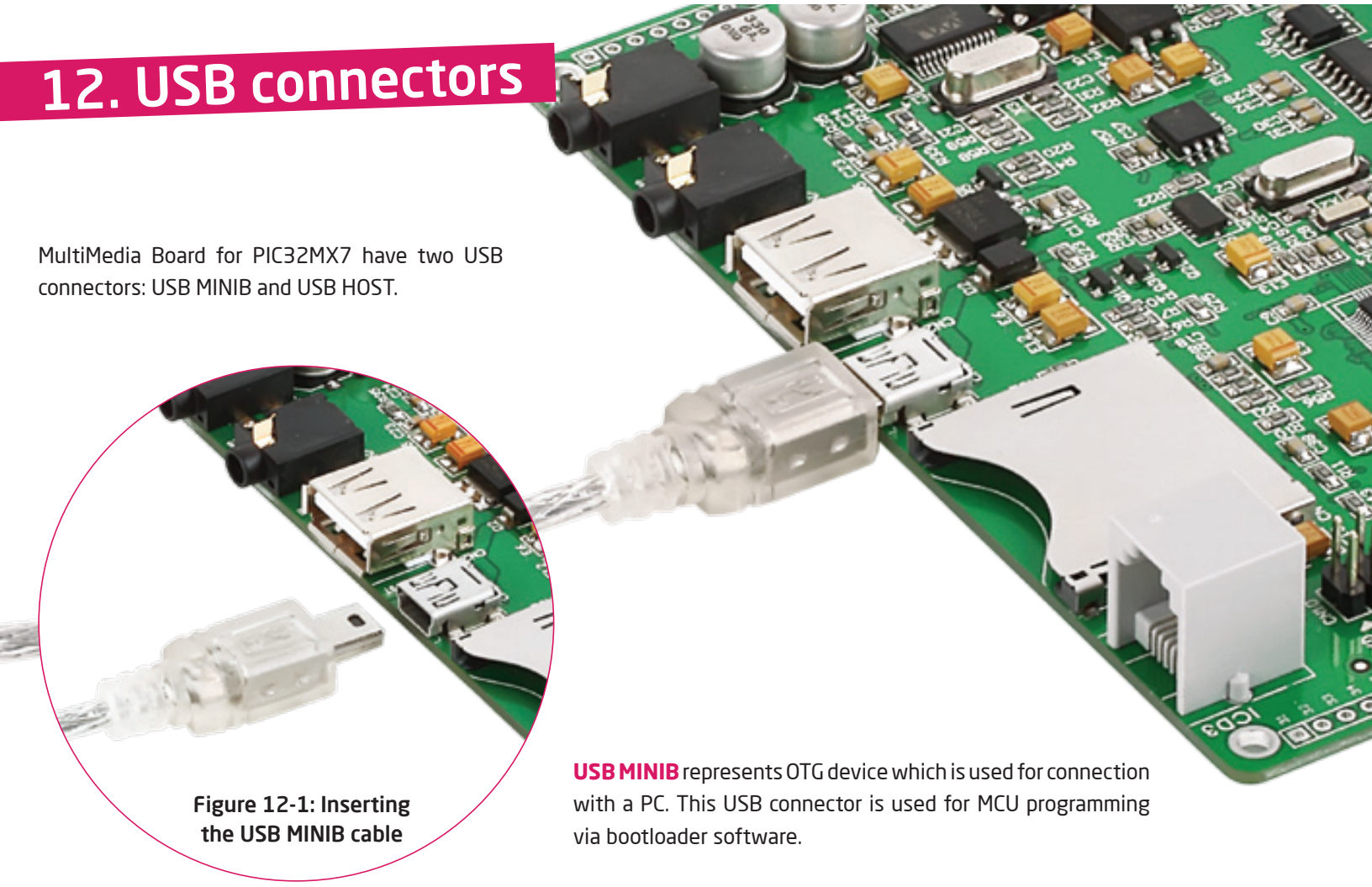


**Figure 12-1: Inserting the USB MINIB cable**

**USB MINIB** represents OTG device which is used for connection with a PC. This USB connector is used for MCU programming via bootloader software.

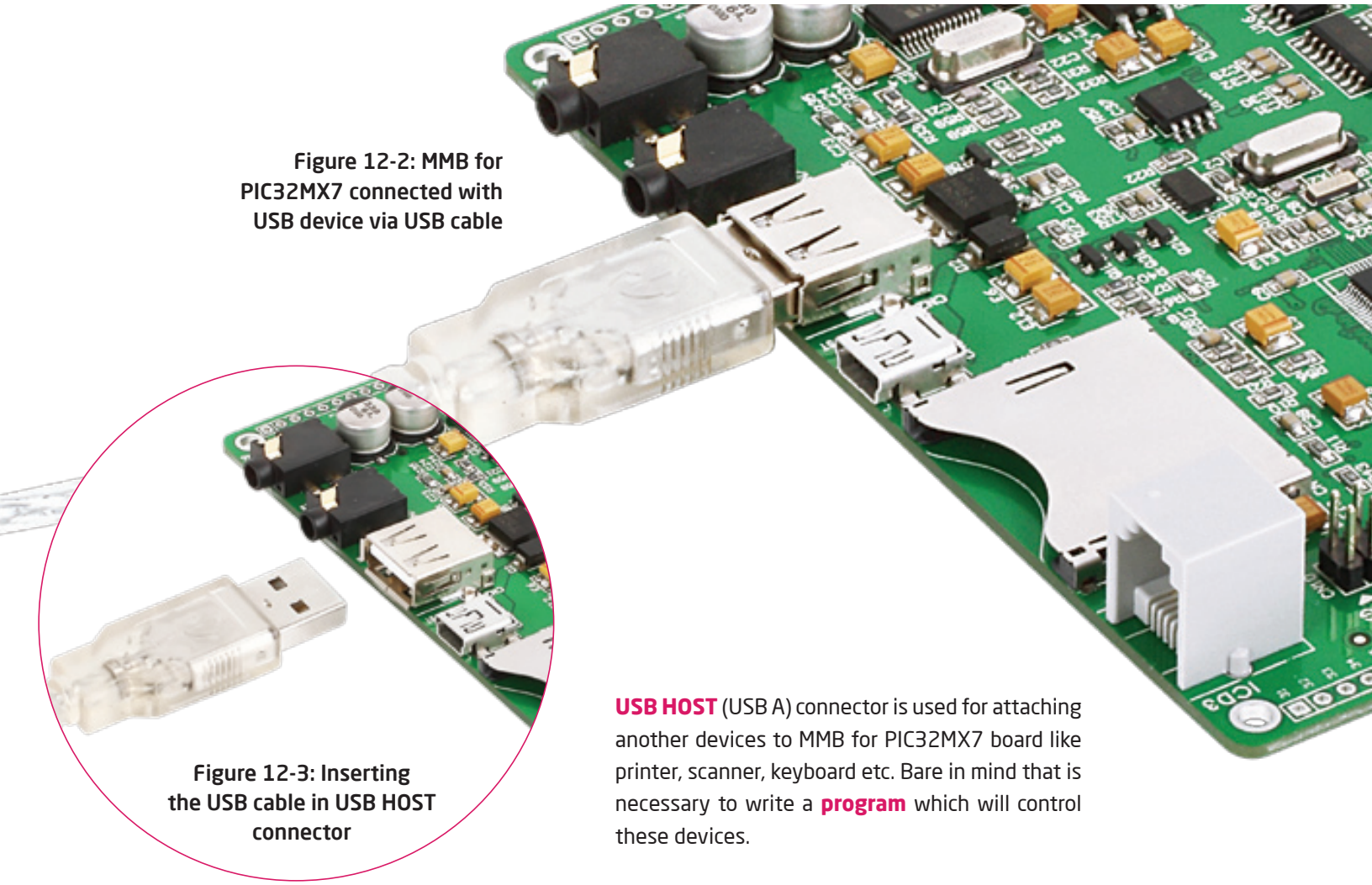


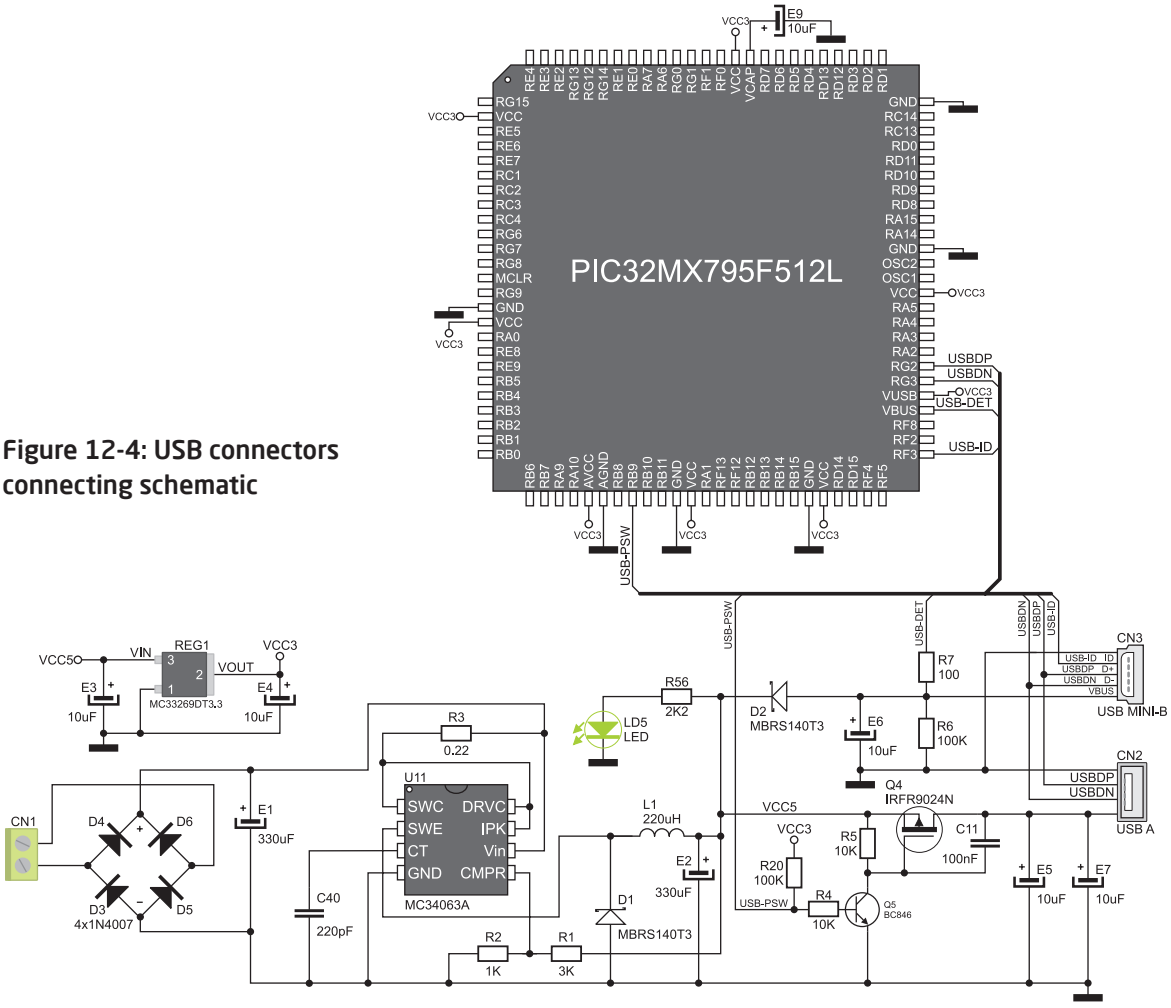
Figure 12-2: MMB for PIC32MX7 connected with USB device via USB cable



Figure 12-3: Inserting the USB cable in USB HOST connector

**USB HOST** (USB A) connector is used for attaching another devices to MMB for PIC32MX7 board like printer, scanner, keyboard etc. Bare in mind that is necessary to write a **program** which will control these devices.

**Figure 12-4: USB connectors connecting schematic**



# 13. Indication LEDs

An **LED** (Light-Emitting Diode) is a highly efficient electronic source of light. When connecting LEDs, it is necessary to use a current limiting resistor. A common LED diode voltage is approximately 2.5V, while the current varies from 1 to 20mA depending on the type of LED. The Multimedia Board uses LEDs with current I=1mA.

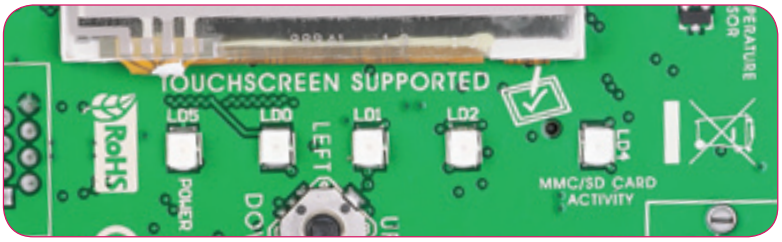
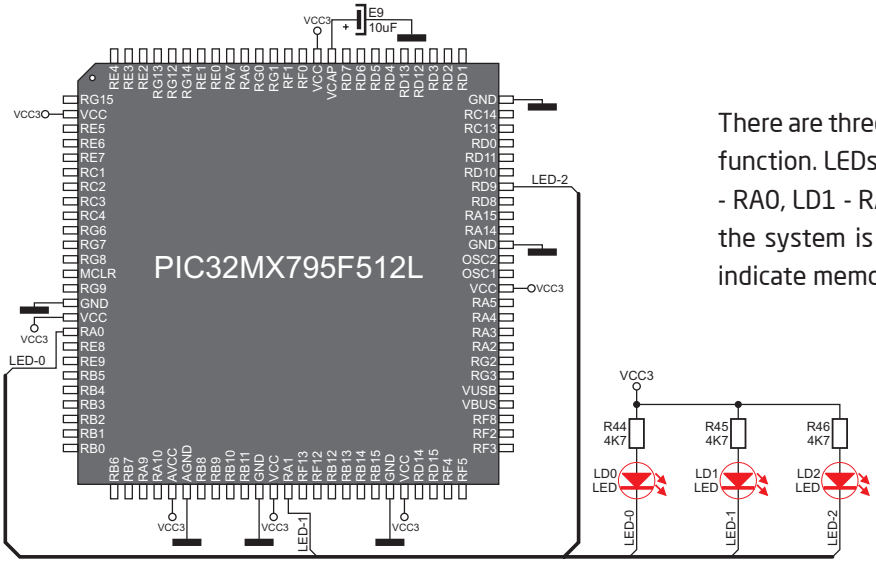



**Figure 13-1: On-board LEDs**




There are three LEDs on the Multimedia Board that can be assigned a signal function. LEDs are connected to the following I/O microcontroller pins: LD0 - RA0, LD1 - RA1 and LD2 - RD9. The LED marked **POWER** indicates when the system is turned on, whereas the diode marked **MMC/SD** is used to indicate memory card activity.

**Figure 13-2: LEDs connecting schematic**

# 14. RS-232 module

The development board features the **RS-232** module which communicates with MCU via UART communication.

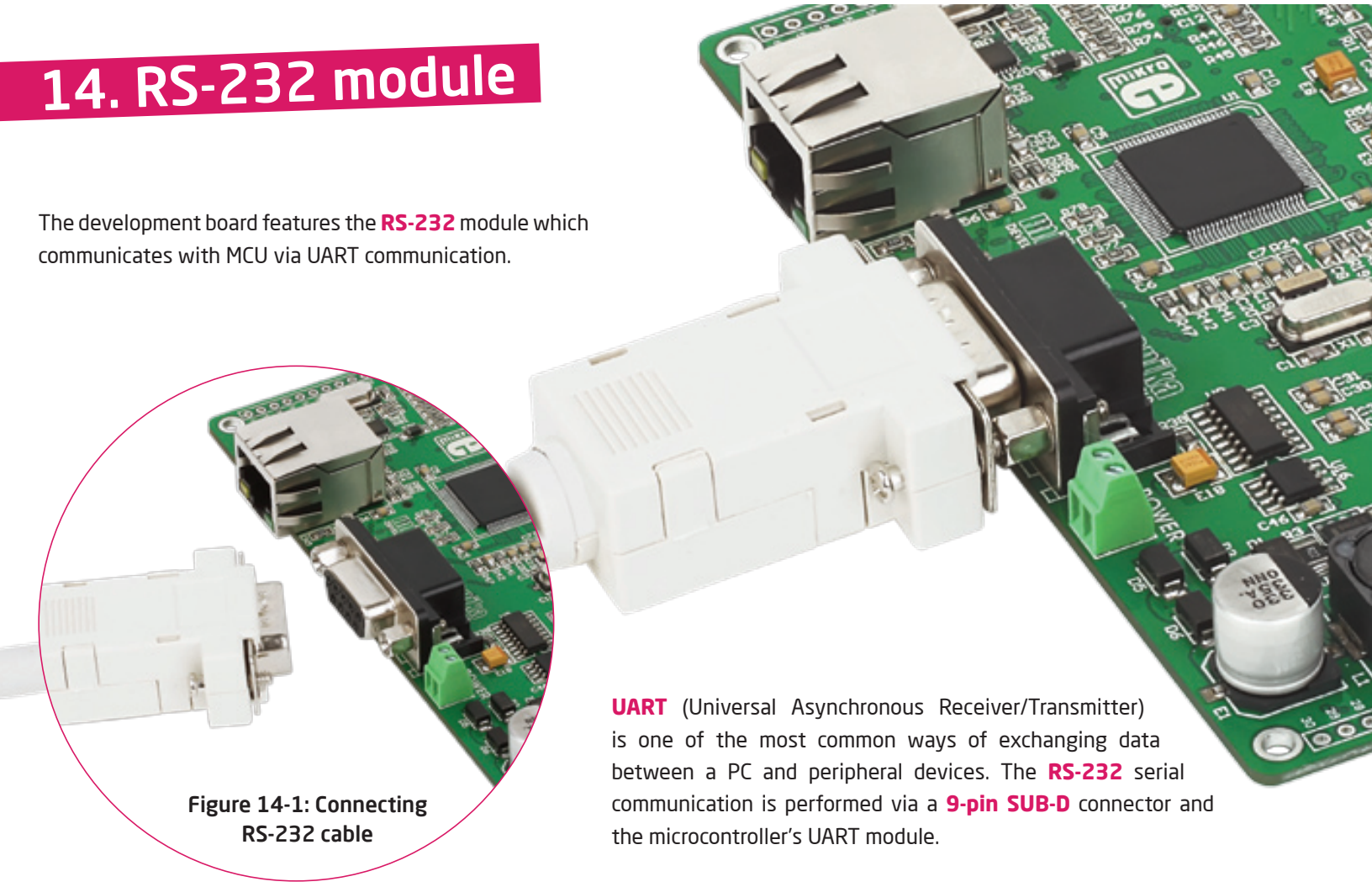


**Figure 14-1: Connecting RS-232 cable**

**UART** (Universal Asynchronous Receiver/Transmitter) is one of the most common ways of exchanging data between a PC and peripheral devices. The **RS-232** serial communication is performed via a **9-pin SUB-D** connector and the microcontroller's UART module.

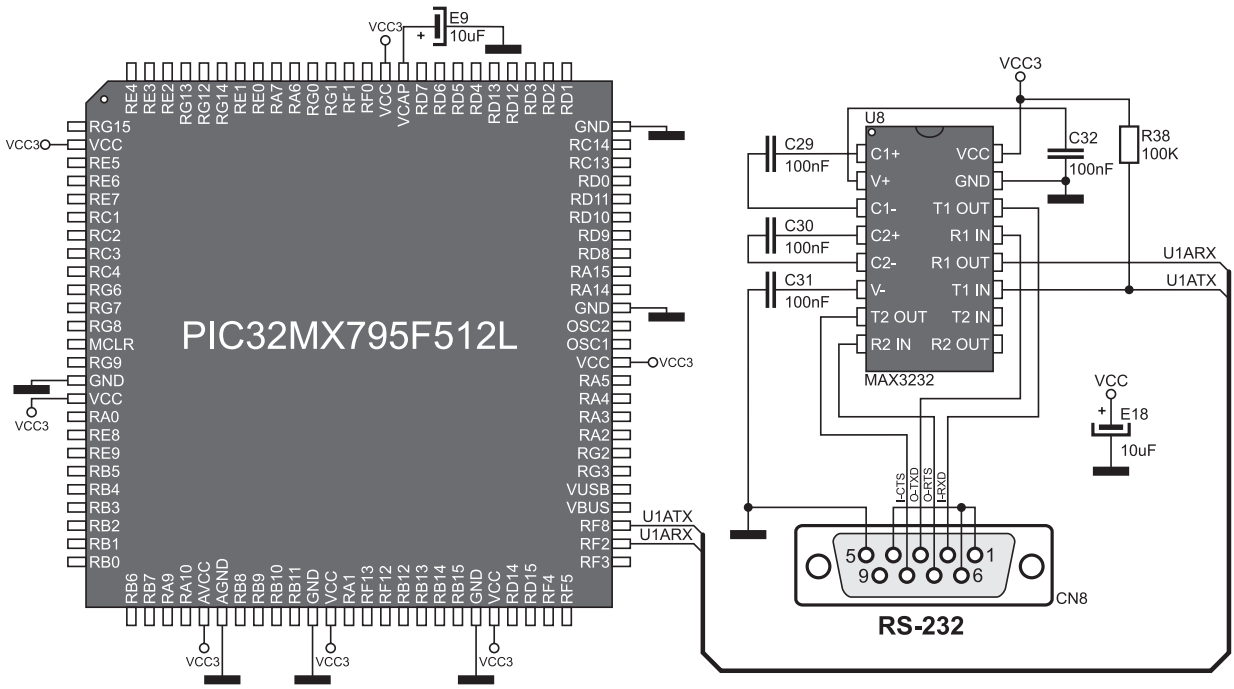



**Figure 14-2: RS-232 module connecting schematic**

# 15. Ethernet module

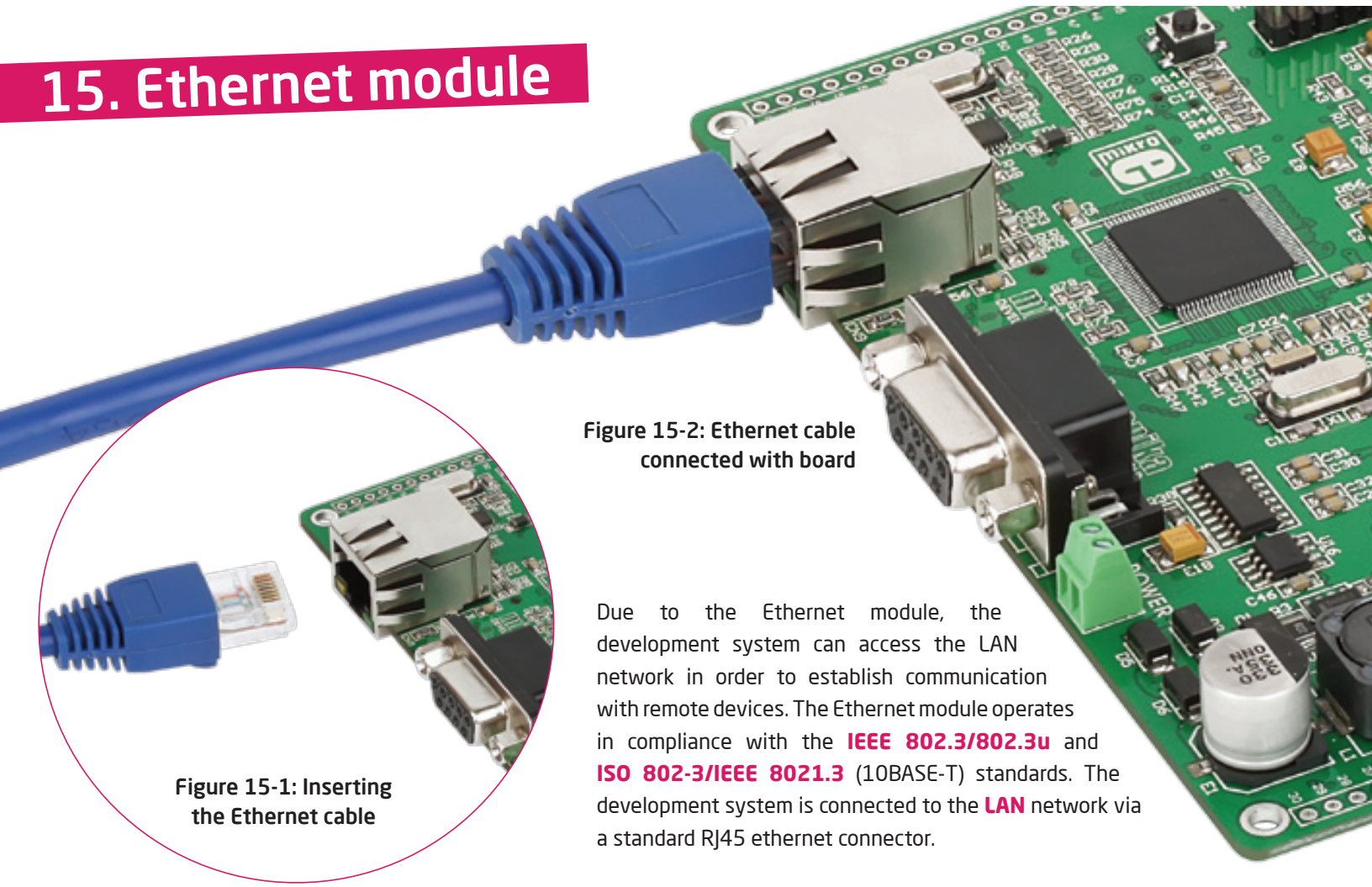


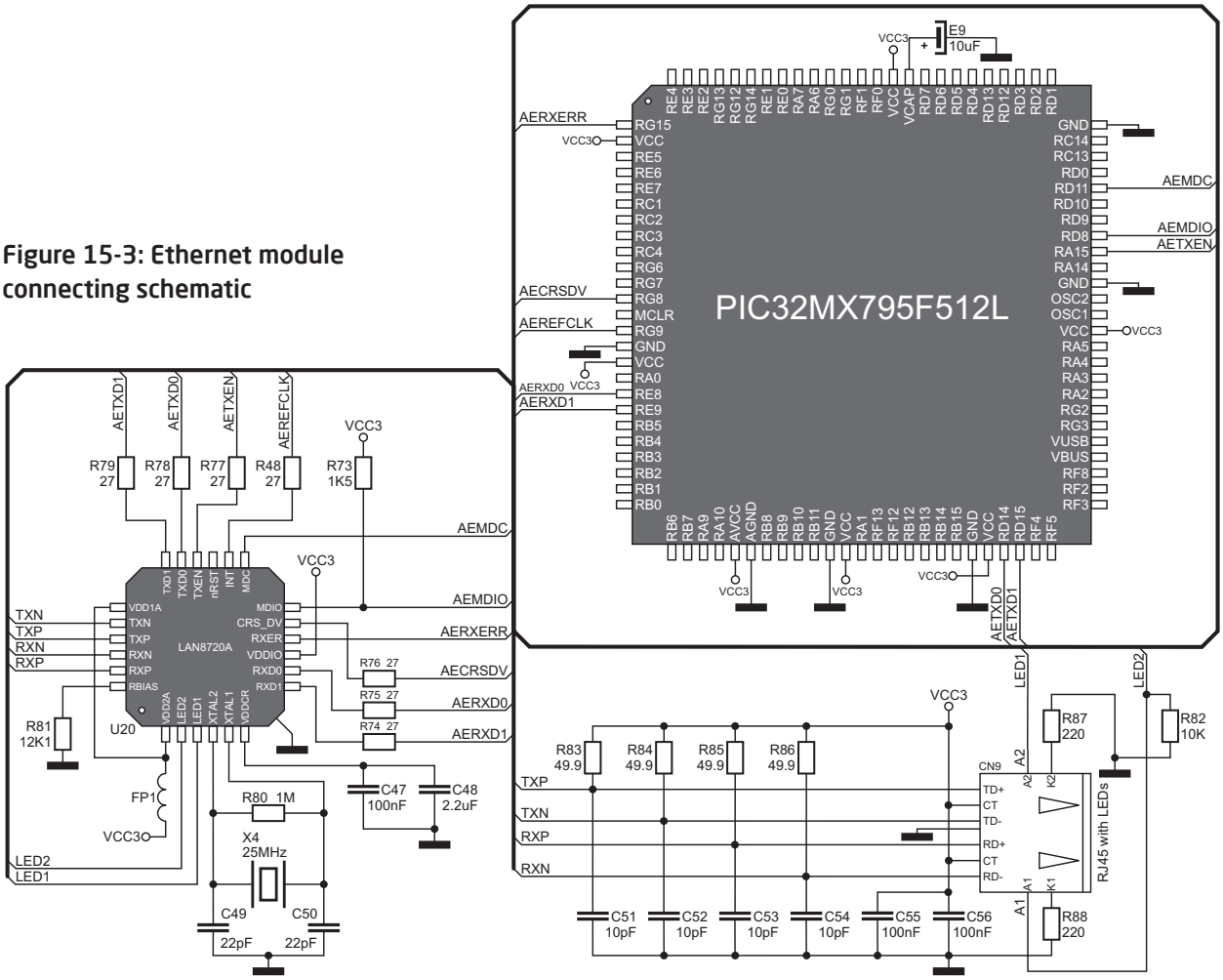
Figure 15-2: Ethernet cable connected with board



Figure 15-1: Inserting the Ethernet cable

Due to the Ethernet module, the development system can access the LAN network in order to establish communication with remote devices. The Ethernet module operates in compliance with the **IEEE 802.3/802.3u** and **ISO 802-3/IEEE 8021.3** (10BASE-T) standards. The development system is connected to the **LAN** network via a standard RJ45 ethernet connector.

**Figure 15-3: Ethernet module connecting schematic**



# 16. Accelerometer

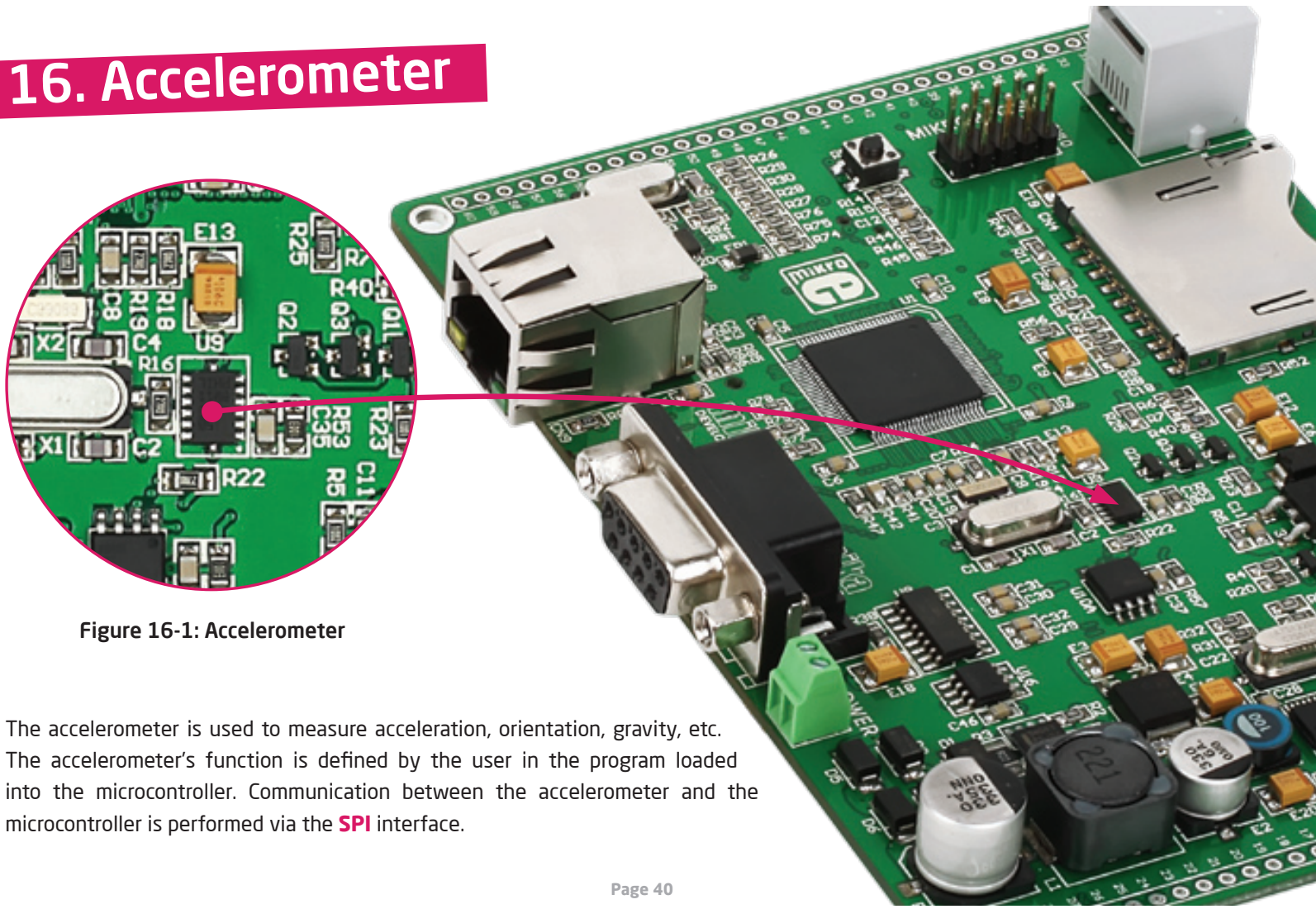



**Figure 16-1: Accelerometer**

The accelerometer is used to measure acceleration, orientation, gravity, etc. The accelerometer's function is defined by the user in the program loaded into the microcontroller. Communication between the accelerometer and the microcontroller is performed via the **SPI** interface.

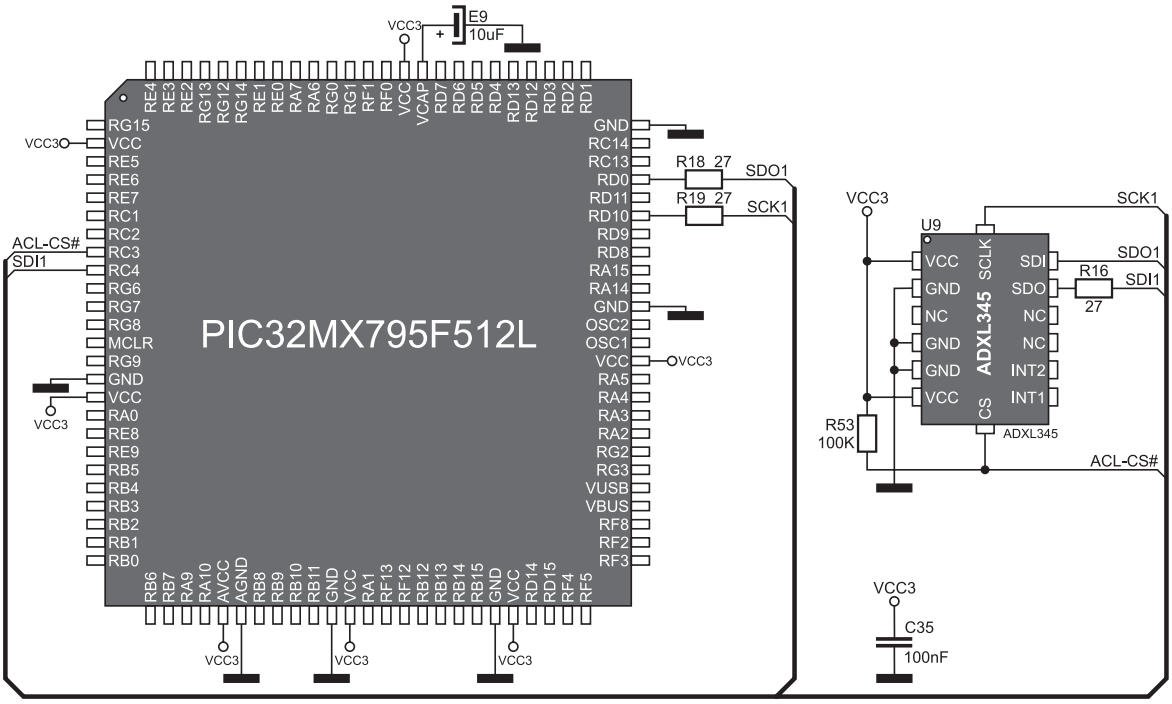



**Figure 16-2: Accelerometer connection schematic**

# 17. Pinout

# 18. Pads

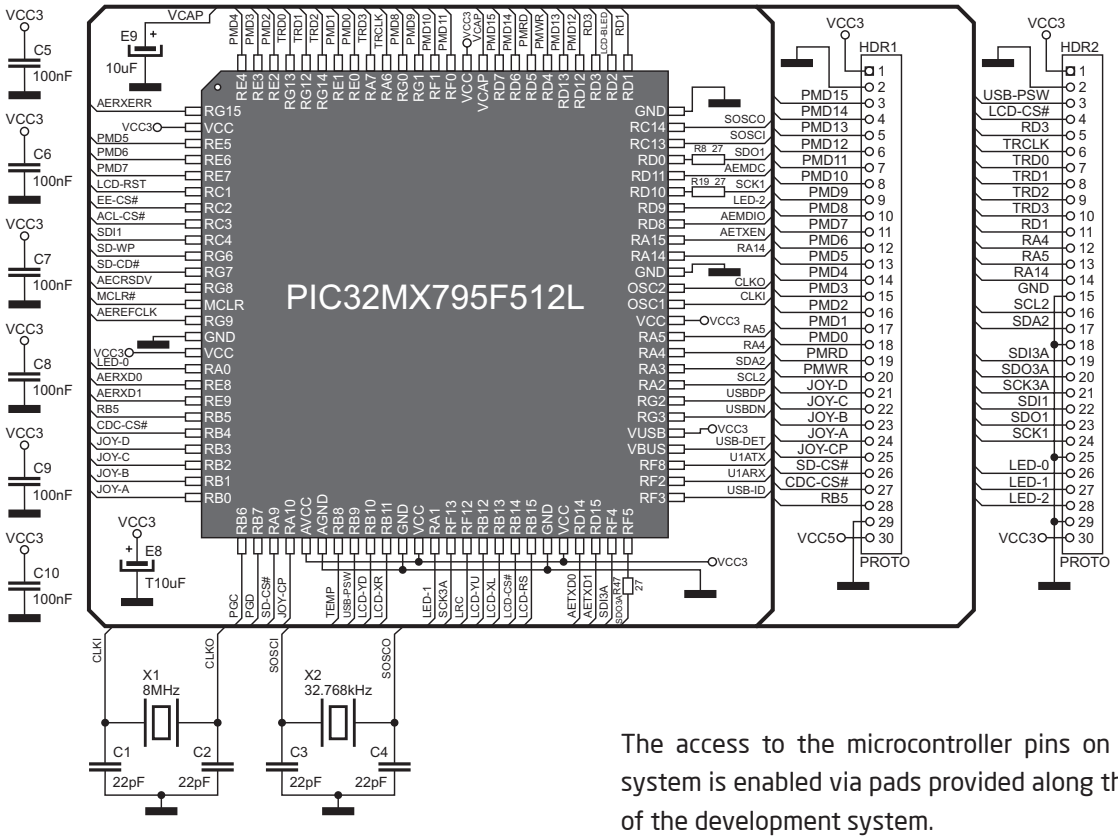
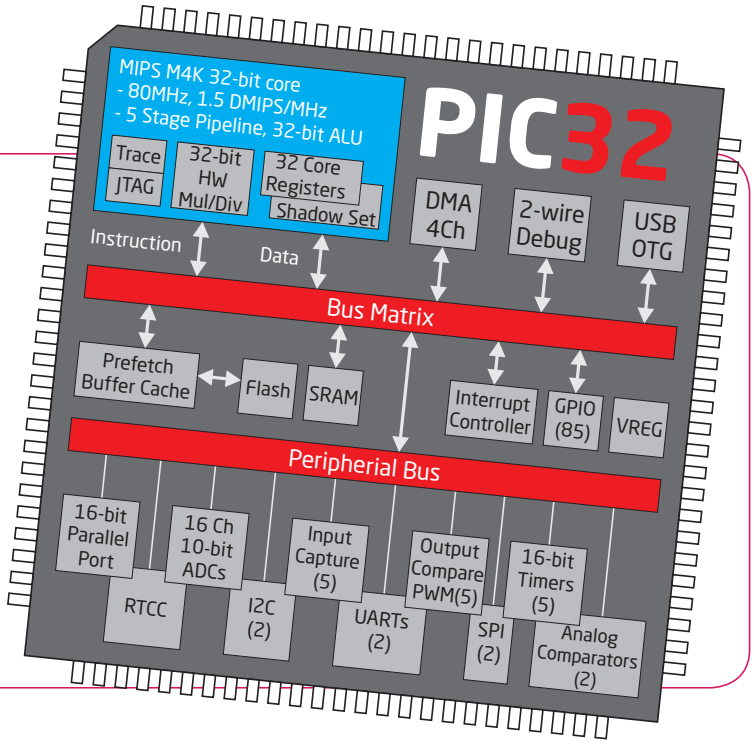



**Figure 18-1: Pads connecting schematic**

The access to the microcontroller pins on the development system is enabled via pads provided along the two short sides of the development system.

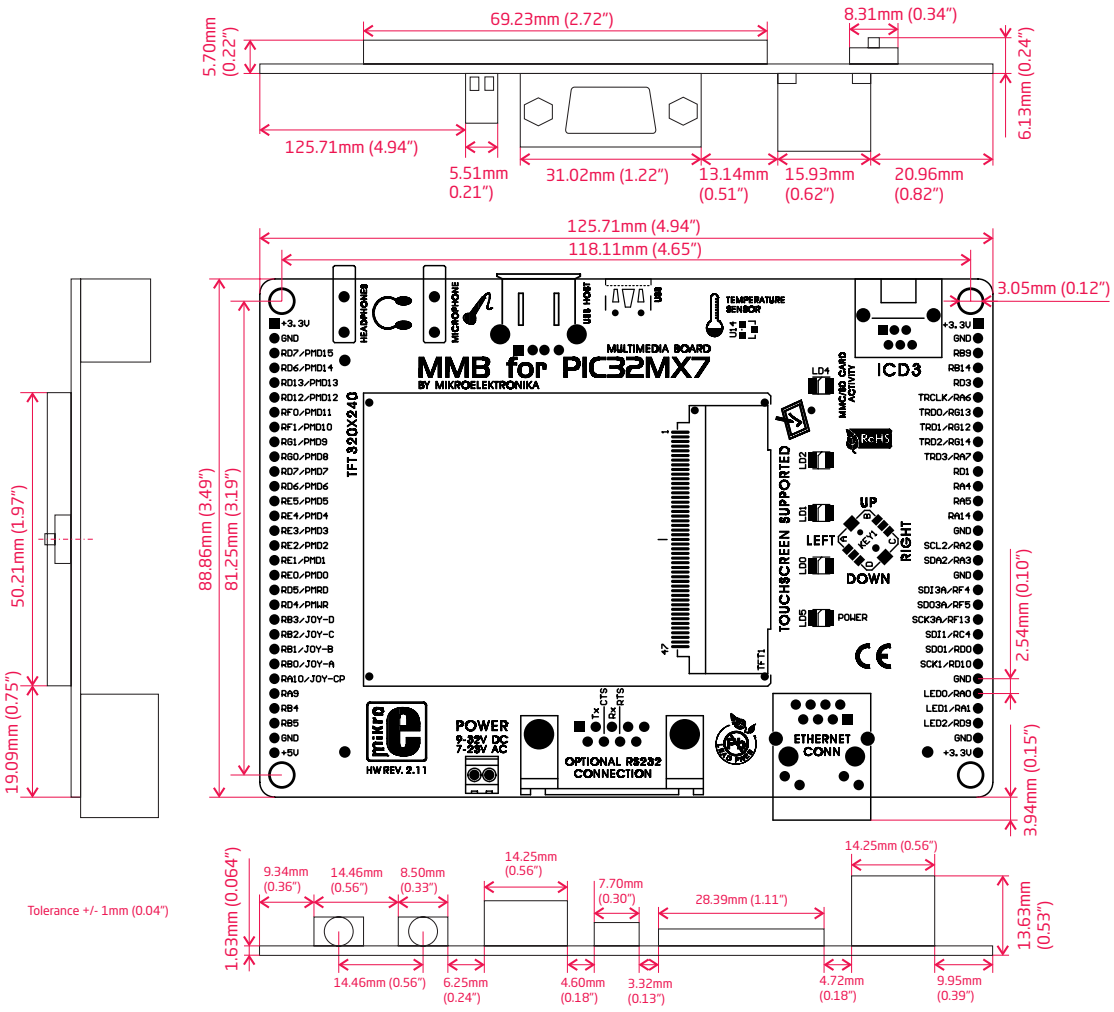
# 19. PIC32MX795F512L Microcontroller

The mikromedia for PIC32 development system comes with the **PIC32MX795F512L** microcontroller. This high-performance **32-bit** microcontroller with its integrated modules and in combination with other on-board modules is ideal for multimedia applications.




## Key microcontroller features

- 1.56 DMIPS/MHz, 32-bit MIPS M4K Core;
- 512K Flash (plus 12K boot Flash);
- 128K RAM (can execute from RAM);
- 85 I/O pins;
- SPI, $I^2C$, A/D;
- 16-bit Digital Timers;
- Internal Oscillator 8MHz, 32kHz;
- RTCC; etc.



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