mikromedia+

for STM32 ARM®

Amazingly compact, all-on-single-pcb development board carring 4.3" TFT Touch Screen and lots of multimedia peripherals, all driven by powerful STM32F407ZG microcontroller from ARM® Cortex™-M4 family

MikroElektronika
DEVELOPMENT TOOLS | COMPILERS | BOOKS

ARM cortex

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 mikromedia+ for STM32 ARM®

The **mikromedia+ for STM32 ARM®** is a compact development system with lots of on-board peripherals which allow development of devices with multimedia contents. The central part of the system is a 32-bit **ARM® Cortex™-M4 STM32F407ZG** 144-pin microcontroller. The mikromedia+ for STM32 ARM® features integrated modules such as stereo MP3 codec, **4.3" TFT 480x272** touch screen display, accelerometer, microSD card slot, buzzer, IR receiver, RGB LED diode, PIN photodiode, temperature sensor, 2.4GHz RF transceiver, Ethernet transceiver, 8 Mbit flash memory, RTC battery, Li-Polimer battery charger etc. The board also contains MINI-B USB connector, power screw terminals, 2x5 JTAG connector, two 1x26 connection pads, ON/OFF switch and other. It comes pre-programmed with USB HID bootloader, but can also be programmed with external programmers, such as **mikroProg™ for STM32** or ST-LINK programmer. Mikromedia is compact and slim, and perfectly fits in the palm of your hand, which makes it a convenient platform for mobile and other multimedia devices. We have also prepared a **mikromedia+ SHIELD for STM32 ARM®** extension board which enables you to easily expand the functionality of your board.

System Specification

power supply

Via USB cable (5V DC) or via screw terminals (5-12V DC)

power consumption

38 mA with erased MCU

(when on-board modules are inactive)

board dimensions

119.54 x 78 mm (4.71 x 3.07 inch)

weight

~112 g (0.247 lbs)

Package Contains

01 Damage resistant protective box

02 mikromedia+ for STM32 ARM® development system

03 Two 1x26 male headers and one 2x5 header

04 mikromedia+ for STM32 ARM® user's guide

05 mikromedia+ for STM32 ARM® schematic

06 USB cable and microSD card

1. Power supply

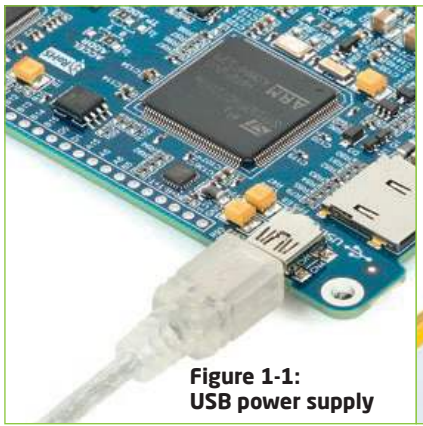


Figure 1-1:
USB power supply

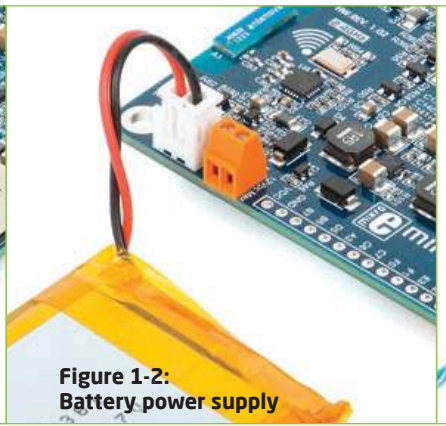


Figure 1-2:
Battery power supply

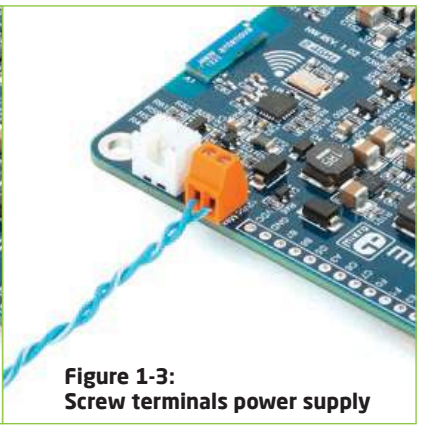


Figure 1-3:
Screw terminals power supply

The mikromedia+ for STM32 ARM® board can be powered in three different ways: via USB connector using MINI-B USB cable provided with the board **(CN4)**, via battery connector using Li-Polymer battery **(CN5)** or via screw terminals using laboratory power supply **(CN3)**. After you plug in the appropriate power supply turn the power switch ON **(SW1)**. The USB connection can provide up to 500mA of current which is more than enough for the operation of all on-board modules and the microcontroller as well. If you decide to use external power supply via screw terminals, voltage values must be within **2.5-12V DC** range. Power **LED ON (GREEN)** indicates the presence of power supply. On-board battery charger circuit **MCP73832** enables you to charge the battery over USB connection or via screw terminals. **LED diode (RED)** indicates when battery is charging. Charging current is ~250mA and charging voltage is 4.2V DC.

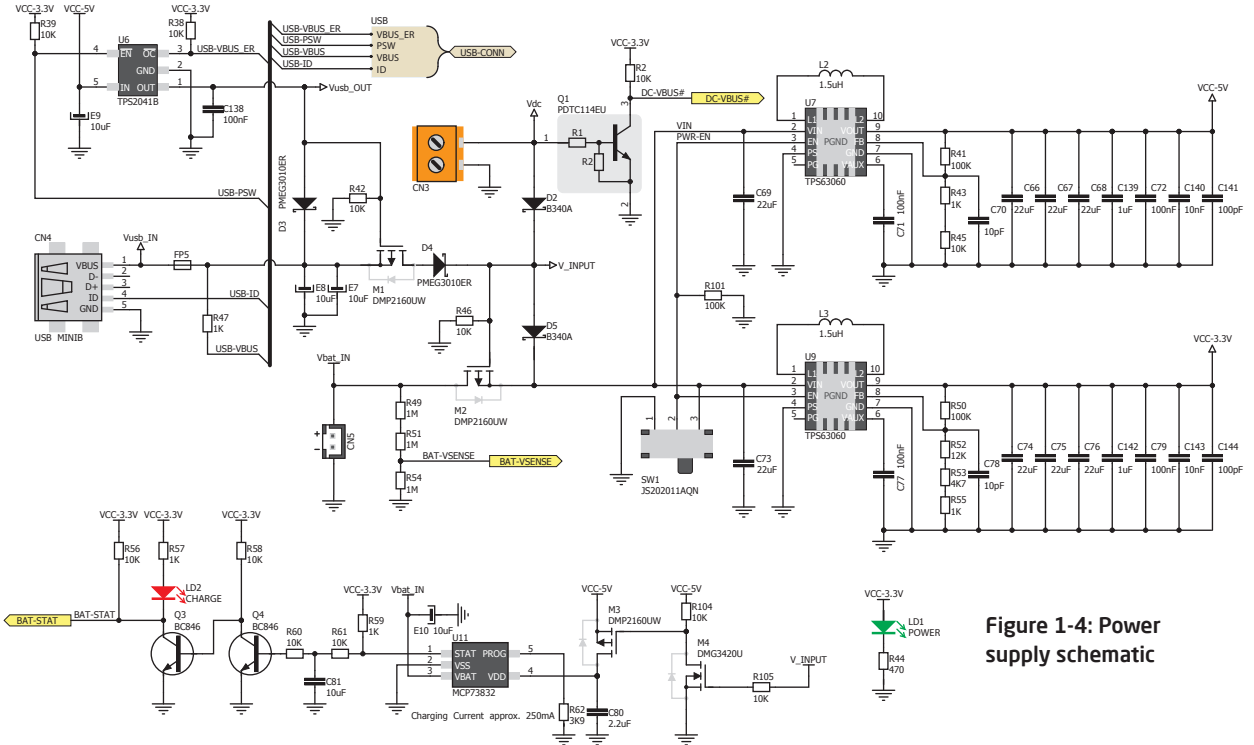
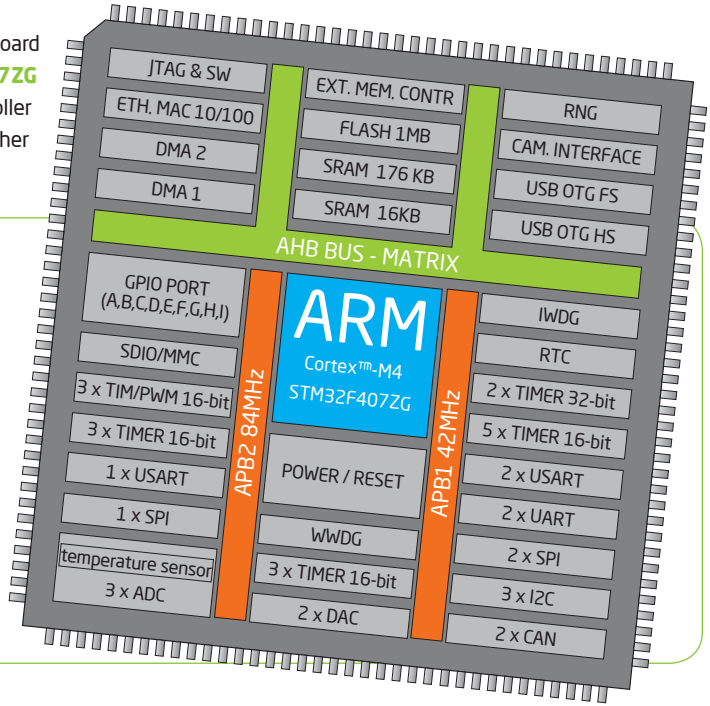


Figure 1-4: Power supply schematic

2. STM32F407ZG microcontroller

The mikromedia+ for STM32 ARM® development board comes with the 144-pin **ARM® Cortex™-M4 STM32F407ZG** 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

- Up to **210 DMIPS** Operation (168MHz);
- 1 MB of Flash memory;
- 192 + 4 KB of SRAM memory;
- up to 140 I/O pins;
- 16/32-bit timers
- 16MHz internal oscillator, 32kHz RTCC, PLL;
- 4xUART, 3xSPI, 3xI²C, 2xCAN, 3xADC, 3XADC etc.
- Ethernet, USB etc.

3. Programming the microcontroller

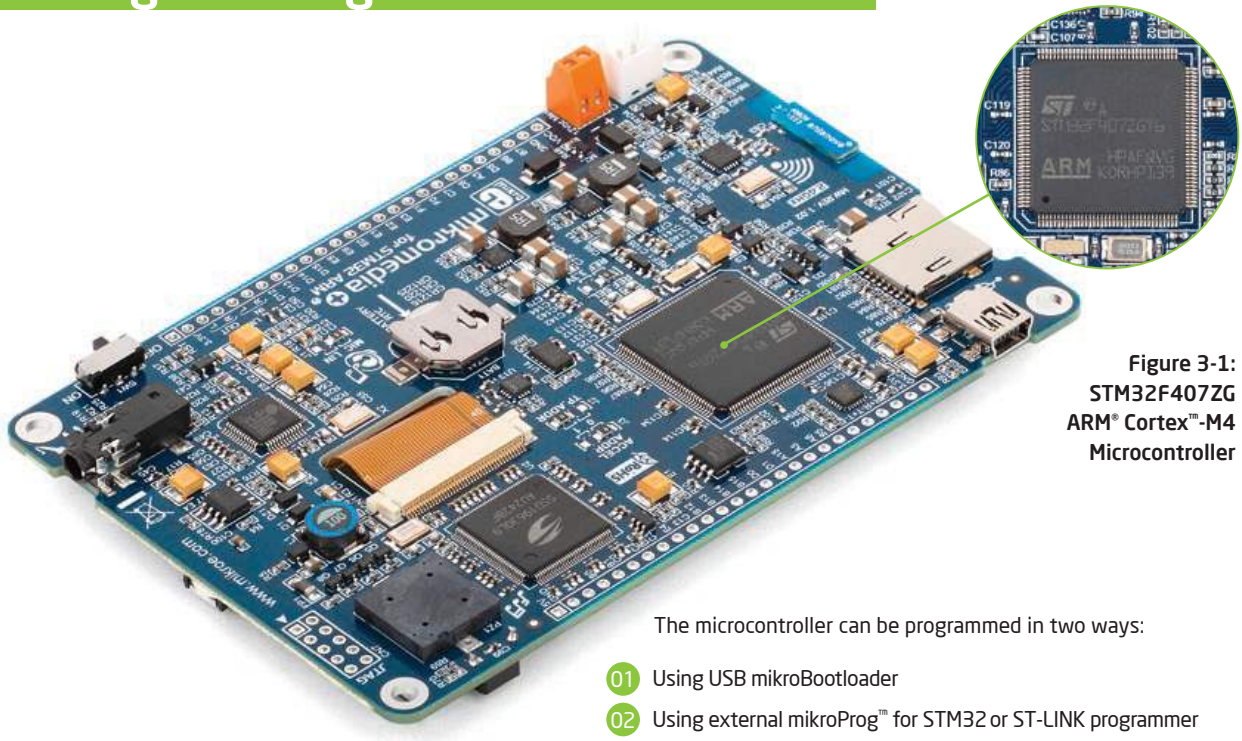


Figure 3-1: STM32F407ZG ARM® Cortex™-M4 Microcontroller

The microcontroller can be programmed in two ways:

01 Using USB mikroBootloader

02 Using external mikroProg™ for STM32 or ST-LINK programmer

Programming with mikroBootloader

You can program the microcontroller with bootloader which is pre programmed into the device by default. 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/downloads/get/1976/mikromedia_plus_mikrobootloader_v210.zip

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

step 1 - Connecting mikromedia

Figure 3-2: USB HID mikroBootloader window

01 To start connect the USB cable or (if already connected) press the **Reset** button on your mikromedia+ board. Click the **Connect** button within 5s to enter the bootloader mode, otherwise existing microcontroller program will execute.

step 2 - Browsing for .HEX file

Figure 3-3: Browse for HEX

01 Click the **Browse for HEX** button and from a pop-up window (**Figure 3.4**) choose the .HEX file that will be uploaded to MCU memory.

step 3 - Selecting .HEX file

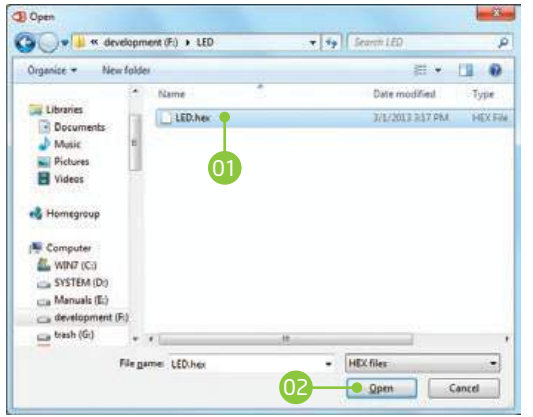


Figure 3-4: Selecting HEX

01 Select .HEX file using open dialog window.

02 Click the **Open** button.

step 4 – Uploading .HEX file

Figure 3-5: Begin uploading

01 To start .HEX file uploading click the **Begin uploading** button.

Figure 3-6: Progress bar

01 You can monitor .HEX file uploading via progress bar

step 5 - Finish upload

Figure 3-7: Restarting MCU

Figure 3-8: mikroBootloader ready for next job

01 Click the **OK** button after uploading is finished. Board will automatically reset and after 5 seconds your new program will execute.

Programming with mikroProg™ programmer

Figure 3-9: mikroProg™ JTAG connector

The microcontroller can be programmed with external **mikroProg™ for STM32 programmer** and **mikroProg Suite™ for ARM® software**. The external programmer is connected to the development system via JTAG connector, **Figure 3-9.** **mikroProg™** is a fast USB 2.0 programmer with hardware Debugger support. It supports ARM® Cortex™-M3 and Cortex™-M4 microcontrollers from STM32. Outstanding performance, easy operation and elegant design are it's key features.

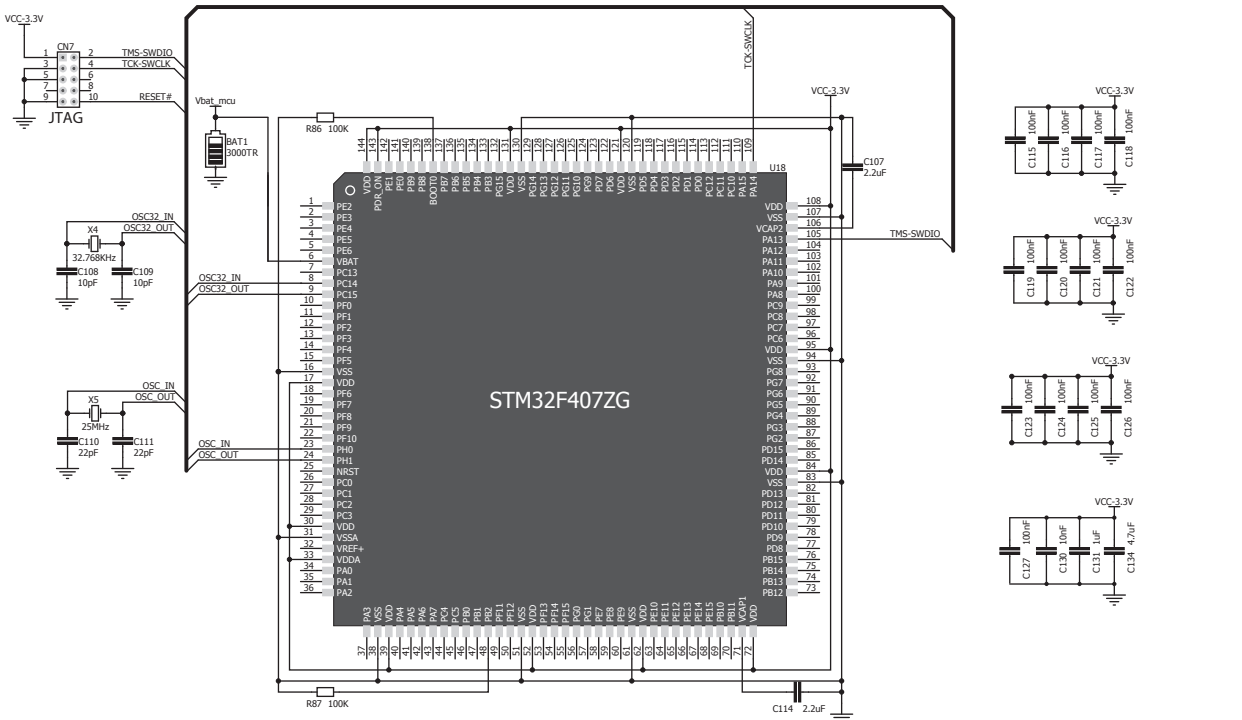


Figure 3-10: mikroProg™ JTAG connector connection schematic

mikroProg Suite™ for ARM® software

mikroProg™ for STM32 programmer requires special programming software called mikroProg Suite™ for ARM®. This software is used for programming ALL of STM32 ARM® Cortex-M3™ and Cortex-M4™ microcontroller families. It features intuitive interface and SingleClick™ programming technology. Software installation is available on a Product DVD:

http://www.mikroe.com/downloads/get/1809/mikroprog_suite_for_arm.zip

After downloading, extract the package and double click the executable setup file to start installation.

Quick Guide

01 Click the **Detect MCU** button in order to recognize the device ID.

02 Click the **Read** button to read the entire microcontroller memory. You can click the **Save** button to save it to target HEX file.

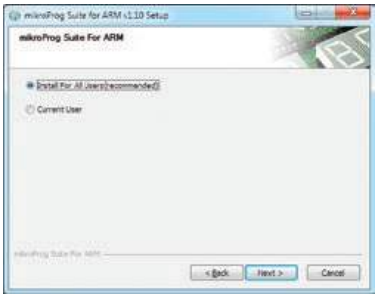
03 If you want to write the HEX file to the microcontroller, first make sure to load the target HEX file using the **Load** button. Then click the **Write** button to begin programming.

04 Click the **Erase** button to wipe out the microcontroller memory.

Software installation wizard

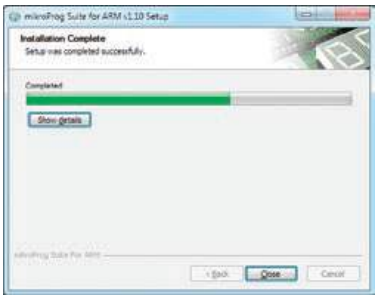
01 Start Installation

02 Accept EULA and continue



03 Install for all users

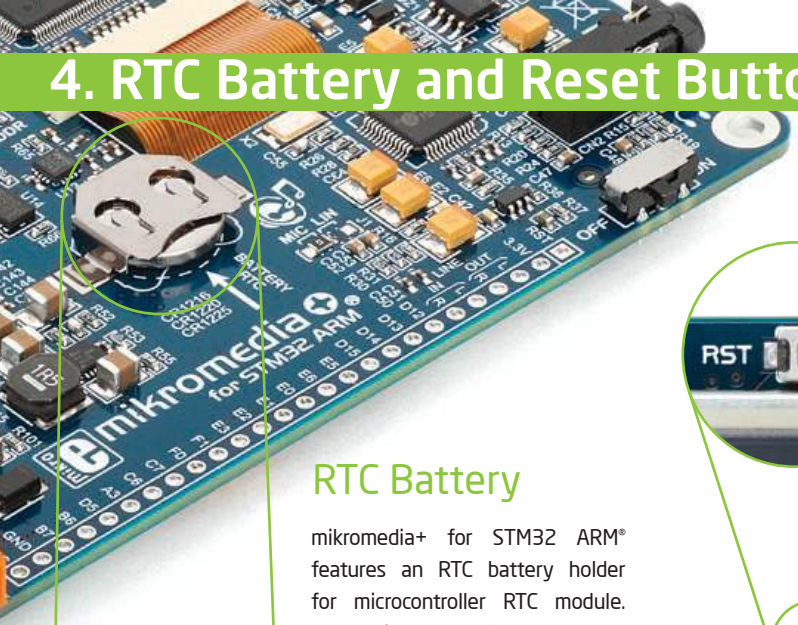
04 Choose destination folder



05 Installation in progress

06 Finish installation

4. RTC Battery and Reset Button



RTC Battery

mikromedia+ for STM32 ARM® features an RTC battery holder for microcontroller RTC module. Battery is used as alternate source of power, so the RTC module can continue to keep time while the primacy source of power is off or currently unavailable. Three types of coin battery are supported: CR1216, CR1220 and CR1225.

Reset Button

The board is equipped with reset button, which is located on the front side of the board. If you want to reset the circuit, press the reset button. It will generate low voltage level on the microcontroller reset pin (input). A reset can also be externally provided through the **pin 27** on the side headers.

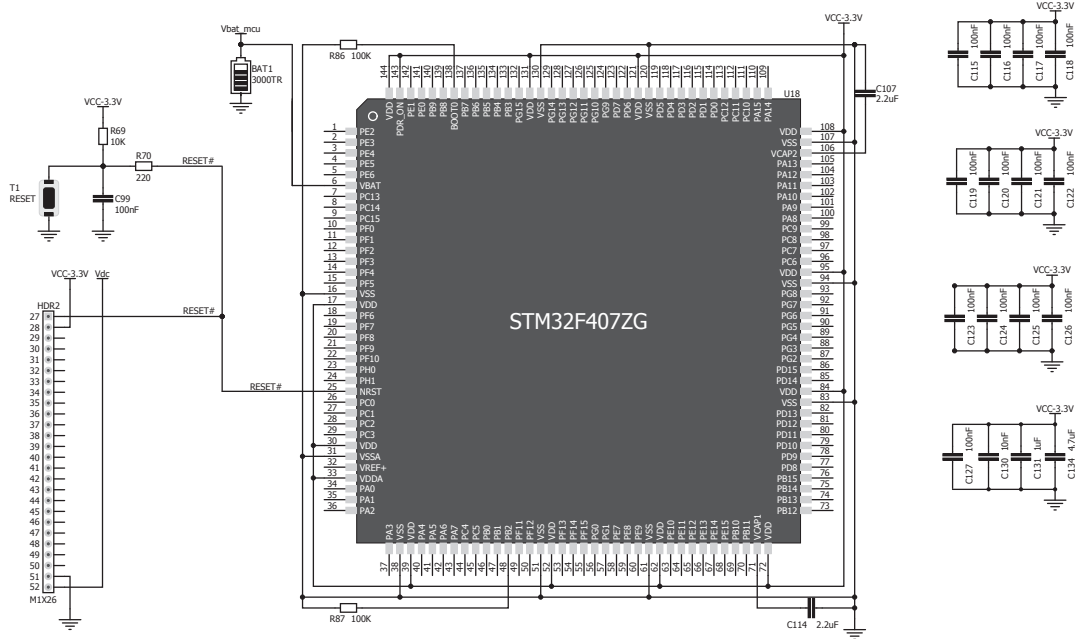


Figure 4-1: Reset circuit and RTC battery schematic

5. Crystal oscillator and 2.048V reference

The board is equipped with 01 **25MHz crystal oscillator (X5)** circuit that provides external clock waveform to the microcontroller OSC0 and OSCI pins. This base frequency is suitable for further clock multipliers and ideal for generation of necessary USB clock, which ensures proper operation of bootloader and your custom USB-based applications. The board also contains 02 **32.768 kHz crystal oscillator (X4)** which provides external clock for internal RTCC module. Microcontroller ADC requires an accurate source of reference voltage signal. That is why we provide the external 03 **voltage reference** to the microcontroller VREF pin which is **2.048V**.

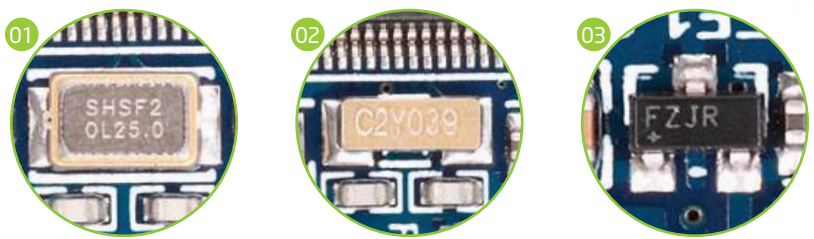


Figure 5-1: Crystal oscillator and 2.048V reference

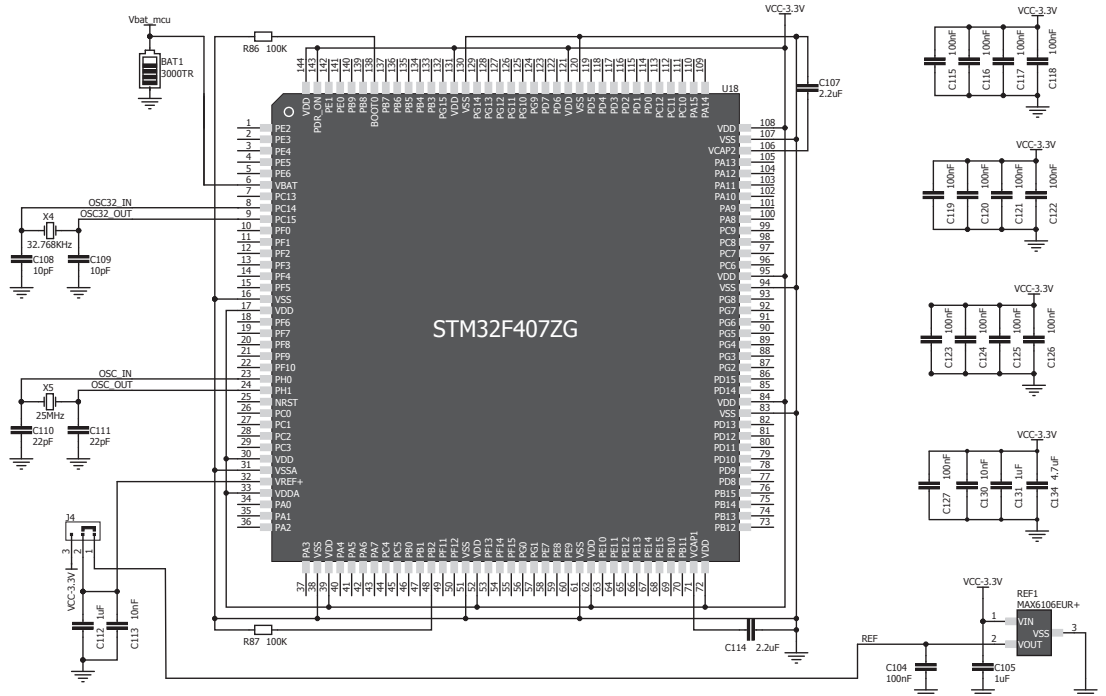
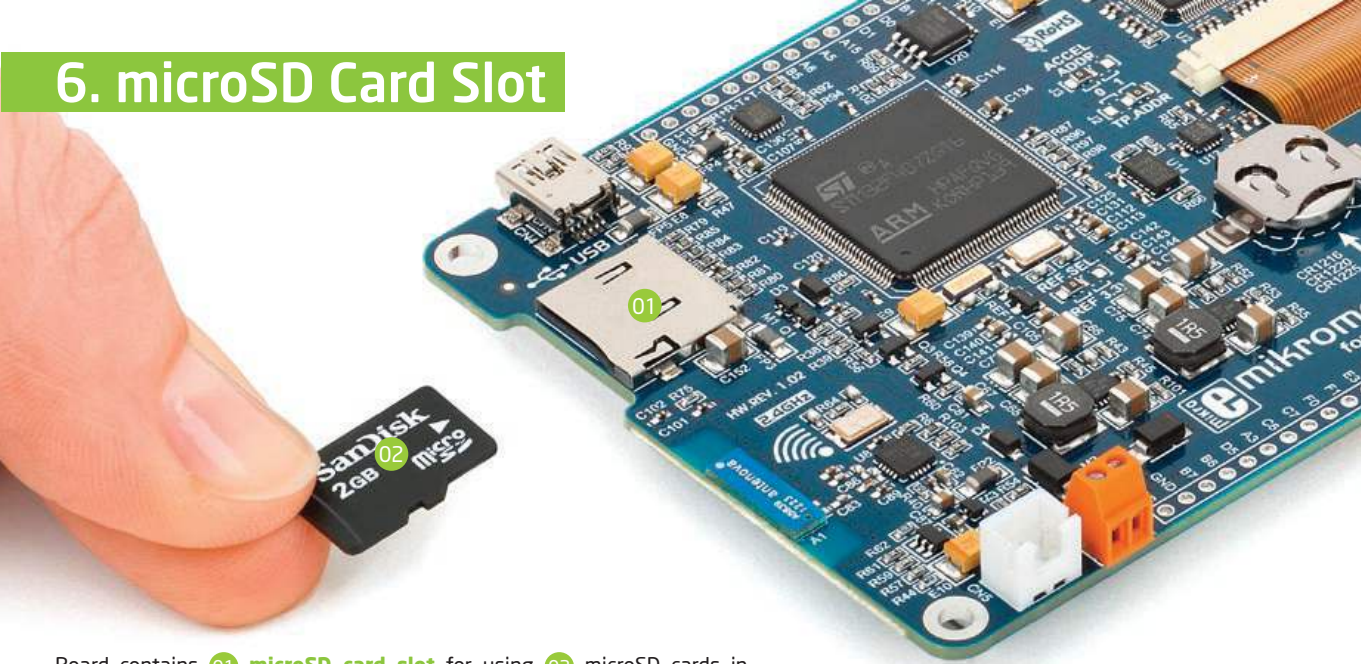


Figure 5-2: Crystal oscillator and voltage reference schematic

6. microSD Card Slot



Board contains 01 **microSD card slot** for using 02 microSD cards in your projects. It enables you to store large amounts of data externally, thus saving microcontroller memory. microSD cards use Serial Peripheral Interface (**SPI**) for communication with the microcontroller. Ferrite and capcitor are provided to compensate the voltage and current glitch that can occur when pushing-in and pushing-out microSD card into the socket. Proper insertion of the microSD card is shown in **Figure 6-1**.

Figure 6-1: microSD card slot

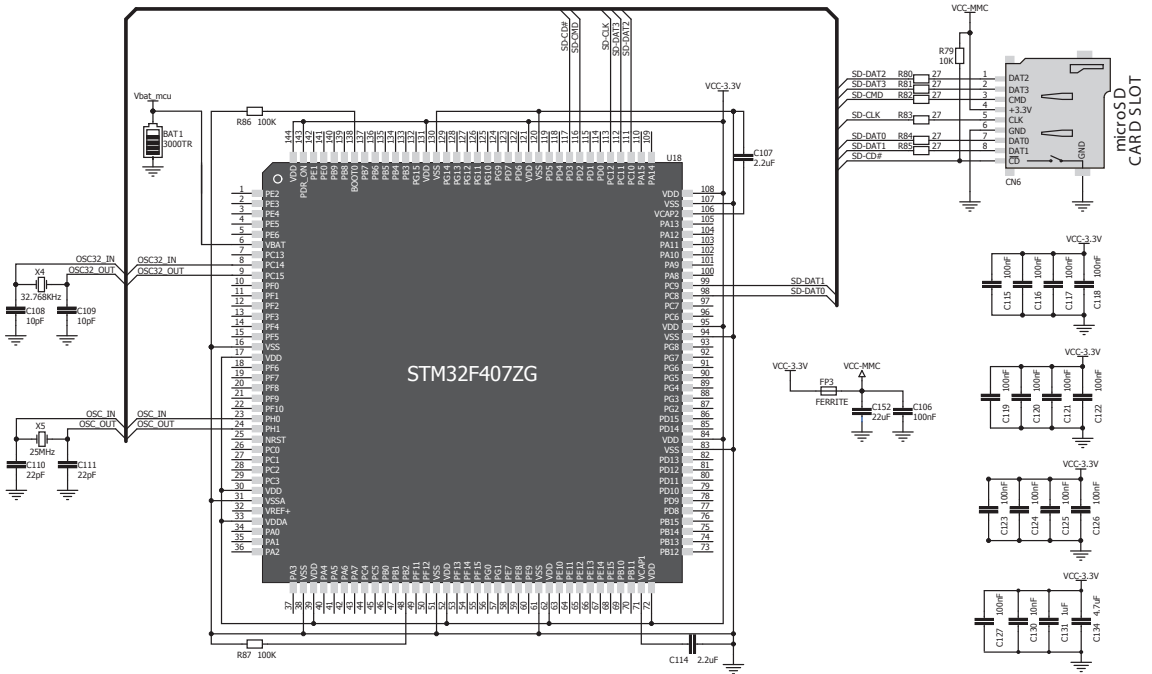


Figure 6-2: microSD Card Slot module connection schematic

7. Touch Screen

The development system features a **4.3" TFT 480x272 display** covered with a **resistive** touch panel. Together they form a functional unit called a **touch screen**, **Figure 7-1.** It enables data to be entered and displayed at the same time. The TFT display is capable of showing graphics in **256K** different **colors**.

Figure 7-1: Touch Screen

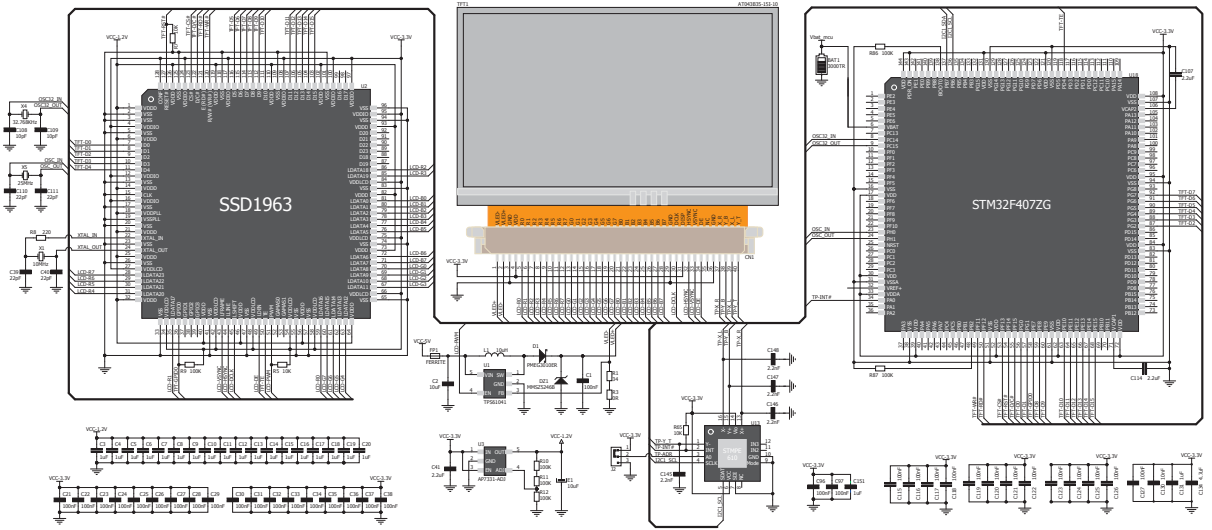


Figure 7-2: Touch Screen connection schematic

8. Audio Module

Figure 8-1: On-board VS1053 MP3 codec

mikromedia+ for STM32 ARM® features stereo audio codec 01 **VS1053**. This module enables audio reproduction and sound recording by using 02 **stereo headphones with microphone** connected to the system via a 03 **3.5mm** connector CN2. All functions of this module are controlled by the microcontroller over Serial Peripheral Interface (**SPI**). IN and OUT channels are also provided on side headers.

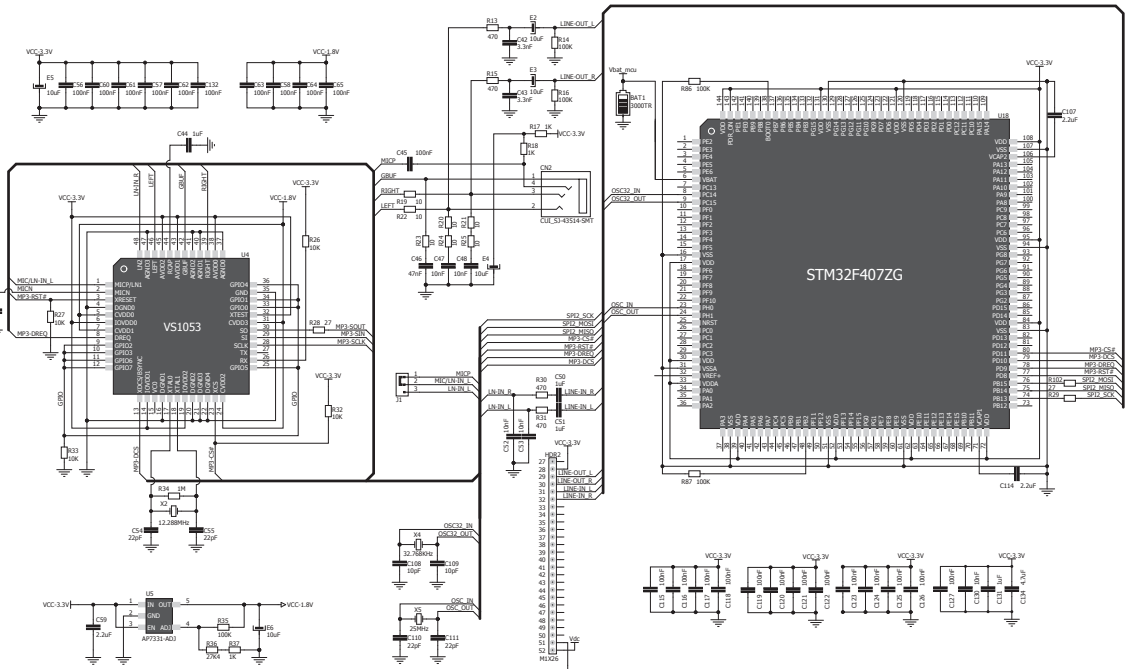


Figure 8-2: Audio module connection schematic

9. USB DEVICE connection

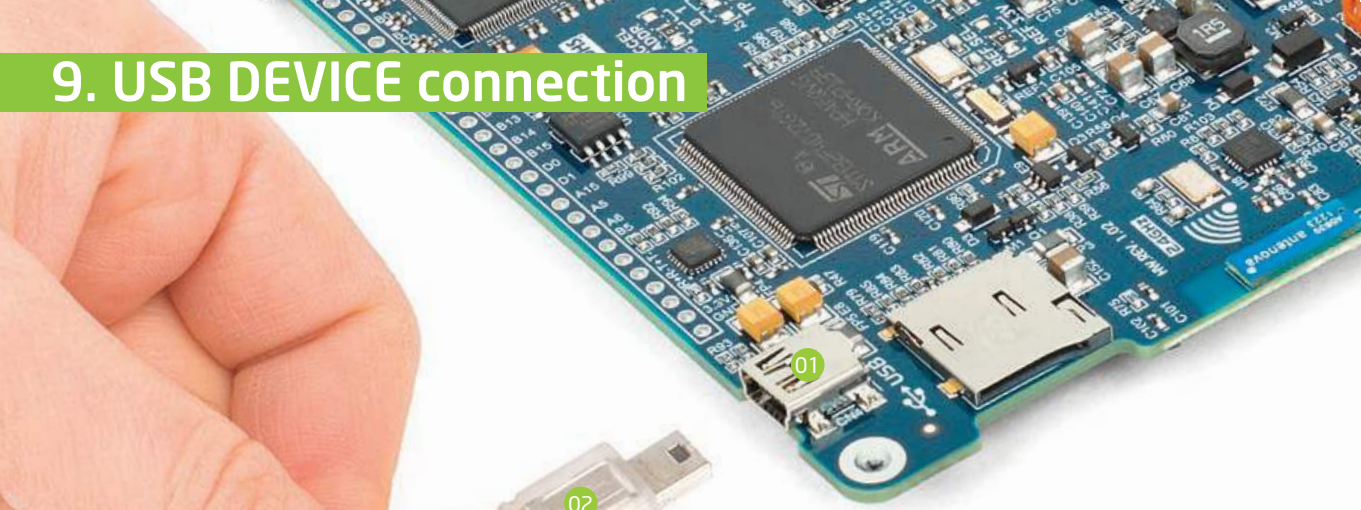


Figure 9-1: Connecting USB cable to MINI-B USB connector

ARM® Cortex™-M4 STM32F407ZG microcontroller has integrated USB module, which enables you to implement USB communication functionality to your mikromedia board. Connection with target USB host is establish over 01 MINI-B USB connector. For proper insertion of the 02 MINI-B USB cable refer to **Figure 9-1**.

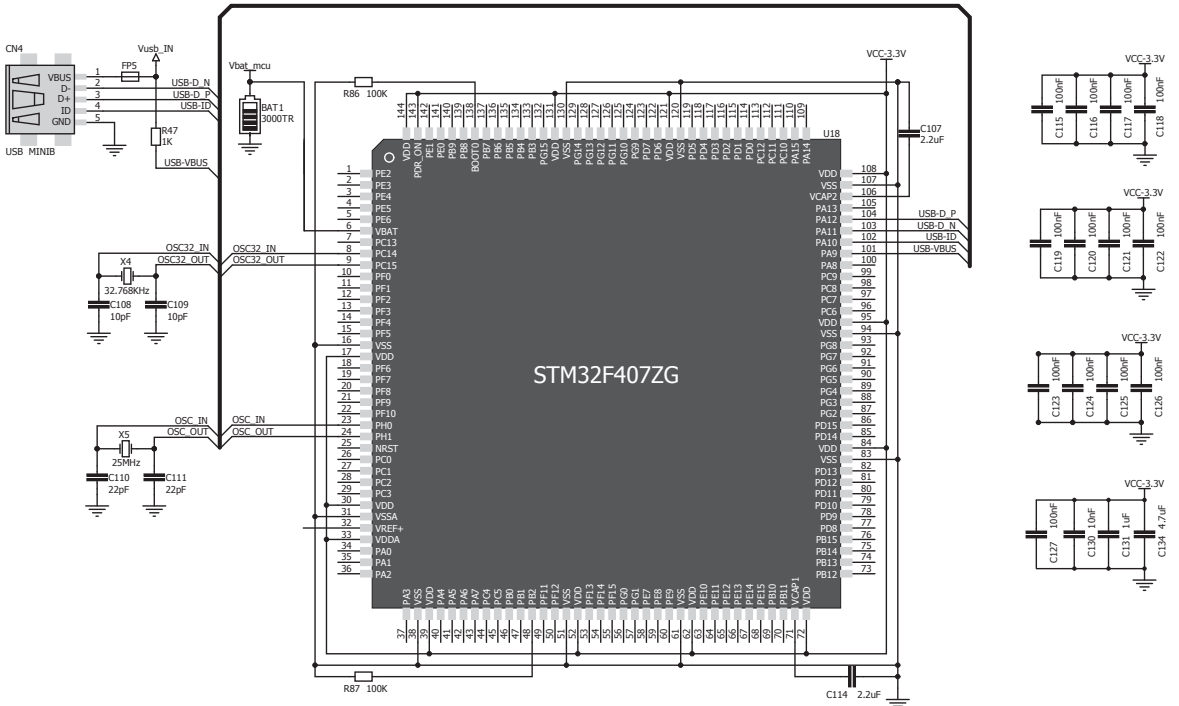


Figure 9-2: USB DEVICE module connection schematic

10. USB HOST connection

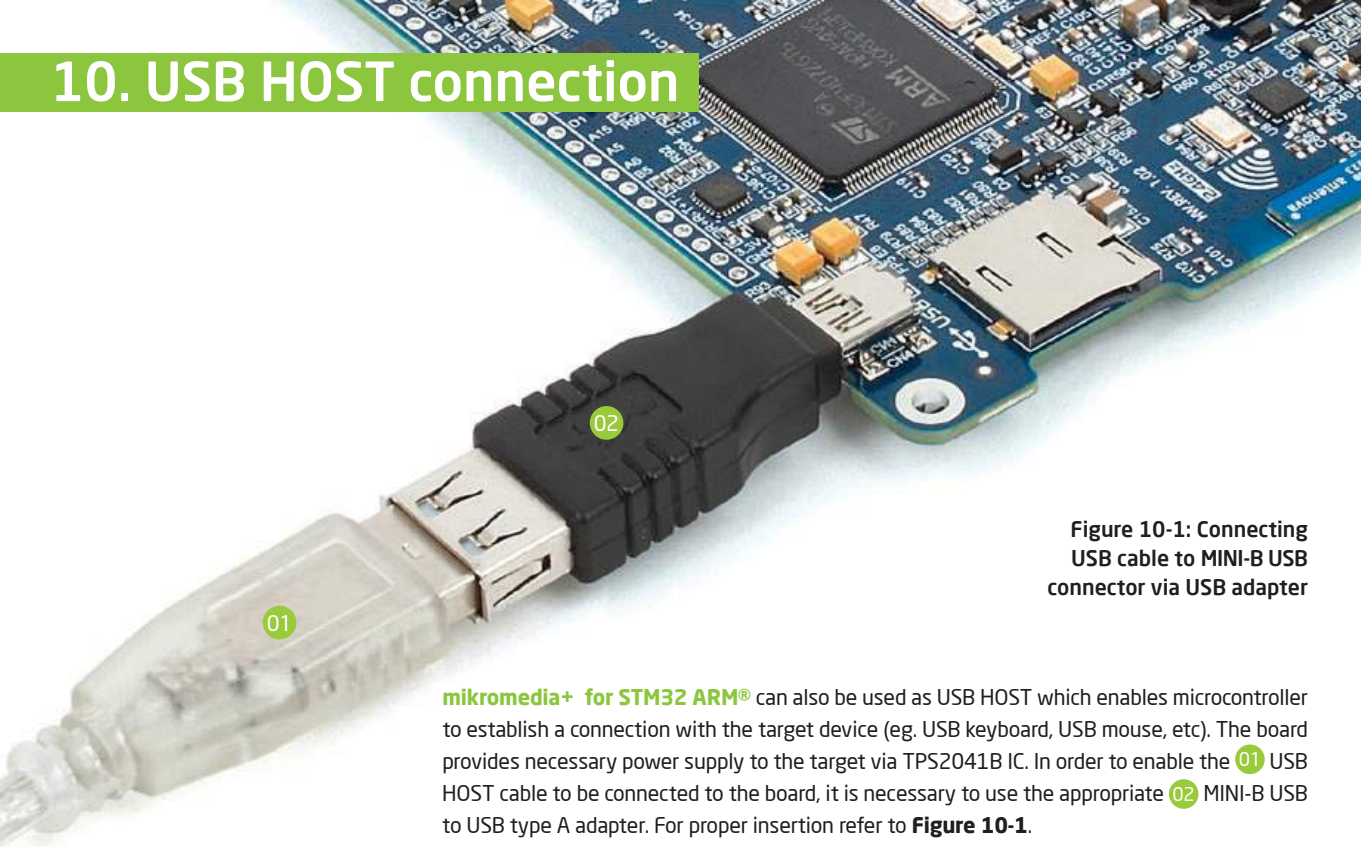


Figure 10-1: Connecting USB cable to MINI-B USB connector via USB adapter

mikromedia+ for STM32 ARM® can also be used as USB HOST which enables microcontroller to establish a connection with the target device (eg. USB keyboard, USB mouse, etc). The board provides necessary power supply to the target via TPS2041B IC. In order to enable the 01 USB HOST cable to be connected to the board, it is necessary to use the appropriate 02 MINI-B USB to USB type A adapter. For proper insertion refer to **Figure 10-1**.

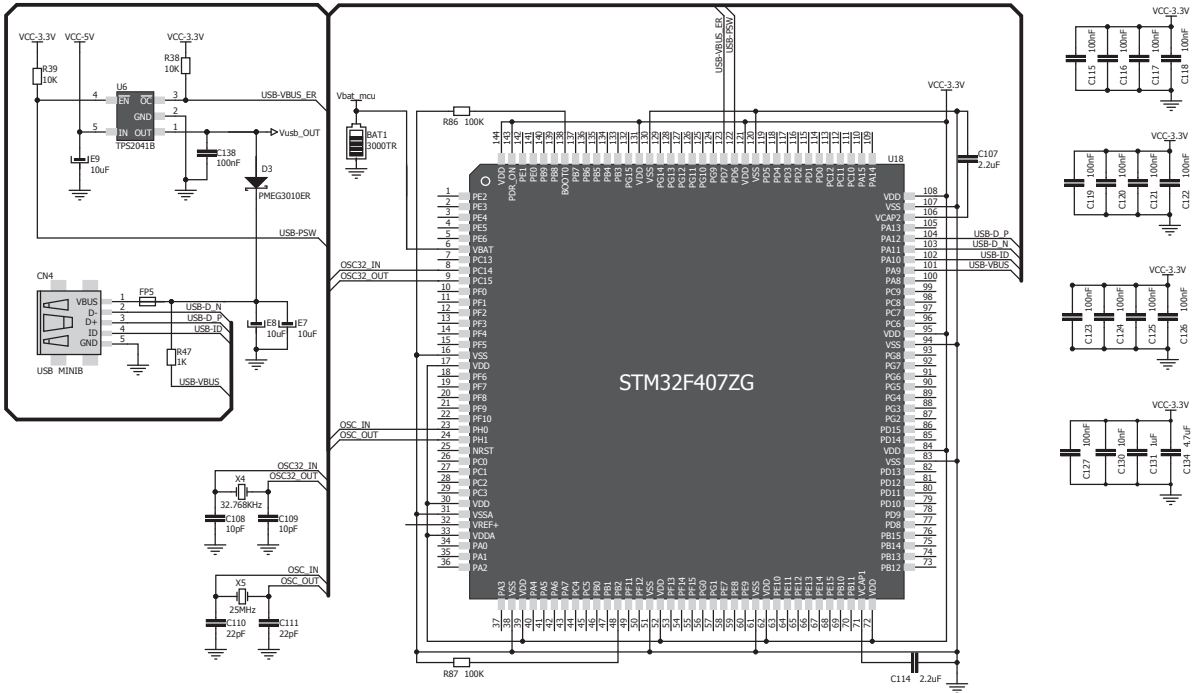


Figure 10-2: USB HOST module connection schematic

11. Accelerometer

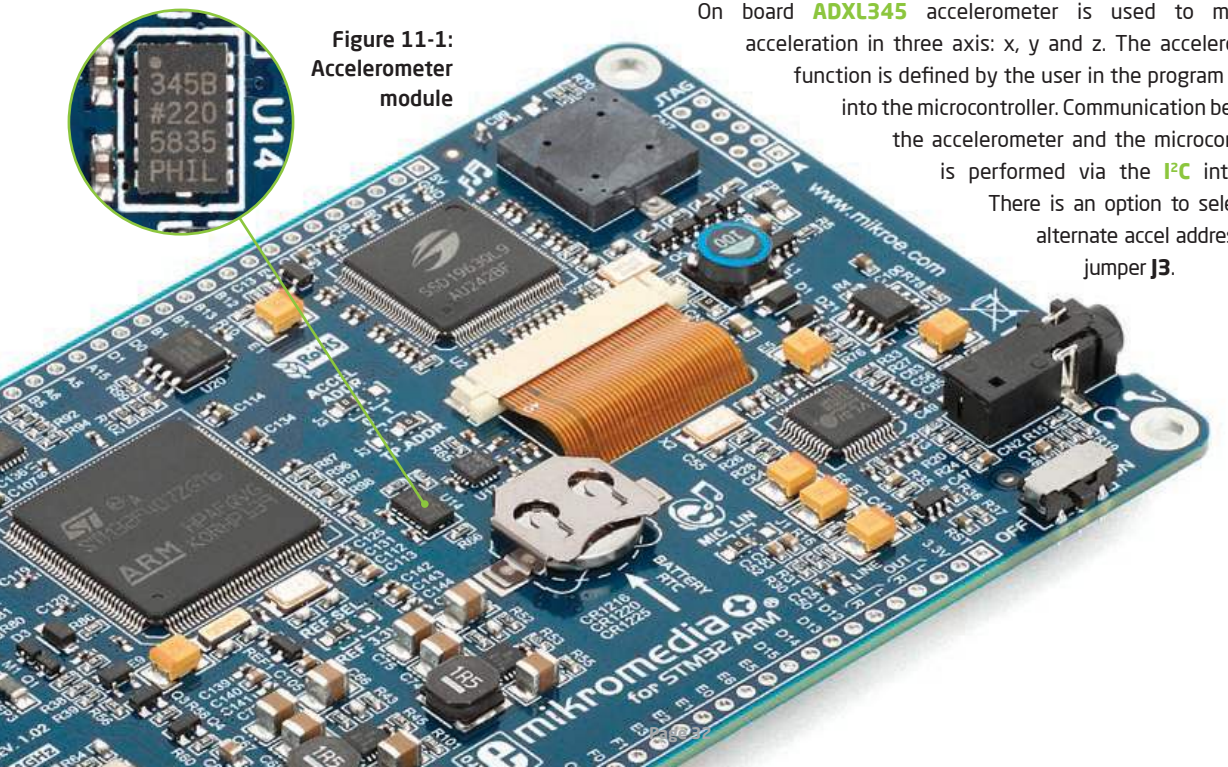


Figure 11-1: Accelerometer module

On board **ADXL345** accelerometer is used to measure acceleration in three axis: x, y and z. The accelerometer function is defined by the user in the program loaded into the microcontroller. Communication between the accelerometer and the microcontroller is performed via the **I²C** interface. There is an option to select the alternate accel address with jumper **J3**.

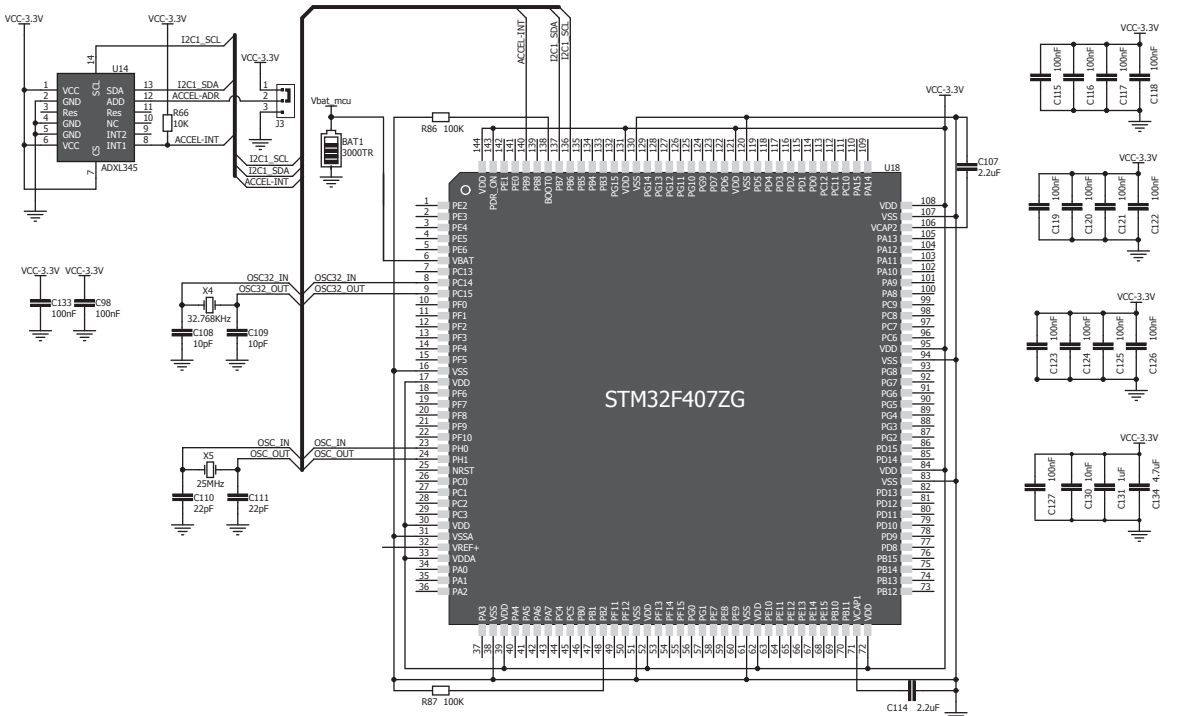


Figure 11-2: Accelerometer connection schematic

12. Flash Memory

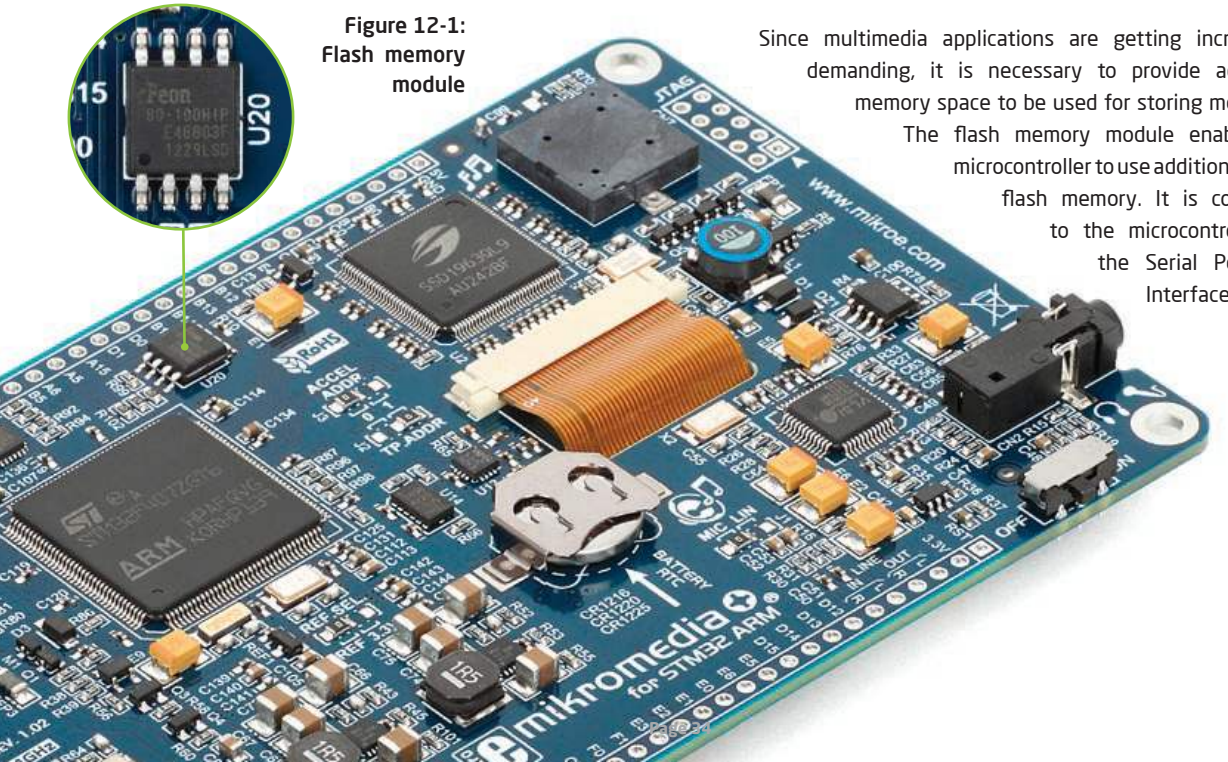


Figure 12-1: Flash memory module

Since multimedia applications are getting increasingly demanding, it is necessary to provide additional memory space to be used for storing more data. 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**).

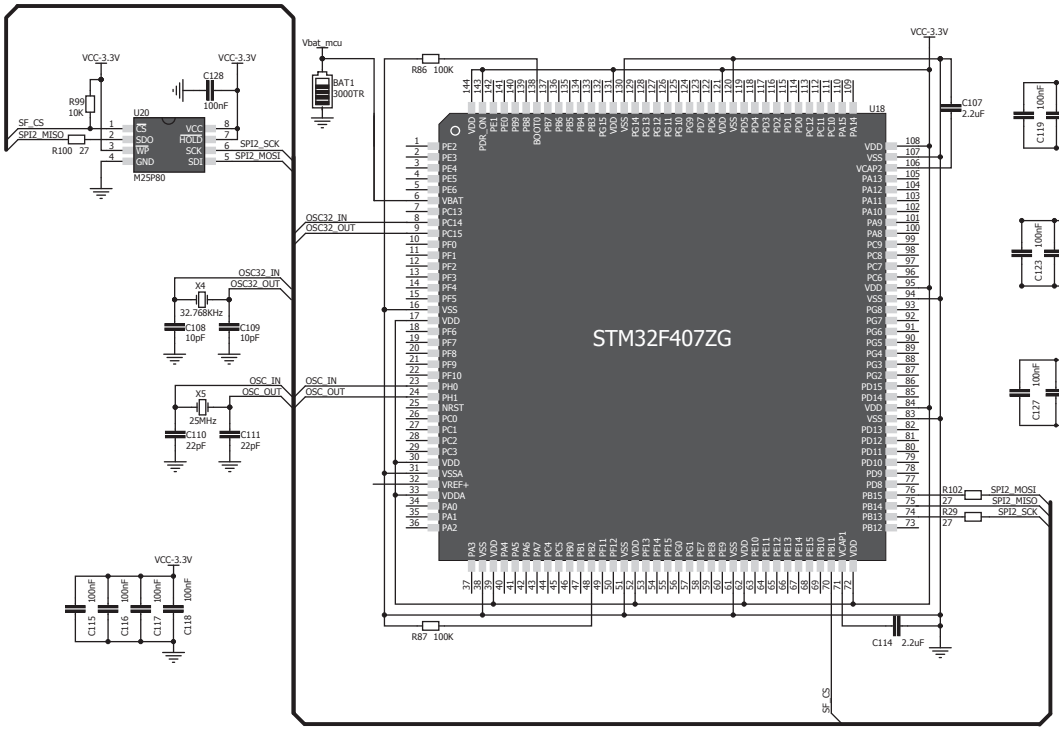


Figure 12-2: Flash memory module connection schematic

13. RF Transceiver

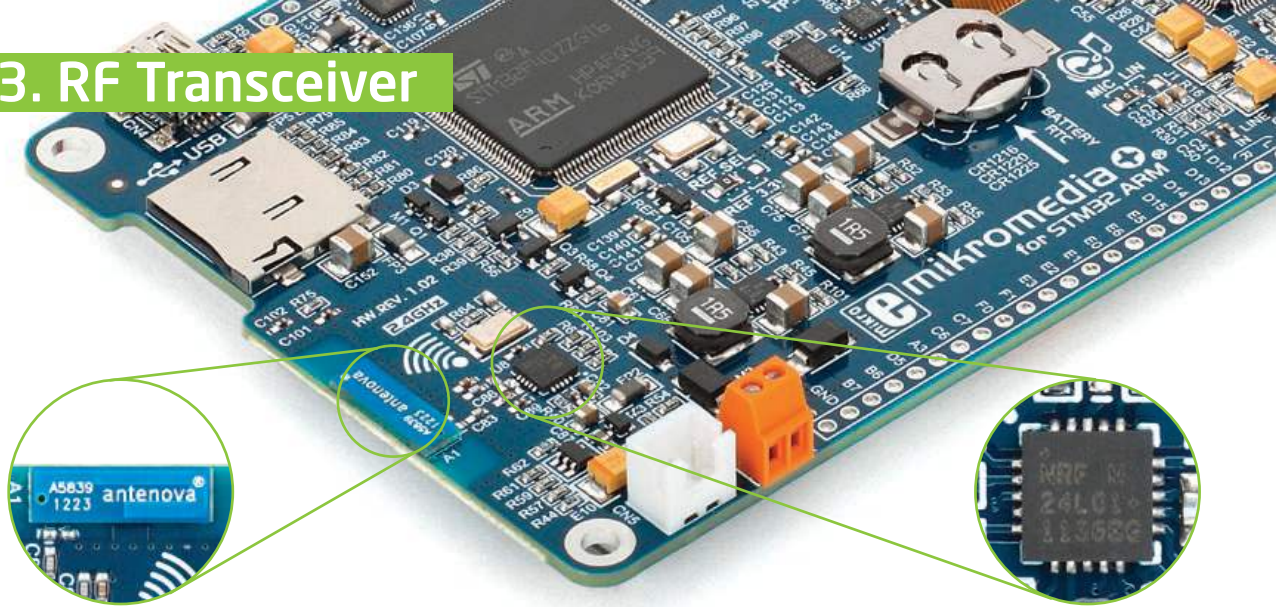


Figure 13-1:
RF transceiver antenna

Figure 13-2:
RF transceiver module

mikromedia+ for STM32 ARM® board features **RF transceiver** chip with **2.4GHz chip antenna**. It is suitable for wireless operation in the world wide ISM frequency band at 2.400 - 2.4835 GHz with air data rate up to 2Mbps. RF transceiver module is connected to the microcontroller via the Serial Peripheral Interface (**SPI**). This RF transceiver module is widely used for wireless PC peripherals, remote controllers, VoIP headsets, game controllers, sensors, home and commercial automation, active RFID, toys and many more.

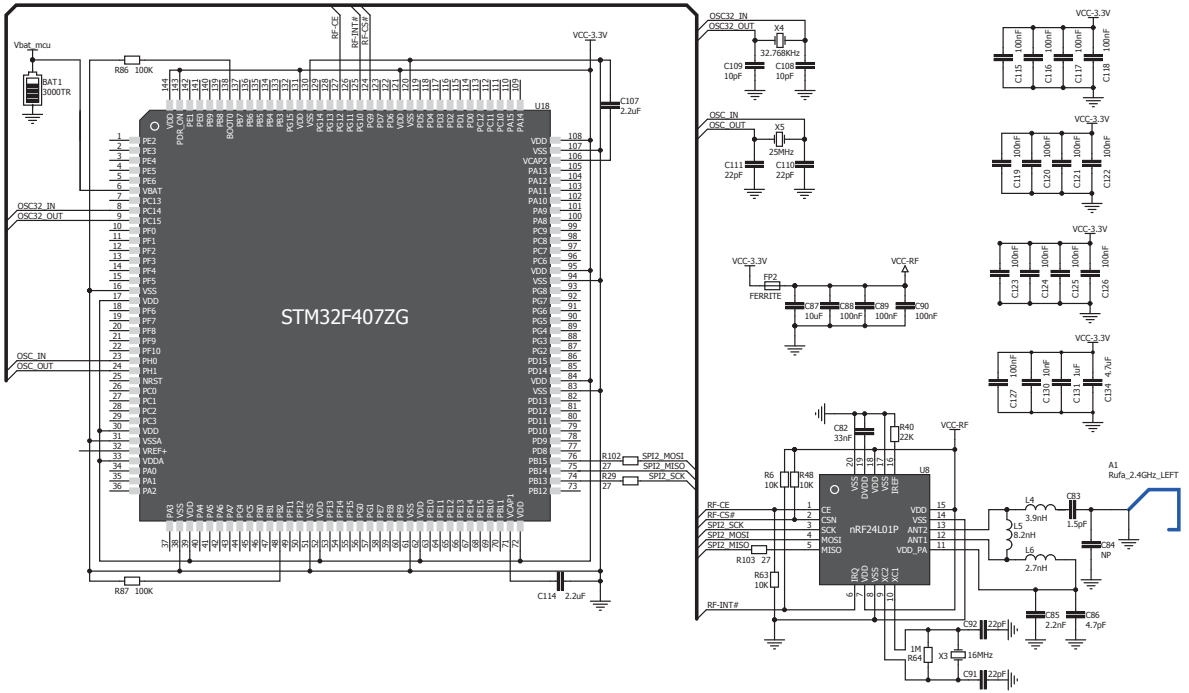


Figure 13-3: RF transceiver module schematic

14. Ethernet transceiver

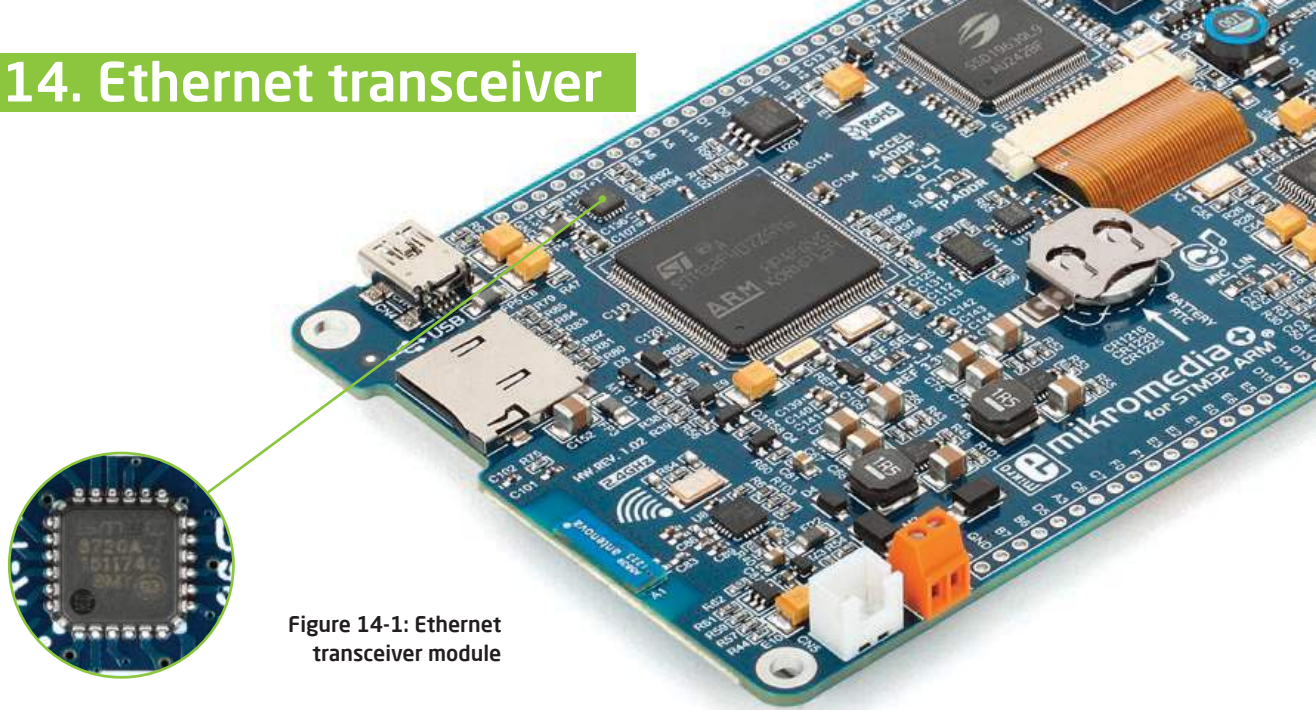


Figure 14-1: Ethernet transceiver module

The development system features a Ethernet transceiver module ideal for local area networking (LAN). Communication over Ethernet is based on data packets called frames. Each frame contains source and destination addresses and error-cheching data so that damaged data can be detected and re-transmitted. If you want to establish a connection with computer, router or other devices you need to use standard RJ-45 connector which is provided on **mikromedia+ SHIELD for STM32 ARM®**. Communication lines are also provided over side headers.

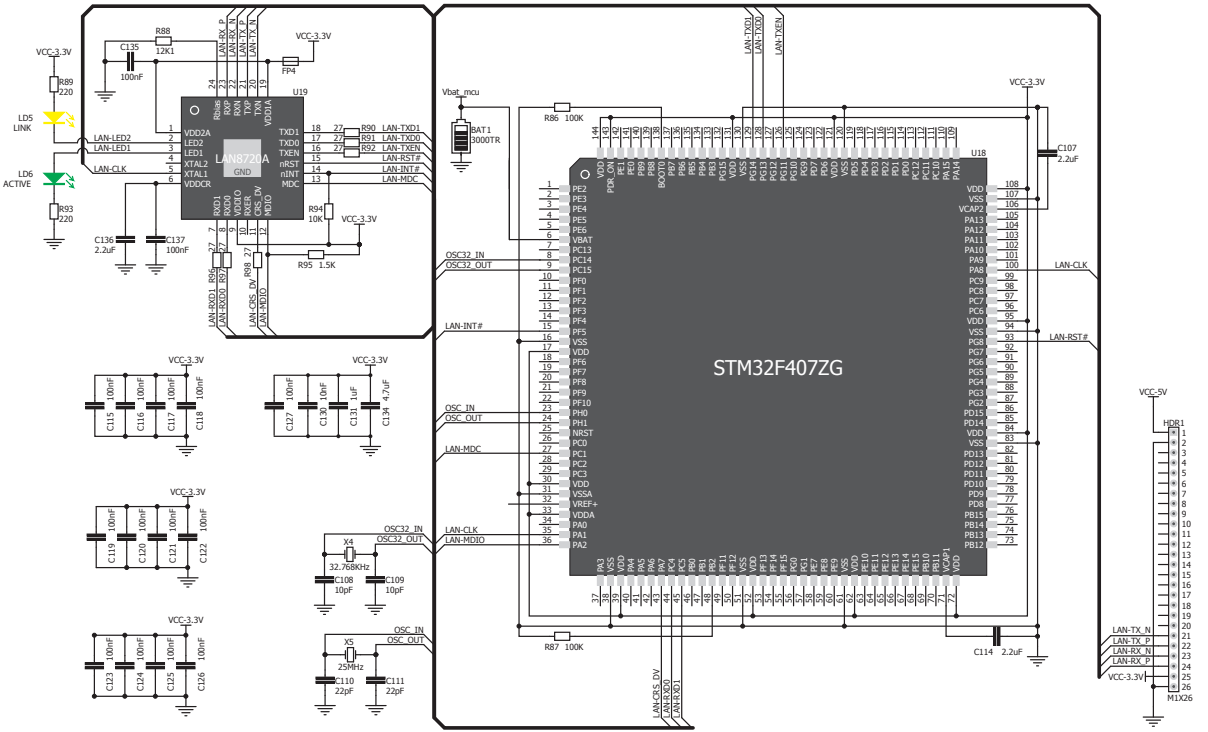


Figure 14-2: Ethernet transceiver module schematic

15. Buzzer

The board is also equipped with piezo buzzer. It is an electric component which can be used to create sound waves when provided with electrical signal. Microcontroller can create sound by generating a PWM signal. Frequency of the signal determines the pitch of the sound and duty cycle of the signal can be used to increase or decrease the volume.

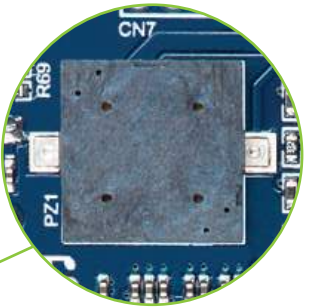


Figure 15-1:
Buzzer module

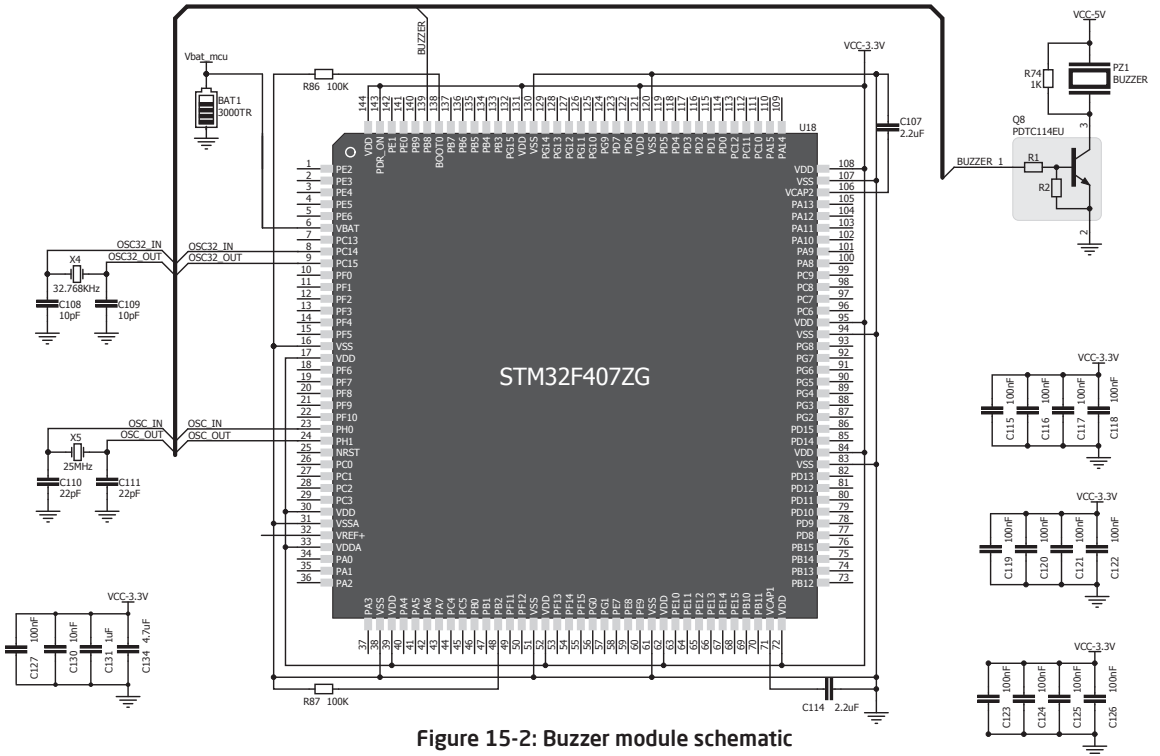


Figure 15-2: Buzzer module schematic

16. Other modules

The board also contains additional peripherals that can be very useful, such as 01 PIN photodiode, 02 IR receiver, 03 RGB led diode and 04 analog temperature sensor. **PIN photodiode** is a type of photo detector capable of converting light into the voltage with high sensitivity and speed of response. It is connected to the microcontroller analog pin. **IR receiver** is used for infrared remote control systems. The demodulated output signal obtained from IR module can be directly decoded by a microcontroller. Many of existing standard data formats are supported. **RGB (Red, Green , Blue) diode** is suitable for light indication in your design. Each of colour is driven separately by transistor. The **analog temperature sensor** converts temperature to analog voltage and it is directly connected to the microcontroller analog pin. Temperature measurement range of mikromedia+ for STM32 ARM® board is from -20°C to 70°C.

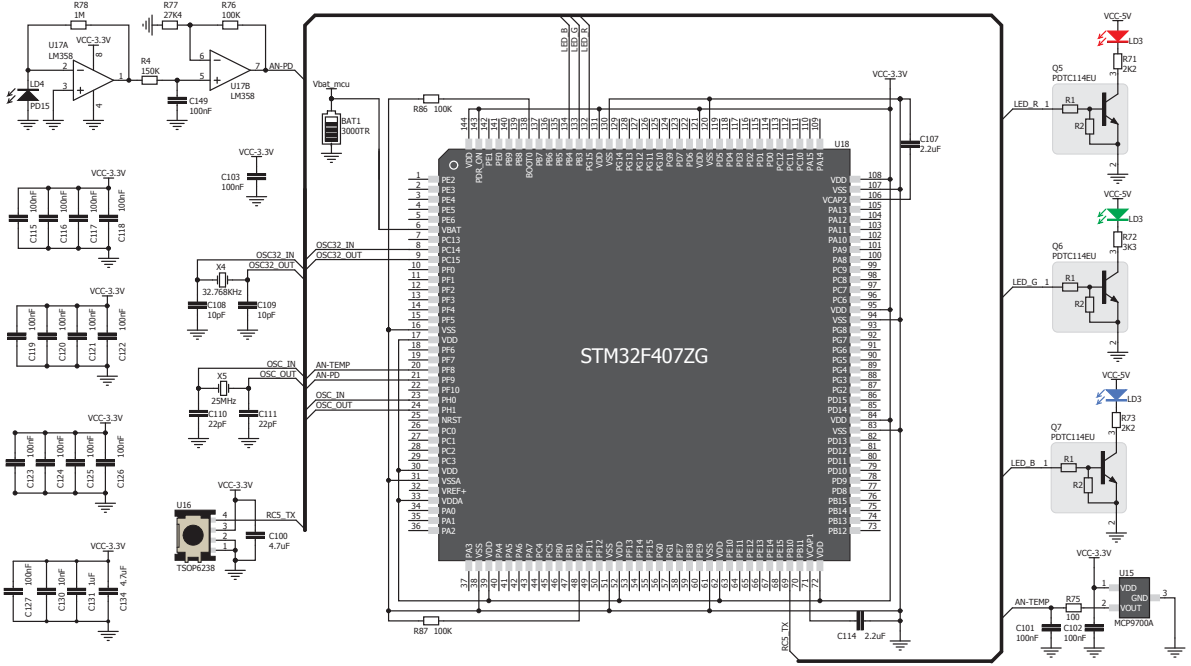
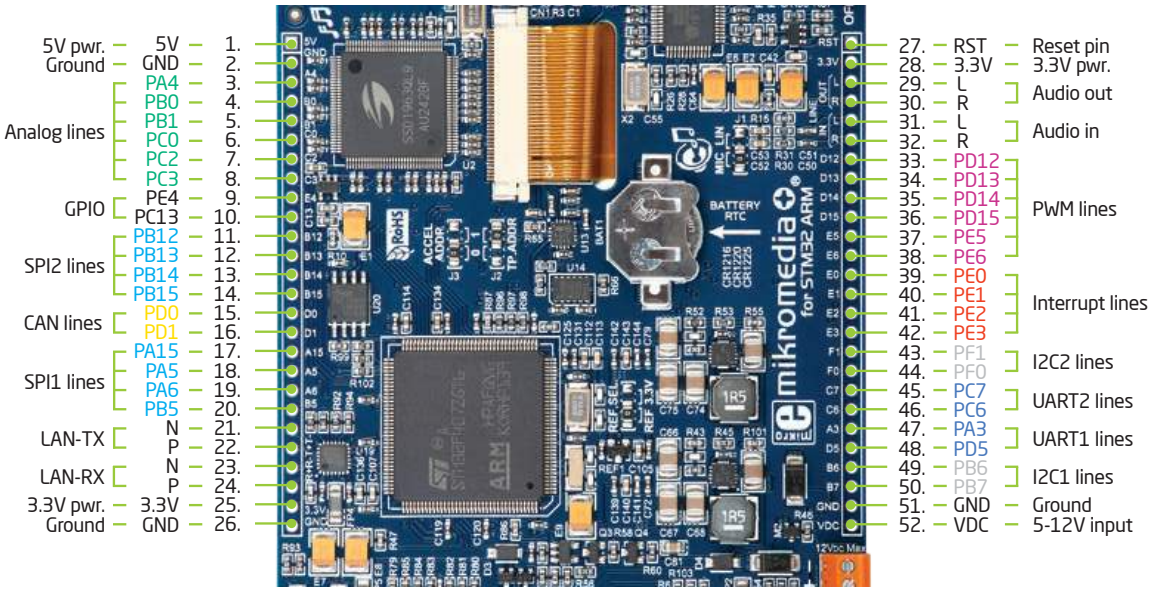


Figure 16-1: Other modules schematic

17. Pads

PWM Interrupt I2C UART Analog lines SPI CAN



Many microcontroller pins are available for further connectivity via two 1x26 rows of connection pads on both sides of the board. They are designed to match with mikromedia+ SHIELD for STM32 ARM®.

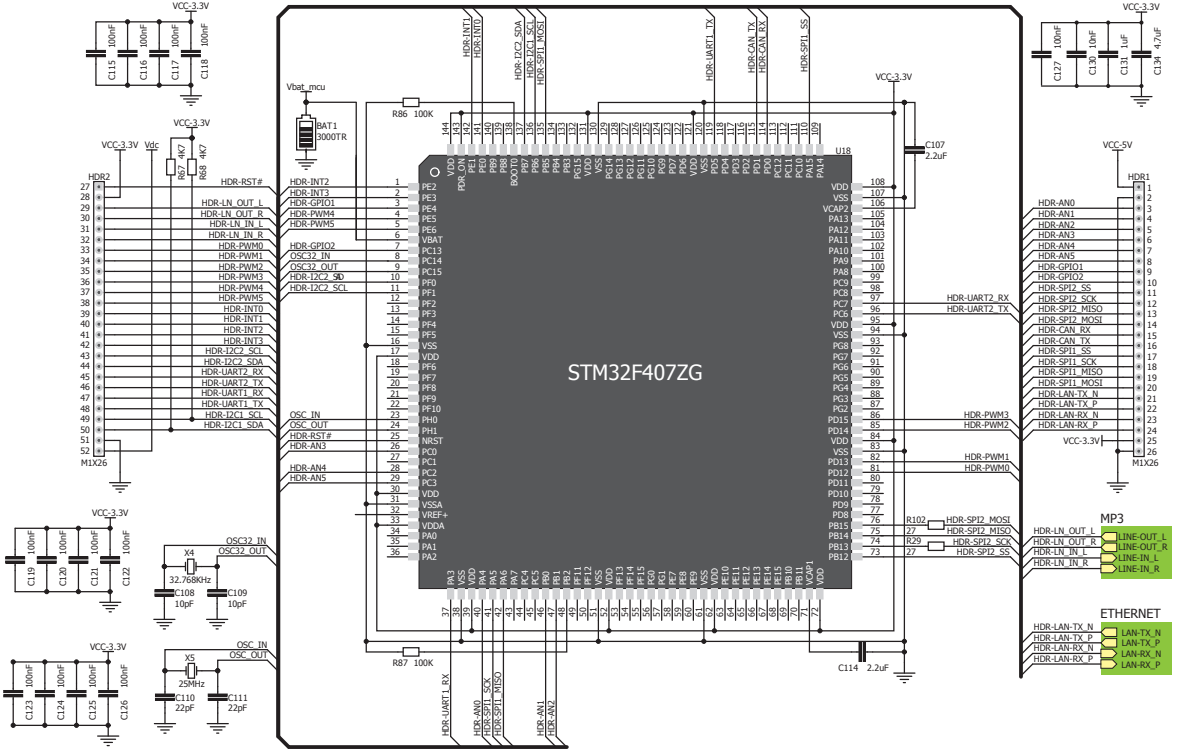


Figure 17-1: Connecting pads schematic

mikromedia+ for STM32 shield

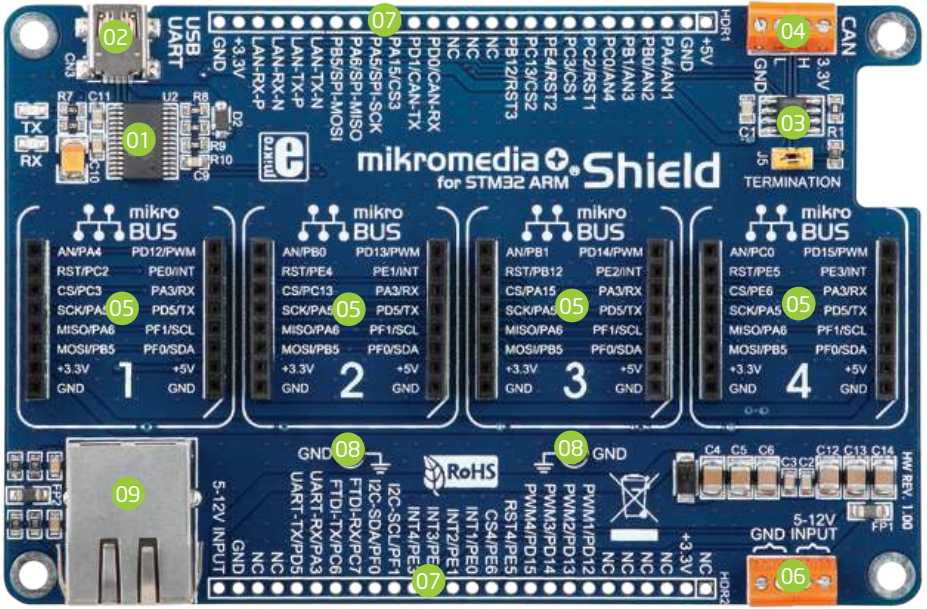


Figure 18-1: mikromedia+ shield

We have prepared an extension board pin-compatible with your mikromedia+ board, which enables you to easily expand your basic board functionality. It is called **mikromedia+ SHIELD for STM32 ARM®**. The shield contains 01 FTDI USB-UART chip with 02 USB MINI-B connector, 03 CAN transceiver with 04 CAN screw terminals, four 05 mikroBUS sockets, 06 screw terminals for external power supply, 07 side connection pads, additional 08 GNDs and 09 Ethernet connector. **mikromedia+ SHIELD for STM32 ARM®** is additional board and it is not provided in the package.

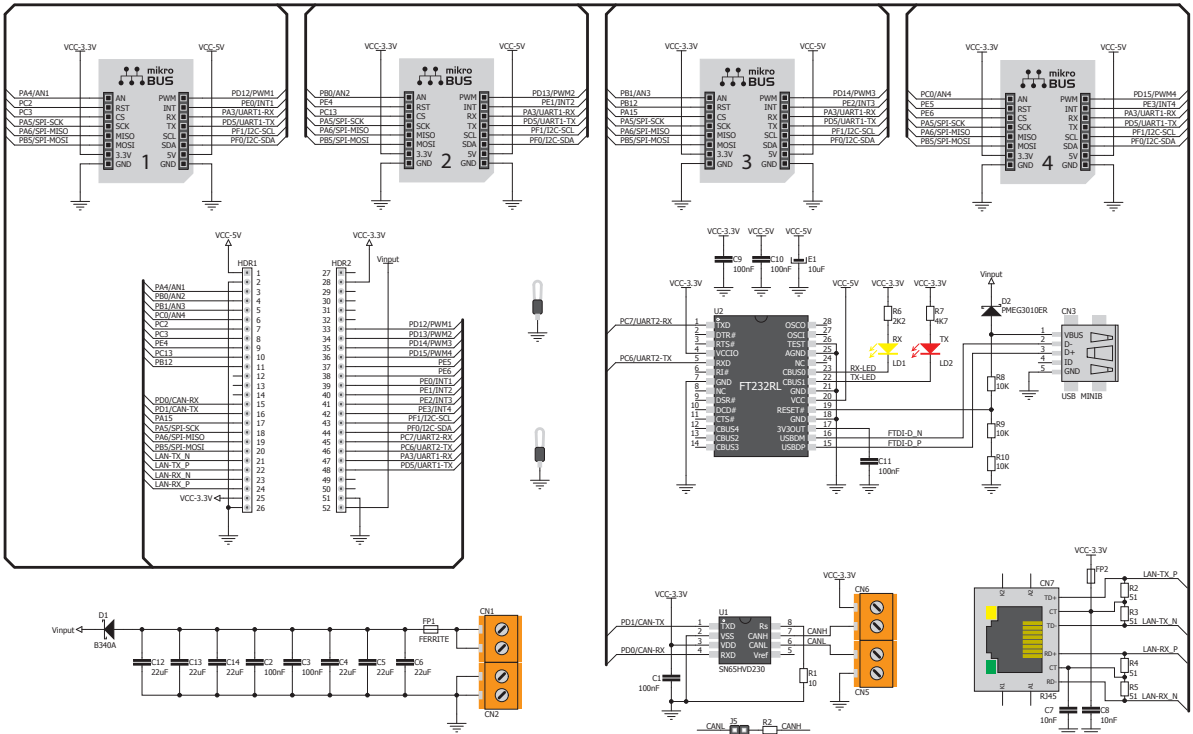


Figure 18-2: mikromedia+ shield schematic

What's next?

You have now completed the journey through each and every feature of mikromedia+ for STM32 ARM® board. You got to know it's modules and organization. Now you are ready to start using your new board. We are suggesting several steps which are probably the best way to begin. We invite you to join the users of mikromedia™ brand. You will find very useful projects and tutorials and can get help from a large ecosystem of users. Welcome!

Compiler

You still don't have an appropriate compiler? Locate ARM® compiler that suits you best on our website:

http://www.mikroe.com/compilers/arm/

Choose between mikroC™, mikroBasic™ and mikroPascal™ and download fully functional demo version, so you can start building your first applications.

Projects

Once you have chosen your compiler, and since you already got the board, you are ready to start writing your first projects. **Visual TFT software** for rapid development of graphical user interfaces enables you to quickly create your GUI. It will automatically create necessary code which is compatible with MikroElektronika compilers. Visual TFT is rich with examples, which are an excellent starting point for your future projects. Just load the example, read well commented code, and see how it works on hardware. Visual TFT is also available on the link bellow:

http://www.mikroe.com/visualtft/

Notes:

Notes:

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