



mikromedia 5

for Tiva™

Amazingly compact, all-on-a-single-pcb development board that carries
5" TFT Touch Screen and lots of multimedia peripherals, all driven by
a powerful **TM4C129L(X)NCZAD**



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.

A white handwritten signature in cursive script, appearing to read 'N. Matic', is positioned on the right side of the page.

Nebojsa Matic
General Manager

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Introduction to mikromedia 5 for Tiva™

The **mikromedia 5 for Tiva™** is a compact development board which allows development of devices with multimedia contents. The central part of the system is a 32-bit 212-pin **TM4C129L(X)NCZAD** microcontroller. The mikromedia 5 for Tiva™ features lots of on board modules such as stereo MP3 codec, **5" TFT 800x480 px** touch screen display, accelerometer, microSD card slot, buzzer, IR receiver, RGB LED diode, PIN photodiode, temperature sensor, 2.4 GHz RF transceiver, Ethernet, Wi-Fi transceiver, 64Mb SDRAM, Li-Polimer battery charger etc. The board also contains two MINI-B USB connectors, 2x5 Cortex Debug connector, two 1x26 connection pads, ON/OFF switch and other. It comes with an **on-board mikroProg™ for Tiva® programmer and debugger**, but can also be programmed with external programmers. **mikromedia 5 for Tiva™** is compact and slim, which makes it a convenient platform for mobile and other multimedia devices.

System Specification



power supply

Via USB cable (5V DC) or via adapter connector (5 - 12 V DC)



power consumption

121 mA with empty MCU
(when on-board modules are disabled)



board dimensions

135x86.6 mm (5.3x3.4 inch)



weight

~136g (0.3 lbs)

Package Contains



- 01 Damage resistant protective box



- 02 mikromedia 5 for Tiva™ development board



- 03 Roll USB cable, roll ethernet cable and headers



- 04 mikromedia 5 for Tiva™ user's guide



- 05 mikromedia 5 for Tiva™ schematic



- 06 Distancers, plastic pen and microSD card

1. Power Supply

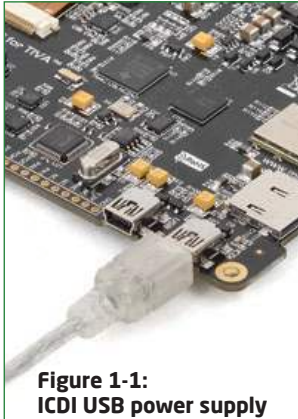


Figure 1-1:
ICDI USB power supply



Figure 1-2:
USB power supply



Figure 1-3:
Battery power supply



Figure 1-4: Adapter
connector power supply

The mikromedia 5 for Tiva™ board can be powered in four different ways: via two USB connectors using MINI-B USB cable provided with the board (**CN9 or CN2**), via battery connector using Li-Polymer battery (**CN3**) or via adapter connector using adapter power supply (**CN1**). After you plug in the appropriate power supply turn the power switch ON (**SW1**). The USB connection can provide up to 500 mA 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 adapter connector, voltage levels must be within **5-12 V DC** range. Power **LED ON (GREEN)** indicates the presence of power supply. On-board battery charger circuit **LM3658SD-A** enables you to charge the battery over two USB connectors or via adapter connector. **LED diode (RED)** indicates when battery is charging. Charging current is ~250 mA and charging voltage is 4.2 V DC.

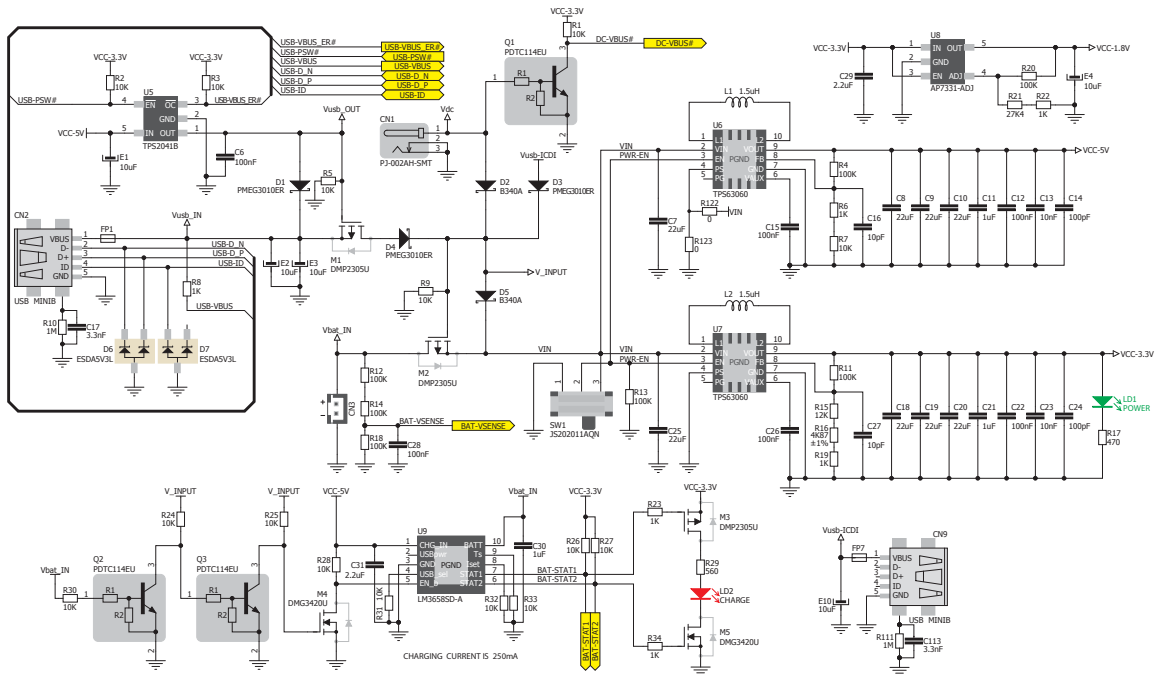


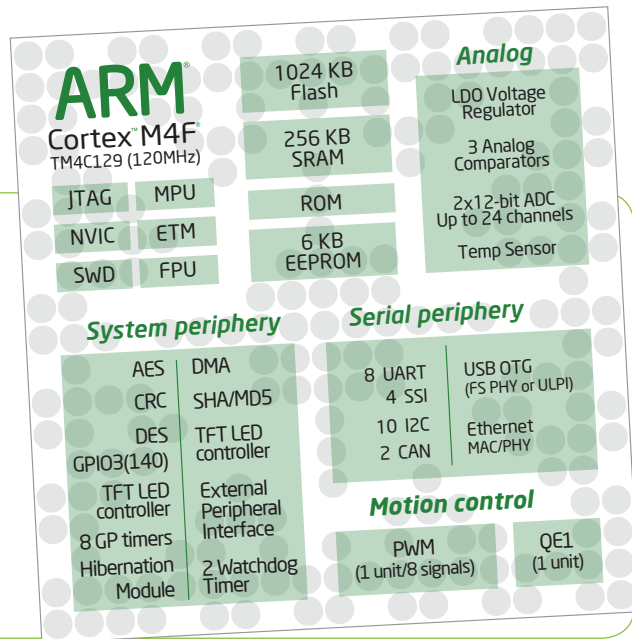
Figure 1-5: Power supply schematic

2. TM4C129L(X)NCZAD microcontroller

The mikromedia 5 for Tiva™ development board comes with the 212-pin **ARM® Cortex™-M4F TM4C129L(X)NCZAD** 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 **150 DMIPS** Operation (120 MHz);
- 1024 KB of Flash memory;
- 256 KB of SRAM memory;
- 6 KB of EEPROM memory;
- up to 140 I/O pins;
- 16/32-bit timers
- 16 MHz internal oscillator, 32 kHz RTCC;
- 8xUART, 4xSSI, 10xI²C, 2xCAN, 2xADC, USB, Ethernet etc.



3. Programming the microcontroller

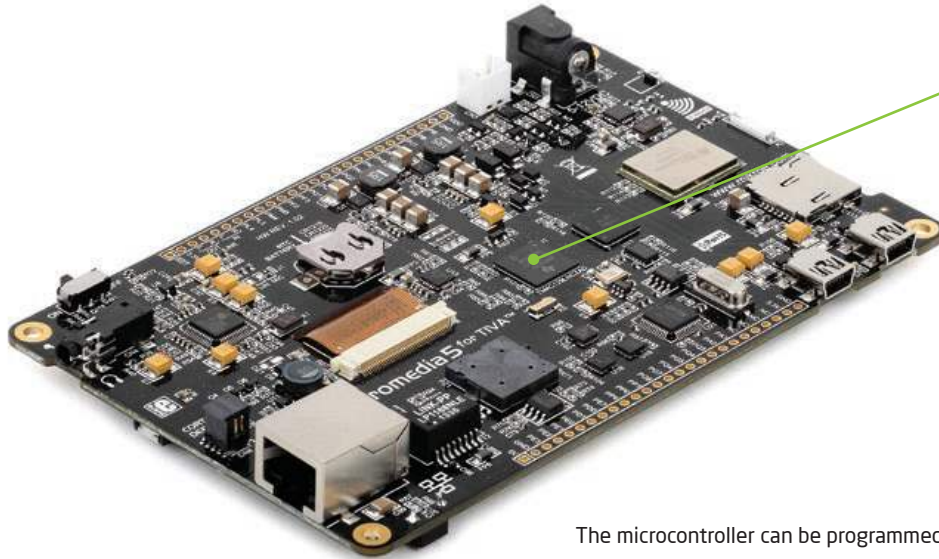


Figure 3-1:
TM4C129L(X)NCZAD
microcontroller

The microcontroller can be programmed in two ways:

- 01 Using on-board mikroProg™ for Tiva® programmer
- 02 Using external programmers

On-board mikroProg™ for Tiva® programmer

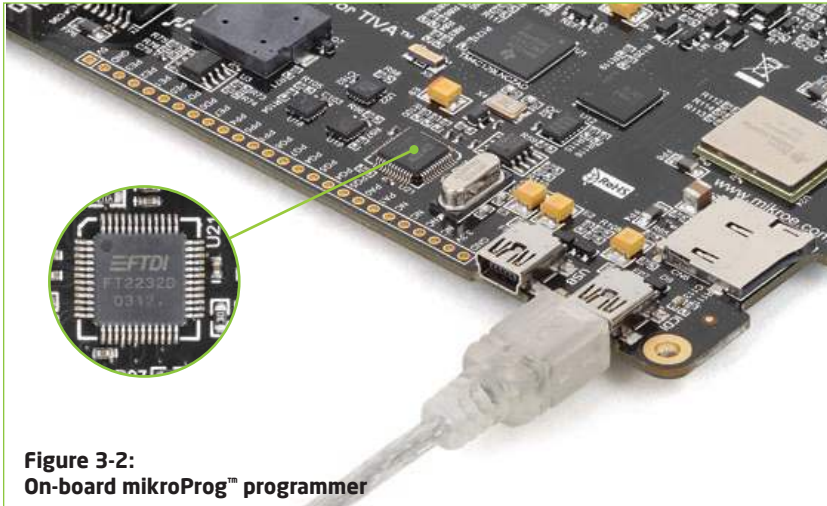


Figure 3-2:
On-board mikroProg™ programmer

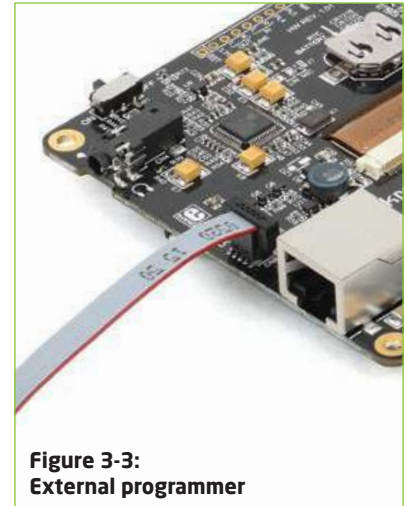


Figure 3-3:
External programmer

The microcontroller can be programmed with on-board **mikroProg™ for Tiva® programmer** and **mikroProg Suite™ for ARM® software**. Connection with PC is established over ICDI USB connector. For proper insertion of the MINI-B USB cable refer to **Figure 3-2**. Signalization LEDs (ACTIVE and DATA) are also provided on the opposite side of the ICDI USB connector. It is also possible to program the microcontroller with external programmers, via 2x5 Cortex Debug connector (**CN8**) with appropriate adapter, **Figure 3-3**.

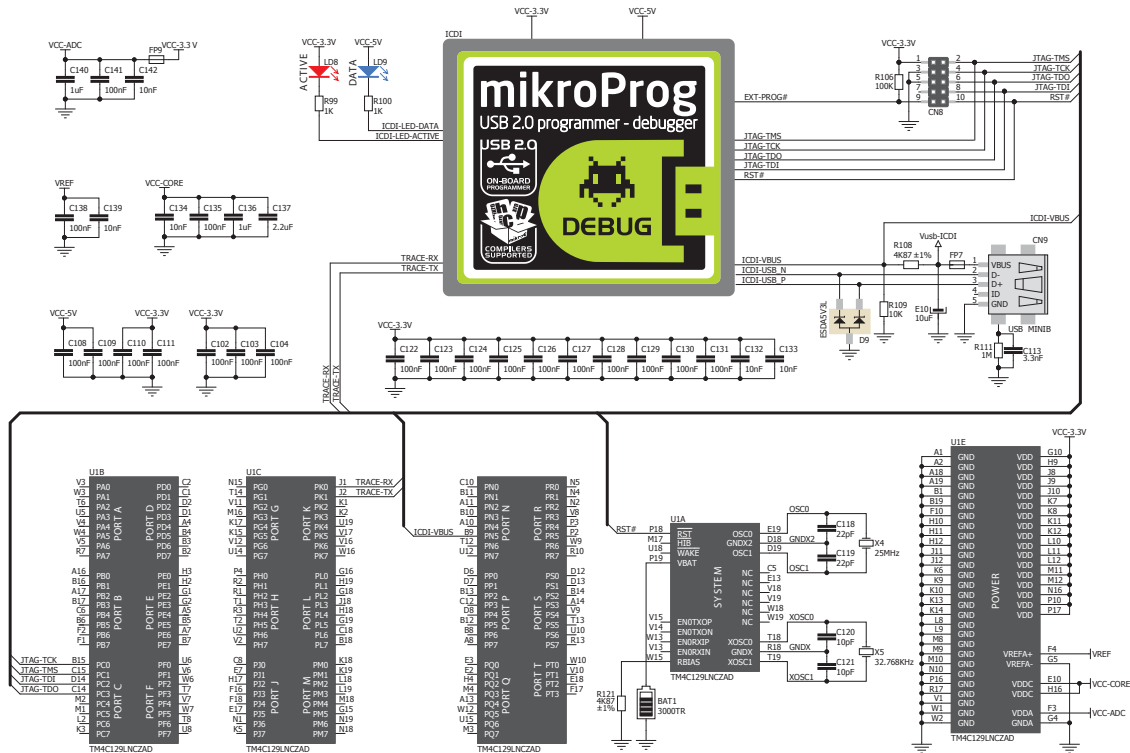


Figure 3-4: Programmer connection schematic

mikroProg Suite™ for ARM® software



On-board mikroProg™ for Tiva™ programmer requires **special programming software** called mikroProg Suite™ for ARM®. This software is used for programming ALL Tiva™ and Stellaris® ARM® Cortex-M3™ and Cortex-M4™ microcontroller families. It features intuitive interface and SingleClick™ programming technology. Software installation is available on following link:



<http://www.mikroe.com/mikroprog/tiva/>

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 the target HEX file.
- 03 If you want to write the HEX file into 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 clear the microcontroller memory.

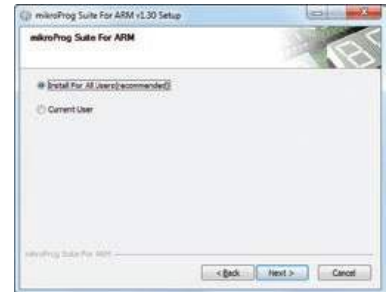
Software installation wizard



01 Start Installation



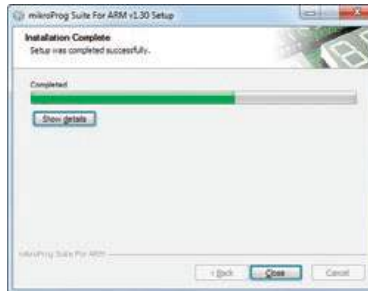
02 Accept EULA and continue



03 Install for all users



04 Choose destination folder



05 Installation in progress

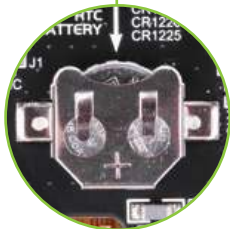


06 Finish installation

4. RTC Battery and Reset Button

RTC Battery

mikromedia 5 for Tiva™ 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 primary 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.



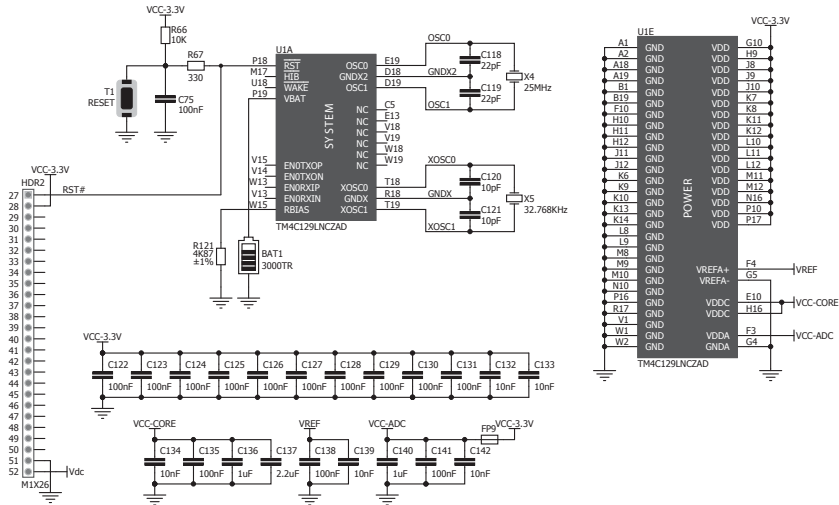


Figure 4-1: Reset button and RTC battery connection schematic

5. Crystal Oscillators and 2.048 V Reference

The board is equipped with **01 25 MHz crystal oscillator (X4)** circuit that provides external clock waveform to the microcontroller **OSC1** and **OSC2** pins. This base frequency is suitable for further clock multipliers and is also 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 (X5)** 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 **2.048 V**.

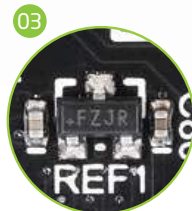
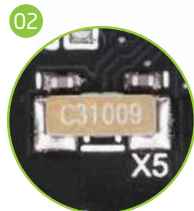
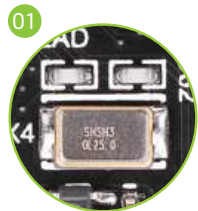
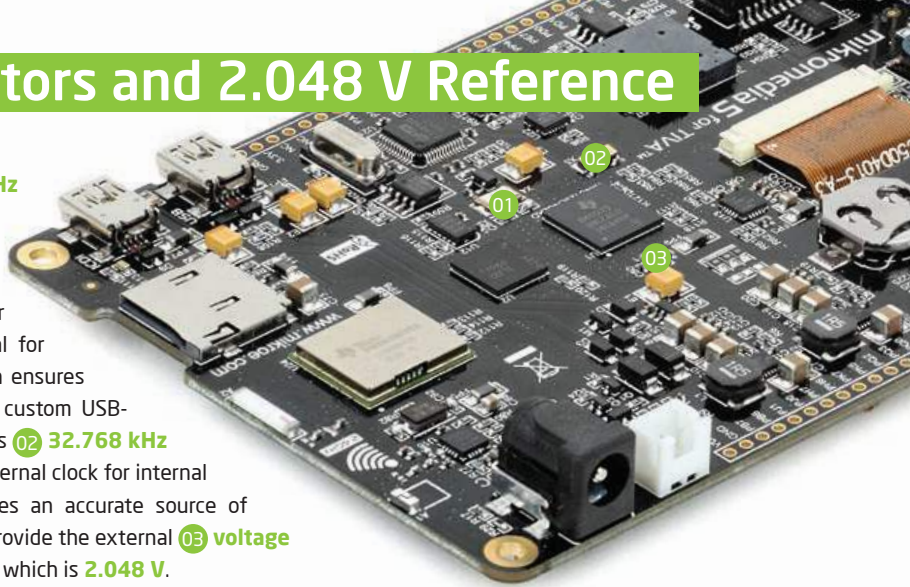


Figure 5-1: Crystal oscillators and 2.048 V reference

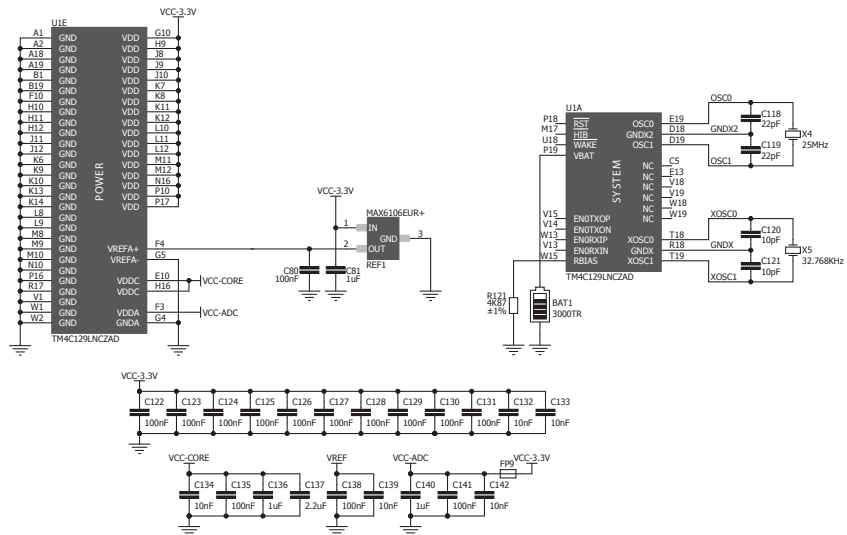
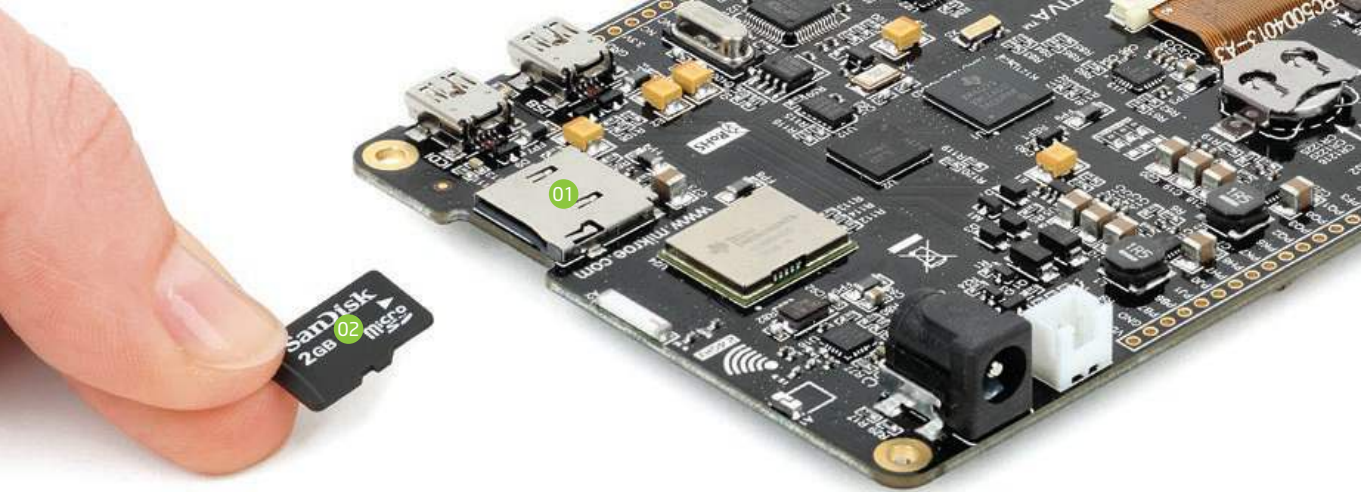


Figure 5-2: Crystal oscillators and voltage reference connection schematic

6. microSD Card Slot



The board contains **01** **microSD card slot** that enables you to use **02** microSD cards in your projects and 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 capacitor are provided to compensate voltage and current glitch that can occur when pushing microSD card in and out of the socket. The proper insertion of the microSD card is shown in **Figure 6-1**.

Figure 6-1:
microSD Card Slot

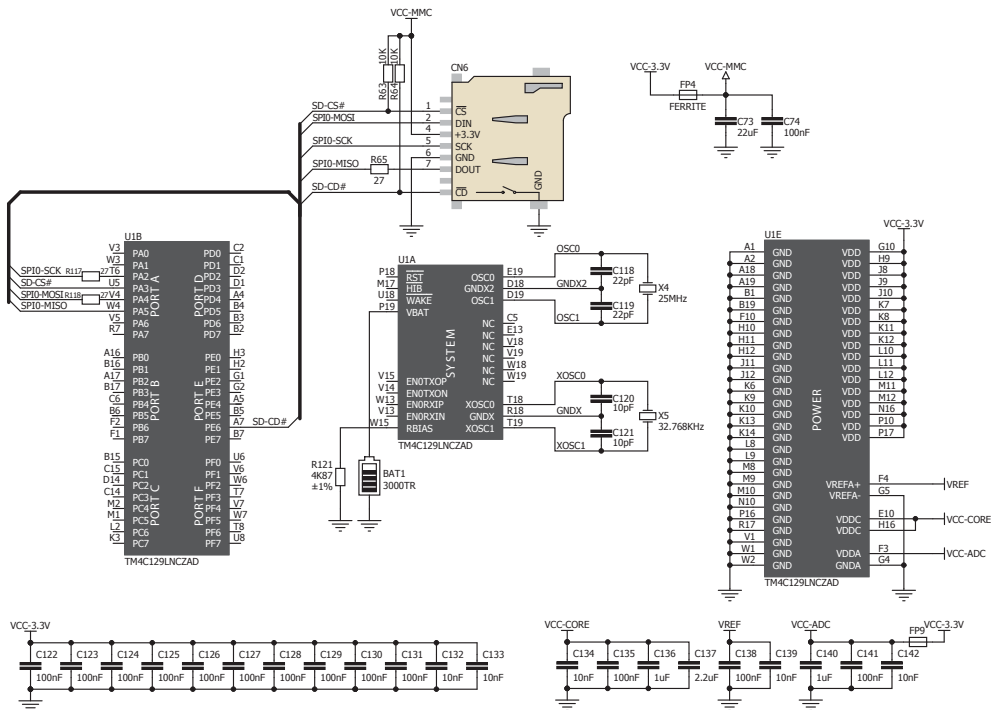


Figure 6-2: microSD Card Slot module connection schematic

7. Touch Screen



The mikromedia features a **5" TFT 800x480 px display** 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 **16.7M** different **colors**.

Figure 7-1: Touch Screen

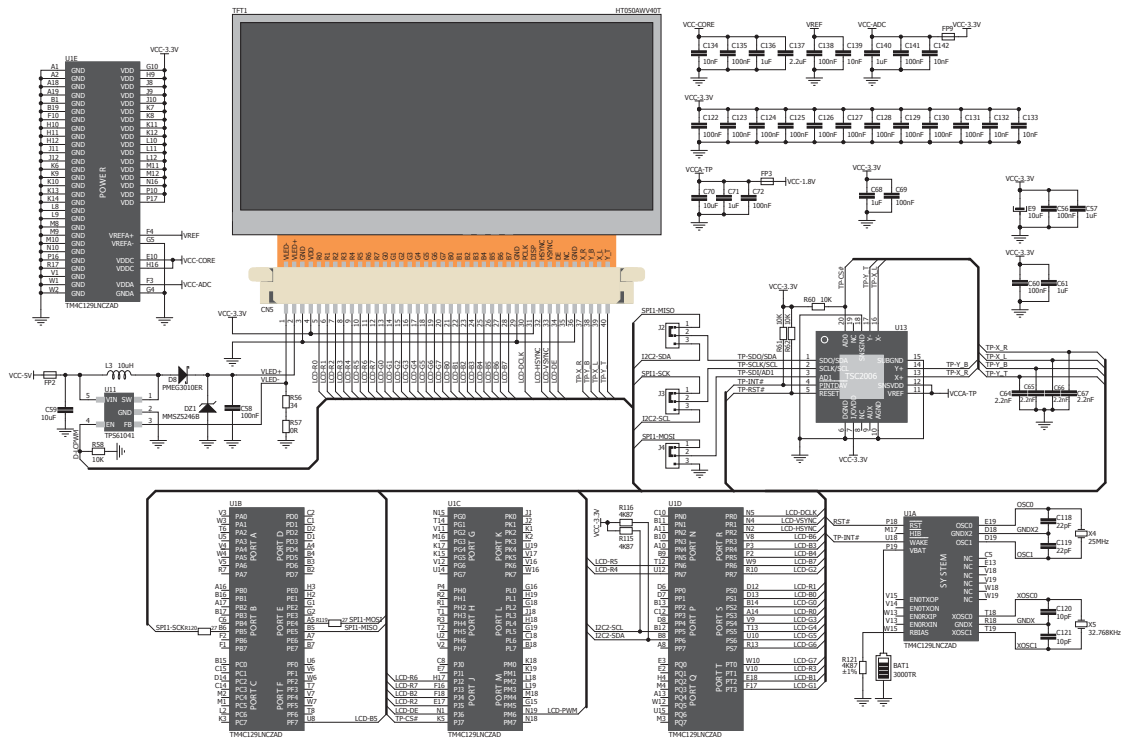
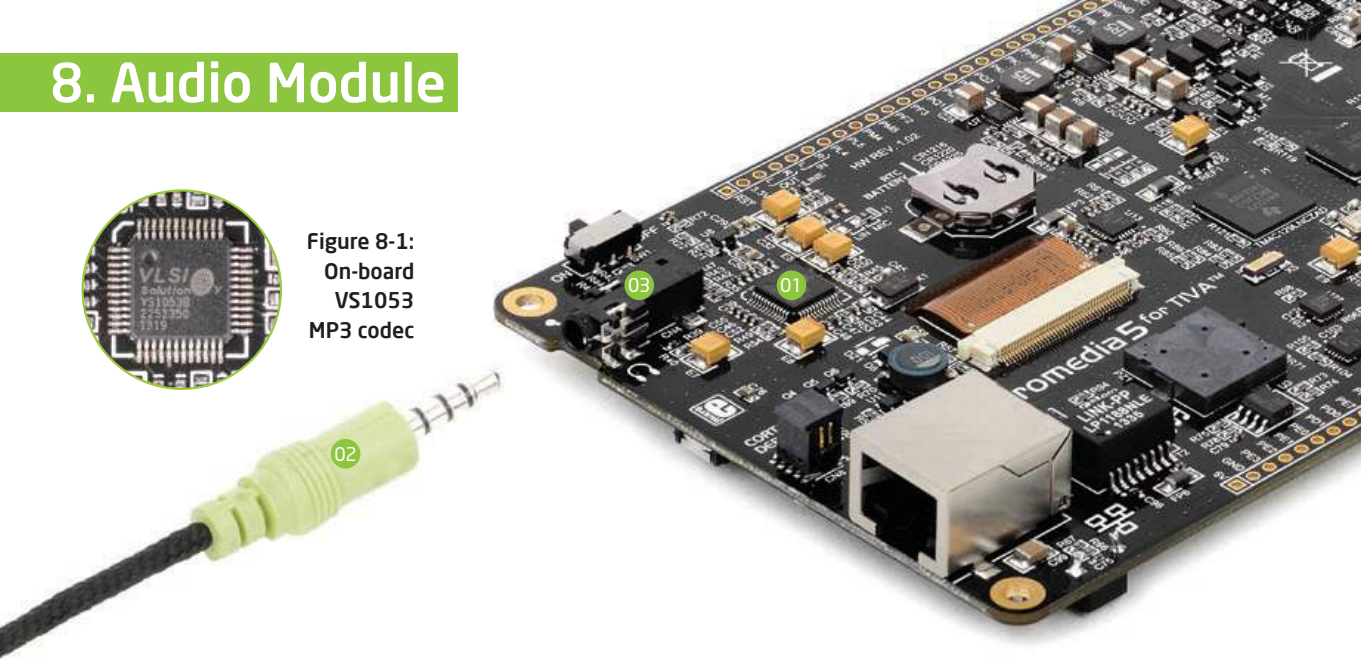


Figure 7-2: Touch Screen connection schematic

8. Audio Module



Figure 8-1:
On-board
VS1053
MP3 codec



mikromedia 5 for Tiva™ 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 3.5 mm** connector **CN4**. All functions of this module are controlled by the microcontroller over Serial Peripheral Interface (**SPI**). **IN and OUT** channels are also provided on the side headers.

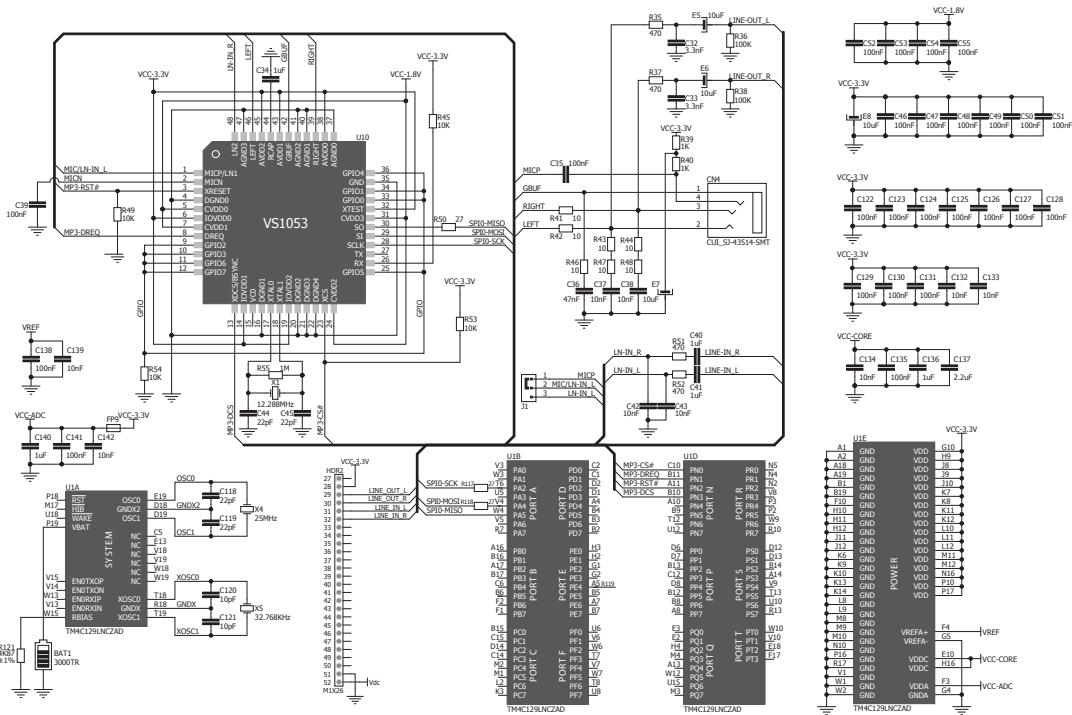


Figure 8-2: Audio module connection schematic

9. USB DEVICE connection

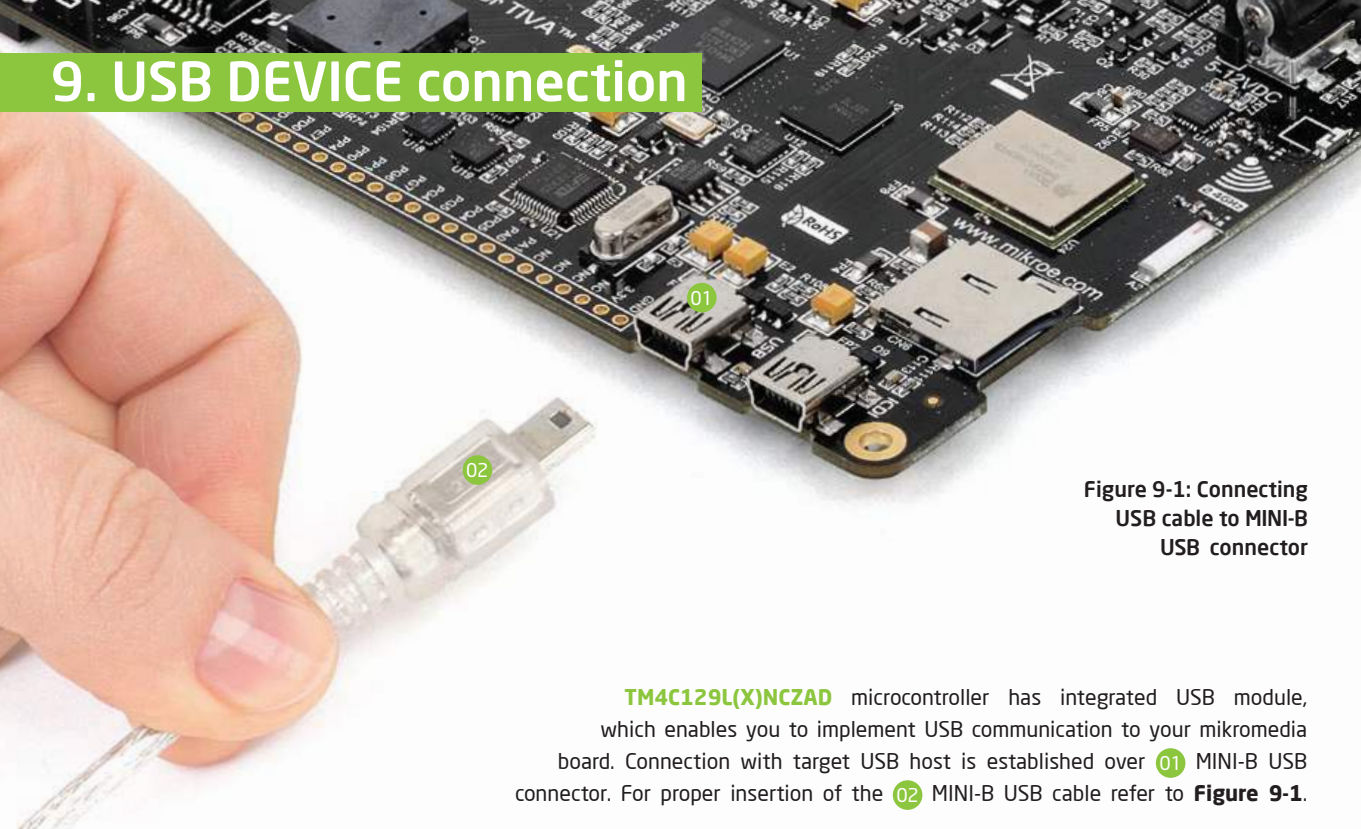


Figure 9-1: Connecting USB cable to MINI-B USB connector

TM4C129L(X)NCZAD microcontroller has integrated USB module, which enables you to implement USB communication to your mikromedia board. Connection with target USB host is established over **01** MINI-B USB connector. For proper insertion of the **02** MINI-B USB cable refer to **Figure 9-1**.

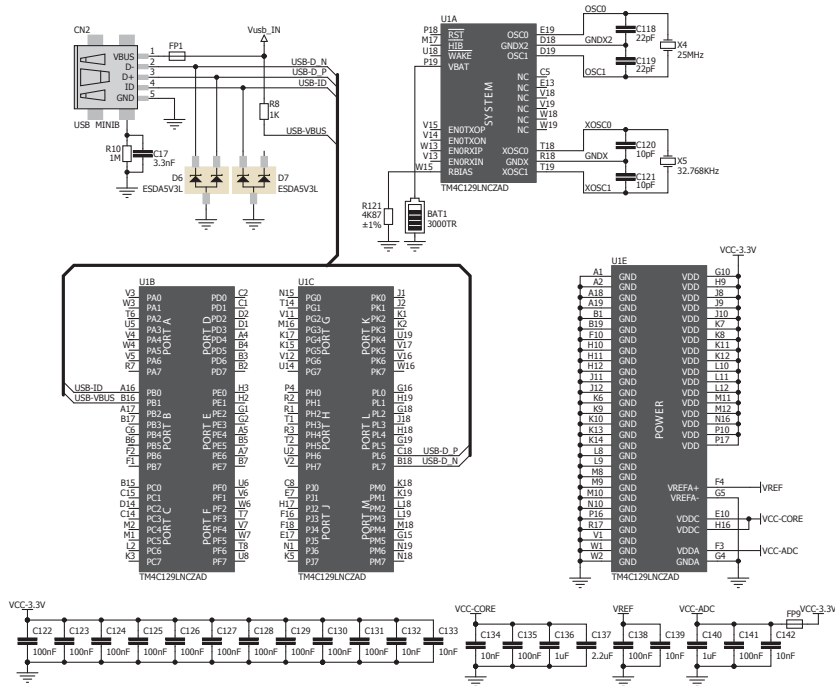


Figure 9-2: USB DEVICE module connection schematic

10. USB HOST connection

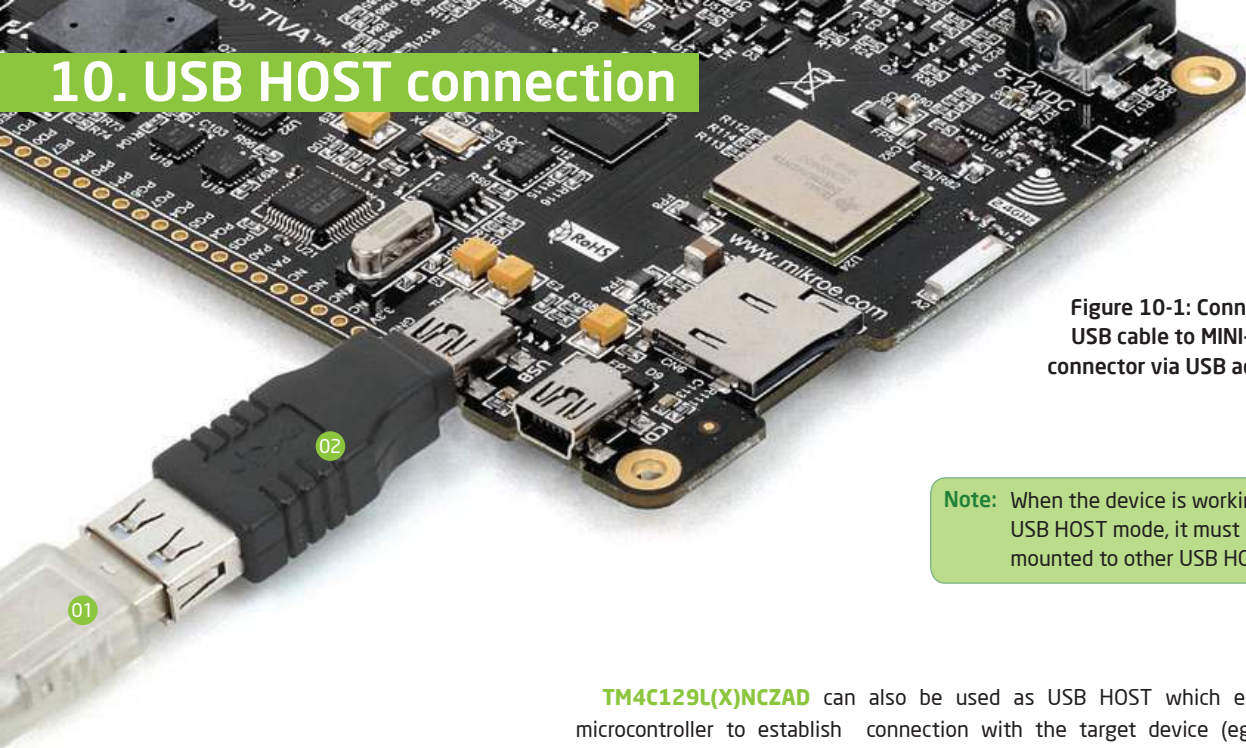


Figure 10-1: Connecting USB cable to MINI-B USB connector via USB adapter

Note: When the device is working in USB HOST mode, it must not be mounted to other USB HOST.

TM4C129L(X)NCZAD can also be used as USB HOST which enables microcontroller to establish connection with the target device (eg. USB keyboard, USB mouse, etc). The board provides necessary power supply to the target via TPS2041B IC. To connect **01** USB HOST cable, it is necessary to use the appropriate **02** MINI-B USB to USB type A adapter. For proper insertion refer to **Figure 10-1**.

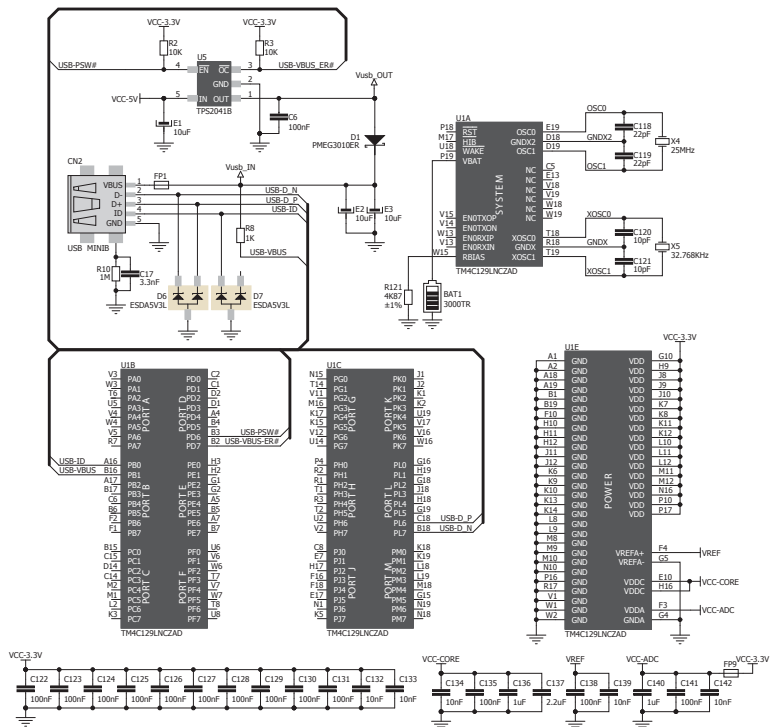


Figure 10-2: USB HOST module connection schematic

11. Accelerometer

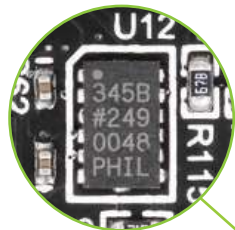
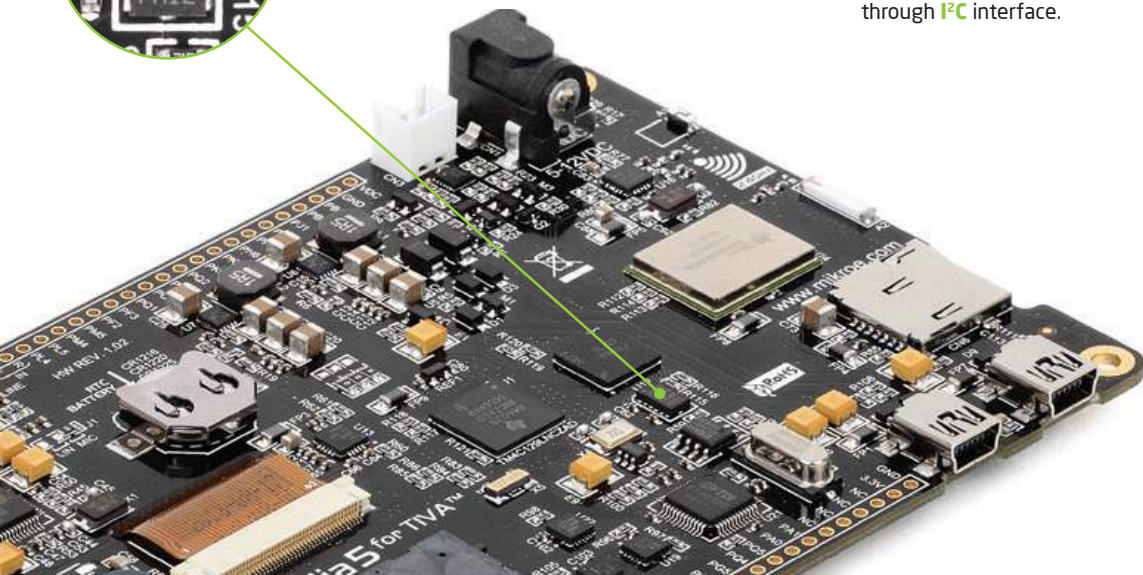
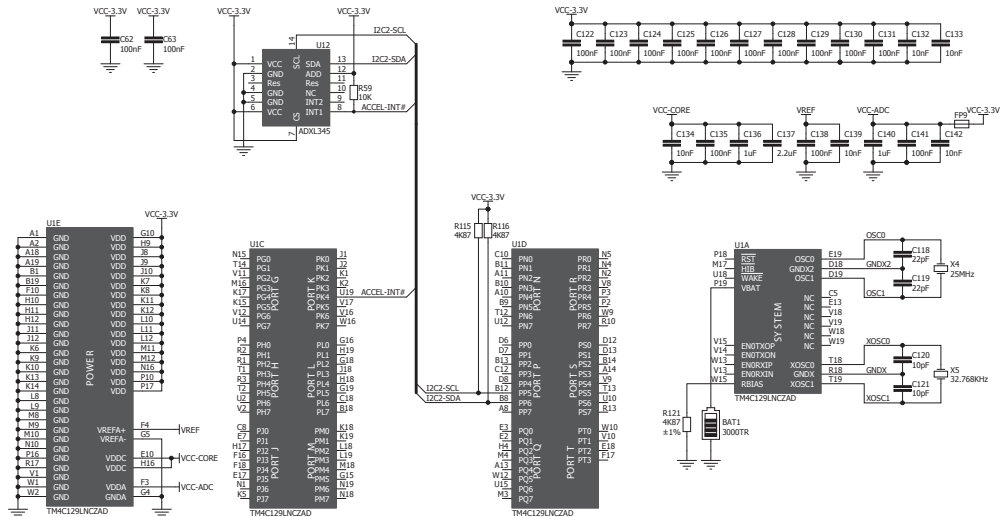


Figure 11-1:
Accelerometer
module

On board **ADXL345** accelerometer measures acceleration in three axis: x, y and z. Most common use is to determine screen orientation, but there are many other fields of usage. Communication between the accelerometer and the microcontroller is established through **I²C** interface.





12. SDRAM

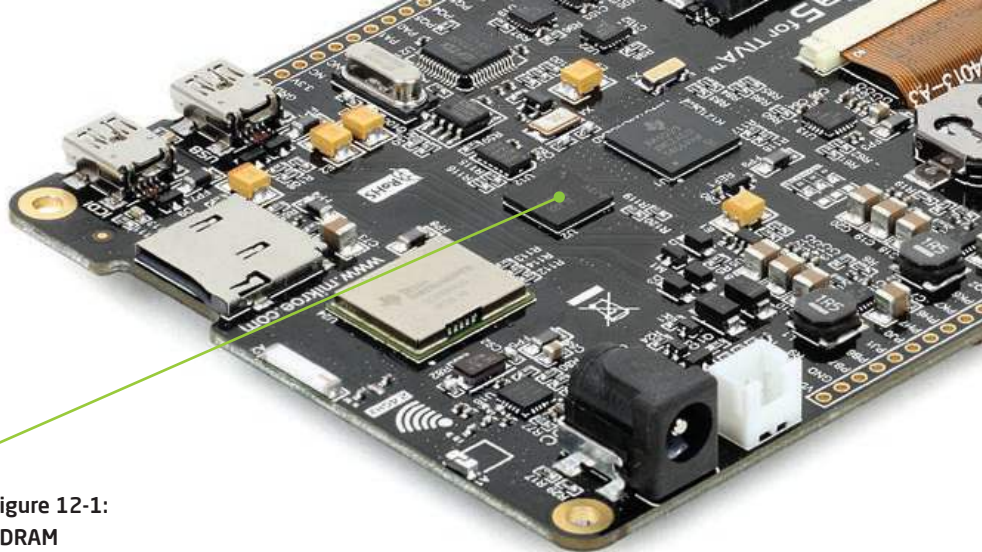


Figure 12-1:
SDRAM

mikromedia 5 for Tiva™ board features high-speed 64 Mbit **M12L64164A SDRAM** (Synchronous Dynamic Random-Access Memory). It is internally organized as 4 x 1,048,576 words by 16 bits. The SDRAM provides for programmable read or write burst lengths of 1, 2, 4, 8 locations, or the full page, with a burst terminate option. SDRAM is connected to the microcontroller via dedicated 16-bit parallel interface providing a high-speed data rate for more demanding multimedia applications, such as TFT display.

13. RF Transceiver

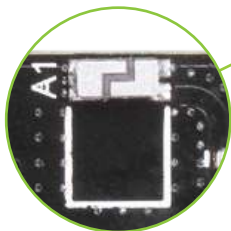


Figure 13-1:
RF transceiver antenna

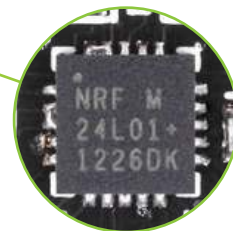


Figure 13-2:
RF transceiver module

mikromedia 5 for Tiva™ board features **nRF24L01P RF transceiver** chip with **2.4 GHz 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 2 Mbps. 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.

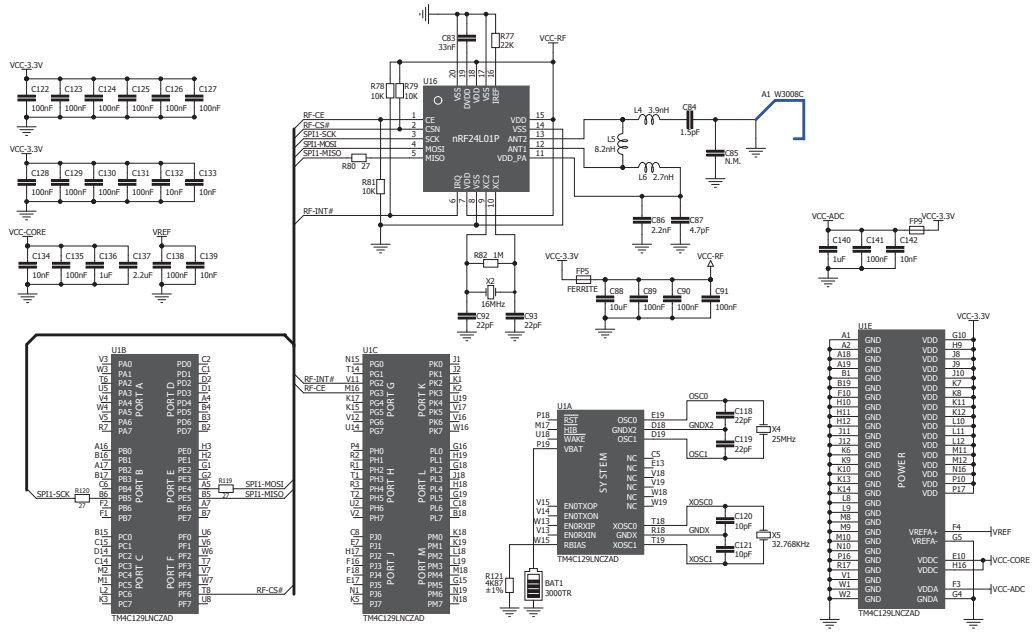


Figure 13-3: RF transceiver module connection schematic

14. Ethernet

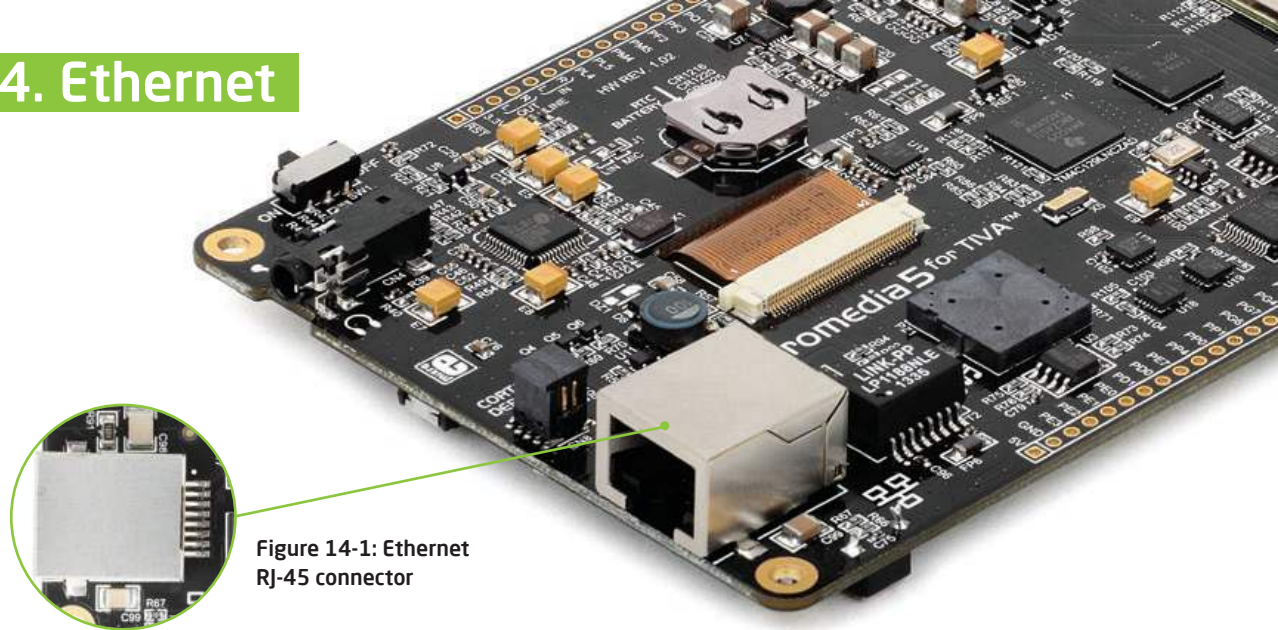


Figure 14-1: Ethernet RJ-45 connector

The development board features an Ethernet controller which is integrated in **TM4C129L(X)NCZAD** microcontroller. It is ideal for local area networking (LAN). If you want to establish connection with computer, router or other devices, the development board also contains standard **RJ-45** connector. Communication over Ethernet is based on data packets called frames. Each frame contains source and destination addresses and error-checking data so that damaged data can be detected and retransmitted. Signalization LEDs are provided on the opposite side of the board.

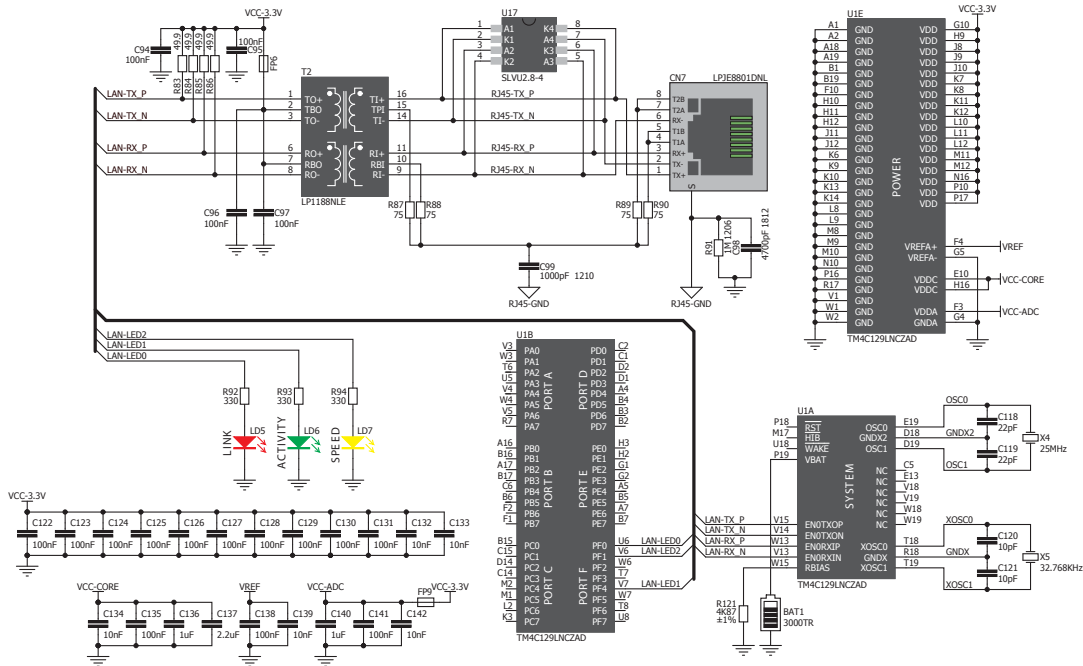


Figure 14-2: Ethernet module schematic

15. Buzzer

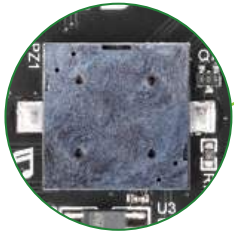


Figure 15-1:
Buzzer module

The board is also equipped with **SPT-1325A piezo buzzer**. It is an electric component which can be used to create sound when is provided with electrical signal. This is usually a PWM signal coming from a microcontroller pin. 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. Piezo buzzer is connected to the microcontroller pin **N18**.

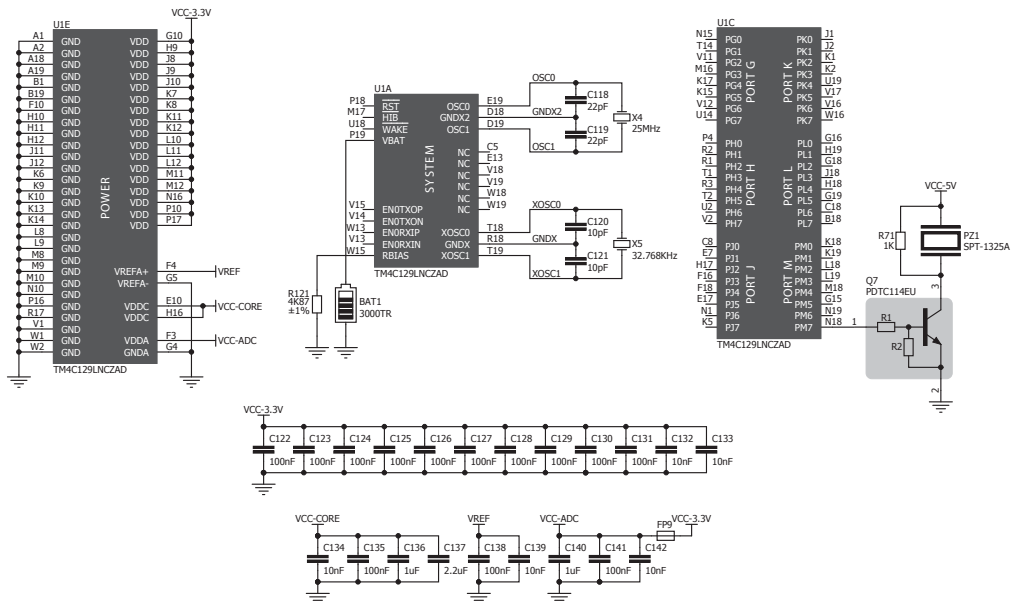


Figure 15-2: Buzzer module connection schematic

16. WiFi



Figure 16-1:
2.4GHz ceramic chip
antenna

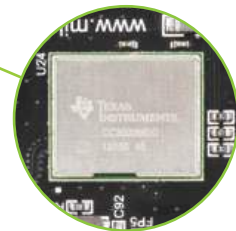


Figure 16-2:
Wi-Fi 802.11b/g network
porcessor

mikromedia 5 for Tiva™ board features **CC3000** - Wi-Fi 802.11 b/g network processor chip and **2.4 GHz ceramic chip antenna**. With integrated IPv4 TCP/IP stack and many built-in network protocols it simplifies the implementation of internet connectivity and minimizes the software requirements of the host microcontroller. It also contains integrated EEPROM which stores firmware patch, network configuration, MAC address and 5 KB of user data. Wi-Fi module is connected to the microcontroller via the Serial Peripheral Interface (**SPI**).

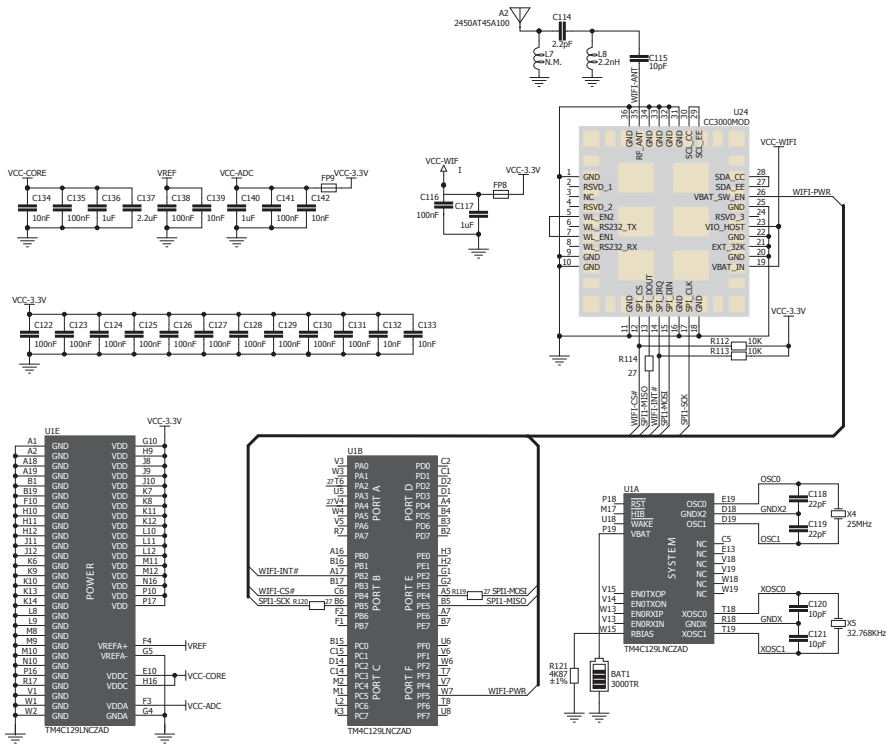
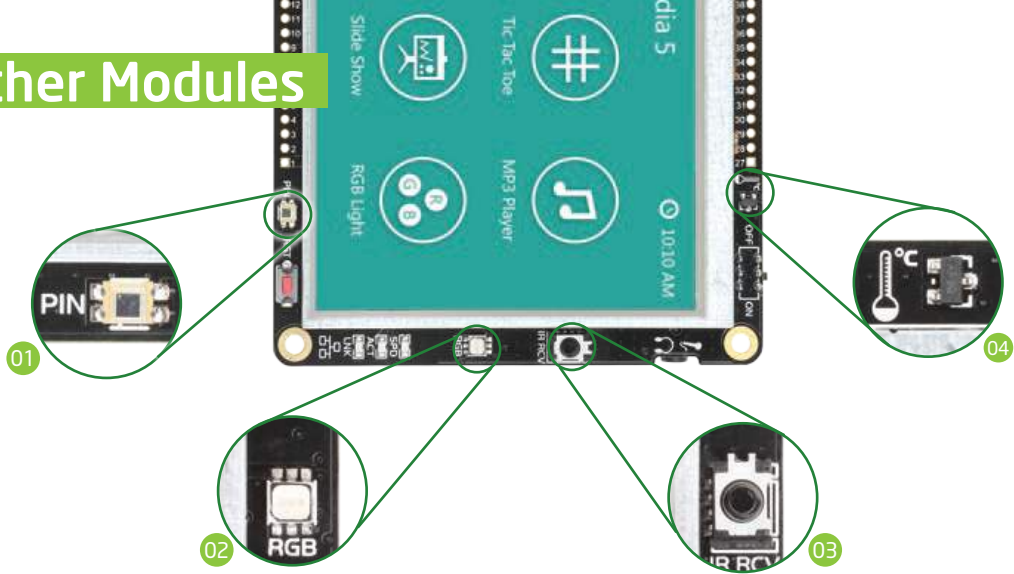


Figure 16-3: WiFi connection schematic

17. Other Modules



The board also contains other useful peripherals such as 01 PIN photodiode, 02 RGB led diode, 03 IR receiver and 04 analog temperature sensor. **PIN photodiode** is a type of photo detector. It is high sensitive and fast responsive. It is connected to the microcontroller analog pin **A8**. **IR receiver** is used in infrared remote control systems. The demodulated output signal obtained from IR module can be directly decoded by microcontroller. Many of standard data formats are supported. **RGB (Red, Green, Blue) diode** can be used as a light indicator. Each color is driven separately by the transistor. The **analog temperature sensor** converts temperature to analog voltage. It is directly connected to the microcontroller **K1** analog pin. Temperature measurement range of mikromedia 5 for Tiva™ board is from -20° C to 70° C.

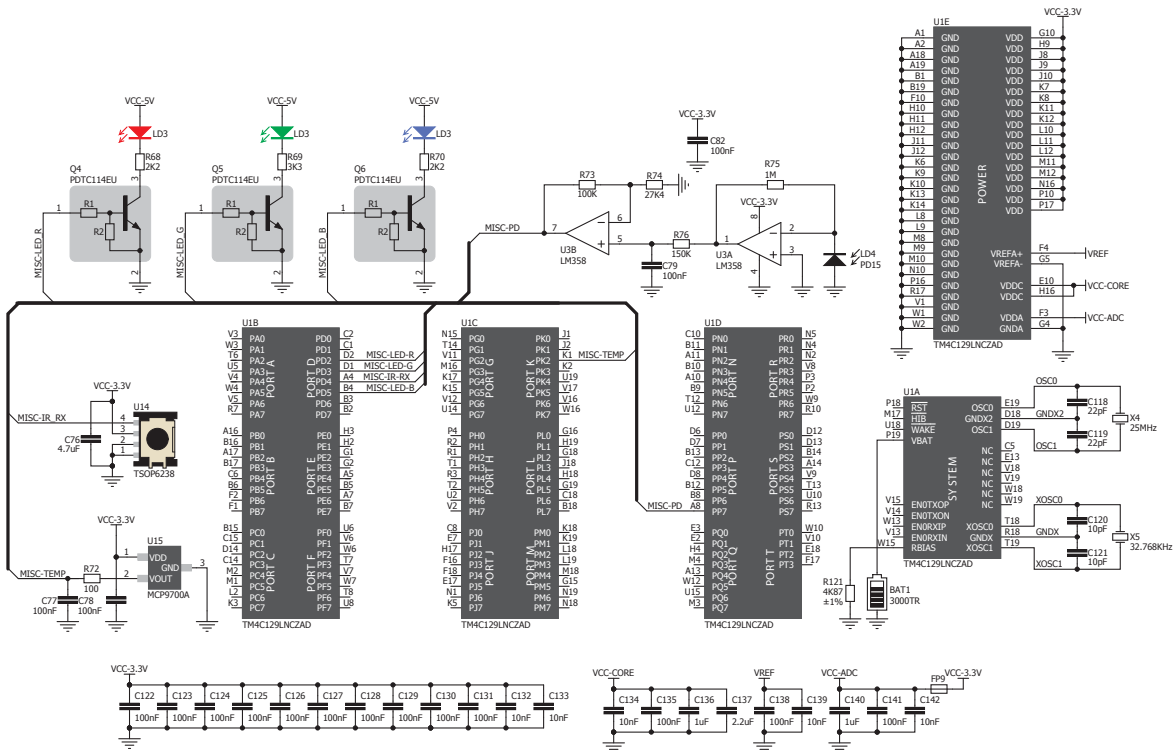
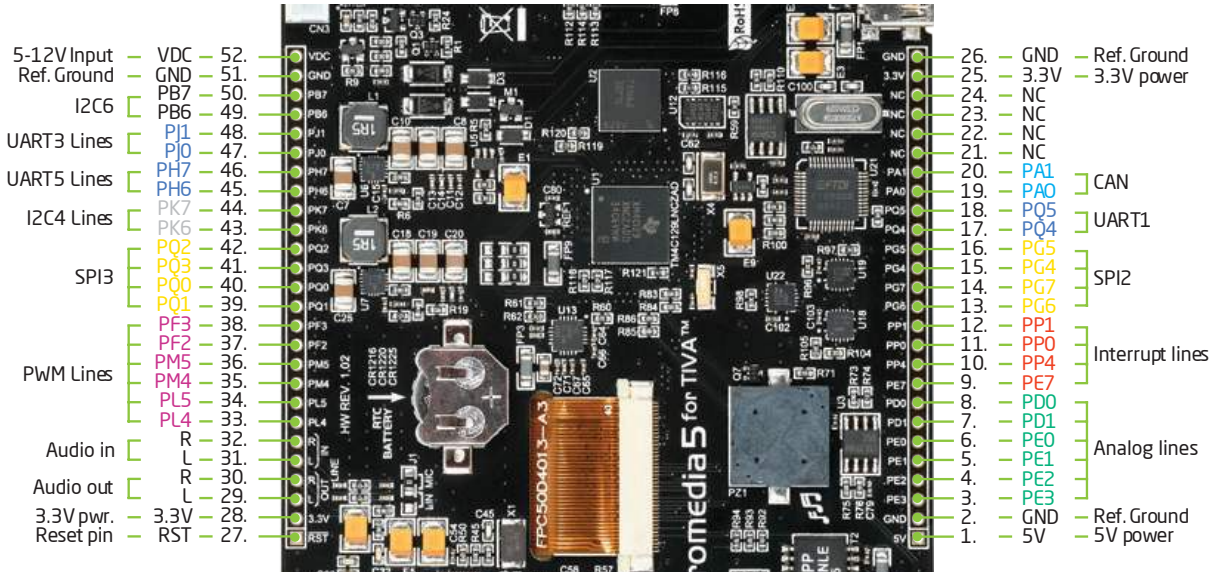


Figure 17-1: Other modules connection schematic

18. Pads

■ Analog lines
 ■ SPI
 ■ CAN
 ■ UART
 ■ PWM
 ■ I2C
 ■ Interrupt



Many microcontroller pins are available for further connectivity via two 1x26 rows of connection pads on both sides of the board

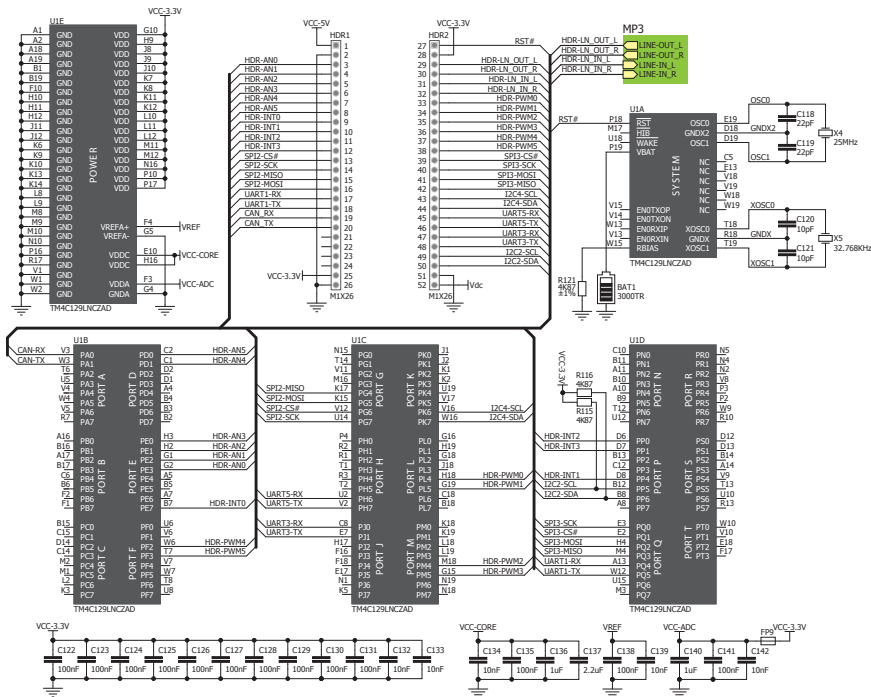


Figure 18-1: Connecting pads schematic

20. What's next?

You have now completed the journey through each and every feature of mikromedia 5 for Tiva™ 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 below:

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

Notes:

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