



# mikromedia™

## for Tiva™ C Series

Compact multimedia development system rich with on-board peripherals  
for all-round development on **TM4C123GH6PZ** device



# 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', set against a dark green background.

Nebojsa Matic  
General Manager

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# Introduction to mikromedia for Tiva™ C Series

The **mikromedia for Tiva™ C Series** 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 TM4C123GH6PZ** microcontroller. The mikromedia for Tiva™ C Series features integrated modules such as stereo MP3 codec, **TFT 320x240** touch screen display, accelerometer, MMC/SD card slot, 8 Mbit flash memory, battery charger. The board also contains MINI-B USB connector, two 1x26 connection pads and other. It comes pre-programmed with USB HID bootloader, but can also be programmed with external programmers, such as **mikroProg™ for Tiva™ C Series** or other programmers. Mikromedia is compact and slim, and perfectly fits in the palm of your hand, which makes it a convenient platform for mobile devices.



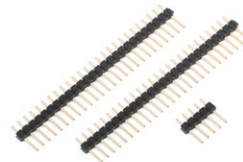
# Package Contains



- 01 Damage resistant protective box



- 02 mikromedia for Tiva™ C Series development system



- 03 Two 1x26 male headers and one 1x5 header



- 04 mikromedia for Tiva™ C Series user's guide



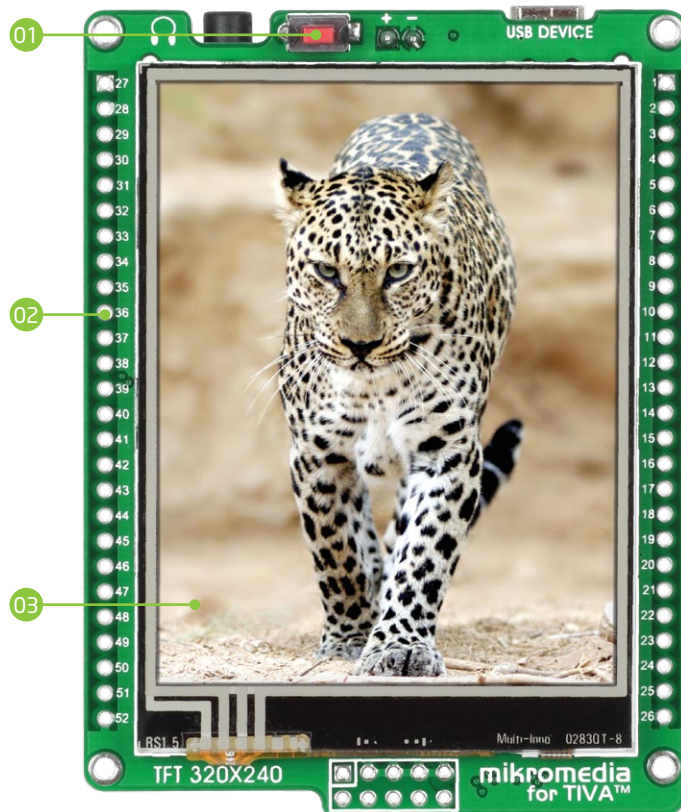
- 05 mikromedia for Tiva™ C Series schematic and pinout

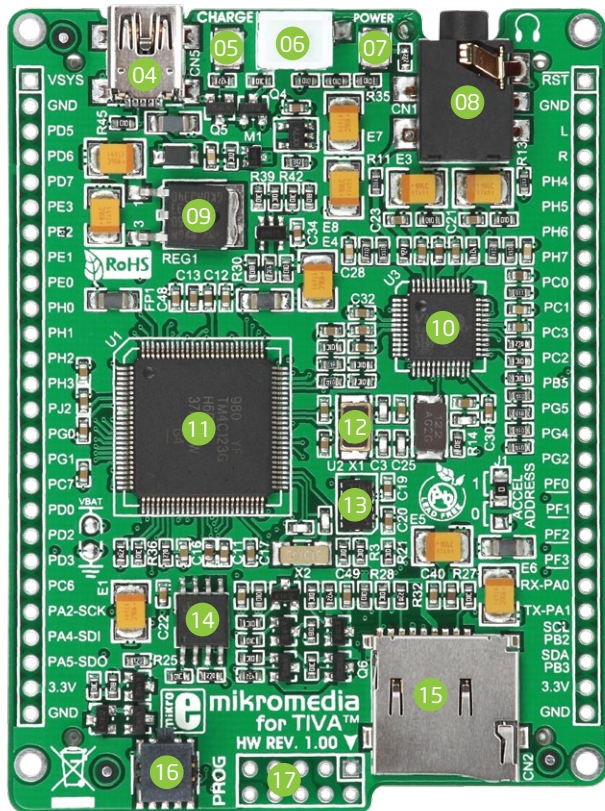


- 06 USB cable

# Key Features

- 01 RESET button
- 02 Connection Pads
- 03 TFT 320x240 display
- 04 USB MINI-B connector
- 05 Charge indication LED
- 06 Li-Polymer battery connector
- 07 Power indication LED
- 08 3.5mm headphone connector
- 09 Power supply regulator
- 10 VS1053 Stereo mp3 coder/decoder
- 11 Tiva™ C Series ARM® Cortex™-M4 TM4C123GH6PZ
- 12 Crystal oscillator
- 13 Accelerometer
- 14 Serial Flash memory
- 15 microSD Card Slot
- 16 Cortex Debug connector
- 17 mikroProg™ connector





## System Specification



**power supply**  
Via USB cable (5V DC)



**power consumption**  
56 mA with erased MCU (when on-board modules are inactive)



**board dimensions**  
61.2 x 60.5 mm (3.19 x 2.38 inch)



**weight**  
~50g (0.11lbs)



**CAUTION: Electrostatic Sensitive Device**  
Permanent damage may occur on devices subjected to high energy electrostatic discharges which readily accumulate on the human body or test equipment and can discharge without detection.

# 1. Power supply

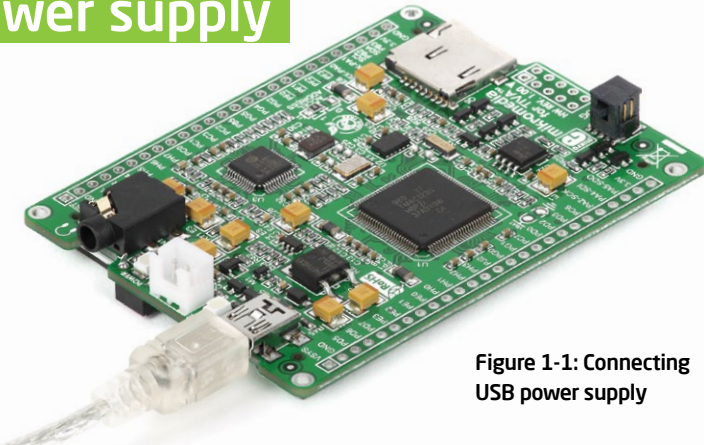


Figure 1-1: Connecting USB power supply

## USB power supply

You can power up the board using the **MINI-B USB** cable provided in the package. On-board voltage regulators provide the appropriate voltage levels to each component on the board. **Power LED (GREEN)** will indicate the presence of a power supply.

## Battery power supply

You can also power the board with a **Li-Polymer** battery, using the on-board battery connector. On-board battery charger circuit **MCP73832** enables you to charge the battery over the USB connection. **LED diode (RED)** will indicate when the battery is charging. Charging current is ~250mA and charging voltage is 4.2V DC.

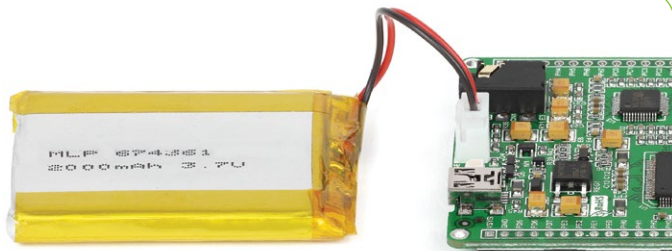


Figure 1-2: Connecting Li-Polymer battery



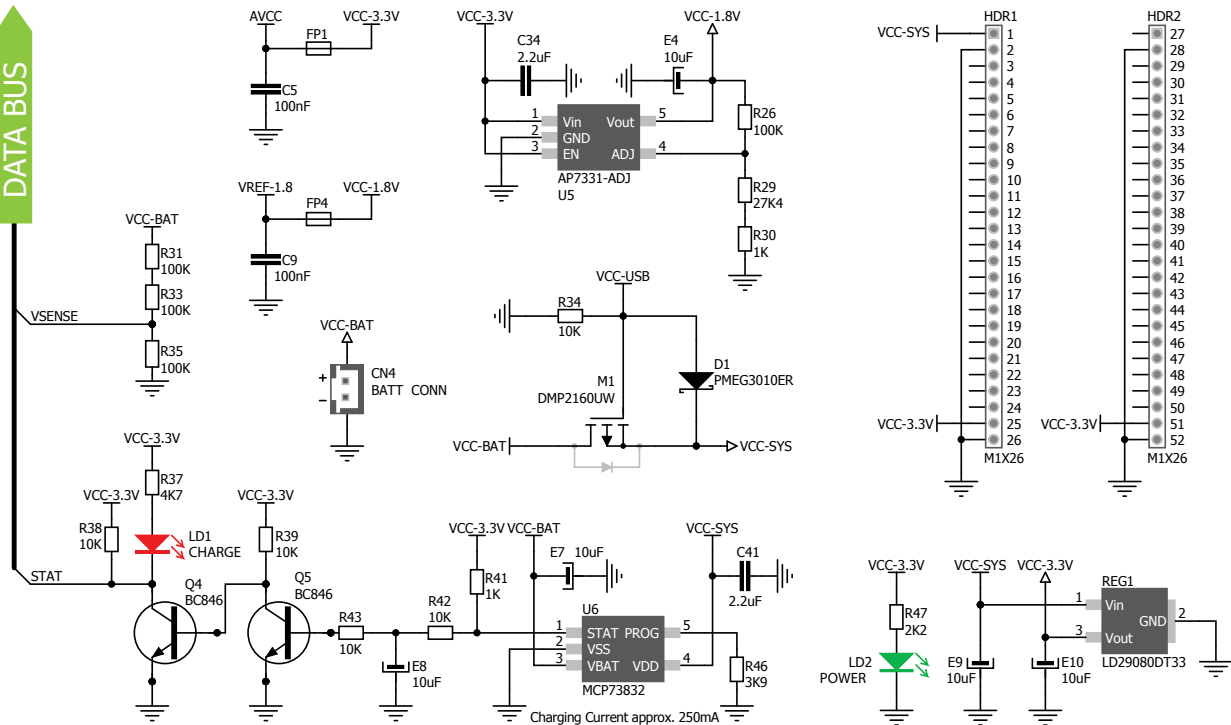


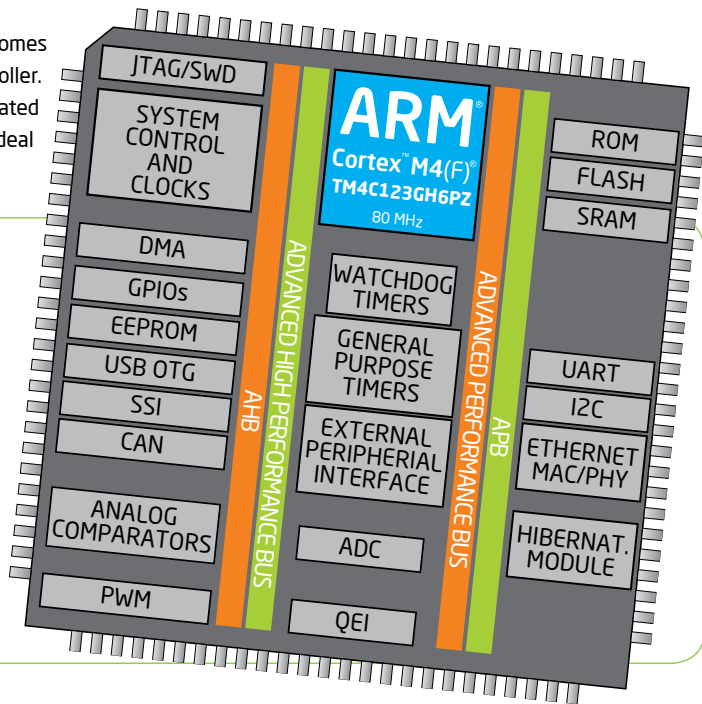
Figure 1-3: Power supply schematics

## 2. TM4C123GH6PZ microcontroller

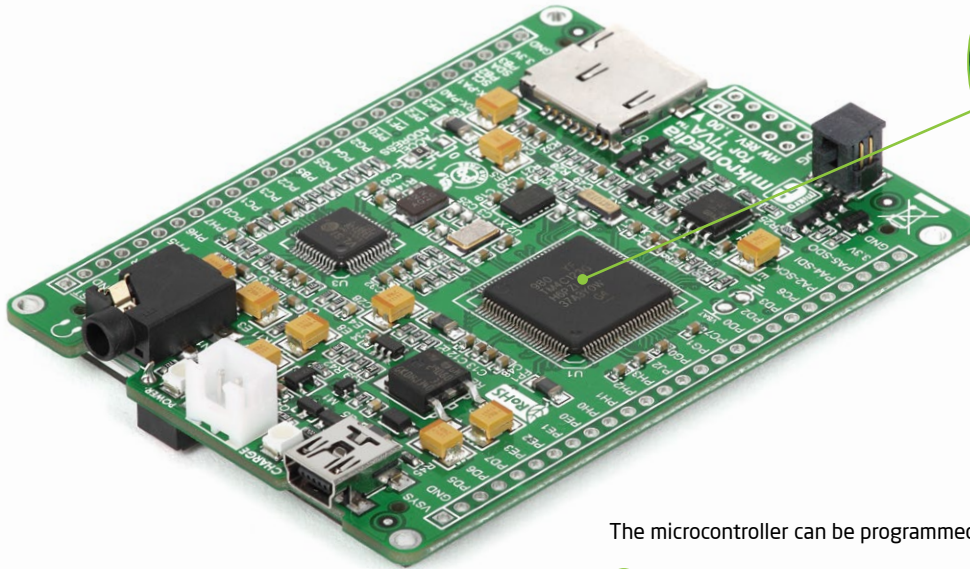
The mikromedia for Tiva™ C Series development board comes with the **ARM® Cortex™-M4 TM4C123GH6PZ** microcontroller. This high-performance **32-bit** microcontroller with its integrated modules and in combination with other on-board modules is ideal for multimedia applications.

### Key microcontroller features

- Up to **100 DMIPS** Operation;
- 32-bit architecture;
- 256KB of Flash;
- 32KB of SRAM, 2KB EEPROM;
- 69 I/O pins;
- Internal oscillator 16MHz, 30kHz, PLL;
- 16/32 bit and 32/64 Timers;
- Ethernet, UART, SPI, I<sup>2</sup>C, CAN, ADC etc.



# 3. Programming the microcontroller



**Figure 3-1:**  
**TM4C123GH6PZ**  
**ARM® Cortex™-M4**  
**Microcontroller**

The microcontroller can be programmed in two ways:

- 01 Over USB mikroBootloader
- 02 Using mikroProg™ for Tiva or other external programmers

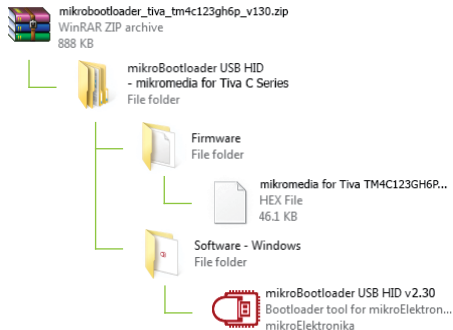
# Programming with mikroBootloader

The microcontroller is preprogrammed with USB HID Bootloader, which can be used to upload new device firmware. To transfer firmware .HEX file from a PC to an MCU you need to use the mikroBootloader USB HID application, which can be downloaded from:



[www.mikroe.com/downloads/get/2090/mikrobootloader\\_tiva\\_tm4c123gh6p\\_v1.30.zip](http://www.mikroe.com/downloads/get/2090/mikrobootloader_tiva_tm4c123gh6p_v1.30.zip)

Upon download, unzip the package to a desired location and start the mikroBootloader application:



## step 1 - Connecting mikromedia



Figure 3-2: USB HID mikroBootloader window

- 01 In order to start, connect the USB cable or (if already connected) press the **Reset** button on your board.
- 02 Click the **Connect** button within 5s to enter the bootloader mode, otherwise the existing 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 you wish to upload to your MCU's memory.

## step 3 - Selecting .HEX file

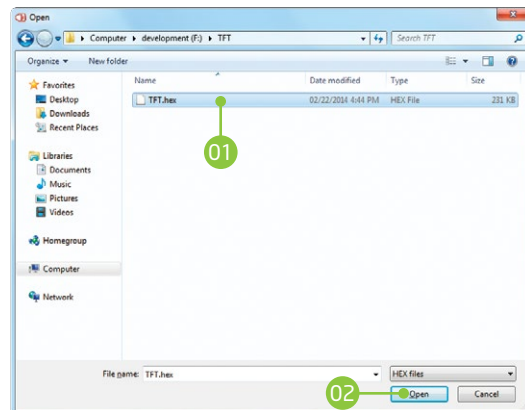


Figure 3-4: Selecting HEX

- 01 Select the .HEX file using the Open dialog window.
- 02 Click the **Open** button.

## step 4 - Uploading .HEX file



Figure 3-5: Begin uploading

- 01 In order to upload the .HEX file click the **Begin uploading** button.



Figure 3-6: Progress bar

- 01 Monitor the upload process via the progress bar.

## step 5 - Finish upload

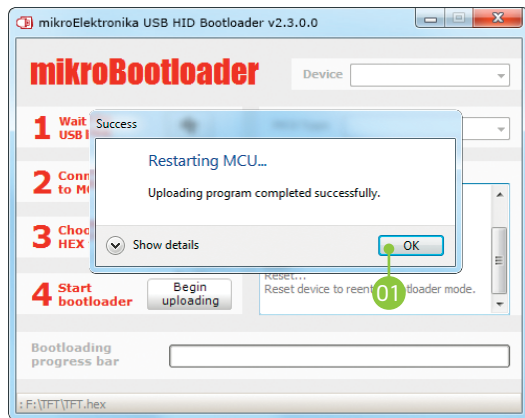


Figure 3-7: Restarting MCU

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



Figure 3-8: mikroBootloader ready for next job

# Programming with mikroProg™ programmer



The microcontroller can be programmed with the external **mikroProg™ programmer** and **mikroProg™ Suite for ARM® software**. The external programmer is connected to the development system via JTAG/SWD connector. **mikroProg™** is a fast USB 2.0 programmer with hardware Debugger support. It supports ARM® Cortex™-M4 microcontrollers from Tiva™ C Series. Outstanding performance, easy operation and elegant design are its key features. The board also contains a Cortex Debug connector which can be used with other external programmers.



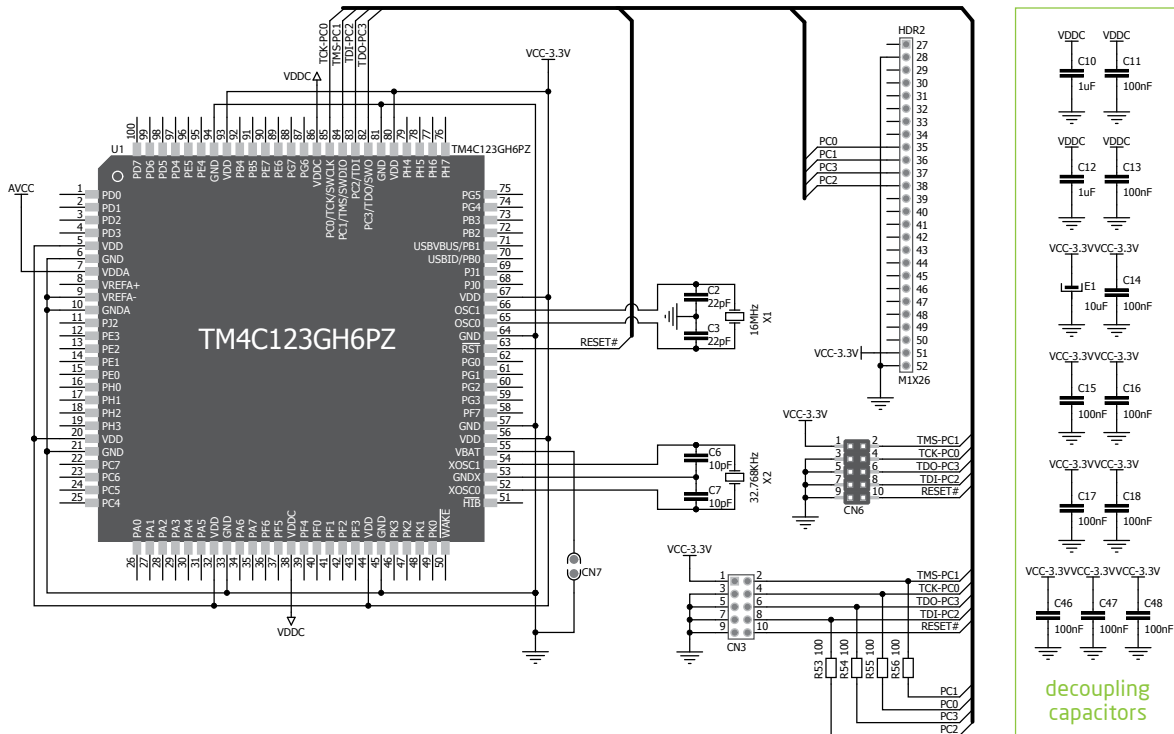


Figure 3-10: mikroProg™ programmer connection schematic

## 4. Reset Button

Figure 4-2:  
Frontal reset button



mikromedia for Tiva™ C Series is equipped with a reset button, which is located at the top of the front side (**Figure 4-2**). If you want to reset the circuit, press the reset button. It will generate a low voltage level on the microcontroller reset pin (input). In addition, a reset can be externally provided through **pin 27** on side headers (**Figure 4-3**).

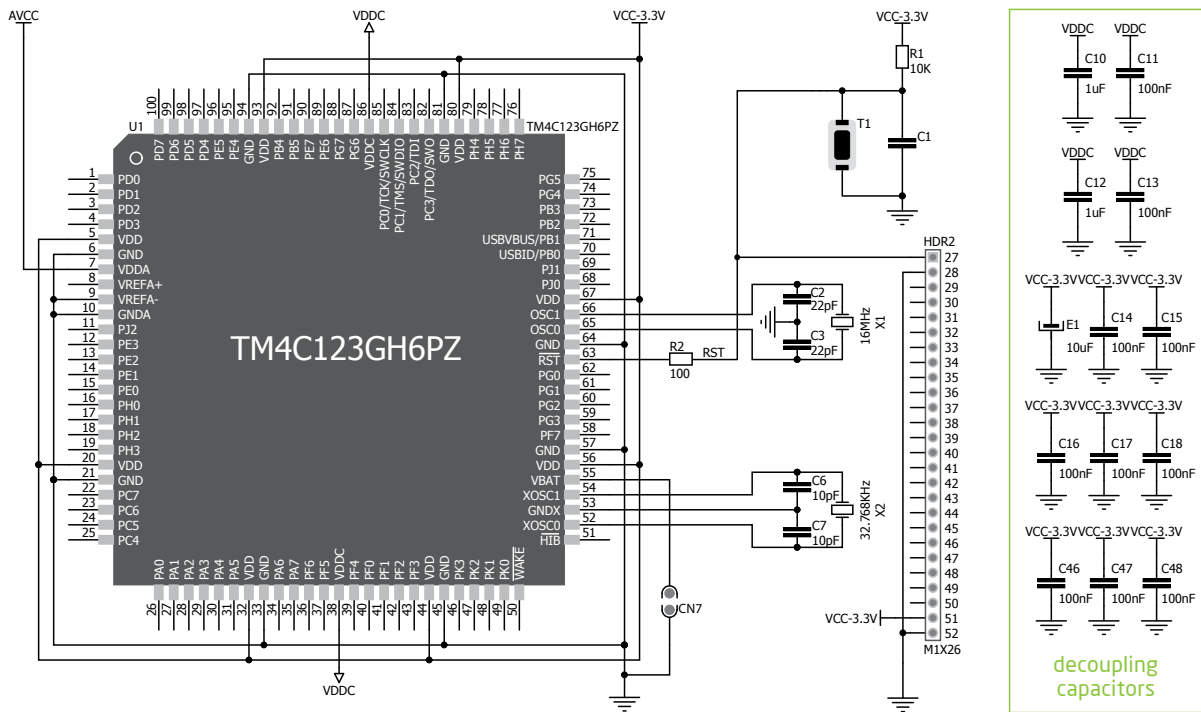
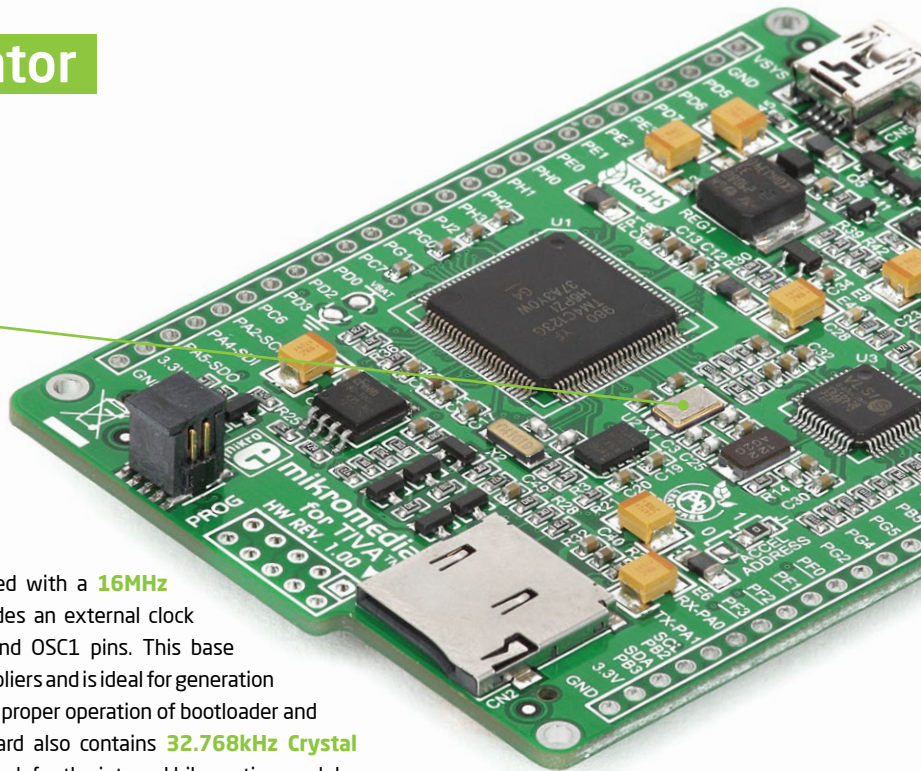


Figure 4-3: Reset circuit schematic

# 5. Crystal oscillator



Figure 5-1:  
16MHz crystal  
oscillator



mikromedia for Tiva™ C Series is equipped with a **16MHz crystal oscillator (X1)** circuit that provides an external clock waveform to the microcontroller OSC0 and OSC1 pins. This base frequency is suitable for further clock multipliers and is ideal for generation of the necessary USB clock, which ensures proper operation of bootloader and your custom USB-based applications. Board also contains **32.768kHz Crystal oscillator (X2)** which provides external clock for the internal hibernation module.

**NOTE:** The use of crystal in all other schematics is implied even if it is purposely left out, because of the schematics clarity.

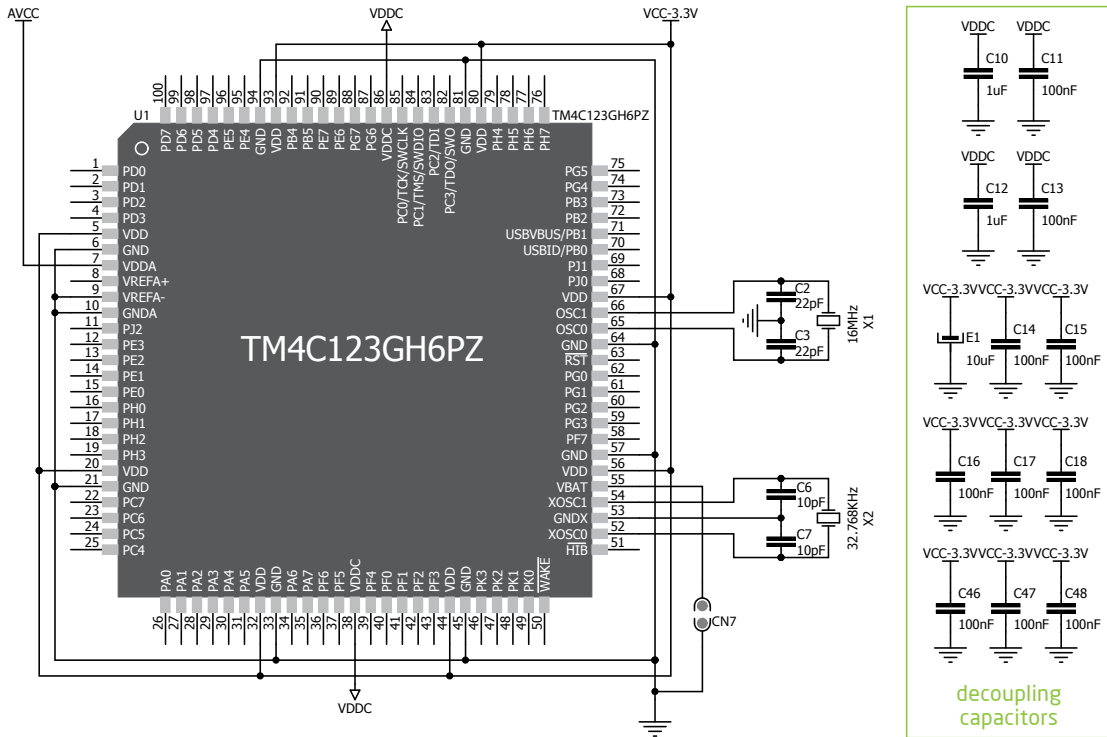


Figure 5-2: Crystal oscillator schematic

## 6. microSD Card Slot

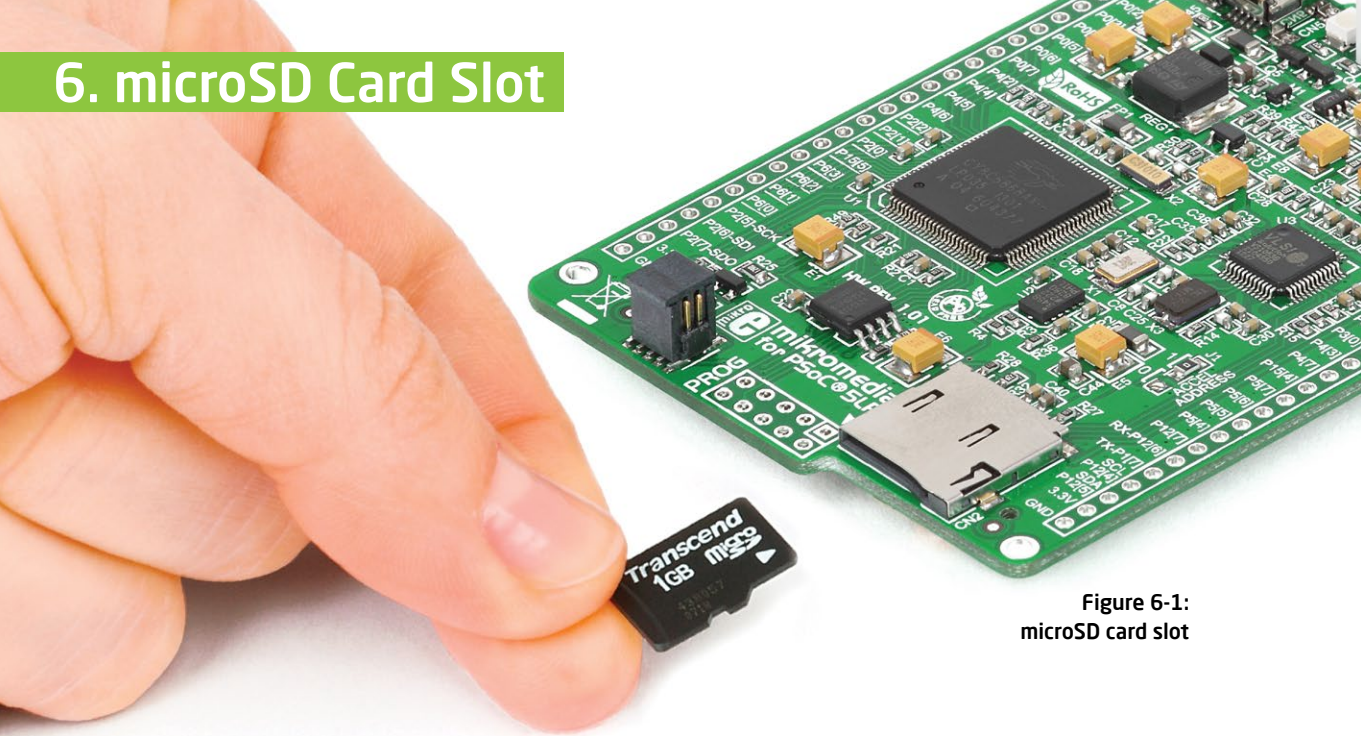


Figure 6-1:  
microSD card slot

mikromedia for Tiva™ C Series contains a **microSD card slot** for using 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.

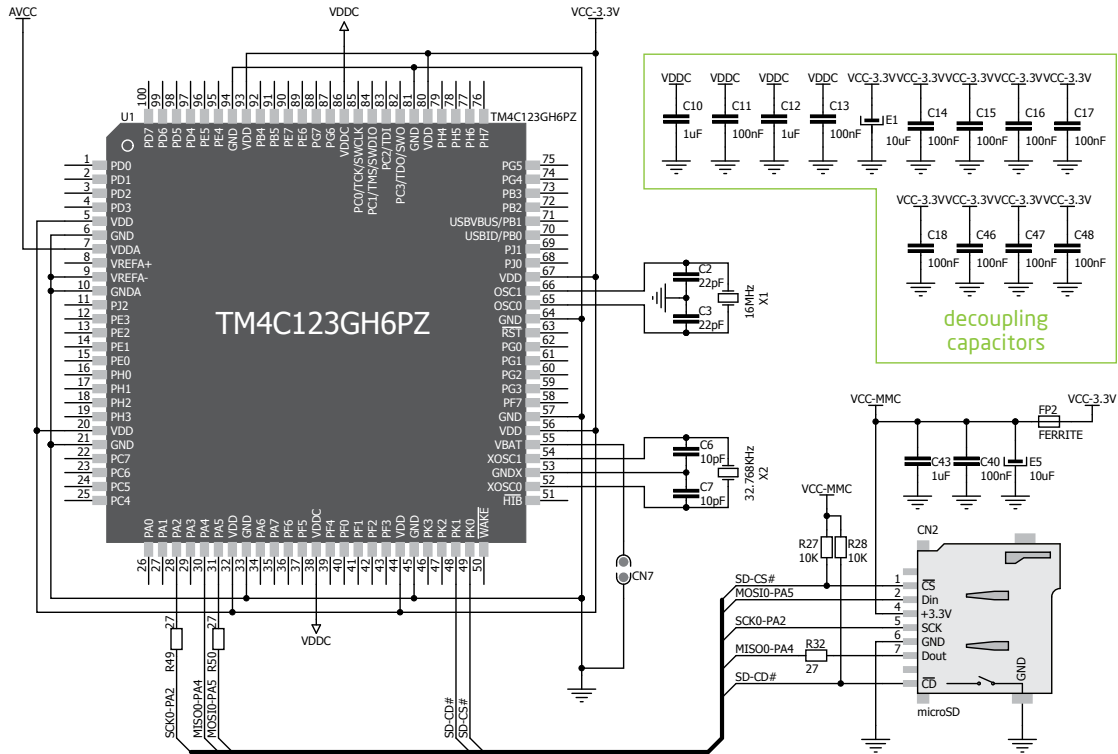
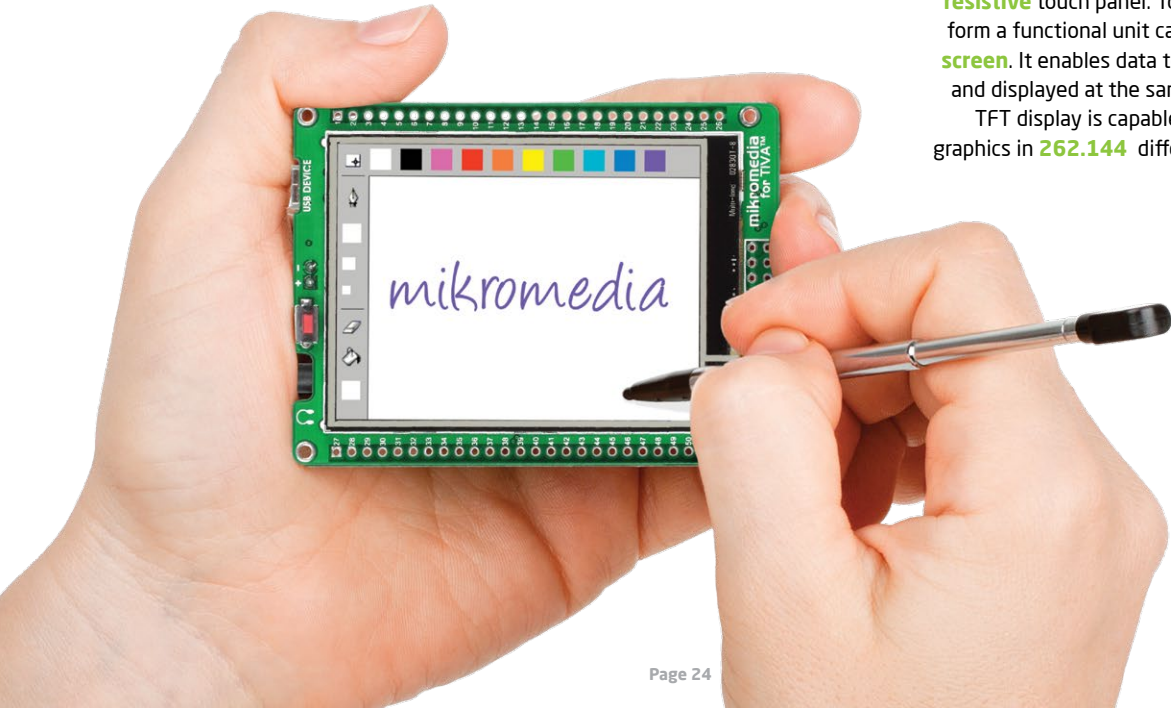


Figure 6-2: microSD Card Slot module connection schematic

## 7. 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 TFT display is capable of showing graphics in **262.144** different **colors**.

**Figure 7-1**  
**Touch Screen**



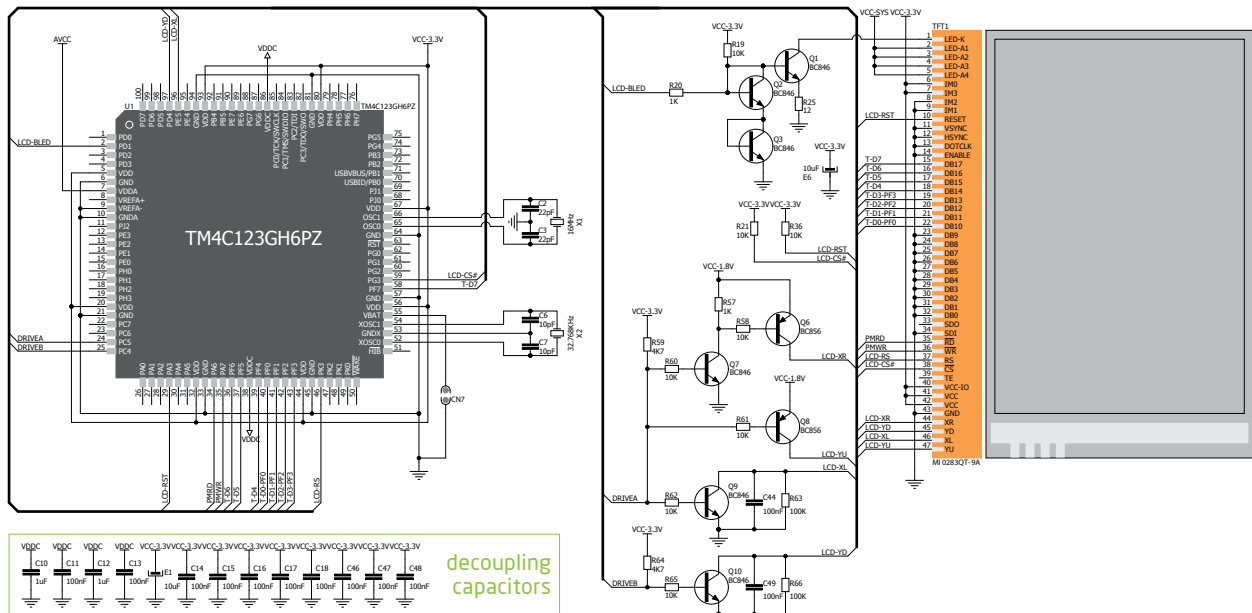


Figure 7-2: Touch Screen connection schematic

## 8. Audio Module



Figure 8-1: On-board VS1053 MP3 codec

mikromedia for Tiva™ C Series features a stereo audio codec **VS1053**. This module enables audio reproduction by using stereo headphones connected to the system via a **3.5mm** connector **CN1**. All functions of this module are controlled by the microcontroller over Serial Peripheral Interface (**SPI**).

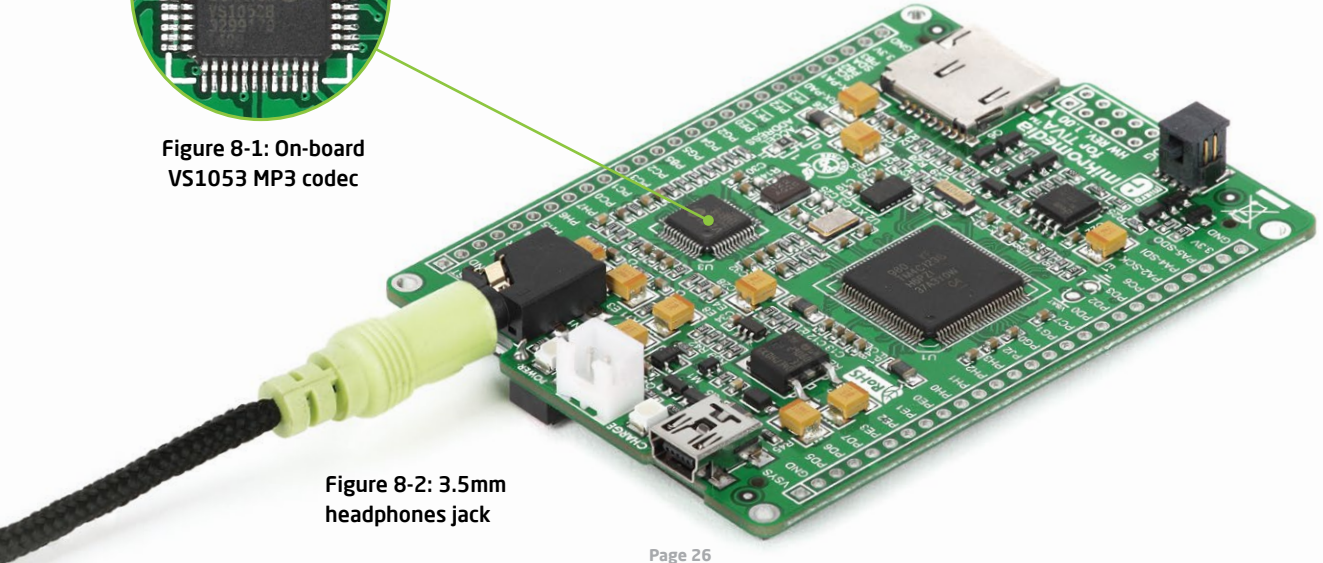


Figure 8-2: 3.5mm headphones jack

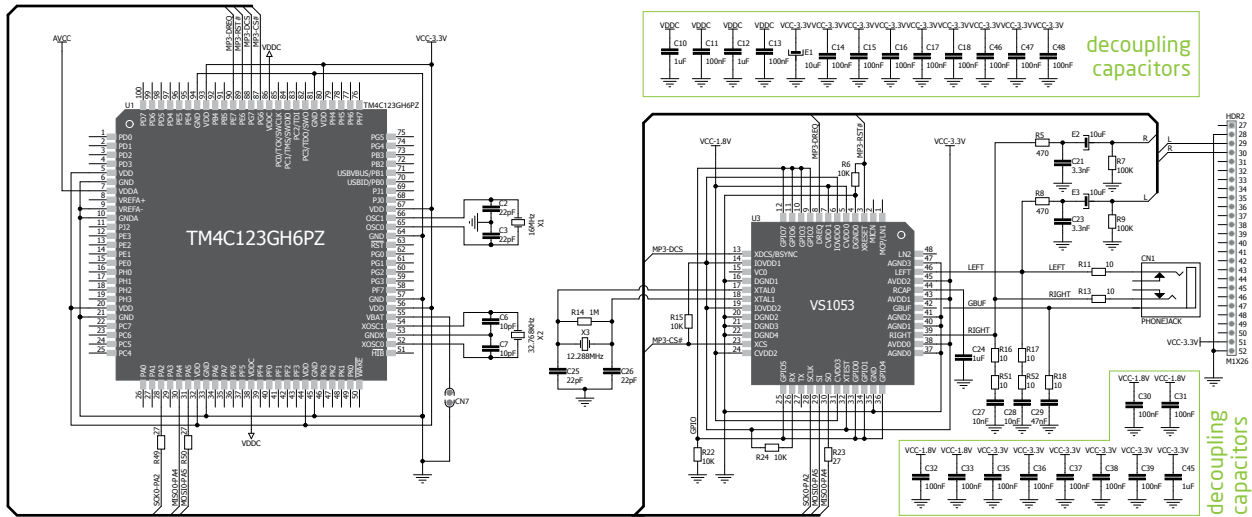
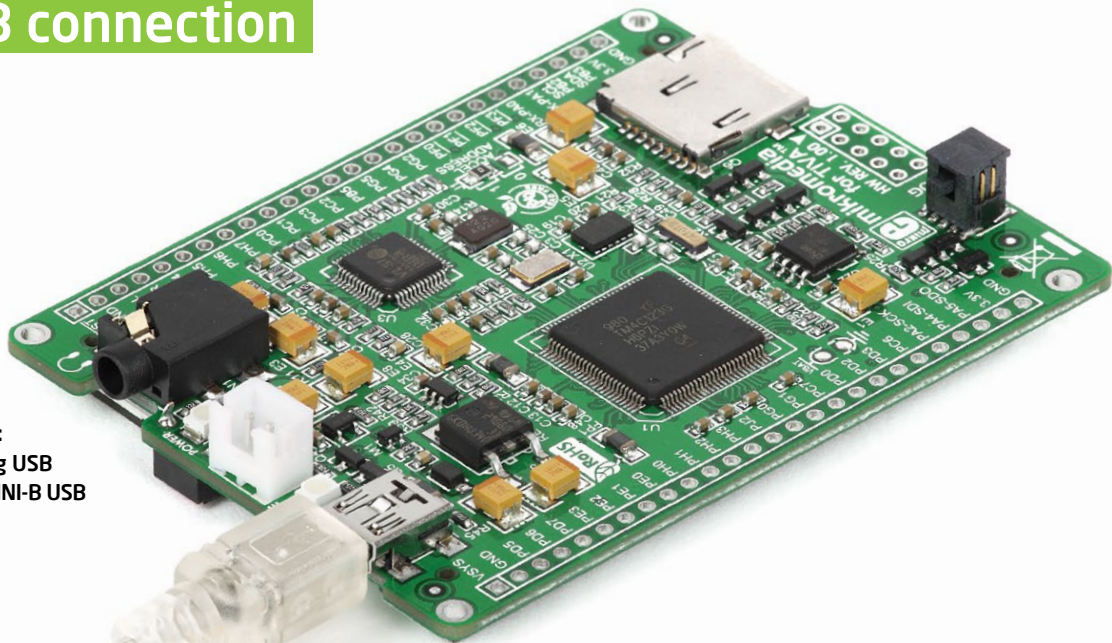


Figure 8-3: Audio module connection schematic

## 9. USB connection

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



**ARM® Cortex™-M4 TM4C123GH6PZ** microcontroller has an integrated USB module, which enables you to implement USB communication functionality to your mikromedia board. Connection with target USB host is done over MINI-B USB connector which is positioned next to the battery connector.

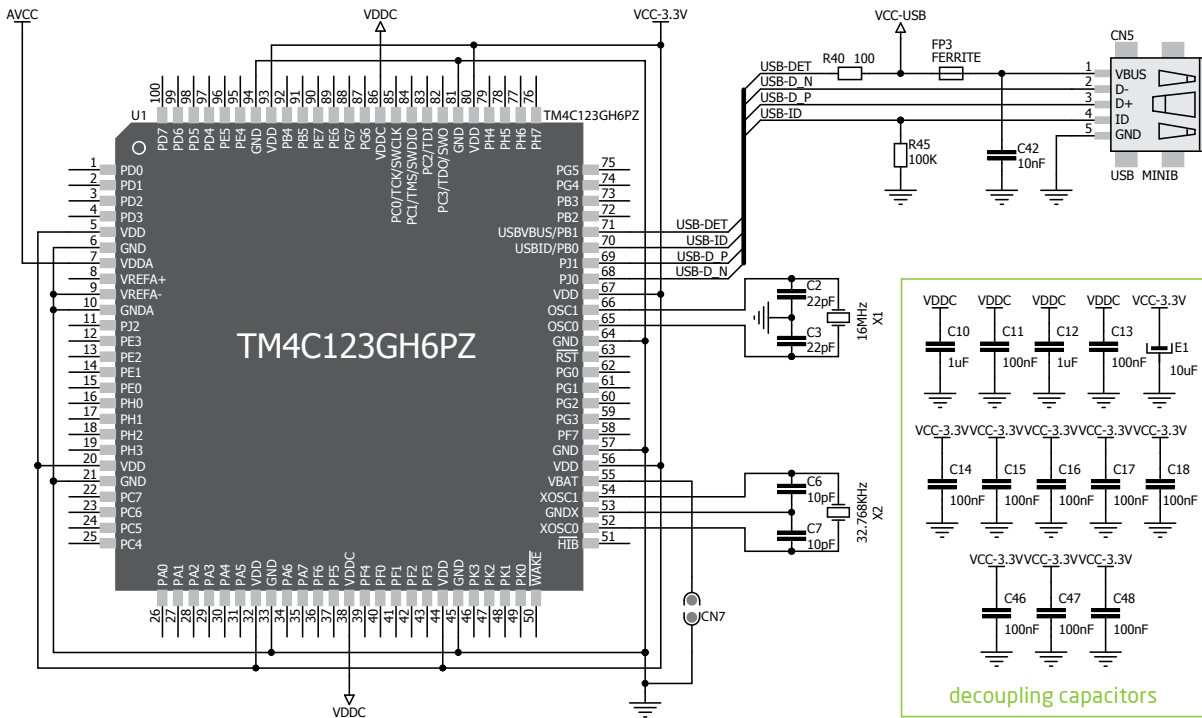


Figure 9-2: USB module connection schematic

# 10. Accelerometer

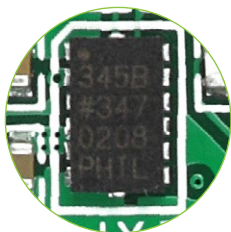
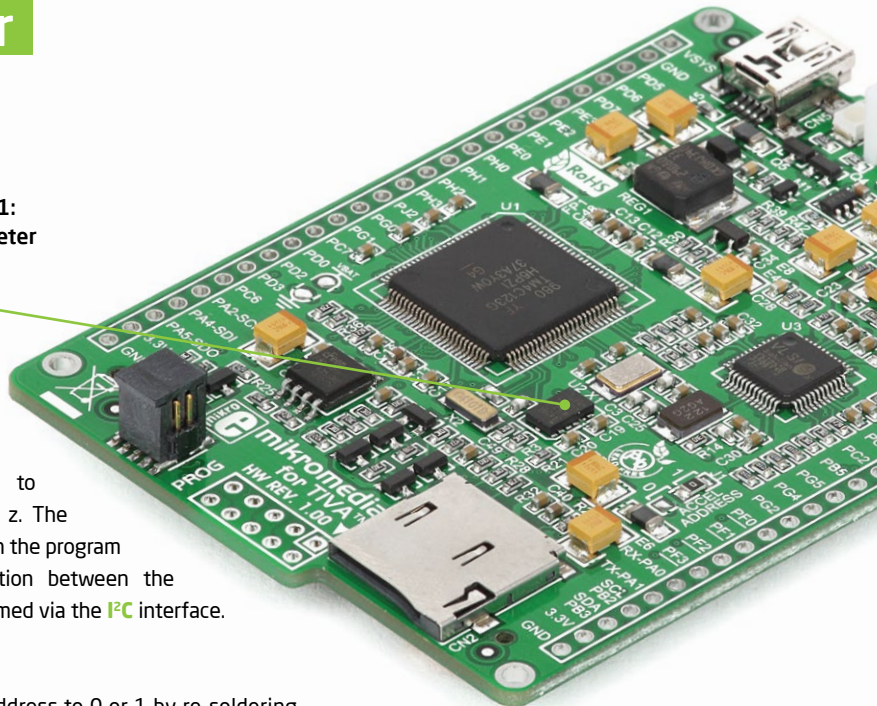


Figure 10-1:  
Accelerometer  
module



On-board **ADXL345** accelerometer is used to measure acceleration in three axes: 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 **I<sup>2</sup>C** interface.



You can set the accelerometer address to 0 or 1 by re-soldering the SMD jumper (zero-ohm resistor) to the appropriate position. Jumper is placed in address 1 position by default.

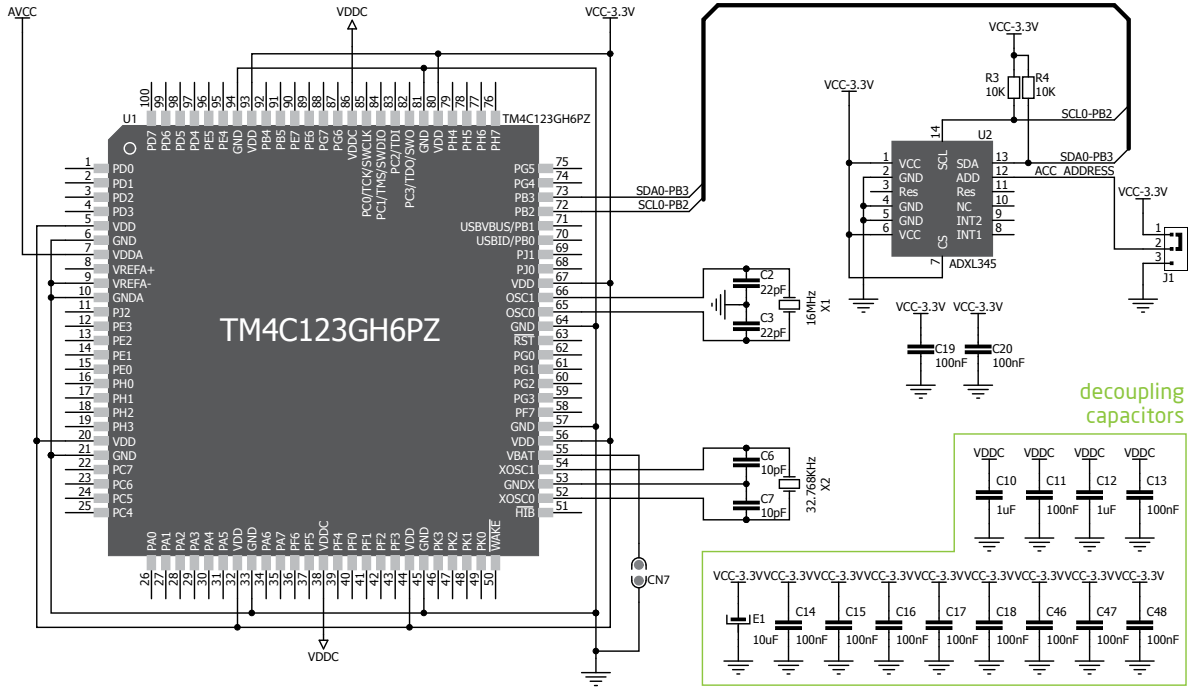
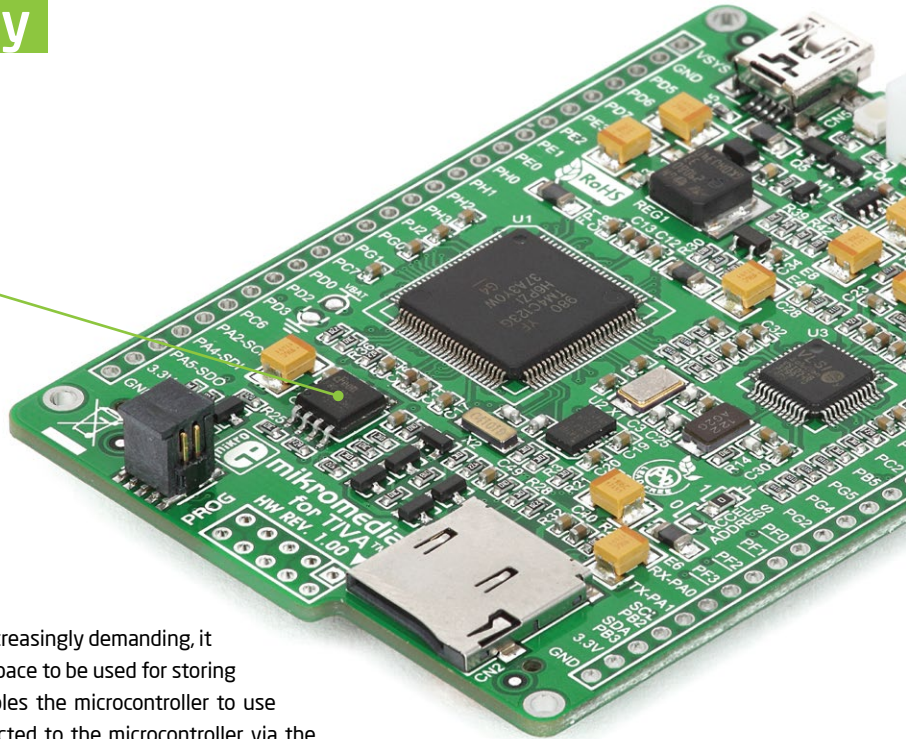


Figure 10-2: Accelerometer connection schematic

# 11. Flash Memory



**Figure 11-1:**  
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**).



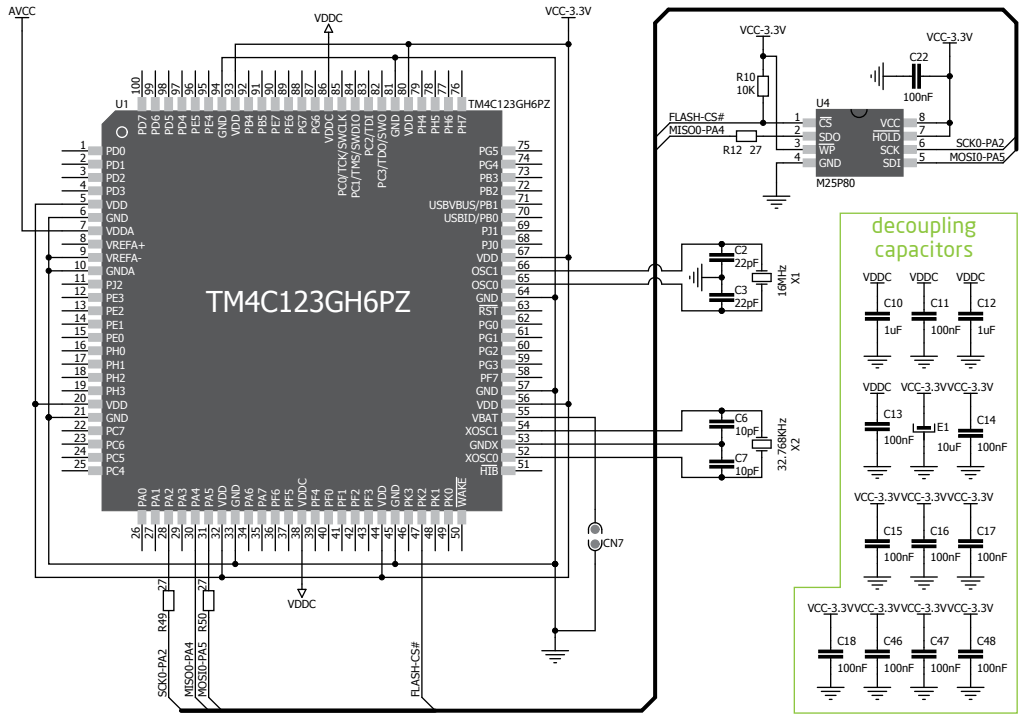


Figure 11-2: Flash memory module connection schematic

# 12. Pads

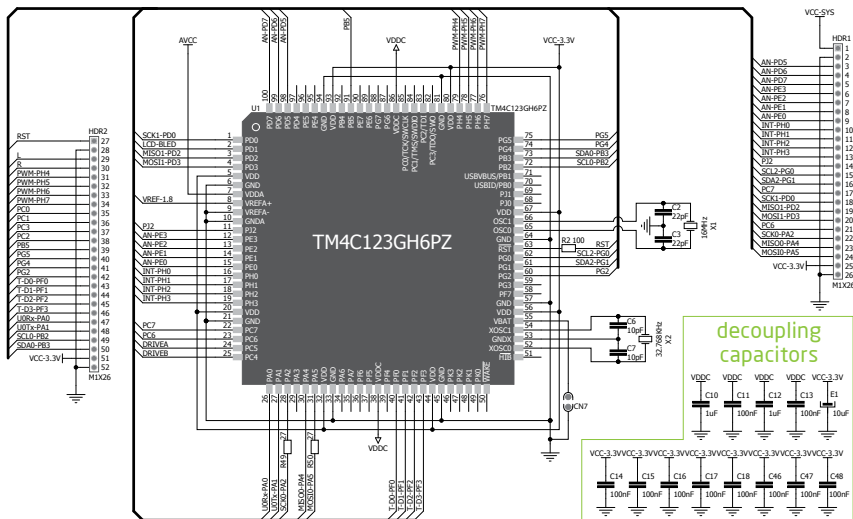
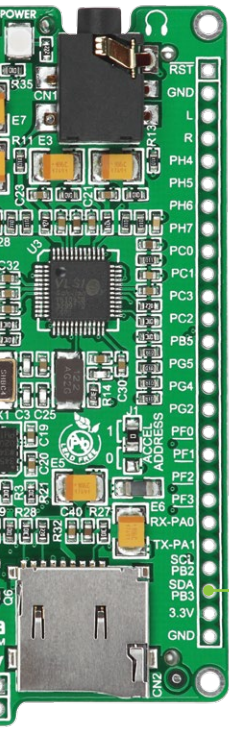
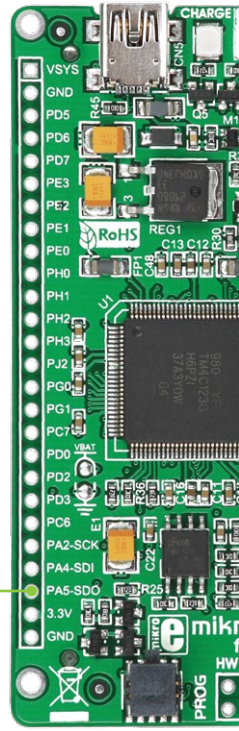


Figure 12-1: Connecting pads schematics

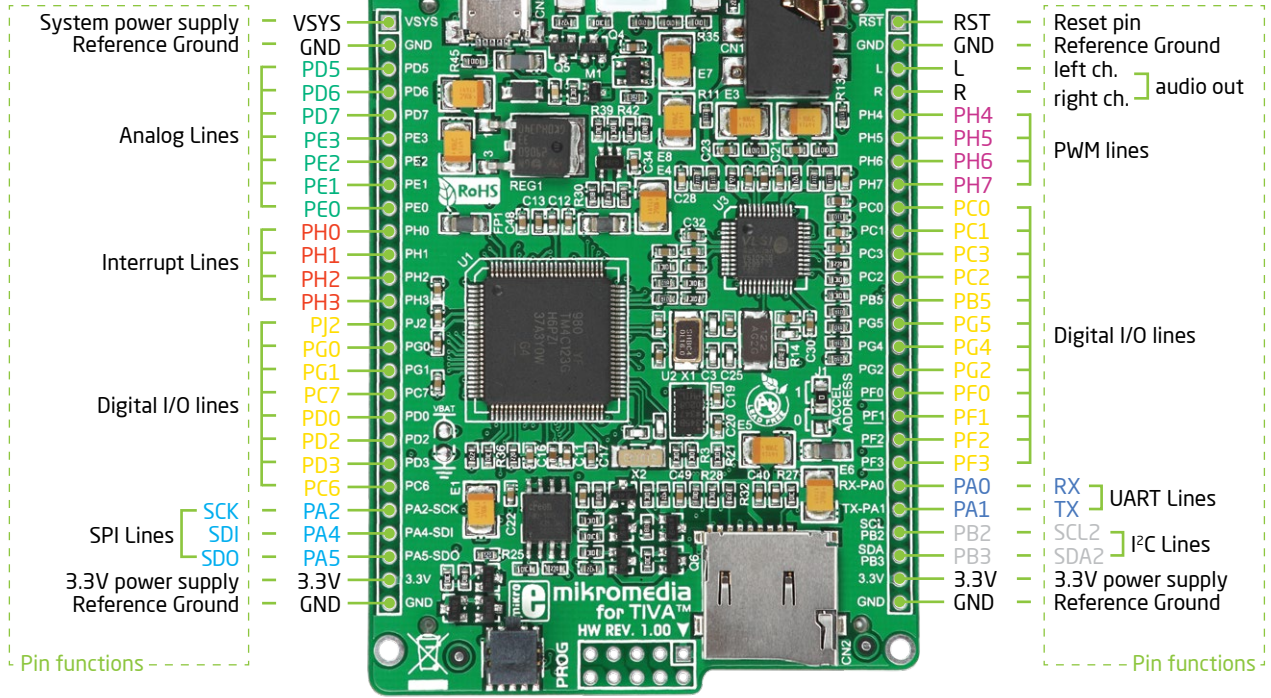
Pads HDR2

Pads HDR1

Most microcontroller pins are available for further connectivity via two 1x26 rows of connection pads on both sides of the mikromedia board. They are designed to match additional shields, such as Battery Boost shield, Gaming, PROTO shield and others.

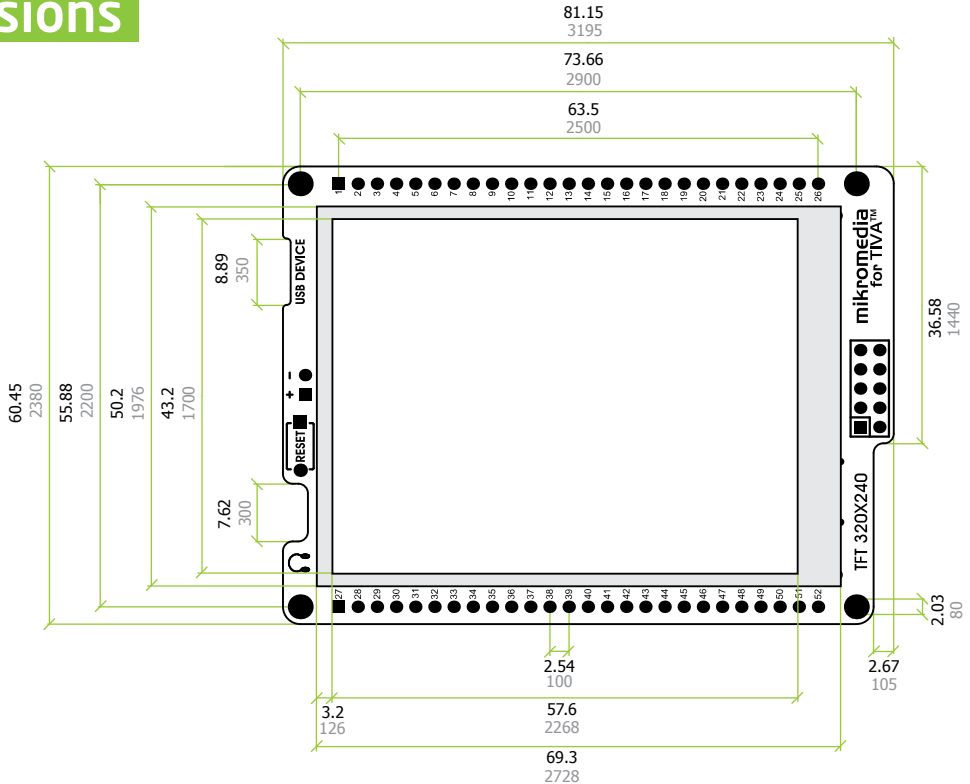
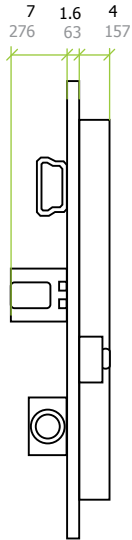


# 13. Pinout



- Digital lines
- Analog Lines
- Interrupt Lines
- SPI Lines
- I2C Lines
- UART lines
- PWM lines

# 14. Dimensions

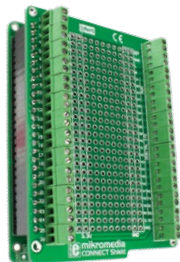


## Legend

- mm
- mils

# 15. mikromedia accessories

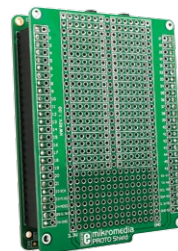
We have prepared a set of extension boards pin-compatible with your mikromedia, which enable you to easily expand your board's basic functionality. We call them mikromedia shields. But we also offer other accessories, such as Li-polymer battery, stacking headers, wire jumpers and more.



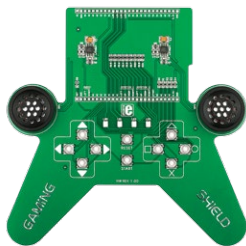
01 Connect shield



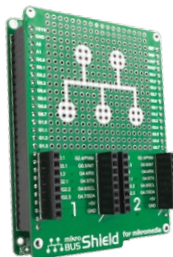
02 BatteryBoost shield



03 PROTO shield



04 Gaming shield



05 mikroBUS™ shield



06 Li-Polymer battery



07 Wire Jumpers

# What's next?

You have now completed the journey through each and every feature of mikromedia for Tiva™ C Series board. You got to know its 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. Find useful projects and tutorials on the **Libstock** website (<http://www.libstock.com/>). Join our **Forum** (<http://www.mikroe.com/forum/>) and get help from a large ecosystem of users.

## Compiler

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



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

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



## Visual TFT

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** enables you to quickly create your GUI. It will automatically generate code compatible with MikroElektronika compilers. Visual TFT is rich with examples, which are an excellent starting point for your future projects. Download it from the link below:



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

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