

# mikromedia for dsPIC33®

Compact development system rich with on-board peripherals for all-round multimedia development on dsPIC33FJ256GP710A 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.

Nebojsa Matic General Manager

The dsPIC\* and Windows\* logos and product names are trademarks of Microchip Technology\* and Microsoft\* in the U.S.A. and other countries.

# Table of Contents

Introduction to mikromedia for dsPIC33®	4
Package contains	5
Key features	6
System specification	7
1. Power supply	8
USB power supply	8
Battery power supply	8
2. dsPIC33FJ256GP710A microcontroller	10
Key microcontroller features	10
3. Programming the microcontroller	11
Programming with mikroBootloader	12
step 1 - Choosing COM port	13
step 2 - Choosing device family	14
step 3 - Choosing device	14
step 4 - Browse for .HEX file	15
step 5 - Set Baud rate	16
step 6 - Uploading .HEX file	16

Programming with mikroProg <sup>™</sup> programmer	18
mikroProg Suite <sup>™</sup> for PIC Software	19
Programming with ICD2 or ICD3 programmer	20
4. Reset buttons	22
5. Crystal oscillator	24
6. microSD card slot	26
7. Touch screen	28
8. Audio module	30
9. USB-UART connection	32
10. Accelerometer	34
11. Flash memory	36
12. Pads	38
13. Pinout	39
14. Dimensions	40
15. mikromedia accessories	41
What's next?	42

## Introduction to mikromedia for dsPIC33<sup>®</sup>

mikromedia for dsPIC33<sup>®</sup> 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 16-bit dsPIC33FJ256GP710A microcontroller, mikromedia for dsPIC33 features integrated modules such as stereo MP3 codec, TFT 320x240 touch screen display, accelerometer, USB connector, audio connector, MMC/SD card slot, 8 Mbit flash memory, 2x26 connection pads and other. It comes pre-programmed with UART bootloader, but can also be programmed with external programmers, such as mikroProg<sup>™</sup> or ICD2/3. Mikromedia is compact and slim, and perfectly fits in the palm of the hand, which makes it a convenient platform for mobile devices.







## Package contains



# **Key features**

- 01 Connection pads
- 02 TFT 320x240 display
- USB MINI-B connector
- 04 CHARGE indication LED
- 05 LI-Polymer battery connector
- 6 3.5mm headphone connector
- 07 Power supply regulator
- 08 FTDI chip
- 09 Serial flash memory
- 10 RESET button
- 11 VS1053 Stereo mp3 coder/decoder
- 2 dsPIC33FJ256GP710A microcontroller
- B Accelerometer
- 14 Crystal oscillator
- 15 Power indication LED
- 16 microSD card slot
- ICD2/3 connector
- 18 mikroProg connector





#### System specification



CONSUMPTIO

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

#### power consumption

77 mA with erased MCU (when on-board modules are inactive)

#### **board dimensions** 81.2 x 60.5 mm (3.19 x 2.38 inch)



CE

weight ~50g (0.11lbs)

#### class B product

Product complies with the Class B limit of EN 55022 and can be used in the domestic, residential, commercial and industrial environments.

#### **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.



### **USB power supply**

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

#### **Battery power supply**

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





Figure 1-3: Power supply schematics

# 2. dsPIC33FJ256GP710A microcontroller

**mikromedia for dsPIC33**<sup>®</sup> development system comes with the **dsPIC33FJ256GP710A** microcontroller. This high-performance 16-bit microcontroller with its integrated modules and in combination with other on-board modules is ideal for multimedia applications.

#### Key microcontroller features

- Up to 40 MIPS Operation;
- 16-bit architecture;
- 256KB of program memory;
- 30.720 Bytes of RAM;
- 85 I/O pins;
- Internal Oscillator 7.37 MHz, 512kHz;
- nanoWatt features: Fast Wake/Fast Control;
- 2-UART, 2-SPI, 2-I2C, 2-CAN;
- DAC, ADC, etc.



# 3. Programming the microcontroller



The microcontroller can be programmed in three ways:



Over UART bootloader

2 Using mikroProg<sup>™</sup> external programmer

Using ICD2/3 external programmer

## Programming with mikroBootloader

You can program the microcontroller with the bootloader which is preprogrammed into the device by default. To transfer .HEX file from a PC to MCU you need bootloader software (**ds30 Loader**) which can be downloaded from:



www.mikroe.com/eng/downloads/get/1493/ mikrommb\_dspic33\_bootloader.zip

Upon download, unzip the file to the desired location and start ds30 Loader software.



🖳 ds30 Loader
File View Help
👷 🕐 Write 💿 Abort
Basic
Hexfile:
Device:
Baud rate: 9600 - Port: Communications Por -
Write program
Write Eeprom
Loading device database492 devices found Loading port plugin ds30LoaderPortSerial.dll:found 1 port Loading settingsok
Copyright © 08-11, Mikael Gustafsson 1.4.1

Figure 3-1: ds30 Loader open-source software



Connect mikromedia for dsPIC33° with a PC before starting ds30 Loader software

### Identifying device COM port

🚔 Device Manager 📃 🗖	×
File Action View Help	
<ul> <li>Mice and other pointing devices</li> <li>Monitors</li> </ul>	^
Network adapters Ports (COM & LPT)	
USB Serial Port (COM5)	=
<ul> <li>J System devices</li> <li>J Universal Serial Bus controllers</li> </ul>	Ļ
	÷

Figure 3-2: Identifying COM port



In Device Manager you can see which COM port is assigned to mikromedia (in this case COM5)

#### step 1 - Choosing COM port

Pd ds30 Loader   File View Help  Write ⊗ Abort  Basic Hexfile:	
Device: Baud rate: 9600 Port: Serial Port (COM5) Communications Port (C USB Serial Port (COK.)) Write Eeprom	-0
Loading device database492 devices found Loading port plugin ds30LoaderPortSerial.dll: found 2 ports Loading settingsok	
Copyright © 08-11, Mikael Gustafsson 1.4.1:	

Figure 3-3: Selecting COM port



From drop down list select USB COM port which is used for communication with a PC (in this case COM5)

### step 2 - Choosing device family

🖷 ds30 Loader	
File View Help	
🗄 한 Write 💿 Abort	
Basic	
Hex-file:	
Device:	
Baud rate: dsPIC30F dsPIC33FJ ● Port: USB Serial Port (COI ▼	01
PIC12F Write p PIC16F	9
Write E PIC18F PIC18FJ	
PIC24F PIC24FJ	
Loading device PIC24HJ devices found Loading port p PIC32MX PortSerial.dll: found 2 ports	
Loading settingsok	
۸	
//	
1	
Copyright © 08-11, Mikael Gustafsson 1.4.1:	

Figure 3-4: Selecting MCU family



From drop down list select MCU family (**dsPIC33FJ**)

#### step 3 - Choosing device

🖳 ds30 Loader		- • •	
File View Help			
👷 🕐 Write 📧 Abort			
Basic			
Hex-file:		▼	
Device: dsPIC33FJ 🔻	06GS101	-	
Baud rate: 9600 👻	12MC202 16GP304	*	
Write program	16GS402 16GS404		
Write Eeprom	16GS502 16GS504 16MC304		
	256GP506		
Loading device database492 d Loading port plugin ds30LoaderP			
Loading settingsok	256GP510A		
	256GP710 256GP710A		-01
	256MC510		U
	256MC510A 256MC710		
1	256MC710A	= }	
Copyright © 08-11, Mikael Gust		1:	
Figuro 2.5:	32GP302 32GP304		
Figure 3-5:	32GS406		
Selecting MCU chip	32GS606		
01 From drop down list se	elect MCU c	hip ( <b>256GP710A</b>	()

#### step 4 - Browse for .HEX file

🖳 ds30 Loader 💼 💼 💌	
File View Help	
👷 🕐 Write 💿 Abort	
Basic	
	-0
Device: dsPIC33FJ V 256GP710A V	
Baud rate: 9600   Port: USB Serial Port (CO)	
Write program	
Write Eeprom	
Loading device database492 devices found Loading port plugin ds30LoaderPortSerial.dll: found 2 ports Loading settingsok	
Copyright © 08-11, Mikael Gustafsson 1.4.1;	

Figure 3-6: Browse for .HEX file



Solution of the second seco	- m / concurator	✓ 49 Search C	
Organize 🔻 New folder			III 🔹 🔲
A Name	^	Date modified	Туре
Documents     Music     Pictures     Videos	D	28/12/2010 15:46	HEX File
Computer Local Disk (C:) Docal Disk (D:)			
mikro (E:)     O2     Local Disk (I:)			
Local Disk (k:)			
File name:		✓ Hex file	

Figure 3-7: Pop-up window for .HEX file choosing



Click on Open button

#### step 5 - Set Baud rate

🖳 ds30 Loader
File View Help
🛃 🕐 Write 🛞 Abort
Basic
Hex-file: E:\mikrommb_dspic33_mikroc\mikroMM 👻 🛄
Device: dsPIC33FJ 🔻 256GP710A 💌
Baud rate: 256000 Port: USB Serial Port (COI -
Write program 01
Write Eeprom
Parsing hex-file File timestamp: 28/12/2010 15:46:20 Validating hex-fileok Hex-file successfully parsed
18433 program words found in 290 rows 0 Eeprom words found 8 config words found
Copyright © 08-11, Mikael Gustafsson 1.4.1:

Figure 3-8: Seting baud rate



From drop down list set baud rate value to 256000

Check Write program check box

#### step 6 - Uploading .HEX file

🖳 ds30 Loader 📃 📼 🕰
File View Help
👷 🕐 Write 💿 Abort
Basic
Hex.file: E:\mikrommb_dspic33_mikroc\mikroMM
Device: dsPIC33FJ V 256GP710A V
Baud rate: 256000  ✔ Port: USB Serial Port (COI ▼
Write program
Write Eeprom
Parsing hex-file File timestamp: 28/12/2010 15:46:20 Validating hex-fileok Hex-file successfully parsed
18433 program words found in 290 rows 0 Eeprom words found 8 config words found
Copyright © 08-11, Mikael Gustafsson 1.4.1:

Figure 3-9: Write program



First RESET mikromedia and then, within 5s

click on Write button

#### note

If you accidently erase bootloader program from MCU memory it is possible to load it again with external programer. mikromedia for dsPIC33<sup>®</sup> bootloader firmware.hex file is located in Firmware subfolder, Page 12.

🖳 ds30 Loader
File View Help
Write 🛿 Abort
Basic
Hex-file: E:\mikrommb_dspic33_mikroc\mikroMM 👻
Device: dsPIC33FJ 🔻 256GP710A 💌
Baud rate: 256000 Vort: USB Serial Port (CO) V
✓ Write program …
Write Eeprom
Initiating write Searching for bl . Found dsPIC33FJ256GP710A fw ver. 2.0.1 Waiting for bootloader to be readyok Writing flash
Copyright © 08-11, Mikael Gustafsson 1.4.1;

Figure 3-10: Program uploading



Progress bar indicates .HEX file upload process

🖳 ds30 Loader 💼 💼 💌			
File View Help			
🛃 한 Write 💿 Abort			
Basic			
Hexfile: E:\mikrommb_dspic33_mikroc\mikroMM			
Device: dsPIC33FJ ▼ 256GP710A ▼			
Baud rate: 256000  ✔ Port: USB Serial Port (COI ✔			
Vitte program			
Write Eeprom			
Initiating write Searching for bl. Found dsPIC33FJ256GP710A fw ver. 2.0.1 Waiting for bootloader to be readyok Writing flashok Write finished Tx 59kB / Fx 346 bytes / 6,4s			
Copyright © 08-11, Mikael Gustafsson 1.4.1			

Figure 3-11: Uploading is finished



After uploading is finished you will get a

notice in ds30 Loader history window

# Programming with mikroProg<sup>™</sup> programmer

The microcontroller can be programmed with **mikroProg**<sup>™</sup> **programmer** and **mikroProg Suite<sup>™</sup> fo PIC**<sup>\*</sup> software. The mikroProg<sup>™</sup> programmer is connected to the development system via the CN6 connector, Figure 3-12.

> mikroProg<sup>™</sup> is a fast USB 2.0 programmer with mikrolCD<sup>™</sup> hardware In-Circuit Debugger. Smart engineering allows mikroProg<sup>™</sup> to support PIC10<sup>°</sup>, PIC12<sup>°</sup>, PIC16<sup>°</sup>, PIC18<sup>°</sup>, dsPIC30/33<sup>°</sup>, PIC24<sup>°</sup> and PIC32<sup>°</sup> devices in a single programmer. It supports over 570 microcontrollers from Microchip<sup>°</sup>. Outstanding performance, easy operation and elegant design are it's key features.

Figure 3-12: Connecting mikroProg<sup>™</sup> to mikromedia<sup>™</sup>

## mikroProg Suite<sup>™</sup> for PIC<sup>®</sup> software



mikroProg<sup>™</sup> programmer requires special programming software called mikroProg Suite<sup>™</sup> for PIC<sup>®</sup>. This software is used for programming all Microchip® microcontroller families, including PIC10°, PIC12°, PIC16°, PIC18°, dsPIC30/33°, PIC24° and PIC32<sup>®</sup>. Software has intuitive interface and SingleClick<sup>™</sup> programming technology. Just by downloading the latest version of mikroProg Suite<sup>™</sup> your programmer is ready to program new devices. mikroProg Suite<sup>™</sup> is updated regularly, at least four times a year, so your programmer will be more and more powerful with each new release.

NOTFREM     0     4 × PLL E       PRCEFM     0     6       NOU     1     1       Read     write     0       Verfy     Blank     Brown Out       Ease     Reset     Powerl       *Exfectors     raw     Watchdog F	A × PLL IS UNC Social Services     ▼       A × PLL SOCIAL Services     ▼       A × PLA × SOCIAL SERVICES     ▼	Code Protect         Data EEPROM         Code 0000-007FF         Code 0200-03FFF         Code 0200-03FFF         Code 0600-07FFF         Code 0600-07FFF         Configuration Bits         Data EEPROM         Code 0000-007FF         Code 0000-07FFF         Code 0000-07FFF         Code 0000-07FFF         Code 0000-07FFF         Code 0000-07FFF
DATA UNIT-ID		Type Revision
Rifie 6 Figure 3-13: Main V	√indow of mikroProg Suite™ for P	IC <sup>®</sup> programming software

201

# Programming with

# ICD2<sup>®</sup> or ICD3<sup>®</sup>

## programmer

The microcontroller can be also programmed with **ICD2**\* **or ICD3**\* **programmer**. These programmers connects with mikromedia board via **ICD2 CONNECTOR BOARD.** 



In order to enable the ICD2<sup>\*</sup> and ICD3<sup>\*</sup> programmers to be connected to the development system, it is necessary to provide an appropriate connector such as the **ICD2 CONNECTOR BOARD**. This connector should be first soldered on the CN5 connector. Then you should plug the ICD2<sup>\*</sup> or ICD3<sup>\*</sup> programmer into it, Figure 3-14.



Figure 3-16: ICD2 / ICD3 & mikroProg<sup>™</sup> programmer connection schematics

## 4. Reset buttons

Board 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**).

**Note** You can also solder an additional reset button on the appropriate place at the back side of the board, **Figure 4-1**.



Figure 4-1: Reset button located at the backside of the board





#### Figure 4-3: Reset circuit schematics

# 5. Crystal oscillator



Figure 5-1: Crystal oscillator module (X1)

Board is equipped with an **8MHz crystal oscillator (X1)** circuit that provides external clock to the microcontroller OSC pins. This base frequency is suitable for further clock multipliers and 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 (X3)** which provides external clock for the internal **RTCC** module.



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 schematics

## 6. microSD card slot

Figure 6-1: microSD card slot

Board 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 schematics

# 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 data in **262.144** different **colors**.





Figure 7-2: Touch Screen connection schematics

# 8. Audio module





Figure 8-3: Audio module connection schematic

# 9. USB-UART connection

Mikromedia contains a USB MINI-B connector which is positioned next to the battery connector. FT232RL USB-UART IC enables you to implement UART serial communication functionality via USB cable, since **dsPIC33FJ256GP710A** does not support USB protocol.

> Figure 9-1: Connecting USB cable to programming connector



Before connecting the board, make sure that you have FTDI drivers installed on your computer. Tx/Rx LED flashes when USB and controller communicate.



#### Figure 9-2: USB module connection schematics

## **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'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 **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**).

mp



Figure 11-2: Flash memory module connection schematic



GND

Ĩ



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.

Page 38

#### **13. Pinout** 5V power supply 5V -RST - Reset pin Reference Ground GND Reference Ground GND -IND AN10 RB1 left ch. audio out RB2 - right ch. -AN2/SS1/CN4 ' R RDO AN3/CN5 RB3 RDO C - OC1 RB4 -RD1 AN4/CN6 RD1 - 10C2 AN5/CN7 RB5 RD2 RD2 0003 RB8 RD3 🗨 RD3 -10C4AN8 RB9 -RD4 - 0C5/CN13 AN9 AN20/INT1 | -RA12-RD5 -1006/0014AN21/INT2 - RA13 RD8 - ¦IC1 -RA14-RD9 - 11C2 INT3 I RD9 INT4 | - RA15 -RA15 RD14 - 107/U1CTS/CN20 PGEC1/AN6/OCFA RD15 - 108/U1RTS/CN21 RB6 -RD6 RD6 - 0C7/CN15 PGFD1/AN7 RB7 -RC2 - AN17/T3CK/T6CK - SCK1/INTO RF6 -RC2IC SPI1 RF12 - U2CTS RF7 SDI1 **SD01** RF8 -RF13 - U2RTS RF0 COFS RG15 RFO RF1 C2RX RGO RF1 C1TX RF2 RD10 B 100 R25 RG6 RF3 SCK2/CN8 X-RF3 RG6-SCk □ SCL1 ] I²C SPI2 RG2 RG7 SDI2/CN9 D67-901 LSD02/CN10 RG8 -RG3 - SDA1 3.3V power supply 3.3V -3.3V - 3.3V power supply 3.30 💽 10 Reference Ground GND -GND GND - Reference Ground GND - Pin functions Pin functions 🛿 Programming lines 📕 Analog Lines 📕 Interrupt Lines 📕 SPI Lines 🔲 I2C Lines 📕 UART lines 📕 PWM lines Comparator lines



USB DEVICE

**8.89** 350 81.15 3195 73.66 2900

63.5

2500

3 5

 RST 3. 30 0 GND 0

PGD 🔴

PGC ●

3.30

**36.58** 1440



157

7 1.6 4

276 63

Page 40

## **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. call them mikromedia We shields. But we also offer other accessories, such as Li-polymer battery, stacking headers, wire iumpers and more.

1

Samile



# What's next?

You have now completed the journey through each and every feature of mikromedia for dsPIC33<sup>®</sup> 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 (**www.libstock.com**). Join our Forum (**www.mikroe.com/forum**) and get help from a large ecosystem of users.

#### Compiler

You still don't have an appropriate compiler? Locate dsPIC<sup>®</sup> compiler that suits you best on our site:

#### http://www.mikroe.com/dspic/compilers/

Choose between mikroC<sup>™</sup>, mikroBasic<sup>™</sup> and mikroPascal<sup>™</sup> and download fully functional demo version, so you can begin 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 bellow:



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

#### DISCLAIMER

All the products owned by MikroElektronika are protected by copyright law and international copyright treaty. Therefore, this manual is to be treated as any other copyright material. No part of this manual, including product and software described herein, may be reproduced, stored in a retrieval system, translated or transmitted in any form or by any means, without the prior written permission of MikroElektronika. The manual PDF edition can be printed for private or local use, but not for distribution. Any modification of this manual is prohibited.

MikroElektronika provides this manual 'as is' without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties or conditions of merchantability or fitness for a particular purpose.

MikroElektronika shall assume no responsibility or liability for any errors, omissions and inaccuracies that may appear in this manual. In no event shall MikroElektronika, its directors, officers, employees or distributors be liable for any indirect, specific, incidental or consequential damages (including damages for loss of business profits and business information, business interruption or any other pecuniary loss) arising out of the use of this manual or product, even if MikroElektronika has been advised of the possibility of such damages. MikroElektronika reserves the right to change information contained in this manual at any time without prior notice, if necessary.

#### HIGH RISK ACTIVITIES

The products of MikroElektronika are not fault - tolerant nor designed, manufactured or intended for use or resale as on - line control equipment in hazardous environments requiring fail - safe performance, such as in the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines or weapons systems in which the failure of Software could lead directly to death, personal injury or severe physical or environmental damage ('High Risk Activities'). MikroElektronika and its suppliers specifically disclaim any expressed or implied warranty of fitness for High Risk Activities.

#### TRADEMARKS

The MikroElektronika name and logo, mikroC", mikroBasic", mikroPascal", mikroProg", Ready", MINI", mikroBUS", EasyPIC", EasyMX", click" boards and mikromedia" are trademarks of MikroElektronika. All other trademarks mentioned herein are property of their respective companies. All other product and corporate names appearing in this manual may or may not be registered trademarks or copyrights of their respective companies, and are only used for identification or explanation and to the owners' benefit, with no intent to infringe.

Copyright © 2014 MikroElektronika. All Rights Reserved.



If you want to learn more about our products, please visit our website at www.mikroe.com If you are experiencing some problems with any of our products or just need additional information, please place your ticket at www.mikroe.com/support If you have any questions, comments or business proposals, do not hesitate to contact us at office@mikroe.com



## **Mouser Electronics**

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

mikroElektronika: MIKROE-606