ATRIVATECH

TECHNICAL DATASHEET

µNico

CH32V003

Microcontroller Development Eco-System

4-PIN COMMUNICATION SUPPORT | COMPACT SIZE | PEN-DRIVE FORM-FACTOR | PROTOTYPING ECOSYSTEM

IMPORTANT NOTICE – PLEASE READ CAREFULLY

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Datasheet

muNico 32

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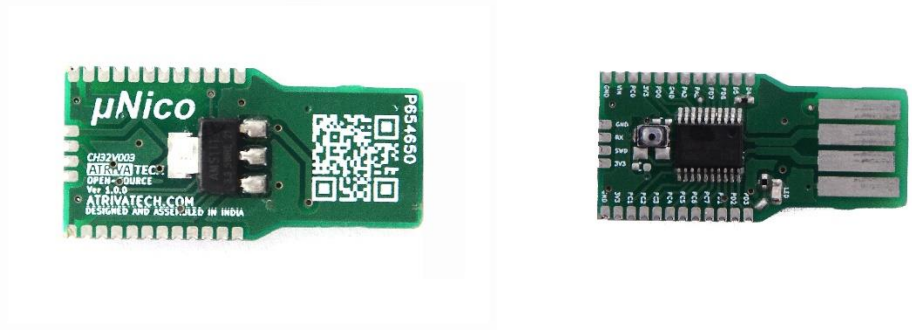
Appendix A

1. About muNico

Mu-Nico term refers to a specialized form factor, which is small and shaped like a USB stick. muNico is the portmanteau of Micro-Nico. The form factor is of 3x20mm with an inbuilt USB port and chipsets supporting USB debugging either via software or via hardware are utilized to provide a superior micro controller development ecosystem.



1.a) muNico Form-Factor of development Boards

The muNico form factor is custom developed for the purposes of providing an ecosystem to prototype with affordable microcontrollers.

The shape of the raw printed circuited board of the muNico has two significant aspects to it. The former being an inbuilt USB A port for facilitating HID compatibility and a slightly elongated microcontroller pinout distribution board on the latter.

The technical design specification of a muNico template board for replicating with other microcontroller ecosystems with respect to shape are:

(munico-outline.pdf)

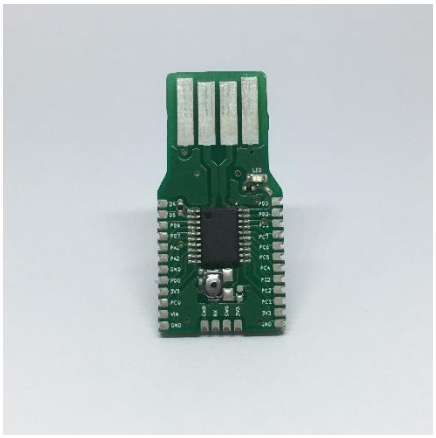
1.b) muNico 32

The muNico 32 is the first version of the series of development hardware featuring software defined USB-HID capabilities with the help of opensource ecosystems.

At its heart it is powered by the CH32V003 which is a RISC-V processor manufactured en masse by WCH .

Known for its performance and its affordability, the chipset brings over a very powerful brain for the first iteration of the board. While future muNico chipsets are possible to be developed with the help of opensource documentation that shall be provided in the current technical datasheet, one may effortlessly develop their own microcontroller powered muNico form factor boards for the use in hobby or in professional environments.

{muNico 32 original top-down image}



1.c) pinout of muNico 32 1.0.1

{muNico.pdf image to be inserted}

2) Hardware Specification

2.a) Mechanical Design

Efforts have been put in greatly to ensure that the muNico has a very sturdy design that can withstand multiple rigorous attempts to withdraw and remove from appropriate USB ports without causing much damage to the actual PCB.

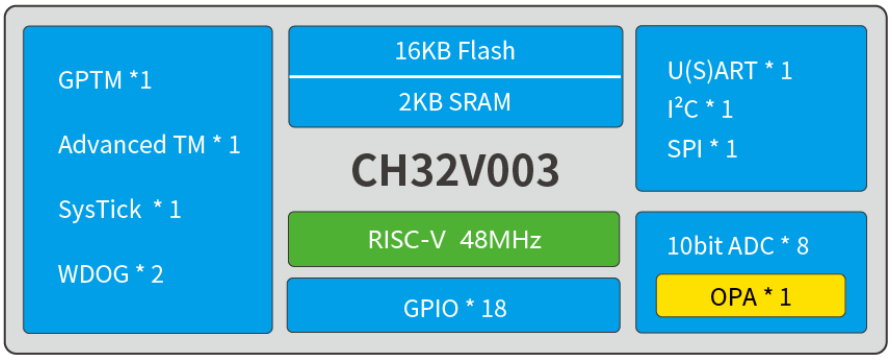
The design has been specialized such that the data lines and powerlines are directly etched on the PCB which is at a greater thickness, without having to rely on an external USB connector. This hereby makes the muNico ecosystem a very handy set of micro controller development ecosystems to operate without having to rely greatly on large external peripherals.

The picture below highlights the approximate position of fundamental power pins that are required to ensure overall compatibility with other muNico peripherals. Designers willing to develop boards in the similar ecosystem may rely on reference diagrams provided for ease of design.

(techdia-1.pdf)

2.b) CH32V003F4P6

It is explained in great detail in this section about the CH32 series of chips. The manufacturer provided SPECS diagram for the series of chips is given below.



The muNico board provided by AtrivaTech utilizes the F4 P6 version of the CH32V003 which is fully compatible with existing opensource software development kits and specialized software CH32V003FUN by Charles Lohr and Arduino IDE plugin provided by WCH themselves.

This particular chip is perfectly compatible with RV003USB which uses software techniques to coerce non-USB compatible hardware to continue communicating with host PCs without dedicated USB communication hardware.

Although the WCH-LINKE is required for fundamental programming of the chip, after the flashing of the bootloader the requirement of this programmer for the device is reduced.

2.c) SMT Footprint

As with any opensource hardware it is imperative that compatible hardware is designed for the community and by the community. To support the initiative as with many more of our products the SMT footprint for building shields, expansion hardware and additional modules with the help electronic design software such as KiCAD is provided publicly. Given below will be the technical design if one would

like to replicate the designing software of their choice. The KiCAD file shall be made available on our website for the use by the designers.

AtrivaTECH/kicad-footprints: KiCad footprints for AtrivaTECH products (github.com)

(1,2.png)

3) Electronic Specification

Disclaimer

The tests below are performed with the muNico 32 board with a current resolution in milliamps and voltage resolution in Volts. The Data given below is strictly for understanding purpose only and AtrivaTech assumes no responsibility for any deeds carried out end user by any of its products.

a) Voltage Regulator
b) External power Input
c) USB Power Input

General Specifications

As with any development board, its general specification is to be made known for easy development with it. Details mentioned below can be used to ensure that your muNico board operates in an appropriate environment for its adequate functioning.

3.a) Voltage Regulator

The muNico 32 has an on-board AMS1117-3.3V Voltage regulator by Advanced Monolithic Systems. The board can support an input voltage of 4.5-9V with varying performance changes and works stable at an input voltage of 5V. A Voltage Input Pin is also provided which is directly connected to the Input pin of the 1117 so that an external power source can be used.

Datasheet of the AMS1117 3.3: Microsoft Word - DS1117 (advanced-monolithic.com)

3.b) External power Input

As explained in previous section, a pin is provided for attaching an external power supply to the board. This pin is tied to the input pin of the voltage regulator on the PCB. A voltage input of 4.5V to 12V can be provided such that the regulator's drop-out voltage is exceeded for the adequate functioning of the MCU.

3.c) USB Power Input

For Power Input, Communication and Programming purposes a PCB USB-A compatible port Is provided. This port is meant to work with Low-Speed USB and is not compatible with USB 2.0 specifications. As the USB Port is tied to the Voltage regulator, even if there are any voltage bursts in the Data Lines of the

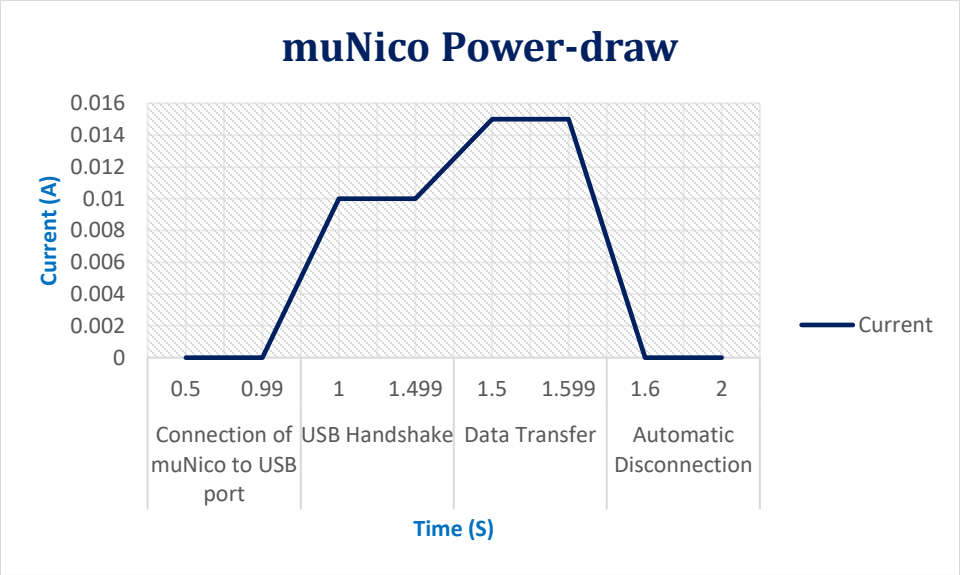
muNico, the board can handle said spikes. However, the data bus is directly connected to the MCU and cannot handle the voltage spike.

(6.jpg)

3.d) Power Draw

The muNico is a highly efficient board the has a very low power draw when functioning with full HID capabilities. The data below has been collected with muNico example code 3 which makes the muNico perform a complete handshake with the computer and initialises as a keyboard and types “ok” and then disconnects automatically from the computer.

The data and graph are as follows:



4) Programming

4.a) With WCH Link-E

WCH provide a single wire debugging programmer based around the CH32 for implementing the protocol to program the chip. This utilizes a 3 wire interfaces wherein 2 of the wires are utilized for providing power and ground while the third wire is utilized for communicating with the chip.

If the bundle including the WCH Link-E are obtained for the muNico the below steps maybe used to initialize the same on windows and on Debian(Linux). The WCH Link-E comes ready with the appropriate firmware and usually does not require additional software fixes and drivers primarily for windows. In certain circumstances it may happen that the link-E cannot comfortably interface with certain OS and devices. However, fixing this particular issue is outside the scope of this guide. Appropriate reference links shall be provided at the end of the section if any issues were to arise.

On windows, a custom driver installation software (Zadig (*LINK TO BE ADDED*)) shall be utilized to install windows and Debian compatible drivers for the Link-E. But the latest Link-E is available that may be included with the latest firmware will not mostly require driver reconfiguration for its functioning.

As a start it is encouraged that from the box the Link-E is connected to your computer to recognize if it is connected successfully. Provided it is, refer to the sub divisions below depending on the OS that is chosen.

4.a.1) Windows

Depending on the programming ecosystem you wish to utilize, the way the Link-E is configured changes. If you are going to use the Arduino ecosystem no changes are required from your end to successfully to interface the muNico with Link-E.

However, if you choose CH3V00FUN or platform IO with VS Code, or Moun River studio IDE it is important that the Link-E driver on your PC is updated with the help of Zadig. The Zadig tool can be obtained from the link provided below. This is only required if you have an older model WCH-LinkE which does not come with the latest drivers from WCH. Doing so will ensure that the IDE can comfortably interact with the muNico ensuring your programming experience is a breeze.

Addition of CH32 Boards to Arduino IDE:

a) Add the board URL via preferences in the Arduino IDE:
   https://github.com/openwch/board_manager_files/raw/main/package_ch32v_index.json
b) Use Board manager to install the CH32 series of boards and set the correct board to program the muNico.
   Tools
   Board (Ch32 EVT boards Support)
   CH32V00X
   Board Select
   CH32V003F4P6 EVT
   Upload Method
   WCH-SWD
c) Use the WCH-Link to program the board.

Zadig Driver:

Zadig - USB driver installation made easy (akeo.ie)

4.a.2) Debian (WSL)

Certain custom libraries tend to function better on Linux ecosystem because of inherent support for C and easier access to install open access tool chains.

Because of this if we have to use a Debian powered PC to program muNico with Link-E one has to ensure that it is recognized successfully.

In an ideal scenario, one will utilize a PC that is powered by Debian alone. Because of the same, the possibilities of conflicts arising are minimal. However, for ease of programming, if you the reader, choose the windows subsystem for Linux(WSL) Debian will fail to recognize that the Link-E has been connected. A software fix for the same, is to use an opensource tool on windows called USB IPD which will help attach specific USB devices to the WSL distribution of choice and to understand the procedure in a detailed manner one may follow the steps as highlighted below.

Step1:

Install USB IPD by obtaining the binaries and installation files from its GitHub page

Releases · dorssel/usbipd-win (github.com)

Step 2:

Run the installer and wait till the process completes

Step 3:

Open an instance of PowerShell as administrator.

Step 4:

Type the command below and press enter to find the list of devices and their BUS IDs as connected to the PC.

usbipd list

Note down the BUS ID of the Link-E. This ID will differ from port to port and system to system. The image provided below is purely for reference purpose only.

(3.png to be attached)

Step 6:

Open a fresh instance of PowerShell as administrator. If you do not have Windows subsystem for Linux preinstalled use the reference link below to install WSL.

wsl –install

Note: This will install an instance of Ubuntu which can be ignored. Also, the computer is to be restarted for the changes made by WSL to take effect.

Step 7:

Install an instance of Debian by running the command below.

wsl --install -d debian

Step 8:

Once the above step is completed. The PowerShell instance is to be closed and a fresh instance is to be opened. Then, type the command in the PowerShell instance to start Debian.

wsl -d debian

Step 9:

Type *cd* to go to the root directory where libraries and programming options of choice maybe installed with ease.

Step 10:

Revert back to your PowerShell initial instance and then use the following command to successfully link the programmer with the Debian instance.

usbipd attach --wsl debian --busid <enter the bus id from step 4>

(5.png to be attached)

Upon successful linking go back to your Debian PowerShell page and run lsusb to confirm that the Link-E has been connected with Debian successfully. This can be done by running the command

lsusb

(4.png to be attached)

Now that the Link-E has been connected to Linux ecosystem on Windows you can use close source or open source to program the muNico with ease.

For CH32V003fun, the steps below can be used to install and use the library. It is to be noted that the parts of installing usbipd and wsl can be ignored. You may also use a different distro of Linux if interested.

Installation · cnlohr/ch32v003fun Wiki (github.com)

4.b) With Arduino (Compatible SWD Programmers)

WCH Utilise a custom communication protocol which is not completely opensource(yet). However, certain talented developers have compiled code to convert Arduino UNOs and generic clones as compatible SWD programmers for CH32s. However, this programmer is not compatible with Arduino IDE. It is only compatible with platform IO extension and opensource libraries like CH32V003FUN.

Providing complete steps for this conversion is outside the scope of this guide. But reference links have been provided if you wish to use your own programmer for the muNico.

For any programming platform not mentioned above, reference material provided below can be used for reference.

Features · cnlohr/ch32v003fun Wiki (github.com)

Appendix B: External Peripherals

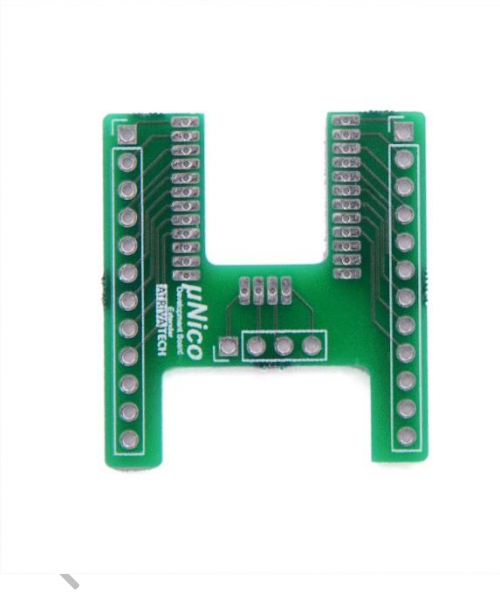
1a) Disclaimer

1) muNico External Header extender

The muNico series of boards come with a 1.27mm pitch header array to accommodate all of the legs of the chip. This layout is not prototyping friendly, however provides the ability to have a very small layout.

To assist with easy programming and prototyping, a breadboard friendly “header extender” has been designed as part of the accessories and parts designed by AtrivaTECH to be compatible with the boards.

This board extender is part of the muNico developer and hobbyist grade bundles as officially distributed by AtrivaTECH with SKUs: AT020002 and AT020003 and is also available individually with SKU: AT020201



All design files can be obtained for replicating the same from:

2) muNico 3D case

The muNico being of the pen drive form-factor to make the ability to use the board as an effective hardware hacking tool, a custom case has been designed to give the tool a very unique look.

The case is part of the official accessories provided with the muNico and is distributed with SKU AT020200

Appendix F:

Source Files.

At AtrivaTECH we firmly believe any open-source product must include all source-files to justify the open nature of our products. We go leaps and bounds to ensure that documentation for our products is always updated and available. As a part of our motto, all fundamental files of the muNico 32 are also made available.

Said source files are released in good-faith and are not meant to be misused. Source file licenses are to be followed. Appropriate references and credits are to be provided wherever contents of this appendix are referred to.

AtrivaTECH takes no responsibility for any damage or harm caused by this product.

1) Schematic
2) Mechanical Outline

(scheme.pdf , drawing.pdf to be attached.)

(It is to be noted that the technical diagram provided in Appendix 2.a can also be referred to as part of the technical drawings of muNico.

Appendix G: Regulatory

A) Certifications

1) OSHWA Certification

muNico 32 is certified open source by the Open-Source HardWare Association. (oshwa.org)

B) Distributors

To ensure optimal distribution of our products, AtrivaTECH is aiming to partner with distributors worldwide. And to enhance business operations we have shifted to a distributor only medium and we will not stock individual parts for sale.

A list of authorised distributors will be updated at: https://atrivatech.com/distributors

To join our distribution network, please email: distr@atrivatech.com (For future distributors)

Appendix H: Version Control

This data sheet is edited on a regular basis to ensure that all data is updated. And to track the same, we have enabled a version control system where each change is mentioned with version below. For any updates regarding changes, please refer to the tabular column.

S No	Change (s) Made	Changes Made By	Publish Date
1	First Copy	Atul (Atriva)	SEP-2024

Appendix I: Issue Reporting

To support AtrivaTECH's commitment to support hardware manufactured for extended periods of time, AtrivaTECH will regularly update the documentation for its product (s) based on reports from users of its products.

To report changes, one may email: reports@atrivatech.com