

OEM module with Atmel's AVR ATmega32U4 processor with USB controller.

AVAILABLE PROCESSOR OPTIONS

Module	Processor	RAM	EEPROM	Flash	Peripherals
Crumb32U4 V1.0	ATmega32U4	2.5kB SRAM	1kB EEPROM	32kB Flash	- 3.3V LDO regulator - USB power LED - status LED and tiny reset button - ESD protection diodes on USB lines

PREINSTALLED FIRMWARE

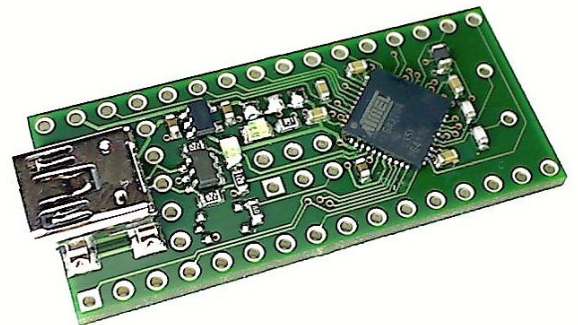
The module comes with a USB HID keyboard demo firmware preloaded, which is based on the LUFA Leight Weight USB Framework for AVRs (see <http://www.fourwalledcubicle.com/LUFA.php>). The module can be directly connected to a PC and will be recognized as USB keyboard without additional USB driver necessary. Just open some text editor, connect the module and see the text sent from the module! Really easy.

The example code is available on the chip45 product download page (<http://shop.chip45.com/AVR-USB-Controller-Modules-Boards/Downloads>).

VOLTAGE REGULATOR

A 3.3V LDO voltage regulator NCP500 is integrated on the module, thus providing two USB powered options and two self powered options for supplying the module:

- **USB powered (J2 closed)**
 1. bypass the LDO and supply from the 5V USB bus power (J1 position 1-2)
 2. supply from the LDOs 3.3V output (J1 position 2-3)
- **Self powered (J2 open)**
 1. bypass the LDO and supply from an external supply voltage (J1 position 1-2)
 2. supply the LDO from an external supply voltage and the module from the LDOs 3.3V output (J1 position 2-3)



In Self Powered configuration, an external supply voltage must be connected to CON3 pin 16.

The LDO voltage regulator can supply up to 150mA, depending on power dissipation and input voltage. Please see the data sheet for details.

USB INTERFACE

The modules comes with a standard 5-pin mini B-type USB connector. It is connected to the ATmega32U4's USB controller signals.

The USB signals are protected against ESD damage by an ESD diode array.

SYSTEM CLOCK OPTIONS

The USB controller requires either a 8MHz or 16MHz external crystal. The factory setting of the ATmega32U4 clock fusebits thus is for an external >8MHz crystal. When no crystal is connected, it is not possible to access the device through ISP! This is other than the normal ATmega microcontrollers and to avoid confusion, chip45 decided to preassemble the crystal and preload a sample firmware (see below).

The crystal frequency can be chosen on the product page.

RESET BUTTON

A tiny reset button is available to force a manual reset of the MCU. A 10kOhm pullup resistor is connected to the MCU's reset signal to make it less susceptible to EMI, than with just the MCU-internal pullup resistor.

STATUS LEDS

A green low-current LED is connected to the USB bus power and will light when connected to USB bus.

A red low-current status LED is connected low-active to the MCU's signal PD5. Setting this pin to output and low will turn on the LED. It can be used to indicate a successful USB connection / enumeration.

ISP CONNECTOR

An ISP header with Atmel's standard 6-pin pinout is available on the module, see pictures below for location and pinout. ISP adapters, like AVRISP-mkII, AVR-Dragon or JTAGICE can be connected directly.

EXPANSION CONNECTORS

All MCU signals are available on the two 16 pin expansion connector on the long sides.

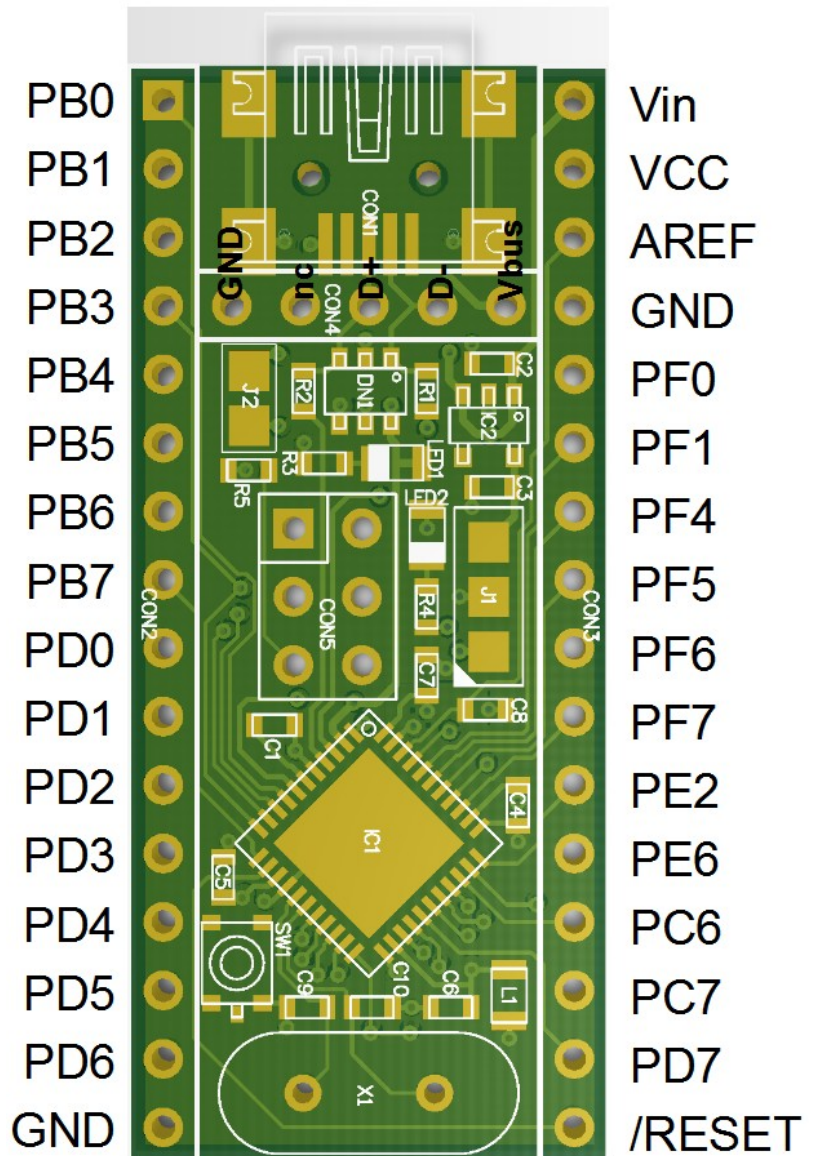
PIN CONFIGURATION AND DIMENSIONS

The picture right shows the module with the location of all onboard components and the pinout of the expansion connectors.

The five pins behind the USB header provide all USB signals and can be used, if the module is plugged onto a mother board, which already features another USB connector.

The jumpers are solder jumpers and need to be closed by placing a small spot of solder across two pads.

The dimension of the module is 17.8mm x 41.7mm and the USB header extends the length by 2mm.



DESIGN AND HANDLING GUIDELINES

This module – just like any other semiconductor devices – is susceptible to damage by ESD. Suitable precautions should be taken when handling and transporting devices. The possible damage to devices depends on the circumstances of the handling and transporting, and the nature of the device. The extent of damage can vary from immediate functional or parametric malfunction to degradation of function or performance in use over time. Devices suspected of being affected should be replaced.

OPERATING CHARACTERISTICS

Symbol	Parameter	Condition	Min	Typ	Max	Units
V _{in}	External Supply Voltage				5.5	V
V _{cc}	Supply Voltage	0-8 MHz	2.7		5.5	V
		0-16 MHz	4.5		5.5	V
I _{cc}	Power Supply Current (I _{cc} strongly depends on CPU activity, like frequency, power saving modes, etc. as well as external circuitry, io pin input and output current, etc. The values denoted here are for reference only and can differ from final application vallues.)	Active 8MHz V _{cc} = 3.3V		5.5		mA
		Active 16MHz V _{cc} = 5V		14		mA
T	Operating Temperature (industrial temperature range on request)		-20		+70	°C

SCOPE OF DELIVERY

This module is being shipped without pin headers (THT components) preinstalled. A Connector Kit with standard pin headers and receptacles can be ordered as option.

DEVELOPMENT TOOLS

The free WinAVR C/C++ compiler toolset is no longer being maintained, but Atmel now provides the avr-libc and AVR GNU Toolchain for free. This is a powerful and stable development environment, which is nicely integrated into Atmel's AVR-Studio development suite. Please visit the following pages for more details:

- Atmel AVR Studio 4.18 (build 684): http://www.atmel.com/forms/software_download.asp?category_id=163&family_id=607&subfamily_id=760&fn=dl_AvrStudio4Setup.exe
- Atmel AVR Studio Service Pack 1 (build 692): http://www.atmel.com/dyn/resources/prod_documents/AVRStudio4.18SP1.exe
- Atmel AVR Studio Service Pack 3 (build 716): http://www.atmel.com/dyn/resources/prod_documents/AVRStudio4.18SP3.exe
- Atmel AVR Toolchain Installer: http://www.atmel.com/forms/software_download.asp?category_id=163&family_id=607&subfamily_id=760&fn=dl_avr-toolchain-installer-3.2.3.579-win32.win32.x86.exe

Note: Make sure to install both service pack 1 and service pack 3 for AVR Studio 4!

WHAT ELSE DO YOU NEED?

- For ISP programmieing, you need an ISP adapter for in-system programming of the MCU, see <http://shop.chip45.com/AVR-ATmega-Xmega-Development-Tools/ISP-PDI-Adapters> for suitable devices.
- If you need source level debugging, you should consider Atmel's JTAGICE debuggers (which are available here: <http://shop.chip45.com/AVR-ATmega-Xmega-Development-Tools/JTAG-DebugWire-Debugger>).
- A development environment and compiler/assembler (see above DEVELOPMENT TOOLS)

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