

*OEM module with Ethernet and USB Interface based on Atmel's AVR ATmega644P processor.*

## AVAILABLE PROCESSOR OPTIONS

Module	Processor	RAM	EEPROM	Flash	Peripherals
Crumb644-NET V2.1	ATmega644P	4kB SRAM	4kB EEPROM	64kB Flash	<ul style="list-style-type: none"><li>- CP2201 ethernet controller</li><li>- ethernet transformer</li><li>- link LED</li><li>- CP2102 USB-UART converter</li><li>- mini USB B 5pin connector</li><li>- status LEDs</li><li>- 3.3V LDO regulator</li><li>- 1MByte data flash</li></ul>

## LDO VOLTAGE REGULATOR

Since the CP2201 ethernet controller and the data flash are 3.3V devices, a ADP3331 3.3V LDO voltage regulator is used to generate onboard 3.3V from the external 5V supply. The 3.3V can be used to power external components (up to 200mA incl. onboard components), but maximum power dissipation of the LDO must not be exceeded. See data sheet for details.

## USB INTERFACE

A USB UART converter CP2102 by Silabs is connected to the MCU's first USART RXD0/PD0 and TXD0/PD1. A standard 5pin mini USB B connector is available onboard and allows for easy connection to a host PC. The CP2102 is always powered from USB bus. It's possible to power the module from USB by connecting VBUS on CON1 to VCC.

## ETHERNET INTERFACE

The module provides an CP2201 ethernet controller by Silicon Labs. It uses an 8 bit data bus for host communication, connected to PA0-7 and PC4-7. See schematics for details. Due to the pin usage, the JTAG interface has to be disabled to communicate with the ethernet controller, hence no source level debugging is possible. The CP2201 is a 3.3V device, so it is powered always from the 3.3V LDO regulator. An ethernet transformer is preinstalled, so just a low cost RJ45 connector is suitable for ethernet connection. The ethernet controller provides a link LED, which can be assembled beside the RJ45 connector. See pinout and drawing for details. The square pad of the LED footprint is the anode.

## PREINSTALLED BOOTLOADER

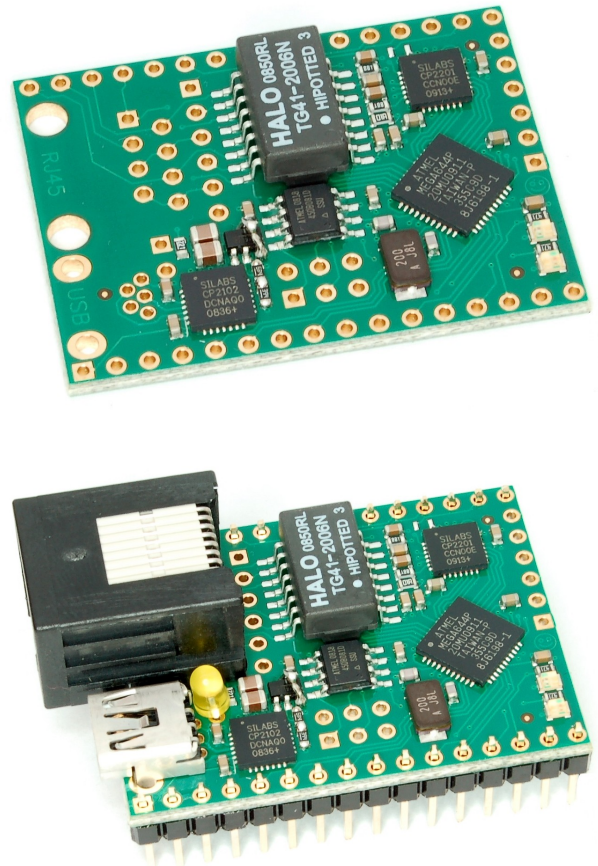
The module comes with the latest version of the chip45boot2 bootloader preprogrammed. It allows for flash and eeprom programming over USB without the need for an ISP adapter. The bootloader is being enabled by a certain character sequence after reset, then automatically adjusts it's baudrate to the host PC's baudrate and shows a command prompt and is ready to work. See [www.chip45.com/info/chip45boot2.html](http://www.chip45.com/info/chip45boot2.html) for details on the chip45boot2 bootloader.

## STATUS LEDs

A green low-current status LED is connected low-active to the MCU's signal PB7. Setting this pin to output and low will turn on the LED.

## EMBEDDED TCP/IP STACK AND WEBSERVER

uIP is an implementation of the TCP/IP protocol stack, optimized for small 8 bit microcontrollers. uIP provides all necessary protocols for internet connectivity, with a very small code footprint and RAM requirements. uIP is open source software, developed in C and may be freely used in both non-commercial as well as commercial projects. uIP is covered by the BSD-Style License. Further information in uIP is available on the uIP homepage of Adam Dunkels'.



A port of the uIP Embedded TCP/IP Stack and webserver for the Crumb644-Net can be downloaded on the module's download page.

With V1.3 of our port a demo webpage is included, which demonstrates measurement and control applications. The onboard LED of the modules can be switched by clicking on a webpage of the webserver and the adc inputs of the module are visualized.

## CRUMB IO FIRMWARE

An alternative port of the uIP stack was done by Stefan Frings and was extended by addition protocols, like SMTP for sending an email on an external event. See Stefan Frings homepage for details. The homepage is currently available only in english, but the source code is documented in english. The Crumb IO firmware is also available in the download section.

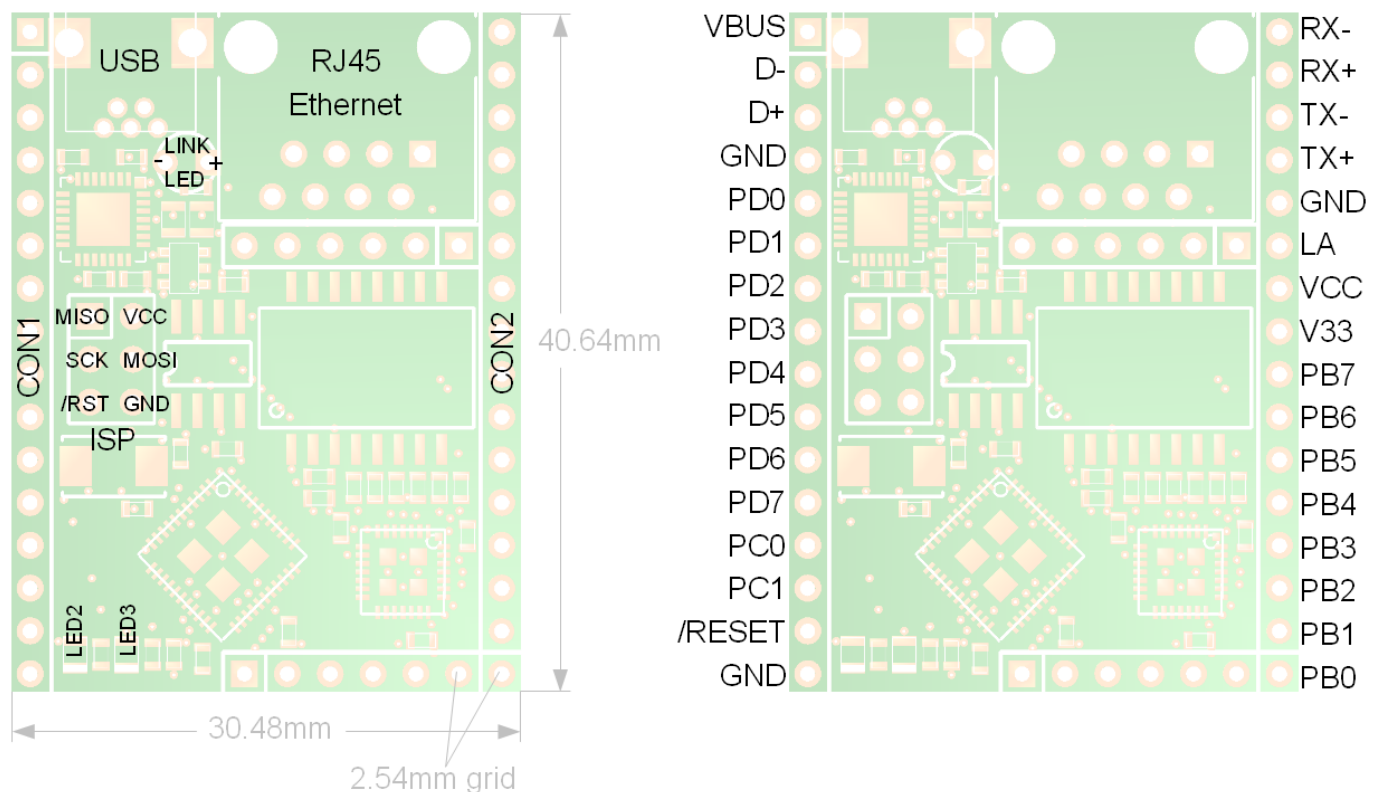
## ISP CONNECTOR

An ISP header with Atmel's standard 6-pin pinout is available on the module, see pictures below for location and pinout.

## EXPANSION CONNECTORS

Two 16 pin headers provide all free MCU signals, as well as the USB signals and ethernet signals.

## PIN CONFIGURATION AND DIMENSIONS



## 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
Vcc	Supply Voltage	20MHz	2.7		5.5	V
Icc	Power Supply Current	Active 20MHz Vcc = 5V		18		mA
	(Icc 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)	ethernet active		+75		mA
		USB bus active		+20		mA
		data flash active		+7		
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.

## CORRECT ATMEGA644P FUSE BIT SETTINGS

The ATmega644 runs with a 20.0000MHz crystal (X1) as clock source. It is necessary to set the clock fusebits to "Full Swing Oscillator...". With this option the ATmega644P oscillator swings with a higher amplitude and can additionally supply the CP2201 ethernet controller with a proper clock signal (through a 100nF capacitor). The picture right shows the default fusebit settings when shipped with the chip45boot2 bootloader preloaded.

## DEVELOPMENT TOOLS

The free WinAVR C/C++ compiler toolset provides 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:  
[http://www.atmel.com/dyn/products/tools\\_card.asp?tool\\_id=2725](http://www.atmel.com/dyn/products/tools_card.asp?tool_id=2725)
- WinAVR compiler toolset: <http://winavr.sourceforge.net/>

## WHAT ELSE DO YOU NEED?

- To use the bootloader comfortably from a Windows PC application, see [www.chip45.com/info/chip45boot2.html](http://www.chip45.com/info/chip45boot2.html) for the latest version of the chip45boot2 GUI application.
- If you prefer ISP programming, you need an ISP adapter for in-system programming of the MCU, see [www.chip45.com/AVR-ISP-Programmer-Adapter](http://www.chip45.com/AVR-ISP-Programmer-Adapter) for suitable devices.
- Windows and Mac users need the latest USB driver for the CP2102 USB UART converter (see CP2102 homepage at <https://www.silabs.com/products/interface/usbtouart/Pages/default.aspx>)
- 
- A development environment and compiler/assembler (see above DEVELOPMENT TOOLS)

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