**AVAILABLE PROCESSOR OPTIONS**

<table>
<thead>
<tr>
<th>Module</th>
<th>Processor</th>
<th>RAM</th>
<th>EEPROM</th>
<th>Flash</th>
<th>Peripherals</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrumbX1-NET V1.2</td>
<td>ATxmega128D3</td>
<td>8kB</td>
<td>4kB</td>
<td>128kB</td>
<td>- CP2201 ethernet controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EEPROM</td>
<td>Flash</td>
<td>- ethernet transformer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flash</td>
<td>- link LED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flash</td>
<td>- CP2102 USB-UART converter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flash</td>
<td>- mini USB B 5pin connector</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flash</td>
<td>- status LEDs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flash</td>
<td>- 3.3V LDO regulator</td>
</tr>
<tr>
<td>Power-PoE-1</td>
<td>optional</td>
<td></td>
<td></td>
<td></td>
<td>Power-Over-Ethernet add-on module, see section “POWER-OVER-ETHERNET” below</td>
</tr>
</tbody>
</table>

**LDO VOLTAGE REGULATOR**

The module comes with an NCP500 3.3V LDO voltage regulator, since both the ATxmega128D3 as well as the CP2201 ethernet controller are 3.3V devices. With the regulator, the module can be powered from an external 5V supply or from USB bus power (see below).

The 3.3V can be used to power external components (up to 150mA incl. onboard components), but maximum power dissipation of the LDO must not be exceeded. See datasheet for details.

**USB INTERFACE**

A USB UART converter CP2102 by Silabs is connected to USARTE0 of the ATxmega128D3. 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 closing jumper J3. See below for jumper location.

**ETHERNET INTERFACE**

The module provides an CP2201 ethernet controller by Silicon Labs. It uses an 8 bit data bus for host communication, connected to PF0-7 and PE4-7. See schematics for details. An ethernet transformer is preinstalled, so just a low cost RJ45 connector is suitable for ethernet connection. The module also provides a yellow link led (LED1), which can be activated by closing jumper J8 on the bottom side (see below). If the onboard LED should not be used, an external link LED can be connected to signal LA (see below). In this case, the onboard LED should be disabled.

**PREINSTALLED BOOTLOADER**

The module can be shipped 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 [http://go.chip45.com/c45b2](http://go.chip45.com/c45b2) for details on the chip45boot2 bootloader. If the preloaded bootloader is desired, please select this as option on the product page.

The module provide an auto-reset feature to allow the GUI application to automatically reset the MCU. To use this feature, the jumper J2 on the bottom side has to be closed.

**ANALOG INPUTS**

The module provides two analog input signals of the ATxmega128D3 (PA0 and PA1) on the expansion headers. If more analog inputs are required, it is possible to close at least one of the jumpers J4 – J7 on the bottom side. These jumper each connect one signal of PB4 – PB7 to the digital signals PC3 – PC0 and hence the additional
analog signals are available on the expansion header. Please make sure in your application software, that the
signals PC3 – PC0 are tristated in this case!!!

OPTIONAL MCU CRYSTAL
The CP2201 ethernet controller uses an own 20MHz crystal and the ATxmega128D3 normally does not need a
crystal. It can be clocked from the internal RC oscillator at a clock frequency up to 32MHz. The internal RC
oscillator normally is accurate enough for most applications. In case an even higher accuracy is required by your
application, it is possible to assemble a 16MHz crystal plus two capacitors on the bottom side of the PCB. Feel free
to add a crystal here or contact us, if you want us to add the crystal.

A suitable crystal would be: FA-365, 16.00MHZ, 50PPM, 16PF by EPSON TOYOCOM:
(http://de.farnell.com/epson-toyocom/fa-365-16-00mhz-50ppm-16pf/xtal-fa-365-16-00mhz-50ppm-16pf/dp/1712820)

STATUS LEDS
A green and a red low-current status LED is connected low-active to the MCU's signals PA3 (green) and PA4 (red),
Setting those pins to output and low will turn on the LEDs.

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 CrumbX1-NET is included in the Crumb IO
Firmware by Stefan Frings:

CRUMB IO Firmware
A port of the uIP stack was done by Stefan Frings and was extended by additional protocols, like SMTP for sending
an email on an external event. See Stefan Frings homepage in english or german for details. The Crumb IO
firmware is also available on the chip45 CrumbX1-NET page: http://go.chip45.com/crumbx1-net-1.2.

Additionally we provide a special version of the Crumb IO Firmware, which is extended by an Atmel Studio 6
project. This special version is available on the CrumbX1-NET page: http://go.chip45.com/crumbx1-net-1.2.
The CrumbX1-NET module will be shipped with preloaded firmware with working DHCP configuration and
webserver example.

IN CIRCUIT PROGRAMMING (ISP/PDI) CONNECTOR
Due to layout and space contraints, it was not possible to add a regular 6-pin ISP/PDI connector to the
module. Instead of it, a tiny 1.27mm pitch connector is being used and a small adapter PCB from 4-
pin/1.27mm to the regular 6-
pin/2.54mm PDI header is available
and is included in the normal Connector Kit.

The adapter PCB can be used in two different orientations (vertical / horizontal) for better flexibility. See the pictures for both methods and how to assemble the adapter PCB properly.

ATXMEGA128D3 FUSE BIT SETTINGS
No special fusebit settings are necessary, if the normal firmware is used without a bootloader.
With the preloaded bootloader the fusebits are already set correctly and need not to be changed.
EXPANSION CONNECTORS
Two 16 pin headers provide a set of MCU signals, as well as the USB signals and ethernet signals.

POWER-OVER-ETHERNET
An optional Power-Over-Ethernet (PoE) addon module can be stacked onto two 5 pin headers.

The Power-PoE-1 module is available at the chip45.com online shop (http://go.chip45.com/power-poe-1-1.2) and provides a tiny IEEE 802.3af Power-Over-Ethernet solution.

The output voltage is fixed to 5V and the module can supply a current of 500mA continuously.

The picture right shows the CrumbX1-NET with stacked Power-PoE-1 module.

PIN CONFIGURATION AND JUMPER POSITIONS

MODULE SCHEMATIC
The full schematic of the module is available here: http://download.chip45.com/CrumbX1-NET_V1.2_schematic.pdf

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**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vcc</td>
<td>Supply Voltage</td>
<td>through LDO</td>
<td>3.5</td>
<td>6.0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LDO bypassed</td>
<td></td>
<td></td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Icc</td>
<td>Power Supply Current</td>
<td>Active 32MHz</td>
<td></td>
<td>110</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vcc = 5V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>micro sd active</td>
<td></td>
<td></td>
<td></td>
<td>t.d.b.</td>
</tr>
<tr>
<td>T</td>
<td>Operating Temperature</td>
<td></td>
<td>-20</td>
<td>+70</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>

**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 optionally.

**DEVELOPMENT TOOLS**

The free Atmel AVR GNU Toolchain 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:


**WHAT ELSE DO YOU NEED?**

- To use the bootloader comfortably from a Windows PC application, see [http://go.chip45.com/c45b2](http://go.chip45.com/c45b2) 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 [http://www.chip45.com/categories/avr_atmega_xmega_entwicklungstools.php](http://www.chip45.com/categories/avr_atmega_xmega_entwicklungstools.php) 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/usbuart/Pages/default.aspx](https://www.silabs.com/products/interface/usbuart/Pages/default.aspx))
- A development environment and compiler/assembler (see above DEVELOPMENT TOOLS)
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