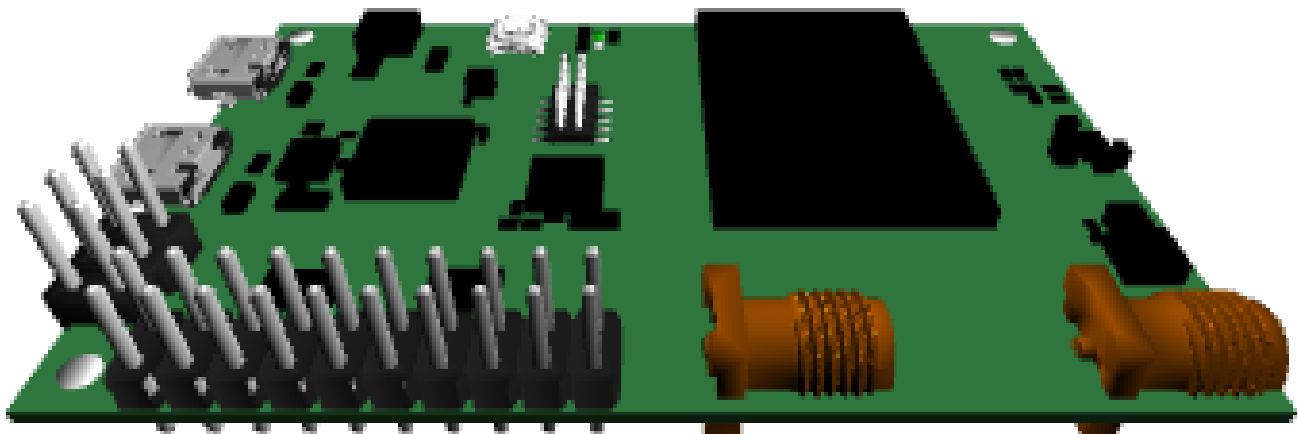


ATmega32U4 IoT Weather Station



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Board Description

IoT Weather Station powered by ATmega32U4 + LoRa transceiver and weather related sensors

Board Dimensions

6.5cm x 4.1cm

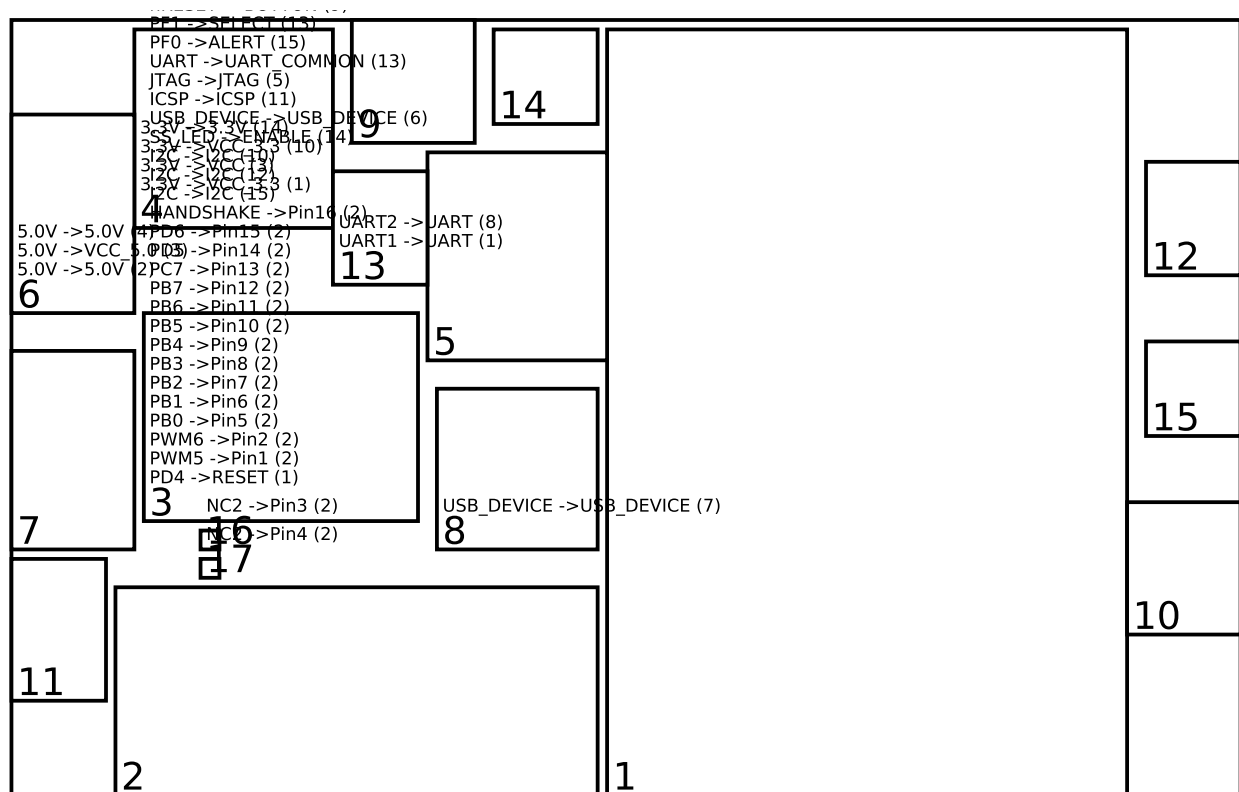


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1 Modules on Board



1.1 Network

1.1.1 LoRa Transceiver (v3) (1)

Microchip's low-power long range transceiver is a sub-1 GHz wireless module with integrated LoRa modem. The module is controlled by a UART interface and provide data communication at ranges exceeding 15 km.

This module utilizes the ISM band for licence exempt operation. Please consult your purchase order to find your model number and local spectrum management regulations before operating. **Operating Spectrum**

Model	Country	Frequency
RN2903	U.S., Canada, Australia, New Zealand	902 MHz - 928 MHz
RN2483	Europe	863 MHz - 870 MHz, 433.05 MHz - 434.79 MHz

The datasheet for the RN2903 module is available at: <http://ww1.microchip.com/downloads/en/DeviceDoc/50002390B.pdf> The datasheet for the RN2483 module is available at: <http://ww1.microchip.com/downloads/en/DeviceDoc/50002346A.pdf>

Highlights

Max Bit Rate:	300	kbps
Receiver Sensitivity:	-148	dBm
Transmitter Power:	14	dBm
Modulation:	LoRa, FSK, GSK	



Connections Its UART bus is connected to UART1 on UART Mux (2 output) (13) Its !RESET line is connected to PD4 on

1.2 Headers

1.2.1 20-Pin Male Header (v11) (2)

The 20-pin male header module offers up to 16 bi-directional GPIO or Pulse Width Modulation (PWM) signals.

This module has the following connections:

- Pin1 to PWM5 from Atmel ATmega32U4 (3)
- Pin2 to PWM6 from Atmel ATmega32U4 (3)
- 5.0V to 5.0V from Micro-B Jack (6)
- Pin3 to NC2 from NC (16)
- Pin4 to NC2 from NC (17)
- Pin5 to PB0 from Atmel ATmega32U4 (3)
- Pin6 to PB1 from Atmel ATmega32U4 (3)
- Pin7 to PB2 from Atmel ATmega32U4 (3)
- Pin8 to PB3 from Atmel ATmega32U4 (3)
- Pin9 to PB4 from Atmel ATmega32U4 (3)
- Pin10 to PB5 from Atmel ATmega32U4 (3)
- Pin11 to PB6 from Atmel ATmega32U4 (3)
- Pin12 to PB7 from Atmel ATmega32U4 (3)
- Pin13 to PC7 from Atmel ATmega32U4 (3)
- Pin14 to PD5 from Atmel ATmega32U4 (3)
- Pin15 to PD6 from Atmel ATmega32U4 (3)
- Pin16 to HANDSHAKE from Atmel ATmega32U4 (3)

1.2.2 JTAG Header (mini ARM) (v6) (5)

This miniature JTAG header (10 pins, 0.050" pitch) connects to a Cortex-M4 microprocessor module. The JTAG header is useful for writing a bootloader to the Cortex-M4 which can be used to load higher-level firmware.

This module breaks out JTAG from Atmel ATmega32U4 (3).

1.2.3 ICSP Header (v1) (11)

ICSP header for Arduino Boards.



1.2.4 NC (v9) (16)

No connection

1.2.5 NC (v9) (17)

No connection

1.3 Processors

1.3.1 Atmel ATmega32U4 (v3) (3)

The low-power Atmel 8-bit AVR RISC-based microcontroller featuring 32KB self-programming flash program memory, 2.5KB SRAM, 1KB EEPROM, USB 2.0 full-speed/low speed device, 12-channel 10-bit A/D-converter, and JTAG interface for on-chip-debug. The device achieves up to 16 MIPS throughput at 16 MHz. 2.7 - 5.5 Volt operation. Requires:

- VCC from 3.3V/1.5A Regulator (4)
- VCC_5.0 from Micro-B Jack (6)

Provides:

- VLOGIC to:
 - LoRa Transceiver (1)
 - 20-Pin Male Header (2)
 - Ambient Temperature Sensor (15)
 - Barometer (12)
 - Humidity Sensor (10)
 - ICSP Header (11)
 - JTAG Header (mini ARM) (5)
 - Tactile Switch (9)
- PD4 to LoRa Transceiver (1)
- PWM5 to 20-Pin Male Header (2)
- PWM6 to 20-Pin Male Header (2)
- PB0 to 20-Pin Male Header (2)
- PB1 to 20-Pin Male Header (2)
- PB2 to 20-Pin Male Header (2)
- PB3 to 20-Pin Male Header (2)
- PB4 to 20-Pin Male Header (2)
- PB5 to 20-Pin Male Header (2)



- PB6 to 20-Pin Male Header (2)
- PB7 to 20-Pin Male Header (2)
- PC7 to 20-Pin Male Header (2)
- PD5 to 20-Pin Male Header (2)
- PD6 to 20-Pin Male Header (2)
- HANDSHAKE to 20-Pin Male Header (2)
- I2C to:
 - Ambient Temperature Sensor (15)
 - Barometer (12)
 - Humidity Sensor (10)
- SS_LED to Top-side LED (14)
- USB_DEVICE to Micro-B Jack (6)
- ICSP to ICSP Header (11)
- JTAG to JTAG Header (mini ARM) (5)
- UART to UART Mux (2 output) (13)
- PF0 to Ambient Temperature Sensor (15)
- PF1 to UART Mux (2 output) (13)
- nRESET to Tactile Switch (9)

1.4 Power

1.4.1 3.3V/1.5A Regulator (v11) (4)

This DC to DC step down regulator provides a 3.3V DC output at 1.5A needed by certain components on this board. It is capable of accepting an input voltage between 3.1 to 16V DC and output is controlled by the TI TPS6211 buck regulator. It receives 5.0V from Micro-B Jack (6).

The dataheet for the TPS6211 regulator is available at:

<http://www.ti.com/lit/ds/symlink/tps62110.pdf>

This regulator provides 3.3V to:

- LoRa Transceiver (1)
- Atmel ATmega32U4 (3)
- Humidity Sensor (10)
- Top-side LED (14)



1.5 USB

1.5.1 Micro-B Jack (v10) (6)

The USB micro-B port module allows your design to connect as a USB device to a USB host.

This module is connected to USB_DEVICE on Atmel ATmega32U4 (3).

It supplies 5.0V to:

- 20-Pin Male Header (2)
- Atmel ATmega32U4 (3)
- 3.3V/1.5A Regulator (4)

1.5.2 Micro-B Jack (v10) (7)

The USB micro-B port module allows your design to connect as a USB device to a USB host.

This module is connected to USB_DEVICE on USB-UART (8).

This module does not supply power.

1.6 Connectivity

1.6.1 USB-UART (v16) (8)

Also known as an FTDI, this USB to UART converter allows a USB connection to the board to behave as a virtual RS232 serial connection. It offers direct and complete access to the system from a development machine by way of the FTDI FT232RQ USB – UART IC.

Technical documentation for the FT232RQ is available at:

http://www.ftdichip.com/Support/Documents/DataSheets/ICs/DS_FT232R.pdf

This USB to UART converter connects a host machine from Micro-B Jack (7) to UART2 on UART Mux (2 output) (13).

1.6.2 UART Mux (2 output) (v6) (13)

A bidirectional 2 x SPDT switch connects two UART interfaces (RX/TX only). A SELECT line is used to control which UART is output.

This UART 2-output mux switches between UART on LoRa Transceiver (1) or UART on USB-UART (8) to UART on Atmel ATmega32U4 (3).

The output is controlled by PF1 on Atmel ATmega32U4 (3).



1.7 IO

1.7.1 Tactile Switch (v15) (9)

This 4.9 sq. mm pull-down touch switch provides a user input for the signal nRESET on Atmel ATmega32U4 (3).

1.7.2 Top-side LED (v3) (14)

The top-side LED module contains a 1608 standard size LED of a user-selected color, mounted on the top side of a Geppetto board.

The LED is active-high on SS_LED from Atmel ATmega32U4 (3).

1.8 Sensors

1.8.1 Humidity Sensor (v3) (10)

The humidity sensor module uses the Silicon Labs Si7021-A20 humidity and temperature sensor to measure ambient humidity. The module communicates with host devices serially over I²C.

The Si7021-A20 sensor's datasheet is available at:

<https://www.silabs.com/Support%20Documents%2FTechnicalDocs%2FSi7021-A20.pdf>

Highlights

Maximum resolution	0.025	5° RH
Maximum temp. resolution	0.01	°C
I ² C slave address		0x40

Connections

The humidity sensor module is connected to I2C on Atmel ATmega32U4 (3).

1.8.2 Barometer (v8) (12)

The barometer module is an ultra-compact, low-power barometric pressure sensor useful for aerial vehicles. The module's MS5611-01BA03 Barometric Pressure Sensor offers a high resolution reading, accurate to within 10 cm and is optimized for altimeter and variometer applications. It can communicate serially either over I²C or SPI buses. *At altitudes close to sea level, covering the barometer module with a light piece of foam may help to improve the accuracy of readings.*

Highlights

Max resolution:	0.065	mbar
Range:	10 – 1200	mbar
Min response time:	0.5	ms
I ² C slave addr:		0x76

Connections

This module is connected to I2C on Atmel ATmega32U4 (3).

Visit <http://www.meas-spec.com/downloads/MS5611-01BA03.pdf> for details.



1.8.3 Ambient Temperature Sensor (v8) (15)

The ambient temperature sensor module hosts the TI TMP102 IC to measure temperatures with an accuracy of $\pm 0.5^{\circ}\text{C}$ and communicates to a host system over I²C.

Download the datasheet for the TMP102 at:

<http://www.ti.com.cn/cn/lit/ds/symlink/tmp102.pdf>

Highlights

Max resolution: 0.0625 °C/LSb

I²C slave addr: 0x48

Connections

The ambient temperature sensor module is connected to I2C on Atmel ATmega32U4 (3).

The overtemperature alert pin is connected to PF0 on Atmel ATmega32U4 (3)



2 Module Connections Graph

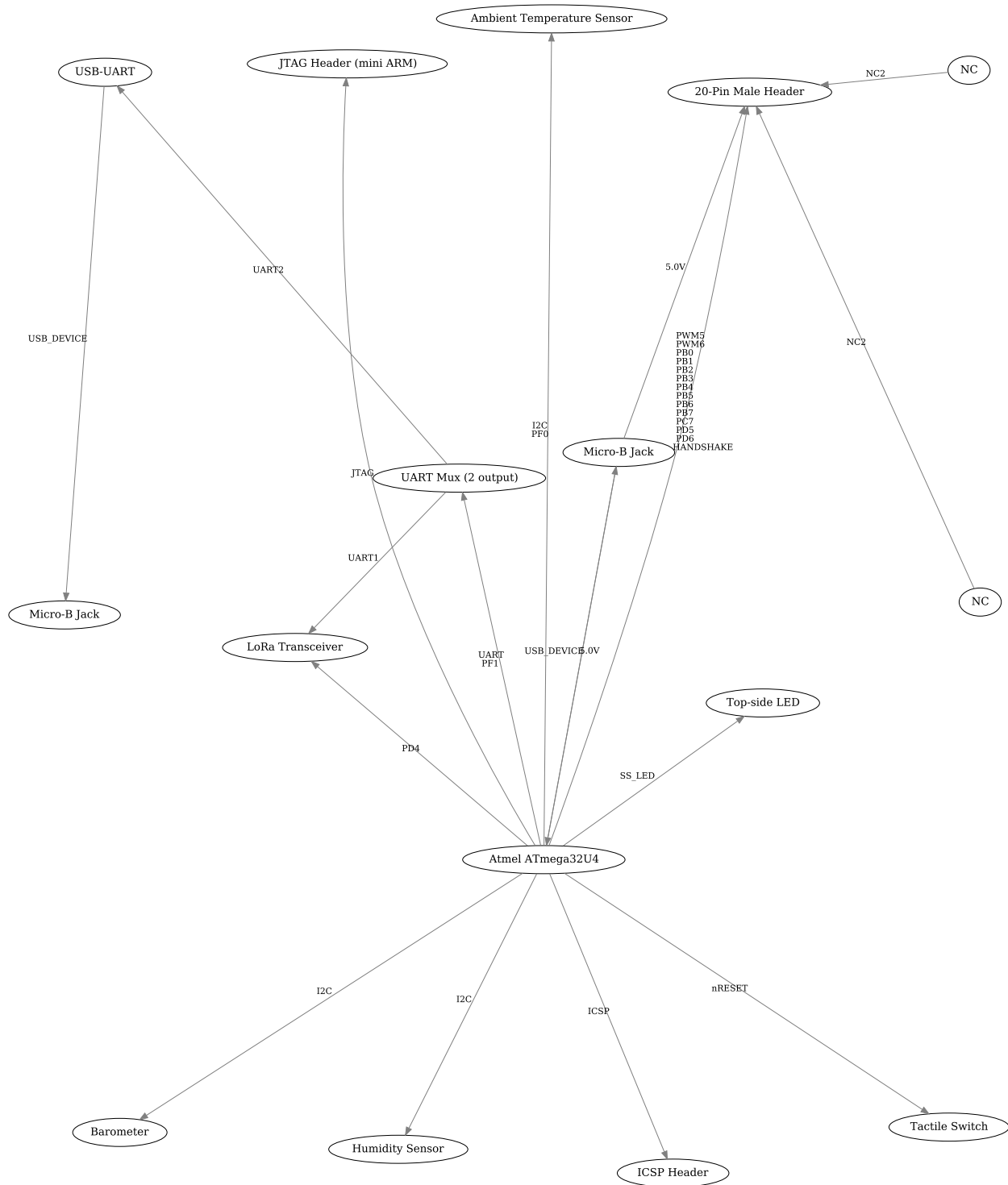


Figure 1: excludes power modules



3 Module Power Graph

3.3V/1.5A Regulator



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