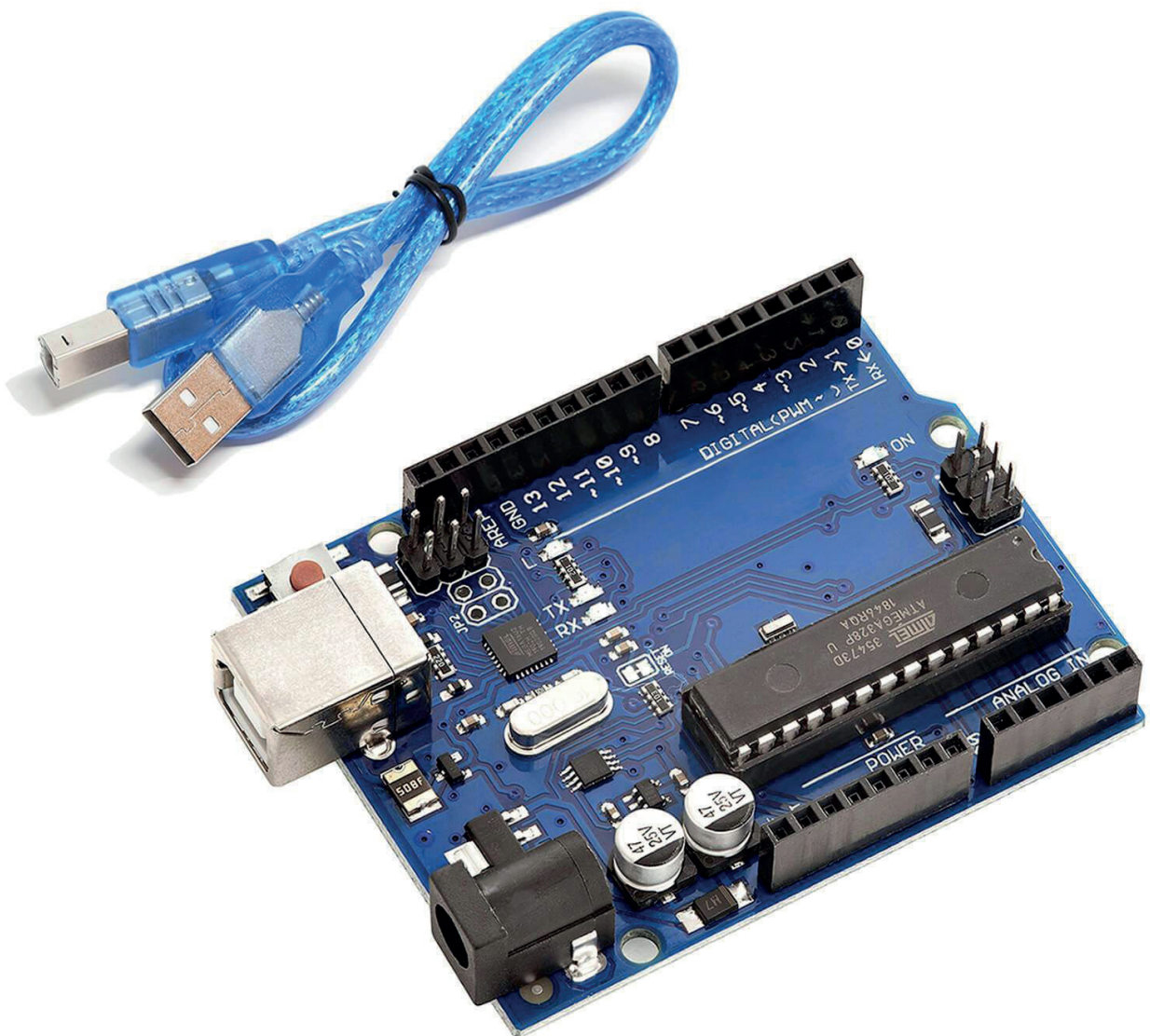


Mikrocontroller Board mit ATMega328 ATMega16U2 Datenblatt



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1. Microcontroller Board Components

ATMEGA328P-PU microcontroller

The most important element in this Board is ATMEGA328P-PU is an 8-bit Microcontroller with flash memory reach to 32k bytes.

- High Performance, Low Power AVR

- Advanced RISC Architecture
 - o 131 Powerful Instructions – Most Single Clock Cycle Execution
 - o 32 x 8 General Purpose Working Registers
 - o Up to 20 MIPS Throughput at 20 MHz
 - o On-chip 2-cycle Multiplier

- High Endurance Non-volatile Memory Segments
 - o 4/8/16/32K Bytes of In-System Self-Programmable Flash program memory
 - o 256/512/512/1K Bytes EEPROM
 - o 512/1K/1K/2K Bytes Internal SRAM
 - o Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
 - o Data retention: 20 years at 85°C/100 years at 25°C
 - o Optional Boot Code Section with Independent Lock Bits
 - o In-System Programming by On-chip Boot Program
 - o True Read-While-Write Operation
 - o Programming Lock for Software Security

- Peripheral Features
 - o Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
 - o One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
 - o Real Time Counter with Separate Oscillator
 - o Six PWM Channels
 - o 8-channel 10-bit ADC in TQFP and QFN/MLF package
 - o Temperature Measurement
 - o 6-channel 10-bit ADC in PDIP Package
 - o Temperature Measurement
 - o Programmable Serial USART

- o Master/Slave SPI Serial Interface
- o Byte-oriented 2-wire Serial Interface (Philips I2 C compatible)
- o Programmable Watchdog Timer with Separate On-chip Oscillator
- o On-chip Analog Comparator
- o Interrupt and Wake-up on Pin Change

- Special Microcontroller Features
 - o Power-on Reset and Programmable Brown-out Detection
 - o Internal Calibrated Oscillator
 - o External and Internal Interrupt Sources
 - o Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

- I/O and Packages
 - o 23 Programmable I/O Lines
 - o 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

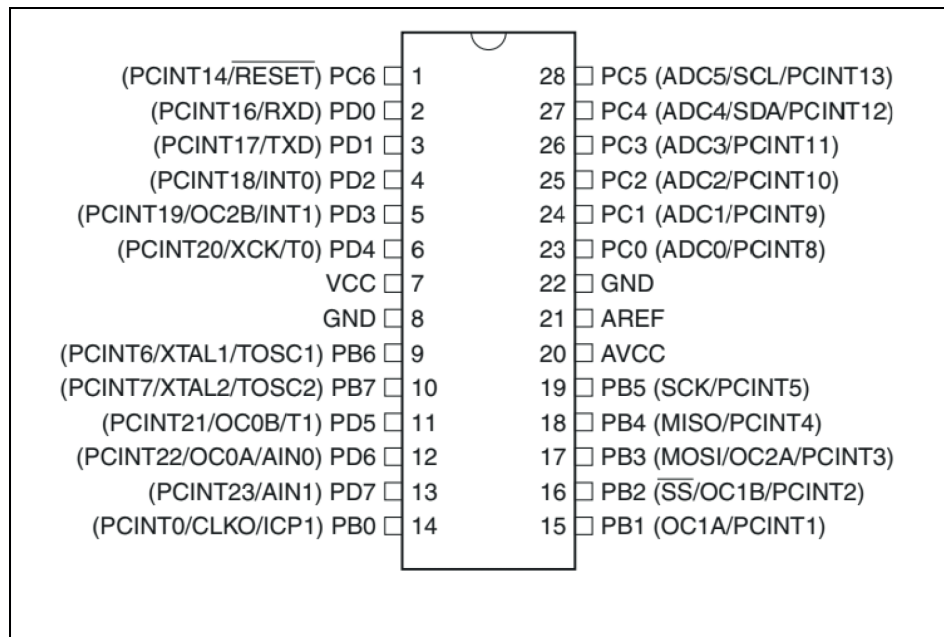
- Operating Voltage:
 - o 1.8 - 5.5V

- Temperature Range:
 - o -40°C to 85°C

- Speed Grade:
 - o 0 - 4 MHz@1.8 - 5.5V, 0 - 10 MHz@2.7 - 5.5.V, 0 - 20 MHz @ 4.5 - 5.5V

- Power Consumption at 1 MHz, 1.8V, 25°C
 - o Active Mode: 0.2 mA
 - o Power-down Mode: 0.1 μ A
 - o Power-save Mode: 0.75 μ A (Including 32 kHz RTC)

ATMEGA328P-PU Pin Configuration



ATMEGA16u2- mu microcontroller

Is a 8-bit microcontroller used as USB driver in microcontroller board it's features as follow:

- High Performance, Low Power AVR
- Advanced RISC Architecture
 - o 125 Powerful Instructions – Most Single Clock Cycle Execution
 - o 32 x 8 General Purpose Working Registers
 - o Fully Static Operation
 - o Up to 16 MIPS Throughput at 16 MHz
- Non-volatile Program and Data Memories
 - o 8K/16K/32K Bytes of In-System Self-Programmable Flash
 - o 512/512/1024 EEPROM
 - o 512/512/1024 Internal SRAM
 - o Write/Erase Cycles: 10,000 Flash/ 100,000 EEPROM
 - o Data retention: 20 years at 85°C/ 100 years at 25°C

- o **Optional Boot Code Section with Independent Lock Bits**
- o **In-System Programming by on-chip Boot Program hardware-activated after reset**
- o **Programming Lock for Software Security**

- **USB 2.0 Full-speed Device Module with Interrupt on Transfer Completion**
 - o **Complies fully with Universal Serial Bus Specification REV 2.0**
 - o **48 MHz PLL for Full-speed Bus Operation: data transfer rates at 12 Mbit/s**
 - o **Fully independent 176 bytes USB DPRAM for endpoint memory allocation**
 - o **Endpoint 0 for Control Transfers: from 8 up to 64-bytes**
 - o **4 Programmable Endpoints:**
 - **IN or Out Directions**
 - **Bulk, Interrupt and Isochronous Transfers**
 - **Programmable maximum packet size from 8 to 64 bytes**
 - **Programmable single or double buffer**
 - o **Suspend/Resume Interrupts**
 - o **Microcontroller reset on USB Bus Reset without detach**
 - o **USB Bus Disconnection on Microcontroller Request**

- **Peripheral Features**

- o **One 8-bit Timer/Counters with Separate Prescaler and Compare Mode (two 8-bit PWM channels)**
- o **One 16-bit Timer/Counter with Separate Prescaler, Compare and Capture Mode (three 8-bit PWM channels)**
- o **USART with SPI master only mode and hardware flow control (RTS/CTS)**
- o **Master/Slave SPI Serial Interface**
- o **Programmable Watchdog Timer with Separate On-chip Oscillator**
- o **On-chip Analog Comparator**
- o **Interrupt and Wake-up on Pin Change**

- **On Chip Debug Interface (debug WIRE)**

- **Special Microcontroller Features**

- o **Power-On Reset and Programmable Brown-out Detection**
- o **Internal Calibrated Oscillator**
- o **External and Internal Interrupt Sources**
- o **Five Sleep Modes: Idle, Power-save, Power-down, Standby, and Extended Standby**

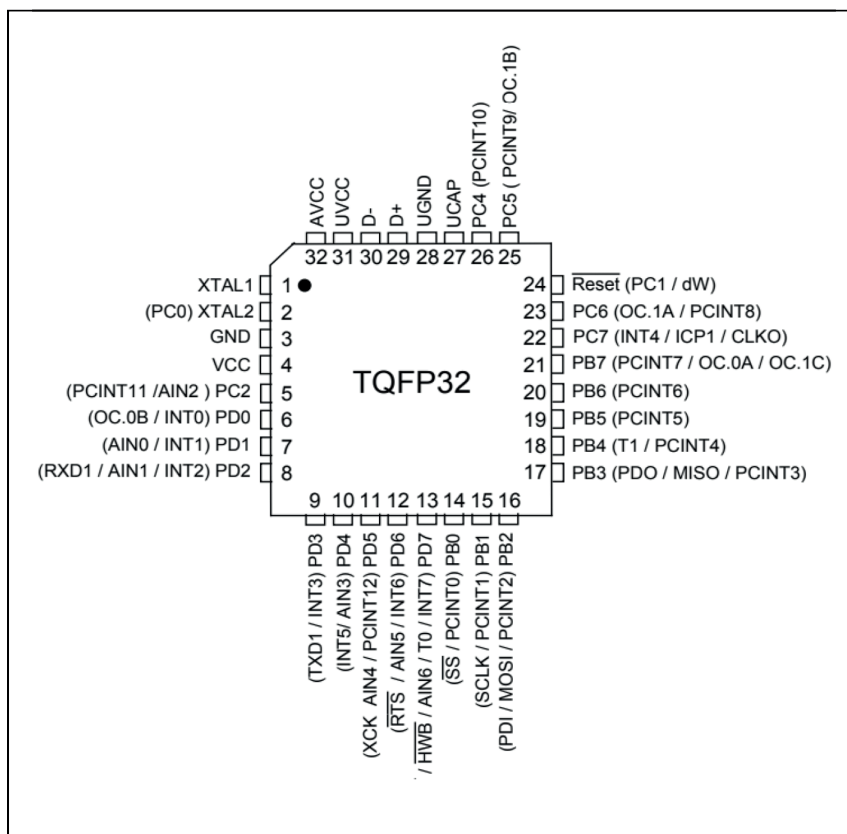
- I/O and Packages
 - o 22 Programmable I/O Lines
 - o QFN32 (5x5mm) / TQFP32 packages

- Operating Voltages
 - o 2.7 - 5.5V

- Operating temperature
 - o Industrial (-40°C to +85°C)

- Maximum Frequency
 - o 8 MHz at 2.7V - Industrial range
 - o 16 MHz at 4.5V - Industrial range

- ATmega 16U2 Pin configuration



Other Microcontroller Board Parts

Input and Output

Each of the 14 digital pins on this Board can be used as an input or output, using pin Mode (), digital Write(), and digital Read() functions. They operate at 5 Volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms. In addition, some pins have specialized functions:

- o **Serial:** 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- o **External Interrupts:** 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- o **PWM:** 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- o **SPI:** 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- o **LED:** 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

This Microcontroller Board has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e.1024 different values). By default they measure from ground to 5 Volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function. Additionally, some pins have specialized functionality:

- **TWI:** A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library. There are a couple of other pins on the board:
- **AREF:** Reference voltage for the analog inputs. Used with analogReference().
- **Reset:** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

2. Microcontroller Board Pinout

