

## Peripheral circuitry of Arduino Mega 2560 Board

The Arduino Mega 2560 is a versatile development board designed to support a wide range of applications, offering more extensive capabilities compared to many other maker boards from Arduino. This board is equipped with the ATmega2560 microcontroller, which runs at a clock frequency of 16 MHz. Among its notable features are 54 digital input/output pins, 16 analog input channels, 4 UARTs (hardware serial ports), a USB connection, power jack, an ICSP header, and a reset button. Furthermore, it contains 256KB flash memory, 4KB EEPROM, 8KB SRAM, an ICSP header, and a reset button. Also, we can observe the following peripheral circuits and subsystems in the board.

1. Microcontroller unit.
2. Power supply system.
3. Communication subsystem.
4. Digital and analog subsystem.
5. Reset and user interface.

### Microcontroller unit.

- ATmega2560: The heart of the Arduino Mega 2560, this is an 8-bit AVR RISC-based microcontroller that comes in the TQFP package. This contains,
  - 32 general-purpose working registers
  - 86 GPIO lines
  - Realtime counter
  - 6 flexible counters with compare modes (Two 8-bit and four 16-bit)
  - Four 8-bit and 6/12 programmable resolution PWM
    - PWM pins on Arduino – 2 to 13, 44 to 46
  - 4 programmable serial USARTs
    - USART pins on Arduino – [0,1], [15,14], [16,17], [19,18]
  - 16-channel 10-bit A/D converter
  - Byte-oriented 2-wire serial interface.
  - Master/Slave SPI Serial interface.
    - SPI pins on Arduino (50(MISO), 51(MOSI), 52(SCK), 53(SS))
  - JTAG interface for on-chip debugging.
    - JTAGPIN9->TDI->ADC7
    - JTAGPIN3->TDO->ADC6
    - JTAGPIN5->TMS->ADC5
    - JTAGPIN1->TCK->ADC4
    - JTAGPIN10->ARDUINO GRND
    - JTAGPIN6->ARDUINO RESET
    - JTAGPIN4->ARDUINO 5V
  - 6 external interrupts (2, 3, 18-21)
  - I2C pins (20, 21)
  - AREF pin for different reference voltage for analog inputs.
  - RESET pin can reset the microcontroller.
- Crystal Oscillator (16 MHz):

Although the Atmega2560 microcontroller includes an internal clock, the Arduino Mega includes an external 16 MHz (SMD) oscillator. Two 22 pF capacitors are connected in parallel with the oscillator. In microcontroller activities, the clock is employed as a reference frequency.

## Power supply system

- Voltage Regulator (LM7805 and LM1117-3.3V): These regulators provide a stable 5V and 3.3V supply voltage, respectively, for the MCU and other components. Also, Power switcher - LMV358IDGKR as the comparator, irlml6402 MOSFET for switch
- We have two power options with the Arduino Mega: one via USB connection and the other via the power jack. The logic voltage is 5V, while the optimum input voltage range is 7-12 V. We can observe the Vin pin in the power pin region, which may potentially be used as a power input. The power switching circuit integrated into the Arduino Mega 2560 may also pick which source to utilize.

## Communication subsystem

The USB interfacing is used to communicate with the computer through the USB port. The Arduino Mega contains an ATmega16U2 microprocessor that works as a USB-to-Serial. On a normal Arduino, it same as an FTDI converter, but we may flash it with any firmware. This microcontroller also has a 16 MHz oscillator (THD) linked to it as an external clock.

## Digital and analog subsystem

In-Circuit Serial Programming (ICSP) employs an ICSP programmer to program the microcontroller. The ICSP programmer communicates and puts the compiled program (Hex) into it. When we upload sketches through USB a little application called the bootloader will help to upload the program. When the microcontroller resets, the bootloader seeks for new software to be uploaded. If there is not a new program to be uploaded, the existing program will begin to execute. When we use ICSP we can program the IC additionally if we need, we may update, alter, or delete the bootloader.

## Reset and user interface.

The reset mechanism plays a vital element in the Microcontroller. Atmega2560 microcontroller features a reset pin in PIN 3. It is an active low reset method which is if the reset pin is grounded microcontroller will be reset. Arduino Mega 2560 board contains a reset button with extra circuitry necessary to reset the microcontroller (10 k $\Omega$  resistor parallel with a diode, a 22 pF capacitor, and a pushbutton).

## References: -

- [1] "Mega 2560 Rev3 | Arduino Documentation." Accessed: Oct. 19, 2023. [Online]. Available: <https://docs.arduino.cc/hardware/mega-2560>
- [2] "A000067-datasheet.pdf." Accessed: Oct. 19, 2023. [Online]. Available: <https://docs.arduino.cc/resources/datasheets/A000067-datasheet.pdf>
- [3] T. Agarwal, "Arduino Mega 2560 Board: Specifications, and Pin Configuration," ElProCus - Electronic Projects for Engineering Students. Accessed: Oct. 19, 2023. [Online]. Available: <https://www.elprocus.com/arduino-mega-2560-board/>