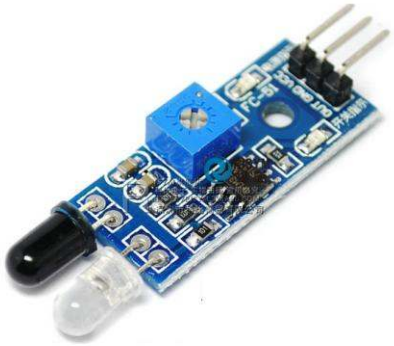
Arduino IR Infrared Obstacle Avoidance Sensor Module



The sensor module adaptable to ambient light, having a pair of infrared emitting and receiving tubes, transmitting tubes emit infrared certain frequency, when the direction of an obstacle is detected (reflection surface), the infrared reflected is received by the reception tube, After a comparator circuit processing, the green light is on, but the signal output interface output digital signal (a low-level signal), you can adjust the detection distance knob potentiometer, the effective distance range of 2 ~ 30cm, the working voltage of 3.3V- 5V. Detection range of the sensor can be obtained by adjusting potentiometer, with little interference, easy to assemble, easy to use features, can be widely used in robot obstacle avoidance, avoidance car, line count, and black and white line tracking and many other occasions.

Specification

1. When the module detects an obstacle in front of the signal, the green indicator lights on the board level, while the OUT port sustained low signal output, the module detects the distance 2 ~ 30cm, detection angle 35 °, the distance can detect potential is adjusted clockwise adjustment potentiometer, detects the distance increases; counter clockwise adjustment potentiometer, reducing detection distance.

2. The sensor active infrared reflection detection, target reflectivity and therefore the shape is critical detection distance. Where the minimum detection distance black, white, maximum; small objects away from a small area, a large area from the Grand.

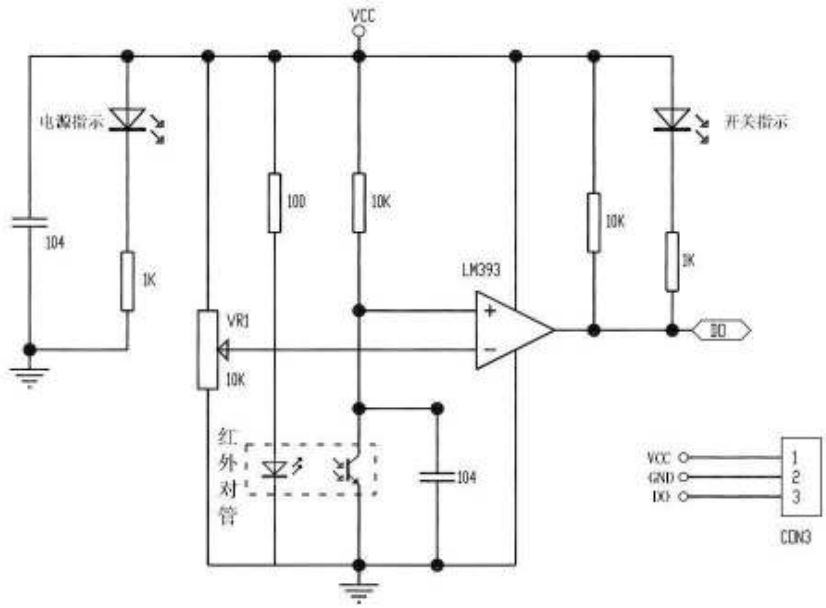
3. The sensor module output port OUT port can be directly connected to the microcontroller IO can also be directly drive a 5V relay; Connection: VCC-VCC; GND-GND; OUT-IO

4. Comparators LM393, stable;

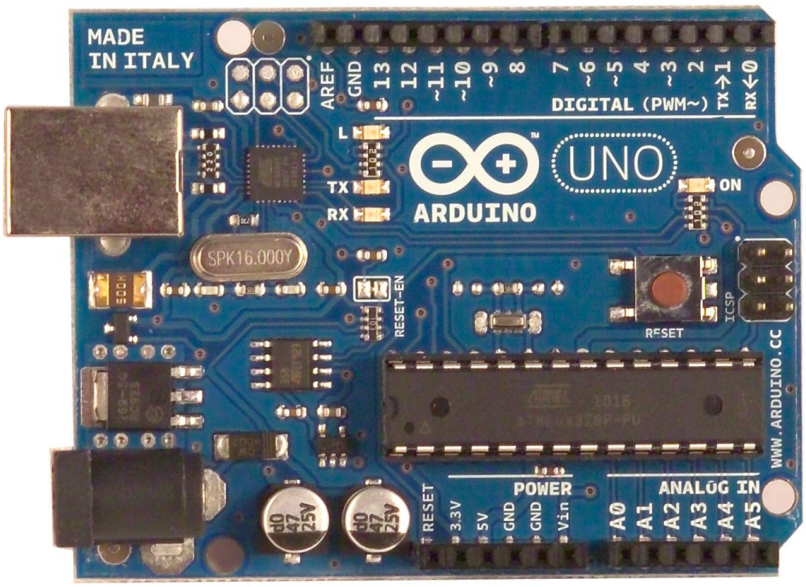
5. The module can be 3-5V DC power supply. When the power is turned on, the red power indicator lights;
6. With the screw holes 3mm, easy fixed installation;
7. Board size: 3.2CM * 1.4CM
8. Each module has been shipped threshold comparator voltage adjusted by potentiometer good, non-special case, do not adjustable potentiometer.

Module Interface Description

1. VCC : 3.3V-5V external voltage (can be directly connected to 5v and 3.3v MCU)
2. GND : GND External
3. OUT : small board digital output interface (0 and 1)



Arduino UNO



Product Overview

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduno, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

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half sqm of green via Impatto Zero® — Page 7

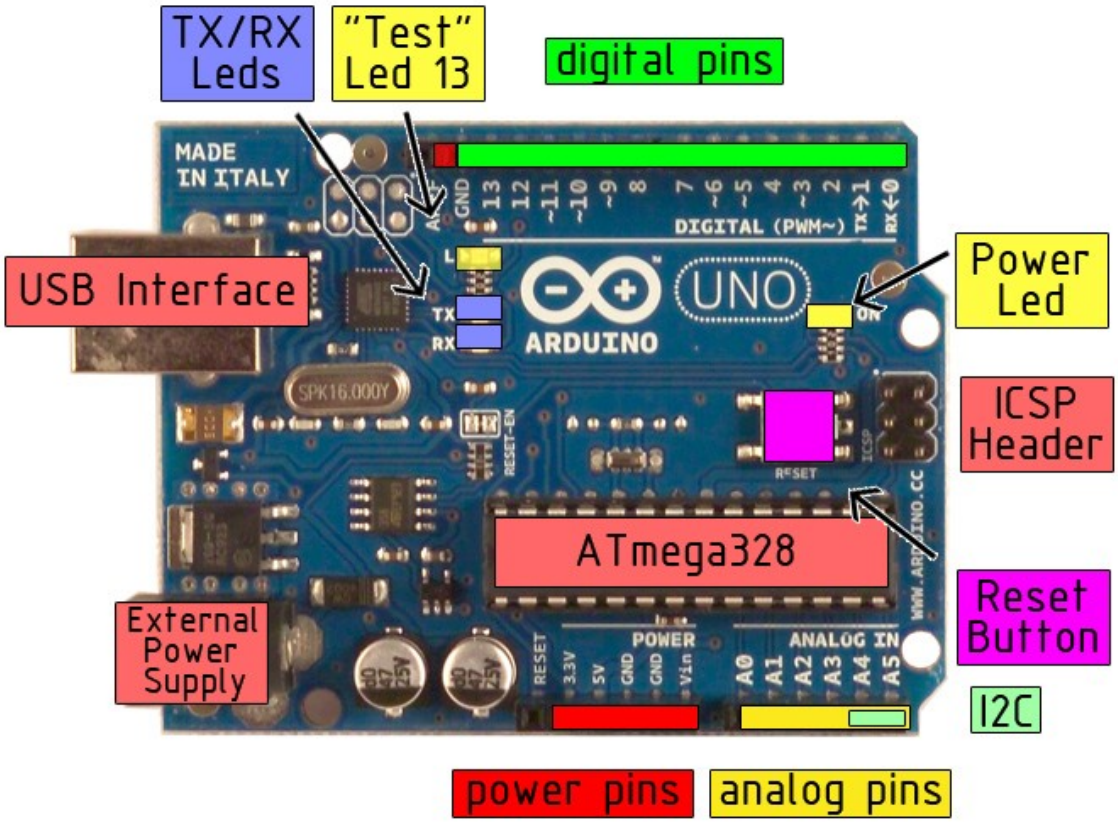
Technical Specification

EAGLE files: arduino-duemilanove-uno-design.zip Schematic: arduino-uno-schematic.pdf

Summary

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

the board



Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND.** Ground pins.

Memory

The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the bootloader); It has also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() 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 kOhms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. TThese pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .
- **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. See the attachInterrupt() function for details.
- **PWM: 3, 5, 6, 9, 10, and 11.** Provide 8-bit PWM output with the analogWrite() function.
- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).** These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

- **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.

The Uno has 6 analog inputs, 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:

- **I²C: 4 (SDA) and 5 (SCL).** Support I²C (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.

See also the mapping between Arduino pins and Atmega328 ports.

Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an *.inf file is required..

The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Uno's digital pins.

The ATmega328 also support I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. To use the SPI communication, please see the ATmega328 datasheet.

Programming

The Arduino Uno can be programmed with the Arduino software (download). Select "Arduino Uno w/ ATmega328" from the **Tools > Board** menu (according to the microcontroller on your board). For details, see the reference and tutorials.

The ATmega328 on the Arduino Uno comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.

The ATmega8U2 firmware source code is available . The ATmega8U2 is loaded with a DFU bootloader, which can be activated by connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader).

Automatic (Software) Reset

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

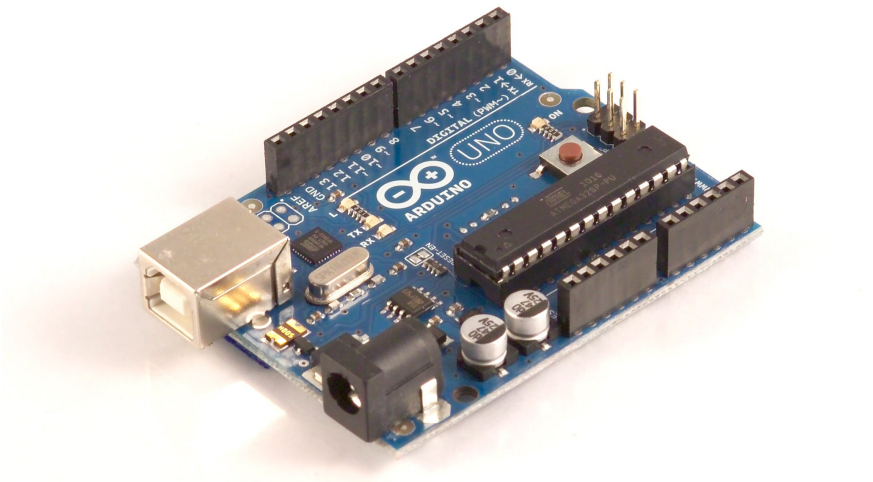
The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

USB Overcurrent Protection

The Arduino Uno has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Physical Characteristics

The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Three screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.



How to use Arduino

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP).

Arduino is a cross-platoform program. You'll have to follow different instructions for your personal OS. Check on the Arduino site for the latest instructions. *http://arduino.cc/en/Guide/HomePage*

Linux Install Windows Install Mac Install

Once you have downloaded/unzipped the arduino IDE, you can Plug the Arduino to your PC via USB cable.

Blink led

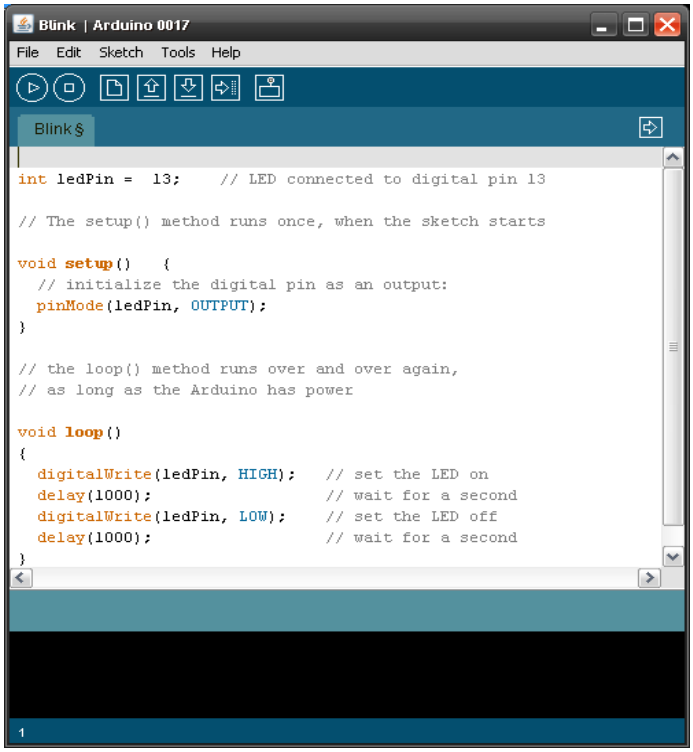
Now you're actually ready to "burn" your first program on the arduino board. To select "blink led", the physical translation of the well known programming "hello world", select

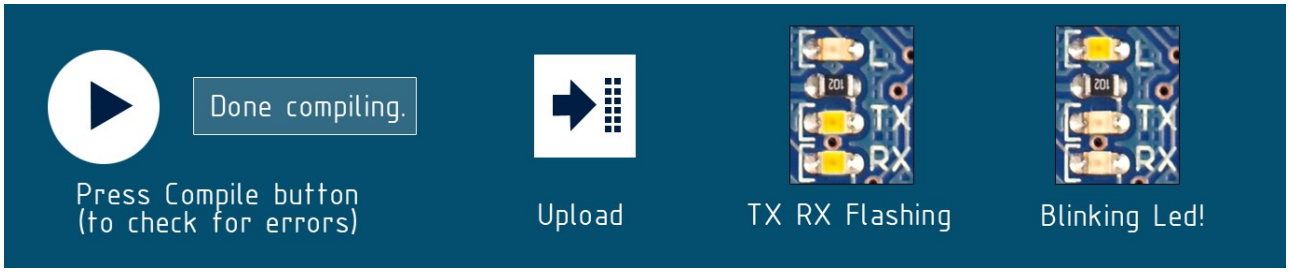
File>Sketchbook>
Arduino-0017>Examples>
Digital>Blink

Once you have your skecth you'll see something very close to the screenshot on the right.

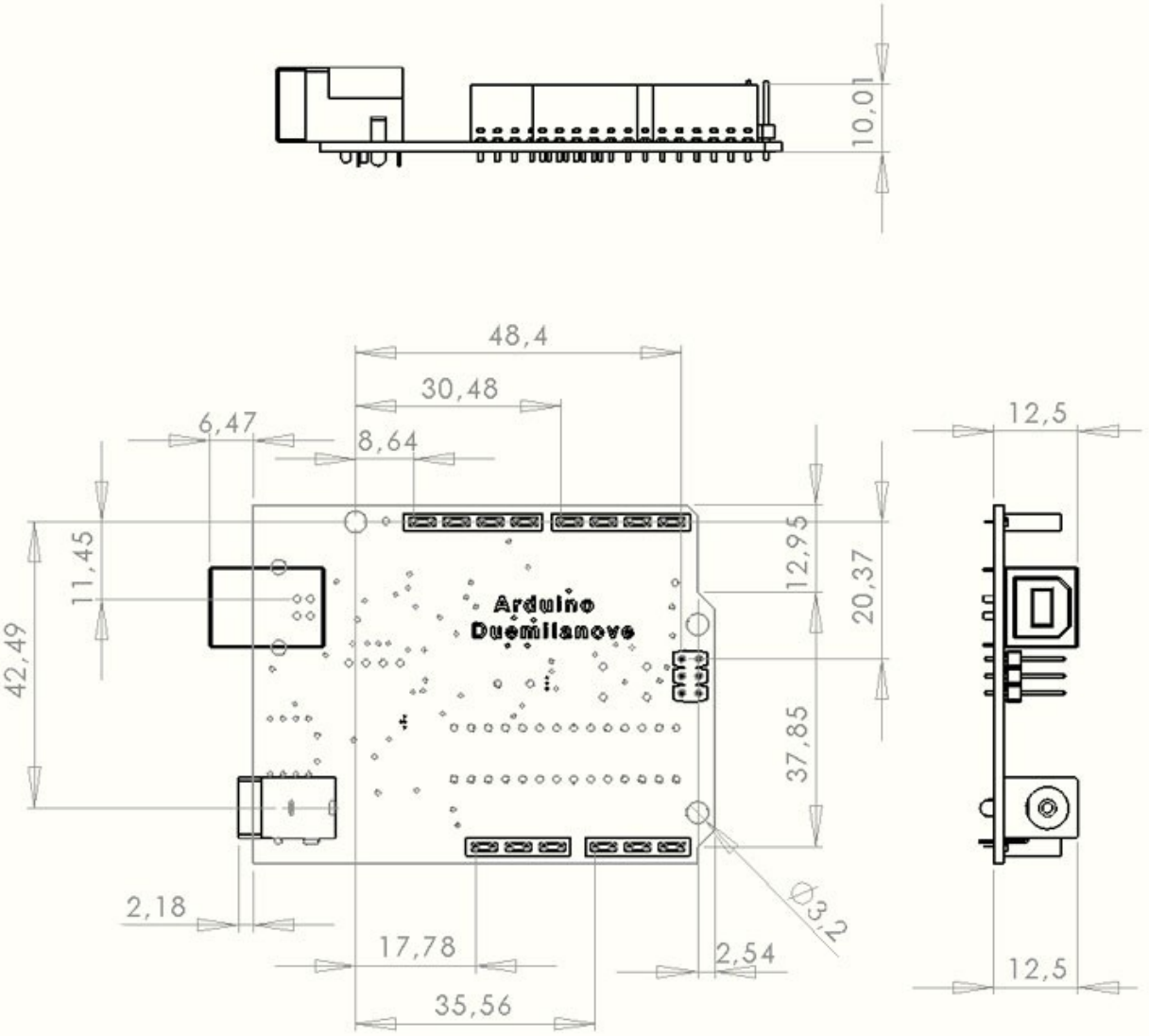
In **Tools>Board** select

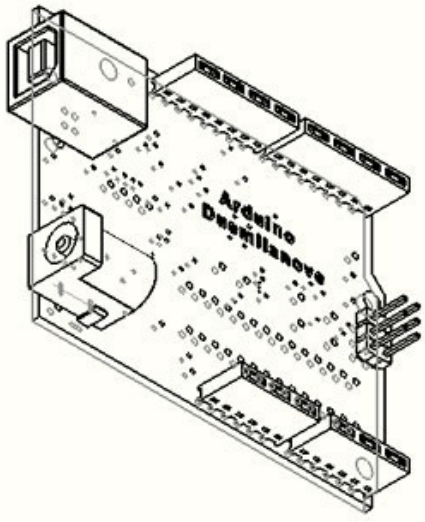
Now you have to go to
Tools>SerialPort
and select the right serial port, the one arduino is attached to.





Dimensioned Drawing





Terms & Conditions

1. Warranties

1.1 The producer warrants that its products will conform to the Specifications. This warranty lasts for one (1) years from the date of the sale. The producer shall not be liable for any defects that are caused by neglect, misuse or mistreatment by the Customer, including improper installation or testing, or for any products that have been altered or modified in any way by a Customer. Moreover, The producer shall not be liable for any defects that result from Customer's design, specifications or instructions for such products. Testing and other quality control techniques are used to the extent the producer deems necessary.

1.2 If any products fail to conform to the warranty set forth above, the producer's sole liability shall be to replace such products. The producer's liability shall be limited to products that are determined by the producer not to conform to such warranty. If the producer elects to replace such products, the producer shall have a reasonable time to replacements. Replaced products shall be warranted for a new full warranty period.

1.3 EXCEPT AS SET FORTH ABOVE, PRODUCTS ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." THE PRODUCER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING PRODUCTS, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE

1.4 Customer agrees that prior to using any systems that include the producer products, Customer will test such systems and the functionality of the products as used in such systems. The producer may provide technical, applications or design advice, quality characterization, reliability data or other services. Customer acknowledges and agrees that providing these services shall not expand or otherwise alter the producer's warranties, as set forth above, and no additional obligations or liabilities shall arise from the producer providing such services.

1.5 The Arduino™ products are not authorized for use in safety-critical applications where a failure of the product would reasonably be expected to cause severe personal injury or death. Safety-Critical Applications include, without limitation, life support devices and systems, equipment or systems for the operation of nuclear facilities and weapons systems. Arduino™ products are neither designed nor intended for use in military or aerospace applications or environments and for automotive applications or environment. Customer acknowledges and agrees that any such use of Arduino™ products which is solely at the Customer's risk, and that Customer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

1.6 Customer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products and any use of Arduino™ products in Customer's applications, notwithstanding any applications-related information or support that may be provided by the producer.

2. Indemnification

The Customer acknowledges and agrees to defend, indemnify and hold harmless the producer from and against any and all third-party losses, damages, liabilities and expenses it incurs to the extent directly caused by: (i) an actual breach by a Customer of the representation and warranties made under this terms and conditions or (ii) the gross negligence or willful misconduct by the Customer.

3. Consequential Damages Waiver

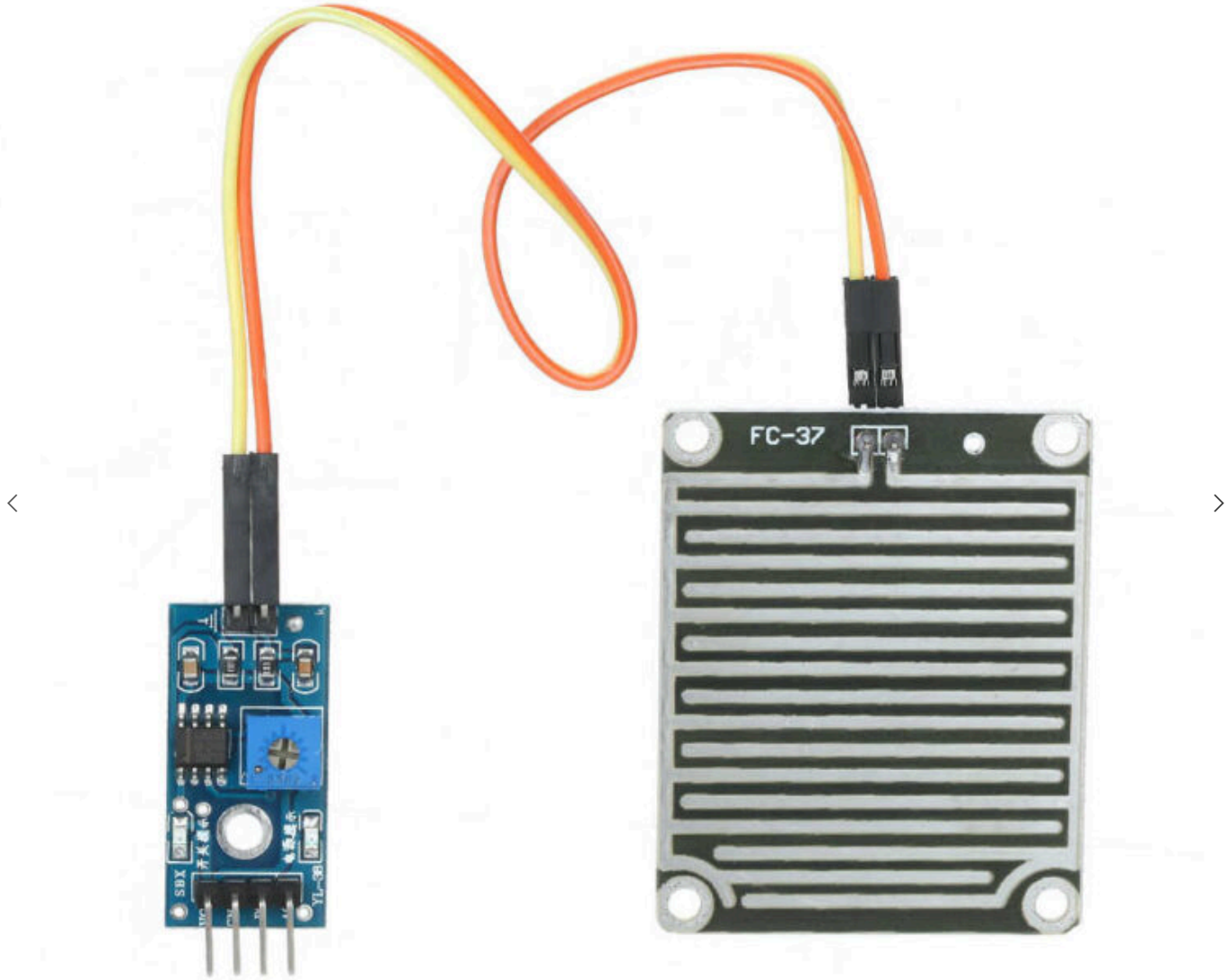
In no event the producer shall be liable to the Customer or any third parties for any special, collateral, indirect, punitive, incidental, consequential or exemplary damages in connection with or arising out of the products provided hereunder, regardless of whether the producer has been advised of the possibility of such damages. This section will survive the termination of the warranty period.

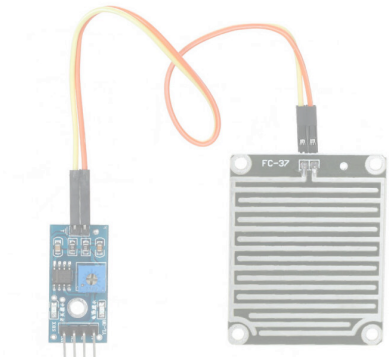
4. Changes to specifications

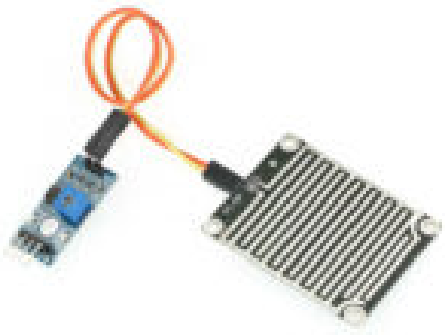
The producer may make changes to specifications and product descriptions at any time, without notice. The Customer must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." The producer reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The product information on the Web Site or Materials is subject to change without notice. Do not finalize a design with this information.

Enviromental Policies

The producer of Arduino™ has joined the Impatto Zero® policy of LifeGate.it. For each Arduino board produced is created / looked after half squared Km of Costa Rica's forest's.







Inicio / Sensores

Características

- Modelo: YL-38
- Chip Comparador: LM393.
- Voltaje de Operación: 3.3 V – 5 V
- Voltaje de salida: 0 ~ 4.2V
- Salida digital de comparador: TTL
- Corriente de operación: 15mA
- Superficie Niquelada resistente a la oxidación
- Potenciómetro para ajustar el umbral de activación del pin digital
- Pines:
  - VCC (5V)
  - GND
  - Interfaz de salida digital
  - Interfaz de salida analógica AO
- Dimensiones:
  - PCB YL-38: 32 mm x 14 mm
  - Celda FC-37: 50 mm x 40 mm

- 1 + AÑADIR AL CARRITO

Compare Add to wishlist

SKU: SEN042

Categoría: Sensores

Etiquetas: arduino, FC, FC-37, lluvia, LM393, SENSOR, YL, YL-38

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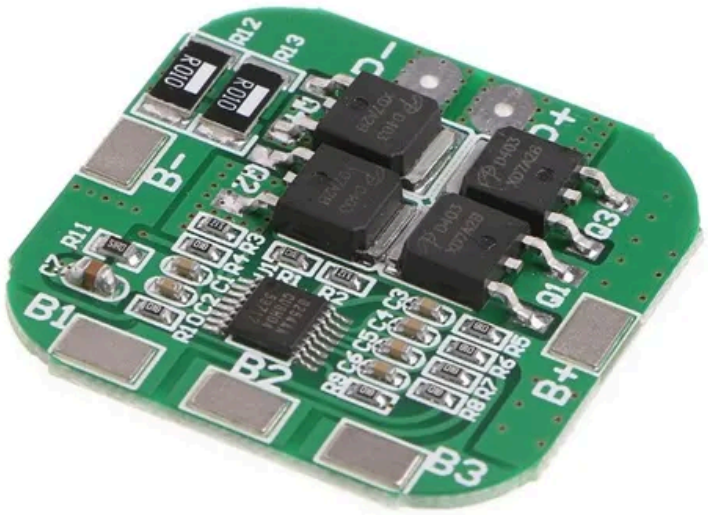
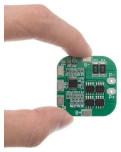
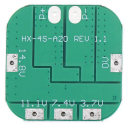




Accesorios , Baterías y cargadores , BMS (sistema de gestión de baterías) , placas de conexión , módulos y placas de conexión

Placa PCB BMS de carga equilibrada con protección, 4S, 20 A, 14,8 V, batería de iones de litio 18650

Placa de protección de batería 4S 20A 14.8V BMS para celda de iones de litio 18650 HX-4S-A20. Evita sobredescargas o sobrecargas durante el uso. Comprar en Pakistán.

Disponibilidad:**En stock**

Rs 330

1

Añadir a la cesta

Descripción Especificación

Placa PCB de protección para cargador de batería 4S 18650 BMS de 20 A y 14,8 V-16,8 V

Placa de protección para batería de iones de litio 18650. El sistema de gestión de batería protege la batería y evita que se descargue o cargue excesivamente durante el uso, lo que podría dañarla.

Características:

- Tamaño pequeño.
- Cableado sencillo.
- Dirigido.
- Instalación personalizada.

Parámetros:

1 Modelo HX-4S-D20
2 Rango de voltaje 4,25~4,35 V ± 0,05 V
3 Tamaño 35
x 35 x 3,6 mm 4 Rango de sobretensión 2,3~3,0 V ± 0,05 V
5 Corriente de trabajo superior 10 A
6 Temperatura de trabajo -40 a +50 Celsius
7 Corriente instantánea máxima 20 A
8 Condiciones de almacenamiento -40 a +80 Celsius
9 Corriente estática Menos de 30 uA
10 Vida útil efectiva Más de 50000 horas
11 Resistencia interna Menos de 100 m ohm
12 Protección contra cortocircuitos Sí, recuperación de carga
13 Voltaje de carga 16,8 V-17 V
14 Controlador S-8254AA, Conecte 4 baterías de litio en B+, B3, B2, B1, B-P+ y P- es salida o entrada

Atención:

Por favor, siga estrictamente el diagrama de cableado: 0 V (B-), 3,7 V (B1), 7,4 V (B2), 11,1 V (B3), 14,8 V (B+), ¡no cortocircuite intencionalmente!
Después de conectar el cable, debe cargarse antes de que tenga salida. En baterías en serie 4, asegúrese de que el voltaje de cada batería sea el mismo. Si es diferente, cargue cada batería por separado y luego úselas en serie. En la prueba de descarga, la rápida disminución del voltaje de la batería se debe a una batería deficiente. ¡No mezcle baterías buenas con baterías malas! ¡Cuanto más similar sea la capacidad de la batería o la resistencia interna, mejor! (El efecto de 2 baterías buenas + 2 baterías malas = El efecto de 4 baterías malas).

Precaución:

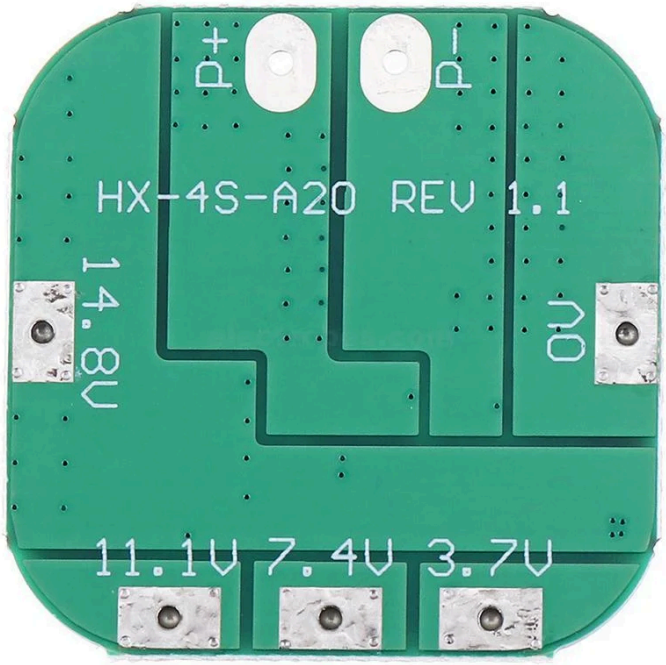
La placa de protección de batería no es compatible con baterías de fosfato de hierro y litio, lámparas para hernias, baterías de taladros eléctricos manuales, baterías electromecánicas para peces eléctricos, baterías de bicicletas eléctricas, baterías de coches infantiles, motores de 775 (4 A) o superior, ni con luces LED de ojo de pez de 1 W.
Para productos de descarga con una corriente de 3 A o superior, la relación de descarga de la batería debe ser superior a 3 °C.

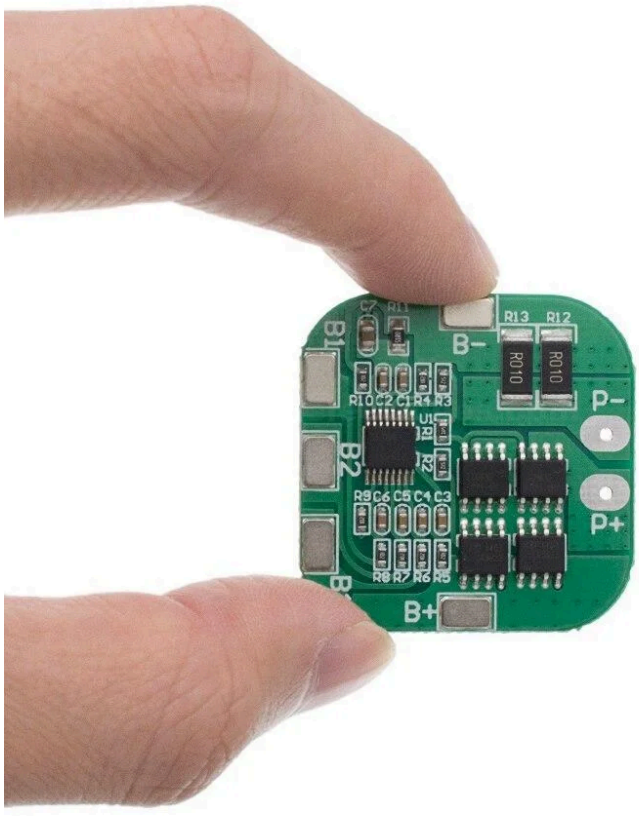
Fórmula de cálculo del multiplicador:

Batería multiplicadora 1C, con una capacidad de 2000 mAh, equivalente a una corriente de trabajo máxima de 2 AH*1 = 2 A.
Batería multiplicadora 3C, con una capacidad de 2000 mAh, equivalente a una corriente de trabajo máxima de 2 AH*3 = 6 A.
Si la batería se calienta durante el uso, el multiplicador no es compatible. En este caso, no se puede utilizar durante un tiempo prolongado y la batería se dañará rápidamente.

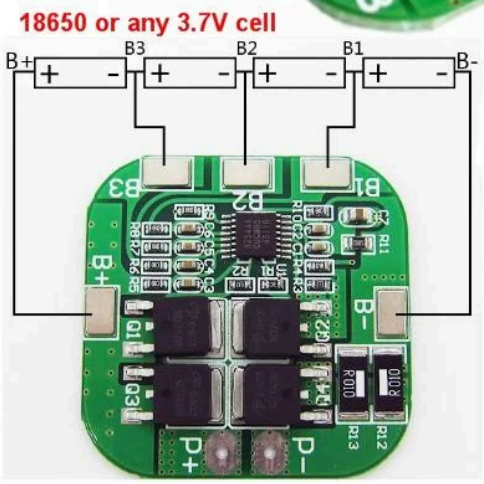
Solicitud:

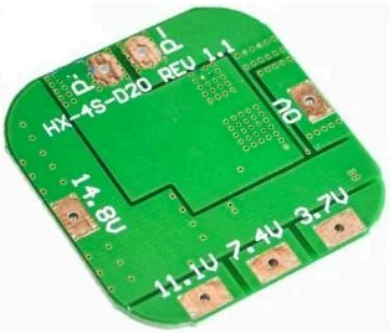
- Inversor de potencia pequeño
- Paquete de baterías del masajeador
- Energía de respaldo para lámpara LED
- productos electrónicos
- Paquete de baterías para farolas solares
- Monitoreo de la fuente de alimentación en espera





English Urdu





SKU: 1615 / **Categorías:** Accesorios , Baterías y cargadores , BMS (sistema de gestión de baterías) , Placas de conexión , Módulos y placas de conexión / **Etiquetas:** 18650 , 20A , 4s , 4s 20a , Batería , BMS , placa , Carga , Li-ion , Litio , Protección

Descripción **Especificación**

-
- Voltaje de sobrecarga 4,25- 4,35 V +- 0,05 V.
- Voltaje de sobredescarga 2,3-3 V +- 0,05 V
- La corriente máxima de trabajo es 10A.

English Urdu

- La corriente máxima de pico es 20A.
- La temperatura de trabajo es de -40 a 50ºC.
- La temperatura de almacenamiento es de -40 a 80ºC.
- Pequeña corriente de 6uA.

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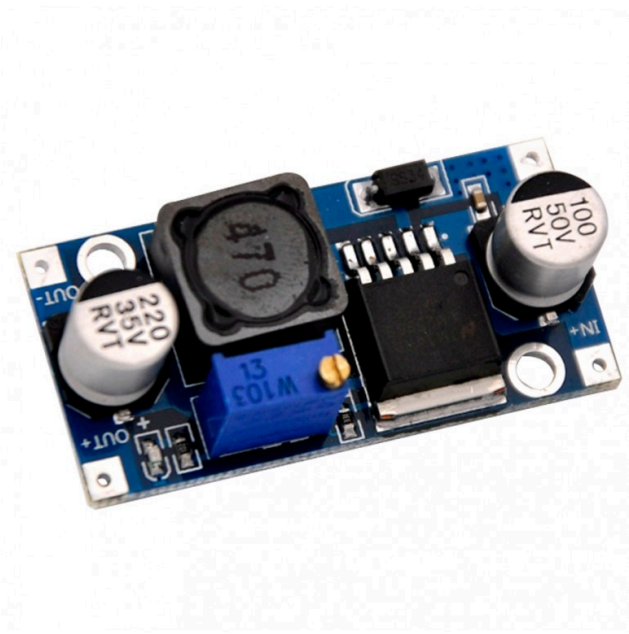



Regulador de voltaje step down LM2596S 1.3V-35V

El circuito LM2596S es un circuito integrado de National Semiconductor que provee la capacidad de regular o disminuir el voltaje de entrada del circuito (boost, flyback, DC-DC). El integrado maneja un rango de operación de 1.23v-37v y el voltaje de salida es ajustable por el usuario vía potenciómetro de precisión.

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DESCRIPCIÓN DETALLES DEL PRODUCTO ⭐ COMENTARIOS (6)

Es una fuente basada en el regulador step-down DC-DC LM2596. Posee un preset multivuelta de alta precisión y es capaz de alimentar una carga de hasta 3A con una alta eficiencia regulando el voltaje de salida dentro de los rango de trabajo del dispositivo.
Tensión de entrada: 4 a 40V (DC)
Salida de tensión: 1.25V a 37V (DC) ajustable
Corriente Máxima de salida: 3A (por arriba de 2A necesita disipador)
Este circuito te permite tener un voltaje regulado a partir de una fuente de alimentación con un voltaje mayor, por ejemplo si tienes una fuente de 12V puedes regularlos a 5V, 3.3V, 2.2V, etc, para el uso con microcontroladores, Arduino, PICs, Raspberry Pi, fuentes variables, drivers para leds, etc.
Este módulo esta basado en el Regulador DC-DC Step Down LM2596 que es un circuito integrado monolítico adecuado para el diseño fácil y conveniente de una fuente de conmutación tipo buck. Es capaz de conducir una corriente de hasta 3A. Maneja una carga con excelente regulación de línea y bajo voltaje de rizado. Este dispositivo está disponible con voltaje de salida ajustable. El módulo reduce al mínimo el uso de componentes externos para simplificar el diseño de fuentes de alimentación.
El módulo convertidor LM2596 es un regulador de tipo conmutado, así que su eficiencia es significativamente mayor en comparación con los populares reguladores lineales de tres terminales, especialmente con tensiones de entrada superiores.

Especificaciones técnicas

- Voltaje de operación: 4.0V ~ 40V DC
- Voltaje de Salida: 1.23V ~ 37V DC Ajustable (el voltaje de entrada debe tener al menos 1.5V más que la salida).
- Corriente de Salida: máx. 3A, 2.5A recomendado (usar disipador para corrientes mayores a 2A).

- Potencia de salida: 50-70W, utilizar disipador
- Eficiencia de conversión: 92%
- Regulación de carga: S (I) ≤ 0.8%.
- Regulación de voltaje: S (u) ≤ 0.8%.
- Frecuencia de Trabajo: 150KHz
- Ripple en la salida:30mV (máx.) 20M bandwidth
- Temperatura de trabajo: -40℃ ~ +85℃
- Protección de cortocircuito y sobre temperatura.
- Aplicaciones: Reducir el voltaje de una fuente como una batería, una fuente de voltaje, cargadores de celular, etc., a un voltaje menor deseado utilizando un proceso muy eficiente comparado a los tradicionales reguladores lineales.
- Dimensiones: 4.2cm x 2.3 cm x 1.2cm.
- peso: 11 gramos

LINKS

- Datasheet LM2596

La compra incluye

- step down LM2596S 1.25V-35V

TAMBIÉN PODRÍA INTERESARLE

PRECIO REBAJADO

Regulador Step Down MP1584 salida 1.5 a 26V 3A

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Detalles de contacto : 011 5263-7073

Como llegar

TodoMicro Villa Urquiza

Handson Technology

Datasheet

ESP32-CAM WiFi+Bluetooth+Camera Module

The ESP32-CAM is a development board with an ESP32-S chip, an OV2640 camera, microSD card slot and several GPIOs to connect peripherals. It allows you to set up a video streaming web server, build a surveillance camera, take photos, face recognition and detection, and much more.

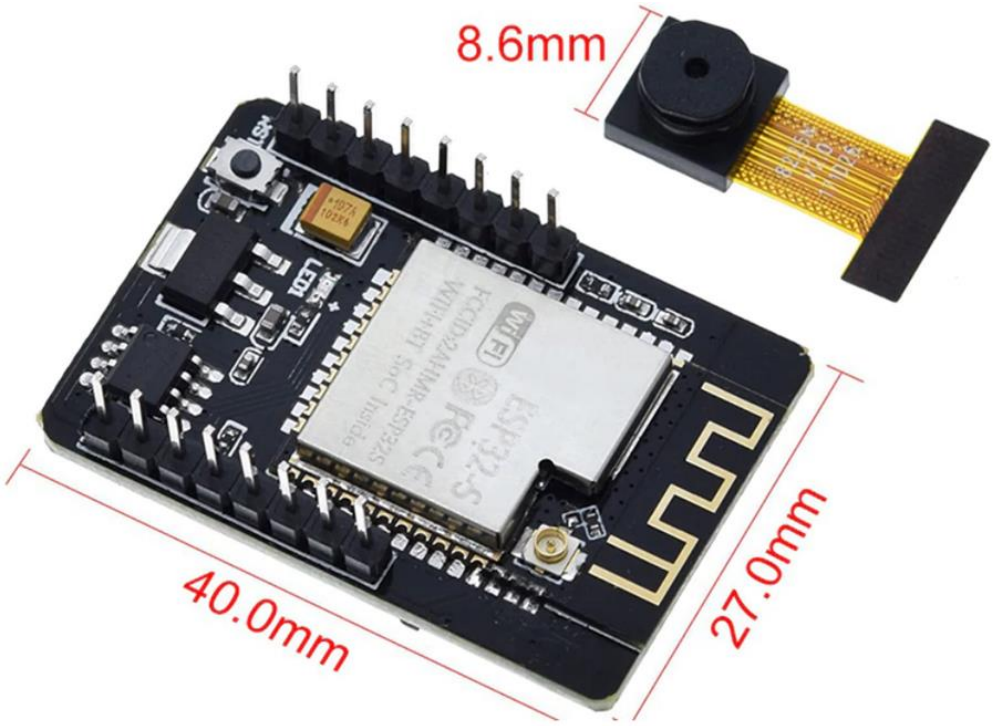
SKU: MDU1112

Brief Data:

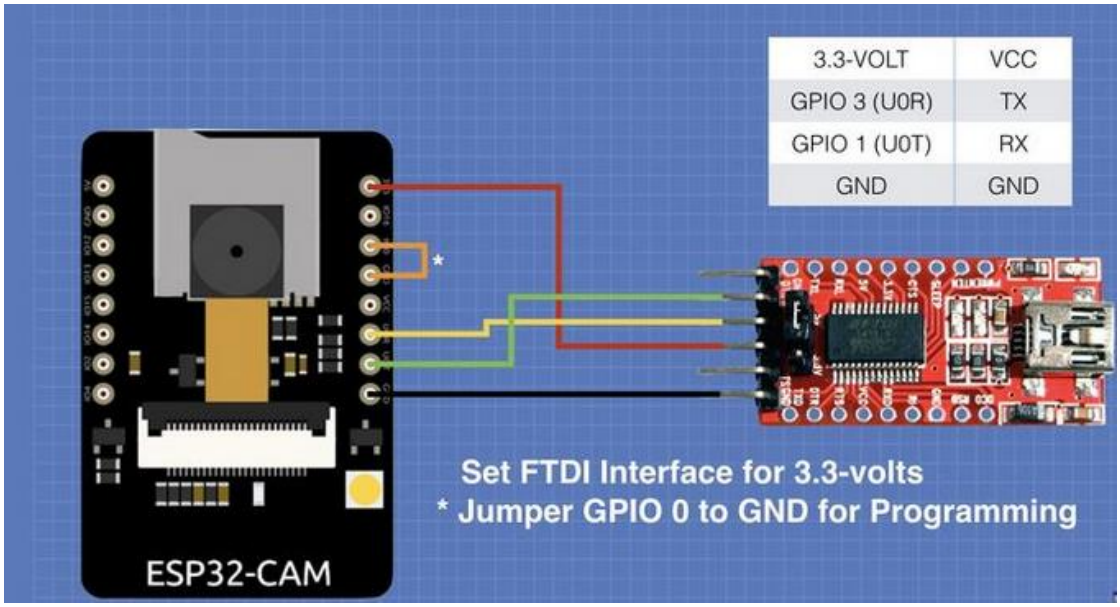
- Product Name: ESP32-CAM.
- WiFi+Bluetooth module: ESP-32S.
- Camera Module: OV2640 2MP.
- Flash Light: LED Built-in on Board.
- Operating Voltage: 3.3/5 Vdc.
- Onboard TF card slot, supports up to 4G TF card for data storage .
- RAM: Internal 512KB + External 4MB PSRAM.
- Power consumption:
  - Flash off: 180mA@5V.
  - Flash on and brightness max: 310mA@5V.
  - Deep-Sleep: as low as 6mA@5V.
  - Modern-Sleep: as low as 20mA@5V.
  - Light-Sleep: as low as 6.7mA@5V
- Dimensions: 40.5mm x 27mm x 4.5mm

Mechanical Dimension:

Unit: mm



Here is the hookup diagram for connecting the FTDI adapter to the ESP32-CAM module:



Upload the below Sketch to ESP32-CAM Module:

To upload the code, follow the next steps:

1) Go to **Tools** > **Board** and select **AI-Thinker ESP32-CAM**.

2) Go to **Tools** > **Port** and select the COM port the ESP32 is connected to.

3) Then, click the upload button to upload the code.

```
/*********

https://handsontec.com

*********/

#include "esp_camera.h"
#include "Arduino.h"
#include "FS.h"                // SD Card ESP32
#include "SD_MMC.h"            // SD Card ESP32
#include "soc/soc.h"           // Disable brownour problems
#include "soc/rtc_cntl_reg.h"  // Disable brownour problems
#include "driver/rtc_io.h"
#include <EEPROM.h>            // read and write from flash memory

// define the number of bytes you want to access
#define EEPROM_SIZE 1

// Pin definition for CAMERA_MODEL_AI_THINKER
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27

#define Y9_GPIO_NUM       35
```

```
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22

int pictureNumber = 0;

void setup() {
  WRITE_PERI_REG(RTC_CNTL_BROWN_OUT_REG, 0); //disable brownout detector

  Serial.begin(115200);
  //Serial.setDebugOutput(true);
  //Serial.println();

  camera_config_t config;
  config.ledc_channel = LEDC_CHANNEL_0;
  config.ledc_timer = LEDC_TIMER_0;
  config.pin_d0 = Y2_GPIO_NUM;
  config.pin_d1 = Y3_GPIO_NUM;
  config.pin_d2 = Y4_GPIO_NUM;
  config.pin_d3 = Y5_GPIO_NUM;
  config.pin_d4 = Y6_GPIO_NUM;
  config.pin_d5 = Y7_GPIO_NUM;
  config.pin_d6 = Y8_GPIO_NUM;
  config.pin_d7 = Y9_GPIO_NUM;
  config.pin_xclk = XCLK_GPIO_NUM;
  config.pin_pclk = PCLK_GPIO_NUM;
  config.pin_vsync = VSYNC_GPIO_NUM;
  config.pin_href = HREF_GPIO_NUM;
  config.pin_sscb_sda = SIOD_GPIO_NUM;
  config.pin_sscb_scl = SIOC_GPIO_NUM;
  config.pin_pwdn = PWDN_GPIO_NUM;
  config.pin_reset = RESET_GPIO_NUM;
  config.xclk_freq_hz = 20000000;
  config.pixel_format = PIXFORMAT_JPEG;

  if(psramFound()){
    config.frame_size = FRAMESIZE_UXGA; // FRAMESIZE_ + QVGA|CIF|VGA|SVGA|XGA|SXGA|UXGA
    config.jpeg_quality = 10;
    config.fb_count = 2;
  } else {
    config.frame_size = FRAMESIZE_SVGA;
    config.jpeg_quality = 12;
    config.fb_count = 1;
  }

  // Init Camera
  esp_err_t err = esp_camera_init(&config);
  if (err != ESP_OK) {
    Serial.printf("Camera init failed with error 0x%x", err);
    return;
  }

  //Serial.println("Starting SD Card");
  if(!SD_MMC.begin()){
    Serial.println("SD Card Mount Failed");
    return;
  }
```

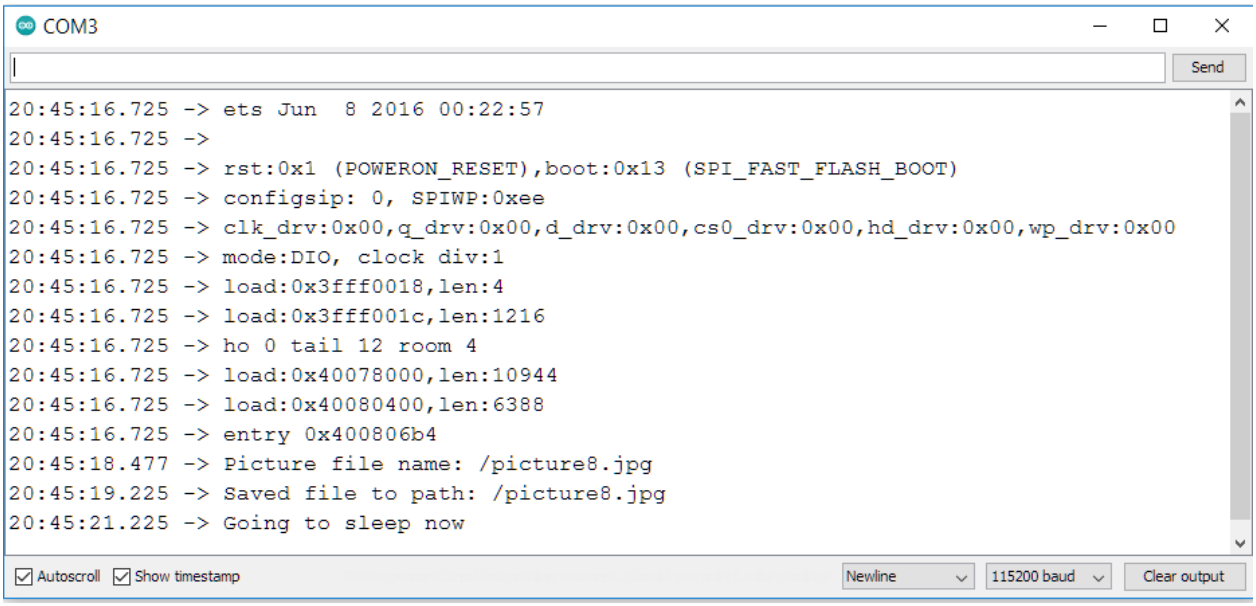
```
  uint8_t cardType = SD_MMC.cardType();
  if(cardType == CARD_NONE){
    Serial.println("No SD Card attached");
    return;
  }

  camera_fb_t * fb = NULL;

  // Take Picture with Camera
  fb = esp_camera_fb_get();
  if(!fb) {
    Serial.println("Camera capture failed");
    return;
  }
  // initialize EEPROM with predefined size
  EEPROM.begin(EEPROM_SIZE);
  pictureNumber = EEPROM.read(0) + 1;

  // Path where new picture will be saved in SD Card
  String path = "/picture" + String(pictureNumber) +".jpg";

  fs::FS &fs = SD_MMC;
  Serial.printf("Picture file name: %s\n", path.c_str());

  File file = fs.open(path.c_str(), FILE_WRITE);
  if(!file){
    Serial.println("Failed to open file in writing mode");
  }
  else {
    file.write(fb->buf, fb->len); // payload (image), payload length
    Serial.printf("Saved file to path: %s\n", path.c_str());
    EEPROM.write(0, pictureNumber);
    EEPROM.commit();
  }
  file.close();
  esp_camera_fb_return(fb);

  // Turns off the ESP32-CAM white on-board LED (flash) connected to GPIO 4
  pinMode(4, OUTPUT);
  digitalWrite(4, LOW);
  rtc_gpio_hold_en(GPIO_NUM_4);

  delay(2000);
  Serial.println("Going to sleep now");
  delay(2000);
  esp_deep_sleep_start();
  Serial.println("This will never be printed");
}

void loop() {

}
```

Demonstration:

After uploading the code, remove the jumper that connects GPIO 0 from GND.

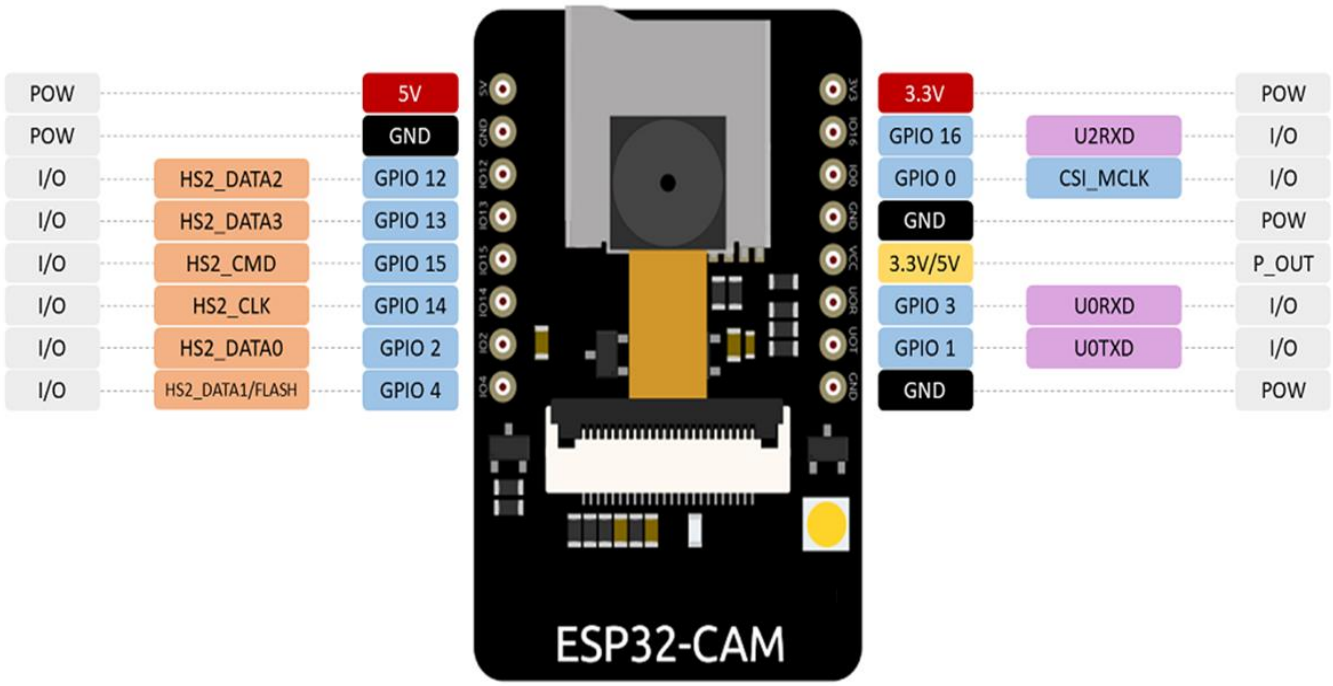
Open the Serial Monitor at a baud rate of 115200. Press the ESP32-CAM reset button. It should initialize and take a photo. When it takes a photo it turns on the flash (GPIO 4).

Check the Arduino IDE Serial Monitor window to see if everything is working as expected. As you can see, the picture was successfully saved in the microSD card.

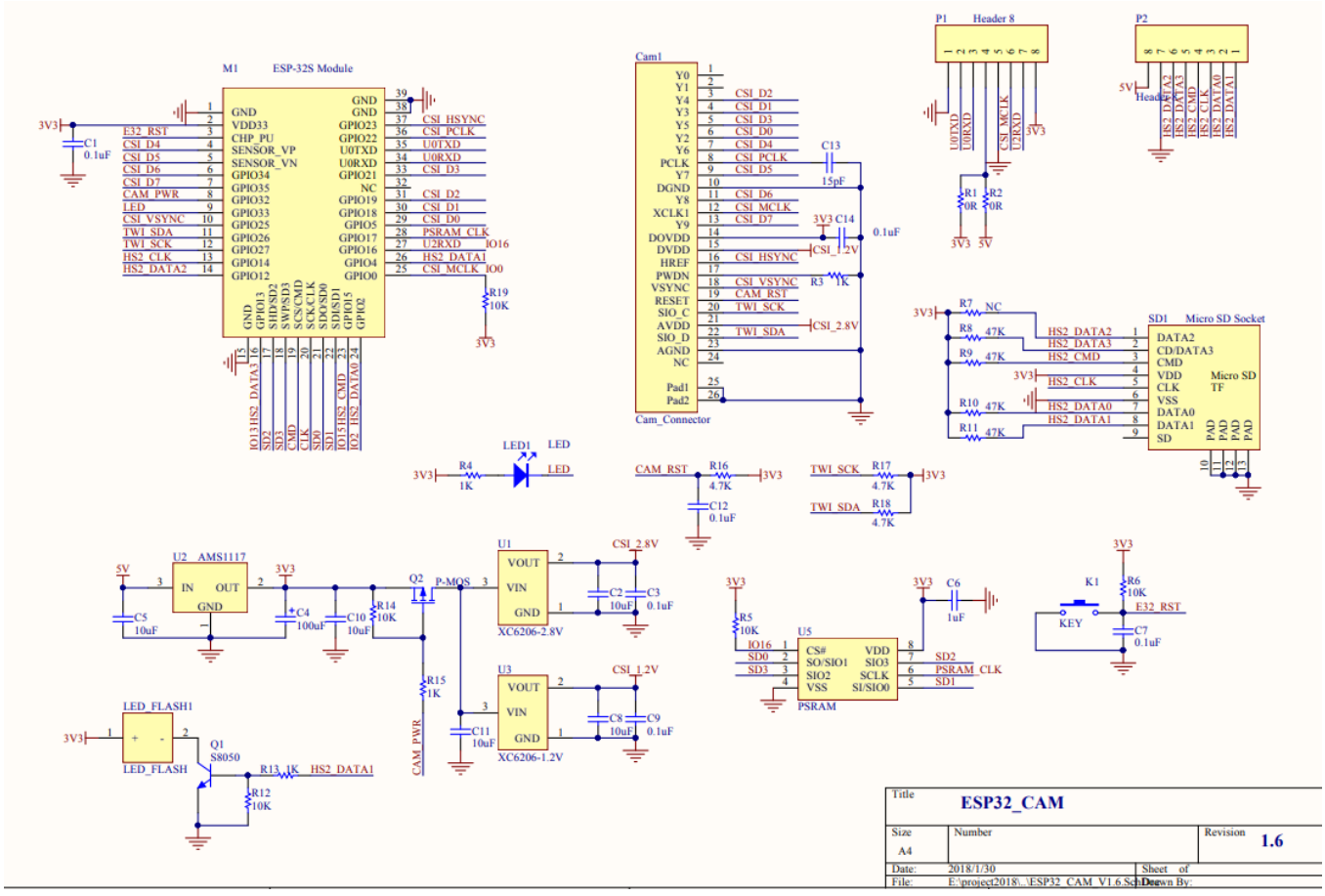


To see the photos taken, remove the microSD card from the microSD card slot and insert it into your computer. You should have all the photos saved.

Pin Assignment:



Schematic:



Web Resources:

- https://github.com/SeeedDocument/forum_doc/blob/master/reg/ESP32_CAM_V1.6.pdf

Setting Up Arduino IDE for ESP32 Development board:

- https://randomnerdtutorials.com/installing-the-esp32-board-in-arduino-ide-windows-instructions/
- https://dronebotworkshop.com/esp32-intro/
- https://randomnerdtutorials.com/esp32-cam-take-photo-save-microsd-card/
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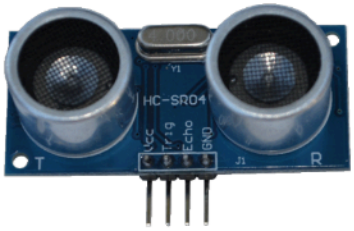
HC-SR04 Ultrasonic Sensor

Elijah J. Morgan

Nov. 16 2014

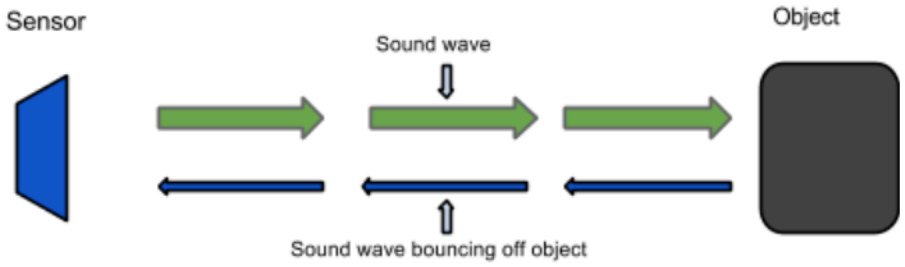
The purpose of this file is to explain how the HC-SR04 works. It will give a brief explanation of how ultrasonic sensors work in general. It will also explain how to wire the sensor up to a microcontroller and how to take/interpret readings. It will also discuss some sources of errors and bad readings.



1. **How Ultrasonic Sensors Work**
2. **HC-SR04 Specifications**
3. **Timing chart, Pin explanations and Taking Distance Measurements**
4. **Wiring HC-SR04 with a microcontroller**
5. **Errors and Bad Readings**

1. How Ultrasonic Sensors Work

Ultrasonic sensors use sound to determine the distance between the sensor and the closest object in its path. How do ultrasonic sensors do this? Ultrasonic sensors are essentially sound sensors, but they operate at a frequency above human hearing.



The sensor sends out a sound wave at a specific frequency. It then listens for that specific sound wave to bounce off of an object and come back (Figure 1). The sensor keeps track of the time between sending the sound wave and the sound wave returning. If you know how fast something is going and how long it is traveling you can find the distance traveled with equation 1.

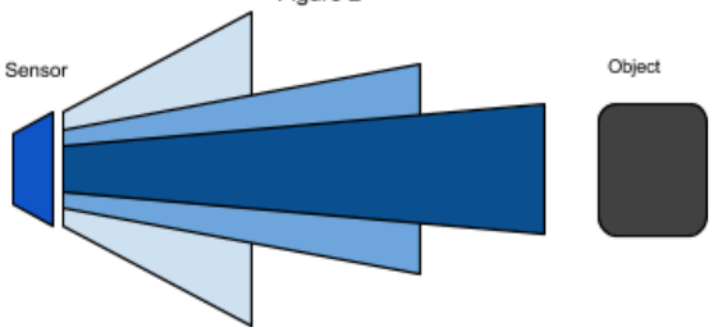
Equation 1. $d = v \times t$

The speed of sound can be calculated based on the a variety of atmospheric conditions, including temperature, humidity and pressure. Actually calculating the distance will be shown later on in this document.

It should be noted that ultrasonic sensors have a cone of detection, the angle of this cone varies with distance, Figure 2 show this relation. The ability of a sensor to

detect an object also depends on the objects orientation to the sensor. If an object doesn't present a flat surface to the sensor then it is possible the sound wave will bounce off the object in a way that it does not return to the sensor.

Figure 2



2. HC-SR04 Specifications

The sensor chosen for the Firefighting Drone Project was the HC-SR04. This section contains the specifications and why they are important to the sensor module. The sensor modules requirements are as follows.

- Cost
- Weight
- Community of hobbyists and support
- Accuracy of object detection
- Probability of working in a smoky environment
- Ease of use

The HC-SR04 Specifications are listed below. These specifications are from the Cytron Technologies HC-SR04 User's Manual (source 1).

- Power Supply: +5V DC
- Quiescent Current: <2mA
- Working current: 15mA
- Effectual Angle: <15º
- Ranging Distance: 2-400 cm
- Resolution: 0.3 cm
- Measuring Angle: 30º
- Trigger Input Pulse width: 10uS
- Dimension: 45mm x 20mm x 15mm
- Weight: approx. 10 g

The HC-SR04's best selling point is its price; it can be purchased at around $2 per unit.

3. Timing Chart and Pin Explanations

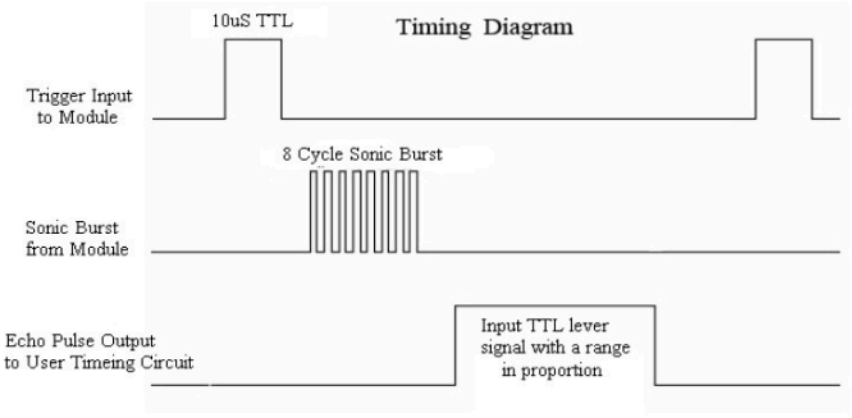
The HC-SR04 has four pins, VCC, GND, TRIG and ECHO; these pins all have different functions. The VCC and GND pins are the simplest -- they power the HC-SR04. These pins need to be attached to a +5 volt source and ground respectively. There is a single control pin: the TRIG pin. The TRIG pin is responsible for sending the ultrasonic burst. This pin should be set to HIGH for 10 µs, at which point the HC-SR04 will send out an eight cycle sonic burst at 40 kHZ. After a sonic burst has been sent the ECHO pin will go HIGH. The ECHO pin is the data pin -- it is used in taking distance measurements. After an ultrasonic burst is sent the pin will go HIGH, it will stay high until an ultrasonic burst is detected back, at which point it will go LOW.

Taking Distance Measurements

The HC-SR04 can be triggered to send out an ultrasonic burst by setting the TRIG pin to HIGH. Once the burst is sent the ECHO pin will automatically go HIGH. This pin will remain HIGH until the the burst hits the sensor again. You can calculate the distance to the object by keeping track of how long the ECHO pin stays HIGH. The time ECHO stays HIGH is the time the burst spent traveling. Using this measurement in equation 1 along with the speed of sound will yield the distance travelled. A summary of this is listed below, along with a visual representation in Figure 2.

1. Set TRIG to HIGH
2. Set a timer when ECHO goes to HIGH
3. Keep the timer running until ECHO goes to LOW
4. Save that time
5. Use equation 1 to determine the distance travelled

Figure 3
Source 2



Source 2

To interpret the time reading into a distance you need to change equation 1. The clock on the device you are using will probably count in microseconds or smaller. To use equation 1 the speed of sound needs to determined,which is 343 meters per second at standard temperature and pressure. To convert this into more useful form use equation 2 to change from meters per second to microseconds per centimeter. Then equation 3 can be used to easily compute the distance in centimeters.

Equation 2. $Distance = \frac{Speed}{170.15\ m} \times \frac{Meters}{100\ cm} \times \frac{1e6\ \mu S}{170.15\ m} \times \frac{58.772\ \mu S}{cm}$

Equation 3. $Distance = \frac{time}{58} = \frac{\mu s}{\mu s/cm} = cm$

4. Wiring the HC-SR04 to a Microcontroller

This section only covers the hardware side. For information on how to integrate the software side, look at one of the links below or look into the specific microcontroller you are using.

The HC-SR04 has 4 pins: VCC, GND, TRIG and ECHO.

1. VCC is a 5v power supply. This should come from the microcontroller
2. GND is a ground pin. Attach to ground on the microcontroller.
3. TRIG should be attached to a GPIO pin that can be set to HIGH
4. ECHO is a little more difficult. The HC-SR04 outputs 5v, which could destroy many microcontroller GPIO pins (the maximum allowed voltage varies). In order to step down the voltage use a single resistor or a voltage divider circuit. Once again this depends on the specific microcontroller you are using, you will need to find out its GPIO maximum voltage and make sure you are below that.

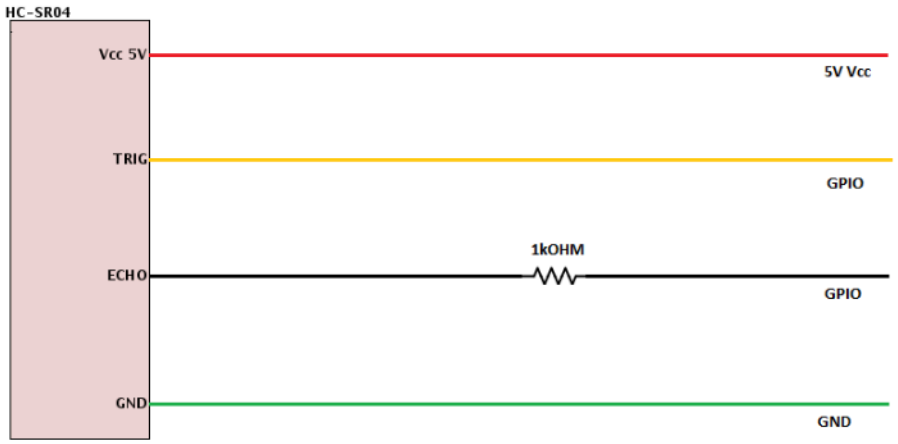
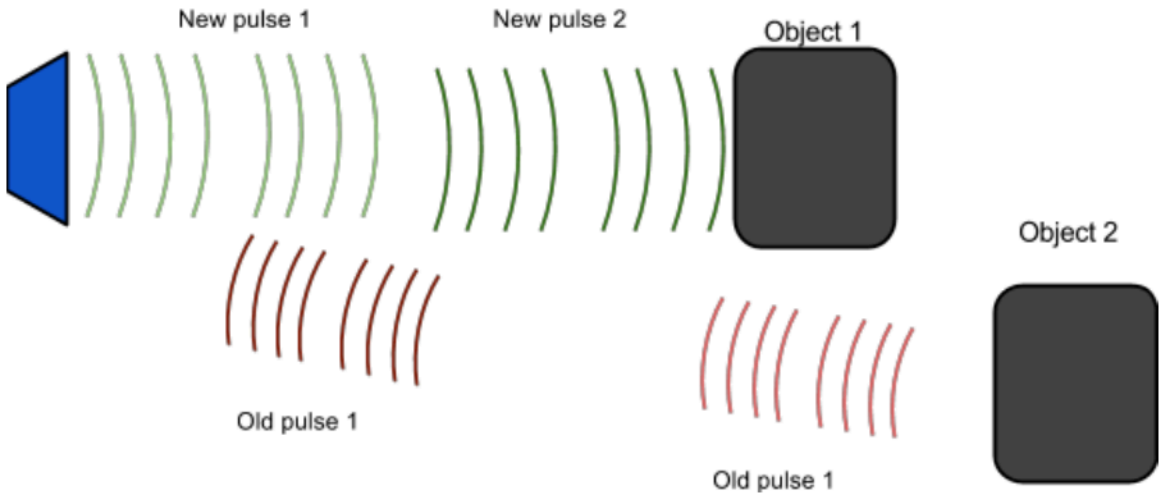


Figure 4

5. Errors and Bad Readings

Ultrasonic sensors are great sensors -- they work well for many applications where other types of sensors fall short. Unfortunately, they do have weaknesses. These weaknesses can be mitigated and worked around, but first they must be understood. The

first weakness is that they use sound. There is a limit to how fast ultrasonic sensors can get distance measurements. The longer the distance, the slower they are at reporting the distance. The second weakness comes from the way sound bounces off of objects. In enclosed spaces it is possible, if not probable that there will be unintended echos. The echos can very easily cause false short readings. In Figure 2 a pulse was sent out. It bounced off of object 1 and returned to the sensor. The distance was recorded and then a new pulse was sent. There was another object farther away, so that when the new pulse reaches object 1, the first signal will reach the sensor. This will cause the sensor to think that there is an object closer than is actually true. The old pulse is smaller than the new pulse because it has grown weaker. The longer the pulse exists the weaker it grows until it is negligible. If multiple sensors are being used, the number of echos will increase along with the number of errors. There are two main ways to reduce the number of errors. The first is to provide shielding around the sensor. This prevents echos coming in from angle outside what the sensor should actually pick up. The second is to reduce the frequency at which pulses are sent out. This gives more time for the echos to dissipate.



Works Cited

Source 1.
"HC-SR04 User's_Manual." *docs.google.* Cytron Technologies, May 2013 Web. 5 Dec. 2009.
<https://docs.google.com/document/d/1Y-yZnNhMYy7rwhAgyL_pfa39RsB-x2qR4vP8saG73rE/edit>

Source 2.
"Attiny2313 Ultrasonic distance (HR-SR04) example." *CircuitDB*. n.a. 7 Sept. 2014 Web. 5 Dec. 2014. <http://www.circuitdb.com/?p=1162>

Links

These are not formatted; you will need to copy and paste them into your web browser.

Want to learn about Ultrasonic Sensors in general?
http://www.sensorsmag.com/sensors/acoustic-ultrasound/choosing-ultrasonic-sensor-proximity-or-distance-measurement-825

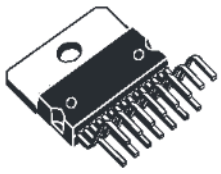
All about the HC-SR04

- http://www.circuitdb.com/?p=1162
- http://www.micropik.com/PDF/HCSR04.pdf
- http://randomnerdtutorials.com/complete-guide-for-ultrasonic-sensor-hc-sr04/
- http://www.ezdenki.com/ultrasonic.php
  (^fantastic tutorial, explains a lot of stuff)
- http://www.elecrow.com/hcsr04-ultrasonic-ranging-sensor-p-316.html
  (^ this one has some cool charts)

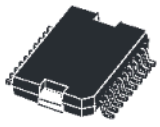
L298

DUAL FULL-BRIDGE DRIVER

- OPERATING SUPPLY VOLTAGE UP TO 46 V
- TOTAL DC CURRENT UP TO 4 A
- LOW SATURATION VOLTAGE
- OVERTEMPERATURE PROTECTION
- LOGICAL "0" INPUT VOLTAGE UP TO 1.5 V (HIGH NOISE IMMUNITY)



Multiwatt15



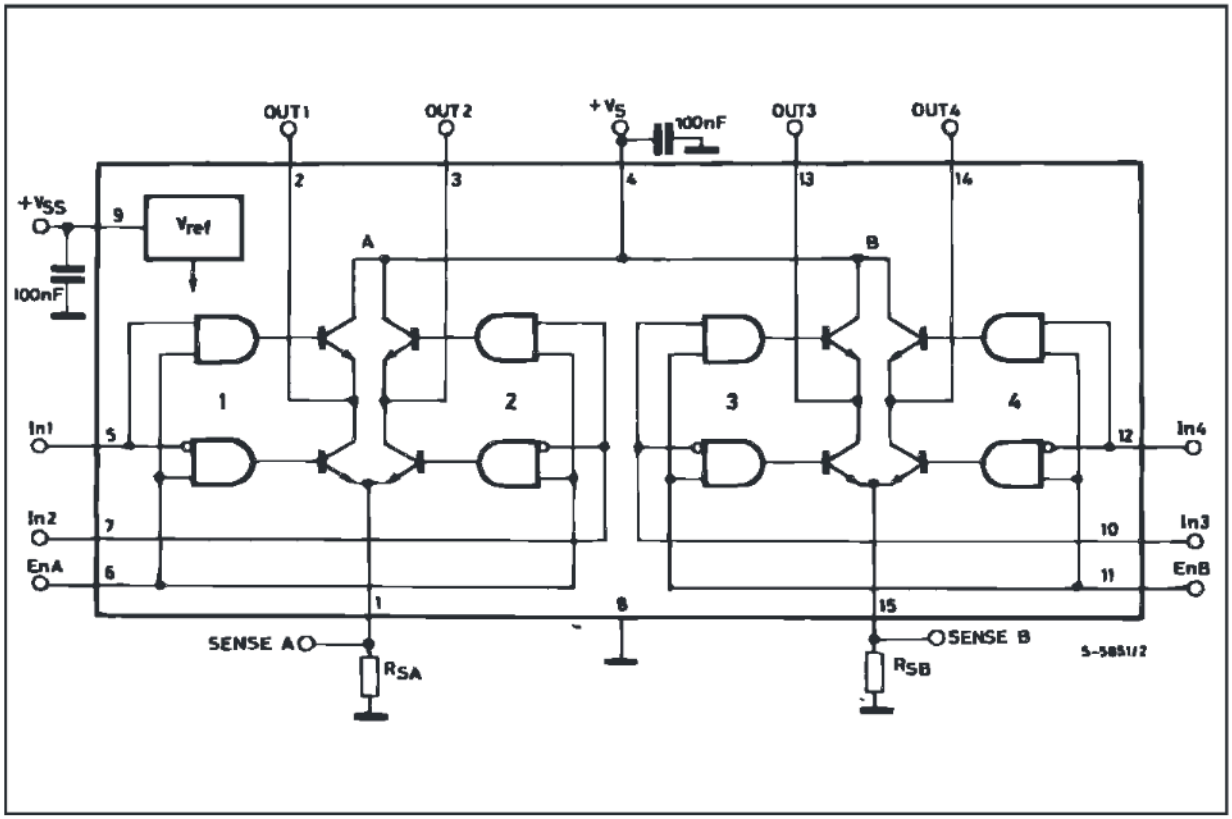
PowerSO20

ORDERING NUMBERS : L298N (Multiwatt Vert.)
L298HN (Multiwatt Horiz.)
L298P (PowerSO20)

DESCRIPTION

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

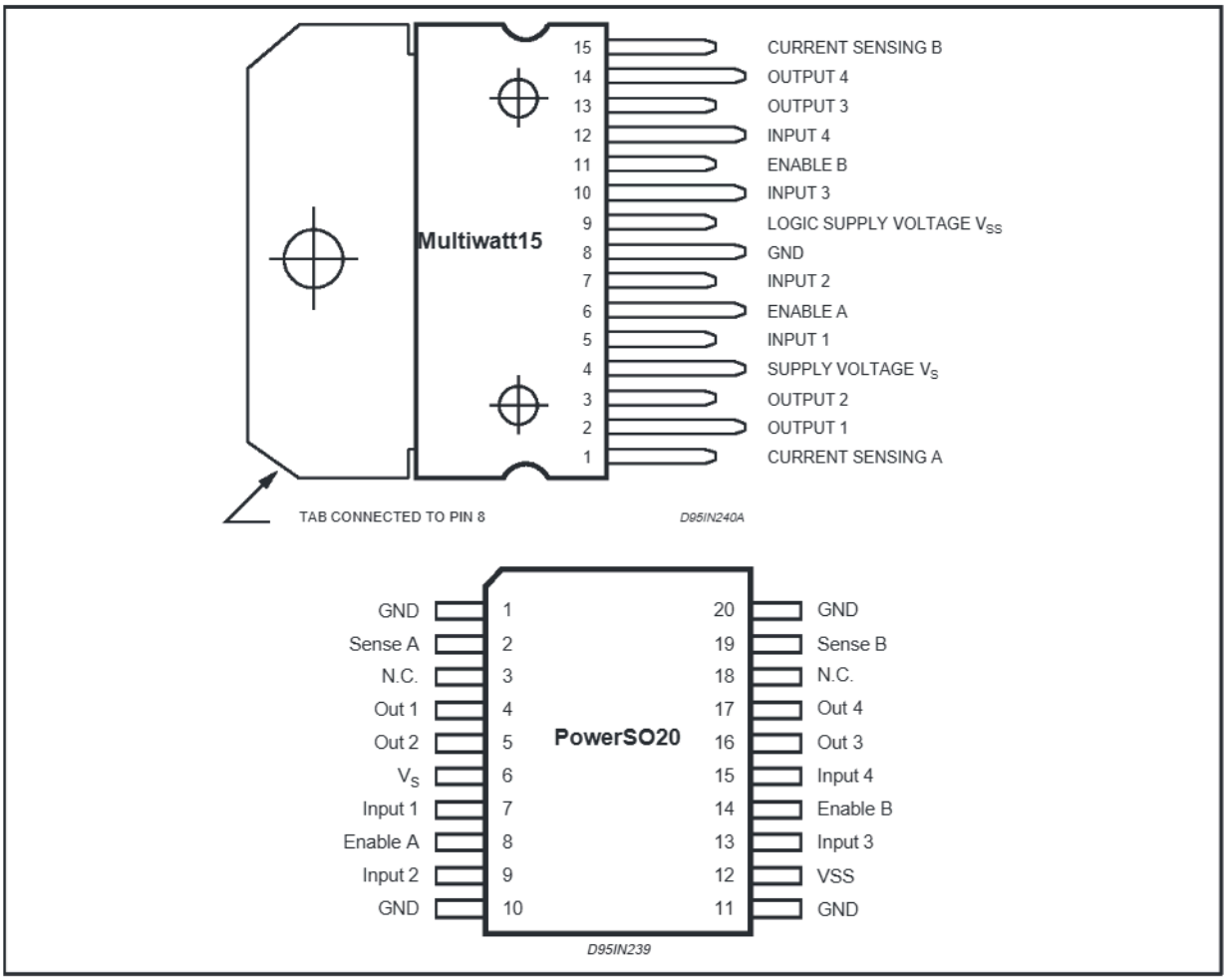
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Power Supply	50	V
V_{SS}	Logic Supply Voltage	7	V
V_I, V_{en}	Input and Enable Voltage	–0.3 to 7	V
I_O	Peak Output Current (each Channel) – Non Repetitive (t = 100μs) –Repetitive (80% on –20% off; t_{on} = 10ms) –DC Operation	 3 2.5 2	 A A A
V_{sens}	Sensing Voltage	–1 to 2.3	V
P_{tot}	Total Power Dissipation (T_{case} = 75°C)	25	W
T_{op}	Junction Operating Temperature	–25 to 130	°C
T_{stg}, T_j	Storage and Junction Temperature	–40 to 150	°C

PIN CONNECTIONS (top view)



THERMAL DATA

Symbol	Parameter		PowerSO20	Multiwatt15	Unit
$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case	Max.	–	3	°C/W
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	Max.	13 (*)	35	°C/W

(*) Mounted on aluminum substrate

PIN FUNCTIONS (refer to the block diagram)

MW.15	PowerSO	Name	Function
1;15	2;19	Sense A; Sense B	Between this pin and ground is connected the sense resistor to control the current of the load.
2;3	4;5	Out 1; Out 2	Outputs of the Bridge A; the current that flows through the load connected between these two pins is monitored at pin 1.
4	6	V_S	Supply Voltage for the Power Output Stages. A non-inductive 100nF capacitor must be connected between this pin and ground.
5;7	7;9	Input 1; Input 2	TTL Compatible Inputs of the Bridge A.
6;11	8;14	Enable A; Enable B	TTL Compatible Enable Input: the L state disables the bridge A (enable A) and/or the bridge B (enable B).
8	1,10,11,20	GND	Ground.
9	12	VSS	Supply Voltage for the Logic Blocks. A100nF capacitor must be connected between this pin and ground.
10; 12	13;15	Input 3; Input 4	TTL Compatible Inputs of the Bridge B.
13; 14	16;17	Out 3; Out 4	Outputs of the Bridge B. The current that flows through the load connected between these two pins is monitored at pin 15.
–	3;18	N.C.	Not Connected

ELECTRICAL CHARACTERISTICS (V_S = 42V; V_{SS} = 5V, T_j = 25°C; unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_S	Supply Voltage (pin 4)	Operative Condition	V_{IH} +2.5		46	V
V_{SS}	Logic Supply Voltage (pin 9)		4.5	5	7	V
I_S	Quiescent Supply Current (pin 4)	V_{en} = H; I_L = 0 V_i = L V_i = H		13 50	22 70	mA mA
		V_{en} = L V_i = X			4	mA
I_{SS}	Quiescent Current from V_{SS} (pin 9)	V_{en} = H; I_L = 0 V_i = L V_i = H		24 7	36 12	mA mA
		V_{en} = L V_i = X			6	mA
V_{iL}	Input Low Voltage (pins 5, 7, 10, 12)		–0.3		1.5	V
V_{iH}	Input High Voltage (pins 5, 7, 10, 12)		2.3		VSS	V
I_{iL}	Low Voltage Input Current (pins 5, 7, 10, 12)	V_i = L			–10	∝A
I_{iH}	High Voltage Input Current (pins 5, 7, 10, 12)	Vi = H ≤ V_{SS} –0.6V		30	100	∝A
V_{en} = L	Enable Low Voltage (pins 6, 11)		–0.3		1.5	V
V_{en} = H	Enable High Voltage (pins 6, 11)		2.3		V_{SS}	V
I_{en} = L	Low Voltage Enable Current (pins 6, 11)	V_{en} = L			–10	∝A
I_{en} = H	High Voltage Enable Current (pins 6, 11)	V_{en} = H ≤ V_{SS} –0.6V		30	100	∝A
$V_{CEsat(H)}$	Source Saturation Voltage	I_L = 1A I_L = 2A	0.95	1.35 2	1.7 2.7	V V
$V_{CEsat(L)}$	Sink Saturation Voltage	I_L = 1A (5) I_L = 2A (5)	0.85	1.2 1.7	1.6 2.3	V V
V_{CEsat}	Total Drop	I_L = 1A (5) I_L = 2A (5)	1.80		3.2 4.9	V V
V_{sens}	Sensing Voltage (pins 1, 15)		–1 (1)		2	V

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
T_1 (V_i)	Source Current Turn-off Delay	0.5 V_i to 0.9 I_L (2); (4)		1.5		∝s
T_2 (V_i)	Source Current Fall Time	0.9 I_L to 0.1 I_L (2); (4)		0.2		∝s
T_3 (V_i)	Source Current Turn-on Delay	0.5 V_i to 0.1 I_L (2); (4)		2		∝s
T_4 (V_i)	Source Current Rise Time	0.1 I_L to 0.9 I_L (2); (4)		0.7		∝s
T_5 (V_i)	Sink Current Turn-off Delay	0.5 V_i to 0.9 I_L (3); (4)		0.7		∝s
T_6 (V_i)	Sink Current Fall Time	0.9 I_L to 0.1 I_L (3); (4)		0.25		∝s
T_7 (V_i)	Sink Current Turn-on Delay	0.5 V_i to 0.9 I_L (3); (4)		1.6		∝s
T_8 (V_i)	Sink Current Rise Time	0.1 I_L to 0.9 I_L (3); (4)		0.2		∝s
fc (V_i)	Commutation Frequency	I_L = 2A		25	40	KHz
T_1 (V_{en})	Source Current Turn-off Delay	0.5 V_{en} to 0.9 I_L (2); (4)		3		∝s
T_2 (V_{en})	Source Current Fall Time	0.9 I_L to 0.1 I_L (2); (4)		1		∝s
T_3 (V_{en})	Source Current Turn-on Delay	0.5 V_{en} to 0.1 I_L (2); (4)		0.3		∝s
T_4 (V_{en})	Source Current Rise Time	0.1 I_L to 0.9 I_L (2); (4)		0.4		∝s
T_5 (V_{en})	Sink Current Turn-off Delay	0.5 V_{en} to 0.9 I_L (3); (4)		2.2		∝s
T_6 (V_{en})	Sink Current Fall Time	0.9 I_L to 0.1 I_L (3); (4)		0.35		∝s
T_7 (V_{en})	Sink Current Turn-on Delay	0.5 V_{en} to 0.9 I_L (3); (4)		0.25		∝s
T_8 (V_{en})	Sink Current Rise Time	0.1 I_L to 0.9 I_L (3); (4)		0.1		∝s

1) 1)Sensing voltage can be –1 V for t ≤ 50 ∝sec; in steady state V_{sens} min ≥ –0.5 V.
2) See fig. 2.
3) See fig. 4.
4) The load must be a pure resistor.

Figure 1 : Typical Saturation Voltage vs. Output Current.

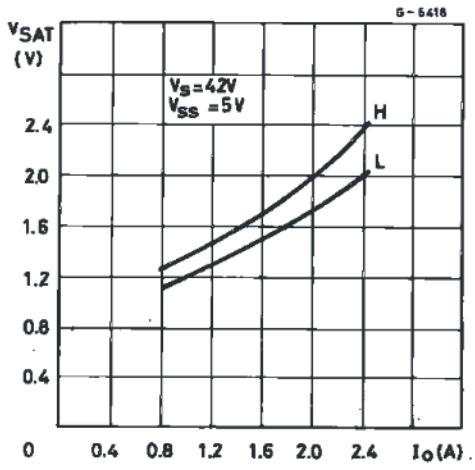
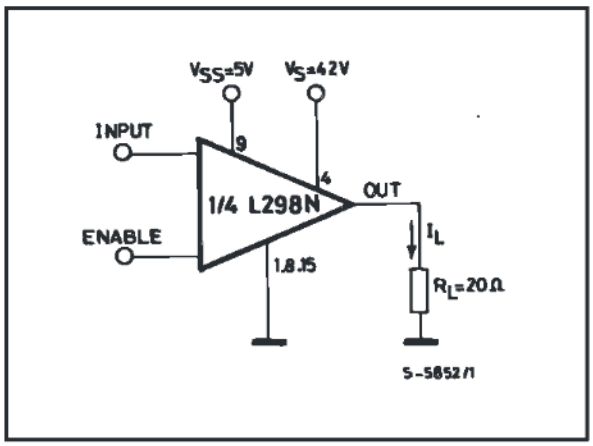


Figure 2 : Switching Times Test Circuits.



Note : For INPUT Switching, set EN = H
For ENABLE Switching, set IN = H

Figure 3 : Source Current Delay Times vs. Input or Enable Switching.

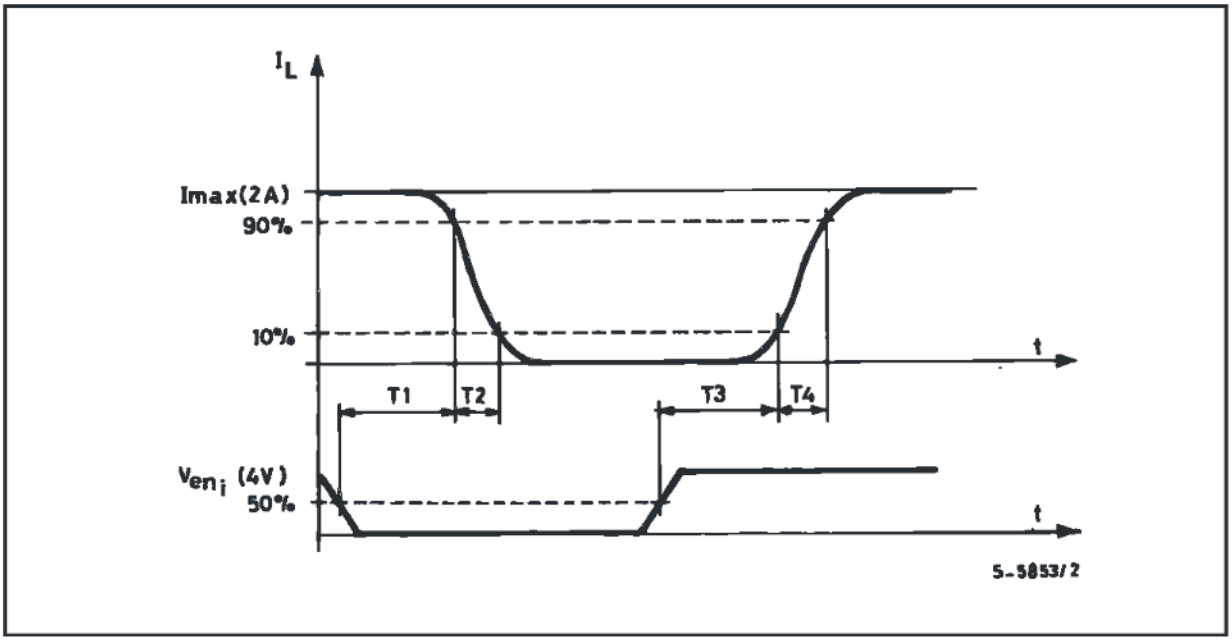
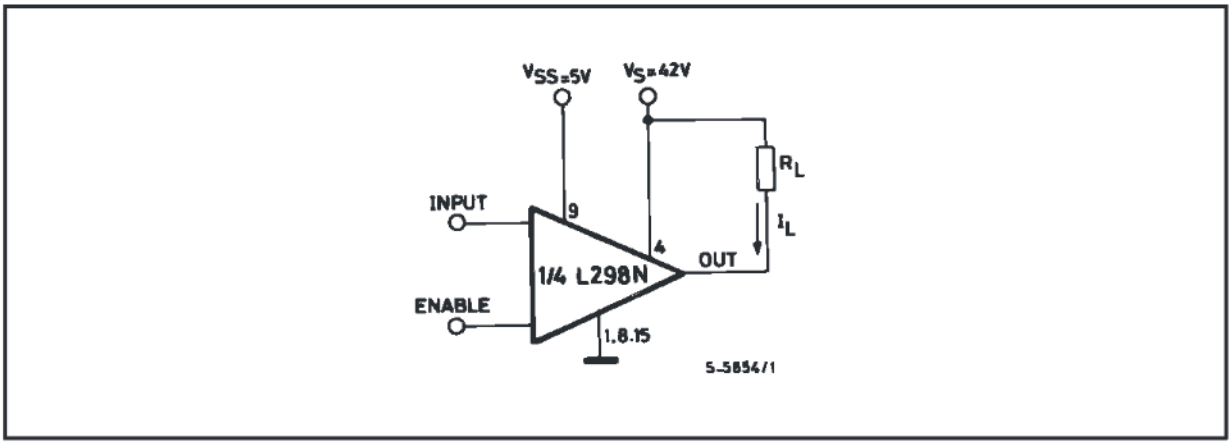


Figure 4 : Switching Times Test Circuits.



Note : For INPUT Switching, set EN = H
For ENABLE Switching, set IN = L

Figure 5 : Sink Current Delay Times vs. Input 0 V Enable Switching.

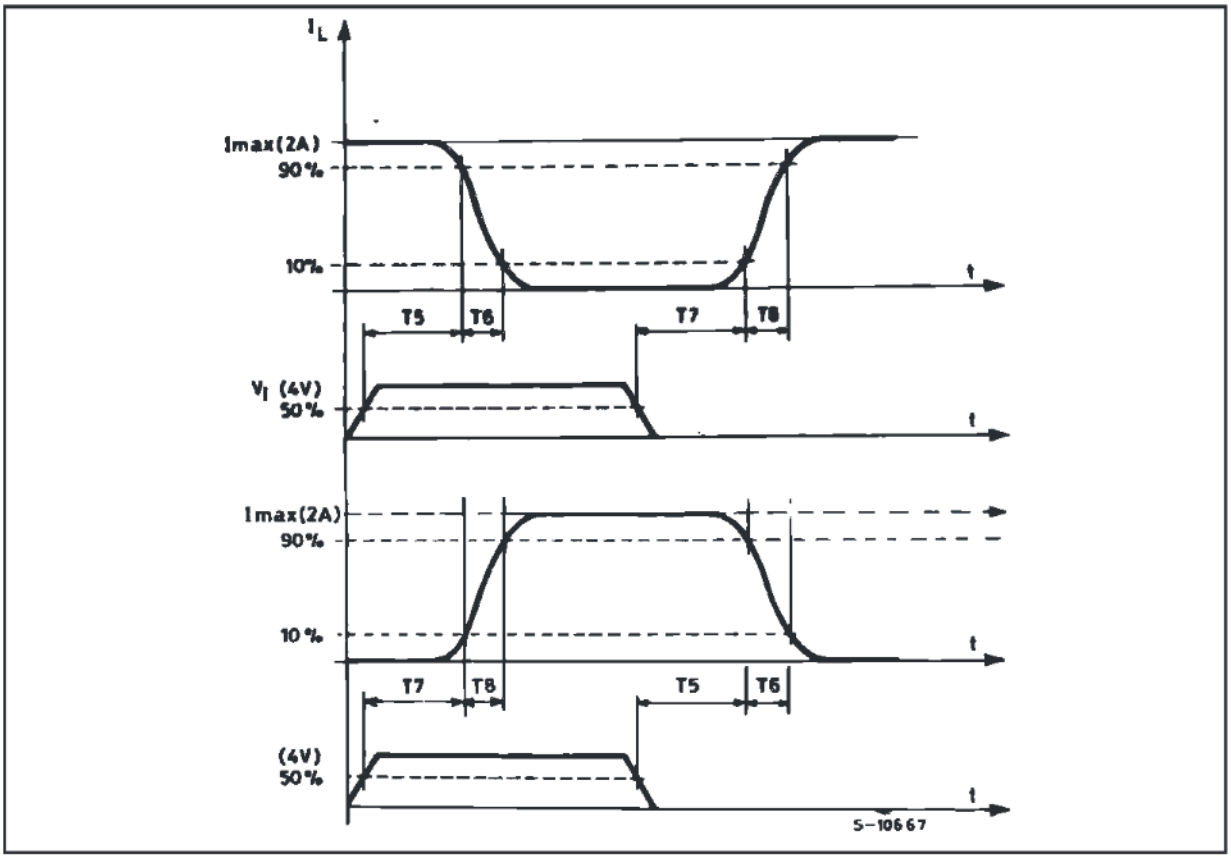
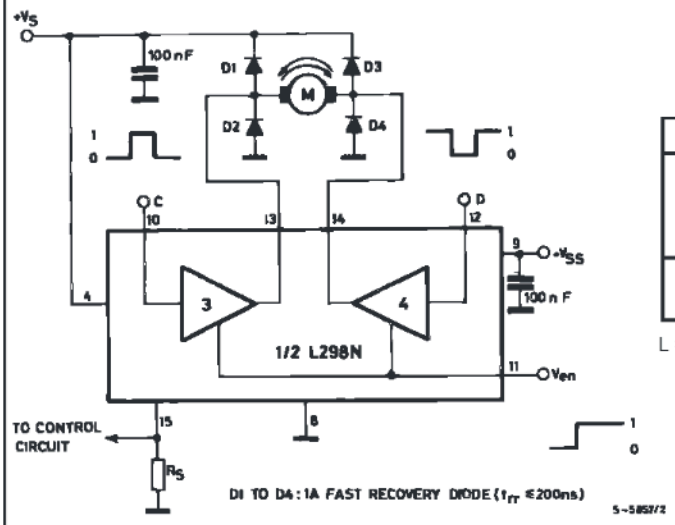


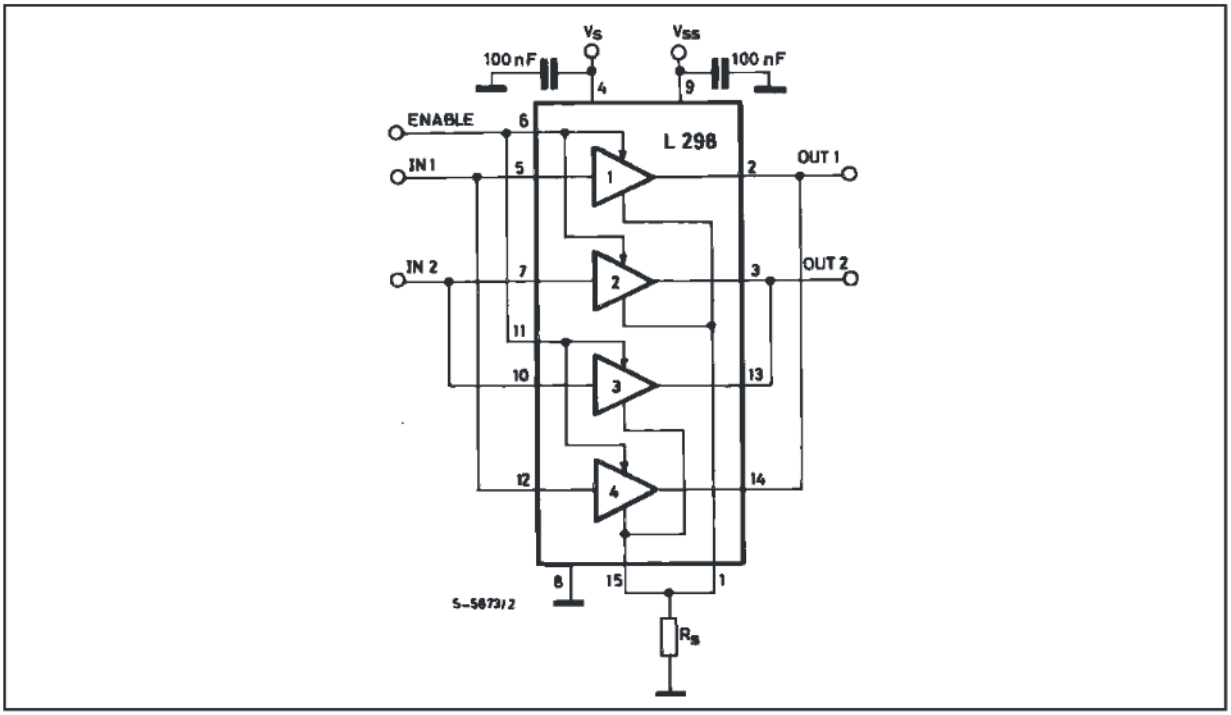
Figure 6 : Bidirectional DC Motor Control.



Inputs		Function
V_{en} = H	C = H ; D = L	Forward
	C = L ; D = H	Reverse
	C = D	Fast Motor Stop
V_{en} = L	C = X ; D = X	Free Running Motor Stop

L = Low H = High X = Don't care

Figure 7 : For higher currents, outputs can be paralleled. Take care to parallel channel 1 with channel 4 and channel 2 with channel 3.



APPLICATION INFORMATION (Refer to the block diagram)

1.1. POWER OUTPUT STAGE

The L298 integrates two power output stages (A ; B). The power output stage is a bridge configuration and its outputs can drive an inductive load in common or differenzial mode, depending on the state of the inputs. The current that flows through the load comes out from the bridge at the sense output : an external resistor (R_{SA} ; R_{SB}.) allows to detect the intensity of this current.

1.2. INPUT STAGE

Each bridge is driven by means of four gates the input of which are In1 ; In2 ; EnA and In3 ; In4 ; EnB. The In inputs set the bridge state when The En input is high ; a low state of the En input inhibits the bridge. All the inputs are TTL compatible.

2. SUGGESTIONS

A non inductive capacitor, usually of 100 nF, must be foreseen between both Vs and Vss, to ground, as near as possible to GND pin. When the large capacitor of the power supply is too far from the IC, a second smaller one must be foreseen near the L298.

The sense resistor, not of a wire wound type, must be grounded near the negative pole of Vs that must be near the GND pin of the I.C.

Each input must be connected to the source of the driving signals by means of a very short path.

Turn-On and Turn-Off : Before to Turn-ON the Supply Voltage and before to Turn it OFF, the Enable input must be driven to the Low state.

3. APPLICATIONS

Fig 6 shows a bidirectional DC motor control Schematic Diagram for which only one bridge is needed. The external bridge of diodes D1 to D4 is made by four fast recovery elements (trr ≤ 200 nsec) that must be chosen of a VF as low as possible at the worst case of the load current.

The sense output voltage can be used to control the current amplitude by chopping the inputs, or to provide overcurrent protection by switching low the enable input.

The brake function (Fast motor stop) requires that the Absolute Maximum Rating of 2 Amps must never be overcome.

When the repetitive peak current needed from the load is higher than 2 Amps, a paralleled configuration can be chosen (See Fig.7).

An external bridge of diodes are required when inductive loads are driven and when the inputs of the IC are chopped; Shottky diodes would be preferred.

This solution can drive until 3 Amps In DC operation and until 3.5 Amps of a repetitive peak current.

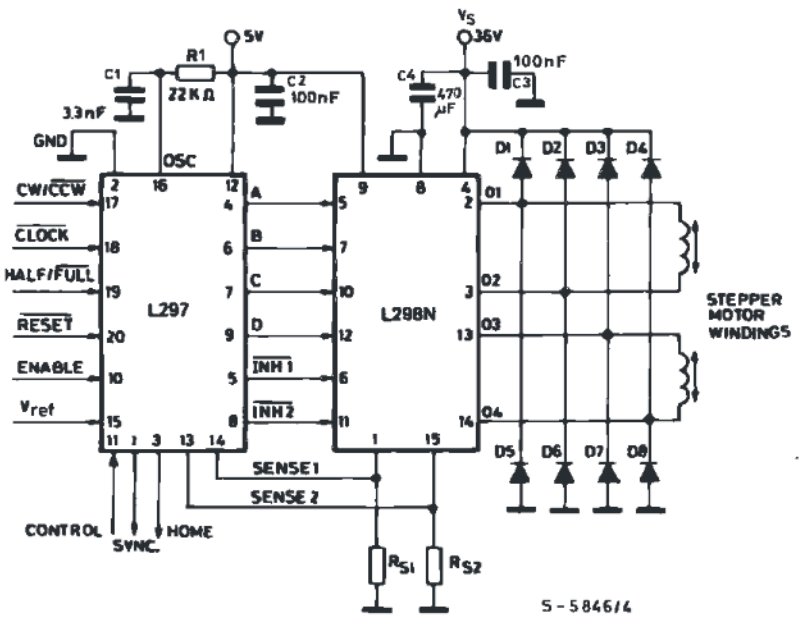
On Fig 8 it is shown the driving of a two phase bipolar stepper motor ; the needed signals to drive the inputs of the L298 are generated, in this example, from the IC L297.

Fig 9 shows an example of P.C.B. designed for the application of Fig 8.

Fig 10 shows a second two phase bipolar stepper motor control circuit where the current is controlled by the I.C. L6506.

Figure 8 : Two Phase Bipolar Stepper Motor Circuit.

This circuit drives bipolar stepper motors with winding currents up to 2 A. The diodes are fast 2 A types.



$R_{S1} = R_{S2} = 0.5\ \Omega$

D1 to D8 = 2 A Fast diodes { $V_F \leq 1.2$ V @ I = 2 A
trr ≤ 200 ns

Figure 9 : Suggested Printed Circuit Board Layout for the Circuit of fig. 8 (1:1 scale).

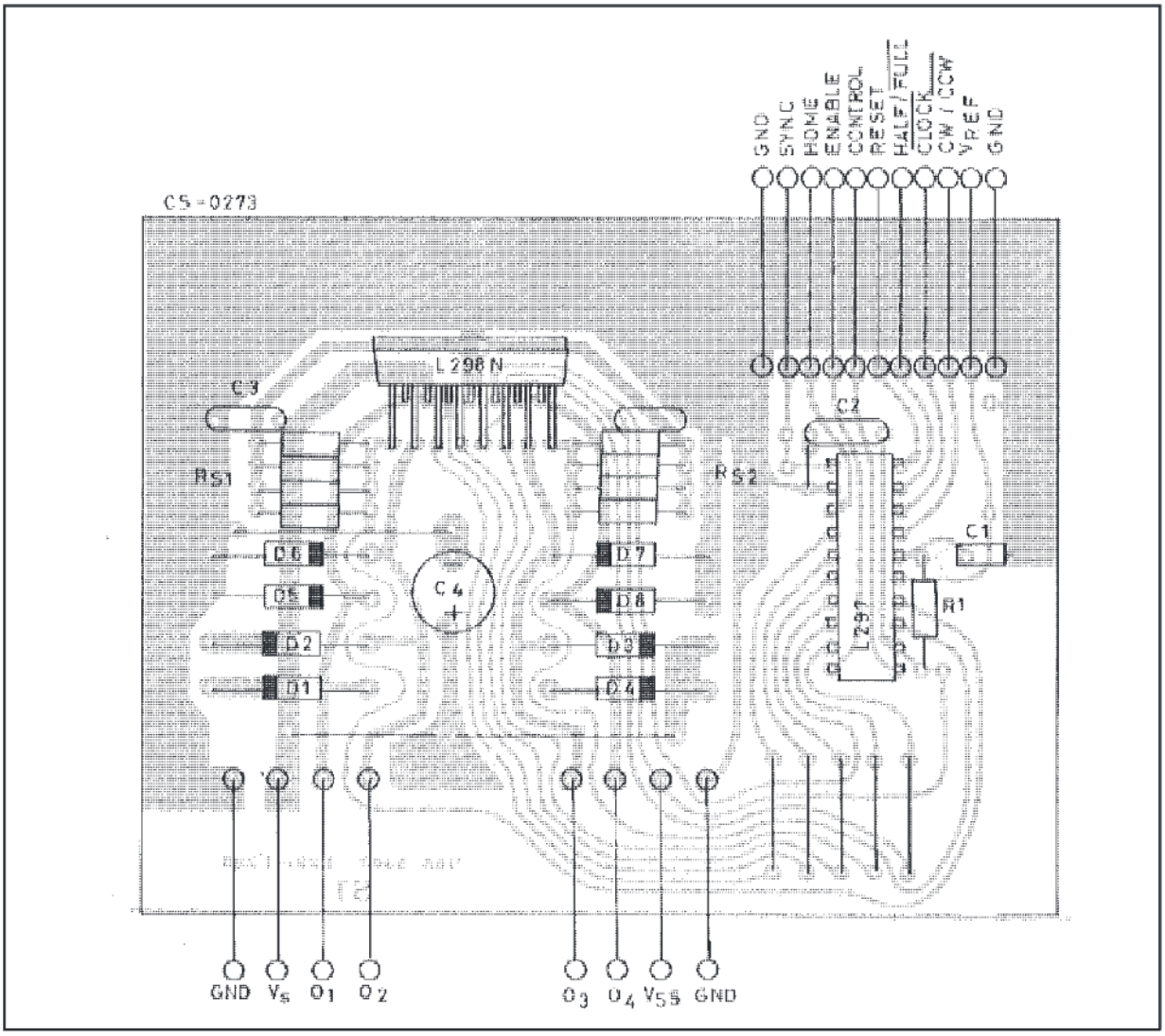
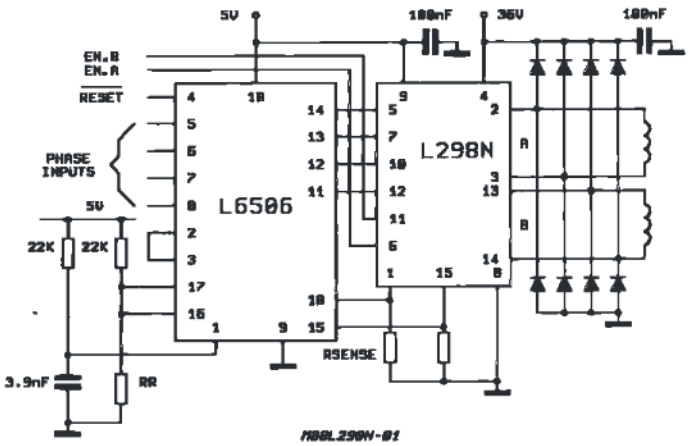


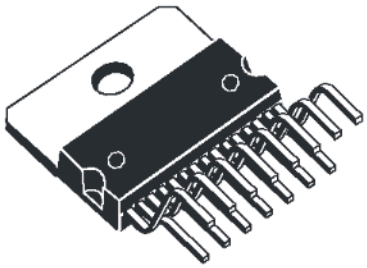
Figure 10 : Two Phase Bipolar Stepper Motor Control Circuit by Using the Current Controller L6506.



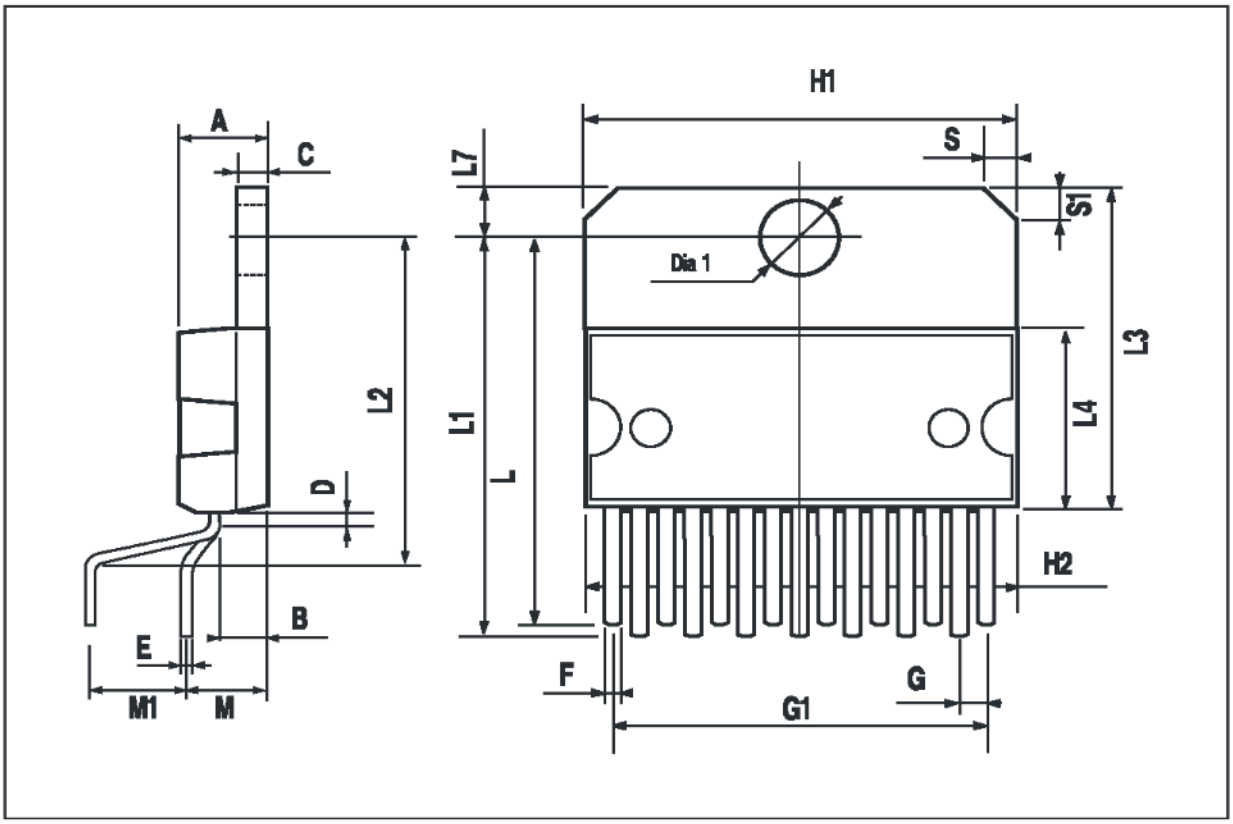
R_R and R_{sense} depend from the load current

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.02	1.27	1.52	0.040	0.050	0.060
G1	17.53	17.78	18.03	0.690	0.700	0.710
H1	19.6			0.772		
H2			20.2			0.795
L	21.9	22.2	22.5	0.862	0.874	0.886
L1	21.7	22.1	22.5	0.854	0.870	0.886
L2	17.65		18.1	0.695		0.713
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
M	4.25	4.55	4.85	0.167	0.179	0.191
M1	4.63	5.08	5.53	0.182	0.200	0.218
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152

OUTLINE AND MECHANICAL DATA

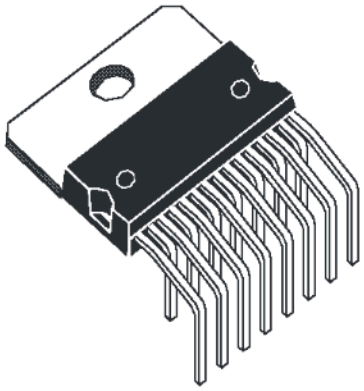


Multiwatt15 V

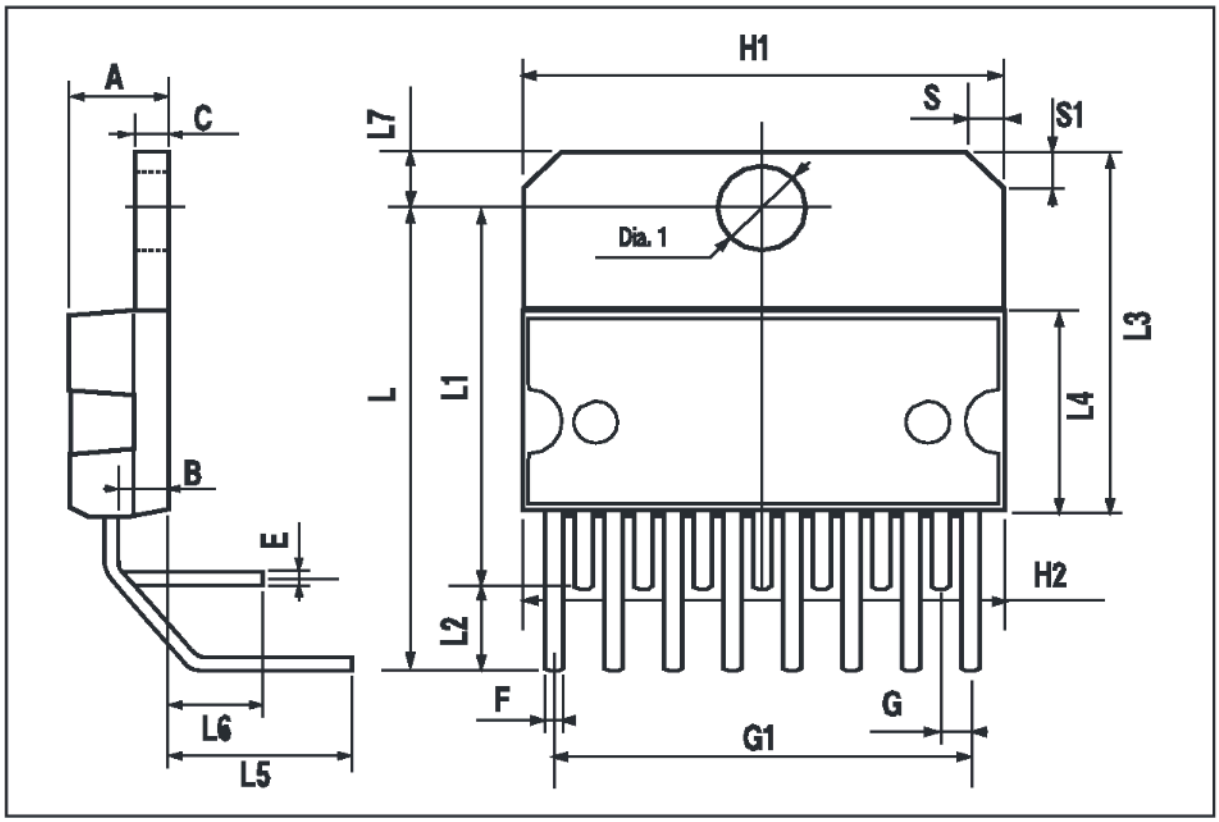


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.14	1.27	1.4	0.045	0.050	0.055
G1	17.57	17.78	17.91	0.692	0.700	0.705
H1	19.6			0.772		
H2			20.2			0.795
L		20.57			0.810	
L1		18.03			0.710	
L2		2.54			0.100	
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L5		5.28			0.208	
L6		2.38			0.094	
L7	2.65		2.9	0.104		0.114
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152

OUTLINE AND MECHANICAL DATA



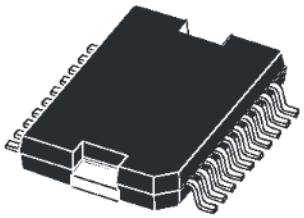
Multiwatt15 H



DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			3.6			0.142
a1	0.1		0.3	0.004		0.012
a2			3.3			0.130
a3	0		0.1	0.000		0.004
b	0.4		0.53	0.016		0.021
c	0.23		0.32	0.009		0.013
D (1)	15.8		16	0.622		0.630
D1	9.4		9.8	0.370		0.386
E	13.9		14.5	0.547		0.570
e		1.27			0.050	
e3		11.43			0.450	
E1 (1)	10.9		11.1	0.429		0.437
E2			2.9			0.114
E3	5.8		6.2	0.228		0.244
G	0		0.1	0.000		0.004
H	15.5		15.9	0.610		0.626
h			1.1			0.043
L	0.8		1.1	0.031		0.043
N	10° (max.)					
S	8° (max.)					
T		10			0.394	

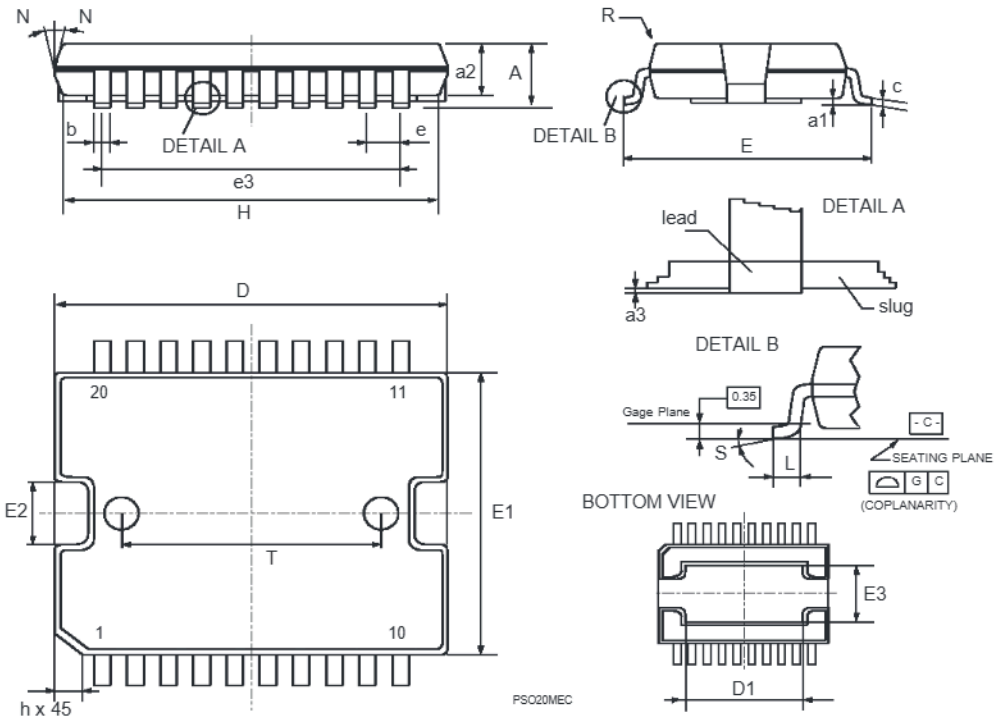
(1) "D and F" do not include mold flash or protrusions.
- Mold flash or protrusions shall not exceed 0.15 mm (0.006").
- Critical dimensions: "E", "G" and "a3"

OUTLINE AND MECHANICAL DATA

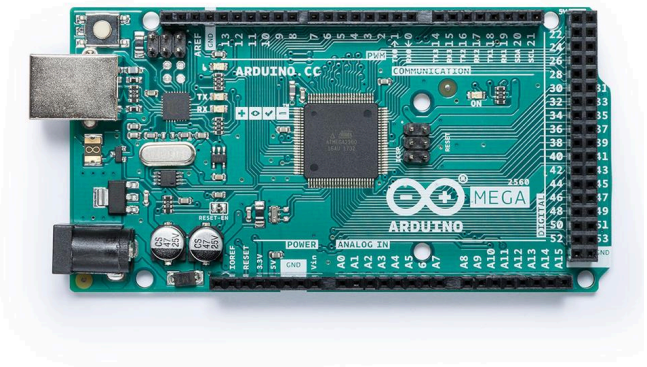


JEDEC MO-166

PowerSO20



User Manual
SKU: A000067



Description

Arduino® Mega 2560 Rev3 is an exemplary development board dedicated for building extensive applications as compared to other maker boards by Arduino. The board accommodates the ATmega2560 microcontroller, which operates at a frequency of 16 MHz. The board contains 54 digital input/output pins, 16 analog inputs, 4 UARTs (hardware serial ports), a USB connection, a power jack, an ICSP header, and a reset button.

Target Areas

3D Printing, Robotics, Maker

Features

- **ATmega2560 Processor**
  - Up to 16 MIPS Throughput at 16MHz
  - 256k bytes (of which 8k is used for the bootloader)
  - 4k bytes EEPROM
  - 8k bytes Internal SRAM
  - 32 × 8 General Purpose Working Registers
  - Real Time Counter with Separate Oscillator
  - Four 8-bit PWM Channels
  - Four Programmable Serial USART
  - Controller/Peripheral SPI Serial Interface
- **ATmega16U2**
  - Up to 16 MIPS Throughput at 16 MHz
  - 16k bytes ISP Flash Memory
  - 512 bytes EEPROM
  - 512 bytes SRAM
  - USART with SPI master only mode and hardware flow control (RTS/CTS)
  - Master/Slave SPI Serial Interface
- **Sleep Modes**
  - Idle
  - ADC Noise Reduction
  - Power-save
  - Power-down
  - Standby
  - Extended Standby
- **Power**
  - USB Connection
  - External AC/DC Adapter
- **I/O**
  - 54 Digital
  - 16 Analog
  - 15 PWM Output

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1 The Board

Mega 2560 Rev3 is a successor board of Arduino Mega, it is dedicated to applications and projects that require large number of input output pins and the use cases which need high processing power. The Mega 2560 Rev3 comes with a much larger set of IOs when we compare it with the traditional Arduino® UNO board considering the form factor of both the boards.

1.1 Application Examples

- **Robotics**: Featuring the high processing capacity, the Mega 2560 Rev3 can handle the extensive robotic applications. It is compatible with the motor controller shield that enables it to control multiple motors at an instance, thus making it perfect of robotic applications. The large number of I/O pins can accommodate many robotic sensors as well.
- **3D Printing**: Algorithms play a significant role in implementation of 3D printers. Mega 2560 Rev3 has the power to process these complex algorithms required for 3D printing. Additionally, the slight changes to the code is easily possible with the Arduino IDE and thus 3D printing programs can be customized according to user requirements.
- **Wi-Fi**: Integrating wireless functionality enhances the utility of the applications. Mega 2560 Rev3 is compatible with Wi-Fi® shields hence allowing the wireless features for the applications in 3D printing and Robotics.

1.2 Accessories

1.3 Related Products

- Arduino® UNO R3
- Arduino® Nano
- Arduino® Due without headers

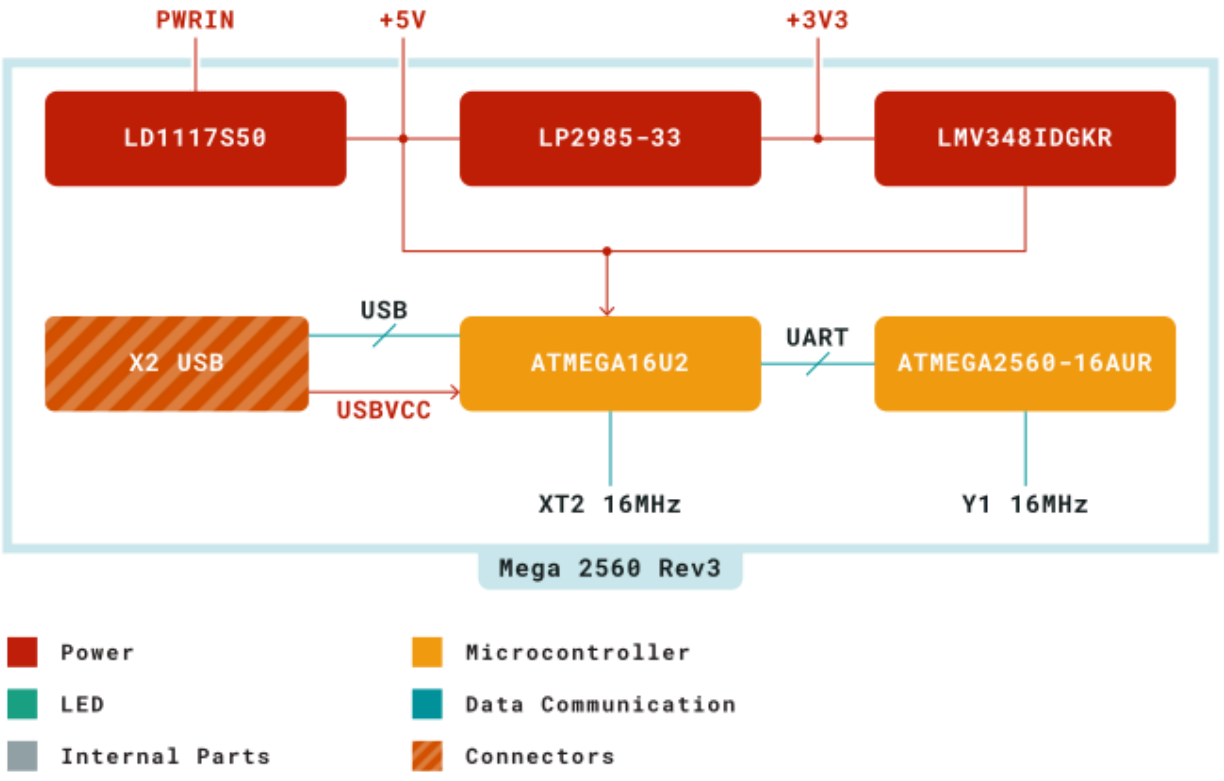
2 Ratings

2.1 Recommended Operating Conditions

Symbol	Description	Min	Typ	Max	Unit
V_{IN}	Input voltage from VIN pad / DC Jack	7	7.0	12	V
V_{USB}	Input voltage from USB connector	4.8	5.0	5.5	V
T_{OP}	Operating Temperature	-40	25	85	°C

3 Functional Overview

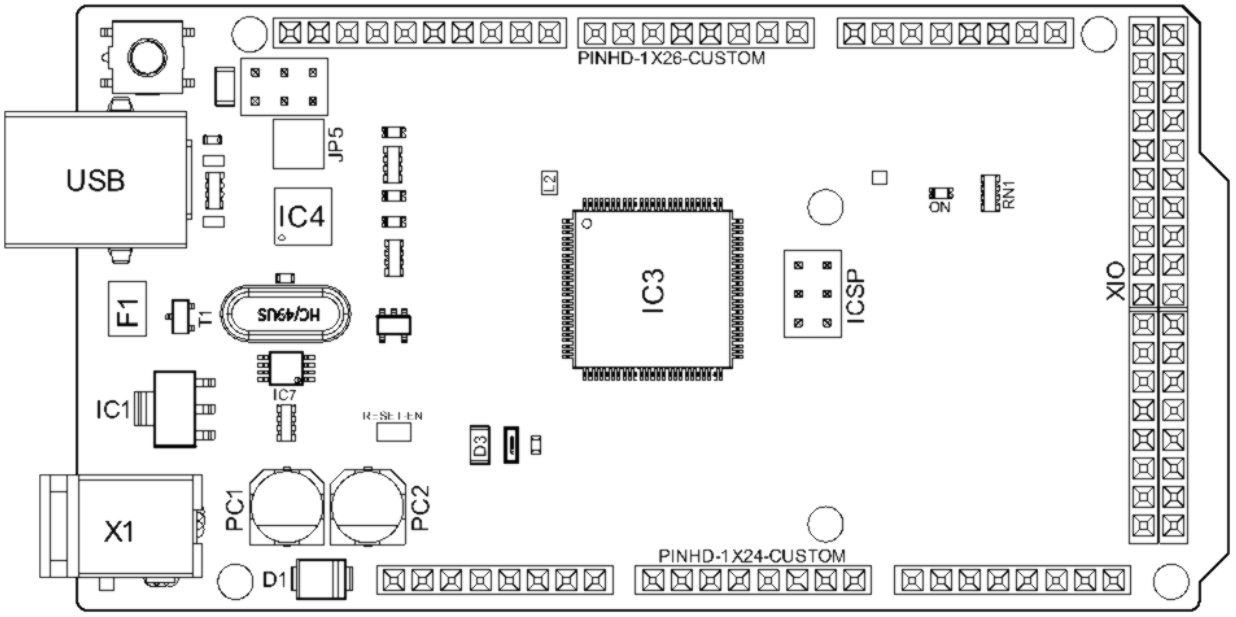
3.1 Block Diagram



Arduino Mega 2560 Rev3 Block Diagram

3.2 Board Topology

Front View



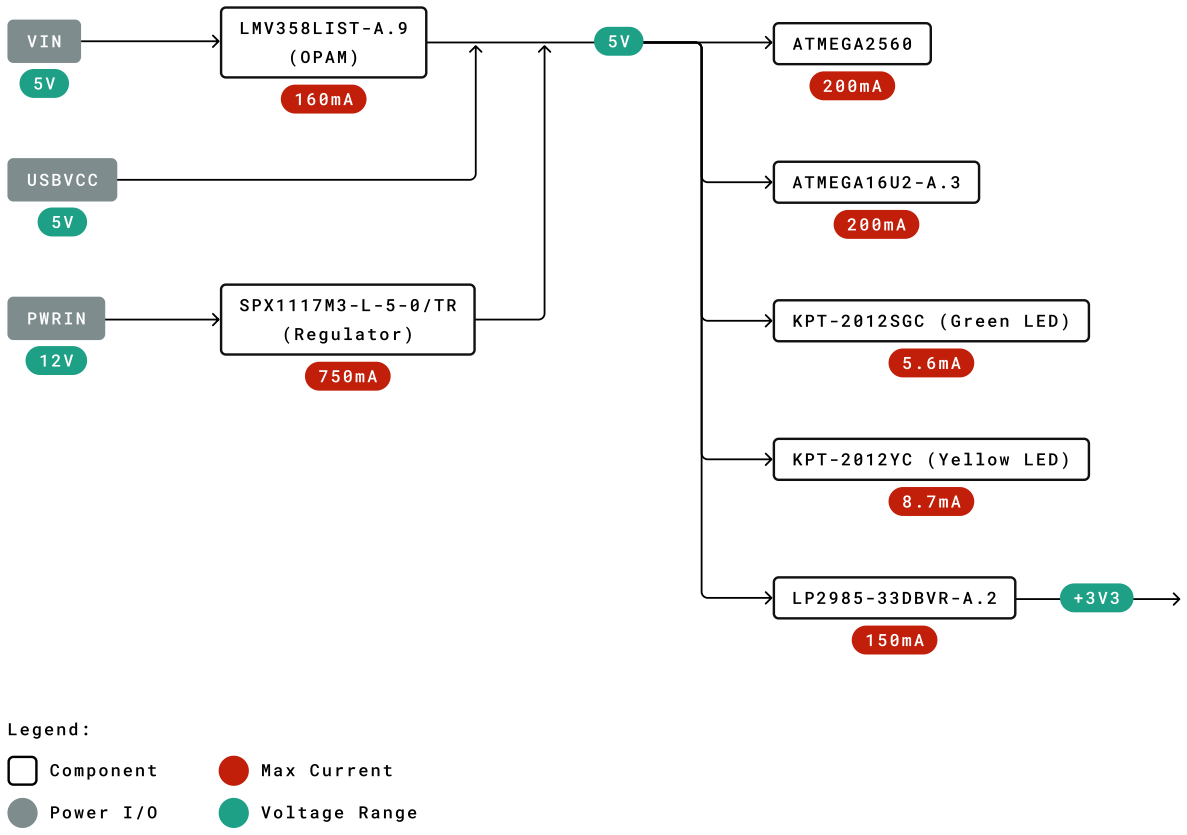
Arduino Mega 2560 Rev3 Top View

Ref.	Description	Ref.	Description
USB	USB B Connector	F1	Chip Capacitor
IC1	5V Linear Regulator	X1	Power Jack Connector
JP5	Plated Holes	IC4	ATmega16U2 chip
PC1	Electrolytic Alumninum Capacitor	PC2	Electrolytic Alumninum Capacitor
D1	General Purpose Rectifier	D3	General Purpose Diode
L2	Fixed Inductor	IC3	ATmega2560 chip
ICSP	Connector Header	ON	Green LED
RN1	Resistor Array	XIO	Connector

3.3 Processor

Primary processor of Mega 2560 Rev3 board is ATmega2560 chip which operates at a frequency of 16 MHz. It accommodates a large number of input and output lines which gives the provision of interfacing many external devices. At the same time the operations and processing is not slowed due to its significantly larger RAM than the other processors. The board also features a USB serial processor ATmega16U2 which acts an interface between the USB input signals and the main processor. This increases the flexibility of interfacing and connecting peripherals to the Mega 2560 Rev3 board.

3.4 Power Tree



Power Tree

4 Board Operation

4.1 Getting Started - IDE

If you want to program your Mega 2560 Rev3 while offline you need to install the Arduino Desktop IDE **[1]** To connect the Mega 2560 Rev3 to your computer, you'll need a Type-B USB cable. This also provides power to the board, as indicated by the LED.

4.2 Getting Started - Arduino Cloud Editor

All Arduino boards, including this one, work out-of-the-box on the Arduino Cloud Editor **[2]**, by just installing a simple plugin.

The Arduino Cloud Editor is hosted online, therefore it will always be up-to-date with the latest features and support for all boards. Follow **[3]** to start coding on the browser and upload your sketches onto your board.

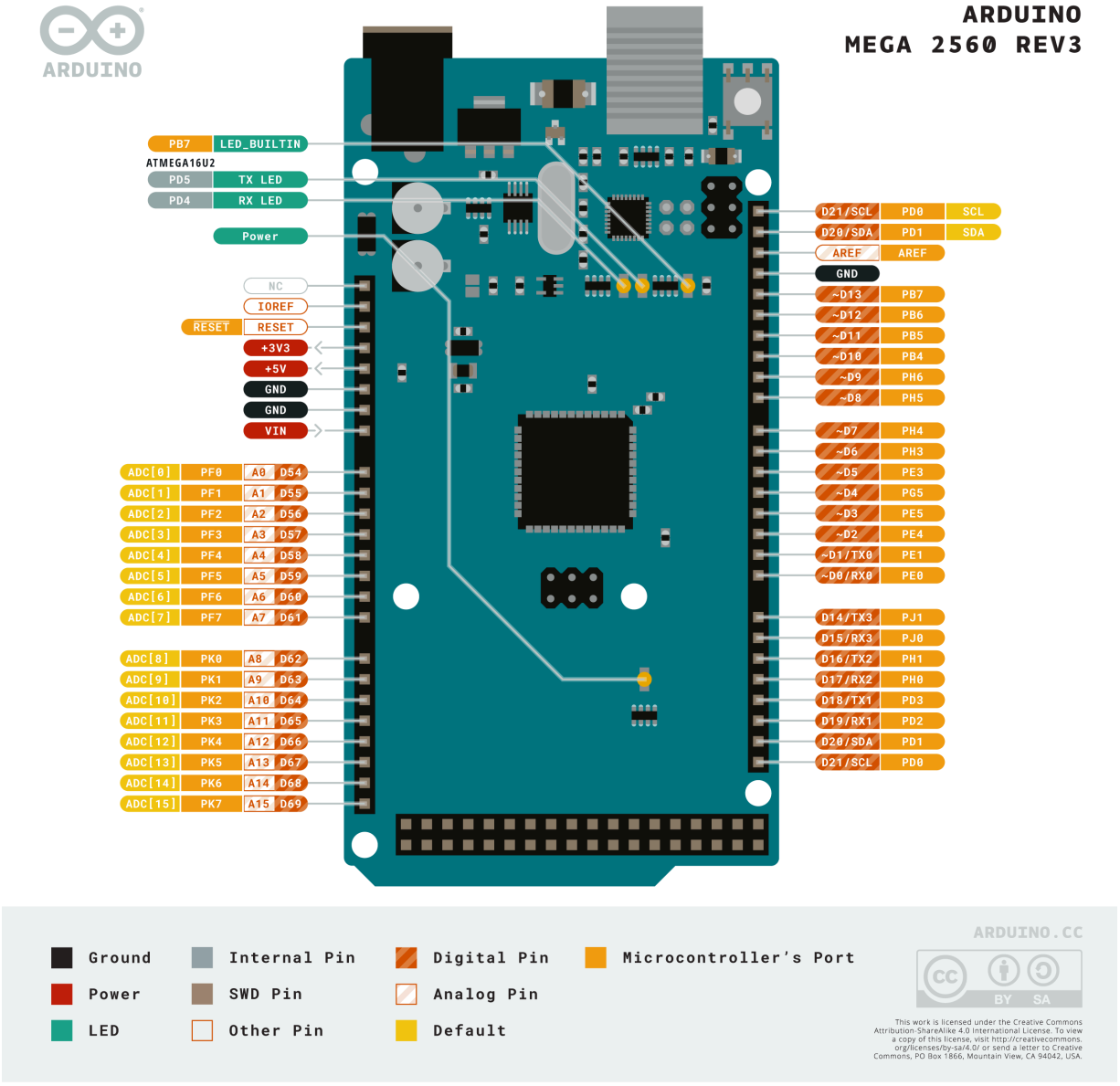
4.3 Sample Sketches

Sample sketches for the Mega 2560 Rev3 can be found either in the "Examples" menu in the Arduino IDE or under the "Documentation" menu on the Arduino website [4].

4.4 Online Resources

Now that you have gone through the basics of what you can do with the board you can explore the endless possibilities it provides by checking exciting projects on Arduino Project Hub **[5]**, the Arduino Library Reference **[6]** and the online store **[7]** where you will be able to complement your board with sensors, actuators and more.

5 Connector Pinouts



Arduino Mega 2560 Rev3 Pinout

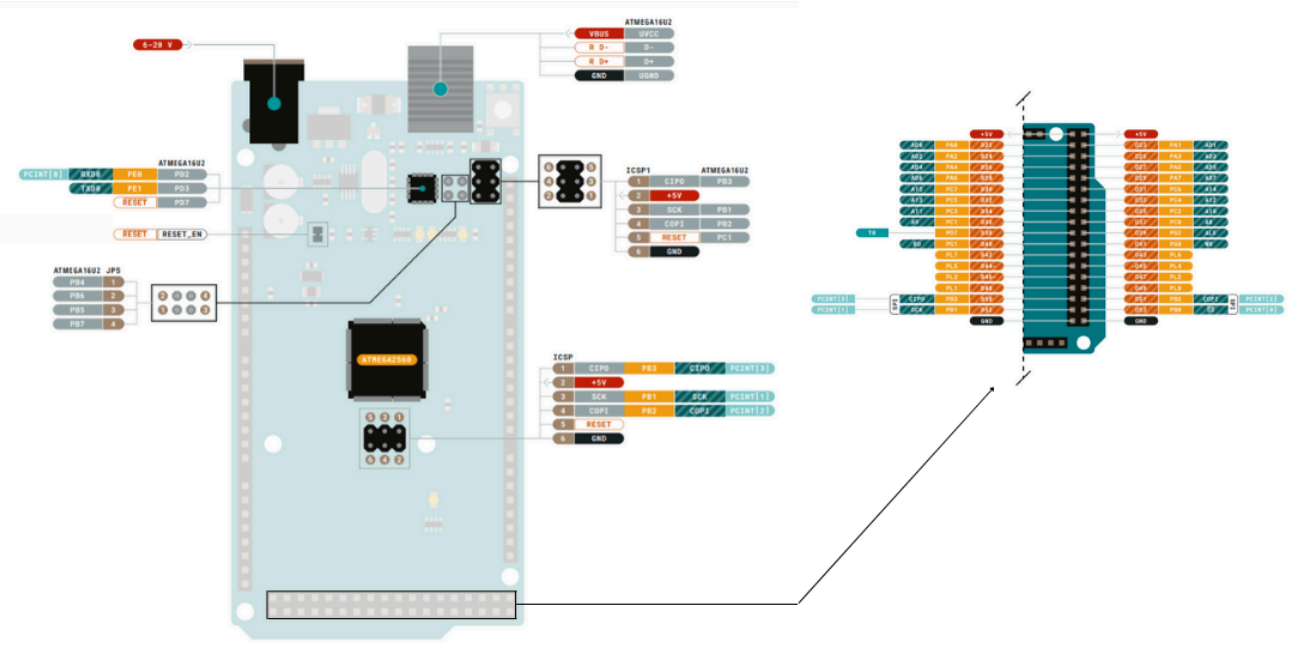
5.1 Analog

Pin	Function	Type	Description
1	NC	NC	Not Connected
2	IOREF	IOREF	Reference for digital logic V - connected to 5V
3	Reset	Reset	Reset
4	+3V3	Power	+3V3 Power Rail
5	+5V	Power	+5V Power Rail
6	GND	Power	Ground
7	GND	Power	Ground
8	VIN	Power	Voltage Input
9	A0	Analog	Analog input 0 /GPIO
10	A1	Analog	Analog input 1 /GPIO
11	A2	Analog	Analog input 2 /GPIO
12	A3	Analog	Analog input 3 /GPIO
13	A4	Analog	Analog input 4 /GPIO
14	A5	Analog	Analog input 5 /GPIO
15	A6	Analog	Analog input 6 /GPIO
16	A7	Analog	Analog input 7 /GPIO
17	A8	Analog	Analog input 8 /GPIO
18	A9	Analog	Analog input 9 /GPIO
19	A10	Analog	Analog input 10 /GPIO
20	A11	Analog	Analog input 11 /GPIO
21	A12	Analog	Analog input 12 /GPIO
22	A13	Analog	Analog input 13 /GPIO
23	A14	Analog	Analog input 14 /GPIO
24	A15	Analog	Analog input 15 /GPIO

5.2 Digital

Pin	Function	Type	Description
1	D21/SCL	Digital Input/I2C	Digital input 21/I2C Dataline
2	D20/SDA	Digital Input/I2C	Digital input 20/I2C Dataline
3	AREF	Digital	Analog Reference Voltage
4	GND	Power	Ground
5	D13	Digital/GPIO	Digital input 13/GPIO
6	D12	Digital/GPIO	Digital input 12/GPIO
7	D11	Digital/GPIO	Digital input 11/GPIO
8	D10	Digital/GPIO	Digital input 10/GPIO
9	D9	Digital/GPIO	Digital input 9/GPIO
10	D8	Digital/GPIO	Digital input 8/GPIO
11	D7	Digital/GPIO	Digital input 7/GPIO
12	D6	Digital/GPIO	Digital input 6/GPIO
13	D5	Digital/GPIO	Digital input 5/GPIO
14	D4	Digital/GPIO	Digital input 4/GPIO

Pin	Function	Type	Description
15	D3	Digital/GPIO	Digital input 3/GPIO
16	D2	Digital/GPIO	Digital input 2/GPIO
17	D1/TX0	Digital/GPIO	Digital input 1 /GPIO
18	D0/Tx1	Digital/GPIO	Digital input 0 /GPIO
19	D14	Digital/GPIO	Digital input 14 /GPIO
20	D15	Digital/GPIO	Digital input 15 /GPIO
21	D16	Digital/GPIO	Digital input 16 /GPIO
22	D17	Digital/GPIO	Digital input 17 /GPIO
23	D18	Digital/GPIO	Digital input 18 /GPIO
24	D19	Digital/GPIO	Digital input 19 /GPIO
25	D20	Digital/GPIO	Digital input 20 /GPIO
26	D21	Digital/GPIO	Digital input 21 /GPIO



Arduino Mega 2560 Rev3 Pinout

5.3 ATMEGA16U2 JP5

Pin	Function	Type	Description
1	PB4	Internal	Serial Wire Debug
2	PB6	Internal	Serial Wire Debug
3	PB5	Internal	Serial Wire Debug
4	PB7	Internal	Serial Wire Debug

5.4 ATMEGA16U2 ICSP1

Pin	Function	Type	Description
1	CIPO	Internal	Controller In Peripheral Out
2	+5V	Internal	Power Supply of 5V
3	SCK	Internal	Serial Clock
4	COPI	Internal	Controller Out Peripheral In
5	RESET	Internal	Reset
6	GND	Internal	Ground

5.5 Digital Pins D22 - D53 LHS

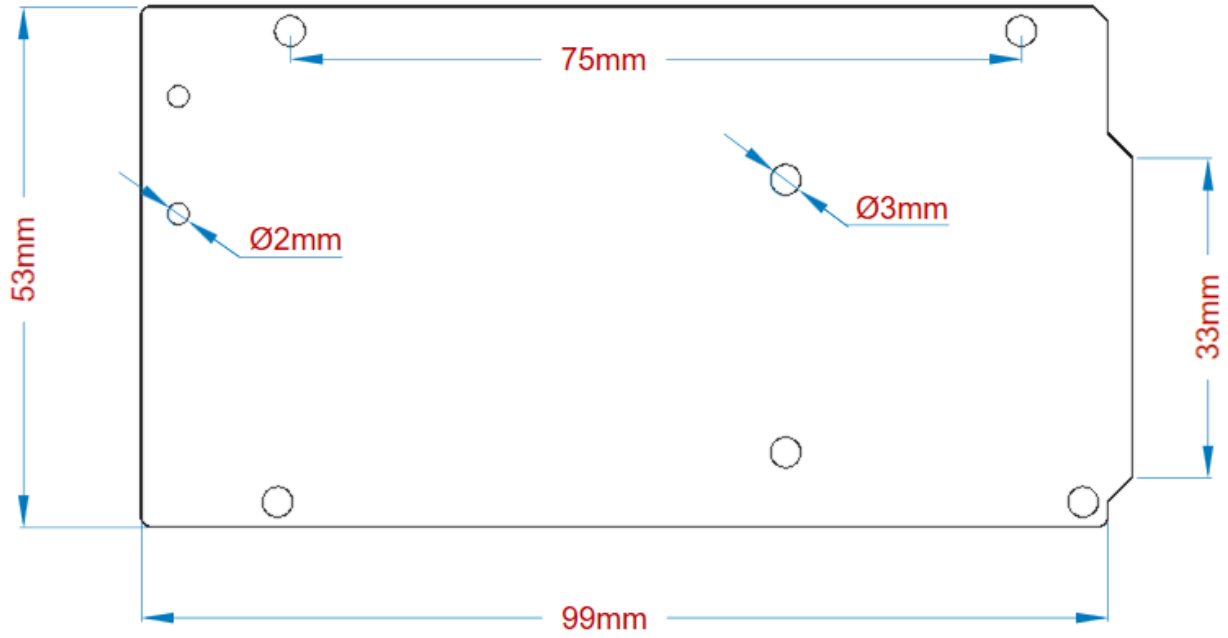
Pin	Function	Type	Description
1	+5V	Power	Power Supply of 5V
2	D22	Digital	Digital input 22/GPIO
3	D24	Digital	Digital input 24/GPIO
4	D26	Digital	Digital input 26/GPIO
5	D28	Digital	Digital input 28/GPIO
6	D30	Digital	Digital input 30/GPIO
7	D32	Digital	Digital input 32/GPIO
8	D34	Digital	Digital input 34/GPIO
9	D36	Digital	Digital input 36/GPIO
10	D38	Digital	Digital input 38/GPIO
11	D40	Digital	Digital input 40/GPIO
12	D42	Digital	Digital input 42/GPIO
13	D44	Digital	Digital input 44/GPIO
14	D46	Digital	Digital input 46/GPIO
15	D48	Digital	Digital input 48/GPIO
16	D50	Digital	Digital input 50/GPIO
17	D52	Digital	Digital input 52/GPIO
18	GND	Power	Ground

5.6 Digital Pins D22 - D53 RHS

Pin	Function	Type	Description
1	+5V	Power	Power Supply of 5V
2	D23	Digital	Digital input 23/GPIO
3	D25	Digital	Digital input 25/GPIO
4	D27	Digital	Digital input 27/GPIO
5	D29	Digital	Digital input 29/GPIO
6	D31	Digital	Digital input 31/GPIO
7	D33	Digital	Digital input 33/GPIO
8	D35	Digital	Digital input 35/GPIO
9	D37	Digital	Digital input 37/GPIO
10	D39	Digital	Digital input 39/GPIO
11	D41	Digital	Digital input 41/GPIO
12	D43	Digital	Digital input 43/GPIO
13	D45	Digital	Digital input 45/GPIO
14	D47	Digital	Digital input 47/GPIO
15	D49	Digital	Digital input 49/GPIO
16	D51	Digital	Digital input 51/GPIO
17	D53	Digital	Digital input 53/GPIO
18	GND	Power	Ground

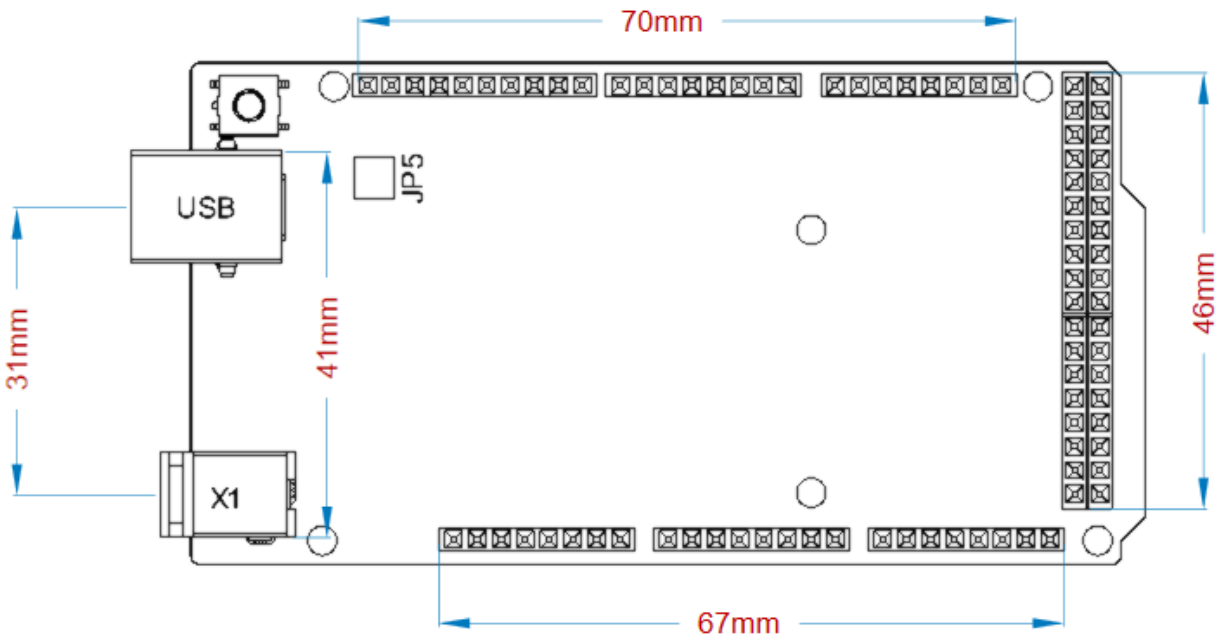
6 Mechanical Information

6.1 Board Outline



Arduino Mega 2560 Rev3 Outline

6.2 Board Mount Holes



Arduino Mega 2560 Rev3 Mount Holes

Certifications

7 Declaration of Conformity CE DoC (EU)

We declare under our sole responsibility that the products above are in conformity with the essential requirements of the following EU Directives and therefore qualify for free movement within markets comprising the European Union (EU) and European Economic Area (EEA).

8 Declaration of Conformity to EU RoHS & REACH 211 01/19/2021

Arduino boards are in compliance with RoHS 2 Directive 2011/65/EU of the European Parliament and RoHS 3 Directive 2015/863/EU of the Council of 4 June 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Substance	Maximum Limit (ppm)
Lead (Pb)	1000
Cadmium (Cd)	100
Mercury (Hg)	1000
Hexavalent Chromium (Cr6+)	1000
Poly Brominated Biphenyls (PBB)	1000
Poly Brominated Diphenyl ethers (PBDE)	1000
Bis(2-Ethylhexyl} phthalate (DEHP)	1000
Benzyl butyl phthalate (BBP)	1000
Dibutyl phthalate (DBP)	1000
Diisobutyl phthalate (DIBP)	1000

Exemptions : No exemptions are claimed.

Arduino Boards are fully compliant with the related requirements of European Union Regulation (EC) 1907 /2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). We declare none of the SVHCs (https://echa.europa.eu/web/guest/candidate-list-table), the Candidate List of Substances of Very High Concern for authorization currently released by ECHA, is present in all products (and also package) in quantities totaling in a concentration equal or above 0.1%. To the best of our knowledge, we also declare that our products do not contain any of the substances listed on the "Authorization List" (Annex XIV of the REACH regulations) and Substances of Very High Concern (SVHC) in any significant amounts as specified by the Annex XVII of Candidate list published by ECHA (European Chemical Agency) 1907 /2006/EC.

9 Conflict Minerals Declaration

As a global supplier of electronic and electrical components, Arduino is aware of our obligations with regards to laws and regulations regarding Conflict Minerals, specifically the Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 1502. Arduino does not directly source or process conflict minerals such as Tin, Tantalum, Tungsten, or Gold. Conflict minerals are contained in our products in the form of solder, or as a component in metal alloys. As part of our reasonable due diligence Arduino has contacted component suppliers within our supply chain to verify their continued compliance with the regulations. Based on the information received thus far we declare that our products contain Conflict Minerals sourced from conflict-free areas.

10 FCC Caution

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

(2) this device must accept any interference received, including interference that may cause undesired operation.

FCC RF Radiation Exposure Statement:

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2. This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment.
3. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

English: User manuals for licence-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both. This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

French: Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l' appareil nedoit pas produire de brouillage

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC SAR Warning:

English This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

French: Lors de l' installation et de l' exploitation de ce dispositif, la distance entre le radiateur et le corps est d 'au moins 20 cm.

Important: The operating temperature of the EUT can't exceed 85°C and shouldn't be lower than -40°C.

Hereby, Arduino S.r.l. declares that this product is in compliance with essential requirements and other relevant provisions of Directive 201453/EU. This product is allowed to be used in all EU member states.

11 Company Information

Company name	**Arduino S.r.l.**
Company Address	Arduino SRL, Via Andrea Appiani 25, 20900 Monza MB, Italy

12 Reference Documentation

Ref	**Link**
Arduino IDE (Desktop)	https://www.arduino.cc/en/Main/Software
Arduino Cloud Editor	https://create.arduino.cc/editor
Arduino Cloud Editor - Getting Started	https://docs.arduino.cc/arduino-cloud/guides/editor/
Arduino Website	https://www.arduino.cc/
Arduino Project Hub	https://create.arduino.cc/projecthub?by=part&part_id=11332&sort=trending
Library Reference	https://www.arduino.cc/reference/en/libraries/
Online Store	https://store.arduino.cc/

13 Revision History

Date	**Revision**	**Changes**
25/04/2024	3	Updated link to new Cloud Editor
09/10/2023	2	Updated recommended operating conditions
29/09/2020	1	First Release

中文（ZH）

描述

与 Arduino 的其他开发板相比，Arduino® Mega 2560 Rev3 是一款用于构建广泛应用的示范性开发板。该电路板内置 ATmega2560 微控制器，工作频率为 16 MHz。电路板包含 54 个数字输入/输出引脚、16 个模拟输入、4 个 UART（硬件串行端口）、一个 USB 连接、一个电源插孔、一个 ICSP 接头和一个复位按钮。

目标领域：

3D 打印、机器人、创客

特点

- **ATmega2560 处理器**
  - 在 16MHz 的工作频率下吞吐量高达 16 MIPS
  - 256k 字节（其中 8k 字节用于引导加载程序）
  - 4k 字节 EEPROM
  - 8k 字节内部 SRAM
  - 32 × 8 通用工作寄存器
  - 带有独立振荡器的实时计数器
  - 四个 8 位 PWM 通道
  - 4 个可编程串行 USART
  - 控制器/外设 SPI 串行接口
- **ATmega16U2**
  - 在 16MHz 的工作频率下吞吐量高达 16 MIPS
  - 16k 字节 ISP 闪存
  - 512 字节 EEPROM
  - 512 字节 SRAM
  - 仅支持 SPI 主设备模式和硬件流控制 (RTS/CTS) 的 USART
  - 主/从 SPI 串行接口
- **休眠模式**
  - 空闲模式
  - ADC 降噪模式
  - 节能模式
  - 掉电模式
  - 待机模式
  - 扩展待机模式
- **电源**
  - USB 连接

  - 外部交流/直流适配器
- **输入/输出**
  - 54 个数字输入/输出引脚
  - 16 个模拟输入
  - 15 个 PWM 输出

目录

14 电路板简介

Mega 2560 Rev3 是 Arduino Mega 的一款升级版电路板，专门用于需要大量输入输出引脚和需要高处理能力的应用和项目。与传统的 Arduino® UNO 电路板相比，尽管两款电路板外形尺寸相似，但 Mega 2560 Rev3 的输入输出引脚数量要多得多。

14.1 应用示例

- **机器人**： Mega 2560 Rev3 具有高处理能力，可以处理大量机器人应用。它与电机控制器扩展板兼容，能够同时控制多个电机，因此非常适合机器人应用。其大量的 I/O 引脚也能容纳许多机器人传感器。
- **3D 打印**： 算法在 3D 打印机的实施过程中发挥着重要作用。Mega 2560 Rev3 能够处理 3D 打印所需的复杂算法。此外，使用 Arduino IDE 可以轻松地对代码进行细微修改，因此可以根据用户要求定制 3D 打印程序。
- **Wi-Fi**： 该电路板集成无线功能，增强了应用的实用性。Mega 2560 Rev3 与 Wi-Fi® 扩展板兼容，因此可以为 3D 打印和机器人应用提供无线功能。

14.2 配件

14.3 相关产品

- Arduino® UNO R3
- Arduino® Nano
- Arduino® Due（不带接头）

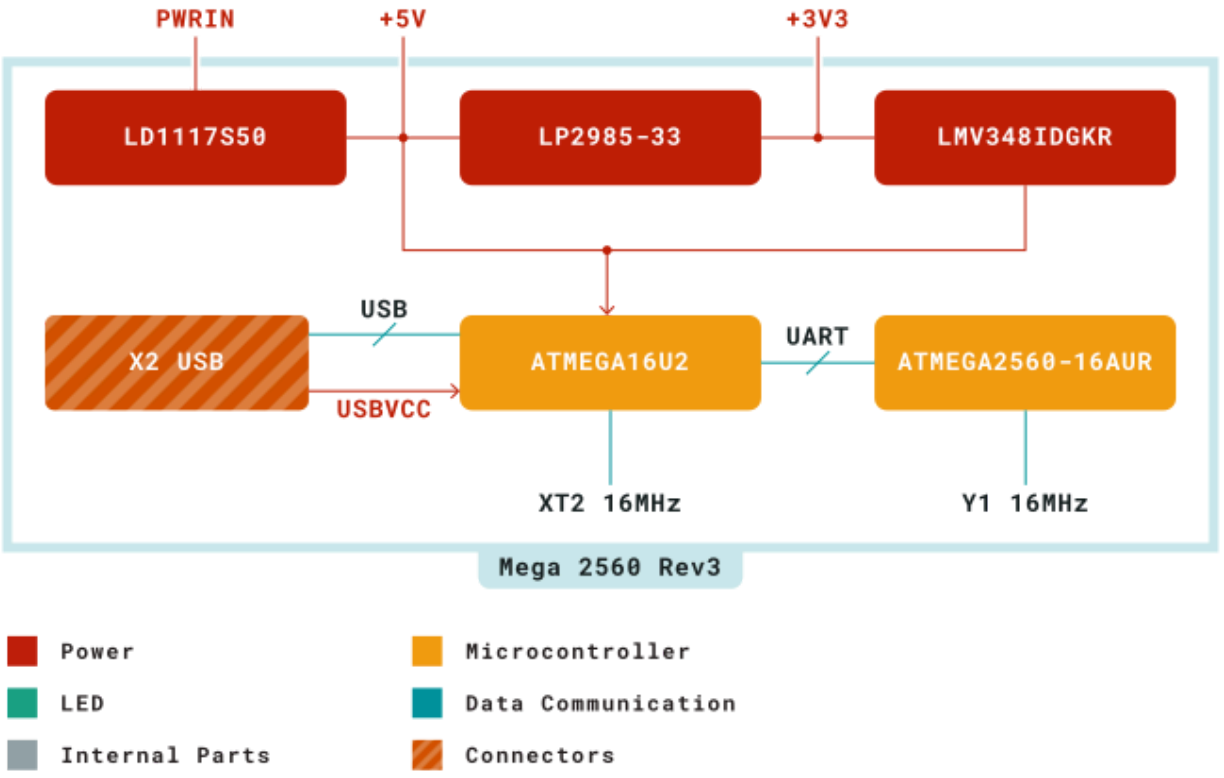
15 额定值

15.1 建议运行条件

符号	描述	最小值	典型值	最大值	单位
V_{IN}	来自 VIN 焊盘/DC 插孔的输入电压	7	7.0	12	V
V_{USB}	来自 USB 连接器的输入电压	4.8	5.0	5.5	V
T_{OP}	工作温度	-40	25	85	°C

16 功能概述

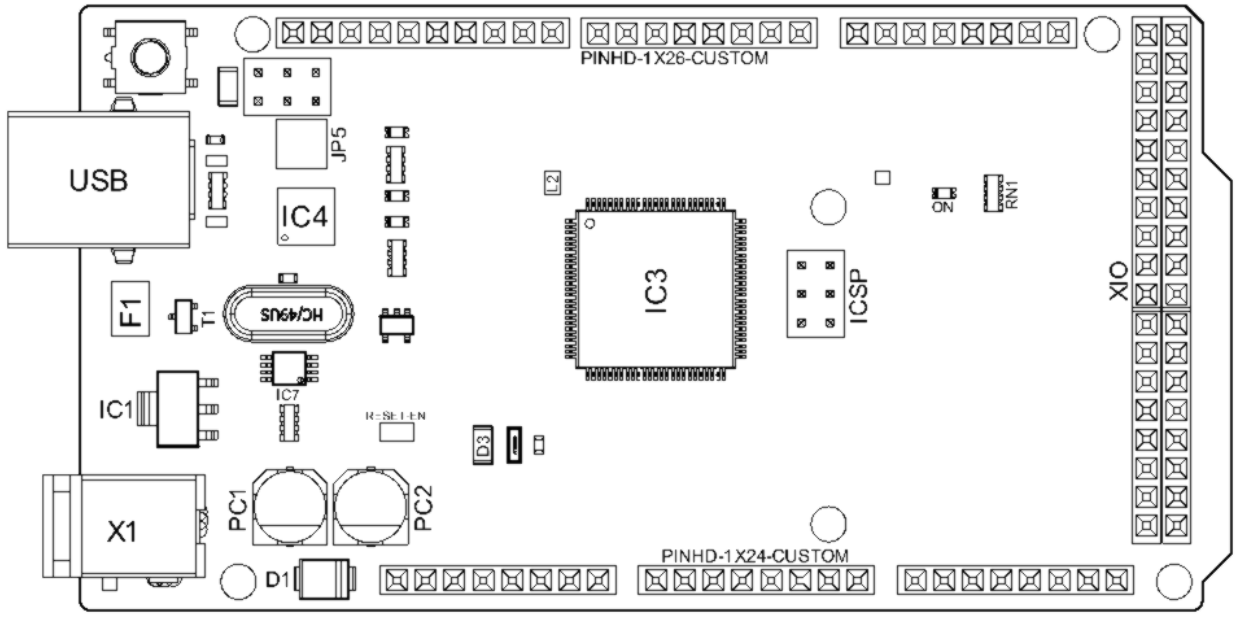
16.1 方框图



Arduino Mega 2560 Rev3 方框图

16.2 电路板拓扑结构

前视图



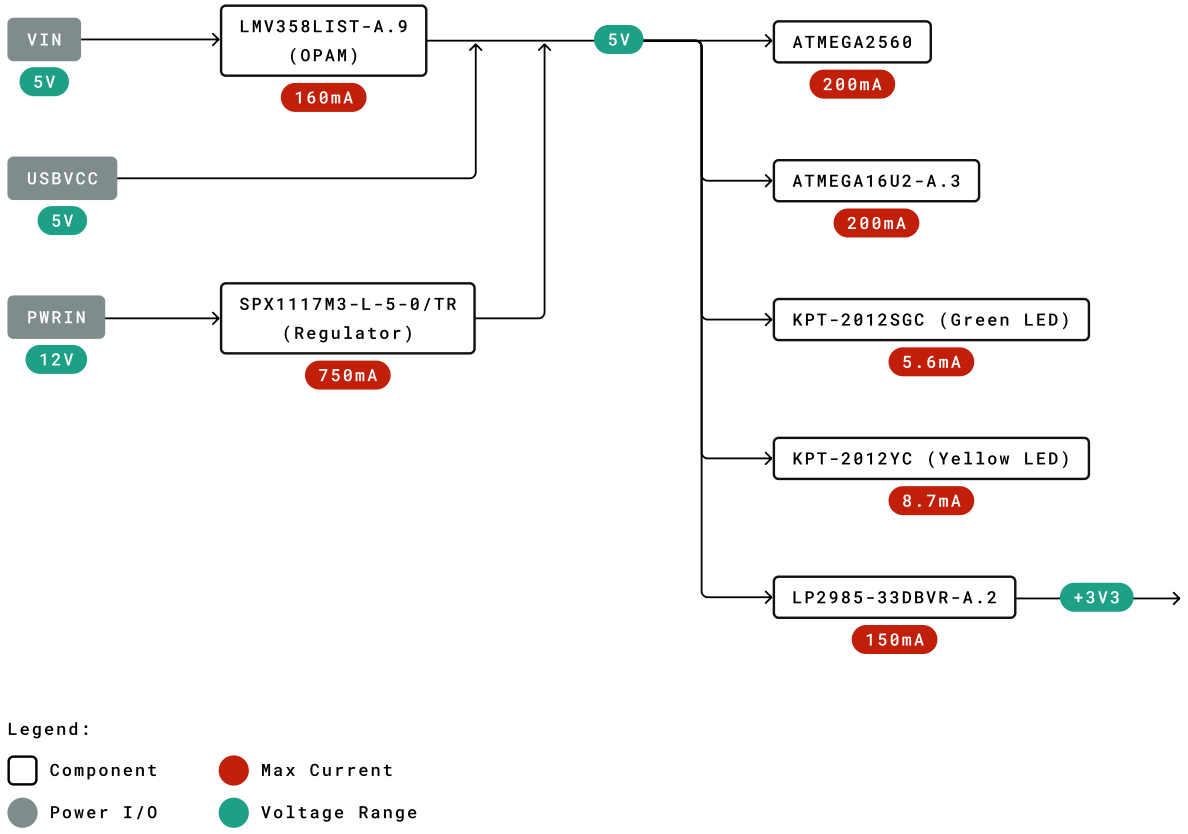
Arduino Mega 2560 Rev3 俯视图

编号	描述	编号	描述
USB	USB B 连接器	F1	片式电容器
IC1	5V 线性稳压器	X1	电源插孔连接器
JP5	电镀通孔	IC4	ATmega16U2 芯片
PC1	电解铝电容	PC2	电解铝电容
D1	通用整流器	D3	通用二极管
L2	固定电感器	IC3	ATmega2560 芯片
ICSP	连接器接头	ON	绿色 LED
RN1	电阻器阵列	XIO	连接器

16.3 处理器

Mega 2560 Rev3 电路板的主处理器是 ATmega2560 芯片，工作频率为 16 MHz。它提供了大量的输入和输出线路，可以连接许多外部设备。同时，由于它的 RAM 比其他处理器大得多，因此操作和处理速度不会减慢。该电路板上还配备一个 USB 串行处理器 ATmega16U2，它是 USB 输入信号与主处理器之间的接口。这增加了将外设连接到 Mega 2560 Rev3 电路板的灵活性。

16.4 电源树



Power Tree

17 电路板操作

17.1 入门指南 - IDE

如需在离线状态下对 Mega 2560 Rev3 进行编程，则需要安装 Arduino Desktop IDE **[1]** 若要将 Mega 2560 Rev3 连接到计算机，则需要使用 Type-B USB 电缆。如 LED 指示灯所示，该电缆还可以为电路板提供电源。

17.2 入门指南 - Arduino Cloud Editor

包括本电路板在内的所有 Arduino 电路板，都可以在 Arduino Cloud Editor **[2]**上开箱即用，只需安装一个简单的插件即可。

Arduino Cloud Editor 是在线托管的，因此它将始终提供最新功能并支持所有电路板。接下来**[3]**开始在浏览器上编码并将程序上传到您的电路板上。

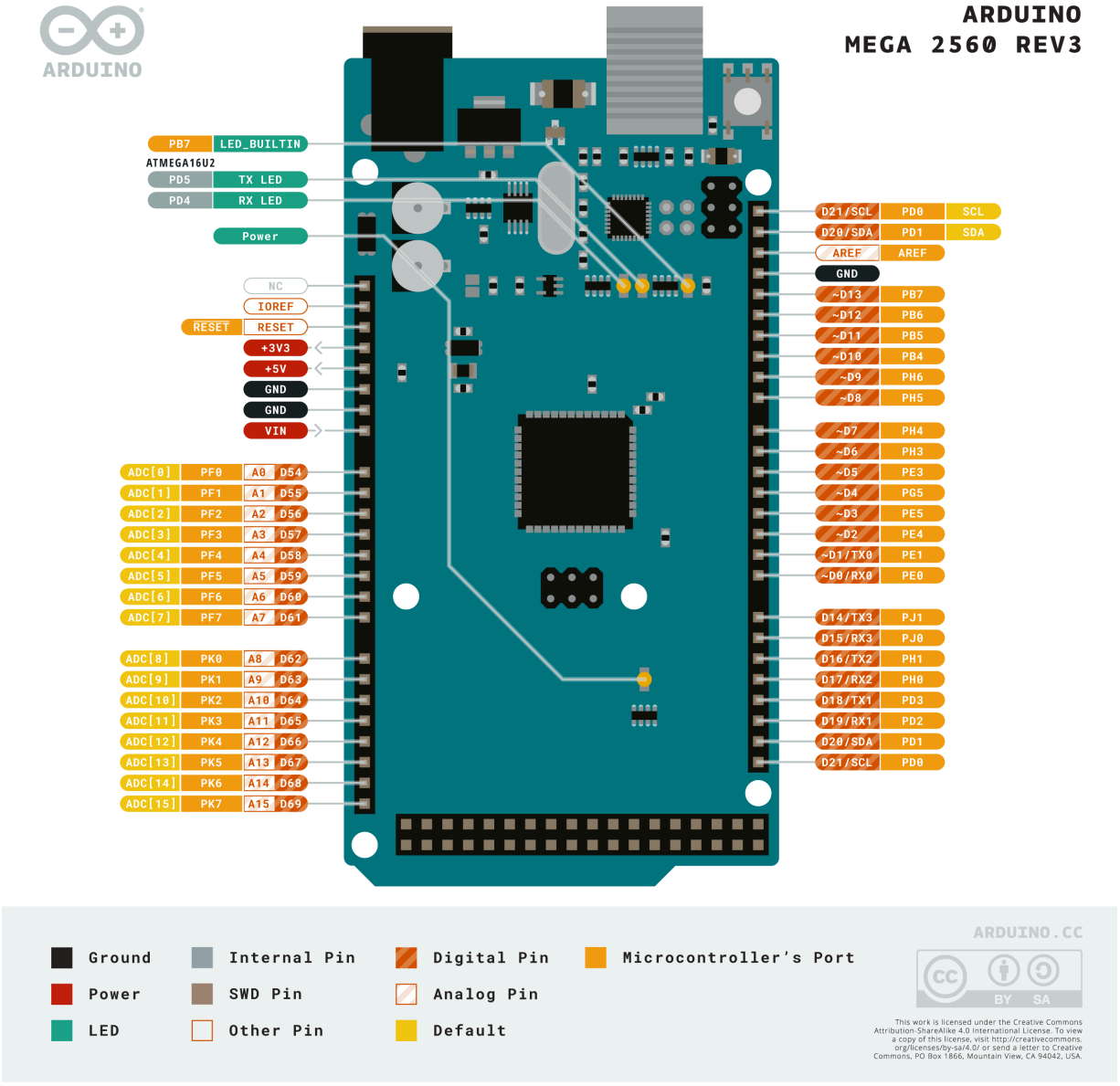
17.3 示例程序

Mega 2560 Rev3 的示例程序可以在 Arduino IDE 的“示例”菜单或 Arduino 网站 **[4]** 的“文档”部分找到。

17.4 在线资源

现在，您已经了解该电路板的基本功能，就可以通过查看 Arduino Project Hub **[5]**、Arduino Library Reference **[6]** 和在线商店 **[7]** 上的精彩项目来探索它所提供的无限可能性；在这些项目中，您可以为电路板配备传感器、执行器等。

18 连接器引脚布局



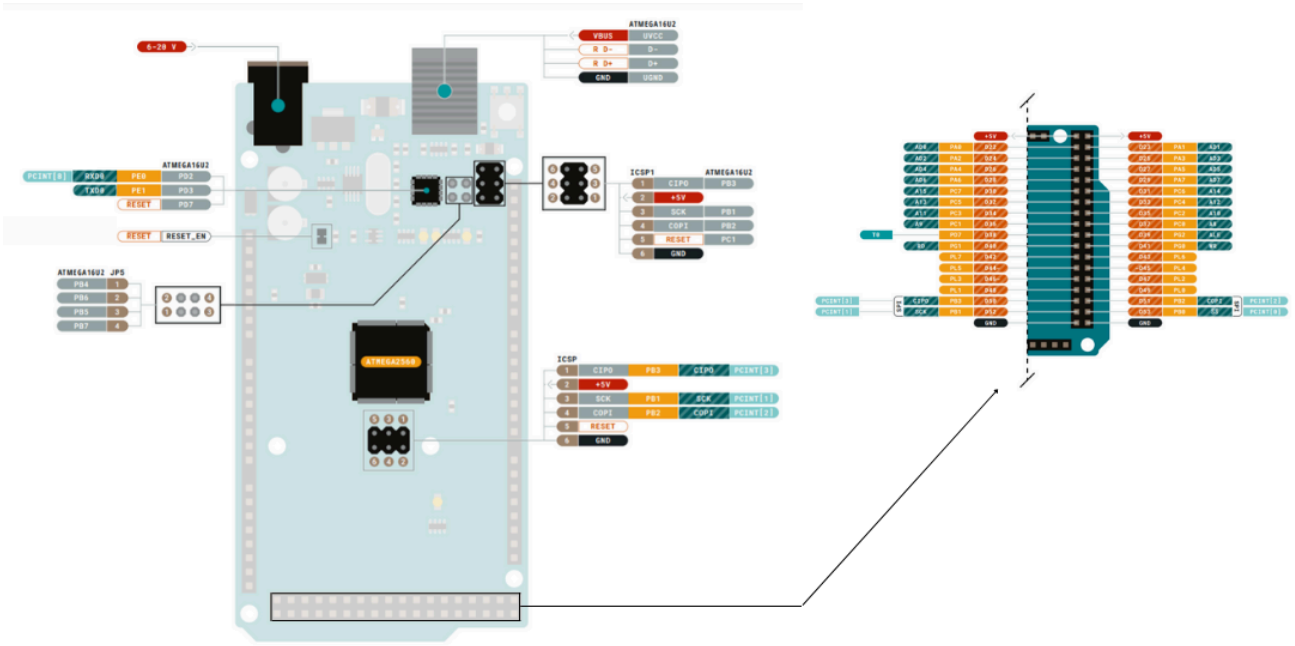
Arduino Mega 2560 Rev3 引脚布局

18.1 模拟

引脚	功能	类型	描述
1	NC	NC	未连接
2	IOREF	IOREF	数字逻辑参考电压 V - 连接至 5V
3	Reset	复位	复位
4	+3V3	电源	+3V3 电源轨
5	+5V	电源	+5V 电源轨
6	GND	电源	接地
7	GND	电源	接地
8	VIN	电源	电压输入
9	A0	模拟	模拟输入0 / GPIO
10	A1	模拟	模拟输入1 / GPIO
11	A2	模拟	模拟输入2 / GPIO
12	A3	模拟	模拟输入3 / GPIO
13	A4	模拟	模拟输入4 / GPIO
14	A5	模拟	模拟输入5 / GPIO
15	A6	模拟	模拟输入6 / GPIO
16	A7	模拟	模拟输入7 / GPIO
17	A8	模拟	模拟输入8 / GPIO
18	A9	模拟	模拟输入9 / GPIO
19	A10	模拟	模拟输入10 / GPIO
20	A11	模拟	模拟输入11 / GPIO
21	A12	模拟	模拟输入12 / GPIO
22	A13	模拟	模拟输入13 / GPIO
23	A14	模拟	模拟输入14 / GPIO
24	A15	模拟	模拟输入15 / GPIO

18.2 数字

引脚	功能	类型	描述
1	D21/SCL	数字输入/I2C	数字输入 21/I2C 数据线
2	D20/SDA	数字输入/I2C	数字输入 20/I2C 数据线
3	AREF	数字	模拟参考电压
4	GND	电源	接地
5	D13	数字/GPIO	数字输入 13/GPIO
6	D12	数字/GPIO	数字输入 12/GPIO
7	D11	数字/GPIO	数字输入 11/GPIO
8	D10	数字/GPIO	数字输入 10/GPIO
9	D9	数字/GPIO	数字输入 9/GPIO
10	D8	数字/GPIO	数字输入 8/GPIO
11	D7	数字/GPIO	数字输入 7/GPIO
12	D6	数字/GPIO	数字输入 6/GPIO
13	D5	数字/GPIO	数字输入 5/GPIO
14	D4	数字/GPIO	数字输入 4/GPIO
15	D3	数字/GPIO	数字输入 3/GPIO
16	D2	数字/GPIO	数字输入 2/GPIO
17	D1/TX0	数字/GPIO	数字输入 1/GPIO
18	D0/Tx1	数字/GPIO	数字输入 0/GPIO
19	D14	数字/GPIO	数字输入 14 /GPIO
20	D15	数字/GPIO	数字输入 15 /GPIO
21	D16	数字/GPIO	数字输入 16 /GPIO
22	D17	数字/GPIO	数字输入 17 /GPIO
23	D18	数字/GPIO	数字输入 18 /GPIO
24	D19	数字/GPIO	数字输入 19/GPIO
25	D20	数字/GPIO	数字输入 20/GPIO
26	D21	数字/GPIO	数字输入 21/GPIO



Arduino Mega 2560 Rev3 引脚布局

18.3 ATMEGA16U2 JP5

引脚	功能	类型	描述
1	PB4	内部	串行线调试
2	PB6	内部	串行线调试
3	PB5	内部	串行线调试
4	PB7	内部	串行线调试

18.4 ATMEGA16U2 ICSP1

引脚	功能	类型	描述
1	CIPO	内部	控制器输入外设输出
2	+5V	内部	5 V的电源
3	SCK	内部	串行时钟
4	COPI	内部	控制器输出外设输入
5	RESET	内部	复位
6	GND	内部	接地

18.5 数字引脚 D22 - D53 LHS

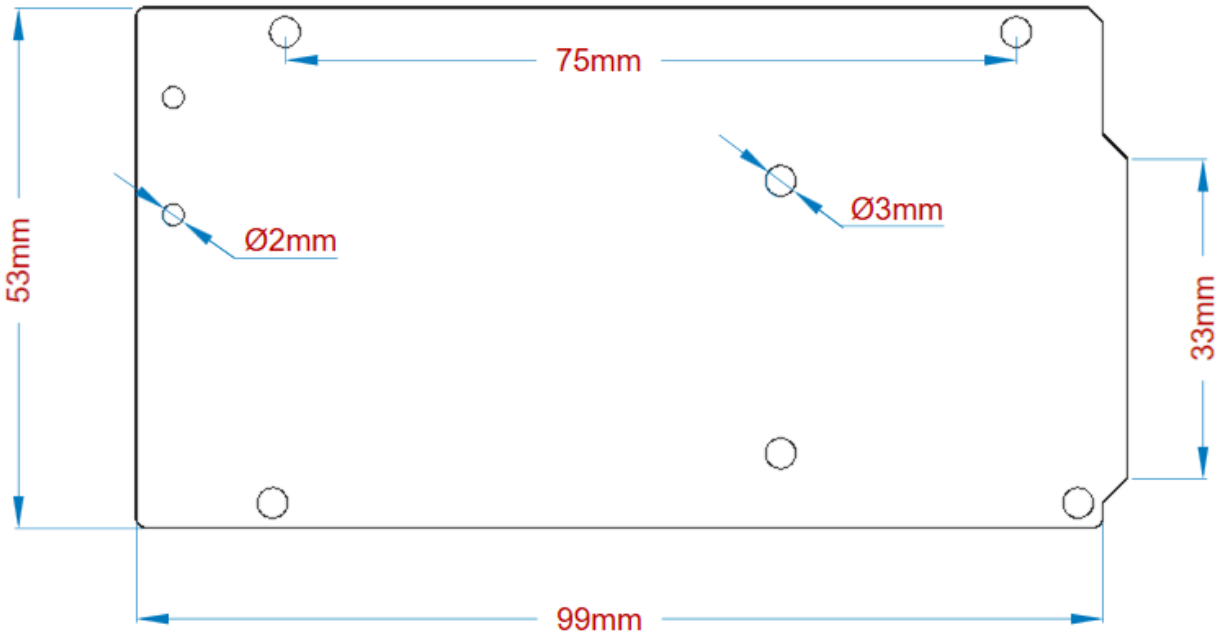
引脚	功能	类型	描述
1	+5V	电源	5 V的电源
2	D22	数字	数字输入 22/GPIO
3	D24	数字	数字输入 24/GPIO
4	D26	数字	数字输入 26/GPIO
5	D28	数字	数字输入 28/GPIO
6	D30	数字	数字输入 30/GPIO
7	D32	数字	数字输入 32/GPIO
8	D34	数字	数字输入 34/GPIO
9	D36	数字	数字输入 36/GPIO
10	D38	数字	数字输入 38/GPIO
11	D40	数字	数字输入 40/GPIO
12	D42	数字	数字输入 42/GPIO
13	D44	数字	数字输入 44/GPIO
14	D46	数字	数字输入 46/GPIO
15	D48	数字	数字输入 48/GPIO
16	D50	数字	数字输入 50/GPIO
17	D52	数字	数字输入 52/GPIO
18	GND	电源	接地

18.6 数字引脚 D22 - D53 LHS

引脚	功能	类型	描述
1	+5V	电源	5 V的电源
2	D23	数字	数字输入 23/GPIO
3	D25	数字	数字输入 25/GPIO
4	D27	数字	数字输入 27/GPIO
5	D29	数字	数字输入 29/GPIO
6	D31	数字	数字输入 31/GPIO
7	D33	数字	数字输入 33/GPIO
8	D35	数字	数字输入 35/GPIO
9	D37	数字	数字输入 37/GPIO
10	D39	数字	数字输入 39/GPIO
11	D41	数字	数字输入 41/GPIO
12	D43	数字	数字输入 43/GPIO
13	D45	数字	数字输入 45/GPIO
14	D47	数字	数字输入 47/GPIO
15	D49	数字	数字输入 49/GPIO
16	D51	数字	数字输入 51/GPIO
17	D53	数字	数字输入 53/GPIO
18	GND	电源	接地

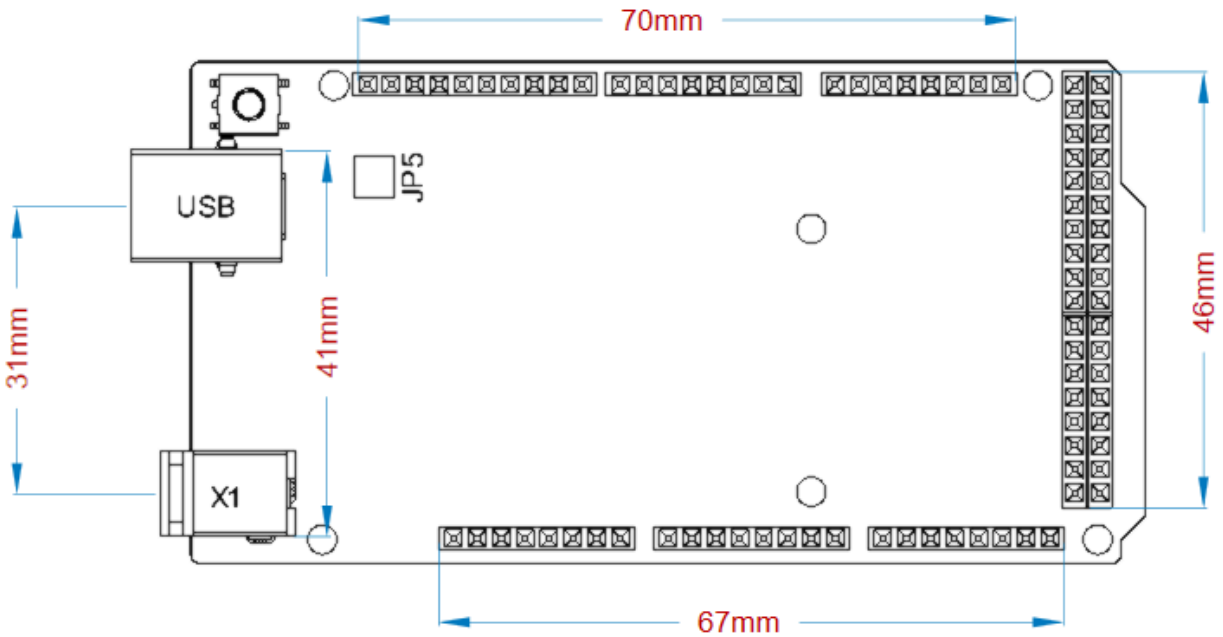
19 机械层信息

19.1 电路板外形图



Arduino Mega 2560 Rev3 外形图

19.2 电路板安装孔



Arduino Mega 2560 Rev3 安装孔

认证

20 符合性声明 CE DoC（欧盟）

我们在此郑重声明，上述产品符合以下欧盟指令的基本要求，因此有资格在包括欧盟（EU）和欧洲经济区（EEA）在内的市场内自由流通。

21 声明符合欧盟 RoHS 和 REACH 211 01/19/2021

Arduino 电路板符合欧洲议会关于限制在电子电气设备中使用某些有害物质的 RoHS 2 指令 2011/65/EU 和欧盟理事会于 2015 年 6 月 4 日颁布的关于限制在电子电气设备中使用某些有害物质的 RoHS 3 指令 2015/863/EU。

物质	最大限值（ppm)
铅 (Pb)	1000
镉 (Cd)	100
汞 (Hg)	1000
六价铬（Cr6+）	1000
多溴联苯（PBB）	1000
多溴联苯醚（PBDE）	1000
邻苯二甲酸二(2-乙基己)酯 (DEHP)	1000
邻苯二甲酸丁苄酯 (BBP)	1000
邻苯二甲酸二丁酯（DBP）	1000
邻苯二甲酸二异丁酯（DIBP）	1000

豁免：未申请任何豁免。

Arduino 电路板完全符合欧盟法规 (EC) 1907/2006 中关于化学品注册、评估、许可和限制 (REACH) 的相关要求。我们声明，所有产品（包括包装）中的 SVHC (https://echa.europa.eu/web/guest/candidate-list-table), （欧洲化学品管理局目前发布的《高度关注物质候选授权清单》）含量总浓度均未超过 0.1%。据我们所知，我们还声明，我们的产品不含 ECHA（欧洲化学品管理局）1907/2006/EC 公布的候选清单附件 XVII 中规定的“授权清单”（REACH 法规附件 XIV）和高度关注物质 (SVHC) 所列的任何物质。

22 冲突矿产声明

作为电子和电气元件的全球供应商，Arduino 意识到我们有义务遵守有关冲突矿产的法律法规，特别是《多德-弗兰克华尔街改革与消费者保护法案》第 1502 条。Arduino 不直接采购或加工锡、钽、钨或金等冲突矿物。冲突矿物以焊料的形式或作为金属合金的组成部分存在于我们的产品中。作为我们合理尽职调查的一部分，Arduino 已联系供应链中的元件供应商，以核实他们是否始终遵守法规的相关规定。根据迄今收到的信息，我们声明我们的产品中含有来自非冲突地区的冲突矿物。

23 FCC 警告

任何未经合规性负责方明确批准的更改或修改都可能导致用户无权操作设备。

本设备符合 FCC 规则第 15 部分的规定。操作须满足以下两个条件：

(1) 此设备不会造成有害干扰

(2) 此设备必须接受接收到的任何干扰，包括可能导致不良操作的干扰。

FCC 射频辐射暴露声明：

1. 此发射器不得与任何其他天线或发射器放置在同一位置或同时运行。
2. 此设备符合为非受控环境规定的射频辐射暴露限值。
3. 安装和操作本设备时，辐射源与您的身体之间至少应保持 20 厘米的距离。

English: User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

French: Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l' appareil nedoit pas produire de brouillage

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC SAR警告：

English This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

French: Lors de l' installation et de l' exploitation de ce dispositif, la distance entre le radiateur et le corps est d 'au moins 20 cm.

重要提示： EUT 的工作温度不能超过 85°C，也不能低于 -40°C。

Arduino S.r.l. 特此声明，本产品符合 201453/EU 指令的基本要求和其他相关规定。本产品允许在所有欧盟成员国使用。

24 公司信息

公司名称	Arduino S.r.l.
公司地址	Via Andrea Appiani 25, 20900 MONZA MB, Italy

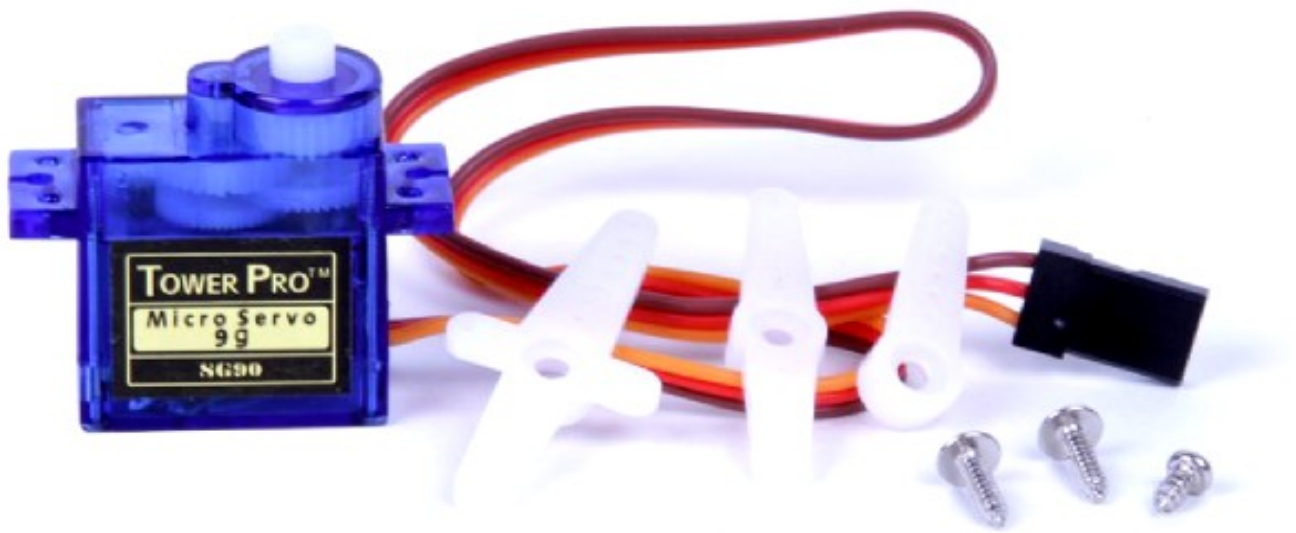
25 参考资料

参考资料	链接
Arduino IDE (Desktop)	https://www.arduino.cc/en/Main/Software
Arduino Cloud Editor	https://create.arduino.cc/editor
Arduino Cloud Editor - 入门指南	https://docs.arduino.cc/arduino-cloud/guides/editor/
Arduino 网站	https://www.arduino.cc/
Arduino Project Hub	https://create.arduino.cc/projecthub?by=part&part_id=11332&sort=trending
库参考	https://www.arduino.cc/reference/en/libraries/
在线商店	https://store.arduino.cc/

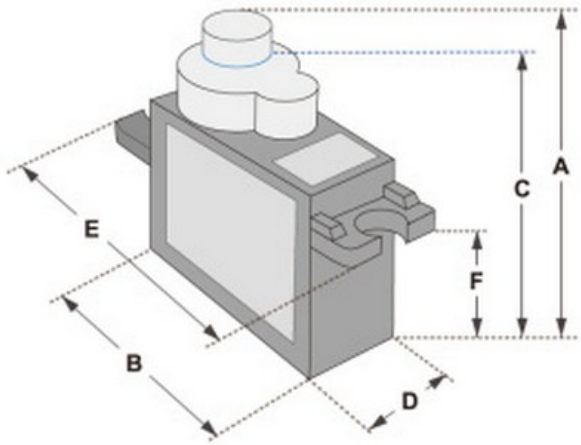
26 修订记录

日期	版次	变更
25/04/2024	3	新的 Cloud Editor 的更新链接
09/10/2023	2	更新的建议运行条件
29/09/2020	1	首次发布

SERVO MOTOR SG90 DATA SHEET



Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.



Dimensions & Specifications
A (mm) : 32
B (mm) : 23
C (mm) : 28.5
D (mm) : 12
E (mm) : 32
F (mm) : 19.5
Speed (sec) : 0.1
Torque (kg-cm) : 2.5
Weight (g) : 14.7
Voltage : 4.8 - 6

Position "0" (1.5 ms pulse) is middle, "90" (~2ms pulse) is middle, is all the way to the right, "-90" (~1ms pulse) is all the way to the left.