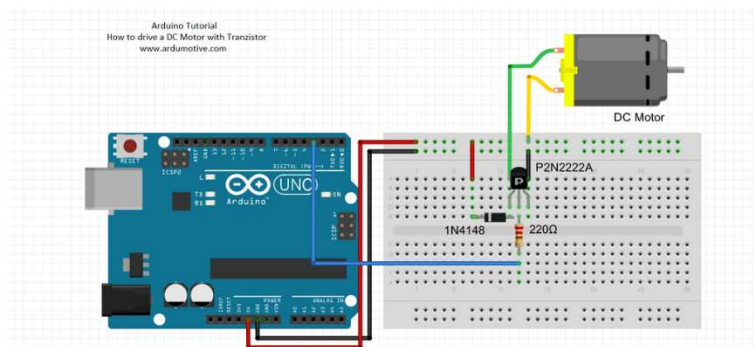


NPN-transistor as a motorcontroller

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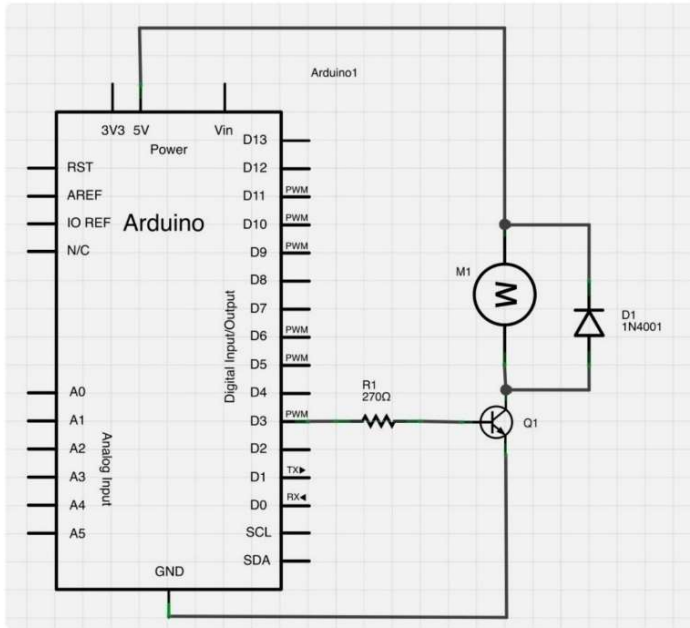


To drive a DC motor, you need a larger amount of current than Arduino board can give. For that reason, you must use a transistor. Transistors have limits and maximum specs, just be sure those values are enough for your use.

The transistor we are using for this tutorial is P2N2222A and is rated at 40V and 200mA, it just perfect for one toy dc motor.

Note: If your motor needs more current than 200mA you can just buy another transistor (ask the staff in the electronics store). The connections below are the same ;-)

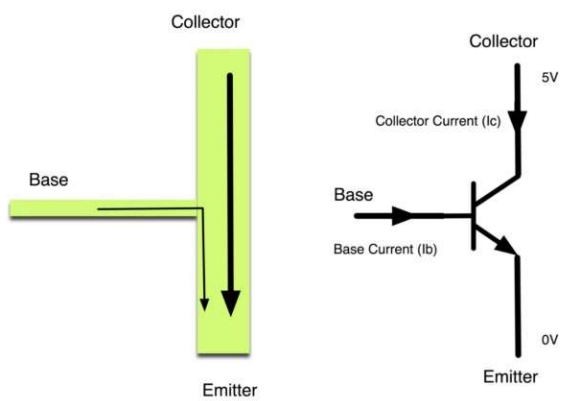
In this tutorial we will spin a dc motor from one direction, with different speed. You will be able to control motor speed from serial monitor!



Parts

For this tutorial you will need:

- Arduino uno
- Breadboard
- 220 Ohm resistor
- Transistor P2N2222A
- Diode 1N4148
- DC Motor



Wiring

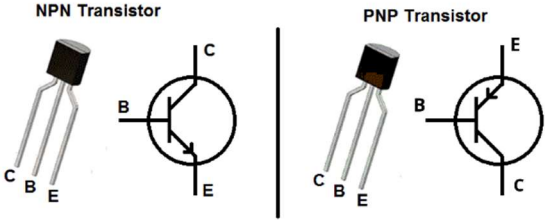
The connections are easy, see the image above with the breadboard circuit schematic.

Diode in circuit:

It is possible, when motor is spinning, suddenly turn off because the magnetic field inside it collapses, generating a voltage spike. This can damage the transistor, to prevent this, we use a diode which diverts the voltage spike around the transistor.

Transistor Pinout: NPN type - front side view (min. 40v, 0,5-2a):

- Collector
- Base
- Emitter



Code

```
//Transistor 'Base' pin or input pin of motor driver ic to Arduino PWM Digital Pin 3
const int motorPin = 3;

int Speed; //Variable to store Speed, by default 0 PWM
int flag;

void setup() {
    pinMode(motorPin, OUTPUT); //Set pin 3 as an OUTPUT
    Serial.begin(9600); //Init serial communication
    //Print a message:
    Serial.println("Give a number from 50 to 255."); //Why minimum value 50? Because with
values below 50 the motor doesn't spin ;)
    Serial.println(""); //Blank line
}

void loop() {
    //Check if incoming data is available:
    if (Serial.available() > 0)
    {
        // If it is, we'll use parseInt() to pull out only numbers:
        Speed = Serial.parseInt();
        flag=0;
    }

    //Valid range is from 50 to 255
    if (Speed>=50 && Speed<=255){
        //Send PWM value with analogWrite to pin 3 and print message to serial monitor
        analogWrite(motorPin, Speed);
        //Print message only once
        if (flag==0){
            //Print PWM value
            Serial.print("Motor spinning with ");
            Serial.print(Speed);
            Serial.println(" PWM");
            flag=1;
        }
    }

    delay(1000);
}
```

BC547 transistor NPN

De BC547 is een NPN bipolaire junctie-transistor (BJT) voor algemeen gebruik. Deze transistor is goedkoop, algemeen verkrijgbaar en voldoende robuust om te worden gebruikt voor experimenten en elektronica hobbyisten.

- Transistor Polarity NPN
- Collector Emitter Voltage VCBO 45V
- Collector-Base Voltage VCEO 50V
- Emitter-Base Voltage VEBO 6V
- DC Collector Current IC 100mA
- Transition Frequency fT 100Mhz

BC337-16

Behuizing: TO-92



Technische gegevens

Algemeen

- Type Low-power transistor, AF
- Technologie NPN
- Ontwerp TO-92

Elektrische gegevens

- Uceo 45 V
- Ic 0.8 A
- Ptot 0.625 W
- fT 200 MHz

Conrad: transistor (BJT) PN2222ATF TO-92-3, 1A 40V

Type PN2222ATF



• Behuizingssoort	TO-92-3
• Fabrikant	ON Semiconductor
• Kanalen	1
• Uitvoering	NPN
• Stroom	1A
• Collector-emitterspanning U(ceo)	40V
• VCE verzadiging (max.)	1V
• Collector reststroom I(ces)	10nA
• P_{tot}	625mW
• DC stroomversterking (hFE)	100
• DC stroomversterking hFE - referentiestroom	150mA
• DC stroomversterking hFE - referentiespanning	10V
• Transitiefrequentie f(t)	300MHz
• Montagewijze	Doorvoergat
• Type	PN2222ATF
• Behuizing	TO-92-3
• Soortnaam	Transistor (BJT) – discreet

Conrad: transistor (BJT) BD237 NPN, 2A 80V

Type BD237



• Behuizingssoort	SOT-32-3
• Fabrikant	STMicroelectronics
• Fabrikantcode	STM
• Kanalen	1
• Uitvoering	NPN
• Stroom	2A
• Collector-emitterspanning U(ceo)	80V
• VCE verzadiging (max.)	600mV
• Collector reststroom I(ces)	100μA
• P_{tot}	25W
• DC stroomversterking (hFE)	25
• DC stroomversterking hFE - referentiestroom	1A
• DC stroomversterking hFE - referentiespanning	2V
• Montagewijze	Doorvoergat
• Soortnaam	Transistor (BJT) - discreet