Embedded Computer Design

(DISEÑO DE COMPUTADORES EMPOTRADOS)

Course 2017/18

Introduction to Actuators
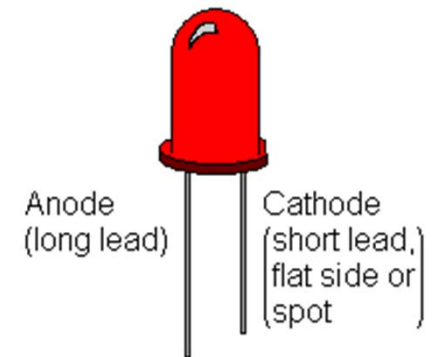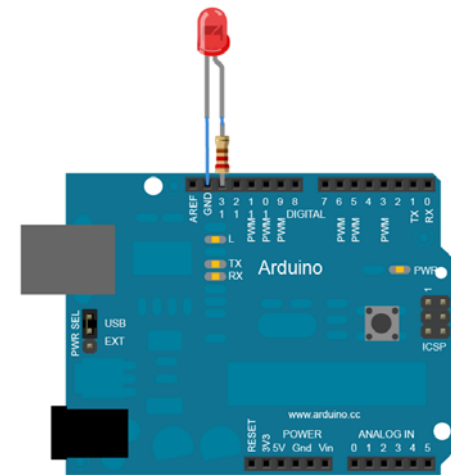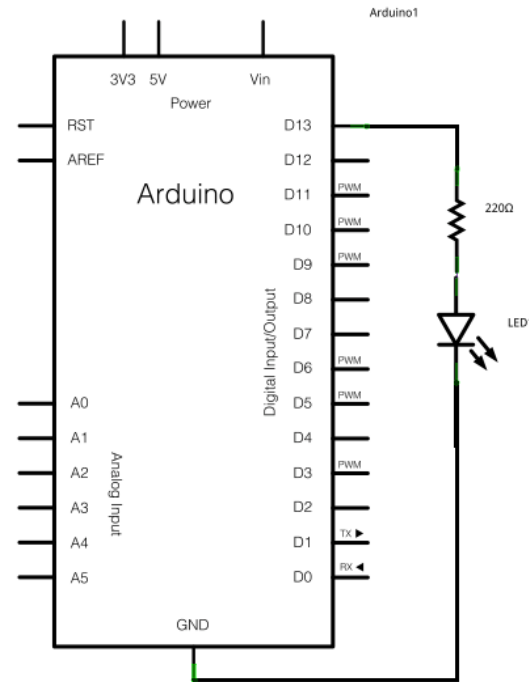
Professors:

- Arturo Morgado Estévez
- Mirian Cifredo Chacón

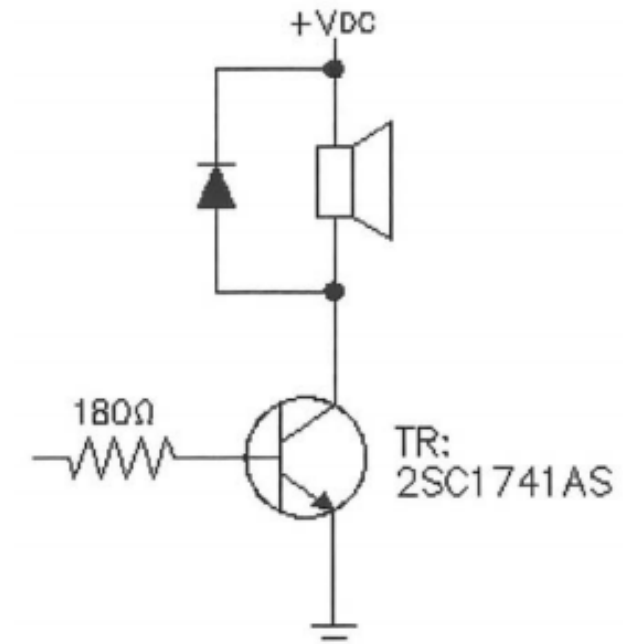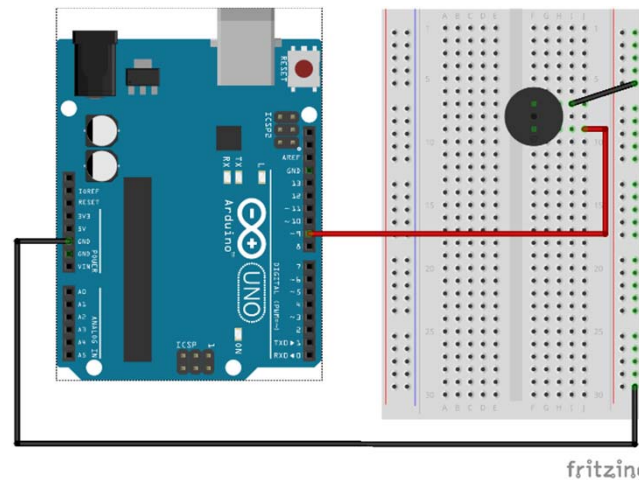### Computer Engineering Degree

Introduction to Actuators

- Basics Components. LED.

Introduction to Actuators

- Piezo Speaker - PC Mount 12mm 2.048kHz

  - This is a small 12mm round speaker that operates around the audible 2kHz range. You can use these speakers to create simple music or user interfaces.

    - http://www.sparkfun.com/datasheets/Components/CEM-1203.pdf

Introduction to Actuators

- 7-Segment Serial Display

  ◦ 4 digit blue alpha-numeric display with TTL, SPI or I2C Serial Interface

  ◦ Display numbers, most letters, and a few special characters

  ◦ Individual control of decimal points, apostrophe, and colon

  ◦ Selectable baud rate

  ◦ Selectable brightness

  ◦ Baud rate and brightness values retained in non-volatile memory

  ◦ Individual segment control for each digit

  ◦ http://www.sparkfun.com/datasheets/Components/LED/7-Segment/SFE-0012-DS-7segmentSerial-v41.pdf
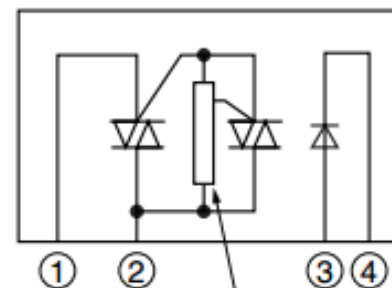
Introduction to Actuators

- Relay SPDT Sealed.

  - These are high quality Single Pole - Double Throw (SPDT) sealed relays. Use them to switch high voltage, and/or high current devices.

  - This relay's coil is rated up to 12V, with a minimum switching voltage of 5V. The contacts are rated up to 5A (@250VAC, 30VDC).

  - Features:

  - 5V DC SPDT Relay

  - Rated up to 5A

  - Fully SealedFEATURES

  - 5A switching capability

  - SPDT configuration

  - Power consumption of 200mW

  - Standard PCB layout

  - http://www.sparkfun.com/datasheets/Components/General/JZC-11F-05VDC-1Z%20EN.pdf
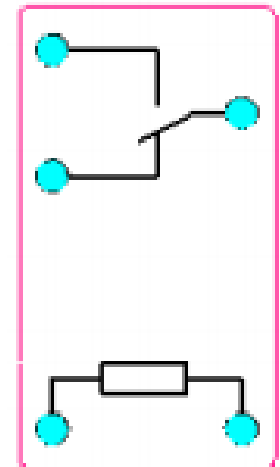
Introduction to Actuators

- Solid State Relay

  ◦ An IC that acts like a mechanical relay. They allow you to control high-voltage AC loads from lower voltage DC control circuitry. They can be switched by a much lower voltage and at a much lower current than most mechanical relays.

  ◦ http://dlnmh9ip6v2uc.cloudfront.net/datasheets/Components/General%20IC/S108,208T02%20Series.pdf

① Output (Triac T1)
② Output (Triac T2)
③ Input (+)
④ Input (−)

Zero Crossing Circuit

Introduction to Actuators

- 10:1 Micro Metal Gearmotor.

  - Features for 6V

    - Ratio   10:1

    - Free Run RPM: 3000

    - Free Run Current: 120mA

    - Stall Current: 1600mA

    - stall torque (oz-in / kg-cm): 4 / 0.3

    - weight> (oz / g): 0.35 / 10

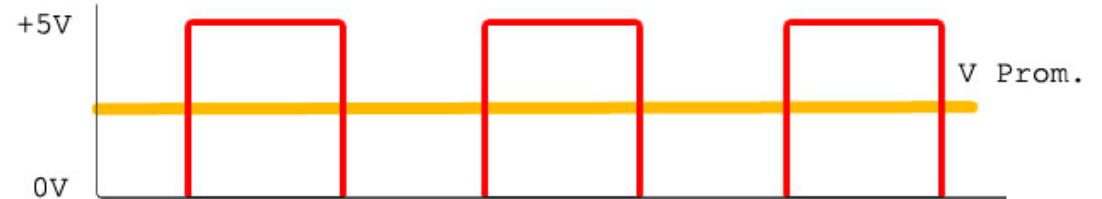   - Size (mm): 1.42" x 0.39" x 0.47"
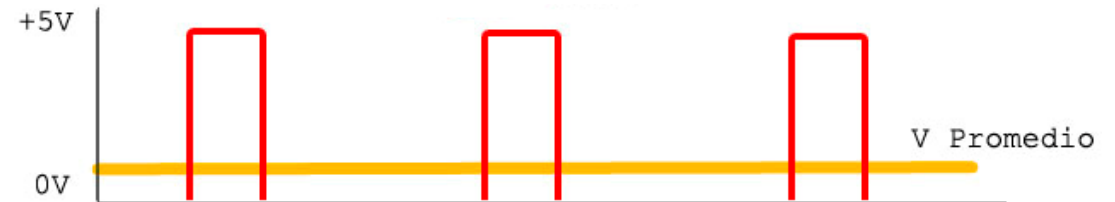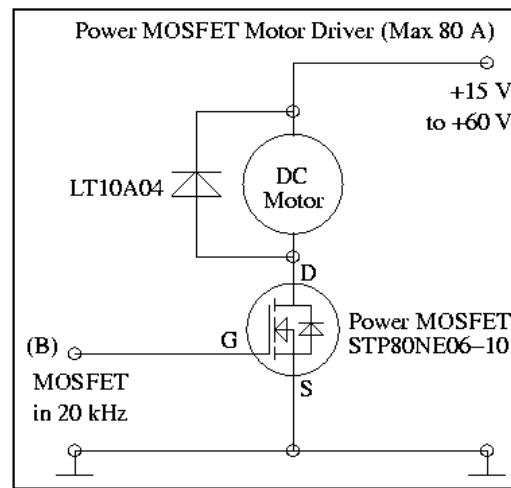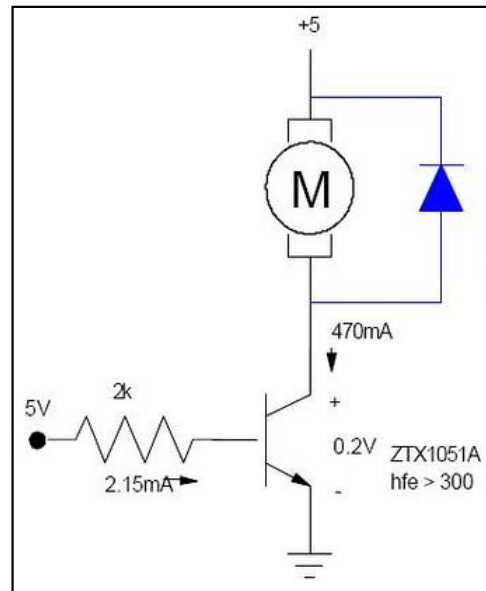
    - Weight: 0.35oz / 10g

Introduction to Actuators

- MOTOR DC 37X57MM - 100:1

  ◦ 100:1 gear ratio

  ◦ 6mm shaft diameter

  ◦ 100rpm free run speed

  ◦ 300mA free run current

  ◦ 5000mA stall current

  ◦ 16kg.cm stall torque

  ◦ - See more at: http://www.robotpark.com/Pololu-100-1-Metal-Gearmotor-37Dx57L-mm#sthash.Rm5h8apI.dpuf
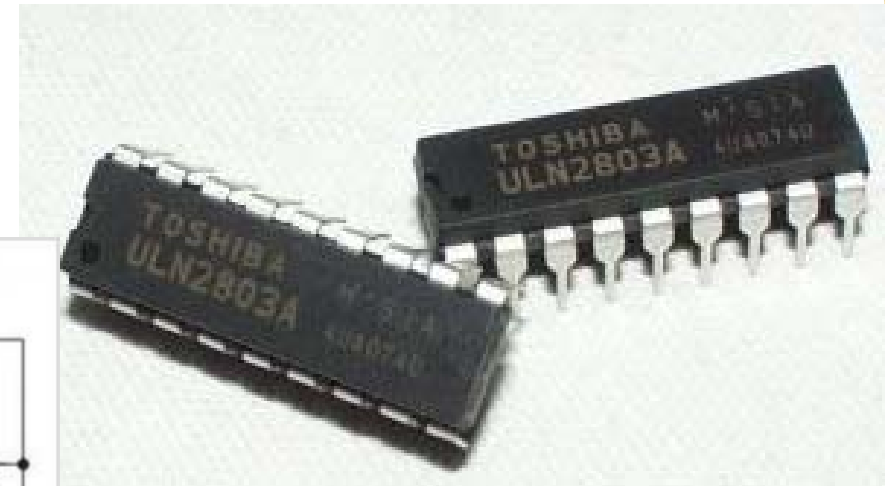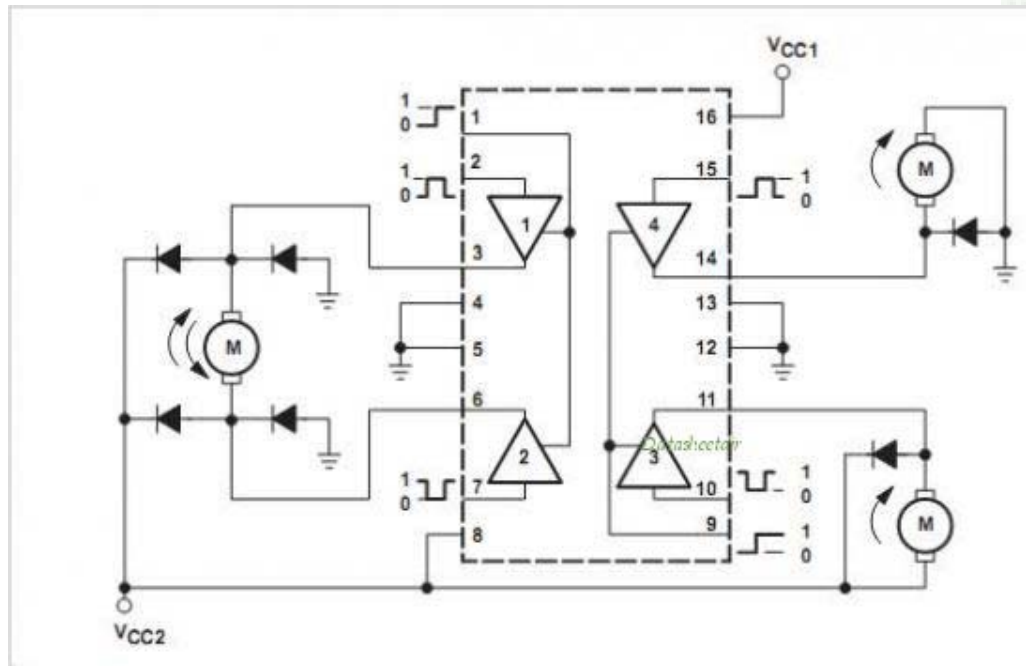
Introduction to Actuators

- Control of DC motors with transistors.
  - PWM (Pulse Width Modulation)

Introduction to Actuators

- DRIVER DARLINGTON 4-CHANNEL - SN754410 – DIP
  - IC SUPPLY VOLTAGE RANGE - VCC1: 4.5 - 5.5V
  - MOTOR SUPPLY VOLTAGE RANGE - VCC2: 4.5 - 36V
 - 1A CONTINUOUS OUTPUT CURRENT PER BRIDGE

Introduction to Actuators

- ULN2803A DARLINGTON TRANSISTOR ARRAYS

    ◦ 500-MA-RATED COLLECTOR CURRENT

    ◦ HIGH-VOLTAGE OUTPUTS: 50 V

    ◦ OUTPUT CLAMP DIODES

    ◦ INPUTS COMPATIBLE WITH VARIOUS TYPES OF LOGIC
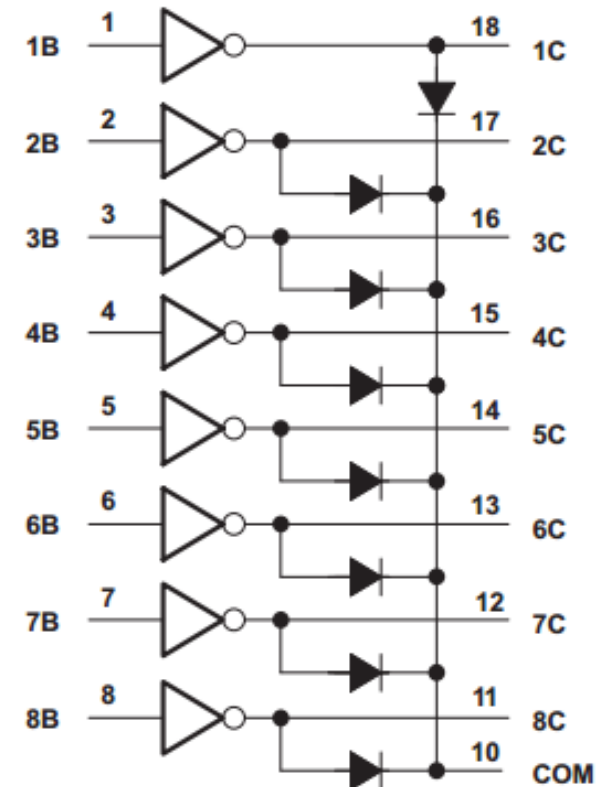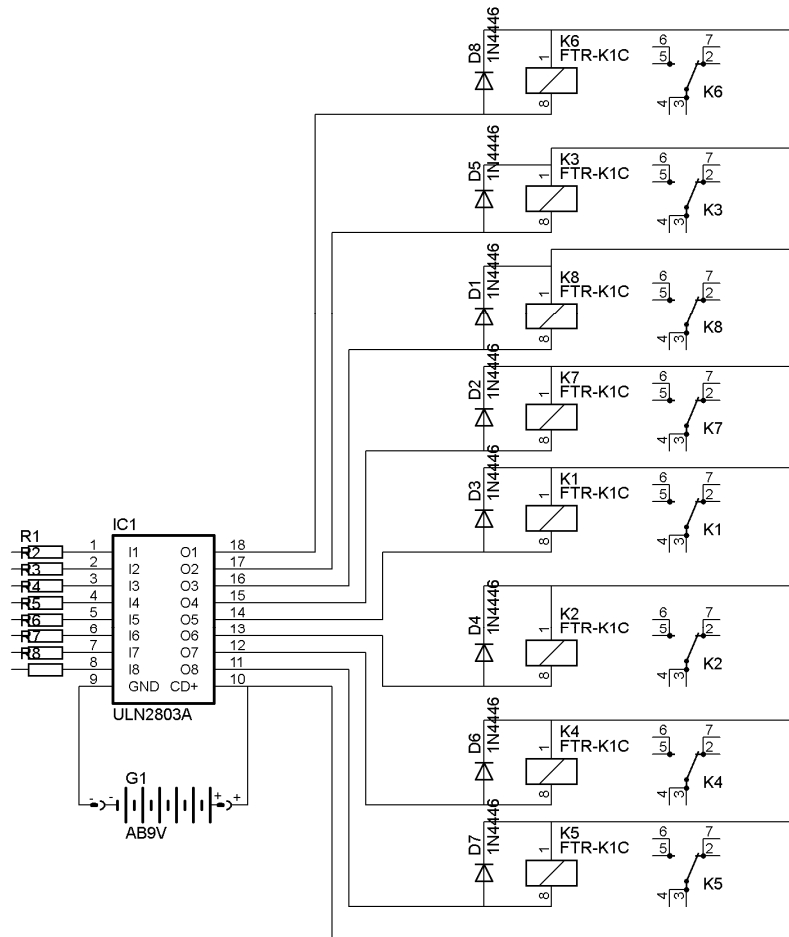
Introduction to Actuators

- ## L298N DUAL FULL-BRIDGE DRIVER
  - Driver: L298
  - Driver power supply: +5V~+46V
  - Driver Iout: 2A
  - Logic power output Vss: +5~+7V (internal supply +5V)
  - Logic current: 0~36mA
  - Controlling level: Low -0.3V~1.5V, high: 2.3V~Vss
  - Enable signal level: Low -0.3V~1.5V, high: 2.3V~Vss
  - Max power: 25W (Temperature 75 cesus)
  - Working temperature: -25C~+130C
  - Dimension: 60mm*54mm
  - Driver weight: ~48g

Introduction to Actuators
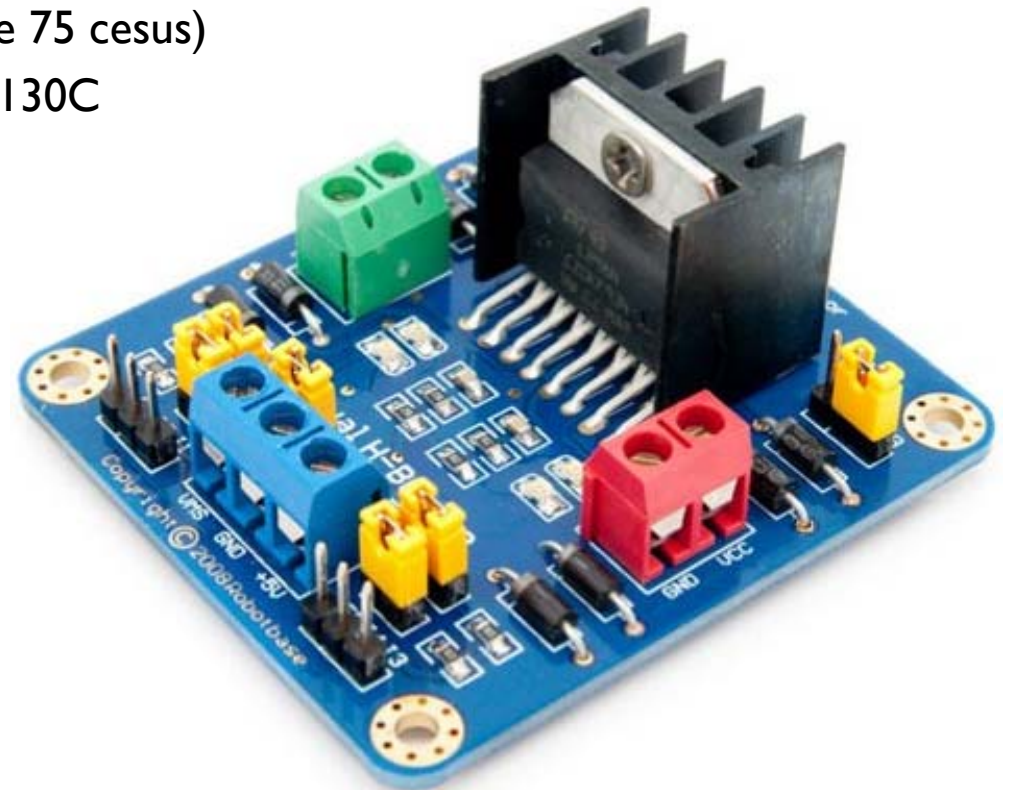
- ### L298N DUAL FULL-BRIDGE DRIVER
  - OPERATING SUPPLY VOLTAGE UP TO 46 V
  - TOTAL DC CURRENT UP TO 4 A
  - LOW SATURATION VOLTAGE
  - OVERTEMPERATURE PROTECTION
  - LOGICAL "0" INPUT VOLTAGE UP TO 1.5 V
  - HIGH NOISE IMMUNITY
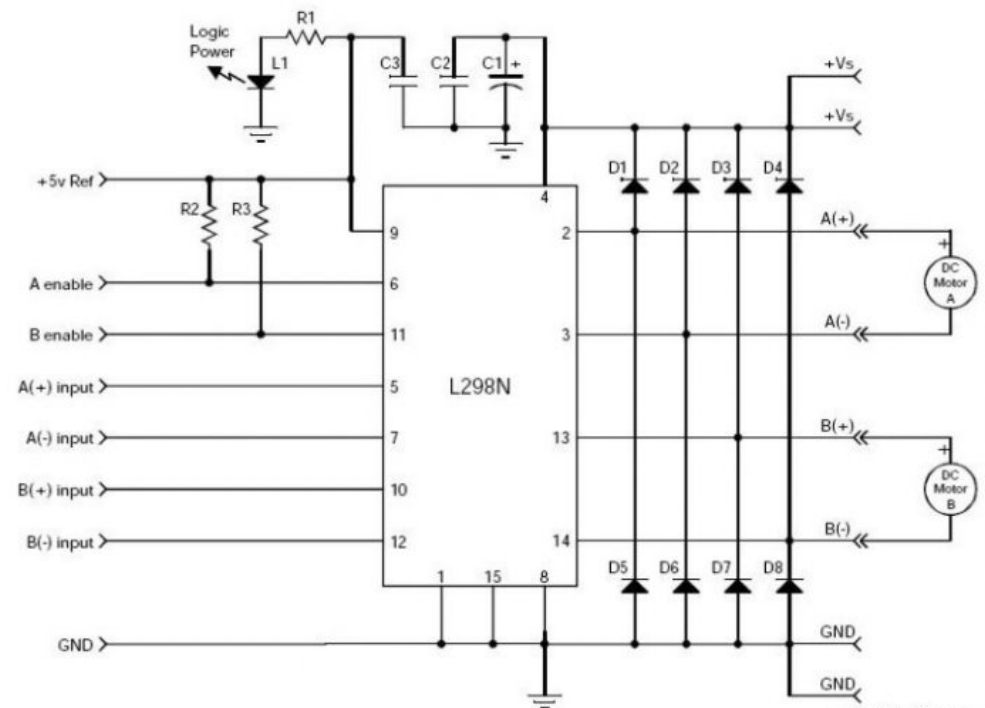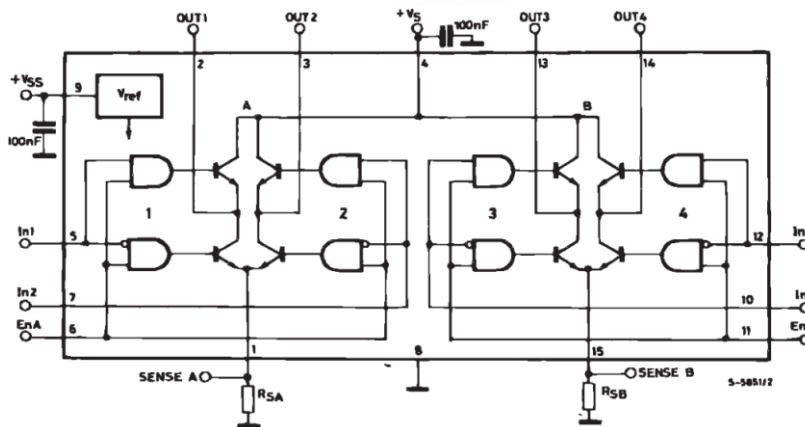
Introduction to Actuators

- FULL-BRIDGE (http://www.learn-c.com/experiment7.htm)
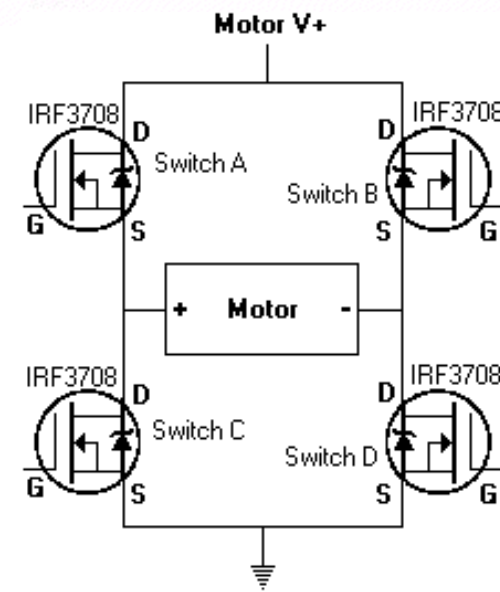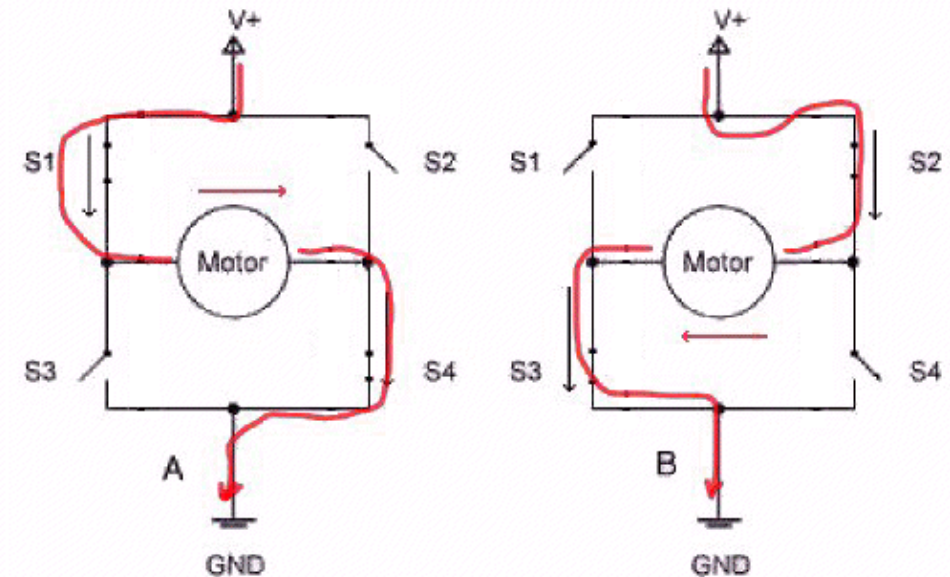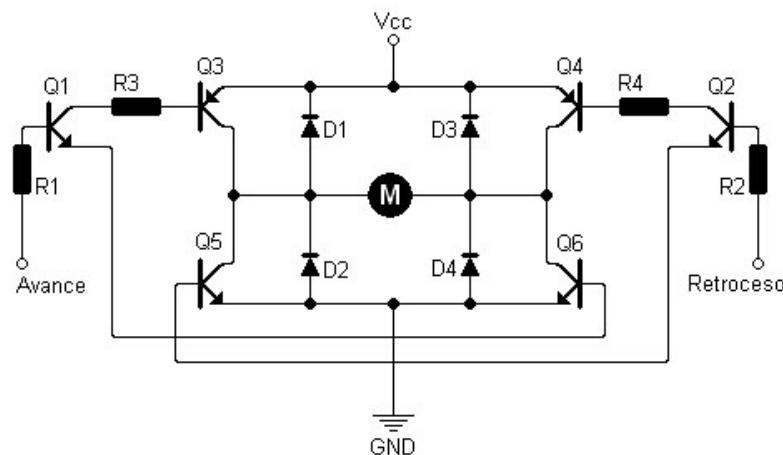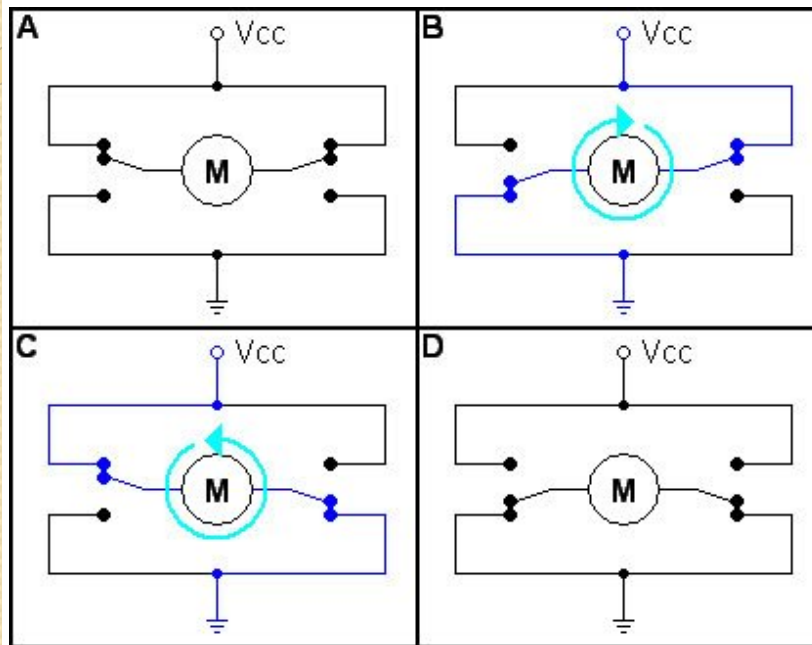
Introduction to Actuators

- ## DC MOTOR DRIVER -15A IRF7862PBF

  - IRF7862PBF MOSFETs Motor Driver
  - 1 Motor Channel
  - Operating Voltage: 5.5 - 24V
  - Continuous output current: 15 Amps
  - Peak output current: 170 Amps
  - Max PWM frequency: 40kHz
  - MOSFET on-resistance: 3.7mOhm
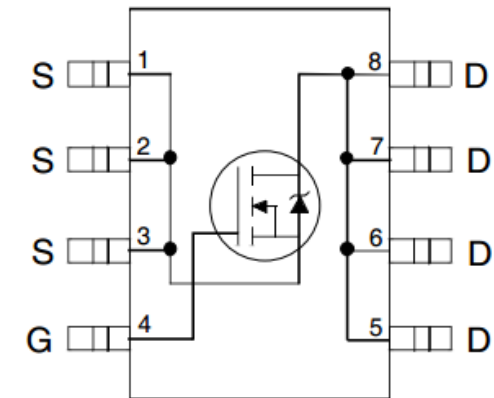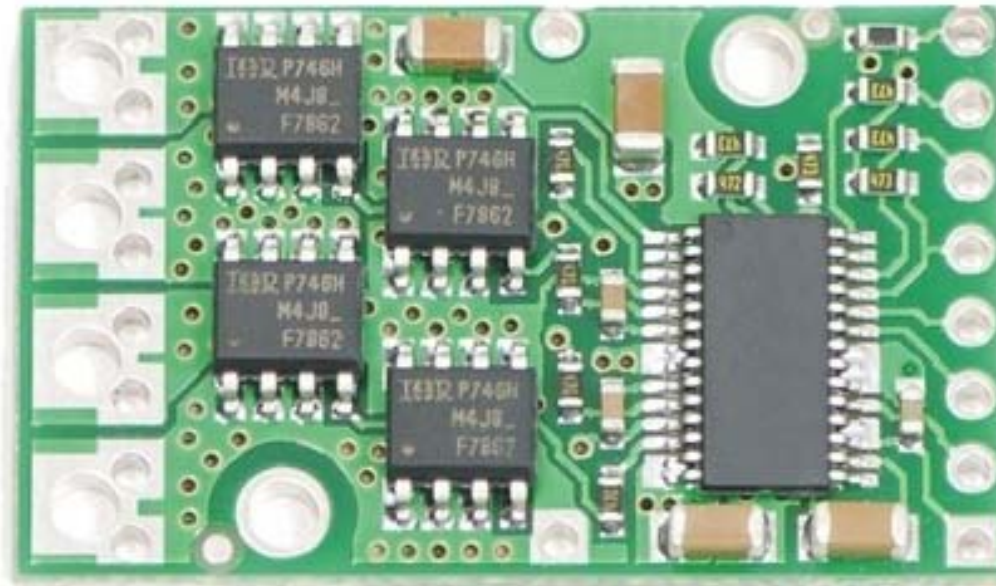
Introduction to Actuators

- **STEPPER MOTOR - 200 STEPS/REV - 9 KG/CM UNIPOLAR**
  - Step Angle (degrees) : 1.8
  - 4-Phase
  - Rated Voltage: 3V
  - Rated Current: 2A/Phase
  - ¼" Diameter Drive Shaft
  - Holding Torque: 90N.cm
  - NEMA 23 form factor
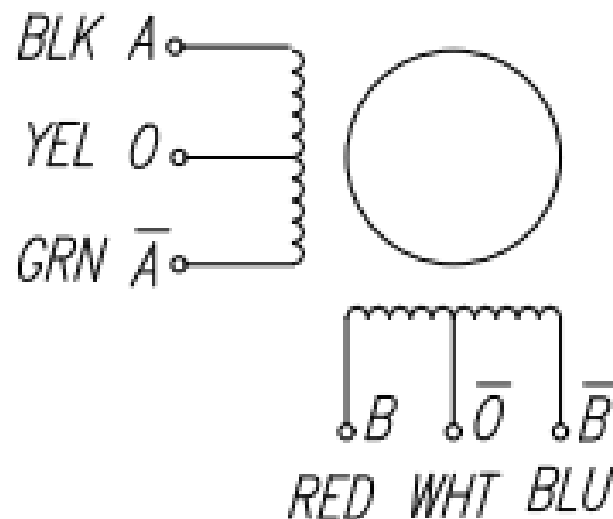
Introduction to Actuators

- **STEPPER MOTOR: BIPOLAR, 200 STEPS/REV, 35×36MM**

  - Size: 35 mm square × 36 mm, not including the shaft (NEMA 14)

  - Weight: 180 g (6 oz)

  - Shaft diameter: 5 mm "D"

  - Steps per revolution: 200

  - Current rating: 1 A per coil /phase

  - Voltage rating: 2.7 V

  - Resistance: 2.7 Ω per coil

  - Holding torque: 1.4 kg-cm (20 oz-in)

  - Inductance: 4.3 mH per coil

  - Lead length: 30 cm (12″)

Embedded Computer Design

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Introduction to Actuators

- STEPPER MOTOR

Motor paso a paso Unipolar

Bobina 1
A
Común
C
Bobina 3

B   D
Bobina 2   Bobina 4
Común

Motor paso a paso Bipolar

A
Bobina 1
B

C   D
Bobina 2
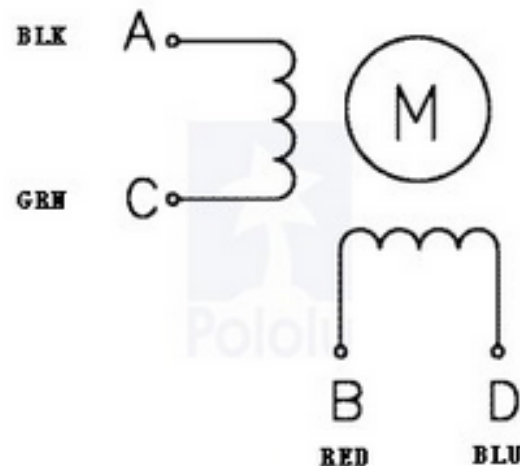
Secuencia simple

	Bobinas			
	A	C	B	D
Paso1	+	-	-	-
Paso2	-	+	-	-
Paso3	-	-	+	-
Paso4	-	-	-	+

Secuencia en onda

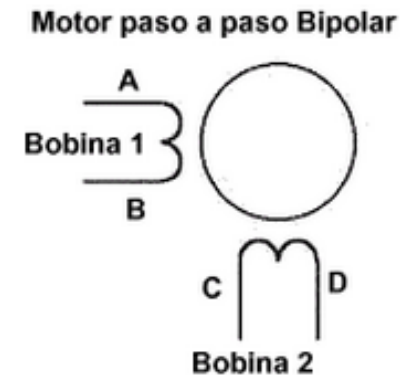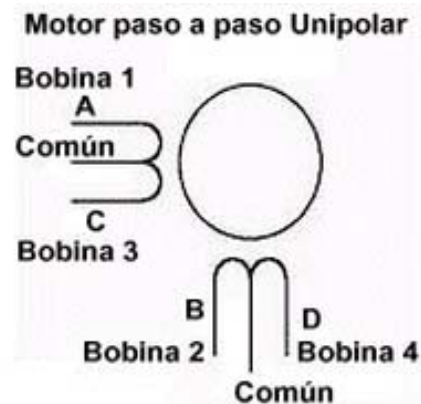|	Bobinas			
	A	C	B	D
Paso1	+	+	-	-
Paso2	-	+	+	-
Paso3	-	-	+	+
Paso4	+	-	-	+

Secuencia medio-paso

	Bobinas			
	A	C	B	D
Paso1	+	-	-	-
Paso2	+	-	+	-
Paso3	-	-	+	-
Paso4	-	+	+	-
Paso5	-	+	0	-
Paso6	-	+	-	+
Paso7	-	-	-	+
Paso8	+	-	-	+

Pasos	Bobinas			
	L1	L3	L2	L4
1	1	0	0	1
2	1	0	1	0
3	0	1	1	0
4	0	1	0	1
5	1	0	0	1
6	1	0	1	0
7	0	1	1	0
8	0	1	0	1

L3   L4
L3-4
L4
L3   M
L1-2
L2   L2   L1
L1
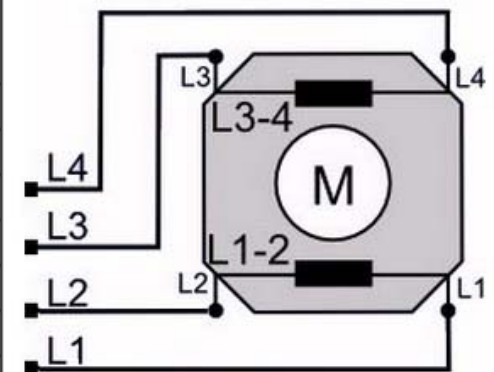
Introduction to Actuators

- ULN2003 - HIGH CURRENT DARLINGTON TRANSISTOR ARRAY
  - ◦ 500mA rated collector current(Single output)
  - ◦ High-voltage outputs: 50V
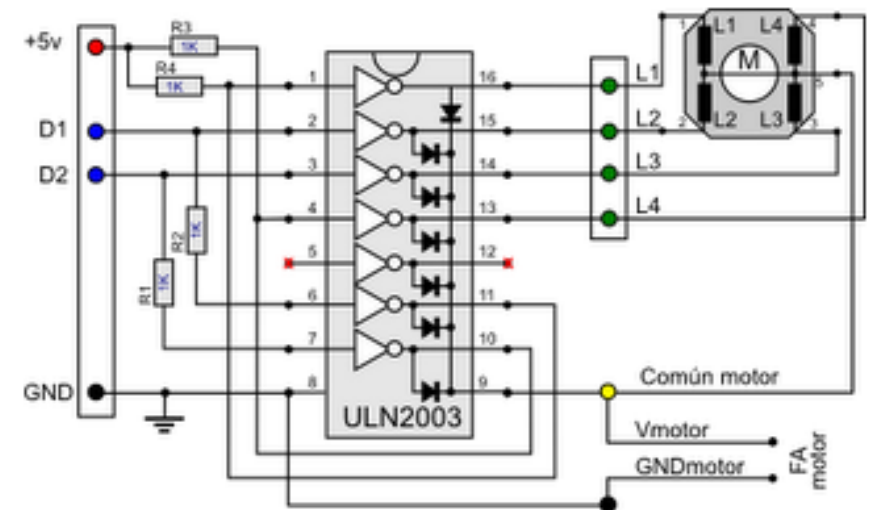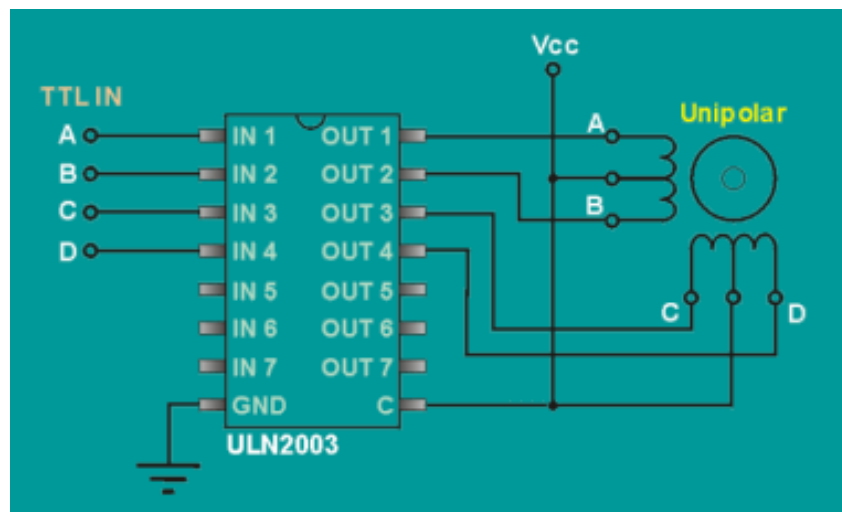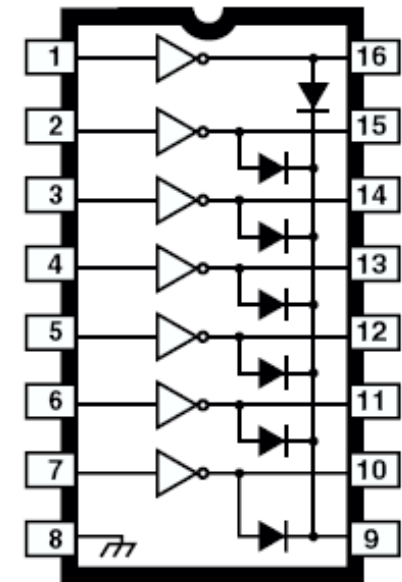
Introduction to Actuators

- EASYDRIVER - STEPPER MOTOR DRIVER

  - A3967 Microstepping Driver

  - MS1 and MS2 pins broken out to change microstepping resolution to full, half, quarter and eighth steps (defaults to eighth)

  - Compatible with 4, 6, and 8 wire stepper motors of any voltage

  - Adjustable current control from 150mA/phase to 700mA/phase

  - Power supply range from 6V to 30V. The higher the voltage, the higher the torque at high speeds

Introduction to Actuators

- ## L6470 STEPPER DRIVER BREAKOUT

  - Supports up to 128 Microsteps per Full Step

  - On-Board Oscillator and Speed/Location Registers

  - Over-Temperature Detect

  - Over-Current Detect

  - Under-Voltage Detect

  - PWM Drive-Voltage Limiting

  - SPI Controlled

  - Stall Detection

  - 5-bit ADC
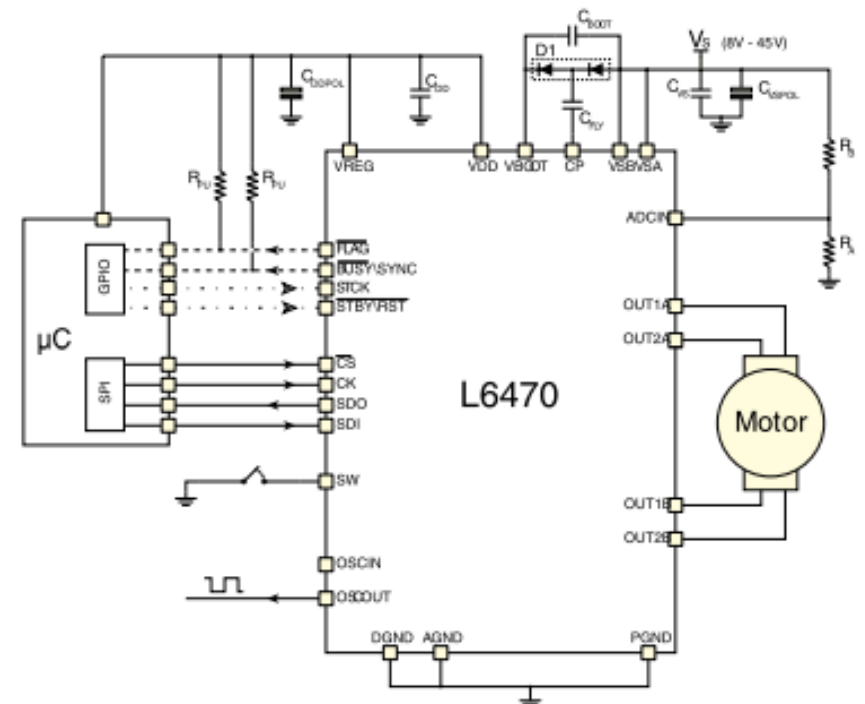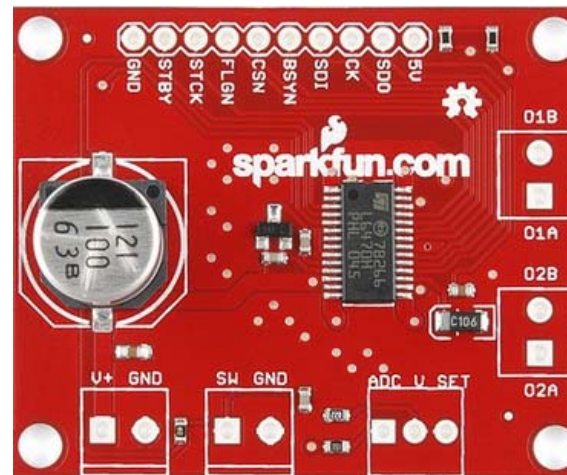
Introduction to Actuators

- POWER HD STANDARD SERVO 3001HB

  - Size: 40.7 x 20.5 x 39.5 mm

  - Weight: 43 g

  - Speed @ 6V: 0.12 sec/60°

  - Stall torque @ 6V: 4.4 kg·cm

  - Speed @ 4.8V: 0.15 sec/60°

  - Stall torque @ 4.8V: 3.5 kg·cm

  - Lead length: 11 in

Servo Motor PWM Timing Diagram

Embedded Computer Design (DISEÑO DE COMPUTADORES EMPOTRADOS)
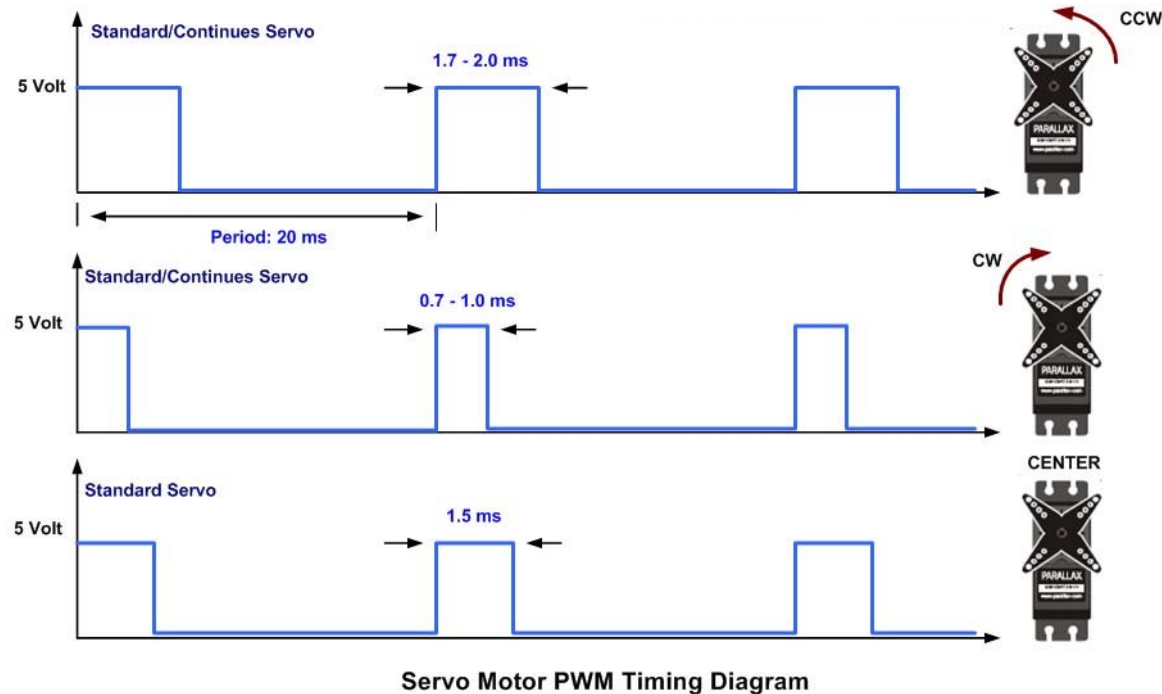
Introduction to Actuators

- **MICRO SERIAL SERVO CONTROLLER (ASSEMBLED)**
  - PCB size: 0.91" x 0.91"
  - Servo ports: 8
  - Resolution: 0.5 μs (about 0.05°)
  - Range: 250-2750 μs
  - Logic supply voltage: 5-16 V
  - Data voltage: 0 and 5 V
  - Pulse rate: 50 Hz
  - Serial baud rate: 1200-38400 (automatically detected)
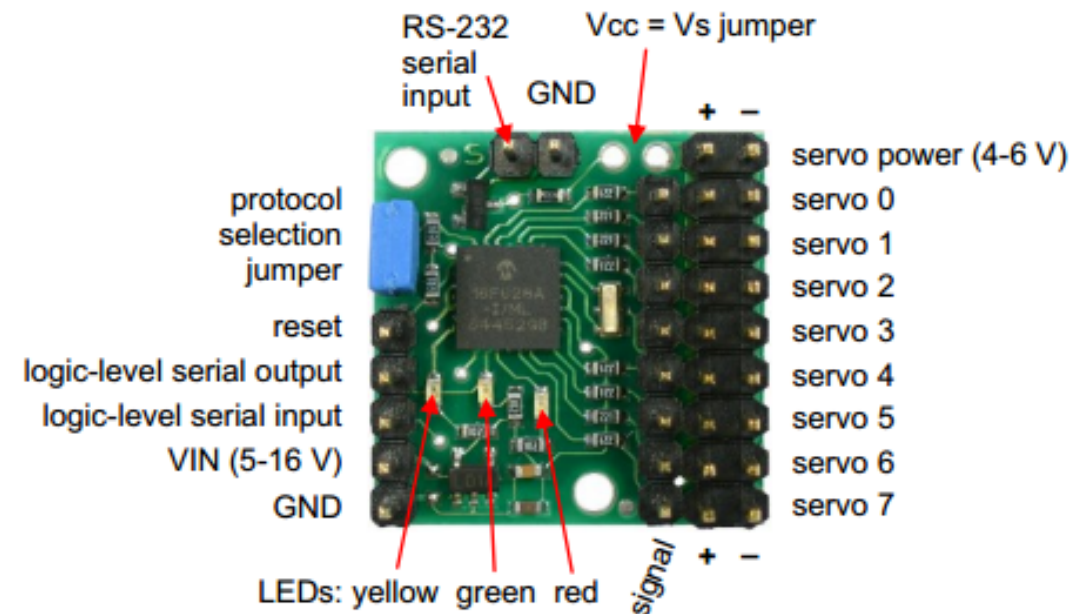 - Current consumption: 5 mA (average)

RS-232 serial input | GND | Vcc = Vs jumper

protocol selection jumper

reset

logic-level serial output

logic-level serial input

VIN (5-16 V)

GND

servo power (4-6 V)
servo 0
servo 1
servo 2
servo 3
servo 4
servo 5
servo 6
servo 7

LEDs: yellow green red

Introduction to Actuators

- MICRO MAESTRO 6-CHANNEL USB SERVO CONTROLLER (ASSEMBLED)
  - Three control methods: USB, TTL (5V) serial, and internal scripting
  - 0.25µs output pulse width resolution (corresponds to approximately 0.025° for a typical servo, which is beyond what the servo could resolve)
  - Pulse rate configurable from 33 to 100 Hz (2)
  - Wide pulse range of 64 to 3280 µs (2)
  - Baudrate: 300 - 250000bps
  - baudrate Autodetection: 300 to 115200bps
  - Power: 5 a 16V
  - Logic current: 20mA

USB mini-B connector
5V (out)
GND
signal + −
servo power
channel 0
channel 1
channel 2
channel 3
channel 4
channel 5
yellow & red status LEDs
green USB LED
RST (board reset)
TX (TTL serial output)
RX (TTL serial input)
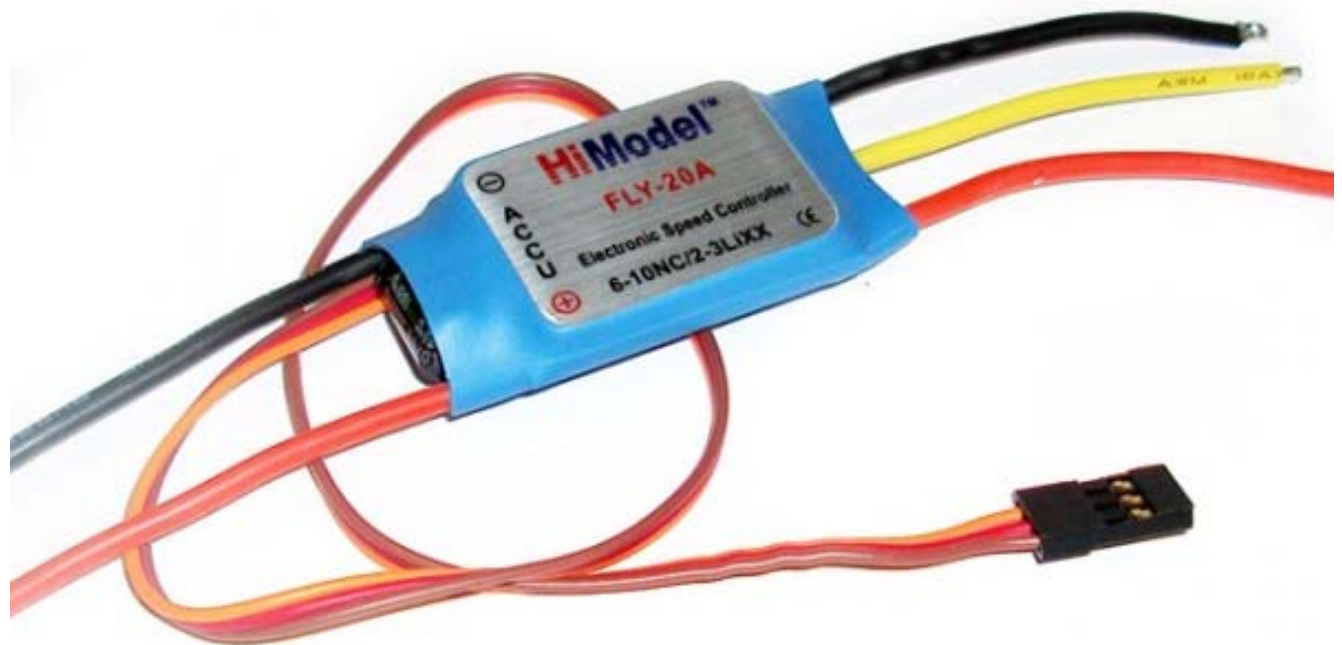VIN (5-16V board power)
GND
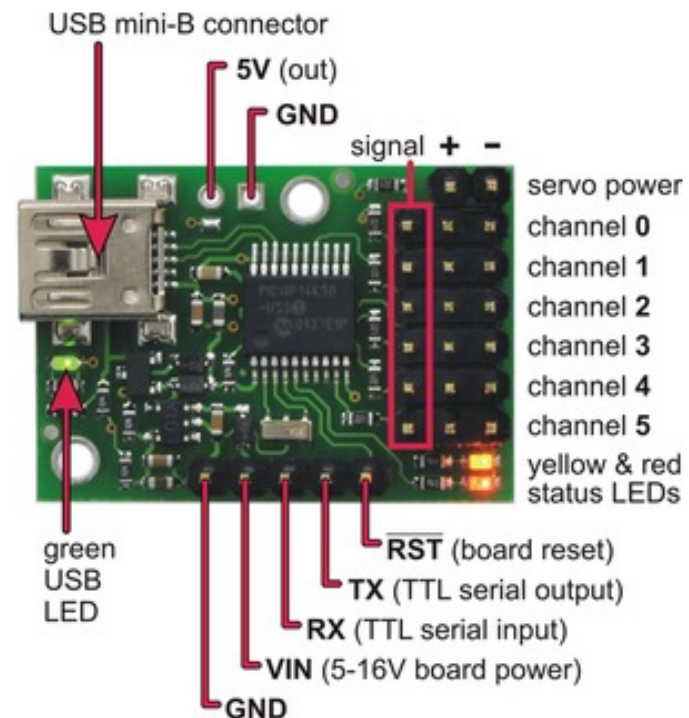
Introduction to Actuators

- MOTOR BRUSHLESS 1450KV OUTRUNNER.
  - Model: FC2822-25
  - KV (rpm/v): 1450
  - IO(A): 0.5
  - Ni-Mh Ni-Cd Battery(cell): 6-9.
  - Lipo Battery (cell): 2 - 3S
  - Max Current (A): 8
  - Running Current (A): <6
  - Weight(g): 29
  - Shaft Diameter(mm): 3.175
  - Max Thrust: 300g
  - Propeller: < 8 x 4 inch

Introduction to Actuators

- VARIADOR BRUSHLESS ESC 20A

  - Type: FLY-20A
  - ·Weight: 18g
  - · Size: 32 x23 x7 mm
  - · Constant Current:20A
  - · Max Current:25A (for ten seconds)
  - · FET: 12
  - · BEC: Yes, 2A
  - · PWM: 8 KHz
  - · Input: 2 to 3 Li-Po, or 6 to10Ni-MH/Ni-Cd

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