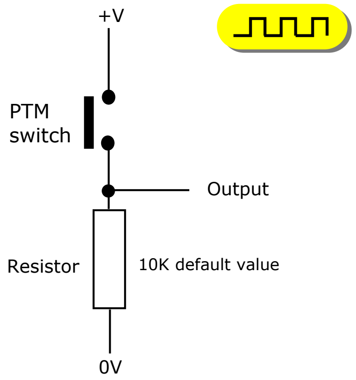
INPUT

Present sensor

Diagram:



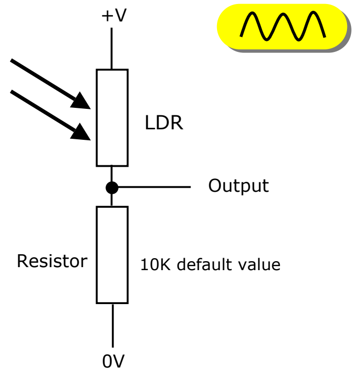
Function:

When the switch is **press** it closes the circuit and the output goes to +V. When the switch is not pressed the output is at 0V.

INPUT

Light sensor

Diagram:



Function:

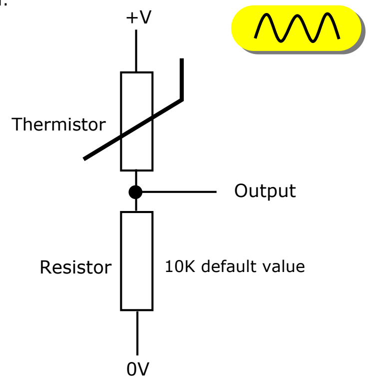
When the LDR is **light** it's resistance is low, making the output +V. When it is dark it's resistance is high making the output 0V.

Varying the light level will create varying voltages at the output. Resistor can be a VR to add adjustment.

INPUT

Hot sensor

Diagram:



Function:

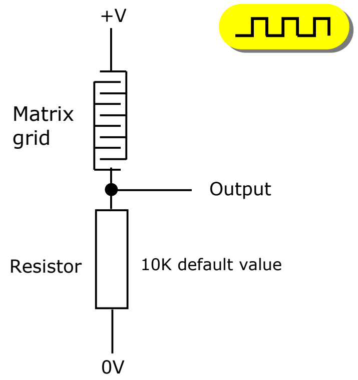
When thermistor is **hot** it's resistance is low, making the output +V. When it is dark it's resistance is high making the output 0V.

Varying temperature will create varying voltages at the output. Resistor can be a VR to add adjustment.

INPUT

Moisture sensor

Diagram:



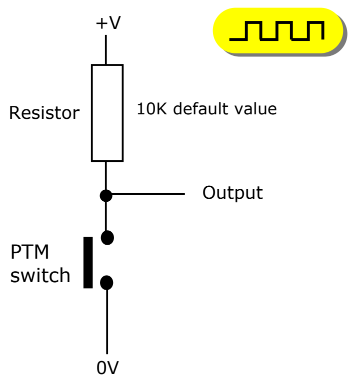
Function:

When the sensor is **wet**, a connection is made and the output will be at +V. When it is dry no connection is made and the output will be at 0V.

INPUT

Not present sensor

Diagram:



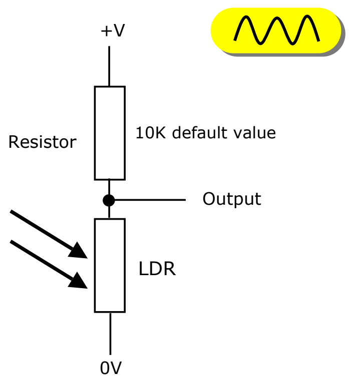
Function:

When the switch is **not press** the output will be at +V. When it is pressed it closes the circuit and the output goes to 0V.

INPUT

Dark sensor

Diagram:



Function:

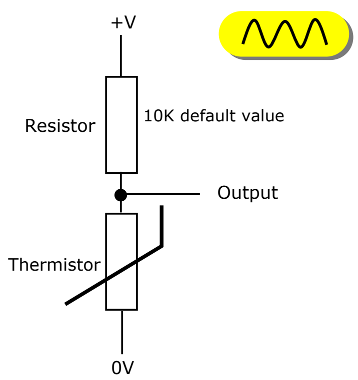
When the LDR is **dark** it's resistance is high, making the output +V. When it is light it's resistance is low making the output 0V.

Varying the light level will create varying voltages at the output. Resistor can be a VR to add adjustment.

INPUT

Cold sensor

Diagram:



Function:

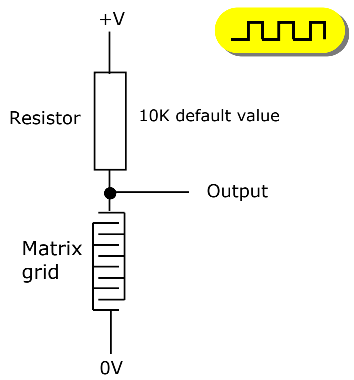
When the thermistor is **cold** it's resistance is high, making the output +V. When it is hot it's resistance is low making the output 0V.

Varying the temperature will create varying voltages at the output. Resistor can be a VR to add adjustment.

INPUT

Dry sensor

Diagram:



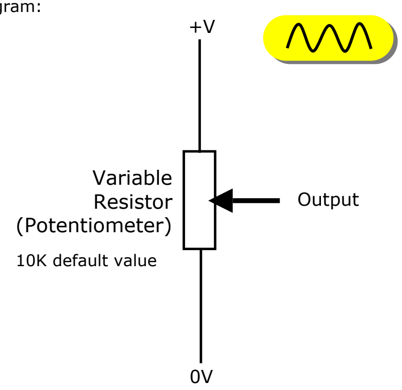
Function:

When the sensor is **wet**, a connection is made and the output will be at +V. When it is dry no connection is made and the output will be at 0V.

INPUT

Position sensor 0-270°

Diagram:



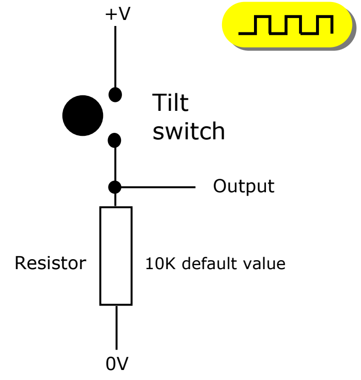
Function:

The output varies with the position of the wiper, one end is 0V and the other is +V, other voltages depend upon its position. It is usually used to set a voltage or one due to its position.

INPUT

Tilt sensor

Diagram:



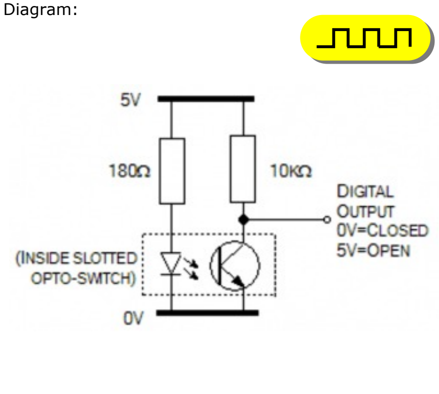
Function:

In one position the ball closes the switch and the output will be at +V. In the other the ball doesn't close the switch so the output will be at 0V

INPUT

Slotted Opto switch

Diagram:



Function:

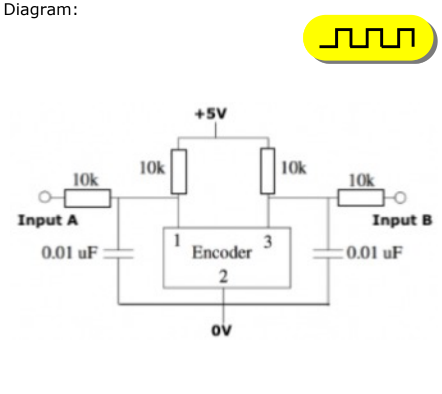
This is used to detect gaps in a slotted disc, used to count rotations, such as found Robots for distance counting.

The LED emits an IR beam which broken by the gaps in the disc and counted.

INPUT

Rotary Encoder

Diagram:



Function:

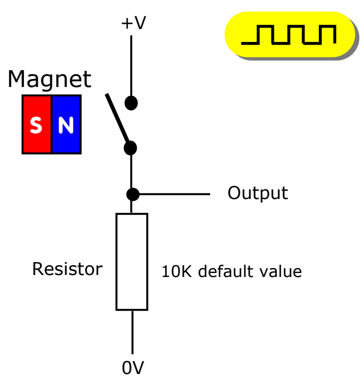
A rotary encoder is a dial which rotates both clockwise and anti-clockwise, AKA a Jog Wheel, good for digital controls.

It produces a set of pulses which give a direction turned and a count of distance turned.

INPUT

Magnetic switch

Diagram:



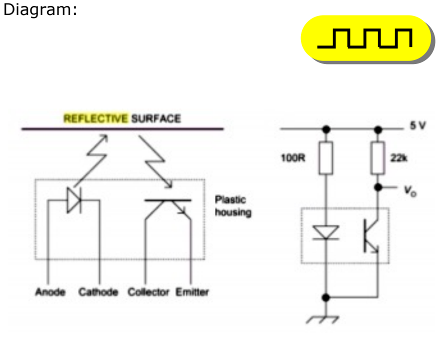
Function:

The output will be at 0V if **NO** magnet is present, since the switch is open. When the magnet is near the switch it closes and the output will be at +V.

INPUT

Reflective Opto switch

Diagram:



Function:

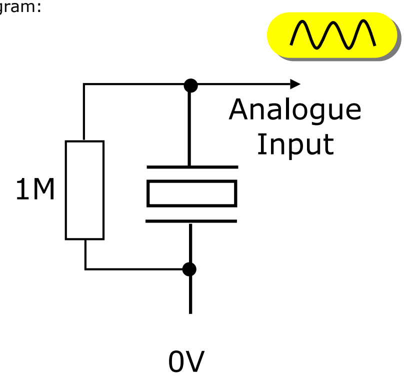
This is used to detect reflective surfaces such as found in white line following Robots.

The LED emits an IR beam which is detected or not by a photo transistor, which produces a high with no reflection & low with a reflection

INPUT

Vibration sensor

Diagram:



Function:

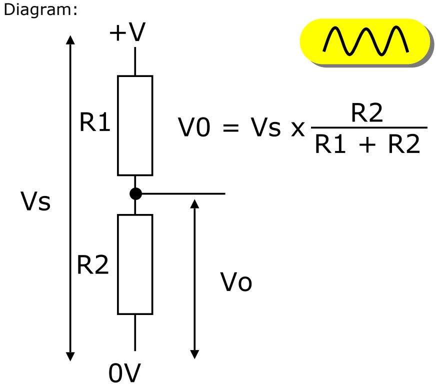
The Piezo transducer when tapped or flexed will produce a voltage which can be read using an analogue input on a microcontroller.

This effect is reversible and is used in the speaker mode of operation - a voltage produces a change in shape.

INPUT

Potential Divider Calculation

Diagram:



Function:

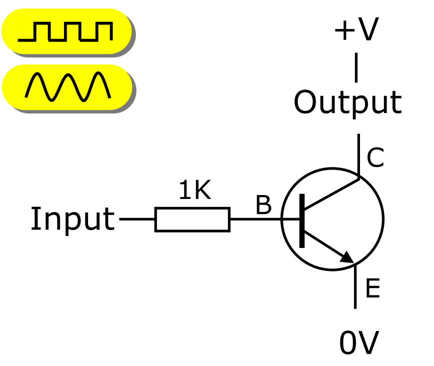
The size of the output voltage is controlled by the sizes of the two resistors and the supply voltage, using the calculation above.

It is a simple ratio, by using 10K for each division you need it is easy to count up how many you for R1 & R2

PROCESS

NPN Transistor

Diagram:



Function:

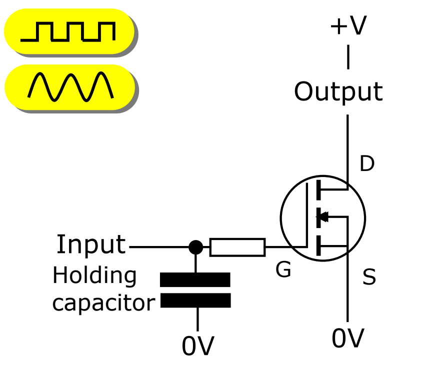
When the input is less than 0.7V the output is off. The output is on when the input is greater than 0.7V.

The max current that flows is determined by the transistor type. **BC548B** is 300mA, **BC337** is 800mA

PROCESS

N MOSFET with memory

Diagram:



Function:

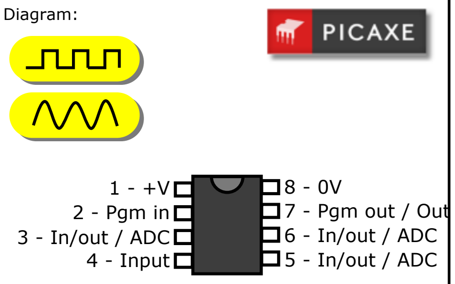
When the input is less than 3V the output is off. The output is on when the input is greater than 3V, and **stays on** until it is made 0V.

The max current that flows is determined by the transistor type. **BS170** is 500mA, **ZVN4206A** is 1A

PROCESS

8 pin Microcontroller

Diagram:



Function:

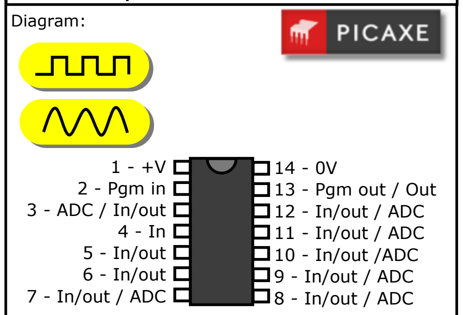
A programmable component with a number of inputs (analogue & digital) and outputs.

Each output can supply up to 20mA, if more current is needed use either a transistor driver or interface driver.

PROCESS

14 pin Microcontroller

Diagram:



Function:

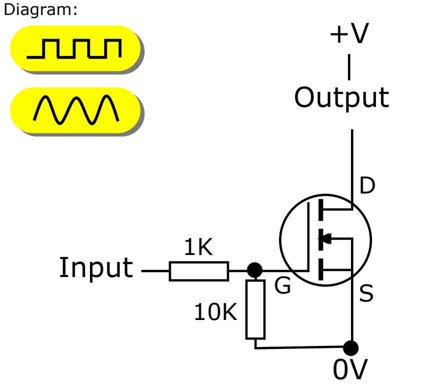
A programmable component with a number of inputs (analogue & digital) and outputs.

Each output can supply up to 20mA, if more current is needed use either a transistor driver or interface driver.

PROCESS

N MOSFET Transistor

Diagram:



Function:

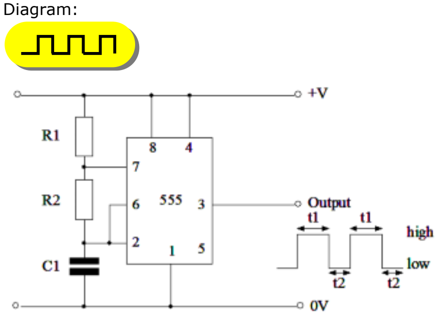
When the input is less than 3V the output is off. The output is on when the input is greater than 3V.

The max current that flows is determined by the transistor type. **BS170** is 500mA, **ZVN4206A** is 1A

PROCESS

555 Timer Astable

Diagram:



High time, T1 = 0.693 x (R1 + R2) x C

Low time, T2 = 0.693 x R2 x C

Function:

The 555 is a general purpose timer, which can be configured to operate as an astable.

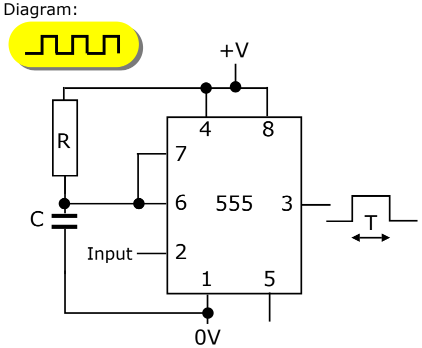
The output frequency is calculated using:

F = 1.44 / C x (R1 + R2 + R2)

PROCESS

555 Timer Monostable

Diagram:



Pin 2 is the input which is normally high and goes low to trigger the pulse

Function:

The 555 is a general purpose timer, which can be configured to operate as a monostable.

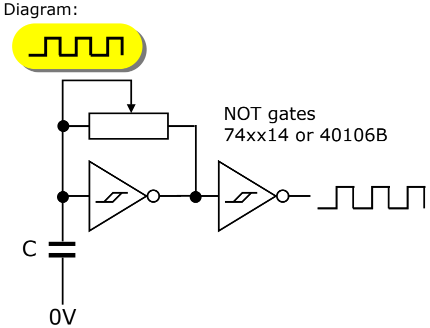
The output pulse length is calculated using:

T = 1.1 x R x C

PROCESS

NOT gate Astable

Diagram:



Note: Most chips have at least 4 gates on them, and always tie unused inputs to 0V or +V

Function:

NOT logic gates can be used to produce simple astables as shown above. The variable resistor is used to 'trim' the frequency of operation.

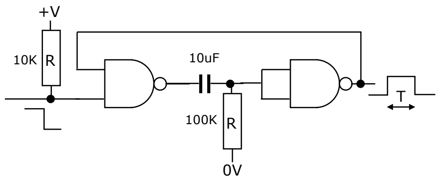
The output frequency is calculated using:

F = 1.44 / R x C

PROCESS

NAND gate Monostable

Diagram:



Typical NAND Gate 74xx00, 4011, 4093

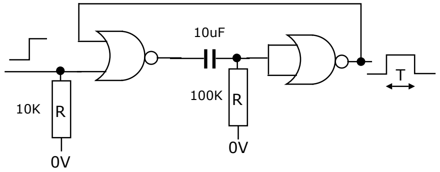
Function:
A monostable can be made from NAND gates in the following manner. A low pulse at the input will trigger a pulse, whose length is approx:

T = R x C

PROCESS

NOR gate Monostable

Diagram:



Typical NOR Gate 74xx02, 4001

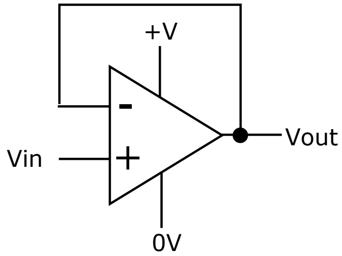
Function:
A monostable can be made from NOR gates in the following manner. A high pulse at the input will trigger a pulse, whose length is approx:

T = R x C

PROCESS

Op-Amp Buffer

Diagram:



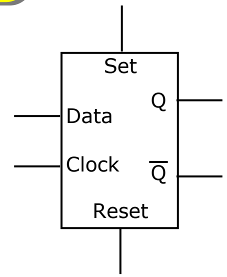
Typical Op-Amp LM324N

Function:
This Op-Amp circuit is known as a **Unity Gain Buffer Amp**, its output is the same voltage as the input, but the current the Op-amp provides is 50mA. This circuit is used to provide higher output currents from circuits that provide low output current.

PROCESS

Logic gate Flip Flop

Diagram:



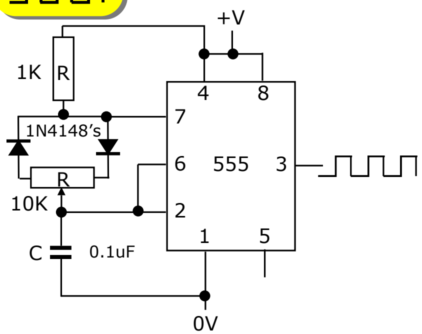
4013 Dual D Flip Flop

Function:
A Flip flop is a simple memory, the logic value at the Data input is stored at the output Q (Q-bar is the opposite Q), when the clock input is pulsed.
The set and reset inputs are normally connect to 0V, they can be used independently if required - use a pull down resistor with a switch for manual operation.

PROCESS

555 Timer PWM

Diagram:



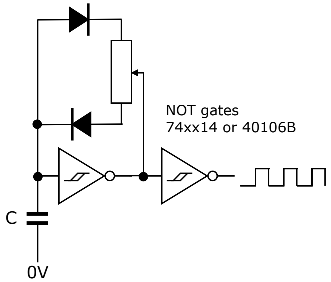
Function:
A 555 timer PWM circuit, this configuration gives variable mark/space ratio at approx 1kHz, use 0.01uF (10nF) for approx 10KHz.

Note the use of diodes to separate the charge/discharge paths to produce the PWM effect.

PROCESS

NOT gate Astable PWM

Diagram:



Note: R>20K for correct operation

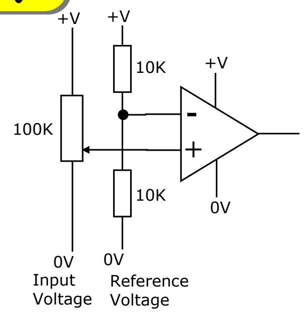
Function:
To control the speed of motors or brightness of LEDs, we use PWM (Pulse Width Modulation). The use of diodes separate the charge/discharge paths giving unequal times for the mark to space ratio.

Mark = ON, Space = OFF

PROCESS

Analogue Comparator

Diagram:



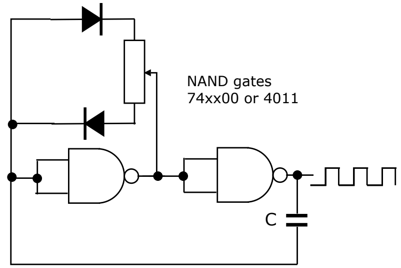
LM339 Quad Comparator

Function:
It compares the input voltage to the reference voltage, if input voltage falls below the reference voltage the output goes low, and high if its above. To make the output work the opposite way around use: - input for the input voltage and + input for the reference voltage.

PROCESS

NAND gate Astable PWM

Diagram:



Note: R>20K for correct operation

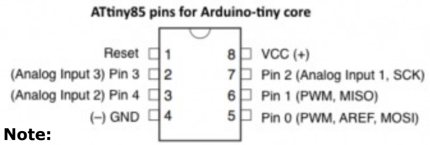
Function:
To control the speed of motors or brightness of LEDs, we use PWM (Pulse Width Modulation). The use of diodes separate the charge/discharge paths giving unequal times for the mark to space ratio.

Mark = ON, Space = OFF

PROCESS

8 pin Microcontroller

Diagram:



Note:

Can be programmed via the Arduino IDE, most standard commands supported and a simple connection circuit.

The ATtiny85 has 8K ROM, 512B RAM, 512B EEPROM

Function:

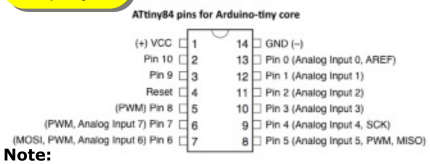
A programmable component with a number of inputs (analogue & digital) and outputs.

Each output can supply up to 40mA, if more current is needed use either a transistor driver or interface driver.

PROCESS

14 pin Microcontroller

Diagram:



Note:

Can be programmed via the Arduino IDE, most standard commands supported and a simple connection circuit.

The ATtiny84 has 8K ROM, 512B RAM, 512B EEPROM

Function:

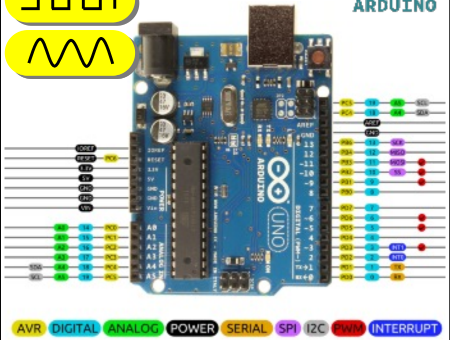
A programmable component with a number of inputs (analogue & digital) and outputs, and is Arduino compatible.

Each output can supply up to 40mA, if more current is needed use either a transistor driver or interface driver.

PROCESS

Arduino Uno

Diagram:



Function:

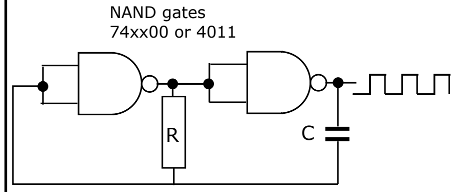
A programmable module with a number of inputs (analogue & digital) and outputs, and has a wide range of add-on Shields to extend its capacity.

Each output can supply up to 40mA, if more current is needed use either a transistor driver or interface driver.

PROCESS

NAND gate Astable

Diagram:



Note: Most chips have at least 4 gates on them, and always tie unused inputs to 0V or +V

Function:

NAND logic gates can be used to produce simple astables as shown above. The variable resistor is used to 'trim' the frequency of operation.

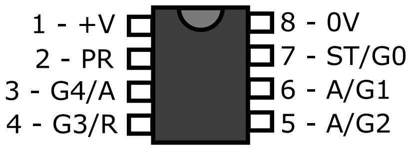
The output frequency is calculated using:

F = 1.44 / R x C

PROCESS

8 pin Microcontroller

Diagram:



Function:

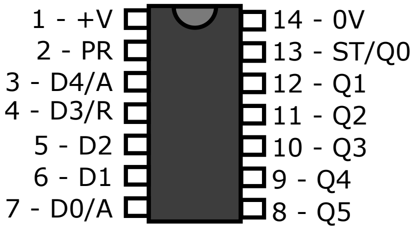
A programmable component with a number of inputs (analogue & digital) and outputs.

Each output can supply up to 20mA, if more current is needed use either a transistor driver or interface driver.

PROCESS

14 pin Microcontroller

Diagram:



Function:

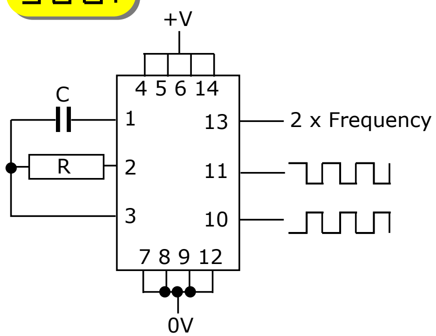
A programmable component with a number of inputs (analogue & digital) and outputs.

Each output can supply up to 20mA, if more current is needed use either a transistor driver or interface driver.

PROCESS

Digital Astable

Diagram:



Function:

The **4047** is a general purpose logic based timer, configured to operate as an astable. Output 1 and 2 are opposite to each other.

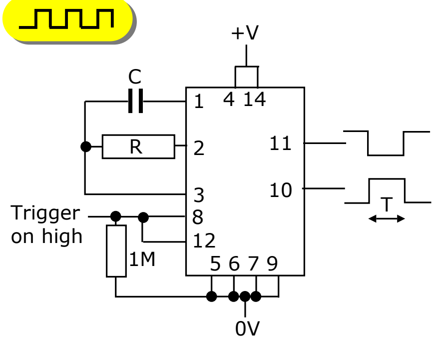
The frequency of the pulses is given by:

f = 1 / 4.4 x R x C

PROCESS

Digital Monostable

Diagram:



Function:

The **4047** is a general purpose logic based timer configured to operate as an monostable. Output 1 and 2 are opposite to each other. R =10K - 10M

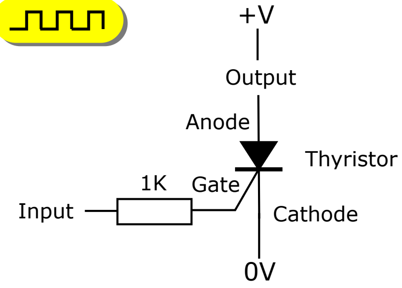
The output pulse length is given by:

T = 2.48 x R x C

PROCESS

Thyristor switching

Diagram:



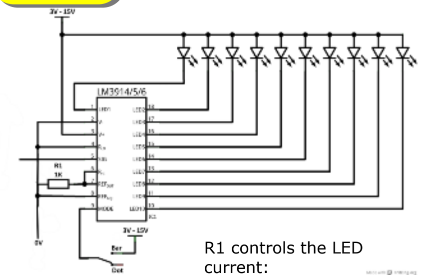
The input to the gate needs to be +V

Function:
A Thyristor is a "switched diode", when a one-off voltage is applied to the gate, the diode conducts. It will continue to conduct until the current between the anode and cathode is turned off.
The max current that flows is controlled by the type used: **2N5060g** is 800mA, **C106D** is 4A.

PROCESS

LM3916 Dot / Bar Driver

Diagram:



R1 controls the LED current:

$I_{LED} = 12.5/R1$

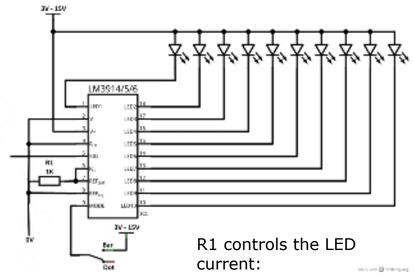
Function:
A 10 LED driver with a **Vu meter response** to the input voltage at pin 5. When using 3V - 15V, the readout range is scaled to -3dB steps, +3dB to -20dB. Pin 9 controls the mode dot or Bar, Pin 9 = +V = bargraph, Pin 9 left open = Dotgraph.

Note: The input can withstand ±35V.

PROCESS

LM3914 Dot / Bar Driver

Diagram:



R1 controls the LED current:

$I_{LED} = 12.5/R1$

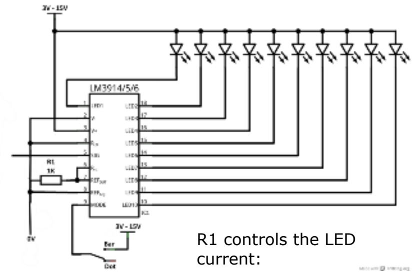
Function:
A 10 LED driver with a **linear response** to the input voltage at pin 5. When using 3V - 15V, the readout range is 0.13V to 1.30V. Pin 9 controls the mode dot or Bar, Pin 9 = +V = bargraph, Pin 9 left open = Dotgraph.

Note: The input can withstand ±35V.

PROCESS

LM3915 Dot / Bar Driver

Diagram:



R1 controls the LED current:

$I_{LED} = 12.5/R1$

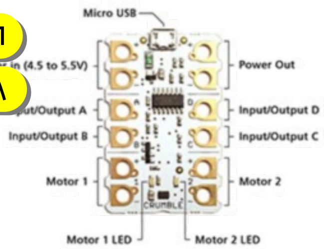
Function:
A 10 LED driver with a **logarithmic response** to the input voltage at pin 5. When using 3V - 15V, the readout range is scaled to -3dB steps, 0dB to -27dB. Pin 9 controls the mode dot or Bar, Pin 9 = +V = bargraph, Pin 9 left open = Dotgraph.

Note: The input can withstand ±35V.

PROCESS

Crumble microcontroller

Diagram:



Note:

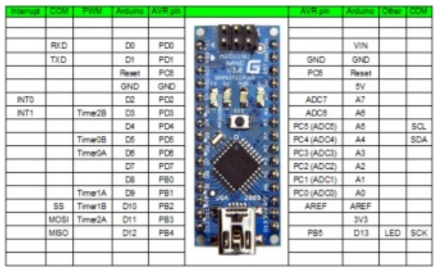
Pads allow terminal blocks to be fitted or a direct solder connection made, while the larger 4mm holes make an easy target for conductive thread and needle.

Function:
The Crumble programmable controller, can drive 2 motors forwards and backwards at variable speeds. It has 4 IO (Input/Output) pads which allow connections to switches, LDRs, low power LEDs and so on. Using 'croc leads' for quick and simple connections.

PROCESS

Arduino Nano

Diagram:

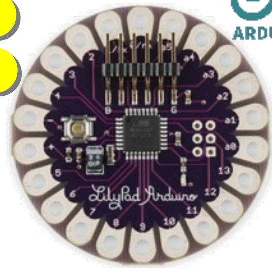


Function:
A programmable module with a number of inputs (analogue & digital) and outputs, the Nano is much smaller than the Uno, as a result can be built into small products.
Each output can supply up to 40mA, if more current is needed use either a transistor driver or interface

PROCESS

Arduino Lilypad

Diagram:



Note:

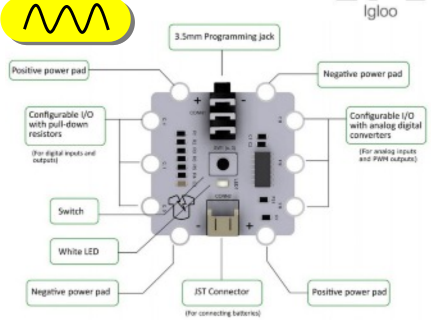
Pads allow terminal blocks to be fitted or a direct solder connection made, while the larger 4mm holes make an easy target for conductive thread and needle.

Function:
The Arduino Lilypad is specifically design for creating wearable products. It has all the capacity of an Uno but with a form factor that allows it to be easy stitched into products and to other e-textile components using conductive thread.

PROCESS

Igloo wearable module

Diagram:

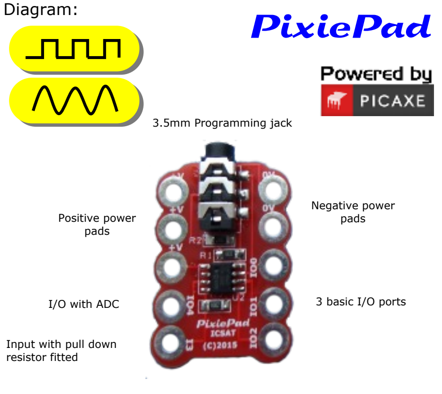


Function:
The Igloo is a programmable control board based on the PICAXE system, the wearable module offers an easy introduction to the world of wearables. The board can be used to read inputs such as switches and sensors. You can also control outputs like LEDs, buzzers.

PROCESS

Pixie Pad

Diagram:

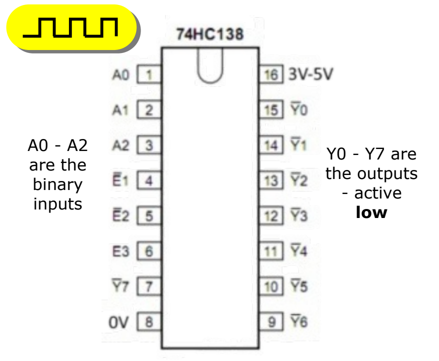


Function:
The Pixie Pad is a programmable control board based on the PICAXE system, the wearable module offers an easy introduction to the world of wearables. The board can be used to read inputs such as switches and sensors. You can also control outputs like LEDs, buzzers.

PROCESS

Binary to 8 Line Decoder

Diagram:

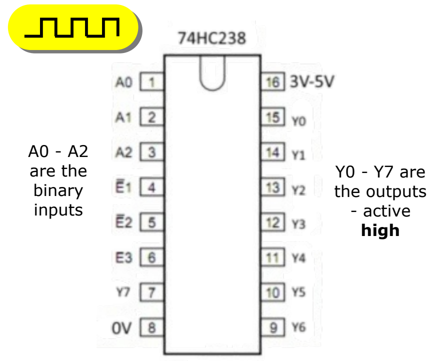


Function:
The 74HC138 is a BCD to 8 line driver it converts a binary number 0-7 into one of 8 outputs which goes **low**, which matches the binary number at the inputs. It is useful in scanning or multiplexing applications. To operate E1 & E2 must be **low** and E3 **high**.

PROCESS

Binary to 8 Line Decoder

Diagram:

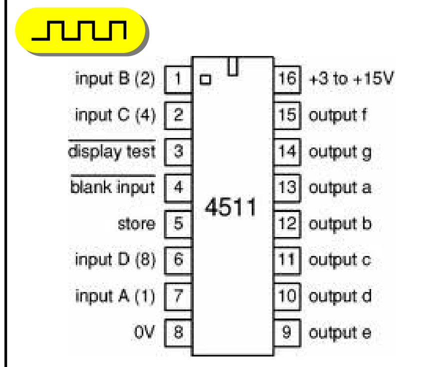


Function:
The 74HC238 is a BCD to 8 line driver it converts a binary number 0-7 into one of 8 outputs which goes **high**, which matches the binary number at the inputs. It is useful in scanning or multiplexing applications. To operate E1 & E2 must be **low** and E3 **high**.

PROCESS

Binary to 7 Segment Decoder

Diagram:

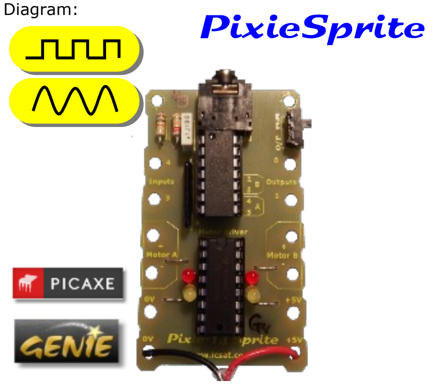


Function:
The 4511 is a BCD to 7-segment decoder driver it converts a binary coded decimal, into signals which will drive a 7-segment display. The display shows the decimal numbers 0-9 and is easily understood.

PROCESS

Pixie Sprite

Diagram:

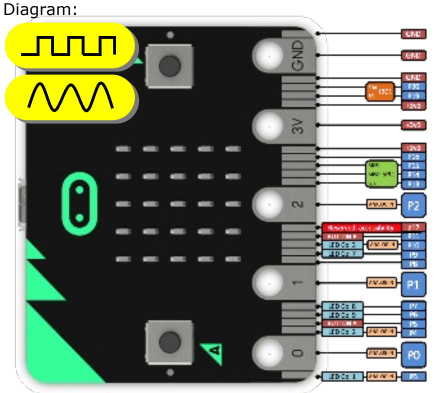


Function:
The Pixie Sprite is a PICAXE or Genie based programmable controller, can drive 2 motors forwards and backwards at variable speeds. It has 4 IO (Input/Output) pads which allow connections to switches, LDRs, low power LEDs and so on. Using 'croc leads' for quick and simple connections.

PROCESS

BBC Micro:bit

Diagram:

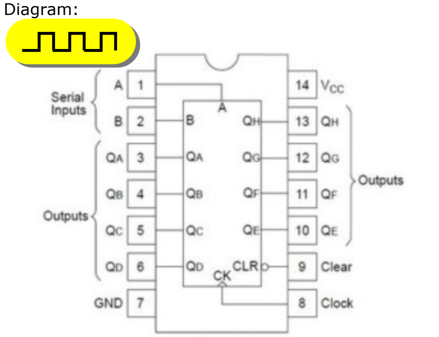


Function:
The Micro:bit is a small all-in-one computer, which has a range of inputs & outputs, more connections are available by using a connector. It has a 5x5 set of LEDs and two switches, along with built-in Bluetooth, accelerometer & compass. **Important it uses a 3V power supply.**

PROCESS

Shift Register

Diagram:



74HC164

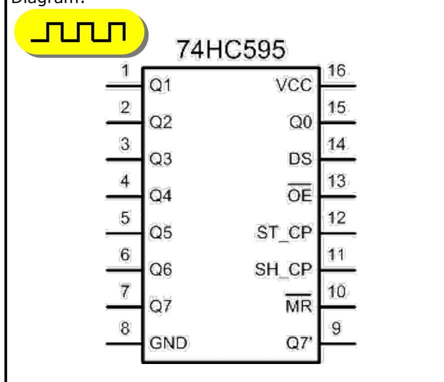
In use the serial inputs A and B are connected together.

Function:
The '164 is an 8 bit shift register, data at the serial input is shifted into the register 1 bit at a time, it takes 8 clock pulses to transfer one byte (8 bits) into all the correct outputs. Great for making 8 bit or 7 segment displays using a small number of pins. The clear pin is held high unless you control it for normal operation.

PROCESS

Shift Register

Diagram:

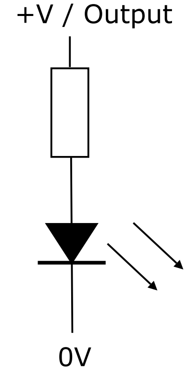


Function:
The data input is pin 14, clock input is pin 11, pin 12 transfers the data to the outputs, pin 10 is the clear pin which is held low unless you control it for normal operations. Pin 13 controls the outputs, which is normally held low unless you control it. Great for making 8 bit or 7 segment displays.

OUTPUT

LED

Diagram:



Function:

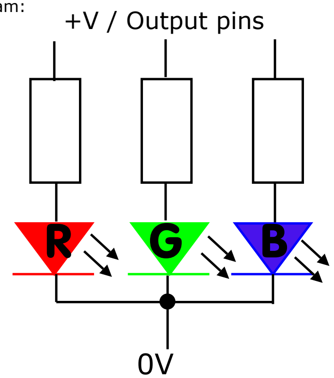
The LED is lit when connected to +V or is driven high by a microcontroller output.

The value of the resistor is found using V=IxR.

OUTPUT

RGB LED

Diagram:



Function:

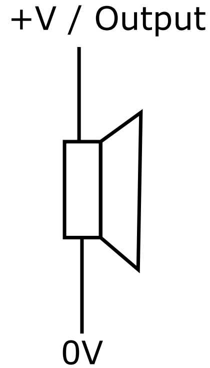
The LEDs are lit when connected to +V or is driven high by a microcontroller output. Varying brightness can be produced by using PWM from a microcontroller.

The value of the resistor is found using V=IxR.

OUTPUT

Speaker

Diagram:



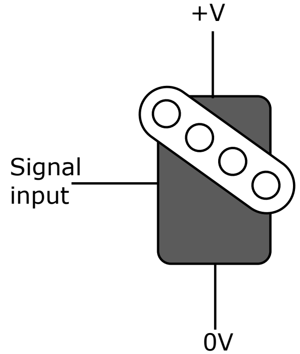
Function:

A transistor or interface drive may be required to operate some speakers.

OUTPUT

Servo motor 180° rotation

Diagram:



Function:

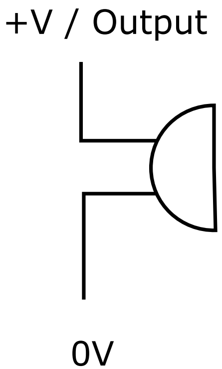
This is a standard RC servo motor, the supply voltage is 5V/6V but needs at least 250mA.

This servo can be positioned at any angle between 0° and 180°, a linkage is fastened to the axle.

OUTPUT

Buzzer

Diagram:



Function:

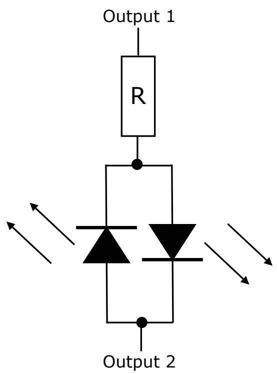
The buzzer sounds when connected to +V or driven high by a microcontroller output.

Buzzers only make a single note and aren't suitable for music, a piezo transducer is required for this.

OUTPUT

Bi-coloured LED

Diagram:



Function:

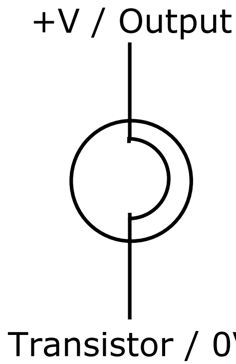
The right hand LED is lit when output 1 is +V or high and output is 0V or low. The opposite values light the left hand LED.

The value of the resistor needs to be calculated using V=IxR

OUTPUT

Bulb

Diagram:



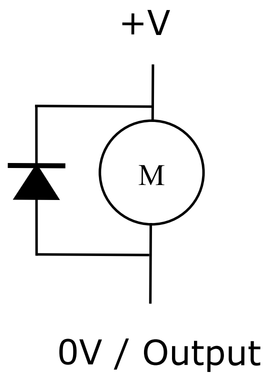
Function:

A transistor or interface driver may be required to operate some bulbs.

OUTPUT

DC Motor

Diagram:



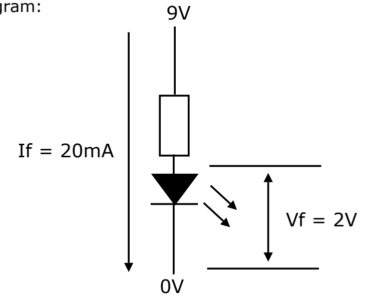
Function:

A transistor or interface driver is needed to operate motors. The 'flyback' diode is required due to the back emf produced by the motor.

The **ULN2803A** or **ULN2003A** don't need then as they already have them built in.

OUTPUT
LED Resistor Calculation

Diagram:



R = (Supply V - Vf) / If
R = (9V - 2V) / 20mA
R = 7V / 20mA
R = 0.35K = 350 ohms

Function:

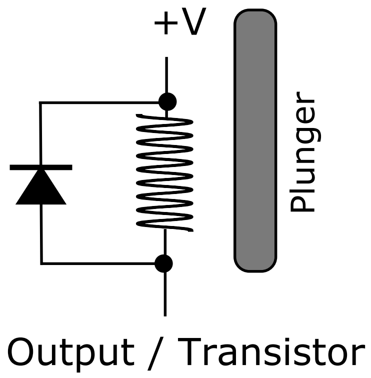
Supply V is the power supply voltage

Vf is the forward voltage needed to make the LED light

If is the maximum current the LED can safely conduct

OUTPUT
Solenoid

Diagram:



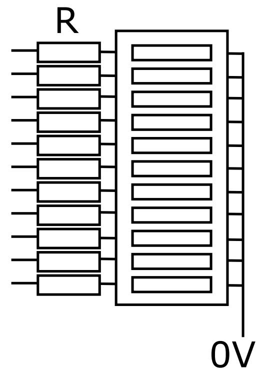
Function:

The LEDs are lit when connected to +V or is driven high by a microcontroller output. Varying brightness can be produced by using PWM from a microcontroller.

The value of the resistor is found using V=IxR.

OUTPUT
LED Bar

Diagram:



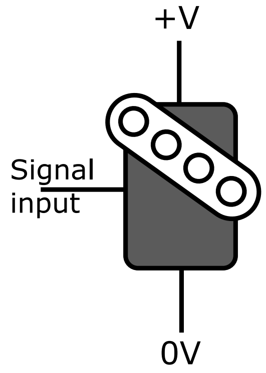
Function:

This display has 10 LEDs in it, it is connect in common cathode mode. The 10 inputs are driven from a microcontroller or a logic circuit, +V or high lights an LED. It can be wired in common anode mode if needed.

The value of the resistors are calculated using V=IxR

OUTPUT
Servo motor 360° rotation

Diagram:



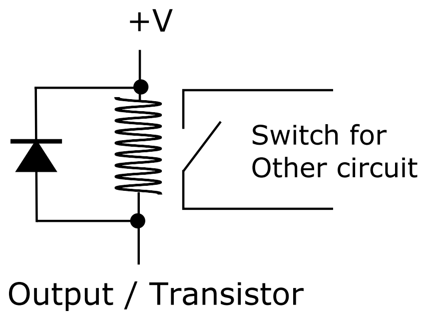
Function:

This is a special RC servo motor adapted to have continuous 360°, the supply voltage is 5V/6V but needs at least 250mA.

This servo can be used as drive motors for Robots, it needs a microcontroller to control it effectively.

OUTPUT
Relay

Diagram:

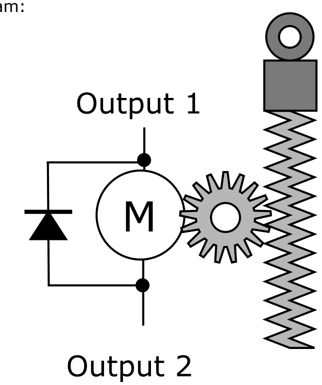


Function:

The relay coil when energised cause the switch contact to close, operating the circuit connect to the relay switch contacts. They are used to control high current / voltage circuits from a low voltage / current system.

OUTPUT
Linear Actuator

Diagram:



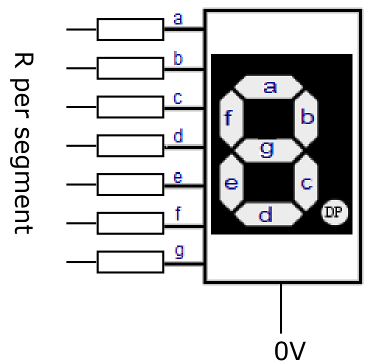
Function:

The linear actuator is operated by a DC motor, and needs to have bi-directional control, to move the arm in & out.

The standard driver is a H-Bridge driver such as the **L293D** or **SN754410**

OUTPUT
7 Segment display

Diagram:



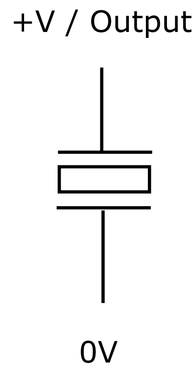
Function:

This display is a common cathode type, connected to 0V. The 7 inputs are driven from a microcontroller or a logic circuit.

The value of the resistors are calculated using V=IxR

OUTPUT
Piezo Transducer

Diagram:



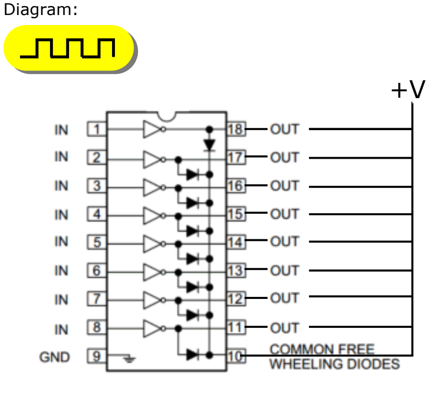
Function:

The Piezo transducer can be used to produce any musical note or sounds, best driven by a microcontroller.

INTERFACE

8 Darlington Driver IC

Diagram:



Function:

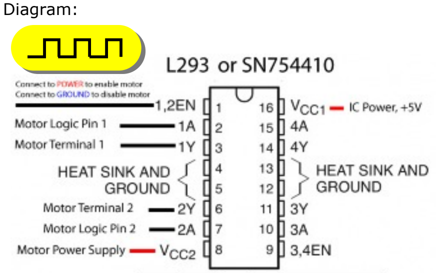
A Darlington Driver is a chip that contains 8 individual drivers each driver can control up to 500mA max, and the +V can be any voltage up to 36V, normally 5V to 9V for motors etc.

ULN2803A - 8 drivers

INTERFACE

H-Bridge Motor driver

Diagram:



EN	1A	2A	FUNCTION
H	L	H	Turn right
H	H	L	Turn left
H	L	L	Fast motor stop
H	H	H	Fast motor stop
L	X	X	Fast motor stop

L = low, H = high, X = don't care

Function:

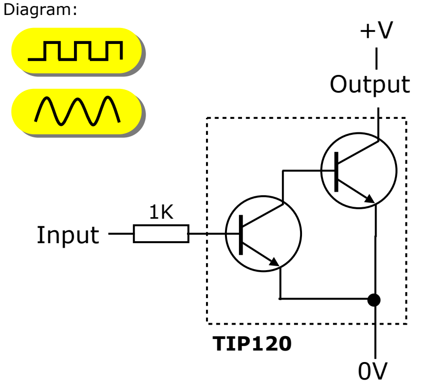
This type of motor driver gives bi-directional control, a single chip can control 2 motors - ideal for a Robot or other type vehicle. Connections 3 & 4 for 2nd motor.

L293D can control 300mA per motor, the **SN754410** can control 600mA per motor

INTERFACE

Darlington Driver

Diagram:



Function:

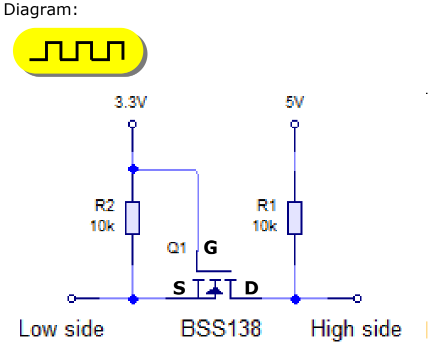
If the output is too small to drive motors and other current hungry devices. The solution is to use a Darlington Driver, which is a special transistor made up from two transistor all in one package.

If you need more than 1 or 2, it is better to use a Darlington Driver IC **ULN28003A** or **ULN2003A**.

INTERFACE

3.3V <> 5V Level shifter

Diagram:



The shifter is bi-directional

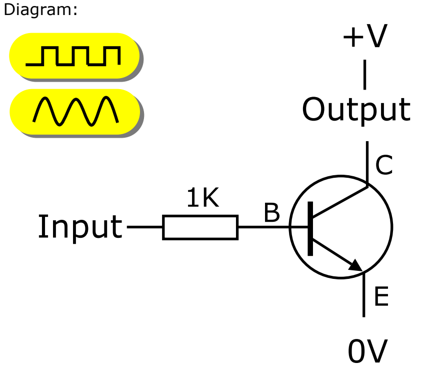
Function:

Microcontrollers use 3.3V or 5V, some devices we use with them only work with 3.3V or 5V, which can be different to their normal supply. To overcome this problem a level shifter is used. The 3.3V input or output is connected to the **low side**, whilst a 5V input or output is connected to the **high side**.

INTERFACE

NPN Transistor driver

Diagram:



Function:

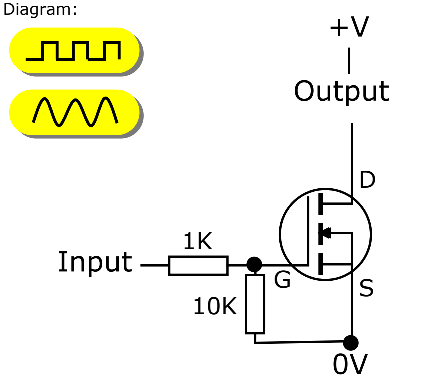
When the input is less than 0.7V the output is off. The output is on when the input is greater than 0.7V.

The max current that flows is determined by the transistor type. **BC548B** is 300mA, **BC337** is 800mA

INTERFACE

N MOSFET Transistor driver

Diagram:



Function:

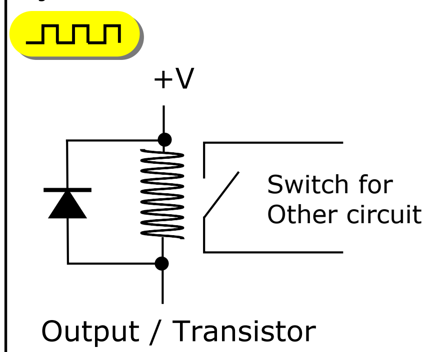
When the input is less than 3V the output is off. The output is on when the input is greater than 3V.

The max current that flows is determined by the transistor type. **BS170** is 500mA, **ZVN4206A** is 1A

INTERFACE

Relay

Diagram:



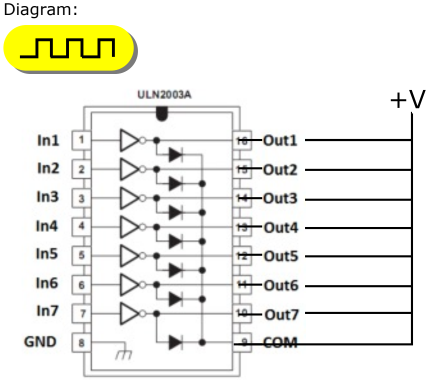
Function:

The relay coil when energised cause the switch contact to close, operating the circuit connect to the relay switch contacts. They are used to control high current / voltage circuits from a low voltage / current system.

INTERFACE

7 Darlington Driver IC

Diagram:



Function:

A Darlington Driver is a chip that contains 7 individual drivers each driver can control up to 500mA max, and the +V can be any voltage up to 36V, normally 5V to 9V for motors etc.

ULN2003A - 7 drivers

POWER

Battery information

Diagram:

Type	Format	Voltage	Capacity mAh
Zinc Carbon	AAA	1.5V	600
	AA	1.5V	1000
	C	1.5V	2800
	PP3	9.0V	380
Alkaline	AAA	1.5V	1200
	AA	1.5V	2700
	C	1.5V	8000
Lithium	AA	1.5V	2500
	PP3	9.0V	1200
	CR2025	3.0V	160
	CR2032	3.0V	210

Function:

The most common power supply for electronic circuits, key considerations are; size, capacity and cost.

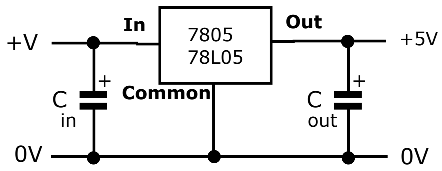
Capacity is how much current can be used before a battery is discharged.

For example a 500mAh cell can supply 500mA for 1 hour before it is discharged, or 50mA for 10 hours.

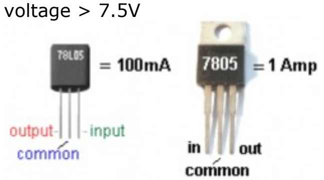
POWER

+5V Voltage Regulator

Diagram:



Input voltage > 7.5V



Function:

The standard circuit for all low voltage power supplies.

Cin optional or use 1uf capacitor

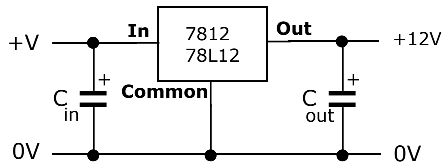
Cout optional or 0.1uF if powering logic circuits

The 7805 provides 1A and the 78L05 provides 100mA of current

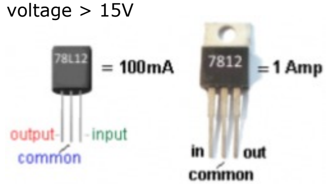
POWER

+12V Voltage Regulator

Diagram:



Input voltage > 15V



Function:

The standard circuit for all low voltage power supplies.

Cin optional or use 1uf capacitor

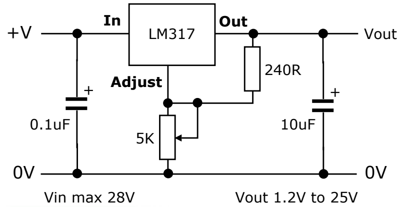
Cout optional or 0.1uF if powering logic circuits

The 7812 provides 1A and the 78L12 provides 100mA of current

POWER

Variable Voltage Regulator

Diagram:



If you require more than 1.5A, use the LM350T which is a 3A version same pinout

Function:

The LM317 can be adjusted to provide any voltage, with a max current of 1.5A. The input voltage must be at least 2V greater than the output voltage.

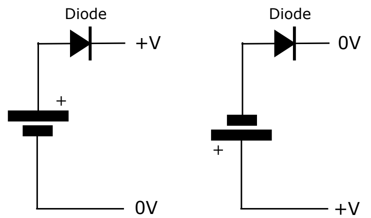
Vout can be calculated using:

Vout = 1.25V x (1+(R2/R1)) + (Iadj x R2)

POWER

Reverse voltage protection

Diagram:



In this arrangement the battery will power the circuit and the output voltage will the battery voltage - 0.5V

In this arrangement the battery will **NOT** power the circuit and **NO** current will flow due to the action of the diode

Typical diodes: 1N4148 < 250mA, 1N4001 > 250mA

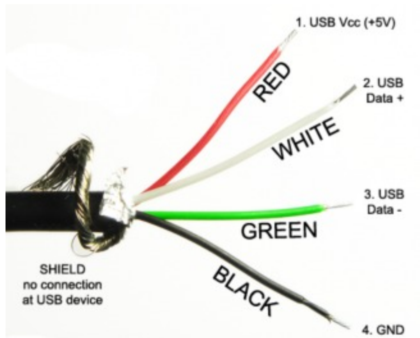
Function:

A common problem with power supplies and in particular with batteries, is that they can be connected the wrong way around. The circuit shown provides a solution to this problem by using a **diode**, which only allows current to flow one way, there will be a 0.5V drop as a result.

POWER

USB power connections

Diagram:



The white & green leads should be cut off

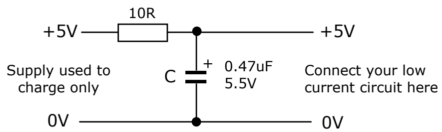
Function:

USB ports on PC's, Laptop's, phone chargers and wall chargers are a very good and easy way to power electronic circuits. It **MUST** be remembered to check the amount of current your circuit needs, PC's/Laptop's can **ONLY supply 500mA max**, if you need more than that you **MUST** use a wall charger.

POWER

Rechargeable Supercapacitor

Diagram:



The **10R resistor** is to control the rate at which the Supercapacitor charges to protect USB ports in particular.

Function:

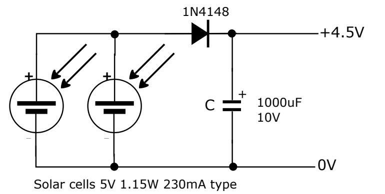
They can be charged up using a suitable battery or USB connection. Once charge they can provide either 2.7V or 5.5V depending upon the type used.

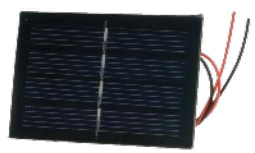
They can then be used to power a low current circuit for up to 15 mins. They make good power sources for portable lighting circuits.

POWER

Solar cell Power Supply

Diagram:





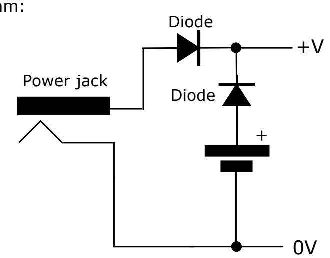
Function:

Solar cell modules make good power supply, each module will only produce a small current eg. 230mA, if more current is required you need to parallel 2 or more cells, 2 cells would give 2 x 230mA = 460mA. If you need a larger voltage connect them in series, eg. 2 x 5V = 10V @ 230mA.

POWER

Power supply switching

Diagram:



When the input voltage is greater than the battery voltage, power comes from the input. If the input is less than the battery or is not plugged in the battery supplies the power.

Typical diodes: 1N4148 < 250mA, 1N4001 > 250mA

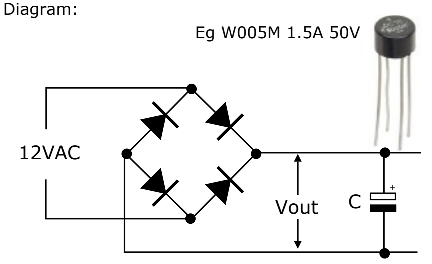
Function:

The use of the diodes in this circuit allow it to automatically switch between the power socket input and the internal battery supply. This system could also be used to switch between say solar cells and a battery for example.

POWER

AC to DC conversion

Diagram:



VAC x 1.414 to give peak-peak value = 16.97Vpp
Vout = 16.97Vpp - 1.4V = 15.75V
The 1.4V is the diode drop per cycle.

This process is known as **full wave rectification**, the smoothing capacitor needs to be 2200uF and rated at 25V.

Function:

Converting AC to DC you need to use a bridge rectifier, a specific arrange of diodes to force the current to flow only one way. The output will have a small ripple that needs to be removed to create true DC. This is done using a ‘smoothing’ capacitor, the output is then used as a DC supply or fed into a voltage regulator circuit.