Automated Switch on Circuits to Drive Water Pump Circuits

**10 SECOND DELAY _ best so far**
This clever circuit turns on the LED 10 seconds after the power has been switched ON. The secret to its performance is the gain of the transistor.
With a gain of 200, the transistor will appear as a 470/200 = 2k3 resistor for the LED and for a 12v supply, this will create a current of 12-1.7 / 2300 = 4.4mA through the LED.
The 100u will take about 10 seconds to charge to a point where the base is 1.7v + 0.6v = 2.3v above the 0v rail. When the electro charges to this voltage, the LED starts to come on. The transistor effectively becomes a 2k3 resistor and that's why no additional current-limiting resistor for the LED is needed. The transistor is the current-limiting device!

3-SECOND DELAY:
When this circuit is connected to a supply (from 3v to 12v), the LED turns on and gradually fades after about 3 seconds.
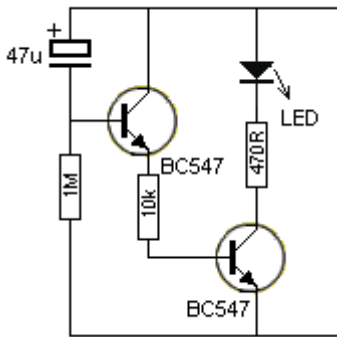
RELAY OFF DELAY
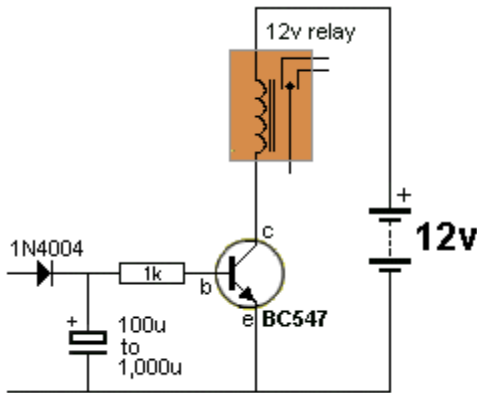
This circuit turns ON a relay when the input is above 2v (change resistor for more volts?) and the relay turns OFF after 2 seconds when the signal is removed. The OFF delay can be increased or decreased.

TOGGLE A RELAY

This circuit will activate a relay when the switch is pressed and released quickly and turn the relay off when the switch is pressed for about 1 second then released.

The circuit relies on a few component values to operate correctly and they may need to be adjusted to get the circuit to operate exactly as required.When the switch is pressed, The BC557 turns ON and supplies nearly rail voltage to the relay.

This closes the contacts and the BC547 is capable of delivering a current to the relay.The transistor acts just like a resistor with a resistance equal to 1/250 the value of the base resistor. This is 40 ohms. If the relay has a coil resistance of 250 ohms, it will see a voltage of about 10v for a 12v supply.When the switch is released, the BC547 keeps the relay energised.

During this activation, the 220u electrolytic helps in activating the relay.

Here's how:Initially the 220u is charged (quite slowly) via the 10k resistor 68 ohm resistor and the coil of the relay.

It is now fully charged and when the switch is pressed, the negative end of the electrolytic is raised via the collector of the BC557. The positive end rises too and this action raises the emitter and when the relay contacts close, the relay is delivered current fro both the BC557 and and BC547. When the sw is released, the BC547 takes over and the discharging of the 220u
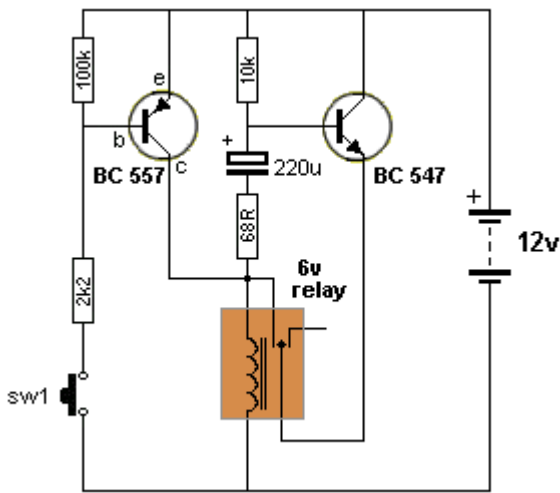
into the base, holds the relay closed. As the 220u gradually discharges, the ability of the BC547 to deliver current reduces slightly and the 10k base resistor takes over and turns the transistor into a 40R resistor. Finally the 220u has a very small voltage across it. When the switch is pressed again, the BC547 acts as a resistor with a resistance less than 40 ohms and it is able to deliver a voltage slightly higher than that provided by the BC547. This slightly higher voltage is passed to the negative lead of the 220u and the positive lead actually rises about rail voltage and the electro gets discharged via the 10k resistor.

When the switch is released, the electro has less than 0.6v across it and the BC547 transistor is not able to deliver current to the relay. The relay is de-activated.
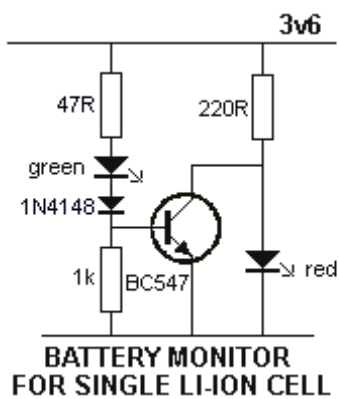d.

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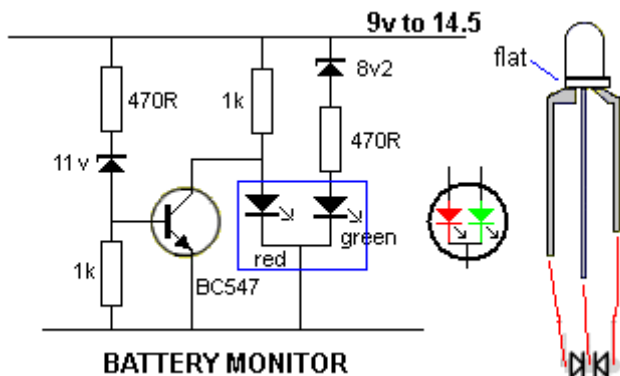
BATTERY MONITOR MkI
A very simple battery monitor can be made with a dual-colour LED and a few surrounding components. The LED produces orange when the red and green LEDs are illuminated.
The following circuit turns on the red LED below 10.5v
The orange LED illuminates between 10.5v and 11.6v.
The green LED illuminates above 11.6v

The following circuit monitors a single Li-ION cell. The green LED illuminates when the voltage is above 3.5v and the goes out when the voltage falls below 3.4v. The red LED then illuminates.

Adjust the 560k for the voltage at which the LED turns ON.
No current-limiting resistor is needed as the transistor only allows a few milliamp collector curent.

Both the 100 kΩ dropping resistor and the 500 Ω load resistance are in series with each other, giving a total circuit resistance of 100.5 kΩ. With a total voltage of 45 volts and a total resistance of 100.5 kΩ, Ohm's Law (I=E/R) tells us that the current will be 447.76 µA. Figuring voltage drops across both resistors (E=IR), we arrive at 44.776 volts and 224 mV, respectively. If we were to re-install the zener diode at this point, it would "see" 224 mV across it as well, being in parallel with the load resistance. This is far below the zener breakdown voltage of the diode and so it will not "break down" and conduct current. For that matter, at this low voltage the diode wouldn't conduct even if it were forward-biased! Thus, the diode ceases to regulate voltage. At least 12.6 volts must be dropped across to "activate" it.

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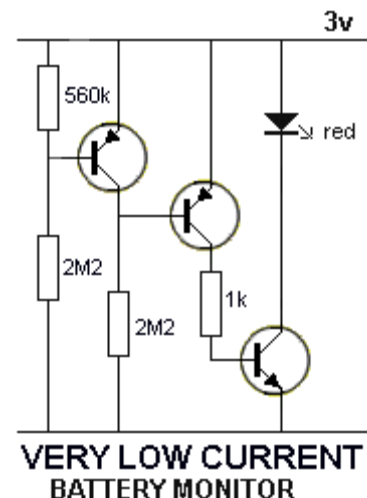
The analytical technique of removing a zener diode from a circuit and seeing whether or not enough voltage is present to make it conduct is a sound one. Just because a zener diode happens to be connected in a circuit doesn't guarantee that the full zener voltage will always be dropped across it! Remember that zener diodes work by limiting voltage to some maximum level; they cannot make up for a lack of voltage.

In summary, any zener diode regulating circuit will function so long as the load's resistance is equal to or greater than some minimum value. If the load resistance is too low, it will draw too much current, dropping too much voltage across the series dropping resistor, leaving insufficient voltage across the zener diode to make it conduct. When the zener diode stops conducting current, it can no longer regulate voltage, and the load voltage will fall below the regulation point.
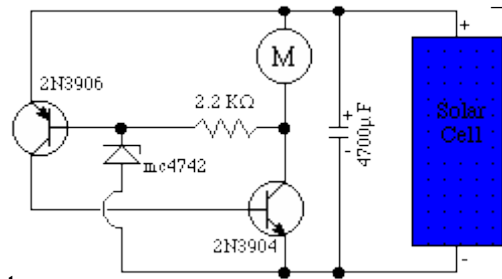
This is a basic idea:
The capacitor charges until the PNP transistor (here shown as a 2N3906, but you could also use a BC327) receives base current through the Zener and turns on.

Then the NPN transistor (here shown as a 2N3904, but you could also use a BC337) turns on and the capacitor is discharged through the motor. As the NPN turns on the 2.2K resistor starts to supply base current to the PNP and the circuit snaps on. When the capacitor voltage drops below about 1V, the the PNP turns off, the NPN turns off and disconnects the motor from the capacitor which starts to charge up again.

A regular diode has a turn on voltage of about .6 to .7 volts. Nothing passes through the diode until that .7 volts hits it. If 12 volts hits the diode you will have a .7 volt drop across that diode and thus product 11.3 volts output from the diode.

OK with that said, the turn on voltage of a zener diode can be selected from .7 volts to fairly high voltages. The one in the voltage regulator is a 12 or 12.5 volt turn on. This zener is hooked to the base of the of the large transistor and once the magneto produces over the set voltage of the zener diode (12 volts) the transistor is turned on. This transistor acts like a switch with varying degrees of resistance. (this resistance it dependant on how hard or how much current is feed into the base of the transistor)

The transistor shorts out the excess (over 12 volts) voltage and as the voltage tries to increase because of the speed of the mag. This produces a greater current flow to the base of the transistor and that turns the transistor on harder allowing more of the mag current to be shorted out.

Zener diodes are the greatest little solid state devices for use in voltage regulators. The zener diode absolutely clip 100% of all voltages above their set value up to the current/wattage limits of the zener.

As well as producing a single stabilised voltage output, zener diodes can also be connected together in series along with normal silicon signal diodes to produce a variety of different reference voltage output values

Lets say I need an LED to indicate when a DC voltage reaches 5 volts or more. I don't want the LED to be dim when it is at 4.5 or anything. I just want it to be full bright at 5, 0 bright at anything below 5. Is there a way I can do this with discrete components (no IC's, just resistors, capacitors, transistors etc.)? I do not require the input has the same power source as the meter. To narrow the voltage range over which the LED turns on, you can use a transistor in order to create voltage gain, to drive a second transistor which drives the current into the LED.
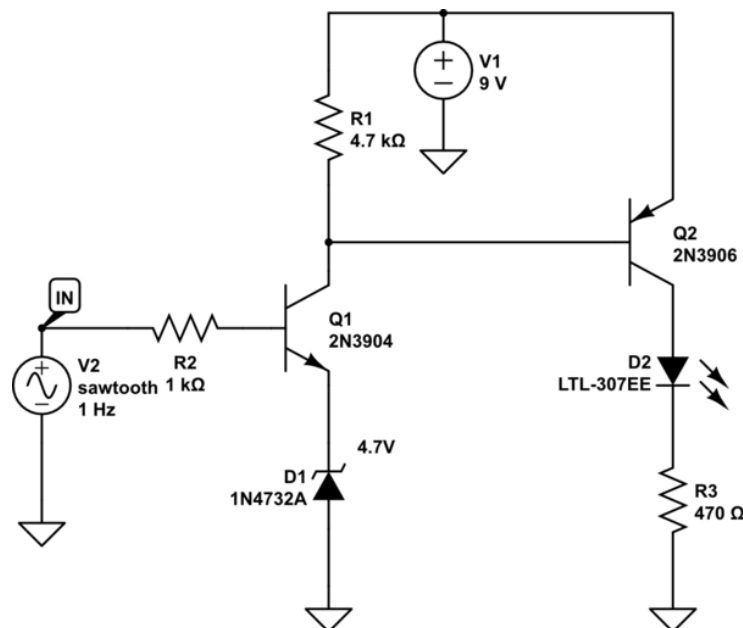
Transistor switch driving a relay
Download for <u>Macintosh</u> or for <u>PC</u>.

A transistor switch is used to allow a 12 volt relay to be operated (turned on and off) by a small input voltage, E_{in}.

The voltage level of the input can be changed by sliding the black arrow- head up and down on this vertical scale. Changing the input voltage causes changes in the base current, collector current, and in the collector voltage. When the current in the relay coil (i.e. the collector current) exceeds a certain value, the relay switches on. The diode reduces the large transient voltages that are produced when the current through an inductor (the relay coil) is changed quickly by switching (called "inductive kick").

To see the current flow through the transistor, click on the "Show current flow" button.

You can change the input (base) resistor, the relay coil resistance, and the power supply voltage (V_{cc}). Just click on the number with the mouse pointer and edite like any text field. You can also inspect and modify the specifications of the transistor - click on the "Show specs" button on the left; this display a table of several specifications (such as the transistor's current gain, beta) that you can modify.

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How to Connect a Transistor as a Switch in a Circuit

So now that we know the theory of why transistors are used as switches, let's go over how to connect a transistor to function as a switch in a circuit.

A transistor is a 3-pin device composed of a base, collector, and emitter for bipolar junction transistors (BJTs).

Below is the pinout of a BJT:

Looking at the back side of the transistor, the emitter is the first pin, the base is the middle, and the collector is the third.

E B C

To connect the transistor as a switch in a circuit, we connect the output of the device that will switch on the transistor to the base of the transistor. The emitter will connect to ground of the circuit. And the collector will connect to the load that the transistor will turn on and the supply voltage of the circuit.

The setup to set the transistor up as a switch is shown in the diagram below:
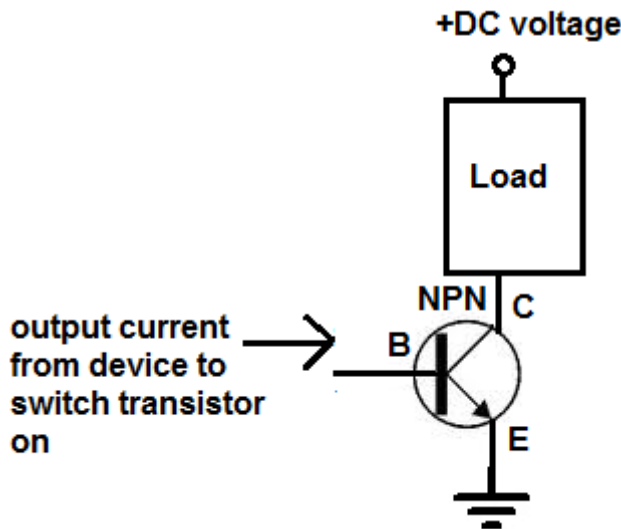
The output of the device that outputs a current will be connected to the base of the transistor. The load will be connected to the collector as well as the positive DC voltage for NPNs. The emitter will connect to ground.

Below is an example of a transistor functioning as a switch in a circuit:

Here we have a PIR motion sensor. When it detects no motion, it outputs no current, so the transistor does not turn on. When the transistor does not receive sufficient current at its base, no current can flow from emitter to collector to power the load, which in this case is a motor.

Even though the collector of the transistor needs positive voltage (for an NPN transistor) in order to operate, it will not turn on just because voltage is attached to it. This is because the transistor acts as an open circuit when it does not receive sufficient base voltage. When a transistor acts an open circuit, no current can flow down to ground. So the +9V of DC voltage that is supplied to the DC motor has no electric potential. It is +9V positive across both terminals of the motor, so, again, there is no electric potential. Only when the transistor turns on and current can flow down to ground is there an established electric potential. This is now when current can flow. Current can only flow when there is an electrical gradient of voltage.

When the motion detector detects motion, it outputs a current from its output pin to the base of the transistor. This electrical current switches the transistor on, so the transistor can now power its load, which is the motor.

In this circuit, the transistor acts as a switch and an amplifier. The same setup to set the transistor as a switch is also to set it up as an amplifier.

If using a PNP transistor, negative voltage is supplied to the collector.
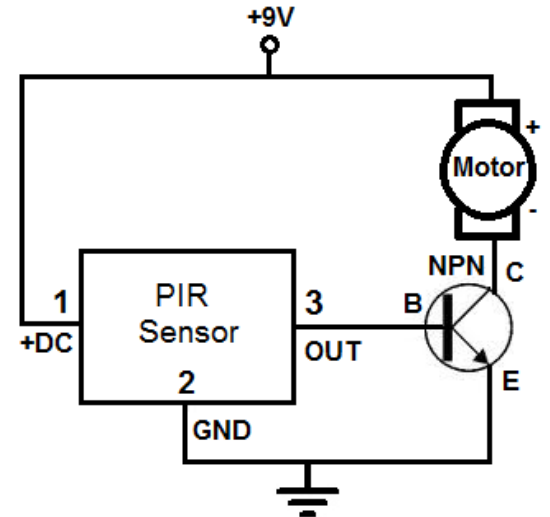
Electronics Components: Use a Transistor as a Switch
By Doug Lowe from Electronics All-in-One For Dummies

One of the most common uses for transistors in an electronic circuit is as simple switches. In short, a transistor conducts current across the collector-emitter path only when a voltage is applied to the base. When no base voltage is present, the switch is off. When base voltage is present, the switch is on.

In an ideal switch, the transistor should be in only one of two states: off or on. The transistor is off when there's no bias voltage or when the bias voltage is less than 0.7 V. The switch is on when the base is saturated so that collector current can flow without restriction.

This is a schematic diagram for a circuit that uses an NPN transistor as a switch that turns an LED on or off.
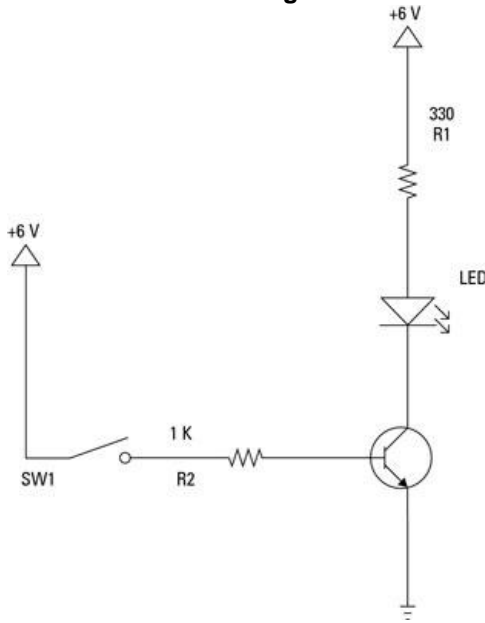
Look at this circuit component by component:

- **LED: This is a standard 5 mm red LED. This type of LED has a voltage drop of 1.8 V and is rated at a maximum current of 20 mA.**

- **R1: This 330 Ω resistor limits the current through the LED to prevent the LED from burning out. You can use Ohm's law to calculate the amount of current that the resistor will allow to flow. Because the supply voltage is +6 V, and the LED drops 1.8 V, the voltage across R1 will be 4.2 V (6 – 1.8). Dividing the voltage by the resistance gives you the current in amperes, approximately 0.0127 A. Multiply by 1,000 to get the current in mA: 12.7 mA, well below the 20 mA limit.**

- **Q1: This is a common NPN transistor. A 2N2222A transistor was used here, but just about any NPN transistor will work. R1 and the LED are connected to the collector, and the emitter is connected to ground. When the transistor is turned on, current flows through the collector and emitter, thus lighting the LED. When the transistor is turned off, the transistor acts as an insulator, and the LED doesn't light.**

- **R2: This 1 kΩ resistor limits the current flowing into the base of the transistor. You can use Ohm's law to calculate the current at the base. Because the base-emitter junction drops about 0.7 V (the same as a diode), the voltage across R2 is 5.3 V. Dividing 5.3 by 1,000 gives the current at 0.0053 A, or 5.3 mA. Thus, the 12.7 mA collector current (I_{CE}) is controlled by a 5.3 mA base current (I_{BE}).**

- **SW1: This switch controls whether current is allowed to flow to the base. Closing this switch turns on the transistor, which causes current to flow through the LED. Thus, closing this switch turns on the LED even though the switch isn't placed directly within the LED circuit.**

You might be wondering why you'd need or want to bother with a transistor in this circuit. After all, couldn't you just put the switch in the LED circuit and do away with the transistor and the second resistor? Of course you could, but that would defeat the principle that this circuit illustrates: that a transistor allows you to use a small current to control a much larger one.

If the entire purpose of the circuit is to turn an LED on or off, by all means omit the transistor and the extra resistor. But in more advanced circuits, you'll find plenty of cases when the output from one stage of a circuit is very small and you need that tiny amount of current to switch on a much larger current. In that case, this transistor circuit is just what you need.

If the current activation is too small,than have a bunch of resistors before the start of the circuit?

need.

Amazing Circuits (good design):
http://www.talkingelectronics.com/projects/30%20LED%20Projects/30%20LED%20Projects.html#67

http://www.talkingelectronics.com/projects/200TrCcts/101-200TrCcts.html

Solar Panel Motor Fan Circuit:

Because some days there may be rain etc, be sure a supercap is charged by the solar panel, and stored. Electricity generated by the solar panel is charged in a capacitor and released when overcast days occur. Also the spare supercap can also be charged by the peltizer also.