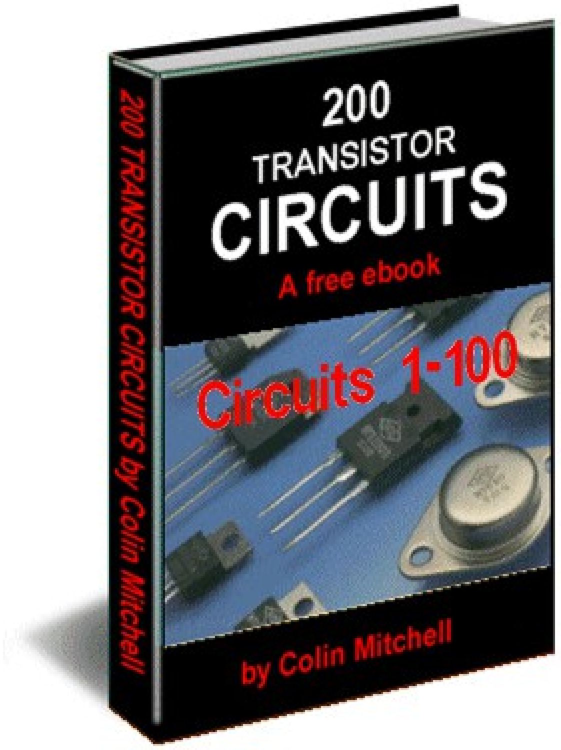


save on your computer as .pdf: **1-100 Transistor circuits.pdf**

Go to: 101 - 200 Transistor Circuits
Go to: 100 IC Circuits

Talking
Electronics

See TALKING ELECTRONICS WEBSITE

email Colin Mitchell: talking@tpg.com.au

INTRODUCTION

This e-book contains 100 transistor circuits. The second part of this e-book will contain a further 100 circuits.
Most of them can be made with components from your "junk box" and hopefully you can put them together in less than an hour.
The idea of this book is to get you into the fun of putting things together and there's nothing more rewarding than seeing something work.
It's amazing what you can do with a few transistors and some additional components. And this is the place to start.
Most of the circuits are "stand-alone" and produce a result with as little as 5 parts.
We have even provided a simple way to produce your own speaker transformer by winding turns on a piece of ferrite rod. Many components can be obtained from transistor radios, toys and other pieces of discarded equipment you will find all over the place.
To save space we have not provided lengthy explanations of how the circuits work. This has already been covered in TALKING ELECTRONICS Basic Electronics Course, and can be obtained on a CD for $10.00 (posted to anywhere in the world) See Talking Electronics website for more details: http://www.talkingelectronics.com
Transistor data is at the bottom of this page and a transistor tester circuit is also provided.
There are lots of categories and I am sure many of the circuits will be new to you, because some of them have been designed recently by me.
Basically there are two types of transistor: PNP and NPN.
We have labelled the NPN transistor as BC547. This means you can use ANY NPN transistor, such as 2N2222, BC108, 2N3704, BC337 and hundreds of others. Some circuits use TUN for Transistor Universal NPN and this is the same as our reasoning - the transistor-type is just to let you know it is not critical.
BC557 can be replaced by: 2N3906, BC327 and many others.
Don't worry too much about the transistor-type. Just make sure it is NPN, it this is the type needed.
If it is an unknown transistor-type, you need to identify the leads then put it in the circuit.
You have a choice of building a circuit "in the air," or using an experimenter board (solderless breadboard) or a matrix board or even a homemade printed circuit board. The choice is up to you but the idea is to keep the cost to a minimum - so don't buy anything expensive.
If you take parts from old equipment it will be best to solder them together "in the air" (as they will not be suitable for placing on a solderless breadboard as the leads will be bent and very short).
This way they can be re-used again and again.
No matter what you do, I know you will be keen to hear some of the "noisy" circuits in operation.
Before you start, the home-made **Speaker Transformer** project and Transistor Tester are the first things you should look at.
If you are starting in electronics, see the **World's Simplest Circuit.** It shows how a transistor works and three transistors in the **8 Million Gain** project will detect microscopic levels of static electricity! You can look through the Index but the names of the projects don't give you a full description of what they do. You need to look at the circuits. And I am sure you will.

KIT OF PARTS

Talking Electronics supplies a kit of parts that can be used to build the majority of the circuits in

this book.
The kit costs $15.00 plus postage.

BUY NOW

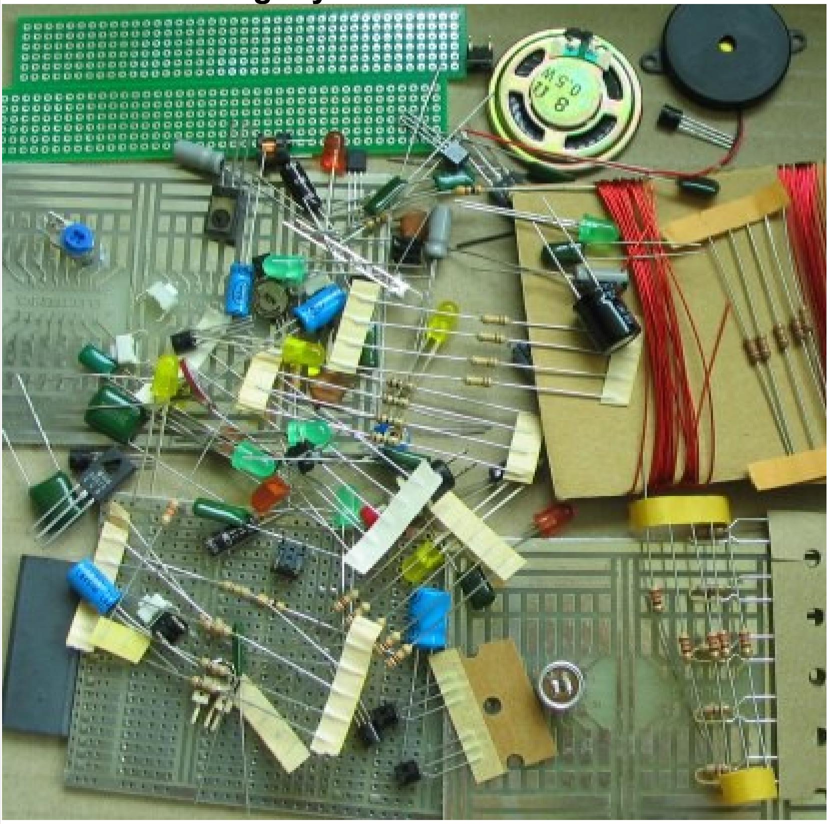
Kit for Transistor Circuits - $15.00

A kit of components to make many of the circuits presented in this eBook is available for $15.00 plus $7.00 post.
Or email Colin Mitchell: talking@tpg.com.au

The kit contains the following components:
(plus **extra** 30 resistors and 10 capacitors for experimenting), plus:

3 - 47R
5 - 220R
5 - 470R
5 - 1k
5 - 4k7
5 - 10k
2 - 33k
4- 100k
4 - 1M
1 - 10k mini pot
1 - 100k mini pot
2 - 10n
2 - 100n
5 - 10u electrolytics
5- 100u electrolytics
5 - 1N4148 signal diodes
6 - BC547 transistors - NPN - 100mA
2 - BC557 transistors - PNP - 100mA
1 - BC338 transistor - NPN - 800mA
3 - BD679 Darlington transistors - NPN - 4amp
5 - red LEDs
5 - green LEDs
5 - orange LEDs
2 - super-bright WHITE LEDs - 20,000mcd
1 - 3mm or 5mm flashing LED
1 - mini 8R speaker
1 - mini piezo
1 - LDR (Light Dependent Resistor)
1 - electret microphone
1m - 0.25mm wire
1m - 0.5mm wire
1 - 10mH inductor
1 - push button
5 - tactile push buttons
1 - **Experimenter Board** (will take 8, 14 and 16 pin chips)
5 - mini Matrix Boards: 7 x 11 hole,
11 x 15 hole, 6 x 40 hole, surface-mount 6 x 40 hole board or others.

Photo of kit of components.
Each batch is slightly different:



There are more components than you think. . . plus an extra bag of approx 30 components. The 8 little components are switches and the LDR and flashing LED is hiding.
In many cases, a resistor or capacitor not in the kit, can be created by putting two resistors or capacitors in series or parallel or the next higher or lower value can be used.

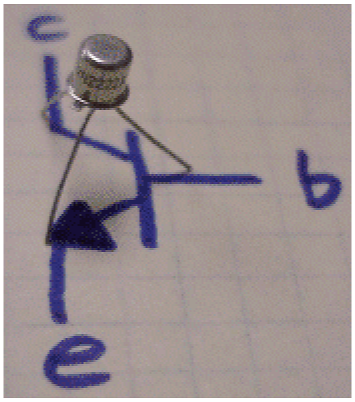
Don't think transistor technology is obsolete. Many complex circuits have one or more transistors to act as buffers, amplifiers or to connect one block to another. It is absolutely essential to understand this area of electronics if you want to carry out design-work or build a simple circuit to carry out a task.

We also have an eBook: **THE TRANSISTOR AMPLIFIER** with over 100 different transistor circuits . . . proving the transistor can be connected in so many ways.

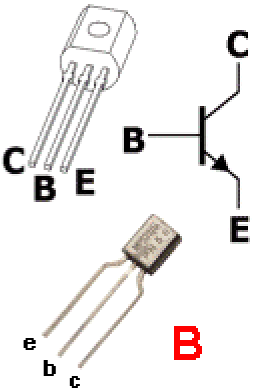
THEORY

Read the full article HERE (the Transistor Amplifier eBook)

The first thing you will want to know is: **HOW DOES A TRANSISTOR WORK**?



A



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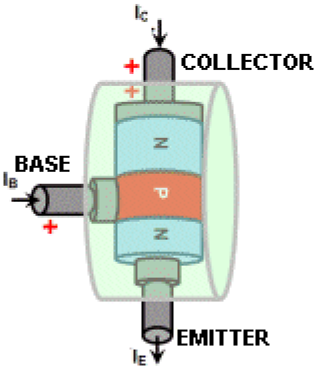

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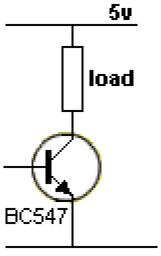
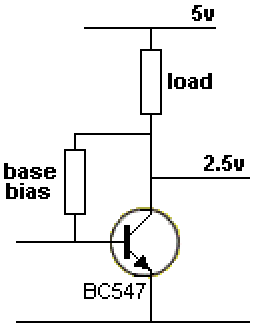
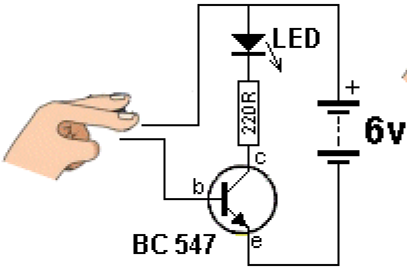


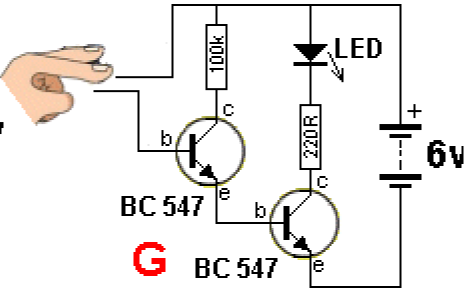
D

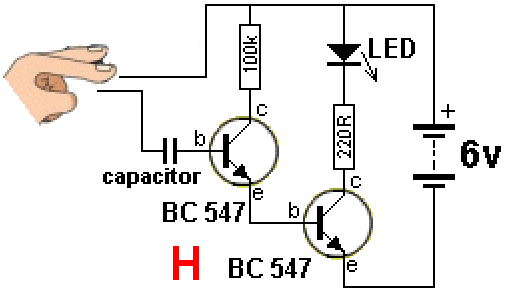


E



F





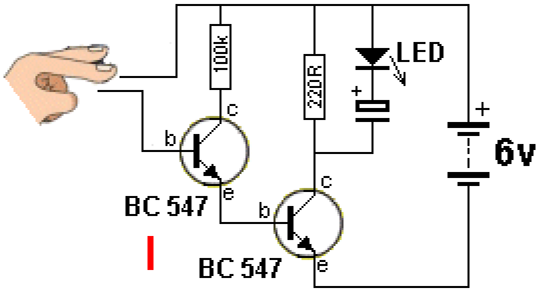
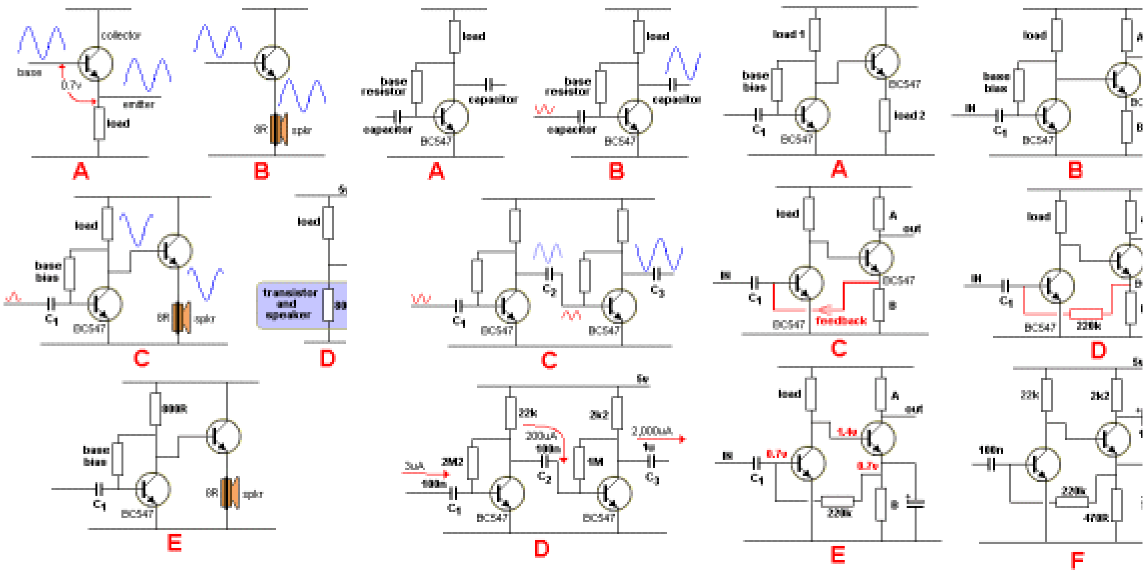


Diagram "A" shows an NPN transistor with the legs covering the symbol showing the name for each lead.
The transistor is a "general purpose" type and and is the smallest and cheapest type you can get. The number on the transistor will change according to the country where the circuit was designed but the types we refer to are all the SAME.
Diagram "B" shows two different "general purpose" transistors and the different pinouts. You need to refer to data sheets or test the transistor to find the correct pinout.
Diagram "C" shows the equivalent of a transistor as a water valve. As more current (water) enters the base, more water flows from the collector to the emitter.
Diagram "D" shows the transistor connected to the power rails. The collector connects to a resistor called a LOAD and the emitter connects to the 0v rail or earth or "ground."
Diagram "E" shows the transistor in SELF BIAS mode. This is called a COMMON EMITTER stage and the resistance of the BASE BIAS RESISTOR is selected so the voltage on the collector is half-rail voltage. In this case it is 2.5v.
To keep the theory simple, here's how you do it. Use 22k as the load resistance.
Select the base bias resistor until the measured voltage on the collector 2.5v. The base bias will

be about 2M2.
This is how the transistor reacts to the base bias resistor:
The base bias resistor feeds a small current into the base and this makes the transistor turn on and create a current-flow though the collector-emitter leads.
This causes the same current to flow through the load resistor and a voltage-drop is created across this resistor. This lowers the voltage on the collector.
The lower voltage causes a lower current to flow into the base and the transistor stops turning on a slight amount. The transistor very quickly settles down to allowing a certain current to flow through the collector-emitter and produce a voltage at the collector that is just sufficient to allow the right amount of current to enter the base.
Diagram "F" shows the transistor being turned on via a finger. Press hard on the two wires and the LED will illuminate brighter. As you press harder, the resistance of your finger decreases. This allows more current to flow into the base and the transistor turns on harder.
Diagram "G" shows a second transistor to "amplify the effect of your finger" and the LED illuminates about 100 times brighter.
Diagram "H" shows the effect of putting a capacitor on the base lead. The capacitor must be uncharged and when you apply pressure, the LED will flash brightly then go off. This is because the capacitor gets charged when you touch the wires. As soon as it is charged NO MORE CURRENT flows though it. The first transistor stops receiving current and the circuit does not keep the LED illuminated. To get the circuit to work again, the capacitor must be discharged. This is a simple concept of how a capacitor works. A large-value capacitor will keep the LED illuminated for a longer period of time.
Diagram "I" shows the effect of putting a capacitor on the output. It must be uncharged for this effect to work. We know from Diagram G that the circuit will stay on when the wires are touched but when a capacitor is placed in the output, it gets charged when the circuit turns ON and only allows the LED to flash.

1. This is a simple explanation of how a transistor works. It amplifies the current going into the base about 100 times and the higher current flowing through the collector-emitter leads will illuminate a LED.
2. A capacitor allows current to flow through it until it gets charged. It must be discharged to see the effect again.

Read the full article HERE



INCREASING THE VOLTAGE

You can change the voltage of many circuits from 6v to 12v or 3v to 6v without altering any of the values. I can see instantly if this is possible due to the value of the components and here's how I do it:
Look at the value of the resistors driving the load(s).
Work out the current entering each load and see if it is less than the maximum allowable.
Then, take a current reading on the lower voltage.
Increase the voltage to the higher value and take another reading.
In most cases the current will increase to double the value (or a little higher than twice the original value).
If it is over 250% higher, you need to feel each of the components and see if any are getting excessively hot.

If any LEDs are taking excessive current, double the value of the current-limiting resistor.
If any transistor is getting hot, increase the value of the load resistor.
In most cases, when the voltage is doubled, the current will will crease to double the original. This means the circuit will consume 4 times the original energy.
This is just a broad suggestion to answer the hundreds of emails I get on this topic.

CONTENTS **circuits in red are in 101-200 Circuits**

Note: **All** circuits use 1/4 watt resistors unless specified on the diagram.

Adjustable High Current Power Supply
Aerial Amplifier
Alarm Using 4 buttons
Amazing LED Flasher - for Bikes
Ammeter 0-1A
Amplifier uses speaker as microphone
AM Radio - 5 Transistor
Amplifying a Digital Signal
Arc Welder Simulator for Model Railways
Audio Amplifier (mini)
Automatic Battery Charger
Automatic Bathroom Light
Automatic Garden Light
Automatic Light - see also Night Light
Automatic PIR LED Light
Automatic Solar Light
Battery Capacity
Battery Charger - 12v Automatic
Battery Charger MkII - 12v trickle charger
Battery-Low Beeper
Battery Monitor MkI
Battery Monitor MkII
Bench Power Supply
Bike Flasher Bike Flasher - amazing
Bike Turning Signal
Beacon (Warning Beacon 12v)
Beeper Bug
Blocking Oscillator
Blown Fuse Indicator
Book Light
Boom Gate Lights
Bootstrap Amplifier
Boxes
Breakdown Beacon
Bright Flash from Flat Battery
Buck Converter for LEDs 48mA
Buck Converter for LEDs 170mA
Buck Converter for LEDs 210mA
Buck Converter for LEDs 250mA
Buck Converter for 3watt LED
Buck Regulator 12v to 5v
Microphone Pre-amplifier
Mobile Phone Alert-2
Model Railway Point Motor Driver
Model Railway time
Motor Speed Controller
Motor Speed Control (simple)
Movement Detector
Multimeter - Voltage of Bench Supply
Music On Hold
Music to Colour
Nail Finder
NiCd Charger
Night Light - see also Automatic Light
On-Off via push Buttons
OP-AMP -using 3 transistors
Passage PIR LED Light
Phaser Gun
Phase-Shift Oscillator - good design
Phone Alert
Phone Alert-2 (for mobile phone)
Phone Bug
Phone Tape-1
Phone Tape-2
Phone Tape-3
Phone Tape-4 - using FETs
Phone Transmitter-1
Phone Transmitter-2
Phone Transmitter-3
Phone Transmitter-4
Phase-shift Oscillator
Plant Needs Watering
PIC Programmer Circuits 1,2 3
Piezo Buzzer - how it works
PIR Detector
PIR LED Light
Point Motor Driver
Powering a LED
Power ON
Power Supplies - Fixed
Power Supplies - Adjustable LMxx series
Power Supplies - Adjustable 78xx series
Power Supplies - Adjustable from 0v
Power Supply - Inductively Coupled

Cable Tracer
Camera Activator
Capacitor Discharge Unit MkII (CDU2) Trains
Capacitor Tester
Car Detector (loop Detector)
Car Light Extender MkII
Car Light Alert
CFL Driver (Compact Fluorescent) 5w
Charge-current without a multimeter
Chaser 3 LED 5 LED Chaser using FETs
Charger - NiCd
Charging Battery via Solar Panel
Chip Programmer (PIC) Circuits 1,2 3
Circuit Symbols Complete list of Symbols
Clock - Make Time Fly
Clap Switch - see also VOX
Clap Switch - turns LED on for 15 seconds
Code Lock
Code Pad
Coin Counter
Colour Code for Resistors - all resistors
Colpitts Oscillator
Combo-2 - Transistor tester
Constant Current
Constant Current Drives two 3-watt LEDs
Constant Current for 12v car
Constant Current Source Cct 2 Cct 4
Constant Current 1.5amp
Continuity Tester
Courtesy Light Extender for Cars MkII
Crossing Lights
Crystal Tester
Dancing Flower
Dancing Flower with Speed Control
Dark Detector for Project
Dark Detector with beep Alarm
Darlington Transistor
Decaying Flasher
Delay Before LED turns ON
Delay Turn-off - turns off circuit after

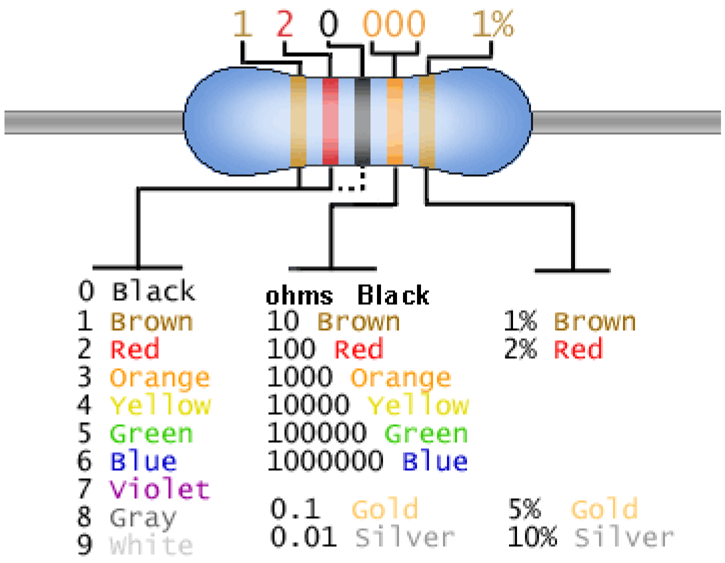
Power Zener
Project can turn ON when DARK
Push-On Push OFF
PWM Controller
Quiz Timer
Radio - AM - 5 Transistor
Railway time
Random Blinking LEDs
Rechargeable Battery Capacity
Rectifying a Voltage
Relay Chatter
Relay OFF Delay
Relay Protection
Resistor Colour Code
Resistor Colour Code - 4, 5 and 6 Bands
Reversing a Motor
Robo Roller
Robot
Robot Man - Multivibrator
Safe 240v Supply
Schmitt Trigger
SCR with Transistors
Second Simplest Circuit
Sequencer
Shake Tic Tac LED Torch
Signal by-pass
Signal Injector
Simple Flasher
Simple Logic Probe
Simple Touch-ON Touch-OFF Switch
Simplest Transistor Tester
Siren
Siren
Soft Start power supply
Solar Engine
Solar Engine Type-3
Solar Light - Automatic
Solar Panel - charging a battery
Solar Photovore
Sound to Light
Sound Triggered LED
Speaker Transformer
Speed Control - Motor
Spy Amplifier
Strength Tester

GOLD DETECTORS - article
Guitar Fuzz
Hartley Oscillator
Hex Bug
H-Bridge
Headlight Extender & see Light Extender Cars
Heads or Tails
Hearing Aid Constant Volume
Hearing Aid Push-Pull Output
Hearing Aid 1.5v Supply
Hee Haw Siren
High Current from old cells
High Current Power Supply
High-Low Voltage Cutout
IR LED Driver
IC Radio
Increasing the output current
Increasing the Voltage - see above
Inductively Coupled Power Supply
Intercom
Latching A Push Button
Latching Relay Toggle A Relay Toggle (Sw)
LED Detects Light
LED Detects light
LED Driver 1.5v White LED
LED Driver for 12v car IR LED Driver
LED Flasher - and see 3 more in this list
LED Flasher 1-Transistor
LED and Transistor Tester
LED Flashes 3 times when power applied
LED 1-watt
LED 1.5 watt
LED Fader
LED flasher 3v White LED
LEDs for 12v car
LEDs on 240v
LED Strip - passage Light
LED Torch
LED Torch with Adj Brightness
LED Torch with 1.5v Supply
LED Turning Flasher
Lie Detector
Walkie Talkie with LM386
Walkie Talkie - 5 Tr - circuit 1
Walkie Talkie - 5 Tr- circuit 2
Warning Beacon
Water Level Detector
Worlds Simplest Circuit
White LED Flasher
White LED Flasher - 3v
White LED with Adj Brightness
White Line Follower
White Noise Generator
Xtal Tester
Zapper - 160v
Zener Diode (making)
Zener Diode Tester
0-1A Ammeter
1 watt LED - a very good design
1-watt LED - make your own
1.5 watt LED
1.5v to 10v Inverter
1.5v LED Flasher
1.5v White LED Driver
3-Phase Generator
3v White LED flasher
3 watt LED Buck Converter for
3v3 from 5v Supply
5v from old cells - circuit1
5v from old cells - circuit2
5v Regulated Supply from 3v
5 LED Chaser
5 Transistor Radio
6 to 12 watt Fluoro Inverter
8 Million Gain
9v Supply from 3v
10 LEDs on 9v
10 Second Delay
12v Battery Charger - Automatic
12v Flashing Beacon (Warning Beacon)
12v Relay on 6v
12v Trickle Charger
12v to 5v Buck Converter
12v Supply
18 LEDs using a 3.7v Li-Ion CELL
20 LEDs on 12v supply
20watt Fluoro Inverter

Light Alarm-1
Light Alarm-2
Light Alarm-3
Light Extender for Cars
Limit Switches
Listener - phone amplifier
Logic Probe - Simple - Simple with PULSE
Logic Probe with Pulse
Low fuel Indicator
Low Mains Drop-out
Low Voltage cut-out
Low-High Voltage Cutout
Low Voltage Flasher
Mains Detector
Mains Hum Detector
Mains Night Light
Make any capacitor value
Make any resistor value
Make Time Fly!
Make you own 1watt LED
Making 0-1A Ammeter
Mains Night Light
Make any capacitor value
Make any resistor value
Metal Detector Metal Detector MkII
Metal Detector - Nail Finder
METAL DETECTORS - article

20 LEDs on 12v supply
24v to 12v for charging
27MHz Door Phone
27MHz Field Strength Meter
27MHz Transmitter
27MHz Transmitter - no Xtal
27MHz Transmitter-Sq Wave
27MHz Transmitter-2 Ch
27MHz Transmitter-4 Ch
27MHz Receiver
27MHz Receiver-2
240v Detector
240v - LEDs
303MHz Transmitter

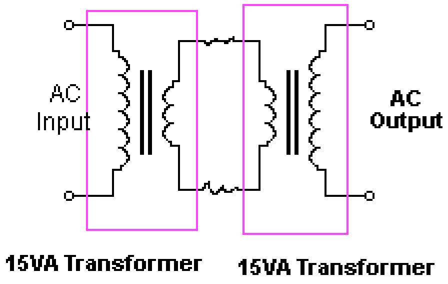
RESISTOR COLOUR CODE



0 Black	ohms Black	
1 Brown	10 Brown	1% Brown
2 Red	100 Red	2% Red
3 Orange	1000 Orange	
4 Yellow	10000 Yellow	
5 Green	100000 Green	
6 Blue	1000000 Blue	
7 Violet		
8 Gray	0.1 Gold	5% Gold
9 White	0.01 Silver	10% Silver

SAFE 240v SUPPLY

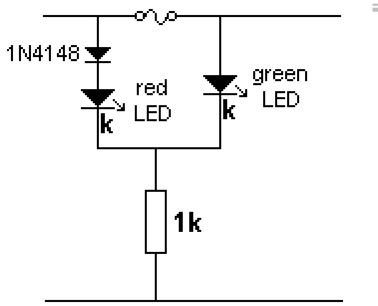
When working on any project that connects to the "mains," it is important to take all precautions to prevent electrocution. This project provides 240v AC but the current it limited to 60mA if a 15 watt transformer is used. Although the output can produce a nasty shock and the voltage will kill you, the circuit provides isolation from the mains and if a short-circuit occurs, it will not blow a fuse, but the transformers will get very hot as start to buzz.
You can use any two identical transformers and the wattage of either transformer will determine the maximum output wattage.
If you don't use identical transformers, the output voltage will be higher or lower than the "mains" voltage and the wattage will be determined by the smaller transformer.



This arrangement is not perfectly safe, but is the best you can get when working on projects such as switch-mode power supplies, capacitor-fed down-lights etc.

RECHARGEABLE BATTERY CAPACITY

This simple circuit tests the capacity of a rechargeable cell. Connect a 4R7 (yellow-purple-gold-gold) resistor across the terminals of a clock mechanism and fit a fully charged rechargeable cell. Set the hands to 12 O'Clock and the clock will let you know how long the cell lasted until the voltage reached about 0.8v.
Now fit another cell and see how long it lasts. You cannot work out the exact capacity of a cell but you can compare one cell with another. The initial current is about 250mA for a 1.2v cell.

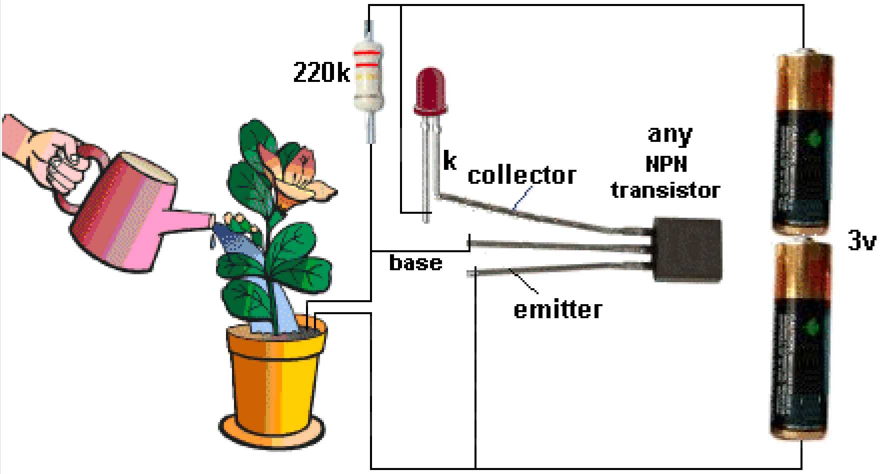


BLOWN FUSE INDICATOR

This circuit indicates when a fuse is "blown."

PLANT NEEDS WATERING

This circuit indicates when the soil is dry and the plant needs watering. The circuit does not have a current-limiting resistor because the base resistor is very high and the current through the transistor is only 2mA. Don't change the supply voltage or the 220k as these two values are correct for this circuit.



THE SOLAR PANEL

This will clear-up a lot of mysteries of the **solar panel**.
Many solar panels produce 16v - 18v when lightly loaded, while other 12v solar panels will not charge a 12v battery.
Some panels say "nominal voltage," some do not give any value other than 6v or 12v, and some specify the wrong voltage. You can't work with vague specifications. You need to know accurate details to charge a battery from a solar panel.
There are 3 things you have to know before buying a panel or connecting a panel to a battery.

1. The **UNLOADED VOLTAGE**.
2. The voltage of the panel when delivering the rated current. Called the **RATED VOLTAGE**
3. The **CURRENT**.

1. The **Unloaded Voltage** is the voltage produced by the panel when it is lightly loaded. This voltage is very important because a 12v battery will produce a "floating voltage" of about 15v when it is fully charged and it will gradually rise to this voltage during the charging period. This means the panel must be able to deliver more than 15v so it will charge a 12v battery.
Sometimes there is a diode and a charging circuit between the panel and battery and these devices will drop a small voltage, so the panel must produce a voltage high enough to allow for them.
The **Unloaded Voltage** can sometimes be determined by counting the

number of cells on the panel as each cell will produce 0.6v.
If you cannot see the individual cells, use a multimeter to read the voltage under good illumination and watch the voltage rise. You can place a 100 ohm resistor across the panel to take readings.

2. The **RATED VOLTAGE** is the guaranteed voltage the panel will deliver when full current is flowing. This can also be called the Nominal Voltage, however don't take anything for certain. Take readings of your own. The Rated Voltage (and current) is produced when the panel receives bright sunlight. This may occur for only a very small portion of the day.

You can clearly see the 11 cells of this panel and it produces 6.6v when lightly loaded. It will barely produce 6v when loaded and this is **NOT ENOUGH** to charge a 6v battery.

This panel claims to be 18v, but it clearly only produces 14.4v. This is not suitable for charging a 12v battery. When you add a protection diode, the output voltage will be 13.8v. A flat battery being charged will reach 13.8v very quickly and it will not be charged any further. That's why the output voltage of a panel is so important.

This is a genuine 18v panel:

The panel needs to produce 17v to 18v so it will have a small "overhead" voltage when the battery reaches 14.4v and it will still be able to supply energy into the battery to complete the charging process.

3. The **Rated Current** is the maximum current the panel will produce when receiving full sunlight.

The current of a panel can be worked out by knowing the wattage and dividing by the unloaded voltage.

A 20 watt 18v panel will deliver about 1 amp.

CHARGING A BATTERY

A solar panel can be used to directly charge a battery without any other components. Simply connect the panel to the battery and it will charge when the panel receives bright sunlight - providing the panel produces a voltage least 30% to 50% more than the battery you are charging.

Here's some amazing facts:

The voltage of the panel does not matter and the voltage of the battery does not matter. You can connect any panel to any battery - providing the panel produces a voltage least 30% to 50% more than the battery you are charging.

The output voltage of the panel will simply adapt to the voltage of the battery. Even though there is a voltage mismatch, there is **NO** "lost" or wasted energy. An 18v panel "drives into" a 12v battery with the maximum current it can produce when the intensity of the sun is a maximum.

To prevent too-much mismatch, it is suggested you keep the panel voltage to within 150% of the battery voltage. (6v battery - 9v max panel, 12v battery - 18v max panel, 24v battery - 36v max panel).

But here's the important point: To prevent overcharging the battery, the wattage of the panel is important.

If the wattage of an 18v panel is 6watts, the current is 6/18 = 0.33 amps = 330mA.

To prevent overcharging a battery, the charging current should not be more than one-tenth its amp-hr capacity.

For instance, a 2,000mAhr set of cells should not be charged at a rate higher than 200mA for 14 hours. This is called its 14-hour rate.

But this rating is a CONSTANT RATING and since a solar panel produces an output for about 8 hours per day, you can increase the charging current to 330mA for 8 hours. This will deliver the energy to fully charge the cells.

That's why a 6 watt panel can be directly connected to a set of (nearly fully discharged) 2,000mAhr cells.

For a 12v 1.2AHr battery, the charging current will be 100mA for 12 hours or 330mA for 4 hours and a regulator circuit will be needed to prevent overcharging.

For a 12v 4.5AHr battery, the charging current will be 375mA for 12 hours and a larger panel will be needed.

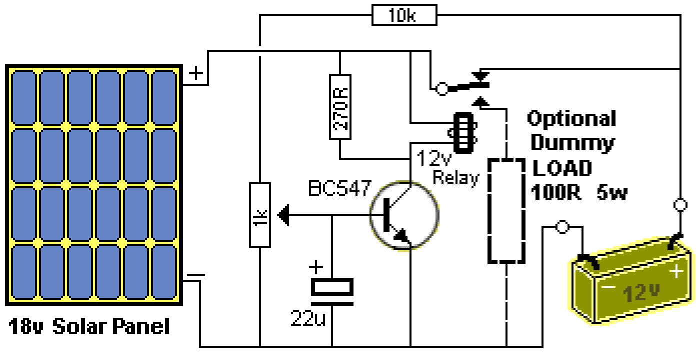
ADDING A DIODE

Some solar panels will discharge the battery (a small amount) when it is not

receiving sunlight and a diode can be added to prevent discharge. This diode drops 0.6v when the panel is operating and will reduce the maximum current (slightly) when the panel is charging the battery. If the diode is Schottky, the voltage-drop is 0.35v.
Some panels include this diode - called a BYPASS DIODE.

PREVENTING OVERCHARGING
There are two ways to prevent overcharging the battery.
1. Discharge the battery nearly fully each night and use a panel that will only deliver 120% of the amp-hour capacity of the battery the following day.
2. Add a **VOLTAGE REGULATOR**.

Here is the simplest and cheapest regulator to charge a 12v battery.
Full details of how the circuit works and setting up the circuit is HERE.
The solar panel must be able to produce at least 16v on NO LOAD. (25-28 cells). The diagram only shows a 24 cell panel - it should be 28 cells.
The only other thing you have to consider is the wattage of the panel. This will depend on how fast you want to charge the battery and/or how much energy you remove from the battery each day and/or the amp-Hr capacity of the battery.
For instance, a 12v 1.2A-Hr battery contains 14watt-hours of energy. An 6watt panel (16v to 18v) will deliver 18watt-hours (in bright sunlight) in 3 hours. The battery will be fully charged in 3 hours.

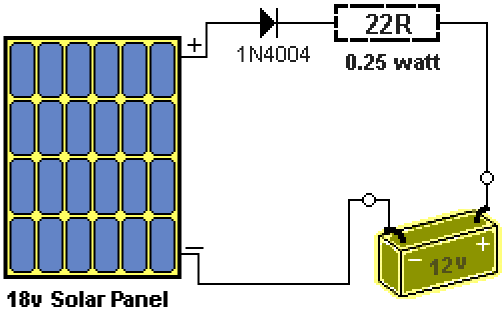


SOLAR BATTERY CHARGER / REGULATOR

The pot is adjusted so the relay drops-out at 13.7v
The charger will turn **ON** when the voltage drops to about 12.5v.
The 100R Dummy LOAD will absorb 3.25 watts and that is the maximum wattage the panel will produce with 100R load.

CHARGE CURRENT

Here is a very clever circuit to find the charging current, if you don't have a



multimeter.

Connect a 22R 0.25 watt resistor in series with the battery and hold your finger on the resistor. The resistor will get very hot if 100mA or more is flowing.
This resistor will indicate ONE WATT of energy is flowing into the battery, but we are using a 0.25 watt resistor to measure the heat as this represents "LOST ENERGY" and we want to keep the losses to a minimum.
To get some idea of 0.25watt of heat, place a 560R 0.25watt resistor across the terminals of a battery.
This is 250mW of heat and is your reference.

A 1.2A-Hr 12 volt battery has 14 watts of energy and if you are charging at ONE WATT, it will take about 16 hours to fully charge the battery.

This circuit can be used when charging a battery from your car, from a solar panel, a battery charger or a pulsed solar-charging circuit. It is also a SAFETY CIRCUIT as it will limit the current to 100mA. If the current is higher than 130mA, the resistor will hot and start to smell.

Note: when the 22R is removed, the current flowing into the battery WILL INCREASE.
The increase may be only 10% from some chargers, but can be as high as 100% OR MORE if the battery is connected to the cigarette lighter plug in your car.

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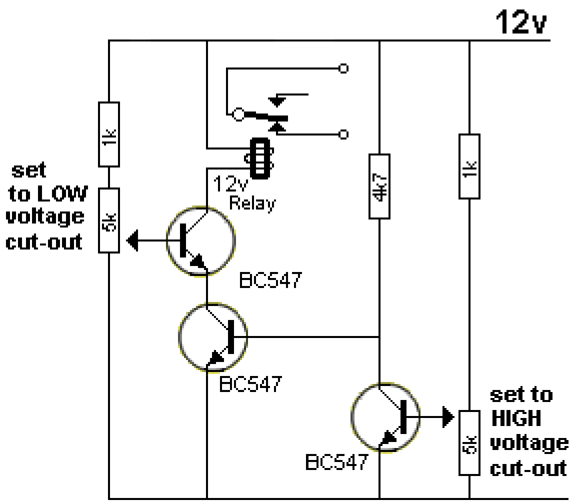
HIGH-LOW VOLTAGE CUT-OUT



This circuit will turn off the relay when the voltage is above or below the "set-points.";
You need either a variable power supply or a 12v battery and an extra 1.5v battery.
Turn the LOW voltage cutout trim pot to mid way and connect the 13.5v supply. Turn the HIGH voltage trim pot to the high end and the relay will turn off.
Now turn the 1.5v battery around the other way and adjust the LOW voltage trim pot to the 10.5v supply.

See resistors from 0.22ohm to 22M in full colour at bottom of this page and another resistor table

TESTING AN unknown TRANSISTOR

The first thing you may want to do is test an unknown transistor for COLLECTOR, BASE AND EMITTER. You also need to know if it is NPN or PNP.
You need a cheap multimeter called an ANALOGUE METER - a multimeter with a scale and pointer (needle).
It will measure resistance values (normally used to test resistors) - (you can also test other components) and Voltage and Current. We use the resistance settings.
It may have ranges such as "x10" "x100" "x1k" "x10"
Look at the resistance scale on the meter. It will be the top scale.
The scale starts at zero on the right and the high values are on the left. This is opposite to all the other scales. .
When the two probes are touched together, the needle swings FULL SCALE and reads "ZERO." Adjust the pot on the side of the meter to make the pointer read exactly zero.

How to read: "x10" "x100" "x1k" "x10"

Up-scale from the zero mark is "1"
When the needle swings to this position on the **"x10"** setting, the value is 10 ohms.
When the needle swings to "1" on the **"x100"** setting, the value is 100 ohms.

When the needle swings to "1" on the **"x1k"** setting, the value is 1,000 ohms = 1k.
When the needle swings to "1" on the **"x10k"** setting, the value is 10,000 ohms = 10k.
Use this to work out all the other values on the scale.
Resistance values get very close-together (and very inaccurate) at the high end of the scale. [This is just a point to note and does not affect testing a transistor.]

Step 1 - FINDING THE BASE and determining NPN or PNP

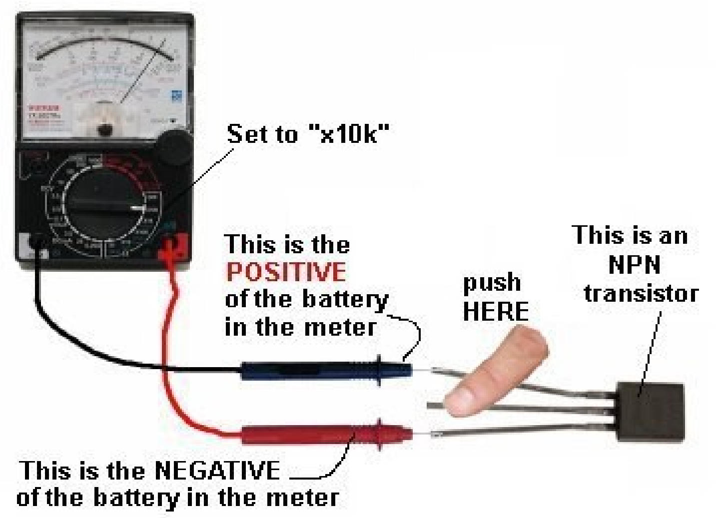
Get an **unknown transistor** and test it with a multimeter set to **"x10"**
Try the 6 combinations and when you have the black probe on a pin and the red probe touches the other pins and the meter swings nearly full scale, you have an **NPN transistor**. The black probe is **BASE**
If the red probe touches a pin and the black probe produces a swing on the other two pins, you have a **PNP transistor**. The red probe is **BASE**
If the needle swings FULL SCALE or if it swings for more than 2 readings, the transistor is FAULTY.

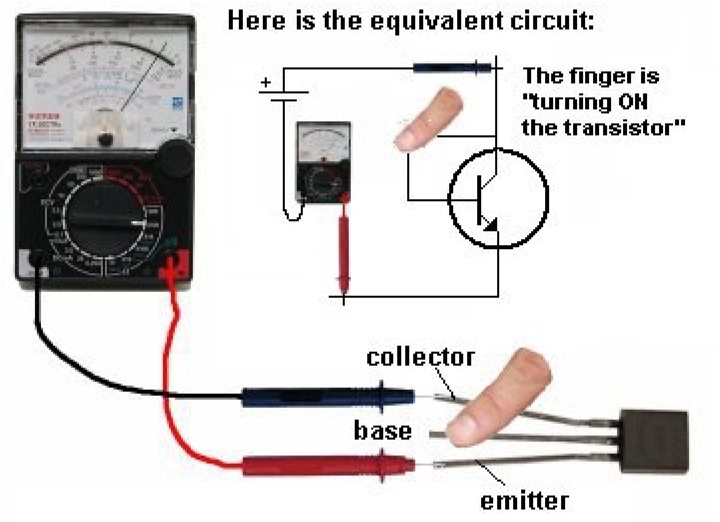
This is an NPN transistor
The black probe is the BASE

This is a PNP transistor
The red probe is the BASE

Step 2 - FINDING THE COLLECTOR and EMITTER

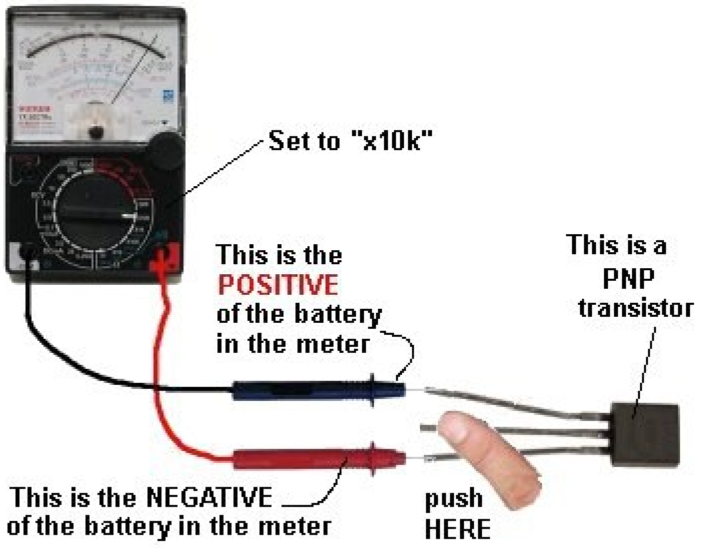
Set the meter to "x10k."
For an NPN transistor, place the leads on the transistor and when you press hard on the two leads shown in the diagram below, the needle will swing almost full scale.

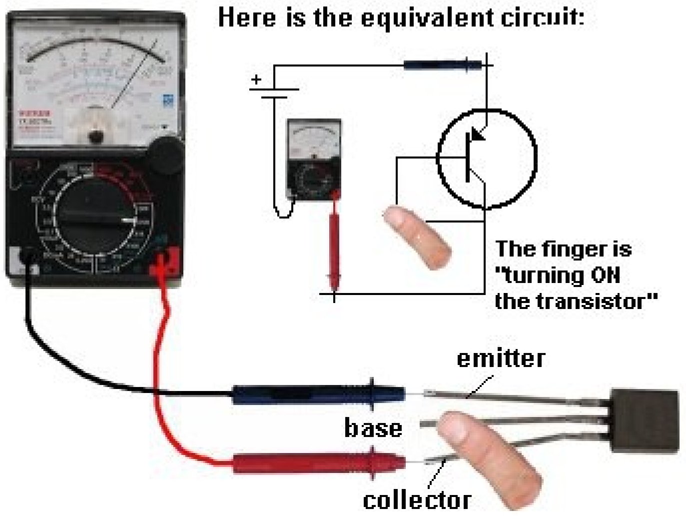




You have found the Collector Base and Emitter

For a PNP transistor, **set the meter to "x10k"** place the leads on the transistor and when you press hard on the two leads shown in the diagram below, the needle will swing almost full scale.

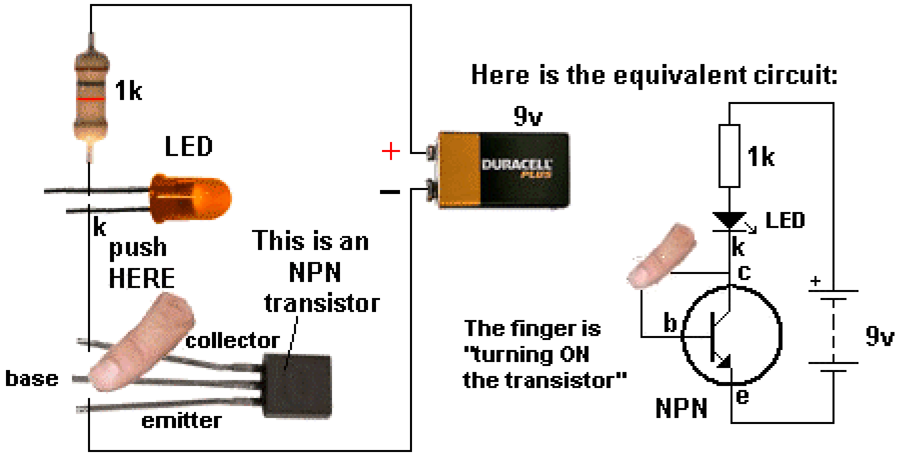


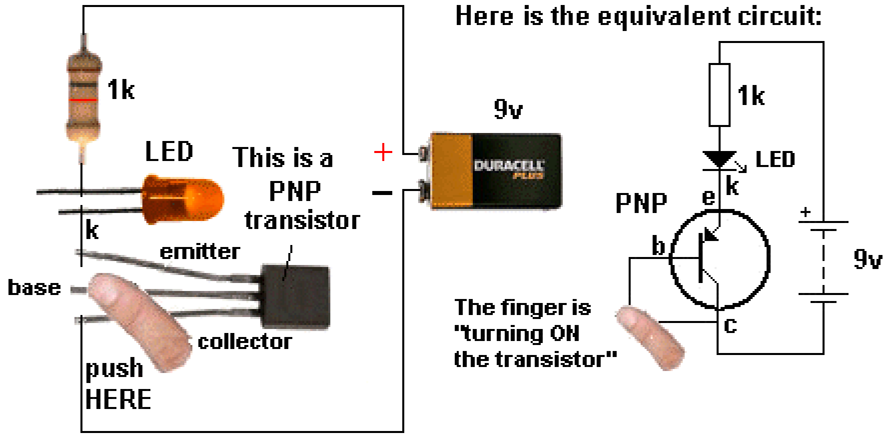


You have found the Collector Base and Emitter

SIMPLEST TRANSISTOR TESTER

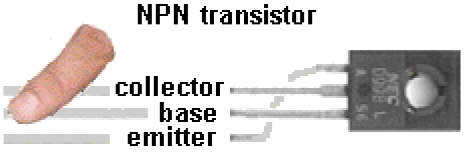
The simplest transistor tester uses a 9v battery, 1k resistor and a LED (any colour). Keep trying a transistor in all different combinations until you get one of the circuits below. When you push on the two leads, the LED will get brighter. The transistor will be NPN or PNP and the leads will be identified:





The leads of some transistors will need to be bent so the pins are in the same positions as shown in the diagrams. This helps you see how the transistor is being turned on. This works with NPN, PNP and Darlington transistors.

NPN transistor



NPN transistor

TRANSISTOR TESTER - 1

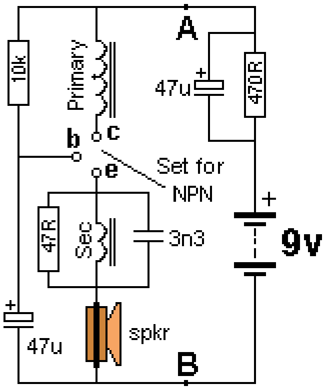
Transistor Tester - 1 project will test all types of transistors including Darlington and power. The circuit is set to test NPN types. To test PNP types, connect the 9v battery around the other way at points A and B.

The transformer in the photo is a 10mH choke with 150 turns of 0.01mm wire wound over the 10mH winding. The two original pins (with the red and black leads) go to the primary winding and the fine wires are called the Sec.

Connect the transformer either way in the circuit and if it does not work, reverse either the primary or secondary (but not both).

Almost any transformer will work and any speaker will be suitable.

If you use the speaker transformer described in the **Home Made Speaker Transformer** article, use one-side of the primary.

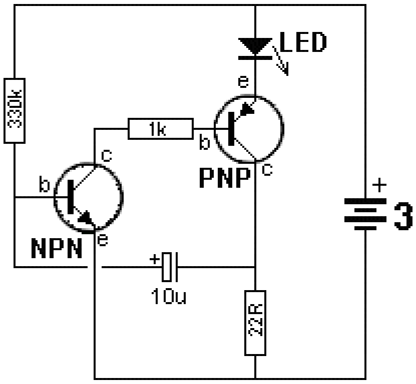


TRANSISTOR TESTER-1 CIRCUIT

The 10mH choke with 150 turns for the secondary

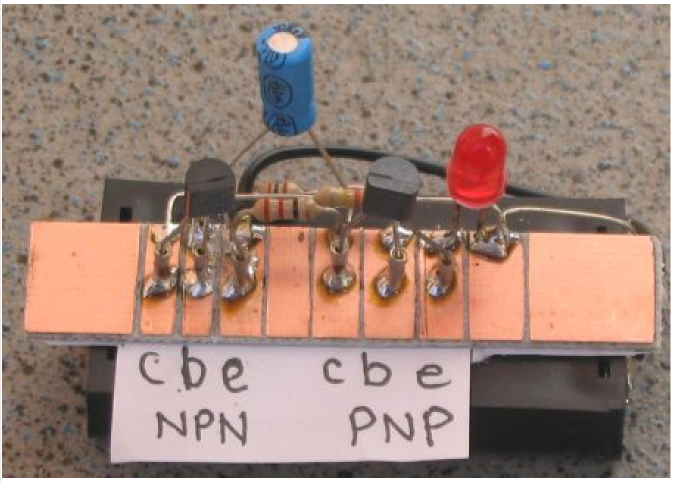
TRANSISTOR TESTER - 2

Here is another transistor tester.



This is basically a high gain amplifier with feedback that causes the LED to flash at a rate determined by the 10u and 330k resistor.

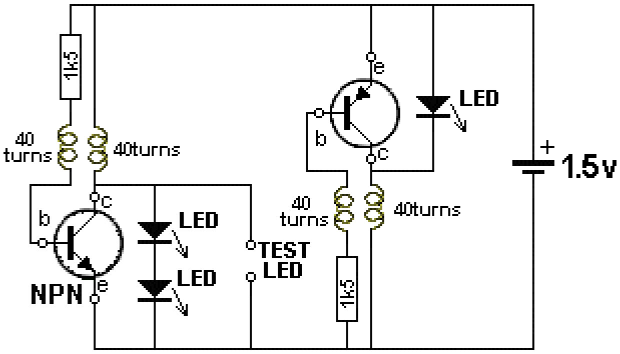
Remove one of the transistors and insert the unknown transistor. When it is NPN with the pins as shown in the photo, the LED will flash. To turn the unit off, remove one of the transistors.

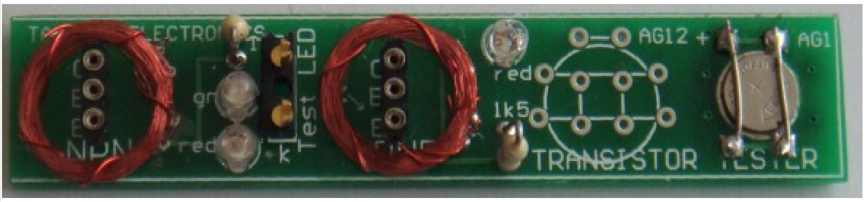


TRANSISTOR and LED TESTER - 3

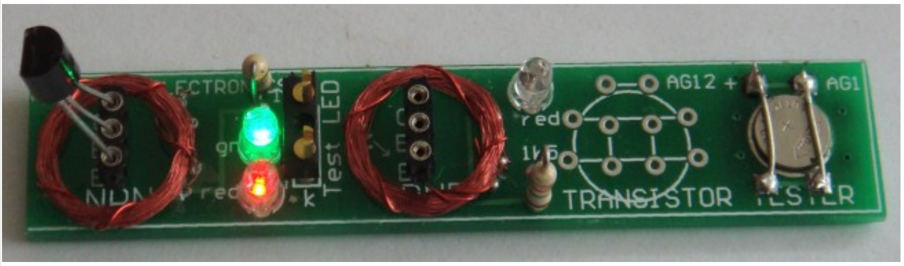
Here is another transistor tester. And it also tests LEDs. See the full project:
Transistor Tester

This circuit is basically a Joule Thief design with the coil (actually a transformer) increasing the 1.5v supply to a higher voltage to illuminate one or two LEDs in series. The "LED Test" terminals uses the full voltage produced by the circuit and it will test any colour LED including a white LED. The two "coils" are wound on a 10mm dia pen with 0.1mm wire (very fine wire). All the components fit on a small PC board. A kit of parts for the project is a available from Talking Electronics for $4.00 plus $3.00 postage.





TRANSISTOR and LED TESTER



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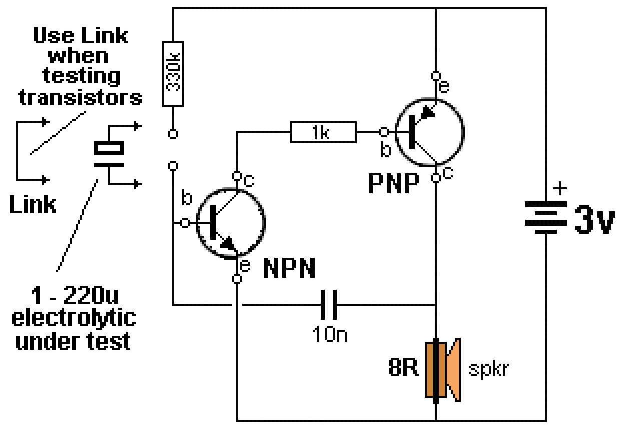
TRANSISTOR TESTER - 4 with ELECTROLYTIC TESTER

This circuit will test transistors and electrolytic capacitors from 1u to 220u for leakage, open, shorts and approx capacitance.

Build the circuit on a strip of PC board as shown in **Transistor Tester-2** so the transistors can be replaced with a suspect transistor and an electrolytic can be fitted in place of the link for the capacitor.

When an electrolytic is fitted to the circuit, it will produce a wailing and eventually stop. If the tone continues, the electrolytic is leaky.

If the tone is not produced, the electrolytic is open. If the tone does not change, the electrolytic is shorted.



TRANSISTOR TESTER - 4 CIRCUIT

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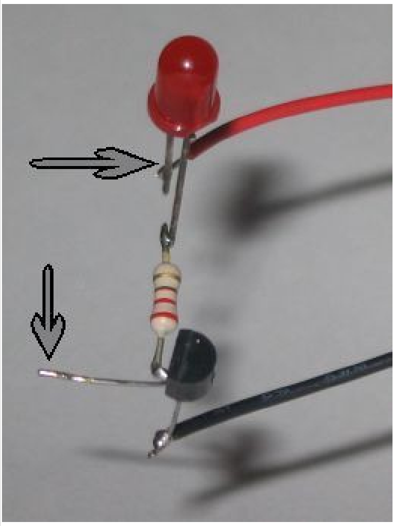
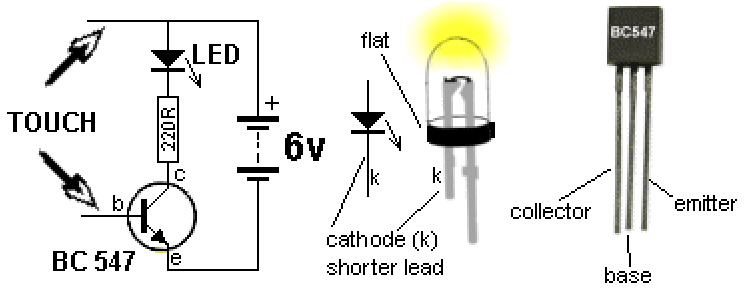


WORLDS SIMPLEST CIRCUIT

This is the simplest circuit you can get. Any NPN transistor can be used.



Connect the LED, 220 ohm resistor and transistor as shown in the photo.
Touch the top point with two fingers of one hand and the lower point with
fingers of the other hand and squeeze.
The LED will turn on brighter when you squeeze harder.

Your body has resistance and when a voltage is present, current will flow though your body (fingers). The transistor is amplifying the current through your fingers about 200 times and this is enough to illuminate the LED.

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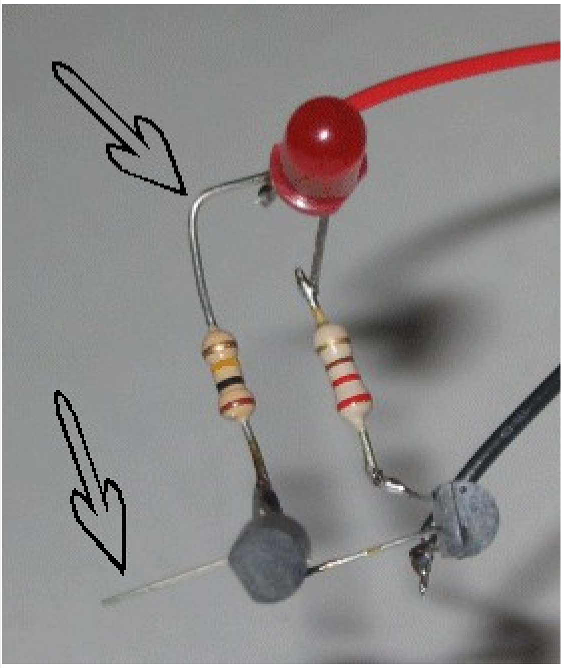
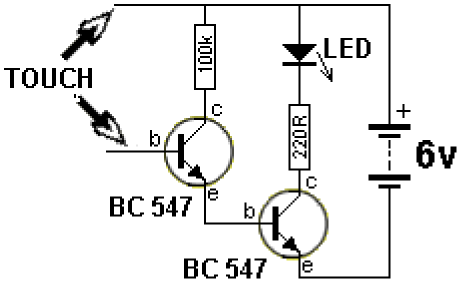
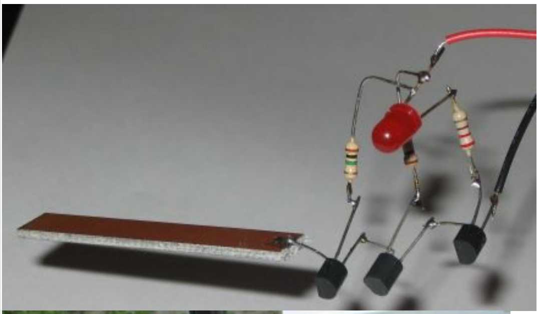
SECOND SIMPLEST CIRCUIT

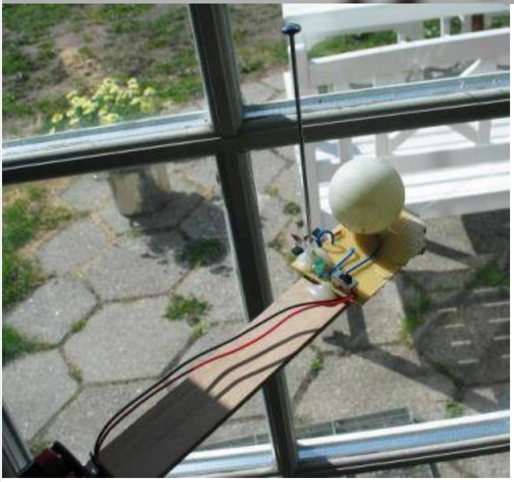




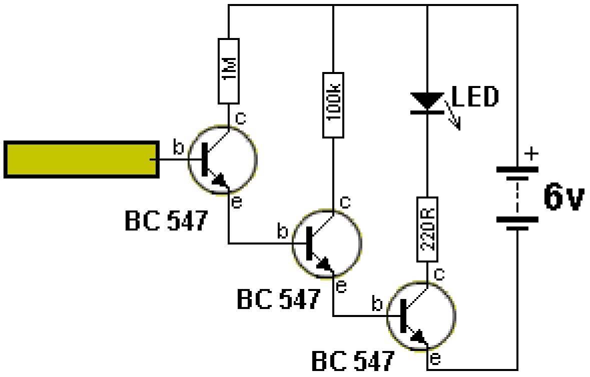
This the second simplest circuit in the world. A second transistor has been added in place of your fingers. This transistor has a gain of about 200 and when you touch the points shown on the diagram, the LED will illuminate with the slightest touch. The transistor has amplified the current (through your fingers) about 200 times.

8 MILLION GAIN!





This circuit is so sensitive it will detect "mains hum." Simply move it across any wall and it will detect where the mains cable is located. It has a gain of about 200 x 200 x 200 = 8,000,000 and will also detect static electricity and the presence of your hand without any direct contact. You will be amazed what it detects! There is static electricity EVERYWHERE! The input of this circuit is classified as very high impedance.



Here is a photo of the circuit, produced by a constructor, where he claimed he detected "ghosts."

http://letsmakerobots.com/node/12034
http://letsmakerobots.com/node/18933

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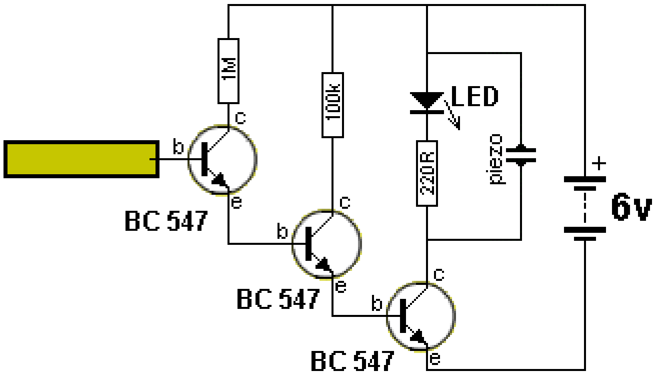
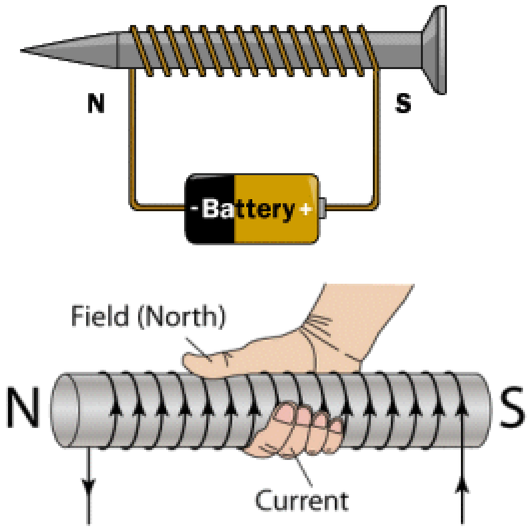
MAINS HUM DETECTOR

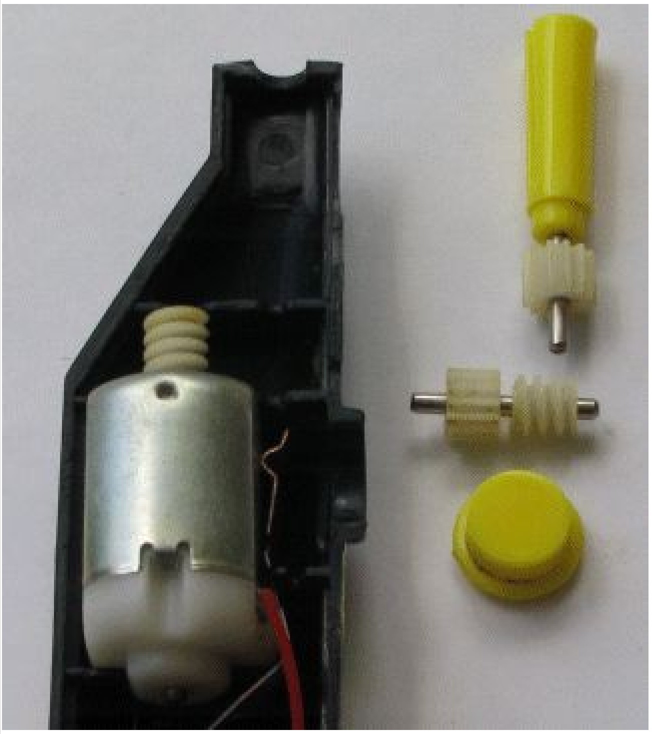
This simple circuit will detect if a cable is carrying the "Mains." The piezo diaphragm is will let you hear the hum: **Do not touch** the copper wire. Only place the detector **near** the plastic covering. It will work at 2cm from the cable.





FINDING THE NORTH POLE

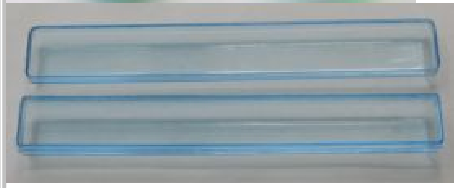
The diagrams show that a North Pole will be produced when the positive of a battery is connected to wire wound in the direction shown. This is Flemmings **Right Hand Rule** and applies to motors, solenoids and coils and anything wound like the turns in the diagram.

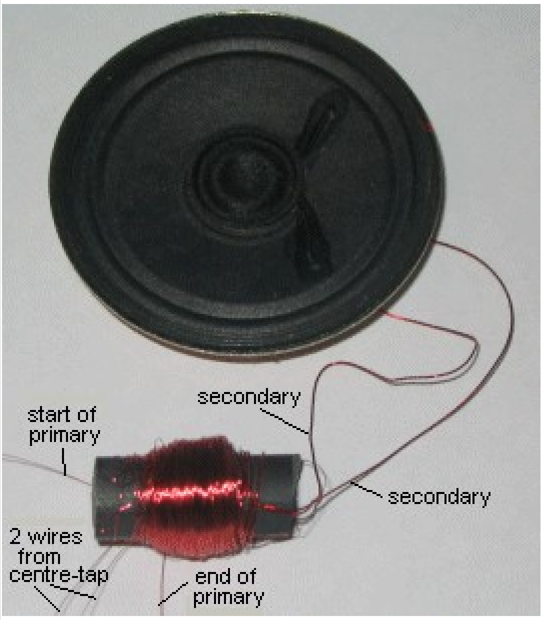


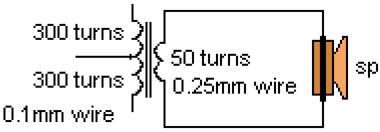
A two-worm reduction gearbox producing a reduction of 12:1 and 12:1 = 144:1 The gears are in the correct positions to produce the reduction.

BOXES FOR PROJECTS

One of the most difficult things to find is a box for a project. Look in your local "junk" shop, $2.00 shop, fishing shop, and toy shop. And in the medical section, for handy boxes. It's surprising where you will find an ideal box.
The photo shows a suitable box for a Logic Probe or other design. It is a toothbrush box. The egg shaped box holds "Tic Tac" mouth sweeteners and the two worm reduction twists a "Chuppa Chub." It cost less than $4.00 and the equivalent reduction in a hobby shop costs up to $16.00!



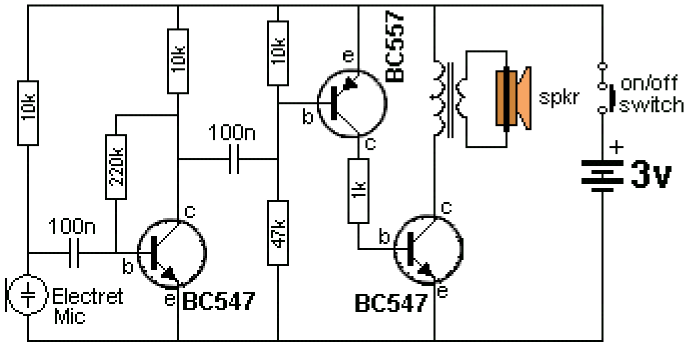




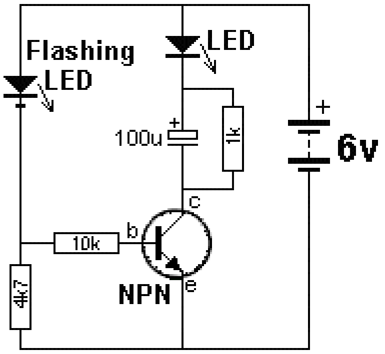
HOME MADE SPEAKER TRANSFORMER

The **speaker transformer** is made by winding 50 turns of 0.25mm wire on a small length of 10mm dia ferrite rod.
The size and length of the rod does not matter - it is just the number of turns that makes the transformer work. This is called the secondary winding.
The primary winding is made by winding 300 turns of 0.1mm wire (this is very fine wire) over the secondary and ending with a loop of wire we call the centre tap.
Wind another 300 turns and this completes the transformer.
It does not matter which end of the

secondary is connected to the top of the speaker.
It does not matter which end of the primary is connected to the collector of the transistor in the circuits in this book.



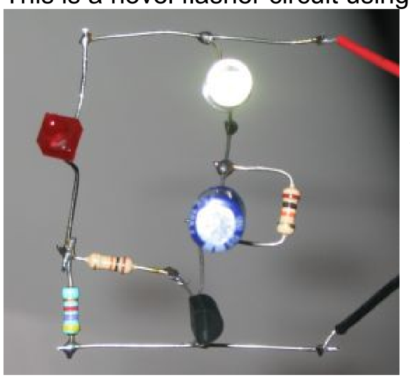
transistor is set for 3v supply. The second and third transistors are not turned on during idle conditions and the quiescent current is just 5mA.
The project is ideal for listening to conversations or TV etc in another room with long leads connecting the microphone to the amplifier.



The circuit uses a flashing LED to flash a super-bright 20,000mcd white LED

LED FLASHER WITH ONE TRANSISTOR!

This is a novel flasher circuit using a single driver transistor

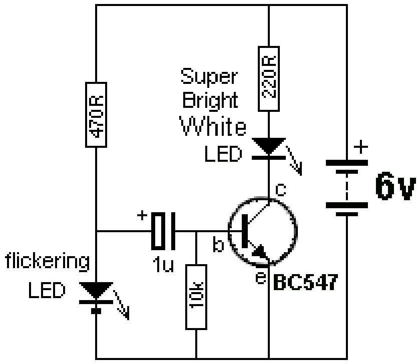


that takes its flash-rate from a flashing LED. The flasher in the photo is 3mm. An ordinary LED will not work.
The flash rate cannot be altered by the brightness of the high-bright white LED can be adjusted by altering the 1k resistor across the 100u electrolytic to 4k7 or 10k.
The 1k resistor discharges the 100u so that when the transistor turns on, the charging current into the 100u illuminates the white LED.
If a 10k discharge resistor is used, the 100u is not fully

discharged and the LED does not flash as bright.
All the parts in the photo are in the same places as in the circuit diagram to make it easy to see how the parts are connected.

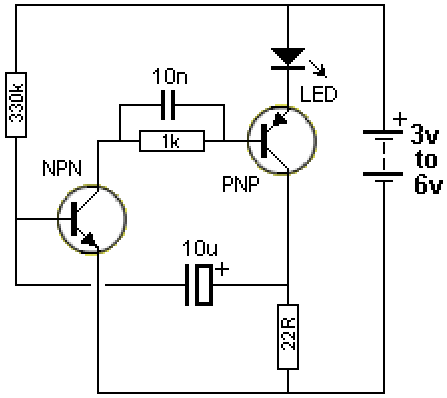
Arc Welder Simulator **for Model Railways**

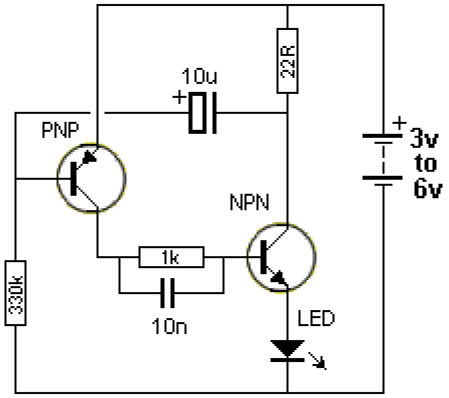
This very simple circuit replaces a very complex circuit (one of our previous projects) because all the random flashing is done via a microscopic microcontroller inside the flickering LED.
These LEDs can be purchased on eBay and you can contact Colin Mitchell for the link.
The super-bright white LED flashes much more than the flickering LED because the transistor and the 1u electrolytic picks up the pulses (the waveform) across the 470R resistor and only the main changes in the signal are transferred to the white LED. The 10k is very important as it discharges the 1u to help produce the OFF portion of the waveform.



LED FLASHER

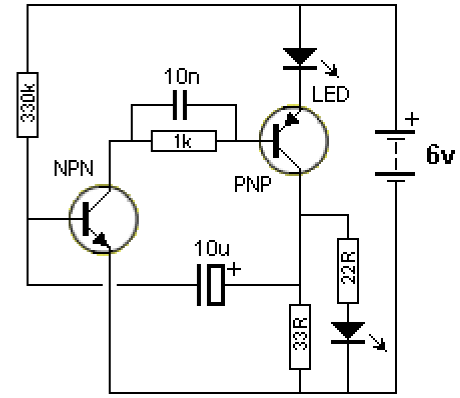
These two circuits will flash a LED very bright and consume less than 2mA average current. Both circuits can use a transistor with a larger current capability for the second transistor. The first circuit needs a PNP transistor and the second circuit needs an NPN transistor if a number of LEDs need to be driven. The second circuit is the basis for a simple motor speed control.
See the note on how the 330k works, in **Flashing Two LEDs** below.

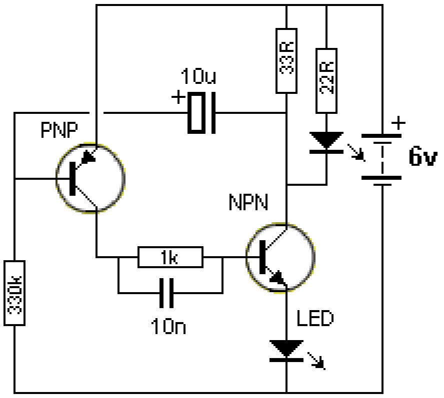


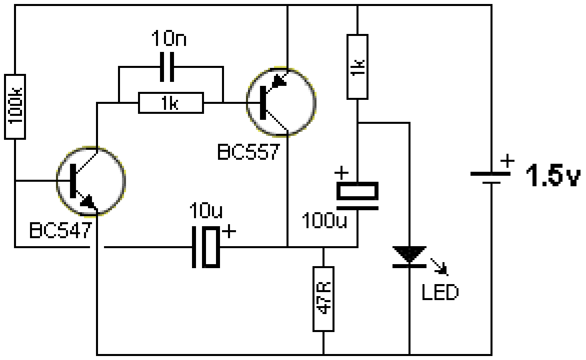


FLASHING TWO LEDS

These two circuits will flash two LEDs very bright and consume less than 2mA average current. They require 6v supply. The 330k may need to be 470k to produce flashing on 6v as 330k turns on the first transistor too much and the 10u does not turn the first transistor off a small amount when it becomes fully charged and thus cycling is not produced.







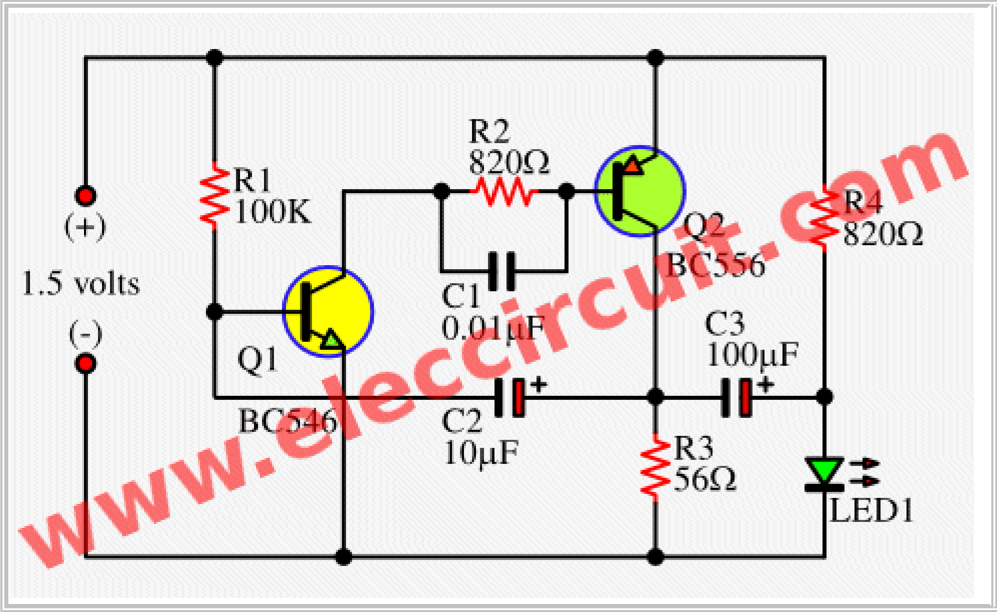
1.5v LED FLASHER

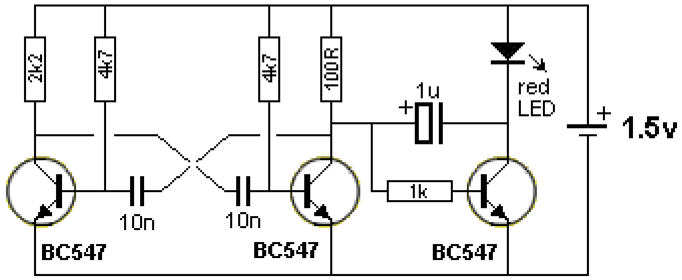
Here is my circuit copied by Eleccircuit.com:

1.5v LED FLASHER

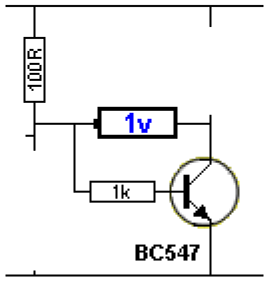
This will flash a LED, using a single 1.5v cell. It may even flash a white LED even though this type of LED needs about 3.2v to 3.6v for operation.
The circuit takes about 2mA but produces a very bright flash.

My circuit has been copied by Eleccircuit.com but my layout makes it much easier to see how the circuit works.

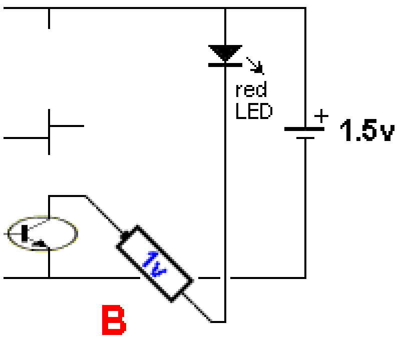




LED ON 1.5v SUPPLY



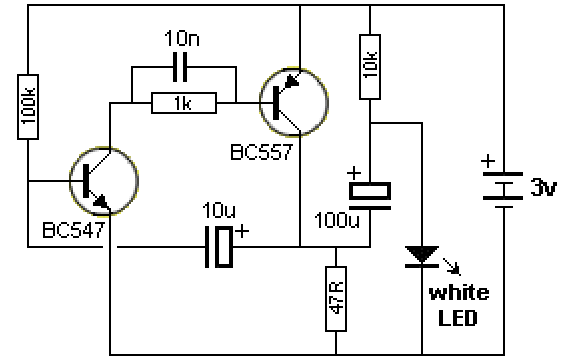
A



B

LED on 1.5v SUPPLY

A red LED requires about 1.7v before it will start to illuminate - below this voltage - NOTHING! This circuit takes about 12mA to illuminate a red LED using a single cell, but the interesting feature is the way the LED is illuminated.
The 1u electrolytic can be considered to be a 1v cell.
(If you want to be technical: it charges to about 1.5v - 0.2v loss due to collector-emitter = 1.3v and a lost of about 0.2v via collector-emitter in diagram B.)
It is firstly charged by the 100R resistor and the 3rd transistor (when it is fully turned ON via the 1k base resistor). This is shown in diagram "A." During this time the second transistor is not turned on and that's why we have omitted it from the diagram. When the second transistor is turned ON, the 1v cell is pulled to the 0v rail and the negative of the cell is actually 1v below the 0v rail as shown in diagram "B."
The LED sees 1.5v from the battery and about 1v from the electrolytic and this is sufficient to illuminate it. Follow the two voltages to see how they add to 2.5v.



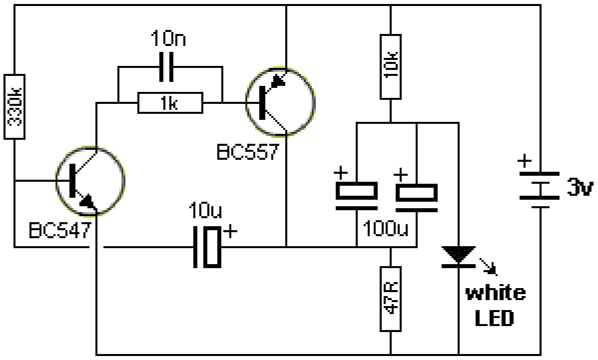
3v WHITE LED FLASHER

3v WHITE LED FLASHER

This will flash a white LED, on 3v supply and produce **a very bright flash.** The circuit produces a voltage higher than 5v if the LED is not in circuit but the LED limits the voltage to its characteristic voltage of 3.2v to 3.6v. The circuit takes about 2mA an is actually a voltage-doubler (voltage incrementer) arrangement. Note the 10k charges the 100u. It does not illuminate the LED because the 100u is charging and the voltage across it is always less than 3v. When the two transistors conduct, the collector of the BC557 rises to rail voltage and pulls the 100u HIGH. The negative of the 100u effectively sits just below the positive rail and the positive of the electro is about 2v higher than this. All the energy in the electro is pumped into the LED to produce a very bright flash.

BRIGHT FLASH FROM FLAT BATTERY

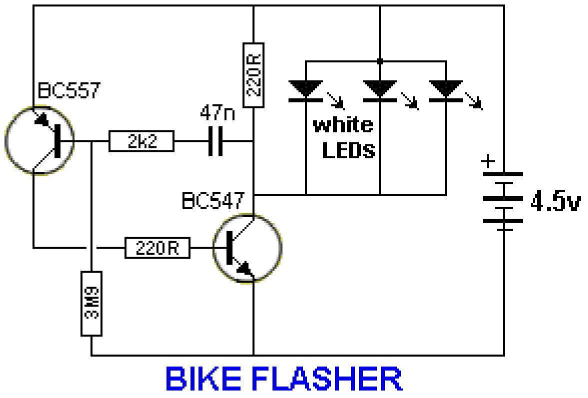
This circuit will flash a white LED, on a supply from 2v to 6v and produce a very bright flash. The circuit takes about 2mA and old cells can be used. The two 100u electros in parallel produce a better flash when the supply is 6v.



WHITE LED FLASHER

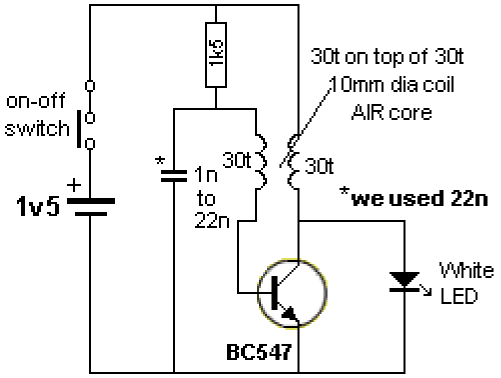
BIKE FLASHER

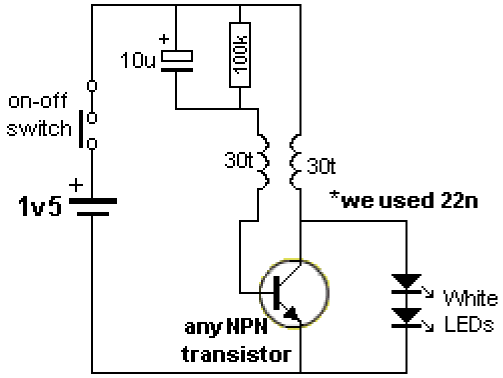
This circuit will flash a white LED (or 2,3 4 LEDs in parallel) at 2.7Hz, suitable for the rear light on a bike.



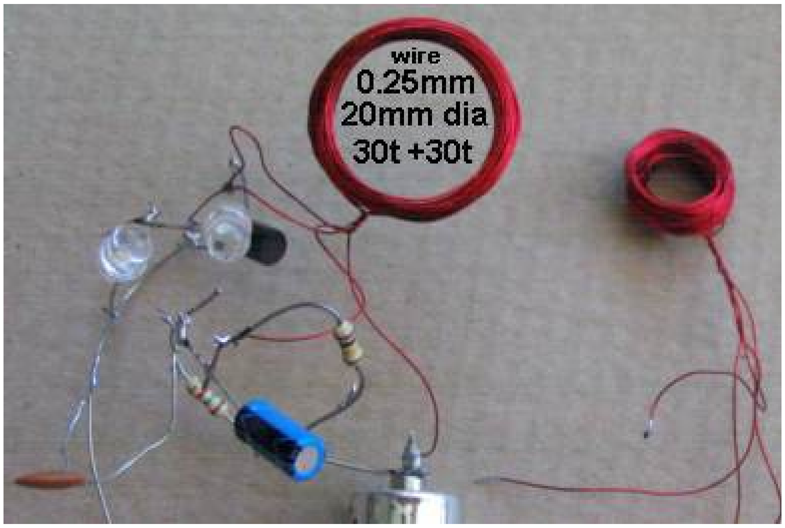
BIKE FLASHER - Amazing!

This bike flasher uses a single transistor to flash two white LEDs from a single cell. And it has **no core** for the transformer - just AIR!
All **Joule Thief** circuits you have seen, use a ferrite rod or toroid (doughnut) core and the turns are wound on the ferrite material. But this circuit proves the collapsing magnetic flux produces an increased voltage, even when the core is AIR. The fact is this: When a magnetic filed collapses quickly, it produces a higher voltage in the opposite direction and in this case the magnetic field surrounding the coil is sufficient to produce the energy we need.
Wind 30 turns on 10mm (1/2" dia) pen or screwdriver and then another 30 turns on top. Build the first circuit and connect the wires. You can use 1 or two LEDs. If the circuit does not work, swap the wires going to the base.
Now add the 10u electrolytic and 100k resistor (remove the 1k5). The circuit will now flash. You must use 2 LEDs for the flashing circuit.





BIKE FLASHER - AMAZING!



THE IMPROVED BIKE FLASHER CIRCUIT

The original 30 turns + 30 turns coil is shown on the right. The circuit took 20mA to illuminate two LEDs.

The secret to getting the maximum energy from the coil (to flash the LEDs) is the maximum amount of air in the centre of the coil. Air cannot transfer a high magnetic flux (density) so we provide a large area (volume) of low flux (density) to provide the energy.

The larger (20mm) coil reduced the current from 20mA to 11mA for the same brightness.

This could be improved further but the coil gets too big. The two 30-turn windings must be kept together because the flux from the main winding must cut the feedback winding to turn ON the transistor **HARD**.

When the transistor starts to turn on via the 100k, it creates magnetic flux in the main winding that cuts the feedback winding and a positive voltage comes out the end connected to the base and a negative voltage comes out the end connected to the 100k and 10u. This turns the transistor ON more and it continues to turn ON until fully turned ON. At this point the magnetic flux is not expanding and the voltage does not appear in the feedback winding.

During this time the 10u has charged and the voltage on the negative lead has dropped to a lower voltage than before. This effectively turns OFF the transistor and the current in the main winding ceases abruptly. The magnetic flux collapses and produces a voltage in the opposite direction that is higher than the supply and this is why the two LEDs illuminate. This also puts a voltage through the feedback winding that keeps the transistor OFF. When the magnetic flux has collapsed, the voltage on the negative lead of the 10u is so low that the transistor does not turn on. The 100k discharges the 10u and the voltage on the base rises to start the next cycle.

You can see the 100k and 1k5 resistors and all the other parts in a "birds nest" (in the photo above), to allow easy experimenting.

This is the first circuit you should build to flash a white LED from a single cell.

It covers many features and shows how the efficiency of a LED increases when it is pulsed very briefly with a high current.

The two coils form a TRANSFORMER and show how a collapsing magnetic field produces a high voltage (we use 6v of this high voltage).

The 10u and 100k form a delay circuit to produce the flashing effect.

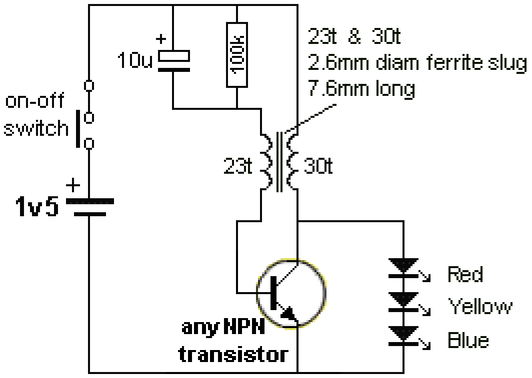
You can now go to all the other **Joule Thief** circuits and see how they "missed the boat" by not experimenting fully to simply their circuits. That's why a "birds nest" arrangement is essential to encourage experimenting.

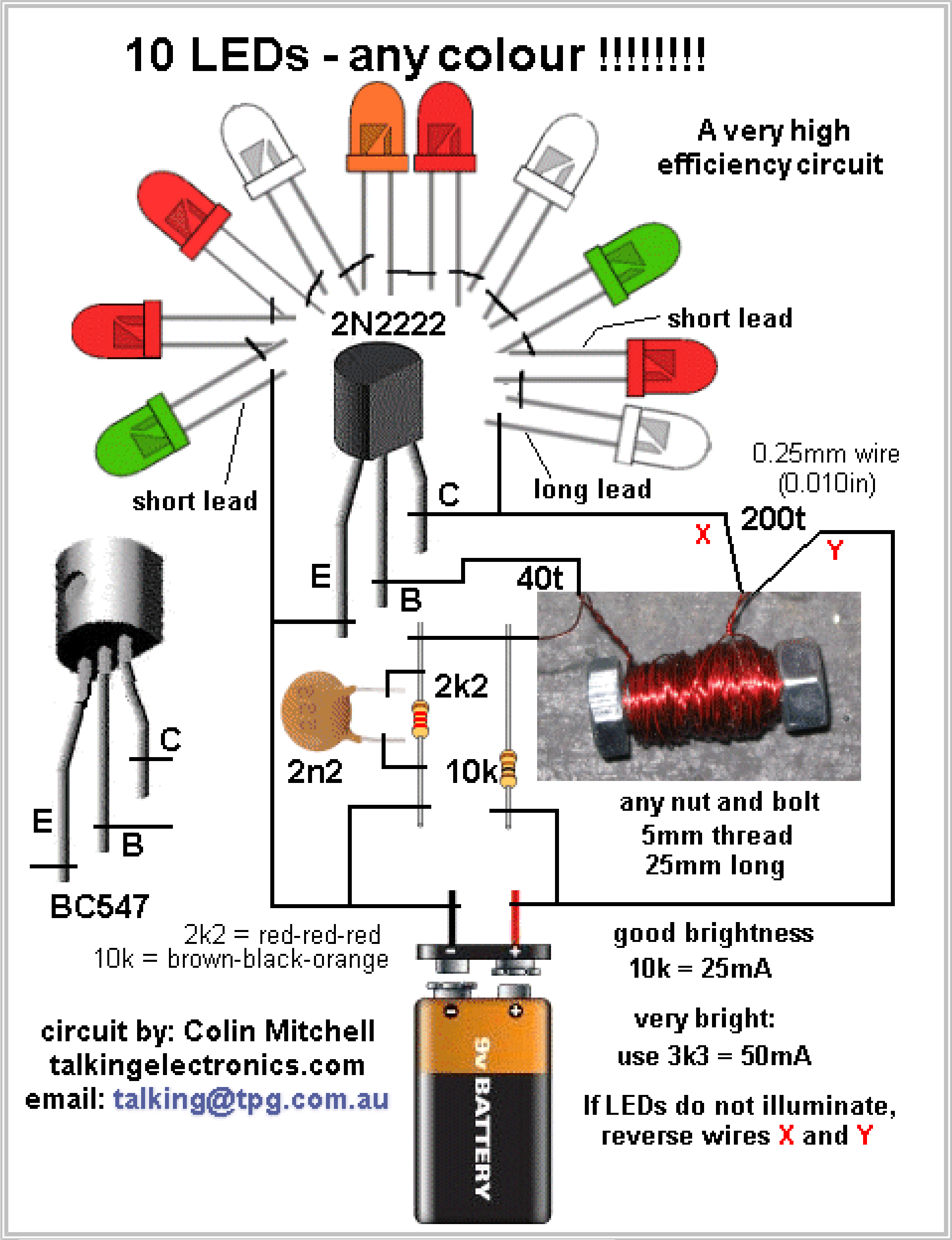
Note: Changing the turns to 40t for the main winding and 20t for the feedback (keeping the turns tightly wound together by winding wire around them) reduced the current to 8-9mA.

The circuit can be made small by using a ferrite slug 2.6mm diam x 7.6mm long.

The inductance of this transformer is quite critical and the voltage across the LEDs must be over 6v for the circuit to work. It will not work with one or two LEDs. It needs THREE LEDs !!!

If the author not not keep experimenting, he would have missed this amazing feature !!





A very high efficiency circuit

any nut and bolt
5mm thread
25mm long

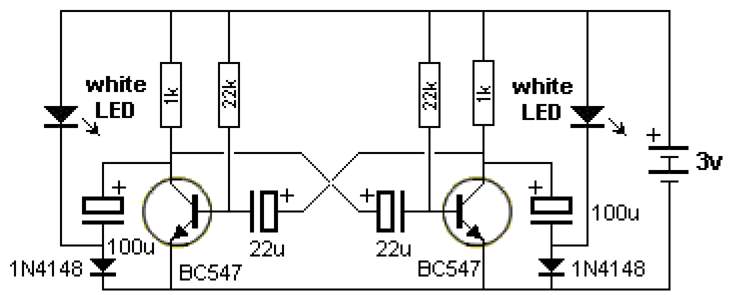
2k2 = red-red-red
10k = brown-black-orange

good brightness
10k = 25mA

very bright:
use 3k3 = 50mA

If LEDs do not illuminate,
reverse wires X and Y

circuit by: Colin Mitchell
talkingelectronics.com
email: talking@tpg.com.au



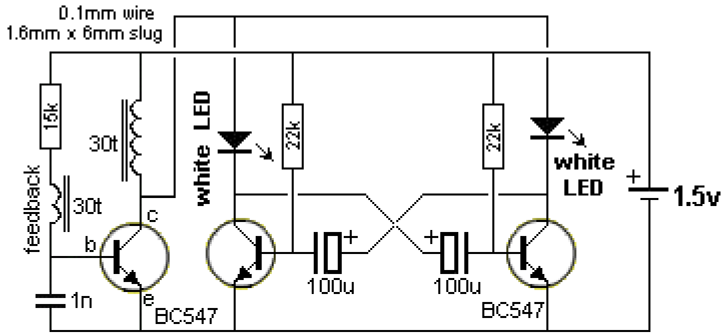
DUAL 3V WHITE LED FLASHER

DUAL 3v WHITE LED FLASHER

This circuit alternately flashes two white LEDs, on a 3v supply and produces a **very bright flash.** The circuit produces a voltage higher than 5v if the LED is not in circuit but the LED limits the voltage to its characteristic voltage of 3.2v to 3.6v. The circuit takes about 2mA and is actually a voltage-doubler (voltage incrementer) arrangement. The 1k charges the 100u and the diode drops 0.6v to prevent the LED from starting to illuminate on 3v. When a transistor conducts, the collector pulls the 100u down towards the 0v rail and the negative of the electro is actually about 2v below the 0v rail. The LED sees 3v + 2v and illuminates very brightly when the voltage reaches about 3.4v. All the energy in the electro is pumped into the LED to produce a very bright flash.

-

DUAL 1v5 WHITE LED FLASHER



DUAL 1.5v WHITE LED FLASHER

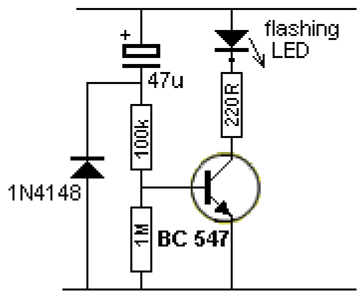
This circuit alternately flashes two white LEDs, on a 1.5v supply and produces a **very bright flash.** The circuit produces a voltage of about 25v when the LEDs are not connected, but the LEDs reduce this as they have a characteristic voltage-drop across them when they are illuminated. Do not use a supply voltage higher than 1.5v. The circuit takes about 10mA.

The transformer consists of 30 turns of very fine wire on a 1.6mm slug 6mm long, but any ferrite bead or slug can be used. The number of turns is not critical.

The 1n is important and using any other value or connecting it to the positive line will increase the supply current.

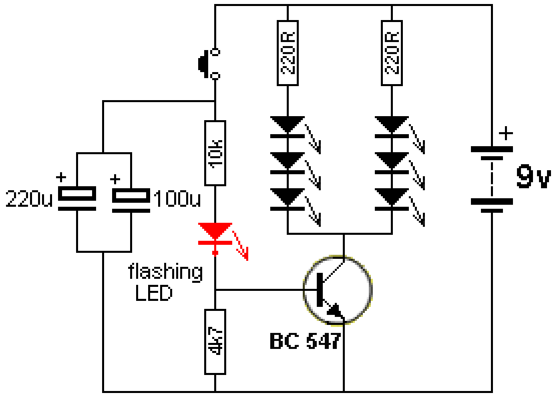
Using LEDs other than white will alter the flash-rate considerably and both LEDs must be the same colour.

-



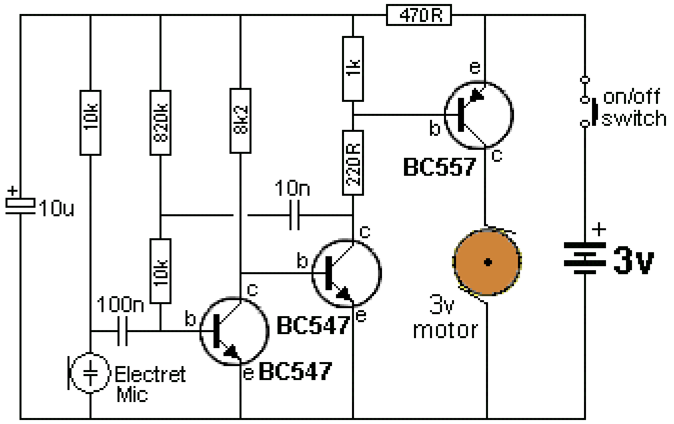
LED FLASHES 3 TIMES WHEN POWER IS APPLIED

This circuits uses a FLASHING LED - not an ordinary LED.
When the circuit turns ON, the electrolytic is uncharged and the charging-current turns on the transistor. This makes the LED flash.
The value of the 47u and 100k will depend on how many times you want the LED to flash.
The 1N4148 diode discharges the electrolytic when the power is turned off so the circuit will start immediately the power is applied.
This diode is not needed if the circuit is turned off for a long time.



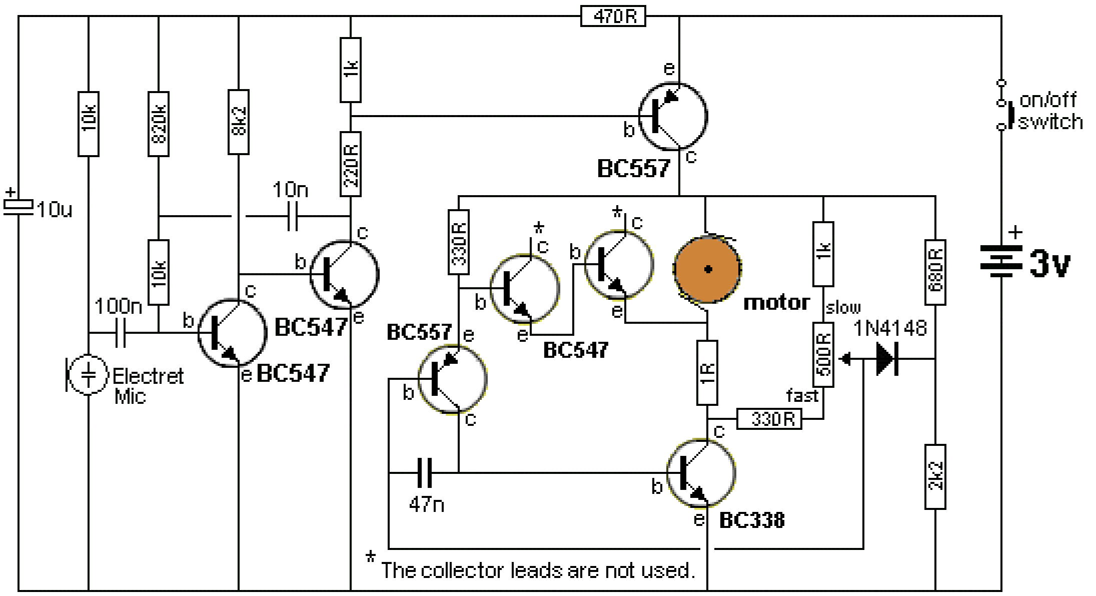
LED FLASHES FOR 5 SECONDS AFTER BUTTON IS RELEASED

This circuits uses a FLASHING LED - not an ordinary LED.
When the switch is pressed, the LEDs flash for about 5 seconds when the switch is released. and turn off.
The circuit takes NO CURRENT after the LEDs have turned OFF.
You can experiment with the value of the electrolytics, the 4k7 and 10k to get the result you want. Use red or green LEDs. Only 2 white LEDs can used in each string for 9v supply



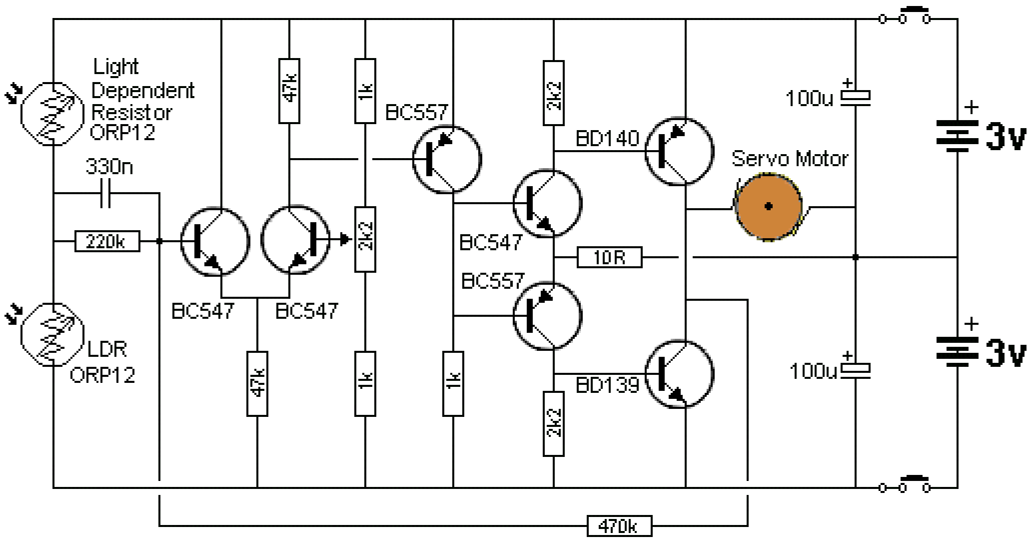
DANCING FLOWER

This circuit was taken from a dancing flower.
A motor at the base of the flower had a shaft up the stem and when the microphone detected music, the bent shaft made the flower wiggle and move.
The circuit will respond to a whistle, music or noise.



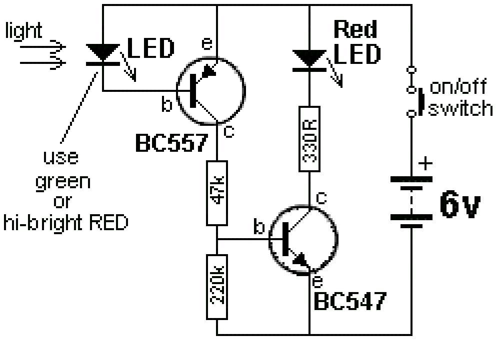
DANCING FLOWER with SPEED CONTROL

The **Dancing Flower** circuit can be combined with the **Motor Speed Control** circuit to produce a requirement from one of the readers.



WHITE LINE FOLLOWER

This circuit can be used for a toy car to follow a white line. The motor is either a 3v type with gearing to steer the car or a rotary actuator or a servo motor. When equal light is detected by the photo resistors the voltage on the base of the first transistor will be mid rail and the circuit is adjusted via the 2k2 pot so the motor does not receive any voltage. When one of the LDR's receives more (or less) light, the motor is activated. And the same thing happens when the other LDR receives less or more light.



LED DETECTS LIGHT

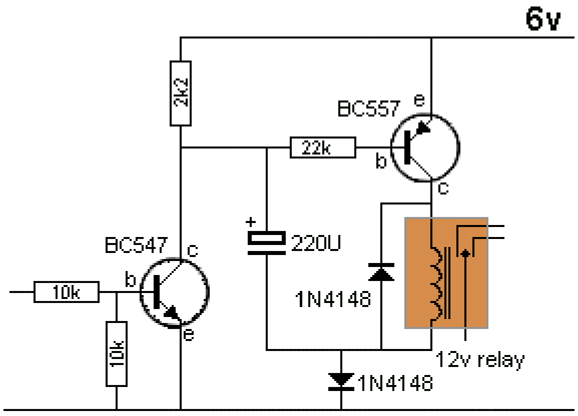
All LEDs give off light of a particular colour but some LEDs are also able to detect light. Obviously they are not as good as a device that has been specially made to detect light; such as solar cell, photocell, photo resistor, light dependent resistor, photo transistor, photo diode and other photo sensitive devices.

A green LED will detect light and a high-bright red LED will respond about 100 times better than a green LED, but the LED in this position in the circuit is classified as very high impedance and it requires a considerable amount of amplification to turn the detection into a worthwhile current-source.

All other LEDs respond very poorly and are not worth trying.

The accompanying circuit amplifies the output of the LED and enables it to be used for a number of applications.

The LED only responds when the light enters the end of the LED and this makes it ideal for solar trackers and any time there is a large difference between the dark and light conditions. It will not detect the light in a room unless the lamp is very close.



12v RELAY ON 6V SUPPLY

This circuit allows a 12v relay to operate on a 6v or 9v supply. Most 12v relays need about 12v to "pull-in" but will "hold" on about 6v. The 220u charges via the 2k2 and bottom diode. When an input above 1.5v is applied to the input of the circuit, both transistors are turned ON and the 5v across the electrolytic causes the negative end of the electro to go below the 0v rail by about 4.5v and this puts about 10v across the relay.

Alternatively you can rewind a 12v relay by removing about half the turns.

Join up what is left to the terminals. Replace the turns you took off, by connecting them in parallel with the original half, making sure the turns go the same way around

MAKE TIME FLY!

Connect this circuit to an old electronic clock mechanism and speed up the motor 100 times!

The "motor" is a simple "stepper-motor" that performs a half-rotation each time the electromagnet is energised. It normally takes 2 seconds for one revolution. But our circuit is connected directly to the winding and the frequency can be adjusted via the pot.

Take the mechanism apart, remove the 32kHz crystal and cut one track to the electromagnet. Connect the circuit below via wires and re-assemble the clock.

As you adjust the pot, the "seconds hand" will move clockwise or anticlockwise and you can watch the hours "fly by" or make "time go backwards."

The multivibrator section needs strong buffering to drive the 2,800 ohm inductive winding of the motor and that's why push-pull outputs have been used. The flip-flop circuit cannot drive the highly inductive load directly (it upsets the waveform enormously).

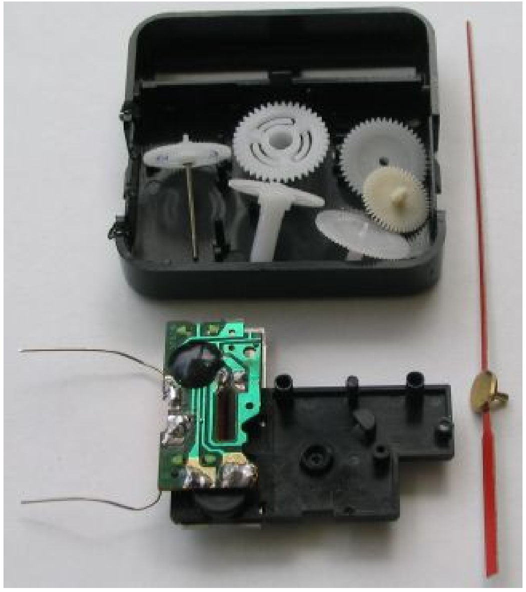
From a 6v supply, the motor only gets about 4v due to the voltage drops across the transistors. Consumption is about 5mA.

HOW THE MOTOR WORKS

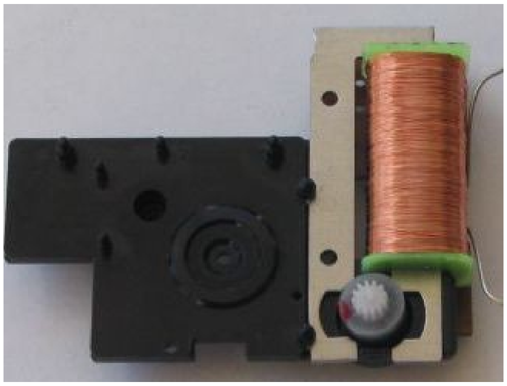
The rotor is a magnet with the north pole shown with the red mark and the south pole opposite.

The electromagnet actually produces poles. A strong North near the end of the electromagnet, and a weak North at the bottom. A strong South at the top left and weak South at bottom left. The rotor rests with its poles being attracted to the 4 pole-pieces equally.

Voltage must be applied to the electromagnet around the correct way so that repulsion occurs. Since the rotor is sitting equally between the North poles, for example, it will see a strong pushing force from the pole near the electromagnet and this is how the motor direction is determined. A reversal of voltage will revolve the rotor in the same direction as before. The design of the motor is much more complex than you think!!

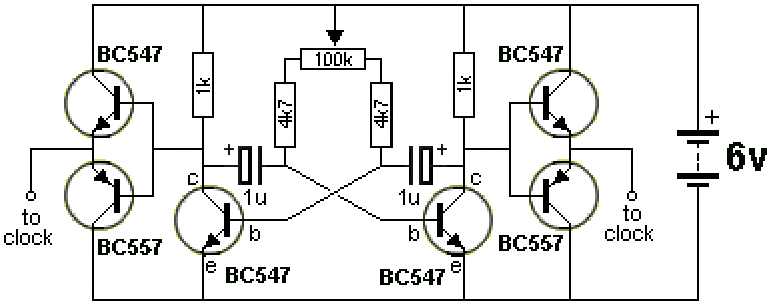


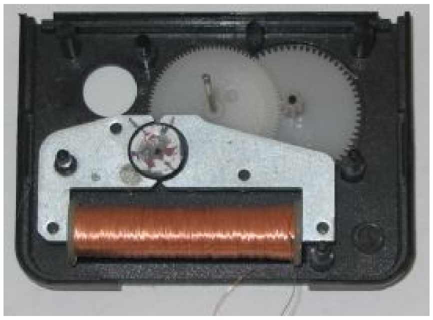
The crystal removed and a "cut track" to the coil. The 6 gears must be re-fitted for the hands to work.



A close-up of the clock motor

Another clock motor is shown below. Note the pole faces spiral closer to the rotor to make it revolve in one direction. What a clever design!!





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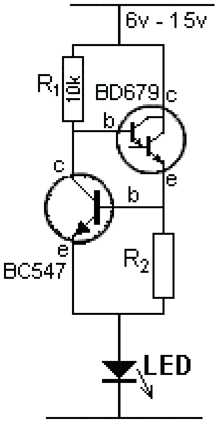
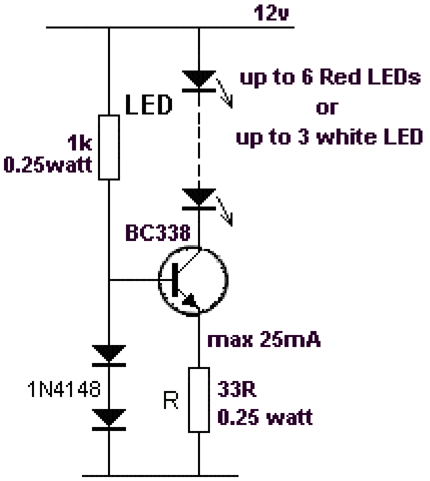


CONSTANT CURRENT SOURCE

This circuit provides a constant current to the LED. The LED can be replaced by any other component and the current through it will depend on the value of R2. Suppose R2 is 560R. When 1mA flows through R2, 0.56v will develop across this resistor and begin to turn on the BC547. This will rob the base of BD 679 with turn-on voltage and the transistor turns off slightly. If the supply voltage increases, this will try to increase the current through the circuit. If the current tries to increase, the voltage across R2 increases and the BD 679 turns off more and the additional voltage appears across the BD 679.

If R2 is 56R, the current through the circuit will be 10mA. If R2 is 5R6, the current through the circuit will be 100mA - although you cannot pass 100mA through a LED without damaging it.

-

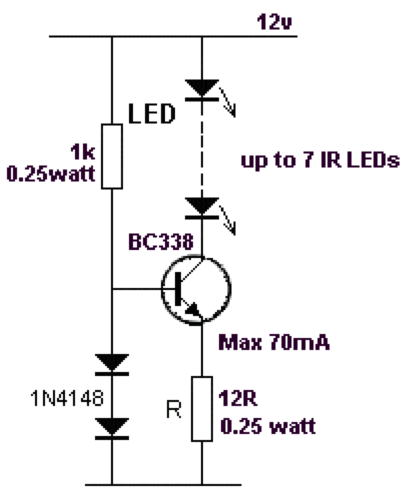


LED driver for 12v CAR

Here is a simple circuit that will drive any number of LEDs in a single string with a constant 25mA without having to work out the value of the dropper resistor. You can use up to 6 red LED or up to 3 white LEDs with the same circuit.

The supply can be 12v to 16v without the brightness altering.

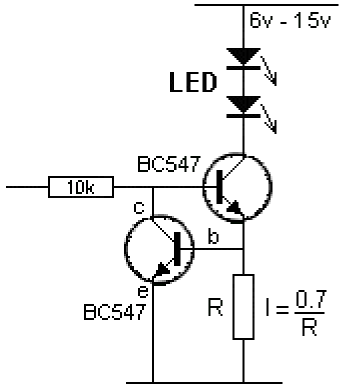
-

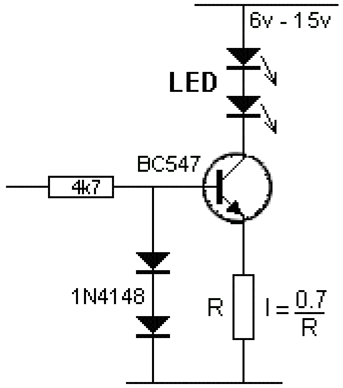


LED driver IR LEDs in a 12v CAR

This circuit will drive up to 7 IR LEDs at a constant current of 70mA from a 12v supply. These LEDs will illuminate ultra-violet sensitive paint to produce a white glow.

-

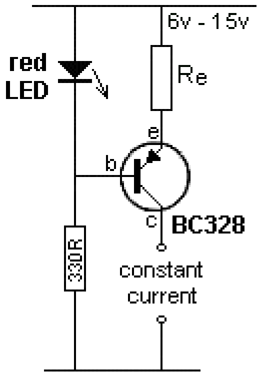


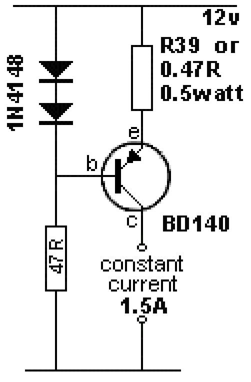


CONSTANT CURRENT SOURCE circuits 2 & 3

By rearranging the components in the circuit above, it can be designed to turn ON or OFF via an input.
The current through the LED (or LEDs) is determined by the value of R.
5mA   R = 120R or 150R
10mA R = 68R
15mA   R = 47R
20mA R = 33R
25mA   R = 22R or 33R
30mA R = 22R

-

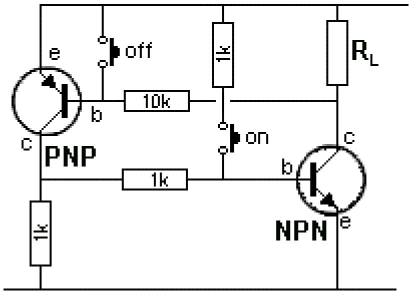




CONSTANT CURRENT SOURCE   circuit 4

The output will be limited to 100mA by using a red LED and 10R for Re.
The output will be limited to 500mA by using a red LED and 2R2 for Re.
BC328 - 800mA max
Use a BD140 in the first circuit and the output will be limited to 1A by using a red LED and 1R0 for R_e.
5watt LEDs (sometimes called "White Big Chip LEDs") have a characteristic voltage across them of 3.2v and draw 1.75amp.
1, 2 or 3 can be connected in series to the second circuit using a heatsinked BD140 transistor.

-

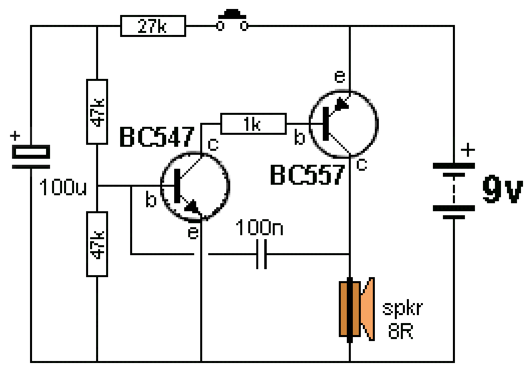


ON - OFF VIA MOMENTARY PUSH-BUTTONS

- see Also Push-ON Push-OFF (in 101-200 Circuits)

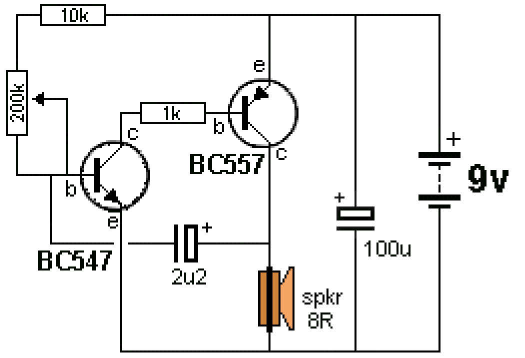
This circuit will supply current to the load R_L. The maximum current will depend on the second transistor. The circuit is turned on via the "ON" push button and this action puts a current through the load and thus a voltage develops across the load. This voltage is passed to the PNP transistor and it turns ON. The collector of the PNP keeps the power transistor ON.
To turn the circuit OFF, the "OFF" button is pressed momentarily. The 1k between base and emitter of the power transistor prevents the base floating or receiving any slight current from the PNP transistor that would keep the circuit latched ON.
The circuit was originally designed by a Professor of Engineering at Penn State University. It had 4 mistakes. So much for testing a circuit!!!! It has been corrected in the circuit on the left.

-



SIREN

This circuit produces a wailing or siren sound that gradually increases and decreases in frequency as the 100u charges and discharges when the push-button is pressed and released. In other words, the circuit is not automatic. You need to press the button and release it to produce the up/down sound.



TICKING BOMB

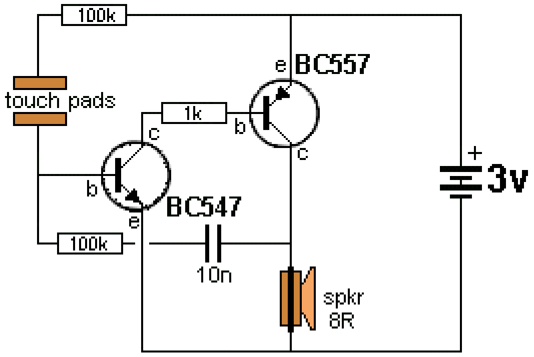
This circuit produces a sound similar to a loud clicking clock. The frequency of the tick is adjusted by the 220k pot.

The circuit starts by charging the 2u2 and when 0.65v is on the base of the NPN transistor, it starts to turn on. This turns on the BC 557 and the voltage on the collector rises. This pushes the small charge on the 2u2 into the base of the BC547 to turn it on more.

This continues when the negative end of the 2u2 is above 0.65v and now the electro starts to charge in the opposite direction until both transistors are fully turned on. The BC 547 receives less current into the base and it starts to turn off. Both transistors turn off very quickly and the cycle starts again.

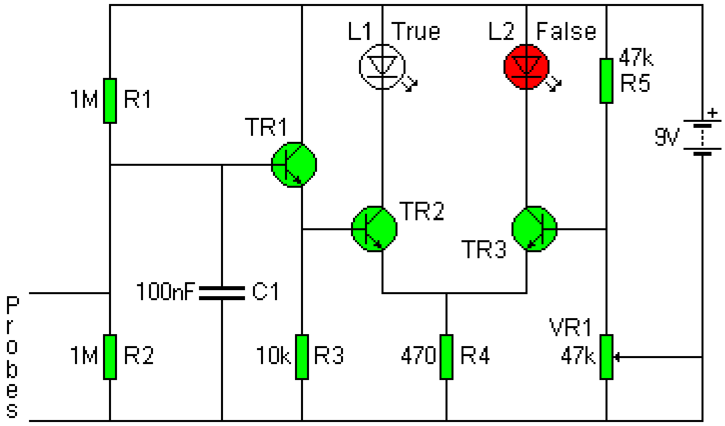
LIE DETECTOR-1

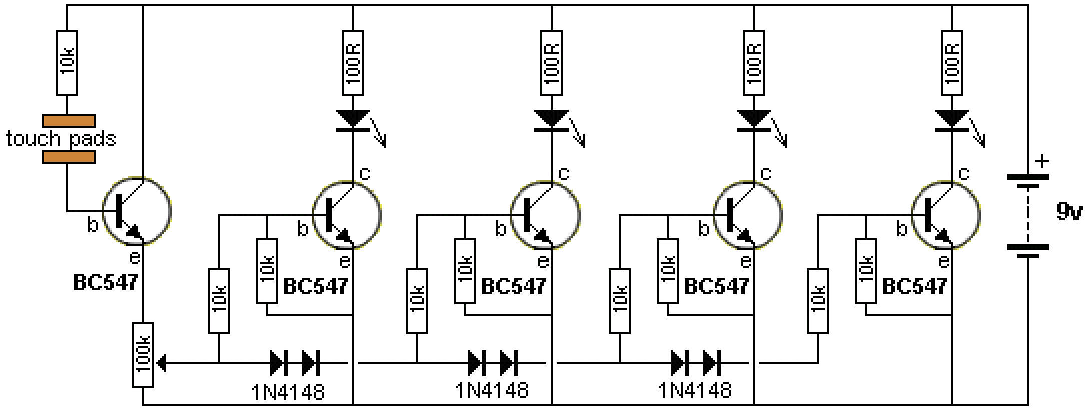
This circuit detects the resistance between your fingers to produce an oscillation. The detection-points will detect resistances as high as 300k and as the resistance decreases, the frequency increases.
Separate the two touch pads and attach them to the back of each hand. As the subject feels nervous, he will sweat and change the frequency of the circuit.
The photos show the circuit built on PC boards with separate touch pads.

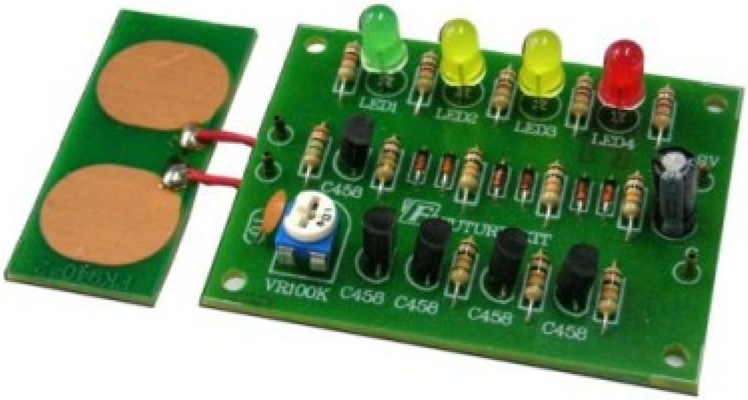


LIE DETECTOR-2

This circuit detects the resistance between your fingers to turn on the FALSE LED. The circuit sits with the TRUE LED illuminated. The 47k pot is adjusted to allow the LEDs to change state when touching the probes.

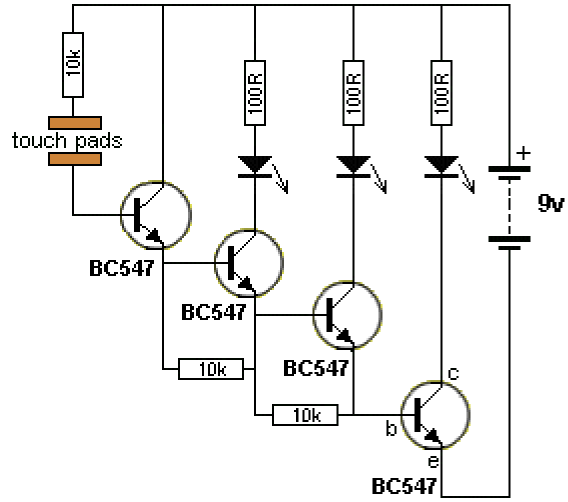






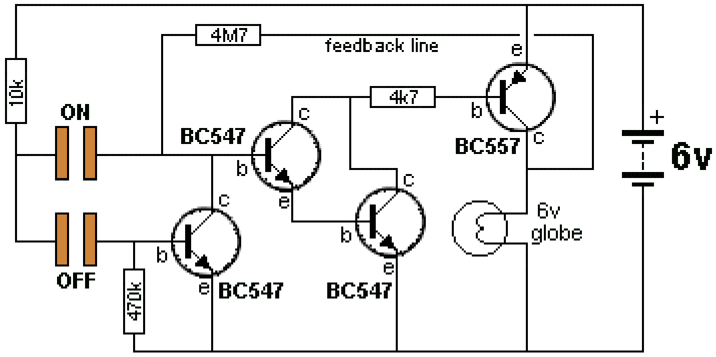
LIE DETECTOR-3

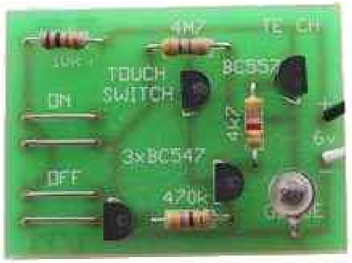
This circuit detects the resistance between your fingers to turn the 4 LEDs. As you press harder, more LEDs are illuminated.



LIE DETECTOR-4

This circuit detects the resistance between your fingers to turn the 3LEDs. As you press harder, more LEDs are illuminated. The circuit is simpler than **Lie Detector-3**.





TOUCH SWITCH - globe

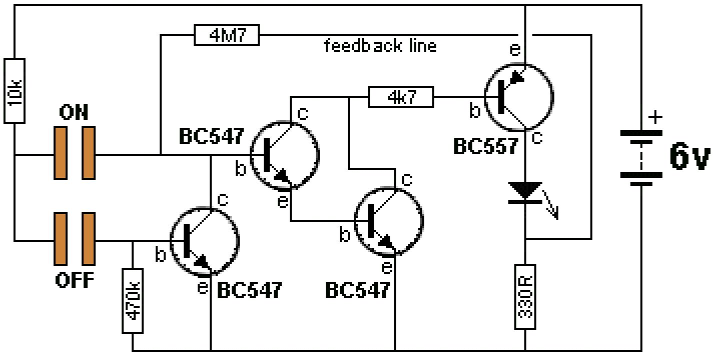
This circuit detects the skin resistance of a finger to deliver a very small current to the super-alpha pair of transistors to turn the circuit ON. The output of the "super transistor" turns on the BC 557 transistor. The voltage on the top of the globe is passed to the front of the circuit via the 4M7 to take the place of your finger and the circuit remains ON.

To turn the circuit OFF, a finger on the OFF pads will activate the first transistor and this will rob the "super transistor" of voltage and the circuit will turn OFF.

This project is available as a kit of parts from Talking Electronics for $6.00 plus $4.00

postage.

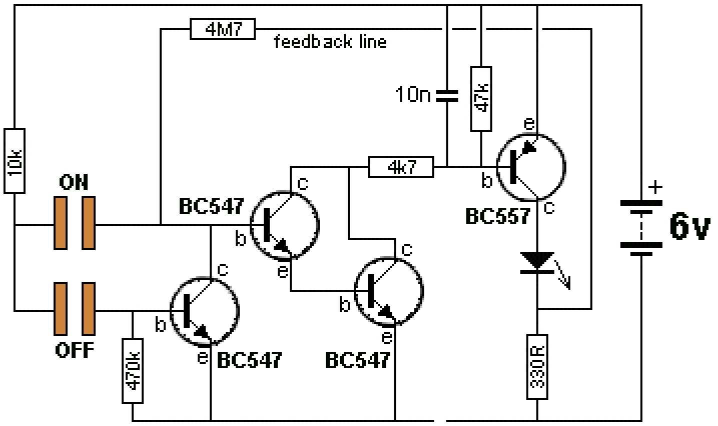
TOUCH SWITCH - LED



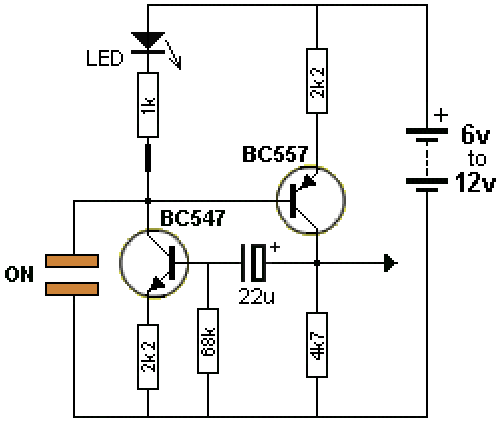
This circuit turns a LED on and off.

TOUCH SWITCH - LED - modification by Mike Grozak

To make the circuit come ON with the LED not illuminated, you need to put a "set" on the circuit.
A "set" is a particular condition that may be ON or OFF but the fact is the circuit ALWAYS starts in a particular way.

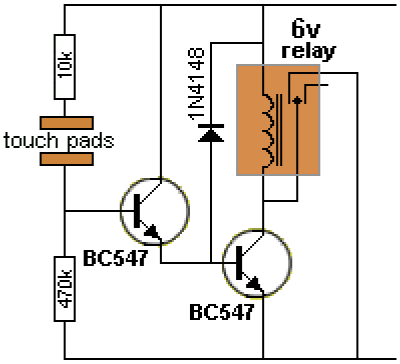


The 10n prevents a voltage appearing on the base of the BC557 transistor when the circuit is turned ON and this means the transistor is OFF. The feedback line will not have any voltage on it and thus the second and third transistor will not be turned ON. Thus the circuit will come ON with the LED not illuminated.



TOUCH SWITCH-2

This circuit detects the skin resistance of a finger to turn the circuit ON for about 1 second. The output can be taken to a counting circuit. The circuit consumes no current when in quiescent mode:

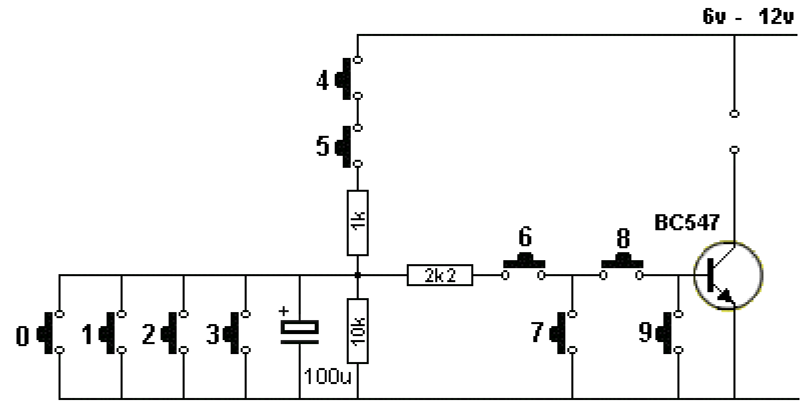


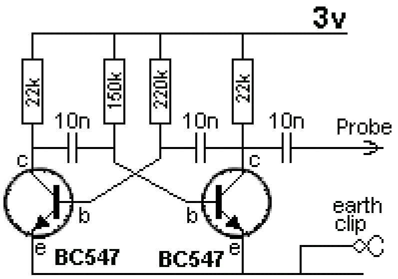
TOUCH SWITCH-3

This circuit stays ON.

CODE PAD

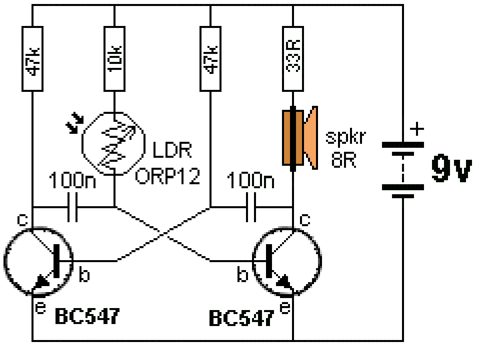
Here is a simple CODE PAD to add to your alarm. It consists of 10 buttons and they must be pressed in a certain order for the output to change. You can see from the circuit how the buttons are pressed and two buttons must be pressed at the same time, the two other buttons at the same time, to gain entry. The operation of this type of pad is very unusual as anyone pressing the buttons by incrementing numbers will not be able to produce the code.





SIGNAL INJECTOR

This circuit is rich in harmonics and is ideal for testing amplifier circuits. To find a fault in an amplifier, connect the earth clip to the 0v rail and move through each stage, starting at the speaker. An increase in volume should be heard at each preceding stage. This Injector will also go through the IF stages of radios and FM sound sections in TV's.

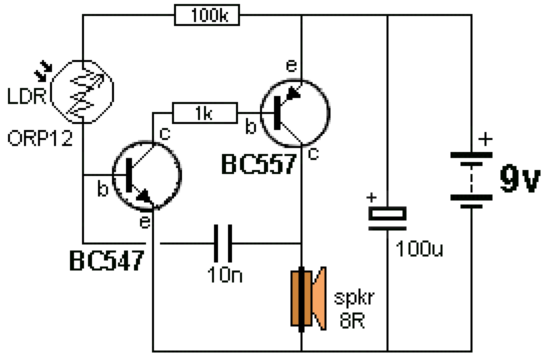


LIGHT ALARM - 1

This circuit operates when the Light Dependent Resistor receives light.

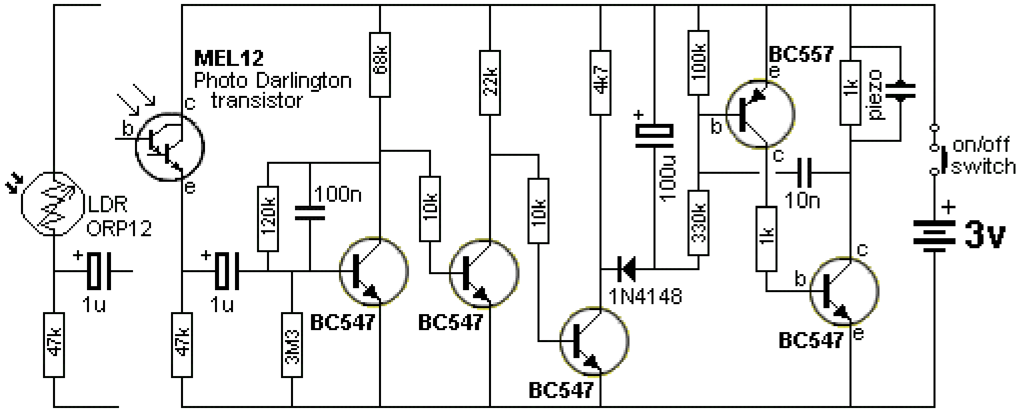
When no light falls on the LDR, its resistance is high and the transistor driving the speaker is not turned on.

When light falls on the LDR its resistance decreases and the collector of the second transistor falls. This turns off the first transistor slightly via the second 100n and the first 100n puts an additional spike into the base of the second transistor. This continues until the second transistor is turned on as hard as it can go. The first 100n is now nearly charged and it cannot keep the second transistor turned on. The second transistor starts to turn off and both transistors swap conditions to produce the second half of the cycle.



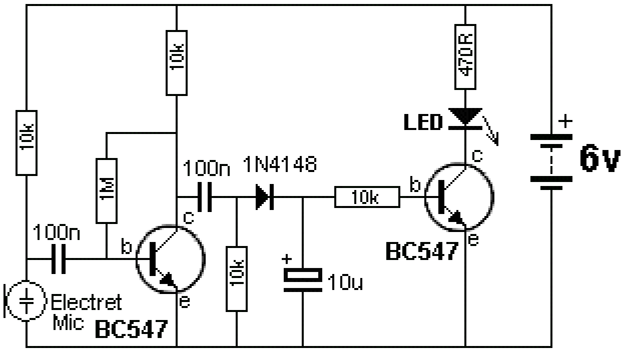
LIGHT ALARM - 2

This circuit is similar to Light Alarm -1 but produces a louder output due to the speaker being connected directly to the circuit.
The circuit is basically a high-gain amplifier that is turned on initially by the LDR and then the 10n keeps the circuit turning on until it can turn on no more. The circuit then starts to turn off and eventually turns off completely. The current through the LDR starts the cycle again.



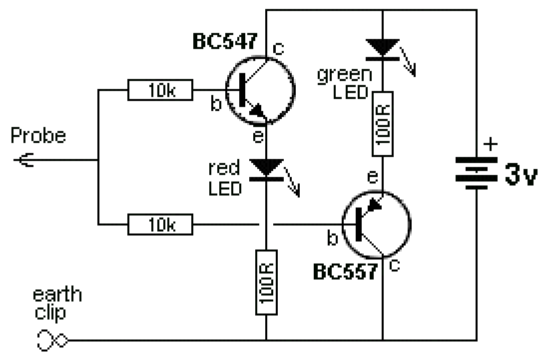
LIGHT ALARM - 3 (MOVEMENT DETECTOR)

This circuit is very sensitive and can be placed in a room to detect the movement of a person up to 2 metres from the unit.
The circuit is basically a high-gain amplifier (made up of the first three transistors) that is turned on by the LDR or photo Darlington transistor. The third transistor charges the 100u via a diode and this delivers turn-on voltage for the oscillator. The LDR has equal sensitivity to the photo transistor in this circuit.



SOUND TRIGGERED LED

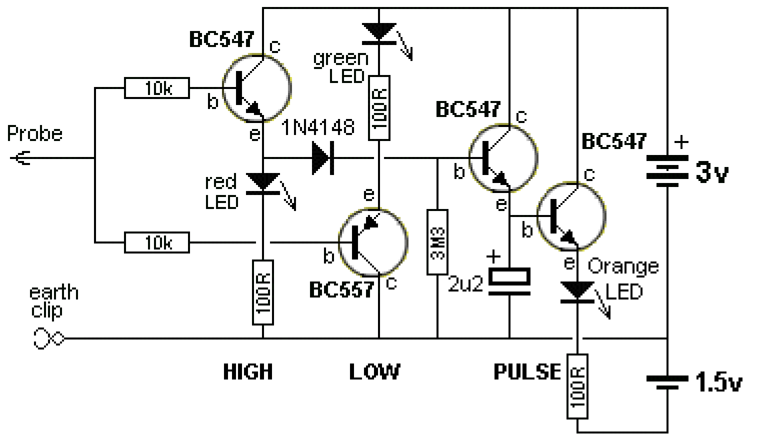
This circuit turns on a LED when the microphone detects a loud sound.
The "charge-pump" section consists of the 100n, 10k, signal diode and 10u electrolytic. A signal on the collector of the first transistor is passed to the 10u via the diode and this turns on the second transistor, to illuminate the LED.



SIMPLE LOGIC PROBE

This circuit consumes no current when the probe is not touching any circuitry. The reason is the voltage across the green LED, the base-emitter junction of the BC557, plus the voltage across the red LED and base-emitter junction of the BC547 is approx: 2.1v + 0.6v + 1.7v + 0.6v = 5v and this is greater than the supply voltage.

When the circuit detects a LOW, the BC557 is turned on and the green LED illuminates. When a HIGH (above 2.3v) is detected, the red LED is illuminated.



SIMPLE LOGIC PROBE with PULSE

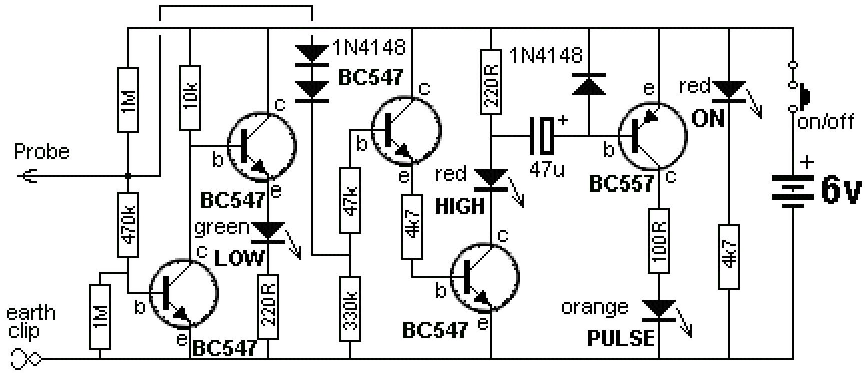
This circuit consumes no current when the probe is not touching any circuitry and the input has a surprisingly HIGH IMPEDANCE. Keep the probe away from stray signals (especially mains hum) as the orange LED will illuminate.

When the red LED illuminates, the HIGH is passed through the 1N4148 diode and the third transistor is an emitter-follower. It increases the current-capability of the pulse and charges a 2u2.

The 4th transistor increases the capacity of the 2u2 by about 100 times to make it a 220u electro to keep the orange LED illuminated for a few milliseconds after the pulse has ceased.

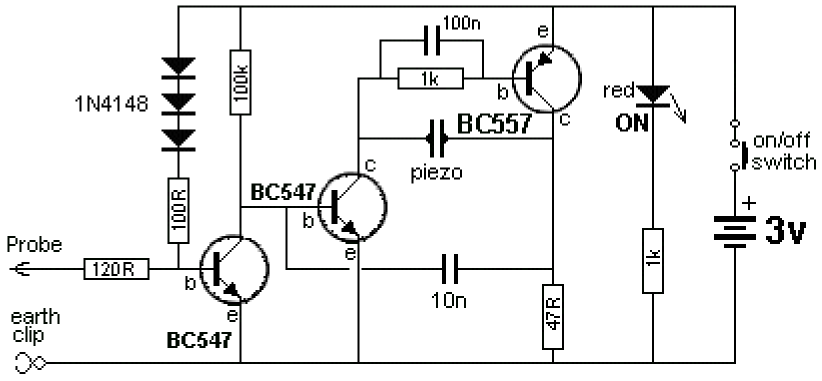
The voltage-drop across the diode and base-emitter junctions of the transistors reduces the voltage on the emitter of the 4th transistor to less than

1v and an extra 1.5v is needed from the supply to illuminate the orange LED.



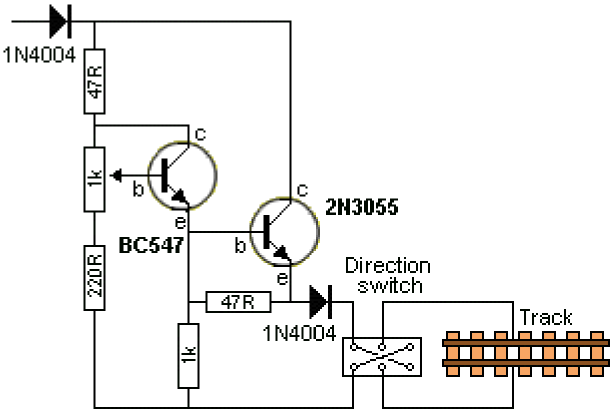
LOGIC PROBE with PULSE

This circuit has the advantage of providing a PULSE LED to show when a logic level is HIGH and pulsing at the same time. It can be built for less than $5.00 on a piece of matrix board or on a small strip of copper clad board if you are using surface mount components. The probe will detect a HIGH at 3v and thus the project can be used for 3v, 5v and CMOS circuits.



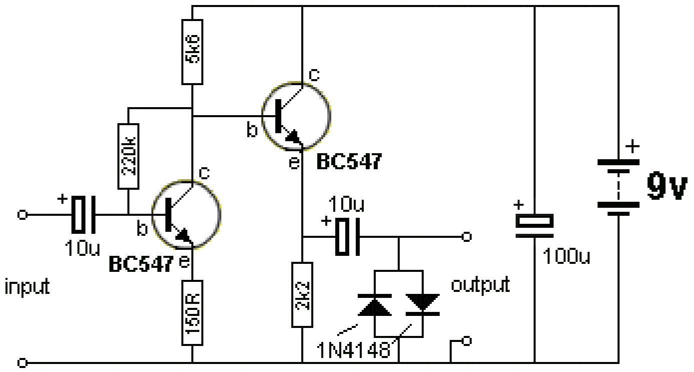
CONTINUITY TESTER

This circuit has the advantage of providing a beep when a short-circuit is detected but does not detect the small voltage drop across a diode. This is ideal when testing logic circuits as it is quick and you can listen for the beep while concentrating on the probe. Using a multimeter is much slower.



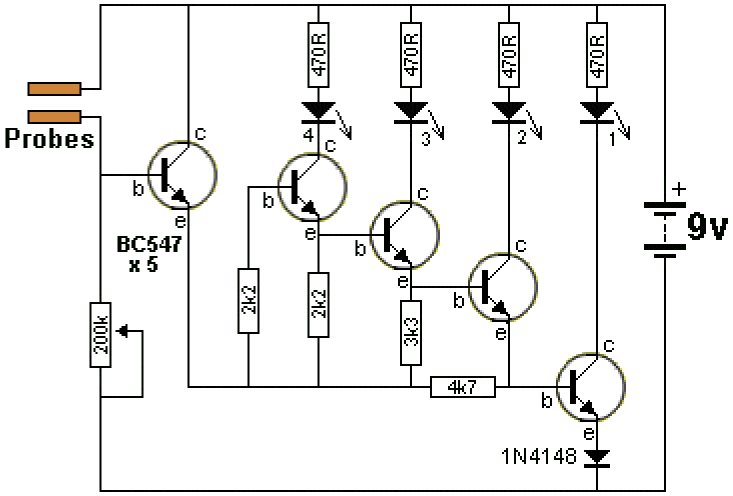
TRAIN THROTTLE

This circuit is for model train enthusiasts. By adding this circuit to your speed controller box, you will be able to simulate a train starting slowly from rest.
Remove the wire-wound rheostat and replace it with a 1k pot. This controls the base of the BC547 and the 2N3055 output is controlled by the BC547. The diodes protect the transistors from reverse polarity from the input and spikes from the rails.



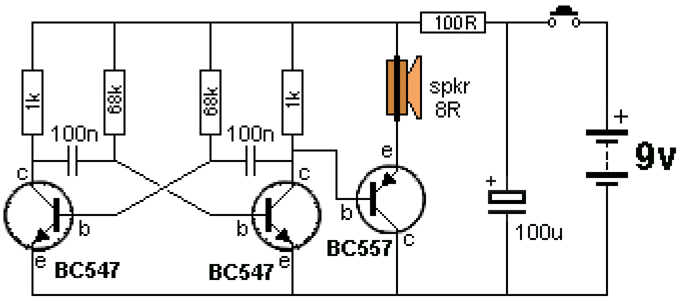
GUITAR FUZZ

The output of a guitar is connected to the input of the Fuzz circuit. The output of this circuit is connected to the input of your amplifier. With the guitar at full volume, this circuit is overdriven and distorts. The distorted signal is then clipped by the diodes and your power amp amplifies the Fuzz effect.



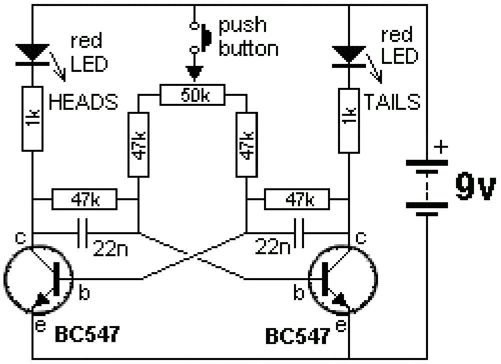
STRENGTH TESTER

This is a simple "staircase" circuit in which the LEDs come on as the resistance between the probes decreases.
When the voltage on the base of the first transistor sees 0.6v + 0.6v + 0.6v = 1.8v, LED1 comes on. LEDs 1&2 will come on when the voltage rises a further 0.6v. The amount of pressure needed on the probes to produce a result, depends on the setting of the 200k pot.



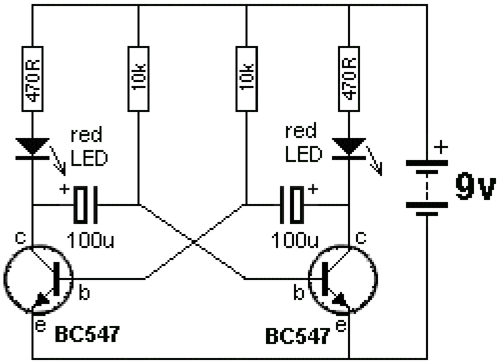
FOG HORN

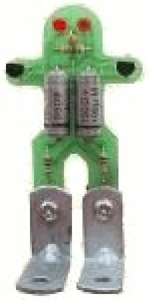
When the push-button is pressed, the 100u will take time to charge and this will provide the rising pitch and volume. When the push-button is released, the level and pitch will die away. This is the characteristic sound of a ship's fog horn.



HEADS OR TAILS

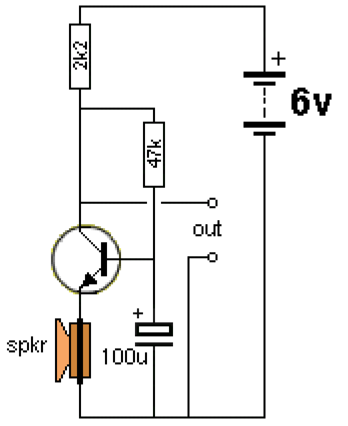
When the push-button is pressed, the circuit will oscillate at a high rate and both LEDs will illuminate. When the push button is released, one of the LEDs will remain illuminated. The 50k is designed to equalise the slightly different values on each half of the circuit and prevent a "bias."





ROBOT MAN

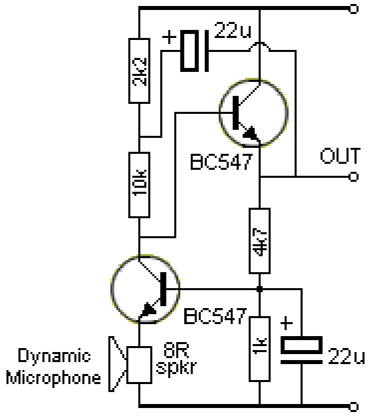
This multivibrator circuit will flash the Robot Man's eyes as shown in the photo. The kit of components is available from Talking Electronics for $8.50 plus postage. Send an email to find out the cost of postage: talking@tpg.com.au



DYNAMIC MICROPHONE AMPLIFIER

This circuit takes the place of an electret microphone. It turns an ordinary mini speaker into a very sensitive microphone.

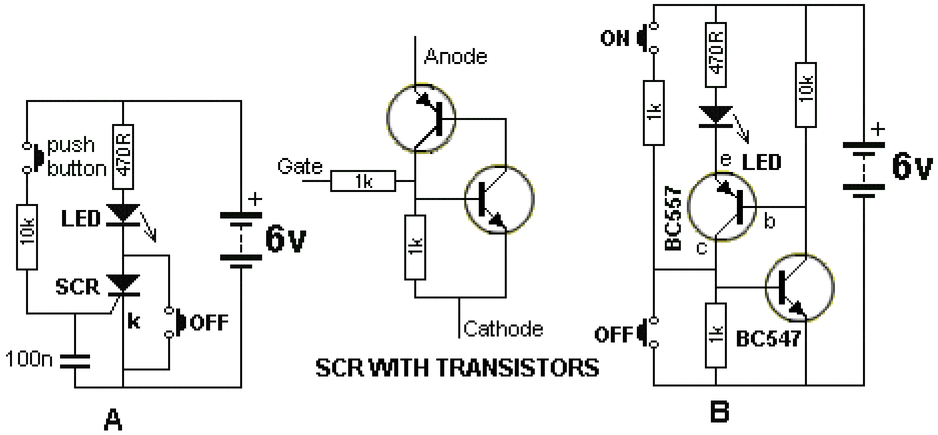
Any NPN transistors such as BC 547 can be used. The circuit will work from 3v to 9v. It is a common-base amplifier and accepts the low impedance of the speaker to produce a gain of more than 100.



DYNAMIC MICROPHONE AMPLIFIER-2

This circuit is a BOOTSTRAP design. It turns an ordinary mini speaker into a very sensitive microphone.

Any NPN transistors such as BC 547 can be used. The circuit will work from 6v to 12v. It has been taken from our **Stereo VU Meter** project.

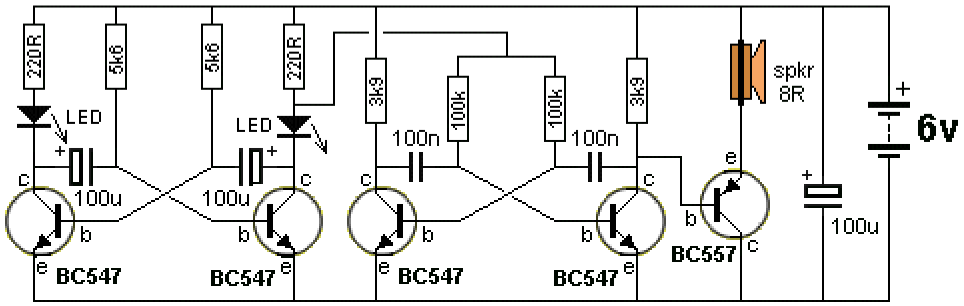


SCR WITH TRANSISTORS

The SCR in circuit A produces a 'LATCH.' When the button is pressed, the LED remains illuminated.

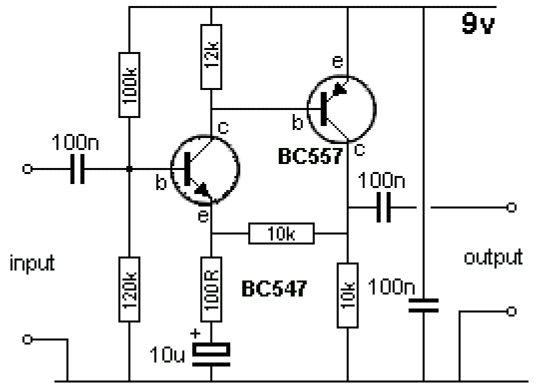
The SCR can be replaced with two transistors as shown in circuit B.

To turn off circuit A, the current through the SCR is reduced to zero by the action of the OFF button. In circuit B the OFF button removes the voltage on the base of the BC547. The OFF button could be placed across the two transistors and the circuit will turn off.



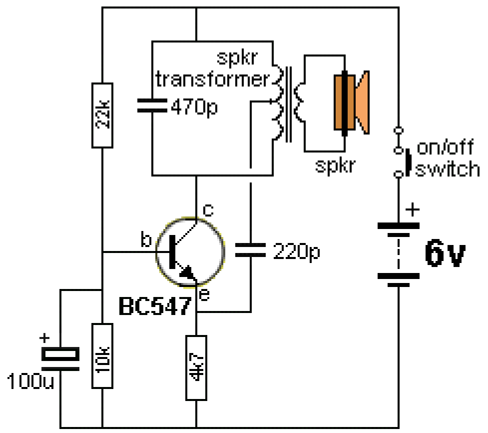
HEE HAW SIREN

The circuit consists of two multivibrators. The first multi-vibrator operates at a low frequency and this provides the speed of the change from Hee to Haw. It modifies the voltage to the tone multivibrator, by firstly allowing full voltage to appear at the bottom of the 220R and then a slightly lower voltage when the LED is illuminated.



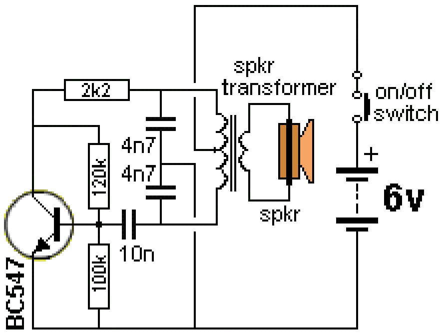
MICROPHONE PRE-AMPLIFIER

This circuit consists of two directly coupled transistors operating as common-emitter amplifiers.
The ratio of the 10k resistor to the 100R sets the gain of the circuit at 100.



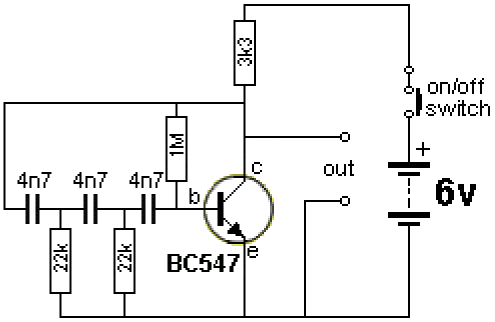
HARTLEY OSCILLATOR

The Hartley Oscillator is characterised by an LC circuit in its collector. The base of the transistor is held steady and a small amount of signal is taken from a tapping on the inductor and fed to the emitter to keep the transistor in oscillation.
The transformer can be any speaker transformer with centre-tapped primary.
The frequency is adjusted by changing the 470p.



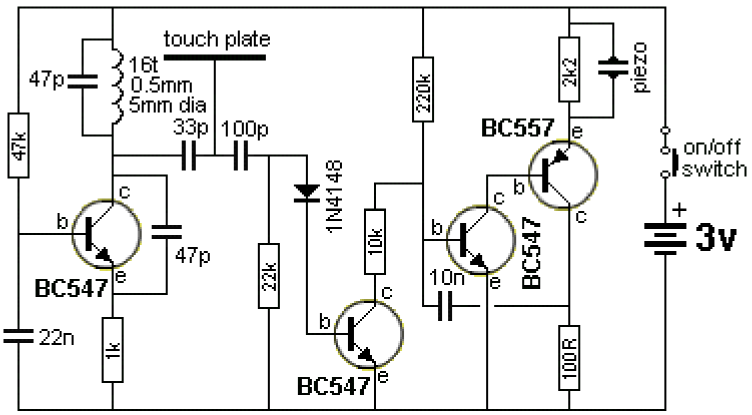
COLPITTS OSCILLATOR

The Colpitts Oscillator is characterised by tapping the mid-point of the capacitive side of the oscillator section. The inductor can be the primary side of a speaker transformer. The feedback comes via the inductor.



PHASESHIFT OSCILLATOR

The Phaseshift Oscillator is characterised by 3 high-pass filters, creating a 180° phase shift. The output is a sinewave. Take care not to load the output - this will prevent reliable start-up and may stop the circuit from oscillating. Reduced the 3k3 load resistor if the load prevents the circuit oscillating. See Phase Shift Oscillator in second section of 200 Transistor Circuits for a better design.

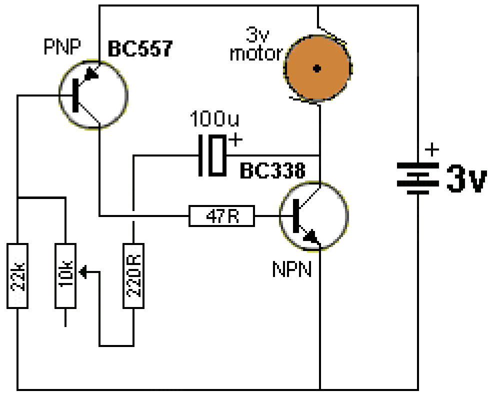


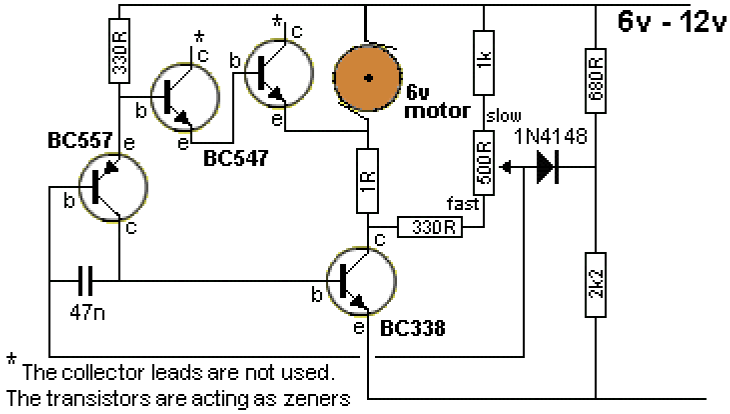
DOOR-KNOB ALARM

This circuit can be used to detect when someone touches the handle of a door. A loop of bare wire is connected to the point "touch plate" and the project is hung on the door-knob. Anyone touching the metal door-knob will kill the pulses going to the second transistor and it will turn off. This will activate the "high-gain" amplifier/oscillator.
The circuit will also work as a "Touch Plate" as it does not rely on mains hum, as many other circuits do.

SIMPLE MOTOR SPEED CONTROL

This circuit is better than reducing the RPM of a motor via a resistor. Firstly it is more efficient. And secondly it gives the motor a set of pulses and this allows it to start at low RPM. It's a simple Pulse-Width circuit or Pulse-Circuit.





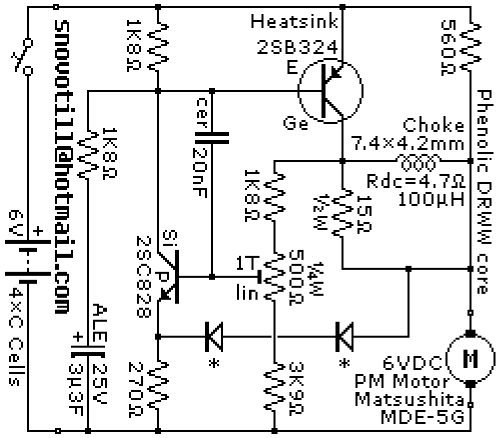
* The collector leads are not used.
The transistors are acting as zeners

MOTOR SPEED CONTROLLER

Most simple motor speed controllers simply reduce the voltage to a motor by introducing a series resistance. This reduces the motor's torque and if the motor is stopped, it will not start again.
This circuit detects the pulses of noise produced by the motor to turn the circuit off slightly. If the motor becomes loaded, the amplitude of the pulses decreases and the circuit turns on more to deliver a higher current.

MOTOR SPEED CONTROL - Circuit 3

Small DC motor speed regulator

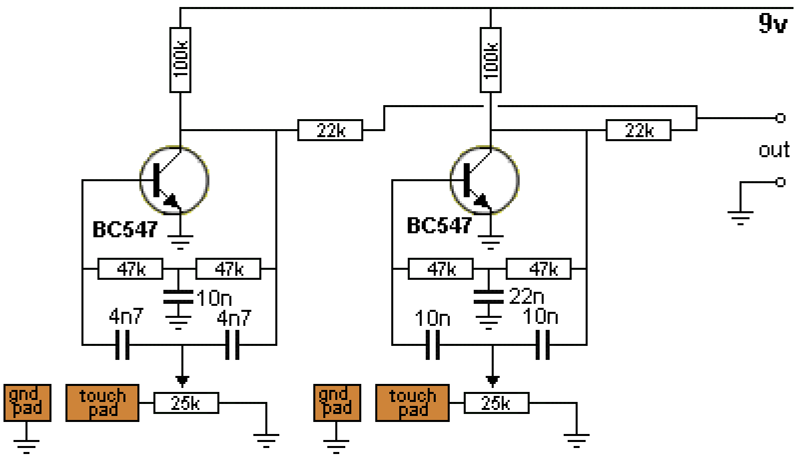


http://members.shaw.ca/novotill

*Unmarked diodes are silicon so use 1N4148.
Top transistor is germanium running at Vbe of 200mV but silicon works perfectly fine as well.
Resistors are 1/4W CF 5% except as noted.
It's ok to use 4.7Ω resistor in place of choke.
Motor power draw under different loadings is:

- 32mA @ 2.4V under zero load freerunning.
- 80mA @ 2.8V under normal regulated load.
- 200mA @ 4V under normal maximum load.
- 300mA @ 4.5V is end of speed regulation.
- 460mA @ 3.9V shaft frozen motor stalled.

-



ELECTRONIC DRUMS

The circuit consists of two "twin-T" oscillators set to a point below oscillation. Touching a Touch Pad will set the circuit into oscillation. Different effects are produced by touching the pads in different ways and a whole range of effects are available.
The two 25k pots are adjusted to a point just before oscillation.
A "drum roll" can be produced by shifting a finger rapidly across adjacent ground and drum pads.

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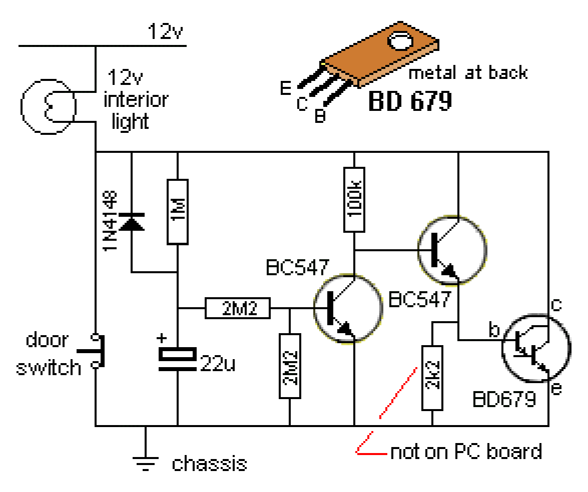


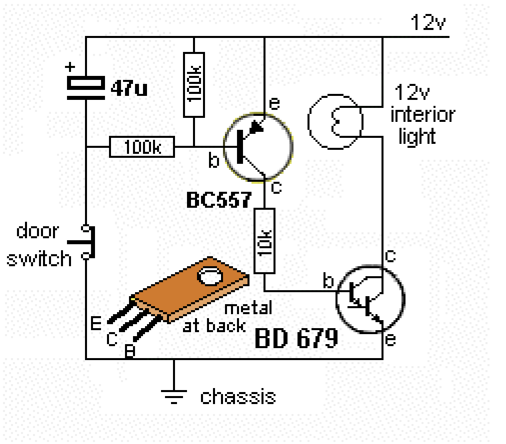
LIGHT EXTENDER

This circuit is a **Courtesy Light Extender** for cars. It extends the "ON" time when a door is closed in a car, so the passenger can see where he/she is sitting.

When the door switch is opened, the light normally goes off immediately, but the circuit takes over and allows current to flow because the 22u is not charged and the first BC 547 transistor is not turned ON. This turns on the second BC547 via the 100k and the BD679 is also turned on to illuminate the interior light.

The 22u gradually charges via the 1M and the first BC547 turns on, robbing the second BC547 of "turn-on" voltage and it starts to turn off the BD679.

The 1N4148 discharges the 22u when the door is opened. A 2k2 may needed to be added to completely turn off the globe.

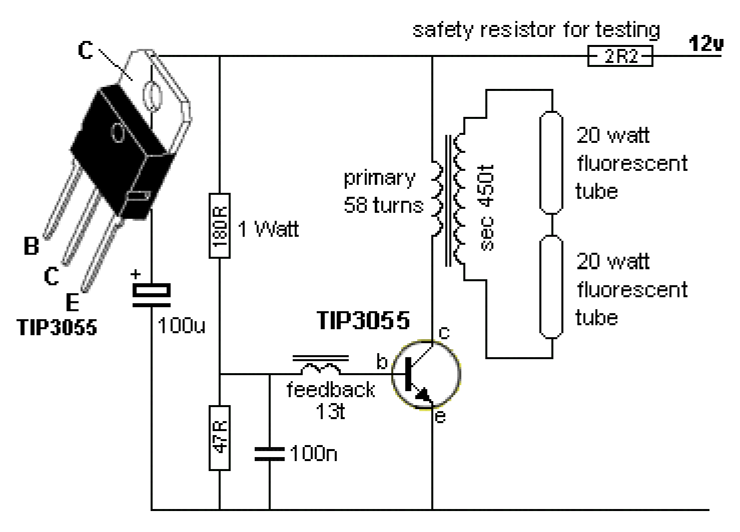


LIGHT EXTENDER MkII

This circuit is a simpler **Courtesy Light Extender** for cars. It extends the "ON" time when a door is closed in a car. Both circuits perform exactly the same. This circuit is slightly simpler.

It uses only a single BC557 and BD679 transistor.

A Kit for this project is available from Talking Electronics for $5.20 plus postage. Click **Here** .



20 WATT FLUORO INVERTER

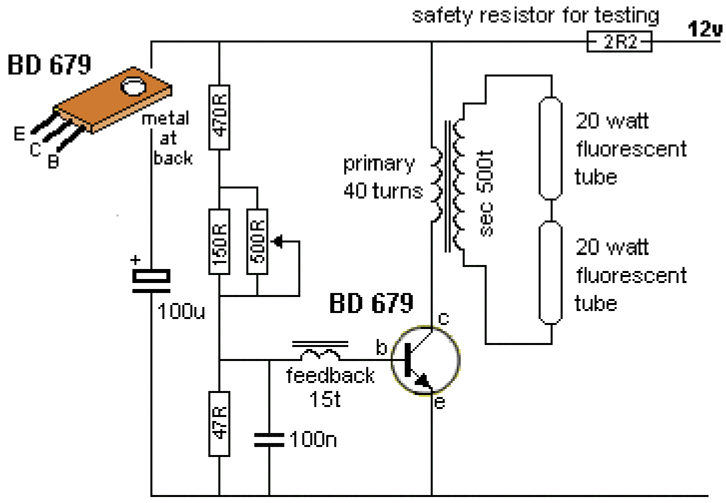
This circuit will drive a 40 watt fluoro or two 20-watt tubes in series.

The transformer is wound on a ferrite rod 10mm dia and 8cm long. The wire diameters are not critical but our prototype used 0.61mm wire for the primary and 0.28mm wire for the secondary and feedback winding.

Do not remove the tube when the circuit is operating as the spikes produced by the transformer will damage the transistor.

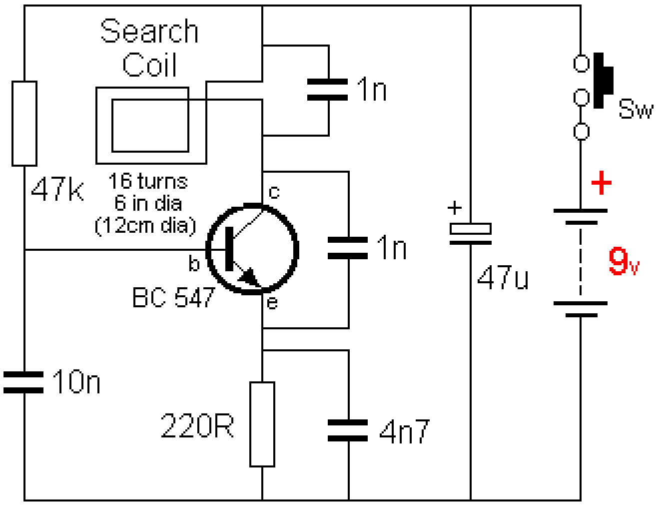
The circuit will take approx 1.5amp on 12v, making it more efficient than running the tubes from the mains. A

normal fluoro takes 20 watts for the tube and about 15 watts for the ballast.
A Kit for this project is available from Talking Electronics called Fluorescent Lamp Inverter for $12.50 plus postage. Click **Here**



6 to 12 WATT FLUORO INVERTER

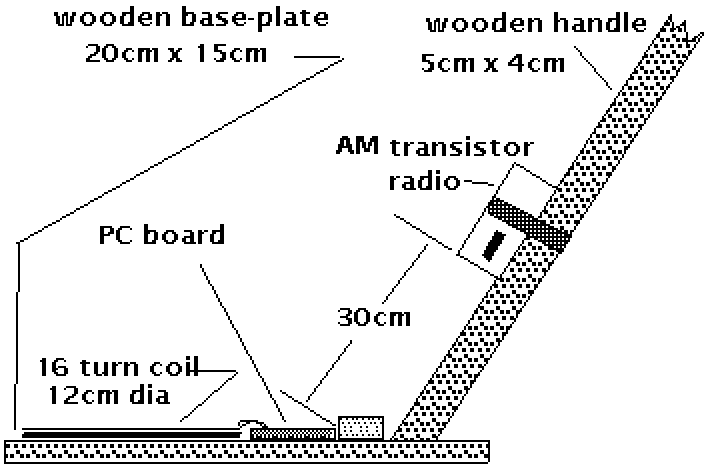
This circuit will drive a 40 watt fluoro or two 20-watt tubes in series but with less brightness than the circuit above and it will take less current.
2 x 20 watt tubes = 900mA to 1.2A and 1 x 20 watt tube 450mA to 900mA depending on pot setting.
The transformer is wound on a ferrite rod 10mm dia and 8cm long. The wire diameter is fairly critical and our prototype used 0.28mm wire for all the windings.
Do not remove the tube when the circuit is operating as the spikes produced by the transformer will damage the transistor. The pot will adjust the brightness and vary the current consumption. Adjust the pot and select the base-bias resistor to get the same current as our prototype. Heat-sink must be greater than 40sq cm. Use heat-sink compound.



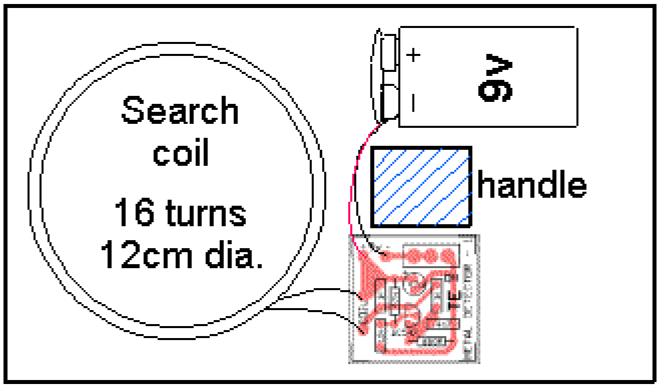
GOLD DETECTOR

see also:
BFO METAL DETECTOR in "100 IC circuits"
SIMPLE BFO METAL LOCATOR in "100 IC circuits"
METAL DETECTORS - article

This very simple circuit will detect gold or metal or coins at a distance of approx 20cm - depending on the size of the object.
The circuit oscillates at approx 140kHz and a harmonic of this frequency is detected by an AM



THE LAYOUT OF THE DETECTOR



The Layout of Metal Detector -1

radio.
Simply tune the radio until a squeal is detected.
When the search coil is placed near a metal object, the frequency of the circuit will change and this will be heard from the speaker.
The layout of the circuit is shown and the placement of the radio.

The TRUTH about Metal (GOLD) Detectors.

A Gold Detector's club in the US created a challenge with 12 members with skills ranging from 12 months detection to over 25 years. They used 5 different detectors to find 30 different items, hidden in sand and under pieces of cardboard.
The results were these: All detectors performed almost equally but the interpretation of the beeps, sounds and readings on the detector were quite often mis-read and the winner was a member with 1 year experience.
The moral of the story is to dig for anything that is detected as it may not be a "ring-pull."

With these findings you can clearly use a very simple, cheap, detector and get results equal to the most expensive equipment.
The only thing you have to remember is this: You need the right frequency for the type of soil to cancel out the effects of minerals etc.
That's why there is a range of frequencies from 6kHz to 150Hz.
All the other modes of producing and injecting the pulse add only a very small improvement to the detection process.
The energy put into the injecting pulse also has an influence of the depth of detection.

Buying Metal Detector kit:

Even though this circuit is the simplest you can get, it performs just like the $50.00 metal detectors because you use an ordinary AM radio to produce the tone. It will detect a small coin at 10cm.

Metal Detector-1 kit: $14.00 FREE Shipping

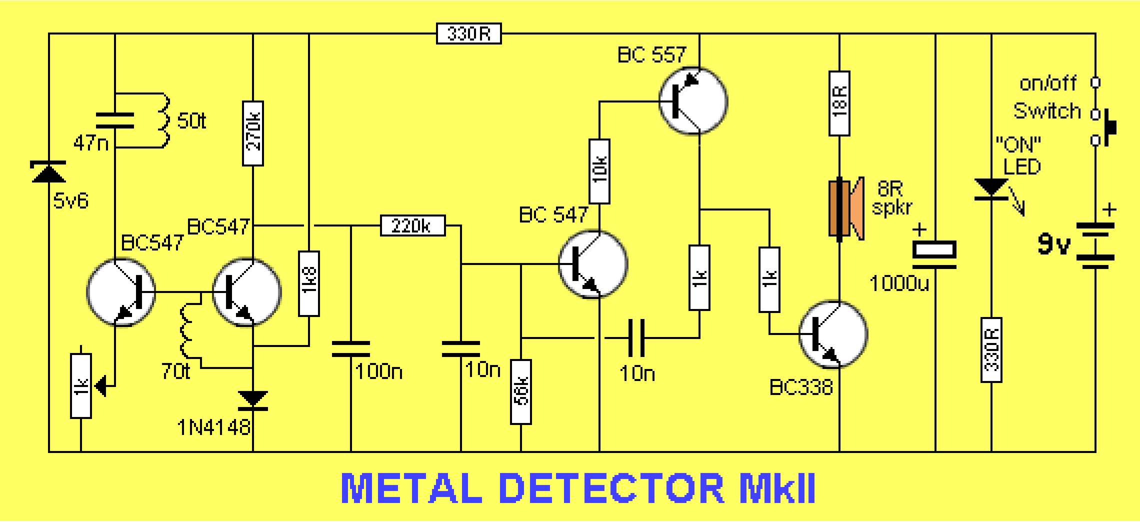
Log in to your PayPal account and send a payment to: talking@tpg.com.au for $14.00 AUD

-

METAL DETECTOR MkII - see the full project: Metal Detector MkII

Metal Detector kit MkII $15.00 plus postage

This is a self-contained metal detector with about the same performance as Metal Detector-1 above.
All Metal detectors having the principle of detecting a metal object with a coil of about 12cm dia and operating at 100kHz, will have the same performance, no matter how complex the circuit.
They all rely on detecting the change in frequency as small as 1Hz or a voltage-change across a coil as small as 1uV.
The secret is to produce the largest waveform while loading the coil as lightly as possible. This allows the coil to detect metal at the furthest distance. See more details on Metal Detector MkII



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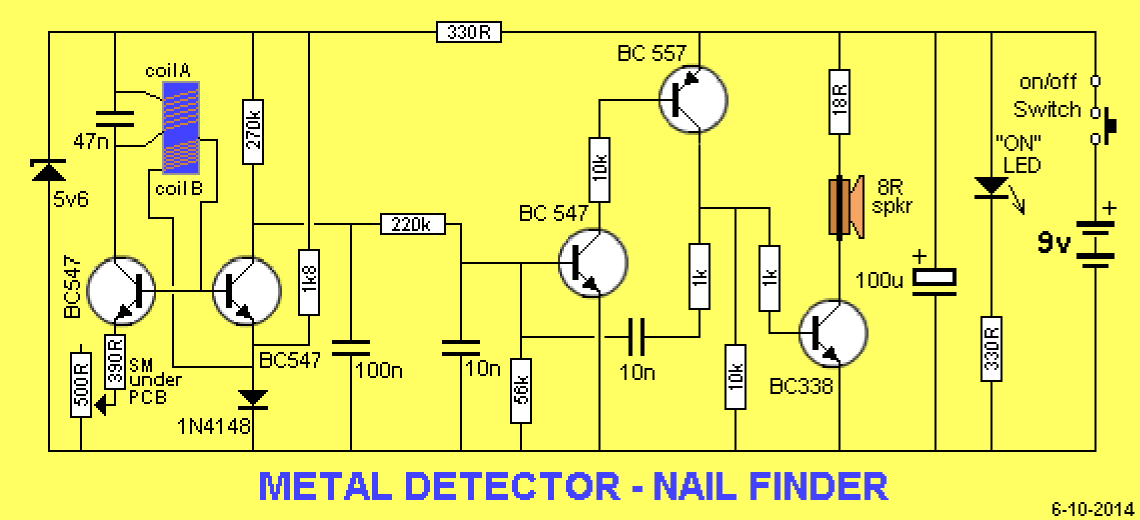
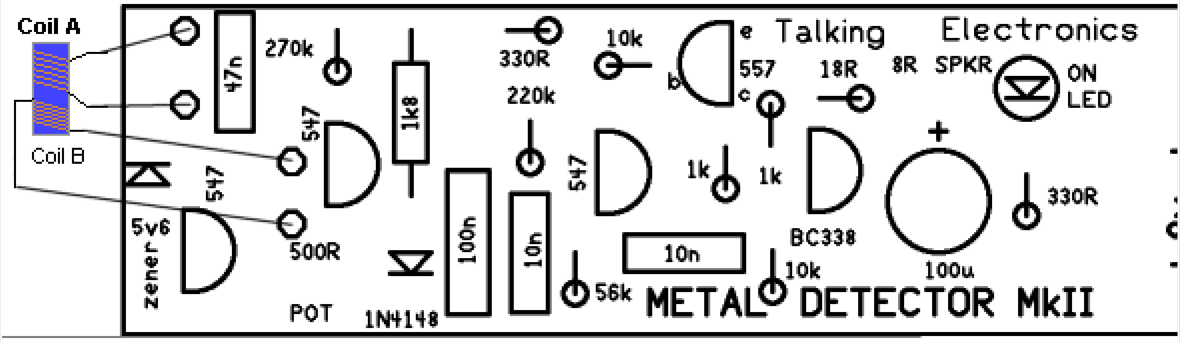
Nail Finder - see the full project: Metal Detector MkII

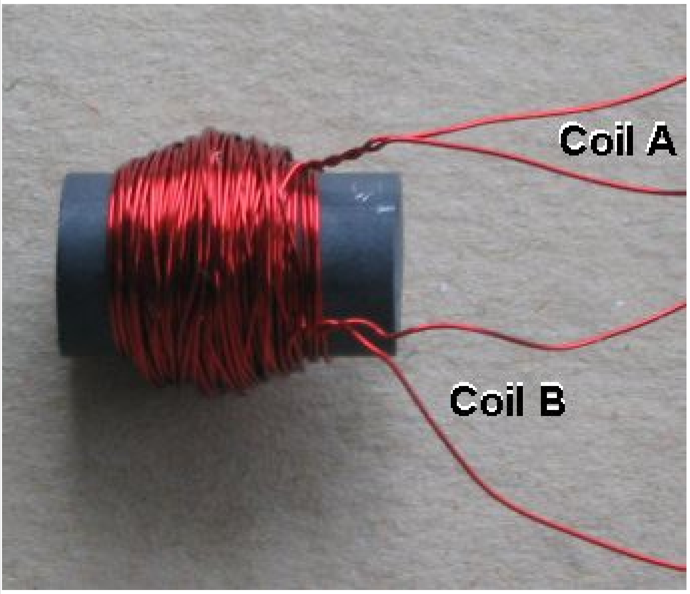
Kits for Metal Detector kit - Nail Finder $17.00 plus postage

This project is an extension of Metal Detector MkII, with a small detecting head to find tiny components such as nails and lost components.

This is an essential tool for servicemen and anyone trying to find a metal object hidden or buried in timber, soil or mud.

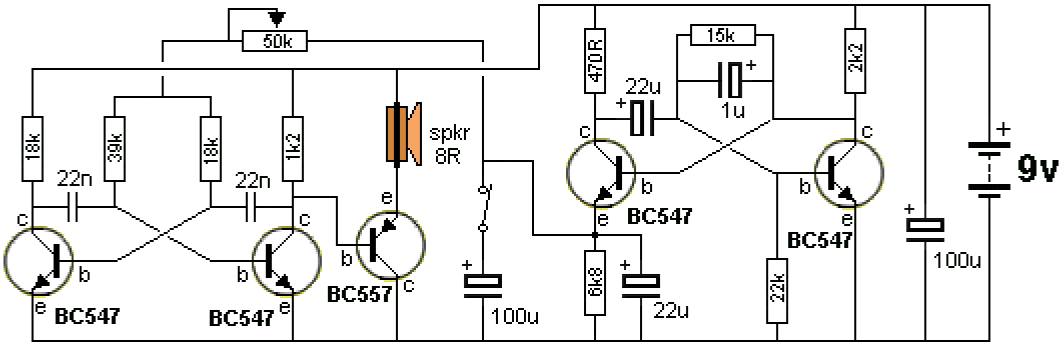






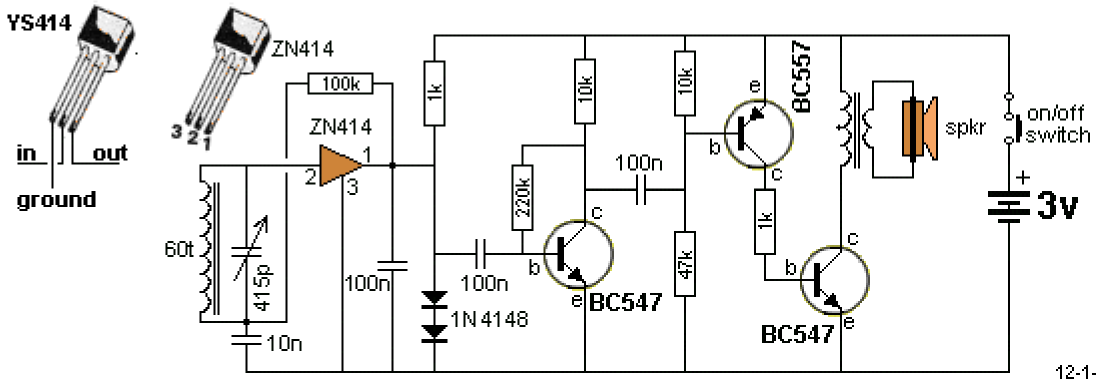
The Nail Finder head

The Nail Finder project is [HERE]



PHASER GUN

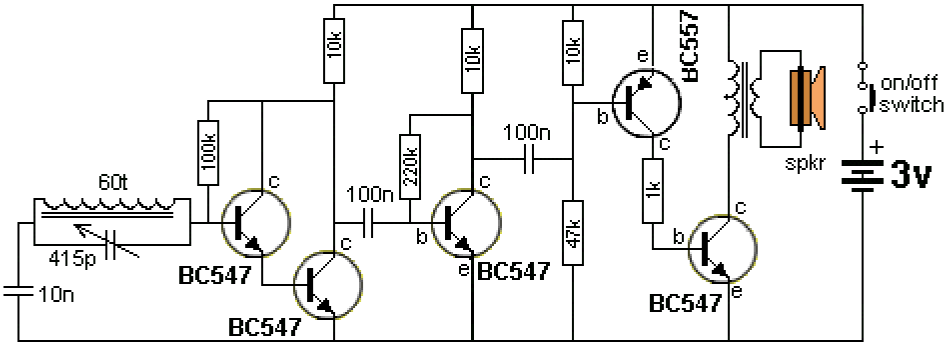
This is a very effective circuit. The sound is amazing. You have to build it to appreciate the range of effects it produces. The 50k pot provides the frequency of the sound while the switch provides fast or slow speed.
Hear the sounds: (built by a reader)
http://www.youtube.com/watch?v=JN_fBZxRpoU&feature=BFa&list=UU2oJeVi1pM3nQy_8X6fFHAA



12-1-2014

IC RADIO

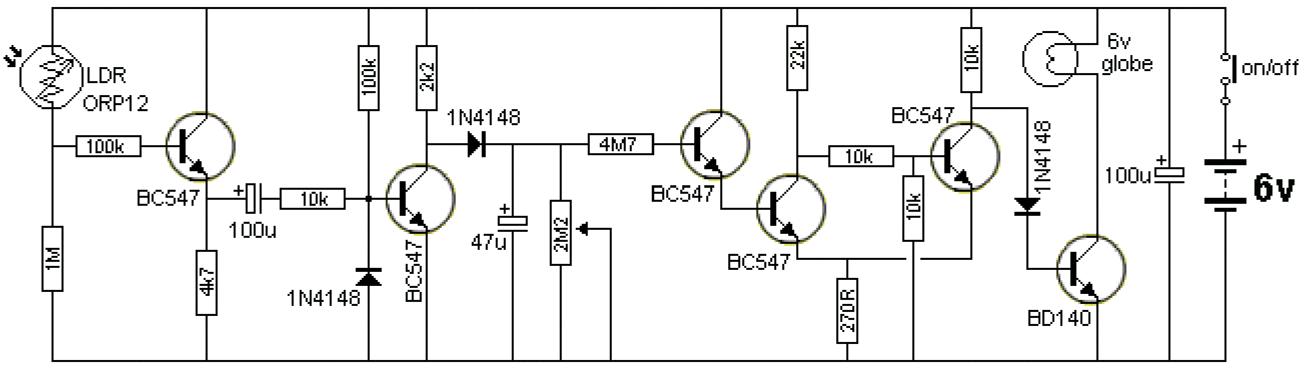
This circuit contains an IC but it looks like a 3-leaded transistor and that's why we have included it here.
The IC is called a "Radio in a Chip" and it contains 10 transistors to produce a TRF (tuned Radio Frequency) front end for our project.
The 3-transistor amplifier is taken from our SUPER EAR project with the electret microphone removed.
The two 1N 4148 diodes produce a constant voltage of 1.3v for the chip as it is designed for a maximum of 1.5v.
The "antenna coil" is 60t of 0.25mm wire wound on a 10mm ferrite rod. The tuning capacitor can be any value up to 450p.
Note: The YS414 IC is identical to ZN414. See above.



12-1-2014

5-TRANSISTOR RADIO

If you are not able to get the ZN414 IC, this circuit uses two transistors to take the place of the chip.



AUTOMATIC LIGHT

This circuit automatically turns on a light when illumination is removed from the LDR. It remains ON for the delay period set by the 2M2 pot.

The important feature of this circuit is the building blocks it contains - a delay circuit and Schmitt Trigger. These can be used when designing other circuits.

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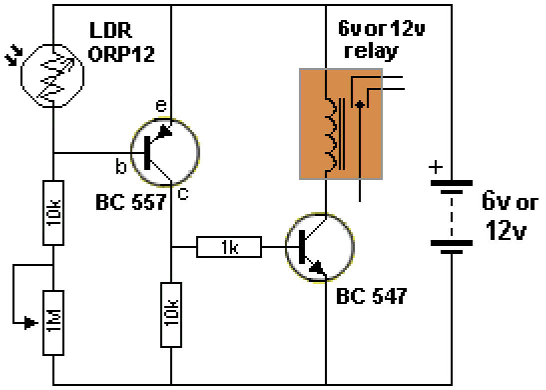
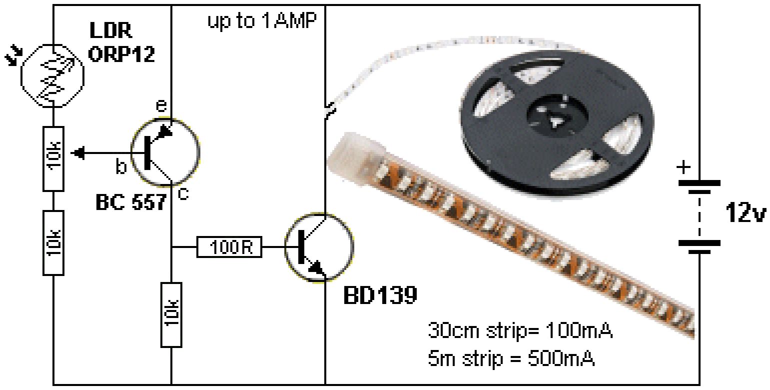


NIGHT LIGHT

This circuit activates a relay when illumination falls below a preset level on the Light Dependent Resistor (Photo Cell).



This circuit will drive 30cm strips to 5m strips. Two 5m strips have been tested with this circuit.

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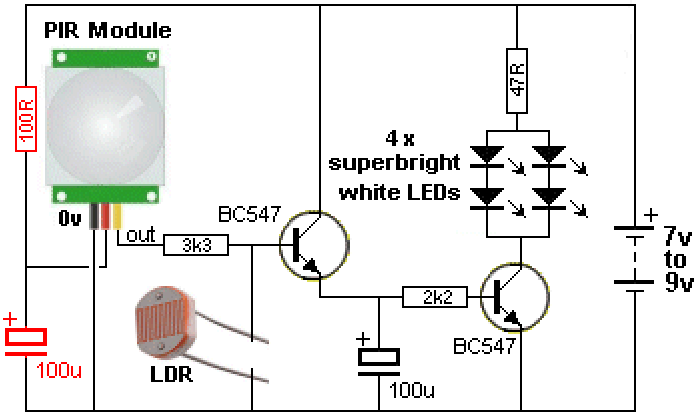
PIR LED LIGHT

PIR detectors make a wonderful detector to turn on LEDs to illuminate a passage, doorway or path.
It has an LDR that only allows the circuit to turn ON at night.

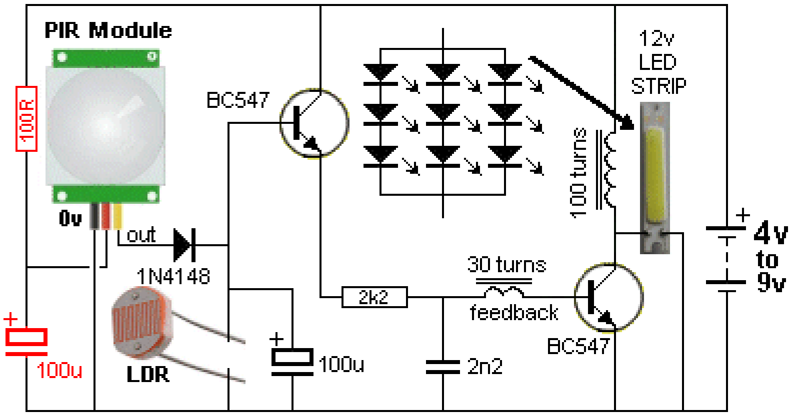


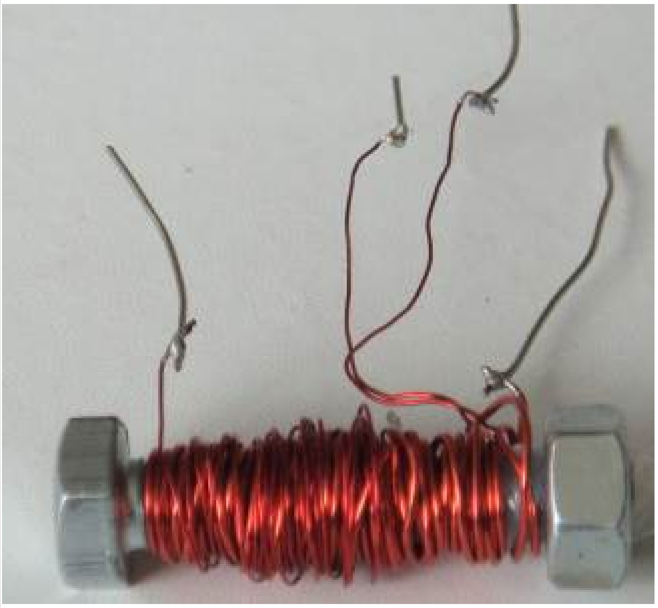
PIR LED LIGHT

This circuit can use old cells as it requires less than 20mA to illuminate the 4 LEDs and less than 0.4mA when sitting around.
There are a number of different PIR detectors and most of them take 1 minute to settle before detecting IR and turn ON for a short period of time. The 100u increases the turn-ON time to about 4 seconds and some detectors keep outputting a signal while you are in front of the lens.
The first transistor increases the current from the PIR module so the 100u can be charged via the 1k and the second transistor acts as a buffer to deliver current to turn on the LEDs.
The 100R and red 100u prevent the PIR re-triggering.
This is a great project for "using up" old batteries.
A kit for this project is available from Talking Electronics for $6.00 plus $4.50 postage.
It is built on a small piece of Matrix Board and includes 4 x super-bright LEDs. Email Colin Mitchell for details.

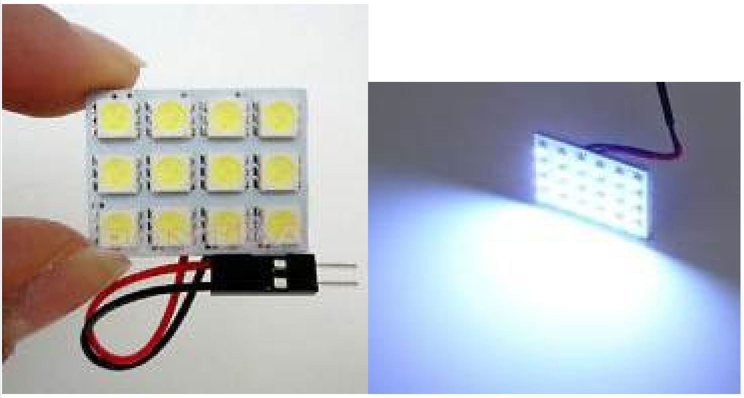
PIR LED LIGHT using LED STRIP

This circuit uses a home-made transformer, wound on a nut and bolt, and a 12v LED Strip or LED Panel.





You can almost any nut and bolt and any wire from 0.2mm to 0.5mm diameter.
The main winding has 100 turns and the feedback winding has 30 turns.



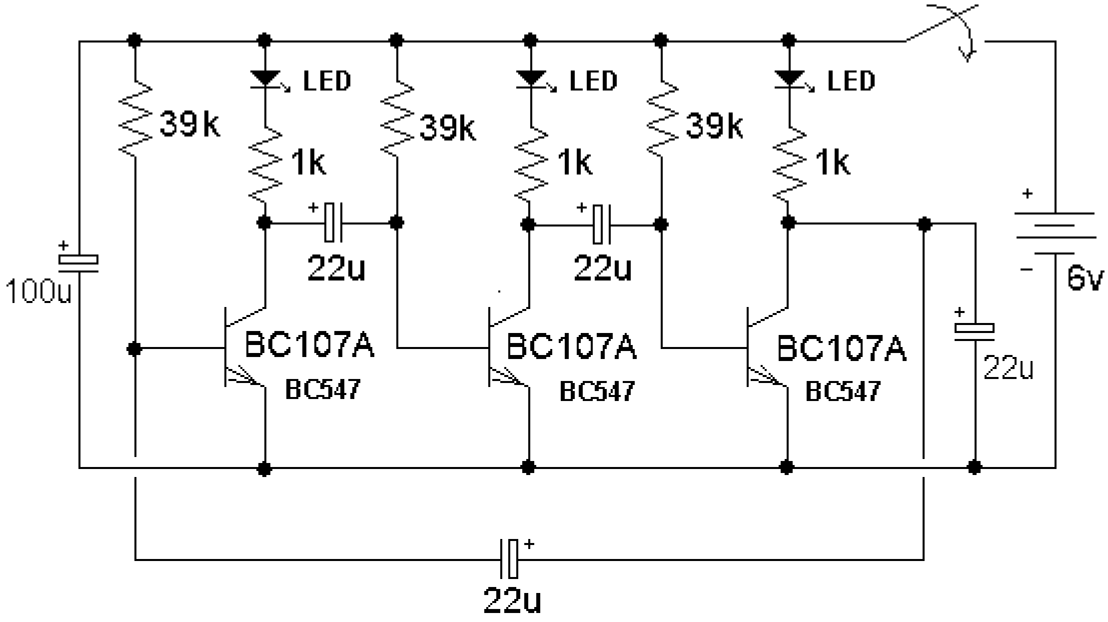
All these LED panels have inbuilt resistors so they can be connected to 12v supplies. We do not need the inbuilt resistors in this circuit however the resistors cannot be removed.

The LED strip shown in the circuit above contains 9 LEDs in groups of 3 with an inbuilt current liming resistor. The current-limiting resistor is not needed in this design but cannot be removed. You can make your own LED strip by connecting three white LEDs in series (NO current-limiting resistor is needed). You can have a total of 9 LEDs. (3 strings of 3 LEDs) or you can use any of the 12v LED panels available on eBay.
If the circuit does not work, connect the feedback wires around the other way.
The LDR is included to turn the circuit ON only at night and the emitter-follower transistor increases the ON-time to about 4 seconds.

You can use old cells and make sure the supply is not higher than 9v as the LED Strip will remain illuminated because you will be supplying enough voltage to illuminate it !!
You will need to experiment with the 2k2 resistor and 2n2 to get the best illumination with the transformer you use and the supply voltage.

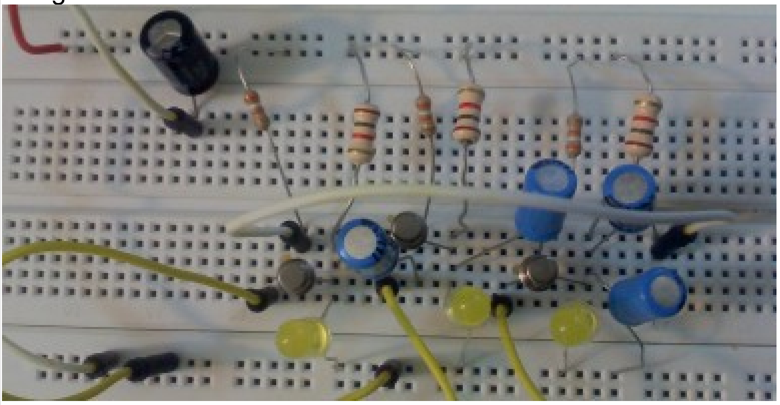
3-LED CHASER by Faraday

s.sh_butterfly@yahoo.com



The LEDs in this circuit produce a chasing pattern similar the running LEDs display in video

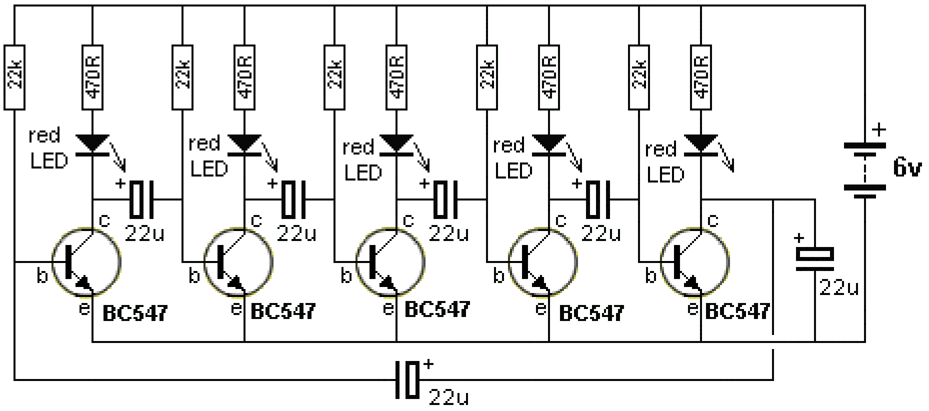
shops.
In fact the effect is called: "Running Hole." All transistors will try to come on at the same time when the power is applied, but some will be faster due to their internal characteristics and some will get a different turn-on current due to the exact value of the 22u electrolytics. The last 22u will delay the voltage-rise to the base of the first transistor and make the circuit start reliably. It is very difficult to see where the hole starts and that's why you should build the circuit and investigate it yourself. The circuit can be extended to any number of odd stages as shown in the next circuit, using 5 transistors.



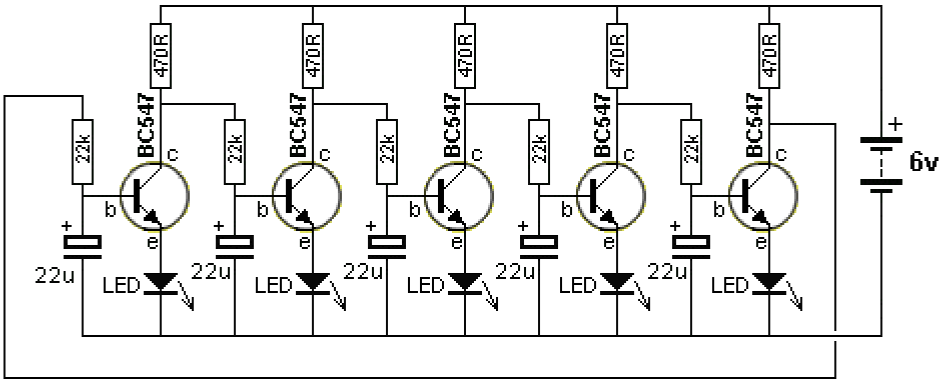
Video by Faraday: 3-LED Chaser mp4 128KB

5-LED CHASER

This is an extension of the 3-LED Chaser above.

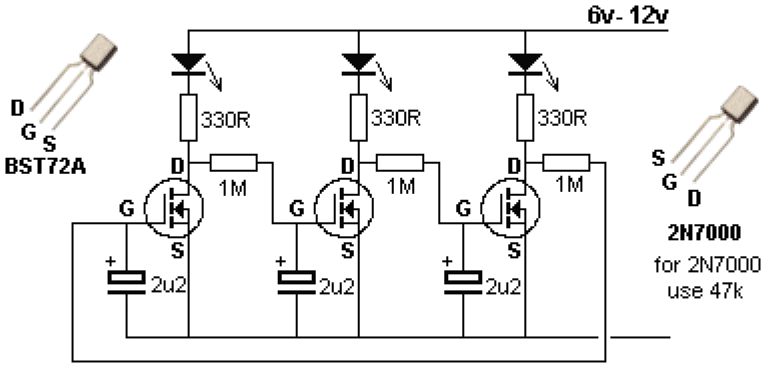


The following circuit produces a slightly different effect because the LEDs are in the emitter. You cannot mix the LED colours.



3-LED CHASER using FETs

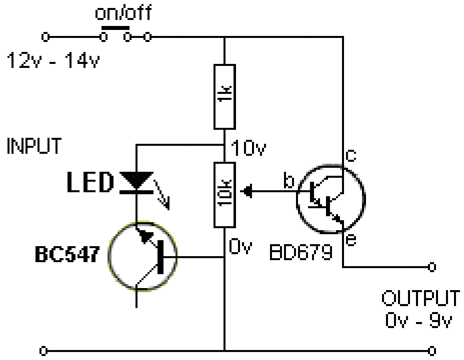
This circuit uses FETs. This circuit has been tested with the following two FETs on 6v to 12v with red and white LEDs. The 1M resistor must be reduced to 47k for the 2N7000. Note the different pin-outs for the two FETs.



for 2N7000 use 47k

use 2u2 to 22u

BENCH POWER SUPPLY



This power supply can be built in less than an hour on a piece of copper-laminate.
The board acts as a heat-sink and the other components can be mounted as shown in the photo, by cutting strips to suit their placement.
The components are connected with enamelled wire and the transistor is bolted to the board to keep it cool.
The Bench Power Supply was designed to use old "C," "D" and lantern batteries, that's why there are no diodes or electrolytics. Collect all your old batteries and cells and connect them together to get at least 12v -14v.
The output of this power supply is regulated by a 10v zener made up of the characteristic zener voltage of 8.2v between the base-emitter leads of a BC547 transistor (in reverse bias) and approx 1.7v across a red LED. The circuit will deliver 0v - 9v at 500mA (depending on the life left in the cells your are using). The 10k pot adjusts the output voltage and the LED indicates the circuit is ON. It's a very good circuit to get the last of the energy from old cells.

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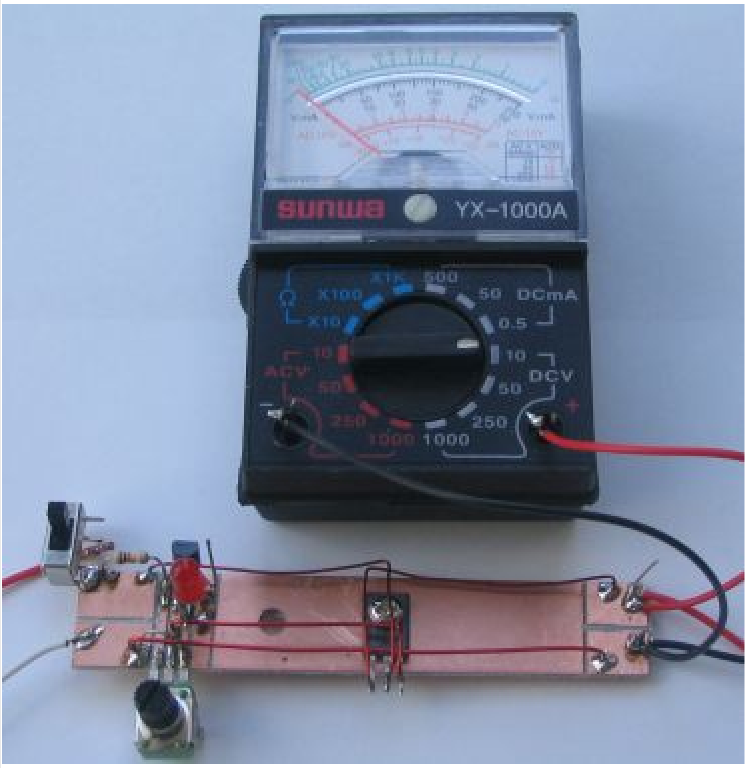
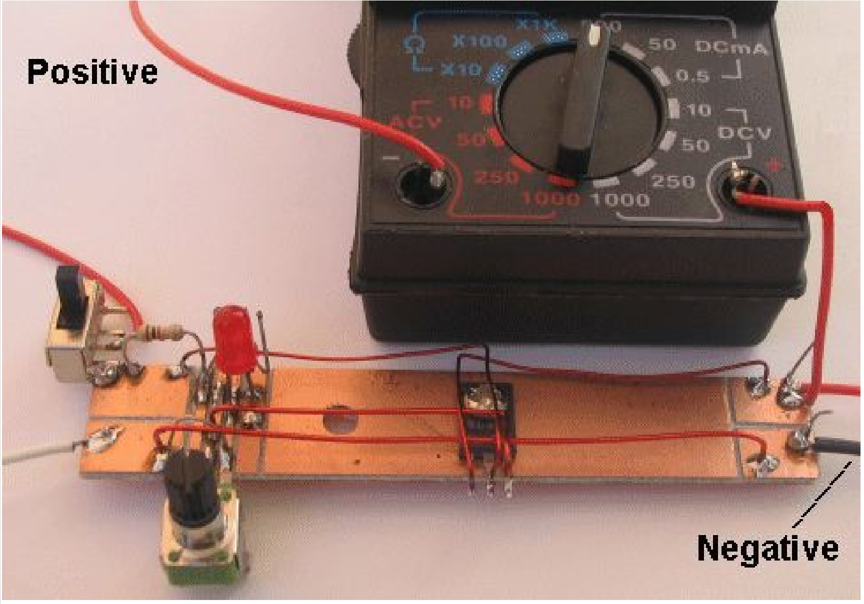
ADDING A VOLT-METER TO THE BENCH POWER SUPPLY



A voltmeter can be added to the Bench Power Supply by using a very low cost multimeter. For less than $10.00 you can get a mini multimeter with 14 ranges, including a 10v range. The multimeter can **also** be used to monitor current by removing the negative lead and making a new RED lead, fitting it to the "—" of the multimeter and selecting the 500mA range as shown in the photo below:



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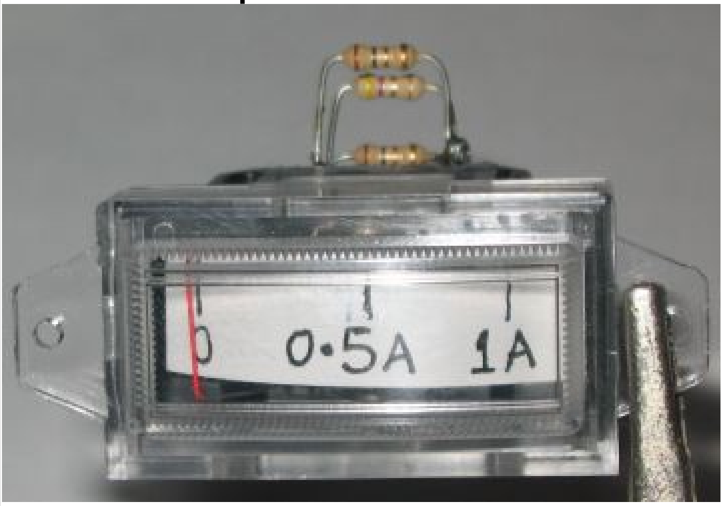
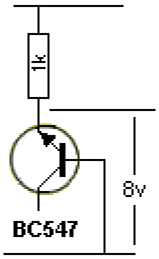
MAKING 0-1Amp meter for the BENCH POWER SUPPLY

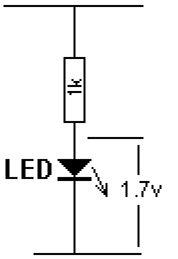


The item in the photo is called a "Movement." A movement is a moving coil with a pointer and no resistors connected to the leads.
Any Movement can be converted to an ammeter without any mathematics.
Simply solder two 1R resistors (in parallel) across the terminals of any movement and connect it in series with an ammeter on the output of the Bench Power Supply. The second ammeter provides a reference so you can calibrate the movement. Connect a globe and increase the voltage.
At 500mA, if the pointer is "up scale" (reading too high) add a trim-resistor. In our case it was 4R7.
The three shunt resistors can be clearly seen in the photo. Two 1R and the trim resistor is 4R7.
You can get a movement from an old multimeter or they are available in electronics shops as a separate item. The sensitivity does not matter. It can be 20uA or 50uA FSD or any sensitivity.

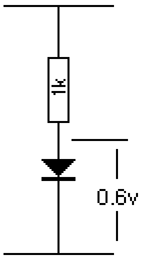
MAKING A ZENER DIODE and POWER ZENER

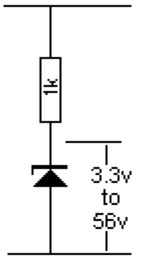
Sometimes a zener diode of the required voltage is not available. Here are a number of components that produce a characteristic voltage across them. Since they all have different voltages, they can be placed in series to produce the voltage you need. A reference voltage as low as 0.65v is available and you need at least 1 to 3mA through the device(s) to put them in a state of conduction (breakdown).



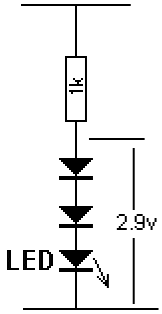


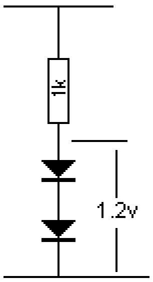
red LED = 1.7v
green LED = 2.3v

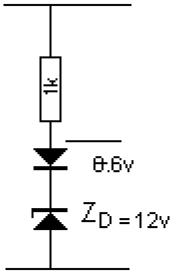




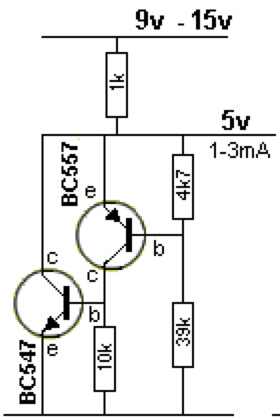
Z voltage = 3v3 to 56v

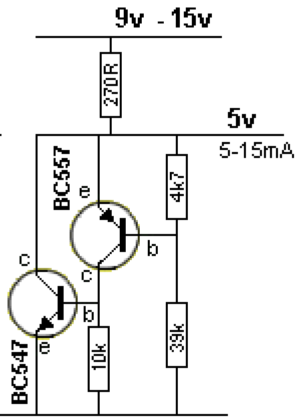


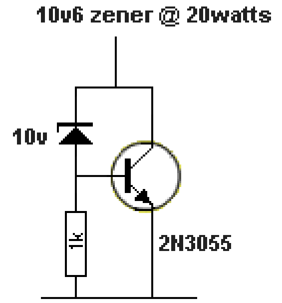




Z voltage = 12.6v



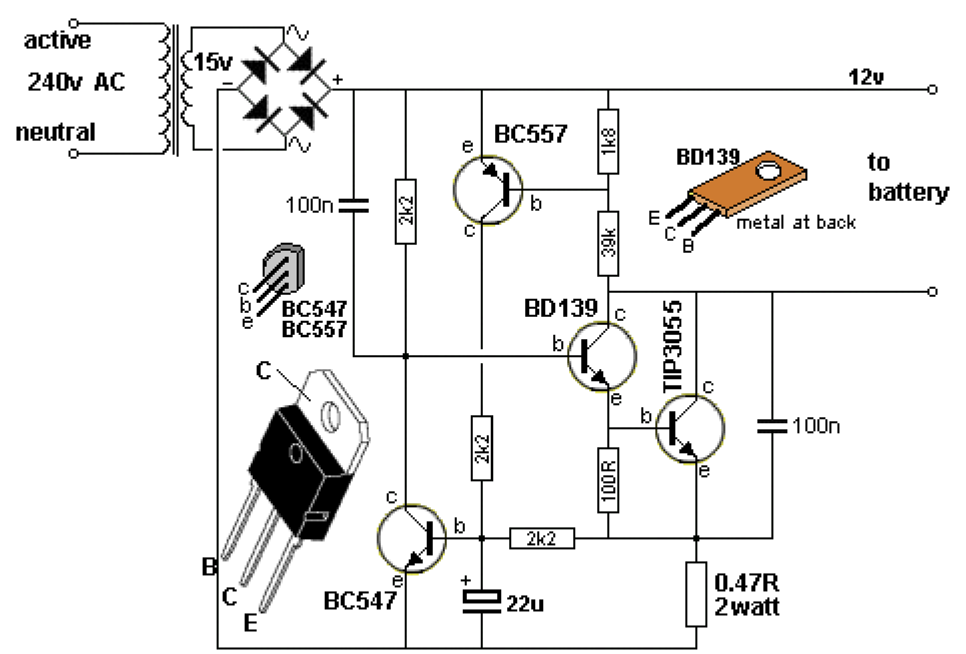




POWER ZENER

A **POWER ZENER** can be made from an ordinary zener and a transistor. The final power-zener voltage will be 0.6v higher than the zener and the wattage of the whole circuit will depend on the type of transistor used. Of course, constant use of this circuit will represent a waste of 20 watts and there are better ways to design a circuit, but it can be used to prevent a rail rising above a certain voltage and will only be used for short durations.

12v TRICKLE CHARGER



The 12v Trickle Charger circuit uses a TIP3055 power transistor to limit the current to the battery by turning off when the battery voltage reaches approx 14v or if the current rises above 2 amp. The signal to turn off this transistor comes from two other transistors - the BC557 and BC 547.

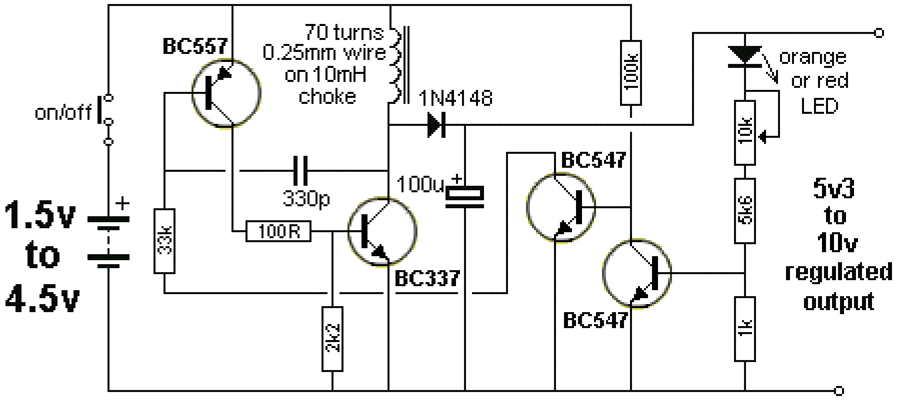
Firstly, the circuit turns on fully via the BD139 and TIP3055. The BC557 and BC 547 do not come into operation at the moment. The current through the 0.47R creates a voltage across it to charge the 22u and this puts a voltage between the base and emitter of the BC547. The transistors turn on slightly and remove some of the turn-on voltage to the BD139 and this turns off the TIP3055 slightly.

This is how the 2 amp max is created.

As the battery voltage rises, the voltage divider made up of the 1k8 and 39k creates a 0.65v between base and emitter of the BC557 and it starts to turn on at approx 14v. This turns on the BC 547 and it robs the BD136 of "turn-on" voltage and the TIP3055 is nearly fully turned off.

All battery chargers in Australia must be earthed. The negative of the output is taken to the earth pin.

1.5v to 10v INVERTER



This very clever circuit will convert 1.5v to 10v to take the place of those expensive 9v batteries and also provide a 5v supply for a microcontroller project.

But the clever part is the voltage regulating section. It reduces the current to less than 8mA when no current is being drawn from the output. With a 470R load and 10v, the output current is 20mA and the voltage drop is less than 10mV. The pot will adjust the output voltage from 5.3v to 10v.

HOW THE CIRCUIT WORKS

The circuit starts by the 100k turning on the BC547 and the BC557 gets turned ON via the 33k resistor.

This turns ON the BC337 via the 100R resistor. You will notice the "current-limiting" resistors are getting small and smaller. This is because the transistor-current is getting larger and larger and we want the resistor to pass this higher current.

Current flowing through the collector-base of the BC337 causes current to flow through the inductor. This current creates expanding flux that cuts all the turns of the inductor and produces a voltage in the OPPOSITE DIRECTION. This voltage OPPOSES the incoming voltage and very little current flows.

Over a period of microseconds, this voltage drops a microscopic amount and thus a slightly higher current will flow.

The voltage on the collector drops and this change is passed through the 330p to turn on the BC557 MORE.

This continues until the BC337 is fully turned ON (by the action of the 330p).

The 330p now charges a little more and this reduces the base current in the BC557 and it starts to turn OFF.

This action starts to turn OFF the BC337 and very soon we have both transistors fully turned OFF.

The BC337 is effectively removed from the circuit and the current flowing through the inductor stops increasing. The magnetic flux stops increasing and the voltage it produces stops IMMEDIATELY.

The magnetic flux now does not have any voltage opposing it and it starts to collapse and cut all the turns of the inductor. It does this very quickly because there is no voltage opposing its collapse.

The result is a very high voltage in the opposite direction to the applied voltage. What this means is the lower terminal of the inductor produces a voltage that is ADDED to the supply voltage.

This voltage can be as high at 100v or more, and is passed through the diode.

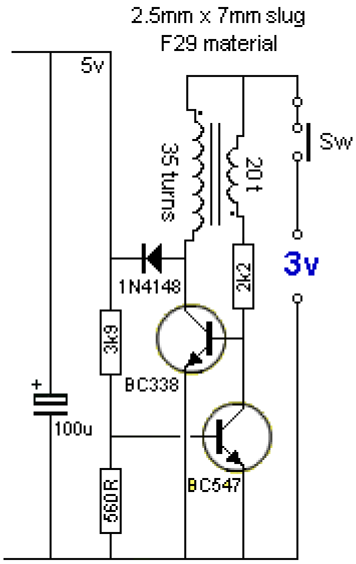
Even though this voltage is very high, it actually consists of a very high voltage with a very small current.

The combination of these two is called ENERGY and it flows into the 100u to charge it.

As the voltage on the 100u increases, its voltage is detected by the 4th transistor and

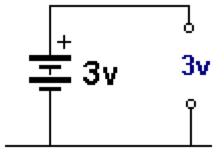
when it reaches 10v, the 3rd transistor is turned OFF slightly so the first two transistors are not driven as hard.
This is how a stable 10v is produced.

5v REGULATED SUPPLY FROM 3V

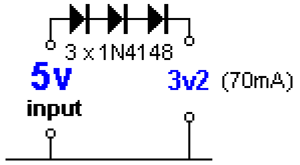


This circuit will produce a 5v regulated output from 2 cells (3v). The output current is limited to 50mA but will be ideal for many microcontroller circuits. The output voltage is set to 5v by the 3k9 and 560R resistors, making up a voltage divider network.

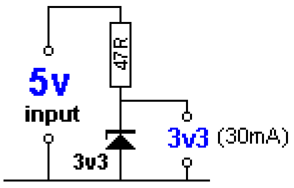
3.3v FROM 5V SUPPLY



A



B



C

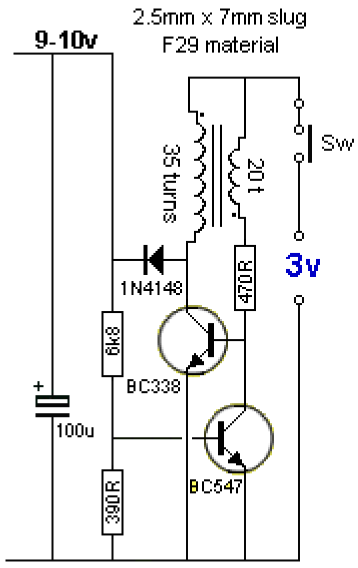
Here are 3 ways to generate a 3.3v supply:

Circuit "A" uses two 1.5v cells. This is the cheapest and best way to create a 3v supply.

Circuit "B" uses 3 x 1N448 signal diodes to drop 1.8v and produce 3.2v on the output. The 5v supply must be regulated.

Circuit "C" produces 3.3v from a 3v3 zener. The 47R limits the output to about 30mA. The 5v can have a small ripple as the zener will create a stable 3v3 output.

9v SUPPLY FROM 3V



You can replace a 9v battery with this circuit.

The output is about 10.4v on no load and 9.6v @30mA .

The advantage is the voltage stays over 9v for the life of the cells.

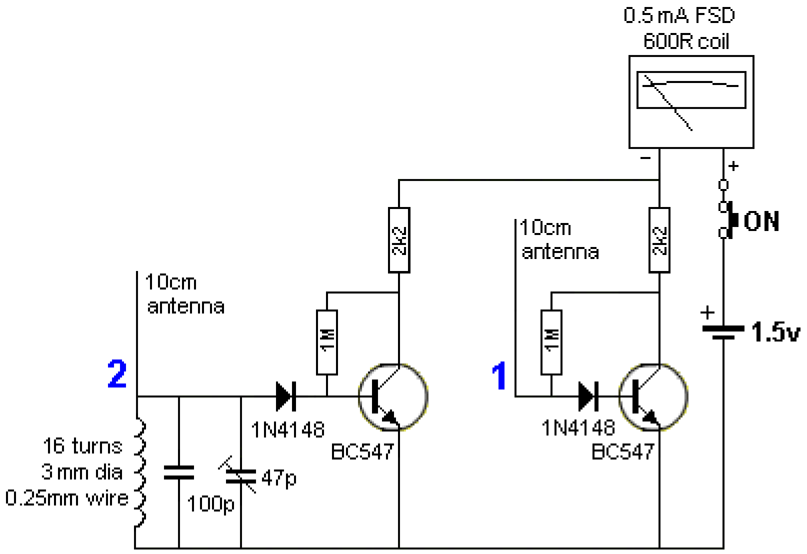
A normal 9v battery drops to 7v very quickly.

The output voltage is set to 9-10v by the 6k8 and 390R resistors. The 470R gives the circuit an idling current of about 20mA and the spikes are about 75mV.

By increasing the 470R, the quiescent current decreases but the voltage drops more when the current is 30mA.

-

27MHz Field Strength Meter



This circuit will test 27MHz transmitters and show the transmitter is operating when the antenna is connected to point 1 and the actual frequency of transmission when the antenna is connected to point 2. See the full project HERE.

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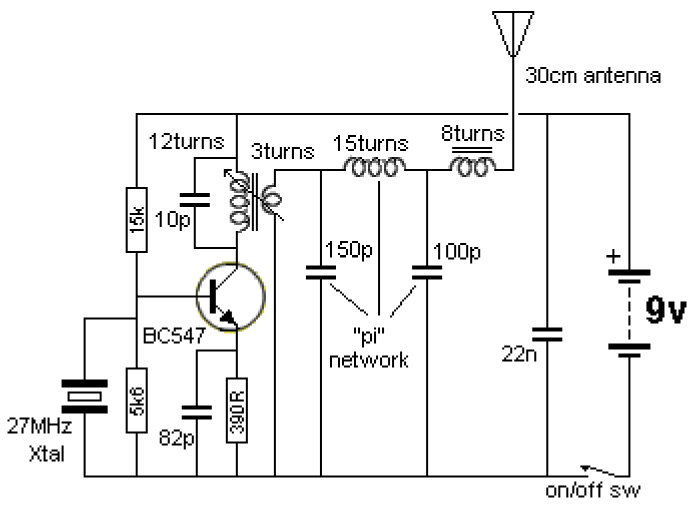
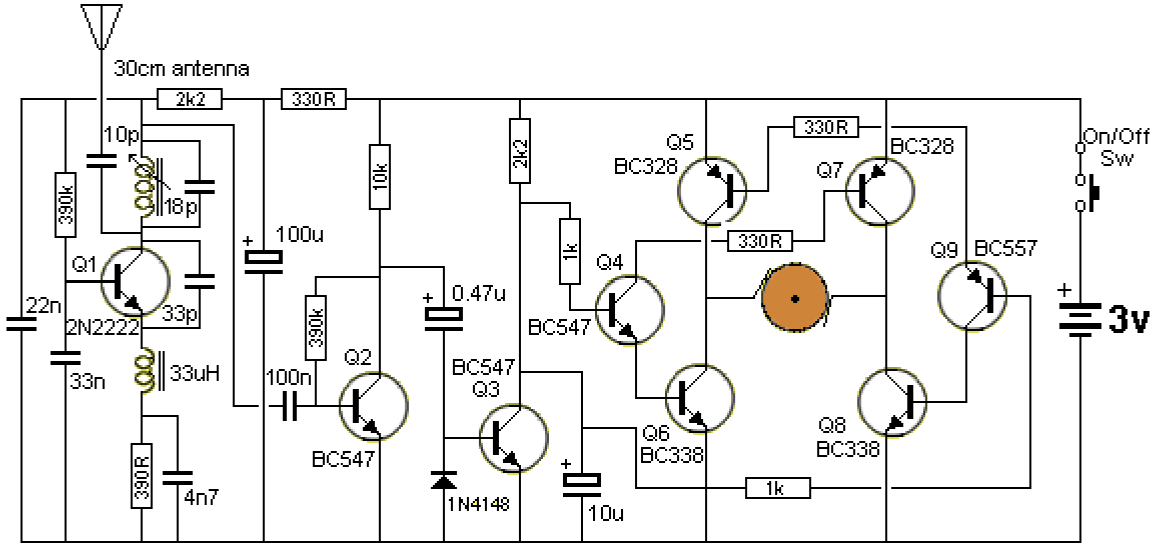


27MHz TRANSMITTER

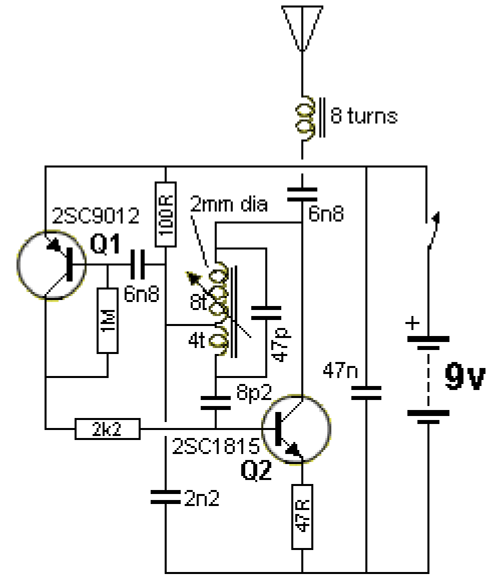
The transmitter is a very simple crystal oscillator. The heart of the circuit is the tuned circuit consisting of the primary of the transformer and a 10p capacitor. The frequency is adjusted by a ferrite slug in the centre of the coil until it is exactly the same as the crystal. The transistor is configured as a common emitter amplifier. It has a 390R on the emitter for biasing purposes and prevents a high current passing through the transistor as the resistance of the transformer is very low. The "pi" network matches the antenna to the output of the circuit. See full description in 27MHz Links article.



27MHz RECEIVER

The 27MHz receiver is really a transmitter. It's a very weak transmitter and delivers a low level signal to the surroundings via the antenna. When another signal (from the transmitter) comes in contact with the transmission from the receiver it creates an interference pattern that reflects down the antenna and into the first stage of the receiver.

The receiver is a super-regenerative design. It is self-oscillating (or already oscillating) and makes it very sensitive to nearby signals. See full description in 27MHz Links article.



27MHz TRANSMITTER WITHOUT A CRYSTAL

A 27MHz transmitter without a crystal. When a circuit does not have a crystal, the oscillator is said to be "voltage dependent" or "voltage controlled" and when the supply voltage drops, the frequency changes.
If the frequency drifts too much, the receiver will not pick up the signal. For this reason, a simple circuit as shown is not recommended. We have only included it as a concept to show how the 27MHz frequency is generated. It produces a tone and this is detected by a receiver.
See full description in 27MHz Links article.

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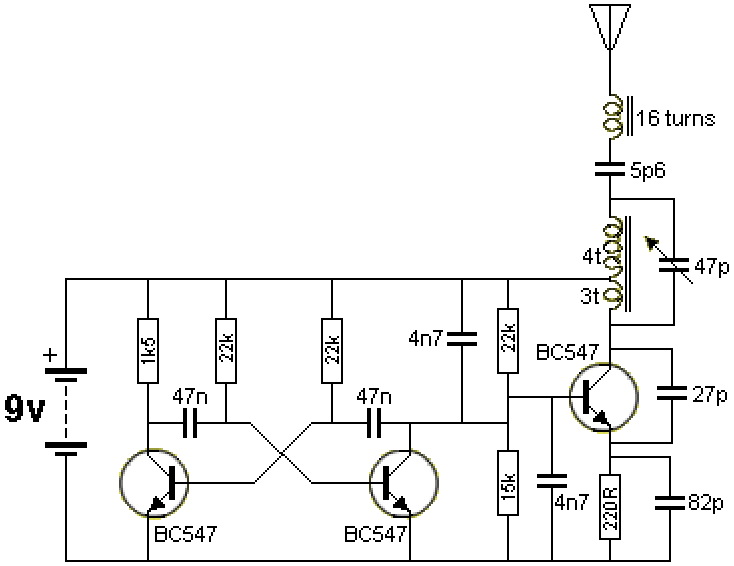

27MHz TRANSMITTER WITH SQUARE-WAVE OSCILLATOR

The circuit consists of two blocks. Block 1is a multivibrator and this has an equal mark/space ratio to turn the RF stage on and off. Block 2 is an RF oscillator. The feedback to keep the stage operating is provided by the 27p capacitor. The frequency-producing items are the coil (made up of the full 7 turns) and the 47p air trimmer. These two items are called a parallel tuned circuit. They are also called a TANK CIRCUIT as they store energy just like a TANK of water and pass it to the antenna. The frequency of the circuit is adjusted by the 47p air trimmer.
See full description in 27MHz Links article.

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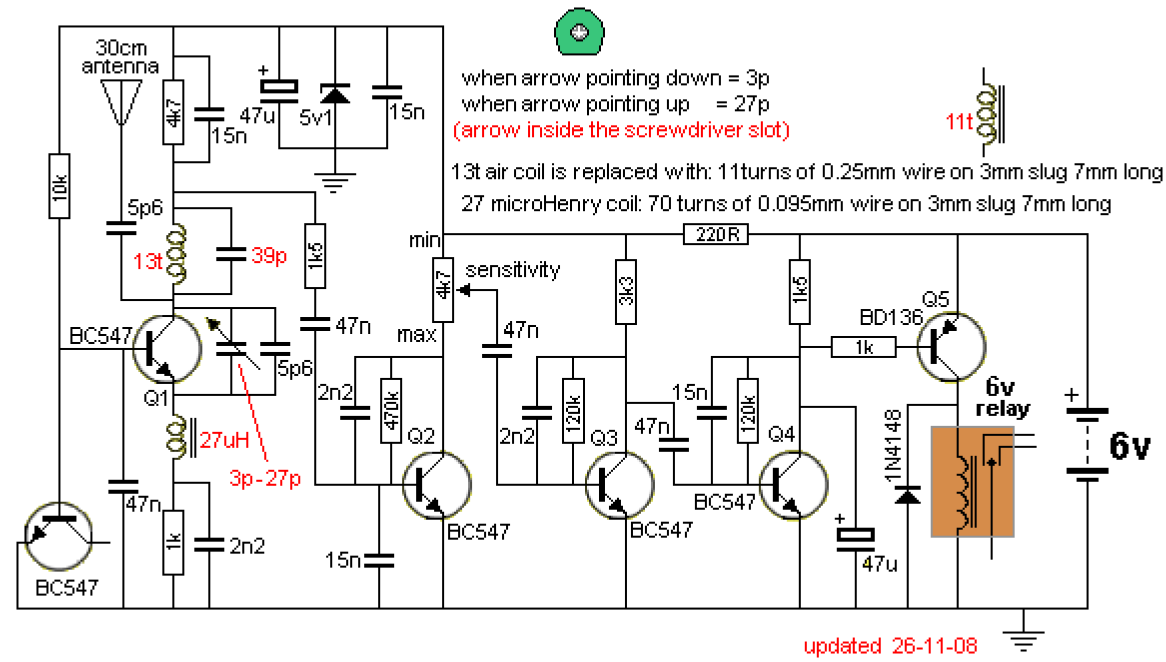


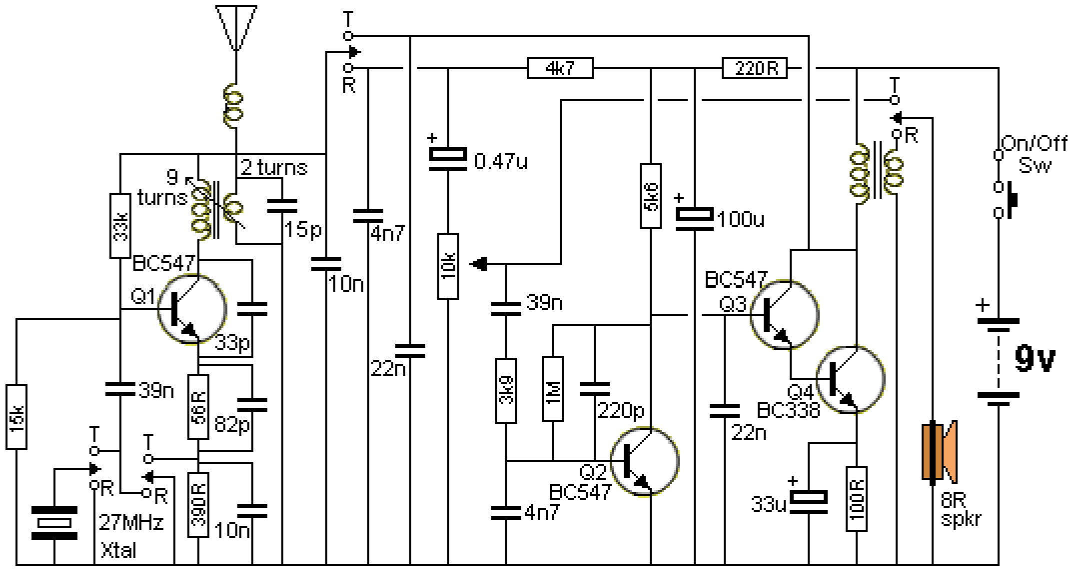
when arrow pointing down = 3p
when arrow pointing up = 27p
(arrow inside the screwdriver slot)

13t air coil is replaced with: 11turns of 0.25mm wire on 3mm slug 7mm long
27 microHenry coil: 70 turns of 0.095mm wire on 3mm slug 7mm long

updated 26-11-08

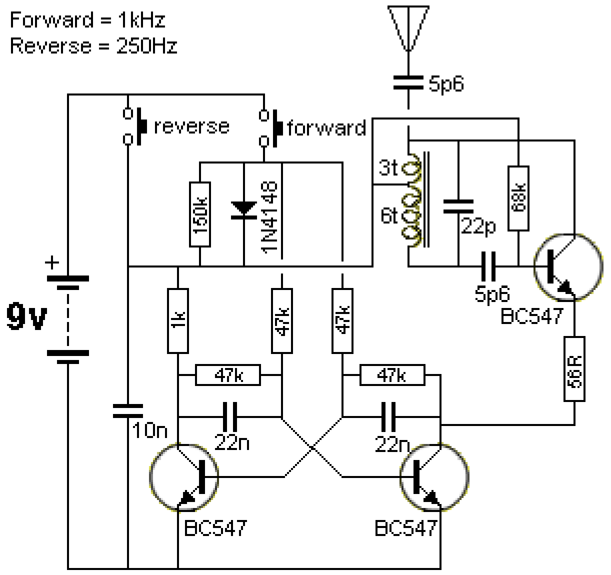
27MHz RECEIVER-2

This circuit matches with the 27MHz Transmitter with Square-wave Oscillator. See full description on Talking Electronics website: 27MHz Links article.
The receiver frequency is fixed. The transmitter is adjusted to suit the receiver. The 3-27p trimmer is adjusted for maximum gain (10p trimmer and 5p6 in our case) and this is a critical adjustment.
The base-emitter junction of the first BC547 sets 0.7v (as it is heavily turned on by the 10k) on the base of the oscillator Q1, and this is fixed. Q1 is very lightly turned on (due to the emitter resistor), and this makes it very sensitive when it is oscillating. Any 27MHz signal from the surroundings will upset the oscillator and any tone in the signal will be passed to the stages for amplification. The coil is 13 turns. It can be replaced with 11 turns of 0.25mm wire on 3mm dia slug 7mm long.
Although the original Russian product worked very well, our prototype did not have very good sensitivity. The circuit was very difficult to set-up.
Note: When making the 27uH inductor and checking its value on an inductance meter; if the meter does not read low values accurately, put two inductors in series. Measure the first inductor, say 100uH. The two inductors in series will be 127uH as inductors combine just like resistors in series! The result is the addition of the individual values.



WALKIE TALKIE

Nearly all the components in the 4-transistor circuit are used for both transmitting and receiving. This makes it a very economical design. The frequency-generating stage only needs the crystal to be removed and it becomes a receiver. Next is a three transistor directly coupled audio amplifier with very high gain. The first transistor is a pre-amplifier and the next two are wired as a super-alpha pair, commonly called a Darlington pair to drive the speaker transformer. See full description in 27MHz Links article.



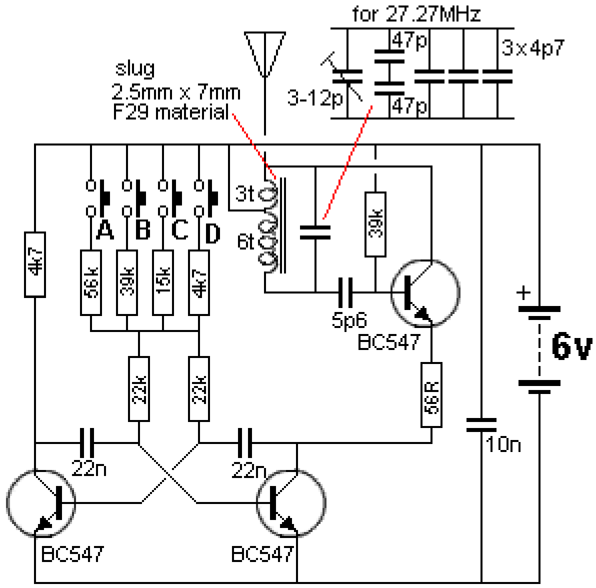
27MHz TRANSMITTER - 2 CHANNEL

This circuit does not use a crystal but has a clever feature of using the two push buttons to turn the circuit on when it is required to transmit.

The frequency of the multivibrator is determined by the value of resistance on the base of each transistor. The multivibrator is driven directly from the supply with the forward button and via a 150k for the reverse frequency.

The receiver requires a 1kHz tone for forward and 250Hz for reverse.

See full description in 27MHz Links article.

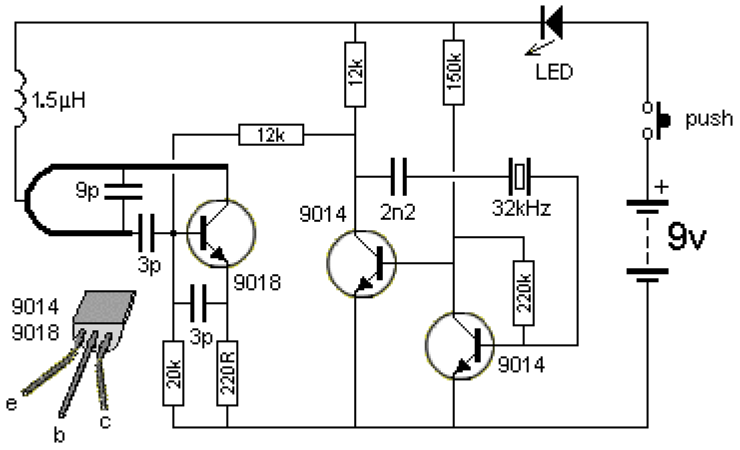


27MHz TRANSMITTER - 4 CHANNEL

This circuit uses the same number of components as the 2-Channel circuit above but has 4 channels.
The frequency of the multivibrator is determined by the value of resistance on the base of each transistor.
A 4 channel receiver has been designed by talking Electronics using a PIC12F628 micro to detect the different frequencies.
See P4 of:
2 Digit Up/Down Counter (see left index on Talking Electronics website).
2 Digit Up/Down Counter has the receiver section.

A = 500Hz B = 550Hz C = 660Hz D = 1kHz

-



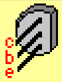
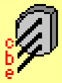
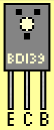
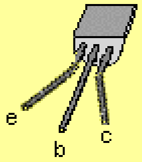
303MHz TRANSMITTER

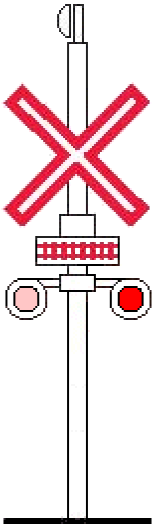
The transmitter circuit is made up of two building blocks - the 303MHz RF oscillator and the 32kHz crystal controlled oscillator to generate a tone so the receiver does not false-trigger.
The 303MHz oscillator consists of a self-oscillating circuit made up of the coil on the PC board and a 9p (9 puff) capacitor.

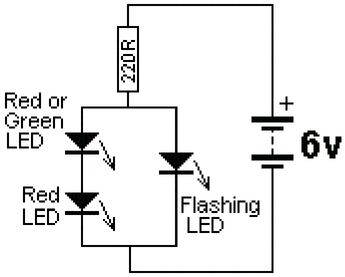
See full description in Wireless Doorbell article.

-

Type:		Gain:	Vbe	Vce	Current	Case
2SC1815	NPN	100	1v	50v	150mA	
2SC3279	NPN	140 to 600 @0.5A	0.75v	10v	2amp	

BC337 BC338	NPN	60 @300mA	0.7v	45v 25v	800mA	
BC547 BC548 BC549	NPN	70 @100mA	0.7v	45v 30v 30v	100mA	
BC557	PNP			45v	100mA	
BD139	NPN	70-100 @150mA	0.5v	80v	1.5A	
BD140	PNP	70-100 @150mA	0.5v	80v	1.5A	
2SCxxx						
8050	NPN			10v	1.5A	
8550	PNP			10v	1.5A	
9012	PNP				500mA	
9013	NPN		1v	20v	500mA	
9014	NPN				100mA	
9015	PNP				100mA	
9018	NPN	700MHz		15v	50mA	



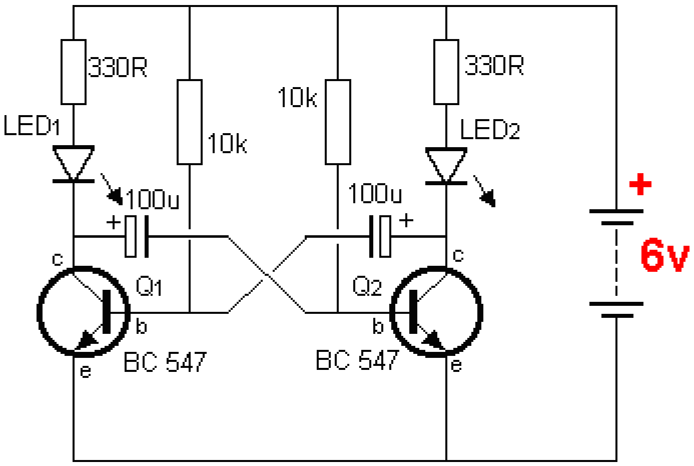


BOOM GATE LIGHTS

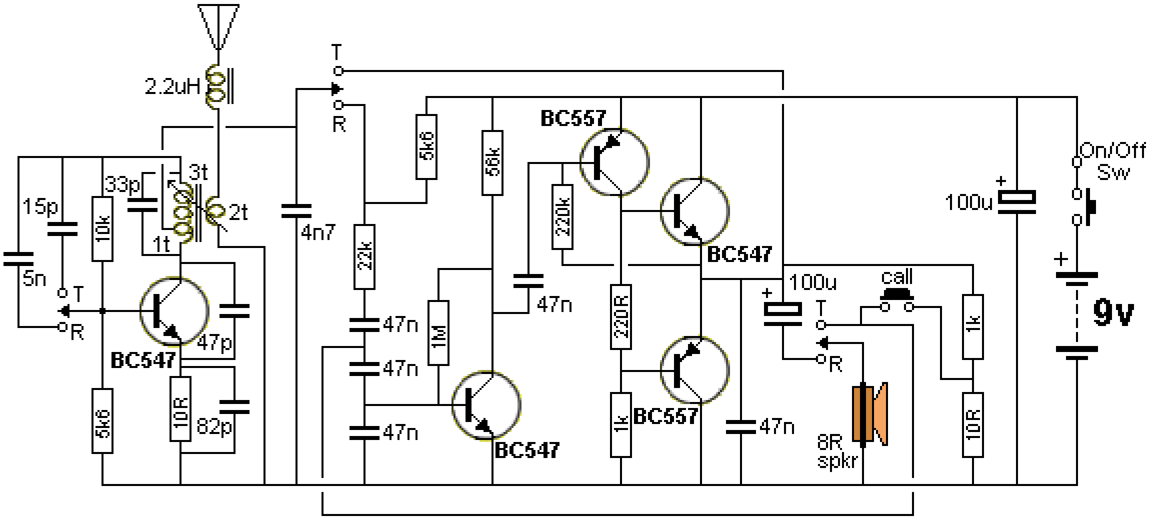
This simple circuit will produce flashing lights for your model railway crossing. It uses one flashing LED and one normal red LED, with a green LED hidden in the background. It can be used somewhere else on your layout but it is needed to produce a voltage drop so the two red LEDs will flash.

You cannot get a simpler circuit.

The second circuit produces the same effect but the flash-rate is more even.

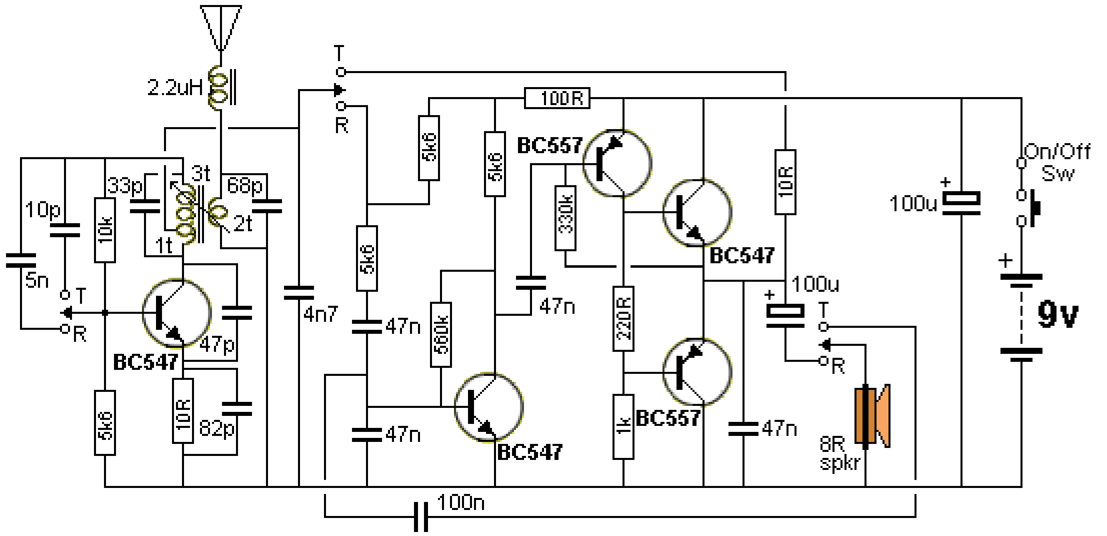


The 1/10th watt resistors used in this circuit, compared with 0.25watt resistors.



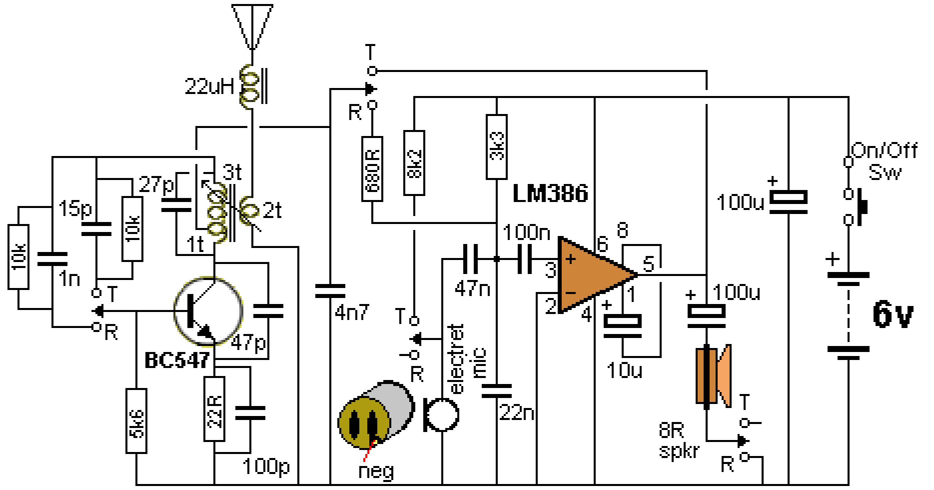
5 TRANSISTOR WALKIE TALKIE - 1

This walkie talkie circuit does not have a crystal or speaker transformer, with the board measuring just 3cm x 4cm and using 1/10th watt resistors, it is one of the smallest units on the market, for just $9.50 to $12.00. The wires in the photo go to the battery, speaker, call-switch and antenna. The most difficult component in the circuit to duplicate is the oscillator coil. See the photo for the size and shape. The coil dia is 5mm and uses 0.25mm wire. The actual full-turn or half turn on the coil is also important. Almost all 5 transistor walkie talkies use this circuit or slight variations. See the article: 27MHz Transmitters for theory on how these transmitters work - it is fascinating.



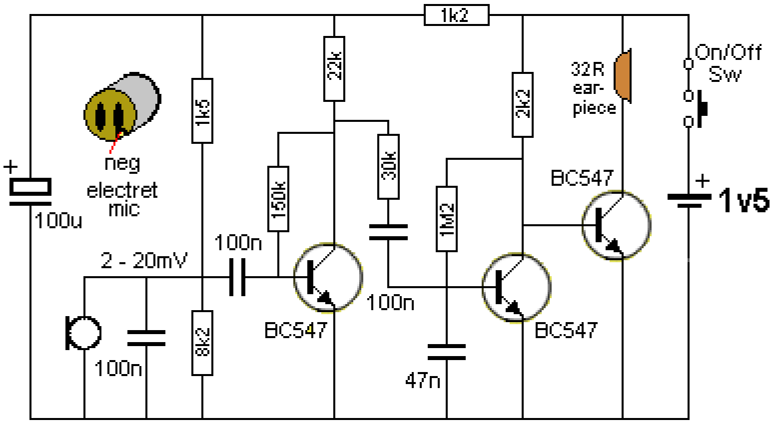
5 TRANSISTOR WALKIE TALKIE - 2

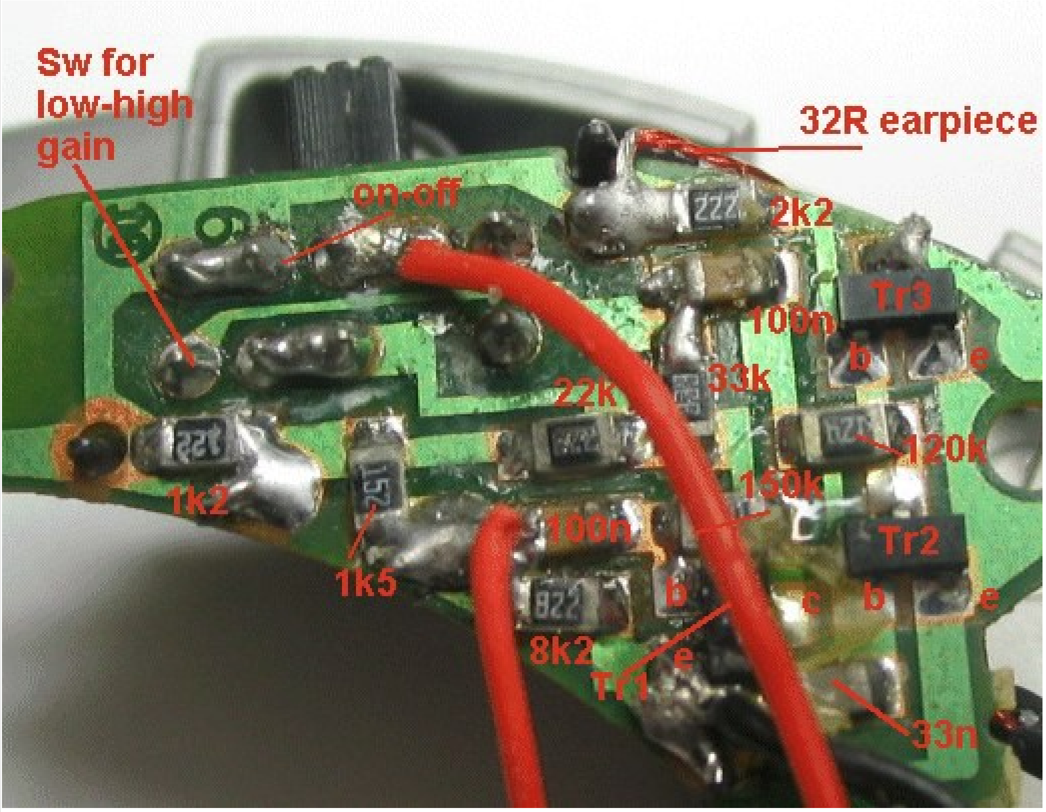
Here is another walkie talkie circuit, using slightly different values for some of the components. See the article: 27MHz Transmitters for theory on how these transmitters work.



WALKIE TALKIE with LM386

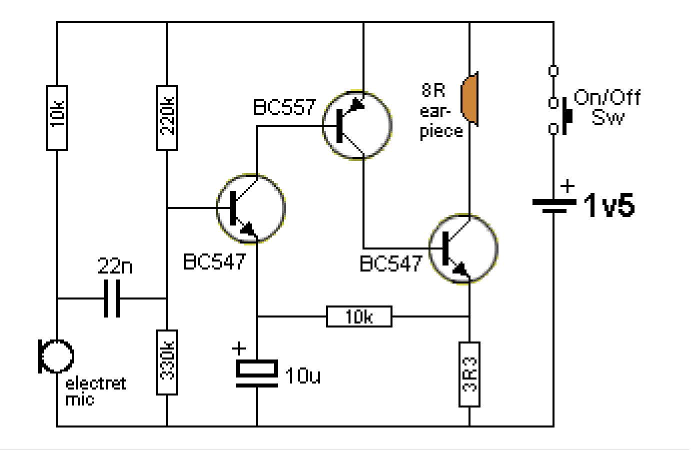
Here is a more up-to-date version of the walkie talkie, using an LM 386 amplifier IC to take the place of 4 transistors.





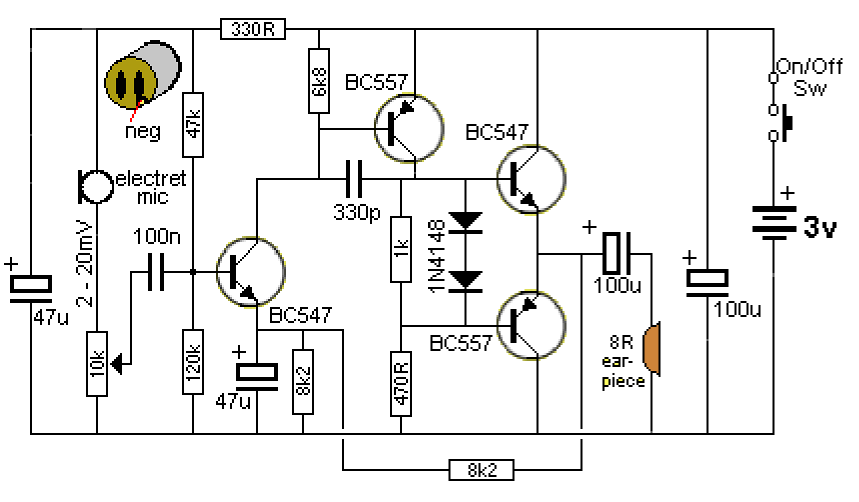
SPY AMPLIFIER

This simple circuit will detect very faint sounds and deliver them to a 32 ohm earpiece. The circuit is designed for 1.5v operation and is available from $2.00 shops for less than $5.00 The photo shows the surface-mount components used in its construction.



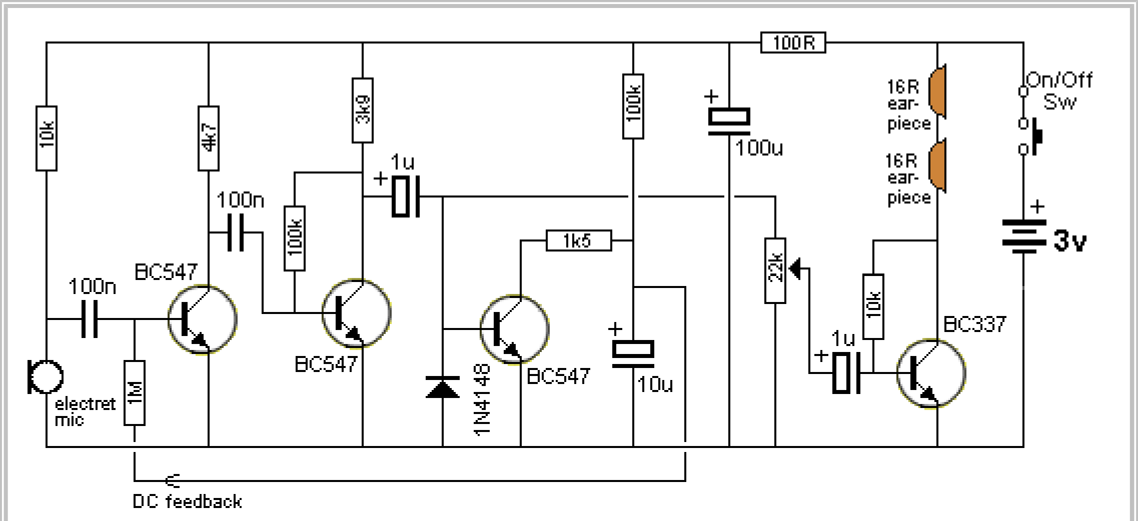
HEARING AID 1.5v SUPPLY

This simple circuit will detect very faint sounds and deliver them to an 8 ohm earpiece. The circuit is designed for 1.5v operation.



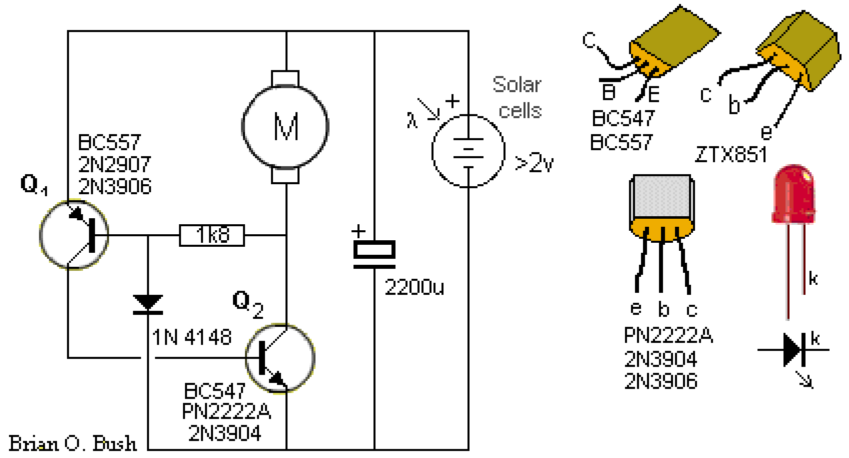
HEARING AID with PUSH PULL OUTPUT

This circuit will detect very faint sounds and deliver them to an 8 ohm earpiece. It is designed for 3v operation.



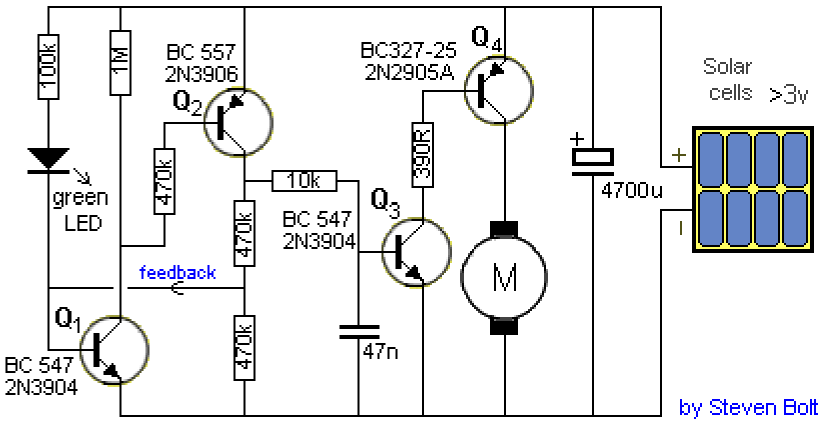
HEARING AID with CONSTANT VOLUME

This is a very handy circuit as it provides constant volume. It is designed for 3v operation.



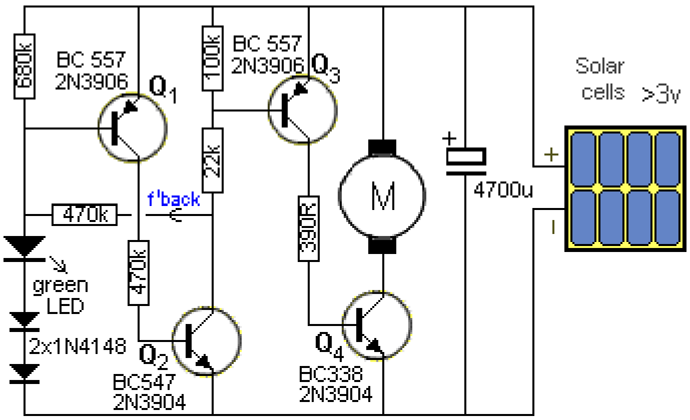
SOLAR ENGINE

This circuit is called Type-1 SE. Low current from a solar cell is stored in a large capacitor and when a preset voltage-level is reached, the energy from the capacitor is released to a motor.
For full details on how the circuit works and how to modify it, see:
http://www.talkingelectronics.com/projects/Robots/Page2.html



SUN EATER-I

An improved design over Solar Engine circuit above. It has a clever 2-transistor self-latching arrangement to keep the circuit **ON** until the voltage drops to 1.5v. The circuit turns on at 2.8v. This gives the motor more energy from the electrolytic at each "pulse." For full details on how the circuit works and how to modify it, see:
http://www.talkingelectronics.com/projects/Robots/Page2.html



SUN EATER-1A

This circuit is an improvement on the **Sun Eater I** shown above. It works exactly the same except the slight re-arrangement of the components allows an NPN power transistor to be used. One less resistor is needed and one less capacitor but two extra diodes have been added to increase the upper turn-on voltage.

For full details on how the circuit works and how to modify it, see:
http://www.talkingelectronics.com/projects/Robots/Page2.html

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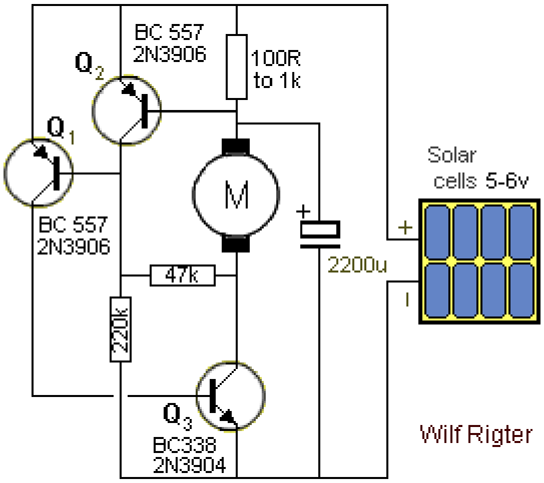

Wilf Rigter

SOLAR ENGINE Type-3

Type-3 circuits are **current controlled** or current-triggered. This is another very clever way of detecting when the electrolytic has reached its maximum charge.

At the beginning of the charge-cycle for an electrolytic, the charging current is a maximum. As the electrolytic becomes charged, the current drops. In the type-3 circuit, the charging current passes through a 100R resistor and creates a voltage drop. This voltage is detected by a transistor (Q2) and the transistor is turned ON.

This action robs transistor (Q1) from turn-on voltage and the rest of the circuit is not activated. As the charging current drops, Q2 is gradually turned off and Q1 becomes turned on via the 220k resistor on the base.

This turns on Q3 and the motor is activated. The voltage across the storage electrolytic drops and the current through the 100R rises and turns the circuit off. The electrolytic begins to charge again and the cycle repeats. For full details on how the circuit works and how to modify it, see:
http://www.talkingelectronics.com/projects/Robots/Page2.html

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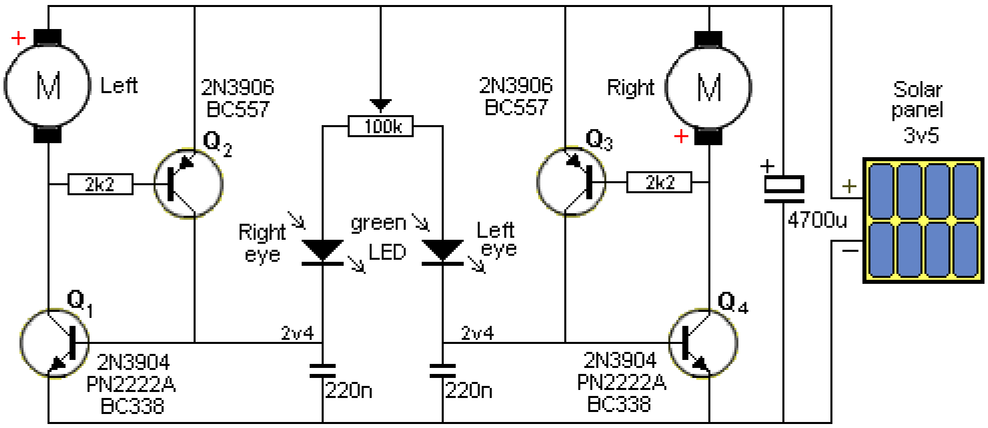
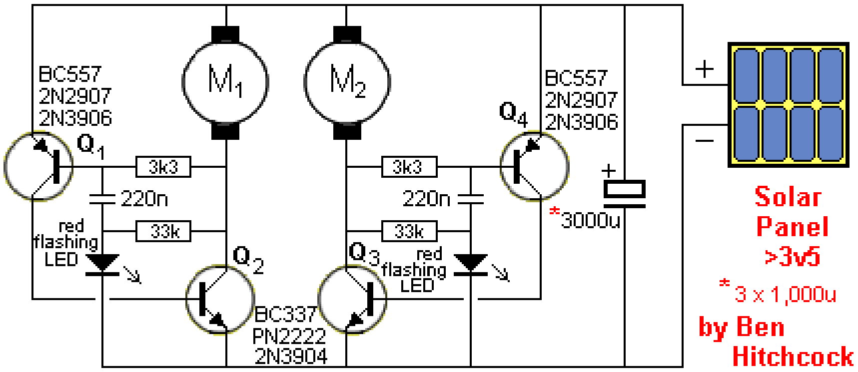
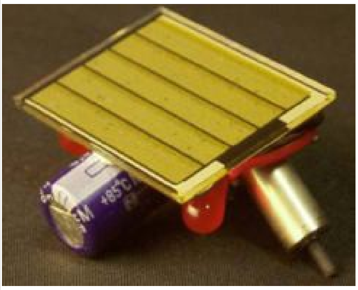


SOLAR PHOTOVORE

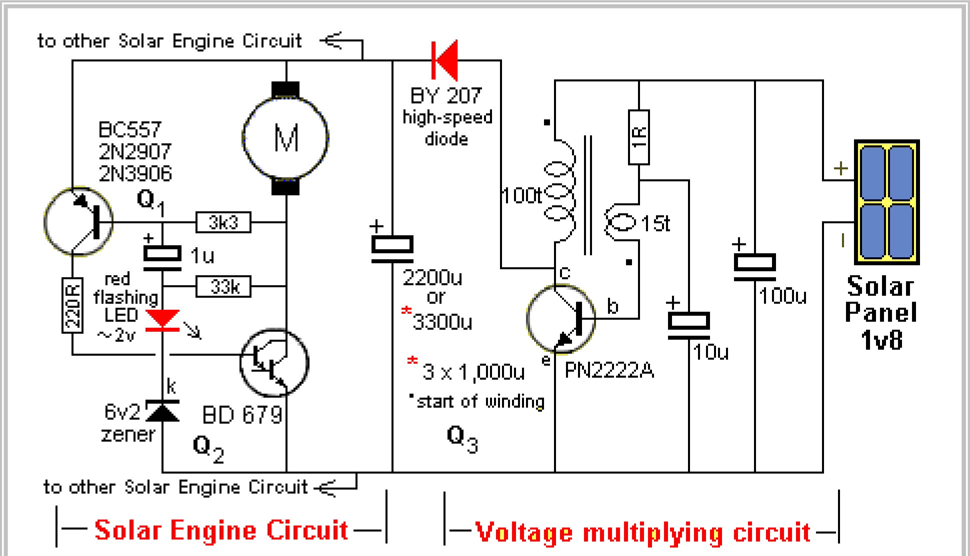
The green LEDs cause the Solar Engine on the opposite side to fire and the **Solar Photovore** turns toward the light source. The motors are two pager "vibe" motors with the weights removed. The 100k pot on the "head" balances the two Solar Engines. If you cannot get the circuit to work with green LEDs, use photo-transistors. For full details on how the circuit works and how to modify it, see:
http://www.talkingelectronics.com/projects/Robots/Page4.html

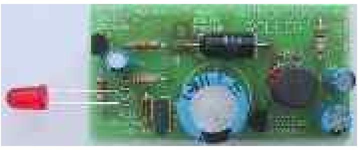




FRED Photopopper (Flashing LED)

It is a Photopopper using low-cost components. It uses two red or green flashing LEDs to turn the circuit **on** when the voltage across the electrolytic has reached about 2.7v. The flashing LEDs change characteristics according to the level of the surrounding light and this turns the circuit into phototropic. For full details on how the circuit works and how to modify it, see:
http://www.talkingelectronics.com/projects/Robots/Page6.html

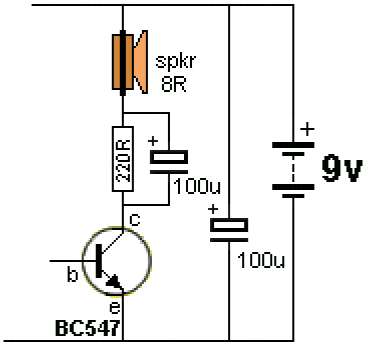




ROBO ROLLER

The circuit consists of two building blocks. The Photopopper circuit and a voltage multiplying (or voltage increasing) circuit from a **Solar Charger** project.

For full details on how the circuit works and how to modify it, see:
http://www.talkingelectronics.com/projects/Robots/Page7.html

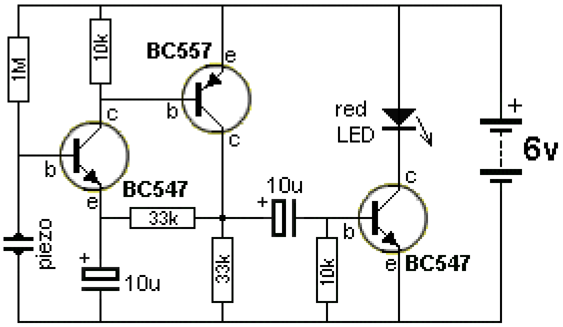


SIGNAL BY-PASS

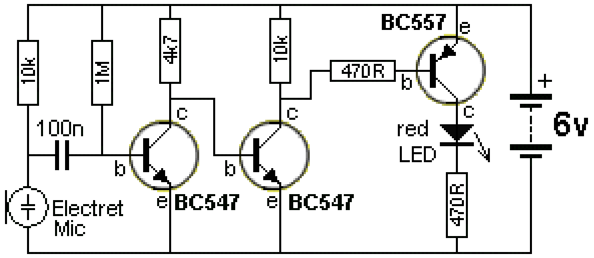
This circuit allows a class-A amplifier to drive a low impedance speaker and has a low quiescent current. The 220R in series with the speaker limits the "wasted" current to about 20mA max as the transistor is generally biased at mid-voltage. However the transistor will be almost directly driving the speaker when a signal is being processed and the only limitation is the ability of the 220R to discharge the 100u during each cycle.

The circuit is called a signal by-pass as the signal by-passes the 220R and drives the speaker directly (via the 100u).

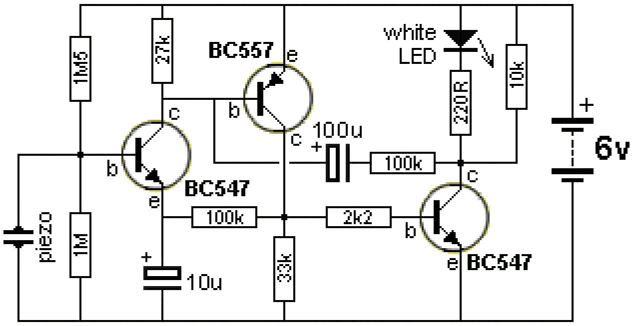
SOUND-TO-LIGHT



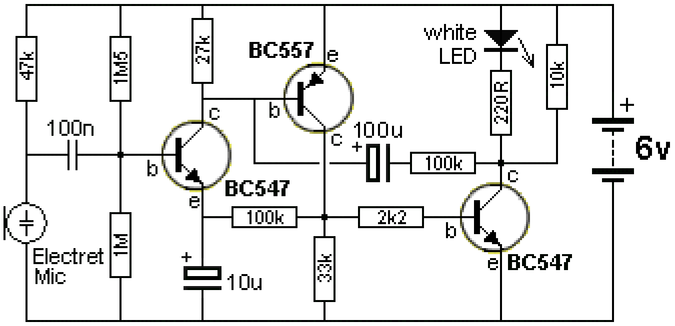
The LED illuminates when the piezo diaphragm detects sound.
Some piezo diaphragms are very sensitive and produce 100mV when whistling at 50cm. Others produce 1mV. You must test them with a CRO.
The sensitivity of the diaphragm will determine the sensitivity of the circuit.
The following circuit uses an electret microphone:



CLAP SWITCH - see also VOX

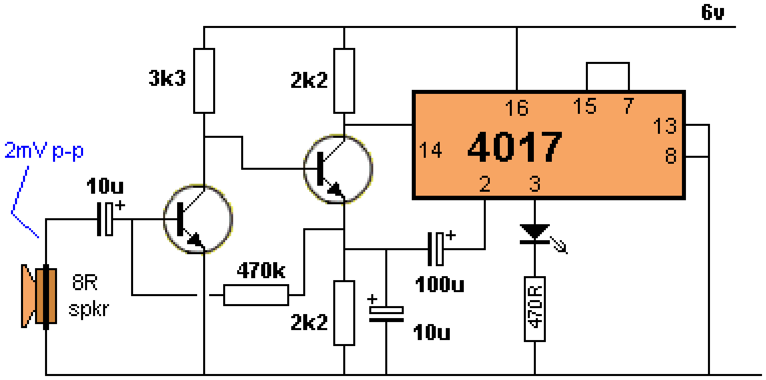


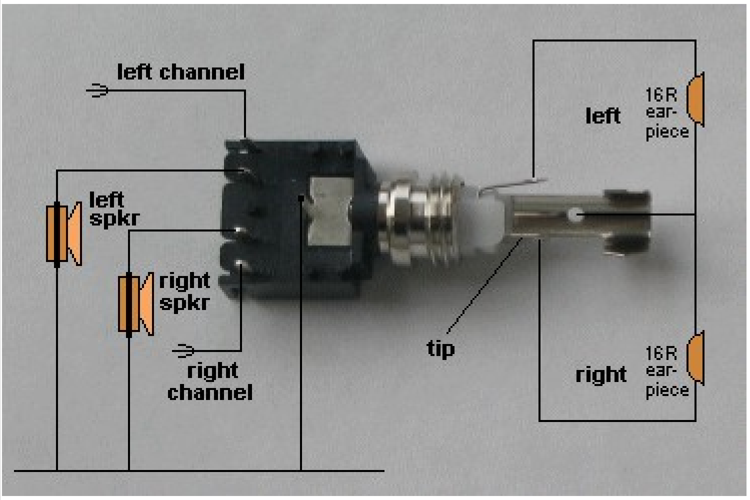
SOUND-TO-LIGHT with Delay
By re-arranging the components slightly from the previous circuit, we create a 15 second illumination of the LED. It will be illuminated with the clap of the hands.
The quiescent current is about 20uA, allowing 4 AA cells to last a long time.
The circuit takes about 20 seconds to reset after the LED goes out.
The 100u discharges through the 27k, 100k and 10k resistors.
The circuit can also be designed to accept an electret microphone:



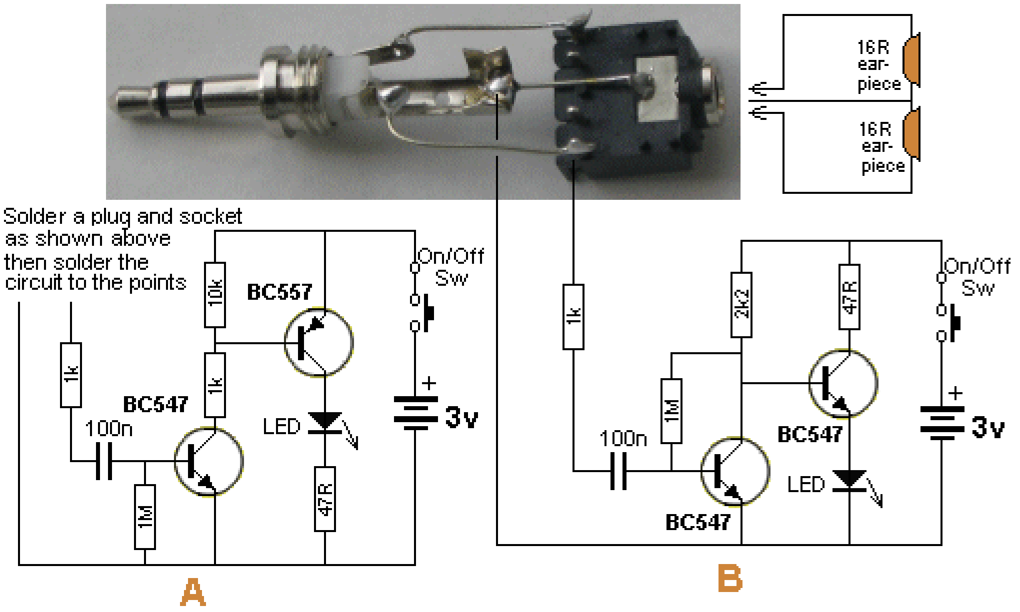
CLAP SWITCH "ON-OFF"

This circuit turns the LED ON with a clap or short whistle. And a further clap turns it OFF. It uses a speaker as a microphone and the fourth output of the 4017 is used to reset the chip. The 100u on pin 2 upsets the amplifier and prevents it clocking the chip, until the electro either charges or discharges. A buffer transistor can replace the LED to operate a relay. It only requires 2mV signal to activate the circuit.



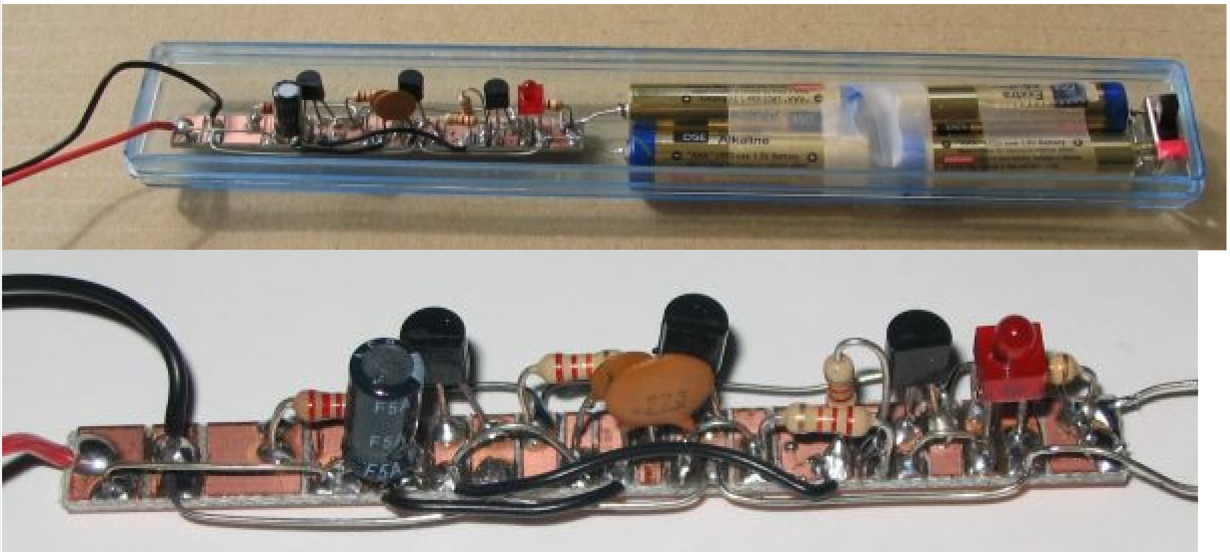


Above: A 3.5mm switched stereo plug and socket wiring.



MUSIC-TO-COLOUR

The LED illuminates when the circuit detects a high amplitude waveform. It can be connected to a "Walkman" or mini radio with earphones. A second channel can be connected to produce a stereo effect. Circuit A consumes less current as the LED is off when no audio is detected. Circuit B pulses the LED brighter when audio is detected.



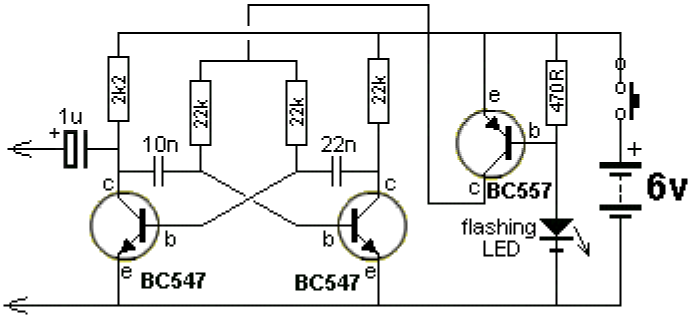
The transmitter is built on a small length of PC board, cut into lands with a file. The photo clearly shows how all the components are mounted and how the board is fitted into a toothbrush holder. The flashing LED shows the unit is ON and serves to control the beep-beep-beep of the circuit. The flashing LED is not an ordinary LED.

You cannot use an ordinary LED. It must be a FLASHING LED as this type of LED has a built-in resistor and a chip to make the LED flash.

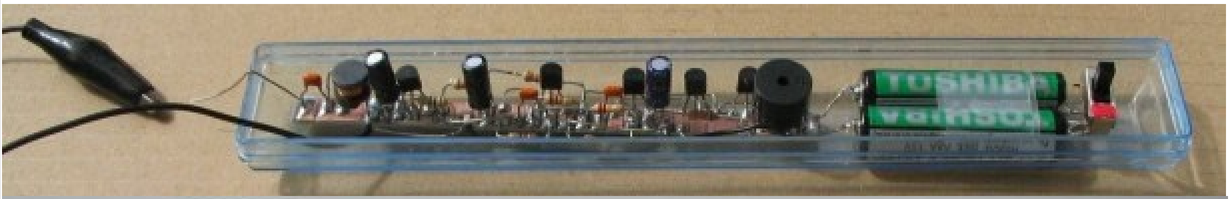
The circuit does not make the LED flash, the LED makes the circuit beep-beep-beep due to the on-off from the chip inside the LED.

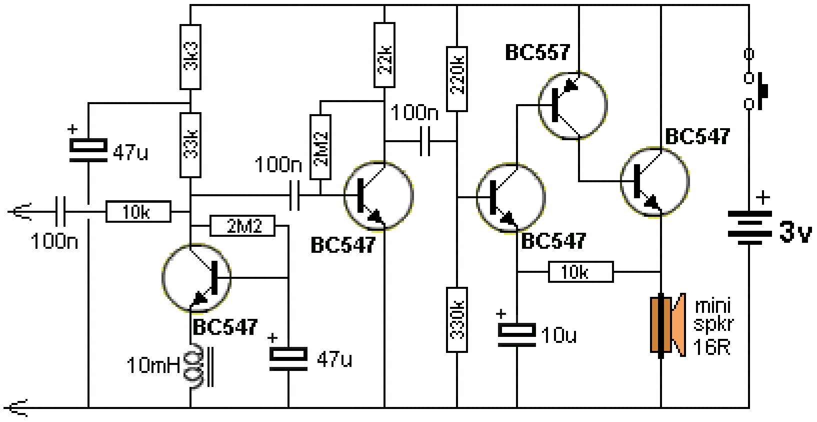
One constructor used an ordinary LED - and BANG! That's why we are the first in the world to create a symbol for a flashing LED. The extra bar represents the chip inside the LED.

This is the professional unit



TRANSMITTER CIRCUIT





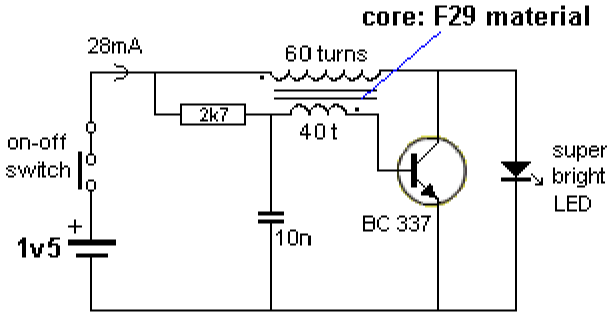
The receiver circuit is a high-gain amplifier and produces constant background noise so the slightest magnetic field can be detected.
The 10mH choke can be any value but the largest number of turns on the core is best.
The mini speaker can be a 16R earpiece but these are not as loud as a mini speaker.
Quiescent current is 50mA so the on-off switch can be a push-button.

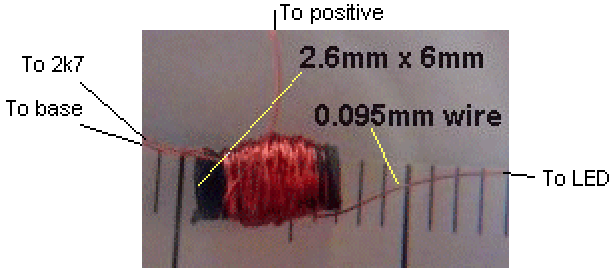
RECEIVER CIRCUIT

CABLE TRACER

Why pay $100 for a cable tracer when you can build one for less than $10.00! This type of tracer is used

by telephone technicians, electricians and anyone laying, replacing or wiring anything, using long cables, such as intercoms, television or security.
Our cable tracer consists of two units. One unit has a multivibrator with an output of 4v p-p at approx 5kHz. This is called the transmitter. The other unit is a very sensitive amplifier with capacitive input for detecting the tone from the transmitter and a magnetic pickup for detecting magnetic lines of force from power cables carrying 240v. This is called the receiver. The circuit also has an inductive loop, made up of a length of wire, to pick up stray signals from power cables, so if one detector does not detect the signal, the other will. Our circuit is nothing like that in the professional unit shown above.

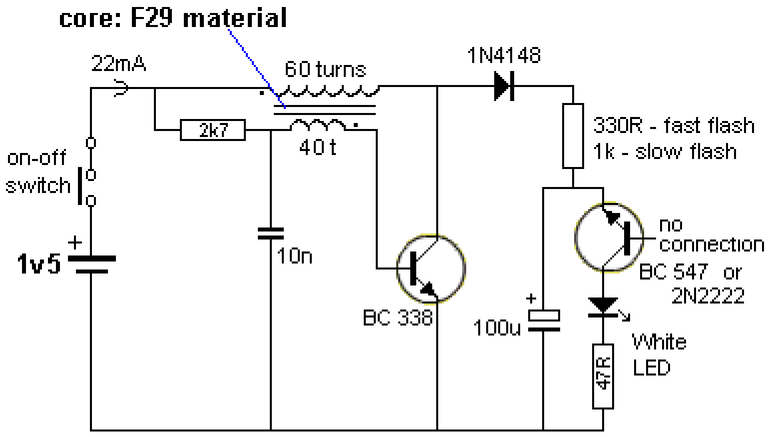




Transformer Details

LED TORCH with 1.5v SUPPLY

This simple circuit will illuminate a super-bright white LED to full brightness with 28mA from a 1.5v cell. The LED is 20,000mcd (20cd @ 15° viewing angle) and has an output of approx 1lumen.
The transformer is wound on a small ferrite slug 2.6mm dia and 6mm long. It is made from F29 ferrite material as the circuit operates at a high frequency (100kHz to 500kHz).
The efficiency of the circuit revolves around the fact that a LED will produce a very high output when delivered pulses, but the overall current will be less than a steady DC current.
BC 337 has a collector-emitter voltage of 45v. (BC338 has 25v collector-emitter voltage rating.)
The voltage across the transistor is no more than 4v as the LED absorbs the spikes. Do not remove the LED as the spikes from the transformer will damage the transistor.
The circuit will drive 1 or 2 while LEDs in series.



WHITE LED FLASHER

This circuit will flash a super-bright white LED from a 1.5v cell.
The transformer is wound on a small ferrite slug 2.6mm dia and 6mm long as shown in a project above.
The circuit uses the zener characteristic of the reverse-base-emitter junction of a BC 547 to pass current and flash the LED.

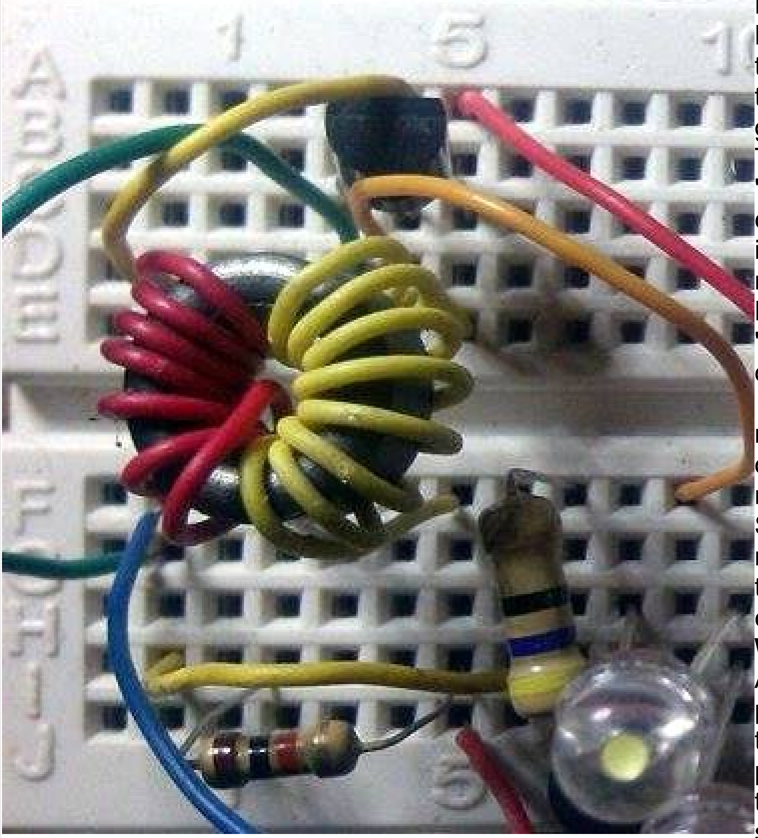
USING A TOROID INDUCTOR

Most of **our** circuits use a ferrite rod and NOT a TOROID. A toroid is a circular core (sometimes called a doughnut or torus or ring or annulus) and is actually the most efficient type of ferrite core because none of the flux is lost to the outside surroundings.

BUT if you use a toroid, you MUST work out the amount of flux you will be generating when the transistor is turned ON and this will give you the flux density in the toroid.

But this is a very difficult thing to do.

If you deliver more flux than the toroid can accept, the expanding flux will not increase at this point in time and the current taken (supplied or delivered) by the transistor will increase ENORMOUSLY and the transistor will be DESTROYED.



If you use a ferrite rod, the flux will be lost to the outside air (out the end of the rod) and the abrupt saturation-point will NOT be generated.

This means a ferrite rod is a much-more "sloppy" or "loose" or "accommodating" component and is much easier to incorporate into a circuit that has not been mathematically designed.

If you want to use a toroid, the only way to "design a circuit" that does not "self-destroy" is to add a lot more turns and gradually remove a few of the turns while feeling the output transistor for temperature-rise or measure the current taken by the circuit.

Sometimes the number of turns will be reduced to 7 turns plus 7 turns for some of the circuits driving LEDs in the boost converters shown below.

Why only 7 turns for a toroid?

As the transistor turns ON, the 7 turns produces much less flux than 30 turns and the transistor can turn on for a much longer period of time. When it is fully turned ON, the core is just at the point of being fully saturated. At this instant, the flux no-longer expands (increases) and thus the voltage produced in the feedback winding ceases. This is when the "increasing" part of the cycle stops, and the "turn-off" part of the cycle starts.

This means the current through the transistor is only a maximum for a very short period of time.

That's why you have to experiment yourself and it's only when you get the circuit to work perfectly, that you will LEARN ELECTRONICS.

The workings of an inductor are much more complex than you think.

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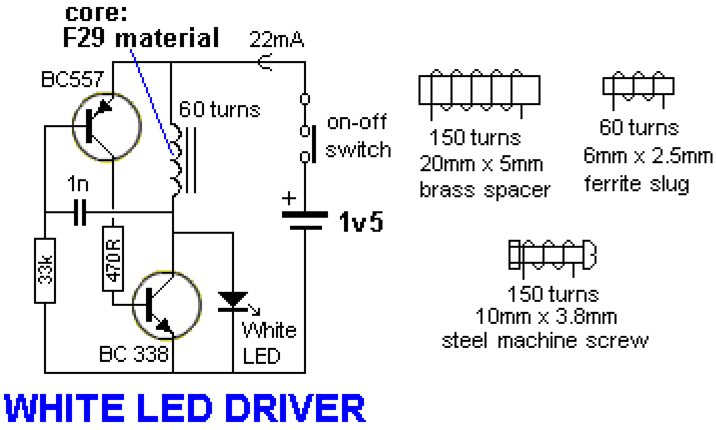
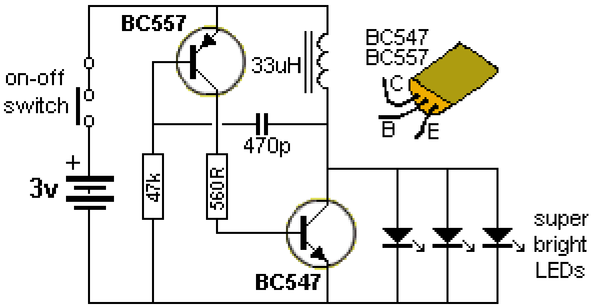
1v5 WHITE LED DRIVER



This circuit will drive a super-bright white LED from a 1.5v cell.
The 60 turn inductor is wound on a small ferrite slug 2.6mm dia and 6mm long with 0.25mm wire.
The main difference between this circuit and the two circuits above is the use of a single winding and the feedback to produce oscillation comes from a 1n capacitor driving a high gain amplifier made up of two transistors.
The feedback is actually positive feedback via the 1n and this turns on the two transistors more and more until finally they are fully turned on and no more feedback signal is passed though the 1n. At this point they start to turn off and the signal through the 1n turns them off more and more until they are fully turned off.
The 33k turns on the BC557 to start the cycle again.

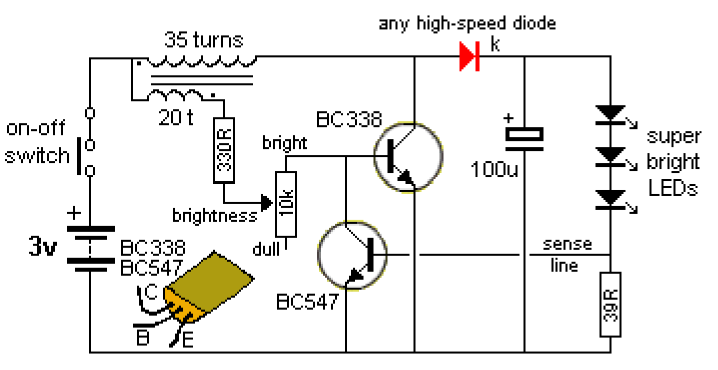
If you do not have a ferrite slug, the inductor can be made from a machine screw 10mm long and about 3-4mm dia. Wind 150 turns of 0.25mm wire. Or you can use a brass ferrule 20mm long x 5mm. Wind 150 turns.

RESULTS for the same brightness:
Slug: 21mA
Brass Spacer: 18mA
Machine screw: 14mA
Isn't this a SURPRISE!



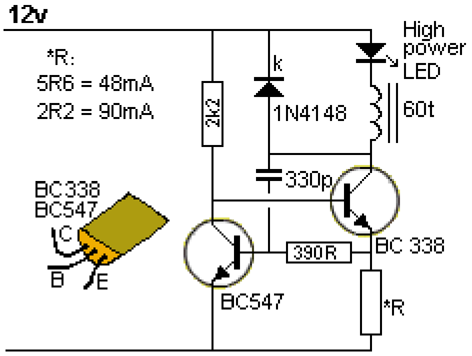
LED TORCH - 3v Supply

This circuit will drive up to 3 high-bright white LEDs from a 3v supply. (It will also work from 1.5v)
The inductor consists of 50 turns on a 1.6mm dia ferrite slug using 0.1mm enamelled wire.
This circuit can use a ready-made 33uH choke, making it suitable for mass production



LED TORCH with ADJUSTABLE BRIGHTNESS

This circuit will drive up to 3 high-bright white LEDs from a 3v supply. The circuit has a pot to adjust the brightness to provide optimum brightness for the current you wish to draw from the battery.
The transformer is wound on a ferrite slug 2.6mm dia and 6mm long as shown in the LED Torch with 1.5v Supply project.
This circuit is a "Boost Converter" meaning the supply is less than the voltage of the LEDs. If the supply is greater than the voltage across the LEDs, they will be damaged.

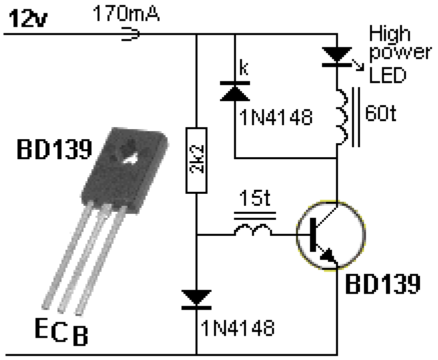


Inductor: 60 turns on 10mm ferrite rod, 15mm long.

BUCK CONVERTER for HIGH-POWER LED

48mA to 90mA

This circuit is a "Buck Converter" meaning the supply is greater than the voltage of the LED. It will drive 1 high-power white LED from a 12v supply and is capable of delivering 48mA when R = 5R6 or 90mA when R = 2R2.
The LED is much brighter when using this circuit, compared with a series resistor delivering the same current. But changing R from 5R6 to 2R2 does not double the brightness. It only increases it a small amount.
The inductor consists of 60 turns of 0.25mm wire, on a 15mm length of ferrite rod, 10mm diameter.
Frequency of operation: approx 1MHz.
The circuit is not designed to drive one 20mA LED.
This circuit draws the maximum for a BC 338.



BUCK CONVERTER for HIGH-POWER LED 170mA

This circuit is slightly simpler than above but it does not have the feature of being able to adjust the drive-current.
The inductor is the same as the photo above but has a feedback winding of 15 turns.
Connect the circuit via a 220R resistor and if the LED does not illuminate, reverse the feedback winding.
The driver transistor will need a small heatsink.

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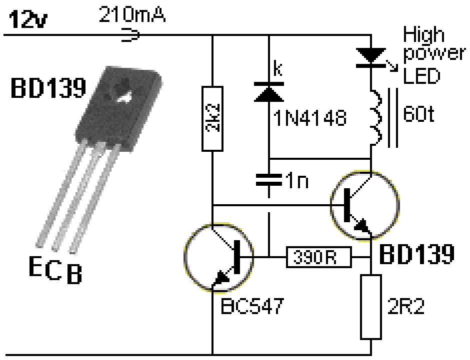

BUCK CONVERTER for HIGH-POWER LED 210mA

This circuit will drive 1 high-power white LED from a 12v supply and is capable of delivering 210mA.
The driver transistor is BD 139 and the details of the inductor are shown above.
The voltage across the LED is approx 3.3v - 3.5v
The driver transistor will need a small heatsink.
The 2R2 can be increased if a lower drive-current is required.

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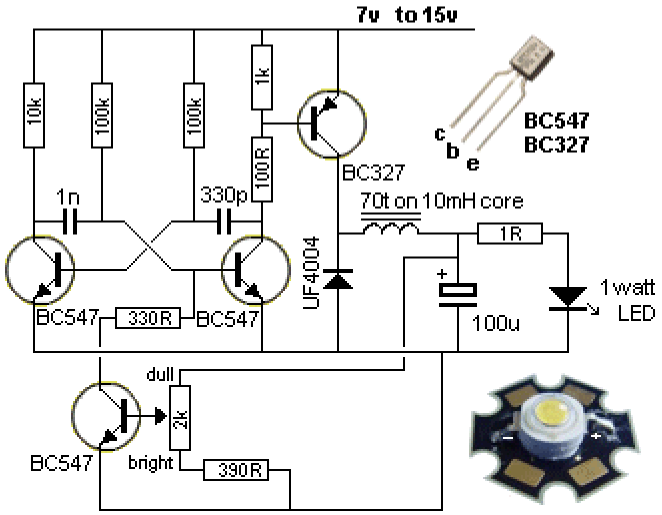
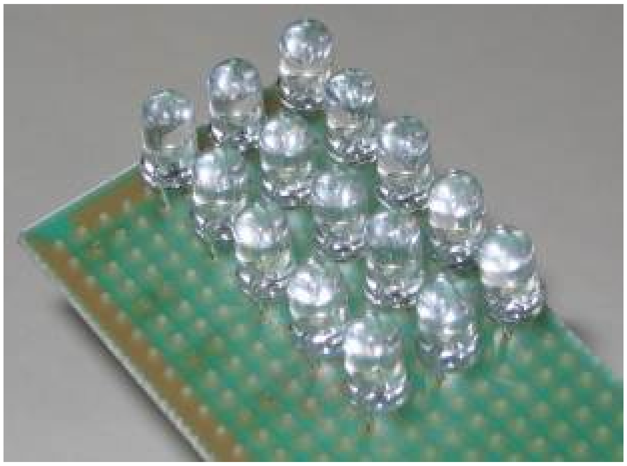


Designed 12-8-2011

BUCK CONVERTER for HIGH-POWER LED 250mA - 1watt LED

This circuit will drive 1watt white LED from a 12v supply and is capable of delivering 300mA.
The driver transistor is BC 327 and the inductor is 70 turns of 0.25mm wire wound on the core of a 10mH inductor.
See Inductor to learn how the inductor works.
The voltage across the LED is approx 3.3v - 3.5v
The 1R is used to measure the mV across it. 300mV equals 300mA LED current.
The diode MUST be high speed. A non-high-speed diode increases current 50mA!
This circuit is the best design as it does not put peaks of current though the LED. Reduce 390R slightly to increase max. current.

MAKE YOUR OWN 1-WATT LED



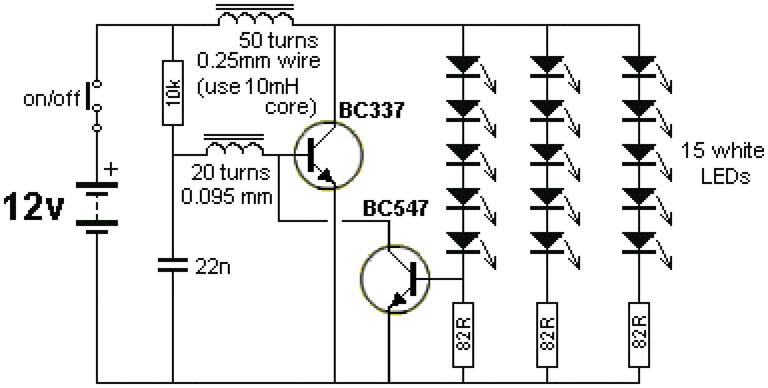
15 LEDs on Matrix board

The transformer consists of 50 turns 0.25mm wire connected to the pins. The feedback winding is 20 turns 0.095mm wire with "fly-leads."

This circuit drives 15 LEDs to produce the same brightness as a 1-watt LED. The circuit consumes 750mW but the LEDs are driven with high-frequency, high-voltage spikes, and become more-efficient and produce a brighter output that if driven by pure-DC.

The LEDs are connected in 3 strings of 5 LEDs. Each LED has a characteristic voltage of 3.2v to 3.6v making each chain between 16v and 18v. By selecting the LEDs we have produced 3 chains of 17.5v Five LEDs (in a string) has been done to allow the circuit to be powered by a 12v battery and allow the battery to be charged while the LEDs are illuminating. If only 4 LEDs are in series, the characteristic voltage may be as low as 12.8v and they may be over-driven when the battery is charging. (Even-up the characteristic voltage across each chain by checking the total voltage across them with an 19v supply and 470R dropper resistor.) The transformer is shown above. It is wound on a 10mH choke with the original winding removed. This circuit is called a "**boost circuit**." It is not designed to drive a single 1-watt LED (a buck circuit is needed).

The LEDs in the circuit are 20,000mcd with a viewing angle of 30 degrees (many of the LED specifications use "half angle." You have to test a LED to make sure of the angle). This equates to approximately 4 lumens per LED. The 4-watt CREE LED claims 160 lumens (or 40 lumens per watt). Our design is between 50 - 60 lumens per watt and it is a much-cheaper design.



18 LEDs using a 3.7v Li-Ion CELL

This circuit drives 18 white LEDs from a 3.7v Li-Ion cell. It has been designed by Samuel Budiyanto budiyantosamuel90@gmail.com using components from an old Compact Fluorescent Lamp. No data is available on the 1mH inductor and the circuit has been provided for experimentation purposes ONLY.

It is an interesting circuit because the two transistors provide a constant brightness and the BC547 provides feedback to keep the circuit oscillating.

The 10k base resistor seems very high but the circuit has been tested for 12 hours on a 1200mA-Hr cell and the brightness remained constant.

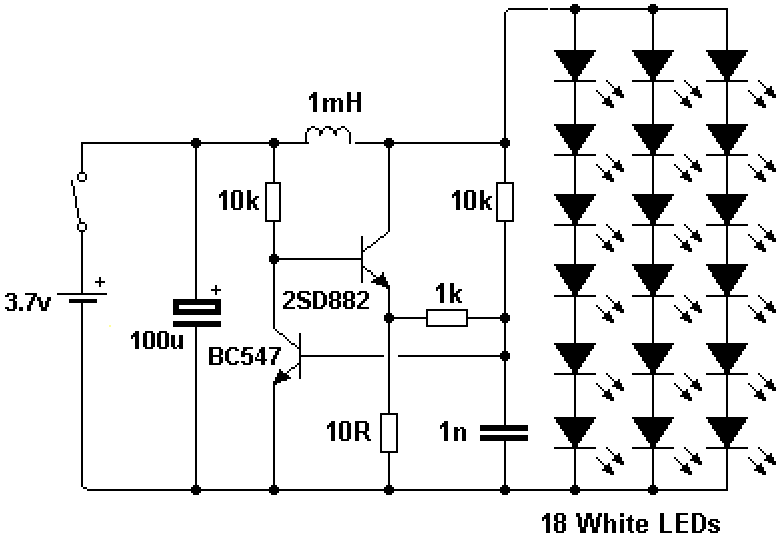
The brightness is determined by how hard you drive the 2SD882 transistor.

It is turned on by the 10k resistor and this will deliver very little current, but since the transistor has a gain of 100 to 300, the collector current will be up to about 100mA.

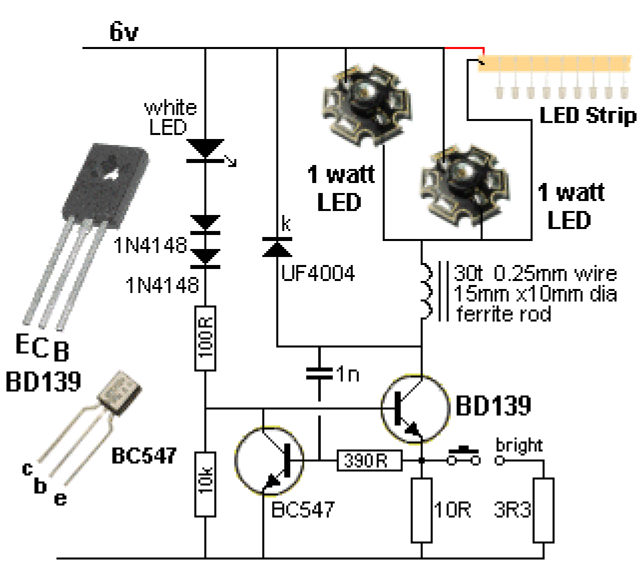
Basically the circuit will over-drive the LEDs and the BC547 will limit the current to the required brightness level.

The BC547 transistor has the effect of turning OFF the 2SD at a particular instant in each cycle to reduce the time when it is turned ON. The BC547 gets its "timing" from the 10k and 1k resistors, by the fact that these resistors form a voltage divider to produce a voltage on the base. When the 2SD turns ON, a voltage is developed across the 10R that adds to this voltage but it is delayed slightly by the 1n capacitor. The 1n determines the frequency at which the circuit will oscillate. By experimenting with these 4 components you get the required brightness and this remains constant for the life of the cell.

All the LEDs are in series on each string and the brightness will depend on matching each string. By swapping some of the LEDs you will be able to adjust the brightness to make them all emit equally.



1-WATT LED - a very good designn



Circuit takes 70mA on LOW brightness and 120mA on HIGH Brightness

see MOD below

This circuit has been specially designed for a 6v rechargeable battery or 5 x 1.2v NiCad cells. **Do not use any other voltage.**

It has many features:

The pulse-operation to the two 1-watt LEDs delivers a high current for a short period of time and this improves the brightness.

The circuit can drive two 1-watt LEDs with extremely good brightness and this makes it more efficient than any other design.

The circuit is a two-transistor high-frequency oscillator and it works like this:

The BD139 is turned ON via the base, through the white LED and two signal diodes and it amplifies this current to appear though the collector-emitter circuit. This current flows though the 1-watt LED to turn it ON and also through the 30-turn winding of the inductor. At the same time the current through the 10R creates a voltage-drop and when this voltage rises to 0.65v, the BC547 transistor starts to turn ON. This robs the base of the BD139 of "turn-on voltage" and the current through the inductor ceases to be expanding flux, but stationary flux.

The 1n capacitor was initially pushing against the voltage-rise on the base of the BC547 but it now has a reverse-effect of allowing the BC547 to turn ON.

This turns off the BD139 a little more and the current through the inductor reduces.

This creates a collapsing flux that produces a voltage across the coil in the opposite direction. This voltage passes via the 1n to turn the BC547 ON and the BD139 is fully turned OFF.

The inductor effectively becomes a miniature battery with negative on the lower LED and positive at the anode of the Ultra Fast diode. The voltage produced by the inductor flows through the UF diode and both 1-watt LEDs to give them a spike of high current. The circuit operates at approx 500kHz and this will depend on the inductance of the inductor.

The circuit has about 85% efficiency due to the absence of a current-limiting resistor, and shuts off at 4v, thus preventing deep-discharge of the rechargeable cells or 6v battery.

The clever part of the circuit is the white LED and two diodes. These form a zener reference to turn the circuit off at 4v. The 10k resistor helps too.

The circuit takes 70mA on low brightness and 120mA on HIGH brightness via the brightness-switch. The LEDs actually get 200mA pulses of current and this produces the high brightness.

The Inductor

The coil or inductor is not critical. You can use a broken antenna rod from an AM radio (or a flat antenna slab) or an inductor from a computer power supply. Look for an inductor with a few turns of thick wire (at least 30) and you won't have to re-wind it.

Here are two inductors from surplus outlets:

http://www.goldmine-elec-products.com/prodinfo.asp?number=G16521B
- 50 cents

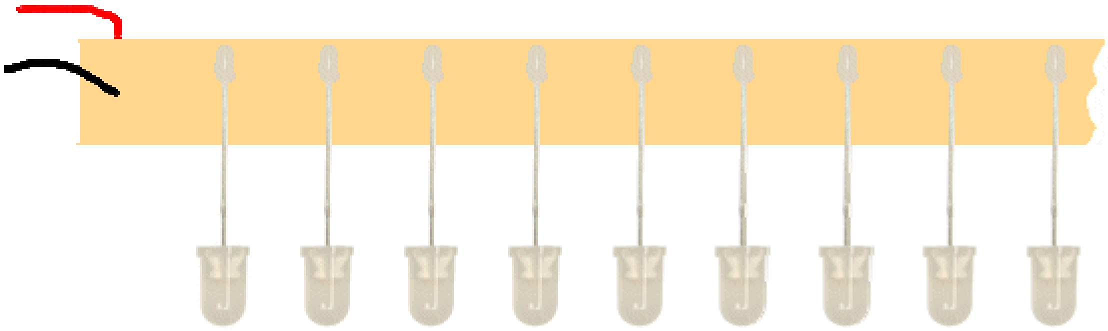
http://www.allelectronics.com/make-a-store/item/CR-345/345-UH-TOROIDAL-INDUCTOR/1.html - 40cents

Here are the surplus inductors:

The cost of surplus is from 10 cents to 50 cents, but you are sure to find something from a computer power supply.
Pick an inductor that is about 6mm to 10mm diameter and 10mm to 15mm high. Larger inductor will not do any damage. They simply have more ferrite material to store the energy and will not be saturated. It is the circuit that delivers the energy to the inductor and then the inductor releases it to the LEDs via the high speed diode.

IMPROVEMENT

By using the following idea, the current reduces to 90mA and 70mA and the illumination over a workbench is much better than a single high-power LED. It is much brighter and much nicer to work under.
Connect fifteen 5mm LEDs in parallel (I used 20,000mcd LEDs) by soldering them to a double-sided strip of PC board, 10mm wide and 300mm long. Space them at about 20mm. I know you shouldn't connect LEDs in parallel, but the concept works very well in this case. If some of the LEDs have a characteristic high voltage and do not illuminate very brightly, simply replace them and use them later for another strip.
You can replace one or both the 1-watt LEDs with a LED Strip, as shown below:



No current-limit resistor. . . why isn't the LED damaged?

Here's why the LED isn't damaged:
When the BD139 transistor turns ON, current flows through the LEDs and the inductor. This current gradually increases due to the gradual turning-on of the transistor and it is also increasing through the inductor. The inductor also has an effect of slowing-down the "in-rush" of current due to the expanding flux cutting the turns of the coil, so there is a "double-effect" on avoiding a high initial current. That's why there is little chance of damaging the LEDs.
When it reaches 65mA, it produces a voltage of .065 x 10 = 650mV across the 10R resistor, but the 1n is pushing against this increase and it may have to rise to 150mA to turn on the BC547. LEDs can withstand 4 times the normal current for very short periods of time and that's what happens in this case. The BD139 is then turned off by the voltage produced by the inductor due to the collapsing magnetic flux and a spike of high current is passed to the LEDs via the high speed diode. During each cycle, the LEDs receive two pulses of high current and this produces a very high brightness with the least amount of energy from the supply. All the components run "cold" and even the 1-watt LEDs are

hardly warm.

Charging and Discharging

This project is designed to use all your old NiCad cells and mobile phone batteries.
It doesn't matter if you mix up sizes and type as the circuit takes a low current and shuts off when the voltage is approx 4v for a 6v pack.
If you mix up 600mA-Hr cells with 1650mA-Hr, 2,000mA-Hr and 2,400mA-Hr, the lowest capacity cell will determine the operating time.
The capacity of a cells is called "C."
Normally, a cell is charged at the 14 hour-rate.
The charging current is 10% of the capacity. For a 600mA-Hr cell, this is 60mA. In 10 hours it will be fully charged, but charging is not 100% efficient and so we allow another 2 to 4 hours.
For a 2,400mA-Hr cell, it is 240mA. If you charge them faster than 14-hr rate, they will get HOT and if they get very hot, they may leak or even explode. But this project is designed to be charged via a solar panel using 100mA to 200mA cells, so nothing will be damaged.
Ideally a battery is discharged at C/10 rate. This means the battery will last 10 hours and for a 600mA-Hr cell, this is 60mA. If you discharge it at the "C-rate," it will theoretically last 1 hour and the current will be 600mA. But at 600mA, the cells may only last 45 minutes. If you discharge is at C/5 rate, it will last 5 hours.
Our project takes 120mA so no cell will be too-stressed. A 600mA-Hr cell will last about 4-5 hours, while the other cells will last up to 24 hours. Try to keep the capacity of each cell in a "battery-pack" equal.

MODIFICATIONS FROM A READER budiyantosamuel90@gmail.com

The 390R changed to 1k. The 1n changed to 470p. Replaced the UF4004 with 4 x 1N4148 in parallel.
The result is amazing, much brighter! I can't believe it.
I put 20 white LEDs in a LED strip... and it works nicely.
Much brighter than two 1 Watt LEDs.
Colin: If the length of a ferrite rod is too short, the magnetic material will saturate and it will not accept any more current and it will start to produce losses by heating-up. A toroid may work better because it will accept a higher flux density because the magnetic path does not have an air gap. (a ferrite rod is said to have an air-gap at the ends of the rod). That's why a toroid will be smaller than a rod.

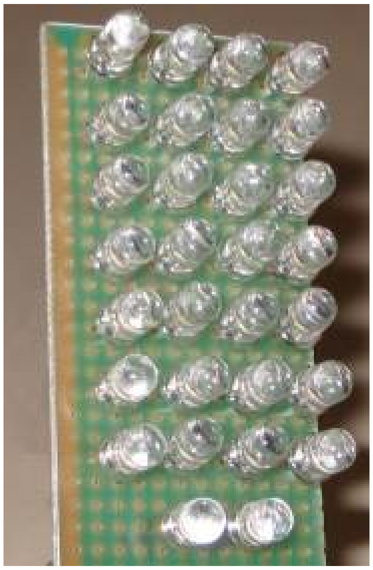
1.5 WATT LED

The circuit below can be modified to drive up to 30 white LEDs.

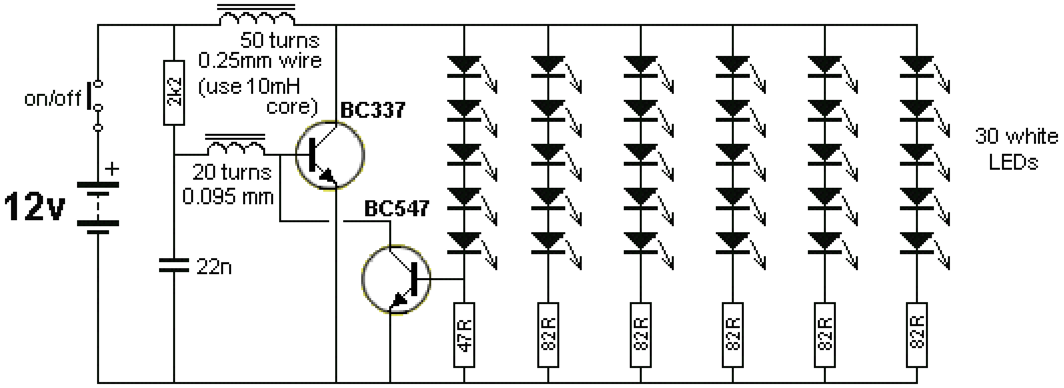
The effectiveness of a LED array increases when they are spread out slightly and this makes them more efficient than a single 1 watt or 2 watt LED.

The two modifications to the circuit make the BC337 work harder and this is the limit of the inductor. The current consumption is about 95mA.

The winding details for the transformer are shown above.



30 LEDs on Matrix board



DRIVE 20 LEDs FROM 12v - approx 1watt circuit

This is another circuit that drives a number of LEDs or a single 1 watt LED. It is a "**Buck Circuit**" and drives the LEDs in parallel. They should be graded so that the characteristic voltage-drop across each of them is within 0.2v of all the other LEDs. The circuit will drive any number from 1 to 20 by changing the "sensor" resistor as shown on the circuit. The current consumption is about 95mA @ 12v and lower at 18v. The circuit can be put into dim mode by increasing the drive resistor to 2k2. The UF4004 is an ultra fast 1N4004 - similar to a high-speed diode. You can use 2 x 1N4148 signal diodes.

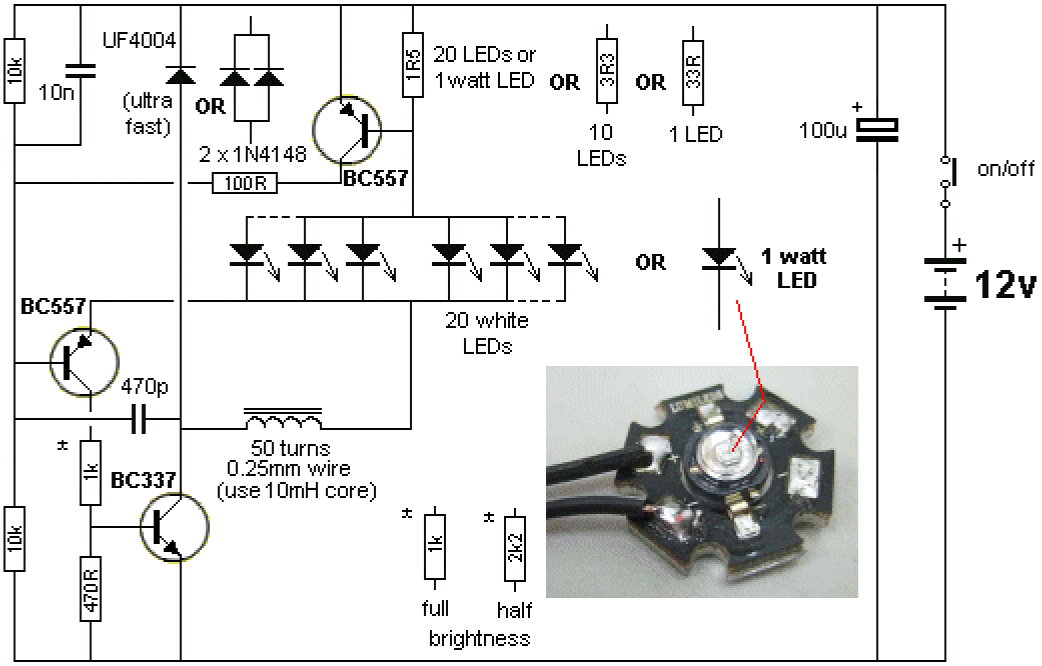
The circuit will not drive two LEDs in series - it runs out of voltage (and current) when the voltage across the load is 7v. It oscillates at approx 200kHz. Build both the 20 LED and 1 watt LED version and compare the brightness and effectiveness.

The photo of the 1 watt LED on the left must be heatsinked to prevent the LED overheating. The photo on the circuit diagram shows the LED mounted on a heatsink and the connecting wires.

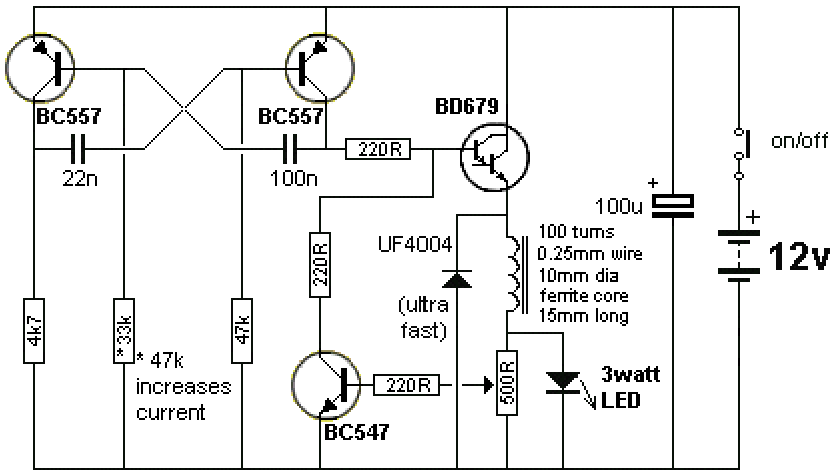
A 1-watt demo board showing the complex step-up circuitry.

This is a Boost circuit to illuminate the LED and is completely different to our design. It has been included to show the size of a 1 watt LED.

The reason for a Boost or Buck circuit to drive one or more LEDs is simple. The voltage across a LED is called a "characteristic voltage" and comes as a natural feature of the LED. We cannot alter it. To power the LED with exactly the correct amount of voltage (and current) you need a supply that is EXACTLY the same as the characteristic voltage. This is very difficult to do and so a resistor is normally added in series. But this resistor wastes a lot of energy. So, to keep the loses to a minimum, we pulse the LED with bursts of energy at a higher voltage and the LED absorbs them and produces light. With a Buck circuit, the transistor is turned on for a short period of time and illuminated the LEDs. At the same time, some of the energy is passed to the inductor so that the LEDs are not damaged. When the transistor is turned off, the energy from the inductor also gives a pulse of energy to the LEDs. When this has been delivered, the cycle starts again.



BUCK CONVERTER for 3watt LED



This circuit drives a 3watt LED. You have to be careful not to damage the LED when setting up the circuit. Add a 10R to the supply rail and hold it in your fingers. Make sure it does not get too hot and monitor the voltage across the resistor. Each 1v represents 100mA. The circuit will work and nothing will be damaged. If the resistor "burns your fingers" you have a short circuit.

The BC557 multivibrator has a "mark-to-space ratio" determined by the 22n and 33k, compared to the 100n and 47k, producing about 3:1 The BD679 is turned ON for about 30% of the time. This produces a very bright output, and takes about 170mA for 30% of the time. You cannot measure this current with a meter as it reads the peak value and the reading will be totally false. The only way to view the waveform is on a CRO, and calculate the current.

The 100-turn inductor allows the BD679 turn turn ON fully and "separates" the voltage on the emitter of the BC679 from the voltage on the top of the 3watt LED.

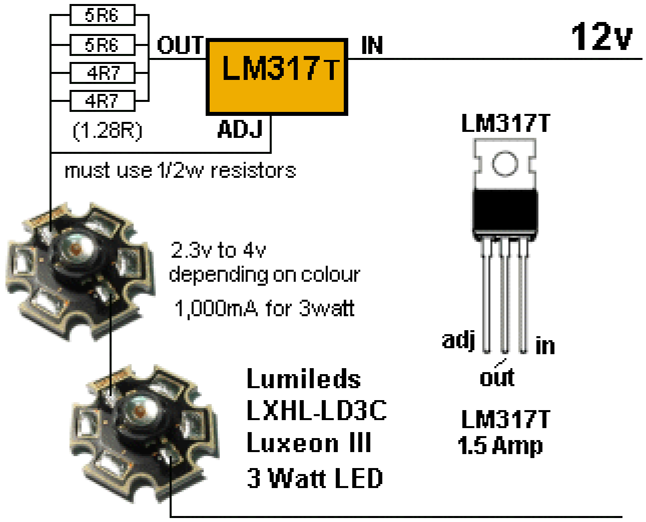
When the BD679 turns ON, the emitter rises to about 10v. But the top of the LED **NEVER** rises above 3.6v. The inductor "buffers" or "separates" these two voltages by producing a voltage across the winding equal to 6.4v and that's why the LED is not damaged.

When the transistor turns off (for 60% of the time), the magnetic flux produced by the current in the inductor collapses and produces a voltage in the opposite direction. This means the inductor now becomes a miniature battery and for a very short period of time it produces energy to illuminate the LED. The top of the inductor becomes negative and the bottom is positive. The current flows through the LED and through the Ultra High-Speed 1N4004 diode to complete the circuit. Thus the circuit takes advantage of the energy in the inductor.

A 500R pot is placed across the LED and a voltage is picked off the pot to turn on a BC547 transistor. This transistor "robs" some of the "turn-on" for the BD679 transistor to reduce the brightness of the LED.

Because the circuit is driving the LED with pulses, very high brightness is obtained with a low current. Our eyes detect peak brightness and you can compare the performance of this circuit with a DC driven LED.

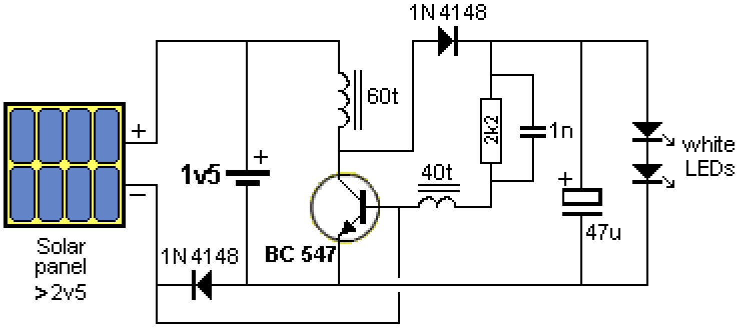
CONSTANT CURRENT DRIVES TWO 3WATT LEDs

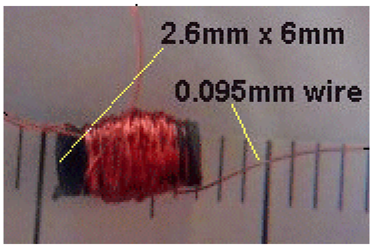


The value of the current-limiting resistor:
Resistor(Ohms) = 1.25(V) / current(A)

http://www.reuk.co.uk/LM317-Current-Calculator.htm

This constant current circuit is designed to drive two 3-watt Luxeon LEDs. The LEDs require 1,000mA (1Amp) and have a characteristic voltage-drop across them of about 3.8v. Approximately 4v is dropped across the LM317T regulator and 1.25v across the current-limiting resistors, so the input voltage (supply) has to be 12.85v. A 12v battery generally delivers 12.6v.
The LM 317T 3-terminal regulator will need to be heatsinked.
This circuit is designed for the LM series of regulator as they have a voltage differential of 1.25v between "adj" and "out" terminals.





Transformer Details
core: F29 material

AUTOMATIC GARDEN LIGHT

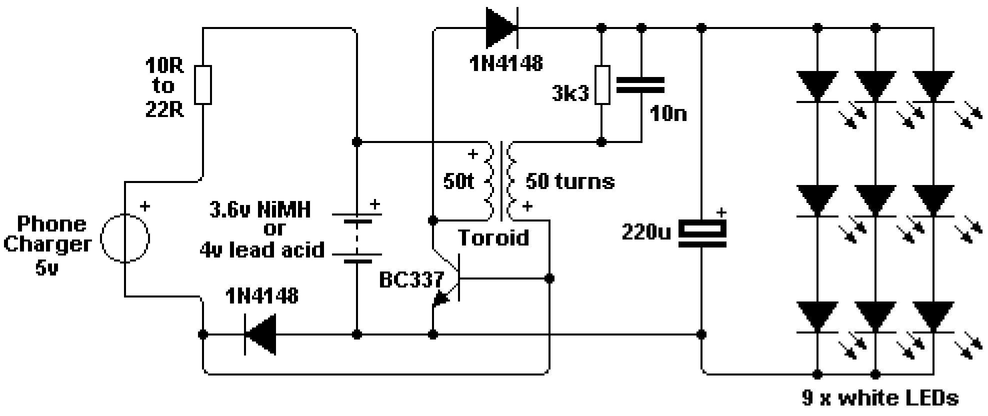
This circuit automatically turns on and illuminates the LEDs when the solar panel does not detect any light. It switches off when the solar panel produces more than 1v and charges the battery when the panel produces more than 1.5v + 0.6v = 2.1v

AUTOMATIC BATHROOM LIGHT or PASSAGE LIGHT

by Samuel Budiyanto budiyantosamuel90@gmail.com

This circuit is for all those who experience black-outs and "power-outs."

It uses a 5v charger from an old mobile phone to trickle charge a 3.6v cell or 2 x lead acid cells. Use a small toroid about 40mm diameter or a 10mm ferrite rod 40mm long and 0.25mm wire. Keep the charge to 10mA to 20mA and the LEDs will come on every time the power fails. My circuit has been working for the past 7 months. If the LEDs don't illuminate with equal brightness, change them around and they will equalise.



AUTOMATIC SOLAR LIGHT

This circuit automatically turns on and illuminates the LEDs when the solar panel does not detect any light. It switches off when the solar panel produces more than 0.5v above the battery voltage.

You can use any number of white LEDs. LEDS should not be connected in parallel, however they work if you selects LEDs that produce the same brightness. Any dull LEDs can be used in another circuit.

When the solar panel receives sunlight, the voltage on the base of the transistor keeps it turned OFF. When the panel receives no illumination, the 470R and 1k resistors turn the transistor ON. You can use a 6v 0.5watt or 1 watt solar panel and the first circuit uses an NPN transistor while the second circuit uses a PNP transistor.

The output of the solar panel automatically adjusts to the voltage of the battery and as more light is detected by the panel, the current increases.

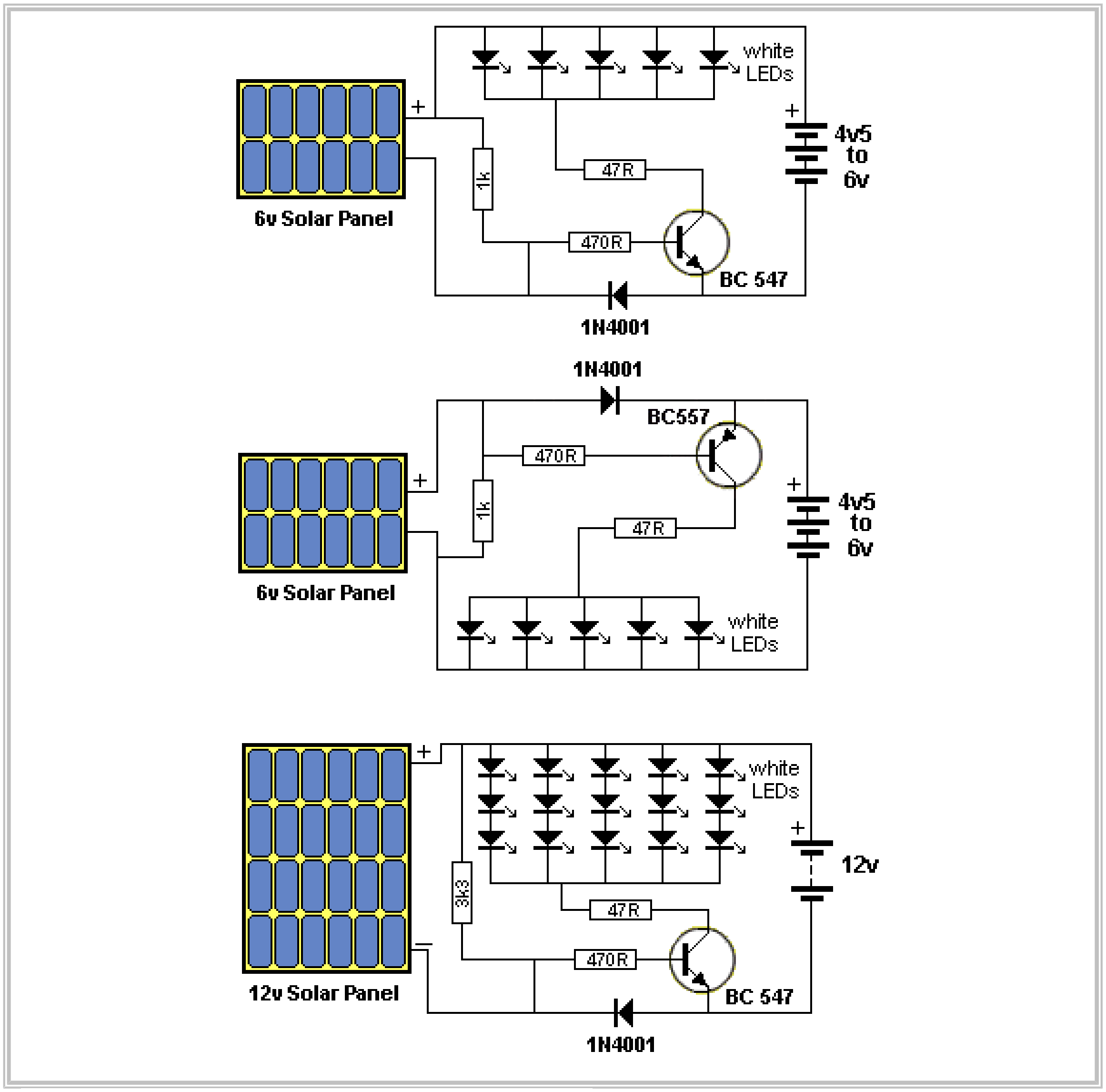
A 0.5watt panel contains 100mA cells and a 1watt panel contains 200mA cells. The battery can have any capacity from 600mAHr to 1800mAHr.

We are assuming the battery is used all night and is flat in the morning.

A 600mAHr battery will take 6-8 hours to fully charge with a 0.5watt panel and a 1800mAHr battery will take 2 days to charge with a 1 watt panel.

Each white LED requires about 20mA for good brightness and the 47R resistor will have to be adjusted to suit the battery voltage and the number of LEDs.

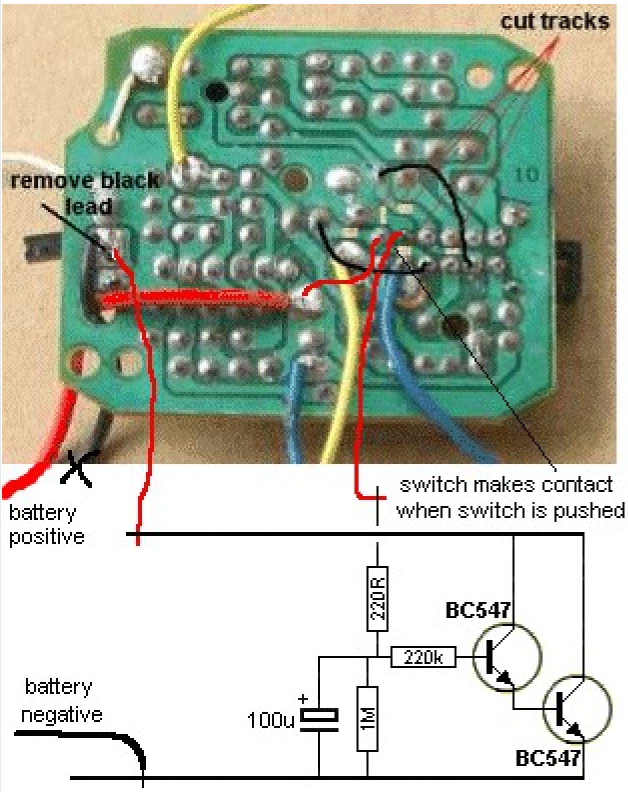
The third circuit uses a 12v 0.5watt or 1 watt solar panel and the circuit is much more efficient as 3 white LEDs can be connected in series for each 20mA of current.


white LEDs
+
4v5 to 6v
+
47R
1k
470R
6v Solar Panel
BC 547
1N4001
1N4001
BC557
470R
+
1k
47R
+
4v5 to 6v
6v Solar Panel
white LEDs
+
white LEDs
+
12v
3k3
47R
470R
–
12v Solar Panel
BC 547
1N4001

27MHz DOOR PHONE

This circuit turns a walkie talkie into a handy wireless door phone. It saves wiring and the receiver can be taken with you upstairs or outside, without loosing a call from a visitor.

A 5-Transistor walkie talkie can be used (see circuit above) and the modifications made to the transmitter and receiver are shown below:



THE TRANSMITTER

Only three sections of the transmit/ receive switch are used in the walkie talkie circuit and our modification uses the fourth section. Cut the tracks to the lands of the unused section so it can be used for our circuit.

There are a number of different printed circuit boards on the market, all using the same circuit and some will be physically different to that shown in the photo. But one of the sections of the switch will be unused.

Build the 2-transistor delay circuit and connect it to the walkie talkie board as shown. When the "push-to-talk" switch is pressed, the PC board will be activated as the delay circuit effectively connects the negative lead of the battery to the negative rail of the board for about 30 seconds.

The 100u gradually discharges via the 1M after the "press-to-talk" switch is released and the two transistors turn off and the current drops to less than 1 micro-amp - that's why the power switch can be left on. .

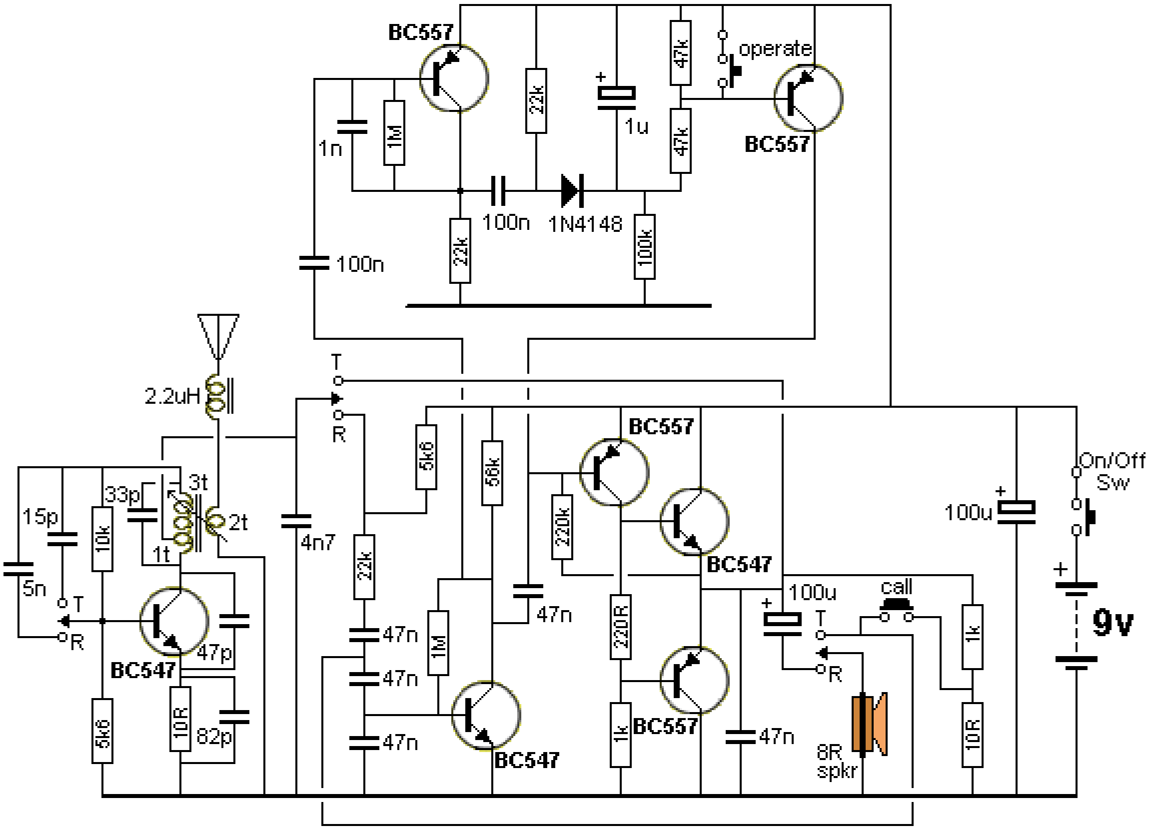
The transmitter walkie talkie is placed at the front door and the power switch is turned on. To call, push the "push-to-talk" switch and the "CALL" button at the same time for about 5 seconds. The circuit will activate and when the "push-to-talk" switch is released, the circuit will produce background noise for about 30 seconds and you will hear when call is answered.

The "push-to-talk" switch is then used to talk to the other end and this will activate the circuit for a further 30 seconds. If the walkie talkie does not have a "CALL" switch, 3 components can be added to provide feedback, as shown in the circuit below, to produce a tone.

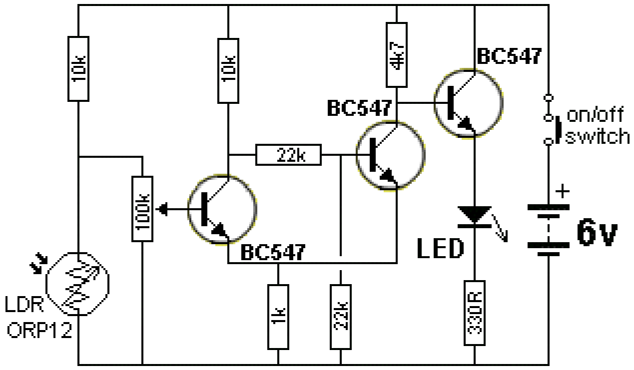
THE RECEIVER

The receiver circuit needs modification and a 2-transistor circuit is added. This circuit detects the tone and activates the 3-transistor direct-coupled amplifier so that the speaker produces a tone.

The receiver circuit is switched on and the 2-transistor circuit we connect to the PC board effectively turns on the 3-transistor amplifier so that the quiescent current drops from 10mA to about 2-3mA. It also mutes the speaker as the amplifier is not activated. The circuit remains on all the time so it will be able to detect a "CALL." When a tone is picked up by the first two transistors in the walkie talkie, it is passed to the first transistor in our "add-on" section and this transistor produces a signal with sufficient amplitude to remove the charge on the 1u electrolytic. This switches off the second transistor and this allows the 3-transistor amplifier to pass the tone to the speaker. The operator then slides a switch called "OPERATE" to ON (down) and this turns on the 3-transistor amplifier. Pressing the "push-to-talk" switch (labelled T/R) allows a conversation with the person at the door. Slide the "OPERATE" switch up when finished.



The receiver walkie talkie with the 2-transistor "add-on"

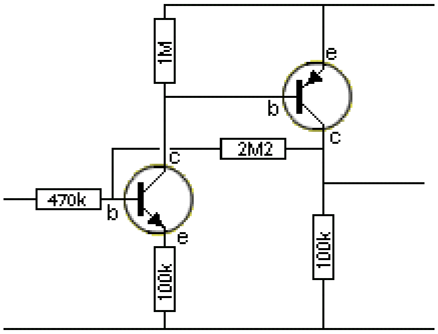


SCHMITT TRIGGER

A Schmitt Trigger is any circuit that has a fast change-over from one state to the other. In our case we have used 2 transistors to produce this effect and the third is an emitter-follower buffer.
The circuit will drive a LED or relay and the purpose is to turn the LED ON quickly at a particular level of illumination and OFF at a higher level.
The gap between ON and OFF is called the HYSTERESIS GAP.

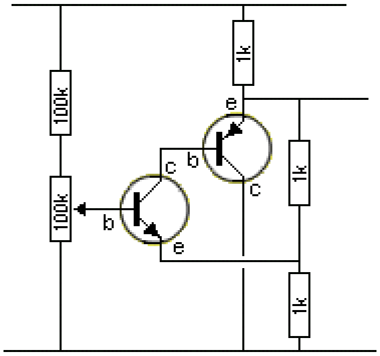
SCHMITT TRIGGER-2

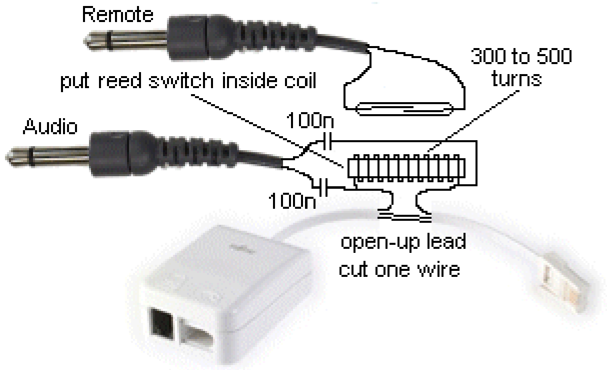
The following circuit is a Schmitt Trigger made with NPN and PNP transistors:



SCHMITT TRIGGER-3

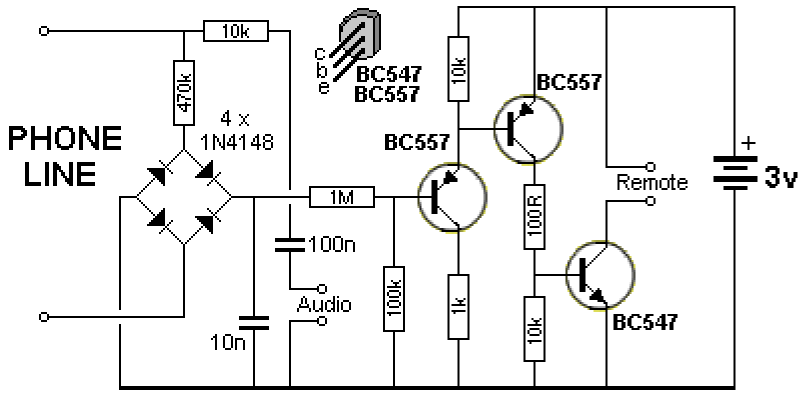
The following circuit is another Schmitt Trigger made with NPN and PNP transistors. The 100k "stop resistor" on the 100k prevents the circuit turning ON when the pot is near the supply rail.





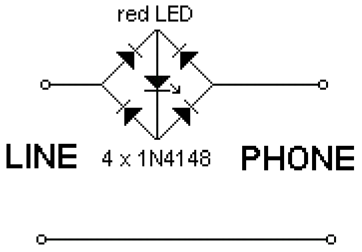
PHONE TAPE - 1

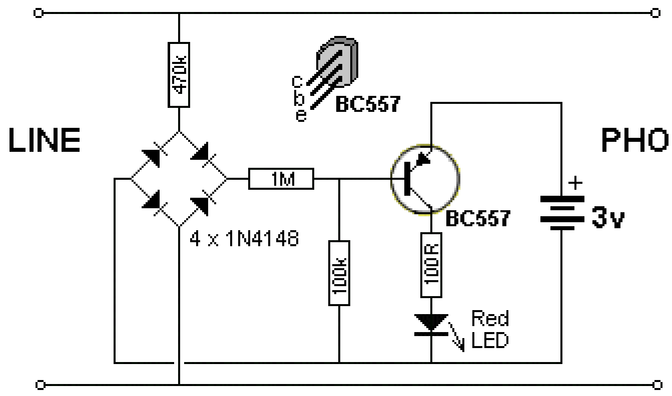
This simple circuit will allow you to tape-record a conversation from a phone line.
It must be placed between the plug on the wall and the phone.
The easiest way is to cut an extension lead. Wind 300-500 turns of 0.095mm wire on a plastic straw and place the reed switch inside. Start with 300 turns and see if the reed switch activates, Keep adding turns until the switch is reliable.
Fit two 100n capacitors to the ends of the winding for the audio. Plug the Audio into "Mic" on tape recorder. Plug the remote into "remote" on the tape recorder and push "record." The tape recorder will turn on when the phone is lifted and record the conversation.



PHONE TAPE - 2

The circuit is turned off when the phone line is 45v as the voltage divider made up of the 470k, 1M and 100k puts 3.5v on the base of the first BC557 transistor. If you are not able to cut the lead to the phone, the circuit above will record a conversation from an extension lead. The remote plug must be wired around the correct way for the motor to operate.





PHONE ALERT

Two circuits are available to show when a phone is being used. The first circuit must be placed between the socket on the wall and the phone - such as cutting into the lead and insert the bridge and diode.

But if you cannot cut the lead to the phone, you will have to add an extension cord and place the second circuit at the end of the line. You can also connect a phone at the end if needed.

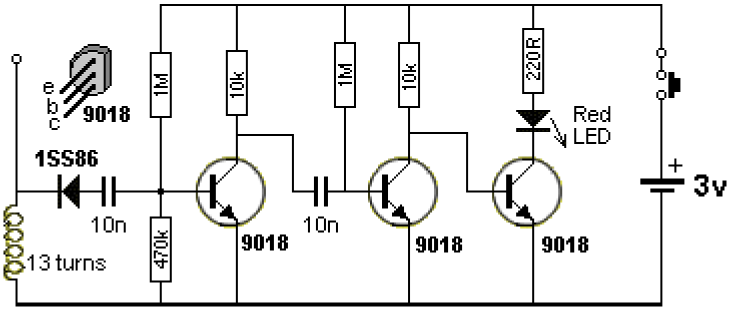
PHONE ALERT-2 (for mobile phone)

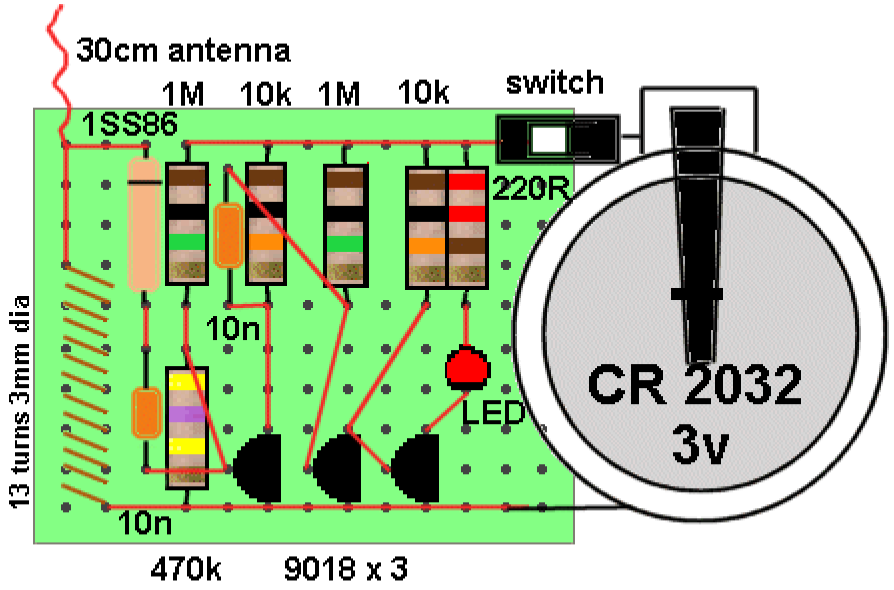
This circuit detects the RF when the phone is communicating with the tower during the hand-shaking prior to it ringing.

The 1SS86 is a Silicon Schottky Barrier Diode for UHF circuits and is 100 times more sensitive than a 1N4148 signal diode. Many of the "clone" 1SS86 diodes (fake or really another type of diode) sold on eBay NOT NOT WORK. The characteristics of the 1SSS86 are really amazing.

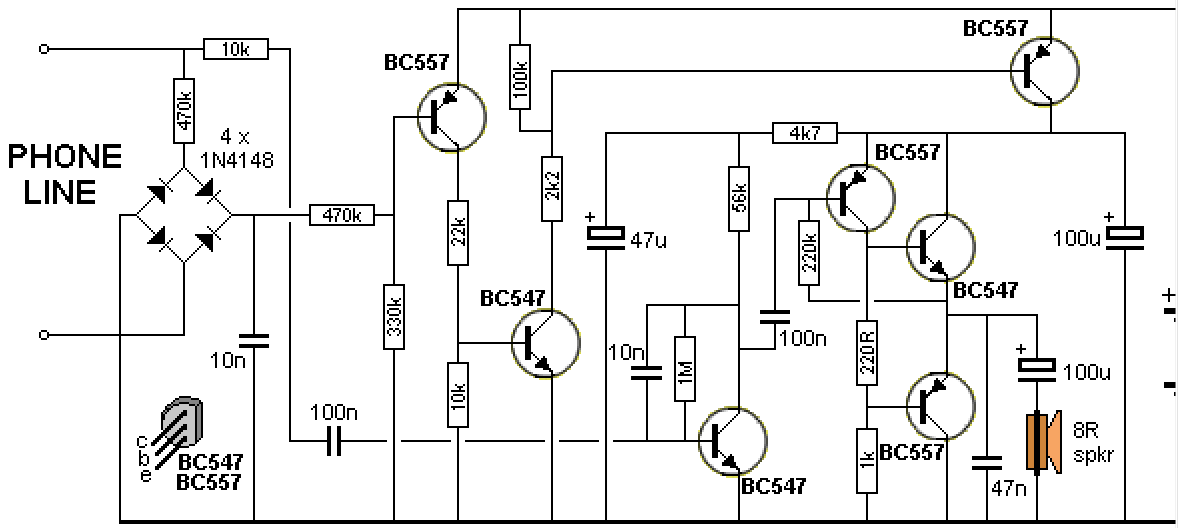
This is an ideal circuit to test different diodes.

The first transistor is biased ON and the signal (waveform) developed across the coil takes the cathode end of the diode NEGATIVE for part of the cycle and this puts a slightly lower voltage on the left lead of the 10n capacitor. The right-lead follows and a slightly lower voltage is applied to the base of the transistor. The transistor turns OFF slightly and this effect is passed to the other two transistors to flash the LED.
With 1N4148, the phone must be 10cm from the project. With a 1SS86 it can be one metre away. The circuit takes about 1mA.



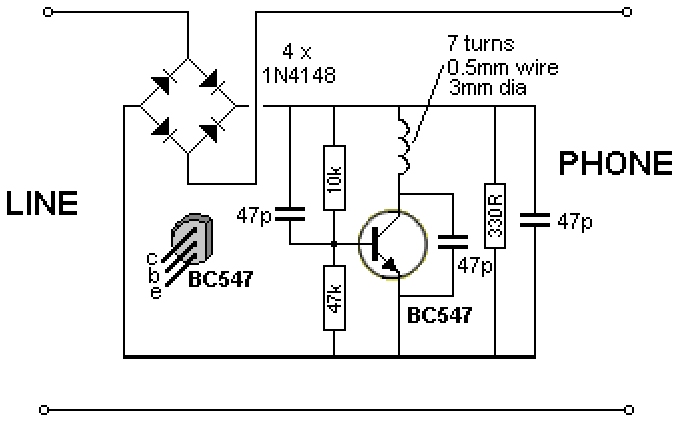


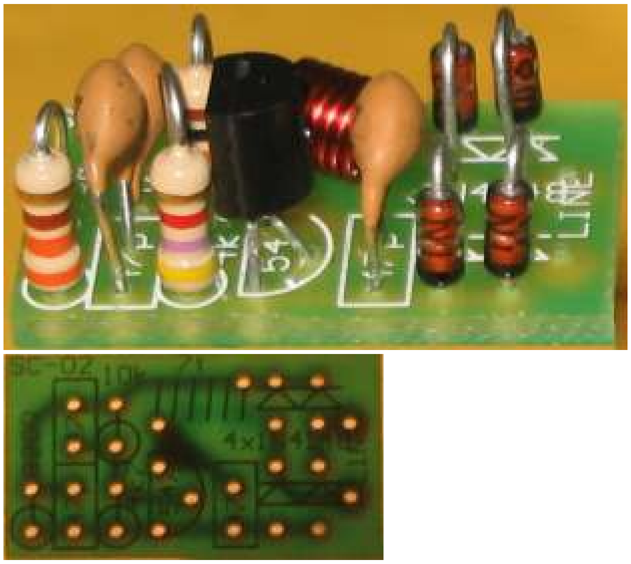
A kit is available from Talking Electronics for $3.00 plus $4.50 postage. The project is built on Matrix Board as shown in the drawing above. Phone Alert kit



THE LISTENER

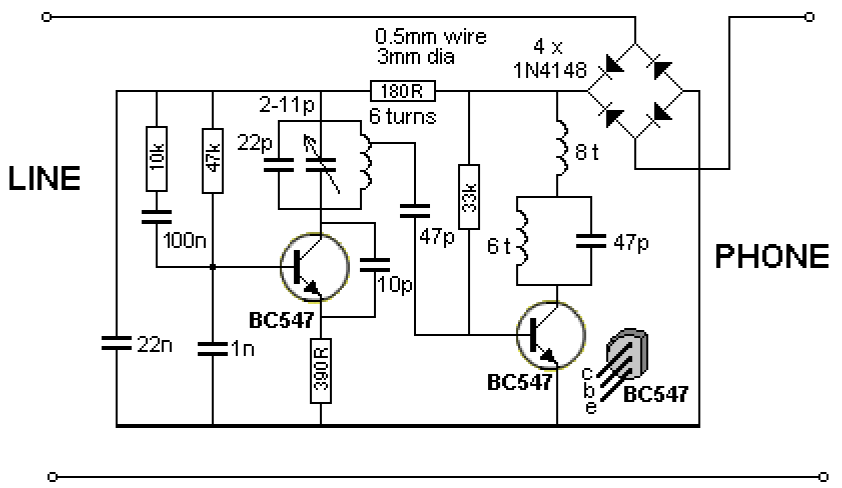
This circuit consists of a 4-transistor amplifier and a 3-transistor "switch" that detects when the phone line is in use, and turns on the amplifier. The voltage divider at the front end produces about 11v on the base of the first BC557 and this keeps the transistor off. Switch the unit off when removed from the phone line.





PHONE TRANSMITTER - 1 **see also Phone Bug circuit in: 101-200 circuits**

The circuit will transmit a phone conversation to an FM radio on the 88-108MHz band. It uses energy from the phone line to transmit about 100metres. It uses the phone wire as the antenna and is activated when the phone is picked up. The components are mounted on a small PC board and the lower photo clearly shows the track-work.

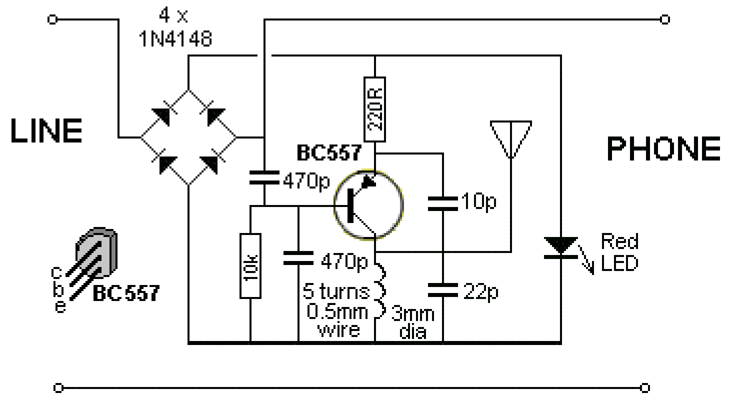


PHONE TRANSMITTER - 2 **see also Phone Bug (101-200 circuits)**

The circuit will transmit a phone conversation to an FM radio on the 88-108MHz band. It uses energy from the phone line to transmit about 200metres. It uses the phone wire as the antenna and is activated when the phone is picked up.

PHONE TRANSMITTER - 3 **see also Phone Bug (101-200 circuits)**

This circuit has poor features but you can try it and see how it performs. It uses a PNP transistor and requires a separate antenna. It also has a supply of less than 1.9v, via the red LED. It would be better to put 2 LEDs in series to get a higher voltage. It is activated when the phone is picked up.



PHONE TRANSMITTER - 4

see also Phone Bug (101-200 circuits)

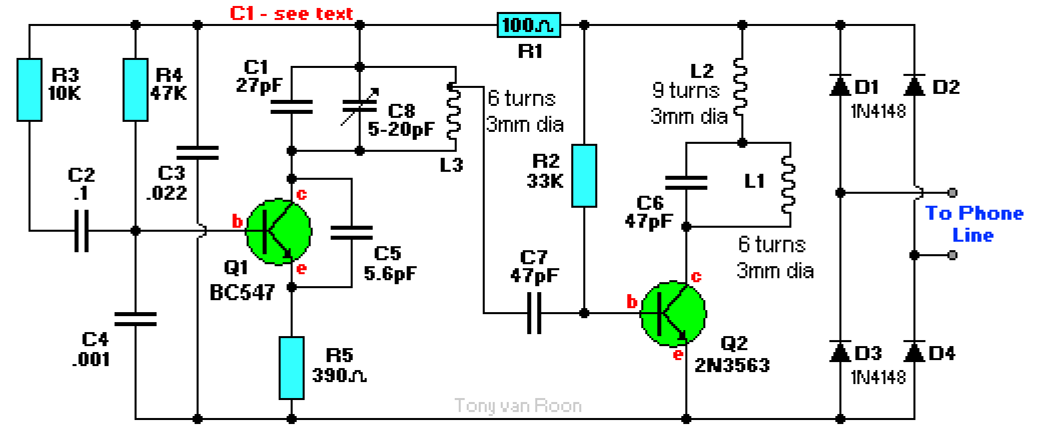
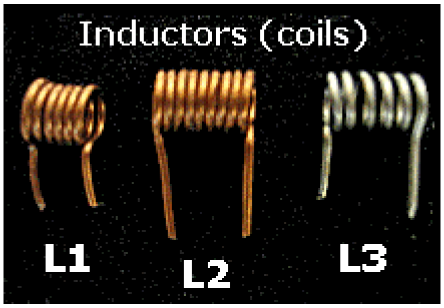


Fig.1-Here's the FM Telephone Transmitter schematic diagram. The circuit connects in series with a phone line, "steals" power from it, and transmit both sides of the conversation to an FM radio tuned between 80 - 108MHz

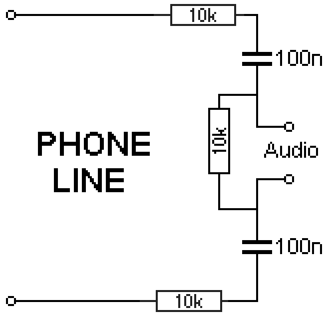


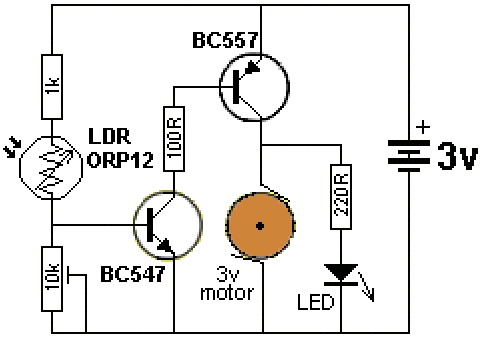
The circuit was originally designed by me and presented in Poptronics magazine. It will transmit a phone conversation to an FM radio on the 88-108MHz band. It uses energy from the phone line to transmit about 200metres and uses the phone wire as the antenna. It is activated when the phone is picked up. The 22p air trimmer is shown as well as the 3 coils. Q2 is a buffer transistor between the oscillator and phone line and will provide a higher output than the previous circuits.

MUSIC ON HOLD

This simple circuit delivers audio to the phone line from the "audio-out" of a tape recorder or radio.

Adjust the volume control of the radio to produce a suitable level of audio.
Use 400v capacitors to be on the safe-side.



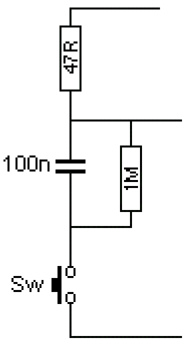


ROBOT-1

A simple robot can be made with 2 motors and two light-detecting circuits, (identical to the circuit above). The robot is attracted to light and when the light dependent resistor sees light, its resistance decreases. This turns on the BC547 and also the BC557. The shaft of the motor has a rubber foot that contacts the ground and moves the robot. The two pots adjust the sensitivity of the LDRs. This kit is available from Velleman as kit number MK127.

SWITCH DEBOUNCER and PULSE PRODUCER

Thus is one of the simplest and cleverest circuits ever produced (by Ron: http://www.zen22142.zen.co.uk/ronj/tg1.html
Ron says: It produces a **complete pulse** every time the button is pressed. When the button is pressed, the output goes low for 3uS and produces a pulse to activate the clock-line of a chip. Our circuit produced 100% reliability and the cap takes 0.1sec to discharge.
The circuit does not have any filtering to prevent switch noise as it relying on the fact that a single pulse is produced in 3uS and the circuit assumes no switch noise can be produced in that time-interval.



100 more transistor circuits: **101-200 Circuits**

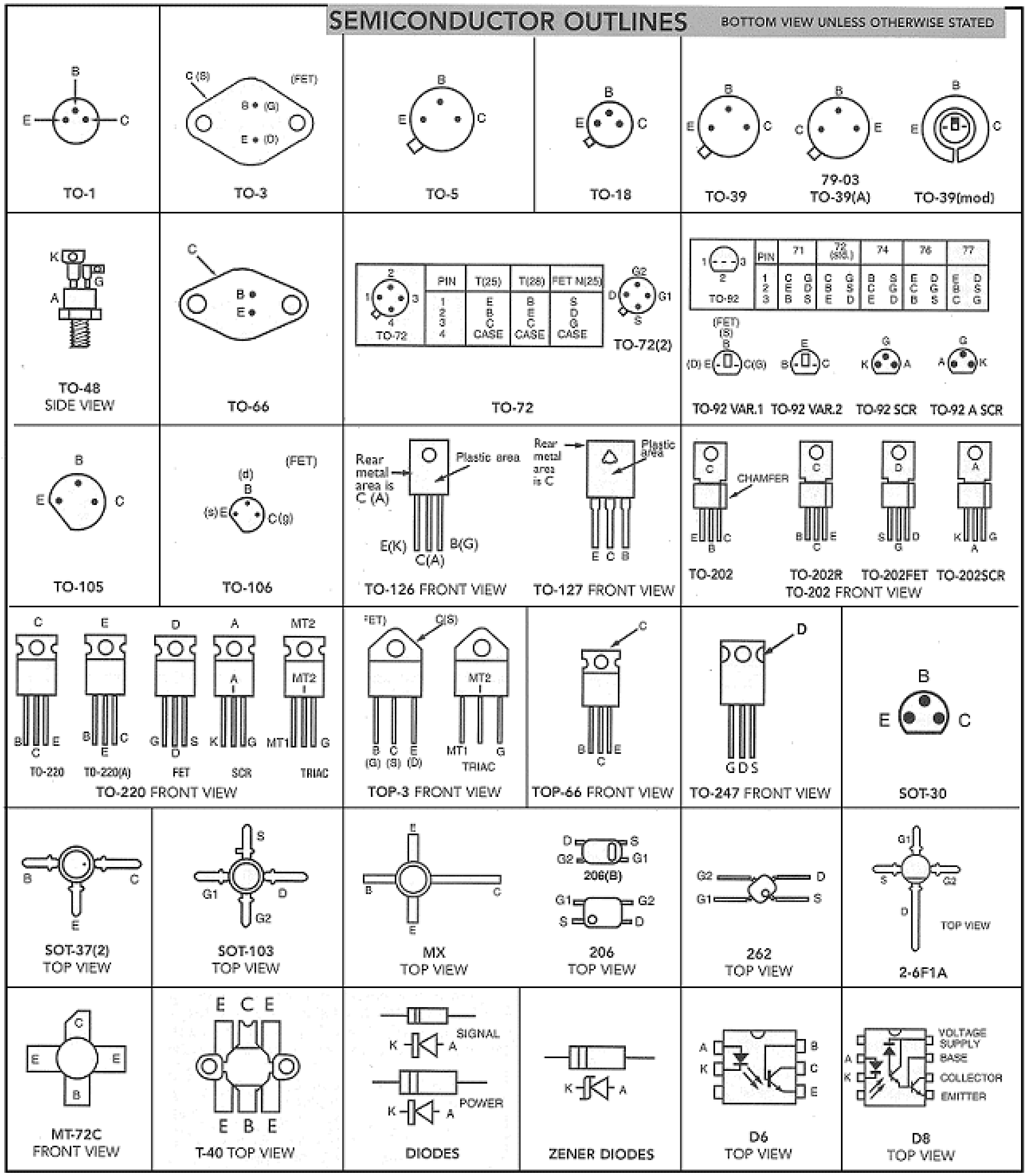
Go to Talking Electronics website: **HERE** **for "new page" format click:** **HERE**

BIPOLAR TRANSISTORS

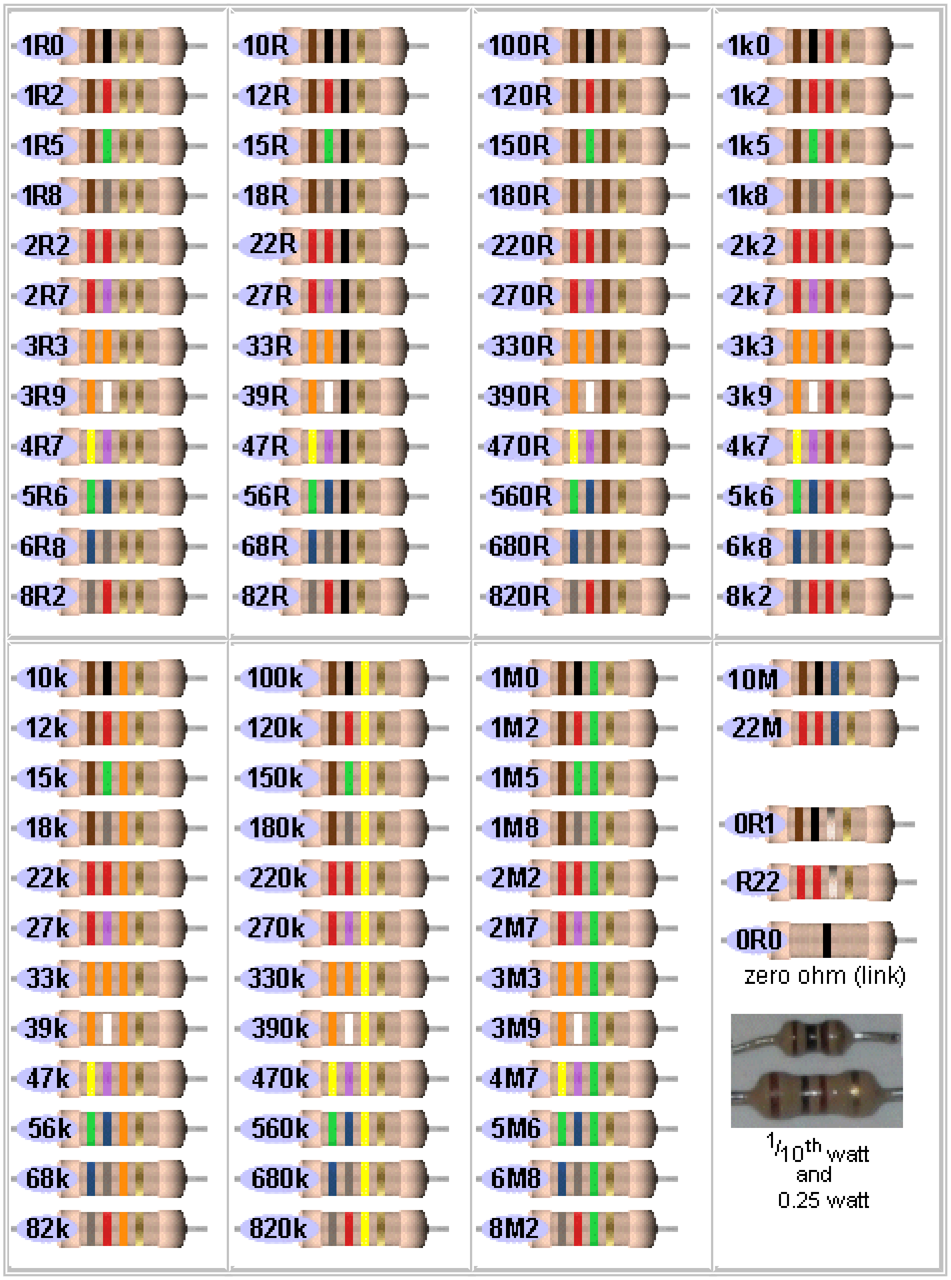
Some small signal transistors may have a TO-92 case and a "PN" prefix. The electrical specifications are the same, only the case is changed.

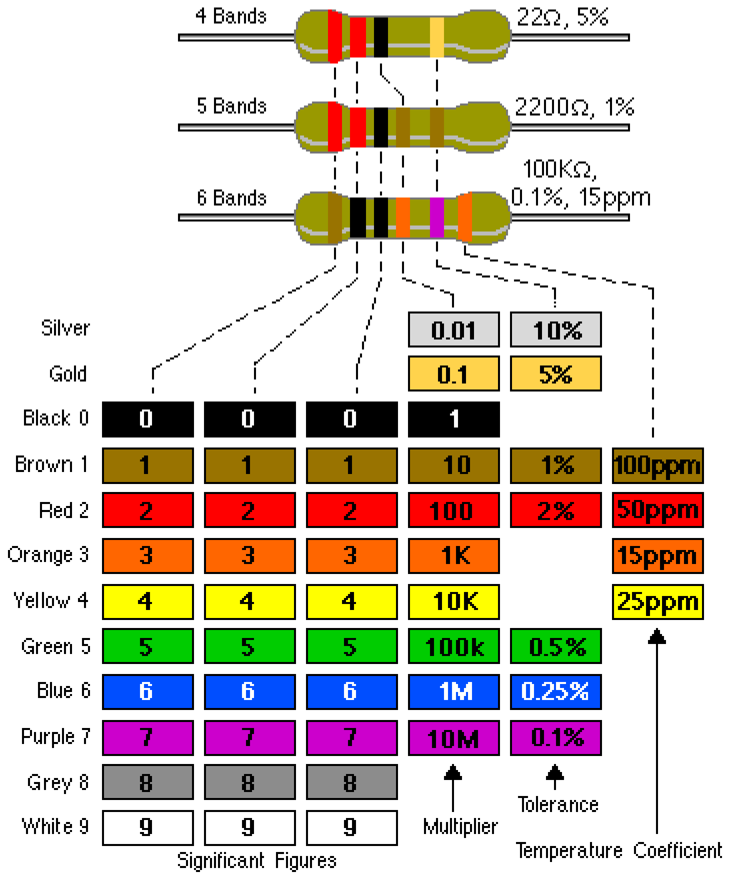
Type	CASE		V_{CE}	V_{CB}	I_C	V_{CEC}	@I_C	h_{FE}	@I_C	FT	@I_C	P_{TOT}	USE	COMPARABL TYPES
		Polarity	mA				mA		mA	MHz	mA	mW		
BC107	TO-18	NS	45	50	100	0.2	10	110-450	2	300	10	300	G.P S.S. amp.	BC207, BC147, BC
BC108	TO-18	NS	20	30	100	0.2	10	110-800	2	300	10	300	G.P S.S. amp.	BC208, BC148, BC
BC109	TO-18	NS	20	30	100	0.25	10	200-800	2	300	10	300	Low noise S.S. amp	BC209, BC149, BC
BC109C	TO-18	NS	20	30	100	0.25	10	420-800	2	300	10	300	Low noise high gain	BC209C BC149C
BC177	TO-18	PS	45	50	100	0.3	10	75-260	2	150	10	300	G.P S.S. amp.	BC157, BC307, BC
BC178	TO-18	PS	25	30	100	0.3	10	75-500	2	150	10	300	G.P. S.S. amp.	BC158, BC308, BC
BC179	TO-18	PS	20	25	100	0.3	10	125-500	2	150	10	300	G.P S.S. amp.	BC159, BC309, BC
BC327	TO-92VAR1	PS	45	50	500	0.7	500	100-600	100	100	10	625	Output	2N3638
BC328	TO-92VAR1	PS	25	30	500	0.7	500	100-600	100	100	10	625	Output	BC327
BC337	TO-92VAR1	NS	45	50	500	0.7	500	1 00-600	100	100	10	625	Output	2N3642
BC338	TO-92VAR1	NS	25	30	500	0.7	500	100-600	100	100	10	625	Output	BC337
BC546	TO-92VAR1	NS	65	80	100	0.6	100	110-450	2	300	10	500	G.P S.S. amp.	
BC547	TO-92VAR1	NS	45	50	100	0.6	100	110-800	2	300	10	500	G.P S.S. amp.	BC107, BC207, BC
BC548	TO-92VAR1	NS	30	30		0.6	100	110-800	2	300	10	500	G.P. S.S. amp.	BC108, BC208, BC
BC549	TO-92VAR1	NS	30	30	100	0.6	100	200-800	2	300	10	500	Low noise S.S. amp.	BC109, BC209, BC
BC549C	TO-92VAR1	NS	30	30	100	0.6	100	420-800	2	300	10	500	Low noise high gain	BC109C, BC149C
BC556	TO-92VAR1	PS	65	80	100	0.65	100	75-475	2	200	10	500	G.P. S.S. amp.	
BC557	TO-92VAR1	PS	45	50	100	0.65	100	75-800	2	200	10	500	G.P. S.S. amp.	BC157
BC558	TO-92VAR1	PS	30	30	100	0.65	100	75-800	2	200	10	500	G.P. S.S. amp.	BC158
BC559	TO-92VAR1	PS	30	30	100	0.65	100	125-800	2	200	10	500	G.P. S.S. amp.	BC159
BC639	TO-92(74)	NS	80	100	1A	0.5	500	40-250	150	130		1W	Audio O/P	MU9610, TT801
BC640	TO-92(74)	PS	80	100	1A	0.5	500	40-250	150	50		1W	Audio O/P	MU9660, TT800
BD139	TO-126	NS	80	10	1.5A	0.5	500	40-250	150	250	50	8W	G.P. O/P	40409
BD140	TO-126	PS	80	10	1.5A	0.5	500	40-250	150	75	50	8W	G.P. O/P	40410
BD262	TO-126	PS	60	60	4A	2.5	1.5A	750	1.5A	7	1.5A	36W	High gain Darl. O/P	BD266
BD263	TO-126	NS	60	80	4A	2.5	1.5A	750	1.5A	7	1.5A	36W	High gain Darl. O/P	BD267
BD266A	TO-220	PS	80	80	8A	2	3A	750	3A	7		60W	High gain Darl. O/P	
BD267A	TO-220	NS	80	10	8A	2	3A	750	3A	7		60W	High gain Darl. O/P	
BD681	TO-126	NS	100	10	4A	2.5	1 ,5A	750	1.5A	1		40W	Darlington O/P	BD263
BD682	TO-126	PS	100	100	4A	2.5	1.5A	750	1.5A	1		40W	Darlington O/P	BD262
BF173	TO-72(28)	NS	25	40	25			40-100	7	550	5	230	T.V. I.F. amp.	
BF199	TO-92VAR2	NS	25	40	25			37	7	550		500	H.F. amp.	BF180
BF463	TO-202	PS	250	25	500			40-180	30	20		2W	H.V. med. power.	
BF469	TO-126	NS	250	25	50			50	25	60	10	1.8W	G.P high-V. amp.	
BF470	TO-126	PS	250	25	50			50	25	60	10	1.8W	G.P. high-V. amp.	
BFR90	SOT-37(2)	NS	15	20	25			25-250	14	5GHz	14	180	Wideband amp..	
BFR91	SOT-37(2)	NS	12	15	35	0.3	30	25-250	30	5GHz	30	180	Wideband amp.	
BFY90	TO-72(25)	NS	15	30	25			25-125	2	1GHz	2	200	Wideband amp.	
BUX80	TO-3	NS	400	80	10A	1.5	5A	30	1.2A	8		100W	Defl'n, high current	
MJ802	TO-3	NS	90	10	30A	0.8	7.5A	25-100	7.5A	2	1A	200W	High power output	
MJ2955	TO-3	PS	60	70	15A	1.1	4A	20-70	4A	2.5	500	115W	G.P. power	
MJ4502	TO-3	PS	90	10	30A	0.8	7.5A	25-100	7.5A	2	1A	200W	High power output	
MJ10012	TO-3	NS	400	60	10A	2	6A	100-2K	6A			175W	Power Darlington	
MJ15003	TO-3	NS	140	14	20A	1	5A	25-150	5A	2	500	250W	High power output	
MJ15004	TO-3	PS	140	140	20A	1	5A	25-150	5A	2	500	250W	High power output	
MJE340	TO-126	NS	300		500	0.75	100	30-240	50			20W	G.P. H.V. power	

Type	CASE		V_{CE}	V_{CB}	I_C	V_{CEC}	@I_C	h_{FE}	@I_C	FT	@I_C	P_{TOT}	USE	COMPARABL TYPES
		Polarity	mA				mA		mA	MHz	mA	mW		
MJE350T	TO-126	PS	300		500	0.77	100	30-240	50			20W	G.P. H.V. power	
MJE2955	TO-220	PS	60	70	10A	1.1	4A	20-100	4A	2	500	75W	G.P. power	TIP 2955
MJE3055T	TO-220	NS	60	70	10A	1.1	4A	20-100	4A	2	500	75W	G.P. power	TIP 3055
MPSA14	TO-92(72)	NS	30	30	500	1.5	100	20000	100	125	10	625	G.R Darlington	
MPSA65	TO-92(72)	PS	30	30	500	1.5	100	20000	100	100	10	625	G.P. Darlington	
MRF629	TO-39A	NS	16	36	400			20-200	100			5W	UHF power	
MRF660	TO-220A	NS	16	36	2.4A			20-160	250			25W	UHF power	
PN100	TO-92(72)	NS	35	60	500	0.5	100	60-240	150	350	50	600	G.P. amp/switch	PN2222, 2N3643
PN2907	TO-92(72)	PS	40	60	600	0.4	150	100-300	150	200	50	625	High S. switch	
PN200	TO-92(72)	PS	35	60	500	0.5	1 50	50-400	150	200	50	600	G.P. amp/switch	2N3638, BC214
TIP 31B	TOP-66	NS	80	80	3A	1.2	3A	25	1A	3	500	40W	Power output	
TIP 32B	TOP-66	PS	80	80	3A	1.2	3A	25	1A	3	500	40W	Power output	
TIP142	TOP-3	NS	100	100	10A	2	5A	>1000	5A			125W	Audio output	TIP140, TIP141
TIP147	TOP-3	PS	100	100	10A	2	5A	>1000	5A			125W	Audio output	TIP145, TIP146
TIP 2955	TOP-3	PS	70	100	15A	1.1	4A	20	4A	3	500	90W	Power output	MJE 2955
TIP 3055	TOP-3	NS	70	100	15A	1.1	4A	20	4A	3	500	90W	Power output	MJE 3055
2N2222A	TO-18	NS	40	75	800	1.6	500	00-300	150	300	20	500	High S. switch	
2N3019	TO-39	NS	80	140	1A	0.5	500	50-100	500	100	50	800	H.F. amp	
2N3053	TO-39	NS	40	60	700	1.4	150	50-250	150	100	50	2.86W	G.R switch	BD137
2N3054	TO-66	NS	60	90	4A	0.1	200	25-100	500	0.8	200	25W	Audio output	TIP 31B
2N3055	TO-3	NS	60	70	15A	1.1	4A	20-70	4A	2.5	500	115W	G.P. power	BDY20
2N3563	TO-106	NS	15	30	50			0-200	8	600	8	200	RF-IF amp	BF173
2N3564	TO-106	NS	15	30	100	0.3	20	20-500	15	400	15	200	RF-IF amp	BF167
2N3565	TO-106	NS	25	30	50	0.35	1	150-600	1	400	1	200	Lowlevel amp	BC108, BC208
2N3566	TO-105	NS	30	40	200	1	100	50-600	10	40	30	300	G.R amp & switch	BC183
2N3567	TO-105	NS	40	80	500	0.25	150	40-120	150	60	50	300	G.P. amp & switch	BC337
2N3568	TO-105	NS	60	80	500	0.25	150	40-120	150	60	50	300	G.P. amp & switch	
2N3569	TO-105	NS	40	80	500	0.25	150	00-300	150	60	50	300	G.P. amp & switch	
2N3638A	TO-105	PS	25	25	500	0.25	50	100	50	150	50	300	G.P. amp & switch	BC328
2N3641	TO-105	NS	30	60	500	0.22	150	40-120		250	50	350	G.P. amp & switch	BC337
2N3642	TO-105	NS	45	60	500	0.22	150	40-120		250	50	350	G.R amp & switch	BC337
2N3643	TO-105	NS	30	60	500	0.22	150	100-300	150	250	50	350	G.P. amp & switch	BC337
2N3644	TO-105	PS	45	45	500	1	300	100-300	150	200	20	300	G.P. amp & switch	BC327
2N3645	TO-105	PS	60	60	500	1	300	100-300	150	200	20	300	G.P. amp & switch	
2N3771	TO-3	NS	40	50	30A	2	15A	15-60	15A	0.2	1A	150W	Power output	
2N3866	TO-39	NS	30	55	400			0-200	50	500	50	1W	VHF amp	
2N3904	TO-92(72)	NS	40	60	200	0.2	10	00-300	10	300	10	310	Lowlevel amp	BC167A, BF194
2N3905	TO-92(72)	PS	40	40	200	0.4	50	50-200	10	200	20	310	G.P. amp & switch	
2N3948	TO-39	NS	20	36	400			15	50	700	50	1W	VHF amp	
2N4030	TO-39	PS	60	60	1A	0.5	500	25	500	260	100	800	G.P. amp & switch	
2N4250	TO-106	PS	40	40	100	0.25	10	50-700	0.1	50		200	Lowlevel amp	BC559
2N4258	TO-106	PS	12	12	50	0.5	50	30-120	10	700	10	200	Saturated switch	
2N4427	TO-39	NS	20	40	400	0.4	100	10-200	100	500	50	1W	VHF/UHF driver	2N3866
2N5401	TO-92(72)	PS	150	160	6000	0.5	50	60-250	10	100	10	625	H.V. switch	MPSL51
2N6557	TO-202	NS	250	250	500			> 40	50	45		2W	H.V. med power	
2SC710	TO-92/76	NS	25	30	30			90		100		200	G.P, RF amp	BFS18
2SC1306	TOP-66	NS	65	65	3A			0-200	500	300		12W	H.F. output	2SC2166
2SC1307	TOP-66	NS	70	70	8A			0-150	2A	150		25W	H.F. output	2SC1969
2SC1674	TO-92(74)	NS	20	30	20	0.3	10	40-180	1	600	1	250	VHP amp	
2SC1969	TOP-66	NS	30	60	6A			0-180	10	150		20W	H.F output	2SC1307
2SC2166	TOP-66	NS	75	75	4A			5-180	100					
2SC2694	T-40	NS	17	35	20A			0-180	1A	800		140W	VHF output	MRF247
2SC3355	TO-92(74)	NS	12	20	100			0-300	20	6.5GHz	20	600	UHFSS	MRF573
2SC3358	MX	NS	12	20	100			0-300	20	7GHz	20	250	UHFSS	MRF573



All the resistor colours:


1R0
1R2
1R5
1R8
2R2
2R7
3R3
3R9
4R7
5R6
6R8
8R2
10R
12R
15R
18R
22R
27R
33R
39R
47R
56R
68R
82R
100R
120R
150R
180R
220R
270R
330R
390R
470R
560R
680R
820R
1k0
1k2
1k5
1k8
2k2
2k7
3k3
3k9
4k7
5k6
6k8
8k2
10k
12k
15k
18k
22k
27k
33k
39k
47k
56k
68k
82k
100k
120k
150k
180k
220k
270k
330k
390k
470k
560k
680k
820k
1M0
1M2
1M5
1M8
2M2
2M7
3M3
3M9
4M7
5M6
6M8
8M2
10M
22M
0R1
R22
0R0
zero ohm (link)
1/10th watt
and
0.25 watt



Silver				0.01	10%	
Gold				0.1	5%	
Black 0	0	0	0	1		
Brown 1	1	1	1	10	1%	100ppm
Red 2	2	2	2	100	2%	50ppm
Orange 3	3	3	3	1K		15ppm
Yellow 4	4	4	4	10K		25ppm
Green 5	5	5	5	100k	0.5%	
Blue 6	6	6	6	1M	0.25%	
Purple 7	7	7	7	10M	0.1%	
Grey 8	8	8	8			
White 9	9	9	9			
	Significant Figures			Multiplier	Tolerance	Temperature Coefficient

Resistor Color Code System

See 101-200 Circuits for resistors in parallel and series and capacitors in parallel and series. You can make ANY VALUE by simply connecting resistors in parallel or series. And the same with capacitors.

Live Traffic Stats