Space and Science Festival – Rocket Soldering Kit

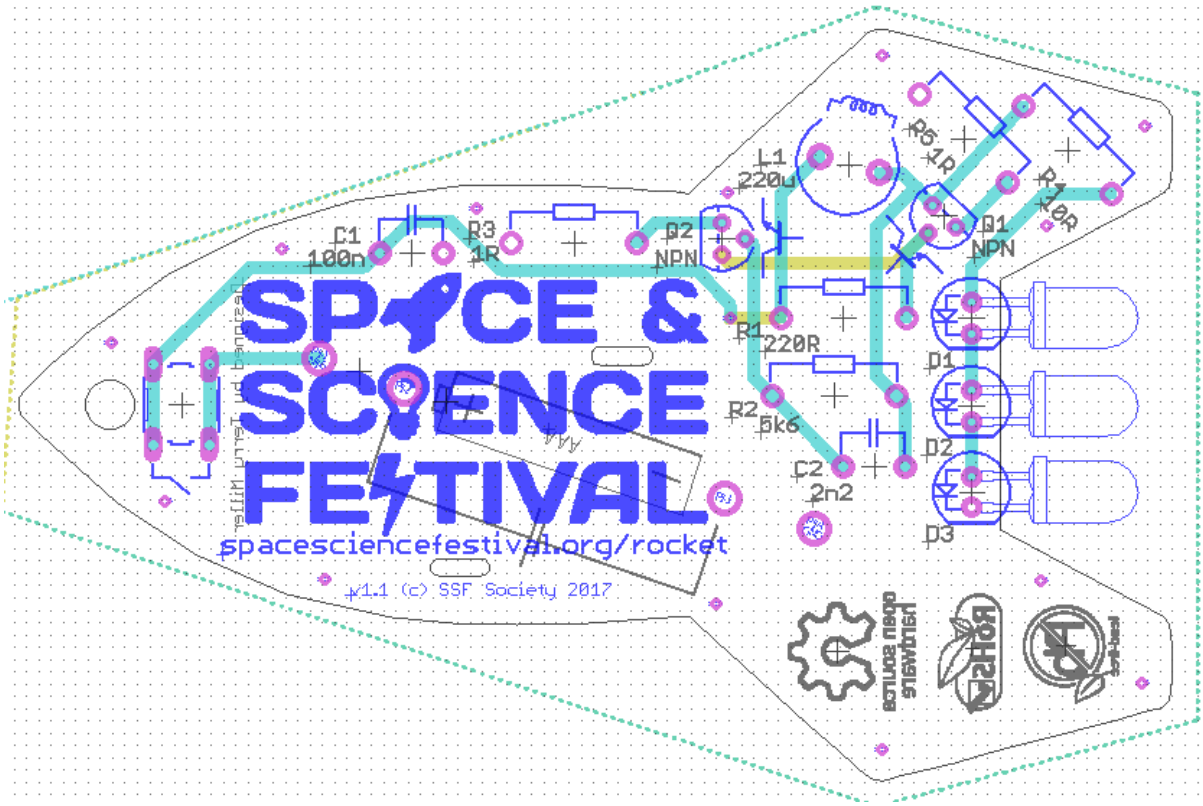
v1.0 - TM – 13/04/2017

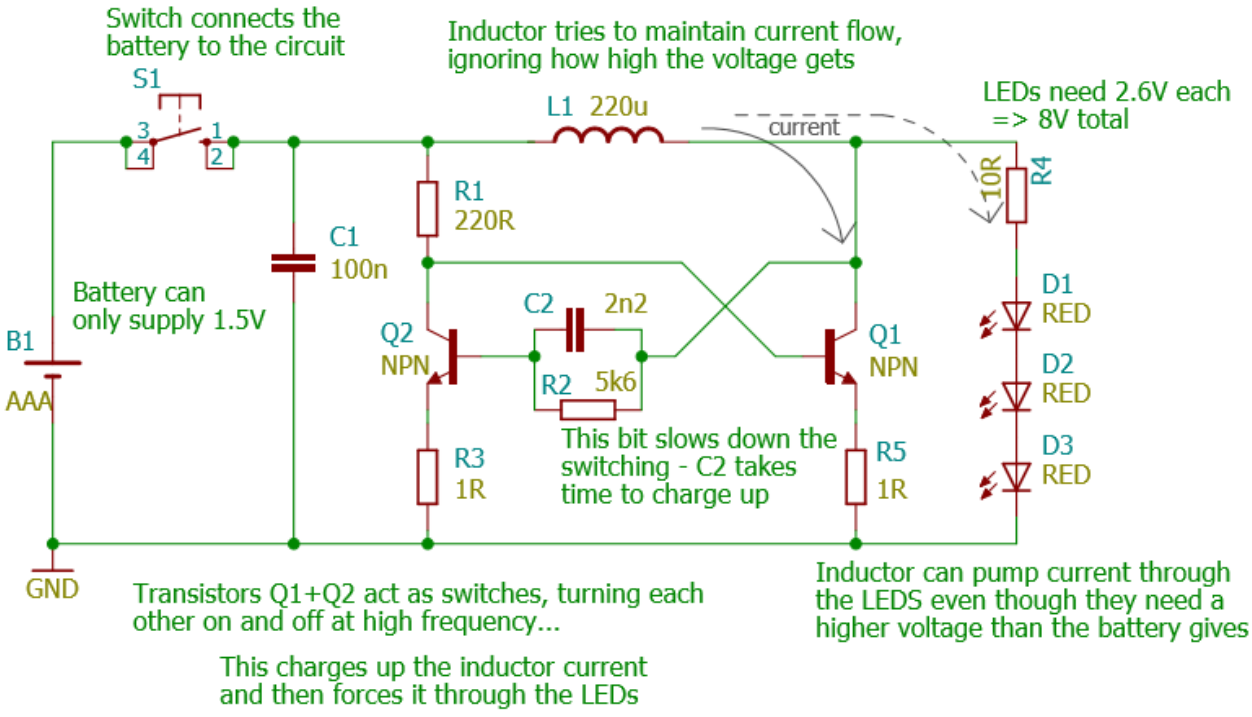
Intro

This electronics assembly kit is brought to you by the Wellington Space and Science Festival, and our sponsors, supporters and volunteers. We are a not-for-profit charity and all proceeds go towards funding the annual festival event.

We aim to promote science, technology and engineering for everyone, and we hope this kit gives you the opportunity to get started learning about electronics (and to build something cool).

All of the components in this kit are lead free and RoHS (restriction of hazardous substances) compliant – safer for you and better for the environment. It is also Open Source and you can find the design files and other information on our website – www.spacesciencefestival.org/rocket

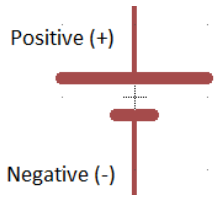
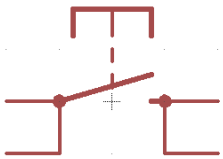
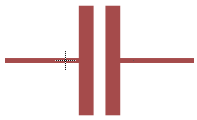
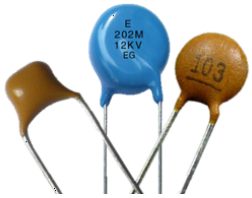
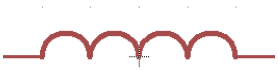
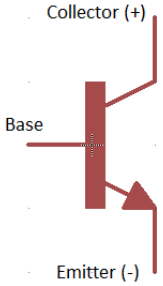
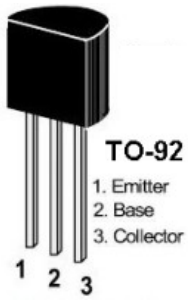
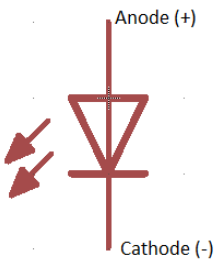
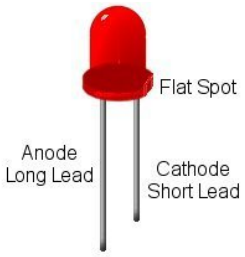




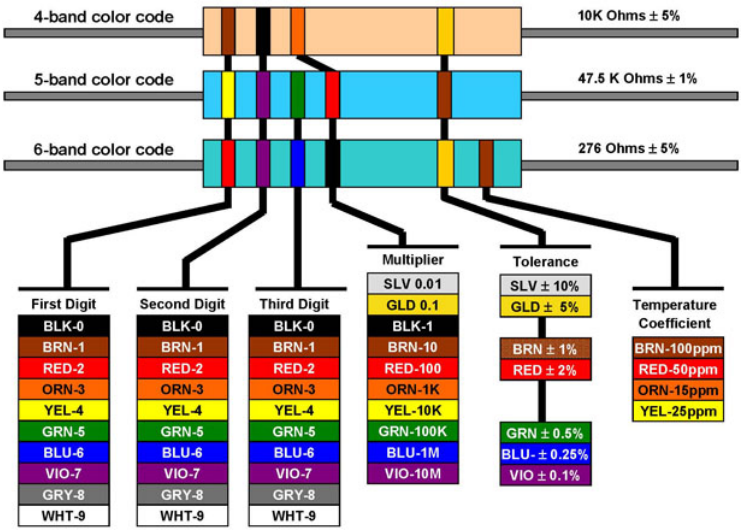
Parts List

The circuit is made up with different kinds of electronic components, and each affects how the electrical current moves through the circuit differently.

On a circuit diagram they are drawn using their international “symbols” but the real things can come in many shapes and sizes.

Name + Units	Description	Symbol	Picture
Battery (B) *Electrical potential in Volts “V”*	A battery uses chemicals to store electrical energy. Our AAA provides 1.5 volts to power the circuit		
Button Switch (S) *Push force in Newtons “N”*	The switch connects the battery to the rest of the circuit, allowing power to flow into it and drive everything		
Resistor (R) *Resistance in Ohms “Ω” or “R”*	A resistor slows the flow of electrical current – a bigger resistor means less current. You can identify the resistor’s value using handy colour codes (see next page)		
Capacitor (C) *Capacitance in Farads “F”*	A capacitor charges up to store energy, and the voltage across it grows over time (or shrinks if its discharging). A bigger cap takes longer to charge, so it can be used as an adjustable timer or delay element.		
Inductor (L) *Inductance in Henries “H”*	An inductor tries to stop changes in current flow by generating an opposing voltage in the circuit. A bigger inductor is better at storing the energy, providing a higher induced voltage for longer.		
Transistor (Q) *Electrical current in Amperes (Amps) “A”*	A Transistor acts as an electronic switch, blocking or allowing current to flow through it. It is turned on and off by applying a small current to the “base” pin. This one is in a commonly used standard “package” or shape, called a “TO-92”		
LED (D) *Colour (wavelength) in nanometres “nm”*	A LED or Light Emitting Diode uses quantum physics to turn electrons into photons, creating light of a specific colour using electrical energy. They are also diodes, which only allow current to flow only in one direction – from Anode to Cathode.		

Resistor Color Code



1 R – brown black gold (gold)
10 R – brown black black (gold)
220 R – red red brown (gold)
5k6 (5600) R – green blue red (gold)

*10 * 0.1 = 1 (5%)*
10 1 = 10 (5%)*
22 100 = 220 (5%)*
*56 * 100 = 5k6 (5%)*

Capacitor Number Codes

EIA Code	nF	µF
102	1	0.001
103	10	0.01
104	100	0.1
202	2	0.002
203	20	0.02
223	22	0.022
224	220	0.22

100 nF = "104"
2n2 (2.2 nF) = "222"

Metric System Prefixes

Prefix	Abbreviation	Meaning
mega	M	1,000,000
kilo	k	1000
no prefix	-	1
deci	d	0.1 (1/10)
centi	c	0.01 (1/100)
milli	m	0.001 (1/1000)
micro	µ	0.000001 (1/1,000,000)
nano	n	0.000000001 (1/1,000,000,000)

Tips

- Please put on your safety glasses for soldering and when you or others are cutting wires.
- Take one component from the bag at a time, and solder it on before getting another one.
- If the inductor has a heatshrink tube over it, you can (carefully) peel it to show the copper coils.
- The leads on the LEDs have little lumps that mark 5mm, so you know where to bend from.
- You may need to bend component legs to help them stay in while soldering. Once soldered down, trim the wires so they don't stick out or accidentally short-circuit something.
- IMPORTANT - Make sure that you solder the transistors, LEDs and battery clips the RIGHT WAY ROUND (as marked on the pcb) - if you don't, the circuit will not work and you will not go to space today.

Soldering

When soldering, always make sure the solder iron tip is hot and clean. To test if it is hot enough try to melt a piece of solder on the tip - the solder should melt almost instantly. Then clean off the melted solder by wiping the tip on a damp sponge.

Remember that solder will only 'stick' to hot surfaces, so don't melt the solder on the soldering iron tip and then try to 'drop' it onto a cold joint.

Testing Before You Put The Battery In

Check that all the joints are connected to both the pad and the wire, and that the wire is held firmly so that it does not 'wobble' when the component is pulled or moved.

Also check that the solder does not accidentally bridge between two pads. This is most likely to happen on the LEDs and transistors.