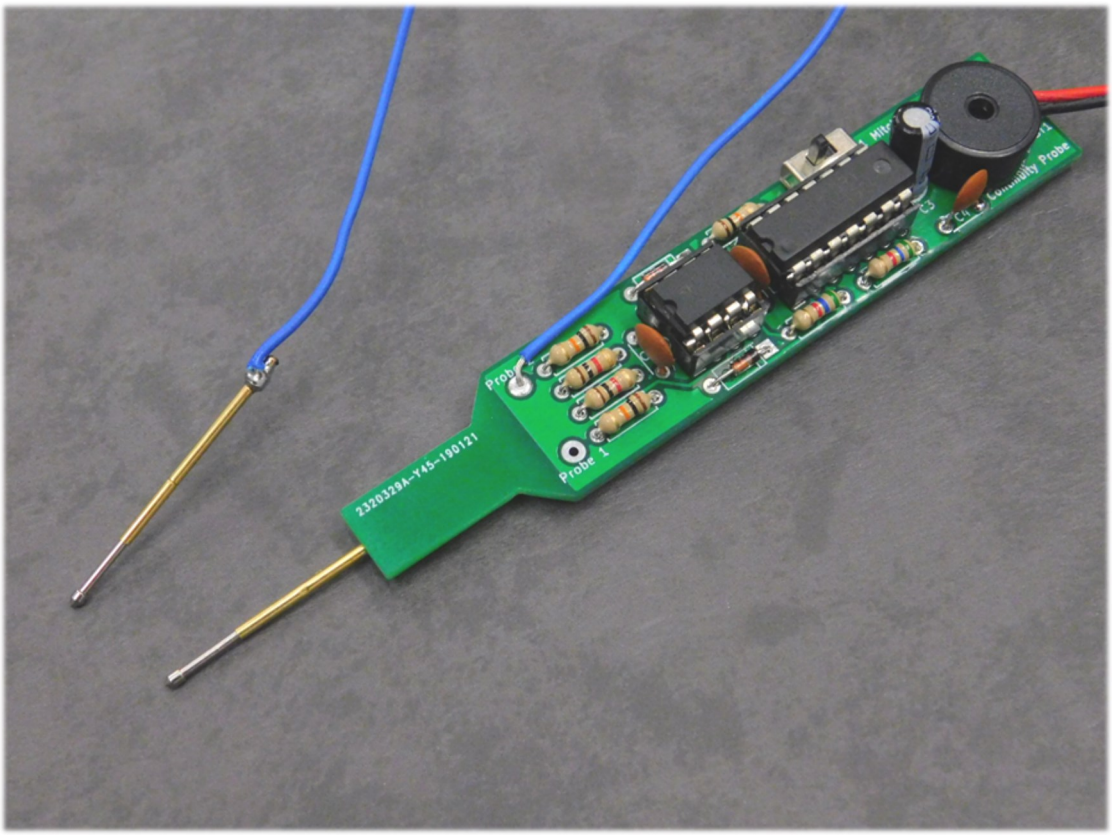
Continuity Probe

MitchElectronics 2019



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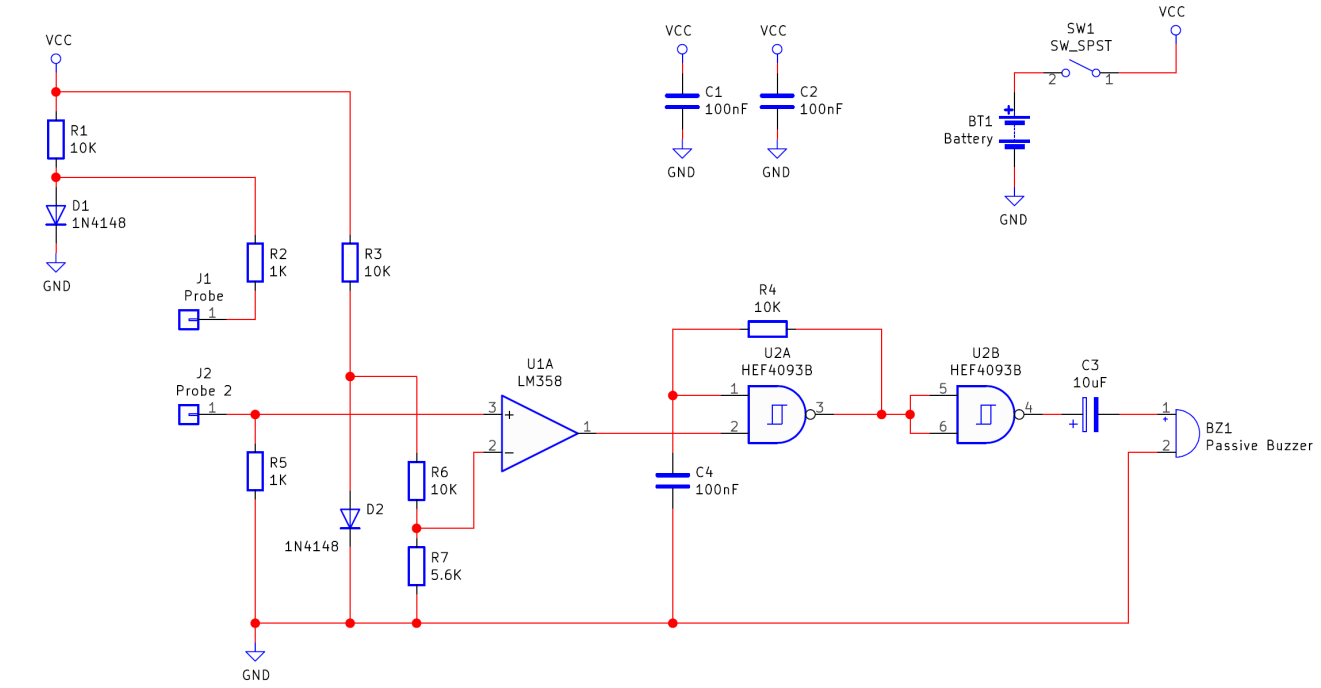
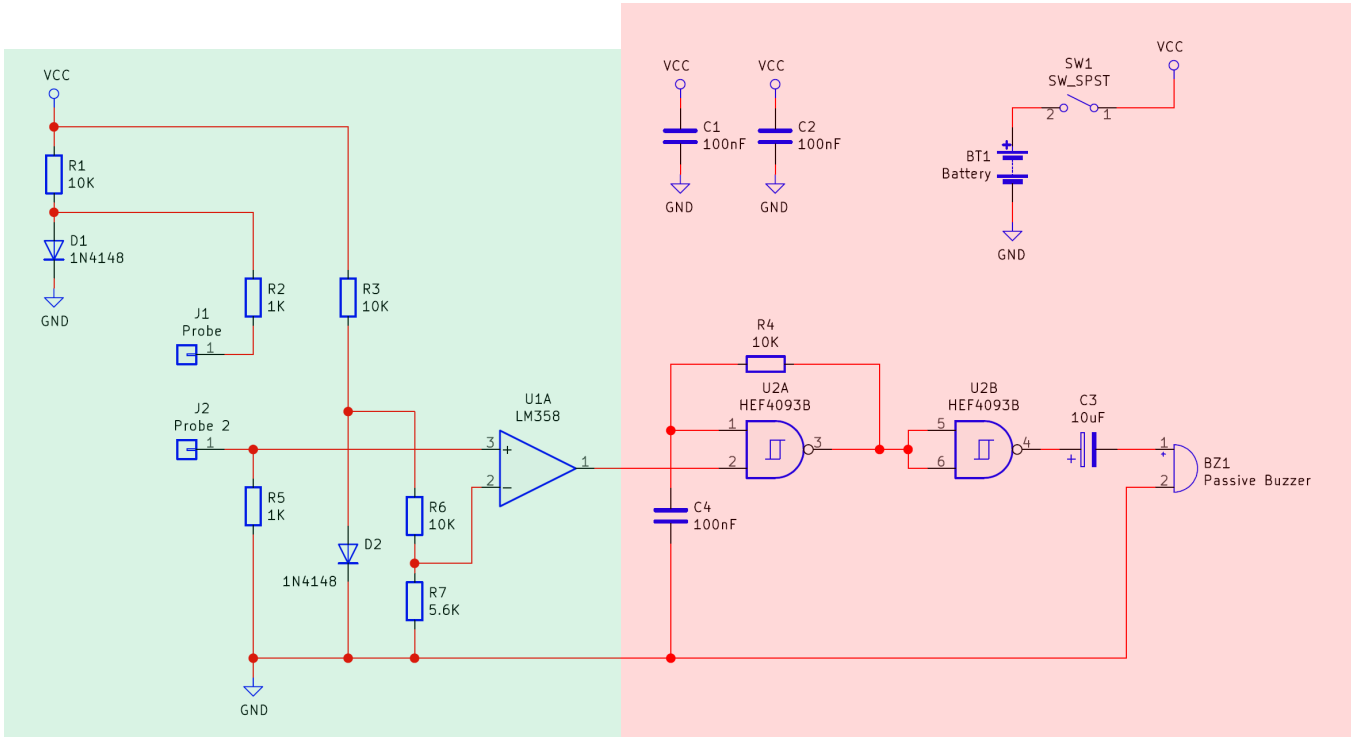




Comparator Stage

Gated Oscillator

SCHEMATIC EXPLANATION

No electronics workshop would be complete without a continuity probe but what exactly do they do? A continuity probe has two probe points that are used to determine if there is an electrical connection between two points. If the two probes probe the same wire then the continuity probe makes a beep sound and if there is resistance between the probe points (or no connection at all), then the continuity probe makes no sound at all.

A simple continuity probe could be built with a buzzer, a battery, and two probes which combine to make a simple buzzer circuit. While this is fine for checking the continuity of wires (ensure the wire is properly connected and undamaged), it is not recommended for potentially sensitive circuits. Applying power to a circuit can potentially cause reverse bias or worse a large current rush could damage components such as LEDs. Therefore, a proper continuity probe is needed which can check for low resistance but not damage sensitive parts!

The MitchElectronics continuity probe is made up of two main sub-circuits

- Comparator circuit (U1)
- Gated Oscillator (U2)

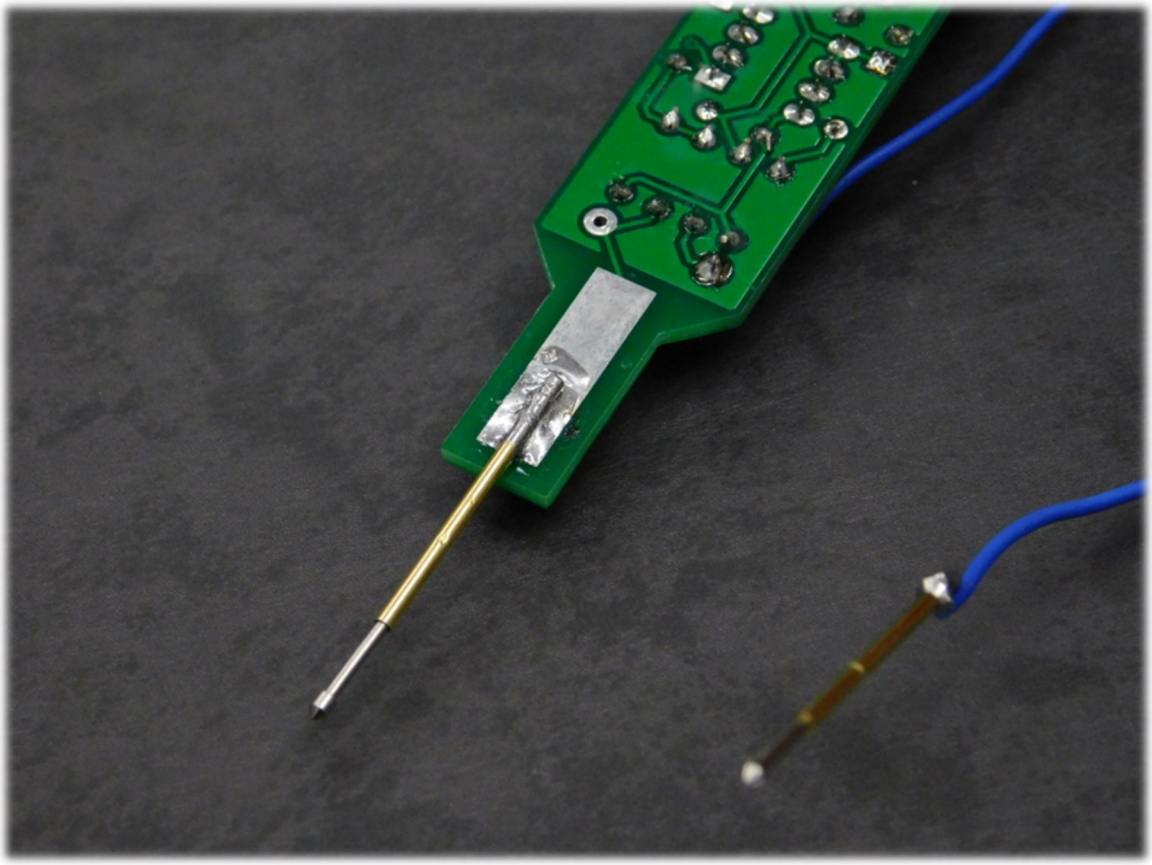
The comparator stage is made up of an op-amp and various components whereby the two voltages that are compared are the voltage present at Probe 2 and across R7. The voltage across R7 is approximately 0.6V * 1/3 = 0.2V and if the two probes are not connected (i.e. there is no continuity) then the voltage across R5 is 0V which means that the output of op-amp U1A is 0V. This output is fed into a gated RC oscillator made using a Schmitt trigger. If the input to the gated oscillator is 0V then the output of the NAND gate stays high and if the input is equal to VCC then U2A can oscillate. This oscillation is buffered by the NAND gate U2B and this buffered square wave is fed into a buzzer.

When the two probes make electrical contact with each other (through a wire or PCB trace), the voltage across R5 is equal to 0.6V / 2 as the potential divider circuit (made up of R2 / R5) is connected to a forward biased diode D1 whose forward voltage is 0.6V. The 0.3V from this divider is greater than the 0.2V across the resistor R7 which means that the output of U1A goes to VCC when there is continuity between the two probes. The reason for using diodes to produce a 0.6V reference is to keep the voltages from the probes below 0.6V which is low enough to prevent damage to sensitive parts such as ICs.

SCHEMATIC EXPLANATION

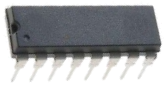
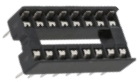
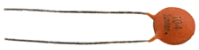
Construction Note

While two probe pads are visible you should solder one probe to the large pad on the underside of the PCB and the other probe to a piece of wire which is then connected to Probe 2



MATERIALS

Check that you have the following components

Component	Component Name	Quantity	Looks like
4093	U2	1	
LM358	U1	1	
14 DIP Socket	U2	1	
8 DIP Socket	U1	1	
1KΩ Resistor	R2, R5	2	
5.6KΩ Resistor	R4, R7	2	
10KΩ Resistor	R1, R3, R6	4	
100nF Capacitor	C1, C2, C4	3	
10uF Capacitor	C3	1	
1N4148	D1, D2	2	
Passive Buzzer	BZ1	1	
Pogo Pin	J1, J2	2	
Wire	J2	1	
PP3 Connector	BT1	1	
Switch	SW1	1	
PCB			

CONSTRUCTION

Download the electronics construction manual

To learn how to construct circuits on PCBs download the Electronics Construction Manual from Mitch-Electronics using the link below. This document shows you how to install all electronic components used in MitchElectronics kits. The list below shows the sections relevant to this kit so do not worry if you see component sections in the document that don't come with this kit!

www.mitchelectronics.co.uk/electronicsConstructionManual.pdf

Relevant sections in the electronics construction manual

Resistors

Capacitors

Diodes

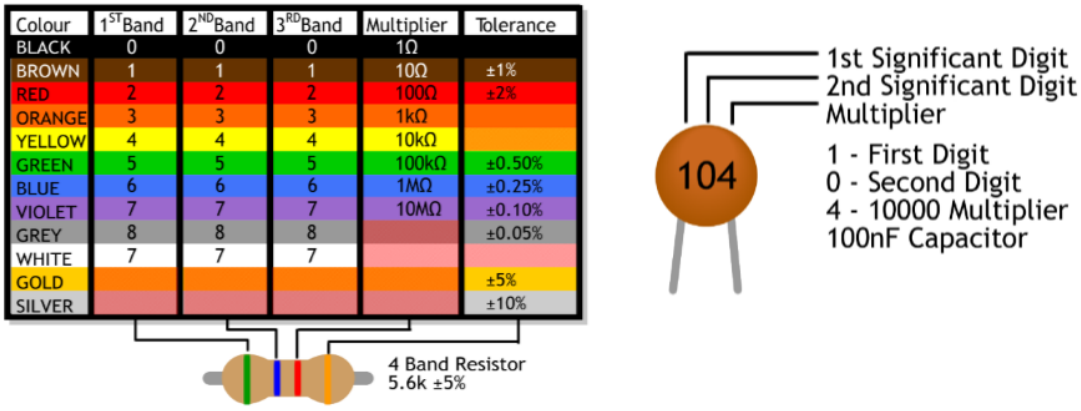
Switches

Probes

Integrated Circuits

Buzzers

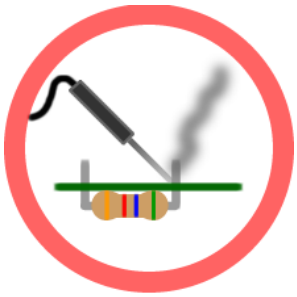
RESISTOR AND CAPACITOR IDENTIFICATION



IMPORTANT INFORMATION

RoHS Compliant Kit (Lead free)

Low Voltage Kit



Caution! Soldering Required