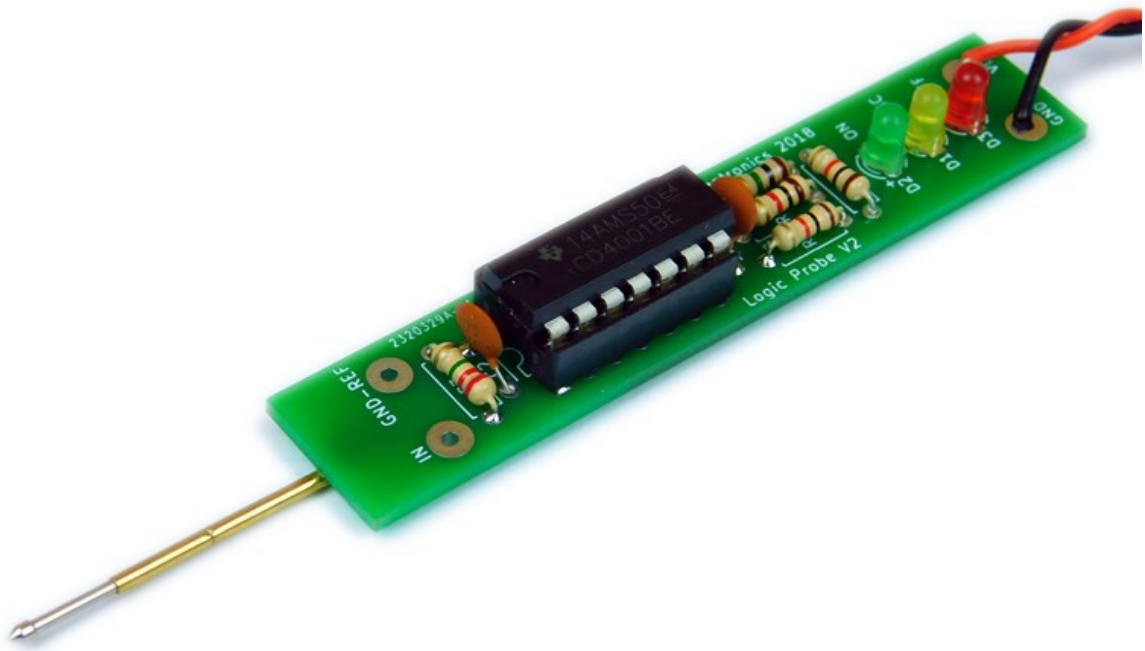
Logic Probe Kit

MitchElectronics 2018



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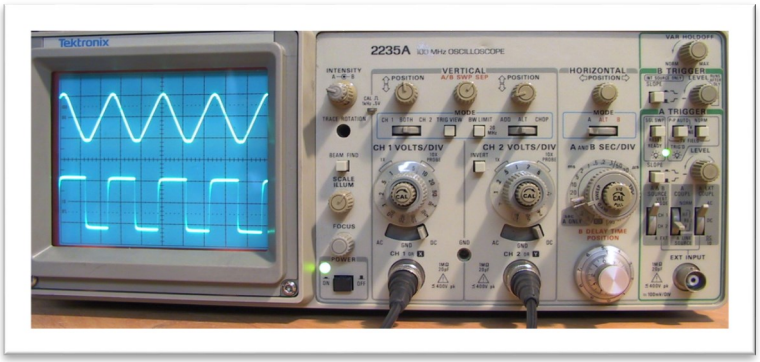
INTRODUCTION

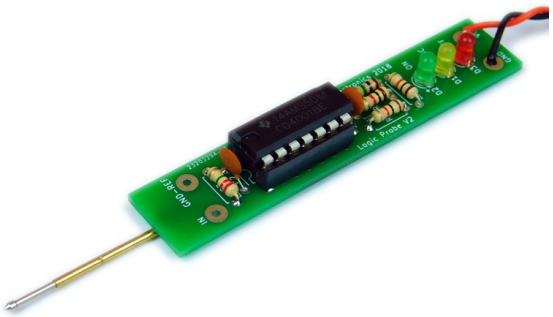
Testing circuits can be done with multi-meters and oscilloscopes but this is not always the best method. For example not everyone has access to an oscilloscope and multi-meters are no good for fast changing signals. Another reason is ease of use, testing a circuit with an oscilloscope can be tricky as you need to probe the contact and then turn away to look at the display. All it takes is for the probe to slip slightly and then the oscilloscope will be showing the signal trace for a completely different connection.



http://en.wikipedia.org/wiki/555_timer_IC

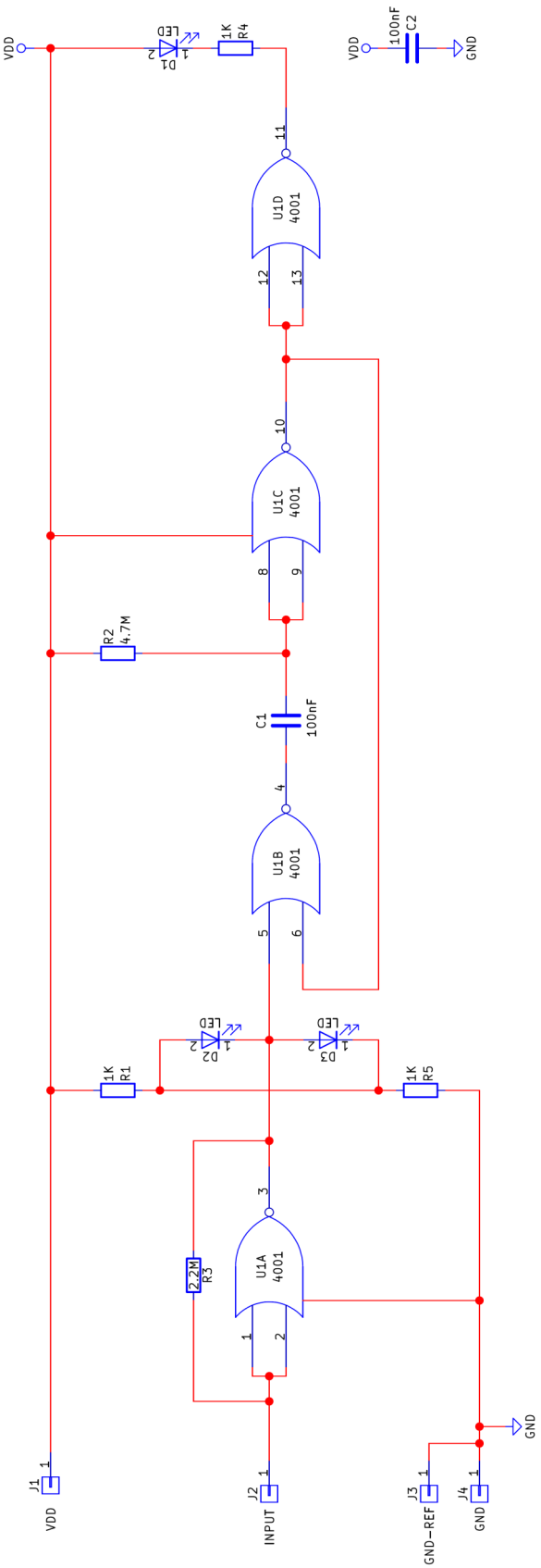
This is where the faithful logic probe saves the day! Instead of having numbers to show voltages or a display to show signals over time the logic probe has just three LEDs for outputs. These outputs can show the following conditions:

LED	Condition
Red	Off
Yellow	Floating
Green	On
All LEDs	Oscillating



So long as the probe has a common ground to the circuit under test (which can be done easily by either using the same power supply or connecting the probes GND-REF to the circuits ground), the probe will display one of the four listed conditions above when the probe contact is connected to a point in the circuit. But how does this probe work? Read on and find out!

SCHEMATIC


VDD
LED
D1
1K
R4
VDD
100nF
C2
GND
11
U1D
4001
12
13
10
U1C
4001
8
9
R2
4.7M
C1
100nF
4
U1B
4001
5
6
LED
D2
LED
D3
1K
R1
1K
R5
3
2.2M
R3
U1A
4001
1
2
J1
1
VDD
J2
1
INPUT
J3
1
GND-REF
J4
1
GND
GND

SCHEMATIC EXPLANATION

The logic probe uses a 4001 quad NOR gate IC, resistors and a capacitor. The first NOR gate is used as a basic oscillator. With the inputs connected together the first NOR gate is transformed into an inverter. R3 is used to feed the output back into the input which results in oscillation if the input is unconnected (floating).

D2 is connected between power through R1 and the output of the NOR gate while D3 is connected to ground through R5 and the output of the NOR gate. If the input to the NOR gate is a logical 1 then the NOR gate will output 0V and this will result in D2 turning on (current flows through R1, through D2 and then into the output which is at 0V). If the input is off then the output of the NOR gate will be VDD and this results in D3 turning on instead of D2 (current flows from the output of the NOR gate through D3 and then to ground through R5).

The next two NOR gates form a basic mono-stable circuit which is used to detect an oscillating signal. If for example the input signal was oscillating at a high rate (more than a MHz), then any LED that is used to show this signal would not be very bright and thus make it hard to tell if the input is oscillating. To solve this the mono-stable formed by the second two NOR gates, capacitor (C1) and resistor (R2) will be constantly triggered and re-triggered by the oscillating input. This results in a constant output which will make an LED bright so long as the oscillation is present. The last NOR gate is used as an LED driver for the mono-stable.

If no input is connected (floating), the NOR gate will weakly oscillate around VCC / 2. The voltage seen by both D2 and D3 will be approximately half VCC and thus results in neither LED turning on and therefore indicates a floating input. This weak oscillation, however, is able to set and reset the monostable which keeps the yellow LED on.

NOTE ON USING THE LOGIC PROBE

The logic probe will only work properly if the GND-REF pad is connected to the ground of the circuit under test. If the ground in the logic probe is not the same as that of the test circuit then there is no return path for any signals which results in the logic probe not being able to take measurements.

In other words, signals can only be measured with respect to some level. There is not such this as an absolute voltage, voltage is relative because it is always with respect to some user defined point. An common example is the mains wiring: The neutral wire is 230VAC with respect to the live wire but 0VAC with respect to earth (and hence you).

CONSTRUCTION

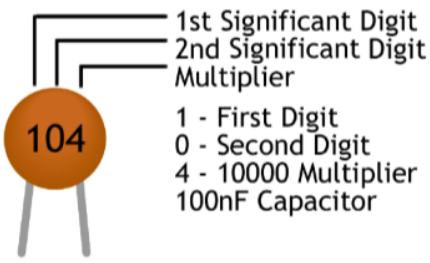
Check that you have the following components

Component	Component Name	Quantity	Looks like
14 DIP Socket	U1	1	
4001	U1	1	
100nF Capacitor	C1, C2	2	
1kΩ Resistor	R1, R4, R5	3	
2.2MΩ Resistor	R3	1	
4.7MΩ Resistor	R2	1	
LED—Green	D2	1	
LED-Red	D3	1	
LED-Yellow	D1	1	
Pogo Pin	-	1	
Wire	2 Black and 1 red	3	
PCB	-	1	

RESISTOR AND CAPACITOR IDENTIFICATION

Colour	1ST Band	2ND Band	3RD Band	Multiplier	Tolerance
BLACK	0	0	0	1Ω	
BROWN	1	1	1	10Ω	±1%
RED	2	2	2	100Ω	±2%
ORANGE	3	3	3	1kΩ	
YELLOW	4	4	4	10kΩ	
GREEN	5	5	5	100kΩ	±0.50%
BLUE	6	6	6	1MΩ	±0.25%
VIOLET	7	7	7	10MΩ	±0.10%
GREY	8	8	8		±0.05%
WHITE	7	7	7		
GOLD					±5%
SILVER					±10%

4 Band Resistor
5.6k ±5%



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

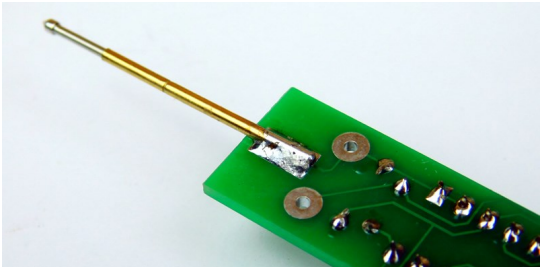
Integrated Circuits

LEDs

Wires

Soldering the Pogo Pin

The pogo pin is a gold rod that has a spring loaded probe on the front. Soldering the pogo pin to the logic probe kit is a rather difficult challenge as the pin is directly soldered to a rectangular pad found on the underside of the probe at the front. While this does not need to be done, getting the probe onto this kits transforms it into a very convenient tool that only needs to be pushed into a test point!

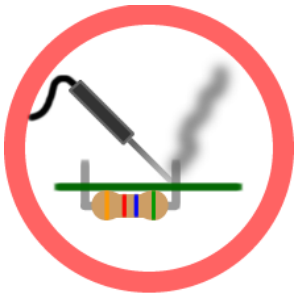


The best method for getting the pogo pin on is to use helping hand stands or tape the pin and PCB down so that neither moves when you solder the pin to the pad.

IMPORTANT INFORMATION

RoHS Compliant Kit (Lead free)

Low Voltage Kit



Caution! Soldering Required