

An Introduction to Circuit Safari

Robert Tristani

Rtristani@cox.net

Feel free to email me with suggested enhancements to this Introduction, but all requests for help with circuits or electrical theory cannot be answered.

Rev 5 July 2020

Section1: What is Circuit Safari, and what does it Help Do?

Section 2: Circuit Safari, Components and Wires

Section 3: Circuits in Circuit Safari

Section 1: What is Circuit Safari, and what does it Help Do?

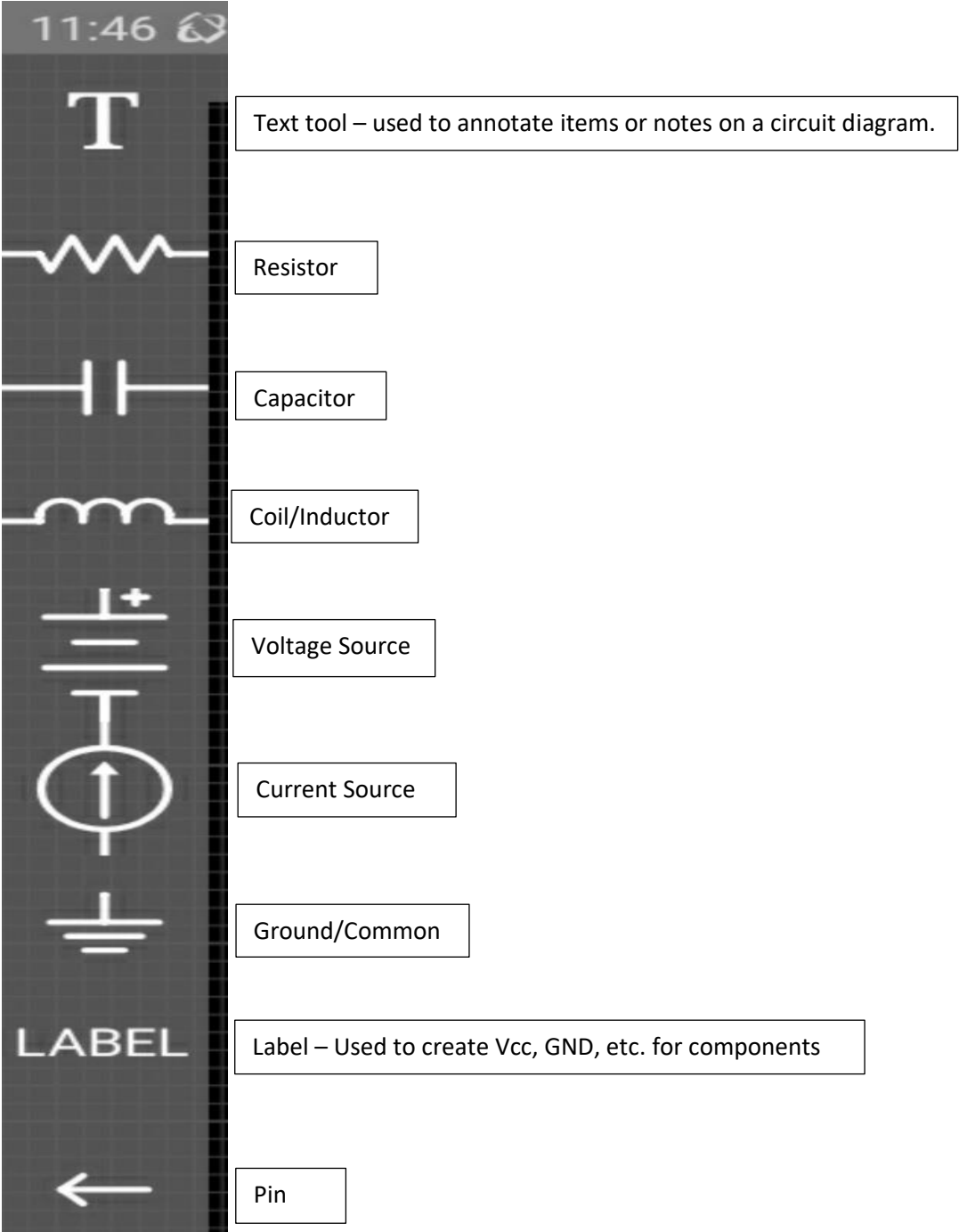
Circuit Safari is an electronic circuit simulator. The user designs an electronic circuit full of batteries, resistors, capacitors, op-amps, 555-timers, etc. Circuit Safari will then simulate the circuit and show results on various meters such as volt meters, amp meters, an oscilloscope, etc. The circuit can be modified in the virtual simulation environment and the simulation re-run until a desired result is achieved. The user can then build the actual physical circuit and be confident that it will work as intended.










Circuit Safari can also be used in other ways, such as modeling proposed changes to an actual circuit, troubleshooting actual circuits, or modeling the effects of swapping obsolete components for more modern ones before changes to a manufacturing line are made.










Section 2: Circuit Safari Components and Wires

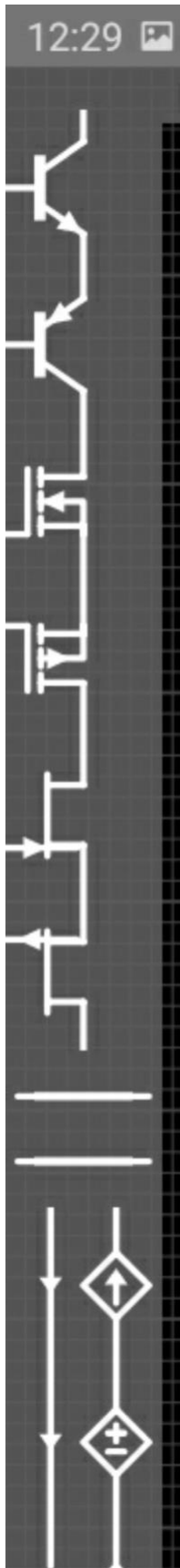
Components:

The discrete components available in Circuit Safari are as follows:



	Text tool – used to annotate items or notes on a circuit diagram.
	Resistor
	Capacitor
	Coil/Inductor
	Voltage Source
	Current Source
	Ground/Common
	Label – Used to create Vcc, GND, etc. for components
	Pin

	Integrated Circuit - Used to insert an integrated sub-circuit
	Oscilloscope probe and readout
	Volt Meter
	Ammeter, also referred to as an amp meter
	Power meter, also referred to as a watt meter
	Ohm meter
	Frequency display
	Percent Total Harmonic Distortion meter
	Diode



NPN Transistor

PNP Transistor

N-Channel Mosfet

P-Channel Mosfet

N-Channel Jfet

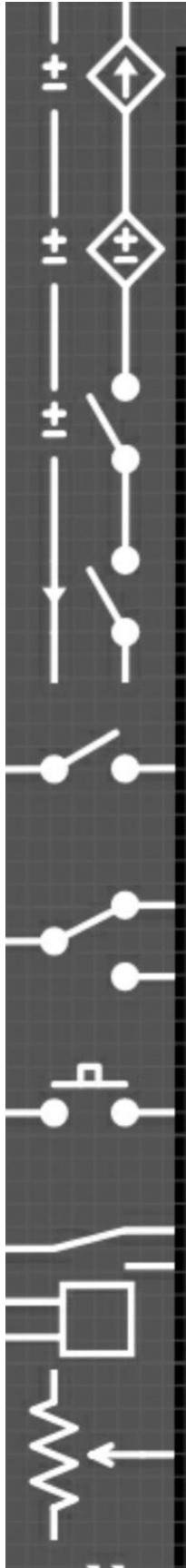
P-Channel Jfet

Long distance power transmission lines

Current controlled current source

Current controlled voltage source

ok



Voltage controlled current source

Voltage controlled voltage source

Voltage controlled switch

Current controlled switch

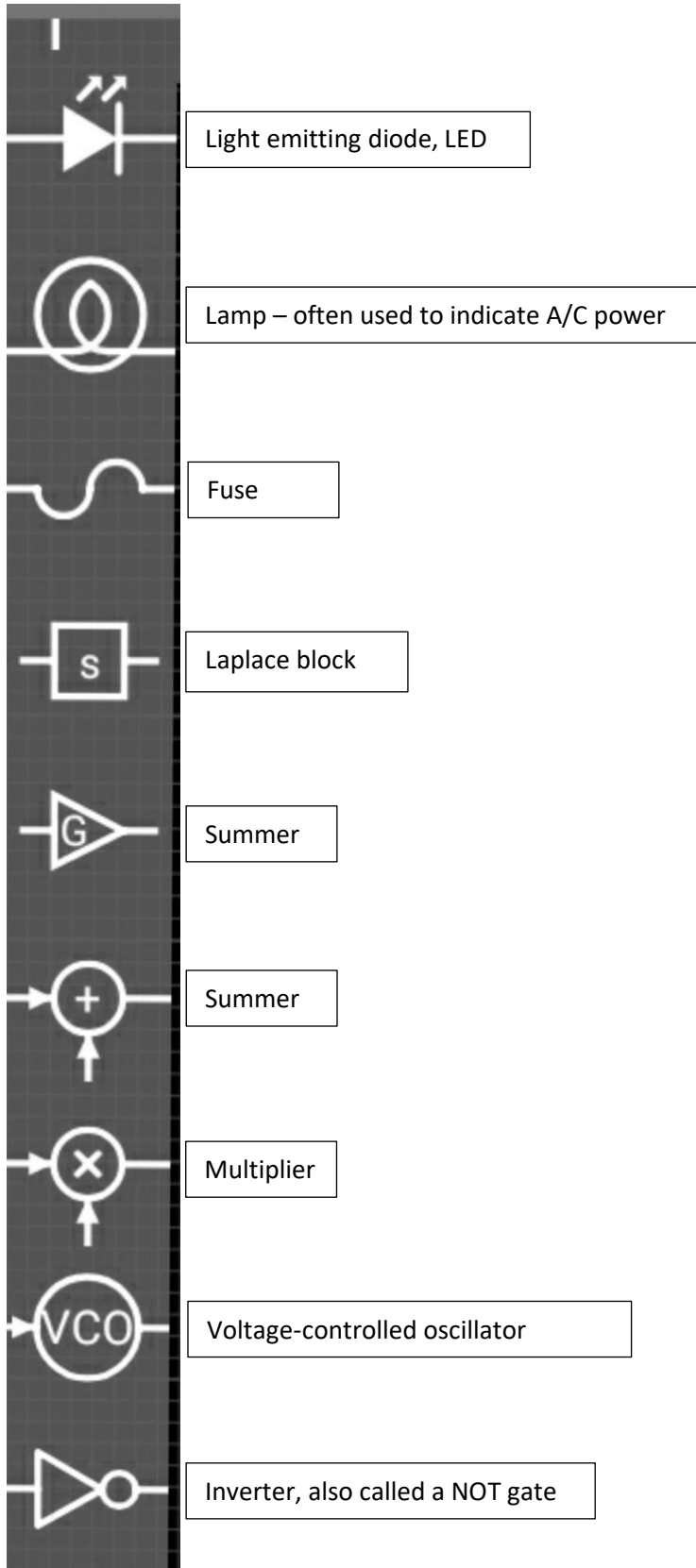
Single pole single throw switch

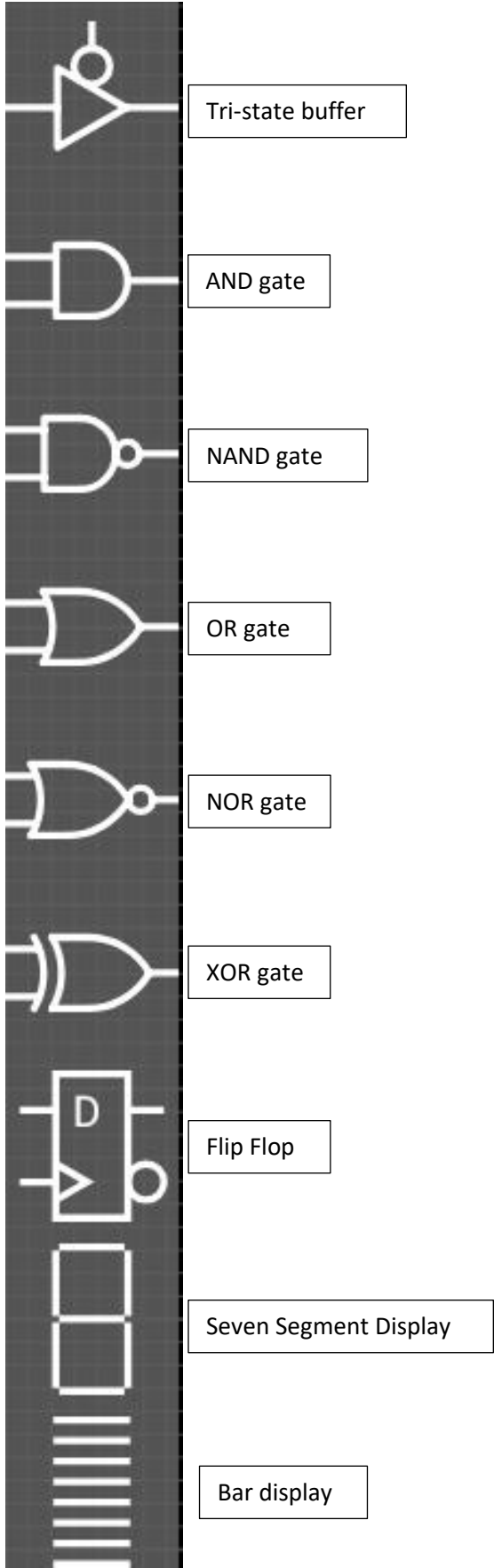
Single pole double throw switch

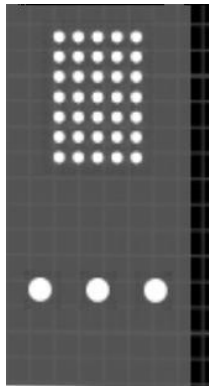
Push button switch

Relay

Variable resistor, also called a potentiometer







Dot-matrix display

Additional components, including:

Accelerometer

Buzzer

Drawing Frame

Memory

Microphone

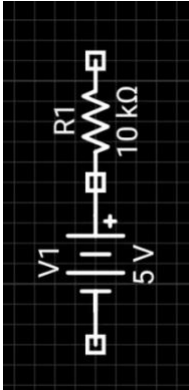
Serial port

Solar Cell

Speaker

Wires:

Components are connected to one another and to labels by wires. Although this sounds obvious, it is prudent to point out that wires **MUST** be drawn. Two components, with their leads sitting on top of one another, are **NOT** connected. Two components whose leads have a wire drawn between them **ARE** connected. See the examples below:



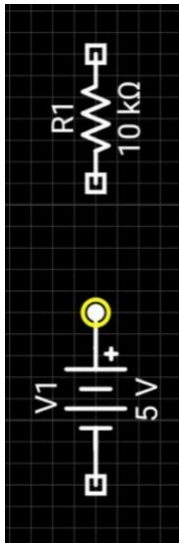
These components are not connected, even though their leads are touching.



These components ARE connected. Note the green wire between them.

Making Wires

Making wires between two components is relatively easy, although it might require you to zoom in the tablet's screen. First touch a lead on the first component. The lead will glow with a yellow dot, as shown on the 5V battery below:

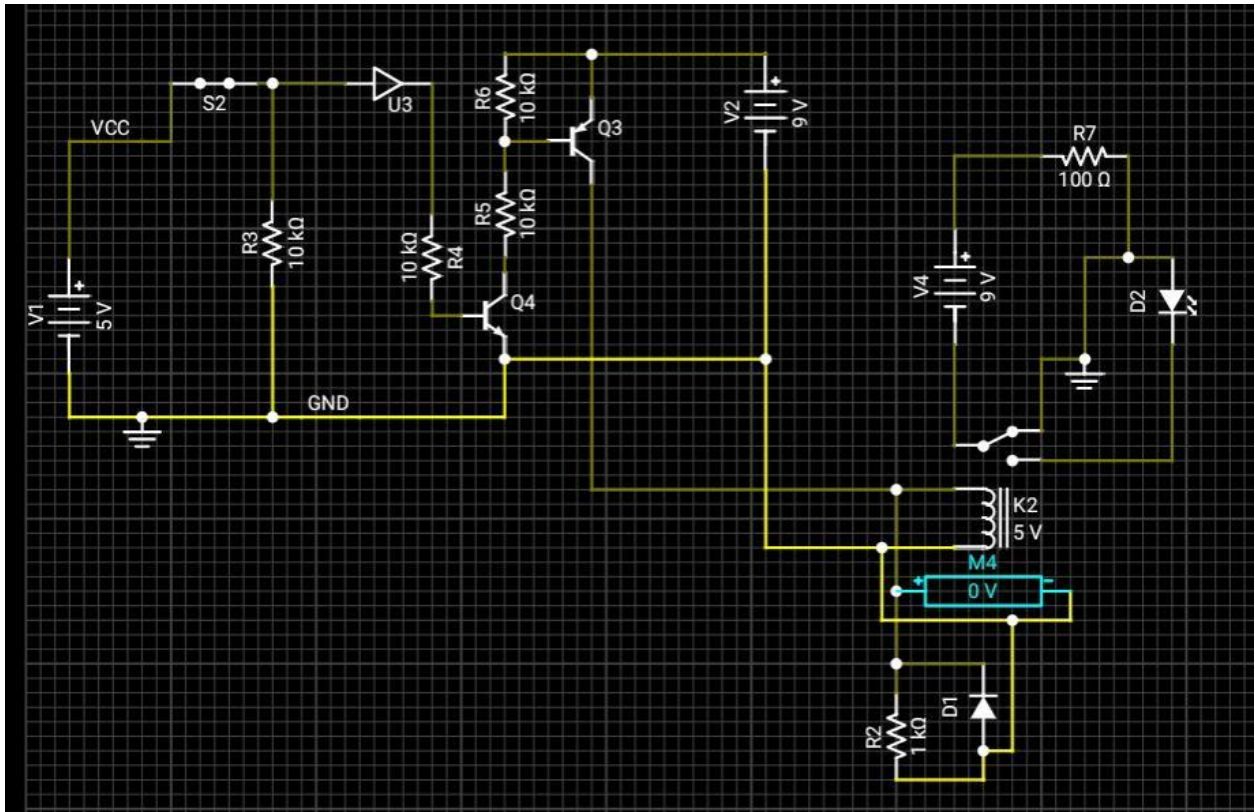


To make a wire between 2 components, first touch a lead on one component.

To complete the wire, touch a lead on the second component.

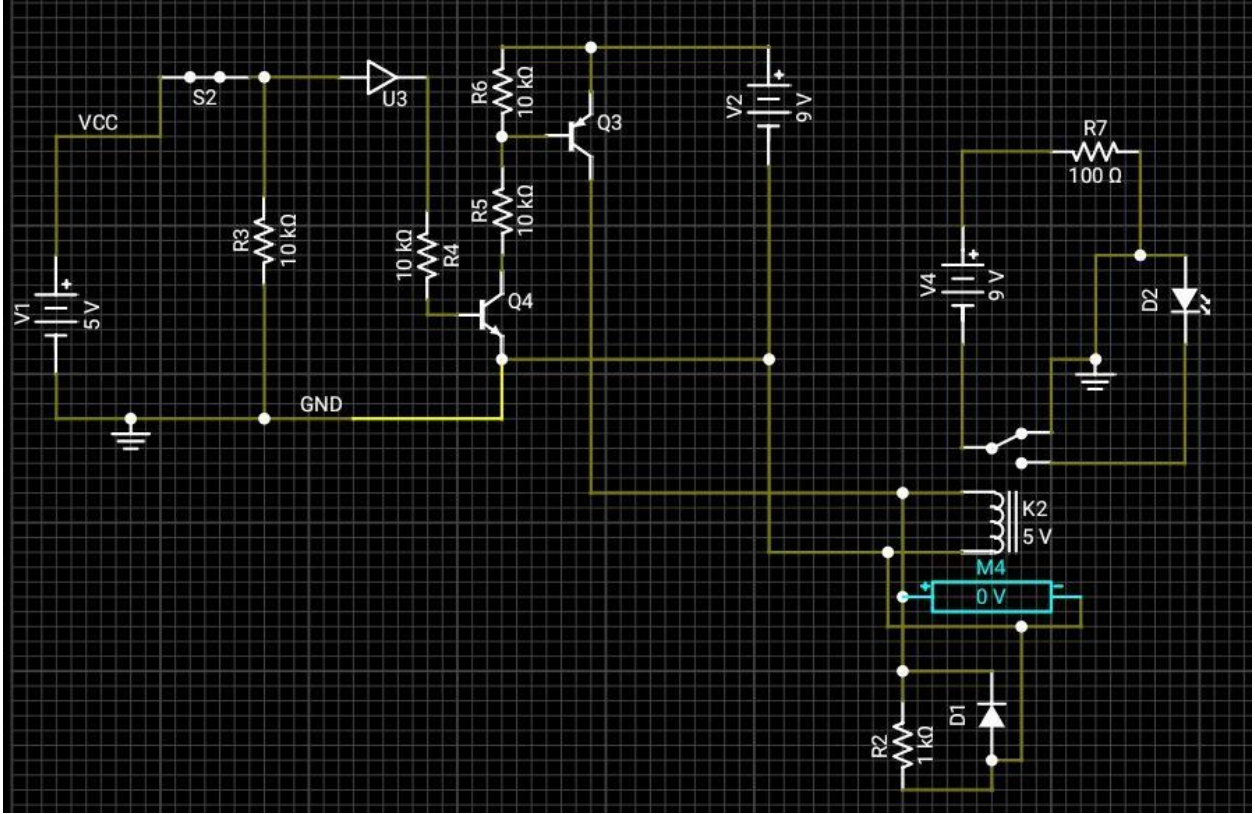
Deleting wires:

There are two ways to delete a wire. The first way will delete a WHOLE RAIL of wire. The second will only delete the wire in question. To delete a wire, touch the wire to be deleted. The wire, or in a complicated circuit, the whole rail, will be highlighted. See below:



By touching anywhere on the grounding wire, the entire GROUND RAIL will be highlit.

If the entire ground rail is highlit, and the user presses the trash can delete button, the whole rail will be deleted. However, if the user touches one segment of the highlit ground rail, the result will be as below:



If the user touches a specific segment of the highlit ground rail, then only that segment will be highlit.

If only the desired section of the rail is highlit, then only the desired section will be deleted if the trash can delete button is pressed.

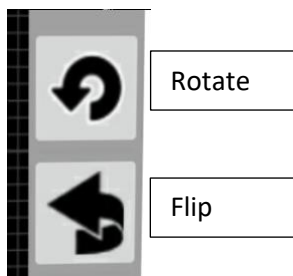
Section 3: Circuits in Circuit Safari

Placing Components

To put a component into the layout, touch the component in the components bar; it will turn yellow. Touch an area on the circuit board. The component will be placed there.

To move one or more components to a different area on the circuit board, touch the component(s) to yellow, and drag them across the board.

To rotate a component, touch it to yellow, and press the rotate button one or more times until the desired orientation is reached. There is also a flip button that will change the orientation of a component. The rotate and flip buttons are depicted below:

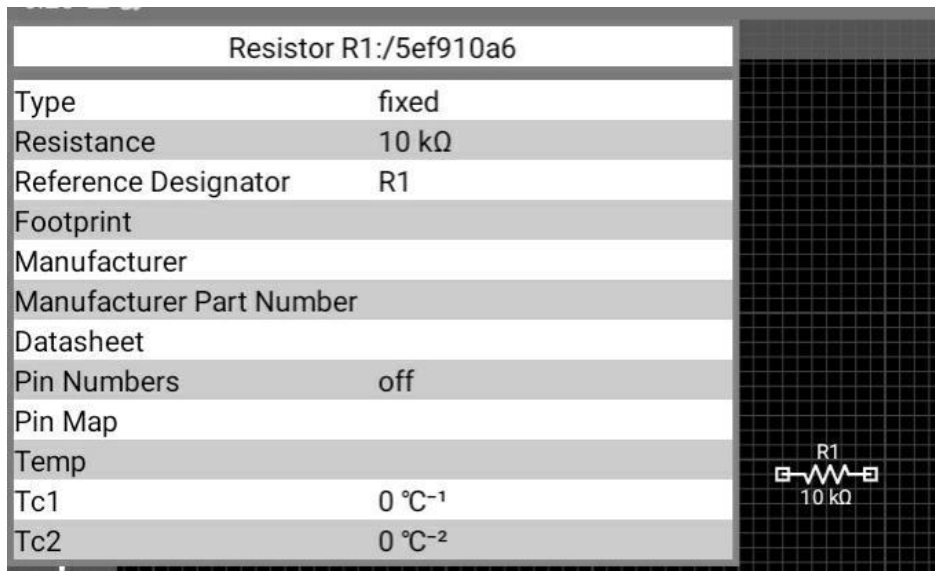


Rotate and flip buttons

Circuit Safari also has Select, Cut, Copy, and Paste functions for both components and for a collection of components. Long pressing on a component, or on a collection of components, brings up a context menu with Cut, Copy, and an ability to look up the component on Wikipedia.org. Also, long pressing on an unused portion of the circuit board brings up the paste function.

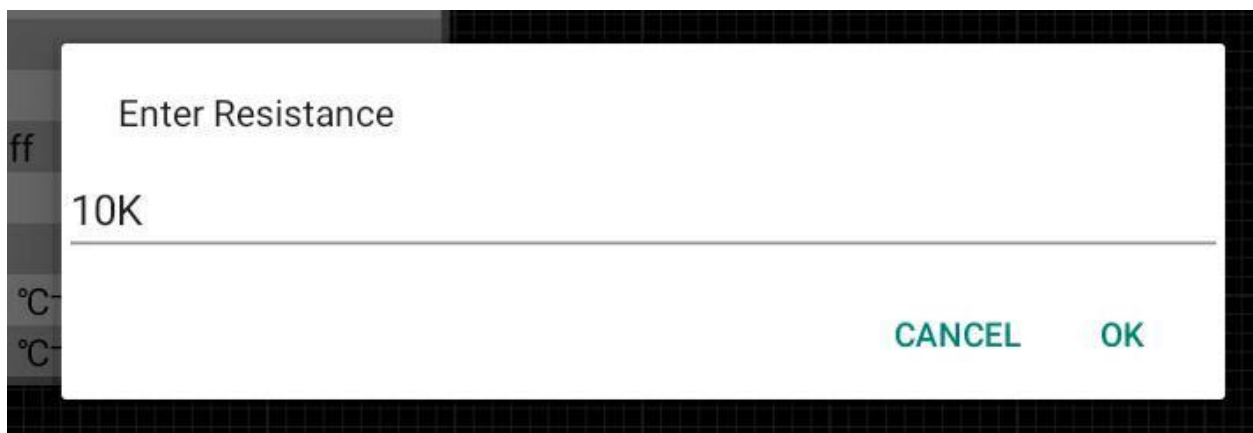
Editing a Component's Values

It will be necessary to edit the values of most components. For example, the ohms of a resistor, the henrys of an inductor, etc. must be set. To edit a component, double-touch it. A parameters box will open showing all of the editable parameters of the component. See below:



The parameters box for resistor R1.

To change the resistance value, for example, double tap the resistance line. A value entry box will open as below:



The value entry box for the resistance of R1

Enter the new value, such as 1000, 1K, 1M, 1000000, etc. Press OK.

Polarized Capacitors and Variable Capacitors

Looking at the component selector bar, there is only 1 capacitor available, and it is unpolarized. To place a polarized capacitor in the circuit, follow the steps below:

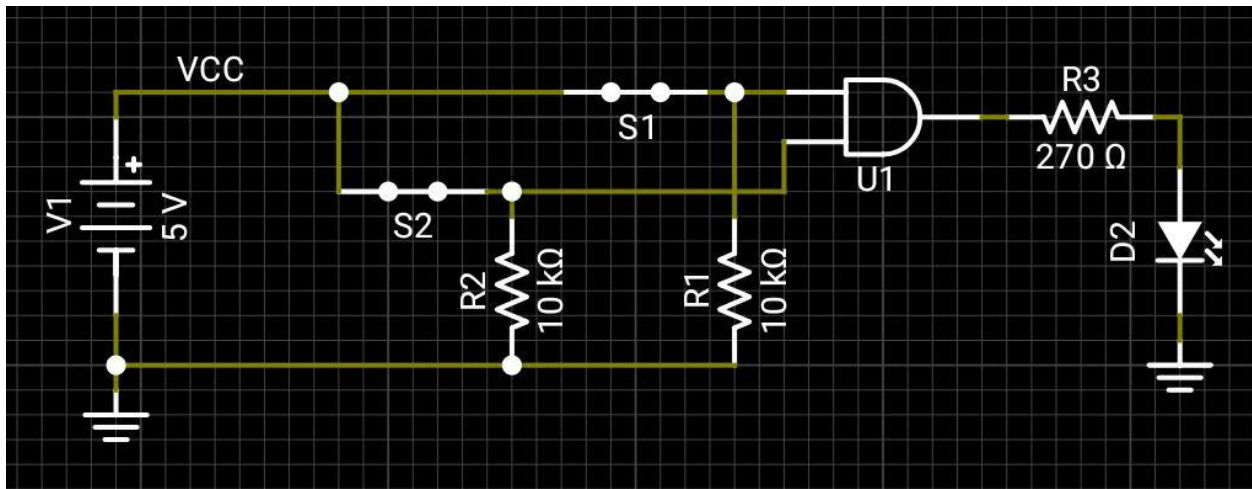
1. Touch the unpolarized capacitor in the components bar.
2. Touch the screen to place the capacitor
3. Double touch the capacitor to bring up its parameters box

4. Double touch on the "Type" row.
5. A popup menu will appear that allows selection of a standard , a polarized, or a variable type.
6. Select "Polarized"
7. Touch the screen to close the parameters box

Labels

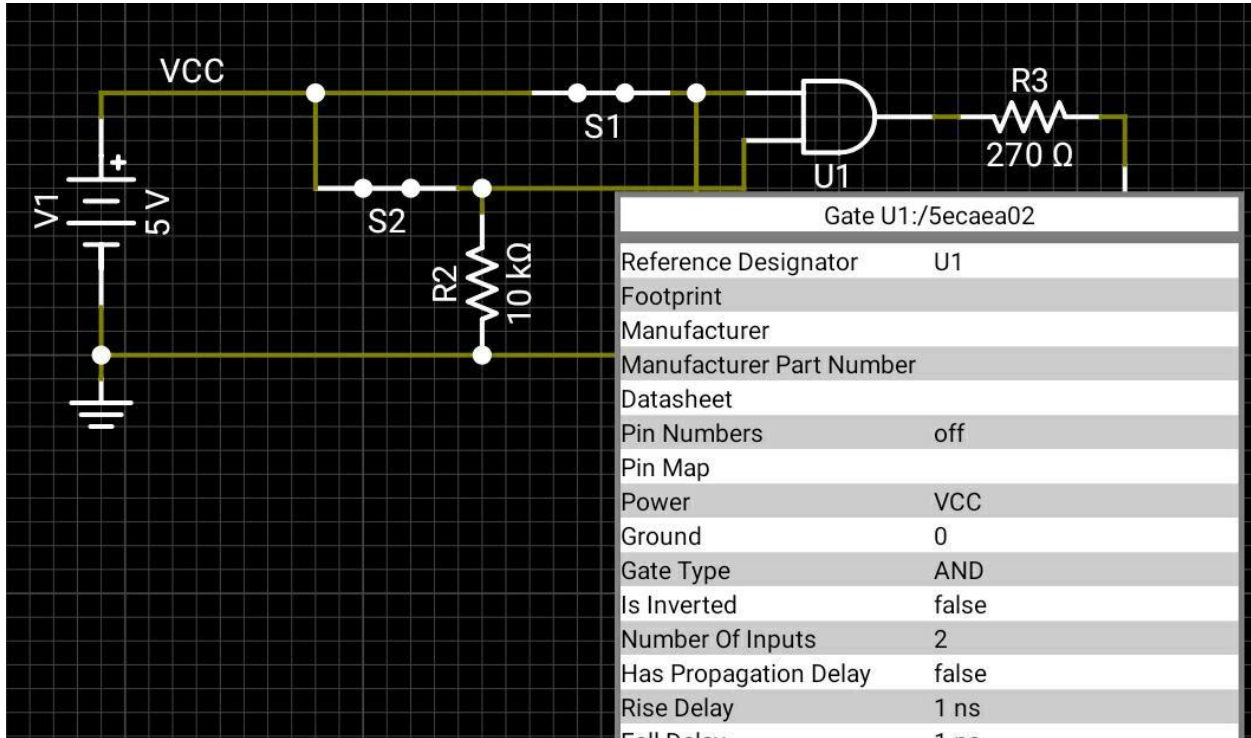
Labels are not just a way of labeling certain things, they actually create an unseen network of supply voltages, grounds, etc. For example, a label is used to create Vcc and GND for a logic gate. There are basically two ways to use labels. One is a situation where the label's wires are connected for other purposes, and the other situation is where the label is physically "out in space" but connected to the unseen network.

An example, taken right from Circuit Safari 's example library, shows the first situation below:



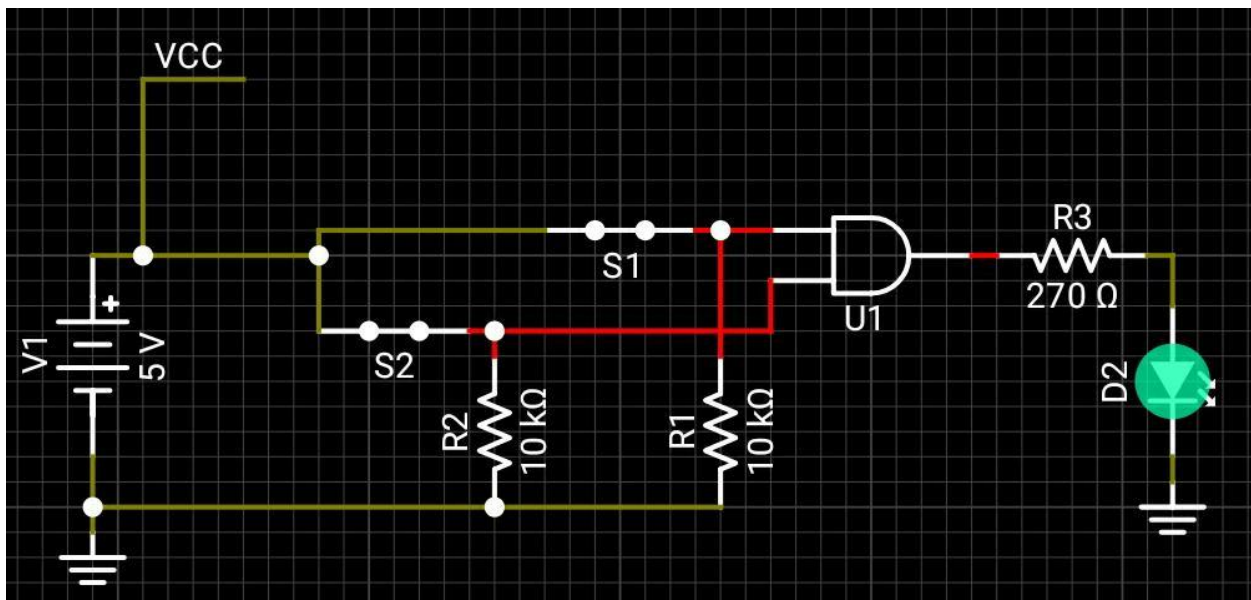
An example showing a Vcc label that is used both to power the AND gate and as an input signal to the same gate.

In the above example, there is only one way to see that the VCC label also powers the gate, and that is to double touch the component to look at the gate's parameters box. The depiction below shows that the power input to the AND gate is VCC and that the label is VCC:



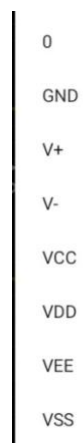
Note the AND gate power supply is VCC, and the label is VCC.

A situation where the label is "out in space" but connected to the unseen network is below:



An example where the VCC label appears to be "out in space" but is actually connected to the unseen net.

In order to set a label's name, double touch on it to bring up its parameters. One parameter will be "Net Name." Double touch the Net Name row to bring up a list of suggested values. The list will look like the below:



0
GND
V+
V-
VCC
VDD
VEE
VSS

The list of suggested Net Name values.

A name is selected, and the same name must be used in the parameters of the components such as the above AND gates.

Additional Net Names can be created. For example a 3.3 Volt net may be necessary for some circuits. The following steps can be followed:

1. Double touch the label to bring up its parameters box.
2. Long press the "Net Name" row.
3. A dialog box will open that allows a custom net name to be created.

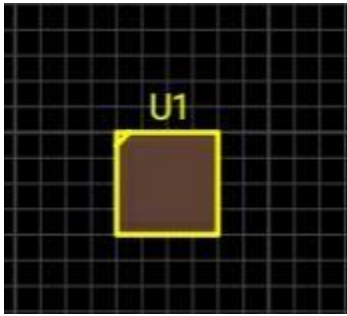
Inserting an Integrated Circuit

In Circuit Safari, integrated circuits (IC) generally refer to microchips other than logic gates. A library of ICs is stored as an array of sub-circuits. Inserting them into a circuit requires nothing more than knowing the name of the IC needed. This guide will walk through inserting a LM555 timer chip.

To insert a 555 timer, follow the steps below:

1. Touch the Integrated Circuit icon in the components bar
2. Touch the desired location in the circuit

Circuit Safari will place a component in the circuit. This component has no "values" assigned to it, but it will look like below:



An IC chip placed in a circuit

3. To make the chip into a 555 timer, double touch the chip to bring up its parameters box. It will look as below:

A screenshot of the Integrated Circuit parameters box. The box is titled "Subcircuit U1: /5eff9465" and contains a list of parameters. The parameters are: Reference Designator (U1), Footprint, Manufacturer, Manufacturer Part Number, Datasheet, Pin Numbers (on), Pin Map, Value, Is Recursive (false), File, Model Name (FOOBAR), Reverse Engineer (off), Unit (1), and Symbol (CircuitSafari:SUBCIRCUIT). The box is overlaid on a black grid background with a brown square representing the IC chip labeled U1.

Subcircuit U1: /5eff9465	
Reference Designator	U1
Footprint	
Manufacturer	
Manufacturer Part Number	
Datasheet	
Pin Numbers	on
Pin Map	
Value	
Is Recursive	false
File	
Model Name	FOOBAR
Reverse Engineer	off
Unit	1
Symbol	CircuitSafari:SUBCIRCUIT

The Integrated Circuit parameters box.

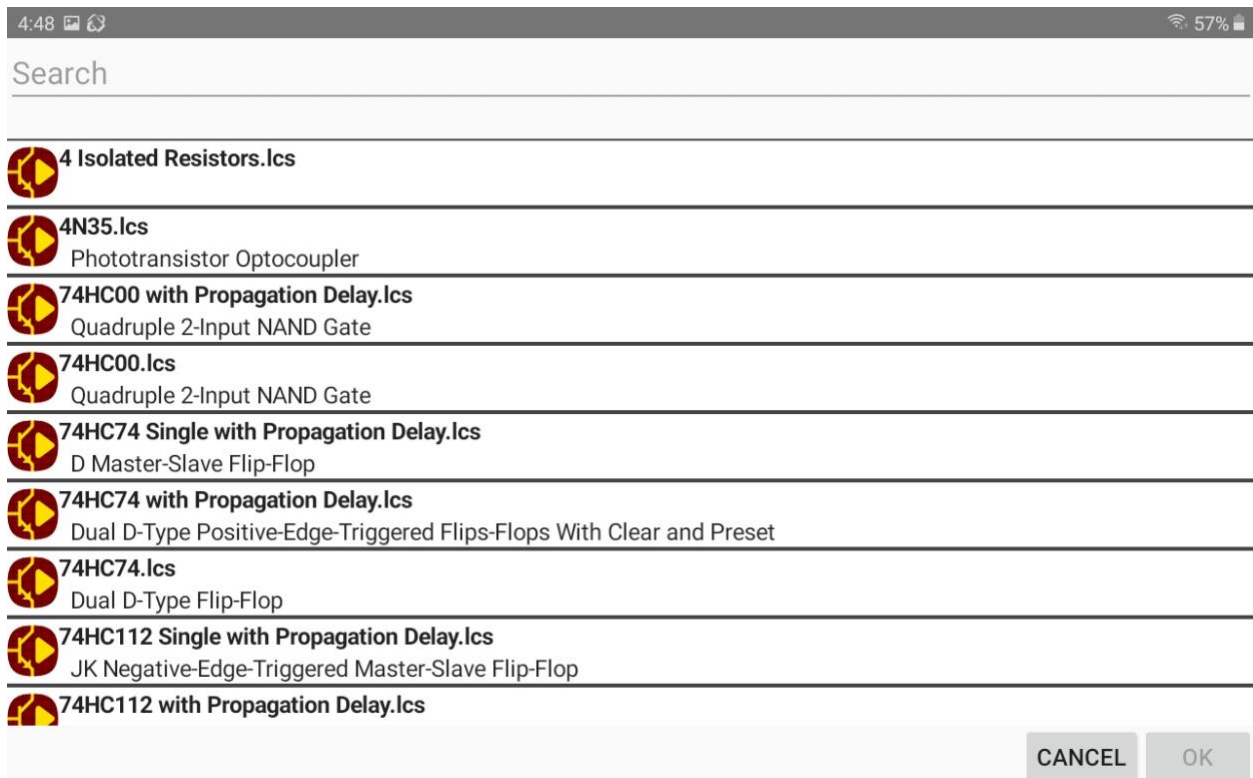
4. Double touch the "File" row.

5. Circuit Safari will bring up a menu as shown below:



6. For the purpose of placing a 555 timer, touch on “Examples.”

7. A library of available sub-circuits will open as shown below:



The library of available sub-circuits


8. Type 555 in the search bar at the top. Alternatively, the list can be scrolled down until LM555 is found.

9. Touch on LM555.lcs, then touch OK at the bottom right.

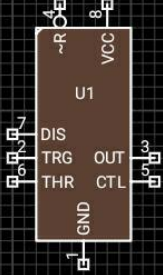
10. A 555 timer is now inserted into the circuit, as shown below:

4:53

Subcircuit U1:/5eff9465, Timer



Reference Designator	U1
Footprint	
Manufacturer	
Manufacturer Part Number	
Datasheet	
Pin Numbers	on
Pin Map	
Value	
Is Recursive	false
File	LM555.lcs
Unit	1
Symbol	CircuitSafari:SUBCIRCUIT



A 555 timer chip is now inserted into the circuit