About the layout / design of the

Transistor Multivibrator Experimentation Board

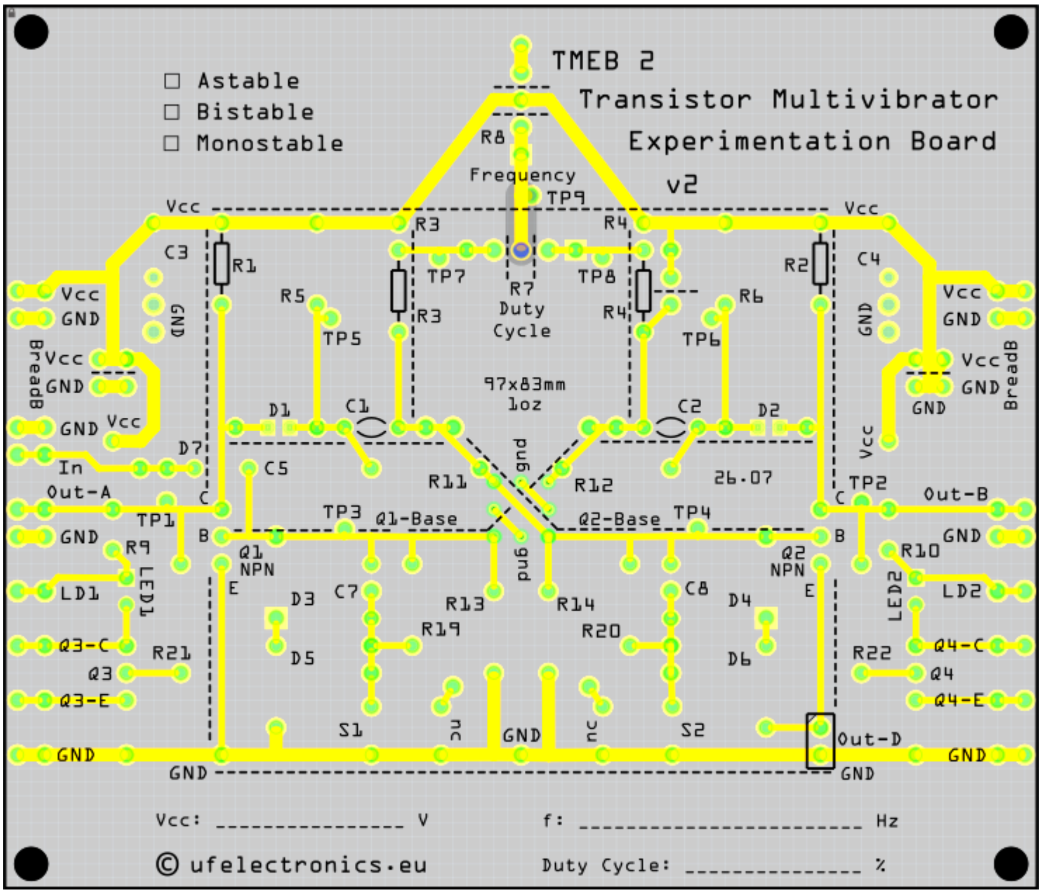
v2 - Multivibrator_v2_2026.07.29-1500

Document Rev. 2 - 2026.08.05-2220

https://ufelectronics.eu/product/transistor-multivibrator-experimentation-board-v2/

Version 2 of the PCB includes:

- Breadboard-friendly input and output pin header footprints, Vcc and ground included
- Less visual clutter for beginners
- Improved labeling
- Various test points
- Transistor driver for LEDs on the outputs



Foreword

The Transistor Multivibrator Experimentation Board is designed as an educational platform for building, experimenting with, and understanding the three classical transistor multivibrator circuits:

- Astable
- Bistable
- Monostable

Rather than providing one fixed circuit, the board allows many different circuit variations to be assembled and modified while observing their behaviour.

Overall Concept

This board is intended as a reusable experimentation platform for transistor multivibrators. Instead of repeatedly building circuits on a breadboard, users can quickly assemble, modify, and compare different multivibrator configurations while keeping a clear overview of the circuit.

Educational Design Philosophy

The footprints, routing, and component placement have been optimized to encourage experimentation, easy probing, and circuit modification while still maintaining good analog performance, rather than optimizing the PCB for one fixed application.

The board encourages learning by observation. Test points, visible routing, and semi-schematic component placement allow users to relate the electrical schematic directly to the physical circuit.

Overall Layout

The components are placed semi-schematic to make the mental shift between schematic and PCB as easy as possible; Helping users relate schematics to their physical implementation.

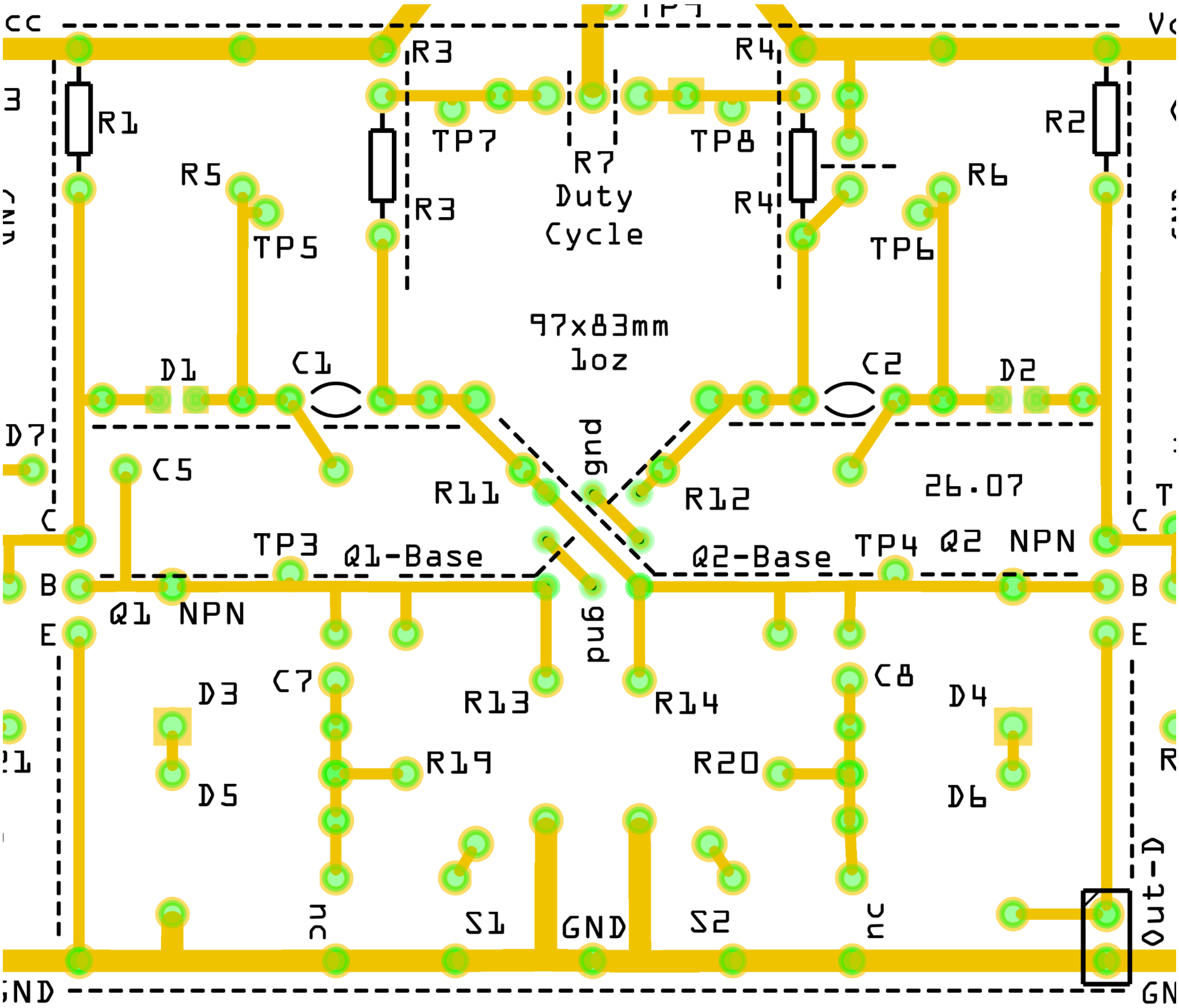
Through-hole PCBs normally place most traces on the solder side. On this board, however, the traces are intentionally routed on the component side so they remain visible during experiments.

The opposite side of the trace side, in this case the bottom side, is a full ground plane.

No ground plane is used on the top layer because the visible traces help users understand how the circuit is interconnected. A purple solder mask was intentionally selected because it provides good visual contrast with the copper traces, making them easier to follow during experiments.

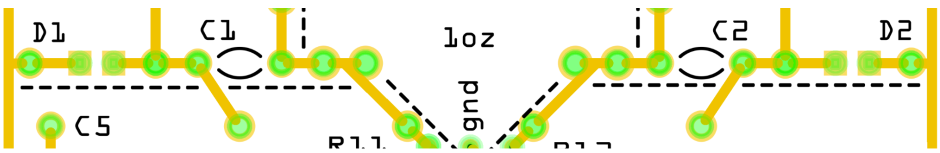
The Basic Main Circuit

The basic main circuit is marked by dashed lines and components symbols.

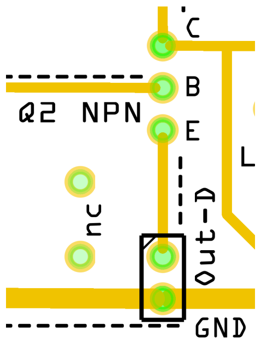


What to short-circuit straight ahead

1st Mandatory Note - D1, D2 - **READ IT OR FAIL !**



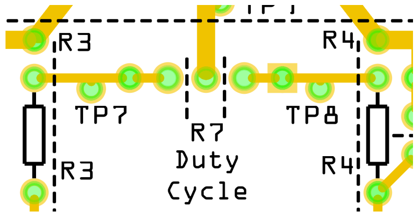
D1 and D2 are only used for advanced circuits, and should initially be short-circuited. Optionally you can put a solder-blob over the SMD footprint. - More about D1 and D2 later.



2nd Mandatory Note - Out-D - **READ IT OR FAIL !**

In the lower right corner, you can find the jumper Out-D. This too is for advanced circuits, and should initially be short-circuited by a jumper.

3rd Mandatory Note - R3, R4 - **READ IT OR FAIL !**



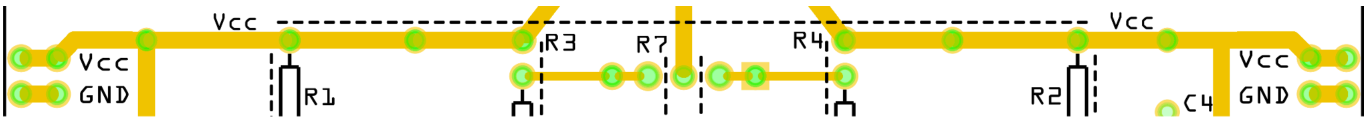
The upper leads of these components should initially be connected to Vcc directly, and ***not*** as shown on the silkscreen symbol to R7. - R7 and R8 (outside this image) are for advanced functionality. - More about them later.

What to ignore initially

Except for handling the previous footprints and labels, ignore the rest until it will be explained.

Power supply and lab equipment connectors

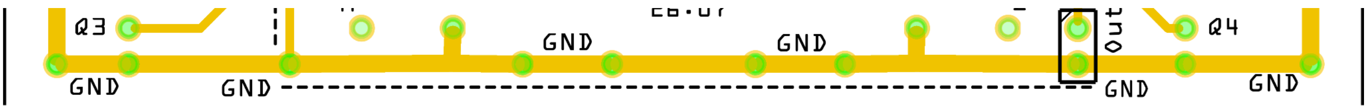
Vcc



There are Vcc and ground connectors at the left-top and right-top. These are in pairs, and sitting close for connecting a single two-pin pin header, preferably male, as these make it easy to connect lab probes also. There is an additional Vcc connector option a little separate from the top-left Vcc-ground pair, so that the Vcc from a lab power supply can be attached here, without getting too close to a ground pin.

The Vcc trace has three footprints for decoupling capacitors. Also an unmarked option for a small fourth one.

Ground



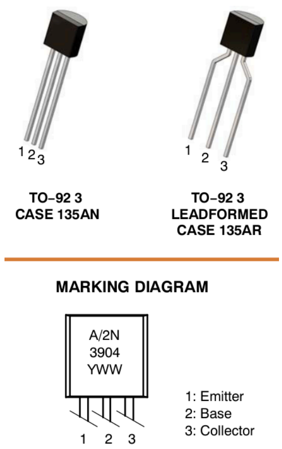
At the lower edge of the PCB you will find several options for ground connected male pin headers. As with the Vcc, you also need the possibility to connect various lab equipment to ground. Even more so for ground than for Vcc.

How to orient the transistors - 2N3904 - **READ IT OR FAIL !**

You can potentially use other transistors than 2N3904. 2N3904 have the pin-out you see to the right. If you use other transistors, you will have to find their datasheet, and read there how to orient them for the specific part you use.

If the transistors aren't mounted correctly, the circuit normally won't work as intended. It might even break the transistors entirely.

In the circuits in this document, the 2N3604 transistors have to have **the flat side with the labeling to the right**. And hence, **the curved side to the left**.

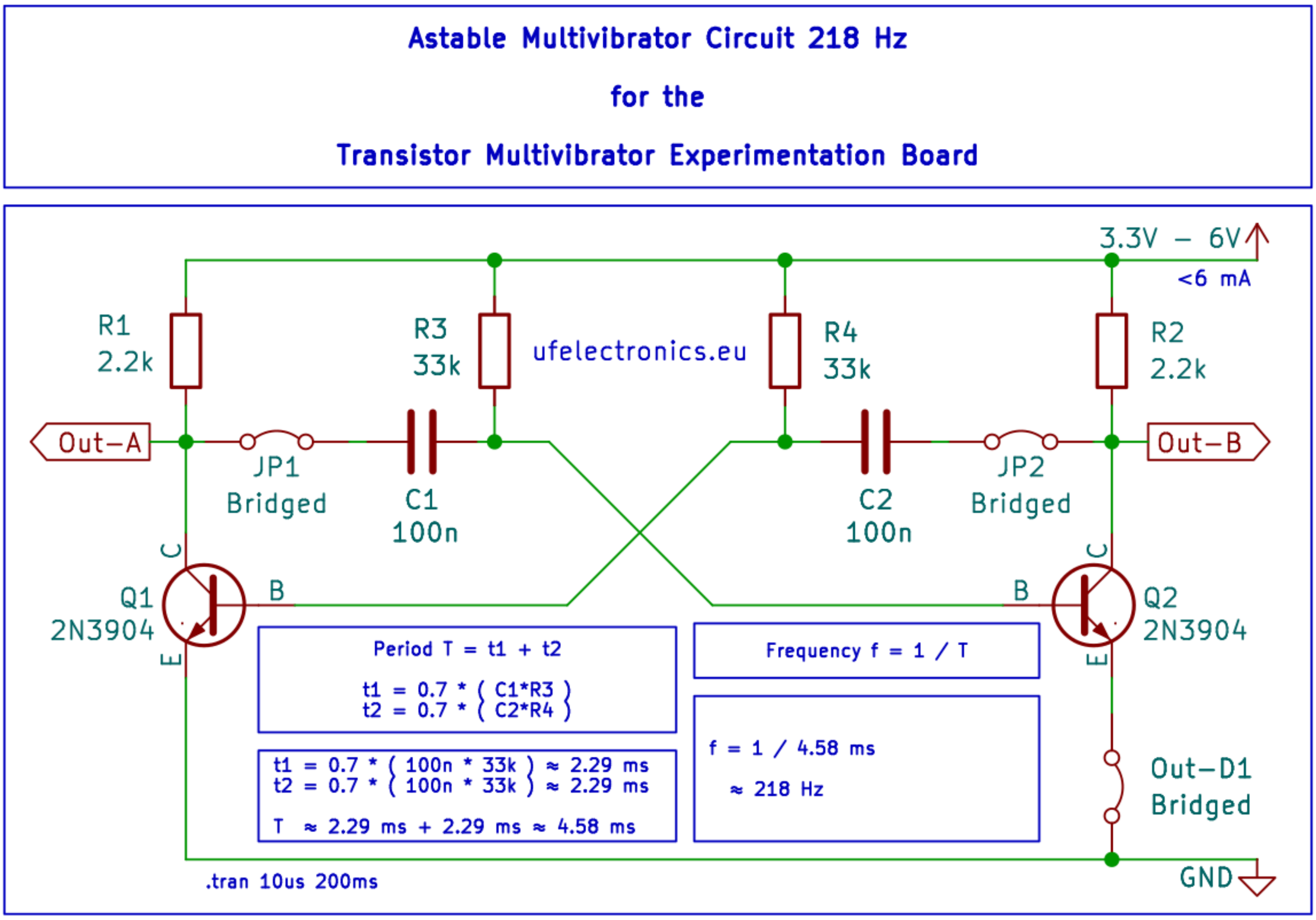


Simple Astable Multivibrator Circuit

An **Astable Multivibrator** is an electronic oscillator that continuously switches between two states without requiring any external trigger.

Because it has no stable state, it repeatedly turns one transistor on while the other turns off, creating a continuous square-wave output. The switching speed is mainly determined by the resistor and capacitor (RC) values in the circuit, allowing the oscillation frequency to be adjusted over a wide range.

Astable multivibrators are commonly used as clock generators, LED flashers, tone generators, and timing circuits. On this experimentation board, you can investigate how the capacitors charge and discharge, observe the alternating transistor operation on an oscilloscope, and see how changing the component values affects the frequency and duty cycle of the output signal.



Let's focus on the left part of the circuit only, for a beginning. In the following, never mind for now why the events happens. Just see it as it happens.

Initial Condition: Q1 is hard ON, Q2 is OFF

- The collector of Q1 is pulled down to approximately 0 V.
- The collector of Q2 is pulled up to approximately Vcc.
- C1 is charged to approximately Vcc.
- The left side of C1 is approximately 0 V and the right side is approximately Vcc.
- Therefore, C1 has a voltage across it approximately equal to Vcc.

This capacitor charge is crucial, because when Q1's collector later starts rising, the voltage across C1 cannot change instantaneously, so the voltage on the right side must rise by approximately the same amount. That is the mechanism that helps trigger the next switching event.

1st Event: Q1 begins to turn OFF

- Q1 stops conducting collector current. - It stops pulling the collector to 0V.
- R1 therefore pulls the collector of Q1 upward toward Vcc.
- The voltage on the left side of C1 rises together with the collector voltage.

At this instant, C1 is still charged to approximately Vcc. - ***A capacitor cannot change its voltage instantaneously***, so as the voltage on the left side rises, the voltage on the right side must rise by approximately the same amount.

- As a result, the base voltage of Q2 rises and Q2 begins to turn ON. Current starts flowing through Q2.

A more tangible example:
Imagine the left side of C1 is initially 0 V and the right side is 2 V. The voltage across C1 is therefore 2 V.

If the left side suddenly rises to 1 V, the capacitor initially maintains its 2 V voltage. Therefore, the right side also rises by 1 V and becomes 3 V.

This effect lies close to what is called a charge pump. More about a charge pump another day.

2nd Event: Q2 turns ON

- Current starts flowing through Q2.
- The collector voltage of Q2 begins to fall.
- The falling collector voltage is coupled through C2 to the base of Q1.

Since C2 cannot change its voltage instantaneously, the voltage at the base of Q1 is pulled downward.

This reduces the base current in Q1.

At this point, Q1 turning OFF causes Q2 to turn ON, and Q2 turning ON causes Q1 to turn OFF even more. The two transistors therefore reinforce each other's state changes.

3rd Event: Positive Feedback Takes Over

The reduction in Q1 base current causes Q1 to turn OFF even harder.

As Q1 turns OFF harder:

- Its collector rises further.
- C1 drives the base of Q2 even higher.
- Q2 turns ON even harder.

At the same time:

- Q2's collector falls further.
- C2 pulls Q1's base even lower.
- Q1 turns OFF even harder.

This regenerative process happens very quickly and forces the circuit into its new state:

- Q1 OFF
- Q2 ON

The RC networks create the **delay**, but the actual switching occurs because of **positive feedback** between the two transistors.

Why does Q1 begin to turn OFF in the first place?

Until now, we deliberately ignored why the first event occurs.

Let's return to the **Initial Condition**:

- Q1 is ON.
- Q2 is OFF.
- Q1's collector is approximately 0 V.
- Q2's collector is approximately Vcc.

At this moment, the timing network consisting of **R4 and C2** is already at work.

Initial State of C2

Since Q2 is OFF:

- The collector of Q2 is approximately Vcc.
- The left side of C2 is therefore approximately Vcc.
- The base of Q1 is approximately 0.7 V because Q1 is ON.

Therefore:

- The voltage across C2 is approximately:

    Vcc - 0.7V

In other words, C2 stores energy and has a substantial voltage across it.

1st Timing Event: R4 Begins to Recharge C2

R4 is connected between Vcc and the base of Q1.

As time passes:

- Current flows through R4.
- This gradually changes the charge stored in C2.
- The voltage at the base of Q1 slowly changes.

This process is much slower than the switching action because it depends on the RC time constant:

$$\tau = R4 \times C2$$

(τ is the Greek letter *tau*. Engineers use it to represent the *time constant*. The time constant is a measure of how fast a capacitor charges or discharges. A large τ means "slow", while a small τ means "fast". In an RC circuit, τ is found by multiplying the resistance (R) by the capacitance (C).)

For this circuit:

$$\tau = 33\ \text{k}\Omega \times 100\ \text{nF}$$

$$= 3.3\ \text{ms}$$

approximately.

2nd Timing Event: Q1 Receives Less and Less Base Drive

As C2 continues to recharge:

- The base current available to Q1 slowly decreases.
- Q1 remains ON for a while.
- However, Q1 is no longer held ON quite as strongly as before.

Nothing dramatic happens yet.

The collector of Q1 is still near 0 V.

The collector of Q2 is still near Vcc.

To an outside observer, it looks as though the circuit is doing absolutely nothing.

3rd Timing Event: Q1 Reaches the Tipping Point

Eventually:

- The base current becomes just a little too small.
- Q1 begins leaving saturation.
- The collector voltage of Q1 starts to rise.

This rise may initially be only a few millivolts. - However, that is enough.

Why? - Because the switching mechanism described earlier now takes over.

4th Timing Event: The Switching Sequence Begins

As soon as Q1's collector starts rising:

- C1 transfers the rise to the base of Q2.
- Q2 begins turning ON.
- Q2's collector falls.
- C2 pulls Q1's base downward.
- Positive feedback takes over.

The entire switching sequence described previously now happens very rapidly.

Summary

The circuit operates in two distinct phases:

Slow Phase (Timing)

- R4 and C2 slowly change the voltage conditions around the base of Q1.
- This process determines how long Q1 remains ON.
- Most of the oscillation period is spent here.

Fast Phase (Switching)

- Q1 begins to turn OFF.
- C1 and C2 couple the change to the opposite transistor.
- Positive feedback rapidly forces the circuit into the opposite state:
  - Q1 OFF
  - Q2 ON.

A useful mental model is:

> R4-C2 loads the spring. Positive feedback pulls the trigger.

Improving the Switching Edges - D1, D2, R5, R6

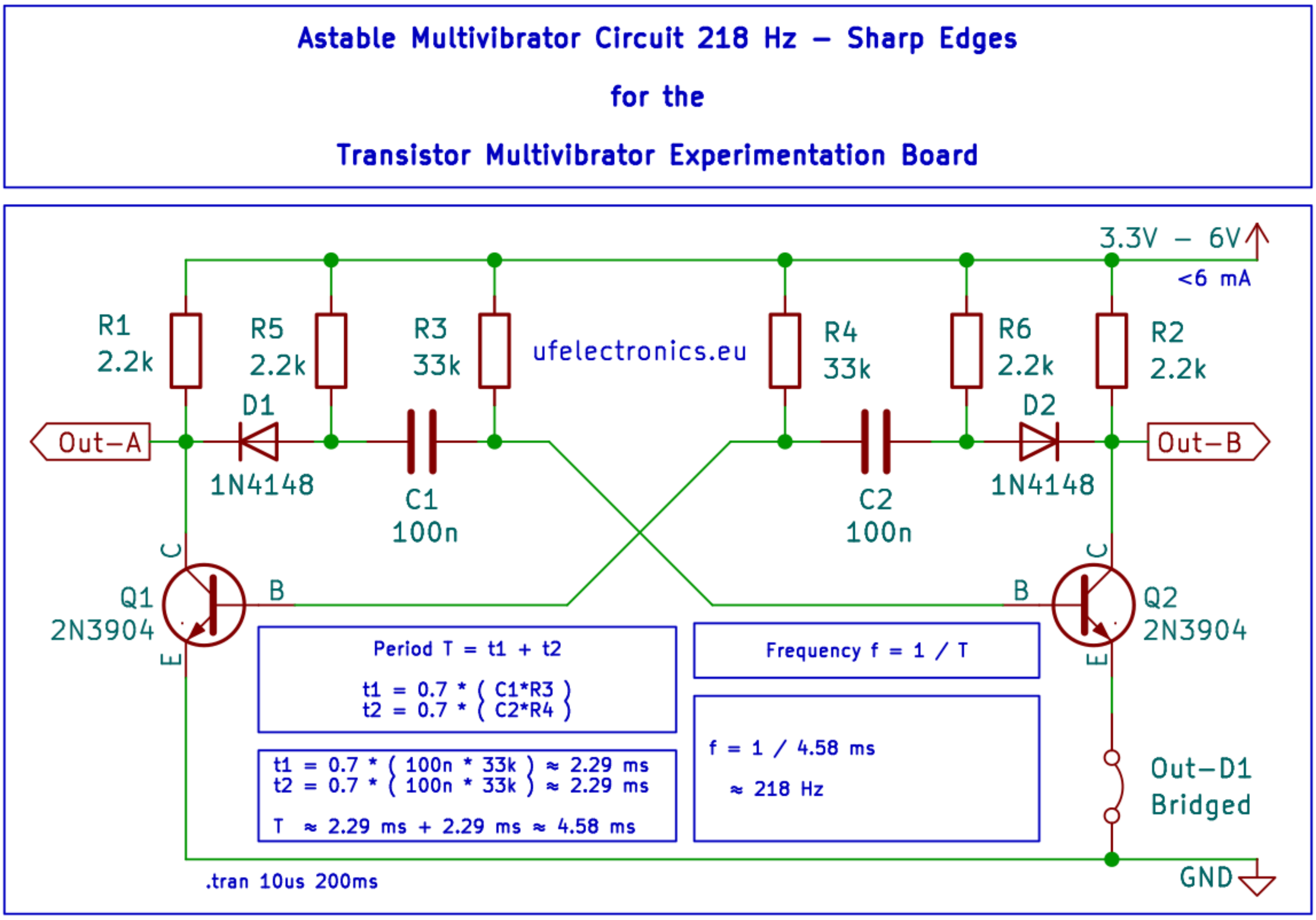
A drawback of the basic astable multivibrator is that the timing capacitors are connected directly to the collector nodes. As a transistor turns OFF and its collector voltage rises, part of the current supplied through the collector resistor is used to charge the timing capacitor.

As a result, the collector voltage does not jump immediately from LOW to HIGH. Instead, the voltage rises with a noticeable curve.

This effect can be observed in the basic 218 Hz astable multivibrator circuit.

The rounded voltage transition is usually not a problem for simple blinking or educational applications. However, when a waveform closer to an ideal square wave is desired, the circuit can be improved by adding two diodes, D1 and D2, and two additional resistors, R5 and R6.

The Improved Schematic



The Idea Behind the Improvement

The purpose of D1 and D2, in the improved schematic, is to separate the collector nodes from the capacitor charging currents during part of the oscillation cycle.

Consider the right-hand side of the circuit. When Q2 turns OFF, the collector voltage rises rapidly. As the collector voltage rises, D2 becomes reverse-biased and effectively disconnects the collector node from the charging path of C2.

Because C2 is no longer charged through the collector resistor R2, the collector of Q2 can rise much more quickly toward VCC.

Instead, C2 receives its charging current through R6.

The same mechanism occurs on the left-hand side:

- D1 isolates the collector of Q1 during its OFF period.
- R5 supplies the charging current for C1.
- The collector voltage therefore rises more rapidly.

Why the Edges Become Sharper

In the original circuit, a collector resistor serves two purposes:

1. Pulling the collector voltage toward VCC.
2. Charging the timing capacitor.

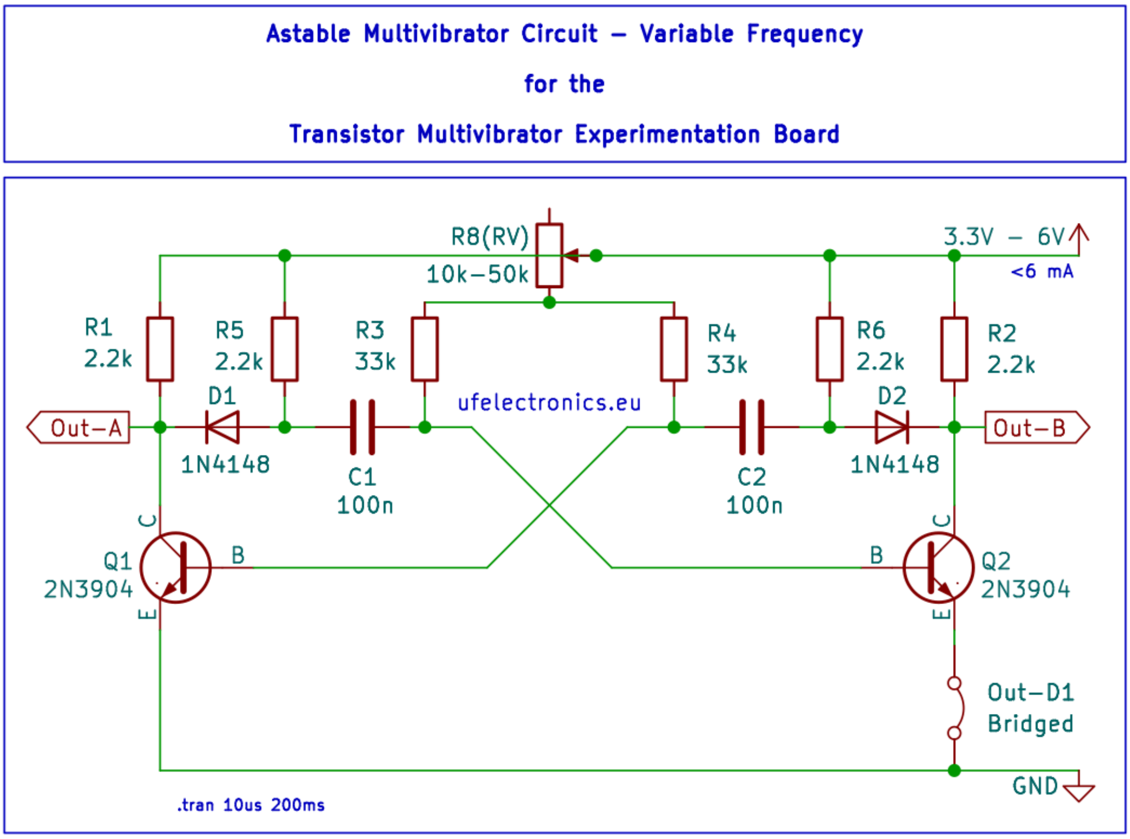
These two tasks compete for current.

In the improved circuit, the extra resistor-diode network separates the two functions:

- R1 and R2 mainly establish the collector voltage.
- R5 and R6 mainly charge the timing capacitors.
- D1 and D2 steer the current so that the capacitor charging current does not significantly load the collector transition.

The result is steeper rising edges and a waveform that more closely resembles an ideal square wave.

Variable Frequency - R8

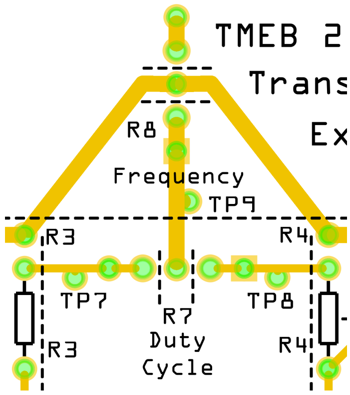


To enable frequency adjustment, the upper ends of R3 and R4 are disconnected from Vcc and connected to R8 via R7. - R7 must therefore be bridged.

Potentiometer R8 is used as a variable resistor in series with both R3 and R4. As the resistance of R8 is increased, the charging paths for C1 and C2 become more resistive, causing the capacitors to charge more slowly.

Since the oscillation frequency is determined by the charging and discharging of C1 and C2, increasing R8 reduces the frequency, while decreasing R8 increases the frequency.

Because R8 affects both timing networks equally, the circuit remains symmetrical. The mark-to- space ratio therefore stays approximately the same while the frequency is adjusted.

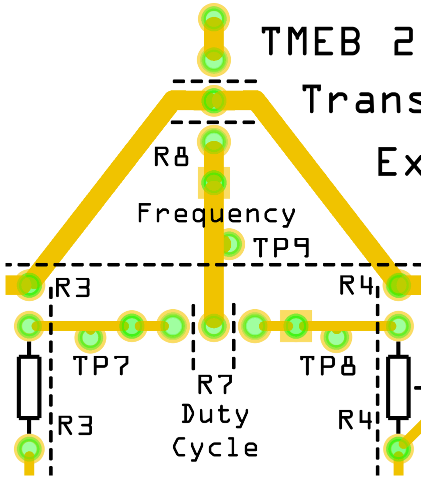


R8 effectively adds resistance to both timing resistors, R3 and R4. The timing equations therefore become approximately:

$t1 \approx 0.7 \times C1 \times (R3 + R8)$ and $t2 \approx 0.7 \times C2 \times (R4 + R8)$

Because the same amount of resistance is added to both sides of the multivibrator, the two timing periods change together, preserving the duty cycle.

Variable Duty Cycle - R7



The following schematic shows how a potentiometer at R7 can be used to introduce a degree of duty-cycle adjustment. - Note that R8 must be bridged. And R3 and R4 should connect just left and right of the potentiometer / trimpot.

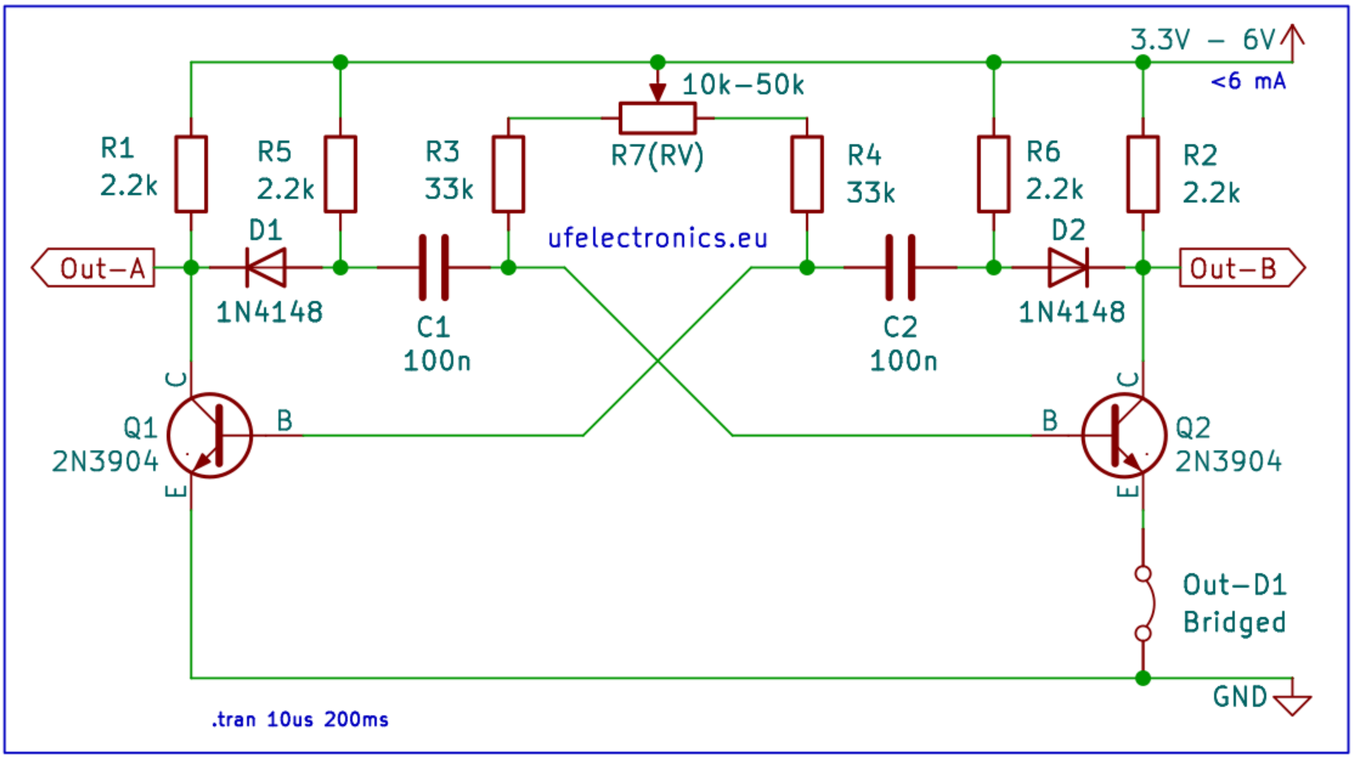
In the standard circuit, the left and right timing networks are identical, resulting in an approximately 50% duty cycle. By introducing potentiometer R8 into the timing network, the charging conditions of C1 and C2 can be altered unequally.

This causes one transistor to remain ON for longer than the other, changing the duty cycle (mark-to-space ratio) of the output waveform. The frequency may also change slightly, but the primary effect is a change in the relative ON and OFF times.

Astable Multivibrator Circuit – Variable Duty Cycle

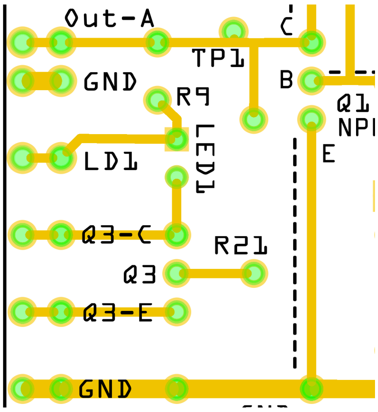
for the

Transistor Multivibrator Experimentation Board



- Guess what happens if you combine R7 and R8 into one circuit ... - Try it out !

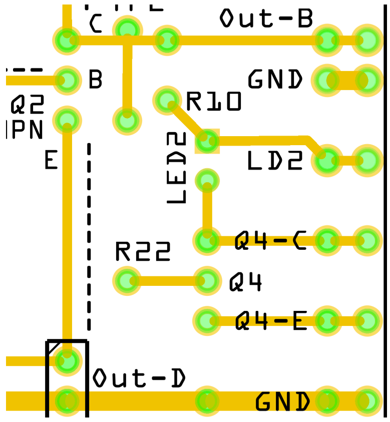
Output



Out-A, Out-B

To the left, you have Out-A, and to the right, Out-B.

Both reflect the collector voltage of Q1 and Q2 at any given time.



Blinky LEDs - LED1, LED2, R9, R10

From both Out-A and Out-B is there an option for a resistor, R9 and R10 and a LED - LED1 and LED2 - down to ground / 0V. - Taking the supply for the LEDs from the output, you must in this case short-circuit Q3 from Q3-C to GND and Q4 from Q4-C to GND (ground). - Another option, using Q3 and Q4 actively, is in the next section "Transistor Power Output - Q3, Q4, R21, R22".

Calculating the LED resistor

Start by noticing that an LED has a voltage drop across itself. This means that not all of the supply voltage appears across the resistor. The forward voltage depends mainly on the colour (and therefore the semiconductor material) of the LED. - Typical values are:

- Infrared: 1.2 - 1.5 V
- Red: 1.8 - 2.2 V
- Orange: 2.0 - 2.2 V
- Yellow: 2.0 - 2.4 V
- Green (traditional): 2.0 - 2.4 V
- Green (modern high-brightness): 2.8 - 3.4 V
- Blue: 2.8 - 3.5 V
- White: 2.8 - 3.5 V
- UV (near-ultraviolet): 3.2 - 4.0 V

A normal LED should receive around 5 - 15 mA (0.005 - 0.015 A). If we want to determine the needed resistance only to let maximal 15 mA through, we would use the following equation:

$$R = (Vcc - V\_LED) / I\_LED$$

This means;

Resistance equals (Voltage supply minus voltage drop over the LED) divided by Ampere.

For example, with a 9 V supply, a red LED (2.0 V) and a desired current of 15 mA:

$$R = (9\ V - 2\ V) / 0.015\ A = 7\ V / 0.015\ A \approx 467\ \Omega$$

The nearest standard values are 510 Ω or 470 Ω. - (Ω is the Greek letter for Ohm, and denotes resistance).

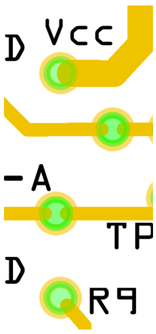
- So if you have a 5V power supply, you will need a resistor around: (5 V - 2V) / 0.015 A = 200 Ohm resistor. => Closest standard values are 220 and 200 Ohm.

- So if you have a 12V power supply, you will need a resistor around: (12 V - 2 V) / 0.015 A = 667 Ohm resistor. => Closest standard value is 680 Ohm.

At the given voltages, if you make the resistor smaller, more current will run through the LED. And, if the LED gets too much current, it will break and never work again.

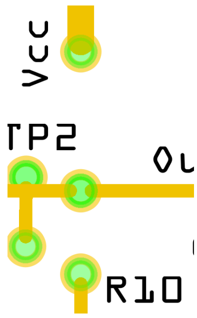
Transistor Power Output - Q3, Q4, R21, R22

Q3 and Q4 provide the option for advanced output handling. First of all, transistors at these footprints can manipulate higher current (mA) than you can draw directly from the multivibrator circuit without disturbing its functionality. Instead of a few mA, Q3 and Q4 could draw up to 100 mA, depending on the transistor used. This is possible as Q3 and Q4 can be supplied by Vcc directly, circumventing the multivibrator circuit. - This is for advanced users, knowing what they do.



Instead of taking the supply from Out-A, you will slight more 'north' find a Vcc footprint. The same counts at Out-B. - The 'southern' leads of the resistors R9 and R10 are shown and marked.

The resistors R9 and R10 determine how much current will be able to arrive at Q3 and Q4. Both resistors could be a short-circuit as a wire, if needed.

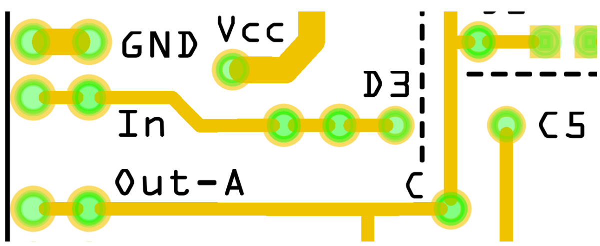


Out-D

Unless you know how to use this, short-circuit it with a jumper or a solder blob straight from the beginning. Most builds won't work unless there is a short here.

- If it is the first time you read this about Out-D, then you have missed to read the most important section of the document: "What to short-circuit straight ahead". - See the index for where to find it.

Input - In, C5, D3 - S1, S2



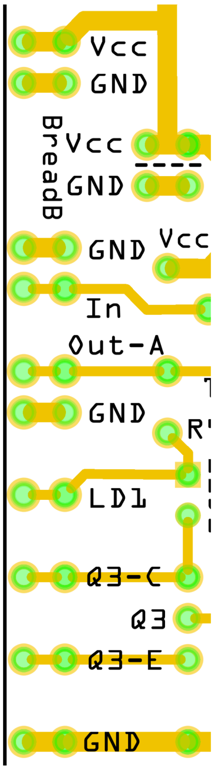
In, C5, D3

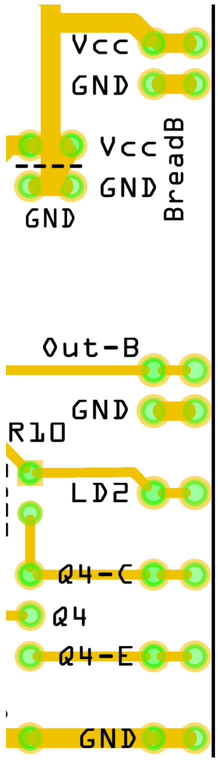
For the case that you want to induce external influence on the base of Q1, is there a footprint here marked 'In' for doing so. This signal can be coupled via the capacitor C5, going to D3. This capacitor share the same footprint with D3, and would hence substitute the use of D3.

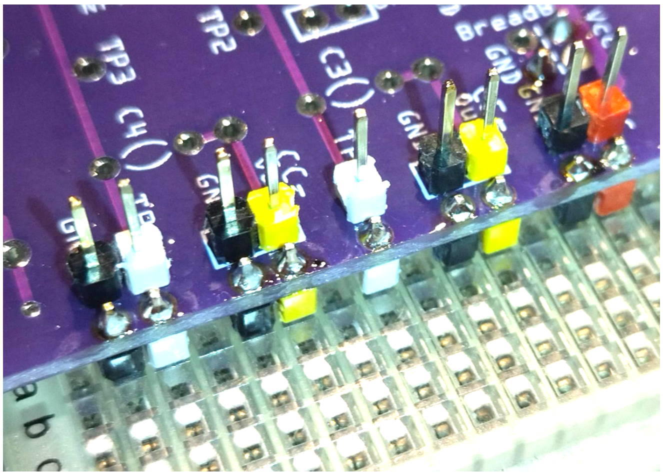
Some schematic call for a diode here. Hence the marking D3. This would substitute the capacitor C5, as they share footprint.

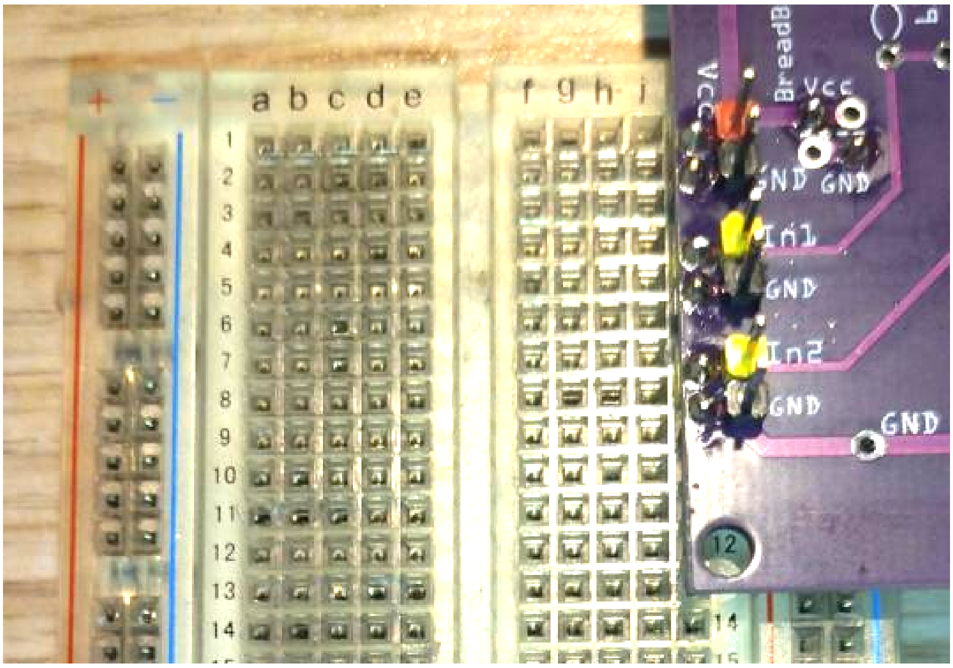
Breadboard Connectors

To be able to integrate the PCB into other experiments, both the left and right side of it facilitates the option for downwards male pin headers as shown in the following images (with another PCB design).

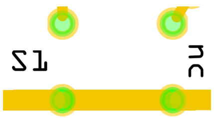




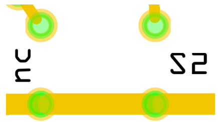




Triggered Bistable Multivibrator - S1, S2



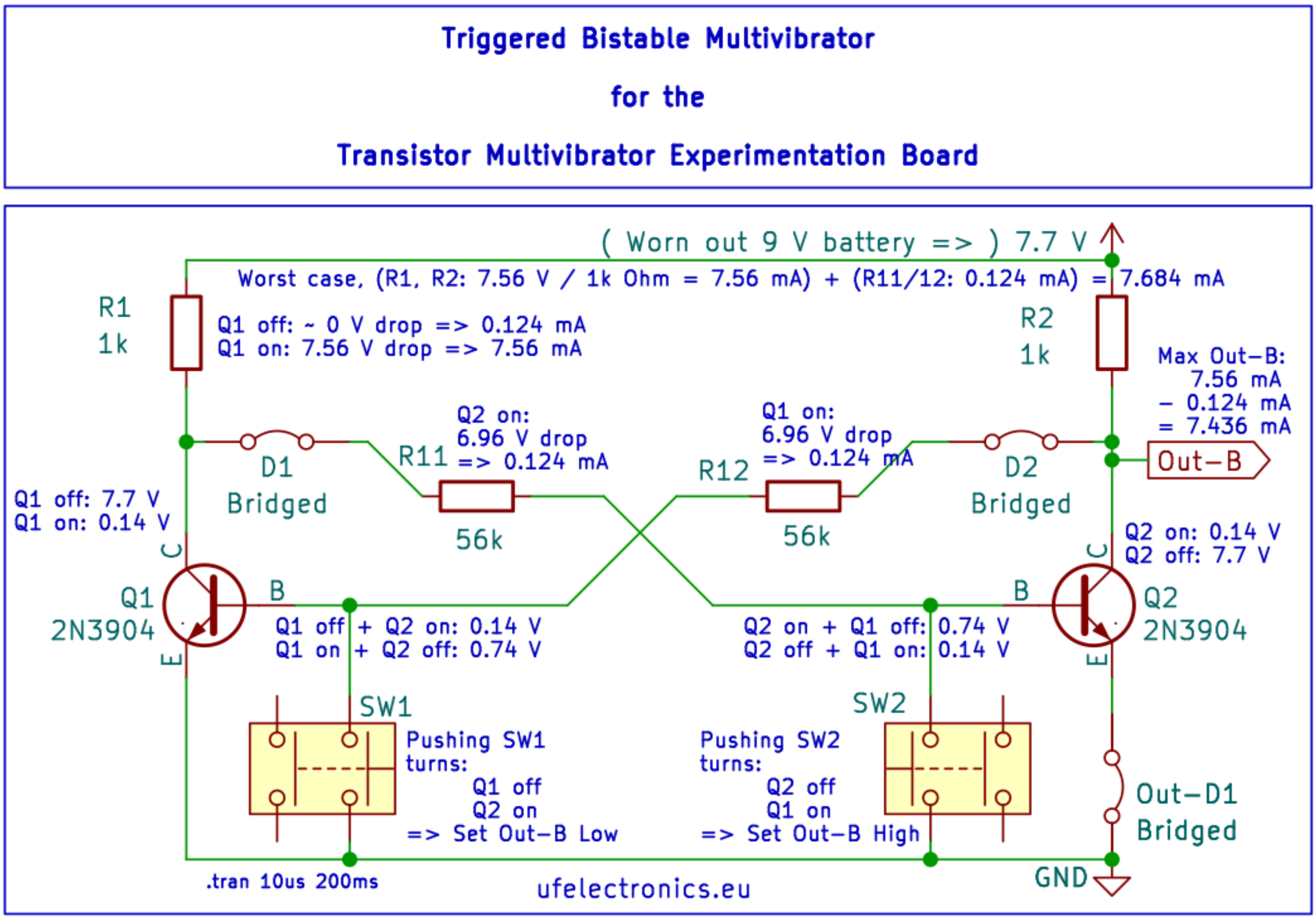
There are two button footprints available, S1 and S2, to potentially manipulate the base of Q1 and Q2. - With these, you could potentially build a triggered bistable multivibrator.



A **Triggered Bistable Multivibrator** is a simple electronic circuit that can remember one of two stable states, making it a basic form of electronic memory.

Unlike an astable multivibrator, it does not change state on its own. Instead, it remains in its current state until it receives a trigger signal, such as a short voltage pulse or the press of a push button. Each valid trigger causes the circuit to switch to its other stable state, where it stays until the next trigger arrives.

Because it can store a single binary value (0 or 1), the bistable multivibrator is the foundation of flip-flops, digital memory, counters, and many switching circuits. On this experimentation board, you can explore how transistor-based bistable circuits operate, observe the switching action on an oscilloscope, and gain a practical understanding of one of the fundamental building blocks of digital electronics.



Remember to short out C7 and C8 up to the base traces of Q1 and Q2 accordingly on the PCB.

Monostable Multivibrator - S2, C8, R20, D4, D6

A monostable multivibrator, often called a one-shot, is a circuit with one stable state and one temporary state. Under normal conditions, it remains in its stable state until an external trigger is applied.

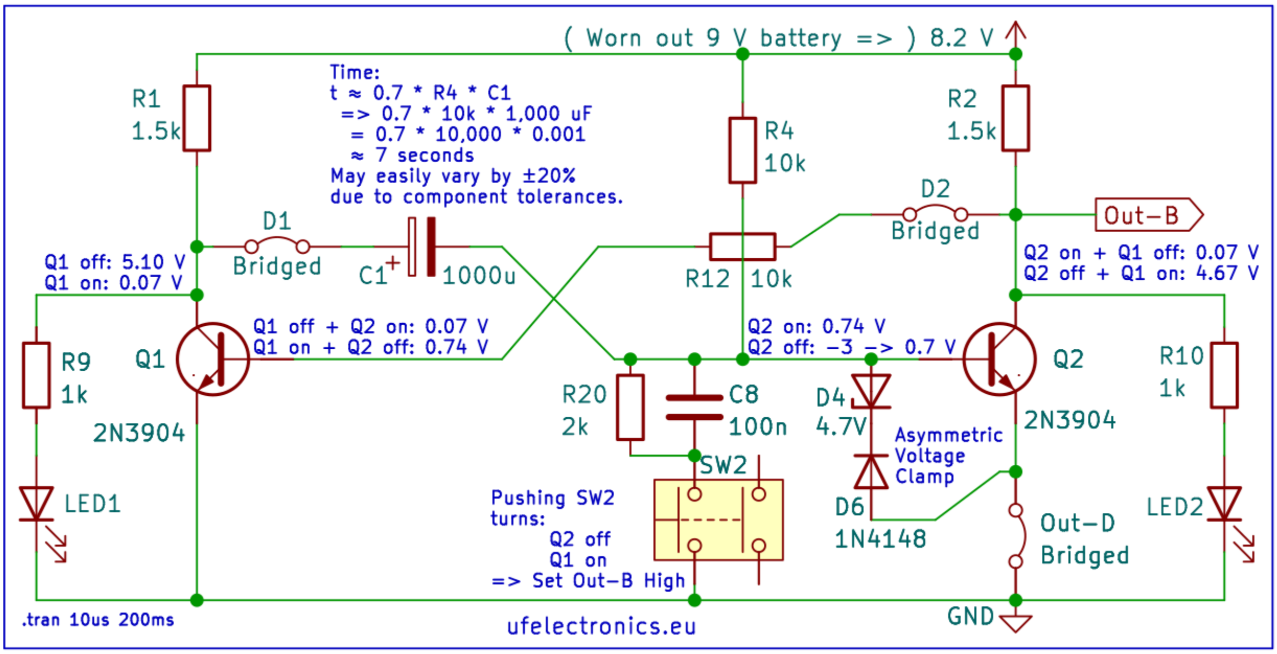
The trigger causes the circuit to switch to its temporary state for a predetermined period of time before automatically returning to its stable state. The duration of this pulse is typically determined by a resistor-capacitor (RC) timing network.

Monostable multivibrators are widely used for pulse generation, timing, switch debouncing, and creating controlled delays in electronic circuits.

Monostable Multivibrator

for the

Transistor Multivibrator Experimentation Board



General Overview

The above circuit is triggered by a short pulse to ground. There exists circuits where the pulse is positive, or triggered at other points in the circuit. - Just that you are aware that other circuits online might have another configuration and way of working. The alternative ways of triggering a monostable multivibrator have an influence on its circuit and component values.

In the above circuit, C1 and R4 determines the time Out-B goes high after the button S2 is pushed.

C8 ensures that the base of Q2 is only pulled down to ground for a short time. In conjunction with C8, we have R20. R20 ensures C8 is discharged again after the button has been pushed.

D4 and D6 form an asymmetric voltage clamp. As here, it prevents the base of Q2 to be exposed to too low voltages. - The base of 2N3904 can only handle 6V below emitter voltage.

How it works in detail

1. Initial stable state

_b1 : base of Q1	_b2 : base of Q2
_c1 : collector of Q1	_c2 : collector of Q2
_be : base-emitter	

Initially:

- **Q1 is OFF**
  - $V_{b1} < 0.5$ V
  - $V_{c1} \approx 8.1$ V
- **Q2 is ON**
  - $V_{b2} \approx 0.7$ V
  - $V_{c2} \approx 0$ V

Since capacitor C1 is connected between Q1 collector and Q2 base, it charges to

$$V_{C1} \text{ (capacitor)} = 8.1 - 0.75 \approx 7.35 \text{ V}$$

with the **left side (Q1 collector) positive**.

This is the stable state of the circuit.

2. Triggering

When the trigger switch momentarily pulls the base of Q2 to ground,

Q2 immediately turns OFF.

Its collector rises toward Vcc.

That collector voltage is fed through R12 to the base of Q1, causing Q1 to turn ON.

Now

- **Q1 ON**
  - $V_{c1} \approx 0$ V
- **Q2 OFF**
  - $V_{c2} \approx 8.1$ V

Since a capacitor cannot change its voltage instantaneously, the voltage across capacitor C1 remains approximately **7.35 V**.

Because the left plate suddenly falls from 8.1 V to approximately 0 V, the right plate (Q2 base) also falls by approximately 8.1 V.

The base of Q2 therefore becomes negative (about −7.3 V initially), ensuring that Q2 remains firmly switched OFF.

3. Trigger released

When the trigger switch is released, R4 again attempts to pull the base of Q2 upward toward Vcc.

However, the negative voltage produced by C1 opposes this rise.

Consequently, the base voltage of Q2 increases only slowly.

During this time,

- Q1 remains ON.
- Q2 remains OFF.
- The circuit is in its temporary (quasi-stable) state.

4. Charging (actually recharging) of C1

With Q1 ON, its collector is held near 0 V.

R4 supplies current into the base node of Q2.

That current also flows into capacitor C1, gradually restoring its original voltage.

As C1 charges through R4, the base voltage of Q2 rises approximately exponentially.

The time constant τ is

$$\tau = R4 * C1$$

and the pulse duration is approximately

$$t \approx 0.7 * R4 * C1$$

For the values given in the circuit,

- R4 = 10 kΩ
- C1 = 1,000 μF

giving

$$t \approx 7 \text{ s.}$$

5. Return to the stable state

Eventually the base of Q2 reaches approximately

$$V_{be} \approx 0.7\ \text{V}.$$

Q2 then begins to conduct.

Its collector voltage rapidly falls toward ground.

That falling collector voltage is coupled through R12 to the base of Q1, removing its base drive.

Q1 therefore switches OFF.

Its collector immediately rises back to approximately 8.1 V.

C1 quickly re-establishes its original charge of approximately 7.35 V, and the circuit has returned to its original stable state, ready for the next trigger pulse.

Labeling Your Build

☐ Astable
☐ Bistable
☐ Monostable

To distinguish one build from another, you have the option to mark it with a dot if it is an astable, bistable or monostable construction.

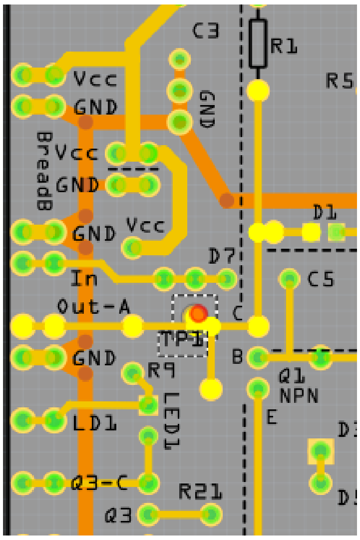
You can also label the intended voltage or voltage range, together with nominal frequency and duty cycle.

f: ___________________ Hz

Duty Cycle: __________ %

Vcc: ________________ V

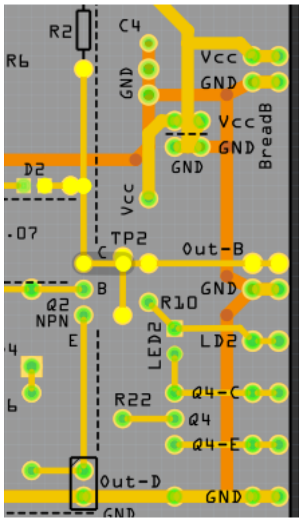
Test Points

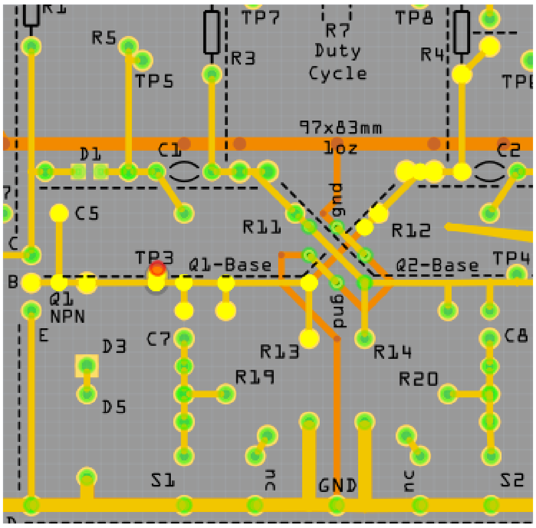


As you will notice in the following images, can you see the range of the test point by the highlighted color of the trace and the lead pads.

TP1

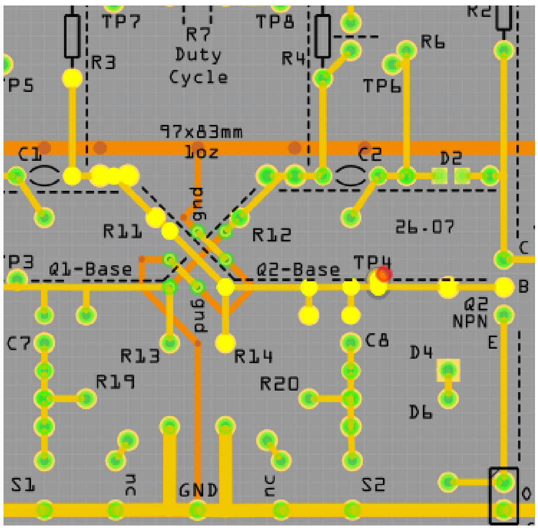
TP2



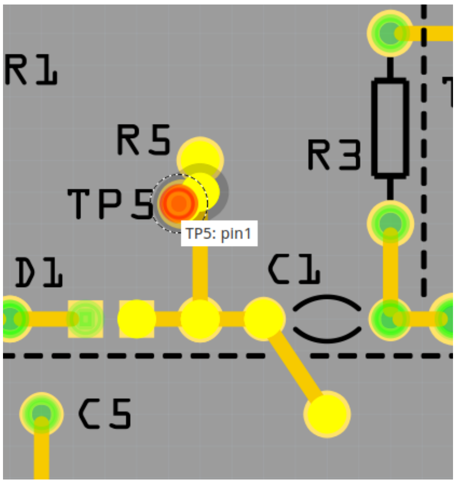


TP3

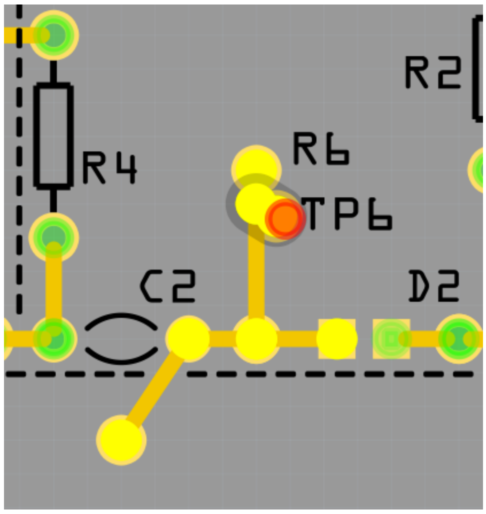
TP4



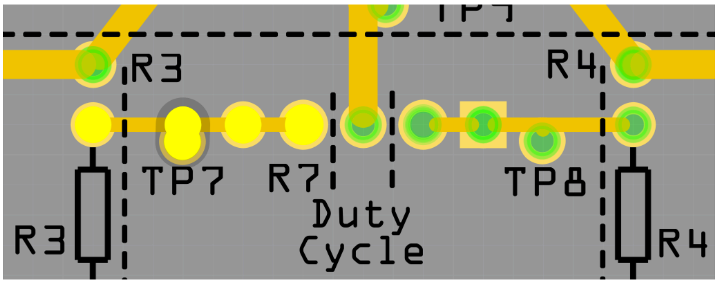
TP5



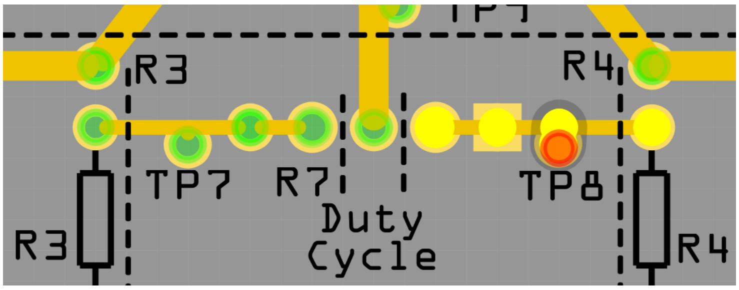
TP6

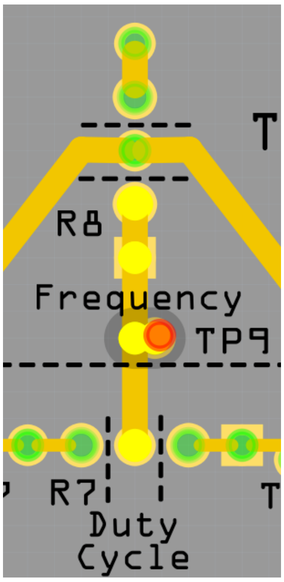


TP7



TP8





TP9

Suggestions?

Have suggestions for improvements, or need a personalized PCB design? - Feel free to get in touch:

Contact

https://ufelectronics.eu/about/contact/

Social

YouTube: https://www.youtube.com/@ufelectronics

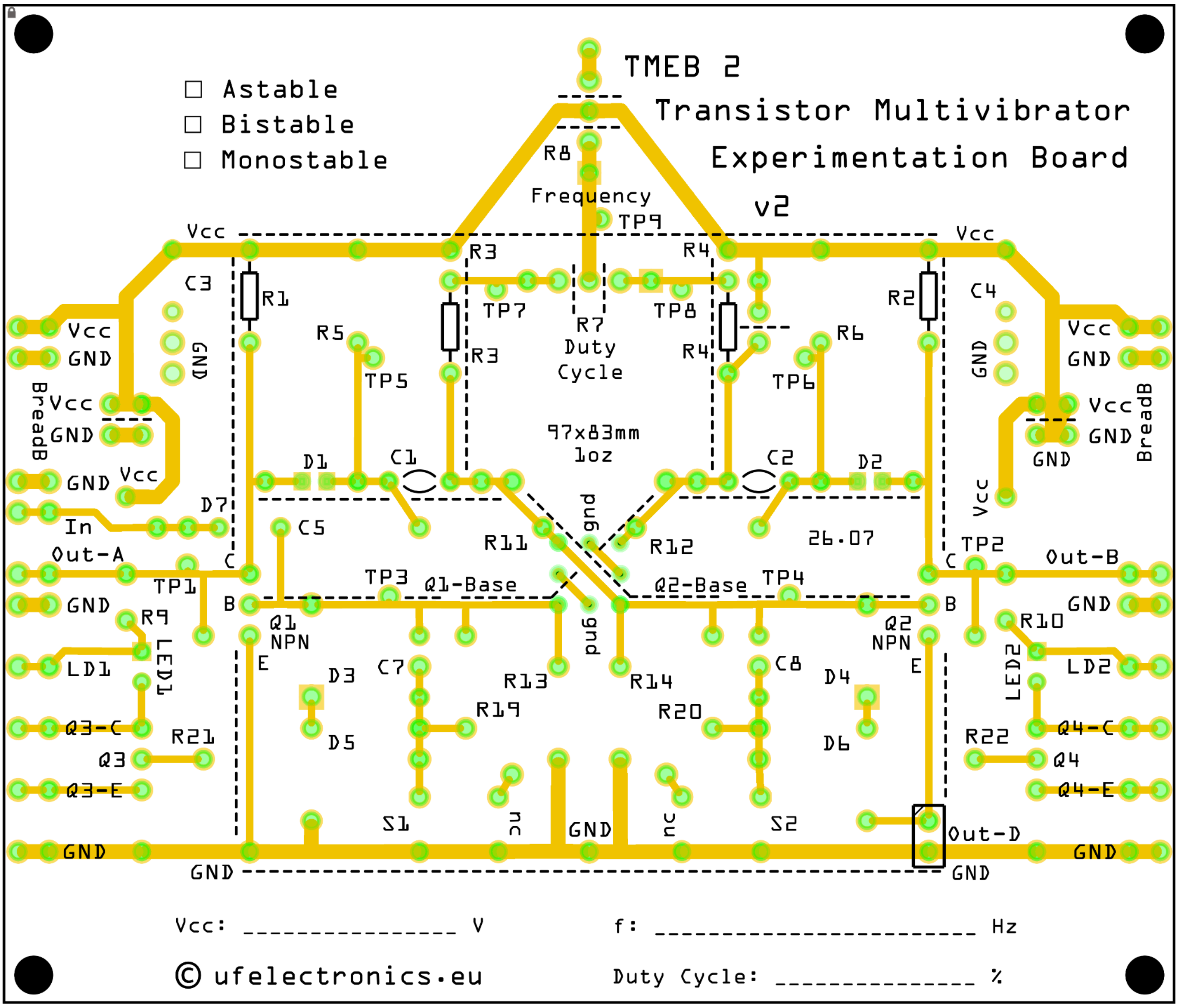
Discord: https://discord.com/channels/1373552306817339535/1373552307467325542

Facebook: https://www.facebook.com/profile.php?id=61577320711532

LinkedIn: https://www.linkedin.com/company/ufelectronics/posts/?feedView=all

Semi-Schematic PCB Layout

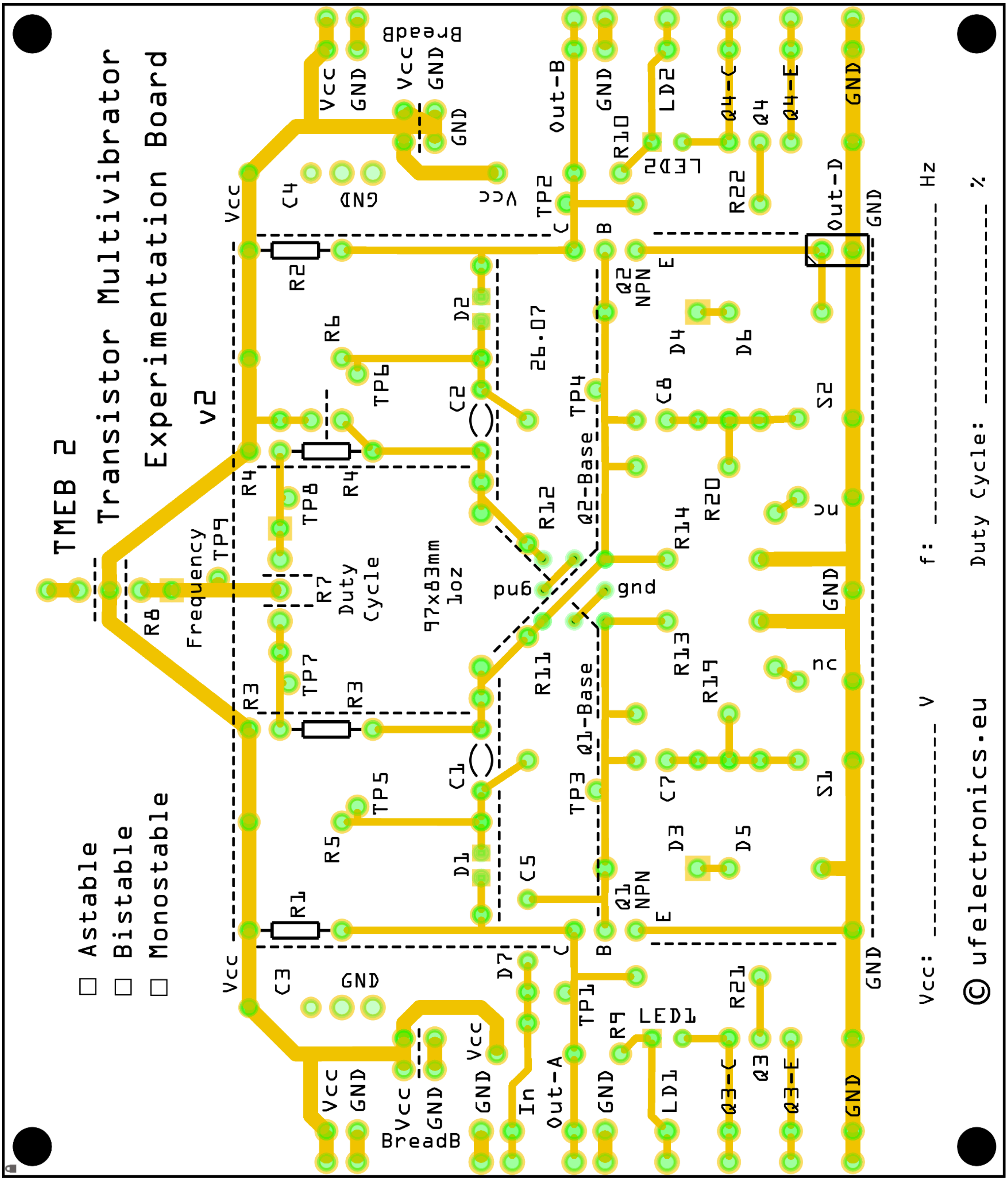
Horizontal Version



The figure above shows the routing on the top layer of the PCB.

Ground is routed on the bottom side of the PCB. The bottom layer with the ground plane is not visible in the figure above.

Vertical Version



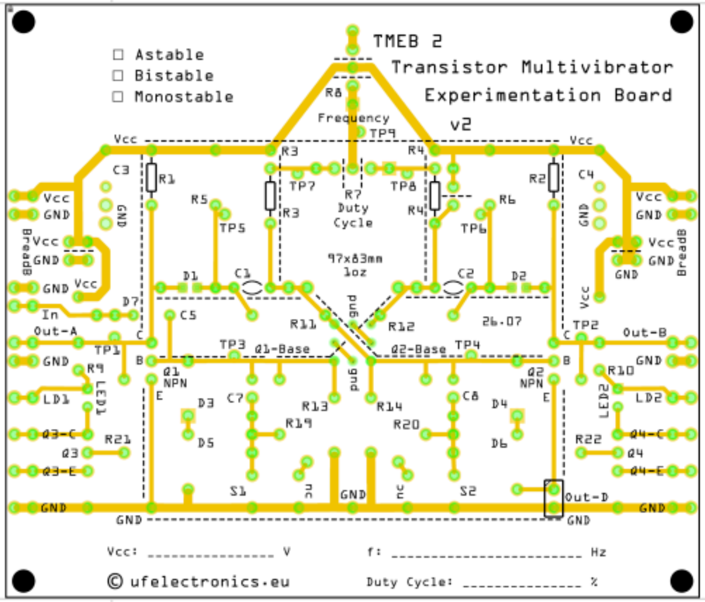
The figure above shows the routing on the top layer of the PCB. Ground is routed on the bottom side of the PCB. The bottom layer with the ground plane is not visible in the figure above.

Assembly Sheet

Multivibrator - v2 - Assembly Sheet

Circuit .... :

Vers. / Date :



Notes

Vcc:

S1:

S2:

Resistors	Value	Capacitors	Value
R1		C1	
R2		C2	
R3		C3	
R4		C4	
R5		C5	
R6		C7	
R7		C8	
R8		Q1	
R9		Q2	
R10		Q3	
R11		Q4	
R12		D1	
R13		D2	
R14		D3	
R15		D4	
R16		D5	
R19		D6	
R20		D7	
R21		LED1	
R22		LED2	