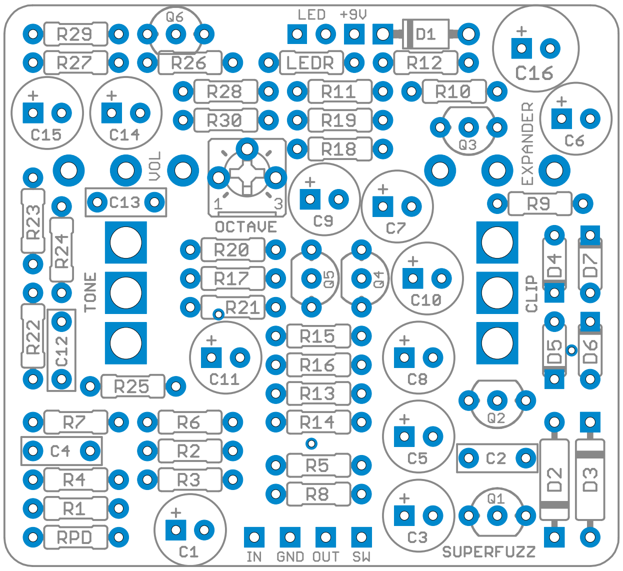
Rift

Based on the Univox Superfuzz

Overview

Rift Project Link



The Rift is a modified version of the Univox Superfuzz, a classic octave fuzz. It was originally developed by the Shin-Ei company in Japan and called the FY-6, but they also rebadged the circuit for over a dozen other brands such as Apollo, Electra and Hohner. However, the Univox Superfuzz was the most well-known of the brands and is considered the definitive version of the circuit.

The Rift includes two modifications that lend more flexibility to this circuit. While the original unit only had a tone switch to go between two presets, here you have the option of using a pot instead to blend between them. There is also a clipping switch to allow you to choose between two different sets of diodes, or lift them altogether for a different (and much louder) sound.

Controls & Usage

The controls for the Superfuzz are pretty standard:

- **Expander** controls the fuzz level of the effect. (This acts as a volume control after a fixed-level input boost stage, very similar to the Sustain knob on a Big Muff.)
- **Volume** controls the overall output level.
- **Tone** allows you to switch between two fixed tone sections, one with a mid-scoop and another with a flatter and less aggressive sound. This can be wired as a pot instead of a switch, allowing you to fade between the two settings.
- **Clip** allows you to select a different set of diodes or lift the diodes altogether.

Modifications & Experimentation

If you want to use a **tone pot** instead of the switch, you'll find it convenient that the pot fits in the exact same pads and you just need to drill the enclosure differently. This allows for blending between the two fixed tone settings, which makes it a much more flexible control.

The **clipping switch** lets you choose from two sets of diodes. The stock unit uses germanium, around 0.3V forward voltage, but lots more sounds can be had by using different diodes with a higher clipping threshold, or by removing the diodes entirely in the center position. For the second set of diodes, I recommend using two 1N914s in series, but you should socket them and experiment.

Expect to make significant volume adjustments when switching between the different clipping diode options. This circuit uses hard clipping by way of anti-parallel diodes going to ground. As a result, the volume level is directly affected by the total clipping threshold (forward voltage) of the diodes being used.

Parts List

Mouser Parts List (Spreadsheet)

Resistors

R1	22k [1]
R2	100k
R3	100k
R4	1k8
R5	47k
R6	470k
R7	10k
R8	47k
R9	3k3 [1]
R10	220k
R11	150k
R12	10k
R13	10k
R14	470R
R15	470R
R16	100k
R17	22k
R18	10k
R19	1k8 [1]
R20	22k
R21	100k
R22	47k
R23	10k
R24	22k
R25	10k
R26	100k
R27	15k
R28	10k
R29	1k
R30	100k
RPD	2M2
LEDR	4k7

Capacitors

C1	10uF electro
C2	2n2 [1]
C3	10uF electro
C4	100n
C5	10uF electro
C6	10uF electro
C7	10uF electro
C8	10uF electro
C9	10uF electro
C10	10uF electro
C11	10uF electro
C12	1n
C13	100n
C14	10uF electro
C15	10uF electro
C16	100uF electro

Semiconductors

Q1-6	2SC828 [2]
D1	1N4002
D2-D3	1N34A [3]
D4-D7	1N914 [4]
LED	5mm LED

Potentiometers

EXPANDER	50kB
VOLUME	50kB
TONE	50kB [5]
OCTAVE	10kB trim (3362P)

Switches

TONE	SPDT [5]
CLIP	SPDT center off

Footnotes can be found on the next page.

Additional Part Notes

- Capacitors are shown in nanofarads (n or nF) where appropriate. 1000n = 1uF. Many online suppliers do not use nanofarads, so you'll often have to look for 0.047uF instead of 47n, 0.0056uF instead of 5n6, etc.
- The PCB layout assumes the use of film capacitors with 5mm lead spacing for all values 1nF through 1uF. I prefer WIMA box film: the FKS2 series for 1n to 10n and the MKS2 series for 10n to 1uF.
- Potentiometers are Alpha 16mm right-angle PCB mount.
- I recommend using these dust covers / insulators from Small Bear to insulate the back of the pots from the board and prevent shorts. If you don't use these, use some electrical tape or cardboard to act as insulation. The right-angle pots will make direct contact with the solder pads otherwise.

Build Notes

[1] **Shin-Ei FY-2:** The Shin-Ei FY-2 has a few small value changes from the Superfuzz:

R1 = **100k**
C2 = **1n**
R9 = **jumper**
R19 = **2k**

[2] **Transistors:** See the next section titled "Transistor selection" for a discussion on how to choose the right transistors for this circuit.

[3] **Clipping diodes:** Any germanium diodes will do fine here—the part number isn't important. You could also use a more readily-available diode such as the BAT41 Schottky for a very similar sound.

[4] **Optional clipping diodes:** To provide good contrast with the stock germanium diodes, I recommend using 1N914s for D4-D7. They'll be a good bit louder than the germaniums but not as loud as the diode lift mode (center switch position). However, feel free to socket these diodes and experiment. You may find something you like even better!

[5] **Tone switch or pot:** The original unit uses a switch to select between two tone settings. You can put a **50kB** pot here instead to act as a balance control to fade between the two. It fits in the same pads as the switch. Needless to say, you can only use one or the other. Make sure to follow the correct drill template depending on whether you use the pot or the switch, as the knob layout is different.

Transistor selection

The original Superfuzz usually used **2SC828** transistors, sometimes **2SC539**. There is nothing special about these transistors, but being early silicons, they were much lower gain than modern silicons—and this makes a big difference in the circuit.

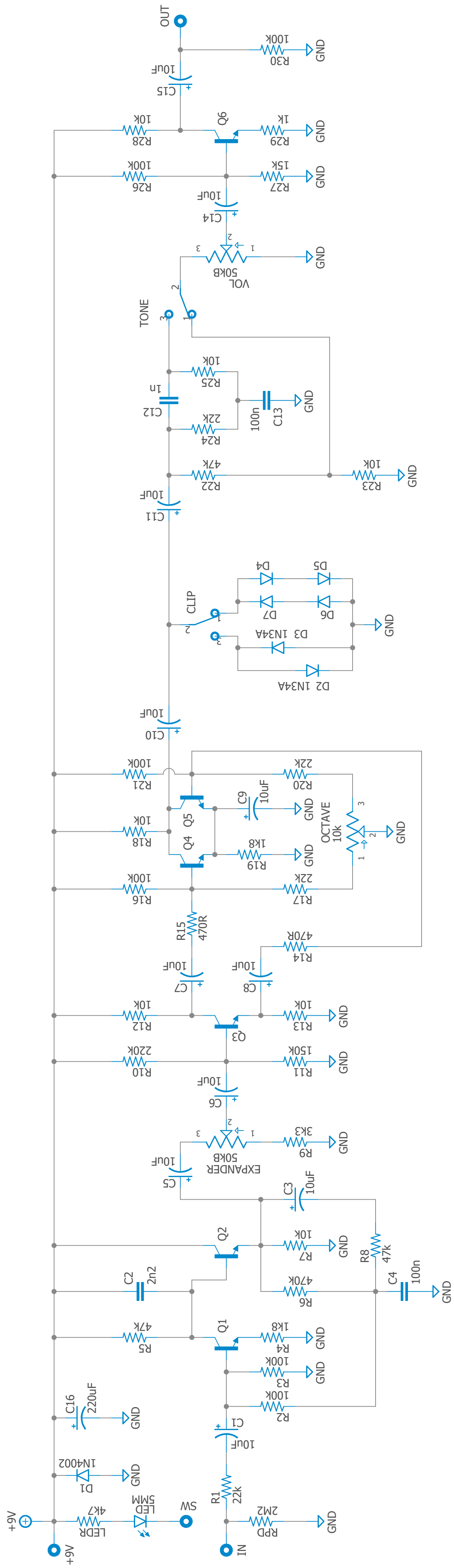
You're looking for any silicon transistor with a gain of about **180 hFE**, with Q1 maybe being a little higher, around 220 hFE. Many **2N3904**s fall in this range, but since the datasheet specifies a range of 100 to 300, you may have to sort through several of them to find six that are right for this circuit.

2SC945 is a good NOS substitute that typically falls in the recommended gain range. These are readily available from Small Bear Electronics. If you buy them elsewhere, you want the "Y" (yellow) designation.

For the most pronounced octave effect, you want to make sure the **Q4** and **Q5** transistors are matched as closely as possible for gain (hFE). Most multimeters have an hFE function to test them. The OCTAVE trimmer is there to compensate for unmatched transistors (and in fact Shin-ei implemented this trimmer because it was easier and cheaper than sorting for matched transistors)—but you will get the best effect if you use the two transistors that are closest in hFE for Q4 and Q5 and then use the octave trimmer to fine-tune the effect.

Important note: The Rift PCB layout uses the USA-standard **E-B-C** pinout (2N3904, 2N5088, etc.) for the transistors. If you do use a vintage transistor like the 2SC828 or 2SC945, make sure to adjust accordingly. Most Japanese transistors with the 2SC prefix use the E-C-B pinout, so it'll require twisting legs 2 and 3 to get them to fit correctly.

Schematic



OUT
C15 10uF
R30 100K
R28 10K
Q6
R29 1K
R26 100K
R27 15K
C14 10uF
VOL 50kB
TONE
R25 10K
C12 1n
C13 100n
R24 22K
R22 47K
R23 10K
C11 10uF
CLIP
D4
D5
D7
D6
D3 1N34A
D2 1N34A
C10 10uF
R21 100K
R20 22K
C9 10uF
Q5
Q4
OCTAVE 10k
R18 10K
R19 1K8
R16 100K
R17 22K
R15 470R
R14 470R
C7 10uF
C8 10uF
R12 10K
R13 10K
Q3
R10 220K
R11 150K
C6 10uF
EXPANDER 50kB
R9 3K3
C5 10uF
C3 10uF
Q2
R7 10K
R8 47k
C2 2n2
R6 470K
C4 100n
R5 47K
Q1
R4 1K8
R3 100K
R2 100K
C16 220uF
C1 10uF
D1 1N4002
R1 22k
LED 5MM
LEDR 4K7
SW
RPD 2M2
+9V
IN
GND

General Build Instructions

These are general guidelines and explanations for all Aion Electronics DIY projects, so be aware that not everything described below may apply to this particular project.

Build Order

When putting together the PCB, it's recommended that you do not yet solder any of the enclosure-mounted control components (pots and switches) to the board. Instead, follow this build order:

1. Attach the **audio jacks**, **DC jack** and **footswitch** to the enclosure.
2. Firmly attach the **pots** and **switches** to the enclosure, taking care that they are aligned and straight.
3. Push the **LED**[1] into the hole in the enclosure with the leads sticking straight up, ensuring that the flat side is oriented according to the silkscreen on the PCB.
4. Fit the **PCB** onto all the control components, including the leads of the LED. If it doesn't fit, or if you need to bend things more than you think you should, double-check the alignment of the pots and switches.
5. Once you feel good about everything, **solder them from the top**[2] as the last step before wiring. This way there is no stress on the solder joints from slight misalignments that do not fit the drilled holes. You can still take it out easily if the build needs to be debugged, but now the PCB is "custom-fit" to that particular enclosure.
6. Wire everything according to the wiring diagram on the last page.

[1] **For the LED**: You can use a bezel if you'd like, but generally it's easier just to drill the proper size of hole and push the LED through so it fits snugly. If you solder it directly to the PCB, it'll stay put even if the hole is slightly too big. Make absolutely sure the LED is oriented correctly (the flat side matches the silk screen) before soldering, as it'll be a pain to fix later! After it's soldered, clip off the excess length of the leads.

[2] **Note on soldering the toggle switch(es):** It will require a good amount of solder to fill the pads. Try to be as quick as possible to avoid melting the lugs, and be prepared to feed a lot of solder as soon as the solder starts to melt. I recommend waiting 20-30 seconds between soldering each lug to give it time to cool down.

"RPD" and "LEDR" resistors

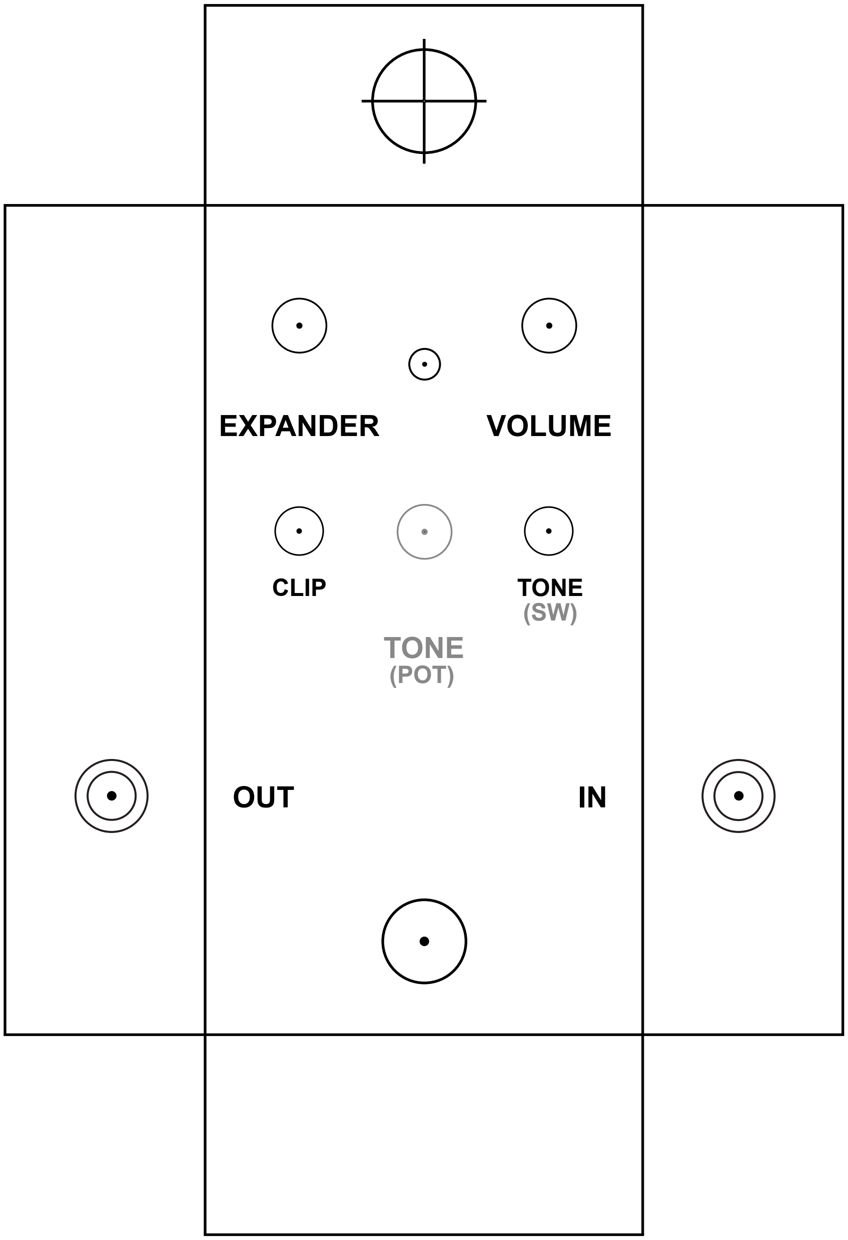
The resistors marked "RPD" and "LEDR" are generally not original to the circuit and can be adjusted to preference. "RPD" is the pulldown resistor to help tame true-bypass popping, while "LEDR" controls the brightness of the LED. I generally use 2.2M for the pulldown resistor and 4.7k for the LED resistor.

Sockets

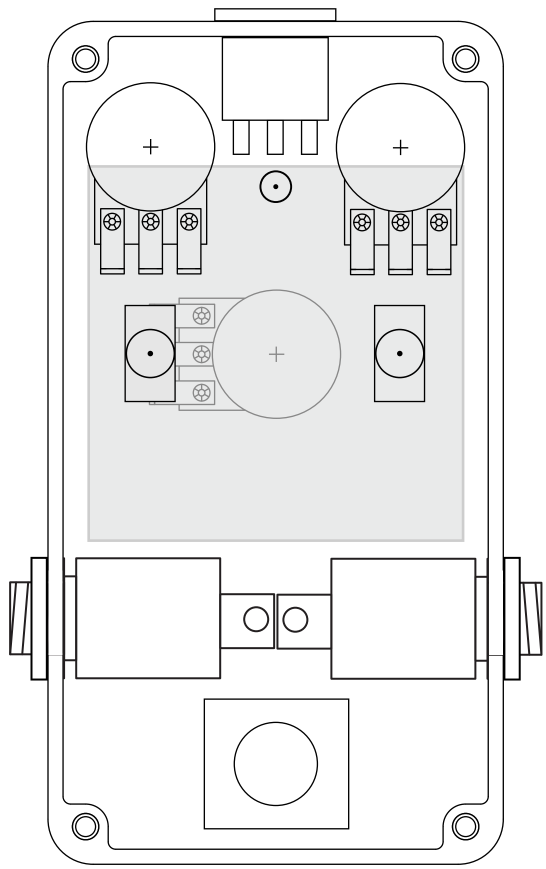
Since double-sided boards can be very frustrating to desolder, especially components with more than 2 leads, it is recommended to use sockets for all transistors and ICs. It may save you a lot of headaches later on.

Drilling & Placement

Print this page and cut out the drilling template below. Tape it to the enclosure to secure it while drilling. Note that the holes are shown slightly smaller than they need to be, so drill out the holes as shown and then step up until they are the correct size for the components.



Hammond 1590B
(bottom/inside view)



Parts Used

- Switchcraft 111X enclosed jacks
- Kobiconn-style DC jack with internal nut

Standard Wiring Diagram

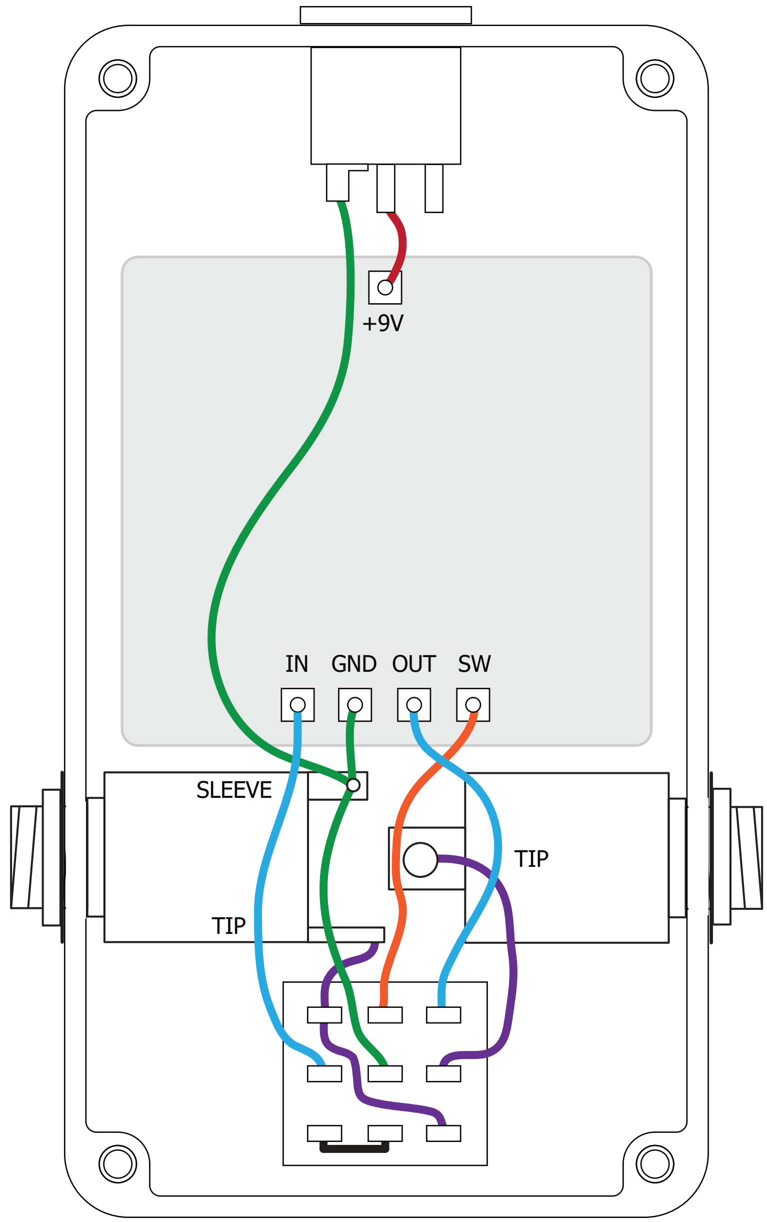
This diagram shows standard true-bypass wiring with a 3PDT switch. When the switch is off, the input of the circuit is grounded and the input jack is connected directly to the output jack.

The **SW** pad is the cathode connection for the LED. This will connect to ground to turn it on when the switch is on. Usage of the on-board LED connection is not required if you have specific placement needs for your enclosure, but's incredibly convenient.

The wiring diagram also makes use of **star grounding** principles where all of the grounds connect to a single ground point (in this case the sleeve of the input jack). This is best practice to avoid added noise caused by improper grounding. The sleeve of the output jack is unconnected.

If using a painted or powdercoated enclosure, **make sure both jacks have solid contact with bare aluminum** for grounding purposes. You may need to sand off some of the paint or powdercoat on the inside in order to make this happen.

Make sure to double-check the markings of the pads on the PCB for your particular project – they are not always in the order shown here!



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No direct support is offered for these PCBs beyond the provided documentation. It is assumed that you have at least some experience building pedals before starting one of these. Replacements and refunds will not be offered unless it can be shown that the circuit or documentation are in error. I have in good faith tested all of these circuits. However, I have not necessarily tested every listed modification or variation. These are offered only as suggestions based on the experience and opinions of others.

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