Lemon Haze: Build Document

Carcharias Effects
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1. About This Circuit

The Lemon Haze is based on the famous four-transistor sustainer circuit (you know the one). It has become a favorite of guitarists and bassists all over the world, having been responsible for some of the most iconic bass and guitar tones in history. It's also one of my favorite builds because it contains what I believe are the three most basic controls you will ever need for a powerful overdrive/distortion/sustainer—distortion (or input gain), volume (output), and tone (frequency response). On bass, it requires no blend, just pure, unadulterated fuzz.

The circuit is comprised of four amplifier stages in series with one another, each one sharing a similar topology but with a few notable differences. The input signal gets amplified at the first stage; it then saturates the second and third stages which clip the signal. The tone stack follows the third stage, shaping the frequency response before the signal gets sent to the fourth and final stage, which provides a healthy volume boost to the signal post-tone stack.

The original was so intuitive in its design that a rich catalogue of different flavors has spread all over the world throughout the decades (which has been comprehensively outlined on Kitrae's impressive website).

As such, the Lemon Haze circuit was originally built to clone my personal favorite edition—the Civil War—but really, the same circuit board can be used to build any number of flavors you might want to try. This is facilitated by the component numbering on the PCB which corresponds to many of the schematics that can be found on Kitrae's website. Apart from the Civil War, you can also try the Triangle, Ram's Head, Black Russian, but there are probably even more. Dig around a little and you'll also find that Kitrae's website lists a variety of mods that you can easily apply to this circuit.

In any case, enjoy your build, have fun with it, post pictures, and don't forget to play the hell out of it. After all, these beautiful circuits were meant to be heard! As always, I welcome points and suggestions, and if you feel there are ways that these PCB's can be improved, feel free to get in touch with me.

Note that this is V2 of the Lemon Haze circuit, which includes several design improvements from the previous model, made for easier and slightly more aesthetic building.

2. Controls

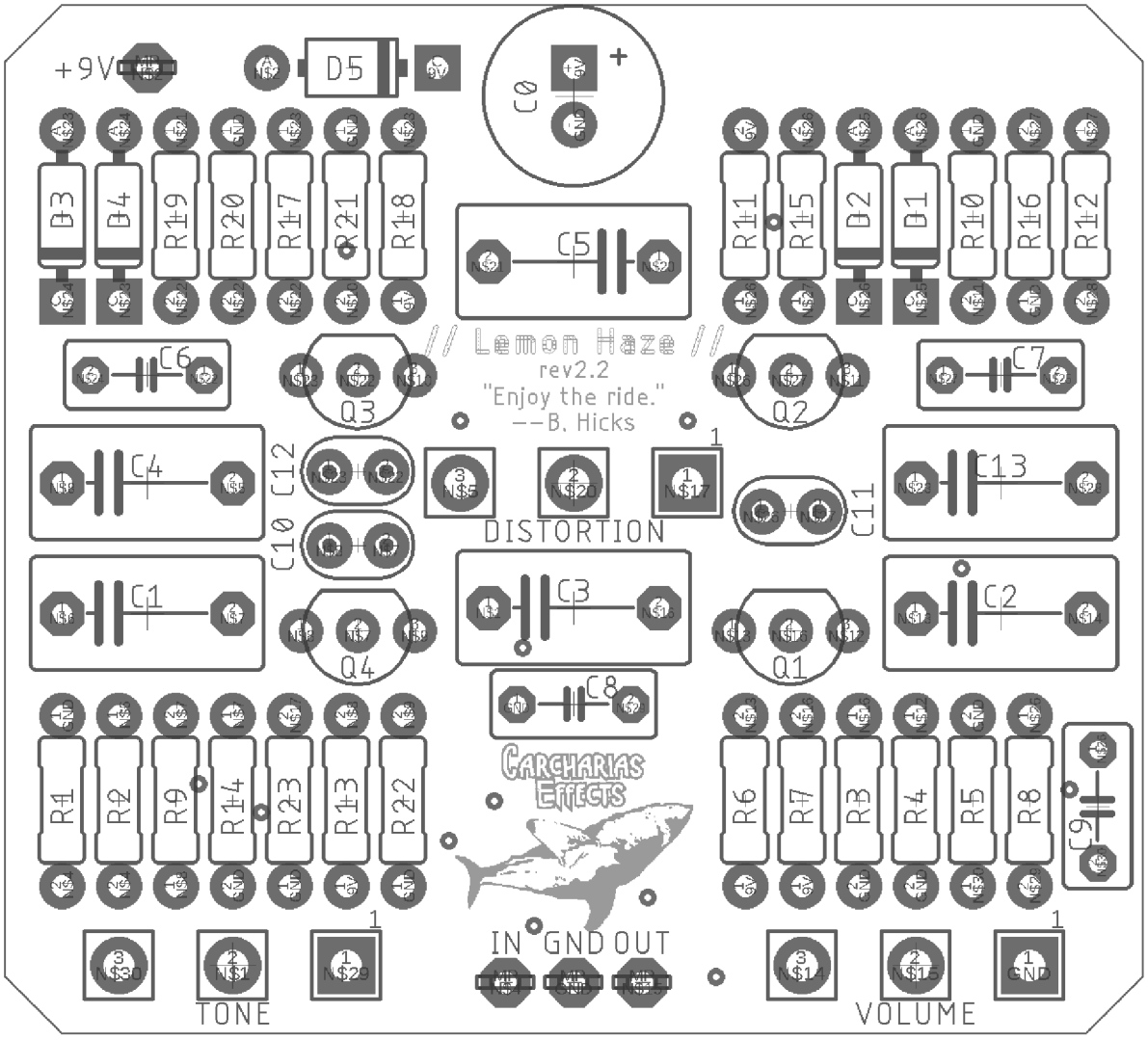
The following are the standard external controls for this pedal:

- **Distortion** — Turning this control clockwise will increase the signal gain after the first gain stage, which saturates the first of the two in-series clipping stages that follow.

- **Tone** — This control alters the frequency response of the signal after the clipping stages, and prior to the final volume boost stage. Turning this control pans between a low-pass filter (100% CCW) and a high-shelf filter (100% CW). Depending on the accuracy of the parts that you use to spec, the crossover will be around 1–1.2 kHz.
- **Volume** — This control gives a necessary clean boost to the signal following the clipping stages and the tone stack (which inherently results in some gain reduction). It is pretty powerful, but thankfully can be modified rather easily (see the *Build Notes* section of this document)

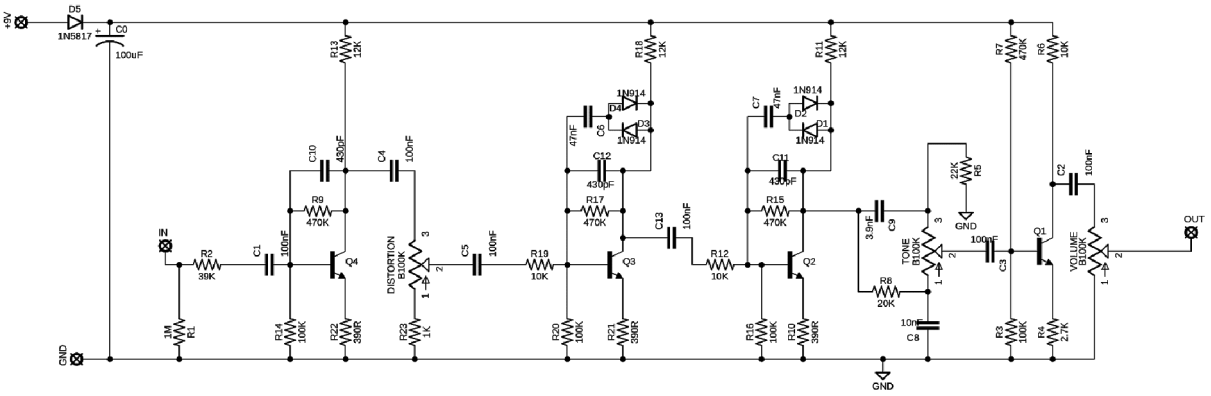
3. Circuit Board

The following is a screen capture of the printed circuit board (PCB):



4. Schematic

The following is a screen capture of this circuit's schematic, which can be used for reference when debugging:



5. Bill of Materials

You will need the following components to complete your build:

Qty	Value	Parts	Description
1	1N5817	D5	Diode
4	1N914	D1, D2, D3, D4	Diode
1	100uF	C0	Electrolytic capacitor
4	2N5088, BC550, etc.	Q1, Q2, Q3, Q4	NPN Transistor
1	10nF	C8	Polyester film, greencap capacitor
1	3.9nF	C9	Polyester film, greencap capacitor
2	47nF	C6, C7	Polyester film, greencap capacitor
3	430pF	C10, C11, C12	Polyester film, greencap capacitor
6	100nF	C1, C2, C3, C4, C5, C13	Polyester film, greencap capacitor
3	B100K	DISTORTION, TONE, VOLUME	Potentiometer
1	1K	R23	Resistor
1	1M	R1	Resistor
1	2.7K	R4	Resistor
1	20K	R8	Resistor
1	22K	R5	Resistor
1	39K	R2	Resistor
3	10K	R6, R12, R19	Resistor
3	12K	R11, R13, R18	Resistor
3	390R	R10, R21, R22	Resistor
4	100K	R3, R14, R16, R20	Resistor
4	470K	R7, R9, R15, R17	Resistor

The Lemon Haze PCB can also be used for other BMP flavors. See the following table:

Part	Triangle (V1 1967 #1)	Violet Ram's Head (V2 1973 #5)	Civil War (V7 Sovtek)	Black Russian (V7C/8)	NYC
C0	100u	100u	100u	100u	100u
C1	100n	100n	100n	100n	1u
C2	100n	100n	100n	100n	1u
C3	100n	100n	100n	100n	1u
C4	100n	100n	100n	100n	1u
C5	100n	100n	100n	100n	1u
C6	100n	100n	47n	47n	1u
C7	100n	100n	47n	47n	1u
C8	10n	12n	10n	10n	10n
C9	4n	4n	3.9n	3.9n	3.9n
C10	500p	560p	430p	470p	470p
C11	500p	560p	430p	470p	470p
C12	500p	560p	430p	470p	470p
C13	100n	100n	100n	100n	1u
D1-D4	1N914	1N914	1N914	1N914	1N6263
D5	1N5817	1N5817	1N5817	1N5817	1N5817
Q1-Q4	FS36999	2N5133	KT3102E	549C	2N5088
R1	1M	1M	1M	1M	1M
R2	33K	39K	39K	39K	39K
R3	100K	100K	100K	100K	100K
R4	2.7K	2.7K	2.7K	2.7K	2K
R5	33K	39K	22K	22K	22K
R6	12K	10K	10K	10K	10K
R7	390K	390K	470K	470K	470K
R8	33K	39K	20K	20K	22K
R9	470K	470K	470K	470K	510K
R10	100R	100R	390R	390R	390R
R11	15K	15K	12K	12K	10K
R12	8.2K	8.2K	10K	10K	10K
R13	15K	15K	12K	12K	10K
R14	100K	100K	100K	100K	100K
R15	470K	470K	470K	470K	470K
R16	100K	100K	100K	100K	100K
R17	470K	470K	470K	470K	470K
R18	10K	10K	12K	12K	10K
R19	8.2K	8.2K	10K	10K	10K
R20	100K	100K	100K	100K	100K
R21	100R	100R	390R	390R	390R
R22	100R	100R	390R	390R	100R
R23	820R	1K	1K	1K	1.8K
TONE	B100K	B100K	B100K	B100K	B100K
VOLUME	B100K	B100K	B100K	B100K	B100K
DISTORTION	B100K	B100K	B100K	B100K	B100K

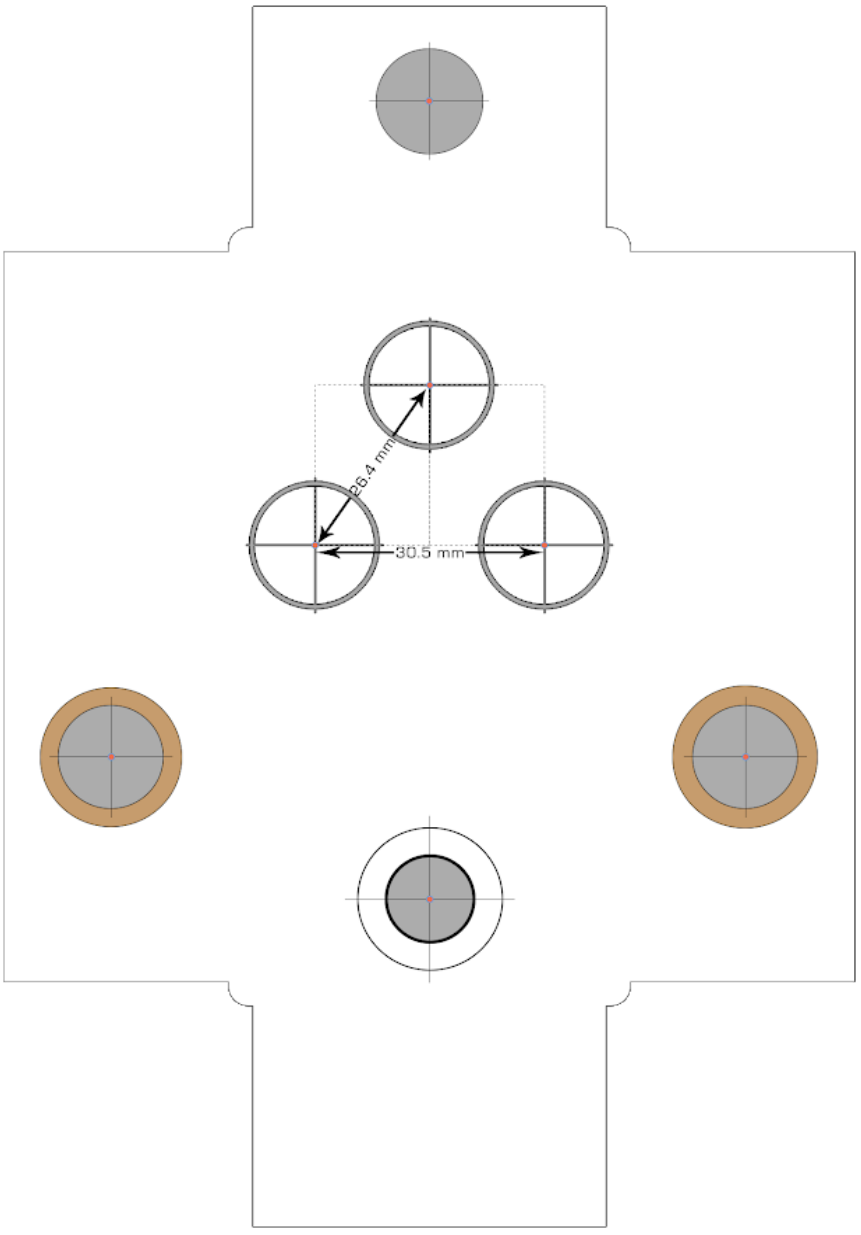
6. Build Notes

The following are a collection of notes, comments, and tips about this circuit.

- Diode and Capacitor outlines are missing from the silkscreen print, but you can still see the correct labels and orientation. For reference, a screenshot of the circuit board with correct labels has been included in this document.
- The output volume might be a bit much for some. I say some, because some people might like it that the circuit can give upwards of **46 dB above unity** when the Volume pot is dimed. But in any case, if you would like to tame the output volume for a bit of a more reasonable sweep, such that unity is achieved at about halfway (12:00), then an easy mod can be done by connecting a 100K resistor from output to ground. This can easily be done between lugs 2 and 1 of the Volume pot.

7. Drill Template

The following is a sample drill template which I have generated from Photoshop. As this document has been written on A4 paper dimensions, you should ensure that you are printing at 100% scale. This circuit has been designed to fit ideally with a 1590B-style enclosure, and real-world measurements of the dimensions between the holes have been provided on the template itself; however, you should always double-check the size of your actual enclosure by first printing a draft copy on regular paper, cutting it up, trying it on your own enclosure, and verifying the provided measurements yourself to ensure accuracy.



Terms of Use

The printed circuit board (PCB) discussed herein may be used for DIY purposes, such as personal builds or small commercial operations. This PCB may not be resold as part of a commercial kit. Resale from peer to peer is approved.

I do not claim any cloned circuit (whether partially or entirely) as the intellectual property of Carcharias Effects, nor am I in the business of intentionally violating any copyrights. Unless otherwise noted, many of the circuits available on www.carchariaseffects.com are based on schematics that represent the works of many hardworking people who came before me, who have designed many wondrous and unique electronics for musicians. I am just one guy with a hobby and love for these electronics, and designing and selling these PCB's is simply one way that I can ensure that my hobby continues to be self-sustaining.

Change Log

- **Rev1 (June 10, 2019):** First draft of this document, includes all standard features. This document corresponds to **PCB rev1.0**.
- **Rev2 (June 24, 2020):** Revised for V2 of the Lemon Haze PCB, with an added table for trying other Big Muff flavors. This document corresponds to **PCB rev2.2**.

Contact

If you encounter any problems or issues with the PCB, or have any questions or comments, feel free to reach out to me anytime. I will try my best to be as responsive as possible. Here are the best ways to reach me:

- Instagram/Facebook (DM): **Carcharias.Effects**
- Email: carcharias.effects@gmail.com
- Web: www.carchariaseffects.com/

I **love** seeing pictures of other peoples' builds, so feel free to tag me (**carcharias.effects**) on Instagram or Facebook.

Best of luck and happy building!