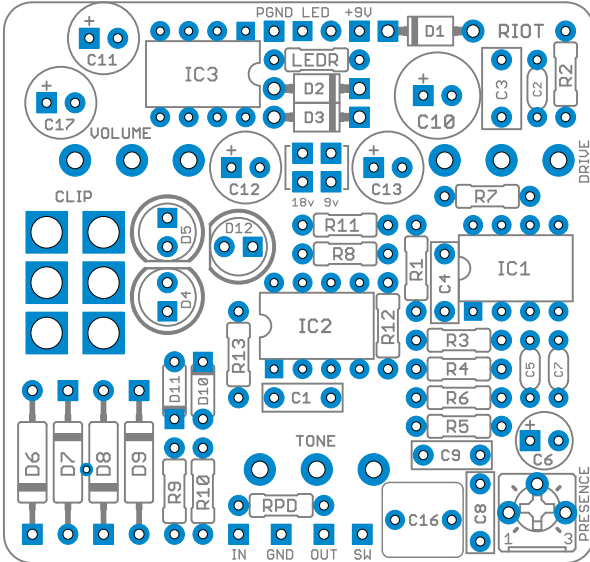


Fusion

Based on the Suhr Riot

Overview

[Fusion Project Link](#)



The Fusion Distortion circuit is inspired by the Suhr® Riot Distortion™, which was originally a modified clone of the MI Audio Crunch Box (available as my [Crescent](#) project). The Crunch Box in turn was a tweaked variant of the [Marshall Bluesbreaker](#) with some inspiration from the [Fulltone® OCD®](#). Like the Crunch Box, the Riot is in the family of Marshall-like pedals and is lauded for its high-gain “stack of amps” tone. It was originally released in 2009.

The Fusion is not a direct clone or copy of the Riot or its successor, the Riot Reloaded. It is most similar to the original version, but with an added option for 18V operation using a charge pump as well as an internal “Presence” control which the original does not have.

Aion Electronics has no affiliation with Suhr® or JS Technologies. Riot Distortion™ is a trademark of JS Technologies.

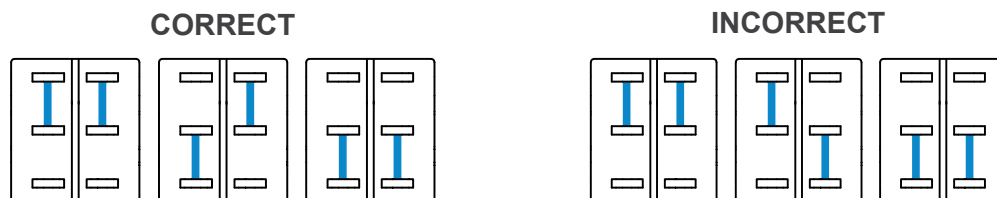
Controls & Usage

- **Drive** controls the amount of gain from the op amp that is fed through the clipping stage.
- **Volume** is the output level of the effect.
- **Tone** is a basic treble cut.
- **Clip** selects between three different sets of clipping diodes: the center position is two LEDs; one side of the switch is an LED in one direction and two silicon diodes in the other; and the third position is two germanium diodes in each direction.
- **Presence** (internal) affects the overall ‘shape’ of the tone of the pedal. It interacts with the tone control.

Modifications

The biggest modification is the addition of a charge pump circuit for 18V operation from a 9V supply. Use the jumpers on board to select either 9V or 18V mode. You can even put this on an external switch if you want, although you might need to use a bigger enclosure or mount it to the side. **You must use the jumpers to select either 9V or 18V mode or the effect will not work!**

The clipping diodes are arranged in a way that allows you to have three different clipping options using a DPDT “on-on-on” switch. It is important to make sure that you use the correct type of on-on-on switch, since there are two different configurations for the center switch position depending on the manufacturer and style:



Parts

Resistors

R1	1M
R2	1k
R3	10k
R4	1M
R5	470R
R6	1k
R7	22k
R8	22k
R9	470R
R10	220R
R11	100R
R12	100k
R13	100R
RPD1	2M2
LEDR	4k7

Capacitors

C1	22n
C2	100pF MLCC
C3	220n
C4	100n
C5	100pF MLCC
C6	2u2 electro
C7	33pF MLCC
C8	22n
C9	22n
C10	100uF electro
C11	10uF electro ¹
C12	10uF electro
C13	10uF electro
C16	1uF film
C17	10uF electro

Semiconductors

IC1, IC2	JRC4580
IC3	TC1044SCPA ¹
D1	1N4002
D2-D3	1N4002 ¹
D4-D5	LED (clear red) ²
D6-D9	1N34A germanium
D10-D11	1N914 ³
D12	LED (clear blue) ²
LED	5mm LED

Potentiometers

Drive	100k Ω
Volume	10k Ω
Tone	10k Ω
Presence	20k Ω trim (3362P)

Switches

CLIP	DPDT on-on-on
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Build Notes

¹ **Charge pump:** If you don't want to have 18V mode available, leave off IC2, D2-D3, and C11 and jumper the "9V" pads. (You can still choose to select 9V mode via the jumpers if the charge pump is installed.)

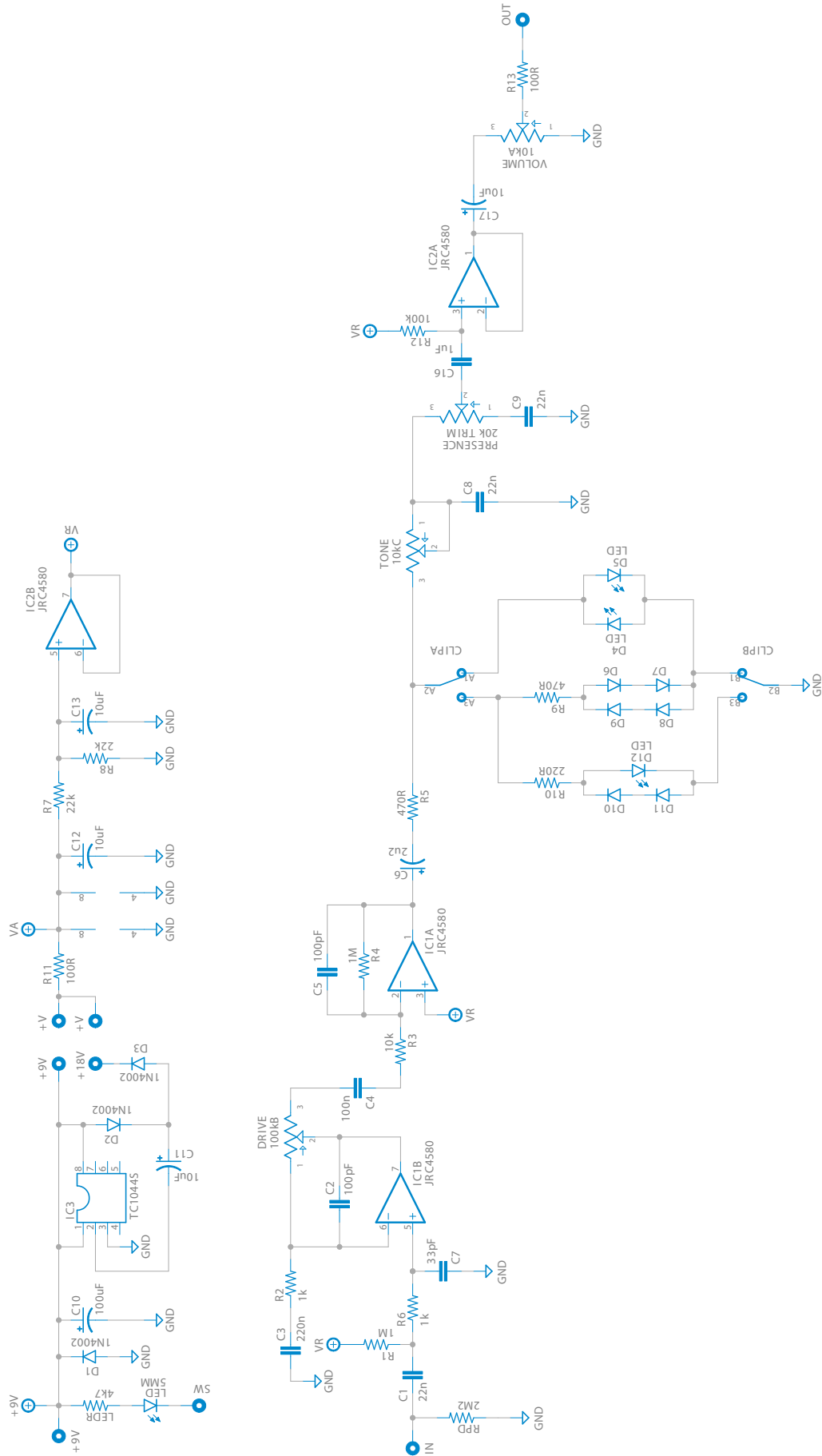
² **Clipping LEDs:** The original unit uses SMD LEDs as clipping diodes. Their exact forward voltages have not been measured, but they are the water-clear type. D4 and D5 are red while D12 is blue. This PCB has been designed to use 3mm or 5mm LEDs here. I would recommend using the same colors as the original since red and blue do have different forward voltages.

³ **Clipping diodes:** The original unit uses a dual 51V zener SMD package with marking "51Y". However, the way it's hooked up, it behaves exactly like two run-of-the-mill silicon diodes. It was chosen by the designer for convenience and cost rather than any of its characteristics. Two 1N914s will sound exactly the same here.

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 470nF. I prefer [EPCOS box film](#) or [Panasonic ECQ-B/V-series](#).
- 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.

Schematic



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.

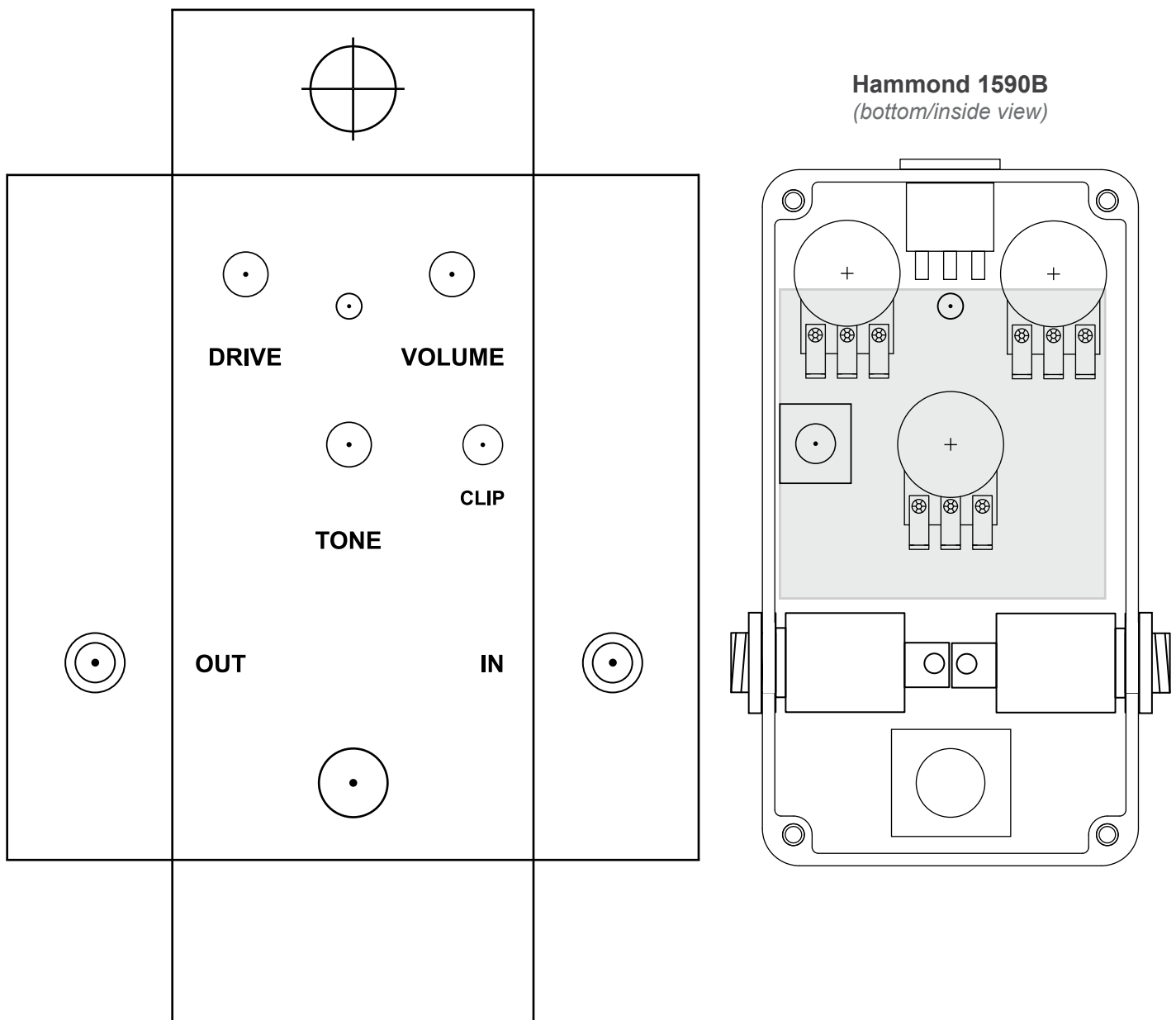
Sockets

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.

IMPORTANT: When using a 1590B, the PCB mounts very close to the wall of the enclosure on the side with the DPDT switch. Make sure your drilling is accurate! There will be no adverse effects if the PCB does touch the side of the enclosure, but we want to be sure it fits. (This was measured and tested using a Hammond-brand 1590B; equivalents from other brands may not be the exact same width.)



Parts Used

- [Switchcraft 111X](#) enclosed jacks
- [Kobiconn-style DC jack](#) with internal nut

Standard Wiring Diagram

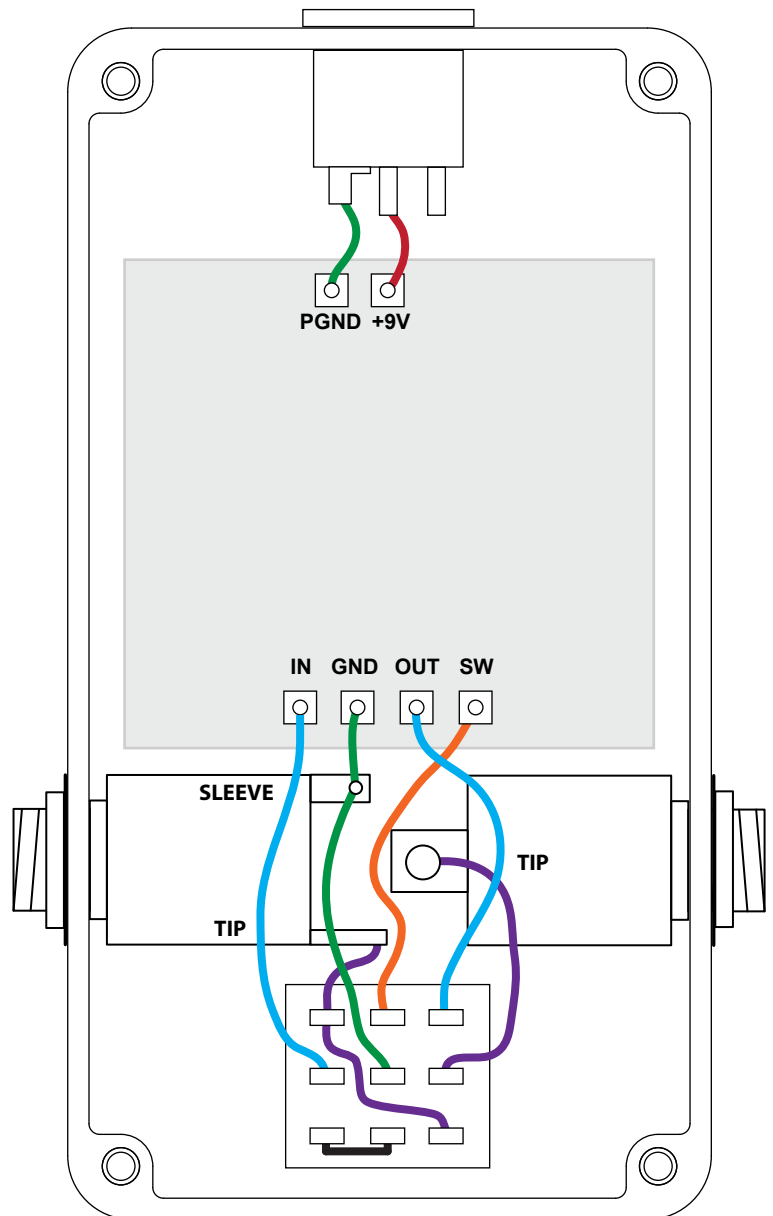
This diagram shows standard true-bypass wiring with a 3PDT switch. When the switch is off, the input of the circuit is grounded and the input jack is connected directly to the output jack.

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!



License / Usage

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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