Experimental Improved Regulated B+ Circuit and Solid State VR Tube Replacement *

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In a previous article I wrote for ER magazine I described how to mod an existing receiver's power supplies for soft start for both B+ and filaments[1]. My mod used zener diodes powered by a dropping resistor to obtain the reference voltage for the MOSFT pass regulator circuit.

Looking through back issues or ER I came across a power supply design used by Tom Marcellino in a QRP transmitter article[2]. In his design he used LR8 three terminal high voltage regulator IC's for the pass transistors. At the time of writing my article I was unaware of this IC.

I immediately realized that this was the "missing link" for a much better B+ regulated power supply and also could be configured to replace gas regulator tubes.

The reason for this is that with using zeners for the high voltage reference one has to calculate a power resistor value that keeps the zener current in about the middle of the Izt range and taking into the minimum and maximum unregulated B+ values caused by AC input voltage variations. Then you have the heat loss to deal with.

This "missing link" needed to make a simple HV regulator circuit is the LR8 made by Microchip and others. It's designated as a "High-Input Voltage, Adjustable, 3-Terminal, Linear Regulator". Its rated input is 13.2 to 450 volts and an output of 1.2 to 438 volts. And it's cheap! Less than $1 at major distributors. Most importantly for us old geezers is that it is available in a TO 92 package or TO-252. Not something the size of a pinhead requiring a special expensive socket costing 10X the IC. Perfboard be us!

Using the LR8 is as simple as one could wish. After meeting the requirement that the input voltage must be at least 12.1 volts above the desired output, the desired voltage is determined by using just two resistors. See Fig. 1 for the manufactures rather complex formula for the two resistors values as well as Tom's greatly simplified method.

There are two additional simple components required not usually found with 3 terminal regulators: a current drawing load resistor and a stabilization capacitor.

Tom Marcelo determined with a 2K output-to-sense terminal the second resistor going to ground is calculated by the formula of:

With R_1 2K, the desired output voltage X 1.64K = resistor value R_2

So for a 0A2 replacement of +150 volts, we have: 150 X 1.64K = 246K. Since this is not a standard RETMA value some combination of fixed and/or fixed variable would be needed to get that exact voltage. The sink current limit is 10 mA. The chosen load resistor draws around 1mA

Where this can be especially valuable is for the oddball gas regulator values used such as 75, 90 and 105 volts.

So if used to replace a 0A2 one just needs to slightly rewire the socket from a 2 wire to 3 wire configuration. The large heat producing OEM power resistor can be removed saving space and removing unnecessary heat.

The LR8 was used to replace the original zener reference in a MOSFET soft start regulated B+ supply shown in Fig 2 that was published in my previous article. Additionally, a LR8 was used for the +150 volt supply. While this circuit was designed for a Hammarlund SP 600 receiver it is easily modified for any receiver by changing the R_2 and R_L values.

Although the manufacturer says the reverse protection diode is only needed under specific conditions I chose to use a 1N4007 to be on the safe side as it only added pennies to the cost for cheap insurance.

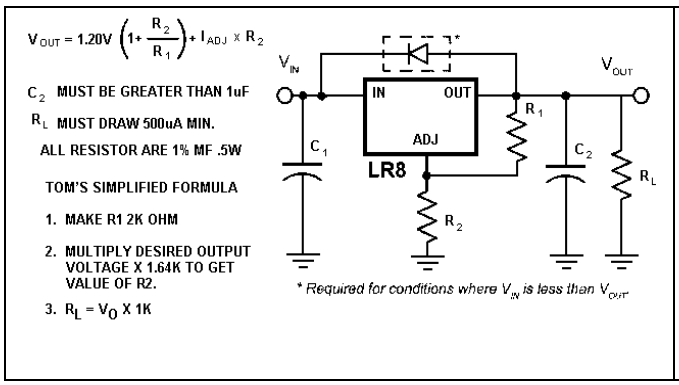

Fig. 1

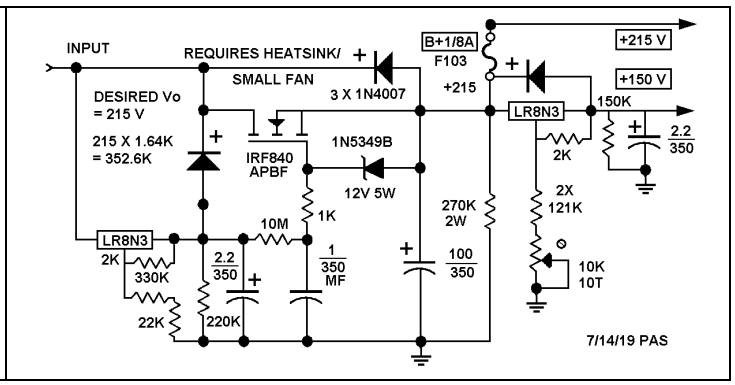

Fig. 2

1. Voltage Management for Large Boat Anchor Receivers ER#350 July 2018

2. The Stacked 40 Meter QRP Transmitter Tom Marcellino ER #321 Feb. 2016

* Due to the fact we're moving, I haven't been able to wire up this circuit. It should work as shown as the LR8 circuitry is from the manufactures data sheet and the information from Tom's article.

The MOSFET regulator is an adaption of a Wellburn circuit.

Thanks to Jacques Fortin VE2JFE for his corrections to my original circuit and other helpful advice.