A Solid-State Filter Choke or Field Coil Replacement

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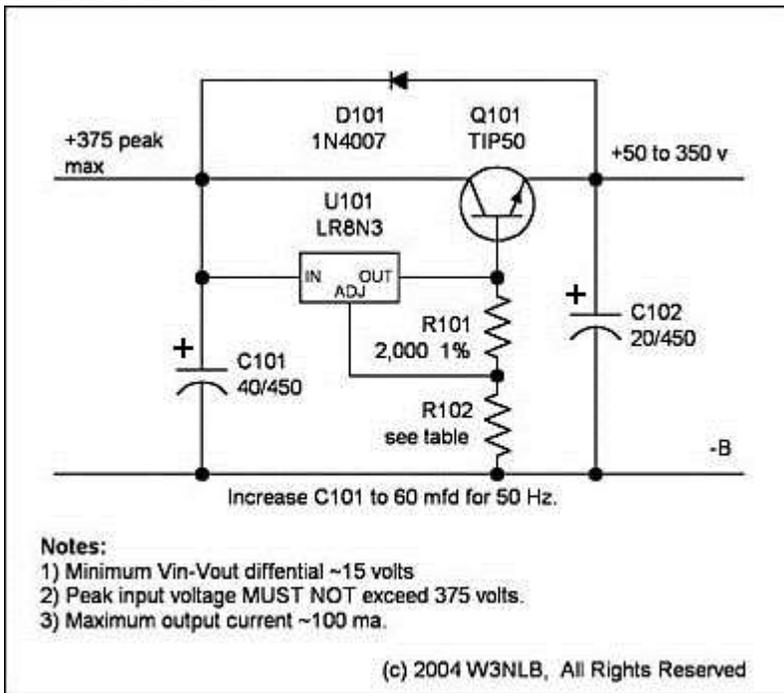*Circleville, OH 43113*
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This month's contribution comes from Leigh Bassett, W3NLB (Laurel, MD). It's a circuit designed to replace the filter chokes and capacitors in sets where the originals are beyond salvage. The device should be especially useful for replacing open chokes in radios like the metal-box Atwater Kents. It can be built on a small PC board and installed in the power pack case after the original bad components have been removed. dko

This simple circuit provides a regulated output up to 350 volts and 100 mA. Ripple content of the output is essentially zero. Substituting the circuit for a filter choke or field coil in a radio costs less than $2. The output is set by changing a single resistor, or a variable resistor can be used.

At the heart of this high-tech marvel is the Supertex LR8N3 three-terminal regulator. Rated for input up to 450 volts and output up to 400 volts, it can supply up to 10 mA of current. The device comes in a TO-92 plastic transistor package. Increased current capacity is provided by using the LR8 output to drive the base of a TIP50 power transistor, housed in a standard TO-220 package. With a minimum beta of 30 for the TIP50, the combination can supply up to 100 mA continuously.

D101 1N4007   Q101 TIP50
+375 peak max
+50 to 350 v
U101 LR8N3
IN   OUT   ADJ
R101 2,000 1%
+ C102 20/450
+ C101 40/450
R102 see table
-B
Increase C101 to 60 mfd for 50 Hz.

Notes:
1) Minimum Vin-Vout diffential ~15 volts
2) Peak input voltage MUST NOT exceed 375 volts.
3) Maximum output current ~100 ma.

Leigh Bassett's hi-tech filter network or field coil replacement.

In most applications, the pass transistor will not require a heat sink. For example, in a circuit with 50 volts differential across the TIP50 and 100 mA load, the pass transistor is only dissipating 5 watts. The TIP50 is rated 40 watts dissipation.

The metal tab of the TO-220 case is the collector, which is connected to the DC input in this circuit. If a heat sink is required, a suitable insulated mounting kit must be used.

The actual current capacity from the supply depends on the input-output voltage differential across the LR8 and the amount of current which it must supply to the pass transistor. The LR8 can supply up to 10 mA, but it is protected from both over-current and over-temperature conditions by internal circuitry.

The minimum input-output voltage differential across the LR8 is 12 volts. Therefore, the input voltage at the low-point of the ripple should exceed the desired output by at least 15 volts, allowing for the base-emitter drop in the pass transistor. Increase the size of the input capacitor if needed to achieve this.

Note the limit of 375 volts peak input to the regulator. This is measured at the crest of the ripple waveform and insures that the components will not be damaged in the event of line voltage excursions.

As a replacement for a filter choke or field coil, the active regulator provides 60 Hz ripple suppression in excess of 60 dB with only 1uF. of capacitance on the output. In the circuit presented here, the value should be greater than 66 dB due to the larger output capacitor and the 120 Hz. ripple frequency.

Output voltage is determined by the value of R102. The table below gives values for various outputs. The supply can also be made adjustable by replacing R102 with a 500k ohm potentiometer in series with a 75k ohm, 1% resistor.

Output Voltage	R102-k ohms
350	572
325	531
300	490
275	449
250	408
225	367
200	326
175	285
150	244

PARTS LIST				
Ref	Part No.	Mfr. and Description	Vendor	Price
D101	1N4007	Fairchild 1000 PIV/1A. rectifier	Mouser**	$0.05
Q101	TIP50	ST Micro NPN HV power transistor	" "	$0.80
R101	RN55D	Vishay 2k ohm, 1/8w, 1%	" "	$0.16

		resistor		
R102	RN55D	Vishay 1/8 w., 1% resistor*	" "	$0.16
U101	LR8N3	Supertex HV 3-term. regulator (TO-92)	" "	$0.82

Total parts costs = $1.99

Prices are single-piece online as of 12 February 2004.

* Value from table above.
**Mouser Electronics - www.mouser.com
Data sheets available at onsemi.com (TIP50) and supertex.com