Lyrima, Ltd

Application Note: Assembling the DHT Coleman Regulator for Transmitting DHTs: 2.5A to 3.6A.

Please Read this Note together with Andht01 [PDF Manual]

1. Parts you will need (NOT supplied in the kit):

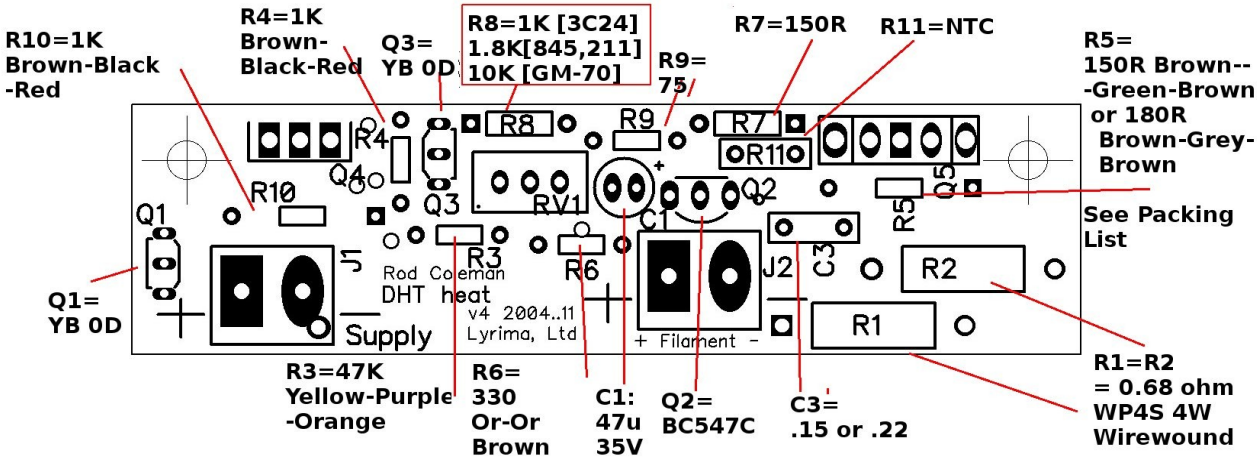
   Silicone Heatsink Compound (Apply smoothly between power transistors and heatsink). Recommended type: Electrolube HTC10 [eg 10ml syringe, Farnell 317950]. Mouser Part Nr.: 590-860-4G would seem to do a similar job in 4g x 100pcs.

   Test Resistors, e.g.: 3R 50W (845, 211: 10V filaments) to test the regulator. Or use some old dead power tubes like EL34s [1.5A 6.3V] wired in series/parallel to give approximately correct load. 1R and lower value resistors are also needed to build the raw dc supply [see the dc supply paragraphs], so be sure to have plenty of these in hand.

   Mounting screws. Transistor and PCB mounting holes are suited to M3 screws.

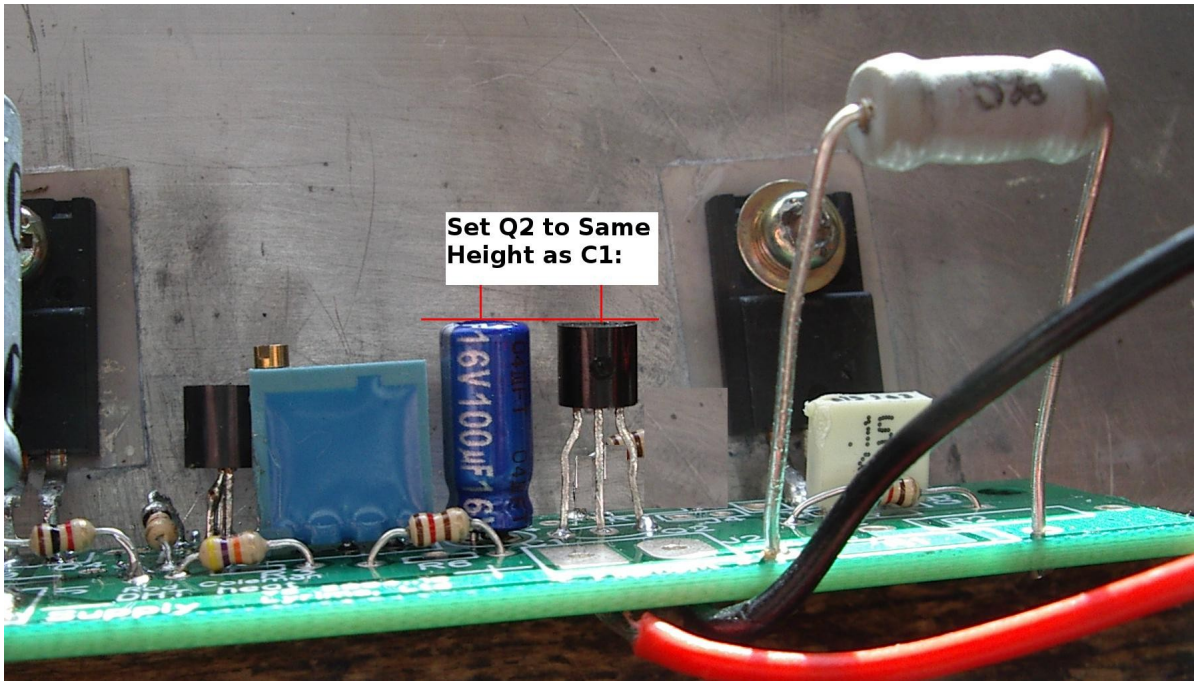
   Components for a raw dc supply: See final section. Additional 1000uF 35V [Panasonic FC] if your wiring between the raw dc supply and the regulator is more than 150mm [6”].

2. PCB components:All the components mounted on the PCB come in the kit: Check the diagram and see that all parts are ready to stuff the board:



3. Lead Formation.

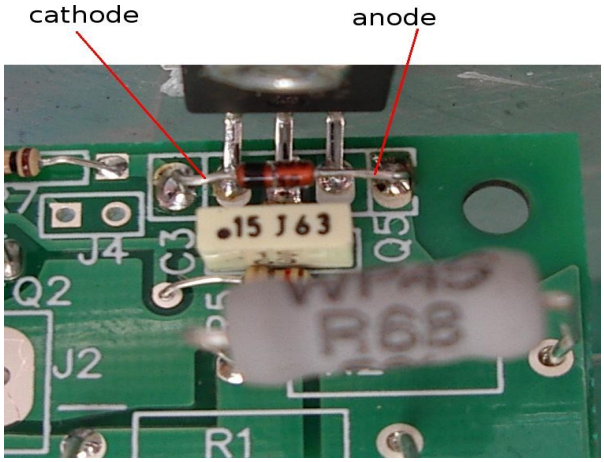
3.1 Q2: Set the top of Q2 level with C1:



3.2 Resistor R1 and R2. These resistors sense the current. They are 4W types, but are only stressed at 25 .. 35% of this, to prevent them running very hot. Still **they will reach 150 degrees Centrigrade or more**, so be careful not to touch them when running the heater. Mount the resistors so that the body **is 14mm or more from the PCB**, or the board may be burned.

3.3 RV1 trimmer. Mount this so that the adjustment screw is at the top-left [i.e.: nearest R4.

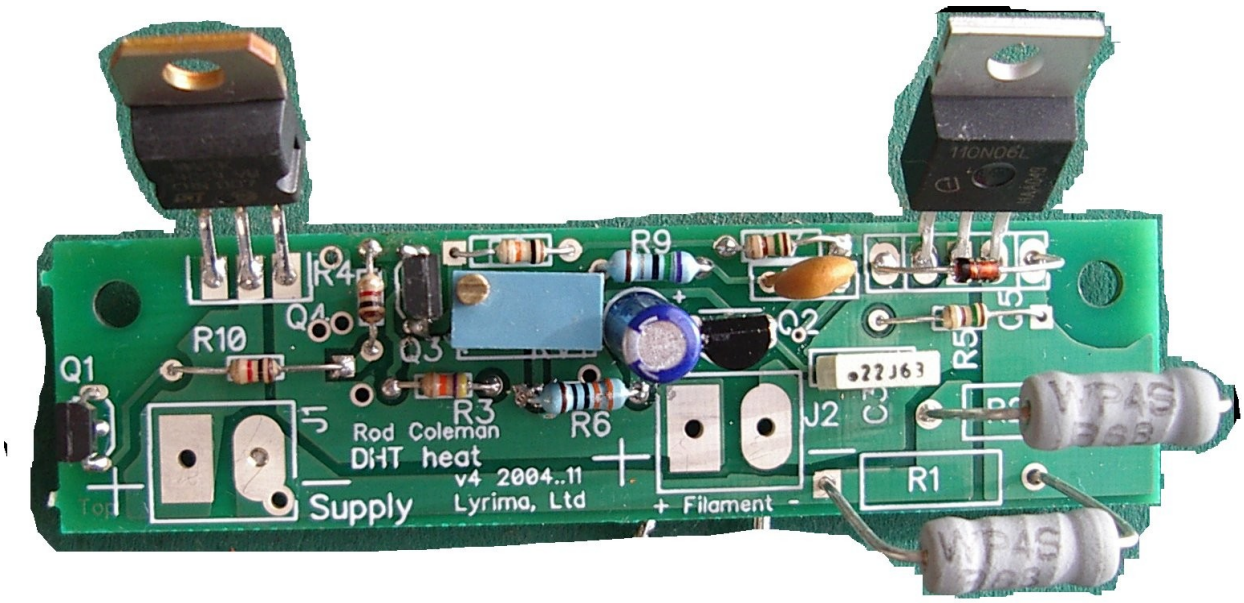
3.4 Zener diode Z1. For Transmitters with a supply voltage above 16V, a zener diode is included in the kit, to protect against the possibility that the Q5 gate-voltage is exceeded. This can only happen if the filament is *disconnected* at switch-ON. Z1 (12V) is installed on the extra gate & source pins of Q5. See the picture, right:



3.5 Power transistors Q4 and Q5. You must decide how to mount the regulator in relation to the heatsink and chassis before forming these leads. You can mount them under the PCB [if you want a horizontal mounted regulator] or with formed leads and TO-220 body at right angles, if you want (say) the PCB on the amplifier base, and the back panel as a heatsink. See picture for this transistor mounting style.

3.6 Power Transistor isolation. The power transistors Q4 & Q5 require isolation from the heatsink. Use TO220 Mica insulators & mounting washer. Apply thermal grease to the heatsink interface, on both sides.

4. Assembled PCB picture. The finished board should look like this. Double check the orientation/polarisation of C1, RV1, Q1,Q2,Q3.



5. Testing the Regulator.

   When you have stuffed the board according to the diagram, test it carefully before connecting to a DHT filament.

   5.1 Inspection. Use a lens to check that no solder shorts are present, especially around fine-pitch parts like C1, Q1, Q3.

   5.2 Meter Test.

   Set a DMM to resistance [20K range]. Try the Supply input [red to +]: should only give momentary or high impedance reading. Try Filament Terminals [both directions], should also read HIGH IMPEDANCE.

   5.3 Raw dc [Open] Test

   Check your raw dc supply gives the OPEN CIRCUIT voltage predicted by PSUDii [see the Application Note on power supply design].

   5.4 Dummy load Test

   Mount the Regulator on a Heatsink. Pass transistors will be destroyed if the regulator is used - even for less than 1 second - without a heatsink. Connect the Test Resistors [dummy load] to the Filament Terminals, with an Ammeter in series. Monitor supply voltage and filament voltage. Power ON, and check that current is in the range 2.5 to 3.6A. If too high, immediately power OFF, and look for short circuits, or wrong components values. If OK, use a trimmer screwdriver to check the adjustment range is at least 2.6 to 3.6A. When this is OK, set the trimmer to **minimum current** and switch OFF.

   5.5 Connect DHT

   Now wire the DHT filament (see *CONNECTING* section of the General Application Note: AN_DHT_01.PDF).

5.5.1. Turn the trimmer RV1 fully anticlockwise. It's a 25-turn trimmer, for precision adjustment.

5.5.2. Swtich ON filament supply WITHOUT B+ (HT supply) and adjust current until the rated voltage appears across the filament (6.3V for 3C24, 10V for 805/845/211; 20V for GM70).

5.5.3. Keep monitoring filament current, and apply B+. The current will increase a little! Adjust again, and keep monitoring until the amplifier is warmed up.

5.5.4. Although the regulator controls current (there is no voltage servo, for best sound) the current is temperature stabilised by the NTC R11 and its network. You only need to adjust the current when the filament has warmed up. After that, you should not need to adjust again, right across the lifetime of the DHT.

5.5.5. But if you install a different DHT, remember to adjust the current again.

6. Power Supply Design.

6.1 For 6.3V transmitters, eg 3C24, a Raw dc voltage of **11V minimum, 12V nominal, 13.5V maximum** is the recommended level.

6.2 For 10V transmitters: 845, 211, 805 etc., a Raw dc voltage of **14.5V minimum, 15.5V nominal, 17V maximum** is the recommended level.

6.3 For 20V GM70 & GK71 transmitters, a Raw dc voltage of **24.3V minimum, 26V nominal, 29V maximum** is the recommended level.

6.4 Please study the General Application Note to see the refinements of good power supply design. The screenshot shows an example power supply. For 845 and GM70, use a 160VA transformer or greater, to get high enough voltage, and low regulation. (one transformer for each tube, **DO NOT share L & R channels).**

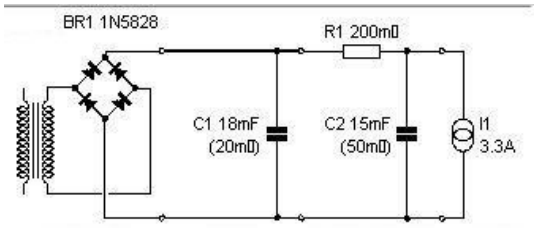
6.5 Rectifier bridge made with 10A schottky rectifiers, e.g. MBR1045 [Farnell 1702813; Mouser 844-MBR1045PBF]. C1 and C2 capacitors are Nichicon LG, Panasonic TSUP or TSHA or TSHB or Samwha HC series. The ripple current handling must be at least 7A for a Transmitter's regulator. 3300UF 50V or 4700uF 63V “snap-in” types, x3 or x4 are a good way to get the right ripple handling. **Using single large capacitors is not recommended –** you need a very high value to get 7A ripple-current handling (eg 33000uF) and this will cause excessively high peak currents in the rectifiers, and unnecessary stress in the transformer/rectifier.

6.6 I believe that the action of the Regulator means that “Audio Quality” capacitors are not needed.

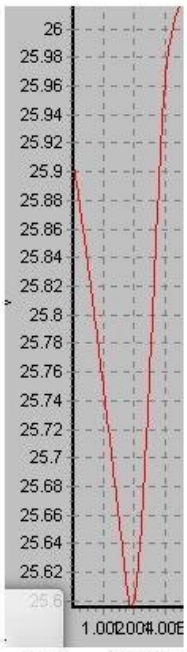
6.7 If your local mains has problems with HF noise, or you have radio stations nearby, try adding a 5A common mode choke .

6.8 Have some 0.05R and 0.1R resistors at hand, to fine-tune the raw dc voltage by inserting them at the R1/R2 position [see R1 and R2 in the general Application Note] for designing the raw dc Supply.

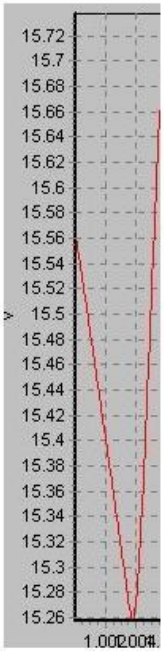
Examples:



C1= (e.g.)
3300uF/50V
4 pcs
[Ripple Handling
12A total



Output for GM70 Regulator, using 20V 160VA secondary



Output for 845/211 using 12V 160VA secondary