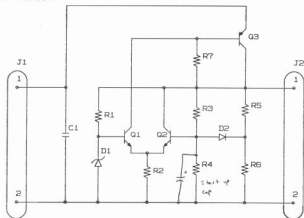


Fan Speed Controller

Fan noise is a problem in electronic equipment used in the office or home. Since the fan must provide sufficient cooling at maximum operating ambient temperature, there is excess under normal operating conditions. If this excess could be eliminated, then there would be a corresponding reduction of fan noise.



D1	5.1V Zener
R1	470
R2	470
R3	5.2K
R4	NTC Thermistor (9.8K @ 25C, 4.8K @ 48C)
R5	470
R6	470
D2	1N4148
R7	580K
Q1	2N3984
Q2	2N3984
Q3	2N2984A

This circuit provides a simple and inexpensive solution for systems using a small 12V DC fan. It is a voltage regulator with an NTC thermistor in the feedback network. Some important features:

- Inexpensive
- Low component count
- Low voltage drop (from V_{CC} to V_o)
- Output short circuit protection
- Minimum output voltage clamp

Output voltage is determined by the equation:

$$V_o = 5.1(R3 + R4)/R4$$

Therefore, R3 and R4 must be selected to provide full output voltage (11.8V) at maximum operating ambient temperature. R4's temperature coefficient should be such that at minimum output voltage, the fan provides just enough cooling to maintain constant junction temperatures. As the temperature increases, so does V_o .

R5, R6, and D2 provide the clamp for minimum output voltage. This is to prevent the fan from stopping. R7 provides enough base current to Q3 to initiate start-up. Once V_o reaches about 1V, the differential amplifier, Q1 and Q2, will turn on and sink Q3 base current and provide regulation.

Using the values in the circuit above, the actual output voltage is plotted against the desired voltage.

