

supplies for cars

In order to function effectively, electronic equipment used in cars must have an appropriate power supply, which in addition to providing a regulated voltage from the battery supply, must also suppress interference appearing on the battery voltage from the car electrical systems. To be effective, such power supplies must of course be used in conjunction with the measures described elsewhere in this issue for the suppression of radiated interference at source.

Two power supplies will be described; a simple zener stabilizer with built-in suppression, for low-power circuits such as instruments (electronic tachometer etc.) up to about 170 mA and a high-power stabilized supply, for powering such things as portable cassette recorders, up to about 2 A.

Low-power circuit

Figures 1 and 2 show the low-power circuit configuration for negative- and positive-earth cars respectively. L1 and D1 provide high-frequency decoupling. L1 may be wound on a wire-ended cylindrical ferrite core, with a diameter of about 10 mm, using 45 turns of 0.5 mm enamelled copper wire (25 SWG). Zener diode Z1 stabilizes the output voltage at 5.6 V, which is suitable for TTL circuitry, but 5.1 V or 4.7 V types would also do, as they are within the supply voltage limits for TTL. Other voltages may, of course, be used for different equipment.

If a supply voltage is required that is almost equal to the available battery voltage, then R1 and the zener diode may be omitted. Of course, the circuit

will then not provide stabilization of the supply voltage, but only interference suppression. This would be quite adequate for COSMOS IC's, which are fairly tolerant of supply voltage variations.

The difference between battery voltage and output voltage is dropped across R1. In the example given, for a 6 V battery R1 would be 8.2 ohm ¼ W, and for a 12 V battery 47 ohm 2 W. C2 should be a low-inductance type such as ceramic and D1 can be any diode that will carry 200 mA.

High-Power Circuit

This circuit (figure 3) is designed to provide a stable, interference-free supply for cassette recorders, audio amplifiers and other equipment. Car radios generally have their own inbuilt suppression circuits.

The circuit is a simple feedback stabilizer. T5 and T6 form a differential amplifier with a constant-current emitter load (T7). This compares a portion of the output voltage at the slider of P1 with a reference voltage provided by D6. T3 provides a constant

current through this zener diode. T4 is a constant-current load for the collector of T6, which drives the Darlington-connected transistors T8 and T9. Current limiting is provided by T1 and T2. When the current through R4 is such that the voltage drop across it exceeds the base-emitter voltage of T1, this transistor turns on, which turns on T2, pulling down the collector of T6 and reducing the drive to T8. The maximum output current required determines the value of R4:

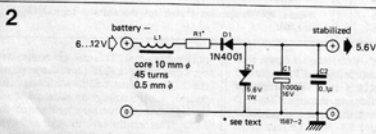
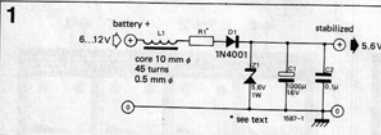
$$R_4 = \frac{0.5}{I_{max}} (\Omega)$$

L1 is wound from 45 turns of 1.0 mm copper wire (19 SWG) on a ferrite core and thus provides interference suppression due to its high inductance. P1 will adjust the output between about 5.6 V and 12 V, although the higher figure can only be obtained when the (12 V) car battery is fully charged and in good condition, so that the supply voltage is around 14 V, since some voltage must be dropped across the series regulator transistor and R4.

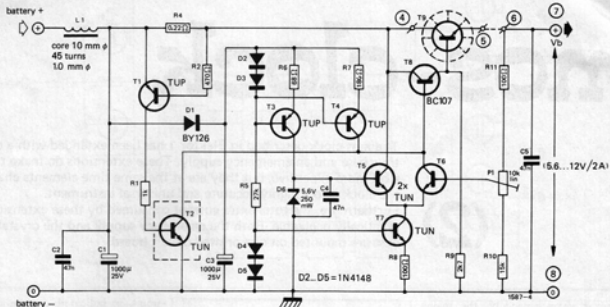
A printed circuit layout for this supply is given in figure 4. The connections shown encircled in figure 3 are shown on the board layout. The circuit of figure 3 is for use with negative earth cars, but may be modified for positive earth simply by reversing all diodes and electrolytic capacitors and replacing transistors by their complementary equivalents.

If higher output currents are required, an external transistor (e.g. MJ3055) can be added. The connections to this transistor (T10) are shown dotted in figure 4; it should be mounted on an adequate heatsink, with mica washers for isolation. If this transistor is not required, the connections 5 and 6 on the pcb must be bridged.

To avoid deterioration of the board in the car due to humidity and dirt it is best to encapsulate the circuit (once it has been tested) in epoxy resin or silicone rubber.



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Parts list for figures 3 and 4:

Resistors:

R1 = 1 k
 R2 = 470 Ω
 R4 = 0.22 Ω^*
 R5 = 27 k
 R6 = 68 Ω
 R7 = 180 Ω
 R8, R11 = 100 Ω
 R9 = 2k7
 R10 = 15 k
 P1 = 10 k, preset

Capacitors:

C1, C3 = 1000 μ /25 V
 C2, C4, C5 = 47 n

Semiconductors:

T1, T3, T4 = TUP
 T2, T5, T6, T7 = TUN
 T8 = BC107 or equ.
 T9 = BD 131 or equ.
 (T10 = MJ3055 or equ.*
 D1 = BY 126
 D2 ... D5 = 1N4148
 D6 = 5.6 V/250 mW zener

Coil:

L1 = 45 turns of 1.0 mm enamelled copper wire on 10 mm ϕ ferrite former.

* see text

Figures 1 and 2. Simple zener stabilized supply with high-frequency suppression. Figure 1 is for negative earth and 2 is for positive earth.

Figure 3. A high-power regulated supply for car electronics. The output voltage may be adjusted from 5.6 V to 12 V and the circuit will supply 2 A continuously.

Figure 4. P.c. board and component layout for the circuit of figure 3.

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