

Unity-gain stage is 50-ohm driver

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A recurring problem for the circuit designer is the connection of his op amp, his oscillator, or his test instrument to the low-impedance outside world. The simple buffer-driver shown here provides unity-gain class A operation, high input impedance, and 50-ohm output impedance over a wide frequency range. It also provides blast-out (short-circuit) protection and can be built with a single IC.

Because the base-to-emitter voltages of transistors Q_1 and Q_2 cancel each other, the dc voltage between input and output is near zero. With 2N2222 and 2N2907 transistors, actual offset voltage will run from 0 to 50 millivolts. This offset can be balanced out by adjustment of resistor R_5 .

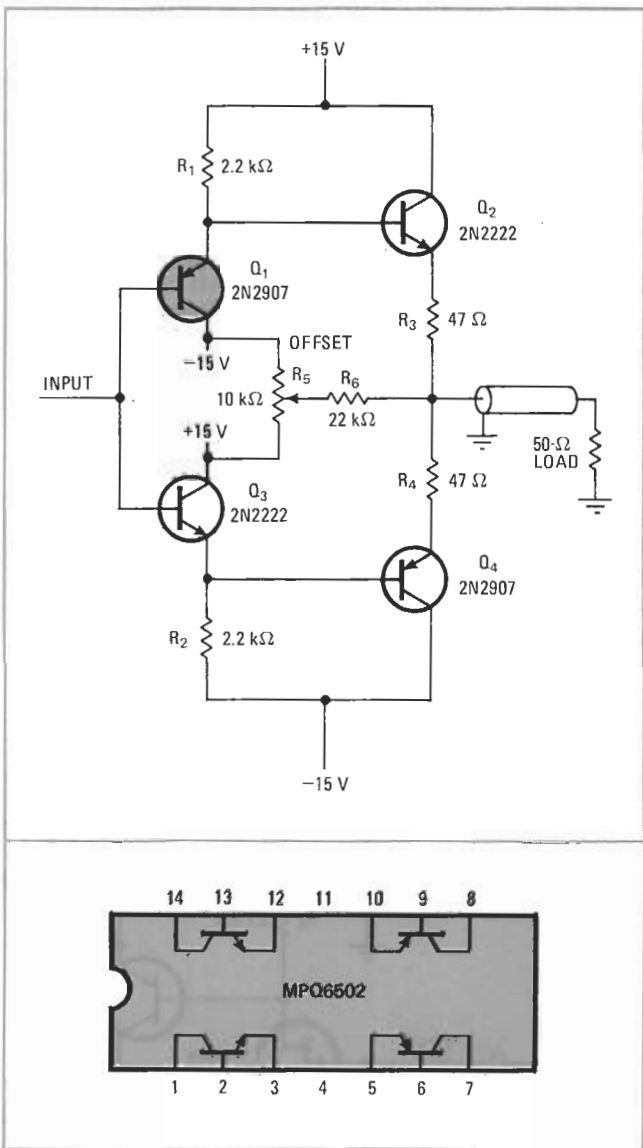
With ± 15 -v supplies and the resistor values shown, this driver will deliver 10 v peak to peak, undistorted, into a 50-ohm load. Without the external load, the output will double to 20 v p-p. For total circuit protection against a shorted output and dc inputs, resistors R_3 and R_4 should be rated at 4 watts. The circuit draws about 17 milliamperes in the quiescent state.

Actual supply voltages are not critical. Resistors R_1 and R_2 can be changed for the appropriate drive to accommodate any supply voltages from ± 5 v to ± 20 v. For ± 5 -v supplies, R_1 and R_2 should be 680 ohms.

The input impedance of the circuit is a function of the gains of the transistors used. For transistors with h_{FE} between 50 and 100, the input impedance is in the range from 50 to 100 kilohms at 1 kHz and decreases to 25 to 50 kilohms at 1 MHz. This impedance is normally high enough to offer imperceptible loading on op amps. Even a 2-kilohm potentiometer, used as an amplitude adjuster, sees only a 4% loading from low frequencies to 1 MHz.

For the circuit shown, the driver has a bandwidth of about 10 MHz when the source has an impedance of 1 kilohm. With a source impedance of 50 ohms, the frequency response is greater than 10 MHz.

A convenient means of packaging this circuit is the MPQ6502 complementary quad shown in the inset. The MPQ6502 has two 2N2222 (npn) and two 2N2907 (pnp) transistors in the handy 14-pin dual-in-line package. □



Driver delivers. Unity-gain driver has zero offset, delivers 20 V p-p into an open circuit, or 10 V p-p into a 50-ohm load. Useful as output for op amps and test instruments, it has high input impedance, good frequency response, and low current drain. Supply voltages are not critical. The four transistors are packaged in an MPQ6502 IC.

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