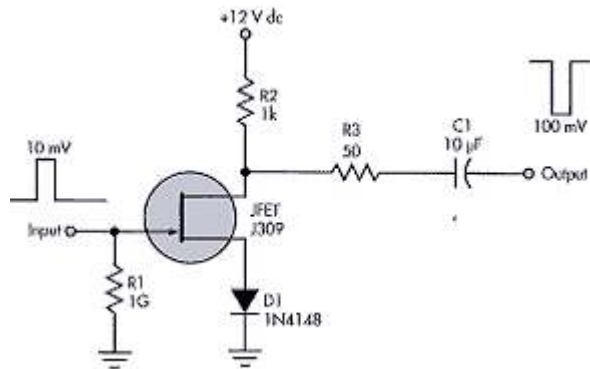


Superior JFET biasing improves amplifier performance

An N-channel JFET has a low bias current when its gate is biased negative to the source. However, this requires either that the gate voltage be biased negative with respect to the source voltage or that source voltage be biased positive with respect to the gate voltage. For ac amplifier designs, gate biasing can be made self-biased by using an RC network at the source to hold the positive voltage for a period longer than the time period of the input pulse/frequency source.

In the design described here, the JFET source is constantly biased. Hence, its frequency response is excellent from dc to 10 MHz. This improvement is due to stable diode biasing. Diode biasing exhibits only a 2mV/°C drop in voltage with increasing temperature from 0°C to 100°C. This is excellent stability.

In this example of a pulsed amplifier design, the signal source has been biased by a 1Gohm resistance to ground, and the JFET source is biased using a fast diode, a 1N4148, at a source-drain current of about 5mA. The gate is maintained at ground potential so that no bias voltage is injected into the input dc circuit. This scheme makes the gate remain at zero voltage unless a signal to be amplified changes it.



This technique is illustrated in the figure, where the input impedance of the circuit is maintained at 1Gohm, unless it's shunted by the impedance of the signal source. The JFET's output current is kept significantly high at 5mA to let the JFET drain voltage remain at its mid-operating point, about 5 V. This enables the JFET to work for both positive and negative input signals.

In this circuit, a J309 or IFN152 JFET is the most suitable device, with an input bias current of about 100pA. The amplifier delivers a good signal response to about 10 MHz. A 2N4117A JFET would reduce the input bias current but also reduce the high-frequency response considerably.

This circuit makes an excellent input-stage amplifier for oscilloscopes, where input impedance isn't greater than 1Mohm. The amplifier improves the input stage to 1Gohm. The circuit is most suitable for piezoelectric detectors, photodiode-based radiation detectors, and low-capacitance sensors with a very small charge in the range of 10fC to 1pC.

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