Category: Special Circuits **CIRCUIT IDEAS FOR DESIGNERS** Schematic no. SPCKT_10001.0

Precision Ramp Generator & Comparator

Description

This circuit generates a precision linear ramp from −5V to +5V that could be stopped within 1mV of the DUT (device under test) desired output. The DUT in this example is the ALD1108 MOSFET. The V_{GS} voltage of this device is defined as that gate voltage at which the drain current is $1\mu A$ and the drain voltage is at 100mV. The challenge in this case is to measure that gate voltage V_{GS} at which $V_{DS}=100mV$ and drain current $I_{DS}=1\mu A$ simultaneously. This is accomplished by using a precision current source that supplies a calibrated $1\mu A$ to the drain of the DUT while setting up a precision comparator to continuously comparing the drain voltage V_{DS} to that of a precision reference voltage set at 100mV. When the ramp voltage increments from V-=-5V, it charges the holding capacitor C2, and V_{GS} measurement accuracy is determined by the accuracy and response time of the comparator and the time it takes to subsequently control the logic and open the analog switch to stop the ramp generator. The comparator selected has an input offset voltage specification of 0.2mV. The current source accuracy, the comparator Input Reference voltage accuracy, the input offset voltage of the buffer operational amplifier and the precision of the readout meter all contribute to the measurement error terms. Last but not least, the value as well as the quality of the holding capacitor C2, the leakage currents surrounding this C2 node has direct impact on the leakage currents and the accuracy of the readout. In general, the actual reading using a high precision external DVM as a readout meter can be obtained within a second or less at a total error of less than 1mV. A high quality C2 such as a low leakage polypropylene type can retain the measured voltage for well over a minute without additional errors due to internal leakage currents.

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