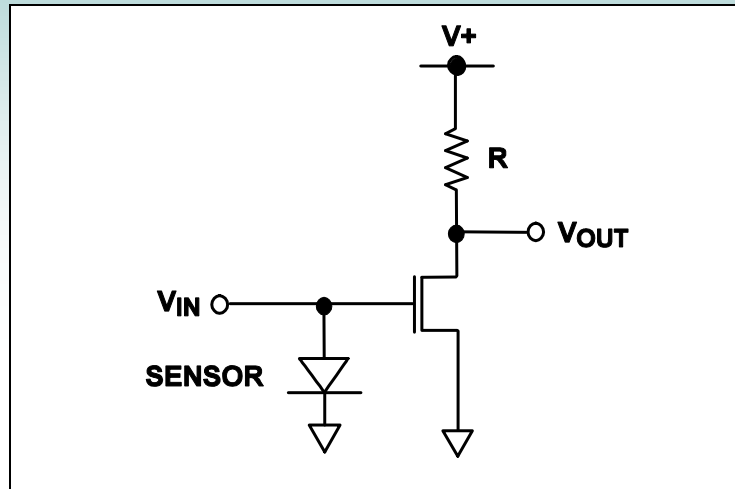




Zero-Power Voltage Detector



Description

This is a zero-power voltage detector suitable for extremely low duty cycle voltage detection applications. As an illustration, a sensor with outputs ranging from 0.1V to 0.5V is used. 0.1V may represent a "0", or OFF-state, while 0.5V may represent a "1", or ON-state. A MOSFET device with a precision threshold voltage of 0.4V +/-0.02V can be used. This MOSFET has a threshold voltage sufficiently accurate that the threshold voltage can be used as a rough voltage reference for the purposes of this circuit. The MOSFET device also acts as a voltage comparator as it has an inverting voltage gain = $g_m \times R$. R is a resistor value selected to be 20MΩ. At sensor output of 0.1V, the MOSFET is operating in its sub-threshold mode, and its drain current can be estimated from its performance characteristics at about 2nA. At $V_+ = +1.5V$, the nominal output voltage $V_{OUT} = 1.5 - 2nA \times 20M\Omega = 1.46V$. At sensor output of 0.5V, the MOSFET drain current is estimated at 2μA and the output voltage is now = $1.5 - 2\mu A \times 20M\Omega = \sim 0.0V$. If this circuit is used as an alarm circuit, where the normal OFF-state is 0.1V, then the MOSFET and the entire circuit is normally draining about 2nA, with the power drain = $2nA \times 1.5V = \sim 3nW = \sim$ zero power.

Recommended Components

EPAD MOSFET: ½ [ALD110904](#) with R = 22MΩ.

Other Related Circuit Ideas

[Schematic no. fet_11124.0](#) Micro-power Precision Normally-ON Power Switch

[Schematic no. fet_11125.0](#) ALD1109xx Zener Voltage Clamp Circuit