



[Maxim](#) > [Design Support](#) > [Technical Documents](#) > [Application Notes](#) > [Amplifier and Comparator Circuits](#) > APP 3473

Keywords: galvanic isolation, digital state detection, single-turn transformer

APPLICATION NOTE 3473

# Read Isolated Digital States Without Power Drain

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*Abstract: A simple circuit employs a small transformer and latched comparator to sense the state of a digital line without drawing power from the line.*

A similar version of this article appeared in the November 25, 2004 issue of *EDN* magazine.

Electronic systems must often isolate their inputs or outputs from the main reference common (ground). Various conditions can make necessary such galvanic isolation: the type of input sensor or driven actuator, safety considerations for medical equipment attached to a patient, or circuit components operating in an explosive or otherwise sensitive environment.

A requirement common to these applications is the need to sense the state of a digital line on the floating side of the circuit. That task is usually accomplished with an optocoupler, but optocouplers have limitations—they consume quite a bit of power from the sensing side, they are relatively slow, and the light emitter's aging reduces the current-transfer gain.

The circuit in **Figure 1** replicates the state of a digital signal with no power drain from the side being sensed, and with only modest power consumption on the grounded side. It simply detects the value of a resistive load (the low  $R_{DS(on)}$  of a fully conducting MOSFET, or an open circuit with the MOSFET off) applied to the secondary of a miniature, 1:1 single-turn transformer. Acquisition speed is a few tens of nanoseconds.



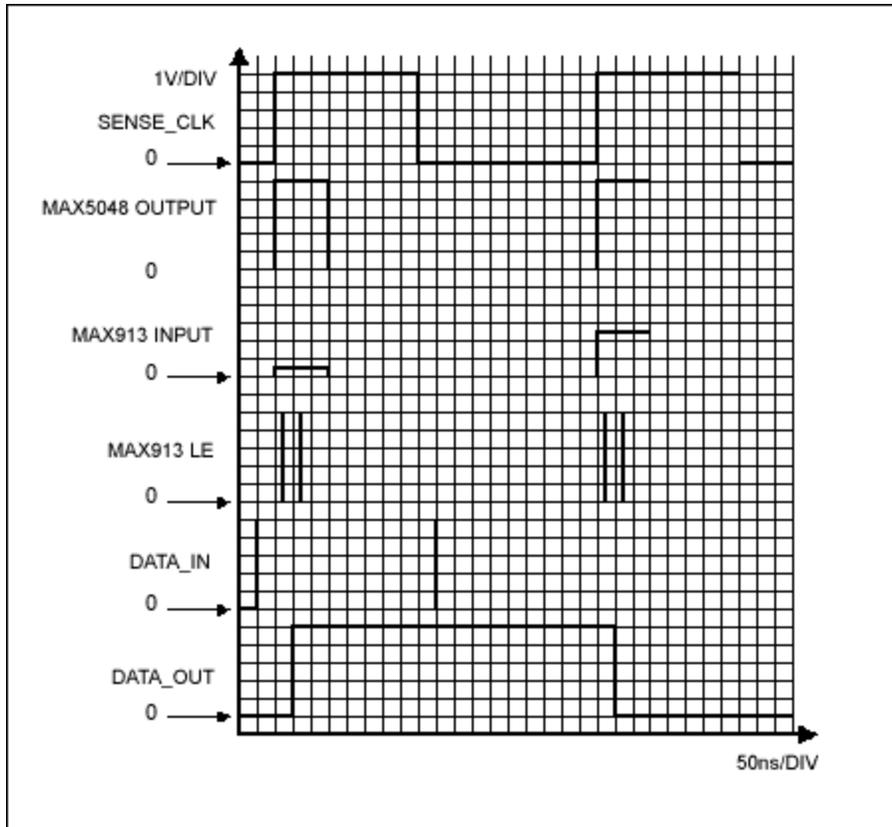


Figure 2. Timing relationships for selected signals in the circuit of Figure 1.

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