

Ideal Diode Controllers Protect Against Reverse Battery Polarity In Cars

[Diodes'](#) AP74502Q and AP74502HQ automotive-compliant 80-V ideal diode controllers, providing robust and reliable protection against reverse connections and voltage transients. Typical applications include advanced driver assistance systems (ADASs), body control modules, infotainment systems, exterior lighting, and USB charging ports.

The ideal diode controllers have all the features necessary to implement an efficient and fast reverse polarity protection circuit. They also include a load-disconnect function in case of overvoltage and undervoltage events. With an 80-V capability, they are suitable for all 12-V and 24-V batteries. This includes batteries in hybrid and battery electric vehicles (EVs), as well as the emerging 48-V systems.

The shift to 48 V is paving the way for EV innovations, enabling features like electric turbocharging and improved regenerative braking. The higher voltage also facilitates advanced infotainment systems and electrified auxiliary components. It could also lead to a zonal architecture, allowing more efficient power distribution and reduced wiring needs. The ± 80 -V rating is particularly relevant for the stricter overvoltage stress conditions associated with these 48-V systems (see the figure).

The AP74502Q and AP74502HQ controllers also support input voltages as low as 3.2 V, ensuring correct and reliable operation even during severe cold crank conditions, which can cause the battery voltage to drop significantly. Both devices share a peak gate turn-off sink current of 2.3 A, enabling rapid turnoff of the external n-channel MOSFETs when required, for example, during overvoltage or undervoltage events.

When the charge pump is enabled, the operating quiescent current (I_Q) is 62 μ A, and 1 μ A in disabled mode. This minimizes the overall power consumption of the system and reduces battery drain to an absolute minimum.

The AP74502Q features a peak gate source current, typically 60 μ A, which provides a smooth start-up with inherent inrush current control. This is advantageous in applications where limiting the initial current surge is important. In contrast, the AP74502HQ boasts a higher 11-mA peak gate source current, similar to earlier members of Diodes' ideal diode controller portfolio. This stronger gate drive allows for a faster turn-on of the external MOSFET, within 1 μ s (typ.).

The AP74502Q and AP74502HQ are available in the industry-standard SOT28 package with an operating temperature range from -40°C to $+125^\circ\text{C}$. Both devices are available at \$0.27 each for 1,000-piece quantities.

For more see the [AP74502Q](#) and [AP74502HQ](#) pages.



Figure. Unlike ideal diodes with reverse current blocking features, these ideal diode controllers are suitable for applications where energy may return to the input supply. However, they can also be configured as surge stoppers to protect overvoltage supply and downstream loads against unsuppressed load dump transients.