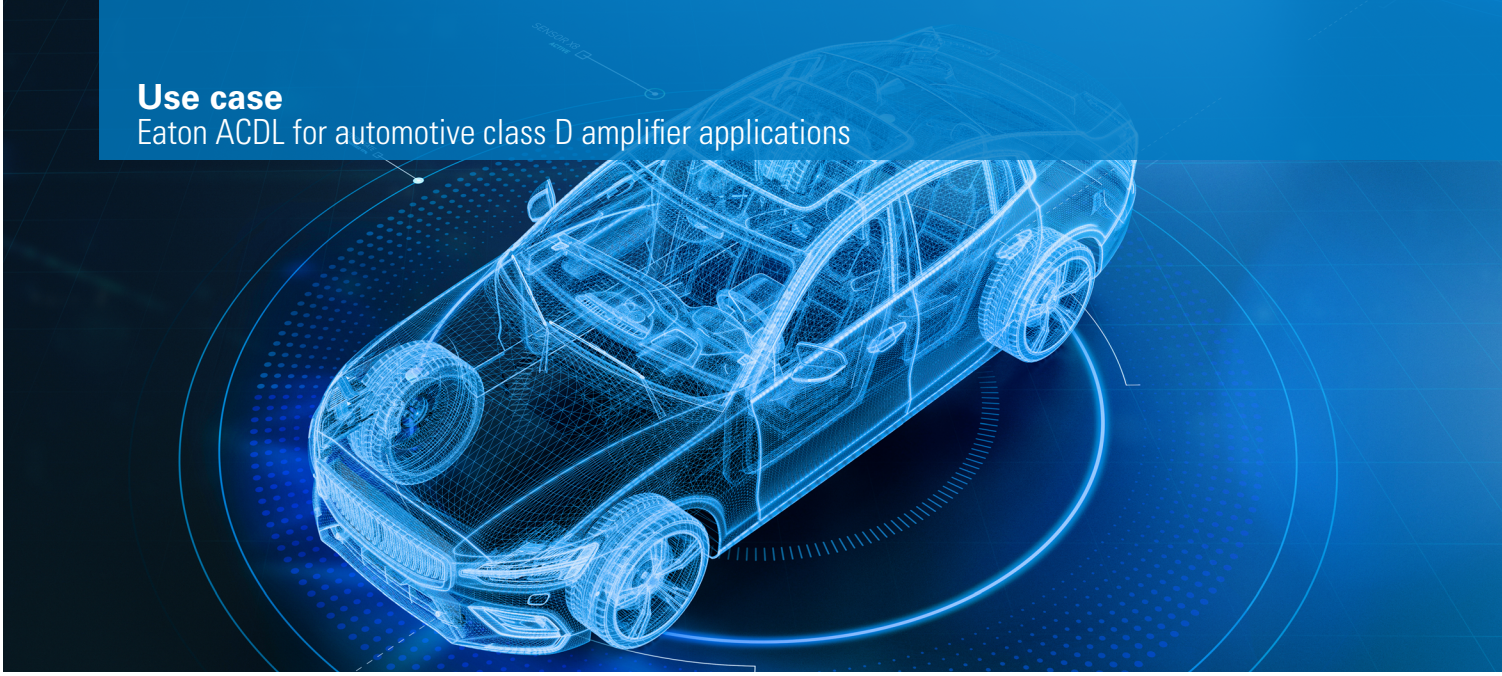
Use case
Eaton ACDL for automotive class D amplifier applications



Eaton ACDL for automotive class D amplifier applications

Class D amplifiers provide several benefits over the more common Class AB amplifiers in automotive applications. While these amplifiers have been around for over a decade, their adoption has been limited, but new advancements in Class D amplifier technology have led to engineers increasingly incorporating these components into a host of automobile applications.

From a design standpoint, these amplifiers operate similar to synchronously rectified buck converters -- but in reverse. However, unlike conventional buck converters, Class D amplifiers deliver a constantly changing voltage to fixed loads and achieve high power efficiencies (greater than 90%) with lower power consumption and heat generation. One of the main reasons for this is that while the internal MOSFETs are on, the device offers very low ON-resistances and consumes virtually no power when switched off.

One of the most vital considerations for selecting an inductor for Class-D audio systems is a component that is not significantly impacted by varying current levels. This feature is necessary to maintain linearity and mitigate EMI in automotive systems. Due to higher current levels in modern automobiles, larger inductor sizes are typically required for EMI filtering. However, Class-D dual inductors - which consist of two un-coupled inductors in a small footprint can help optimize board space savings with high current capability in a wide range of automotive applications. The uncoupled dual-inductor design reduces design complexity by increasing the design flexibility to account for future changes and improves time-to-market agility.

Automotive safety standards (e.g., the AEC-Q200 qualification) are coveted by leading automakers for high reliability and stable performance in magnetics across a wide range of temperatures. Their requirements include high frequencies for higher power with low losses and a wide inductance range to support multiple power levels throughout the vehicle. Automotive electronics must be sufficiently small and lightweight for seamless integration into component-dense PCBs, and Eaton's Class D amplifiers provide these benefits and more.

Eaton's ACDL is a complete family of automotive-grade Class D dual inductors consisting of ACDL1V (molded-alloy construction) and ACDL2V (ferrite construction). The ACDL1V's molded construction is suitable for high currents requiring soft inductance saturation and performance stability over a wide temperature range, while the ACDL2V's ferrite construction offers high efficiency and lower DCR. Both ACDL1V and ACDI2V are magnetically shielded for EMI immunity in electronic applications.

The ACDL1V is ideal for engineers looking to filter class D output at high current levels with low heat loss while maintaining good signal output for speaker lines. The ACLD2V can be used by those using standard class D amplifiers with standard 10mm and 12 mm PCB footprints. It is also suitable for amplifiers operating at higher frequencies where inductors with low AC losses are required. ACDL1V/ACDL2V offer reliable performance, suitable for harsh automotive applications over a wide range of temperatures (-55 °C to +155 °C for ACDL1V and -40 °C to +125 °C for the ACDL2V). Applications for Eaton ACDL Class D amplifiers include Bi-directional DC/DC converters (12V/24V/48V), EV battery chargers, onboard chargers, and EV electrical systems.

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