ALLEGRO A89110 – A VERSATILE INTEGRATED MOSFET DRIVER FOR BLDC AND MULTI-LOAD ZONAL ARCHITECTURES

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INTRODUCTION

The Allegro A89110 is an automotive-grade, three-phase integrated N-channel MOSFET driver designed to address the growing demand for flexible, efficient, and scalable control of motors and actuators in modern vehicle architectures. As automotive systems evolve toward higher levels of electrification and consolidated zonal architectures, the A89110 delivers a highly integrated solution capable of driving BLDC and PMSM motors as well as a wide variety of DC motors, solenoids, and resistive loads. The device supports full three-phase control for advanced BLDC motor operation, including block commutation and field-oriented control, while also enabling independent half-bridge operation for multi-load applications. Integrated diagnostics, programmable gate drive characteristics, and ASIL B compliance enhance system safety, reliability, and integration of power supplies and gate drive reduces electromagnetic sources. Housed in a compact 28-pin QFN package with an integrated charge pump and low-power sleep modes, the A89110 helps reduce system complexity, Bill of Materials, and optimizes PCB area while supporting scalable power and load configurations. The capabilities of the A89110 provide exceptional versatility for a wide range of inductive loads for BLDC and DC motors, pumps, latches, valves, and other distributed loads within next-generation automotive zonal control platforms.

BLDC MOTOR APPLICATIONS

At its core, the A89110 is engineered as a three-phase integrated MOSFET driver, making it ideally suited for Brushless DC (BLDC) motors and Permanent Magnet Synchronous Motors (PMSM). It provides full control over all six external power MOSFETs in a three-phase bridge configuration, enabling both block commutation and FOC excitation. This capability is critical for applications requiring precise and efficient motor control. Applications include cooling pumps, pneumatic pumps, and even lidar scanner motors.

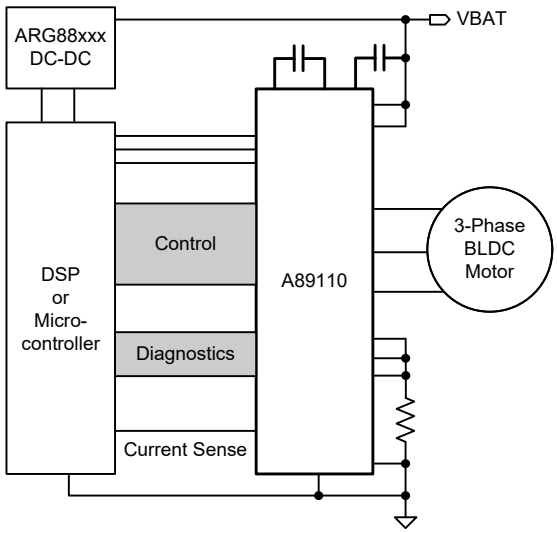

Figure 1: This block diagram illustrates the A89110 in a typical application controlling a three-phase BLDC motor, showing the microcontroller interface, current sense, and power stage.

VERSATILITY IN HALF-BRIDGE AND MULTI-LOAD APPLICATIONS

Beyond traditional three-phase BLDC motor control, the A89110's design offers remarkable flexibility for other half-bridge and multi-load applications. The device contains six N-channel power MOSFETs configured as three half-bridges, which can be operated independently or together. This allows for diverse use cases such as:

- Single BLDC Motor: The primary application, as a full three-phase driver.
- Multiple DC Motors/Actuators: The A89110 can drive up to three independent DC motors or actuators by utilizing its half-bridge stages. Each half-bridge can be used to control a single DC motor.
- Solenoids and Resistive Loads: By driving only the high-side (HS) or low-side (LS) FETs, the A89110 can function as a multi-channel HS/LS driver, making it ideal for controlling solenoids and other resistive loads.

Examples of these applications include frunk latches, eRelease latches, park lock actuators, mirror controls, electronic expansion valves, and active suspension spool valves. For optimizing architectures, a half-bridge can even be shared between two motors, demonstrating the device's adaptability to various power requirements.

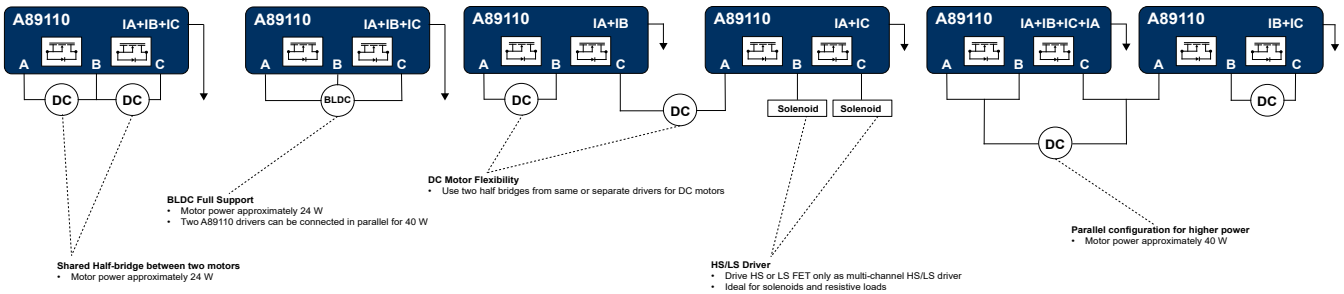

Figure 2: A89110 load partitioning for driving 9 independent actuators

The A89110 includes independent half-bridge control which enables multi-load architectures, and allows for the creation of highly flexible drives with common device and design. It is ideal for < 40 W motors used in HVAC, Latch release, parking claw, pneumatic pump, valve control, and flexible zonal architectures with various loads and common µP.

ENABLING ZONAL ARCHITECTURES

The A89110 is particularly well-suited for emerging zonal architectures in automotive systems. Zonal architectures consolidate electronic control units (ECUs) into fewer, more powerful domains, reducing wiring complexity and enabling greater scalability and flexibility. The A89110's high integration, compact 28-QFN package, and comprehensive diagnostic features make it an excellent fit for these distributed control nodes.

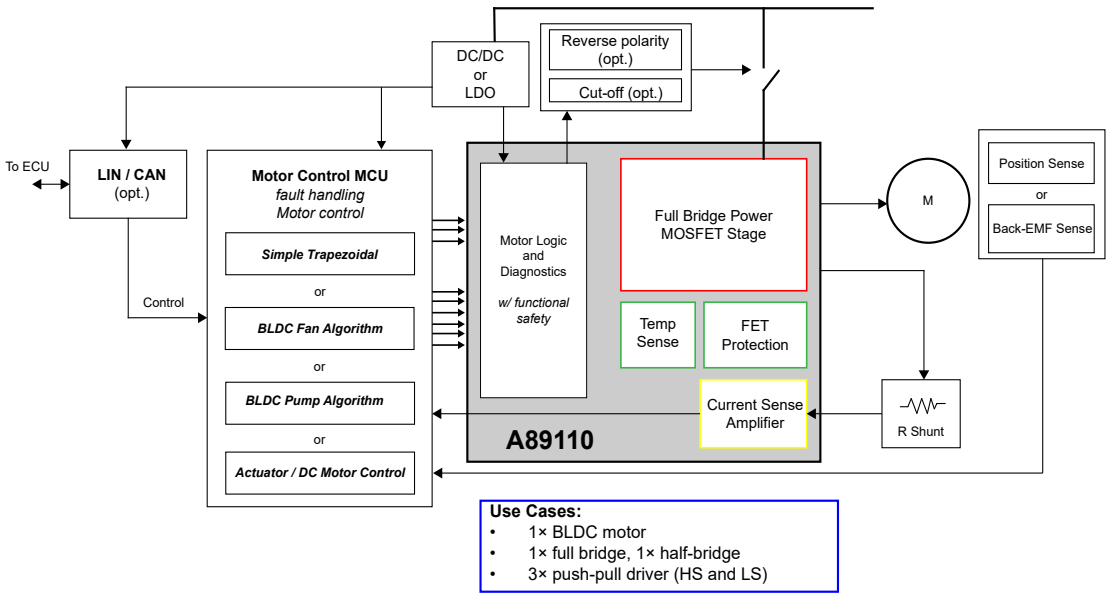

Figure 3: A89110 Block Diagram

The block diagram illustrates how the A89110 fits into a typical zonal architecture for pump or actuator control, showing its integration with an MCU, power management, and various sensors.

The ability of the A89110 to drive multiple types of loads (BLDC, DC, solenoids) from a single device or multiple devices within a zone simplifies the ECU design for various actuators and pumps. This approach allows for a common device and design across different loads, optimizing architectures for cost and performance.

SCALABILITY WITH MULTIPLE A89110 DEVICES

A key benefit of the A89110's architecture is its inherent scalability. Designers can deploy multiple A89110 devices within a zonal architecture to drive a wide array of loads. For instance, a single controller can interface with several A89110s via SPI and GPIO, each managing different motors or actuators. This allows for:

- Increased Power Output: For higher power BLDC motors, two A89110 devices can be connected in parallel to achieve greater power delivery, such as driving a 40W motor.
- Diverse Load Management: A zonal ECU can efficiently manage a manifold of pumps (BLDC or DC) or various actuators by assigning each A89110 to specific loads. This distributed control minimizes wiring and centralizes processing, leading to more robust and manageable systems.

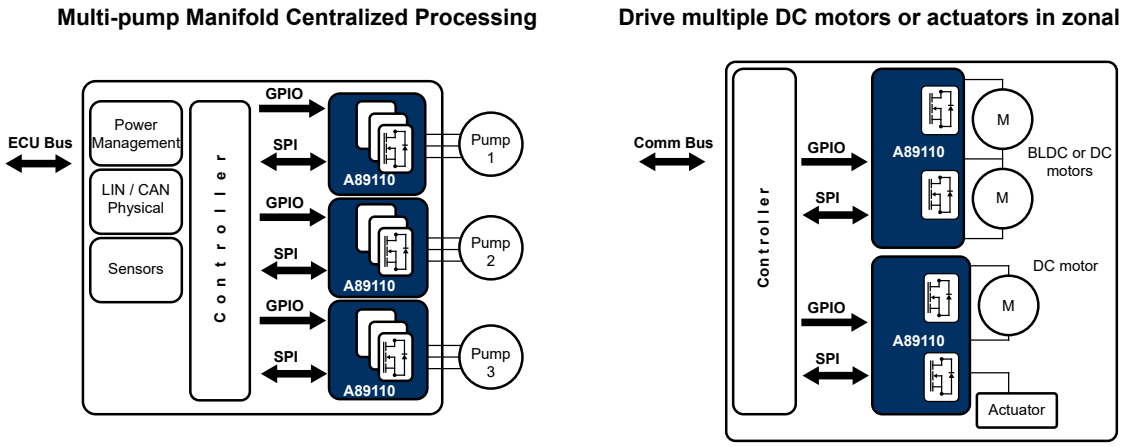

Figure 4: Multiple A89110 devices can be controlled by a single ECU in a multi-pump manifold setup, showcasing the centralized processing capability within a zonal architecture.

- Optimized Resource Utilization: The independent half-bridge control and configurable diagnostics mean that each A89110 can be tailored to its specific load requirements, ensuring optimal performance and protection across the entire system.

Key Features Supporting Versatility and Robustness

Several features of the A89110 contribute to its suitability for these diverse applications:

- ASIL B Compliance: Developed in accordance with ISO 26262, the A89110 is ASIL B compliant, crucial for safety-critical automotive systems.
- Integrated Diagnostics: Comprehensive diagnostics monitor internal faults, system faults, and power bridge faults, providing detailed information via a serial interface. This reduces the need for external monitoring components and enhances system reliability.
- Programmable Gate Drive: Configurable slew rate settings allow designers to optimize Electromagnetic Interference (EMI) performance and system efficiency, adapting the driver to different motor types and operating conditions.
- Low Power Sleep Mode: Extends battery life in electric vehicles by significantly reducing quiescent current when the device is inactive.

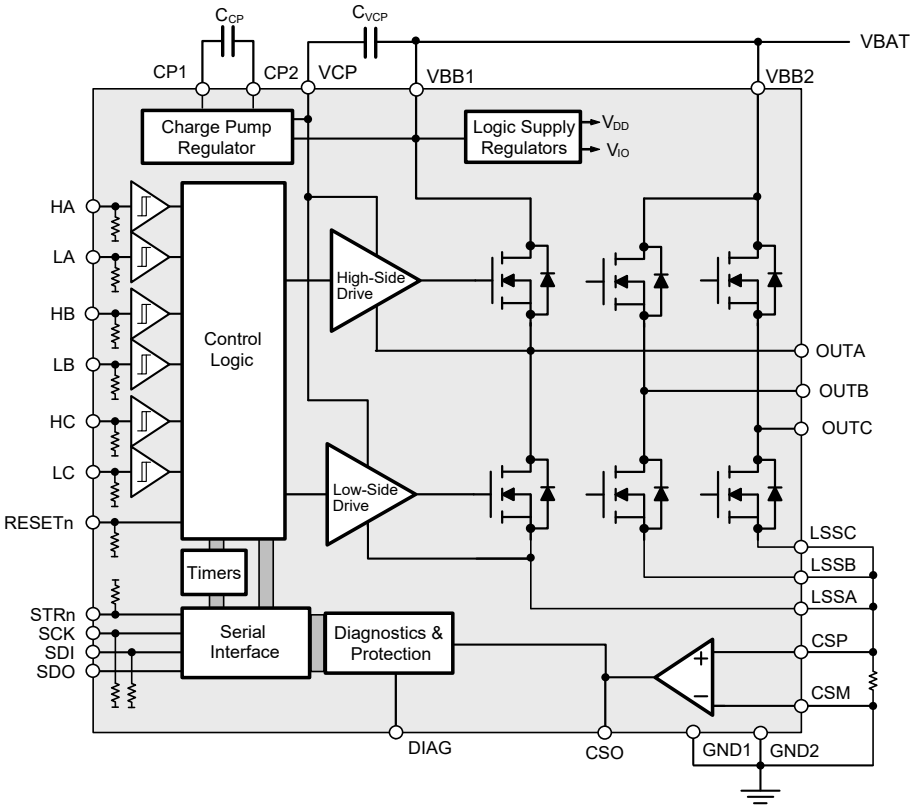

Figure 5: A detailed functional block diagram of the A89110

The detailed functional block diagram shows the charge pump, control logic, gate drives, diagnostics, and serial interface,, which illustrates its high level of integration.

- Compact Package: The 5mm x 5mm, 28-contact QFN package with an exposed thermal pad facilitates enhanced thermal dissipation, contributing to a smaller BOM and PCB footprint.

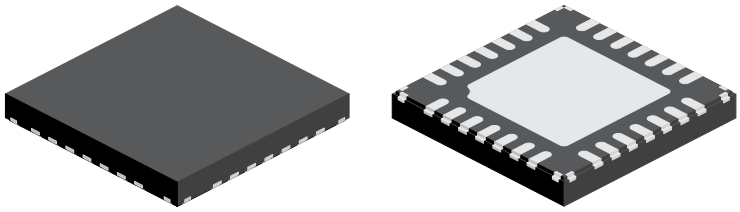

Figure 6: An image of the 28-contact wettable flank QFN (ET) package

CONCLUSION

The Allegro A89110 stands out as a highly versatile and robust integrated MOSFET driver, perfectly positioned for the evolving demands of automotive electronics. Its ability to efficiently drive BLDC motors, combined with its flexibility for various half-bridge applications, makes it an ideal choice for a broad spectrum of inductive loads. Furthermore, its integrated features, ASIL B compliance, and inherent scalability empower designers to implement cost-effective, high-performance, and safe solutions within modern zonal architectures, ultimately contributing to a safer, more sustainable, and autonomous future.

Revision History

Number	Date	Description	Responsibility
–	July 30, 2026	Initial release	Dan Jacques

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