



Analog Solutions—Robust, Reliable Performance

MC33816

SD6 Programmable Solenoid Controller for Precision Solenoid Control Applications



Overview

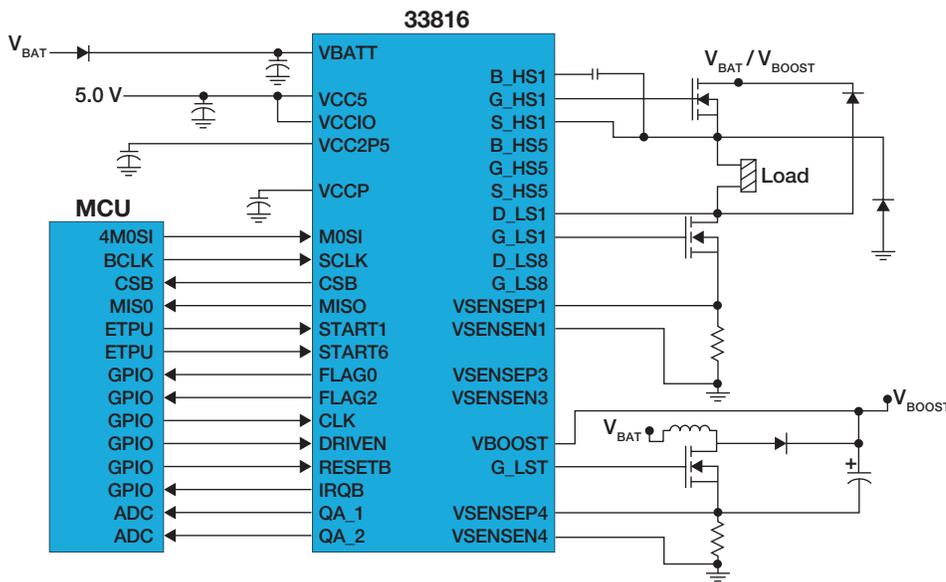
The MC33816 is a programmable gate driver IC for precision solenoid control applications. The IC consists of five external MOSFET high-side pre-drivers and seven external MOSFET low-side pre-drivers. The MC33816 provides a flexible solution for MOSFET's gate drive with a versatile control and optimized latency time. Gate drive, diagnosis and protection are managed through four independent microcores and two code RAM and two data RAM banks.

The IC contains two internal voltage regulators with overvoltage and undervoltage monitoring and protection. There are four current sense modules and VDS monitoring for fault detection and annunciation via a serial peripheral interface (SPI).

Typical Applications

- Automotive, marine (12 V), truck and industrial (24 V) powertrain
- Diesel and gasoline direct injection
- Solenoid and valve actuation
- Transmission

MC33816 Simplified Application Drawing



AE SUFFIX (Pb-FREE)
98ASA00237D
64-pin LQFP-EP

Features

High-Side/Low-Side Pre-Drivers

- Five high-side pre-drivers for driving logic level N-channel MOSFETs using four programmable slew rates
- Six low-side pre-drivers for logic level N-channel MOSFETs using four programmable slew rates
- Integrated bootstrap circuitry for each high-side pre-driver
- Integrated charge pump circuitry for each high-side pre-driver for 100% duty cycle capability

DC-DC Converter

- One low-side pre-driver logic level N-channel MOSFET is optionally dedicated to boost DC-DC converter with four programmable slew rates
- Boost voltage monitoring (with integrated feedback)

Current Measurement and Diagnostic

- Three independent current sense measurement channels including ADC mode, programmable threshold and gain, 8-bit D/A based
- One current measurement (channel 4) is optionally configurable to support DC-DC converter in current mode with overload detection
- Five high-side and six low-side with independent VDS monitoring (eight programmable values) for protection and diagnostics
- Integrated load biasing to VBATT/2 (on all high-side sources and all low-side drains)
- Capable of detecting missing ground connections

Power Supplies and Monitoring

- Integrated 7 V linear regulator (VCCP) for high-side/low-side power supply (must be supplied externally for 24 V operation), with undervoltage monitoring
- Integrated 2.5 V linear regulator for digital core supply based on VCC5 input supply with undervoltage monitoring
- External VCC5 (5 V) supply with under/overvoltage monitoring
- Thermal monitoring
- Selectable VCCIO external supply (5 or 3.3 V) for digital I/O

Digital

- Four digital microcores, each with its own ALU with crossbar switch
- Two memory banks: 1023 x 16-bit of code RAM with error detection (CRC32) and 64 x 16-bit of data RAM
- Code RAM BIST activated by SPI with pass/fail status

Features

Differentiators	Benefits
Four programmable microcore controllers for flexible current profiles	Up to four simultaneous and independent threads of code execution for up to four independent and concurrent actuations
Tightly coupled feedback with 0.9 micro seconds response time	<ul style="list-style-type: none"> • Accurate and repeatable peak and hold current profile • Accurate current regulation • Precise fuel quantity injection • Reduced emissions and increased fuel efficiency
Fully multiplexed five high-side and seven low-side pre-drivers with dedicated integrated boost controller	System design flexibility—any core can drive any output
Outputs configurable for up to three banks with external high-side	System design flexibility to drive three banks of two solenoids with interbank overlap
Output current and voltage sensing with integrated diagnostics	System MCU offload requiring no external components
Thirteen line level outputs	Extended digital functions (additional pre-driver control)
Embedded encryption for microcode protection	Increased customer IP security and inhibited reverse engineering
SPI control with IRQB plus three interrupt flags	Fast hardware interrupt with efficient diagnosis reporting
Functional integration	System BOM cost reduction up to 13%, higher density implementations and improved reliability

Documentation

Document Number	Title	Description
MC33816	SD6 Programmable Solenoid Controller for Precision Solenoid Control Applications	Data Sheet
SG1002	Analog, Mixed Signal and Power Management	Selector Guide
SG187	Automotive	Selector Guide

- Thirteen general-purpose digital I/Os configurable through microcode
- 16-bit slave SPI at up to 10 MHz (two protocols), programmable slew rate

automotive, consumer, industrial and networking markets. Analog solutions interface with real-world signals to control and drive for complete embedded systems.

Freescale: A Leader in Automotive Solutions

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