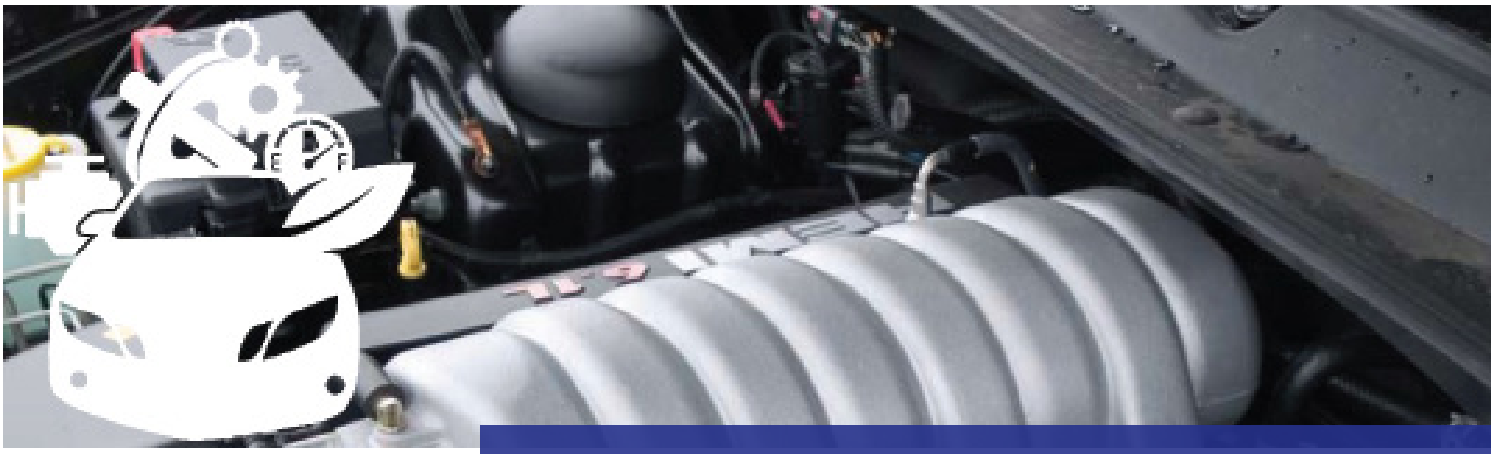


Analog, Mixed Signal and Power Management

MC33816

Engine control IC with smart gate control

Applications

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

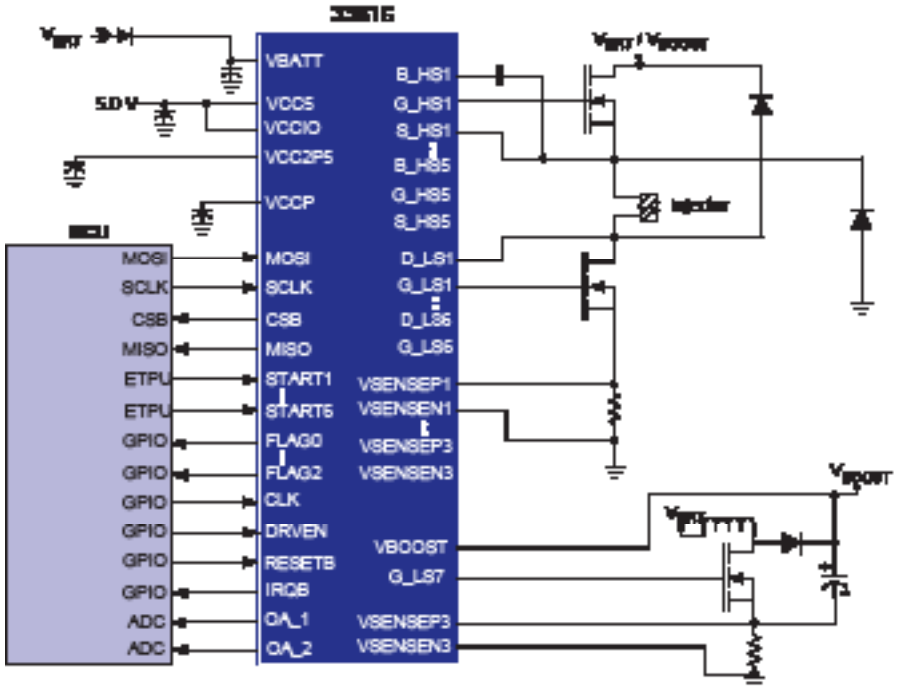
Overview

The 33816 is a 12 channel gate driver IC for automotive engine control applications. The IC consist of five external MOSFET high side pre-drivers and seven external MOSFET low side pre-drivers. The 33816 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 over-voltage and under-voltage monitoring and protection. There are four current sense modules and VDS monitoring for fault detection and annunciation via a serial peripheral interface (SPI).

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

MC33816 Simplified Application Diagram



Product Features

HS/LS Pre-driver

- 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 source and all low side drain)
- Capable of detecting missing ground connections.

Power Supplies and Monitoring

- Integrated 7.0 V linear regulator (VCCP) for HS/LS power supply (optionally externally supplied for 24 V battery system), with undervoltage monitoring
- Integrated 2.5 V linear regulator for digital core supply based on VCC5 input supply, with undervoltage monitoring
- External VCC5 (5.0 V) supply with under/overvoltage monitoring
- Thermal monitoring
- Selectable VCCIO external supply (5.0 V or 3.3 V) for digital I/O

Digital

- Four digital µCores including ALU with crossbar switch
- Two memory banks: 1024 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
- 13 general purpose digital IOs – configurable through microcode

Benefits

- Self protected EMC/ESD IC
- High Integration – reduced parts count
- Fully programmable control and extensive diagnostic
- Solution covering up to six cylinder engine applications
- Boost control for optimization of startup injection phase
- Microcontroller and gate drive close to the load

Performance

Parametric	Typical Values
Battery Type	5.5 V < V_{BATT} < 32 V
Pre-driver operating voltage (max. rating)	72 V
HS / LS pre-driver PWM capability	Up to 100 kHz - 30 nC (max 50 nC)
HS / LS programmable slew rate	12.5 - 25 -50 – 300 V/us
HS / LS VDS monitoring threshold	0 - 0.5 -1- 1.5- 2- 2.5 - 3 - 3.5 V
DC-DC LS pre-driver PWM capability	Up to 300 kHz – 30 nC (max 75 nC)
DC-DC LS programmable slew rate	25 – 50 – 300 – 1500 V/us
Logic channels	2
Digital µCores per logic channel	2
System clock frequency	24 MHz (based on 1.0 MHz external clock)
System backup clock frequency	24 MHz (based on 1.0 MHz backup clock)

Protection

Parametric	Detect	Limiting	Shutdown	Autoretry	Status Reporting
Overvoltage	•		•	•	
Overcurrent / SC	•	•	•		•
Overtemperature	•		•	•	•
OpenLoad	•				•

Questions

- Are you designing a control application for a small engine?
- Is your local government planning to issue environmental regulations for small engines?
- Are you planning to move from a mechanical to an electrical engine control system?
- Do you need a reference design for a transition from mechanical to an electrical engine control system?
- Is the space limited in your current electronically controlled small engine?
- Do you want to consolidate/integrate multiple functions into a single IC?

Orderable Part Numbers

Part Number (for Tape and Reel, add an R2 suffix)	Temp. Ranges	Package
PC33813AE	-40 to +125 °C	98ASA00237D 64 -pin LQFP-EP

Development

Part Number	Description
KIT33816AEEVM	33816 Evaluation Board (Contact Sales for Availability

Documentation

Document Number	Title	Description
MC33816	Automotive Engine Control IC with Smart Gate Control with Smart Gate Control	Data Sheet
SG1002	Analog, Mixed Signal and Power Management	Selector Guide
SG187	Automotive	Selector Guide

For more information, visit freescale.com

Document Number: MC33816FS REV 3.0