

Analog, Mixed-Signal and Power Management

# MC20XS4200

## Dual 24 V, 20 mOhm High Side Switch

### Overview

The MC20XS4200 device is part of a 24 V high side switch product family with integrated control, and a high number of protective and diagnostic functions. It is designed for truck, bus, and industrial applications. The low  $R_{DS(ON)}$  channels (<20 mΩ) can control different load types; bulb lamps, solenoids, or DC motors.

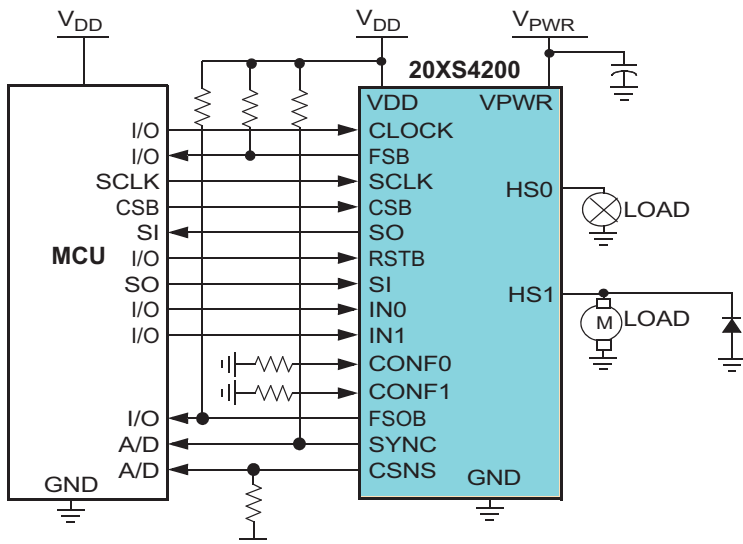
Control, device configuration, and diagnostics are performed through a 16-bit serial peripheral interface (SPI), allowing easy integration into existing applications. Both channels can be controlled individually by external or internal clock signals, or by direct inputs. Using the internal clock allows fully autonomous device operation. Programmable output voltage slew-rates (individually programmable) help improve electromagnetic compatibility (EMC) performance.

To avoid shutting off the device due to inrush current, while still being able to closely track the load current, a dynamic over-current threshold profile is featured. Switching current of each channel can be sensed with a programmable sensing ratio. Whenever communication with the external microcontroller is lost, the device enters a Fail-safe operation mode, but remains operational, controllable, and protected.

### Applications

- Automotive (12 V system)
- Truck, Bus, industrial vehicles (24 V system)
- Low voltage automotive lighting
- Halogen bulbs
- Light-emitting diodes (LEDs)
- Low and High beam
- Flashers
- Low voltage industrial lighting

### MC20XS4200 Simplified Application Diagram



## Features

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- Two fully-protected 20 mΩ (@ 25 °C) high side switches
- Up to 3.0 A steady state current perchannel
- Separate bulb and DC motor latched over-current handling
- Individually programmable internal/external PWM clock signals
- Over-current, short-circuit, and overtemperature protection with programmable autoretry functions
- Accurate temperature and current sensing
- Open-load detection (channel in OFF & ON state), also for LED applications (7.0 mA typ.)
- Normal operating range: 8.0 to 36 V, extended range: 6.0 to 58 V
- 3.3 V and 5.0 V compatible 16-bit SPI port for device control, configuration and diagnostics at rates up to 8.0 MHz

## Benefits

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- Offer an intelligent high-side switch for 24 V truck and bus applications
- Allow decentralized lighting management (autonomous operation)
- Provide a high number of protective and diagnostic functions
- Allow to drive bulb lamps (Tungsten filament), LED lights and DC-motors
- Guarantee full functional and electrical compatibility between family members
- Offer a 16-bit SPI interface for daisy chaining multiple devices
- Allows multiple channel & device current sensing with only one precision resistor

## Questions

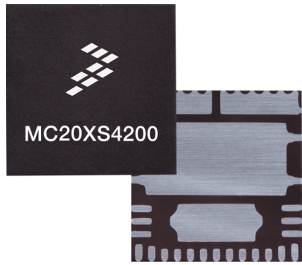
- Does your application require high lifetime expectancy (over 30,000 hrs) or 1.5 million km?
- Do you need to improve your application robustness with respect to wear out mechanisms?
- Do you have a need to drive higher nominal and transient voltages?
- Do you have a need to drive higher nominal load currents?
- Does your system require Fail-safe operation?
- Do you need pulse-width modulation (PWM) for load protection/control and efficiency?
- Do you need a device that can report Diagnostics (opens, shorts, over current, over temperature, etc.)?
- Do you have a need to reduce cost, size, weight and improve efficiency?

## Performance

| Parametric                               | Typical Values                               |
|--|--|
| # of Outputs                             | 2  |
| $R_{DS(ON)}$ @ 25 °C                     | Dual 20 mΩ                                   |
| Operating Voltage                        | 8 to 36 V                                    |
| Extended Operating Range                 | 6 to 58 V                                    |
| Peak Current                             | 38.5 A                                       |
| ESD                                      | ± 8.0 kV power I/Os<br>± 2.0 kV digital I/Os |
| Ambient Operating Temperature ( $T_A$ )  | - 40 °C < $T_A$ < 125 °C                     |
| Junction Operating Temperature ( $T_J$ ) | - 40 °C < $T_J$ < 150 °C                     |

## Protection

| Protection       | Detect | Shut Down | Auto Retry | Status Reporting |
|------------------|--------|-----------|------------|------------------|
| Short-circuit    | •      | •         |            | •                |
| Over-temperature | •      | •         | •          | •                |
| Over-current     | •      | •         | •          | •                |
| Over-voltage     | •      |           |            | •                |
| Under-voltage    | •      | •         | •          | •                |
| Open Load Detect | •      |           |            | •                |



MC20XS4200

98ASA00428D  
23 PIN PQFN (12 X12 mm)

### Orderable Part Numbers

| Part Number  | Temp Range (Ambient) | Package |
|--------------|----------------------|---------|
| MC20XS4200FK | -40 to +125 °C       | 23 PQFN |

Note: Add R2 Suffix for Tape and Reel

### Development Tools

| Part Number     | Description                                |
|-----------------|--|
| KIT20XS4200EVBE | Evaluation Board - Contact Freescale Sales |

### Documentation

| Document Number | Title   | Description      |
|-----------------|---|------------------|
| MC20XS4200      | Dual 24 V, 20 mΩ High Side Switch                           | Data Sheet       |
| SG1002          | Analog, Mixed Signal and Power Management                   | Selector Guide   |
| SG187           | Automotive  | Selector Guide   |
| AN2467          | Power Quad Flat No-Lead (PQFN) Package Application Note     | Application Note |
| AN4473          | Compact Thermal Model Application Note                      | Application Note |
| AN4474          | EMC and Fast Transient Pulses Performances Application Note | Application Note |
| AN4516          | IBIS Model Application Note                                 | Application Note |

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