Save time and space in body motor design

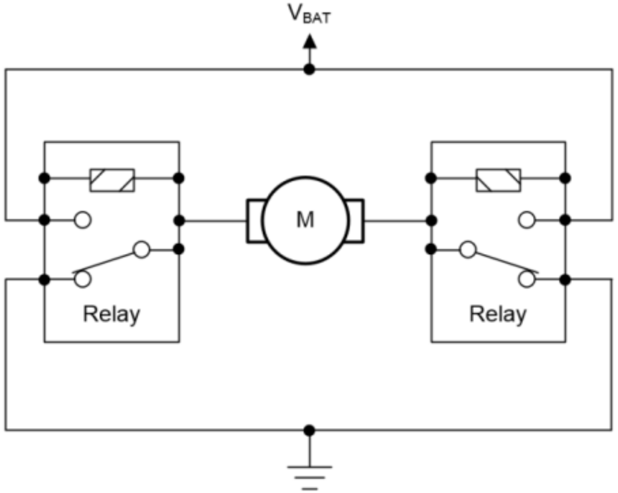
Featuring door, roof, trunk and seat applications

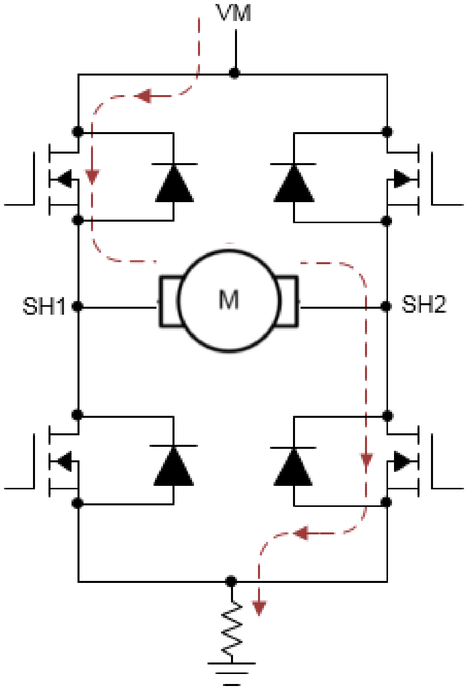
Madison Eaker - body electronics and lighting systems

Automotive body motors at a glance

Crossing the H-bridge

- Relays operate switches in an H-bridge
- Make a “clicking” sound
- Lack precise motor position and control





- MOSFET switching is faster than relays
- Allow PWM for speed control
- Higher reliability

The *switch* to MOSFETs

One big advantage: Enhanced motor control and performance

- Suppress electromagnetic interference (EMI) from pulse-width-modulated (PWM) signals.
- Thermal management to address heat generated from the current.
- Current sensing to detect malfunctions and determine position and commutation.
- Power-off braking to prevent damage to electronic components.
- Diagnostics and protection to detect circuit continuity faults such as open and short circuits.

Mitigating EMI with an H-bridge

Design challenges

- Control speed with pulse width modulation
- Low electromagnetic emissions
- Pass CISPR tests

DRV8706-Q1	DRV8706-Q1 EVM	Videos and Demos

Simplify EMI optimizations using Texas Instruments' Smart Gate Drive and Spread Spectrum Clocking feature!

On-line technical information at training.ti.com

Other IC options: DRV8106-Q1, DRV8714-Q1, DRV8718-Q1

Thermal design with motor drivers

Design challenges

- Drive high power motors efficiently
- Operate at high temperatures
- Low power losses

DRV8705-Q1

NEW

DRV8705-Q1 EVM

NEW

Application notes


Texas Instruments
Application Report
SLVA959A–November 2018–Revised January 2019
Best Practices for Board Layout of Motor Drivers
Motor Drive Business Unit

Texas Instruments
Application Report
SLVA968A–January 2019–Revised February 2019
External or internal FETs for motor drive in automotive applications
Automotive Systems

ABSTRACT

Modern automobiles use electric motors to drive an increasing number of applications, such as power windows, locks, seats, mirror adjustments, blowers, and trunk lifts. Transistor-based solid-state drive circuits are used to switch the current to the motors used in these applications. Designers can choose motor drive integrated circuits (IC) with either external field-effect transistors (FETs) or internal FETs for the final drive stage. This document discusses some of the tradeoffs in choosing the external-FET or internal-FET approach. Additionally, this application report focuses on key comparisons in terms of board size and thermal performance.

From Integrated FET Motor Drives to multichannel gate drivers TI has the right device for your design

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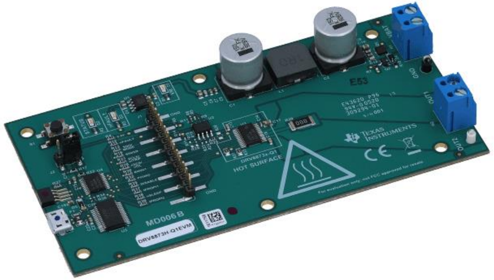
Current sensing

Design challenges

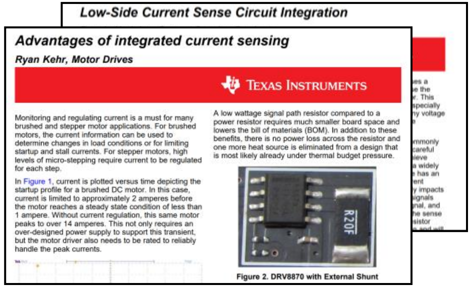
- Monitor motor current to detect faults
- Motion feedback with ripple counting
- In-line or low-side sensing

DRV8873-Q1

DRV8873-Q1 EVM



Application notes



Low-Side Current Sense Circuit Integration

Advantages of integrated current sensing

Ryan Kehr, Motor Drives

Texas Instruments

Monitoring and regulating current is a must for many brushed and stepper motor applications. For brushed motors, the current information can be used to determine changes in load conditions or for limiting startup and stall currents. For stepper motors, high levels of micro-stepping require current to be regulated for each step.

In Figure 1, current is plotted versus time depicting the startup profile for a brushed DC motor. In this case, current is limited to approximately 2 amperes before the motor reaches a steady state condition of less than 1 ampere. Without current regulation, this same motor peaks to over 14 amperes. This not only requires an over-designed power supply to support this transient, but the motor driver also needs to be rated to reliably handle the peak currents.

A low wattage signal path resistor compared to a power resistor requires much smaller board space and lowers the bill of materials (BOM). In addition to these benefits, there is no power loss across the resistor and one more heat source is eliminated from a design that is most likely already under thermal budget pressure.

Figure 2. DRV8870 with External Shunt

On-line technical information at training.ti.com

TI motor drives eliminate the need for external current sense amplifier and more to reduce your BOM and cost!

Other IC options: DRV8871-Q1, DRV8874-Q1 DRV8876-Q1

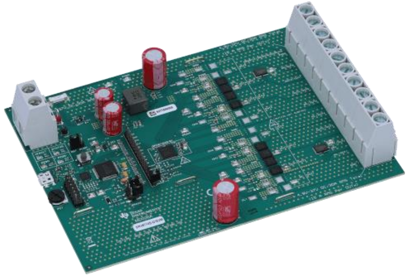
Power off braking

Design challenges

- Movement of mechanical parts
- Unpowered motors generate voltage
- Protect drive circuits from dangerous levels

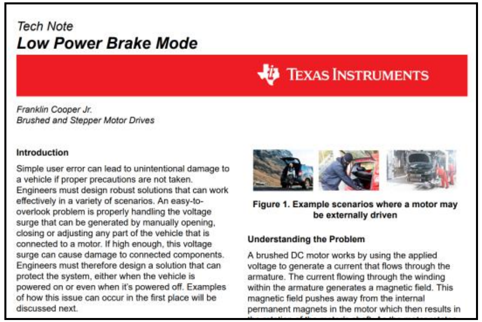
DRV8714-Q1

DRV8714-Q1 EVM



Integrated protection against back EMF when your system is On or OFF

Application note



Tech Note

Low Power Brake Mode

Texas Instruments

Franklin Cooper Jr.
Brushed and Stepper Motor Drives

Introduction

Simple user error can lead to unintentional damage to a vehicle if proper precautions are not taken. Engineers must design robust solutions that can work effectively in a variety of scenarios. An easy-to-overlook problem is properly handling the voltage surge that can be generated by manually opening, closing or adjusting any part of the vehicle that is connected to a motor. If high enough, this voltage surge can cause damage to connected components. Engineers must therefore design a solution that can protect the system, either when the vehicle is powered on or even when it's powered off. Examples of how this issue can occur in the first place will be discussed next.

Figure 1. Example scenarios where a motor may be externally driven

Understanding the Problem

A brushed DC motor works by using the applied voltage to generate a current that flows through the armature. The current flowing through the winding within the armature generates a magnetic field. This magnetic field pushes away from the internal permanent magnets in the motor which then results in

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Other IC options: DRV8718-Q1

Advanced diagnostics

Design challenges

- Detect short-circuit faults to battery
- Detect faults in drive circuit
- Notify MCU for corrective action or safe mode

Short to supply

Detects motor winding short-to-battery while the motor is not in motion and alerts the MCU promptly for corrective action.

Short to ground

Detects motor winding short-to-ground while the motor is not in motion and alerts the MCU promptly for corrective action.

Open Load Fault

Detects load getting disconnected at power-up or while in motion.

Explore products

Control module	Load	Products
Door	Single window with BDC motor	DRV8705-Q1, DRV8706-Q1
	Door lock motor Dual window with BDC motor	DRV8714-Q1, DRV8718-Q1, DRV8873-Q1
	Single window with BLDC motor	DRV8343-Q1
	Mirror X/Y motor Mirror fold motor	DRV8908-Q1, DRV8873-Q1
Roof	Roof motor	DRV8705-Q1, DRV8706-Q1
	Multiple roof motor	DRV8714-Q1, DRV8718-Q1
Trunk	Single trunk lift BDC motor	DRV8705-Q1, DRV8706-Q1
	Multiple trunk lift BDC motors	DRV8714-Q1, DRV8718-Q1
	Single trunk lift BLDC motor	DRV8343-Q1
	Trunk cinch motor	DRV8873-Q1
Seat	Seat position adjust motor	DRV8714-Q1, DRV8718-Q1
	Lumbar support bladder pump motor	DRV8873-Q1, DRV8874-Q1
	Seat ventilation motor	DRV10983-Q1
	Seat base rotation motor	DRV8343-Q1

Thank you!

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