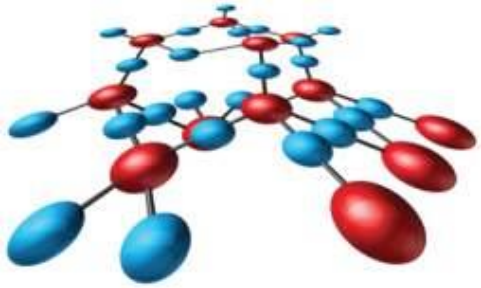
Delivering MORE Together

您的更佳选择！



TEXAS INSTRUMENTS

德州仪器模拟电机驱动产品推介

Alvin Zheng
2015-3-12

议程

- 对电机驱动的新要求
- **TI**模拟电机驱动产品介绍
- 新品介绍
- 成功案例分享

对电机驱动的新要求

更安全	运行安全稳定，故障率低
更绿色	提高运行效率，降低功耗
更智能	算法先进，易于理解使用

TI模拟电机驱动产品的优势

TI模拟电机驱动产品的优势

丰富经验

德州仪器模拟电机驱动产品

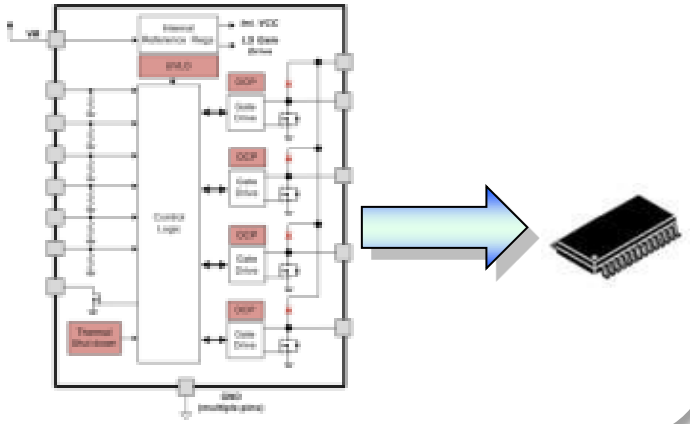
- 持续销售 **超过 15 年**
- 累计销售 **超过 10 亿 颗**
- 广泛应用于**硬盘、光驱、喷墨打印机、数码相机**等产品中
- 为诸多**行业顶尖企业**所采用

高度可靠

更安全

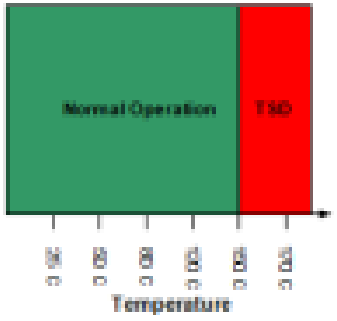
高度集成的解决方案

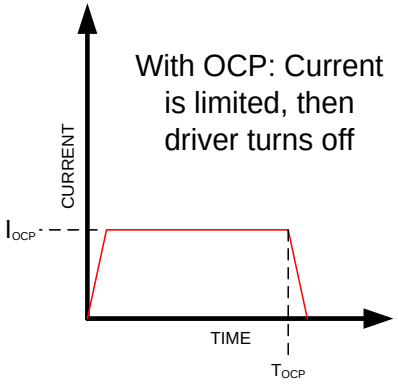
- 大幅缩减BOM、减小PCB
- 无需分立方案设计经验



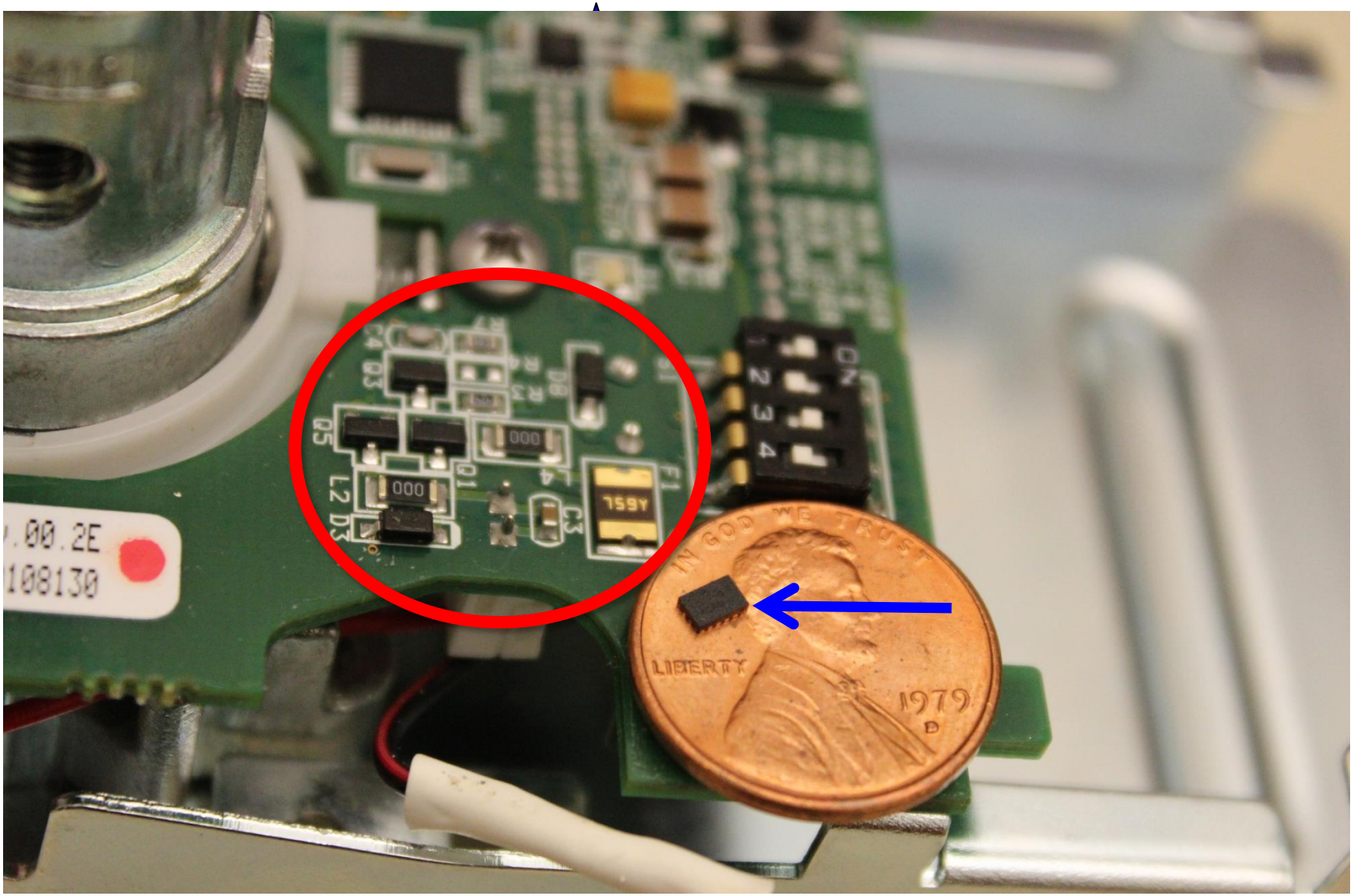
万全保护

- 过电流 / 短路保护
- 过热保护
- 低电压锁定
- 击穿保护





我可以用分立方案，我不需要集成方案。



DRV8837

1.8A Low Voltage Brushed DC Motor Driver

更安全

Features

- Single H-Bridge motor driver
  - Dual Supplies: Vm = 1.8 to 11V
    Vcc = 1.8 to 7.0V
  - Output current: 1.8A cont / peak
  - RDSON: 280mR (LS + HS)
- PWM control I/F
- Brake and coast mode support
- Sleep mode operation (35nA @ 5V)
- Integrated protection features including over-current, thermal, shoot-through and UVLO protection.

Benefits

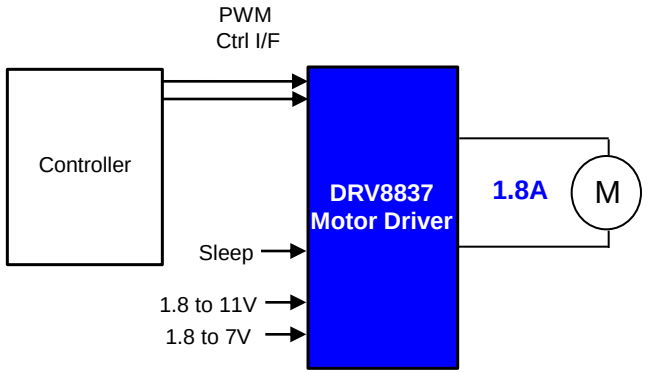
- Supports battery powered applications; dual supply prevents battery droop from tripping UVLO protection
- Low RDSON improves thermal performance / reduces case temperature.
- Independent control of each half bridge
- Brake quickly bring the motor to a stop
- Sleep function minimizes power consumption
- Advanced on-chip protection reduces design complexity and enables higher system reliability

Applications

- Dual brushed motors, stepper motor, solenoids
- Toys, e-locks, consumer products

In Production

2.0 x 2mm, 8-pin
WSON package

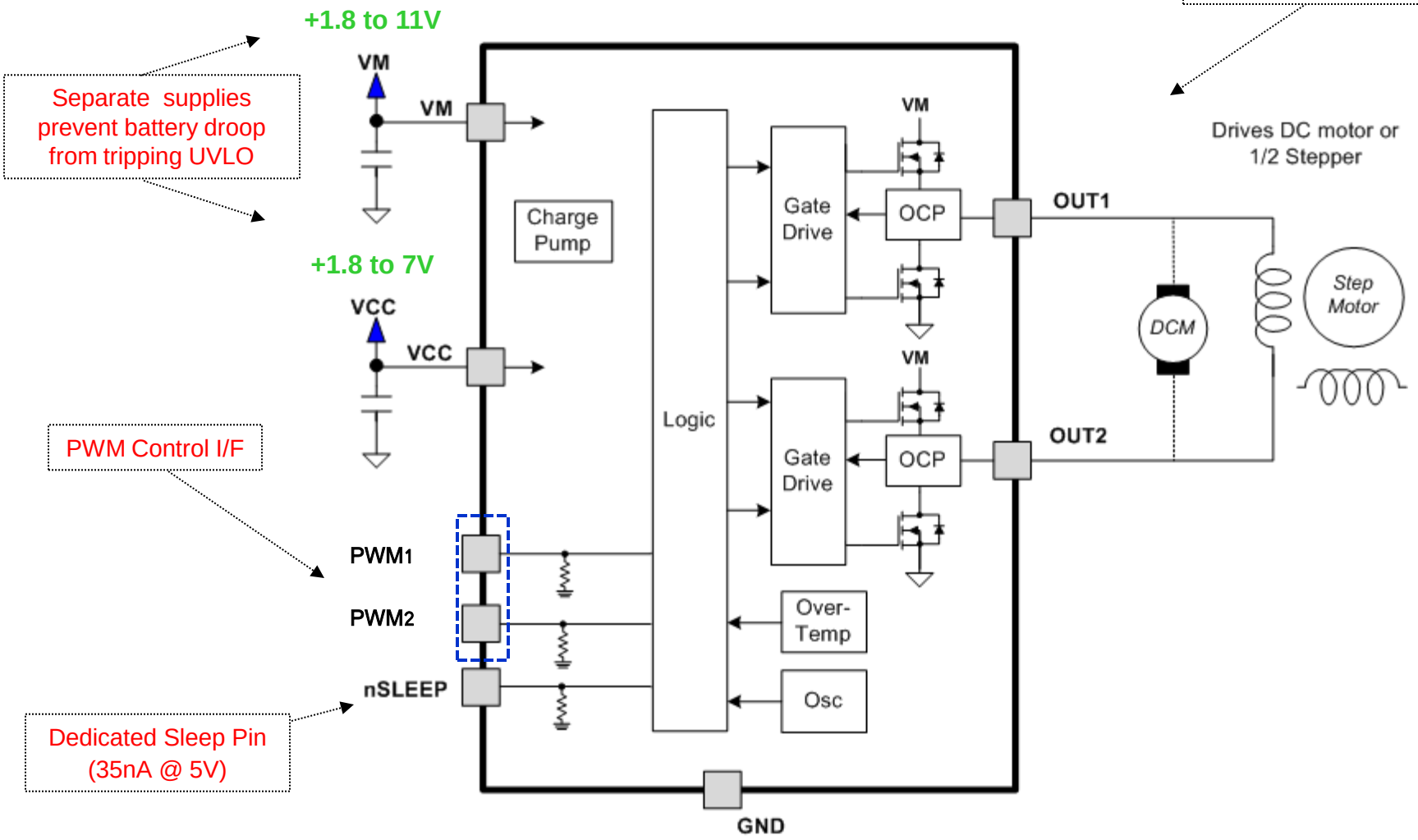


DRV8837: Low-Voltage Full Bridge DC Motor Driver

更安全

1.8A cont / 1.8A peak

Separate supplies prevent battery droop from tripping UVLO



DRV8837

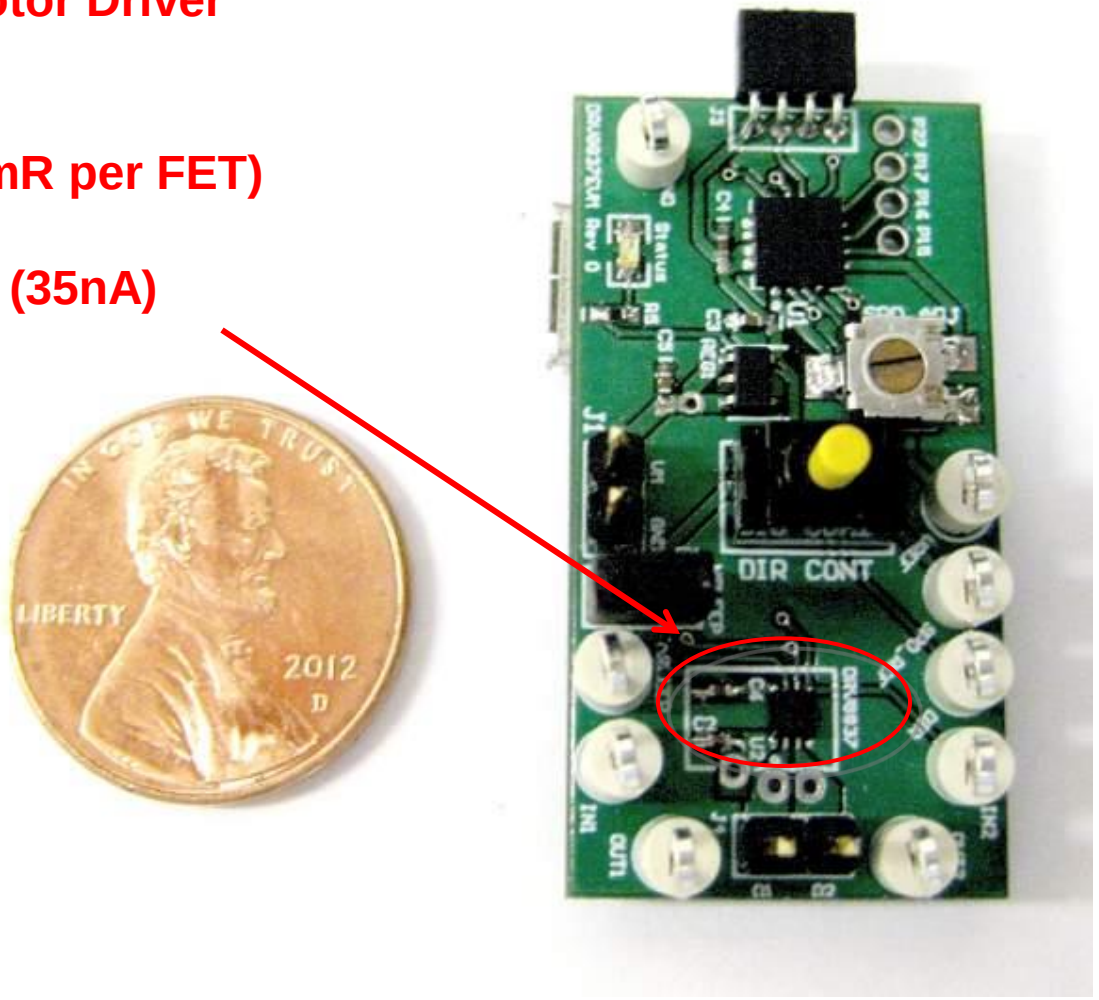
1.8A Low Voltage Brushed DC Motor Driver

Worlds smallest 1.8 Motor Driver (2 x 2 mm)

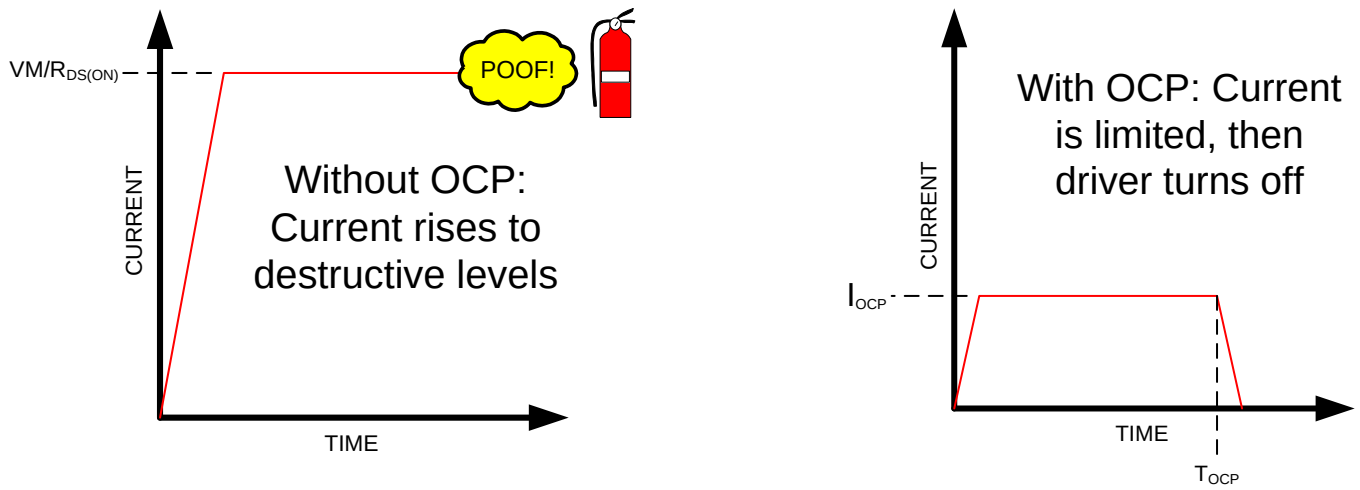
Ultra low RDSON (140mR per FET)

Ultra low sleep current (35nA)

Fully Protected

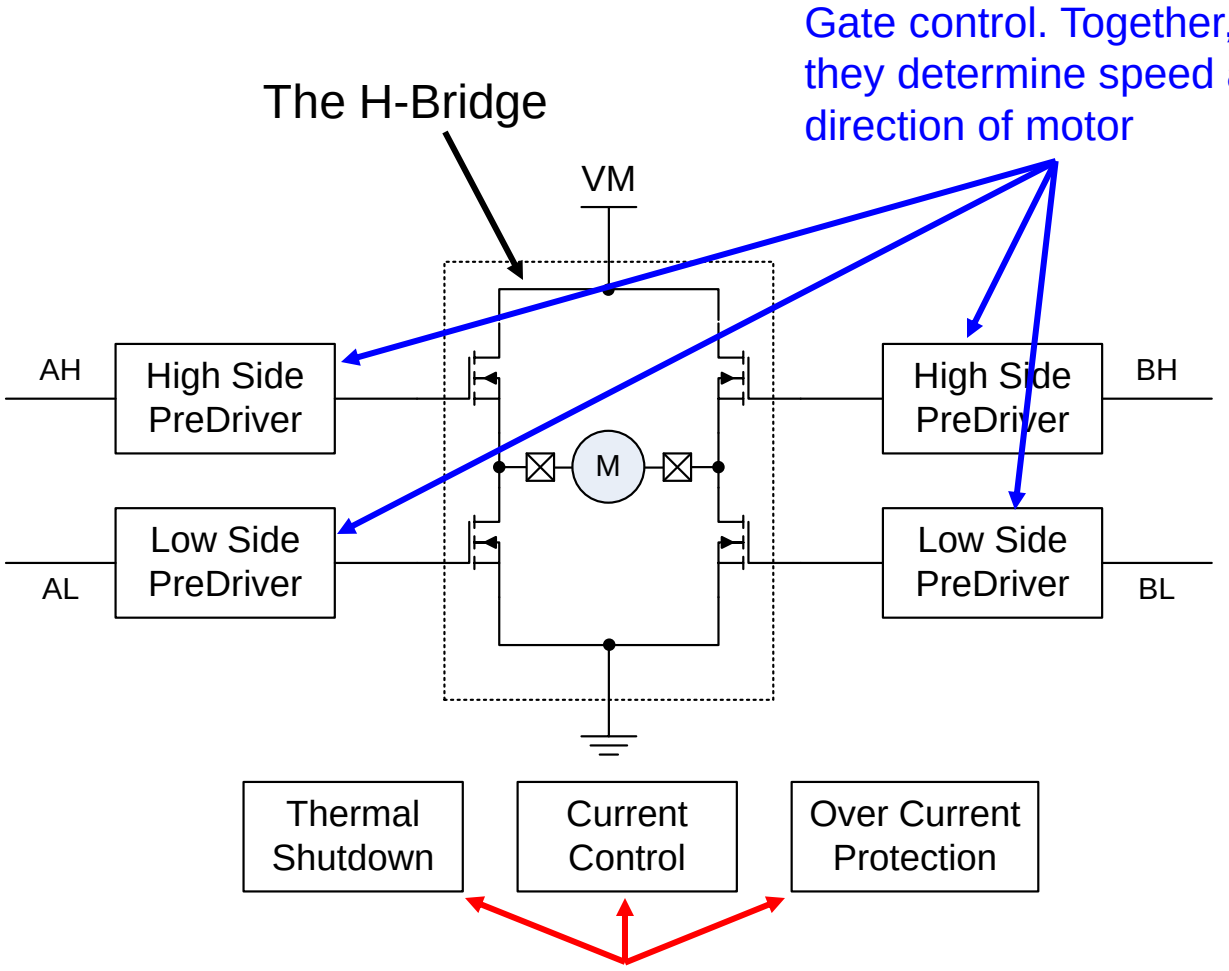


过电流保护(OCP)



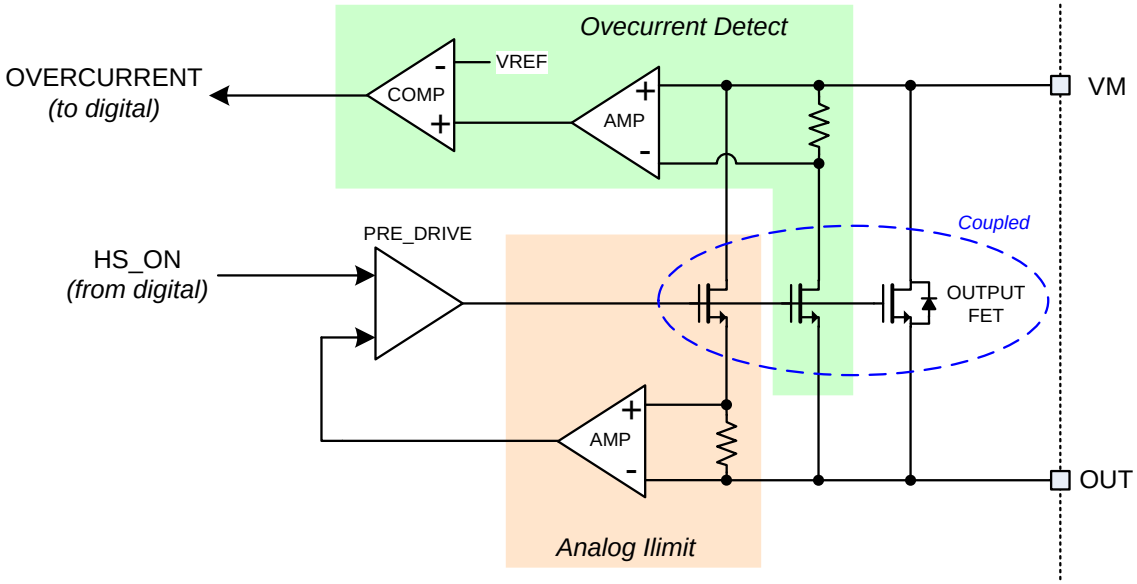
- 当出现：对地短路、对电源短路、输出短路等最糟糕的情况时，保护芯片不被损坏。
- 每个MOSFET都被单独保护，所以可保护任意短路破坏。
- 高速响应。
- 保护模式可选：关断 / 自恢复。
- 部分产品可在保护动作时，向MCU提供错误输出信号。

最基本的电机驱动电路 – H桥



Protection circuits for a variety of fault conditions enable a simplified design while providing protection at circuit, motor and board levels against potentially damaging events

OCP 的实现（DRV88xx)



Analog OCP implementation (high side shown)

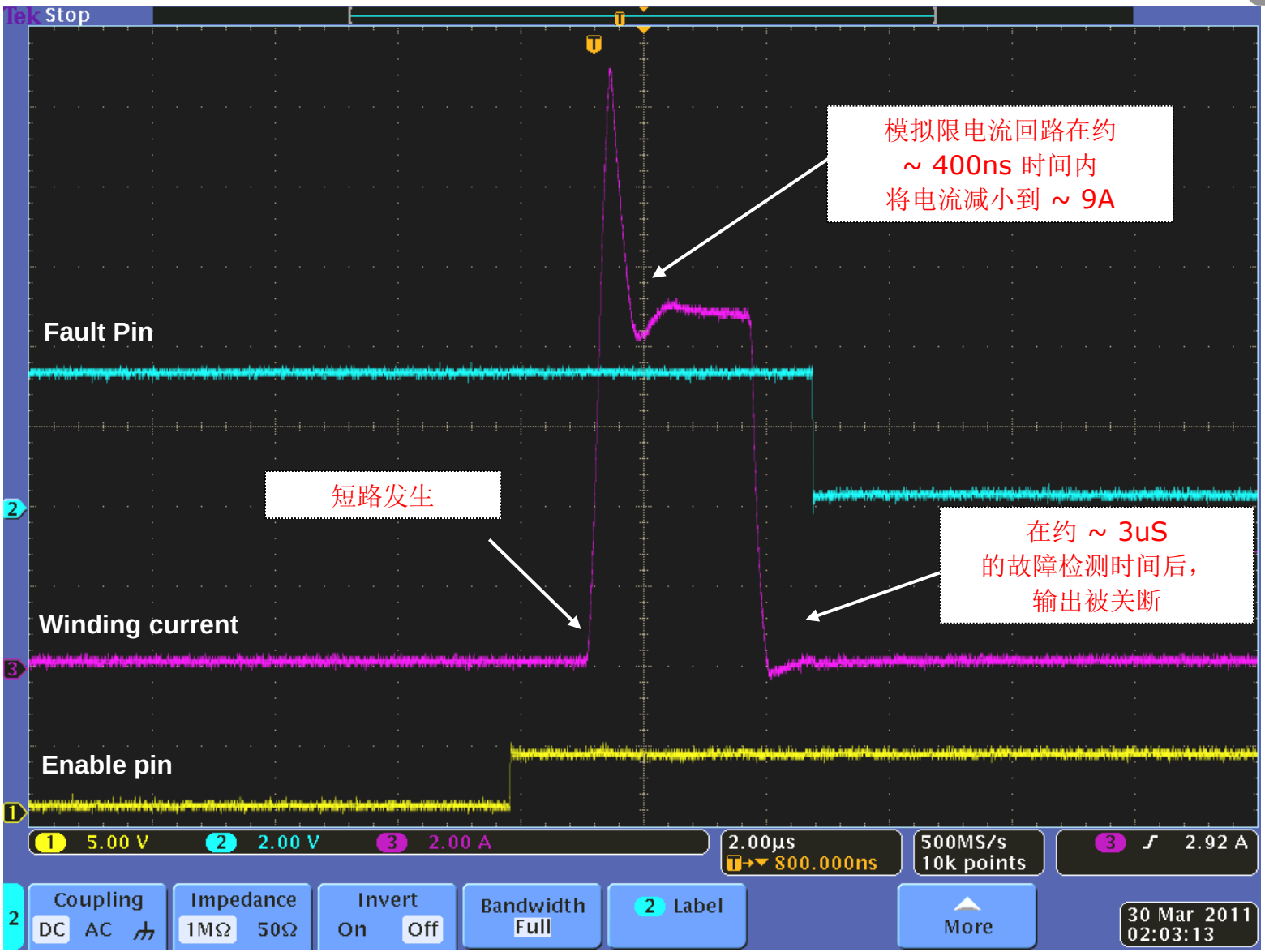
关键点:

模拟方式OCP包含两部分:

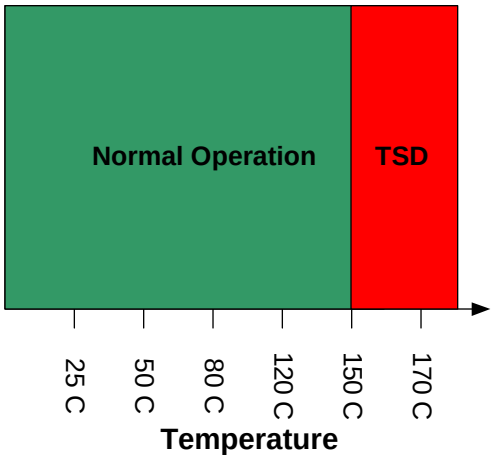
- 限电流回路移除MOSFET的门极驱动，以防止大电流流过而损坏MOSFET。(ILIMIT)
- 过电流检测回路监控电流，并在电流超过IOCP时向数字核提供过电流信号。

DRV88xx 的完全短路

更安全



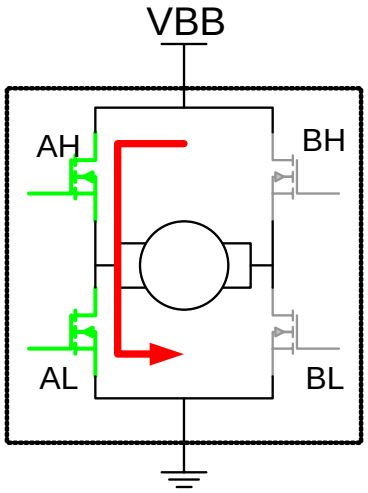
热关断保护



- 在晶圆上分布多个热传感器，持续检测温度。当出现过热时，输出被关断。
- 保护模式可选：关断 / 自恢复。
- 部分产品可在保护动作时，向MCU提供错误输出信号。
- 部分产品提供两级热保护。在关断前可先提供警告信号。

低电压/击穿保护

- 低电压保护
  - 持续检测输入电压，当电压过低，无法保证H桥的正常输出时，芯片输出将被关断。
- 击穿保护
  - 同侧的上、下管永远不会被允许同时开通。同侧的上、下管交替开通中插入了死区时间。



Shoot–through!!

DRV8312

3-Phase PWM Motor Driver with Cycle-by-Cycle Overcurrent Protection

Features

- The highest power heatsink-less drive on the market
  - Supply Voltage up to 52V (50V +/- 5%)
  - Output Current 3.5A RMS / 6.5A Peak (10ms)
- Advanced architecture with high efficiency up to 97%
  - PWM operation frequency up to 500kHz
  - Low Rdson MOSFETs (110mohm)
- Intelligent gate drive and cross conduction prevention
  - Short dead time (5ns)
  - Spike voltage control to reduce overshoot
- Integrated Protection Features
  - Short circuit and cycle-by-cycle current protection
  - Two stage thermal protection
- No External Snubber or Schottky Diode required

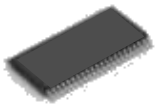
Benefits

- Minimized board space and design time while maximizing performance
- Ultra Low Rdson FETs and thermally efficient package with thermal pad allows for maximum heat dissipation without external heat-sinks
- High linearity of output signals to guarantee precise and smooth operation
- Advanced on-chip protection reduces design complexity and enables higher system reliability

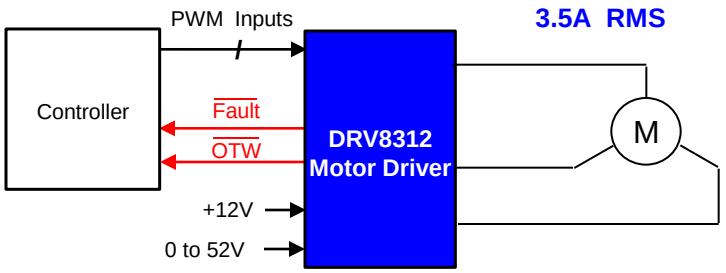
Applications

- Brushless DC Motors
- Permanent magnet synchronous motors

In Production

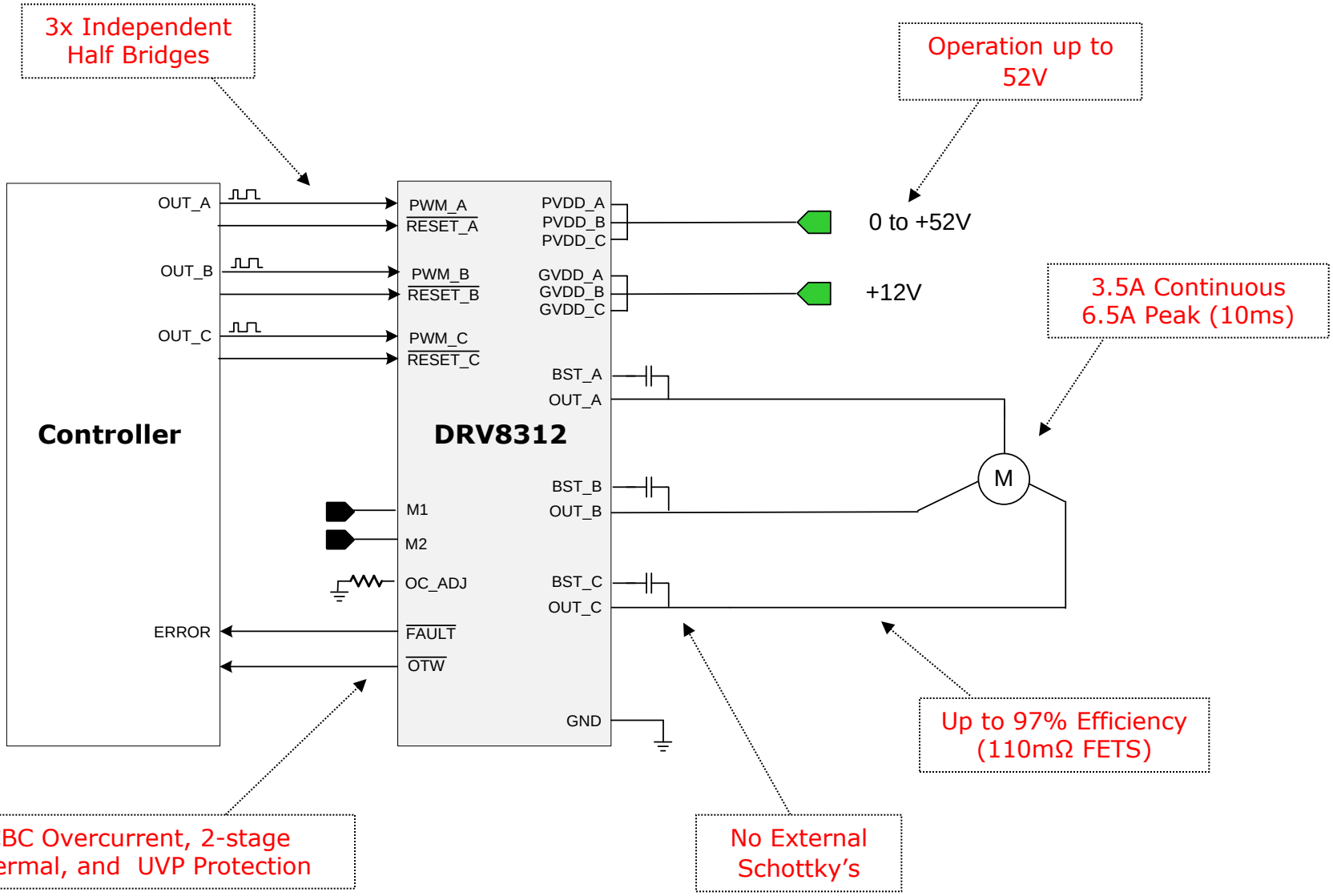


14 x 8.1mm, 44-pin
TSSOP, package (PP)



Roadmap

DRV8312: 3-Phase PWM Motor Driver



DRV8332

3-Phase PWM Motor Driver with Cycle-by-Cycle Overcurrent Protection

更安全

Features

- Three independent Half Bridge motor driver
  - Supply Voltage up to 52V (50V +/- 5%)
  - Output Current 8A RMS / 13A Peak (10ms)
- Advanced architecture with high efficiency up to 97%
  - PWM operation frequency up to 500kHz
  - Low Rdson MOSFETs (110mohm)
- Intelligent gate drive and cross conduction prevention
  - Short dead time (5ns)
  - Spike voltage control to reduce overshoot
- Integrated Protection Features
  - Programmable cycle-by-cycle current limit
  - Two stage thermal protection
- No External Snubber or Schottky Diode required

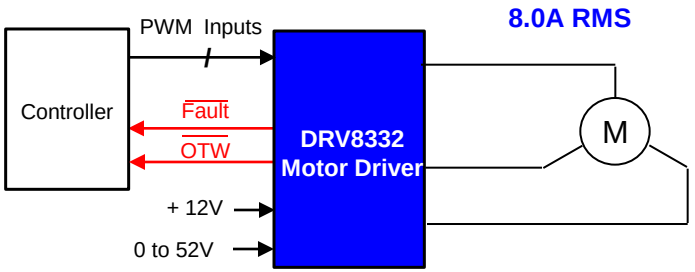
Benefits

- Minimized board space and design time while maximizing performance
- Ultra Low Rdson FETs and thermally efficient package with thermal pad allows for maximum heat dissipation without external heat-sinks
- High linearity of output signals to guarantee precise and smooth operation
- Advanced on-chip protection reduces design complexity and enables higher system reliability

Applications

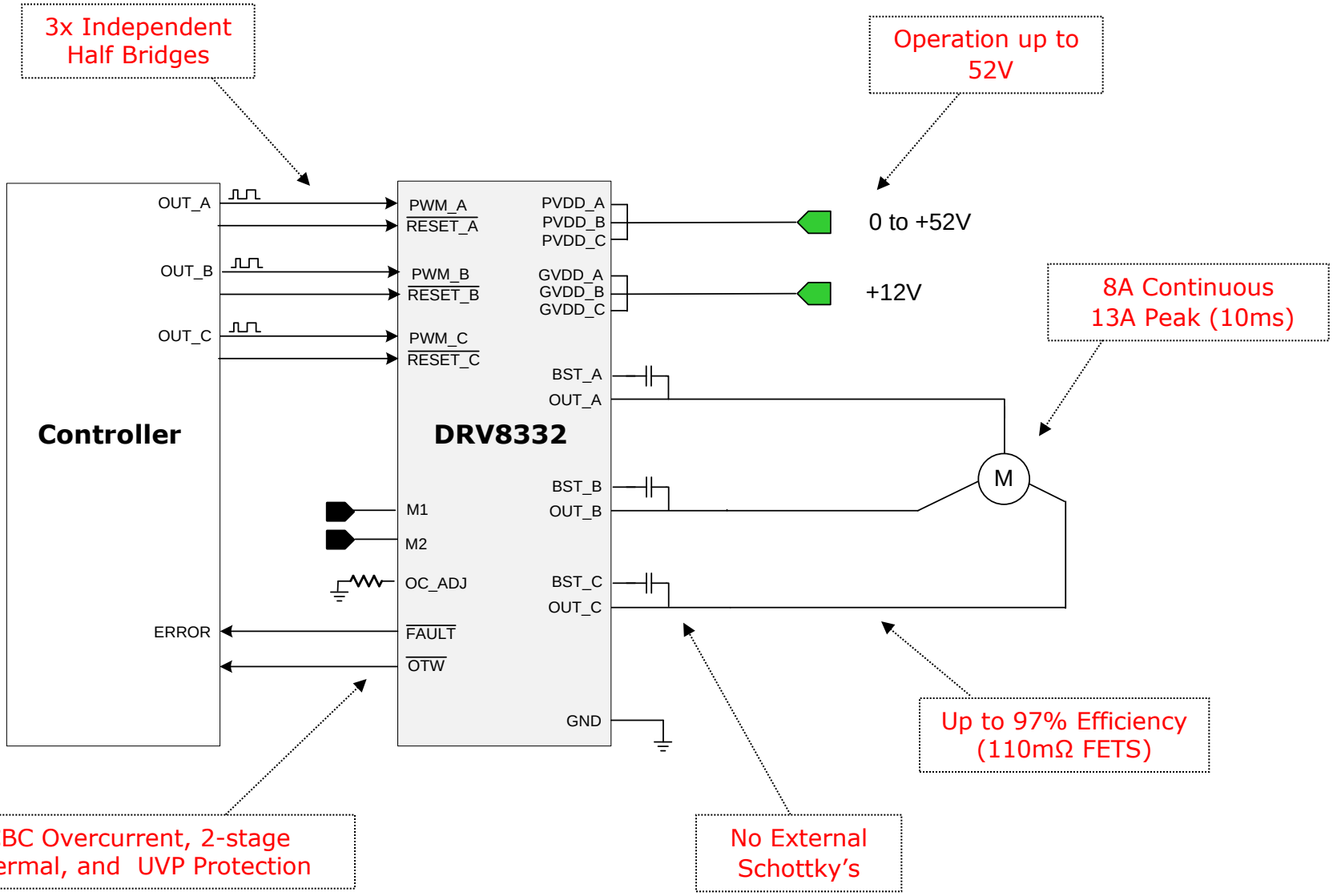
- Brushless DC Motors
- Permanent magnet synchronous motors

15.9 x 14.2mm, 36-pin
PSOP3 package

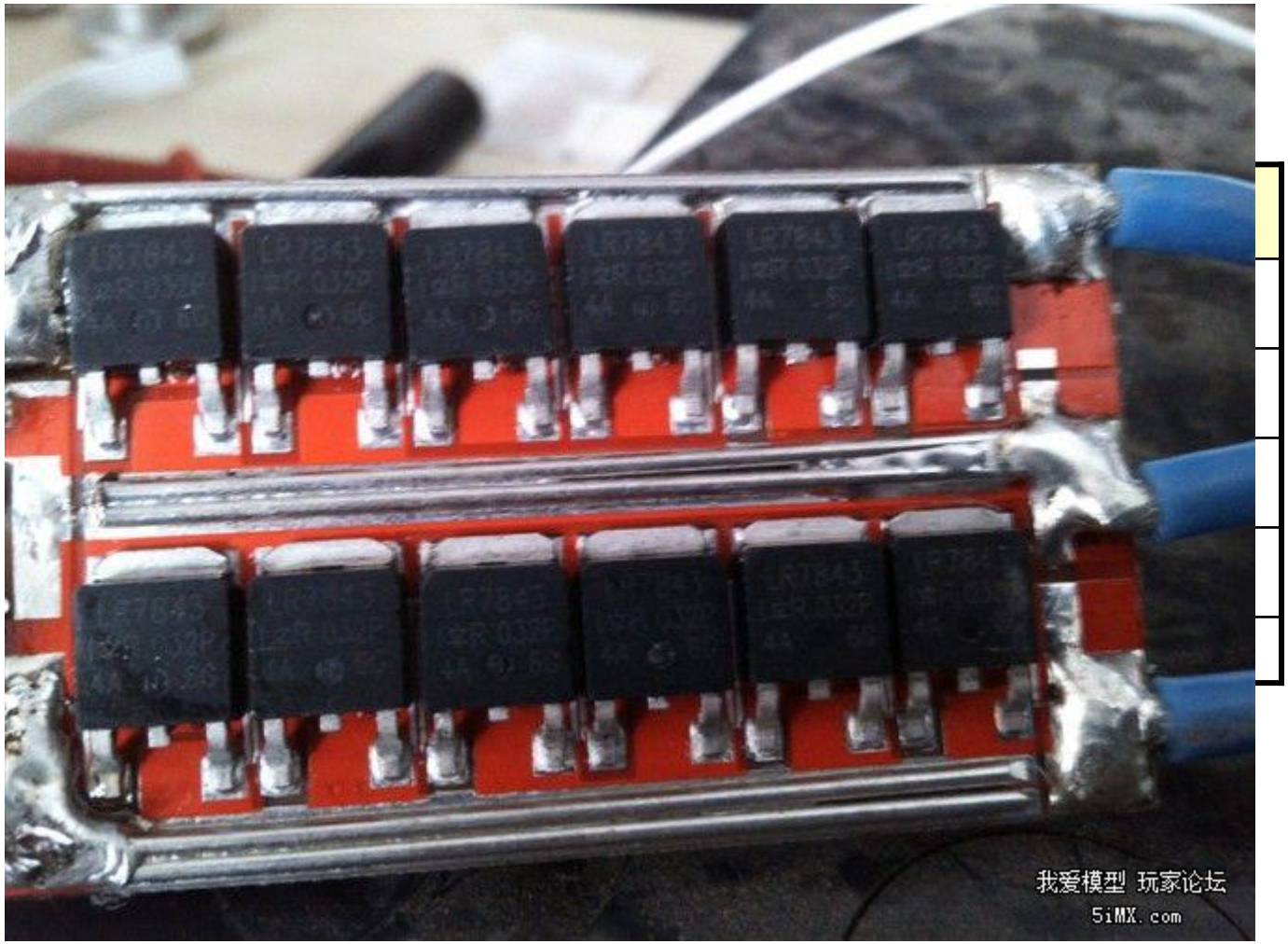


Texas Instruments

DRV8332: 3-Phase PWM Motor Driver



Device Selection Guide



DRV8412

Dual Brushed / Single Stepper PWM Motor Driver

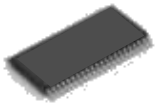
Features

- The highest power heatsink-less drive on the market
  - Supply Voltage up to 52V (50V +/- 5%)
  - Output Current
    Dual: 3A RMS / 6A Peak (10ms)
    Single: 6A RMS / 12A Peak (10ms)
- Advanced architecture with high efficiency up to 97%
  - PWM operation frequency up to 500kHz
  - Low Rdson MOSFETs (110mohm)
- Intelligent gate drive and cross conduction prevention
  - Short dead time (5ns)
- Integrated Protection Features
  - Programmable cycle-by-cycle current limit
  - Two stage thermal protection
- No External Snubber or Schottky Diode required

Applications

- Brushed or Stepper Motors

In Production

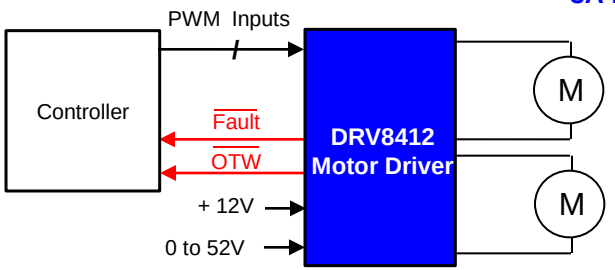


14 x 8.1mm, 44-pin
TSSOP, package (PP)

Benefits

- Minimized board space and design time while maximizing performance
- Ultra Low Rdson FETs and thermally efficient package with thermal pad allows for maximum heat dissipation without external heat-sinks
- High linearity of output signals to guarantee precise and smooth operation
- Advanced on-chip protection reduces design complexity and enables higher system reliability
- Reduced cost and board space

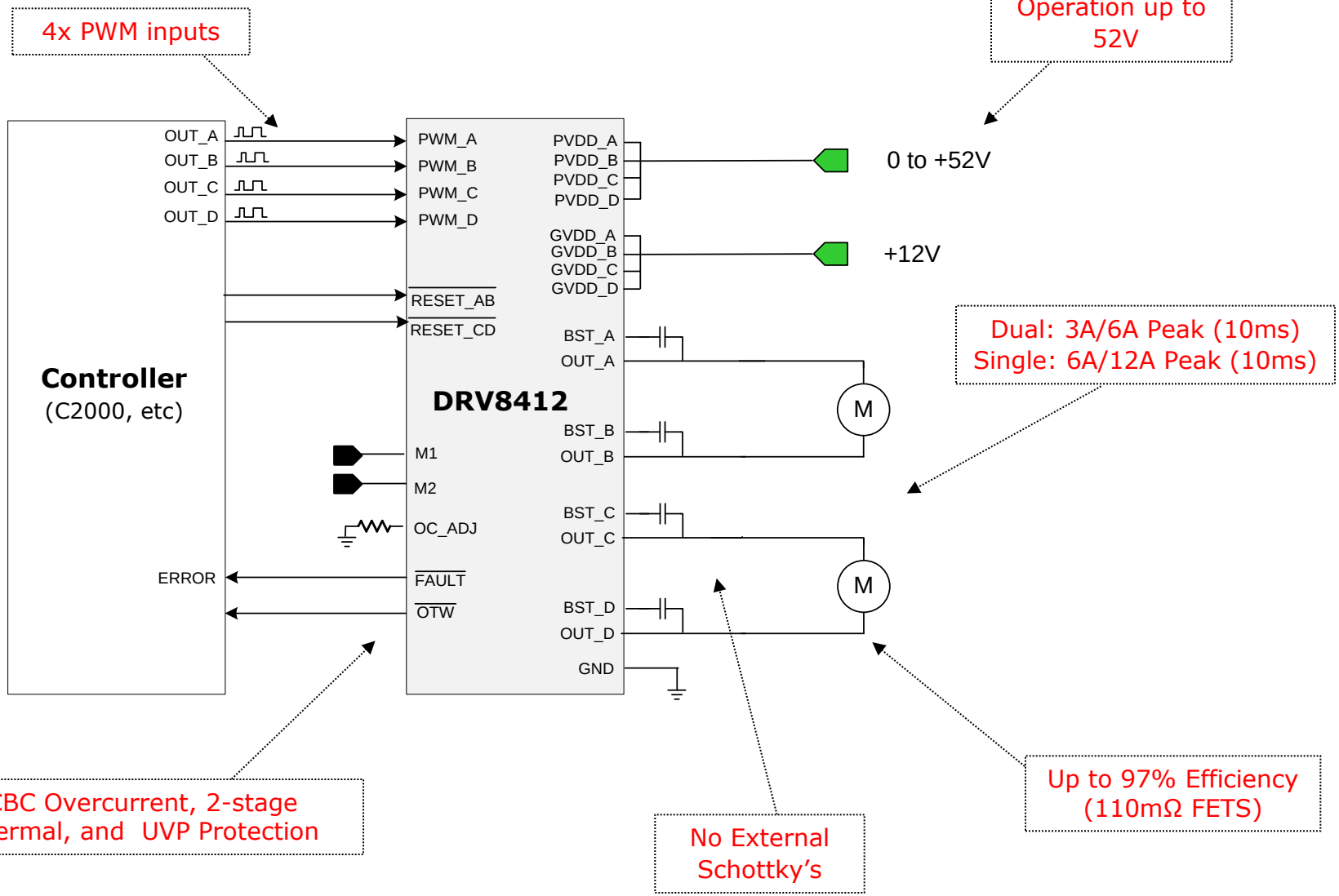
2x
3A RMS



Stepper Roadmap | Brushed Roadmap

Texas Instruments

DRV8412: Dual Full Bridge Motor Driver



DRV8432

Dual Brushed / Single Stepper PWM Motor Driver

更安全

Features

- High power Dual H-Bridge motor driver
  - Supply Voltage up to 52V (50V +/- 5%)
  - Output Current
    Dual: 7A RMS / 12A Peak (10ms)
    Single: 14A RMS / 24A Peak (10ms)
- Advanced architecture with high efficiency up to 97%
  - PWM operation frequency up to 500kHz
  - Low Rdson MOSFETs (110mohm)
- Intelligent gate drive and cross conduction prevention
  - Short dead time (5ns)
- Integrated Protection Features
  - Programmable cycle-by-cycle current limit
  - Two stage thermal protection
- No External Snubber or Schottky Diode required

Benefits

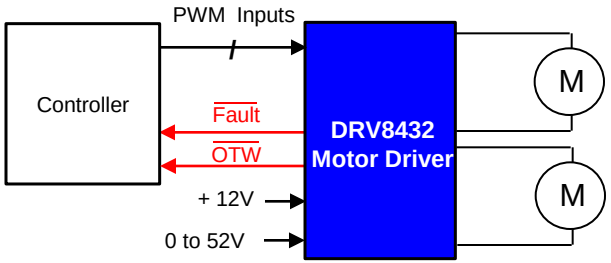
- Minimized board space and design time while maximizing performance
- Ultra Low Rdson FETs and thermally efficient package with thermal pad allows for maximum heat dissipation without external heat-sinks
- High linearity of output signals to guarantee precise and smooth operation
- Advanced on-chip protection reduces design complexity and enables higher system reliability

Applications

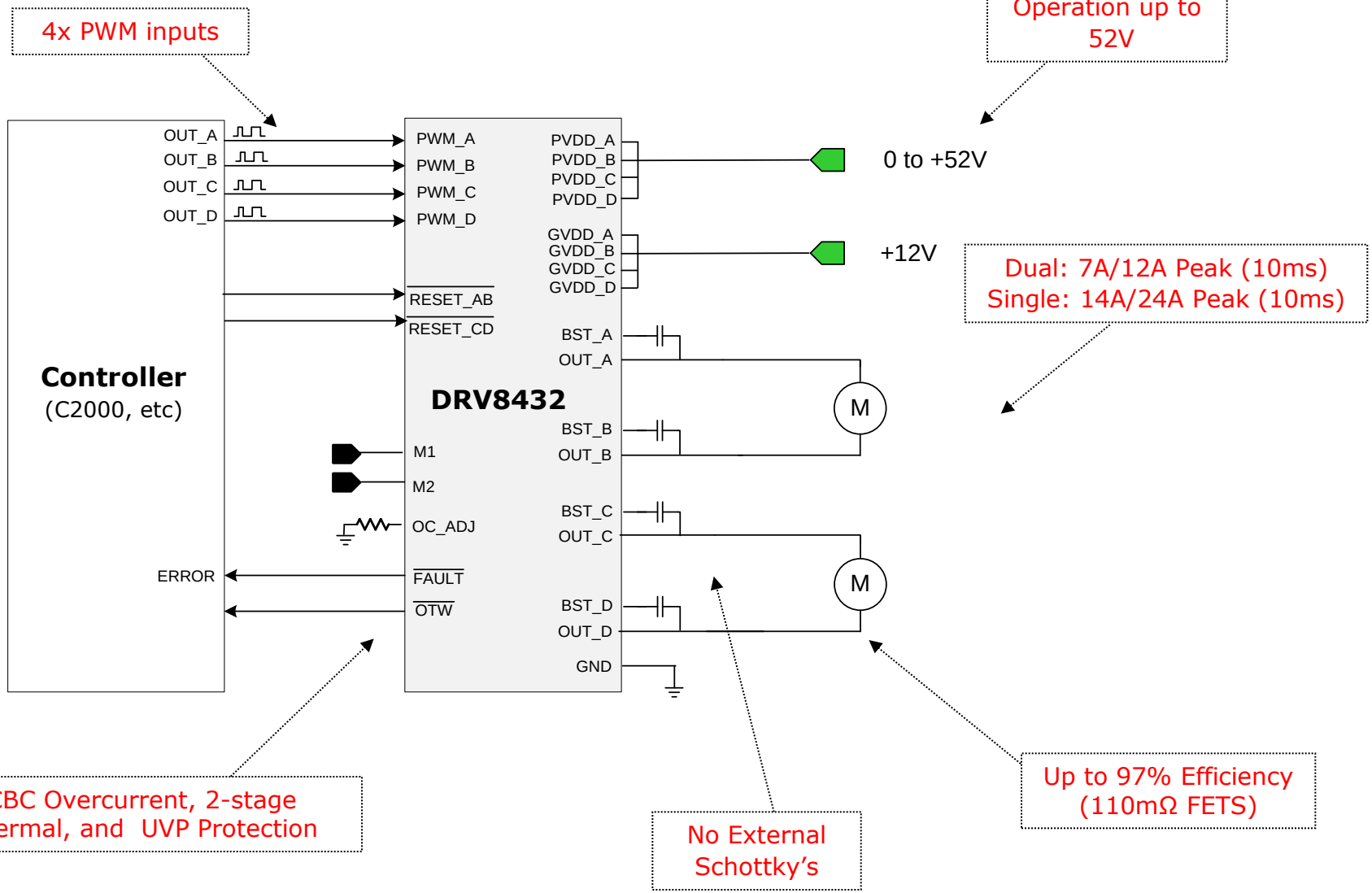
- Brushed or Stepper Motors

In Production

15.9 x 14.2mm, 36-pin
PSOP3 package

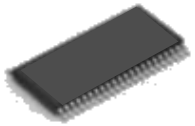


DRV8432: Dual Full Bridge Motor Driver



Device Selection Guide

	DRV8412	DRV8432
Total RMS Current (A)	2 x 3 or 1 x 6	2 x 7 or 1 x 12
Total Peak Current (A)	2 x 6 or 1 x 12	2 x 14 or 1 x 24
Package	TSSOP DDW-44	PSOP3 DKD-36
Thermal Pad	Pad down	Pad up



DRV8302

3-Phase Brushless Gate Driver with Dual Shunt Amplifiers & 1.5A Buck Converter

更安全

Features

- 3-phase gate driver
  - Supply voltage: 8 to 60V
  - Gate Drive Current: 1.7A source / 2.3A sink
  - Adjustable dead time & 100% duty cycle
- Dual Bi-directional current shunt amplifiers
  - Adjustable gain (10x & 40x) and offset (up to 3V)
  - DC Calibration
- Integrated buck converter
  - Up to 1.5A (3.5V to 60V) / RDSON of 200mR
- Fully protected
  - 2-stage thermal, CBC over current, UVLO, & shoot through protection with fault feedback
- Hardware Management Interface

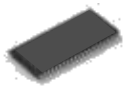
Benefits

- Wide operating voltage and ability to drive up to 60A external FETs.
- Reduced board space and system cost; DC calibration allows MCU to adjust for DC offset & temperature drift
- Reduced board space and system cost; Buck can be used to power MCU and/or other systems power needs.
- Advanced on-chip protection reduces design complexity and enables higher system reliability
- Access detailed fault reporting and easily configure slew rate, sense amp gain & DC calibration, set overcurrent limit, etc via the SPI interface.

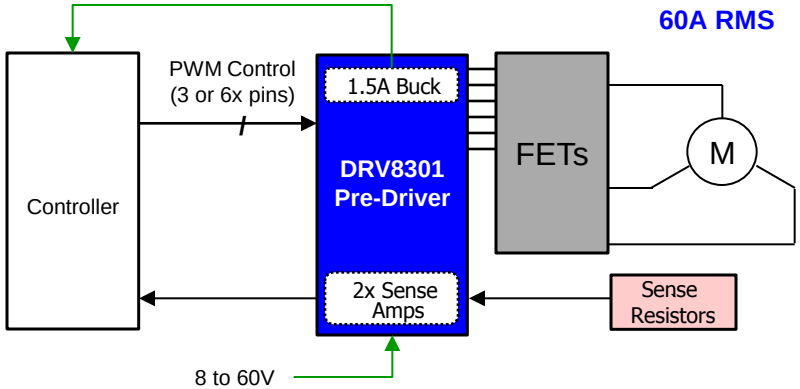
Applications

- Brushless DC & PMSM Motors
- Brushed DC Motors (Use 2 of the 3 Half Bridges)

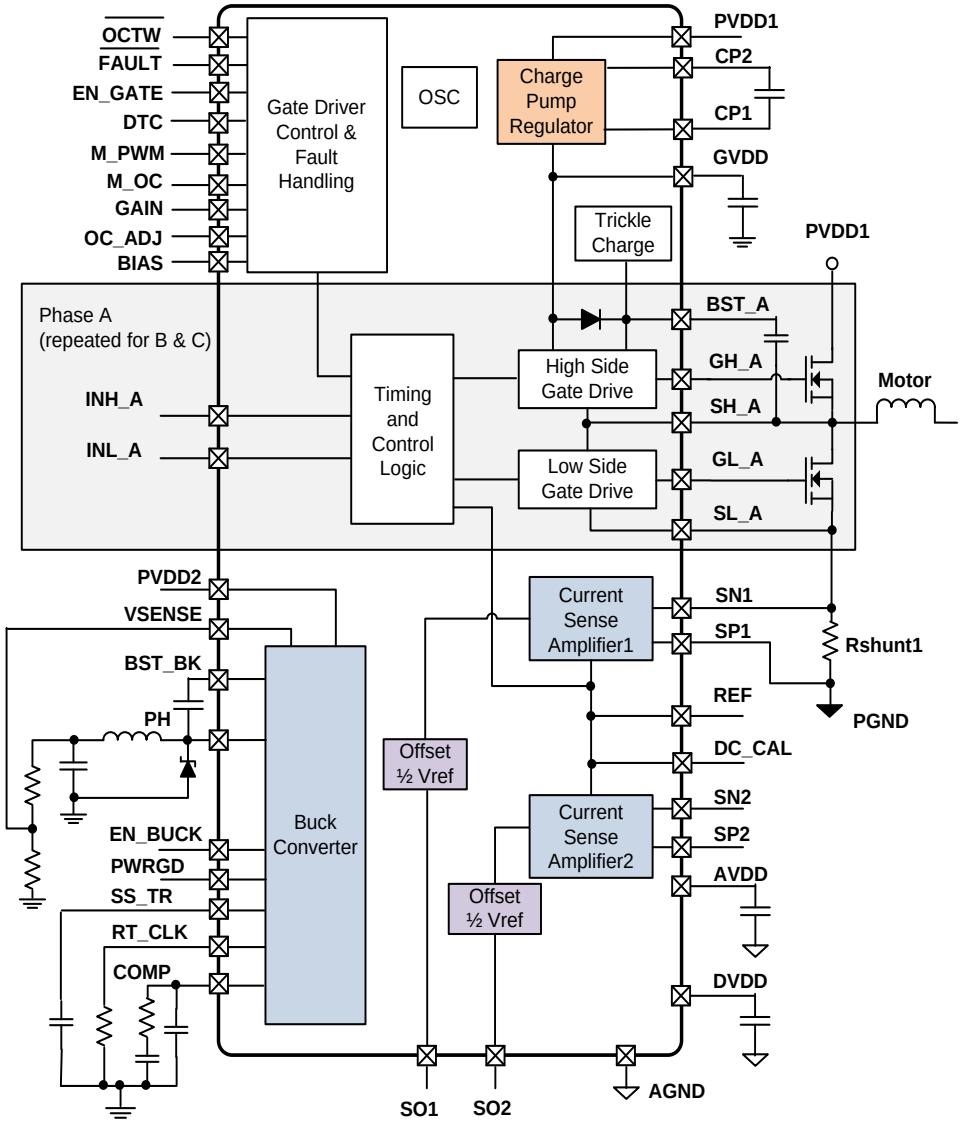
In Production

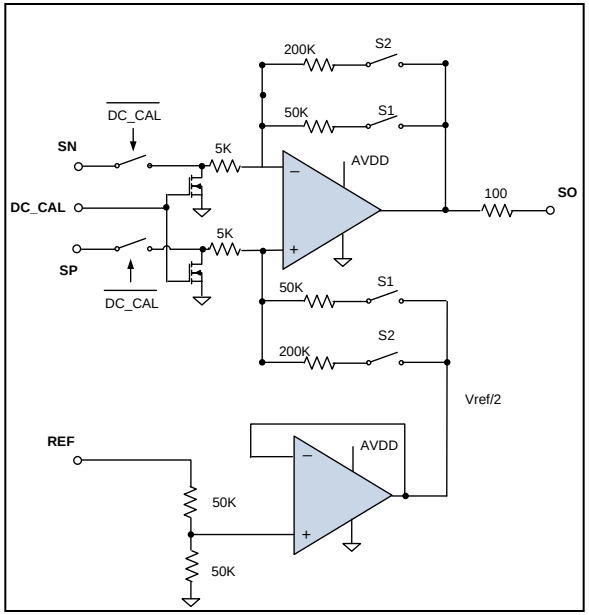


14 x 8.1mm, 56-pin HTSSOP package



DRV8302: Block Diagram





Current Sense Amps

$$V_o = \frac{V_{REF}}{2} - G \cdot (SN_X - SP_X)$$

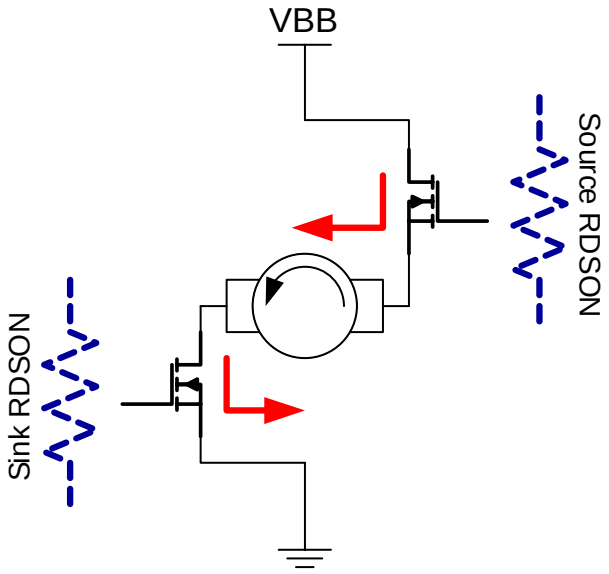
TI模拟电机驱动产品的优势

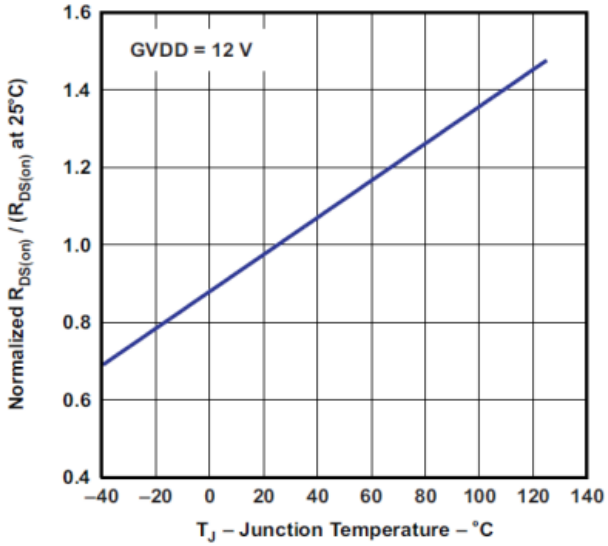
先进工艺，低功耗特性

更绿色

先进工艺
超低Rds ON

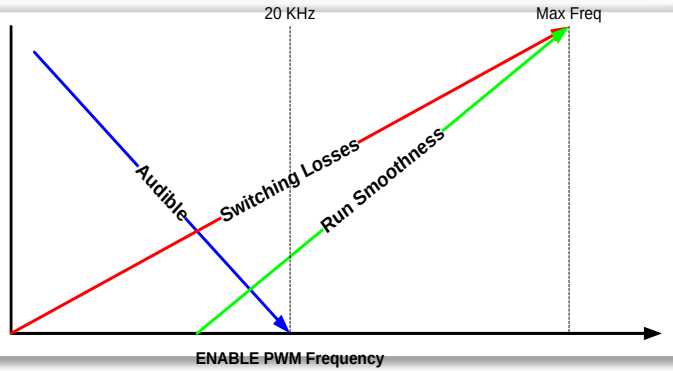
- 高输出效率
- 优秀的热表现





低功耗特性

- 支持待机功能
- 优化的PWM频率
- 优化的死区时间



DRV8837

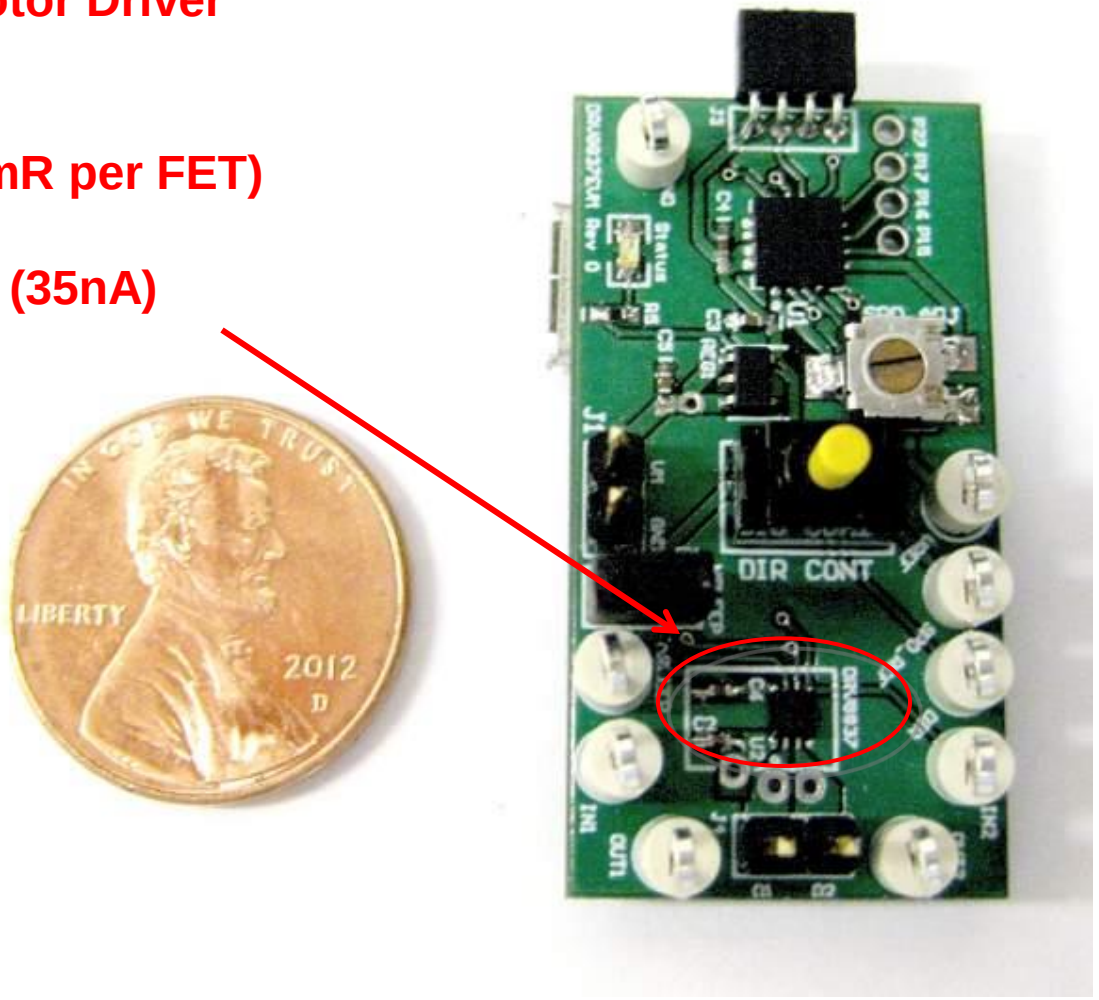
1.8A Low Voltage Brushed DC Motor Driver

Worlds smallest 1.8 Motor Driver (2 x 2 mm)

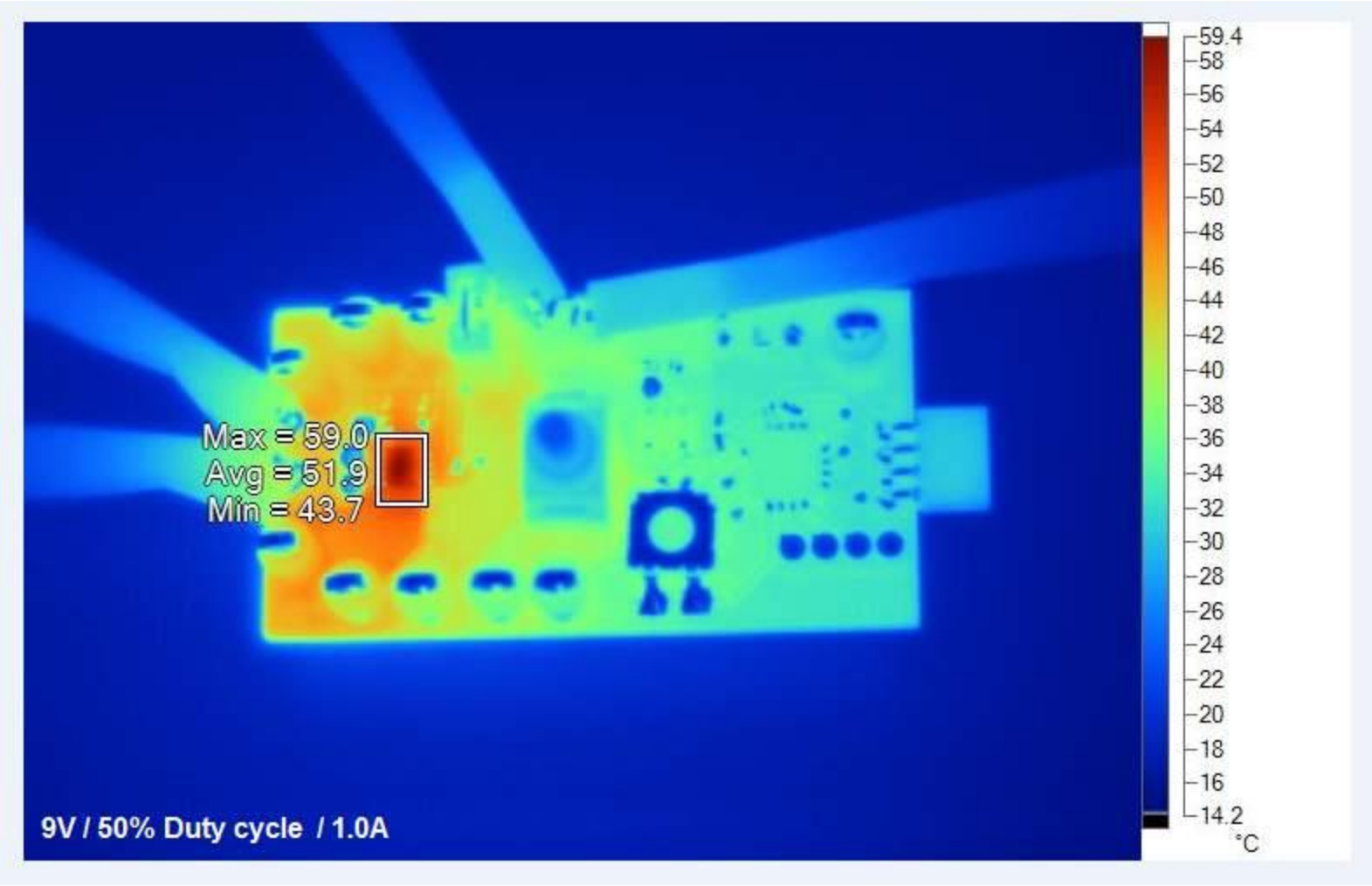
Ultra low RDSON (140mR per FET)

Ultra low sleep current (35nA)

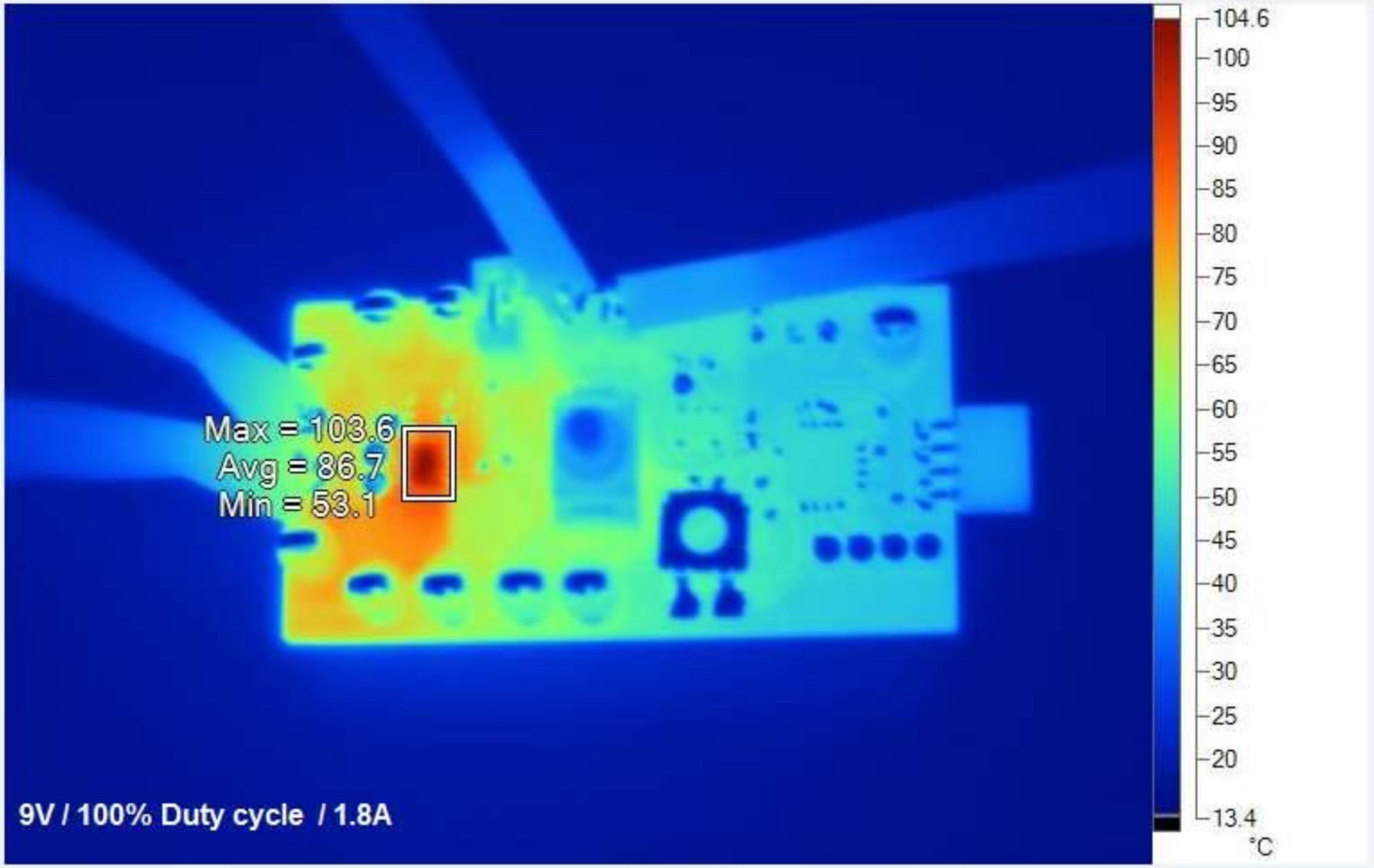
Fully Protected



1A / 9V : Average case temp = 52° C



1.8A / 9V : Average case temp = 87° C



DRV8818

2.5A Stepper Motor Driver with On-Chip 1/8 Micro-stepping Indexer

Features

- Dual H-Bridge motor driver
  - Supply voltage: 8 to 35V
  - Output current: 1.75A RMS / 2.5A peak
- Low RDSON FETs 0.37-Ω (HS + LS); P2P with DRV8811
- On-chip indexer emulates sine-wave in quadrature, supporting up to 1/8 micro-stepping
- Slow, fast and mixed decay with adjustable decay ratio and fixed off time current regulation
- Integrated protection features including over-current, thermal, shoot-through and UVLO protection.

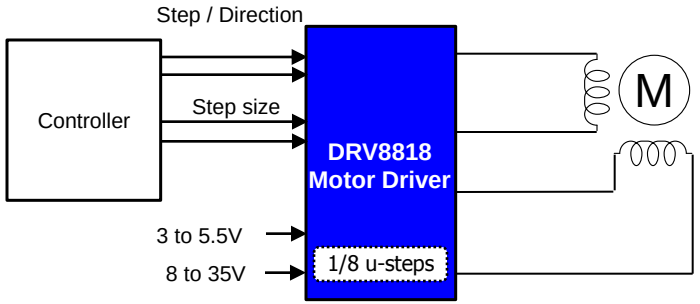
Benefits

- Wide supply range supports industry standard supplies and high output current delivers maximum performance.
- Improved thermal performance; Scalable current options
- Constant torque operation without support from the system controller.
- Smoother, quieter microstepping motion profiles; little processor support needed.
- Advanced on-chip protection reduces design complexity and enables higher system reliability

Applications

- Bipolar Stepper Motor

9.7 x 6.4mm, 28-pin
HTSSOP package



1/8 Micro-Stepper

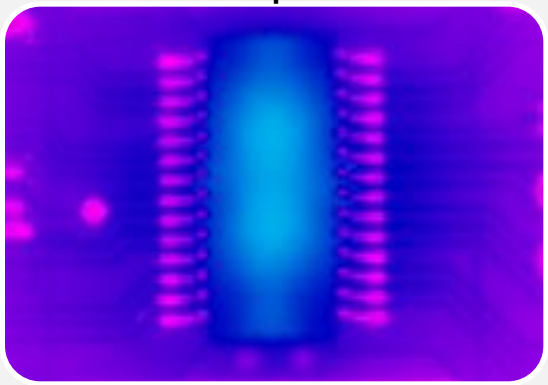
DRV8818 - The Coolest 2.5A Microstepping Motor Driver

更绿色

Greater than 30% temperature reduction

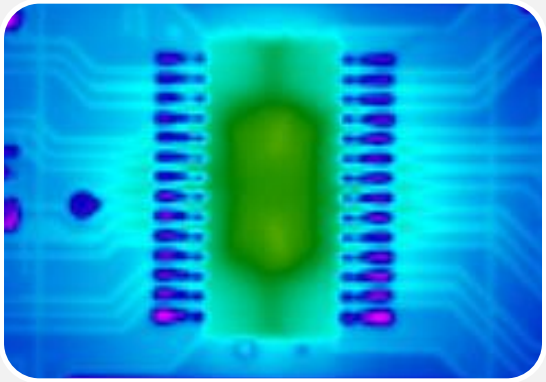
Pin to pin compatible drops into existing layout

Max Temp 107° C



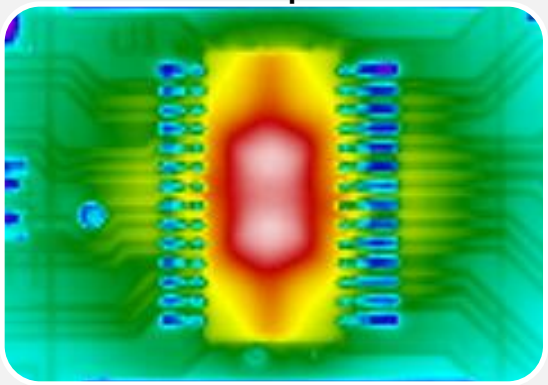
TI - DRV8818

Max Temp 130° C



R

Max Temp 157° C



A

2.5A sine wave peak, 1/8 micro-stepping, 2-layer board

DRV8833

2.0A Low Voltage Stepper or Single/Dual Brushed DC Motor Driver

Features

- Dual H-Bridge motor driver
  - Supply voltage: 2.7 to 10.8V
  - Output current: 1.5 cont / 2A peak per bridge
    3A cont / 4A peak paralleled
  - RDSON: 360mR (LS + HS)
- PWM control interface
- Supports brake/coast (DC motors) and full/half-step modes (stepper motors)
- Current regulation / CBC inrush protection
- Sleep mode (1.6uA Typ @ 5V)
- Integrated protection features including over-current, thermal, shoot-through and UVLO protection.

Benefits

- Supports battery powered applications
- Low RDSON increases efficiency and improves thermal performance / reduces case temperature.
- Independent control of each half bridge
- Flexibility to support brushed DC or stepper motors for a single IC.
- Limit in-rush start up and stall currents and support stepper operation.
- Sleep mode minimizes power consumption
- Advanced on-chip protection reduces design complexity and enables higher system reliability

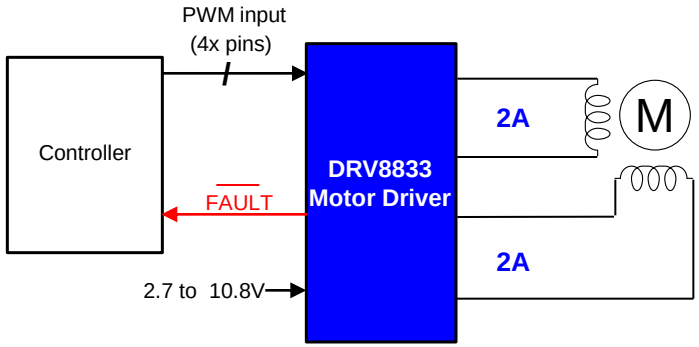
Applications

- 1x or 2x Brushed DC or 1x Stepper motor
- 4x solenoids

In Production

5.0 x 6.4mm,16-pin
HTSSOP package

4.0 x 4.0mm,16-pin
QFN package



DRV8835

1.5A Low Voltage Stepper or Single/Dual Brushed DC Motor Driver

Battery Powered Applications

Features

- Dual H-Bridge motor driver
  - Dual Supplies: Vm = 2.0 to 11V
    Vcc = 2.0 to 7V
  - Output current: 1A cont / 1.5A peak per bridge
    2A cont / 3A peak paralleled
  - RDSON: 295mR (LS + HS)
- PWM or Phase/Enable control interface options
- Brake mode support
- Ultra low sleep/standby current (50nA @ 5V)
- Integrated protection features including over-current, thermal, shoot-through and UVLO protection.

Benefits

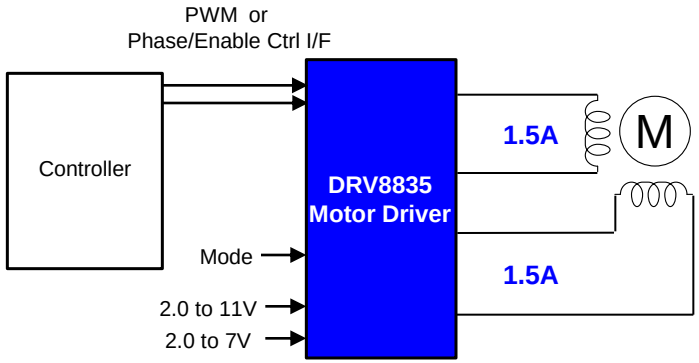
- Supports battery powered applications; dual supply prevents battery droop from tripping UVLO protection
- Low RDSON improves thermal performance / reduces case temperature.
- Flexible control options support legacy designs; Independent control of each half bridge
- Brake support quickly bring the motor to a stop
- Sleep function minimizes power consumption
- Advanced on-chip protection reduces design complexity and enables higher system reliability

Applications

- Dual brushed motors, stepper motor, solenoids
- Toys, cameras, consumer products

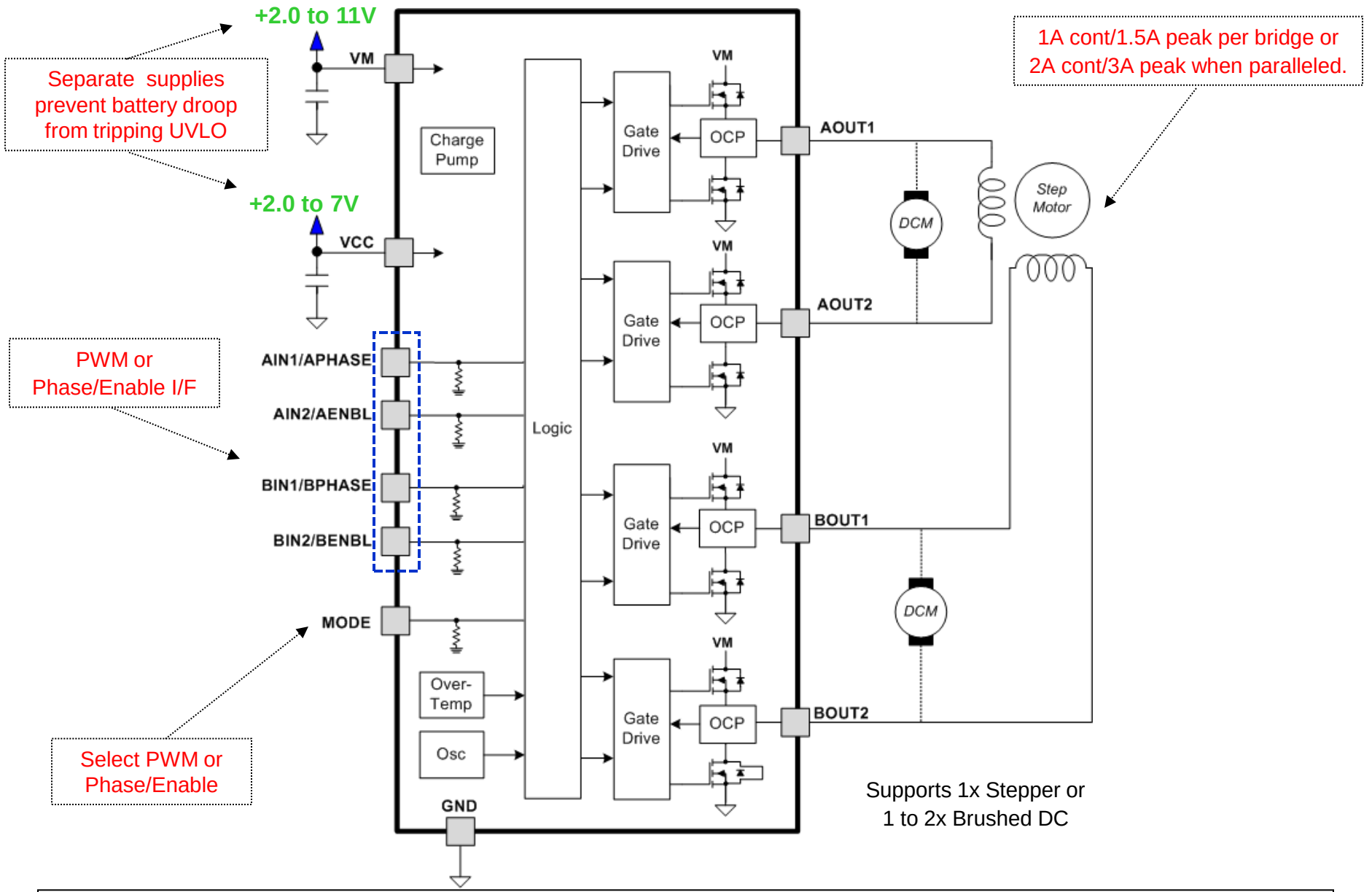
Sampling

2.0 x 3.0mm,12-pin
WSON package



Texas Instruments

DRV8835: Low-Voltage Dual Full Bridge DC Motor Driver

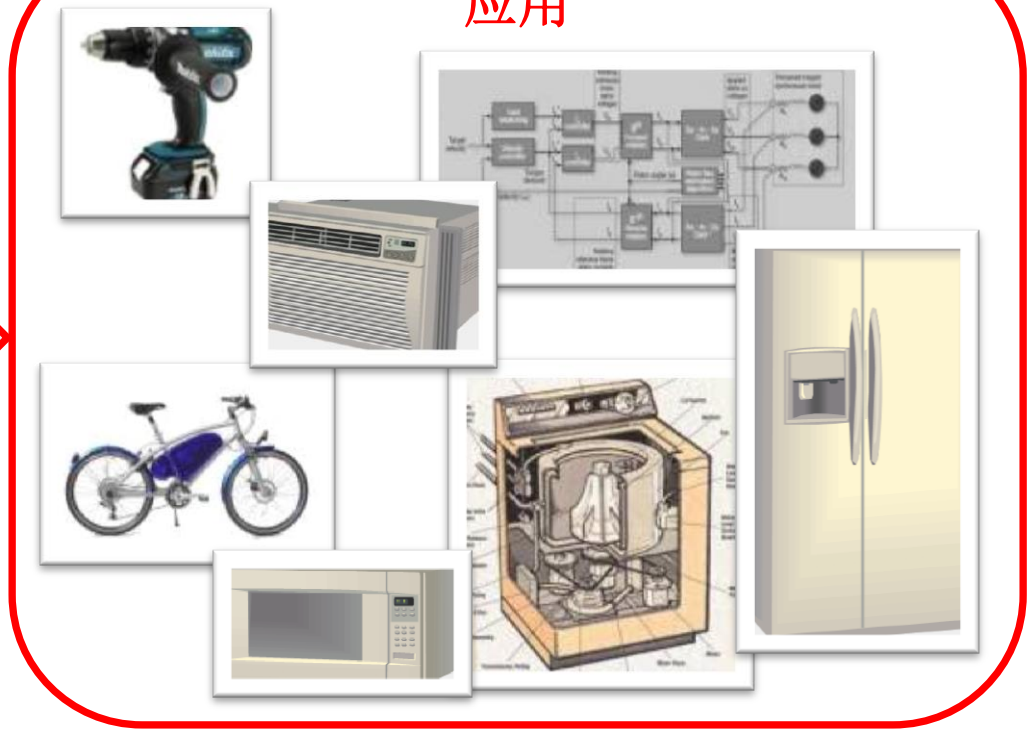


TI模拟电机驱动产品的优势

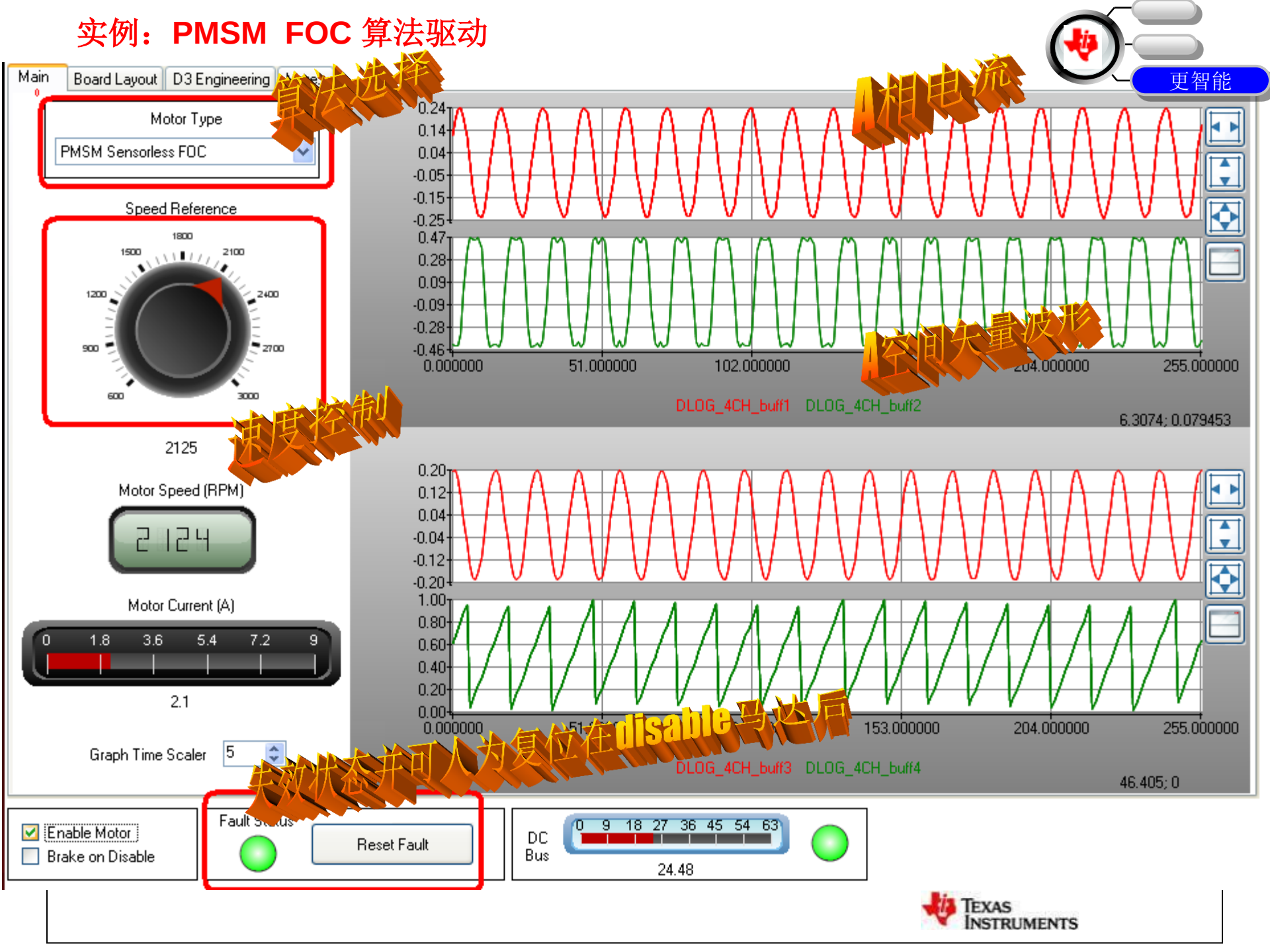
先进算法： Motor Lab @ Kilby

大学 → Motor Lab @ Kilby ← 顾客反馈

应用



实例：PMSM FOC 算法驱动



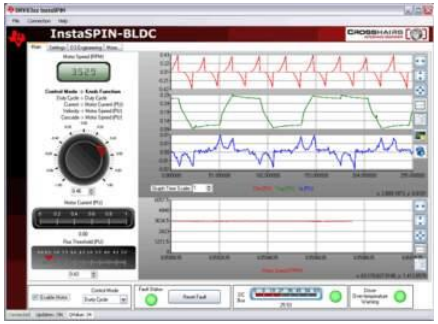
Quicker Time to Spin!

DRV8312-C2-KIT 3-Phase Brushless Motor Drive and Control

更智能

Features:

- Software Support:
  - Field Oriented Control (sensorless)
  - Trapezoidal (sensored & sensorless)
  - InstaSPIN support
- Speed & torque control loops
- Piccolo + DRV8312 *(3.5A RMS / 6.5A peak / 50V)*
- Kit includes motor w/ hall sensors, power supply, and USB stick with Quick Start GUI and guide.



In Stock / In Production
Order Now!

Texas Instruments

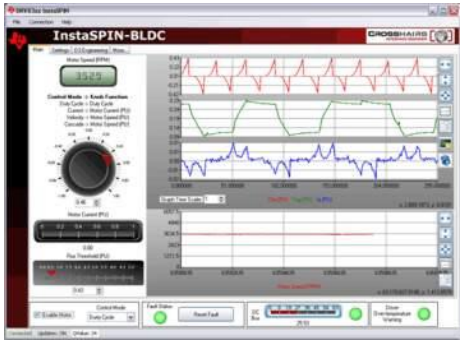
Quicker Time to Spin!

DRV8301-HC-C2-KIT 3-Phase Brushless Motor Drive and Control

更智能

Features:

- Software Support:
  - Field Oriented Control (sensorless)
  - InstaSPIN support
- Speed & torque control loops
- Supports up to 60V / > 60A applications
- Piccolo + DRV8301 (1.7A Pre-driver with 2x current sense amps and 1.5A buck) + 120A FETs.



In Stock / In Production
Order Now!

Texas Instruments

DRV8834:

2.2A Low Voltage Stepper Motor Driver with 1/32 Indexer

Features

- Dual H-Bridge motor driver
  - Supply voltage: 2.5 to 10.8V
  - Output current: 1.5 RMS / 2.2A peak per bridge
  - RDSON: 305mΩ (LS + HS)
- Step / Direction control interface with on-chip indexer supports up to 1/32 step microstepping or > 1/32 step microstepping with external reference.
- Phase Enable control interface supports dual brushed DC motors or Stepper
- Slow, fast and adjustable mixed decay modes (25,50,75%); Dynamic TBLANK
- Integrated protection features including over-current, thermal, shoot-through and UVLO protection.

Benefits

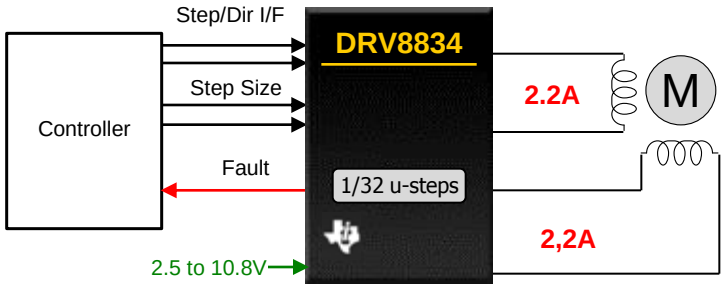
- Supports battery powered applications
- Low RDSON improves thermal performance / reduces case temperature and extends battery life.
- On-chip indexer supports smooth and quiet motion profiles without support from the system controller.
- Single device supports both brushed and stepper motors. Supports > 32 u-steps with external reference.
- Dynamic TBLANK and Mixed decay modes minimize output distortion for ultra smooth motion profiles
- Advanced on-chip protection reduces design complexity and enables higher system reliability

Applications

- Security Cameras, IP Cameras
- POS Micro-Printers , Medical Analysis Equipment

24-pin HTSSOP
(7.8 x 6.4mm)

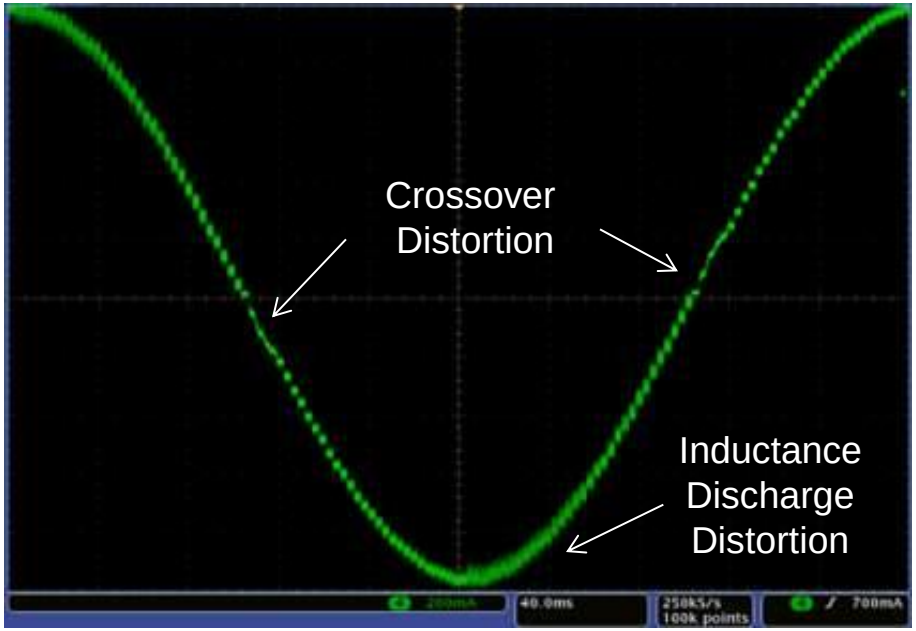
24-pin QFN
(4 x 4mm)



DRV8834: Dynamic TBLANK & Mixed Decay Modes

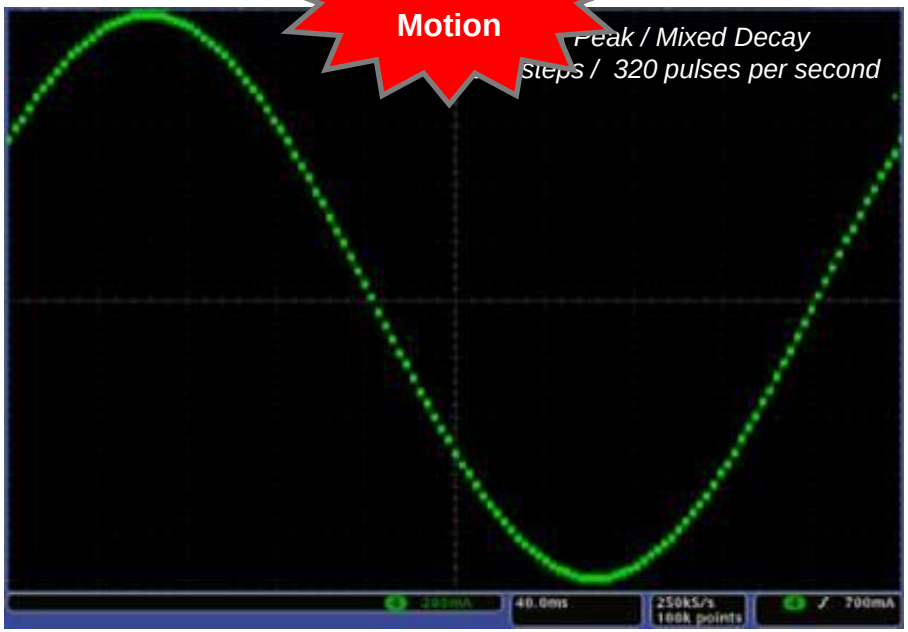
更智能

Competitor: A



DRV8834

Ultra Smooth Motion

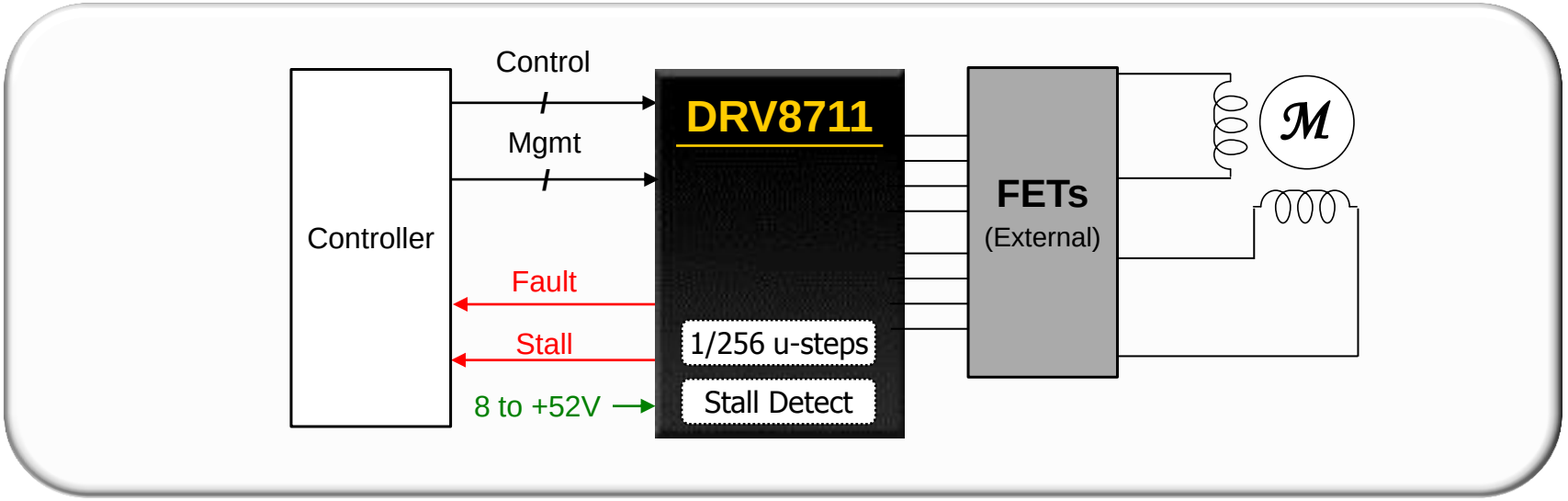


Less Distortion = Less Torque Ripple = Smoother Motion

- **Dynamic TBLANK minimizes crossover distortion**
- **Variable Mixed Decay Ratio minimizes discharge distortion**

DRV8711

High Performance Stepper Pre-Driver



- **Ultra Smooth Motion Profiles**
  - *Up to 256 u-steps (Indexer)*
  - *Auto-mixed decay current control*
- **Excellent Thermal Performance**
  - External FETs
- **Scalable Output Currents**
  - *Supports 1 to 10A (or higher)*
- **Stall Detect**
  - *Optional BEMF output*
- **Highly Configurable**
  - *Register based (SPI I/F)*
- **Fully Protected**

DRV8711:

Stepper pre-driver with on-chip 1/256 micro-stepping indexer and stall detect

Features

- Bipolar stepper gate driver:
  - Supply voltage: 8 to 52V
  - Gate drive: Up to 200mA source / 400mA sink
  - Adjustable slew rate / dead-time
- Step/Dir, PWM, or SPI control options; SPI mgmt. I/F
- On-chip indexer supports up to 256 micro-steps
- Advanced highly configurable current regulation
  - Programmable fixed time off & blanking times
  - Slow, fast, programmable mixed decay, auto mixed decay modes; scalable output current
- Stall detect with optional Back EMF output
- Integrated protection features including over-current, thermal, shoot-through, UVLO, & gate drive over-current

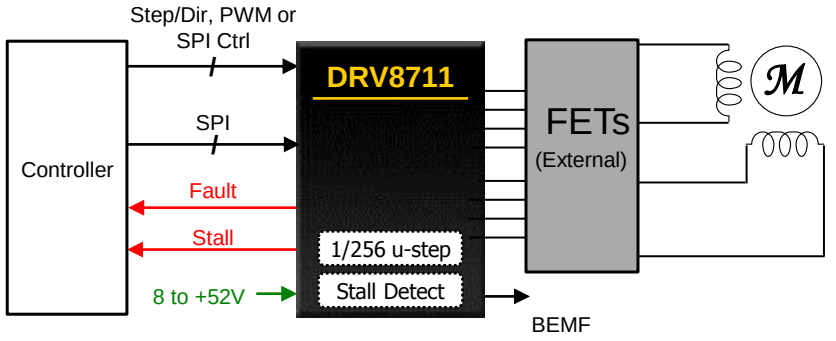
Applications

- Textile mfg equipment, factory automation
- Security cameras, ATM, robotics, stage lighting

38-pin HTSSOP
(9.7 x 6.4mm)

Benefits

- Wide supply range supports industry standard supplies; tune gate driver performance to applications needs.
- Flexible ctrl options and access to detailed fault reporting
- On-chip indexer supports smooth and quiet motion profiles without support from the system controller.
- High performance current regulation minimizes output ripple and distortion, delivering smoother motion profiles
- System controller is notified and can take corrective action when a stall event occurs.
- Advanced on-chip protection reduces design complexity and enables higher system reliability



Auto Mixed Decay = Ultra Smooth Motion

DRV8711: Stepper Pre-Driver

- Up to 256 u-steps (Indexer)
- Advanced Current Regulation
- Highly Configurable / Fully Protected

10mA rail for MCU or other system needs

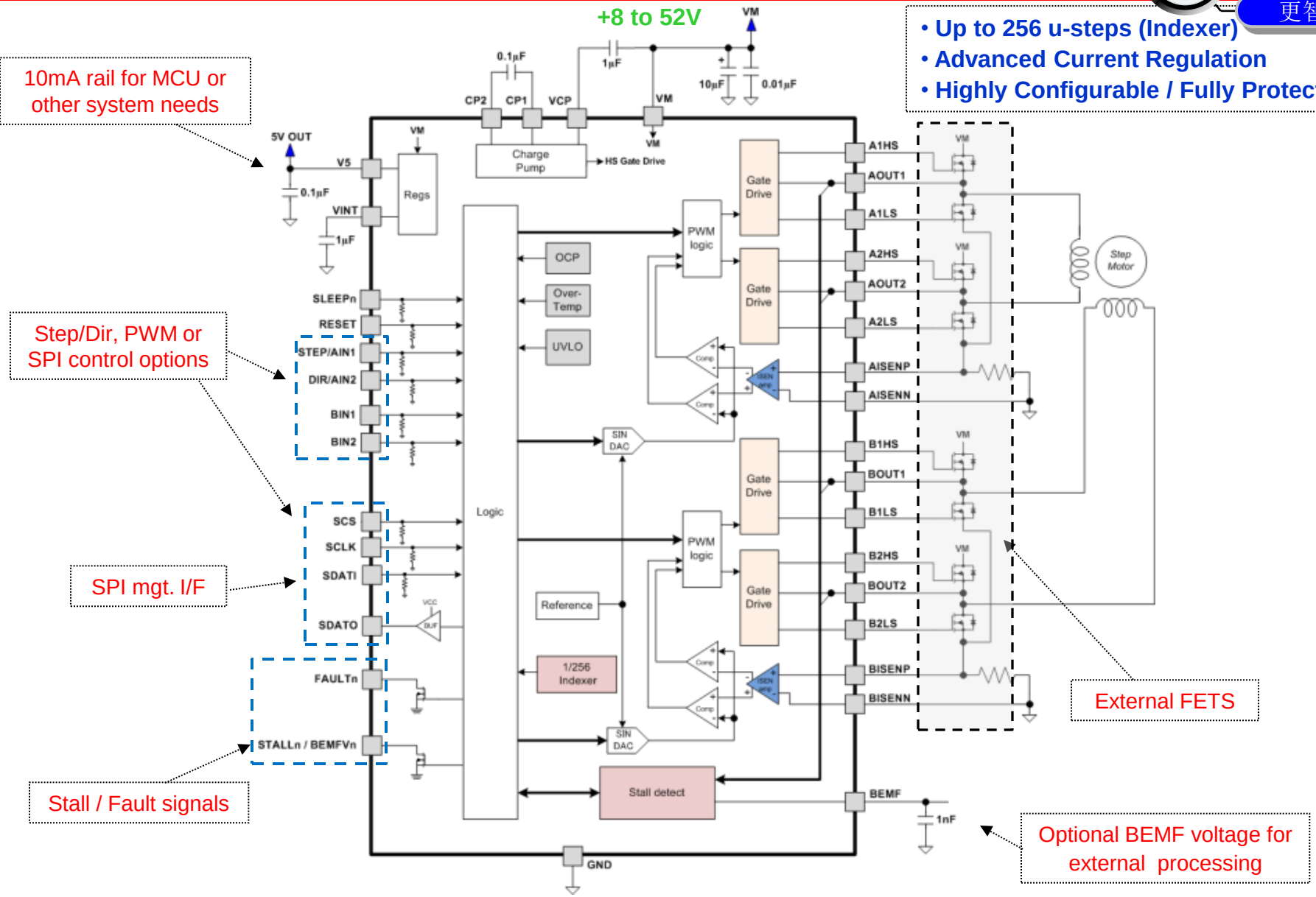
Step/Dir, PWM or SPI control options

SPI mgt. I/F

Stall / Fault signals

External FETS

Optional BEMF voltage for external processing

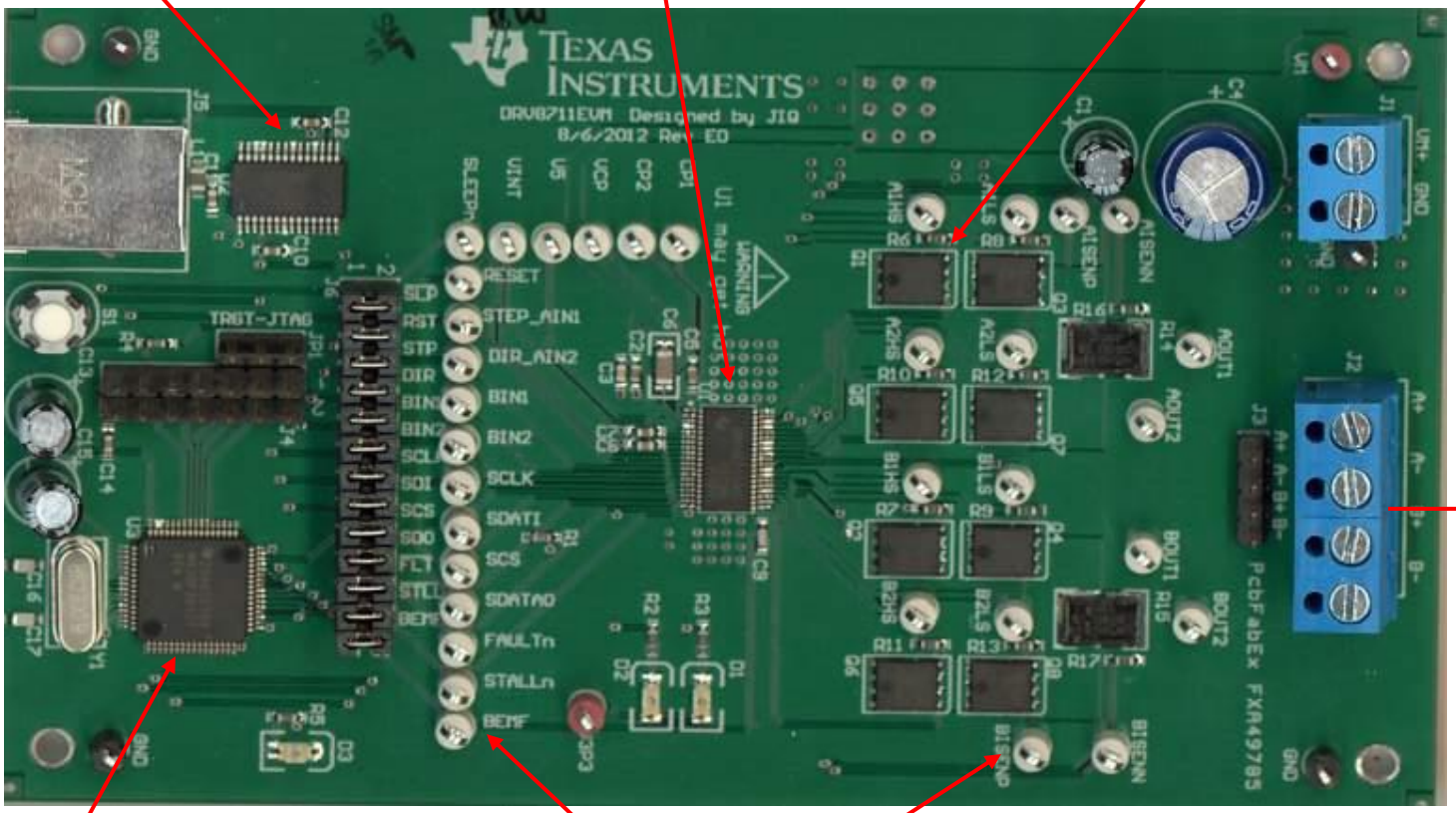


DRV8711: Highly Configurable

更智能

Feature	Configurable Range
Current Regulation ✓	
Fixed Time Off	*500nS to 128uS (steps of 500nS)*
Blanking Time	*500nS to 5.12uS (steps of 20nS)*
Adaptive Blank Time	*On / Off (< 30% FS current = ½ blank time)*
Scalable Current (Torque register)	*0 to 100% FS current (steps of 0.4%)*
Decay Modes	*Slow, fast, mixed, & auto mixed*
Mixed Decay Ratio	*% fast decay (steps of 500nS)*
Sense Amp Gain	*5x, 10x, 20x, or 40x*
Gate Drive ✓	
Dead Time	*50nS, 100nS, 200nS, or 400nS*
Gate Drive/Slew Rate	*50mA, 100mA, 150mA, 200mA (Source)*
Gate Drive Initial Pulse “On” Time	*250nS, 500nS, 1uS, & 2uS*
Stall Detect ✓	
BEMF Output Signal	*On / Off & scale down by 4x, 8x, 16x, or 32x*
Stall Detect Threshold	*1, 2, 4, or 8 missed steps*
OCP ✓	
OCP Level	*250mV, 500mV, 750mV, & 1V*
Deglitch Time	*1uS, 2uS, 4uS, & 8uS*

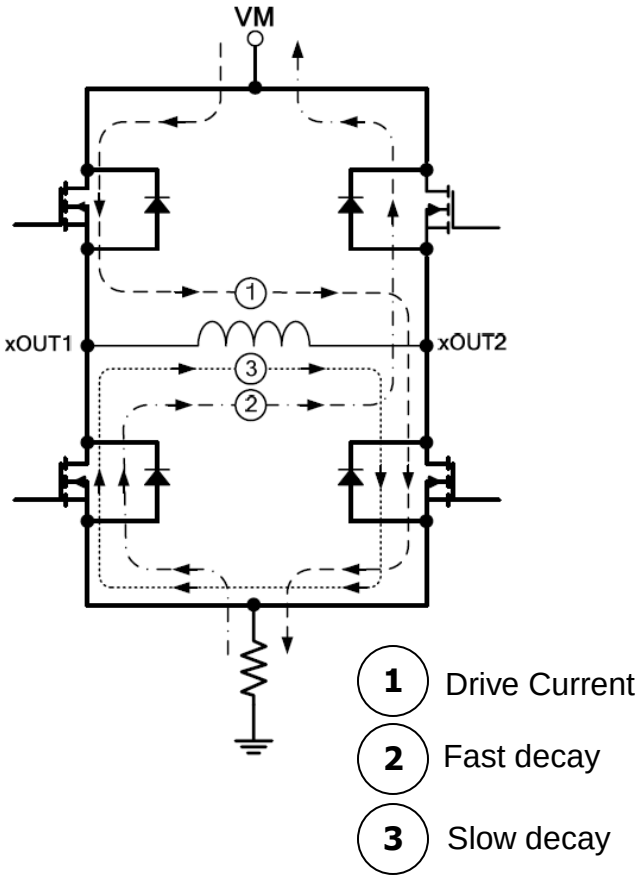
DRV8711: Evaluation Module (EVM)

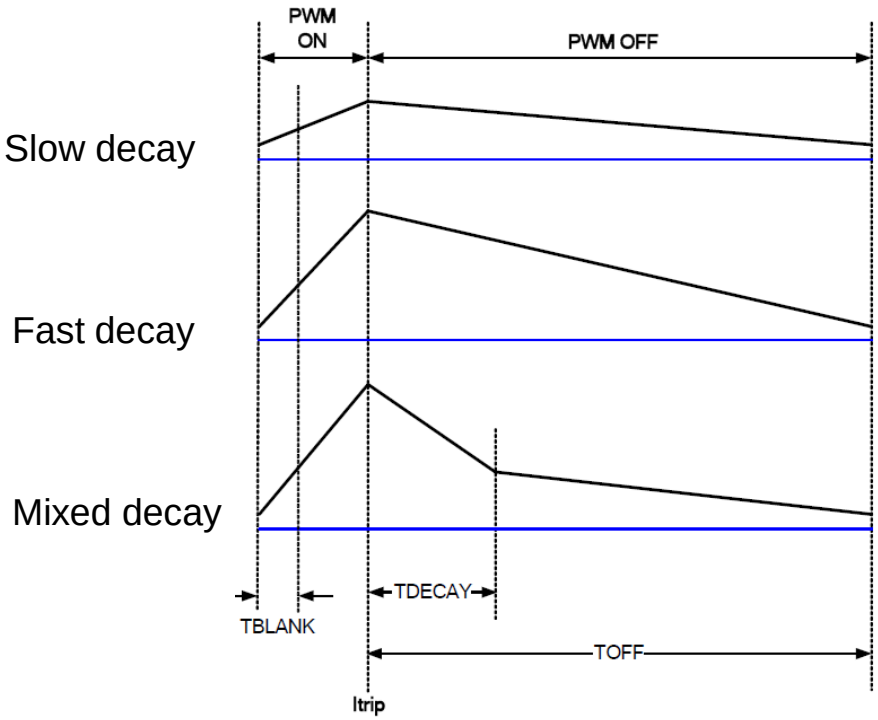


Decay mode

更智能

Total Five kinds of decay mode with slow, fast, mixed and combinations.
Auto mixed decay mode is added also.



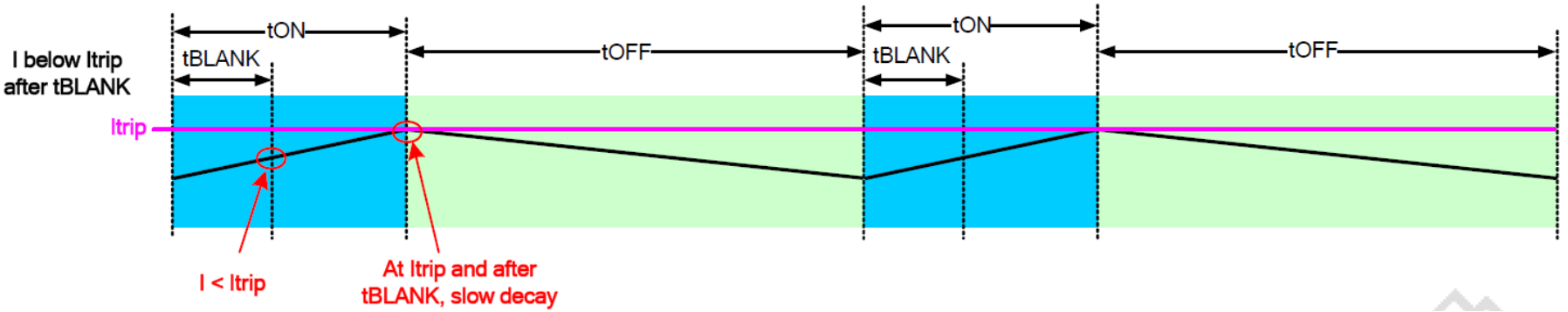


Auto mixed decay mode

Auto mixed decay mode samples the current level and make different choice automatically to get smoother current regulation ability.

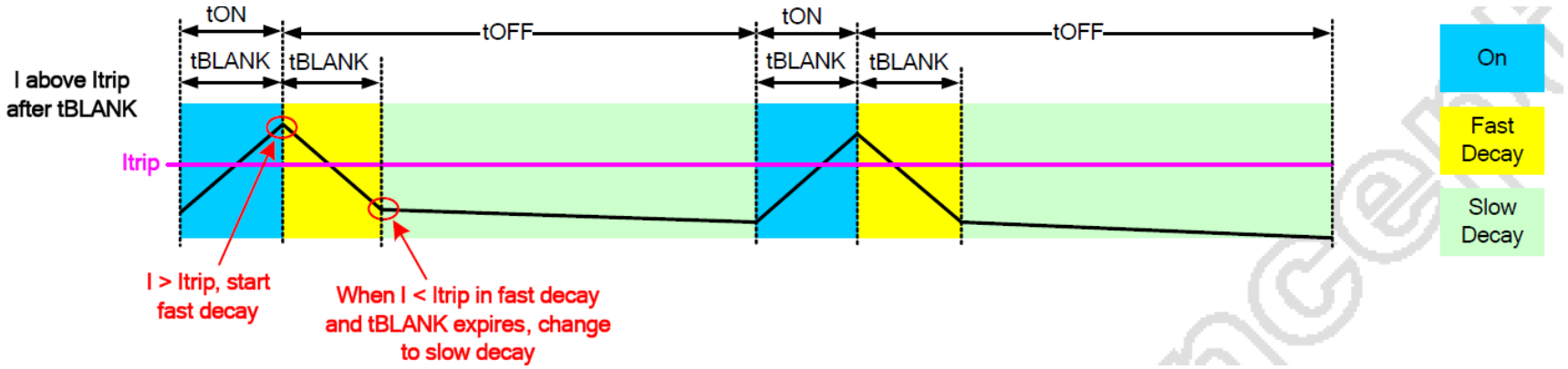
(1) I < Itrip @ tBLANK

Bridge remains on until the current reaches Itrip then slow decay.



(2) I > Itrip @ tBLANK

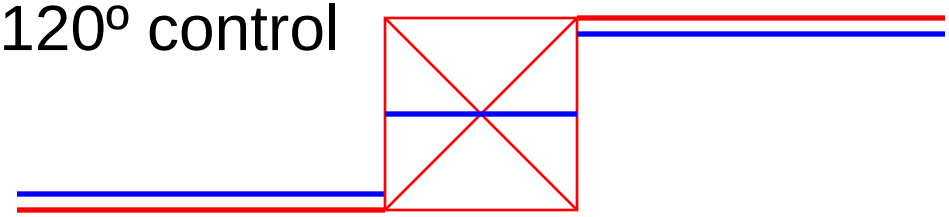
Fast decay another tBLANK if < Itrip then change to slow decay



120º,150º control

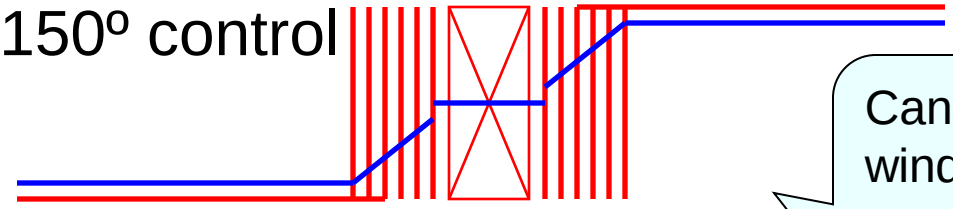
120º control

Phase Current
Phase Voltage



150º control

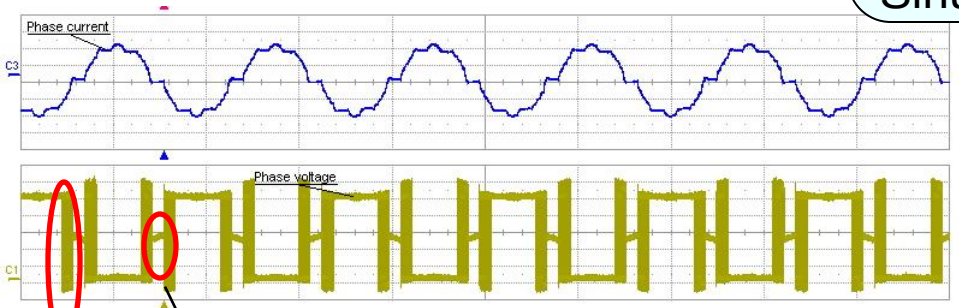
Phase Current
Phase Voltage



Can we make the window to Zero, then generate pure Sinusoidal Current.

Phase current

Phase Voltage



Modulation

Window

DRV11873

12V 3-Phase Sensor-less BLDC Fan Driver

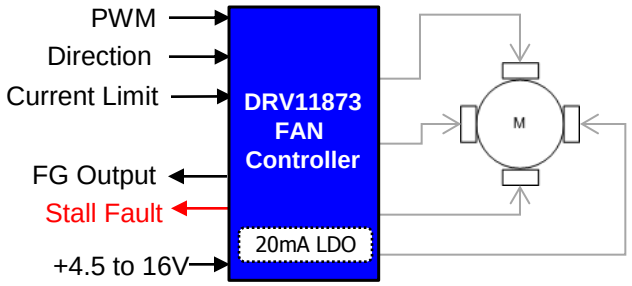
更智能

Features

- 3x Half-Bridge Motor Driver and Controller
  - Supply voltage: 4.5 to 16V
  - Output Current 1.5A cont / 2A Peak
  - RDSON (LS + HS): 450mΩ
  - 150° Sensor-less BACK EMF Control
- PWM and Forward/Reverse control pins
- Synchronous rectification / no external sense resistor improves efficiency
- FG output enables closed loop speed control
- On-chip 5V, 20mA LDO
- On-chip protection:
  - Rotor Lock / Stall Protection
  - Overcurrent Protection
  - Thermal / UVLO protection
  - AVS (during PWM from 100% to lower duty)

Benefits

- Fully integrated solution with wide supply range
- Sensorless control reduces system cost and board space by eliminating Hall sensors.
- Ultra efficient architecture
- FG out provides FAN speed to DCU or MCU for speed control
- Advanced on-chip protection reduces design complexity and enables higher system reliability



Applications

- Appliance, Desktop, Server cooling fans

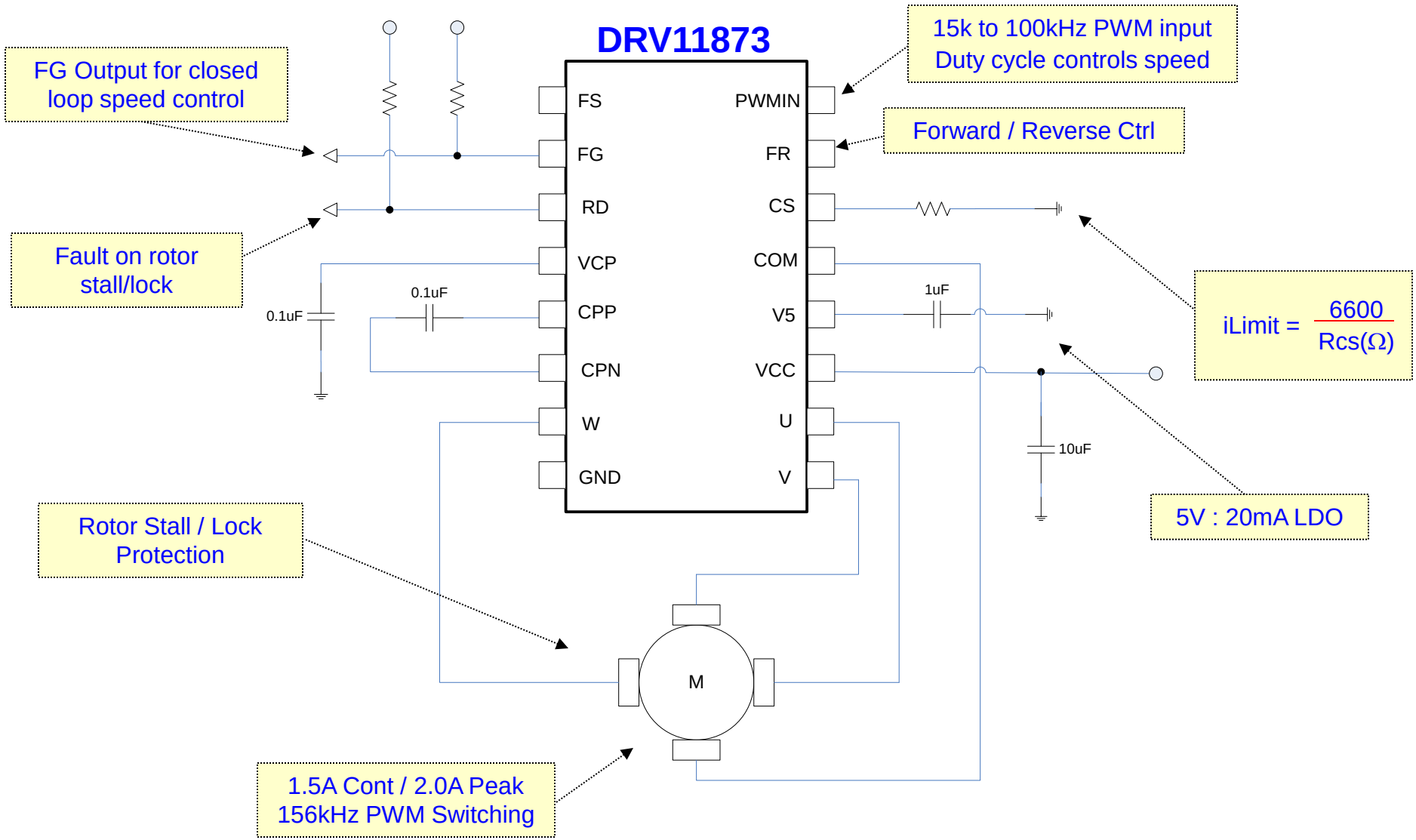
5 x 6.4mm , 16-pin
HTSSOP package

Sensor-less

Texas Instruments

DRV11873: 12V 3相无传感器电机驱动IC

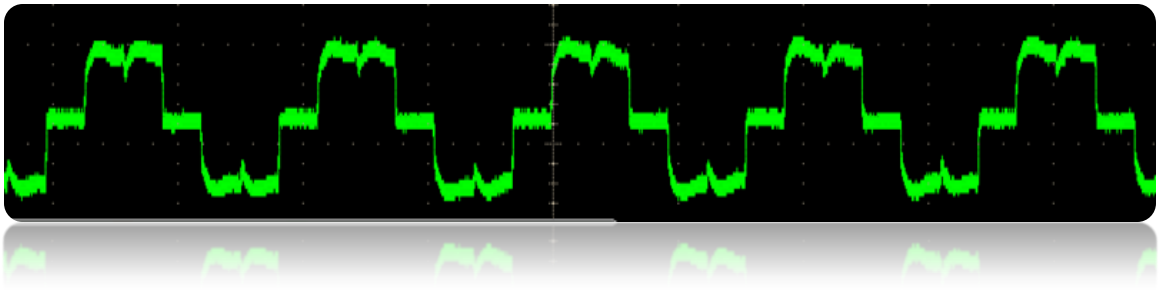
更智能



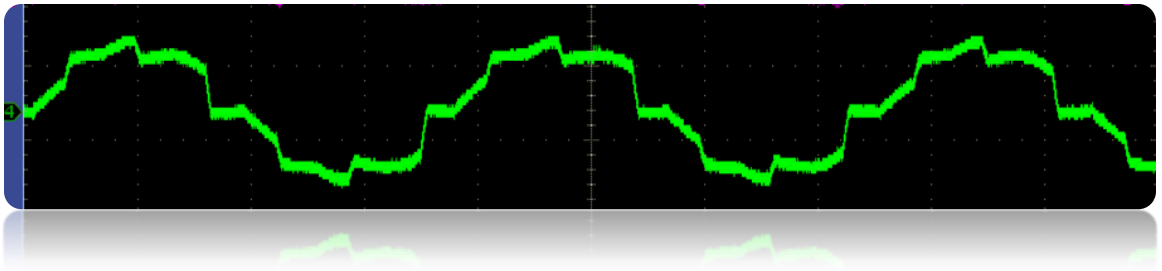
Driving Technology

更智能

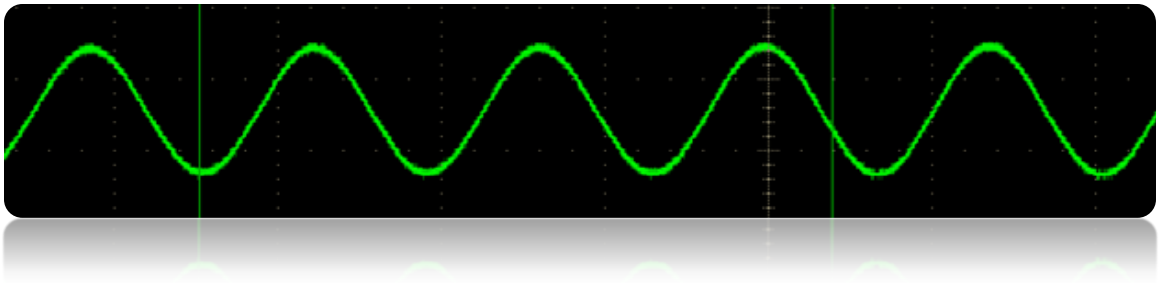
120° Driving
Phase current
驱动相电流波形



150° Driving
Phase current
驱动相电流波形



180° Driving
Phase current
驱动相电流波形



DRV10963

5V 180° 3-Phase Sensor-less BLDC Fan Dr...
5V 180° 3相 无刷 无传感器 集成马达驱动器

更智能

Features 特性

- ✓ Supply voltage: 2.1~5.5V
- ✓ **180°无传感器正弦驱动技术，高效低噪声**
- ✓ Total RDSON (上臂+下臂): 1.2Ω
- ✓ 无外接电流采样电阻
- ✓ PSM or PWM Speed Control 兼容电压调速或脉
- ✓ Synchronous PWM 闭环高效同步PWM调速
- ✓ 5μA Stand by 休眠待机模式
- ✓ Lock detect 堵转检测和保护
- ✓ Thermal Protection 过热保护
- ✓ UVLO 欠压保护

微型化 10PIN
3mm × 3mm × 0.75mm
SON Package 封装

DRV10983:

24V, 3-phase Sinusoidal BLDC Sensor-less Motor Driver

更智能

Features

- 3x Half-Bridge Motor Driver and Controller
  - Supply voltage: 8 to 26V
  - Output Current 2A
  - RDSON (LS + HS): < 400mΩ
  - 180° Sensor-less Back-EMF Control
- Synchronous rectification / no external sense resistor improves efficiency
- FG output provides TACH feedback
- Dedicated SPEED pin
- On-chip protection:
  - Rotor Lock / Stall Protection
  - Thermal / UVLO Protection
  - OVP on Vcc (during rotor lock / standby mode)

Benefits

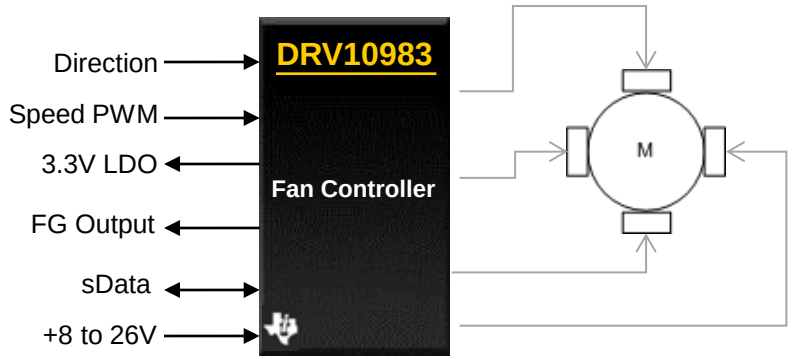
- Fully integrated solution with wide supply range
- Sensor-less control reduces system cost and board space by eliminating Hall sensors.
- Ultra efficient architecture, only requires two discrete passive components
- FG out provides motor speed to MCU
- Integrates speed loop on-chip, removing complexity and potentially decreased cost.
- Advanced on-chip protection reduces design complexity and enables higher system reliability

Applications

- Fans
- Pumps

In Production

7.9 x 6.6mm, 24-pin
TSSOP package



Sensor-less

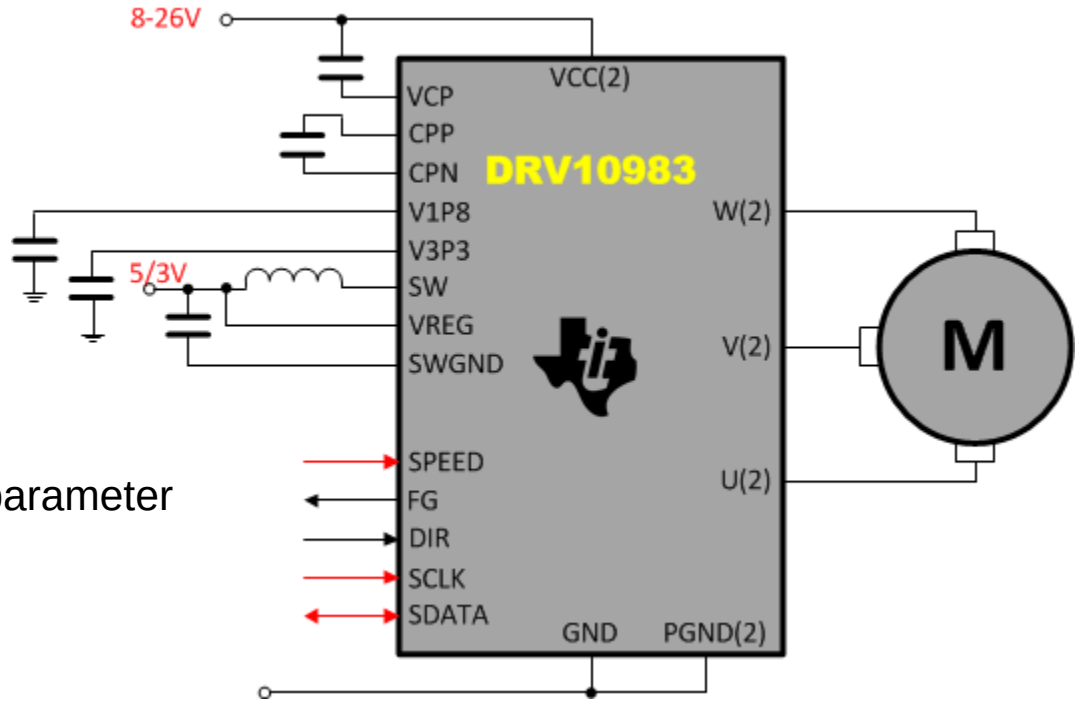
Roadmap

Texas Instruments

DRV10983

24V, 3-phase Sinusoidal BLDC Sensor-less Motor Driver

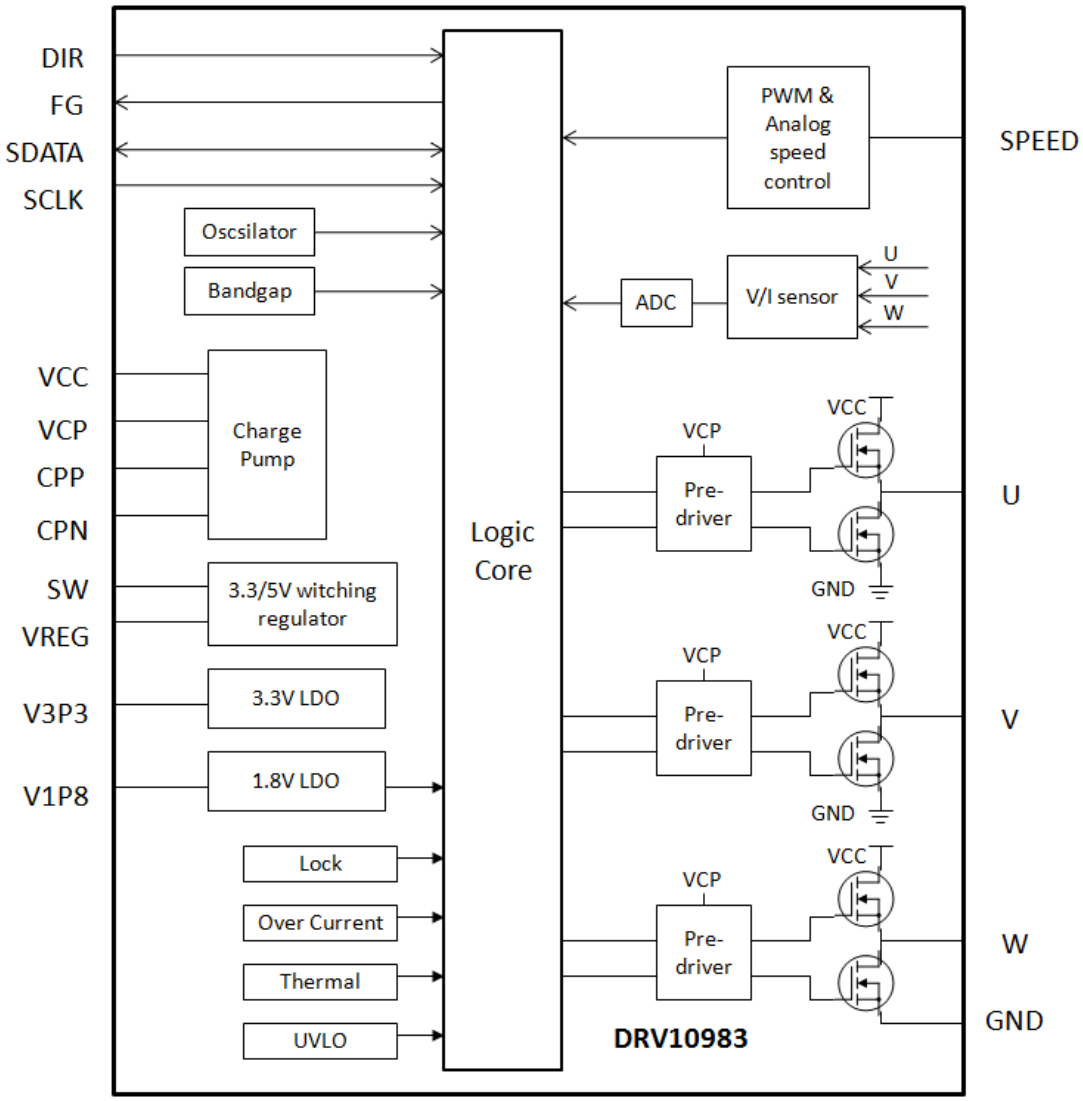
- **Smart**
  - **2.0A direct drive**
  - **Pure sinusoidal output**
  - 5/3V buck 100mA output
  - SPEED control via PWM, analog or I2C
  - FG TACH output
  - DIR direction control
  - I2C to configurable motor parameter and read operation status
- Safe
  - OCP Configurable
  - UVLO Under Voltage Lock Out
  - OT Over Temperature shutdown
  - RD Rotation lock Detection
- *Wide 8 - 26V and flexible configuration options ideal for a range of fan and pump applications*



6.5 x 6.4mm , 24-pin HTSSOP package

DRV10983

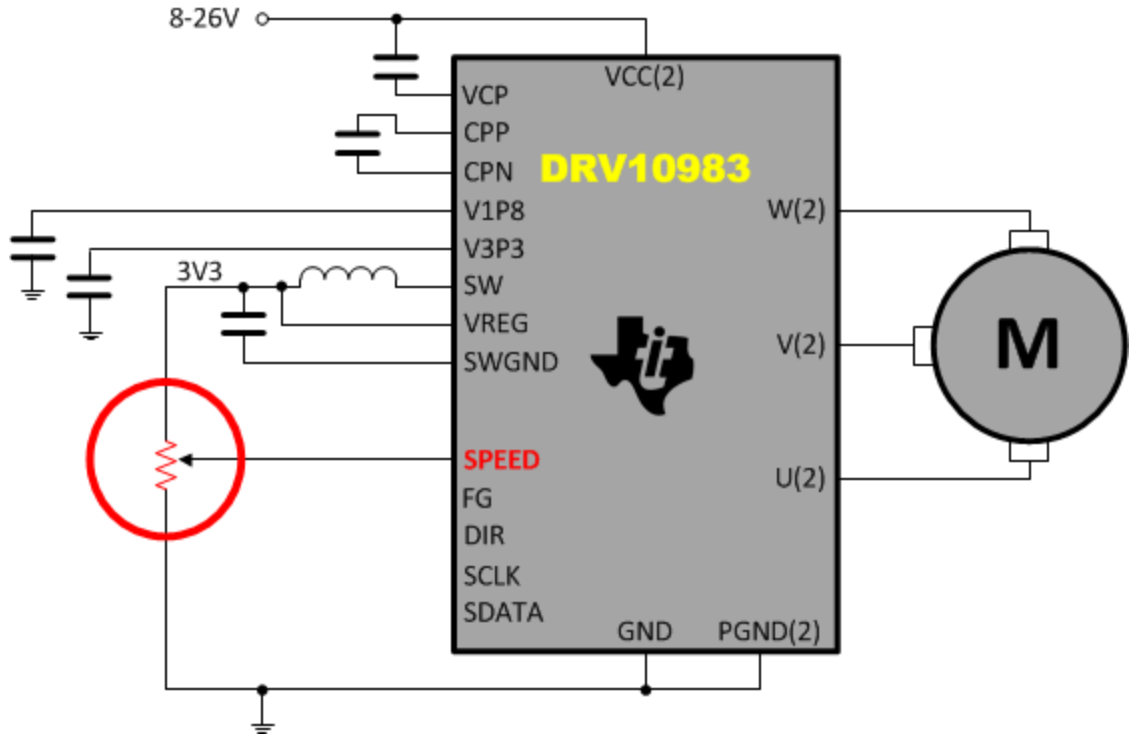
更智能



Texas Instruments

DRV10983

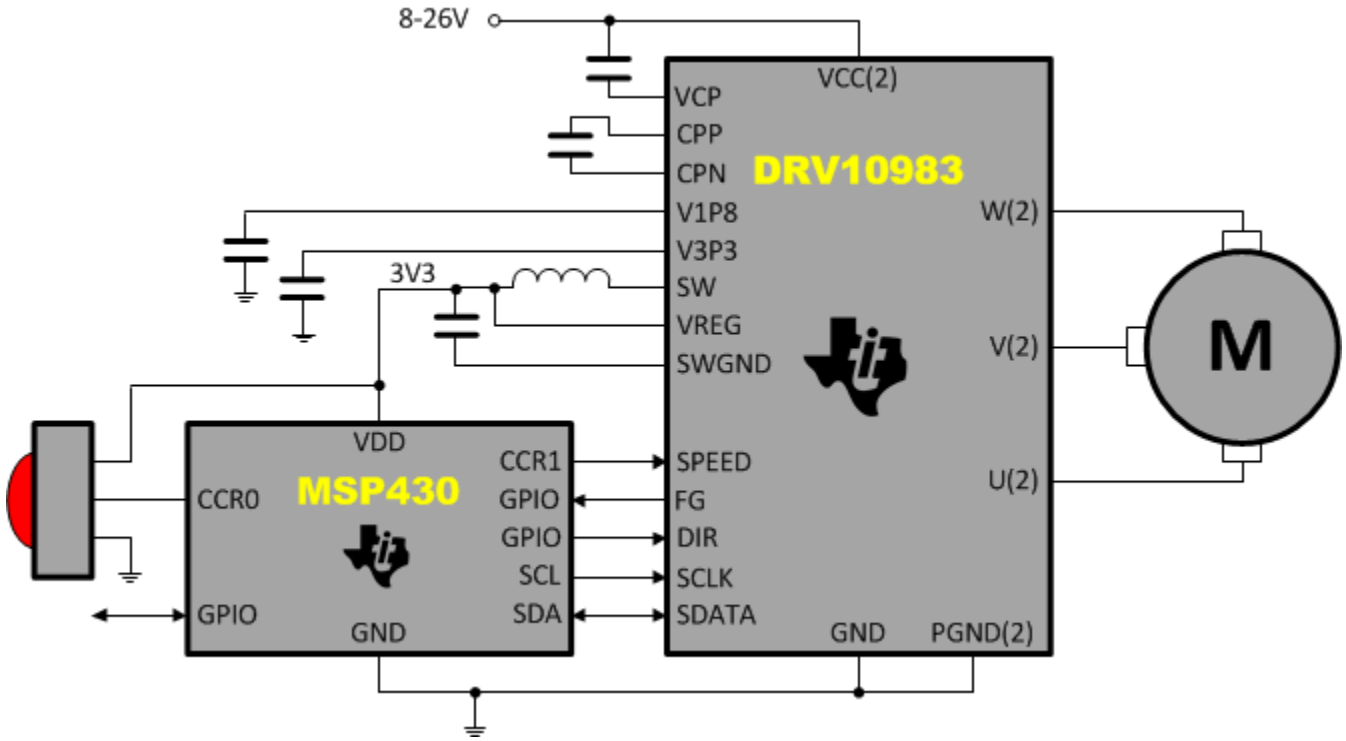
Optional Analog Speed Control



- **Directly connect potentiometer, NTC thermistor or other sensor**
- **Full speed control with no external MCU**
- **Low-cost, code-free, complete system**

DRV10983 Application

Complete 24V, 40-watt Ceiling Fan Reference Design



- **Smart: Synchronous rectification saves energy**
- **Safe: Over-current, voltage, temperature and lock detection**
- **Low-cost: Only two I/C's using integrated switching regulator**

DRV8308

3-Phase BLDC Controller and Pre-Driver and Integrated Digital Speed Loop

Features	Benefits

• 3-phase BLDC pre-driver
  • Supply voltage: 8.5 to 32 V
  • Gate drive current: 10 to 130mA
  • Adjustable slew rate and dead time
	• Supports 12V and 24V motors with the ability to drive six external FETs
	• Lowers switching noise and improves EMC performance

• Integrated digital speed loop • Programmable gain and loop filters	• Allows motor to maintain speed under variable loads

• Intelligent commutation modes
  • 120° (trap) and 180° (sine) commutation modes with tunable delays
  • Switches from 3 to 1 Hall sensor control at target speed
	• Decreases torque ripple and increases power efficiency
	• Sine mode minimizes acoustic noise
	• Eliminates jitter due to non-ideal Hall placement / matching

• Fully protected
  • OCP, OTP, UVLO, & charge pump fail/short protection with fault feedback
  • Locked rotor protection with auto-retry
	• Advanced on-chip protection reduces design complexity and enables higher system reliability

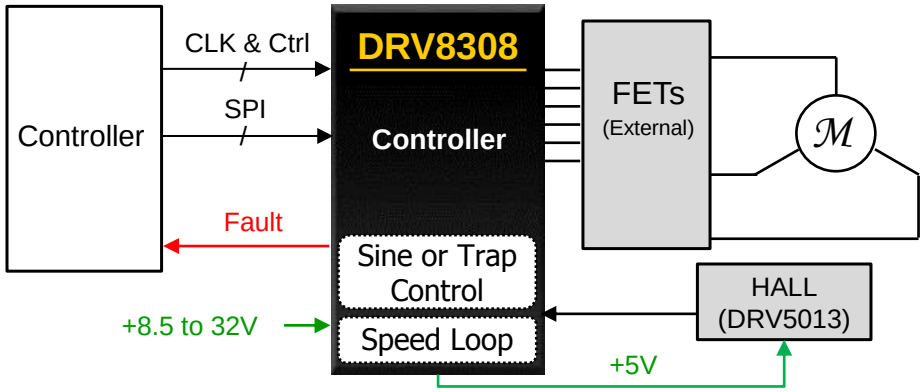
• SPI management interface	• Access detailed fault reporting and easily configure settings

Applications

- Brushless DC & PMSM Motors

In Production

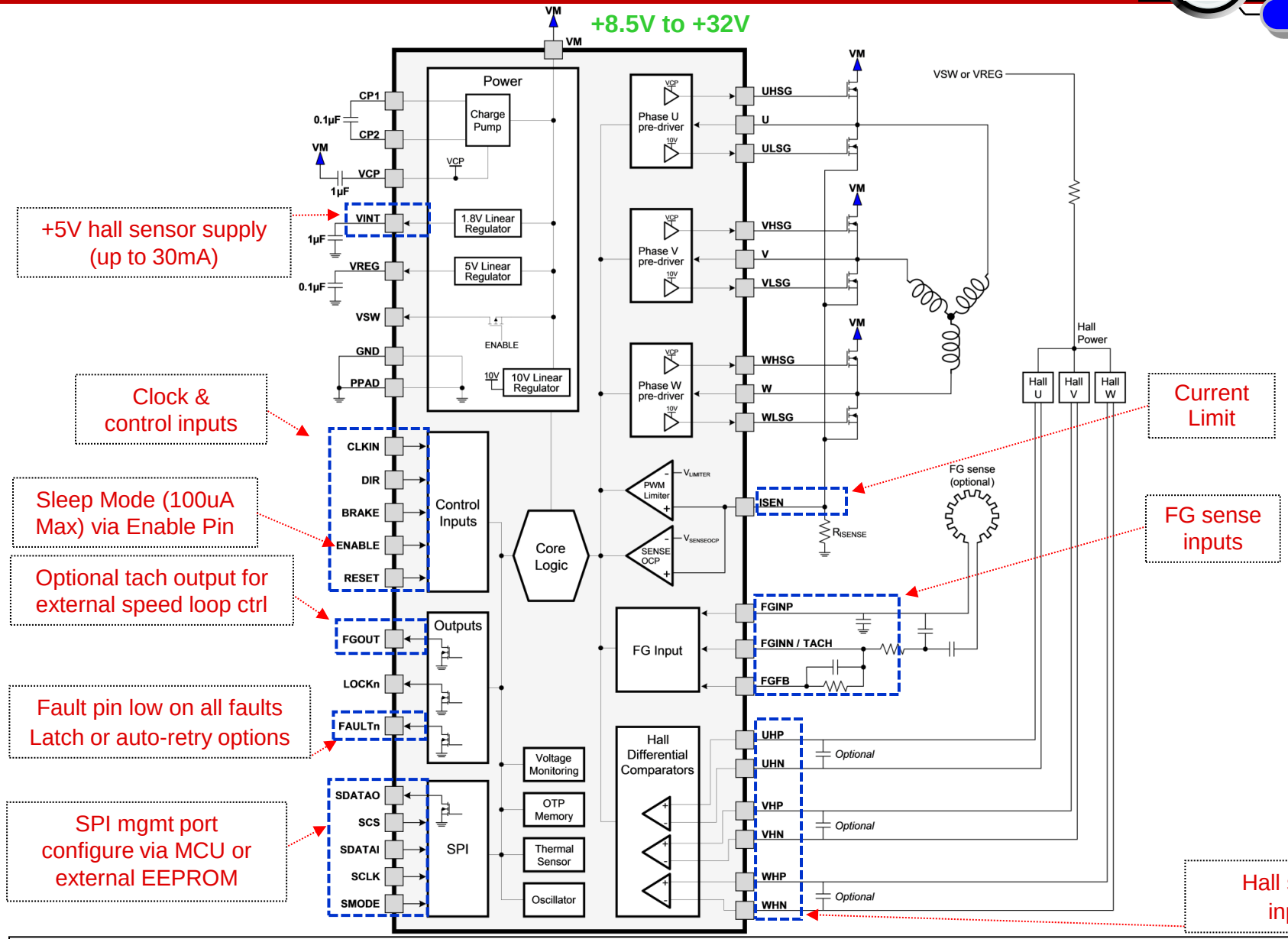
6 x 6mm, 40-pin
QFN package



Roadmap

Texas Instruments

DRV8308: Block Diagram



Roadmap

TEXAS INSTRUMENTS

DRV8307

3-Phase BLDC Controller and Pre-Driver

Features	Benefits

• 3-phase BLDC pre-driver
  • Supply voltage: 8.5 to 32 V
  • Gate drive current: 30mA
	• Supports 12V and 24V motors and drives six external FETs
	• Lowers switching noise and improves EMC performance

• Simple PWM control interface • Single PWM input for speed control	• Reduces design complexity and time

• On-chip 5V regulator for Hall sensors
  • Integrated commutation logic
  • Switches from 3 to 1 Hall sensor control at target speed
	• Additional power rail reduces system cost
	• Eliminates jitter due to non-ideal Hall placement / matching

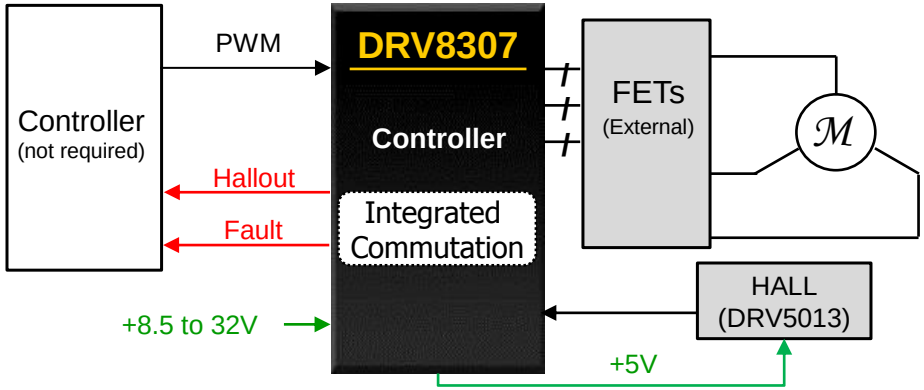
• Fully protected
  • OCP, OTP, UVLO & charge pump fail/short protection with fault feedback
  • Locked rotor detection with auto-retry
	• Advanced on-chip protection reduces design complexity and enables higher system reliability

• Low-power standby mode • Can sense when motor has stopped to decrease power	• Conserves overall system power during inactive periods

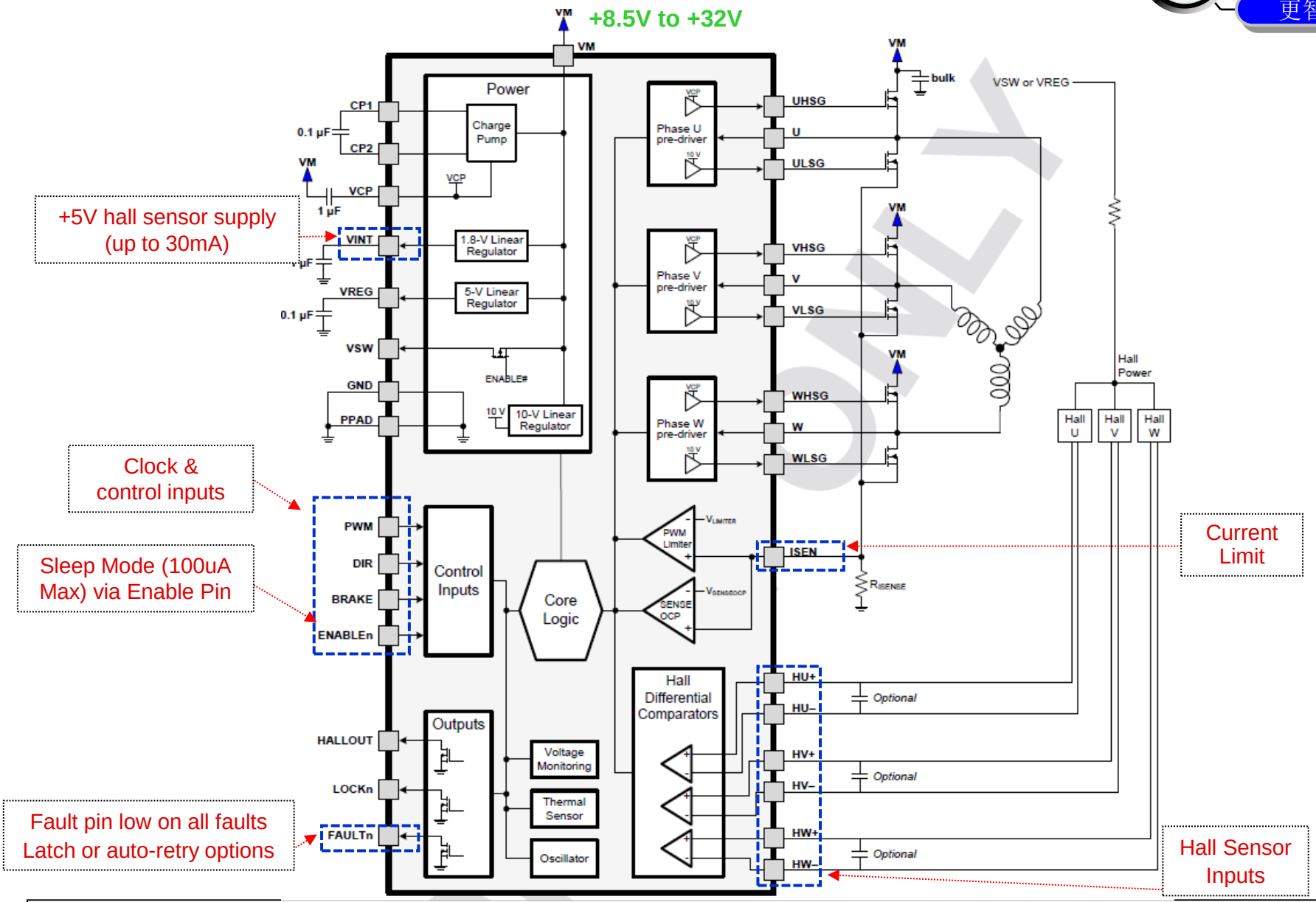
Applications

- Brushless DC & PMSM Motors

6 x 6mm, 40-pin
QFN package



DRV8307: Block Diagram



基于DRV8308的带速度闭环控制的24V带霍尔位置传感器的无刷电机参考设计
TIDA-00197

更智能

完整的产品阵容

Stepper Motor Driver

DRV84x, 87x, 88x
(Battery, 12, 24, 36 & 48V)

- Indexers / precision micro-stepping
- Fault diagnostics and stall detection
- Advanced current control

Ultra Smooth Motion Profiles

Brushed DC Motor Driver

DRV84x, 87x, 88x
(Battery, 12, 24, 36 & 48V)

- Smaller footprint; higher efficiency vs. discrete solutions
- Inrush current protection
- Faster time to market

Up to 20x Smaller! Fully Protected

Brushless DC Motor Driver

DRV83x, 10x
(Battery, 12, 24, 36 & 48V)

- Sensored & sensorless options with advanced diagnostics
- Configurable closed-loop control
- Integrated current sensing & power management

Embedded Intelligence

Solenoid Driver

DRV88x
(Battery, 12, 24, 36 & 48V)

- Multi-channel drivers
- Serial / parallel interface options
- Complete protection and diagnostics

Highly Integrated Fully Protected

Hall Effect Sensor IC

DRV5x
(2.5 to 38V)

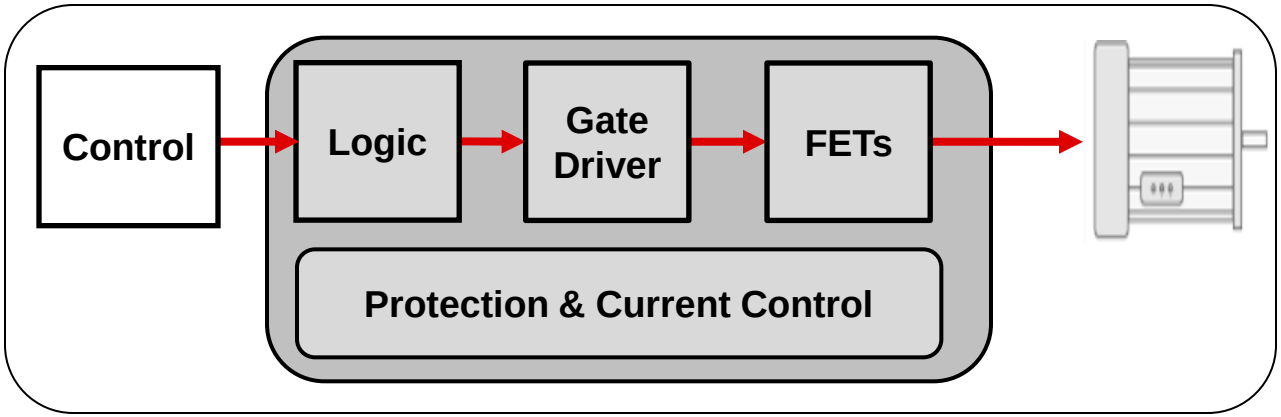
- Digital and linear versions
- Industrial and automotive options (Grade 1 & 0)
- Fully Protected
  - Reverse supply
  - Short-to-ground protection

Robust & Reliable

集成驱动器 & 预驱动器

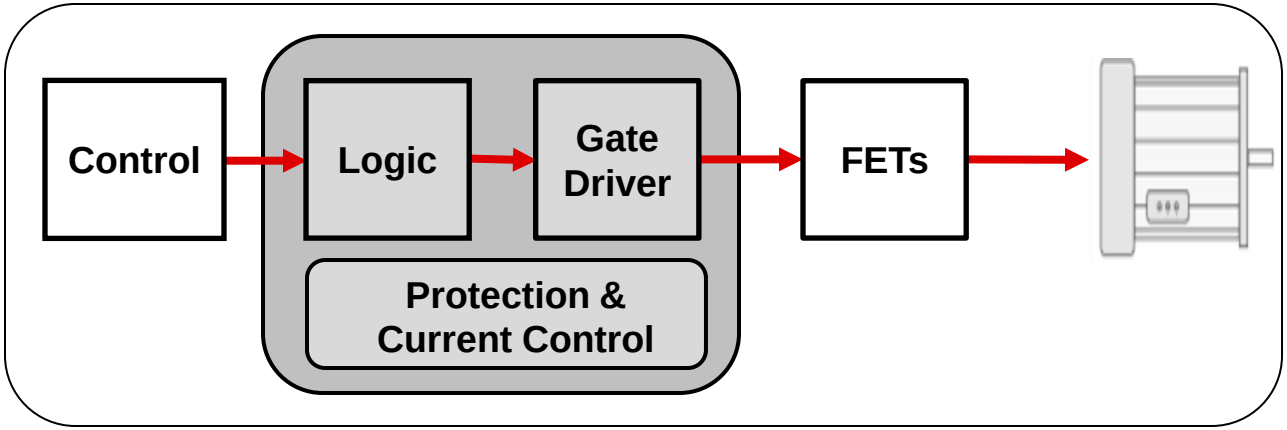
Integrated Driver

- Smallest board space
- Excellent performance
- Simple design
- Fully protected



Pre-Driver

- Scalable currents
- Lower RDSON
- Better thermals
- Reduced board space
- Fully protected



TI's DRV8x Motor Drivers

Support up to 60V/60A

Stepper Drivers

- 2.0V to 60V; Up to 12A
- Up to 32 u-steps indexer support
- Up to 256 u-steps & greater w/ external ref
- Indexer, phase enable, PWM, & serial ctrl

Precise Position Control



Brushed DC Drivers

- 2.0V to 60V; Up to 24A
- Inrush current protection
- Brake and Coast support
- Phase enable, PWM , and serial ctrl

Simplicity & Low Cost



3-Phase Brushless Drivers

- 8 to 60V; Up to 13A
- Pre-Drivers support up to 60A
- Integrated current sense amps / buck
- PWM and Clock ctrl

Reliability & Efficiency



TEXAS INSTRUMENTS

What is the DRV10?

Integrated 3-phase Sensor-less Fan Motor Drivers

- Fully Integrated 3-phase Motor Driver
  - Direct sensor-less connection to motor
  - Eliminate external components
  - Save cost and reduces board space
  - 1.65V-24V wide supply supports a variety of apps
  - Up to 2A max continuous drive
  - Tiny!
- Safe
  - Over current protection
  - Under/over voltage protection
  - Lock detection and thermal shutdown
- Applications
  - Computer, server, instrumentation and appliance cooling fans
  - Toys, personal health care and fluid pumps

Spin in a minute … with no code development !

DRV10x Roadmap

Fan Control

- **DRV10688** — 1 & 3 phase Closed loop Controller

12 & 24V, 3 Phase Drivers

- **DRV10983** — 24V, 2A Driver, 3 Phase, 180°
- **DRV11873** — 12V, 1.5A Driver, 3 Phase, 150°
- **DRV10975** — 12V, 2A Driver, 3 Phase, 180°
- **DRV10970** — 12V, 1.5A Driver, 3 Phase, 180°

5V, 3 Phase Drivers

- **DRV10863** — 5V, 0.5A Driver, 3 Phase, 150°
- **DRV10866** — DRV10863 with longer lock detection
- **DRV10963** — 5V, 0.5A Driver, 3 Phase, 180°

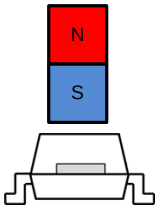
1 & 2 Phase Pre-Drivers/ Drivers

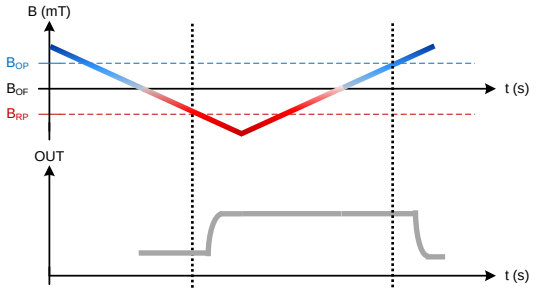
- **TMP814, 816** — 6 - 16V, Pre-Driver, 1 Phase, Full-wave
- **TMP821** — 4-28V, Pre-Driver, 2 Phase, Half-wave
- **TMP815** — 6-16V, Pre-Driver, 1 Phase, Full-wave

DRV5000: 3 types of output

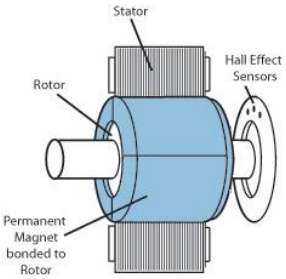
DRV501x: digital latch

Ex. DRV5013
Drop-in replacement packages



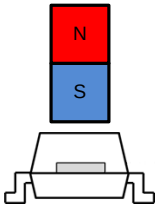


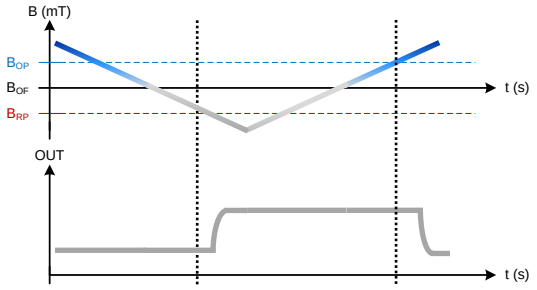
Ex. digital latch



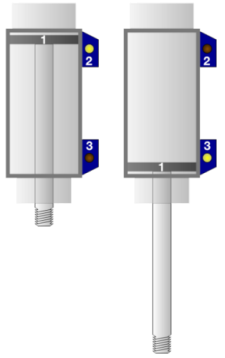
DRV502x/3x: digital switch

Ex. DRV5023
Drop-in replacement packages



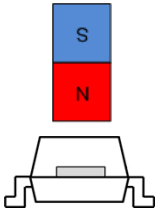


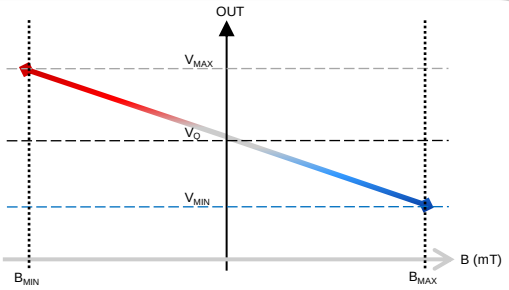
Ex. digital switch



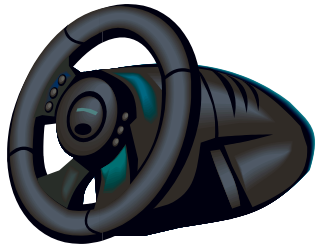
DRV505x: analog linear output

Ex. DRV5053
Drop-in replacement packages





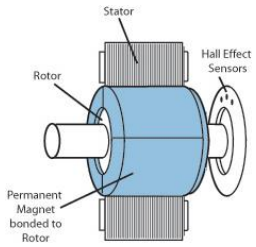
Ex. analog linear



DRV50x3: TI's first generation Hall sensors

DRV5013: digital latch

Sensitivity variants (Bop/Brp)	
DRV5013AD	+3/-3mT
DRV5013AG	+6/-6mT
DRV5013BC	+12/-12mT



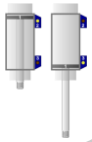
Pin-to-pin with Infineon TLE4946, A122x & others

DRV5023/33: digital switch

Sensitivity variants (Bop/Brp)	
DRV5023AJ	+9/+3mT
DRV5023BI	+16/+6mT
DRV5023DG	+36/+12mT

Sensitivity variants (Bop/Brp)	
DRV5033AJ*	+9/+3, -9/-3mT

*Omnipolar switch



Pin-to-pin with Infineon TLE4906, A120x & others

DRV5053: analog linear output

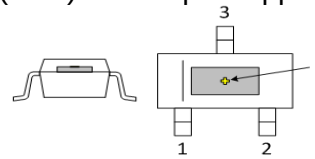
Sensitivity variants (Bop/Brp)	
DRV5053OA	-10 mV/mT
DRV5053PA	-20 mV/mT
DRV5053RA	-40 mV/mT
DRV5053VA	-80 mV/mT

Sensitivity variants (Bop/Brp)	
DRV5053CA	+20 mV/mT
DRV5053EA	+40 mV/mT

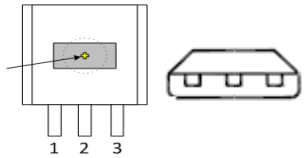
Device options

2 package options available:

- SOT-23 (DBZ) for compact applications



- TO-92S (LPG) to place Hall as close as possible



Temp/grades available:

- Industrial temp: -40 to 125
- AEC-Q100 qualified: -40 to 125 (Grade 1)
- AEC-Q100 qualified: -40 to 150C (Grade 0)

Features/Value Adds:

- Large voltage operating range (2.5V-38V)
- Supports high-volt load dump (up to 40V)
- Power-on "ready" pulse
- Fast power-on time (50 usec)
- Fast switching time (less than 15usec)
- Reverse supply protection (up to -22V)
- Overcurrent protection

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- 在线社区：www.deyisupport.com & http://e2e.ti.com/
- 800免费支持电话：800-820-8682

本地
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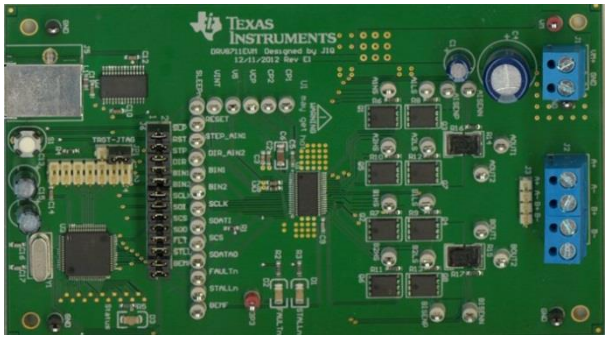
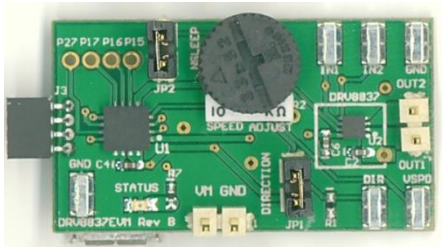
- ECHN FAE: Alvin Zheng (Shanghai)
- MAT Group (AE) : Wilson Zuo (Beijing)

DRV8x Kits & Designs

DRV8308
Reference Design

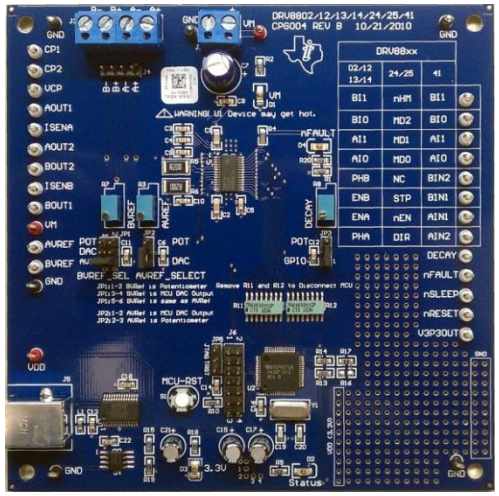


DRV8711EVM



DRV8837EVM

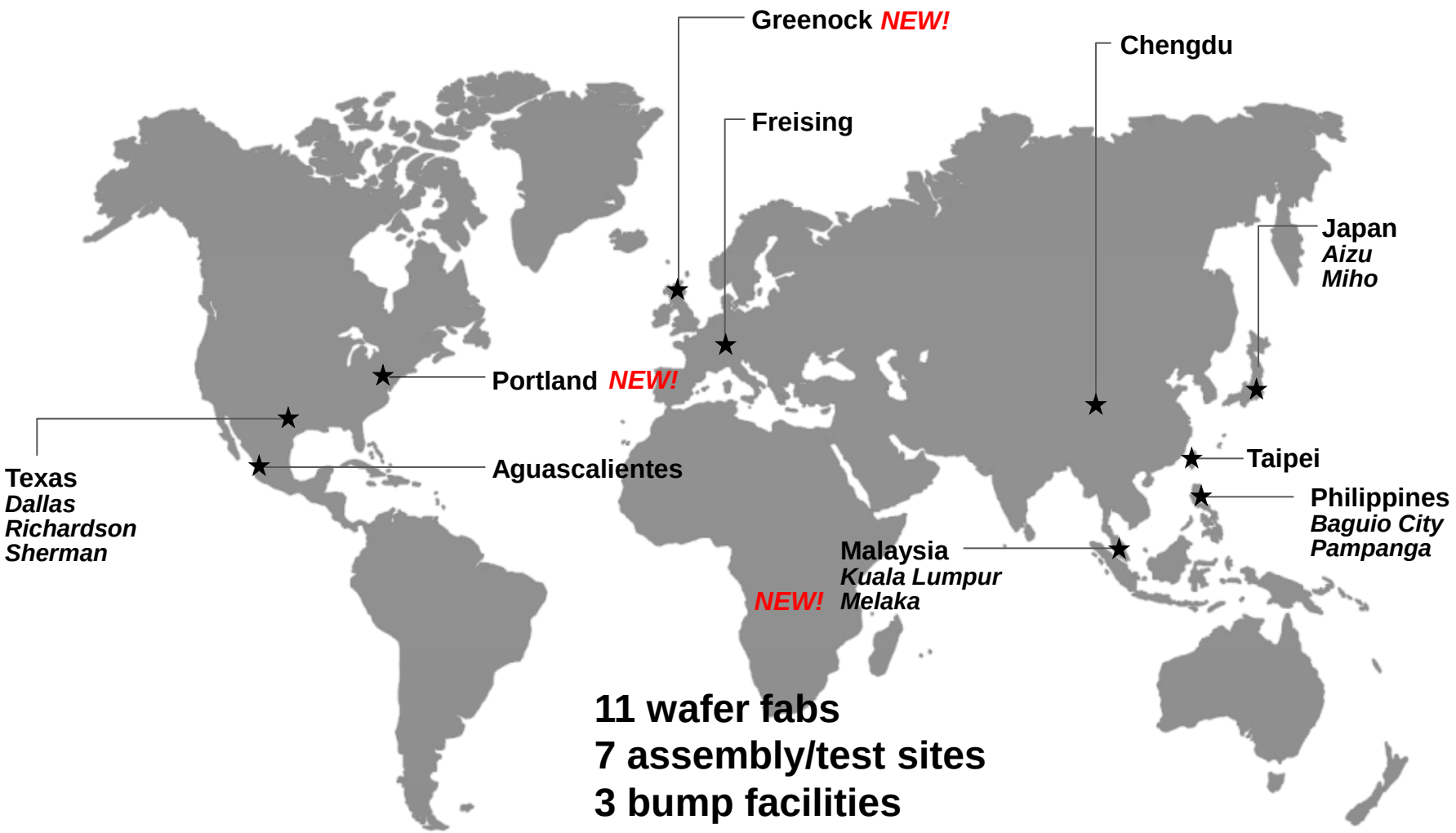
BOOSTXL-DRV8301



DRV8825EVM

持续供货保障:遍布全球的生产工厂

U.S., Asia and Europe



成功案例：24V Motor Sample Application

Printers
STP：Sheet Feeder / Scanner
DCM：Paper Cutter, Stapler, Sheet Lifter

ATM / Cash Resistor
STP：Bill / Receipt Sender, Receipt Printer Head
DCM：Paper Cutter, Cover Opener

Sewing Machine
STP：
Textile Feeder
Thread / Needle

Vending Machine
STP：Feeder (Ticket, Drink)
DCM：Feeder
(Bill Senders are supplied as a Module)

Slot Machine
STP：Reel Rotator
DCM：Coin Hopper
(Bill Senders are supplied as a Module)

Time Recorder
DCM：Card Feeder
Printer Head

Automation
STP：Robot

成功案例：3 to 15V Motor Sample Application

Label Printer
STP：Paper Feeder
DCM：Paper Cutter

Projector
STP：Auto Focus
Zoom, Iris, Lens shift

Toy R/C, Toy Robot
STP：Joint Control
DCM：Drive / Wheel Control

Security Camera
STP：Lends AF, Zoom, Tilt

Vacuum Cleaner
DCM：Auto Filter Cleaner

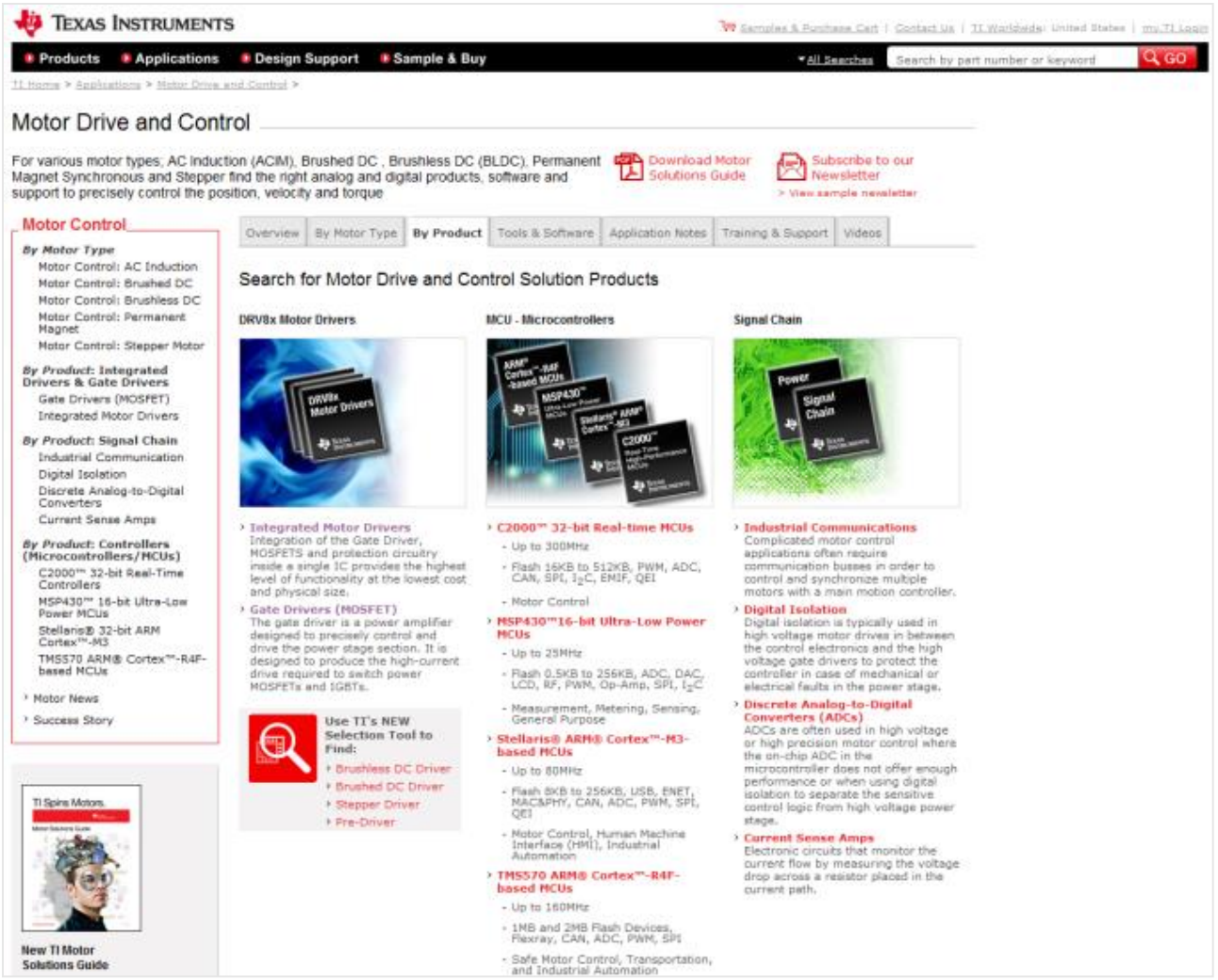
Air Conditioner
STP：Auto Filter Cleaner

Refrigerator
STP：Flow Adjuster
DCM：Ice Maker

POS / Card Terminal
STP：Paper Feeder
DCM：Paper Cutter
(Cash Drawers are supplied as a Module)

For More Information:

Motor Solutions Home Page: www.ti.com/motor



Texas Instruments

For Local Support

ECHN MDBU FAE

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