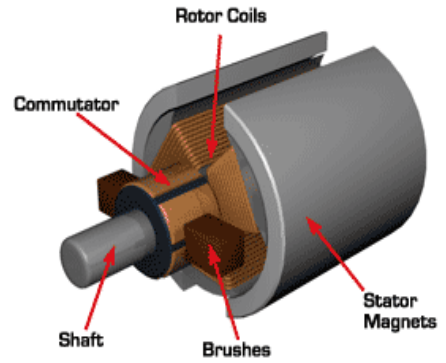
DRV8711 - Stepper pre-driver with on-chip 1/256 micro-stepping state machine and stall detect

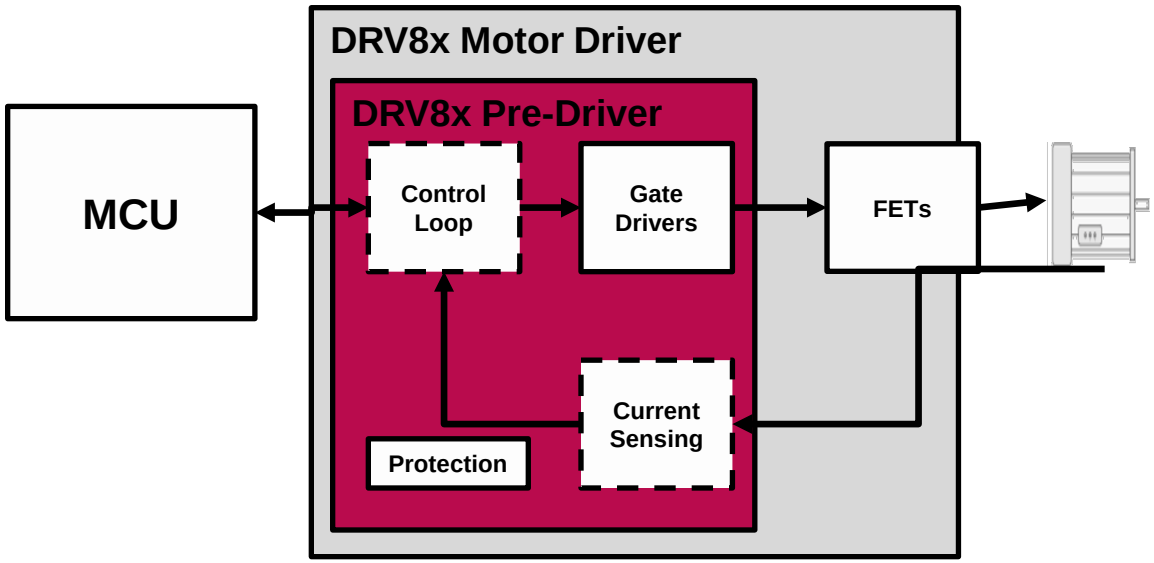
TI Spins Motors.

Smarter. Safer. Greener.



Christoph Stangl
Business Development Manager - Motor Control

DRV8x Motor Driver - System overview



Key benefits of the integrated DRV8x solution:

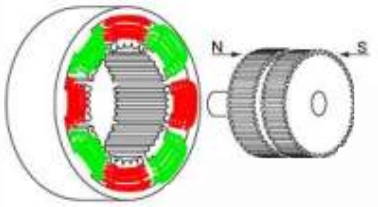
- Robust solution, thanks to the integrated protection features (over-current, over-temp, under-voltage, cross-conduction, etc).
- Reduced development time, efforts and costs.
- Reduced PCB space and BOM.
- Different interfaces and levels of control loop integration.
- Support of different motors:
  - Single H-bridge for Brushed DC motors
  - Dual H-bridge for Stepper motors
  - 3 half-bridges for BLDC and PMSM motors

TI's Motor Drivers

Support up to 60V and >60A

Stepper Drivers

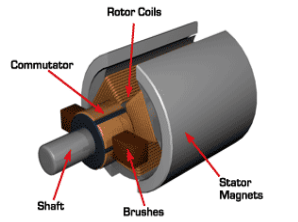
- **1.8V to 60V; Up to 12A**
- **Indexers / high count microstepping**
- **Stall Detect / Advanced current control**
- **Pre-drivers & drivers with integrated FETS**



Open Loop Control

Brushed DC Drivers (H-bridge)

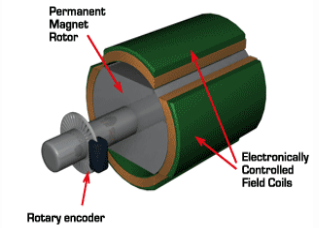
- **1.8V to 60V; Up to 24A**
- **Inrush current protection**
- **Pre-drivers & drivers with integrated FETs**



Simplicity & Low Cost

3-Phase Brushless Drivers

- **1.65 to 60V; Up to 13A**
- **Pre-drivers for >60A**
- **Integrated current sense amplifiers & DCDC converter**



Reliability & Efficiency

DRV8711 Application Examples

Stage Lighting

Cash machines

Pressure Valves

Industrial MFG Equipment

Medical Pumps

Vending Machines

Textile Machines

Stepper Motor Drivers

On Chip Indexers: Up to 32-uSteps

DRV8821
- 1.5A (8 to 32V)
- 1/8 uStep (Dual Stepper)

DRV8824 *P2P* **DRV8825**

DRV8824:
- 1.6A (8.2 to 45V)
- 1/32 uStep

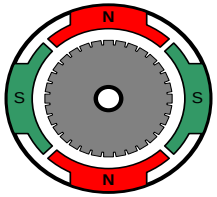
DRV8825:
- 2.5A (8.2 to 45V)
- 1/32 uStep

DRV8811 *P2P* **DRV8818** *New*

DRV8811:
- 1.9A (8 to 38V)
- 1/8 uStep

DRV8818:
- 2.5A (8 to 35V)
- 1/8 uStep

DRV8711
- Stepper Pre-driver (8 to 52V)
- 1/256 u/step; stall detect



Mid Current Steppers: > 32-uSteps

DRV8812 *P2P* **DRV8813**

DRV8812:
- 1.6A (8.2 to 45V)
- Phase/Enable Ctrl

DRV8813:
- 2.5A (8.2 to 45V)
- Phase/Enable Ctrl

DRV8841/43
- 2.5A (8.2 to 45)
- PWM Ctrl

DRV8823
- 1.5A (8 to 32V)
- SPI Ctrl
- **Drives 2x Steppers**

High Current Steppers: > 32-uSteps

DRV8828 *P2P* **DRV8829**

DRV8828:
- 3A (8.2 to 45V)
- Phase/Enable Ctrl
- **½ Stepper**

DRV8829:
- 5.0A (8.2 to 45V)
- Phase/Enable Ctrl
- **½ Stepper**

DRV8842
- 5A (8.2 to 45)
- PWM Ctrl
- **½ Stepper**

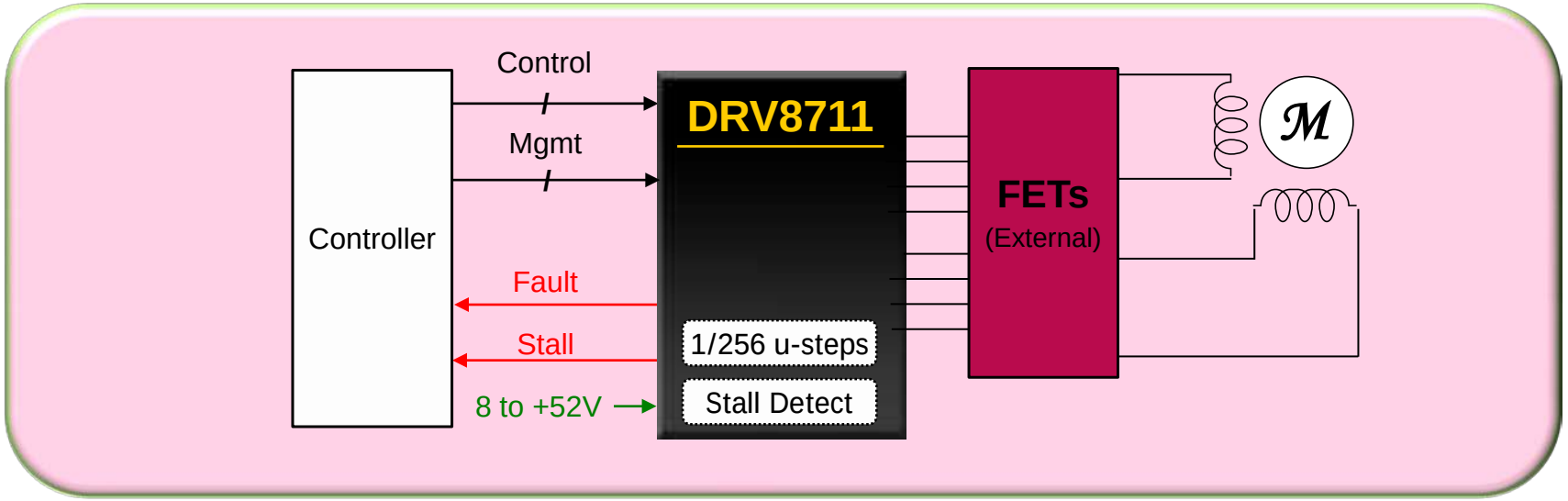
DRV8412
- 6A (0 to 52V)
- 500kHz / 5ns Dead-time
- PWM Ctrl

DRV8432
- 12A (0 to 52V)
- 500kHz / 5ns Dead-time
- PWM Ctrl

Selection Matrix

Production | **Sampling** | **In Design**

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**

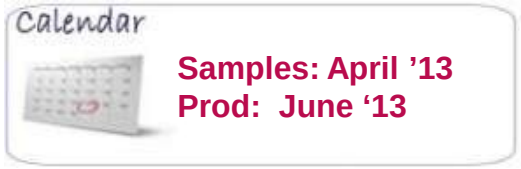
DRV8711 - Stepper pre-driver with on-chip 1/256 micro-stepping indexer and stall detect

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

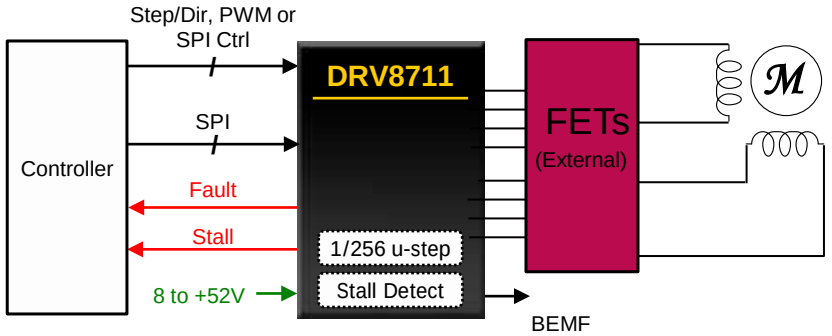
- Textile mfg equipment, factory automation
- Security cameras, ATM, robotics, stage lighting



38-pin HTSSOP
(9.7 x 6.4mm)

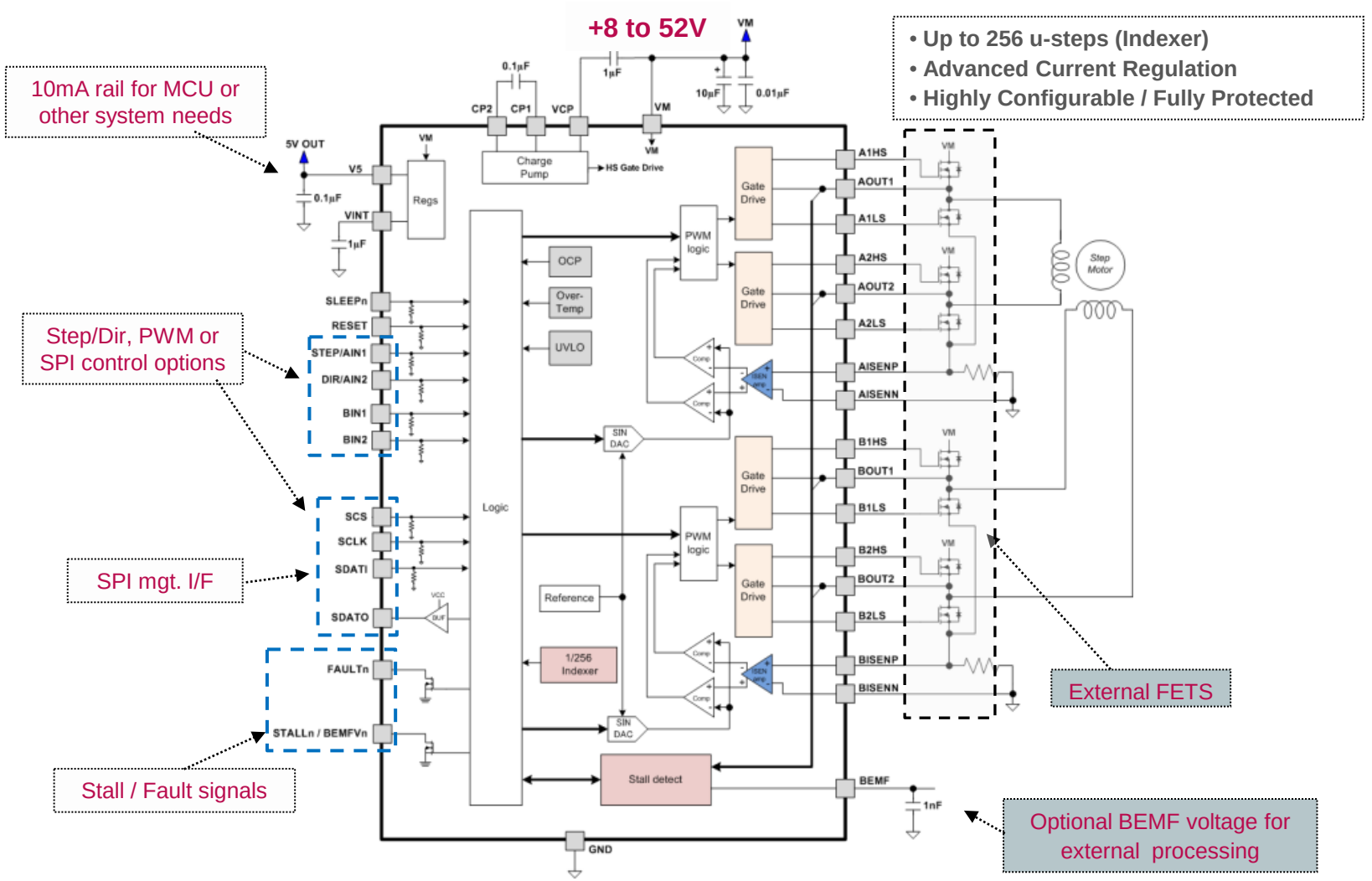
Benefits

- 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

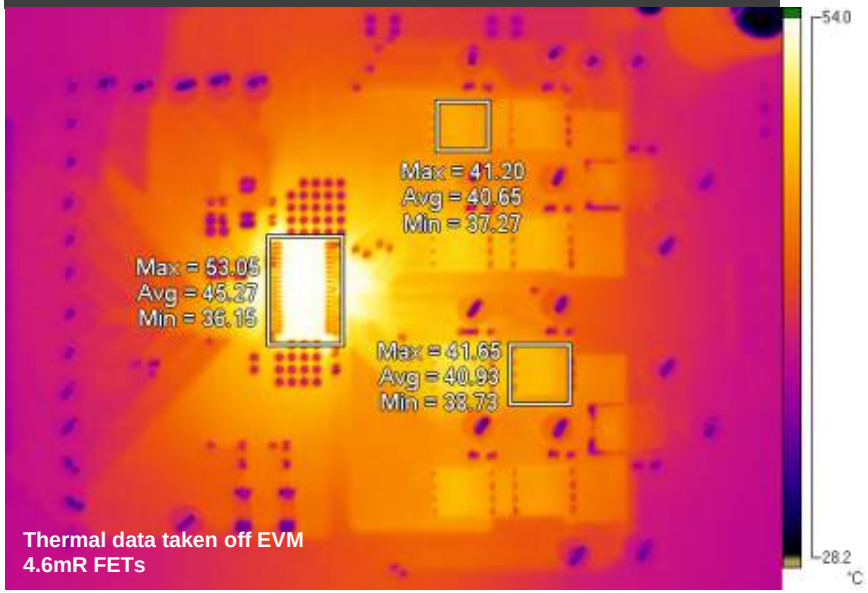
DRV8711 - Stepper Pre-Driver



DRV8711 - Stepper Pre-Driver

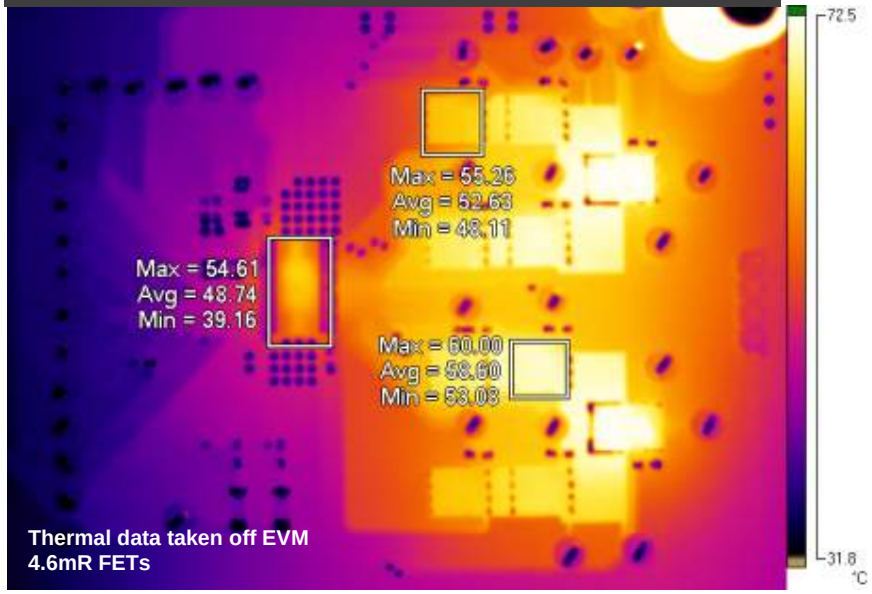
- Excellent thermal performance at both high & low currents
- Scale FET size down or up depending on current / cost requirements

3A Peak @ +24V
256 u-Steps



Max Temp of 53°C

9A Peak @ +24
256 u-Steps



Max Temp of 60 ºC

DRV8711 - Highly Configurable

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)