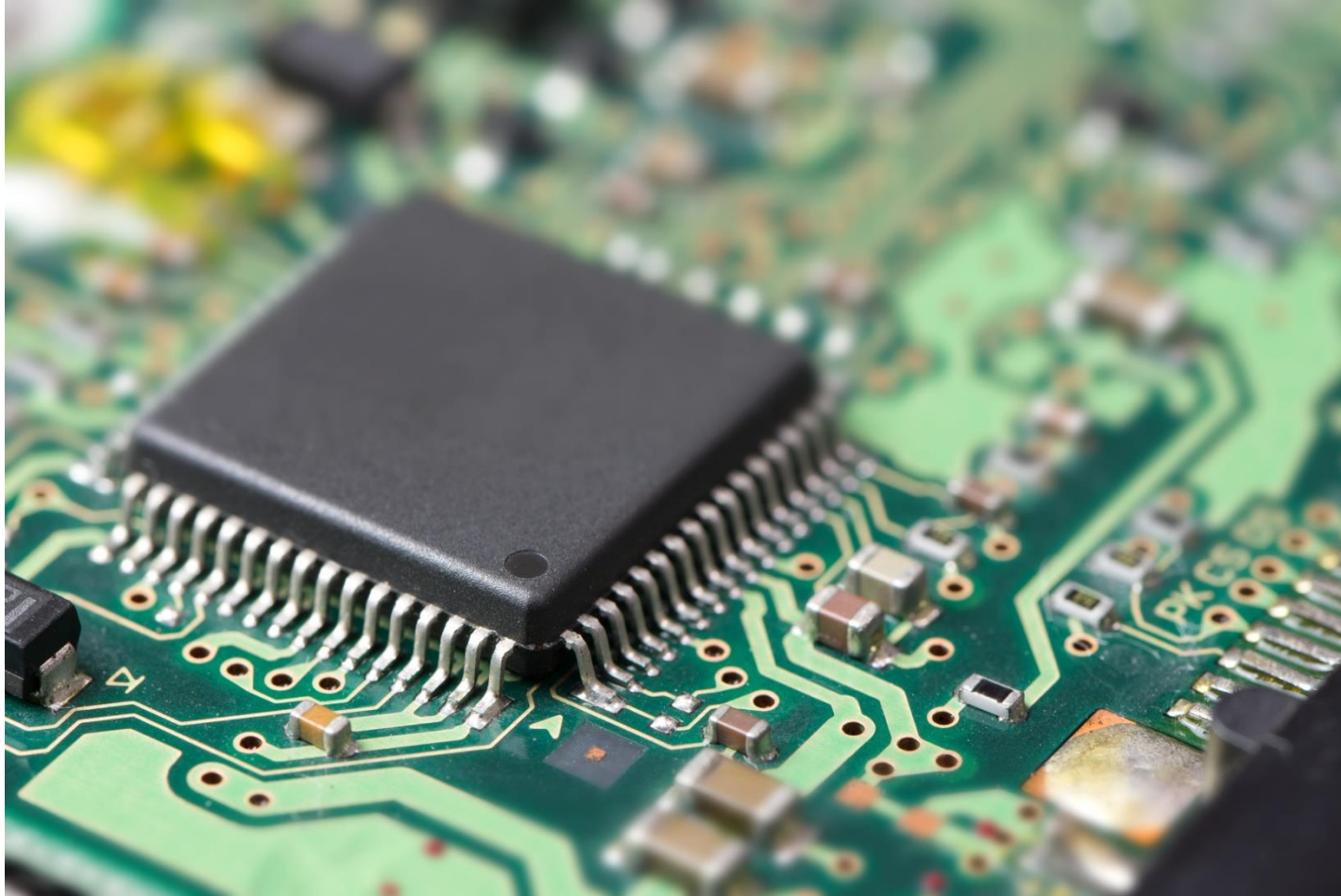


# Design 1: Selecting a Motor Driver

TI Precision Labs - Motor Drivers

Presented and Prepared by Hector Hernandez

# Motor drivers



## Reduce

- Cost
- Debugging time

## Increase

- System efficiency
- Motor drive smoothness
- Performance

# Selection: motor type

## Brushed-DC motor

### Pros

- Cost
- Easy to drive

### Cons

- Maintenance
- EMI

### Applications

- Automatic gates
- Electronic door locks
- Battery-powered robotic toys
- Automotive body motors
- Shut off valves



## Stepper DC motor

### Pros

- Cost
- Simple control interface

### Cons

- Noise & resonance
- High Heat & inefficiency

### Applications

- Security cameras
- Printers
- Refrigerator dampers
- EPOS and banking automation
- Adaptive headlights in cars



## Brushless-DC motor

### Pros

- Operational life & reliability
- Low EMI & efficiency

### Cons

- Complex drive design
- Cost

### Applications

- Appliance pumps and fans
- Cordless vacuum cleaners
- E-bikes
- Automotive powertrain & safety motors



# Selection: voltage

- The supply voltage applied to the motor
- Commonly called  $V_s$ ,  $V_M$ ,  $PVDD$ ,  $V_{BB}$ ,  $V_{BAT}$
- *Examples:* 24 V from wall outlet, 6-cell lithium-ion battery, 2x AAA alkaline battery
- Typical supply variation:  $24V \pm 10\%$ , 14 - 21V
- Additional supply variation caused by motor
  - Motor inrush current (supply droop)
  - Motor coasting (supply pump)
- Determine minimum and maximum voltage range acceptable for your system

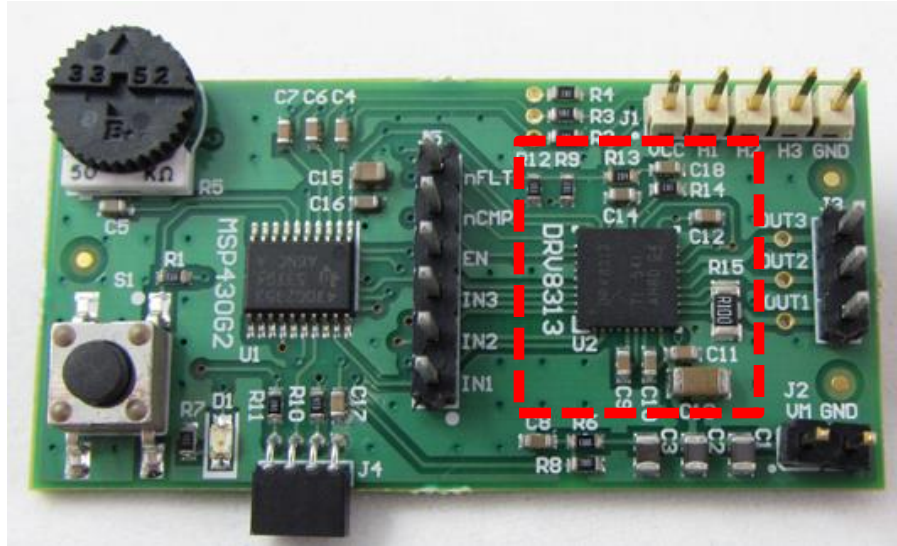


# Selection: current

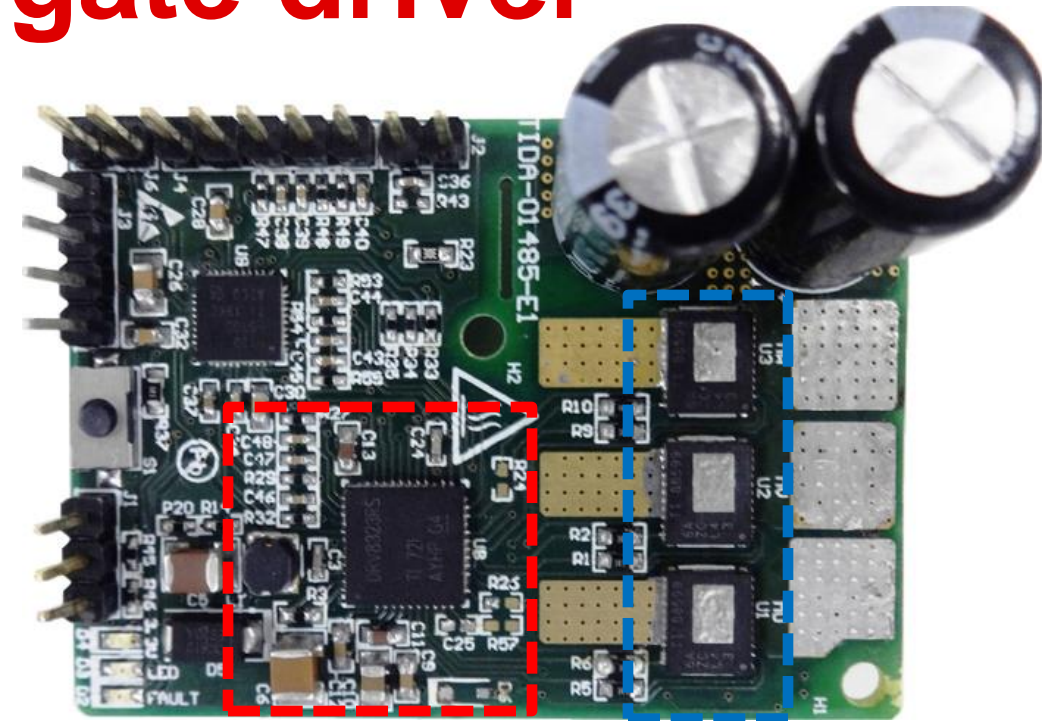


- Current relates to the motor power
- *Peak current*: maximum possible current when driving the motor
  - If current lasts longer than tens of milliseconds, it is probably closer to an RMS current
- *RMS, average or continuous current*: typical current in the motor
  - Relates to thermal performance
- High power systems – *use a gate driver*

# Selection: integrated driver vs gate driver



TIDA-00827



TIDA-01485

- **Integrated driver: MOSFETs are included**
  - Low to mid-power applications
  - Easy schematic & schematic
  - Simple system design
  - *Parameters:* Peak Current &  $R_{DS(ON)}$

- **Gate driver: MOSFETs required outside**
  - Can support high power
  - Better thermal performance
  - Selectable & scalable power
  - *Parameter:* Gate Drive Current

# Selection: qualification and ratings

- Qualification & ratings
  - Catalog (commercial & industrial)
  - AEC-Q100 (Automotive)
  - EP (Enhanced products)
  - QMLQ, QMLV, QMLV-RHA (Military & Space)
- Operating Temperature Range:
  - -40 C to 85°C (Catalog, AEC-Q100)
  - -40 C to 125°C (Catalog, AEC-Q100)
  - -55 C to 125°C (EP, QMLQ, QMLV)
  - -40 C to 150°C (AEC-Q100)



**To find more motor driver technical resources and search products, visit [ti.com/motordrivers](https://www.ti.com/motordrivers)**