Motor Types

TI Precision Labs – Motor Drivers

Presented and prepared by Dalton Ortega

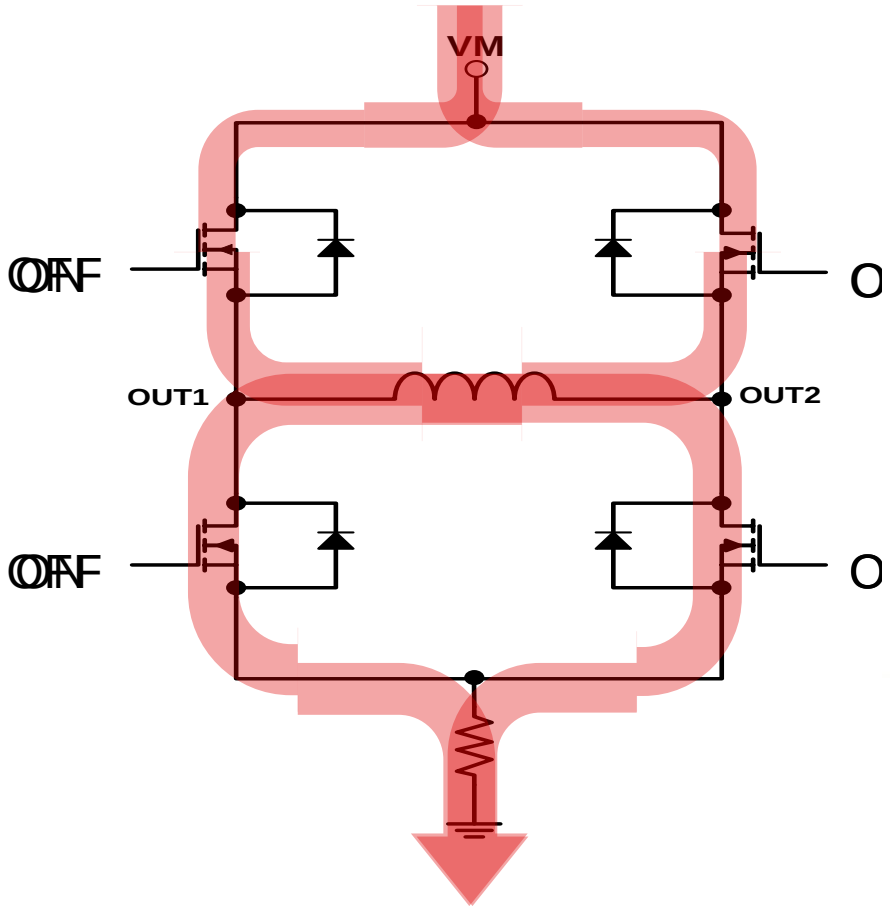
Brushed-DC Motors

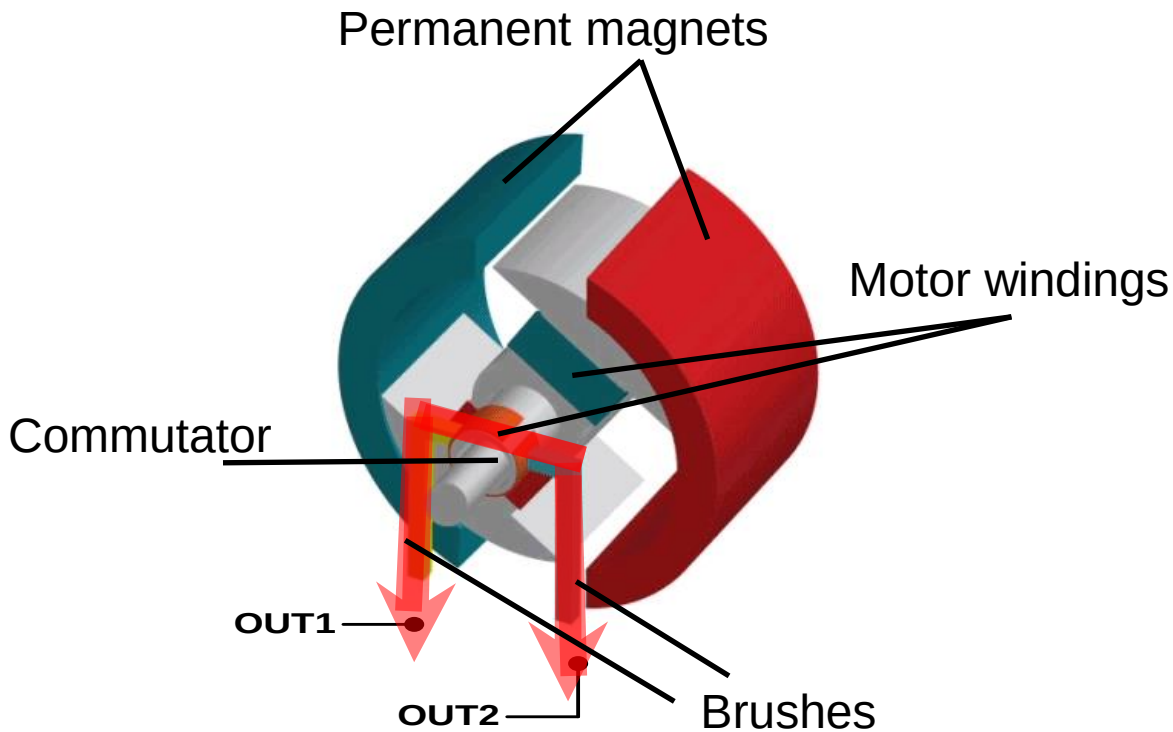
Drive performance with Brushed DC (BDC) motor drivers

Integrated FET and Smart Gate Drive solutions for Brushed DC motor control

Brushed – DC motor commutation

Bidirectional brushed motor driver

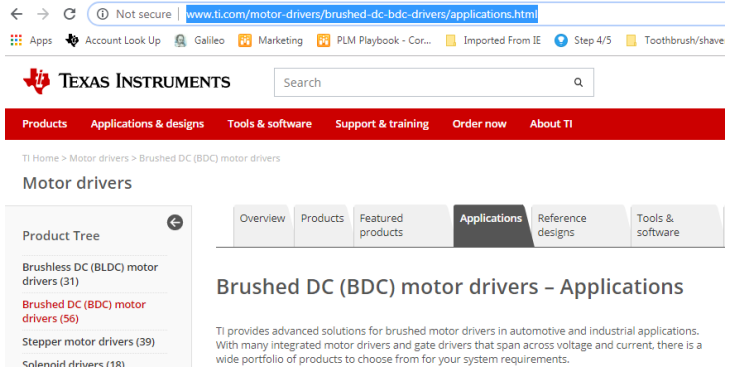




Reversed Drive

Brushed-DC motor tradeoffs, common applications

- Basic function: move a load in one direction only or both directions.
- Advantages:
  - Low cost solution
  - Current control not required
  - Easy to control
- Disadvantages
  - Brushes wear out
  - Loud, sparking, may have EMI concerns
  - Requires external sensors for speed/position control



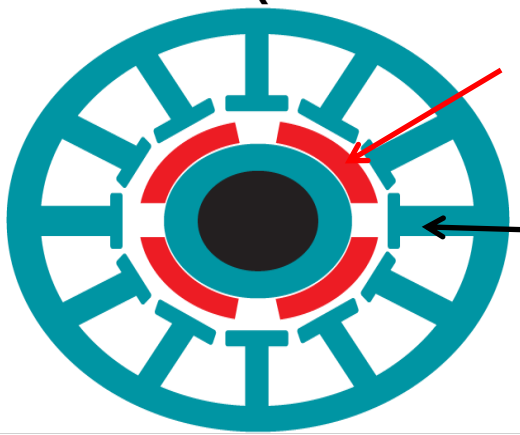
Brushless-DC Motors

Brushless DC (BLDC) Motor Drivers

Smart gate drivers and integrated motor drivers for BLDC motor control

Brushless-DC motor construction (Cont.)

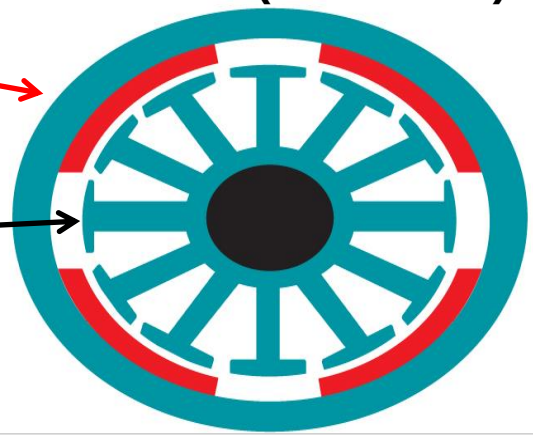
Inner Rotor (Conventional)



Smaller construction (compact)
Better heat dissipation
Lower rotor inertia
Quick speed change applications
High torque and speed
High cogging torque
Harder to wind the coils
High performance magnets

Servos, actuators, pumps

Outer Rotor (Outrunner)

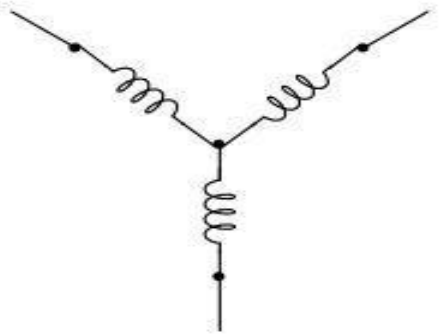


Larger construction
Worse heat dissipation
Higher rotor inertia
Constant speed applications
Higher torque at low rpm
Low cogging torque
Easier to wind the coils
Lower performance magnets

Fans, hard disk, printers

Brushless-DC motor winding connections

Wye (Y) Winding
Star connection

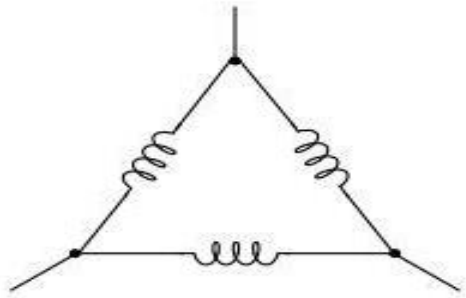


Normally more efficient
Less resistive losses
Immune to parasitic currents

Higher torque at low speed
Lower top speed

Most common

Delta (Δ) Winding



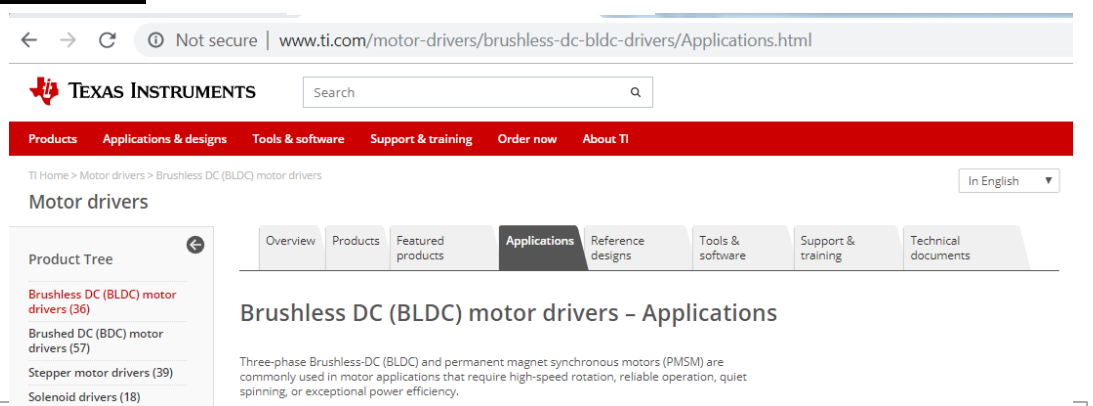
Normally less efficient
More resistive losses
Parasitic currents can circulate

Lower torque at low speed
Higher top speed

Both are driven the same way

Brushless DC motor tradeoffs and common applications

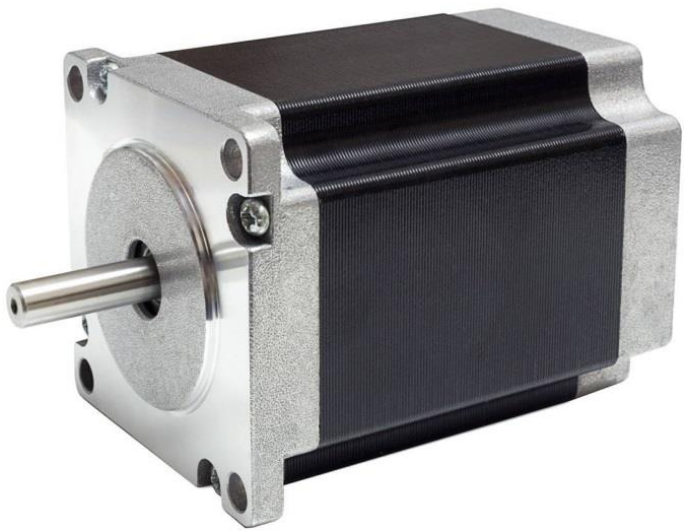
- Basic function: user can control how fast they can move a load
- Advantages:
  - High efficiency
  - Very reliable
  - Long life
- Disadvantages
  - Expensive
  - Design complexity



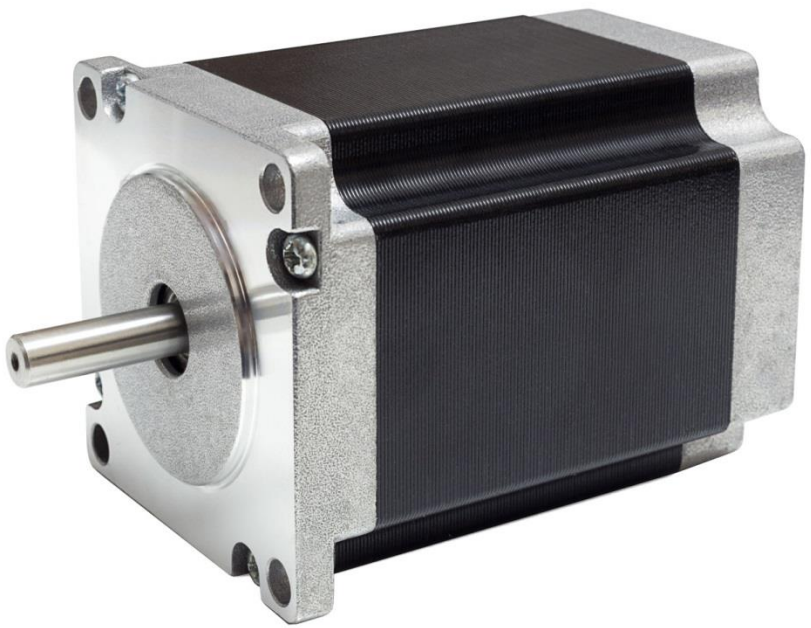
Stepper Motors

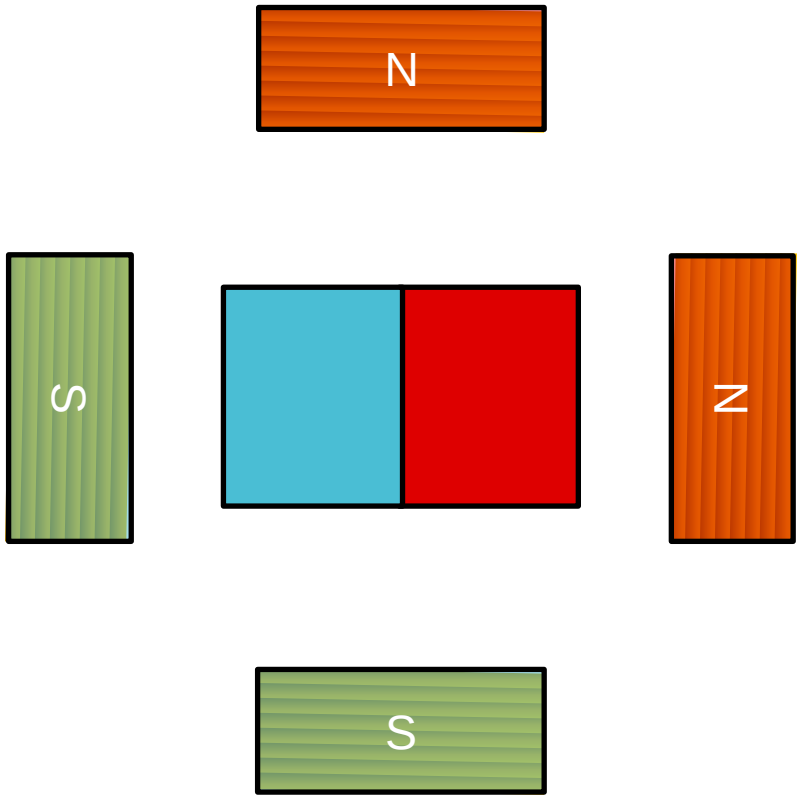
Step into simple speed and position control

Highly accurate & smooth motion that is easy to design

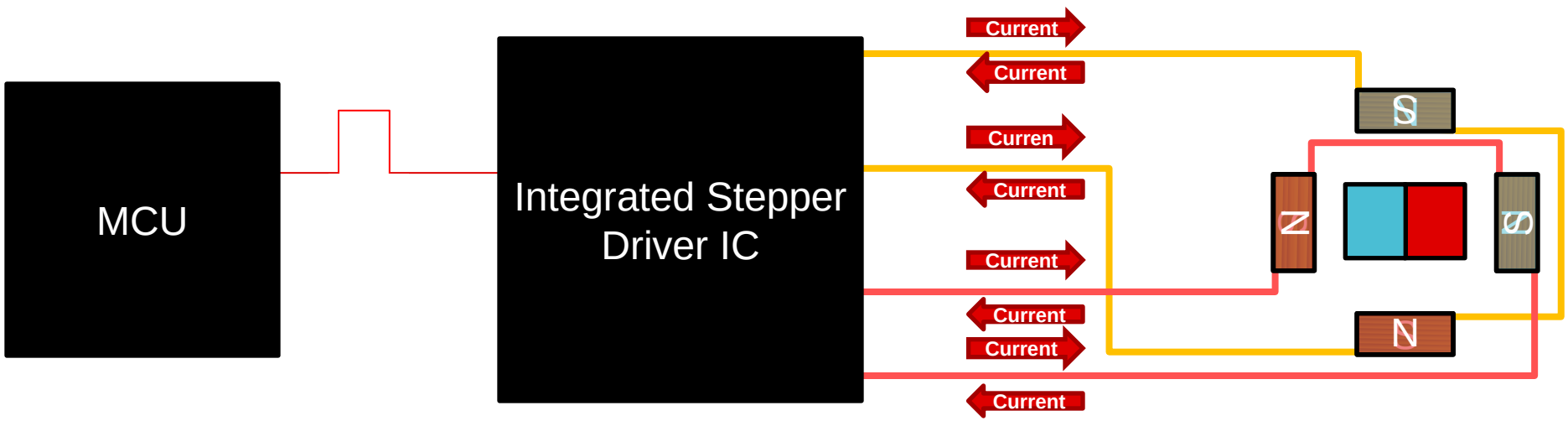


Stepper motor



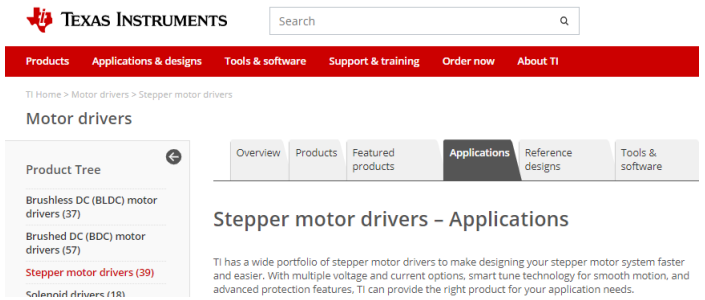


Basic stepper driving



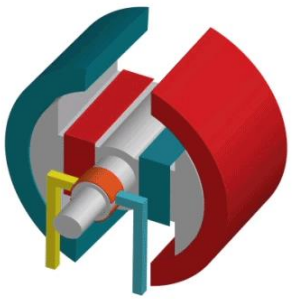
Stepper motor tradeoffs and common applications

- Basic function: uses electrical signals to control rotor position
- Advantages:
  - Hold rotor in place for long periods of time
  - Precise positioning without sensors
  - Low cost
  - Easy to control
- Disadvantages
  - Noise
  - Resonance
  - Typically require current control



Motor types

Brushed-DC motor

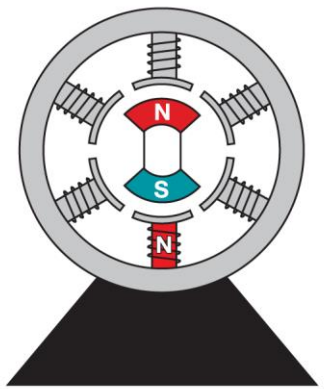


+ Low cost
+ Easy to design

- Brushes wear out
- Inefficient

Application Reference Designs
Smart Meters, Video Surveillance, Small and Large Appliances, Electronic Locks

Brushless-DC motor

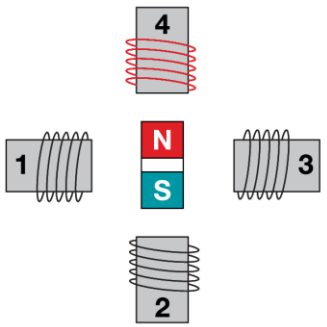


+ Very efficient
+ Long life / reliable

- Expensive
- Complex design

Application Reference Designs
Garden and Power Tools, Appliance Pumps and Fans, E-Mobility, Factory Automation & Logistics

Stepper motor



+ Open loop position / speed control
+ Simple control

- Resonance
- Noise

Application Reference Designs
Printers, Refrigerator & Freezer, Mobile EPOS Printers, Stage Lighting

To find more brushed DC motor driver technical resources and search products, visit http://www.ti.com/motor-drivers.html