

一体化伺服电机解决方案

让运动控制系统更紧凑

November 2019

PMSM/BLDC Technology Overview

PMSM/BLDC Motor

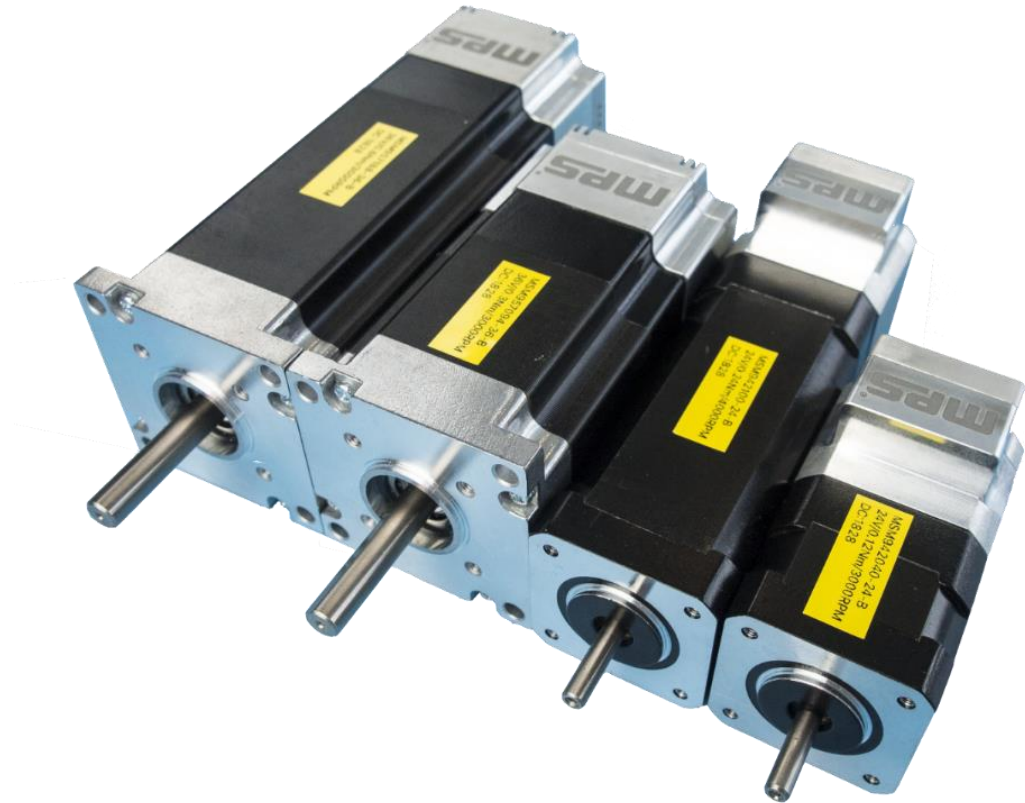
PMSM/BLDC Motor

Advantages

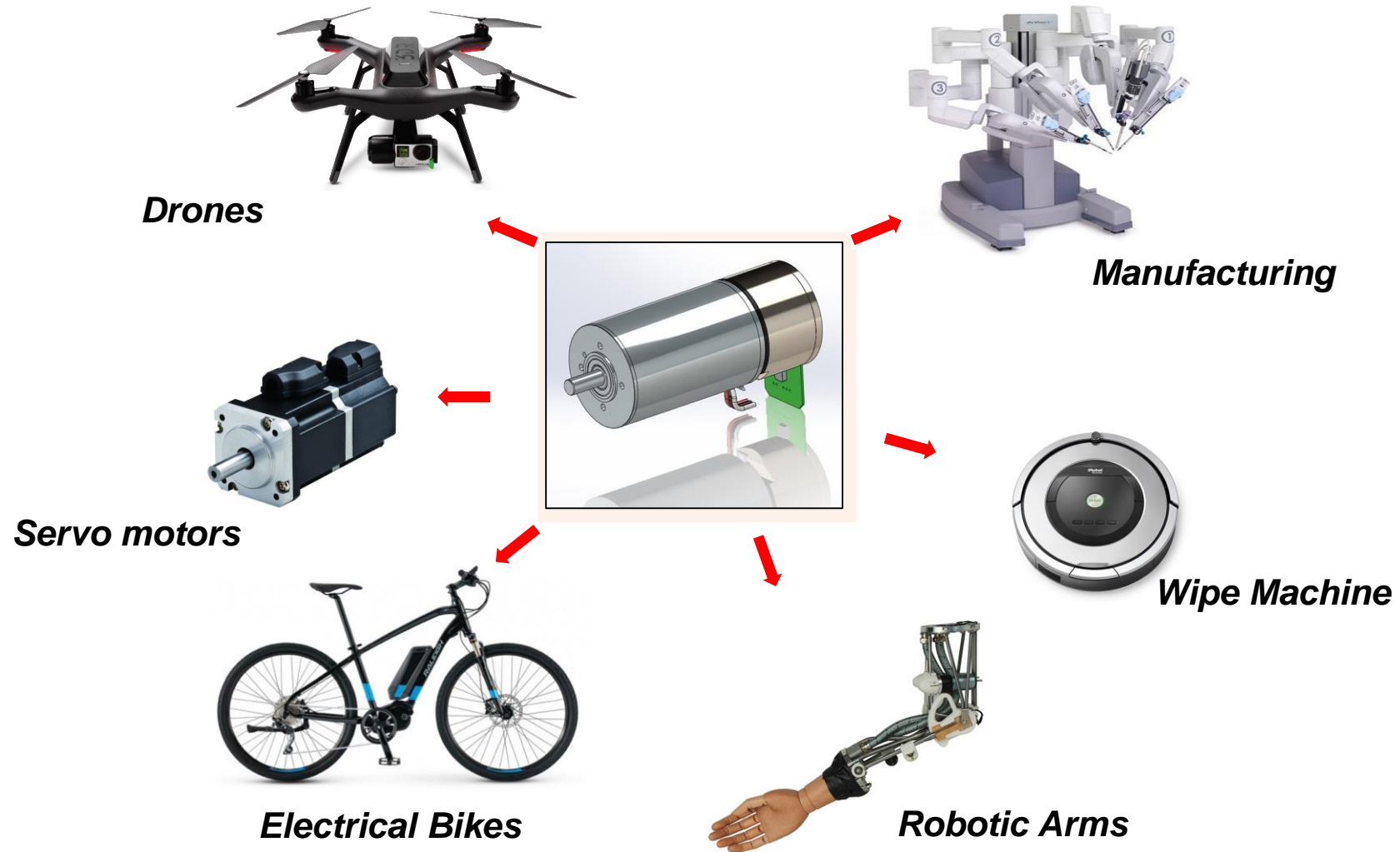
- Small Size
- High efficiency
- Low inertia
- Higher Speed
- Long Life-time
- Low Noise

Disadvantages

- Difficult to control
- Higher price



Applications

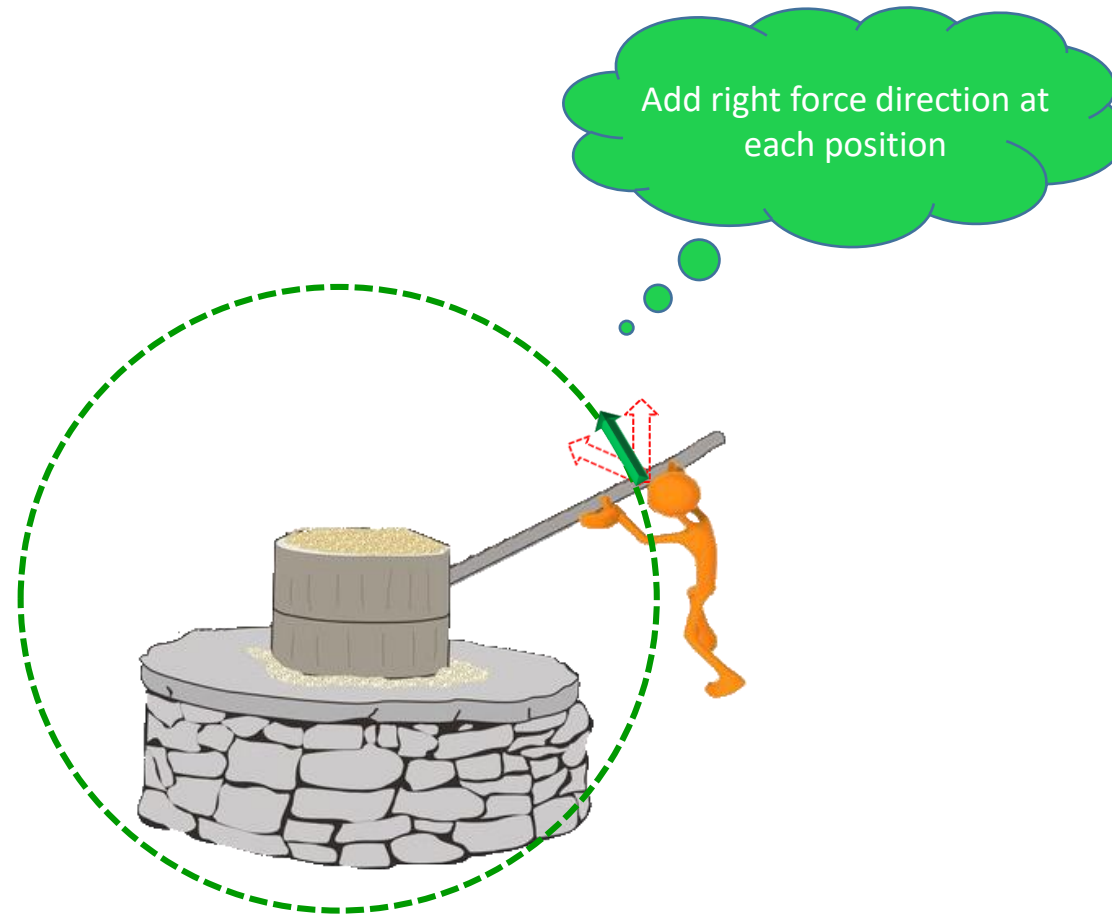


PMSM/BLDC Technology Overview

FOC Control

Why FOC?

How to get it done efficiently?

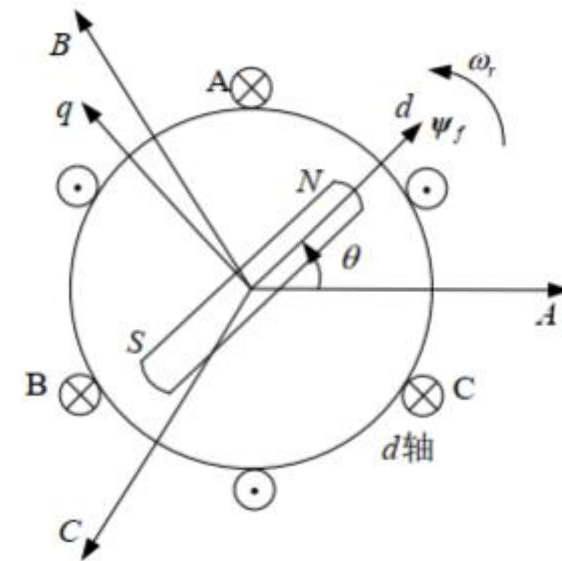
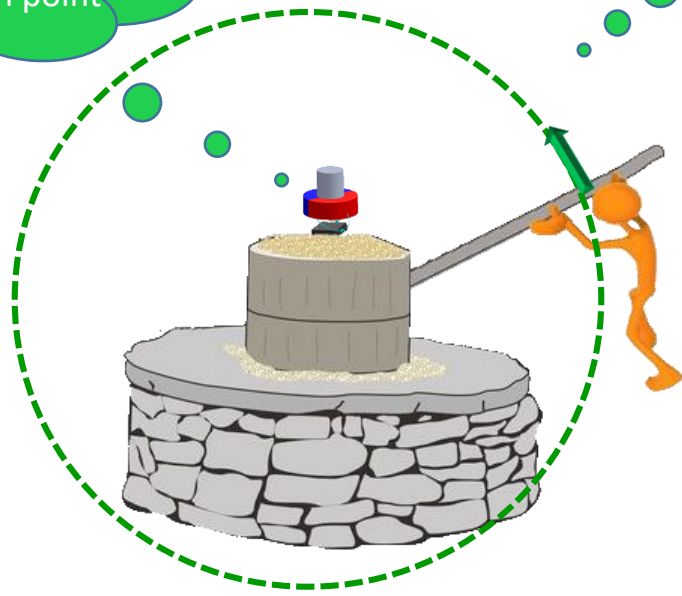


Why FOC?

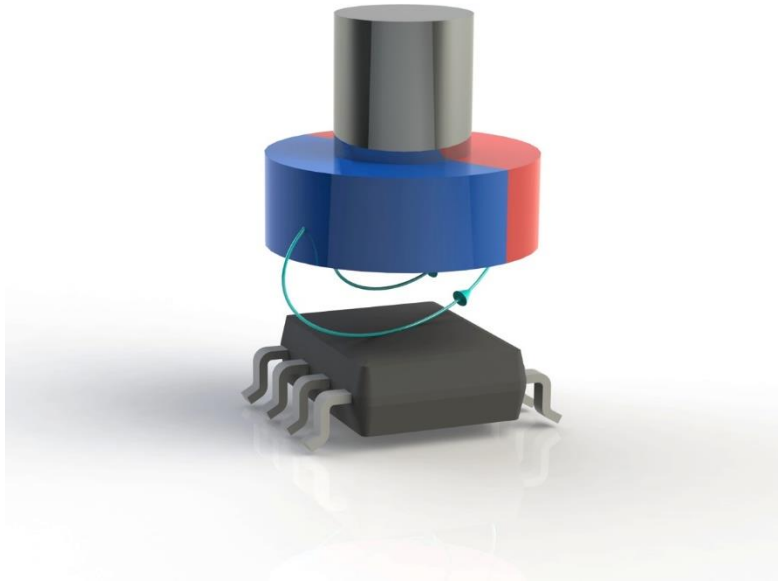
Similar In Motor System:

Sensor gives the rotor position beautifully @ each point

FOC gives right torque & direction w/ stator current



Embedded Magnet Sensor



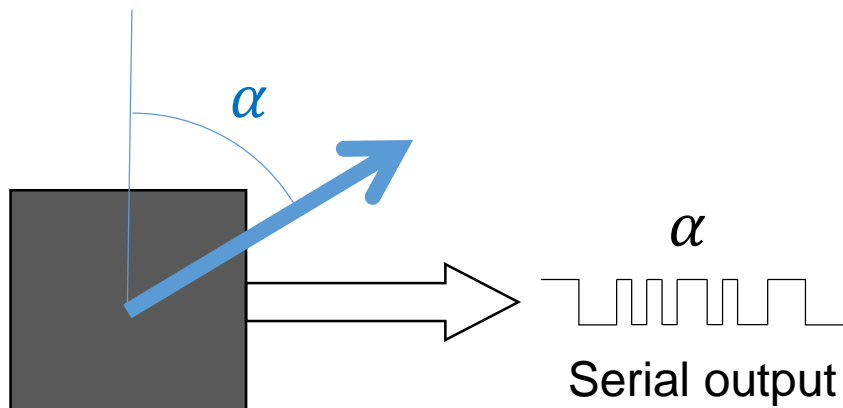
Output:

absolute direction of the magnetic vector in the die plane

→ **Contactless digital angle sensor**

Where can it be used?

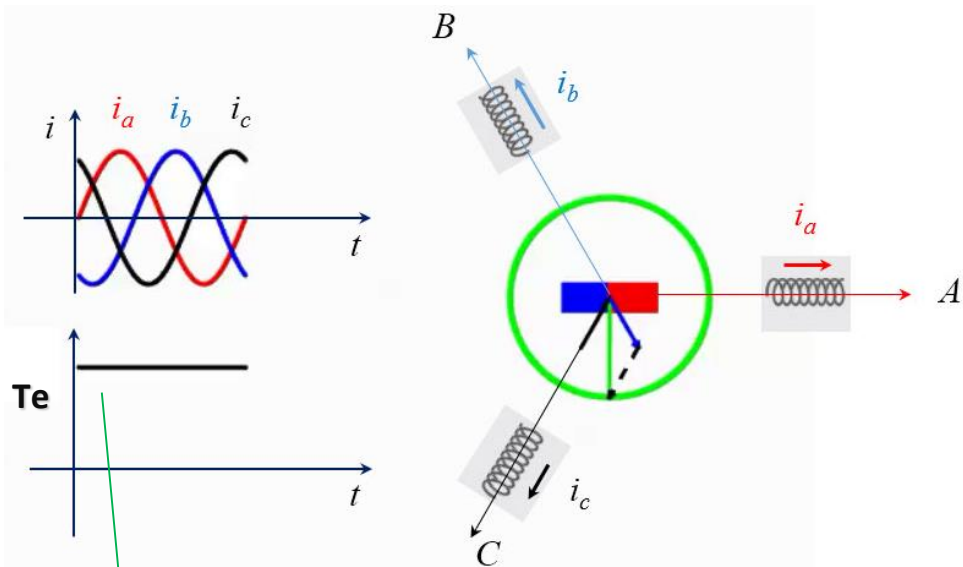
- Motor position control (servo)
- Speed control
- BLDC commutation
- Manual knobs and commands
- Etc.



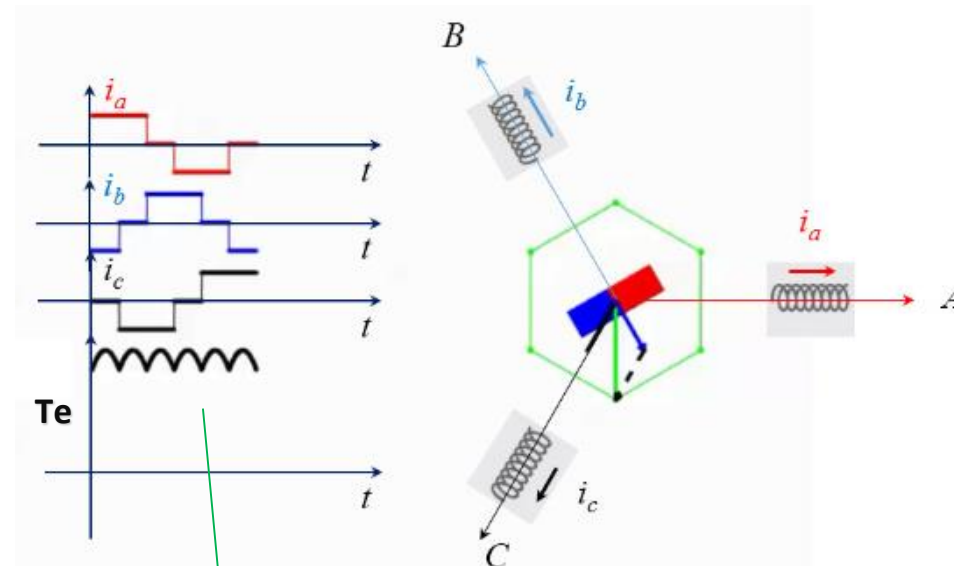
Why FOC?

Torque ripple in FOC and Square-wave

- FOC provides 4.7% higher torque
- FOC has less torque ripple



Torque w/ FOC Control



Torque w/ Square-wave Control

Motor Driver Technology

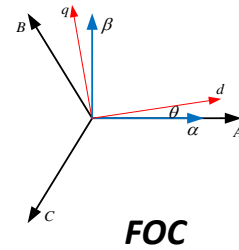
Traditional solution vs. e.Motion solution

Traditional solution vs. e.Motion Solution

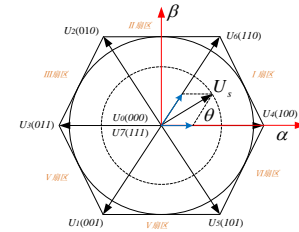
What do you need when developing a motor controller?



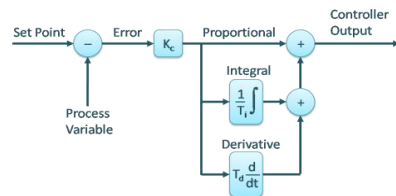
Motor



FOC



SVPWM



Control Theory



Code



Encoder



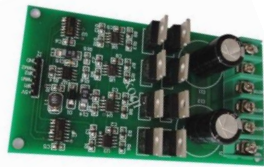
Engineers

Traditional solution vs. e.Motion Solution

Traditional Solution



Encoder



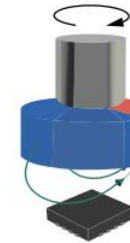
Power Stage



MCU/DSP

e.Motion Solution

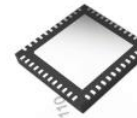
Spinaxial 3D Magnetic
Field Measurement



FOC
Algorithm



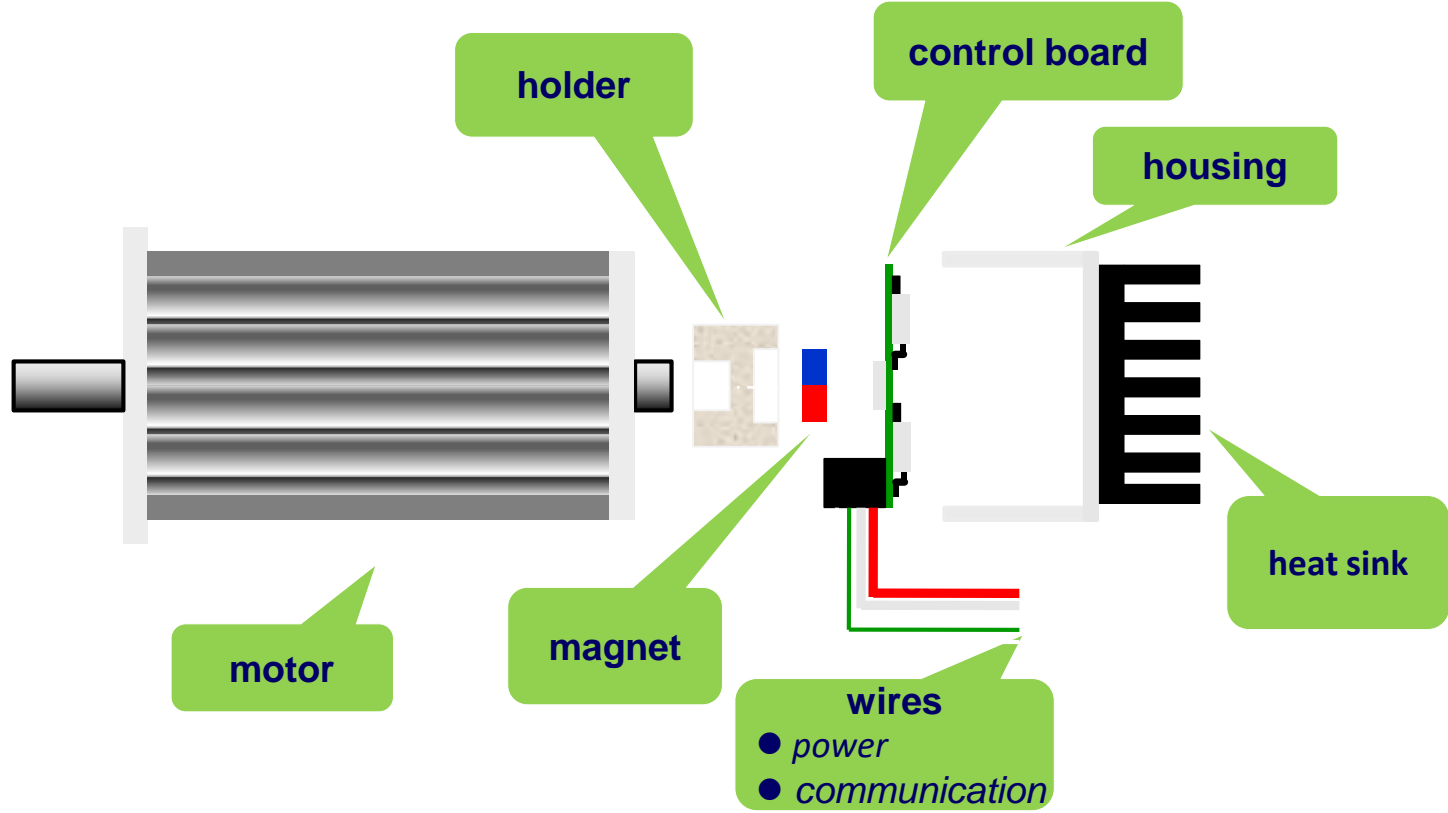
**e.Motion
Platform**



- *No Hall sensors*
- *No Encoder*
- *No DSP*
- *FOC Control*
- *30% more efficient*
- *90% space saving*

Traditional solution vs. e.Motion Solution

e.Motion Solution Concept



MPS e.Motion Family Products

IC & Smart Motors

MP6570

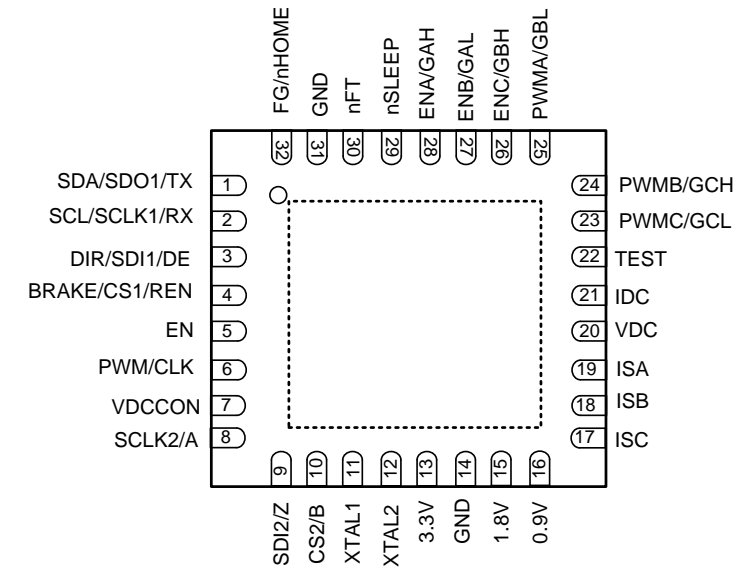
3-Phase BLDC Controller with High Accuracy Angular Sensor

Features

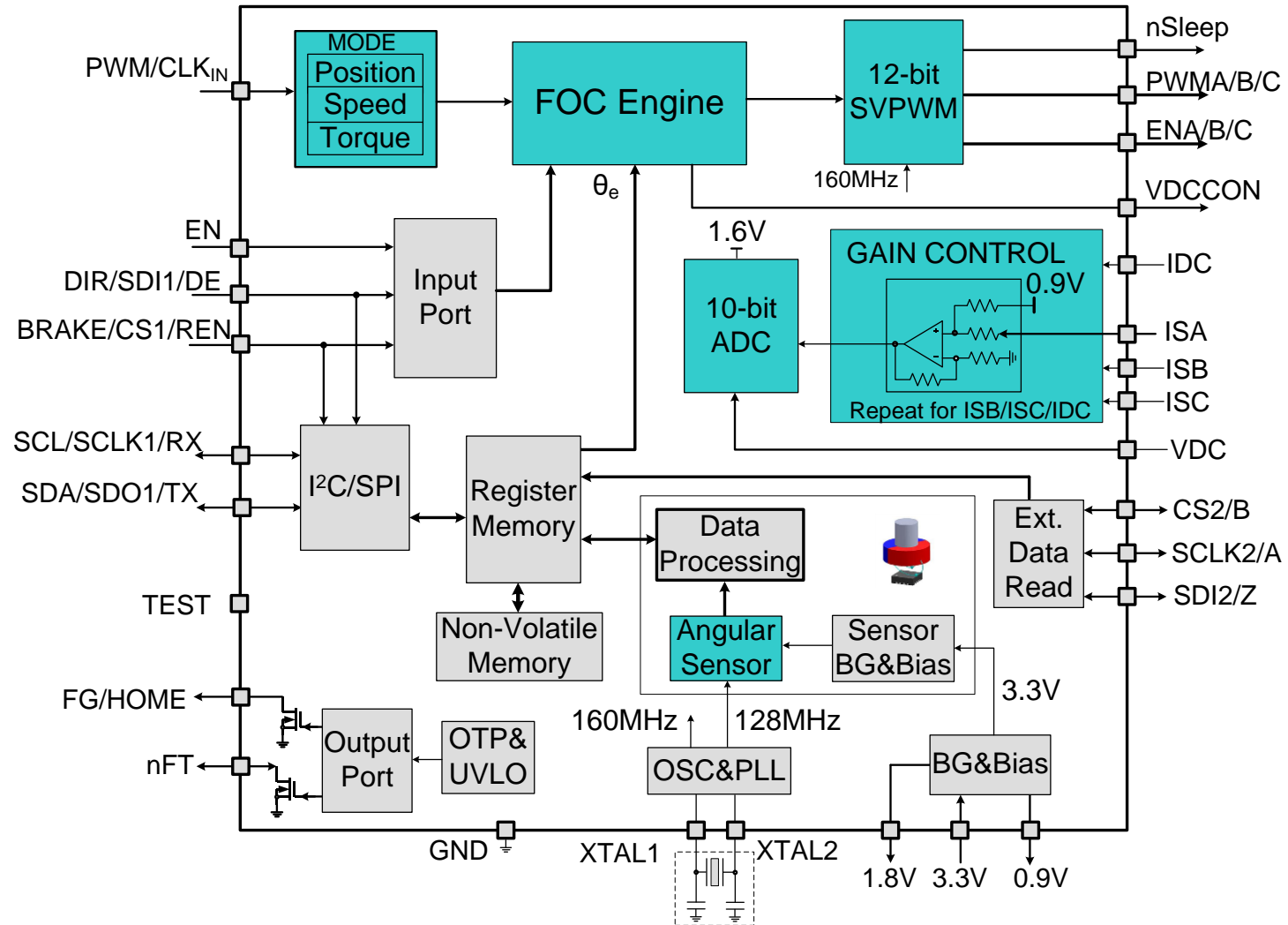
- Flexible Parameter Configuration with
 1. Non-Volatile Memory
 2. Selectable SPI/I2C/RS485 interface
- Embedded Accurate Angular Sensor
- FOC Control Algorithms
- Position/Speed/Torque Mode
- PWM/Clock/Digital Interface Reference
- 10-bit ADC w/ Programmable Gain
- up to 80kHz Switching Frequency
- Low-Power Standby Mode
- Locked Rotor Detection and Restart
- Programmable Over-Current Limit Threshold
- QFN32-4x4mm package

Applications

- 3-phase BLDC motor
- 3-phase PMSM motor

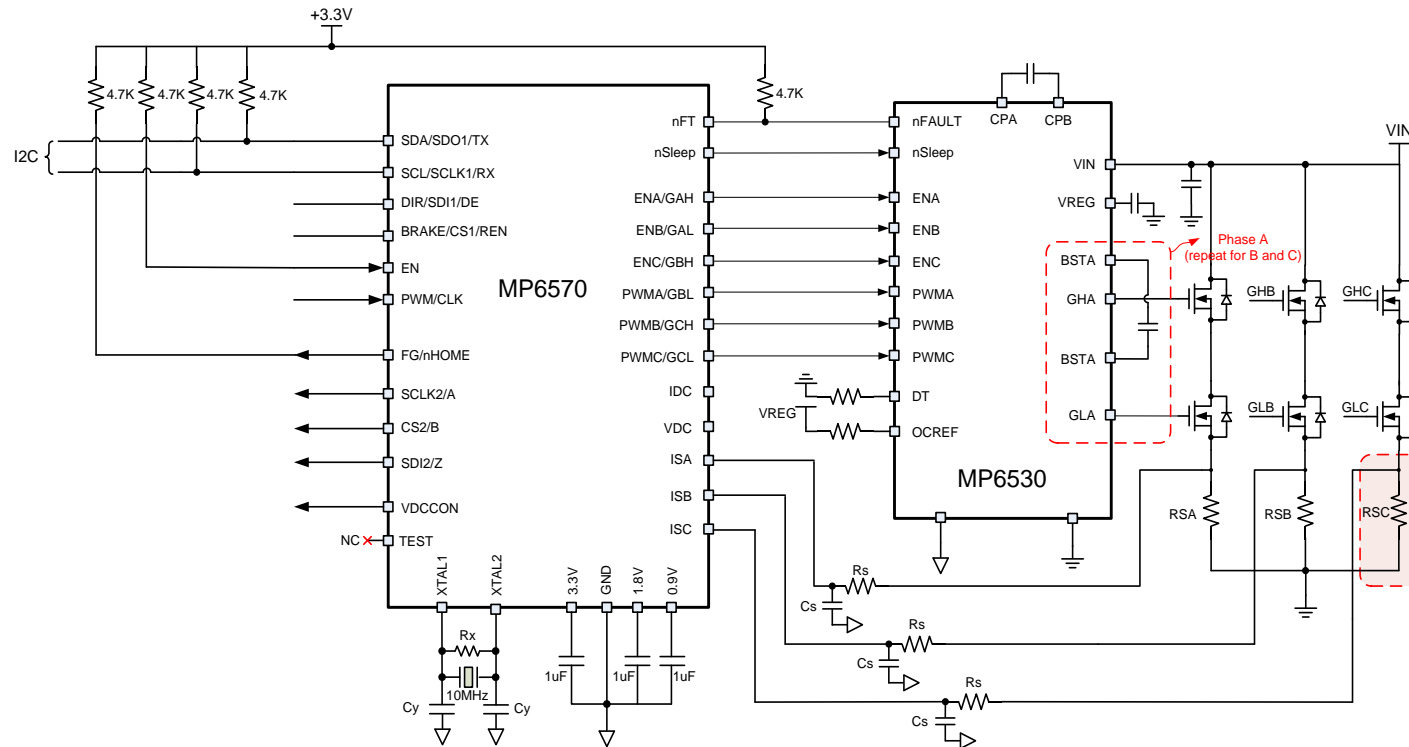


MP6570 Block Diagram



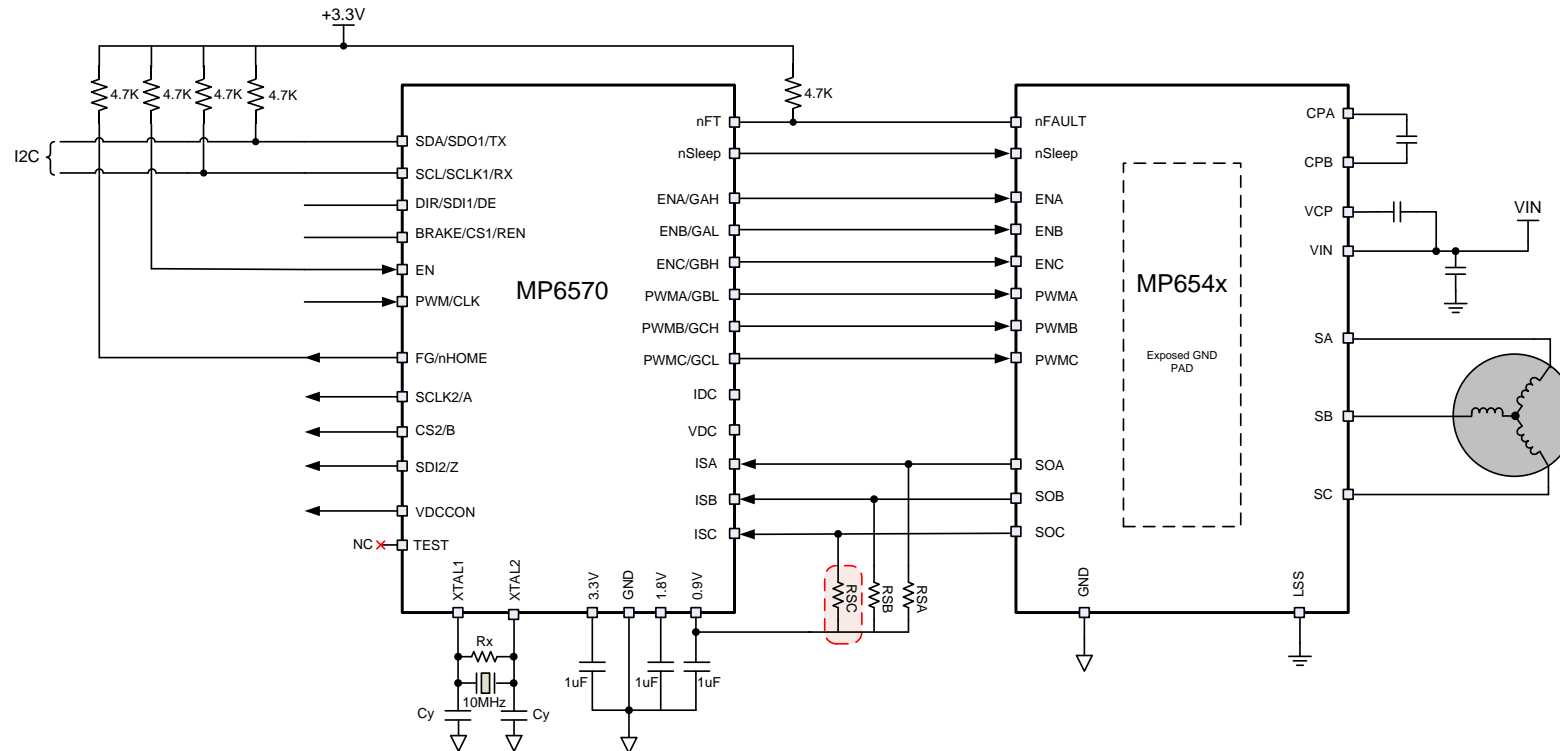
Typical Application Circuit

MP6570 + MP653x + Discrete MOS



Typical Application Circuit

MP6570 + MP654x



MP6710

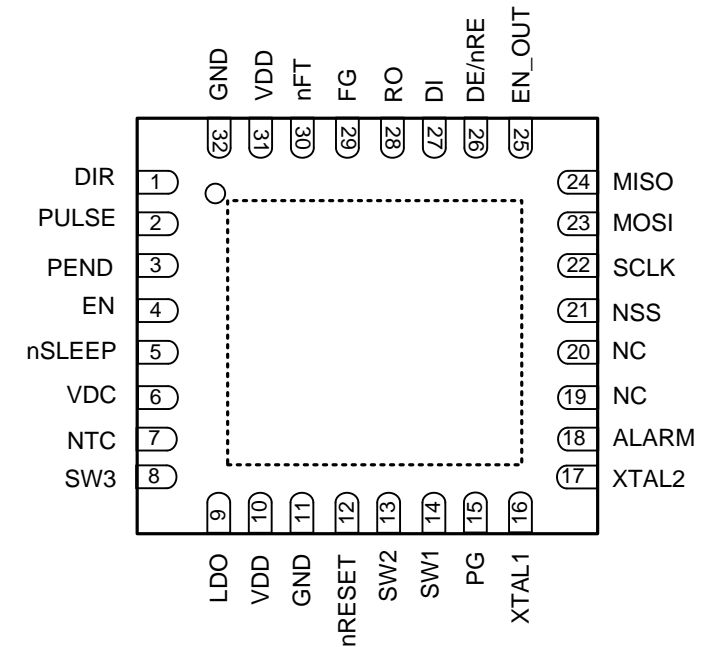
e.Motion System Servo Motor Controller

Features

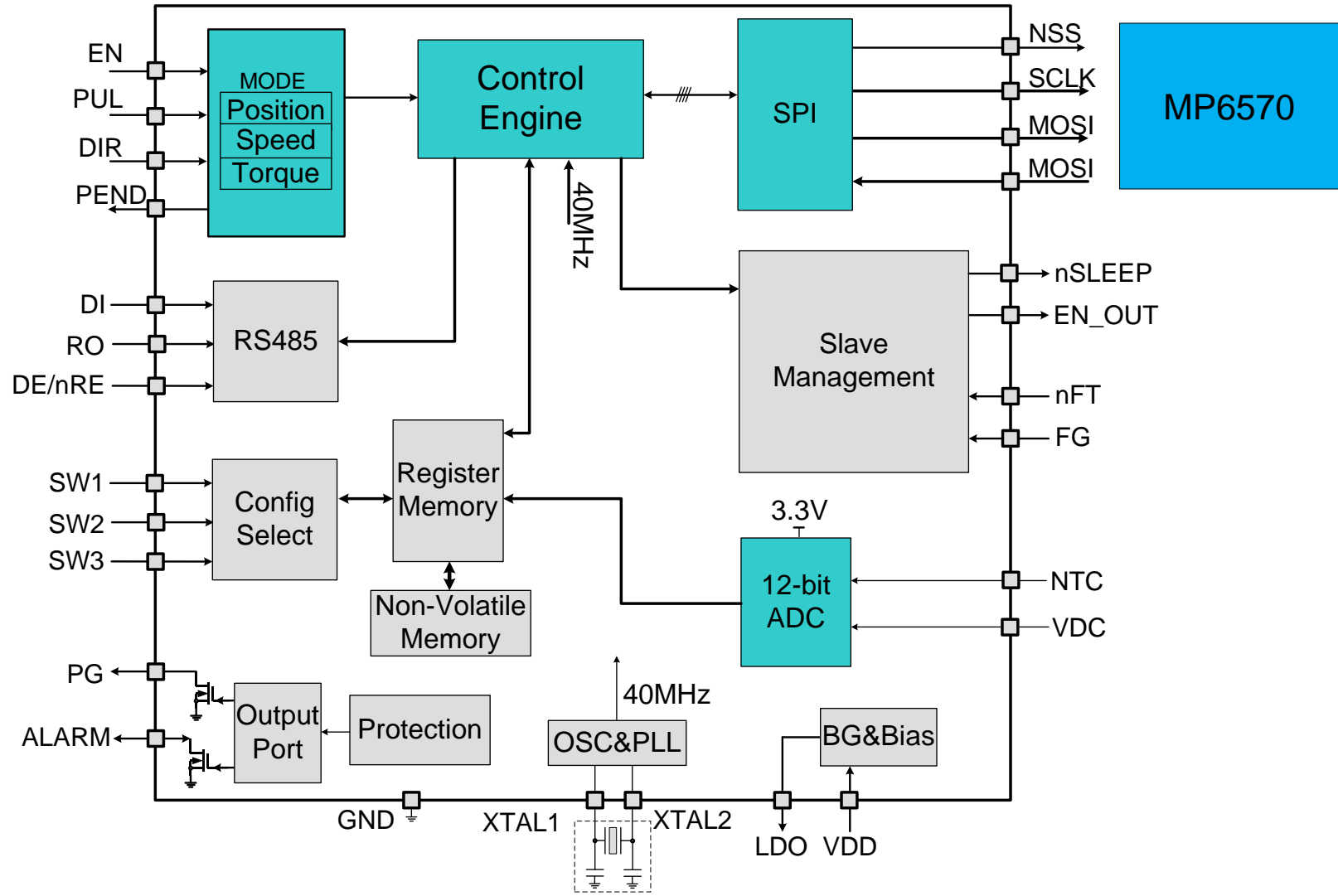
- Three Loop Control
- Good Dynamic Performance
- Position/Speed/Torque Operation Modes
- PWM/Clock/Digital Interface Reference Input
- Energy Regeneration Braking Mode
- Up to 127 Programmable Slave Addresses
- Input Bus UVLO and Over-Voltage Protection
- Over Current Protection
- Locked Rotor Detection and Restart
- Programmable Speed Limit In Torque Mode

Applications

- servo motor
- robotics



MP6710 Block Diagram



MSM Series Smart Motors

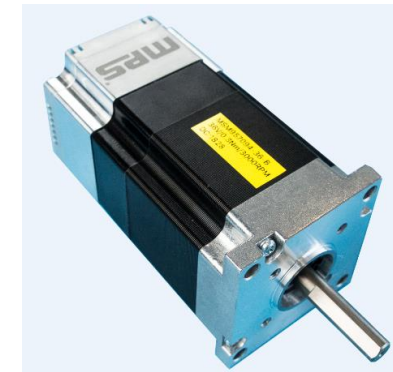
Features

- All in One Solution
- Embedded Magnetic Sensor
- FOC Control
- Speed/Position/Torque Control
- RS485 or PUL/DIR Control
- Easy to Use GUI

Series	Smart Motor Part Number	Vin Spec (Min, Nominal, Max)	Rated RPM	Rated Torque (Nm)
42mm	MSM942038-24-C-R	(18V, 24V, 36V)	3000	0.12
	MSM942052-24-C-R			0.125
	MSM942077-24-C-R		4000	0.185
	MSM942105-24-C-R			0.25
57mm	MSM957094-36-C-R	(18V, 36V, 70V)	3000	0.3
	MSM957141-36-C-R		3000	0.45
	MSM957188-36-C-R		3000	0.6



MSM942xxx-24-C-R



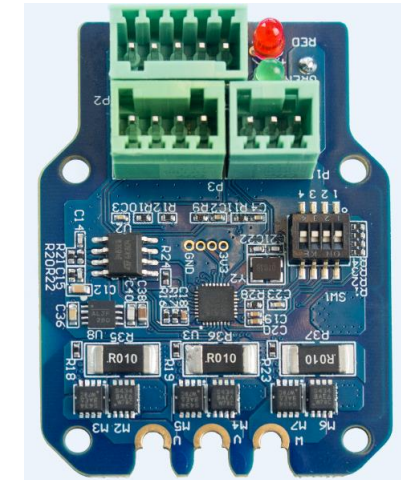
MSM957xxx-36-C-R

MMP Series Motor Control Module

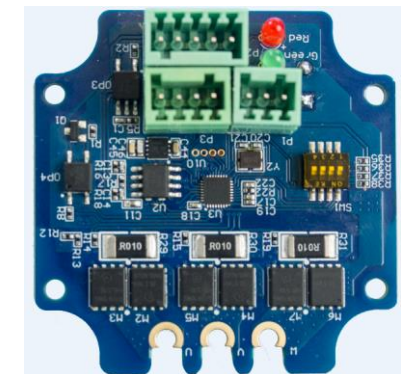
Features

- Up to 200W
- Wide Input Voltage Range
- RS485 or PULSE/DIR Input
- FOC Control
- Speed/Position/Torque Control
- Easy to Install

Series	Smart Motor Part Number	Vin Spec (Min, Nominal, Max)	Rated Power(W)
42mm	MMP742038-24-C	(18V, 24V, 36V)	38
	MMP742052-24-C		52
	MMP742077-24-C		77
	MMP742105-24-C		105
57mm	MMP757094-36-C	(18V, 36V, 70V)	94
	MMP757141-36-C		141
	MMP757188-36-C		188

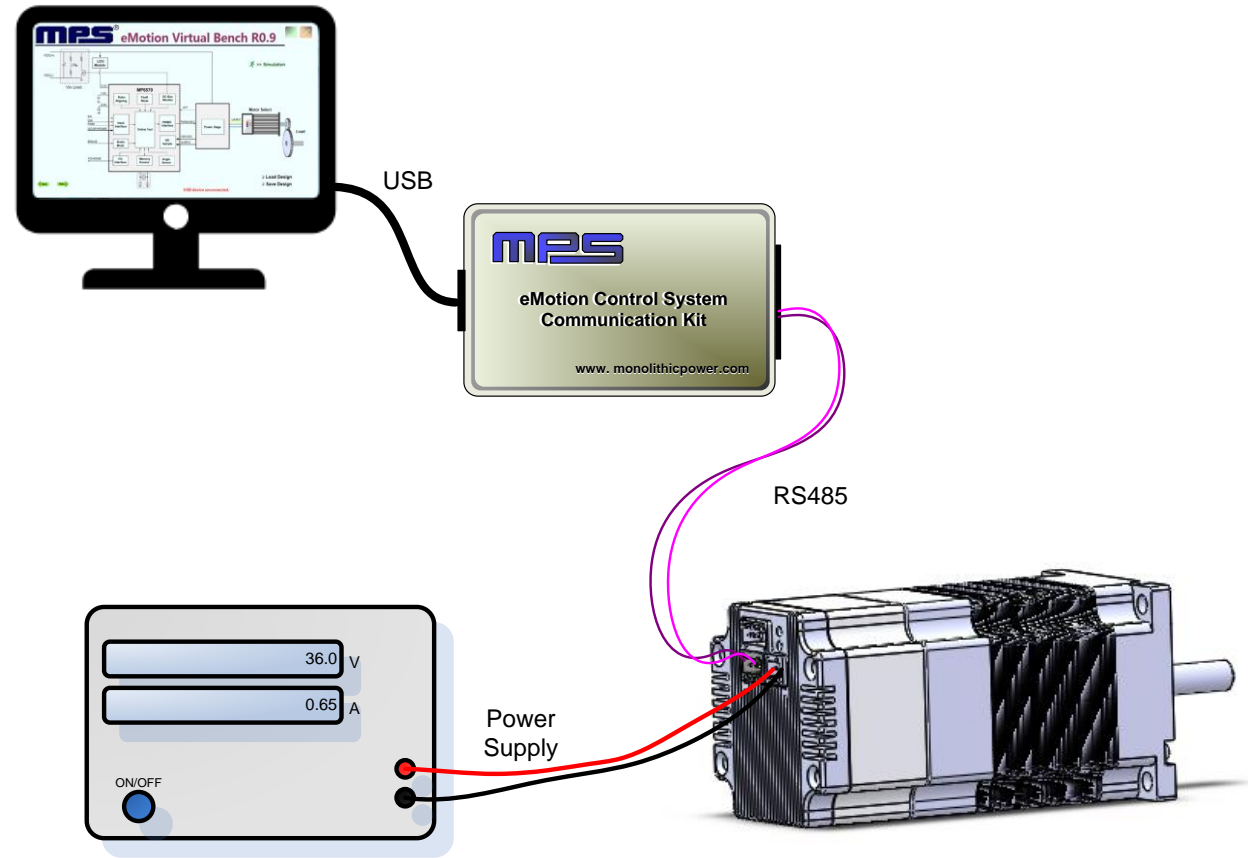


MMP742xxx-24-C

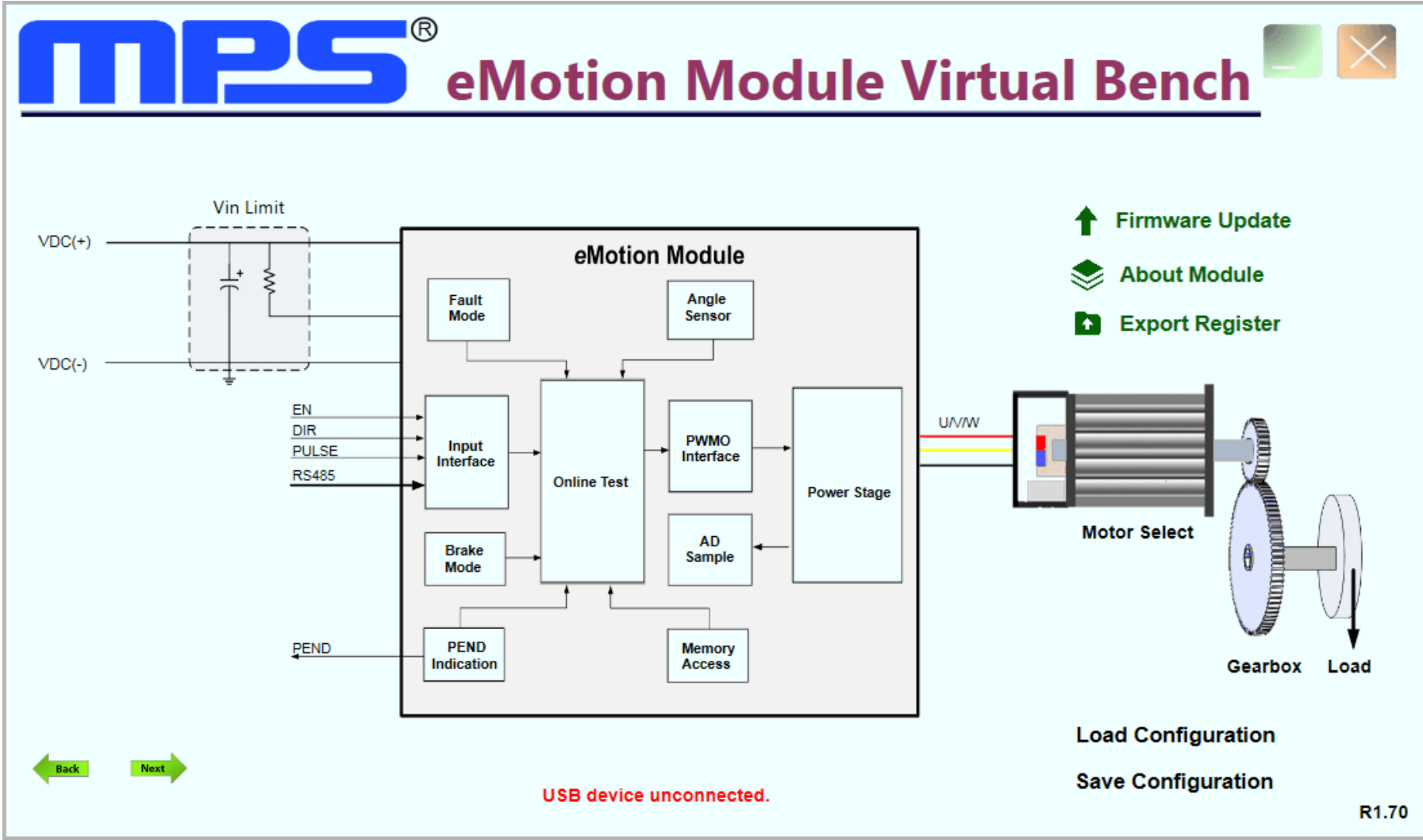


MMP757xxx-36-C

MPS e.Motion Virtual Bench



MPS e.Motion Virtual Bench



MPS e.Motion Virtual Bench

MPS[®] eMotion Module Virtual Bench

Online Test

Direction: F R Brake: Yes No Incremental: Yes No

Reference
Max Speed(rpm): Acceleration:
Position(deg): @ (Rotations)

Position Loop

Bandwidth(Hz):

Speed Loop

Bandwidth(Hz): PI Zero(Hz):

Current Loop

Bandwidth(Hz):

Fault indication:
Over Current: Temperature: 0 °C
Rotor Lock: Overload:

Speed

Speed(rpm) vs Time(s)

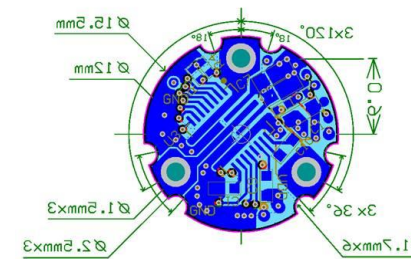
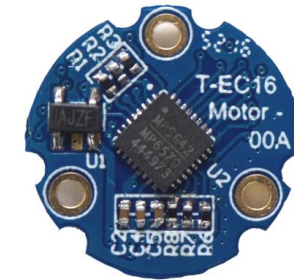
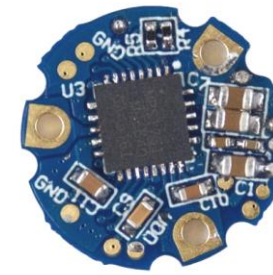
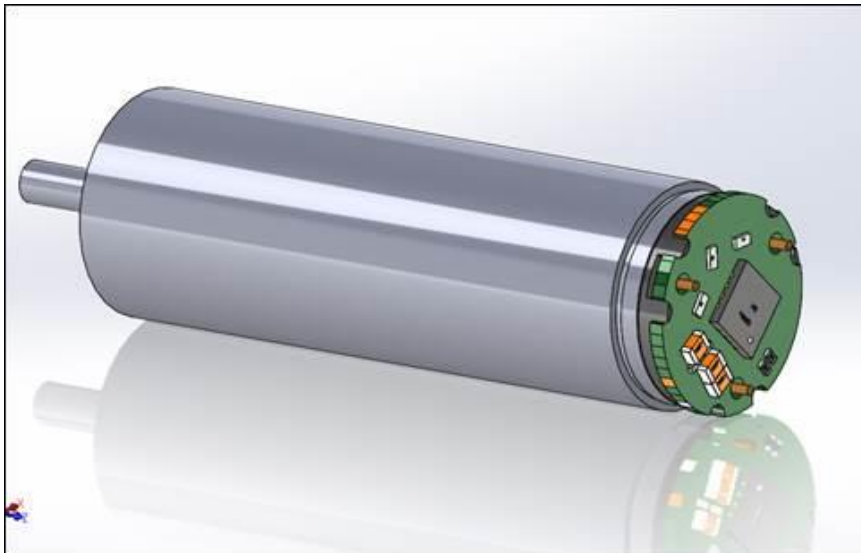
Speed Position UD

Design Examples

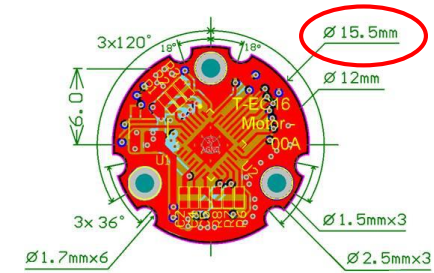
Very Small Size Design

Maxon ECX16 Motor Driver Design

- Controller: MP6570
- Power Stage: MP6540H
- Motor Diameter: 16mm
- Power: 20W
- Speed: Up to 60000rpm



Top View

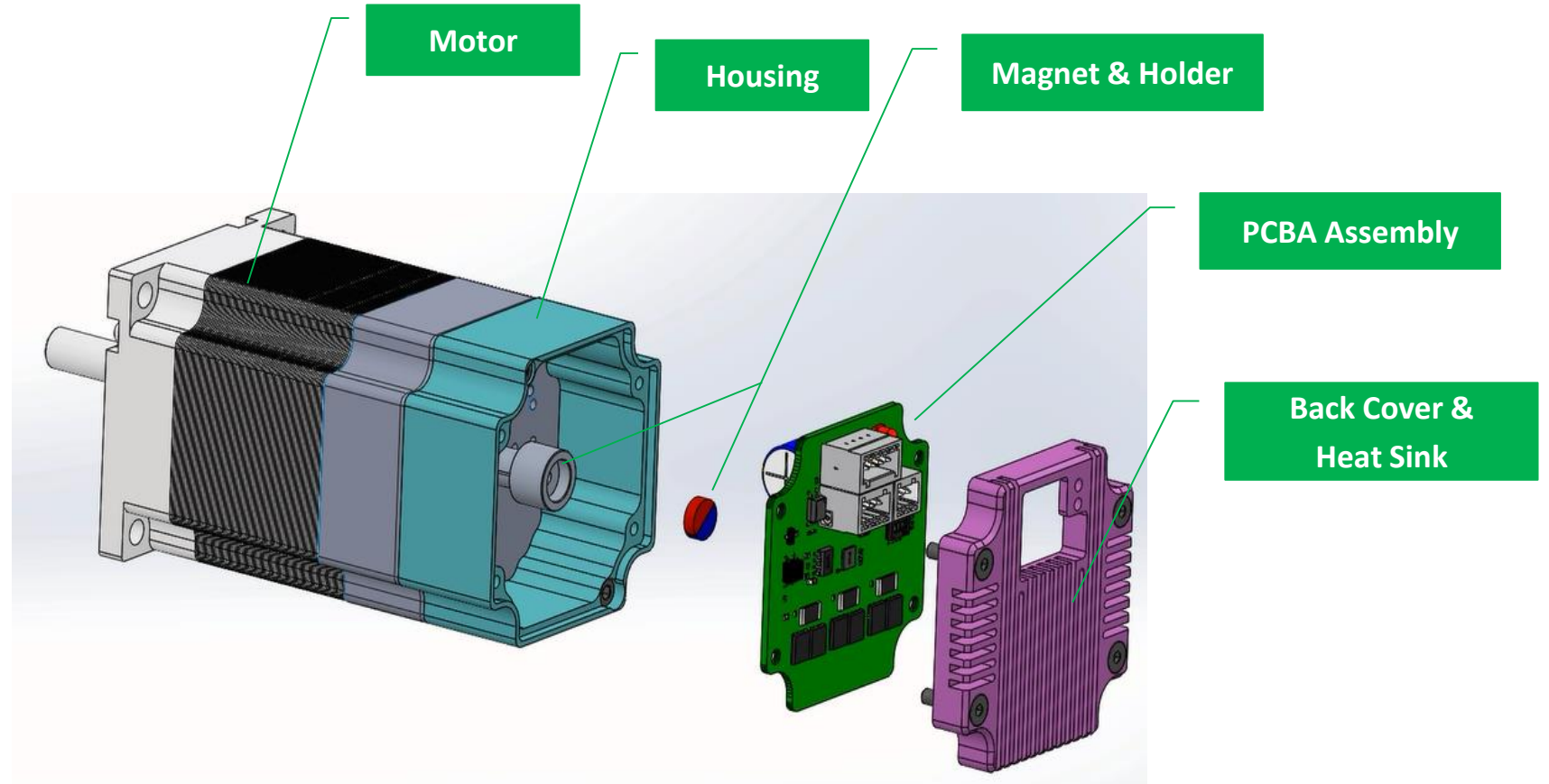


Bottom View

Standard Size Motor Design

57mm Servo Motor Design

- Controller: MP6570 + MP6710
- Power Stage: MP6539 + MOS
- Motor Size: 57mm
- Power: up to 200W
- Speed: 3000rpm



Q & A