

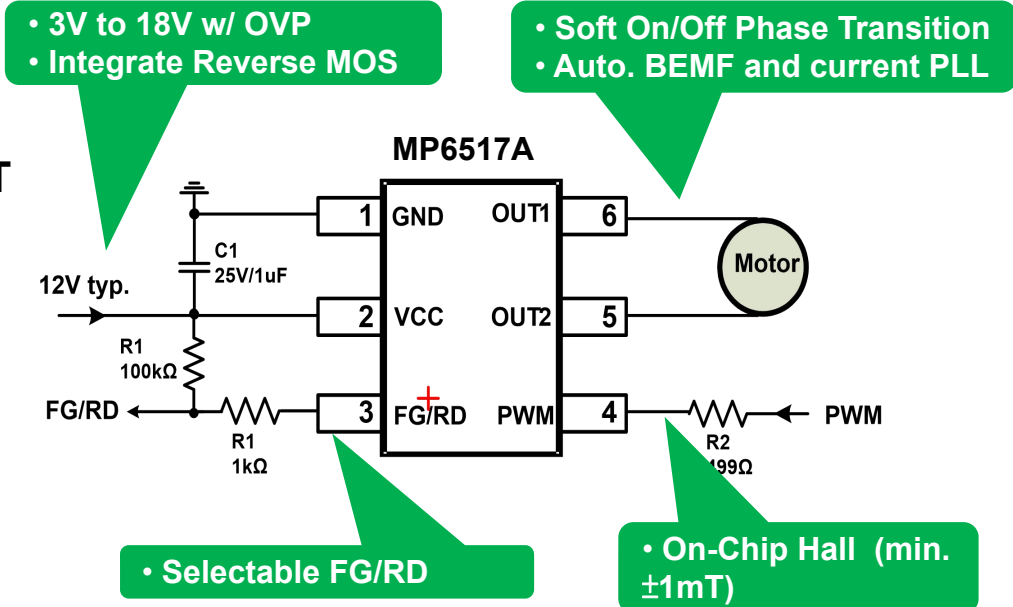
MPS电机应用解决方案

—秦鸿强, 2017.05.01

- 单相电机应用高度集成控制方案
- 三相电机驱动方案
- 高精度磁编码器解决方案

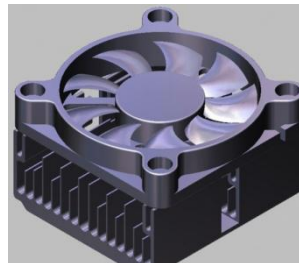
Feature:

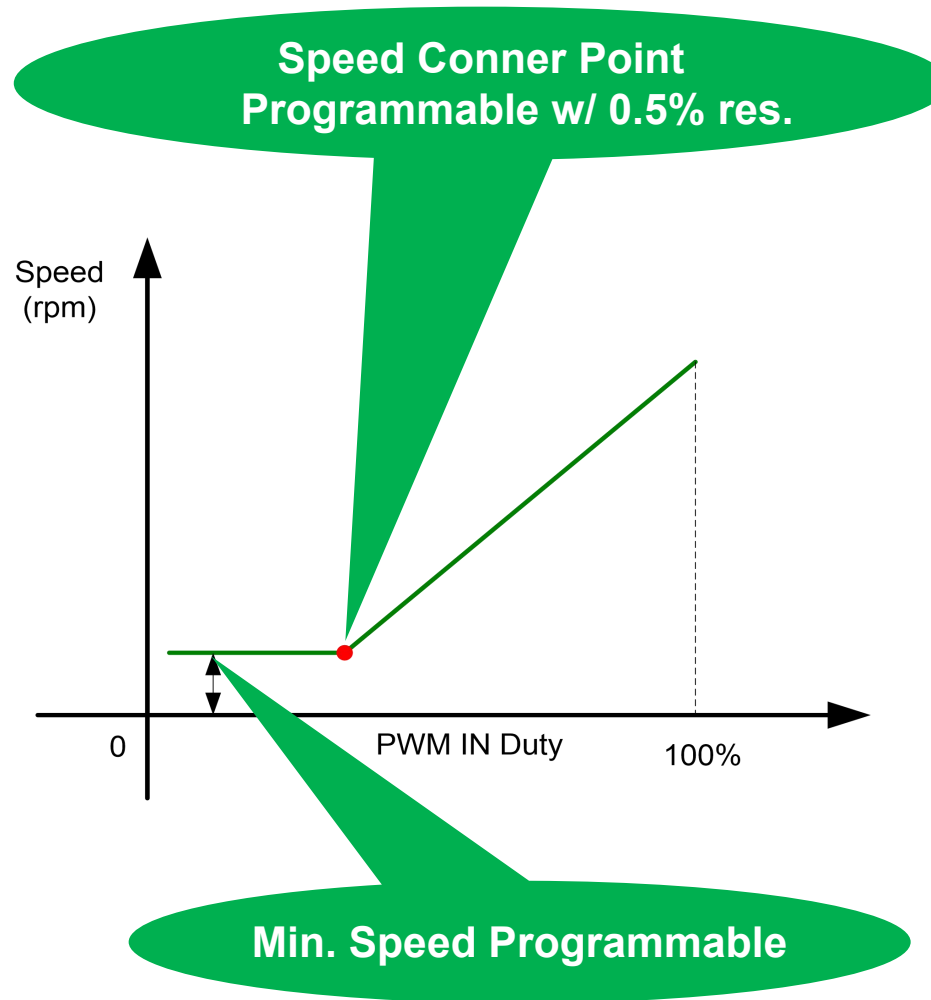
- 3V to 18V Input Operating Range
- On-Chip Hall Sensor
- Up to 1.2A Current Limit
- Integrated Reverse Blocking MOSFET
- Integrated power MOSFETs HS/LS: 850mΩ
- Auto BEMF & Current PLL
- 2-page OTP Programmable
- Soft On/Off Phase Transition
- 12-48kHz Input PWM Range
- 27kHz Output Switching Frequency
- OVP/OTP/UVLO/OCF
- Speed or Rotor Lock Indication
- TSOT23-6 package



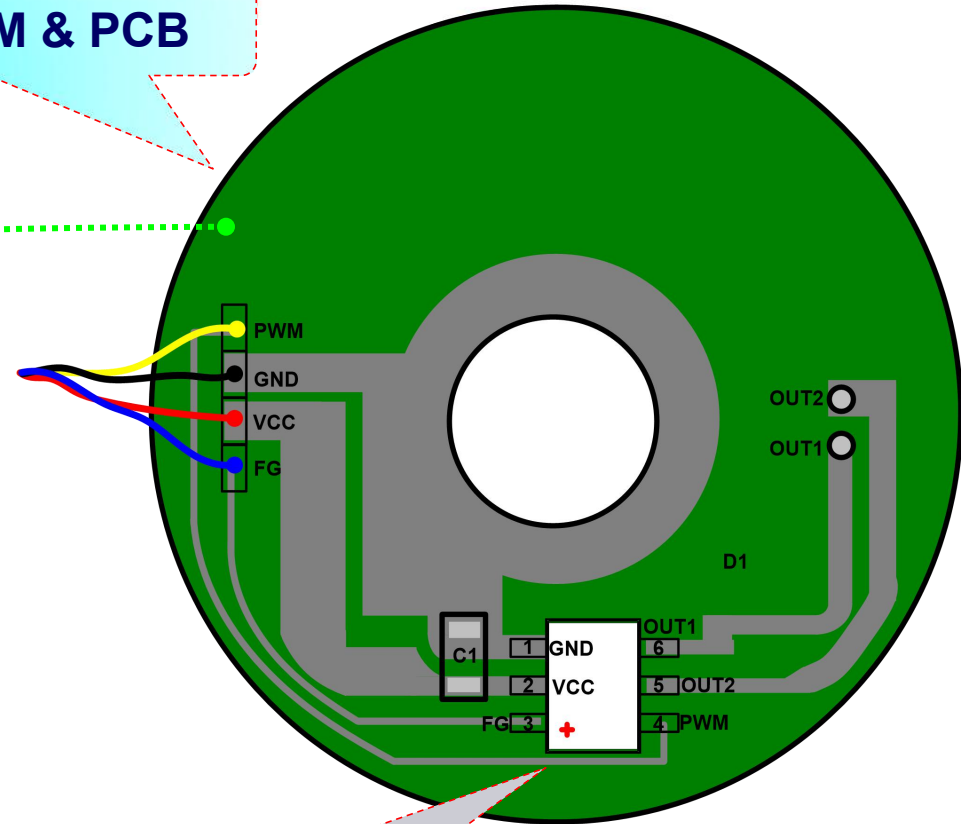
Applications:

- Single-phase fan driver

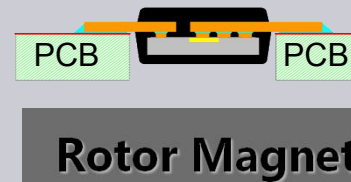




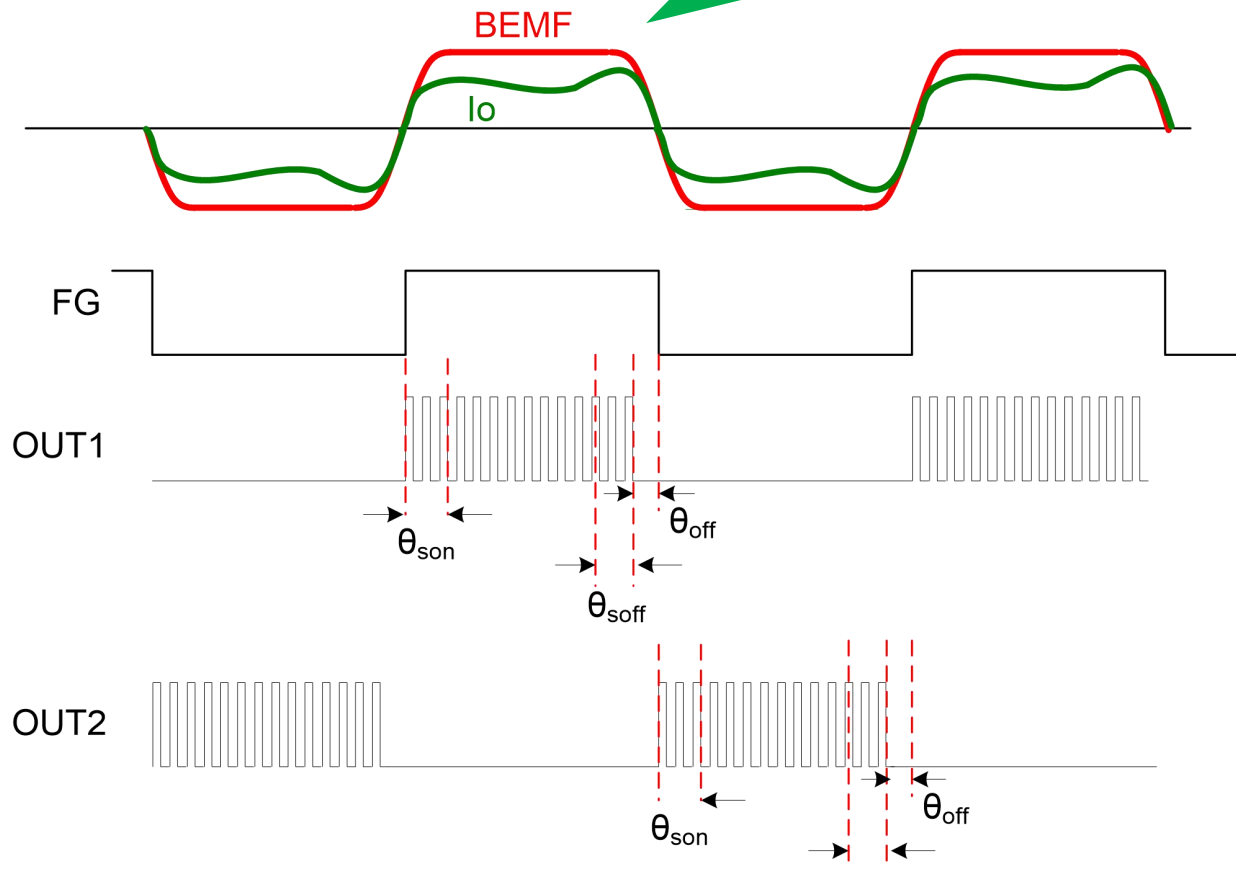
- Very Clear BOM & PCB



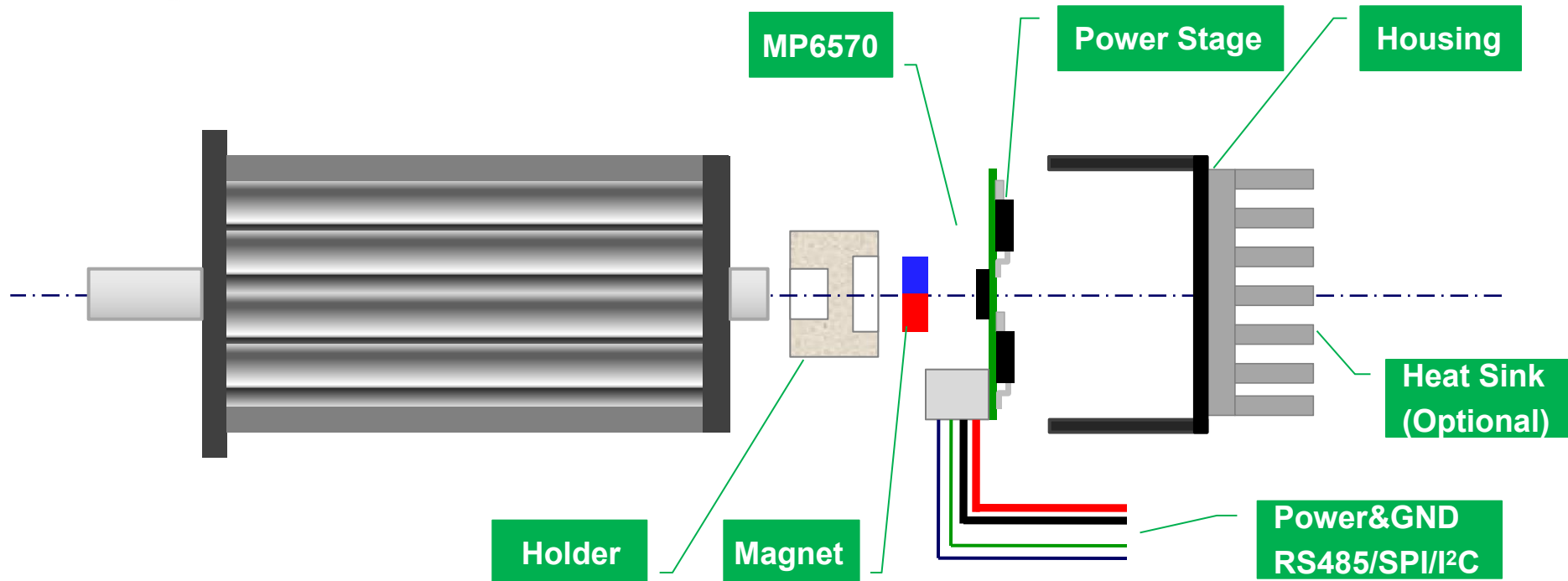
Straight Lead TSOT23-6



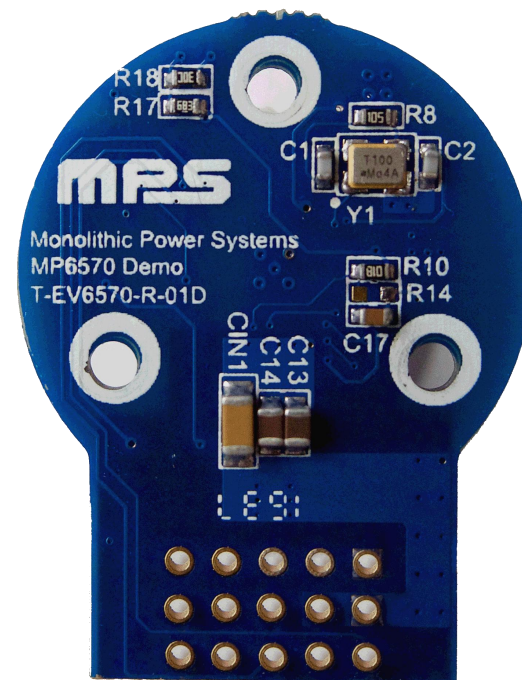
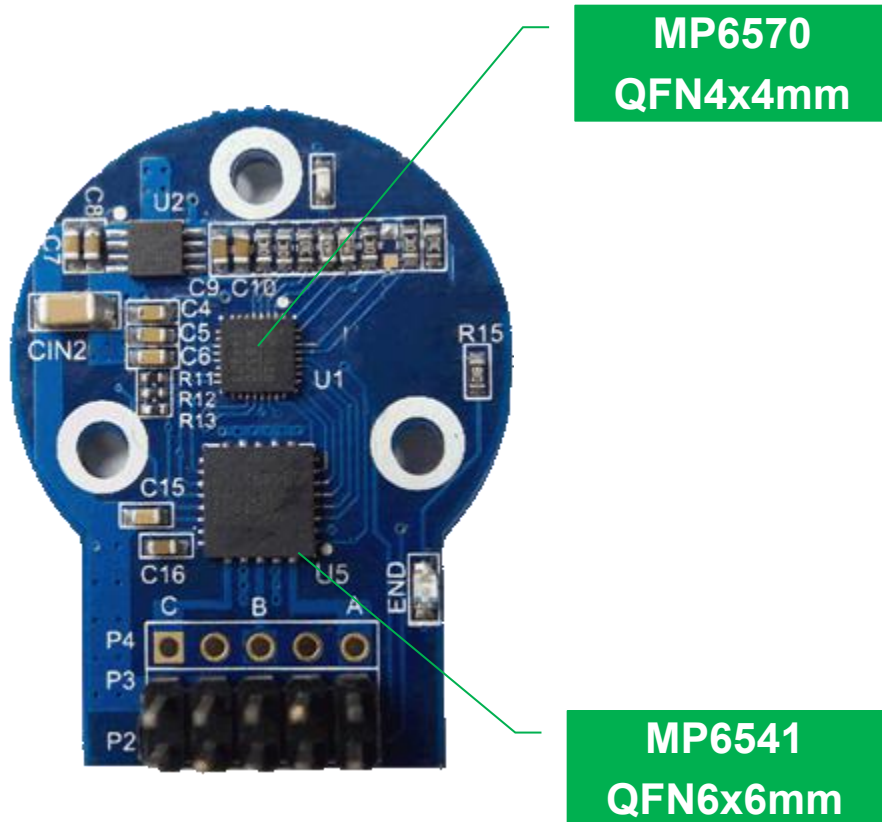
- Soft On/Off Phase Transition to Reduce Audible Noise
- High Efficiency with Auto. BEMF and current PLL



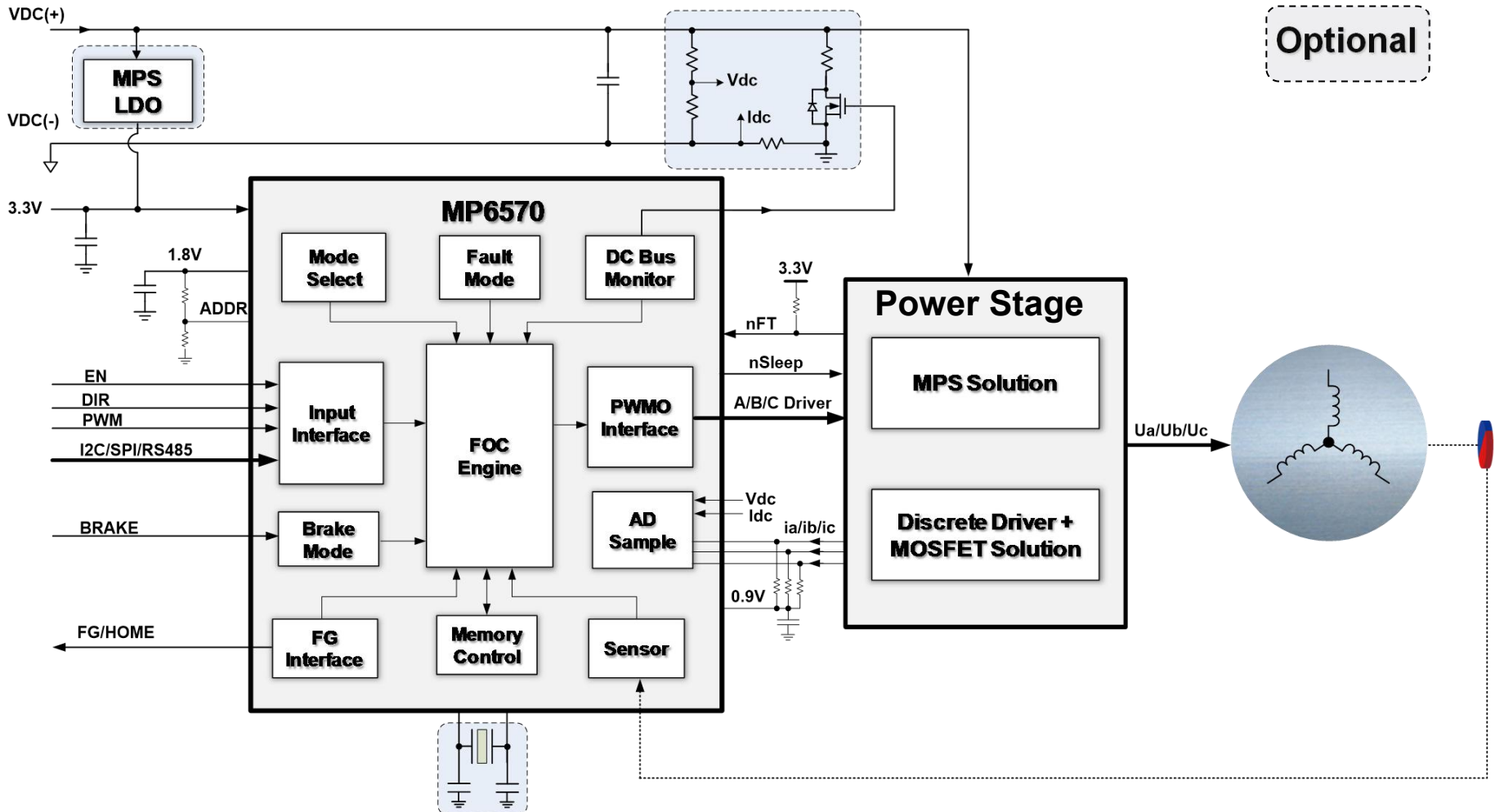
- Embedded 14-bit Resolution Angle Sensor
- FOC Control For
 - High Efficiency
 - Fast Transient Behavior
 - Low Torque Ripple
- Flexible Mode w/ Position/Control/Torque
- Make Design Easy
- Compact PCB Solution



▪ Demo PCB Example w/ End Shaft Mounting



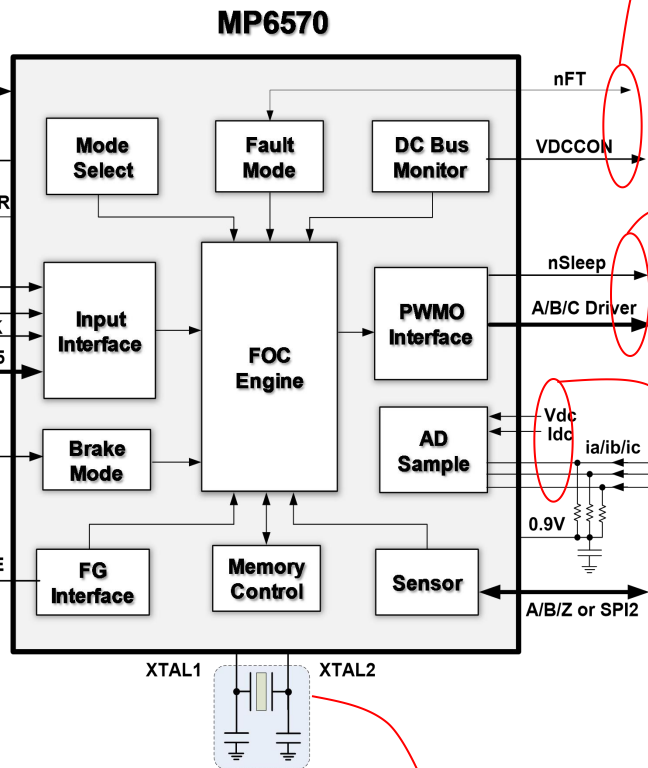
Typical Circuit



- **PWM Input @Speed/Torque**
- 1kHz-100kHz range
- **Clock Input @Speed/Position**
- 360°/2¹⁴*NSTEP @clock
- **DIR**: Direction Input
- **BRAKE**: Brake Input

- **I2C Interface**
- 600KHz Speed
- **SPI Interface**
- 20MHz Speed
- **RS485 Interface**
- 2.5MHz Speed
- **16 Slave Address**

- **FG @ Speed**
- 1 to 32 pulse /cycle
- **HOME @ Position**
- Home indication



- **nFT**
- OCP/Lock Fault Indication
- Ext. Fault Input
- **VDCCON**
- DC Bus Protect Output

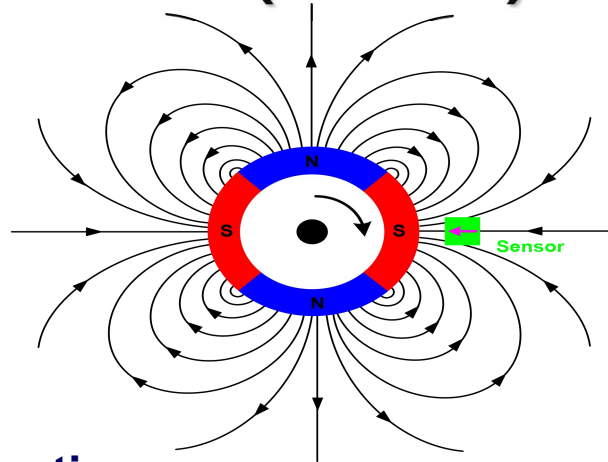
- **A/B/C Driver**
- MP653x/654x Compatible
- Each MOS Separate Gate

- **Vdc/Idc**
- Bus Voltage/Current Sample
- **Ia/Ib/Ic**
- Phase Current AD Sample

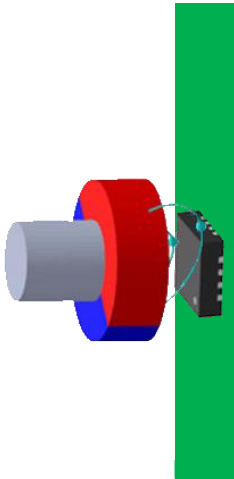
- **A/B/Z Output**
- A/B/Z Signal w/ Int. Sensor
- **SPI2 Interface**
- Ext. Sensor Angle Input

- **Internal Oscillator**
- ±1.5% Accuracy
- **External Oscillator**
- 10MHz Passive Crystal

- In-Plane Magnet Flux ($>30\text{mT}$)



- End Shaft Mounting



- Side Shaft Mounting





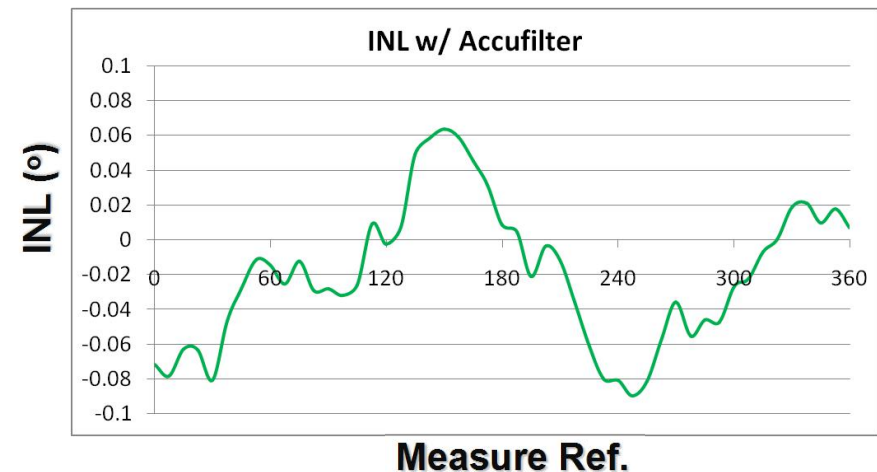
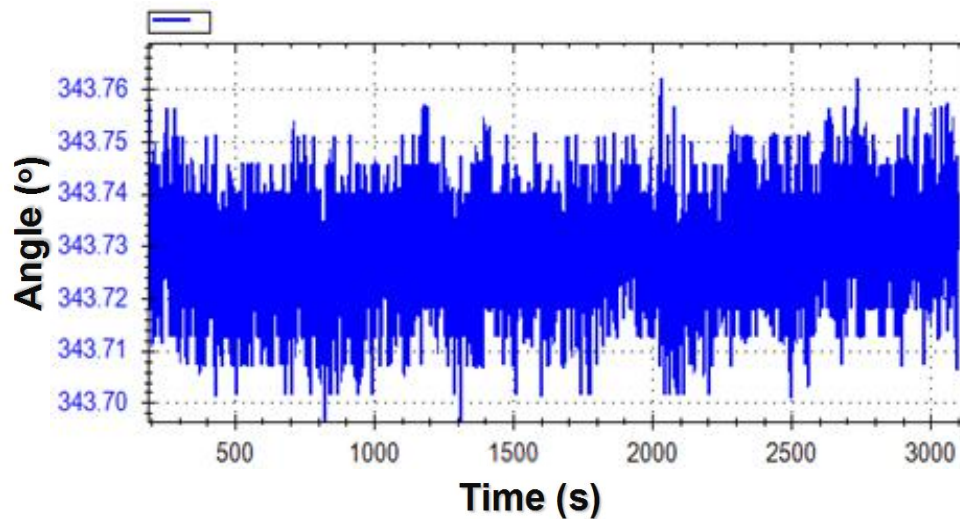
High-Accuracy Angular Sensor

▪ INL & Resolution

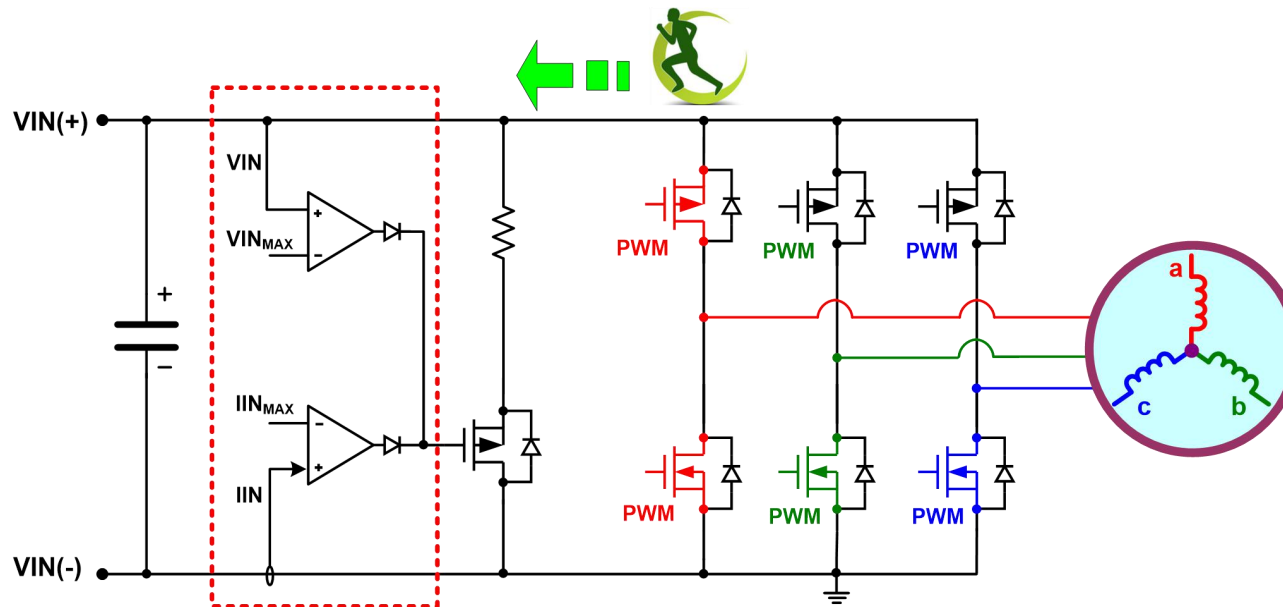
- Max. $\pm 0.08^\circ$ INL w/ AccuFilter @ End-Shaft Mounting
- Max. $\pm 0.04^\circ$ (13-14 bit) Resolution
- BCT Trimming for Side-Shaft Mounting

▪ Support Internal/External Sensor Mode

- A/B/Z and 16-bit Reg. Output For Internal Sensor
- External Sensor SPI Input Compatible w/ MA300/700

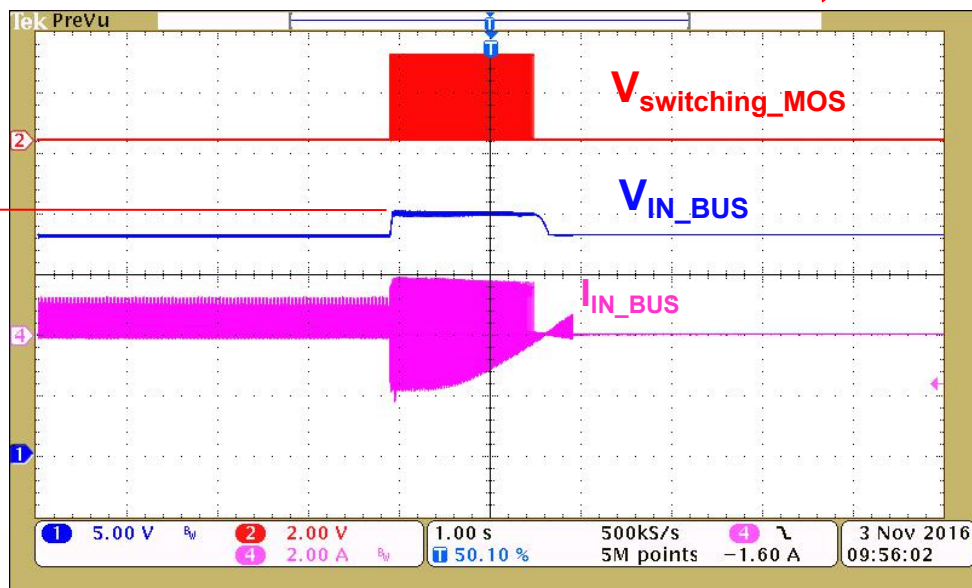
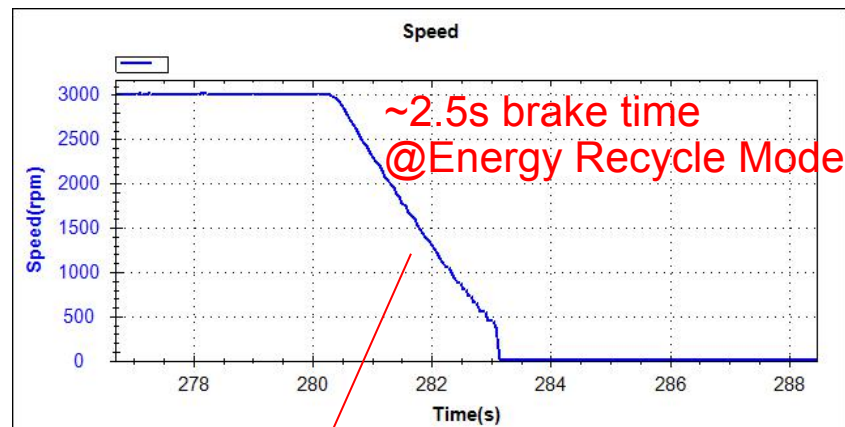
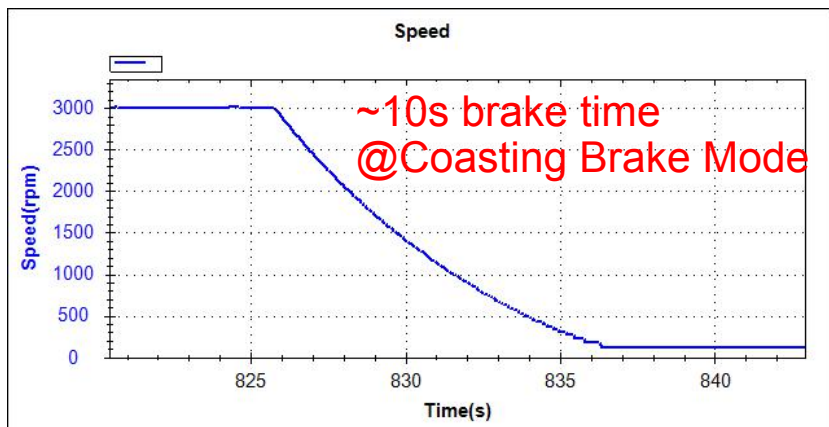


- **Coasting Brake Mode**
 - All FETs Off
 - Longest Braking Time
- **Fast Brake Mode**
 - All LS FETs On and HS FETs Off
 - Fast Brake Time but High Current Spike
- **Energy Recycle Mode**
 - Negative Torque Loop Control
 - Fast Brake Time and Energy Recycle



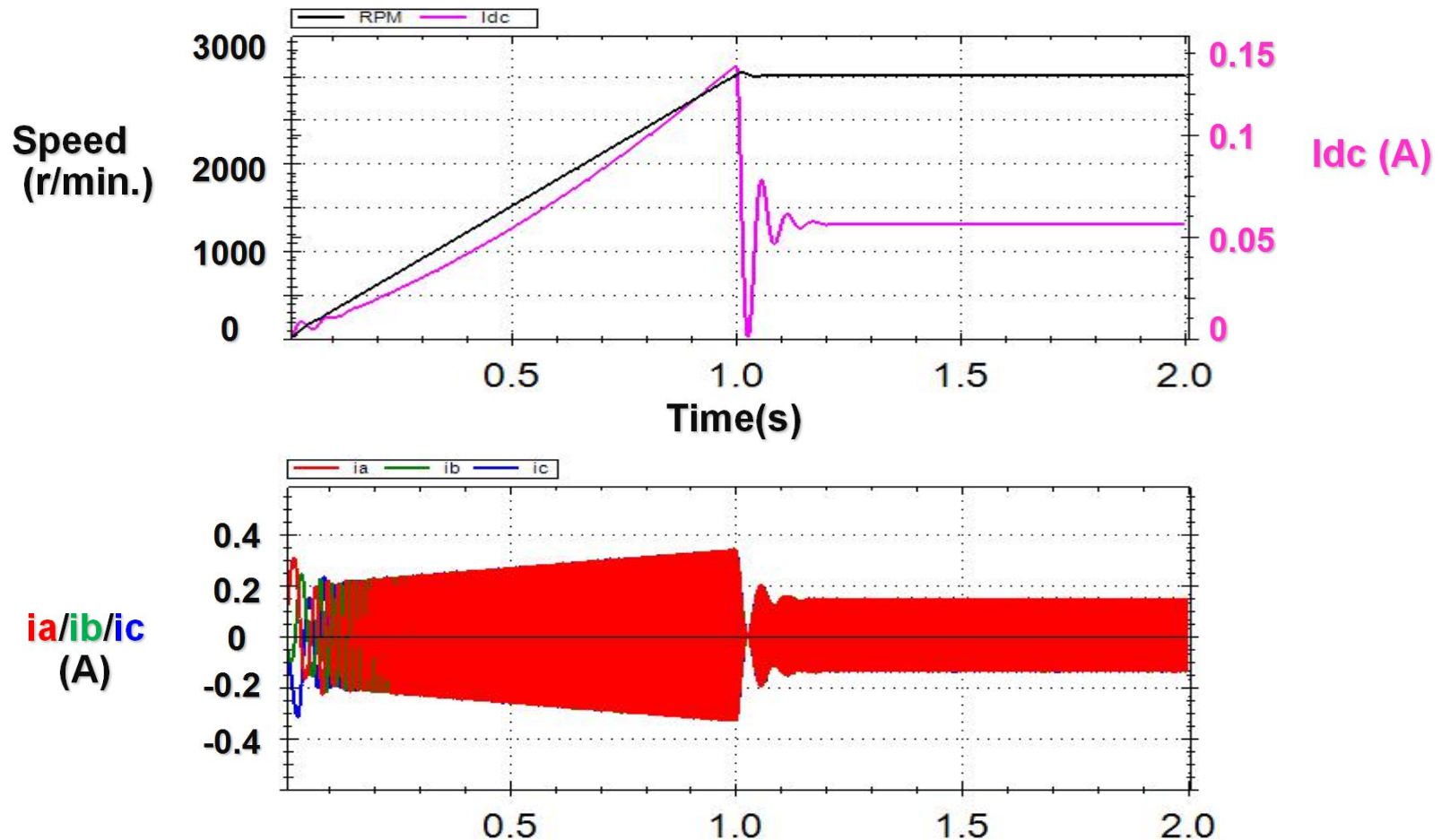
■ MP6570 Brake Mode Test

• 3000RPM to 0RPM, $T_{\text{BRAKE}} = -35\text{mN}\cdot\text{m}$, $J = 3100\text{g}\cdot\text{cm}^2$



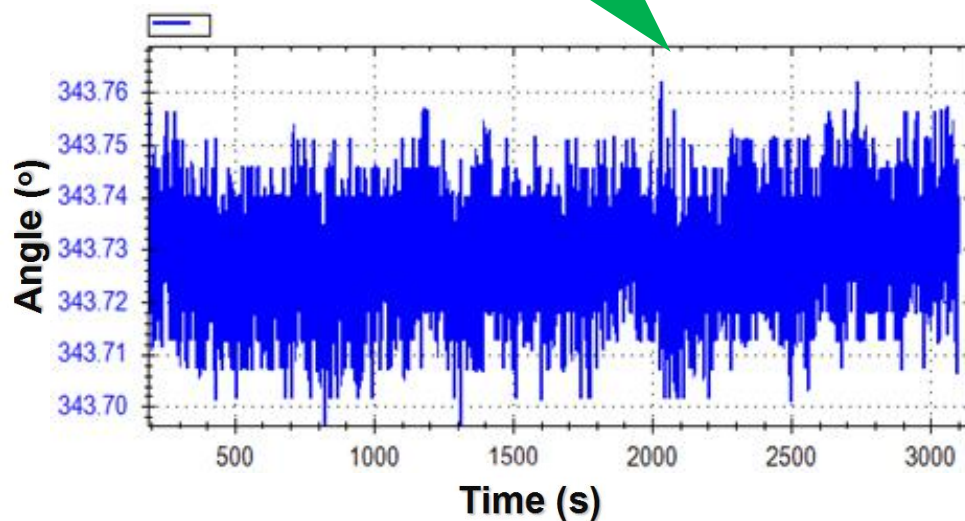
■ Transient Behavior @Speed Mode

- ($L_d=L_q=322\mu\text{H}$, $p_0=8$, $R_s=0.462$, $J=135\text{g}\cdot\text{cm}^2$, $K_v=380\text{rpm/V}$)

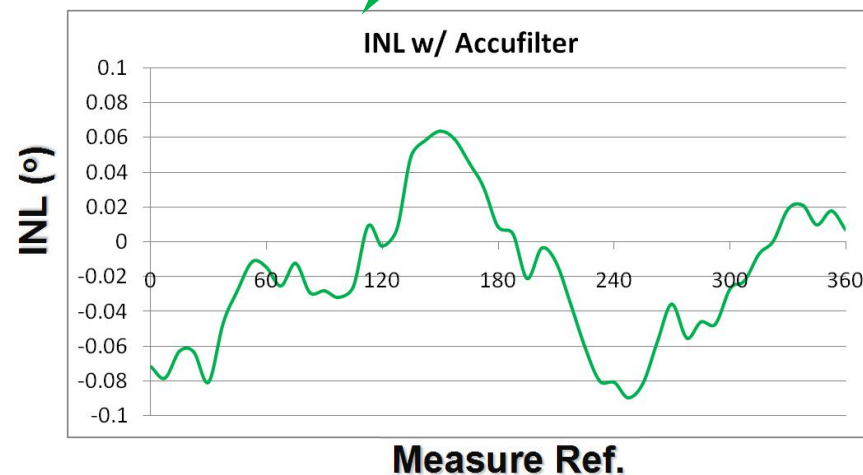


■ MP6570 Sensor Test Result w/ AccuFilter™

$\pm 0.035^\circ$
(13-14bit resolution)



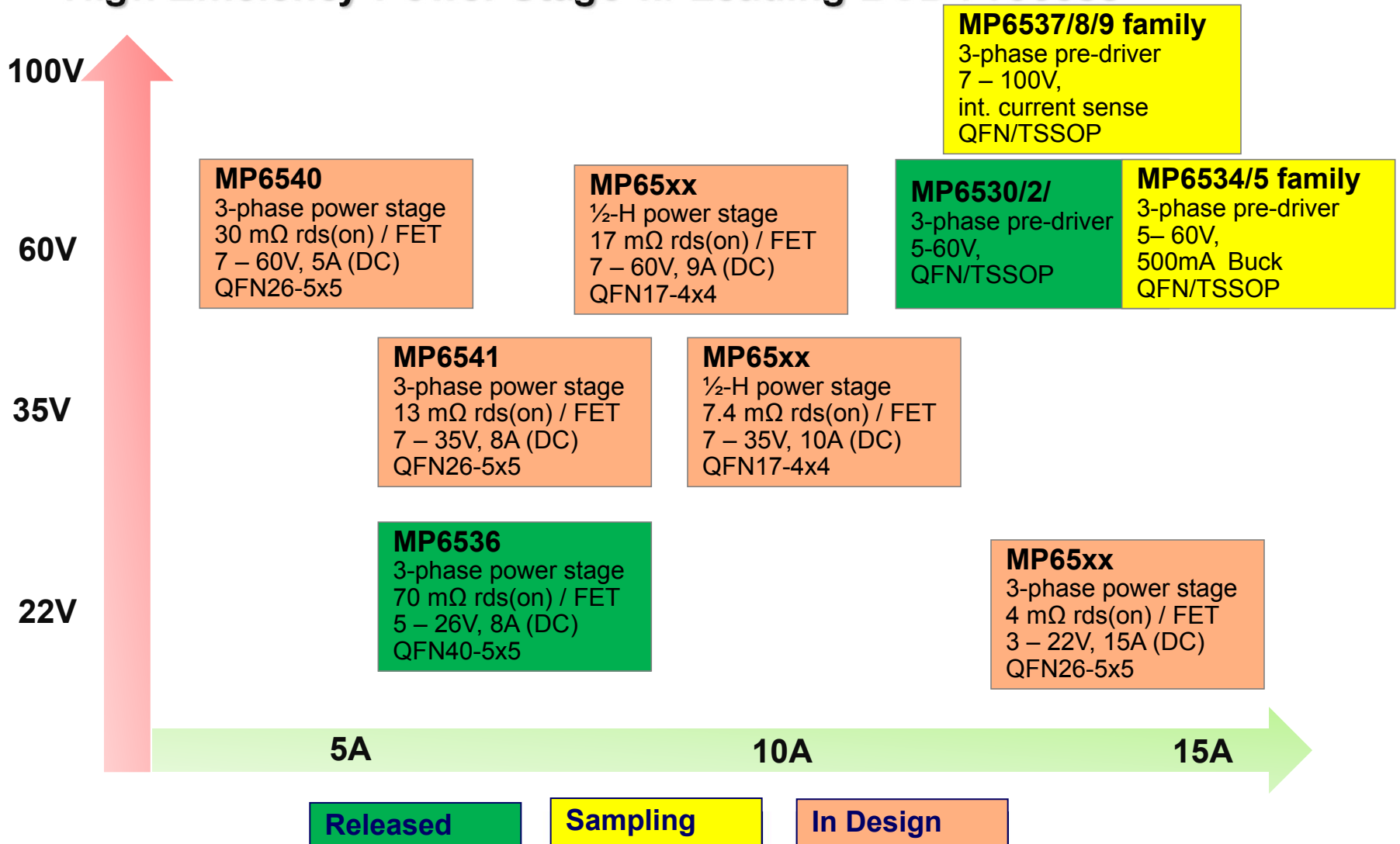
$\pm 0.07^\circ$ INL

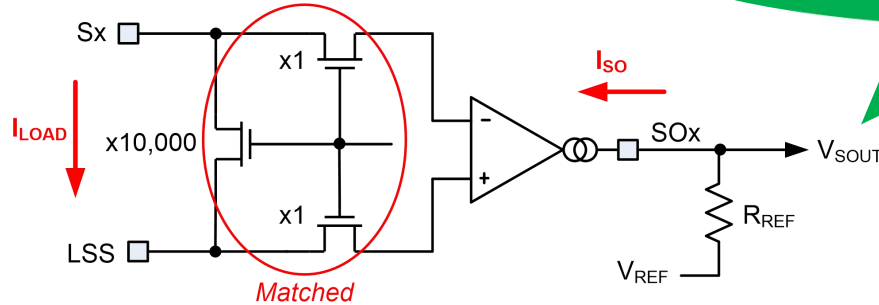




3-Phase BLDC Power Stage Solution

■ High Efficiency Power Stage w/ Leading BCD Process

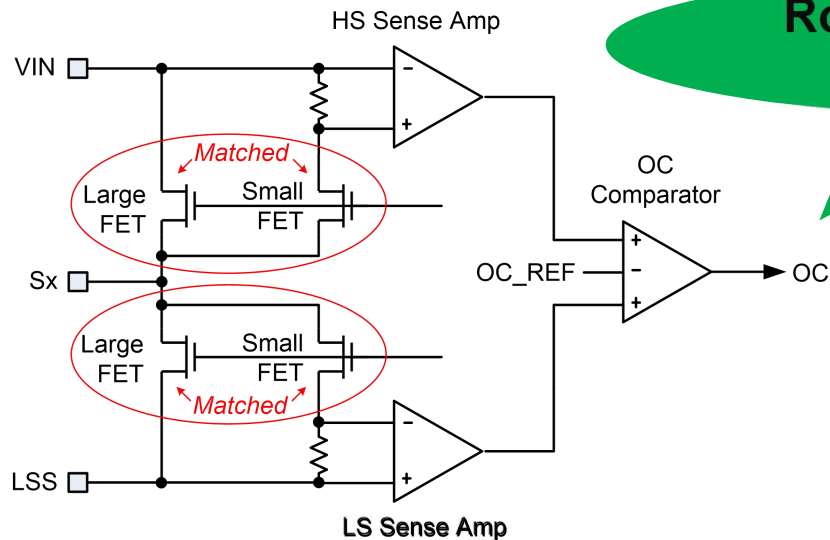




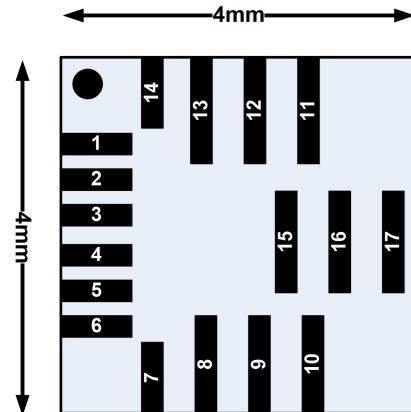
$$I_{SO} = I_{LOAD} / 10,000$$

$$V_{SO} = V_{REF} + (I_{SO} * R_{REF})$$

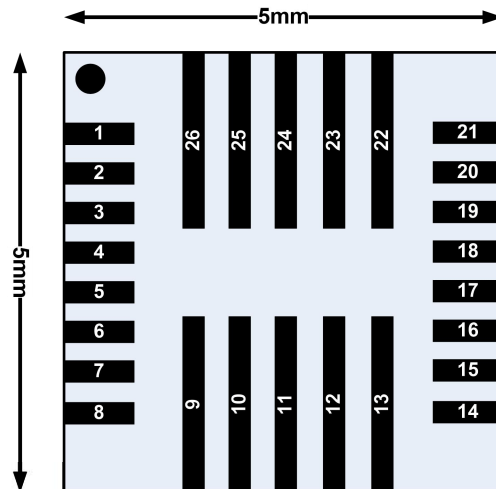
$$= V_{REF} + ((I_{LOAD} * R_{REF}) / 10,000)$$



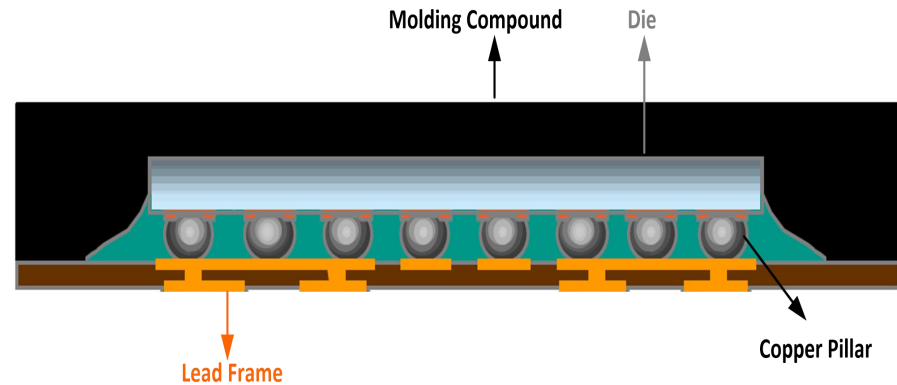
**½-H: 17 pads, 4mm x 4mm,
2.8 Watts @ 25°C**



**3-phase: 26 pads, 5mm x 5mm,
3.5 Watts @ 25°C**



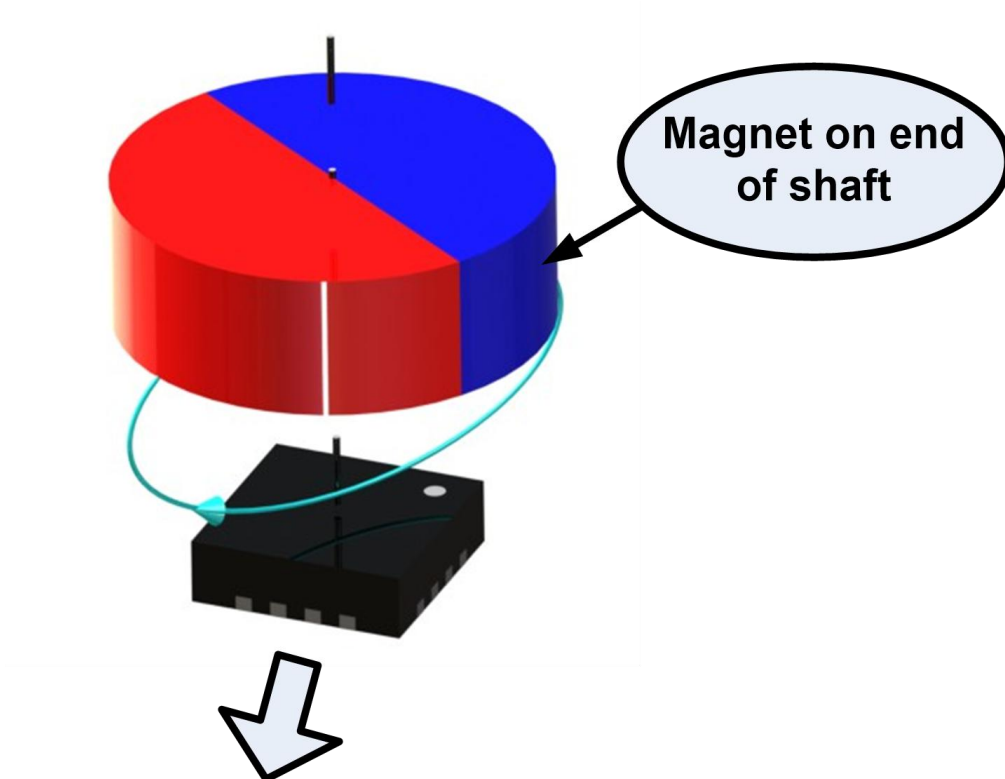
**Mesh Connect™
(No Wire Bond)**



• **Advantages over standard packages:**

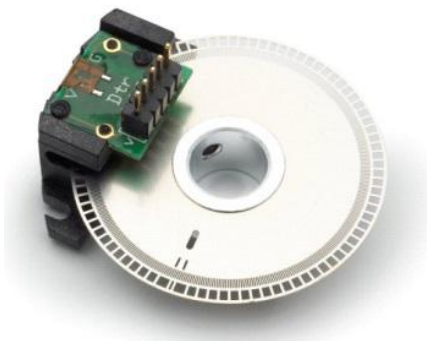
- Very low parasitic resistance
- Very low inductance
- Reduced thermal resistance
- Small size
- Low cost

- 磁角度传感器：

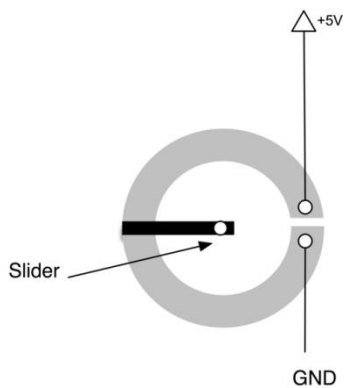


Angle information:

- U, V, W like Hall sensors
- A, B, I like optical encoder
- SPI readout

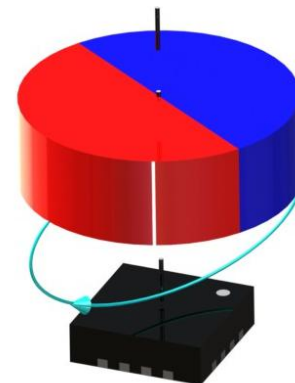


High precision
High cost
Heavy
Large profile
Sensitive to vibration



Low cost
Low precision
Low speed
Low lifetime
Required ADC
Large slider-hysteresis

VS.

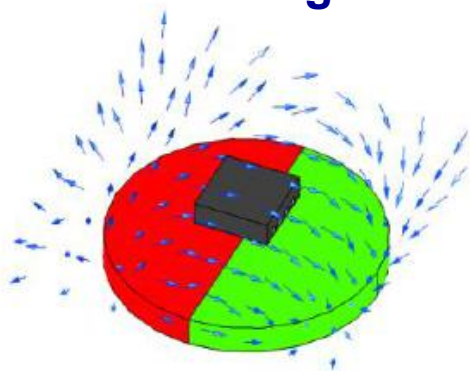


Low cost
High precision
High speed*
Side-of-Shaft ability*
Tiny system profile
Extremely long life

* SENSIMA Product

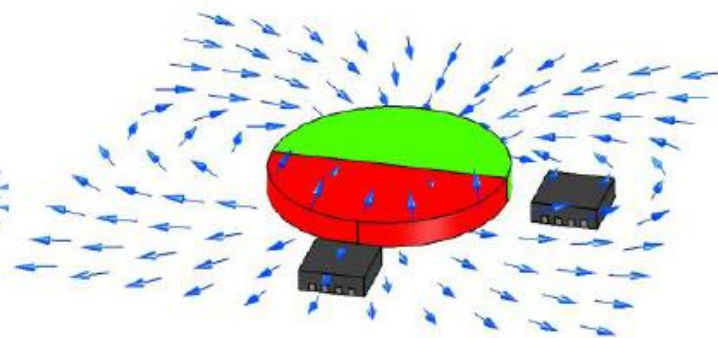
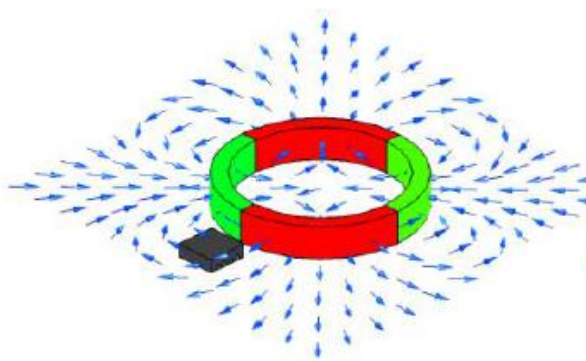
end-of-shaft

Sensor on-axis of magnet



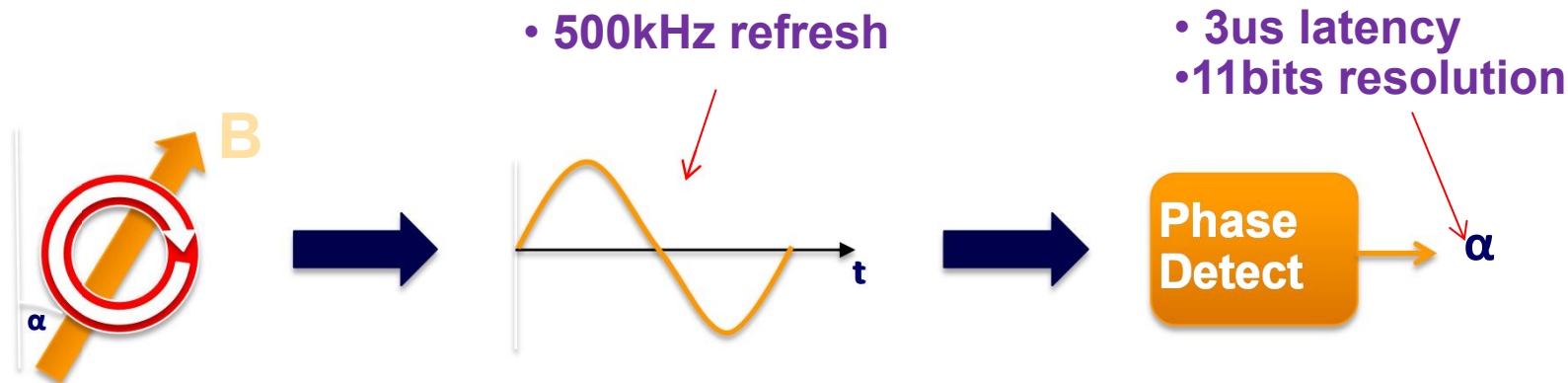
side-shaft

Sensor off-axis of magnet



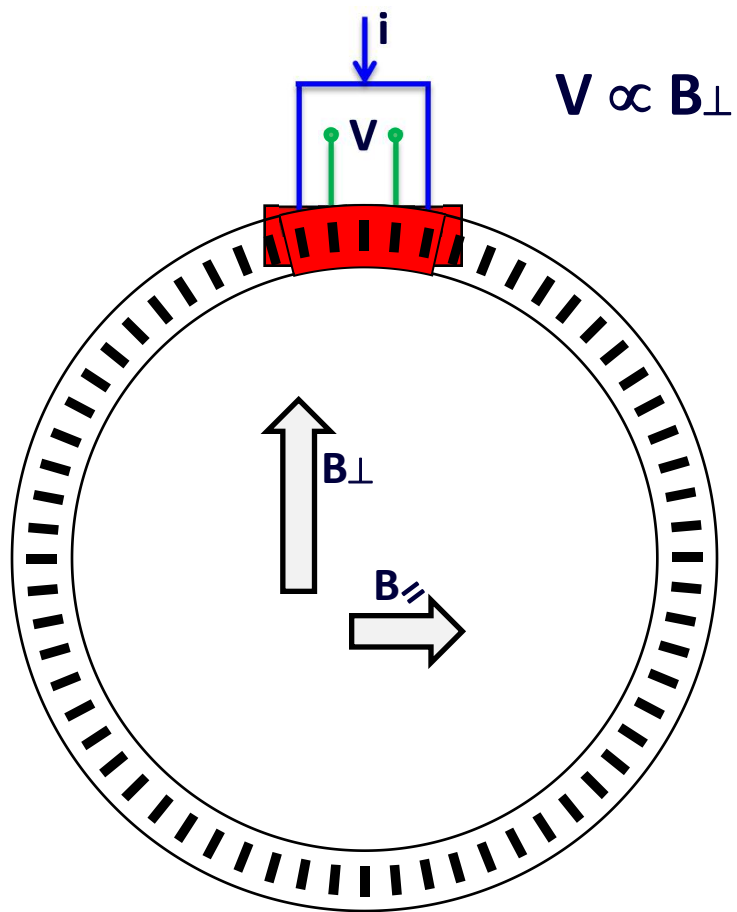
Basic paradigm shift towards **MPS** *spinaxis*:

Instead of using digitized amplitudes
we measure the angle through a phase detection

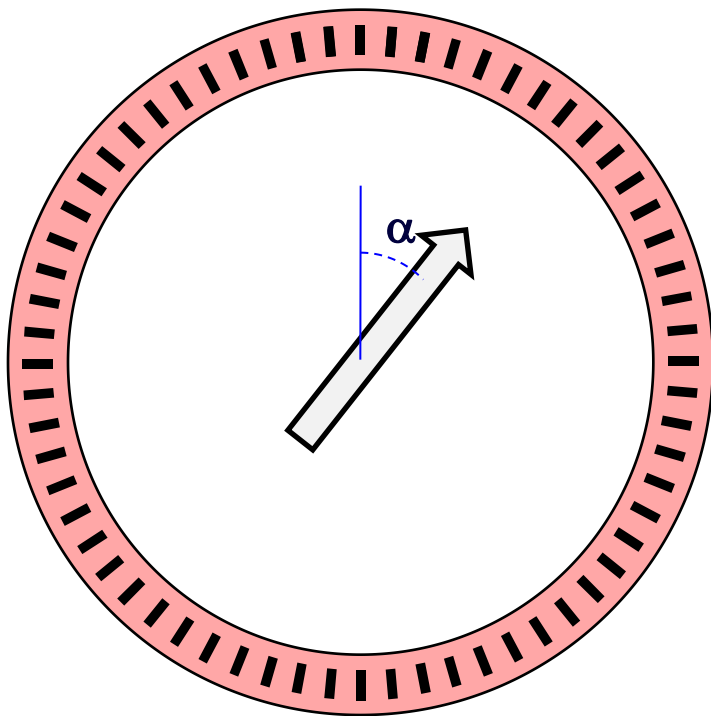


MPS sensor provide extremely fast response and high precision!

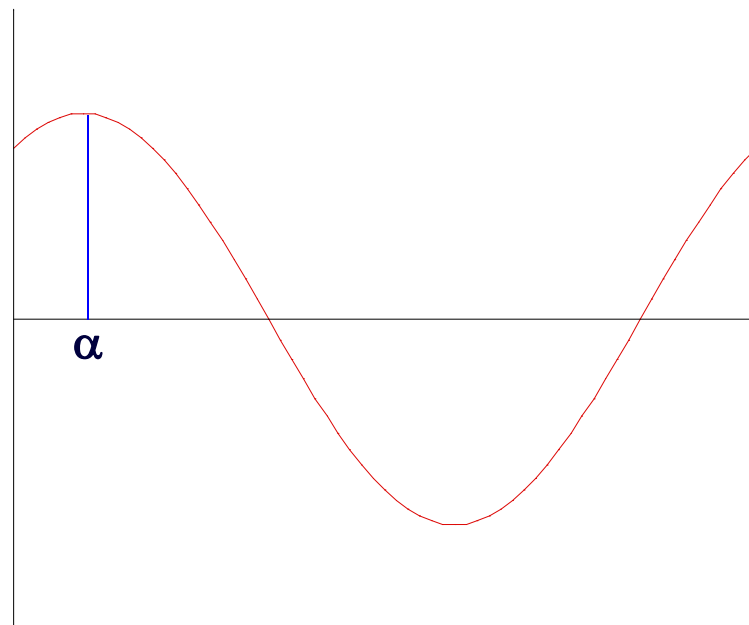
How does *Spinaxis* work?



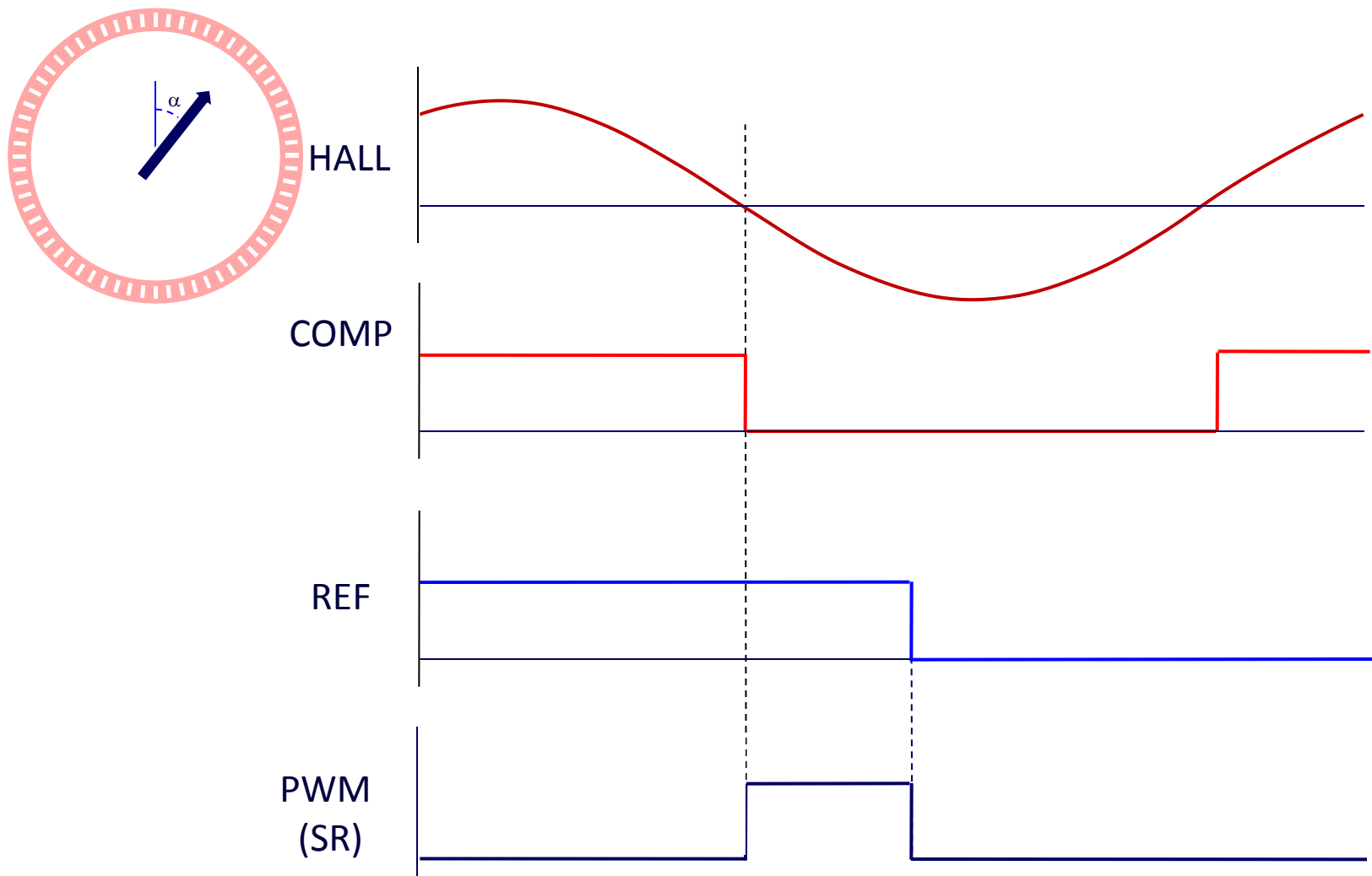
How does *Spinaxis* work?



Filtered output:



How does *Spinaxis* work?





MPS Solution in the Market

Product	Application	Absolute			motor commutation	Incremental		zero setting	side shaft linearization	low power optimization
		SPI		PWM		8 bit	10 bit			
		8 bit	16 bit							
MA100	Motor commutation	✓			✓			✓	✓	
MA120	Motor commutation	✓			✓			✓		
MA200	Motor commutation & speed control	✓			✓	✓		✓	✓	
MA300	Motor commutation & position control		✓		✓		✓	✓	✓	
MA700	High performance encoder		✓				✓	✓	✓	
MA720	Low power encoder		✓					✓	✓	✓
MA750	Contactless potentiometer	✓		✓				✓		

Upcoming features

Motor commutation:	multiple pole pair rotor with simple target magnet	[MA100, MA120, MA200, MA300]
Alarm:	High /Low field alarm: all products	
Incremental:	reduced wiring Mode, configurable index, differential output	[MA200, MA300, MA700]
Absolute:	SSI output (in addition to SPI):	[MA700, MA720, MA750]
Speed:	speed output via SPI:	[MA200, MA300, MA700]

- 机器人抛球装置介绍





Q & A

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Tel: (408) 826-0600