

# SENSOR SOLUTIONS

Designed for Applications In:

» AUTOMOTIVE

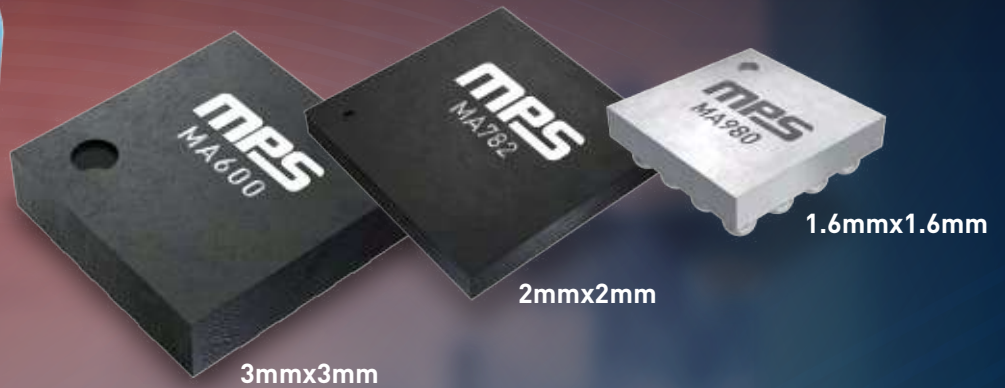
» INDUSTRIAL

» MEDICAL

» CONSUMER



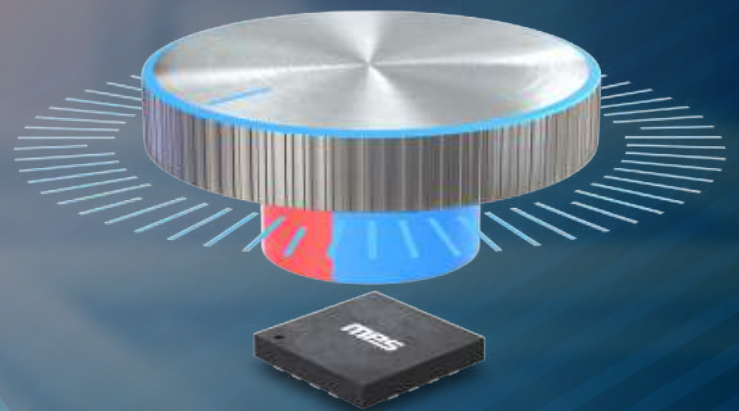
## POSITION SENSING



## CURRENT SENSING



## HMI




**MPS**  
MonolithicPower.com

# Quality Assurance & Reliability Commitment

The MPS Quality Assurance organization develops, coordinates, and champions strategic quality initiatives throughout MPS Inc., its foundries, and subcontractors. Its mission is to enable MPS to design, develop, manufacture, and deliver products to our customers with world-class quality and reliability that meet and exceed our customers' expectations.

## MPS and Its Supplier Quality Systems and Certificates:

- ISO9001:2008 (MPS)
- EU RoHS/HF/REACH Compliant (MPS)
- Sony Green Partner (MPS & Suppliers)
- TS16949 (Suppliers)
- ISO14001 (Suppliers)
- Current Sensor UL Certification # CA-11398-UL 

## Product Quality:

- Automotive Products Qualified per AEC-Q100 Standard
- Standard Products Qualified per JEDEC and Military Standards
- Reliability Failure Rate <10FIT
- Product Quality Level <1.0ppm

## Quality Control and Monitoring:

- On-Site Foundry and Assembly Teams for Real-Time Actions
- Quarterly Supplier Quality Review and Annual Supplier Audit
- Short-Term Reliability Monitor Test – Daily
- Long-Term Reliability Monitor Test – Monthly
- Real-Time Engineering Actions on Monitor Failure
- Quarterly Reliability Monitor Reports



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# MagAlpha™, MagDiff™, and MagVector™ Contactless Magnetic Angle Sensors

## Advantages of MagAlpha™ & MagDiff™ Sensors:

- » Instantaneous, Absolute Angle Sensing
- » High Resolution
- » Factory-Calibrated Low Error (INL): <math><0.6^\circ</math>
- » Less than - » High Bandwidth Up to 21kHz
- » Robust against Parasitic Stray Fields Exceeding 4kA/m DC
- » Ideal for Battery-Powered Applications: 25µA Average Current
- » Smallest Footprint: WLCSP (1.6mmx1.6mm) and UTQFN (2mmx2mm)
- » Flexible Sensor Location: End-of-Shaft (On-Axis) or Side-Shaft (Off-Axis)

MagAlpha™ and MagDiff™ sensors utilize an array of Hall plates that are sampled successively at very high speeds in such a way that the signal phase represents the angle to be measured. The “phase-to-digital” SpinAxis™ technique captures the angle instantaneously every 1µs without the need for traditional analog-to-digital conversion or arc tangent calculation. This means that the sensor is able to operate across a wider magnetic field range (typically 30mT to 150mT), giving greater flexibility and tolerance for magnet positioning.

The MPS MagDiff™ family is ideal for applications that require stray-field immunity, such as motor control with other motors in close proximity. The angle is extracted from the difference of the magnetic field at several locations on the sensor IC. This differential method eliminates the contribution of parasitic magnetic fields, and is suitable for sensors positioned at the end-of-shaft with a simple target magnet.

## Side-Shaft Capability

MagAlpha™ sensors support both end-of-shaft and side-of-shaft topologies. At end-of-shaft, the sensor is placed directly below the magnet connected to the rotating shaft. This topology offers the best performance, but is not always mechanically convenient because the end of a rotating shaft may not be accessible. For example, in a motor, it may be hidden by the shaft bearing, or driving into a gearbox. (see Figure 1).

The MagVector™ is our third type of magnetic position sensor. It is different than the MagAlpha™ or MagDiff™ in that it detects the direction and strength of a 3-dimensional (Bx, By, Bz) magnetic field and provides the digitized component data to the MCU via an SPI or I²C interface. Common applications for 3D sensing include power-meter tamper protection, joysticks, and gaming applications.

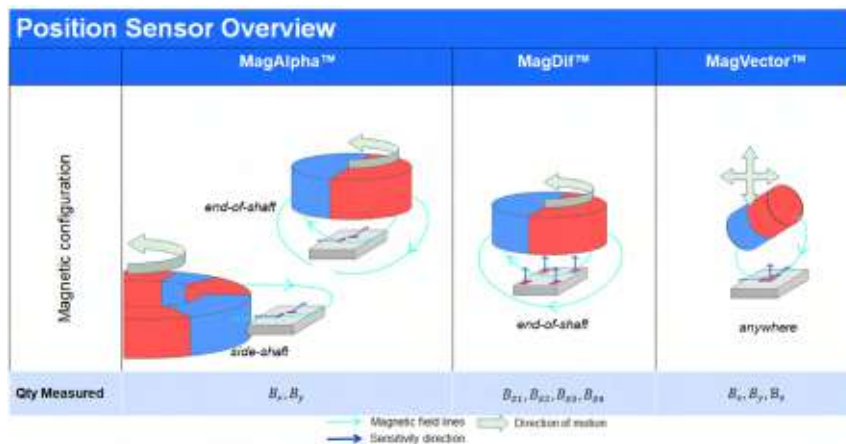


Figure 1: Magnet and Sensor Positioning

## Current Sensors

### Advantages of MPS Current Sensors:

- » Complete Isolated Current Sensors in SOIC-8 or WSOIC-10/16 packages
- » Ultra-Small QFN-12 (3mmx3mm) for Non-Isolated Applications
- » Lowest Primary Conductor Resistance for Higher Peak and Smaller Package
- » Wide Current-Sensing Range from  $\pm 5\text{A}$  to  $\pm 400\text{A}$ , AC or DC
- »  $\pm 2.5\%$  Accuracy over Temp, Factory-Trimmed
- » Immune to Stray Magnetic Fields via Differential Sensing
- » No Magnetic Hysteresis

MPS current sensors integrate galvanic isolation, high-voltage continuous operation, and high-current sensing into a small, industry-standard SOIC-8 or WSOIC-10/16 package. Our current sensors utilize an array of differential, linear Hall sensors that pick up the target induced magnetic field from the primary conductor while rejecting unwanted stray fields. This makes our current sensors ideal for use in magnetically noisy environments. In addition, the low resistance of the integrated conductor results in improved efficiency and reduced power loss compared to a traditional shunt resistor solution.

The primary conducting leads are electrically isolated from the sensor leads on the secondary side, producing a sensor with a high isolation voltage and working voltage. This makes our current sensors ideal for high-side current sensing without the need for expensive, large-footprint optical or inductive isolation alternatives.



MCS2804

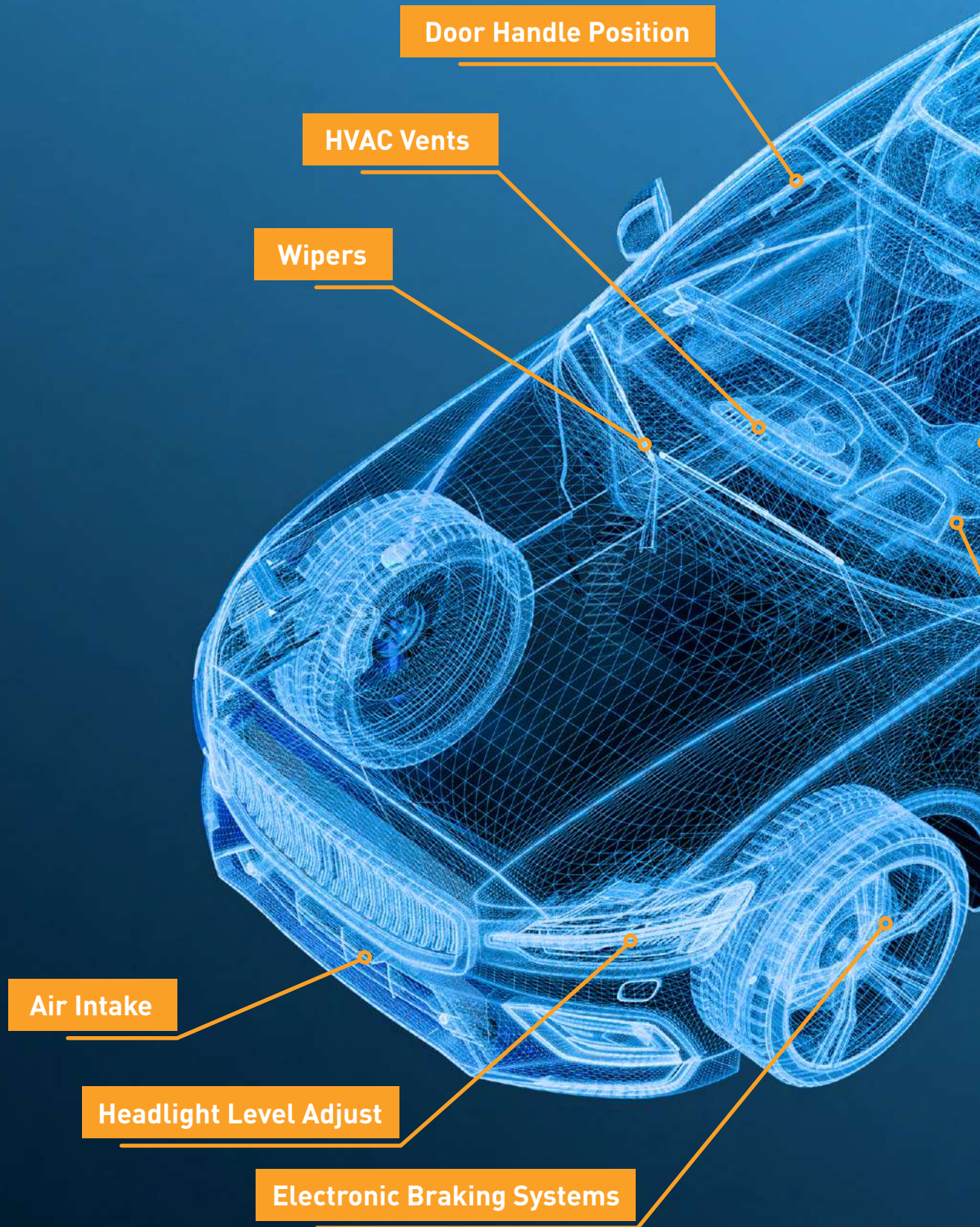


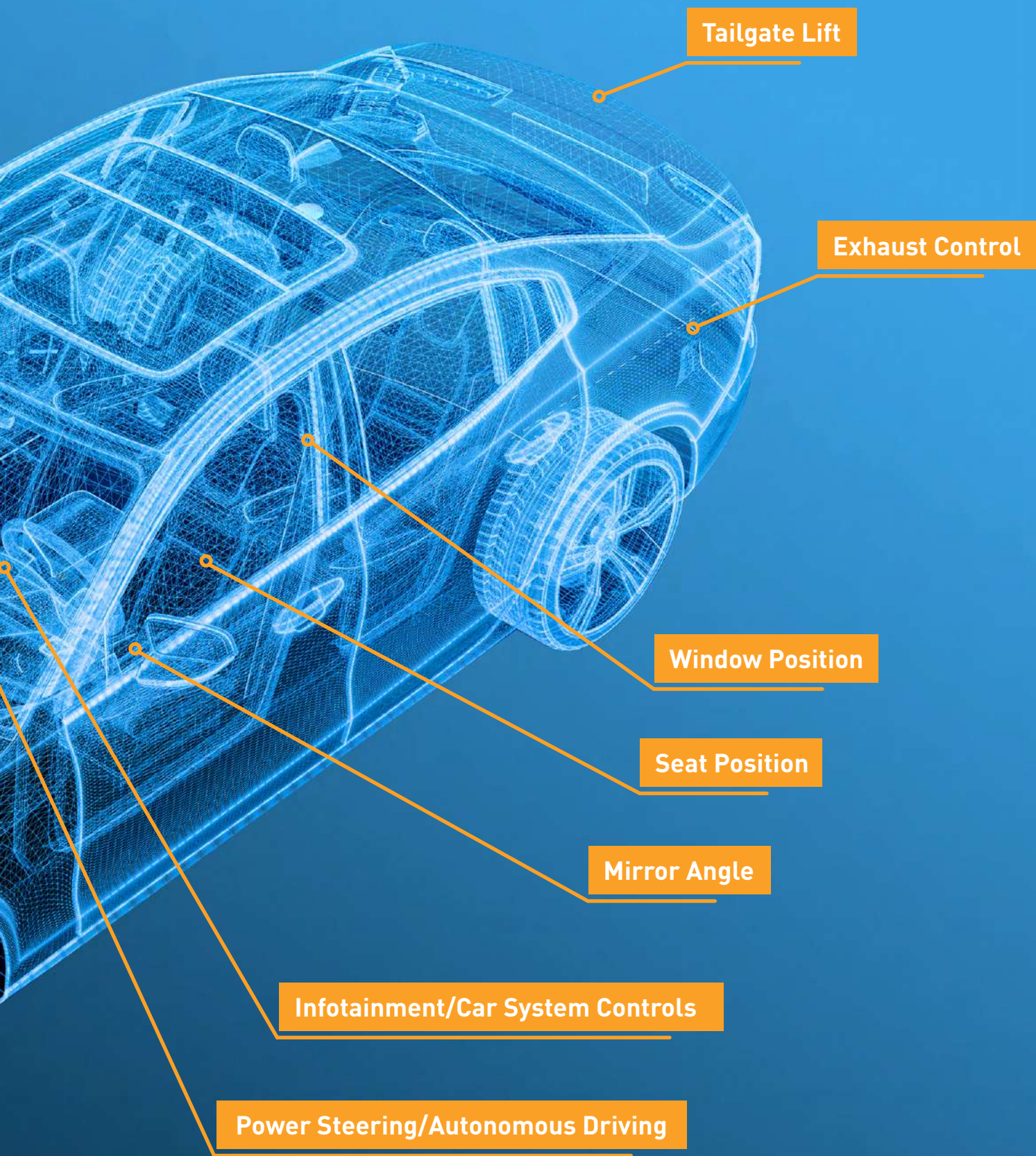
MCS1805/6



MCS1810/12

# Sensors for Motor Position/Speed Control and Current Sensors



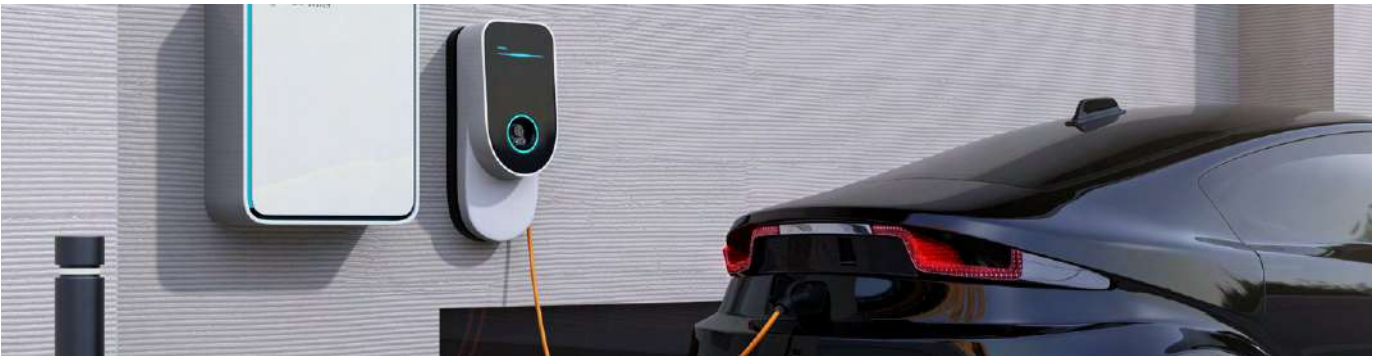


## Body Electronics



- » Retracting Door Handles
- » Tailgate Lifters
- » Suspension Sensors
- » Wiper Motors
- » Spoiler Actuation

## Power Management



- » Precision, High-Current Sensing and Control:
  - Wallbox Chargers
  - Qi Chargers
  - Power Monitoring Systems

## Thermal Management



- » Fluid Pumps
- » Air-Grill Shutters
- » Cooling Fan Modules



## Interior Cabin Control and Car Audio



- » Contactless Infotainment Consoles
- » Audio Amplifier Current Sensing
- » Contactless Gearshift Control
- » Seat Position Motor Control
- » Sunroof Motor Control

## Electronic Power Steering (EPS)

### Product Highlight

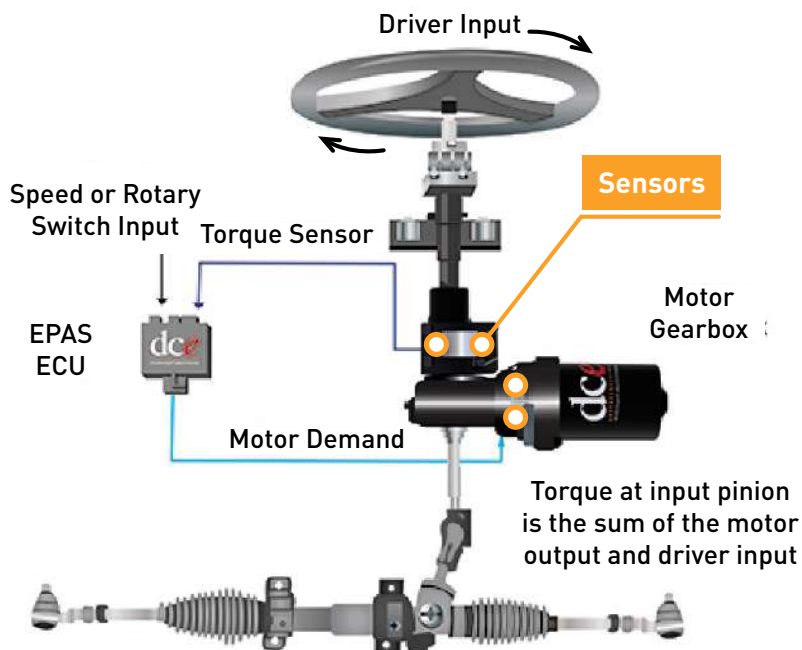
## Replace Optical Sensors in Automotive Power-Assisted Steering (PAS)

### MAQ600, MAQ473, and MAQ79010

- » Cost-Effective, Contactless Alternative to Optical Sensing
- » AEC-Q100 Grade 1 Qualified
- » Wide Operating Temperature Range: -40°C to +150°C


### MAQ79010

- » Differential Sensing, Immune to Stray Magnetic Fields in Excess of 4kA/m DC
- » ASIL-B Compliant with Functional Safety



## AUTOMOTIVE PRODUCT SELECTOR GUIDE

### Coreless Integrated Current Sensors

Part Number	Current Range (A)	V <sub>CC</sub> (V)	Over-Temp Accuracy	Temperature Range (°C)	Isolation Voltage (V <sub>RMS</sub> )	Working Voltage (V <sub>RMS</sub> )	Reinforced Isolation (V <sub>RMS</sub> )	Bandwidth (kHz)	Over-Current Detection	Voltage Reference	Primary Conductor Resistance (mΩ)	UL Certification 	Package	Notes
<b>N</b> MCQ1805	±5, ±10, ±20, ±30, ±40, ±50	3.3, 5	2.5%	-40 to +125	3000	500	-	100	✓	-	0.9	✓ + TUV	SOIC-8	AEC-Q100, coreless, ratiometric analog output, immune to external magnetic field gradients
<b>N</b> MCQ1806	±5, ±10, ±20, ±30, ±40, ±50	3.3, 5	2.5%	-40 to +125	3000	500	-	100	-	-	0.9	✓	SOIC-8	AEC-Q100, coreless, ratiometric analog output
<b>S</b> MCQ1810	±5, ±10, ±20, ±30, ±40, ±50, ±65, ±80, ±100	3.3, 5	2%	-40 to +150	5000	1100	560	350	✓	✓	0.3	Planned	SOIC-10W	AEC-Q100, coreless, low primary conductor resistance, bi- or unidirectional sensing, ratiometric or absolute analog output, OCD with 1μs response time
<b>S</b> MCQ1812	±5, ±10, ±20, ±30, ±40, ±50, ±60, ±70, ±80	3.3, 5	2%	-40 to +150	5000	1100	560	350	✓	✓	1.0	Planned	SOIC-16W	AEC-Q100, coreless, bi- or unidirectional sensing, ratiometric or absolute analog output, prog. OCD with 1μs response time
<b>N</b> MCQ1823	±5, ±10, ±20, ±30, ±40, ±50	3.3, 5	2.5%	-40 to +125	100	-	-	120	✓	-	0.6	✓	QFN-12 (3x3)	AEC-Q100, coreless, bi- or unidirectional sensing, ratiometric or absolute analog output, immune to external magnetic field gradients
<b>S</b> MCQ2803	±50, ±100, ±150, ±200, ±250, ±300, ±400	3.3, 5	3.5%	-40 to +150	5000	1000	475	150/300	-	-	0.1	Planned	5-Pin THM, 5-Pin SMT	AEC-Q100, bi- or unidirectional sensing, ratiometric or absolute analog output
<b>S</b> MCQ2804	±50, ±100, ±150, ±200, ±250, ±300, ±400	3.3, 5	3.5%	-40 to +150	5000	1000	475	150/300	✓	-	0.1	Planned	6-Pin THM, 6-Pin SMT	AEC-Q100, bi- or unidirectional sensing, ratiometric or absolute analog output, OCD with 1μs response time

### MagAlpha™ Magnetic Position Sensors

Part Number	±3σ Resolution	Interface	Supply Voltage (V)	Supply Current (mA)	Sensing Range (mT)	Cutoff Frequency (Hz)	Latency at Constant Speed (µs)	Magnetic Field Detection	Temperature Range (°C)	Package	Wettable Flanks	Notes
<b>MAQ430</b>	12-Bit	SPI, UVW, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	390	8	-	-40 to +150	QFN-16 (3x3)	✓	AEC-Q100, wettable flanks
<b>MAQ470</b>	12-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	390	8	✓	-40 to +150	QFN-16 (3x3)	✓	AEC-Q100, wettable flanks
<b>MAQ473</b>	10-Bit to 14-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	23 to 6k	8	✓	-40 to +150	QFN-16 (3x3)	✓	AEC-Q100, prog. filter, wettable flanks
<b>N MAQ600</b>	12-Bit to 15-Bit	SPI, ABZ, PWM, UVW, SSI	3 to 3.6	7	20+ (No Upper Limit)	75 to 17k	0	✓	-40 to +125	QFN-16 (3x3)	✓	AEC-Q100, TMR front-end, high accuracy & BW, 0.6° INL (<0.1° INL thru user calibration with 32-word lookup table), no speed error
<b>N MAQ800</b>	8-Bit	SPI, SSI	3 to 3.6	11.7	30+ (No Upper Limit)	90	4000	✓	-40 to +125	QFN-16 (3x3)	✓	Optimized for automotive HMI applications, SSI output, wettable flanks
<b>N MAQ820</b>	8-Bit	SPI, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	90	4000	✓	-40 to +125	QFN-16 (3x3)	✓	Optimized for automotive HMI applications, SSI output, wettable flanks
<b>N MAQ850</b>	8-Bit	SPI, PWM	3 to 3.6	11.7	30+ (No Upper Limit)	90	4000	✓	-40 to +125	QFN-16 (3x3)	✓	Optimized for automotive HMI applications, SSI output, wettable flanks

### MagDiff™ Magnetic Position Sensors with Stray Field Immunity

Part Number	±3σ Resolution	Interface	Supply Voltage (V)	Supply Current (mA)	Sensing Range (mT)	Cutoff Frequency (Hz)	Latency at Constant Speed (µs)	Magnetic Field Detection	Temperature Range (°C)	Package	Wettable Flanks	Notes
<b>S MAQ79010</b>	10-Bit to 14.5-Bit	SPI, SSI, I <sup>2</sup> C, UVW, SENT, ABZ	3.3, 5	12	8+ (No Upper Limit)	12 to 100k	0	✓	-40 to +150	QFN-16 (3x3)	✓	AEC-Q100, ASIL-B compliant, robust against parasitic stray fields >4kA/m DC, or 5mT, wettable flanks
<b>P MAQ79016</b>	10-Bit to 14.5-Bit	SPI, SSI, I <sup>2</sup> C, UVW, SENT, ABZ	Up to 26	12	8+ (No Upper Limit)	12 to 100k	0	✓	-40 to +150	QFN-16 (3x3)	✓	AEC-Q100, ASIL-B compliant, 26V with reverse polarity protection, robust against parasitic stray fields >4kA/m DC, or 5mT
<b>S MAQ900</b>	10-Bit to 14.5-Bit	SPI, SSI, I <sup>2</sup> C, UVW, SENT, ABZ	3.3, 5	12	8+ (No Upper Limit)	12 to 100k	0	✓	-40 to +150	QFN-16 (3x3)	✓	AEC-Q100, robust against parasitic stray fields >4kA/m DC, or 5mT

### MagVector™ 3D Magnetic Position Sensors

Part Number	Data Length	Interface	Supply Voltage (V)	Supply Current (mA)	Sensing Range (mT)	Conversion Time (µs)	Temperature Range (°C)	Package	Notes
<b>P MVQ310</b>	12-bit	I <sup>2</sup> C, SPI	3.3	25nA to 2.3	±125 or ±250	40	-40 to +150	TSOT23-6	AEC-Q100, digital component output, selectable operating power modes and sensing axis

# INDUSTRIAL BUILDING & FACTORY AUTOMATION



## Safety & Security



- » Access Control
- » Automated Doors
- » Smart Door Locks
- » Elevators and Escalators
- » Fire Prevention

## Power Management



- » Solar Inverters
- » Power Monitoring
- » Power Access
- » Light Monitoring

# Solar Inverters



## Product Highlight

### Maintain Maximum Power Point Tracking

#### MCS1805, MCS1806, and MCS1810

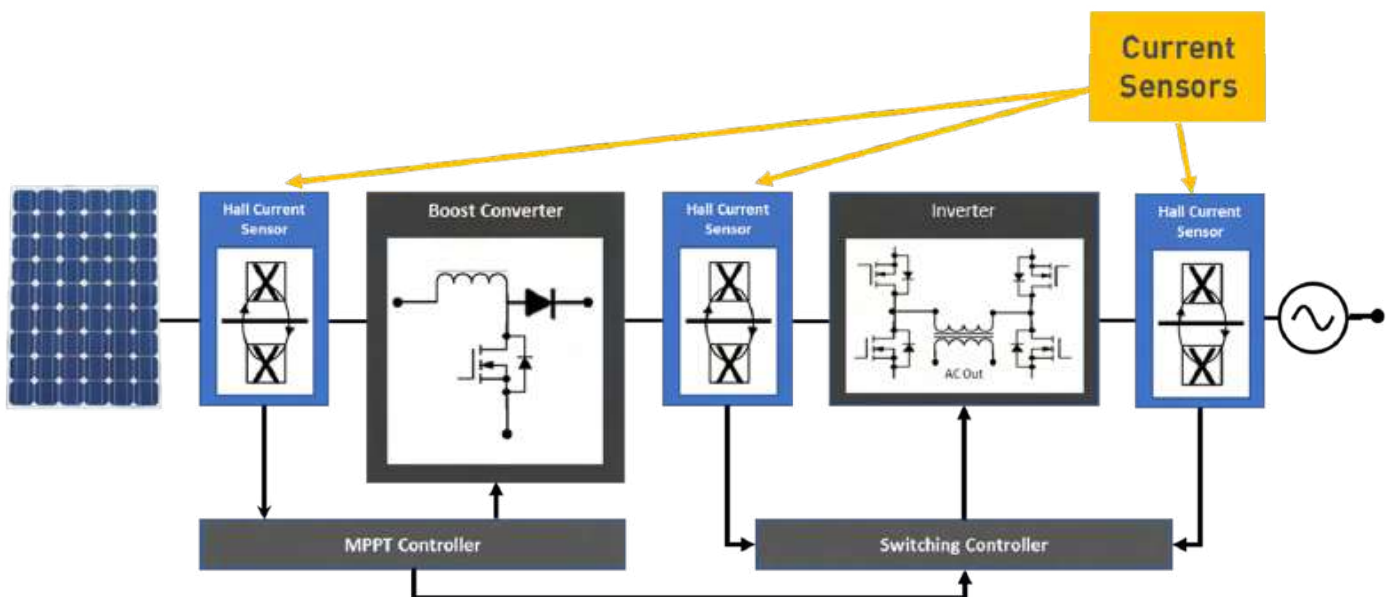
- » Accurate High-Side or Low-Side Current Sensing
- » Up to 3kV<sub>RMS</sub> High Isolation from Line Voltage
- » Fast Over-Current Detection Flag <1μs
- » UL Certified

#### Boost Modules

- » Accurate Current Sampling to Detect the Power Output from the PV Cells
- » Control the PWM Duty Cycle to Increase or Decrease the Downstream Impedance

#### Inverter Stage

- » Accurately Track Current Phase to Match Line Current
- » Accurately Track Power Delivered to the Line



## Climate & Energy Efficiency



- » Shutters and Blinds
- » HVAC – Compressors, Blowers, Flow Control
- » Climate Control – Thermostats
- » Lighting Dimmer Control

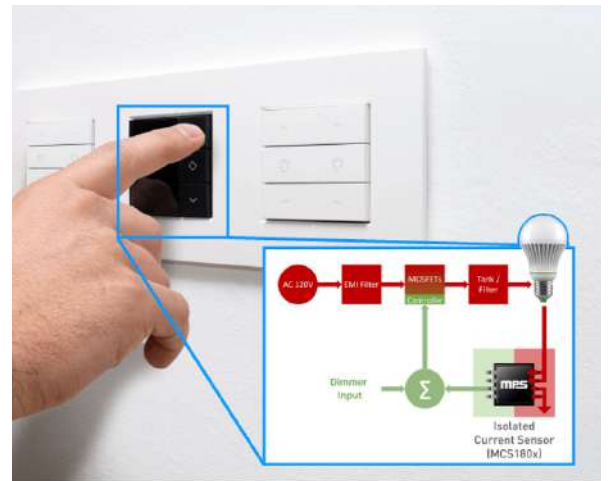
### Product Highlight

## Smart Lighting Dimmers



### MCS1806

- » Direct Sensing in Industry-standard 8-Pin SOIC Package
- » Wide Sensing Range from  $\pm 5A$  to  $\pm 50A$
- » Low  $0.9m\Omega$  Primary Conductor Resistance
- »  $3000V_{RMS}$  Isolation

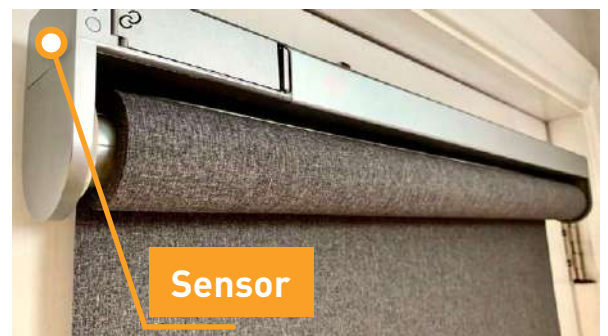


### Product Highlight

## Smart Shades

### MA732, MA330, MA735, MA736, and MA782

- » Motor Commutation and/or Position Feedback
- » Provides Absolute Feedback
- » Operates with a Low-Cost Magnet
- » Works with All Types of Motors
- » Can Be Operated at Side-Shaft or End-of-Shaft Locations
- » Ideal for Space-Constrained Applications
  - MA735, MA736, MA782: UTQFN (2mmx2mm) Package
- » MA782 Is Ideal for Battery-Powered Applications
  - Includes Wake-Up on Angle Detection
  - $0.5\mu A$  Standby Current





## Product Highlight

### Precision Robotic Joint Control

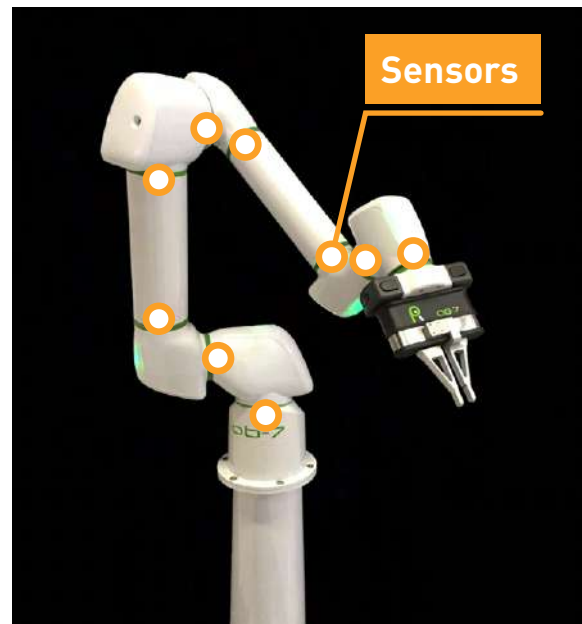
#### MA600 and MA900

##### MA600:

- » Factory-Calibrated:  $0.6^\circ$  Error (INL) over Temp
- »  $<0.1^\circ$  Error (INL) after User Calibration with On-Board Chip Look-Up Table
- » 12-Bit to 15-Bit Noise-Free Resolution
- » 21kHz Bandwidth
- » Zero Latency to Minimize Speed Errors

##### MA900:

- » Differential Sensing, Immune to Stray Magnetic Fields in Excess of 4kA/m DC
- » 10-Bit to 14.5-Bit Noise-Free Resolution
- » Available in a Tiny QFN-16 (3mmx3mm) Package



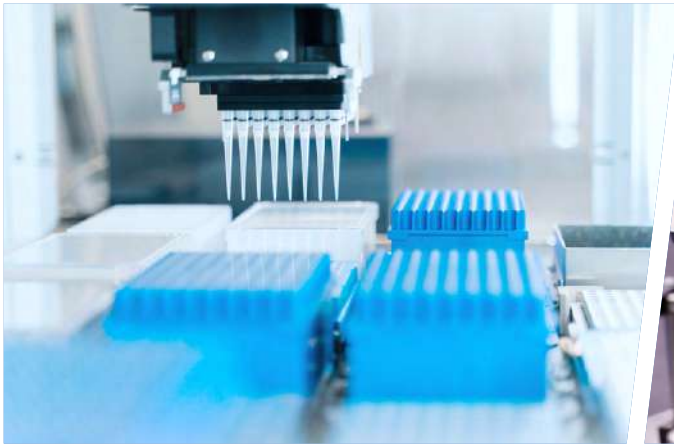
#### Cost-Effective Solution for Managing:

- » High-Speed Torque
- » Position
- » Speed Control

# MEDICAL TECHNOLOGY



## Lab Automation



- » Robot Control
- » Probe Processing
- » Pump Motor Control
  - Infusion Pumps
  - Insulin Pumps



## Surgical Robotics



- » Automated and Remote Surgical Robots
- » Dental Processing

### Product Highlight

## Surgical Robotics

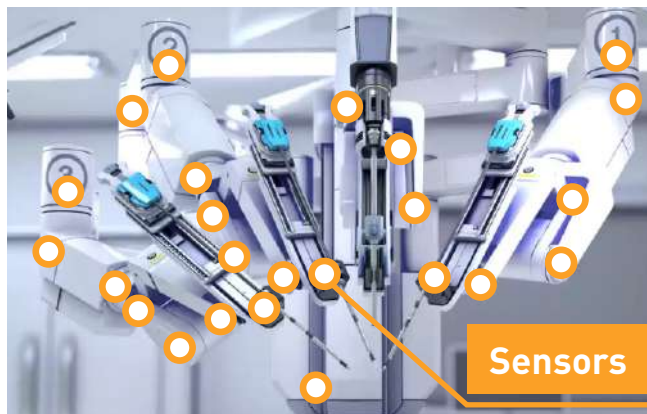
### MA600 and MA900

#### MA600:

- » Factory-Calibrated: 0.6° Error (INL) over Temp
- » <math><0.1^\circ</math> Error (INL) after User Calibration with On-Board Chip Look-Up Table
- » 12-Bit to 15-Bit Noise-Free Resolution
- » 21kHz Bandwidth
- » Zero Latency to Minimize Speed Errors

#### MA900:

- » Differential Sensing, Immune to Stray Magnetic Fields in Excess of 4kA/m DC
- » 10-Bit to 14.5-Bit Noise-Free Resolution
- » Available in a Tiny QFN-16 (3mmx3mm) Package



#### Cost-Effective Solution for Managing:

- » High-Speed Torque
- » Position
- » Speed Control

# Insulin Pumps



## Product Highlight

### Accuracy and Reliability in Tiny Form Factor

#### MA980

- » 9-Bit To 13-Bit Absolute Resolution
- » Differential Sensing Rejects Stray Fields
- »  $\mu$ Power Operation through Duty Cycle Control
- » CSP-16 (1.6mmx1.6mm) Package Is Ideal for Space-Constrained Applications

# CONSUMER PRODUCTS



## Mobile Phones, Laptops, and VR Headsets



- » Foldable Mobile Flip-Phone Angle Management
- » Foldable Tablet Angle Sensing
- » Precision Open/Close Angle Management
- » HMI Contactless Knobs & Buttons

Product Highlight

## No-Bezel Laptops and Foldable Phones

### MA782

- » Smallest Open/Close Detection Solution
- » Helps Minimize or Eliminate Bezel
- » Can Be Placed in the Folding Axis
- » Smallest UTQFN (2mmx2mm) Package
- » Lowest Power: <math><0.5\mu\text{A}</math> Standby Current
- » Wake-On-Change Angle Detection
- » Very Small (<math><1\text{mm}\times 1\text{mm}</math>) Magnet
- » Provides Absolute Angle Output



## Kitchen Appliances/Mixers with Cooking Options



Product Highlight

### Main Motor Position Detection

#### MA732, MA735, MA736, and MA900

- » Motor Commutation and/or Position Feedback
- » Ideal for Space-Constraint Applications
  - MA735, MA736: UTQFN (2mmx2mm) Package
- » Differential Sensing Rejects Stray Fields
  - MA900: End-of-Shaft Only

### Control and Menu Buttons

#### MA800

- » Contactless Sensing for Long Life with No Wear
- » 8-Bit Resolution Absolute Angle Encoder
- » Push and Pull Detection with Configurable Thresholds

### Secure Lid Closure Detection

#### MV300, MV310

- » Senses Position of Magnets in Lid
- » Flexible I<sup>2</sup>C or SPI Interface

### Current Sensing (Heating, Motor Control, Power Supplies)

#### MCS1806

- » Complete Isolated Current Sensor
- » Wide Sensing Range
  - $\pm 5\text{A}$  to  $\pm 50\text{A}$ , AC or DC

## E-Bikes & Scooters



- » BLDC Motors – Smaller, Lighter, Increased Reliability
- » Enables Highest Power Density
- » Provides Absolute Angle, Position, and Torque

### Flexible Interface:

- » SPI Commutation for UVW Commutation
- » ABZ Speed Control

### Product Highlight

## E-Bike Ultra-Small BLDC Motors


### MA302

- » Speed, Torque, and Absolute Position Control
- » Smallest QFN (3mmx3mm) Package
- » No Customer Calibration Required
- » Factory Calibrated
- » On-Chip Non-Volatile Memory (NVM)
- » Wide -40°C to +125°C Operating Temp Range
- » Flexible Interface
  - SPI for Digital Angle Readout and Sensor Configuration
  - ABZ/UVW for Motor Control, Commutation, and Incremental Output
  - No Firmware Changes Required when Replacing Optical Encoders; ABZ Output is Compatible with Optical Outputs



# CONSUMER & INDUSTRIAL PRODUCT SELECTOR GUIDE

## Integrated Current Sensors

Part Number	Current Range (A)	V <sub>CC</sub> (V)		Over-Temp Accuracy	Temperature Range (°C)	Isolation Voltage (V <sub>RMS</sub> )	Working Voltage (V <sub>RMS</sub> )	Reinforced Isolation (V <sub>RMS</sub> )	Bandwidth (kHz)	Over-Current Detection	Voltage Reference	Primary Conductor Resistance (mΩ)	UL Certification 	Package	Notes
<b>MCS1800</b>	±12.5, ±25	3.3	3%	-40 to +125	1000	200	-	100	-	-	1.2	-	SOIC-8	Coreless, ratiometric analog output	
<b>MCS1801</b>	±12.5, ±25	5	3%	-40 to +125	1000	200	-	100	-	-	1.2	-	SOIC-8	Coreless, ratiometric analog output	
<b>MCS1802</b>	±5, ±10, ±20, ±30, ±40, ±50	3.3	2.5%	-40 to +125	2200	250	-	100	-	-	0.9	✓	SOIC-8	Coreless, ratiometric analog output	
<b>MCS1803</b>	±5, ±10, ±20, ±30, ±40, ±50	5	2.5%	-40 to +125	2200	250	-	100	-	-	0.9	✓	SOIC-8	Coreless, ratiometric analog output	
<b>N</b> <b>MCS1805</b>	±5, ±10, ±20, ±30, ±40, ±50	3.3, 5	2.5%	-40 to +125	3000	500	-	100	✓	-	0.9	✓ + TUV	SOIC-8	Coreless, ratiometric analog output, immune to external magnetic field gradients	
<b>MCS1806</b>	±5, ±10, ±20, ±30, ±40, ±50	3.3, 5	2.5%	-40 to +125	3000	500	-	100	-	-	0.9	✓	SOIC-8	Coreless, ratiometric analog output	
<b>S</b> <b>MCS1810</b>	±5, ±10, ±20, ±30, ±40, ±50, ±65, ±80, ±100	3.3, 5	2%	-40 to +125	5000	1100	560	350	✓	✓	0.3	Planned	SOIC-10W	Coreless, low primary conductor resistance, bi- or unidirectional sensing, ratiometric or absolute analog output, prog. OCD with 1µs response time	
<b>S</b> <b>MCS1812</b>	±5, ±10, ±20, ±30, ±40, ±50, ±60, ±70, ±80	3.3, 5	2%	-40 to +125	5000	1100	560	350	✓	✓	1.0	Planned	SOIC-16W	Coreless, bi- or unidirectional sensing, ratiometric or absolute analog output, prog. OCD with 1µs response time	
<b>N</b> <b>MCS1823</b>	±5, ±10, ±20, ±30, ±40, ±50	3.3, 5	2.5%	-40 to +125	100	N/A	-	120	✓	-	0.6	✓	QFN-12 (3x3)	Coreless, bi- or unidirectional sensing, ratiometric or absolute analog output, immune to external magnetic field gradients	
<b>N</b> <b>MCS1826</b>	±15.5, ±31	3.3 to 5	3%	-40 to +125	100	N/A	-	120	✓	-	0.6	✓	QFN-12 (3x3)	Coreless, bidirectional sensing, ratiometric analog output, immune to external magnetic field gradients	
<b>S</b> <b>MCS2803</b>	±50, ±100, ±150, ±200, ±250, ±300, ±400	3.3, 5	3.5%	-40 to +150	5000	1000	475	150 /300	-	-	0.1	Planned	5-Pin THM, 5-Pin SMT	Bi- or unidirectional sensing, ratiometric or absolute analog output	
<b>S</b> <b>MCS2804</b>	±50, ±100, ±150, ±200, ±250, ±300, ±400	3.3, 5	3.5%	-40 to +150	5000	1000	475	150 /300	✓	-	0.1	Planned	6-Pin THM, 6-Pin SMT	Bi- or unidirectional sensing, ratiometric or absolute analog output, prog. OCD with 1µs response time	

### MagVector™ 3D Magnetic Position Sensors

	Part Number	Data Length	Interface	Supply Voltage (V)	Supply Current (mA)	Sensing Range (mT)	Conversion Time (µs)	Temperature Range (°C)	Package	Notes
N	<b>MV300</b>	12-Bit	I <sup>2</sup> C, SPI	3.3	10nA to 2.5	±50 or ±180	40	-40 to +125	TSOT23-6	Digital component output, selectable operating power modes
P	<b>MV310</b>	12-Bit	I <sup>2</sup> C, SPI	3.3	25nA to 2.3	±125 or ±250	40	-40 to +125	TSOT23-6	Digital component output, selectable operating power modes and sensing axis

### MagDiff™ Magnetic Position Sensors with Stray Field Immunity

	Part Number	±3σ Resolution	Interface	Supply Voltage (V)	Supply Current (mA)	Sensing Range (mT)	Cutoff Frequency (Hz)	Latency at Constant Speed (µs)	Temperature Range (°C)	Package	Notes
S	<b>MA900</b>	10-Bit to 14.5-Bit	SPI, SSI, I <sup>2</sup> C, UVW, ABZ	3.3, 5	12	8+ (No Upper Limit)	12 to 100k	0	-40 to +125	QFN-16 (3x3)	Robust against parasitic stray fields exceeding 4kA/m DC, or 5mT
P	<b>MA980</b>	9-Bit to 13-Bit	SPI	3.3, 5	25µA	8+ (No Upper Limit)	5 to 160k	0	-40 to +125	WLCSP (1.6x1.6)	Micropower, smallest footprint, robust against parasitic stray fields

### MagAlpha™ Magnetic Position Sensors

	Part Number	±3σ Resolution	Interface	Supply Voltage (V)	Supply Current (mA)	Sensing Range (mT)	Cutoff Frequency (Hz)	Latency at Constant Speed (µs)	Temperature Range (°C)	Package	Notes
	<b>MA102</b>	12-Bit	SPI, UVW	3 to 3.6	11.7	30+ (No Upper Limit)	390	8	-40 to +125	QFN-16 (3x3)	Motor commutation angle sensor, UVW multi-pole pair, differential outputs
	<b>MA302</b>	12-Bit	SPI, UVW, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	390	8	-40 to +125	QFN-16 (3x3)	Motor commutation angle sensor, 12-bit SPI output, ABZ & UVW incremental outputs
	<b>MA310</b>	12-Bit	SPI, UVW, ABZ	3 to 3.6	11.7	15+ (No Upper Limit)	93	8	-40 to +125	QFN-16 (3x3)	Motor commutation angle sensor, 12-bit SPI output, low magnetic field
	<b>MA330</b>	10-Bit to 14-Bit	SPI, UVW, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	23 to 6k	8	-40 to +125	QFN-16 (3x3)	Motor commutation angle sensor, up to 14-bit SPI output, programmable filter
N	<b>MA600</b>	12-Bit to 15-Bit	SPI, ABZ, PWM, UVW, SSI	3 to 3.6	7	20+ (No Upper Limit)	75 to 17k	0	-40 to +125	QFN-16 (3x3)	TMR front-end high accuracy & BW, 0.6° INL (<0.1° INL thru user calibration with 32-word lookup table), no speed error
	<b>MA702</b>	12-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	390	8	-40 to +125	QFN-16 (3x3)	12-bit SPI output, ABZ incremental & PWM outputs
	<b>MA704</b>	10-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	2970	8	-40 to +125	QFN-16 (3x3)	12-bit SPI output, high BW, ABZ incremental & PWM outputs

MagAlpha™ Magnetic Position Sensors

Part Number	±3σ Resolution	Interface	Supply Voltage (V)		Supply Current (mA)	Sensing Range (mT)	Cutoff Frequency (Hz)	Latency at Constant Speed (µs)	Temperature Range (°C)	Package	Notes
<b>MA710</b>	12-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	15+ (No Upper Limit)	93	8	-40 to +125	QFN-16 (3x3)	12-bit SPI output, low magnetic field, ABZ incremental & PWM outputs	
<b>MA730</b>	14-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	40+ (No Upper Limit)	23	8	-40 to +125	QFN-16 (3x3)	14-bit SPI output, ABZ incremental & PWM outputs	
<b>MA732</b>	10-Bit to 14-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	23 to 6k	8	-40 to +125	QFN-16 (3x3)	Prog. filter, ABZ incremental & PWM outputs	
<b>MA734</b>	8-Bit to 12.5-Bit	SPI	3 to 3.6	11	30+ (No Upper Limit)	95, 380, 95k	3	-40 to +125	QFN-16 (3x3)	Prog. filter, low latency	
<b>MA735</b>	9-Bit to 13-Bit	SPI, SSI, PWM, ABZ	3 to 3.6	11.7	40+ (No Upper Limit)	23 to 6k	8	-40 to +125	UTQFN-14 (2x2)	Ultra-small footprint, prog. filter, ABZ incremental & PWM outputs	
<b>MA736</b>	8-Bit to 12.5-Bit	SPI	3 to 3.6	11	30+ (No Upper Limit)	95, 380, 95k	3	-40 to +125	UTQFN-14 (2x2)	Ultra-small footprint, prog. filter, low latency	
<b>MA780</b>	8-Bit to 12-Bit	SPI	3 to 3.6	0.5µA to 10	30+ (No Upper Limit)	5 to 160k	4 to 4000	-40 to +125	QFN-16 (3x3)	Optimized for low-power, integrated wake-up and IRQ	
<b>MA782</b>	8-Bit to 12-Bit	SPI	3 to 3.6	0.5µA to 10	30+ (No Upper Limit)	5 to 160k	4 to 4000	-40 to +125	UTQFN-14 (2x2)	Micropower, ultra-small footprint, integrated wake-up and IRQ	
<b>MA800</b>	8-Bit	SPI, SSI	3 to 3.6	11.7	30+ (No Upper Limit)	90	4000	-40 to +125	QFN-16 (3x3)	Optimized for HMI applications	
<b>MA820</b>	8-Bit	SPI, ABZ	3 to 3.6	11.7	30+ (No Upper Limit)	90	4000	-40 to +125	QFN-16 (3x3)	Optimized for HMI applications	
<b>MA850</b>	8-Bit	SPI, PWM	3 to 3.6	11.7	30+ (No Upper Limit)	90	4000	-40 to +125	QFN-16 (3x3)	Optimized for HMI applications	



Position Sensor Magnets

Part Number	Magnetization	Geometry	Material	OD (mm)	ID (mm)	Height (mm)	Air Gap Min (mm)	Air Gap Max (mm)	Radial Tolerance (mm)	Notes
<b>MAG10-2C-30.25</b>	Diametrical	Cylinder	NdFeB, Grade N35SH	3	-	2.5	0	2	0.1	-
<b>MAG10-2C-40.25</b>	Diametrical	Cylinder	NdFeB, Grade N35SH	4	-	2.5	0	2.6	0.2	Standard-size, cost-effective
<b>MAG10-2C-50.25</b>	Diametrical	Cylinder	NdFeB, Grade N35SH	5	-	2.5	0	3.1	0.2	Standard-size, cost-effective
<b>MAG10-2C-60.25</b>	Diametrical	Cylinder	NdFeB, Grade N35SH	6	-	2.5	0	3.6	0.3	-
<b>MAG10-2C-80.25</b>	Diametrical	Cylinder	NdFeB, Grade N35SH	8	-	2.5	0	4.5	0.4	-
<b>MAG10-2R-50.12.25</b>	Diametrical	Ring	NdFeB, Grade N35SH	5	1.25	2.5	1	1.4	0.4	Accurate application
<b>MAG10-2R-60.15.25</b>	Diametrical	Ring	NdFeB, Grade N35SH	6	1.5	2.5	1.3	1.6	0.6	Accurate application
<b>MAG10-2R-80.20.25</b>	Diametrical	Ring	NdFeB, Grade N35SH	8	2	2.5	2	2.5	0.8	Accurate application
<b>MAG10-2B-40.25</b>	Axial	Half-Cylinder	NdFeB, Grade N35SH	4	-	2.5	0	2.1	<0.1	Low field emission
<b>MAG10-2B-50.25</b>	Axial	Half-Cylinder	NdFeB, Grade N35SH	5	-	2.5	0	2.7	<0.1	Low field emission
<b>MAG10-2B-60.25</b>	Axial	Half-Cylinder	NdFeB, Grade N35SH	6	-	2.5	0	3.2	<0.1	Low field emission
<b>MAG10-2B-80.25</b>	Axial	Half-Cylinder	NdFeB, Grade N35SH	8	-	2.5	0	4.2	0.1	Low field emission

## ABOUT MONOLITHIC POWER SYSTEMS

### Who we are

We are creative thinkers. We break boundaries. We take technology to new levels. As a leading international semiconductor company, Monolithic Power Systems (MPS) creates cutting-edge solutions to improve the quality of life with green, easy-to-use products.

### What we do

We make power design fun! With our innovative proprietary technology processes, we thrive on reimagining and redefining the possibilities of high-performance power solutions in industrial applications, telecom infrastructures, cloud computing, automotive, and consumer applications.

### Where we come from

It started with a vision. Michael Hsing, pioneering engineer and CEO, founded Monolithic Power Systems, Inc. in 1997 with the belief that an entire power system could be integrated onto a single chip. Under his leadership, MPS has succeeded not only in developing a monolithic power module that truly integrates an entire power system in a single package, but also it continues to defy industry expectations with its patented groundbreaking technologies.

### Our values

#### We cultivate creativity

As a company, we believe in creating an environment that encourages and challenges our employees to collaborate and think outside the box to excel beyond their preconceived capabilities.

#### We do not accept the status quo

We do not believe in limitations. It is not about what is, but what can be. Possibilities are endless at MPS.

#### We are passionate about sustainability

It's about the future. From materials to finances, we are committed to conservation. We will not tolerate waste in an effort to improve and preserve the quality of life.

#### We are committed to providing innovative products to our customers

Let us do the heavy lifting. We relentlessly strive to make system design versatile and effortless to meet our customers' specific needs. We'll do the work, so our customers can have the fun!

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