# SENSOR SOLUTIONS

Designed for Applications In:

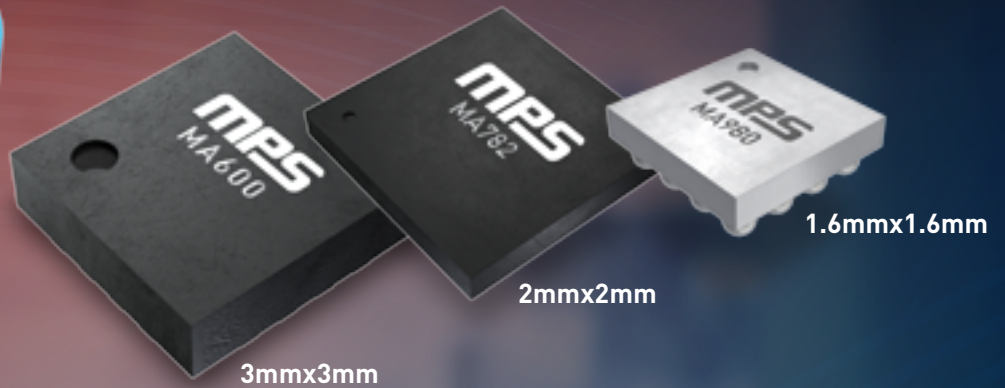>> AUTOMOTIVE >> INDUSTRIAL >> MEDICAL >> CONSUMER
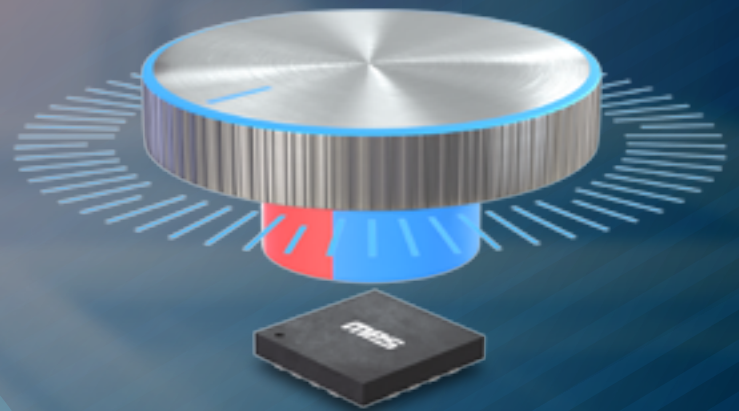
**POSITION SENSING**

MPS MA600

MPS MA782

MPS MA980

1.6mmx1.6mm

2mmx2mm

3mmx3mm

**CURRENT SENSING**

MPS MCS1810

**HMI**

MPS

0   V   VCC

## 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

# In This Guide

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

**Advantages of MagAlpha™ & MagDiff™ Sensors:**

» Instantaneous, Absolute Angle Sensing
» High Resolution
» Factory-Calibrated Low Error (INL): <0.6°
» Less than 0.1° Error (INL) with In-System Calibration
» 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 andprovides 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.
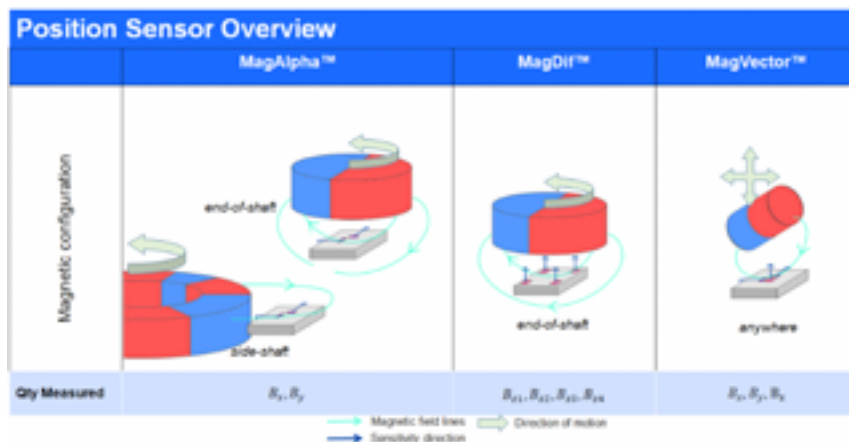


**Figure 1: Magnet and Sensor Positioning**

# 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 ±5A to ±400A, AC or DC
» ±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

Door Handle Position

HVAC Vents

Wipers

Air Intake

Headlight Level Adjust

Electronic Braking Systems

**Tailgate Lift**

**Exhaust Control**

**Window Position**

**Seat Position**

**Mirror Angle**

**Infotainment/Car System Controls**

**Power Steering/Autonomous Driving**
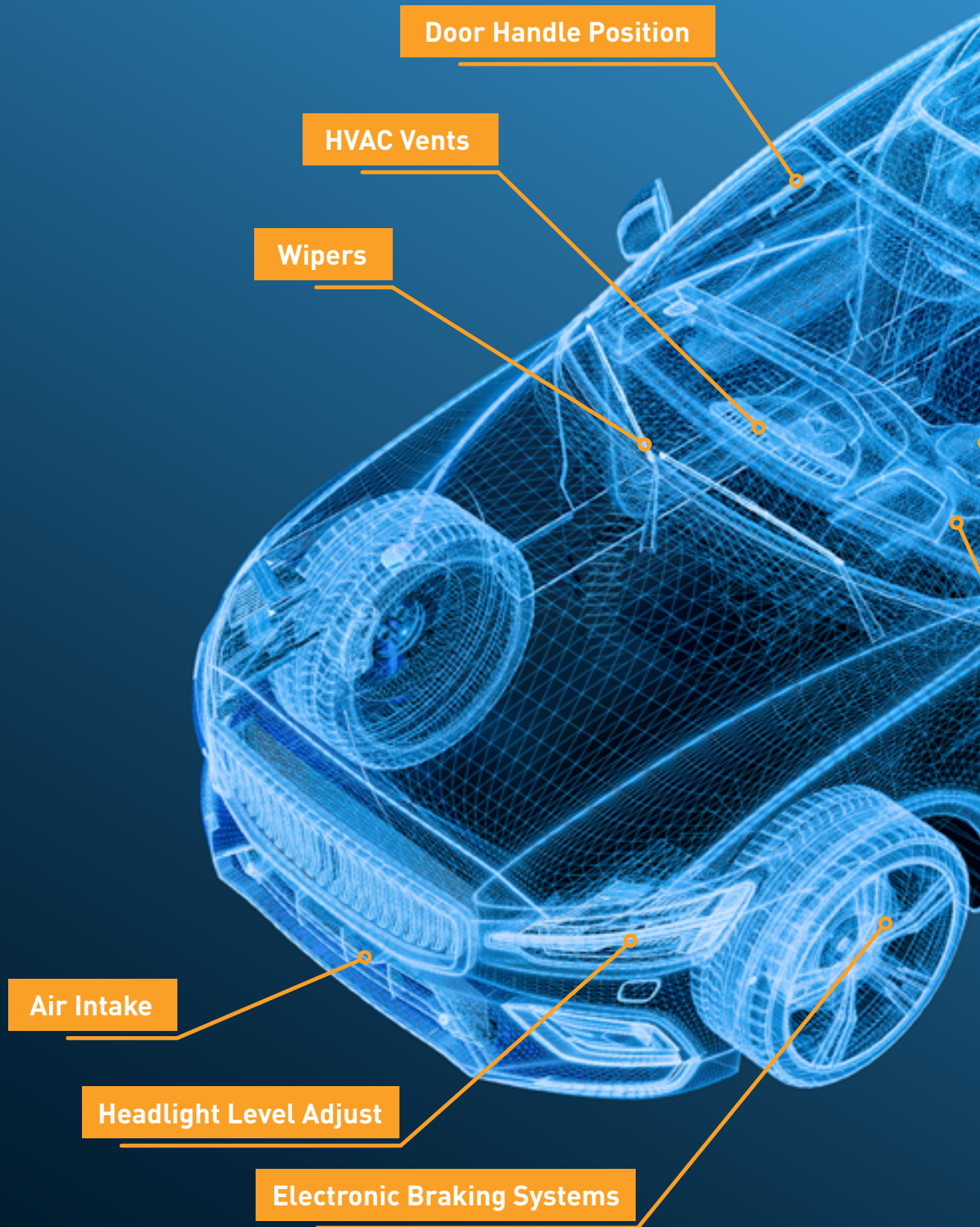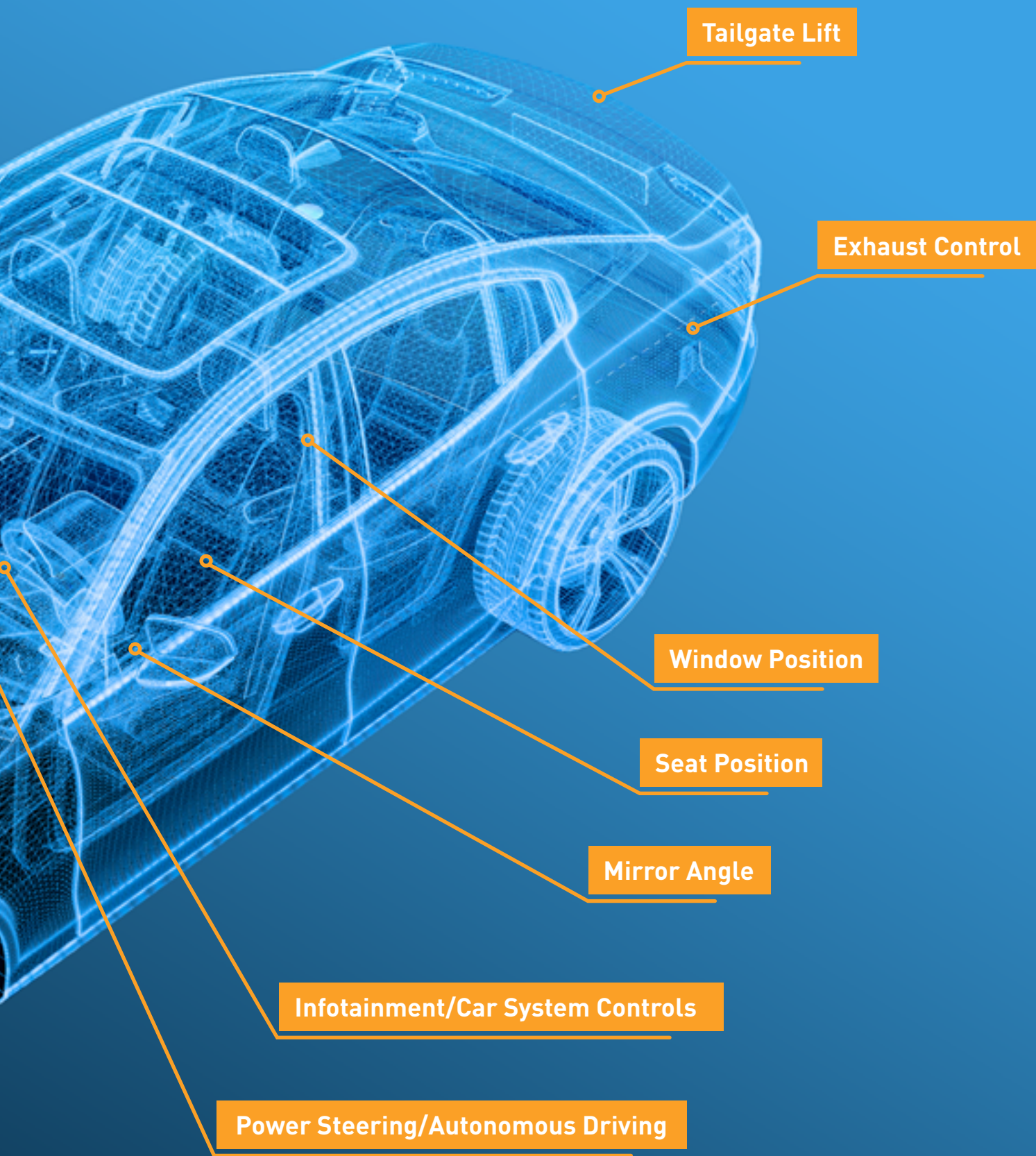
# Body Electronics




» **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



Driver Input

Speed or Rotary Switch Input

Torque Sensor

Sensors

EPAS ECU

Motor Gearbox

Motor Demand

Torque at input pinion is the sum of the motor output and driver input
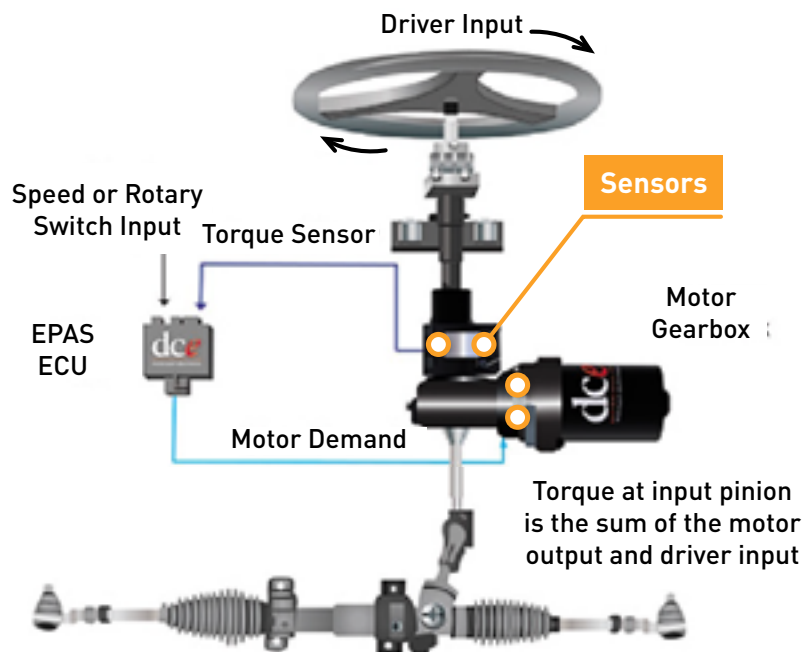
## AUTOMOTIVE PRODUCT SELECTOR GUIDE

**Coreless Integrated Current Sensors**

| Part Number | Current Range (A) | $V_{cc}$ (V) | Over-Temp Accuracy | Temperature Range (°C) | Isolation Voltage ($V_{RMS}$) | Working Voltage ($V_{RMS}$) | Reinforced Isolation ($V_{RMS}$) | Bandwidth (kHz) | Over-Current Detection | Voltage Reference | Primary Conductor Resistance (mΩ) | UL Certification | Package | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (N) 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 |
| (N) 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, ratiomentric analog output |
| (P) 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 |
| (P) 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 |
| (N) 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 |
| (S) 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 |
| (S) 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MAQ430** | 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 |
| **MAQ470** | 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 |
| **MAQ473** | 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 |
| Ⓝ **MAQ600** | 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 |
| Ⓝ **MAQ800** | 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 |
| Ⓝ **MAQ820** | 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 |
| Ⓝ **MAQ850** | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ⓢ **MAQ79010** | 10-Bit to 14.5-Bit | SPI, SSI, I²C, 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 |
| Ⓟ **MAQ79016** | 10-Bit to 14.5-Bit | SPI, SSI, I²C, 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 polatity protection, robust against parasitic stray fields >4kA/m DC, or 5mT |
| Ⓢ **MAQ900** | 10-Bit to 14.5-Bit | SPI, SSI, I²C, 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 |
|---|---|---|---|---|---|---|---|---|---|
| Ⓟ **MVQ310** | 12-bit | I²C, 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 |

Ⓝ - New Product   Ⓢ - Sampling Product   Ⓟ - Preview Product

# 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

**MCS1823, MCS1805, and MCS1806**

» Accurate High-Side or Low-Side Current Sensing
» Up to $3kV_{RMS}$ 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
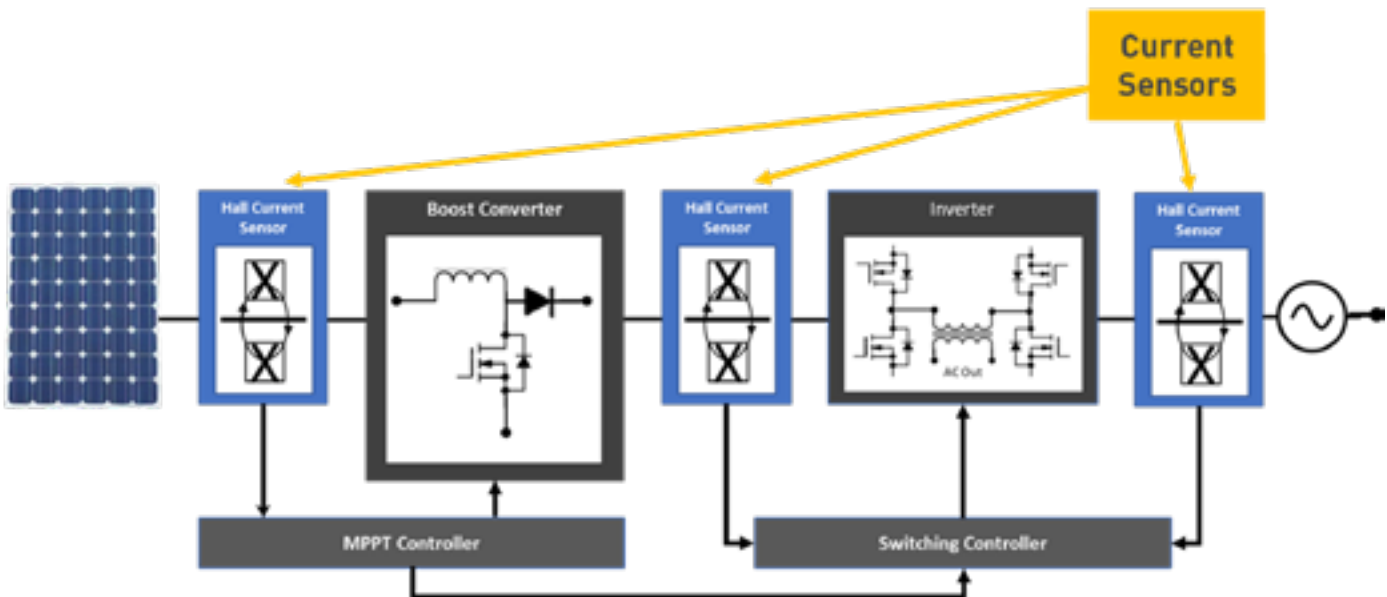
# Climate & Energy Efficiency



- » **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 ±5A to ±50A
- » Low 0.9mΩ Primary Conductor Resistance
- » $3000V_{RMS}$ Isolation
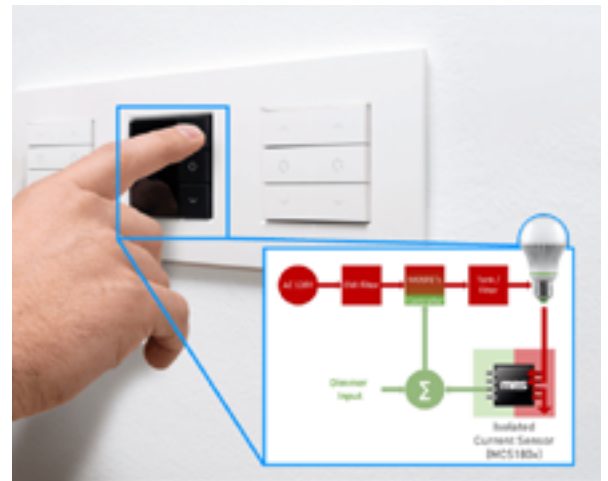


**Product Highlight**

## 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
  - 0.5µA Standby Current



**Sensor**

# Industrial Automation
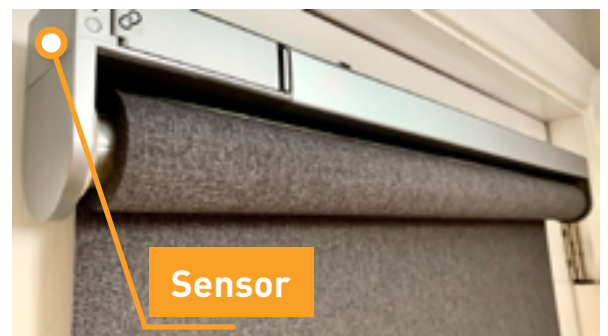
**Product Highlight**

## Precision Robotic Joint Control

**MA600 and MA900**

**MA600:**

» Factory-Calibrated: 0.6° Error (INL) over Temp
» <0.1° 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
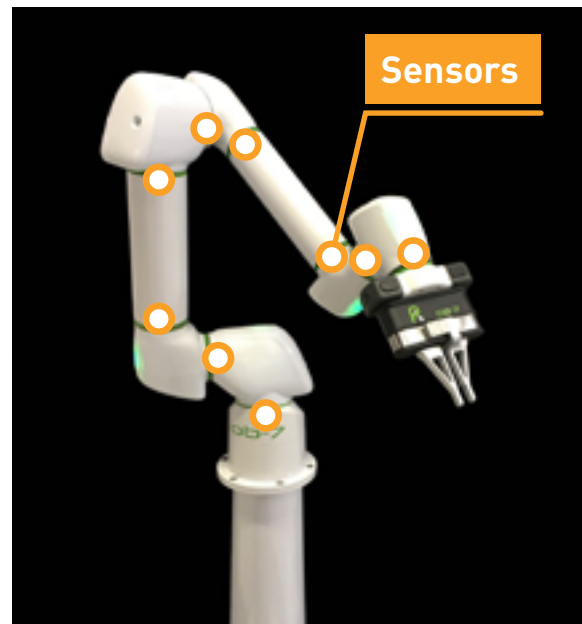


Cost-Effective Solution for Managing:
» High-Speed Torque
» Position
» Speed Control

# MEDICAL TECHNOLOGY



## Lab Automation
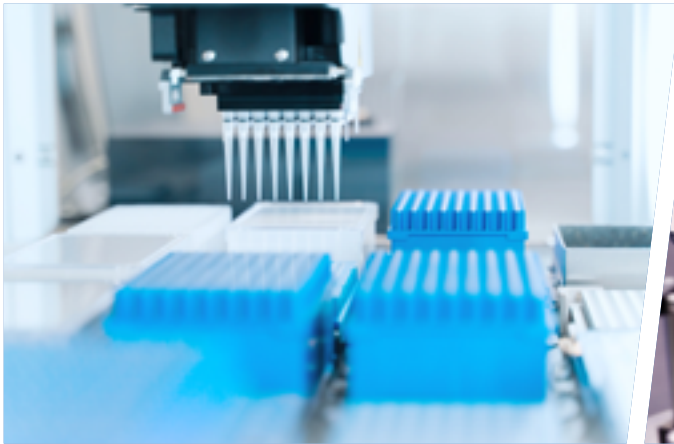


» **Robot Control**
» **Probe Processing**
» **Pump Motor Control**
   - Infusion Pumps
   - Insulin Pumps

# Surgical Robotics



» **Automated and Remote Surgical Robots**
» **Dental Processing**

## Surgical Robotics

**MA600 and MA900**

**MA600:**

» Factory-Calibrated: 0.6° Error (INL) over Temp
» <0.1° 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



Sensors

Cost-Effective Solution for Managing:
» High-Speed Torque
» Position
» Speed Control

# Insulin Pumps

## Accuracy and Reliability in Tiny Form Factor

**MA980**

» 9-Bit To 13-Bit Absolute Resolution

» Differential Sensing Rejects Stray Fields

» µPower 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: <0.5µA Standby Current
- » Wake-On-Change Angle Detection
- » Very Small (<1mmx1mm) Magnet
- » Provides Absolute Angle Output



# Kitchen Appliances/Mixers with Cooking Options



**Sensors**

**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

## Secure Lid Closure Detection

### MV300, MV310

- » Senses Position of Magnets in Lid
- » Flexible $I^2C$ or SPI Interface

## 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

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

### MCS1806

- » Complete Isolated Current Sensor
- » Wide Sensing Range
  - ±5A to ±50A, 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) | $V_{CC}$ (V) | Over-Temp Accuracy | Temperature Range (°C) | Isolation Voltage ($V_{RMS}$) | Working Voltage ($V_{RMS}$) | Reinforced Isolation ($V_{RMS}$) | Bandwidth (kHz) | Over-Current Detection | Voltage Reference | Primary Conductor Resistance (mΩ) | UL Certification | Package | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MCS1800 | ±12.5, ±25 | 3.3 | 3% | -40 to +125 | 1000 | 200 | - | 100 | - | - | 1.2 | - | SOIC-8 | Coreless, ratiometric analog output |
| MCS1801 | ±12.5, ±25 | 5 | 3% | -40 to +125 | 1000 | 200 | - | 100 | - | - | 1.2 | - | SOIC-8 | Coreless, ratiometric analog output |
| MCS1802 | ±5, ±10, ±20, ±30, ±40, ±50 | 3.3 | 2.5% | -40 to +125 | 2200 | 250 | - | 100 | - | - | 0.9 | ✓ | SOIC-8 | Coreless, ratiometric analog output |
| MCS1803 | ±5, ±10, ±20, ±30, ±40, ±50 | 5 | 2.5% | -40 to +125 | 2200 | 250 | - | 100 | - | - | 0.9 | ✓ | SOIC-8 | Coreless, ratiometric analog output |
| Ⓝ MCS1805 | ±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 |
| MCS1806 | ±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 |
| Ⓟ MCS1810 | ±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, ratometric or absolute analog output, prog. OCD with 1μs response time |
| Ⓟ MCS1812 | ±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 |
| Ⓝ MCS1823 | ±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 |
| Ⓝ MCS1826 | ±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 |
| Ⓢ MCS2803 | ±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 |
| Ⓢ MCS2804 | ±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 |

Sensor Solutions
Q1 2024

## 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 | MV300 | 12-Bit | I²C, SPI | 3.3 | 10nA to 2.5 | ±50 or ±180 | 40 | -40 to +125 | TSOT23-6 | Digital component output, selectable operating power modes |
| P | MV310 | 12-Bit | I²C, 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 | MA900 | 10-Bit to 14.5-Bit | SPI, SSI, I²C, 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 | MA980 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MA102 | 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 |
| | MA302 | 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 |
| | MA310 | 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 |
| | MA330 | 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 | MA600 | 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 |
| | MA702 | 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 |
| | MA704 | 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 |

N - New Product    S - Sampling Product    P - Preview Product

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| **MA710** | 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 |
| **MA730** | 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 |
| **MA732** | 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 |
| **MA734** | 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 |
| **MA735** | 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 |
| **MA736** | 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 |
| **MA780** | 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 |
| **MA782** | 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 |
| **MA800** | 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 |
| **MA820** | 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 |
| **MA850** | 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| MAG10-2C-30.25 | Diametrical | Cylinder | NdFeB, Grade N35SH | 3 | - | 2.5 | 0 | 2 | 0.1 | - |
| MAG10-2C-40.25 | Diametrical | Cylinder | NdFeB, Grade N35SH | 4 | - | 2.5 | 0 | 2.6 | 0.2 | Standard-size, cost-effective |
| MAG10-2C-50.25 | Diametrical | Cylinder | NdFeB, Grade N35SH | 5 | - | 2.5 | 0 | 3.1 | 0.2 | Standard-size, cost-effective |
| MAG10-2C-60.25 | Diametrical | Cylinder | NdFeB, Grade N35SH | 6 | - | 2.5 | 0 | 3.6 | 0.3 | - |
| MAG10-2C-80.25 | Diametrical | Cylinder | NdFeB, Grade N35SH | 8 | - | 2.5 | 0 | 4.5 | 0.4 | - |
| MAG10-2R-50.12.25 | Diametrical | Ring | NdFeB, Grade N35SH | 5 | 1.25 | 2.5 | 1 | 1.4 | 0.4 | Accurate application |
| MAG10-2R-60.15.25 | Diametrical | Ring | NdFeB, Grade N35SH | 6 | 1.5 | 2.5 | 1.3 | 1.6 | 0.6 | Accurate application |
| MAG10-2R-80.20.25 | Diametrical | Ring | NdFeB, Grade N35SH | 8 | 2 | 2.5 | 2 | 2.5 | 0.8 | Accurate application |
| MAG10-2B-40.25 | Axial | Half-Cylinder | NdFeB, Grade N35SH | 4 | - | 2.5 | 0 | 2.1 | <0.1 | Low field emission |
| MAG10-2B-50.25 | Axial | Half-Cylinder | NdFeB, Grade N35SH | 5 | - | 2.5 | 0 | 2.7 | <0.1 | Low field emission |
| MAG10-2B-60.25 | Axial | Half-Cylinder | NdFeB, Grade N35SH | 6 | - | 2.5 | 0 | 3.2 | <0.1 | Low field emission |
| MAG10-2B-80.25 | 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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