



# Magnetoresistive angle sensor systems

## Cover all the angles in your automotive systems

NXP's magnetoresistive sensor technology is the superior choice for automotive measurement systems. Features such as lack of wear, long term stability and direct measurement combine to deliver highly accurate and robust sensors. With stand-alone sensors, companion signal conditioning ICs and complete single-package sensing solutions our range of cost-effective angle sensors covers all your application needs.

### Key benefits

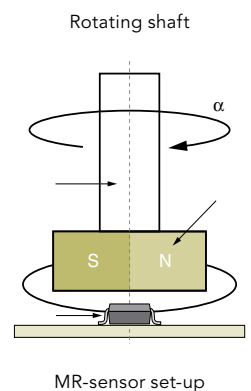
- ▶ Contactless angle measurement up to 180°
- ▶ Measurement independent of magnetic drift caused by life time and temperature changes
- ▶ Operation independent of mechanical tolerances and magnet shifts caused by thermal stress
- ▶ High temperature range
- ▶ Automotive qualification
- ▶ Highly flexible solutions that measure any automotive angle effectively
- ▶ Fully stable operation over long life-cycle

### Key applications

- ▶ Electronic throttle control (ETC)
- ▶ Variable valve control (VVC)
- ▶ Pedal and wiper positioning
- ▶ Active suspension
- ▶ Automatic headlight adjustment
- ▶ Electronic steering
- ▶ Seat positioning

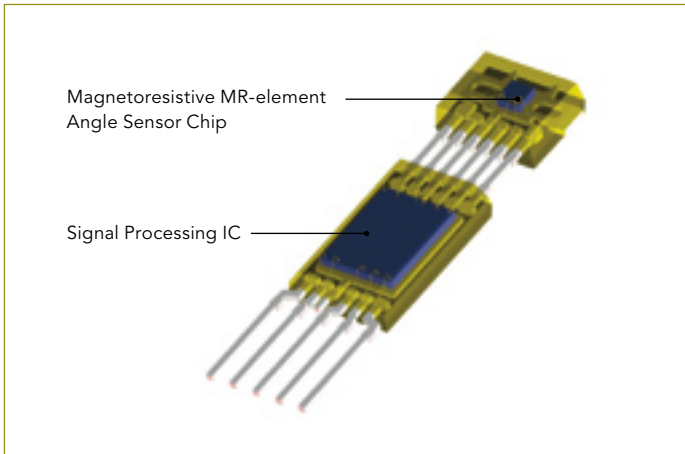
Offering many technical benefits over other technologies, our magnetoresistive (MR) angle sensors provide car manufacturers with a more reliable and accurate solution for automotive angle measurement – reducing the risk of mechanical breakdown and improving overall vehicle safety. This is an increasingly important area within automotive electronics as the industry moves closer to incorporating advanced X-by-wire networks and control systems, such as FlexRay, that rely on accurate measurement data.

MR sensors use magnetic fields to conduct measurement information between physical value and sensor. This contactless principle allows isolation of all rotating components, making the entire sensing system robust with respect to pollution and mechanical degradation. Also, MR sensors evaluate the direction of the magnetic field and not the field strength. As a result, MR sensors can tolerate variations in field strength caused by ageing, mechanical fluctuations or temperature sensitivity of the magnet.

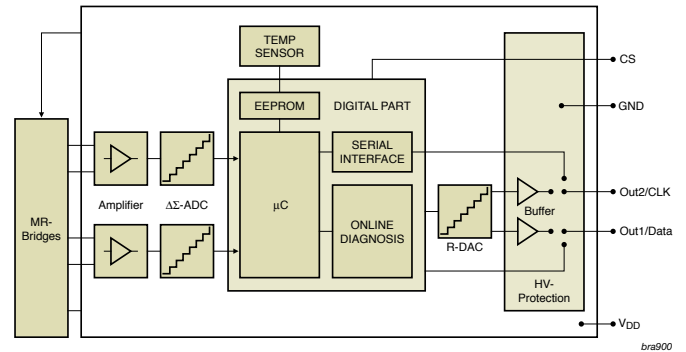


### Single package angle sensor System with on-chip diagnostics- KMA200

The KMA200 is a pre-aligned, ready to use angular sensor system. It consists of a magnetoresistive element containing two independent MR sensor bridges and a signal conditioning IC in a special multi-chip package that allows 90° bending of the MR element.



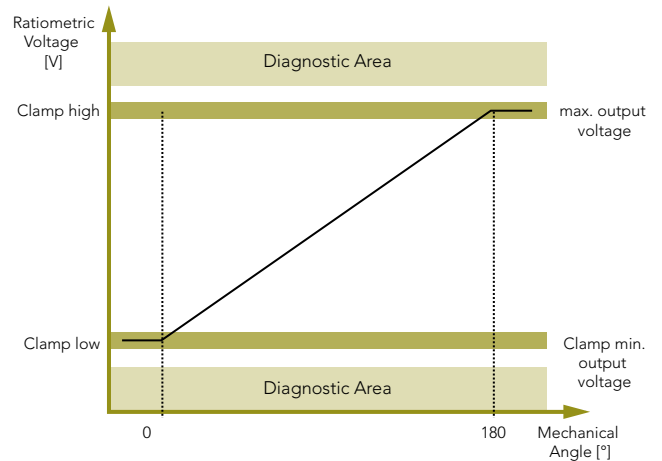
The KMA200 sensor system



KMA200 sensor system

### KMA200 key features

- ▶ Magnetic field angular sensing
- ▶ high accuracy
- ▶ operating temperature range from -40°C to 160°C
- ▶ online diagnosis
- ▶ bidirectional digital interface (SPI)
- ▶ Programmable maximum angle up to 180°
- ▶ pre-calibrated, ready to use device
- ▶ one package angle sensor system
- ▶ resolution better than 0,05°
- ▶ digital or analog output signals (user programmable)
- ▶ overvoltage protection at all external pins
- ▶ EEPROM (user programmable)
- ▶ Programmable zero point

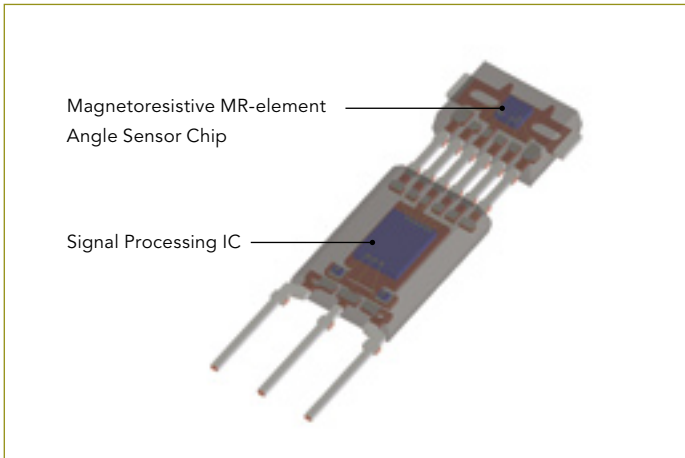


Example for analog output voltage with positive slope

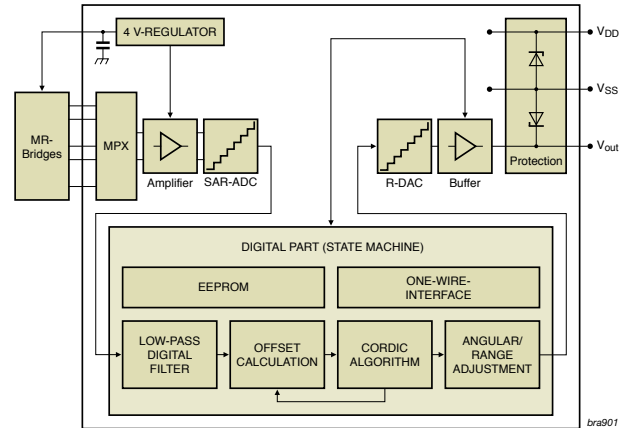
Key specifications	
Property	KMA200
Angular measurement range	180°
Output mode	4 analog/2 digital, selectable
Maximum error from reference line	-1.65°...+1.65°
Temperature drift (-25...+125 °C)	-0.64°...+0.64°
Microlinearity	-0.1°...+0.1°
Temperature range	-40...+160 °C
Supply voltage	5 V + - 10%
Over-voltage protection	26,5V ( 32V for 400ms)
Reverse Voltage Protection	16,5V

### Single package angle sensor System - KMA199E

The KMA199E is a pre-aligned, ready to use angular sensor system like KMA200 but intended for applications with basic feature set. KMA199E contains additional Protection diodes to make it robust against ESD and electrical transients.



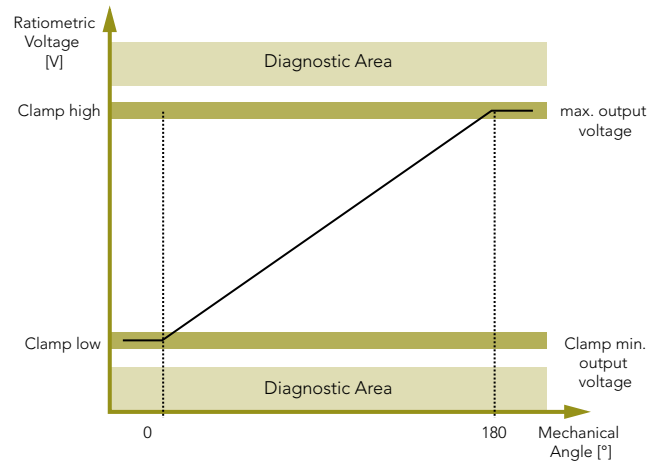
The KMA199E sensor system



KMA199E sensor system

### KMA199E key features

- ▶ High precision sensor for magnetic angular measurement
- ▶ Programmable user adjustments, including zero angle and angular range
- ▶ Single package sensor system
- ▶ Magnet-lost and power-lost detection
- ▶ Built-in transient protection
- ▶ User-programmable 32-bit identifier
- ▶ Ready to use
- ▶ Ratiometric output voltage
- ▶ Independent from the magnetic field strength above 35 kA/m
- ▶ Programming via One-Wire Interface (OWI)
- ▶ Fail-safe EEPROM
- ▶ high temperature range
- ▶ Factory calibrated

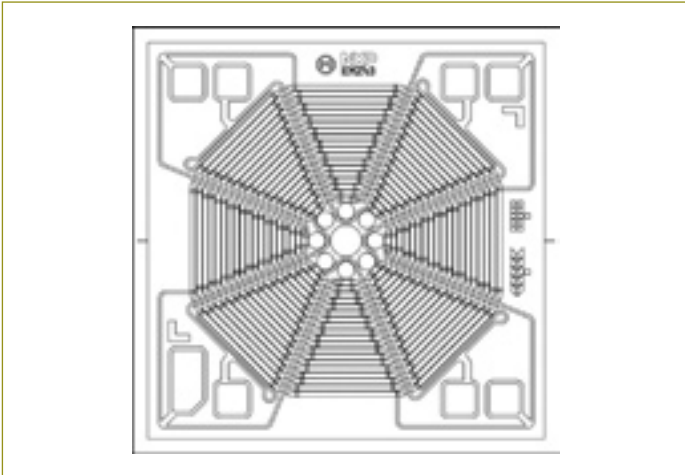


Example for analog output voltage with positive slope

Key specifications	
Property	KMA199E
Angular measurement range	180°
Output mode	ratiometric analog
Linearity error	1,55°
Temperature drift related to room temperature	0.55°
Microlinearity	-0.1°...+0.1°
Temperature range	-40...+160 °C
Supply voltage	5 V + - 10%

### Magnetoresistive angle sensors KMZ41/KMZ43

Our KMZ41 and KMZ43 sensor bridges contain eight MR resistors, connected as two individual Wheatstone bridges aligned at 45°. Possessing different sensitivities. Ensuring maximum flexibility, we offer MR sensor bridges both as standalone devices in SO8 package and as bare die for space-critical solutions.



KMZ43T chip layout, showing the two 45° aligned bridges

Type	Product	Package	Supply voltage (V)	Angle range	Output value	Output type	Operating temperatures °C
KMZ41	sensor	SO8	5.0 ... 9.0	180°	78 mV peak (5 V)	sin/cos	-40 ...+150
KMZ43	sensor	SO8	5.0 ... 9.0	180°	67 mV peak (5 V)	sin/cos	-40 ...+150
X3T-KMZ43	sensor	die	5.0 ... 9.0	180°	67 mV peak (5 V)	sin/cos	-40 ...+150