Magnetic Sensors

8-May-2018

Switch & Latch

Linear Hall

Triaxis® Hall <-Todays Topic

Current Sensors

Presented By:
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Marketing Manager

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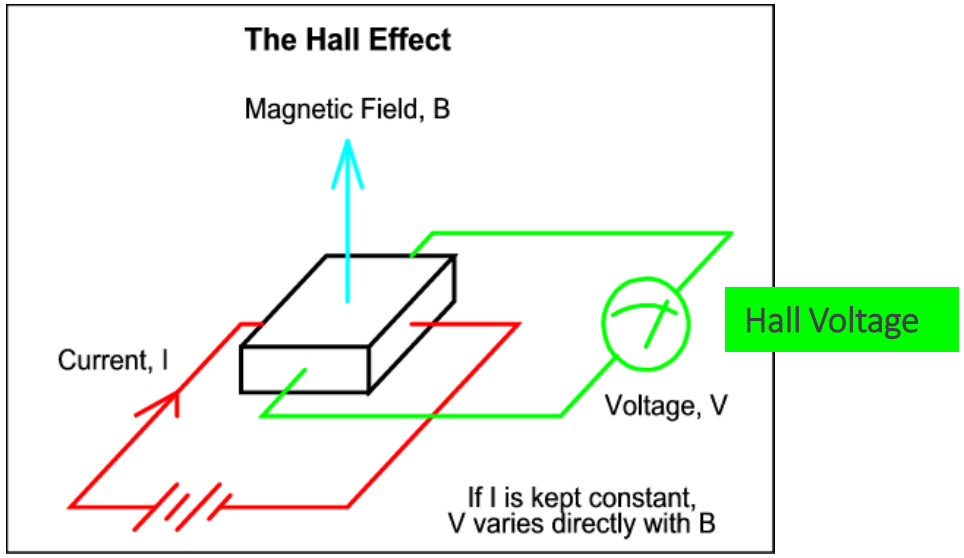
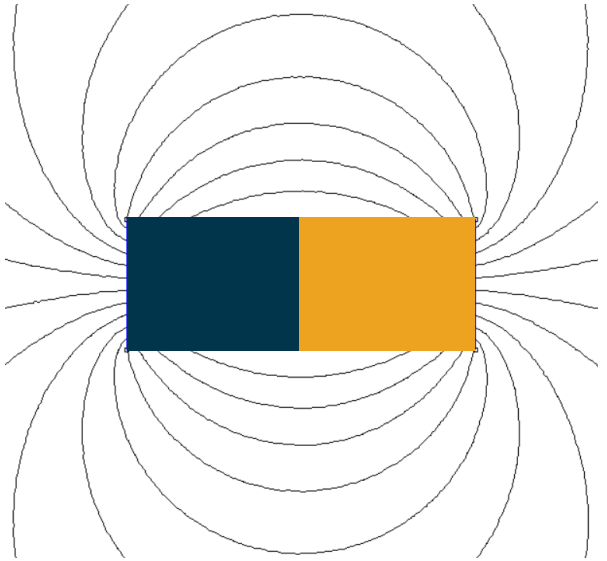
What Is Triaxis?

Magnetic Sensors

Hall Effect Principle

- Melexis magnetic sensors utilize the Hall Effect
  - Discovered in 1879 by Edwin Herbert Hall (1855-1938)
  - Effect results in a measured voltage proportional to the applied magnetic field
  - Magnetic field (flux density) measured in Tesla or Gauss



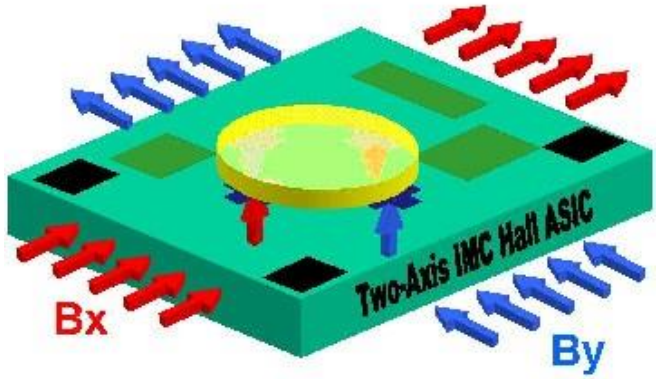


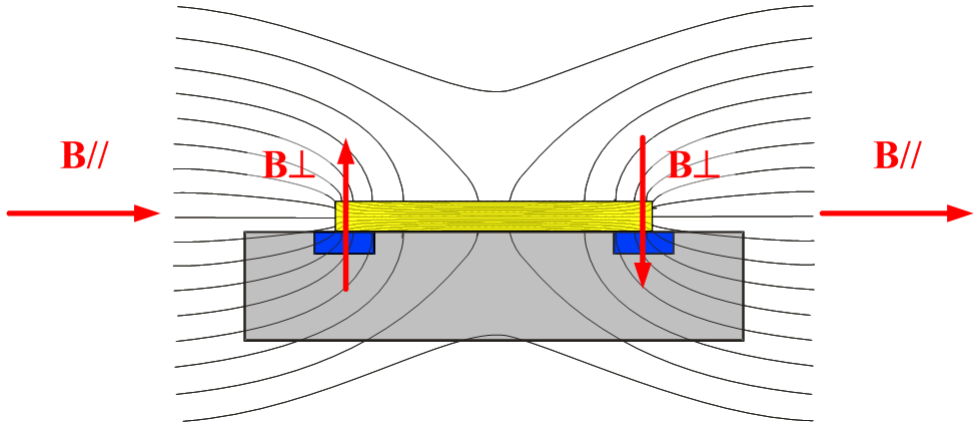
What is Triaxis?

IMC® Hall

Integrated Magneto Concentrator + Planar Hall

(1 × IMC Disk) (2 × 2 plates)

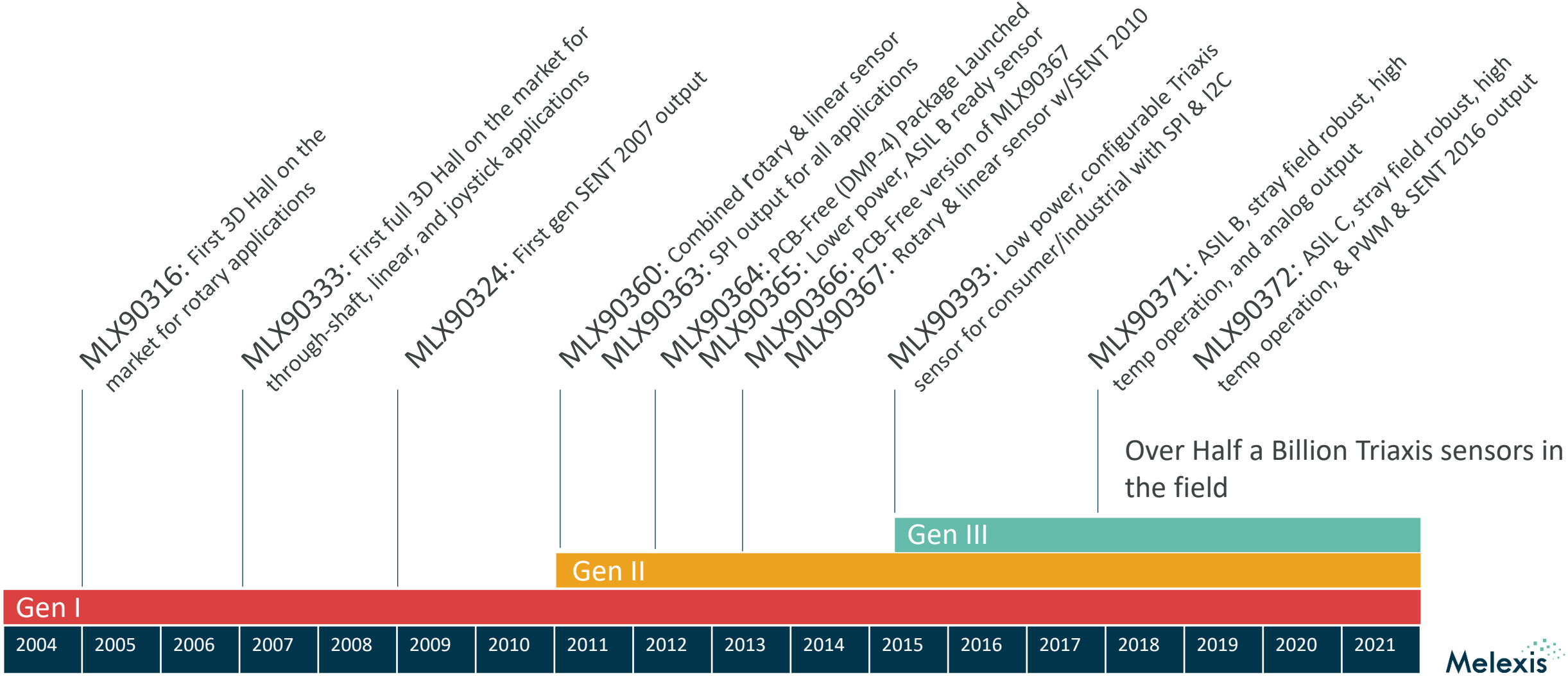




Thanks to the IMC, the flux density parallel (horizontal) to the IC surface is *converted* into orthogonal (vertical) components suitable for the planar Hall plates

A History of Innovation

From 2004 Onwards…

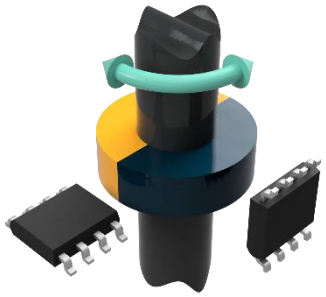


Why Use Triaxis Sensors?

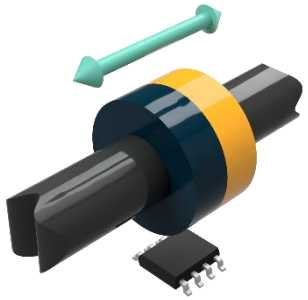
Triaxis® Position Sensors

Bring Application Flexibility…

Rotary On-Axis



Rotary Off-Axis



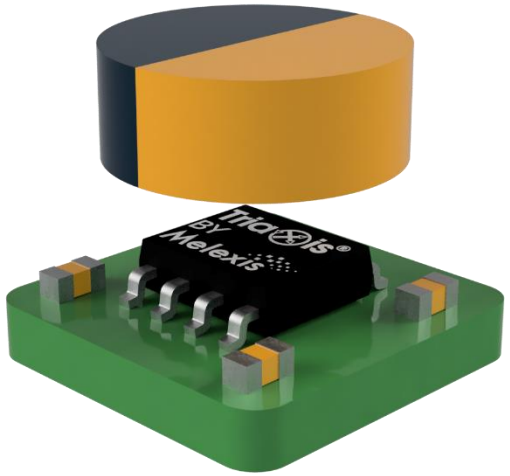
Linear

Joystick

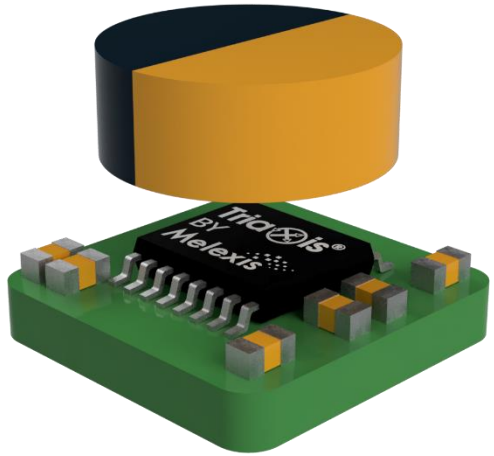
Triaxis® Position Sensors

Bring High Integration – PCB mounted applications

- All the Triaxis sensors are available in industry-standard PCB surface mount packages
  - Single Die: SOIC-8
  - Fully Redundant Dual Die: TSSOP-16



SOIC-8 Package



TSSOP-16 Package

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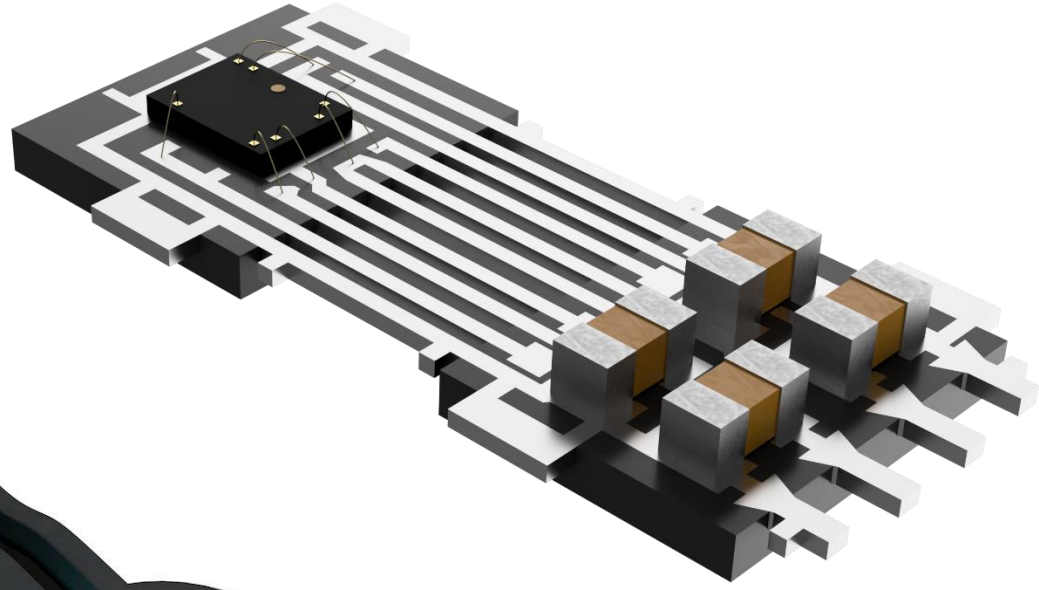
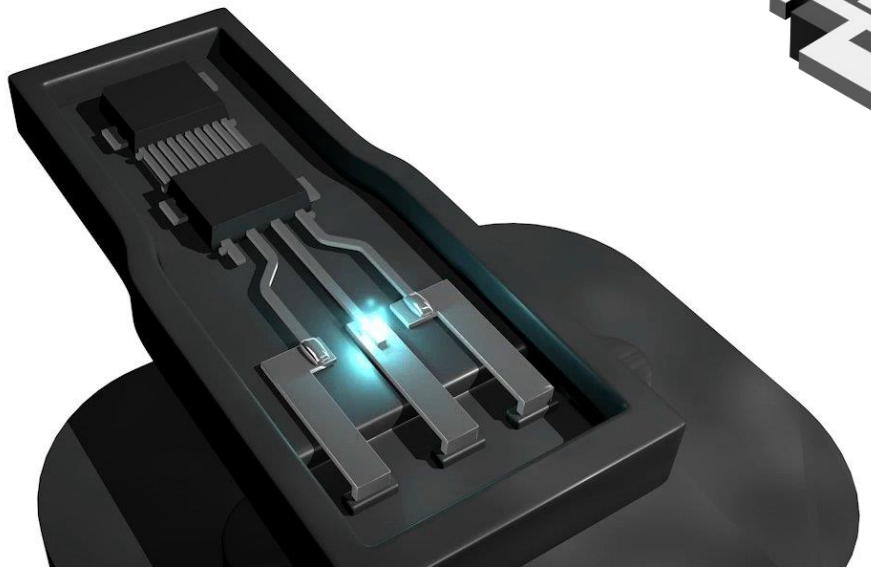
Triaxis® Position Sensors

Bring High Integration – PCB-Less Packaging

- Highly Integrated Sensor Assembly: Dual Mold Package (DMP) featuring:
  - Triaxis® Position Sensing Die
  - Integrated EMC Capacitors
- Improved Robustness
  - Mechanical (mounting)
  - Electrical (ESD/EMC)
  - Environmental (vibrations, temperature)
- Small Size / Low Weight
- Increased Long-Term Reliability





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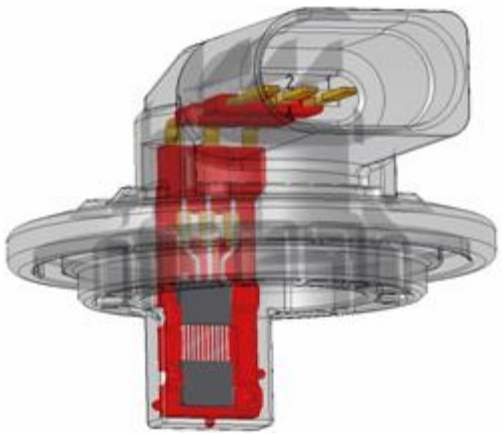
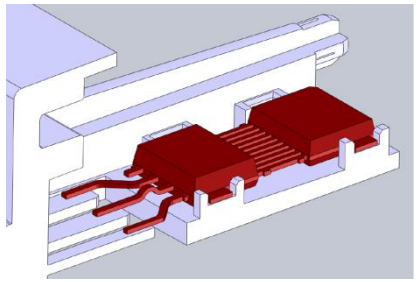
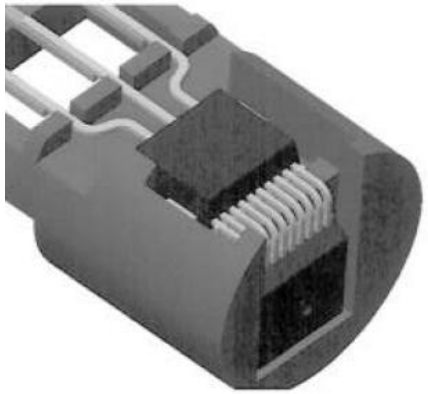
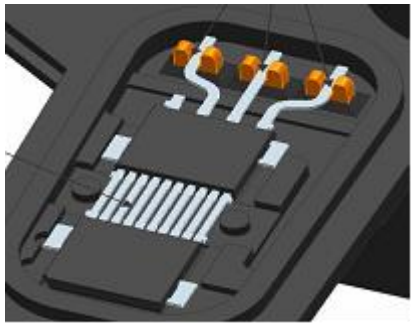
Triaxis® Position Sensors

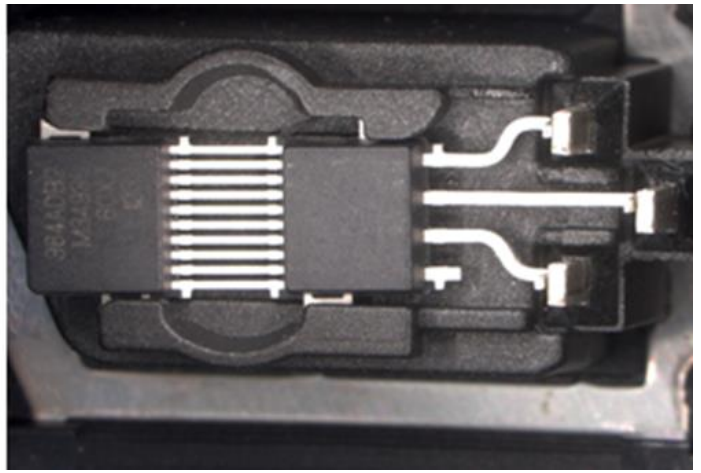
Bring High Integration – PCB-Less Packaging









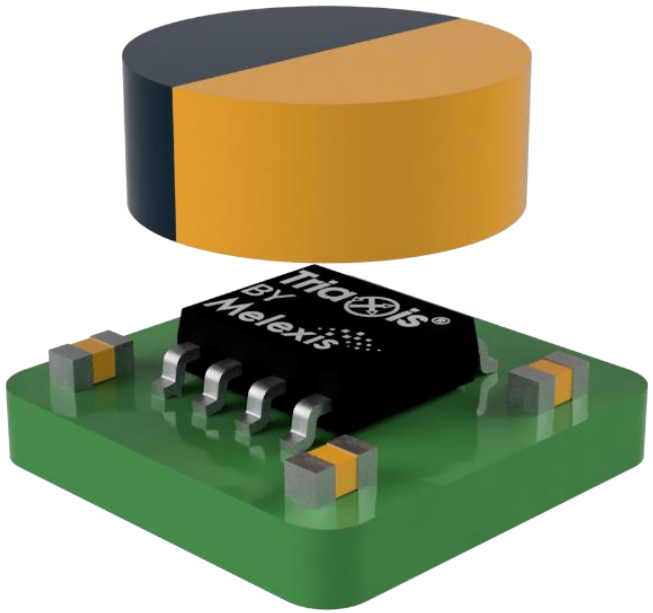


- Common Automotive Applications
  - Electric Throttle Body
  - Exhaust Gas Recirculation
  - Turbo Wastegate

Triaxis® Position Sensors

Bring High Reliability

- Triaxis sensors are non-contacting devices
  - “Seal-able” against liquid contamination
  - Insensitive to dirt or dust
  - Can operate through non-ferrous boundaries
    - Aluminum, Magnesium, …
    - Plastic
    - Wood
    - Glass



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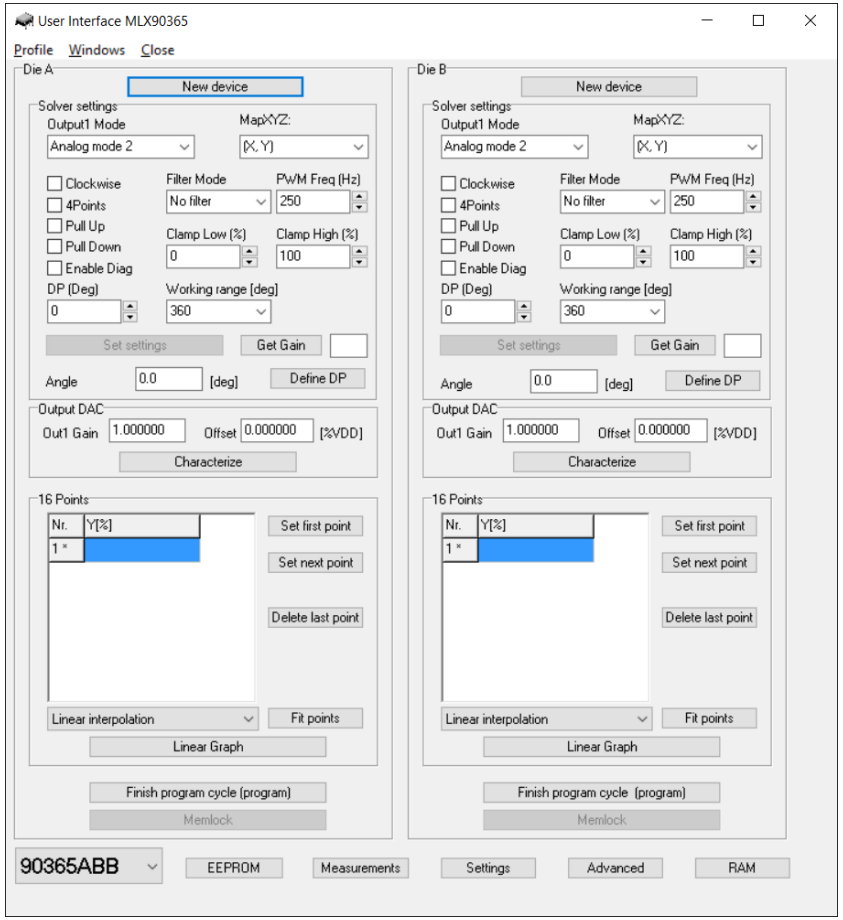
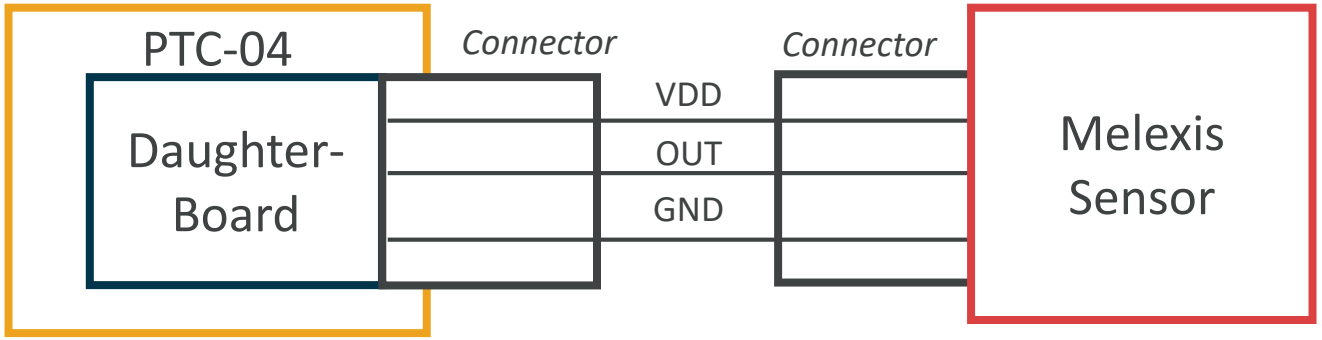
Triaxis® Position Sensors

Bring Easy Development and Production Via the PTC-04

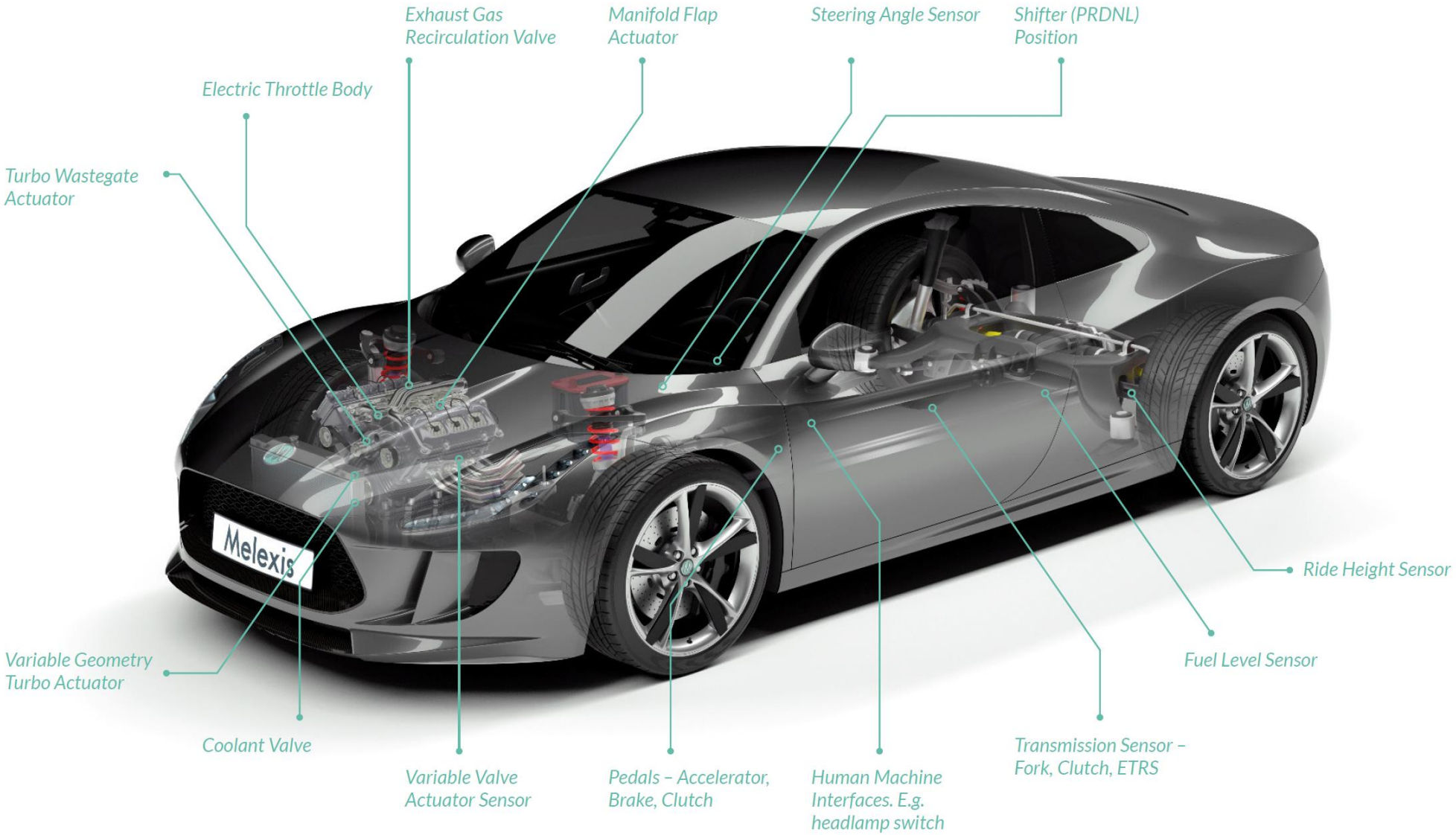


Interfaces via:
.Net (VB, C#)
Labview



Triaxis® Position Sensors

Selected Automotive Applications



Triaxis® Position Sensors

Generation I

Parameter		MLX90316 Rev. BCG	MLX90316 Rev. BDG	MLX90316 Rev. BCS	MLX90324 Rev. DBO	MLX90333 Rev. BCT
MOTION	Rotary	▪	▪	▪	▪	▪
	Linear					▪
	Joystick					▪
PACKAGE	SOIC-8	▪	▪	▪	▪	▪
	TSSOP-16	▪	▪	▪	▪	▪
OUTPUT	Analog	▪		▪ (2x)	▪	▪
	PWM	▪		▪ (2x)	▪	▪
	SENT				▪ (2007)	
	SPI	▪	▪			▪

Triaxis® Position Sensors

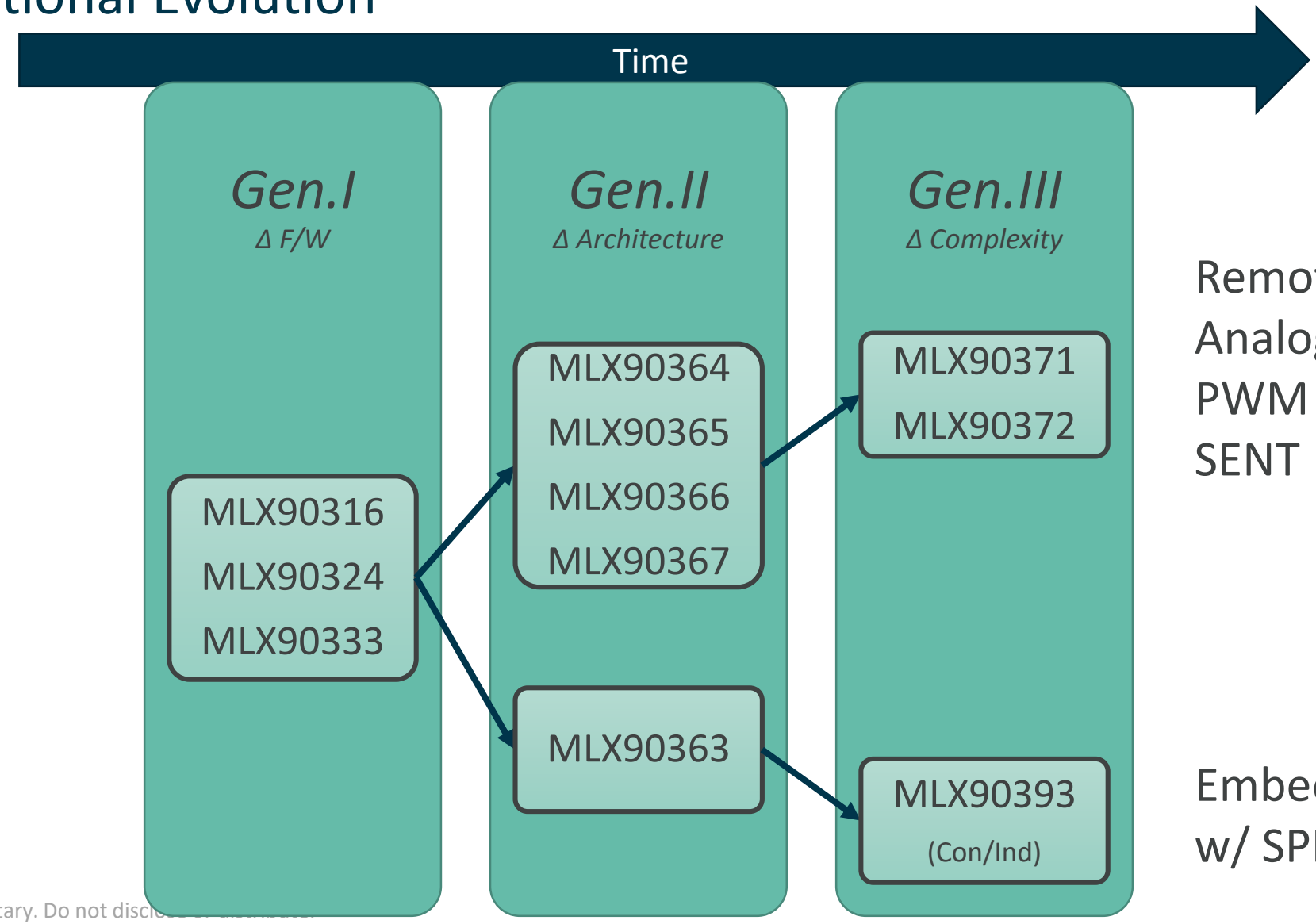
Generation II

Parameter		MLX90363 Rev. ABB	MLX90364 Rev. ADD	MLX90365 Rev. ABD	MLX90366 Rev. ADV/U	MLX90367 Rev. ABV/U
MOTION	Rotary	▪	▪	▪	▪	▪
	Linear	▪	▪	▪	▪	▪
	Joystick	▪				
PACKAGE	SOIC-8	▪		▪		▪
	TSSOP-16	▪		▪		▪
	DMP (PCB-less)		▪		▪	
OUTPUT	Analog		▪	▪		
	PWM		▪	▪		
	SENT				▪	▪
	SPI	▪				
ASIL	B (SEooC)	▪	▪	▪	▪	▪

Third Generation Triaxis

Triaxis Sensors

Generational Evolution

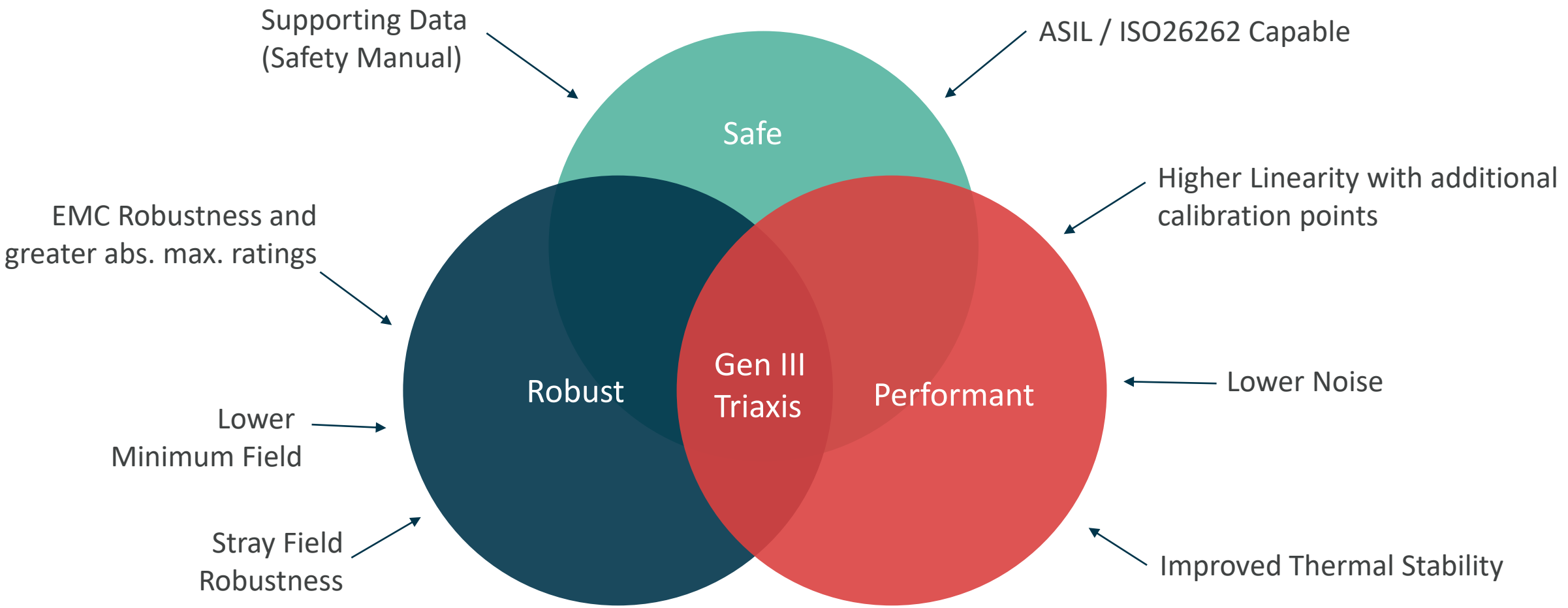


Remote Sensing w/
Analog
PWM
SENT

Embedded Sensing
w/ SPI & I2C

Triaxis® Position Sensors

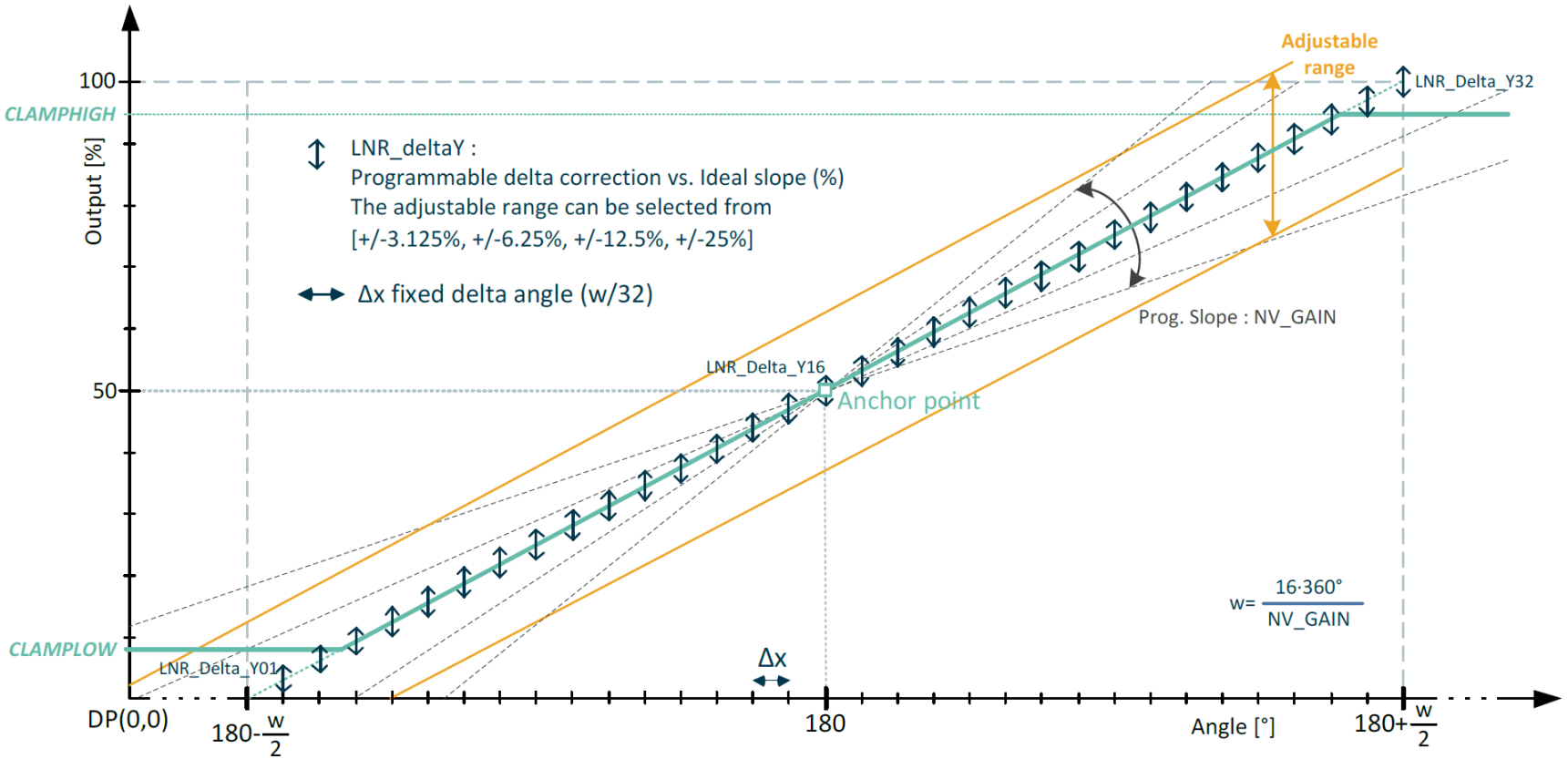
Improvements in Generation III Devices



Triaxis® Position Sensors

Feature Improvements – All Modes, All Devices

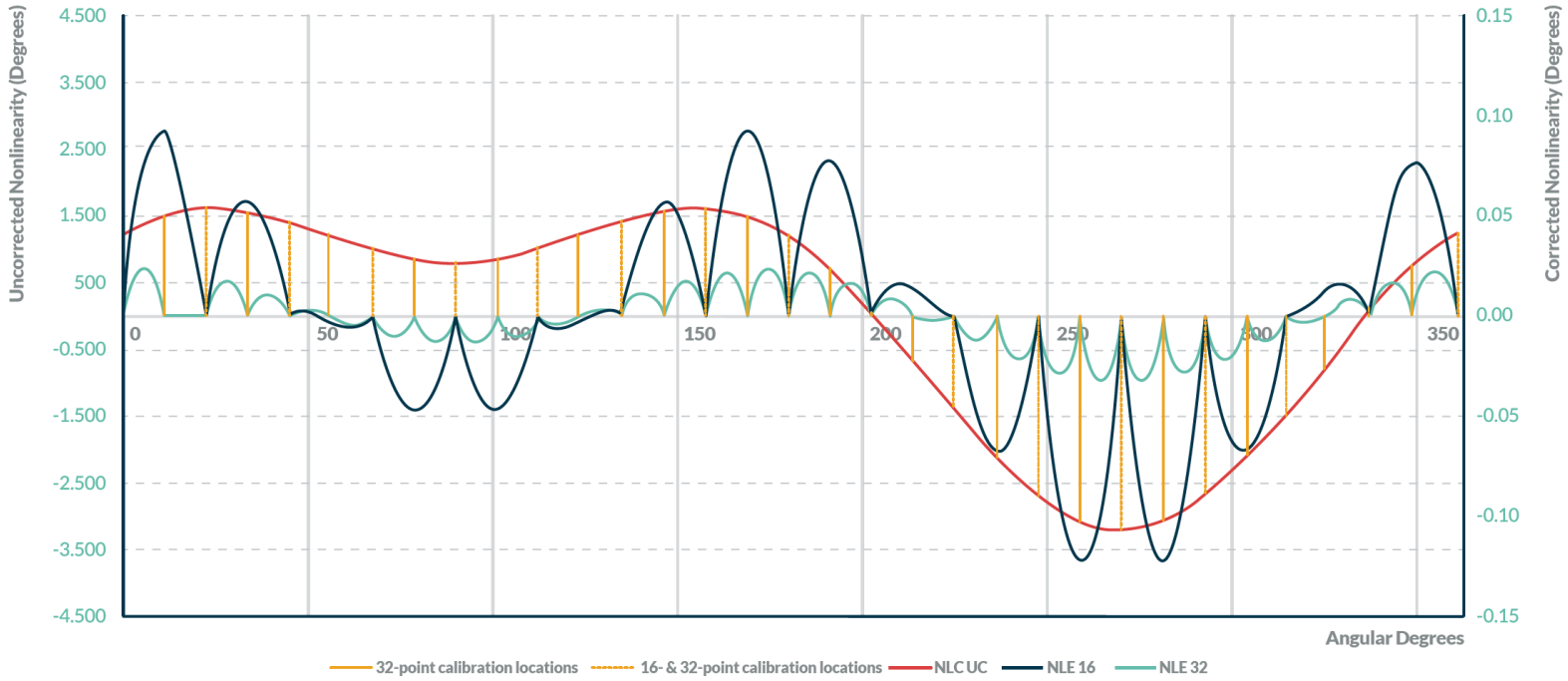
- Enhanced Calibration
  - 32 points on fixed grid or 8 arbitrary points



Triaxis® Position Sensors

Feature Improvements – All Modes, All Devices

- Enhanced Calibration with 32 Points
  - Allows for further reduction in nonlinearity errors vs 16 points



Linearity improvement by 16-point and 32-point method found in Generation III Triaxis®

Simulation – Real world results may vary

Triaxis® Position Sensors

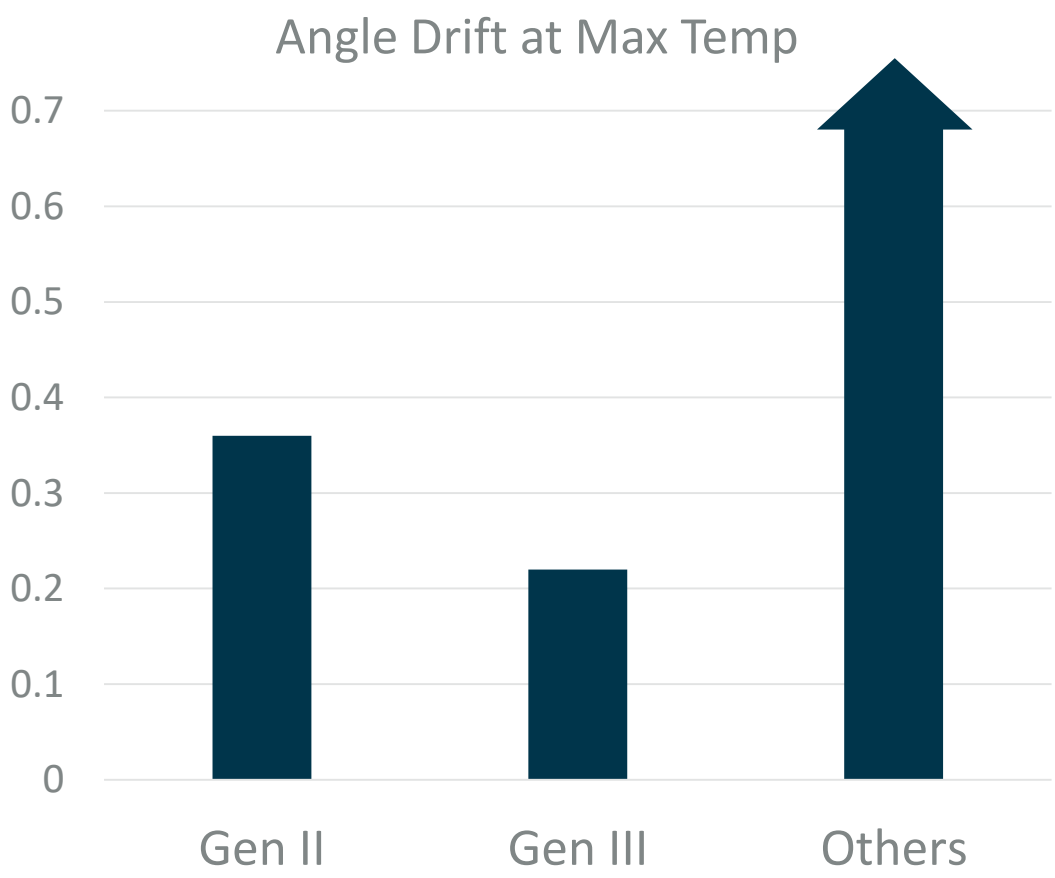
Generation III – Performance Improvements

- Lower Flux Density Requirement
  - 10mT vs 20mT of existing products. Allows for smaller or lower cost magnets reducing total system cost
- Higher Ambient Temperature
  - 160°C ambient with low degradation of performance (e.g. drift, noise) to allow customers to target high temp applications (e.g. engine compartment)

Triaxis® Position Sensors

Generation III – Performance Improvements

- Thermal Drift and Noise Substantially Improved over Gen II
- Additionally,
  - Gen III operates at a higher ambient temperature of 160°C
  - Or at a lower minimum field (10mT)

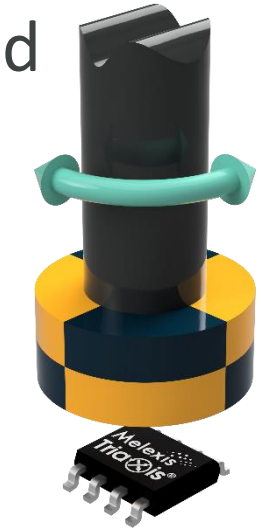


Triaxis® Position Sensors

How can we meet stray field requirements?

- Gen II (and others) Solution
- More Field
  - More Field
    - More Field
- R.O.T.: 1% of good field as stray field = 0.6 deg error
  - 4mT stray @ 20mT > 11° error
  - 4mT stray @ 120mT < 2° error
- Drawback: Bigger magnet or small airgap required

- Gen III Solution
  - Ignore the stray field
- Available on MLX90371 and MLX90372
- Excellent for existing stray-field requirements from OEM's
- Utilizes a two or four-pole magnet (linear or rotary)



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Triaxis® Position Sensors

Gen III – Stray Field Mode

- Stray Field Robustness
  - Based on ISO11452-8 (4000A/m = 5mT) and current carrying conductor tests (400A@25mm = 3.2mT) to meet next-gen OEM requirements
- Gradient Measurement vs Homogenous Measurement
  - 10mT/mm gradient field
- For on-axis rotation a new magnet is used
  - 4-pole axially magnetized. (Contact MLX for an app note)
- For off-axis rotation or linear motion a 2-pole magnet can still be used (Contact MLX for an app note)

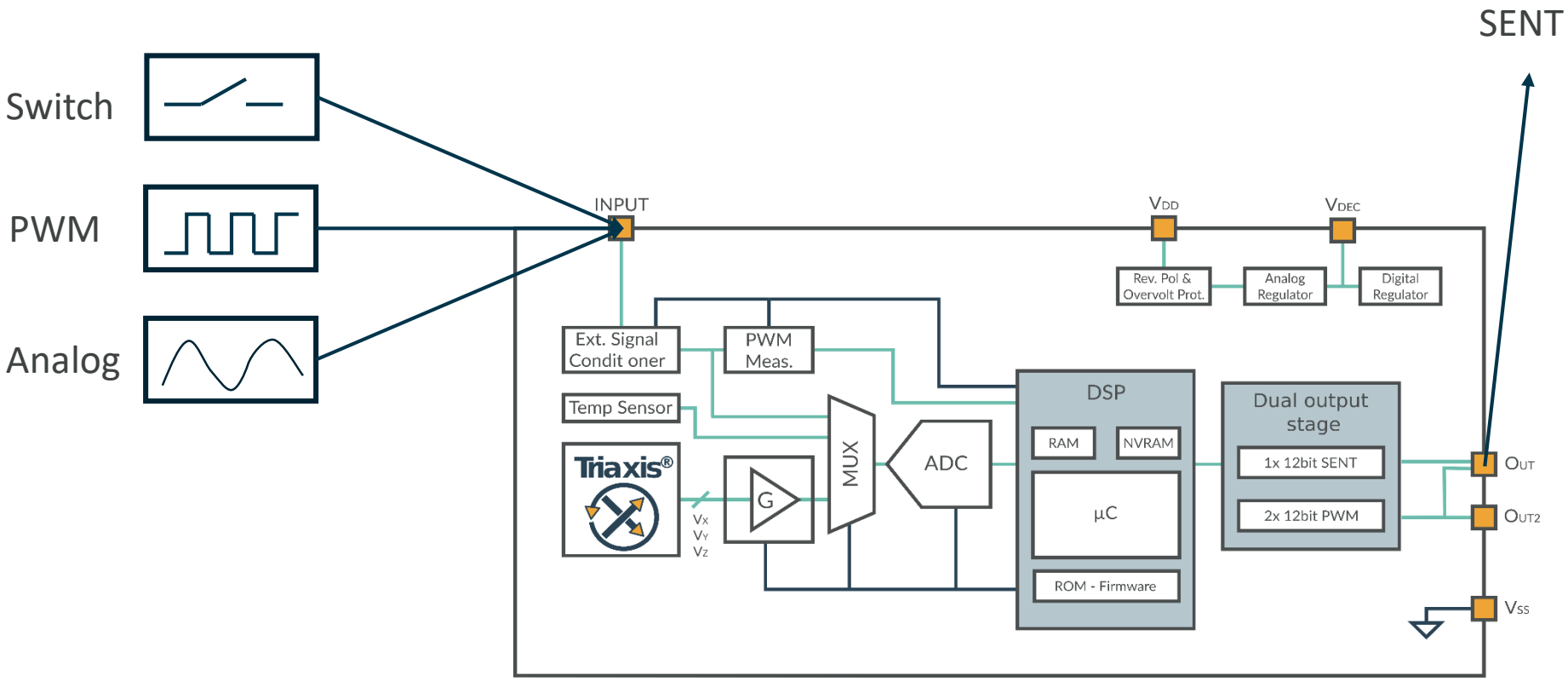
Triaxis® Position Sensors

Performance and Feature Improvements – All Modes

- ISO26262 - ASIL READY BY MELEXIS
  - Supported via SEooC (Safety Element out of Context) approach
  - ASIL B – MLX90371
  - ASIL C – MLX90372
  - Safety Manuals available upon request
- Extended On Board Diagnostics Supporting ASIL Capability
- Gateway for External Sensor (Readout / Input)
  - PWM, NTC, or a switch can be read

Triaxis® Position Sensors

MLX90372: Input Pin for Expansion Capabilities

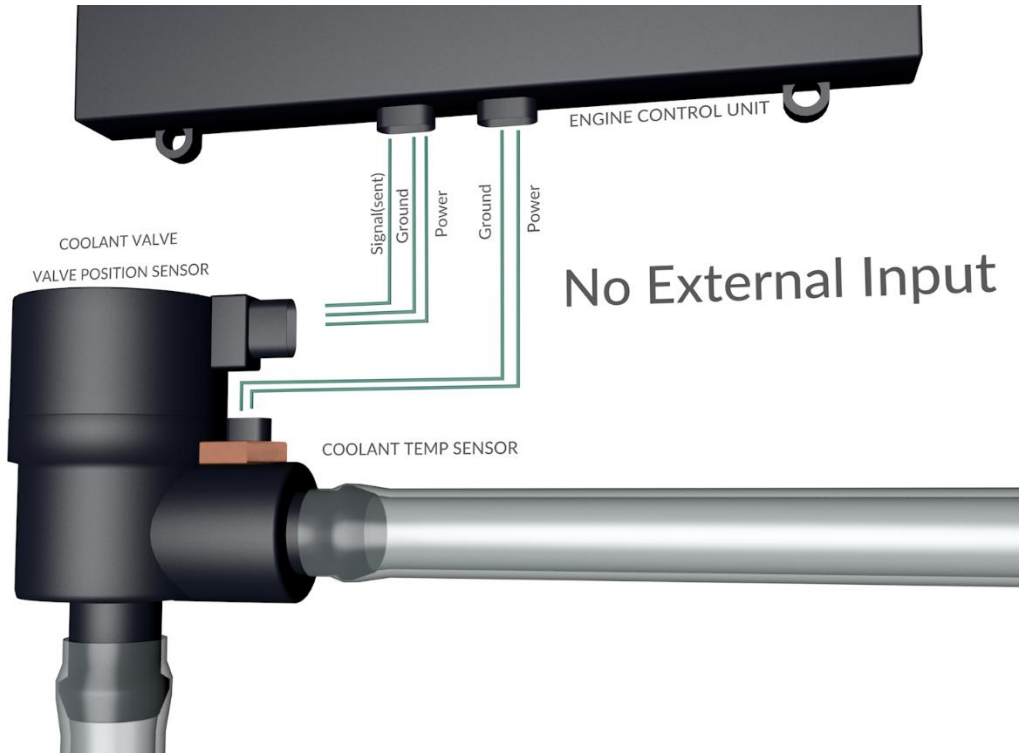


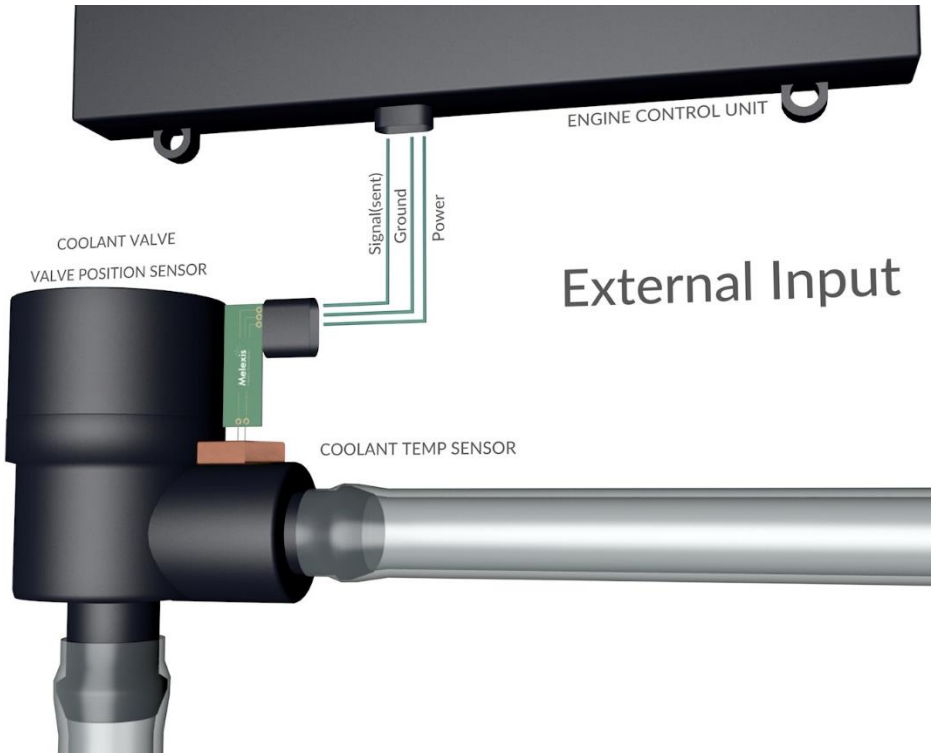
SENT	CH1	CH2	Serial
	Angle	Angle	Input
	Angle	Input	Other
	Input	Angle	Other

Triaxis® Position Sensors

MLX90372: Input Pin for Expansion Capabilities

- Input pin allows for reduction in wire count and harness complexity -> further integration & weight savings





Gen III Triaxis

Planned Family Members

Parameter		MLX90371	MLX90372
MOTION	Rotary	▪	▪
	Linear	▪	▪
	Joystick		
PACKAGE	SOIC-8	▪	▪
	TSSOP-16	▪	▪
	PCB-less (DMP-4)	▪	▪
OUTPUT	Analog	▪	
	PWM		▪
	SENT		▪
ASIL	B (SEooC)	▪	
	C (SEooC)		▪

More Coming Soon

26-March-2018

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Triaxis® Position Sensors

Gen III Short Summary of Improvements – XY Nominal Mode

Metric (datasheet spec)	Gen II (e.g. MLX90367)	Gen III (e.g. MLX90372)
Output	SENT / PWM	SENT / PWM
Thermal Drift	20mT: +/-0.60 deg	10mT: +/-0.45 deg
Noise (max, 40mT)	0.2 deg	0.1 deg
Calibration Points	16 max	32 max
Input pin / Gateway	No	Yes
Abs Max Ratings / EMC	Vdd: -12V / +24V Vout: -0.3V / 18V	Vdd: -20V / +37V Vout: -14V / 28V

Gen III Short Summary of Improvements – Stray Field Immunity

Metric (datasheet spec)	Gen II (e.g. MLX90367)	Gen III (e.g. MLX90372)
4kA/m Stray Field	Substantial Deviation (>10deg)	No or minimal impact (<0.4 deg)

Tools and Samples

- Tools:
  - Programming tool is the same PTC-04 as previous generations
  - Using a new daughterboard (Hall06)
- Small EVB's (~25mm x 25mm) available with pre-programmed parts.
  - Custom options possible on request with additional lead time.
- Application notes for magnetic design available on request

- Samples:
  - Available directly from Melexis for the immediate future
  - Please contact your organizations sales contact or the email addresses below:
    - Sales_Europe@Melexis.com
    - Sales_USA@Melexis.com