Inertial sensors

TDK releases Tronics AXO®315 – high performance, force-rebalance SMD MEMS accelerometer with digital interface

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TDK Corporation (TSE: 6762) announces the release of Tronics AXO®315, a miniature high performance 1-axis closed-loop MEMS accelerometer with a 24-bit digital SPI interface and SMD package that reaches quartz sensors performances, outperforms commercial MEMS sensors, and eases integration. The new force-rebalance accelerometer delivers an excellent one-year composite bias repeatability of 1 m*g* and composite scale factor repeatability of 600 ppm under severe temperature and vibration conditions common in industrial, land, railway, naval and construction applications. Its characteristics enable significant reduction in size, weight and cost of materials for industrial motion control units, Inertial Measurement Units (IMU) and Inertial Navigation Systems (INS).

AXO315 is a ±14 *g* range, in-plane linear accelerometer. It has been designed and developed to provide high precision and reliability in the most challenging environments. It achieves a 1 m*g* composite bias repeatability over one year at temperatures ranging from -55 °C to +105 °C, and 4 *g* vibrations with an outstanding vibration rejection. Performance is augmented by its superior Allan variance characteristics, with an excellent bias instability of 4 µ*g,* a velocity random walk of 0.006 m/s/√h, and very low noise of 15 $\mu g/\sqrt{}$Hz, thus enabling high resolution and low error.

The new AXO315's performance is equivalent to the incumbent analog quartz accelerometers and mechanical inclinometers, but at a fraction of their size, weight, and price, while remaining free from dual-use export control according to Annex 1 of Council Regulation (EC) No 428/2009. AXO315 exhibits higher performance levels than any current commercially available MEMS sensors components and delivers an 80% gain in temperature stability compared to Tronics' previous accelerometer generation AXO®215. The new accelerometer complements the existing lineup of Tronics high performance GYPRO® digital gyros for high-performance IMUs and INS. It comes in a lightweight 1.4 g hermetic SMD J-lead ceramic package (12 x 12 x 5 mm), enabling low-cost assembly and reliability on PCB, even in fast-changing temperature conditions.

With its superior performance and robustness, AXO315 is an ideal sensor for applications requiring high accuracy and stability in demanding environments, such as servo inclinometers and dynamic inclinometers in industrial motion control units, IMUs and INS for GNSS-aided positioning, and navigation of manned and unmanned ground vehicles and trains.

The AXO315 accelerometers are manufactured, tested and calibrated at Tronics Microsystems' facility in Grenoble, France. Pre-production and customer sampling have begun. Evaluation of the sensors can also be made through an Arduino-based evaluation kit that is specifically designed to provide developers with improved testing functionalities such as output reading and recording, recalibration and digital self-tests. Full production of the sensors and availability through its network of distributors are scheduled for summer 2021.

Glossary

- 1-year composite bias repeatability: typical bias error repeatability over 1-year in operation under temperature and vibrations
- 1-year composite scale factor repeatability: typical precision over operating temperature during 1-year in operation
- Closed-loop / force rebalance: When the sensor is subjected to linear acceleration, the acceleration acts on the proof-mass, which is itself counterbalanced by applying voltages that generate electrostatic forces to rebalance the proof mass (closed-loop operation). The applied voltage is directly proportional to the input acceleration

Main applications

- Servo-inclinometer for precise industrial motion and tilt control
- IMU and INS for ground and underground vehicles, trains and robots
- Test instrumentation

Main features and benefits

- High precision and fidelity with 1-year composite bias repeatability of 1 m*g* and a 600 ppm composite scale factor repeatability over temperature and vibrations (-55 °C to +105 °C, >4 *g* rms vibration), making it compatible with demanding applications such as train and vehicle localization, , heavy-industry and construction machines positioning and motion control, as well as test instrumentation.
- Force-rebalance closed-loop MEMS accelerometer with quartz sensors -equivalent performances at a fraction of their size (<0.8 cm^3 vs <10 cm^3), weight (<1.4 g vs 50 g) and price (2-3 times cheaper)
- SMD component with digital SPI interface reducing the cost of integration and BOM: standard SMT assembly on FR4 board, no ADC required and easier system calibration
- Non classified under dual use applications enabling civil and security usage without export license

Key data

AXO315 performance	Unit	Typical values
Input range	*g*	±14
Operating temperature range	°C	-55 to +105
1 year composite bias repeatability	m*g*	1
Vibration Rectification Error	µ*g*/*g*²	20
Bias instability (Allan variance)	µ*g*	4
Velocity Random Walk (Allan variance)	m/s/√h	0.006
Noise density	µ*g*/√Hz	15
1 year composite scale factor repeatability	ppm	600
Scale factor non linearity	ppm	100
Bandwidth	Hz	>300
Data rate	Hz	2500
Power supply	V	5
Size (l x w x h)	mm	12 x 12 x 5.5

About TDK Corporation

TDK Corporation is a world leader in electronic solutions for the smart society based in Tokyo, Japan. Built on a foundation of material sciences mastery, TDK welcomes societal transformation by resolutely remaining at the forefront of technological evolution and deliberately “Attracting Tomorrow.” It was established in 1935 to commercialize ferrite, a key material in electronic and magnetic products. TDK's comprehensive, innovation-driven portfolio features passive components such as ceramic, aluminum electrolytic and film capacitors, as well as magnetics, high-frequency, and piezo and protection devices. The product spectrum also includes sensors and sensor systems such as temperature and pressure, magnetic, and MEMS sensors. In addition, TDK provides power supplies and energy devices, magnetic heads and more. These products are marketed under the product brands TDK, EPCOS, InvenSense, Micronas, Tronics and TDK-Lambda. TDK focuses on demanding markets in automotive, industrial and consumer electronics, and information and communication technology. The company has a network of design and manufacturing locations and sales offices in Asia, Europe, and in North and South America. In fiscal 2020, TDK posted total sales of USD 12.5 billion and employed about 107,000 people worldwide.

About Tronics Microsystems

Tronics Microsystems SA is a division of TDK's Temperature & Pressure Sensors Business Group that manufactures custom MEMS products and standard inertial sensors. Addressing high-growth markets relying on increasing miniaturization of electronic devices, the company provides custom and standard products especially to the industrial, aeronautics, security, and medical markets. Founded in 1997, Tronics is located in Crolles, near Grenoble (France) and in Dallas, Texas (United States), and has around 100 employees, most of them engineers and scientists. Following a tender offer ending January 2017, TDK Electronics AG (formerly EPCOS AG) now holds 74 percent of Tronics’ shares.

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