

True zero-speed sensor includes running mode calibration

The new ATS642LSH from Allegro MicroSystems Europe is a Hall-effect speed sensor which incorporates a novel running-mode calibration system to address the critical performance requirements found in two-wire automotive antilock braking systems (ABS) and industrial speed-sensing applications.

The new device is an optimised Hall-effect sensing integrated circuit and magnet combination that provides a user-friendly solution for true zero-speed digital gear-tooth sensing in two-wire applications. The sensor consists of a single-shot moulded plastic package that includes a samarium-cobalt magnet, a pole piece, and a Hall-effect IC that has been optimised to the magnetic circuit.

The device incorporates signal-processing circuitry which switches in response to differential magnetic signals created by ferrous gear teeth. This circuitry is designed to reduce magnet and system offsets, to calibrate the gain for air-gap independent switchpoints, and to achieve true zero-speed operation.

Signal optimisation occurs at power-up through the combination of offset and gain adjustment, and is maintained via the running-mode calibration system, which addresses critical requirements specific to ABS speed-sensing applications. In particular, it incorporates algorithms that provide immunity to environmental effects such as micro-oscillations of the target or sudden air-gap changes.

The ATS642LSH centres the internally processed differential signal at power-up. It then immediately begins to track the differential signal and enters into the calibration phase. During calibration, the device effectively watches the amplitude of the signal. If the amplitude is sufficiently large, it reduces the gain to an optimal setting and centres the signal if required to maintain optimum switching. The ATS642 continues to monitor the signal and, once amplitude has been optimised, enters into running mode operation.

During running mode, the device follows the differential signal and looks for three consecutive peaks out of range, which is a potential sign of target micro-vibration. It then assumes that it has miscalibrated, adjusts the gain accordingly and, if necessary, readjusts the signal to compensate for any offset. This is all accomplished without missing a transition and while keeping very tight duty cycle over speed and temperature.

The device features robust EMC and ESD protection, and incorporates an on-chip voltage regulator which permits operation over a wide supply voltage range. Undervoltage lockout eliminates output chatter when the device is powered up.

The LSH package, measuring only 8 mm diameter × 5.5 mm depth with a 1.5 mm Hall element spacing in a two-wire leadframe, is optimised for fine-pitch gear-tooth-based configurations, but can be easily configured for a wide variety of gear shapes and sizes. The package is lead (Pb) free, with 100% matt tin leadframe plating.

