Invensense® announces the world?s first motionprocessor with integrated 3-axis gyroscope, 3-axis accelerometer and 9-axis sensor fusion

Medical Design Technology

InvenSense, Inc., the leading solution provider of MotionProcessors for consumer electronics, today announced the release of its highly anticipated MPU-6000 product family. The MPU-6000 is a breakthrough in MEMS motion sensing technology with the integration of a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die together with an onboard Digital Motion Processor™ (DMP) capable of processing complex 9-axis sensor fusion algorithms. With increasing popularity of motion sensors in everyday consumer electronics, pioneered by Nintendo® with the Wii™ console and later by Apple® with the iPhone™, motion processing is quickly expanding into smart phones, tablets, TV remotes, handheld gaming devices and gaming consoles, digital still and video cameras and many other consumer products.

The MPU-6000 family of MotionProcessors eliminates the challenges associated with selection and integration of many different motion sensors that could require signal conditioning, sensor fusion and factory calibration. It features integrated 9-axis sensor fusion algorithms that utilize an external magnetometer output through its master I2C bus to provide dead reckoning functionality. The MPU-6000 is offered in the same 4x4x0.9 mm QFN package and the same pinout as the current MPU-3000 product family of integrated 3-axis gyroscopes, making it easy to fit on already space constrained boards. It also offers ease of integration and interface to various application processors through an I2C or SPI bus and its standard MotionProcessing Library™ (MPL) and APIs.

Adoption of motion processing functions in smartphones, tablets and many other portable consumer electronic devices is promising to bring a host of new and enhanced functionalities and benefits to consumers including: precise sensing of hand jitter to improve image quality and video stability; GPS dead reckoning for vehicles and indoor pedestrian navigation and new motion-based user interfaces, augmented reality and more immersive gaming experiences to name a few. However, market adoption has been slow primarily due to a lack of available off-the-shelf solutions that could be adopted quickly and easily by OEMs. Today, developing an integrated motion sensor solution requires using various components offered by many different suppliers, adding signal conditioning, developing proprietary sensor fusion algorithms, processing overhead and resource allocation and understanding the complex IP challenges in this space, all of which adds cost and delays in adoption by end customers.

Although integrated 3-axis accelerometers have been around since early 2000 in consumer electronics devices and have been offered by a variety of companies, high performance consumer grade gyroscopes have presented many more technical challenges. InvenSense has been the pioneer and market leader for MEMS consumer gyroscopes with the world’s first integrated 3-axis gyroscopes, introduced last year. The availability of a fully integrated 6-axis solution is a breakthrough that will greatly benefit the market and customers alike. A key benefit of an integrated 6-axis solution on the same chip is the perfect alignment of all axes between the gyroscope and accelerometer that will eliminate costly factory calibrations that are currently required. Further, it has eliminated the need for a separate, standalone 3-axis accelerometer and is offered in the same exact package and footprint as the current 3-axis gyroscope from InvenSense. Last, the addition of a master I2C port for inputting the 3-axis compass output can allow a complete 9-axis sensor fusion using the InvenSense proprietary and patent pending DMP and MPL solution. The InvenSense MPL is a software layer that makes the integration and interfaces to an application processor a very easy task without requiring expertise in the field of motion processing.
“*InvenSense, with the development of the Nasiri-Fabrication™ process and the building of a flexible manufacturing infrastructure, has established an enabling platform to support the integration of multiple axis of motion detection in a single chip*,” said **JC Eloy**, CEO of Yole Développement. “*InvenSense is developing in parallel of the silicon device, software functions and applications software that will simplify the integration of motion processors into modules and systems, paving the way towards a larger market and wide diffusion of motion processors into consumer electronics*.”
“*InvenSense has been leading the innovation of the motion sensing market with the introduction of a series of*

'World's First' products that have leapfrogged the size, cost, and performance benchmarks in the industry," said **Steve Nasiri**, Founder, CEO, and chairman of InvenSense. "*The MPU-6000 is truly a breakthrough even by our standards both in terms of time-to-market and for addressing the real market need by offering a total solution that takes the complexity out of integrating motion sensors in consumer products*."

With over 100 million units shipped by InvenSense to major consumer electronics makers around the globe, continuity of supply and quality is of the utmost importance. InvenSense leverages its patented and production-hardened Nasiri-Fabrication platform to bring the world's first integrated 6-axis solution to the market. Nasiri-Fabrication is the key enabling technology behind MotionProcessing allowing direct integration of MEMS mechanical structures and CMOS electronics at the wafer level, hence taking all the scaling challenges out of the MEMS fabrication by making it a typical fabless semiconductor supply chain. The MPU product family leverages proven 8" fabrication lines from world class foundries and in-house high volume test and calibration facilities in Taiwan to support the high volume requirements of the consumer marketplace. The MPU-6000 will include the company's proprietary and patent pending DMP engine, enabling 9-axis sensor fusion and MPL APIs to deliver the only complete solution available in the market today.

The MPU-6000 includes a range of dynamic full scale capabilities at ±250dps, ±500dps, ±1000dps, and a top range of ±2,000dps for angular rate sensing and ±2*g*, ±4*g*, ±8*g* and ±16*g* for linear acceleration sensing. This permits the use of a single MotionProcessing solution to perform every possible motion application from slow motion menu selection to very fast hand gestures, all with 16-bit resolution. Rate noise performance sets the industry standard at 0.005 degrees/sec/√Hz, providing the highest-quality user experience for image stabilization, pointing and gaming applications. High-accuracy factory calibration targeting ±1% initial sensitivity reduces customer calibration requirements. The gyroscope operates at a resonant frequency above 27kHz making the MPU-6000 immune to interference from audible frequencies (20-20,000Hz) such as music, phone ringers, crowds or white noise, which becomes critical for noise sensitive applications such as image stabilization. Other industry-leading features include the 4x4x0.9mm plastic 24-pin QFN package, on-chip16-bit ADCs, programmable digital filters, a precision clock with 2% accuracy over -40°C to 85°C, an embedded temperature sensor, programmable interrupts, and a low 5.5mA current consumption. Parts are available with I2C and SPI serial interfaces, a VDD operating range of 2.5 to 3.6V, and a VLOGIC interface voltage from 1.71V to 3.6V.

The MPU-6000 is available for immediate selected customer sampling. For more information visit InvenSense at http://www.invensense.com. **About InvenSense** InvenSense is the leading solution provider of MotionProcessors for the consumer electronics market, with proven technology and cumulative shipments of over 100 million units to leading customers worldwide. The company's patented and patent pending MotionProcessing technology and Nasiri-Fabrication platform address the emerging needs of many mass-market consumer applications such as gaming, image stabilization, remote controls, tablets and smartphones that require improved performance, enhanced features, and new and more intuitive motion and gesture-based user-interface solutions. InvenSense is a privately held company with headquarters located in Sunnyvale, California. More information can be found at http://www.invensense.com [1].

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