Evaluation of a 3D motion sensor including accelerometer and geomagnetic sensor

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Abstract: This paper presents a development of a 3D motion sensor which detects inertial movements and earth's magnetic fields for a compass heading. It consists of a 3-axis accelerometer, a 2-axis geomagnetic sensor, and a microcontroller. An automatic calibration and measurement system is developed to reduce test lead time. For the geomagnetic sensor part, an accuracy of ±5 degrees, a resolution of ±1 degrees, and a linearity of ±1% in full scale range have been achieved. The accelerometer has a full measurement range of ±2g. Both sensitivity of 819 count/g with a 12-bit analog-to-digital converter and a linearity of ±0.5% in full scale have been achieved. While driving voltage can operate between 2.7 and 3.3 V, current consumption is 3.2 mA at 2.8 V. Thorough reliability test is performed and the sigma level of geomagnetic sensor heading accuracy is 5.6σ, and that of accelerometer sensitivities are 4.6σ, 5.6σ, and 4.5σ for x, y, and z axis respectively. Pedometer software is tested and showed 85% of step count accuracy. The dimension of a packaged chip is 8.3 mm X 5.3 mm X 1.5 mm.

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