SENSOR PLATFORMS

SSP1235

HDD Rotational Vibration Cancellation IC

for Data Transfer Rate Performance Improvement

Rotational Vibration (RV) degrades HDD I/O Throughput

As the track pitch of hard disk drives (HDDs) narrows with increasing drive capacity, keeping the read/write head on track becomes more challenging. Rotational vibration (RV) is a primary contributor in degrading HDD throughput by pushing the head off track. RV is most acute in multi-drive systems, such as networked storage and rack-mounted servers, where the activities of neighboring drives progressively impact the performance of each drive in the system.

Conventional RV cancellation implementations use carefully matched shock sensors. They are sensitive to mechanical variances of chassis of servers or storage arrays and become much less effective when the HDD is subjected simultaneously to translational vibration and RV.

SSP1235 Features

The SSP1235 is a single-chip solution that provides superior RV cancellation.

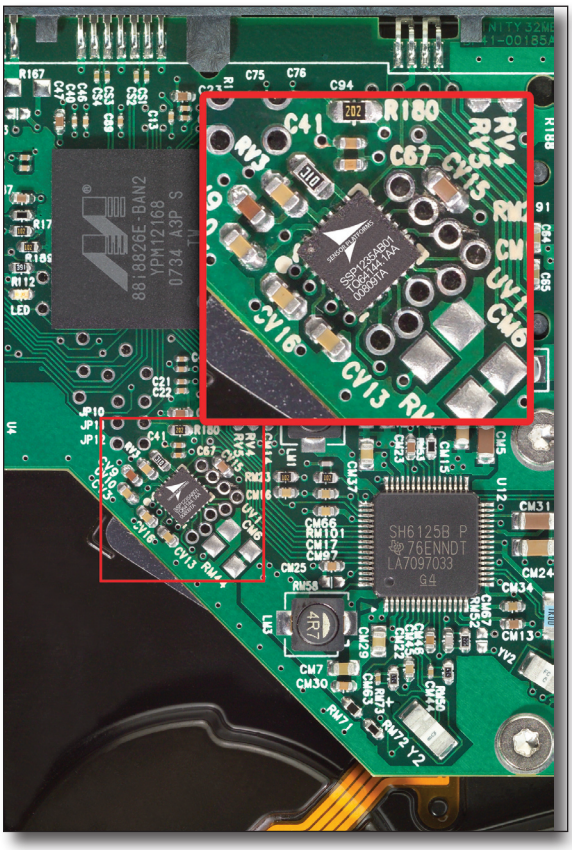

Photo of a hard disk drive using the SSP1235 (enlarged in red box) for RV cancellation

- Up to 30dB RV rejection from 100 to 1.5kHz
- Advanced circuits and algorithms that ignores false signals introduced by translational vibration
- Operates with piezo electric shock sensors/accelerometers from multiple manufacturers
- Automatically compensates for variance in sensitivity between the two shock sensors due to production variance, PCB mounting tolerance, temperature, moisture, etc.
- Requires only PES and SEEK input from HDD controller. No firmware interaction for standalone operation.
- Compact package: 4 x 4 x 0.8mm 24-pin QFN

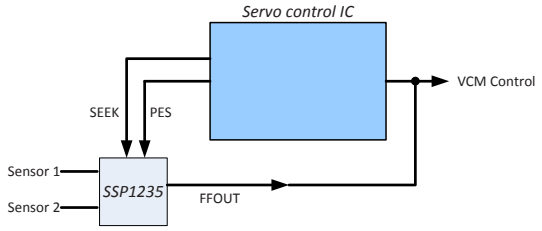

Figure 1. RV Cancellation using the SSP1235. The device connects directly to the shock sensors and takes the position error signal (PES) and a seek indicator (SEEK) from the HDD controller as inputs. Its analog output is summed with the input to the voice-coil motor (VCM) control signal. The implementation requires minimal firmware modifications.

Benefits

The SSP1235 is a sophisticated mixed-signal device that marries precision analog circuits with advanced algorithms. Used standalone, it effectively cancels the negative impacts of RV on HDD throughput without firmware modifications.

The SSP1235 continuously calibrates and compensates for any sensitivity mismatches between the two shock sensors it uses to detect vibrations. Consequently it is able to accurately measure rotational vibration even in the presence of strong translational vibration.

A "drop-in" solution

The SSP1235 is a drop-in solution requiring few external components and no firmware programming. Figure 1 shows the SSP1235 connected to two piezoelectric shock sensors. The device receives two signals from the HDD controller: position error (PES) and seek indication (SEEK). It provides an analog feedforward signal (FFOUT) that can be summed with the input to the servo control.

The compact footprint, a 24-pin QFN package, allows the SSP1235 to be easily adopted on any PCB.

Adaptation

The most distinct capability of the SSP1235 is its ability to self calibrate. The device compares the measured acceleration directly to the position error signal (PES). The result is used in a proprietary algorithm to adaptively control the gain of each shock sensor. This allows the SSP1235 to self-calibrate continuously over time. Thus, the need and the cost to control sensor sensitivity variance by binning during production can be eliminated.

www.sensorplatforms.com 2860 Zanker Road, Suite 210 | San Jose, CA 95134 | (408) 850-9350

Latency

Latency, or phase delay, is a critical parameter in feed forward correction systems. Excess latency degrades the effectiveness of feed forward RV cancellation since the corrections arrive after they are needed, and can even amplify the vibration (if they arrive 180° out of phase). Using dedicated hardware to manage the feed forward correction system allows the SSP1235 to minimize latency and avoid the inefficiencies of having to hand craft DSP code in the HDD controller to fit into latency constraints.

Sensor Platforms, Inc.

Sensor Platforms Inc is a fabless semiconductor company enabling the next wave in personal electronic devices as they progress beyond personal computers and web-enabled handsets to include solutions that interact with their physical environment and acclimate to the surroundings, such as location- and motion-aware personal electronics devices.

Sensor Platforms has assembled a brain trust of leaders in the fields of accelerometers, micro-magnetometers, algorithms and precision analog technology to address the rich opportunities opening up as this demand for location-aware sensors grows exponentially, requiring new applications to deliver higher levels of personal productivity.

Our ICs enable new intelligent devices to overcome existing performance and cost limitations using precision analog/mixed signal designs, application-specific heuristics and advanced algorithms. Our products cover applications including free-space remote control, position tracking, rotational media vibration cancellers, and general purpose sensor control.

Sensor Platforms was founded in 2004, is venture funded, and is headquartered in San Jose, California. For more information, visit www.sensorplatforms.com.