

## APPLICATION NOTE

### Accelerometers for strong motion measurements

30N.S-MOTION.B.05.11



The SF2006 class B seismic sensor

#### Features

- Extreme low noise
- Wide frequency response
- High reliability
- Harsh environment (shock, vibration, temperature)
- Small size

#### Reliable performance

Strong motion recorders are used to map earthquakes and record how earthquakes affect structures. Earthquake data is used to create precise maps for earthquake hazard mitigation. The maps enable buildings to be constructed appropriately according to local earthquake risks. Once structures have been built, they are monitored during an earthquake so that engineers can validate building designs, document failures, and evaluate building codes. Strong motion applications require accelerometers with excellent stability, linearity, dynamic range and DC response. The Si-Flex accelerometer meets these demanding requirements and offers other advantages over conventional sensors.



#### Self testing and super sensitive

Once installed, strong motion recorders are typically left unattended and expected to work whenever an earthquake occurs. This means the entire system including the accelerometer must be reliable and consistent over extended periods of time. The MEMS technology behind the Si-Flex accelerometers produces results that are reliable and repeatable over time. This is evident from the low offset thermal coefficient of  $\pm 100 \mu\text{g}/^\circ\text{C}$  and low linearity error of  $\pm 0.1 \%$  of the Si-Flex accelerometers.

Accelerometers for strong motion recorders in buildings are often located in areas with limited access. They are mounted to key structural elements such as beams, foundations and walls. Because these areas are not readily accessible, self-testing capability of the accelerometer is important. The Si-Flex SF1500 or SF2006 accelerometers are designed with a self-test capability specifically for strong motion applications. A TTL signal can be remotely applied to the self-test pin of the sensor. The signal is injected into the feedback loop of the accelerometer, producing a pulse in the output channel of the accelerometer.

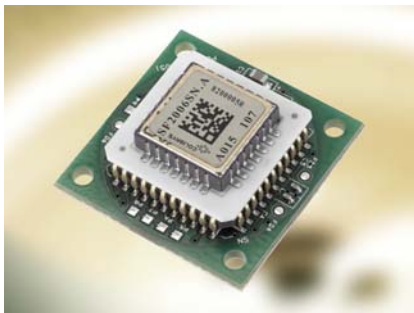


Fig. 2: SiFlex accelerometer

Seismic events vary greatly in magnitude, ranging from weak tremors that are imperceptible to catastrophic events that destroy structures. It is important for strong motion accelerometers to have enough dynamic range to measure local events with a good signal-to-noise ratio and on scale. The small events provide a source signal for structure health monitoring and characterization. This can help reveal flaws in construction or design and indicate warning signs of premature aging of structures. Structure response to large quakes can help identify failure modes and improve designs.

## APPLICATION NOTE

Structures within buildings and large structures such as bridges often have low frequency modes. Since damaging seismic energy occurs at low frequencies, a DC coupled accelerometer with a flat frequency response is required in order to faithfully record these events. A stable DC coupled accelerometer used for strong motion applications can also measure static changes in tilt or displacement after a large event. Since the Si-Flex accelerometer has both excellent DC stability and a flat frequency response, it is particularly well suited for strong motion measurements.

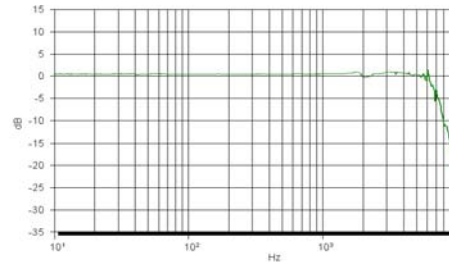


Fig. 3: Frequency response up to few kHz

### Protecting People and Property

The Si-Flex accelerometer is uniquely well suited to the demanding performance requirements of strong motion applications. Strong motion recording systems play an important role in protecting life and property in earthquake prone areas. The performance and success of these systems is highly dependent on accelerometer technology and performance.

