



Abstract: High-G Impact Sensors for Hostile Environments  
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**Problem:** The immediate problem addressed was the development of an impact sensor that could survive 50kGs yet be sensitive to 50Gs of impact, occupy less than 1 cubic mm, incorporate damping to minimize vibration sensitivity, have a lifetime of over 20 years, and be delivered as a low cost hermetically sealed surface mount component.

**Innovation:** HT Micro has designed, developed and delivered such impact sensors that are fully microfabricated and hermetically packaged in a low profile surface mount technology at wafer level. There is no post singulation processing required. The sensor is manufactured in a mix of materials, including ceramic, high strength nickel alloy, and contact metallurgy developed by HT Micro specifically for the high shock environment. Fabrication is a so-called “direct LIGA” process, incorporating both X-ray and UV-photolithography. The sensor is made with a multi-layer process to accommodate the multiple materials, and to accommodate high aspect ratio features that provide full 3-dimensional sensing and squeeze film damping. Under specified impact, the normally open sensor registers a resistance of less than 10 ohms down to a low of 100 milliohms. Tests have been conducted by an independent supplier verifying that the sensors meet all requirements.

**Application:** The immediate application is for low-cost fuzing of 40 mm munitions for both launch and impact detection. In the longer term, there is a broad spectrum of military munitions that will benefit from such a sensor. Additional commercial applications are envisioned in material handling and other situations in which the sensor is expected to sustain high shock without performance degradation. Because the sensors are hermetically packaged, they are expected to also find utility in hostile environment applications that quite dirty.