Low G MEMS Inertia Switches for Fusing Applications

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Issues
- Reliability
- Scaling

Approach
- Design
- Fabrication

Results
- Initial Testing
Reliability

- Reliability  ➔ Force  ➔ Δ Energy  ➔ Volume
Reliability

\[ F_{ctct} = (ma - kx_{ctct}) \]
Force at 25% overdrive versus acceleration for varying proof mass thickness
Design

Force at 25% overdrive versus acceleration for varying proof mass thickness

- 1000
- 500
- 200
- 100
- 50
- 20
- 10

Contact Force (mN)

Acceleration Threshold (Gs)
Design

\[ FOM \sim \frac{F \eta}{\$A} \sim \frac{\rho \eta}{\$} \]
Keys for High FOM / Viable Microfabricated Component

1) Materials – ρ, σ_y, σ-n - $

2) High Aspect Ratio - $

3) Tolerances / Integration / Packaging  - $

4) Testing - $
Design

Integrated Inertia Switch Anatomy

- Custom metal proof mass
- Hard Gold Contact Pads
- Spin contact not visible
- Conductive via fill
- Ceramic Package (Hermetic)
- Bottom contact
- Top contact
- Common contact
- Side contact
Multi-layer spring-mass fabrication
multi-layer fabrication
Multi-layer spring-mass fabrication
Multi-layer spring-mass fabrication
ma = kx

acceleration threshold vs. fo

acceleration threshold (Gs)

resonant frequency (Hz)
\[ ma = kx \]

\[ \sim 0.05 \, \text{G} / \text{Hz} \]
Diced Wafer
‘WLP’ Diced Parts
Edge of Device
Resonance Measurements

Resonance Scan T1

Resonance Scan T2
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