

- 1) A MEMS Si cantilevered beam is used as a spring. It is $500\ \mu\text{m}$ long, $20\ \mu\text{m}$ thick and $10\ \mu\text{m}$ wide. At its free end, there is an attached Si rectangular proof mass, $20\ \mu\text{m}$ thick, $1000\ \mu\text{m}$ long and $1000\ \mu\text{m}$ wide. For Si having a Young's Modulus of $170\ \text{GPa}$ and a density of $2.35\ \text{g/cm}^3$:
 - a. What is the spring constant in N/m ?
 - b. What is the volume of the proof mass in m^3 ?
 - c. What is the mass of the proof mass in g ?
 - d. What is the systems natural frequency in Hz ?
 - e. If the mass experiences a $500\ \text{G}$ acceleration so that the beam bends in the direction of its thickness, what is the displacement of the proof mass in μm ($1\ \text{G} = 9.8\ \text{m/s}^2$)?

- 2) For the MEMS device shown below, what is an approximate expression for the system spring constant for the mode where the proof mass moves perpendicular to the plane of the paper, in terms of E , L , t and w ?

