Durham University

# MEMS Multimorph Capacitive Temperature Sensors in COMSOL Multiphysics®

Level 3 Semiconductor, Physics and Devices

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## Abstract

This report describes how the $C$–$T$ characteristics of MEMS multimorph capacitive temperature sensors vary with geometry, material choice and thermal-annealing temperature. The sensors were modelled using FEM and physics simulation software—COMSOL Multiphysics®—so the key design choices for the model and mesh are also included.


## Nomenclature

MEMS Microelectromechanical systems

## 1 Introduction

In an increasingly data centric world with the number of sensors

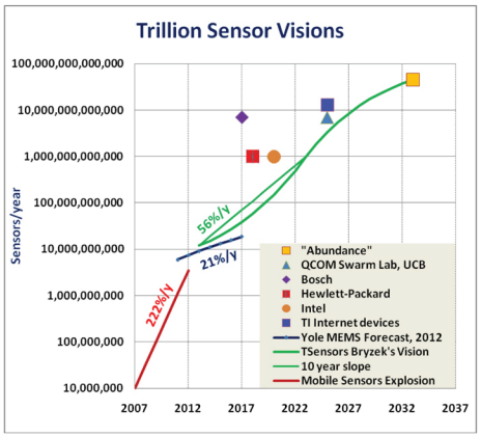


Figure 1: Janusz Bryzek's trillion sensor vision [1]

*why sense temperature?*
*what temperature sensors are available?*
*why* MEMS*?*

## 2 Background

*what is a multimorph capacitor?*

### 2.1 Construction

*how do we build an effective multimorph*
*how do we make the sensor practical*

### 2.2 Characterisation

*multimorph capacitance*
*how do we characterise sensitivity?*
*how do we characterise linearity?*

## 3 Modelling

### 3.1 Geometry

*symmetry*

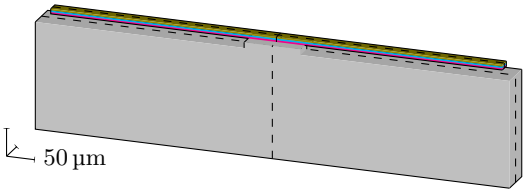


Figure 2: Symmetry lines of the multimorph capacitive temperature sensor—marked with dashed lines.

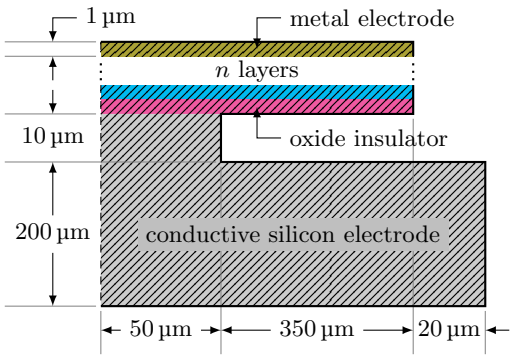


Figure 3: Cross-section of the multimorph temperature sensor—not to scale.

*dimensions*
*mesh*

### 3.2 Materials

### 3.3 Physics

## 4 Results

## 5 Analysis

## 6 Conclusion