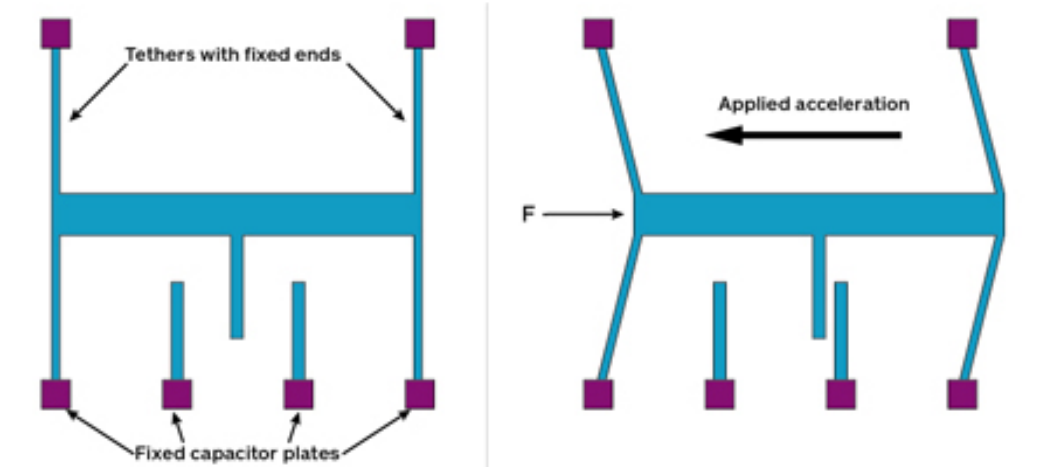
Accelerometer Intro

Last updated 7/21/23

Accelerometer Intro

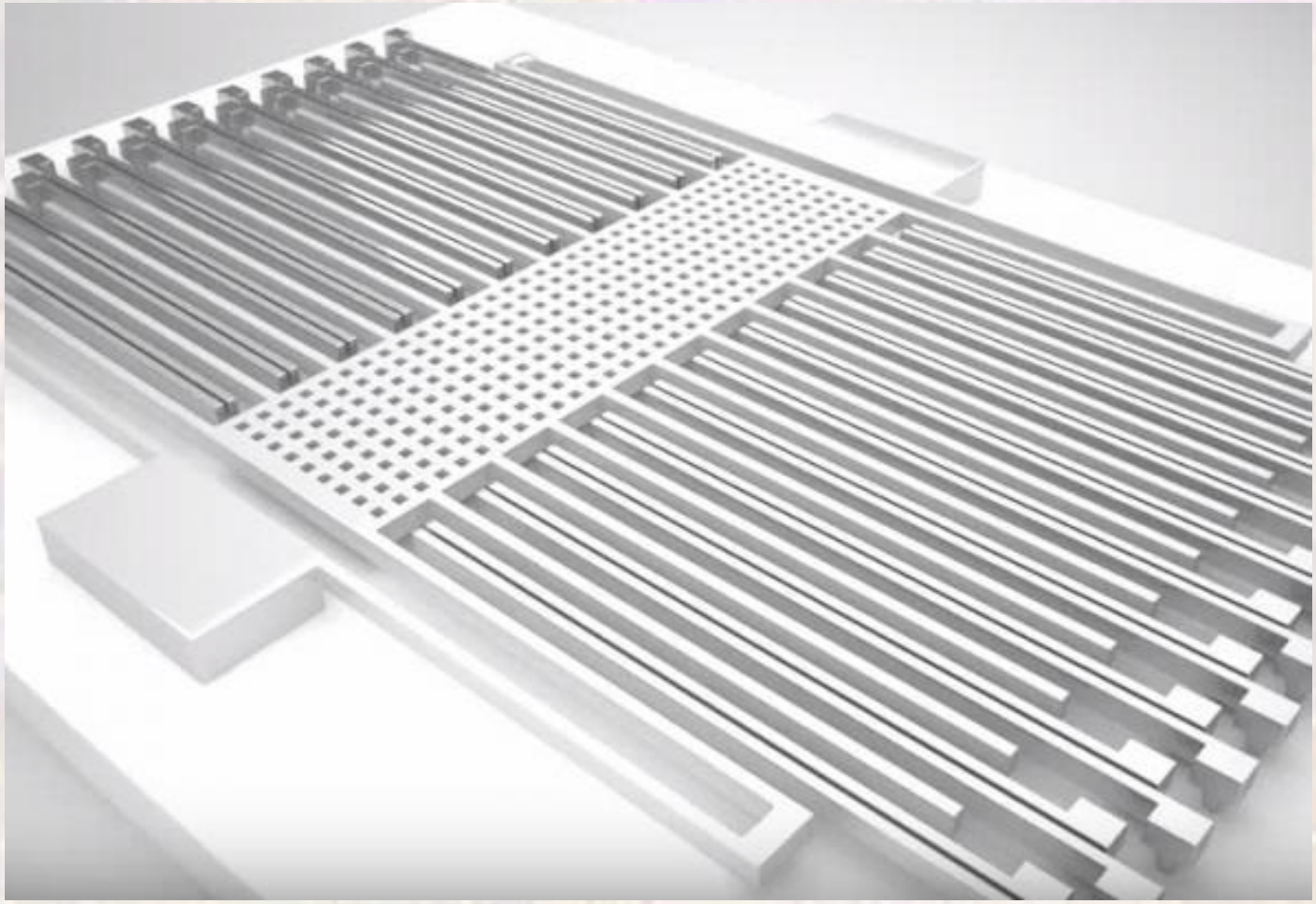
- Basic Accelerometer Operation
  - Suspend a conductive mass from fixed points
  - Interleave fixed conductors
  - Acceleration → movement of the suspended mass → changes in relative capacitance between the suspended conductors and the fixed conductors



Capacitive accelerometer operation.
Image credit: Silicon Far East

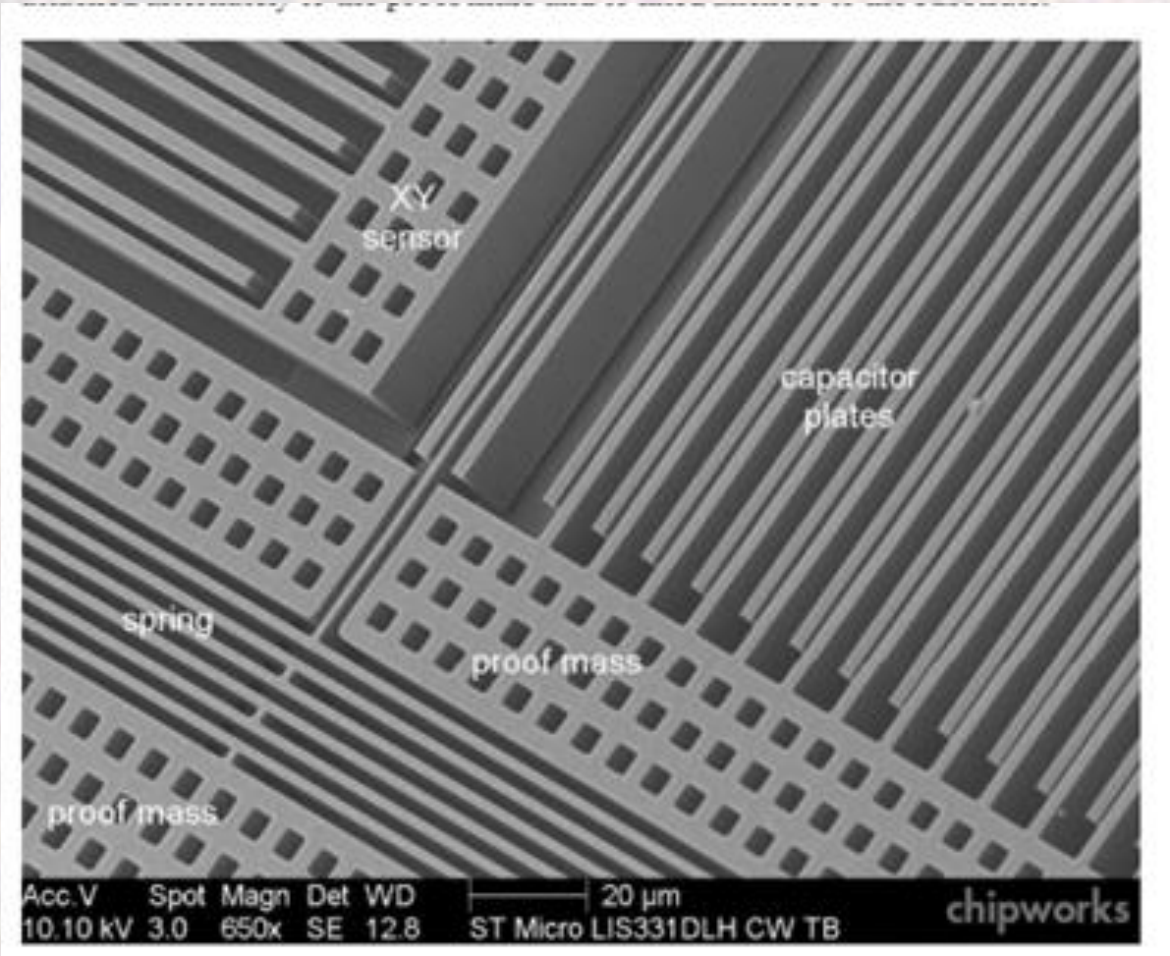
Accelerometer Intro

- Single Axis



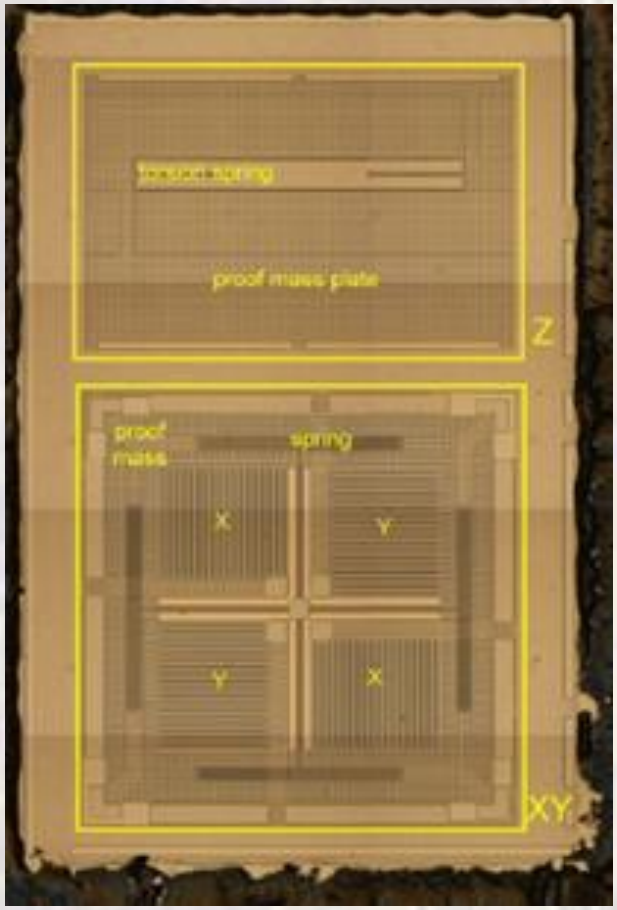
Accelerometer Intro

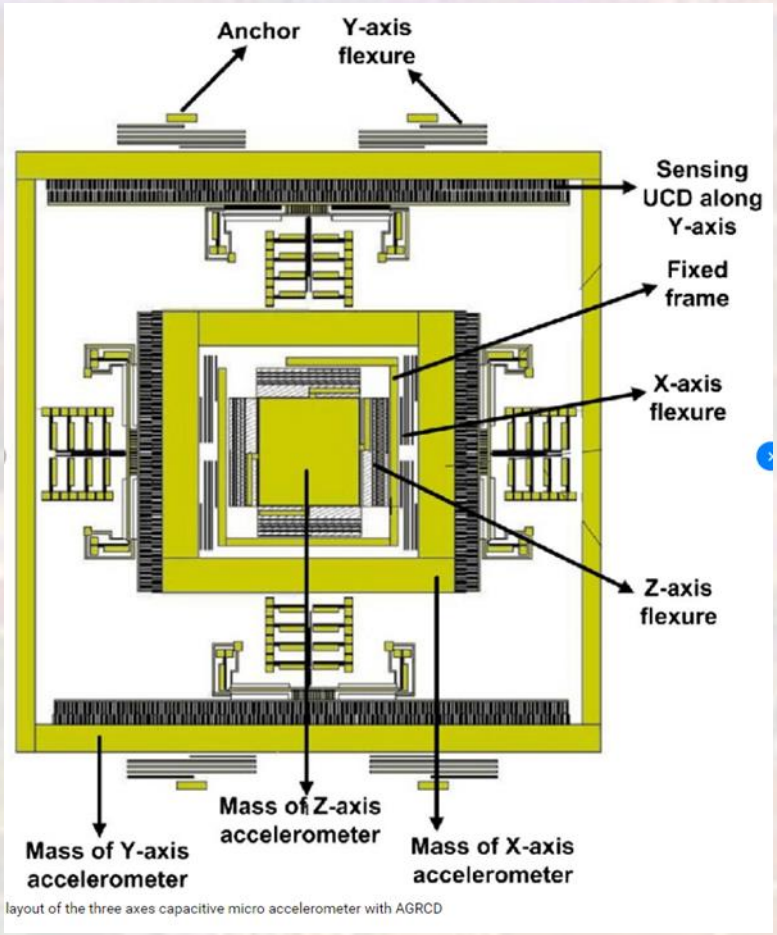
- Dual Axis



Accelerometer Intro

- 3-Axis

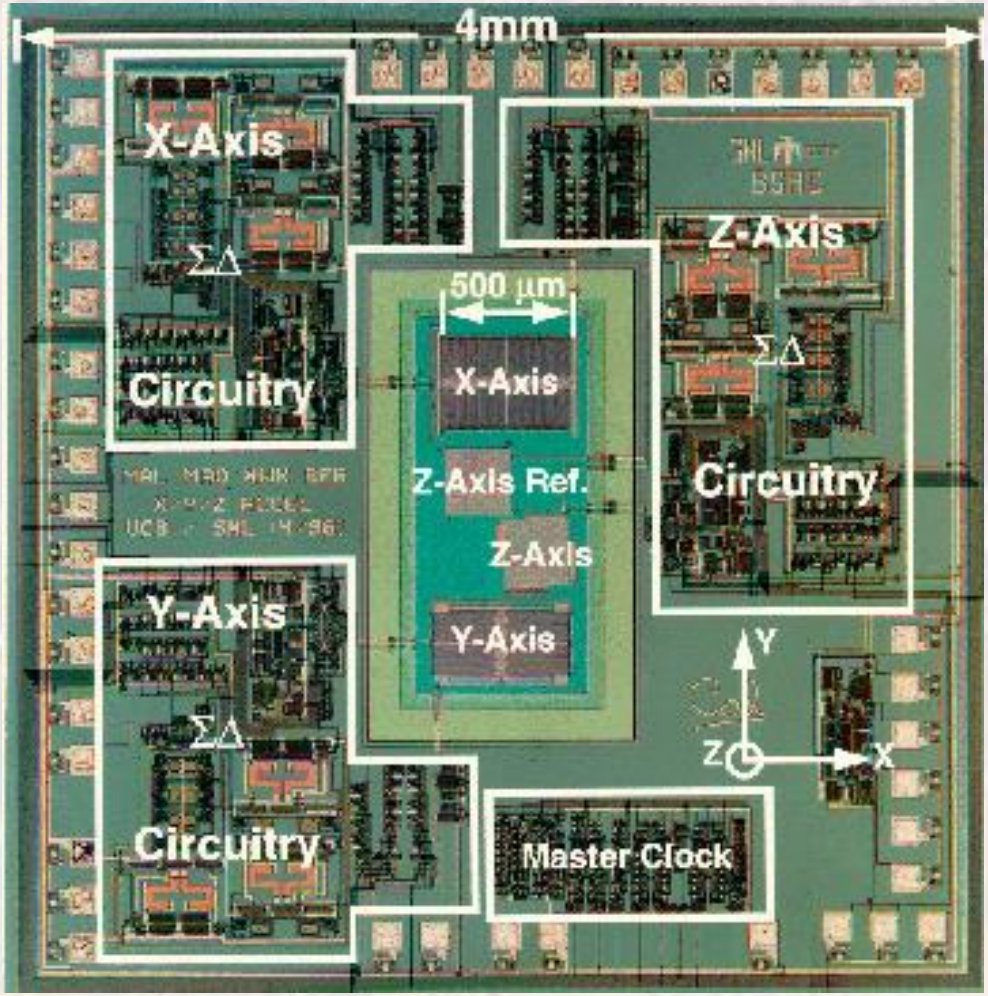




layout of the three axes capacitive micro accelerometer with AGRCD

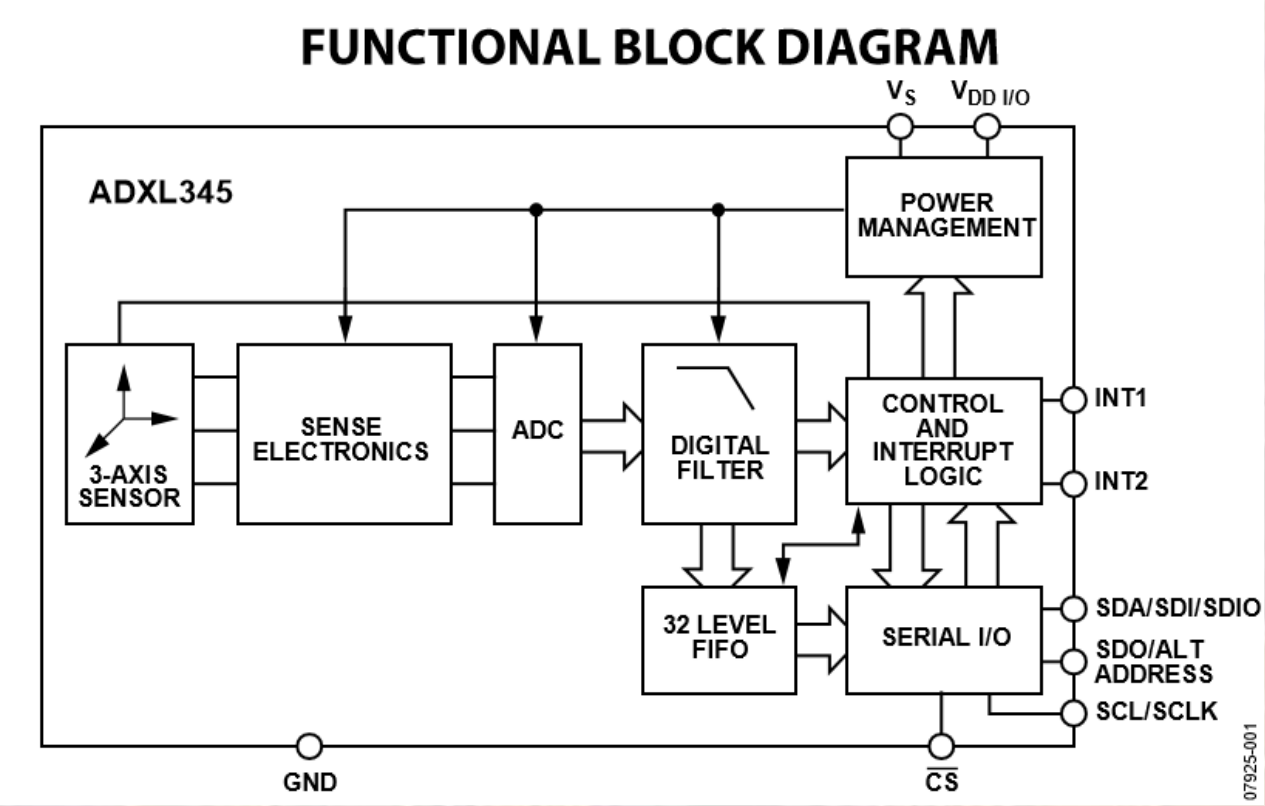
Accelerometer Intro

- Integrated electronics



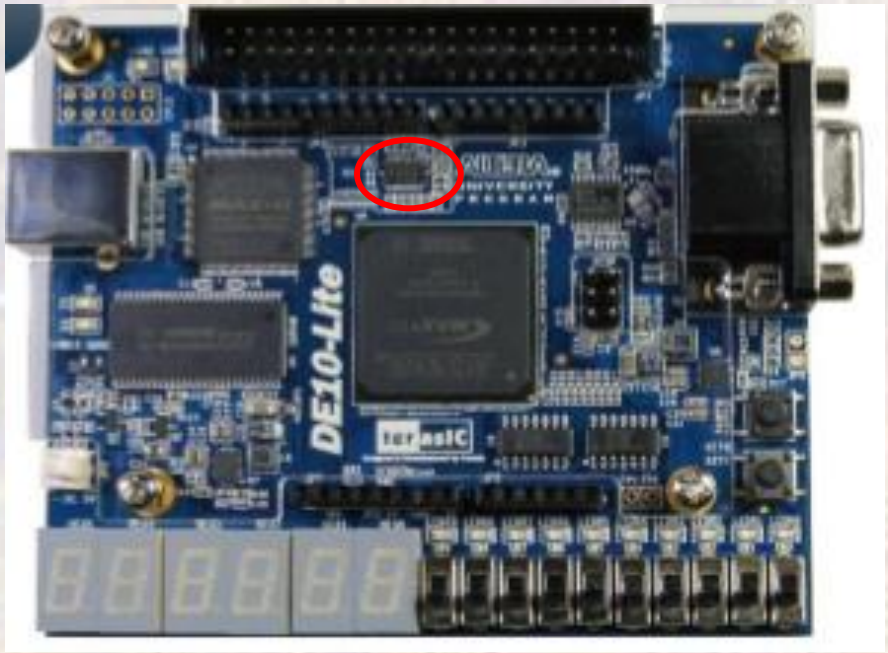
Accelerometer Intro

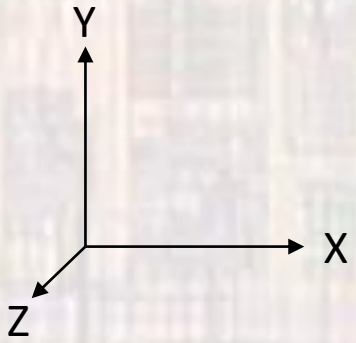
- ADXL345 – 3-axis Accelerometer
  - I2C and SPI interfaces
  - FIFO sample storage



Accelerometer Intro

- ADXL345 – 3-axis Accelerometer
  - Selectable ±2, ±4, ±8, ±16 g measurement range
  - 10bit resolution: 4.3mg/LSB -34.5mg/LSB
  - Up to 3200Hz data rate





Accelerometer Intro

- ADXL 345 Default modes
  - 4 wire SPI
  - 10bit
  - Data: right justified, sign extended
  - +/- 2g range
  - Trigger on int1

Accelerometer Intro

- Limitations

$$a = \frac{dv}{dt} \qquad dv = a\,dt \qquad v = \int a\,dt \qquad v = at + c \qquad v = at + v_0$$

$$v = \frac{dx}{dt} \qquad dx = v\,dt \qquad x = \int v\,dt \qquad x = \int (at + v_0)\,dt \qquad x = \frac{1}{2}at^2 + v_0 t + c$$

$$x = \frac{1}{2}at^2 + v_0 t + x_0$$

$$x = \int\int a_x\,dt^2$$