An Energy Harvesting System for In-tire TPMS

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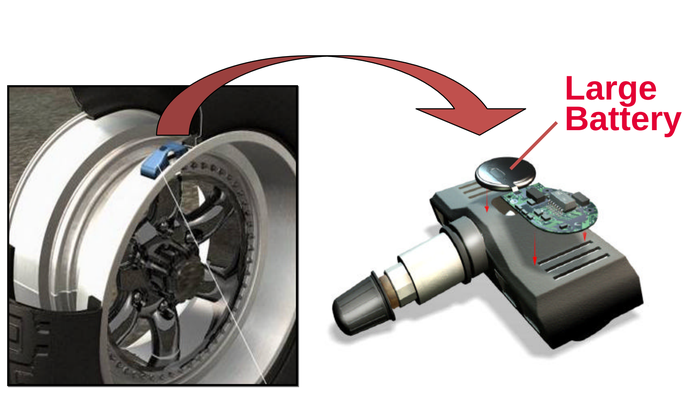
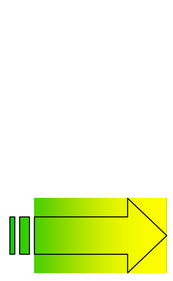
Today's rim-mounted TPMS:

60 cm³

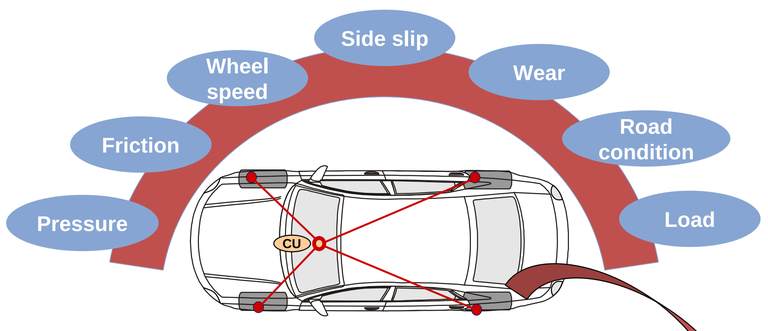




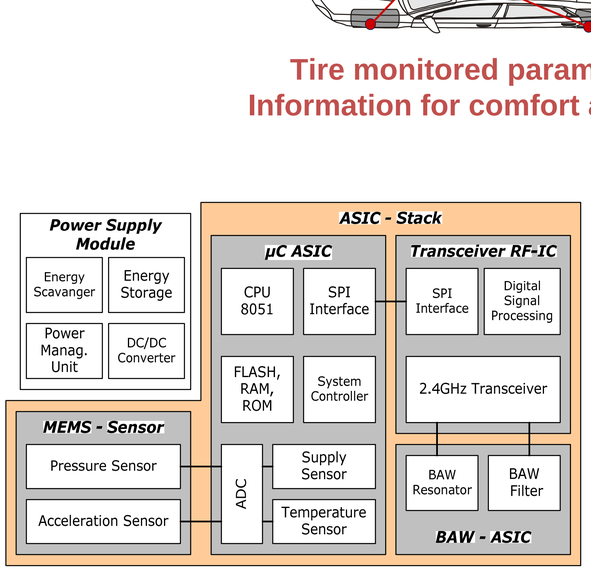
Future self-sufficient tire-mounted TPMS:

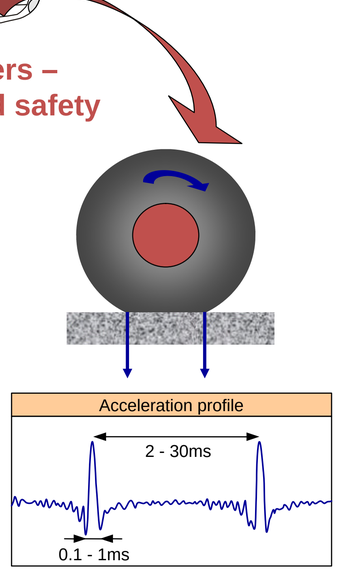
< 1 cm³

Application Background



Tire monitored parameters – Information for comfort and safety

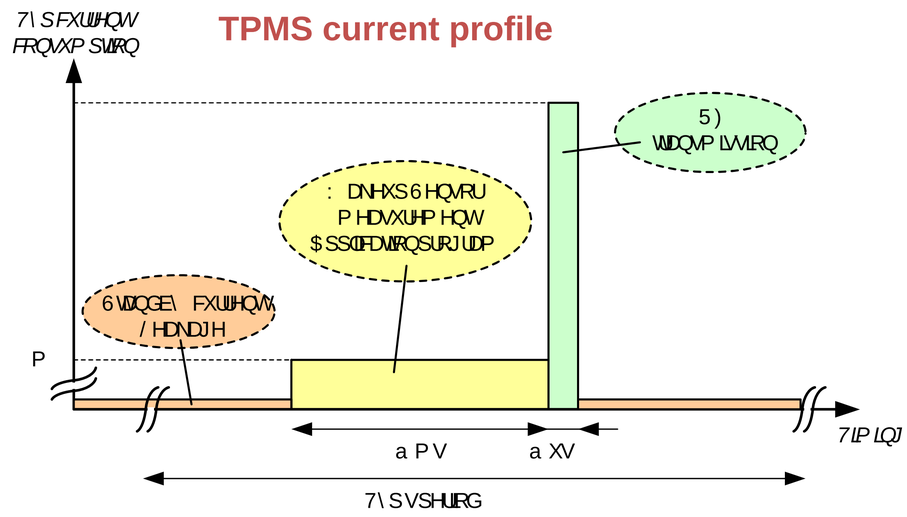




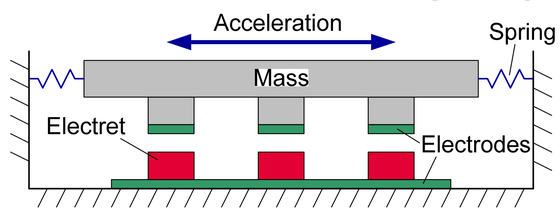
TPMS Supply Requirements

- Mechanical reliability to shocks and vibration up to 2000g
- Operating temperature range from -40°C to 125°C
- Life time > 10 Years
- High efficiency of Energy Scavenger even at low vehicle speed
- Low-leakage energy storage device
- Competitive costs to rim-mounted supply unit

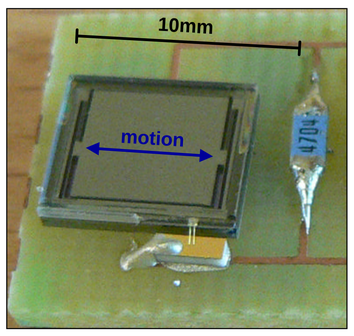
TPMS current profile



Electrostatic transduction principle

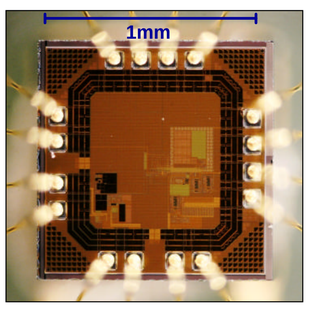


- Electret as bias for the transducer
- In-plane motion
- High aspect ratio micromachining



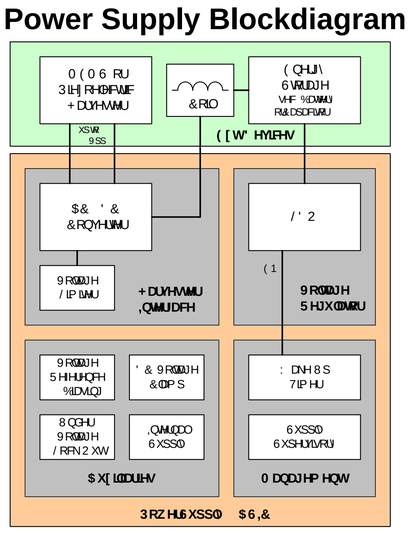
MEMS Prototype

- Compatible to MEMS- or piezoelectric-harvester
- On-chip handling of AC input voltage up to 36V_{pp}
- Total current consumption < 50nA
- Measurements on first test chips prove feasibility

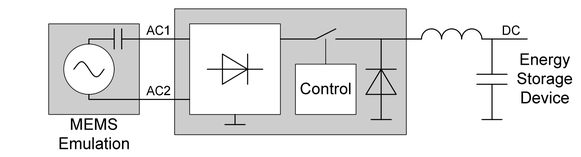


Power Supply - Test Chip

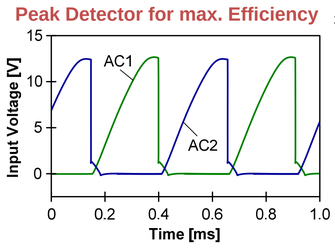
Power Supply Blockdiagram



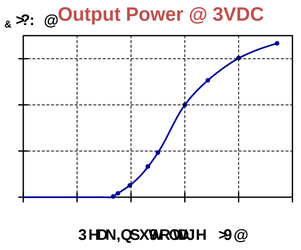
Harvester Interface



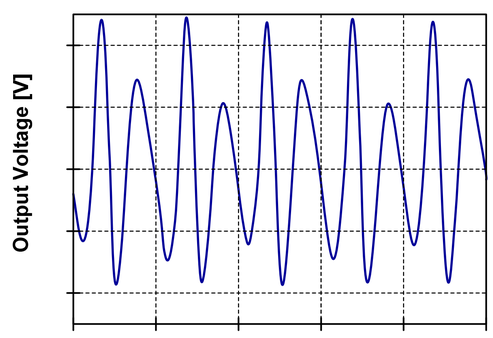
Peak Detector for max. Efficiency



Output Power @ 3VDC



Laboratory measurements



- Simulations show that a few µW of in-tire harvested power is possible at driving speeds down to 50km/h
- Measurement of first prototype confirms the workability of our design concept