An Integrated Position-Sensing System for a MEMS-Based Cochlear Prosthesis

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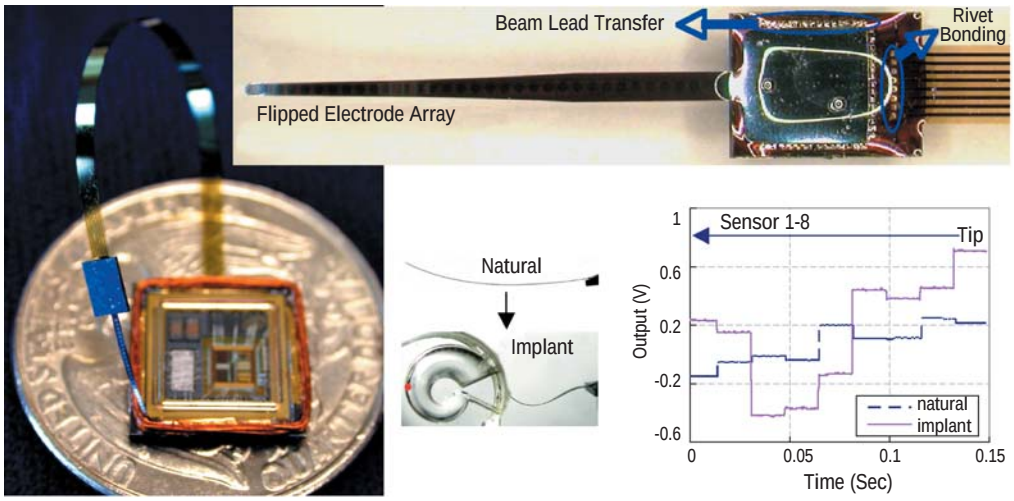
The WIMS ERC is developing an implantable MEMS-based cochlear prosthesis that provides high-density stimulation and embedded position sensing to achieve high-quality sound perception, minimize insertion damage, and optimize implant placement in restoring hearing to the profoundly deaf. A custom integrated circuit (ASIC) mounts on the rear of a 32-site thin-film electrode array, interfacing with a hermetically packaged WIMS microcontroller and wireless chip over an 8-lead polymeric cable. The 2.4mm x 2.4mm ASIC chip operates on 5 volts and performs command validation, stimulus generation, sensor selection, offset compensation, and signal conditioning (amplification and band-limiting). The electrode array incorporates polysilicon piezoresistors to sense array position and wall contact. The position sensors have typical gauge factors of 15, while the wall contact sensor at the tip of the array provides a contact signal of more than 100mV. Arranged in eight segments that cover the length of the array, the position sensors allow overall array shape to be determined to better than 50μm.



In the WIMS cochlear prosthesis (left), a hybrid multi-site electrode (right top) is flip-chip bonded to a signal-processing chip (ASIC). Array position/shape and wall contact are monitored by sensors distributed along the shank (right bottom).