

Smart actuators for flow control using MEMS technique

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An actuator is one of the most important components for flow control, especially when intelligent control is necessary. Our group is developing two types of MEMS actuators, one of which is a synthetic jet actuator for separation control and the other is a wall deformation actuator for turbulence control. The wall deformation actuator was designed for 4th generation system of turbulence control which also includes arrayed wall shear stress sensor, VLSI based control system and neural network. One very small VLSI controller includes all the electronic circuits necessary for handling one sensor and one actuator. Fig1 and Fig2 show design and real chip of VLSI specially designed for 4th generation system. Main improvements of 4th generation actuator are the size reduction (3mm→1mm) and fabrication method change (handwork→MEMS). Reduced size of the actuator makes turbulence control to be extended to higher Reynolds number and MEMS fabrication technique increases the productivity of the actuator and reduces heat generation during turbulence control.

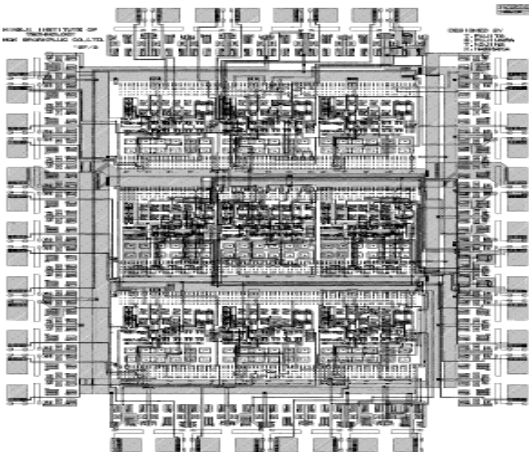


Fig1 Patterned VLSI – 9 blocks, 42 pads

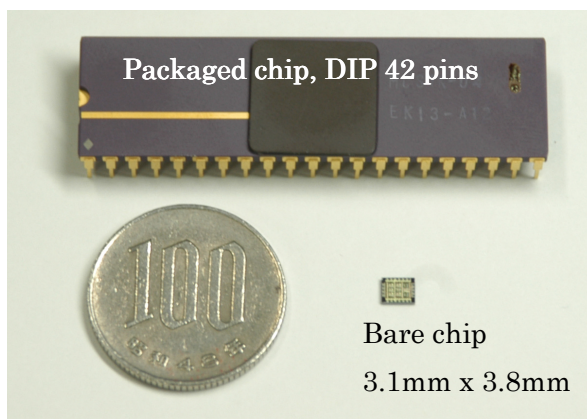


Fig2 Photograph of VLSI chip

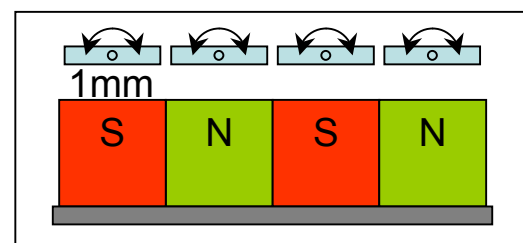
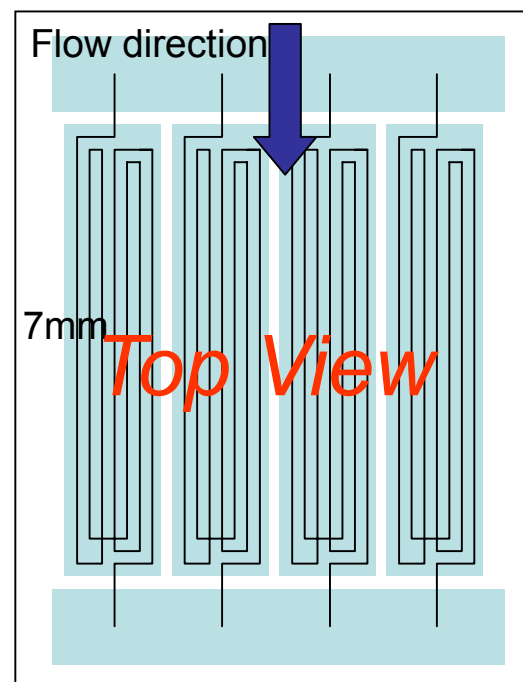


Fig3 4th generation MEMS actuator