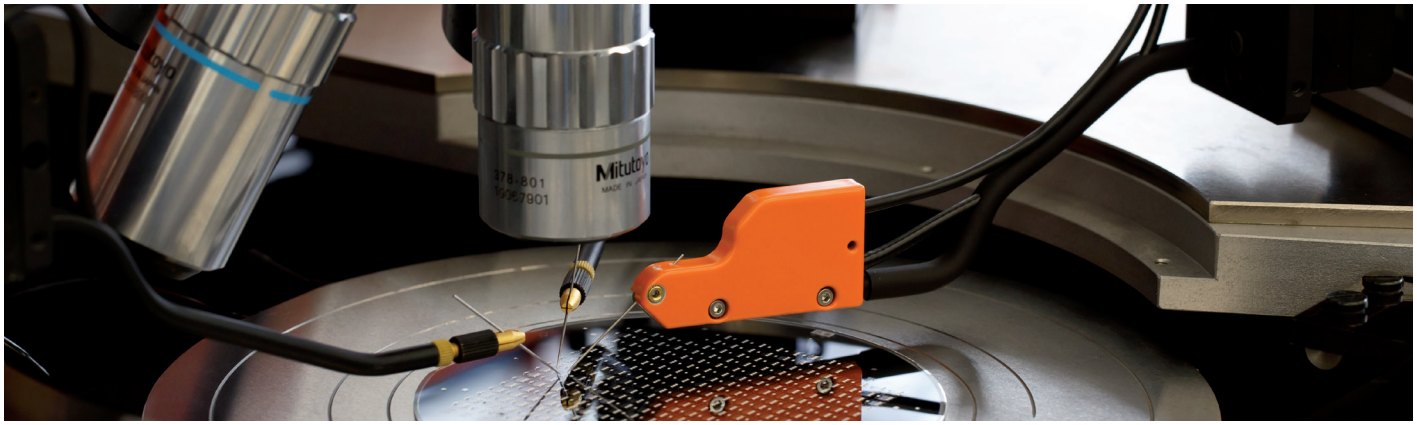
MEMS ACTIVE PROBE FOR WAFER AND CHIP LEVEL CHARACTERIZATION OF MEMS



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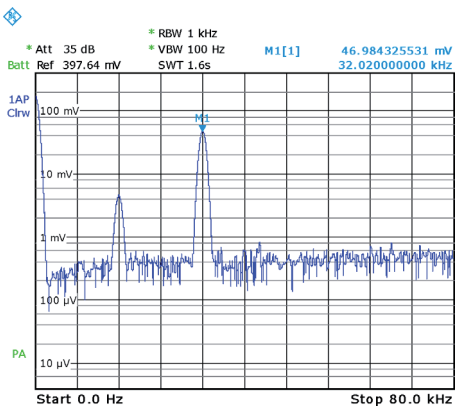
Micro electro mechanical systems (MEMS) are typically batch-fabricated on wafers with diameters of 4'', 6'' or 8''. Each wafer contains up to several hundred MEMS dies. The batch fabrication of MEMS always has process related deviations that induce changes of geometric shapes with relation to the position on the wafer. These technological tolerances lead to variations for example in the modal frequencies. For the acceptance test of many micromechanical structures it thus is necessary to characterize essential parameters such as the modal frequencies and Q-factors. Therefore the mechanical motion of the MEMS needs to be measured. A capacitance-change to voltage conversion is a cheap and commonly used method for the dynamic characterization. The conversion as close as possible to the MEMS is desirable to achieve an optimal signal to noise ratio. The presented MEMS Active Probe has been developed and built for exactly this case of application. It allows the measurement of motion induced currents of micromechanical elements. The MEMS Active Probe covers the frequency range from 40 Hz up to 200 kHz (3 dB) with a sensitivity of up to 90 mV/nA. The output impedance is matched to 50 Ohm to be directly used with a spectrum analyzer. The polarization voltage for the generation of the currents to be measured is provided by the MEMS Active Probe itself. The bracket of the MEMS Active Probe can be used with common positioners and the probe tip is interchangeable. With the MEMS Active Probe it becomes possible to dynamically measure very low currents in the range of picoampere to nanoampere. The figure below shows a sample spectrum of such a measurement. The MEMS has been electrostatically excited with a signal of varying frequency. The resonant frequency has been found to be 32 kHz with a Q-factor of 5000.



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