

Testing of Membrane-type MEMS Devices on Wafer-level by Using Wafer-Probers

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MEMUNITY is a network of MEMS test experts focused on wafer-level test technology. Its goal is both developing test technology and appropriate test equipment. Wafer-probers are a proven platform for performing wafer tests but measuring only the electrical behavior of MEMS devices is not enough - non-electrical stimuli and/or measurement of non-electrical behavior are beneficial or mandatory. This requires additional modules. Several solutions for on wafer-level testing membrane-type MEMS devices e.g. pressure sensors and Silicon microphones have been developed and successfully implemented at several MEMS companies and research institutes. In this paper we will give an overview about existing field-proven wafer-level test solutions for membrane-type MEMS devices.

Pressure sensors can be tested by applying static pressure to the device-under-test's diaphragm while measuring the resistance of the Wheatstone bridge. All these systems are based on 3 main principles. (1) The test pressure can be applied to wafer's backside by a unique chuck system. This principle is limited in pressure range and design requirements. (2) Alternatively, it can be applied to the DUT from top by a proximity nozzle causing an impact pressure. This method can be used both for absolute and differential sensors up to 7bar overpressure. (3) Finally, the wafer-prober can be placed inside a pressurized chamber and operated from rough vacuum up to high vacuum of 50bar.

An alternative method is the dynamic test of membrane behavior by applying vibration to it and detecting the resulting frequencies. This dynamic approach has been developed in multilateral project of eight MEMUNITY partners from MEMS industry, research institutes and test equipment manufacturers.

Microphones are a special kind of pressure sensors and so we are presenting a setup for testing Silicon microphones on wafer-level, too. The setup consists of acoustic stimuli, integrated reference microphone and acoustic test software and can be implemented both on manual and automatic wafer-probers.