

**(Gordon E. Moore
Award Presentation)
Wide Bandgap Semiconductors
for Sensing Applications**

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The biosensor market is forecasted to reach \$4.4 billion by 2014 in the US. This growth will be sustained especially by a high demand for biosensors that can be used for medical applications such as glucose monitoring, biomarker detection for infectious diseases and cancer diagnosis. In addition, there will be strong demand for biosensors with applications in biodefense, environmental monitoring, food, and pharmaceutical industries. There is currently great interest in developing sensors that could be used in point-of-care applications or on-field measurements to reduce medical costs and emergency room visits. Transistor based sensors are promising for these applications. These sensors need to have high precision, compact size, fast response time and be sensitive to small amounts of biological material. Semiconductor properties including current, potential, and impedance characteristics that can be used to directly measure chemical or physical stimuli on the semiconductor surface. The wide energy bandgap semiconductor gallium nitride (GaN) material system is attracting much interest for commercial applications of green, blue, and UV light emitting diodes (LEDs), laser diodes, as well as high speed and high frequency power devices. Due to the wide-bandgap nature of the material (3.2 eV for GaN as compared to 1.12eV for Si), it is very thermally stable, and electronic devices can be operated at temperatures up to 500°C. The GaN based materials are also chemically stable, and no known wet chemical etchant can etch these materials; this makes them very suitable for operation in chemically harsh environments. GaN based sensors for gas and chemical detection as well as medical applications will be presented.