AN INTEGRATED ON-CHIP PRESSURE SENSOR
FOR ACCURATE CONTROL APPLICATIONS

by Joseph M. Staller & William S. Cumberledge

Abstract

Recent developments in microprocessor technology have opened up entire new vistas for control and monitoring applications that had previously been either too costly or impractical from an engineering standpoint. The result has been an overall increase in both reliability and accuracy of the control function, accompanied by a dramatic decrease in cost. The co-requirement for these improvements, a low-cost pressure sensor element capable of communicating directly with the MPU, is now available to further push the state of the art: the Motorola MPX3000.

In the past, pressure sensing has been largely accomplished using mechanical techniques of questionable reliability and often requiring complex, expensive electronic interface circuitry if a control function was to be included as part of the measurement. The introduction of semiconductor pressure a few years ago increased reliability and reduced the cost, but these early units still had the need for off-chip temperature compensation and calibration, and the output, in millivolts, required additional signal conditioning before it could interface with the controlling microprocessor. The idea of a low-cost sensor with all of these functions built into a single chip has been talked about for some time, but until now, the technology melding had not been sufficiently accomplished to offer a commercially available product.

The transition from basic sensing element to integrated sensor has involved the blending of sophisticated micro-machining techniques, thin-film resistor technology and bipolar wafer processing, each with its own particular processing problems.

The problems, and attendant solutions, that will be addressed in detail in the paper are:

1. Sensor technology - past and present
2. Cavity etch - present approach, alternates, etch stop
3. Thin-film resistor technology
4. Laser trimming techniques
5. Amplifiers - modifications to fit sensor processing, basic requirements for this application, alternate types

Future plans for new sensor devices will also be discussed.