ASICs for SENSORS

An HMT Core Competency

HMT microelectronic AG

Sensors bridge the gap between the physical world and intelligent electronic control, for which they require specialised analogue electronics both for excitation and signal evaluation. Here custom integrations offer key advantages:

- **cost reduction** -by cutting the component count for the power supply, analogue processing and electronic interface
- **size** - integration gives access to minimum dimensions; custom device pin-out and standard chip scale packaging fit the tightest spaces
- **performance** - the flexibility provided by thousands of transistors gives electronics trimmed precisely to the application
- **power consumption** eliminating package parasitics, and long PCB tracks, allows great power reduction
- **high temperatures** - sourcing and qualifying discrete components for high temperatures can be a headache, avoided by eliminating these parts
- **calibration** - on chip EEPROM or OTP (One Time Programmable memory) allows the analogue characteristics of a device to be directly programmed in production test
- **diagnostics** - access to the analogue components, and free digital gates enables device monitoring; cumbersome in a discrete solution
- **signal processing** - even very minimal logic can be expensive in a discrete system. ASICs provide a gateway to thousands of dedicated gates, essentially low cost

Performance

ASIC parasitics are often three orders of magnitude smaller than with discrete components: parasitic capacitances are measured in femto Farads, inter-block track lengths in µm, internal leakage currents are in pA; and transistors are essentially free. Individual transistors, resistors and capacitors can all be closely matched to create precision circuits. The design freedom available with this palette is enormous, and gives access to new design structures (eg. mixers, switched-mode filtering, non-linear AD/DA converters etc.) which are otherwise impractical.

With freedom from outside electrical interference and tiny internal capacitances, power levels can be drastically cut, all important for battery applications, and in telemetry applications with remote powering.

Direct power supply

Sensors often do not have the luxury of a low voltage, stable power supply and quite often find themselves in a tight space at the end of a long cable, with the challenge of carrying out precision analogue electronics.

Most of HMT's designs incorporate some form of precision regulator, dimensioned specifically for the application, providing optimum conversion efficiency and rejection of power supply noise. Direct connection to high voltage power supplies (HMT max. 600V) eliminates many external components and, giving the ability to handle a wide range of input voltages, even removes the need to stock different electronic modules for different supplies.

Linear power regulation is normally ideal for sensor applications, but inductive DC-DC conversion and charge-pumps can readily be incorporated, and often facilitate sensor (or LCD) excitation. Specific start-up and shut-down sequences, and power down modes give additional control and improve power management.

Extreme temperatures

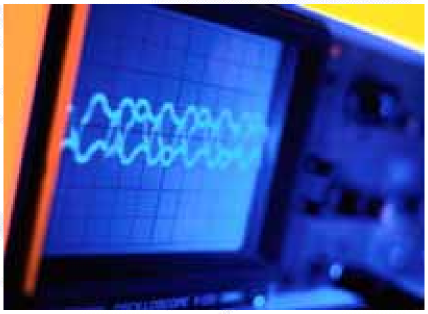
Where sensors are physically close to what they are measuring, they must perform at both high and low temperatures. This calls for electronics to match and HMT can design for temperatures from -40°C to 200°C. With fewer external components, component sourcing for extreme temperatures is simplified.

Calibration

Sensors need to be accurate, but tolerance in sensor head manufacture leads to unavoidable variability, requiring calibration to meet device specifications.

Special on-chip memory cells (EEPROM or OTP One Time Programmable memory) allow faster calibration than laser trimming, and only require standard electrical test equipment. The adjustments are far more flexible, as capacitances, currents, frequencies, and voltages can be directly trimmed.

Additionally, memory cells can store device identification information, or select device options.



Diagnostics

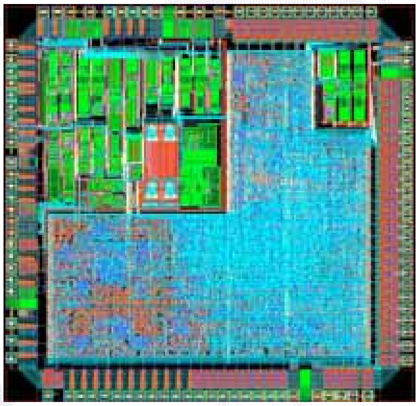
Mechanical parts age, especially in harsh environments, and it is increasingly important to identify the onset of these effects for timely and efficient maintenance. A comparator here, a transistor current monitor there, or even a full auto-test sequence, have minimal additional cost in an ASIC. The added value of continuous monitoring, however, can be substantial.

An ASIC can additionally protect itself and the sensor head against short-circuits, open-circuits, over-temperatures and low supply voltages. These are all monitoring functions which require significant overhead in a discrete solution.

Signal processing, digitally

Digital signal processing conjures up an image of powerful processors and complex algorithms. For sensors this generally not needed, but some digital signal evaluation and filtering is normally desirable.

HMT offers a design and simulation ability in both verilog and VHDL, and has experience in the development of minimised processor cores. Customers often implement the digital algorithms themselves when this is one of their core competencies, and here HMT provides guidelines to design for efficient integration and effective test. The back-end processing steps of scan-path insertion, automatic test pattern generation and place and route can naturally be carried out by HMT.



HMT History in sensor ASICs

Since 1978, HMT has had a strong activity in ASIC design for sensors, and developments include ASICs for inductive and capacitive proximity detectors, hall sensors, optical triangulation sensors, high speed optical transducers, pressure sensors and strain gauges, microphones, and naturally current and voltage detectors.

HMT Microelectronic AG
Alfred-Aebi-Strasse 75
2503 Biel/Bienne, Switzerland

Tel: +41 (0) 32 365 11 81
Fax: +41 (0) 32 365 82 80
mailbox@hmt.ch

www.hmt.ch

SICK Sensor Intelligence.

CONTRINEX

MEDOS

Johnson & Johnson

US Representative: Meric Technology, Inc.
Website: http://www.merictech.com
Email: sales@merictech.com
Tel: 1 (408) 773-2767
Fax:1 (408) 773-2781