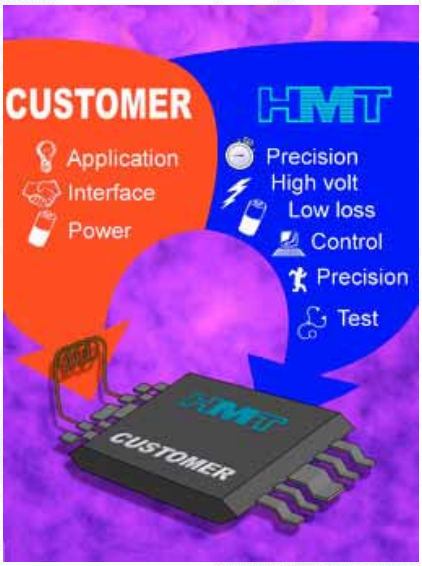
ASICs for Actuators

An HMT Core Competency

HMT microelectronic AG

Introduction



Piezos and solenoids are ubiquitous in industry: from airflow control to electrical protection, they reliably and efficiently bridge between the electronic and mechanical worlds. Custom ASICs offer clear advantages for equipment manufacturers:

- **cost reduction** - by cutting the component count for the power supply, analogue front-end and electronic interface
- **size** - integration gives access to minimum dimensions; custom device pin-out and standard chip scale packaging fit the tightest spaces
- **parallelism** – many channels can be controlled in a cost-effective manner saving on cabling and assembly
- **efficiency** – with more accurate current and voltage control, and dc-dc converter techniques, lower power can be used for the actuation allowing higher packing densities or higher operating frequencies
- **diagnostics** – access to the analogue components, and free digital gates enable self-monitoring, giving early warning of device ageing and facilitating maintenance

High voltage semiconductors

If you need to connect directly to the mains eliminating transformers, to automotive batteries, to drive piezos or implement zener free-wheels for inductors, you will need high voltages. HMT have access to a range of process from BCD at 30V to SOI at 650V designed to meet these challenges.

Even where the output drivers are not integrated, up to 20V is needed to drive high power MOSFETs efficiently, well outside the mainstream trend for process technologies.

HMT have a focus in the optimum use of these high voltage technologies, implementing specialist techniques for robust design.

Performance

Due to their tiny dimensions ASICs have great immunity to coupled electrical disturbances. It is possible to use far smaller currents, often slashing the quiescent power budget of an actuator. Together with intelligent power-down modes an ASIC solution often only requires a tiny fraction of the power of its discrete counterpart.

ASIC designers have the luxury of many thousands of transistors, and hundreds of digital gates, without a significant impact on device cost. The ASIC design world really is very different to the discrete world. For actuators this allows new functionality which would be impractical or impossible in a discrete solution. It is possible to detect the motion of a solenoid, rotor position in a motor, or to measure the resistance, inductivity or capacitance of the physical device. This information can then be used directly in the control loop for more efficient and accurate control, or for diagnostic purposes.

Turning this raw potential into a real commercial benefit requires an accurate understanding of the customer's needs and an accurate interpretation of the impact on the device and development cost. HMT's skilled team of interdisciplinary engineers with long experience in customer applications is well placed to offer a streamlined development.

Switched mode power supply

Actuators require real power and a critical part of any serious actuator solution is the power chain from the supply to the actuator. Switched mode techniques are the solution of choice offering:

- **high efficiency** - critical with a restricted power budget in battery applications, or where residual power from an ailing mains source is used, or where self-heating is an issue
- **small magnetics** –fit into tight spaces and budgets
- **flexibility** – power conversion can be maintained over a wide range of input and output voltages, and a single product can be used in different supply environments.

ASICs from HMT combine the power conversion electronics with the actuation, often offering cost and space savings and greatly simplifying the implementation. With a power converter designed for the application, higher efficiency is achieved, especially in combination with application specific power down modes.

Switched mode power supply design is a discipline of its own and demands skills in driving inductive loads, often at high voltages and currents, as well as the design of control loops over a wide range of operating conditions. HMT is proud to offer the appropriate tools, technologies and experience.

Characterisation

Specifying one ASIC which will work across an entire product palette often requires a close characterisation and modelling of customer parts. HMT have an on-site laboratory equipped for this sort of characterisation, and software tools to build up and simulate device models, and to validate ASIC designs with these models.

Nothing can beat a demonstration to boost confidence and understanding, and HMT routinely develop high quality test boards to mirror the future ASIC functionality. These additionally allow customers to proceed with application development even before the final ASIC is available.

Electrical interface

The industrial and automotive environments use a range of electrically robust industrial protocols, from current and voltage loops, to CAN and LIN buses and proprietary buses for cabled links, or serial protocols I^2C, SPI etc., for local links.

The same process technologies ideal for actuation also naturally support the electrically robust protocols. ASICs from HMT provide the natural platform to combine the communication and the actuation in one device, saving cost and space.

Test program development

Creating a design to fulfil a functional specification is only the first step. An ASIC must also perform correctly over all process variations for a high and reproducible yield. Even so, every device is fully tested to ensure parametric conformance.

Full testing requires both careful planning of test functions into the silicon itself, and equally careful design of the test program to reach high test coverage. Affordable test equipment is often extended with ASIC specific hardware to test high voltage, high current or precision analogue circuits. A major part of the activity at HMT is invested in the test program and hardware in close cooperation with the test-house.

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

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

FESTO Rockwell Automation saia-burgess ort and safety

Since 1978, HMT has had a strong activity in ASIC design for actuators, and developments include coil drivers for pneumatic and electrical safety equipment.