"I don't want to be competitive and don't really care about costs", said no company ever!
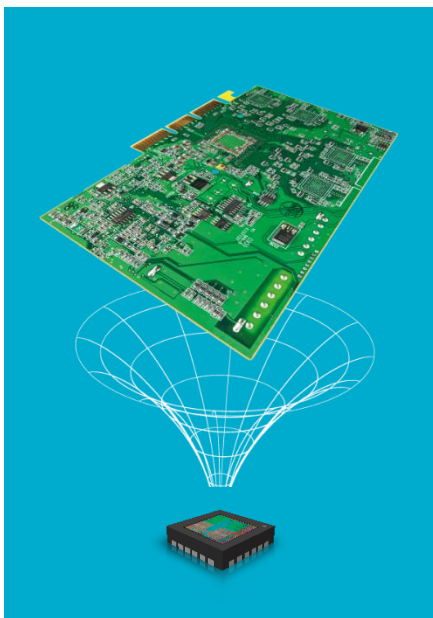
And a major supplier of plant equipment to the oil and gas sector based in the US was no different here. They had been brainstorming internally while working on their product roadmap to try and understand options to remain competitive while maintaining control of their product costs. They had an internal appreciation of the advantages a custom chip integration could offer. They also recognized in Dialog a company with many decades of experience in implementing industrial custom system-on-chip designs, resulting in substantial cost reductions in bill of materials and superior technical performance. So, they approached us to help them establish and quantify the exact benefits they could expect.

A face to face meeting was arranged at short notice where the customer and Dialog reviewed their product features, desired roadmap, the application area and the assets they wished to Sense, Control & Connect. Dialog likes to take a holistic view of the discovery process so that, if possible, future proofing can be allowed for and considered early in the development process. This enables our customers to be able to take advantage of changes in the market but also to be able to scale and enter parallel application areas.

The key criteria that became apparent during these discussions with the customer were:

- Allow for portfolio tiering
- Multiple Sensor Interfaces (pressure, temperature, diagnostics
- Integrated smart control loop
- Low Power
- Designed to be intrinsically safe
- Multiple Industrial Communications Interfaces (FOUNDATION Fieldbus, Highway Addressable Remote Transducer (HART)
- Integrated Arm Processor and PIC Controller
- Valve Positioning

Their incumbent solution comprised mainly discrete components using commercial off the shelf products. The customer was not happy with the prevailing BOM cost and also felt it was unnecessarily over specified to achieve the performance they required. Product tiering was not possible, and they had regular reviews to check that all these catalogue standard products were still being supported and available to order to meet their product and product lifetime needs.

Following the initial meeting, a short report on the integration options which would likely deliver the greatest benefits with the least amount of risk. The parties engaged on a feasibility and design specification phase where the details of a number of the most promising integration options were further elaborated. There were many detailed exchanges concerning the sensing needs, measurement needs, control and programmability needs, connectivity needs and security needs for the desired solution. After a period of 3 months the functional specification of the custom chip was clear and a detailed project plan for implementation of the design right up to the qualification and production was presented and agreed with the customer. An overview of the project timeline is represented in the graphic below.

Apply our silicon economics and systems knowledge, Dialog developed and manufactured using our foundry partners a complete integrated mixed signal system-on-chip (SoC) for the customer, coming in on time and on budget. This SoC delivered:

- ARM Cortex-M4 core
- PIC microcontroller
- AFE
- Optimized power management blocks
- FLASH & SRAM memories
- Industrial Communication Interfaces
- Multiple Digital Interfaces

The chip delivered dynamic power of 157mW/MHz in 19mm^2 TFBGA package and when compared to the previous solution, it was shown to:

- Meet the low power budget supplied from 4-20mA control loop
- Achieve BOM cost reduction of 90%
- Allow portfolio tiering
- Substantially reduce footprint
- Provide exclusive supply of custom chip

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