JAVELIN ASIC DEVICES

WHITE PAPER

# Demystifying Analog ASICs
# A Powerful Tool in Your Engineering Toolbox

*— Bob Frostholm —*

Application-specific integrated circuits (ASICs) typically conjure up the notion of massively complex logic chips containing tens or hundreds of thousands (even millions) of transistors configured to solve a customer's unique set of problems. Unlike multi-function standard product ICs, such as a micro-controller that can find its way into a wide variety of applications, ASICs are designed for one specific application and generally for one specific product or product family.

Considering one for your product might seem overwhelming. **It's not.**

The truth is that many are deceptively simple and there are valid reasons to consider an ASIC, regardless of the complexity of your system or your anticipated annual volumes. This paper seeks to dispel several ancient myths that may be holding you back.

There are many reasons to consider using an analog ASIC, including:

- Size reduction
- Power reduction
- Improved product performance
- Protection from product obsolescence
- Improved quality and reliability
- Lower overall component costs
- Lower system manufacturing costs
- Reduced procurement and inventory costs

## ➢ Myth #1: Analog ASICs Are High Risk

Javelin and our partners are continually working to take all the risky aspects out of ASIC development and production. I wish I could tell you that the risk is zero; it's not, but it is extremely low. There are several reasons for this.

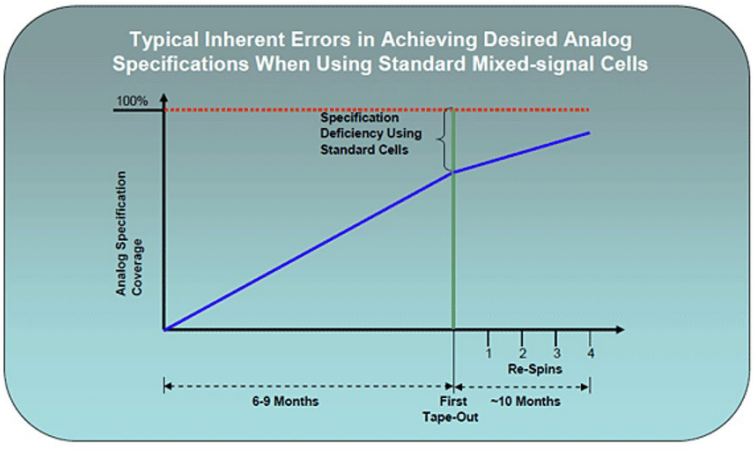
Wafer foundries that produce silicon have historically focused on supporting production of digital technologies. In recent years, many have dramatically improved their offerings to include processes developed specifically for analog designs — things like high-voltage transistors, low-noise devices for precision small-signal applications, capacitors, and low-TC elements that are critical for today's analog applications.

Additionally, the tools used in designing, simulating, and verifying analog designs — such as those from Cadence — continue to improve, which greatly increases the chances of a first pass functionality success.

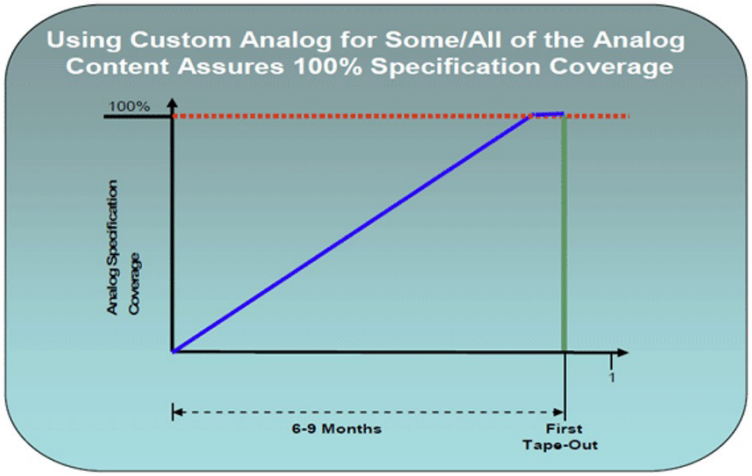
Reputable companies like Javelin will insist on doing a feasibility study in advance of undertaking a development project with you. The deliverables include a target specification for the ASIC chip and a risk assessment of the various functional blocks in the design. Additionally, a development schedule and detailed cost analysis are provided, all before you make a major financial commitment.

## ➢ Myth #2: Mixed-Signal ASIC Means the Same Thing as Analog ASIC

While the term "mixed signal" implies a combination of analog and digital circuitry on a single chip, there is a distinct difference in the skill levels required to combine mixed-signal library cells (analog and digital) on a silicon chip versus creating a custom analog design that uniquely satisfies all requirements of the specification. For many applications, analog library cells offer sufficient performance to meet the system requirements.



However, more and more frequently, the increased sophistication of the analog application necessitates designs that are truly application-specific, meaning they are designed specifically for your product and not a compilation of pre-designed, general-purpose analog blocks.




True analog ASIC companies employ experienced analog designers that are artisans of analog invention. Many of them have spent years at the big analog companies, learning from the industry gurus.

Be careful not to let a mixed-signal design house negotiate you away from your ideal specification. Close isn't good enough, analog must be exact.

## ➢ Myth #3: Only Ultra-High-Volume Applications Can Benefit From Analog ASICs

Large semiconductor companies limit their ASIC efforts to a handful of their very large customers. Many have annual per-ASIC sales requirements in the millions or even tens of millions of dollars. Clearly, these are the privileged few and everyone else (probably you) must seek out development and manufacturing partners that can and will meet your needs. It's not a difficult task if you know what you're looking for.

First, it's best to avoid public companies. They are motivated almost exclusively by profits and satisfying their shareholders and boards of directors. With careful research, you can find reputable private companies (LLC) that deal with startups and smaller entities. These companies can cater to the needs of smaller customers by being flexible with development payment schedules, managing low-volume production needs that may be only a few thousand pieces per year initially.

Some, like Javelin, are willing to minimize their profit margins to meet your market entry needs while you establish your business.

## ➢ Myth #4: Handcrafted (Custom) Analog Is Too Expensive Compared to Standard Cells

There is a time and place where standard analog cells are more than adequate. Experienced analog ASIC design houses recognize this and only offer fully custom analog designs when the need merits it.

Handcrafted analog can create the differentiation required for you to break out of the pack with a superior-performing chip, and thus a better end product for your customer. Additionally, stepping back from the cell library approach opens up options for manufacturing, since cell libraries are typically developed for one process at one fab. Broader use libraries are available that specify a process — 180nm BICMOS, for example — but have relaxed specifications so they can be instantiated in multiple different fabs.

Handcrafted analog creates an unlimited set of manufacturing options, especially through the use of boutique foundries. Many of the boutique fabs differentiate themselves by the variety of services they offer and their willingness to make adjustments to their processes to accommodate optimization of the chip's performance. A recent example is a circuit developed for a major automotive component supplier. The chip required a high-voltage MOSFET that was not available in the boutique foundry's standard process. Integration was critical to the success of the project. By working with the foundry, the unique MOSFET was developed and integrated into the ASIC. The subsequent design provided the high-voltage robustness needed for the application, while minimizing the parts count and the physical size of the end product.

Non-recurring engineering (NRE) costs are a compilation of several variables. These costs must be amortized over the number of chips produced during the lifetime of the product to determine their effect on the unit cost of the ASIC. When executed properly, NRE costs associated with handcrafting the analog circuitry return a disproportionately lower unit cost of the final chip. The key to success is the analog design experience of the ASIC house doing the integration.

## ➢ Myth #5: Analog ASIC Means no Digital Circuit Elements

The term analog ASIC is meant to infer that the majority of the chip is dedicated to processing analog signals and providing the support circuitry such as precision voltage references, LDOs, clocks, A/D and D/A converters, charge pumps, and more.

It is quite possible to have significant amounts of digital on the analog ASIC since the process upon which it will be designed is one that supports digital too. The digital portions simply will not need to take advantage of the higher voltage capability or lower noise, or other analog-related attributes.

Please note that the converse — adding precision analog on a digital process — is usually not possible.

## Conclusion

Despite the many myths and misconceptions associated with ASICs, the fact is that they are a powerful tool in your engineering toolbox, allowing you to enhance your products through customized, efficient, and high-performance circuit designs. Whether your goal is to reduce size, improve performance, or extend the lifecycle of your product, analog ASICs can provide the tailored functionality and reliability you need. Javelin ensures that businesses of all sizes can leverage these advantages, while minimizing any potential risks.

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