Imagination

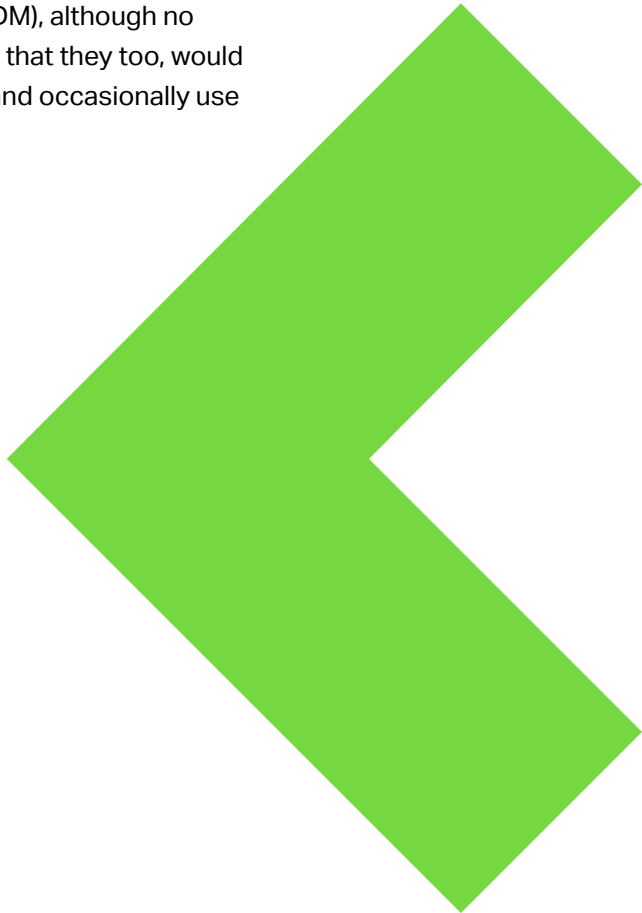
SHARPENING YOUR COMPETITIVE EDGE

When total cost of ownership becomes the difference between win or lose

When semiconductor chip companies develop their designs, a critical decision to make is whether to create it entirely from their own technology or 'buy-in' parts of it. Imagination's 25+ year history in the semiconductor IP space has shown us that when chip companies are undertaking this "make or buy" decision, the total cost figure they come up with will typically be out by a factor of between two to five times. The primary reason behind this is that they are not making a like for like comparison. While they look at the upfront investment, they fail to consider the total cost of ownership, which is made up of both the direct and indirect costs taken over a longer time period.

While companies have a strong idea of what it might cost them to build technology, such as a GPU or a Wi-Fi chip, in terms of internal resources using their own engineers, they often underestimate the challenges in creating the required technology from scratch. In many instances, we have seen many customers try and fail to create their own solutions. Not only do they have to create a working piece of highly complex technology, but they must design one that is competitive on their first attempt, and all without infringing fundamental patents in that domain space. It's a mammoth task with which even the most well-resourced companies struggle.

Of course, it never used to be this difficult. In the 1970s and early 1980s, chip companies were one-stop shops, with design, fabrication, test, and packaging all done in-house. However, due to the influence of Moore's Law (which says that the number of transistors doubles every two years) and Dennard scaling (which states that as transistor density doubles and circuits become faster, power consumption stays the same), chips were able to integrate more functionality, and hence became too complex for any one company to create the whole thing. This led to disaggregation of the industry supply chain into intellectual property (IP) companies, fabless chip companies, dedicated third-party semiconductor foundries, with each focusing on what it did best. A few companies choose to stick with the model of the integrated device manufacturer (IDM), although no longer as purists, given that they too, would procure third-party IP and occasionally use third-party foundries.



In the IP model, companies with deep expertise in a particular technology domain would specialise in creating building blocks for a chip, which could be then licensed by the chip manufacturer, integrated within their chip design and then sold on to equipment manufacturers – the OEMs or ODMs. Electronic design automation (EDA) tools were used to help create these ever more complex chips, while if the chip company was not an IDM, manufacturing was often outsourced to specialist foundries. Each of these companies was able to focus on their own areas of expertise, enabling highly complex chips to be brought to market in reasonable time scales.

In the 1990s, some OEMs tried to design their own ASICs but due to the immense costs abandoned these efforts and looked to off-the-shelf chips. Recently, however, rather than consuming IP, the size and financial clout of the very largest OEMs in the industry has enabled some of them to move back to a fully vertically integrated model, so that they can tightly control every aspect of their product, from design and manufacture to supply chain and to monetise each part. That said, while companies like Apple, Huawei, Samsung, and Sony have chip design teams that make such chips for use "internally" in their own products, they often use third-party IP.

The semiconductor IP model then is still vital and growing in value, and, **according to this report from research firm Markets and Markets** is expected to increase from $4.9 billion in 2018 to $6.5 billion by 2024, at a CAGR of 4.78%.



Why IP should be your M.O.

There are many reasons for this expected increase in the growth of IP licensing – the model makes sense for all parties. The customer, usually an SoC manufacturer, pays the IP company an upfront license fee for the right to use that IP and the IP company will receive royalties for each chip shipped that incorporates that IP. If the IP vendor has recovered the development cost of the IP by licensing it to multiple customers, then the subsequent royalties are pure profit and are the necessary reward for taking on the risk of creating the IP that involves considerable upfront costs and many engineer- years of work. Each customer only pays a fraction of the complete development costs for the IP, encompassing its design, test, software tools, and third-party ecosystem support.

If the IP company is able to recoup its costs and make a profit it can then continue its R&D to create the next-generation design, providing the customer with a roadmap for future products. In this model, the IP company and the customer share the risk and reward. The former only succeeds when the customer does, so it is incentivised to create designs that meet the needs of the market as a whole and to work closely with its customers to ensure their product is successful.

While the companies who believe they can do it all themselves may baulk at the cost of the license fee and having to pay royalties on each shipping product, doing so is very much in their interests. It means they are not only paying for the IP technology and the work that went into creating it but are ensuring that the IP company has the investment it needs to build a roadmap of products that can provide the customer with what they need to be competitive, not just now but also in the future. This also protects their investment as the IP company will be around to provide them with ongoing support and guidance in the long-term.

Using IP, therefore, makes strategic sense for the chip company. In the short, to medium term it lowers their costs and increases their revenues. Using IP:

- accelerates time to market
- increases your revenue
- removes technical risk
- helps protect the customer from legal challenges such as patent infringement
- delivers compliance to industry technical standards
- provides a source of software tools, support, and a third-party eco-system
- increases time-in-market, as the IP vendor can produce a more competitive IP than the licensee

Accelerate time to market

The SoCs found in the devices we use every day are incredibly complex. Take the average smartphone; it contains more than five billion transistors – double that for premium devices (particularly the graphics processing unit, (GPU), which is invariably the largest single component). Very few companies, probably in the single digits, have the expertise to create every part of a modern SoC, and if a company were able to design its own it could take years to do so. With our proven technology, you can get your product designed and into the market much quicker, which is increasingly important as product cycles reduce.

The cost conundrum

Creating complex technology also requires a significant investment in people with very specific expertise. This makes them very expensive to hire, but also provides no absolute guarantee of success.

With third-party IP, the chip company not only knows the capabilities of the IP before licensing, but they also have a clear understanding of the costs so there are no surprises of the kind they'd get from extended in-house development.

It's not just designing the chip that is challenging. Validation and verification are far from straightforward and IP companies have unique and well-proven methodologies for doing this. Imagination is a case in point. It pre-verifies all its IP using proven methodologies that have been relied on by the biggest global Tier 1 companies to create world-class products. As domain experts, IP companies such as Imagination extensively test against peculiar 'corner cases' that would be unfamiliar to non-experts.

Cut out risk

Financial, technical and legal risks are interrelated and unavoidable if a chip company tries to go it alone. There are plenty of examples of companies that chose to take this path, only to come out with a chip that offered less performance and used more power than expected, making it uncompetitive in the market. That might be because of the sheer technical challenges involved but it might be because many technical solutions are protected by patents. So even if a company can employ the hard-to-find experts they need and design their own product without infringing – which cannot be guaranteed – working around those patents can add a lot of time to the process and might result in an uncompetitive end product.

There are also many unforeseen pitfalls that might get in the way. An internal development programme can overrun, exceeding the allotted budget and miss its market window, costing revenues and locking a company out of a market's design cycle. If the resulting chip does ship, it may be uncompetitive, and thus unable to gain market share without lowering the price, attracting lower-tier customers, affecting profit margins and shipment volumes. Conversely, a competitive chip in a heavily patented area will attract both curiosity and scrutiny from the holders of those fundamental patents.

At Imagination, we have seen this happen more than once, and these companies, having tried and failed, went on to license the IP for their next product.

"Working around patents can add a lot of time to the process and might result in an uncompetitive end product."

Your IP armoury

Patents are sometimes used as a weapon by companies looking to block a competitor in the marketplace. In such situations, it is a significant advantage to be using a product with an established history of innovation and uniqueness, which is much less likely to infringe on the patents of others. Imagination has an extensive portfolio of products for a company its size and has real-world experience defending customers from patent claims against their chips, by proving that Imagination's IP does not infringe the patents in question. To date, Imagination's GPUs have never been found by a court to infringe a valid patent.

Imagination also maintains a significant patent portfolio of its own, further highlighting the uniqueness of its products and providing deterrence against attacks from third parties. Imagination has well over 2,000 patents and applications on technologies from across its product range, of which around half are in the GPU space. Recently, Imagination was ranked as the UK's 10th most active patent applicant at the European Patent Office in 2018 and was ranked 11th for the number of patents granted at the UKIPO for all companies (worldwide) in 2018.

Support from the start

Hardware is, of course, just part of the picture. An ecosystem of software applications is needed to make a successful product and Imagination has an extensive ecosystem of developers creating applications for its IP, a 'ready-to-go' ecosystem that developers can tap into from the start. Imagination also has extensive software drivers and tools, which are widely acknowledged to be of the highest quality, allowing for smart and efficient debugging and application optimisation. As our IP is widely licensed and shipped by several customers, we are able to leverage the network effects of this larger ecosystem to attract Tier 1 developers to support our platform.

"Imagination has well over 2,000 patents and applications."

Meet the standard

IP vendors are also much better suited to meeting industry standards, whether that's the Khronos standards for graphics and AI, meeting functional safety standards for automotive, or dealing with complex regulatory issues around spectrum for connectivity technology. Indeed, as domain experts, IP companies work closely with the various bodies in establishing these standards.

With IP, these issues are already taken care of. Imagination will also work with the chip company or its customer in the event of unexpected issues and can draw on its experience to deal with unusual use cases.

Increase your time in market

A factor not often considered is that not only will great IP get you to market quicker but that by having a competitive chip you can remain in the market with it for longer. This means that you are effectively amortising your upfront chip development costs over a larger volume, getting more value from your investment in third-party IP. The alternative, designing your own building block, is likely to result in a chip that isn't competitive and needs replacing sooner, forcing you to develop a replacement, affecting the profitability of the chip product line. With the cadence of technology cycles getting shorter and shorter – even in traditionally long cycle segments like automotive – the combination of time to market and time in market can be the make or break factor to reaching profitability.

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Despite a shift to vertical integration for the very biggest players, IP remains the best way for chip companies to develop competitive chips efficiently. Ready-made, off-the-shelf IP also plays well with fast-follower strategies, enabling quick movers to take advantage of emerging opportunities in the market, while our architecture and patent licenses can help our more sophisticated customers to bring their know-how to third-party IP/IPR and couple them more closely to increase their competitive edge.

Ultimately, third-party IP reduces your costs and risks, getting you to market faster and unhindered by patent trolls; it enhances your competitiveness, enabling you to sell your product for a higher average selling price, and increases your time in market, increasing revenues and profits. The IP can also be reused across multiple chip designs and different chip product lines, multiplying the aforementioned benefits. All of this serves to offer a much lower total cost of ownership than trying to design complex IP in-house. Developing a chip gets you into the game; using Imagination IP helps you to win it.

About Imagination Technologies

Imagination is a UK-based company that creates silicon and software intellectual property (IP) designed to give its customers an edge in a competitive global technology market. Its graphics, compute, vision & AI, and connectivity technologies enable outstanding power, performance and area (PPA), robust security, fast time-to-market and lower total cost of ownership. Products based on Imagination IP are used by billions of people across the globe in their phones, cars, homes, and workplaces. Imagination Technologies was acquired in 2017 by Canyon Bridge, global private equity investment fund.

enquiries@imaginationtech.com
imaginationtech.com
UK t: +44 1923 260511
US t: +1 408 530 5000

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