S3 SEMICONDUCTORS

WHITEPAPER

The Compelling Economics for OEMs to Commission their own Semiconductor Chips

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Contents

Introduction

This article illustrates how lucrative it now is to integrate your electronic assemblies on to a semiconductor chip and provide significant savings which to date were the privilege of big volume consumer electronic OEMs.

Changing Economics

Whilst the semiconductor headlines are grabbed with stories of mega-mergers, there is something much more significant happening in the industry.

The cost of integrating circuitry on a chip has been coming down and has now reached a very interesting point where the economics of integration can pay back in less than 2 years for any electronics assembly.

Geometry is the trick

Key to this economics is that the manufacturing process for making an integrated circuit are now priced at historic low levels, and the trick is not to use the latest leading-edge geometries!

The semiconductor industry advances by continually shrinking the size of the smallest geometric feature it can make. Building a new state-of-the-art semiconductor factory today for a leading-edge process geometry costs many billions of dollars, and, it will take time before the yields are tuned and the reliability is high. Therefore, the time to make a return can be long especially if your volumes are not in the many millions of units per year. Conversely, there are many fully depreciated foundries not at the leading-edge in which yield and reliability have been sorted, and for which there is no capital expenditure (CapEx) cost recovery constraint. These are the geometries that enable these “cheap as chips” opportunities.

A simple example to illustrate the economics:

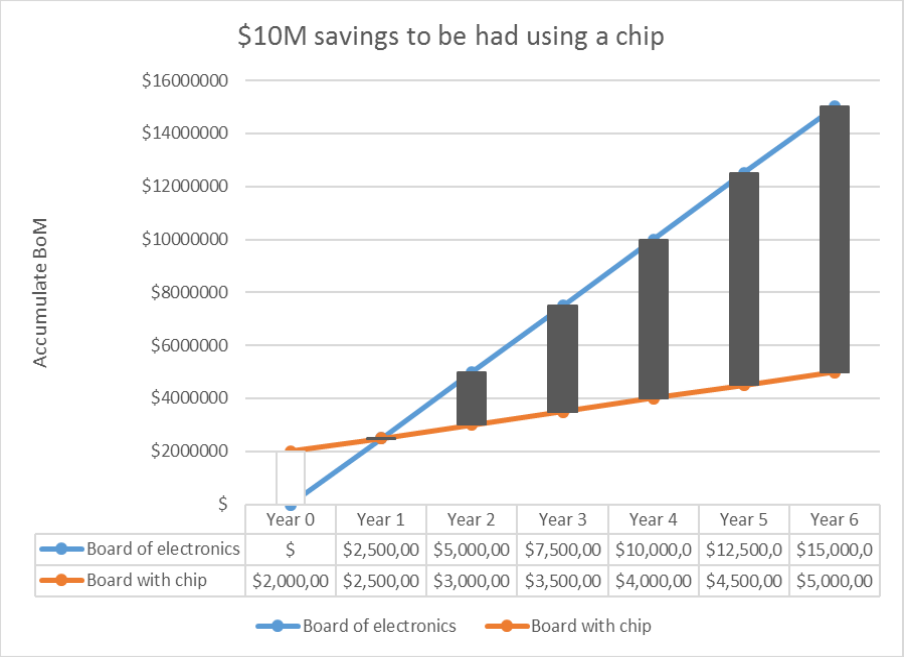
*For a board-level electronics product with a bill of materials (BoM) of $50, which sells 50,000 units per year, the total annual BoM for this product would be $2.5M (=$50*50,000). Such a product would be a suitable target to consider integration into a chip.*

By integrating much of the electronics components into a chip the result can be a bill of materials reduction to $10 and a once-off, non-recurring engineering (NRE) charge of $2M. The once-off, non-recurring engineering charge is the cost of doing this integration, designing the chip and preparing it for manufacture. The total

*annual BoM cost for the new product using a chip is £0.5M (=$10*50,000).*

This result would be an annual saving of $2M, which in this example, would mean the saving in one year would cover the NRE cost of designing the chip. In all subsequent years, the $2M savings accumulate. As illustrated in Fig. 1, these saving start to pay back after one year! Further, after one year the annual savings can be huge, making the economics compelling. In this example the savings are $10M by year 6 of using a chip based board in place of the original board of electronics.

This approach of integrating circuitry in a chip works particularly well if the board of electronics contains analog, mixed-signal or RF electronics in addition to digital, as typically these analog, mixed-signal and RF components cost more.



	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Board of electronics	$	$2,500,00	$5,000,00	$7,500,00	$10,000,0	$12,500,0	$15,000,0
Board with chip	$2,000,00	$2,500,00	$3,000,00	$3,500,00	$4,000,00	$4,500,00	$5,000,00

Fig. 1. Graph showing the Bill of Materials (BoM) cost of a board of electronics in a product (blue) and the cost of a similar board of electronics in which a custom integrated circuit (chip) has been used to integrate much of the electronics (orange). The black vertical bars show the cumulative saving of $10M achieved.

Why is this Possible Now?

The timing is considerably helped by an unintended consequence of the mega-merger mania that has seized the semiconductor industry[1]. As the big players in the semiconductor industry engage in mergers and acquisitions to get bigger, they are forced to pay less attention to smaller markets, and a new breed of semiconductor companies have stepped in. This new breed, typified by the likes of S3 Semiconductors, are companies who specialise in designing custom chips. They partner with the biggest factories and suppliers in the semiconductors world, so the chips are produced in the same factories used by the likes of Apple and Qualcomm, but because this new breed are much more customer focused, more nimble, and have deep experience and track records, they can provide this competitive approach.

The second factor, which is causing this shift in the semiconductor industry is that the foundries, which had been always under pressure to build newer and newer factories to chase the ever-smaller geometries resulting from Moore's Law, find themselves with mature, reliable factories at capable geometries that are not at the risky leading edge. These factories now have spare capacity, as previous products have moved to newer geometries. In addition, these factories are all fully depreciated and so their costs are lower. Consequently, it is very economical to produce chips in the factories.

In various markets, companies are now spotting the opportunity this presents them in terms of making their product for less and thus being more competitive.

Conclusion

With the costs now being very cheap, the pay back times being 12/18 months, and with the emergence of a new breed of dynamic, customer focused, specialist semiconductor companies, the real question is why are you not integrating your electronics into a chip and gaining that huge competitive advantage it provides?

[1] Qualcomm acquiring NXP for $47Bn, Avago acquires Broadcom for $37Bn, Softbank acquiring ARM for $32Bn, Intel acquiring Mobileye, $15.3Bn, Analog Devices acquiring Linear Technology $14.8Bn …