



# **Smart Tools for Smart Manufacturers**

## ***White Paper***

- ▶ **How to speed up production by choosing the right devices and the most efficient programming (manufacturing) strategy**

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## Introduction

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When design engineers dream up that “next generation”, “newest”, “most amazing” product, they are trying to do one thing above all else. They are trying to design that next great thing, the “break through product”, the most successful “widget” ever conceived, i.e. the “killer application.” By their nature, design engineers want to top what came before; to make whatever it is, improved, smaller, faster than before, in short, to make it better.

So, how do design engineers continue to improve on existing products, making superior versions of previous ideas? We can examine the development of mobile communication technologies as a case in point. Some design engineers attempt to make the superior product by incorporating more “features” into their product offering, thus turning the mere mobile phone into a multifunctional tool that serves as a phone, game console, PDA, GPS system and alarm clock, just to name a few of the more common “extras” available today. In the very near future, with the adoption of third generation mobile technology, the phone in your pocket will be an MP3 player, a video conferencing device, a stock ticker on top of all the other aforementioned features. Because one thing is certain, with the addition of new, expanded features, the previously existing ones are kept as well. All this computing power in a device that is no bigger than a deck of cards. But all these additional features are not enough to guarantee success in the market, the product also has to be the “first” to offer these features. The most influential keys to product success today are time to market and cost position. Early market share returns considerable profits to the provider.

The ever increasing trend towards more complex, more feature rich mobile phones has placed significant pressure on the semiconductor manufacturers to produce denser, smaller and more capable Flash memory, all at competitive costs and with faster access and write times (including also, low voltage power consumption for longer battery life). Many semiconductor vendors have tried to respond to the needs of the mobile communications market by increasing device density and decreasing device footprint size, so that next generation mobile phones can offer more features in space saving solutions. The constant demand for smaller silicon size with greater densities and capabilities challenges the design engineer to continue to realize competitive products, in spite of the difficulties linked to the production and the expected time to market. The purpose of this white paper is to suggest to you some tools and strategies from ST and Data I/O to help your product be more successful by incorporating smart tools and the right devices into your next generation application, particularly in the manufacturing process based on the principles of “Lean Manufacturing.”



The major problem with very high density devices is that they can have longer programming times depending on the capacity utilized. These longer programming times can increase manufacturing costs by complicating the use and management of the mentioned high density NOR flash devices.

Lean manufacturing theory tells us that the most efficient use of a production line is to have zero waste, minimal inventory, minimum “hand-offs” and to manufacture just what you need when you need it. The “beauty” in Lean Manufacturing is that inventory is kept to a minimum, meaning capital is liquid and production more flexible. When you couple this with the need for competitive time to market, these needs begin to influence your production strategy. The timing of manufacturing, the devices and the strategy you ultimately choose, affect your production efficiency. ST and Data I/O are strongly committed to combine advanced NOR Flash technologies (like ST’s multilevel cell technology) with the latest flash programming architecture (like Data I/O’s FlashCORE) to reach outstanding and reliable results.

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#### About ST’s Newest Breakthroughs in NOR Flash Memory Technology

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The 256Mb M30L0R8000T0 and M30L0R8000B0 NOR Flash product is the first STMicroelectronics device combining a multi-bit per cell technology, multiple bank architecture, 1.8V power supply voltage and a Synchronous Burst Read Mode to increase the performance of more complex 3G mobile phones. Its development reflects ST's continuing commitment to meet the market's needs for advanced applications with innovative solutions.

ST is already a stable and broad range supplier of NOR Flash memories optimized for low-power, wireless systems and ideal for portable embedded applications, such as cellular phones, pagers and personal digital assistants (PDAs). The new family combines higher density, thanks to the state of the art multi-bit per cell technology, low power consumption, greater programming throughput and smaller package, with high flexibility provided by the multiple bank architecture. All these features are essential for the mobile market.

As an example: The multi-bit cell 256Mb device included in the new family, top and bottom configuration (T0 and B0 versions).

This device features asymmetric block architecture, with an array of 259 blocks, divided into 16Mb banks. There are 15 banks each containing sixteen main blocks of 64KWords, and one parameter bank containing four parameter blocks of 16KWords and fifteen main blocks of 64KWords. The parameter blocks are at the top of the memory address space in the M30L0R8000T0, and at the bottom of the memory space in the M30L0R8000B0.



The multiple bank architecture allows dual operations: while programming or erasing in one bank, read operations are possible in the other banks. The device supports Synchronous Burst Read and Asynchronous Read from all blocks of the memory array; at power-up it is configured for Asynchronous Read. In Synchronous Burst Read mode, data is output on each clock cycle at frequencies of up to 54MHz. The Synchronous Burst Read operation can also be suspended and resumed.

Marco Dallabora, STMicroelectronics NOR Flash Wireless Division General Manager said: "These devices are part of a new family including different densities (from 128Mb already marketed, to 512Mb soon available) and the result of ST's strong focus in developing dedicated NOR solutions for wireless applications. The entire family combines advanced features with leading-edge technology and is actually perceived as a strategic part of our wide portfolio; moreover, in combination with PSRAM and LPSPDRAM memories, they are the right choice to maximise the features required by today's and tomorrow's mobile applications"

The M30L0R8000 device, also in multi-chip package solutions with PSRAM and LPSPDRAM memories, features fast programming capabilities: the buffer program command makes use of the device's x32-Word write buffer to speed up programming; the buffer enhanced factory program command is used to program large streams of data within one block and has been specifically developed to speed up programming in manufacturing environments where the programming time is critical. And for any customer for whom the programming of Flash memories is critical to the overall success of the production, then that customer should be using FlashCORE Technology from Data I/O.

#### FlashCORE Technology and "Lean Manufacturing"

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Data I/O's FlashCORE Technology represents the fastest programming architecture for flash based silicon available today. The FlashCORE architecture is at the heart of Data I/O's "Connected Programming Solutions" that link design to manufacturing by standardizing algorithms, adapters and programming hardware so transfer of firmware is seamless from the design engineer to the production line. Data I/O incorporates FlashCORE in its FlashPAK desktop programmer and its family of automated handlers, the PS288FC, PS300FC, the new PS588FC and the "Just in Time" programming solution, "The ProLINE RoadRunner.

The basic tenet of "Lean Manufacturing" is to "reduce waste," primarily attacked by reducing inventory of unassembled parts, especially "parts" that have some sort of "value" or "cost" associated with them (as is programmed parts). If you send your flash memories out for programming at the local programming service provider, you are paying in advance (based on a forecast) for a service



that you hope to need eventually. But as those parts sit in inventory (and cost you money in the payments you have made to the programming service provider), these parts are not making you any money. Lean Manufacturing would dictate that you program those parts as late in the manufacturing process as possible, preferably just before final assembly. Many manufacturers have adopted this strategy, which is generally referred to as “just in time programming,” be it with board level programming solutions or with the use of the ProLINE RoadRunner as an “In-Line” solution.<sup>1</sup>

Data I/O FlashCORE technology takes advantage of ST’s leading silicon features to achieve breathtaking programming times of less than 1.3 seconds per Megabyte for some of the fastest parts available today.<sup>2</sup> With programming times of less than 1.3 seconds per MB, smart manufacturers will be able to utilize the FlashCORE technology as part of their overall manufacturing strategy, along with silicon from ST. FlashCORE is incorporated into such programming tools as the ProLINE RoadRunner, the PS288FC, the PS300FC and the all new PS588FC. The FlashCORE technology is designed to allow manufacturers to program the highest density flash memories from leading edge semiconductor vendors like ST in the shortest time possible. And by incorporating programming solutions like the ProLINE RoadRunner as part of an overall “Lean Manufacturing” strategy, Data I/O helps companies manufacture faster, more efficiently and at a lower cost than other solutions on the market today.

The prevailing issue with on board programming is that it takes significant resources to develop, manage and maintain the test tools to enable on board programming and there are few commercial quality solutions available. These solutions are also notorious for not being flexible or scalable. By contrast, the ProLINE RoadRunner, because it programs components directly before placement on the PCB, has no direct effect on takt time, beat rate or line throughput (it does not make contact with the boards). Unlike other, custom solutions, the RoadRunner is scalable, flexible and takes up zero production floor space. And with programming times of 1.29 seconds per MB, companies can take advantage of technology breakthroughs from companies like ST without fear of creating bottlenecks in their production lines.

The new frontier of electronics is breathtaking in what engineers have accomplished and will still yet accomplish. And with smart tools from leading edge companies like ST and Data I/O, these “visions” of the future will be able to move seamlessly from the design engineer’s mind to the happy customer’s hands.

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<sup>1</sup> Data I/O estimates that over 200,000,000 products have been produced with FlashCORE technology since its introduction.

<sup>2</sup> FlashCORE programs the ST M58WR064 in 10.3 seconds. This does not include verify time.