Microchip Expands its Manufacturing Of Atomic Clocks and Low Power OCXOs To European Region

Interview with Marco Peter, a senior engineering manager in Microchip Technology's Frequency and Time Systems business unit.

What are the key advantages of manufacturing Microchip's atomic clocks and EMXO products in Europe for the company and its customers?

Manufacturing atomic clocks and Evacuated Miniature Crystal Oscillators (EMXO) products in its Neckarbischofsheim facility in Germany provides several advantages to Microchip and its customers. The European Union is home to many high-tech industries, including aerospace, defense and telecommunications, where precision timing is essential. Manufacturing within the EU allows Microchip to enhance supply chain resilience due to reducing reliance on a single region and mitigating risks associated with global supply chain disruptions (e.g., geopolitical tensions, pandemics or transportation bottlenecks). Producing these products in Germany, where we already manufacture high-performance quartz oscillators today, allows Microchip to be closer to European customers, enabling faster response times, reduced lead times and shipping costs, and global customer service. Additionally, for critical applications, European customers often prefer or require components to be manufactured within their own territory to meet security and regulatory standards. European countries may offer incentives such as tax breaks, grants, or subsidies for high-tech manufacturing and research, which can reduce operational expenses. Overall, establishing manufacturing in its Neckarbischofsheim facility in Germany is an effective way for Microchip to diversify European timing products manufacturing, supporting both business continuity and customer confidence.

What are the main applications of atomic clocks (i.e., CSAC and MAC) and EMXOs?

Microchip's Atomic clocks include the Chip-Scale Atomic Clocks (CSAC) and Miniature Atomic Clocks (MAC), along with EMXO, are essential for timing and synchronization across a wide range of applications. These devices are fundamental, for instance, in Global Navigation Satellite Systems (GNSS), telecommunications networks, aerospace applications, defense and military systems, financial trading platforms, industrial automation, and power grid management, where accurate timing ensures reliable operation and data integrity. Industry trends show a growing demand for compact, low-power, and highly stable timing solutions as systems become more interconnected and reliant on precise synchronization, especially with the expansion of 5G networks, the Internet of Things (IoT), and autonomous technologies. As a result, both atomic clocks and EMXOs are increasingly integrated into advanced infrastructure to support the evolving needs of modern digital and communication systems.

How do atomic clocks and EMXOs compare to traditional quartz oscillators?

Atomic clocks and EMXOs, offer improvements over traditional quartz oscillators in several key areas. In terms of performance, atomic clocks provide far superior frequency stability and accuracy, making them essential for applications requiring high-precision timing and synchronization. EMXOs also outperform standard quartz oscillators by using evacuated enclosures to minimize power consumption and environmental effects, further enhancing stability. Regarding reliability, both atomic clocks and EMXOs are less susceptible to temperature changes, and mechanical stress, resulting in more consistent performance compared to most of the traditional quartz oscillators. In terms of size, modern CSACs and MACs are designed to be compact, sometimes approaching the size of traditional quartz oscillators, while EMXOs are also miniaturized for integration into space-constrained systems. As mentioned above, EMXOs consume less power compared to traditional oven-controlled quartz oscillators primarily due to their evacuated enclosure design, Atomic clocks typically consume more power than quartz oscillators. However, advances in CSAC technology have significantly reduced power requirements, making them suitable for portable and battery-powered devices as well. Overall, while quartz oscillators remain more cost-effective and adequate for less demanding applications, atomic clocks and EMXOs are preferred where precision, reliability, and environmental resilience are critical.

What are the differences in manufacturing between atomic clocks, EMXOs and traditional quartz oscillators?

The manufacturing of atomic clocks and EMXOs differs significantly from that of traditional quartz oscillators due to the need for highly controlled processes, cleanroom operations, and advanced high-vacuum sealing technologies. Atomic clocks require precise assembly of atomic cells and integration of sophisticated electronics to manipulate and measure atomic transitions, all of which must be performed in cleanroom environments to prevent contamination and ensure accuracy. Similarly, EMXOs involve the use of high-vacuum sealing technologies to evacuate the crystal oscillator enclosure, minimizing environmental influences and enhancing performance. These processes demand specialized equipment and strict quality control. In contrast, traditional quartz oscillators are generally manufactured using less stringent processes, as they do not require vacuum environments or the same level of contamination control. As a result, the production of atomic clocks and EMXOs is more complex, costly, and time-consuming, but it yields devices with superior stability and reliability.

What is the expected manufacturing capacity and lead-times for EMXO and atomic clocks?

Currently, the lead-time for atomic clocks and EMXOs is often longer than for traditional quartz oscillators due to the highly specialized processes, stringent quality controls, and advanced technologies involved, such as vacuum sealing and cleanroom assembly. To address these challenges, Microchip is focusing on expanding and thus increasing production capacity and streamlining manufacturing workflows, which is expected to result in significant lead-time improvements. These enhancements not only enable faster delivery of products but also allow for better responsiveness to customer needs. By increasing capacity and reducing lead-times, Microchip can provide its customers with high-quality, precision timing solutions more quickly and reliably than before.

Will the product performance of German-built atomic clocks and EMXOs be the same as the US-built products?

The product performance of German-built atomic clocks and EMXOs will be the same as that of US-built products, as the product design will not change and all manufacturing processes will be conducted under strictly controlled conditions within its Neckarbischofsheim facility in Germany. Microchip ensures that its production standards and quality controls are consistent across all locations, preventing any performance degradation regardless of where the products are manufactured. Customers can expect to receive the same high-performance and reliable atomic clocks and EMXOs with no compromise in accuracy, stability, or durability. This commitment to uniformity and excellence transcends globally to our German-based manufacturing, maintaining the trusted quality and performance customers rely on.

MICROCHIP