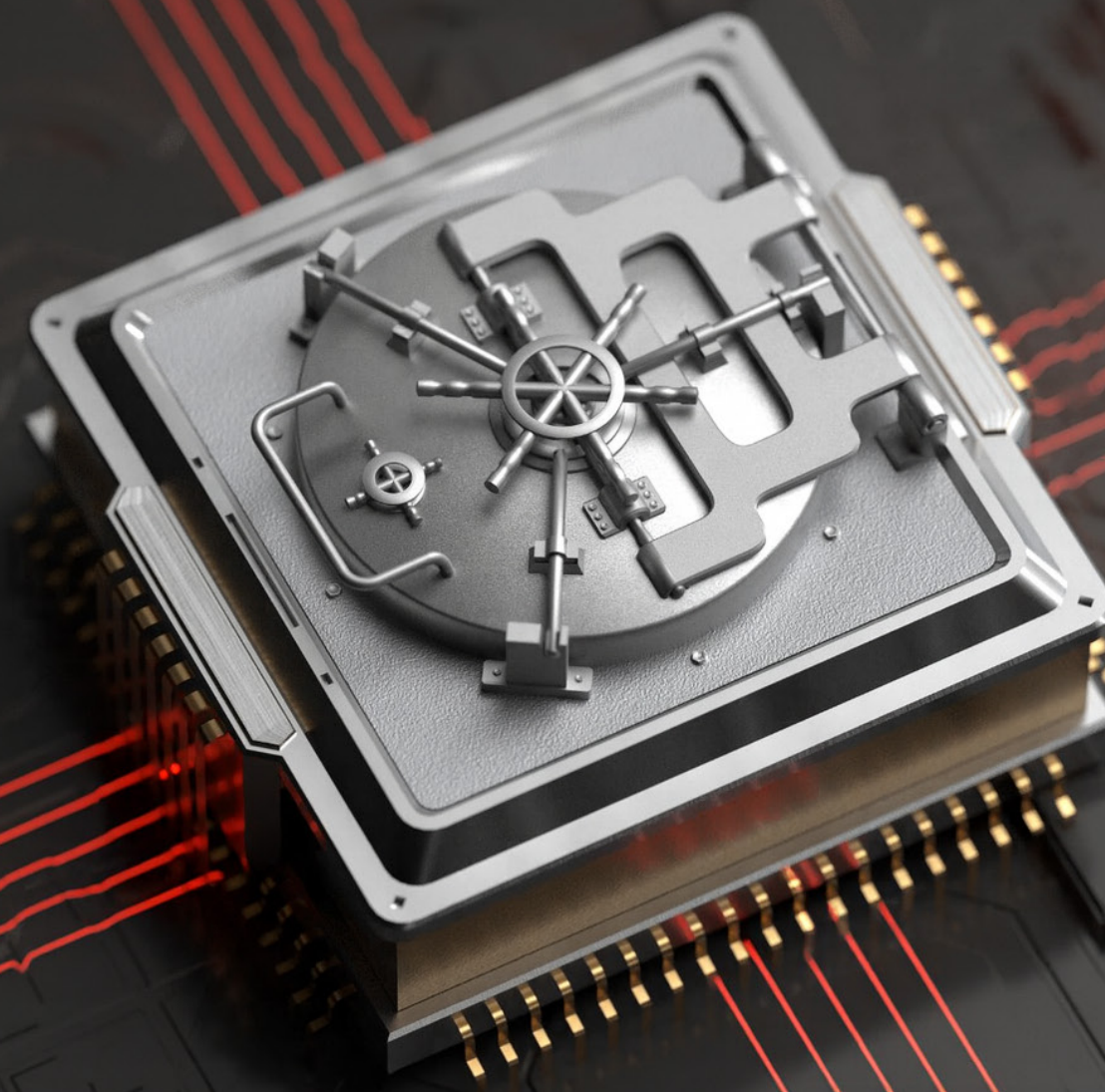




Cost Optimization through Automated Programming and Security Provisioning in High-Volume SoC and Module Manufacturing

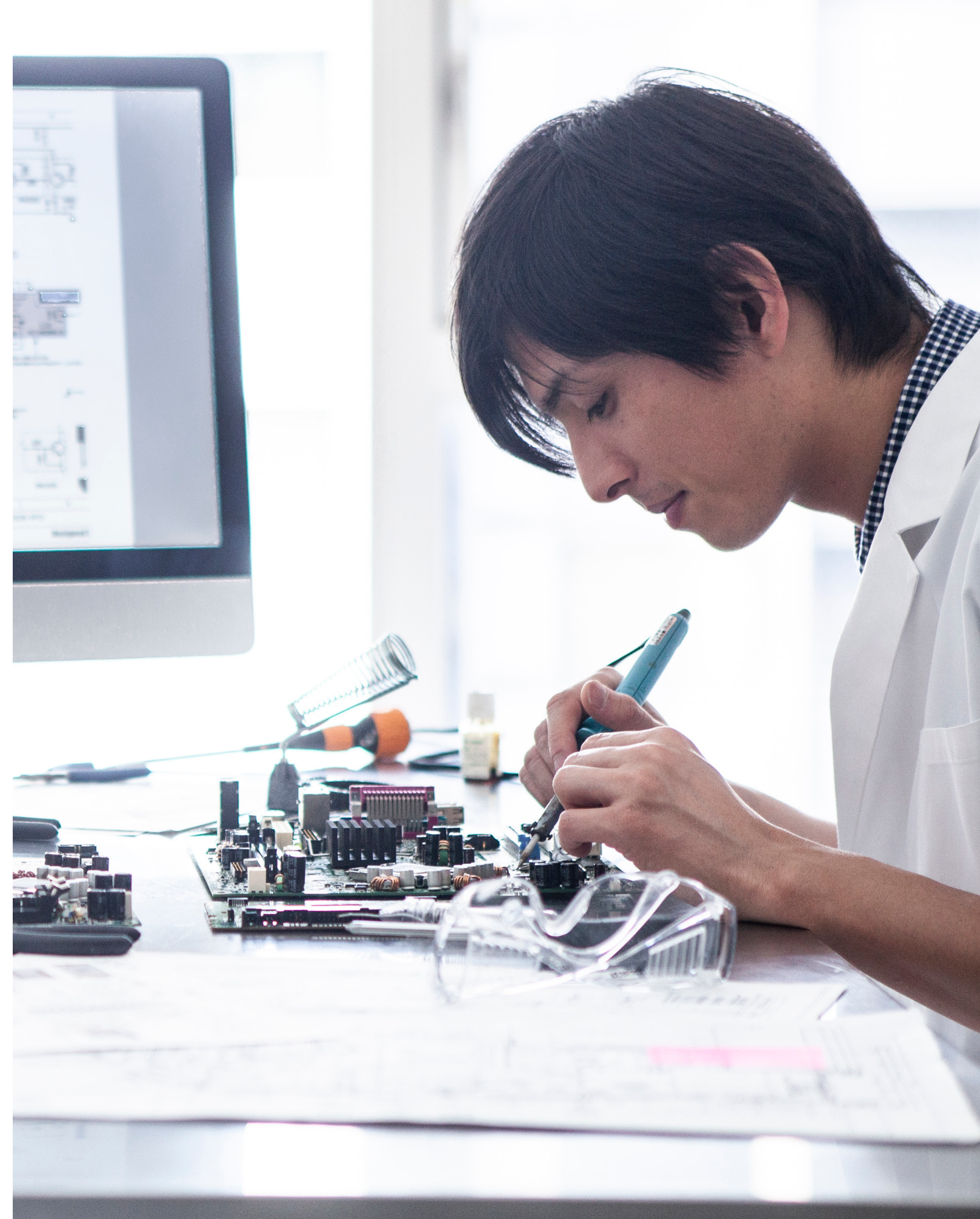
Author: Rohit Ravichandran



Executive Summary

The increasing demand for connected devices across industries such as IoT, automotive, and industrial automation is accelerating the complexity and production scale of system-on-chips (SoCs) and modules. In high-volume manufacturing environments, reducing per-unit costs while ensuring consistent quality and security has become critical.

This whitepaper focuses on cost factors that can be optimized through [Silicon Labs' Custom Part Manufacturing Service \(CPMS\)](#). Specifically, it examines areas of manufacturing where automation can significantly reduce costs and errors, including firmware programming, security provisioning, and production-line integration. By narrowing the focus to optimizable costs, this paper highlights how CPMS contributes to scalable, efficient, and secure manufacturing workflows.

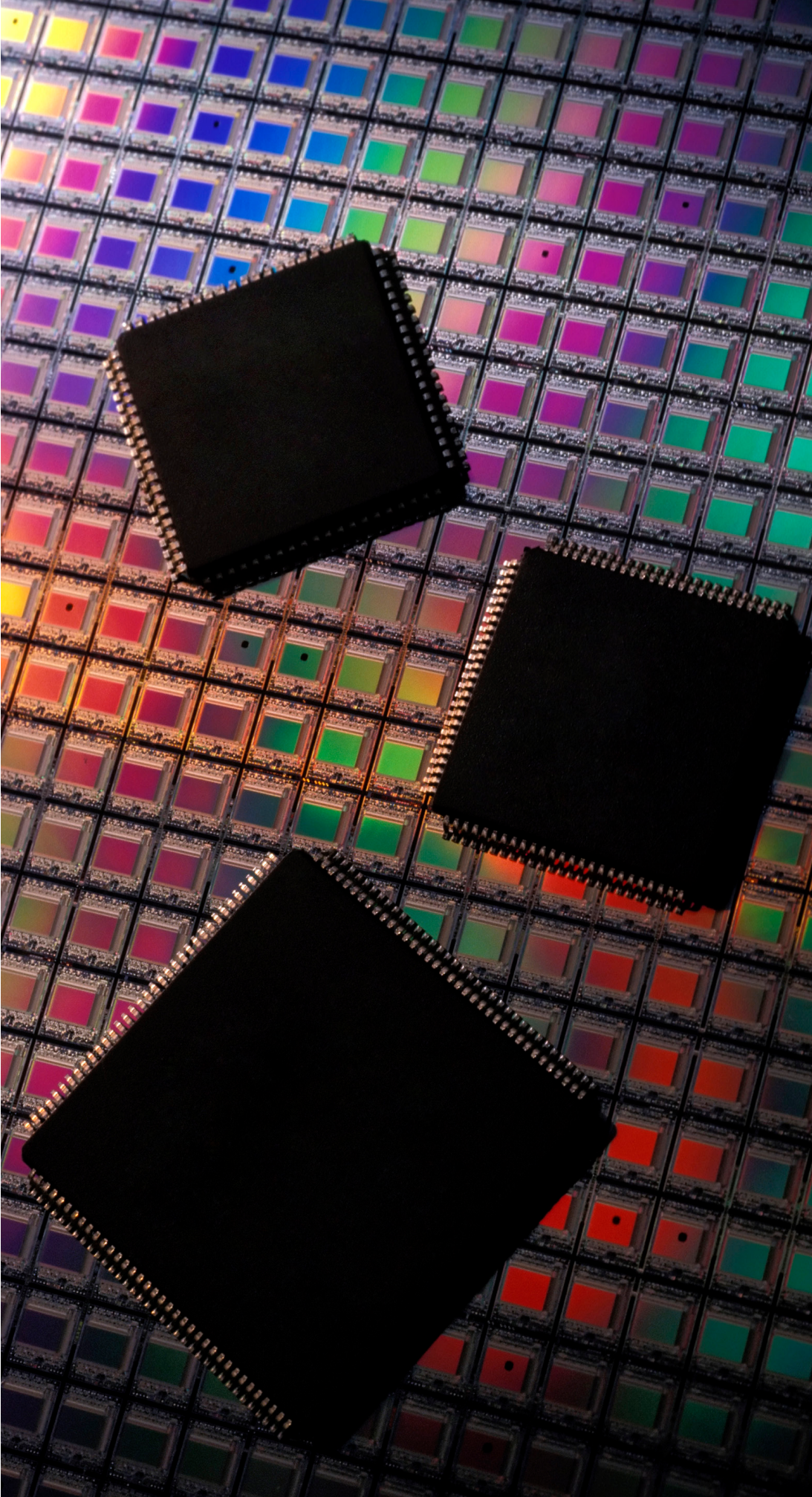


Introduction

As SoCs and modules grow in complexity, the overhead associated with device configuration, secure provisioning, and firmware programming increases. Traditionally, these tasks introduce variability, cost, and time delays in production lines. Automating these aspects not only minimizes human error but also streamlines workflows across different volumes of production.

Silicon Labs' CPMS enables device manufacturers to address these challenges with a secure, automated, and scalable programming service. CPMS is designed to optimize the manufacturing process by reducing costs tied to firmware loading, secure key injection, and configuration setup.





Cost Areas Optimized by CPMS

1. Programming Equipment and Setup

CPMS reduces or eliminates the need for on-site investment in firmware programming equipment. Traditional approaches may require in-system programmers, programming fixtures, and manual configuration stations.

Optimizable Costs:

- **In-System Programmers:** \$1,000–\$100,000 depending on throughput
- **Programming Fixtures:** \$2,000–\$10,000 per configuration
- **Automation Setup (Programming Integration):** \$10,000–\$50,000

By offloading these processes to CPMS, manufacturers avoid capital expenditure and maintenance overhead associated with specialized hardware.

2. Per-Unit Firmware and Security Provisioning

CPMS delivers firmware and configuration directly onto SoCs and modules during manufacturing. It supports secure provisioning through cryptographic key injection, secure boot setup, and encryption services.

Optimizable Costs:

- **Firmware Programming:** \$0.50–\$2.00 per unit
- **Security Provisioning (e.g., key injection, secure boot enablement):** \$0.50–\$5.00 per unit
- **Configuration Loading:** Included with above processes

Through CPMS, these processes are fully automated, ensuring consistency and traceability while reducing the per-unit cost for these operations.

Cost Areas Optimized by CPMS

3. Automation Infrastructure for Programming and Provisioning

CPMS eliminates the need for custom automation infrastructure to manage firmware loading and secure key provisioning. This includes automated stations, software tools, and scheduling infrastructure necessary to manage high-throughput workflows.

Optimizable Costs:
- Automation Integration Software and Tooling: \$5,000–\$20,000 - Production Flow Management Tools: \$10,000–\$30,000

By using CPMS, manufacturers benefit from a production-ready pipeline that scales without requiring significant setup or configuration changes on their part.



4. Migration Flexibility and Reduced Transition Costs

Migrating to a new SoC or module variant often introduces additional setup costs, such as the development of new programming workflows, secure provisioning scripts, or configuration loaders. CPMS minimizes these transition costs by providing scalable, reusable infrastructure that can be quickly adapted to new part numbers.

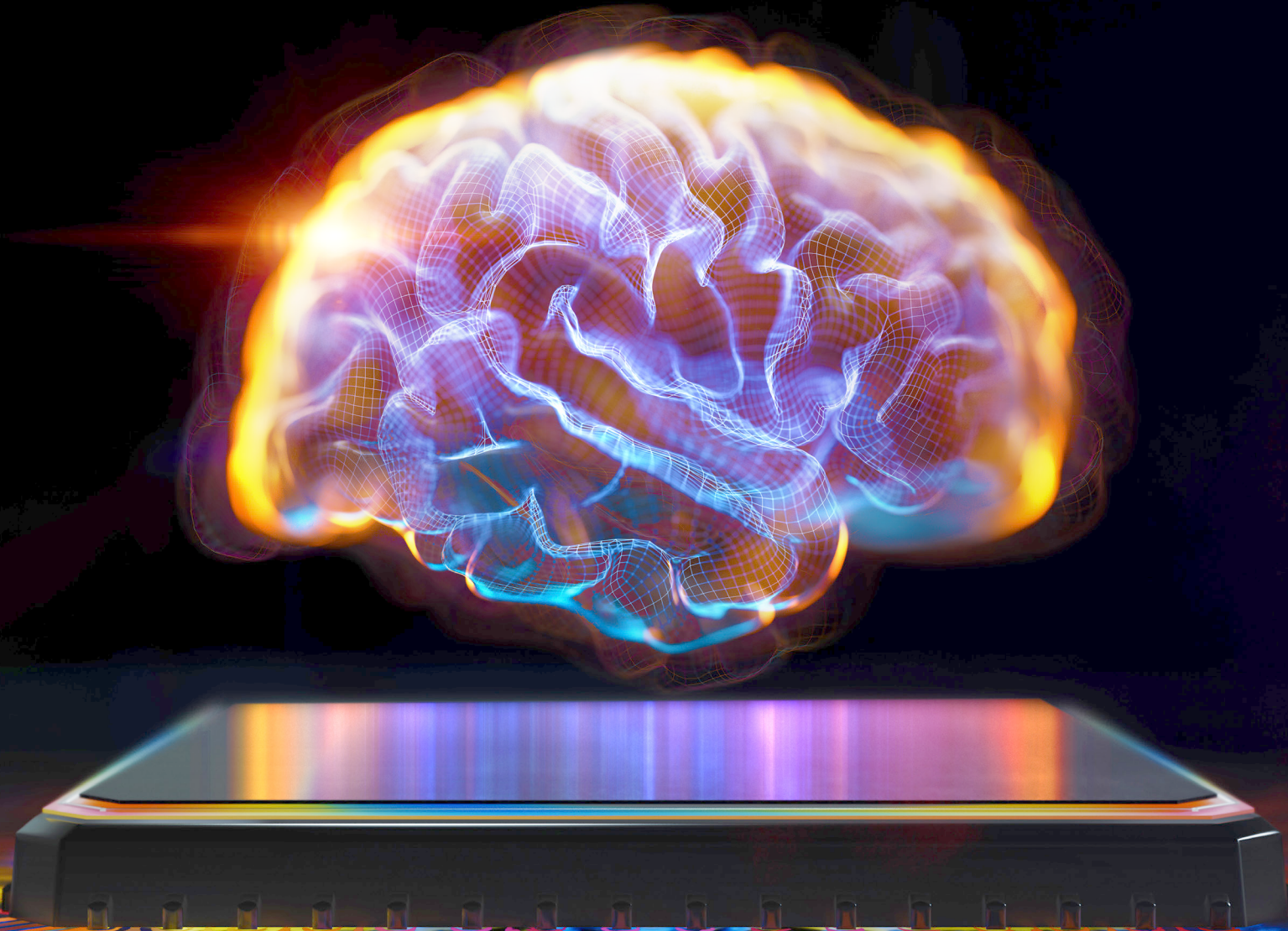
Optimizable Costs:
- Test and Configuration Program Development: \$5,000–\$15,000 per part - Migration Downtime and Engineering Labor: Reduced or avoided due to CPMS onboarding support

This flexibility makes CPMS particularly advantageous for customers managing multiple product lines or frequently introducing new device variants.

Cost Comparison Summary

Production Volume	Traditional Setup Costs (Avoided via CPMS)	Per-Unit Cost Savings
Low (1,000–10,000 units)	\$10,000 – \$30,000	\$1 – \$3 per unit
Medium (10,000–50,000 units)	\$30,000 – \$60,000	\$1 – \$4 per unit
High (50,000+ units)	\$50,000 – \$100,000+	\$1 – \$2 per unit

Note: Hardware testing and QA costs are essential and not addressed by CPMS. This whitepaper focuses only on costs directly impacted by CPMS services.



Benefits of CPMS in Production

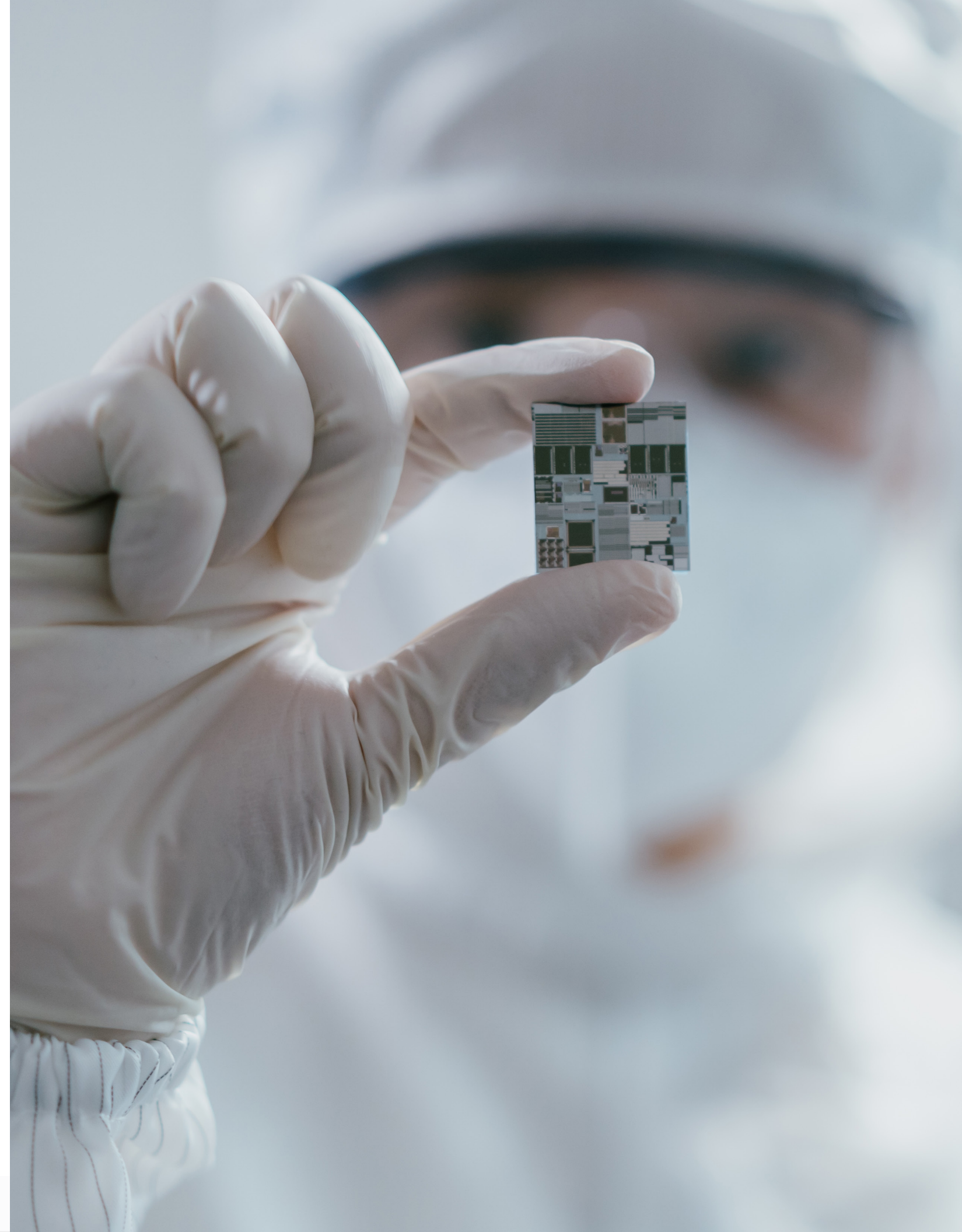
1. Improved Programming Efficiency	2. Secure Provisioning	3. Cost Avoidance and Scalability
- Automated firmware and configuration loading - Support for multiple device SKUs and revisions	- Cryptographic key injection - Secure boot and encryption enablement - Use of hardware security modules (HSMs) for key protection	- No need for programming hardware or integration infrastructure - Optimized per-unit pricing, especially at higher volumes
4. Faster Time-to-Market	5. Compliance and Traceability	6. Easier Migration Between Devices
- Minimal setup and validation cycles - Reduced production onboarding time	- Adherence to industry standards for secure provisioning - Audit logs and traceable configuration workflows	- Reduced engineering overhead for new part onboarding - Scalable infrastructure adaptable to evolving product portfolios

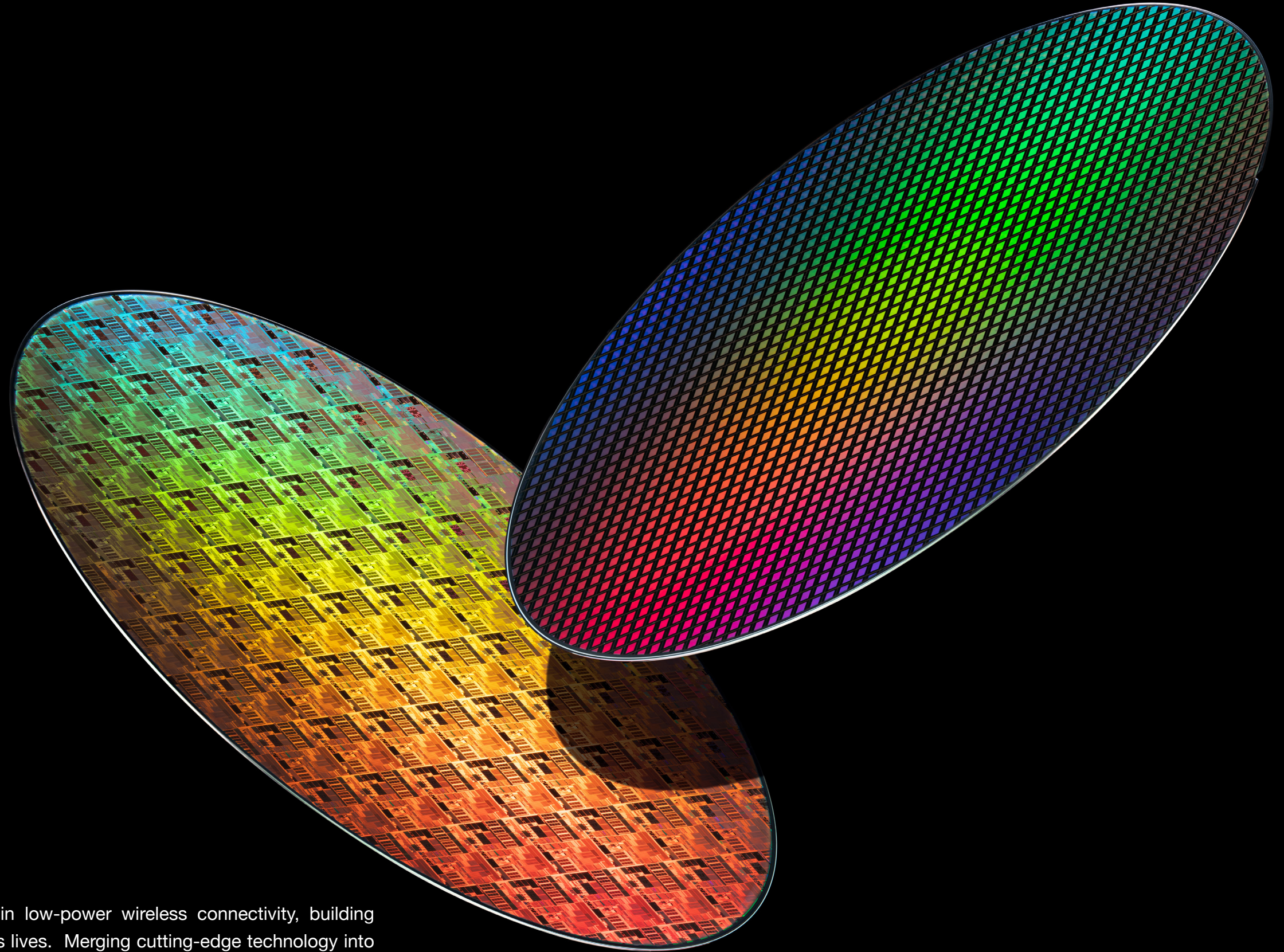


Conclusion

CPMS offers a highly effective way to reduce manufacturing costs associated with programming and security provisioning in high-volume SoC and module production. By eliminating the need for specialized equipment and reducing per-unit programming expenses, CPMS allows device manufacturers to scale securely and efficiently. While hardware testing remains a necessary part of the production process, CPMS addresses a focused and impactful subset of production costs, delivering tangible savings and operational advantages.

Depending on production volume and device complexity, manufacturers using CPMS can typically save between \$1 and \$4 per unit compared to managing firmware programming and security provisioning independently or through contract manufacturers. These savings can scale significantly across tens or hundreds of thousands of units, offering both economic and operational benefits. CPMS also streamlines the migration process between different parts, helping teams avoid costly redevelopment of test programs and infrastructure each time a new device is introduced.





Silicon Labs

Silicon Labs (NASDAQ: SLAB) is the leading innovator in low-power wireless connectivity, building embedded technology that connects devices and improves lives. Merging cutting-edge technology into the world's most highly integrated SoCs, Silicon Labs provides device makers with the solutions, support, and ecosystems needed to create advanced edge connectivity applications. Headquartered in Austin, Texas, Silicon Labs has operations in over 16 countries and is the trusted partner for innovative solutions in the smart home, industrial IoT, and smart cities markets. Learn more at www.silabs.com.