works with
by SILICON LABS

CMP-102

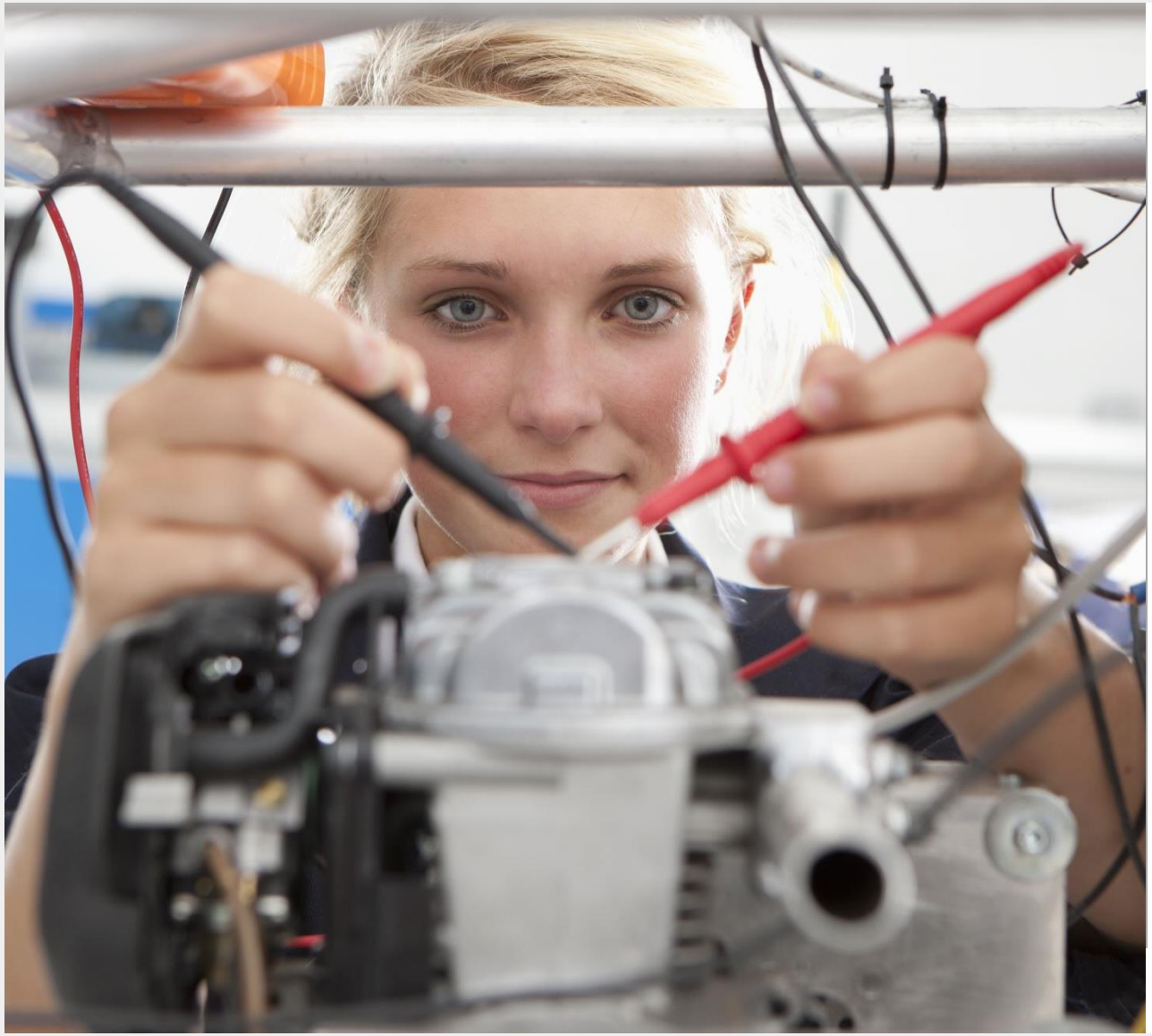
Reimagining Motor Control: From Fragmented Designs to a Unified, Secure Platform

Jayant Jyoti

Senior Manager (Product Marketing)

Agenda

Why reimagine connected Motor Control?



Motors Have Evolved

- From mechanical parts to intelligent, connected systems—motors now power everything from smart home appliances to industrial automation.

What's Now Possible

- Today's systems demand more than motion:
  - Connectivity
  - Intelligence
  - Security
  - Responsiveness

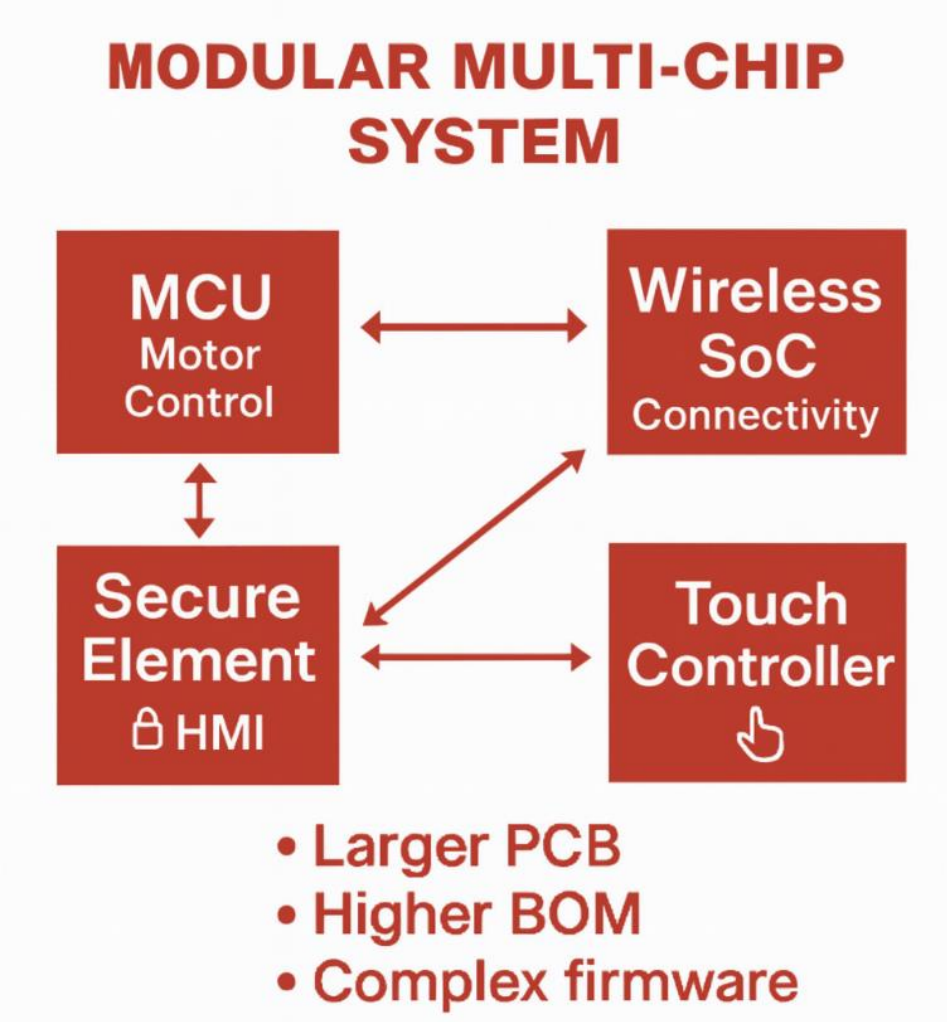
Motors are now **smart nodes** in large, dynamic ecosystems.

Where the Industry Stands

- Most engineers use multi-chip solutions for flexibility:
- Custom components for motor control, wireless, and security proven innovation drivers—but complexity is rising.

Current Landscape & Market Gap

The multi-chip solution—powerful but fragmented



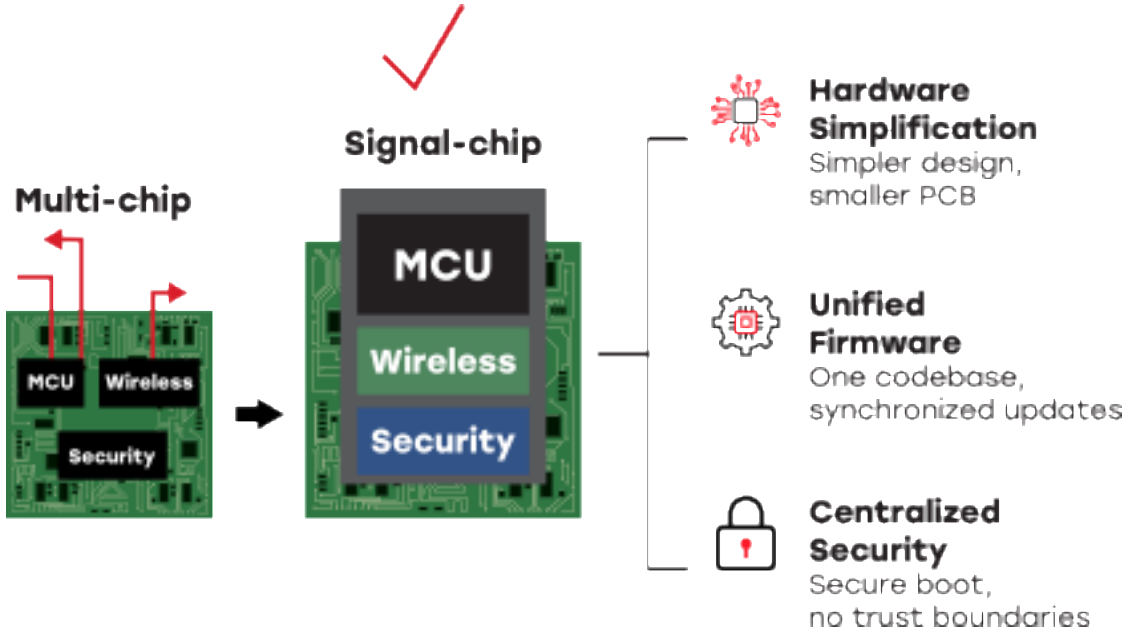
- **Typical System Design:**
  - Many current solutions combine:
    - Motor control MCU
    - Separate wireless SoC
    - Secure element
    - Sometimes an HMI/touch controller—each adding to the system.

- **Flexible but Comes at a Cost:**
  - Modular approach offers design flexibility.
  - But increases BOM, PCB size, power draw, and firmware integration complexity.

- **Market Looking for Simplicity:**
  - There's a clear shift toward integrated platforms that reduce system overhead while still delivering performance.

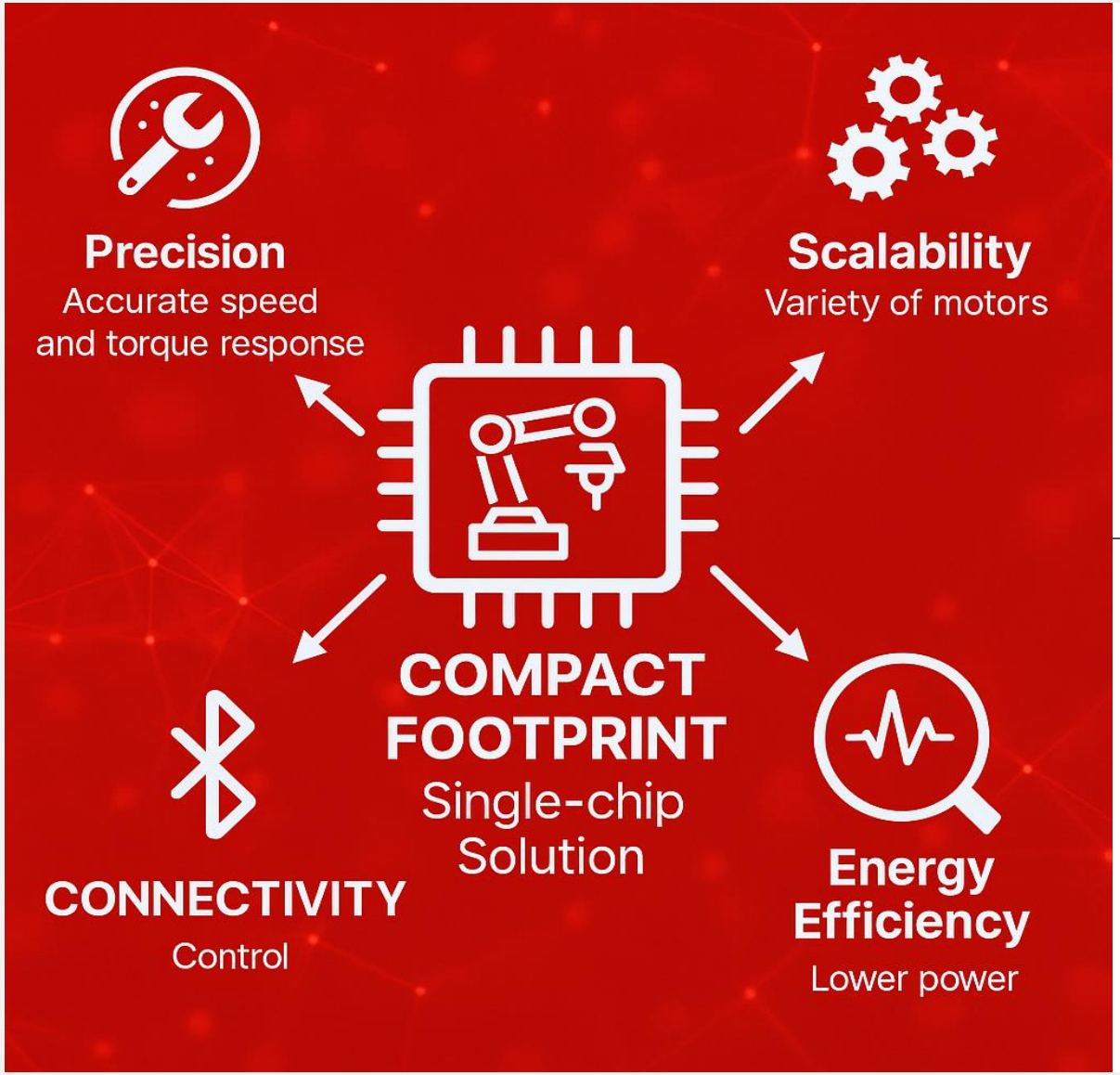
Single-Chip Solution

One chip. One firmware. One trusted design



- **Compact & Efficient Hardware**
  - Less PCB routing
  - Smaller board footprint
  - Simplified power supply design
- **Streamlined Software Architecture**
  - One OTA pipeline
  - Unified security domain
  - No inter-chip communication
- **Performance & Reliability Gains**
  - Eliminates version mismatches
  - Reduces latency
  - Fewer failure points

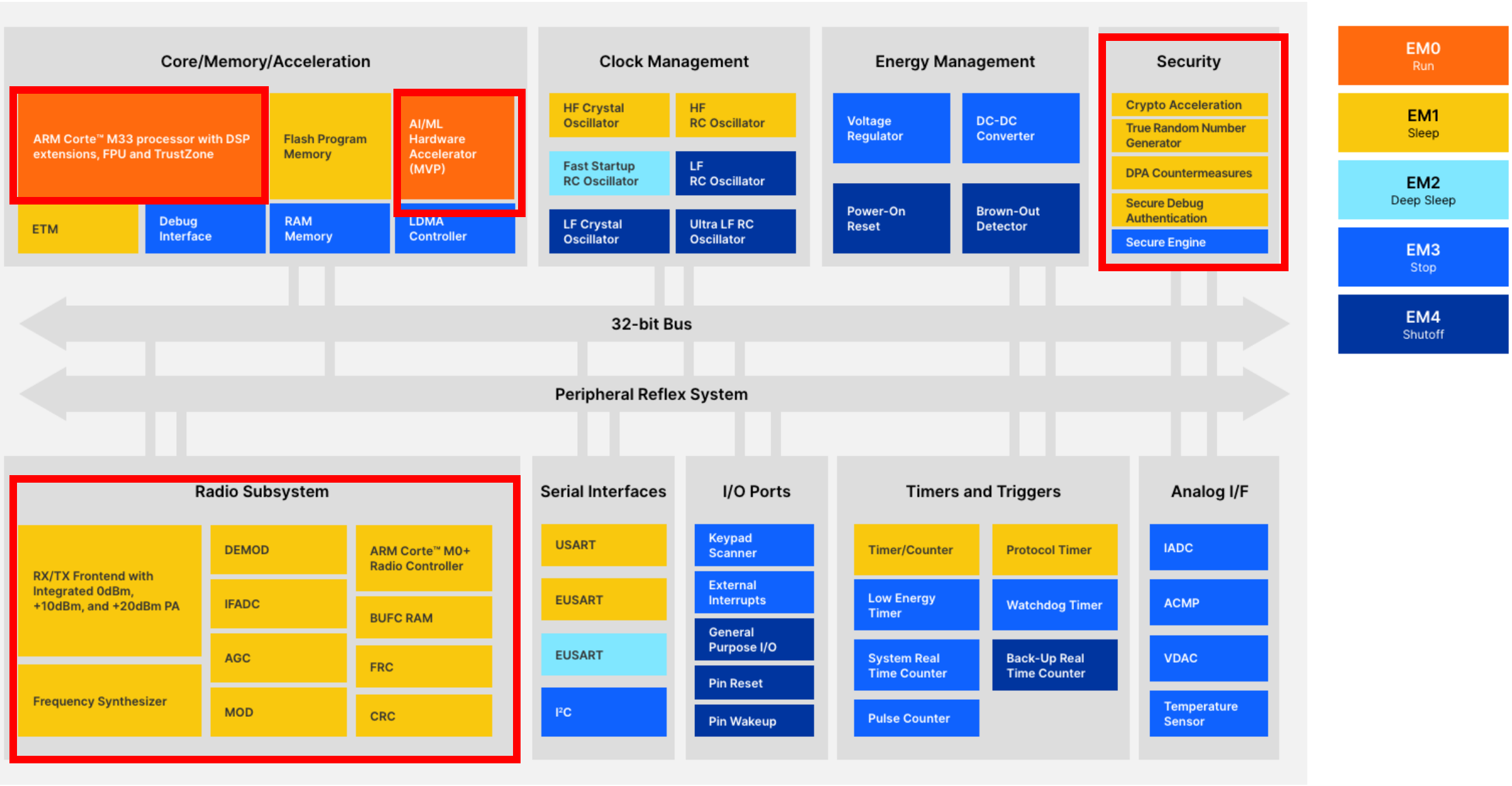
Design Priorities for Next-Gen Motor Control



- **Insights**
  - **Precision:** Essential for applications requiring accurate control of motor speed and torque to improve performance and reliability.
  - **Energy Efficiency:** Optimized power consumption per torque unit enables longer operational life and reduced environmental impact.
  - **Scalability:** Flexible architecture supports a wide range of motor types, reducing redesign costs.
  - **Connectivity:** Seamless integration with wired or wireless control systems for smarter, real-time motor management.
  - **Compact Footprint:** Single-chip design saves space, simplifies assembly, and lowers system costs.

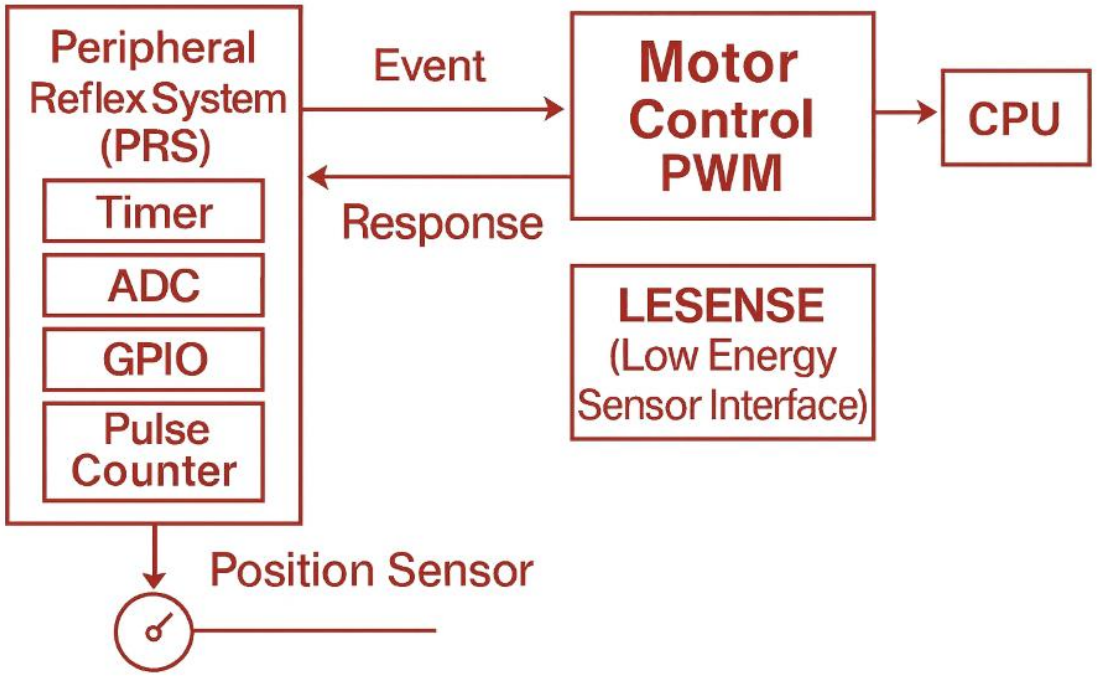
- **MG24: Single-Chip Solution**
  - **Accurate Motion Control** – Advanced PWM, real-time feedback for smooth speed & torque regulation.
  - **Optimized Energy Use** – Ultra-low power modes extend runtime and cut operating costs.
  - **Versatile Motor Support** – Compatible with BLDC, PMSM, and stepper designs.
  - **Smart Integration** – Built-in Bluetooth LE & Matter enable wireless, connected control.
  - **All-in-One Design** – MCU, wireless, and security in one compact package.

MG24 Architecture Overview



Smart Peripherals for Motor Control

Low-power reflex control without CPU intervention



Highlight: Eliminates CPU wake-ups → Saves power, reduces latency

Practical Applications of PRS in Motor Control

Real-time hardware signal routing for faster, lower-power control

Closed-Loop Speed Control
Timer → ADC → PWM
Maintains speed stability

Overcurrent Protection
ADC → GPIO/PWM shutdown
Instant fault response

Hall Sensor Position Detection
PCNT → PWM
Precise commutation

Sensor-Based Wake Events
Torque sensor → PWM
Smooth load response

Dynamic Torque Adjustment
Smoothes torque PWM

Practical Applications of LESENSE in Motor Control

Ultra-low power sensor interface for intelligent motor management

Position Detection
Reads Hall sensors
< 2 µA operation

Inductive Sensing
Detects rotor/stator position
No CPU wake-up

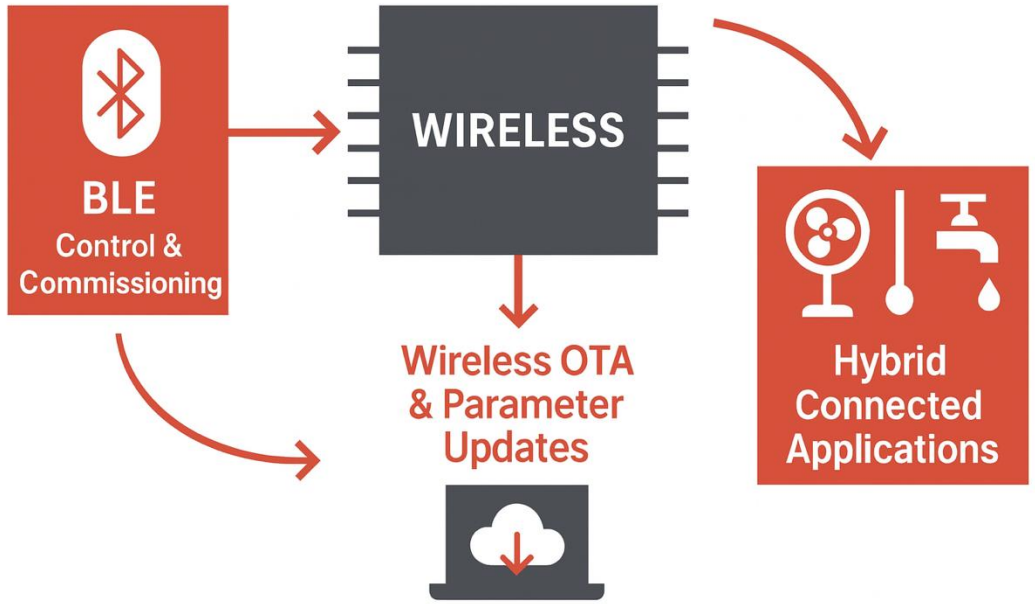
Start/Stop Trigger
Wakes MCU on motion detection

Proximity-based Control
Enables motor only when needed
Extends system life

Safety Interlock
Stops motor if unsafe position detected

Seamless Wireless Integration

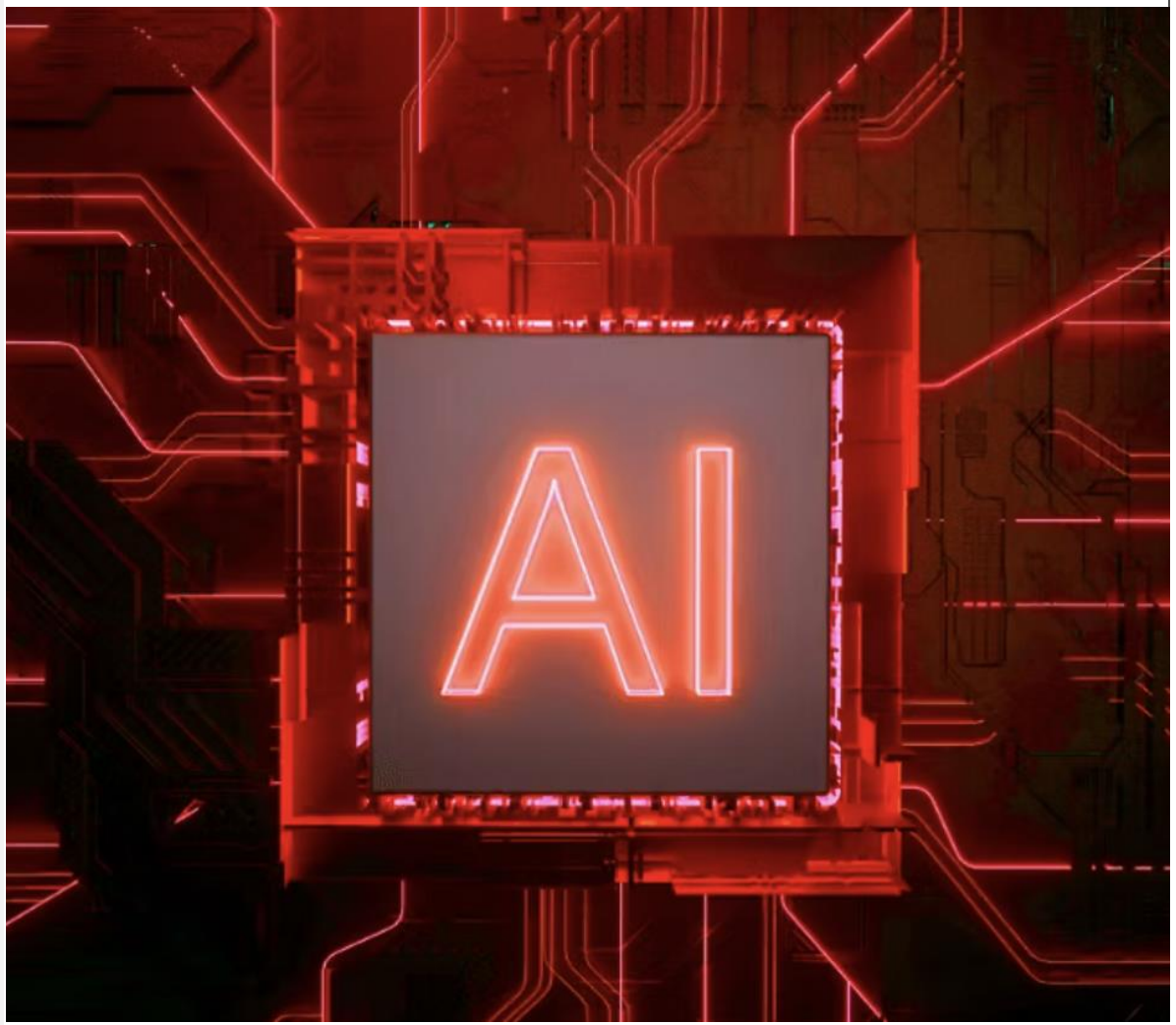
Wireless connectivity without complexity



- BLE for commissioning and app control for runtime communication.
- Use BLE to update firmware or change parameters.
- Enables hybrid connected devices like smart fans, HVAC dampers, and irrigation valves.
- **BLE Mobile App:**
  - Interface for monitoring and control: torque, RPM, current.
  - Allows users to push configuration profiles and receive live feedback.
- **OTA Update Storage:**
  - Up to 1536 kB of flash for firmware image storage and safe updates.

On-Device Intelligence with MVP Accelerator

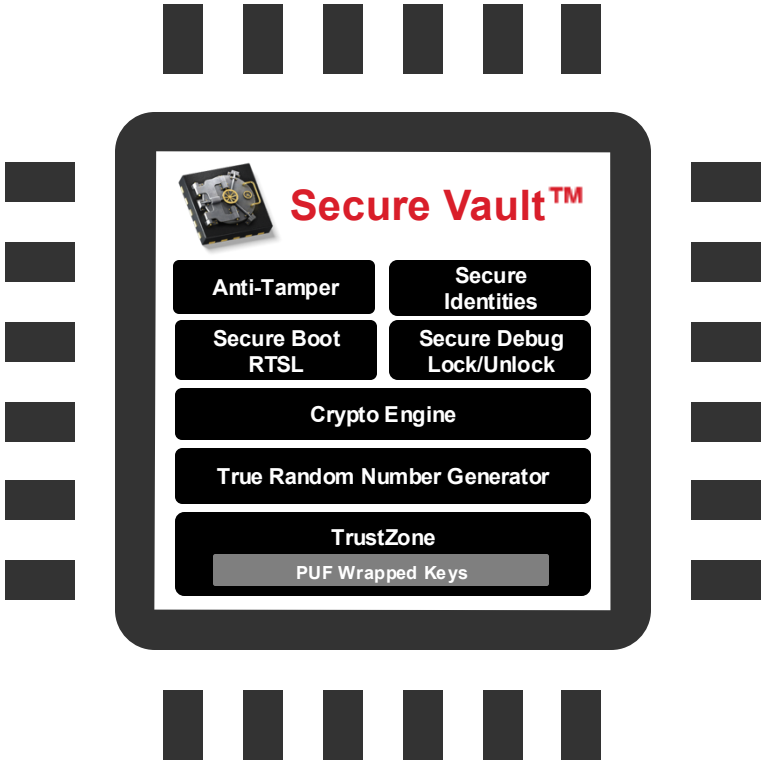
Give your motor system a brain



- **Run ML Models Directly on the Chip**
  - Process data at the edge without relying on the cloud.
- **Early Fault Detection**
  - Identify anomalies and prevent failures before they occur
- **Predictive Maintenance**
  - Monitor vibration, temperature, and performance trends for proactive service.
- **No Delay, No Extra Processor**
  - Real-time decisions with zero latency and reduced hardware cost.

Secure Vault for Industrial-Grade Security

Trust built into Silicon



- Secure Boot with Root of Trust, Secure Debug, Anti-Rollback, and Tamper Detection
- Achieves PSA Level 4—most competitors stop at Level 1 or 2 or use external secure elements
- Simplifies compliance for medical, industrial, and home automation sectors.

SECURE VAULT
PSA LEVEL 4 CERTIFIED

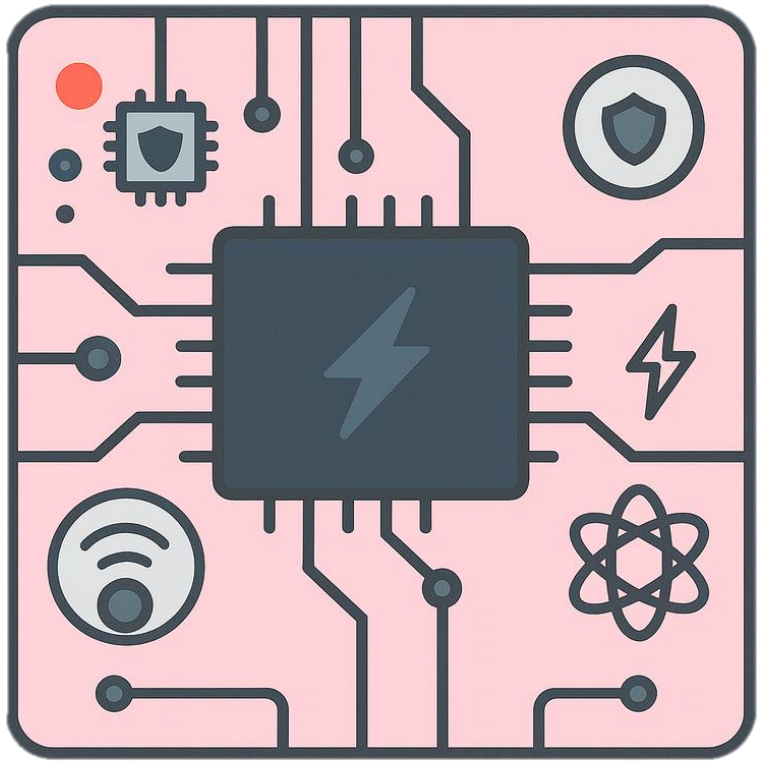
works with by SILICON LABS

Differentiation & Comparison

Feature	Series 2 BLE + FOC	Competitors
BLE Motor Tuning	Yes	No
OTA Firmware Updates	Yes	No
High RPM BLE Stability	Yes (5K+ RPM)	No
FOC Motor Control	Yes (Sine, SVPWM)	Partial
Mobile UI Control	Yes	No

- **BLE Motor Tuning**
  - Native BLE integration enables parameter adjustments (speed, ramp rate, torque) from a smartphone/tablet.
  - Ideal for prototyping, production calibration, and remote servicing.
- **OTA Firmware Updates**
  - Supports wireless delivery of new features and bug fixes.
  - Enables remote configuration updates without physical access.
- **High RPM BLE Stability**
  - Series 2 SoC maintains stable BLE communication even beyond 5,000 RPM.
  - Ensures reliable telemetry/control under real-time motor conditions.
- **FOC Motor Control**
  - Supports Sine PWM and SVPWM control strategies.
  - Delivers efficient, quiet, and precise motor operation.
- **Mobile UI Control**
  - Enables real-time performance monitoring via mobile apps.
  - Supports diagnostics, config deployment, and OTA updates.

Reimagining Motor Control with MG24



From Fragmented Designs to a Unified, Secure Platform

One Chip, Many Functions
Control, connectivity, ML, and security in a single SoC.

Compact & Efficient
Smaller footprint, lower BONcost, and reduced power consumption

Smart Peripherals
Reflex motor control (PRS + LESENSE) without CPU wake-ups

Seamless Wireless
BLE 5.3 for commissioning, OTA updates, and hybrid device integration

Built-in Intelligence
On-chip ML for predictive mintenance and anomaly detection

Industrial-Grade Security
PSA Level 4 Secure Vault with robust protection features

SILICON LABS

CONNECTED INTELLIGENCE