

OSM modules: Driving the future of EV charging

The growth of Electric Vehicles (EVs) brings a pressing need for efficient and reliable charging infrastructure. As more people switch to EVs, the demand for charging stations that can keep up with this technology surges. This increase presents both challenges and opportunities for those working in the EV charging field.

Open Standard Modules (OSM) will change how we design EV charging systems. In this article, we'll look at how ADLINK's OSM, based on the i.MX 93 applications processor, addresses the complex needs for future EV charging designs.

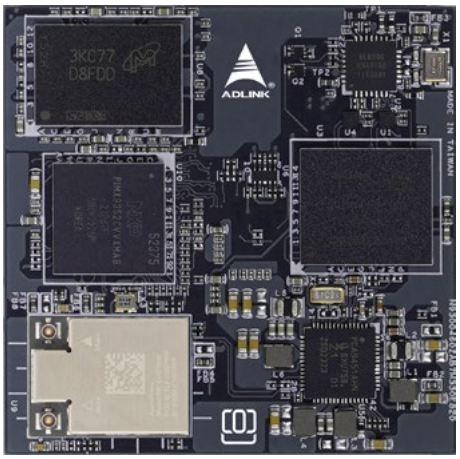
Open standard modules: A new approach to EV charging

Open Standard Modules (OSM) represent a shift in embedded system design. They combine the good parts of system-on-chip (SoC) designs with the flexibility of modular computing, making them particularly useful for complex applications like EV charging.

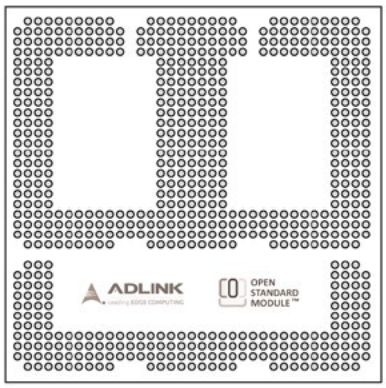
At its core, OSM is about standardization and flexibility. Imagine building with Lego bricks, where each brick is a powerful computer. You can easily swap out one brick for a more powerful one as your needs change without rebuilding the whole structure.

Modules come in different sizes, from tiny modules perfect for space-constrained designs to larger, more powerful modules suitable for complex applications like EV charging stations. The Size-L modules are particularly relevant for EV charging due to their processing power and connectivity options.

Several advantages become clear when we compare OSM to other approaches like SMARC or Qseven. OSM redefines size efficiency, with the largest module measuring a mere 45mm x 45mm, 28% smaller than the Qseven (70x70mm), and 51% smaller than SMARC (82x50mm). This has the direct benefit of enabling the most compact form factors, crucial in EV charging stations where space is often limited.



ADLINK OSM-IMX93 Module



OSM Size-L (Large) Module Dimensions
Size-L (45 x 45mm)

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Modules are designed to be soldered directly onto a carrier board, which makes them more resistant to vibration and harsh environments. This ruggedness is crucial for outdoor charging stations that withstand years of weather and use.

Perhaps the most significant advantage of OSM lies in its standardization. All OSM modules, regardless of manufacturer, use identical interfaces. Consequently, manufacturers can design a charging station using one module today and easily upgrade it with a more powerful module in the future as needs evolve. The concept is similar to upgrading a processor in a desktop computer but applied to embedded systems.

This standardization extends to software as well. OSM supports a wide range of operating systems and software frameworks, which gives engineers flexibility in their designs. Whether you prefer to work with Linux®, RTOS, or bare-metal programming, OSM can accommodate your needs.

OSM in action: Transforming EV charging design

The primary advantage of a modular approach is that it allows manufacturers to create a range of solutions with different performance levels, all based on the same core hardware design. This standardization significantly reduces engineering effort and time to market for new products.

Consider two scenarios that a manufacturer might want to address:

1. A simple office charging station might not require a user interface, billing system or complex authorization. It just needs to deliver power to the vehicle safely and communicate basic status information.
2. A public charging station: This needs to handle user authentication, payment processing, reservations and potentially display advertisements or other information on a screen. It might also need to communicate with a central management system and implement smart charging algorithms.

With OSM, the manufacturer can design a single base charging system. For example, the office charger product line could use a lower-power OSM module, keeping costs down. In contrast, the public charger product line could use a more powerful module like the ADLINK i.MX 93 OSM to handle the increased processing and communications demands. The key here is that both products could use the same base hardware design and power electronics, with the OSM entiating factor.

This approach offers several benefits:

1. Reduced Development Time: reduce development and testing time for new products by reusing the same base design across multiple products.
2. Simplified Product Line Evolution: As market needs change or new technologies emerge, manufacturers can introduce new products or update existing ones by simply designing around a new OSM module. This approach is faster and more cost-effective than redesigning entire systems.
3. Scalability: Manufacturers can offer a range of products at different price points and with different capabilities, all based on the same core design, allowing them to address various market segments efficiently.
4. Future-Proofing: As new requirements emerge in the EV charging market (such as new communication protocols or security standards), manufacturers can often meet them by developing new products based on more advanced OSM modules without completely redesigning their charging systems.
5. Performance Upgrades: When new, more powerful processors become available, manufacturers can quickly integrate them into their product lines. For example, if a new OSM module with enhanced AI capabilities becomes available, a manufacturer could easily design a new “smart” version of their charging station with predictive maintenance or advanced energy management features.

This standardization also benefits the entire EV charging ecosystem. As manufacturers adopt OSM, responding quickly to market demands and regulatory changes becomes easier. This agility can lead to more rapid innovation in the EV charging space, ultimately benefiting end users with more advanced and cost-effective charging solutions.

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The ADLINK i.MX 93 OSM module: Features and applications in EV charging

The ADLINK OSM-IMX93, based on NXP's i.MX 93 processor family, offers a compelling set of features that make it particularly well-suited for EV charging applications.

At the heart of the module is a dual-core ARM® Cortex®-A55 processor paired with a Cortex-M33 core. This combination proves especially useful in the context of EV charging. The A55 cores handle general-purpose computing tasks such as managing user interfaces and processing payments, while the M33 core takes care of real-time operations like controlling power delivery and monitoring safety systems. This separation of tasks leads to more reliable and responsive charging stations.

One standout feature is the integrated neural processing unit (NPU), which opens up interesting possibilities for AI-driven functionalities. A prime example is predictive maintenance. By continuously analyzing data from various sensors within the charging system - including temperature, voltage, current, and usage patterns - the NPU can identify subtle changes that might indicate impending component failure. This capability allows operators to schedule maintenance proactively, reducing downtime and extending the lifespan of the charging infrastructure.

Networking is crucial for modern EV charging stations. The i.MX 93 processor features dual Gigabit Ethernet ports, one of which supports Time-Sensitive Networking (TSN). These advanced networking capabilities facilitate efficient communication between multiple chargers in large charging stations. The module's powerful processor can run complex algorithms to optimize charging operations, dynamically adjusting power allocation to maximize efficiency and throughput.

The robust networking features also enable seamless integration with smart grid systems. Charging stations can communicate effectively with grid operators, respond to demand response signals and adjust charging rates based on real-time electricity prices. This functionality helps balance grid load and minimize operational costs, benefiting both charging station operators and end-users.

Security is another area where the i.MX 93 module shines with its embedded secure enclave that is perfectly suited for accelerating the cryptographic operations required in the latest version of ISO 15118- 20 ensuring developers can switch to the latest standards at their convenience. EV charging stations also handle sensitive data and control significant amounts of power, making them potential targets for cyberattacks. The module includes several hardware security features, such as a secure enclave for storing encryption keys and a hardware root of trust. These features provide a solid foundation for building secure charging systems conforming to evolving global standards such as IEC 62443, US Cyber Trust mark and SESIP/PSA L3 certification

The module's processing power also enables the implementation of advanced user interfaces directly on the charging station. These could include realtime energy pricing displays, accurate charging time estimates based on specific vehicle and charging conditions, or even augmented reality guides for firsttime users. The dual-core processor ensures these interface features run smoothly without interfering with critical charging control functions.

Over-the-air updates become more secure and manageable with the i.MX 93 module's features. Charging station operators can continually improve their systems, add new features and patch security vulnerabilities without physical site visits. This flexibility is invaluable in the rapidly evolving landscape of EV charging standards and payment systems.

The module boasts a wide operating temperature range, functioning reliably from -40°C to 85°C. This resilience means it can be deployed in charging stations from the frigid Canadian winter to the scorching Arizona summer, without requiring expensive cooling or heating systems.

All these features come in a compact package designed for easy integration. The module can be soldered directly onto a carrier board, simplifying the manufacturing process and increasing durability. This robustness is particularly crucial for outdoor charging stations that must withstand years of vibration and weather exposure.

Designing with OSM: Practical considerations

The i.MX 93 module is well-suited for many charging applications. However, it's important to consider your specific requirements. Think about the processing power you need, the connectivity options required, and your power budget. OSM offers a range of modules, so you can choose one that best fits your needs.

When designing the carrier board for your OSM, pay close attention to power delivery and thermal management. EV charging involves high power levels, so proper design is crucial for safety and reliability. Consider factors like power dissipation, component placement, and cooling requirements. The OSM standard provides guidelines for these aspects, but you must tailor them to your specific application.

Remember to design with future upgrades in mind. One of the key advantages of OSM is its standardization. This means you can design your system to accept future modules with higher performance or new features. This ability to swap out modules as technology advances can significantly extend the lifespan of your charging infrastructure.

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ADLINK I-Pi OSM IMX93 Development Kit

The future of EV charging with OSM

As we look to the future, it's clear that EV charging technology will continue to evolve rapidly. Modules like the ADLINK OSM-IMX93 exemplifies the flexibility, security and power of OSM-based designs, which will play a key role in this evolution.

We expect even more integration between EV charging and smart grid technologies. Charging stations will become active participants in grid management, helping to balance loads and integrate renewable energy sources. OSM processing power and networking capabilities will be crucial for implementing these complex systems.

AI and machine learning will likely play an increasing role in EV charging. From optimizing charging schedules to predicting maintenance needs and potential network cyber attacks, these technologies have the potential to make charging systems more efficient and reliable. The neural processing capabilities of processors like the i.MX 93 family put this power at the edge, where it can have the most immediate impact.

User experience will continue to be a focus area. As EV adoption grows, charging systems must cater to a wider range of users, from tech-savvy early adopters to those less comfortable with technology. The ability to implement rich, intuitive interfaces directly on charging stations will be key to making EV charging accessible to all.

Security will remain a critical concern. As charging stations become more connected and handle sensitive data, they will also become more attractive targets for cyberattacks. The robust security features of OSM modules provide a strong foundation for building secure systems, but ongoing vigilance and updates will be necessary.

For engineers in the EV charging space, staying up-to-date with these trends will be crucial. OS provides a flexible platform that can adapt to these changing needs, allowing you to focus on innovation rather than reinventing the wheel for each new project.

Whether you're developing home charging solutions, building public charging networks, or working on fleet electrification, OSM offers a powerful and flexible platform to build—the ADLINK OSM-IMX93, with its blend of processing power, connectivity and security features, is a prime example of how OSM can meet the complex needs of EV charging applications.

As you plan your next EV charging project, consider the advantages of OSM and the ADLINK OSM-IMX93 can bring. Its combination of performance, flexibility, and standardization could be the key to unlocking the next generation of EV charging solutions. The road to a fully electrified transport system is long, but with tools like these, we're well-equipped for the journey ahead.

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