Application Note

Leveraging AM62/AM62L Enables EV Charging Station

Zekun Bai

ABSTRACT

This application note presents a comprehensive overview of the Smart, Connected Electric Vehicle Supply Equipment (EVSE) development platform based on Texas Instruments' AM62/AM62L Sitara™ MPU processor family. The platform integrates complete analog power design, digital communication protocol support, and Human Machine Interface (HMI) functionality, supporting both AC Level 2 charging and DC fast-charging scenarios. By adhering to IEC-61851 basic charging standards and ISO-15118 high-level charging standards, this design enables vehicle-to-grid (V2G) bidirectional power transfer capabilities. This document is targeted at EV charging equipment manufacturers, embedded systems engineers, and power electronics design teams, aiming to help engineering teams accelerate time-to-market while reducing development costs and system complexity.

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1 Introduction

1.1 Background and Challenges

With rapid global growth in electric vehicle adoption, establishing comprehensive charging infrastructure has become a critical challenge. EV charging systems must address multiple requirements.

- **Hardware Complexity**: High-power analog design, safety isolation circuits, noise-immune signal processing
- **Software Diversity**: ISO-15118 communication protocols, vehicle-specific software stacks, cloud connectivity and management
- **Standards Compliance**: IEC-61851 basic charging, ISO-15118 advanced charging, OCPP (Open Charge Point Protocol) versions 1.6/2.0
- **Interoperability Challenges**: Communication differences between vehicle brands, multiple connector standards (CCS, NACS, and so on.)

1.2 Design Requirements

Many engineering teams face a fundamental challenge: while teams can possess deep expertise in one specific domain (such as analog power design, digital communications, or HMI), it is extremely difficult to master all domains simultaneously. This results in extended development cycles, increased costs, and delayed product market entry.

2 AM62/AM62L-EVSE Development Platform Overview

2.1 Platform Architecture

The EVSE development platform based on AM62/AM62L employs a layered architecture design.

Processor Layer (MPU Level)

- AM62: Quad-core Cortex-A53 processor, up to 1.4GHz clock frequency
- AM62L: Dual-core Cortex-A53 processor, up to 1.25GHz (power-optimized variant)
- Integrated security acceleration engine supporting critical cryptographic verification

Control Layer (MCU Level)

- Integrated M4(For AM62 only, AM62L does not integrate MCU) or external M0+ microcontroller, or high-end networking MCU.
- Responsible for low-latency real-time control (CP signaling, PWM modulation, fault detection)
- Supports 100-microsecond response time requirements

Connectivity Layer

- Dual Gigabit Ethernet ports supporting local networking and cloud connectivity
- M.2 2230 expansion interface for Wi-Fi 6, Bluetooth, and Sub-1GHz communication modules
- LVDS/DPI display interface supporting full HD HMI display

2.2 Key Platform Features

Table 2-1. Key Platform Features

FEATURE	DESCRIPTION
Charging Standards	AC Level 1/2/3 charging; DC fast charging; V2G bidirectional charging support
Communication Protocols	ISO-15118, IEC-61851, HomePlug Green PHY
OCPP Support	Open Charge Point Protocol versions 1.6/2.0, cloud management capable
Display Output	Full HD LVDS/DPI interface with multi-screen expansion support
Wireless Connectivity	Wi-Fi 6, Bluetooth, cellular modem interface
Power Consumption	AM62L static power <1.5W
Cost Efficiency	Single-port design starting from $6

3 Key Technology Implementation

3.1 IEC-61851 Basic Charging Control

Basic charging is implemented through an analog handshake protocol.

Proximity Pilot (PP) Signal: The vehicle determines connection status through specific resistor values; in European standards, the charging station also uses this signal to identify the rated current capacity of the charging cable.

Control Pilot (CP) Signal: The charging station uses ±12V voltage signals to inform the vehicle of charging status. The vehicle modifies the voltage through load resistance, allowing the charging station to detect connection status and identify potential faults.

AM62/AM62L implements these controls through integrated analog front-end and PWM generation modules:

- PWM module generates CP carrier signal (1kHz)
- Integrated 10-bit ADC samples CP line voltage
- GPIO drives relay control of current paths
- 100-microsecond response time meets standard requirements

3.2 ISO-15118 Advanced Charging and V2G

The ISO-15118 standard defines the digital communication layer between vehicles and charging stations, enabling advanced features through the following mechanisms:

Plug & Charge: Vehicles automatically authenticate through digital certificates without manual intervention, initiating charging directly.

Smart Charging: Dynamically adjusts charging power according to grid load, electricity pricing, or user preferences.

Bidirectional Charging (V2G): EV batteries can feed power back to the grid, supporting peak shaving, valley filling, and backup power functions.

Implementation:

- PLC PHY (HomePlug Green PHY) module transmits data over power lines
- AM62 processor runs ISO-15118 protocol stack, handling complex handshake and verification procedures
- Supports TLS encryption and digital certificate management for secure communication

3.3 OCPP Cloud Connectivity and Management

OCPP (Open Charge Point Protocol) enables communication between charging stations and backend management systems:

- **Local Operation**: Charging stations can operate independently without cloud dependency
- **Remote Management**: Supports real-time monitoring, firmware updates, dynamic pricing configuration
- **Version Support**: OCPP 1.6 for mature markets, OCPP 2.0 supporting new features like Plug & Charge

The dual-core architecture of AM62/AM62L allows one A53 core to focus on OCPP business logic while another handles real-time control tasks, achieving functional decoupling and performance optimization.

3.4 HMI Display Subsystem

AM62/AM62L supports flexible display configurations:

- **Full HD LVDS Output**: Drives 10.1-inch or larger touch-enabled displays
- **Multi-Screen Support**: Displays status of 1-N charging ports, interactive menus, advertising content
- **3D GPU Acceleration** (optional): Enables advanced UI rendering and information visualization
- **Integrated Touch Control**: Responds to user input, providing intuitive charging experience

4 Scalable System Architecture and Scenarios

4.1 Expansion Design from Single-Port to Multi-Port

The AM62/AM62L platform employs modular design supporting flexible port expansion.

Single-Port Configuration:

- Single AM62 MPU + PLC PHY module
- Designed for residential charging and small commercial applications
- Cost-optimized design

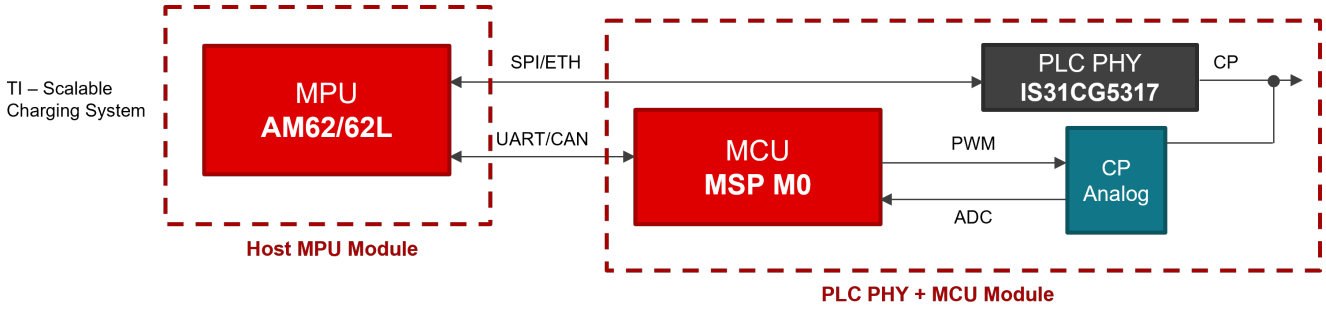

Figure 4-1. Single-Port System Architecture

Dual-Port Configuration:

- 1× AM62 MPU + 1× MSPM0G3507 microcontroller
- Single MCU manages safety and communications for two charging ports
- Balanced cost and functionality

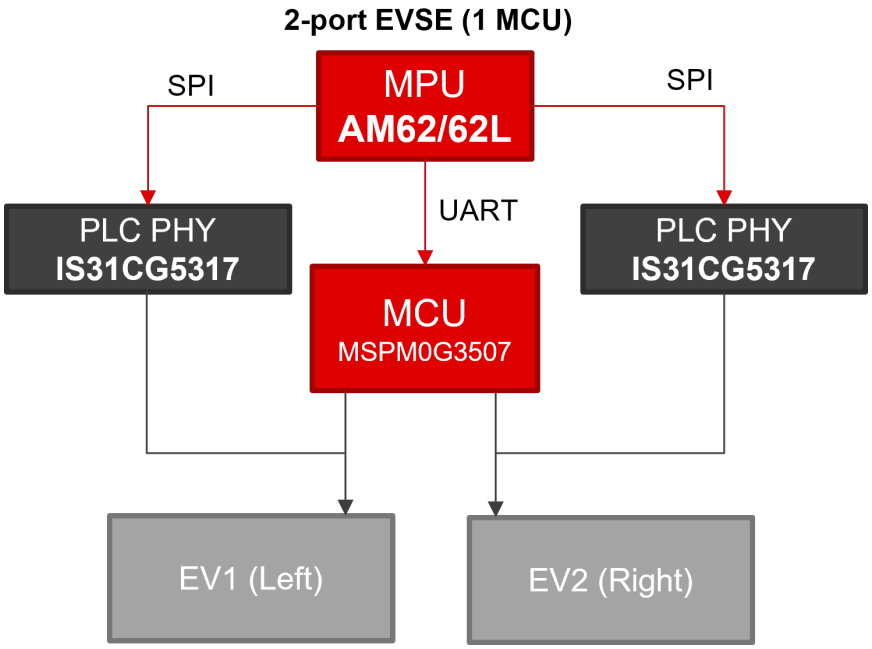

Figure 4-2. Dual-Port System Architecture

Four-Port and Beyond Configurations:

- AM62 MPU serves as primary controller with multiple MCU modules cascaded via Ethernet
- Each MCU module independently manages one charging port
- Supports Star or Ring network topology
- Enables highly scalable commercial charging station designs

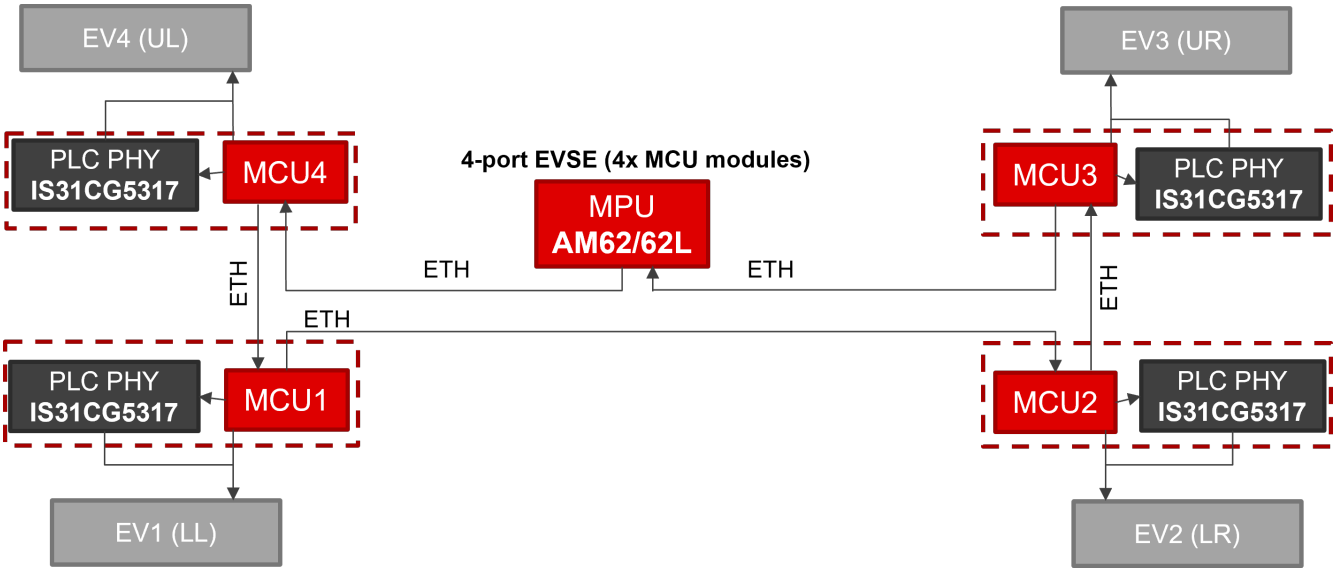

Figure 4-3. 4-Port System Architecture

4.2 Modular Hardware Design

Key sub-modules include:

Table 4-1. Key Sub-Modules

Module	Function
Display Kit	10.1" LCD touchscreen + LED backlight
Development Board	phyBOARD-AM62x carrier board
Wireless Module	M.2 Wi-Fi/Bluetooth integration card
PLC PHY	HomePlug Green PHY expansion board
Analog Reference Design	AC Level 2 charging power supply

See *AM62L EVSE Evaluation Module* for details.

See *AM62-EVSE-DEV-PLATFORM Development kit* for details.

4.3 Deployment Scenarios

Home Charging (Level 1/2 AC)

- Single port, no HMI or simplified display
- AM62L power-optimized variant
- Pre-configured fixed charging power

Commercial Public Charging

- 2-4 charging ports
- Full-featured HMI + cloud connectivity
- Dynamic power management, payment integration
- ISO-15118 V2G support

DC Fast Charging Stations

- Multi-port expansion architecture
- High-precision current/voltage monitoring
- Real-time power regulation
- Fault isolation and overload protection

5 Summary

The AM62/AM62L-EVSE development platform significantly simplifies EV charging system development by integrating high-performance MPU, flexible MCU architecture, and comprehensive reference designs. The platform offers the following advantages:

✓ **Accelerated Time-to-Market**: Pre-integrated hardware and open-source software reduce development cycles from months to weeks

✓ **Cost Optimization**: Scalable architecture supports designs starting from $6 for single-port to complete multi-port commercial systems

✓ **Standards Compliance**: Supports IEC-61851, ISO-15118, OCPP, and global charging standards

✓ **Future-Ready**: Firmware upgrades support emerging standards (such as NACS/SAE J3400)

✓ **Ecosystem Support**: Deep collaboration with industry leaders

As the global EV market accelerates, interoperability and user experience are key competitive factors. The AM62/AM62L-based intelligent charging design is specifically designed to address these requirements, helping manufacturers build reliable, efficient, and future-proof charging infrastructure.

6 References

1. Texas Instruments, AM62-EVSE-DEV-PLATFORM Development kit, webpage.
2. Texas Instruments, AM62L-EVSE-DEV-EVM Evaluation Module, EVM user's guide.
3. Texas Instruments, AM62L-EVSE-DEV-EVM User Guide, user's guide.
4. Texas Instruments, AM62x Sitara Processors, datasheet.
5. Texas Instruments, AM62L data sheet, product information and support, product page.

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