WS026-L2EVCHGR-REFZ

22kW Three-phase EVSE System

Introduction

This manual describes the operation of the 22kW three-phase EVSE system. The WS026-L2EVCHGR-REFZ, built on a modular architecture comprising a Power Board and an HMI Board, enables efficient power management, user interaction, and secure communication. With safety-critical features handled by the RA2A2 microcontroller on the Power Board and advanced connectivity managed by the RA6M3-based HMI Board, the system delivers reliable electric vehicle charging with support for OCPP, NFC authentication, and real-time monitoring.

Contents

1. Hardware Details

1.1 Hardware Architecture

The EVSE three-phase 22kW system is designed with a modular hardware architecture consisting of two core subsystems, the Power Board and the HMI (Human-Machine Interface) Board. These boards operate in coordination to ensure reliable power delivery, real-time monitoring, secure communication, and intelligent user interaction within the electric vehicle charging infrastructure.

The Power Board serves as the foundation for power management and electrical protection. It integrates the RA2A2 microcontroller, which performs high-precision measurement of AC voltage, current, and earth voltage. Critical safety features are embedded at the hardware level to protect against overvoltage, undervoltage, overcurrent, current leakage, earth failure, Control Pilot (CP) line failure, and emergency stop conditions. These safety responses are fast and deterministic, safeguarding both the vehicle and the charger.

The HMI Board is based on the high-performance RA6M3 microcontroller and is responsible for system connectivity, control logic, user interface, and communication protocol handling. It connects to the Power Board with UART, enabling synchronized operation and seamless data exchange between the subsystems. The RA6M3 MCU establishes external communication using multiple UART interfaces: it interfaces with the Quectel EC200U 4G module for cellular connectivity, the Dialog DA16200 WiFi module for wireless networking, and the Dialog DA14531 Bluetooth module for short-range communication. The system also integrates a PTX100R NFC controller using the I²C interface, enabling secure contactless authentication and user interaction.

To support demanding protocol stacks, rich graphical interfaces, and local data storage, the HMI Board is equipped with a wide array of memory components, including external RAM, EEPROM, Quad SPI Flash, and SD card support. It also interfaces with an RGB-based LCD display for real-time status updates, configuration, and diagnostics. The system is fully compatible with the Open Charge Point Protocol (OCPP), enabling secure and standardized communication with backend management systems for charging authorization, monitoring, and billing.

1.2 Block Diagram

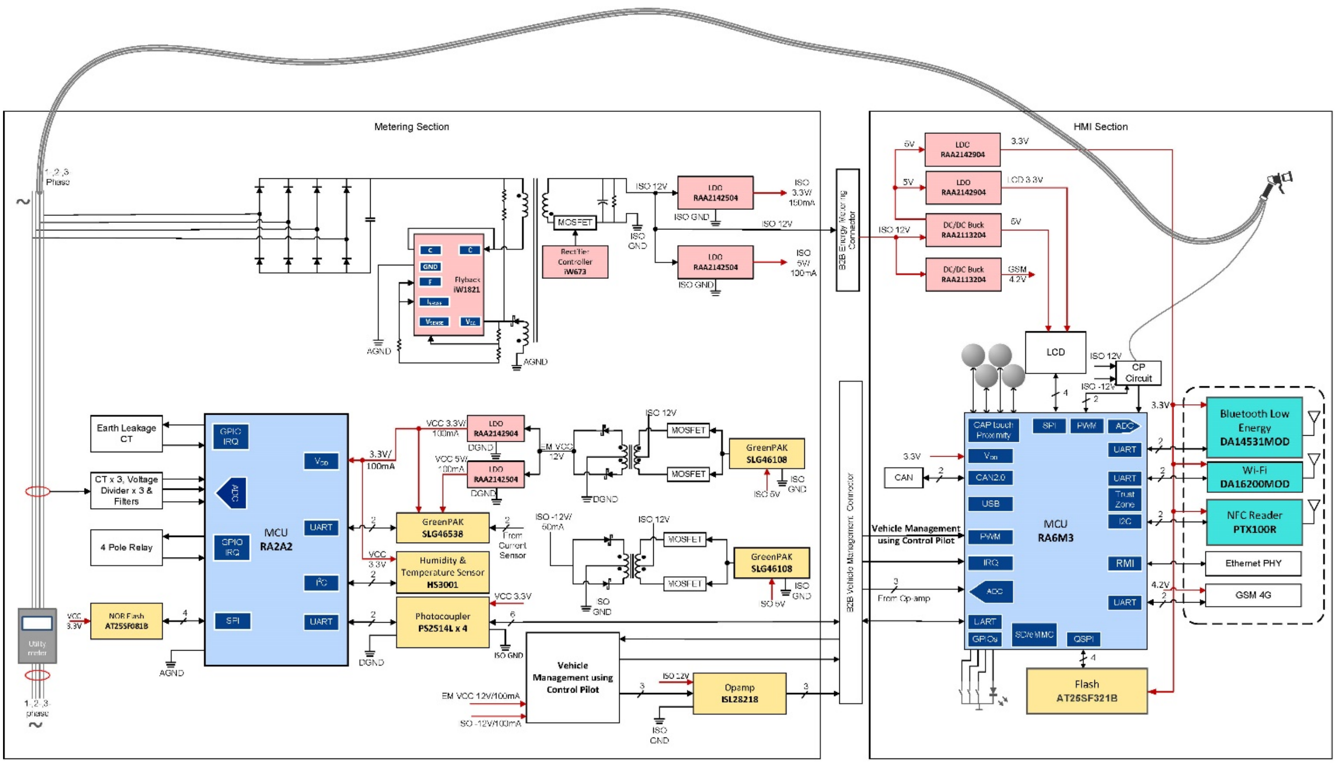

Figure 1. EVSE Block Diagram

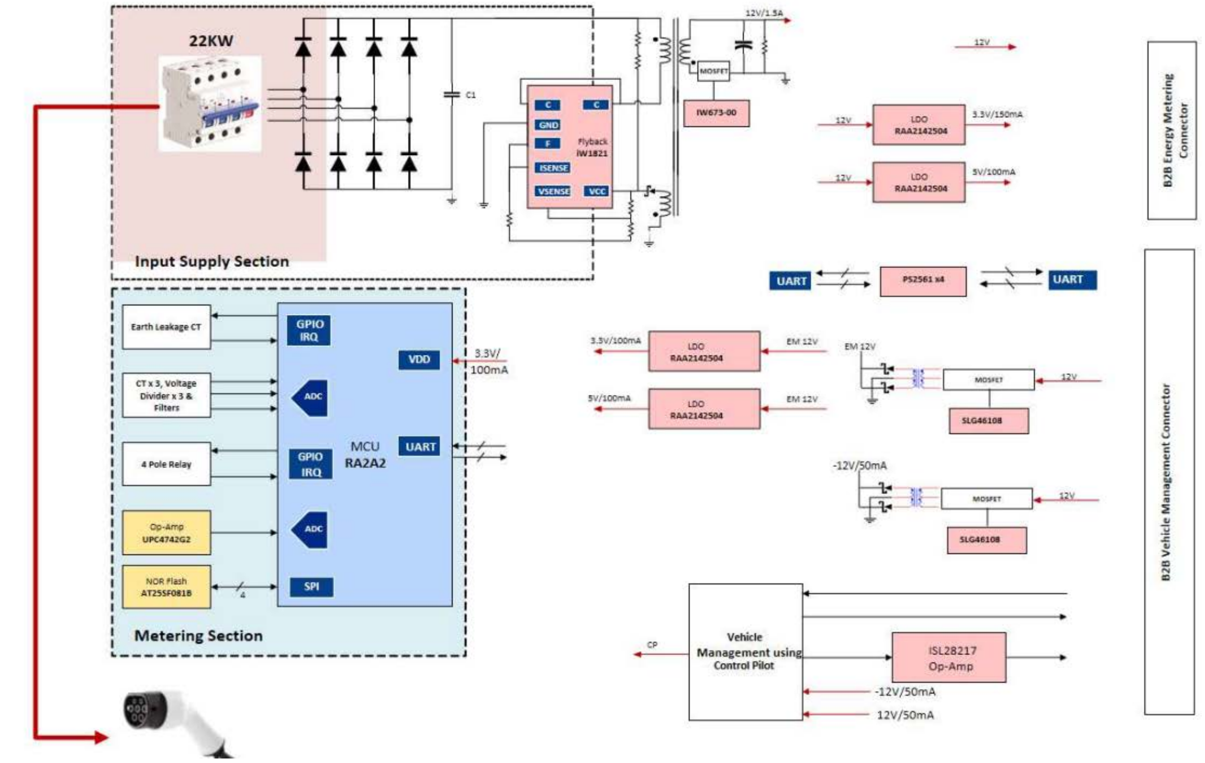

Figure 2. Block Diagram for Power Board

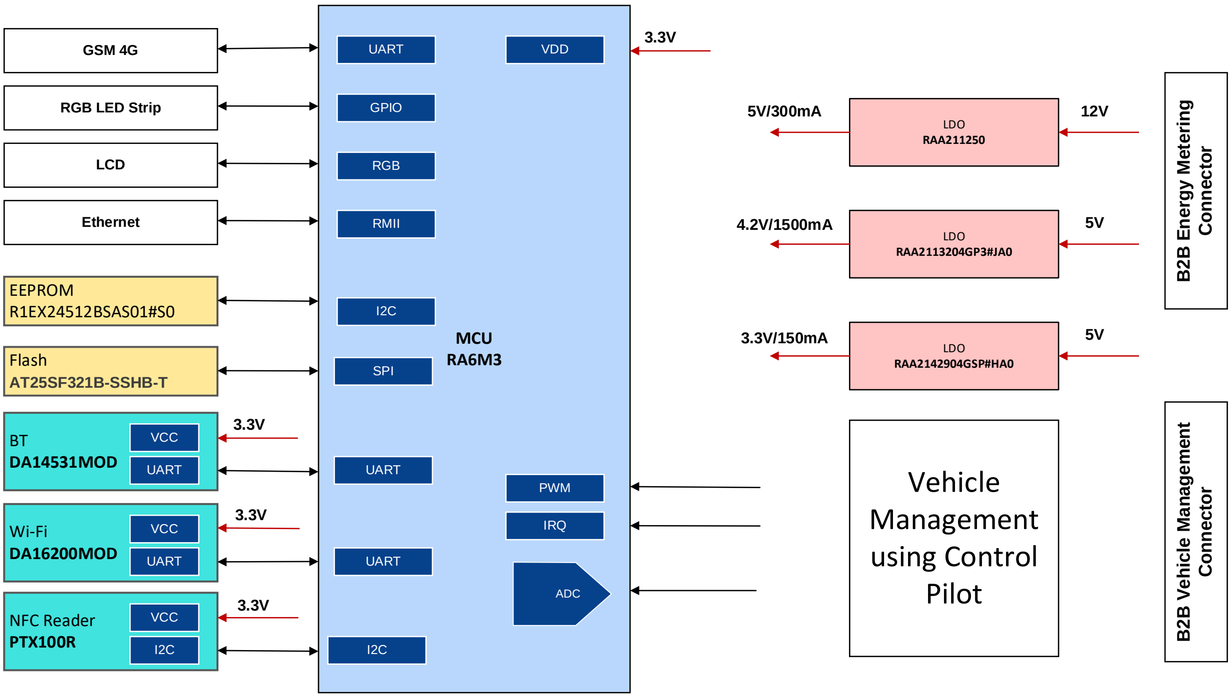

Figure 3. Block Diagram for HMI Board

1.3 Electrical Specifications: Hardware

Category	Parameters	EVSE 7.4kW	EVSE 11 KW and 22KW	Detection / Threshold/ Status	Standard / Authority	Comments	Result
Electrical and Charging	Input Voltage	100V to 300V AC; 50Hz	340V to 460V AC (L-L); 50Hz	-	IS 17017-1 / IS 3043 / IEC 60364 / AIS 138	-	Tested OK
	Max. Current Output; Power	32A; 7.4kW	16A; 11kW	-	BIS IS 17017-1 / AIS 138 Part 1 (AC Mode 3)	-	Functional Verification
			32A; 22kW	-	BIS IS 17017-1 / AIS 138 Part 1 (AC Mode 3)	-	Tested OK
	Input AC System	L + N + PE (1Ph AC supply)	3-Phase, 5 Wire (3Ph + N + PE)	-	IS 3043 / IEC 60364 / AIS 138	-	Desgined Verified
	Output Voltage	220V to 240V AC	304V to 456V AC, 3-Phase	-	IS 17017-2-2 / IS 3043 / IEC 60364 / AIS 138	-	Tested OK
	Maximum Output Current	32A	32A	>32A → Overcurrent	BIS IS 17017-1 / AIS 138 / IEC 61851-1	-	Tested OK
	Charger Connector	Type-2 AC 5-wire	-	AIS 138 Part 1 / IEC 62196	-	Tested OK	Charger Connector
	Rated Frequency	50Hz (47Hz to 53Hz)	-	IEC 61851-1	-	Tested OK	Rated Frequency
	Cooling	Natural air cooling	-	Industrial standard	-	Tested OK	Cooling
	Mounting	Wall-mounted / Pedestal-mounted	-	Industrial standard	-	Tested OK	Mounting
	Charging Mode	Mode 3	-	-	-	Tested OK	Charging Mode
	Backend Communication	OCPP 1.6		-	-	OCPP / CEA guidelines	-
Communi-cation and Smart Charging	Vehicle-Charger Communication	Control Pilot (CP)		-	AIS 138 Part 1 / IEC 61851-1	-	Tested OK (Functional verification)
	Backend Communication	OCPP 1.6		-	Open Charge Point Protocol / CEA guidelines	-	Tested OK
	Connectivity	NFC, BLE, Wi-Fi, 4G, Ethernet, RFID		-	AIS 138 / BIS / CEA	-	Tested OK

Category	Parameters	Specification EVSE 7.4kW	Specification EVSE 11kW and 22kW	Detection / Threshold/ Status	Standard / Authority	Comments
Safety and Protection	Leakage Current	AC: >30 mA, DC: >6 mA	-	Exceeded → Fault / relay cut	IEC 62955 / AIS 138 / IS 3043	Response type, time: Trip, <300ms (instant for safety)
	Ground / Earthing	Proper earthing	-	Earth fault: (L-N)-(L-E) >25V	IS 3043 / IEC 60364	-
	Overcurrent	Relay off / circuit breaker	-	Output > 32A	IEC 60947 / IS 3036	-
	Overvoltage (Per Phase)	Input Phase Voltage > 265V	Nominal voltage: 415V (3-phase) OV level: 440V to 460V (L-L) Trip delay: 1 to 2 seconds Reset level: ~420V	Input > 265V	IEC 61000-4-5 / IS 3043	Voltage level detections and protection, also done on each Phase level as per IEC61000-4-5
	Undervoltage (Per Phase)	Input Phase Voltage < 175V	Nominal voltage: 415V (L-L) UV Trip level : 320V to 340V (L-L) % of Nominal: ~75% to 80% Trip Delay: 1 to 5 seconds Reset / Recovery Level: ~360V to 380V	Input < 175V	IEC 61851 / IS 3043	Voltage level detections and protection, also done on each Phase level as per IEC61000-4-5
	Emergency Stop	Manual switch	-	Pressed → Disable charging	IEC 60204-1 / AIS 138	-
	Short-circuit Protection	Auto trip / relay	-	Current spike detected	IEC 60947	-

1.4 Electrical Specifications: Software

Category	Parameters	EVSE 7.4kW	EVSE 11kW and 22kW	Detection / Threshold/ Status	Standard / Authority	Comments	Result
Software Level	Electrical / Connector	Yes	Yes	Available	SAE J1772	Standard AC Connector Type 2(3p)	Available
	Electrical / Control	Yes	Yes	Available	IEC 61851	Mode-2, EV connected to AC grid through cable incorporating RCD protection (Slow AC)	Available
	Vehicle Communication	Yes	Yes	Optional	ISO 15118	ISO 15118-2 (Road Vehicles – Vehicle to grid communication interface) PLC Module Available on board; Implementation in progress, planned to complete by Q3'26	Optional
	Vehicle Communication	Yes	Yes	Optional	ISO 15118-2	ISO 15118-2 (Road Vehicles – Vehicle to grid communication interface) PLC Module Available on board; Implementation in progress, planned to complete by Q3'26	Optional
	Vehicle Communication	Yes	Yes	Not Available	ISO 15118-20	Bidirectional Power Transfer (BPT), Not supported, which Enables Vehicle-to-Grid (V2G) and Vehicle-to-Home (V2H) services, allowing EVs to supply power back to the grid or home	Not Available
	Field Communication	Yes	Yes	Not Available	Modbus (RTU/TCP)	Customer responsibility, presently Renesas offers UART port for expansion.	Not Available
	Messaging / IoT	Yes	Yes	Optional	MQTT	LTE module is available on board; Customer responsibility, Currently, there is no MQTT Implementation.	Optional
	Backend Communication	Yes	Yes	Available	OCPP 1.6	OCPP-1.6J EVSE CSMS Communication (Full Implementation As Library)	Available
	Backend Communication	Yes	Yes	Available	OCPP 2.0.1	OCPP-2.0.1 EVSE CSMS Communication (Minimal Implementation - Can only support, Heartbeat, Connector Status, Remote CSMS Control Stop/start and Transaction related the same)	Available
	Backend Communication	Yes	Yes	Not Available	OCPP 2.1	Not Implemented	Not Available
	Data Link /PHY	Yes	Yes	Optional	SLAC / ISO 15118-3	Module Available on board; Implementation in progress, planned to complete by Q3'26	Optional
	Data Models	Yes	Yes	Not Available	SunSpec	No Bi-directional Metering	Not Available

1.5 Device Details

1.5.1 Microcontrollers

RA2A2 – The MCU integrates a multiple series of software-compatible and pin-compatible Arm®-based 32-bit cores that share a common set of Renesas peripherals, enabling scalable design across product families. This series features an energy-efficient Arm Cortex-M23 32-bit core, optimized for low-power and cost-sensitive applications. It includes up to 512 KB of code flash memory organized as two 256 KB banks, and 48 KB of SRAM. The device supports advanced features such as a Memory Mirror Function (MMF) for enhanced code reliability, a 12-bit A/D Converter (ADC12), and a high-resolution 24-bit Sigma-Delta A/D Converter (SDADC24) for precision analog measurements. Also, it offers a segment LCD controller/driver for display integration, an independent power supply Real-Time Clock (RTC) for timekeeping during low-power states, and an on-chip 32-bit multiplier with a multiply-accumulator to support efficient mathematical processing. Additionally, integrated security features provide protection for making this MCU well-suited for secure, power-efficient embedded applications.

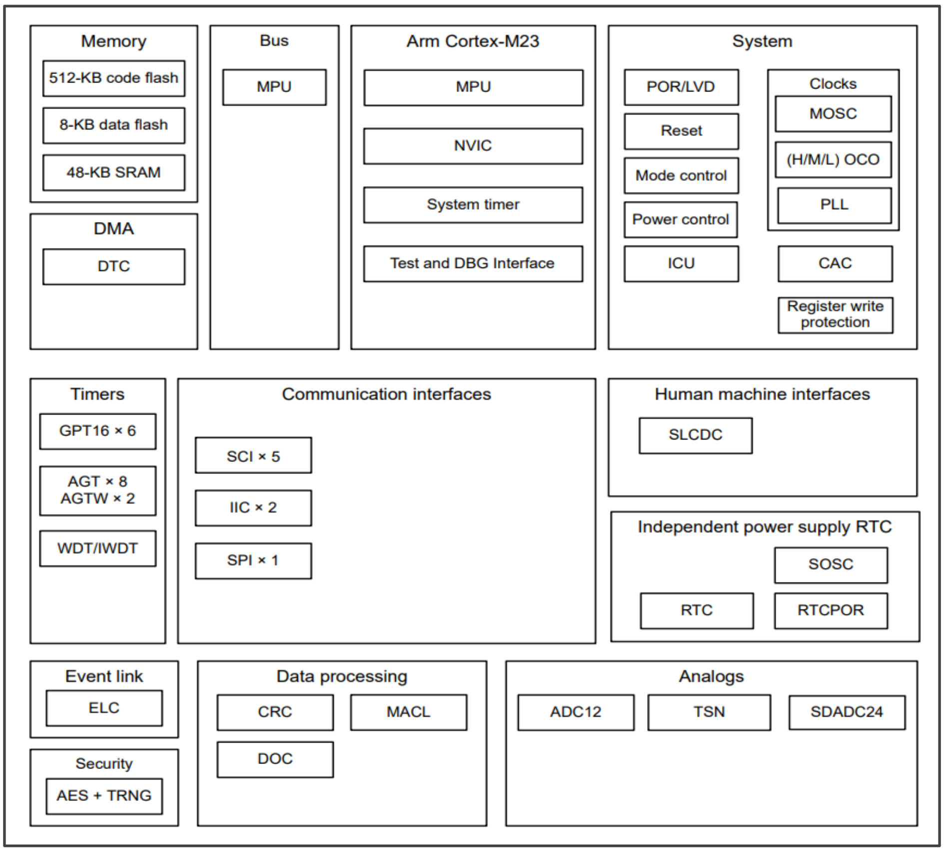

Figure 4. Block Diagram for RA2A2 Microcontroller

RA6M3 – The MCU integrates a family of software-compatible and pin-compatible Arm-based 32-bit cores, enabling design scalability and efficient platform-based product development through a shared set of Renesas peripherals. At the core of this series is a high-performance Arm Cortex-M4 processor operating at up to 120 MHz, featuring up to 2 MB of code flash memory and 640 KB of SRAM. It supports advanced graphical capabilities through a Graphics LCD Controller (GLCDC) and a 2D Drawing Engine (DRW), along with a Capacitive Touch Sensing Unit (CTSU) for intuitive user interfaces. For communication and peripheral expansion, it includes an Ethernet MAC Controller (ETHERC) with IEEE 1588 Precision Time Protocol (PTP), USB Full-Speed (USBFS) and High-Speed (USBHS) interfaces, and an SD/MMC host interface. Additionally, it provides a Quad Serial Peripheral Interface (QSPI) for high-speed external memory access, integrated security and safety features, and a range of analog peripherals that make it highly suitable for complex embedded applications.

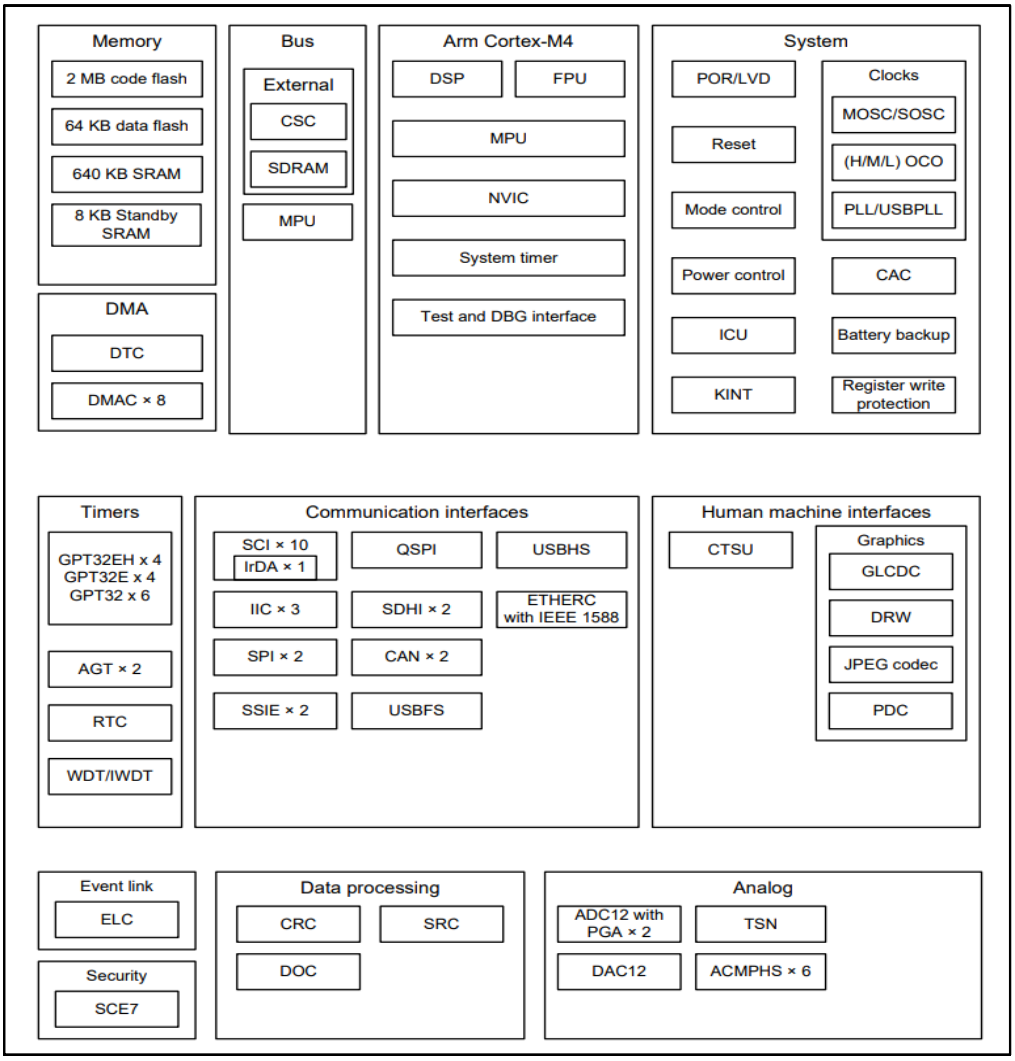

Figure 5. Block Diagram for RA6M3 Microcontroller

1.5.2 LTE Module

The EC200U LTE module is integrated into the HMI board to enable 4G wireless connectivity with the backend server. Communication between the RA6M3 MCU and the LTE module is established through a UART interface. The module operates using AT command-based firmware that allows the MCU to control its functions. By issuing AT commands, the MCU initiates a TCP connection to the server and transmits data reliably over the TCP protocol, ensuring seamless cloud communication and remote monitoring capabilities.

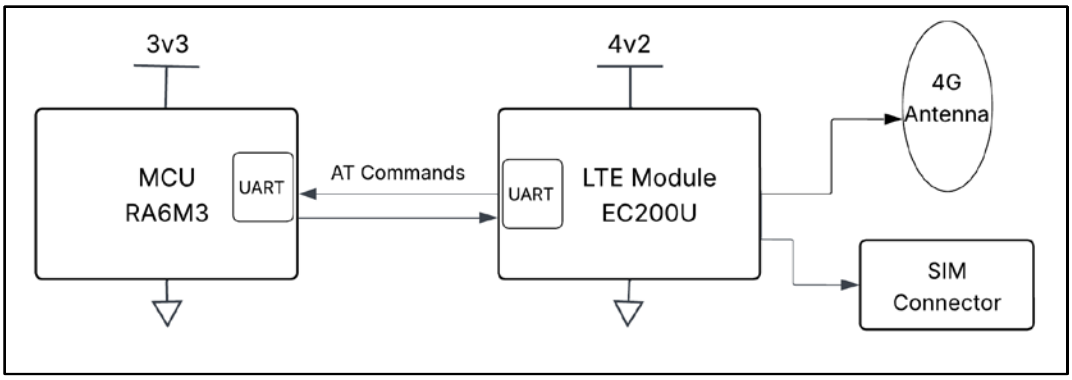

Figure 6. Block Diagram for LTE Module

1.5.3 Wi-Fi Module

The DA16200 Wi-Fi module is used in the HMI board to provide wireless connectivity to the server over a Wi-Fi network. It communicates with the RA6M3 MCU with a UART interface and operates using AT command-based firmware. The MCU controls the module by sending AT commands to establish a Wi-Fi connection, connect to a TCP server, and transmit data over the TCP protocol. This enables reliable and efficient wireless communication for remote monitoring and server interaction through a local Wi-Fi network.

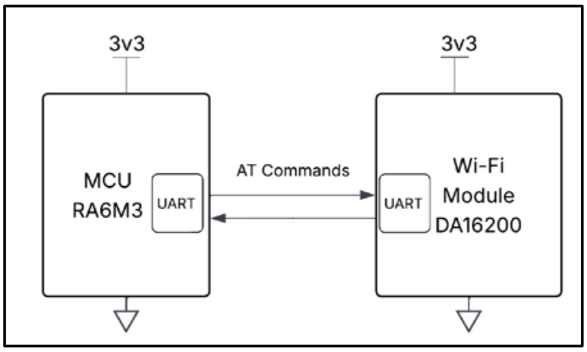

Figure 7. Block Diagram for Wi-Fi Module

1.5.4 Bluetooth Module

The DA14531 Bluetooth module is integrated into the HMI board to enable local wireless configuration of the charger through a mobile device. It communicates with the RA6M3 MCU with a UART interface and operates using AT command-based firmware. Through this interface, users can connect using Bluetooth to configure charger credentials such as selecting or switching Wi-Fi networks and updating either the IP address or the port of the target TCP server. This functionality allows convenient local setup and diagnostics without requiring direct physical access to the internal system of the charger.

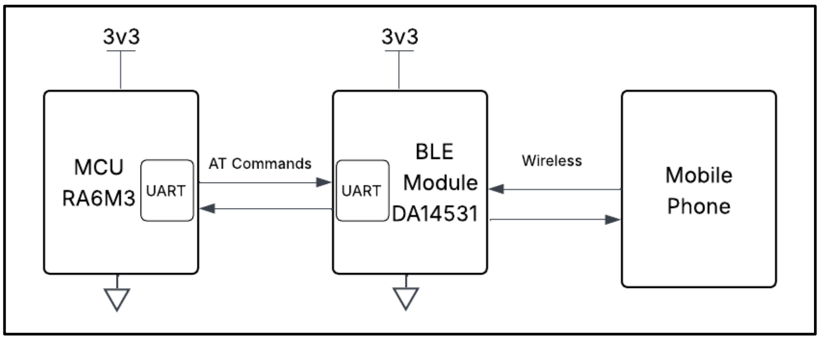

Figure 8. Block Diagram for Bluetooth Module

1.5.5 NFC

The NFC functionality in the HMI board is handled by an NFC IC connected to the RA6M3 MCU using the I²C interface. The MCU continuously communicates with the NFC IC to detect RFID cards presented near the antenna. When a valid card is detected, the IC reads the RFID data and sends it to the MCU. Based on the credentials of the card, the user can securely start or stop a charging session through contactless authentication, enabling a seamless and user-friendly charging experience.

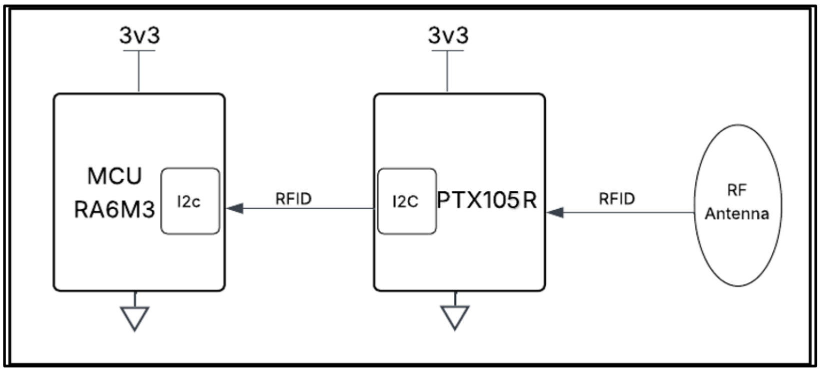

Figure 9. Block Diagram for NFC

2. Board Design

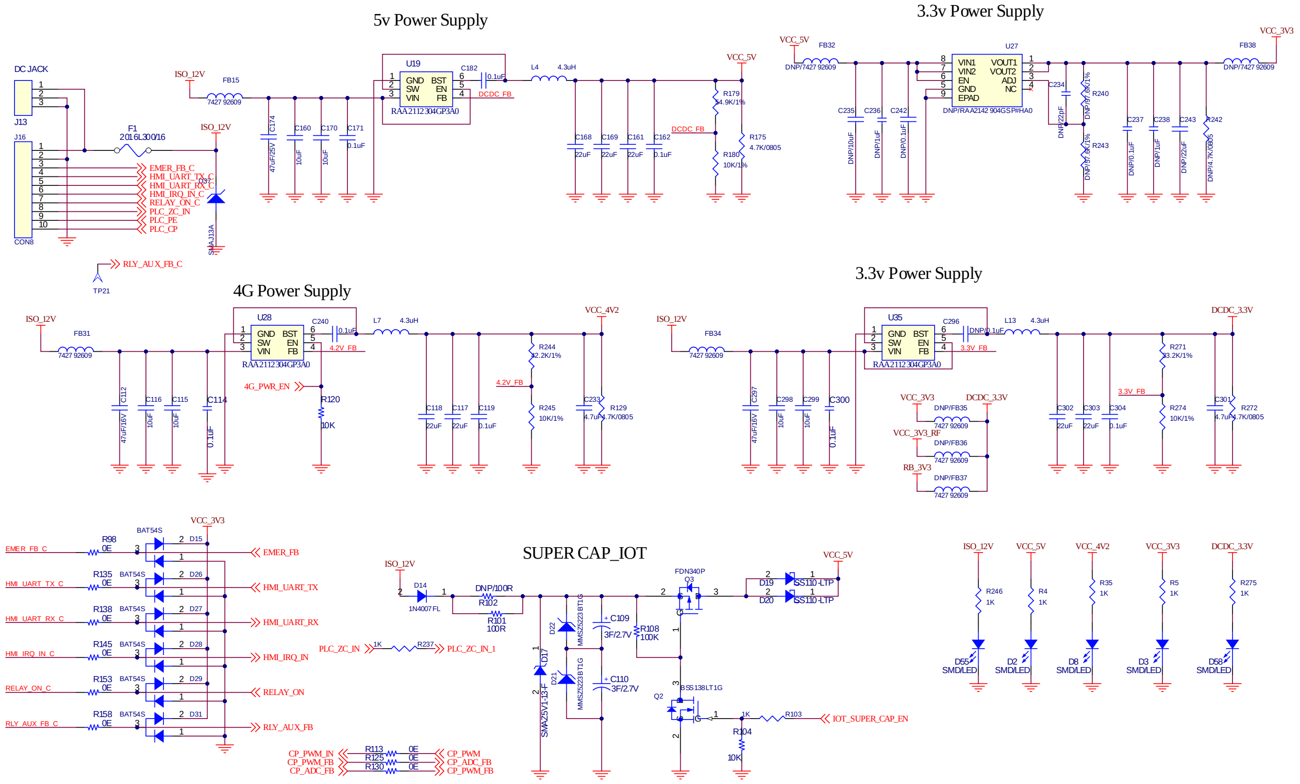

Figure 10. WS026-L2EVCHGR-REFZ Schematic (1 of 16)

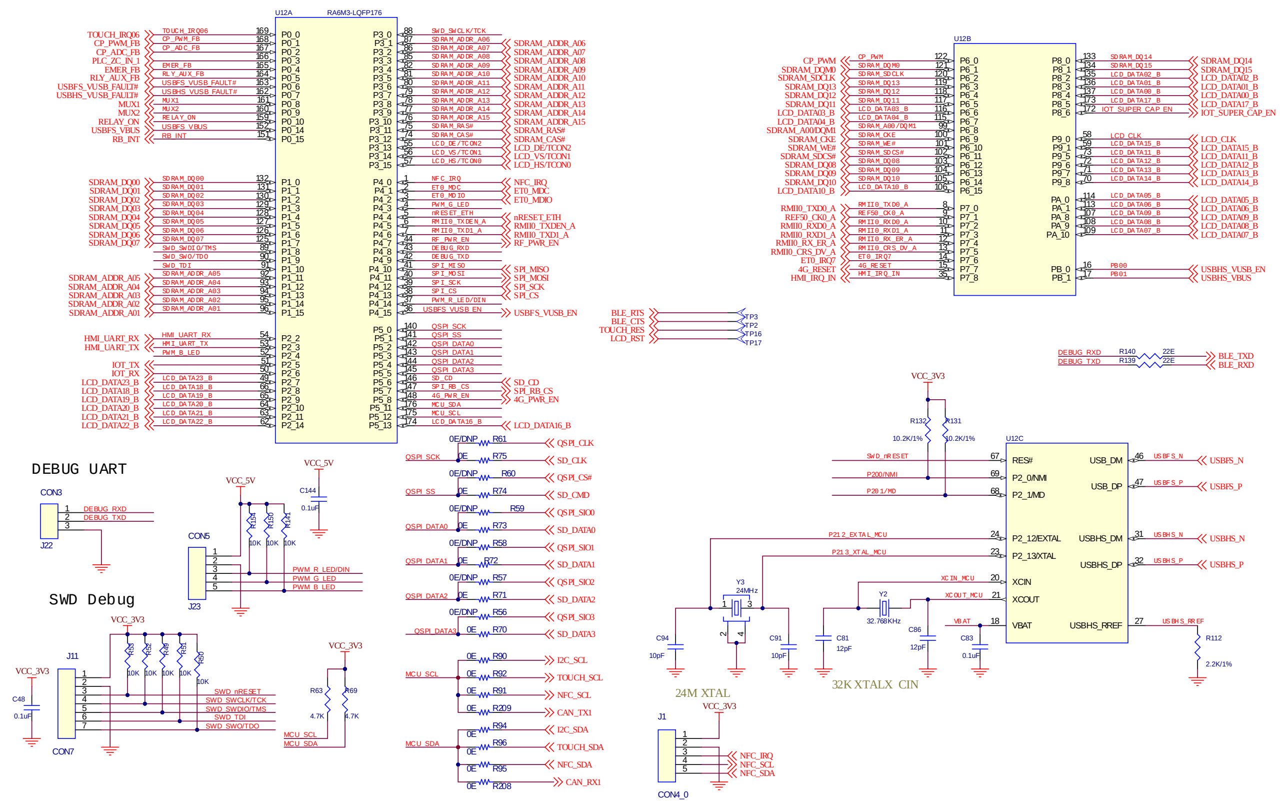

Figure 11. WS026-L2EVCHGR-REFZ Schematic (2 of 16)

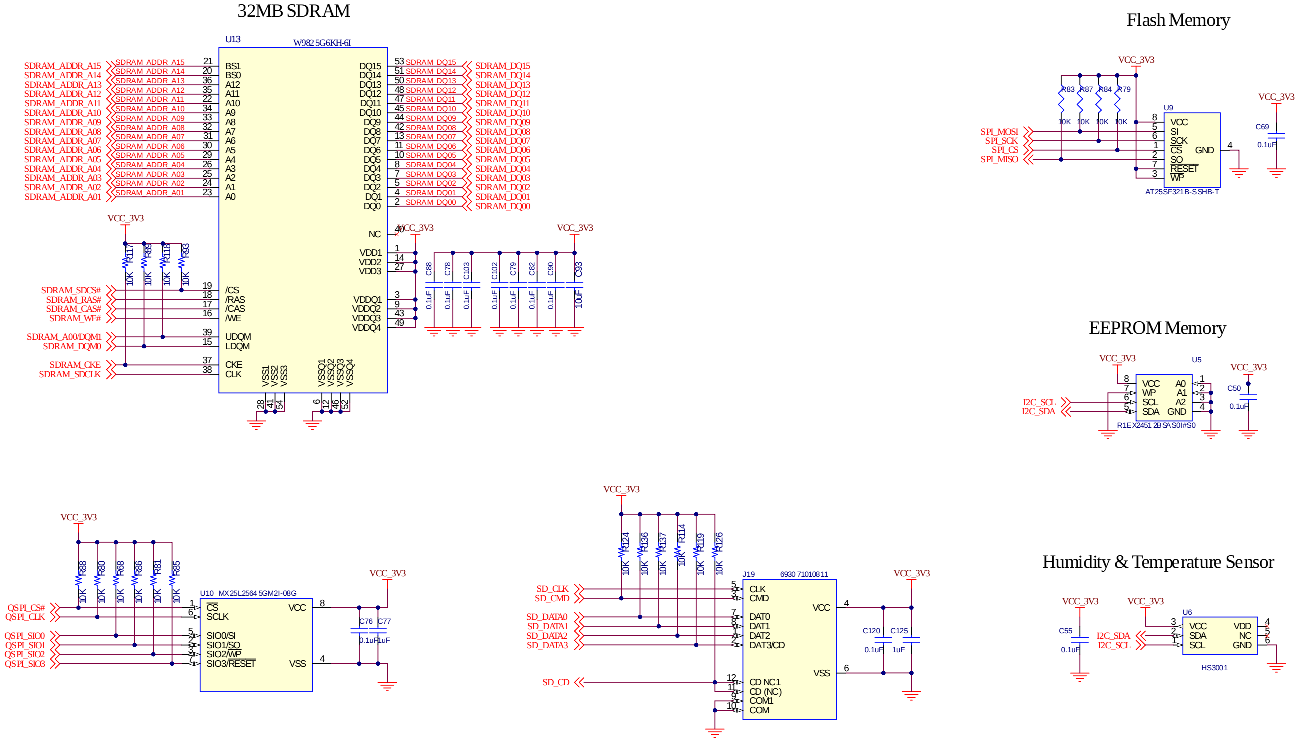

Figure 12. WS026-L2EVCHGR-REFZ Schematic (3 of 16)

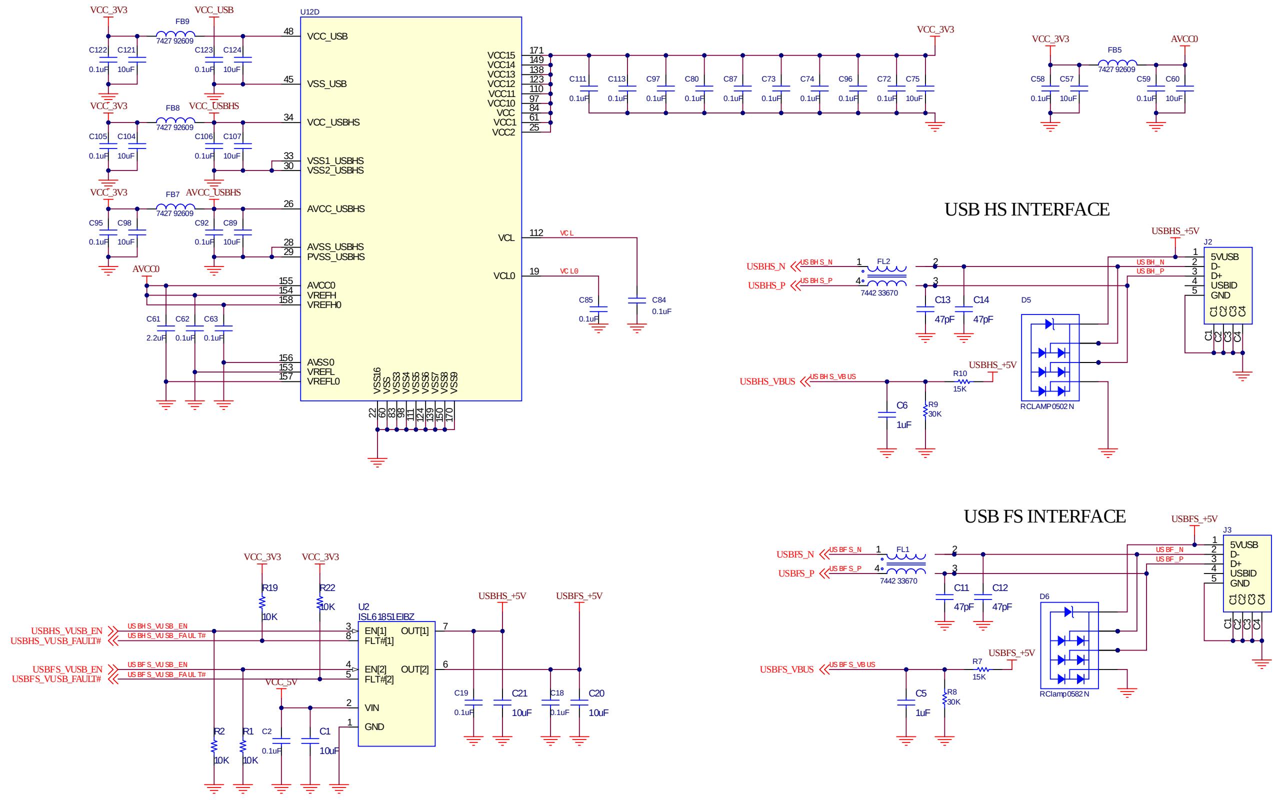

Figure 13. WS026-L2EVCHGR-REFZ Schematic (4 of 16)

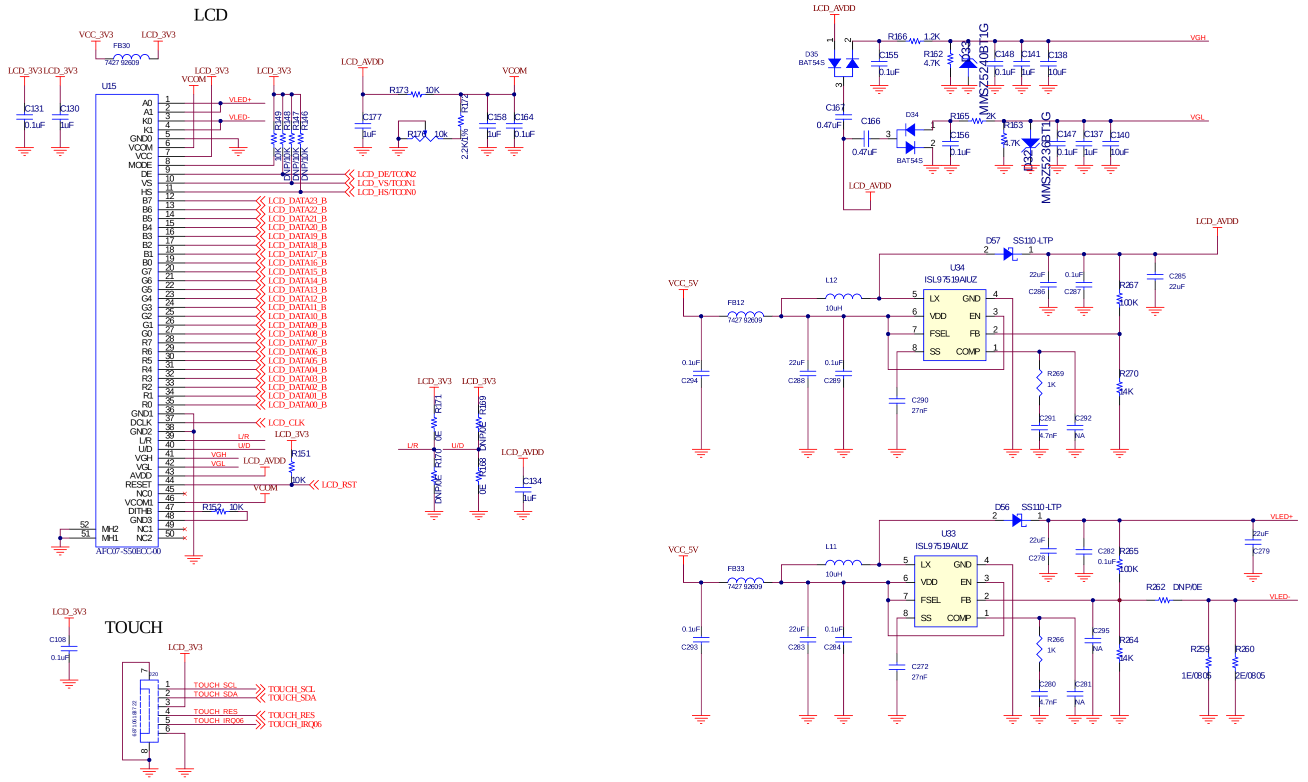

Figure 14. WS026-L2EVCHGR-REFZ Schematic (5 of 16)

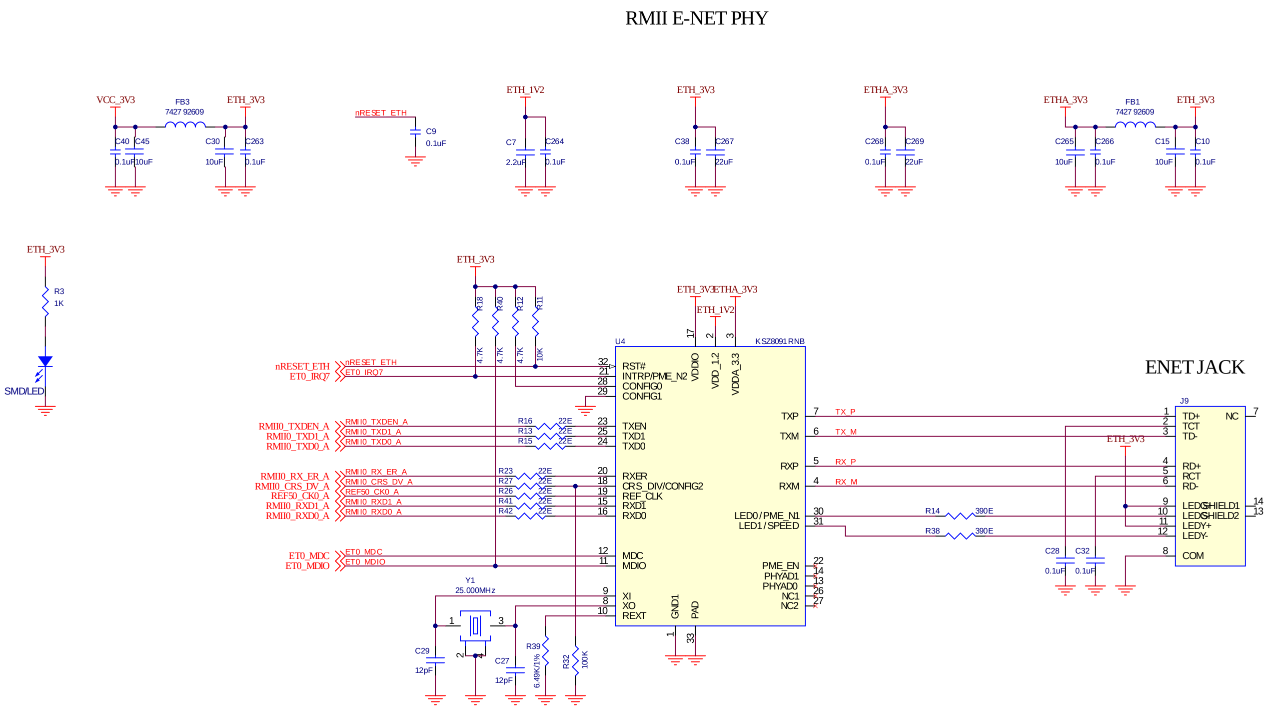

Figure 15. WS026-L2EVCHGR-REFZ Schematic (6 of 16)

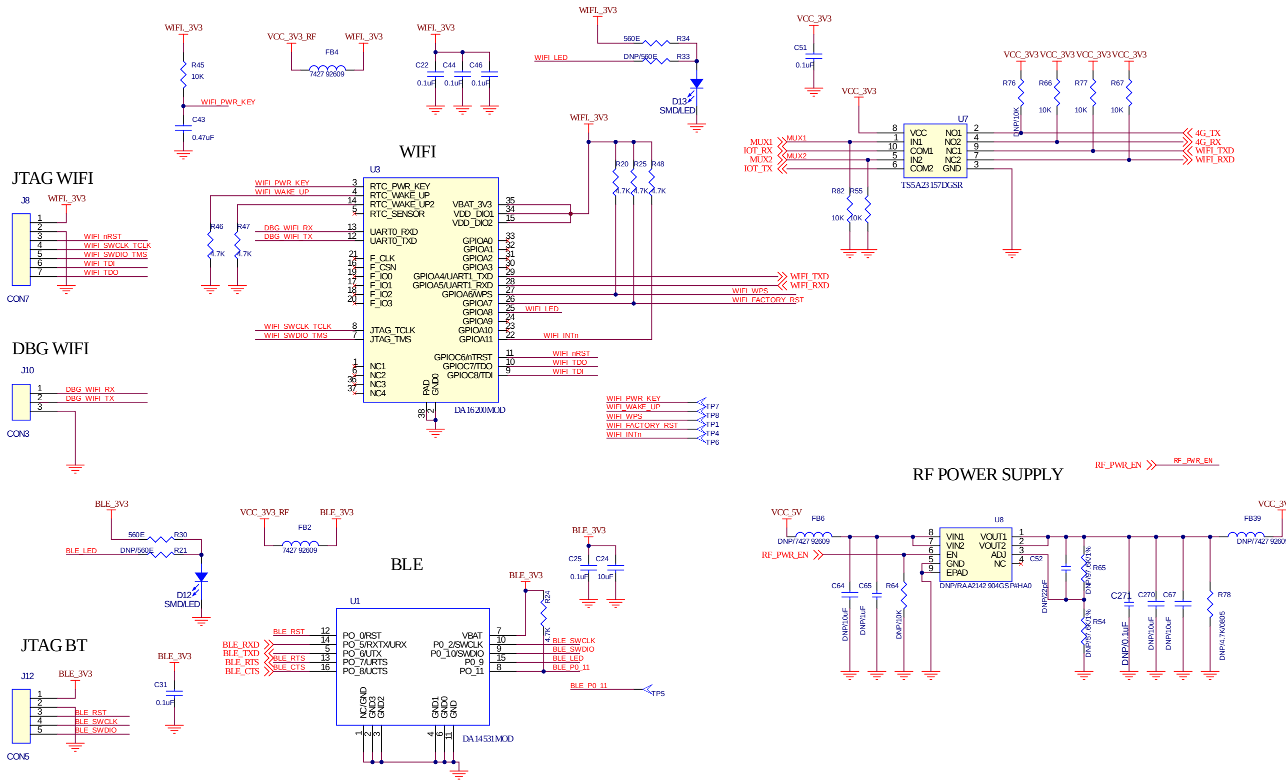

Figure 16. WS026-L2EVCHGR-REFZ Schematic (7 of 16)

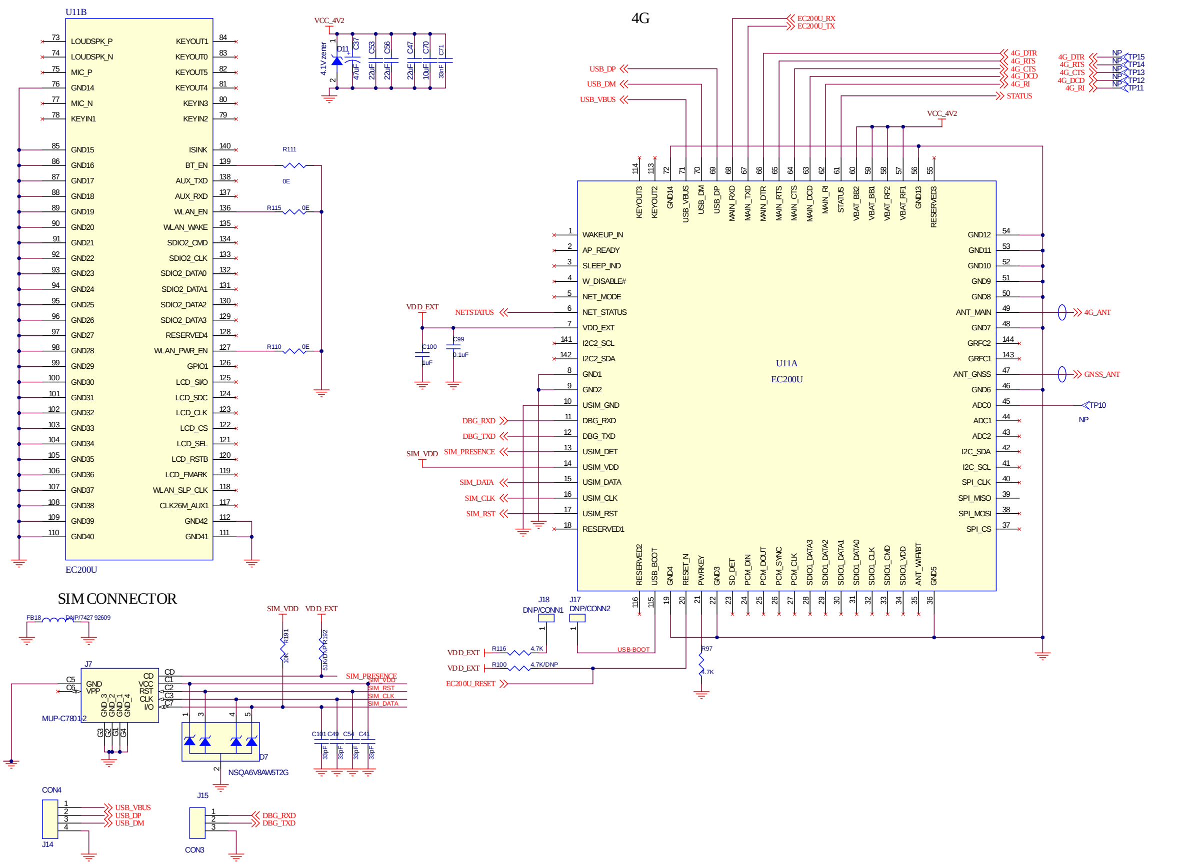

Figure 17. WS026-L2EVCHGR-REFZ Schematic (8 of 16)

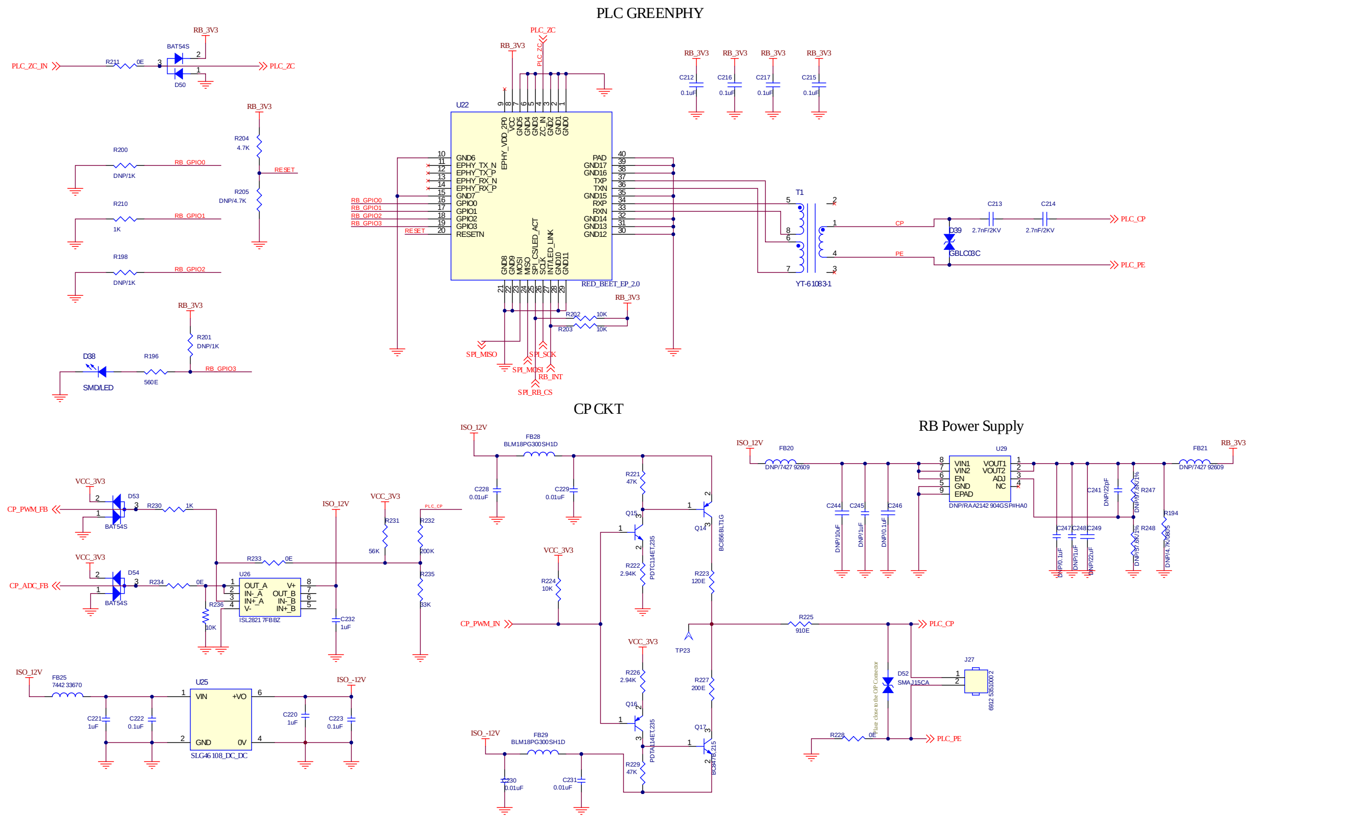

Figure 18. WS026-L2EVCHGR-REFZ Schematic (9 of 16)

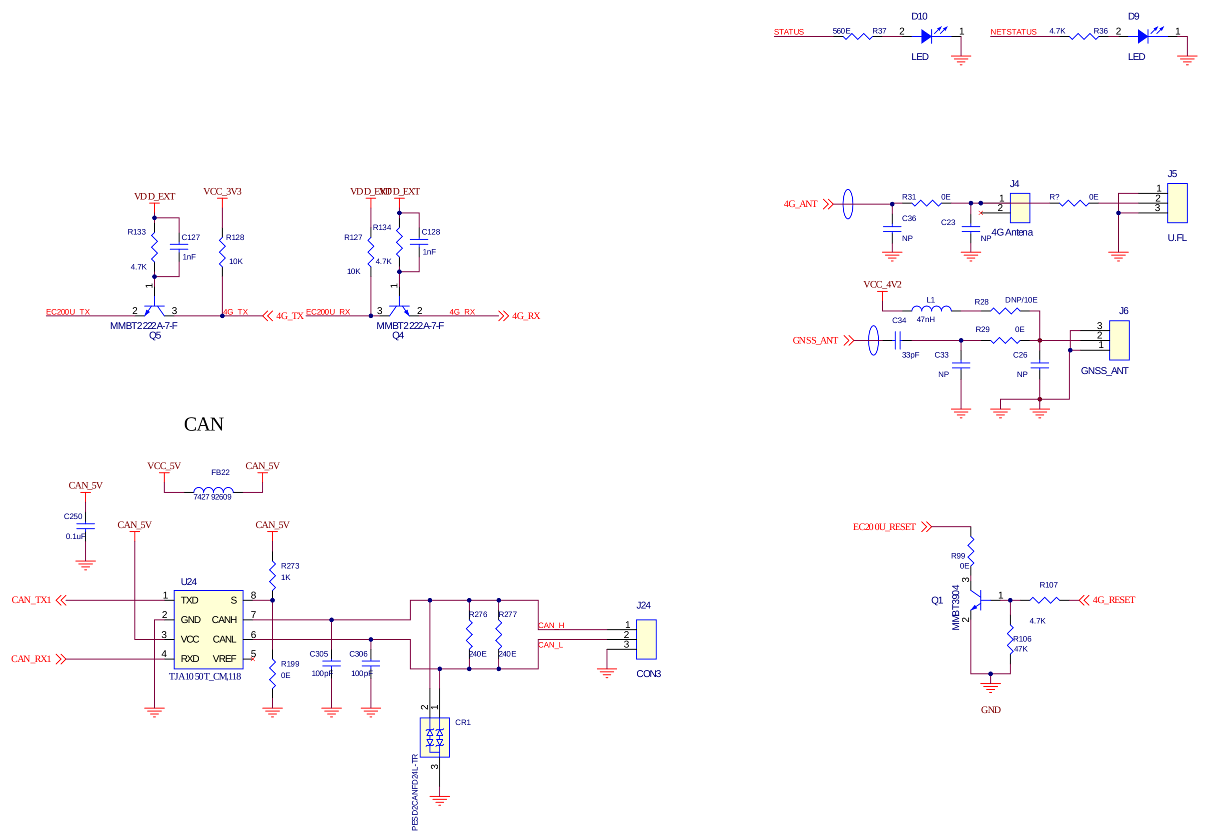

Figure 19. WS026-L2EVCHGR-REFZ Schematic (10 of 16)

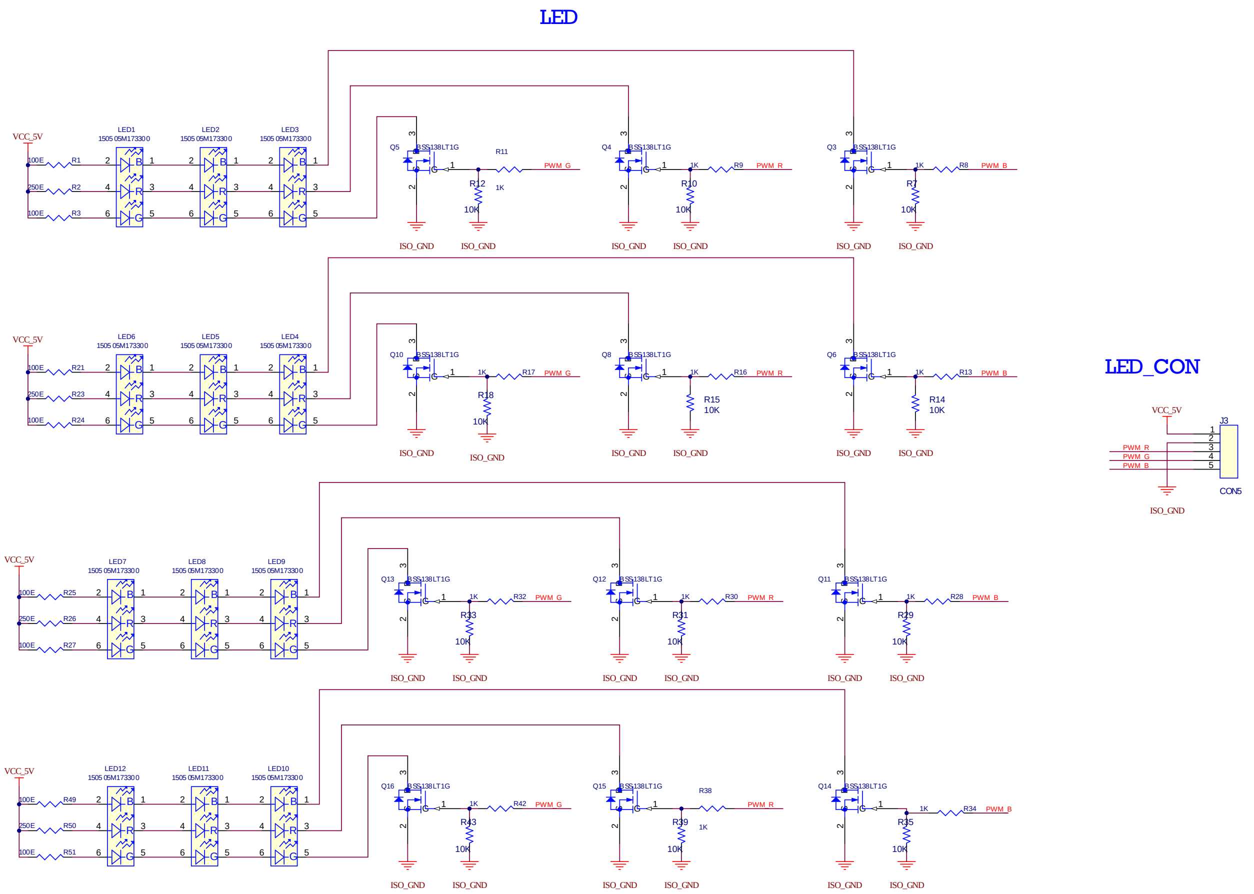

Figure 20. WS026-L2EVCHGR-REFZ Schematic (11 of 16)

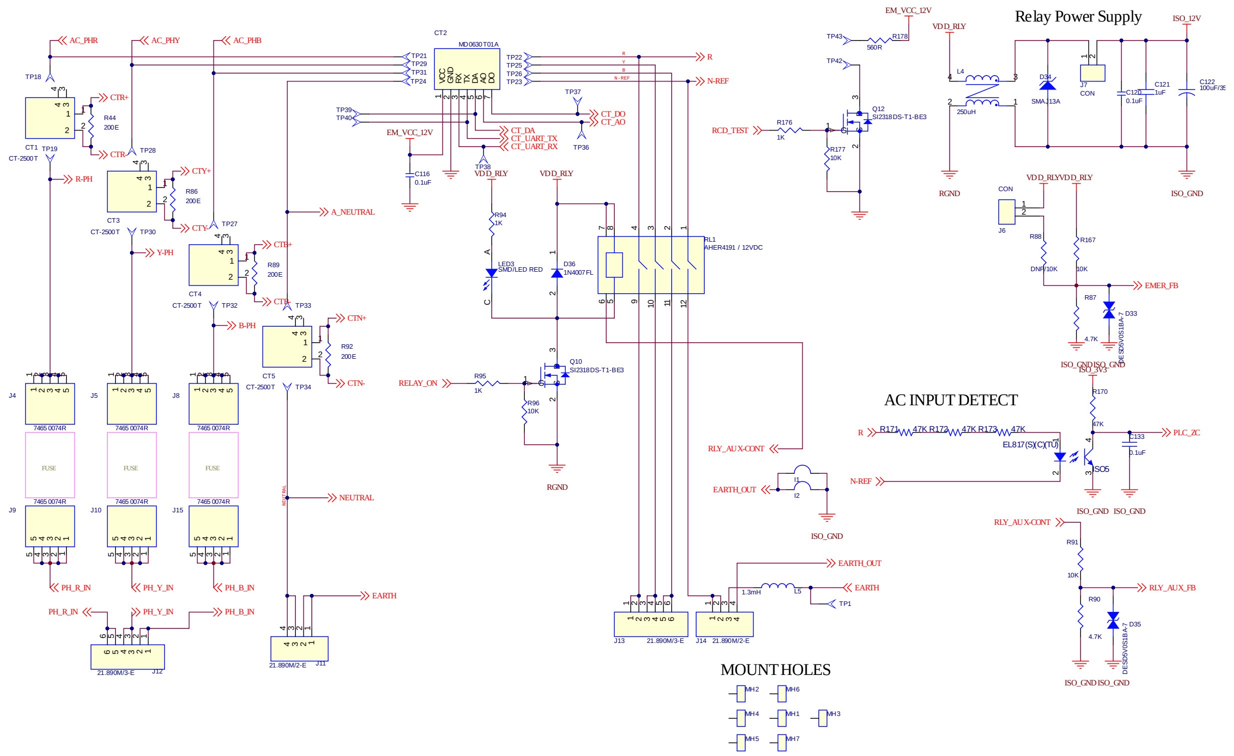

Figure 21. WS026-L2EVCHGR-REFZ Schematic (12 of 16)

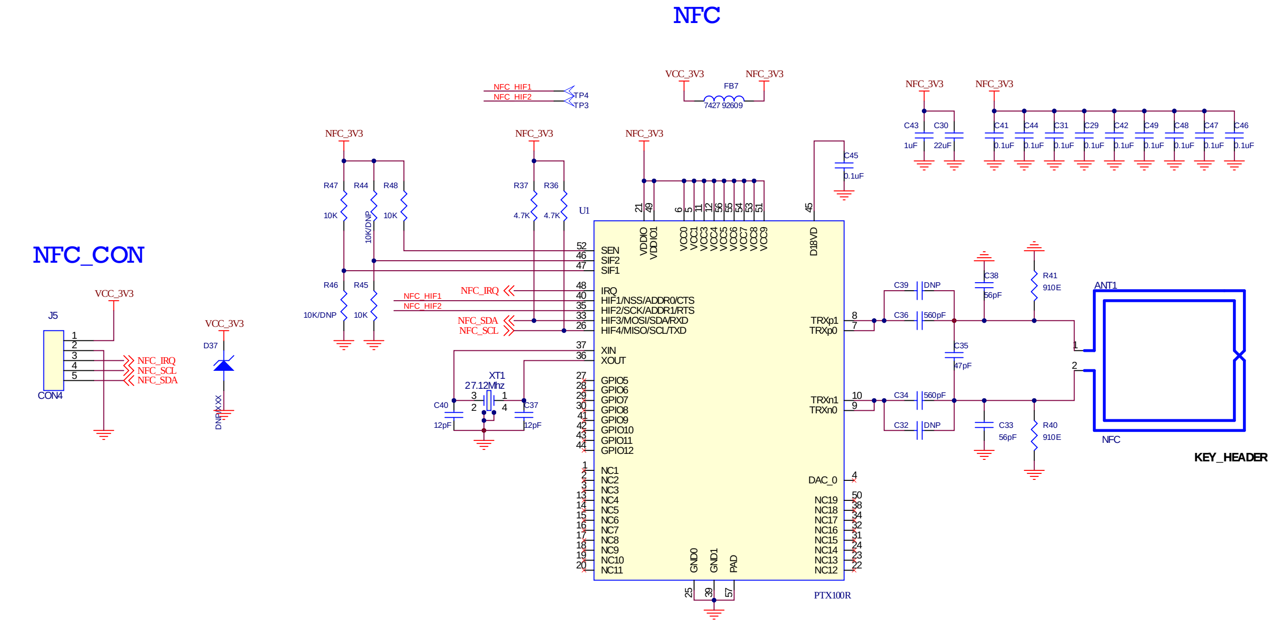

Figure 22. WS026-L2EVCHGR-REFZ Schematic (13 of 16)

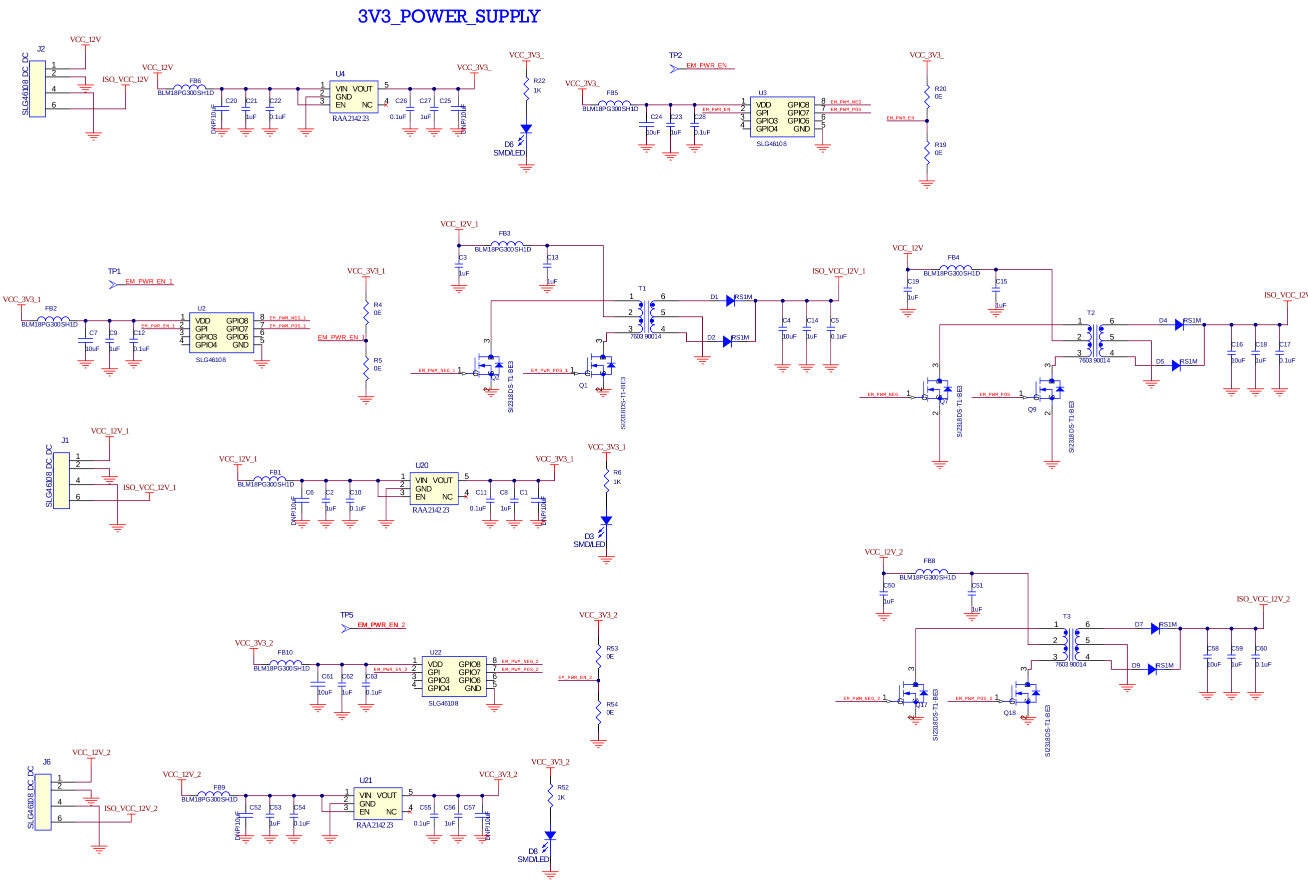

Figure 23. WS026-L2EVCHGR-REFZ Schematic (14 of 16)

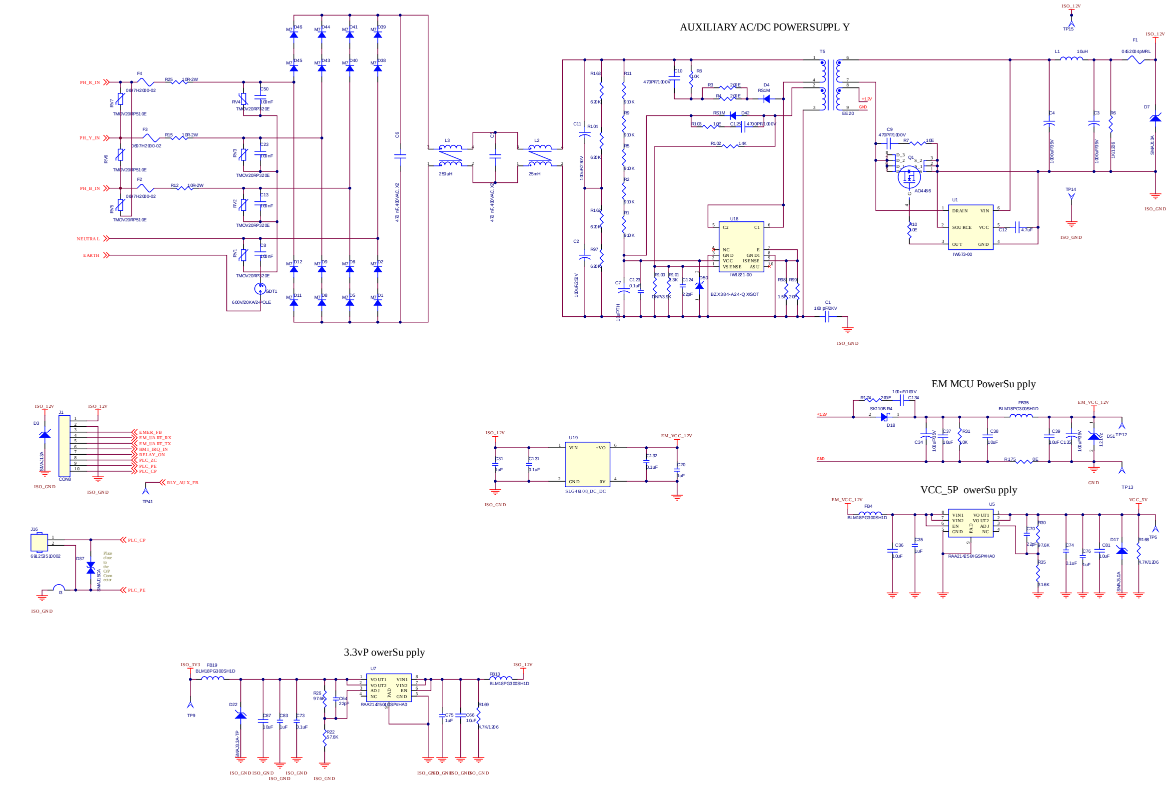

Figure 24. WS026-L2EVCHGR-REFZ Schematic (15 of 16)

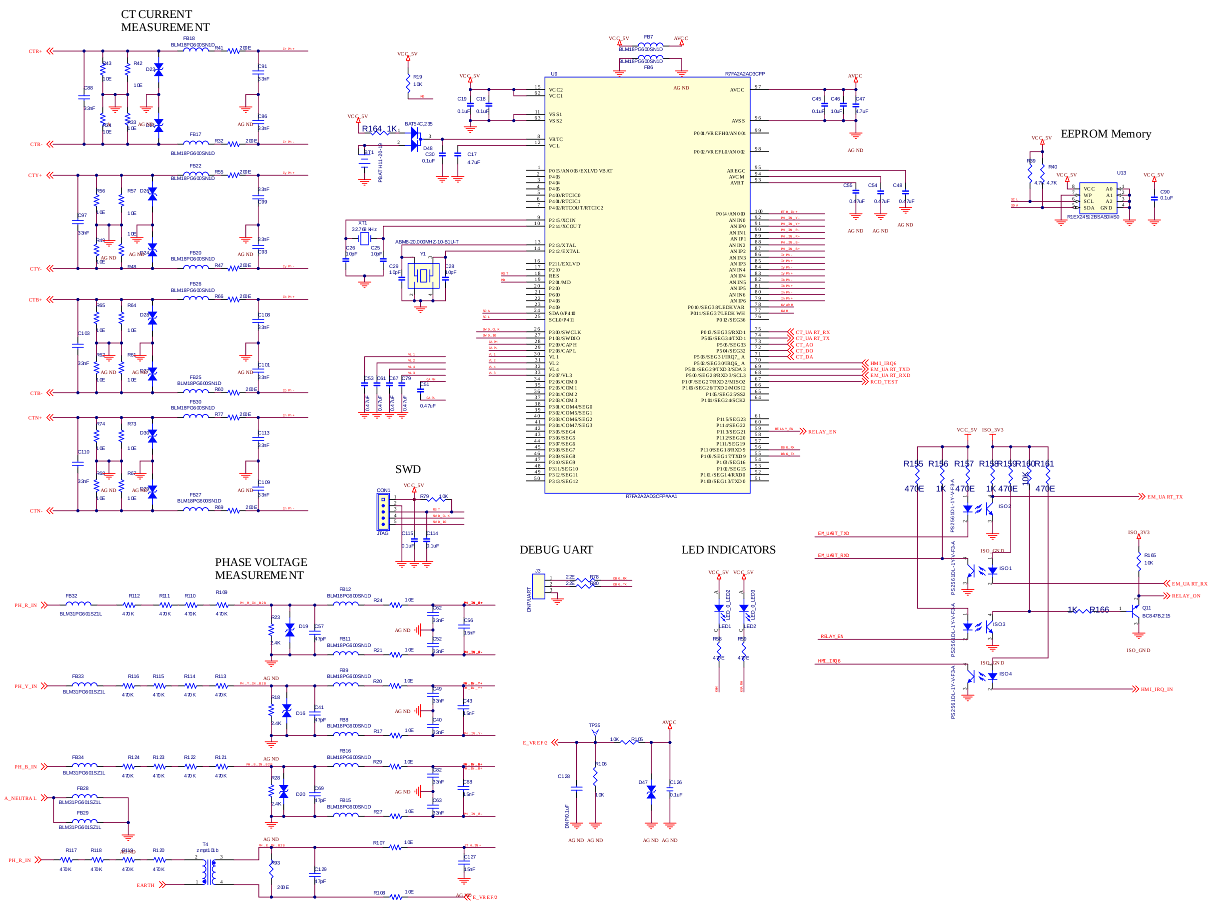

Figure 25. WS026-L2EVCHGR-REFZ Schematic (16 of 16)

3. Installing the Charger

1. Connect the three-phase Input to the Input connector.

Figure 26. Three-Phase AC Input Connector

2. Connect the three-phase Gun (Type 2) to the Output connector.

Figure 27. Three-Phase AC Output Connector

3. Connect the CP wire from the Gun to the CP connector.

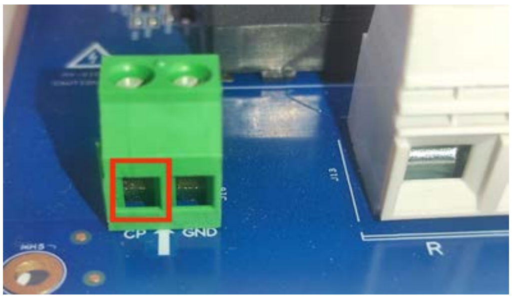

Figure 28. CP Connector

4. Make sure the (1) Emergency switch, (2) B-B Connector, (3) and Super Cap connectors are connected properly.

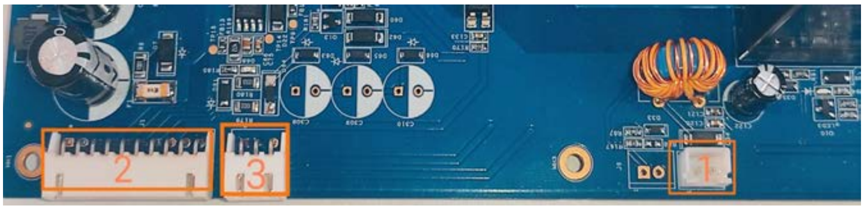

Figure 29. B-B, Supercap and Emergency Connectors

5. Insert the Micro SIM into the SIM connector to get a 4G network to connect to the server.

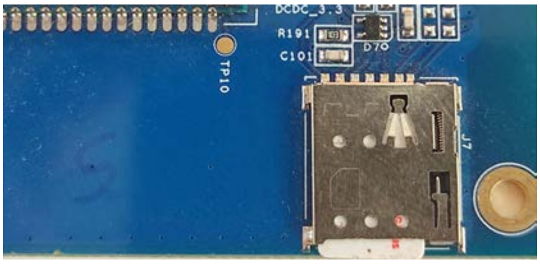

Figure 30. Micro SIM Card Slot

6. To access the Internet through Ethernet, connect the Ethernet cable from the router to the Ethernet connector in the Enclosure.

Figure 31. Ethernet Cable Connector

Note: By default, the charger is in W-Fi mode. To access the Wi-Fi network or switch the network, the charger configuration can be changed using Bluetooth. For more details about Bluetooth configuration, refer to the section Network Configuration (LTE, Wi-Fi, Ethernet, Bluetooth).

4. Power Specifications

4.1 Input Supply Requirements

The EV charger is designed to operate from a standard three-phase AC supply. It supports an input voltage range of 400 V AC ±10%, with a frequency of 50/60 Hz. The system is compatible with common earthing configurations such as TN-S. Proper upstream protection devices (for example, MCBs, RCCBs) must be used for safe operation.

4.2 Output Ratings

The charger provides AC output up to 22 kW through a Type-2 (IEC 62196-2) connector, making it suitable for a wide range of electric vehicles with onboard chargers. The output parameters and protection features are detailed in Table 1.

Table 1. Setup Specifications

Parameter	Specification
Input Voltage Range	400 V AC ±10% (3-phase, L1-L2-L3)
Input Frequency	50/60 Hz
Maximum Input Current	~32 A per phase
Output Power Rating	22 kW (Three-phase AC output)
Output Voltage	400 V AC (L-L), same as input
Output Current (Max)	32 A per phase
Output Connector Type	Type-2 (IEC 62196-2)

4.3 Power Protection Mechanisms

To ensure user and equipment safety, the charger incorporates the following protection mechanismss

- Overvoltage and undervoltage protection on both input and output lines
- Overcurrent protection per phase.
- Short-circuit protection.
- Earth leakage monitoring using differential current detection.
- Control Pilot (CP) fault detection.
- Emergency stop functionality (manual).
- Thermal protection is provided using temperature sensors placed on key power components.
  These features are actively managed by the RA2A2 and RA6M3 microcontrollers to ensure real-time fault handling and protection.

4.4 Power Efficiency

The charger is engineered for high efficiency, achieving over 95% efficiency under nominal load conditions. During idle or standby conditions, power consumption for the power board is maintained below 4W, and the HMI board is maintained below 6W. This efficient performance is achieved through optimized switching topologies, thermal design, and intelligent load regulation, contributing to long-term reliability and reduced operational costs.

5. Communication and Networking

5.1 Communication Interfaces Overview

- UART (Universal Asynchronous Receiver-Transmitter) – Used for communication with wireless modules (LTE, Wi-Fi, Bluetooth), the microcontroller, and peripheral devices. UART is the key interface for data transmission, supporting commands for remote monitoring and management. Additionally, the charger uses UART for board-to-board communication between the controller board and power board, ensuring synchronized operation of both components.
- I^2C (Inter-Integrated Circuit) – Primarily used for communication with the NFC module for RFID-based authentication and access control.
- Ethernet – For wired network connections, enabling stable and high-speed data communication with external servers for remote diagnostics, status monitoring, and control.
- SPI (Serial Peripheral Interface) – The SPI interface is used for communication with external peripherals like the quad flash memory. This interface allows for high-speed data exchange, enabling the charger to read and write data to the external flash storage.

5.2 Network Configuration (LTE, Wi-Fi, Ethernet, Bluetooth)

The charger supports multiple networking options to ensure flexible connectivity in different environments. Each networking option is designed to provide robust communication capabilities for remote monitoring, management, and firmware updates.

- LTE (4G Network) – The LTE module (EC220U) provides a reliable 4G connection to a server for remote monitoring and control via the mobile network. The module supports communication through UART and AT commands, ensuring connectivity over long distances and in locations where wired internet is unavailable.
- Wi-Fi – The charger is equipped with the DA16200 Wi-Fi module, allowing it to connect to local Wi-Fi networks. This feature is particularly useful for environments where Ethernet cables are impractical but a wireless network is available.
- Bluetooth – The DA14531 Bluetooth module enables communication with mobile devices for configuration, monitoring, and management. Users can pair their smartphones with the charger to set network parameters, such as IP address and TCP server configurations.
- Ethernet – For wired network connectivity, Ethernet offers high stability and speed, making it ideal for industrial applications where fast and uninterrupted communication is critical.

5.3 Protocols Used (OCPP1.6, TCP/IP, UART, I^2C, SPI)

The charger supports several communication protocols to ensure compatibility with industry standards and external systems.

- OCPP (Open Charge Point Protocol) – OCPP is a widely adopted communication protocol used in electric vehicle (EV) charging infrastructure. The charger supports the latest version of OCPP, allowing it to communicate with a central system for managing charging sessions, billing, and monitoring.

- TCP/IP – The charger supports TCP/IP networking protocols, ensuring it can communicate over the internet using standard networking technologies. This enables seamless integration with server systems for data exchange, remote control, and status monitoring.
- UART – UART is used for communication between the charger's MCU and various modules like LTE, Bluetooth, and Wi-Fi. This simple, yet effective, serial communication protocol ensures reliable data transfer between devices. Additionally, UART facilitates board-to-board communication between the controller and power boards, allowing them to work in unison during the charging process.

- I^2C – The I^2C protocol is used for communication with sensors and peripheral devices like the NFC module for RFID-based charging initiation.
- SPI – The SPI interface is used to communicate with quad flash memory. This allows high-speed data transfer, enabling the charger to store critical operational data and firmware efficiently.

5.4 Relay Control and Super Capacitor Management with the RA6M3

- Relay Control – The RA6M3 manages the relay and is responsible for initiating and terminating the charging session. It ensures that the relay operates safely, allowing the charger to start or stop the charging process based on system conditions, user commands, or external factors.
- Super Capacitor Management – The RA6M3 is also responsible for controlling the super capacitor, which serves as a backup power source in case of a power failure. The super capacitor ensures that critical components, such as the communication interface and system monitoring, remain functional during power outages. In the event of a power failure, the super capacitor helps to maintain power long enough for the charger to notify the server about the incident.
- When a power failure occurs, the RA6M3 detects the loss of input power and activates the super capacitor. This allows the system to send a status update to the central server, indicating that the charging point has entered a power failure state. The server is then able to log the incident and potentially trigger additional actions, such as notifying users or initiating recovery protocols.

6. User Interface and Interaction

6.1 Display Functions

The charger includes a local display that provides critical information about the charging session, status updates, and system alerts. The display helps users to quickly understand the charging status without needing to rely on external devices or network connections.

- Charger Status – The display presents various system states to inform the user of the current operation mode. Each state represents a specific charger condition:

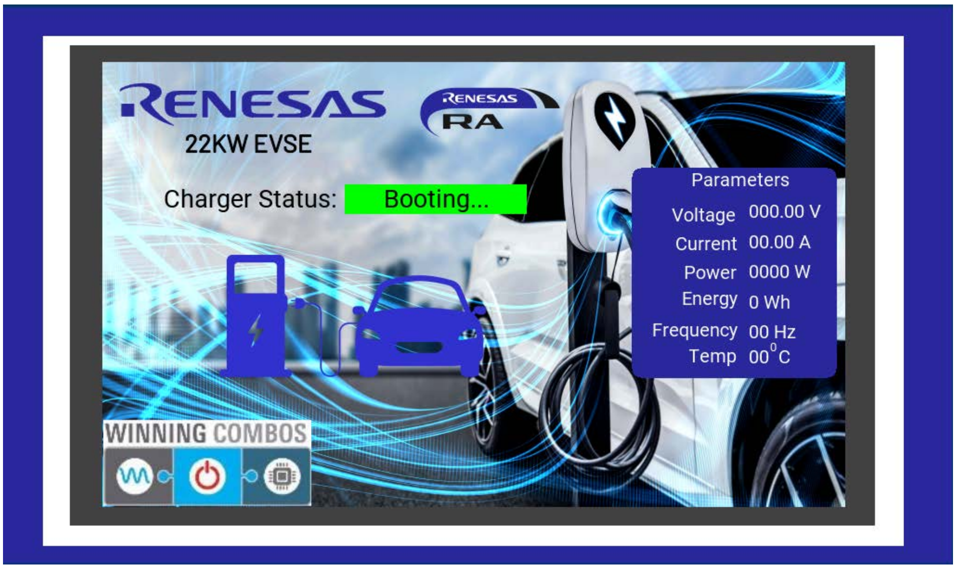

Figure 32: Block Diagram for Display Indication

Table 2. Display Indications

Indication	Description
Booting….	The charger module or sub-device (for example, 4G module) is starting or restarting (does not refer to MCU reboot).
Available	Charger is online, connected to the server, and ready to begin charging.
Preparing	The charging gun is connected to the vehicle, but charging has not yet begun.
Charging	Active charging session is in progress.
Finishing	Charging session has completed successfully without errors.
RFID Detected	NFC tag/card has been tapped and recognized.
No SIM	SIM card is missing while operating in 4G mode.
Connecting….	Charger is trying to establish a connection to the server.
Connected	Charger is successfully connected to the backend server.
Connecting Wi-Fi	Charger is attempting to connect to a configured Wi-Fi network.
Wi-Fi Connected	Charger is connected to a Wi-Fi network.
Connect ETH	Ethernet mode is selected, but the cable is unplugged or the link is not detected.
Faulted	Charger has encountered a system error or fault; it cannot proceed with charging until resolved.

- Charging Status – The display shows whether the charging session is ongoing, complete, or paused. Users can easily see if the charger is connected to the vehicle and if the charging is happening properly.

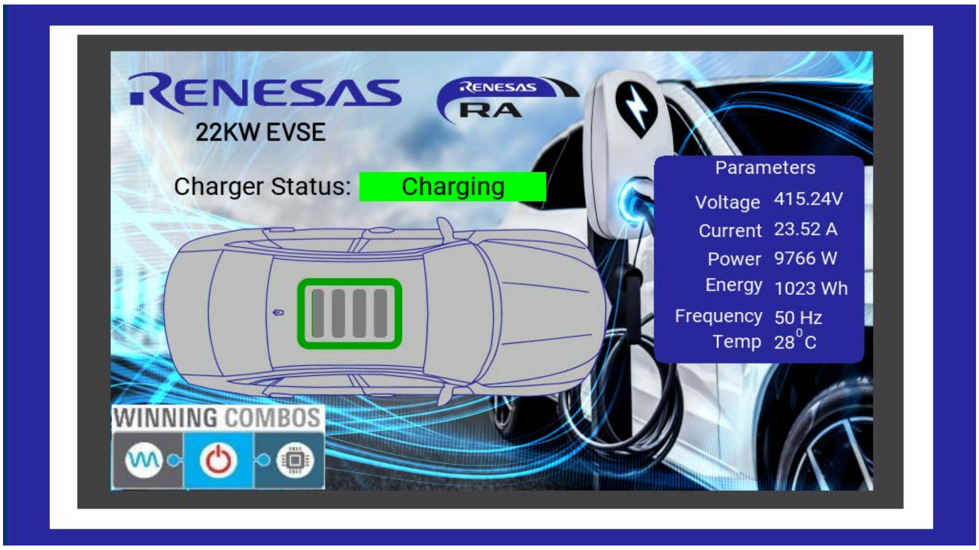

Figure 33. Block Diagram for Charging Indication in Display

- Charging Parameters: The display shows key information about the ongoing charging session, such as:
  - Voltage – Displays the current voltage level at which the charger is operating.
  - Current – Indicates the amount of current being drawn during the charging session.
  - Power – Shows the power being consumed by the charger, allowing users to monitor the charging rate.
  - Energy – Provides a cumulative energy reading, allowing users to track the total energy delivered during the session.
  - Frequency – Displays the frequency of the incoming AC power, ensuring it is within the expected range for proper operation.
  - Temperature – Indicates the temperature of the charger, helping users monitor potential overheating issues and ensuring safe operation.
- Error Notifications – In case of system errors or faults (for example, overcurrent, overvoltage, or power failure), the display provides relevant error messages or diagnostic codes, helping users troubleshoot or call for support.

6.2 Charger Configuration Using Bluetooth

The charger supports Bluetooth-based configuration through the Renesas Smart Console mobile application. This feature enables users or service personnel to interact directly with the DA14531 Bluetooth module integrated on the HMI board, offering a convenient and wireless interface for local setup and diagnostics.

Upon establishing a Bluetooth connection using the mobile app, the user can perform various configuration and query operations, including:

- Selecting the preferred network interface (Wi-Fi / 4G / Ethernet)
- Modifying Wi-Fi credentials, including SSID and password
- Viewing current network settings, such as:
  - Active network mode
  - Current Wi-Fi SSID in use
  - Configured APN for 4G connectivity
- Retrieving assigned RFID tags used for local authorization
- Setting and querying the IP address and port number of the backend server
- Monitoring the total energy consumed by the charger

For more details about how to access the Bluetooth of the charger and how to perform configuration and query operations, refer to the Bluetooth User Guide.

6.3 RFID/NFC-Based Charging Control

The charger features NFC-based control using RFID tags to enable secure and user-specific charging sessions. Each NFC tag (card) must be pre-assigned to a specific user by the charger provider. Only assigned and authorized tags can initiate a charging session, ensuring that charges are properly tracked and billed to the correct user.

Unregistered or unknown NFC cards are rejected by the system preventing unauthorized usage.

In addition to online authentication, the system supports local offline authorization. If the charger is temporarily disconnected from the server, users can still start a charging session using an NFC card that has been locally authorized. These authorized tags can be configured using Bluetooth using the Renesas Smart Console mobile app. This ensures uninterrupted charging availability even in the absence of internet connectivity.

This NFC integration enhances user access control and system reliability, making the charger suitable for both public and private deployments.

7. Fault Detection and Handling

Table 3. Fault Detection and Root Cause

Fault Type	Detection Range/Threshold	Description / Root Cause
Overvoltage	Input Voltage > 265V	Input supply exceeds rated voltage range
Undervoltage	Input Voltage < 175V	Input voltage falls below acceptable limit
Overcurrent	Output Current >32A	Load draws more current than supported
Emergency Trigger	Manual emergency button pressed	Charger manually disabled for safety
Earth Fault	(L-N voltage) − (L-E voltage) > 25 V	Indicates improper or missing ground connection
No Load	Output Current < 20 mA for >1 min	No current drawn by the vehicle after relay is ON; possible loose connection or unresponsive EV
Leakage Current	> 30mA	Current leakage to ground exceeds safety limits
CP Fault	CP voltage < 3V or > 12V	Control Pilot line error or disconnected gun
Power Failure	No input supply	Charger lost main power

8. Mechanical and Environmental Details

8.1 Enclosure and Mounting Guidelines

The enclosure for the EV charger is designed to ensure safety, durability, and ease of installation in various environmental conditions. It is typically built using high-strength, weather-resistant materials such as polycarbonate or powder-coated metal to comply with industrial protection standards.

8.1.1 Front View

The front view includes the following:

- LCD display screen
- NFC reader area
- QR code placement (for app scan)

Figure 34. Enclosure Front View

8.1.2 Back View

The back view includes the following:

- Back case with wall-mount support
- Hanging clamp

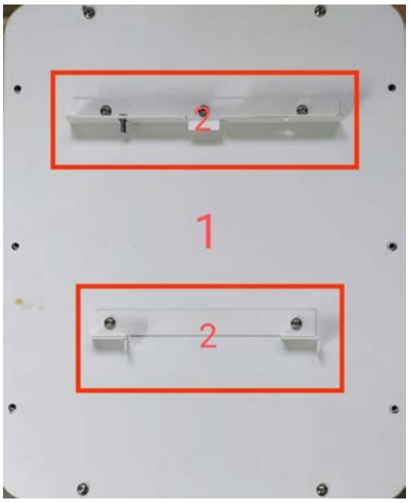

Figure 35. Enclosure Back View

8.1.3 Bottom View

The bottom view includes the following:

- Input power cable gland
- Output (charging gun) cable gland
- Ethernet port
- Emergency push-button

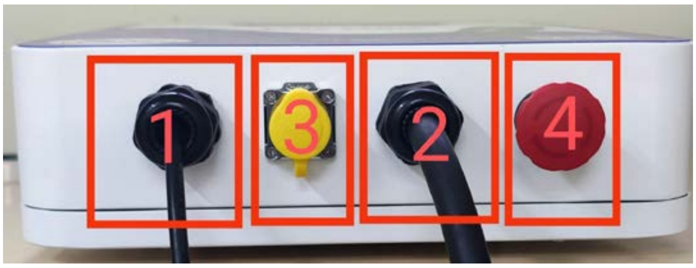

Figure 36. Enclosure Bottom View

9. Ordering Information

Part Number	Description
WS026-L2EVCHGR-REFZ	22kW three-phase EVSE system

10. Revision History

Revision	Date	Description
1.00	May 26, 2026	Initial release.

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins
   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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