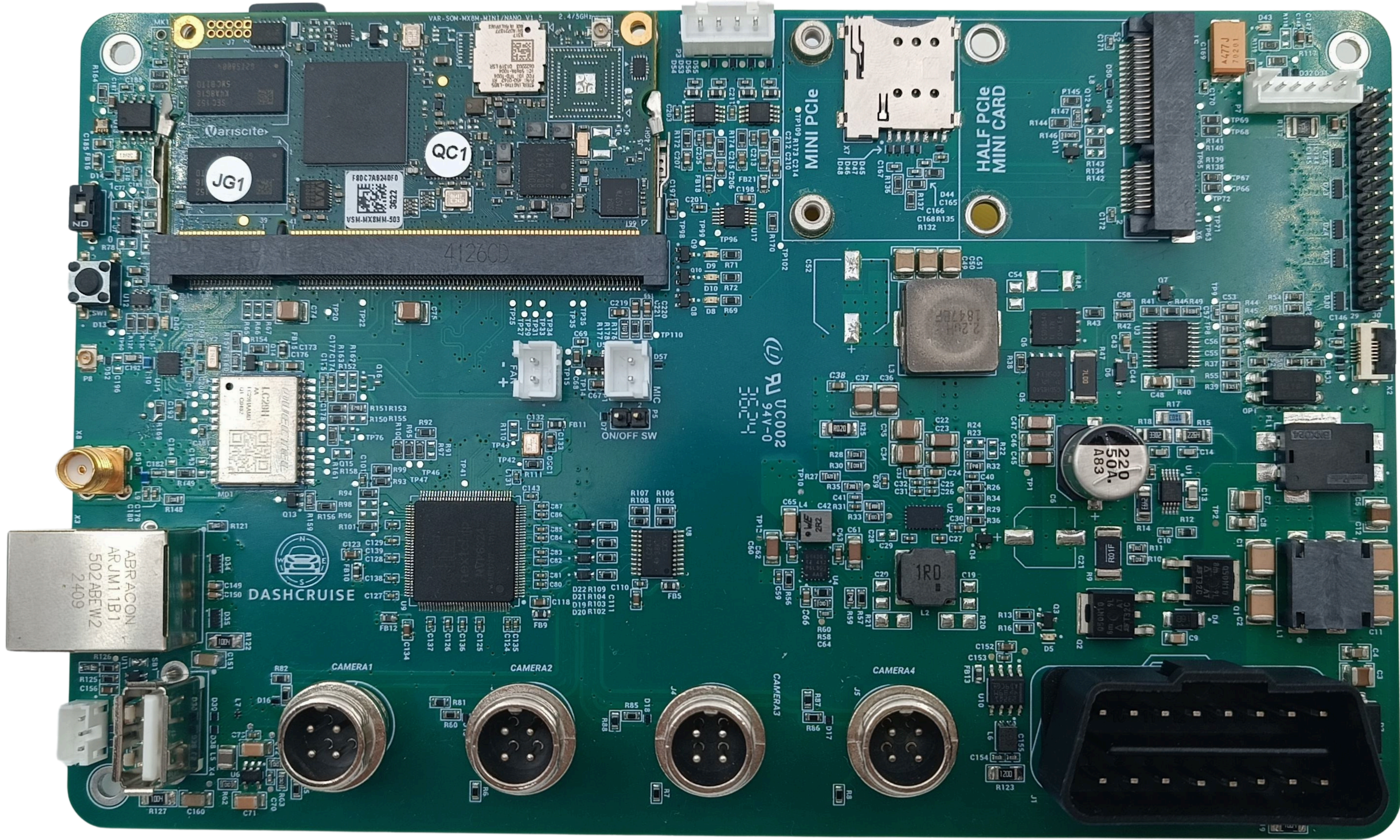




Nitra Solutions -Capabilities Deck

(From Prototype to Production – Embedded Excellence)

Version 1.0-MAY 2025



Product Specs

CPU/SoC	NXP i.MX8M Mini Quad-core ARM Cortex-A53 (1.6GHz), Cortex-M4 co-processor
WIRELESS	Integrated Wi-Fi 802.11 b/g/n and Bluetooth 4.2 (BLE)
VIDEO INPUT	4x Analog Cameras via NVP6324 (Supports AHD, CVBS, PAL formats)
VIDEO INTERFACE	MIPI CSI-2 (connected to NVP6324 AHD bridge)
DISPLAY OUTPUT	LVDS (Dual-channel, supports up to 1080p)
TOUCH INTERFACE	Capacitive touch panel (I2C-based)
CELLULAR	4G LTE Module with UART & USB connection (with reset and DTR control)
GNSS	Integrated GNSS receiver (UART)
USB	1x USB 2.0 Host Port
STORAGE	microSD Card Slot
OPERATING VOLTAGE	9–36V DC input (protected by LTC4368 – UV, OV, inrush, reverse current)
AUDIO	Dual Line-In, speaker output (4ohm-2W), DMIC input,
COMMUNICATION INTERFACE	2x CAN/CAN-FD (ISO 11898 compliant)
RESET & WATCHDOG	External watchdog supervisor and manual reset support
OPERATING TEMPERATURE	–40 °C to +85 °C (automotive-grade component support)

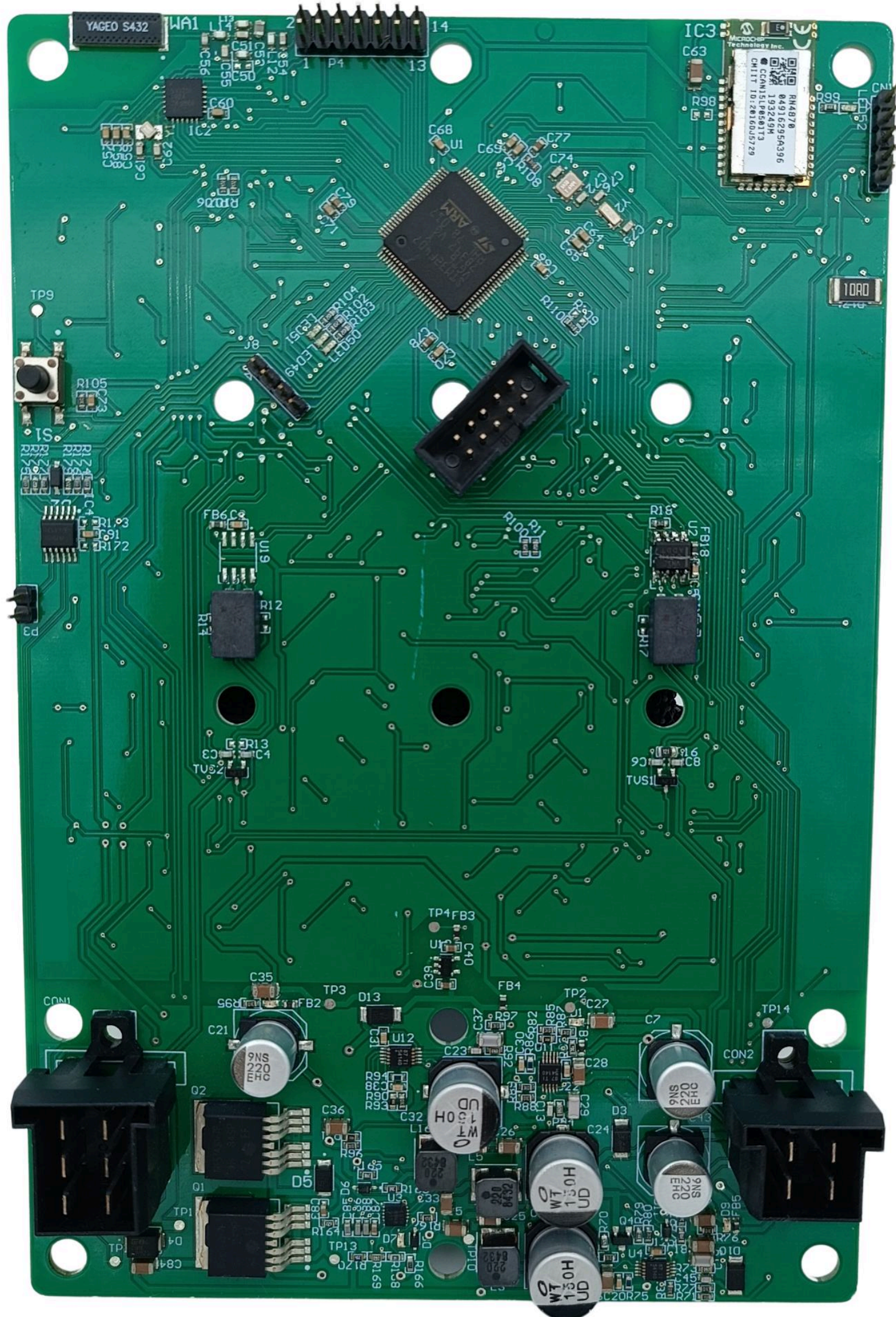
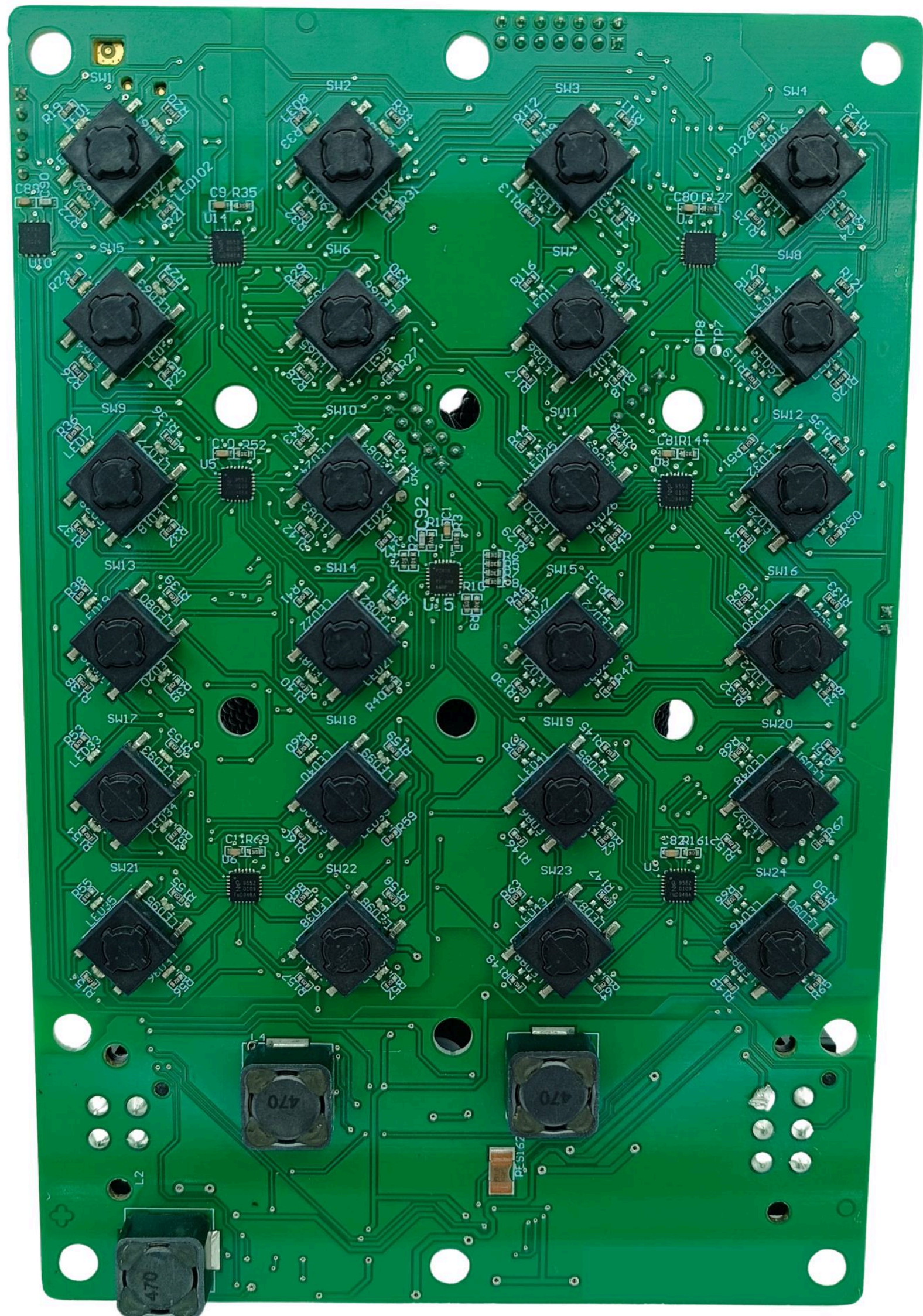
Product Highlights

The automotive OBD2 vision board is a robust and high-performance automotive diagnostic and video processing platform, powered by the i.MX8M Mini SoC. Designed for integration into modern vehicles and commercial fleets, it provides edge intelligence for visual monitoring, safety systems, and telematics.

Equipped with the NVP6324 AHD-to-MIPI bridge, the system supports 4-channel analog camera input (AHD, CVBS, PAL), making it ideal for high-resolution multi-camera applications. It delivers real-time video to the system over MIPI CSI, enabling use in safety-critical scenarios.

Application Areas

- » Driver Monitoring Systems (DMS) for fatigue and distraction detection
- » Behavioral Observation for safety and training in fleet vehicles
- » 360-Degree Surround View Systems in passenger or commercial vehicles
- » Blind Spot Detection solutions for large vehicles such as trucks and trailers



Product Specs

CPU/SoC	Master:STM32H750VBT6 – ARM Cortex-M7 @ 480 MHz, 128KB Flash, 1MB RAM Slave:ESP32-C3-MINI – RISC-V @ 160 MHz, BLE 5.0 module
WIRELESS	On-board BLE Module (Microchip RN4870)
KEY FOB RECEIVER	433 MHz ASK/OOK Receiver (WS18211) with PCB trace antenna
KEYPAD INPUT	6x4 Matrix keypad with tactile switches (scanned via TCA8418 I2C IC)
VISUAL FEEDBACK	48x red LEDs + 48x white backlight LEDs (controlled by dual IS31FL3235A drivers)
STORAGE	Internal MCU flash, no external flash needed
OPERATING VOLTAGE	9–36V DC input (protected by LTC4368 – UV, OV, inrush, reverse current)
DEBUG	Debug UART via STM32
AUDIO	1x Buzzer Output (5V @ 30mA, GPIO-controlled)
OPERATING VOLTAGE	9–36V DC input (protected by LTC4368 – UV, OV, inrush, reverse current)
COMMUNICATION INTERFACE	2x CAN/CAN-FD (ISO 11898 compliant)
RESET & WATCHDOG	External watchdog supervisor + reset push button
OPERATING TEMPERATURE	–40 °C to +85 °C (automotive-grade component support)

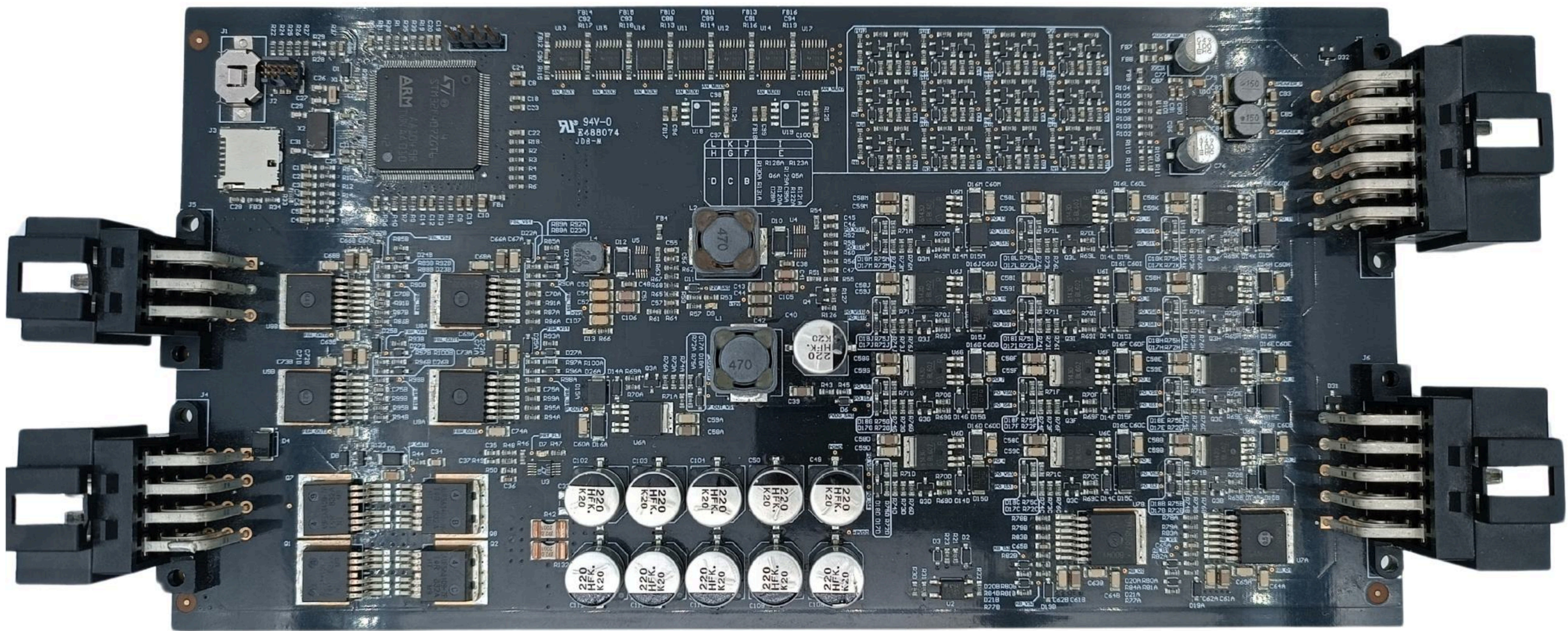
Product Highlights

The 6x4 Keypad Module is a rugged, intelligent input controller designed for advanced automotive, industrial, and security systems. It supports a 6x4 matrix (24 keys), integrated RGB or red LED indicators, haptic buzzer feedback, Bluetooth Low Energy connectivity, and CAN bus communication for distributed control.

At its core, the system combines a high-performance STM32H750VBT6 microcontroller with an RN4870 BLE module, offering both real-time processing and wireless interfacing. Integrated LED drivers allow dynamic backlight or status indication for each key or function.

Application Areas

- » Vehicle Status Monitor (VSM) modules in commercial fleets.
- » Customizable keypad interface for controlling or monitoring vehicle systems.
- » Passengers can send commands wirelessly using remote buttons via integrated 433 MHz RF receiver.
- » 96 LED indicators (red + white) for status feedback, alerts, or UI navigation.



Product Specs

CPU/SoC	STM32F446ZET6 – ARM Cortex-M4 @ 180MHz, 512KB Flash, 128KB SRAM
STORAGE	On-board microSD slot (for logging PGN/SPN or diagnostic data)
POWER INPUT PROTECTION	Automotive-grade surge/overvoltage/reverse protection (up to 100V, 50A) (nominal: 9-36V)
IGNITION INPUT	Dedicated ignition line to enable/disable board operation for battery saving
HIGH SIDE SWITCHES	13x High side output (up to 8A @ 24V), for inductive and resistive load control
HALF-BRIDGE DRIVERS	2x Half bridge drivers for motor control
FULL-BRIDGE DRIVERS	2x Full bridge drivers for motor control with direction
COMMUNICATION INTERFACES	2x CAN/CAN-FD (ISO 11898 compliant)
DIGITAL I/Os	12x Configurable digital input/output lines
REAL-TIME CLOCK(RTC)	Integrated hardware RTC with backup battery support
I/O INTERFACES	CAN Bus, I2C, GPIOs, optocoupled Door/Reset button inputs
RESET & WATCHDOG	External watchdog supervisor + reset push button
OPERATING TEMPERATURE	–40 °C to +85 °C (automotive-grade component support)

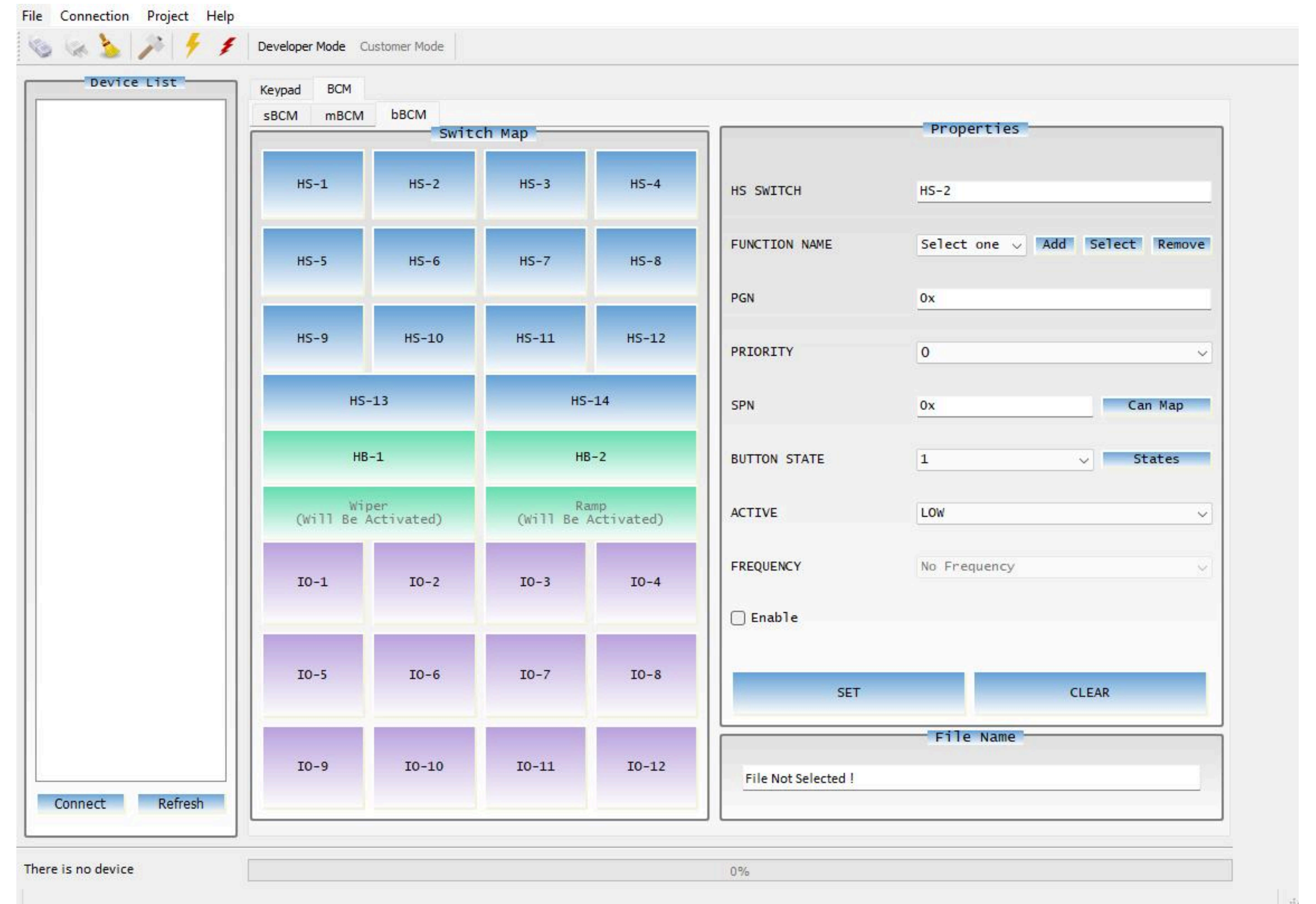
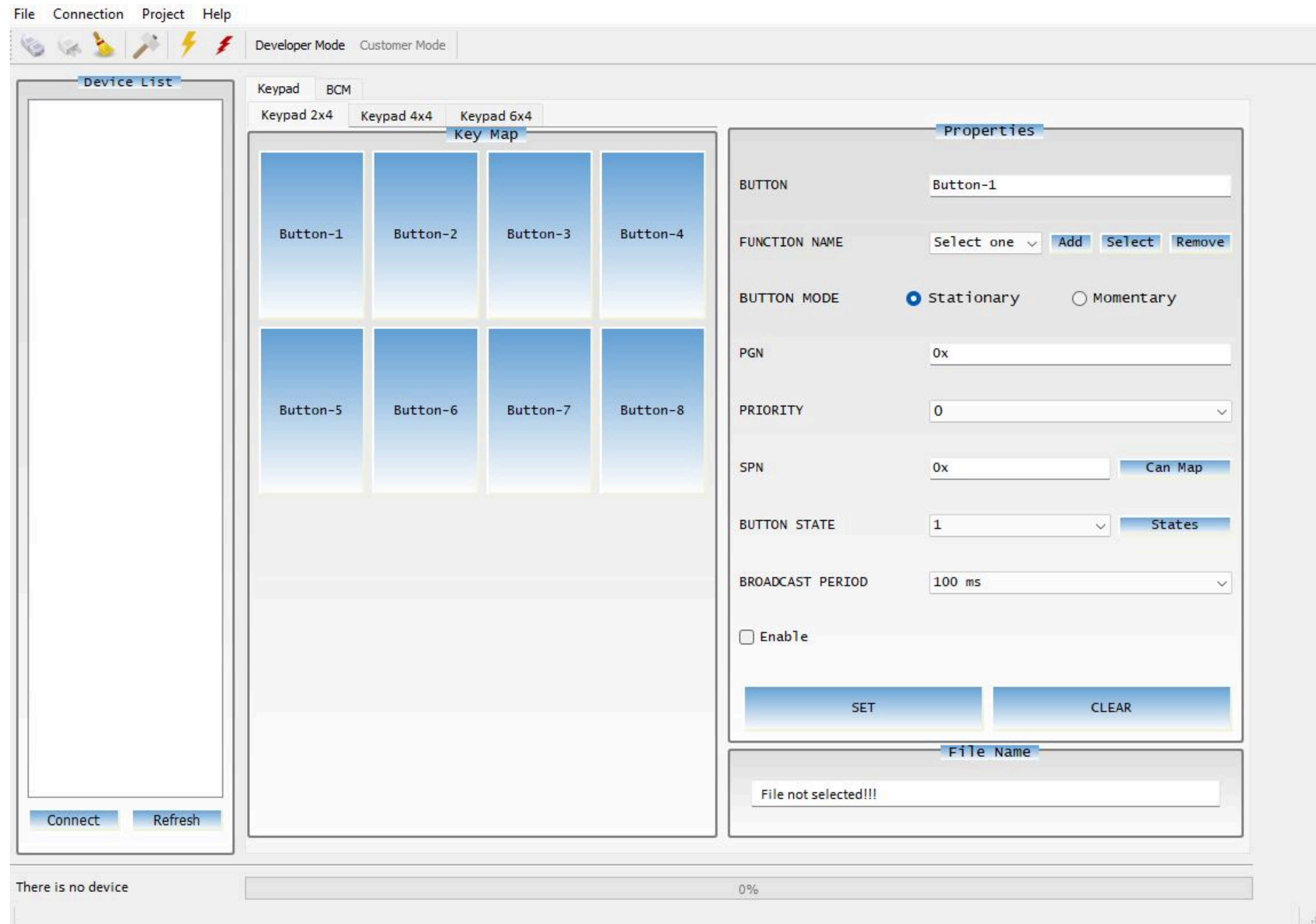
Product Highlights

The Automotive Power & Control ECU is a rugged, high-performance controller designed for demanding automotive and industrial applications. Featuring an STM32F446 MCU, high-side load switching, and multiple motor drivers, it handles both logic-level interfacing and high-current actuation in a compact embedded design.

The unit supports 13 high-side outputs (up to 8A each), half-bridge and full-bridge motor control, and 12 configurable digital I/Os. It includes dual CAN interfaces, an RTC, and microSD storage for PCN/SPN logging. With ignition-controlled startup and flexible load control, it's ideal for smart distribution modules.

Application Areas

- » Body Control Module for Off-Highway Machinery
- » Body Control Module for Public Bus
- » Hydraulic Pump & PTO Control
- » CAN-Based Load Switching



Product Specs

Keypad Configuration

- » Function name assignment per button
- » Button mode selection: momentary or stationary
- » PGN and SPN mapping
- » Priority setting
- » Button state definition
- » Broadcast period customization

Keypad Configuration

- » PGN and SPN setup
- » Function name allocation per output
- » Priority control
- » Output mode selection

System Architecture

- » Qt GUI Application (C++)
- » J1939 CAN Protocol Handling
- » Runs on Windows/Linux
- » Real-time CAN message sync

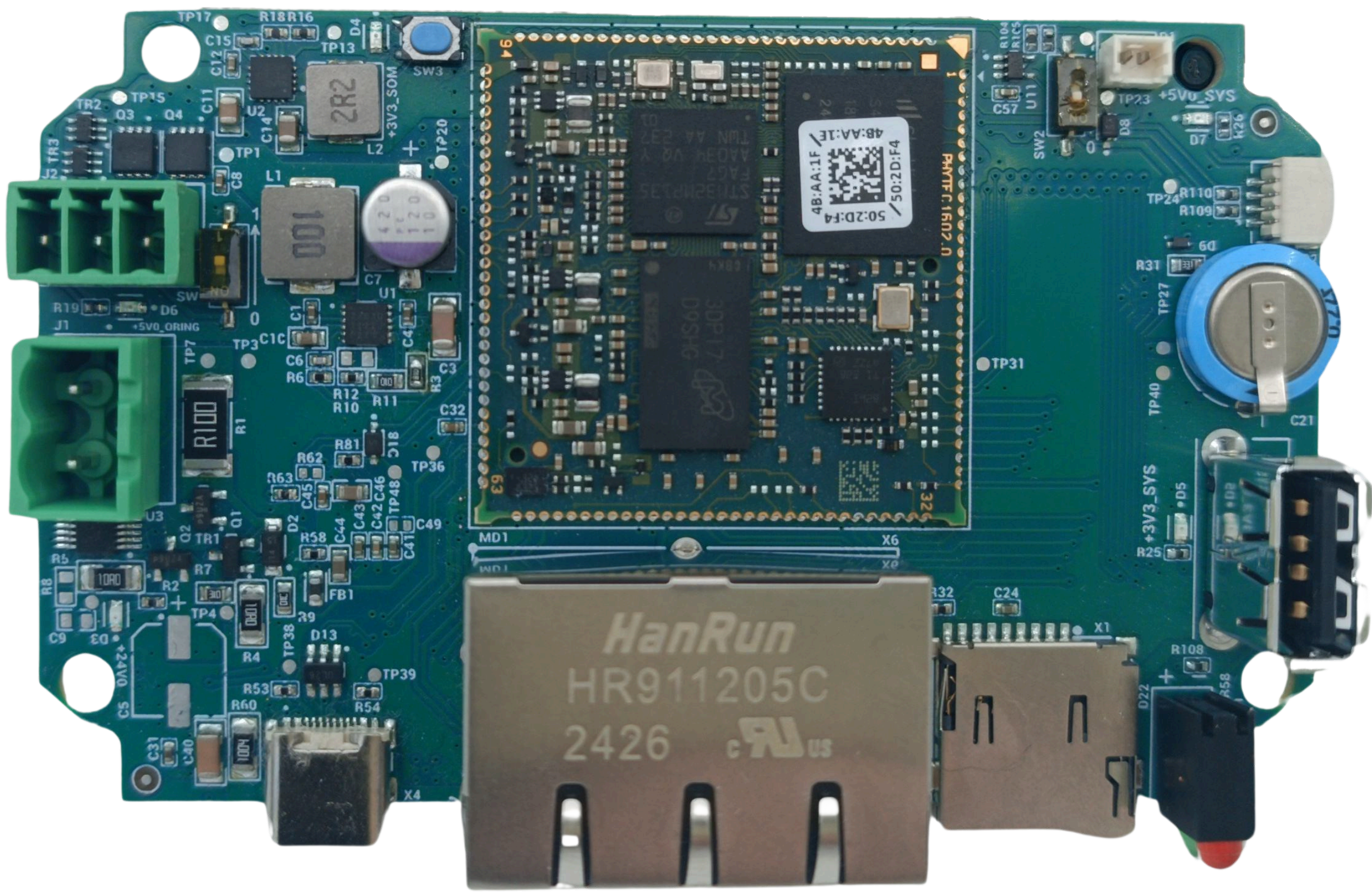
Product Highlights

The automotive config tool is a Qt-based desktop app for in-vehicle calibration and control. It maps custom key functions in distributed keypads and configures I/O channels in BCM units. Supporting digital and analog functions, it enhances system flexibility and simplifies integration across vehicle platforms.

Designed for OEM use, the tool ensures smooth ECU communication via CAN and standard protocols. Its user-friendly UI and modular structure speed up setup, minimize errors, and enable OTA updates—making it vital for modern automotive systems with high configurability and efficient maintenance needs.

Application Areas

- » In-vehicle keypad customization and deployment
- » Body Control Module (BCM) calibration and I/O tuning
- » Body Control Module (BCM) calibration and I/O tuning
- » Over-the-air (OTA) function assignment systems



Product Specs

CPU/SoC	STM32MP1 Dual ARM Cortex-A7 + Cortex-M4		
EXTERNAL MEMORY	Flash: 4GB to 256GB eMMC	DDR3L: 128MB up to 1GB	EEPROM:4kB up to 32kB
DISPLAY	4.3" TFT capacitive touchscreen		
COMMUNICATION	Configurable CAN/RS-485 interface (Modbus-RTU capable)		
ETHERNET	2x 10/100 Mbps Ethernet ports		
USB	1x USB Type-A Host, 1x USB Type-C (for SSH/config)		
POWER INPUT	9–30V DC with OVP, OCP, reverse polarity protection		
RTC	Integrated real-time clock		
USER INTERFACE	2x User LEDs		
EXPANSION	UART, I2C, GPIO (expandable via internal header)		
FORM FACTOR	Compact industrial-grade PCB		
ENVIRONMENT	Designed for robust and continuous industrial operation		

Product Highlights

This compact industrial controller integrates an STM32MP1 processor, dual Ethernet, CAN/RS485, USB Host and USB-C. It includes a 4.3" touchscreen for intuitive control and monitoring. The system is ideal for modern HMIs, industrial gateways, or edge computing in harsh environments.

It runs on 9–30V input with full protection against surges, reverse polarity, and overload. Features like eMMC or SD boot, onboard RTC, and user LEDs make it highly adaptable for various automation setups. Its robust design ensures reliable performance in demanding industrial settings.

Application Areas

- » Industrial HMI (Human-Machine Interface)
- » Touchscreen Control Panel for Industrial Machines
- » PLC or Control Node for Factory Automation
- » SCADA/Modbus-compatible Control Interfaces



Product Specs

MCU	ESP32-S3-WROOM-1U - 240 MHz dual-core, Wi-Fi 4/BLE 5, 3 × UART, I ² C, USB-OTG
POWER INPUT	85–264 VAC → 12 V @ 10 W on-board SMPS (HLK-10M12)
VFD LINK	ISO3082 isolated half-duplex RS-485, 120 Ω termination, MODBUS-RTU up to 200 kbps
USER I/O	3x 3 × illuminated push-buttons (24 V opto-in + low-side LED drivers) + 3 × illuminated push-buttons (24 V opto-in + low-side LED drivers)
SAFETY	E-stop input, ISO3082 isolation 2.5 kVrms, TVS & resettable fuses on RS-485 lines
SENSING	HX711 24-bit load-cell front end ±80 mV range
DISPLAY PORT	1 × 2.1-inch TFT dial display (UART TX/RX + reset)
LIGHTING OUTPUT	TPS22810 high-side switch, 12 V/2 A LED light-bar
OPERATING TEMP	–20 °C ... +80 °C
PCB SIZE	110 mm × 80 mm, four 3 mm mounting holes, 2-layer FR-4

Product Highlights

This smart controller powers an industrial food cutter by sending speed commands to a VFD motor over RS-485. It features an ESP32-S3, supports Modbus-RTU, and runs on universal AC input. Designed for reliability, it ensures clean power, robust communication, and safe operation in tough environments.

The board features software-configurable inputs for 24 V proximity sensors, RGB push-buttons, and an e-stop via opto-isolators. A 24-bit HX711 enables precise weight sensing, while a high-side switch controls lighting. A 2.1" TFT dial display port offers real-time UI with UART debug access.

Application Areas

- » Industrial kitchen food cutters and mixers
- » Automated portion control systems
- » Smart control panels with real-time feedback
- » Machines operating in humid, high-interference environments