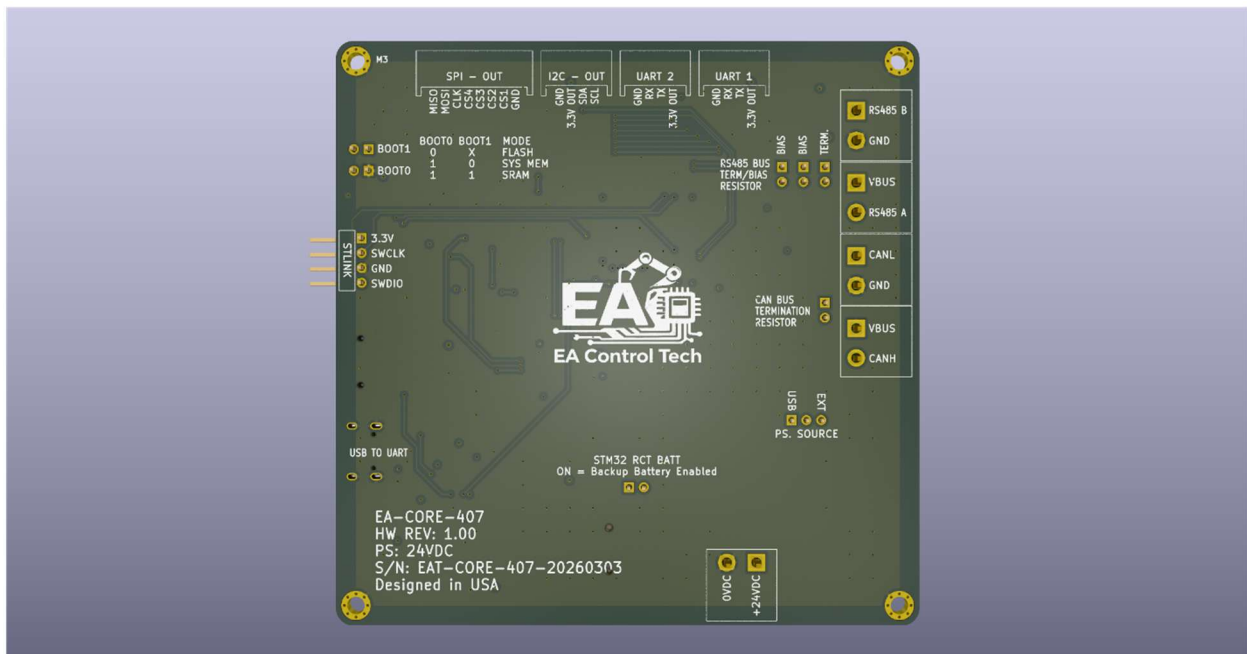
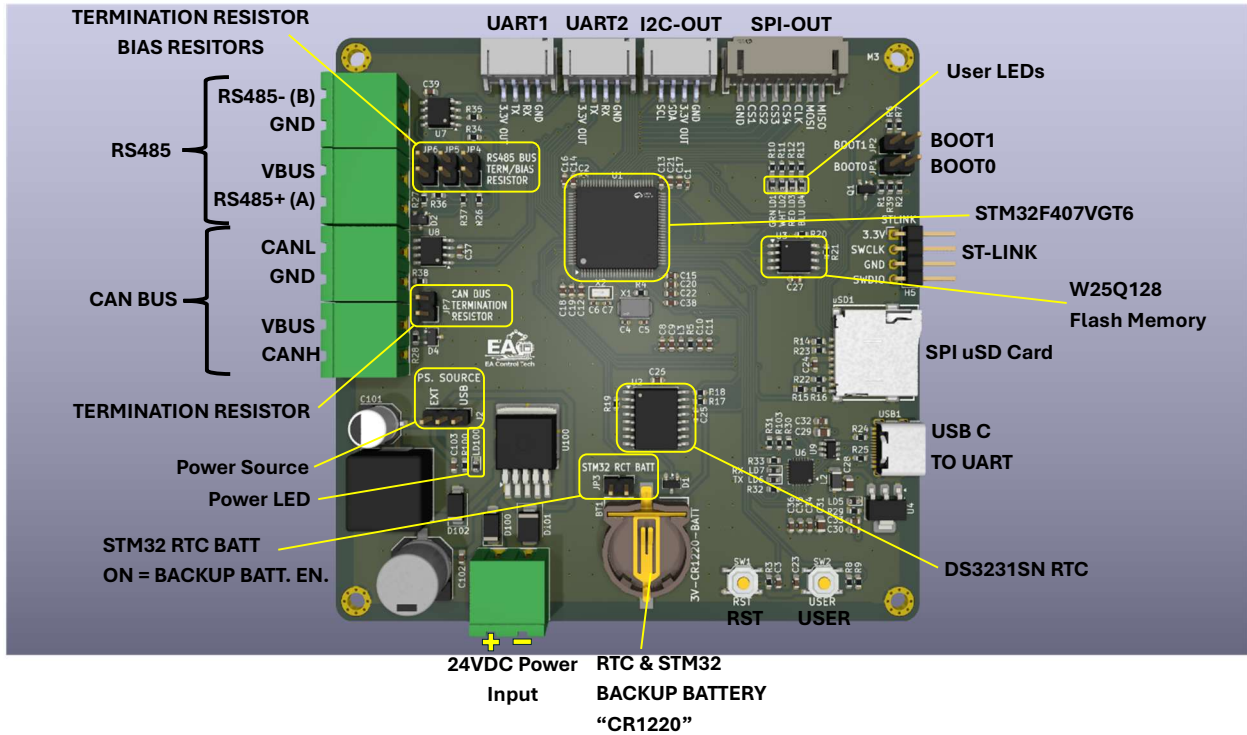


**EA Control Tech**  
**STM32F407 Industrial CPU Board**

**Model: EA-CORE-407**  
**Hardware Revision: V1.0**



## EA-CORE-407-STM32F407 GPIO Map

**PORT A**

Pin	STM32 Pin	Signal	Function
23	PA0	PA0_WKUP	Wake-up input
24	PA1	PA1	GPIO
25	PA2	DEBUG_TX	UART debug TX
26	PA3	DEBUG_RX	UART debug RX
29	PA4	SPI_FLASH_CS (W25Q128)	Flash chip select
30	PA5	SPI_FLASH_CLK (W25Q128)	Flash clock
31	PA6	SPI_FLASH_MISO (W25Q128)	Flash data
32	PA7	SPI_FLASH_MOSI (W25Q128)	Flash data
67	PA8	RS485_DE	RS485 driver enable
68	PA9	RS485_TX	RS485 transmit
69	PA10	RS485_RX	RS485 receive
70	PA11	CAN1_RX	CAN receive
71	PA12	CAN1_TX	CAN transmit
72	PA13	SWDIO	Debug interface
76	PA14	SWCLK	Debug interface
77	PA15	PA15	GPIO

**PORT B**

Pin	STM32 Pin	Signal	Function
35	PB0	PB0	GPIO
36	PB1	PB1	GPIO
37	PB2	BOOT1	Boot configuration
89	PB3	SPI_CLK	SPI OUT - CLK
90	PB4	SPI_MISO	SPI OUT - MISO
91	PB5	SPI_MOSI	SPI OUT - MOSI
92	PB6	RTC_INT	RTC interrupt
93	PB7	uSD_DETECT	SD card detect
95	PB8	I2C_SCL	I2C OUT - CLK
96	PB9	I2C_SDA	I2C OUT - data
47	PB10	RTC_SCL	RTC I2C clock (DS3231SN)
48	PB11	RTC_SDA	RTC I2C data (DS3231SN)
51	PB12	uSD_CS	SD card chip select
52	PB13	uSD_CLK	SD card clock
53	PB14	uSD_MISO	SD card data
54	PB15	uSD_MOSI	SD card data

**PORT C**

Pin	STM32 Pin	Signal	Function
15	PC0	PC0	GPIO
16	PC1	PC1	GPIO
17	PC2	PC2	GPIO
18	PC3	PC3	GPIO
33	PC4	PC4	GPIO
34	PC5	PC5	GPIO
37	PC6	UART_TX_1	UART1 TX
38	PC7	UART_RX_1	UART1 RX
39	PC8	PC8	GPIO
40	PC9	PC9	GPIO
78	PC10	UART_TX_2	UART2 TX
79	PC11	UART_RX_2	UART2 RX
80	PC12	PC12	GPIO
9	PC15	PC15	GPIO

**PORT D**

Pin	STM32 Pin	Signal	Function
81	PD0	CS_1	IO SPI CS1
82	PD1	CS_2	IO SPI CS2
83	PD2	CS_3	IO SPI CS3
84	PD3	CS_4	IO SPI CS4
85	PD4	PD4	GPIO
86	PD5	PD5	GPIO
87	PD6	PD6	GPIO
88	PD7	PD7	GPIO
55	PD8	PD8	GPIO
56	PD9	PD9	GPIO
57	PD10	PD10	GPIO
58	PD11	PD11	GPIO
59	PD12	LED_GRN	Status LED
60	PD13	LED_WHT	Status LED
61	PD14	LED_RED	Status LED
62	PD15	LED_BLU	Status LED

**PORT E**

Pin	STM32 Pin	Signal	Function
97	PE0	SPI_FLASH_IO2 (W25Q128)	Quad SPI flash
98	PE1	SPI_FLASH_IO3 (W25Q128)	Quad SPI flash
1	PE2	PE2	GPIO
2	PE3	PE3	GPIO
3	PE4	PE4	GPIO
4	PE5	PE5	GPIO
5	PE6	PE6	GPIO
38	PE7	PE7	GPIO
39	PE8	PE8	GPIO
40	PE9	PE9	GPIO
41	PE10	PE10	GPIO
42	PE11	PE11	GPIO
43	PE12	PE12	GPIO
44	PE13	PE13	GPIO
45	PE14	PE14	GPIO
46	PE15	PE15	GPIO



## Table of Contents

<b>Product Overview</b> .....	4
<b>Main Microcontroller</b> .....	4
<b>Power System</b> .....	5
<b>Real Time Clock</b> .....	6
<b>USB-C to UART Interface</b> .....	6
<b>Communication Interfaces</b> .....	7
<b>External Memory</b> .....	9
<b>Expansion Interfaces</b> .....	9
<b>Programming and Debugging</b> .....	11
<b>Mechanical Specifications</b> .....	11
<b>Clock System</b> .....	12
<b>Power Pins</b> .....	12
<b>Connector Pinouts</b> .....	12
<b>RS485 Connector</b> .....	12
<b>CAN Bus Connector</b> .....	13
<b>SPI Expansion Connector</b> .....	13
<b>I2C Connector</b> .....	14
<b>UART1 Connector</b> .....	14
<b>UART2 Connector</b> .....	14
<b>ST-LINK Debug Connector</b> .....	15
<b>USB-C UART Interface</b> .....	15
<b>Peripheral Map</b> .....	15
<b>Clock Configuration</b> .....	17
<b>Backup Domain</b> .....	17
<b>Power Domain</b> .....	17
<b>External Storage</b> .....	17
<b>Communication Interfaces</b> .....	18
<b>PCB Layout and Mechanical Dimensions</b> .....	19

## Product Overview

The EA-CORE-407 is an industrial microcontroller board built around the STM32F407VGT6 ARM Cortex-M4 MCU. The board is designed to serve as the central controller for automation and embedded control systems.

It integrates multiple industrial communication interfaces, non-volatile storage, real-time clock support, and flexible power input options.

Primary features include:

- STM32F407VGT6 microcontroller
- RS485 communication interface
- CAN Bus interface
- USB-C to UART interface
- SPI Flash memory
- MicroSD card storage
- Real-time clock with backup battery
- Multiple expansion interfaces (SPI, UART, I2C)
- Industrial 24V power input
- On-board switching power supply

## Main Microcontroller

### STM32F407VGT6

The EA-CORE-407 is built around the **STM32F407VGT6** microcontroller from STMicroelectronics.

Key specifications:

Feature	Specification
<b>Core</b>	ARM Cortex-M4
<b>Clock Frequency</b>	Up to 168 MHz
<b>Flash Memory</b>	1 MB
<b>SRAM</b>	192 KB
<b>Operating Voltage</b>	3.3 V
<b>Peripherals</b>	UART, SPI, I2C, CAN, USB, ADC, Timers

The microcontroller acts as the main processing unit and manages all board peripherals and communication interfaces.

## Power System

### 24VDC Power Input

The board is powered through a **24VDC industrial power input connector**.

Supported voltage range: 18V – 30V DC

The power input is protected by:

- Input protection diode
- Transient voltage suppressor (TVS)
- Bulk filtering capacitors

### Switching Power Supply

The onboard power supply uses an LM2596 **switching regulator** to convert the 24V input to **3.3V**.

Features:

- High efficiency switching regulator
- Industrial input voltage range
- Output voltage: 3.3V
- Supplies the MCU and all peripherals

Output filtering includes:

- Inductor
- Output capacitors
- Protection diode

### Power Source Selection

A jumper allows selecting the system power source.

Possible sources:

- External 24VDC supply
- USB power (optional use)

## Real Time Clock

### DS3231SN RTC

The board integrates a **DS3231SN high precision Real Time Clock**.

Features:

- Temperature compensated crystal oscillator
- Battery backed timekeeping
- I2C communication interface
- High accuracy clock

The RTC allows the system to maintain accurate time even when the main power is removed.

### Backup Battery

The board supports a **CR1220 coin cell battery**.

Functions:

- Maintains RTC time
- Maintains STM32 backup registers

Battery voltage: 3V

A jumper allows enabling or disabling the backup battery connection for the STM32.

## USB-C to UART Interface

### CP2102 USB-UART Bridge

The board includes a **CP2102 USB-to-UART converter** connected to a **USB-C connector**.

This interface provides:

- Serial communication with the MCU
- Firmware upload capability
- Debug terminal interface

When connected to a PC, the board appears as a **Virtual COM Port**.

### UART Activity LEDs

Two LEDs indicate UART activity:

LED	Function
TX LED	Data transmitted from PC
RX LED	Data transmitted from MCU

### Automatic Bootloader Control

The CP2102 control lines are connected to the STM32 control pins.

CP2102 Signal	STM32 Signal	Function
RTS	BOOT0	Boot mode selection
DTR	NRST	MCU reset

This configuration allows firmware tools to automatically place the MCU into **bootloader mode** for firmware programming.

## Communication Interfaces

### RS485 Interface

The board includes an RS485 interface for industrial communication.

Connector signals:

Signal	Description
RS485-A	Differential line
RS485-B	Differential line
GND	Signal ground
VBUS	External bus power



## EA Control Tech STM32F407 Industrial CPU Board

Features:

- Differential communication
- High noise immunity
- Industrial network compatibility

### RS485 Bias and Termination

Jumpers allow enabling:

- Bus bias resistors
- 120Ω termination resistor

This allows the board to operate as:

- End node
- Intermediate node

### CAN Bus Interface

The board supports **CAN communication**.

Connector signals:

Signal	Description
<b>CANH</b>	CAN high
<b>CANL</b>	CAN low
<b>GND</b>	Ground
<b>VBUS</b>	Optional bus power

### CAN Termination

A jumper enables the **120Ω CAN termination resistor**.

This resistor should only be enabled when the board is located at the **end of the CAN network**.

## External Memory

### SPI Flash Memory

The board includes a **W25Q128 SPI flash memory**.

Specifications:

Feature	Value
Capacity	128 Mbit
Interface	SPI
Use	Data storage, logging

Possible applications:

- Firmware storage
- Data logging
- Configuration storage

### MicroSD Card

A **microSD card slot** is provided for large storage capacity.

Interface:

SPI

Typical uses:

- Data logging
- File storage
- Firmware update packages

## Expansion Interfaces

The board exposes several communication interfaces for external modules.

### SPI Expansion Connector

Signals:

Signal	Description
MOSI	Master Out Slave In

<b>MISO</b>	Master In Slave Out
<b>SCLK</b>	Clock
<b>CS1-CS4</b>	Chip Select
<b>GND</b>	Ground

Used for connecting SPI peripherals.

### **I2C Connector**

Signals:

<b>Signal</b>	<b>Description</b>
<b>SDA</b>	Data
<b>SCL</b>	Clock
<b>3.3V</b>	Power
<b>GND</b>	Ground

Used for sensors and I2C peripherals.

### **UART Connectors**

Two UART connectors are available:

<b>Connector</b>	<b>Signals</b>
<b>UART1</b>	TX, RX, 3.3V, GND
<b>UART2</b>	TX, RX, 3.3V, GND

These connectors allow connecting external serial devices.

## Programming and Debugging

### ST-LINK Connector

The board provides a **standard ST-LINK programming header**.

Signals:

Signal	Description
3.3V	Target voltage
SWCLK	Debug clock
SWDIO	Debug data
GND	Ground

Supported tools:

- ST-LINK
- STM32CubeProgrammer
- OpenOCD
- PlatformIO

### Boot Mode Jumpers

Two jumpers allow selecting the STM32 boot mode.

BOOT1	BOOT0	Mode
0	0	Flash
0	1	System Bootloader
1	1	SRAM

## Mechanical Specifications

Mounting holes: 4 × M3

Board type: 4-layer PCB

Dimensions: 100x100 mm

## Clock System

Component	Frequency	Purpose
X1	8 MHz	Main MCU oscillator
X2	32.768 kHz	RTC clock

## Power Pins

Pin	Function
VDD	3.3V digital supply
VDDA	Analog supply
VSS	Ground
VBAT	Backup battery input
VCAP1	Internal regulator capacitor
VCAP2	Internal regulator capacitor

## Connector Pinouts

### RS485 Connector

Industrial differential communication interface.

Connector Pin	Signal	STM32 Pin	STM32 Pin #	Description
1	RS485-B	—	—	Differential line B
2	GND	—	—	Signal ground
3	VBUS	—	—	Optional bus power
4	RS485-A	—	—	Differential line A

### RS485 MCU Control Signals

Signal	STM32 Pin	STM32 Pin #	Description
RS485_TX	PA9	68	UART transmit
RS485_RX	PA10	69	UART receive
RS485_DE	PA8	67	Driver enable control

### CAN Bus Connector

Connector Pin	Signal	STM32 Pin	STM32 Pin #	Description
1	CANL	—	—	CAN Low
2	GND	—	—	Signal ground
3	VBUS	—	—	Optional bus power
4	CANH	—	—	CAN High

### CAN MCU Signals

Signal	STM32 Pin	STM32 Pin #	Description
CAN_RX	PA11	70	CAN receive
CAN_TX	PA12	71	CAN transmit

### SPI Expansion Connector

Connector Pin	Signal	STM32 Pin	STM32 Pin #	Description
1	MOSI	PA7	32	SPI master output
2	MISO	PA6	31	SPI master input
3	SCLK	PA5	30	SPI clock
4	CS1	PD0	81	Chip select 1
5	CS2	PD1	82	Chip select 2
6	CS3	PD2	83	Chip select 3

7	CS4	PD3	84	Chip select 4
8	GND	—	—	Ground

#### I2C Connector

Connector Pin	Signal	STM32 Pin	STM32 Pin #	Description
1	3.3V	—	—	Power
2	GND	—	—	Ground
3	SDA	PB9	96	I2C data
4	SCL	PB8	95	I2C clock

#### UART1 Connector

Connector Pin	Signal	STM32 Pin	STM32 Pin #	Description
1	3.3V	—	—	Power
2	TX	PC6	63	UART1 transmit
3	RX	PC7	64	UART1 receive
4	GND	—	—	Ground

#### UART2 Connector

Connector Pin	Signal	STM32 Pin	STM32 Pin #	Description
1	3.3V	—	—	Power
2	TX	PC10	78	UART2 transmit
3	RX	PC11	79	UART2 receive
4	GND	—	—	Ground

### ST-LINK Debug Connector

Connector Pin	Signal	STM32 Pin	STM32 Pin #	Description
1	3.3V	—	—	Target reference
2	SWCLK	PA14	76	Debug clock
3	GND	—	—	Ground
4	SWDIO	PA13	72	Debug data

### USB-C UART Interface

The USB-C connector connects to a **CP2102 USB-to-UART bridge**.

Signal	STM32 Pin	STM32 Pin #	Description
UART_TX	PA2	25	Debug transmit
UART_RX	PA3	26	Debug receive
BOOT0 control	BOOT0	60	Bootloader selection
RESET control	NRST	14	MCU reset

### Peripheral Map

The table below summarizes how the **STM32F407VGT6 peripherals are used on the EA-CORE-407 board**.

Peripheral	Interface	STM32 Pins	STM32 Pin #	Description
Debug UART	USART2	PA2, PA3	25, 26	Connected to CP2102 USB-UART interface
RS485	USART1	PA9, PA10	68, 69	Industrial RS485 communication
RS485 Driver Enable	GPIO	PA8	67	Controls RS485 transceiver direction
CAN Bus	CAN1	PA11, PA12	70, 71	Industrial CAN network
SPI Flash	SPI1	PA4, PA5, PA6, PA7	29-32	W25Q128 external flash memory

<b>Flash IO2/IO3</b>	GPIO	PE0, PE1	97, 98	Quad-SPI data lines
<b>MicroSD Card</b>	SPI2	PB12-PB15	51-54	External storage
<b>MicroSD Detect</b>	GPIO	PB7	93	Detects card insertion
<b>SPI – OUT Bus</b>	SPI3	PB3, PB4, PB5	89-91	SPI Communication Bus
<b>I2C – OUT Bus</b>	I2C1	PB8, PB9	95, 96	I2C Communication Bus
<b>RTC Communication</b>	I2C2	PB10, PB11	47, 48	DS3231 RTC
<b>RTC Interrupt</b>	GPIO	PB6	92	Alarm interrupt from RTC
<b>UART1 Expansion</b>	USART6	PC6, PC7	63, 64	External UART device
<b>UART2 Expansion</b>	UART4	PC10, PC11	78, 79	External UART device
<b>SPI Expansion CS1</b>	GPIO	PD0	81	External SPI device
<b>SPI Expansion CS2</b>	GPIO	PD1	82	External SPI device
<b>SPI Expansion CS3</b>	GPIO	PD2	83	External SPI device
<b>SPI Expansion CS4</b>	GPIO	PD3	84	External SPI device
<b>Status LED (Green)</b>	GPIO	PD12	59	Status indicator
<b>Status LED (White)</b>	GPIO	PD13	60	Status indicator
<b>Status LED (Red)</b>	GPIO	PD14	61	Status indicator
<b>Status LED (Blue)</b>	GPIO	PD15	62	Status indicator
<b>SWD Debug</b>	SWD	PA13, PA14	72, 76	ST-LINK programming interface
<b>Boot Configuration</b>	BOOT1	PB2	37	Boot mode selection
<b>Boot Configuration</b>	BOOT0	BOOT0 pin	60	Boot mode selection
<b>Reset</b>	NRST	NRST pin	14	MCU reset input

## Clock Configuration

The board uses two oscillators.

Oscillator	Frequency	Connected To	Purpose
X1	8 MHz	PH0, PH1	Main system clock
X2	32.768 kHz	PC14, PC15	RTC clock

## Backup Domain

The backup domain is powered by a **CR1220 battery**.

Pin	Function
VBAT	Backup power for RTC
VCAP1	Internal regulator capacitor
VCAP2	Internal regulator capacitor

This allows:

- RTC timekeeping during power loss
- Retention of backup registers

## Power Domain

Rail	Source	Used By
24V	External supply	Main power input
3.3V	LM2596 regulator	MCU and peripherals
VBAT	CR1220 battery	RTC and backup domain

## External Storage

### SPI Flash

Device	Interface	Capacity
W25Q128	SPI	128 Mbit



## EA Control Tech STM32F407 Industrial CPU Board

Used for:

- Firmware storage
- Configuration
- Data logging

### MicroSD Card

Interface	Mode
SPI	SPI2

### Communication Interfaces

Interface	Standard	Typical Use
USB-UART	USB	Debug and firmware upload
RS485	Industrial bus	PLC communication
CAN	Industrial bus	Field devices
UART1	Serial	External modules
UART2	Serial	External modules
SPI	High speed bus	SPI IO expansion
I2C	Peripheral bus	I2C IO expansion

PCB Layout and Mechanical Dimensions

