



# EAXVA05 Datasheet



## Revision History

| Date    | Version | Description   |
|---------|---------|---------------|
| 2021.10 | V1.0    | First Release |
|         |         |               |
|         |         |               |

### Contact us:

Web: <http://www.ecotron.ai>

Email: [info@ecotron.ai](mailto:info@ecotron.ai)  
[support@ecotron.ai](mailto:support@ecotron.ai)

Address: 13115 Barton Rd, STE H  
Whittier, CA, 90605  
United States

Tel: +1 562-758-3039  
+1 562-713-1105

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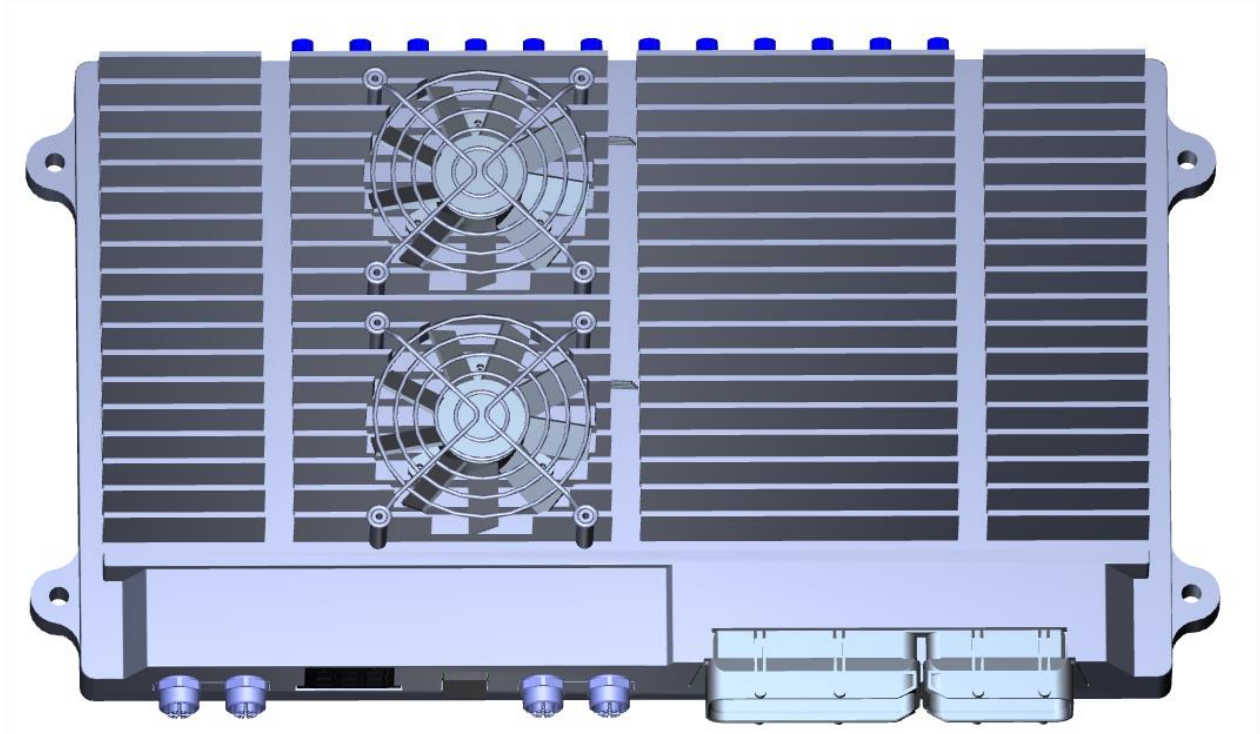
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## Chapter 1 General Information

Ecotron's newest generation ADCU, EAXVA05, is an intelligent computing platform designed specifically for autonomous driving systems. EVXVA05 is equipped with 2 NVIDIA Xavier chips and 1 Infineon TC297 chip. With basic software and development tools, developers can safely, conveniently, and efficiently build low-speed L4-level autonomous driving systems in confined areas.

NVIDIA designs Xavier particularly for embedded intelligent systems. Xavier supports autonomous driving functions such as sensor fusion, environment perception, and path planning. Infineon TC297 has a TriCore™ architecture and has an operating frequency of 300MHz. Moreover, it has 728KB + 8MB capacity and ECC (error correction coding) RAM protection. Ecotron's ADCU is designed based on the ISO26262 standard and supports ASIL-D safety level requirements. Engineers can develop vehicle control and functional safety-related strategies based on this MCU.

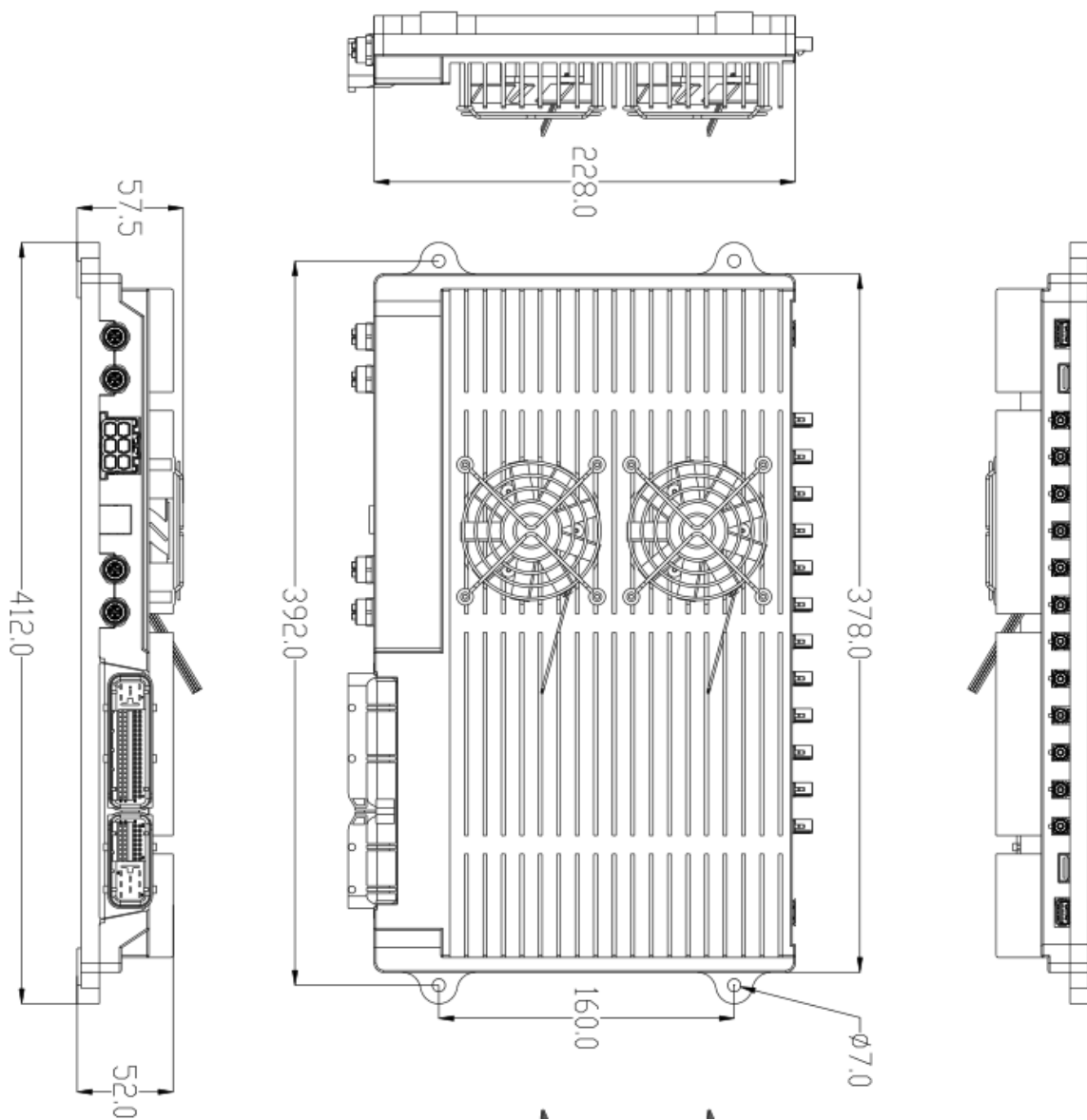


## Chapter 2 Interface Description

| EAXVA05 (NVIDIA Xavier * 2 + Infineon TC297) |          |                                                                                                                     |        |                                 |
|----------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------|--------|---------------------------------|
| Interface Type                               | Quantity | Function                                                                                                            | Chip   | Connector                       |
| M.2 KEY M                                    | 2        | Extended storage                                                                                                    | SOC    | Internal                        |
| Camera Interface                             | 12       | FPDlink III                                                                                                         | SOC    | FAKRA                           |
| Gigabit Standard Ethernet                    | 4        | 100BASE-T/1000BASE-T Standard                                                                                       | Switch | 4*Aviation Connectors           |
| Gigabit Automotive Ethernet                  | 5        | 100Base-T1/1000Base-T1                                                                                              | Switch | 1*Automotive Ethernet Connector |
| HDMI                                         | 2        |                                                                                                                     | SOC    | HDMI Connector                  |
| USB                                          | 2        | TYPE-A*2                                                                                                            | SOC    | TYPE-A Connector                |
| RS232                                        | 8        | One channel used for debug                                                                                          | SOC    | 121PIN-CMC                      |
| RS485                                        | 2        |                                                                                                                     | SOC    |                                 |
| CAN                                          | 4        |                                                                                                                     | SOC    |                                 |
| PPS_IN                                       | 2        | Support 3.3V-16V Hardware configuration                                                                             | SOC    |                                 |
| PPS_OUT                                      | 8        | 2 Channels 5V or 3.3V output<br>2 Channels 12V output                                                               | SOC    |                                 |
| CANFD                                        | 6        | 2 Channels with specific frame wake-up                                                                              | MCU    |                                 |
| LIN                                          | 4        | No wake-up needed                                                                                                   | MCU    |                                 |
| KEYON                                        | 4        | 2 Channel for SOC<br>2 Channels for MCU                                                                             |        |                                 |
| Digital Input                                | 6        | Default configuration, 4 channels active high, 2 channels active low                                                | MCU    |                                 |
| Analog Input                                 | 6        | Default configuration,<br>2 channels 5V voltage type,<br>2 channels 36V voltage type,<br>2 channels resistance type | MCU    |                                 |
| Digital Low Side Output                      | 8        | 8 Channels @250mA                                                                                                   | MCU    |                                 |
| Digital High Side Output                     | 4        | 4 Channels @1A                                                                                                      | MCU    |                                 |
| 5V Sensor Supply                             | 2        | Maximum current 100mA                                                                                               | MCU    |                                 |
| Positive Power Supply                        | 4        |                                                                                                                     |        |                                 |
| Power Ground                                 | 4        |                                                                                                                     |        |                                 |
| Signal Ground                                | 8        |                                                                                                                     |        |                                 |

## Chapter 3 Mechanical Structure

### 3.1 Dimensions



### 3.2 Connectors

The connectors used by EAXVA05 are qualified automotive rated products. The connector models are as follows:

| #  | Connector           | Name                          | Type          | Supplier | Link                                                                                                                                                                        |
|----|---------------------|-------------------------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | 121P                | PCB Header                    | 1746979-1     | TE       | <a href="https://www.te.com/usa-en/product-1746979-1.html">https://www.te.com/usa-en/product-1746979-1.html</a>                                                             |
| 2  |                     | 81P Housing                   | 1473244-1     | TE       | <a href="https://www.te.com/usa-en/product-1473244-1.html">https://www.te.com/usa-en/product-1473244-1.html</a>                                                             |
| 3  |                     | 40P Housing                   | 1473252-1     | TE       | <a href="https://www.te.com/usa-en/product-1473252-1.html">https://www.te.com/usa-en/product-1473252-1.html</a>                                                             |
| 4  |                     | Terminal                      | 964273-2      | TE       | <a href="https://www.te.com/usa-en/product-964273-2.html">https://www.te.com/usa-en/product-964273-2.html</a>                                                               |
| 5  |                     | Terminal                      | 968220-1      | TE       | <a href="https://www.te.com/usa-en/product-968220-1.html">https://www.te.com/usa-en/product-968220-1.html</a>                                                               |
| 6  |                     | 81P Covers                    | 1473247-1     | TE       | <a href="https://www.te.com/usa-en/product-1473247-1.html">https://www.te.com/usa-en/product-1473247-1.html</a>                                                             |
| 7  |                     | 40P Covers                    | 1473255-1     | TE       | <a href="https://www.te.com/usa-en/product-1473255-1.html">https://www.te.com/usa-en/product-1473255-1.html</a>                                                             |
| 8  |                     | 81P TPA                       | 368382-1      | TE       | <a href="https://www.te.com/usa-en/product-368382-1.html">https://www.te.com/usa-en/product-368382-1.html</a>                                                               |
| 9  |                     | 40P TPA                       | 368388-1      | TE       | <a href="https://www.te.com/usa-en/product-1473244-1.html">https://www.te.com/usa-en/product-1473244-1.html</a>                                                             |
| 10 | FAKRA               | FAKRA Connector               | KH-FAK-K509-B | Kinghelm | <a href="https://www.oneyac.net/product/26257576.html">https://www.oneyac.net/product/26257576.html</a>                                                                     |
| 11 | Automotive Ethernet | Automotive Ethernet connector | ESN032-BRMXP  | Amphenol |                                                                                                                                                                             |
| 12 | Aviation Plug       | Board side                    | M12-8L-S-X    | YINGWEI  |                                                                                                                                                                             |
| 13 |                     | Harness side                  | M12-8L-M-X    | YINGWEI  |                                                                                                                                                                             |
| 14 | USB                 | Receptacle                    | 1932258-1     | TE       | <a href="https://www.te.com/usa-en/product-1932258-1.html?q=1932258-1&amp;source=header">https://www.te.com/usa-en/product-1932258-1.html?q=1932258-1&amp;source=header</a> |
| 15 | HDMI                | Receptacle                    | 10029449      | Amphenol | <a href="https://www.amphenol-icc.com/hdmi-10029449001rlf.html">https://www.amphenol-icc.com/hdmi-10029449001rlf.html</a>                                                   |

## Chapter 4 Quick Start

### 4.1 Prepare in Advance

Before using this device, please prepare the following items:

- Stable power supply, 12V DC/ 20A min or 24V DC/ 10A min
- USB to RS-232 adapter
- Laptop

### 4.2 Basic Knowledge

If you are a Linux beginner, it is helpful to learn how to use Linux command line tools. Here is a good Linux tutorial: [tutorial](#).

### 4.3 Get Started

#### 1. Connection

Connect the positive and negative of the ACU to a DC power source, and then connect the RS232-1 of the device to the computer through the USB to RS-232 adapter. Please make sure that the computer can use the serial port normally.

#### 2. Configuration

Configure serial port:

Baud rate: 115200

8 data bits

No parity checks

1 stop bit

Please use Putty or Minicom to open the serial port.

#### 3. Start ADCU

Turn on the ACU KeyOn switch first and turn on the device power. The device first starts U-Boot, then runs the Linux system.

If you see the login dialog in the serial terminal window, it indicates that the system starts normally. The default username and password are as follows:

**Username: nvidia Password: nvidia**

## Chapter 5 Hardware

The hardware circuit of the computing platform is designed according to the application requirements of the autonomous driving system. The electrical parameters meet the requirements of the automotive industry regulations and have a variety of data transmission interfaces to meet the needs of multi-sensor fusion of the autonomous driving system. The main chip contains a variety of high-performance computing units to adapt to the computation-intensive characteristics of autonomous driving, including sequential and parallel computing.

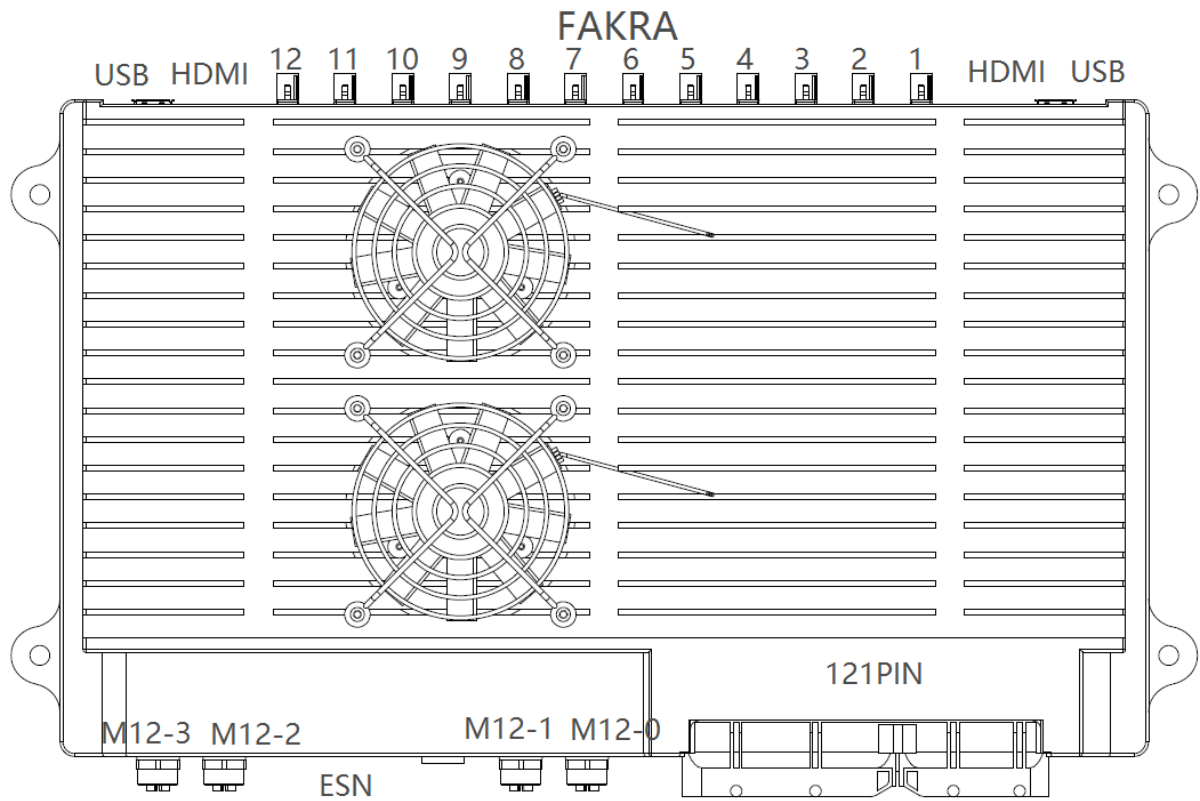
### 5.1 Specifications

| Item                  | Parameter                |
|-----------------------|--------------------------|
| Operating voltage     | DC 9-32V                 |
| Operation memory      | 64GB                     |
| Storage memory        | 64GB                     |
| Operating temperature | -25 to 70 °C             |
| Operating humidity    | 0 - 95%, no condensation |
| Storage temperature   | -40 to 85 °C             |
| Dimensions            | 412mm*251mm*57.5mm       |
| Weight                | ≤3700g                   |

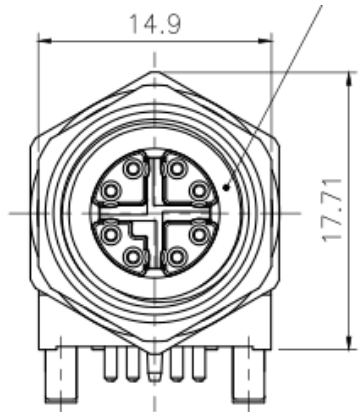
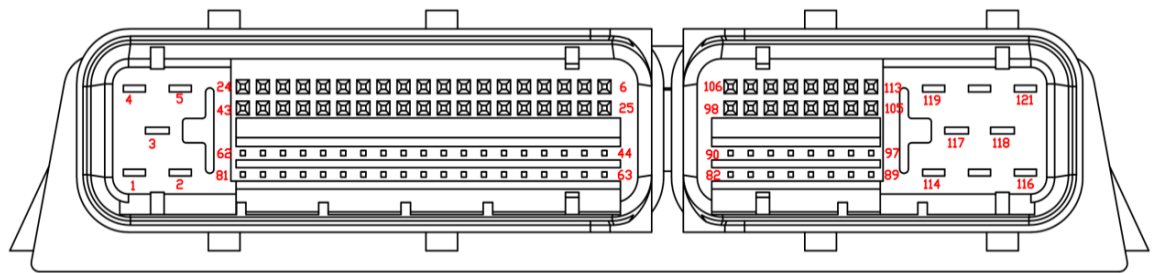
### 5.2 Device Ports

#### 5.2.1 Port Placement

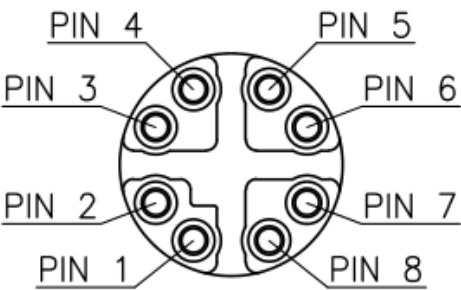
The distribution of input and output ports of the ACU is shown in the figure below. All the figures are shown in the front view.



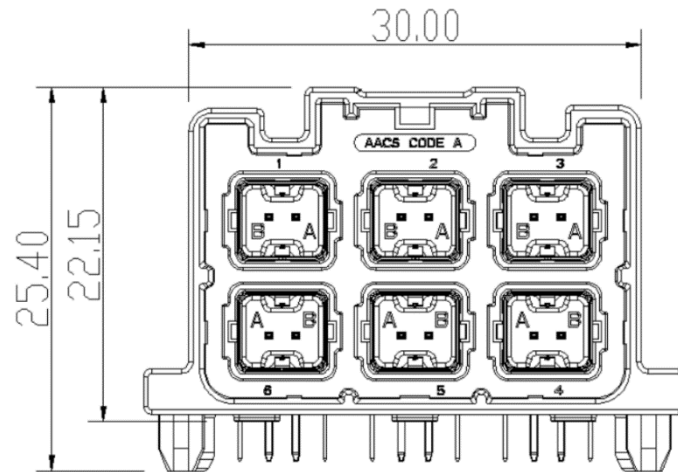
121PIN:



M12:



VIEW A



Car ethernet socket:

### 5.2.2 Pinout

The input and output pin definition are shown in the following table:

| Signal Name     | PIN     | Socket discription          | Note                   |
|-----------------|---------|-----------------------------|------------------------|
| Car ethernet    |         |                             |                        |
| ENet0_N         | B1      | Car ethernet connector 0    | 1000Base-T1/100Base-T1 |
| ENet0_P         | A1      |                             |                        |
| ENet1_N         | B2      | Car ethernet connector 1    | 1000Base-T1/100Base-T1 |
| ENet1_P         | A2      |                             |                        |
| ENet2_N         | B3      | Car ethernet connector 2    | 1000Base-T1/100Base-T1 |
| ENet2_P         | A3      |                             |                        |
| Enet3_N         | B5      | Car ethernet connector 3    | 1000Base-T1/100Base-T1 |
| Enet3_P         | A5      |                             |                        |
| Enet4_N         | B6      | Car ethernet connector 4    | 1000Base-T1/100Base-T1 |
| Enet4_P         | A6      |                             |                        |
| Normal Ethernet |         |                             |                        |
| APort3_BI_DD+   | M12-0-1 | Normal ethernet connector 0 | 100BASE-TX/1000BASE-T  |
| APort3_BI_DD-   | M12-0-2 |                             |                        |
| APort3_BI_DC+   | M12-0-3 |                             |                        |
| APort3_BI_DC-   | M12-0-4 |                             |                        |
| APort3_BI_DB+   | M12-0-5 |                             |                        |
| APort3_BI_DB-   | M12-0-6 |                             |                        |
| APort3_BI_DA+   | M12-0-7 |                             |                        |
| APort3_BI_DA-   | M12-0-8 |                             |                        |
| APort4_BI_DD+   | M12-1-1 | Normal ethernet connector 1 | 100BASE-TX/1000BASE-T  |
| APort4 BI DD-   | M12-1-2 |                             |                        |

|                  |              |                                        |                             |                       |
|------------------|--------------|----------------------------------------|-----------------------------|-----------------------|
| A                | Port4_BI_DC+ | M12-1-3                                |                             |                       |
| A                | Port4_BI_DC- | M12-1-4                                |                             |                       |
| A                | Port4_BI_DB+ | M12-1-5                                |                             |                       |
| A                | Port4_BI_DB- | M12-1-6                                |                             |                       |
| A                | Port4_BI_DA+ | M12-1-7                                |                             |                       |
| A                | Port4_BI_DA- | M12-1-8                                |                             |                       |
| B                | Port3_BI_DD+ | M12-2-1                                | Normal ethernet connector 2 | 100BASE-TX/1000BASE-T |
| B                | Port3_BI_DD- | M12-2-2                                |                             |                       |
| B                | Port3_BI_DC+ | M12-2-3                                |                             |                       |
| B                | Port3_BI_DC- | M12-2-4                                |                             |                       |
| B                | Port3_BI_DB+ | M12-2-5                                |                             |                       |
| B                | Port3_BI_DB- | M12-2-6                                |                             |                       |
| B                | Port3_BI_DA+ | M12-2-7                                |                             |                       |
| B                | Port3_BI_DA- | M12-2-8                                |                             |                       |
| B                | Port4_BI_DD+ | M12-3-1                                | Normal ethernet connector 3 | 100BASE-TX/1000BASE-T |
| B                | Port4_BI_DD- | M12-3-2                                |                             |                       |
| B                | Port4_BI_DC+ | M12-3-3                                |                             |                       |
| B                | Port4_BI_DC- | M12-3-4                                |                             |                       |
| B                | Port4_BI_DB+ | M12-3-5                                |                             |                       |
| B                | Port4_BI_DB- | M12-3-6                                |                             |                       |
| B                | Port4_BI_DA+ | M12-3-7                                |                             |                       |
| B                | Port4_BI_DA- | M12-3-8                                |                             |                       |
| Camera connector |              |                                        |                             |                       |
| Camera-1         | FAKRA-1      | FPD-Link III Serial camera connector 1 | P Type                      |                       |
| Camera-2         | FAKRA-2      | FPD-Link III Serial camera connector 2 | P Type                      |                       |
| Camera-3         | FAKRA-3      | FPD-Link III Serial camera connector 3 | P Type                      |                       |
| Camera-4         | FAKRA-4      | FPD-Link III Serial camera connector 4 | P Type                      |                       |
| Camera-5         | FAKRA-5      | FPD-Link III Serial camera connector 5 | P Type                      |                       |
| Camera-6         | FAKRA-6      | FPD-Link III Serial camera connector 6 | P Type                      |                       |
| Camera-7         | FAKRA-7      | FPD-Link III Serial camera connector 7 | P Type                      |                       |
| Camera-8         | FAKRA-8      | FPD-Link III Serial camera connector 8 | P Type                      |                       |
| Camera-9         | FAKRA-9      | FPD-Link III Serial camera connector 9 | P Type                      |                       |

|                        |          |                                         |                                                      |
|------------------------|----------|-----------------------------------------|------------------------------------------------------|
| Camera-10              | FAKRA-10 | FPD-Link III Serial camera connector 10 | P Type                                               |
| Camera-11              | FAKRA-11 | FPD-Link III Serial camera connector 11 | P Type                                               |
| Camera-12              | FAKRA-12 | FPD-Link III Serial camera connector 12 | P Type                                               |
| BATT                   |          |                                         |                                                      |
| BATT                   | 121P-1   | BATT                                    |                                                      |
|                        | 121P-3   |                                         |                                                      |
|                        | 121P-113 |                                         |                                                      |
|                        | 121P-115 |                                         |                                                      |
|                        | 121P-116 |                                         |                                                      |
|                        | 121P-118 |                                         |                                                      |
|                        | 121P-121 |                                         |                                                      |
| Ground                 |          |                                         |                                                      |
| PGND                   | 121P-2   | Ground                                  |                                                      |
|                        | 121P-4   |                                         |                                                      |
|                        | 121P-5   |                                         |                                                      |
|                        | 121P-105 |                                         |                                                      |
|                        | 121P-114 |                                         |                                                      |
|                        | 121P-117 |                                         |                                                      |
|                        | 121P-119 |                                         |                                                      |
|                        | 121P-120 |                                         |                                                      |
| Signal ground          |          |                                         |                                                      |
| GND                    | 121P-36  | Signal ground                           |                                                      |
|                        | 121P-45  |                                         |                                                      |
|                        | 121P-57  |                                         |                                                      |
|                        | 121P-59  |                                         |                                                      |
|                        | 121P-65  |                                         |                                                      |
|                        | 121P-84  |                                         |                                                      |
|                        | 121P-87  |                                         |                                                      |
|                        | 121P-92  |                                         |                                                      |
|                        | 121P-95  |                                         |                                                      |
|                        | 121P-100 |                                         |                                                      |
|                        | 121P-108 |                                         |                                                      |
| 5V sensor power output |          |                                         |                                                      |
| 5V-1                   | 121P-107 | 5V-1 sensor power output                | Maximum current 100mA                                |
| 5V-2                   | 121P-99  | 5V-2 sensor power output                | Maximum current 100mA                                |
| KEYON                  |          |                                         |                                                      |
| KEYON1                 | 121P-56  | KEYON1                                  | High effective, Control TC297 rising edge triggering |

|                             |          |                                      |                                                                                      |
|-----------------------------|----------|--------------------------------------|--------------------------------------------------------------------------------------|
| KEYON2                      | 121P-39  | KEYON2                               | High effective, control TC297<br>high voltage level triggering                       |
| KEYON3                      | 121P-44  | KEYON3                               | High effective, High effective,<br>control Xavier-A high voltage<br>level triggering |
| KEYON4                      | 121P-63  | KEYON4                               | High effective, High effective,<br>control Xavier-B high voltage<br>level triggering |
| <b>Analog input</b>         |          |                                      |                                                                                      |
| AI01                        | 121P-42  | Analog input 0~5V (Voltage<br>type)  | 12 bits                                                                              |
| AI02                        | 121P-60  | Analog input 0~5V (Voltage<br>type)  | 12 bits                                                                              |
| AI03                        | 121P-43  | Analog input (Resistor type)         | 12 bits                                                                              |
| AI04                        | 121P-24  | Analog input (Resistor type)         | 12 bits                                                                              |
| AI13                        | 121P-62  | Analog input 0~36V (Voltage<br>type) | 12 bits                                                                              |
| AI14                        | 121P-40  | Analog input 0~36V (Voltage<br>type) | 12 bits                                                                              |
| <b>Digital input</b>        |          |                                      |                                                                                      |
| DI01                        | 121P-20  | Digital input 0~BATT                 | High effective                                                                       |
| DI02                        | 121P-58  | Digital input 0~BATT                 | High effective                                                                       |
| DI03                        | 121P-77  | Digital input 0~BATT                 | Low effective                                                                        |
| DI04                        | 121P-38  | Digital input 0~BATT                 | Low effective                                                                        |
| DI21                        | 121P-74  | Digital input 0~BATT                 | High effective                                                                       |
| DI22                        | 121P-16  | Digital input 0~BATT                 | High effective                                                                       |
| <b>High-side output</b>     |          |                                      |                                                                                      |
| HSO01                       | 121P-88  | Rated 0.5A, maximum 1A               |                                                                                      |
| HSO02                       | 121P-89  | Rated 0.5A, maximum 1A               |                                                                                      |
| HSO03                       | 121P-97  | Rated 1A, maximum 1.5A               |                                                                                      |
| HSO04                       | 121P-96  | Rated 1A, maximum 1.5A               |                                                                                      |
| LSO01                       | 121P-101 | Rated 250mA                          |                                                                                      |
| LSO02                       | 121P-102 | Rated 250mA                          |                                                                                      |
| LSO03                       | 121P-111 | Rated 250mA                          |                                                                                      |
| LSO04                       | 121P-112 | Rated 250mA                          |                                                                                      |
| LSO05                       | 121P-110 | Rated 250mA                          |                                                                                      |
| LSO06                       | 121P-103 | Rated 250mA                          |                                                                                      |
| LSO07                       | 121P-109 | Rated 250mA                          |                                                                                      |
| LSO08                       | 121P-104 | Rated 250mA                          |                                                                                      |
| <b>Serial communication</b> |          |                                      |                                                                                      |
| CAN_0_H                     | 121P-31  | Includes 120 $\Omega$ end resistor   |                                                                                      |

|             |         |                                            |                                                                              |
|-------------|---------|--------------------------------------------|------------------------------------------------------------------------------|
| CAN_0_L     | 121P-32 |                                            | Support CANFD, optional terminal resistance, Corresponds to CANA in EcoCoder |
| CAN_1_H     | 121P-11 | Includes 120 $\Omega$ end resistor         | Support CANFD, optional terminal resistance, Corresponds to CANB in EcoCoder |
| CAN_1_L     | 121P-12 |                                            |                                                                              |
| CAN_2_H     | 121P-29 | Includes 120 $\Omega$ end resistor         | Support CANFD, optional terminal resistance, Corresponds to CANC in EcoCoder |
| CAN_2_L     | 121P-30 |                                            |                                                                              |
| CAN_3_H     | 121P-13 | Includes 120 $\Omega$ end resistor         | Support CANFD, optional terminal resistance, Corresponds to CAND in EcoCoder |
| CAN_3_L     | 121P-14 |                                            |                                                                              |
| CAN_R0_H    | 121P-27 | does not Include 120 $\Omega$ end resistor | Support CANFD, optional terminal resistance, Corresponds to CANE in EcoCoder |
| CAN_R0_L    | 121P-28 |                                            |                                                                              |
| CAN_R1_H    | 121P-9  | does not Include 120 $\Omega$ end resistor | Support CANFD, optional terminal resistance, Corresponds to CANF in EcoCoder |
| CAN_R1_L    | 121P-10 |                                            |                                                                              |
| CAN_AX0_H   | 121P-47 | Includes 120 $\Omega$ end resistor         | Optional terminal resistance Corresponds to CAN0 in Xavier-A                 |
| CAN_AX0_L   | 121P-66 |                                            |                                                                              |
| CAN_AX1_H   | 121P-48 | Includes 120 $\Omega$ end resistor         | Optional terminal resistance Corresponds to CAN1 in Xavier-A                 |
| CAN_AX1_L   | 121P-67 |                                            |                                                                              |
| CAN_BX0_H   | 121P-18 | Includes 120 $\Omega$ end resistor         | Optional terminal resistance Corresponds to CAN0 in Xavier-B                 |
| CAN_BX0_L   | 121P-17 |                                            |                                                                              |
| CAN_BX1_H   | 121P-22 | Includes 120 $\Omega$ end resistor         | Optional terminal resistance Corresponds to CAN1 in Xavier-B                 |
| CAN_BX1_L   | 121P-21 |                                            |                                                                              |
| CAN_SHILD-1 | 121P-46 | CAN shielding                              |                                                                              |
| CAN_SHILD-2 | 121P-8  | CAN shielding                              |                                                                              |
| LIN0        | 121P-6  | LIN0 bus                                   |                                                                              |
| LIN1        | 121P-26 | LIN1 bus                                   |                                                                              |
| LIN2        | 121P-7  | LIN2 bus                                   |                                                                              |
| LIN3        | 121P-25 | LIN3 bus                                   |                                                                              |
| RS232_1_TXD | 121P-52 | RS-232 serial port 1                       | Xavier-A <code>ttyTHS0</code>                                                |
| RS232_1_RXD | 121P-71 |                                            |                                                                              |
| RS232_2_TXD | 121P-69 | RS-232 serial port 2                       | Xavier-A <code>ttyTHS1</code>                                                |
| RS232_2_RXD | 121P-50 |                                            |                                                                              |

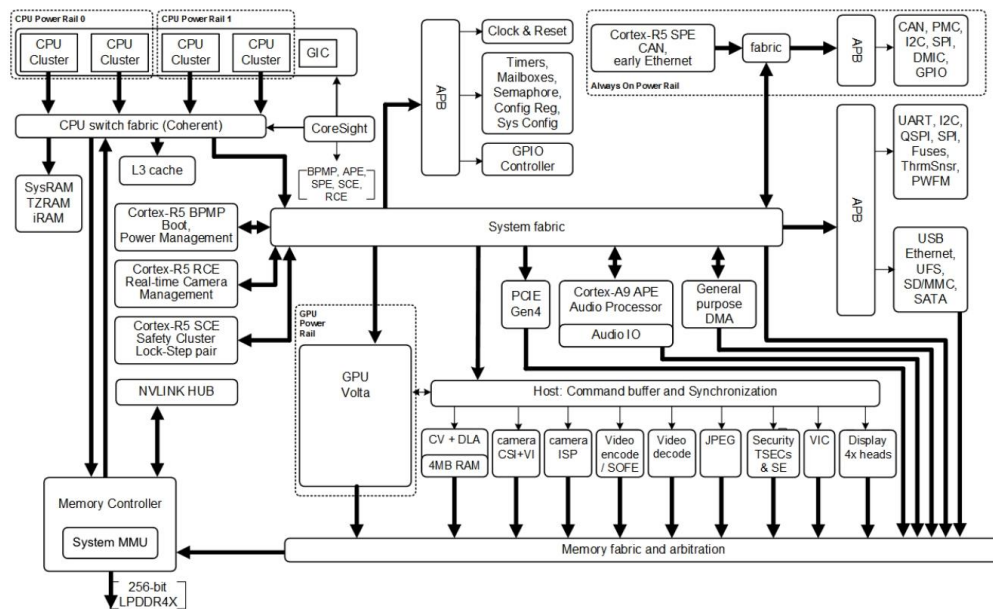
|                   |          |                                            |                                                     |
|-------------------|----------|--------------------------------------------|-----------------------------------------------------|
| RS232_3_TXD       | 121P-51  | RS-232 serial port 3                       | Xavier-A ttyTCU0 defaulted for Debug                |
| RS232_3_RXD       | 121P-70  |                                            |                                                     |
| RS232_4_TXD       | 121P-68  | RS-232 serial port 4                       | Xavier-A <i>ttyTHS6</i>                             |
| RS232_4_RXD       | 121P-49  |                                            |                                                     |
| RS232_5_TXD       | 121P-83  | RS-232 serial port 5                       | Xavier-B <i>ttyTHS0</i>                             |
| RS232_5_RXD       | 121P-82  |                                            |                                                     |
| RS232_6_TXD       | 121P-94  | RS-232 serial port 6                       | Xavier-B <i>ttyTHS1</i>                             |
| RS232_6_RXD       | 121P-93  |                                            |                                                     |
| RS232_7_TXD       | 121P-86  | RS-232 serial port 7                       | Xavier-B ttyTCU0 defaulted for Debug                |
| RS232_7_RXD       | 121P-85  |                                            |                                                     |
| RS232_8_TXD       | 121P-91  | RS-232 serial port 8                       | Xavier-B <i>ttyTHS6</i>                             |
| RS232_8_RXD       | 121P-90  |                                            |                                                     |
| RS485_1_A         | 121P-34  | RS485 serial port 1                        | Xavier-A <i>ttyTHS4</i>                             |
| RS485_1_B         | 121P-33  |                                            |                                                     |
| RS485_2_A         | 121P-54  | RS485 serial port 2                        | Xavier-B <i>ttyTHS4</i>                             |
| RS485_2_B         | 121P-53  |                                            |                                                     |
| The Remained Ones |          |                                            |                                                     |
| PPS_IN1           | 121P-23  | Second pulse synchronization input signal  | Xavier-A, supports 3.3V-16V, hardware configuration |
| PPS_IN2           | 121P-55  | Second pulse synchronization input signal  | Xavier-B, supports 3.3V-16V, hardware configuration |
| PPS_OUT1          | 121P-81  | Second pulse synchronization output signal | Xavier-A, 12V output                                |
| PPS_OUT2          | 121P-80  | Second pulse synchronization output signal | Xavier-A, 12V output                                |
| PPS_OUT3          | 121P-79  | Second pulse synchronization output signal | Xavier-A, 3.3V or 5V output                         |
| PPS_OUT4          | 121P-78  | Second pulse synchronization output signal | Xavier-A, 3.3V or 5V output                         |
| PPS_OUT5          | 121P-106 | Second pulse synchronization output signal | Xavier-B, 12V output                                |
| PPS_OUT6          | 121P-98  | Second pulse synchronization output signal | Xavier-B, 12V output                                |
| PPS_OUT7          | 121P-19  | Second pulse synchronization output signal | Xavier-B, 3.3V or 5V output                         |
| PPS_OUT8          | 121P-37  | Second pulse synchronization output signal | Xavier-B, 3.3V or 5V output                         |

### 5.3 System Main Chip

The main chip of EAXVA05 is NVIDIA Jetson AGX Xavier which is designed for embedded autonomous driving control systems. The computing performance of different internal processors is listed below.

- 8-Core CPU: 8-Core Carmel CPU based on ARMv8 ISA
- Deep Learning Accelerator (DLA): 5 TFLOPS (FP16) | 10 TOPS (INT8)
- Volta GPU: 512 CUDA cores | 20 TOPS (INT8) | 1.3 TFLOPS (FP32)
- Vision Processor: 1.6 TOPS
- Stereo and Optical Flow Engine (SOFE): 6 TOPS
- Image Signal Processor (ISP): 1.5 Giga Pixels/s
- Video Encoder: 1.2 GPix/s
- Video Decoder: 1.8 GPix/s

The internal structure of the chip is shown below:

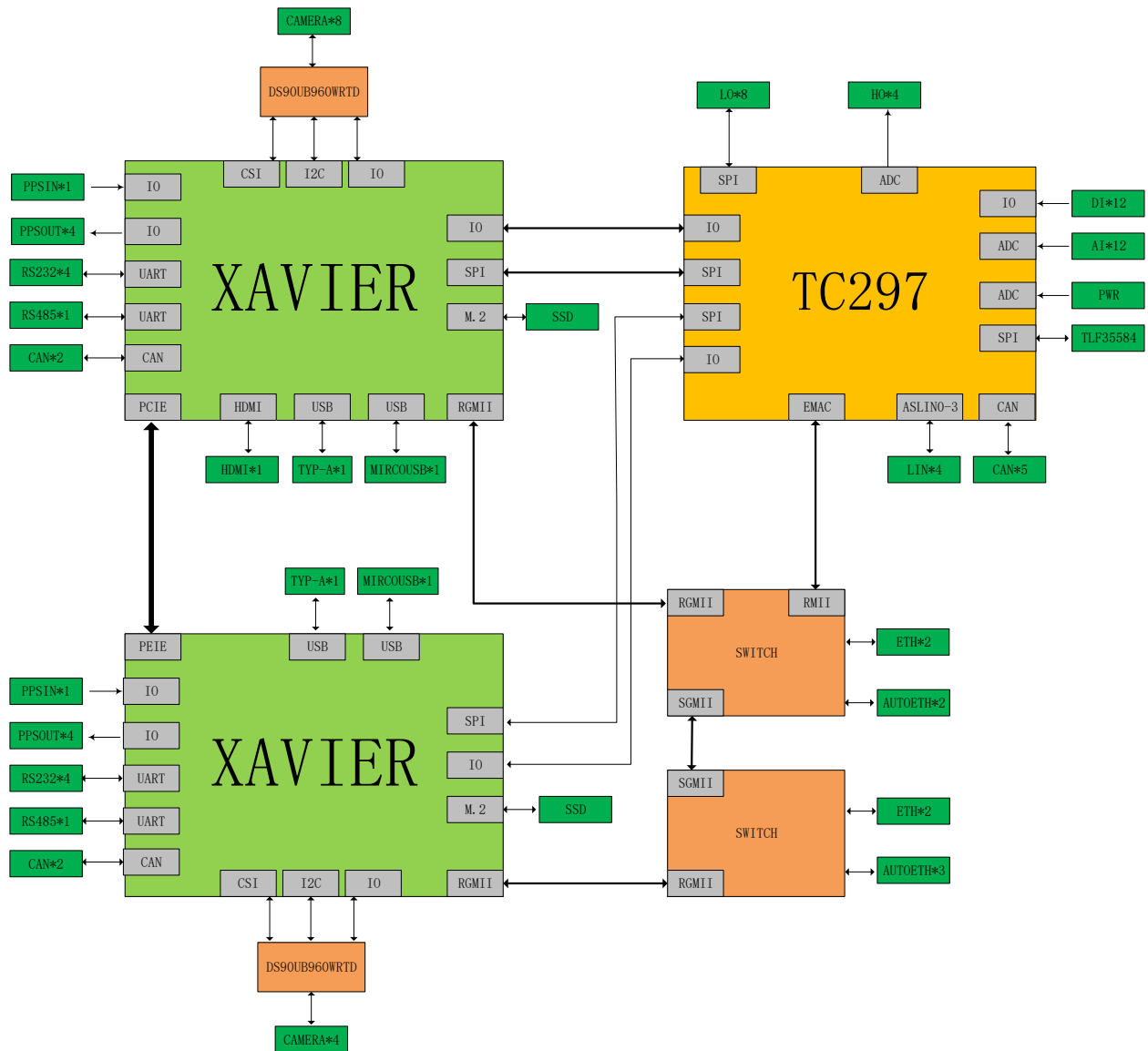


The microcontroller used in EAXVA05 is Infineon TC297 which has a TriCore™ architecture, working at 300MHz and has an ECC (Error Correction Code) protected RAM with a capacity of up to 728KB + 8MB, designed based on ISO26262, supporting up to ASIL-D. By working with a system basic chip (SBC), a hardware core security architecture design is realized. The resources of the chip are as follows:

| Feature                | Detail                  |
|------------------------|-------------------------|
| Micro Control Core     | 32-bit Infineon TC297TP |
| Maximum Frequency      | 300MHz                  |
| Flash                  | 8M                      |
| SRAM                   | 728K                    |
| EEPROM                 | 128K                    |
| Float Point Capability | Yes                     |
| SBC                    | TLF35584                |

## 5.4 Circuit Structure

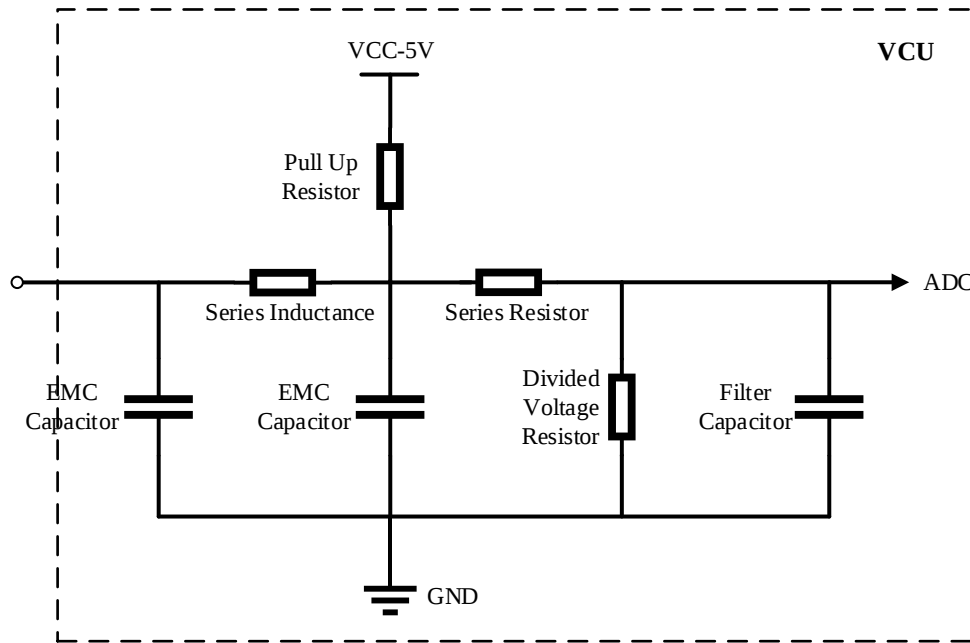
The internal circuit structure of EAXVA05 is shown below:



## 5.5 Circuit Description

### 5.5.1 Analog Input

The analog input channel circuit has the same structure. The circuit schematic and circuit details are shown below:

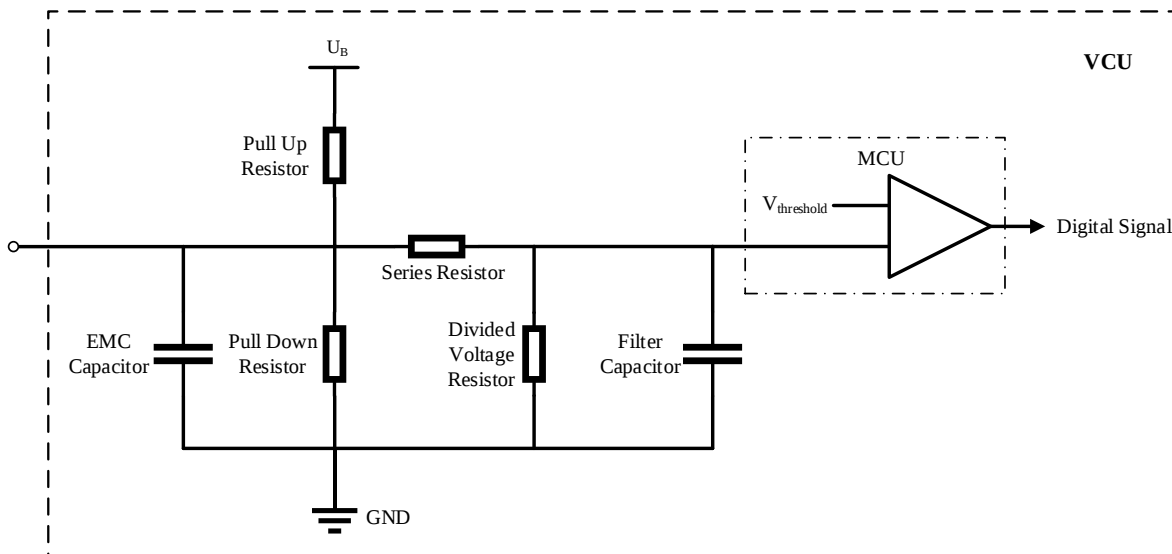


Note: 1. "---" means not soldered; 2. UB means power supply BATT voltage; 3. AI28 collects BATT voltage signal.

| Pin # | AI   | EMC Capacitor | Pull Up Resistor | Series Resistor | Divided Voltage Resistor | Filter Capacitor | Input Range |     | Conditions / Remarks |
|-------|------|---------------|------------------|-----------------|--------------------------|------------------|-------------|-----|----------------------|
|       |      | (F)           | to 5V (Ohm)      | (Ohm)           | (Ohm)                    | (F)              | Min         | Max |                      |
| 42    | AI01 | 100n          | --               | 22k             | --                       | 1n               | 0V          | 5V  |                      |
| 60    | AI02 | 100n          | --               | 22k             | --                       | 1n               | 0V          | 5V  |                      |
| 43    | AI03 | 100n          | 10k              | 22k             | --                       | 1n               | --          | --  | Resistance type      |
| 24    | AI04 | 100n          | 10k              | 22k             | --                       | 1n               | --          | --  | Resistance type      |
| 62    | AI13 | 100n          | --               | 22k             | 3.48k                    | 1n               | 0V          | 32V |                      |
| 40    | AI14 | 100n          | --               | 22k             | 3.48k                    | 1n               | 0V          | 32V |                      |
| --    | AI28 | 100n          | --               | 22k             | 3.48k                    | 1n               | 0V          | 32V | BATT                 |

### 5.5.2 Digital Input

The digital input channel circuit has the same structure. The circuit schematic and circuit details are shown below:



Note: 1. "--" means not welded. 2.  $U_B$  represents the power supply BATT voltage. 3. KEYON and DC\_WAKE only make hard-wire wake-up signal. 4. Digital input DI21, DI22 can be configured as frequency input SPEED1, SPEED2.

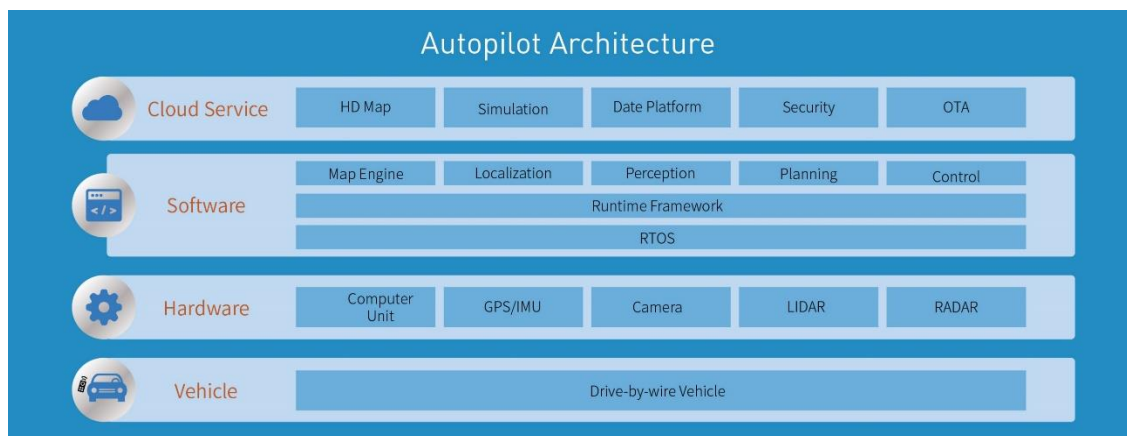
| Pin # | DI   | Pull Up Resistor | Pull Down Resistor | Operation Threshold for Input Signal |            | Input Range |       | Conditions/Remarks |
|-------|------|------------------|--------------------|--------------------------------------|------------|-------------|-------|--------------------|
|       |      | to $U_B$ (Ohm)   | (Ohm)              | $V_{low}$                            | $V_{high}$ | Min         | Max   |                    |
| 20    | DI01 | --               | 10k                | 3V                                   | 8.5V       | 0V          | $U_B$ | High effective     |
| 58    | DI02 | --               | 10k                | 3V                                   | 8.5V       | 0V          | $U_B$ | High effective     |
| 77    | DI03 | 10k              | --                 | 3V                                   | 8.5V       | 0V          | $U_B$ | Low effective      |
| 38    | DI04 | 10k              | --                 | 3V                                   | 8.5V       | 0V          | $U_B$ | Low effective      |
| 74    | DI21 | --               | 10k                | 3V                                   | 8.5V       | 0V          | $U_B$ | High effective     |

|    |      |    |     |    |      |    |                |                |
|----|------|----|-----|----|------|----|----------------|----------------|
| 16 | DI22 | -- | 10k | 3V | 8.5V | 0V | U <sub>B</sub> | High effective |
|----|------|----|-----|----|------|----|----------------|----------------|

## Chapter 6 SoC Basic Software

The SOC software system of the computing platform is customized for the autonomous driving system. A typical framework of an autonomous driving system is displayed below. The SoC software system of EAXVA05 consists of RTOS and Runtime Framework. RTOS is a Linux operating system. Runtime Framework is ROS (Robot Operating System) Melodic.

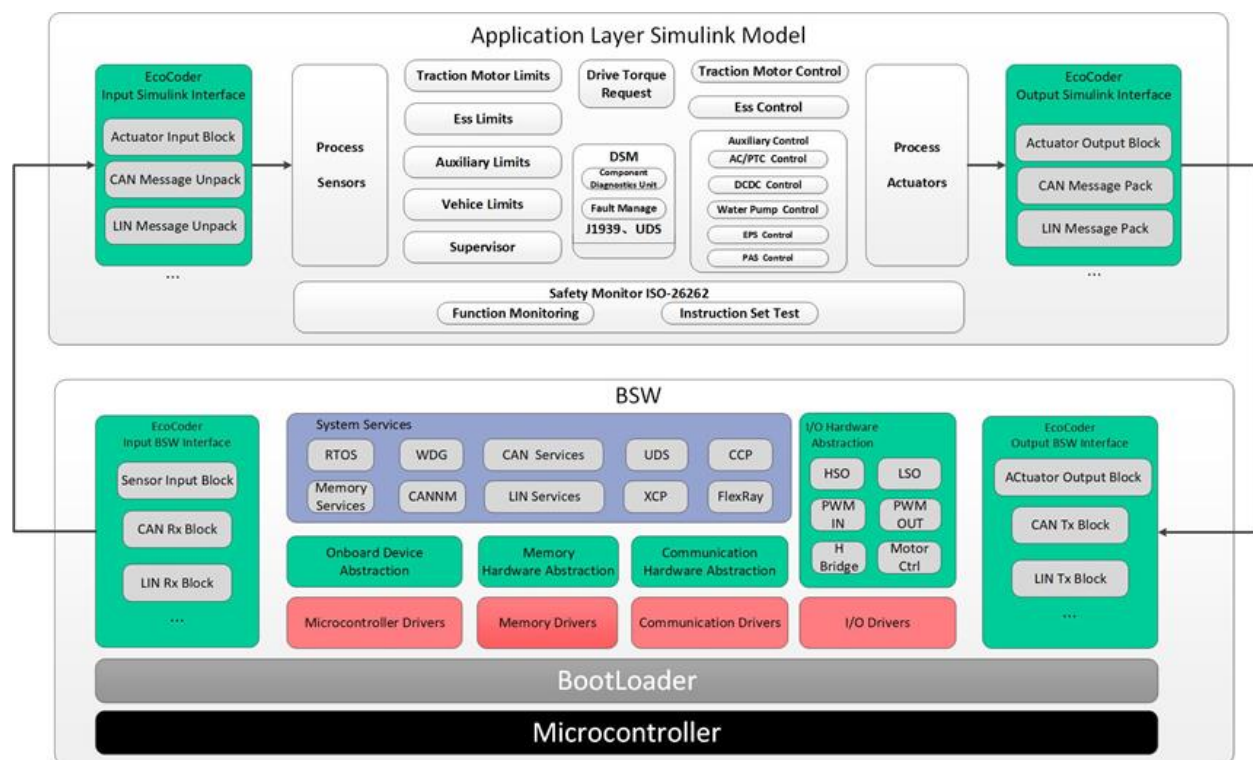
Linux connects the hardware and the users, providing functions such as Process Management, Memory Management, File System, Network, Security, User Interface, and Device Drivers. Users can enter commands through the user interface of the operating system. The operating system interprets the commands, drives the hardware devices, and implements user requirements. ROS provides some standard operating system services, such as Hardware Abstraction, Low-Level Device Control, Inter-Process Messaging, and Message Packet Management. ROS is built on a graph architecture. Various nodes can publish, subscribe, and aggregate all kinds of information, e.g., sensing, control, status, planning.



The software architecture of the MCU inside EAXVA05 is designed according to AUTOSAR, which is divided into Application Software Layer and Basic Software Layer. Basic Software Layer consists of a microcontroller abstraction layer, an ECU abstraction layer, a service layer, and a complex driver. Application software and basic software are connected and integrated through EcoCoder.

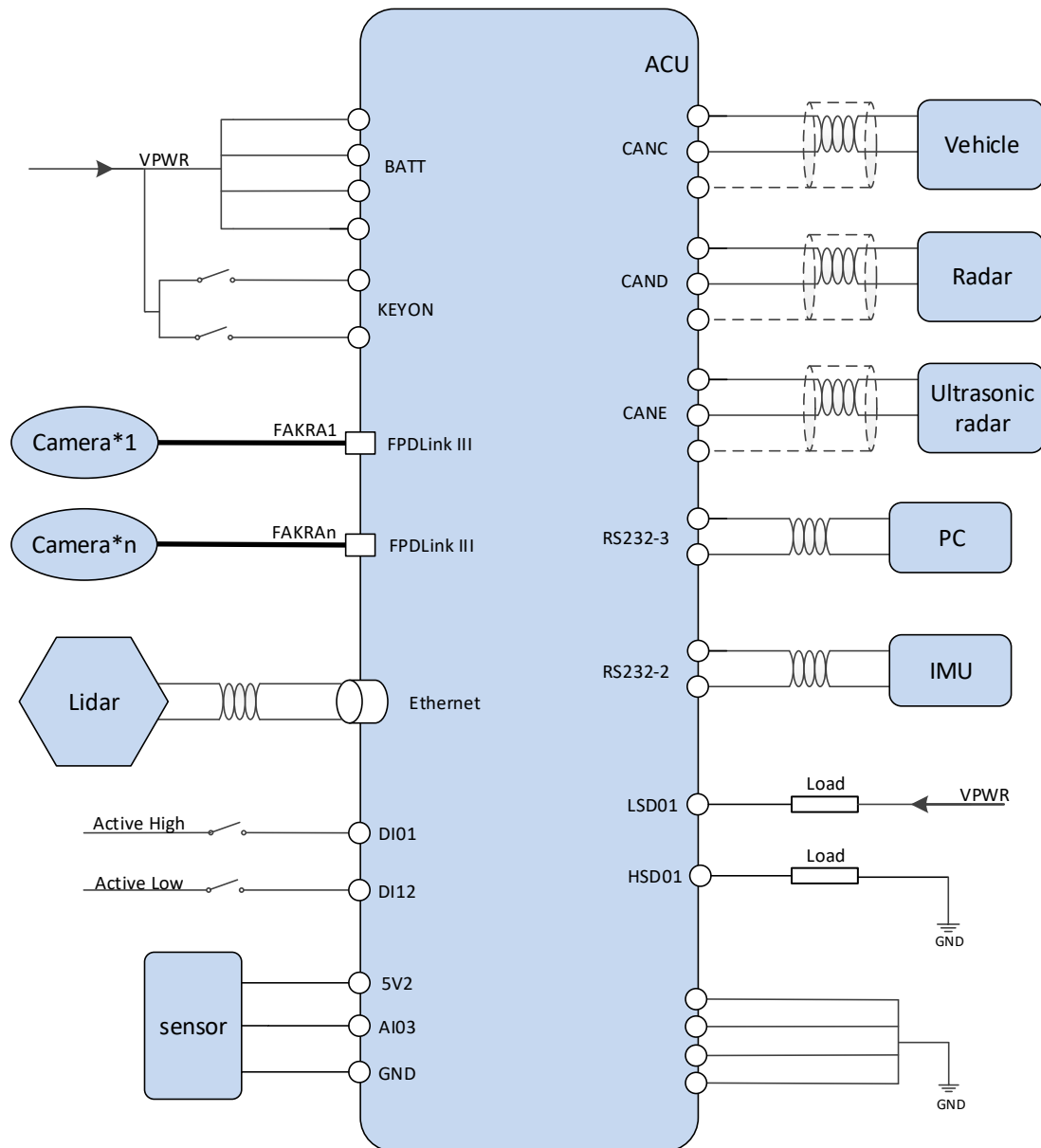
EcoCoder encapsulates the low-level software interfaces into the Simulink library via s-functions. Application developers can use Simulink to build the model and generate executable program files for TC297 via Simulink with just one click.

The basic software interfaces that EcoCoder encapsulates can read digital and analog input signals, control high and low side outputs, support .dbc file interpretation, implement CCP and UDS protocols, and define the measurement, calibration, and NVM variables. MCU application development is implemented with the calibration software EcoCAL and the flashing software EcoFlash.



## Chapter 7 Demo Application

A demo for an autonomous driving hardware platform is shown below, which consists of EAXVA05 and sensors.

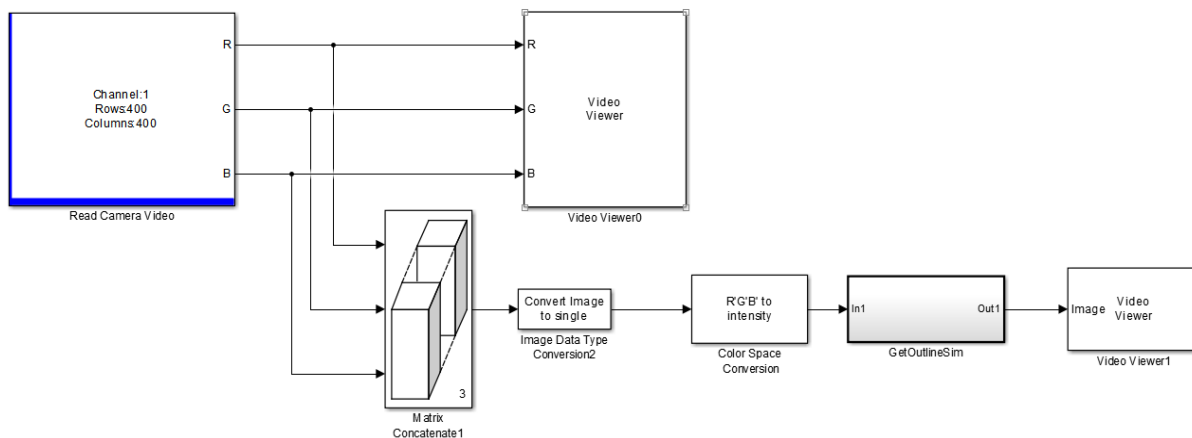


## Chapter 8 Development Tool

Devices composed of hardware, operating system stacks, and runtime environments cannot achieve autonomous driving. Continuous software development for packages that can implement specific functions is needed. In addition, deployment to devices is necessary as well. For the intelligent driving processor Xavier, we provide a development tool EcoCoder-AI. For the microcontroller TC297, we provide three other development tools EcoCoder, EcoCAL, EcoFlash. Users can utilize them to develop customized special applications suitable for specific scenarios.

### 8.1 EcoCoder-AI

EcoCoder-AI is a powerful automatic code generation library based on Matlab / Simulink that links directly to the target controller. EcoCoder-AI integrates code generation, compilation, and one-click generation of executable files. In addition, the control model based on Simulink can be directly converted into a ROS-based executable program suitable for the target controller and downloaded to the target controller. For details, please refer to EcoCoder-AI Manual.



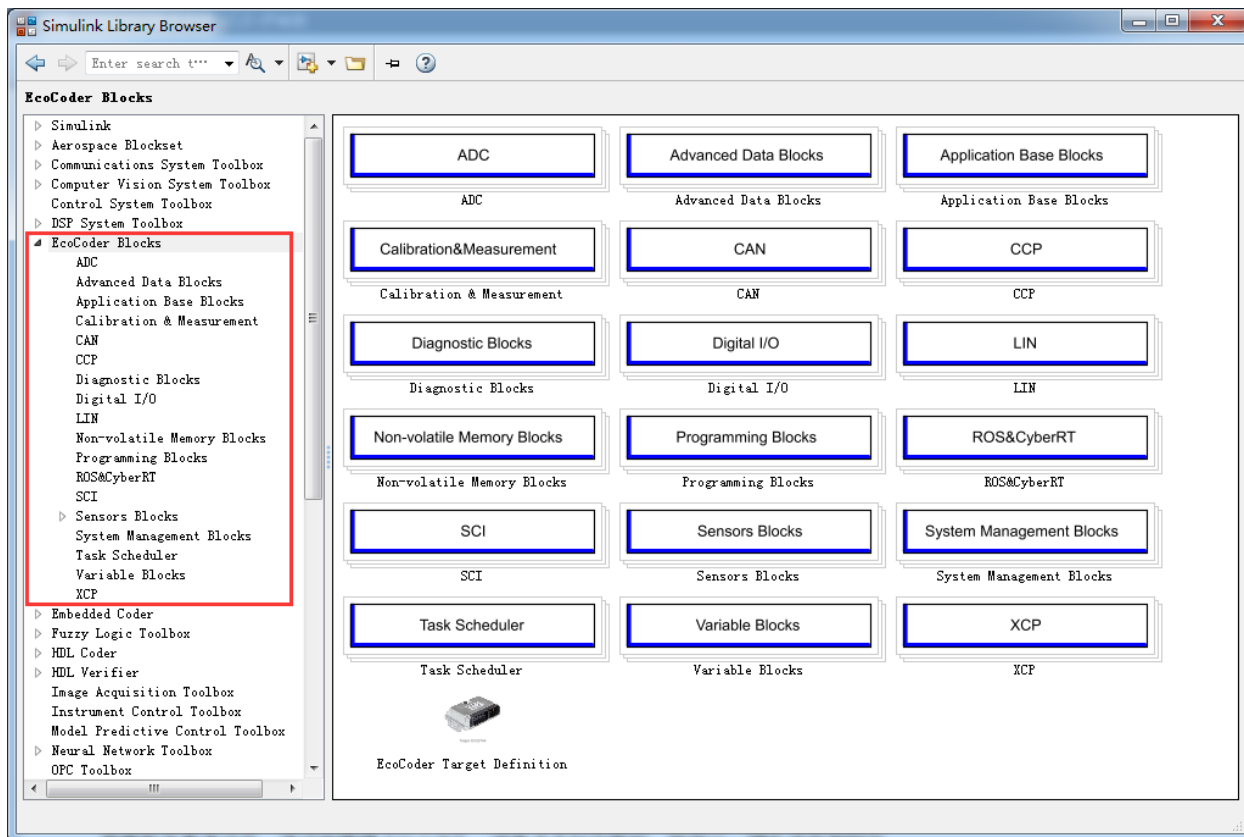
### 8.2 EcoCoder

EcoCoder is an application development tool for the control system, which makes it easier for users to develop embedded application software in the Simulink environment. It expands the resources of Simulink and Real-Time Workshop embedded encoders to generate the necessary

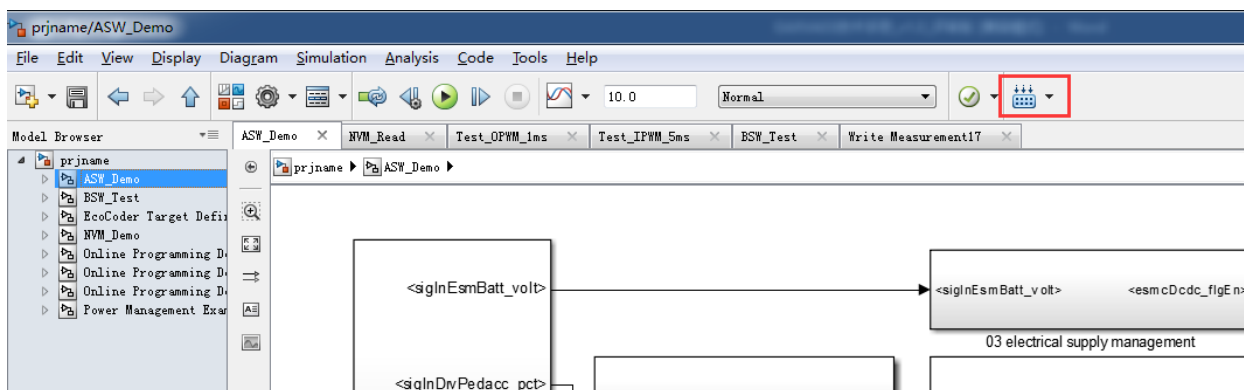
code module and automatically configures and optimizes code generation. By encapsulating the low-level software library to s-functions, EcoCoder allows developers to use low-level software interfaces by model-based-design method and configure basic parameters. It can generate executable files and data description files with one click and provide .a2l file address update tool.

**Features:**

- Users develop embedded application software in the Simulink environment.
- Application developers can focus on control strategy development without knowing all the information about hardware.
- By encapsulating the low-level software library to s-functions, EcoCoder enables developers to use the low-level software interfaces and configure parameters using the model-based-design method.
- Executable file and data description file can be generated with one click, and a .a2l file address update tool is provided. During the generation, the code generated by the model is integrated with the low-level software automatically in the background, then makefile is used to call the compiler to generate executables.



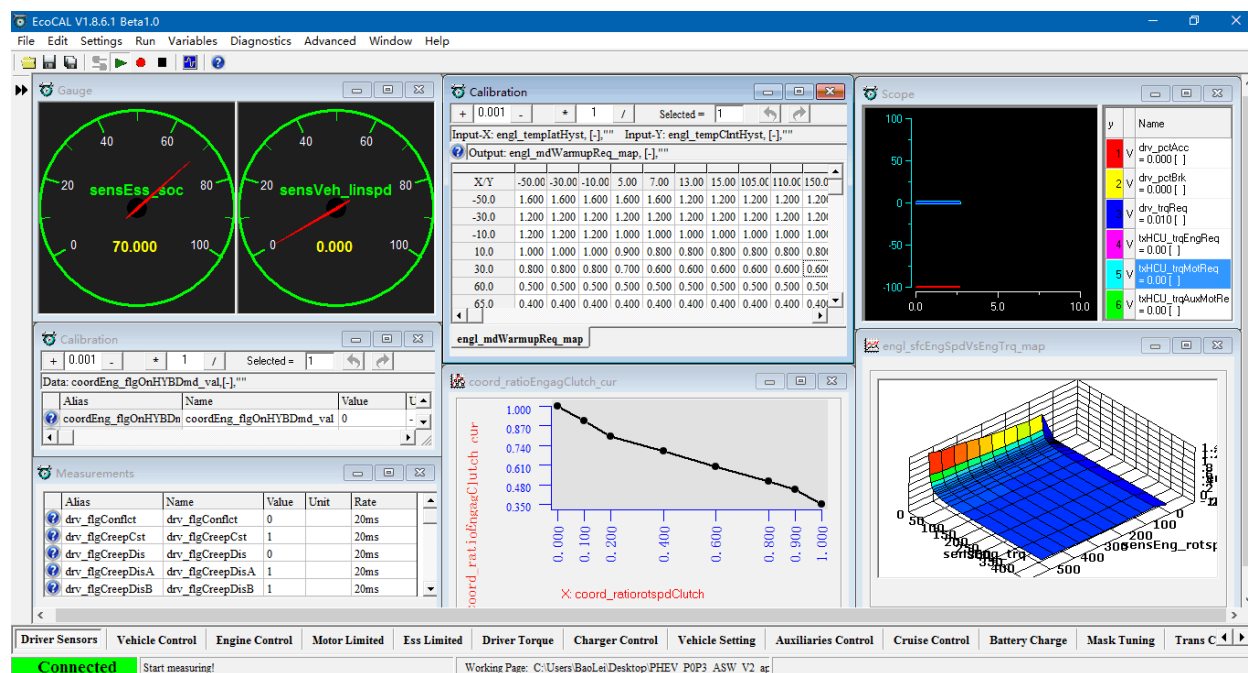
After completing the compilation of the model, use the shortcut “Ctrl + B” or click the button shown below. After that, the files will be ready to be flashed and then generated.



Developers can use EcoCoder to develop application software for MCU in EAXVA05. Please refer to EcoCoder User Manual.

### 8.3 EcoCAL

EcoCAL is a PC-side calibration software based on the CCP protocol. By loading .a2l and .hex files, real-time observation of the measurable variables and on-the-fly calibration can be realized. It can assist control strategy development engineers to debug and calibrate application software. Please refer to EcoCAL User Manual for more details.



## 8.4 EcoFlash

EcoFlash is a PC-side software working with BootLoader to flash target program files. The CAN communication uses CCP/UDS protocol, and supports .s19, .mot and .hex files..

