# EV1-80001 Evaluation Kit

EV1 Datasheet

## Product Highlights

- Full System Breakout
- USB 3.1 Type-C + DP-ALT Mode
- Auto Enumerate Plug-n-Play
- Supports Windows 10, Android, & Linux
- Onboard MCU for Data Processing
- Expandable

Items covered in this datasheet:

| Part Number | Product Description |
|---|---|
| EV1-80001 | MARS Evaluation Kit |
| HBB-50001 | High Brightness Backlight |
| RDP551 | FHD LCoS Panel |

## Applications

- Evaluation of the VX MARS system
- Sensor testing and integration
- Custom module design

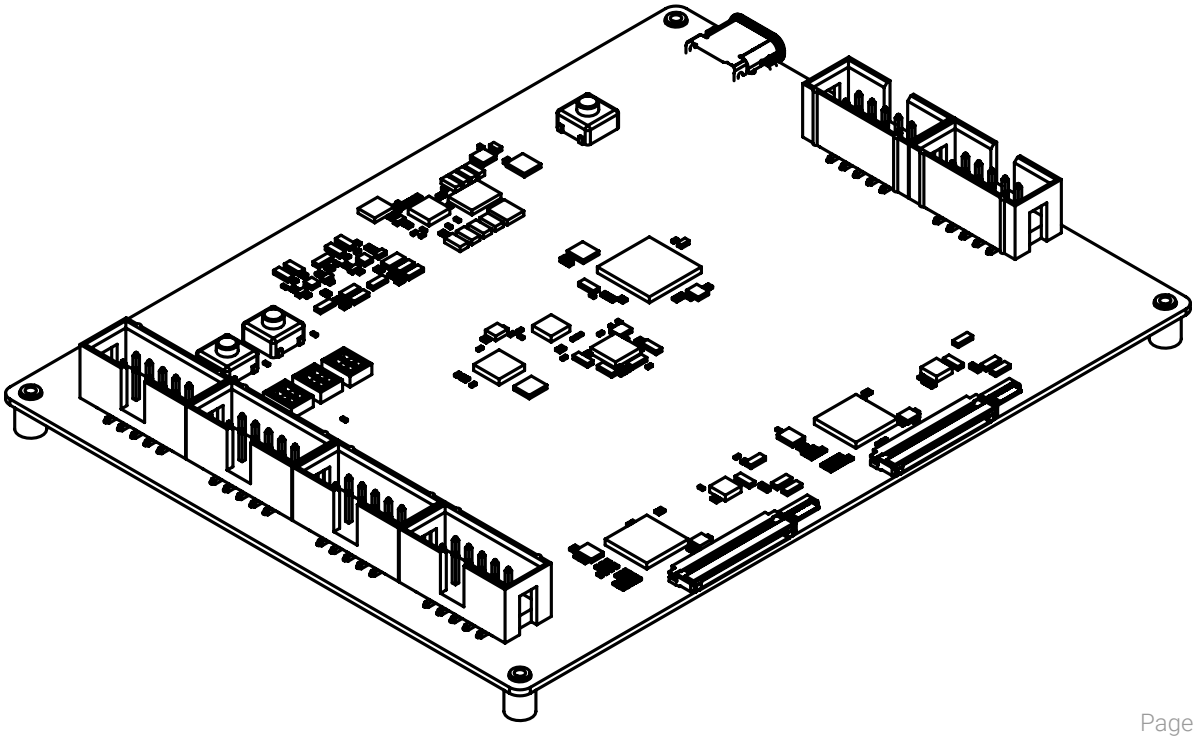
## Abstract

This document describes the hardware features and specifications of the **EV1-80001** Evaluation Kit for the VX Modular Augmented Reality System (**MARS**). The EV1 combines all the components of the MARS onto a single board and is a fully-featured evaluation kit. This kit is built to support VX customers in their product development.

The kit includes all that is needed to evaluate sub-systems and validate functionality of the CNEDs, HBB Backlights, cameras, and sensors. This kit can be used to program USB Billboard ID, DP-ALT mode, HMI functions, and HBB Backlight power optimization.

The VX EV1-80001 Eval-Kit works with fully-featured USB Type-C devices. The displays and sensors enumerate automatically.

EV1 Evaluation Kit



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## Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

**001 - Draft Release**
Basic information added for a draft release.

**002 - Initial Release**
Updated information with engineering approval. Supplementary data will be published later.

## Part Number Ordering Information

**SSS - NNNNN - XX - VVV**

**(Series) - (Part Type & Number) - (Option Configuration) - (Version)**

# Hardware Overview

## Description

The EV1-80001 Evaluation kit is a single board that highlights the VX Modular Augmented Reality System (MARS). The Eval-Kit is a complete set of MARS boards in one. Developers can test and evaluate with USB Type-C PD negotiation, sensor integration, and onboard data processing for the headsets plug-n-play accessory modules.

The platform supports either two FHD CNED displays or two RDP551 LCoS panels with HBB backlights. The EV1 also supports a 5 Gbit/s data bus, high-speed multiplexing, and full device control via the serial, MIPI, and I2C interfaces.

## Features

The EV1 combines all the components of the MARS onto a single board. The full range of hardware features includes IDC header breakouts, on-board programming interface, and isolatable logic groups. This allows for easy testing and development.

The system is designed for modularity and efficiency. Sensor integration is easy with three data protocols and power available at each modular interface point. The onboard microcontroller handles the communication of the integrated sensors, peripheral devices, and human-machine-interface.

Application firmware examples are provided with each kit. Additional support is available through service packages.

## Feature List

- **USB 3.1 Type-C DP-ALT Mode**
- **Auto Enumerate Plug-n-Play**
- **Supports Windows 10, Android, & Linux**
- **Onboard MCU for Data Processing**
- **Expandable Sensor Testing**
- **Supports two LCoS & HBB backlights**

# Specifications

## Functional Specifications

| Feature | Description | Typical | Units |
|---|---|---|---|
| Type-C | USB-PD 2.0 with ALT Mode | USB 3.1 | - |
| DP-ALT | DisplayPort version support | 1.2 | - |
| Device Bandwidth | Maximum data rate for displays and modules combined | 10 | Gbit/s |
| Module Bandwidth | Maximum data rate for all modules combined | 5 | Gbit/s |
| Display Bandwidth | Maximum data rate for DisplayPort 1.2 | 8 | Gbit/s |

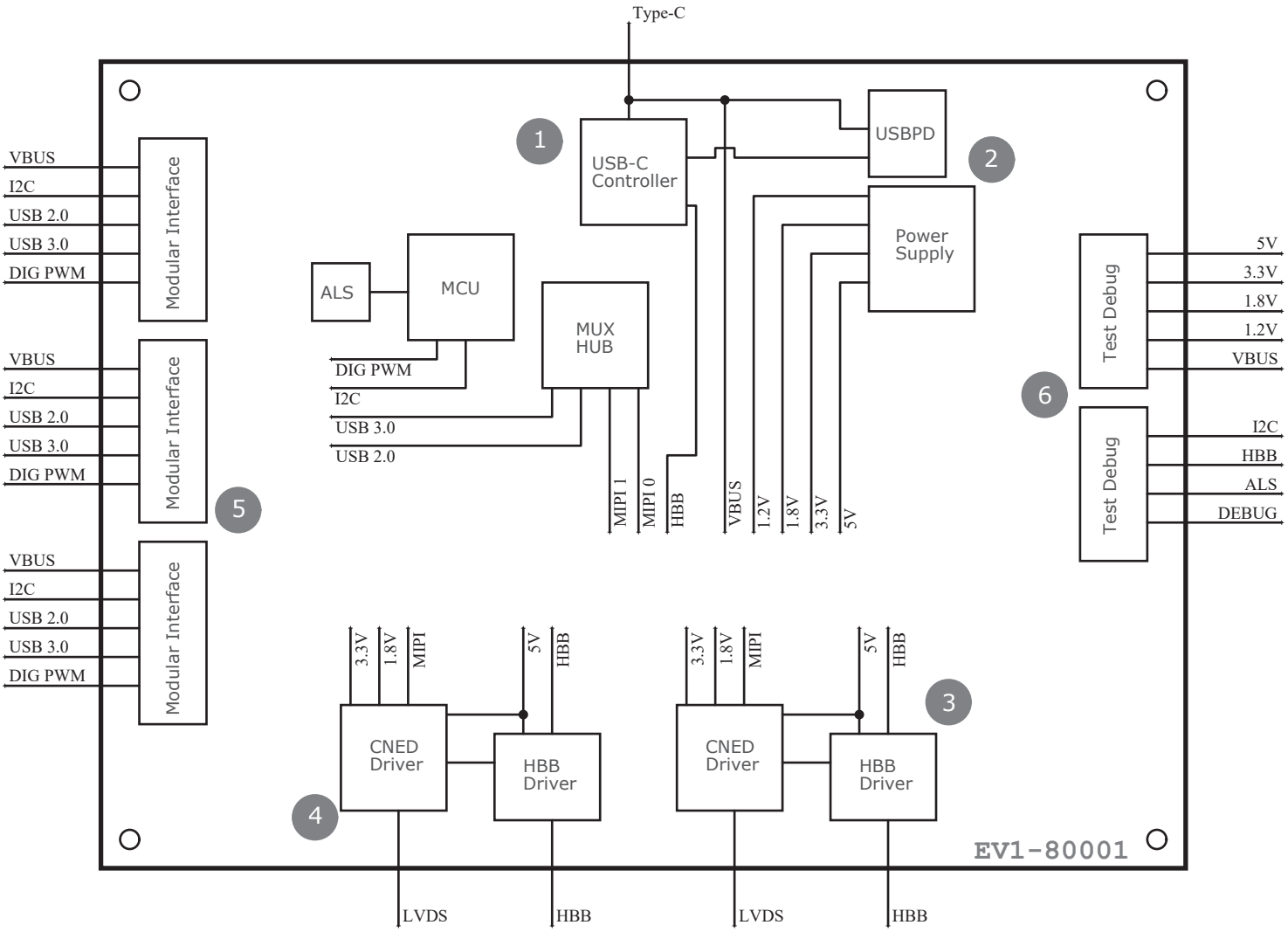
## Absolute Maximum Ratings

Exceeding the Absolute Maximum Rating may cause permanent damage to the device. Continuous use at the absolute maximum rating for extended periods may affect device reliability. Absolute maximum ratings are based on environmental conditions of 22°C and 50% relative humidity. Use outside of these conditions will require independent testing and verification by the customer.

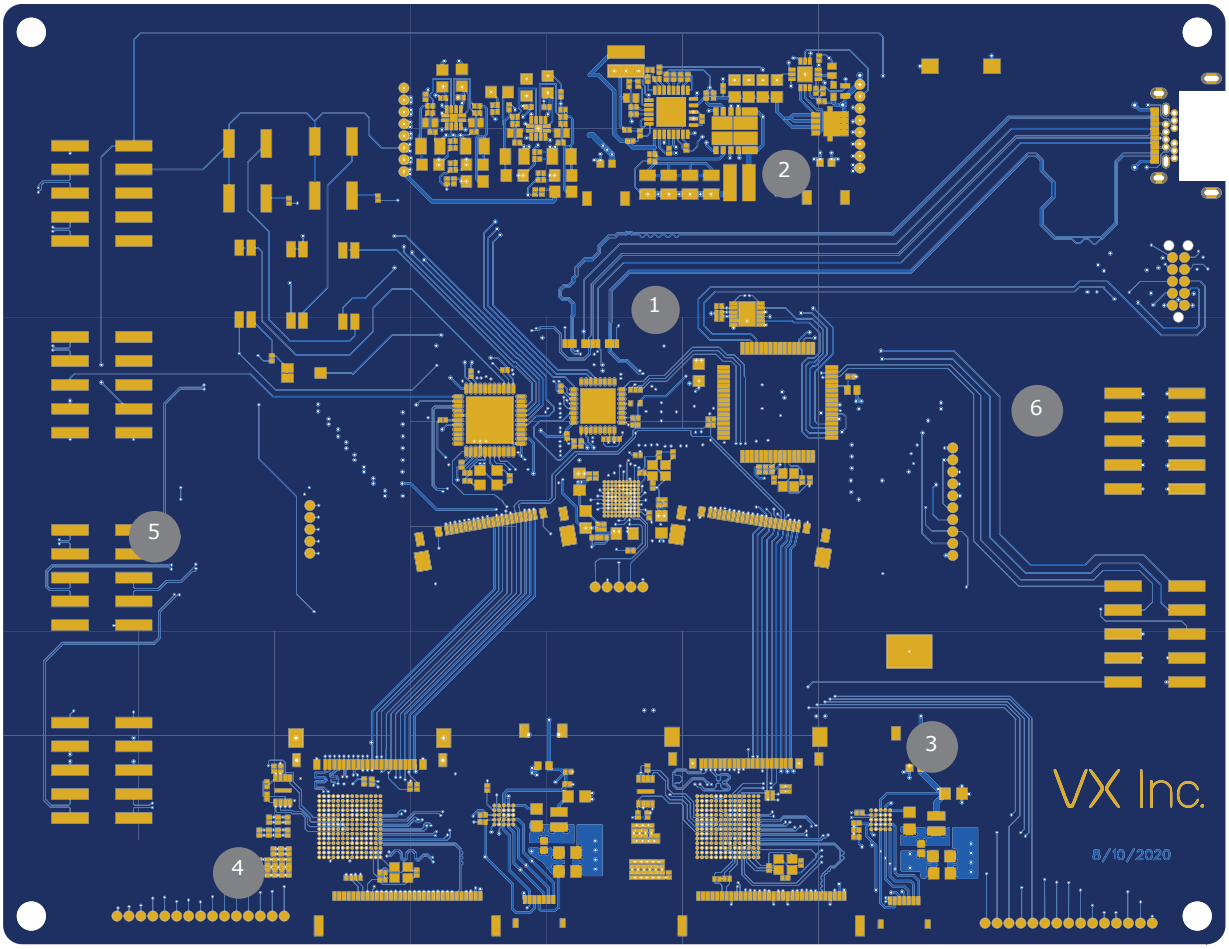
| Name | Description | Minimum | Maximum | Units |
|---|---|---|---|---|
| VBUS | Device current draw from VBUS | - | 3 | A |
| | Voltage for Type-C port VBUS | 5 | 20 | VDC |
| CC1, CC2 | Voltage for Type-C port pins | -0.6 | 22 | VDC |
| TX1, TX2, RX1, RX2 | Voltage for Type-C port differential pins | -0.3 | 4 | VDC |
| SUB1, SUB2 | Voltage for Type-C port I/O pins | -0.3 | 4 | VDC |
| IDC Headers | Combined IDC pins current draw | - | 2 | A |
| | Voltage for digital pins | -0.5 | 5 | VDC |
| | Current for IDC digital pins. Each | - | 25 | mA |
| | Voltage for IDC differential and I/O pins | -0.3 | 5.5 | VDC |
| $T_{STG}$ | Storage temperature range | -18 | 38 | °C |

* Thermal consideration is recommended when the system is using more than 0.3A.

## Functional Block Diagram



## System Overview




① Type-C input and signal control
② USB-C Power Delivery
③ Right Eye display driver and control
④ Left Eye display driver and control
⑤ IDC headers for Modules
⑥ IDC headers for High-brightness Backlights
⑦ Development Switches
   i. SW1: Tact switch with pull-down resistor connected to SW5
   ii. SW2: Tact switch with pull-down resistor connected to SW4
   iii. SW3: Dip switch selection between on-board ALS or off-board ALS
   iv. SW4: Dip switch selection between SW1 and RMOD_PWM_D6
   v. SW5: Dip switch selection between SW2 and RMOD_PWM_D6
   vi. SW7: Power reset button

## Pinout Tables

The following tables define the basic pin functions. Full pin definitions are available in the reference package. The following tables are for information only. Schematics are available with the reference package.

### ODN-80001 (Mainboard Logic Group)

| Connector - Pin | Name | Type | Description |
|---|---|---|---|
| J2 - 1 | DGND | Ground | Device Ground |
| J2 - 2 | USB_RMOD_N | Input / Output | Right Module USB 2.0, Negative |
| J2 - 3 | USB_RMOD_P | Input / Output | Right Module USB 2.0, Positive |
| J2 - 4 | USB_RMOD_TX_P | Input / Output | Right Module USB 3.0 Transmit, Positive |
| J2 - 5 | USB_RMOD_TX_N | Input / Output | Right Module USB 3.0 Transmit, Negative |
| J2 - 6 | USB_RMOD_RX_P | Input / Output | Right Module USB 3.0 Receive, Positive |
| J2 - 7 | USB_RMOD_RX_N | Input / Output | Right Module USB 3.0 Receive, Negative |
| J2 - 8 | RMOD_PWM_D5 | Input / Output | Sensor Input/Output for Right Module |
| J2 - 9 | RMOD_PWM_D6 | Input / Output | Sensor Input/Output for Right Module |
| J2 - 10 | SDA | Input / Output | $I^2C$ Data |
| J2 - 11 | SCL | Input | $I^2C$ Clock |
| J2 - 12 | VBUS_15V | Power | USBPD VBUS Power |
| | | | |
| J3 - 1 | SIG (ALS) | Analog Input | Ambient Light Sensor Input |
| J3 - 2 | DGND | Ground | Ambient Light Sensor Ground |
| J3 - 3 | 5V_SYS | Power | 5.0 Volt System Power |
| | | | |
| J4 - 1 | 5V_SYS | Power | 5.0 Volt System Power |
| J4 - 2 | DGND | Ground | Device Ground |
| | | | |
| J5 - 1 | MIPI_10_L0_P | Output | MIPI Lane 0, Positive |
| J5 - 2 | MIPI_10_L0_N | Output | MIPI Lane 0, Negative |
| J5 - 3 | MIPI_10_L1_P | Output | MIPI Lane 1, Positive |
| J5 - 4 | MIPI_10_L1_N | Output | MIPI Lane 1, Negative |
| J5 - 5 | MIPI_10_L2_P | Output | MIPI Lane 2, Positive |
| J5 - 6 | MIPI_10_L2_N | Output | MIPI Lane 2, Negative |
| J5 - 7 | MIPI_10_L3_P | Output | MIPI Lane 3, Positive |
| J5 - 8 | MIPI_10_L3_N | Output | MIPI Lane 3, Negative |
| J5 - 9 | MIPI_10_CLK_P | Output | MIPI Clock, Positive |
| J5 - 10 | MIPI_10_CLK_N | Output | MIPI Clock, Negative |
| J5 - 11 | Reserved | - | Reserved |
| J5 - 12 | Reserved | - | Reserved |

Continued - ODN-80001 (Mainboard Logic Group)

| Connector - Pin | Name | Type | Description |
|---|---|---|---|
| J5 - 13 | Reserved | - | Reserved |
| J5 - 14 | Reserved | - | Reserved |
| J5 - 15 | Reserved | - | Reserved |
| J5 - 16 | Reserved | - | Reserved |
| J5 - 17 | Reserved | - | Reserved |
| J5 - 18 | AVDD33 | Power | 3.3 Volt Supply for Analog Circuitry |
| J5 - 19 | DVDD18 | Power | 1.8 Volt Supply for Digital Circuitry |
| J5 - 20 | VDD12 | Power | 1.2 Volt System Power |
| | | | |
| J6 - 1 | MIPI_00_L0_P | Output | MIPI Lane 0, Positive |
| J6 - 2 | MIPI_00_L0_N | Output | MIPI Lane 0, Negative |
| J6 - 3 | MIPI_00_L1_P | Output | MIPI Lane 1, Positive |
| J6 - 4 | MIPI_00_L1_N | Output | MIPI Lane 1, Negative |
| J6 - 5 | MIPI_00_L2_P | Output | MIPI Lane 2, Positive |
| J6 - 6 | MIPI_00_L2_N | Output | MIPI Lane 2, Negative |
| J6 - 7 | MIPI_00_L3_P | Output | MIPI Lane 3, Positive |
| J6 - 8 | MIPI_00_L3_N | Output | MIPI Lane 3, Negative |
| J6 - 9 | MIPI_00_CLK_P | Output | MIPI Clock, Positive |
| J6 - 10 | MIPI_00_CLK_N | Output | MIPI Clock, Negative |
| J6 - 11 | Reserved | - | Reserved |
| J6 - 12 | Reserved | - | Reserved |
| J6 - 13 | Reserved | - | Reserved |
| J6 - 14 | Reserved | - | Reserved |
| J6 - 15 | Reserved | - | Reserved |
| J6 - 16 | Reserved | - | Reserved |
| J6 - 17 | Reserved | - | Reserved |
| J6 - 18 | AVDD33 | Power | 3.3 Volt Supply for Analog Circuitry |
| J6 - 19 | DVDD18 | Power | 1.8 Volt Supply for Digital Circuitry |
| J6 - 20 | VDD12 | Power | 1.2 Volt System Power |
| | | | |
| J7 - 1 | 5V_SYS | Power | 5.0 Volt System Power |
| J7 - 2 | DGND | Ground | Device Ground |
| | | | |
| J8 - 1 | VBUS_15V | Power | USBPD VBUS Power |
| J8 - 2 | DGND | Ground | Device Ground |

Continued - ODN-80001 (Mainboard Logic Group)

| Connector - Pin | Name | Type | Description |
|---|---|---|---|
| J9 - 1 | USB_FMOD_N | Input / Output | Front Module USB 2.0, Negative |
| J9 - 2 | USB_FMOD_P | Input / Output | Front Module USB 2.0, Positive |
| J9 - 3 | USB_FMOD_TX_P | Input / Output | Front Module USB 3.0 Transmit, Positive |
| J9 - 4 | USB_FMOD_TX_N | Input / Output | Front Module USB 3.0 Transmit, Negative |
| J9 - 5 | USB_FMOD_RX_P | Input / Output | Front Module USB 3.0 Receive, Positive |
| J9 - 6 | USB_FMOD_RX_N | Input / Output | Front Module USB 3.0 Receive, Negative |
| J9 - 7 | FMOD_DIG_D7 | Input / Output | Sensor Input/Output for Front Module |
| J9 - 8 | FMOD_DIG_D8 | Input / Output | Sensor Input/Output for Front Module |
| J9 - 9 | Reserved | - | Reserved |
| J9 - 10 | SDA | Input / Output | $I^2C$ Data |
| J9 - 11 | SCL | Input | $I^2C$ Clock |
| J9 - 12 | Reserved | - | Reserved |
| J9 - 13 | LMOD_PWM_D9 | Input / Output | Sensor Input/Output for Left Module |
| J9 - 14 | LMOD_PWM_D10 | Input / Output | Sensor Input/Output for Left Module |
| J9 - 15 | USB_LMOD_N | Input / Output | Left Module USB 2.0, Negative |
| J9 - 16 | USB_LMOD_P | Input / Output | Left Module USB 2.0, Positive |
| J9 - 17 | USB_LMOD_TX_P | Input / Output | Left Module USB 3.0 Transmit, Positive |
| J9 - 18 | USB_LMOD_TX_N | Input / Output | Left Module USB 3.0 Transmit, Negative |
| J9 - 19 | USB_LMOD_RX_P | Input / Output | Left Module USB 3.0 Receive, Positive |
| J9 - 20 | USB_LMOD_RX_N | Input / Output | Left Module USB 3.0 Receive, Negative |
| | | | |
| J_PWR1 - 1 | DGND | Ground | Device Ground |
| J_PWR1 - 2 | TCPP_CC2 | Signal | USBPD Type-C Controller CC2 |
| J_PWR1 - 3 | TCPP_CC1 | Signal | USBPD Type-C Controller CC1 |
| J_PWR1 - 4 | CC2c | Signal | USBPD CC2 Port Over-voltage Protection |
| J_PWR1 - 5 | CC1c | Signal | USBPD CC1 Port Over-voltage Protection |
| J_PWR1 - 6 | DB_CC2 | Signal | Low Voltage Fault Reporting |
| J_PWR1 - 7 | FLT_CC1 | Signal | USBPD Fault Reporting |
| J_PWR1 - 8 | VBUS_15V | Power | USBPD VBUS Power |
| | | | |
| J_PWR2 - 1 | AVDD10 | Power | 1.0 Volt Supply for Analog Circuitry |
| J_PWR2 - 2 | DVDD10 | Power | 1.0 Volt Supply for Digital Circuitry |
| J_PWR2 - 3 | VDD12 | Power | 1.2 Volt System Power |
| J_PWR2 - 4 | DVDD18 | Power | 1.8 Volt Supply for Digital Circuitry |
| J_PWR2 - 5 | DVDD33 | Power | 3.3 Volt Supply for Digital Circuitry |
| J_PWR2 - 6 | 5V_SYS | Power | 5.0 Volt System Power |
| J_PWR2 - 7 | AVDD33 | Power | 3.3 Volt Supply for Analog Circuitry |
| J_PWR2 - 8 | AVDD18 | Power | 1.8 Volt Supply for Analog Circuitry |

## ODN-80005 (CNED Driver Board Logic Group)

| Connector - Pin | Name | Type | Description |
|---|---|---|---|
| J10 - 1 | VDD12 | Power | 1.2 Volt system power |
| J10 - 2 | DVDD18 | Power | 1.8 Volt supply for digital circuitry |
| J10 - 3 | AVDD33 | Power | 3.3 Volt supply for analog circuitry |
| J10 - 4 | Reserved | - | Reserved |
| J10 - 5 | Reserved | - | Reserved |
| J10 - 6 | Reserved | - | Reserved |
| J10 - 7 | Reserved | - | Reserved |
| J10 - 8 | Reserved | - | Reserved |
| J10 - 9 | Reserved | - | Reserved |
| J10 - 10 | Reserved | - | Reserved |
| J10 - 11 | MIPI_CLK_N | Output | MIPI Clock Negative |
| J10 - 12 | MIPI_CLK_P | Output | MIPI Clock Positive |
| J10 - 13 | MIPI_L3_N | Output | MIPI Lane 3 Negative |
| J10 - 14 | MIPI_L3_P | Output | MIPI Lane 3 Positive |
| J10 - 15 | MIPI_L2_N | Output | MIPI Lane 2 Negative |
| J10 - 16 | MIPI_L2_P | Output | MIPI Lane 2 Positive |
| J10 - 17 | MIPI_L1_N | Output | MIPI Lane 1 Negative |
| J10 - 18 | MIPI_L1_P | Output | MIPI Lane 1 Positive |
| J10 - 19 | MIPI_L0_N | Output | MIPI Lane 0 Negative |
| J10 - 20 | MIPI_L0_P | Output | MIPI Lane 0 Positive |
| J10 - Shield | DGND | Ground | Device Ground |
| | | | |
| J12 - 1 | DGND | Ground | Device Ground |
| J12 - 2 | T-OUT | Input | Temperature Input (Device Side) |
| J12 - 3 | 2.8V | Power | Optional 2.8 Volt for Temperature Output |
| J12 - 4 | VDDLED | LED Input | LED Sequential Pulse |
| J12 - 5 | B-OUT | LED Output | Blue LED Output |
| J12 - 6 | G-OUT | LED Output | Green LED Output |
| J12 - 7 | R-OUT | LED Output | Red LED Output |
| | | | |
| J13 - 1 | DGND | Ground | Device Ground |
| J13 - 2 | 5V_SYS | Power | 5.0 Volt System Power |

# Software Integration

## Firmware

The VX MARS comes with a base firmware package that allows customers to control integrated sensors via the onboard microcontroller. Programming functionality can be done through the Atmel Studio or the Arduino IDE.

Supplementary documents will be provided with each versioned firmware package.
Please visit www.vx-inc.com for more information.

## Supported Operating Systems

The VX MARS supports Windows 10, Linux, and Android.

## Host System Hardware Recommendations

Customers are responsible for confirming DisplayPort Alternate Mode support with the manufacturer of the host system. Most USB Type-C devices fail to meet full USB PD requirements.

**Windows**

| Component | Recommended System Requirements | Minimum System Requirements |
|---|---|---|
| Processor | Intel i7 Comet Lake or newer | Intel i5 Comet Lake |
| GPU | NVIDIA Pascal or RTX | Gen12 Intel Integrated Graphics |
| Memory | 16 GB RAM or more | 8 GB RAM or more |
| Video output | Thunderbolt DP-ALT Mode | USB PD DP-ALT Mode |
| Operating System | Windows 10 | Windows 10 |

**Android**

| Component | Recommended System Requirements | Minimum System Requirements |
|---|---|---|
| SOC | Snapdragon 845 | Snapdragon 800 Family |
| Memory | 16 GB RAM or more | 8 GB RAM or more |
| Video output | Thunderbolt DP-ALT Mode | USB PD DP-ALT Mode |
| Operating System | Android 11 | Android 9 |

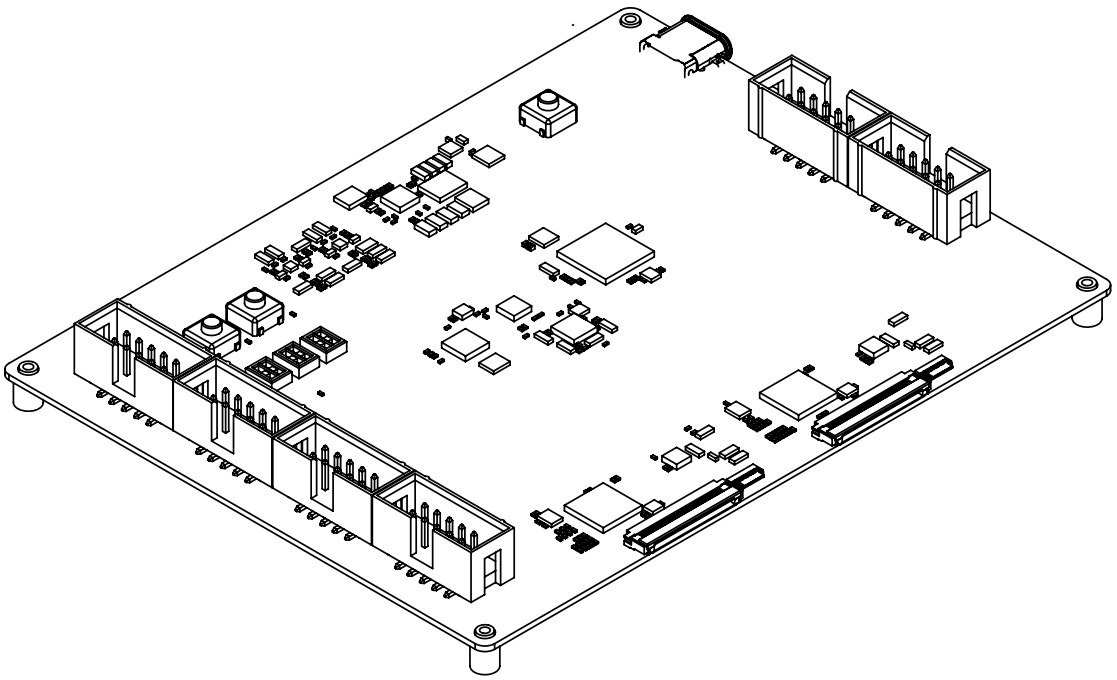
# Mechanical Drawings

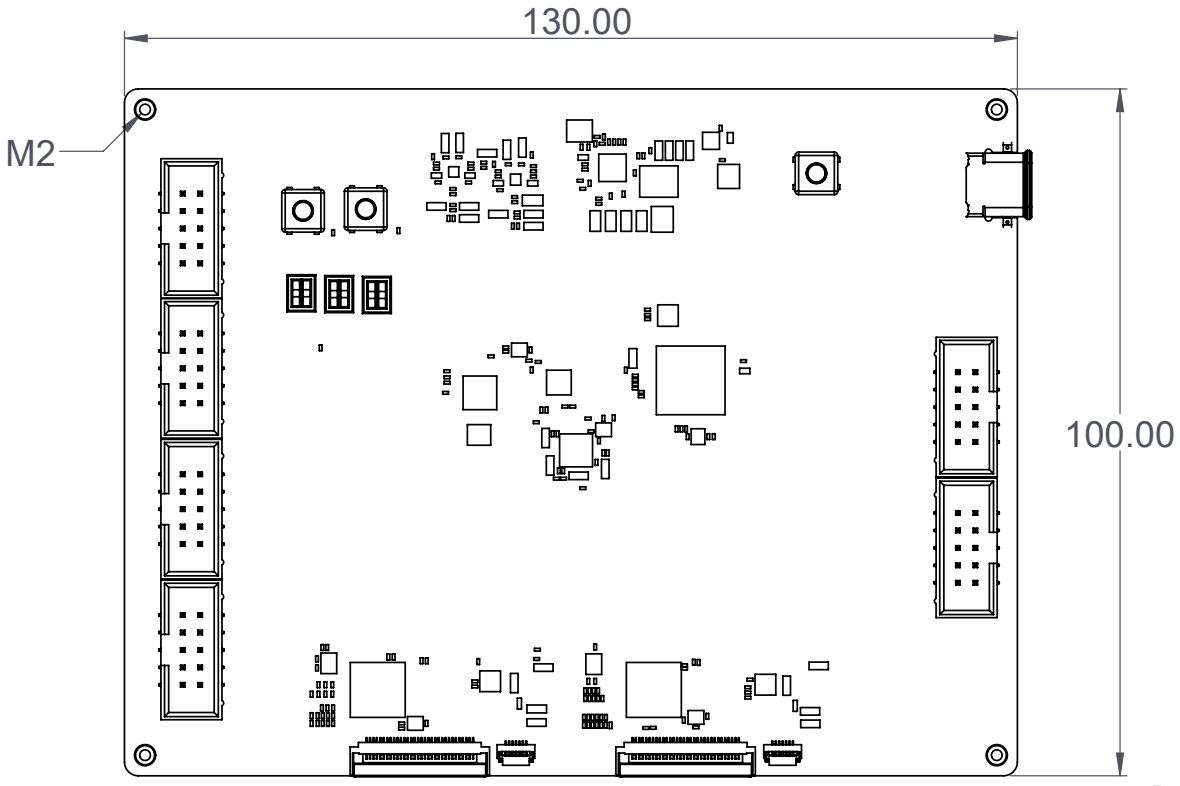
This is a limited dimension drawing to be used for part information and reference. 3D CAD takes precedence over these drawings.

Global tolerance is 0.3mm unless otherwise stated.

Detail drawings are available upon request.

3D STEP models are available under NDA





## Important Notice – Please Read Carefully

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Storage: 22°C at 50% relative humidity is recommended. Prolonged storage is not recommended.

Resale of VX products shall void any warranty granted by VX for such products.

This product shall not be used in life-support devices or other medical systems. Customer to independently verify information and shall test for all required certifications, including but not limited to, RoHS, ANSI Z87, and FDA.

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Augmented Reality
Design
Displays
Integration