# VT-SBC-EKT Single Board Computer



# User Manual

## Version: 1.3

## Revision History

| No. | Version | Description | Date |
|-----|---------|-------------|------|
| 1 | V1.0 | First release | Aug. 12, 2021 |
| 2 | V1.1 | Added GPIO & COM debugging | Jul. 20, 2022 |
| 3 | V1.2 | Updated the description on secure boot in BIOS | Jan. 9, 2023 |
| 4 | V1.3 | Added driver description, GPIO & COM debugging to the Windows manual | Jul. 24, 2023 |

# Table of Contents

# Foreword

Thank you for purchasing VT-SBC-EKT single board computer ("the Board" or "the Product"). This manual intends to provide guidance and assistance necessary on setting up, operating or maintaining the Product. Please read this manual and make sure you understand the functionality of the Product before putting it into use.

## Intended Users

This manual is intended for:

- Embedded software developer
- Custom development software engineer
- Other technically qualified personnel

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It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without notice.

## Technical Support and Assistance

Should you have any question about the Product that is not covered in this manual, contact your sales representative for solution. Please include the following information in your question:

- Product name and PO number;
- Complete description of the problem;
- Error message you received, if any.

## Vantron Technology, Inc.

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## Symbology

This manual uses the following signs to prompt users to pay special attention to relevant information.

| | |
|---|---|
| ⚠ | Caution for latent damage to system or harm to personnel |
| ⓘ | Attention to important information or regulations |

## General Safety Instructions

The Product is supposed be installed by knowledgeable, skilled persons familiar with local and/or international electrical codes and regulations. For your safety and prevention of damage to the Product, please read and observe carefully the following safety instructions prior to installation and operation. Keep this manual well for future reference.

- Do not disassemble or otherwise modify the Product. Such action may cause heat generation, ignition, electronic shock, or other damages including human injury, and may void your warranty.

- Keep the Product away from heat source, such as heater, heat dissipater, or engine casing.

- Do not insert foreign materials into any opening of the Product as it may cause the Product to malfunction or burn out.

- To ensure proper functioning and prevent overheating of the Product, do not cover or block the ventilation holes of the Product.

- Follow the installation instructions with the installation tools provided or recommended.

- The use or placement of the operation tools shall comply with the code of practice of such tools to avoid short circuit of the Product.

- Cut off the power before inspection of the Product to avoid human injury or product damage.

## Precautions for Power Cables and Accessories

⚠ Use proper power source only. Make sure the supply voltage falls within the specified range.

⚠ Place the cables properly at places without extrusion hazards.

⚠ There is a coin cell battery for powering the RTC. Therefore, please avoid short circuit of the battery during transportation or operation at high temperatures.

⚠ Cleaning instructions:

- Power off before cleaning the Product
- Do not use spray detergent
- Clean with a damp cloth
- Do not try to clean exposed electronic components unless with a dust collector

⚠ Power off and contact Vantron technical support engineer in case of the following faults:

- The Product is damaged
- The temperature is excessively high
- Fault is still not solved after troubleshooting according to this manual

⚠ Do not use in combustible and explosive environment:

- Keep away from combustible and explosive environment
- Keep away from all energized circuits
- Unauthorized removal of the enclosure from the device is not allowed. Do not change components unless the power cable is unplugged. In some cases, the device may still have residual voltage even if the power cable is unplugged. Therefore, it is a must to remove and fully discharge the device before replacement of the components.

# CHAPTER 1 INTRODUCTION

## 1.1    Product Overview

VT-SBC-EKT single board is powered by Intel® Elkhart Lake Atom® x6425E high-performance processor that has four cores capable of delivering high computing power for various embedded applications while keeping the CPU performance at a maximum of 15W power consumption. The Board supports two Ethernet ports transmitting at 10/100/1000Mbps. As to internal expansion, the box offers two M.2 slots, one for Wi-Fi and BT and the other optionally expandable for 4G/5G connection to keep the communication uninterrupted.

The board comes with an HDMI interface, a DP interface, and an LVDS/eDP connector to optimize image display. Five serial connectors are available to communicate with external devices to ensure a reliable, error-free data path.

Above all, its strong performance, stable quality, and excellent cost performance are second to none for smart business applications, making it a reliable solution for industrial IoT applications.

## 1.2    Terminology/Acronym

| Terminology/Acronym | Description |
|---|---|
| NC | No connection |
| VCC | Voltage common collector |
| GND | Ground |
| / | Active low signal |
| + | Positive of difference signal |
| - | Negative of difference signal |
| I | Input |
| O | Output |
| I/O | Input/output |
| P | Power or ground |
| A | Analog |
| OD | Open drain |
| CMOS | 3.3 V CMOS |
| LVCMOS | Low Voltage CMOS |
| LVTTL | Low Voltage TTL |
| 3.3V | 3.3 V signal level |

## 1.3    Block Diagram
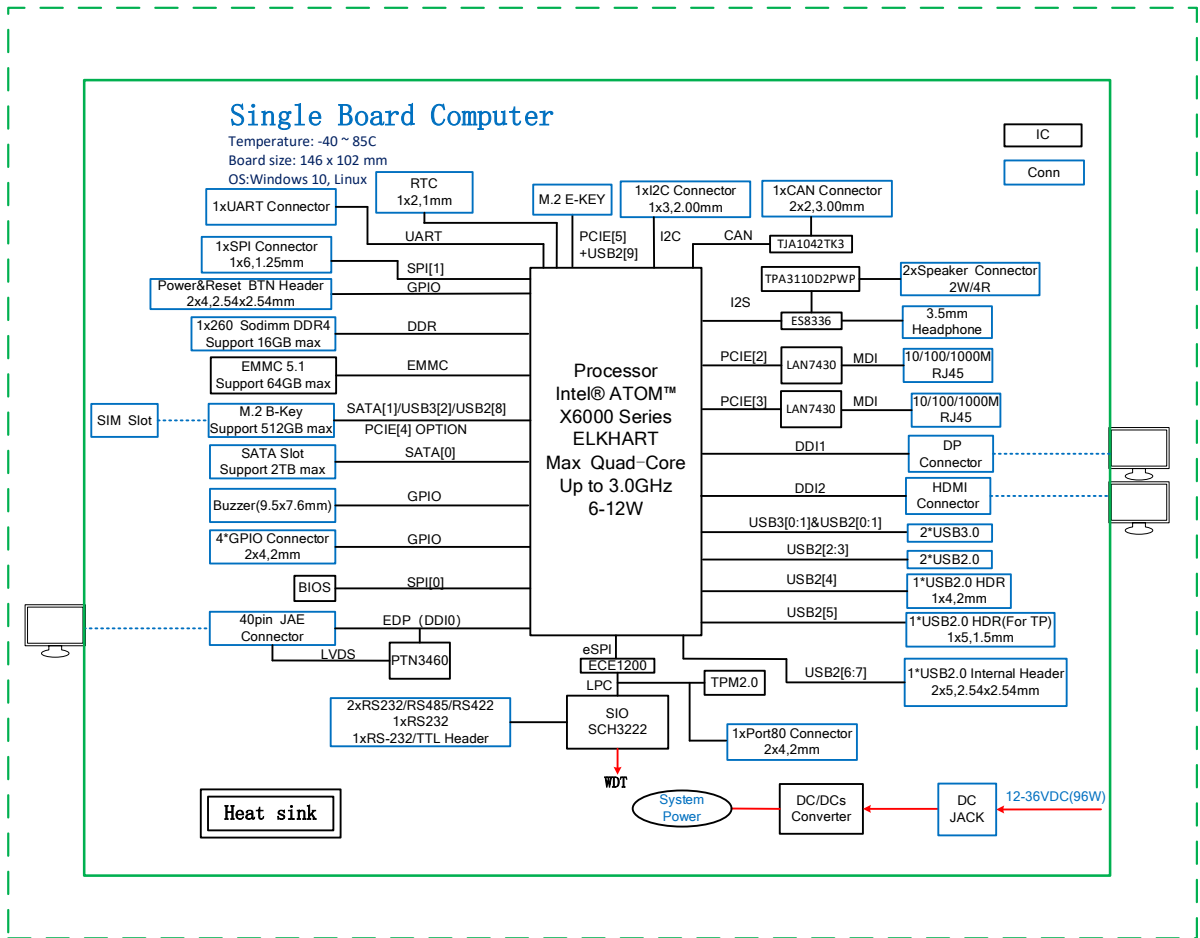
## 1.4    Specifications

| VT-SBC-EKT | | |
|---|---|---|
| **System** | CPU | Intel® Elkhart Lake Atom® x6425E processor, Quad-core, 3.0GHz (Max.) |
| | Memory | 1 x DDR4 SO-DIMM socket, 3200MT/s, up to 16 GB |
| | Storage | 64GB on-board eMMC (optional)<br>M.2 SSD supported (up to 256GB)<br>1 x SATA Gen 3 slot (6Gb/s, up to 2TB) |
| **Communication** | Ethernet | 2 x RJ45, 10/100/1000 Base-T, LAN7430 |
| | Wi-Fi & BT | Supported (expansion by an M.2 E-Key slot) |
| | 4G/5G | Supported (expansion by an M.2 B-Key slot) |
| **Media** | Display | 1 x HDMI 2.0b, 4096 x 2160 @60Hz<br>1 x DP 1.4, 7680 x 4320 @60Hz<br>1 x Dual LVDS/eDP connector, up to 3840 x 2160 @30Hz |
| | Audio | 1 x Headphone jack<br>1 x 3.5mm Microphone jack<br>2 x 2W/8R Speaker connector |
| **I/Os** | Serial | 2 x RS232/RS422/RS485 connector<br>2 x RS232 connector<br>1 x RS485 connector |
| | USB | 2 x USB 2.0 Host (Type-A)<br>2 x USB 3.0 Host (Type-A)<br>2 x USB 2.0 connector |
| | RTC | Supported |
| | Watchdog | Supported |
| | SATA | 1 x SATA Gen 3 slot |
| | Power | 1 x Power connector<br>1 x Power jack |
| | SIM card slot | 1 x Micro SIM card slot |
| **Expansion** | M.2 | 1 x M.2 B-Key, for SSD (2242) or 4G/5G (3052)<br>1 x M.2 E-Key, for Wi-Fi & BT (2230) |
| | GPIO | 4 x GPIO |
| | CAN | 2 x CAN |
| | SPI | 1 x SPI |
| **System control** | Button | 1 x Power button |
| **Security** | TPM | TPM 2.0 supported |
| **Power** | Input | 12-36V DC |
| | Consumption | 15W+ |
| **Software** | Operating system | Linux, Windows 10 |
| | SDK | SDK available |
| **Mechanical** | Dimensions | 153.5mm x 123 mm |
| | Cooling mode | Aluminum alloy heat sink (fanless) |
| **Environment Condition** | Temperature | Operating: -20°C ~ +60°C<br>Storage: -40°C ~ +85°C |
| | Humidity | 5%-95%RH (Non-condensing) |
| | Certifications | UL, FCC, IC, CE, RoHS, PTCRB |

## 1.5 Operating System

VT-SBC-EKT supports Linux and Windows operating systems. Currently this manual is based on the Windows operating system.

## 1.6 Mechanical Dimensions

- 153.5mm x 123mm
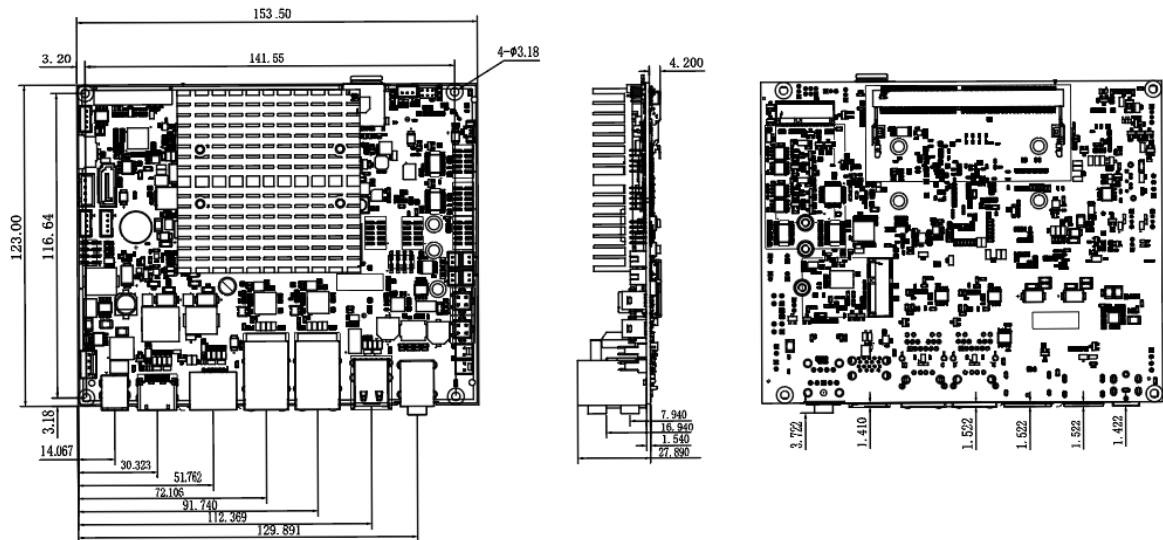


## 1.7 Power Supply and Consumption

VT-SBC-EKT works with 12V-36V DC power supply with 1.5A current recommended.

The power consumption of the Board is about 40W with speakers functioning and 15W with speakers not working. It should be pointed out that the power consumption is largely dependent on the RAM, storage capacity, and other configurations of the Board.

## 1.8 Environmental Specifications

VT-SBC-EKT works at a temperature ranging from -20℃ to +60℃, at relative humidity of 5%-95% for non-condensing purpose, and is designed to be stored at a temperature ranging from -40℃ to +85℃.

# CHAPTER 2 CONNECTORS AND PIN ASSIGNMENT

## 2.1    Product Layout
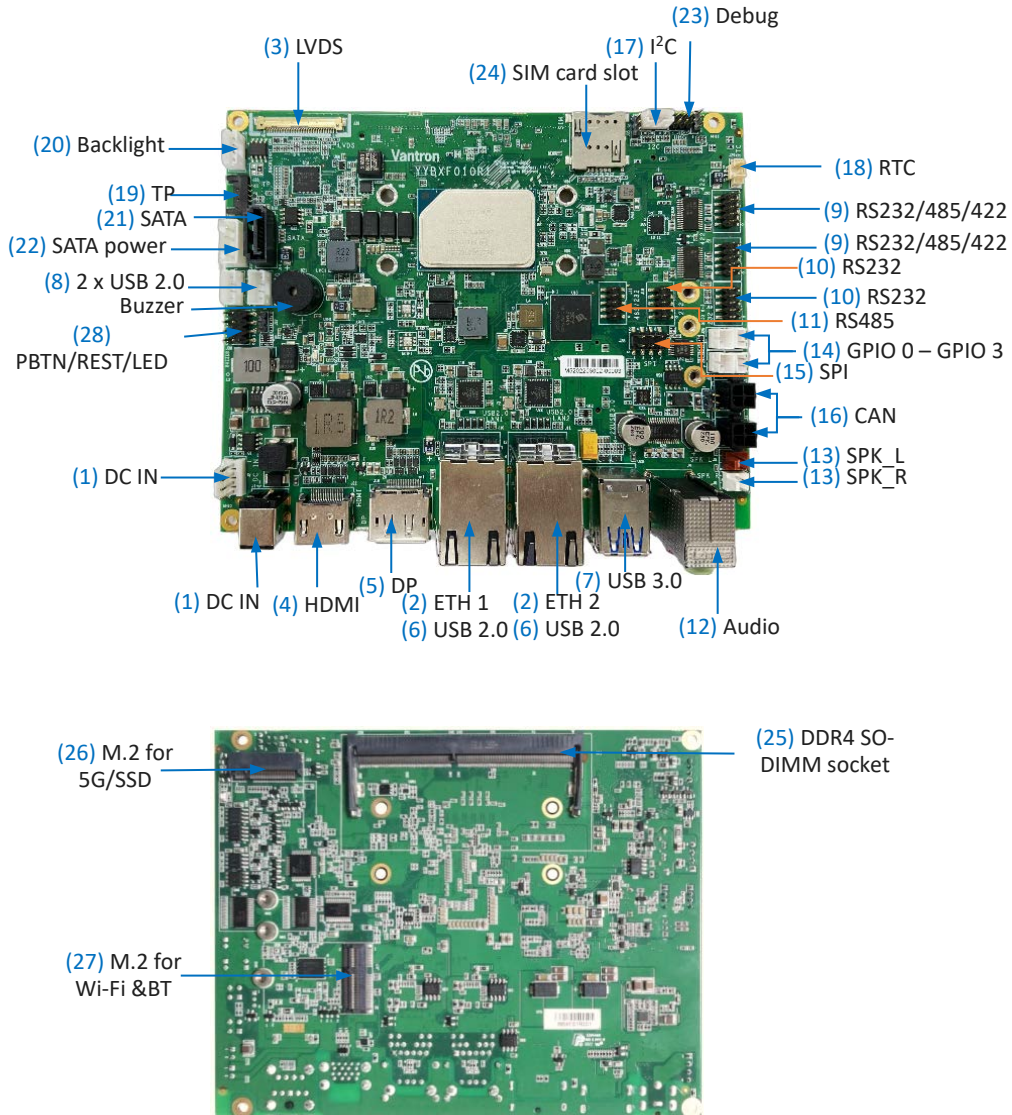




> ℹ️ *The board I/Os will be described in detail in 2.3 Connectors and Jumpers following the sequencing numbers provided here.*

## 2.2 System Configurations

### 2.2.1 CPU

VT-SBC-EKT is powered by Intel® Elkhart Lake Atom® x6425E quad-core processor.

### 2.2.2 Memory

VT-SBC-EKT provides a DDR4 SO-DIMM socket, supporting up to 16GB memory with transfer rate at 3200MT/s.

### 2.2.3 Storage

Depending on customer requests, the Board may provide 64GB on-board eMMC. The storage capacity is also expandable via an M.2 B-Key slot that supports up to 256GB storage, and a SATA Gen 3 slot that supports up to 3TB storage with transfer rate at 6Gb/s.

## 2.3 Connectors and Jumpers

This section is going to brief on the connectors/jumpers with corresponsive pinout description.

### 2.3.1 J2/J1 Power input (1)

VT-SBC-EKT provides a 4-pin power connector and a power jack to supply power for the Board.

Specification of the power connector (J2): 2.54mm, 10.0mm (H), 5A, Male, Vertical, White, WDT, THR, RoHS

Specification of the power jack (J1): 6mm, 10mm (H), Male, WDT, THR, RoHS

Pin 1

J2 Power connector                    J1 Power jack

Pinout description of the 4-pin power connector:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | +VDC | DC-IN POWER + |
| 2 | +VDC | DC-IN POWER + |
| 3 | GND | Ground |
| 4 | GND | Ground |

Pinout description of the power jack:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | +VDC | DC-IN POWER + |
| 2 | GND | Ground |
| 3 | GND | Ground |
| 4 | GND | Ground |
| 5 | GND | Ground |
| 6 | GND | Ground |

## 2.3.2  J10/J11 Ethernet jacks (2)

VT-SBC-EKT offers two RJ45 Ethernet jacks each with two LED indicators (L-Y, R-G), green for activity indication and yellow for link indication. The interfaces support 10/100/1000 Mbps transmission rate.

Ethernet port  Ethernet port

Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | L_MDI_0P | Ethernet MDI0+ Signal |
| 2 | L_MDI_0N | Ethernet MDI0- Signal |
| 3 | L_MDI_1P | Ethernet MDI1+ Signal |
| 4 | L_MDI_1N | Ethernet MDI1- Signal |
| 5 | L_MDI_2P | Ethernet MDI2+ Signal |
| 6 | L_MDI_2N | Ethernet MDI2- Signal |
| 7 | L_MDI_3P | Ethernet MDI3+ Signal |
| 8 | L_MDI_3N | Ethernet MDI3- Signal |

## 2.3.3 J39 LVDS/eDP connector (3)

VT-SBC-EKT implements a dual LVDS/eDP connector for connection of a display, supporting a resolution of up to 3840 x 2160 @30Hz.

Specification: 1 x 40, 0.5mm, 0.5A, 1.0mm (H), Right Angle, WDT, SMT, RoHS

Pin 1

Pinout description:

| Pin | Signal | Description |
|---|---|---|
| 1 | LVDS_B_D0- | LVSAE_DATA |
| 2 | LVDS_B_D0+ | LVSAE_DATA |
| 3 | LVDS_B_D1- | LVSAE_DATA |
| 4 | LVDS_B_D1+ | LVSAE_DATA |
| 5 | LVDS_B_D2- | LVSAE_DATA |
| 6 | LVDS_B_D2+ | LVSAE_DATA |
| 7 | GND | Ground |
| 8 | LVDS_B_CLK- | LVSAE_CLOCK |
| 9 | LVDS_B_CLK+ | LVSAE_CLOCK |
| 10 | LVDS_B_D3- | LVSAE_DATA |
| 11 | LVDS_B_D3+ | LVSAE_DATA |
| 12 | LVDS_A_D0- | LVSDO_DATA |
| 13 | LVDS_A_D0+ | LVSDO_DATA |
| 14 | GND | Ground |
| 15 | LVDS_A_D1- | LVSDO_DATA |
| 16 | LVDS_A_D1+ | LVSDO_DATA |
| 17 | LCD_DETECT- | LVDS DETECT |
| 18 | LVDS_A_D2- | LVSDO_DATA |
| 19 | LVDS_A_D2+ | LVSDO_DATA |
| 20 | LVDS_A_CLK- | LVSDO_CLOCK |
| 21 | LVDS_A_CLK+ | LVSDO_CLOCK |
| 22 | LVDS_A_D3- | LVSDO_DATA |
| 23 | LVDS_A_D3+ | LVSDO_DATA |

| | | |
|---|---|---|
| 24 | GND | Ground |
| 25 | GND | Ground |
| 26 | NC | |
| 27 | NC | |
| 28 | VDD_LCD | LCD POWER +5V |
| 29 | VDD_LCD | LCD POWER +5V |
| 30 | VDD_LCD | LCD POWER +5V |
| 31 | SEL 6/8 | SELECT 6 OR 8 DEPTH |
| 32 | LCD_BKLTEN | LCD BKL ENABLE |
| 33 | LCD_BKLT_PWM | LCD BKL PWM |
| 34 | GND | Ground |
| 35 | GND | Ground |
| 36 | GND | Ground |
| 37 | VCC_BLK | BKL Power+ |
| 38 | VCC_BLK | BKL Power+ |
| 39 | VCC_BLK | BKL Power+ |
| 40 | VCC_BLK | BKL Power+ |

### 2.3.4 J22 HDMI (4)

VT-SBC-EKT offers an HDMI 2.0b interface that supports a resolution of 4096 x 2160 @60Hz.

Specification: Type-A, FLN, Female, Right Angle, WDT, SMT, RoHS



Pinout description:

| Pin | Signal | Description |
|---|---|---|
| 1 | HDMI_DATA2+ | HDMI DATA |
| 2 | GND | Ground |
| 3 | HDMI_DATA2- | HDMI DATA |
| 4 | HDMI_DATA1+ | HDMI DATA |
| 5 | GND | Ground |
| 6 | HDMI_DATA1- | HDMI DATA |
| 7 | HDMI_DATA0+ | HDMI DATA |
| 8 | GND | Ground |
| 9 | HDMI_DATA0- | HDMI DATA |

| 10 | HDMI_CLK+ | HDMI CLK |
|----|-----------|----------|
| 11 | GND | Ground |
| 12 | HDMI_CLK- | HDMI CLK |
| 13 | NC | |
| 14 | NC | |
| 15 | HDMI_DDC_SCL | HDMI DDC I2C CLK |
| 16 | HDMI_DDC_SDA | HDMI DDC I2C DATA |
| 17 | GND | Ground |
| 18 | VCC_HDMI | HDMI POWER +5V |
| 19 | HDMI_HPD | HDMI HOT PLUG DETECTION |

### 2.3.5　J16 DP (5)

VT-SBC-EKT offers a DP 1.4 interface that supports a resolution of 7680 x 4320 @60Hz.

Specification: Type-A, FLN, Female, Right Angle, WDT, SMT, RoHS



Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | DP_DATA0+ | DP DATA |
| 2 | GND | Ground |
| 3 | DP_DATA0- | DP DATA |
| 4 | DP_DATA1+ | DP DATA |
| 5 | GND | Ground |
| 6 | DP_DATA1- | DP DATA |
| 7 | DP_DATA2+ | DP DATA |
| 8 | GND | Ground |
| 9 | DP_DATA2- | DP DATA |
| 10 | DP_DATA3+ | DP DATA |
| 11 | GND | Ground |
| 12 | DP_DATA3- | DP DATA |
| 13 | CONFIG1 | |
| 14 | CONFIG2 | |
| 15 | DP_AUX- | DP_AUX |

| 16 | GND | Ground |
|----|-----|--------|
| 17 | DP_AUX+ | DP_AUX |
| 18 | DP_HPD | DP HOT PLUG DETECTION |
| 19 | RETURN | |
| 20 | PWR_3.3V | DP POWER +3.3V |

## 2.3.6  J10/J11 USB 2.0 (6)

The two USB 2.0 Type-A interfaces on VT-SBC-EKT are designed to connect peripherals to expand the functions.

Specification: 2.0, Type-A, Female, Right Angle, Retention, WDT, THR, RoHS



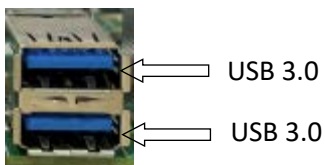The pinout description of the interfaces is in line with the pin assignment of standard USB 2.0 Type-A.

## 2.3.7  U26 USB 3.0 (7)

There are two USB 3.0 Type-A interfaces on VT-SBC-EKT for expansion of functions.

Specification: 3.0, Type-A, Female, 17.5mm (L), Right Angle, WDT, THR, RoHS



The pinout description of the interfaces is in line with the pin assignment of standard USB 3.0 Type-A.

## 2.3.8  J7/J8 USB 2.0 connectors (8)

There are two USB 2.0 connectors on the Board for function expansion too.

Specification: 1 x 4, 2.0mm, 2A, 6mm(H), Male, RA, WDT, THR, RoHS

Pin 1 ⟶          ⟵ Pin 1

Pinout description of J7:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | VCC_USB2.0_1 | USB POWER +5V |
| 2 | USB2.0_DN2 | Reserved usb2.0 Negative |
| 3 | USB2.0_DP2 | Reserved usb2.0 Positive |
| 4 | GND | Ground |

Pinout description of J8:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | VCC_USB2.0_1 | USB POWER +5V |
| 2 | USB2.0_DN9 | Reserved usb2.0 Negative |
| 3 | USB2.0_DP9 | Reserved usb2.0 Positive |
| 4 | GND | Ground |

## 2.3.9  J20/J21 RS232/RS422/RS485 (9)

VT-SBC-EKT implements two 10-pin RS232/RS422/RS485 multiplexers.

Specification: 2 x 5, 2.0mm,1.5A, 5.5mm (H), Male, Vertical, Black, WDT, THR, RoHS

Pin 1 ⟶          ⟵ Pin 2
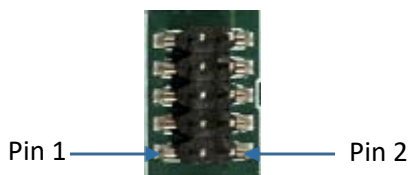
Please refer to the next page for the pinout of the connectors.

Pinout description:

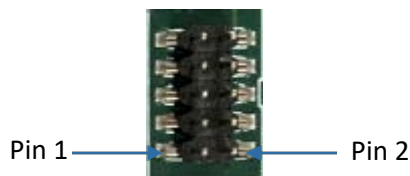| Pin No. | Signal | | | Device name |
|---|---|---|---|---|
| | RS232 | RS422 | RS485 | |
| 1 | DCD | 422TX+ | 485_A | |
| 2 | RXD | 422TX- | 485_B | |
| 3 | TXD | 422RX+ | / | |
| 4 | DTR | 422RX- | / | |
| 5 | GND | / | / | J20: /dev/ttyUSB0 |
| 6 | DSR | / | / | J21: /dev/ttyUSB3 |
| 7 | RTS | / | / | |
| 8 | CTS | / | / | |
| 9 | RI | / | / | |
| 10 | +V5_S | / | / | |

## 2.3.10 J18/J19 RS232 (10)

VT-SBC-EKT also implements two 10-pin RS232 connectors.

Specification: 2 x 5, 2.0mm, 1.5A, 5.5mm (H), Male, Vertical, Black, WDT, THR, RoHS



Pin 1 ——————→ ←—————— Pin 2

Pinout description:

| Pin | Signal | Description | Device name |
|---|---|---|---|
| 1 | DCD | RS232_RIN | |
| 2 | RXD | RS232_RXD | |
| 3 | TXD | RS232_TXD | |
| 4 | DTR | RS232_DTR | |
| 5 | GND | Ground | J18: /dev/ttyUSB2 |
| 6 | DSR | RS232_DSR | J19: /dev/ttyUSB1 |
| 7 | RTS | RS232_DOUT | |
| 8 | CTS | RS232_RIN | |
| 9 | RI | RS232_RIN | |
| 10 | +V5_S | +5V Power | |

## 2.3.11 J31 RS485 (11)

There is another 10-pin RS485 connector on the Board. The connector is not in use for the moment.

Specification: 2 x 5, 2.0mm, 1.5A, 6mm (H), Male, Vertical, WDT, THR, RoHS



Pin 1 —————→ Pin 2
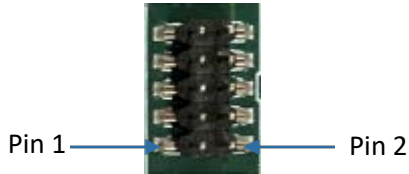
Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | NC | |
| 2 | NC | |
| 3 | HSUART0 _RS485_RX_DP | RS485_RX_DP |
| 4 | HSUART0 _RS485_TX_DP | RS485_TX_DP |
| 5 | HSUART0 _RS485_TX_DN | RS485_TX_DN |
| 6 | HSUART0 _RS485_RX_DN | RS485_RX_DN |
| 7 | NC | |
| 8 | NC | |
| 9 | GND | Ground |
| 10 | NC | |

## 2.3.12 J4 Audio jacks (12)

VT-SBC-EKT implements two 3.5mm audio jacks on the board, one is a headphone jack and the other is a Microphone jack.

Specification: 3.5mm, 4-Pole, Female, Right Angle, THR, RoHS



Headphone

Microphone
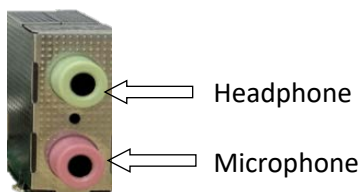
Please refer to the next page for the pinout of the jacks.

Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | GND | Ground |
| 2 | HPOUT_L_CRL | AUDIO JACK LEFT VOICE |
| 3 | HP_JD | HP Insert |
| 4 | GND | Ground |
| 5 | HPOUT_R_CRL | AUDIO JACK RIGHT VOICE |
| 21 | GND | Ground |
| 22 | MIC1_LLL | LEFT INPUT |
| 23 | MIC_JD | MIC Insert |
| 24 | GND | Ground |
| 25 | MIC1_RRR | RIGHT INPUT |

## 2.3.13 J19/J22 Speaker connectors (13)

There are two speaker connectors on the Board, providing left and right stereo sound experience to users when connected to the speakers.

Specification of the connectors: 1 x 2, 2.54 mm, 4A, 10.8mm (H), Male, Vertical, THR, RoHS



J19 Speaker (L) ⇒ ← Pin 1

J22 Speaker (R) ⇒ ← Pin 1
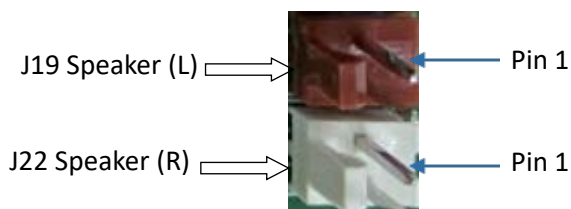
Pinout description of the J19 connector:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | OUTPL+ | 4R/2W SPEAKER ANODE |
| 2 | OUTPL- | 4R/2W SPEAKER CATHODE |

Pinout description of the J22 connector:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | OUTPR+ | 4R/2W SPEAKER ANODE |
| 2 | OUTPR- | 4R/2W SPEAKER CATHODE |

## 2.3.14 J24/J25/J26/J27 GPIO (14)

There are four 2-pin GPIOs on the Board for user expansion.

Specification: 1 x 2, 2.0mm, 2A, 6.0mm (H), Male, Vertical, WDT, THR, RoHS



Pinout description of J24:

| Pin | Signal | Description |
| --- | --- | --- |
| 1 | GPIO_0 | 3.3V TTL GPIO |
| 2 | GND | Ground |

Pinout description of J25:

| Pin | Signal | Description |
| --- | --- | --- |
| 1 | GPIO_1 | 3.3V TTL GPIO |
| 2 | GND | Ground |

Pinout description of J26:

| Pin | Signal | Description |
| --- | --- | --- |
| 1 | GPIO_2 | 3.3V TTL GPIO |
| 2 | GND | Ground |

Pinout description of J27:

| Pin | Signal | Description |
| --- | --- | --- |
| 1 | GPIO_3 | 3.3V TTL GPIO |
| 2 | GND | Ground |

## 2.3.15 J38 SPI (15)

VT-SBC-EKT implements an 8-pin SPI connector.

Specification: 2 x 4, 2.54mm, 2A, 8.7mm (H), Male, Vertical, WDT, THR, RoHS
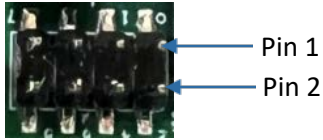


Pinout description:

| Pin | Signal | Description |
| --- | --- | --- |
| 1 | VCC_SPI1 | +3.3V POWER |
| 2 | SPI1_IO3_R | SPI1 |
| 3 | SPI1_CLK_R | SPI1_CLK |
| 4 | SPI1_IO2_R | SPI1 |
| 5 | SPI1_IO0_MOSI_R | SPI1 |
| 6 | SPI1_IO2_R | SPI1 |
| 7 | SPI1_CS0_N_R | SPI1 |
| 8 | SPI1_IO1_MISO_R | SPI1 |

## 2.3.16 J33/J34 CAN (16)

There are two 4-pin CAN connectors on the Board.

Specification: 2 x 4, 3.0mm, 9.2mm (H), Male, Vertical, WDT, THR, RoHS
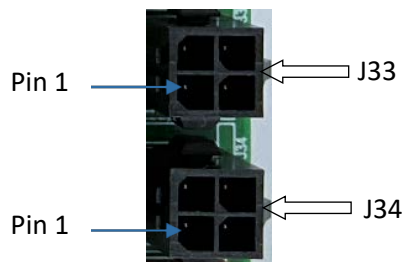


Please refer to the next page for the pinout of the connectors.

Pinout description of J33:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | CAN1_Hi+ | CAN1_H |
| 2 | +V5A | +5V POWER |
| 3 | CAN1_Hi- | CAN1_L |
| 4 | GND | Ground |

Pinout description of J34:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | CAN0_Hi+ | CAN0_H |
| 2 | +V5A | +5V POWER |
| 3 | CAN0_Hi- | CAN0_L |
| 4 | GND | Ground |

## 2.3.17 J36 I$^2$C (17)

The Board offers a 3-pin I2C connector.

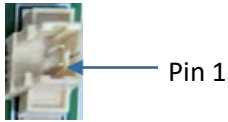Specification: 1 x 3, 2.0mm, 2A, 6mm (H), Male, Vertical, WDT, THR, RoHS



Pin 1

Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | GND | Ground |
| 2 | SOC_I2C0_SDA | I2C0_SDA |
| 3 | SOC_I2C0_SCL | I2C0_SCL |

## 2.3.18 J29 RTC battery connector (18)

There is an RTC battery connector on the Board to provide the battery signal.

Specification: 1 x 2, 1.25mm, 1A, 4.6mm (H), Male, Vertical, White, WDT, THR, RoHS
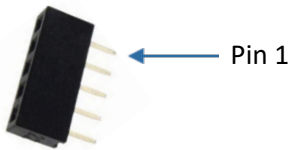
Pin 1

Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | BAT_PWR | RTC + |
| 2 | GND | RTC - |

## 2.3.19 J23 TP connector (19)

The 5-pin TP connector is designed to connect a touch panel.

Specification: 1 x 5, 1.50mm, 1.5A, 6mm (H), Male, Vertical, WDT, THR, RoHS

Pin 1

Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | GND | Ground |
| 2 | GND | Ground |
| 3 | USB2.0_DP7 | USB2.0_DP |
| 4 | USB2.0_DN7 | USB2.0_DN |
| 5 | USB_2.0_TP | +5V POWER |

## 2.3.20 J40 Backlight connector (20)

VT-SBC-EKT offers a backlight connector that supplies power for the backlight of the touch panel.

Specification: 1 x 4, 2.0mm, 2A, 6mm (H), Male, Vertical, WDT, THR, RoHS

Pin 1

Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | VCC_BLK | +12V/+5V POWER |
| 2 | GND | Ground |
| 3 | LCD_BKLT_PWM | BKLT_PWM |
| 4 | LCD_BKLTEN | LCD_BKLTEN |

## 2.3.21 J16 SATA connector (21)

The SATA connector is designed to connect a storage device for capacity expansion.
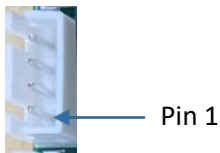
Specification: 7-Pin, 1.27mm, 8.4mm (H), WDT, SMT, RoHS

The pinout description of the connector is in line with the pin assignment of standard SATA connector.

## 2.3.22 J17 SATA power connector (22)

VT-SBC-EKT offers a 4-pin power connector to supply power to the storage device.

Specification: 1 x 4, 2.54mm, 2A, 6mm (H), Male, Vertical, WDT, THR, RoHS

Pin 1

Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | +V5_S | POWER +5V |
| 2 | GND | Ground |
| 3 | GND | Ground |
| 4 | +V12_S | POWER +12V |

### 2.3.23 J9 Debug connector (23)

The debug connector is used for Board debugging.

Specification: 2 x 3, 2.0mm, 1.5A, 8mm (H), Male, Vertical, Black, WDT, THR, RoHS



Pin 1

Pinout description:

| Pin | Signal | Description |
| --- | --- | --- |
| 1 | +V3.3A | POWER +V3.3A |
| 2 | SPI1_POT80_CS_N_R | SPI1_POT80_CS |
| 3 | SPI1_POT80_CS_N_R | SPI1_POT80_CS |
| 4 | SPI1_CLK_DBG_PORT80 | SPI1_CLK_DBG |
| 5 | SPI1_IO0_MOSI_PORT80 | SPI1_IO0_MOSI |
| 6 | GND | Ground |

### 2.3.24 J13 SIM card slot (24)

VT-SBC-EKT offers a Micro SIM card slot.

Specification: Micro SIM, push-push, -25℃~90℃, No WP, SMT, RoHS

### 2.3.25 U11 DDR4 SO-DIMM socket (25)

The DDR4 SO-DIMM socket supports up to 16GB memory with transfer rate at 3200MT/s.

### 2.3.26 J12 M.2 B-Key slot (26)

VT-SBC-EKT offers an M.2 B-Key that can be expanded as a SATA or 4G/5G interface as per demands from the customer.

The pinout of the M.2 B-Key slot is in line with the pin assignment of standard M.2 slot for Key B.

## 2.3.27 J17 M.2 E-Key slot (27)

VT-SBC-EKT offers an M.2 E-Key that can be expanded as a Wi-Fi & BT interface as per demands from the customer.

The pinout of the M.2 E-Key slot is in line with the pin assignment of standard M.2 for Key E.

## 2.3.28 J30 PBTN/REST/LED (28)

VT-SBC-EKT offers a pin header that provides signals for SATA/LED/PBTN/REST.

Specification: 2 x 4, 2.54mm, 2A, 6.2mm (H), Male, Vertical, WDT, THR, RoHS

Pin 2 ⟶      ⟵ Pin 1
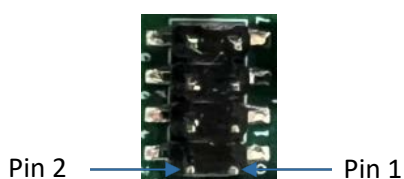
Pinout description:

| Pin | Signal | Description |
|-----|--------|-------------|
| 1 | SATA_ACT+ | +3.3V POWER |
| 2 | LED_POWER | +3.3V POWER |
| 3 | SATA_ACT# | GPIO |
| 4 | GND | Ground |
| 5 | GND | Ground |
| 6 | PBTN_IN#_C | PBTN_IN |
| 7 | SYS_REST#_R | SYS_REST |
| 8 | GND | Ground |

# CHAPTER 3 BIOS AND WINDOWS

Prerequisites for 3.1 ~ 3.5:

- VT-SBC-EKT

- Software release package of VT-SBC-EKT

- A keyboard, mouse and monitor to connect the Board for easier operation

- A host computer running Windows system

- 12V power adapter for powering up the Board

## 3.1    BIOS Introduction

BIOS initializes hardware like CPU and memory, and saves hardware settings for installation and loading of the operating system (OS).

Users may need to run BIOS Setup program when:

- An error message appears suggesting that the user should run BIOS Setup;

- Default settings need to be customized.

▷ *Please be aware that BIOS will be under continuous update for better system performance, therefore the description in this chapter might vary slightly and is for reference only.*
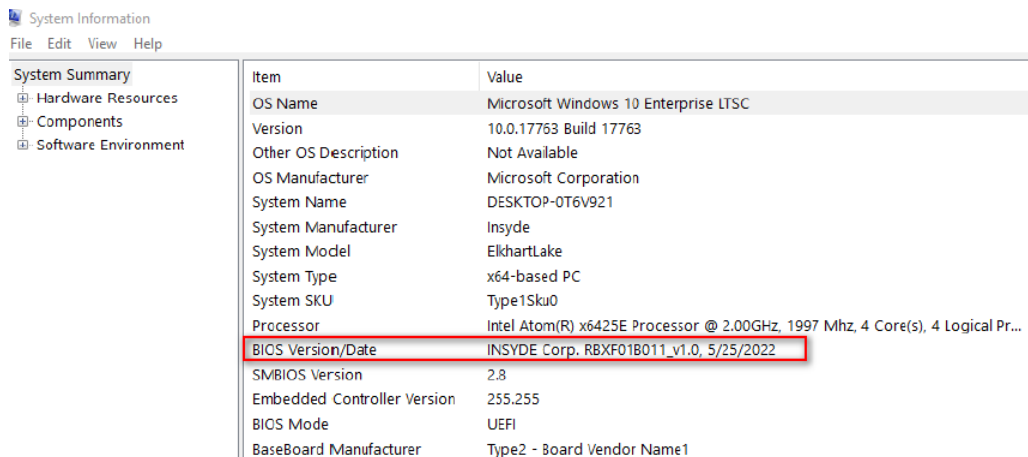
## 3.2    BIOS Version

The Board supports Windows operating system. You can check the BIOS version of the Board in Windows system in accordance with the following steps:

1. Press "Win + R" with the keyboard to call the command box;

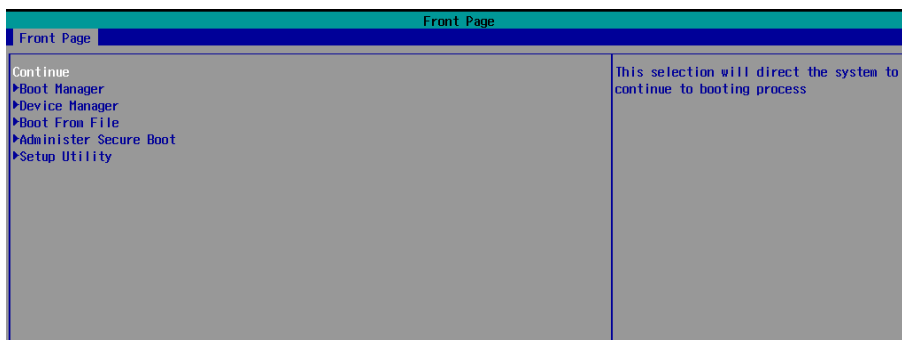2. Input **msinfo32** in the command box and click "OK" to confirm;
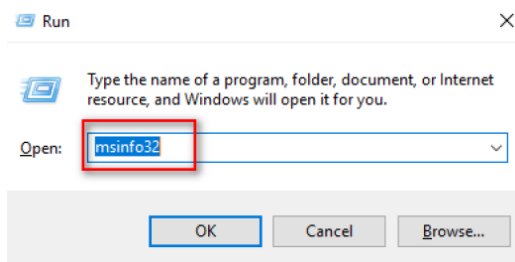
3. Move to BIOS Version/Date on the open page to check the detailed information.



## 3.3 BIOS Setup

### 3.3.1 Entering Setup

Power on the Board and the system will start the power-on self-test process. Then press **ESC** key to enter BIOS configuration page (front page) as shown below.



Description of the options:

| Option | Description |
|---|---|
| Continue | Proceed with the booting process |
| Boot Manager | View all boot devices, including USB drives, SSD, etc. |
| Boot From File | Choose to boot from an internal file, only for EFI partition |
| Administer Secure Boot | Configure secure boot function, and enable/disable secure boot |
| Setup Utility | Overview of all BIOS setup options. You must be very careful when modifying the default settings. |

### 3.3.2  Secure Boot

Secure Boot is firmware-dependent and requires that the computer BIOS is set to **UEFI** mode. It is disabled by default.

1. Power on the Board and press **ESC** to enter BIOS;

2. Select **Administer Secure Boot** on the front page;

3. Set **Erase all Secure Boot Settings** and **Restore Secure Boot to Factory Settings** to **Enabled**;
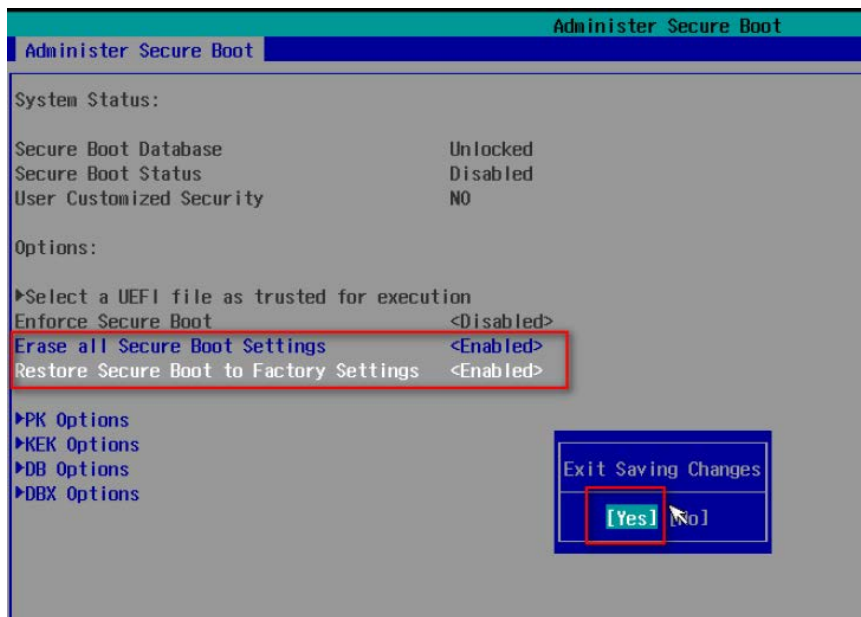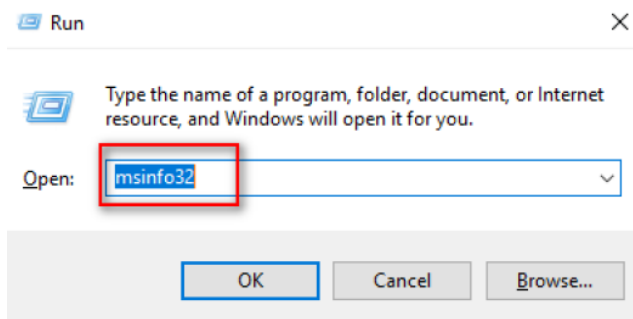


4. Press **F10** to save and exit;

5. There will be a dialog box indicating the system will be reset. Click **OK**, and the system will reboot;

6.  If you need to disable Secure Boot after that, set **Enforce Secure Boot** to **Disabled**.
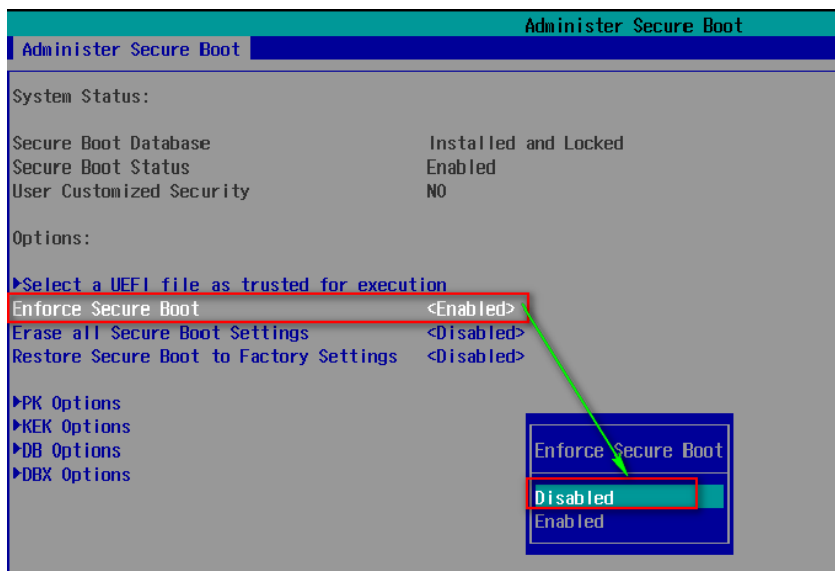
Check the Secure Boot State in the Windows system:

1. Press the "Win + R" with the keyboard to call the command box;
2. Input **msinfo32** in the command box and click "OK" to confirm;



3. Move to **BIOS Mode** and **Secure Boot State** on the open page to check the detailed information.

Use the up and down arrow keys on the keyboard to enter BIOS Setup Utility, which features the following menus in the menu bar:

- Main (basic system configurations, like BIOS version, processor information, system language, system time and date)

- Advanced (advanced configurations to allow users to customize the system)

- Security (system security settings where users can set supervisor passwords)

- Power (CPU power settings for power management purpose)

- Boot (system boot options)

- Exit (BIOS load or exit options with or without changes saved)

### 3.3.3  Setup Utility – Main
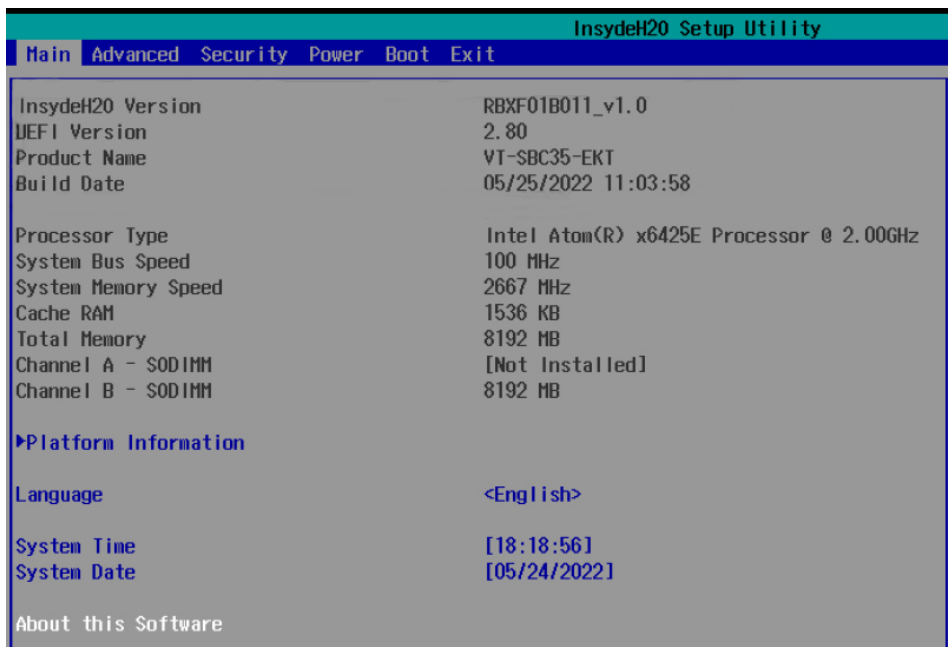


- Language: You can select from English, French, Chinese, and Japanese for system language.

- System Time: The time format is <Hour>: <Minute>: <Second>.

- System Date: The date format is <Month>/ <Day>/<Year>.

### 3.3.4 Setup Utility – Advanced
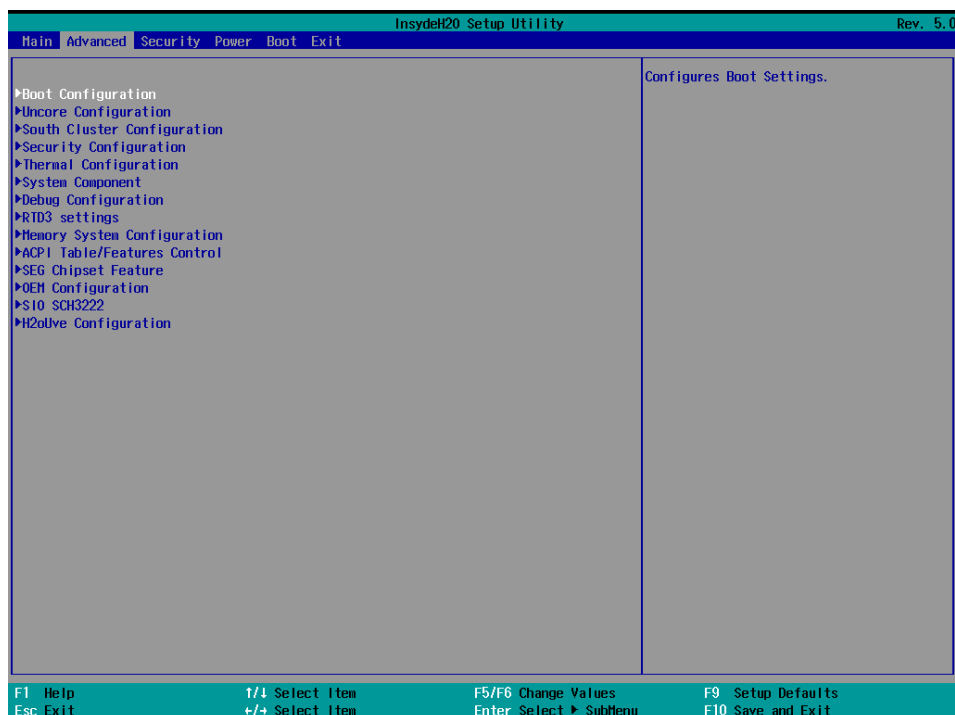


- Boot Configuration: You can select the operating system that you would like the Board to run on.

- Uncore Configuration: You can customize the video settings, GOP settings, IGD settings, and IPU PCI device settings here.

- South Cluster Configuration: This page provides configuration options for audio, GMM, ISH, LPSS, PCIe, SATA, SCC, USB, Timer, etc.

- Security Configuration: TPM device settings are made here.

- Thermal Configuration: Thermal management settings are customized here.

- System Component: Spread spectrum clocking configurations could be accessed from here.

- Debug Configuration: You can enable/disable the debugger here.

- Memory System Configuration: You can enable/disable the memory scrambler and other memory-related settings here.

- ACPI Table/Features Control: This option allows you to enable/disable S4 wakeup from RTC (only available for ACPI).

- SEG Chipset Feature: This option allows you to enable/disable wakeup on USB from S5 state.

- OEM Configuration: LVDS configurations are available to change.

- SIO SCH 3222: Serial ports are configured here.

- H2OUVE Configuration: You can enable/disable the configuration interface of H2OUVE tool.

### 3.3.5 Setup Utility – Security
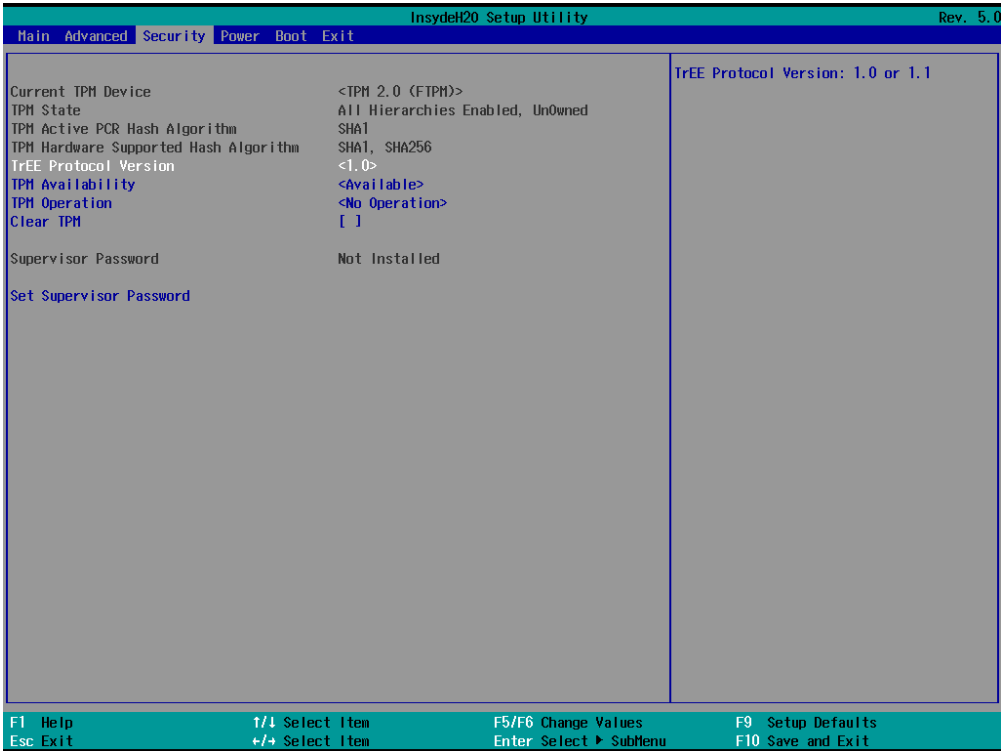


- Information of current TPM device is available here and you can set the supervisor passwords as well.

## 3.3.6 Setup Utility – Power
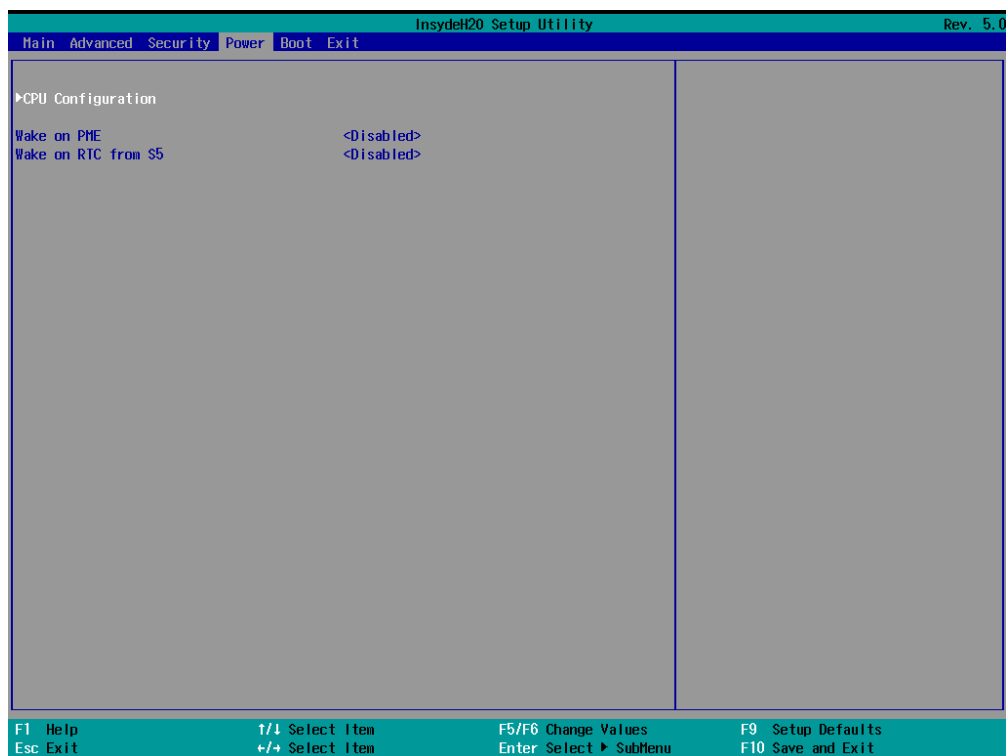


- CPU configurations are customizable.

- Options for wakeup on PME/RTC from S5 are available.

## 3.3.7  Setup Utility – Boot
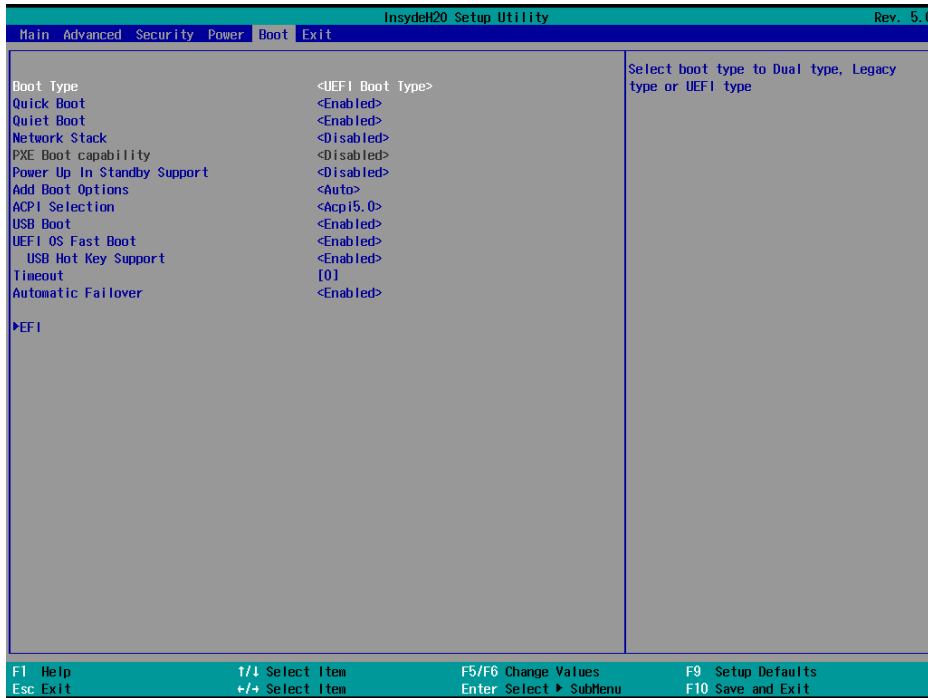


- Users can set the boot mode, the sequence, timeout, and automatic failover of boot devices when BIOS attempts to load the operating system.

- The PXE feature will help users efficiently deploy the operating system through network after enabling Network Stack and PXE Boot capability on the Boot page.

### 3.3.8  Setup Utility – Exit

```
                              InsydeH20 Setup Utility                         Rev. 5.0
   Main  Advanced  Security  Power  Boot  Exit

                                                        Exit system setup and save your changes.
Exit Saving Changes
Save Change Without Exit
Exit Discarding Changes
Load Optimal Defaults
Load Custom Defaults
Save Custom Defaults
Discard Changes
```

```
F1  Help              ↑/↓ Select Item       F5/F6 Change Values      F9  Setup Defaults
Esc Exit              ←/→ Select Item       Enter Select ▶ SubMenu   F10 Save and Exit
```

- Options for users to load or exit BIOS Setup include loading system optimal defaults or loading custom settings, exiting with custom changes save or not saved.

## 3.4    Driver Introduction

The table below lists the drivers in the software release package of the Board (path: \Win10 Driver) that might be used to run VT-SBC-EKT and their respective use.

| Driver folder | Description |
| --- | --- |
| Audio | To provide advanced audio effects and processing options for audio devices |
| Chipset | To tell the user if the chipset INF file needs to be updated |
| CSME | To provide support for various features and enhancements for graphics rendering and display |
| Graphic | |
| HID | To filter and manage the input of various HID & input devices |
| LAN | To provide support for the LAN7400 Ethernet Controller commonly used in network interface cards |
| PSE | To provide support for the Ethernet connection; to improve the performance and security of the system |
| Serial IO | To provide support for various input/output devices |
| USB2UART | To enable communication between the USB port on the device and the UART interface |
| WLAN&BT | To provide various features and enhancements for wireless and Bluetooth connectivity |
| WWAN | To enable communication between the scanner and the operating system |

## 3.5    GPIO & COM Debugging

### 3.5.1  GPIO setup

Run the test tool **GpioDemo.exe** from the directory \SW Guide\GPIO Test\TestGpioDemo_vxxx.zip in the release package to test the GPIOs. Make sure Windows Desktop runtime 6.0 (\RuntimeLib) is installed before running the test tool.
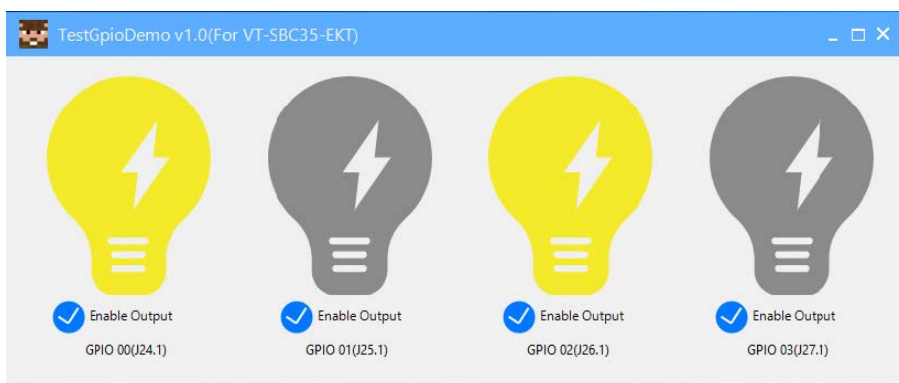


When the **Enable output** option before a GPIO is ticked, the interface is set to the output mode and you can pull it up or down by clicking the bulb icon.

| GPIO | Header number | CPU GPIO | Default mode | Default level |
|------|---------------|----------|--------------|---------------|
| GPIO0 | J24.1 | GP_H12 | Output | Low |
| GPIO1 | J25.1 | GP_H13 | Output | Low |
| GPIO2 | J26.1 | GP_H15 | Output | Low |
| GPIO3 | J27.1 | GP_H21 | Output | Low |

### 3.5.2  Serial port setup

VT-SBC-EKT implements 5 serial connectors including two RS232/RS422/RS485 multiplexers (J20 & J21) and two RS232 connectors (J18 & J19). J31 (RS485) is not in use for the moment. In the BIOS system, J20, J21, J18 & J19 are mapped as serial ports A, B, C, D, respectively.

After connecting the serial ports to the host computer, if you need install a serial port driver, navigate to the directory of the USB2UART driver (\Win 10 Driver\USB2UART) and run the **xrusbser.exe** after unzipping the driver folder.

If you wish to change the mode of the J20/J21 multiplexers (COM A & COM B),

1. Power on the Board and press the **ESC** key during the system boot to enter BIOS;

2. Nvigate to **Setup Utility > Advanced > COM Configuration** in sequence;

3. Move the cursor to **Serial Port A Mode / Serial Port B Mode** (depending on which serial port you intend to use), and use the up & down arrows to change the modes;
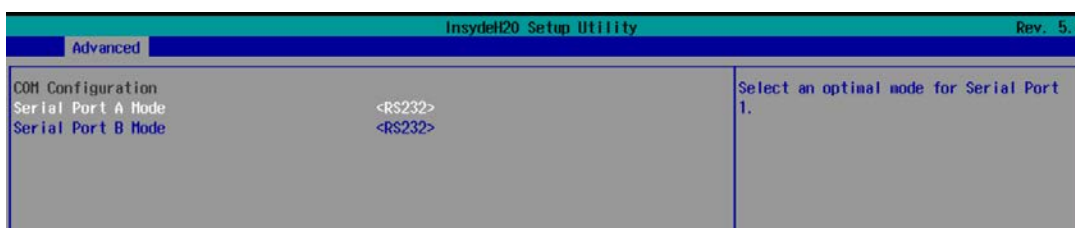


4. Press **F10** to save and exit.

You can use the **TestCommPC Vxxx** tool in the directory of \SW Guide\COM test in the release package for serial debugging.

## 3.6    Installing Windows 10 System

### 3.6.1  Prerequisites

- VT-SBC-EKT

- A USB drive with capacity no less than 8GB, preferably supporting USB 3.0

- Release package of VT-SBC-EKT

- A program for making the bootable device: rufus-xxx .exe (path in the release package: \Firmware)

- Windows 10 image (path in the release package: \Firmware)

- A host computer running Windows system

- A keyboard, mouse and monitor to connect the Board for easier operation

- 12V power adapter for powering up the Board

### 3.6.2  Making a Bootable USB Drive for Windows 10

Plug the USB drive into the host computer. Run rufus-xxx .exe and it will automatically detect the USB drive. Then follow the steps below to make a bootable USB drive.

1. Click on **Device** and choose the USB drive you want to use from the drop-down list;

2. Select the ISO image you want to burn onto the USB drive and click **Select**;

3. Generally, users would like to create a **Standard Windows installation**, and Rufus will automatically detect the correct **Partition Scheme** based on the USB drive. Yet make sure the partition scheme is **GPT**;

4. Set the Target system as **UEFI** and the File system as **FAT32** or **NTFS**;

5.  Click **START** to make the bootable USB drive;
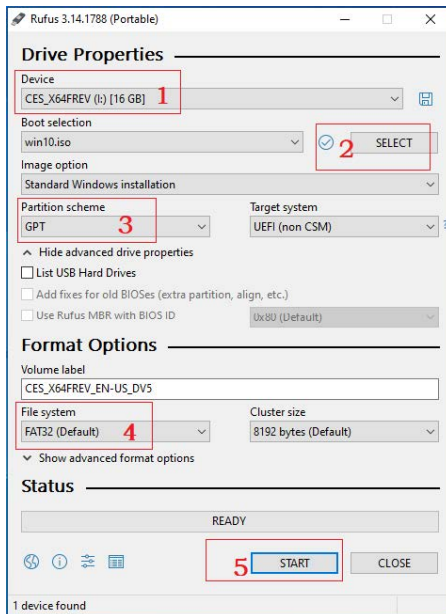


6.  Unplug the USB drive from the host computer after the bootable device is successfully made.

### 3.6.3  System Installation

1.  Plug the bootable USB drive into the Board;

2.  Power on the Board and it will enter the boot process;

3.  Press **ESC** during the system bootup to enter the BIOS configuration page;

4.  Navigate to **Boot Manager** in the configuration page;

5.  Select the bootable USB drive you created for Windows 10 and press **ENTER**;
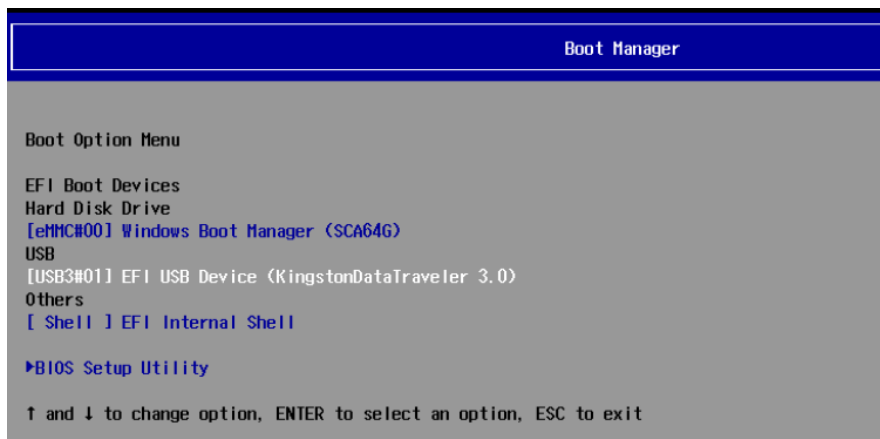


6.  Wait for the installation of Windows 10 on the Board.

# CHAPTER 4 UBUNTU SYSTEM MANUAL

Prerequisite for 4.1 ~ 4.2:

- VT-SBC-EKT

- A keyboard, mouse and monitor to connect the Board for easier operation

- An Ubuntu host computer

- 12V power adapter for powering up the Board

## 4.1　About the System

Ubuntu is a Linux distribution and VT-SBC-EKT is running Ubuntu 18.04 LTS.

### 4.1.1　User and password

Users need to login to the system after system boot.

o User name: vantron

o Password: vantron

You can use the sudo su command to switch to the root user (password: vantron).

### 4.1.2　System information

1. Connect the Board with a USB mouse, a keyboard and a monitor for easier operation;

2. Power on the Board and input the password to login the default user ("vantron");

   Password: vantron

3. Click the **Show Applications** icon ⊞ on the bottom left corner to access the system applications;

4. Click **Settings > About** to check more information about the device system；

5. You can also run the cat /proc/version command to check the system information.

### 4.1.3  Date & time setup

Please confirm if the system time is correct after first bootup. To change the system time, click **Settings > Date & Time** to open the setup page：

1. Toggle on **Automatic Date & Time** to keep the device time with the Internet (the Board shall have internet access);

2. You can also input the date and time manually once you toggle off the option;

3. Select/search for the target time zone and set the time format;

4. Click **Lock** at the top of the interface to save the settings;

5. Exit and await the settings to take effect.

### 4.1.4  Ethernet/Wi-Fi

VT-SBC-EKT is configured to have Internet access once it connects to a live Ethernet or joins to a Wi-Fi network. Users can add a VPN network in the **Settings > Network** interface.

Make sure you have installed the Wi-Fi antennas before connecting to an existing wireless network.

You can input the following command to check the information of the network interface: ip link show.

### 4.1.5  User

Users will be able to edit the system account and add/delete a user after inputting the password and unlocking the current user.

## 4.2    GPIO & COM Debugging

### 4.2.1  GPIO setup

Please refer to 2.3.14 for the pinout description of the GPIOs. Hardware GPIO0 ~ GPIO3 are mapped as GPIO1, GPIO2, GPIO3, and GPIO4, respectively in the software system.

Use the **gpiotool** script to control the GPIO pins.

1. Give the user the permission to read and write the **gpiotool** folder;

   # sudo chmod 777 gpiotool

2. Run the following command to open GPIO0and set the level of GPIO0 to "high";

   # sudo ./gpiotools 1 on

3. Close GPIO1 and set the level of GPIO0 to "low";

   # sudo ./gpiotools 1 off

You can repeat the above steps to set the level of the other GPIOs.

### 4.2.2  Serial port setup

VT-SBC-EKT implements 5 serial connectors including two RS232/RS422/RS485 multiplexers (J20 & J21) and two RS232 connectors (J18 & J19). J31 (RS485) is not in use for the moment. In the BIOS system, J20, J21, J18 & J19 are mapped as serial ports A, B, C, D, respectively.

You have to enter BIOS to switch the serial mode of the multiplexers.

1. Power on the Board and press the **ESC** key during the system boot to enter BIOS;

2. Nvigate to **Setup Utility > Advanced > COM Configuration** in sequence;

3. Move the cursor to **Serial Port A Mode / Serial Port B Mode** (depending on which serial port you intend to use), and use the up & down arrows to change the mode;
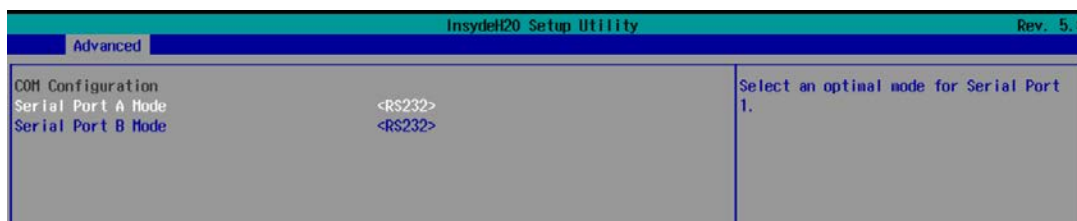


4. Press **F10** to save and exit.

To test if the serial ports function properly, use a USB-to-serial adapter to connect a serial port and the host computer first, then use a serial communication program to check if the serial port functions properly.

Alternatively, you can cross connect any two serial ports (TX to RX, RX to TX, GND to GND for RS232, A to A, B to B for RS485, TX+ to RX+, TX- to RX- for RS422) and use one for transmitting data and the other for receiving data via a serial communication program. This allows you to input the commands directly in the console.

J20 and J21 are mapped as /dev/ttyUSB0 and ttyUSB3, respectively in the software system, and J18 and J19 are mapped as /dev/ttyUSB2 and ttyUSB1, respectively.

1. Use a proper serial adapter to connect a serial port to the host computer, or cross connect the serial ports on the Board;

2. Use a serial communication program (e.g., microcom) to open the serial port (e.g., J20);

   # microcom -s 115200 /dev/ttyUSB0

3. Type any data string in the terminal and press Enter to send the data to the connected serial device;

4. Open a serial emulator on the connected serial device to check if the data is received.

## 4.2.3 CAN

The Board implements two CAN connectors, CAN0 and CAN1. CAN1 is not in use for the moment.

1. Bring down CAN0 and bring it back up to configure its baud rate to 125000;

   $ sudo ifconfig can0 down

   $ sudo ip link set can0 up type can bitrate 125000

2. Send data;

   # cansend can0 500#1E.10.12.22

3. Receive data.

   # candump can0

## 4.3   Image Flashing on an Ubuntu Host Computer

### 4.3.1  Prerequisites

- VT-SBC-EKT

- An Ubuntu host computer

- Release package of VT-SBC-EKT

- A USB Type-A to Type-C cable

### 4.3.2  Image flashing

1. Connect the Device with the host computer using the USB Type-A to Type-C cable;

2. Open a Terminal and input the following command to install ADB tool, if needed;

   $ sudo apt-get install adb -y

3. Check if the Board is connected to the Ubuntu host via ADB;

   $ adb devices -l

4. Run adb shell to execute shell commands on the Board;

5. Input reboot loader to reboot the Board in loader mode;

6. Copy the release package of VT-SBC-EKT to the Ubuntu host (for instance, in the root directory of Documents);
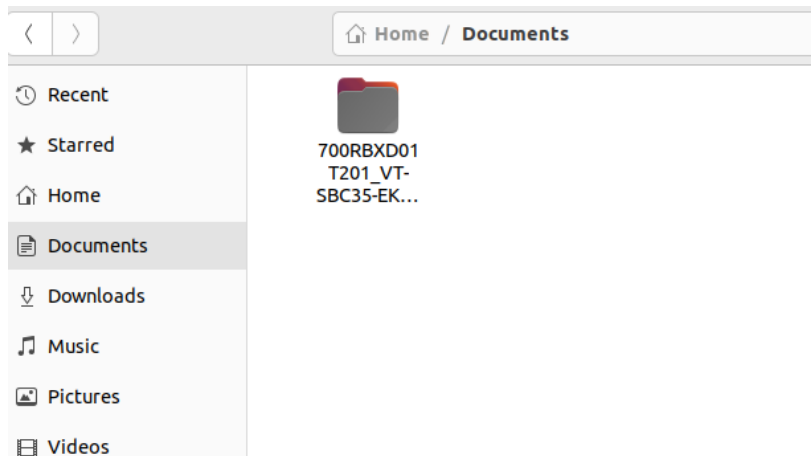
7.  Unzip the package and open the **image** folder, right click the mouse in an empty area and click **Open in Terminal** to execute the subsequent commands in the new Terminal;
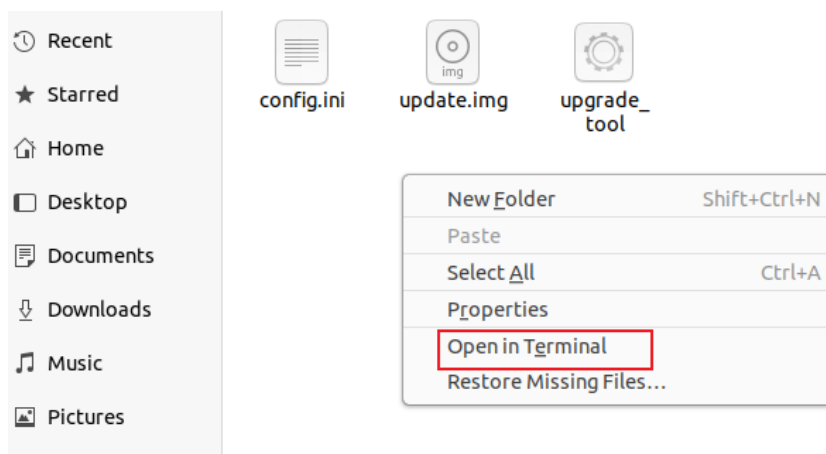


8.  Input the following command to download the image and upgrade;

    sudo ./upgrade_tool uf update.img

9.  Input the sudo password to download the system image;

10. The system will start upgrading once the download finishes, and the Board will reboot automatically when the upgrade finishes.

# CHAPTER 5 DISPOSAL AND WARRANTY

## 5.1 Disposal

When the device comes to end of life, you are suggested to properly dispose of the device for the sake of the environment and safety.

Before you dispose of the device, please back up your data and erase it from the device.

It is recommended that the device is disassembled prior to disposal in conformity with local regulations. Please ensure that the abandoned batteries are disposed of according to local regulations on waste disposal. Do not throw batteries into fire or put in common waste canister as they are explosive. Products or product packages labeled with the sign of "explosive" should not be disposed of like household waste but delivered to specialized electrical & electronic waste recycling/disposal center.

Proper disposal of this sort of waste helps avoid harm and adverse effect upon surroundings and people's health. Please contact local organizations or recycling/disposal center for more recycling/disposal methods of related products.

## 5.2    Warranty

### Product warranty

VANTRON warrants to its CUSTOMER that the Product manufactured by VANTRON, or its subcontractors will conform strictly to the mutually agreed specifications and be free from defects in workmanship and materials (except that which is furnished by the CUSTOMER) upon shipment from VANTRON. VANTRON's obligation under this warranty is limited to replacing or repairing at its option of the Product which shall, within **24 months** after shipment, effective from invoice date, be returned to VANTRON's factory with transportation fee paid by the CUSTOMER and which shall, after examination, be disclosed to VANTRON's reasonable satisfaction to be thus defective. VANTRON shall bear the transportation fee for the shipment of the Product to the CUSTOMER.

### Out-of-Warranty Repair

VANTRON will furnish the repair services for the Product which are out-of-warranty at VANTRON's then-prevailing rates for such services. At customer's request, VANTRON will provide components to the CUSTOMER for non-warranty repair. VANTRON will provide this service as long as the components are available in the market; and the CUSTOMER is requested to place a purchase order up front. Parts repaired will have an extended warranty of 3 months.

### Returned Products

Any Product found to be defective and covered under warranty pursuant to Clause above, shall be returned to VANTRON only upon the CUSTOMER's receipt of and with reference to a VANTRON supplied Returned Materials Authorization (RMA) number. VANTRON shall supply a RMA, when required within three (3) working days of request by the CUSTOMER. VANTRON shall submit a new invoice to the CUSTOMER upon shipping of the returned products to the CUSTOMER. Prior to the return of any products by the CUSTOMER due to rejection or warranty defect, the CUSTOMER shall afford VANTRON the opportunity to inspect such products at the CUSTOMER's location and no Product so inspected shall be returned to VANTRON unless the cause for the rejection or defect is determined to be the responsibility of VANTRON. VANTRON shall in turn provide the CUSTOMER turnaround shipment on defective Product within **fourteen (14) working days** upon its receipt at VANTRON. If such turnaround cannot be provided by VANTRON due to causes beyond the control of VANTRON, VANTRON shall document such instances and notify the CUSTOMER immediately.