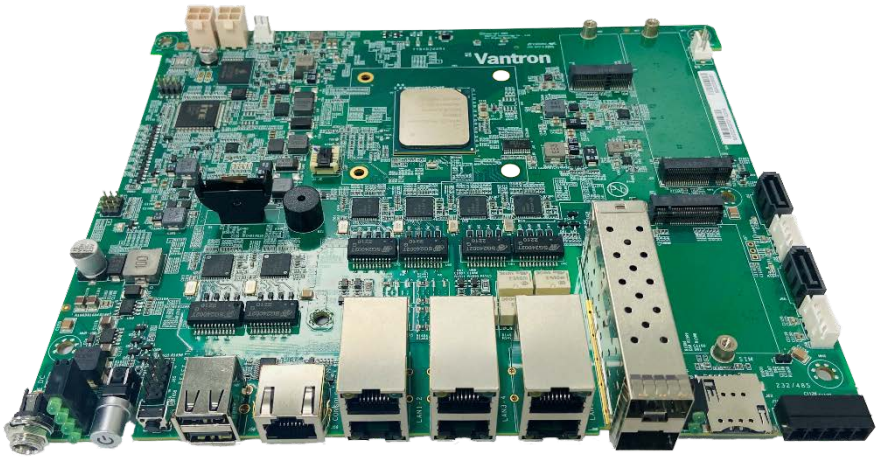
VT-SBC-C3558R Single Board Computer



User Manual

Version: 1.2

Revision History

No.	Version	Description	Date
1	V1.0	First release	Nov. 23, 2022
2	V1.1	1. Modified Wi-Fi AP mode test steps 2. Added LED indicator (HA) and WDT debugging instructions	Jan. 10, 2023
3	V1.2	1. Added LED indicator (bypass) debugging instructions 2. Updated WDT debugging instructions 3. Updated description of the jumper blocks	Apr. 19, 2023

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Foreword

Thank you for purchasing VT-SBC-C3558R 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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Disclaimer

While all information contained herein has been carefully checked to assure its accuracy in technical details and typography, Vantron does not assume any responsibility resulting from any error or features of this manual, nor from improper uses of this manual or the software.

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-C3558R single board computer is powered by Intel Atom® C3558R Quad-core processor that extends low-power Intel® architecture into new segments and accelerates IoT innovation across a wide range of environments and use cases.

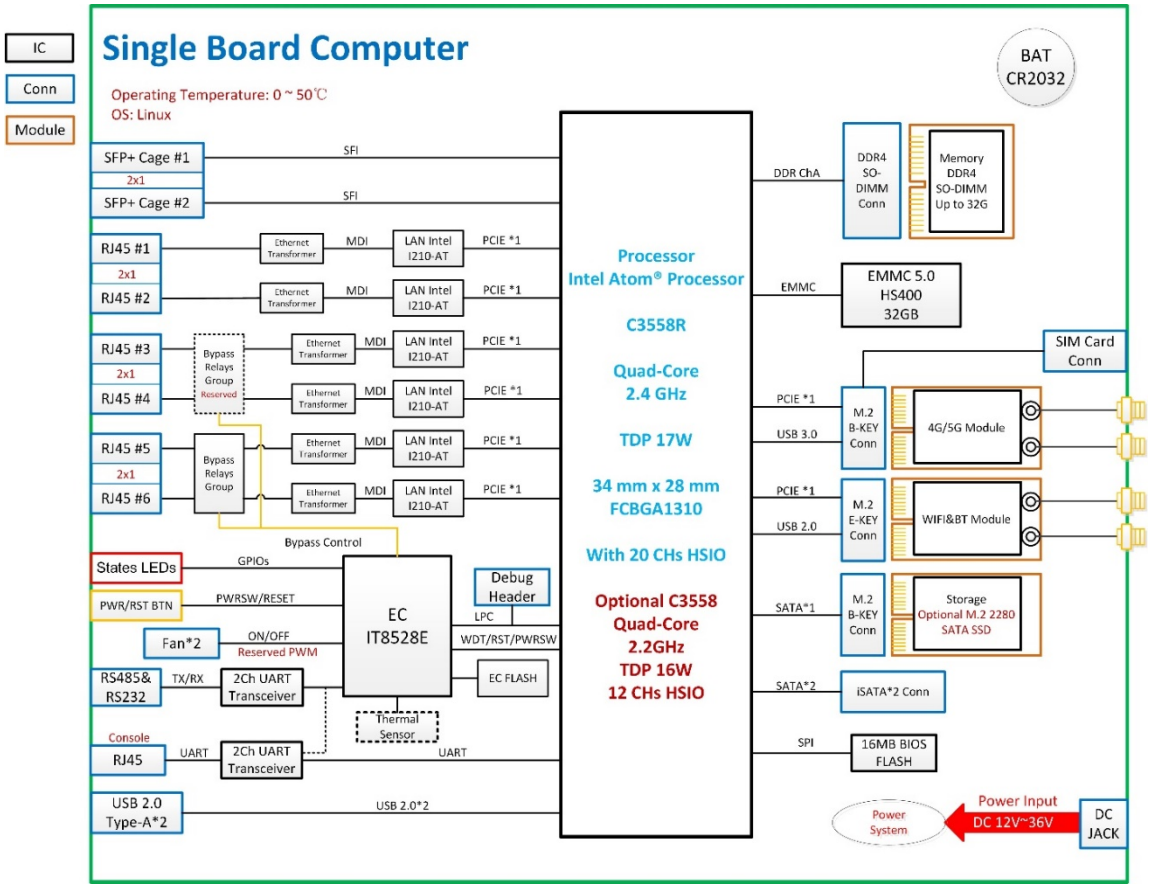
The Board offers 6 Ethernet jacks, including 2 that are bypassed by default to keep data transfer uninterrupted in case of network failure. Customers also have an expansion option to implement two gigabyte SFP connectors in stacked configuration for high-speed signal conversion and data transmission. The Board implements an M.2 B-Key slot for 4G/5G cellular communication.

The integrated technologies and pre-validated solutions of VT-SBC-C3558R enable industrial, energy, aerospace, robotics, public sector, and other customers with demanding edge IoT workloads to easily extract value from data, reduce time to market, and innovate new connected technologies faster.

1.2 Terminology

Terminology	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
5V	5V signal level
USB	5V tolerant signal
PCIe	PCI Express signal, not 3.3 V tolerant

1.3 Block Diagram



1.4 Specifications

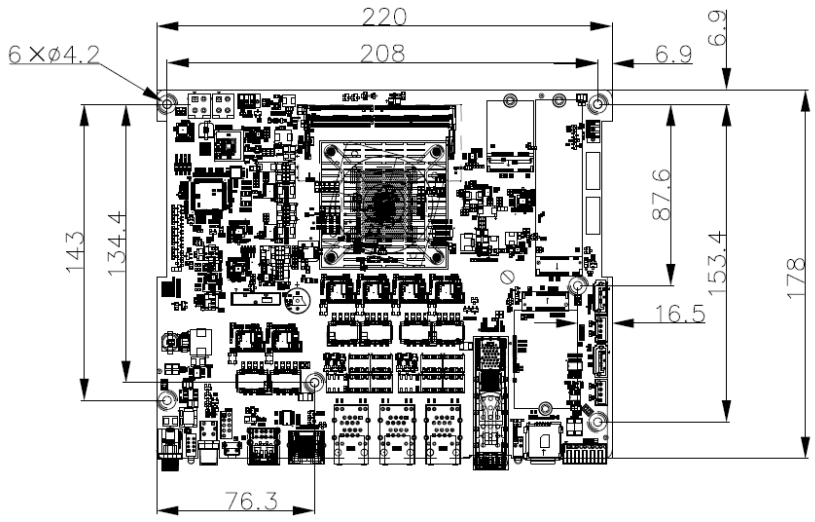
VT-SBC-C3558R			
System	CPU	Intel Atom® C3558R Quad-core processor, 2.4GHz (17W TDP)	
	Memory	1 x DDR4 SO-DIMM socket (up to 32GB)	
	Storage	32GB eMMC V5.0 2 x SATA 3.0 connector 1 X M.2 B-Key for SSD card	
Communication	Ethernet	6 x RJ45, 10/100/1000Mbps Bypass: 1 pair (Optional: 2 pairs)	
	SFP	2 x 10Gb SFP connector with activity indicators (Optional)	
	Cellular	Optional	
	Wi-Fi & BT	Optional	
I/Os	Serial port	1 x RS232	1 x RS485
	USB	2 x USB 2.0 Type-A	
	Console	1 x RJ45 Console	
	SIM slot	1 x Micro SIM slot	
	Security	FTPM 2.0 (Default) or DTPM 2.0	
	Jumper	1 x Clear RTC jumper 1 x Clear CMOS jumper	1 x Flash descriptor security override jumper
	RTC	Supported	
	WDT	Supported	
Expansion	Bus	1 x M.2 E-Key (2242) for Wi-Fi/BT module 1 x M.2 B-Key (3052) for 4G/5G module 1 x M.2 B-Key (2280) for SATA SSD	
System Control	Button	1 x Reset button	1 x Power button
	LED indicator	1 x Power indicator 1 x System indicator	1 x HA indicator 1 x Bypass indicator
Power	Input	12V~36V DC	1 x Power jack (wide input voltage) 2 x Internal power connector (12V)
	Consumption	40W+	
Software	Operating system	Yocto	
Mechanical	Dimensions	220mm x 178mm	
	Cooling mode	2 x Fan connector (12V DC)	
Environment Condition	Temperature	Operating: 0°C~+50°C	Storage: -20°C~+70°C
	Humidity	Operating and storage: RH 10%-85% (Non-condensing)	
	Certification	RoHS	

1.5 Operating system

VT-SBC-C3558R supports Yocto operating system. Please refer to Yocto Project Reference Manual for the guidelines on developing a Yocto project.

1.6 Mechanical Dimensions

- 220mm x 178mm



1.7 Power Supply and Consumption

VT-SBC-C3558R works with 12V-36V DC power supply.

The power consumption of the Board is about 40W. It should be pointed out that power consumption is largely determined by the RAM, storage capacity, and other configurations of the board.

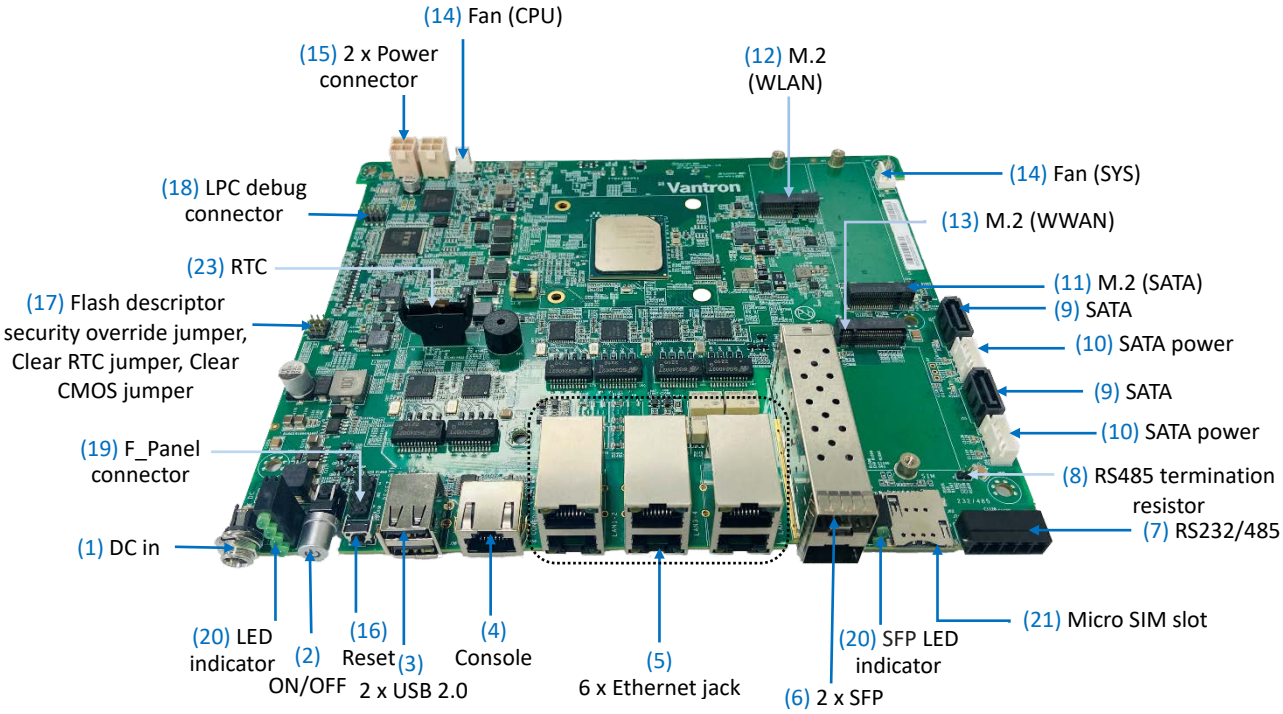
1.8 Environmental Specifications

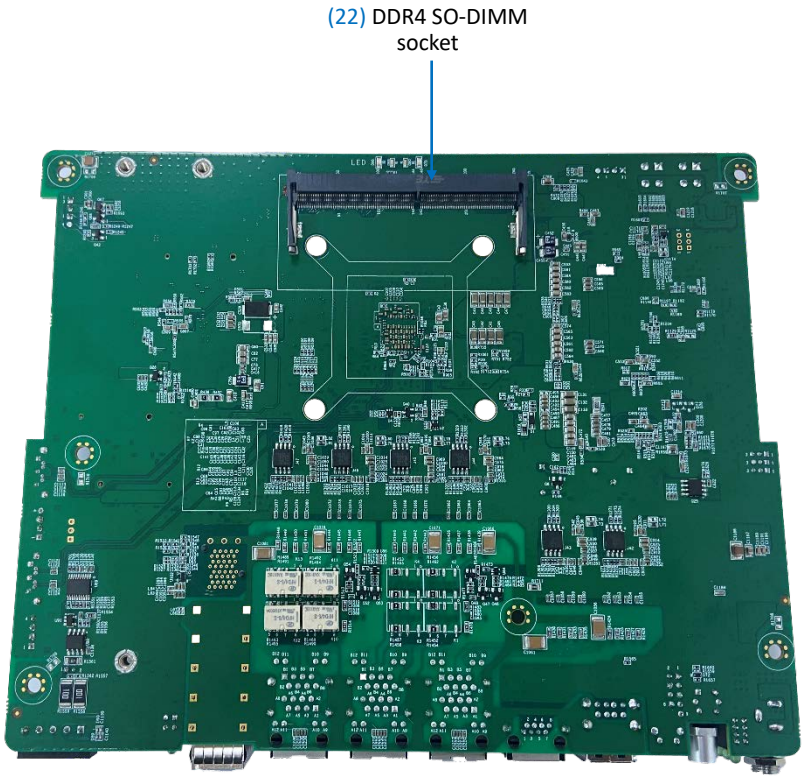
VT-SBC-C3558R works at a temperature ranging from 0℃ to +50℃ and is designed to work and be stored at relative humidity of 10% to 85% for non-condensing purpose.

CHAPTER 2

CONNECTOR DESCRIPTION

2.1 Product Layout





2.2 Memory and Storage

2.2.1 DDR4 RAM

VT-SBC-C3558R implements a DDR4 SO-DIMM socket, supporting up to 32GB RAM.

2.2.2 eMMC Flash

VT-SBC-C3558R provides an eMMC 5.0 flash with 32GB capacity by default. It is used as the default boot and storage device.

There are additional two SATA 3.0 connectors and an M.2 B-Key (2280) on the Board for users to expand the storage capacity.

2.3 Identification of Pin 1

Unless otherwise stated, pin 1 of a connector is seated on a square pad that is different from the round pads used for other pins. Sometimes, pin 1 is next to a trigonal mark on the board. When there are two rows of pins on a connector, the row with pin 1 is composed of odd numbers and the other is composed of even numbers.

Usually, there will be numbers or marks next to the pins of a connector on the board to indicate the pinouts.

2.4 Connectors and Jumpers

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

2.4.1 J66 Power jack (1)

VT-SBC-C3558R implements a power jack that supports wide input voltage range to supply power for the Board. The recommended input power is 19V @3.24A DC.

Specification: 2.5mmD, 5.5mmD, 5A, 24V, M, Lock, RA, -20~70℃, THR, RoHS

Pinout description:

Pin	Name	Type	Description
1	+VDC	P	DC-IN POWER +
2	GND	P	Ground
3	ADP_DET	I	Adapter detection

2.4.2 SW1 ON/OFF button (2)

The on/off button is used for turning the Board on or off. The Board is turned on by default after power application. Then a press of the on/off button will turn off the Board.

2.4.3 J58 USB 2.0 Type-A (3)

VT-SBC-C3558R implements two USB 2.0 Type-A interfaces that are stacked in layers to connect peripherals.

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

2.4.4 J59 Console port (4)

The Board is designed to connect the host PC for debugging or configuration via the Console port with an RJ45 to USB adapter. The software device name of the Consoles port is **/ttyS2**.

Specification: Retention: 7.7kg, Durability: 750 mating cycles mini, 0 LED, F-SHLD, F, RA, IND, THR, RoHS

Pinout description:

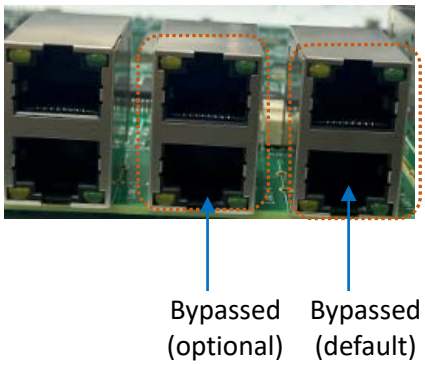
Pin	Name	Type	Description
1	NC		
2	NC		
3	CONSOLE_TXD1_R	O	RS232 TX
4	NC		
5	GND	P	Ground
6	CONSOLE_RXD1_R	I	RS232 RX
7	NC		
8	NC		

2.4.5 J48/J49/J50 RJ45 Ethernet jacks (5)

VT-SBC-C3558R offers six 10/100/1000Mbps RJ45 Ethernet jacks with every two jacks stacked in layers. Every Ethernet jack is provided with two LEDs, green for activity indication and yellow for link indication.

The two stacked Ethernet jacks on the right side are configured in bypass mode by default, wherein the Ethernet jacks are disconnected from the system and switched over to each other to create a crossed connection loop-back between the jacks, and all packets received from one port are transmitted to another in this pair and vice versa. If needed, the two Ethernet jacks in the middle can also be bypassed to keep data transfer uninterrupted in case of system failure.

Specification: 10/100/1000Mbps, No MAG, Ful-SHLD, F, RA, WDT, THR, RoHS



2.4.6 J51 SFP connectors + cage (6)

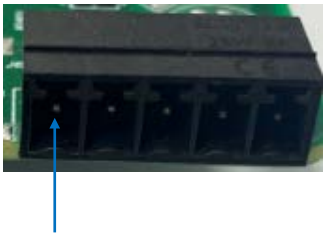
VT-SBC-C3558R offers an expansion option to customers to have two 10Gb SFP connectors with cages in stacked configuration. The SFP connectors support hot plug for data transmission.

Specification: SFP + CAGE, RA, WDT, THR, RoHS

2.4.7 J71 RS232 & RS485 (7)

VT-SBC-C3558R offers an RS232 & RS485 connector which is connected to the host PC via a USB to serial converter. RS232 corresponds to node /ttyS0 and RS485 to node /ttyS1 in the software environment.

Specification: 1 x 5, 3.81mm, 8A, No Lock, M, RA, -40~105℃, THR, RoHS



Pinout description:

Pin	Name	Type	Description
1	RS485A	IO	RS485A
2	RS485B	IO	RS485B
3	TXD1_R	O	RS232 TXD
4	RXD1_R	I	RS232 RXD
5	GND	P	Ground

2.4.8 JP1 RS485 termination resistor (8)

There is a 120Ω RS485 termination resistor on the Board to prevent reflection at the ends of the network for improved signal quality.

Specification: 1 x 2, 2.0mm, 1A, 8.2mmH, M, Vert, WDT, THR, RoHS

Normal mode (default)

Termination mode between RS485 A & B (pins 1 and 2 shorted)

2.4.9 J53/J55 SATA connectors (9)

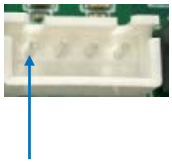
VT-SBC-C3558R implements two SATA 3.0 connectors for expansion of the storage.

Specification: STD, 7P, F, Vert, CMT, THR, RoHS

2.4.10 J54/J56 SATA power connectors (10)

The two 4-pin SATA power connectors are used to supply power for the storage devices.

Specification: 1 x 4, 2.5mm, 3A, 7.0mmH, M, Vert, IND, THR, RoHS



Pin 1

Pinout description:

Pin	Name	Type	Description
1	+V5S	P	+5VDC POWER
2	GND	P	Ground
3	GND	P	Ground
4	+V12S	P	+12VDC POWER

2.4.11 J52 M.2 B-Key (11)

VT-SBC-C3558R implements an M.2 B-Key (2280) slot, supporting SATA bus to connect an SSD card for storage expansion.

Specification: KEY B, 75P, 0.5mm, 6.4mmH, WDT, SMT, RoHS

2.4.12 J60 M.2 E-Key (12)

VT-SBC-C3558R implements an M.2 E-Key (2242) slot, supporting PCIe x1 bus to connect a Wi-Fi module or supporting USB 2.0 to connect a Bluetooth module for wireless communication.

Specification: KEY E, 75P, 0.5mm, 6.7mmH, WDT, SMT, RoHS

2.4.13 J61 M.2 B-Key (13)

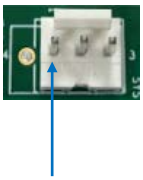
VT-SBC-C3558R implements an M.2 B-Key (3042) slot, supporting PCIe x1/USB 3.0 bus to connect a 4G/5G cellular module for wireless communication.

Specification: KEY B, 75P, 0.5mm, 6.4mmH, WDT, SMT, RoHS

2.4.14 J67/J68 Fan connectors (14)

The two fan connectors on the Board are used for active heat dissipation for the system and CPU.

Specification: 1 x 3, 2.54mm, 4A, 8.18mmH, M, Vert, WDT, THR, RoHS



Pin 1

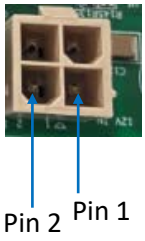
Pinout description:

Pin	Name	Type	Description
1	FAN_TACH_OUT	I	FAN Tachometer Data
2	+V12S	P	+12VDC POWER
3	GND	P	Ground

2.4.15 J69/J70 Power connector (15)

VT-SBC-C3558R offers two power connectors to supply 12V DC to the board. One could be used as the backup power supply in case of any failure on the other.

Specification: 2 x 2, 9.6 x 9.7mm, 6A, 12.8mmH, M, Vert, -40~105℃, THR, RoHS



Pinout description:

Pin	Name	Type	Description
1	GND	P	Ground
2	GND	P	Ground
3	+12VA	P	+12VDC POWER INPUT
4	+12VA	P	+12VDC POWER INPUT

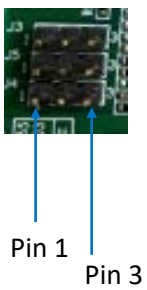
2.4.16 SW2 Reset button (16)

There is a reset button on the Board, and a short press of the button will restart the Board.

2.4.17 J3/J4/J5 Jumper blocks (17)

There are three jumper blocks on the Board, the flash security override jumper, the clear RTC jumper, and the clear CMOS jumper.

Specification: 1 x 3, 2.0mm, 1.5A, 6mmH, M, Vert, HL, WDT, THR, RoHS



- J3 Flash security override jumper

This jumper is used to enable/disable the BIOS flash. Under normal operations, the flash descriptor is locked (default). The security measures defined in the flash descriptor will be in effect. In the override mode, the flash descriptor is unlocked.

Normal mode (default):

Pins 1 and 2 shorted or

No shorting

Override mode:

Pins 2 and 3 shorted

Note: Asserting Flash Security Override Hard Strap high on the rising edge of RSMRST_N will also halt Intel ME after SoC bring up and disable runtime Intel ME features. This is a debug mode and must not be asserted after manufacturing/debug.

- J4 Clear CMOS jumper

This jumper allows you to clear the CMOS RAM.

Normal mode (default):

Pins 1 and 2 shorted or

No shorting

Clear CMOS mode:

Pins 2 and 3 shorted

Note: Unless CMOS is being cleared (only to be done in the G3 power state) or the battery is low, the signal input must always be high when all other RTC power planes are on.

- J5 Clear RTC jumper

This jumper allows you to reset all register bits in the RTC well.

Normal mode (default):

Pins 1 and 2 shorted

or

No shorting

Clear RTC mode:

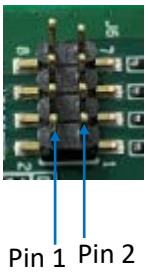
Pins 2 and 3 shorted

Note: Unless registers are being cleared (only to be done in the G3 power state), the signal input must always be high when all other RTC power planes are on.

2.4.18 J6 LPC debug connector (18)

The LPC debug connector is for connecting a debug card to monitor the BIOS POST status.

Specification: 2 x 4, 2 x 2mm, 2A, 4.7mmH, M, Vert, WDT, SMT, RoHS



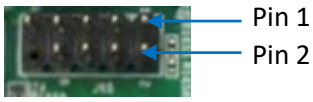
Pinout description:

Pin	Name	Type	Description
1	DBG_LPC_LAD0	IO	LPC_LAD0
2	+V3P3A	P	+3.3VDC POWER
3	DBG_LPC_LAD1	IO	LPC_LAD1
4	SOC_LPC_FRAME_N	O	LPC_FRAME
5	DBG_LPC_LAD2	IO	LPC_LAD2
6	SOC_LPC_CLKOUT1	O	LPC_CLK
7	DBG_LPC_LAD3	IO	LPC_LAD3
8	GND	P	Ground

2.4.19 J65 Front panel connector (19)

The front panel connector connects the power switch, reset switch and LED indicators on the front panel.

Specification: 2 x 5, 2.54 x 2.54mm, 9-Pin, 3A, 6mmH, M, Vert, WDT, THR, RoHS

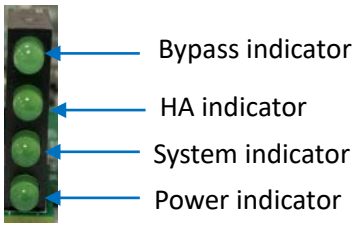


Pinout description:

Pin	Name	Type	Description
1	SATA LED+	P	3.3VDC SATA LED Power
2	SYSTEM LED+	P	3.3VDC SYSTEM LED Power
3	SATA LED-	O	SATA LED Signal
4	SYSTEM LED-	O	SYSTEM LED Signal
5	GND	P	Ground
6	PBTN_IN#	I	Power Button Signal Input
7	SYS_REST#	I	Reset Button Signal Input
8	GND	P	Ground
9	NC		NC

2.4.20 D69 LED indicators (20)

Apart from the SFP activity LED indicators, there are 4 independent LED indicators on the Board, including a power indicator, a system indicator, an HA indicator (programmable), and a bypass indicator (programmable). Please refer to **3.10** for the details of the programmable indicators.



2.4.21 J62 Micro SIM slot (21)

VT-SBC-C3558R offers a Micro SIM card slot.

Specification: Micro, Push-Push, 6P (outside), WDT, SMT, RoHS

2.4.22 DDR4 SO-DIMM (22)

VT-SBC-C3558R implements a DDR4 SO-DIMM socket at the back, supporting up to 32GB RAM.

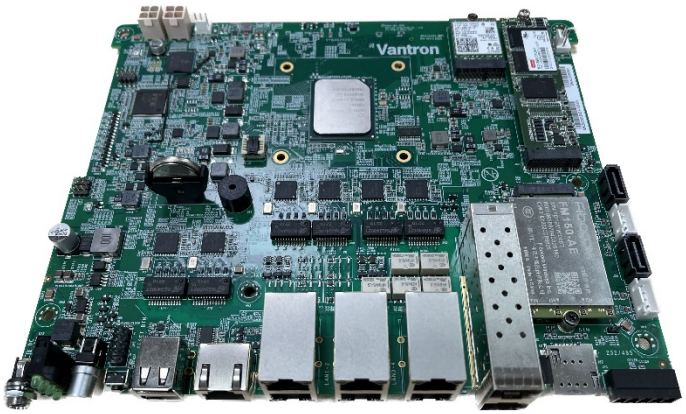
Specification: 5.2mm (H), 260P, Right angle, Cable-to-board

CHAPTER 3

FIRST-USE DEBUGGING

3.1 Interface Definition

Insert the necessary modules/cards when you debug the Board for the first use.



3.1.1 Console port

The Board is designed to be connected to a host PC for configuration or debugging via the Console port using an RJ45 to USB adapter.

The software device name of this port is **ttyS2**.

To test if the Console port works properly:

1. Connect the Console port of the Board to an Ubuntu host using an RJ45 to USB adapter;
2. Power up the Board;
3. Test if the Console port works properly.

```
# echo "this is console com" > /dev/ttyS2
this is console com
```

3.1.2 Serial port

VT-SBC-C3558R offers a connector that consists of an RS232 and an RS485, corresponding to **ttyS0** and **ttyS1** as to the device names, respectively. Please refer to 2.4.7 for the pinout description of the connector.

To activate the serial communication, follow the steps below:

1. Use a USB to serial converter to connect the serial connector of the Board and the host PC;

2. Open the settings of the serial communication tool (e.g., minicom);

```
$ sudo minicom -s
```

3. Change the serial device and baud rate as follows (RS232 port (ttyS0) for showcase);

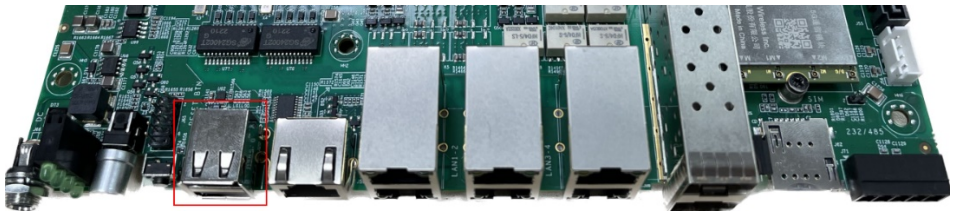
```
+-----------------------------------------------------------------------+
| A -    Serial Device      : /dev/ttyS0                                |
| B - Lockfile Location     : /var/lock                                 |
| C -   Callin Program      :                                           |
| D -  Callout Program      :                                           |
| E -    Bps/Par/Bits       : 115200 8N1                                |
| F - Hardware Flow Control : No                                        |
| G - Software Flow Control : No                                        |
| H -     RS485 Enable      : No                                        |
| I -   RS485 Rts On Send   : No                                        |
| J -  RS485 Rts After Send : No                                        |
| K -  RS485 Rx During Tx   : No                                        |
| L -  RS485 Terminate Bus  : No                                        |
| M - RS485 Delay Rts Before: 0                                         |
| N - RS485 Delay Rts After : 0                                         |
|                                                                       |
|    Change which setting?                                              |
+-----------------------------------------------------------------------+
```

4. Save the changes as default settings and exit the minicom;
5. Open the serial port using the minicom.

```
# sudo minicom -D /dev/ttyS0 -b 115200

Welcome to minicom 2.7.1

OPTIONS: I18n

Port /dev/ttyS0, 05:04:47

Press CTRL-A Z for help on special keys
```

3.1.3 USB interface

Insert a USB device via either of the USB Type-A interfaces on the Board before debugging.



Input the following commands to check/configure the USB interface.

1. Check the information of USB interfaces:

```
$ lsusb
```

2. Display details of the partitions on the USB device:

```
$ fdisk -l
```

3. Mount a USB device to a specified directory (e.g., /mnt):

```
$ mount /dev/xxx /mnt
```

4. Check the mounted content:

```
$ ls /mnt
```

5. Unmount the USB device:

```
$ umount /dev/xxx
```

3.2 Ethernet

3.2.1 1Gbps Ethernet jack

Connect any of the Ethernet jacks on the Board to the host PC with an Ethernet cable, then you can proceed to test the Ethernet jack.

1. Enable the “iperf” service before testing the bandwidth of the network;

```
# iperf -s
```

2. Test the bandwidth of the network by sending 1000MB of data to the iperf server (Ubuntu host).

```
# iperf -c 192.168.9.171 -n 1000M
 //replace the IP address with that of the iperf server (Ubuntu host)
------------------------------------------------------------
Client connecting to 192.168.9.171, TCP port 5001
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  3] local 192.168.9.123 port 52292 connected with 192.168.9.171 port 5001
[ ID] Interval       Transfer     Bandwidth
[  3]  0.0- 8.9 sec  1000 MBytes   942 Mbits/sec
```

3.2.2 10Gbps SFP port

Connect either of the SFP ports on the Board to the host PC with an SFP cable, then you can proceed to test the SFP port.

1. Enable the “iperf” service before testing the bandwidth of the network;

```
# iperf -s
```

2. Test the bandwidth of the network by sending 1000MB of data to the iperf server (Ubuntu host).

```
# iperf -c 192.168.9.171 -n 1000M
 //replace the IP address with that of the iperf server (Ubuntu host)
```

3.3 Wi-Fi

VT-SBC-C3558R implements an M.2 E-Key (2242) slot, supporting PCIe x1 bus to connect a Wi-Fi module or supporting USB2.0 to connect a Bluetooth module for wireless communication.

Before you set up the Wi-Fi network, please insert a Wi-Fi module into the slot and install the antenna, then use the *wpa_supplicant* tool and the *systemd* service manager for wi-Fi network connection and configuration.

3.3.1 Client mode

To use the Board as a client to connect a Wi-Fi hotspot:

1. Make sure the AP mode is disabled and check the status of the hotspot;

```
# systemctl stop hostapd
# systemctl status hostapd
```

2. Open the configuration file;

```
# vi /etc/wpa_supplicant.conf
```

3. Create the */etc/wpa_supplicant* directory and the */etc/wpa_supplicant/wpa_supplicant-wlan0.conf* file, and add an access point named “Jay iPhone”;

```
# vi /etc/wpa_supplicant.conf

ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=0
update_config=1

network={
      ssid="Jay iPhone"
      psk="jiayuhao"
}
```

4. Enable the *wpa_supplicant-wlan0* service to start connection;

```
# systemctl start wpa_supplicant@wlan0.service


pcieport 0000:00:09.0: AER: Multiple Corrected error received: id=0048
pcieport 0000:00:09.0: PCIe Bus Error: severity=Corrected, type=Physical Layer, id=0048(Receiver ID)
pcieport 0000:00:09.0:   device [8086:19a4] error status/mask=00000001/00002000
pcieport 0000:00:09.0:    [ 0] Receiver Error         (First)
IPv6: ADDRCONF(NETDEV_UP): wlan0: link is not ready
pcieport 0000:00:09.0: AER: Multiple Corrected error received: id=0048
pcieport 0000:00:09.0: PCIe Bus Error: severity=Corrected, type=Physical Layer, id=0048(Receiver ID)
pcieport 0000:00:09.0:   device [8086:19a4] error status/mask=00000001/00002000
pcieport 0000:00:09.0:    [ 0] Receiver Error         (First)
wlan0: authenticate with 5e:4c:7e:84:18:b7
wlan0: send auth to 5e:4c:7e:84:18:b7 (try 1/3)
wlan0: authenticated
wlan0: associate with 5e:4c:7e:84:18:b7 (try 1/3)
wlan0: RX AssocResp from 5e:4c:7e:84:18:b7 (capab=0x431 status=0 aid=1)
wlan0: associated
IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
```

5. Enable the *DHCP* service to obtain an IP address automatically;

```
# udhcpc -i wlan0
udhcpc: started, v1.27.2
udhcpc: sending discover
udhcpc: sending select for 172.20.10.2
udhcpc: lease of 172.20.10.2 obtained, lease time 86400
ip: RTNETLINK answers: File exists
/etc/udhcpc.d/50default: Adding DNS 172.20.10.1
```

6. Add a default route;

```
# route add default gw 172.20.10.1
```

7. Add a domain resolution server;

```
# vi /etc/resolv.conf
nameserver 8.8.8.8
```

8. Use the ping command to check if the network is connected properly.

```
# ping -I wlan0 www.yahoo.com
PING www.a.shifen.com (39.156.66.14) from 172.20.10.2 wlan0: 56(84) bytes of data.
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=1 ttl=50 time=337 ms
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=2 ttl=50 time=91.5 ms
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=3 ttl=50 time=134 ms
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=4 ttl=50 time=75.3 ms
```

3.3.2 AP mode

Disable the *wpa_supplicant@wlan0.service* (authentication for Wi-Fi client mode) service before using the Board as an access point.

```
# systemctl stop wpa_supplicant@wlan0.service

# ifconfig wlan0 down

# ifconfig wlan0 192.168.100.2 up
```

1. Open the *hostapd.conf* file;

```
# vi hostapd.conf
```

2. Edit the SSID and password for the Board;

```
# vi hostapd.conf


interface=wlan0
driver=nl80211
ssid=vt-sbc-c3558-AP
hw_mode=g
channel= 11
dtim_period= 1
rts_threshold=2347
fragm_threshold=2346
auth_algs=3
wpa= 1
```

```
wpa_passphrase=12345678
wpa_key_mgmt=WPA-PSK
wpa_pairwise=TKIP CCMP
rsn_pairwise=CCMP
```

3. Run the following command to open the hotspot configuration file and enable the hotspot service;

```
# hostapd -B hostapd.conf
Configuration file: hostapd.conf
Using interface wlan0 with hwaddr f0:57:a6:26:8e:91 and ssid "vt-sbc-c3558-AP"
IPv6: ADDRCONF(NETDEV_CHANGE): wlan0: link becomes ready
wlan0: interface state UNINITIALIZED->ENABLED
wlan0: AP-ENABLED
root@vt-sbc-c3558r:~# pcieport 0000:00:09.0: AER: Multiple Corrected error received: id=0048
pcieport 0000:00:09.0: PCIe Bus Error: severity=Corrected, type=Physical Layer, id=0048(Receiver ID)
pcieport 0000:00:09.0:   device [8086:19a4] error status/mask=00000001/00002000
pcieport 0000:00:09.0:    [ 0] Receiver Error         (First)
```

4. Open and edit the configuration file of the DHCP server;

```
# vi ~/wlan0_dhcpd.conf
start 192.168.100.3
end 192.168.100.100
interface wlan0
opt dns 8.8.8.8
opt subnet 255.255.255.0
opt router 192.168.100.222
opt lease 23
```

5. Start the DHCP service;

```
# udhcpd -fS ~/wlan0_dhcpd.conf
udhcpd: started, v1.27.2
```

6. Use a mobile device to connect the hotspot named **vt-sbc-c3558-AP** with the pre-set password (12345678).

```
udhcpd: sending OFFER of 192.168.100.3
udhcpd: sending OFFER of 192.168.100.3
udhcpd: sending ACK to 192.168.100.3
udhcpd: sending ACK to 192.168.100.3
```

3.4 Bluetooth

Remember to insert the Bluetooth module into the M.2 E-Key (2242) slot before running the Bluetooth service.

1. List all the USB devices and identify the Bluetooth device;

```
# lsusb
Bus 001 Device 002: ID 8087:0025 Intel Corp.
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 002: ID 2cb7:0105
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
# lsusb -t
/:  Bus 02.Port 1: Dev 1, Class=root_hub, Driver=xhci_hcd/4p, 5000M
    |__ Port 3: Dev 2, If 0, Class=Vendor Specific Class, Driver=, 5000M
    |__ Port 3: Dev 2, If 1, Class=Vendor Specific Class, Driver=, 5000M
    |__ Port 3: Dev 2, If 2, Class=Vendor Specific Class, Driver=, 5000M
    |__ Port 3: Dev 2, If 3, Class=Vendor Specific Class, Driver=, 5000M
    |__ Port 3: Dev 2, If 4, Class=Communications, Driver=cdc_ether, 5000M
    |__ Port 3: Dev 2, If 5, Class=CDC Data, Driver=cdc_ether, 5000M
    |__ Port 3: Dev 2, If 6, Class=Vendor Specific Class, Driver=, 5000M
/:  Bus 01.Port 1: Dev 1, Class=root_hub, Driver=xhci_hcd/4p, 480M
    |__ Port 4: Dev 2, If 0, Class=Wireless, Driver=btusb, 12M
    |__ Port 4: Dev 2, If 1, Class=Wireless, Driver=btusb, 12M
```

2. Enable the Bluetooth service;

```
# hciconfig hci0 up
# hciconfig
```

```
hci0:   Type: Primary  Bus: USB
        BD Address: F0:57:A6:26:8E:95  ACL MTU: 1021:4  SCO MTU: 96:6
        UP RUNNING
        RX bytes:16661 acl:0 sco:0 events:2629 errors:0
        TX bytes:639694 acl:0 sco:0 commands:2627 errors:0
```

3. Use the *bluetoothctl* tool to connect a Bluetooth device;

```
# bluetoothctl
[bluetooth]# power on
[bluetooth]# agent off
[bluetooth]# agent on
[bluetooth]# default-agent
[bluetooth]# pairable on
[bluetooth]# scan on
...
[NEW] Device D8:CE:3A:CA:8E:B7 xxx Phone
...
[bluetooth]# scan off
[bluetooth]# pair D8:CE:3A:CA:8E:B7
[bluetooth]# trust D8:CE:3A:CA:8E:B7
[bluetooth]# connect D8:CE:3A:CA:8E:B7
[bluetooth]# quit
```

4. Create a 10MB file filled with zeros (bt_test.txt) and store it on the Board for the transfer test;

```
# dd if=/dev/zero of=/root/bt_test.txt bs=1M count=10 conv=fsync
10+0 records in
10+0 records out
10485760 bytes (10 MB, 10 MiB) copied, 0.107421 s, 97.6 MB/s

# ls /root/ -lh
total 10M
-rw-r--r-- 1 root root 10M Mar 31 08:30 bt_test.txt
```

5. Enable *obexd* for automatic file receiving and *obexctl* for file sending;

```
# /usr/libexec/bluetooth/obexd -r /root/ -a & obexctl
[obex]# connect D8:CE:3A:CA:8E:B7
```

6. Send the file created beforehand;

```
[2C:48:81:F9:9B:26]# send /root/bt_test.txt
Attempting to send /root/bt_test.txt to /org/bluez/obex/client/session0
[NEW] Transfer /org/bluez/obex/client/session0/transfer0
Transfer /org/bluez/obex/client/session0/transfer
    Status: queued
    Name: bt_test.txt
    Size: 10485760
    Filename: /root/bt_test.txt
    Session: /org/bluez/obex/client/session0
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Status: active
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 8048 (@8KB/s 21:12)
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 121154 (@113KB/s 01:29)
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 339287 (@218KB/s 00:45)
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 581657 (@242KB/s 00:39)
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 824027 (@242KB/s 00:38)
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 1058318 (@234KB/s 00:39)
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 1308767 (@250KB/s 00:35)
....
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Transferred: 10485760 (@242KB/s 00:00)
[CHG] Transfer /org/bluez/obex/client/session0/transfer0 Status: complete
[DEL] Transfer /org/bluez/obex/client/session0/transfer0
[2C:48:81:F9:9B:26]#
```

7. Receive the file.

```
[2C:48:81:F9:9B:26]#
[NEW] Session /org/bluez/obex/client/session0 [default]
[NEW] ObjectPush /org/bluez/obex/client/session0
Connection successful
[NEW] Session /org/bluez/obex/server/session1
[NEW] Transfer /org/bluez/obex/server/session1/transfer0
[CHG] Transfer /org/bluez/obex/server/session1/transfer0 Status: active
[CHG] Transfer /org/bluez/obex/server/session1/transfer0 Transferred: 5 (@0KB/s 14316557:37)
[CHG] Transfer /org/bluez/obex/server/session1/transfer0 Status: complete
[DEL] Transfer /org/bluez/obex/server/session1/transfer0
[DEL] Session /org/bluez/obex/server/session1
[2C:48:81:F9:9B:26]#
```

3.5 Cellular Network

VT-SBC-C3558R implements an M.2 B-Key (3042) slot, supporting PCIe x1/USB 3.0 bus to connect a 4G/5G cellular module for wireless communication.

Before you set up the cellular network, please insert a cellular module to the M.2 B-Key slot, install the antennas and plug in an activated SIM card. Power up the Board and generally the cellular module will be started.

1. Display the module information;

```
# lsusb
```

2. List the serial interface (ttyUSB) enumerate by the cellular module.

```
# ls /dev/ttyUSB*
```

In the following content, the Fibocom FM150 5G module is used to illustrate the steps for debugging the cellular module. Please refer to the manual of your cellular module to determine which interface is used for the module debugging using AT commands and the general AT commands for that purpose.

1. Open ttyUSB2 (AT interface) via minicom and confirm if the module is in ECM mode;

```
# minicom -D /dev/ttyUSB2 -b 115200
Welcome to minicom 2.7.1

OPTIONS: I18n
Compiled on Mar 23 2023, 12:01:16.
Port /dev/ttyUSB2, 09:47:34

AT+GTUSBMODE?
+GTUSBMODE: 18

OK
```

2. If the value of the USBMODE returned is not 18 as shown above, run the following command to change the value and reboot the Board;

```
# minicom -D /dev/ttyUSB2 -b 115200
Welcome to minicom 2.7.1

OPTIONS: I18n
Compiled on Mar 23 2023, 12:01:16.
Port /dev/ttyUSB2, 09:47:34

AT+GTUSBMODE=18       // set the value of USBMODE to 18

OK
# reboot
```

3. Dail-up for the first time (not necessary for non-first-time use);

```
# minicom -D /dev/ttyUSB2 -b 115200
Welcome to minicom 2.7.1

OPTIONS: I18n
Compiled on Mar 23 2023, 12:01:16.
Port /dev/ttyUSB2, 09:47:34

Press CTRL-A Z for help on special keys

AT
OK

AT+CPIN?       // check if the SIM card is inserted
+CPIN: READY
```

```
OK

AT+CSQ        // check the signal strength
+CSQ: 31,99

OK

AT+CREG?      // check if the cellular module is registered in CS domain
+CREG: 0,1      // 1 or 5 means registered

OK

AT+CGREG?     // check if the cellular module is registered in PS domain
+CGREG: 0,1     // 1 or 5 means registered

AT+GTRNDIS=1,1    // enable the RNDIS adapter on the cellular module
OK

AT+GTRNDIS?     // check the status of the RNDIS adapter on the module
+GTRNDIS:
1,1,"10.103.73.251,2409:8962:3a1:a9dc:d0fd:146d:4ac5:484f","223.87.253.100,240
9:8062:2000:2::1","223.87.253.253,2409:8062:2000:2::2"   // RNDIS connection with
the host PC established
```

4. Exit the AT command mode;
5. Figure out the name of the RNDIS adapter/network interface (often after "USB interface" or "Ethernet gadget");

```
# dmesg | grep usb

……..

 [ 9.164534] cdc_ether 2-1:1.4 usb0
```

6. Get up usb0;

```
# ifconfig usb0 up
```

7. Activate the cellular module to obtain an IP address automatically and check the status of usb0;

```
# udhcpc -i usb0
udhcpc: started, v1.27.2
udhcpc: sending discover
udhcpc: sending discover
udhcpc: sending select for 192.168.225.51
udhcpc: lease of 192.168.225.51 obtained, lease time 43200
ip: RTNETLINK answers: File exists
/etc/udhcpc.d/50default: Adding DNS 192.168.225.1

# ifconfig  usb0
usb0      Link encap:Ethernet  HWaddr 2A:0F:09:2B:58:4D
          inet addr:192.168.225.51 Bcast:192.168.225.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:48 errors:0 dropped:0 overruns:0 frame:0
          TX packets:70 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4612 (4.5 KiB)
          TX bytes:10885 (10.6 KiB)
```

8. Add a default route;

```
# route add default gw 192.168.225.1
```

9. Add a domain resolution server;

```
# vi /etc/resolv.conf

nameserver 8.8.8.8
```

10. Use the ping command to check if the network is connected properly.

```
# ping -I usb0 www.yahoo.com
PING www.a.shifen.com (39.156.66.14) from 192.168.225.51 usb0: 56(84) bytes of data.
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=1 ttl=51 time=70.4 ms
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=2 ttl=51 time=82.2 ms
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=3 ttl=51 time=70.9 ms
64 bytes from 39.156.66.14 (39.156.66.14): icmp_seq=4 ttl=51 time=69.6 ms
```

3.6 SATA

VT-SBC-C3558R implements two SATA 3.0 connectors for expansion of the storage.

Before you debug the SATA connectors, please use a SATA power splitter to connect an SSD card to either of the SATA 3.0 connectors and the SATA power connector next to it.

1. Check the device name of the SSD card;

```
# lsusb
```

2. Check the capacity of the SSD card;

```
# fdisk -l /dev/sdb          // the device name shall be the one enumerated in step 1
Disk /dev/sdb: 223.6 GiB, 240057409536 bytes, 468862128 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0xa67685bd

Device     Boot Start      End   Sectors   Size Id Type
/dev/sdb1        2048 468862127 468860080 223.6G 83 Linux
```

3. Check the information about the total space and available space on the SSD card and its mount directory;

```
# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sdb1       220G   28K  208G   1% /run/media/sdb1
```

4. Test if the device could read and write data (a 1000MB file).

```
# dd if=/dev/zero of=/run/media/sdb1/test.txt bs=1M count=1000 conv=fsync
1000+0 records in
1000+0 records out
1048576000 bytes (1.0 GB, 1000 MiB) copied, 4.39932 s, 238 MB/s

# ls /run/media/sdb1/test.txt -lh
-rw-r--r-- 1 root root 1000M Mar 31 07:35 /run/media/sdb1/test.txt
```

3.7 M.2 SSD

VT-SBC-C3558R implements an M.2 B-Key (2280) slot, supporting SATA bus to connect an SSD card for storage expansion.

Before you debug the slot, please insert an SSD card to the slot. Please refer to **3.6** for the commands that might be used for the debugging.

3.8 RTC

RTC module provides accurate time and date information to the system. If you are using the RTC for the first time, please calibrate the RTC time to the system time.

1. Set the system date & time;

```
# date -s "2023-03-24 14:38:10"
```

2. Synchronize the RTC time with the system time;

```
# hwclock -w
```

3. Reboot the Board;

```
# reboot
```

4. Check the RTC time information.

```
# hwclock -r
```

3.9 Watchdog Timer

3.9.1 System watchdog timer

1. Enable the watchdog timer;

```
# echo 0 > /dev/watchdog
```

2. The system will automatically shut down after 30s;
3. Set a feeding frequency;

```
# echo “xxx” > /dev/watchdog
```

4. Disable the watchdog timer.

```
# echo V > /dev/watchdog
```

3.9.2 EC watchdog timer

Tool description:

```
# ec_wdt_tools -h
Usage: ec_wdt_tools [Options...]
Options:
-T cmd_type < -t timeout >: cmd_type:0-disable 1-enable 2-feed, timeout:x min
-h: Show application options
eg:
    ec_wdt_tools -T 1 -t 1
```

1. Open the watchdog and set timeout to 1 min;

```
# ec_wdt_tools -T 1 -t 1
enable ec watchdog, timeout:1 min
```

2. Close the watchdog;

```
# ec_wdt_tools -T 0
disable ec watchdog
```

3. Feed the watchdog.

```
# ec_wdt_tools -T 2
feed ec watchdog
```

3.10 Programmable LED Indicators

The Board offers four LED indicators, including a power indicator, a system indicator, and two programmable indicators (HA indicator & Bypass indicator).

3.10.1 Bypass indicator

The bypass indicator is programmable and is stacked on top of other indicators from top down.

BIOS firmware creates four bypass types: Always On; Always Off; Auto On, Auto Off; Auto On, Manual Off.

Only in "**Auto On, Manual Off**" mode, system can modify bypass state by following setup

1. Turn on the bypass indicator;

```
# gpio_tools -T 0 -s 1
```

2. Turn off the bypass indicator.

```
# gpio_tools -T 0 -s 0
```

3.10.2 HA indicator

The HA indicator is below the bypass indicator.

1. Turn on HA_LED;

```
# gpio_tools 1
```

2. Turn off HA_LED.

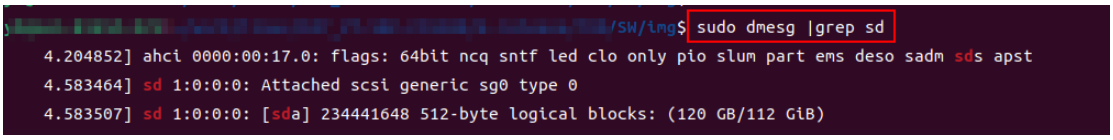
```
# gpio_tools 0
```

CHAPTER 4

SYSTEM UPGRADE

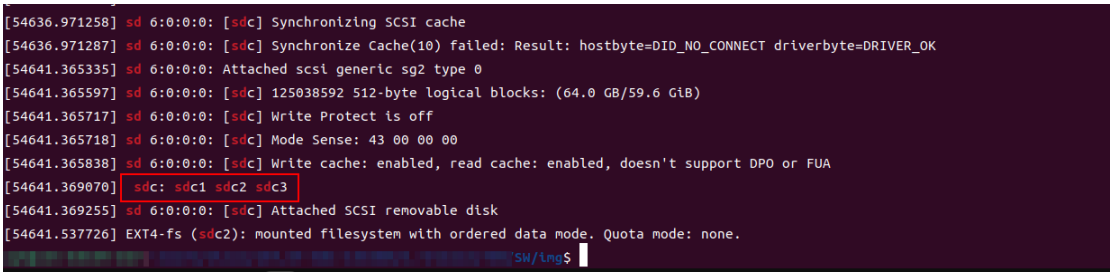
4.1 Creating a Bootable USB Flash Drive

1. Insert a USB flash drive into an Ubuntu host;
2. Open a terminal and type `sudo dmesg|grep sd` to enumerate the name of the USB devices;



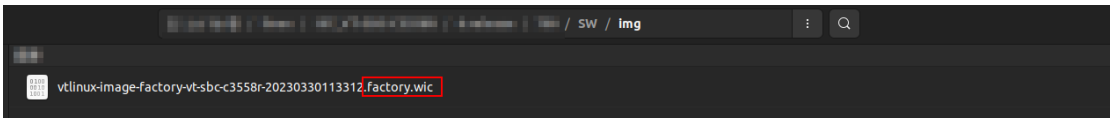
…

3. The USB flash drive is mapped as **sdc** in the system;



4. Unmount the USB flash drive;

5. Enter the directory (…/SW/img) of the image file (xxx .wic);



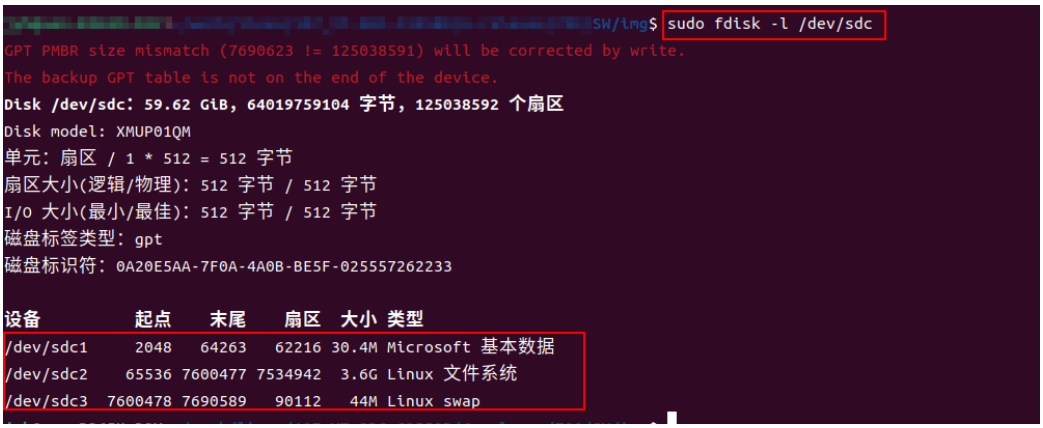
6. Use the `dd` command to write the image file to the USB flash drive;

7. Synchronize the data to the USB flash drive (`sync`);

8. Unplug the USB flash drive and re-plug it to the Ubuntu host;

9. Input the following command to check the device partition, and the detailed information of the operating system proves the success of creating the bootable USB flash drive.

```
$ sudo fdisk -l /dev/sdc
```



4.2 Image flashing

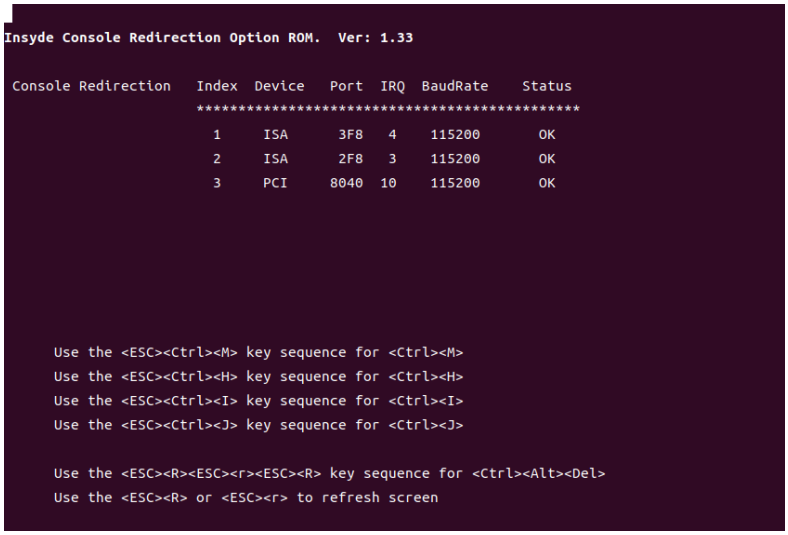
1. Connect the Console port of the Board to the Ubuntu host using an RJ45 to USB adapter;
2. Check the device name of the adapter (ttyUSB0 in this case);

```
# dmesg|grep tty
```

3. Use the serial communication tool (e.g., minicom) to open the Console port;

```
# sudo minicom -D /dev/ttyUSB0 -b 115200
```

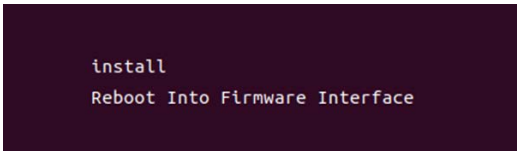
4. Plug the bootable USB flash drive into the USB 2.0 interface of the Board, then insert a USB keyboard into the USB 2.0 interface of the Board;
5. Power up the Board and press **ESC** repeatedly to enter BIOS setup when the following image shows up;



6. Use the arrows on the keyboard to select **boot manager** and press **Enter** to enter the option;

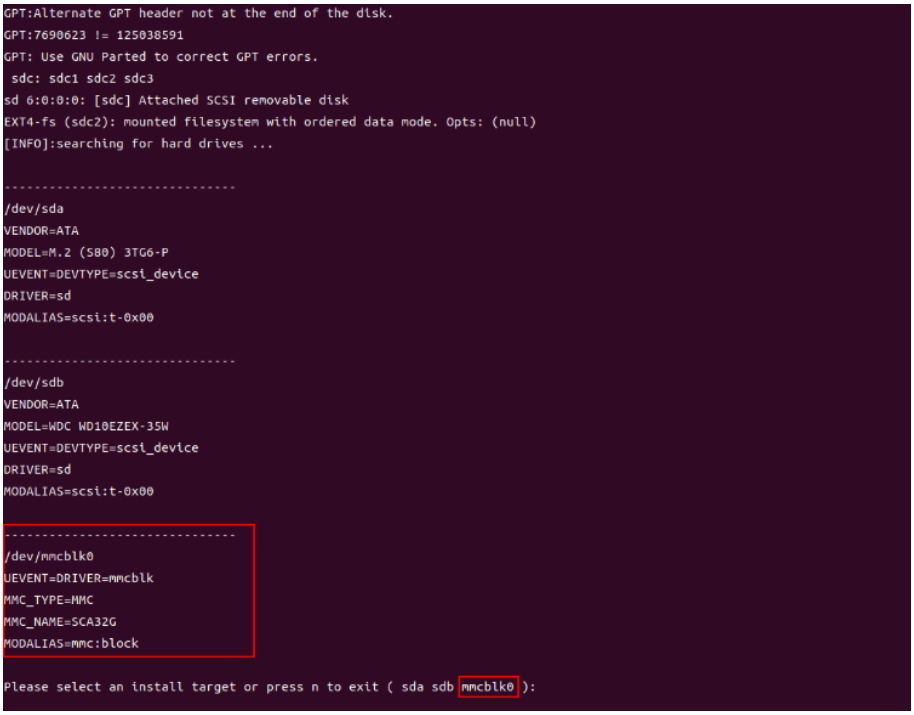
7. Select **EFI USB Device** and press **Enter** to confirm to start the system from the USB flash drive;

8. If the system starts properly from the USB flash drive, the system will show “install”, suggesting that image flashing is about to start;

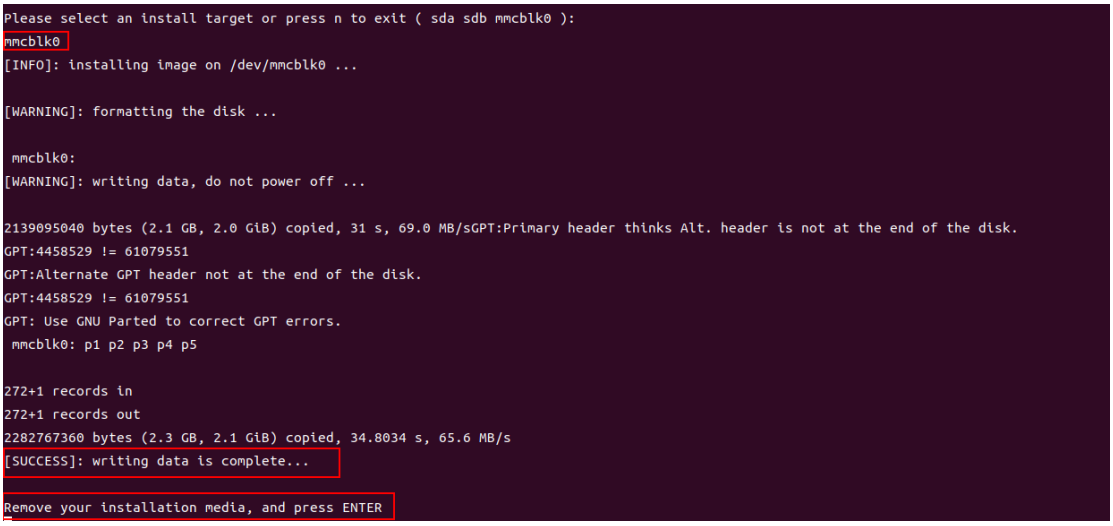


9. Press **Enter** or leave it for about 5 seconds, and the system will start to flash the image;

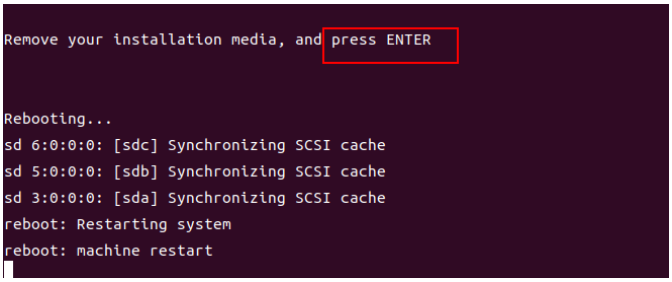
10. The system will scan the storage media and print the information accordingly;



11. The system is supposed to be installed to the eMMC flash, so input **mmcblk0** as the install target and wait for the completion of the process;



12. After completion, unplug the USB flash drive first and then press **Enter** as indicated, and the system will reboot automatically.



CHAPTER 5

DISPOSAL AND PRODUCT 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.