StarFive 赛昉科技

VisionFive 2 Lite Single Board Computer Quick Start Guide

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Legal Statements

Important legal notice before reading this documentation.

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Contact Us

Address: Room 506, Building 2, No. 61 Shengxia Rd., China (Shanghai) Pilot Free Trade Zone, Shanghai, 201203, China

Website: http://www.starfivetech.com

Email: sales@starfivetech.com(sales) , support@starfivetech.com(support)

Preface

About this guide and technical support information.

About this document

This document mainly provides the users with the necessary information about the StarFive VisionFive 2 Lite SBC (single board computer), including features, specifications, board appearance, and pinout, as well as the guidelines to get started with the Debian operating system.

Revision History

Table 0-1 Revision History

Version	Released	Revision
0.9	2025/09/30	The preliminary release.

Notes and notices

The following notes and notices might appear in this guide:

- **Tip:**
  Suggests how to apply the information in a topic or step.
- **Note:**
  Explains a special case or expands on an important point.
- **Important:**
  Points out critical information concerning a topic or step.
- **CAUTION:**
  Indicates that an action or step can cause loss of data, security problems, or performance issues.
- **Warning:**
  Indicates that an action or step can result in physical harm or cause damage to hardware.

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1. Features and Specifications

This chapter describes the features and specifications of VisionFive 2 Lite.

1.1. Features

VisionFive 2 Lite provides the following features.

1.1.1. Hardware

This section describes the following VisionFive 2 Lite hardware functions.

Processor

- StarFive JH-7110S with RISC-V quad-core CPU with 2 MB L2 cache and a monitor core, supporting RV64GC ISA, working up to 1.25 GHz
- IMGBXE-4-32 MC1 with work frequency up to 400MHz

Memory

VisionFive 2 Lite provides the system memory of 2 GB, 4 GB, or 8 GB LPDDR4 SDRAM up to 2,800 Mbps.

Storage

- Onboard TF card slot or eMMC.
- QSPI Flash: The firmware to store U-Boot and BootLoader.

Video Processing

The video processing of VisionFive 2 Lite has the following features.

- Video decoder supports up to 4K@60fps and multi-stream for H264/H265
- Video encoder supports up to 1080p@30fps and multi-stream for H265
- JPEG encoder/decoder

1.1.2. Interfaces

- 1× 2-lane MIPI DSI
- 1× 2-lane MIPI CSI
- 1× USB-C port for charging
- 1× USB device port (by reusing the USB-C port)
- 3× USB 2.0 and 1 ×USB 3.0/USB 2.0 ports

- 1× M.2 M-Key (size:2242)
- 1× WiFi 6 & BT 5.4
- 1× HDMI 2.0
- 1× RJ45 Ethernet port
- 1× 4-pin PoE header
- 1× 2-pin fastboot header
- 1× boot key (recovery mode)
- 1× 40-pin GPIO header

1.1.3. Software

Operating System

VisionFive 2 Lite supports Ubuntu and Debian operating system.

For more software resources, please follow the StarFive GitHub repository.

1.2. Specifications

VisionFive 2 Lite has the following specifications.

Table 1-1 VisionFive 2 Lite Specification

Type	Item	Description
Processor	StarFive JH-7110S	StarFive JH-7110S with RISC-V quad-core CPU with 2 MB L2 cache and a monitor core, supporting RV64GC ISA, working up to 1.25 GHz
	Imagination GPU	IMGBXE-4-32 MC1 with work frequency up to 400MHz
Memory	2GB/4GB/8GB	LPDDR4SDRAM, up to 2,800 Mbps
Storage	Onboard TF card slot or eMMC	Either the eMMC or the TF card can be chosen.
	QSPI Flash	The firmware to store U-Boot and BootLoader
Multimedia	Video Output	1× 2-lane MIPI DSI display port, supporting up to 1080p@30fps 1× HDMI 2.0, supporting up to 4K@30fps or 2K@60fps
	Camera	1× 2-lane MIPI CSI camera port, supporting up to 1080p@30fps
	Encoder/Decoder	Video decoder supports up to 4K@60fps and multi-stream for H264/H265 Video encoder supports up to 1080p@30fps and multi-stream for H265 JEPG encoder/decoder
Connectivity	Ethernet	1× RJ45 Gigabit Ethernet ports
	USB Host	3× USB 2.0 and 1× USB 3.0/USB 2.0 ports (multiplexed with a PCIe 2.0 1× lane)

Table 1-1 VisionFive 2 Lite Specification (continued)

Type	Item	Description
	USB Device	1× USB device port (by reusing the USB-C port)
	M.2 Connector	M.2 M-Key, size: 2242
	Wireless	Onboard WiFi 6 & BT 5.4
Power	USB-C port	USB Type C 5V / 3A
	GPIO Power In	5V DC via GPIO header
	PoE (Power over Ethernet)	Power function is enabled and requires separate PoE HAT
GPIO	40-Pin GPIO Header	1× 40-pin GPIO header, supporting various interface options: • 3.3 V (on 2 pins) • 5 V (on 2 pins) • Ground (on 8 pins) • GPIO • CAN bus • DMIC • I2C • I2S • PWM • SPI • UART
Button	Boot button	Used for recovering the BootLoader
Dimensions	85 × 56 mm	-
Compliance	RoHS, FCC, CE	-
Environment	Recommended operating temperature	0-50 ℃
Other	Debug function	UART TX and UART RX are available through the 40-pin GPIO header
	Fast boot mode	Used for flashing the OS image to the eMMC Short the J20 header by Jumper and power on, then the board will automatically enter the fastboot mode, the user can flash the OS image to the eMMC via USB-C

2. Hardware Overview

This chapter provides the hardware overview of VisionFive 2 Lite.

2.1. Board Appearance

Figure 2-1 Board Appearance (Top View)

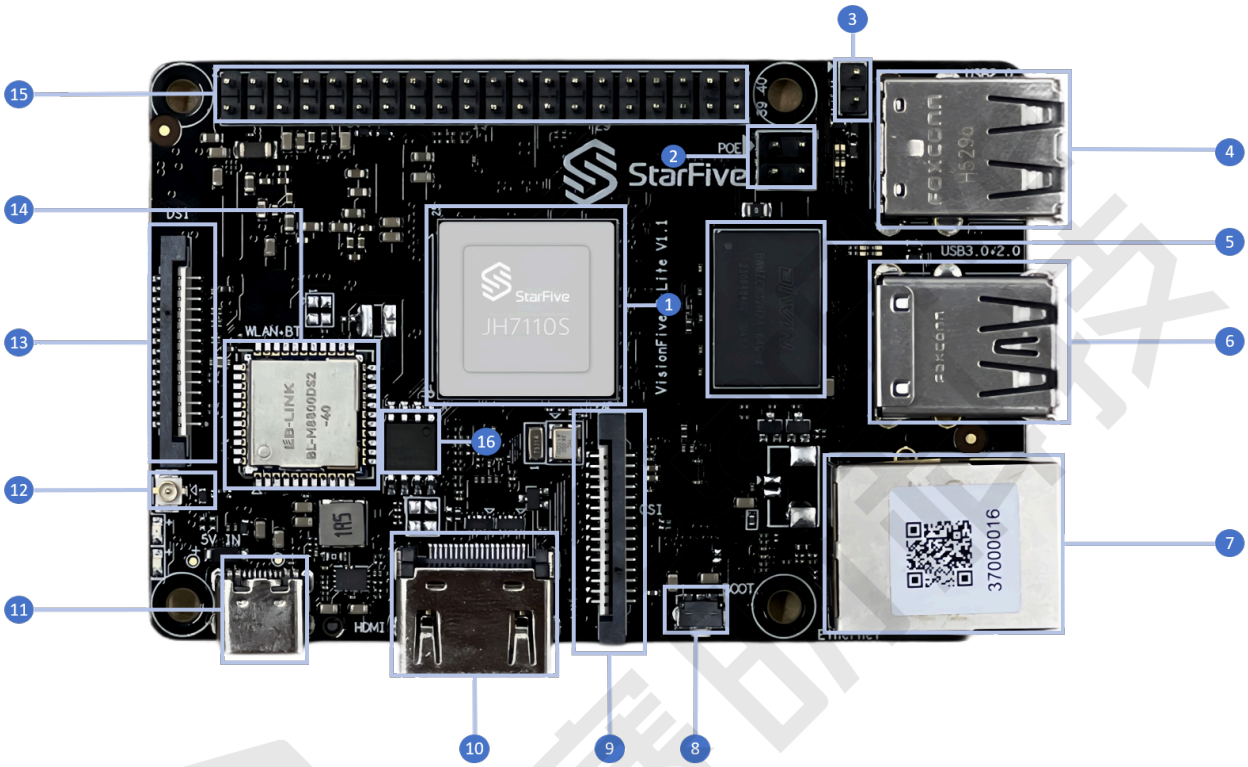
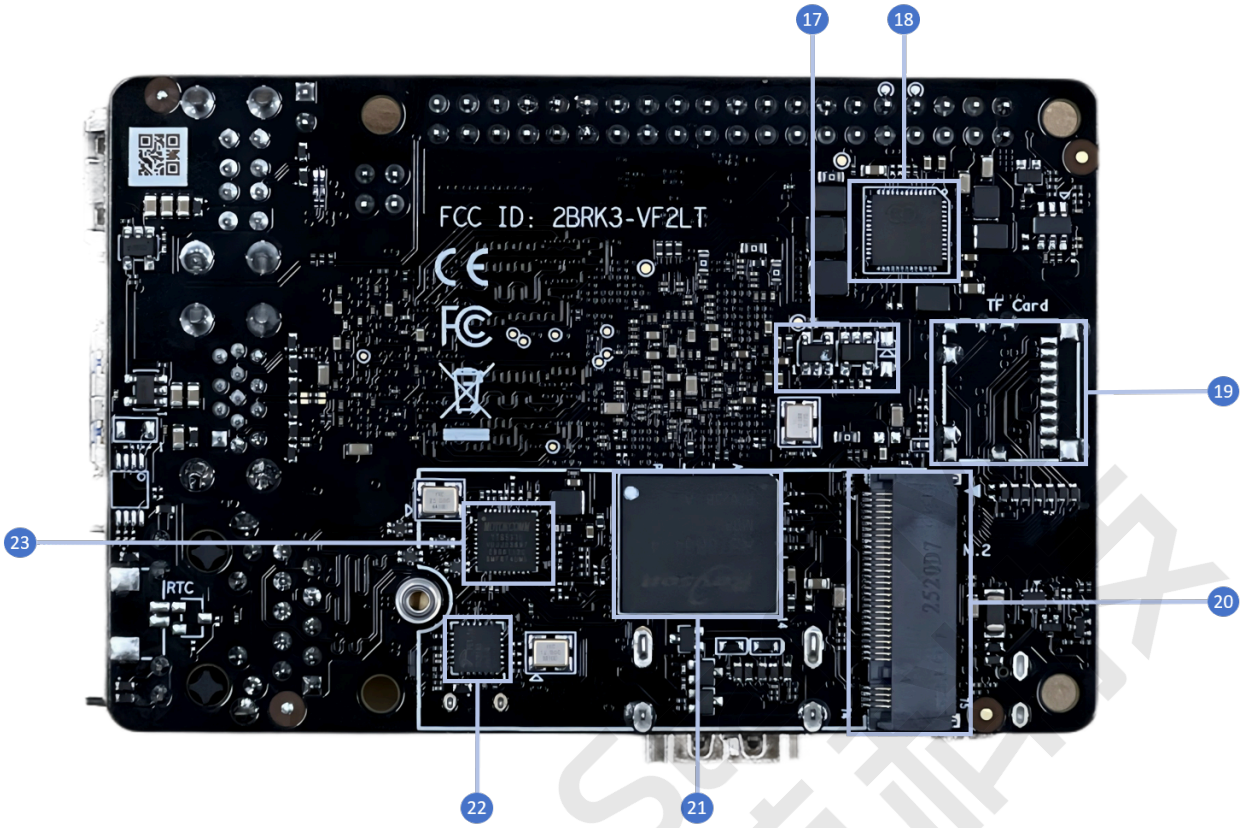


Figure 2-2 Board Appearance (Bottom View)



CAUTION:

During the use of VisionFive 2 Lite, avoid contact with hard objects that may cause damage.

Table 2-1 Board Appearance Description

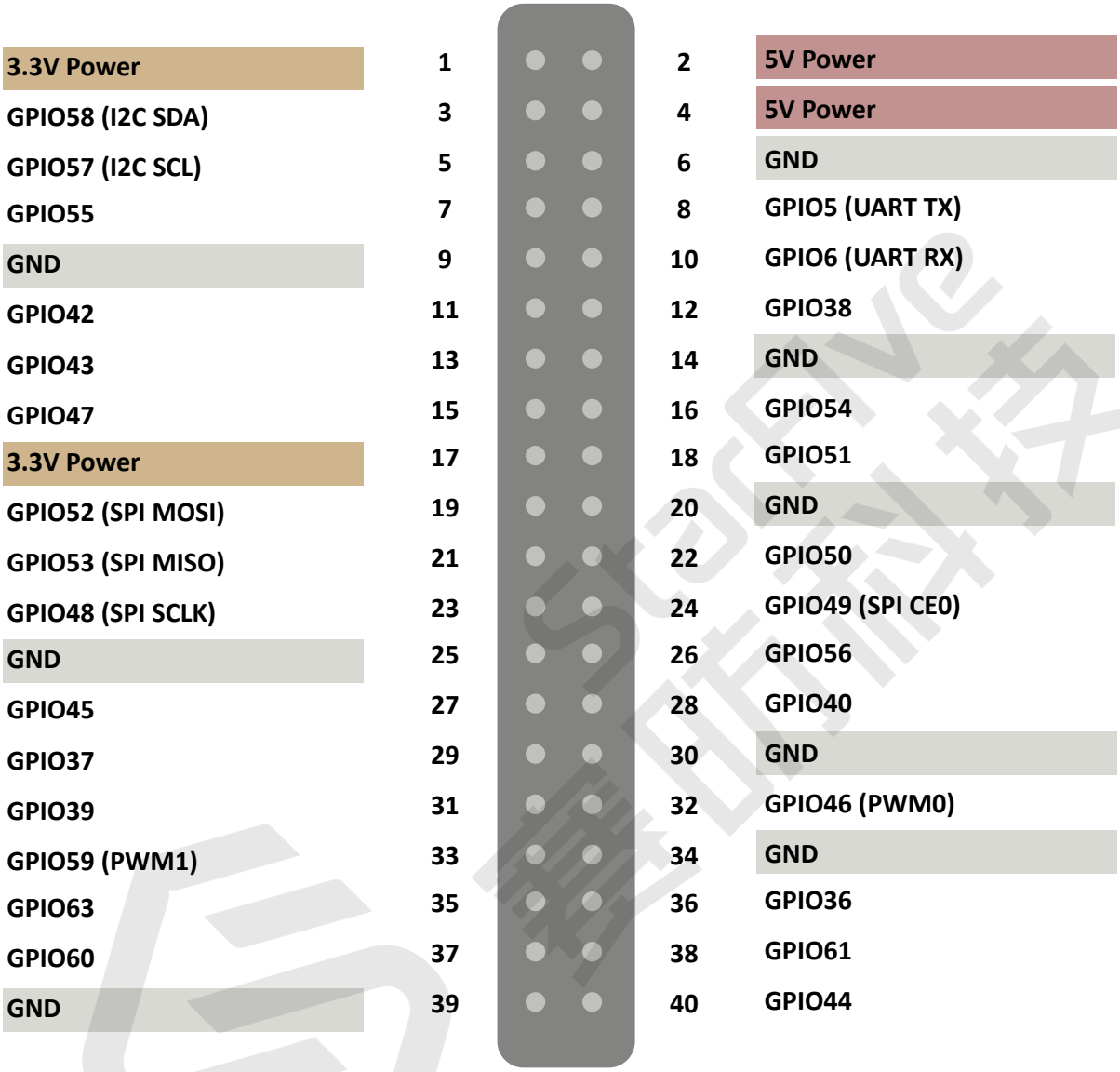
No.	Description	No.	Description
1	StarFive JH-7110S with RISC-V quad-core CPU, supporting RV64GC ISA	12	2.4G/5.8GHz Antenna Connector
2	PoE Header	13	2-Lane MIPI DSI
3	Fastboot pins[1]	14	WiFi/BT module
4	2× USB 2.0 Port	15	40-Pin GPIO Header
5	2GB/4GB/8GB LPDDR4 SDRAM	16	QSPI Flash
6	1× USB 3.0 Port and 1×USB 2.0 Port	17	EEPROM
7	1× Ethernet Port (RJ45)	18	PMIC
8	Recovery Button	19	TF card slot (TF version)
9	2-Lane MIPI CSI	20	M.2 M key
10	HDMI 2.0 Port	21	Onboard eMMC (eMMC version)
11	USB Type C	22	USB2.0 Hub FE1.1S
-	-	23	GMAC0 PHY

1. Short these pins before powering on the board to force entry to the U-Boot Fastboot mode on startup.

2.2. Pinout Diagram

The following is the pinout diagram:

Figure 2-3 Pinout Diagram



Note:

- Each GPIO pin can safely draw a maximum current of 32 mA, whereas the maximum current draw when all GPIOs are combined should be less than 100 mA. Please take this into account or otherwise, you will end up destroying the GPIO pins.
- All GPIOs can be configured to support different functions including but not limited to SDIO, Audio, SPI, I2C, UART, and PWM. Since VisionFive 2 Lite uses the same GPIO header as VisionFive 2, refer to the *VisionFive 2 40-Pin GPIO Header User Guide* for GPIO configuration.

3. Getting Started

This chapter provides steps to get started with VisionFive 2 Lite.

3.1. Required Hardware

Make sure you have prepared the following hardware items:

- VisionFive 2 Lite
- Micro SD card (TF version, 16 GB or more)
- USB card reader for your host PC (TF version)
- PC with Linux/Windows/Mac OS
- Power adapter
- USB Type-C Cable
- For desktop environment usage:
  - Keyboard and mouse
  - Monitor or TV
  - HDMI cable
- Additionally, here are some optional components which you may also need:
  - Ethernet LAN cable (opt)
  - USB to UART Serial converter module

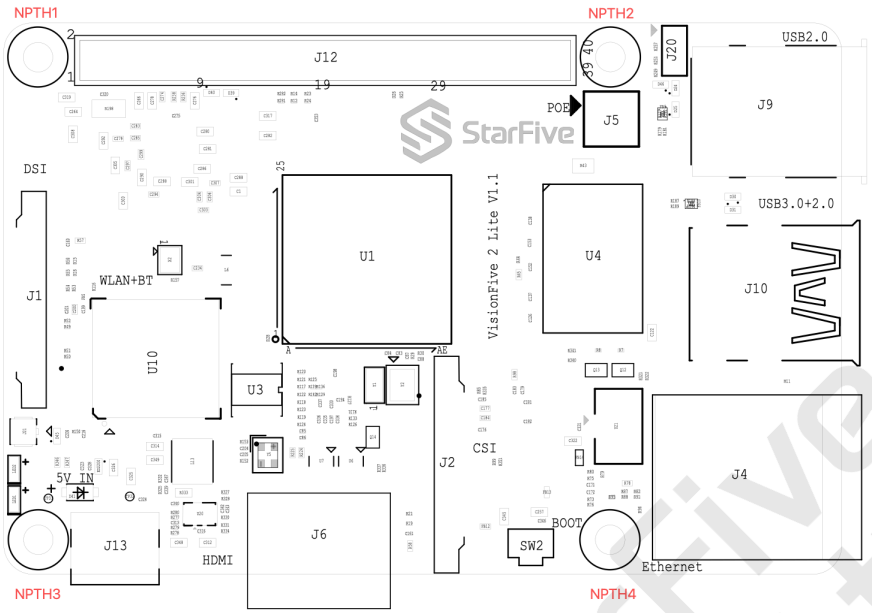
Tip:
This is used for system recovery via UART boot mode.

Note:

Warning:

During the use of VisionFive 2 Lite, avoid contact with hard objects that may cause damage. Thus, StarFive recommends that you use spacers for the following NPTHs (Non Plating Through Hole):

Figure 3-1 NPTHs on VisionFive 2 Lite



For spacers, StarFive strongly recommends that you use the copper columns or studs with the following specifications:

- Single head hexagonal copper columns (Size: M2.5*10+6mm)

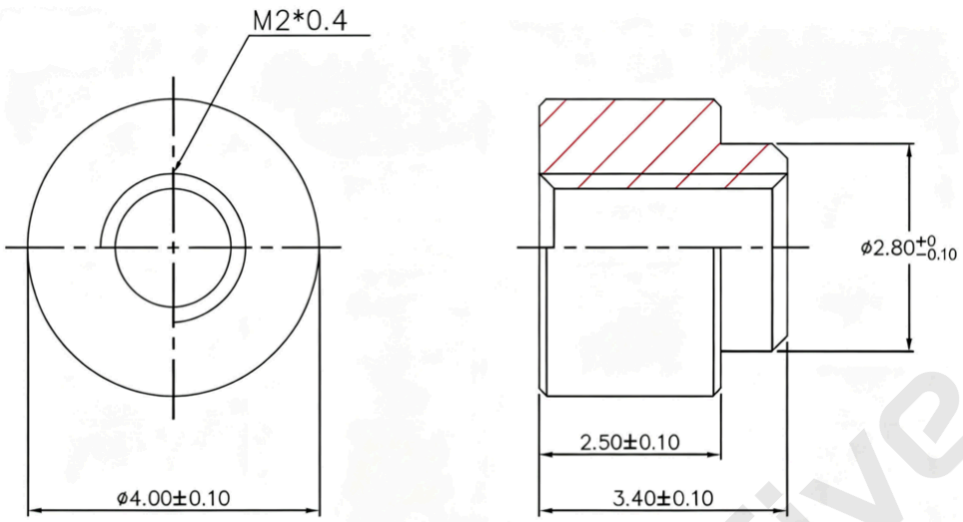
Figure 3-2 Single head hexagonal copper columns

- Double way hexagon copper studs (Size: M2.5*4)

Figure 3-3 Double way hexagon copper studs

Note:
The recommended SSD mounting screw for VisionFive 2 Lite is M2 × 3 mm or M2 x2.5 mm.

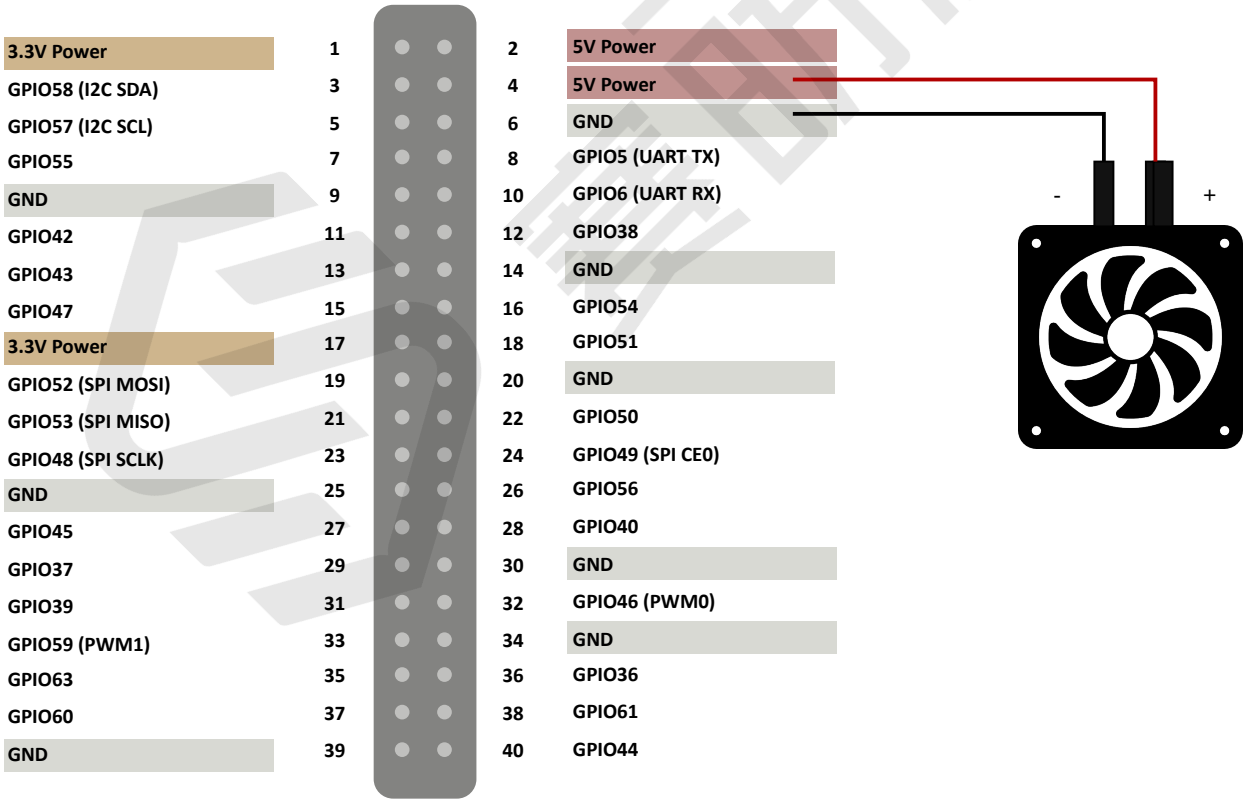
Figure 3-4 M2 Standoff Specification



3.2. (Optional) Connecting a Fan to VisionFive 2 Lite

You can connect a 2-pin 5 V fan to VisionFive 2 Lite's 40-pin GPIO header for further cooling as follows:

Figure 3-5 Connecting a Fan to VisionFive 2 Lite



3.3. Flashing OS to a Micro-SD Card (TF Version)

Now we need to burn Ubuntu or Debian (which is a Linux distribution) to a micro-SD card so that it can run on the VisionFive 2 Lite. This chapter provides example steps to flash the OS to a Micro-SD card with Linux or Windows.

3.3.1. Flashing with Linux or Windows

To flash the image with Linux or Windows, perform the following steps:

1. Insert a micro-SD card into the computer through a micro-SD card reader, or by a built-in card reader on a laptop.
2. Download the latest Debian image from: this link.
3. Extract the `.bz2` file.

   The image downloaded is in an `img.bz2` compressed format. To extract the image, you will need to use a tool like 7-Zip in Windows/Linux or `bzip2` command.

   For bzip2, you can use the following command, this command will remove the original img.bz2 file. :

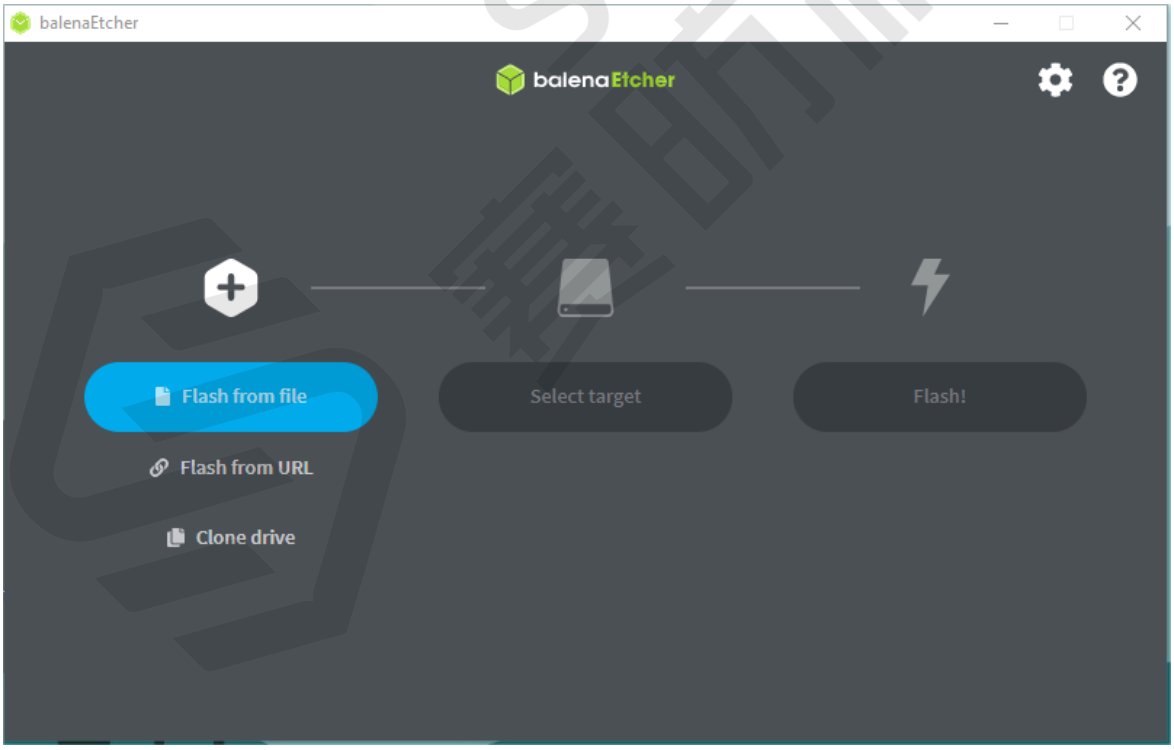
   ```
   bzip2 -d <filename>.img.bz2
   ```

   To preserve the original file, you will need to use:

   ```
   bzip2 -dk <filename>.img.bz2
   ```

4. Visit this link to download BalenaEtcher. We will use BalenaEtcher software to flash the Debian image to a micro-SD card.
5. Install BalenaEtcher and open it.

   Figure 3-6 Install BalenaEtcher

6. Click **Flash from file** and select the location of the image where we just unzipped the following file:

   `starfive-jh7110S-VF2-Lite-<Version>.img`

   Tip:
   <Version> indicates the version number of the Debian image.

7. Click **Select target** and select the connected micro-SD card.
8. Click **Flash!** to start the flash task.

3.4. Flashing OS to Onboard eMMC (eMMC Version)

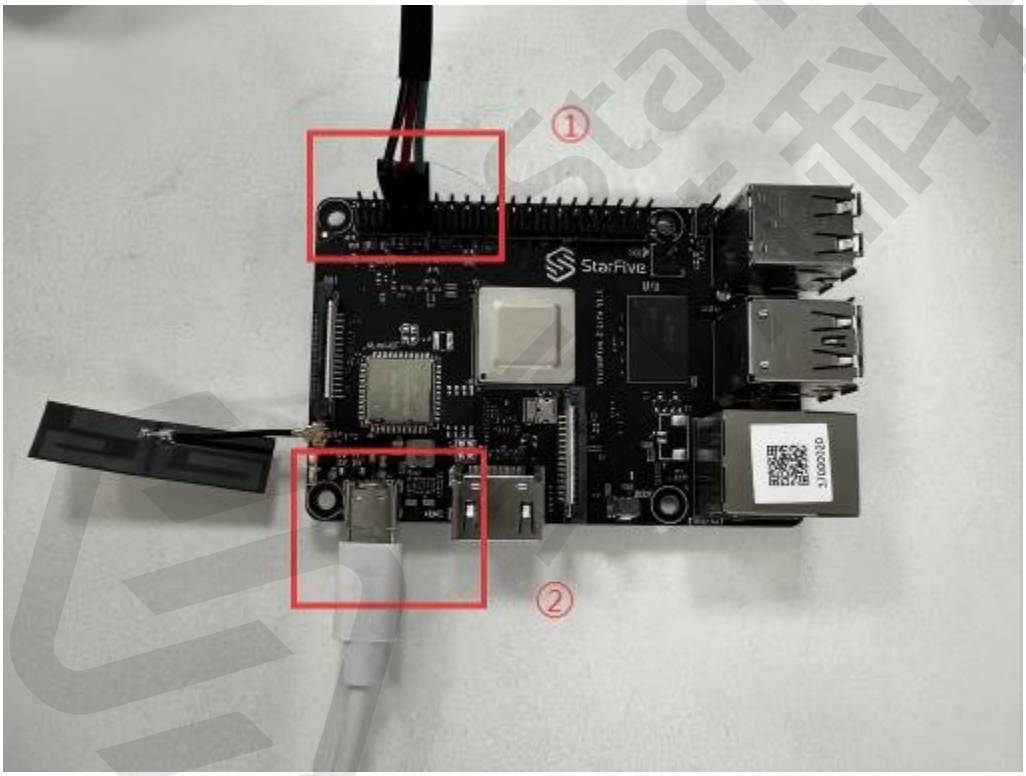
Now we need to burn Ubuntu or Debian (which is a Linux distribution) to the onboard eMMC with fastboot tool or fastboot commands on Linux so that it can run on the VisionFive 2 Lite. This chapter provides example steps to flash Debian or Ubuntu to a eMMC by using fastboot tool with Windows or Ubuntu.

3.4.1. Preparation

Hardware Preparation

1. Except for the hardware items described in Required Hardware *(on page 13)*, one USB C to USB A/C cable is required to flash OS to onboard eMMC.
2. Before using the fastboot tool to flash the image, connect the serial port and USB data cable properly as the following:

Figure 3-7 Set up Hardware



①: Connect the serial port to VisionFive 2 Lite (for entering to fastboot mode by running commands during starup).

②: Connect the USB-C port of the USB-C to USB-A/C cable to the VisionFive 2 Lite, and connect the other end to the PC.

Software Preparation

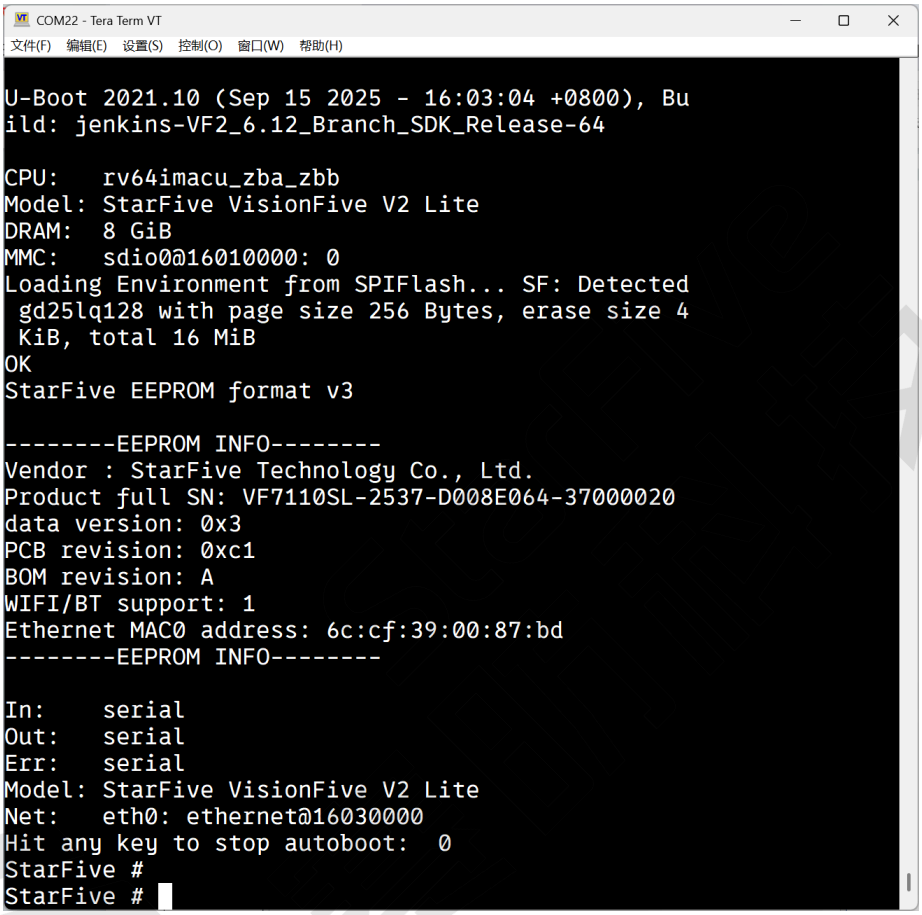
Perform the following steps to install drivers for using StarFive Fastboot Tool on Windows for the first time or fastboot on Ubuntu:

1. Download and decompress the **SFFB_Tool_V1.0.7z**
2. Enter fastboot mode by perform one of the following methods:

- By enter commands during starup *(on page 18)*
- By shorting fastboot pins before powering on *(on page 18)*
- By enter commands during startup:

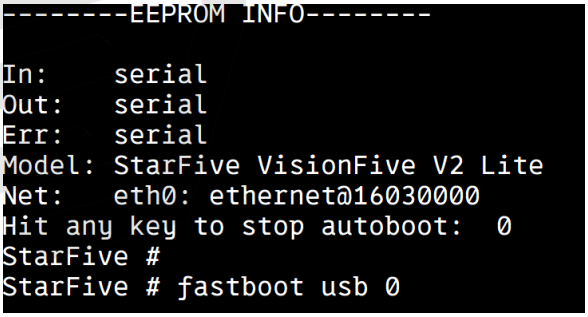
  a. Power on the VisionFive 2 Lite, and press any key to stop at U-Boot.

  Figure 3-8 Press Any Key to Stop at U-Boot



  b. Enter `fastboot usb 0` and wait.

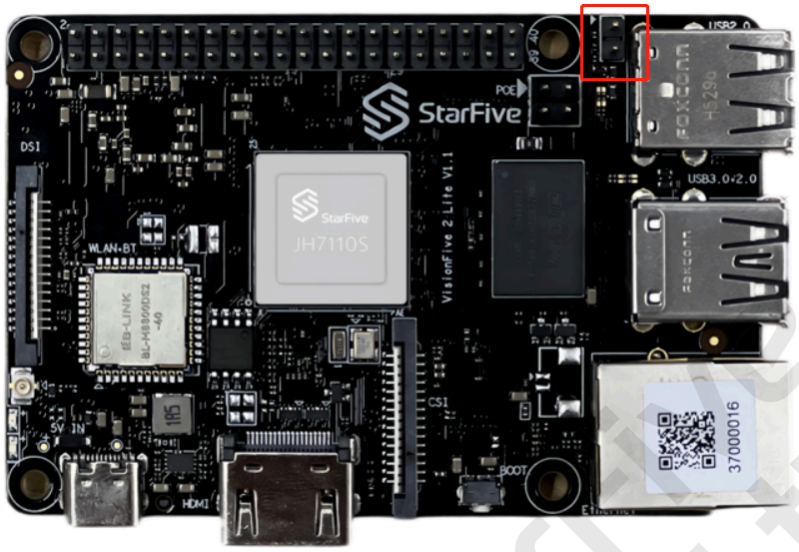
  Figure 3-9 Enter fastboot usb 0



- By shorting fastboot pins before powering on:

a. Shorting the fastboot pins before powering on can also make the board enter fastboot mode automatically.

Figure 3-10 Shorting Fastboot Pins



Note:
The highlighted area is the fastboot pins.

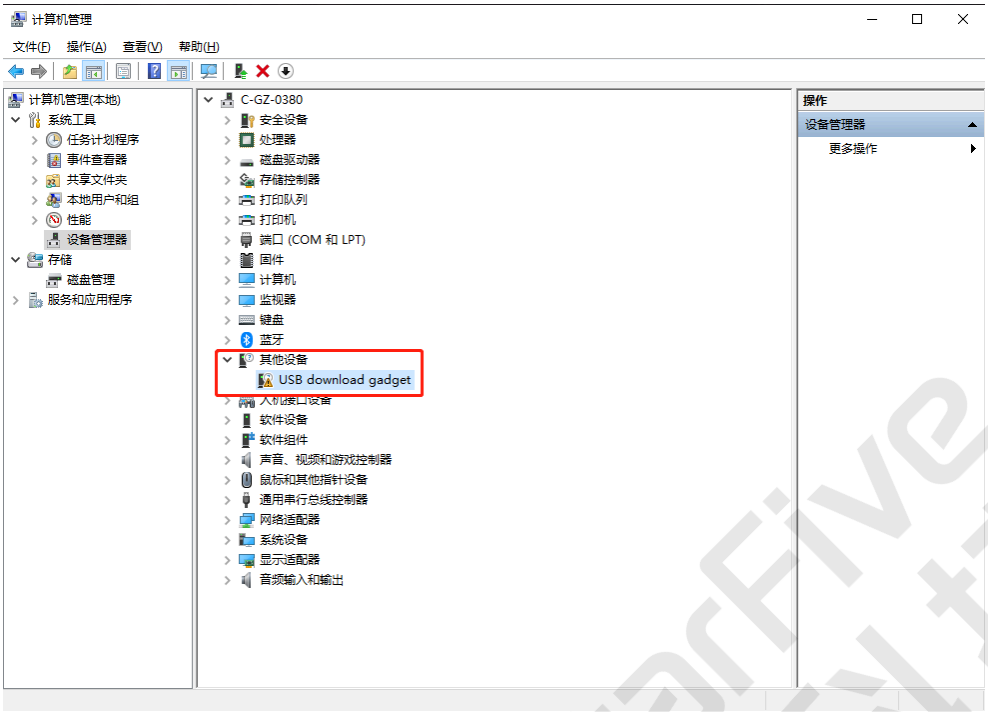
Figure 3-11 Fastboot Mode

```
--------EEPROM INFO--------

In:    serial
Out:   serial
Err:   serial
Model: StarFive VisionFive V2 Lite
Net:   eth0: ethernet@16030000
Hit any key to stop auto-fastboot:  0
```

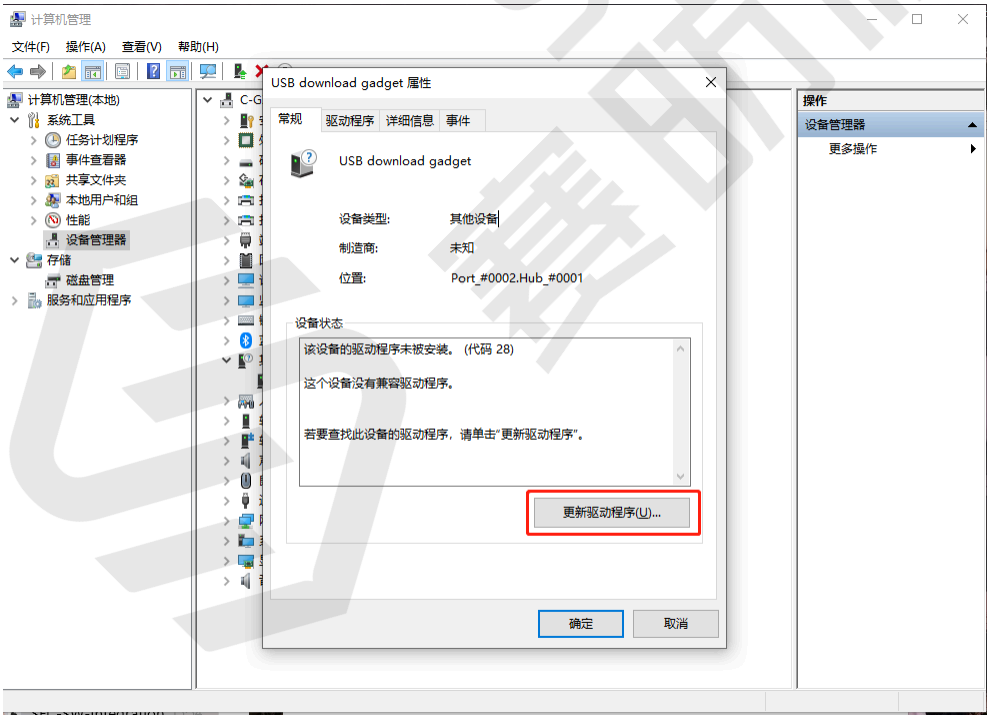
3. Open **Device Manager** on Windows, a device named **USB Download Gadget** will appear under **Other Devices**.

Figure 3-12 USB Download Gadget



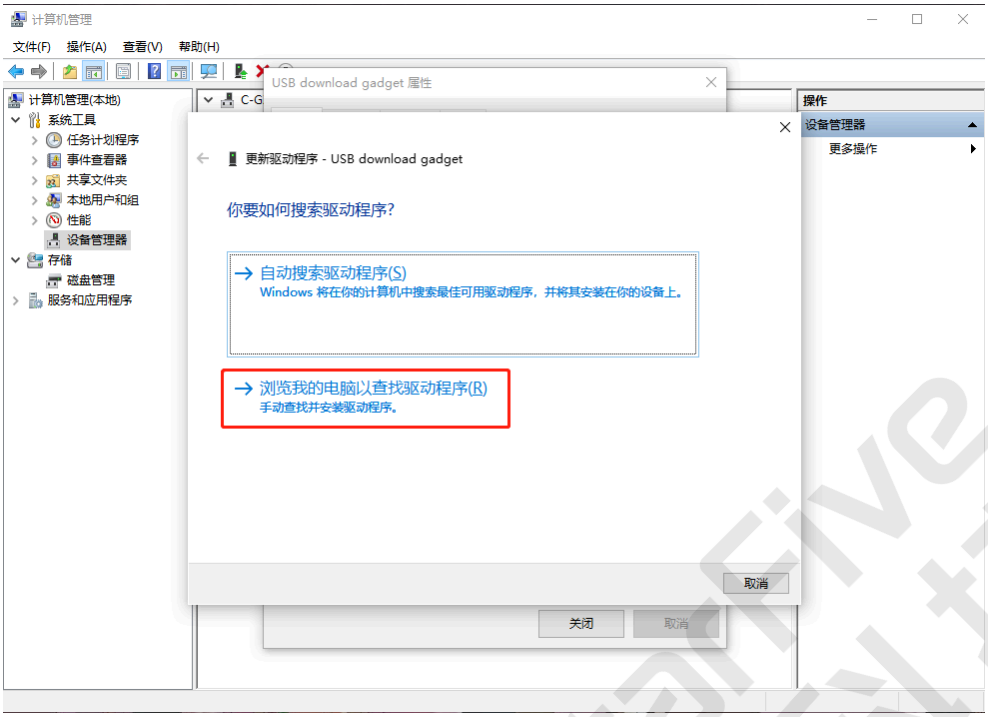
4. Double click **USB Download Gadget** to open **Properties** menu, and then click **Update driver** .

Figure 3-13 Update Driver



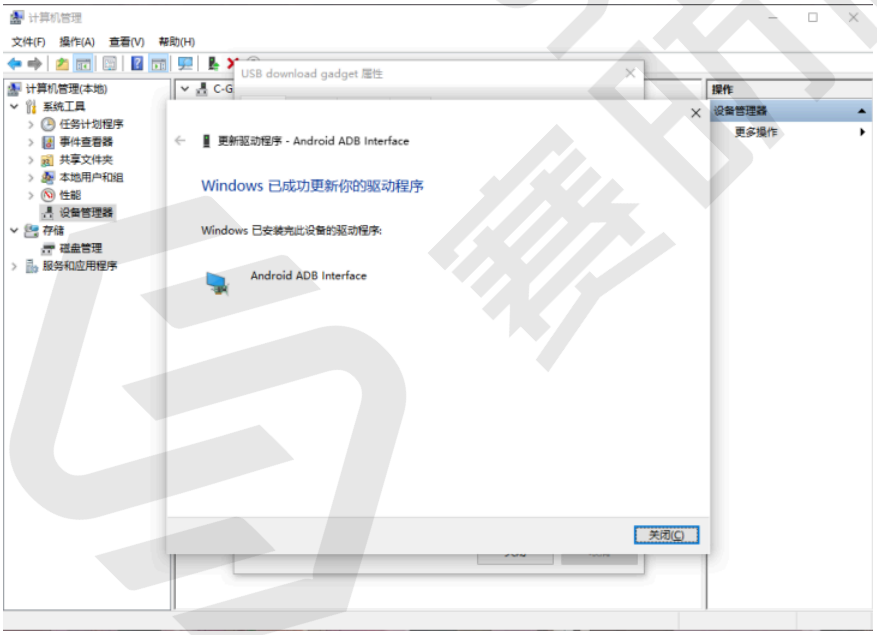
5. Select **Browse my computer for drivers**.

Figure 3-14 Browse My Computer for Drivers



The following output indicates a successful installation:

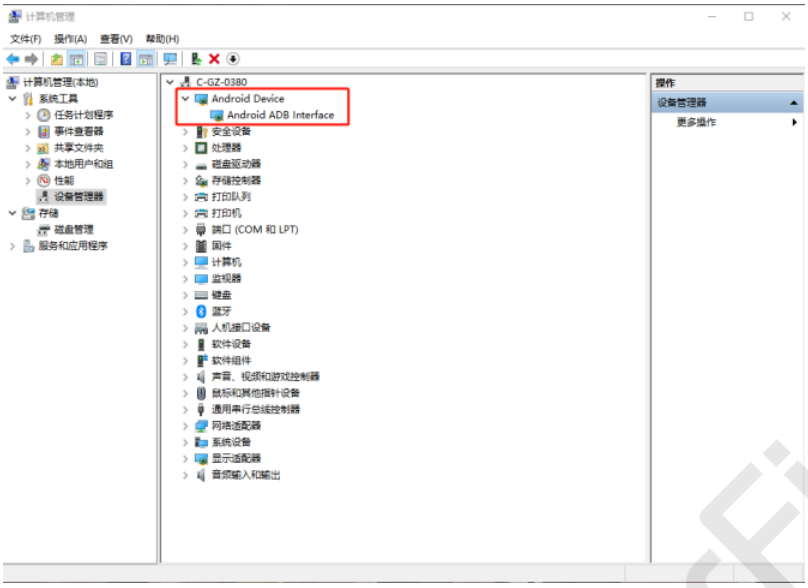
Figure 3-15 Successful Installation



6. Verify the installation in **Device Manager**.

The device name should display under the **Device Manager** after success installation.

Figure 3-16 Verification



3.4.2. Burn the Distro into eMMC

3.4.2.1. Using StarFive Fastboot Tool on Window

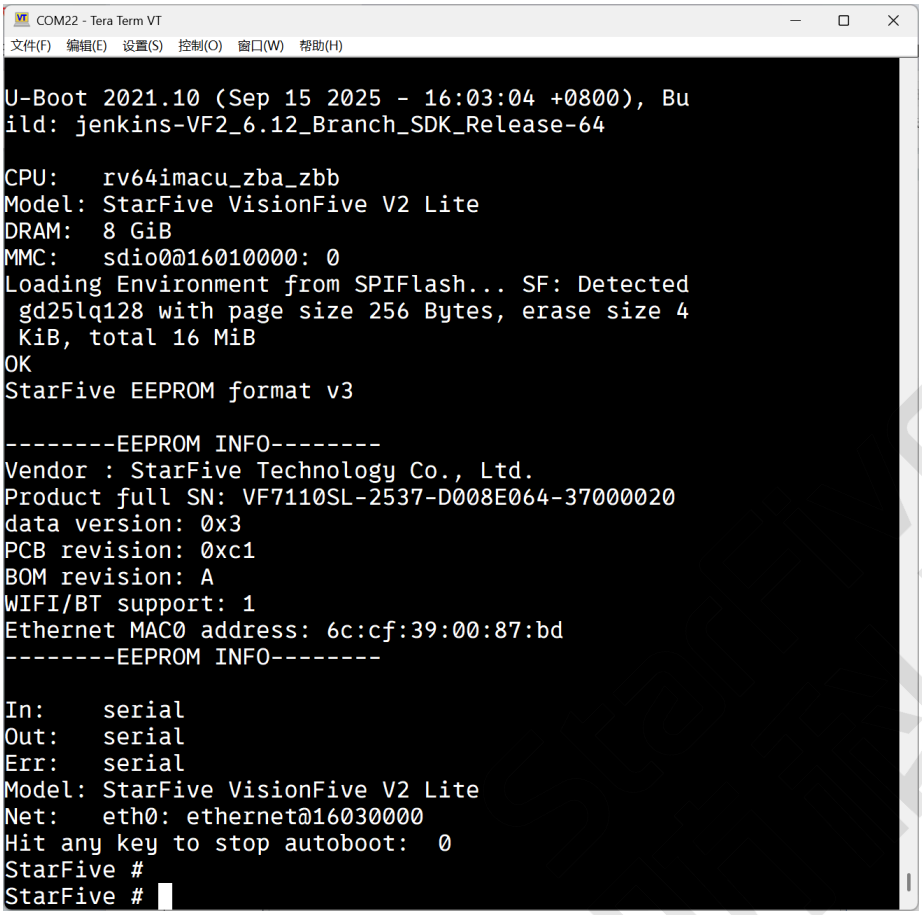
Note:

- Always open the software (Fastboot Tool) before powering on the board.
- Automatic FastBoot mode is only triggered during the very first boot of the board. A successfully programmed board will skip this mode on subsequent startups.
- To prevent accidental automatic programming of a new device, click the **Reset** button to clear the set file path once the current burning session is complete.

1. Startup and connection:

   Open the software, power on the VisionFive 2 Lite, press any key at the U-Boot prompt to interrupt the boot process and enter the command (`fastboot usb 0`).

Figure 3-17 Press Any Key to Stop at U-Boot



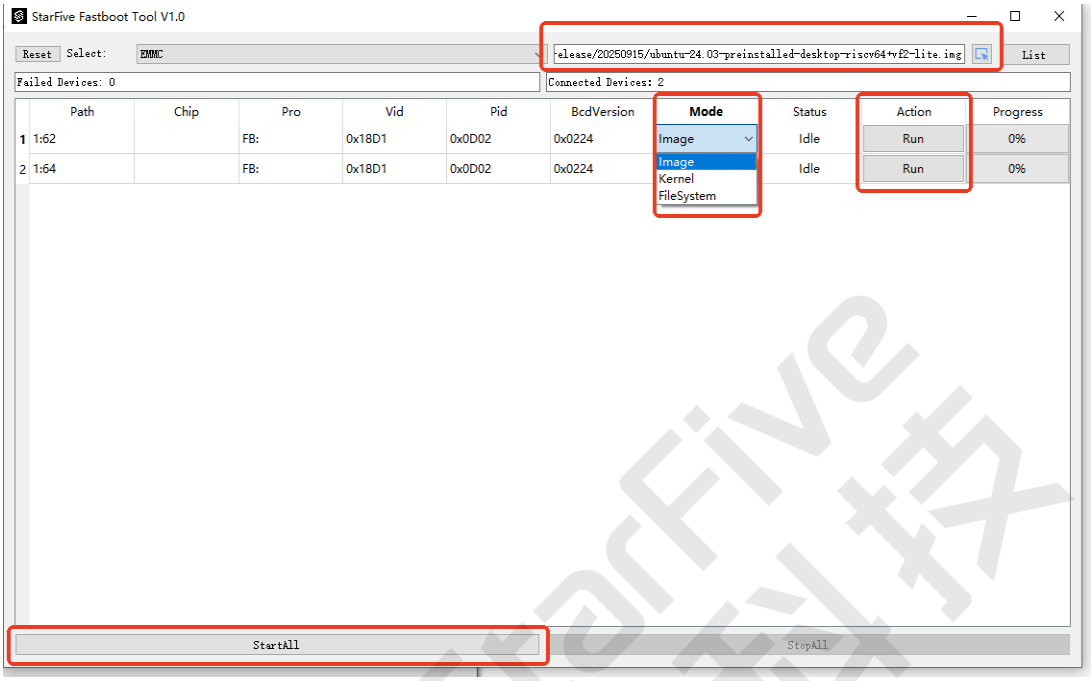
2. Select burning mode and file:

   a. Choose the appropriate burning mode based on your requirements:

      - Image: For burning system image files (`*.img`).
      - Kernel: For burning the Linux kernel file (`starfive-visionfive2-vfat.part`).
      - FileSystem: For burning filesystem images (`*.ext4`).

b. Select the corresponding image file (e.g., `ubuntu-24.03-preinstalled-desktop-riscv64+vf2-lite.img`).

Figure 3-18 Select Image File



3. Start burning by clicking the **Run or Start All** button to begin the download. Wait for the progress bar to reach 100%, indicating the burning process is complete.

Figure 3-19 Start Burning

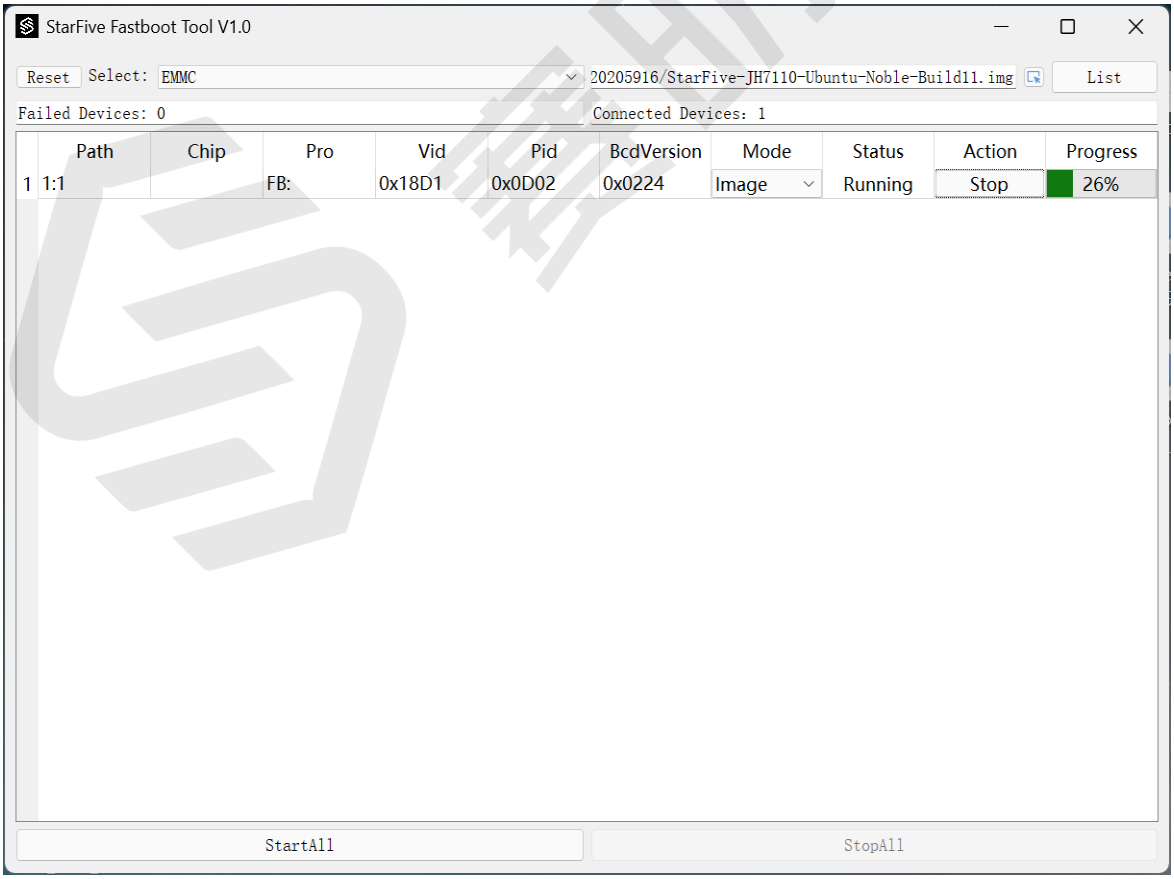
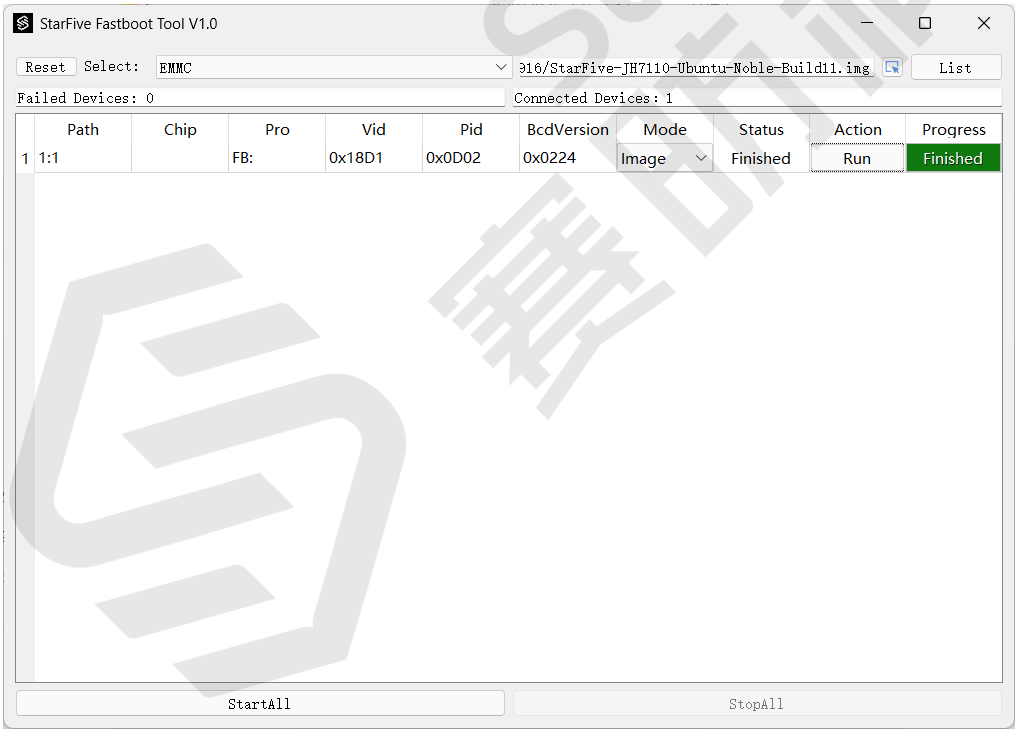


Figure 3-20 Example Output

```
Flashing Sparse Image
........ wrote 16776192 bytes to 'all'
Starting download of 16776244 bytes
..........................................................
.........................
..........................................................
....
downloading of 16776244 bytes finished
Flashing sparse image at offset 0
Flashing Sparse Image
........ wrote 16776192 bytes to 'all'
Starting download of 16776244 bytes
..........................................................
.........................
..........................................................
....
downloading of 16776244 bytes finished
Flashing sparse image at offset 0
Flashing Sparse Image
```



4. Once the image is successfully burned, restart the board.

3.4.2.2. Using Fastboot Tool on Ubuntu

Perform the following steps to use Fastboot Tool:

1. Install Fastboot Tool on Ubuntu:

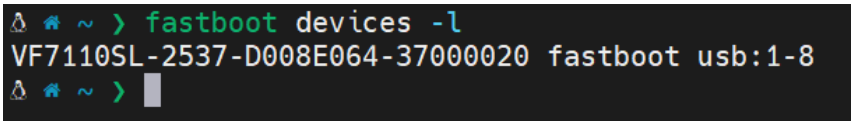
```
$ sudo apt install fastboot
```

2. For enabling faster and more reliable flashing, image should be converted into a sparse format to skip empty data blocks.

```
$ sudo apt install img2simg
$ img2simg StarFive-JH7110-Ubuntu-Noble-Build11.img xxxxx.img
```

3. Enter the fastboot mode on Ubuntu. For details, see Enter fostboot mode step in Software Preparation *(on page 17)*
4. Run `fastboot devices -l` and find the device.

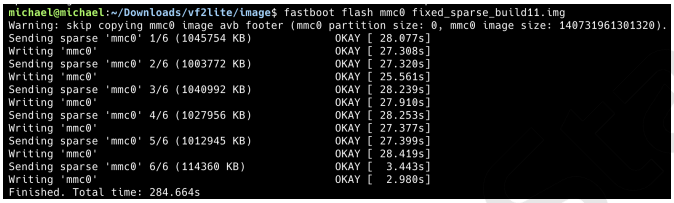
Figure 3-21 Example Output



5. Run `fastboot flash mmc0 xxxxx.img` to burn the image into eMMC, and then restart the device after flashing:

Tip:
xxxxx.img is the file generated in Step 2 *(on page 26)*.

Figure 3-22 Example Output



3.5. Logging into Distro

Perform the following steps to log into Distro:

1. Connect a display to VisionFive 2 Lite via HDMI.
2. Insert the TF card with the Ubuntu or Debian image into VisionFive 2 Lite and power it on.
3. Enter the credentials as follows:
   - **Username**: user
   - **Password**: starfive
4. You can log into Ubuntu OS by:
   - Using Desktop over HDMI *(on page 26)*
   - Using SSH over Ethernet *(on page 27)*
   - Using a USB to Serial Converter *(on page 30)*

3.5.1. Using Desktop over HDMI

After installing Ubuntu, you can log in to Ubuntu OS on VisionFive 2 Lite using desktop over HDMI.

Steps:

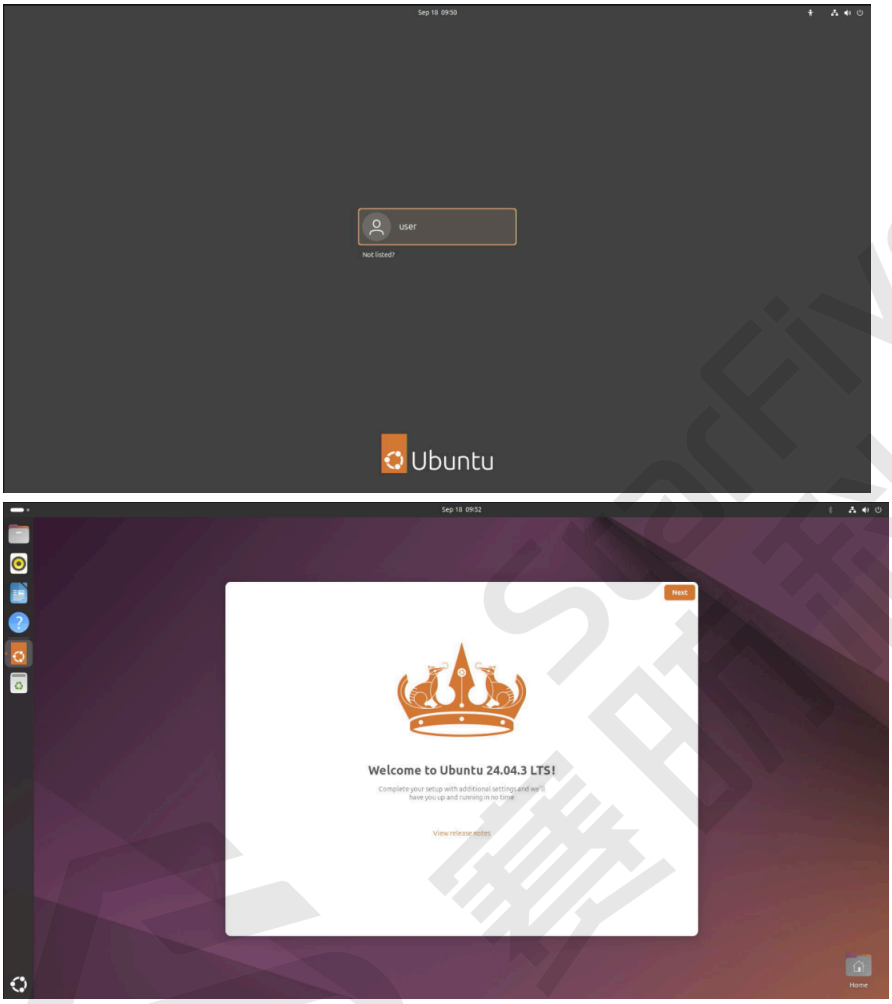
1. After the HDMI of the display screen is connected, insert the micro-SD card with the Debian image into the VisionFive 2 Lite and power on.
2. After the desktop login system is displayed, you can use the keyboard and mouse on VisionFive 2 Lite.
3. Enter the credentials as follows:

- **Username**: user
- **Password**: starfive

Result:

You will see the following interface:

Figure 3-23 Ubuntu Interface



3.5.2. Using SSH over Ethernet

After installing Ubuntu, you can log in to Ubuntu OS on VisionFive 2 Lite through an SSH connection over the local network.

1. Prepare a VisionFive 2 Lite with Ubuntu image and power on.
2. Connect one end of an Ethernet cable to the RJ45 connector on the VisionFive 2 Lite and the other end of the cable to a router.
3. After a successful Ethernet connection, your router will assign an IP address to the VisionFive 2 Lite and it will be connected to the Internet.
4. Continue the steps according to your OS:
   - For Windows *(on page 28)*
   - For Mac/Linux *(on page 29)*

3.5.2.1. For Windows

1. Log in to your router (usually you need to enter `192.168.0.1` on the web browser to enter the router).
2. Go to DHCP configuration and find the IP address of the VisionFive 2 Lite.

   Tip:
   You can easily find the IP address of the VisionFive 2 Lite by referring to its hostname, `starfive`.

3. Download and install Putty by visiting this link.

   Tip:
   Putty is an SSH and telnet client through which you can connect to the Carrier Board. You can skip this step if you already have Putty installed.

4. Open Putty or other SSH terminal tool to log in to Ubuntu.
5. Select **SSH** under the **Connection Type**.
6. Configure the settings as follows:
   - **Host Name**: IP address of your VisionFive 2 Lite
   - **Port**: 22
7. Click **Open**.
8. (Optional) Decide the user account. If you need to use the `root` account for privileged operations in remote access, follow the instructions in Using SSH over Ethernet as Root Account *(on page 40)*.

   Note:
   If you don't need to login as `root`, skip this step.

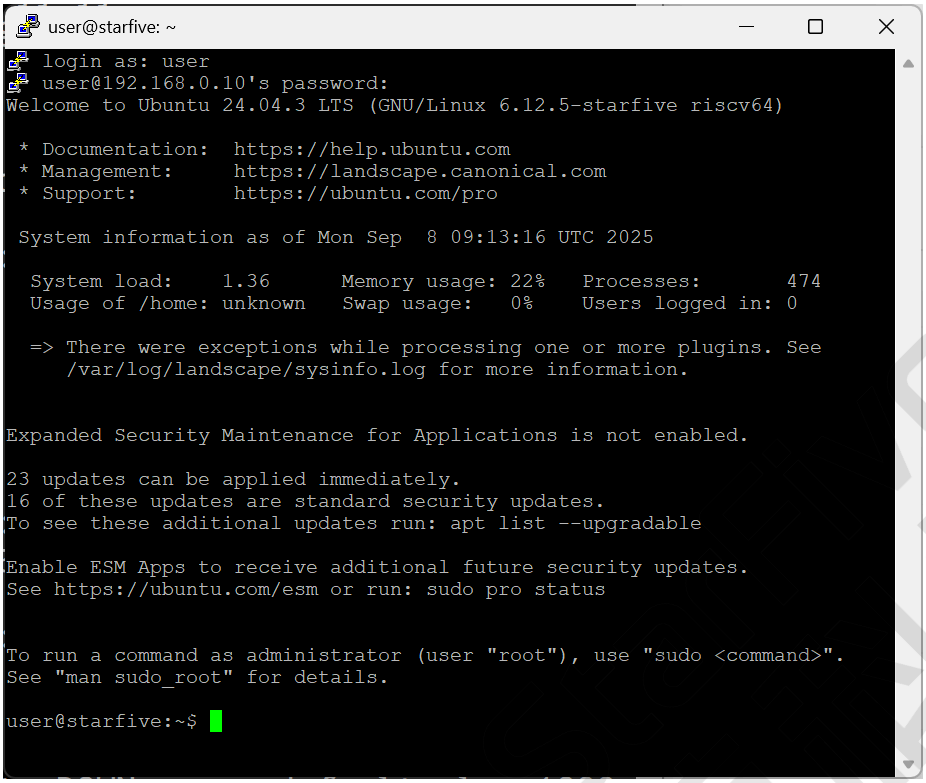
9. Enter the credentials as follows:

   Note:
   If you want to login as `root` account, perform the previous step and change the **Username** as `root` in the following credentials.
   - **Username**: user
   - **Password**: starfive

Result:

Now you have connected with the VisionFive 2 Lite via SSH using windows!

Figure 3-24 Example Output



3.5.2.2. For Mac/Linux

1. Log in to your router (usually you need to enter **192.168.0.1** on the web browser to enter the router).
2. Go to DHCP configuration and find the IP address of the VisionFive 2 Lite.

   Tip:
   You can easily find the IP address of the VisionFive 2 Lite by referring to its hostname, **starfive**.

3. (Optional) Decide the user account. If you need to use the `root` account for privileged operations in remote access, follow the instructions in Using SSH over Ethernet as Root Account *(on page 40)*.

   Note:
   If you don't need to login as `root`, skip this step.

4. Open a terminal window and type the following:

   Note:
   The following command is using `user` account as an example. If you need to login as `root` account, make sure you perform the previous step and change `user` as `root` in the following command.

   ```
   ssh user@192.168.1.xxx
   ```

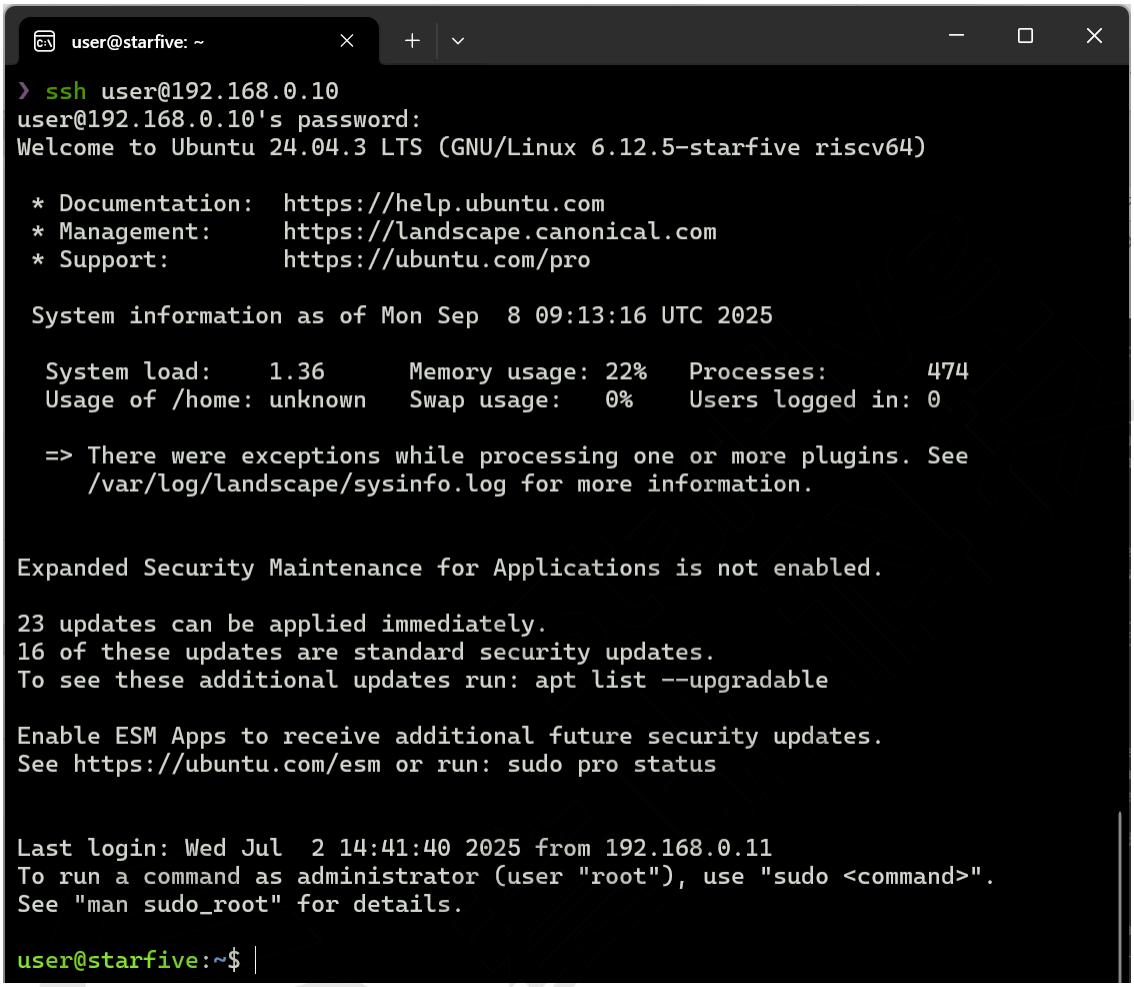
   Tip:
   `192.168.1.xxx` is the IP address of VisionFive 2 Lite.

5. Type the password as `starfive` in the prompt.
   Result:

Now you have connected with the VisionFive 2 Lite via SSH using Mac/Linux!

Tip:
`192.168.0.xxx` is the IP address of VisionFive 2 Lite.

Figure 3-25 Example Output



3.5.3. Using a USB to Serial Converter

You can log in to Ubuntu OS on VisionFive 2 Lite using a USB-to-Serial converter. Please follow the following steps according to your OS:

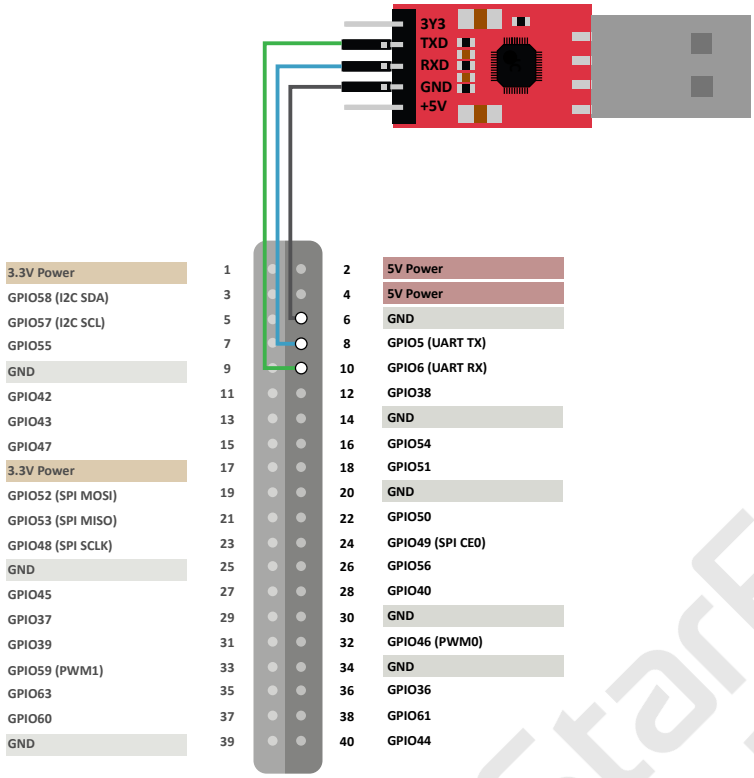
- For Windows *(on page 30)*
- For Mac/Linux *(on page 33)*

3.5.3.1. For Windows

Steps:

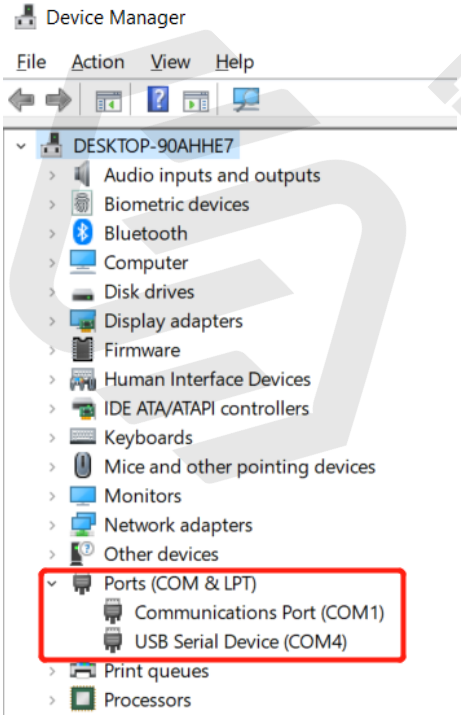
1. Insert the micro-SD card with the Debian image burned into VisionFive 2 Lite.
2. Connect one end of the USB Type-C cable to the USB Type-C port on the VisionFive 2 Lite, and connect the other end of the cable to the power adapter.
3. Connect the jumper wires from the USB to Serial Converter to the 40-Pin GPIO header of the VisionFive 2 Lite as follows.

Figure 3-26 Connecting Jumper Wire



4. Connect the USB-to-Serial converter to the PC.
5. Open Device Manager by typing **Device Manager** in the windows search box.
6. Click the drop-down arrow from **Ports (COM & LPT)** and find the name of the connected serial port (e.g.: **COM4**).

Figure 3-27 Example

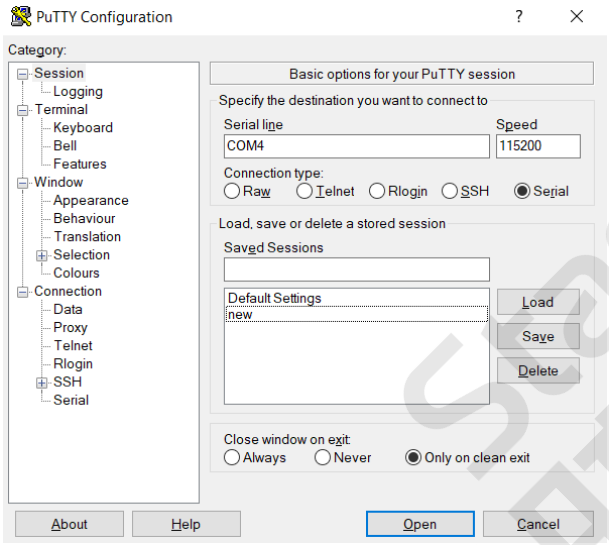


7. Download and install PuTTY by visiting this link.

Tip:
PuTTY is an SSH and telnet client through which you can connect to the Carrier Board via SSH. You can skip this step if you already have PuTTY installed.

8. Open Putty to connect the PC to the Carrier Board.
   a. Select **Serial** under the **Connection Type**.
   b. Configure the settings as follows:
      - **Serial line**: COM4 (choose your COM port)
      - **Speed**: 115200

Figure 3-28 Example Configuration



   c. Click **Open**.
9. Power on the VisionFive 2 Lite.
10. Type username and password in the prompt as follows:

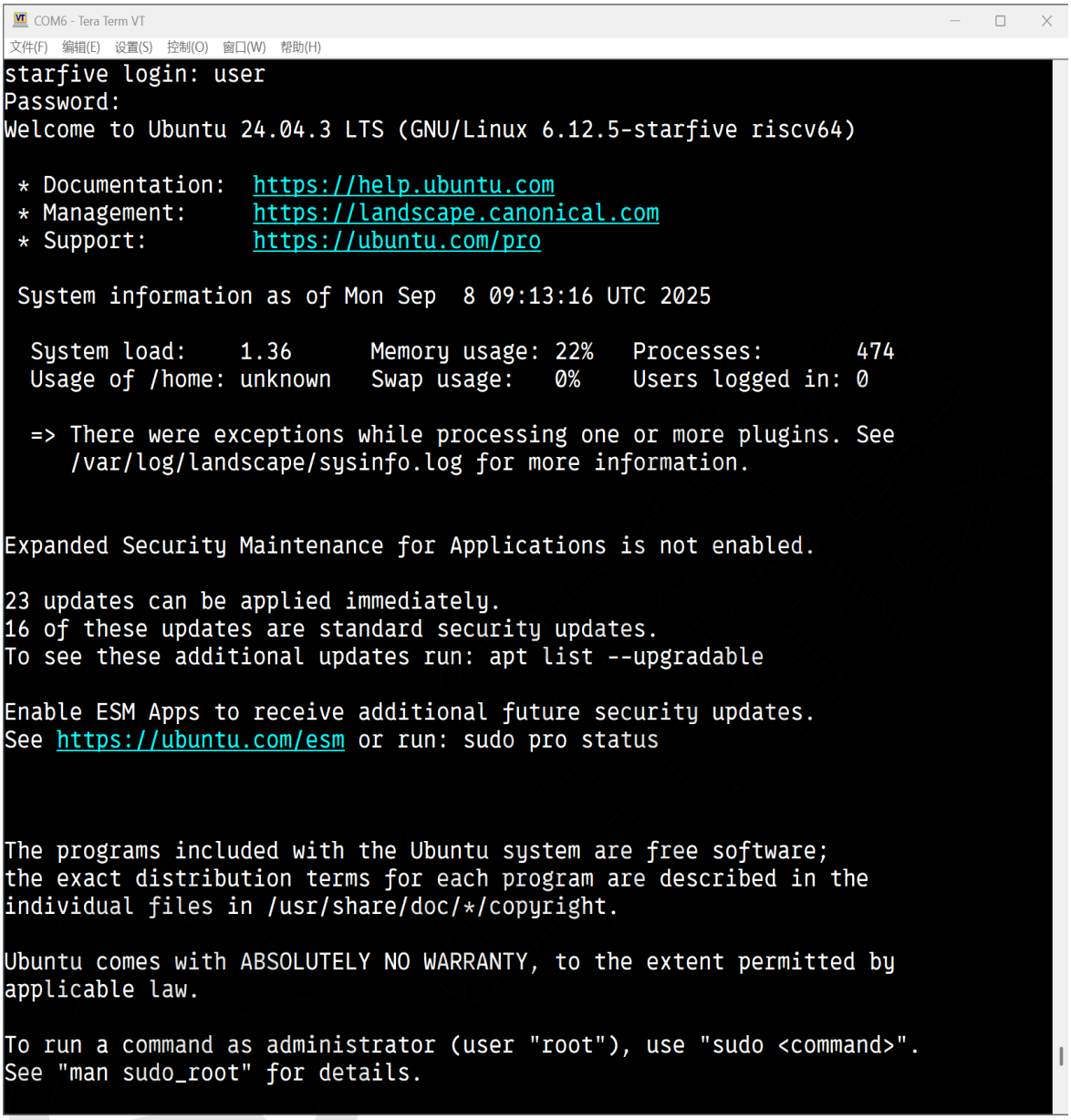
Note:
You can use either `user` or `root` account to login. The following example use `user` to login.

- **Username**: user
- **Password**: starfive

Result:

Now you have connected with the VisionFive 2 Lite via serial communication using windows!

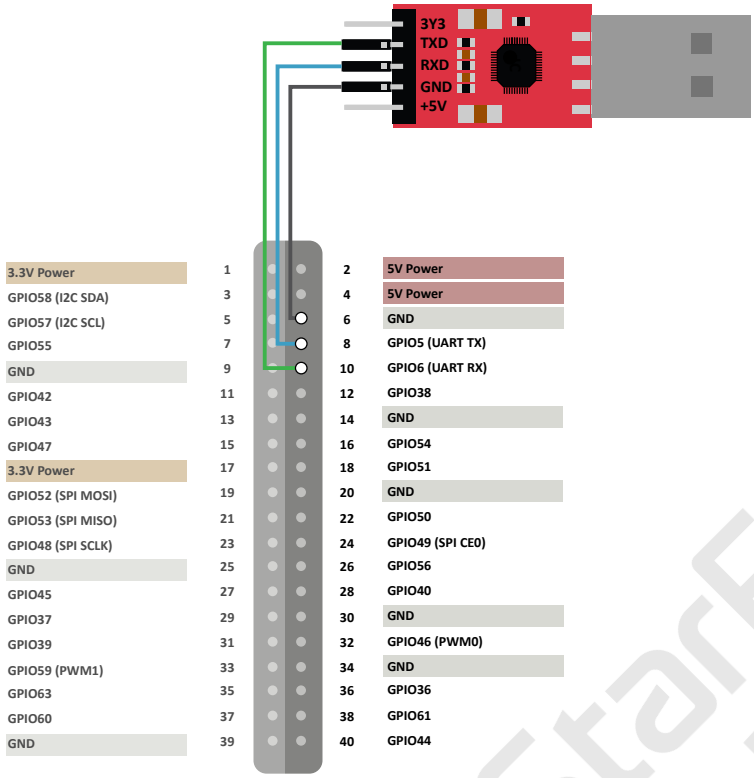
Figure 3-29 Example Output



3.5.3.2. For Mac/Linux

1. Prepare a VisionFive 2 Lite with Ubuntu image.
2. Connect one end of the USB Type-C cable to the USB Type-C port on the VisionFive 2 Lite, and connect the other end of the cable to the power adapter.
3. Connect the jumper wires between the USB-to-Serial converter and the 40-Pin GPIO header of the VisionFive 2 Lite as follows.

Figure 3-30 Connecting Jumper Wires



4. Connect the USB-to-Serial converter to the PC.
5. Open a terminal window on Mac/Linux.
6. Update the packages list by typing the following command.

```
sudo apt-get update
```

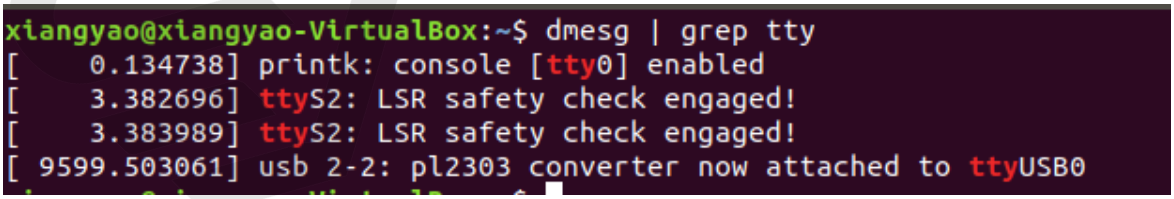
7. Install minicom by typing the following command.

```
sudo apt-get install minicom
```

8. View the connected serial devices.

```
dmesg | grep tty
```

Figure 3-31 Example Output

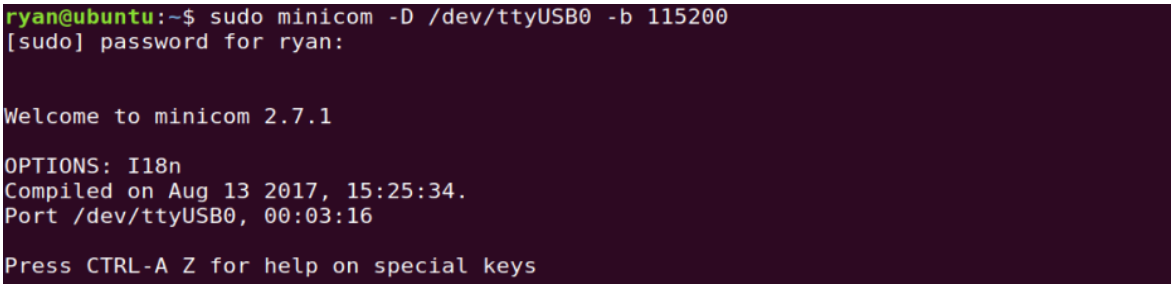


9. Connect to the serial device by typing the following command.

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

Note:
The baud rate is set to 115,200.

Figure 3-32 Example Output



10. Power on the VisionFive 2 Lite.
11. Type username and password in the prompt as follows:

Note:

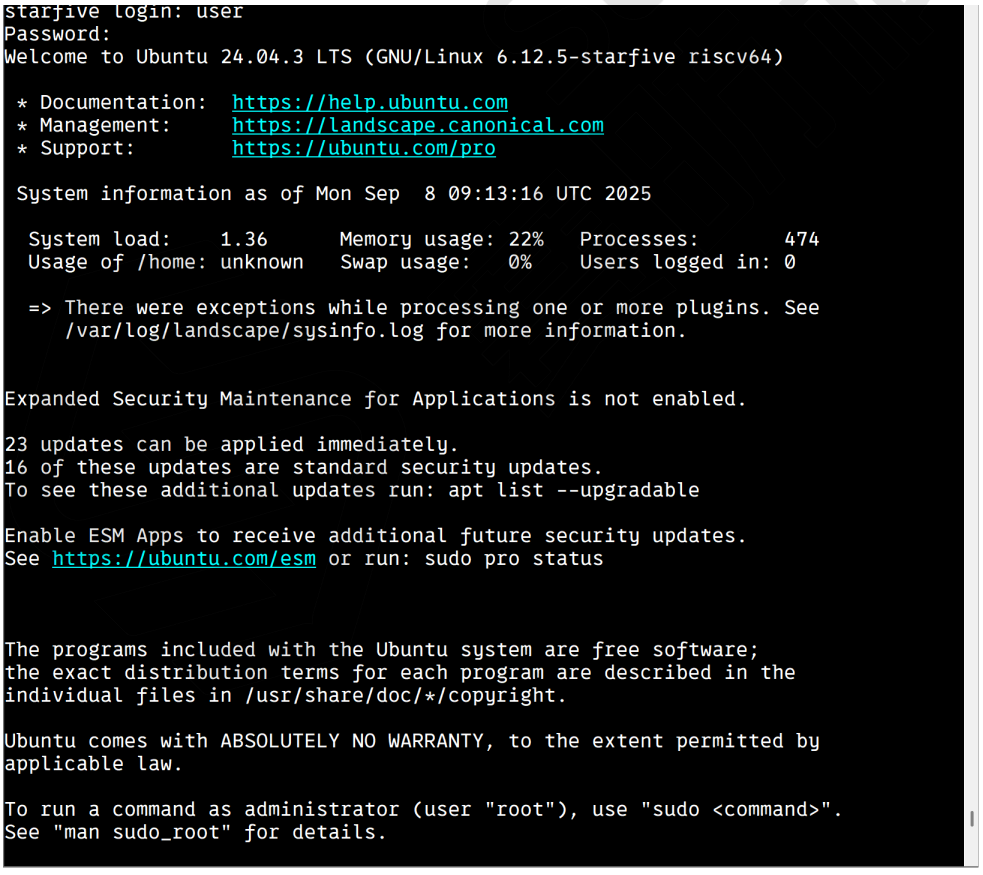
You can use either `user` or `root` account to login. The following example use `user` to login.

- **Username**: user
- **Password**: starfive

Result:

Now you have connected with the VisionFive 2 Lite via serial communication using MacOS/Linux!

Figure 3-33 Example Output



3.6. Install Packages

Install Essential Packages

There are some packages that you can install to improve the overall user experience, which includes:

- vim
- nautilus (Gnome File Viewer)

Installing packages provided by StarFive

The following are the packages provided to install:

Some packages particular are not available to download via apt/apt-get, and is provided by StarFive apt source:

- Node.js 18.19.1
- v8 10.2.154.13
- libsdl2-dev 2.0-0
- QT 5.15.13
- Firefox 126.0.1-1
- Libreoffice 4:24.2.7
- NW.js 0.65.1
- FFmpeg 7:6.1.1-3ubuntu5
- GStreamer 1.24.2-1ubuntu0.1
- v4l2test (This is a custom shell script to use the CSI camera) 1.1-OK5

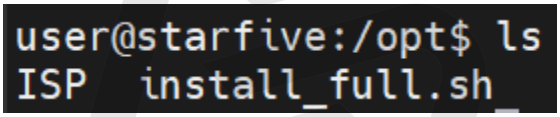
There is a script prepared so that you can install the packages (and its runtime dependencies) with the run of a script.

You will just need to run:

Note:
Make sure VisionFive 2 Lite is connected to the Internet before running the script.

```
cd /opt/sudo ./install_package_and_dependencies.sh
sudo ./install_all.sh
```

Figure 3-34



3.7. Updating SPL and U-Boot of Flash

To update SPL and U-Boot of flash for VisionFive 2 Lite, two methods are provided:

Note:
For instructions to create SPL and `fw_payload` (U-Boot) files, refer to *Creating SPL File* and *Creating fw_payload File* sections in the *VisionFive 2 Lite Single Board Computer Software Technical Reference Manual* (Coming Soon).

1. Through the `tftpboot` command as described in Through tftpboot Command (U-Boot) *(on page 36)*.
2. Through the `flashcp` command as described in Through flashcp Command (Linux Distribution) *(on page 38)*.

Through `tftpboot` Command (U-Boot)

To update SPL and U-Boot through the `tftpboot` command, perform the following steps:

Note:
Step 1-7 are performed on the host PC while Step 8-13 are performed on VisionFive 2 Lite.

1. Connect one end of an Ethernet cable to the VisionFive 2 Lite RJ45 connector, and connect the other end of the cable to a router.
2. Install a TFTP server on the host PC by executing:

```
sudo apt-get update
sudo apt install tftpd-hpa
```

3. Check the server status:

```
sudo systemctl status tftpd-hpa
```

4. Execute the following to enter the TFTP server:

```
sudo nano /etc/default/tftpd-hpa
```

5. Configure the TFTP server as follows:

```
TFTP_USERNAME="tftp"
TFTP_DIRECTORY="/home/user/tftp"
TFTP_ADDRESS=":69"
TFTP_OPTIONS="-c -l -s"
```

Note:
TFTP_DIRECTORY refers to the directory to store `bootloader`, `u-boot`, SPL, image and so on.

6. Create `tftp-server` folder to store the files:

```
sudo mkdir -p /home/user/tftp
```

7. Restart the TFTP server by executing:

```
sudo systemctl restart tftpd-hpa
```

8. Power on VisionFive 2 Lite and wait until it enters the U-Boot command line interface.

Tip:

- Prerequisite:
  - An USB to TTL (Transistor-Transistor Logic) converter. Connect the USB to the computer, and connect the Dupont cable to the correct extension pin of VisionFive 2 Lite. Please pay attention to the cross connection of TX and RX.
  - Install Putty or secureCRT on your PC.
- When you power on the VisionFive 2 Lite, the serial port will print countdown, usually starting from 3. Hit any key to stop autoboot before the number decreases to 0, and you can enter the U-Boot command mode.

9. Configure the environment variables by executing:

```
setenv ipaddr 192.168.120.222;setenv serverip 192.168.120.99
```

Note:
Generally, the default IP of a router is 192.168.120.1. In this case, use the server IP as the IP assigned by the DHCP server of the router and use the VisionFive 2 Lite IP as 192.168.120.xxx. However, if your router IP is different (for example, 192.168.2.1), make sure the server IP and VisionFive 2 Lite IP are in the same IP domain (for example, 192.168.2.xxx).

10. Check the connectivity by pinging the host PC from VisionFive 2 Lite.

Example command:

```
ping 192.168.120.99
```

Result:

The following output indicates that the host PC and VisionFive 2 Lite have established communication on the same network.

```
StarFive # ping 192.168.120.99
speed: 1000, full duplex
Using dwmac.10020000 device
host 192.168.120.99 is alive
```

11. Initialize SPI Flash:

```
sf probe
```

Result:

```
StarFive # sf probe
SF: Detected gd25lq128 with page size 256 Bytes, erase size 4 KiB, total 16 MiB
```

12. Update SPL binary, the following is the command and example output:

```
StarFive # tftpboot 0xa0000000 ${serverip}:u-boot-spl.bin.normal.out
Using ethernet@16030000 device
TFTP from server 192.168.120.99; our IP address is 192.168.120.222
Filename 'u-boot-spl.bin.normal.out'.
Load address: 0xa0000000
Loading: ##########
1.6 MiB/s
done
Bytes transferred = 132208 (20470 hex)

StarFive # sf update 0xa0000000 0x0 $filesize
device 0 offset 0x0, size 0x20470
0 bytes written, 132208 bytes skipped in 0.23s, speed 5206961 B/s
```

13. Update U-Boot binary, the following is the command and example output:

```
StarFive # tftpboot 0xa0000000 ${serverip}:visionfive2_fw_payload.img
Using ethernet@16030000 device
TFTP from server 192.168.120.99; our IP address is 192.168.120.222
Filename 'visionfive2_fw_payload.img'.
Load address: 0xa0000000
Loading: ##################################################################
#################################################################
#################################################################
#######
2.2 MiB/s
done
Bytes transferred = 2955397 (2d1885 hex)

StarFive # sf update 0xa0000000 0x100000 $filesize
device 0 offset 0x100000, size 0x2d1885
0 bytes written, 2955397 bytes skipped in 0.507s, speed 5922361 B/s
StarFive #
```

Through `flashcp` Command (Linux Distribution)

To update SPL and U-Boot through the `flashcp` command, perform the following steps:

1. Install the `mtd-utils` package by executing the following command:

```
apt install mtd-utils
```

2. Transfer the latest `u-boot-spl.bin.normal.out` and `visionfive2_fw_payload.img` files to Debian or Ubuntu system through SCP.

3. Execute the following command to check the MTD partition:

```
cat /proc/mtd
```

Example Output:

You will see the partition information in the QSPI flash:

```
dev: size erasesize name
mtd0: 000f0000 00001000 "spl"
mtd1: 00010000 00001000 "uboot-env"
mtd2: 00f00000 00001000 "uboot"
```

4. Update the SPL and U-Boot binaries according to different partitions:

   - Example command to update SPL:

     ```
     flashcp -v u-boot-spl.bin.normal.out /dev/mtd0
     ```

   - Example command to update U-Boot:

     ```
     flashcp -v visionfive2_fw_payload.img  /dev/mtd2
     ```

Example Command and Output:

```
# flashcp -v u-boot-spl.bin.normal.out /dev/mtd0
Erasing blocks: 36/36 (100%)
Writing data: 143k/143k (100%)
Verifying data: 143k/143k (100%)


# flashcp -v visionfive2_fw_payload.img  /dev/mtd2
Erasing blocks: 736/736 (100%)
Writing data: 2943k/2943k (100%)
Verifying data: 2943k/2943k (100%)
```

5. Restart the system to make the updates take effect.

4. Appendix

4.1. Using SSH over Ethernet as Root Account

After the new system is installed, the rejected connection denial appears when you try to log on to the Debian Linux server as a root user. Here is the example information:

```
$ ssh root@192.168.120.41
ssh: connect to host 192.168.120.41 port 22: Connection refused
```

To enable SSH root login, perform the following steps:

1. Run the following command to configure the SSH server:

   ```
   echo 'PermitRootLogin=yes'  | sudo tee -a /etc/ssh/sshd_config
   ```

2. Restart the SSH server:

   ```
   sudo systemctl restart sshd
   ```

   Result:

   You will be able to use SSH login using the root account. The following output indicates the login is successful:

   Example Output:

   ```
   $ ssh root@192.168.120.41
   root@192.168.120.41's password:
   Linux starfive 5.15.0-starfive #1 SMP Fri Feb 24 03:26:44 EST 2023 riscv64

   The programs included with the Debian GNU/Linux system are free software;
   the exact distribution terms for each program are described in the
   individual files in /usr/share/doc/*/copyright.

   Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
   permitted by applicable law.
   Last login: Mon Feb 27 08:05:28 2023 from 192.168.120.130
   root@starfive:~#
   ```

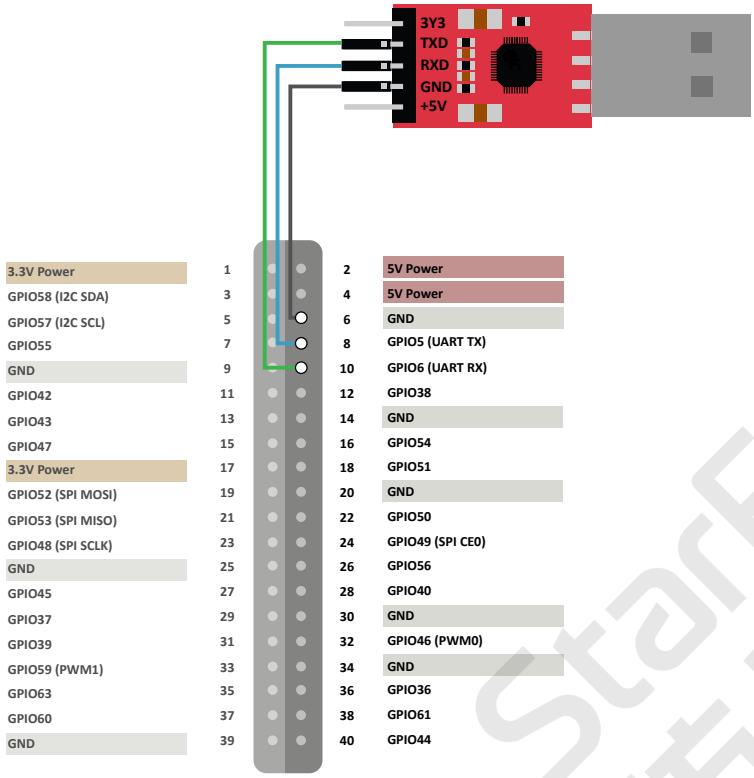
3. Login as `root` account using SSH as described in Using SSH over Ethernet *(on page 27)*.

4.2. Recovering the Bootloader

The SPL and U-Boot are stored inside the SPI flash of your board. There may be situations where you accidentally empty the flash or if the flash is damaged on your board. In these situations, it's better to recover the bootloader.

1. Connect the jumper wires between the USB-to-Serial converter and the Debug pins of VisionFive 2 Lite 40-pin GPIO header. The following figure is an example:

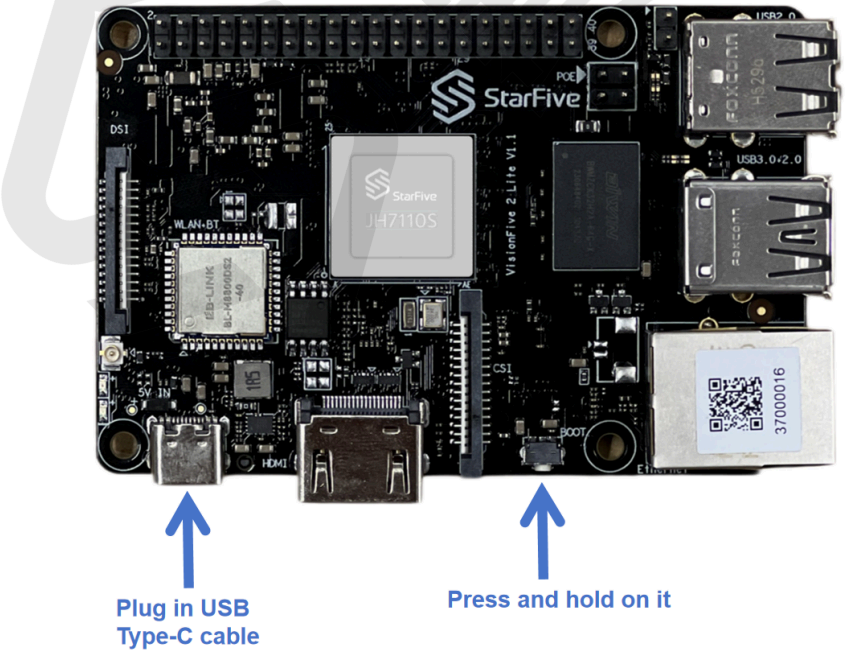
Figure 4-1 Connecting to the Debug Pins of VisionFive 2 Lite 40-pin GPIO Header



2. Before you recover the bootloader, press and hold the recovery button while to UART mode.

Tip:
The following figure shows the UART boot mode settings. .

Figure 4-2 Enter UART boot mode



3. Configure the serial port baud rate settings to `115200` bps.

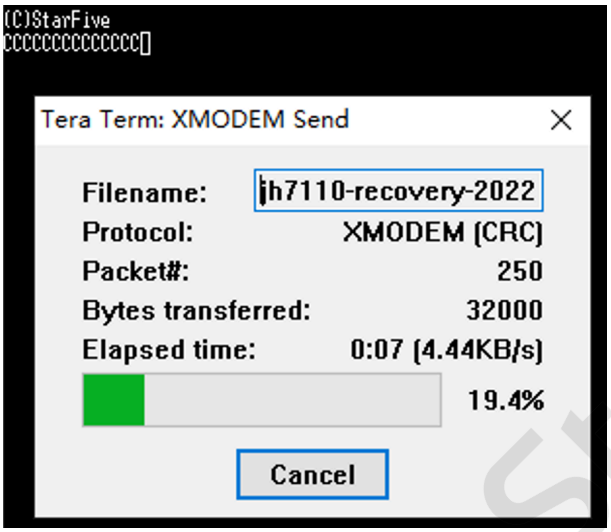
4. Power up, you will see an output like this:

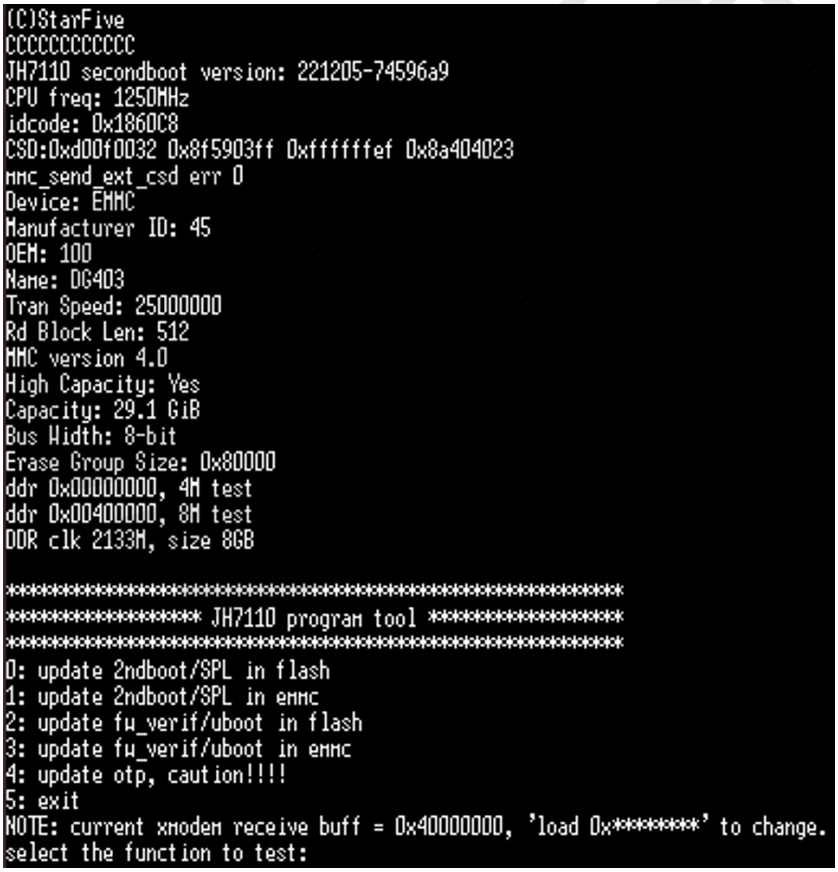
```
ccccccccccccccccccccc
```

5. Transfer the latest recovery binary (`jh7110-recovery-<Version>.bin`) by XMODEM. The recovery binary is located at: https://github.com/starfive-tech/Tools/tree/master/recovery.

> **Tip:**
> *<Version>* indicates the version number of the recovery file. Make sure you use the latest version.

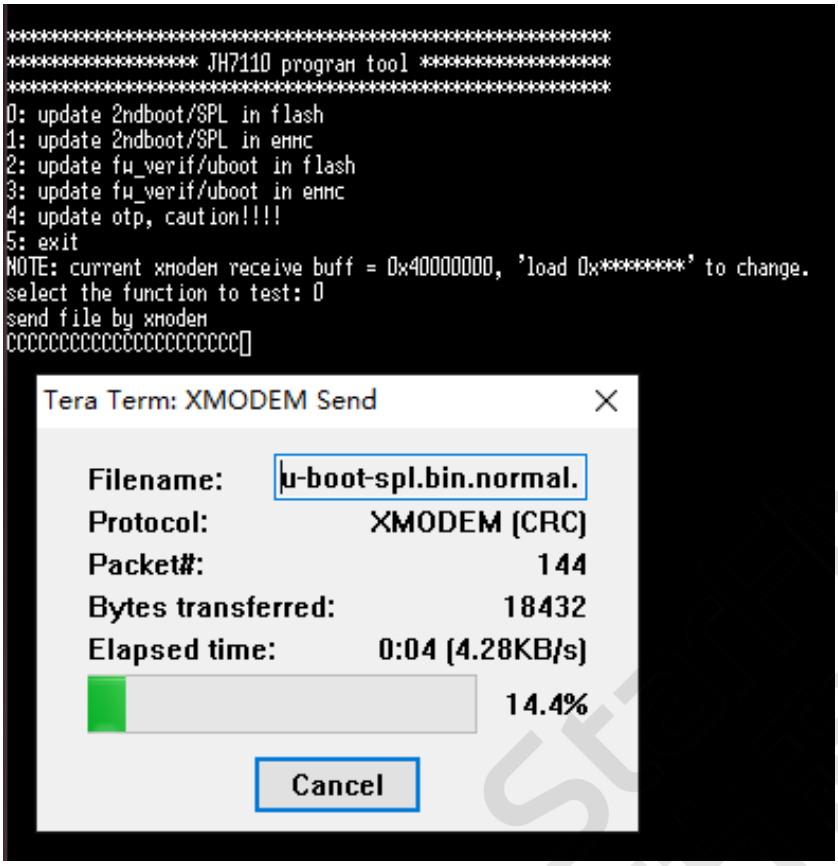
Figure 4-3 Example Output

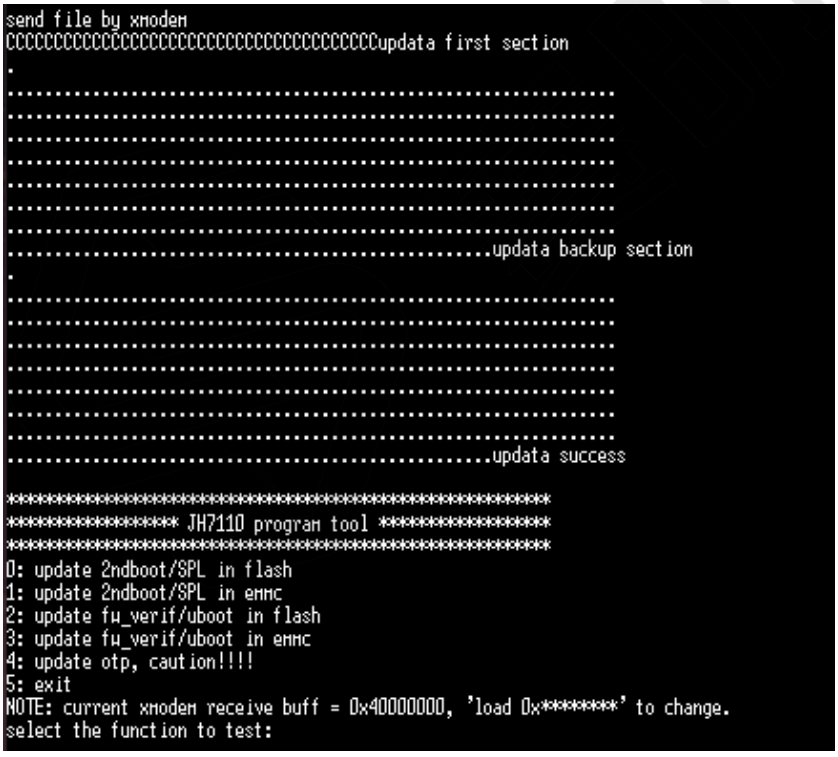




6. Type `0` and press **Enter** on your keyboard to update SPL binary <`u-boot-spl.bin.normal.out`>.

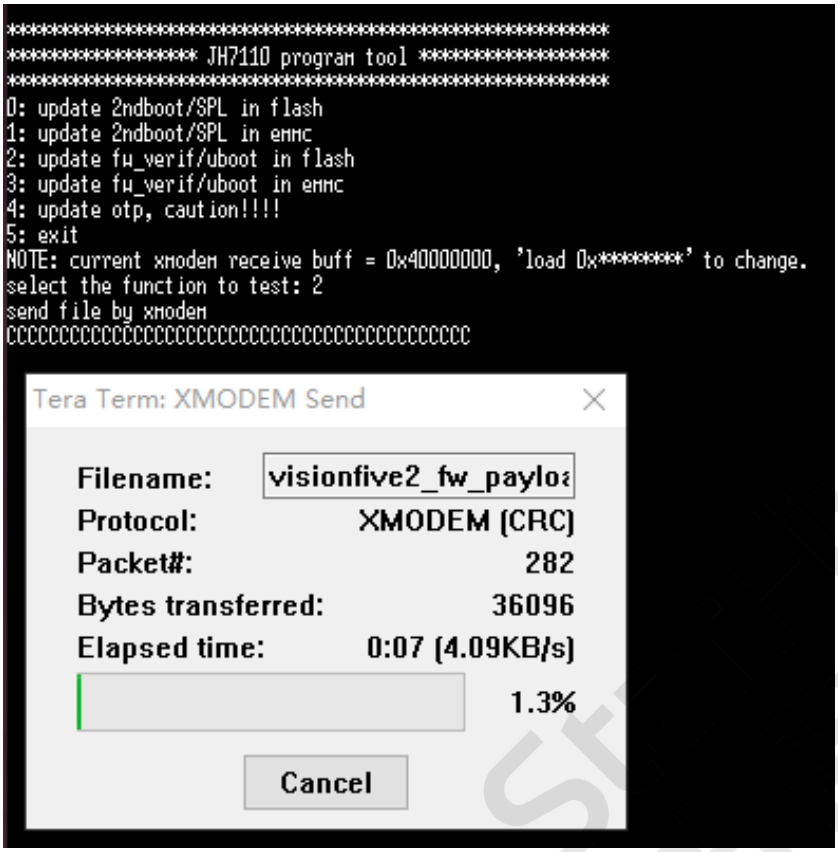
Figure 4-5 Example Output





7. Type 2 and press **Enter** on your keyboard to update U-Boot binary <visionfive2_fw_payload.img>.

Figure 4-7 Example Output



8. Reboot VisionFive 2 Lite.

4.3. GitHub Repository

The following table describes the GitHub Repository addresses:

Note:
Make sure you have switched to the corresponding branch.

Table 4-1 GitHub Repository Addresses

Type	Repository
Buidlroot SDK	Code Release
Ubuntu & Debian	GitHub
Recovery bin	Recovery bin
StarFive Fastboot Tool	Fastboot Tool