StarFive 赛昉科技

VisionFive 2 Datasheet

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Legal Statements

Important legal notice before reading this documentation.

PROPRIETARY NOTICE

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Preface

About this guide and technical support information.

About this document

This document mainly provides the users with the features and technical specifications for StarFive next generation single board computer - VisionFive 2.

Revision History

Table 0-1 Revision History

Version	Released	Revision
1.4	2022/1/16	Added power consumption specification.
1.3	2022/12/8	Added a note about using spacers in Mechanical Specification *(on page 13)*. Updated the dimensions.
1.2	2022/10/20	• Revised the display of MIPI CSI. • Updated the support information. • Updated the USB-C description. • Updated the GPU description. • Updated the Reset button description. • Updated USB Host *(on page 19)*. • Added USB Device Port *(on page 19)*. • Updated the pin assignments in GPIO Pin Assignments *(on page 17)*. • Updated the block digram. • Updated the description in Audio Jack *(on page 19)*.
1.1	2022/09/08	• Updated the mechanical drawings and the block diagram (bottom view). • Updated the description about Reset button.
1.0	2022/09/05	The first 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.

1. Overview
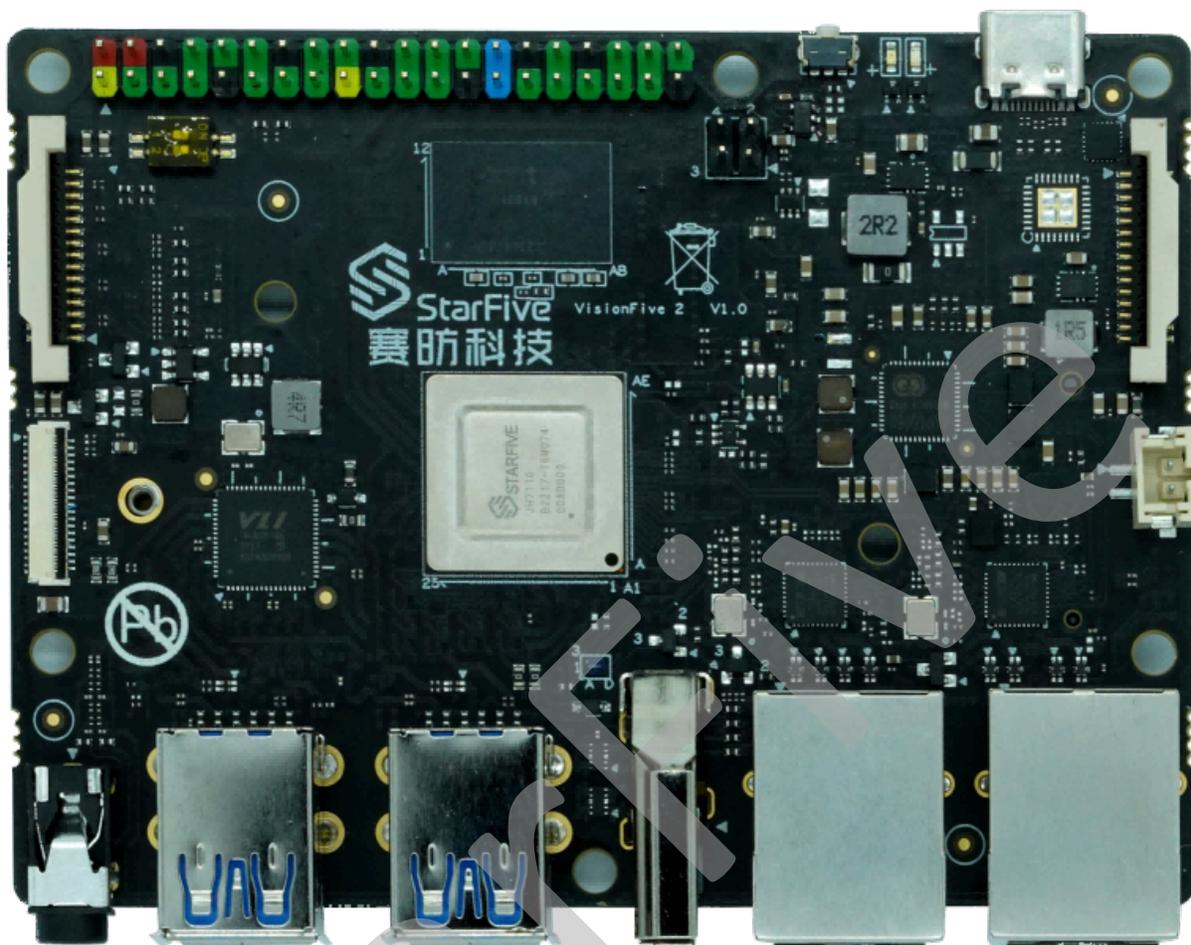
VisionFive 2 is the world's first high-performance RISC-V single board computer (SBC) with an integrated GPU. Compared with its last generation, VisionFive 2 has been fully upgraded with significant improvements in the processor work frequency, multimedia processing capabilities, scalability, etc. Its superior performance and reasonable price make VisionFive 2 the best affordable RISC-V development board ever.

VisionFive 2 boasts a quad-core 64-bit SoC with RV64GC ISA, running up to 1.5 GHz, and integrated with IMG BXE-4-32 MC1, supporting OpenCL 3.0, OpenGL ES 3.2, and Vulkan 1.2. Available with 2/4/8 GB LPDDR4 RAM options, VisionFive 2 provides rich I/O peripherals such as M.2 connector, eMMC socket, USB 3.0 ports, a 40-pin GPIO header, Gigabit Ethernet ports, a TF card slot, and many more. It has onboard audio and video processing capabilities and has MIPI-CSI and MIPI-DSI connectors as multimedia peripherals. The open source SBC also provides wide software compatibility including support for Debian.

1.1. Block Diagram

The following figure displays the block diagrams of VisionFive 2.

Figure 1-1 VisionFive 2 Block Diagram - Top View

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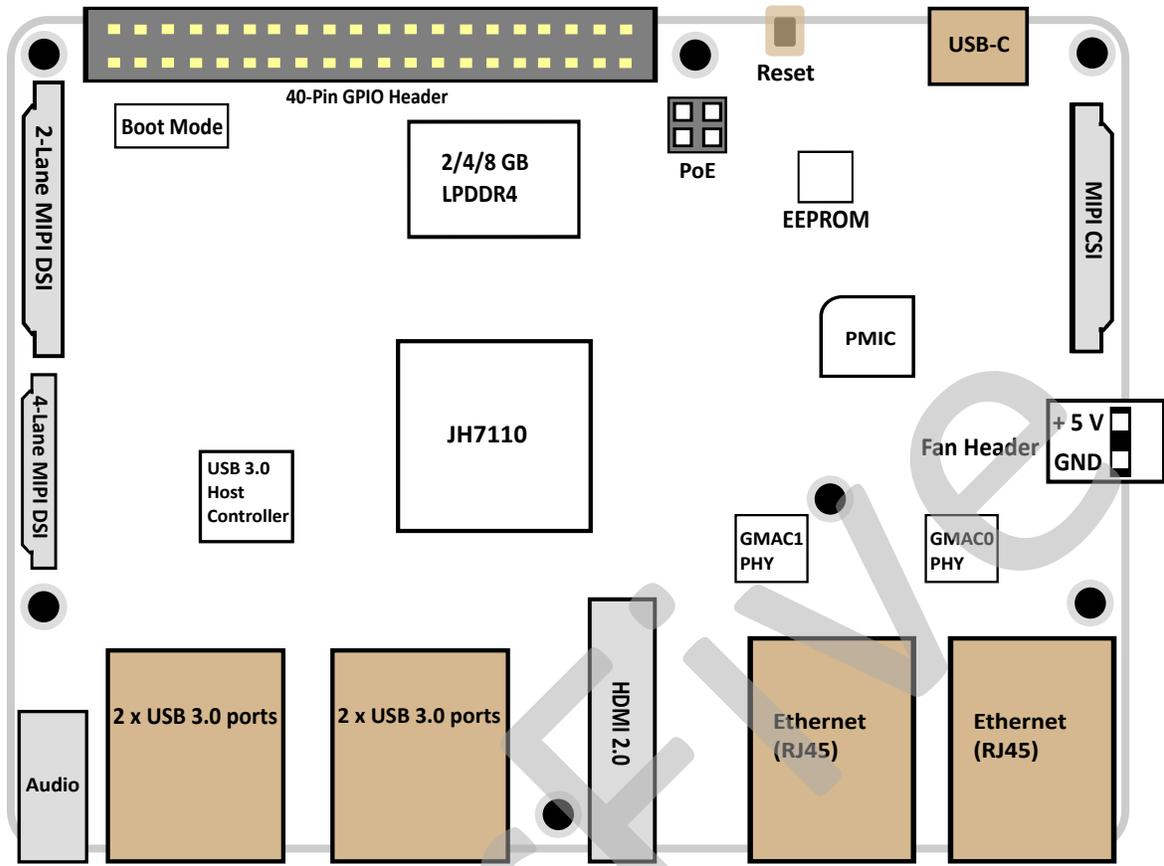
Figure 1-2 VisionFive 2 Block Diagram - Bottom View

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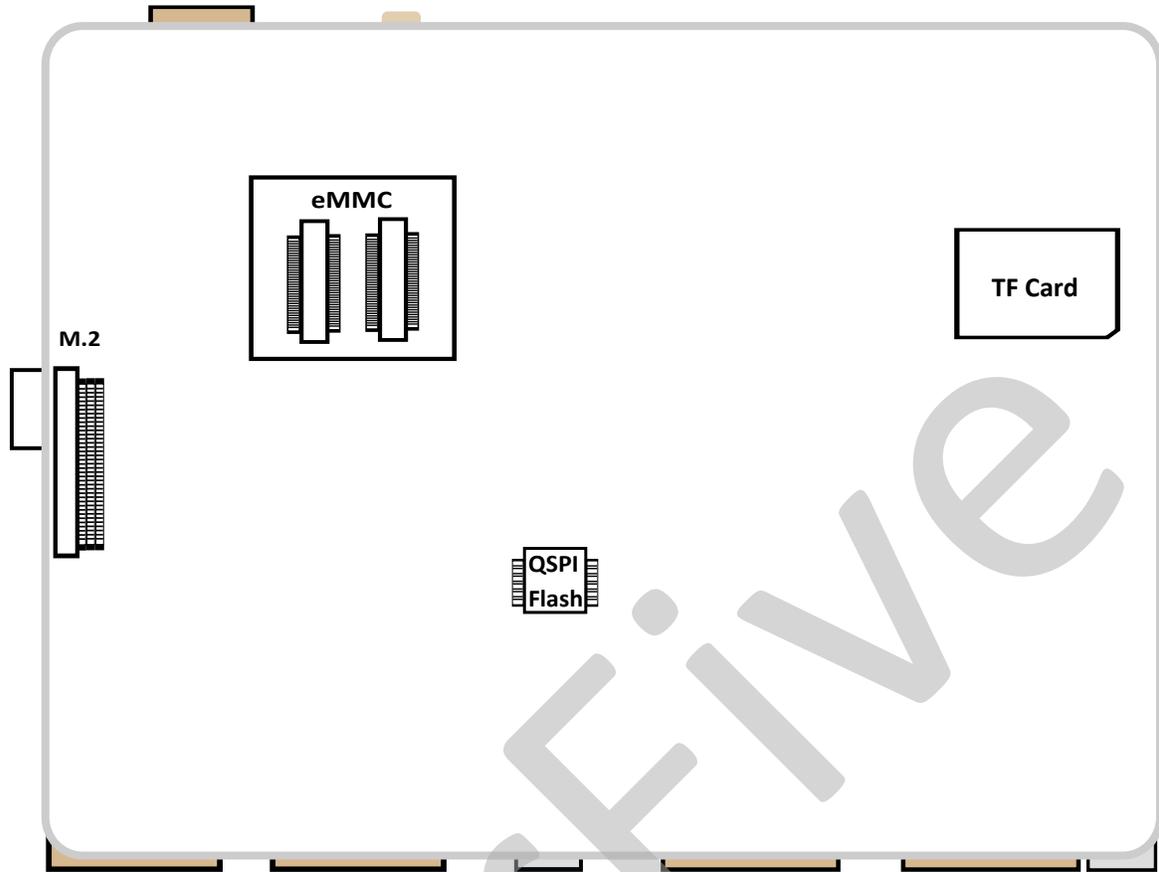
2. Features

VisionFive 2 provides the following features.

2.1. Hardware

This section describes the following VisionFive 2 hardware functions.

Processor

- StarFive JH7110 with RISC-V quad-core CPU with 2 MB L2 cache and a monitor core, supporting RV64GC ISA, working up to 1.5 GHz
- IMG BXE-4-32 MC1 with work frequency up to 600 MHz

Memory

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

Storage

- Onboard TF card slot: The VisionFive 2 can boot from the TF card.
- Flash: The firmware to store U-Boot and bootloader.

Video Processing

The video processing of VisionFive 2 has the following features.

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

2.2. Interfaces

- 1 × 2-lane MIPI DSI
- 1 × 4-lane MIPI DSI
- 1 × 2-lane MIPI CSI
- 1 × 3.5 mm Audio Jack
- 1 × USB-C port for charging
- 1 × USB device port (by reusing the USB-C port)
- 4 × USB 3.0 ports (multiplexed with a PCIe 2.0 1x lane)
- 1 × HDMI 2.0

- 2 × RJ45 Ethernet ports

- 1 × 4-pin PoE header

- 1 × 2-pin fan header

- 1 × Reset button

- 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

  ◦ and so on

2.3. Software

Operating System

VisionFive 2 supports Debian operating system.

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

3. Mechanical Specification

The mechanical drawing of VisionFive 2 is as the following:

Figure 3-1 VisionFive 2 Mechanical Drawing (Top View)
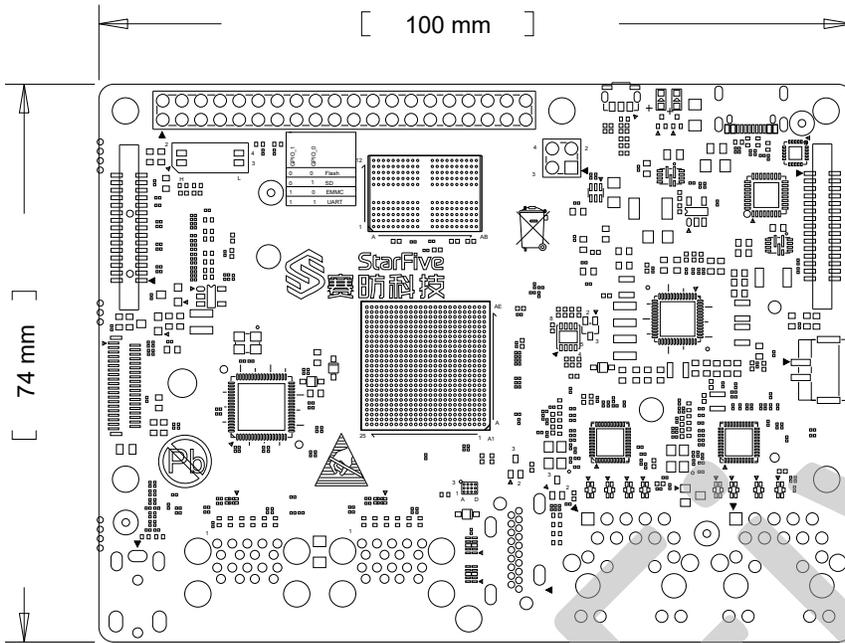
Figure 3-2 VisionFive 2 Mechanical Drawing (Bottom View)
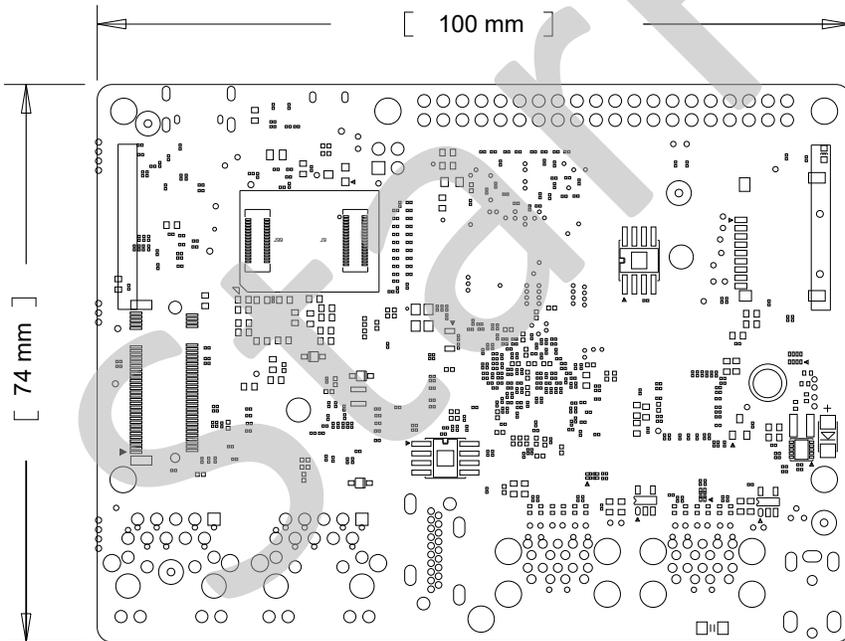
Dimensions

VisionFive 2 has the following dimensions.

- Length: 100 mm

- Width: 74 mm

Note:

During the use of VisionFive 2, 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 3-3 NPTHs on VisionFive 2
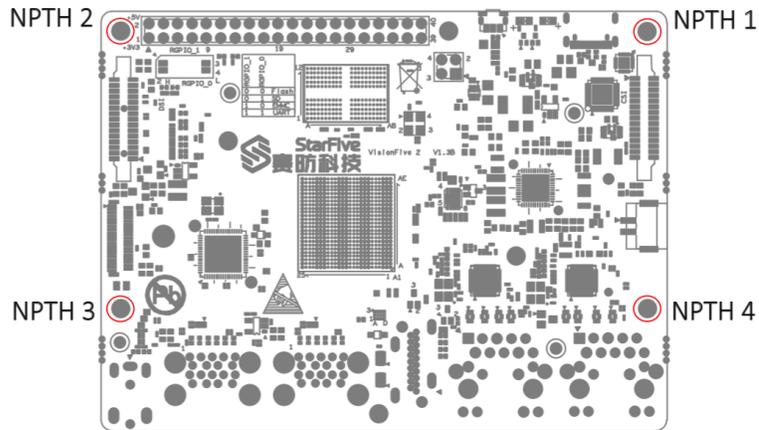
For spacers, StarFive strongly recommends that you use the copper columns or studs with the following specifications:

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

Figure 3-4 Single Head Hexagonal Copper Columns

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

Figure 3-5 Double Way Hexagon Copper Studs

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4. Electrical Specification

This chapter describes the VisionFive 2 electrical specification.

4.1. Power Requirements

Input Power

VisionFive 2 supports various ways of powering, smart power adapter as well as fixed voltage:

- USB PD 2.0

- Support USB Type C PD 2.0, 9 V/2 A, 12 V/2 A, 15 V/2 A, 20 V/2 A

- Qualcomm® Quick Charge™ 2.0

- Support QC3.0/2.0 adapter, 9 V/2 A, 12 V/1.5 A

- Power adapter with fixed voltage from 5 V to 20 V on the USB C power port

- 5 V Power from the GPIO Pin 2 and 4

4.2. Power Consumption

The following table shows the power consumption of VisionFive 2 in standby mode.

Table 4-1 VisionFive 2 Power Consumption in Standby Mode

Scenario	Temperature（℃)			Consumption (W)		
	Min	Typ	Max	Min	Typ	Max
VisionFive 2 without external modules, standby mode, network boot, disconnected with network cable	47.11	50.06	52.32	3.17	3.22	3.6
VisionFive 2 without external modules, standby mode, network boot, connected with network cable	48.9	-	52.32	3.66	-	3.6
VisionFive 2 standby mode, SD card boot, disconnected with network cable	47.22	50.81	53.19	3.25	3.31	3.68
VisionFive 2 standby mode, SD card boot, connected with network cable (GMAC0)	49.31	51.92	54.3	3.8	3.74	4.12

The following table shows the power consumption of VisionFive 2 in real work.

Table 4-2 VisionFive 2 Power Consumption in Real Work

Scenario	Temperature（℃)			Consumption (W)		
	Min	Typ	Max	Min	Typ	Max
VisionFive 2 playing video of 4K@60fps (Vdec, HDMI, HDMI I2S), connected with network cable (GMAC0)	58.65	60.62	60.8	4.86	5.3	5.32
VisionFive 2 capturing image and displaying via HDMI (MIPI CSI, ISP, HDMI), connected with network cable (GMAC0)	-	-	62.24	-	-	5.66

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Table 4-2 VisionFive 2 Power Consumption in Real Work (continued)

Scenario	Temperature（℃）			Consumption (W)		
	Min	Typ	Max	Min	Typ	Max
VisionFive 2 performing reading and writing tests (PCIe1 to M.2, PCIe0 to USB(VL805), connected with network cable (GMAC0)	-	-	72.57	-	-	13.16
VisionFive 2 performing encoding and decoding tests (JPU, Vdec, Venc), connected with network cable (GMAC0)	-	-	67.75	-	-	6.3

The following table shows the power consumption of VisionFive 2 in full workload.

Table 4-3 VisionFive 2 Power Consumption in Full Workload

Scenario	Tempera-ture（℃）	Current (mA)	Consump-tion (W)
VisionFive 2 full workload (GPU, HDMI, GMAC1, Video Encoder, Video Decoder, JPU, PWMDAC, PCIe1(NVMe), SD card)	73	780	9.36
VisionFive 2 full workload (GPU, HDMI, GMAC1, Video Encoder, Video Decoder, JPU, PWMDAC, PCIe1(NVMe), SD card, fan)	39	580	6.96
VisionFive 2 full workload (MIPI CSI, ISP, HDMI, GMAC1, Video Encoder, Video Decoder, JPU, PWMDAC, PCIe1(NVMe), SD card)	69	780	9.36
VisionFive 2 full workload (MIPI CSI, ISP, HDMI, GMAC1, Video Encoder, Video Decoder, JPU, PWMDAC, PCIe1(NVMe), SD card, fan)	36	580	6.96

4.3. GPIO Voltage

The required voltage level for all GPIO pins is 3.3 V.

5. Peripherals

VisionFive 2 has the following peripherals.

5.1. GPIO Interface

VisionFive 2 offers 40-Pin GPIO expansion which is compatible with most accessories on the market, 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

- and so on

5.1.1. GPIO Pin Assignments

The following table describes the GPIO pin assignments.

Table 5-1 GPIO Pin Assignments

Pin Name	Pin Num	Pin Num	Pin Name
+3.3V	1	2	+5V
GPIO58 (I2C SDA)	3	4	+5V
GPIO57 (I2C SCL)	5	6	GND
GPIO55	7	8	GPIO5 (UART TX)

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Table 5-1 GPIO Pin Assignments (continued)

Pin Name	Pin Num	Pin Num	Pin Name
GND	9	10	GPIO6 (UART RX)
GPIO42	11	12	GPIO38
GPIO43	13	14	GND
GPIO47	15	16	GPIO54
+3.3V	17	18	GPIO51
GPIO52 (SPI MOSI)	19	20	GND
GPIO53 (SPI MISO)	21	22	GPIO50
GPIO48 (SPI SCLK)	23	24	GPIO49 (SPI CE0)
GND	25	26	GPIO56
GPIO45	27	28	GPIO40
GPIO37	29	30	GND
GPIO39	31	32	GPIO46 (PWM0)
GPIO59 (PWM1)	33	34	GND
GPIO63	35	36	GPIO36
GPIO60	37	38	GPIO61
GND	39	40	GPIO44

5.1.2. GPIO Alternative Functions

All GPIOs can be switched (multiplexed) to support different functions including but not limited to SDIO, Audio, DMIC, SPI, I2C, UART, PWM, and CAN bus. For detailed instructions, refer to the *VisionFive 2 40-Pin GPIO Header User Guide* (coming soon). The alternate peripheral functions are described in detail in the *JH7110 Datasheet*.

5.2. eMMC Socket

VisionFive 2 offers a high speed eMMC socket for eMMC modules as OS and data storage. The eMMC socket is compatible with industrial commonly used pinout and form factor.

5.3. Camera and Display Interfaces

The following connectors are backward compatible with other industrial commonly used camera and display peripherals.

Camera

VisionFive 2 has 1 × 2-lane MIPI CSI camera port, supporting up to 1080p@30fps

Display

VisionFive 2 has the following interfaces for camera and display.

- 1 × 2-lane MIPI DSI display port, supporting up to 1080p@30fps

- 1 × 4-lane MIPI DSI display port, supporting up to 2K@30fps in both single display and dual display modes.

- 1 × HDMI 2.0, supporting up to 4K@30fps or 2K@60fps

> **Note:**
> Only one MIPI DSI port can be used for display at a time.

5.4. USB Host

VisionFive 2 has 4 × USB 3.0 ports (multiplexed with a PCIe 2.0 1x lane).

5.5. USB Device Port

VisionFive 2 has 1 × USB device port by reusing the USB-C port.

5.6. HDMI

VisionFive 2 has 1 × HDMI port, supporting HDMI 2.0 with resolutions up to 4K@30fps or 2K@60fps.

5.7. Audio Jack

VisionFive 2 supports analog audio output via a 4-ring 3.5 mm headphone jack.

5.8. M.2 Connector

VisionFive 2 offers an M.2 M-Key SSD socket with 1 × PCIe 2.0 interfaces, providing high speed storage access.

5.9. Gigabit Ethernet Port

VisionFive 2 has 2 × RJ45 Gigabit Ethernet ports.

5.10. Boot Mode Pins

VisionFive 2 provides pins to determine the boot mode before it is powered up. The following are the available boot modes:

- 1-bit QSPI Nor Flash

- SDIO3.0

- eMMC

- UART

5.11. 4-Pin PoE Header

VisionFive 2 provides Power over Ethernet (PoE) function. PoE carries electrical power through data cables, and reduces the cabling requirements for network devices. You can use this function by adding a separate PoE HAT out of our product package.

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5.12. Fan Header

VisionFive 2 has a 2-pin fan header. You can connect a 2-pin 5 V fan to the board if needed.

5.13. Button

VisionFive 2 provides 1 × Reset button.

> ✎ **Note:**
> To reset VisionFive 2, press and hold the Reset button for more than 3 seconds to ensure the reset is successful.

5.14. Temperature Range and Thermals

The recommended ambient operating temperature range is 0 to 50 degrees Celcius.

To reduce thermal output when idling or under light load, VisionFive 2 reduces the CPU clock speed and voltage. During heavier load, the speed and voltage (and hence thermal output) are increased. The internal governor will throttle back both the CPU speed and voltage to make sure the CPU temperature never exceeds 85 degrees C.

VisionFive 2 will operate perfectly well without any extra cooling and is designed for sprint performance - expecting a light use case on average and ramping up the CPU speed when needed (for example, when loading a webpage). If a user wishes to load the system continually or operate it at a high temperature at full performance, further cooling may be needed.

6. Support

For support, post questions to the [RVspace](#) forum.