Radxa ROCK 5B+ Product Brief

8K Pico-ITX Single Board Computer with LPDDR5

Revision 1.0

2024-06-25

Radxa Computer

Contents

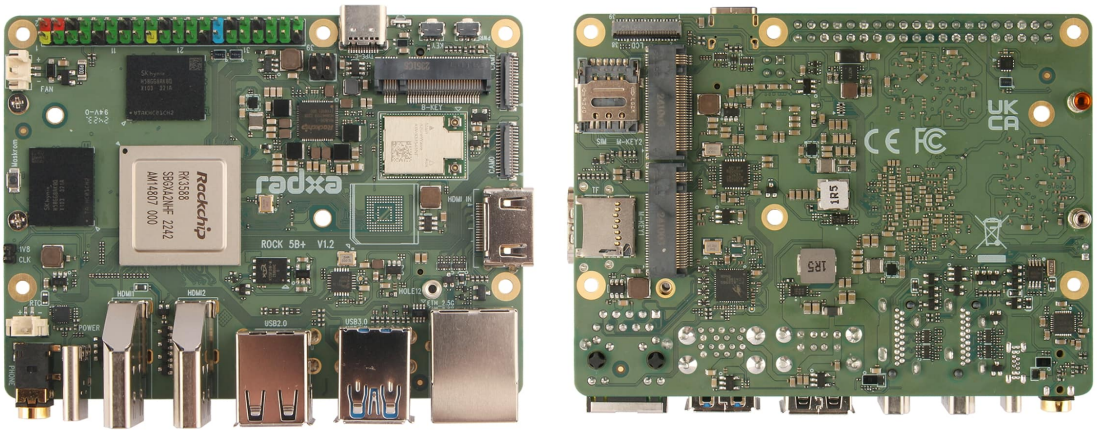
1 Revision Control Table

Version	Date	Changes from previous version
1.0	2024-06-25	First Version

2 Introduction

the Radxa ROCK 5B+ stands as an upgraded version of the Radxa ROCK 5B, presenting itself as a compact single-board computer (SBC) endowed with a myriad of cutting-edge features, characteristics, and expansion possibilities. Catering to manufacturers, IoT enthusiasts, hobbyists, gamers, PC users, and anyone seeking an ideal platform with outstanding performance and reliability, the ROCK 5B+ from Radxa emerges as the preferred choice. Radxa offers various options for LPDDR5 memory configurations on the ROCK 5B+ board:

- 4GB
- 8GB
- 16GB
- 24GB
- 32GB



Note: The actual board layout or components' location may change during the time but the main connectors type and location will remain the same

3 Features

3.1 Hardware

- Rockchip RK3588 SoC
- Quad Cortex®-A76 @ 2.2/2.4GHz and a quad Cortex®-A55 @ 1.8GHz based on Arm® DynamIQ™ configuration
- Arm® Mali™ G610MC4 GPU supporting:
  - OpenGL® ES1.1, ES2.0, and ES3.2
  - OpenCL® 1.1, 1.2 and 2.2
  - Vulkan® 1.1 and 1.2
  - Embedded high performance 2D image acceleration module
- NPU supporting INT4 / INT8 / INT16 / FP16 / BF16 and TF32 acceleration and computing power is up to 6TOPs
- 64bit LPDDR5 RAM 5500MT/S options:
  - 4GB
  - 8GB
  - 16GB
  - 24GB
  - 32GB
- Onboard eMMC options:
  - 16GB
  - 32GB
  - 64GB
  - 128GB
  - 256GB
- Able to provide 4 display outputs via two HDMI, one DP (type C) and one MIPI DSI
- H.265 / H.264 / VP9 / AV1 / AVS2 video decoder up to 8K@60fps
- H.264 / H.265 video encoder up to 8K@30fps

3.2 Interfaces

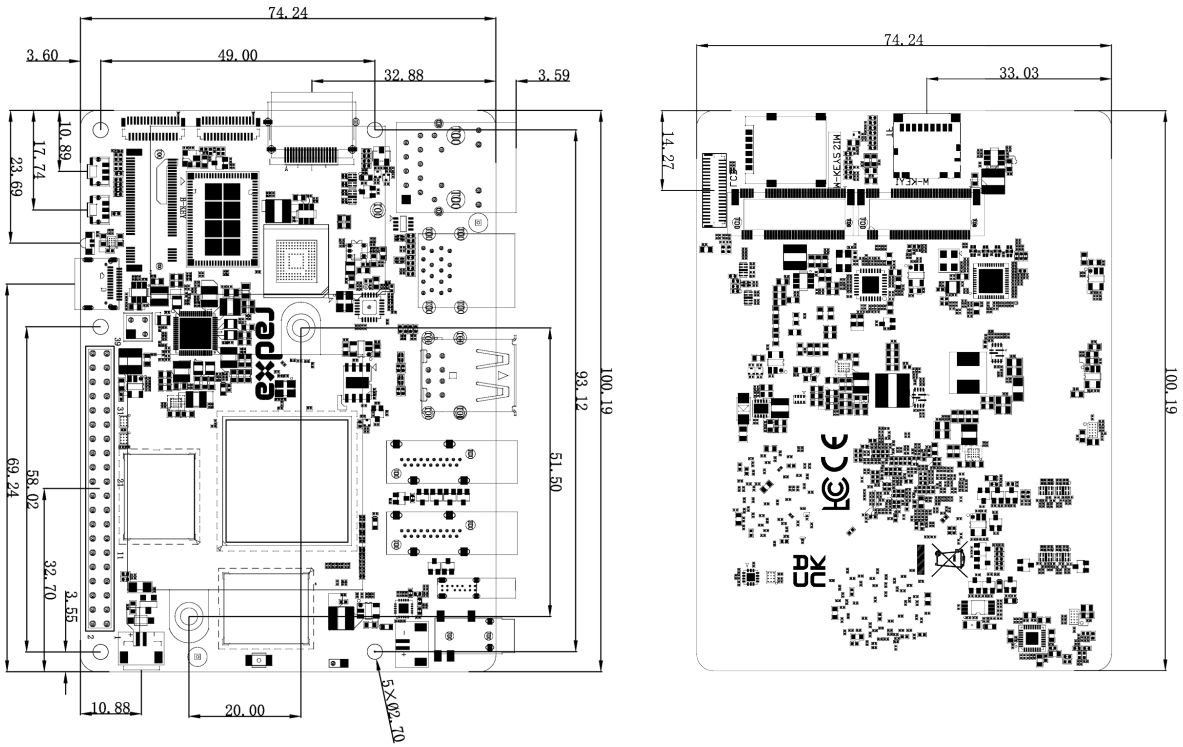
- IEEE 802.11a/b/g/n/ac/ax Wireless LAN (Wi-Fi 6)
- BT 5.2 with BLE
- 1x back USB Type-C™ port for power input

- 1x front USB Type-C™ port supporting:
  - DP display up to 4Kp60
  - USB 3.0 OTG / HOST
- 1x Micro SD Card Slot
- 2x Standard HDMI output ports, one supporting displays up to 8Kp60 resolution, one supporting up to 4Kp60
- 1x Standard HDMI input port, supporting up to 4Kp60 display input
- 2x USB2 Type A HOST ports
- 2x USB3 Type A HOST ports
- 1x 2.5 Gigabit Ethernet port with PoE support(Additional PoE HAT Required)
- 2x M.2 M Key Connectors with PCIe 3.0 2-lane support
- 1x M.2 B Key Connectors
- 2x Camera port (2x four-lane MIPI CSI or 2x two-lane MIPI CSI)
- 1x MIPI LCD port (four-lane MIPI DSI)
- 1x Headphone Jack with Microphone Input
- Miscellaneous
  - 1x RTC Battery Connector
  - 1x Fan Socket with PWM Control
  - 1x Power button
  - 1x Recovery button
  - 1x Maskrom button
  - 1x RGB power/status/user LED
  - 2x Heatsink Mounting Holes
- 40 pin 0.1” (2.54mm) header supporting a wide range of interface options:
  - 2 x UART
  - 2 x SPI bus
  - 2 x I2C bus
  - 1 x PCM/I2S
  - 1 x SPDIF
  - 1 x PWM
  - 1 x ADC
  - 6 x GPIO
  - 2 x 5V DC power in/out
  - 2 x 3.3V power out

3.3 Software

- ArmV8 Instruction Set
- Debian/Ubuntu Linux support
- Android 12 support
- OpenFyde OS(Chromium OS fork) support
- RKNPU2 NPU software stack
- Hardware access/control library for Linux/Android

4 Mechanical Specification



5 Electrical Specification

5.1 Power Requirements

The ROCK 5B+ supports various power supply technologies including smart power adapter as well as fixed voltage:

- USB Type-C PD Version 2.0 with 9V, 12V, 15V and 20V input support
- Power adapter with fixed voltage in 5V to 20V range on the USB Type-C port
- 5V Power applied to the GPIO PIN 2 & 4

The recommended power source should be able to produce, at least, 24W without a M.2 SSD or 40W with a M.2 SSD.

5.2 GPIO Voltage

GPIO	Voltage Level	Tolerance
All GPIO	3.3V	3.63V
SARADC_IN4	1.8V	1.98V

6 Operating Conditions

The ROCK 5B+ has been designed to operate between 0°C to 50°C.

This temperature range was defined based on typical usage where the efficient use of Arm big.LITTLE technology can automatically select which processor core to utilise for a given task, the result of which is minimal heat generation and responsive user experience.

The ROCK 5B+ is built on a high-performance mobile chipset which is designed to operate for extended durations on batteries with efficiency at its core. As with all electronic devices heat is a by-product of operation which increases with performance and workload; during basic use cases such as web browsing, editing text or listening to music the SoC will automatically select the smallest processors available or dedicated hardware accelerators to reduce heat generation thus reserving the higher performance processors and thermal window for demanding tasks as and when required.

The SoC (RK3588) is specified to limit its maximum internal temperature to 80°C before throttling the clock speeds to maintain reliability within the allowed temperature range. If the ROCK 5B+ is intended to be used continuously in high performance applications, it may be necessary to use external cooling methods (for example, heat sink, fan, etc.) which will allow the SoC to continue running at maximum clock speed indefinitely below its predefined 80°C peak temperature limiter.

7 Peripherals

7.1 GPIO Interface

The ROCK 5B+ offers a 40 pin GPIO expansion header which provides extensive compatibility with a wide range of accessories developed for the SBC market.

7.1.1 GPIO Alternate Functions

Function5	Function4	Function3	Function2	Function1	Pin#	Pin#	Function1	Function2	Function3	Function4	Function5
				+3.3V	1	2	+5.0V				
I2S1_SDO2_M0	I2C7_SDA_M3	PWM15_IR_M1	CAN1_TX_M1	GPIO4_B3	3	4	+5.0V				
I2S1_SDO1_M0	I2C7_SCL_M3	PWM14_M1	CAN1_RX_M1	GPIO4_B2	5	6	GND				
SPI1_CS1_M1	I2C8_SDA_M4	UART7_CTSN_M2	PWM15_IR_M0	GPIO3_C3	7	8	GPIO0_B5	UART2_TX_M0	I2S1_MCLK_M1	I2C1_SCL_M0	
				GND	9	10	GPIO0_B6	UART2_RX_M0	I2S1_SCLK_M1	I2C1_SDA_M0	
		SPI1_CLK_M1	UART7_RX_M1	GPIO3_C1	11	12	GPIO3_B5	PWM12_M0	CAN1_RX_M0	UART3_TX_M1	I2S2_SCLK_M1
		SPI1_MOSI_M1	I2C3_SCL_M1	GPIO3_B7	13	14	GND				
	SPI1_MISO_M1	I2C3_SDA_M1	UART7_TX_M1	GPIO3_C0	15	16	GPIO3_A4	SPI4_CS1_M1	UART8_RTSN_M1	I2S3_SDI	
				+3.3V	17	18	GPIO4_C4	I2C7_SDA_M1	UART9_RTSN_M2	SPI3_MISO_M0	PWM5_M2
	UART4_RX_M2	PDM1_SDI3_M1	SPI0_MOSI_M2	GPIO1_B2	19	20	GND				
		PDM1_SDI2_M1	SPI0_MISO_M2	GPIO1_B1	21	22	SARADC_IN4				
	UART4_TX_M2	PDM1_CLK1_M1	SPI0_CLK_M2	GPIO1_B3	23	24	GPIO1_B4	SPI0_CS0_M2	PDM1_CLK0_M1	UART7_RX_M2	
				GND	25	26	GPIO1_B5	SPI0_CS1_M2	UART7_TX_M2		
PWM7_IR_M3	SPI3_CLK_M0	UART7_CTSN_M1	I2C0_SDA_M1	GPIO4_C6	27	28	GPIO4_C5	I2C0_SCL_M1	UART9_CTSN_M2	SPI3_MOSI_M0	PWM6_M2
	UART1_CTSN_M2	I2C8_SDA_M2	PWM15_IR_M3	GPIO1_D7	29	30	GND				
UART1_RX_M1	I2C5_SDA_M3	SPDIF_TX_M0	PWM13_M2	GPIO1_B7	31	32	GPIO3_C2	PWM14_M0	UART7_RTSN_M2	I2C8_SCL_M4	SPI1_CS0_M1
			PWM8_M0	GPIO3_A7	33	34	GND				
I2S2_LRCK_M1	UART3_RX_M1	CAN1_TX_M0	PWM13_M0	GPIO3_B6	35	36	GPIO3_B1	PWM2_M1	UART2_TX_M2		
			REFCLK_OUT	GPIO0_A0	37	38	GPIO3_B2	PWM3_IR_M1	UART2_RX_M2	I2S2_SDI_M1	
				GND	39	40	GPIO3_B3	UART2_RTSN	I2S2_SDO_M1		

7.2 Network

ROCK 5B+ provides a 10/100/1000/2500 Mbps RJ45 connector for wired networking. When equipped with an additional PoE module or HAT, the ROCK 5B+ can be powered through

an Ethernet cable connected to the RJ45 port, leveraging the capabilities of a PoE-enabled switch or router.

7.3 Camera and Display Interfaces

The ROCK 5B+ is equipped with two four-channel MIPI CSI camera connectors and one four-channel MIPI DSI connector. These connectors are specifically designed for Radxa camera and monitor accessories. Moreover, they offer backward compatibility, allowing the use of standard industrial camera and monitor peripherals through Radxa's adapter FPC cables.

7.4 USB

The ROCK 5B+ is equipped with a USB 3.0 OTG Type-C port and supports a DP interface, which allows for a maximum resolution of 4Kp60.

Furthermore, the ROCK 5B+ features two USB 2.0 HOST ports and two USB 3.0 HOST ports, all of which are Type-A connectors. The combined output power for these four ports is 2A.

7.5 HDMI Output

The ROCK 5B+ is equipped with two standard HDMI output ports, both featuring CEC support and HDMI 2.1 compatibility. These ports offer impressive resolutions, delivering 8Kp60 and 4Kp60, respectively.

7.6 HDMI Input

The ROCK 5B+ features a single standard HDMI input port, supporting HDMI 2.1 input with a resolution of 4Kp60.

7.7 Audio Jack

The ROCK 5B+ supports high quality analogue audio output via a 4-ring 3.5mm headphone jack. The analog audio output can drive 32 Ohm headphones directly. The audio jack also supports microphone input as default.

7.8 M.2 Connector

At the back of the circuit board, there are two M.2 M Key connectors, offering a total of two dual-channel PCIe 3.0 interfaces. Each M.2 M Key connector on the board features a standard M.2 2280 mounting hole, allowing the installation of M.2 2280 NVMe solid-state drives. It's important to note that M.2 SATA solid-state drives are not supported.

7.9 Fan Connector

The ROCK 5B+ has a 2pin 1.25mm header that enables users to connect a 5V fan (or other peripheral). The fan can be PWM controlled without speed feedback.

8 Availability

Radxa guarantees availability of the Radxa ROCK 5B+ until at least September 2032.

9 Support

For support please see the hardware documentation section of the Radxa Website and post questions to the Radxa forum.

Note: Some SIM card slots configured with the product are not used. If a SIM card slot is used, it will be retested and a new certification will be applied for.

FCC WARNING

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.