Product Brief

radxa x okdo

Radxa ROCK 5 Model B
8K Single Board Computer with Quad Display

Revision 1.2

2023-01-20

Radxa Computer

Contents

1 Revision Control Table

Version	Date	Changes from previous version
1.0	14/10/2022	First version
1.1	27/10/2022	Add 24GB RAM variant
		Add OpenFyde OS support
		Update board picture with ports label and description
		Add Operating Conditions note
		Add Fan header description
		Add RJ45 PoE capability
		Add CSI split 2x two-lanes info
1.2	20/01/2023	Correct revision control table dates
		Improve readability

2 Introduction

The Radxa ROCK 5 Model B (ROCK 5B) is a Single Board Computer (SBC) in a compact form factor packed with a wide range of class-leading functionality, features and expansion options. The ROCK 5B is an ideal choice for makers, IoT enthusiasts, hobbyists, gamers, PC users and everyone who need an extremely highly specified platform with outstanding performance and reliability. Radxa offers the ROCK 5B board in various LPDDR4x RAM memory options:

- 4GB
- 8GB
- 16GB
- 24GB(Available in Q1 2023)

⑯ PoE
⑰ PMIC RK806
⑱ 40-PIN Header
⑮ HDMI Input
⑭ RGB LED
⑬ Recovery Button
⑫ Power Button
⑲ Fan
⑳ Maskrom Button
⑪ M2 E Key (WiFi/BT)
⑩ RTC Battery
㉑ RAM
㉒ SoC RK3588
⑨ Ethernet Phy
① Headphone
② USB Power
③ HDMI1
④ HDMI2
⑥ USB 2.0
⑤ SPI Nor Flash
⑧ 2.5GbE
⑦ USB 3.0

㉓ TF
㉔ RTC
㉕ MIPI CSI
㉖ MIPI DSI
㉙ Audio Codec
㉗ M2 M Key(SSD)
㉘ eMMC Socket
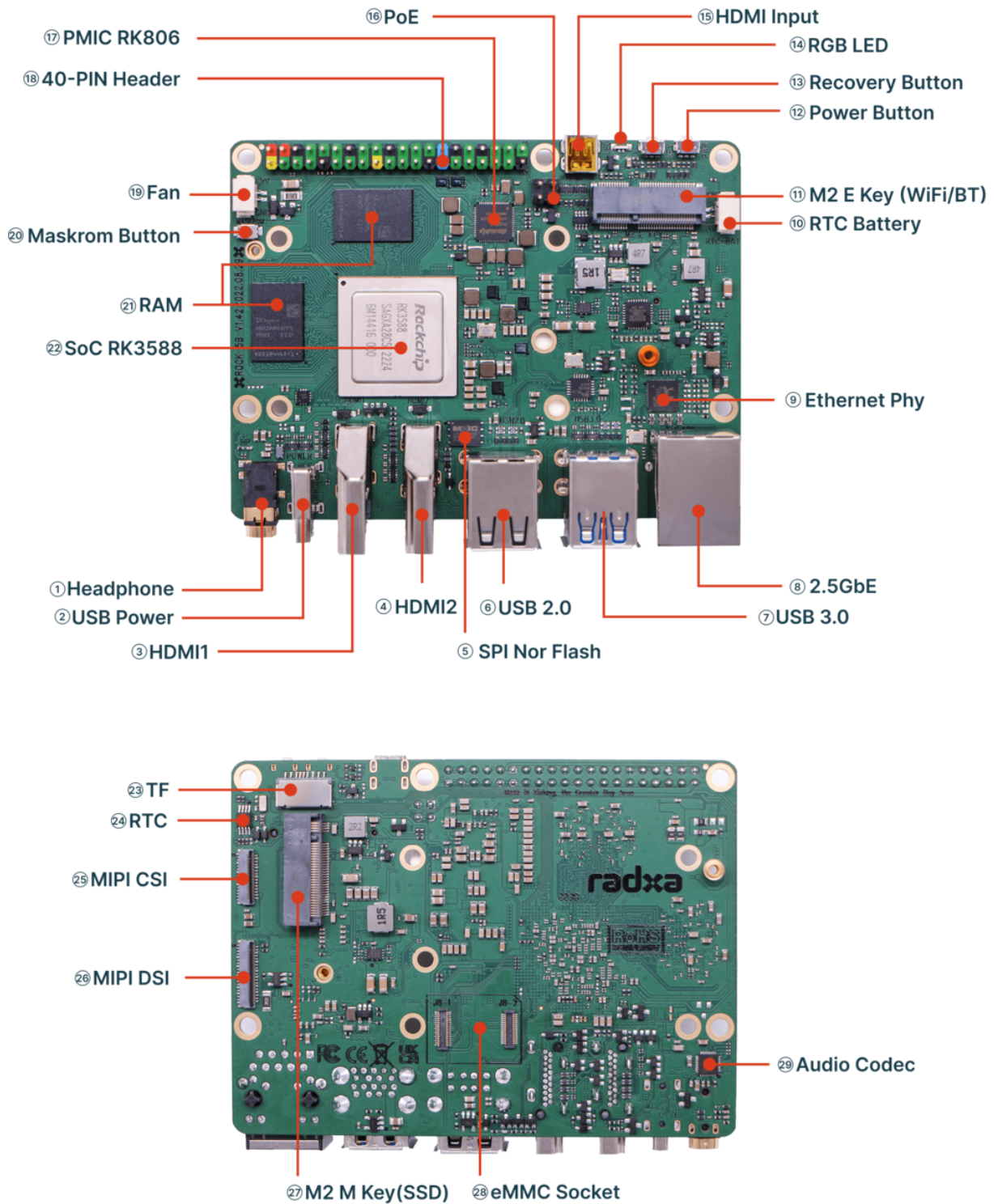
Note: The actual board layout or components' location may change during the time but the main connectors type and location will remain the same

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
- 64bits LPDDR4x RAM options:

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

- Able to provide 4 display outputs via two HDMI, one DP (type C) and one MIPI DSI
- H.265/H.264/AV1/AVS2 multivideo decoder up to 8K@60fps
- H.264/H.265 multivideo decoder up to 8K@30fps

## 3.2 Interfaces

- 1x Full function USB Type-C™ port supporting:

    - PD Version 2.0
    - DP display up to 4Kp60
    - USB 3.0

- 1x Micro SD Card
- 2x Standard HDMI output ports, one supporting displays up to 8Kp60 resolution, one supporting up to 4Kp60
- 1x Micro HDMI input port, supporting up to 4Kp60 display input
- 2x USB2 Type A HOST ports
- 1x USB3 Type A HOST port, 1x USB3 Type A OTG/HOST port

- 1x 2.5 Gigabit Ethernet port (supports PoE with add-on PoE HAT)
- 1x M.2 M Key with PCIe 3.0 four-lane support
- 1x M.2 E Key with PCIe 2.1 one-lane, SATA, SDIO, PCM, UART support
- 1x eMMC module connector for eMMC 5.1 support. The eMMC module shall be larger than 8GB.
- 1x Camera port (1x four-lane MIPI CSI or 2x two-lane MIPI CSI)
- 1x Display port (four-lane MIPI DSI)
- Miscellaneous
  - 1x RTC battery connector
  - 1x PWM fan connector
  - 1x Power button
  - 1x Recovery 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
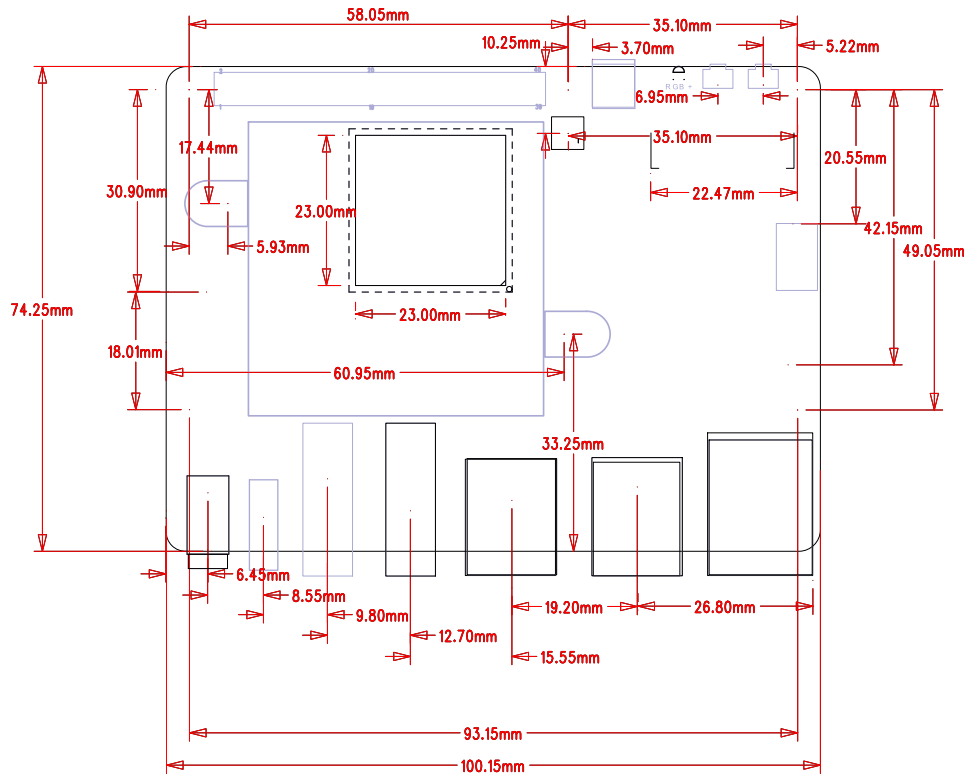
5 Electrical Specification

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/2A, 12V/2A, 15V/2A and 20V/2A.

- 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 30W 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 oper- ate 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 prede- fined 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_M0	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_M0	SPI3_MOSI_M0	PWM6_M2
	UART1_CTSN_M1	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_M1	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 offers a 10/100/1000/2500 Mbit RJ45 connector for wired networking. With additional PoE module/HAT, ROCK 5B can be powered by ethernet cable via RJ45 port by a PoE capable switch/router.

7.3 eMMC Socket

ROCK 5B offers a high speed eMMC socket for eMMC modules which can be used for OS and data storage. The eMMC socket is compatible with readily available industrial pinout and form factor hardware.

It is worth noting that the eMMC module shall be larger than 8GB and there is not maximum size limitation.

7.4 Camera and Display Interfaces

The ROCK 5B has one four-lane(can be split into 2x two-lane) MIPI CSI Camera and one four-lane MIPI DSI Display connector. These connectors are designed for Radxa Camera

and Display accessories and also backwards compatible with standard industrial camera and display peripherals with adapter FPC cables by Radxa.

7.5 USB

The ROCK 5B features one USB 3.0 Type-C port supporting PD Version 2.0 and a DP supporting up to 4Kp60 as an alternative function.

The ROCK 5B has two USB2 HOST, one USB3 HOST and one USB3 OTG/HOST type-A connectors. The power output across these ports is 2A in aggregate over the four connectors.

7.6 HDMI Output

The ROCK 5B has two HDMI output ports (Type A), both support CEC and HDMI 2.1 with resolutions of 8Kp60 and 4Kp60 respectively.

7.7 HDMI Input

The ROCK 5B has one HDMI input port (Type D), which support HDMI 2.1 input with resolutions of 4Kp60.

7.8 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.

7.9 M.2 Connector

The ROCK 5B offers two M.2 connectors:

- On the front site of the board there is a M.2 E Key connector with 2230 mounting hole providing PCIe 2.1 one-lane, USB, SATA, SDIO, PCM and UART signal, supporting industrial standard M.2 WiFi 6 modules.

- On the back site of the board there is a M.2 M Key connector with four-lane PCIe 3.0 interface. A standard M.2 2280 mounting hole is on the board to enable the deployment of a M.2 2280 NVMe SSD. Please note that M.2 SATA SSDs are not supported.

7.10 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 ROCK 5B until at least September 2032.

9 Support

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