Radxa Orion O6 Product Brief

ARM AI PC Motherboard

Version 1.2

2025-04-28

Radxa Computer

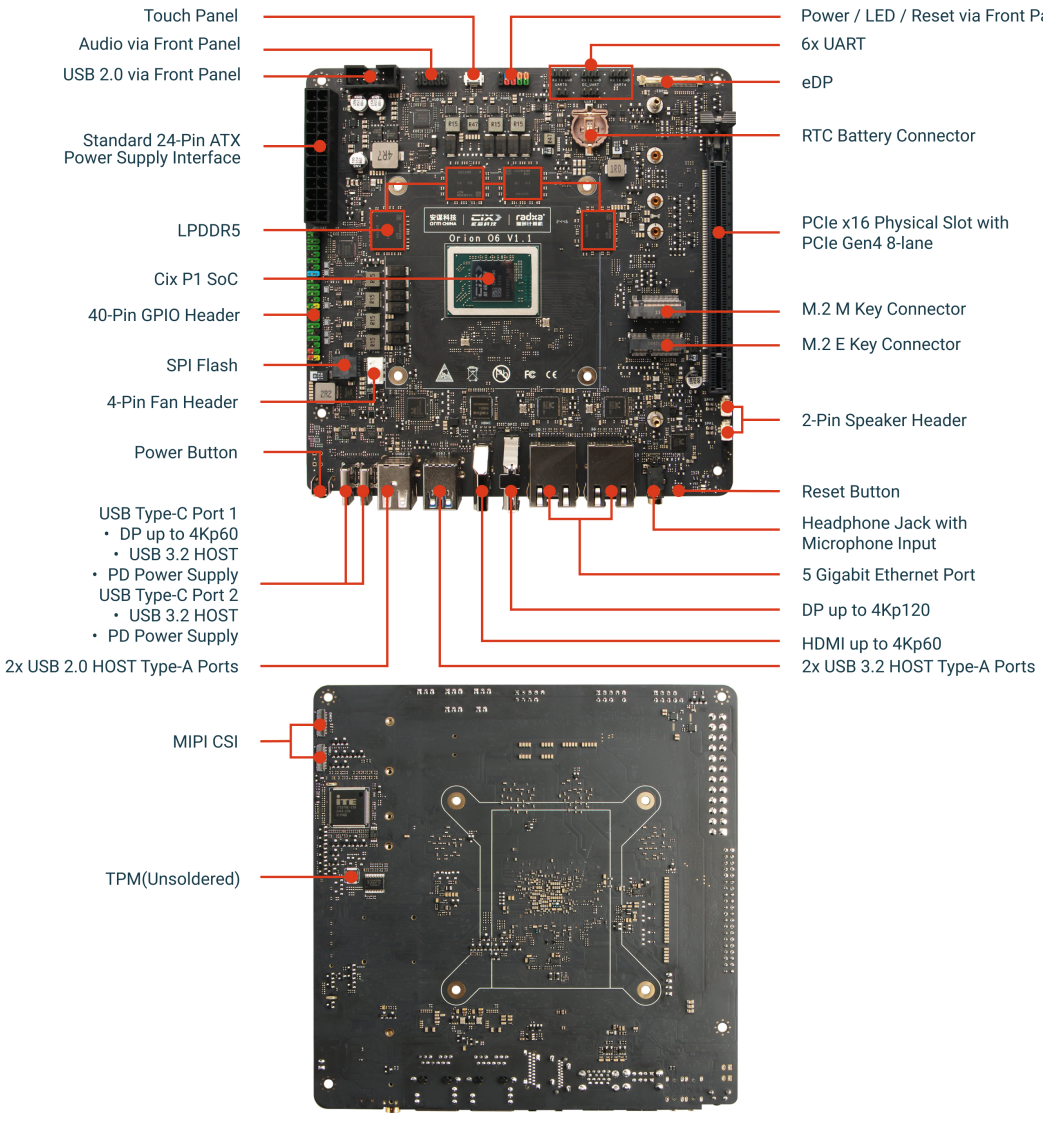
Contents

1 Revision Control Table

Version	Date	Changes from previous version
1.0	2024-12-16	First version
1.1	2025-04-25	Change PDF fonts to avoid CJK characters
1.2	2026-04-17	Update AI acceleration description

2 Introduction

The Radxa Orion O6 is a professional-grade Mini ITX motherboard designed for AI computing and multimedia applications. Powered by the Cix P1 SoC and featuring up to 64GB LPDDR5 RAM, it delivers server-class performance in a compact form factor. With comprehensive I/O options including quad display outputs, dual 5GbE networking, and PCIe Gen4 expansion, the Orion O6 is ideal for AI development workstations, edge computing nodes, and high-performance personal computing.



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

Processing Unit

- SoC: Cix P1 (6nm TSMC process)
  - 4x Cortex®-A720 (Big cores)
  - 4x Cortex®-A720 (Medium cores)
  - 4x Cortex®-A520 (LITTLE cores)
  - 12MB shared L3 cache

Memory System

- RAM: LPDDR5
  - 128-bit memory bus
  - Over 5500MT/s transfer speed
  - Over 100GB/s bandwidth
  - Configurations: 8GB/16GB/32GB/64GB

Graphics & Display

- GPU: Arm® Immortals™ G720 MC10
  - Hardware Ray-Tracing enabled
  - Graphics APIs:
    - Vulkan® 1.3
    - OpenGL® ES 3.2
    - OpenCL® 3.0
- Display Outputs:
  - 1x USB-C with DisplayPort Alt Mode
  - 1x HDMI port
  - 1x DisplayPort
  - 1x eDP connector
  - Support for concurrent quad-display operation

Media Processing

- Hardware Decoder:
  - Resolution: Up to 8K@60fps
  - Formats: AV1, H.265, H.264, VP9, VP8, H.263, MPEG-4, MPEG-2

- Hardware Encoder:
  - Resolution: Up to 8K@30fps
  - Formats: H.265, H.264, VP9, VP8

AI Acceleration

- Combined AI performance (NPU + CPU + GPU): up to 45 TOPS
- NPU standalone — Precision: INT4 / INT8 / INT16 / FP16 / TF32

3.2 Interfaces

3.2.1 Back Panel Connectors

- **DisplayPort™ 1.4**
  - Maximum resolution: 4K@120Hz
  - MST (Multi-Stream Transport) support
  - Dual-stream capability
- **HDMI™ 2.0**
  - Maximum resolution: 4K@60Hz
  - HDMI CEC not supported
- **Ethernet**
  - 2x Multi-gigabit RJ45 ports
  - Speeds: 10/100/1000/2500/5000 Mbps
- **Dual USB Type-C™**
  - Port 1: USB 3.2 Gen 2 (10Gbps) + Power Delivery
  - Port 2: USB 3.2 Gen 2 (10Gbps) + DP Alt Mode (4K@60Hz) + Power Delivery
- **USB Type-A Ports**
  - 2x USB 3.2 Gen 2 (10Gbps)
  - 2x USB 2.0
- **3.5mm Combo Jack**
  - 32Ω headphone drive capability
  - Integrated microphone input

3.2.2 Internal Headers & Connectors

Power & System

- **24-pin ATX Power Connector**
  - Standard motherboard power input
  - Compatible with ATX power supplies
- **Cooling System**
  - 4-pin CPU fan header with smart PWM control
  - Fan speed monitoring via TACH
  - 75x75mm heatsink mounting holes

Storage & Expansion

- **M.2 SSD Slot (M-Key)**
  - PCIe Gen4 x4 lanes
  - Supports high-performance NVMe SSDs
- **M.2 Wireless Slot (E-Key)**
  - PCIe Gen4 x2 lanes + USB
  - Perfect for WiFi 6E + Bluetooth modules
- **PCIe Expansion**
  - x16 physical slot
  - Gen4 x8 electrical lanes
  - Supports graphics cards and other PCIe devices

Embedded Display

- **Embedded DisplayPort (eDP)**
  - Built-in touch panel interface
  - Compatible with high-resolution LCD panels
  - Up to 4Kp60 FPS

Camera Support

- **Dual MIPI Camera Ports**
  - 2x versatile camera interfaces
  - Configurable as 4-lane or 2-lane MIPI CSI each
  - Ideal for AI vision applications

Front Panel Connections

- **System Control Header**
  - Power button
  - Reset button
  - Status LED indicators
- **USB Header**
  - Supports 2x USB 2.0 ports
  - Standard front panel connection
- **Audio Header**
  - HD Audio front panel connector
  - Standard PC case audio support

Maintenance & Debug

- **Real-Time Clock**
  - On-board battery holder
  - CR1220 battery support
  - Power-off time keeping
- **Debug Features**
  - Serial console header
  - System monitoring sensors

3.3 Software Support

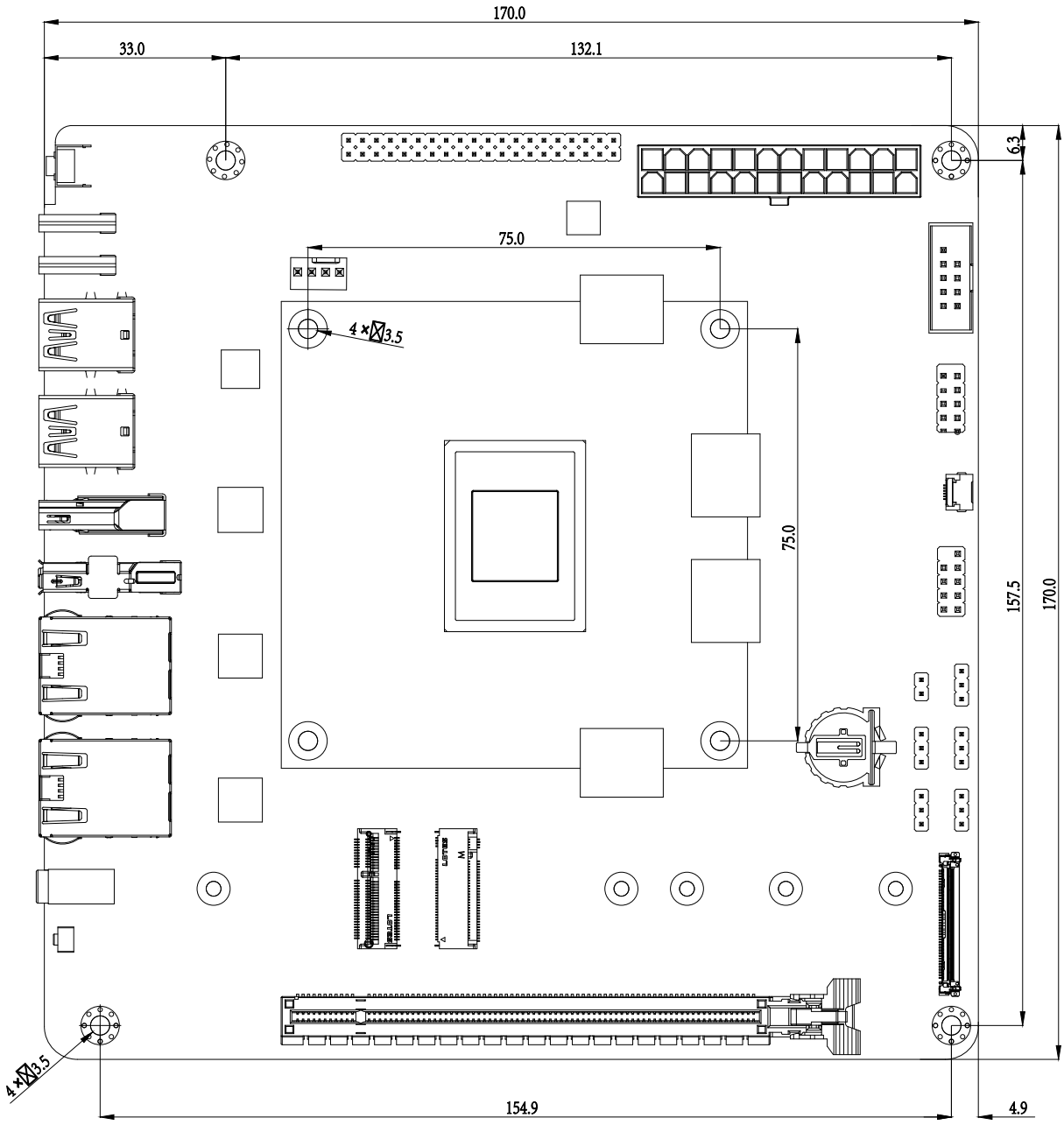
Operating Systems

- Debian Linux distributions
- Full UEFI support via EDKII
- BSP and SDK available

Development Resources

- Comprehensive hardware and software documentation
- Active community forum support
- Regular firmware & OS updates
- Open-source BIOS / EDKII and Linux kernel

4 Mechanical Specification



5 Electrical Specification

5.1 Power Requirements

The Orion O6 supports various power supply technologies including standard ATX PSU, USB PD power input as well as DC power input:

- Standard ATX PSU from the ATX power connector
- USB C PD power supply with 20V voltage support
- Dummy USB C power input with 20V voltage

The recommended power source should be able to produce at least 65W(20V / 3.25A or larger)

Please do not apply multiply power source at the same time, it may damage the board and the other end power source.

6 Availability

Radxa guarantees availability of the Radxa Orion O6 until at least September 2029.

7 Support

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