

Radxa Orion 06 Product Introduction

安谋科技
arm CHINA

×

CIX
此芯科技

×

radxa®



Excellent Abilities of the Technical Team
Profound Understanding of Open Source
Ambitious Goals

2024.7.30 ○ Official Project Initiation

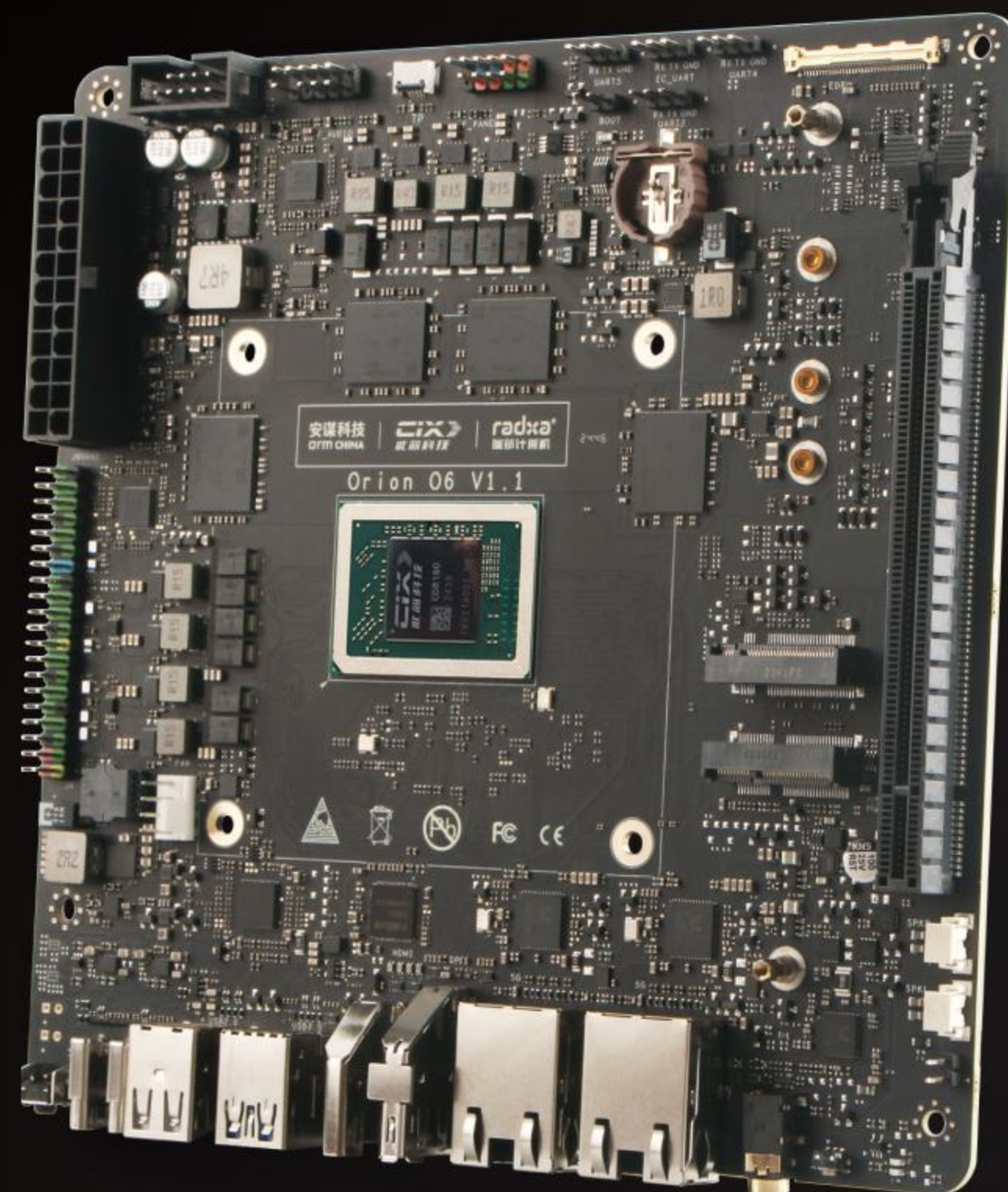
2024.9.29 ○ First Prototype Boot OS

Today ○ Mass Production



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WORLD'S FIRST



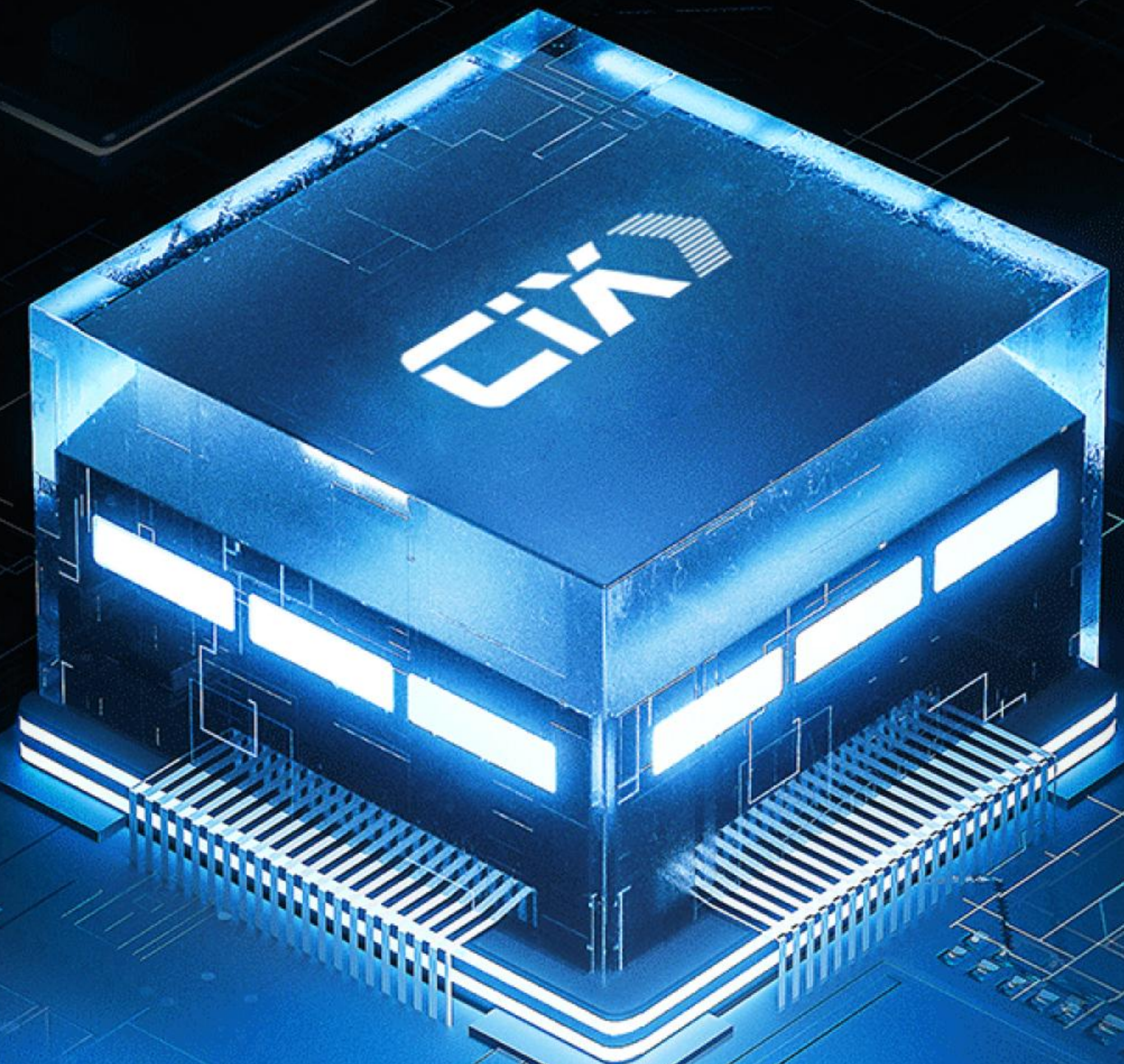
Open Source
ARM V9 Motherboard

RICH INTERFACES
POWERFUL PERFORMANCE

CPU
12 Cores

GPU
Desktop

NPU
30 Tops



CPU

ARMv9.2 Architecture

A720
Up to 2.8GHz

A720
Up to 2.8GHz

A720
Up to 2.4GHz

A720
Up to 2.4GHz

A720
Up to 2.4GHz

A720
Up to 2.4GHz

A720
Up to 2.8GHz

A720
Up to 2.8GHz

A520
1.8GHz

A520
1.8GHz

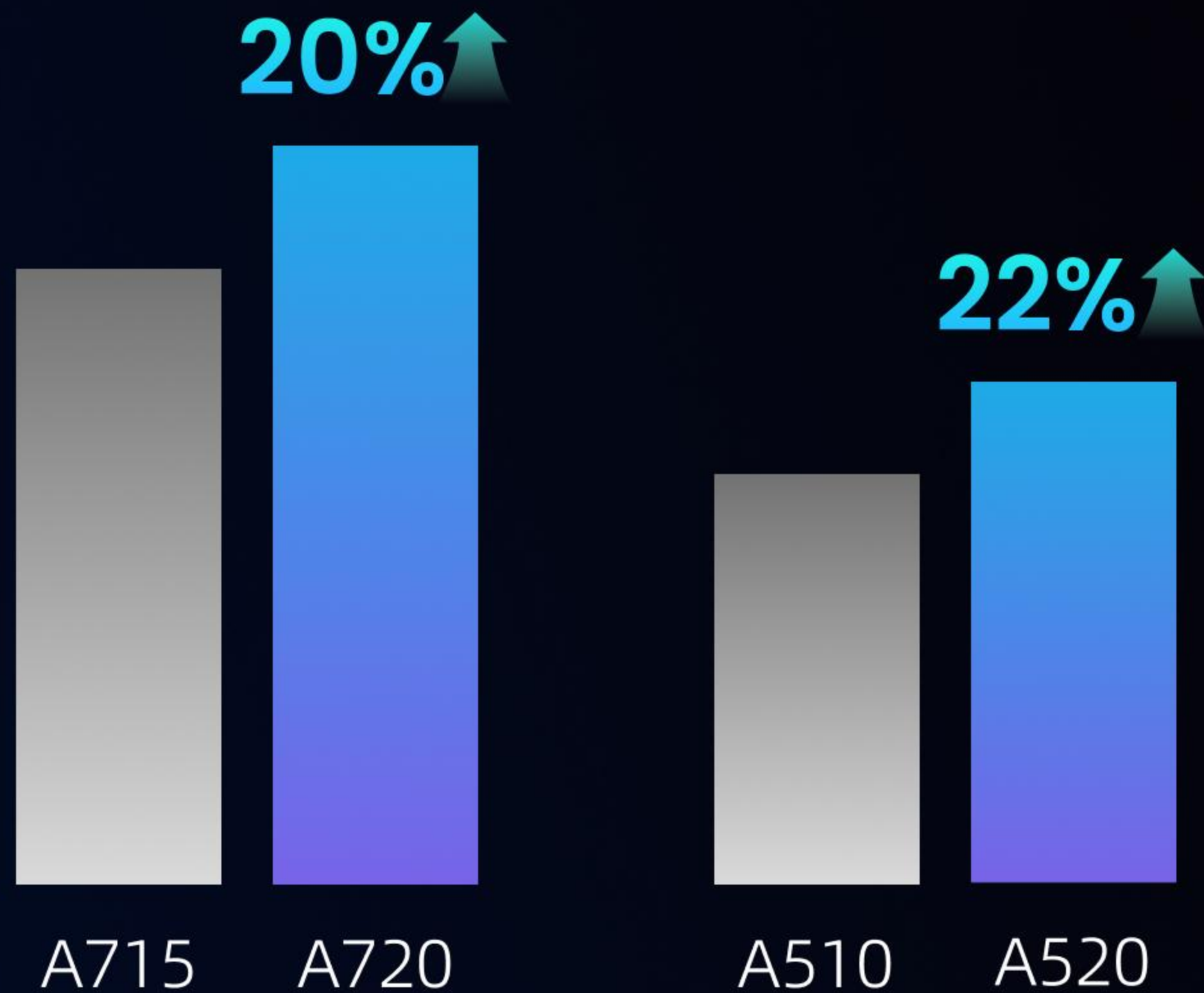
A520
1.8GHz

A520
1.8GHz

CPU

ARMv9.2 Architecture

Energy Efficiency Ratio



CIX P1 VS Apple M1 VS Qualcomm 8CX Gen3



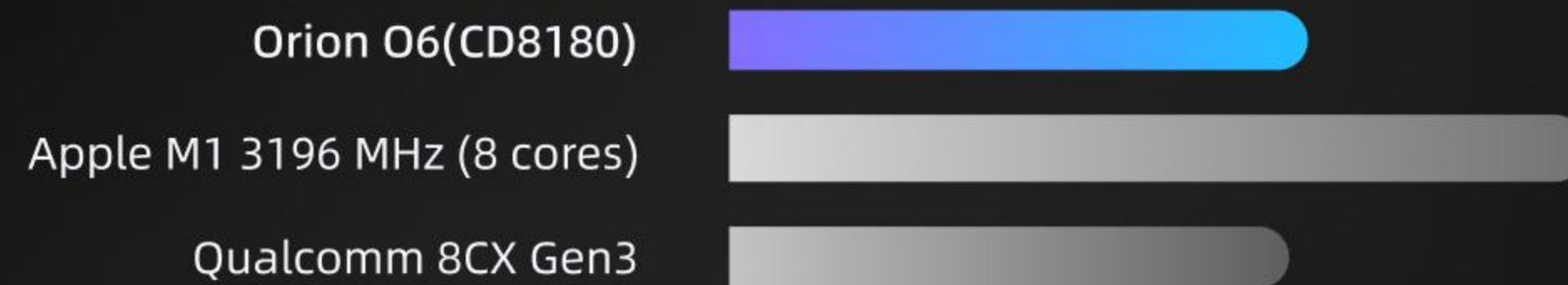
VS



VS



Single Threaded



Multi-Core Score





GPU

Immortalis-G720

- High-performance Desktop-grade GPU
- Meet the Demands of Extreme Graphics Rendering and General AI Computing



Energy Efficiency Ratio/Performance



GPU

Immortalis-G720

- High-performance Desktop-grade GPU
- Meet the Demands of Extreme Graphics Rendering and General AI Computing



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**Heterogeneous AI Computing Power
is up to 45 TOPs**

Meeting AI PC computing power requirements

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Supported AI Large Models

- Can Successfully Run Large Models within 10 Billion Parameters
- The Maximum Performance Can Reach up to 30 Tokens per Second (Based on Qwen 2 - 1.5B)



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Multimedia

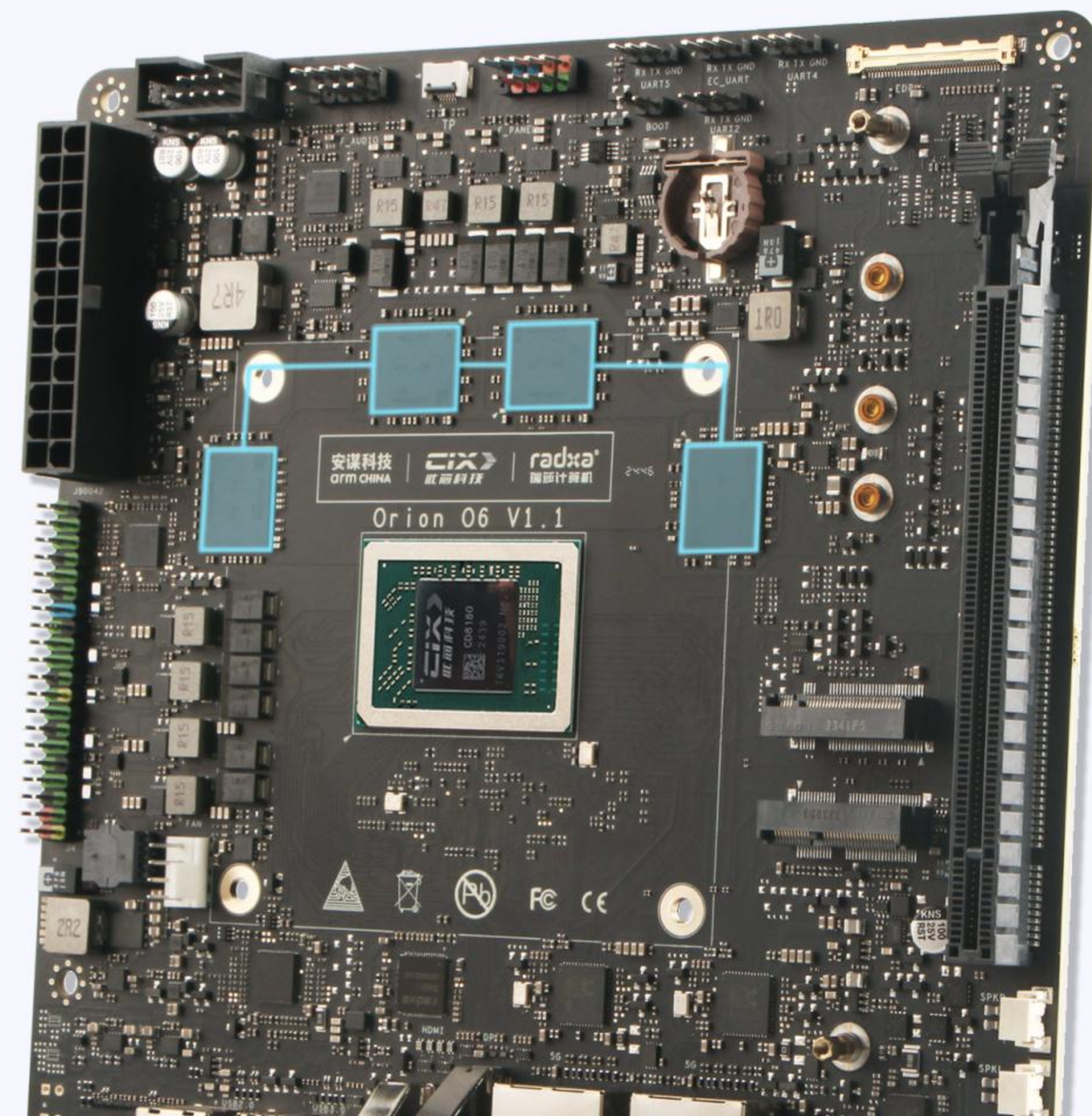
- Hardware Decoder:
 - Resolution: Up to 8K@60fps
 - Formats: AV1, H.265, H.264, VP9, VP8, H.263, MPEG-4, MPEG-2
- Hardware Encoder:
 - Resolution: Up to 8K@30fps
 - Formats: H.265, H.264, VP9, VP8



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LPDDR5

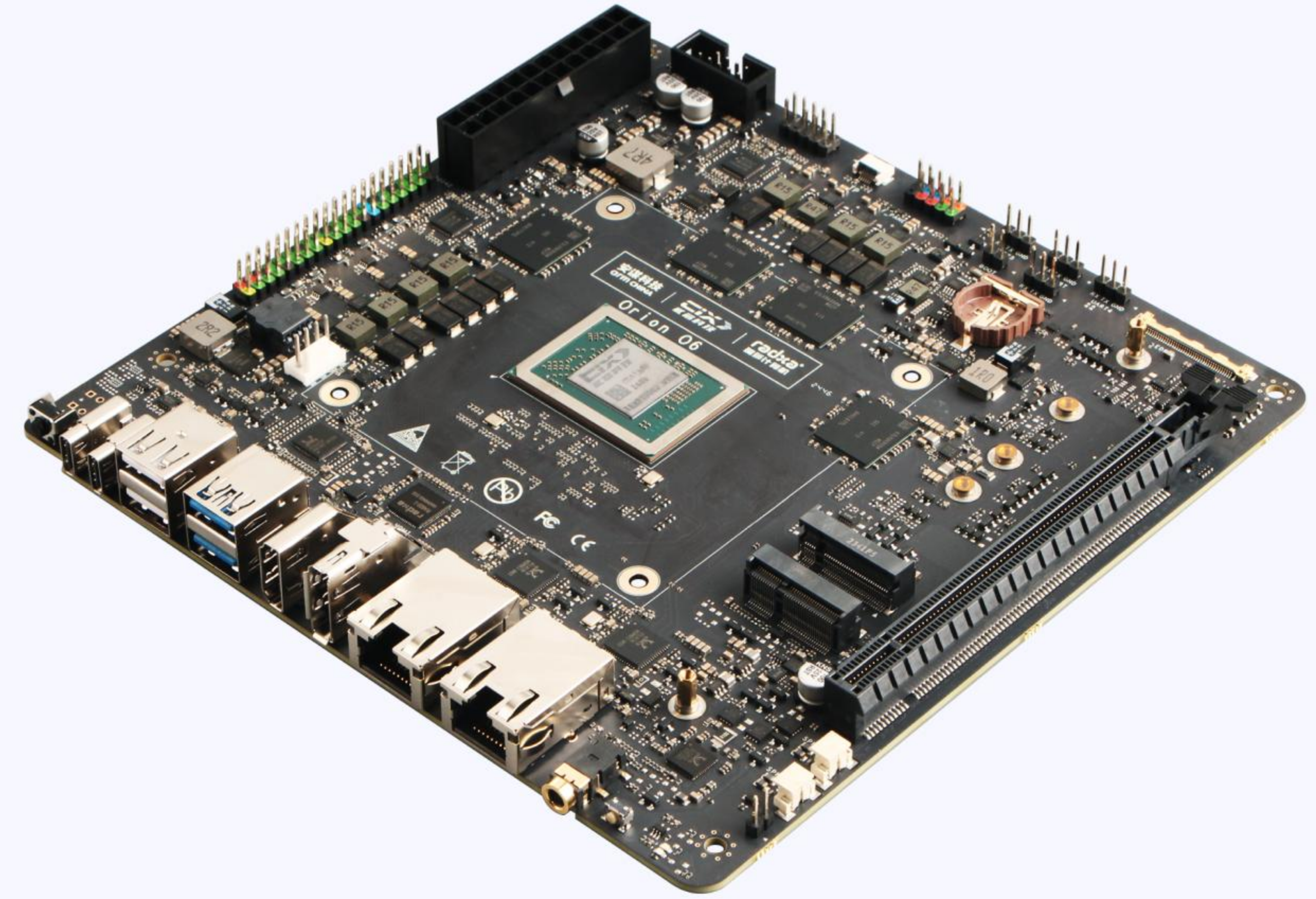
Memory Bus Width: 128 bit
Bandwidth > 100GB/s
Frequency > 5500MT/s
Maximum Capacity of 64GB



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Interfaces

- 1 x HDMI 2.0 up to 4K@60Hz
- 2 x 5 Gigabit Ethernet Ports
- 1 x DP 1.4 up to 4K@120Hz
- 1 x PCIe Gen4 X16 Slot with PCIe Gen4x8
- 1 x eDP up to 4K@60Hz
- 1 x M.2 M KEY Connector with PCIe Gen4x4
- 2 x USB Type-C(1xFull-featured)
- 1 x M.2 E KEY Connector with PCIe Gen4x2 + USB for Wi-Fi 7
- 2 x USB2.0
- 2 x USB3.2 Gen2 (10Gbps)
- 40 Pin GPIO Header





Display

1 x HDMI 2.0 up to 4K@60Hz

1 x DP 1.4 up to 4K@120Hz

1 x eDP up to 4K@60Hz

1 x USB Type-C

Up to 4x Display, DP Display Up to 4K@120Hz



WiFi 7™



PCIe Expansion

PCIe 4.0

- 1 x PCIe Gen4 X16 Slot with PCIe Gen4x8
- 1 x M.2 M KEY Connector with PCIe Gen4x4
- 1 x M.2 E KEY Connector with PCIe Gen4x2 + USB

40 Pin GPIO Header

3 x UART

3 x I2C

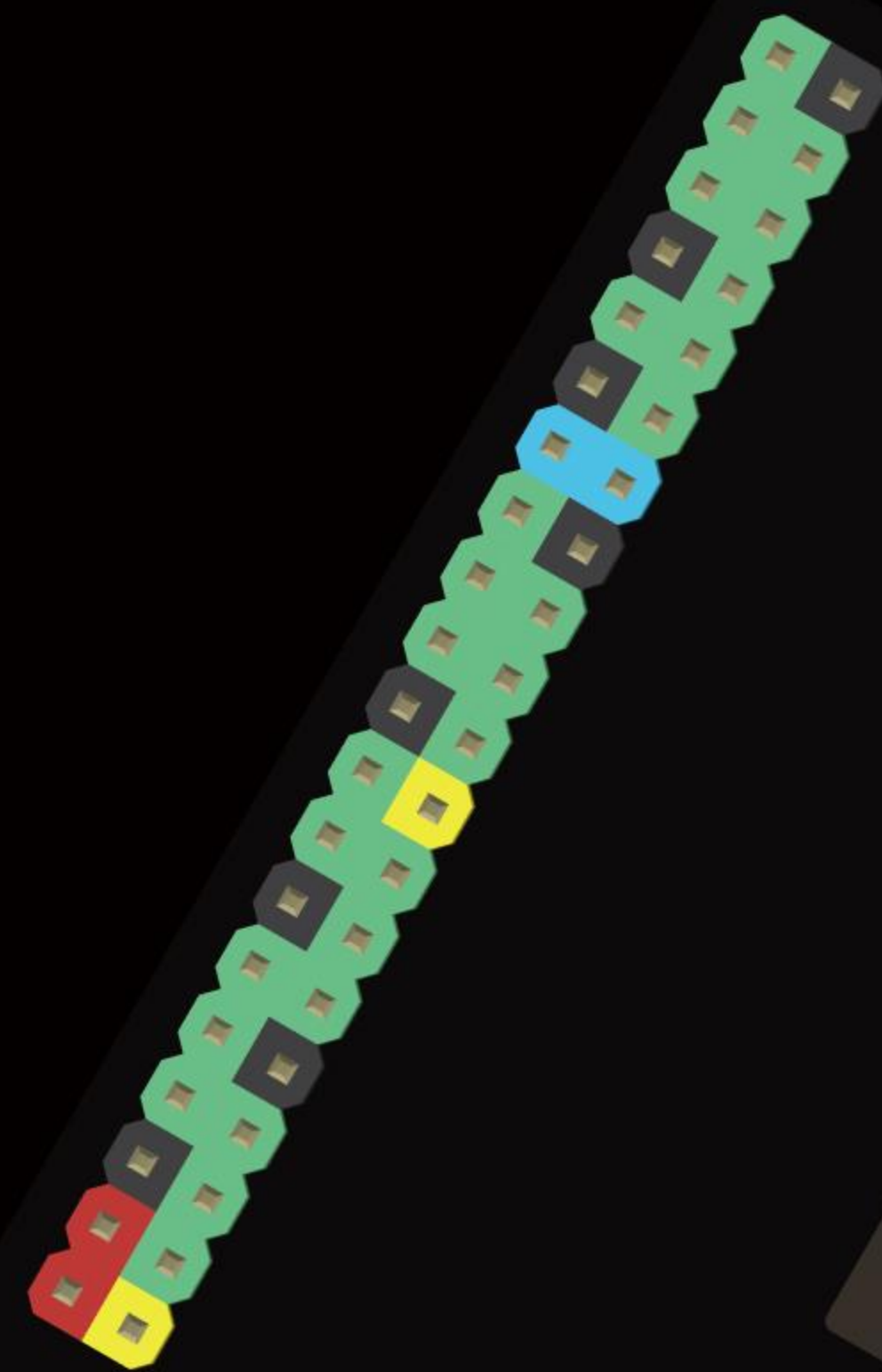
2 x I2S

2 x PWM

1 x SPI

10+ x GPIO

...



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**Native Linux / Debian support
with UEFI / BIOS**

Supported OS:

 **debian**

 **fedora**

Upcoming Support OS:


android

 **Ubuntu**

 **deepin**

 **Windows**

openKYLIN



Power Supply

24-Pin ATX Power Connector
Type C PD Power Supply

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Designing ARM Motherboards with PC Architecture

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**How We Build ARM Motherboard
with PC Architecture**

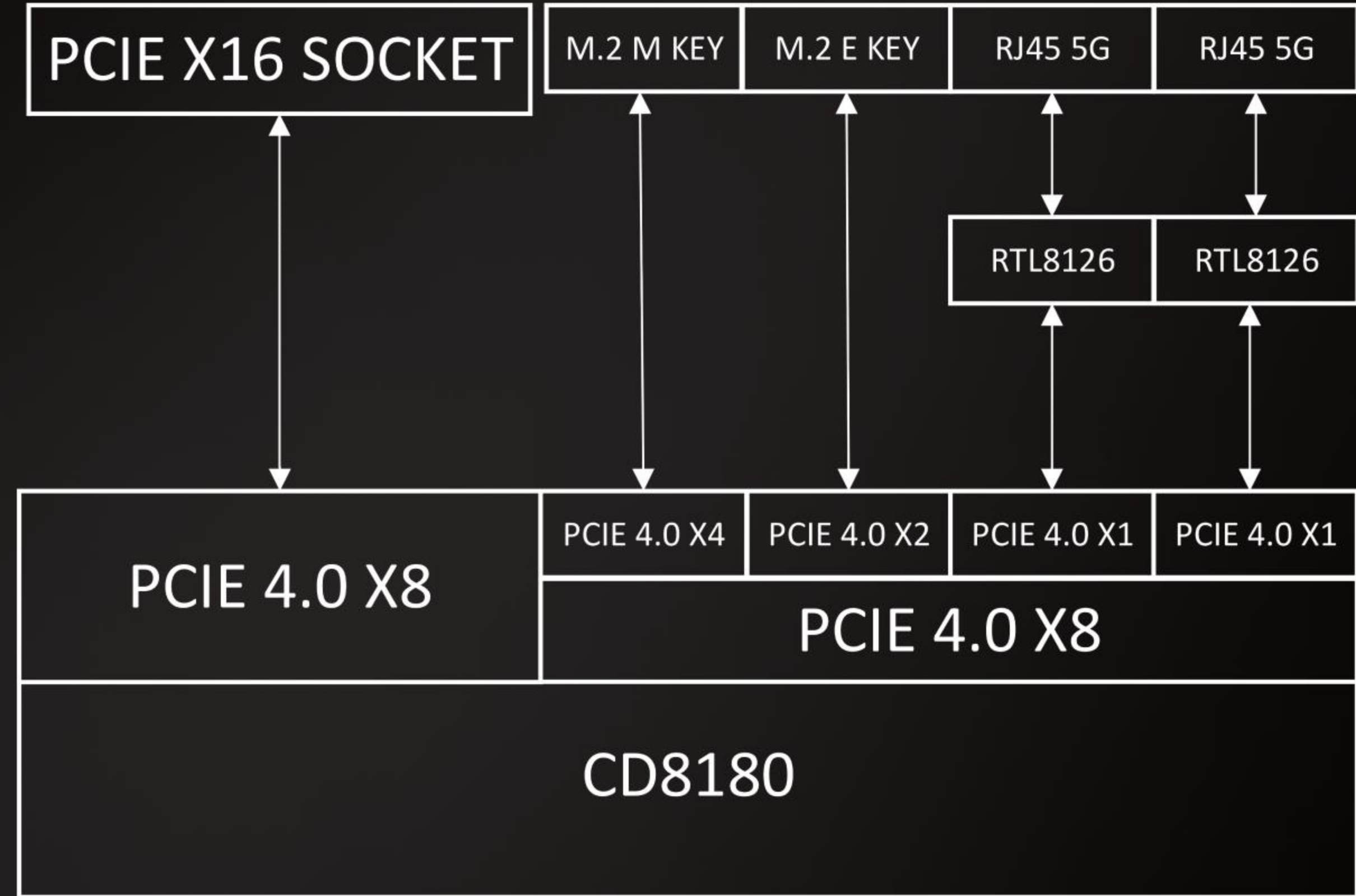
Hardware

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High Speed I/O

PCIe Gen4

X8 + X4 + X2 + X1 + X1

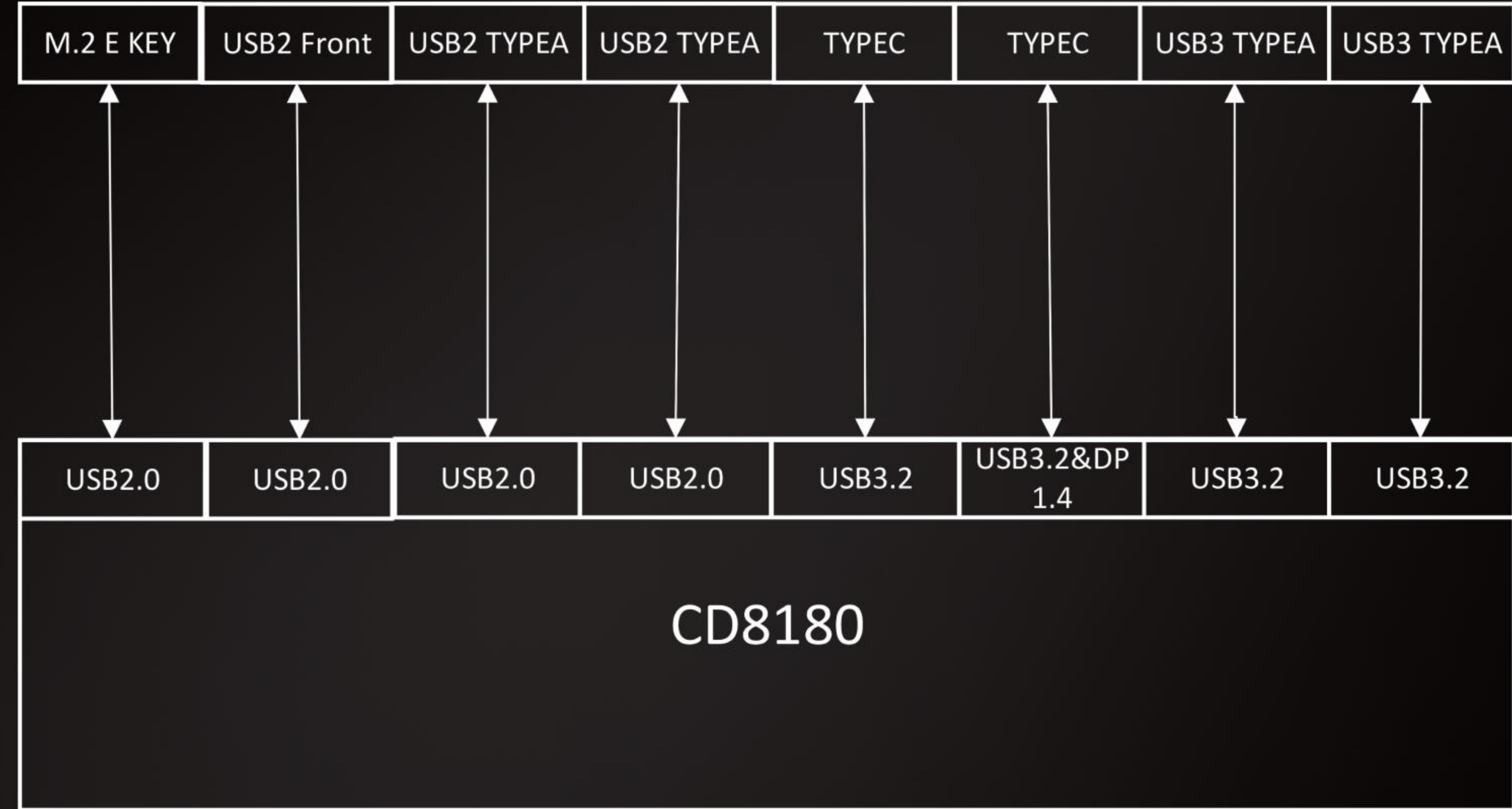


Hardware

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USB

- Front_USB
- USB3.2/2 Type-A
- Full Mode Type-C
- E-Key

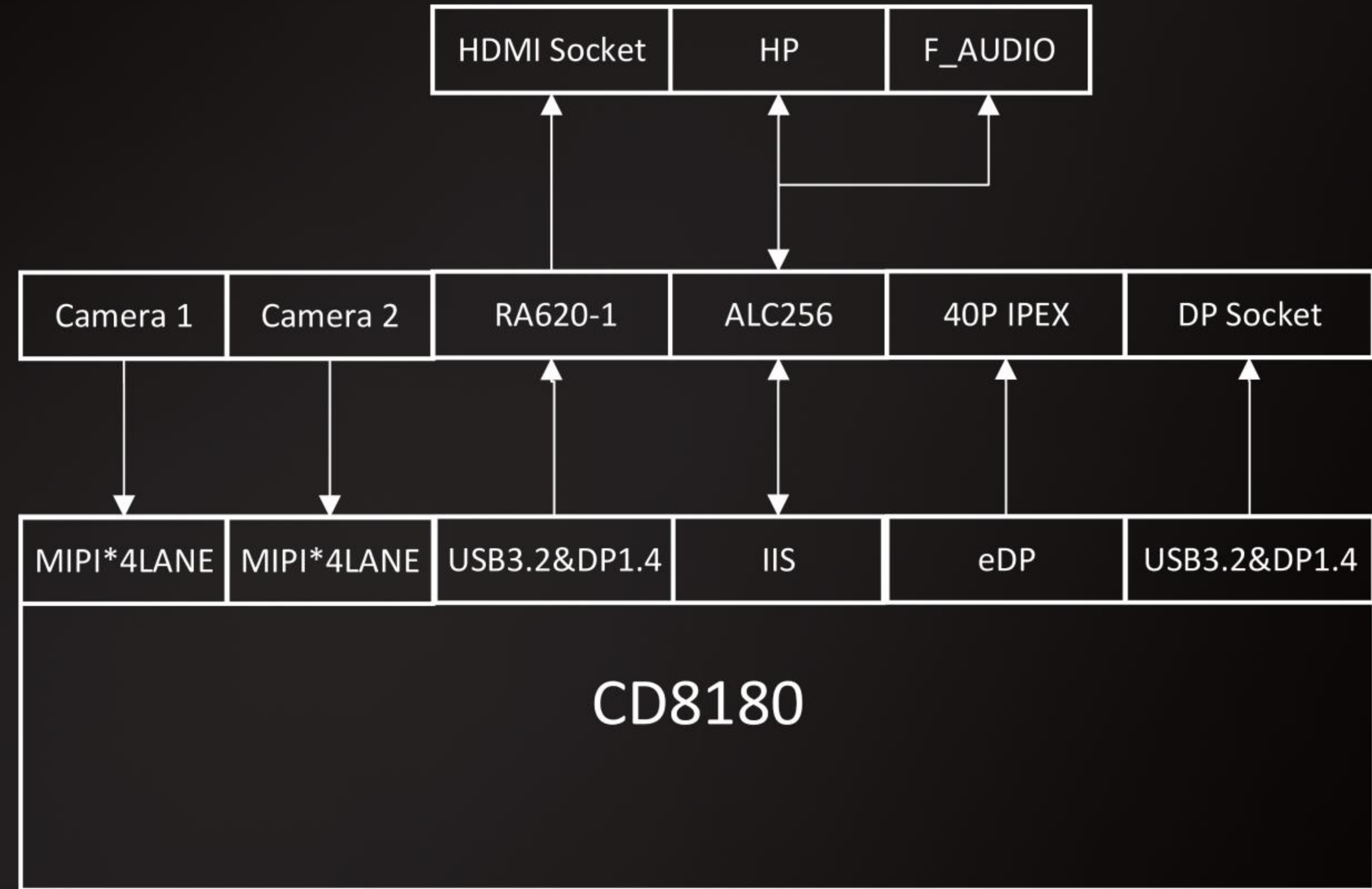


Hardware

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Video Output / Input

- HDMI
- DP
- eDP
- USB-C with DP
- Camera
- F_Audio

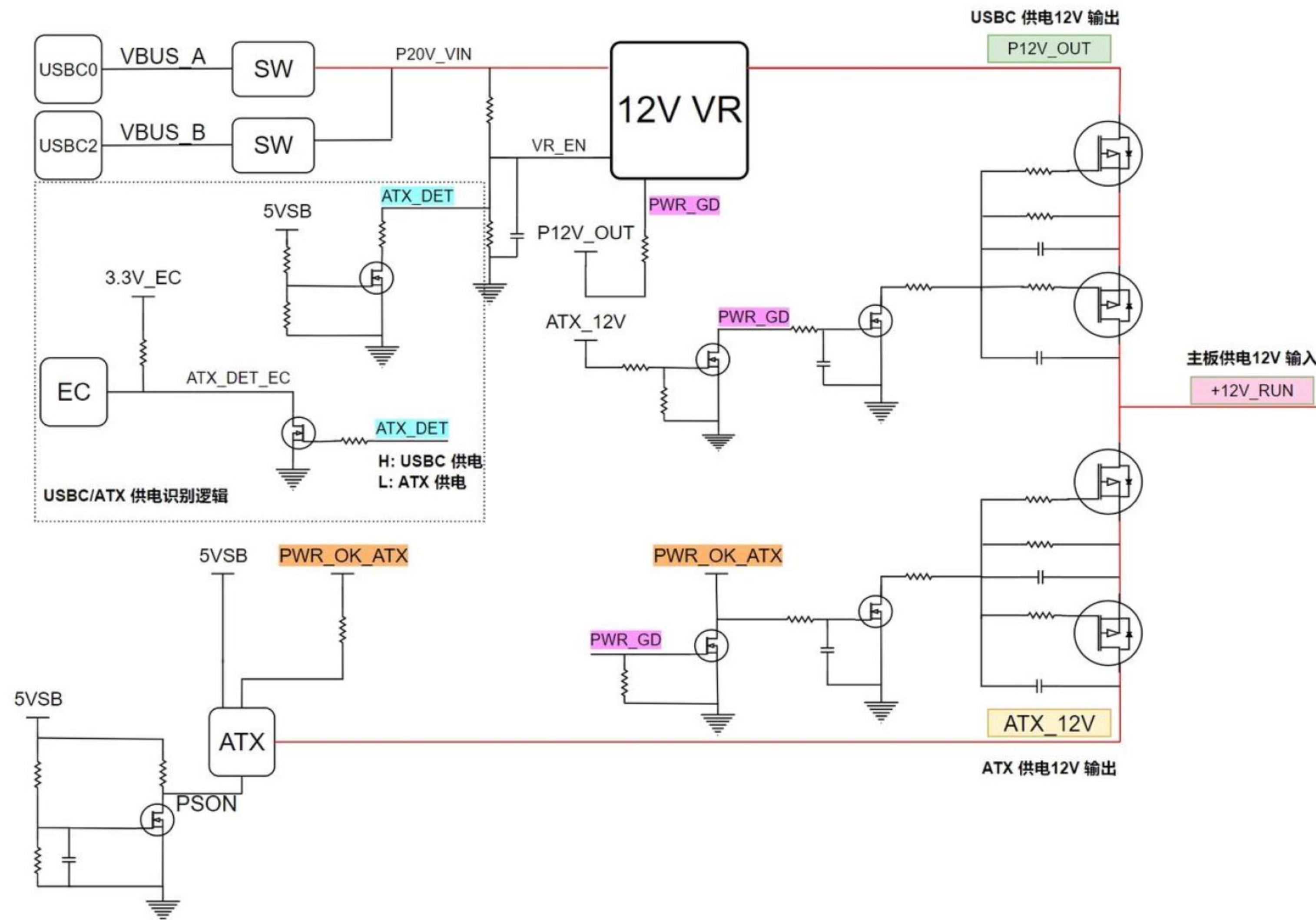


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Power Supply Priority Management

ATX > Type-C

Stable Power Supply Without Backflow



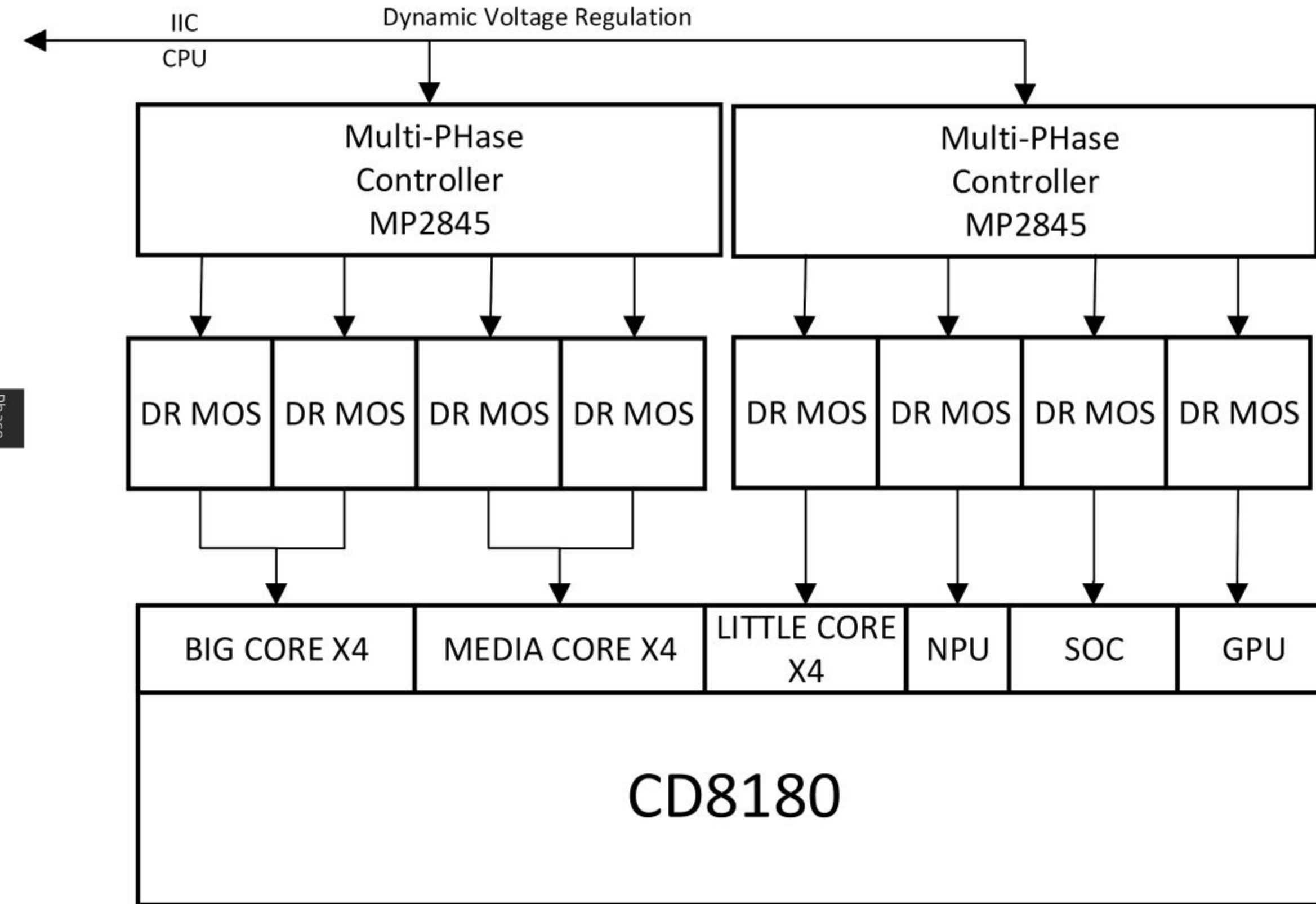
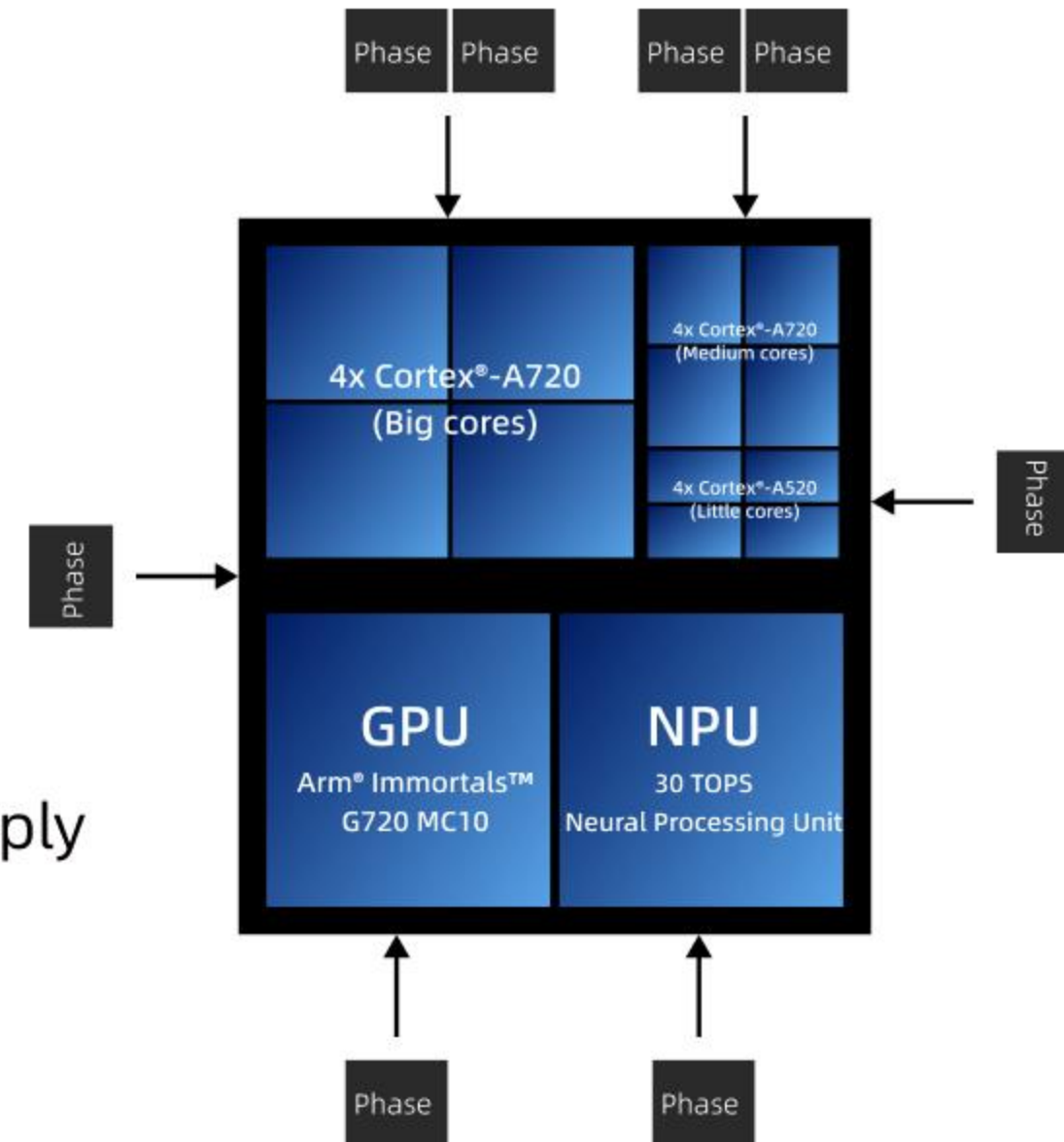
Power Supply Design

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8-Phase

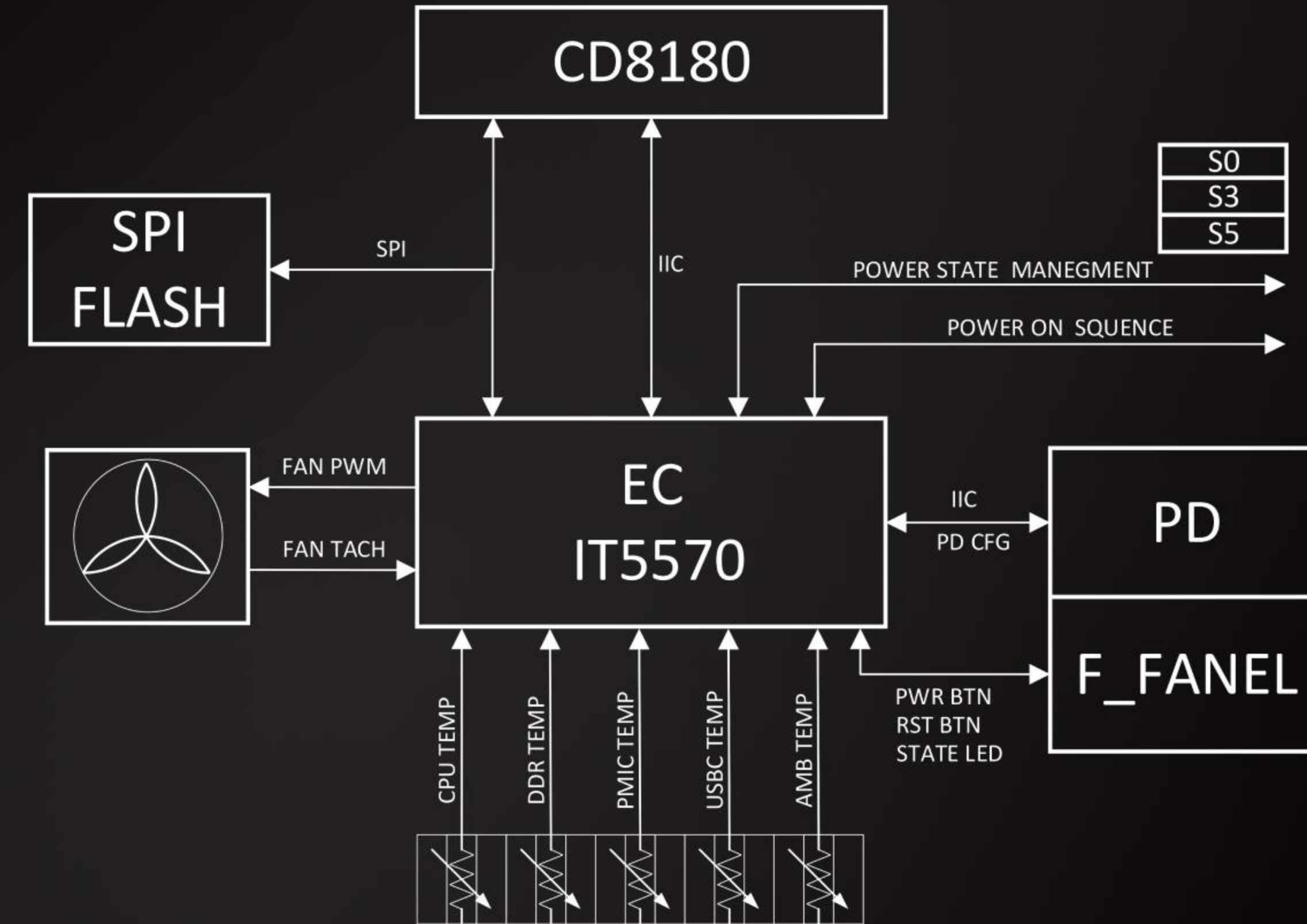
Peak Current of Up to 37A per Phase
Meet the Transient High Current for Core Power Supply

Dynamic Power Consumption Management



Radxa Orion 06 EC Motherboard Manager

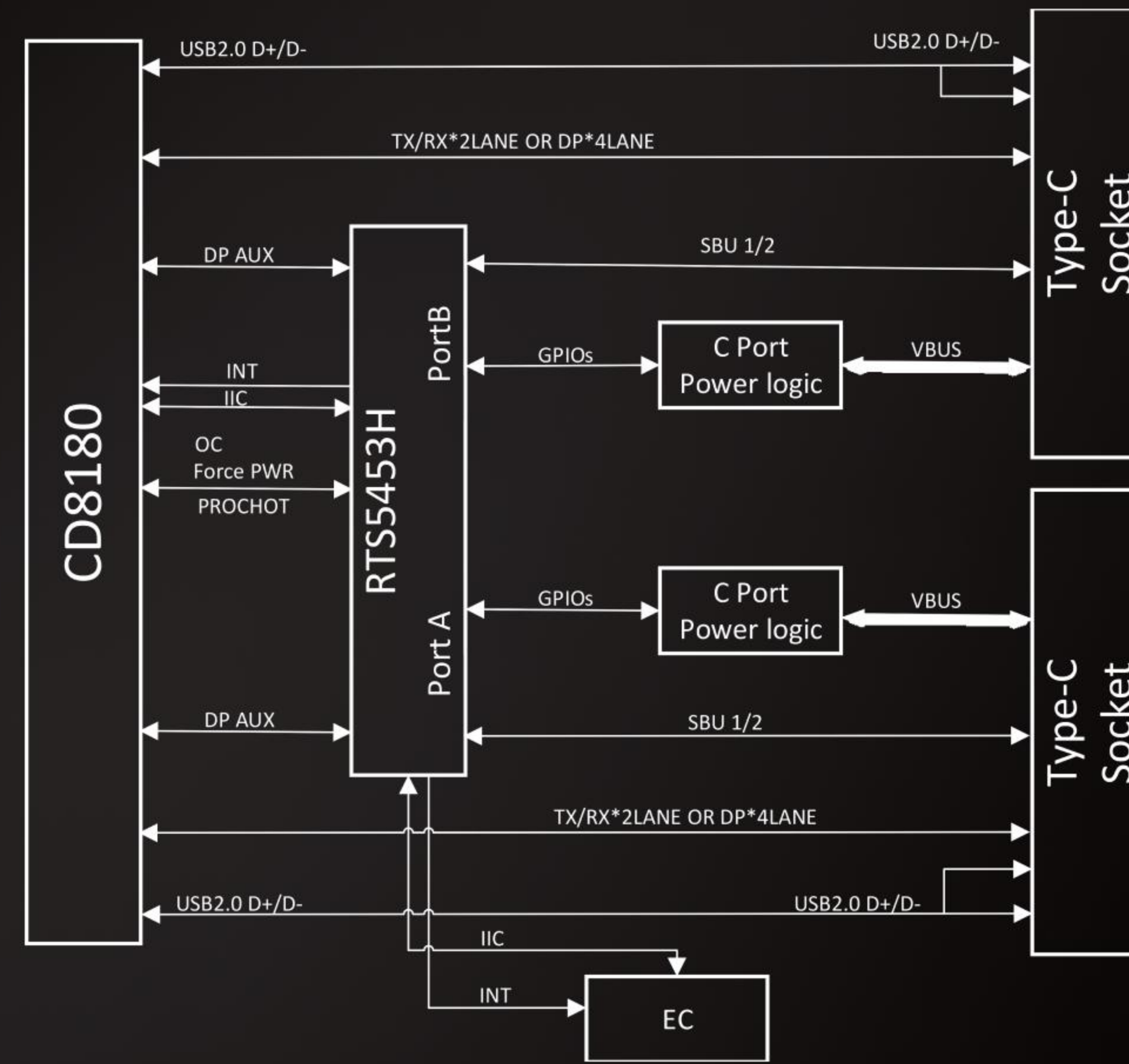
Fan Management, Temperature Detection,
Voltage Monitoring of Key Parts, Board ID
Management, Power Management,
Power-on Sequence Control, Reset
Control, S0/S3/S5 State Control



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Full-featured Type-C

- Power Supply and External Power Supply
- Priority Management
- Dual Type-C Design
- USB/DP Switching



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Open Hardware Schematics

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An Easy-to-Develop Platform

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BSP Development

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We Are the First Users of Our Products



Radxa Orion 06 Software Development Role Configuration

Embedded Systems
Development Role



BSP Engineer

Radxa Orion 06 Development Role Configuration



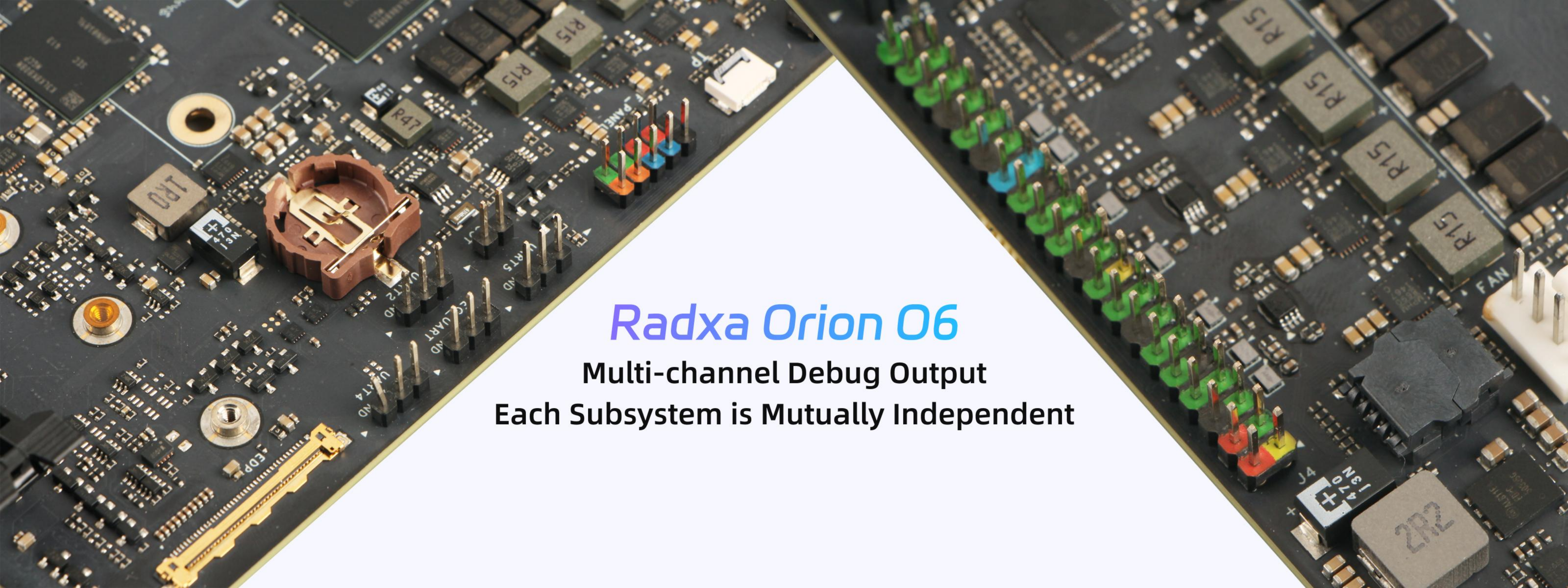
EC Development
Engineer



BIOS Development
Engineer



OS Development
Engineer

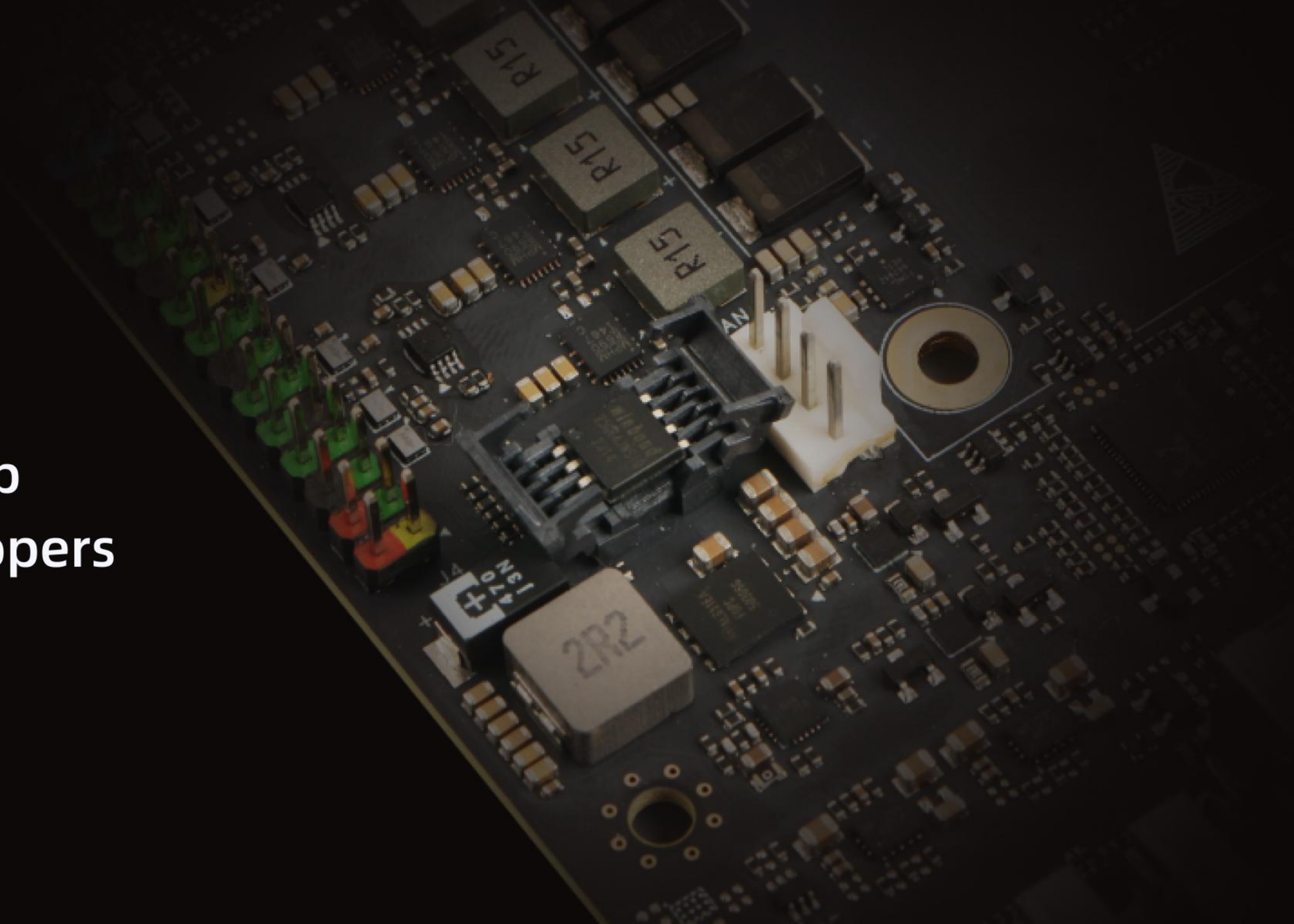


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**Multi-channel Debug Output
Each Subsystem is Mutually Independent**

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Replaceable BIOS SPI Flash Memory Chip
Reduce the Cost of Trial and Error for Developers



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Operating System Development

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Boot Chain Based on EDK2

```
U-Boot latest-2023.10-1-gcc60ff4058d (Dec 13 2024 - 07:29:10 +0000) radxa-zero
```

U-Boot

```
Radxa Orion 06  
CIX CD8180 Processor 2.60 GHz  
0.1.0-1-3e272e3-debug:2024-12-13T07:48:52+00:00 16384 MB RAM  
  
Select Language <English> This is the option  
one adjusts to change  
> Device Manager the language for the  
> Boot Manager current system  
> Boot Maintenance Manager  
  
Continue  
Reset  
  
^v=Move Highlight <Enter>=Select Entry
```

EDK2

```

Device Manager

Devices List
> System Information
> Platform Configuration
> Secure Boot Configuration

Press <Enter> to view
current system
information.

Press ESC to exit.

^v=Move Highlight    <Enter>=Select Entry    Esc=Exit

```

```

Platform Configuration

System Table Selection
Restore AC Power Loss
Network Stack
Ipv4 Pxe Boot
Ipv6 Pxe Boot
Ipv4 Http Boot
Ipv6 Http Boot

<Device Tree>
<Power On>
<Enabled>
<Enabled>
<Enabled>
<Enabled>
<Enabled>

ACPI/DT choice for
specific OS

Press ESC to exit.

^v=Move Highlight    F9=Reset to Defaults    F10=Save
<Enter>=Select Entry    Esc=Exit

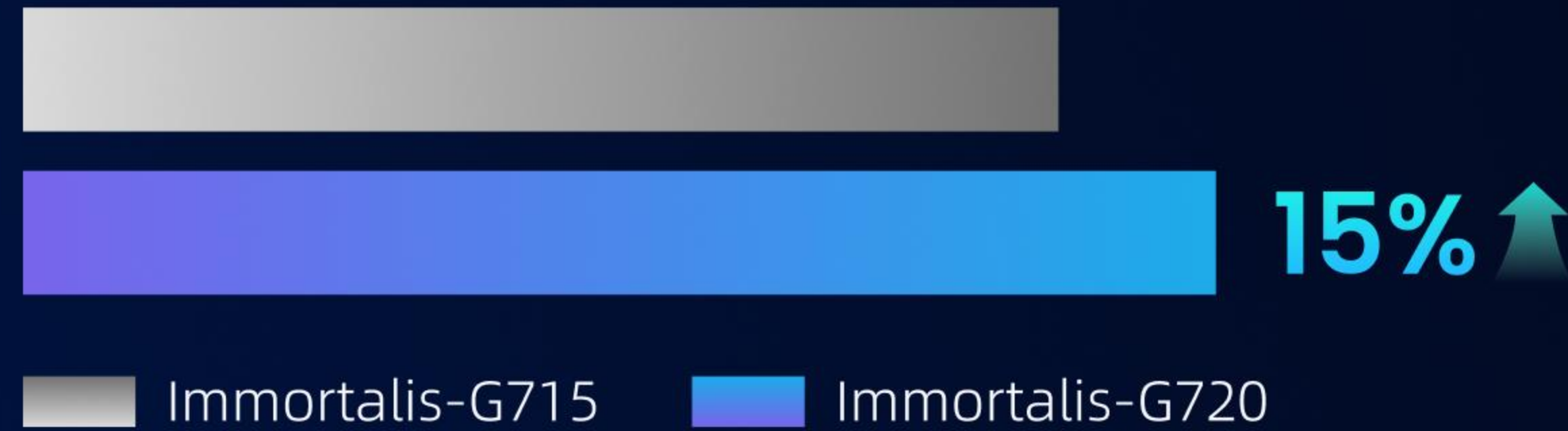
```

Configuration Options of Orion O6

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Upper-layer Application Development

Energy Efficiency Ratio/Performance



GPU

Immortalis-G720

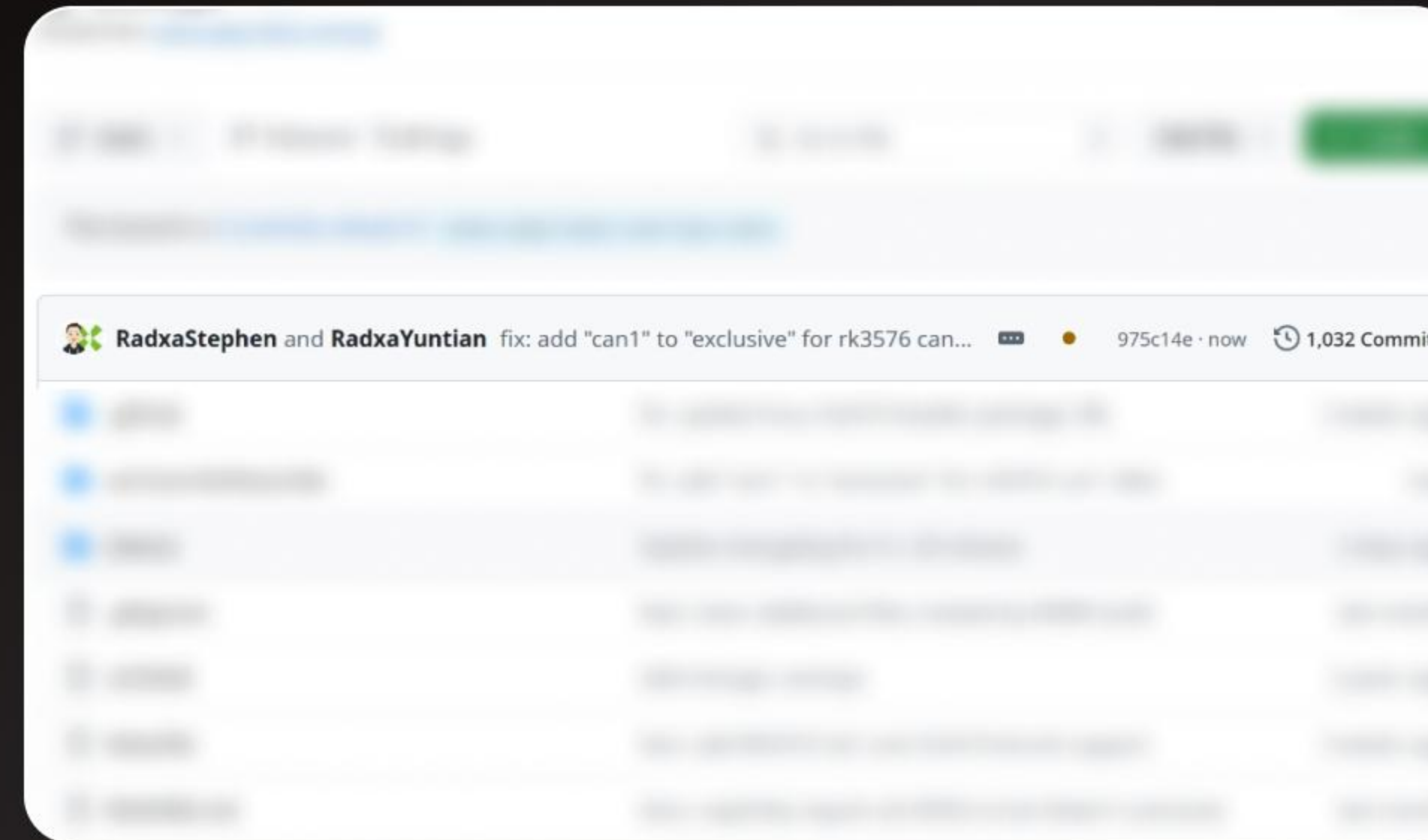
- High-performance Desktop-grade GPU
- Meet the Demands of Extreme Graphics Rendering and General AI Computing



Radxa Orion 06

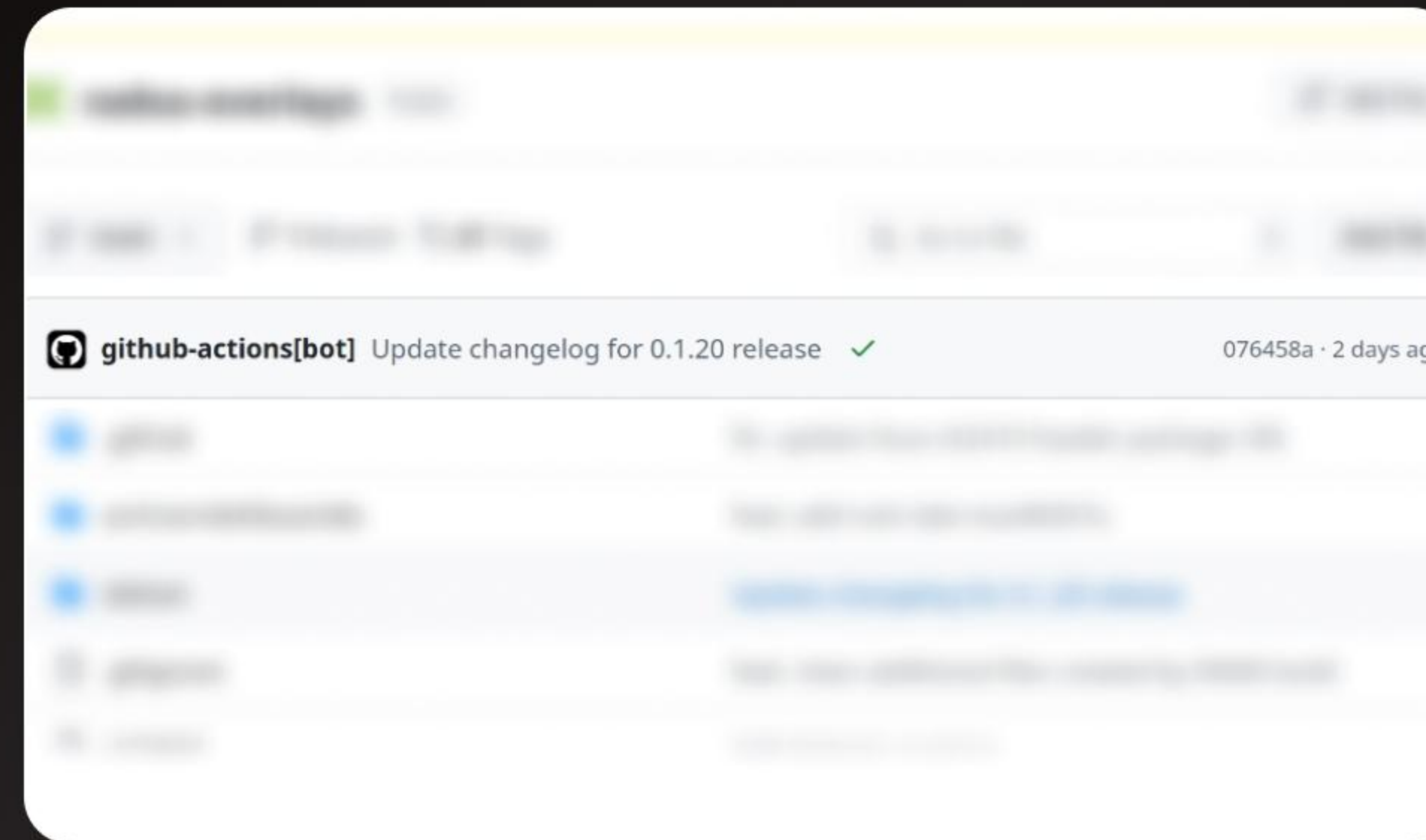
Sustainable Software Delivery

```
overlays on pr384:main [!] via C v14.2.1-gcc took 13s  
at 20:38:22 > git push stephen HEAD:main  
warning: not sending a push certificate since the receiving end does not support it  
Enumerating objects: 60, done.  
Counting objects: 100% (60/60), done.  
Delta compression using up to 20 threads  
Compressing objects: 100% (28/28), done.  
Writing objects: 100% (32/32), 3.00 KiB | 1023.00 KiB/s, done.  
Total 32 (delta 25), reused 0 (delta 0), pack-reused 0 (from 0)  
remote: Resolving deltas: 100% (25/25), completed with 23 local objects.
```



Trigger Code CI for Submission

```
overlays on ↗ main [$?] via C v14.2.1-gcc  
at 20:19:24 > make release
```



Automatically Complete Version Release via Command Line Locally

```
▼ ✓ Update Test repos
  1 ▶ Run radxa-repo/update-repo-action@main
 22 ▶ Run peter-evans/repository-dispatch@v3
 44 ▶ Run peter-evans/repository-dispatch@v3
 66 ▶ Run peter-evans/repository-dispatch@v3
 88 ▶ Run peter-evans/repository-dispatch@v3
110 ▶ Run peter-evans/repository-dispatch@v3
```

```
new_package_release
Update packages #147: Repository dispatch triggered by RadxaYuntian
```

Successfully Released Software Triggers Software Source Updates

```
rsdk on  main [!] via v20.18.0 via impure (devenv-shell-env)
at 20:44:02 > rsdk infra-product-build
-h          radxa-cm3-rpi-cm4-io  radxa-e52c      rock-3a          rock-5b-plus    rock-pi-4b      -t
--help      radxa-cm3-sodimm-io   radxa-e54c      rock-3b          rock-5c          rock-pi-4b-plus --test
-p          radxa-cm4-rpi-cm4-io  radxa-nx5-io    rock-3c          rock-5d          rock-pi-4c
--production radxa-cm5-io          radxa-zero      rock-4c-plus    rock-5-itx      rock-pi-e
radxa-cm3i-io radxa-cm5-rpi-cm4-io radxa-zero-2pro rock-4se         rock-5t          rock-pi-n10
radxa-cm3-io   radxa-e23             radxa-zero3     rock-5a          rock-pi-4a      rock-pi-s
radxa-cm3j-rpi-cm4-io radxa-e25         rock-2          rock-5b          rock-pi-4a-plus rock-s0

rsdk on  main [!] via v20.18.0 via impure (devenv-shell-env)
at 20:44:02 > rsdk infra-product-build rock-5b-plus --test
```

The screenshot shows a CI/CD pipeline interface with a list of jobs. The job 'Build image for test channel' is highlighted in green, indicating it has passed. Below the job name, it says 'Build image for test channel #2: Manually run by RadxaYuntian'. To the right of the job name is a 'main' branch indicator. The interface also shows other jobs in the pipeline, some of which are partially visible and also appear to be in a successful state.

Generate the Final Image from the Continuously Updated Software Source

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Code Release Schedule

BIOS and Operating System Binary Images

Release on January 15th, 2025

**BIOS and Operating
System Binary Images**

Release on January 15th, 2025

**BIOS and Linux Kernel
Source Code**

Open source in Q1 of 2025.

BIOS and Operating System Binary Images

Release on January 15th, 2025

BIOS and Linux Kernel Source Code

Open source in Q1 of 2025.

Tools for Building Images

Available in Q1 2025.

Radxa Orion 06 AI PC Kit

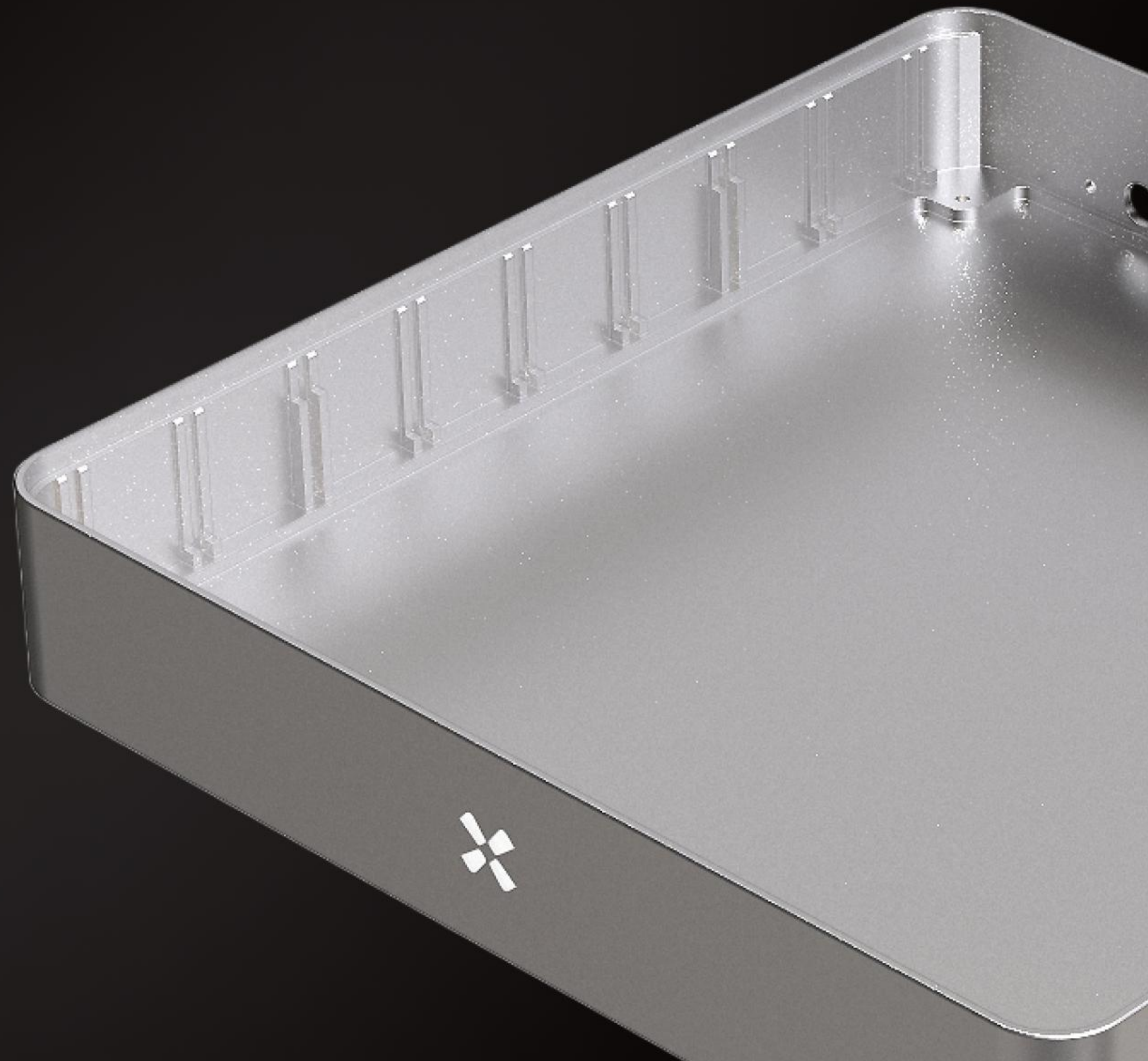
Radxa Orion 06 AI PC Kits





Radxa Orion 06 AI PC Kits

- Aluminum Alloy Integral Die-Casting
- CNC-Crafted
- Titanium Gold Baking Finish Combined
- Logo Highlight Laser Engraving Technology
- 184mm x 184mm



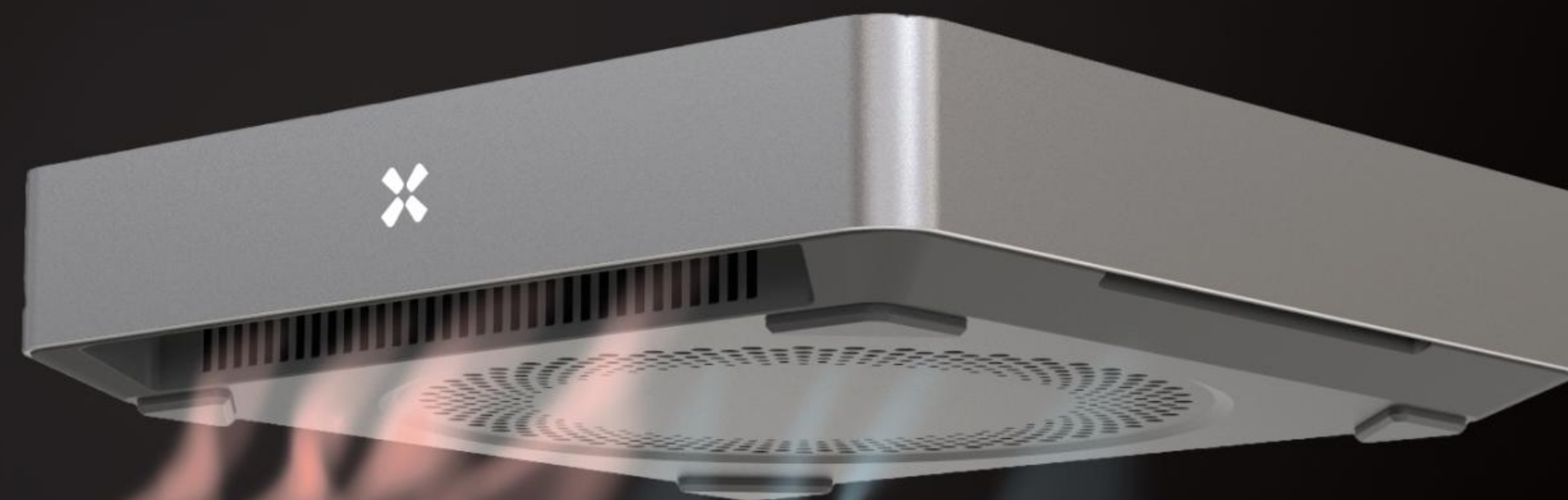
Radxa Orion 06 AI PC Kits

Efficient Heat Dissipation

Fully Concealed Air Outlet Design

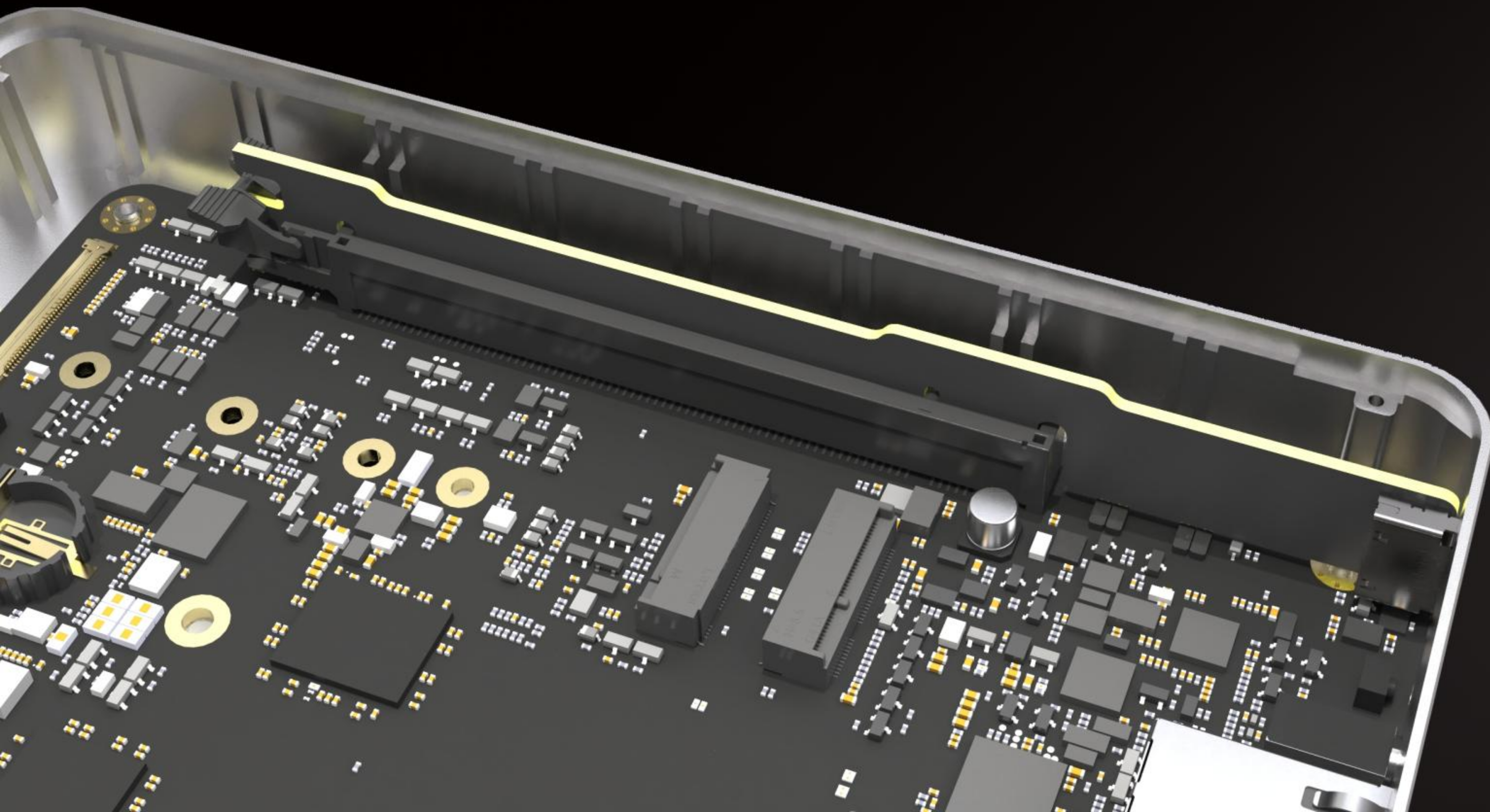


Customized Integrated High-end
Graphics Card Level Cooling

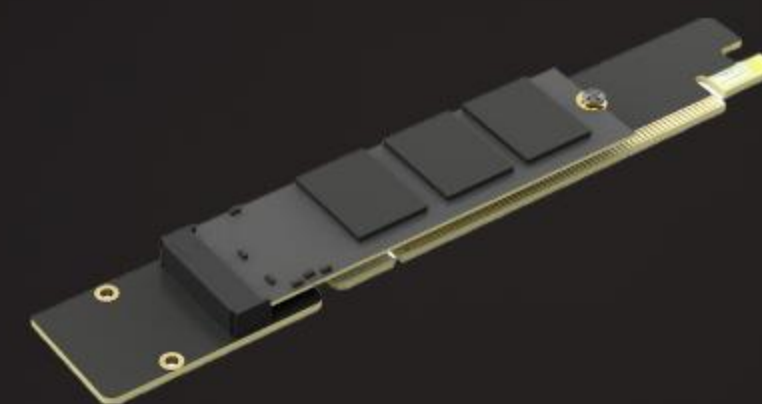


Radxa Orion 06 AI PC Kits

PCIe Expansion

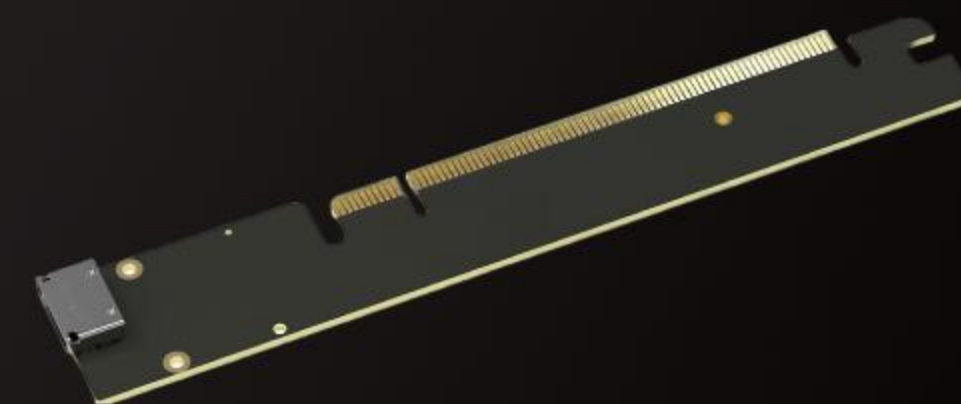


Optional



M.2 2280/110 SSD

Optional



Oculink Adapter

Radxa Orion 06 AI PC 开发套件

Provided in kit form

Enjoy the fun of assembly

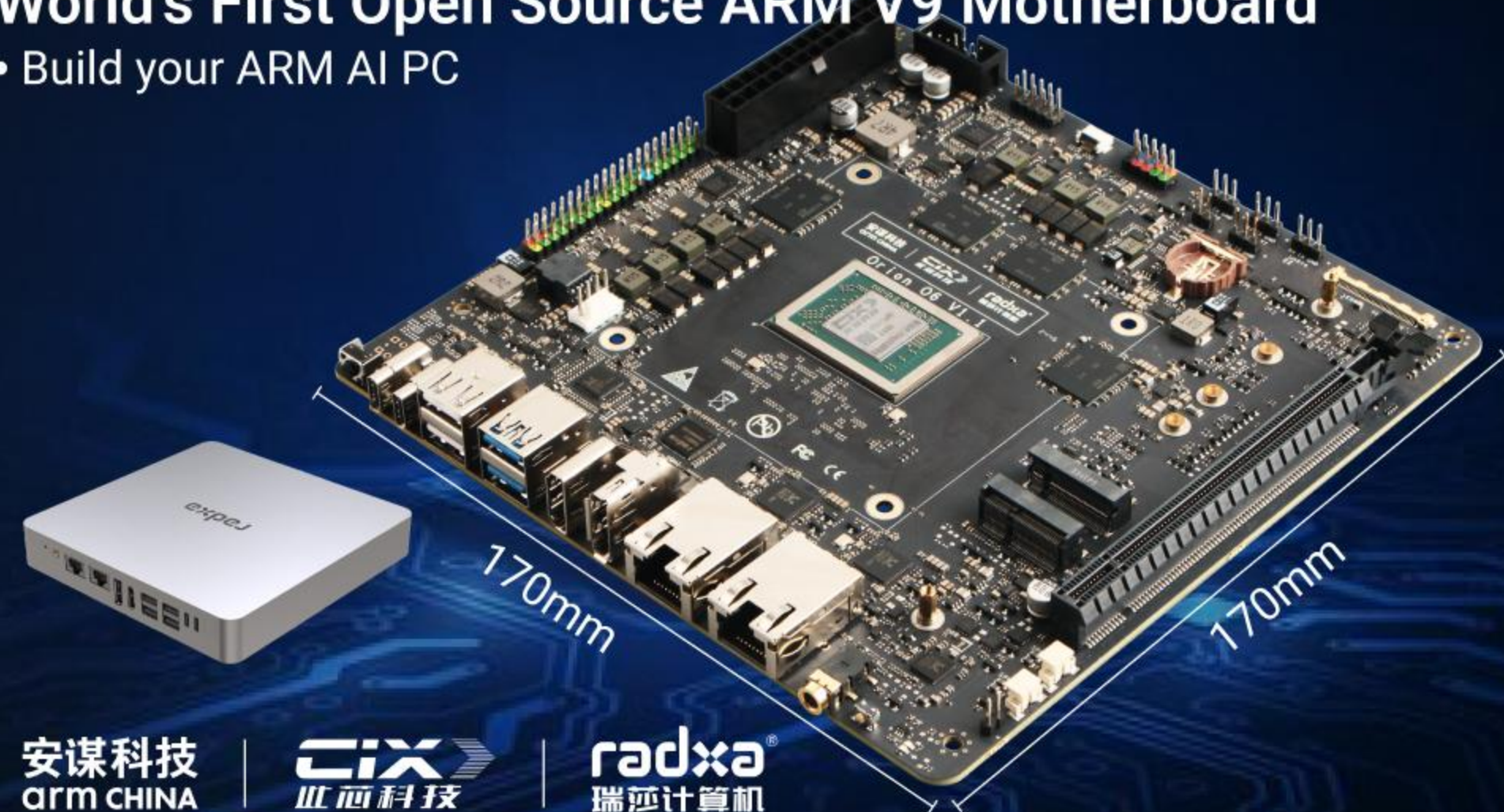
Tutorials provided by the official docs



Radxa Orion 06

World's First Open Source ARM V9 Motherboard

- Build your ARM AI PC



128bit LPDDR5

Up to 64GB

> 100GB/s bandwidth

Impressive 8K Video Codec Capabilities

H.265
HEVC

H.264
MPEG-4/AVC

AV1

VP9

Powered by the Cix CD8180 SoC

CPU

- Quad Big Cortex®-A720
- Quad Medium Cortex®-A720
- Quad Little Cortex®-A520
- 12MB L3 shared across all cores

GPU

- Arm® Immortals™ G720 MC10 GPU
- Hardware-based Ray-Tracing
- OpenGL® ES3.2
- OpenCL® 3.0
- Vulkan® 1.3



NPU

NPU
30 TOPs



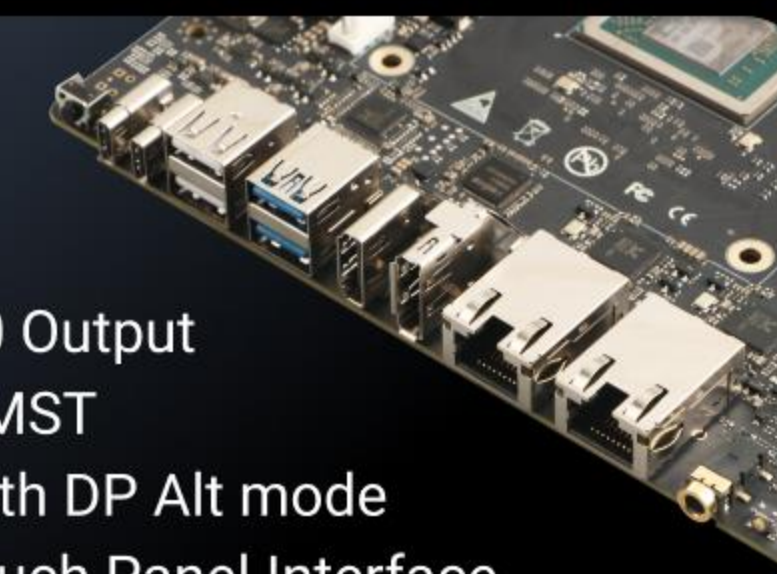
Native Linux support with BIOS/UEFI



Dual 5 Gigabit Ethernet Ports



PCIe x16 Physical Slot with PCIe Gen4 8-lane



- 1x HDMI 2.0 Output
- 1x DP with MST
- 1x USB C with DP Alt mode
- eDP with Touch Panel Interface

Up to 4x Display, Up to 4K@120Hz



2x MIPI CSI(4-lane)



2x USB 3.2 10Gbps



M.2 E Key Connector



M.2 E Key Connector



M.2 M Key Connector with PCIe Gen4x4



Headphone Jack with Microphone Input

Radxa Orion 06

Official Pre-sale Launch

December 18, 2024

Radxa Orion 06

Starting from

\$

2889

Radxa Orion 06

World's First Open Source ARM V9 Motherboard
Official Retail Price

8GB

\$ 289

16GB

\$ 329

32GB

\$ 389

64GB

\$ 539

Radxa Orion 06 *VS* ROCK 5 ITX

Radxa Orion 06 (P1)

12-core Arm V9

128bit LPDDR5 Up to 64GB

dual 5GbE

Desktop-grade GPU

8 lane PCIe 4.0 slot

30Tops NPU

ROCK 5 ITX (RK3588)

8-core Arm V8

64bit LPDDR5 Up to 32GB

dual 2.5GbE

Embedded GPU

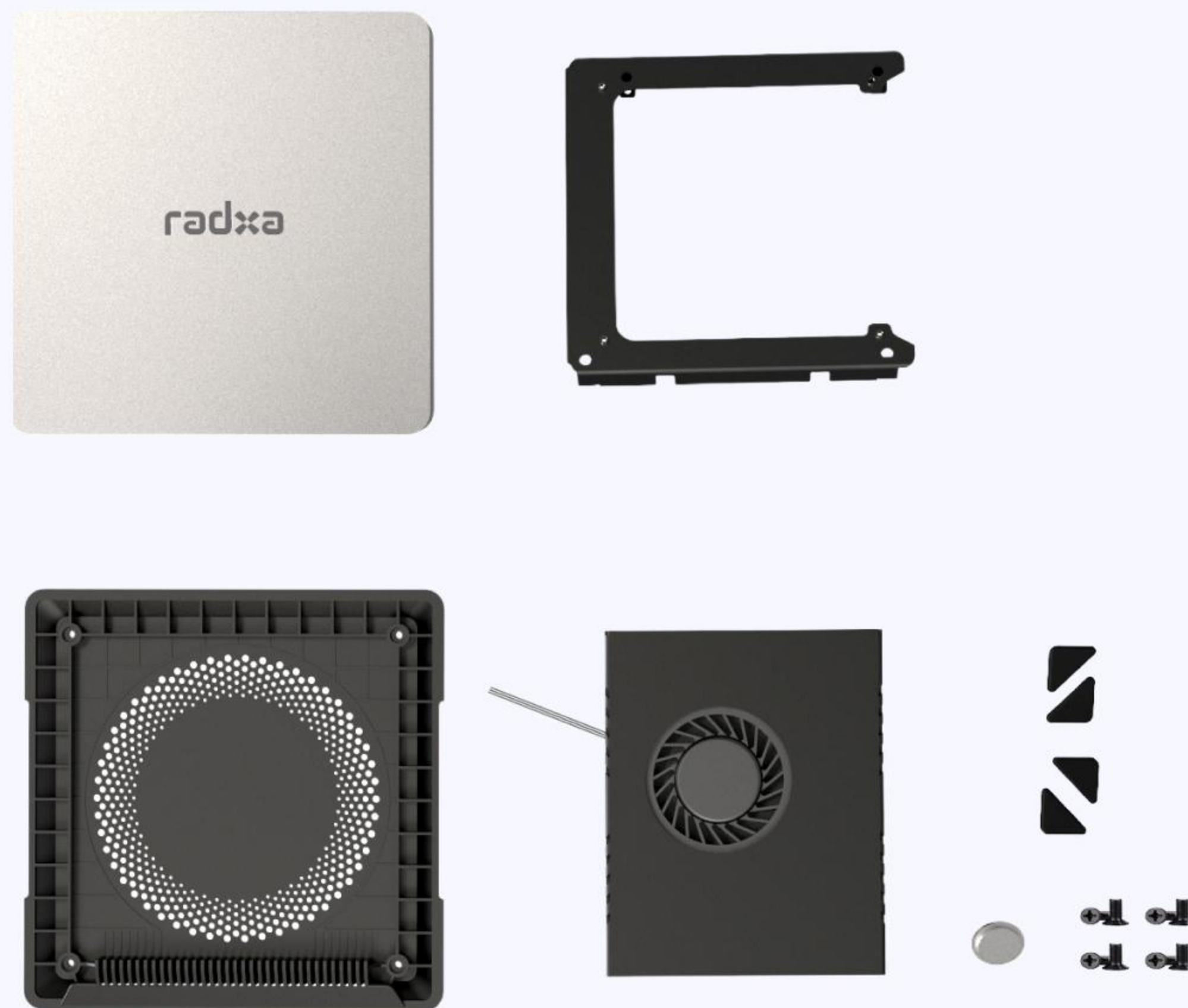
N/A

6Tops NPU

Radxa Orion 06

Order before December 31, 2024.

Shipment before January 27, 2025.



Radxa Orion 06 AI PC Kits

\$39

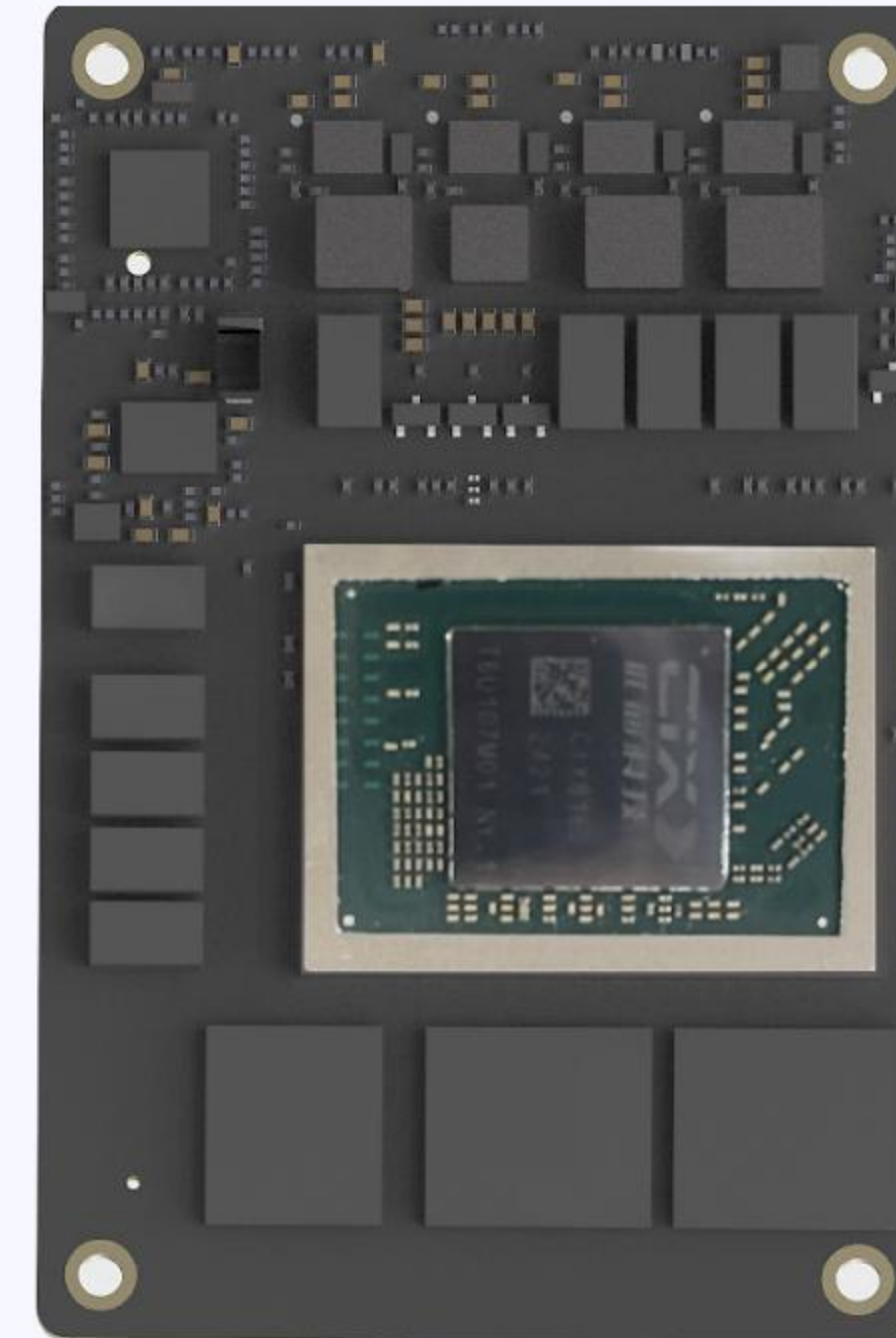
Shipment after February 5, 2025.

Expected before March 18, 2025.

Radxa Orion 06 CoM

- CD8180 Industrial Grade
- 128bit LPDDR5
- 16 lane PCIe 4.0
- Compliant with CoM Express Protocol Specifications

Stay tuned!



Contact Us
Sales@radxa.com