TB-96AIoT
( RK1808 Core Board )
Product Specification
V1.0

<table>
<thead>
<tr>
<th>Version</th>
<th>Date of Revision</th>
<th>Content of Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.0</td>
<td>2019-05-08</td>
<td>The first version officially released</td>
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</tbody>
</table>
1、Product overview

1.1 Summary

On April 1st, 2019, Linaro officially released the 96Boards System-on-Moudle (SoM) specification V1.0 in Bangkok, Thailand. At the same time, it also launched two cores conforming to the 96Boards SoM specification developed by Xiamen Beiqi Technology Co., Ltd. Module TB-96AI and TB-96AIoT, TB-96AI uses RK3399Pro as the main control chip, TB-96AIoT uses RK1808 as the main control chip.

The TB-96AIoT is a low-power, high-powered core board for the AIoT field. It is equipped with a powerful neural network processing unit (NPU) and is compatible with a variety of mainstream inference models such as caffe and tensor flow. Together with the bottom board CarrierBoard developed by Xiamen Beiqi Technology Co., Ltd., it can form a complete development board or evaluation board; the base board that can be customized according to the actual needs of the customer can directly form the industrial application board, which can meet the sweeping robot, drone, smart speaker. , automotive products, smart wear, security monitoring, AI computing modules and other areas of demand.

1.2 Features

The following features are quoted from RockChip. If you have any questions, please contact BEIQICLOUD for more technical support.

1.2.1 CPU

- Dual-core ARM Cortex-A53 CPU for ultra-low power consumption.
- Includes vfp v4 hardware that supports single and double precision operations.
- ARM Neon Advanced SIMD (Single Instruction, Multiple Data) supports accelerated media and signal processing calculations.

1.2.2 Built-in neural network processor NPU, super high AI computing power
- Support 8bit/16bit computing, AI computing power up to 3.0TOPs (INT8 Inference);
  
  (300 GOPs for INT16, 100 GFLOPs for FP16)

<table>
<thead>
<tr>
<th>Model</th>
<th>Model name</th>
<th>FPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image recognition</strong></td>
<td>VGG16</td>
<td>46.4</td>
</tr>
<tr>
<td></td>
<td>ResNet50</td>
<td>81.2</td>
</tr>
<tr>
<td><strong>Image classification</strong></td>
<td>Inception_v4</td>
<td>21.7</td>
</tr>
<tr>
<td><strong>Target Detection</strong></td>
<td>YOLO_v2</td>
<td>43.4</td>
</tr>
</tbody>
</table>

- Compatible with Caffe/Mxnet/TensorFlow model, support multi-class framework, support mainstream layer type, easy to add custom layer;

- Provide easy-to-use development tools, PC-side model conversion, performance estimation, and accuracy verification;

- AI Application Develop Flow
1.2.3 Video codec

- Video decoder
  - Support H.264/AVC BASE/MAIN/HIGH@LEVEL4.2;
  - Up to 1920×1080@60fps

- Video encoder
  - Support H.264 video encoder BP/MP/HP@4.2 level
  - Up to 1920×1080@60fps

1.2.4 Rich extension interface for AIoT applications

The TB-96AIoT has a rich peripheral interface for easy application expansion. Video supports MIPI input, supports MIPI display output; has a series of sensor input and output interfaces such as PWM/I2C/SPI/UART; has high-speed device interface such as Type-C/USB2.0/PCIE, built-in Gigabit Ethernet module and WiFi/ BT module; audio supports microphone array input and supports audio
output.

- Camera interface
  - MIPI-CSI×1, Built-in ISP image processor
  - Maximum support input resolution 1920×1080

- Display output interface
  - MIPI-DSI×1
  - Supports up to 1920×1080@60fps display output

- Audio port
  - Speaker×1
  - Headphone×1
  - Mic×1
  - I2S×1

- PCIe×1

- USB2.0 HOST×1;

- Type-C DRM×1;

- I2C×3

- LAN×1, 1000M ETH

- UART Debug×1

- SPI×1

- SD Card ×1

- PWM×1

- ADC×1, One for key input and the other for headphone insertion detection
1.2.5 High-speed on-board connector for more stability and reliability

- 2 Panasonic high-speed onboard connectors for higher speed signal stability
- The core board can be fixed by 4 screw posts for various working environments.

1.2.6 Ultra-high integration, ultra-small size

- The core board integrates RK1808, LPDDR3, eMMC, power management module, Ethernet PHY chip, WiFi/BT chip, which has super high integration, which greatly reduces the design difficulty of the application backplane, and can help enterprises to quickly develop mass production specific applications. product.

- Designed to be 50mm x 50mm, it can be deployed more easily and flexibly to all types of application boards.

1.2.7 Easy to develop

Support for Linux operating system, AI application development SDK supports C / C++ and Python, convenient for customers to convert from floating point to fixed point network and debugging, development is very convenient.
1.2.8 Rich open materials, 96Boards community

The TB-96AI will be officially launched on Linaro's 96Boards, sharing 96Boards' rich software resources and easily communicating with developers around the world. For detailed reports, please visit Linaro’s website: https://www.linaro.org/news/linaro-announces-launch-of-96boards-system-on-module-som-specification/

- Development board / evaluation board. Visit Beiqi Technology Official Outlet Store (Taobao Store): https://shop467163226.taobao.com/, you can directly purchase TB-96AIoT and the matching CarrierBoard to form a complete RK1808AIoT development board for algorithm development.

- Learning or product evaluation.

  - TB-96AIoT_RK1808 core board_Product Specification.pdf

- Hardware related information.
  - Circuit schematic reference design
  - Connector PCB package
  - Core board size
  - Pin definition, interface package

- Software related materials.
  - Software development guide.pdf
  - Tools.
  - Firmware.
  - Source code

For more technical support, please contact us at service@beiqicloud.com
## 2、Specifications

<table>
<thead>
<tr>
<th>Basic Parameters</th>
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<tbody>
<tr>
<td><strong>SoC</strong></td>
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<tr>
<td><strong>CPU</strong></td>
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</tbody>
</table>
| **NPU** |  Support 8bit/16bit operation, computing power up to 3.0TOPS  
 Support TensorFlow, Caffe model |
| **VPU** |  1080p@60P H.264 Decoder,  
 1080p@30P H.264 Encoder |
| **RAM** | Optional configuration with the following options:  
 1GB LPDDR3  
 2GB LPDDR3  
 4GB LPDDR3 |
| **Flash** | Optional configuration with the following options:  
 16GB eMMC  
 32GB eMMC  
 64GB eMMC  
 128GB eMMC |

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<tr>
<th>Hardware Characteristics</th>
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<tr>
<td><strong>Ethernet</strong></td>
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<tr>
<td><strong>WiFi/BT</strong></td>
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<tr>
<td><strong>Camera Interface</strong></td>
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<tr>
<td>Feature</td>
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<tr>
<td>-------------------------</td>
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<tr>
<td>Display Interface</td>
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<tr>
<td>Audio Port</td>
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<td>Type-C</td>
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<td>USB</td>
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<td>Extension Port</td>
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<td>Power input</td>
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<td>System Software</td>
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<tr>
<td>System Support</td>
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<tr>
<td>Software Support</td>
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consumption is low;

- The AI Application Development SDK supports C/C++ and Python, which facilitates the conversion and debugging of floating-point to fixed-point networks, and is extremely easy to develop.

<table>
<thead>
<tr>
<th>Other Specifications</th>
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<tbody>
<tr>
<td>Size</td>
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<tr>
<td>PCB Specification</td>
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<tr>
<td>Connector</td>
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</tbody>
</table>
3、Structure Size
四、TB-96AIoT+Carrierboard Guide for use

The following figure shows the use of TB-96AIoT RK1808 SOM on the Carrier board.

The following figure shows the interfaces on the board that can be provided to TB-96AIoT RK1808 SOM

Download firmware

Connect the TYPEC to PC
Long press and hold the Maskrom button as shown in the following figure.

Insert power supply.

**Interface use**

- **Som connector:** Use the X1 X2
- **LAN:** Only can use the Ethernet2
- **Camera:** Only can use CAM3 connector
- **Wifi:** Only use the WIFI module on SOM
- **HDMI:** No HDMI interface
- **PCIE:** Only use the PCIE1 (Different SOM hardware required)
- **USB:** Only USB2.0 on the USBx.0 connector

The TF card, debug usb, power key, reset key, user key, user leds, DC Jacket, Audio Jacket are common connector.

**Switch**

The switches for TB-96AIoT are configured as follows:

- All switch on S1, S2, S6, S7, S10, S11, S12, S14, S15, config to disconnect.
- All switch on S8, S9 config to connect for TFcard
- Bit2, bit3 on S16 config to connect.
- Bit1, bit2 on S5 config to connect for debug uart
- Bit4 on S3 config to connect for debug uart
- Bit1, bit2 on S13 config to connect for USB
5、Interface definition
<table>
<thead>
<tr>
<th>PIN</th>
<th>Connector</th>
<th>Description</th>
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<tbody>
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</table>

**Pad type:** IO Pull

**Domain:** VCC5V0_S3

**IO Pull:** 5V System power supply

**1.8V:**
- microphone to detect
- MIPI_CSI differential lane 2 negative
- DPHY_RX_D3P
- I2S0_SDO2/I2C2_SCL_M0/LCDC_VSYNC_M1/GPIO3_B3_d
- I2S0_LRCK_TX/ISP_FLASHTRIGOUT/GPIO3_B6_d
- camera_MCLK

**3.3V:**
- VDC_PWRON
- PMIC_SLEEP_H
- VCC_1V8
- SPI0_CSN

**3.3V power supply:**
- GND

**5V System power supply:**
- GND

**GND:**
- GND
- GND
- GND
- GND

**I/O DOWN:**
- 1.8V
- LAN_MDI3-
- MIPI_DSI_D2N
- I/O DOWN
- 1.8V
- I2C1_SCL/GPIO0_C0_d
- LAN_MDI3-
- MIPI_CSI_D3P
- I2C1_SCL_TP
- LAN_MDI0+
- LED0_AD0
- SDMMC0_D0/UART2_TX_M0/GPIO4_A2_u
- LAN_MDI2-
- 1.8V
- 5V System power supply
- VCC_LAN

**Default function:**
- PWRON
- PCIE power enable
- GND

**Default function description:**
- microphone to detect

**Microphone to detect:**
- microphone to detect

**Microphone to detect description:**
- microphone to detect