StarFive 赛昉科技

StarFive JH-7110 Product Brief

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Preface

About this guide and technical support information.

About this document

This document mainly provides the users with the general information and feature description for StarFive next generation SoC platform - JH-7110.

Revision History

Table 0-1 Revision History

Version	Released	Revision
1.5	2024/08/29	Updated Block Diagram *(on page 8)*.
1.4	2023/08/02	Synchronized the document with Datasheet.
1.3	2022/12/8	Added GMAC limitations.
1.2	2022/10/20	Refined block diagram and refined MIPI output specs.
1.1	2022/09/15	Updated block diagram in sync with Datasheet.
1.0	2022/08/23	1st official release of the document.

Notes and notices

The following notes and notices might appear in this guide:

- **Tip:**
  Suggests how to apply the information in a topic or step.
- **Note:**
  Explains a special case or expands on an important point.
- **Important:**
  Points out critical information concerning a topic or step.
- **CAUTION:**
  Indicates that an action or step can cause loss of data, security problems, or performance issues.
- **Warning:**
  Indicates that an action or step can result in physical harm or cause damage to hardware.

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1. Introduction

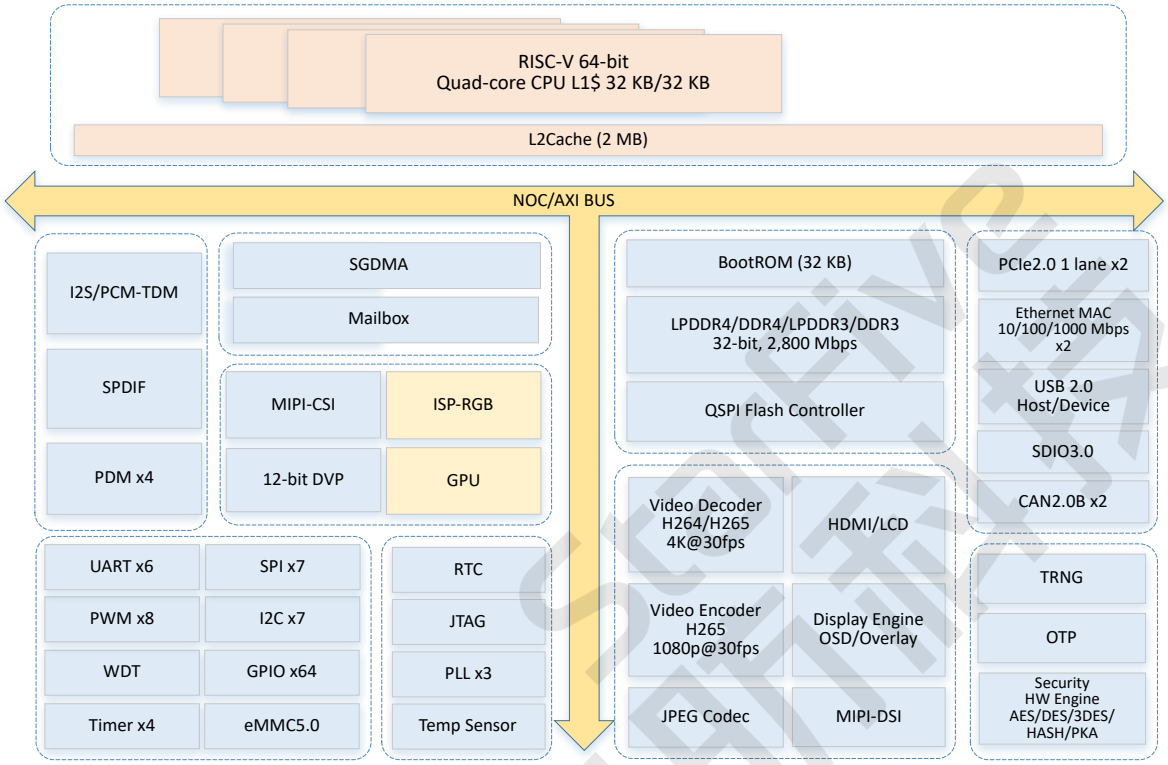
JH-7110 is a high-performance RISC-V SoC for featuring high-performance, low-power-consumption, rich interface options, and powerful image and video processing capabilities.

JH-7110 is equipped with a 64-bit high-performance quad-core RISC-V processor core sharing 2 MB of cache coherency, whose working frequency is 1.5 GHz. JH-7110 has a rich high-speed native interface, supports the Linux operating system, and has powerful image and video processing system. The StarFive ISP is compatible with mainstream camera sensors, built-in image/video processing subsystem supports H.264/H.265/JPEG codec. The integrated GPU makes its image processing capabilities stronger, such as 3D rendering. With high-performance, OpenCL/OpenGL ES/Vulkan support, JH-7110 can further enhance intelligence and efficiency. JH-7110 can complete a variety of complex image/video processing and intelligent visual calculations. Also, it meets multiple visual real-time processing requirements at the edge.

2. Block Diagram

The following figure shows the block diagram of JH-7110.

Figure 2-1 Block Diagram



Note:

- JH-7110 supports one USB port. One of the PCIe2.0 lanes can be shared by USB3.0.
- JH-7110 supports one port for SDIO and one port for eMMC, or both ports for SDIO.

3. Application

An introduction to the application scenarios.

JH-7110 applies to the following scenarios.

- Commercial Electronics
    - Personal *Single Board Computer (SBC)*
    - Home NAS
    - Router (Soft routing)
    - Notebook computer
- Smart Home
    - Sweeping robot
    - Intelligent home appliances
    - Video surveillance
- Industrial Intelligence
    - Industrial robot
    - Unmanned store

4. Highlighted Feature

JH-7110 has the following highlighted features.

- RISC-V U74 quad-core with 2 MB L2 cache
- Support Linux OS with kernel versions 5.10 and 5.15
- CPU work frequency up to 1.5 GHz
- GPU IMG BXE-4-32
- 32-bit LPDDR4/DDR4/LPDDR3/DDR3, up to 2,800 Mbps
- Video decoder supports up to 4K@30fps and multi-stream for H.264/H.265
- Video encoder supports up to 1080p@30fps and multi-stream for H.265
- Provide JPEG encoder/decoder
- Support up to 1080p@30fps full-functional ISP
- Support video input: 1 × DVP and 1 × MIPI-CSI with 4D1C up to 4K@30fps
- Support video output: MIPI display output with 4D1C up to 1080p@60fps
- Support 1 × HDMI2.0 port display up to 4K@30fps
- Support 24-bit RGB parallel interface up to 1080p@30fps
- Support 2 × PCIe2.0, 1 lane
- Support USB3.0 Host/Device (By reusing 1 of the PCIe2.0 lanes)
- Support 2 × Ethernet MAC 1,000 Mbps, 2 × CAN2.0B
- Support IEEE 1588-2002 and IEEE 1588-2008 standards
- Support TRNG and support OTP, DMA, QSPI, and other peripherals
- Dedicated audio processing and sub-system

5. Feature

CPU Subsystem

- 64-bit high-performance RISC-V CPU quad-core
    - Support RV64GC RISC-V ISA
    - L1-cache: I$32 KB/D$32 KB
    - Cache coherence for quad-core
- 32-bit RISC-V CPU core
    - Support RV32IMFC RISC-V ISA
    - 16 KB I-cache only
- L2-cache up to 2 MB cache size
- Dual DMA controllers support up to 16+4 channels

Memory and Storage

- BUS RAM up to 256 KB
- DDR controller support 1 channel of x32
    - DDR4/3 and LPDDR4/3 for 2800 Mbps
    - Support 2 pieces of x16 or 1pcs of x32 devices
    - Support DDR memory density up to 8 GB
- QSPI controller support external flash memory
    - Support XIP mode and Page mode
    - Separate 1/2/4 data width
    - Support SPI Nor Flash size up to 16 MB
    - Support SPI Nand Flash size up to 2 GB

GPU Subsystem

- Support OpenCL 3.0
- Support OpenGL ES 3.2
- Support Vulkan 1.2

Video Processing Subsystem

- Camera MIPI Interface
    - MIPI CSI-2 RX DPHY
- Up to 6 lanes of 1.5 Gbps
- Support 4D1C × 1 MIPI sensors
- Support 2D1C × 1 MIPI sensors
- ISP (Image Signal Process)
    - Support 1 × MIPI CSI channel and 1 × DVP input channel
    - Support up to 1080p@30fps CMOS RGB image sensor
    - ISP core support

- Defective pixel correction
- R/G/B LUT, AE/AWB/AF
- Histogram analysis
- Lens Shading/Color Shading
- Sensor spatial crosstalk cancellation
- Global tone mapping/Spatial noise reduction
- Seamless digital scale down from 1/4x to 1x
- Video Encoder
    - H.265 Encoder, 1080p@30fps
    - Support I/P type slice
    - High-performance CABAC encoding
    - Support Region of Interest (ROI)
- Video Decoder
    - 4K@60fps or 1080p@30fps
    - Compatible with the ITU-T Recommendation H.264
    - Compatible with ISO/IEC 23008-2 H.265
    - Support Format 420, 8-bit/10-bit
    - Support I/P type slice
    - H.265 Main/Main10, L5.1
    - H.264 High/High10, L5.2
- JPEG
    - Up to 290 MPixel/Sec for YUV420, 210 MPixel/Sec for YUV422, 140 MPixel/Sec for YUV444
    - Bit rate 480 Mbps (MJPG 8M@30fps 422 1:8)
    - Compliant with Baseline/Extended sequential ISO/IEC 10918-1 JPEG
    - Compliant with Motion JPEG
    - Support from 16x16 pixels to 32 K × 32 K (32,768 × 32,768)

Display Subsystem

- Display
    - Support 1 × HDMI 2.0 up to 4 K@30fps display
    - RGB656, RGB888 I/F, up to 1080p@30fps display
    - Support 6 image layers shared by 2 display panels (screens)
    - Support 1/64-64 times scaler (1/64 not covered)
    - Support MIPI TX DPHY lane connected with panel module
- MIPI Display Interface
    - MIPI TX DSI Controller for single display output
    - MIPI TX DPHY support up to 4D1C lanes
    - Data rate support up to 2.5 Gbps

Connectivity Subsystem

- 2x PCIe2.0 controller with integrated PHY
  - X1 PCI Express Core
  - Support link rate of 5 GT/s per lane
- USB 2.0 host/device mode with high speed and full speed
- 2 × Ethernet GMAC for 10/100/1000 Mbps with RGMII
- Ethernet GMAC supports data transfer rates of 10/100/1,000 Mbps auto-negotiation using the following PHY models
  - YT8521DH/DC
  - YT8531DH/DC
- Ethernet GMAC supports data transfer rates of 1,000 Mbps only using all other PHY models
- 2 × SDIO 3.0/eMMC 5.0 host controllers
- 2 × CAN2.0B data rates up to 5 Mbps

Security Subsystem

- Encrypt Engines: AES; DES/3DES; HASH; PKA
- Compliant with TRNG
- Support 256-bit random number generation
- 512 × 32-bit (2 KB) of OTP for key data on-die storage

Audio Interface

- 8 channel TX and RX I2S/PCM TDM
- Provide 4 sets of I2S/PCM I/F and support DMA interface
- Provide 2 sets of SPDIF and support RX mode and TX mode
- 4-channel PDM input for digital MIC application

Rich System Peripherals

- 6 × UART
- 7 × I2C
- 7 × SPI
- 2 × SDIO
- 1 × DPI (Parallel RGB Display)
- 1 × PCM/I2S
- 7 × 32-bit timers
- 1 × temperature sensor
- 2 × INTC
- 8 × PWM outputs
- 1 × 32-bit WDT reset output
- 64 × GPIO
- 1 × DVP sensor input interface
- 3 × GPCLK outputs

Package

- Body Size 17 × 17 mm, 0.65 mm ball pitch, FCBGA 625 balls

Power Supply

- 0.9 V core voltage
- 3.3 V/2.5 V/1.8 V I/O voltage