Highly Power-Efficient 64-bit Embedded AI Microprocessor

RENESAS RZ/V2H GROUP

The RZ/V2H is an embedded AI microprocessor (MPU) with the next generation DRP-AI3 – a state-of-the-art AI accelerator – delivering high power efficiency of up to 10 TOPS/W. It can process complex real-time object recognition with power consumption comparable to a conventional embedded MPU, eliminating the need for cooling fans which is essential in conventional AI applications. In addition to the Arm® Cortex®-A55 (1.8GHz) quad-core CPU for Linux, a Cortex®-R8 (800MHz) with high real-time performance is also embedded in RZ/V2H MPU, making it possible to develop robotic devices, automated guided vehicle (AGV), and applications that need real-time recognition and AI judgment with a single chip.

Features

- Cortex®-A55 (1.8GHz) x 4 cores
- Cortex®-R8 (800MHz) x 2 cores
- Cortex®-M33 (200MHz) x 1 core
- AI Accelerator DRP-AI3
- Dynamically Reconfigurable Processor (DRP)
- Arm® Mali™-C55 ISP (option)
- 6MB on-chip SRAM
- LPDDR4/LPDDR4X Memory Interface
- Giga-bit Ethernet 2ch
- USB2.0 Interface 2ch (OTG x1ch, Host x1ch)
- USB3.2 (Gen2) Interface 2ch (Host only)
- PCIe® Interface (Gen3/4-lane) 1ch
- MIPI® CSI-2® Camera Interface 4ch
- CAN Interface (CAN-FD) 6ch
- Package
  - 19x19mm 1368-pin BGA 0.5mm pitch

Advantages

- AI pruning technology improves AI efficiency and achieves up to 80 TOPS
- Power-efficient DRP-AI3 reduces cooling components and system costs
- High-speed real-time CPU enables advanced coordination of AI and control
- The DRP accelerates conventional image processing such as OpenCV

Applications

- Robotics (AMR/AGV)
- FA Machine Vision
- Smart Retail

RZ/V2H Block Diagram

System
- Arm Debugger
- Arm Trust Zone
- Interrupt Controller
- PLL / SSCG
- Standby
- DMAC 80ch
- Event Link Controller

Timers
- GPT x 16ch
- RTC
- GTM (32-bits x 8ch)
- CMTW (32-bits x 8ch)
- WDT x 4ch

Audio
- SSI (I2S) TDM x 10ch
- SPDIF x 3ch
- SCU / ADMAC
- ADG
- PDM (input) x 6ch

CPU

Cortex-A55	Cortex-R8	Cortex-M33
Quad 1.8 GHz	Dual 800 MHz	200 MHz
L1: (I = 32 KB + D = 32 KB)/core L3: 1MB	L1: (I = 32 KB + D = 32 KB)/core TCM: (I = 128 KB + D = 128 KB)/core	FPU DSP extension

Internal Shared Memory
- RAM 6MB w/ECC

AI Accelerator
- DRP-AI3

Dynamically Reconfigurable Processor
- DRP

Video & Graphics

GPU [Mali-G31] (option)	ISP [Mali-C55] (option)
Camera IN: MIPI CSI 2 4 lanes x 4	H.264/265 Enc./Dec.
Display OUT: MIPI DSI 4 lanes x 1	Image Scaling Unit

Security IP (Option)

Secure Boot	Device Unique ID
Crypto Engine	JTAG Disable
TRNG	OTP 32-Kbit

Interfaces
- LPDDR4/4X w/ECC 32-bits x 2 (12.8 GB/s x 2)
- xSPI (4, 8-bits DTR)
- SDIO + eMMC x 1ch
  SDIO x 2ch
- USB3.2 (Gen2 x 1)
  - Host x 2ch
- USB2.0
  - Host / Func. x 1ch
  - Host x 1ch
- GbEthernet x 2ch
- PCIe Gen3
  4 lanes x 1/2 lanes x 2
- IRQ x 16ch
  NMI
- I3C x 1ch
  I2C x 9ch
  SCIF x 1ch
- RSCI(UART/SPI/I2Chost) x 10ch
- RSPI x 3ch
- CAN-FD x 6ch
- GPIO x 86 port

Analog
- 12-bit 2.5-Msps ADC x 8ch
- Temp. Sensor x 2ch

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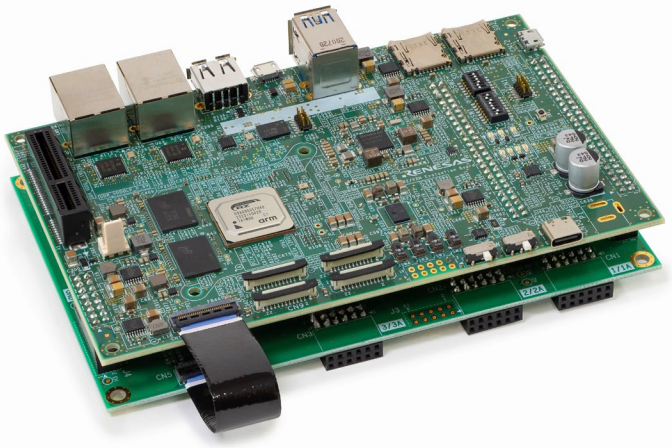
Evaluation Board Kit (EVK)

The RZ/V2H Evaluation Board Kit (EVK) consists of two boards – the main board and an expansion board for HDMI output and audio evaluation.



P/N: RTK0EF0168C04000BJ

Main Board
(Dimension: 153 mm x 100 mm)

- Processor: RZ/V2H
- PMIC: RAA215300
- Clock Generator: 5L35023B
- Main Memory: LPDDR4X (8GB) x 2
- xSPI Flash Memory: 64MB
- External Memory: micro SD Slot x 2
- High Speed Interface
  - Gigabit Ethernet x 2 ports
  - USB3.2 Gen2 x 2ch (Host only)
  - USB2.0 x 2ch (OTG x1ch, Host-only x1)
  - PCIe Gen3 x 1ch (4 lanes max)
  - MIPI CSI-2 Camera Interface x 4 ch
  - MIPI DSI Display Interface x 1ch

Expansion Board
(Dimension: 153 mm x 100 mm)

- HDMI Tx x 1ch
- Audio Auxiliary Input x 1 ch
- Audio Microphone Input x 1 ch
- Audio Headphone Output x 1 ch
- Pmod x 4 ch

Ordering Information

Product Group	RZ/V2H			
Part Number	R9A09G057H41GBG	R9A09G057H42GBG	R9A09G057H45GBG	R9A09G057H46GBG
3G Graphics Accelerator	--	Mali™-G31	--	Mali-G31
Image Signal Processor	--			
Security	No		Yes	
Package	PBGA			
Pin Count	1368-Pin			
Package Information	19mm 0.5mm pitch			

Product Group	RZ/V2H	
Part Number	R9A09G057H44GBG	R9A09G057H48GBG
3G Graphics Accelerator	Mali-G31	
Image Signal Processor	Mali-C55	
Security	No	Yes
Package	PBGA	
Pin Count	1368-Pin	
Package Information	19mm 0.5mm pitch	

For more information, visit www.renesas.com/rzv2h

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