64-BIT SoC based chipset solution
RENESAS R-CAR S4 + PMIC + TIMING IC

Communication Gateway (CoGW) ASIL D System-on-Chip with 32k DMIPS @ Low Power with tailored PMIC and Timing IC

The automotive gateway solution with R-Car S4 system on chips (SoCs), power management ICs (PMICs) and Timing IC for next-generation vehicle computers, communication gateways, domain servers and application servers: It is Renesas’ first monolithic integration of RH850/U2x MCU functionality on an Automotive SoC.

This new chipset meets the automotive industry’s high demands for high performance, high-speed networking, high security, and high functional safety levels that are required as E/E architectures evolve into domains and zones. The R-Car S4 also dramatically improves development efficiency by enabling software reusability. And the new best-in-class PMICs are designed to work seamlessly with the R-Car S4 – A smart chipset system approach with outstanding ratio of overall computation performance to power consumption.

COMMUNICATION GATEWAY CHALLENGES
R-CAR S4 PROVIDES THE SOLUTION FOR CONNECTION ECU AND CLOUD CONNECTION

Target applications and chipset key features

**TARGET APPLICATIONS**
- Vehicle computing
- Communication Gateway
- Domain servers and application servers

**KEY FEATURES R-CAR S4**
- 8x Cortex® A55 configurable in lock-step, 1x dual Cortex® R5z core (lock-step) and 2x dual RH850 64MHz cores (lock-step) deliver up to 27 kDMIPS application performance plus 5.3 kDMIPS real-time performance
- Abundant automotive interfaces including 16 CAN FD, 16x LIN, 8x SENT, 1x FlexRay, 4x PCIe 4.0
- Integrated 3-port Ethernet TSN switch with 3x 2.5 Gbps
- 8 MiB SRAM to execute code on the RH850 64MHz core with low latency
- Multiple hardware security modules (HSMs)
- Power management features, such as Deep Standby Control or Cyclic-Wake-up Control
- R-Car S4 is compliant to ISO 26262 and supports functional safety according to ASIL B or ASIL D

**KEY FEATURES PMIC**
- Programmability enables easy adaption to support R-Car S4 and future R-Car SoCs
- Advanced power control to support extremely low power operation for always-on, cyclic-run, and suspend-to-RAM modes.
- RAA271041 is a pre-regulator that offers two 42 V synchronous controllers, one buck and one boost. The device’s boost stage supports the buck stage when the battery voltage drops during cranking transients as low as 2.5 V.
- RAA271005 is a safe system PMIC offering 5 switching regulators and 6 low drop-out linear regulators (LDOs). RAA271041 and RAA271005 were developed per ISO-26262 and are capable up to ASIL D.
- Integrated 12-bit SAR ADC monitors external signals and eliminates external ADC.
- Dynamic Voltage Frequency scaling changes output voltage to save power.
- Optional spread-spectrum clocking mitigates EMI
- Built-in support SoC activation streamlines SoC self-test procedures

**KEY FEATURES AUTOCLOCK™ TIMING IC**
- Flexible clock generator for any system architecture: “Any Frequency” clock generation up to 650 MHz
- Low jitter, suitable for up to PCIe V5.0 and 10GbE
- Factory-programmed OTP-ROM configuration(s)
- Saves cost, power and board space
- Solves clock-related Functional Safety challenges:
  - Embedded self-monitoring feature on Timing IC increases system-level Fussa metrics
  - Crystal redundancy: the entire system keeps running in case of crystal failure
Benefits

- A complete and scalable chip set solution including R-Car S4 + PMIC + Timing IC is offered for Car Server/Communication Gateway application with optimized ratio of computing performance and low power consumption.
- Scalability and pin compatibility with four R-Car S4 performance and package variants from high-end to mid-range to support various customer requirements.
- R-Car S4 offers higher integration of configurable application cores and real-time cores, an integrated 3-port Ethernet Switch, latest HSMs and best-in-class FuSa technology up to ASIL D all leading to ECU size and BOM cost reduction.

Vehicle Computer evaluation platform VC4

- The ideal easy-to-start platform to evaluate and benchmark new E/E Architectures and PoC using the R-CAR S4 and chipset in Gateway Car Server, or Zone Control applications.
- The Vehicle Computer VC4.0 features the R-CAR S4 SoC. This SoC incorporates MCU elements and a 3-port Ethernet Switch which drastically reduces the BOM cost of this platform.
- It provides the newest automotive network technologies like TSN Ethernet Switch, 10BASE-T1S, 1000BASE RH optical fiber and 2.5GBASE-T1 plus legacy networks like CAN, LIN, FlexRay and SENT.

SPECIFICATION ITEM

<table>
<thead>
<tr>
<th>VC4</th>
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<tbody>
<tr>
<td>ARM Cortex</td>
<td>R-Car S4</td>
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<tr>
<td>Realtime core</td>
<td>8x A55</td>
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<tr>
<td>NVRAM Flash</td>
<td>512M</td>
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<tr>
<td>LPDDR4</td>
<td>4GB</td>
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<td>10GBASE-T Eth.</td>
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<td>CAN/FD</td>
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<td>LIN</td>
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<tr>
<td>FlexRay</td>
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<tr>
<td>ADC</td>
<td>3</td>
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<td>I/O</td>
<td>2 CH</td>
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Hardware Ordering Reference

- R-Car S4:
  - RA2A7104BD [part name depends on application core lock step configuration]
  - Timing IC: RA2A7124A (AutoClock™)
- PMIC:
  - RA271005
- Pre-regulator IC:
  - RA271041
- Vehicle Computer VC4.0:
  - TBD

Availability

- Samples of the R-Car S4 SoCs, Vehicle Computer evaluation boards and starter kits are available for selected customers now. For more information, please visit:
  - https://www.renesas.com/products/automotive-products/automotive-system-chips-soCs
- Samples of the RA2A71041 and RA271005 are available respectively. More information is available at:
  - https://www.renesas.com/products/automotive-products/automotive-power-management