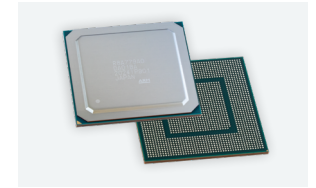




64-BIT SoC based chipset solution

# RENESAS R-CAR S4 + PMIC + TIMING IC



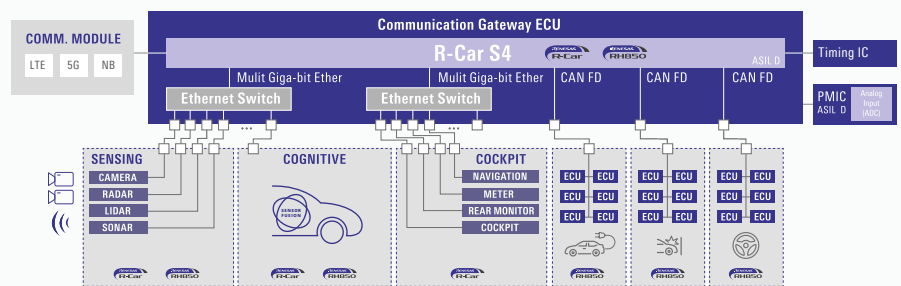
Communication Gateway (CoGW) ASIL D System-on-Chip with 32k DMIPS @ Low Power with tailored PMIC and Timing IC

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

MCU Feature	Multi-protocol Gateway	Network Security	OTA Update	Application Server
<ul style="list-style-type: none"> <li>Low power scheme: cyclic wake-up, deep standby mode</li> <li>Classic AUTOSAR</li> <li>Software reusability</li> </ul>	<ul style="list-style-type: none"> <li>CAN / Ethernet routing</li> <li>Gbit Ethernet</li> <li>CAN-Ethernet conversion</li> </ul>	<ul style="list-style-type: none"> <li>Firewall, IPS</li> <li>Message Authentication</li> <li>Encryption</li> </ul>	<ul style="list-style-type: none"> <li>Update agent</li> <li>OTA orchestration</li> <li>Enhanced Security, FuSa</li> </ul>	<ul style="list-style-type: none"> <li>Domain integrated application, Hypervisor</li> <li>Cloud-related service</li> </ul>



## 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® R52 core (lock-step) and 2x dual RH850 G4MH cores (lock-step) deliver up to 27 kDMIPS application performance plus 5.3 kDMIPS real-time performance
- Abundant automotive interfaces including 16x CAN FD, 16x LIN, 8x SENT, 1x FlexRay, 4x PCIe V4.0
- Integrated 3-port Ethernet TSN switch with 3x 2.5 Gbps
- 8 MB SRAM to execute code on the RH850 G4MH 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

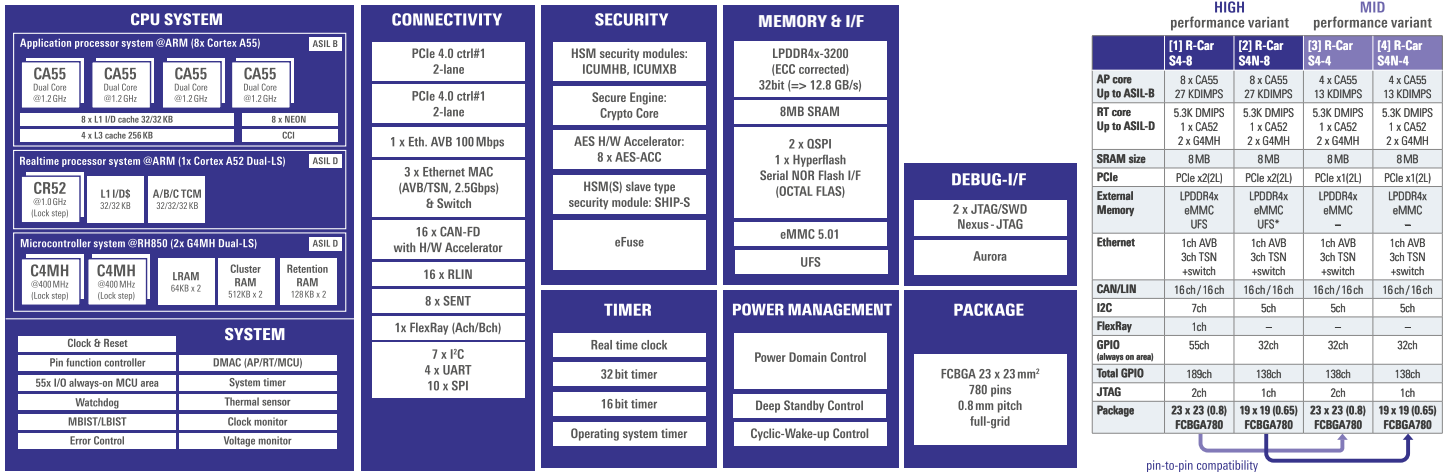
- Programmability enables easy adaption to support R-Car S4 and future R-Car SOCs
- Advanced power control to support extremely low power operation for always-on, cyclic-run, and suspend-to-RAM modes.
- RAA271041 is a pre-regulator that offers two 42 V synchronous controllers, one buck and one boost. The device's boost stage supports the buck stage when the battery voltage drops during cranking transients as low as 2.5V.
- 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 FuSa metrics
  - Crystal redundancy: the entire system keeps running in case of crystal failure

## Block diagram R-Car S4 and variants



## 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
- Maximum re-use of existing RH850 and R-Car Gen3 based software reduces overall project development time/cost/risk at customer and allows a better time-to-market
- The 3<sup>rd</sup> party virtual platform (VPF) for R-Car S4 and the Vehicle Computer evaluation platform allow rapid prototyping/POC and project development can start now

## Vehicle Computer evaluation platform VC4

SPECIFICATION ITEM	VC4
ARM Cortex	8x A55
Realtime core	1x R52; 2x G4MH
NOR Flash	512M
UFS	64GB
LPDDR4	4GB
10BASE-T1S	3
100BASE-TX Eth.	1 shared
100BASE-T1 Eth.	1 shared
1000BASE-T1 Eth.	3 shared
1000BASE-RH Eth.	1 shared
2.5GBASE-T1 Eth.	2 shared
CAN/CAN FD	16 (4 shared)
LIN	8
FlexRay	1 shared
Sent (PWM)	2
USB2.0	-
ADC	3
PCIe	2 CH

- 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.



### HARDWARE ORDERING REFERENCE

Hardware	Part Number	Reference
R-Car S4	RBA779FLAX0BG (part name depends on application core lock-step configuration)	Timing IC
PMIC	RAA271005	R-Car S4 starter kit
Pre-regulator IC	RAA271041	Vehicle Computer VC4.0
		RCA2121x (AutoClock™)
		Y-ASK-RCAR-S4
		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: <a href="https://www.renesas.com/products/automotive-products/automotive-system-chips-socs">https://www.renesas.com/products/automotive-products/automotive-system-chips-socs</a>	Samples of the RAA271041 and RAA271005 are available respectively. More information is available at: <a href="https://www.renesas.com/products/automotive-products/automotive-power-management">https://www.renesas.com/products/automotive-products/automotive-power-management</a>
--	---