RENESAS

RENESAS R-Car

RENESAS VEHICLE COMPUTER GENERATION 4

The four megatrends of autonomous driving, connected cars, electric vehicles and shared mobility have significant impact to the E/E architecture which moves from domain based into a zonal architecture. This new zonal architecture addresses the increasing complexity and the computation demand of the next generation vehicles. Renesas has developed a comprehensive Communication Gateway ECU (Vehicle Computer) offering the newest automotive network technologies like a TSN Ethernet Switch, 10BASE-T1S, 1000BASE-RH (optical fiber) and 2.5GBASE-T1 plus legacy networks like CAN, LIN, FlexRay and SENT as well as sufficient computing power to host the ever-increasing amount of user applications.
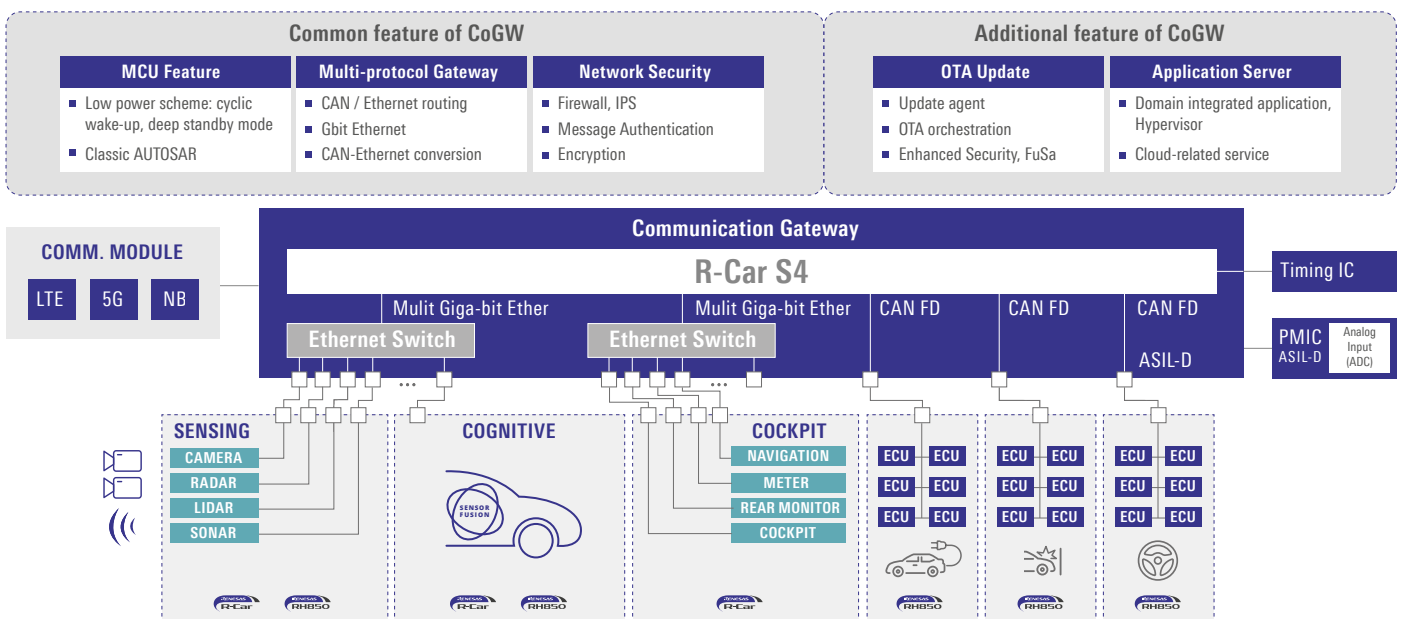
Universal development platform

This Communication Gateway ECU is considered as universal development platform for automotive customers. This type of platform typically requires Application performance which is provided by a cluster of several Arm® CPU's.

Beside that also real-time performance is needed that traditionally is provided by a micro controller that carries the typical automotive communication interfaces as well. In the past this required a mix of several chips on one PCB. Now with the new R-Car S4 everything is provided by a single device, this allows a drastic BOM cost reduction.
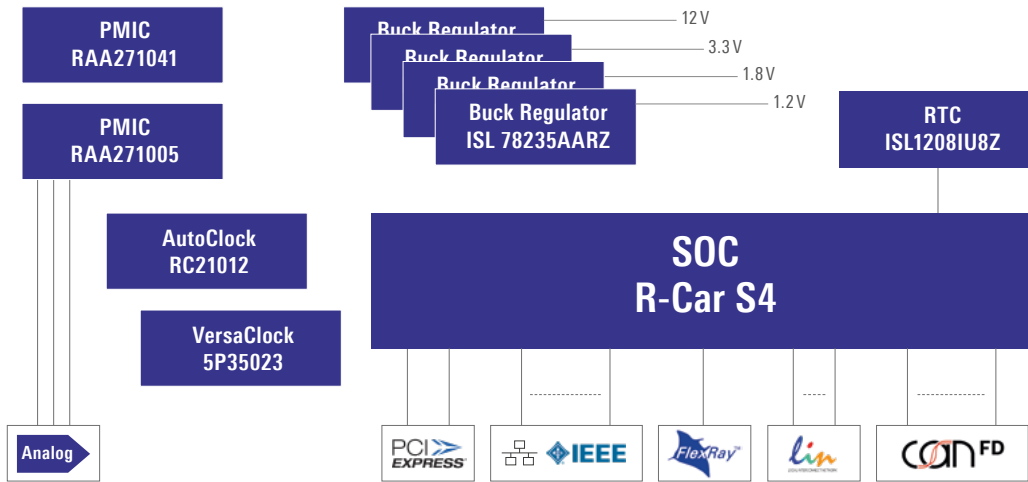
High level of software compatibility

The Renesas R-Car S4 SoC is the first product in Renesas' 4th-generation R-Car Family. It includes multiple Arm® Cortex® A55, Cortex® R52 and an integrated high performance G4MH CPU core for control domain management. R-Car S4 SoCs offers a huge number of automotive interfaces such as 16x CAN FD, 16x LIN, 8x SENT, 1x FlexRay, 2x PCIe V4.0 and also a high-bandwidth 3 x 2.5Gbit Ethernet Switch to enable rich communication and connectivity options both inside and outside of the vehicle. The R-Car S4 solution allows designers to re-use up to 80 percent of software code developed for three generations of R-Car SoCs and RH850 MCU applications. The software package supports the real-time cores with various drivers and basic software such as Linux BSP and hypervisors.

Block Diagram

Common feature of CoGW		
MCU Feature	**Multi-protocol Gateway**	**Network Security**
■ Low power scheme: cyclic wake-up, deep standby mode ■ Classic AUTOSAR	■ CAN / Ethernet routing ■ Gbit Ethernet ■ CAN-Ethernet conversion	■ Firewall, IPS ■ Message Authentication ■ Encryption

Additional feature of CoGW	
OTA Update	**Application Server**
■ Update agent ■ OTA orchestration ■ Enhanced Security, FuSa	■ Domain integrated application, Hypervisor ■ Cloud-related service

Vehicle Computer VC4 Block diagram

The VC4 is based on a complete Renesas chipset. The centerpiece is the R-Car S4 with 8x Cortex®A55 cores, 1x Cortex® R52 core 2x RH850 G4MH delivering up to 27K DMIPS application performance plus >5.3K DMIPS lock step real-time performance. It incorporates an 8MB SRAM to execute code on the RH850 G4MH cores with low latency. A rich selection of automotive interfaces including a 3-port Ethernet Switch, 16x CAN FD, 8x LIN, 4x SENT, 1x FlexRay, 2x PCIe V4.0 allow a wide range of connectivity inside the vehicle.

Together with the powerful Renesas PMIC components RAA271041 and RAA271005 which provide advanced power control to support extremely low power operation for always-on, cyclic-run, and suspend-to-RAM modes. The RAA271041 device's supports the buck stage when the battery voltage drops during cranking transients as low as 2.5V. The RAA271005 has an integrated 12-bit SAR ADC monitors external signals. Finally, high precision timing devices RC21012 and 5P35023 will provide perfect clocking to all devices.

It is the ideal platform to evaluate new E/E Architectures using the R-Car S4 in Gateway, Car Server or Zone Control applications.

Characteristics

KEY FEATURES

- Gateway solution based on R-Car S4 SoCs
- Automotive qualified components (timing IC and PMIC)
- Robust Metal housing
- Wide temperature range 40 °C to 85 °C
- Input voltage range 2.5V to 40 V
- Wake-up support
- Real Time clock on board

INTERFACES

- 10BASE-T1S
- 100BASE-T1
- 1000BASE-T1
- 1000BASE-RH
- 2.5GBASE-T1
- CAN/CAN FD
- FlexRay
- LIN
- SENT
- PCIe
- Analog Input

For more details, please visit: **https://www.renesas.com/r-car-s4**