Renesas’ Automotive Computing Platform for Intelligent Connected Cars

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Computing by Semiconductor

Semiconductor drives automotive computing innovations.
Autonomous drive will lead the semiconductor innovation.
Automotive Computing for Autonomous Driving

Level 1: Function-specific Automation
Level 2: Combined Function Automation
Level 3: Limited Autonomous-Driving Automation
Level 4: Full Autonomous-Driving Automation

City Pilot

Highway Pilot

Assisting Auto Pilot, Parking

Single function by Vision / Radar

Driving responsibility

Driver

Driver

System

System

computing resources
Automotive Computing for HMI*

*HMI: Human Machine Interface
Concept of Renesas’ Cockpit
Renesas Automotive Computing

- **IVI* HMI**: R-Car H, R-Car M, R-Car E & R-Car T RH850/F
- **Meter Cluster**: R-Car H, R-Car M, R-Car E & R-Car D RH850/D
- **Autonomous Driving**: R-Car H, R-Car M & R-Car V RH850/P
- **Connected Car**: R-Car W

*IVI: In-Vehicle Infotainment*
Renesas’ Leading Next Generation Automotive Solution Lineup

RENESAS is the TOTAL SOLUTION PROVIDER for Next Generation Automotive Systems

Sensing
- Camera
- Radar
- V2X

Cognitive
- Renesas R-Car
- Renesas RH850

Human Interface
- Human Interface
- Drivers Monitoring
- Global No.1

Control / Driving
- Gateway
- EV Motor
- Engine
- Braking
- Steering
- Global No.1

Robustness
- Reliability
- Security
- Functional Safety
28nm MCU Joint Development with TSMC

Renesas and TSMC collaborate on joint development of the world’s first 28nm automotive MCU to address enhanced performance, low power and increased memory capacity requirements of next-generation green and autonomous vehicles.

Joint development and consignment production for automotive MCUs

Highly reliable/high-speed scalable MONOS flash technology

High performance/low power 28nm HKMG process technology

Integrated ECUs

Security

Over-the-Air

Green cars, Energy efficiency

Autonomous driving

HKMG : High-k Metal Gate
Renesas’ ADAS Car Challenge

**V2x system**
X1 reference board
R-Car W2R (Wave RF) and R-Car E2 (HOST)

**Lidar**
X6 (4 corners, front, rear)
100-110 angle x 250m FOV
Synchronized scanning

**SRR**
X4 (4 corners, built under bumper)
76Ghz Dual FOVs 150 angle x 100m

**LRR**
X1 (front)
76Ghz Dual FOVs 90 angle x 60m
20 angle x 174m

**View camera**
X4 (front, Rear, Left, right)

**Camera**
X2 (Left, Right)
360 angle x 100m
Rotational scanning

**IMU**

**3D Surround View System**
x1 R-Car H2 board

**Sensor Fusion System**
x2 R-Car H2 board

**Renesas R-Car**
Renesas’ ADAS Car Challenge
Renesas’ Connected Car Challenge

Cloud-based autonomous valet parking demo

Automotive Control + Sensing & Detection

Renesas RH850 R-Car

SEMICON TAIWAN
Renesas’ Connected Car Challenge
R-Car is a Real Advanced Automotive Computing Platform

Platform for augmented reality HMI
Platform for autonomous drive cognitive engine

SCALABLE PLATFORM
for multiple segments and car-model grades

FLEXIBLE PLATFORM
for brand configuration and SW integration

SUSTAINABLE PLATFORM
for multiple generations and maintenance
How These Can be Built into Up on R-Car

R-Car has been built up with over 15 years experience in automotive infotainment:

SOFTWARE: scalable BSP across series, Linux OS with Wayland/Weston, Yocto project, Long Term Support Initiative, big.LITTLE, AArch64, Android OS – Google AOSP, QNX CAR2, Green hill software – Integrity and Multvisor, AUTOSAR, MCAL/CDD, QSSL - QNX operating system and QNX, Renesas Graphic Library, Gstreamer, V4L2, Stagefreight, Surface flinger, OpenMAX IL, DVD, DTV, multi media package, OpenGL ES3.1, localization by EGO motion, sensor fusion, OpenCV, OpenVX, 6-axis Color Management for multi screen, USB host/function, USB OTG, Quality back light control, super resolution, ALSA, sampling rate converter, Android Auto, CarPlay, Mirrorlink, HTML5, Qt frameworks, Deep Learning, localization by EGO motion, sensor fusion, OpenCV, OpenVX, 6-axis Color Management for multi screen, USB host/function, USB OTG, Quality back light control, super resolution, ALSA, sampling rate converter, Android Auto, CarPlay, Mirrorlink, HTML5, Qt frameworks, Deep Learning,

How to build and deploy
tasks into the R-Car platform

SYSTEM PARTNERS: Community reviewed public BSP, “upstream first” philosophy for sustainable board support package in mainline open source, over 10 years for GENIVI Simple Reference Platform and GEVNI Demo Platform is R-Car, AGL Unified Code Base, update, GENIVI Simple Reference Platform and GEVNI Demo Platform is R-Car, AGL Unified Code Base, [include more details here]

COMMUNITY & ECO

all supports together with over 180 members across world, R-Car

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Renesas’ Advanced Technologies Recognized by Academic Institutions

- Feb.2016, ISSCC : 197mW 70ms-latency Full-HD 12-ch Video Processing SoC
- Feb.2016, ISSCC : 16nm FinFET Heterogeneous Nona-Core SoC complying with ISO26262 ASIL-B : achieving 10^-7 random HW failure per hour reliability
- Dec.2015, IEDM : 2RW Dual-port SRAM Design Challenges in Advanced Technology Nodes
- Dec.2014, IEDM : 16nm FinFET High-k/Metal-gate 256-kbit 6T SRAM Macros with Word line Overdriven Assist
- Arp.2015, IEEE COOLCHIPS : Acceleration Methods of Accurate Ego-Motion Using an Image Recognition Hardware for Advanced Driver Assistance Systems
Renesas’ Commitment on Leading & Contributing to the Automotive Industry and OSS* Community

GENIVI and AGL adopt R-Car as primarily reference platform

R-Car easy-to-use reference board

Renesas support R-Car based software eco-system creation and GENIVI and AGL support


*OSS: Open Source Software
Renesas’ R-Car Eco-System

Renesas R-Car Consortium

Over 180 companies
Let’s Challenge Together to Build Intelligent Connected Cars with Renesas’ Automotive Computing Platform