RH850/U2B SERIES
MICROCONTROLLER INTRODUCTION

11/2021
AUTOMOTIVE SOLUTION BUSINESS UNIT
RENESAS ELECTRONICS CORPORATION
KEY TRENDS
E/E ARCHITECTURE TREND

- CENTRAL UNIT PERFORMANCE GROWTH WITH CENTRALIZATION
- EVOLVED THROUGH DOMAIN ARCHITECTURE TO ZONE ARCHITECTURE
- MANY PARTIAL INTEGRATIONS IN THE MARKET

MIGRATION
2025CY to 2030CY

Domain Architecture

PAST
Central Architecture

CENTRAL UNIT PERFORMANCE GROWTH WITH CENTRALIZATION

FUTURE
Beyond 2030CY
Zonal Architecture

Future Architecture
TECHNOLOGY
28NM WORLD-LEADING FLASH TECHNOLOGY

Changing Industry Needs Driving Automotive MCUs

- Multi-Core (High Performance & Robustness)
- Low Power Consumption (Overheating Prevention)
- Increasing Program Capacity
- High Integration (Cutting-Edge Features)

Development & Production Partnership of Next-Gen World Standard 28nm MCU *1

*1: Announced on September 1, 2016
PRODUCT POSITIONING
RENESAS AUTOMOTIVE MCU LINE UP

Powertrain
- Accelerator for model-based design & AI
- RH850/E Series

xEV
- RDC for high carrier, Multiphase control
- RH850/C Series

DCU / Zone / Gateway
- QoS, Hardware Accelerator
- High performance CPU
- Hypervisor
- Low power consumption
- RH850/P Series

Chassis & Safety
- Small package, Multi Core
- RH850/P Series

Energy Management
- Low Standby Power
- RH850/F Series

Body Control / Actuator
- Low Power & Wide Line-up
- RL78/F Series

NEW
- RH850/U2B
  - CPU: up to 8x 400MHz
  - ROM: up to 32MB

- RH850/U2A
  - CPU: up to 4x 400MHz
  - ROM: up to 16MB

Software Reusability
RH850/U2B OVERVIEW
**RH850/U2B SERIES – HIGHLIGHTS & KEY FEATURES**

**Performance ➔ Highest at Low Power Consumption**
- Multi-core: Up to 8 CPUs @400MHz ➔ high performance in Zone area
- HW accelerators: Floating point SIMD (FXU), Data Flow Processor (DFP), E-Motor control Unit (EMU3S)
- Optimized system configuration with extremely fast memory access (flash, RAM)

**Scalability & Flexibility**
- Line-up with up to 32MB code flash, multi core up to (main + lockstep)
- Comprehensive IP consolidation ➔ SW re-usability within Renesas RH850 Series

**Technologies**
- **FMONOS ➔ 28nm extremely fast flash technology, reliable, qualified about to enter MP**
- **Over-The-Air update ➔ No-wait OTA in field**
- **CPU virtualization & QoS ➔ ECU integration using Hypervisor & Quality of Service**
- **Network + Connectivity ➔ Gbit Ethernet**
- **eMotor position sensing ➔ embedded Resolver-to-Digital-Converter (RDC)**

**Safety & Security ➔ ASIL D and Evita-Full**
- **HSM for EVITA-Full including Elliptic Curve Cryptography**
- **Dedicated AES Cryptographic Engine Units (ACEU)**

**System Development Environment ➔ Model-based**
- **Virtual Platform for early SW development and performance analysis**
- **Collaborating with all relevant 3rd parties in Zone area**
# RH850/U2B

## 32-bit CPU
- Up to 8 RH850 G4MH Core
- + 4 Lock Step Core
  - @ 400 MHz
  - \( \text{Tj} = -40 \sim \text{up to} +160 \, ^\circ\text{C}^* \)
- Hypervisor, QoS
- MPU, FPU, FXU

## Memory
- Up to 32 MB Code Flash
- Up to 512 KB Data Flash
- Up to 5.1 MB RAM
- eMMC*
- SFMA

## Interfaces
- Up to Gbit Ethernet*
  - (TSN/SGMII) w/ Switch
- RSCAN-FD
- FlexRay
- MSPI
- RLIN3
- RHSIF
- RIIC*
- RHSB
- RSENT
- PSI5*
- PSI5-S*

## System
- DMA + DTS
- Clock Monitor
- Temperature Sensor
- CVM
- Error Control Module
- MBIST/LBIST
- Boundary scan
- Power: Deep Stop
- Full OTA
- KCRC
- ICU-MH Security
- EVITA-Full
- NEXUS, RHSIF*

## Motor Control IP
- RDC*
- EMU3S*

## Accelerator
- DFP (DR1000C)*

## Generic Timers
- GTM v4.1
- TAUD
- TAUJ*
- TAPA
- TSG3
- ENCA
- TPBA
- HRPWM
- OSTM
- WDTB
- SWDT
- TPTM
- LTSC
- ATU-VI

## Analog
- SAR-ADC, T/H
- DS-ADC
- Cyclic-ADC*
- Fast Comparator
- DFE

## Abbreviations:
- ADC: Analog to Digital Converter
- ATU-VI: Advanced Timer Unit for Powertrain
- DFP: Data Flow Processor
- DFE: Digital Filter Engine
- EMU3: Enhanced Motor Control Unit 3
- FPU: Floating Point Unit
- FXU: Floating-point operation coprocessor
- GTM: Generic Timer Module
- MPU: Memory Protection Unit
- QoS: Quality of Service
- RDC: Resolver Digital Converter
- TSG3: Motor Control Timer
- T/H: Track & Hold

*dep. on the line-ups and packages
ZONE SUPPORT
ZONE ECU
HOW TO ASSURE THAT APPLICATIONS DON’T DISTURB EACH OTHER?

Build in Hardware Support for Hypervisor

Build in Hardware Support for System FFI

FFI (Freedom of Interference) between Applications secured

Hypervisor SW from 3rd party

Hardware

Memory / bus / peripherals features to ensure FFI
- MPU
- Safe guard
- Secure communication
- Quality of Service*
- Safety : 4x ERROUT
- Peripheral separation

*U2B
RH850/U2B CONCEPT FOR TRACTION INVERTER CONTROL

INTEGRATION CONCEPT

1. High performance & Safety
   - Multi-core, 400MHz
   - Enhanced diagnostic functions
   - Functional Safety

2. Built-in redundant Resolver to Digital Converter (RDC*)
   - Reduce system cost with integrated RDC
   - Improvement of failure diagnosis

3. Built-in redundant Motor Control Support (EMU3S* or GTM)
   - Built-in flexible, optional hardware logic for motor control
   - Able to control up to 2 motors independently in conjunction with the TSG3 or GTM v4.1 timer
FUNCTIONAL SAFETY SUPPORT PROGRAM FOR AUTOMOTIVE
FUNCTIONAL SAFETY SUPPORT PROGRAM FOR AUTOMOTIVE
RH850/U2B ECOSYSTEM