Disclaimer
Renesas Electronics and its affiliates do not make any warranty of accuracy, usefulness, certainty or any other kind, relating to the contents and any other information in this presentation (hereinafter "Contents"). The Contents including but not limited to physical and electrical specifications/characteristics of products, block diagrams, etc. subject to change without any notice. In no event shall Renesas Electronics and its affiliates be liable for any loss, expense or damage arising out of or in connection with the use of or reliance upon the Contents. Please refer to the product datasheet and user manual for the most accurate information for the purpose of planning and developing your product.
AGENDA

Introduction
✓ Renesas & Product Portfolio
✓ IoT Challenges
✓ Synergy Platform for IoT

Synergy Hardware
✓ Microcontrollers
✓ Kits
✓ Ordering & Resources

Synergy Software
✓ Synergy Software Package
✓ Software Add-ons
✓ Development Tools

Synergy Solutions Gallery
✓ Download Center
✓ Technical Support
✓ Getting Started in 3 Easy Steps
Renesas creates leading semiconductor solutions that spark innovation for a connected world.
INTERNET OF THINGS
CHALLENGES & PAIN POINTS

Access to latest technology

Innovation & Differentiation

Risk & Complexity Management

Intense Competition

Resource Constraints

Security & Connectivity

Learning Curve & Training

Development, Integration & Testing

Maintenance & Support

Concept

Production

Each step in the long journey from concept to production adds to time to market & costs
INTERNET OF THINGS
PLATFORM APPROACH

Platform approach provides a faster path from concept to production
SYNERGY PLATFORM FOR IoT
PROVIDES A FASTER PATH TO PRODUCTION

SYNERGY PLATFORM

Solutions Gallery

Software
- Development Tools
- Synergy Software Package
- Software Add-Ons

Hardware
- Kits
- Microcontrollers

Concept → Production

Watch video
Visit & learn more at: Renesas.com/synergy
SYNERGY PLATFORM FOR IoT
PROVIDES A FASTER PATH TO PRODUCTION

Key Features
- Complete & qualified platform for IoT
- Best in class MCUs, software & tools
- Integrated & tested
- More functionality available using software add-ons
- Support & maintenance provided by Renesas
- Production licenses for software and tools included for no charge

Watch video
Visit & learn more at: Renesas.com/synergy
APPLICATION EXAMPLES
SYNERGY PLATFORM ENABLES SMART CONNECTED PRODUCTS

Consumer Appliances
- Entertainment
- Kitchen appliances
- Heating & cooling
- Personal devices
- Computing accessories

Health Care & Wearables
- Fitness & health tracking
- Clinical instrumentation
- Portable medical devices

Smart Factories & Industrial Automation
- PLC
- Process control
- Sensors & actuators
- Motion & position control

Smart Buildings & Automation
- Security
- Fire & safety
- HVAC
- Lighting
- Energy management

Smart Cities & Infrastructure
- Advanced metering
- Utility infrastructure
- Waste management
- Communication
SYNERGY HARDWARE
MICROCONTROLLERS & KITS

Visit & learn more at:
Renesas.com/synergy/hardware
SYNERGY MICROCONTROLLERS
THE FOUNDATION OF SYNERGY PLATFORM FOR IoT

Ultra-Low Power Series
Arm® Cortex®-M0+ 32 MHz
64 KB – 256 KB Flash
16 KB - 24 KB SRAM
Starting at $1.54@10K pcs

High Efficiency Series
Arm® Cortex®- M4 48 MHz
256 KB - 1 MB Flash
32 KB - 192 KB SRAM
Starting at $2.73@10K pcs

High Integration Series
Arm® Cortex®- M4 120 MHz
512 KB - 2 MB Flash
256 KB - 640 KB SRAM
Starting at $5.10@10K pcs

High Performance Series
Arm® Cortex®- M4 240 MHz
3 MB - 4 MB Flash
640 KB SRAM
Starting at $10.36@10K pcs

Watch video

Visit & learn more at:
Renesas.com/synergy/mcus
SYNERGY MICROCONTROLLERS
SCALABLE & COMPATIBLE MCU SERIES

Visit & learn more at: Renesas.com/synergy/mcus

Package Footprint

Register Set and Features

APIs and Functionality

Pin compatibility

Feature compatibility

Functional compatibility

No. of APIs

Functionality

© 2019 Renesas Electronics Corporation. All rights reserved.
S1 SERIES
ULTRA-LOW POWER SERIES

- 130-nm process
- Operating temperature range: -40°C to 105°C
- MCU Groups: S1JA, S128, S124
- GPIO pins: Up to 51
- Packages options for S1 series products
  - QFN: 32, 40, 48, 64
  - LQFP: 32, 48, 64
  - LGA: 36
- Typical current consumption of S1 series products
  - 113 μA/MHz (Normal Mode)
  - 47 μA/MHz (Sleep Mode)
  - 440 nA (Software Standby Mode)

Visit & learn more at:
Renesas.com/synergy/s1 | Renesas.com/synergy/mcuglossary | Renesas.com/synergy/s128
S3 SERIES
HIGH EFFICIENCY SERIES

- 130-nm process
- Operating temperature range: -40°C to 105°C
- MCU Groups: S3A7, S3A6, S3A3, S3A1
- GPIO pins: Up to 124
- Packages options for S3 series products
  - QFN: 40, 48, 64
  - LQFP: 48, 64, 100, 144
  - BGA: 121
  - LGA: 100, 145
- Typical current consumption of S3 series products
  - 173 μA/MHz (Normal Mode)
  - 69 μA/MHz (Sleep Mode)
  - 800 nA (Software Standby Mode)

Visit & learn more at:
Renesas.com/synergy/s3 | Renesas.com/synergy/mcuglossary | Renesas.com/synergy/s3a1
S5 SERIES
HIGH INTEGRATION SERIES

- 40-nm high-performance process
- Operating temperature range: -40°C to 105°C
- MCU Groups: **S5D9** **S5D5** **S5D3**
- GPIO pins: Up to 133
- Packages options for S5 series products
  - LQFP: 64, 100, 144, 176
  - BGA: 176
  - LGA: 145
  - QFN: 64
- Typical current consumption of S5 series products
  - 100 μA/MHz (Normal Mode)
  - 1.3 μA (Software Standby Mode)
  - 900 nA (V_BATT for RTC)

Visit & learn more at:
Renesas.com/synergy/s5 | Renesas.com/synergy/mcuglossary | Renesas.com/synergy/s5d9
S7 SERIES
HIGH PERFORMANCE SERIES

- 40-nm high-performance process
- Operating temperature range: -40°C to 105°C
- MCU Groups: S7G2
- GPIO pins: Up to 172
- Packages options for S7 series products
  - LQFP: 100, 144, 176
  - BGA: 176, 224
  - LGA: 145
- Typical current consumption of S7 series products
  - 133 µA/MHz (Normal Mode)
  - 2.4 µA (Software Standby Mode)
  - 900 nA (V_BATT for RTC)

Visit & learn more at: Renesas.com/synergy/s7 | Renesas.com/synergy/mcuglossary | Renesas.com/synergy/s7g2
PRODUCT KITS
EXPLORE & EVALUATE ANY SYNERGY MCU PRODUCT GROUP

- ~35 Application projects
  - Application note
  - Source code & project
- Key Features
  - On-board debugging interface
  - Access to most pins
  - Wired/wireless connectivity
  - Expandable ecosystem connectors
  - Complete engineering collateral – user manuals, schematics, BOM, layout, gerbers, etc.

<table>
<thead>
<tr>
<th>Target Board Kits</th>
<th>Starter Kits</th>
<th>Development Kits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low cost kit with MCU and headers that allow access to all MCU pins to evaluate a particular MCU Group</td>
<td>Great starting kits to explore full functionality of the Synergy Software Package</td>
<td>Full function kit for serious development and highly customized proof-of-concepts</td>
</tr>
</tbody>
</table>

Visit & learn more at: Renesas.com/synergy/kits

Watch video

© 2019 Renesas Electronics Corporation. All rights reserved.
## SOLUTION KITS
EXPLORE TECHNOLOGY & APPLICATIONS

- ~15 Application projects
  - Application note
  - Source code & project
- **Key Features**
  - Highly optimized for specific end-application or technology
  - Solid engineering reference
  - Complete engineering collateral – user manuals, schematics, BOM, layout, gerbers, etc.

### Application Example Kits
Showcases a core technology or end-application solution utilizing Synergy Hardware & Software elements

### Product Example Kits
Reference design of end-product to help create similar solutions & products

**Watch video**

Visit & learn more at: [Renesas.com/synergy/kits](https://Renesas.com/synergy/kits)
LEARN MORE & ORDER ONLINE
SYNERGY HARDWARE

Find the right MCU & Kit

▪ MCUs (User Manual, Datasheets)
  ▪ MCU Series
    – Renesas.com/synergy/s1
    – Renesas.com/synergy/s3
    – Renesas.com/synergy/s5
    – Renesas.com/synergy/s7

▪ Kits (User Manual, Schematics, Design Files, etc.)
  ▪ Kit – Renesas.com/synergy/sk-s7g2 (*ex.)

Order MCU & Kits globally from Leading Distributors

▪ Global
  – Digi-Key, Mouser

▪ Regional
  – Americas - Arrow, Avnet, Future, Karimex (Brazil)
  – Europe - Arrow, Avnet, Rutronik, Glyn, Anglia, RS Components (UK), Renesas Shop
  – Japan - Marutsu, Chip One Stop, RS Components
  – South East Asia & Oceania - Dragon, Future, Braemac, Arrow, Rabyte, SM Electronics

* Replace with series, MCU group or kit name of your choice. Examples below:
  ▪ S5D9 MCU Group – Renesas.com/synergy/s5d9
  ▪ Target Board for S5D5 – Renesas.com/synergy/tb-s5d5
  ▪ Development Kit for S128 – Renesas.com/synergy/dk-s128
  ▪ Application Example for HMI – Renesas.com/synergy/pe-hmi1

Visit & learn more at:
Renesas.com/synergy/hardware
SYNERGY SOFTWARE

Synergy Software

Development Tools

IAR Embedded Workbench® for Renesas Synergy

Development Tools

Synergy Software Package (SSP)

Software APIs

RTOS

Application Framework

Middleware

Functional Libraries

HAL Drivers

Board Support Package

Verified Software Add-ons (VSA)

Software APIs

Stacks

Algorithms

Functions

Specialties

… and more

Visit & learn more at: Renesas.com/synergy/software

Watch video
SYNERGY SOFTWARE PACKAGE

KEY COMPONENTS

- **Key features**
  - Uses Express Logic’s ThreadX® and X-Ware®
  - Commercial software worth over $100K
  - Unlimited production licenses at no additional cost
  - Fully tested, maintained and supported by Renesas

Visit & learn more at:
Renesas.com/synergy/ssp
Renesas.com/synergy/softwareglossary
SYNERGY SOFTWARE PACKAGE
QUALITY ASSURANCE

- Quality testing performed by a dedicated quality team
  - 10K+ testcases used to verify 80+ SSP modules
  - 60K+ lines of executable test code
  - Run on 25 MCU hardware systems across 4 MCU series
  - Built with 2 compliers – GCC & IAR
  - Tested for backward compatibility

- 5 Key quality metrics for SSP
  1. Meet coding standards
  2. Maintain low complexity
  3. Traceability to requirements
  4. Clean builds
  5. Full test coverage

Visit & learn more at: Renesas.com/synergy/ssp
SOFTWARE ADD-ONS
ADDITIONAL SOFTWARE WHICH CAN BE USED WITH THE SSP

Extend functionality of the platform using libraries, drivers, stacks, etc. to enable a wide range of specialized functions

- **Verified & Supplemental Add-ons**
  - 3rd Party software compatible with SSP – tested by Renesas
  - Evaluation version provided at no cost. Commercial version sold & supported by 3rd parties.

- **Partner Projects**
  - 3rd Party software, compatible with SSP – tested by 3rd party
  - Drivers, trace tools, demos, connectivity stacks, etc.
  - Supported by 3rd parties

- **Application Projects & Module Guides**
  - Reference code and example code with application notes for different SSP modules
  - Synergy Kits comes with application projects and module guides

Visit & learn more at:
Renesas.com/synergy/addons | Renesas.com/synergy/partnerprojects | Renesas.com/synergy/applicationprojects
DEVELOPMENT TOOLS
INTEGRATED DEVELOPMENT ENVIRONMENTS (IDE)

Professional embedded software development &
debugging tools at no additional cost!

- No license and maintenance fee
- No limitation on code size or number of users
- Segger J-Link® debugger integration
- Graphic configurators
  - Pin, clock, interrupts, SSP module configurations
  - Auto code generation

<table>
<thead>
<tr>
<th>Tool Chain</th>
<th>Compilers supported at no charge</th>
<th>Products supported</th>
<th>Utilities supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>e² studio (eclipse-based)</td>
<td>GNU &amp; IAR</td>
<td>Synergy MCUs &amp; other Renesas MCUs</td>
<td>Trace X &amp; Synergy Standalone Configurator (included)</td>
</tr>
<tr>
<td>IAR Embedded Workbench for Renesas Synergy</td>
<td>IAR</td>
<td>Synergy MCUs</td>
<td>Synergy Standalone Configurator (add-on)</td>
</tr>
</tbody>
</table>

Visit & learn more at: Renesas.com/synergy/tools
DEVELOPMENT UTILITIES
EMBEDDED & SYSTEM APPLICATIONS

Advanced utilities at no additional cost!

▪ **GUIX Studio™**
  - PC-based drag-and-drop WYSIWYG design tool for embedded graphical user interfaces, Automatically generates C code compatible with GUIX™ run-time library

▪ **TraceX®**
  - PC-based graphical event analysis tool for ThreadX performance monitoring

▪ **Capacitive Touch Workbench**
  - Tuning tool for capacitive touch applications

▪ **IAR C-RUN® & S-STAT®**
  - Static and run-time analysis

Visit & learn more at:
Renesas.com/synergy/tools
LEARN MORE & DOWNLOAD
SYNERGY SOFTWARE

Download Synergy Software & Documentation

- Synergy Software Package
  - Renesas.com/synergy/ssp
- Software Glossary - Renesas.com/synergy/softwareglossary
- Software Add-ons
  - Renesas.com/synergy/addons
- Getting Started Collateral
  - Application Projects - Renesas.com/synergy/applicationprojects
  - Partner Projects - Renesas.com/synergy/partnerprojects

Download Synergy Development & Debugging Tools/Utilities

- Tools
  - IDE e² studio - Renesas.com/synergy/e2studio
  - IDE IAR EWB for Synergy - Renesas.com/synergy/ews synergy
  - Standalone configurator - Renesas.com/synergy/ssc
- Drivers & Utilities
  - J-Link Drivers - Renesas.com/synergy/jlink
  - TraceX - Renesas.com/synergy/tracex
  - GUIX Studio - Renesas.com/synergy/guixstudio
  - Capacitive Touch Workbench - Renesas.com/synergy/captouchworkbench

Visit & learn more at:
Renesassynergy.com/software
Download everything you need to use the Synergy Platform including the Synergy Software Package, Synergy Software add-ons, and Synergy development tools

- **Solutions Gallery categories**
  - Software
  - Software Tools
  - Partner Projects
  - Application Projects
  - Kits & Hardware Components
  - Hardware Tools
  - Production Tools
  - Cloud Connectivity
  - HMI

Visit & learn more at: Renesas.com/synergy/solutionsgallery
GET SUPPORT
WE ARE PARTNERS IN YOUR JOURNEY

- **Self-help resources**

  **Documentation** - download datasheets, application notes, software projects, user manuals and design assets
  Renesas.com/synergy/docs

  **Knowledgebase** – explore a collection of easily searchable how-to articles and FAQs
  Renesas.com/synergy/knowledgebase

  **Forum** – interact with a community of developers to find and share solutions
  Renesas.com/synergy/forum

  **Training** – on-demand, hands-on product training
  Renesas.com/synergy/training

  **Videos** – watch tutorials on official Synergy Platform YouTube channel
  Renesas.com/synergy/videos

- **Personalized resources**

  **Chat** - Instantly chat around the clock with a Synergy Platform expert
  Renesas.com/synergy/support
START NOW
BEGIN DEVELOPING IN JUST THREE EASY STEPS

1. Get a kit
Order a Synergy kit featuring the Synergy MCU of your choice

Click here to learn how

2. Download
Download & install embedded software and development tools

Click here to learn how

3. Develop
Begin developing using one of the existing applications projects or partner projects

Click here to learn how