

RENESAS SYNERGY™ PLATFORM FOR IoT OVERVIEW PRESENTATION

IoT PLATFORM BUSINESS DIVISION
20 FEBRUARY 2019

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Click icons to jump to:



Home



Hardware



MCU



Kits



Software



Tools



SSP



Add-Ons

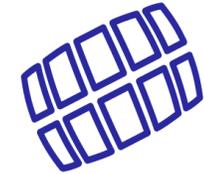
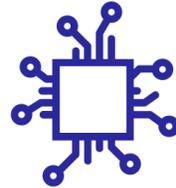


Solutions
Gallery



Support

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 ELECTRONICS CORPORATION

INTRODUCTION



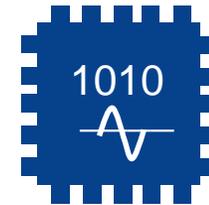
Among leading Japanese semiconductor companies



Global operations in 14 countries
~20,000 staff



Established in 2002.
Formed by several iconic M&As



Digital, analog & mixed-signal products for automotive, industrial & broad-based applications



FY2016 ~US\$6.8B sales

Renesas creates leading semiconductor solutions that spark innovation for a connected world.

RENESAS ELECTRONICS CORPORATION

PRODUCT PORTFOLIO


Solutions
Products
Platforms
Design & Support
About

Q

Microcontrollers & Microprocessors

- RL78 MCUs
- RX MCUs
- RH850 MCUs
- RZ MPUs
- Renesas Synergy™ MCUs
- Other MCUs / MPUs

Automotive

- MCUs and Processors
- Systems-on-Chip (SOC)
- Power Management
- Battery Management
- Video & Display

Embedded System Platforms

- Renesas Autonomy™ Platform for Automotive
- R-IN Platform for Industrial
- RZ/G Platform for HMI
- Renesas Synergy™ Platform for IoT

Others

- Analog
- Interface
- Memory
- Optoelectronics
- Power Management
- Sensors
- Space & Harsh Environment
- Timing & Digital Logic

Software & Tools

- Boards & Kits
- Software & Drivers
- Tools & Downloads
- Gadget Renesas

Reference

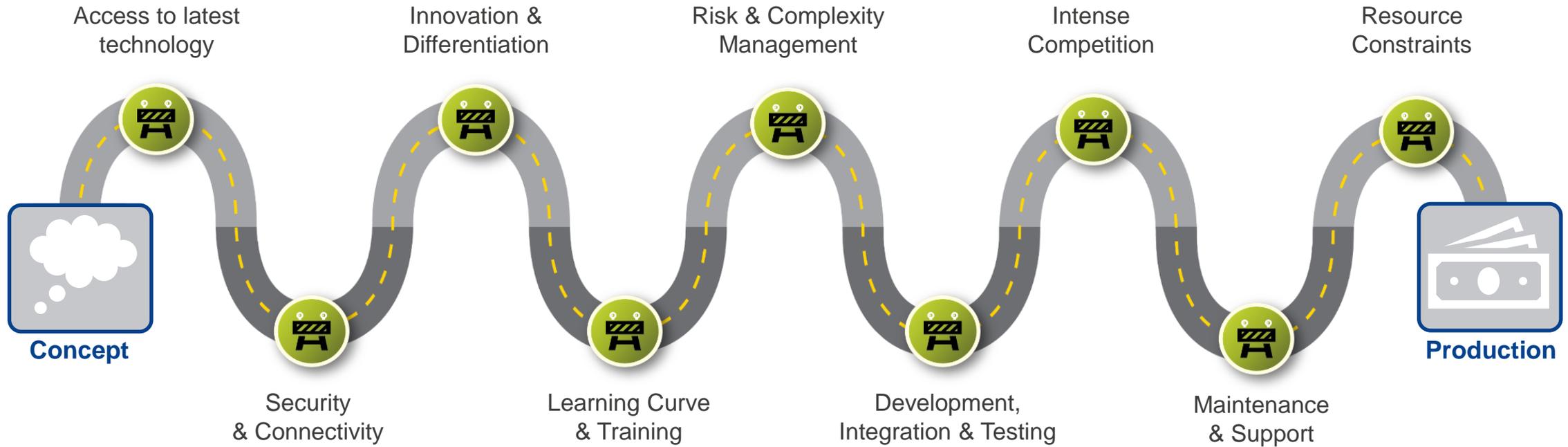
- Packaging Overview
- ROM Ordering
- Part Number Decoder

Find Products

- Parametric Search
- Cross Reference
- PowerCompass

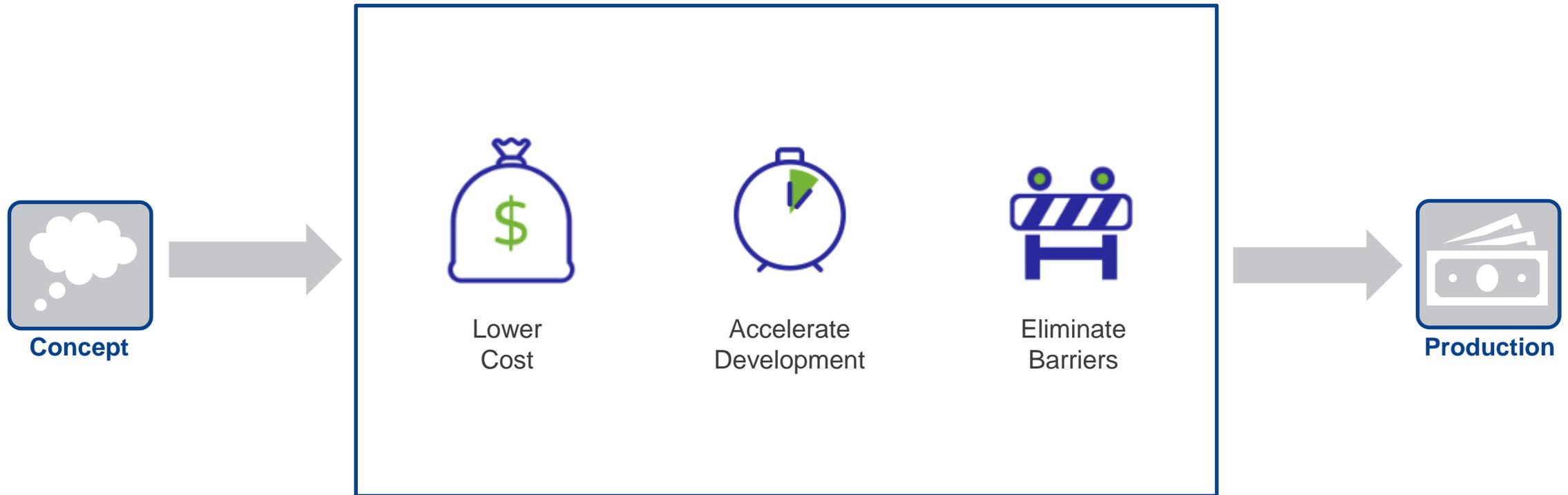
INTERNET OF THINGS

CHALLENGES & PAIN POINTS



Each step in the long journey from concept to production adds to time to market & costs

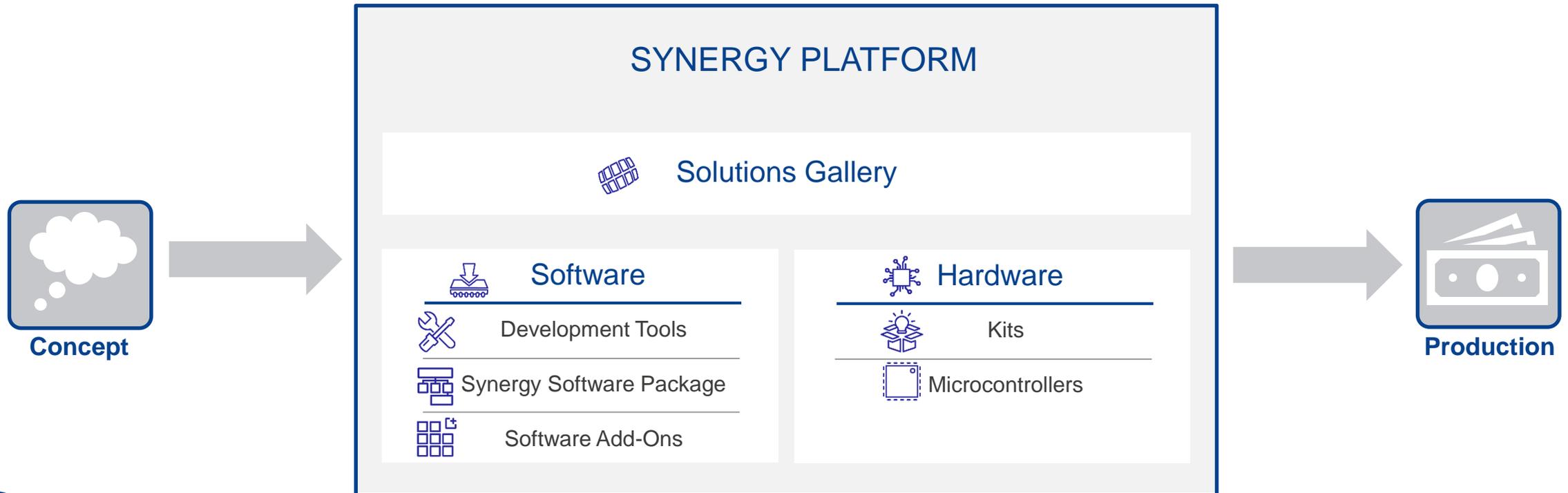
INTERNET OF THINGS PLATFORM APPROACH



Platform approach provides a faster path from concept to production

SYNERGY PLATFORM FOR IoT

PROVIDES A FASTER PATH TO PRODUCTION

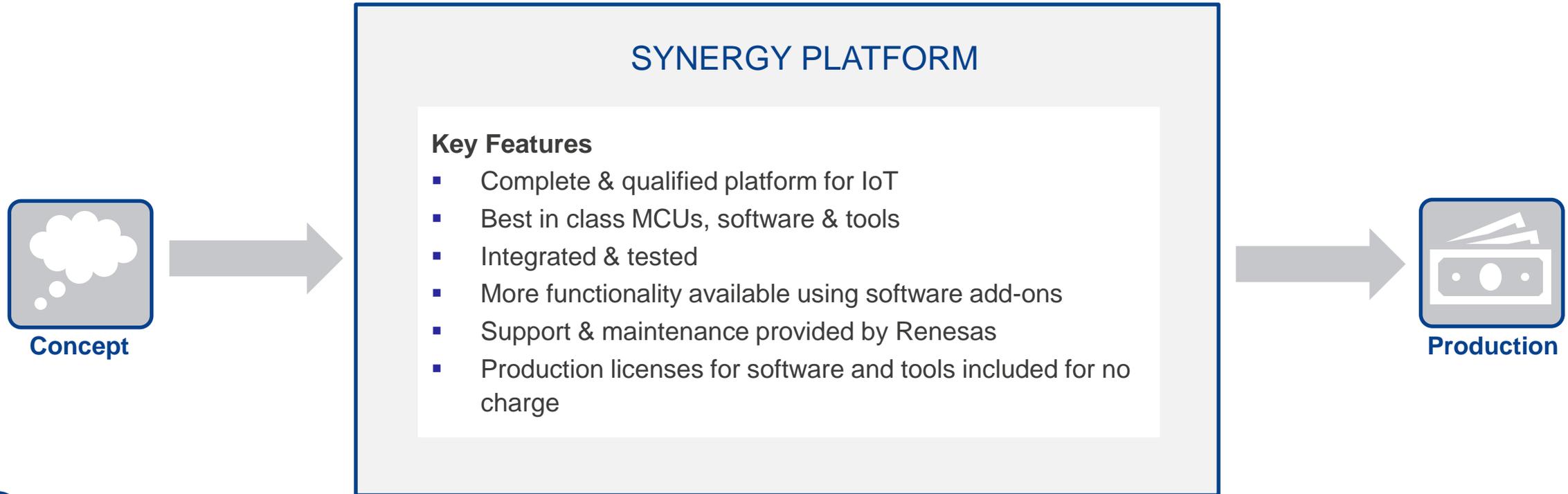


 [Watch video](#)

 Visit & learn more at:
[Renesas.com/synergy](https://www.renesas.com/synergy)

SYNERGY PLATFORM FOR IoT

PROVIDES A FASTER PATH TO PRODUCTION



 [Watch video](#)

 Visit & learn more at:
[Renesas.com/synergy](https://www.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

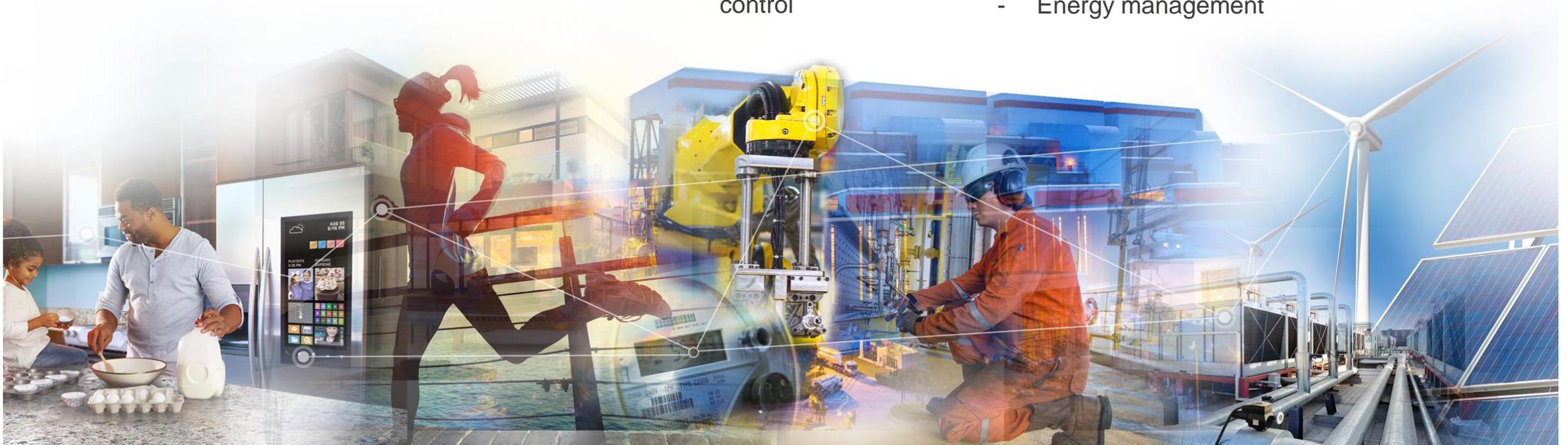
- PLC
- Process control
- Sensors & actuators
- Motion & position control

Smart Buildings & Automation

- Security
- Fire & safety
- HVAC
- Lighting
- Energy management

Smart Cities & Infrastructure

- Advanced metering
- Utility infrastructure
- Waste management
- Communication



SYNERGY HARDWARE

MICROCONTROLLERS & KITS



SYNERGY HARDWARE



Synergy Microcontrollers

S1

S3

S5

S7



Synergy Kits

Starter Kits

Target Board Kits

Development Kits

Application & Product Example Kits

Visit & learn more at:
[Renesas.com/synergy/hardware](https://www.renesas.com/synergy/hardware)

SYNERGY MICROCONTROLLERS

THE FOUNDATION OF SYNERGY PLATFORM FOR IoT



MCU Series

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

S1JA S128 S124

High Efficiency Series
 Arm® Cortex®- M4 48 MHz
 256 KB - 1 MB Flash
 32 KB - 192 KB SRAM

Starting at \$2.73@10K pcs

S3A7 S3A6 S3A3 S3A1

High Integration Series
 Arm® Cortex®- M4 120 MHz
 512 KB - 2 MB Flash
 256 KB - 640 KB SRAM

Starting at \$5.10@10K pcs

S5D9 S5D5 S5D3

High Performance Series
 Arm® Cortex®- M4 240 MHz
 3 MB - 4 MB Flash
 640 KB SRAM

Starting at \$10.36@10K pcs

S7G2

MCU Groups



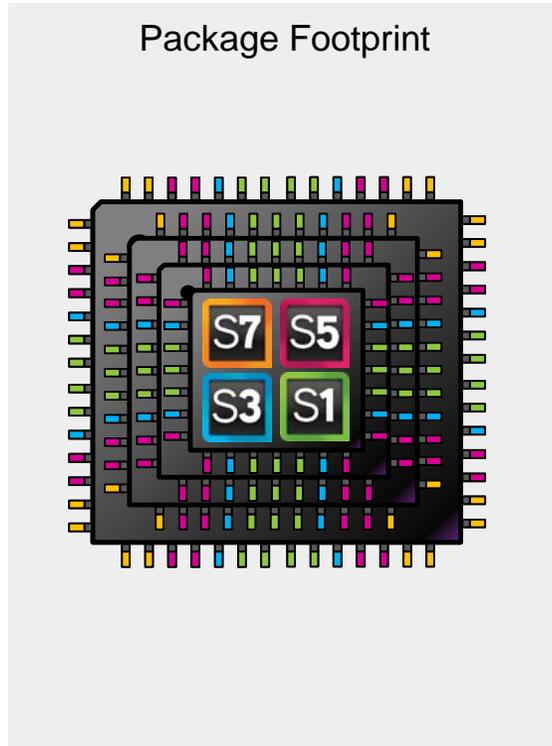
[Watch video](#)



Visit & learn more at:
[Renesas.com/synergy/mcus](https://www.renesas.com/synergy/mcus)

SYNERGY MICROCONTROLLERS

SCALABLE & COMPATIBLE MCU SERIES

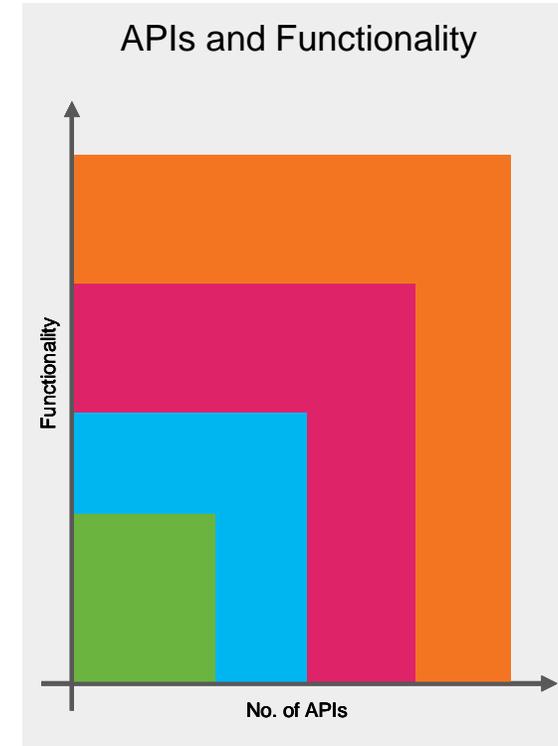


Pin compatibility

Register Set and Features

Rn	31	30	...	...	2	1	0
...	31	30	...	...	2	1	0
...	31	30	...	...	2	1	0
...	31	30	...	...	2	1	0
...	31	30	...	...	2	1	0
...	31	30	...	...	2	1	0
R3	31	30	...	...	2	1	0
R2	31	30	...	...	2	1	0
R1	31	30	...	...	2	1	0
R0	31	30	...	...	2	1	0

Feature compatibility



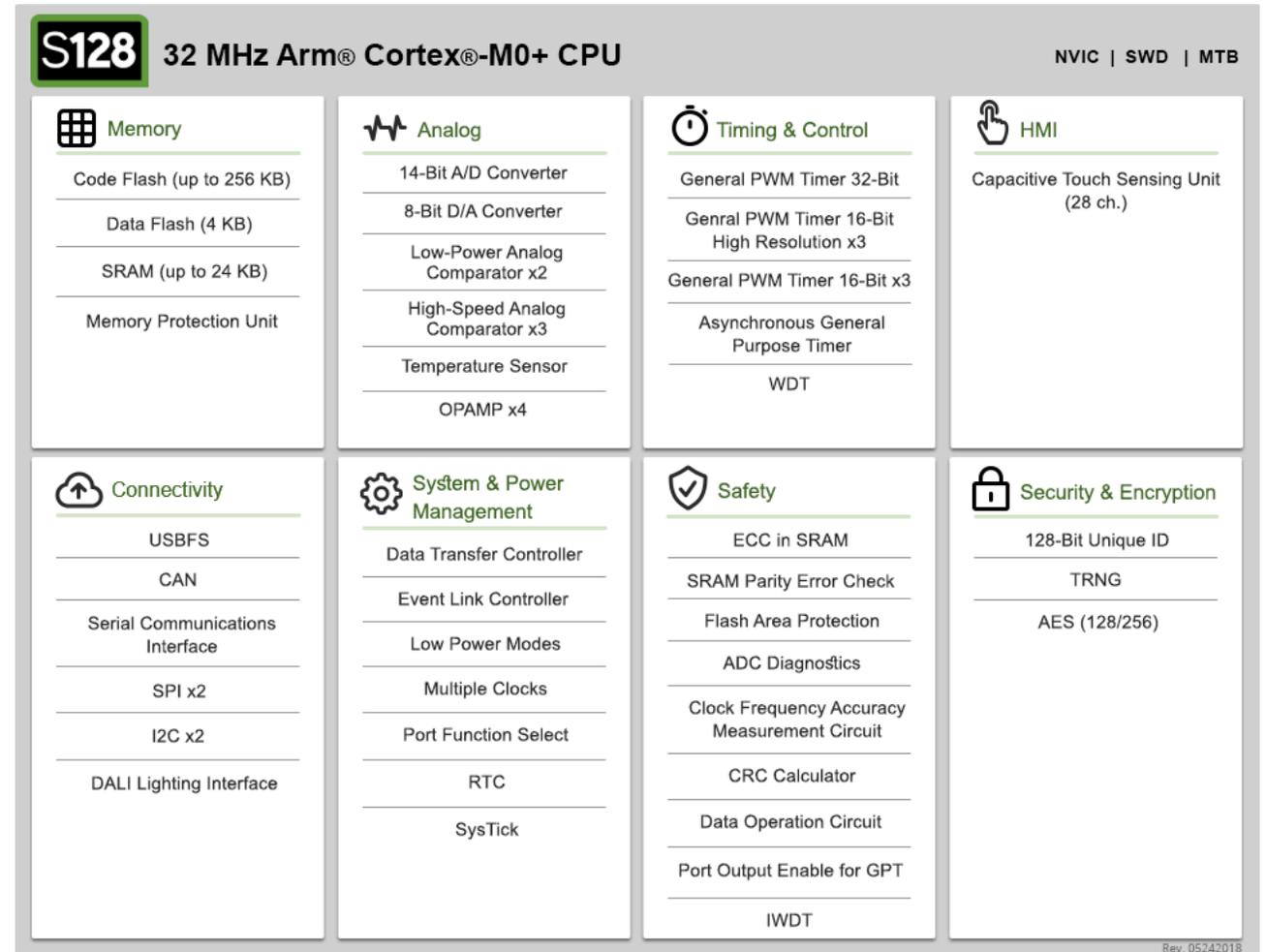
Functional compatibility


 Visit & learn more at:
[Renesas.com/synergy/mcus](https://www.renesas.com/synergy/mcus)

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)



S128 MCU Group Block Diagram



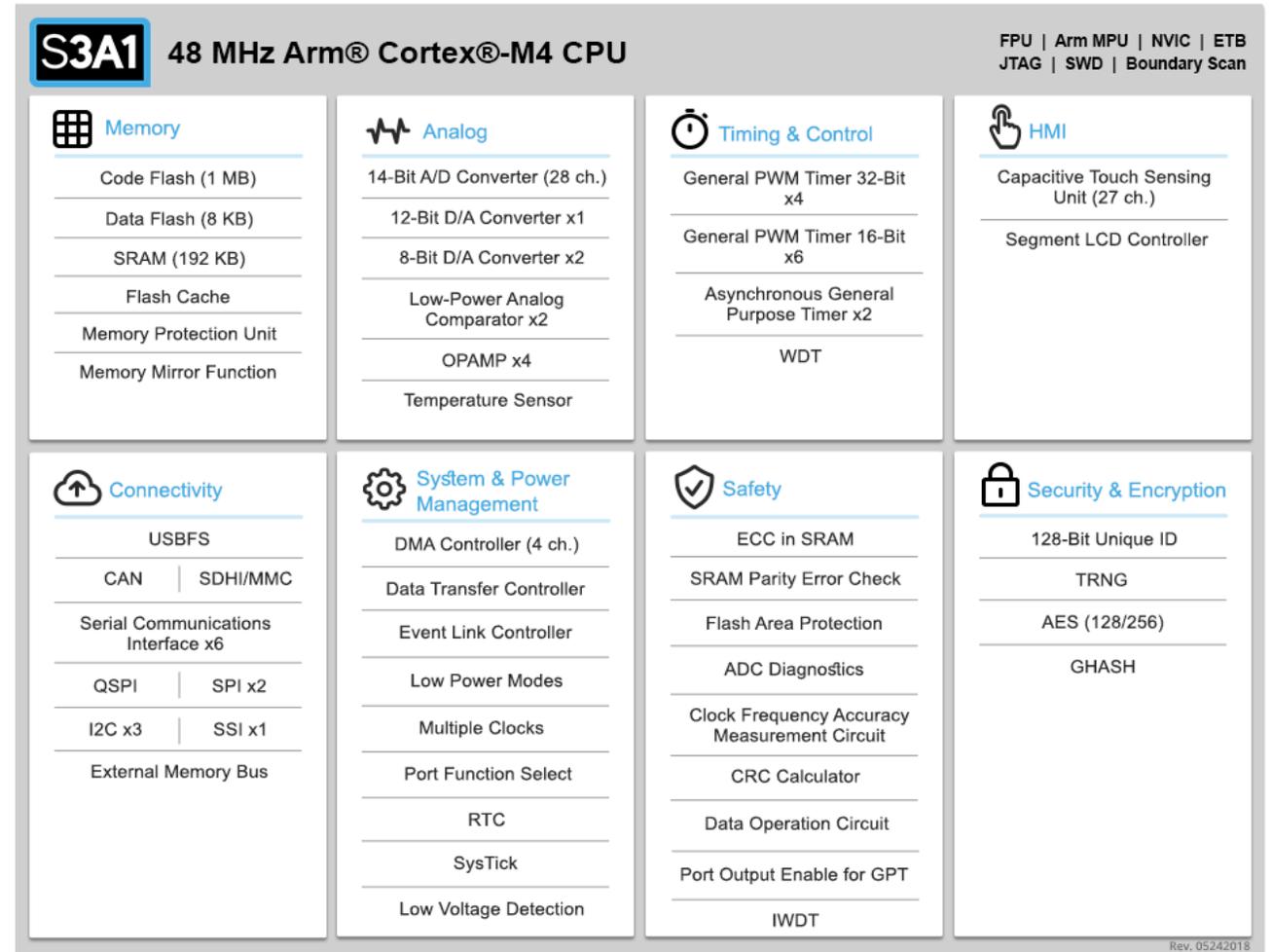
Visit & learn more at:

[Renesas.com/synergy/s1](https://www.renesas.com/synergy/s1) |
 [Renesas.com/synergy/mcuglossary](https://www.renesas.com/synergy/mcuglossary) |
 [Renesas.com/synergy/s128](https://www.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 μ A/MHz (Normal Mode)
 - 69 μ A/MHz (Sleep Mode)
 - 800 nA (Software Standby Mode)



S3A1 MCU Group Block Diagram



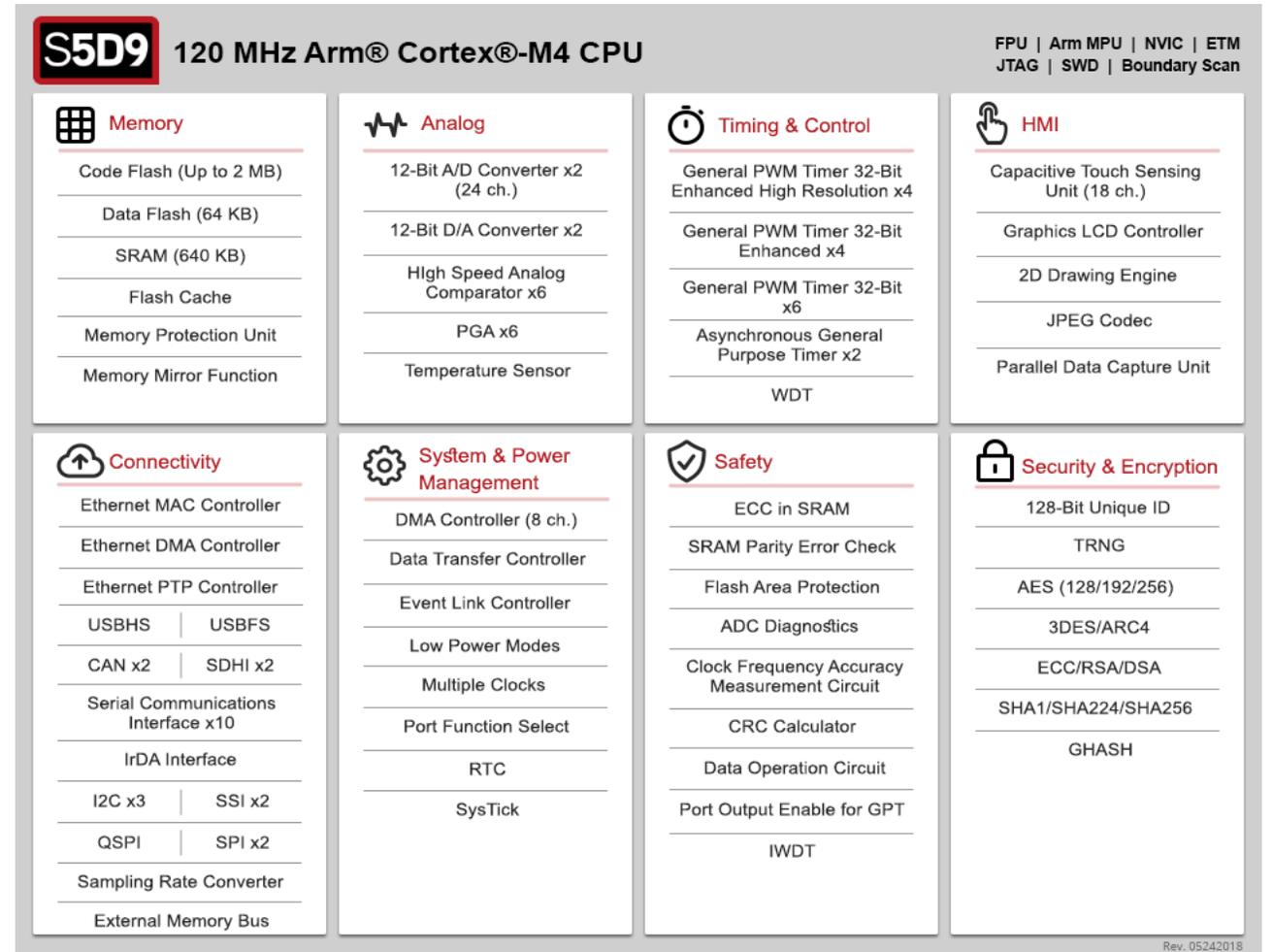
Visit & learn more at:

[Renesas.com/synergy/s3](https://www.renesas.com/synergy/s3) |
 [Renesas.com/synergy/mcuglossary](https://www.renesas.com/synergy/mcuglossary) |
 [Renesas.com/synergy/s3a1](https://www.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 μ A/MHz (Normal Mode)
 - 1.3 μ A (Software Standby Mode)
 - 900 nA (V_{BATT} for RTC)



S5D9 MCU Group Block Diagram



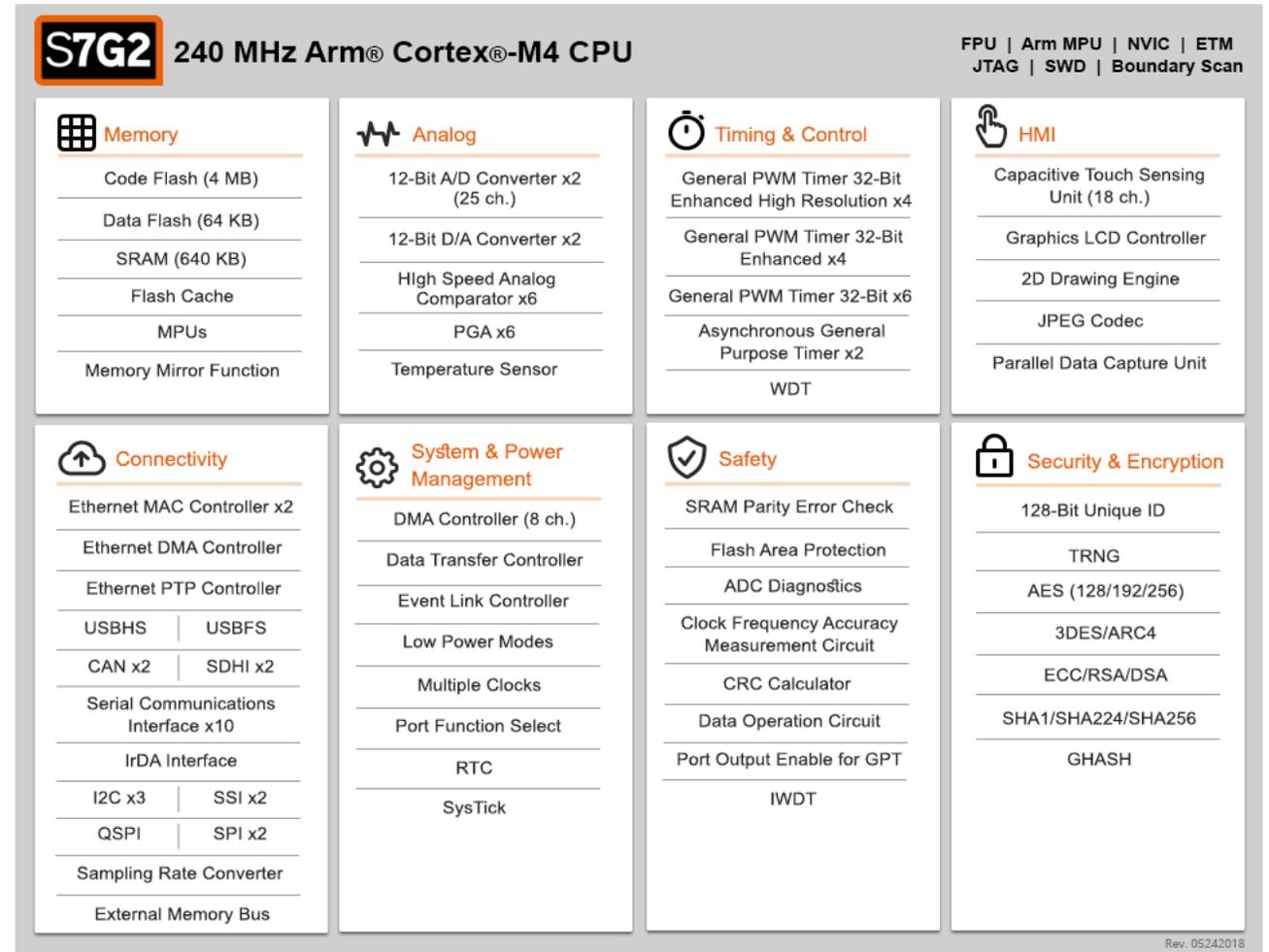
Visit & learn more at:

[Renesas.com/synergy/s5](https://www.renesas.com/synergy/s5) | [Renesas.com/synergy/mcuglossary](https://www.renesas.com/synergy/mcuglossary) | [Renesas.com/synergy/s5d9](https://www.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 μ A/MHz (Normal Mode)
 - 2.4 μ A (Software Standby Mode)
 - 900 nA (V_{BATT} for RTC)



S7G2 MCU Group Block Diagram



Visit & learn more at:

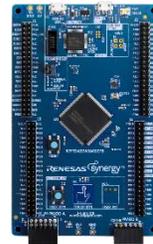
[Renesas.com/synergy/s7](https://renesas.com/synergy/s7) |
 [Renesas.com/synergy/mcuglossary](https://renesas.com/synergy/mcuglossary) |
 [Renesas.com/synergy/s7g2](https://renesas.com/synergy/s7g2)

PRODUCT KITS

EXPLORE & EVALUTE 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.

Target Board Kits



Low cost kit with MCU and headers that allow access to all MCU pins to evaluate a particular MCU Group

Starter Kits



Great starting kits to explore full functionality of the Synergy Software Package

Development Kits



Full function kit for serious development and highly customized proof-of-concepts

S5D3

YSTBS5D3E10

S5D5

YSTBS5D5E10

S1JA

YSTBS1JAE10

S7G2

YSSKS7G2E30

S5D9

YSPKS5D9E10

S7G2

YSDKS7G2S30

S3A7

YSDKS3A7E20

S3A1

YSTBS3A1E10

S3A3

YSTBS3A3E10

S3A6

YSTBS3A6E10

S128

YSDKS128E10

S124

YSDKS124S20



[Watch video](#)



Visit & learn more at:
[Renesas.com/synergy/kits](https://www.renesas.com/synergy/kits)

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://www.renesas.com/synergy/kits)

S5D9

YSAECLOUD2
 Cloud
 Connectivity

S124 S3A7

YSAECAP1S11
 Capacitive Touch

S7G2

YSPEHMI1S20WS2
 Human Machine
 Interface

LEARN MORE & ORDER ONLINE

SYNERGY HARDWARE

Find the right MCU & Kit

- **MCUs (User Manual, Datasheets)**
 - **MCU Series**
 - [Renesas.com/synergy/s1](https://renesas.com/synergy/s1)
 - [Renesas.com/synergy/s3](https://renesas.com/synergy/s3)
 - [Renesas.com/synergy/s5](https://renesas.com/synergy/s5)
 - [Renesas.com/synergy/s7](https://renesas.com/synergy/s7)
- **Kits (User Manual, Schematics, Design Files, etc.)**
 - **Kit** – [Renesas.com/synergy/sk-s7g2](https://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

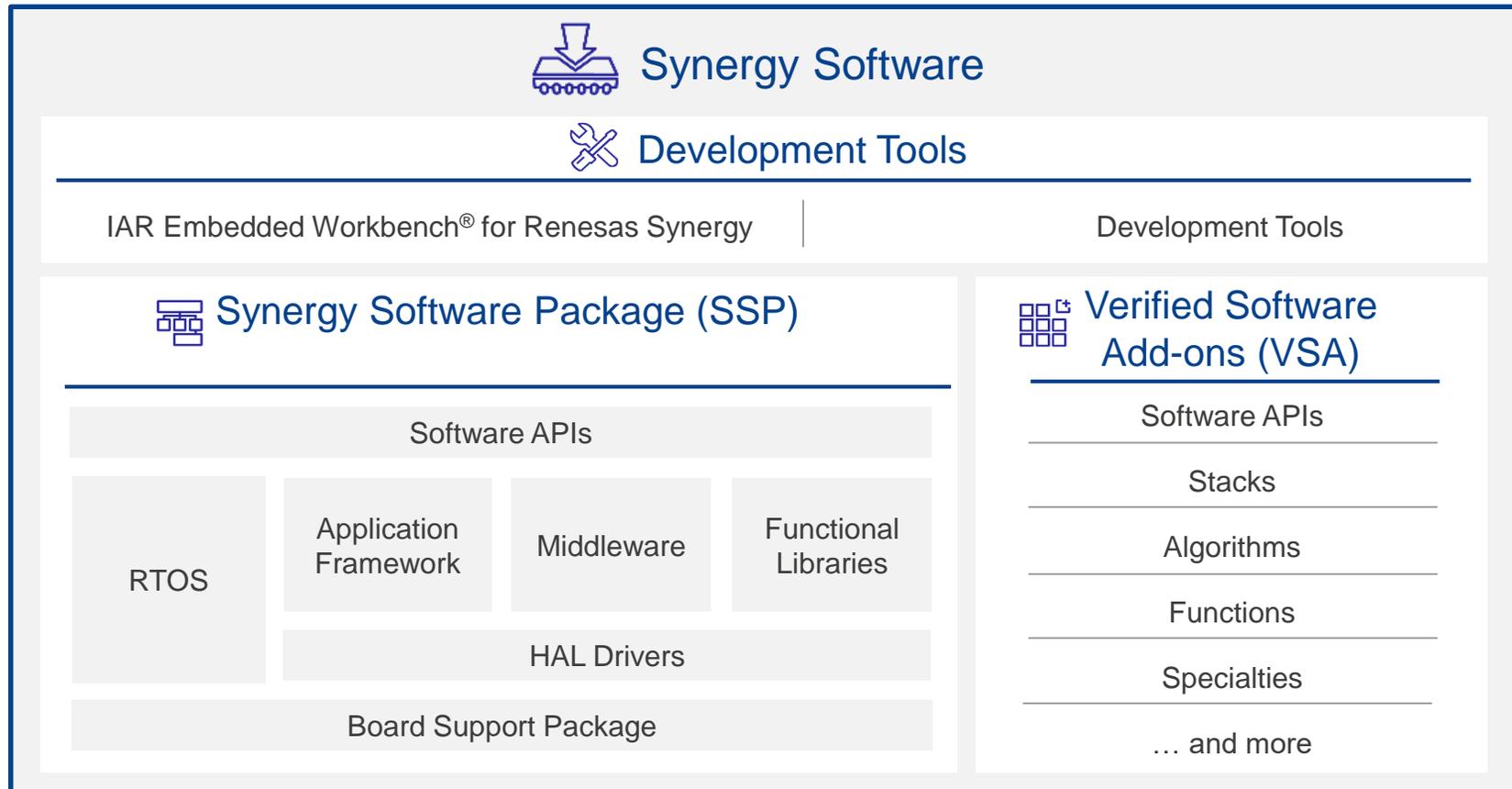


- * Replace with series, MCU group or kit name of your choice. Examples below:
- [S5D9](https://renesas.com/synergy/s5d9) MCU Group – [Renesas.com/synergy/s5d9](https://renesas.com/synergy/s5d9)
 - Target Board for [S5D5](https://renesas.com/synergy/tb-s5d5) – [Renesas.com/synergy/tb-s5d5](https://renesas.com/synergy/tb-s5d5)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



Visit & learn more at:
[Renesas.com/synergy/hardware](https://renesas.com/synergy/hardware)

SYNERGY SOFTWARE



[Watch video](#)



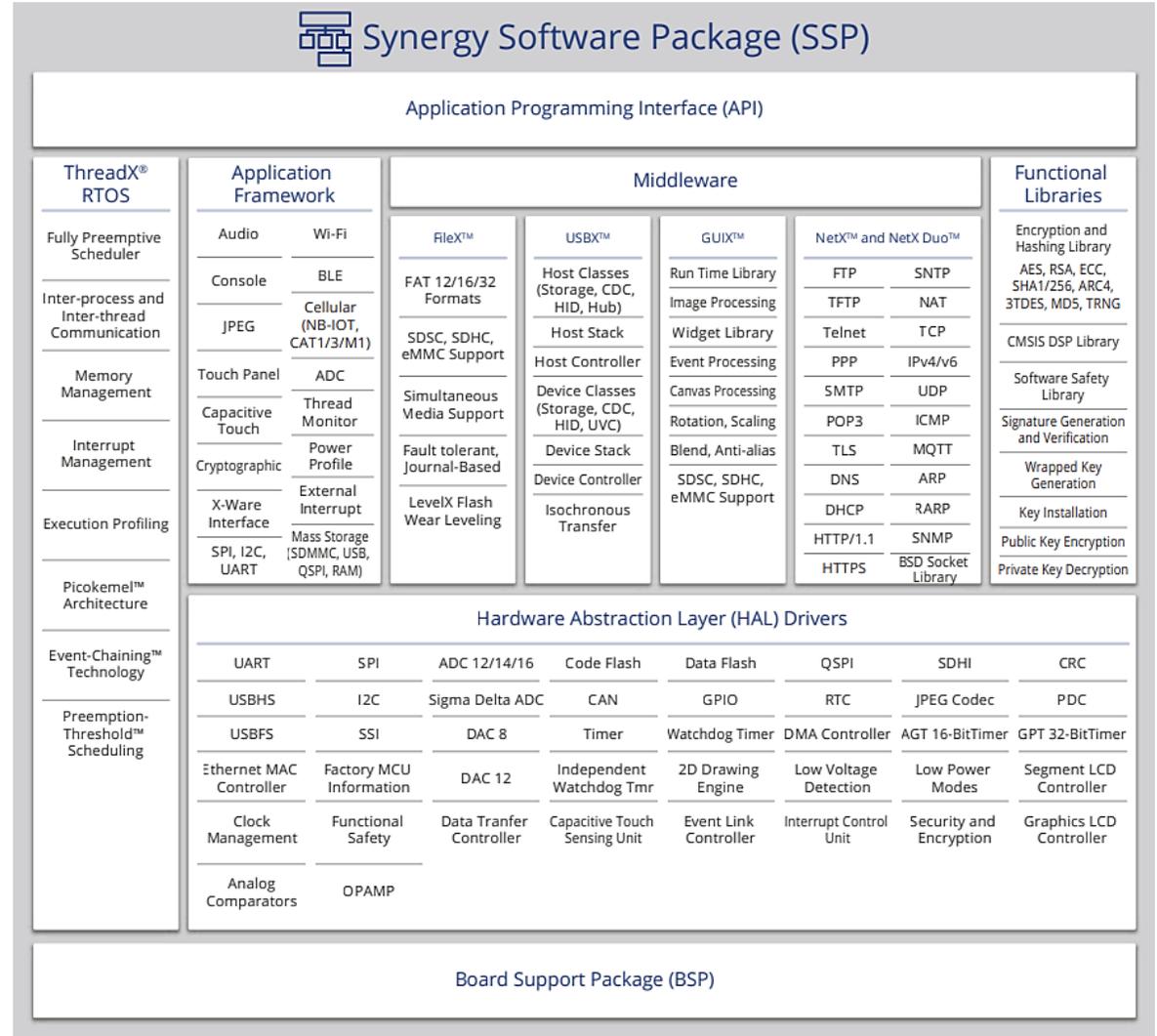
Visit & learn more at:
[Renesas.com/synergy/software](https://www.renesas.com/synergy/software)

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:

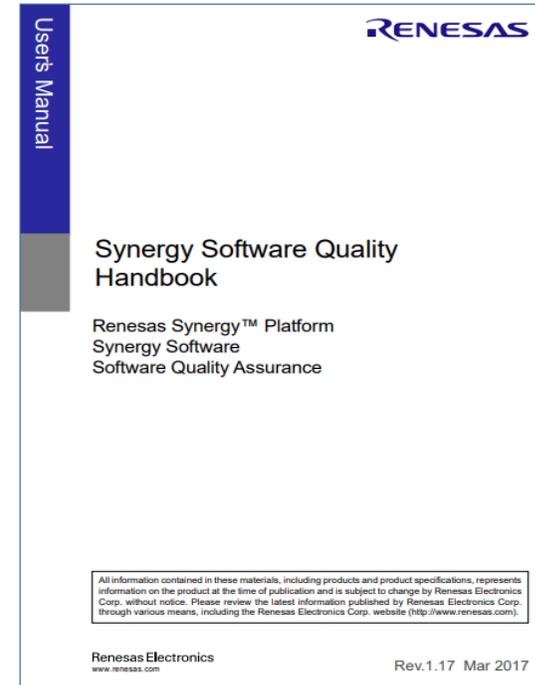
[Renesas.com/synergy/ssp](https://www.renesas.com/synergy/ssp)

[Renesas.com/synergy/softwareglossary](https://www.renesas.com/synergy/softwareglossary)

SYNERGY SOFTWARE PACKAGE

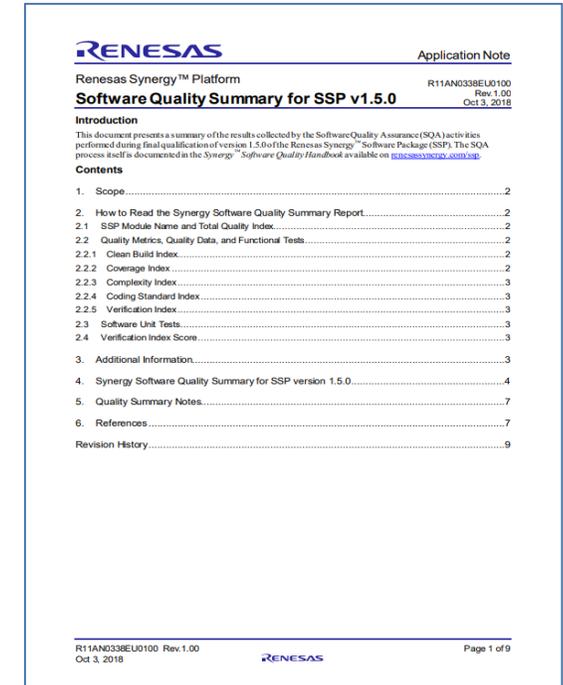
QUALITY ASSURANCE

- **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 compilers – 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



Software Quality Handbook

Click here to Download



Software Quality Summary

Click here to Download


 Visit & learn more at:
[Renesas.com/synergy/ssp](https://www.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](https://www.renesas.com/synergy/addons) |
 [Renesas.com/synergy/partnerprojects](https://www.renesas.com/synergy/partnerprojects) |
 [Renesas.com/synergy/applicationprojects](https://www.renesas.com/synergy/applicationprojects)

DEVELOPMENT TOOLS

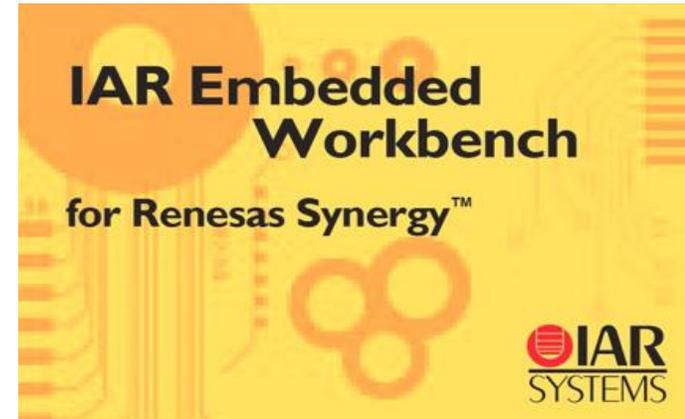
INTEGRATED DEVELOPMENT ENVIRONMENTS (IDE)

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



e² studio



IAR Embedded Workbench for Renesas Synergy™

Tool Chain	Compilers supported at no charge	Products supported	Utilities supported
e ² studio (eclipse-based)	GNU & IAR	Synergy MCUs & other Renesas MCUs	Trace X & Synergy Standalone Configurator (included)
IAR Embedded Workbench for Renesas Synergy	IAR	Synergy MCUs	Synergy Standalone Configurator (add-on)



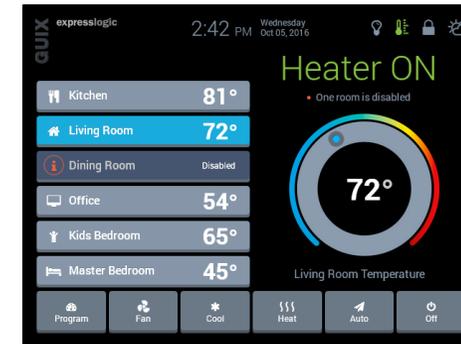
Visit & learn more at:
[Renesas.com/synergy/tools](https://www.renesas.com/synergy/tools)

DEVELOPMENT UTILITIES

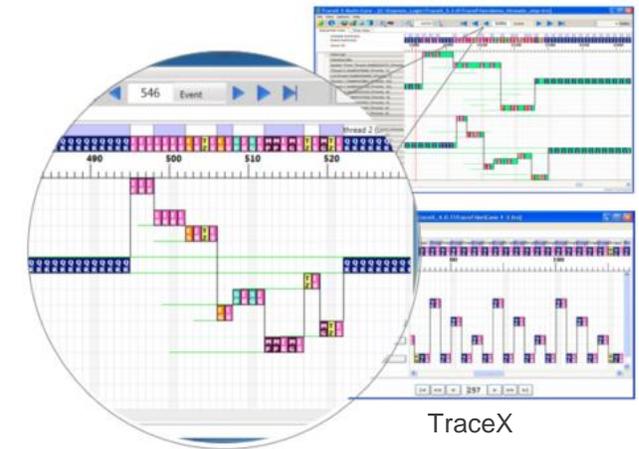
EMBEDDED & SYSTEM APPLICATIONS

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



GUIX Studio



TraceX



Visit & learn more at:
[Renesas.com/synergy/tools](https://www.renesas.com/synergy/tools)

LEARN MORE & DOWNLOAD SYNERGY SOFTWARE

Download Synergy Software & Documentation

- **Synergy Software Package**
 - [Renesas.com/synergy/ssp](https://renesas.com/synergy/ssp)
 - **Software Glossary** - [Renesas.com/synergy/softwareglossary](https://renesas.com/synergy/softwareglossary)
- **Software Add-ons**
 - [Renesas.com/synergy/addons](https://renesas.com/synergy/addons)
- **Getting Started Collateral**
 - **Application Projects** - [Renesas.com/synergy/applicationprojects](https://renesas.com/synergy/applicationprojects)
 - **Partner Projects** - [Renesas.com/synergy/partnerprojects](https://renesas.com/synergy/partnerprojects)

Download Synergy Development & Debugging Tools/Utilities

- **Tools**
 - **IDE e² studio** - [Renesas.com/synergy/e2studio](https://renesas.com/synergy/e2studio)
 - **IDE IAR EWB for Synergy** - [Renesas.com/synergy/ewsynergy](https://renesas.com/synergy/ewsynergy)
 - **Standalone configurator** - [Renesas.com/synergy/ssc](https://renesas.com/synergy/ssc)
- **Drivers & Utilities**
 - **J-Link Drivers** - [Renesas.com/synergy/jlink](https://renesas.com/synergy/jlink)
 - **TraceX** - [Renesas.com/synergy/tracex](https://renesas.com/synergy/tracex)
 - **GUIX Studio** - [Renesas.com/synergy/guixstudio](https://renesas.com/synergy/guixstudio)
 - **Capacitive Touch Workbench** - [Renesas.com/synergy/captouchworkbench](https://renesas.com/synergy/captouchworkbench)



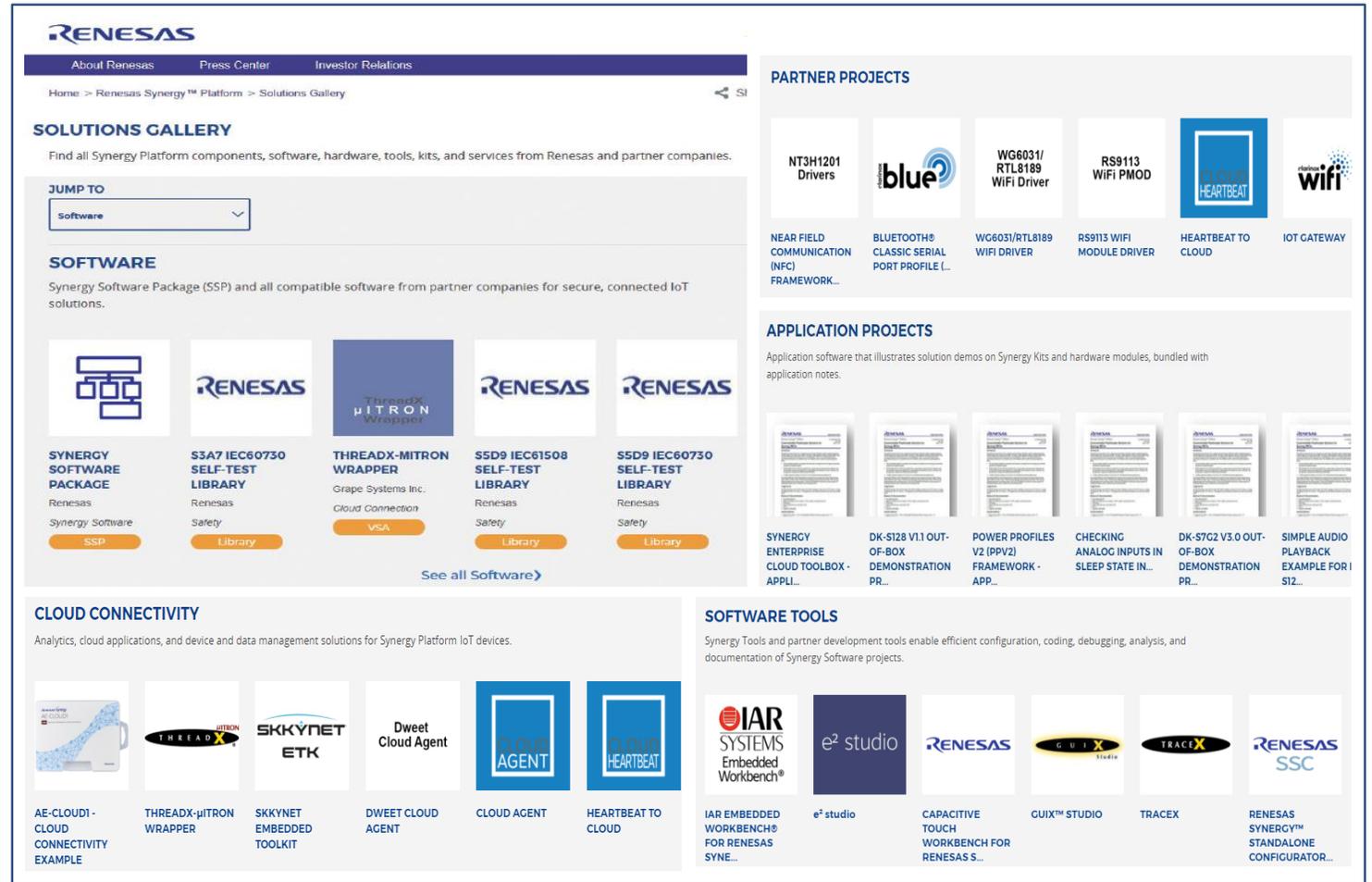
Visit & learn more at:

[Renessasynergy.com/software](https://renessasynergy.com/software)

SYNERGY SOLUTIONS GALLERY

DOWNLOAD CENTER

- 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



The screenshot displays the Renesas Synergy Solutions Gallery website. The header includes navigation links for Home, Hardware, MCU, Kits, Software, Tools, SSP, Add-Ons, Solutions Gallery, and Support. The main content area is divided into several sections:

- SOLUTIONS GALLERY:** A search bar labeled "JUMP TO" with "Software" selected. Below it, a "SOFTWARE" section lists items like "SYNERGY SOFTWARE PACKAGE", "S3A7 IEC60730 SELF-TEST LIBRARY", "THREADX-MITRON WRAPPER", "S5D9 IEC61508 SELF-TEST LIBRARY", and "S5D9 IEC60730 SELF-TEST LIBRARY".
- PARTNER PROJECTS:** A row of project cards including "NT3H1201 Drivers", "blue", "WG6031/RTL8189 WiFi Driver", "RS9113 WiFi PMOD", "HEARTBEAT TO CLOUD", and "IoT GATEWAY".
- APPLICATION PROJECTS:** A row of application project cards such as "SYNERGY ENTERPRISE CLOUD TOOLBOX - APPL...", "DK-S128 V1.1 OUT-OF-BOX DEMONSTRATION PR...", "POWER PROFILES V2 (PPV2) FRAMEWORK - APP...", "CHECKING ANALOG INPUTS IN SLEEP STATE IN...", "DK-S7C2 V3.0 OUT-OF-BOX DEMONSTRATION PR...", and "SIMPLE AUDIO PLAYBACK EXAMPLE FOR I S12...".
- CLOUD CONNECTIVITY:** A section for analytics, cloud applications, and device and data management solutions, featuring cards for "AE-CLOUDI-CLOUD CONNECTIVITY EXAMPLE", "THREADX-MITRON WRAPPER", "SKKYNET ETK", "Dweet Cloud Agent", "CLOUD AGENT", and "HEARTBEAT TO CLOUD".
- SOFTWARE TOOLS:** A section for development tools including "IAR EMBEDDED WORKBENCH FOR RENESAS SYNE...", "e² studio", "CAPACITIVE TOUCH WORKBENCH FOR RENESAS S...", "GUIX™ STUDIO", "TRACEX", and "RENESAS SYNERGY™ STANDALONE CONFIGURATOR...".



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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

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3. Develop

Begin developing using one of the existing applications projects or partner projects

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