

BASICS OF THE RENESAS SYNERGY™ PLATFORM

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CHAPTER 6

RENESAS SYNERGY™

KITS

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6 RENESAS SYNERGY™ KITS

What you will learn in this chapter:

- What the different hardware kits of the Synergy Platform, their details and their intended use.

There is a point during every development project when you will need hardware to run your first tests. And as all engineers know, this will almost always be the case well before their own hardware is even close to being ready for use. Or maybe the hardware guys don't want to loan one of their rare prototypes to their beloved software colleagues, who may even destroy the board (not that this happened ever to me!)

Renesas has a solution: Renesas offers four kinds of easy-to-use boards which make starting with the platform easy and hassle-free for the software designer, as he can test his programs right away. The hardware designer will also benefit from the boards as he can access most of the pins of the microcontroller conveniently at the different connectors of the kits.

6.1 The Different Types of Hardware Kits

Which kit to choose depends on what the designer wants to achieve. The Starter Kit SK-S7G2 offers an easy entry to the Synergy Platform, as it is based on the Synergy microcontroller series offering the largest memory sizes and the largest choice of on-chip peripherals. So it is an excellent choice if it is not clear yet which microcontroller will finally be chosen for the project, or if you have not yet determined which Development Kit is the right one for you.

The Development Kits on the other hand are more intended for a full project prototyping, giving access to all pins and providing additional hardware for specific applications, like a detachable capacitive-touch display. Common to all boards is their modularity and their expandability, as well as their extremely easy and error-proof configuration.

Promotion Kits are designed to demonstrate the main features of the Synergy Platform. They are intended to act as an initial evaluation platform that you can use to determine which kit is appropriate for further development of your project. And, one of the Promotion Kits, the PK-S5D9 is used for the exercises in this book.

And last but not least, the Target Board Kits provide an inexpensive starting point to evaluation, prototyping and developing for the Synergy family of MCUs. They allow the access to the signals of the MCU through pin headers and come with several on-board peripherals.

6.2 The SK-S7G2 Starter Kit

The SK-S7G2 Starter Kit is your low-cost entrance card to the entire Synergy Platform. It allows you to explore the Synergy platform without delay, including the microcontroller and all its peripherals. The compact design gives you access to more than 80% of the pins of the device through Arduino and Pmod™ connectors, allowing for rapid prototyping of your application.

The on-board QVGA touch display makes interaction with the board a snap, especially if used together with the GUIX™ middleware from the Synergy Software Package (SSP) and GUIX Studio™, a Windows program, which can be downloaded from the Synergy Solutions

Gallery and used to design Graphical User Interfaces (GUI). Connectivity to the outside world is available through USB, Ethernet, RS-232/485 and Bluetooth Low Energy (BLE) 4.1 on the board.

Easy debugging of the software and programming of the device is possible through the on-board J-Link™ debugger. A comprehensive set of documentation is available from the Renesas web site: The Starter Kit SK-S7G2 User's manual, a Quick Start Guide and the board schematics, as well as the S7G2 data sheet and manual.

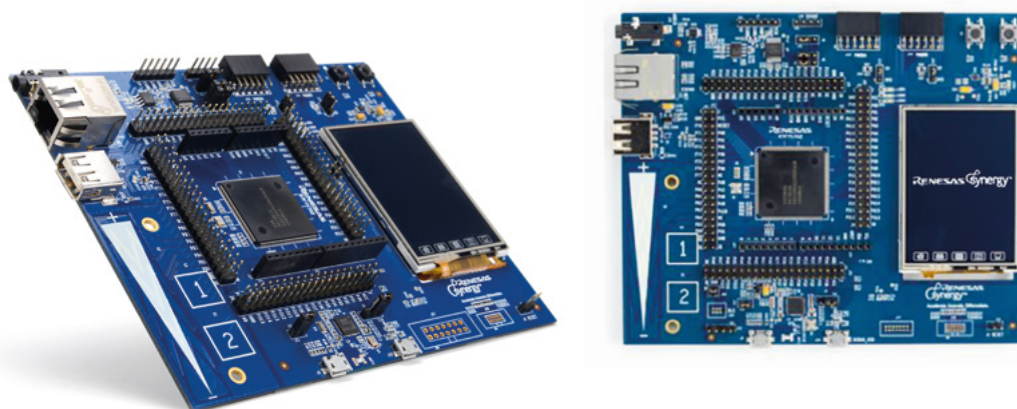


Figure 6-1: The SK-S7G2 Starter Kit

Other features of the Starter Kit include:

- 2.4" TFTLCD QVGA (320 x 240) colour display with touchscreen which uses the internal SRAM of the S7G2 as display frame buffer memory.
- Expansion:
 - Arduino UNO Shield compatible connector
 - 2 x Pmod™ connectors
 - Pin row headers
- Wired connectivity
 - USB (1 x HS Host, 1 x FS Device)
 - Ethernet with RMI and IEEE 1588 Precision Time Protocol (PTP) support
 - RS232/RS485 available on pins with transceiver
 - CAN available on pins with transceiver
- Wireless connectivity
 - Bluetooth Low Energy (BLE) 4.1 on board plus many options through Arduino and Pmod™ expansion connectors
- Memory
 - On-chip: 4 MB flash + 640 KB SRAM
 - External: 8-MB QSPI flash

6.3 Synergy Development Kits

If the SK-S7G2 Starter Kit is your standard entrance card to the Synergy Platform, the Development Kits (DK) are your VIP-pass, as they can be used for complete project prototyping with 100% of the pins available through Pmod™ connectors and through pin row headers.

As most pins on the Synergy microcontrollers support multiple functions, they can be connected to more than one connector or device on the kits. DIP-switches on the PCB allow an easy, safe and error free routing of the different functions. Each DIP-switch controls a high-speed buffer which, depending on the switch setting, either connects or insulates the MCU-pins from the peripheral or connector. Additionally the DIP-switches can be read by software through the I/O expanders' IIC-port and, if the switch is open, the software can enable the buffers. LEDs will then indicate when the respective device is connected under software control. This is a pretty cool feature as you do not have to move tons of tiny jumpers around, so routing of the signals is really simple.

There are a couple of features which are available on each of the different Development Kits:

- Full access to all the pins and features of the microcontroller.
- Wired connectivity:
 - USB
 - RS232/RS485 through screw-in connectors
 - CAN through screw-in connectors
- Wireless connectivity
 - Bluetooth Low Energy (BLE) 4.0 on board plus many options through Pmod™ connectors
- Sensors for temperature, acceleration, light, etc.
- Debugging and programming through J-Link® on-board debugger

There are several Development Kits available for different devices and additional peripherals will be available on the PCB (depending on the feature set of the microcontroller used). As with the Starter Kit, a full set of documentation is available for each of the boards.

6.3.1 The DK-S7G2 Development Kit

The DK-S7G2 is hosting the S7 Series S7G2 MCU which is today's flagship device in the Synergy Platform. Designed with ease of use in mind, it features all the different things mentioned already and much more. The kit consists actually of several boards: One breakout board carrying different interfaces like Ethernet 10/100 or connectors for the camera board, a main board with the microcontroller, several connectors, LEDs, etc., and two Expansion Boards, one display board carrying a WQVGA TFT LCD and one camera board, carrying a CMOS VGA image sensor.

Unique features of the board in addition to those already mentioned are:

- 4.3" WQVGA (480 x 272) TFTLCD colour display with capacitive touch
- VGA (640 x 480) CMOS image sensor with support for a maximum of 30 FPS
- Expansion through pin-row connectors and four Pmod™ connectors
- Wired connectivity:
 - Ethernet with RMIII and IEEE 1588 precision time protocol (PTP) support
- Memory:
 - On-chip: 4 MB flash plus 640 kB SRAM
 - Off-chip: 16 MB SDRAM, plus 16 MB QSPI flash plus 2 GB eMMC
- Full size SD card interface

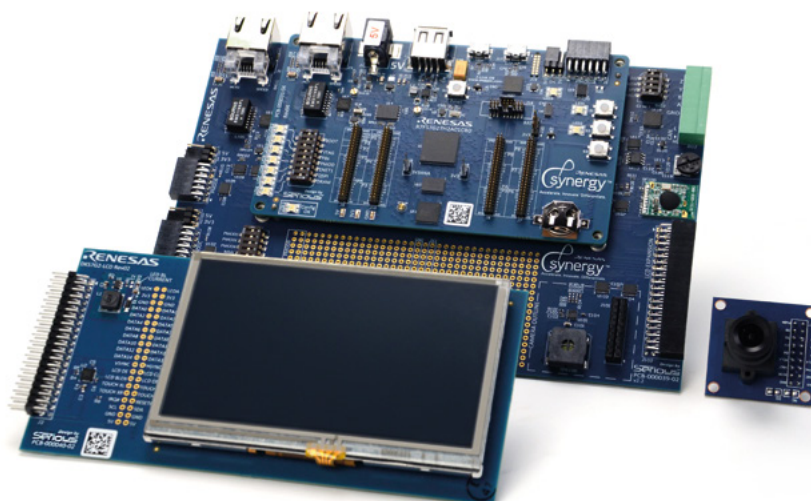


Figure 6-2: The DK-S7G2 Development Kit

6.3.2 The DK-S3A7 Development Kit

The DK-S3A7 features an S3 Series S3A7 MCU, a super-efficient microcontroller inside the Synergy family of microcontrollers. The kit was designed to allow end-product development while measuring the efficiency of the device. The kit consists of three boards: One Main Board with the microcontroller and several connectors and interfaces, one Breakout Board with several peripherals like sensors for light and temperature, as well as Pmod™ connectors and one LCD panel with a 176-segment display.

Unique features of the board in addition to those already mentioned are:

- Detachable 176-segment T6022A-1PRP0 LCD panel
- Expansion through pin-row connectors and three Pmod™ connectors
- Memory:
 - On-chip: 1 MB flash plus 160 kB SRAM
 - Off-chip: 32 MB QSPI flash

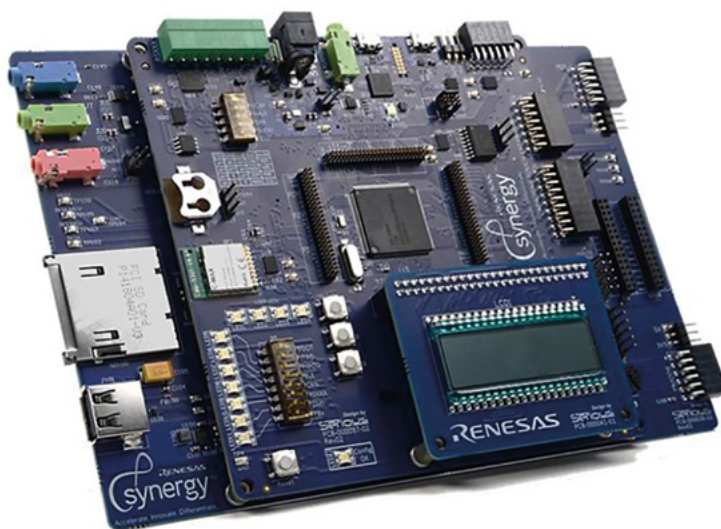


Figure 6-3: The DK-S3A7 Development Kit

6.3.3 The DK-S124 Development Kit

The DK-S124 is hosting the S1 Series S124 microcontroller, a very power efficient MCU with a smart mix of analogue and digital peripherals. Its design allows to make precise measurements of the microcontroller' current consumption in all modes of operation, as well as a detailed estimation of the performance of the devices analogue peripherals. The kit consists of two boards, one main board with the MCU and I/Os and one display board with the following features:

- A small RSK Pmod™ connected display board
- Capacitive touch buttons, one slider
- Expansion through pin-row connectors and one Pmod™ connector
- On-chip 128 kB flash plus 16 kB SRAM

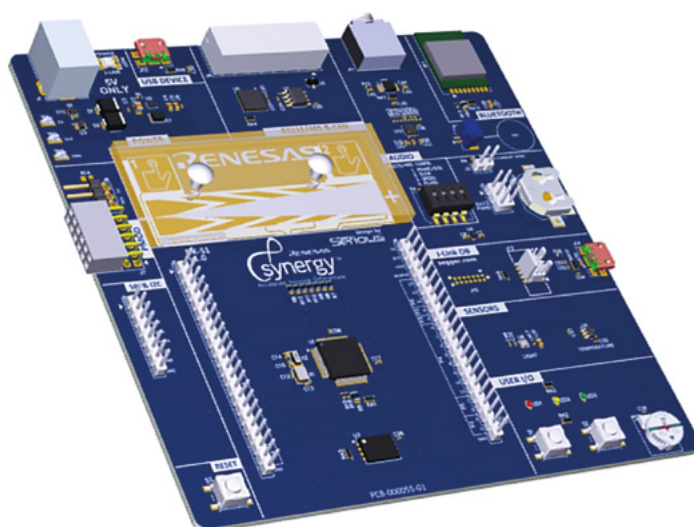


Figure 6-4: The DK-S124 Development Kit

6.4 The PK-S5D9 Promotion Kit

The PK-S5D9 Promotion Kit is your entry card to the world of the S5 series of the Synergy family of microcontrollers and it is the board used for the exercises in this book. It allows you to evaluate the capabilities of this series within minutes and provides you with easy-to-access interfaces to the S5D9 group of MCUs for application development. Plus, it lets you experience all the ingredients of the Synergy Platform instantly. You can also use it as initial evaluation platform to determine which other kit might be appropriate for further development of your product.

Connectivity to the outside world is available through USB, Ethernet, RS-232/485 and CAN, as well as through two user buttons and three generic user LEDs. Four header connectors allow you to easily access most of the pins of the S5D9 microcontroller. Debugging and programming of the device is made easy through the on-board J-Link™ debugger. The on-board touch display makes the interaction with the PK really painless, especially if used together with the GUIX™ middleware from the SSP and the GUIX Studio™, a Windows based program downloadable from the Synergy Solutions Gallery.

An extensive set of documentation is available for this kit from the Renesas website: A Quick Start Guide walking you through the first start of the kit, a User's Manual, giving you all the technical details of the board and a design files package containing the schematics of the board, the BOM, Gerber files and much more.

Other features of this Promotion Kit include:

- 2.4" TFTLCD QVGA (320 x 240) colour display / touchscreen which uses the internal SRAM of the S5D9 for frame buffer memory.
- Expansion:
 - Arduino UNO Shield compatible connector
 - 2 x Pmod™ connectors
 - Pin row headers
- Wired connectivity
 - USB (1 x HS Host, 1 x FS Device)
 - Ethernet with RMI and IEEE 1588 Precision Time Protocol (PTP) support
 - RS232/RS485 available on pins with transceiver
 - CAN available on pins with transceiver
- On-board Bluetooth Low Energy (BLE) 4.1
- 2 MB flash memory + 640 KB SRAM on-chip, as well as 8-MB QSPI flash memory externally



Figure 6-5: The PK-S5D9 Promotion Kit

6.5 The TB-S5D5 Target Board Kit

The TB-S5D5 Target Board Kit provides an inexpensive development kit for the Renesas Synergy S5D5 group of microcontroller in an LQFP-144 package. It is designed to help you to get started with initial firmware development and serves as an evaluation platform for this group. Despite its small size, it gives you access to all interface signals, and to voltages for all Main MCU power ports through four pin headers, allowing for rapid prototyping of your design.

Debugging and programming of the device is made easy through the onboard J-Link™ debugger. A 10-pin JTAG/SWD interface is also provided for connecting optional external debuggers and programmers. A full set of documentation is available from the Renesas web site: The Target Board Kit TB-S5D5 User's Manual, which includes the schematics of the board, a Quick Start Guide walking you through the first start of the kit, as well as the S5D5 data sheet and several application reports.

Other features of this Target Board Kit include:

- Connectivity:
 - A device USB connector for the Main CPU
 - 2 x Pmod™ connectors, allowing the use of Pmod compliant plug-in modules for rapid prototyping
- General purpose I/O ports
 - One jumper to allow measuring the current of the Main CPU
 - Copper jumpers for configuration and access to selected MCU signals
- Memory
 - On-chip: 1 MB code flash
 - On-chip: 32 KB data flash
 - On-chip: 384 KB SRAM
- Other features
 - A two-color status, a red user LED and a user push-button
 - A user capacitive touch button and an optional user potentiometer

Points to take away from this chapter:

- Renesas provides four different kind of boards to serve the different needs of the developers.
- The SK-S7G2 Starter Kit is your entry to the Synergy Platform, where you can test most of its features.

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