Renesas RA Family

# EK-RA4M1 Example Project Bundle

## Introduction

This document describes the contents of the Example Project Bundle for the EK-RA4M1 kit. The Example Projects contained within the bundle show how to write code for the various Renesas Flexible Software Package (FSP) modules supported by the EK-RA4M1 kit.

Flexible Software Package is an optimized software package designed to provide easy to use, scalable, high-quality software for embedded system design. The primary goal is to provide lightweight, efficient drivers that meet common use cases in embedded systems. FSP code quality is enforced by peer reviews, automated requirements-based testing, and automated static analysis. FSP provides uniform and intuitive APIs that are well documented. Each module is supported with detailed user documentation including example code. FSP modules can be used on any MCU in the RA family, provided the MCU has any peripherals required by the module. FSP modules can be configured at build-time to optimize the size of the module for the feature set required by the application.

## Supported Kit

EK-RA4M1

## Supported FSP Version

FSP v5.2.0

## Supported Toolchains

For the latest version of each Integrated Development Environment (IDE) and toolchain listed below, please refer to the FSP release notes

- e² studio with GCC Arm Embedded
- Keil MDK with Arm compiler toolchain
- IAR EWARM with IAR toolchain for Arm

## 1. Using the Example Projects

To use EK-RA4M1 Example Projects, follow the steps mentioned in the following documents:

- Example Project Usage Guide
  https://github.com/renesas/ra-fsp-examples/blob/master/example_projects/Example%20Project%20Usage%20Guide.pdf
- e² studio AC6 porting Guide
  https://en-support.renesas.com/knowledgeBase/19375553

Users who are new to the FSP are recommended to refer to the section **Starting Development** > **Tutorial: Your First RA MCU Project – Blinky** in the RA FSP Documentation prior to attempting to program or debug an example project.

## 2. List of Example Projects Supported on Different Toolchains in the Bundle

The following table lists example projects supported by each IDE. These are ready to import using the import process for each IDE.

**Note**:

1. Additional example projects other than those mentioned above, may be available in the example project repository. However, they are supported with older version of FSP. Please refer the example_projects/version_info_table.md file in the repository to identify the appropriate FSP version for the example project of interest.
2. All projects supported by e$^2$ studio/GCC are supported with e$^2$ studio/AC6 via port from GCC.

**Table 1. IDE Support for the Example Project**

| | IDE Support | | |
|---|---|---|---|
| **Example Project** | **e² studio/GCC** | **IAR** | **Keil MDK** |
| **NetX_wifi** | Supported | | |
| **_quickstart** | Supported | | |
| **acmplp** | Supported | | |
| **adc** | Supported | | |
| **adc_gpt_periodic_sampling** | Supported | | |
| **agt** | Supported | Supported | Supported |
| **audio_playback_pwm** | Supported | | |
| **cac** | Supported | | |
| **can** | Supported | | |
| **can_fifo** | Supported | | |
| **cpp** | Supported | | |
| **crc** | Supported | | |
| **dac** | Supported | | |
| **dma_spi** | Supported | | |
| **dmac** | Supported | Supported | Supported |
| **doc** | Supported | | |
| **elc** | Supported | | |
| **flash_lp** | Supported | Supported | Supported |
| **freertos** | Supported | Supported | Supported |
| **gpt** | Supported | Supported | Supported |
| **gpt_input_capture** | Supported | | |
| **icu** | Supported | Supported | Supported |
| **iic_master** | Supported | | |
| **iic_slave** | Supported | Supported | Supported |
| **iwdt** | Supported | | |
| **kint** | Supported | | |
| **lpm** | Supported | | |
| **lvd** | Supported | | |
| **mbed_crypto** | Supported | | |
| **opamp** | Supported | | |
| **rtc** | Supported | Supported | Supported |
| **sci_i2c** | Supported | | |
| **sci_spi** | Supported | | |
| **sci_uart** | Supported | Supported | Supported |
| **slcdc** | Supported | | |
| **spi** | Supported | Supported | Supported |
| **ssi** | Supported | | |

| | IDE Support | | |
|---|---|---|---|
| **Example Project** | **e² studio/GCC** | **IAR** | **Keil MDK** |
| **usb_pcdc** | Supported | | |
| **usb_phid** | Supported | | |
| **usb_pvnd** | Supported | | |
| **vee_flash** | Supported | | |
| **wdt** | Supported | Supported | Supported |

## Website and Support

Visit the following URLs to learn about key elements of the RA family, download components and related documentation, and get support.

| | |
|---|---|
| RA Product Information | renesas.com/ra |
| RA Product Support Forum | renesas.com/ra/forum |
| RA Flexible Software Package | renesas.com/FSP |
| Renesas Support | renesas.com/support |

## Revision History

| | | Description | |
|---|---|---|---|
| **Rev.** | **Date** | **Page** | **Summary** |
| 1.00 | Apr.23.20 | — | First release document. |
| 1.01 | Jun.01.20 | — | Examples updated for IAR support. |
| 1.02 | Jul.09.20 | — | Updated for FSP v1.2.0. |
| 1.03 | Jul.23.20 | — | Updated to add new EPs supported in FSP v1.2.0. |
| 1.04 | Aug.12.20 | NA | Package updated to include this document. |
| 1.05 | Sep.03.20 | — | Updated for FSP v1.3.0. |
| 1.06 | Sep.14.20 | — | This revision includes changes to the code files. There are no changes to this document. |
| 1.07 | Oct.12.20 | — | Added support for FSP v2.0.0. |
| 1.08 | Oct.23.20 | — | Updated support for IAR and Keil, VEEPROM added. |
| 1.09 | Nov.02.20 | — | Added support for FSP v2.1.0. |
| 1.10 | Dec.01.20 | — | Added support for FSP v2.2.0. |
| 1.11 | Feb.02.21 | — | Added support for FSP v2.3.0. |
| 1.12 | Mar.10.21 | — | Added support for USB PVND. |
| 1.13 | Apr.06.21 | — | Added support for FSP v2.4.0. |
| 1.14 | May.03.21 | — | Added support for FSP v3.0.0. |
| 1.15 | May.13.21 | — | Added support for FSP v3.0.0 (2). |
| 1.16 | Jun.16.21 | — | Added support for FSP v3.0.0 (4). |
| 1.17 | Jul.12.21 | — | Added support for FSP v3.1.0 (1). |
| 1.18 | Jul.26.21 | — | Added support for FSP v3.1.0 (2). |
| 1.19 | Aug.30.21 | — | Added support for FSP v3.1.0 (3). |
| 1.20 | Sep.10.21 | — | Added support for FSP v3.2.0. |
| 1.21 | Sep.29.21 | — | Added support for FSP v3.3.0 (2). |
| 1.22 | Oct.20.21 | — | Added support for FSP v3.4.0 (2). |
| 1.23 | Dec.20.21 | — | Added support for FSP v3.5.0 (2). |
| 1.24 | Mar.21.22 | — | Added support for FSP v3.6.0. |
| 1.25 | Apr.11.22 | — | Added support for FSP v3.6.0 (2). |
| 1.26 | Jul.18.22 | — | Added support for FSP v3.8.0 (1). |
| 1.27 | Aug.11.22 | — | Added support for FSP v3.8.0 (2). |
| 1.28 | Sep.20.22 | — | Added support for FSP v4.0.0. |
| 1.29 | Oct.17.22 | — | Added support for FSP v4.0.0 (2). |
| 1.30 | Nov.14.22 | — | Added support for FSP v4.1.0 (1). |
| 1.31 | Dec.01.22 | — | Added support for FSP v4.1.0 (2). |
| 1.32 | Jan.10.23 | — | Added support for FSP v4.2.0 (1). |
| 1.33 | Mar.24.23 | — | Added support for FSP v4.3.0 (2). |
| 1.34 | Apr.28.23 | — | Added support for FSP v4.4.0 (1). |
| 1.35 | Jun.01.23 | — | Added support for FSP v4.4.0 (2). |
| 1.36 | Jun.17.23 | — | Added support for FSP v4.5.0 (1). |
| 1.37 | Sep.18.23 | — | Added support for FSP v4.5.0 (2). |
| 1.38 | Sep.26.23 | — | Added support for FSP v4.6.0 (1). |
| 1.39 | Oct.23.23 | — | Added support for FSP v4.6.0 (2). |
| 1.40 | Nov.06.23 | — | Added support for FSP v5.0.0 (2). |
| 1.41 | Dec.05.23 | — | Added support for FSP v5.0.0 (3). |
| 1.42 | Dec.19.23 | — | Added support for FSP v5.1.0 (2). |
| 1.43 | Jan.29.24 | — | Added support for FSP v5.1.0 (4). |
| 1.44 | Mar.11.24 | — | Added support for FSP v5.2.0 (1). |

| | | | |
|---|---|---|---|
| 1.45 | Mar.21.24 | — | Added support for FSP v5.2.0 (2). |

# General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between $V_{IL}$ (Max.) and $V_{IH}$ (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between $V_{IL}$ (Max.) and $V_{IH}$ (Min.).
7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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