RE01 1500KB Group QSPI XIP Mode (Low Level Code)

QSPI XIP Sample Code

Introduction

This application note explains the QSPI sample code which does not use the RE01 1500KB Group CMSIS driver function.

In this sample code, the registers of Peripheral modules are directly accessed.

This sample code is intended for users who need to:

- Improve performance by eliminating overhead code in the driver.
- Reduce ROM/RAM size.
- Develop simple, easy-to-understand code.
- Implement features not supported by the driver.

Target Device

RE01 1500KB Group

Contents

1. Specifications

This sample code includes two projects. The contents of each project are shown below.

プロジェクト名	内容
r01an5154_re_qspi_write_program	This project uses the direct communication mode of the QSPI function to write the program to the external flash memory (MX25R6435F) on the Evaluation Kit for the RE01 1500KB. The program to be written to the external flash is located in the ".qspi_flash_data" section. Refer to "1.2 Linker file settings" for the ".qspi_flash_data" section definition.
r01an5154_re_qspi_xip_LLCode	This project uses the XIP mode of the QSPI to execute a function in the external flash memory (MX25R6435F) on the Evaluation Kit for the RE01 1500KB. Be sure to use this project after writing a program to the external flash memory with "r01an5154_re_qspi_write_program".

The operation of the sample code is shown below.

[Project: r01an5154_re_qspi_write_program]

- After reset release,the QSPI is initialized in ROM access communication mode.
- Write the program located in the ".qspi_flash_data" section to the external flash memory in the direct communication mode. The following programs are located in the ".qspi_flash_data" section.

  led_operation function: Turns on and off LED0 to LED2 sequentially

  led_wait function: Wait for LED lighting interval
- Perform verification. If the data written to the external flash memory matches the program in the ".qspi_flash_data" section, turn on LED0; otherwise, turn on LED1.

[Project: r01an5154_re_qspi_xip_LLCode]

- After reset release, QSPI is initialized in ROM access communication mode.
- Transit to XIP mode and execute the function on the external flash memory. Functions on the external flash memory turn on and off LED0 to LED2 sequentially.

1.1 Sample Code Information

Table 1. Sample Code Information

Item	Description	Remarks
Peripheral Function	QSPI	Fast read Quad I/O 16MHz
Interrupt	IRQ4	SW2
Pins	P602(QSPCLK) P601(QSSL) P500(QIO0) P015(QIO1) P014(QIO2) P013(QIO3) P508(IRQ4) P009(LED0) P008(LED1) P007(LED2)	SCLK CS SI/SIO0 SO/SIO1 WP/SIO2 RESET/SIO3 SW2 input
Environment (IDE, Compiler)	IDE: IAR Embedded Workbench for ARM Version 8.40.2 C compiler：IAR C/C++ Compiler for ARM Version 8.40.2	
	IDE: Renesas e² studio Version 7.6.0 C Compiler：GCC ARM Embedded Version 6.3.1.20170620GNU 6-2017-q2-update	
Target Board	Evaluation Kit RE01 1500KB	
External flash memory	MX25R6435F (included in Evaluation Kit)	QuadEnable mode HighPerformance mode

1.2 Linker file settings

"r01an5154_re_qspi_write_program" In the project, place the program to be written to the external flash memory in the ".qspi_flash_data" section. Therefore, the linker file is modified. Figure 1.1 shows the modified contents of the linker file with the GCC compiler and Figure 1.2 with the IAR compiler.

```
SECTIONS
{
        . . .
       __qspi_flash_data_start = .;
       KEEP(*(.qspi_flash_data))
       __qspi_flash_data_end = .;
        . . .
} > FLASH = 0xFF
```

Figure 1.1 Linker file changes (GCC compiler: RE01_1500KB.ld)

```
place in IROM_region  { readonly, section .ramfunc_init, block .ramobj_init,
section .ramdata_init, section .ehc_ramfunc_init , section .qspi_flash_data};
```

Figure 1.2 Linker file changes (IAR compiler: RE01_1500KB.icf)

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Dec.26.2019	-	First edition issued

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   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.
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   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.
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   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.
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   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.).
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