Compatibility Considerations: Migrating From RM48x to RM46x Safety Microcontrollers

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ABSTRACT

This application report provides a summary of the differences between the RM48x and the RM46x series of microcontrollers.

Contents

1   Introduction

The RM48x series incorporates a superset of the functionality incorporated on the RM46x series. There are some enhancements implemented on the RM46x series, while still maintaining application code compatibility to the RM48x series. An application written for the RM48x series runs correctly on the RM46x series as long as only the common functions are exercised.

Memory Configuration Differences

There are some memory configuration differences between the RM48x and RM46x series of microcontrollers. These are listed below:

- Flash: Program Memory:

  The RM48x series includes parts with either 3MB of 2MB of program Flash, while the RM46x series includes parts with 1.25MB or 1MB of program Flash.

- Program Flash Memory: Boot Sector:

  The first sector in the Flash program memory is 32kB on the RM48x series, while the first sector is 16kB on the RM46x series. The second sector on the RM46x is also 16kB, so that a boot code that uses the full 32kB on RM48x can run as-is on the RM46x. The Flash API calls for programming or erasing use the absolute address as an argument passed by the calling routine.

- CPU Data RAM:

  The LS3137 superset part in the RM48x series includes 256kB of tightly-coupled RAM, while the LS1227 superset part in the RM46x series includes 192kB of tightly-coupled RAM. The 256kB RAM on the LS3137 is divided into four separate power domains of 64kB each. The 192kB RAM on LS1227 is divided into three separate power domains of 64kB each.

2   Package Compatibility Considerations

All the parts in the RM48x and RM46x series of microcontrollers are supported in either a 337 ball grid array (337 BGA) or a 144-pin quad flat pack (144 QFP) package.

2.1   144QFP Pin-Out Compatibility

The parts in RM48x and the RM46x series are 100% pin-out compatible in the 144QFP package. The parts have been designed to allow the same hardware to be used for parts from both the series, as long as the common functions are exercised.

2.2   337BGA Ball-Map Compatibility

The RM46x series of microcontrollers does not include trace and debug modules such as the ARM Embedded Trace Macrocell (ETM-R4), the RAM trace port (RTP) and the Data Modification Module (DMM). The terminals assigned to these modules are either "No Connects" or they now default to any alternate function implemented on these terminals. Please check the device-specific data sheet for details.

The RM46x series also implements an external memory interface (EMIF) with a reduced number of external address lines – 13, compared to the 23 address lines implemented on the RM48x series of microcontrollers. The terminals assigned to the nine fewer higher-order external address lines are now either "No Connects" or they now default to any alternate function implemented on these terminals. Please check the device-specific data sheet for details.

Input/Output Considerations

There are some drive strength differences for output signals between the RM48x and RM46x series of microcontrollers. These are listed in Output Drive-Strength Differences Between RM48x and RM46x.

Output Drive-Strength Differences Between RM48x and RM46x

Output Signal Name	Drive Strength on RM48x	Drive Strength on RM46x
N2HET2[5]	2 mA Zero-Dominant	8 mA
N2HET2[7]	2 mA Zero-Dominant	8 mA
N2HET2[9]	2 mA Zero-Dominant	8 mA
N2HET2[11]	2 mA Zero-Dominant	8 mA
N2HET2[13]	2 mA Zero-Dominant	8 mA
N2HET2[15]	2 mA Zero-Dominant	8 mA
SPI4_nCS[0]	2 mA Zero-Dominant	8 mA
SPI4_nENA	2 mA Zero-Dominant	8 mA

Module Compatibility Considerations

All the **common** modules implemented on the RM46x series of microcontrollers are functionally compatible to those on the RM48x series of microcontrollers. Code written for these modules on the RM48x parts will function on the RM46x parts with no changes required. The RM46x series also includes some new peripherals as well as some enhancements to some common peripherals. These are listed and briefly described in the following sections.

Module Enhancements on RM46x Series

The RM46x series of microcontrollers implements enhancements to two peripherals: the high-end timer (N2HET) and the multi-buffered analog-to-digital converter (ADC).

2.2.1   N2HET Enhancements on RM46x Series

- Selectable Hardware Angle Generator (HWAG) Toothed-Wheel Input

  The N2HET modules, on both the RM48x as well as the RM46x microcontrollers, supports an embedded HWAG. The function of the HWAG is to generate an angle value from a toothed-wheel input. This toothed-wheel input to the N2HET came from the N2HET[2] channel. This allocation was fixed and could not be programmed by the application on the RM48x series of microcontrollers. The HWAG on the RM46x series now includes a programmable register that allows the application to select the N2HET channel that is used to provide the toothed-wheel input. This register still defaults to using N2HET[2] as the toothed-wheel input, thereby, maintaining backwards compatibility to the N2HET peripheral on RM48x.

- Input Capture Enhancements

  The N2HET input capture functionality is also enhanced on the RM46x series of microcontrollers compared to the RM48x series. On the RM48x series, the input signal on an N2HET channel must follow these two rules:

  – The input signal period must be at least twice the N2HET loop-resolution-clock period, and

  – Each phase of the input signal must be at least one N2HET loop-resolution-clock period

  On the RM46x series, the input signal on an N2HET channel must follow these two rules:

  – The input signal period must be at least one N2HET loop-resolution-clock period, and

  – Each phase of the input signal must be at least twice the N2HET high-resolution-clock period

  As can be seen, the N2HET on the RM46x can be used to measure input pulse widths smaller than one loop-resolution-clock period.

ADC Enhancements on the RM46x Series

- Enhanced Channel Selection Mode

  The ADC module on the RM48x series performs sequential conversions on the number of channels selected in any particular conversion group (event group, group1 or group2). This conversion starts with the lowest numbered channel selected and proceeds in ascending order until all selected channels have been converted. The RM46x series introduces an enhanced channel selection mode, wherein, a look-up table is used to define the channel number to be converted. This provides the application the capability of repeatedly sampling the same analog input channel, or to define an arbitrary channel conversion sequence, or to switch the conversion sequence while conversions are already ongoing. For more details, see the *ADC* chapter of the *RM46 16/32-Bit RISC Flash Microcontroller Technical Reference Manual* (SPNU514).

- Support for External Analog Multiplexors

  The look-up table used to support the enhanced channel selection mode also allows the application to output external channel select and enable signals. These signals can then be connected to external analog multiplexors, thereby, increasing the number of analog input channels that can be converted by the ADC. The RM46x series supports connecting up to 4:1 external analog multiplexor on each of the 24 unique ADC input channels, effectively providing the ability to convert up to 96 input channels.

New Modules on the RM46x Series

The RM46x series introduces enhanced timing peripherals listed below. The terminals for these peripherals are multiplexed with existing functions and require additional configuration of the I/O multiplexing module to enable outputs from these peripherals.

- Enhanced Translator Pulse-Width Modulator (eTPWM)

  There are seven eTPWM modules that could be synchronized to a single time base, or run on their own time base. Each eTPWM module can output two pulse width modulation (PWM) signals that are synchronized to a common time base and are generated based on independent or complementary counter compares. The eTPWM modules also support adjustable dead-band generation for leading or trailing edges. There are also six separate fault conditions that can be used by the application to trip the eTPWM module outputs. Three of these trip conditions can be driven from external sources, with the other three being internal.

- Enhanced Capture Module (eCAP)

  There are six eCAP modules on the RM46x series. The enhanced capture module uses a 32-bit time base and registers up to four programmable events in continuous, or one-shot capture modes. This module can also be configured to generate an auxiliary PWM signal.

- Enhanced Quadrature Encoded Pulse Generator (eQEP)

  There are two eQEP modules on the RM46x series. The eQEP module uses a 32-bit position counter, supports low-speed measurement using capture unit and high-speed measurement using a 32-bit unit timer. This module has a watchdog timer to detect motor stall and input error detection logic to identify simultaneous edge transition in QEP signals.

3 References

- *RM46 16/32-Bit RISC Flash Microcontroller Technical Reference Manual* (SPNU514)

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