



RAM Controller (RAMCTL)

NOTE: This chapter is an excerpt from the *MSP430x5xx and MSP430x6xx Family User's Guide*. The latest version of the full user's guide can be downloaded from <http://www.ti.com/lit/pdf/slau208>.

The RAM controller (RAMCTL) allows control of the operation of the RAM.

Topic	Page
1.1 RAM Controller (RAMCTL) Introduction	2
1.2 RAMCTL Operation	2
1.3 RAMCTL Registers.....	3

1.1 RAM Controller (RAMCTL) Introduction

The RAMCTL provides access to the different power modes of the RAM. The RAMCTL enters retention mode to reduce the leakage current while the CPU is off. The RAM can also be switched off by software. In retention mode, the RAM content is saved. In off mode, the RAM content is lost.

The RAM is partitioned in sectors, typically of 4KB (sector) size. See the device-specific data sheet for actual block allocation and size. Each sector is controlled by the RAM controller RAM Sector Off control bit (RCRSyOFF) of the RAMCTL Control 0 register (RCCTL0). The RCCTL0 register is protected with a key. The RCCTL0 register content can be modified only if the correct key is written during a word write. Byte write accesses or write accesses with a wrong key are ignored.

1.2 RAMCTL Operation

Active mode

In active mode, the RAM can be read and written at any time. If any RAM address in a sector must hold data, the whole sector cannot be switched off.

Low-power modes

In all low-power modes, the CPU is switched off. As soon as the CPU is switched off, the RAM enters retention mode to reduce the leakage current.

RAM off mode

Each sector can be turned off independent of the other sectors by setting the respective RCRSyOFF bit to 1. Reading from a switched off RAM sector returns 0 as data. All data previously stored in a switched off RAM sector is lost and cannot be read, even if the sector is turned on again.

Stack pointer

The program stack is located in RAM. Sectors holding the stack must not be turned off if an interrupt must be executed or if a low-power mode is entered.

USB buffer memory

On devices with USB, the USB buffer memory is located in RAM. Sector 7 is used for this purpose. RCRS7OFF can be set to switch off this memory if it is not required for USB operation or is not being used in normal operation.

1.3 RAMCTL Registers

The RAMCTL module register is listed in [Table 1-1](#). The base address can be found in the device-specific data sheet. The address offset is given in [Table 1-1](#).

NOTE: All registers have word or byte register access. For a generic register *ANYREG*, the suffix "_L" (*ANYREG_L*) refers to the lower byte of the register (bits 0 through 7). The suffix "_H" (*ANYREG_H*) refers to the upper byte of the register (bits 8 through 15).

Table 1-1. RAMCTL Registers

Offset	Acronym	Register Name	Type	Access	Reset	Section
00h	RCCTL0	RAM Controller Control 0	Read/write	Word	6900h	Section 1.3.1
00h	RCCTL0_L		Read/write	Byte	00h	
01h	RCCTL0_H		Read/write	Byte	69h	

1.3.1 RCCTL0 Register

RAM Controller Control 0 Register

Figure 1-1. RCCTL0 Register

15	14	13	12	11	10	9	8
RCKEY							
rw-0	rw-1	rw-1	rw-0	rw-1	rw-0	rw-0	rw-1
7	6	5	4	3	2	1	0
RCRS7OFF	RCRS6OFF	RCRS5OFF	RCRS4OFF	RCRS3OFF	RCRS2OFF	RCRS1OFF	RCRS0OFF
rw-0	rw-0	rw-0	rw-0	rw-0	rw-0	rw-0	rw-0

Table 1-2. RCCTL0 Register Description

Bit	Field	Type	Reset	Description
15-8	RCKEY	RW	69h	RAM controller key. Always read as 69h. Must be written as 5Ah, otherwise the RAMCTL write is ignored.
7	RCRS7OFF	RW	0h	RAM controller RAM sector 7 off. Setting the bit to 1 turns off the RAM sector 7. All data of the RAM sector 7 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.
6	RCRS6OFF	RW	0h	RAM controller RAM sector 6 off. Setting the bit to 1 turns off the RAM sector 6. All data of the RAM sector 6 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.
5	RCRS5OFF	RW	0h	RAM controller RAM sector 5 off. Setting the bit to 1 turns off the RAM sector 5. All data of the RAM sector 5 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.
4	RCRS4OFF	RW	0h	RAM controller RAM sector 4 off. Setting the bit to 1 turns off the RAM sector 4. All data of the RAM sector 4 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.
3	RCRS3OFF	RW	0h	RAM controller RAM sector 3 off. Setting the bit to 1 turns off the RAM sector 3. All data of the RAM sector 3 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.
2	RCRS2OFF	RW	0h	RAM controller RAM sector 2 off. Setting the bit to 1 turns off the RAM sector 2. All data of the RAM sector 2 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.
1	RCRS1OFF	RW	0h	RAM controller RAM sector 1 off. Setting the bit to 1 turns off the RAM sector 1. All data of the RAM sector 1 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.
0	RCRS0OFF	RW	0h	RAM controller RAM sector 0 off. Setting the bit to 1 turns off the RAM sector 0. All data of the RAM sector 0 is lost. See the device-specific data sheet to find the number of RAM sectors available along with their respective address ranges and sizes.

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