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April 1st, 2010
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78K0R/Kx3 Microcontroller

Sample Program

Operation Manual

(UART Consecutive Reception + ACK Transmission (DMA Controller), ASM Source)

This software is for reference only and NEC Electronics does not guarantee its operation.
Thoroughly evaluate this software on your set prior to use.

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1st Product Solution Group, Multipurpose Microcomputer Systems Division,
Microcomputer Operations Unit
NEC Electronics Corporation

CONTENTS

1. OVERVIEW

This manual explains the sample program functions of the DMA controller (UART consecutive reception + ACK transmission) for the 78K0R/Kx3.

In this sample program, a DMA controller (UART consecutive reception + ACK transmission) operation is performed.

The outline of the processing is as follows.

- Performs consecutive reception of UART0 and outputs ACK to P10 to indicate completion of reception.
- DMA channel 0 is used for DMA transfer.
- DMA start source: Software trigger (DMA transfer by interrupt is disabled.)
- Transfers FFF12H of UART receive data register 0 (RxD0) to 64 bytes of FFE00H to FFE3FH of RAM.

In this sample program, UART processing (reception mode) is used, but a description of this processing is omitted. For details, refer to the description of UART Processing (Reception Mode).

2. RESOURCES USED

Resource	Description	Remark
Main clock specification	Internal high-speed oscillator used (8 MHz (TYP.))	Always oscillated
	High-speed system clock used (20 MHz)	Oscillated by initial processing. Supplied to CPU and peripheral hardware
Subclock	XT1 (32.768 kHz)	Oscillated by initial processing
Related hardware	DMA SFR address register 0 (DSA0)	
	DMA RAM address register 0 (DRA0)	
	DMA byte count register 0 (DBC0)	
	DMA mode control register 0 (DMC0)	
	Port mode register 1 (PM1)	
	Port register 1 (P1)	
I/O	Input: RxD0 (P11) Output: P10	
Interrupt	End of DMA0 transfer interrupt (INTDMA0)	
Others	Refer to UART Processing (Reception Mode).	

3. SOFTWARE CONFIGURATION

Files

File Name	Processing Outline	Remark
K0R_vct.asm	Vector processing, reset processing	
K0R_init.asm[Note]	Initialization processing	
K0R_main.asm	Main processing	
K0R_sfr_set.asm	DMA controller processing (UART consecutive reception + ACK transmission)	
K0R_uart_re.asm	UART processing (reception mode)	Explained in detail in UART Processing (Reception Mode) Only the interrupt servicing is described in this sample program.

Note This file is commonly used by the sample programs.

4. FUNCTION EXPLANATIONS

[File name]

K0R_main.asm

Function

Function Name	Processing Outline	Argument	Return Value
MMA_STRT	Main routine	None	None

Function explanations

Function name	MMA_STRT
Processing	Main routine
Argument	–
Return value	–
Description	Executes initialization processing and then starts a UART reception operation by DMA transfer.
Remark	–

[File name]

K0R_sfr_set.asm

Functions

Function Name	Processing Outline	Argument	Return Value
DMA_UAIN	Initializes DMA controller (UART consecutive reception + ACK transmission).	None	None
DMA_UAST	Starts DMA controller (UART consecutive reception + ACK transmission).	None	None
DMA_UABK	End processing of DMA controller (UART consecutive reception + ACK transmission)	None	None
DMA_UAIT	Transfer end interrupt of DMA controller (UART consecutive reception + ACK transmission)	None	None

Function explanations

Function name	DMA_UAIN
Processing	Initializes DMA controller (UART consecutive reception + ACK transmission).
Argument	–
Return value	–
Description	Executes initialization.
Remark	–

Function name	DMA_UAST
Processing	Starts DMA controller (UART consecutive reception + ACK transmission).
Argument	–
Return value	–
Description	Starts DMA transfer operation.
Remark	–

Function name	DMA_UABK
Processing	End processing of DMA controller (UART consecutive reception + ACK transmission)
Argument	–
Return value	–
Description	Performs end processing of DMA transfer operation.
Remark	–

Function name	DMA_UAIT
Processing	Processing during transfer end interrupt of DMA controller (UART consecutive reception + ACK transmission)
Argument	–
Return value	–
Description	Performs DMA controller end processing during transfer end interrupt.
Remark	–

[File name]

K0R_uart_re.asm

Function

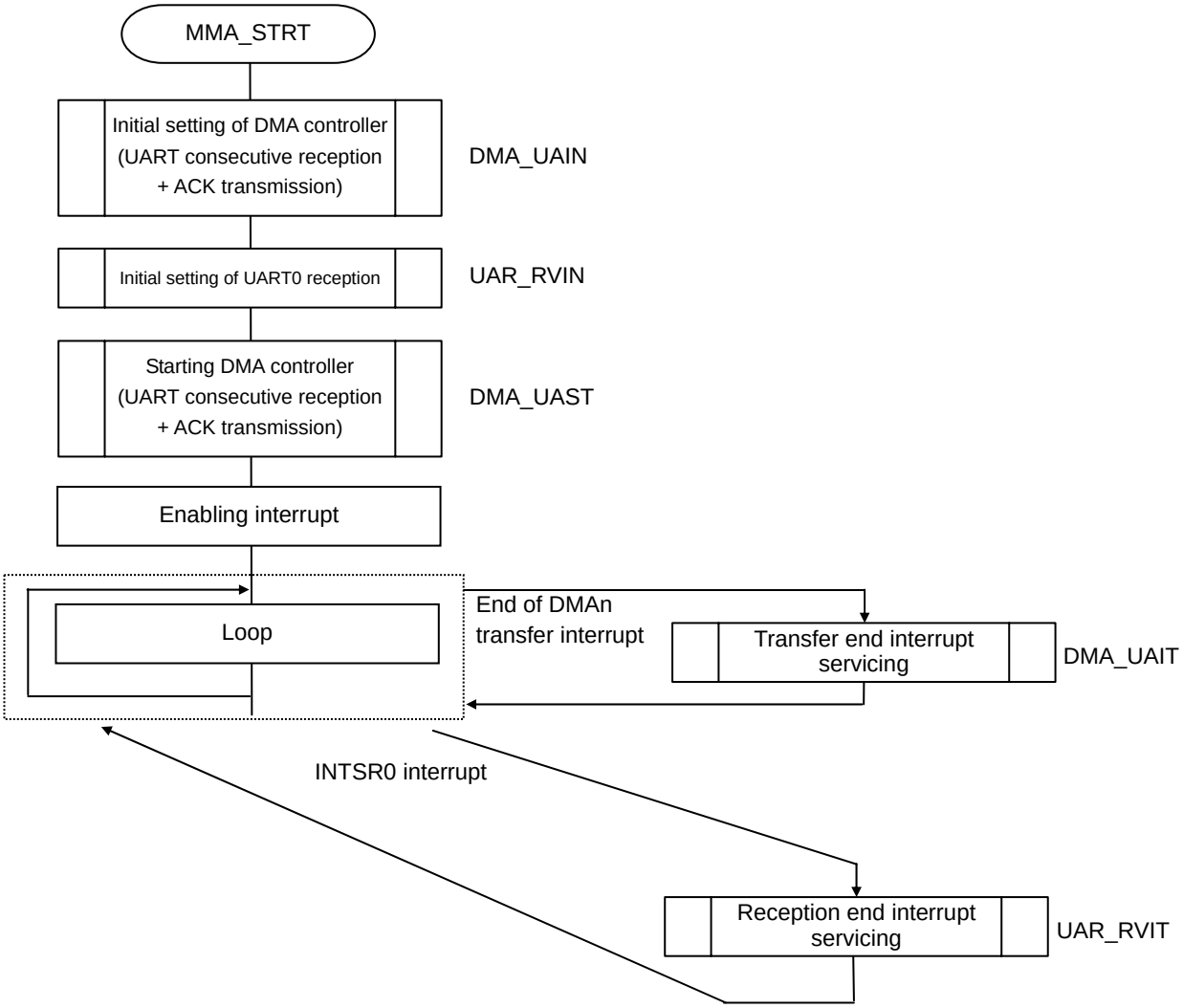
Function Name	Processing Outline	Argument	Return Value
UAR_RVIT	INTSR0 reception end interrupt	None	None

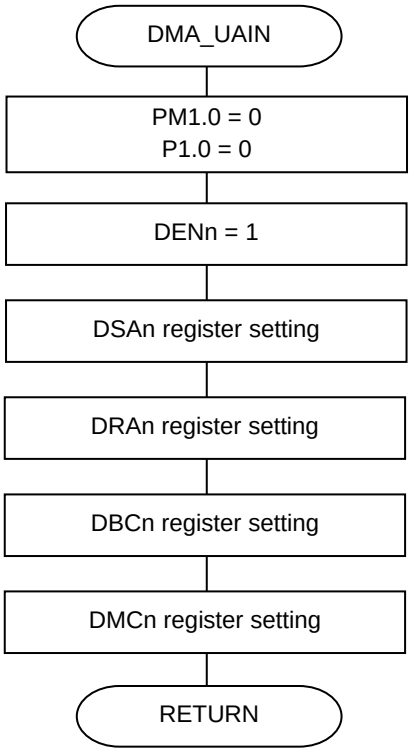
Function explanations

Function name	UAR_RVIT
Processing	INTSR0 reception end interrupt servicing
Argument	–
Return value	–
Description	Issues receive data DMA transfer request and performs ACK transmission.
Remark	–

Remark For the other functions of the “K0R_uart_re.asm” file, refer to the description of UART Processing (Reception Mode).

5. FLOWCHARTS





Enables the ACK transmission port.

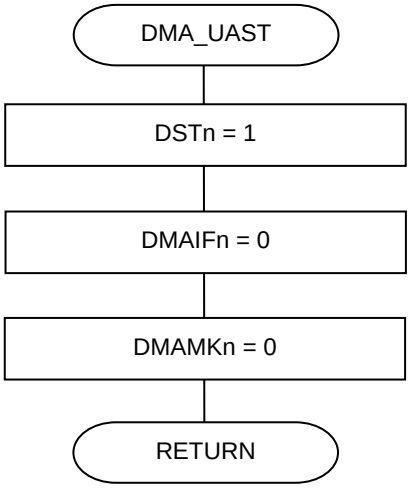
Enables DMA operation of DMA channel n.

Sets the DMA SFR address.

Sets the DMA RAM address.

Sets the number of times of DMA channel transfer.

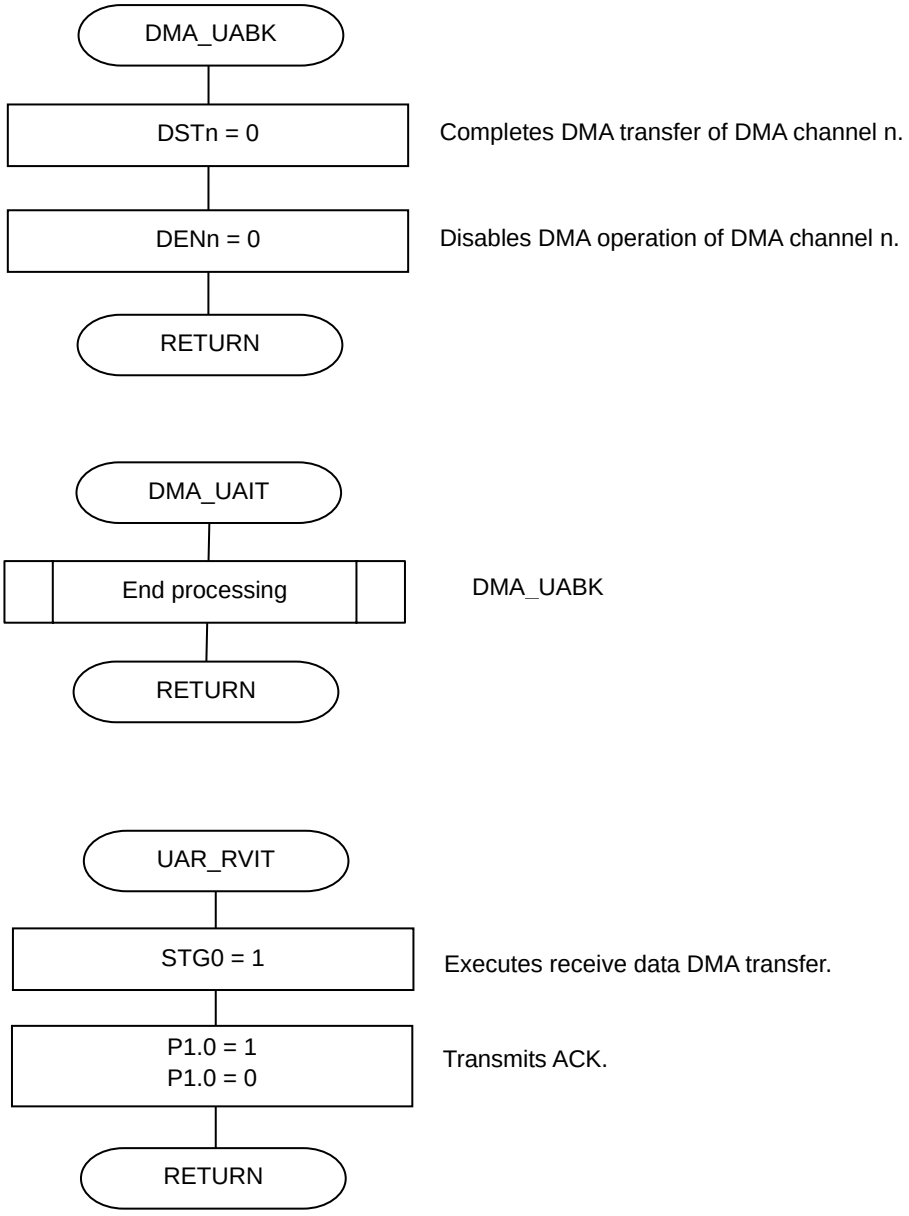
Software trigger does not operate.
Transfer direction: SFR → internal RAM
Transfer data size: 8 bits
Executes DMA transfer by a DMA start request.
Disables DMA transfer by interrupt.



Waits for a DMA trigger.

Clears the interrupt flag.

Enables interrupt.



Remark n: DMA channel number (n = 0, 1)

n = 0 for this sample program.