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April 1st, 2010
Renesas Electronics Corporation

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78K0R/Kx3 Microcontroller

Sample Program

Operation Manual

(3-Wire Serial I/O Processing (Master Transmission/Reception, Continuous Transmission/Reception Mode) (Serial Array Unit), 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 3-wire serial I/O processing (master transmission/reception (continuous transmission/reception mode)) for the 78K0R/Kx3.

In this sample program, master transmission/reception (continuous transmission/reception) operation in 3-wire serial I/O communication is performed.

The communication conditions are as follows.

- f_{CLK} = 20 MHz
- CSI00 (unit 0, channel 0) is used.
- 9,600 bps, 8-bit data
- Data phase: Normal
- Clock phase: Normal
- LSB first
- Transmit data: 3AH (10 bytes)
- Receive data: 10 bytes
- INTCSI00 buffer empty interrupt servicing is used.

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	Peripheral enable register 0 (PER0)	
	Serial clock select register 0 (SPS0)	Clock used: CK00 ($1/2^4$ of main clock), 1.25 MHz (0.8 μs)
	Serial mode register 00 (SMR00)	
	Serial communication operation setting register 00 (SCR00)	Transmission/reception, data length: 8 bits
	Serial data register 00 (SDR00)	Transfer rate: 9,600 bps
	Serial flag clear trigger register 00 (SIR00)	Used to clear an error flag.
	Serial channel start register 0 (SS0)	
	Serial channel stop register 0 (ST0)	
	Serial output register 0 (SO0)	
	Serial output enable register 0 (SOE0)	
	Port mode register 1 (PM1)	
	Port register 1 (P1)	
	SIO00 register (SIO00)	Used to write transmit data.
I/O	Data input: SI00 (P11) Data output: SO00 (P12) Clock output: SCK00 (P10)	
Interrupt	Transfer end interrupt (INTCSI00) of CSI00	
Others	Not used	

3. SOFTWARE CONFIGURATION

Files

File Name	Processing Outline	Remark
K0R_vct.asm	Vector processing	
K0R_init.asm[Note]	Initialization processing	
K0R_main.asm	Main processing	
K0R_sfr_set.asm	3-wire serial I/O processing Master transmission/reception (continuous transmission/reception mode)	

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 transmission/reception operation. Aborts the operation after reception completion and then resumes the operation.
Remark	_

[File name]

K0R_sfr_set.asm

Functions

Function Name	Processing Outline	Argument	Return Value
SER_MTRCIN	Initializes 3-wire serial I/O.	None	None
SER_MTRCST	Starts 3-wire serial I/O operation.	None	None
SER_MTRCBK	Aborts 3-wire serial I/O operation.	None	None
SER_MTRCRE	Resumes 3-wire serial I/O operation.	None	None
SER_MTRCSP	Stops 3-wire serial I/O operation.	None	None
SER_MTRCIT	INTCSI00 buffer empty interrupt/transfer end interrupt servicing	None	None

Function explanations

Function name	SER_MTRCIN
Processing	Initializes 3-wire serial I/O.
Argument	–
Return value	–
Description	Executes initialization.
Remark	–

Function name	SER_MTRCST
Processing	Starts 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Starts transmission/reception operation.
Remark	–

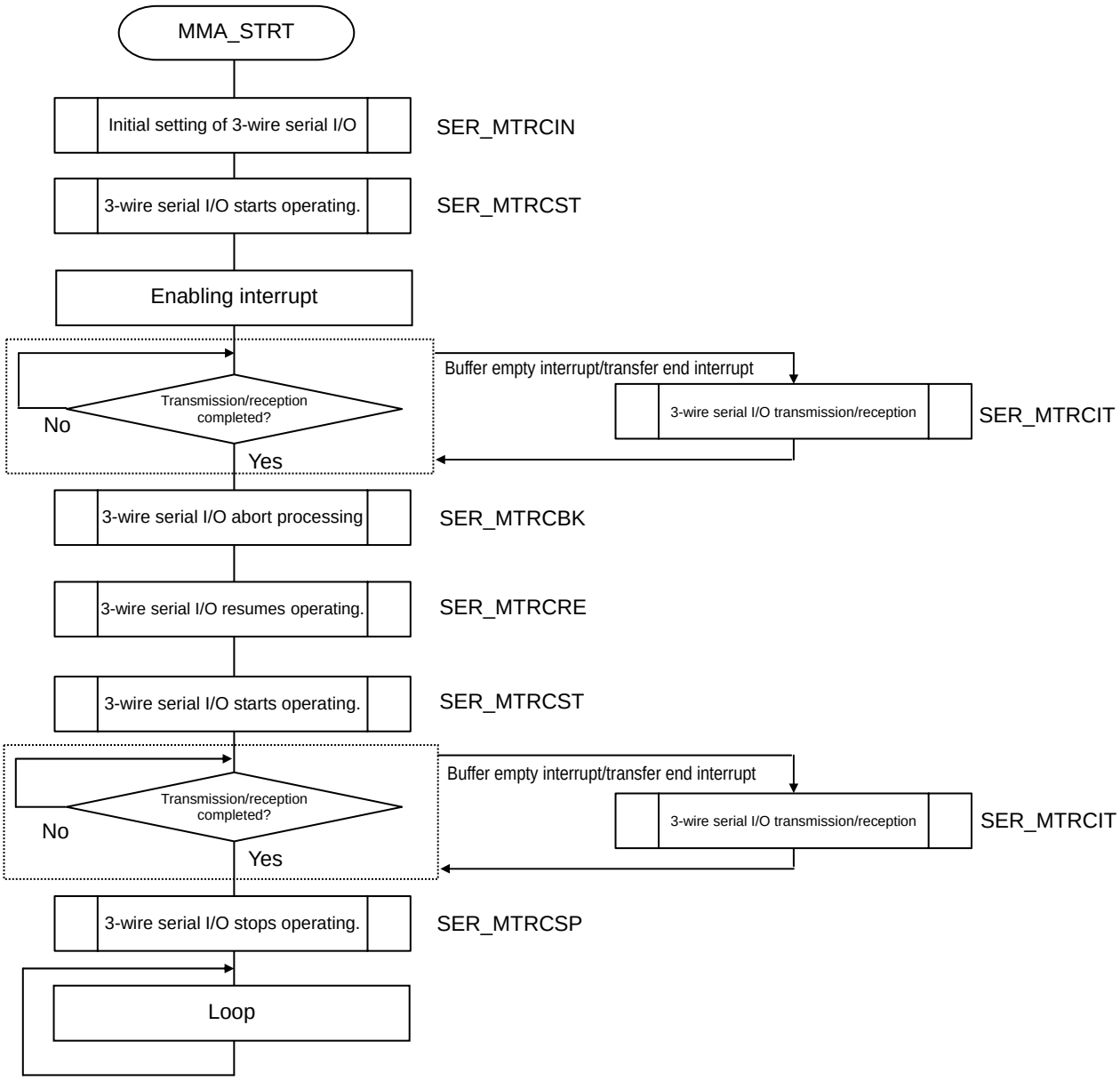
Function name	SER_MTRCBK
Processing	Aborts 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Transits to a communication operation stop state.
Remark	–

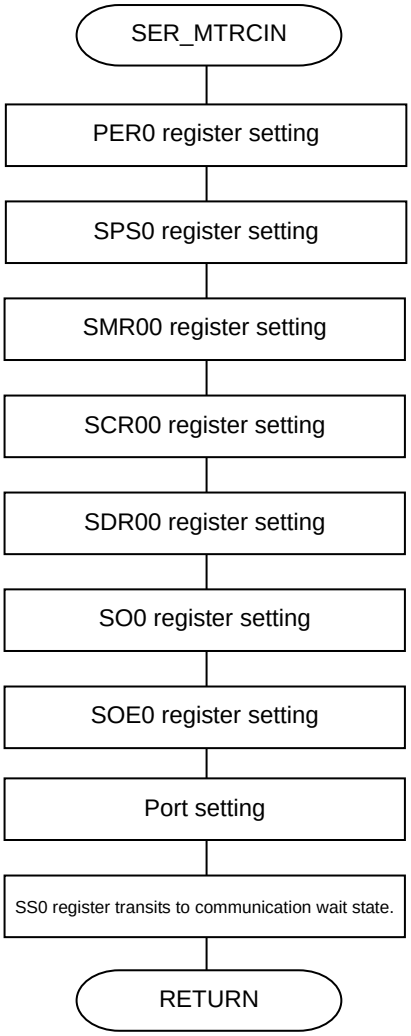
Function name	SER_MTRCRE
Processing	Resumes 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Resumes transmission/reception operation.
Remark	–

Function name	SER_MTRCSP
Processing	Stops 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Stops clock supply.
Remark	–

Function name	SER_MTRCIT
Processing	3-wire serial I/O transmission/reception
Argument	–
Return value	–
Description	INTCSI00 buffer empty interrupt/transfer end interrupt servicing An interrupt is generated when a buffer empty interrupt is generated. When this interrupt is generated, the receive data is read and transmit data is set. When reception is completed, transfer is completed and processing is terminated.
Remark	–

5. FLOWCHARTS





Releases the serial array unit from the reset status and starts clock supply.

Sets the transfer rate, sets the SPS0 register at least 4 clocks after the PER0 register has been set to 1.

Communication setting (communication operation)

Communication setting (communication format: 8-bit data, LSB)

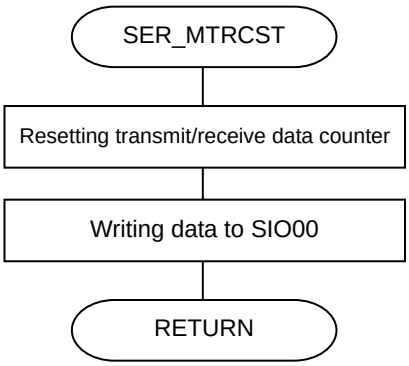
Transfer rate setting: 9,600 bps

Manipulates the SO00 and CKO00 bits and sets the initial output level.

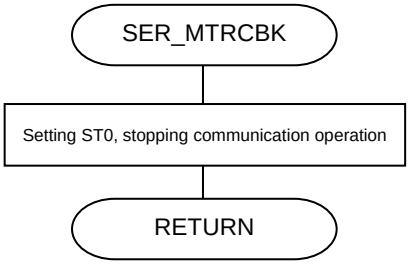
Sets 1 to the SOE00 bit and enables data output of the target channel.

Validates data output of the target channel by setting the port register and port mode register.

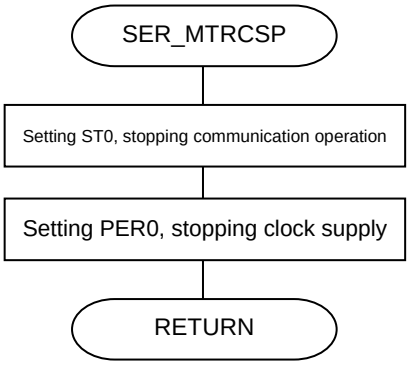
Sets 1 to the SS00 bit of the target channel and sets SE00 to 1.



Writes transmit data.

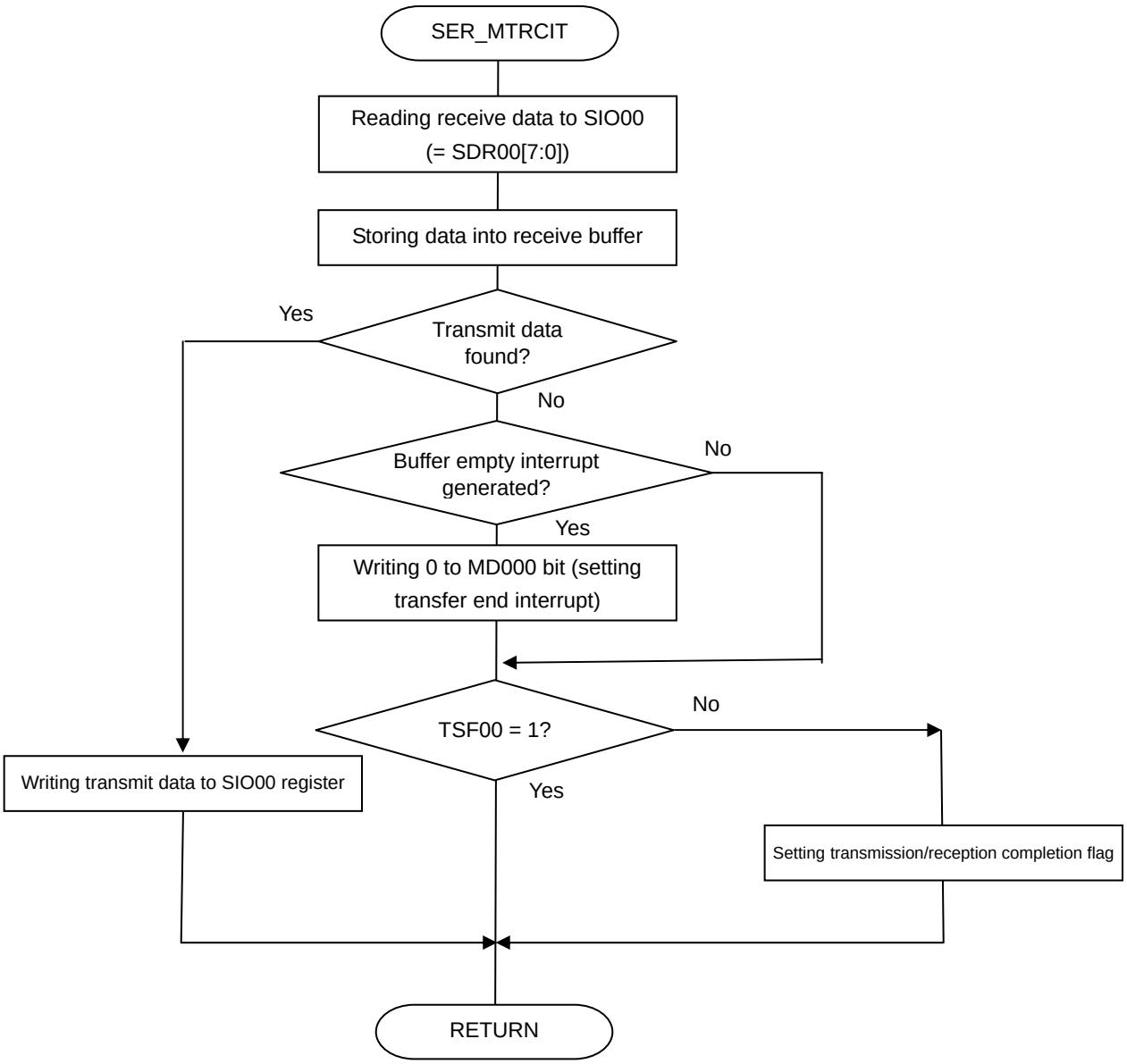


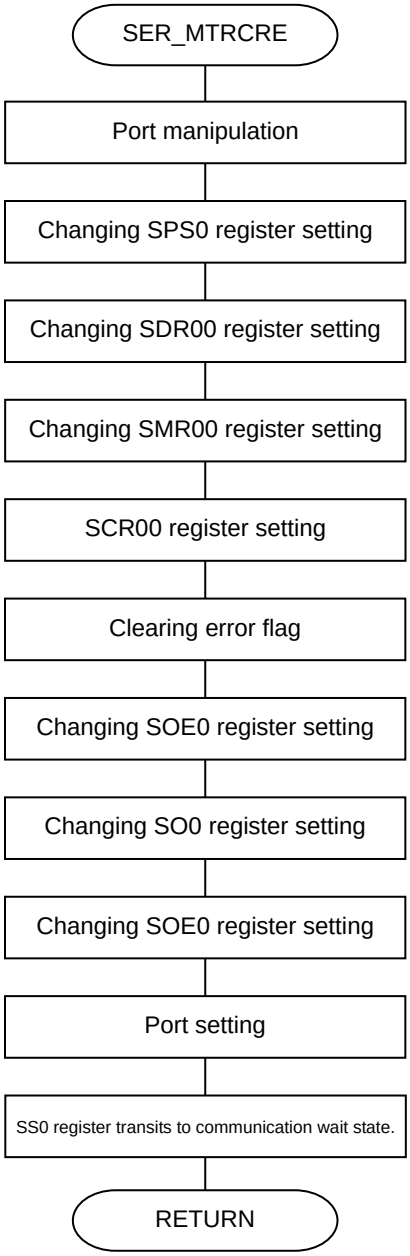
Stops communication operation.



Stops communication operation.

Stops clock supply.


SER_MTRCIT
Reading receive data to SIO00 (= SDR00[7:0])
Storing data into receive buffer
Transmit data found?
Yes
No
Buffer empty interrupt generated?
No
Yes
Writing 0 to MD000 bit (setting transfer end interrupt)
TSF00 = 1?
No
Yes
Writing transmit data to SIO00 register
Setting transmission/reception completion flag
RETURN



Invalidates data output and clock output of the target channel by setting the port register and port mode register.

Changes the setting if the division ratio of the operation clock is incorrectly set.

Changes the setting if the transfer baud rate is incorrectly set.

Changes the setting if the SMR00 register is incorrectly set.

Changes the setting if the SCR00 register is incorrectly set.

Clears the FEF, PEF, and OVF flags, if they are set, by using the SIR00 register.

Sets 0 to the SOE00 bit and stops data output of the target channel.

Manipulates the SO00 and CKO00 bits and sets the initial output level.

Sets 1 to the SOE00 bit and enables data output of the target channel.

Validates data output of the target channel by setting the port register and port mode register.

Sets 1 to the SS0 bit of the target channel and sets SE00 to 1.