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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 (Slave Transmission/Reception, Continuous Transmission/Reception Mode) (Serial Array Unit), C 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 (slave transmission/reception (continuous transmission/reception mode)) for the 78K0R/Kx3.

In this sample program, slave 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.
- 8-bit data
- LSB first
- Transmit data: 3BH (10 bytes)
- Receive data: 10 bytes
- INTCSI00 buffer empty interrupt/transfer end 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)	Sets the transfer rate.
	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)	
I/O	Data input: SI00 (P11) Data output: SO00 (P12) Clock input: SCK00 (P10)	
Interrupt	Transfer end interrupt (INTCSI00) of CSI00	
Others		

3. SOFTWARE CONFIGURATION

Files

File Name	Processing Outline	Remark
K0R_def.h[Note]	Definition file	
K0R_init.c[Note]	Initialization processing	
K0R_ext.h	External declaration	
K0R_main.c	Main processing	
K0R_sfr_set.c	3-wire serial I/O processing Slave transmission/reception (continuous transmission/reception mode)	

Note These files are commonly used by the sample programs.

4. FUNCTION EXPLANATIONS

[File name]

K0R_main.c

Function

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

Function explanations

Function name	main
Processing	Main routine
Argument	–
Return value	–
Description	Executes initialization processing and then starts transmission operation.
Remark	–

[File name]

K0R_sfr_set.c

Functions

Function Name	Processing Outline	Argument	Return Value
SER_STRCIN	Initializes 3-wire serial I/O.	None	None
SER_STRCRE	Resumes 3-wire serial I/O operation.	None	None
SER_STRCST	Starts 3-wire serial I/O operation.	None	None
SER_STRCBK	Aborts 3-wire serial I/O operation.	None	None
SER_STRCSP	Stops 3-wire serial I/O operation.	None	None
SER_STRCIT	INTCSI00 buffer empty interrupt/transfer end interrupt servicing	None	None

Function explanations

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

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

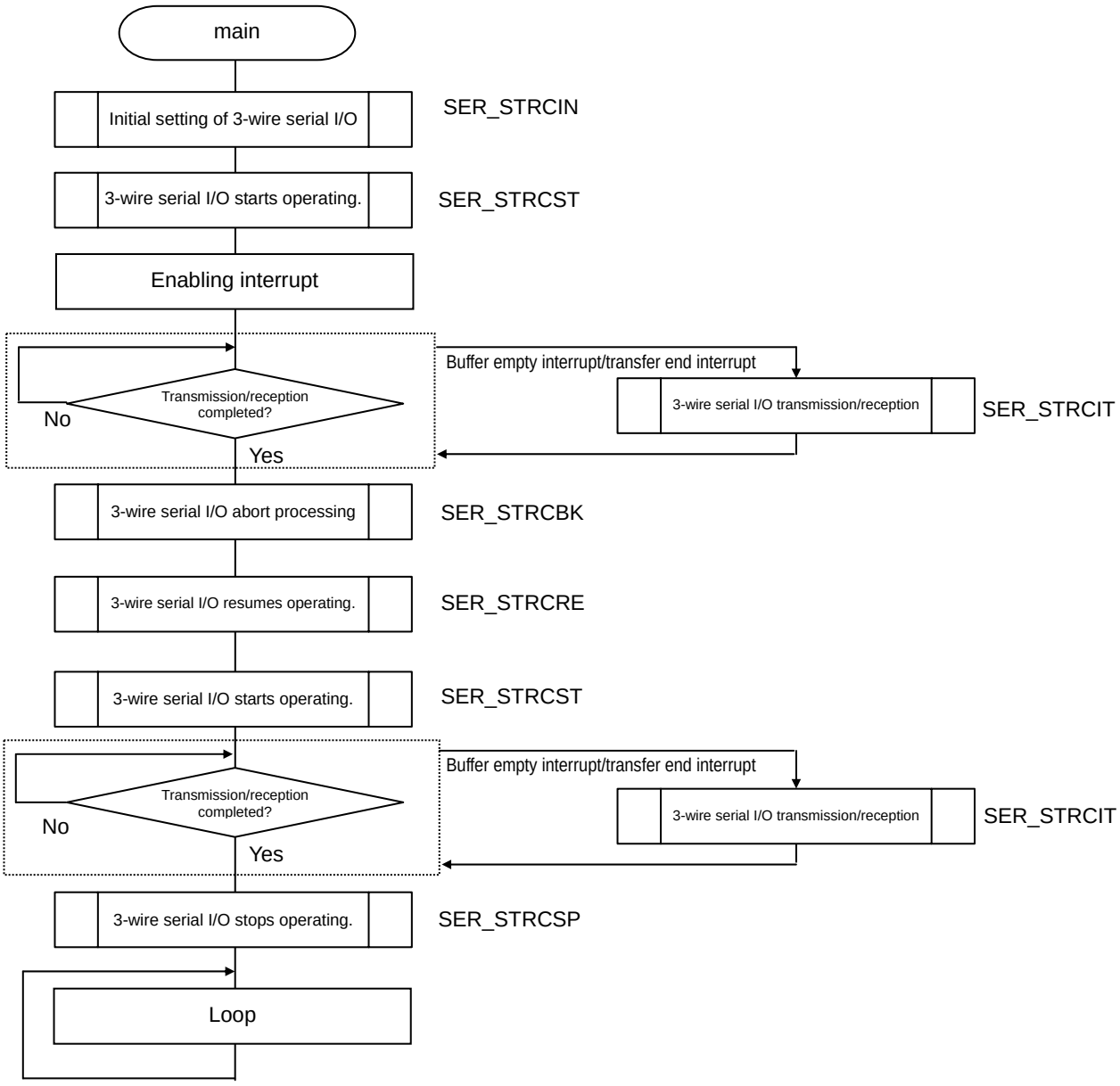
Function name	SER_STRCST
Processing	Starts 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Enables clock output.
Remark	–

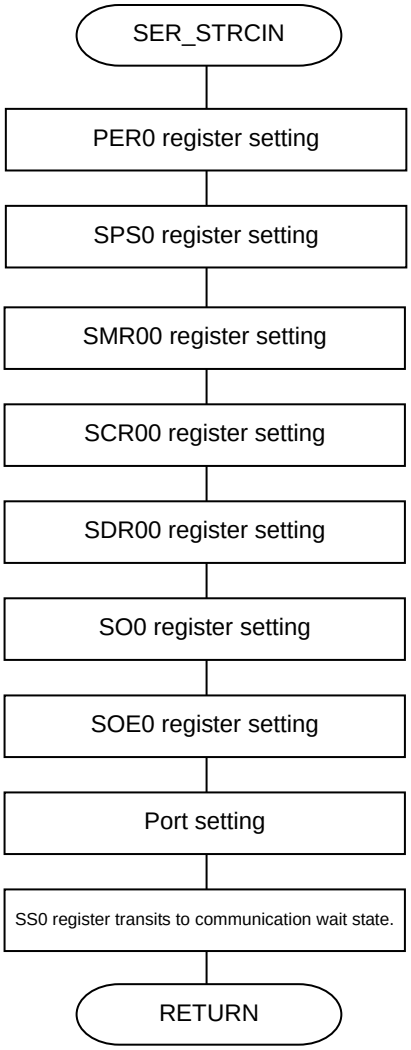
Function name	SER_STRCBK
Processing	Aborts 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Performs transmission/reception operation abort processing.
Remark	–

Function name	SER_STRCSP
Processing	Stops 3-wire serial I/O operation.
Argument	–
Return value	–
Description	Performs transmission/reception operation stop processing.
Remark	–

Function name	SER_STRCIT
Processing	3-wire serial I/O transmission/reception
Argument	–
Return value	–
Description	INTCSI00 buffer empty interrupt/transfer end interrupt servicing 3-wire serial I/O transmission/reception operates by a buffer empty interrupt during initialization, and by a transfer end interrupt when reception is completed. The operation is completed when the transfer end interrupt is generated.
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)

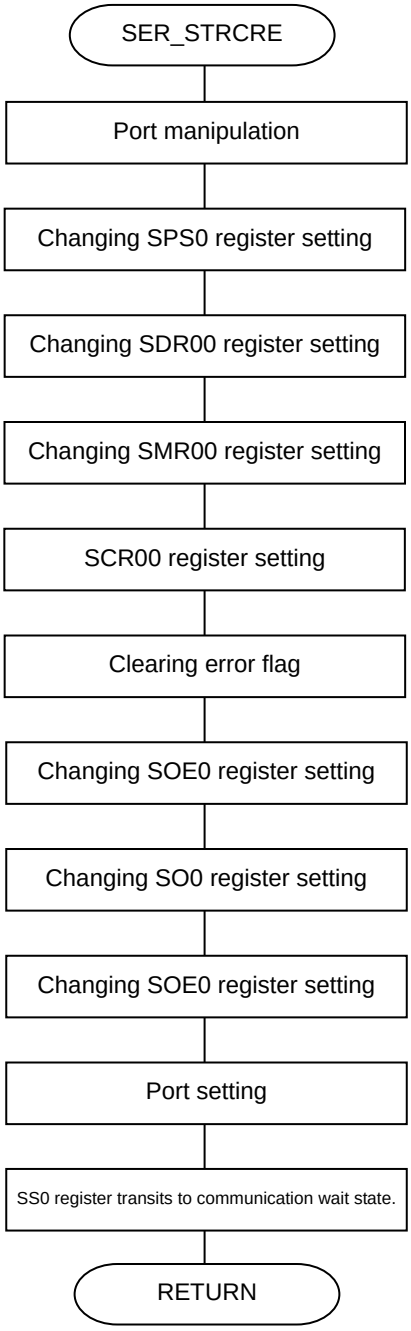
Sets the transfer rate to 0000H.

Output setting

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.



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 division ratio of the operation clock 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.

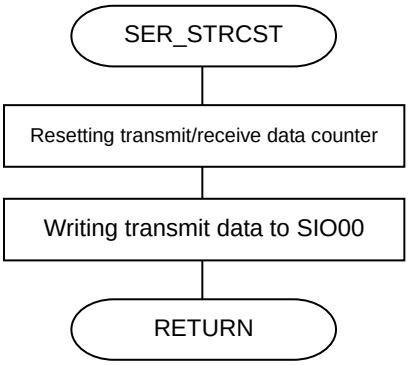
Sets 0 to the SOE00 bit and stops data output of the target channel.

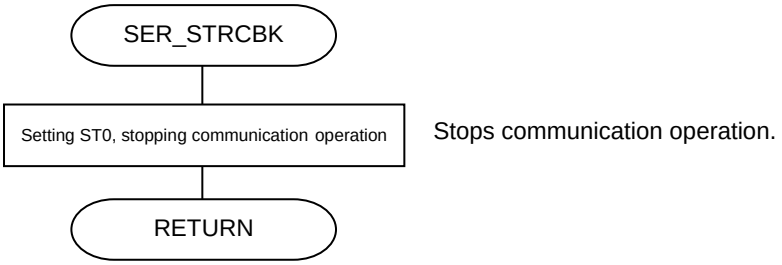
Manipulates the SO00 and CK000 bits, and sets the initial output level.

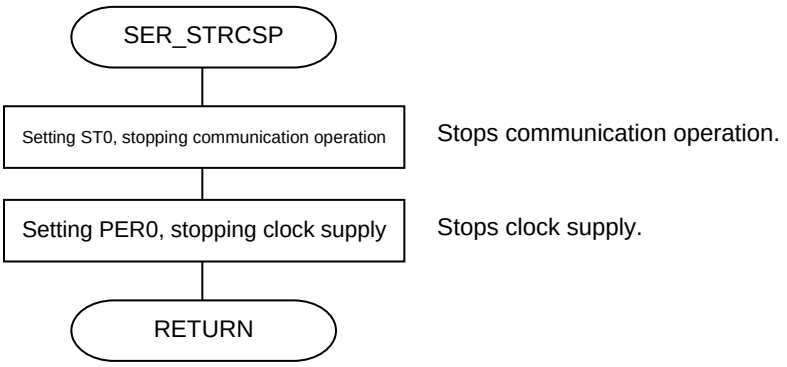
Sets 1 to the SOE00 bit and enables data output of the target channel.

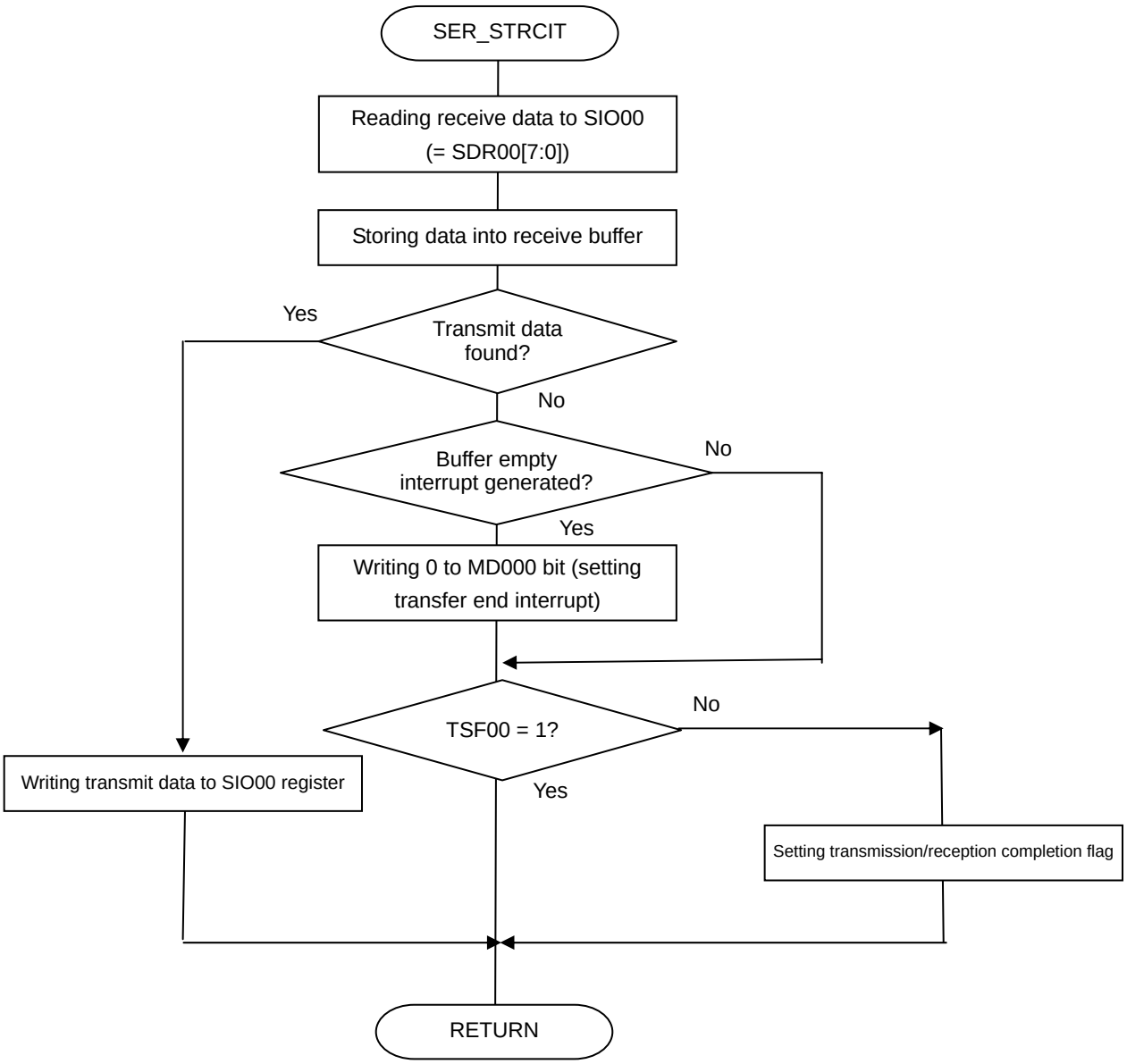
Validates data output of the target channel by setting the port register and port mode register.

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


SER_STRCST
Resetting transmit/receive data counter
Writing transmit data to SIO00
Writes transmit data.
RETURN


SER_STRCBK
Setting ST0, stopping communication operation
Stops communication operation.
RETURN


SER_STRCSP
Setting ST0, stopping communication operation
Stops communication operation.
Setting PER0, stopping clock supply
Stops clock supply.
RETURN


SER_STRCIT
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