M3H Group(1)
Application Note
Serial Peripheral Interface
(TSPI-B)

Outlines

This application note is a reference material for developing products using the serial peripheral interface (TSPI) functions of M3H Group(1).
This document helps the user check operation of the product and develop its program.

Target sample program: TSPI_FLASH

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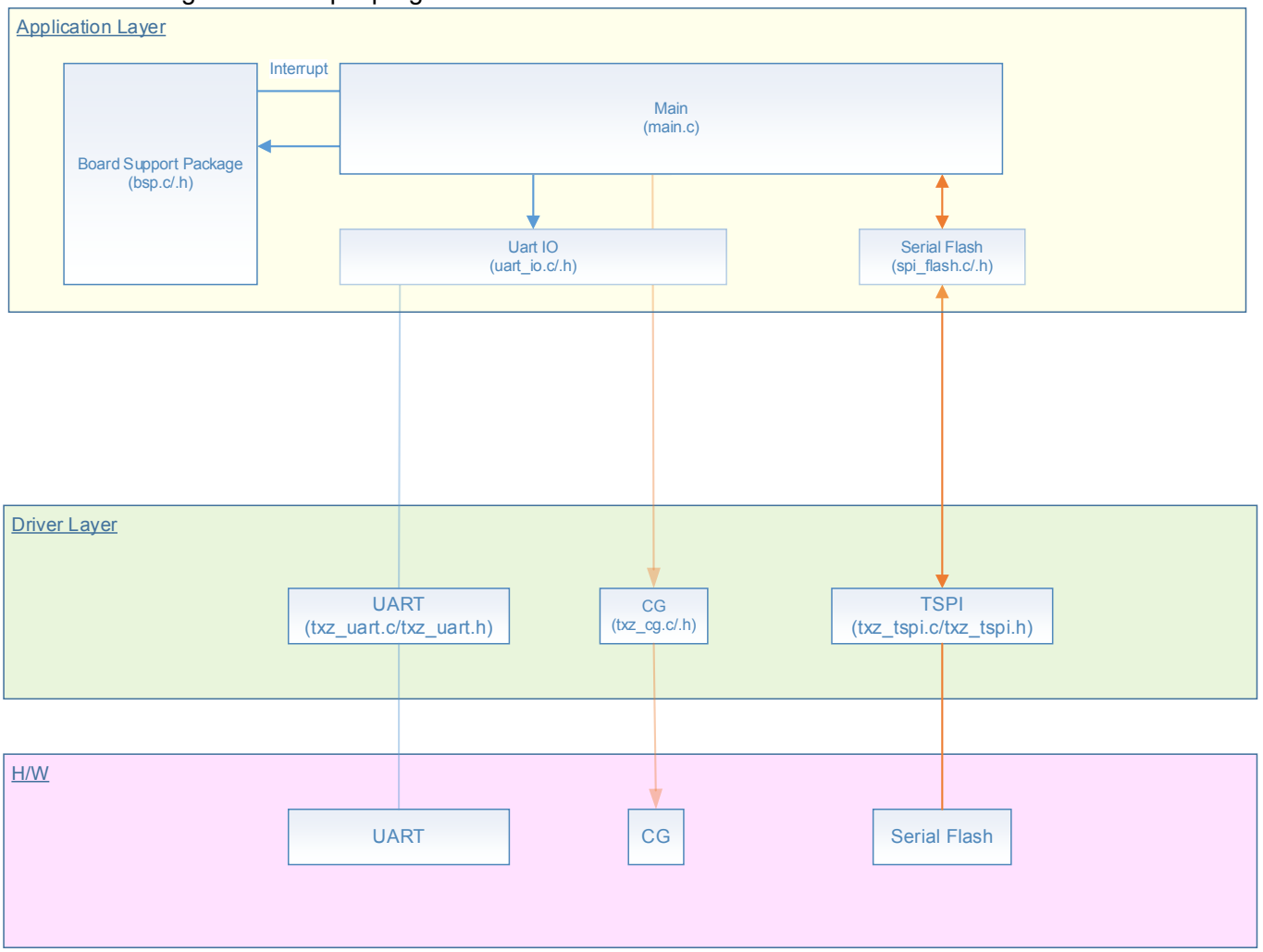
Table of Contents

1. Preface

This sample program is used to check the operation of TSPI communication function.
It writes data to SPI EEPROM and reads data from SPI EEPROM through USB-UART interface on the terminal software on the host PC.

Structure diagram of Sample program



2. Reference Document

- Datasheet
  TMPM3H group (1) datasheet Rev2.0 (Japanese edition)
- Reference manual
  Serial peripheral interface (TSPI-B) Rev2.1 (Japanese edition)
- Other reference document
  TMPM3H(1) Group Peripheral Driver User Manual (Doxygen)

3. Function to Use

IP	channel	port	Function / operation mode
Serial peripheral interface	ch1	PP0 (TSPI1CLK) PP1 (TSPI1TXD) PP2 (TSPIRXD) PL6(TSPI1CS0)	SPI mode
Asynchronous communication	ch0	PA1 (UT0TXDA) PA2 (UT0RXD)	UART mode

4. Target Device

The target devices of application note are as follows.

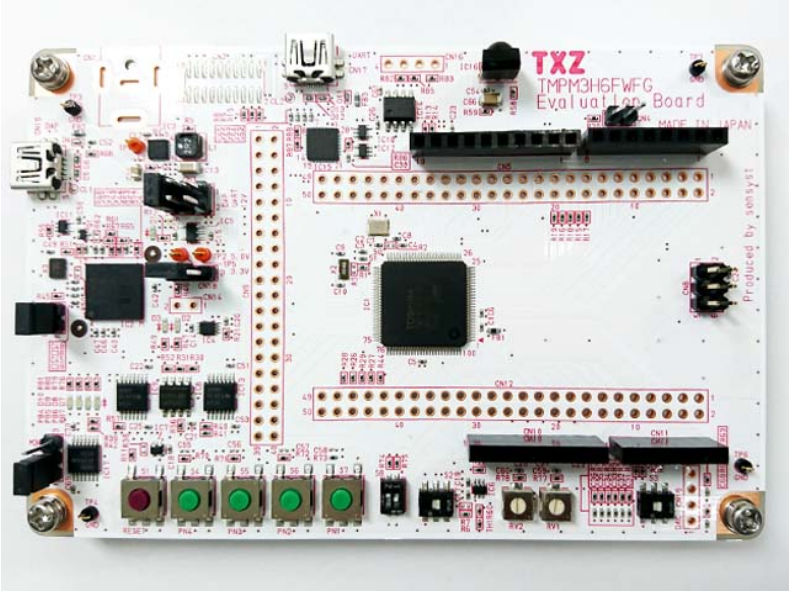
TMPM3H6FWFG	TMPM3H6FUFG	TMPM3H6FSFG
TMPM3H6FWDFG	TMPM3H6FUDFG	TMPM3H6FSDFG
TMPM3H5FWFG	TMPM3H5FUFG	TMPM3H5FSFG
TMPM3H5FWDFG	TMPM3H5FUDFG	TMPM3H5FSDFG
TMPM3H4FWUG	TMPM3H4FUUG	TMPM3H4FSUG
TMPM3H4FWFG	TMPM3H4FUFG	TMPM3H4FSFG
TMPM3H3FWUG	TMPM3H3FUUG	TMPM3H3FSUG
TMPM3H2FWDUG	TMPM3H2FUDUG	TMPM3H2FSDUG
TMPM3H2FWQG	TMPM3H2FUQG	TMPM3H2FSQG
TMPM3H1FWUG	TMPM3H1FUUG	TMPM3H1FSUG
TMPM3H1FPUG	TMPM3H0FSDUG	TMPM3H0FMDUG

* This sample program operates on the evaluation board of TMPM3H6FWFG.
If other function than the TMPM3H6 one is checked, it is necessary that CMSIS Core related files (C startup file and I/O header file) should be changed properly.
The BSP related file is dedicated to the evaluation board (TMPM3H6). If other function than the TMPM3H6 one is checked, the BSP related file should be changed properly.

5. Operation confirmation condition

Used microcontroller TMPM3H6FWFG
Used board TMPM3H6FWFG Evaluation Board (Product of Sensyst)
Unified development environment IAR Embedded Workbench for ARM 8.11.2.13606
Unified development environment µVision MDK Version 5.24.2.0
Terminal software Tera Term V4.96
Sample program V1100

Evaluation board (TMPM3H6FWFG Evaluation Board) (Top view)



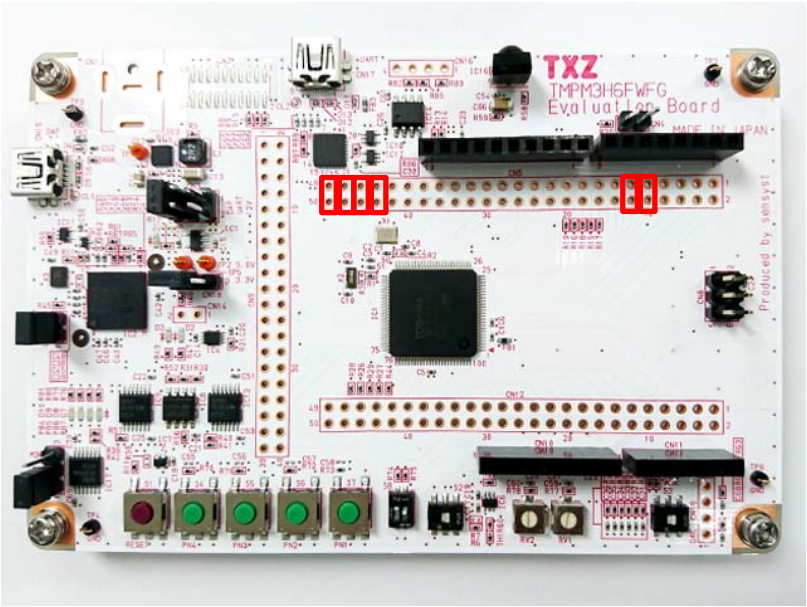
For purchasing the board, refer to the following homepage. (http://www.chip1stop.com/)

6. Evaluation Board Setting

The following pin connections should be done on the evaluation board.

CN5		
Use	Through-hole No.	Setting
UART (RXD)	9-10	Connection
UART (TXD)	11-12	Connection

CN9		
Use	Through-hole No.	Setting
TSPI (FSS)	43-44	Connection
TSPI (CLK)	45-46	Connection
TSPI (DO)	47-48	Connection
TSPI (DI)	49-50	Connection



7. Operation of Evaluation Board

Connect the PC with the USB_UART terminal of the evaluation board with a USB cable.
After activating the terminal software (Tera Term), the PC performs communication setting.
Push the reset button on the evaluation board.

8. Outline of Serial Peripheral Interface

TSPI (synchronous serial communication) can select SPI and SIO formats, and the clock can be selected between Clock master and Clock slave. So it has four modes to operate. 1 unit circuit operates as 1 channel transmission and reception circuit (TSPIxTXD, TSPIxRXD, TSPIxSCK, SPIxCS0/1/2/3, and TSPIxCSIN).

8.1. Clock Supply

When TSPI is used, the corresponding clock enable bits should be set to “1” (Clock supply) in fsys supply stop register A (***[CGFSYSENA]***), fsys supply stop register B (***[CGFSYSENB]***), and fc supply stop register (***[CGFCEN]***).
For the details, refer to “Clock Control and Operation Mode” in Reference manual.

When stopping supply of a clock, please check that TSPI has stopped (***[TSPIxCR0]***<TSPIE>=0 (TSPI control)).
Moreover, also when you change operational mode to STOP1/STOP2, please check that TSPI has stopped.

9. Sample Program

Enter the command (write or read) on the terminal software.
When the “write” command is executed, the input character is stored to I2C EEPROM. When the “read” command is executed, the data stored in I2C EEPROM is read and displays it in the terminal software.

9.1. Initialization

The following initialization is done after power is supplied.
The PORT setting is executed after the initialization of each clock setting, the watchdog timer setting and the clock setting.

9.2. Sample program main operation

After the initialization operation, shift to the main function and do the following initialization.

1: Initialization of BSP (Board Support Package)
2: Initialization of variables
3: Initialization of application
4: Initialization of board
5: Initialize the driver
6: Erase SPI FLASH
7: Main control of sample program

After the above processing, perform the following operations on PC terminal software (Tera Term).
"Command>" is displayed in Tera Term.
The “write” or “read” command should be input according to the following format.
“write” command: The input character is stored to SPI EEPROM (Address 0x0).
“read” command: SPI EEPROM (Address 0x0) is read and the read data is displayed through Tera Term.
Command format:

write␣command

write␣X X: Any character

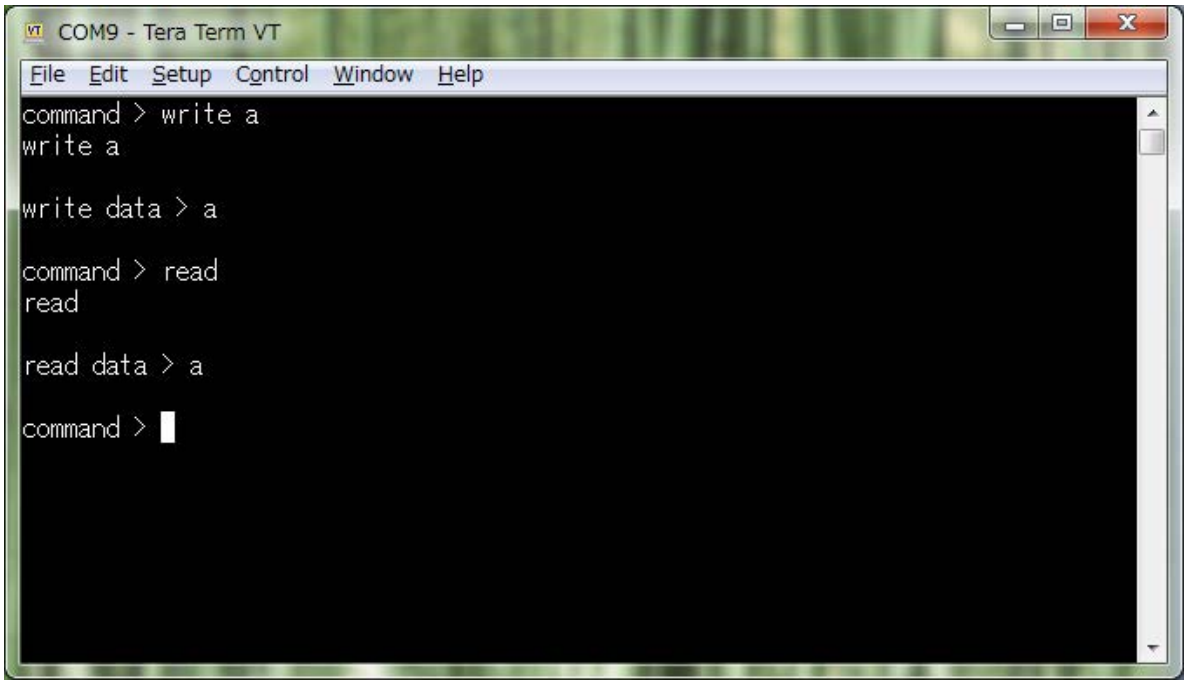
read␣command

read

Used memory	SPI EEPROM: M25P16-VMN6TP
Used port	FSS:PL6, CLK:PP0, DO:PP1, DI:PP2

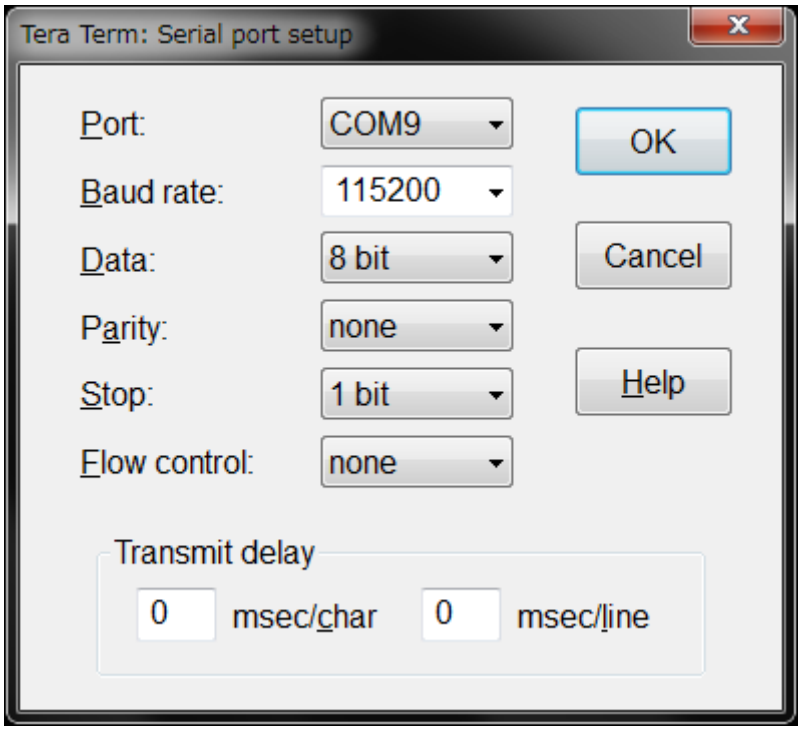
9.3. Output Example of Sample Program

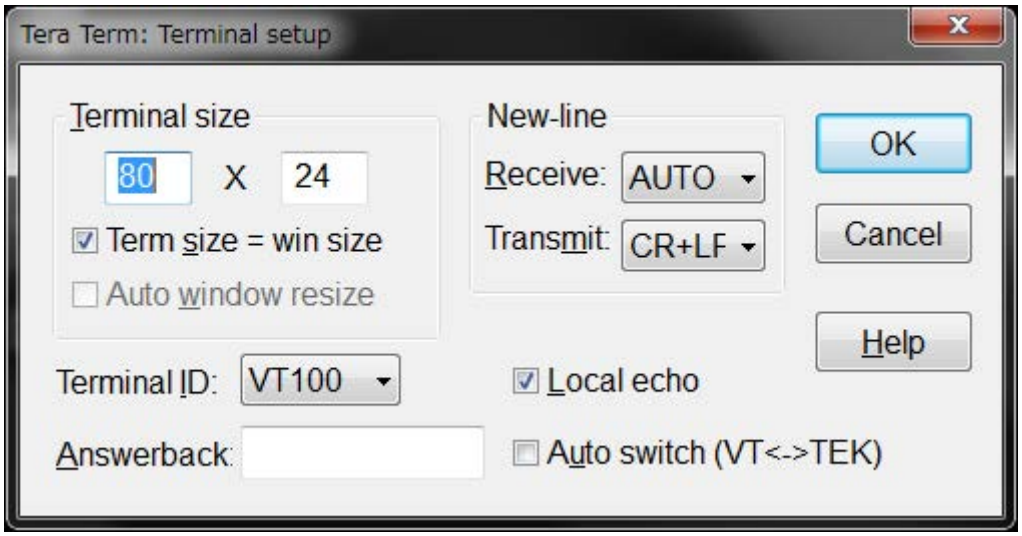
When the sample program operates, the command results are shown as follows.



9.3.1. Setting Example of Terminal Software

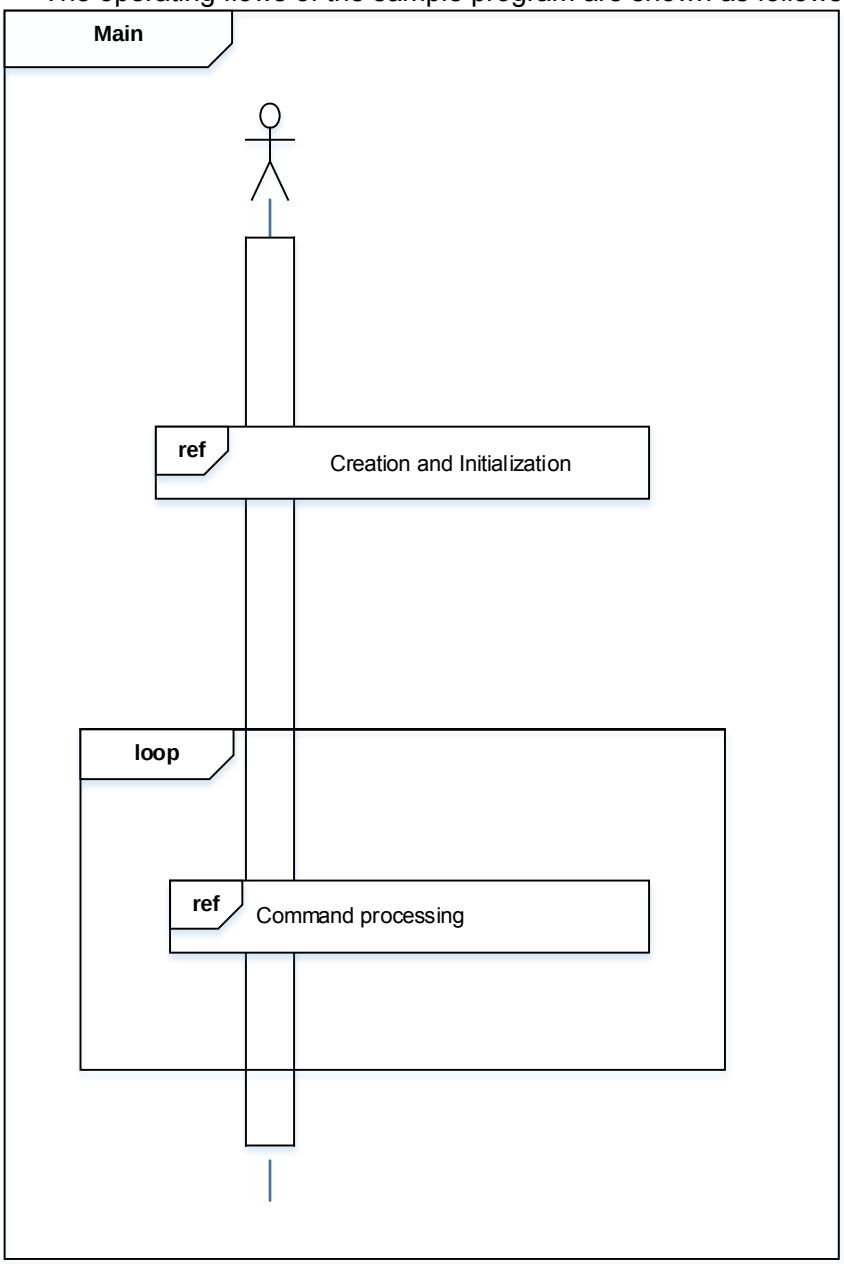
The operation of the terminal software (Tera Term) has been checked with the following settings.

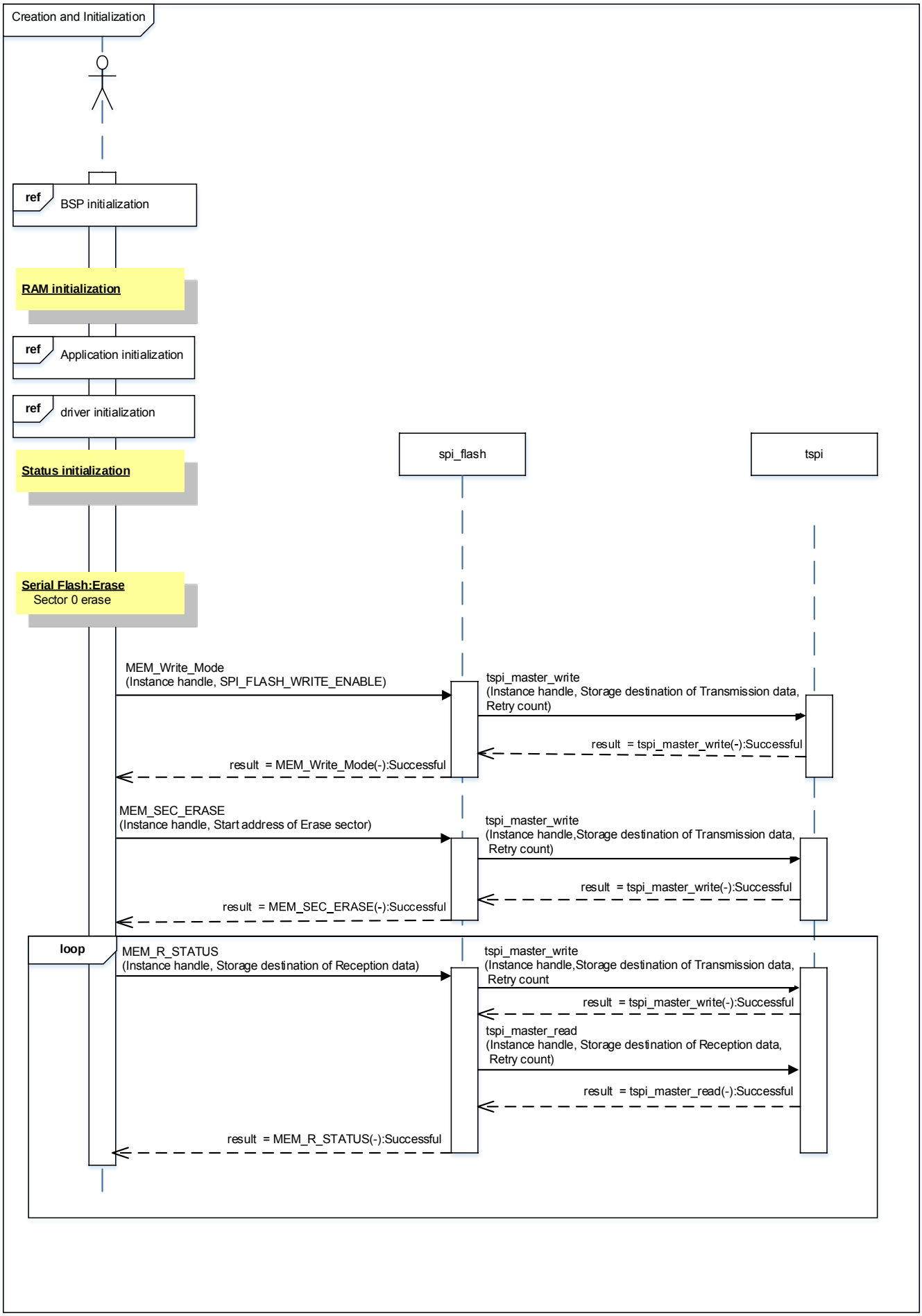


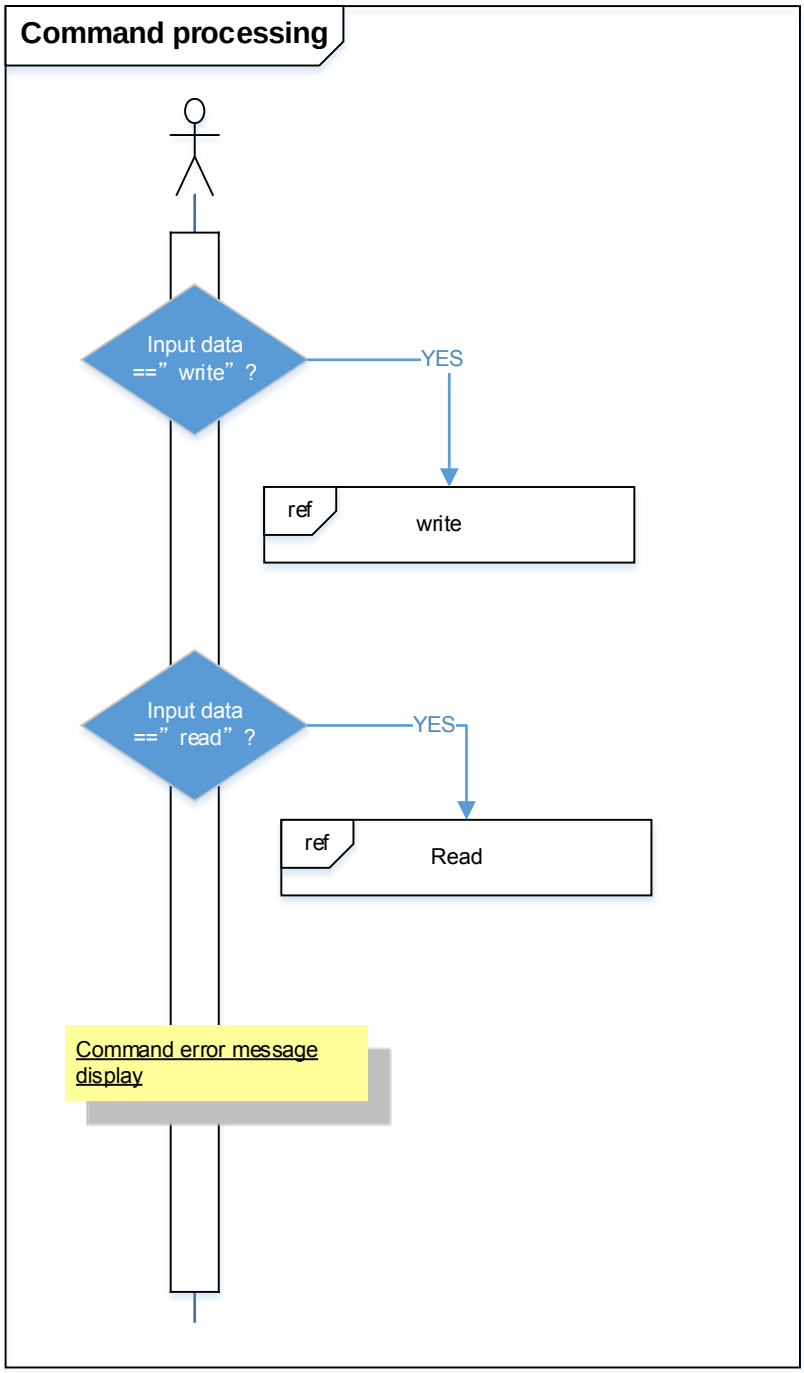


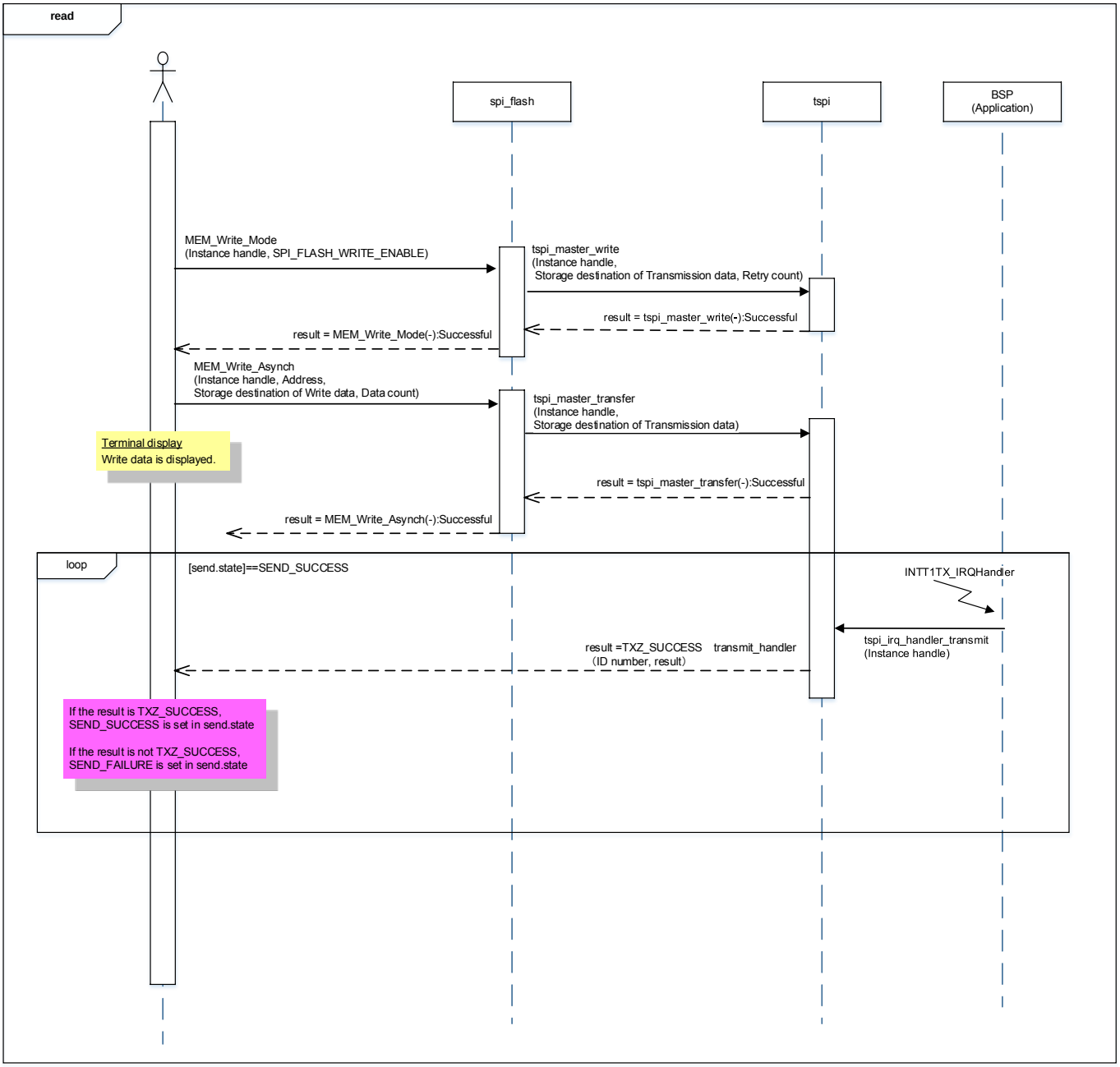
9.4. Operating Flow of Sample program

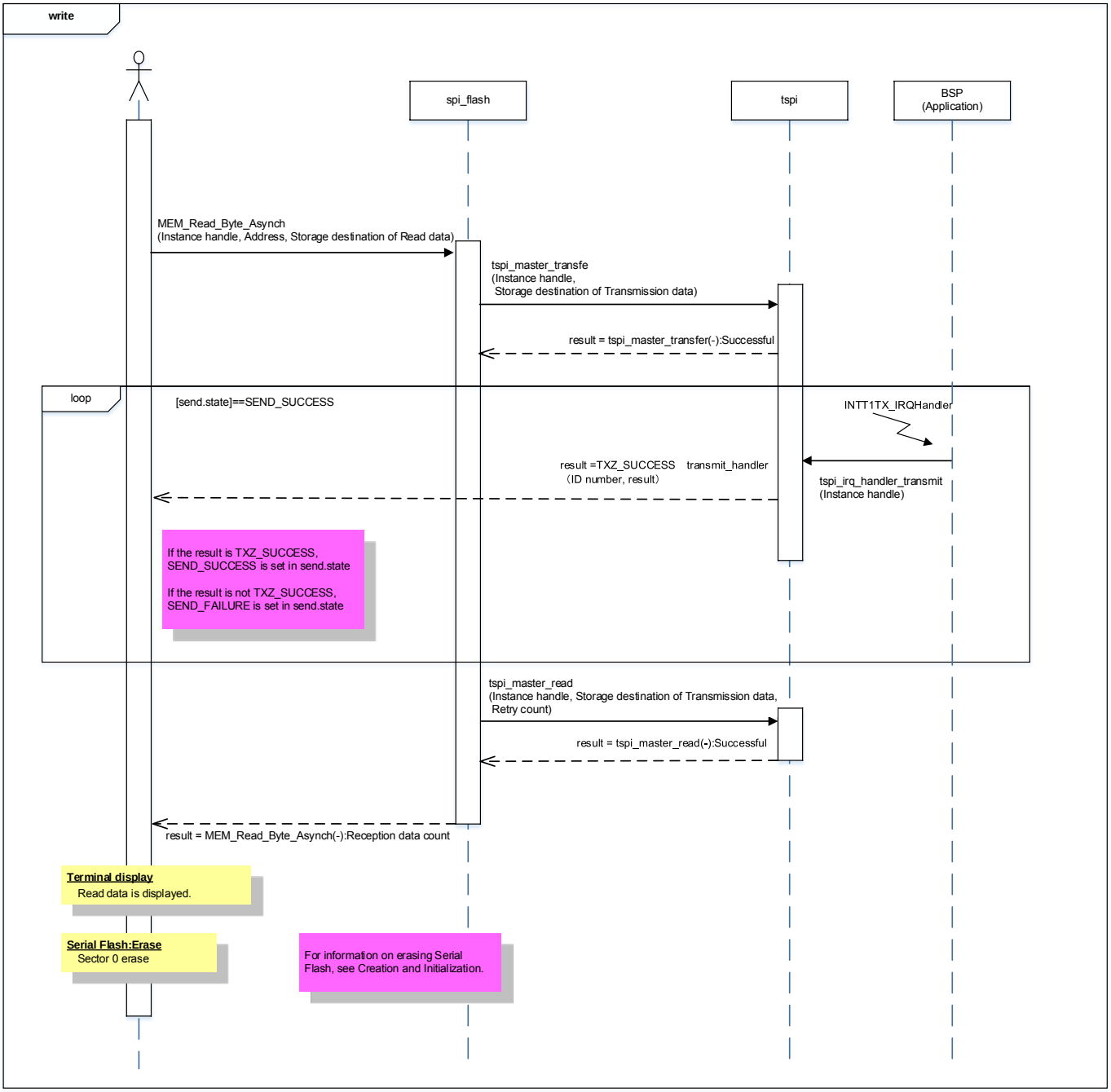
The operating flows of the sample program are shown as follows.




Creation and Initialization
ref
BSP initialization
RAM initialization
ref
Application initialization
ref
driver initialization
Status initialization
spi_flash
tspi
Serial Flash:Erase
Sector 0 erase
MEM_Write_Mode
(Instance handle, SPI_FLASH_WRITE_ENABLE)
tspi_master_write
(Instance handle, Storage destination of Transmission data,
Retry count)
result = tspi_master_write(-):Successful
result = MEM_Write_Mode(-):Successful
MEM_SEC_ERASE
(Instance handle, Start address of Erase sector)
tspi_master_write
(Instance handle,Storage destination of Transmission data,
Retry count)
result = tspi_master_write(-):Successful
result = MEM_SEC_ERASE(-):Successful
loop
MEM_R_STATUS
(Instance handle, Storage destination of Reception data)
tspi_master_write
(Instance handle,Storage destination of Transmission data,
Retry count
result = tspi_master_write(-):Successful
tspi_master_read
(Instance handle, Storage destination of Reception data,
Retry count)
result = tspi_master_read(-):Successful
result = MEM_R_STATUS(-):Successful


Command processing
Input data
==" write" ?
YES
ref
write
Input data
==" read" ?
YES
ref
Read
Command error message
display


read
spi_flash
tspi
BSP
(Application)
MEM_Write_Mode
(Instance handle, SPI_FLASH_WRITE_ENABLE)
tspi_master_write
(Instance handle,
Storage destination of Transmission data, Retry count)
result = tspi_master_write(-):Successful
result = MEM_Write_Mode(-):Successful
MEM_Write_Asynch
(Instance handle, Address,
Storage destination of Write data, Data count)
tspi_master_transfer
(Instance handle,
Storage destination of Transmission data)
Terminal display
Write data is displayed.
result = tspi_master_transfer(-):Successful
result = MEM_Write_Asynch(-):Successful
loop
[send.state]==SEND_SUCCESS
INTT1TX_IRQHandler
tspi_irq_handler_transmit
(Instance handle)
result =TXZ_SUCCESS transmit_handler
(ID number, result)
If the result is TXZ_SUCCESS,
SEND_SUCCESS is set in send.state
If the result is not TXZ_SUCCESS,
SEND_FAILURE is set in send.state


write
spi_flash
tspi
BSP
(Application)
MEM_Read_Byte_Asynch
(Instance handle, Address, Storage destination of Read data)
tspi_master_transfe
(Instance handle,
Storage destination of Transmission data)
result = tspi_master_transfer(-):Successful
loop
[send.state]==SEND_SUCCESS
INTT1TX_IRQHandler
result =TXZ_SUCCESS transmit_handler
(ID number, result)
tspi_irq_handler_transmit
(Instance handle)
If the result is TXZ_SUCCESS,
SEND_SUCCESS is set in send.state
If the result is not TXZ_SUCCESS,
SEND_FAILURE is set in send.state
tspi_master_read
(Instance handle, Storage destination of Transmission data,
Retry count)
result = tspi_master_read(-):Successful
result = MEM_Read_Byte_Asynch(-):Reception data count
Terminal display
Read data is displayed.
Serial Flash:Erase
Sector 0 erase
For information on erasing Serial
Flash, see Creation and Initialization.

10. Precaution

When using the sample program with CPU other than TMPM3H6, please check operation sufficiently.

11. Revision History

Rev	Date	Page	Description
1.0	2018-03-09	-	First release

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