

**M4K 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) function of M4K Group (1).

This document helps the user check operation of the product and develop its program.

Target sample program: TSPI\_ChToCh\_M4K4A

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### 1. Preface

This sample program is used to check the function of the Serial peripheral interface. The character string "TOSHIBA" is written and the read data is output to the terminal software, in the TSPI SIO mode.

### 2. Reference Document

1. Datasheet  
TMPM4K Group (1) datasheet Rev2.0 (Japanese edition)
2. Reference manual  
Serial Peripheral Interface (TSPI-B) Rev3.0 (Japanese edition)  
Asynchronous Serial Communication Circuit (UART-C) Rev3.0 (Japanese edition)
3. Application note  
M4K Group (1) Application Note Startup (CMSIS System & Clock Configuration) Rev1.0
4. Other reference document  
TMPM4KxA Group Peripheral Driver User Manual (Doxygen) V1.0.4.0

### 3. Function to Use

IP	Channel	Port	Function/Operation mode
Serial Peripheral Interface	ch1	PA0 (TSPI1TXD)	Transmission (SIO mode)
		PA2 (TSPI1SCK)	
	ch3	PC1 (TSPI3RXD)	Reception (SIO mode)
		PC2 (TSPI3SCK)	
Asynchronous Serial Communication Circuit	ch0	PK0 (UT0RXD) PK1 (UT0TXDA)	UART mode

### 4. Target Device

The target devices of this application note are as follows;

TMPM4K4FYAUG	TMPM4K4FWAUG	TMPM4K4FUAUG	TMPM4K4FSAUG
TMPM4K4FYAFG	TMPM4K4FWAFG	TMPM4K4FUAFG	TMPM4K4FSAFG
TMPM4K2FYADUG	TMPM4K2FWADUG	TMPM4K2FUADUG	TMPM4K2FSADUG
TMPM4K1FYAUG	TMPM4K1FWAUG	TMPM4K1FUAUG	TMPM4K1FSAUG
			TMPM4K0FSADUG

\* This sample program operates on the evaluation board of TMPM4K4FYAUG.

If other function than the TMPM4K4 one is checked, it is necessary that CMSIS Core related files (the startup file and I/O header file) should be changed properly.

Additionally, the name of microcontroller which is set to the project should be changed.

The BSP related file is dedicated to the evaluation board (TMPM4K4FYAUG). If other function than the TMPM4K4 one is checked, the BSP related file should be changed properly.

## 5. Operation Confirmation Condition

Used microcontroller	TMPM4K4FYAUG
Used board	TMPM4K4 evaluation board (Product of ESP-kikaku Co. Ltd.)
Integrated development environment	IAR Embedded Workbench for ARM 8.22.2
Integrated development environment	Arm® Keil® MDK Version 5.24.2.0
Terminal software	Tera Term V4.96
Sample program	v1.0.0

## 6. Evaluation Board Operation

Board function	Microcontroller pin name
Transmission (SIO mode)	PA0 (TSPI1TXD) PA2 (TSPI1SCK)
Reception (SIO mode)	PC1 (TSPI3RXD) PC2 (TSPI3SCK)

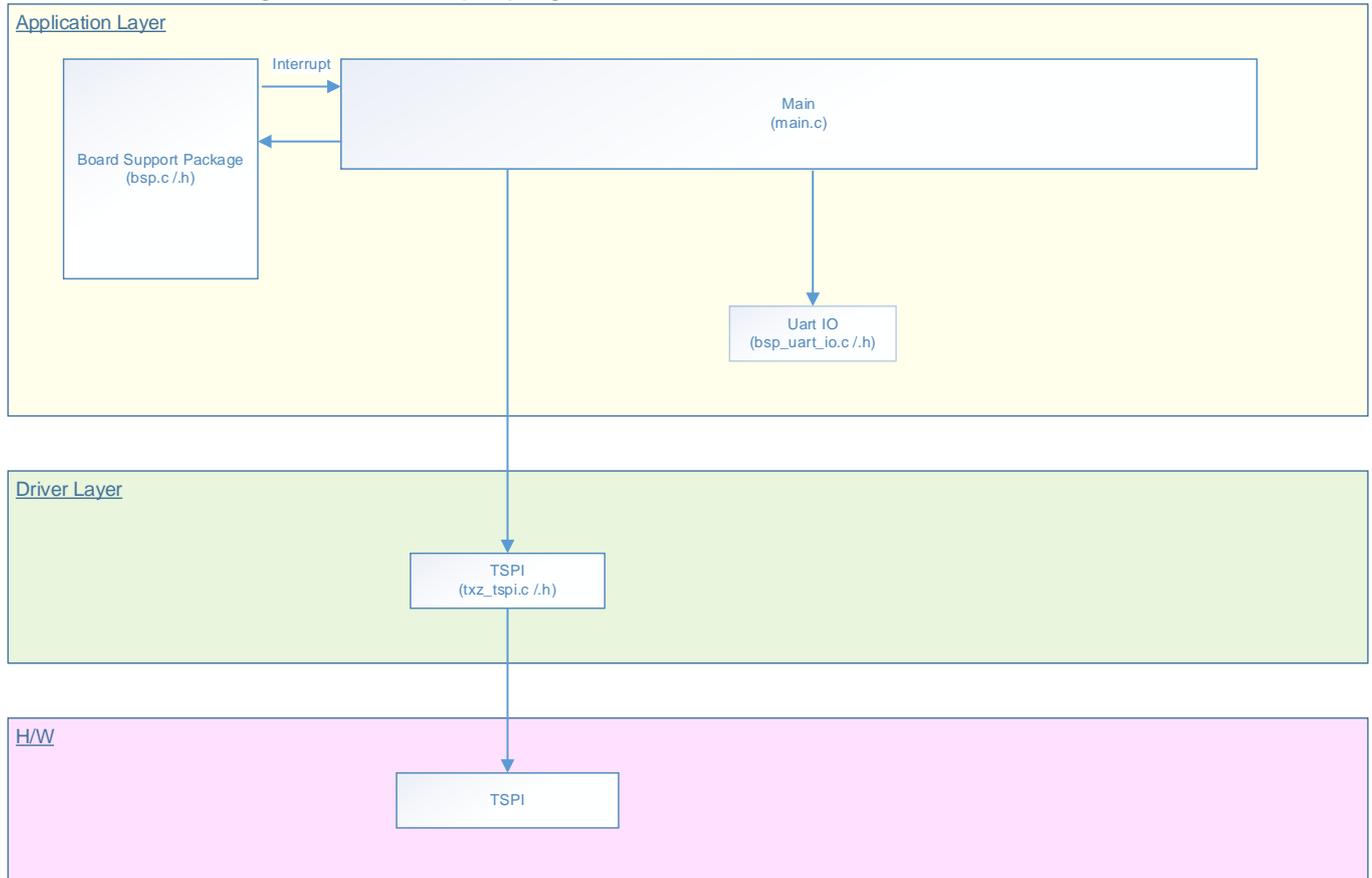
A PC should be connected to the USB\_UART connector to communicate with the terminal software. PA0 and PA2 should be connected to PC1 and PC2, respectively, on the evaluation board to do data transmission and reception for the TSPI.

When the “write” command is input to the terminal software, a data is written. When the “read” command is input, the written data can be read. The read data is output to the terminal software.

## 7. Sample Program

### 7.1. Structure Diagram of Sample Program

The structure diagram of the sample program is shown below.



### 7.2. Startup Routine

The following initialization is done after power is supplied.

The initialization of each clock setting and the initialization of the watchdog timer setting are done.

### 7.3. Main Operation

The initialization of the BSP should be done.

The initialization of the TSPI channel should be done.

The initialization of the USB\_UART and the initialization of the TSPI should be done as the initialization of the application software.

The channel 1 of the TSPI operates as a master channel and the channel 3 of the TSPI operates as a slave channel.

The sample program waits for the input of a command from the terminal software.

When the “write” command is executed in the transmitter, a data is transmitted to the transmission data buffer. The character string “TOSHIBA” is transmitted in this sample program.

When the “read” command is executed, a data is received from the reception buffer. And the received data is output to the terminal software.

After that, the sample program waits for an input and the operations above repeat.

Command format:

“write” command

write

“read” command

read

#### **7.4. Setting of Write Data**

“TOSHIBA” has been set as default to the data which is written by the “write” command.  
The transmission data can be modified by changing the following content in the 199th line in the “main.c”.

```
static uint8_t write_data[10] = "TOSHIBA";
```

### 7.5. Output Example of Terminal Software

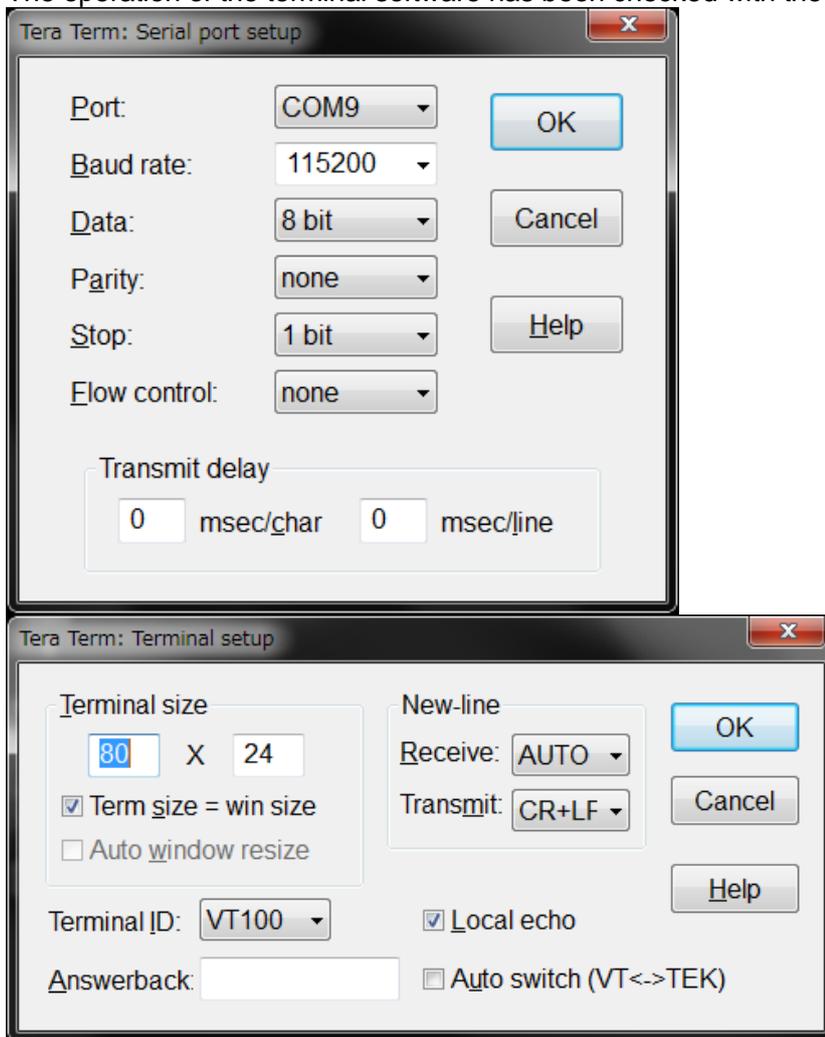
When the sample program is executed, the write and read results of the TSPI are displayed as follows;

```
command > write
command > read
read data > TOSHIBA
command > 012345

Command Error !!
command >
```

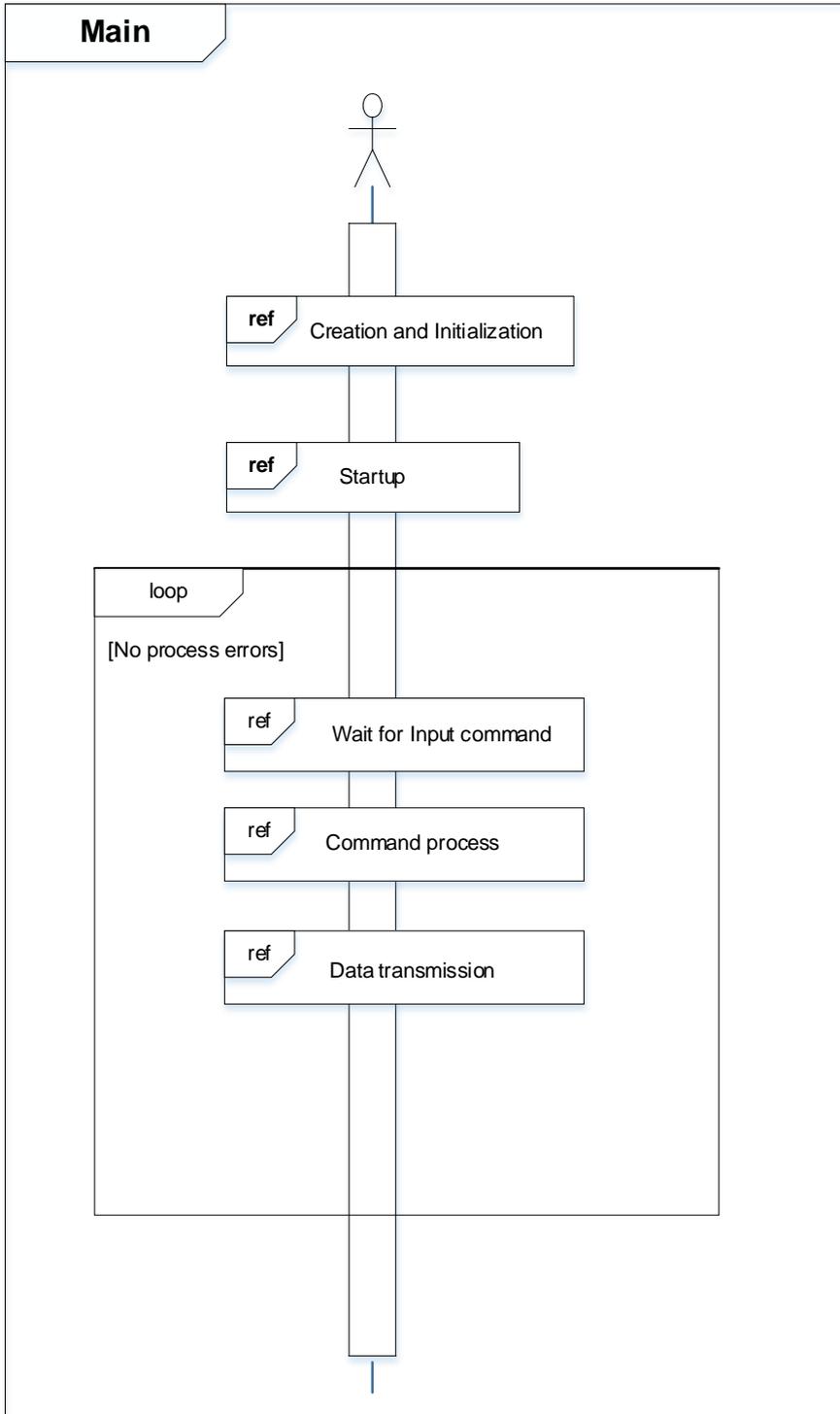
#### 7.5.1. Setting Example of Terminal Software

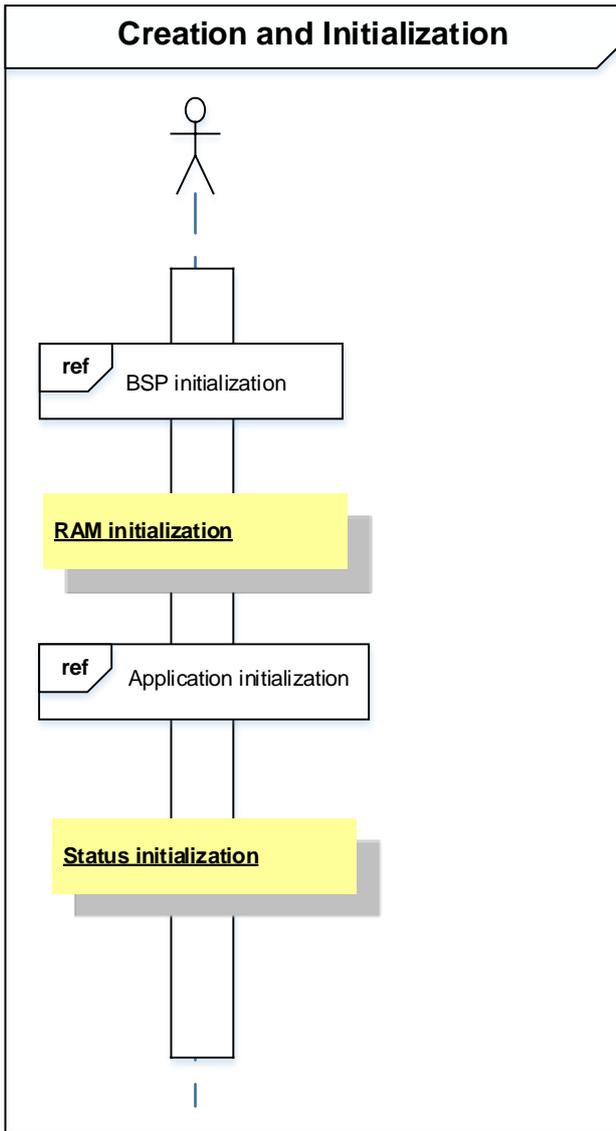
The operation of the terminal software has been checked with the following settings.

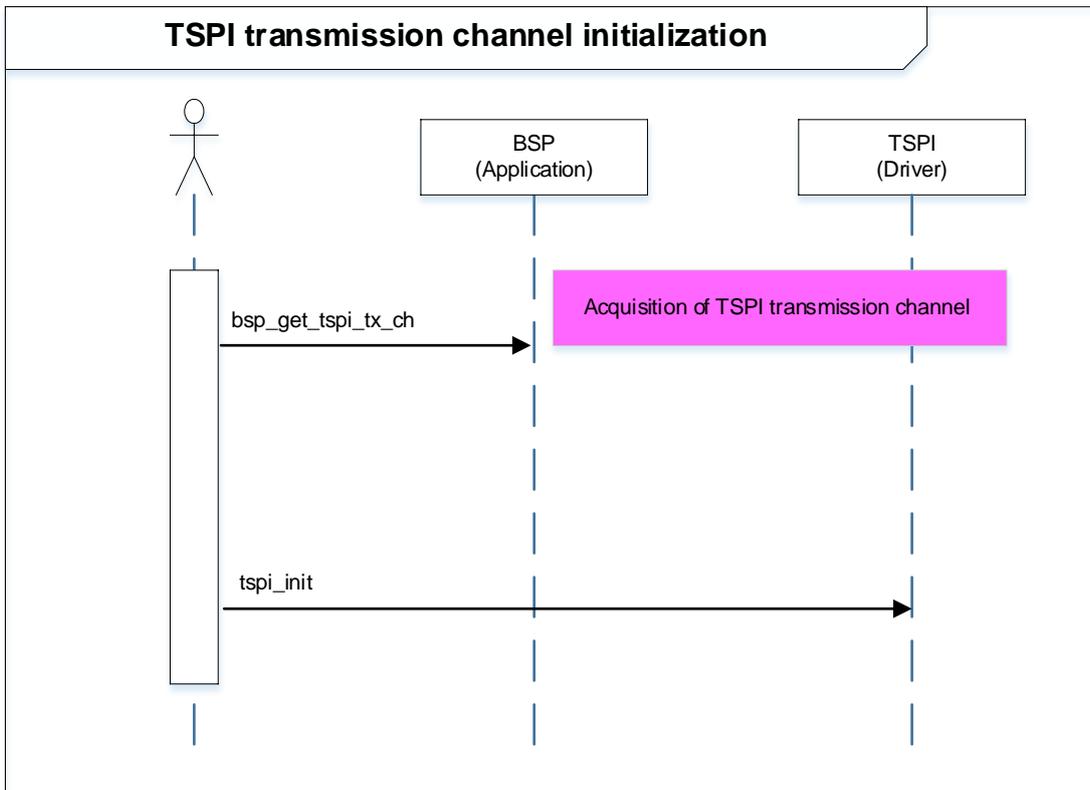
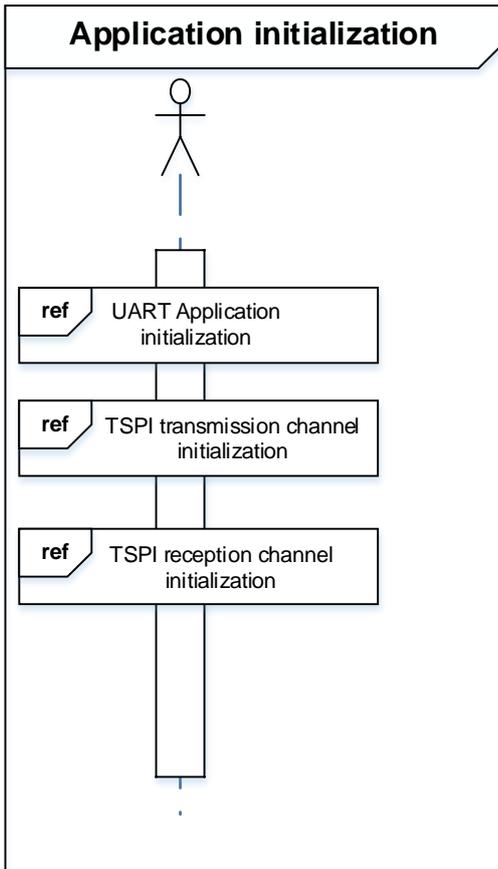


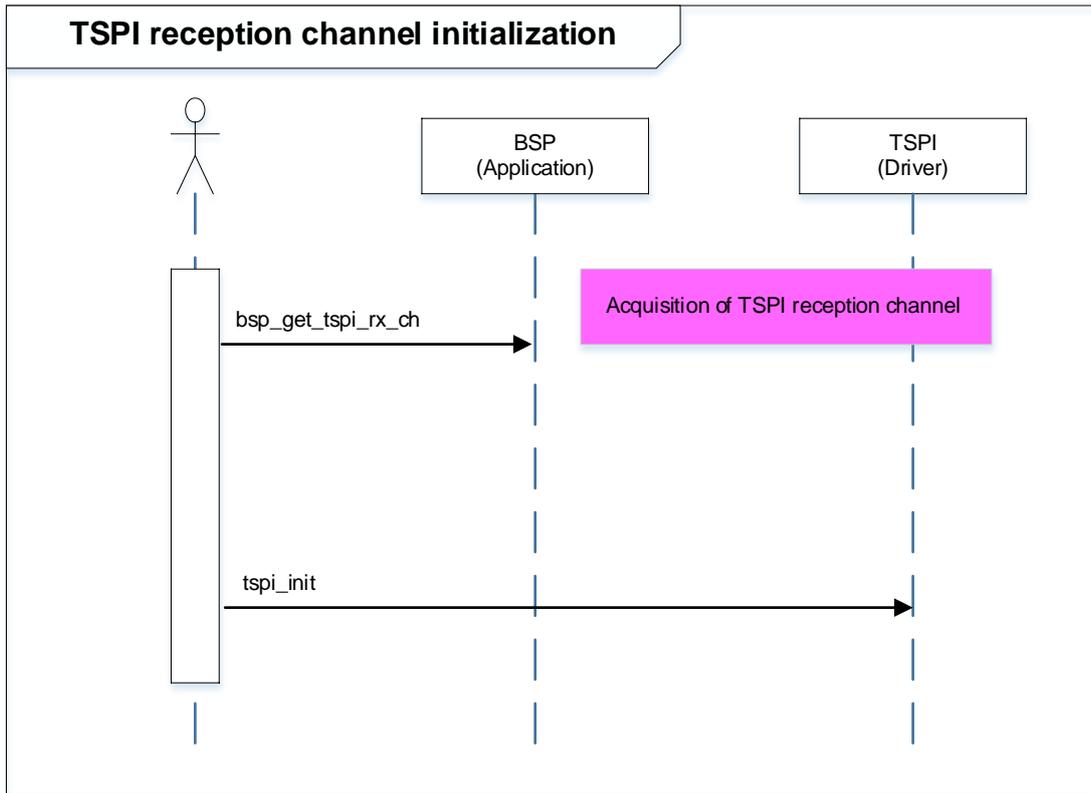
### 7.6. Operating Flow of Sample Program

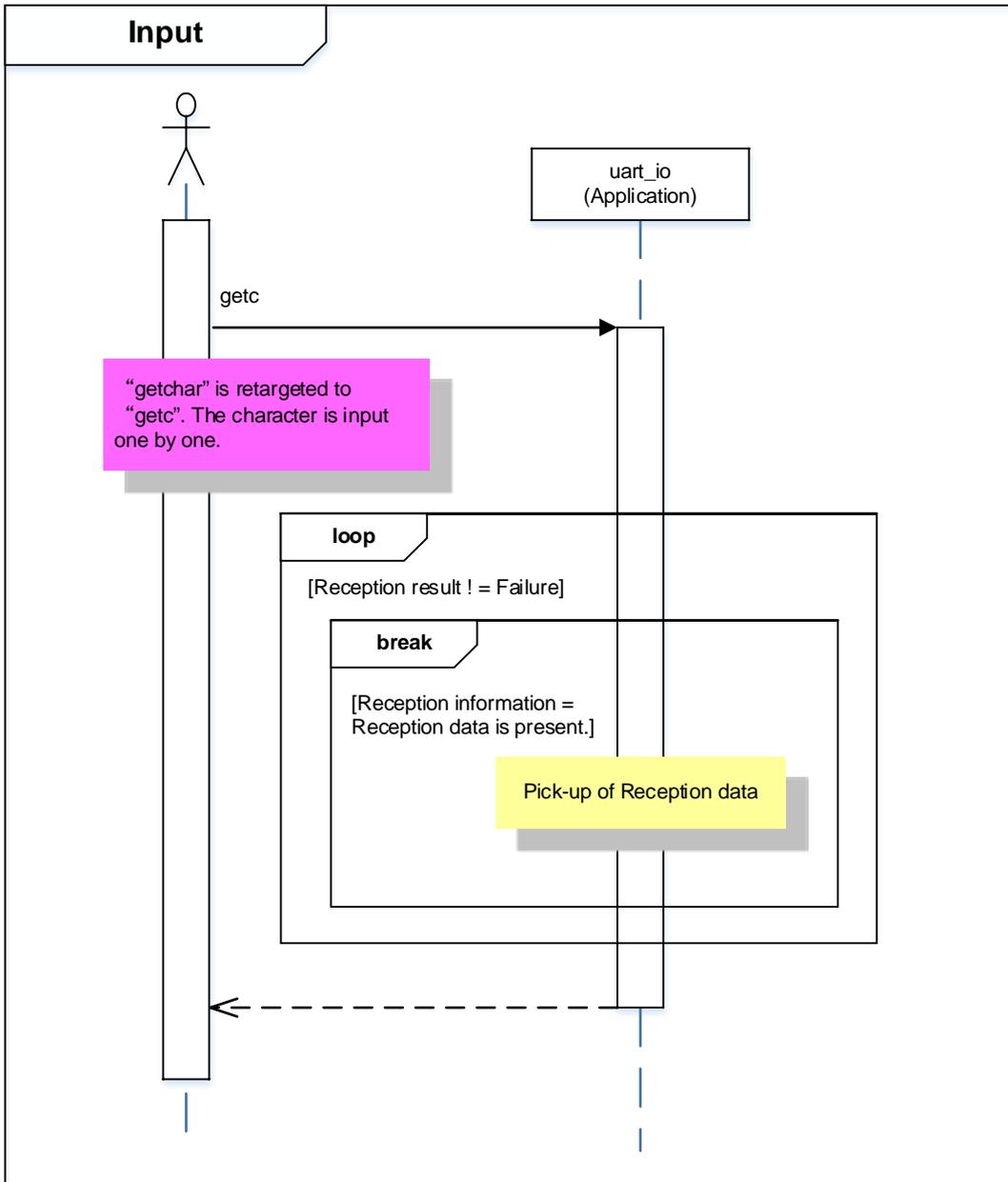
The basic operating flows of the sample program are shown in the following;

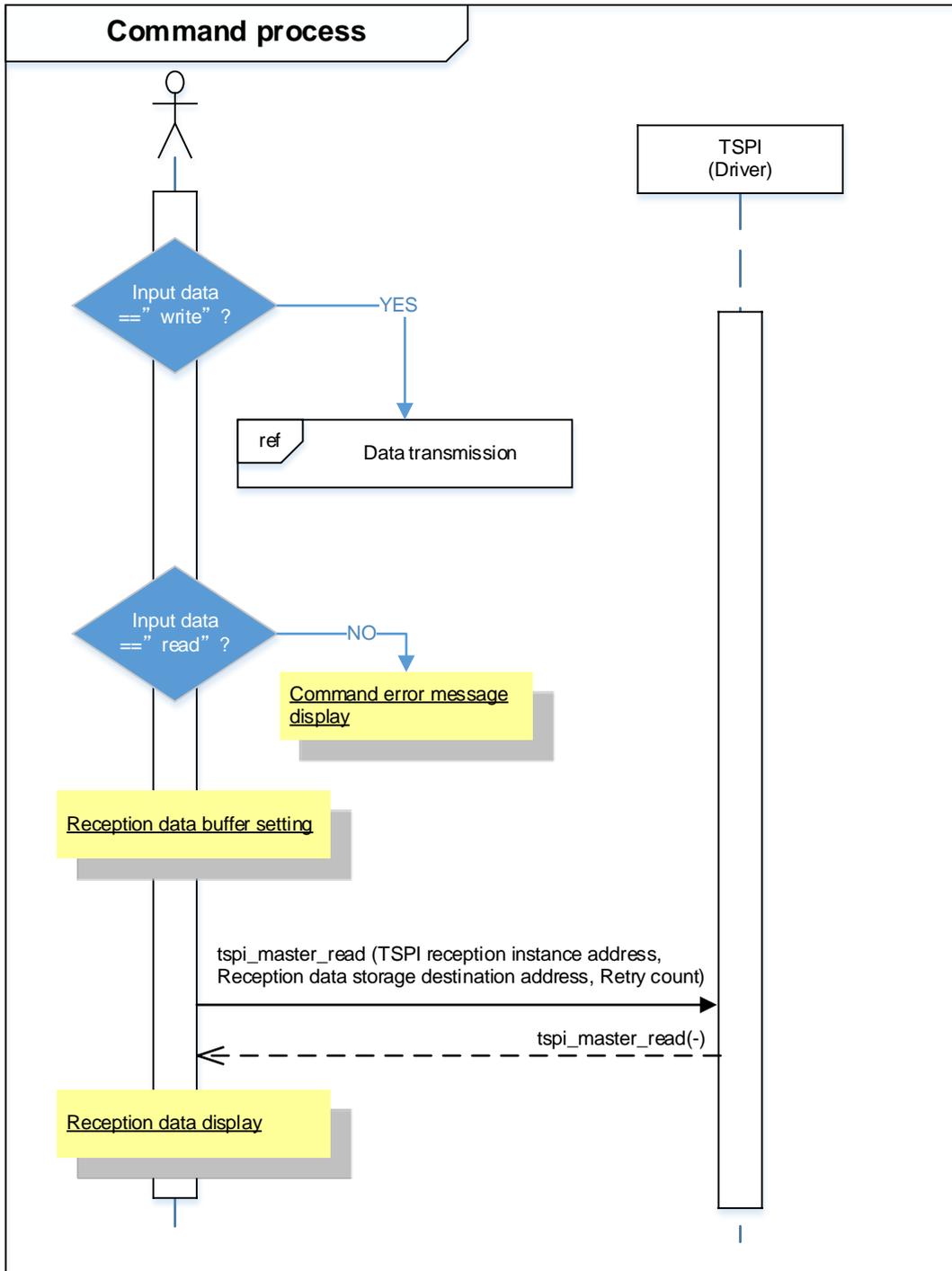


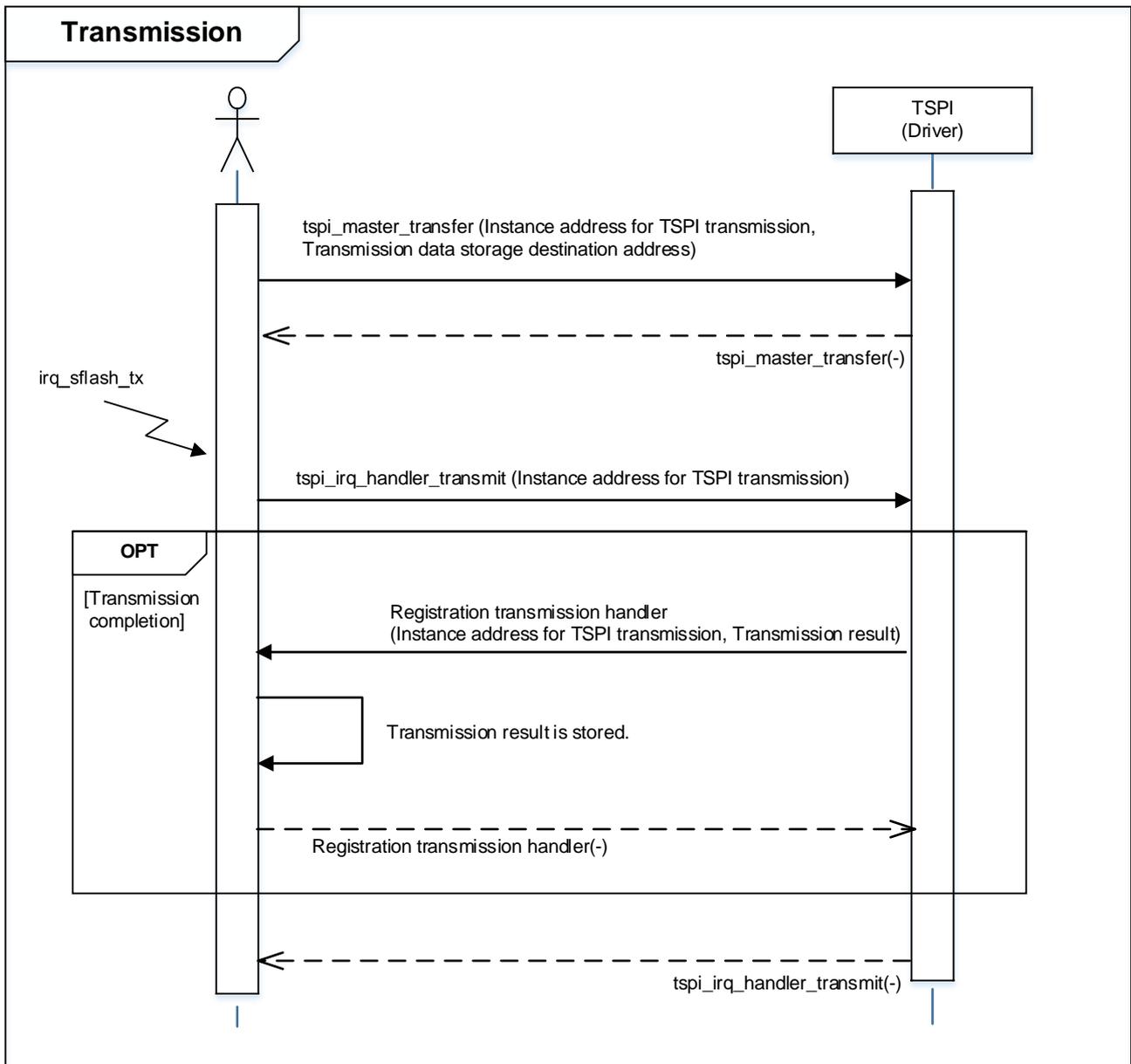












## 8. Points to Remember on Handling of Sample Programs

When using the sample program with other than “Operation Confirmation Condition”, please check the operation sufficiently.

## 9. Revision History

Revision	Date	Description
1.0	2019-10-21	First release

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