

Application Note

TMPM4L UsersManual

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1. Preface

This application note describes a reference for the usage environment when running the sample program on TMPM4L4.

If you select something other than TMPM4L4 on the MCU, a compile error may occur due to insufficient terminal or IP channel.

In that case, please modify the program and check the operation.

2. Technical Term

Term/Abbreviation	Definition
BSP	Board Support Package
UART	Universal Asynchronous Receiver Transmitter
LED	Light-emitting diode
TSPI	Toshiba Serial Peripheral Interface
I2C	Enhanced Inter-Integrated Circuit

3. Reference Document

Document	Notes
Data sheet	Refer to the data sheet of MCU to be used.
Reference manual	Refer to the reference manual of each IP to be used.
Application Note MCU User Guide	Refer to the MCU user guide to be used.

4. Operation Confirmation Condition

Item	Name	Version
Used Microcontroller	TMPM4L4FYAUG	-
Used Board	SBK-M4L4	-
Integrated Development Environment	IAR Embedded Workbench for ARM	9.50.2
Integrated Development Environment	Arm® Keil® MDK	5.40.00
Integrated Development Environment	SEGGER Embedded Studio	8.12a
Sample Program	TXZp_TMPM4L_V100	V1.0.0

5. Used Channel and Port Assignment

5.1. User Interface

5.1.1. Push-Switch

Channel	Function	Port
BSP_PSW_1	Input	PJ0
BSP_PSW_2	Input	PJ1
BSP_PSW_3	Input	PE3
BSP_PSW_4	Input	PF0
BSP_PSW_5	Input	-

5.1.2. Slide-Switch

Channel	Function	Port
BSP_SSW_1	Input	PH1
BSP_SSW_2	Input	PA7
BSP_SSW_3	Input	PE1
BSP_SSW_4	Input	PE2

5.1.3. LED

Channel	Function	Port
BSP_LED_1	Output	PB0
BSP_LED_2	Output	PB2
BSP_LED_3	Output	PB4
BSP_LED_4	Output	PD4
BSP_LED_5	Output	PD5
BSP_LED_6	Output	PB6

5.2. Communication

5.2.1. UART Communication

Channel	Peripheral Channel	Function	Port
BSP_UART_1	ch0	BSP_UART1_TXD	PD3
		BSP_UART1_RXD	PD2
		BSP_UART1_CTS	-
		BSP_UART1_DTR	-
BSP_UART_2	-	BSP_UART2_TXD	-
		BSP_UART2_RXD	-
		BSP_UART2_CTS	-
		BSP_UART2_DTR	-

5.2.2. TSPI Communication

Channel	Peripheral Channel	Function	Port
BSP_TSPI_1	ch0	BSP_SPI1_TXD	PG0
		BSP_SPI1_RXD	PG1
		BSP_SPI1_SCK	PG2
		BSP_SPI1_CS	PG3
		BSP_SPI1_CSIN	PG3
BSP_TSPI_2	ch1	BSP_SPI2_TXD	PC2
		BSP_SPI2_RXD	PC3
		BSP_SPI2_SCK	PC1
		BSP_SPI2_CS	PC0
		BSP_SPI2_CSIN	-

5.2.3. EI2C Communication

Channel	Peripheral Channel	Function	Port
BSP_EI2C_1	ch1	BSP_EI2C1_SCL	PA5
		BSP_EI2C1_SDA	PA6
BSP_EI2C_2	-	BSP_EI2C2_SCL	-
		BSP_EI2C2_SDA	-

5.2.4. SMIF Communication

Channel	Peripheral Channel	Function	Port
BSP_SMIF_1	ch0	BSP_SMIF1_CS	PC0
		BSP_SMIF1_CLK	PC1
		BSP_SMIF1_D0	PC2
		BSP_SMIF1_D1	PC3
		BSP_SMIF1_D2	PC4
		BSP_SMIF1_D3	PC5

5.3. Timer

Channel	Peripheral Channel	Function	Port
BSP_T32A_1	BSP_T32A_TIMER_1	1ms Timer	-
BSP_T32A_2	BSP_T32A_PPG_1	ch2A: Pulse Output (T32A_PPG Sample)	PA4
BSP_T32A_3	BSP_T32A_PPG_2	ch0B: Pulse Output (TRM Sample)	PB7
BSP_T32A_4	BSP_T32A_CAPT_1	ch2B: Pulse Input (TRM Sample)	PJ2
BSP_T32A_7	BSP_T32A_CAPT_2	ch2B: Pulse Input (T32A_MEASURE Sample)	-

5.4. ADC

Channel	Peripheral Channel	Function	Port
BSP_ADC_1	BSP_THERMISTOR_1	Variable resistance voltage	-
BSP_ADC_2	BSP_VR_1	Variable resistance voltage	PE4
BSP_ADC_3	BSP_VR_2	Variable resistance voltage	-

5.5. DAC

Channel	Peripheral Channel	Function	Port
BSP_ADC_1	-	(AINA17)	-
BSP_ADC_2	-	(AINA18)	-
BSP_ADC_3	-	-	-
BSP_ADC_4	-	-	-

5.6. COMP

Channel	Peripheral Channel	Function	Port
BSP_COMP_1	BSP_COMP1_CH0_AIN	ch0 Analog Input 0(AINA09)	PF1
	BSP_COMP1_CH0_RIN	DAC ch0	-
	BSP_COMP1_CH1_AIN	ch1 Analog Input 0(AINA09)	PF1
	BSP_COMP1_CH1_RIN	DAC ch1	-
BSP_COMP_2	BSP_COMP2_CH2_AIN	ch2 Analog Input 0(AINA10)	PF2
	BSP_COMP2_CH2_RIN	DAC ch0	-
	BSP_COMP2_CH3_AIN	ch3 Analog Input 0(AINA10)	PF2
	BSP_COMP2_CH3_RIN	DAC ch1	-
BSP_COMP_3	BSP_COMP3_CH4_AIN	ch4 Analog Input 1(AINA11)	PF3
	BSP_COMP3_CH4_RIN	DAC ch0	-
	BSP_COMP3_CH5_AIN	ch5 Analog Input 1(AINA11)	PF3
	BSP_COMP3_CH5_RIN	DAC ch1	-

5.7. A-ENC2

Channel	Peripheral Channel	Function	Port
BSP_ENC_1	BSP_ENC1_A	Encoder Input	PA0
	BSP_ENC1_B	Encoder Input	PA1
	BSP_ENC1_Z	Encoder Input	-
BSP_ENC_2	BSP_ENC2_A	Encoder Input	-
	BSP_ENC2_B	Encoder Input	-
	BSP_ENC2_Z	Encoder Input	-

6. System Setting

6.1.1. Power supply voltage

V	Notes
5.0	-

6.1.2. Clock setting

Clock	Function	MHz	Notes
fEHOSC	External oscillator	10	-
fIHOSC	Internal oscillator	10	-
fs	Low-speed oscillator	None	-
fc	High-speed clock	80	-
fsys	High speed system clock	80	-
fsysh	High speed system clock	None	-
fsysm	Medium speed system clock	None	-
ϕ T0	-	80	-
ϕ T0h	High speed pre-scaler clock	None	-
ϕ T0m	Medium speed pre-scaler clock	None	-

Note: It's basic setting. Settings change depending on the sample software.

7. Communication Setting

7.1. UART Communication Setting

7.1.1. UART Setting

Item	Setting Value	Notes
Baud Rate	115200(bps)	-
Data Length	8(bit)	-
Parity	None	-
Stop Bit	1(bit)	-
Flow Control	None	-

7.1.2. Log Control line feed code

Item	Setting Value	Notes
[line feed] (Send to Terminal emulator)	LF	-
[line feed] (Receive from Terminal emulator)	LF	-

7.1.3. Log Control error

Item	Setting Value	Notes
Error Log_Command	"Command Error!![line feed]"	When an unsupported command is entered
Error Log_Parameter	"Parameter Error!![line feed]"	Command parameter is not the expected value
Error Log_Input	"Input Error!![line feed]"	When an input request other than a command is not an expected value
Error Log_Erasing	"Erasing Error!![line feed]"	Used in Flash samples
Error Log_Writing	"Writing Error!![line feed]"	Used in Flash samples
Error Log_Reading	"Reading Error!![line feed]"	Used in Flash samples

7.1.4. Log Control and others

Item	Setting Value	Notes
MCU name	TMPM4L4FYA	-

7.2. I2C Communication Setting

7.2.1. I2C Setting

Item	Setting Value	Notes
I2C Clock (EI2C-A)	800KHz	In Concrroller operation
I2C Clock (I2C-B)	-	-
Data Length	8bit	-
Acknowledge	Available	-
Start/Stop Condition	Generated	-

7.2.2. Target Operating Specifications

Item	Setting Value	Notes
Target Address	0x60	Indicates 7bit that enters <7:1>
Sub Address Size	0x02	Sub Address is 2byte
Start Sub Address	0x0000	Indicates the leading Address of Sub Address
Data Size	0x10	Indicates the valid data size (byte) >>Sub Address range:0000-000F
Init Value	0x55	Initial value of Data.
Dummy Data	0xAA	This is returned when Read request is out of scope

7.3. SPI Communication Setting

Item	Setting Value	Notes
SPI Clock	10MHz	In Controller operation
	20MHz	In TSPI_Flash operation
Data Length	8bit	-
Parity	None	-
Data Transfer Direction	MSB	-

7.4. SMIF Communication Setting

Item	Specification	Notes
SMIF Clock	20MHz	-
Connected Capacitance	16MB	-
Communication Mode	STR-Quad	-

8. Flash Control range

8.1. Reference Manual

Reference manual	Notes
TXZ+ Family Reference Manual Flash Memory	FLASH256F-A

8.2. Code Flash Required specification control range

Flash Area	Start	Stop	Size	Notes
Flash All Area	0x00000000	0x0003FFFF	256kbyte	
Flash Area 0	0x00000000	0x0001FFFF	128 kbyte	
Flash Block 0	0x00000000	0x00001FFF	8 kbyte	
Flash Page 0	0x00000000	0x0000007F	128byte	
Flash Page 1	0x00000080	0x000000FF	128byte	
...	...	...	...	
Flash Page 63	0x00001F80	0x00001FFF	128byte	
Flash Block 1	0x00002000	0x00003FFF	8 kbyte	CODE Area A
Flash Block 2	0x00004000	0x00005FFF	8 kbyte	CODE Area B
...	...	...	...	
Flash Block 15	0x0001E000	0x0001FFFF	8 kbyte	
Flash Area 1	0x00020000	0x0003FFFF	128 kbyte	Data All Area, Data Area C
Flash Block 16	0x00020000	0x00021FFF	8 kbyte	Data Area
Flash Page 1024	0x00020000	0x0002007F	128byte	
Flash Page 1025	0x00020080	0x000200FF	128byte	
Flash Page SIZE	0x00000080	-	4 kbyte	CODE Area Size
Flash Block 17	0x00022000	0x00023FFF	8 kbyte	Data Area B
Flash Block SIZE	0x00002000	-	8 kbyte	Data Size A

9. Interrupt List by Sample

9.1. A_ENC

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A, Increment Timer Counter Every 1 ms

9.2. ADC_Monitor

Interrupt Source	Control Overview
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
INTADACP0	ADC Monitor. Used to monitor potentiometer values
INTADACP1	ADC Monitor. Used to monitor potentiometer values

9.3. CG_EXINT

Interrupt Source	Control Overview
INT06	External interrupt generated by BSP_PSW_5 button press.
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms

9.4. COMP

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
INTUART0RX	UART Receive Interrupt
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.5. CRC

Interrupt Source	Control Overview
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.6. DAC

Interrupt Source	Control Overview
INTUART0RX	UART Receive Interrupt
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.7. DNF

Interrupt Source	Control Overview
INT06	External interrupt generated by BSP_PSW_5 button press.
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms

9.8. Common I2C Functions

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A, Increment Timer Counter Every 1 ms

9.9. Common FLASH Functions

Interrupt Source	Control Overview
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms

9.10. LVD

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A, Increment Timer Counter Every 1 ms

9.11. OFD

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A, Increment Timer Counter Every 1 ms

9.12. PORT

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A, Increment Timer Counter Every 1 ms

9.13. RAMParity

Interrupt Source	Control Overview
INTPARI	RAMP RAM Parity Interrupt
INTUART0RX	UART Receive Interrupt
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.14. SIWDT

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
NMI	Watchdog Timer Interrupt

9.15. SMIF

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
INTUART0RX	UART Receive Interrupt
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.16. T32A_MEASURE

Interrupt Source	Control Overview
INTT32A02AC	T32A Timer A Increments the timer counter every 512 ms for PPG output generation
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.17. T32A_IntervalTimer

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms

9.18. T32A_PPG

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.19. TRM

Interrupt Source	Control Overview
INTT32A02BCAP	T32A Channel x Timer y Capture0 Used for pulse measurement of the external reference clock
INTT32A02BCAP	T32A Channel x Timer y Capture1 Used for pulse measurement of the external reference clock
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.20. TSPI_xxx_RECEIVE

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
INTT0RX	SPI Receive Interrupt
INTT0ERR	SPI Error Interrupt
INTDMAATC	DMA Transmit Complete Interrupt
INTDMAAERR	DMA Error Interrupt

9.21. TSPI_xxx_TRANS

Interrupt Source	Control Overview
INTT0TX	T32A Timer A Increment Timer Counter Every 1 ms
INTT0TX	SPI Transmit Interrupt
INTT0ERR	SPI Error Interrupt
INTDMAATC	DMA Transmit Complete Interrupt
INTDMAAERR	DMA Error Interrupt

9.22. TSPI_Flash

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
INTT1TX	SPI Transmit Interrupt
INTT1RX	SPI Receive Interrupt
INTT1ERR	SPI Error Interrupt
INTUART0TX	UART Receive Interrupt
INTUART0RX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt

9.23. UART_RECEIVE

Interrupt Source	Control Overview
INTUART0RX	UART Receive Interrupt
INTUART0ERR	UART Error Interrupt
INTDMAATC	DMA Transmit Complete Interrupt
INTDMAAERR	DMA Error Interrupt

9.24. UART_TRANS

Interrupt Source	Control Overview
INTT32A00AC	T32A Timer A Increment Timer Counter Every 1 ms
INTUART0TX	UART Transmit Interrupt
INTUART0ERR	UART Error Interrupt
INTDMAATC	DMA Transmit Complete Interrupt
INTDMAAERR	DMA Error Interrupt

10. Activity Diagram Symbol

10.1. CG_EXINT

Symbol	Values	Notes
x	6	Interrupt Source Number
y	A	Control Register

10.2. DNF

Symbol	Values	Notes
x	6	Interrupt Source Number
y	A	Control Register

10.3. TSPI_xxxx_TRANS

Symbol	Values	Notes
x	0	Channel Number

10.4. TSPI_xxxx_RECEIVE

Symbol	Values	Notes
x	0	Channel Number

11. Precautions for Use

Please confirm the operation sufficiently if use in an environment other than the operation check environment.

12. Revision History

Revision	Date	Description
1.0	2026-07-30	First release

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