Application Note

<u>UART_RECEIVE</u> (UART-C)

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1. Preface

This application note describes the sample software for UART_RECEIVE using Universal Asynchronous Receiver Transmitter (UART).

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

2. Technical Term

Term/Abbreviation	Definition
BSP	Board Support Package
CG	Clock Control and Operation Mode
DMA	Direct Memory Access
UART	Universal Asynchronous Receiver Transmitter

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. Target Sample Program

Sample Program	Outline
UART_RECEIVE	Sample program of UART function (UART Receive)

5. Configuration Diagram



6. Sample Program:UART_RECEIVE

This sample software that receives the character string input from the terminal emulator using the receive function of the UART communication function and turn on LED every time it matches the character string 1.

6.1. Outlines of Operation

Wait for the input of the character string of the terminal emulator.

If BSP_LED_3 is turn on, it will turn off.

When a character string is input, the character string 1 is compared with the received character string, and when the character strings match, BSP_LED_1 is turn on.

If there is a mismatch, turn off BSP_LED_1.

When error occurs, turn on BSP_LED_3 and turn off BSP_LED_1.

6.2. Function to Use

The functions to use are as follows:

For the Port assignment of each BSP channel, refer to the MCU user guide.

IP	Channel	Objective
UART	BSP_UART_1	For terminal emulator communication
	BSP_LED_1	For operation check
PORT(LED)	BSP_LED_3	For operation check

6.3. Interrupt to Use

Interrupt	Outlines
*1	UART receive interrupt
*2	UART error interrupt

*1 For SBK-M4KN/SBK-M4KN10, "INTSCORX", for AdBun-M3HQF10/AdBun-M3HQA, "INTUARTORX"

*2 For SBK-M4KN/SBK-M4KN10, "INTSC0ERR", for AdBun-M3HQF10/AdBun-M3HQA, "INTUART0ERR"

6.4. Configuration

"main.c" configuration setting.

Configuration	Current Value	Description
Character string 1	*1	Comparison target of character strings input from terminal emulator
Communication control selection	*2 NODMAC	Switchable between NODMAC (does not use DMAC) and DMA (uses DMAC)

*1 For SBK-M4KN/SBK-M4KN10, "TMPM4KNFYA¥n" For AdBun-M3HQF10, "TMPM3HQF10"

*2 For details on how to switch when using DMAC, see Chapter 6.6.

6.5. Example of Terminal Emulator Output

Nothing.

For AdBun-M3HQA, "TMPM3HQFDA"

6.6. How to switch DMAC function

Follow the steps below to enable/disable the DMAC function.

6.6.1. IAR Embedded Workbench

Category:					Factory Settings
General Options] 🗌 Multi-file Co	ompilation			
Static Analysis	Discar	d Unused Publics			
Runtime Checking					
C/C++ Compiler	Language		2 Code	Optimization	ns Output
Assembler	List	Preprocessor	Diagnostics	s Encodings	Extra Options
Output Converter					
Custom Build	Ignore :	standard include di	rectories		
Build Actions	Additional	include directories	: (one per line	e)	
Linker	\$PROJ DI		× 1		
Debugger		R\$¥¥¥¥¥Utility	¥inc		1 ····
Simulator		R\$¥¥¥¥¥BSP¥S		:	
CADI		R\$¥¥¥¥¥MCU¥			
CMSIS DAP	\$PROJ_DI	R\$¥¥¥¥¥MCU¥	CMSIS¥startu	p¥iar	
GDB Server	Preinclude	file:			
I-jet					
J-Link/J-Trace					
TI Stellaris	Defined sy	mbols: (one per lin	e)		
Nu-Link	NODMAC			Preprocessor outp	out to file
PE micro	UART_DM/	A_TRANSFER_USE		Preserve comm	nents
ST-LINK				🔽 Generate #line	directives
Third-Party Driver			•		
TI MCD FFT					

Open "Project" \rightarrow "Options" \rightarrow "C/C++ Compiler" \rightarrow "Preprocessor". Change "Defined symbol" as follows: • If you do not use DMAC: "NODMAC"

- When using DMAC: "DMA", "UART_DMA_TRANSFER_USE"



Workspace	▲ 廿 ×	
Sample_FYAx	~	
Files ■ UART_RECEIV ■ APP ■ BSP ■ BSP ■ BSP .c ■ BSP .config. ■ BSP .config.	_sbk	
He Startup	Options Make Compile Rebuild All Clean	٦
	C-STAT Static Analysis Stop Build	>
	Add	>
UART_RECEIVE	Nemove	

egory: atic Analysis	Override inherited settings			Factory Setting
ntime Checking /C++ Compiler ustom Build	List Preprocessor D	Diagnostics	Encodings	Extra Options
astorn baild	Language 1 Language 2	Code	Optimizatio	ns Output
	Language C C++ Auto (extension-based)	O Sta	age conformanc andard with IAR andard rict	
	C dialect C C89 Standard C Allow VLA C++ inline semantics Require prototypes	En	ptions able exceptions able RTTI estroy static obje	cts

Right-click the file you want to configure, open options, and change "Exclude from build". If you want to use the file, uncheck "Exclude from build", otherwise uncheck "Exclude from build".

DMAC disabled:

bsp_config_sbk_m4xn_uart_io.c	Use files
bsp_config_sbk_m4xn_uart_io_dma.c	Don't use files
DMAC enabled: bsp_config_sbk_m4xn_uart_io.c bsp_config_sbk_m4xn_uart_io_dma.c	Don't use files Use files

Please build after changing the settings.

6.6.2. Keil µVision

Options for Target 'Sample_FVAx'		×	
Device Target Output Listing User	C/C++ Asm Linker Debug Utilities		
Preprocessor Symbols		_	
Define: NODMAC,UART_DMA_TRA	NSFER_USE		
Undefine:			
Language / Code Generation			
Execute-only Code	Strict ANSIC Warnings: All Warnings 💌		
Optimization: Level 1 (-01) -	🔲 Enum Container always int 👘 Thumb Mode		
Coptimize for Time	🔽 Plain Char is Signed 🗌 No Auto Includes		
Split Load and Store Multiple	☐ Read-Only Position Independent		
✓ One ELF Section per Function	☐ Read-Write Position Independent ☐ GNU extensions		
Paths Misc	ART¥UART_RECEIVE;¥¥¥¥Utility¥inc;¥¥¥¥¥MCU¥Driver		
Compiler control string			
ОК	Cancel Defaults Help		

Open "Project" \rightarrow "Options for Target 'Sample'" \rightarrow "C/C++". Change "Define:" of "Preprocessor Symbols" as shown below.

- · If you do not use DMAC, select "NODMAC"
- "DMA" and "UART_DMA_TRANSFER_USE" when using DMAC



Project 📮 🗵			
Project: UART_RECEIVE			
🗄 ᇶ Sample_FYAx			
🕀 🚂 APP			
BSP			
bsp.c			
bsp_config_sbk_m4kn_uart io c bsp_config_sbk_m4kn_uart io c bsp_config_sbk_m4kn_uart io c	sbk m4kn uart io.c' Alt+F7		
Startup Startup			
Manage Project tens			
Open bsp_config_sbk_m4kn_uart_io.c Open bsp_config_sbk_m4kn_uart_io.c			
Rebuild all target files			
Build Target F7			
Translate bsp_config_sbk_m4	Translate bsp_config_sbk_m4kn_uart_io.c		
Show Include File Dependencies			
Show include File Dependencies			
Options for File 'bsp_config_sbk_m4kn_uart_io.c'	×		
Presenting to (our)			
Properties C/C++	1		
Path:	uart_io.c		
File Type: C Source file	✓ Include in Target Build		
Size: 19873 Bytes	Aiways Build		
last change: Thu Mar 7 15:40:42 2024	Generate Assembler SRC File		
last change. Thu Mar 7 13.40.42 2024	Assemble SRC File		
Stop on Exit Code: Not specified	✓ Image File Compression		
Custom Arguments:			
Memory Assignment:			
Code / Const: <a>			
Zero Initialized Data: ">www.default>			
Other Data: <a>default>			
Layer: <not assigned=""></not>			
OK Cancel Det	faults Help		

Right-click the file you want to configure, open Options for File 'xxxx.c' and change "Include in Target Build". If you want to use the file, check "Include in Target Build", otherwise uncheck "Include in Target Build".

DMAC disabled:

bsp_config_sbk_m4xn_uart_io.c bsp_config_sbk_m4xn_uart_io_dma.c

DMAC enabled:

bsp_config_sbk_m4xn_uart_io.c bsp_config_sbk_m4xn_uart_io_dma.c Don't use files Use files

Don't use files

Use files

Please build after changing the settings.

6.6.3. SEGGER Embedded Studio

👈 🧅 🕄 Sample_FYAx 🛛 👻	Search Options	Show Modified Option	ns On
Code	Option	Value	
Assembler			
Build	▲ ■ Preprocessor		
Code Analyzer	 Add Property Group Options 	Yes	•
Code Generation	Ignore Includes	No	
Compiler	Include Files		
Compiler Warning	Include Files Assembler Only		
External Build	Include Files C Compiler Only		
File	Include Files C++ Compiler Only		
Libraries	Macro Files Macro Files Assembler Only		
Library	Macro Files Assembler Only Macro Files C Compiler Only		
Linker	Macro Files C compiler Only Macro Files C++ Compiler Only		-
Preprocessor	Preprocessor Definitions	NODMAC;UART_DMA_TRANSFER	2115
Printf/Scanf	Preprocessor Definitions Preprocessor Definitions	NODIMAC, OAKT_DIMA_INANSI EI	0.00
Runtime Memory Area	Preprocessor Definitions C Compiler Only		_
Section	Preprocessor Definitions C++ Compiler Only		
	Preprocessor Undefinitions		
Source Code			
User Build Step	Add Property Group Options		
ø Debug			
Debugger	Supply the defines and includes that are selected by the property group.		
GDB Server			
J-Link			
Loader			

 $\label{eq:open_project} \mbox{Open "Project"} \ \rightarrow \ \mbox{"Options"} \ \rightarrow \ \mbox{"Preprocessor"}.$

Change "Preprocessor Definitions" as shown below.

- · If you do not use DMAC, select "NODMAC"
- "DMA" and "UART_DMA_TRANSFER_USE" when using DMAC

* Change "Common" as well as "Sample_xxx".

Value	
DMA;UART DMA TRANSFER USE modified;inherits	
ve macro expansion applied to it.	
	DMA;UARI_DMA_IRANSFER_USE modified(inherits)

Project Explorer					×
🕄 Sample_F10Ax 🔹 🔄 🖆 🖸		>	1	7 4	Þ
Project Items			Code	Data+R	20
 Solution 'UART_RECEIVE' Project 'UART_RECEIVE' Setup 1 file Sourse Files 15 files APP 1 file BSP 4 files bsp.c bsp_config_sbk_m4kn_led.c bsp_config_sbk_m4kn_uart_io.c 					
bsp_config_sbk_m4kn_uart_io_dm		Options	Alt+Return		
 TSB_driver 9 files Utility 1 file System 4 files 	e L	Compile Export Build Analyze Open Binary Editor Show Preprocessor Output Show Preprocessor Defines Format Code	Ctrl+F7		
		Exclude From Build Import Copy Full Path Select in File Explorer Flag	> ,		
	× 1	Cut Copy Remove	Ctrl+X Ctrl+C		

Right-click the file you want to configure and change "Exclude From Build". If you want to use a file, uncheck "Exclude From Build", otherwise check "Exclude From Build".

DMAC disabled:

osp_config_sbk_m4xn_uart_io.c osp_config_sbk_m4xn_uart_io_dma.c	Use files Don't use files
abled: osp_config_sbk_m4xn_uart_io.c osp_config_sbk_m4xn_uart_io_dma.c	Don't use files Use files

Please build after changing the settings.

7. Activity diagram

7.1. main





7.2. variable_initalize



7.3. driver_initialize



7.4. driver_finalize



7.5. driver_dma_initialize



7.6. driver_dma_finalize



7.7. application_initialize



7.8. application_finalize



7.9. clear_input_data



7.10. uart_initialize



7.11. Interrupt











8. Revision History

Revision	Date	Description
1.0	2023-10-16	First release
1.1	2024-03-25	Added method to switch DMAC function
1.2	2024-07-16	Added detailed description of DMAC function switching

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