

Application Note

UART

Arm and Keil are registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

All other company names, product names, and service names mentioned herein may be trademarks of their respective companies.

Table of Contents

Table of Contents	2
1. Preface	3
2. Technical Term	3
3. Reference Document	3
4. Target Sample Program	4
5. Configuration Diagram	4
6. Sample Program : UART	5
6.1. Outlines of Operation	5
6.2. Function to Use	5
6.3. Interrupt to Use	5
6.4. Configuration	5
6.5. Example of Terminal Emulator Output	5
6.5.1. Normal Operation	5
6.5.2. Case of Error Occurrence	5
7. UART Driver	6
7.1. List of driver	6
7.2. Details	6
8. Revision History	7
RESTRICTIONS ON PRODUCT USE	8

1. Preface

This application note describes sample software for the UART (Hand Shake Function: Unused) control function.

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

2. Technical Term

Term/Abbreviation	Definition
UART	Universal Asynchronous Receiver Transmitter
BSP	Board Support Package
Timer	T32A : 32-bit Timer Event Counter
CG	Clock control and Operation Mode

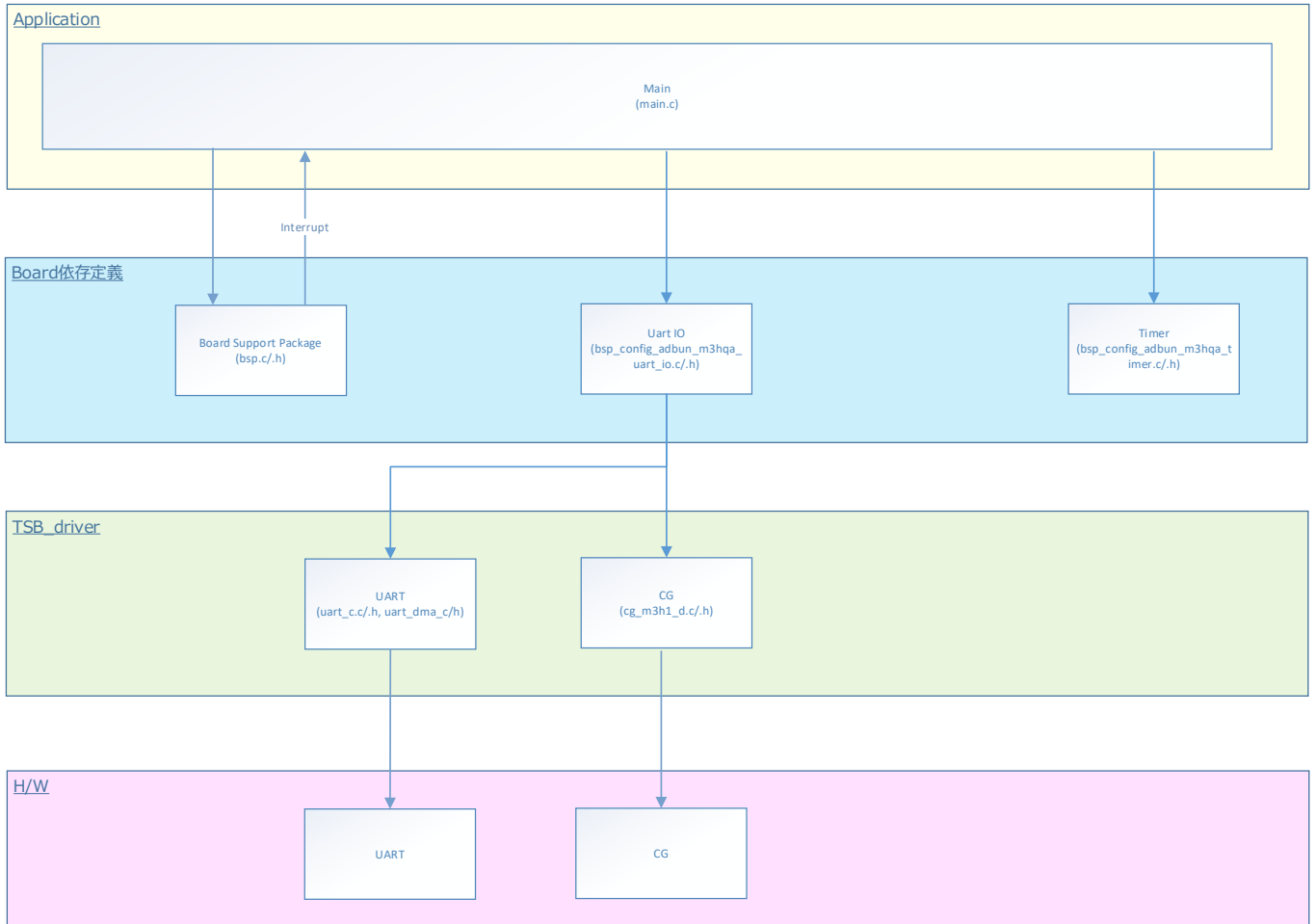
3. Reference Document

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 manual to be used.
Driver API list	Refer to the MCU Doc folder to be used.

4. Target Sample Program

Sample Program	Outline
UART	Sample program of UART function

5. Configuration Diagram



6. Sample Program : UART

This is sample software that echoes back the data input from the terminal emulator.

6.1. Outlines of Operation

Data input for Max data size is accepted from the terminal emulator.
Confirm that the data has been input and output echo back.

6.2. Function to Use

The functions to use are as follows.
For the Port assignment of each channel, refer to the MCU user manual.

IP	Channel	Objective
UART	BSP_UART_1	For terminal emulator communication (Outputs log)

6.3. Interrupt to Use

Interrupt	Outlines
INTT32A00A	T32A ch0 Timer_A Timer counter increment every 1ms
INTUART0RX	UART ch0 Receive interrupt for terminal emulator
INTUART0TX	UART ch0 Transmission interrupt for terminal emulator
INTUART0ERR	UART ch0 Error interrupt for terminal emulator

6.4. Configuration

“main.c” configuration setting.

Configuration	Current Value	Description
Max Data size	32	32 characters

6.5. Example of Terminal Emulator Output

6.5.1. Normal Operation

```
Input = 12345
Echo = 12345
```

6.5.2. Case of Error Occurrence

```
Input = 123456789012345678901234567890123
Input Error !!
```

7. UART Driver

7.1. List of driver

The UART is controlled by using the following interface.
For an example of use, refer to the source code.

Driver	Control Outlines
uart_init	UART Object initialization
uart_deinit	UART Release the object
uart_discard_transmit	Discard transmission
uart_discard_receive	Discard reception
uart_transmitlt	Send data. Non-blocking communication
uart_receivevt	Receive data. Non-blocking communication
uart_transmit_irq_handler	IRQ handler for transfer
uart_receive_irq_handler	IRQ handler for receiving
uart_error_irq_handler	IRQ handler for errors
uart_get_status	Get status
uart_get_error	Get error
uart_get_boudrate_setting	Get boudrate settings
uart_dma_init	UART DMA Object initialization
uart_dma_deinit	UART DMA Release the object
uart_dma_discard_transmit	Discard transmission
uart_dma_discard_receive	Discard reception
uart_dma_transmitlt	Send data. Non-blocking communication
uart_dma_receivevt	Receive data. Non-blocking communication
uart_send_break	Send a break
uart_stop_break	Stop break
uart_enable_half_clock	Half clock mode enabled
uart_disable_half_clock	Half clock mode disabled
uart_enable_loopback	Enable loopback
uart_disable_loopback	Disable loopback
uart_enable_wakeup	Enable wake-up
uart_disable_wakeup	Disable wake-up

7.2. Details

See “3. Reference Documents” for more information.

8. Revision History

Revision	Date	Description
1.0	2022-04-08	First release

RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA". Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, lifesaving and/or life supporting medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, and devices related to power plant. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative or contact us via our website.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**

Toshiba Electronic Devices & Storage Corporation

<https://toshiba.semicon-storage.com/>