To our customers,

Old Company Name in Catalogs and Other Documents

On April 1\textsuperscript{st}, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1\textsuperscript{st}, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)
Send any inquiries to http://www.renesas.com/inquiry.
Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.

2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.

4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.

5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.

6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.

7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

“Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

“High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

“Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.

8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.

9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.

10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.

12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.
V850E/IF3, V850E/IG3
32-bit Single-Chip Microcontrollers
Sample Programs for Serial Communication (CSIB)

V850E/IF3:
- μPD70F3451
- μPD70F3452

V850E/IG3:
- μPD70F3453
- μPD70F3454
NOTES FOR CMOS DEVICES

① VOLTAGE APPLICATION WAVEFORM AT INPUT PIN
Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between $V_{IL}$ (MAX) and $V_{IH}$ (MIN) due to noise, etc., the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between $V_{IL}$ (MAX) and $V_{IH}$ (MIN).

② HANDLING OF UNUSED INPUT PINS
Unconnected CMOS device inputs can be cause of malfunction. If an input pin is unconnected, it is possible that an internal input level may be generated due to noise, etc., causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using pull-up or pull-down circuitry. Each unused pin should be connected to $V_{DD}$ or GND via a resistor if there is a possibility that it will be an output pin. All handling related to unused pins must be judged separately for each device and according to related specifications governing the device.

③ PRECAUTION AGAINST ESD
A strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it when it has occurred. Environmental control must be adequate. When it is dry, a humidifier should be used. It is recommended to avoid using insulators that easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors should be grounded. The operator should be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with mounted semiconductor devices.

④ STATUS BEFORE INITIALIZATION
Power-on does not necessarily define the initial status of a MOS device. Immediately after the power source is turned ON, devices with reset functions have not yet been initialized. Hence, power-on does not guarantee output pin levels, I/O settings or contents of registers. A device is not initialized until the reset signal is received. A reset operation must be executed immediately after power-on for devices with reset functions.

⑤ POWER ON/OFF SEQUENCE
In the case of a device that uses different power supplies for the internal operation and external interface, as a rule, switch on the external power supply after switching on the internal power supply. When switching the power supply off, as a rule, switch off the external power supply and then the internal power supply. Use of the reverse power on/off sequences may result in the application of an overvoltage to the internal elements of the device, causing malfunction and degradation of internal elements due to the passage of an abnormal current. The correct power on/off sequence must be judged separately for each device and according to related specifications governing the device.

⑥ INPUT OF SIGNAL DURING POWER OFF STATE
Do not input signals or an I/O pull-up power supply while the device is not powered. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Input of signals during the power off state must be judged separately for each device and according to related specifications governing the device.
Caution: This product uses SuperFlash® technology licensed from Silicon Storage Technology, Inc.

SuperFlash is a registered trademark of Silicon Storage Technology, Inc. in several countries including the United States and Japan.

The information contained in this document is being issued in advance of the production cycle for the product. The parameters for the product may change before final production or NEC Electronics Corporation, at its own discretion, may withdraw the product prior to its production.

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.

NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.

Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.

While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.

NEC Electronics products are classified into the following three quality grades: "Standard", "Special", and "Specific". The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics products before using it in a particular application.

"Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.

"Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

"Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics’ willingness to support a given application.

(Note)
(1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).
INTRODUCTION

Cautions 1. This Application Note explains a case where the V850E/IG3 is used as a representative microcontroller. Use this Application Note for your reference when using the V850E/IF3.


3. This sample program is provided for reference purposes only and operations are therefore not subject to guarantee by NEC Electronics Corporation. When using sample programs, customers are advised to sufficiently evaluate this product based on their systems, before use.

4. When using sample programs, reference the following startup routine and link directive file and adjust them if necessary.
   - Startup routine: ig3_start.s
   - Link directive file: ig3_link.dir

Target Readers
This Application Note is intended for users who understand the functions of the V850E/IF3 (μPD70F3451, 70F3452), and V850E/IG3 (μPD70F3453, 70F3454), and who design application systems that use these microcontrollers.

Purpose
This manual is intended to give users an understanding of the basic functions of the V850E/IF3 and V850E/IG3, using the application programs.

How to Use This Manual
It is assumed that the reader of this Application Note has general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.

For details of hardware functions (especially register functions, setting methods, etc.) and electrical specifications

For details of instruction functions
→ See the V850E1 Architecture User’s Manual.

Conventions
Data significance: Higher digits on the left and lower digits on the right
Active low representation: xxx (overscore over pin or signal name)
Memory map address: Higher addresses on the top and lower addresses on the bottom

Note: Footnote for item marked with Note in the text
Caution: Information requiring particular attention
Remark: Supplementary information
Numeric representation:
   Binary ... xxxx or xxxxB
   Decimal ... xxxx
   Hexadecimal ... xxxxH

Prefix indicating the power of 2 (address space, memory capacity):
   K (kilo): \(2^{10} = 1,024\)
   M (mega): \(2^{20} = 1,024^2\)
   G (giga): \(2^{30} = 1,024^3\)
The function lists are structured as follows.

### Hardware name (symbol)

<table>
<thead>
<tr>
<th>[Function]</th>
<th>Function description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Function name]</td>
<td>Name of sample function</td>
</tr>
<tr>
<td>[Argument(s)]</td>
<td>Type and overview of argument(s)</td>
</tr>
<tr>
<td>[Processing content]</td>
<td>Processing content of sample function</td>
</tr>
<tr>
<td>[SFR(s) used]</td>
<td>Register name and setting content</td>
</tr>
<tr>
<td>[call function(s)]</td>
<td>Name and function of call function(s)</td>
</tr>
<tr>
<td>[Variable(s)]</td>
<td>Type, name, and overview of variable(s) used in sample function</td>
</tr>
<tr>
<td>[Interrupt(s)]</td>
<td>Name of function</td>
</tr>
<tr>
<td>[Interrupt source(s)]</td>
<td>Name</td>
</tr>
<tr>
<td>[File name]</td>
<td>Name of corresponding sample program file</td>
</tr>
<tr>
<td>[Caution(s)]</td>
<td>Caution(s) upon function usage</td>
</tr>
</tbody>
</table>

### Interrupt function

<table>
<thead>
<tr>
<th>[Function name]</th>
<th>Name of interrupt function</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Servicing content]</td>
<td>Servicing content of interrupt function</td>
</tr>
<tr>
<td>[SFR(s) used]</td>
<td>Name of interrupt and conditions for occurrence</td>
</tr>
<tr>
<td>[call function(s)]</td>
<td>None</td>
</tr>
<tr>
<td>[Variable(s)]</td>
<td>Name of variable, function</td>
</tr>
<tr>
<td>[File name]</td>
<td>Name of corresponding sample program file</td>
</tr>
<tr>
<td>[Caution(s)]</td>
<td>None</td>
</tr>
</tbody>
</table>
Related Documents

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Documents related to V850E/IF3 and V850E/IG3

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Document No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>V850E1 Architecture User's Manual</td>
<td>U14559E</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (UARTA) Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (UARTB) Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (CSIB) Application Note</td>
<td>This manual</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Serial Communication (I2C) Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for DMA Function Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Timer M Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Watchdog Timer Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Timer AA Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Timer AB Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Timer T Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Port Function Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Clock Generator Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Standby Function Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Interrupt Function Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for A/D Converters 0 and 1 Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for A/D Converter 2 Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 Sample Programs for Low-Voltage Detector (LVI) Function Application Note</td>
<td>To be prepared</td>
</tr>
<tr>
<td>V850E/IF3, V850E/IG3 6-Phase PWM Output Control by Timer AB, Timer Q Option, Timer AA, A/D Converters 0 and 1 Application Note</td>
<td>U18717E</td>
</tr>
</tbody>
</table>
CONTENTS

CHAPTER 1 CONTINUOUS TRANSFER MODE ................................................................. 9
  1.1 Continuous Transfer Mode (Master Mode, Transmission Mode)...................... 9
  1.2 Continuous Transfer Mode (Master Mode, Reception Mode) ......................... 14
  1.3 Continuous Transfer Mode (Master Mode, Transmission/Reception Mode) .... 19
  1.4 Continuous Transfer Mode (Slave Mode, Transmission Mode) ...................... 25
  1.5 Continuous Transfer Mode (Slave Mode, Reception Mode) .......................... 30
  1.6 Continuous Transfer Mode (Slave Mode, Transmission/Reception Mode) ...... 36

CHAPTER 2 SINGLE TRANSFER MODE ................................................................. 43
  2.1 Single Transfer Mode (Master Mode, Transmission Mode) ....................... 43
  2.2 Single Transfer Mode (Master Mode, Reception Mode) ............................. 48
  2.3 Single Transfer Mode (Master Mode, Transmission/Reception Mode) .......... 54
  2.4 Single Transfer Mode (Slave Mode, Transmission Mode) ........................... 60
  2.5 Single Transfer Mode (Slave Mode, Reception Mode) ............................... 65
  2.6 Single Transfer Mode (Slave Mode, Transmission/Reception Mode) .......... 71
CHAPTER 1 CONTINUOUS TRANSFER MODE

1.1 Continuous Transfer Mode (Master Mode, Transmission Mode)

[Function] Sets communication mode to master mode and transfer direction mode to MSB first, and performs data transmission for ten times in continuous transfer mode. Validates communication start trigger and sets communication clock to \( f_{XX}/256 \), and transfer data length to 8 bits.

[Function name] csib1_main

[Argument] None

[Processing content] Sets transmission count (count_tx) to initial value 0. Starts transmission after calling each setting function.

[SFRs used] 
- CB0TIC: 0x07 (Clears CSIB0 transmission enable interrupt request signal (INTCB0T), releases mask, sets to priority level 7.)
- CB0STR.CB0TSF Communication status flag

[call function] csib_port, csib_set, csib_start, csib_end

[Variables] 
- unsigned char buf_tx[ ]: Transmit data storing buffer
- volatile unsigned char count_tx: Transmission count variable
- unsigned char count: Transmit data generating variable

[Interrupt] csib_int_send

[Interrupt source] INTCB0T

[File name] csib1.c

[Caution] None

---

[Function name] csib_port

[Processing content] Sets port 4 as CSIB0 I/O pin.

[SFRs used] 
- PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
- PFCE4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
- PMC4 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)

[call function] None

[Variable] None

[File name] csib1.c

[Caution] None
**[Function name]** csib_set

**[Processing content]** Sets CSIB0 control register.

**[SFRs used]**
- CB0CTL1: 0x06 (Sets to communication type 1 and sets communication clock to fxx/256 (0.25 MHz).)
- CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)
- CB0CTL0: 0x43 (Enables CSIB0 transmission operation, sets to MSB first and continuous transfer mode, and validates communication start trigger.)

**[call function]** None

**[Variable]** None

**[File name]** csib1.c

**[Caution]** CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

---

**[Function name]** csib_start

**[Processing content]** Enables CSIB0 operation and writes a value to transmit data register.

**[SFRs used]**
- CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)
- CB0TX: Transmit data register

**[call function]** None

**[Variables]**
- unsigned char buf_tx[ ]; Transmit data storing buffer
- volatile unsigned char count_tx: Transmission count variable

**[File name]** csib1.c

**[Caution]** None

---

**[Function name]** csib_end

**[Processing content]** Disables CSIB0 operation and transmission operation.

**[SFRs used]**
- CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
- CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.)

**[call function]** None

**[Variable]** None

**[File name]** csib1.c

**[Caution]** None
Interrupt function

<table>
<thead>
<tr>
<th>[Function name]</th>
<th>csib_int_send</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Servicing content]</td>
<td>Sets new data for transmitting next data.</td>
</tr>
<tr>
<td>[SFR used]</td>
<td>CB0TX Transmit data register</td>
</tr>
<tr>
<td>[call function]</td>
<td>None</td>
</tr>
</tbody>
</table>
| [Variables] | unsigned char buf_tx[ ]; Transmit data storing buffer  
volatile unsigned char count_tx: Transmission count variable |
| [File name] | csib1.c |
| [Caution] | None |
**Figure 1-1. Continuous Transfer Mode (Master Mode, Transmission Mode) (1/2)**

- **csib1_main**
  - DI
  - count\(\_tx = 0\)
  - **csib_port** Alternate-function pin setting function
  - **csib_set** CSIB0 control register setting function
  - count = 0
  - count > TX\_SIZE
    - Yes
    - Check count for transmit data generated.
    - CB0TIC = 0x07
    - Clears INTCB0T interrupt request signal, releases mask, sets to priority level 7.
    - EI
    - Enables maskable interrupt request.
    - **csib_start** Serial transfer start function
      - CB0TSF == 0
        - No
        - Checks communication status flag.
        - **csib_end** Serial transfer disable function
          - Substitutes value in buf\_tx[].
          - count++
          - Increments count for transmit data generated.
          - buf\_tx[count] = count + 1
          - Checks count for transmit data generated.
          - count = 0
          - Initializes count for transmit data generated.
Figure 1-1. Continuous Transfer Mode (Master Mode, Transmission Mode) (2/2)

Alternate-function pin setting function

- csib_port
- PFC4 = 0x00
- PFCE4 = 0x00
- PMC4 = 0x07
- ret

CSIB0 control register setting function

- csib_set
- CB0CTL1 = 0x06
- CB0CTL2 = 0x00
- CB0CTL0 = 0x43
- ret

Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input

Sets data reception timing to communication type 1. Sets communication clock to f\text{CPU}/256 (0.25 MHz).

Sets transfer data length to 8 bits.

Enables transmission operation, sets to continuous transfer mode, validates communication start trigger.

Serial transfer start function

- csib_start
- CB0PWR = 1
- Enables CSIB0 operation.
- CB0TX = buf\_tx[0]
- Writes to CB0TX register.
- count\_tx++
- Increments transmission count.
- ret

Serial transfer disable function

- csib_end
- CB0PWR = 0
- Disables CSIB0 operation.
- CB0TXE = 0
- Disables CSIB0 transmission operation.
- ret

Serial transfer disable function

- csib_end
- CB0PWR = 0
- Disables CSIB0 operation.
- CB0TXE = 0
- Disables CSIB0 transmission operation.
- ret

INTCB0T interrupt

- INTCB0T interrupt function
- csib_int_send
- CB0TX = buf\_tx[count\_tx]
- Checks transmission count.
- count\_tx < TX\_SIZE
- Yes
- Substitutes data in transmission register.
- count\_tx++
- Increments transmission count.
- reti
- No
1.2 Continuous Transfer Mode (Master Mode, Reception Mode)

[Function] Sets communication mode to master mode and transfer direction mode to MSB first, and performs data reception for ten times in continuous transfer mode. Validates communication start trigger and sets communication clock to fxx/256, and transfer data length to 8 bits.

[Function name] csib2_main

[Argument] None

[Processing content] Sets reception count (count_rx) to initial value 0. Starts reception after calling each setting function.

[SFRs used] CB0RIC: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)
CB0REIC: 0x07 (Clears CSIB0 reception error interrupt request signal (INTCB0RE), releases mask, sets to priority level 7.)
CB0STR.CB0TSF Communication status flag

[call function] csib_port, csib_set, csib_start, csib_end

[Variables] unsigned char buf_rx[]: Receive data storing buffer
volatile unsigned char count_rx: Reception count variable

[Interrupts] csib_int_receive, csib_error

[Interrupt sources] INTCB0R, INTCB0RE

[File name] csib2.c

[Caution] None

---

[Function name] csib_port

[Processing content] Sets port 4 as CSIB0 I/O pin.

[SFRs used] PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PFC0E4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)

[call function] None

[Variable] None

[File name] csib2.c

[Caution] None
### CHAPTER 1 CONTINUOUS TRANSFER MODE

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Sets CSIB0 control register.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0CTL1: 0x06 (Sets to communication type 1 and sets communication clock to fxx/256 (0.25 MHz).)  
CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)  
CB0CTL0: 0x23 (Enables CSIB0 reception operation, sets to MSB first and continuous transfer mode, and validates communication start trigger.) |
| call function | None |
| Variable | None |
| File name | csib2.c |
| Caution | CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously. |

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Enables CSIB0 operation and performs dummy read on receive data register.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)  
CB0RX Receive data register |
| call function | None |
| Variable | unsigned char buf_rx[ ]; Receive data storing buffer |
| File name | csib2.c |
| Caution | None |

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Disables CSIB0 operation and reception operation.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)  
CB0CTL0.CB0RXE: 0 (Disables CSIB0 reception operation.) |
| call function | None |
| Variable | None |
| File name | csib2.c |
| Caution | None |
## Interrupt functions

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Stores receive data to buffer.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0RX Receive data register  
CB0CTL0.CB0SCE: 0 (Invalidates communication start trigger.) |
| Call function | None |
| Variables | volatile unsigned char count_rx: Reception count variable |
| File name | csib2.c |
| Caution | None |

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Clears reception error flag.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0RX Receive data register  
CB0STR.CB0OVE: 0 (Clears overrun error flag.) |
| Call function | None |
| Variables | volatile unsigned char count_rx: Reception count variable |
| File name | csib2.c |
| Caution | None |
Figure 1-2. Continuous Transfer Mode (Master Mode, Reception Mode) (1/2)

- `csib2_main`
  - `DI`
    - Disables maskable interrupt request.
  - `count_rx = 0`
    - Initializes reception count.
  - `csib_port`
    - Alternate-function pin setting function
  - `csib_set`
    - CSIB0 control register setting function
  - `CB0RIC = 0x07`
    - Clears INTCB0R interrupt request signal, releases mask, sets to priority level 7.
  - `CB0REIC = 0x07`
    - Clears INTCB0RE interrupt request signal, releases mask, sets to priority level 7.
  - `EI`
    - Enables maskable interrupt request.
  - `csib_start`
    - Serial transfer start function
  - `CB0TSF == 0`
    - Checks communication status flag.
  - `Yes`
    - Serial transfer disable function
  - `csib_end`
Figure 1-2. Continuous Transfer Mode (Master Mode, Reception Mode) (2/2)
### 1.3 Continuous Transfer Mode (Master Mode, Transmission/Reception Mode)

| [Function] | Sets communication mode to master mode and transfer direction mode to MSB first, and performs transmission/reception for ten times each in continuous transfer mode. Validates communication start trigger and sets communication clock to \( f_{XX}/256 \), and transfer data length to 8 bits. |
| [Function name] | csib3_main |
| [Argument] | None |
| [Processing content] | Sets transmission count (count_tx) to initial value 0. Sets reception count (count_rx) to initial value 0 and starts transmission/reception after calling each setting function. |
| [SFRs used] | CB0REIC: 0x07 (Enables CSIB0 reception error interrupt (INTCB0RE) servicing.) |
| | CB0RIC: 0x07 (Enables CSIB0 reception end interrupt (INTCB0R) servicing.) |
| | CB0TIC: 0x07 (Enables CSIB0 transmission enable interrupt (INTCB0T) servicing.) |
| | CB0STR.CB0TSF Communication status flag |
| [call functions] | csib_port, csib_set, csib_start, csib_end |
| [Variables] | unsigned char buf_tx[ ]; Transmit data storing buffer |
| | unsigned char buf_rx[ ]; Receive data storing buffer |
| | volatile unsigned char count_tx: Transmission count variable |
| | volatile unsigned char count_rx: Reception count variable |
| | unsigned char count: Transmit data generating variable |
| [Interrupts] | csib_error, csib_int_send, csib_int_receive |
| [Interrupt sources] | INTCB0RE, INTCB0R, INTCB0T |
| [File name] | csib3.c |
| [Caution] | None |

---

| [Function name] | csib_port |
| [Processing content] | Sets port 4 as CSIB0 I/O pin. |
| [SFRs used] | PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.) |
| | PFCE4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.) |
| | PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.) |
| [call function] | None |
| [Variable] | None |
| [File name] | csib3.c |
| [Caution] | None |
CHAPTER 1 CONTINUOUS TRANSFER MODE

[Function name] csib_set
[Processing content] Sets CSIB0 control register.
[SFRs used] CB0CTL1: 0x06 (Sets to communication type 1 and sets communication clock to \( f \times 256 \) (0.25 MHz).)
CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)
CB0CTL0: 0x63 (Enables CSIB0 transmission/reception operation, sets to MSB first and continuous transfer mode, and validates communication start trigger.)
[call function] None
[Variable] None
[File name] csib3.c
[Caution] CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

[Function name] csib_start
[Processing content] Enables CSIB0 operation and writes a value to transmit data register.
[SFRs used] CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation)
CB0TX Transmit data register
[call function] None
[Variables] unsigned char buf_tx[ ]; Transmit data storing buffer
volatile unsigned char count_tx: Transmission count variable
[File name] csib3.c
[Caution] None

[Function name] csib_end
[Processing content] Disables CSIB0 operation and transmission/reception operation.
[SFRs used] CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
CB0CTL0.CB0RXE: 0 (Disables CSIB0 reception operation.)
CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.)
[call function] None
[Variable] None
[File name] csib3.c
[Caution] None
### Interrupt functions

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Clears reception error flag.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0RX Receive data register</td>
</tr>
<tr>
<td></td>
<td>CB0STR.CB0OVE: 0 (Clears overrun error flag.)</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[]: Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib3.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_send</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Sets new data for transmitting next data.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0TX Transmit data register</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_tx[]: Transmit data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_tx: Transmission count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib3.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Stores receive data to buffer.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0RX Receive data register</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[]: Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib3.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 1-3. Continuous Transfer Mode (Master Mode, Transmission/Reception Mode) (1/3)

```
+----------+                  +---------+                  +----------+
| csib3_main|                  | DI       |                  | csib3_main|
|           | Disables maskable interrupt request. | initialization count tx = 0 | Initialization reception count variable. |
| count_tx = 0 |       |             | count_rx = 0 |                        |
| csib_port | Alternate-function pin setting function | csib_port | CSIB0 control register setting function |
| count = 0 |            |             |            |                        |
| count > TX_SIZE Yes | Checks communication status flag. | count > TX_SIZE No | Checks count for transmit data generated. |
|            |            |            |            | Substitutes value in buf_tx[]. |
|            |            |            |            | Increments count for transmit data generated. |
|            |            |            |            | |
|            |            |            |            | CB0TSF = 0
|            |            |            | No | Sel transfer disable function |
|            |            |            | Yes | Sel transfer start function |
|            |            |            |            | CB0TIC = 0x07
|            |            |            |            | CB0RIC = 0x07
|            |            |            |            | CB0REIC = 0x07
|            |            |            |            | EI Enables maskable interrupt request. |
|            |            |            |            | csib_start Serial transfer start function |
|            |            |            |            |            |
|            |            |            |            |            |
|            |            |            |            |            |
|            |            |            |            |            |
|            |            |            |            |            |
|            |            |            |            |            |
|            |            |            |            |            |
```
Figure 1-3. Continuous Transfer Mode (Master Mode, Transmission/Reception Mode) (2/3)

Alternate-function pin setting function

- **csib_port**
  - **PFC4 = 0x00**
  - **PFCE4 = 0x00**
  - **PMC4 = 0x07**
  - **ret**

Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.

Serial transfer start function

- **csib_start**
  - **CB0PWR = 1**
  - **CB0TX = buf_tx[0]**
  - **count_tx++**
  - **ret**

Enables CSIB0 operation.

Serial transfer disable function

- **csib_end**
  - **CB0PWR = 0**
  - **CB0RXE = 0**
  - **CB0TXE = 0**
  - **ret**

Disables CSIB0 operation.

CSIB0 control register setting function

- **csib_set**
  - **CB0CTL1 = 0x06**
  - **CB0CTL2 = 0x00**
  - **CB0CTL0 = 0x63**
  - **ret**

Sets data reception timing to communication type 1.
Sets communication clock to fXX/256 (0.25 MHz).
Sets transfer data length to 8 bits.
Enables transmission/reception operation, sets to continuous transfer mode, validates communication start trigger.

Disables CSIB0 reception operation.
Disables CSIB0 transmission operation.
Figure 1-3. Continuous Transfer Mode (Master Mode, Transmission/Reception Mode) (3/3)

INTCB0RE interrupt

INTCB0RE interrupt function

csib_error

buf_rx[count_rx] = CB0RX

CBOOVE = 0

Cleans error flag.

reti

INTCB0R interrupt

INTCB0R interrupt function

csib_int_receive

buf_rx[count_rx] = CB0RX

count_rx++

Stores reception result to buffer.

Increments reception count.

reti

INTCB0T interrupt

INTCB0T interrupt function

csib_int_send

count_tx < TX_SIZE

No

Checks transmission count.

Yes

CB0TX = buf_tx[count_tx]

Substitutes data in transmission register

count_tx++

Increments transmission count

reti
1.4 Continuous Transfer Mode (Slave Mode, Transmission Mode)

[Function] Sets communication mode to slave mode and transfer direction mode to MSB first, and performs transmission for ten times in continuous transfer mode. Validates communication start trigger and sets communication clock to external clock, and transfer data length to 8 bits.

[Function name] csib4_main

[Argument] None

[Processing content] Sets transmission count (count_tx) to initial value 0. Starts transmission after calling each setting function.

[SFRs used] CB0TIC: 0x07 (Clears CSIB0 transmission enable interrupt request signal (INTCB0T), releases mask, sets to priority level 7.)
CB0STR.CB0TSF Communication status flag

[call function] csib_port, csib_set, csib_start, csib_end

[Variables] unsigned char buf_tx[ ]: Transmit data storing buffer
volatile unsigned char count_tx: Transmission count variable
unsigned char count: Transfer data generating variable

[Interrupt] csib_int_send

[Interrupt source] INTCB0T

[File name] csib4.c

[Caution] None

---

[Function name] csib_port

[Processing content] Sets port 4 as CSIB0 I/O pin.

[SFRs used] PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PFCE4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)

[call function] None

[Variable] None

[File name] csib4.c

[Caution] None
[Function name] csib_set
[Processing content] Sets CSIB0 control register.
[SFRs used] CB0CTL1: 0x07 (Sets to communication type 1 and external clock.)
CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)
CB0CTL0: 0x43 (Enables CSIB0 transmission operation, sets to MSB first and continuous transfer mode, and validates communication start trigger.)
[call function] None
[Variable] None
[File name] csib4.c
[Caution] The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

[Function name] csib_start
[Processing content] Enables CSIB0 operation and writes a value to transmit data register.
[SFRs used] CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)
CB0TX: Transmit data register
[call function] None
[Variables] unsigned char buf_tx[]: Transmit data storing buffer
volatile unsigned char count_tx: Transmission count variable
[File name] csib4.c
[Caution] None

[Function name] csib_end
[Processing content] Disables CSIB0 operation and transmission operation.
[SFRs used] CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.)
[call function] None
[Variable] None
[File name] csib4.c
[Caution] None
Interrupt function

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_send</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Sets new data for transmitting next data.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0TX Transmit data register</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
</tbody>
</table>
| Variables | unsigned char buf_tx[]: Transmit data storing buffer  
volatile unsigned char count_tx: Transmission count variable |
| File name | csib4.c |
| Caution | None |
Figure 1-4. Continuous Transfer Mode (Slave Mode, Transmission Mode) (1/2)

- `csib4_main`
  - `DI` Disables maskable interrupt request.
  - `count_tx = 0` Initializes transmission count.

- `csib_port` Alternate-function pin setting function

- `csib_set` CSIB0 control register setting function
  - `count = 0` Initializes count for transmit data generated.

```
DI
count_tx = 0
```

```
yes
No
```

```
buf_tx[count] = count + 1
```

```
count++
```

```
CB0TIC = 0x07
```

```
EI
```

```
csib_start
```

```
CB0TSF == 0
```

```
csib_end
```

- Checks for transmit data generated.
- Substitutes value in `buf_tx[count]`.
- Increments count for transmit data generated.
- Clears INTCB0T interrupt request signal, releases mask, sets to priority level 7.
- Enables maskable interrupt request.
- Serial transfer start function
- Checks communication status flag.
- Serial transfer disable function
### Alternate-function pin setting function

- `csib_port`
- `PFC4 = 0x00
PFC4E = 0x00
PMC4 = 0x07`
- `ret`

### CSIB0 control register setting function

- `csib_set`
- `CB0CTL1 = 0x07`
- `CB0CTL2 = 0x00`
- `CB0CTL0 = 0x43`
- `ret`

Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.

Sets data reception timing to communication type 1

Sets communication clock to external clock

Sets transfer data length to 8 bits

Enables transmission operation, sets to continuous transfer mode, validates communication start trigger

---

**Figure 1-4. Continuous Transfer Mode (Slave Mode, Transmission Mode) (2/2)**

- **Alternate-function pin setting function**
  - `csib_port`
  - `PFC4 = 0x00
PFC4E = 0x00
PMC4 = 0x07`
  - `ret`

- **CSIB0 control register setting function**
  - `csib_set`
  - `CB0CTL1 = 0x07`
  - `CB0CTL2 = 0x00`
  - `CB0CTL0 = 0x43`
  - `ret`

Sets data reception timing to communication type 1

Sets communication clock to external clock

Sets transfer data length to 8 bits

Enables transmission operation, sets to continuous transfer mode, validates communication start trigger

---

**Serial transfer start function**

- `csib_start`
- `CB0PWR = 1`
- `CB0TX = buf_tx[0]`
- `count_tx++`
- `ret`

Enables CSIB0 operation.

Writes to CB0TX register.

Increments transmission count.

---

**Serial transfer disable function**

- `csib_end`
- `CB0PWR = 0`
- `CB0TXE = 0`
- `ret`

Disables CSIB0 operation

Disables CSIB0 transmission operation

---

**INTCB0T interrupt function**

- `csib_int_send`
- `count_tx < TX_SIZE`
- `CB0TX = buf_tx[count_tx]`
- `count_tx++`
- `ret`

Checks transmission count.

Substitutes data in transmission register.

Increments transmission count.

---

**INTCB0T interrupt function**

- `csib_int_send`
- `count_tx < TX_SIZE`
- `CB0TX = buf_tx[count_tx]`
- `count_tx++`
- `ret`
1.5 Continuous Transfer Mode (Slave Mode, Reception Mode)

[Function] Sets communication mode to slave mode and transfer direction mode to MSB first, and performs reception for ten times in continuous transfer mode. Validates communication start trigger and sets communication clock to external clock, and transfer data length to 8 bits.

[Function name] csib5_main

[Argument] None

[Processing content] Sets reception count (count_rx) to initial value 0. Starts reception after calling each setting function.

[SFRs used] CB0RIC: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)
CB0REIC: 0x07 (Clears CSIB0 reception error interrupt request signal (INTCB0RE), releases mask, sets to priority level 7.)
 CB0STR.CB0TSF Checks communication status flag

[call function] csib_port, csib_set, csib_start, csib_end

[Variables] unsigned char buf_rx[ ]: Receive data storing buffer
volatile unsigned char count_rx: Reception count variable

[Interrupts] csib_int_receive, csib_error

[Interrupt sources] INTCB0R, INTCB0RE

[File name] csib5.c

[Caution] None

---

[Funtion name] csib_port

[Processing content] Sets port 4 as CSIB0 I/O pin.

[SFRs used] PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PFCE4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)

[call function] None

[Variable] None

[File name] csib5.c

[Caution] None
### csib_set

**Function name:** csib_set

**Processing content:** Sets CSIB0 control register.

**SFRs used:**
- `CB0CTL1`: 0x07 (Sets to communication type 1 and sets communication clock to external clock.)
- `CB0CTL2`: 0x00 (Sets transfer data length to 8 bits.)
- `CB0CTL0`: 0x23 (Enables CSIB0 reception operation, sets to MSB first and continuous transfer mode, and validates communication start trigger.)

**call function:** None

**Variable:** None

**File name:** csib5.c

**Caution:** The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

### csib_start

**Function name:** csib_start

**Processing content:** Enables CSIB0 operation and performs dummy read on receive data register.

**SFRs used:**
- `CB0CTL0.CB0PWR`: 1 (Enables CSIB0 operation.)
- `CB0RX`: Receive data register

**call function:** None

**Variable:** unsigned char buf_rx[ ]: Receive data storing buffer

**File name:** csib5.c

**Caution:** None

### csib_end

**Function name:** csib_end

**Processing content:** Disables CSIB0 operation and reception operation.

**SFRs used:**
- `CB0CTL0.CB0PWR`: 0 (Disables CSIB0 operation.)
- `CB0CTL0.CB0RXE`: 0 (Disables CSIB0 reception operation.)

**call function:** None

**Variable:** None

**File name:** csib5.c

**Caution:** None
## Interrupt functions

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Stores receive data to buffer.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0RX Receive data register CB0CTL0.CB0SCE: 0 (Invalidates communication start trigger.)</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[ ]: Receive data storing buffer volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib5.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Clears reception error flag.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0RX Receive data register CB0STR.CB0OVE: 0 (Clears overrun error flag.)</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[ ]: Receive data storing buffer volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib5.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 1-5. Continuous Transfer Mode (Slave Mode, Reception Mode) (1/3)

```
Figure 1-5. Continuous Transfer Mode (Slave Mode, Reception Mode) (1/3)

- csib5_main
  - DI
    - count_rx = 0
      - csib_port
        - CB0R0C = 0x07
          - CB0REIC = 0x07
            - EI
              - csib_start
                - CB0TSF == 0
                  - No
                    - csib_end
                  - Yes
          - Checks communication status flag.
          - Serial transfer disable function
```
Figure 1-5. Continuous Transfer Mode (Slave Mode, Reception Mode) (2/3)

- **Alternate-function pin setting function**
  - `csib_port`
  - `PFC4 = 0x00`
  - `PFCE4 = 0x00`
  - `PMC4 = 0x07`

- **Serial transfer start function**
  - `csib_start`
  - `CB0PWR = 1`
  - `buf_rx[0] = CB0RX`

- **Serial transfer disable function**
  - `csib_end`
  - `CB0PWR = 0`

- **CSIB0 control register setting function**
  - `csib_set`
  - `CB0CTL1 = 0x07`
  - `CB0CTL2 = 0x00`
  - `CB0CTL0 = 0x23`

- **Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.**
- **Sets data reception timing to communication type 1.**
- **Sets communication clock to external clock.**
- **Sets transfer data length to 8 bits.**
- **Enables reception operation, sets to continuous transfer mode, validates communication start trigger.**
Figure 1-5. Continuous Transfer Mode (Slave Mode, Reception Mode) (3/3)

INTCB0RE interrupt function

- `csib_error`
- `buf_rx[count_rx] = CB0RX`
- `CB0OVE = 0`
- `reti`

INTCB0RE interrupt

INTCB0R interrupt function

- `csib_int_receive`
- `buf_rx[count_rx] = CB0RX`
- `count_rx++`
- `count_rx >= RX_SIZE-1`
- `CB0SCE = 0`
- `reti`

INTCB0R interrupt

- Checks reception count
- Invalidates communication start trigger.
1.6 Continuous Transfer Mode (Slave Mode, Transmission/Reception Mode)

[Function] Sets communication mode to slave mode and transfer direction mode to MSB first, and performs data transmission/reception for ten times each in continuous transfer mode. Validates communication start trigger and sets communication clock to external clock, and transfer data length to 8 bits.

[Function name] csib6_main

[Argument] None

[Processing content] Sets transmission count (count_tx) to initial value 0. Sets reception count (count_rx) to initial value 0 and starts transmission/reception after calling each setting function.

[SFRs used] CB0REIC: 0x07 (Clears CSIB0 reception error interrupt request signal (INTCB0RE), releases mask, sets to priority level 7.)
CB0RIC: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)
CB0TIC: 0x07 (Clears CSIB0 transmission enable interrupt request signal (INTCB0T), releases mask, sets to priority level 7.)
CB0STR.CB0TSF Communication status flag

[call function] csib_port, csib_set, csib_start, csib_end

[Variables] unsigned char buf_tx[ ]; Transmit data storing buffer
unsigned char buf_rx[ ]; Receive data storing buffer
volatile unsigned char count_tx: Transmission count variable
volatile unsigned char count_rx: Reception count variable
unsigned char count: Transfer data generating variable

[Interrupts] csib_error, csib_int_send, csib_int_receive

[Interrupt sources] INTC0RE, INTC0T, INTC0R

[File name] csib6.c

[Caution] None
## CHAPTER 1 CONTINUOUS TRANSFER MODE

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Sets port 4 as CSIB0 I/O pin.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)</td>
</tr>
<tr>
<td></td>
<td>PFCE4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)</td>
</tr>
<tr>
<td></td>
<td>PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
<tr>
<td>Variable</td>
<td>None</td>
</tr>
<tr>
<td>File name</td>
<td>csib6.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Sets CSIB0 control register.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0CTL1: 0x07 (Sets to communication type 1 and sets communication clock to external clock.)</td>
</tr>
<tr>
<td></td>
<td>CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)</td>
</tr>
<tr>
<td></td>
<td>CB0CTL0: 0x63 (Enables CSIB0 transmission and reception operation, sets to MSB first and continuous transfer mode, and validates communication start trigger.)</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
<tr>
<td>Variable</td>
<td>None</td>
</tr>
<tr>
<td>File name</td>
<td>csib6.c</td>
</tr>
<tr>
<td>Caution</td>
<td>The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Enables CSIB0 operation and writes a value to transmit data register.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)</td>
</tr>
<tr>
<td></td>
<td>CB0TX: Transmit data register</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_tx[ ]; Transmit data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_tx: Transmission count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib6.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
CHAPTER 1 CONTINUOUS TRANSFER MODE

[Function name] csib_end

[Processing content] Disables CSIB0 operation and transmission/reception operation.

[SFRs used] CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
CB0CTL0.CB0RXE: 0 (Disables CSIB0 reception operation.)
CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.)

[call function] None

[Variable] None

[File name] csib6.c

[Caution] None

Interrupt functions

[Function name] csib_error

[Servicing content] Clears reception error flag.

[SFRs used] CBORX Receive data register
CBOSTR.CB0OVE: 0 (Clears overrun error flag.)

[call function] None

[Variables] unsigned char buf_rx[ ]; Receive data storing buffer
volatile unsigned char count_rx: Reception count variable

[File name] csib6.c

[Caution] None

[Function name] csib_int_send

[Servicing content] Sets new data for transmitting next data.

[SFR used] CB0TX Transmit data register

[call function] None

[Variables] unsigned char buf_tx[ ]; Transmit data storing buffer
volatile unsigned char count_tx: Transmission count variable

[File name] csib6.c

[Caution] None
<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Stores receive data to buffer.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0RX Receive data register</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[]: Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib6.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 1-6. Continuous Transfer Mode (Slave Mode, Transmission/Reception Mode) (1/3)

- **DI**: Disables maskable interrupt request.
- **count_tx = 0**: Initializes transmission count.
- **count_rx = 0**: Initializes reception count.

**Alternate-function pin setting function**

**CSIB0 control register setting function**

- **count = 0**: Initializes reception count.
- **CB0TIC = 0x07**: Enables maskable interrupt request
- **CB0TREIC = 0x07**: Clears INTCB0T interrupt request signal, releases mask, sets to priority level 7.
- **CB0RIC = 0x07**: Clears INTCB0R interrupt request signal, releases mask, sets to priority level 7.
- **CB0RIC = 0x07**: Clears INTCB0T interrupt request signal, releases mask, sets to priority level 7.
- **EI**: Enables maskable interrupt request.

**Serial transfer start function**

- **CB0TSF == 0**: Checks communication status flag.
- **count > TX_SIZE**: Checks count for transmit data generated.
- **buf_tx[count] = count + 1**: Substitutes value in buf_tx[].
- **count++**: Increments count for transmit data generated.
- **count = 0**: Serial transfer disable function.
Figure 1-6. Continuous Transfer Mode (Slave Mode, Transmission/Reception Mode) (2/3)

Alternate-function pin setting function

- \texttt{csib\_port}
  - \texttt{PFC4 = 0x00}
  - \texttt{PFCE4 = 0x00}
  - \texttt{PMCE4 = 0x07}

- \texttt{ret}

Serial transfer start function

- \texttt{csib\_start}
  - \texttt{CB0PWR = 1}
  - \texttt{CB0TX = buf\_tx[0]}
  - \texttt{count\_tx++}

- \texttt{ret}

Serial transfer disable function

- \texttt{csib\_end}
  - \texttt{CB0PWR = 0}

- \texttt{CB0RXE = 0}

- \texttt{CB0TXE = 0}

- \texttt{ret}

CSIB0 control register setting function

- \texttt{csib\_set}
  - \texttt{CB0CTL1 = 0x07}
  - \texttt{CB0CTL2 = 0x00}
  - \texttt{CB0CTL0 = 0x63}

- \texttt{ret}

Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.

Sets data reception timing to communication type 1.
Sets communication clock to external clock.
Sets transfer data length to 8 bits.
Enables transmission/reception operation, sets to continuous transfer mode, validates communication start trigger.
Disables CSIB0 operation.
Disables CSIB0 reception operation.
Disables CSIB0 transmission operation.

Serial transfer disable function
Figure 1-6. Continuous Transfer Mode (Slave Mode, Transmission/Reception Mode) (3/3)
CHAPTER 2 SINGLE TRANSFER MODE

2.1 Single Transfer Mode (Master Mode, Transmission Mode)

[Function] Sets communication mode to master mode and transfer direction mode to MSB first, and performs data transmission for ten times in single transfer mode. Validates communication start trigger, and sets communication clock to f_{xx}/256 and transfer data length to 8 bits.

[Function name] csib7_main

[Argument] None

[Processing content] Sets transmission count (count_tx) to initial value 0. Starts transmission after calling each setting function.

[SFR used] CB0RIC: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)

[call function] csib_port, csib_set, csib_start, csib_end

[Variables] unsigned char buf_tx[ ]; Transmit data storing buffer
volatile unsigned char count_tx: Transmission count variable
unsigned char count: Transfer data generating variable

[Interrupt] csib_int_send

[Interrupt source] INTCB0R

[File name] csib7.c

[Caution] None

[Function name] csib_port

[Processing content] Sets port 4 as CSIB0 I/O pin.

[SFRs used] PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PFCE4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)

[call function] None

[Variable] None

[File name] csib7.c

[Caution] None
**CHAPTER 2 SINGLE TRANSFER MODE**

### csib_set

**Function name**: csib_set

**Processing content**: Sets CSIB0 control register.

**SFRs used**:
- CB0CTL1: 0x06 (Sets to communication type 1 and sets communication clock to fxx/256 (0.25 MHz).)
- CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)
- CB0CTL0: 0x41 (Enables CSIB0 transmission operation, sets to MSB first and single transfer mode, and validates communication start trigger.)

**call function**: None

**Variables**: None

**File name**: csib7.c

**Caution**: The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

### csib_start

**Function name**: csib_start

**Processing content**: Enables CSIB0 operation and writes a value to transmit data register.

**SFRs used**:
- CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)
- CB0TX Transmit data register

**call function**: None

**Variables**:
- unsigned char buf_tx[n]: Transmit data storing buffer
- volatile unsigned char count_tx: Transmission count variable

**File name**: csib7.c

**Caution**: None

### csib_end

**Function name**: csib_end

**Processing content**: Disables CSIB0 operation and transmission operation.

**SFRs used**:
- CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
- CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.)

**call function**: None

**Variables**: None

**File name**: csib7.c

**Caution**: None
Interrupt function

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_send</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Sets new data for transmitting next data.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0TX Transmit data register</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_tx[ ]: Transmit data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_tx: Transmission count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib7.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 2-1. Single Transfer Mode (Master Mode, Transmission Mode) (1/2)

- **csib7_main**
  - **DI**
    - Enables maskable interrupt request.
  - **count_tx = 0**
    - Initializes transmission count.
  - **csib_port**
    - Alternate-function pin setting function
  - **csib_set**
    - CSIB0 control register setting function
  - **count = 0**
  - **count > TX_SIZE**
    - Checks count for transmit data generated.
  - **buf_tx[count] = count + 1**
    - Substitutes value in buf_tx[].
  - **count++**
    - Increments count for transmit data generated.
  - **CB0RIC = 0x07**
    - Clears INTCB0R interrupt request signal, releases mask, sets to priority level 7.
  - **EI**
    - Enables maskable interrupt request.
  - **csib_start**
    - Serial transfer start function
  - **count_tx >= TX_SIZE**
    - Checks transmission count.
  - **csib_end**
    - Serial transfer disable function
Figure 2-1. Single Transfer Mode (Master Mode, Transmission Mode) (2/2)

Alternate-function pin setting function

```
csib_port
```

Sets alternate function to SCKB0 I/O, S0B0 output, SIB0 input.

```
PFC4 = 0x00
PFCE4 = 0x00
PMC4 = 0x07
```

```
ret
```

Serial transfer start function

```
csib_start
```

```
CB0PWR = 1
```

Enables CSIB0 operation.

```
CB0TX = buf_tx[0]
```

Writes to CB0TX register.

```
count_tx++
```

Increments transmission count.

```
ret
```

Serial transfer disable function

```
csib_end
```

```
CB0PWR = 0
```

Disables CSIB0 operation.

```
CB0TXE = 0
```

Disables CSIB0 transmission operation.

```
ret
```

CSIB0 control register setting function

```
csib_set
```

Sets data reception timing to communication type 1. Sets communication clock to fxx/256 (0.25 MHz).

```
CB0CTL1 = 0x06
CB0CTL2 = 0x00
CB0CTL0 = 0x41
```

Sets transfer data length to 8 bits.

```
ret
```

Enables transmission operation, sets single transfer mode, validates communication start trigger.

```
INTCB0R interrupt function
```

```
csib_int_send
```

```
count_tx < TX_SIZE
```

Checks transmission count.

```
No
```

```
CB0TX = buf_tx[count_tx]
```

Substitutes data in transmission register.

```
Yes
```

```
count_tx++
```

Increments transmission count.

```
reti
```

INTCB0R interrupt
2.2 Single Transfer Mode (Master Mode, Reception Mode)

<table>
<thead>
<tr>
<th>Function</th>
<th>Sets communication mode to master mode and transfer direction mode to MSB first, and performs data reception for ten times in single transfer mode. Validates communication start trigger and sets communication clock to ( f_{xx}/256 ), and transfer data length to 8 bits.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function name</td>
<td>csib8_main</td>
</tr>
<tr>
<td>Argument</td>
<td>None</td>
</tr>
<tr>
<td>Processing content</td>
<td>Sets reception count (count_rx) to initial value 0. Starts reception after calling each setting function.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0RIC: \( 0x07 \) (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)  
CB0REIC: \( 0x07 \) (Clears CSIB0 reception error interrupt request signal (INTCB0RE), releases mask, sets to priority level 7.) |
| call functions | csib_port, csib_set, csib_start, csib_end |
| Variables | unsigned char buf_rx[ ]: Receive data storing buffer  
volatile unsigned char count_rx: Reception count variable |
| Interrupts | csib_int_receive, csib_error |
| Interrupt sources | INTCB0R, INTCB0RE |
| File name | csib8.c |
| Caution | None |

| Function name | csib_port |
| Processing content | Sets port 4 as CSIB0 I/O pin. |
| SFRs used | PFC4: \( 0x00 \) (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)  
PFCE4: \( 0x00 \) (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)  
PMC4: \( 0x07 \) (Sets SCKB0 I/O, SOB0 output, and SIB0 input.) |
| call function | None |
| Variable | None |
| File name | csib8.c |
| Caution | None |
### Function: csib_set

**Processing content:** Sets CSIB0 control register.

- **SFRs used:**
  - CB0CTL1: 0x06 (Sets to communication type 1 and sets communication clock to \( f_{\text{xx}}/256 \) (0.25 MHz).)
  - CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)
  - CB0CTL0: 0x21 (Enables CSIB0 reception operation, sets to MSB first and single transfer mode, and validates communication start trigger.)

**Call function:** None

**Variable:** None

**File name:** csib8.c

**Caution:** The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

### Function: csib_start

**Processing content:** Enables CSIB0 operation and performs dummy read on receive data register.

- **SFRs used:**
  - CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)
  - CB0RX: Receive data register

**Call function:** None

**Variable:** unsigned char buf_rx[:]; Receive data storing buffer

**File name:** csib8.c

**Caution:** None

### Function: csib_end

**Processing content:** Disables CSIB0 operation and reception operation.

- **SFRs used:**
  - CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
  - CB0CTL0.CB0RXE: 0 (Disables CSIB0 reception operation.)

**Call function:** None

**Variable:** None

**File name:** csib8.c

**Caution:** None
### Interrupt functions

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Stores receive data to buffer.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0RX Receive data register</td>
</tr>
<tr>
<td></td>
<td>CB0CTL0.CB0SCE: 0 (Invalidates communication start trigger.)</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[ ]: Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib8.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Clears reception error flag.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0RX Receive data register</td>
</tr>
<tr>
<td></td>
<td>CB0STR.CB0OVE: 0 (Clears overrun error flag.)</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[ ]: Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib8.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 2-2. Single Transfer Mode (Master Mode, Reception Mode) (1/3)

1. `csib8_main`
   - Disables maskable interrupt request.

2. `DI`
   - Initializes reception count.

3. `count_rx = 0`
   - Alternate-function pin setting function

4. `csib_port`
   - CSIB0 control register setting function

5. `csib_set`
   - Clears INTCB0R interrupt request signal, releases mask, sets to priority level 7.

6. `CB0RIC = 0x07`

7. `CB0REIC = 0x07`
   - Enables maskable interrupt request.

8. `EI`
   - Serial transfer start function

9. `csib_start`

10. `count_rx >= RX_SIZE`  
    - Checks reception count.

11. `csib_end`
    - Serial transfer disable function
**Figure 2-2. Single Transfer Mode (Master Mode, Reception Mode) (2/3)**

- **Alternate-function pin setting function**
  ```
  csib_port
  PFC4 = 0x00
  PFCE4 = 0x00
  PMC4 = 0x07
  
  ret
  ```

- **Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.**

- **Serial transfer start function**
  ```
  csib_start
  
  CB0PWR = 1
  Enables CSIB0 operation.
  
  buf_rx[0] = CB0RX
  Performs CB0RX dummy read.
  
  ret
  ```

- **Sets transfer data length to 8 bits.**

- **Serial transfer disable function**
  ```
  csib_end
  
  CB0PWR = 0
  
  CB0RXE = 0
  Disables CSIB0 reception operation.
  
  ret
  ```

- **CSIB0 control register setting function**
  ```
  csib_set
  
  CB0CTL1 = 0x06
  Sets data reception timing to communication type 1.
  
  CB0CTL2 = 0x00
  Sets communication clock to fX/256 (0.25 MHz).
  
  CB0CTL0 = 0x21
  Sets transfer data length to 8 bits.
  
  ret
  ```

- **Enables reception operation, sets to single transfer mode, validates communication start trigger.**

- **INTCB0R interrupt function**
  ```
  count_rx >= RX_SIZE-1
  Checks reception count.
  
  No
  
  Yes
  
  CB0SCE = 0
  Invalidates communication start trigger.
  
  buf_rx[count_rx] = CB0RX
  Stores reception result to buffer.
  
  count_rx++
  Increments reception count.
  
  reti
  ```
Figure 2-2. Single Transfer Mode (Master Mode, Reception Mode) (3/3)

INTCB0RE interrupt

INTCB0RE interrupt function

ctib_error

buf_rx[count_rx] = CB0RX

Reads CB0RX register.

CB0OVE = 0

Clears error flag.

reti
### 2.3 Single Transfer Mode (Master Mode, Transmission/Reception Mode)

| [Function] | Sets communication mode to master mode and transfer direction mode to MSB first, and performs transmission/reception for ten times each in single transfer mode. Validates communication start trigger and sets communication clock to \( f_{xx}/256 \), and transfer data length to 8 bits. |
| [Function name] | csib9_main |
| [Argument] | None |
| [Processing content] | Sets transmission count (count\(_{tx}\)) to initial value 0. Sets reception count (count\(_{rx}\)) to initial value 0 and starts transmission/reception after calling each setting function. |
| [SFRs used] | CB0REIC: 0x07 (Clears CSIB0 reception error interrupt request signal (INTCB0RE), releases mask, sets to priority level 7.)  
CB0RIC: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)  
CB0TIC: 0x07 (Clears CSIB0 transmission enable interrupt request signal (INTCB0T), releases mask, sets to priority level 7.) |
| [call functions] | csib_port, csib_set, csib_start, csib_end |
| [Variables] | unsigned char buf\(_{tx}\)[ ]; Transmit data storing buffer  
unsigned char buf\(_{rx}\)[ ]; Receive data storing buffer  
volatile unsigned char count\(_{tx}\): Transmission count variable  
volatile unsigned char count\(_{rx}\): Reception count variable  
unsigned char count: Transmit data generating variable |
| [Interrupts] | csib_error, csib_int_send, csib_int_receive |
| [Interrupt sources] | INTCB0RE, INTCB0T, INTCB0R |
| [File name] | csib9.c |
| [Caution] | None |

---

| [Function name] | csib_port |
| [Processing content] | Sets port 4 as CSIB0 I/O pin. |
| [SFRs used] | PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)  
PFC4E: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)  
PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.) |
| [call function] | None |
| [Variable] | None |
| [File name] | csib9.c |
| [Caution] | None |
**CHAPTER 2 SINGLE TRANSFER MODE**

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Sets CSIB0 control register.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0CTL1: 0x06 (Sets to communication type 1 and sets communication clock to fxx/256 (0.25 MHz).)  
CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)  
CB0CTL0: 0x61 (Enables CSIB0 transmission and reception operation, sets to MSB first and single transfer mode, and validates communication start trigger.) |
| Call function | None |
| Variable | None |
| File name | csib9.c |
| Caution | The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are re writable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously. |

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Enables CSIB0 operation and writes a value to transmit data register.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)  
CB0TX Transmit data register |
| Call function | None |
| Variables | unsigned char buf_tx[]: Transmit data storing buffer  
volatile unsigned char count_tx: Transmission count variable |
| File name | csib9.c |
| Caution | None |

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing content</td>
<td>Disables CSIB0 operation and transmission/reception operation.</td>
</tr>
</tbody>
</table>
| SFRs used | CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)  
CB0CTL0.CB0RXE: 0 (Disables CSIB0 reception operation.)  
CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.) |
| Call function | None |
| Variable | None |
| File name | csib9.c |
| Caution | None |
## Interrupt functions

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Clears reception error flag.</td>
</tr>
<tr>
<td>SFRs used</td>
<td>CB0RX Transmit data register</td>
</tr>
<tr>
<td></td>
<td>CB0STR.CB0OVE: 0 (Clears overrun error flag.)</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[ ]; Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx; Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib9.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_send</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Sets new data for transmitting next data.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0TX Transmit data register</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_tx[ ]; Transmit data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_tx; Transmission count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib9.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Stores receive data to buffer.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0RX Receive data register</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_rx[ ]; Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx; Reception count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib9.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 2-3. Single Transfer Mode (Master Mode, Transmission/Reception Mode) (1/3)

- **csib9_main**
  - **DI**
    - Disables maskable interrupt request.
  - **count_tx = 0**
    - Initializes transmission count.
  - **count_rx = 0**
    - Initializes reception count.

- **csib_port**
  - Alternate-function pin setting function

- **csib_set**
  - CSIB0 control register setting function

- **count = 0**
  - Initializes count for transmit data generated.

- **count > TX_SIZE**
  - Checks count for transmit data generated.
  - **buf_tx[count] = count + 1**
    - Substitutes value in buf_tx[].
  - **count++**
    - Increments count for transmit data generated.

- **CB0REIC = 0x07**
  - Clears INTCB0RE interrupt request signal, releases mask, sets to priority level 7.

- **CB0RIC = 0x07**
  - Clears INTCB0R interrupt request signal, releases mask, sets to priority level 7.

- **CB0TIC = 0x07**
  - Clears INTCB0T interrupt request signal, releases mask, sets to priority level 7.

- **EI**
  - Enables maskable interrupt request.

- **csib_start**
  - Serial transfer start function

- **count_rx >= RX_SIZE**
  - Checks reception count.
  - **No**
    - **csib_end**
      - Serial transfer disable function
  - **Yes**
    - **csib_end**
      - Serial transfer disable function
Figure 2-3. Single Transfer Mode (Master Mode, Transmission/Reception Mode) (2/3)

Alternate-function pin setting function
- \texttt{csib\_port}
  - \texttt{PFC4 = 0x00}
  - \texttt{PFCE4 = 0x00}
  - \texttt{PMC4 = 0x07}
- \texttt{ret}

Serial transfer start function
- \texttt{csib\_start}
  - \texttt{CB0PWR = 1}
  - \texttt{CB0TX = buf\_tx[0]}
  - \texttt{count\_tx++}
  - \texttt{ret}

Serial transfer disable function
- \texttt{csib\_end}
  - \texttt{CB0PWR = 0}
  - \texttt{CB0RXE = 0}
  - \texttt{CB0TXE = 0}
  - \texttt{ret}

CSIB0 control register setting function
- \texttt{csib\_set}
  - \texttt{CB0CTL1 = 0x06}
  - \texttt{CB0CTL2 = 0x00}
  - \texttt{CB0CTL0 = 0x61}
  - \texttt{ret}

Alternate-function pin setting function
- Sets alternate function to \texttt{SCKB0 I/O, SOB0 output, SIB0 input.}
- \texttt{csib\_set}
  - \texttt{ret}

Sets transfer data length to 8 bits.
- \texttt{CSIB0 control register setting function}
  - \texttt{CB0CTL1 = 0x06}
  - \texttt{CB0CTL2 = 0x00}
  - \texttt{CB0CTL0 = 0x61}
  - \texttt{ret}

Sets data reception timing to communication type 1.
- \texttt{CSIB0 control register setting function}
  - \texttt{CB0CTL1 = 0x06}
  - \texttt{CB0CTL2 = 0x00}
  - \texttt{CB0CTL0 = 0x61}
  - \texttt{ret}

Sets communication clock to \texttt{fXX/256 (0.25 MHz)}.
- \texttt{CSIB0 control register setting function}
  - \texttt{CB0CTL1 = 0x06}
  - \texttt{CB0CTL2 = 0x00}
  - \texttt{CB0CTL0 = 0x61}
  - \texttt{ret}

Enables transmission/reception operation, sets to single transfer mode, validates communication start trigger.
**Figure 2-3. Single Transfer Mode (Master Mode, Transmission/Reception Mode) (3/3)**

- **INTCB0RE interrupt function**
  - `csib_error`
  - Reads CB0RX register.
  - `buf_rx[count_rx] = CB0RX`
  - `CB0OVE = 0`
  - Clears error flag.
  - `reti`

- **INTCB0R interrupt function**
  - `csib_int_receive`
  - Stores reception result to buffer.
  - `buf_rx[count_rx] = CB0RX`
  - `count_rx++`
  - Increments reception count.
  - `reti`

- **INTCB0R interrupt function**
  - `csib_int_send`
  - Checks transmission count.
  - `count_tx < TX_SIZE`
  - `Yes`
  - `CB0TX = buf_tx[count_tx]`
  - `count_tx++`
  - Increments transmission count.
  - `reti`
  - `No`
  - `count_tx++`
  - `reti`
2.4 Single Transfer Mode (Slave Mode, Transmission Mode)

[Function] Sets communication mode to slave mode and transfer direction mode to MSB first, and performs transmission for ten times in single transfer mode. Validates communication start trigger and sets communication clock to external clock, and transfer data length to 8 bits.

[Function name] csib10_main

[Argument] None

[Processing content] Sets transmission count (count_tx) to initial value 0. Starts transmission after calling each setting function.

[SFR used] CB0RIC: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)

[call functions] csib_port, csib_set, csib_start, csib_end

[Variables] unsigned char buf_tx[]: Transmit data storing buffer
volatile unsigned char count_tx: Transmission count variable
unsigned char count: Transfer data generating variable

[Interrupt] csib_int_send

[Interrupt source] INTCB0R

[File name] csib10.c

[Caution] None

---

[Function name] csib_port

[Processing content] Sets port 4 as CSIB0 I/O pin.

[SFRs used] PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PFD4E: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)
PMO4: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)

[call function] None

[Variable] None

[File name] csib10.c

[Caution] None
### CHAPTER 2 SINGLE TRANSFER MODE

<table>
<thead>
<tr>
<th>[Function name]</th>
<th>csib_set</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Processing content]</td>
<td>Sets CSIB0 control register.</td>
</tr>
<tr>
<td>[SFRs used]</td>
<td>CB0CTL1: 0x07 (Sets to communication type 1 and external clock.)&lt;br&gt;CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)&lt;br&gt;CB0CTL0: 0x41 (Enables CSIB0 transmission operation, sets to MSB first and single transfer mode, and validates communication start trigger.)</td>
</tr>
<tr>
<td>[call function]</td>
<td>None</td>
</tr>
<tr>
<td>[Variable]</td>
<td>None</td>
</tr>
<tr>
<td>[File name]</td>
<td>csib10.c</td>
</tr>
<tr>
<td>[Caution]</td>
<td>The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[Function name]</th>
<th>csib_start</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Processing content]</td>
<td>Enables CSIB0 operation and writes a value to transmit data register.</td>
</tr>
<tr>
<td>[SFRs used]</td>
<td>CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)&lt;br&gt;CB0TX: Transmit data register</td>
</tr>
<tr>
<td>[call function]</td>
<td>None</td>
</tr>
<tr>
<td>[Variables]</td>
<td>unsigned char buf_tx[ ]: Transmit data storing buffer&lt;br&gt;volatile unsigned char count_tx: Transmission count variable</td>
</tr>
<tr>
<td>[File name]</td>
<td>csib10.c</td>
</tr>
<tr>
<td>[Caution]</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[Function name]</th>
<th>csib_end</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Processing content]</td>
<td>Disables CSIB0 operation and transmission operation.</td>
</tr>
<tr>
<td>[SFRs used]</td>
<td>CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)&lt;br&gt;CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.)</td>
</tr>
<tr>
<td>[call function]</td>
<td>None</td>
</tr>
<tr>
<td>[Variable]</td>
<td>None</td>
</tr>
<tr>
<td>[File name]</td>
<td>csib10.c</td>
</tr>
<tr>
<td>[Caution]</td>
<td>None</td>
</tr>
</tbody>
</table>
## Interrupt function

<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_send</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Sets new data for transmitting next data.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0TX</td>
</tr>
<tr>
<td></td>
<td>Transmit data register</td>
</tr>
<tr>
<td>Call function</td>
<td>None</td>
</tr>
<tr>
<td>Variables</td>
<td>unsigned char buf_tx[]: Transmit data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_tx: Transmission count variable</td>
</tr>
<tr>
<td>File name</td>
<td>csib10.c</td>
</tr>
<tr>
<td>Caution</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 2-4. Single Transfer Mode (Slave Mode, Transmission Mode) (1/2)

```
DI
Disables maskable interrupt request.

count_tx = 0
Initializes transmission count.

csib_port
Alternate-function pin setting function

csib_set
CSIB0 control register setting function

count = 0
Initializes count for transmit data generated.

count > TX_SIZE
Yes
Checks count for transmit data generated.

buf_tx[count] = count + 1
Substitutes value in buf_tx[].

count++
Increments count for transmit data generated.

CB0RIC = 0x07
Cleans INTCB0R interrupt request signal, releases mask, sets to priority level 7.

EI
Enables maskable interrupt request.

csib_start
Serial transfer start function

count_tx >= TX_SIZE
No
Checks transmission count.

Yes
Serial transfer disable function
```

```
Figure 2-4. Single Transfer Mode (Slave Mode, Transmission Mode) (2/2)

Alternate-function pin setting function

- **csib_port**
- **PFC4 = 0x00**
- **PFCE4 = 0x00**
- **PMC4 = 0x07**
- **ret**

Serial transfer start function

- **csib_start**
- **CB0PWR = 1**
- **CB0TX = buf_tx[0]**
- **count_tx++**
- **ret**

Serial transfer disable function

- **csib_end**
- **CB0PWR = 0**
- **CB0TXE = 0**
- **ret**

CSIB0 control register setting function

- **csib_set**
- **CB0CTL1 = 0x07**
- **CB0CTL2 = 0x00**
- **CB0CTL0 = 0x41**
- **ret**

Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.

Sets transfer data length to 8 bits.

Enables transmission operation, sets to single transfer mode, validates communication start trigger.

Sets data reception timing to communication type 1.
Sets communication clock to external clock.

INTCB0R interrupt function

- **csib_int_send**
- **count_tx < TX_SIZE**
- **CB0TX = buf_tx[count_tx]**
- **count_tx++**
- **ret**

Checks transmission count.
Substitutes data in transmission register.
Increments transmission count.

INTCB0R interrupt

Disables CSIB0 operation.
Disables CSIB0 transmission operation.
### 2.5 Single Transfer Mode (Slave Mode, Reception Mode)

<table>
<thead>
<tr>
<th>Function</th>
<th>Sets communication mode to slave mode and transfer direction mode to MSB first, and performs reception for ten times in single transfer mode. Validates communication start trigger and sets communication clock to external clock, and transfer data length to 8 bits.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function name</td>
<td>csib11_main</td>
</tr>
<tr>
<td>Argument</td>
<td>None</td>
</tr>
<tr>
<td>Processing content</td>
<td>Sets reception count (count_rx) to initial value 0. Starts reception after calling each setting function.</td>
</tr>
</tbody>
</table>
| SFRs used | **CB0RIC**: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)  
**CB0REIC**: 0x07 (Clears CSIB0 reception error interrupt request signal (INTCB0RE), releases mask, sets to priority level 7.) |
| call functions | csib_port, csib_set, csib_start, csib_end |
| Variables | unsigned char buf_rx[ ]; Receive data storing buffer  
volatile unsigned char count_rx: Reception count variable |
| Interrupts | csib_int_receive, csib_error |
| Interrupt sources | INTCB0R, INTCB0RE |
| File name | csib11.c |
| Caution | None |

| Function name | csib_port |
| Processing content | Sets port 4 as CSIB0 I/O pin. |
| SFRs used | **PFC4**: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)  
**PFCE4**: 0x00 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.)  
**PMC4**: 0x07 (Sets SCKB0 I/O, SOB0 output, and SIB0 input.) |
| call function | None |
| Variable | None |
| File name | csib11.c |
| Caution | None |
[Function name] csib_set

[Processing content] Sets CSIB0 control register.

[SFRs used] CB0CTL1: 0x07 (Sets to communication type 1 and sets communication clock to external clock.)
CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)
CB0CTL0: 0x21 (Enables CSIB0 reception operation, sets to MSB first and single transfer mode, and validates communication start trigger.)

[Variable] None

[File name] csib11.c

[Caution] The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

[Function name] csib_start

[Processing content] Enables CSIB0 operation and performs dummy read on receive data register.

[SFRs used] CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)
CB0RX: Receive data register

[Variable] unsigned char buf_rx[:]: Receive data storing buffer

[File name] csib11.c

[Caution] None

[Function name] csib_end

[Processing content] Disables CSIB0 operation and reception operation.

[SFRs used] CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
CB0CTL0.CB0RXE: 0 (Disables CSIB0 reception operation.)

[Variable] None

[File name] csib11.c

[Caution] None
### Interrupt functions

<table>
<thead>
<tr>
<th>[Function name]</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Servicing content]</td>
<td>Stores receive data to buffer.</td>
</tr>
<tr>
<td>[SFRs used]</td>
<td>CB0RX</td>
</tr>
<tr>
<td></td>
<td>CB0CTL0.CB0SCE: 0 (Invalidates communication start trigger.)</td>
</tr>
<tr>
<td>[call function]</td>
<td>None</td>
</tr>
<tr>
<td>[Variables]</td>
<td>unsigned char buf_rx[ ]: Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>[File name]</td>
<td>csib11.c</td>
</tr>
<tr>
<td>[Caution]</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[Function name]</th>
<th>csib_error</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Servicing content]</td>
<td>Clears reception error flag.</td>
</tr>
<tr>
<td>[SFRs used]</td>
<td>CB0RX</td>
</tr>
<tr>
<td></td>
<td>CB0STR.CB0OVE: 0 (Clears overrun error flag.)</td>
</tr>
<tr>
<td>[call function]</td>
<td>None</td>
</tr>
<tr>
<td>[Variables]</td>
<td>unsigned char buf_rx[ ]: Receive data storing buffer</td>
</tr>
<tr>
<td></td>
<td>volatile unsigned char count_rx: Reception count variable</td>
</tr>
<tr>
<td>[File name]</td>
<td>csib11.c</td>
</tr>
<tr>
<td>[Caution]</td>
<td>None</td>
</tr>
</tbody>
</table>
Figure 2-5. Single Transfer Mode (Slave Mode, Reception Mode) (1/3)

- **csib11_main**
  - **DI**
    - Disables maskable interrupt request.
  - **count_rx = 0**
    - Initializes reception count.
  - **csib_port**
    - Alternate-function pin setting function
  - **csib_set**
    - CSIB0 control register setting function
  - **CB0RIC = 0x07**
    - Clears INTCB0R interrupt request signal, releases mask, sets to priority level 7.
  - **CB0REIC = 0x07**
    - Clears INTCB0RE interrupt request signal, releases mask, sets to priority level 7.
  - **EI**
    - Enables maskable interrupt request.
  - **csib_start**
    - Serial transfer start function
  - **count_rx >= RX_SIZE**
    - Serial transfer disable function
  - **csib_end**
    - No
  - **Yes**
Figure 2-5. Single Transfer Mode (Slave Mode, Reception Mode) (2/3)

Alternate-function pin setting function

`csib_port`

- **PFC4 = 0x00**
- **PFCE4 = 0x00**
- **PMC4 = 0x07**

Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.

`ret`

Serial transfer start function

`csib_start`

- `CB0PWR = 1`
- Enables CSIB0 operation.

`buf_rx[0] = CB0RX`

Performs CB0RX dummy read.

`ret`

Serial transfer disable function

`csib_end`

- `CB0PWR = 0`
- Disables CSIB0 reception operation.

`CB0RXE = 0`

Sets data reception timing to communication type 1.

Sets communication clock to external clock.

Sets transfer data length to 8 bits.

Enables reception operation, sets to single transfer mode, validates communication start trigger.

CSIB0 control register setting function

`csib_set`

- **CB0CTL1 = 0x07**
- **CB0CTL2 = 0x00**
- **CB0CTL0 = 0x21**

Sets data reception timing to communication type 1.

Sets communication clock to external clock.

Sets transfer data length to 8 bits.

Enables reception operation, sets to single transfer mode, validates communication start trigger.

INTCB0R interrupt function

- **CB0SCE = 0**
- Invalidates communication start trigger.

`csib_int_receive`

- `buf_rx[count_rx] = CB0RX`
- Stores reception result to buffer.

- `count_rx++`
- Increments reception count.

- `reti`

INTCB0R interrupt function

- **count_rx >= RX_SIZE-1**
- Checks reception count.

- **Yes**
- Invalidates communication start trigger.

- **No**
- Checks reception count.

- `reti`
Figure 2-5. Single Transfer Mode (Slave Mode, Reception Mode) (3/3)

INTCB0RE interrupt function

csib_error

buf_rx[count_rx] = CB0RX
Reads CR0RX register.

CB0OVE = 0
Clears error flag.

reti
2.6 Single Transfer Mode (Slave Mode, Transmission/Reception Mode)

[Function] Sets communication mode to slave mode and transfer direction mode to MSB first, and performs data transmission/reception for ten times each in single transfer mode. Validates communication start trigger and sets communication clock to external clock, and transfer data length to 8 bits.

[Function name] csib12_main

[Argument] None

[Processing content] Sets transmission count (count_tx) to initial value 0. Sets reception count (count_rx) to initial value 0 and starts transmission/reception after calling each setting function.

[SFRs used] CB0REIC: 0x07 (Clears CSIB0 reception error interrupt request signal (INTCB0RE), releases mask, sets to priority level 7.)
CB0RIC: 0x07 (Clears CSIB0 reception end interrupt request signal (INTCB0R), releases mask, sets to priority level 7.)
CB0TIC: 0x07 (Clears CSIB0 transmission enable interrupt request signal (INTCB0T), releases mask, sets to priority level 7.)

[call functions] csib_port, csib_set, csib_start, csib_end

[Variables] unsigned char buf_tx[]: Transmit data storing buffer
unsigned char buf_rx[]: Receive data storing buffer
volatile unsigned char count_tx: Transmission count variable
volatile unsigned char count_rx: Reception count variable
unsigned char count: Transfer data generating variable

[Interrupts] csib_error, csib_int_send, csib_int_receive

[Interrupt sources] INTCB0RE, INTCB0T, INTCB0R

[File name] csib12.c

[Caution] None
### Function: `csib_port`
- **Processing content**: Sets port 4 as CSIB0 I/O pin.
- **SFRs used**:
  - PFC4: 0x00 (Sets SCKB0 I/O, SOB0 output and SIB0 input.)
  - PFCE4: 0x00 (Sets SCKB0 I/O, SOB0 output and SIB0 input.)
  - PMC4: 0x07 (Sets SCKB0 I/O, SOB0 output and SIB0 input.)
- **Call function**: None
- **Variable**: None
- **File name**: `csib12.c`
- **Caution**: None

### Function: `csib_set`
- **Processing content**: Sets CSIB0 control register.
- **SFRs used**:
  - CB0CTL1: 0x07 (Sets to communication type 1 and external clock.)
  - CB0CTL2: 0x00 (Sets transfer data length to 8 bits.)
  - CB0CTL0: 0x61 (Enables CSIB0 transmission and reception operation, sets to MSB first and single transfer mode, and validates communication start trigger.)
- **Call function**: None
- **Variable**: None
- **File name**: `csib12.c`
- **Caution**: The CB0TXE, CB0RXE, CB0DIR, and CB0TMS bits of the CB0CTL0 register are rewritable only when the CB0PWR bit is 0. However, the CB0PWR bit can be set to 1 simultaneously.

### Function: `csib_start`
- **Processing content**: Enables the CSIB0 operation and writes a value to the transmit data register.
- **SFRs used**:
  - CB0CTL0.CB0PWR: 1 (Enables CSIB0 operation.)
  - CB0TX: Transmit data register
- **Call function**: None
- **Variables**:
  - unsigned char buf_tx[:]: Transmit data storing buffer
  - volatile unsigned char count_tx: Transmission count variable
- **File name**: `csib12.c`
- **Caution**: None
[Function name] csib_end

[Processing content] Disables CSIB0 operation and transmission/reception operation.

[SFRs used] CB0CTL0.CB0PWR: 0 (Disables CSIB0 operation.)
CB0CTL0.CB0RXE: 0 (Disables CSIB0 reception operation.)
CB0CTL0.CB0TXE: 0 (Disables CSIB0 transmission operation.)

[call function] None

[Variable] None

[File name] csib12.c

[Caution] None

Interrupt functions

[Function name] csib_error

[Servicing content] Clears reception error flag.

[SFRs used] CB0RX Receive data register
CB0STR.CB0OVE: 0 (Clears overrun error flag.)

[call function] None

[Variables] unsigned char buf_rx[ ]; Receive data storing buffer
volatile unsigned char count_rx: Reception count variable

[File name] csib12.c

[Caution] None

[Function name] csib_int_send

[Servicing content] Sets new data for transmitting next data.

[SFR used] CB0TX Transmit data register

[call function] None

[Variables] unsigned char buf_tx[ ]; Transmit data storing buffer
volatile unsigned char count_tx: Transmission count variable

[File name] csib12.c

[Caution] None
<table>
<thead>
<tr>
<th>Function name</th>
<th>csib_int_receive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing content</td>
<td>Stores receive data to buffer.</td>
</tr>
<tr>
<td>SFR used</td>
<td>CB0RX Receive data register</td>
</tr>
<tr>
<td>call function</td>
<td>None</td>
</tr>
</tbody>
</table>
| Variables | unsigned char buf_rx[]: Receive data storing buffer  
volatile unsigned char count_rx: Reception count variable |
| File name | csib12.c |
| Caution | None |
Figure 2-6. Single Transfer Mode (Slave Mode, Transmission/Reception Mode) (1/3)

- **csib12_main**
  - DI: Disables maskable interrupt request.
  - count_rx = 0: Initializes reception count.
  - count_tx = 0: Initializes transmission count.

- **csib_port**
  - Alternate-function pin setting function.

- **csib_set**
  - CSIB0 control register setting function.
  - count = 0: Initializes count for transmit data generated.

- **count > TX_SIZE**
  - Yes: Checks count for transmit data generated.
  - No: Buf_tx[count] = count + 1; Substitutes value in buf_tx[].
  - count++: Increments count for transmit data generated.

- **CB0REIC = 0x07**
  - Clears INTCB0RE interrupt request signal, releases mask, sets to priority level 7.

- **CB0RIC = 0x07**
  - Clears INTCB0R interrupt request signal, releases mask, sets to priority level 7.

- **CB0TIC = 0x07**
  - Clears INTCB0T interrupt request signal, releases mask, sets to priority level 7.

- **EI**
  - Enables maskable interrupt request.

- **csib_start**
  - Serial transfer start function.

- **count_rx >= RX_SIZE**
  - No: Checks reception count.
  - Yes: Serial transfer operation disable function.
Figure 2-6. Single Transfer Mode (Slave Mode, Transmission/Reception Mode) (2/3)

- Sets transfer data length to 8 bits.
- Sets data reception timing to communication type 1.
- Sets communication clock to external clock.
- Enables transmission/reception operation, sets to single transfer mode, validates communication start trigger.

Alternate-function pin setting function

```
csib_port
```

Sets alternate function to SCKB0 I/O, SOB0 output, SIB0 input.

```
PFC4 = 0x00
PFCE4 = 0x00
PMC4 = 0x07
```

Serial transfer start function

```
csib_start
```

Enables CSIB0 operation.

```
CB0PWR = 1
```

```
CB0TX = buf_tx[0]
```

```
count_tx++
```

```
ret
```

Serial transfer disable function

```
csib_end
```

Disables CSIB0 operation.

```
CB0PWR = 0
```

```
CB0RXE = 0
```

```
CB0TXE = 0
```

```
ret
```
Figure 2-6. Single Transfer Mode (Slave Mode, Transmission/Reception Mode) (3/3)

INTCB0RE interrupt function

```
csib_error
```

Reads CB0RX register.

```
buf_rx[count_rx] = CB0RX
```

CBOOVE = 0

Clears error flag.

```
reti
```

INTCB0R interrupt function

```
csib_int_receive
```

Stores reception result to buffer.

```
buf_rx[count_rx] = CB0RX
```

count_rx++

Increments reception count.

```
reti
```

INTCB0R interrupt

```
csib_int_send
```

Checks transmission count.

```
count_tx < TX_SIZE
```

No

```
CB0TX = buf_tx[count_tx]
```

Substitutes data in transmission register.

```
count_tx++
```

Increments transmission count.

```
reti
```
For further information, please contact:

NEC Electronics Corporation
1753, Shimonumabe, Nakahara-ku,
Kawasaki, Kanagawa 211-8668,
Japan
Tel: 044-435-5111
http://www.necel.com/

[America]
NEC Electronics America, Inc.
2880 Scott Blvd.
Santa Clara, CA 95050-2554, U.S.A.
Tel: 408-588-6000
800-366-9782
http://www.am.necel.com/

[Europe]
NEC Electronics (Europe) GmbH
Arcadiastrasse 10
40472 Düsseldorf, Germany
Tel: 0211-65030
http://www.eu.necel.com/

Hanover Office
Podbielkistrasse 166 B
30177 Hannover
Tel: 0 511 33 40 2-0

Munich Office
Werner-Eckert-Strasse 9
81829 München
Tel: 0 89 92 10 03-0

Stuttgart Office
Industriestrasse 3
70565 Stuttgart
Tel: 0 711 99 01 0-0

United Kingdom Branch
Cygns House, Sunrise Parkway
Linford Wood, Milton Keynes
MK14 6NP, U.K.
Tel: 01908-691-133

Succursale Française
9, rue Paul Dautier, B.P. 52
78142 Velizy-Villacoublay Cédex
France
Tel: 01-3067-5800

Sucursales en España
Juan Esplandiu, 15
28007 Madrid, Spain
Tel: 091-504-2787

Tyskland Filial
Täby Centrum
Entrance S (7th floor)
18322 Täby, Sweden
Tel: 08 638 72 00

Filiale Italiana
Via Fabio Filzi, 25/A
20124 Milano, Italy
Tel: 02-667541

Branch The Netherlands
Steijgerweg 6
5616 HS Eindhoven
The Netherlands
Tel: 040 265 40 10

[Asia & Oceania]
NEC Electronics (China) Co., Ltd
7th Floor, Quantum Plaza, No. 27 ZhiChunLu Haidian District, Beijing 100083, P.R.China
Tel: 010-8235-1155
http://www.cn.necel.com/

Shanghai Branch
Room 2509-2510, Bank of China Tower,
200 Yincheng Road Central,
Pudong New Area, Shanghai, P.R.China P.C:200120
Tel:021-5888-5400
http://www.cn.necel.com/

Shenzhen Branch
Unit 2509-2510, Bank of China Tower,
200 Yincheng Road Central,
Pudong New Area, Shanghai, P.R.China P.C:200120
Tel:021-5888-5400
http://www.cn.necel.com/

NEC Electronics Hong Kong Ltd.
Unit 1601-1613, 16/F., Tower 2, Grand Century Place,
193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: 2886-9318
http://www.hk.necel.com/

NEC Electronics Taiwan Ltd.
7F, No. 363 Fu Shing North Road
Taipei, Taiwan, R. O. C.
Tel: 02-8175-9600
http://www.tw.necel.com/

NEC Electronics Singapore Pte. Ltd.
238A Thomson Road,
#12-08 Novena Square,
Singapore 307684
Tel: 6253-8311
http://www.sg.necel.com/

NEC Electronics Korea Ltd.
11F., Samik Lavied’or Bldg., 720-2,
Yeoksam-Dong, Kangnam-Ku,
Seoul. 135-080, Korea
Tel: 02-558-3737
http://www.kr.necel.com/