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April 1st, 2010
Renesas Electronics Corporation

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H8S Family
Multiprocessor Communication

Introduction
Uses the H8S/2339 multiprocessor function to transmit and receive data asynchronously, sharing a serial communication line with an H8S/2339 and an H8/2215 units.

Target Device
H8S/2339, H8S/2215

Contents

1. Specifications.............................................................................................................. 2
2. Description of Functions .......................................................................................... 3
3. Principles of Operation......................................................................................... 5
4. Description of Software....................................................................................... 7
5. PAD......................................................................................................................... 9
1. Specifications

1. As shown in figure 1, this sample task transmits and receives data between an H8S/2339 and an H8S/2215 units, sharing the serial communication line.

2. When H8S/2339 transmits data to H8S/2215, the H8S/2215 only receives data oriented to the main station. In a receiving station, data matching the main station ID is received.

3. 8-bit data is transmitted and received at 38400 bps with 1-stop bit and non-parity.

![Diagram](image-url)  
*Figure 1  Block Diagram of Asynchronous SCI Using Multiprocessor Function*
2. Description of Functions

1. This sample task uses the SCI multiprocessor communication function to perform multiprocessor communication.
   A. The block diagram of the transmitting station SCI used by the sample task is shown in figure 2.
   This sample task uses the following SCI functions for transmission:
   - Function that performs data communication in the asynchronous mode in 8-bit data units for synchronization (asynchronous mode).
   - Function that performs data communication in which a multiprocessor bit is added (multiprocessor communication function).
   - Function that generates an interrupt at start of transmission (TXI interrupt).

![Figure 2 Block Diagram of Transmitting Station SCI](image-url)
B. The block diagram of the receiving station SCI used by the sample task is shown in figure 3. This sample task uses the following SCI functions for reception:

- Function that performs data communication in the asynchronous mode in 8-bit data units for synchronization (asynchronous mode).
- Function that performs data communication in which a multiprocessor bit is added (multiprocessor communication function).
- Function that generates an interrupt at reception of a multiprocessor bit (multiprocessor interrupt).
- Function that generates an interrupt at completion of reception (RXI interrupt).

![Block Diagram of Receiving Station SCI](image)

**Figure 3** Block Diagram of Receiving Station SCI
3. Principles of Operation

1. Transmission

The principles of transmission operations used of this task are shown in figure 4. This task performs software and hardware processing at timing in figure 4 to transmit data to the receiving station, H8S/2215.

![Diagram of Principles of Operations Used for Multiprocessor Communication (Transmitting Station)](image)

**Figure 4** Principles of Operations Used for Multiprocessor Communication (Transmitting Station)
2. Reception

The principles of reception operations used by this sample task are shown in figure 5. This task performs software and hardware processing at timing in figure 5 to receive data from the transmitting station.

![Diagram](image)

Figure 5 Principles of Operations Used of Multiprocessor Communication (Receiving Station)
4. Description of Software

1. Description of Sending Station Software
   A. Description of Modules

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Label Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main routine</td>
<td>MPMASMN</td>
<td>Performs initial setting of SCI.</td>
</tr>
<tr>
<td>Data transmission</td>
<td>MPSCITX</td>
<td>Starts up by a TXI interrupt and transmits the ID and data.</td>
</tr>
</tbody>
</table>

B. Description of Arguments

<table>
<thead>
<tr>
<th>Label Name</th>
<th>Function</th>
<th>Data Length</th>
<th>Used in</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>txdata</td>
<td>Buffer storing the ID and data to be transmitted to the receiving station H8S/2215.</td>
<td>unsigned char</td>
<td>Main routine</td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Data transmission</td>
<td>Input</td>
</tr>
<tr>
<td>txendf</td>
<td>Indicates transmission end.</td>
<td>unsigned char</td>
<td>Main routine</td>
<td>Input</td>
</tr>
<tr>
<td></td>
<td>1: Transmission ended</td>
<td></td>
<td>Data transmission</td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td>0: Transmission in progress</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. Description of Internal Registers Used

<table>
<thead>
<tr>
<th>Register Name</th>
<th>Function</th>
<th>Used in</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMR1</td>
<td>Sets the SCI mode (asynchronous), the transfer format, and selected clock to the baud rate generator (φ clock input).</td>
<td>Main routine</td>
</tr>
<tr>
<td>SCR1</td>
<td>Set the multiprocessor mode. Enables interrupt (TXI) and sets SCI enable/disable transmission.</td>
<td>Main routine</td>
</tr>
<tr>
<td>SSR1</td>
<td>Clears TDRE (b7) to instruct transmission to start.</td>
<td>Main routine</td>
</tr>
<tr>
<td>TDR1</td>
<td>Sets the ID and data to be transmitted to the receiving station H8S/2215.</td>
<td>Main routine</td>
</tr>
<tr>
<td>BRR1</td>
<td>Sets the transfer rate.</td>
<td>Main routine</td>
</tr>
<tr>
<td>MSTPCR</td>
<td>Cancels the SCI module stop mode.</td>
<td>Main routine</td>
</tr>
</tbody>
</table>

D. RAM Usage

Table below describes RAM usage in this sample task.

<table>
<thead>
<tr>
<th>Label Name</th>
<th>Function</th>
<th>Data Length</th>
<th>Used in</th>
</tr>
</thead>
<tbody>
<tr>
<td>txcnt</td>
<td>Counts transmitted data items.</td>
<td>unsigned char</td>
<td>Main routine (initial setting)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Data transmission</td>
</tr>
<tr>
<td>txdata</td>
<td>Sets the ID and data to be transmitted [0] to [3] = H'02, H'FF, H'03, and H'48</td>
<td>unsigned char</td>
<td>Main routine</td>
</tr>
</tbody>
</table>
2. Description of Receiving Station Software
   A. Description of Modules

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Label Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main routine</td>
<td>MPSRVMN</td>
<td>Performs initial setting of SCI.</td>
</tr>
<tr>
<td>Data reception</td>
<td>MPSCIRX</td>
<td>Starts up by an RXI interrupt and receives the ID and data.</td>
</tr>
</tbody>
</table>

B. Description of Arguments

<table>
<thead>
<tr>
<th>Elements</th>
<th>Function</th>
<th>Data Length</th>
<th>Used in</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>rcv_data</td>
<td>Sets the received ID and data.</td>
<td>unsigned char</td>
<td>Data reception</td>
<td>Output</td>
</tr>
<tr>
<td>idrcvf</td>
<td>Flag indicating reception of the main station ID.</td>
<td>unsigned char</td>
<td>Main routine</td>
<td>Input</td>
</tr>
<tr>
<td></td>
<td>1: ID received    0: ID not received</td>
<td></td>
<td>Data reception</td>
<td>Output</td>
</tr>
<tr>
<td>dtrcvf</td>
<td>Flag indicating data reception</td>
<td>unsigned char</td>
<td>Data reception</td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td>1: Data received  0: Data not received</td>
<td></td>
<td>Main routine</td>
<td>Input</td>
</tr>
</tbody>
</table>

C. Description of Internal Registers Used

<table>
<thead>
<tr>
<th>Register Name</th>
<th>Function</th>
<th>Used in</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMR1</td>
<td>Sets the SCI mode (asynchronous), the transfer format, and selected</td>
<td>Main routine</td>
</tr>
<tr>
<td></td>
<td>clock to the baud rate generator (φ clock input).</td>
<td></td>
</tr>
<tr>
<td>SCR1</td>
<td>Set the multiprocessor mode.</td>
<td>Main routine</td>
</tr>
<tr>
<td></td>
<td>Enables an interrupt (RXI) and sets SCI reception enabled.</td>
<td></td>
</tr>
<tr>
<td>RDR1</td>
<td>Sets the ID and data received from the transmitting station H8S/2215.</td>
<td>Data reception</td>
</tr>
<tr>
<td>BRR1</td>
<td>Sets the transfer rate.</td>
<td>Main routine</td>
</tr>
<tr>
<td>MSTPCR</td>
<td>Cancels the SCI module stop mode.</td>
<td>Main routine</td>
</tr>
</tbody>
</table>

D. RAM Usage

Table below describes RAM usage in this sample task.

<table>
<thead>
<tr>
<th>Label Name</th>
<th>Function</th>
<th>Data Length</th>
<th>Used in</th>
</tr>
</thead>
<tbody>
<tr>
<td>rxid</td>
<td>Sets the received ID.</td>
<td>unsigned char</td>
<td>Main routine</td>
</tr>
<tr>
<td>rxdata</td>
<td>Sets received data.</td>
<td>unsigned char</td>
<td>Main routine</td>
</tr>
<tr>
<td>myid</td>
<td>Sets the main station ID.</td>
<td>unsigned char</td>
<td>Data reception</td>
</tr>
</tbody>
</table>
5. PAD

1. Transmitting Station
   A. Main Routine

   **Main routine**
   
   **MPMASMN**
   
   ```
   while (1)
   
   Cancel the SCI module stop mode.
   
   Set the asynchronous mode, transfer format, and multiprocessor communication mode.
   
   Set the transfer rate to 38400 bps.
   
   If i < 550, increment i.
   
   Set MPBT.
   
   Clear transmission end flag.
   
   Clear transmission counter.
   
   Set ID in TDR1.
   
   Enable transmission.
   
   Clear TDRE and start transmission.
   
   Enable transmission interrupt (TXI).
   
   Clear I flag and enable interrupt.
   
   UNTIL transmission ended?
   
   while (1)
   ```

   B. Data Transmission

   **MPSCITX**

   ```
   Invert MPBT.
   
   Increment transmission counter by 1. (txcnt)
   
   Set next transmit data in TDR1.
   
   Clear TDRE.
   
   Transmission counter < 4?
   
   Yes
   
   Set transmission end flag.
   
   No
   
   Disable transmission interrupt (TXI).
   ```
2. Receiving Station
   A. Main Routine

   **Main routine**
   - MPSRVMN
   - Cancel the SCI module stop mode.
   - Set the asynchronous mode, transfer format, and multiprocessor communication mode.
   - Set the transfer rate to 38400 bps.
   - If i < 550, increment i.
   - Enable multiprocessor interrupts.
   - Enable reception interrupt (RXI).
   - Enable reception.
   - Clear I flag and enable interrupt.
   - While (1)

   **Standby when idrcvf == 0**
   - rxid = rcv_data
   - idrcvf = 0
   - Standby when dtrcvf == 0
   - rxdata = rcv_data
   - dtrcvf = 0

   **B. Data Reception**

   **Data reception**
   - MPSCIRX
   - Acquire received data from RDR1.
   - Clear RDRF.
   - MPB = 1?
   - Yes
     - cv_data = myid?
       - Yes
         - Clear MPIE.
         - Set idrcvf.
       - No
         - Set dtrcvf.
         - Set MPIE.
   - No
## Revision Record

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>Feb.17.05</td>
<td>First edition issued</td>
</tr>
</tbody>
</table>

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