



## RSCAN Software Driver

# RH850

## 32-bit Microcontroller

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# Chapter 1 Introduction

**RSCAN Family** RSCAN High End CAN Controller

**Product** RSCAN Software Driver

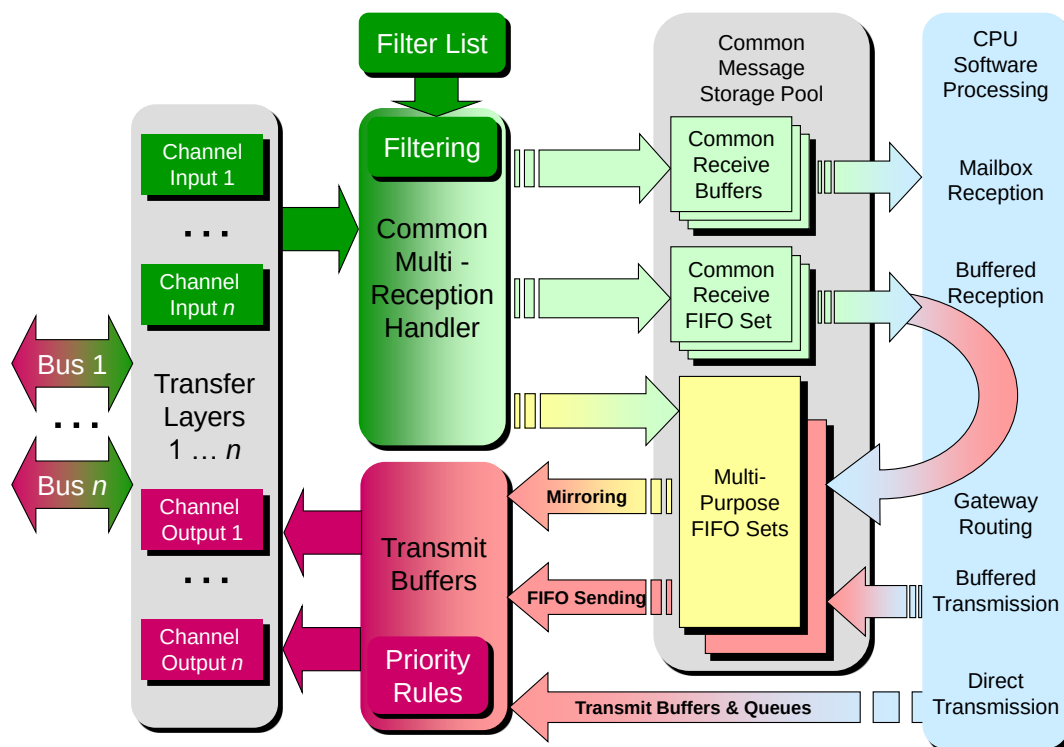
**Usage** This document provides further support information for customers using a CAN macro from the RSCAN family line.

**Overview** At this application note a basic functional description of the RSCAN is given. Further a complete C based software driver plus API description is provided.

The practical experience for the user is improved by application and test functions based of the API.

## Chapter 2 RSCAN general feature descriptions

**RS-CAN** The RSCAN is a high end CAN Controller. In figure 1 the functional block diagram of the RSCAN is shown.



**Figure 1: Functional Block RSCAN**

Inside the block, the transfer layer handles the protocol depended tasks for every channel. All the incoming messages are handled by the multi-reception handler. The handler filters and maps the messages to the dedicated buffers in the message storage pool. For coordinating the outgoing messages the transmit buffer controls the output stream based on the priority rules.

Overall the functionality is split into two groups: Transmission path and reception path.

**Reception Path** All incoming messages to the RSCAN channel are processed by the transfer layer and multi reception handler. To filter the incoming messages the acceptance filter rules are used. The AFL rules are stored at the RAM and are accessible for the RSCAN. Further the AFL rules define the storage path for the filtered messages.

The message storing place could be divided into two classes of buffers: Normal Buffers and FIFO Buffers. The receive buffers handle the messages like a mailbox. Therefore it is required to read or save incoming messages, before a new message comes in. The second class of buffers are the FIFO's. The RSCAN has two kinds of FIFO's: Receive FIFO and TX/RX FIFO. The FIFO's could receipt the incoming message like a stream format. All incoming messages are saved at the buffer, till the maximum FIFO size is reached.

**Transmission Path** All outgoing messages are handled by the transmission path. The main components at the transmission path are the transmit buffers. They coordinate the order of the outgoing messages by the priority rules. The priority order depends of the transmit buffer or Message-ID. General three types of transmission are possible: Normal Transmission, FIFO Transmission and Gateway Transmission.

For further description, please refer to the corresponding User Manual.

## Chapter 3 RSCAN Software Driver

In this chapter, first an overview of the SW Driver Structure is given. After that a detailed description of the corresponding API function follows.

### 3.1 SW Driver Structure

**File Structure** The Table 1 shows all source files available and ordered.

| Path or File:              | Description:                                               |
|----------------------------|------------------------------------------------------------|
| .\ include \ ..            | Header Path                                                |
| .\ device.h                | Device Specific Header and Environment Includes            |
| .\ map_rscan.h             | Macro Size, Address and Clock definition (mapping)         |
| .\ map_rscan_irq.h         | Interrupt Service Routines (mapping)                       |
| .\ map_rscan_irqbundling.h | Interrupt Handling Function                                |
| .\ ree_types.h             | Renesas Defines (Type-definitions)                         |
| .\ ..                      | Root Path / Source Path                                    |
| .\ rscan.h                 | Main Macro SW Header (Register Structure + SW Definitions) |
| .\ rscan_p.h               | Driver Header (API)                                        |
| .\ rscan_p.c               | Driver Source                                              |
| .\ rscan_s.h               | Application Data (Configurations, AFL)                     |
| .\ rscan_a.h               | Application Test Header                                    |
| .\ rscan_a.c               | Application Test Source                                    |
| .\ rscan_as.c              | Driver Source (AUTOSAR style)                              |
| .\ rscan_as.h              | Driver Header (AUTOSAR style API)                          |

**Table1: File Structure of API, Test and Application Source Files**

**Mapping** There are three files used, to provide the mapping compatibility for the driver:

- device.h
- map\_rscan.h
- map\_rscan\_irq.h

The “device.h” contains the device specific header files. This comprises the interrupt control register definitions and port names. Further, compiler dependent includes are defined.

The opportunity to configure the driver to various products and macro sizes, the file “map\_rscan.h” is used. Also the memory mapping is defined in this file.

Device dependent interrupt sources and their service routines are defined in “map\_rscan\_irq.h”.

**Interrupt Handling**

To manage interrupt handling of the RSCAN, an interrupt bundling function is defined. This function handles the interrupt lines and reset the interrupt request flags. The function is defined in "map\_rscan\_irq.h". The function delivers a global variable with a request flag, set in the associated interrupt service routine.

**Macro Register**

The register mapping of the RSCAN is defined in "rscan.h". It contains several type specifications, to depict all register from the macro.

All register groups are merged in the main type-structure "ee\_rscan\_common". This type is used to define a pointer at the basic offset address. This allows the whole access of all Registers over the "ee\_rscan\_common\_p" pointer. The register / memory mapping with pointer and address specification could be found in "map\_rscan.h".

## 3.2 RSCAN SW Driver API

### 3.2.1 API predefined Data

The following data is used for RSCAN configuration and can be found in “rscan\_s.h”. It could be used for application and test software or as an example.

The schema of the data table documentation is explained at table 2.

| Type <i>Name_of_Data</i>        |                                                                                        |                 |                                |
|---------------------------------|----------------------------------------------------------------------------------------|-----------------|--------------------------------|
| Description:                    | General Description and Usage of the Data. Example Data could be found in “rscan_s.h”. |                 |                                |
| Name:                           | Type Structure / Data :                                                                | Size:           | Register:                      |
| <i>Name_of_Structure_Item_0</i> | <i>Type_of_Structure_Item_0</i>                                                        | <i>Bit_size</i> | <i>Register_Name of Item 0</i> |
| ...                             | ...                                                                                    | ...             | ...                            |
| <i>Name_of_Structure_Item_n</i> | <i>Type_of_Structure_Item_n</i>                                                        | <i>Bit_size</i> | <i>Register_Name of Item n</i> |

**Table2: Schema of Data Description**

| const struct ee_rscan_cfg_global <i>EE_RSCAN_A_GCFCG_xx</i> |                                                                        |            |                                              |
|-------------------------------------------------------------|------------------------------------------------------------------------|------------|----------------------------------------------|
| Description:                                                | The constant data type contains the Global Configuration of the Macro. |            |                                              |
| Name:                                                       | Type Structure / Data :                                                | Size:      | Register:                                    |
| <i>gcfg</i>                                                 | <i>ee_rscan_c_gcfg</i>                                                 | 32 bit     | Global Configuration Register                |
| <i>gctr</i>                                                 | <i>ee_rscan_c_gctr</i>                                                 | 32 bit     | Global Control Register                      |
| <i>rmnb</i>                                                 | Unsigned Integer                                                       | 32 bit     | Receive Buffer Number Configuration Register |
| <i>rnc [ EE_RSCAN_CHANNELS ]</i>                            | Unsigned Integer Array                                                 | 1x 32 bit  | Receive Rule Number Set Register             |
| <i>rfcc [ EE_RSCAN_MAXRXFIFOS ]</i>                         | <i>ee_rscan_c_rfcc</i> Array                                           | 2 x 32 bit | Receive FIFO control Register                |

**Table 3: Global Configuration Data**



| <i>const struct ee_rscan_cfg_channel</i> <a href="#">EE_RSCAN_A_CHCFG_xx</a> |                                                            |        |                                                                 |
|------------------------------------------------------------------------------|------------------------------------------------------------|--------|-----------------------------------------------------------------|
| Description:                                                                 | The constant data type contains the Channel Configuration. |        |                                                                 |
| Name:                                                                        | Type Structure / Data :                                    | Size:  | Register / Property:                                            |
| <i>bitrate</i>                                                               | <i>Unsigned Integer</i>                                    | 32 bit | <i>This Value contains the Bitrate to be configured per SW.</i> |
| <i>tq_perbit</i>                                                             | <i>Unsigned Char</i>                                       | 8 bit  | <i>Optional Value. Calculated by SW.</i>                        |
| <i>syncjumpwidth</i>                                                         | <i>Unsigned Char</i>                                       | 8 bit  | <i>Optional Value. Calculated by SW.</i>                        |
| <i>samplingpointpos</i>                                                      | <i>float</i>                                               |        | <i>Optional Value. Calculated by SW.</i>                        |
| <i>ctr</i>                                                                   | <i>ee_rscan_c_ctr</i>                                      | 32 bit | <i>Channel Control Register</i>                                 |
| <i>tmiec</i>                                                                 | <i>Unsigned Short</i>                                      | 16 bit | <i>Transmit Buffer Interrupt Enable Register</i>                |
| <i>txqcc</i>                                                                 | <i>ee_rscan_c_txqcc</i>                                    | 32 bit | <i>Transmit Queue Configuration</i>                             |
| <i>thlcc</i>                                                                 | <i>ee_rscan_c_thlcc</i>                                    | 32 bit | <i>Transmit History Buffer Control Register</i>                 |
| <i>cfcc</i>                                                                  | <i>ee_rscan_c_cfcc</i>                                     | 32 bit | <i>Transmit/Receive FIFO Control Register</i>                   |

**Table 4: Channel Configuration Data**

| const struct ee_rscan_a_afl <a href="#">EE_RSCAN_A_AFL_xx</a> |                                                            |        |                                                            |
|---------------------------------------------------------------|------------------------------------------------------------|--------|------------------------------------------------------------|
| Description:                                                  | The constant data type contains the Channel Configuration. |        |                                                            |
| Name:                                                         | Type Structure / Data :                                    | Size:  | Register / Property:                                       |
| <i>id</i>                                                     | <i>ee_rscan_a_aflid</i>                                    | 32-bit | CAN ID to be filtered                                      |
| <i>mask</i>                                                   | <i>ee_rscan_r_mask</i>                                     | 32-bit | Binary mask on CAN ID to be filtered                       |
| <i>ptr0</i>                                                   | <i>ee_rscan_a_aflptr0</i>                                  | 32-bit | Destination message box reception activation and DLC check |
| <i>ptr1</i>                                                   | <i>ee_rscan_a_aflptr1</i>                                  | 32-bit | FIFO reception activation mask                             |

**Table 5: Acceptance Filter Entry**

| struct ee_rscan_message <a href="#">SendMessage_xx</a> or <a href="#">ReceiptMessage_xx</a> |                                                |          |                                      |
|---------------------------------------------------------------------------------------------|------------------------------------------------|----------|--------------------------------------|
| Description:                                                                                | This data type is used to define Message-Data. |          |                                      |
| Name:                                                                                       | Type Structure / Data :                        | Size:    | Register / Property:                 |
| <i>hdr</i>                                                                                  | <i>ee_rscan_t_mask</i>                         | 32 bit   | ID, IDE, RTR and THLEN (only for TX) |
| <i>flag</i>                                                                                 | <i>ee_rscan_r_ptr</i>                          | 32 bit   | TS, PTR and DLC                      |
| <i>data[EE_RSCAN_DLC_MAX]</i>                                                               | Unsigned Char                                  | 8x 8 bit | Data of the Message                  |
| <i>path</i>                                                                                 | Unsigned Char                                  | 8 bit    | EE_RSCAN_PATH_MSGBOX                 |
|                                                                                             |                                                |          | EE_RSCAN_PATH_COMFIFO                |
|                                                                                             |                                                |          | EE_RSCAN_PATH_RXFIFO                 |
|                                                                                             |                                                |          | EE_RSCAN_PATH_ANY                    |
| <i>pathdetail</i>                                                                           | Unsigned Char                                  | 8 bit    | Buffer Number                        |

**Table 6: Storage Data for Messages (Transmission, Reception)**

### 3.2.2 Low Level API Functions

| <i>Return_type Function_Name(function_variable_0, ..., function_variable_n);</i> |                                     |                       |                                                                                                                                    |                                                 |
|----------------------------------------------------------------------------------|-------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Description:                                                                     | <i>Description of the Function.</i> |                       |                                                                                                                                    |                                                 |
| Direction:                                                                       | Parameter:                          | Type:                 | Description:                                                                                                                       | Value:                                          |
| Input:                                                                           | <i>Variable_0</i>                   | <i>Variable Type</i>  | <i>Variable Description 0</i>                                                                                                      | <i>Macro Specific Value or Enumerated Value</i> |
|                                                                                  | ...                                 | ...                   | ...                                                                                                                                | ...                                             |
|                                                                                  | <i>Variable_n</i>                   | <i>Variable Type</i>  | <i>Variable Description n</i>                                                                                                      | <i>Macro Specific Value or Enumerated Value</i> |
| Output:                                                                          | <i>Return</i>                       | <i>Bit (REE Type)</i> | <i>Return value gives a true or false back. It's a function error check. This mechanism is given for all functions at the API.</i> | <i>True = check result</i>                      |
|                                                                                  |                                     |                       |                                                                                                                                    | <i>False = check result</i>                     |

**Table 7: Schema of Function Description**

| <i>extern bit EE_RSCAN_Port_Enable( u08 Unit_u08, u08 Channel_u08);</i> |                                                                                                            |                      |                                                                                                     |              |
|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------|--------------|
| Description:                                                            | <i>This Function configures the Channel associated Port. The transmit and receive port are configured.</i> |                      |                                                                                                     |              |
| Direction:                                                              | Parameter:                                                                                                 | Type:                | Description:                                                                                        | Value:       |
| Input:                                                                  | <i>Unit_u08</i>                                                                                            | <i>Unsigned Char</i> | <i>Specific RSCAN Macro at Platform</i>                                                             | <i>0</i>     |
|                                                                         | <i>Channel_u08</i>                                                                                         | <i>Unsigned Char</i> | <i>Specific Channel at Macro</i>                                                                    | <i>0</i>     |
| Output:                                                                 | <i>Return</i>                                                                                              | <i>Bit</i>           | <i>The Return value gives a true or false callback. The Value returns the function fault check.</i> | <i>True</i>  |
|                                                                         |                                                                                                            |                      |                                                                                                     | <i>False</i> |

**Table 8: Enable dedicated Port for Channel**

| extern bit <b>EE_RSCAN_Start</b> (u08 UnitNumber_u08, u08 ChannelNumber_u08, u08 OperationMode_u08, u08 ClearErrorCounter_u08, u16 TimeStampSetting_u16); |                                           |                |                                                                                              |                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Description:                                                                                                                                              | This Function activates RSCAN operations. |                |                                                                                              |                                                                                                                           |
| Direction:                                                                                                                                                | Parameter:                                | Type:          | Description:                                                                                 | Value:                                                                                                                    |
| Input:                                                                                                                                                    | Unit_u08                                  | Unsigned Char  | Specific RSCAN Macro at Platform                                                             | 0                                                                                                                         |
|                                                                                                                                                           | Channel Number_u08                        | Unsigned Char  | Specific channel of macro                                                                    | 0 ... 5;<br>0xFF for all channels                                                                                         |
|                                                                                                                                                           | Operation Mode_u08                        | Unsigned Char  | Operation Mode to be entered                                                                 | EE_RSCAN_OPMODE_OPER<br>EE_RSCAN_OPMODE_RESET<br>EE_RSCAN_OPMODE_HALT<br>EE_RSCAN_OPMODE_RECONLY<br>EE_RSCAN_OPMODE_STEST |
|                                                                                                                                                           | ClearError Counter_u08                    | Unsigned Char  | Set to >0 to clear TEC and REC before starting                                               | 0 or 1                                                                                                                    |
|                                                                                                                                                           | TimeStamp Setting_u16                     | Unsigned Short | Set to >0 to clear current time stamp count                                                  | 0 or 1                                                                                                                    |
| Output:                                                                                                                                                   | Return                                    | Bit            | The Return value gives a true or false callback. The Value returns the function fault check. | True                                                                                                                      |
|                                                                                                                                                           |                                           |                |                                                                                              | False                                                                                                                     |

Table 9: Start of RSCAN

| extern bit <b>EE_RSCAN_Stop</b> ( u08 Unit_u08, u08 Channel_u08, u08 StopMode_u08); |                                       |               |                                                                       |                                                                        |
|-------------------------------------------------------------------------------------|---------------------------------------|---------------|-----------------------------------------------------------------------|------------------------------------------------------------------------|
| Description:                                                                        | This Function stops RSCAN operations. |               |                                                                       |                                                                        |
| Direction:                                                                          | Parameter:                            | Type:         | Description:                                                          | Value:                                                                 |
| Input                                                                               | Unit_u08                              | Unsigned Char | Specific RSCAN Macro at Platform                                      | 0                                                                      |
|                                                                                     | Channel_u08                           | Unsigned Char | Specific Channel of macro                                             | 0 ... 5;<br>0xFF to perform globally                                   |
|                                                                                     | StopMode_u08                          | Unsigned Char | Stopping operation option                                             | EE_RSCAN_OPMODE_SLEEP<br>EE_RSCAN_OPMODE_RESET<br>EE_RSCAN_OPMODE_HALT |
| Output                                                                              | Return                                | Bit           | Return value gives a true or false back. It's a function error check. | True                                                                   |
|                                                                                     |                                       |               |                                                                       | False                                                                  |

Table 10: Stop of RSCAN

|                                                                                                                                                                                        |                                              |                                   |                                                                       |                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------|-----------------------------------------------------------------------|----------------------|
| extern bit <a href="#">EE_RSCAN_SetGlobalConfiguration</a> ( u08 Unit_u08, u08 Channel_u08,<br>const struct ee_rscan_cfg_global* Global_CFG,<br>struct ee_rscan_a_afl FilterEntry[] ); |                                              |                                   |                                                                       |                      |
| Description:                                                                                                                                                                           | This Function sets all global configuration. |                                   |                                                                       |                      |
| Direction:                                                                                                                                                                             | Parameter:                                   | Type:                             | Description:                                                          | Value:               |
| Input                                                                                                                                                                                  | Unit_u08                                     | Unsigned Char                     | Specific RSCAN Macro at Platform                                      | 0                    |
|                                                                                                                                                                                        | Channel_u08                                  | Unsigned Char                     | Specific Channel at Macro                                             | 0                    |
|                                                                                                                                                                                        | Global_CFG                                   | const struct ee_rscan_cfg_global* | Global Configuration of the RSCAN Macro.                              | Global Configuration |
|                                                                                                                                                                                        |                                              |                                   |                                                                       | Global Control       |
|                                                                                                                                                                                        |                                              |                                   |                                                                       | RMNB                 |
|                                                                                                                                                                                        |                                              |                                   |                                                                       | RNC                  |
|                                                                                                                                                                                        |                                              |                                   |                                                                       | RFCC                 |
|                                                                                                                                                                                        | FilterEntry[]                                | struct ee_rscan_a_afl             | All AFL Rules are defined for the specific Channel.                   | ID                   |
|                                                                                                                                                                                        |                                              |                                   |                                                                       | MASK                 |
| PTR0                                                                                                                                                                                   |                                              |                                   |                                                                       |                      |
| Output                                                                                                                                                                                 | Return                                       | Bit                               | Return value gives a true or false back. It's a function error check. | True                 |
|                                                                                                                                                                                        |                                              |                                   |                                                                       | False                |

Table 11: Global Configuration Activation

| extern bit <a href="#">EE_RSCAN_SetAFLEntry</a> ( u08 Unit_u08, u08 Channel_u08,<br>u16 RuleNumber_u16,<br>struct ee_rscan_a_afl *AFLEntry); |                                                               |                         |                                                                       |            |
|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------|------------|
| Description:                                                                                                                                 | This Function enters the AFL Rules into the AFL storage area. |                         |                                                                       |            |
| Direction:                                                                                                                                   | Parameter:                                                    | Type:                   | Description:                                                          | Value:     |
| Input                                                                                                                                        | Unit_u08                                                      | Unsigned Char           | Specific RSCAN Macro at Platform                                      | 0          |
|                                                                                                                                              | Channel_u08                                                   | Unsigned Char           | Specific Channel at Macro                                             | 0 ... 5    |
|                                                                                                                                              | AFLEntry                                                      | struct ee_rscan_a_afl * | One AFL Rule to be defined for the specific Channel.                  | ID         |
|                                                                                                                                              |                                                               |                         |                                                                       | MASK       |
| Output                                                                                                                                       | Return                                                        | Bit                     | Return value gives a true or false back. It's a function error check. | PTR0, PTR1 |
|                                                                                                                                              |                                                               |                         |                                                                       | True       |
| Output                                                                                                                                       | Return                                                        | Bit                     | Return value gives a true or false back. It's a function error check. | False      |
|                                                                                                                                              |                                                               |                         |                                                                       | False      |

Table 12: AFL Rule Entry

| extern bit <i>EE_RSCAN_SetChannelConfiguration</i> ( u08 Unit_u08, u08 Channel_u08, const struct ee_rscan_cfg_channel* Ch_CFG); |                                                       |                                           |                                                                              |                                   |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------|-----------------------------------|
| Description:                                                                                                                    | <i>This Function sets the Channel Configurations.</i> |                                           |                                                                              |                                   |
| Direction:                                                                                                                      | Parameter:                                            | Type:                                     | Description:                                                                 | Value:                            |
| Input                                                                                                                           | <i>Unit_u08</i>                                       | <i>Unsigned Char</i>                      | <i>Specific RSCAN Macro at Platform</i>                                      | <i>0</i>                          |
|                                                                                                                                 | <i>Channel_u08</i>                                    | <i>Unsigned Char</i>                      | <i>Specific Channel at Macro</i>                                             | <i>0 ... 5</i>                    |
|                                                                                                                                 | <i>Ch_CFG</i>                                         | <i>const struct ee_rscan_cfg_channel*</i> | <i>Channel Configuration for specific Channel_u08.</i>                       | <i>Bitrate</i>                    |
|                                                                                                                                 |                                                       |                                           |                                                                              | <i>TQ per Bit</i>                 |
|                                                                                                                                 |                                                       |                                           |                                                                              | <i>Synchronization jump width</i> |
|                                                                                                                                 |                                                       |                                           |                                                                              | <i>Sampling Point Position</i>    |
|                                                                                                                                 |                                                       |                                           |                                                                              | <i>Channel Control</i>            |
|                                                                                                                                 |                                                       |                                           |                                                                              | <i>TMIEC</i>                      |
|                                                                                                                                 |                                                       |                                           |                                                                              | <i>THLCC</i>                      |
| Output                                                                                                                          | <i>Return</i>                                         | <i>Bit</i>                                | <i>Return value gives a true or false back. It's a function error check.</i> | <i>True</i>                       |
|                                                                                                                                 |                                                       |                                           |                                                                              | <i>False</i>                      |

**Table 13: Channel Configuration**

| extern bit <i>EE_RSCAN_CreateInterrupt</i> ( u08 Unit_u08, u08 Channel_u08, u08 IntNumber_u08, u08 SetIntLevel_u08, void (*FunctionVector)()); |                                                                                           |                            |                                                                              |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------|--------------------------|
| Description:                                                                                                                                   | <i>This Function enables Interrupt Sources and bundles the Interrupt with a Function.</i> |                            |                                                                              |                          |
| Direction:                                                                                                                                     | Parameter:                                                                                | Type:                      | Description:                                                                 | Value:                   |
| Input                                                                                                                                          | <i>Unit_u08</i>                                                                           | <i>Unsigned Char</i>       | <i>Specific RSCAN Macro at Platform</i>                                      | <i>0</i>                 |
|                                                                                                                                                | <i>Channel_u08</i>                                                                        | <i>Unsigned Char</i>       | <i>Specific Channel at Macro</i>                                             | <i>0 ... 5</i>           |
|                                                                                                                                                | <i>IntNumber_u08</i>                                                                      | <i>Unsigned Char</i>       | <i>Interrupt Source</i>                                                      | <i>EE_RSCAN_INT_GERR</i> |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_RXF0</i> |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_RXF1</i> |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_TX</i>   |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_TXA</i>  |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_TXQ</i>  |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_CERR</i> |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_TXHL</i> |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_RXCF</i> |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>EE_RSCAN_INT_TXCF</i> |
|                                                                                                                                                | <i>SetIntLevel_u08</i>                                                                    | <i>Unsigned Char</i>       | <i>Interrupt Priority Level</i>                                              | <i>0 ... 3</i>           |
|                                                                                                                                                | <i>( *FunctionVector )()</i>                                                              | <i>Depends on function</i> | <i>Pointer to bundled Interrupt Function</i>                                 | <i>Function</i>          |
| Output                                                                                                                                         | <i>Return</i>                                                                             | <i>Bit</i>                 | <i>Return value gives a true or false back. It's a function error check.</i> | <i>True</i>              |
|                                                                                                                                                |                                                                                           |                            |                                                                              | <i>False</i>             |

**Table 14: Function to create Interrupt**

| extern bit <i>EE_RSCAN_SetInterrupt</i> ( u08 Unit_u08, u08 Channel_u08, u08 InterruptSelection_u08, u16 InterruptSubSelection_u16); |                                                                                                     |                      |                                                                              |                                          |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------|------------------------------------------------------------------------------|------------------------------------------|
| Description:                                                                                                                         | <i>This function enables the specific Interrupt or Sub Interrupt Element of the Interrupt Line.</i> |                      |                                                                              |                                          |
| Direction:                                                                                                                           | Parameter:                                                                                          | Type:                | Description:                                                                 | Value:                                   |
| Input                                                                                                                                | <i>Unit_u08</i>                                                                                     | <i>Unsigned Char</i> | <i>Specific RSCAN Macro at Platform</i>                                      | <i>0</i>                                 |
|                                                                                                                                      | <i>Channel_u08</i>                                                                                  | <i>Unsigned Char</i> | <i>Specific Channel at Macro</i>                                             | <i>0 ... 5</i>                           |
|                                                                                                                                      | <i>InterruptSelection_u08</i>                                                                       | <i>Unsigned Char</i> | <i>Interrupt Source</i>                                                      | <i>EE_RSCAN_INT_GERR</i>                 |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_RXF0</i>                 |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_RXF1</i>                 |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_TX</i>                   |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_TXA</i>                  |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_TXQ</i>                  |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_CERR</i>                 |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_TXHL</i>                 |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_RXCF</i>                 |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>EE_RSCAN_INT_TXCF</i>                 |
|                                                                                                                                      | <i>InterruptSubSelection_u16</i>                                                                    | <i>Unsigned Char</i> | <i>Enable Interrupt Element</i>                                              | <i>Depends on InterruptSelection_u08</i> |
| Output                                                                                                                               | <i>Return</i>                                                                                       | <i>Bit</i>           | <i>Return value gives a true or false back. It's a function error check.</i> | <i>True</i>                              |
|                                                                                                                                      |                                                                                                     |                      |                                                                              | <i>False</i>                             |

**Table 15: Function to set Interrupt**



| extern bit <i>EE_RSCAN_GetStatus</i> ( u08 Unit_u08, u08 Channel_u08, u08 StatusNumber_u08, pu08 StatusValue_u08 ); |                                                   |               |                                                                       |                                   |
|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------|-----------------------------------------------------------------------|-----------------------------------|
| Description:                                                                                                        | This function checks the Global or Channel status |               |                                                                       |                                   |
| Direction:                                                                                                          | Parameter:                                        | Type:         | Description:                                                          | Value:                            |
| Input                                                                                                               | Unit_u08                                          | Unsigned Char | Specific RSCAN Macro at Platform                                      | 0                                 |
|                                                                                                                     | Channel_u08                                       | Unsigned Char | Specific Channel at Macro                                             | 0 ... 5<br>0xFF (EE_RSCAN_GLOBAL) |
|                                                                                                                     | StatusNumber_u08                                  | Unsigned Char | Status to be checked                                                  | EE_RSCAN_STATUS_OPMODE            |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_PSMODE            |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_RECEIVE           |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_TRANSMIT          |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_BUSOFF            |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_ERRCNTLEV         |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_TOVF              |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_THPM              |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_TGPT              |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_NEWTXHISTORY      |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_VALID             |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_TRERRCOUNT        |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_RXERRCOUNT        |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_ERRPLEV           |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_INT_RXFIFO        |
|                                                                                                                     |                                                   |               |                                                                       | EE_RSCAN_STATUS_INTERRUPT         |
| Output                                                                                                              | StatusValue_u08                                   | Unsigned Char | Status Flag/Value                                                     | Depends on StatusNumber           |
|                                                                                                                     | Return                                            | Bit           | Return value gives a true or false back. It's a function error check. | True<br>False                     |

Table 16: Function to get Status

| extern bit <i>EE_RSCAN_GetError</i> ( u08 Unit_u08, u08 Channel_u08, pu16 InterruptErrorFlag_pu16, pu16 LastErrorFlag_pu16 ); |                                                                                                                                                  |                        |                                                                       |                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------|
| Description:                                                                                                                  | This function gives the Global or Channel depended Error Source back. The Information contains the Last Occurred Error Code and Last Error Flag. |                        |                                                                       |                                                                        |
| Direction:                                                                                                                    | Parameter:                                                                                                                                       | Type:                  | Description:                                                          | Value:                                                                 |
| Input                                                                                                                         | Unit_u08                                                                                                                                         | Unsigned Char          | Specific RSCAN Macro at Platform                                      | 0                                                                      |
|                                                                                                                               | Channel_u08                                                                                                                                      | Unsigned Char          | Specific Channel at Macro                                             | 0 ... 5<br>0xFF (EE_RSCAN_GLOBAL)                                      |
|                                                                                                                               | InterruptErrorFlag_pu16                                                                                                                          | Unsigned Short Pointer | Last occurred Error Code                                              | EE_RSCAN_GINT_NONE<br>EE_RSCAN_GINT_MSGLOST<br>EE_RSCAN_GERROR_THLLOST |
|                                                                                                                               | LastErrorFlag_pu16                                                                                                                               | Unsigned Char          | Status Flag/Value                                                     | GERFLERR<br>ERFLERR                                                    |
|                                                                                                                               | Return                                                                                                                                           | Bit                    | Return value gives a true or false back. It's a function error check. | True                                                                   |
|                                                                                                                               |                                                                                                                                                  |                        |                                                                       | False                                                                  |

Table 17: Function to get Errors

| extern bit <i>EE_RSCAN_SendMessage</i> ( u08 Unit_u08, u08 Channel_u08, u08 *Status_u08, struct ee_rscan_message* Message ); |                                                                             |                          |                                                                       |                        |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------|------------------------|
| Description:                                                                                                                 | This Function sends the Message for a specific Channel and Transmit Buffer. |                          |                                                                       |                        |
| Direction:                                                                                                                   | Parameter:                                                                  | Type:                    | Description:                                                          | Value:                 |
| Input                                                                                                                        | Unit_u08                                                                    | Unsigned Char            | Specific RSCAN Macro at Platform                                      | 0                      |
|                                                                                                                              | Channel_u08                                                                 | Unsigned Char            | Specific Channel at Macro                                             | 0 ... 5                |
|                                                                                                                              | Message                                                                     | Struct ee_rscan_message* | Message to be send                                                    | Header                 |
|                                                                                                                              |                                                                             |                          |                                                                       | Flag (ts, ptr and dlc) |
|                                                                                                                              |                                                                             |                          |                                                                       | Data                   |
|                                                                                                                              |                                                                             |                          |                                                                       | Path<br>Pathdetail     |
| Output                                                                                                                       | Return                                                                      | Bit                      | Return value gives a true or false back. It's a function error check. | True                   |
|                                                                                                                              |                                                                             |                          |                                                                       | False                  |

Table 18: Function to send Message

| extern bit <a href="#">EE_RSCAN_TxAbort</a> ( u08 Unit_u08, u08 Channel_u08, struct ee_rscan_message* Message); |                                                                              |                          |                                                                       |                        |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------|------------------------|
| Description:                                                                                                    | This Function aborts the transmission Process of Message Box and RX/TX FIFO. |                          |                                                                       |                        |
| Direction:                                                                                                      | Parameter:                                                                   | Type:                    | Description:                                                          | Value:                 |
| Input                                                                                                           | Unit_u08                                                                     | Unsigned Char            | Specific RSCAN Macro at Platform                                      | 0                      |
|                                                                                                                 | Channel_u08                                                                  | Unsigned Char            | Specific Channel at Macro                                             | 0                      |
|                                                                                                                 | Message                                                                      | Struct ee_rscan_message* | Message to be send                                                    | Header                 |
|                                                                                                                 |                                                                              |                          |                                                                       | Flag (ts, ptr and dlc) |
|                                                                                                                 |                                                                              |                          |                                                                       | Data                   |
|                                                                                                                 |                                                                              |                          |                                                                       | Path                   |
|                                                                                                                 |                                                                              |                          |                                                                       | Pathdetail             |
| Output                                                                                                          | Return                                                                       | Bit                      | Return value gives a true or false back. It's a function error check. | True                   |
|                                                                                                                 |                                                                              |                          |                                                                       | False                  |

**Table 19: Function to abort Transmission**

| extern bit <a href="#">EE_RSCAN_ReceiveMessage</a> ( u08 Unit_u08, pu08 Status_pu08, struct ee_rscan_message* Message ); |                                                                                                                                                               |                          |                                                                       |                        |
|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------|------------------------|
| Description:                                                                                                             | This Function is used to receipt the Message addressed at Message_Path. For detailed selection of Message_Path, please consider the Message-Data Description. |                          |                                                                       |                        |
| Direction:                                                                                                               | Parameter:                                                                                                                                                    | Type:                    | Description:                                                          | Value:                 |
| Input                                                                                                                    | Unit_u08                                                                                                                                                      | Unsigned Char            | Specific RSCAN Macro at Platform                                      | 0                      |
|                                                                                                                          | Message                                                                                                                                                       | Struct ee_rscan_message* | Message to be send                                                    | Header                 |
|                                                                                                                          |                                                                                                                                                               |                          |                                                                       | Flag (ts, ptr and dlc) |
|                                                                                                                          |                                                                                                                                                               |                          |                                                                       | Data                   |
|                                                                                                                          |                                                                                                                                                               |                          |                                                                       | Path                   |
|                                                                                                                          |                                                                                                                                                               |                          |                                                                       | Pathdetail             |
| Output                                                                                                                   | Return                                                                                                                                                        | Bit                      | Return value gives a true or false back. It's a function error check. | True                   |
|                                                                                                                          |                                                                                                                                                               |                          |                                                                       | False                  |

**Table 20: Function to receive Message**

## Chapter 4 Example for using RSCAN SW Driver

The Examples could be found at the files “rscan\_a.c”, “rscan\_a.h” and “rscan\_s.h”.

The List of the Tests and Applications are shown below:

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Application 1<br/>Func.:</b> | <i>EE_RSCAN_BasicTest</i>                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Description:                    | <ul style="list-style-type: none"> <li>● Test the TX Message Buffer for one Channel</li> <li>● Test the RX Message Buffer for one Channel</li> <li>● Create Interrupt for Transmission</li> <li>● Transmit Test Message over TX Message Buffer               <ul style="list-style-type: none"> <li>○ Push Message into Buffer</li> <li>○ Wait till Transmission Interrupt Occur</li> </ul> </li> <li>● Receipt Messages in RX Message Buffer</li> </ul> |

|                                 |                                                                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Application 2<br/>Func.:</b> | <i>EE_RSCAN_BasicSelfTest</i>                                                                                                                     |
| Description:                    | <ul style="list-style-type: none"> <li>● Same Test as “Application 1”</li> <li>● Communication via internal Loopback in Self Test Mode</li> </ul> |

|                                 |                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Application 3<br/>Func.:</b> | <i>EE_AS_RSCAN_BasicTest</i>                                                                                                             |
| Description:                    | <ul style="list-style-type: none"> <li>● Same Test as “Application 1”</li> <li>● Using AUTOSAR compatible API of “rscan_as.c”</li> </ul> |

# General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

## 1. Handling of Unused Pins

Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

## 2. Processing at Power-on

The state of the product is undefined at the moment when power is supplied.

The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.

In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.

In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

## 3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

## 4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable.

When switching the clock signal during program execution, wait until the target clock signal has stabilized.

When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

## 5. Differences between Products

Before changing from one product to another, i.e. to one with a different part number, confirm that the change will not lead to problems.

The characteristics of MPU/MCU in the same group but having different part numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different part numbers, implement a system-evaluation test for each of the products.

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