Introduction

This application note describes USB Host Communication Device Class Driver (HCDC). This module operates in combination with the USB basic firmware (USB-BASIC-F/W). It is referred to below as the USB HCDC.

Target Device

RZ/A1H Group

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

Related Documents

1. Universal Serial Bus Revision 2.0 specification
   http://www.usb.org/developers/docs/
2. USB Class Definitions for Communications Devices Revision 1.2
3. USB Communications Class Subclass Specification for PSTN Devices Revision 1.2
   http://www.usb.org/developers/docs/
5. RZ/A1H Group USB Host and Peripheral Interface Driver (Document No.R01AN3291EJ)
6. RZ/A1H Group Downloading Program to NOR Flash Memory Using ARM® Development Studio 5 (DS-5™) Semihosting Function (for GENMAI) (Document No.R01AN1957EJ)
7. RZ/A1H Group I/O definition header file (Document No.R01AN1860EJ)
8. RZ/A1H Group Example of Initialization (for GENMAI) (Document No.R01AN1864EJ)

- Renesas Electronics Website
  http://www.renesas.com/
- USB Devices Page
  http://www.renesas.com/prod/usb/
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1. Overview

The USB HCDC, when used in combination with the USB-BASIC-F/W, operates as a USB host communications device class driver (HCDC). The HCDC conforms to the PSTN device subclass abstract control model of the USB communication device class specification (CDC) and enables communication with a CDC peripheral device. This module supports the following functions.
- Checking of connected devices
- Implementation of communication line settings
- Acquisition of the communication line state
- Data transfer to and from a CDC peripheral device
- HCDC can connect maximum 2 CDC devices to 1 USB channel by using USB Hub.

1.1 Please be sure to read

It is recommended to use the APIs described in the document (Document No: R01AN3291EJ) when creating an application program using this driver. That document is located in the "reference_documents" folder within the package.

[Note]
a. The document (Document No: R01AN3291EJ) also provides how to create an application program using the APIs described above.
b. If the APIs described in the document (Document No: R01AN3291EJ) are used, there is no need to use the API described in “7.3. List of HCDC API Functions” of this document of this document.

1.2 Operation Confirmation Conditions

The operation of the USB Driver module has been confirmed under the conditions listed in Table 1.1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCU</td>
<td>RZ/A1H</td>
</tr>
</tbody>
</table>
| Operating frequency (Note) | CPU clock (Iφ): 400 MHz  
Image-processing clock (Gφ): 266.37 MHz  
Internal bus clock (Bφ): 133.33 MHz  
Peripheral clock 1 (P1φ): 66.67 MHz  
Peripheral clock 0 (P0φ): 33.33 MHz |
| Operating voltage        | Power supply voltage (I/O): 3.3 V  
Power supply voltage (internal): 1.8 V |
| Integrated development environment | ARM Integrated Development Environment  
• ARM Development Studio (DS-5™) Version 5.16  
• IAR Integrated Development Environment  
• IAR Embedded Workbench for ARM Version 7.40 |
| Compiler                 | ARM C/C++ Compiler/Linker/Assembler Ver.5.03 [Build 102]  
KPIT GNUARM-RZ v14.01  
IAR C/C++ Compiler for ARM 7.40 |
| Operating mode           | Boot mode 0  
(CS0-space 16-bit booting) |
| Communication setting of terminal software | Communication speed: 115200 bps  
Data length: 8 bits  
Parity: None  
Stop bit length: 1 bit  
Flow control: None |
| Board                    | GENMAI board  
R7S72100 CPU board (RTK772100BC00000BR) |
| Device (Functions used on the board) | Serial interface (D-sub 9-pin connector)  
USB1 connector, USB2 connector |
1.3 Limitations

This module is subject to the following restrictions
1. Structures are composed of members of different types (Depending on the compiler, the address alignment of the structure members may be shifted).
Terms and Abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>APL</td>
<td>Application program</td>
</tr>
<tr>
<td>CDC</td>
<td>Communications devices class</td>
</tr>
<tr>
<td>CDCC</td>
<td>Communications Devices Class — Communications Class Interface</td>
</tr>
<tr>
<td>CDCD</td>
<td>Communications Devices Class — Data Class Interface</td>
</tr>
<tr>
<td>cstd</td>
<td>Prefix of function and file for Peripheral &amp; Host Common Basic (USB low level) F/W</td>
</tr>
<tr>
<td>HCD</td>
<td>Host control driver of USB-BASIC-FW</td>
</tr>
<tr>
<td>HCD</td>
<td>Host communication devices class</td>
</tr>
<tr>
<td>HCD</td>
<td>Host device class driver (device driver and USB class driver)</td>
</tr>
<tr>
<td>hstd</td>
<td>Prefix of function and file for Host Basic (USB low level) F/W</td>
</tr>
<tr>
<td>HUBCD</td>
<td>Hub class sample driver</td>
</tr>
<tr>
<td>MGR</td>
<td>Peripheral device state manager of HCD</td>
</tr>
<tr>
<td>non-OS</td>
<td>USB basic firmware for OS less system</td>
</tr>
<tr>
<td>PP</td>
<td>Pre-processed definition</td>
</tr>
<tr>
<td>Scheduler</td>
<td>Used to schedule functions, like a simplified OS.</td>
</tr>
<tr>
<td>Scheduler Macro</td>
<td>Used to call a scheduler function (non-OS)</td>
</tr>
<tr>
<td>Task</td>
<td>Processing unit</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
<tr>
<td>USB-BASIC-FW</td>
<td>USB Basic Host Driver for RZ/A1H Group (non-OS)</td>
</tr>
</tbody>
</table>
2. Software Configuration

Table 2.1 lists the modules, and Figure 2-1 shows a block diagram of HCDC.

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>APL</td>
<td>User application program. Created by customer.</td>
</tr>
<tr>
<td>HCDC</td>
<td>Requests CDC requests command and the data transfer from APL to HCD.</td>
</tr>
<tr>
<td>MGR / HUB</td>
<td>Enumerates the connected devices and starts HCDC. Also performs device state</td>
</tr>
<tr>
<td></td>
<td>management.</td>
</tr>
<tr>
<td>HCD</td>
<td>USB host H/W control driver. (See USB Basic FW.)</td>
</tr>
</tbody>
</table>

Figure 2-1 Software Block Diagram

3. System Resources

The resource which HCDC uses is showed in Table 3.

<table>
<thead>
<tr>
<th>Function</th>
<th>ID</th>
<th>Priority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>usb_hcdc_Task</td>
<td>USB_HCDC_TSK</td>
<td>USB_PRI_3</td>
<td>HCDC Task</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mailbox</th>
<th>ID</th>
<th>Queue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB_HCDC_MBX</td>
<td>USB_HCDC_TSK</td>
<td>FIFO order</td>
<td>for HCDC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Memory Pool</th>
<th>Queue</th>
<th>Memory block (’)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB_HCDC_MPL</td>
<td>FIFO order</td>
<td>40byte</td>
<td>for HCDC</td>
</tr>
</tbody>
</table>

[Note]: The maximum number of memory blocks for the entire system is defined in USB_BLKMAX. The default value is 20.

4. Target Peripheral List (TPL)

When using a USB host driver (USB-BASIC-F/W FIT module) and device class driver in combination, it is necessary to create a target peripheral list (TPL) for each device driver.

For details, see "Target Peripheral List," in USB Basic Firmware application note (Document No. R01AN3291EJ).
5. Compile Setting

In order to use this module, it is necessary to set the USB-BASIC-F/W as a host. Refer to USB Basic Firmware application note (Document No. R01AN3291EJ) for information on USB-BASIC-F/W settings. Please modify r_usb_hcdc_config.h when User sets the module configuration option.

The following table shows the option name and the setting value.

<table>
<thead>
<tr>
<th>Configuration options in r_usb_hcdc_config.h</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB_HCDC_IF_CLASS</td>
<td>Specifies the device class ID of connected CDC devices.</td>
</tr>
<tr>
<td>USB_HCDC_MULTI_CONNECT</td>
<td>Enables this definition when connecting 2 CDC devices to one USB module (USB channel).</td>
</tr>
<tr>
<td>USB_HCDC_IN_DATAPIPE</td>
<td>Specifies the pipe number which is used at the data transfer. (Specifies any one from USB_PIPE1 to USB_PIPE5. Don’t specify the same pipe number.)</td>
</tr>
<tr>
<td>USB_HCDC_OUT_DATAPIPE</td>
<td>Specifies the pipe number which is used at the class notification. (Specifies any one from USB_PIPE6 to USB_PIPE9. Don’t specify the same pipe number.)</td>
</tr>
</tbody>
</table>

[Note]

1. Please confirm the specification of the CDC device before attempting to use it. When using a commercial USB-serial converter (CDC device), check that the device class ID is CDC and not Vendor class.
2. Sets the pipe number to USB_HCDC_IN_DATA_PIPE2, USB_HCDC_OUT_DATA_PIPE2 and USB_HCDC_STATUS_PIPE2 when enabling USB_HCDC_MULTI_CONNECT.
6. Communication Device Class (CDC), PSTN and ACM

This software conforms to the Abstract Control Model (ACM) subclass of the Communication Device Class specification, as specified in detail in the PSTN Subclass document listed in “Related Documents”. The Abstract Control Model subclass is a technology that bridges the gap between USB devices and earlier modems (employing RS-232C connections), enabling use of application programs designed for older modems.

6.1 Basic Functions

The main functions of HCDC are as follows.
1. Verify connected devices
2. Make communication line settings
3. Acquire the communication line state
4. Transfer data to and from the CDC peripheral device

6.2 Abstract Control Model Class Requests - Host to Device

The software supports the following ACM class requests.

<table>
<thead>
<tr>
<th>Request</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SendEncapsulatedCommand</td>
<td>0x00</td>
<td>Transmits an AT command as defined by the protocol used by the device (normally 0 for USB).</td>
</tr>
<tr>
<td>GetEncapsulatedResponse</td>
<td>0x01</td>
<td>Requests a response to a command transmitted by SendEncapsulatedCommand.</td>
</tr>
<tr>
<td>SetCommFeature</td>
<td>0x02</td>
<td>Enables or disables features such as device-specific 2-byte code and country setting.</td>
</tr>
<tr>
<td>GetCommFeature</td>
<td>0x03</td>
<td>Acquires the enabled/disabled state of features such as device-specific 2-byte code and country setting.</td>
</tr>
<tr>
<td>ClearCommFeature</td>
<td>0x04</td>
<td>Restores the default enabled/disabled settings of features such as device-specific 2-byte code and country setting.</td>
</tr>
<tr>
<td>SetLineCoding</td>
<td>0x20</td>
<td>Makes communication line settings (communication speed, data length, parity bit, and stop bit length).</td>
</tr>
<tr>
<td>GetLineCoding</td>
<td>0x21</td>
<td>Acquires the communication line setting state.</td>
</tr>
<tr>
<td>SetControlLineState</td>
<td>0x22</td>
<td>Makes communication line control signal (RTS, DTR) settings.</td>
</tr>
<tr>
<td>SendBreak</td>
<td>0x23</td>
<td>Transmits a break signal.</td>
</tr>
</tbody>
</table>

For details concerning the Abstract Control Model requests, refer to Table 11, “Requests - Abstract Control Model” in “USB Communications Class Subclass Specification for PSTN Devices”, Revision 1.2. The following describes the class request data formats supported by this class driver software.

6.2.1 SendEncapsulatedCommand

The SendEncapsulatedCommand data format is shown in Table 6.2.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>SEND_ENCAPSULATED_COMMAND(0x00)</td>
<td>0x0000</td>
<td>0x0000</td>
<td>Data length</td>
<td>Control protocol command</td>
</tr>
</tbody>
</table>

Note: Items such as AT commands for modem control are set as Data, and wLength is set to match the length of the data.
6.2.2 GetEncapsulatedResponse
The GetEncapsulatedResponse data format is shown Table 6.3.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>GET_ENCAPSULATED_RESPONSE (0x01)</td>
<td>0x0000</td>
<td>0x0000</td>
<td>Data length</td>
<td>The data depends on the protocol.</td>
</tr>
</tbody>
</table>

Note: The response data to SendEncapsulatedCommand is set as Data, and wLength is set to match the length of the data.

6.2.3 SetCommFeature
The SetCommFeature data format is shown Table 6.4.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>SET_COMM_FEATURE (0x02)</td>
<td>Feature Selector Note</td>
<td>0x0000</td>
<td>Data length</td>
<td>Status Either the country code or the Abstract Control Model idle setting/multiplexing setting for Feature Selector.</td>
</tr>
</tbody>
</table>

Note: Shown in Table 4.6 Feature selector Settings.

6.2.4 GetCommFeature Data Format
The GetCommFeature data format is shown below.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>GET_COMM_FEATURE (0x03)</td>
<td>Feature Selector Note</td>
<td>0x0000</td>
<td>Data length</td>
<td>Status Either the country code or the Abstract Control Model idle setting/multiplexing setting for Feature Selector.</td>
</tr>
</tbody>
</table>

Note: Shown in Table 4.6 Feature selector Settings.

A Feature selector setup is shown in Table 6.6. The Status format at the time of ABSTRACT_STATE is shown in Table 6.7.

<table>
<thead>
<tr>
<th>Feature Selector</th>
<th>Code</th>
<th>Targets</th>
<th>Length of Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESERVED</td>
<td>0x00</td>
<td>None</td>
<td>None</td>
<td>Reserved</td>
</tr>
<tr>
<td>ABSTRACT_STATE</td>
<td>0x01</td>
<td>Interface</td>
<td>2</td>
<td>Selects the setting for Abstract Control Model idle state and signal multiplexing.</td>
</tr>
<tr>
<td>COUNTRY_SETTING</td>
<td>0x02</td>
<td>Interface</td>
<td>2</td>
<td>Selects the country code in hexadecimal format, as defined by ISO 3166.</td>
</tr>
</tbody>
</table>
Table 6.7 Status Format when ABSTRACT_STATE Selected

<table>
<thead>
<tr>
<th>Bit Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D15 to D2</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
| D1           | Data multiplexing setting  
  1: Multiplexing of call management commands is enabled for the Data class.  
  0: Multiplexing is disabled.  |
| D0           | Idle setting  
  1: No endpoints of the target interface accept data from the host, and data is not supplied to the host.  
  0: Endpoints continue to accept data and it is supplied to the host.  |

6.2.5 ClearCommFeature

The ClearCommFeature data format is shown Table 6.8.

Table 6.8 ClearCommFeature Data Format

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>CLEAR_COMM_FEATURE (0x04)</td>
<td>Feature Selector Note</td>
<td>0x0000</td>
<td>0x0000</td>
<td>None</td>
</tr>
</tbody>
</table>

Note: Shown in Table 4.6 Feature selector Settings.

6.2.6 SetLineCoding

The SetLineCoding data format is shown Table 6.9.

Table 6.9 SetLineCoding Data Format

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>SET_LINE_CODING (0x20)</td>
<td>0x0000</td>
<td>0x0000</td>
<td>0x0000</td>
<td>Line Coding Structure Format</td>
</tr>
</tbody>
</table>

Line Coding Structure Format is shown Table 6.10.

Table 6.10 Line Coding Structure Format

<table>
<thead>
<tr>
<th>Offset</th>
<th>Field</th>
<th>Size</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>dwDTERate</td>
<td>4</td>
<td>Number</td>
<td>Data terminal speed (bps)</td>
</tr>
</tbody>
</table>
| 4      | bCharFormat    | 1    | Number| Stop bits 0 - 1 stop bit  
  1 - 1.5 stop bits  
  2 - 2 stop bits |
| 5      | bParityType    | 1    | Number| Parity 0 - None  
  1 - Odd  
  2 - Even  
  3 - Mask  
  4 - Space |
| 6      | bDataBits      | 1    | Number| Data bits (5, 6, 7, 8)                         |
6.2.7 GetLineCoding
The GetLineCoding data format is shown Table 6.11.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xA1</td>
<td>GET_LINE_CODING (0x21)</td>
<td>0x0000</td>
<td>0x0000</td>
<td>0x0007</td>
<td>Line Coding Structure See Table 4.10, Line Coding Structure Format</td>
</tr>
</tbody>
</table>

6.2.8 SetControlLineState
The SetControlLineState data format is shown below.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>SET_CONTROL_LINE_STATE (0x22)</td>
<td>Control Signal Bitmap See Table 6.13 Control Signal Bitmap</td>
<td>0x0000</td>
<td>0x0000</td>
<td>None</td>
</tr>
</tbody>
</table>

Table 6.13 Control Signal Bitmap

<table>
<thead>
<tr>
<th>Bit Position</th>
<th>Description</th>
<th>0 - RTS OFF</th>
<th>1 - RTS ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>D15 to D2</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>DCE transmit function control</td>
<td>0 - RTS OFF</td>
<td>1 - RTS ON</td>
</tr>
<tr>
<td>D0</td>
<td>Notification of DTE ready state</td>
<td>0 - DTR OFF</td>
<td>1 - DTR ON</td>
</tr>
</tbody>
</table>

6.2.9 SendBreak
The SendBreak data format is shown below.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x21</td>
<td>SEND_BREAK (0x23)</td>
<td>Break signal output duration</td>
<td>0x0000</td>
<td>0x0000</td>
<td>None</td>
</tr>
</tbody>
</table>
6.3 ACM Notifications from Device to Host

The class notifications supported and not supported by the software are shown Table 6.15.

<table>
<thead>
<tr>
<th>Notification</th>
<th>Code</th>
<th>Description</th>
<th>Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>NETWORK_CONNECTION</td>
<td>0x00</td>
<td>Notification of network connection state</td>
<td>No</td>
</tr>
<tr>
<td>RESPONSEAVAILABLE</td>
<td>0x01</td>
<td>Response to GET_ENCAPSULATED_RESPONSE</td>
<td>Yes</td>
</tr>
<tr>
<td>SERIAL_STATE</td>
<td>0x20</td>
<td>Notification of serial line state</td>
<td>Yes</td>
</tr>
</tbody>
</table>

6.3.1 SerialState

The SerialState data format is shown below.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xA1</td>
<td>SERIAL_STATE</td>
<td>0x0000</td>
<td>0x0000</td>
<td>0x0000</td>
<td>UART State bitmap</td>
</tr>
</tbody>
</table>

UART State bitmap format is shown Table 6.17.

<table>
<thead>
<tr>
<th>Bits</th>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D15  to D7</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>D6</td>
<td>bOverRun</td>
<td>Overrun error detected</td>
</tr>
<tr>
<td>D5</td>
<td>bParity</td>
<td>Parity error detected</td>
</tr>
<tr>
<td>D4</td>
<td>bFraming</td>
<td>Framing error detected</td>
</tr>
<tr>
<td>D3</td>
<td>bRingSignal</td>
<td>INCOMING signal (ring signal) detected</td>
</tr>
<tr>
<td>D2</td>
<td>bBreak</td>
<td>Break signal detected</td>
</tr>
<tr>
<td>D1</td>
<td>bTxCarrier</td>
<td>Data Set Ready: Line connected and ready for communication</td>
</tr>
<tr>
<td>D0</td>
<td>bRxCarrier</td>
<td>Data Carrier Detect: Carrier detected on line</td>
</tr>
</tbody>
</table>

6.3.2 ResponseAvailable

The ResponseAvailable data format is shown below.

<table>
<thead>
<tr>
<th>bmRequestType</th>
<th>bRequest</th>
<th>wValue</th>
<th>wIndex</th>
<th>wLength</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xA1</td>
<td>RESPONSE_AVAILABLE</td>
<td>0x0000</td>
<td>0x0000</td>
<td>0x0000</td>
<td>None</td>
</tr>
</tbody>
</table>
7. USB Host Communication Device Class Driver (HCDC)

7.1 Basic Functions

This software conforms to the Abstract Control Model subclass of the communication device class specification.

The main functions of HCDC are to:
1. Send class requests to the CDC peripheral
2. Transfer data to and from the CDC peripheral
3. Receive communication error information from the CDC peripheral

7.2 Structures

7.2.1 HCDC Request Structure

Table 7.1 describes the “UART settings” parameter structure used for the CDC requests SetLineCoding and GetLineCoding.

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint32_t</td>
<td>dwDTERate</td>
<td>Line speed</td>
<td>Unit: bps</td>
</tr>
<tr>
<td>uint8_t</td>
<td>bCharFormat</td>
<td>Stop bits setting</td>
<td></td>
</tr>
<tr>
<td>uint8_t</td>
<td>bParityType</td>
<td>Parity setting</td>
<td></td>
</tr>
<tr>
<td>uint8_t</td>
<td>bDataBits</td>
<td>Data bit length</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.2 describes the “UART settings” parameter structure used for the CDC requests SetControlLineState.

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint16_t(D1)</td>
<td>bRTS:1</td>
<td>Carrier control for half duplex modems</td>
<td>0 - Deactivate carrier, 1 - Activate carrier</td>
</tr>
<tr>
<td>uint16_t(D0)</td>
<td>bDTR:1</td>
<td>Indicates to DCE if DTE is present or not</td>
<td>0 - Not Present, 1 - Present</td>
</tr>
</tbody>
</table>

Table 7.3 describes the “AT command” parameter structure used for the CDC requests SendEncapsulatedCommand and GetEncapsulatedResponse.

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint8_t</td>
<td>*p_data</td>
<td>Area where AT command data is stored</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>wLength</td>
<td>Size of AT command data</td>
<td>Unit: byte</td>
</tr>
</tbody>
</table>

Table 7.4 describes the “Break signal” parameter structure used for the CDC requests SendBreak.

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint16_t</td>
<td>wTime_ms</td>
<td>Duration of Break</td>
<td>Unit: ms</td>
</tr>
</tbody>
</table>
7.2.2 CommFeature Function Selection Union

Table 7.5 and Table 7.6 describe the “Feature Selector” parameter structure used for the CDC requests SetCommFeature and GetCommFeature, and Table 7.7 describes the parameter union.

Table 7.5 USB_HCDC_AbstractState_t Structure

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint16_t</td>
<td>rsv1:8</td>
<td>Reserved1</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>rsv2:6</td>
<td>Reserved2</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>bDMS:1</td>
<td>Data Multiplexed State</td>
<td></td>
</tr>
<tr>
<td>iomt16_t</td>
<td>bIS:1</td>
<td>Idle Setting</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.6 USB_HCDC_CountrySetting_t Structure

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint16_t</td>
<td>country_code</td>
<td>Country code in hexadecimal format as defined in [ISO3166],</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.7 USB_HCDC_CommFeature_t Union

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB_HCDC_AbstractState_t</td>
<td>abstractState</td>
<td>Abstract Control Model select time parameters</td>
<td></td>
</tr>
<tr>
<td>USB_HCDC_CountrySetting_t</td>
<td>countrySetting</td>
<td>Country Setting select time parameters</td>
<td></td>
</tr>
</tbody>
</table>
### 7.2.3 CDC Request Input Parameter Union

Table 7.8 describes the common parameter structure for CDC requests.

<table>
<thead>
<tr>
<th>Request</th>
<th>Request code Structure type</th>
<th>Member name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SetLineCoding</td>
<td>USB_HCDC_SET_LINE_CODING</td>
<td>LineCoding</td>
<td>Data address send and receive in data stage. Refer to Table 7.1</td>
</tr>
<tr>
<td>GetLineCoding</td>
<td>USB_HCDC_GET_LINE_CODING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SetControlState</td>
<td>USB_HCDC_SET_CONTROL_LINE_STATE</td>
<td>ControlLineState</td>
<td>Value set to the wValue field. Refer to Table 7.2</td>
</tr>
<tr>
<td>SendEncapsulatedCommand</td>
<td>USB_HCDC_SEND_ENCAPSULATED_COMMAND</td>
<td>Encapsulated</td>
<td>Data address send and receive in data stage, and value set to the wValue field. Refer to Table 7.3</td>
</tr>
<tr>
<td>GetEncapsulatedResponse</td>
<td>USB_HCDC_GET_ENCAPSULATED_RESPONSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SendBreak</td>
<td>USB_HCDC_SEND_BREAK</td>
<td>BreakDuration</td>
<td>Value set to the wValue field. Refer to Table 7.4</td>
</tr>
<tr>
<td>SetCommFeature</td>
<td>USB_HCDC_SET_COMM_FEATURE</td>
<td>CommFeature</td>
<td>Data address send and receive in data stage. Refer to Table 7.7</td>
</tr>
<tr>
<td>GetCommFeature</td>
<td>USB_HCDC_GET_COMM_FEATURE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ClearCommFeature</td>
<td>USB_HCDC_CLR_COMM_FEATURE</td>
<td>No structure</td>
<td></td>
</tr>
</tbody>
</table>

### 7.2.4 CDC Request API Function Structure

Table 7.9 describes the CDC request parameter structure.

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>usb_addr_t</td>
<td>devadr</td>
<td>Device address</td>
</tr>
<tr>
<td>USB_REGADR_t</td>
<td>ipp</td>
<td>USB IP Base Address</td>
</tr>
<tr>
<td>uint16_t</td>
<td>ip</td>
<td>USB IP Number</td>
</tr>
<tr>
<td>uint8_t</td>
<td>bRequestCode</td>
<td>Class request code. Refer to Table 7.8</td>
</tr>
<tr>
<td>USB_CDC_ClassRequestParm_t</td>
<td>parm</td>
<td>Parameter setup value. Refer to Table 7.8</td>
</tr>
<tr>
<td>usb_cb_t</td>
<td>complete</td>
<td>Class request processing end call-back function</td>
</tr>
</tbody>
</table>
7.2.5 CDC Notification Format

Table 7.10 and Table 7.11 describe the data format of the CDC notification.

### Table 7.10 Response Available notification format

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint8_t</td>
<td>bmRequestType</td>
<td>0xA1</td>
<td></td>
</tr>
<tr>
<td>uint8_t</td>
<td>bRequest</td>
<td>RESPONSE_AVAILABLE(0x01)</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>wValue</td>
<td>0x0000</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>wIndex</td>
<td>Interface</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>wLength</td>
<td>0x0000</td>
<td></td>
</tr>
<tr>
<td>uint8_t</td>
<td>Data</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

### Table 7.11 Serial State notification format

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint8_t</td>
<td>bmRequestType</td>
<td>0xA1</td>
<td></td>
</tr>
<tr>
<td>uint8_t</td>
<td>bRequest</td>
<td>SERIAL_STATE(0x20)</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>wValue</td>
<td>0x0000</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>wIndex</td>
<td>Interface</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>wLength</td>
<td>0x0002</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>Data</td>
<td>UART State bitmap</td>
<td>Refer to Table 7.12</td>
</tr>
</tbody>
</table>

The host is notified of the “Serial State” when a change in the UART port state is detected. Table 7.12 describes the structure of the UART State bitmap.

### Table 7.12 USB_HCDC_SerialState_t Structure

<table>
<thead>
<tr>
<th>Type</th>
<th>Member</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>uint16_t</td>
<td>rsv1:8</td>
<td>Reserved1</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>rsv2:1</td>
<td>Reserved2</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>bOverRun:1</td>
<td>Overrun error detected</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>bParity:1</td>
<td>Parity error detected</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>bFraming:1</td>
<td>Framing error detected</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>bRingSignal:1</td>
<td>Incoming signal (Ring signal) detected</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>bBreak:1</td>
<td>Break signal detected</td>
<td></td>
</tr>
<tr>
<td>uint16_t</td>
<td>bTxCarrier:1</td>
<td>Line connected and ready for communication</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>uint16_t</td>
<td>bRxCarrier:1</td>
<td>Carrier detected on line</td>
<td>Data Carrier Detect</td>
</tr>
</tbody>
</table>

7.3 List of HCDC API Functions

The HCDC API is shown in Table 7.13.

### Table 7.13 List of HCDC API Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_usb_hcdc_receive_data</td>
<td>USB receive processing</td>
</tr>
<tr>
<td>R_usb_hcdc_send_data</td>
<td>USB send processing</td>
</tr>
<tr>
<td>R_usb_hcdc_serial_state_trans</td>
<td>Class notification Serial State processing</td>
</tr>
<tr>
<td>R_usb_hcdc_class_check</td>
<td>Descriptor check processing</td>
</tr>
<tr>
<td>R_usb_hcdc_SetPipeRegistration</td>
<td>Pipe setting processing</td>
</tr>
<tr>
<td>R_usb_hcdc_class_request</td>
<td>Sends CDC class request</td>
</tr>
<tr>
<td>R_usb_hcdc_driver_start</td>
<td>Driver task start setting for HCDC</td>
</tr>
<tr>
<td>R_usb_hcdc_Task</td>
<td>HCDC task</td>
</tr>
</tbody>
</table>
7.3.1 R_usb_hcdc_receive_data

Host receive data.

Format

```
USB_ER_t R_usb_hcdc_send_data (USB_UTR_t *ptr,
           uint8_t *buf,
           uint32_t size,
           USB_CB_t complete)
```

Argument

- `ptr` Pointer to the USB Communication Structure used for attached device.
- `buf` Pointer to transmit data buffer address
- `size` Transfer size
- `complete` Process completion notice callback function

Return Value

- Error code (USB_E_OK / USB_E_ERROR).

Description

This function requests USB data reception from the USB driver (HCD). When data reception ends (specified data size reached, short packet received, error occurred), the callback function is called. Information on remaining receive data (length, status, error count and transfer end) is determined by the parameters of the callback. USB receive data is stored in the area given by the address specified by 2nd argument (*buf).

Note

1. Call this API in the user application program or the class driver.
2. Set the following members of the USB_UTR_t structure when calling the function.
   ```
   USB_REGADR_t ipp : USB register base address
   uint16_t ip : USB IP Number
   ```
3. Specify the area other than the auto variable (stack) area to the 2nd argument.
4. When the received data is n times of the maximum packet size and less than the specified size in the argument (size), it is considered that the data transfer is not ended and a callback function (complete) is not generated.
5. Set the device address of CDC device which do the USB data transfer to the member "keyword" in USB_UTR_t structure when the definition "USB_HCDC_MULTI_CONNECT" is enabled.
6. The USB transmit process results are obtained from the USB_UTR_t * argument in the call-back function.
7. Refer to the structure for USB communication (USB_UTR_t structure) of a USB Basic Firmware application note.
Example

```c
{
    USB_UTR_t *ptr;
    uint16_t size = 64; /* Data size */

    ptr = (USB_UTR_t *)&utr;
    ptr->ip = USB_HOST_USBIP_NUM; /* USB IP number set */
    ptr->ipp = R_usb_cstd_GetUsbIpAdr( ptr->ip ); /* USB IP base address set */

    R_usb_hcdc_receive_data(ptr, (uint8_t *)receive_data, size,
                            (USB_CB_t)&usb_complete)
}
/* Callback function */
void usb_complete( USB_UTR_t *mess, uint16_t data1, uint16_t data2 );
{
    /* Describe the processing performed when the USB receive is completed. */
}
```
7.3.2 R_usb_hcdc_send_data

Host send data

Format

```c
USB_ER_t R_usb_hcdc_send_data (USB_UTR_t *ptr,
                        uint8_t *buf,
                        uint32_t size,
                        USB_CB_t complete )
```

Argument

- `ptr`: Pointer to the USB Communication Structure used for attached device.
- `buf`: Pointer to Transmit data buffer address
- `size`: Transfer size
- `complete`: Process completion notice callback function

Return Value

- Error code (USB_E_OK / USB_E_ERROR)

Description

This function transfers the USB data in the specified transmit size from the address specified in the Transmit Data Address Table.
When the transmission processing is complete, the call-back function is called.

Note

1. Call this API in the user application program or the class driver.
2. Please set the following member of USB_UTR_t structure.
   ```
   USB_REGADR_t ipp : USB register base address
   uint16_t ip : USB IP Number
   ```
3. Specify the area other than the auto variable (stack) area to the 2nd argument.
4. Set the device address of CDC device which do the USB data transfer to the member "keyword" in USB_UTR_t structure when the definition "USB_HCDC_MULTI_CONNECT" is enabled.
5. The USB transmit processing results are obtained by "USB_UTR_t *" argument in the call-back function.
6. Refer to the USB Basic Firmware application note for info on the USB communication (USB_UTR_t) structure.
Example

```c
{
    USB_USTR_t *ptr;

    ptr = (USB_USTR_t *)&utr;
    ptr->ip = USB_PERI_USBIP_NUM; /* USB IP number set */
    ptr->ipp = R_usb_cstd_GetUsbIpAdr( ptr->ip ); /* USB IP base address set */

    R_usb_hcdc_send_data(ptr, send_data, size, (USB_CB_t)&usb_complete)
}
/* Callback function */
void usb_complete( USB_USTR_t *mess, uint16_t data1, uint16_t data2 );
{
    /* Describe the processing performed when the USB transmit is completed. */
}
```
7.3.3  R_usb_hcdc_serial_state_trans

Handle CDC class and serial state info from peripheral

Format

```
USB_ER_t  R_usb_hcdc_serial_state_trans (USB_UTR_t *ptr,
                                           USB_HCDC_SERIAL_ST_CB_t *complete )
```

Argument

- *ptr  Pointer to the USB Communication Structure used for attached device.
- complete  Process completion notice callback function

Return Value

- Error code (USB_E_OK / USB_E_ERROR).

Description

This function receives the CDC class notification (Serial State) from the peripheral device. Callback function complete is called after the completion of reception. The serial status is received when the callback function is triggered.

Note

1. Call this API in the user application program or the class driver.
2. For information concerning the serial status bit pattern, refer to "Table 6.17 UART State bitmap Format.
3. The USB transmit results are obtained from the USB_UTR_t * argument in the call-back function.
4. Please set the following member of USB_UTR_t structure when calling the function.

```
USB_REGADR_t  ipp  : USB register base address
uint16_t    ip  : USB IP Number
```

5. Set the device address of CDC device which do the USB serial state reception to the member "keyword" in USB_UTR_t structure when the definition "USB_HCDC_MULTI_CONNECT" is enabled.

Example

```c
void usb_hcdc_main_task(USB_VP_INT stacd)
{
    USB_UTR_t    *mess;
    USB_ER_t    err;

    while (1)
    {
        err = R_USB_OPCODE(USB_HCDCSMP_MBX,(USB_OPCODE_t**)&mess);
        if (err == USB_OK)
        {
            err = R_usb_hcdc_serial_state_trans( mess,
                                                  (USB_HCDC_SERIAL_ST_CB_t *)&usb_hcdc_smp_SerialStateReceive );
            if( err != USB_OK )
            {
                USB_PRINTF0("### usb_pcdc_MainTask function bulk read error\n");
            }
        }
    }
}
```
7.3.4 R_usb_hcdc_class_check

Check descriptor

Format

void R_usb_hcdc_class_check (USB_UTR_t *ptr, uint16_t **devinfo)

Argument

*ptr  Pointer to the USB Communication Structure used for attached device.
**devinfo  Device information array

[0] : Device Descriptor
[1] : Configuration Descriptor
[3] : Descriptor Check Result
[4] : HUB Classification
[5] : Port Number
[7] : Device Address

Return Value

Result (USB_E_OK / USB_E_ERROR).

Description

This is a class driver registration function. It is registered to the driver registration structure member classcheck, as a callback function during HCDC registration at startup and called when a configuration descriptor is received during enumeration.

When the check result is OK, the function sets USB_DONE in the descriptor result (table[3]). When the check result is NG, the function sets USB_ERROR and ends the process.

This function references the endpoint descriptor in the peripheral device configuration descriptor, then edits the pipe information table and checks the pipe information of the pipes to be used.

Note

Example

void usb_hcdc_registration(USB_UTR_t *ptr)
{
    USB_HCDREG_t driver;

    driver.ifclass = (uint16_t)USB_IFCLS_CDCC;
    driver.classcheck = (USB_CB_CHECK_t)&R_usb_hcdc_class_check;
    driver.devresume = (USB_CB_INFO_t)&usb_hcdc_dummy_function;
    R_usb_hstd_DriverRegistration(ptr, (USB_HCDREG_t*)&driver);
}
7.3.5  R_usb_hcdc_SetPipeRegistration

Set host USB H/W pipe configuration

Format

\[
\text{USB_ER_t} \quad \text{R_usb_hcdc_SetPipeRegistration (USB_UTR_t *ptr, uint16_t dev_addr)}
\]

Argument

- \( \text{ptr} \): Pointer to the USB Communication Structure used for attached device.
- \( \text{dev_addr} \): Device Address

Return Value

- Rresult (USB_E_OK / USB_E_ERROR).

Description

This function sets the USB hardware to use the communication pipes that correspond to the endpoints used for USB CDC communications. A total of three pipes are setup in host CDC: Bulk IN and Bulk OUT pipes for data communications, as well as an Interrupt IN pipe for receiving the serial state.

Note

1. Call this API from the user application program or the class driver.
2. Please set the following member of USB_UTR_t structure.

   \[
   \begin{align*}
   \text{USB_REGADR_t} & \quad \text{ipp} \quad : \text{USB register base address} \\
   \text{uint16_t} & \quad \text{ip} \quad : \text{USB IP Number}
   \end{align*}
   \]

Example

```c
void usb_hcdc_smp_open(USB_UTR_t *ptr, uint16_t devadr, uint16_t data2)
{
    USB_ER_t err;
    if (devadr != 0)
    {
        usb_shcdc_devadr = devadr;  /* Device Address store */

        /* Host CDC Pipe Registration */
        err = R_usb_hcdc_SetPipeRegistration(ptr, usb_shcdc_devadr);
        if (err != USB_OK)
        {
            USB_PRINTF0("Pipe Registration error !\n");
        }
    }
}
```
Send a CDC Class request

Format

```
USB_ER_t  R_usb_hcdc_class_request (void *pram)
```

Argument

*pram  Class request parameter.

Return Value

Error code (USB_E_OK / USB_E_ERROR).

Description

The following CDC class requests can be sent to an enumerated USB CDC peripheral by HCDC.

1. SendEncapsulatedCommand
2. GetEncapsulatedResponse
3. SetCommFeature
4. GetCommFeature
5. ClearCommFeature
6. SetLineCoding
7. GetLineCoding
8. SetControlLineState
9. SendBreak

Please refer to the following “Example” for details on how to issue these requests.

The parameter set in the void * pram argument will cast USB_HCDC_ClassRequestParm_t*.

Refer to Table 7.8 for the `USB_HCDC_ClassRequest_Parm` structure.

Note

1. Call this API in the user application program or the class driver.
2. Set the following members of the `USB_UTR_t` structure when calling the function.
   ```
   USB_REGADR_t  ipp : USB register base address
   uint16_t   ip : USB IP Number
   ```
3. Refer to the USB Basic Firmware application note for the USB Communication structure `USB_UTR_t`. 
Example

- **SetEncapsulatedResponse**

```c
void SetEncapsulatedResponse
{
    USB_ER_t  err;
    USB_HCDC_ClassRequest_UTR_t  utr_req;

    utr_req.parm.Encapsulated.p_data = p_data; /* Command data buffer */
    utr_req.parm.Encapsulated.wLength = length;
    utr_req.bRequestCode = USB_HCDC_SEND_ENCAPSULATED_COMMAND;
    utr_req.complete = smp_sendencapsulateresponse_cb;
    utr_req.devadr = devadr;   /* Device Address */
    utr_req.ip = USB_USBIP_0;   /* USB IP No (0/1) */
    utr_req.ipp = R_usb_cstd_GetUsbIpAdr( USB_USBIP_0 ); /* USB IP address */

    /* CDC class request */
    err = R_usb_hcdc_class_request( (void*)&utr_req);

    return err;
}
/* Callback function */
void smp_sendencapsulateresponse_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2)
{
    /* Describe the processing performed when the class request is completed. */
}
```

- **GetEncapsulatedResponse**

```c
void GetEncapsulatedResponse
{
    USB_HCDC_ClassRequest_UTR_t  utr_req; /* Line Coding Parameter */
    USB_ER_t  err;

    /* Example of usage. */
    USB_ER_t  err;
    USB_HCDC_ClassRequest_UTR_t  utr_req;

    utr_req.parm.Encapsulated.p_data = p_data; /* Command data buffer */
    utr_req.parm.Encapsulated.wLength = length;
    utr_req.bRequestCode = USB_HCDC_GET_ENCAPSULATED_RESPONSE;
    utr_req.complete = smp_getencapsulateresponse_cb; /* Callback function */
    utr_req.devadr = devadr;   /* USB device address */
    utr_req.ip = USB_USBIP_0;   /* USB IP No (0/1) */
    utr_req.ipp = R_usb_cstd_GetUsbIpAdr( USB_USBIP_0 ); /* USB IP address */

    /* CDC class request */
    err = R_usb_hcdc_class_request( (void*)&utr_req);

    return err;
}
/* Callback function */
void smp_getencapsulateresponse_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2)
{
    /* Describe the processing performed when the class request is completed. */
}
```

- **SetCommFeature**

```c
void SetCommFeature
{
    USB_HCDC_ClassRequest_UTR_t  utr_req;

    utr_req.bRequestCode = USB_HCDC_SET_COMM_FEATURE;
    utr_req.selector = selector; /* Feature Selector */
    utr_req.parm.CommFeature = p_commfeature; /* Feature Parameter set data */
```
if( selector == USB_HCDC_ABSTRACT_STATE )
{
    p_commfeature->abstractState.rsv = 0;
}
uotr_req.complete = (USB_CB_t)&smp_setcommfeature_cb;
uotr_req.devadr = devadr;  /* Device Address */
uotr_req.ip = USB_USBIP_0;  /* USB IP No */
uotr_req.ipp = R_usb_cstd_GetUsbIpAdr( USB_USBIP_0 );/* USB IP address */
/* CDC class request */
err = R_usb_hcdc_class_request( (void*)&utr_req);
return err;

/* Callback function for sending SetLineCoding class request */
void smp_setcommfeature_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2) 
{
    /* Describe the processing performed when the class request is completed. */
}

● GetCommFeature
{
    USB_ER_t err;
    USB_HCDC_ClassRequest_UTR_t utr_req;

    utr_req.bRequestCode = USB_HCDC_GET_COMM_FEATURE;
    /* Feature Parameter storage address */
    utr_req.parm.CommFeature = p_commfeature;
    utr_req.complete = (USB_CB_t)& smp_getcommfeature_cb;
    utr_req.devadr = devadr;  /* Device Address */
    utr_req.selector = selector; /* Feature Selector */
    utr_req.ip = USB_USBIP_0;  /* USB IP No */
    utr_req.ipp = R_usb_cstd_GetUsbIpAdr( USB_USBIP_0 );/* USB IP address */
    /* CDC class request */
    err = R_usb_hcdc_class_request( (void*)&utr_req);
    return err;
}
/* Callback function for sending SetLineCoding class request */
void smp_getcommfeature_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2) 
{
    /* Describe the processing performed when the class request is completed. */
}

● ClearCommFeature
{
    USB_ER_t err;
    USB_HCDC_ClassRequest_UTR_t utr_req;

    utr_req.bRequestCode = USB_HCDC_CLR_COMM_FEATURE;
    utr_req.complete = (USB_CB_t)& smp_clrcommfeature_cb;
    utr_req.devadr = devadr;  /* Device Address */
    utr_req.selector = selector; /* Feature Selector */
    utr_req.ip = USB_USBIP_0;  /* USB IP No */
    utr_req.ipp = R_usb_cstd_GetUsbIpAdr( USB_USBIP_0 );/* USB IP address */
    /* CDC class request */
    err = R_usb_hcdc_class_request( (void*)&utr_req);
return err;
}
/* Callback function */
void smp_clrcommfeature_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2)
{
/* Describe the processing performed when the class request is completed. */
}

** SetLineCoding **
static USB_HCDC_LineCoding_t usb_shcdc_line_coding;
{
    USB_ER_t   err;
    USB_HCDC_ClassRequest_UTR_t utr_req; /* Line Coding Parameter */

    usb_shcdc_line_coding.dwDTERate   = USB_HCDC_SPEED_9600;
    usb_shcdc_line_coding.bDataBits   = USB_HCDC_DATA_BIT_8;
    usb_shcdc_line_coding.bCharFormat = USB_HCDC_STOP_BIT_1;
    usb_shcdc_line_coding.bParityType = USB_HCDC_PARITY_BIT_NONE;

    utr_req.bRequestCode = USB_HCDC_SET_LINE_CODING;
    utr_req.complete    = (USB_CB_t)&smp_setlinecoding_cb;
    utr_req.parm.LineCoding = &usb_shcdc_line_coding;
    utr_req.devadr       = devadr;
    utr_req.ip          = USB_USBIP_0; /* USB IP No */;
    utr_req.ipp          = R_usb_cstd_GetUsbIpAdr( USB_USBIP_0 );/* USB IP address */

    /* CDC Class Request */
    err = R_usb_hcdc_class_request( (void*)&utr_req );
    return err;
}
/* Callback function */
void smp_setlinecoding_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2)
{
/* Describe the processing performed when the class request is completed. */
}

** GetLineCoding **
{
    USB_ER_t   err;
    USB_HCDC_ClassRequest_UTR_t utr;

    utr_req.bRequestCode = USB_HCDC_GET_LINE_CODING;
    utr_req.parm.LineCoding = p_linecoding; /* Line Coding table address */
    utr_req.complete = smp_getlinecoding_cb;
    utr_req.devadr = devadr; /* Device Address */
    utr_req.ip = USB_USBIP_0; /* USB IP No */
    utr_req.ipp = R_usb_cstd_GetUsbIpAdr(USB_USBIP_0 ); /* USB IP address */

    /* CDC class request */
    err = R_usb_hcdc_class_request( (void*)&utr_req);
    return err;
}
/* Callback function for sending SetLineCoding class request */
void smp_getlinecoding_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2)
{
/* Describe the processing performed when the class request is completed. */
SetControlLineState
{
    USB_ER_t err;
    USB_HCDC_ClassRequest_UTR_t utr_req;

    utr_req.bRequestCode = USB_HCDC_SET_CONTROL_LINE_STATE;
    utr_req.parm.ControlLineState.bDTR = dtr; /* RS232 signal DTR */
    utr_req.parm.ControlLineState.bRTS = rts; /* RS232 signal RTS */
    utr_req.complete = (USB_CB_t)smp_setcontrollinestate_cb;
    utr_req.devadr = devadr; /* Device Address */
    utr_req.ip = USB_USBIP_0; /* USB IP No */
    utr_req.ipp = R_usb_cstd_GetUsbIpAdr(USB_USBIP_0); /* USB IP address */

    /* CDC class request */
    err = R_usb_hcdc_class_request((void*)&utr_req);

    return err;
}
/* Callback function */
void smp_setcontrollinestate_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2)
{
    /* Describe the processing performed when the class request is completed. */
}

SendBreak
{
    USB_ER_t err;
    USB_HCDC_ClassRequest_UTR_t utr_req;

    utr_req.bRequestCode = USB_HCDC_SEND_BREAK;
    /* Break Signal output time */
    utr_req.parm.BreakDuration.wTime_ms = time_ms;
    utr_req.complete = (USB_CB_t)smp_sendbreak_cb;
    utr_req.devadr = devadr; /* Device Address */
    utr_req.ip = USB_USBIP_0; /* USB IP No */
    utr_req.ipp = R_usb_cstd_GetUsbIpAdr(USB_USBIP_0); /* USB IP address */

    /* CDC class request */
    err = R_usb_hcdc_class_request((void*)&utr_req);

    return err;
}
/* Callback function */
void smp_sendbreak_cb (USB_UTR_t *mess, uint16_t data1, uint16_t data2)
{
    /* Describe the processing performed when the class request is completed. */
}
7.3.7 R_usb_hcdc_driver_start

HCDC driver task init

Format

    void   usb_hcdc_driver_start ( void )

Argument

    -

Return Value

    -

Description

    This function starts the HCDC driver task.

Note

    Call this API from the user application at user system initialization.

Example

    void usb_hcdc_task_start( void )
    {
        ...
        ptr->ipp = R_usb_cstd_GetUsbIpAddr( ptr->ip );
        R_usb_hstd_usbdriver_start( ptr );  /* Host USB Driver Start Setting */
        usb_hcdc_registration( ptr );  /* Host Application Registration */
        usb_hstd_HubRegistAll(ptr);  /* Hub registration */
        R_usb_hcdc_driver_start( ptr );  /* Host Class Driver Task Start Setting */
        usb_hapl_task_start( ptr );  /* Host Application Task Start Setting */
        R_usb_cstd_UsbIpInit( ptr, USB_HOST_PP );  /* Initialize USB IP */
        ...
    }
7.3.8  R_usb_hcdc_task

HCDC task

Format

```c
void   R_usb_hcdc_task (USB_VP_INT_t stacd)
```

Argument

```
stacd  Task start code - Not used
```

Return Value

```
-      -
```

Description

The HCDC task processes requests from the application, and notifies the application of the results.

Note

In non-OS operations, the function is registered to be scheduled by the scheduler.

Example

```c
void usb_apl_task_switch(void)
{
    while( 1 )
    {
        /* Scheduler */
        R_usb_cstd_Scheduler();

        if( USB_FLGSET == R_usb_cstd_CheckSchedule() )
        {
            R_usb_hstd_HcdTask((USB_VP_INT)0);   /* HCD Task */
            R_usb_hstd_MgrTask((USB_VP_INT)0);   /* MGR Task */
            R_usb_hhub_Task((USB_VP_INT)0);      /* HUB Task */
            usb_hcdc_main_task((USB_VP_INT)0);    /* HCDC Application Task */
            R_usb_hcdc_task((USB_VP_INT)0);      /* HCDC Task */
        }
        else
        {
            /* Idle Task (sleep sample) */
            R_usb_cstd_IdleTask(0);
        }
    }
}
```
8. Sample Application

8.1 Application Specifications

The main functions of the HCDC sample application (hereafter APL) are as follows.
1. Sends receive (Bulk In transfer) requests to the CDC device and receives data.
2. Transfers received data to the CDC device by means of Bulk Out transfers (loopback).
3. Makes RTS and DTR settings by means of the class request SET_CONTROL_LINE_STATE.
4. Makes communication speed and other settings when switches on the evaluation board are operated.
   The communication speed and other settings are made by transmitting the class request
   SET_LINE_CODING to the CDC device. This class request can be used to set the communication
   speed, number of data bits, number of stop bits, and the parity bit.
5. Acquires the communication setting values of the CDC device by sending the class request
   GET_LINE_CODING to the CDC device.

8.1.1 Data Transfer Image

Figure 8-1 shows the data transfer image.

![Data Transfer Image](image)

8.1.2 Baud Rate Settings

The baud rate setting for the connected CDC device should match the baud rate setting of the
INIT_COM_SPEED definition in the common\inc\r_usb_hcdc_apl.h file. Specify a setting of 1200, 2400,
4800, 9600, 14400, 19200, 38400, 57600, or 115200 bps.

Example:

```
#define INIT_COM_SPEED USB_HCDC_SPEED_57600
```
8.2 Application Processing

The APL comprises two parts: initial setting and main loop. The following gives the processing summary for each part.

8.2.1 Initial Setting

In the initial setting part, the initial setting of the USB controller and the initialization of the application program are performed.

8.2.2 Main Loop

The main loop performs loop-back processing in which data received from the CDC device is transmitted unaltered back to the CDC device as part of the main routine. An overview of the processing of the main loop is presented below.

1. When the R_USB_GetEvent function is called after the CDC device attaches to the evaluation board and enumeration finishes, USB_STS_CONFIGURED is set as the return value. When the APL confirms USB_STS_CONFIGURED, it sends class request SET_LINECODING to the CDC device.

2. When it confirms that the class request processing has finished, the APL calls the R_USB_Read function to make a data receive request for data sent from the CDC device. Note that in addition to the data receive request a receive request is also sent for a class notification from the CDC device.

3. When the R_USB_GetEvent function is called after reception of data from the CDC device has finished, USB_STS_READ_COMPLETE is set as the return value. The received data is stored in external variable g_data. The receive data size can be confirmed by means of the size member of the usb_ctrl_t structure. The APL determines that a null packet has been received if the value of the size member is 0 (zero) and performs another data receive request. If the value of the size member is other than 0 (zero), the APL determines that data has been received from the CDC device. It then makes a transmit request to send the received data to the CDC device.

4. When the R_USB_GetEvent function is called after transmission of data to the CDC device finishes, USB_STS_WRITE_COMPLETE is set as the return value. When the APL confirms USB_STS_CONFIGURED, it calls the R_USB_Read function to make a data receive request for data sent by the CDC device.

5. The processing in steps 3 and 4, above, is repeated.

---

**Figure 8-2 Main Loop**
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1. Handling of Unused Pins
   Handle unused pins in accordance 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, an 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.

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