Renesas USB MCU

R01AN0555EJ0213
Rev.2.13
Mar 16, 2015

USB Peripheral Communications Device Class Driver (PCDC) using USB Basic Mini Firmware

Introduction

This document is an application note describing use of the USB Peripheral Communications Device Class Driver (PCDC) built using the USB Basic Mini Firmware.

Target Device

RL78/G1C, RL78/L1C, R8C/34U, R8C/3MK, R8C/34K

This program can be used with other microcontrollers that have the same USB module as the above target devices. When using this code in an end product or other application, its operation must be tested and evaluated thoroughly.

This program has been evaluated using the corresponding MCU's Renesas Starter Kit board.

Contents

1. Overview 2

2. How to Register Class Driver 4

3. Software Configuration 4

4. Peripheral CDC Sample Application (APL) 7

5. Communications Device Class (CDC) 18

6. USB Peripheral Communication Device Class Driver (PCDC) 23

7. Communication Port Driver (CPD) 30

1. Overview

This document is an application note describing use of the USB peripheral Communication Device Class driver (PCDC) and communication port driver sample driver, using the USB Basic Mini FirmwareRenesas.

The ACM subclass of the CDC class is used. For USB applications that need bulk transfer - large amounts of non time critical data, this can be the most straightforward solution, since it can be used together with a PC UART terminal program. These host–side COM port terminal applications most often have a file transfer menu options built in. The terminal program will be opened towards the USB COM-port that will appear after enumeration.

1.1 Functions and Features

The PCDC conforms to the Abstract Control Model of the Communication Device Class specification (CDC) and enables communication with a USB Host.

This class driver is intended to be used in combination with the USB Basic Mini Firmware from Renesas Electronics.

1.2 Related Documents

1. Universal Serial Bus Revision 2.0 specification
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/]
4. User’s Manual: Hardware
5. USB Basic Mini Firmware Application Note (Document No. R01AN0326EJ)
6. USB Peripheral Communications Device Class Driver (PCDC) Installation Guide for Basic Mini Firmware
7. FIT SCI Asynchronous Mode Module Application Note (Document No. R01AN1667EU)

Available from Renesas Electronics WebSite

Renesas Electronics Website
[http:// www.renesas.com]
USB Devices Page
[http://www.renesas.com/prod/usb]

1.3 Terms and Abbreviations

Terms and abbreviations used in this document are listed below.

API	:	Application Program Interface
APL	:	Application program
CDC	:	Communications Devices Class
CDCC	:	Communications Devices Class Communications Interface Class
CDCD	:	Communications Devices Class Data Class Interface
CPD	:	Serial Communication Port Driver
cstd	:	Prefix of function and file for Host & Peripheral USB-BASIC-F/W
Data Transfer	:	Generic name of Control transfer, Bulk transfer and Interrupt transfer
H/W	:	Renesas USB device
PCD	:	Peripheral control driver of USB-BASIC-F/W
PCDC	:	Communications Devices Class for peripheral
PCDCD	:	Peripheral Communications Devices Class Driver
PP	:	Pre-processed definition
pstd	:	Prefix of function and file for Peripheral USB-BASIC-F/W
RSK	:	Renesas Starter Kit
Scheduler	:	Used to schedule functions, like a simplified OS.
Scheduler Macro	:	Used to call a scheduler function
SCI	:	Serial Communication Interface
SW1/SW2/SW3	:	Switch implemented on RSK board
Task	:	Processing unit
USB	:	Universal Serial Bus
USB-BASIC-F/W	:	USB Basic Mini Firmware for Renesas USB device

1.4 How to Read This Document

This document is not intended for reading straight through. Use it first to gain acquaintance with the package, then to look up information on functionality and interfaces as needed for your particular solution.

Chapter 4 explains how the sample application works. You will change this to create your own solution.

Understand how all code modules are divided into tasks, and that these tasks pass messages to one another. This is so that functions (tasks) can execute in the order determined by a scheduler and not strictly in a predetermined order. This way more important tasks can have priority. Further, tasks are intended to be non-blocking by using a documented callback mechanism. The task mechanism is described in Chapter 1.2 above, "BASIC-FW Application Note".

All PCDC tasks are listed in Chapter 3.3 below.

2. How to Register Class Driver

The class driver which the user creates must be registered with the BASIC-FW. Please consult function *usb_papl_registration()* in *r_usb_pcdc_apl.c* on how to register a class driver with the BASIC-FW.

For details, please refer to the BASIC-FW application note.

3. Software Configuration

3.1 Module Configuration

Figure 3-1 shows the configuration of the modules related to PCDC. Table 3.1 lists the software modules.

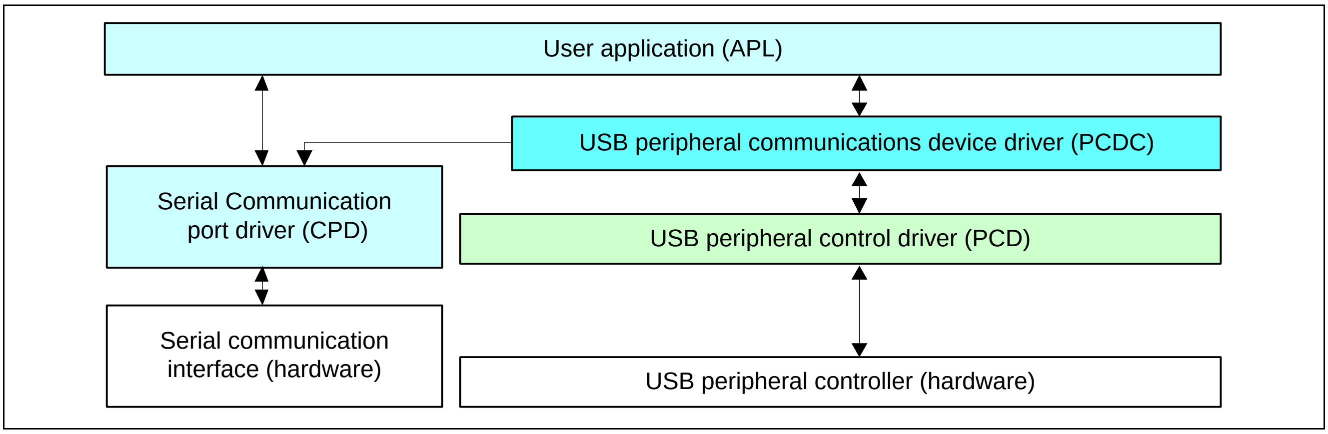


Figure 3-1 Source Code Block Diagram

Table 3.1 Modules

Module	Description
APL	User application program.
PCDC	Sends requests from the APL for requests and data communication involving the CDC to the PCD.
PCD	USB peripheral hardware control driver.
CPD	Serial port control driver

The user application (APL) and PCDC each run as tasks,called by the scheduler.

PCDC communicates with the host via PCD.

APL communicates over USB via PCDC and over the serial port via CPD.

3.2 Structure of Files and folders

3.2.1 Folder Structure

The folder structure of the files supplied with the device class is shown below.

The source codes dependent on each device and evaluation board are stored in each hardware resource folder (***devicename****src**HwResource*).

```
[RL78/G1C, RL78/L1C, R8C]
    ＋(Integrated development environment) [ CS+, HEW, IAR Embedded Workbench, e2 studio ]
      ＋(MCU name)                                  Project File
          ＋ UART                                   UART build result
          ＋ ECHO                                   ECHO build result
          ＋ src
            ＋――― PCDC [ Communication Device  Class driver ]   See Table 3.2
            │       ＋――― inc                       Common header file of CDC driver
            │       ＋――― src                       CDC driver
            ＋―――SmplMain [ Sample Application ]
            │       ＋――― APL                       Sample application
            ＋―――USBSTDFW [Common USB code that is used by all USB firmware ]
            │       ＋――― inc                       Common header file of USB driver
            │       ＋――― src                       USB driver
            ＋――― HwResource [Hardware access layer; to initialize the MCU ]
                      ＋――― inc                     Common header file of hardware resource
                      ＋―――src                      Hardware resource
```

3.2.2 CDC File List

Table 3.2 shows the file structure supplied with PCDC.

Table 3.2 PCDC Folders

Folder	File Name	Description	Note
PCDC/src	r_usb_pcdc_api.c	CDC API functions	
	r_usb_pcdc_driver.c	CDC driver functions	
PCDC/inc	r_usb_pcdc_define.h	CDC type definitions and macro definitions	
	r_usb_pcdc_extern.h	CDC prototype, external reference	
SmplMain	main.c	Main function	
SmplMain/APL	r_usb_pcdc_echo_apl.c	Sample application program for echo mode	
	r_usb_pcdc_uart_apl.c	Sample application program for Serial-USB converter mode	
	r_usb_pcdc_descriptor.c	PCDC descriptor for Sample application	

3.3 System Resources

Table 3.3 lists the ID and priority definitions used to register PCDC in the scheduler.

These are defined in the **r_usb_ckerneid.h** header file.

Table 3.3 Resource Definitions

	Name	Description
Scheduler registration task	USB_PCDC_TSK	**PCDC task** (usb_pcdc_Task) Task priority: 1
	USB_PCDCSMP_TSK	**APL main task** (usb_pcdc_main_task) Task priority: 2
	USB_PCD_TSK	**PCD task** (R_usb_pstd_PcdTask) Task priority : 0
Mailbox ID	USB_PCDC_MBX (default value: USB_PCDC_TSK)	PCDC mailbox ID
	USB_PCDCSMP_MBX (default value: USB_PCDCSMP_TSK)	APL mailbox ID
	USB_PCD_MBX (default value: USB_PCD_TSK)	**PCD** mailbox ID

4. Peripheral CDC Sample Application (APL)

This section explains the peripheral CDC Sample Application (APL).

4.1 Operating Environment

Figure 4-1shows the sample operating environment for the software.

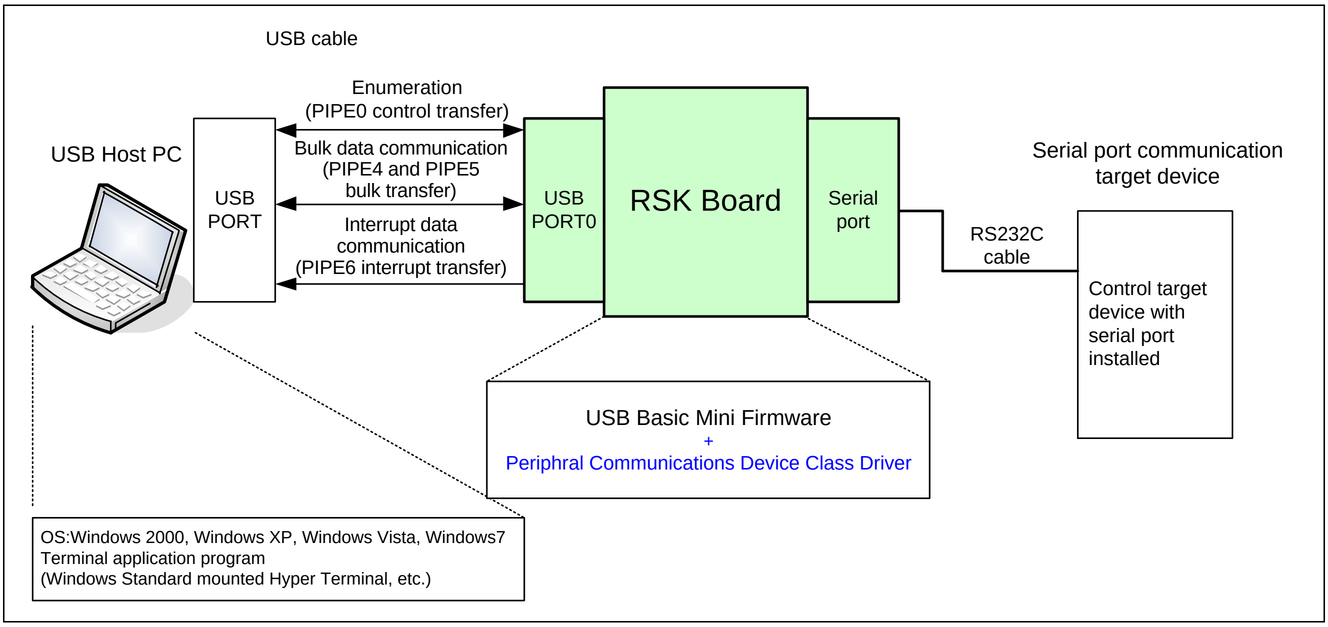


Figure 4-1 Example Operating Environment

When using a Windows PC as the Host PC, you will also need to install the system definition file (reference\cdc_inf\CDC_Demo.inf or CDC_Demo_Win7.inf). The system definition file must be edited to match the Vendor ID (VID) and Product ID (PID) setup in the Rev.2.13. Edit the following places in the system definition file using a text editor or similar editing tool.

[Model]

%STRING_MODEL% = CDC, USB\VID_0000&PID_0000 ← Edit the 4-digit numeric values as 4-digit hexadecimal numbers.

Edit the line as follows for a VID of 0x1234 and a PID of 0x5678.

[Model]

%STRING_MODEL% = CDC, USB\VID_1234&PID_5678 ← Edit the 4-digit numeric values as 4-digit hexadecimal numbers.

The PID and VID values of the peripheral device are defined by USB_VENDORID and USB_PRODUCTID, respectively, in the file WorkSpace\SmplMain\APL\r_usb_echo_apl_descriptor.c.

4.2 Application Program (APL) Overview

The application program works in the following 2 mode. The files of the application program is differ in each mode differ. Refer to chapter 4.2.3 about selecting the mode.

4.2.1 Serial-USB converter mode

The board works as a USB-to-serial (UART) converter. Incoming data from the USB host is sent to the UART port of the board. Conversely, incoming data to the board UART is sent to the USB COM-port, that is, the USB host.

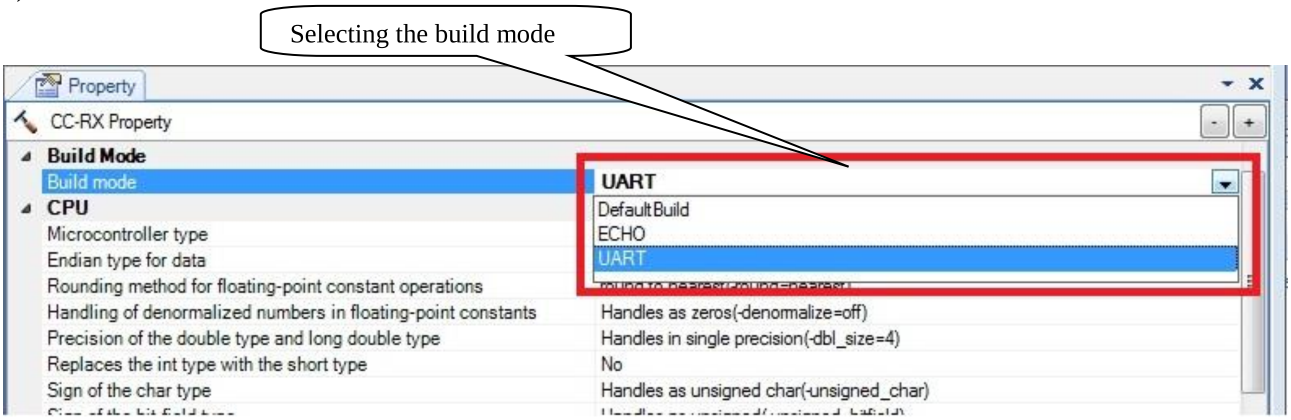
4.2.2 Echo Mode

Echo mode transmits by return the data received from the USB host to a USB host. A UART port is not used in echo mode.

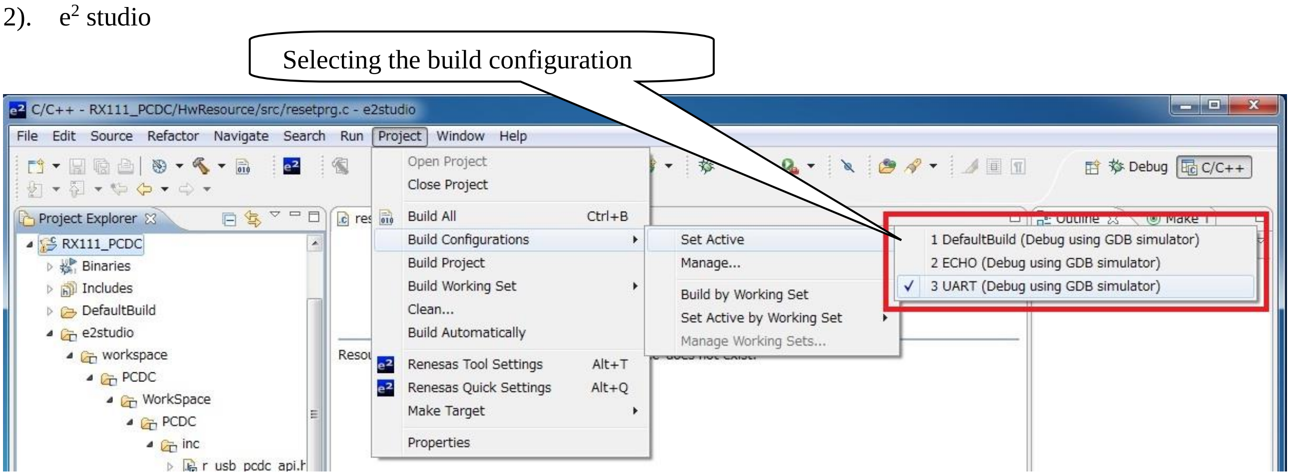
4.2.3 Selecting Serial-USB converter mode / Echo mode

Select "Serial-USB converter mode / Echo mode" on the integrated development environment (IDE) after starting the IDE is supported by each MCU.

1). CS+



2). e^2 studio



4.3 APL Messages

The application module (APL) receives messages from the mailbox USB_PCDCSMP_MBX). APL then processes the messages as described in "Table 4.1 APL Receive Message List".

Table 4.1 APL Receive Message List

Classification	Source of Message
USB_PCDC_RX_COMP	The callback function called at completion of USB reception (OUT): "usb_psmpl_RxCB"
USB_PCDC_TX_COMP	The callback function called at completion of a USB transmission (IN): "usb_psmpl_TxCB"
USB_PCDC_STATUS_TX_COMP	A serial state transmission completion: "usb_psmpl_state_notification"
USB_PCDC_PERIODIC	The cyclical start signal to process the sample application task: "usb_psmpl_periodic_request"

4.4 APL Functions

Table 4.2 lists and describes the APL level functions.

Table 4.2 Lists of APL Functions

Function Name	Description
usb_cstd_task_start	Task start processing
usb_pcdc_task_start	Various task start process for peripheral USB
usb_psmpl_driver_registration	PCDC driver registration
usb_psmpl_open	PCDC open function
usb_psmpl_close	PCDC close function
usb_apl_task_switch	The task-switching loop
usb_psmpl_MainTask	Sample application main task
usb_psmpl_RxCB	The completion callback function of USB reception
usb_psmpl_TxCB	The completion callback function of USB transmitting
usb_psmpl_GetRcvDataCnt	Receive data count acquisition processing
usb_psmpl_change_device_state	Device state callback check
usb_psmpl_ReceiveDataStart	Start the date receive request for Host
usb_psmpl_LineCodingInitial	Line Coding initial processing
usb_psmpl_DummyFunc	Dummy function for the callback
usb_psmpl_state_notification	Callback function for notifying the serial state
usb_psmpl_class_request_callback	Callback function for receiving the class request
usb_psmpl_periodic_request	Application program cyclic start request
usb_psmpl_uart_callback	Callback function for UART driver
usb_psmpl_serial_state_process	Serial State processing
usb_psmpl_is_connected	Return the USB connection state

4.5 APL Dataflow

An application level dataflow overview is shown in Figure 4-2.

4.5.1 Serial-USB converter mode

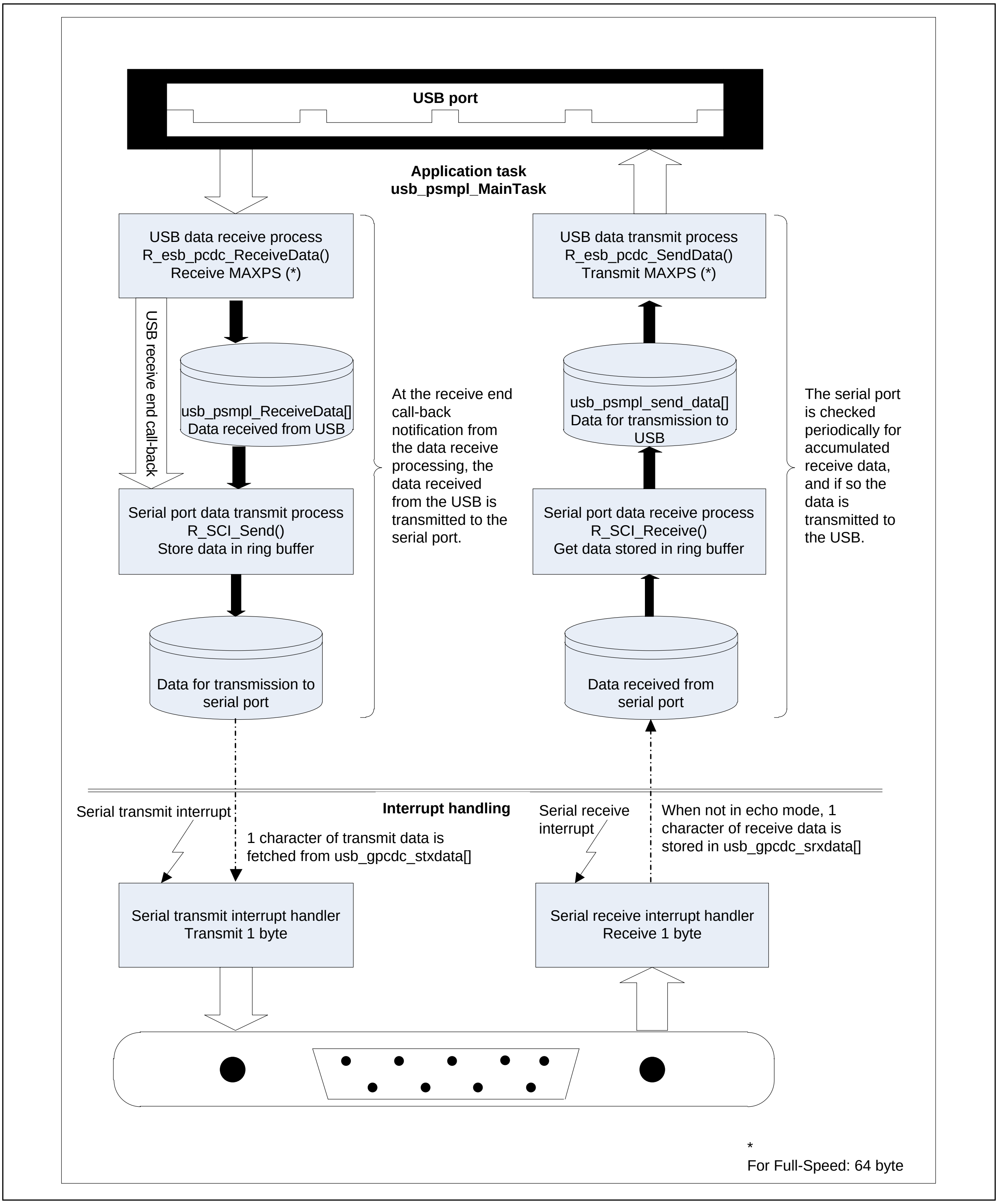


Figure 4-2 APL Data Flow (Serial-USB converter mode)

4.5.2 Echo Mode

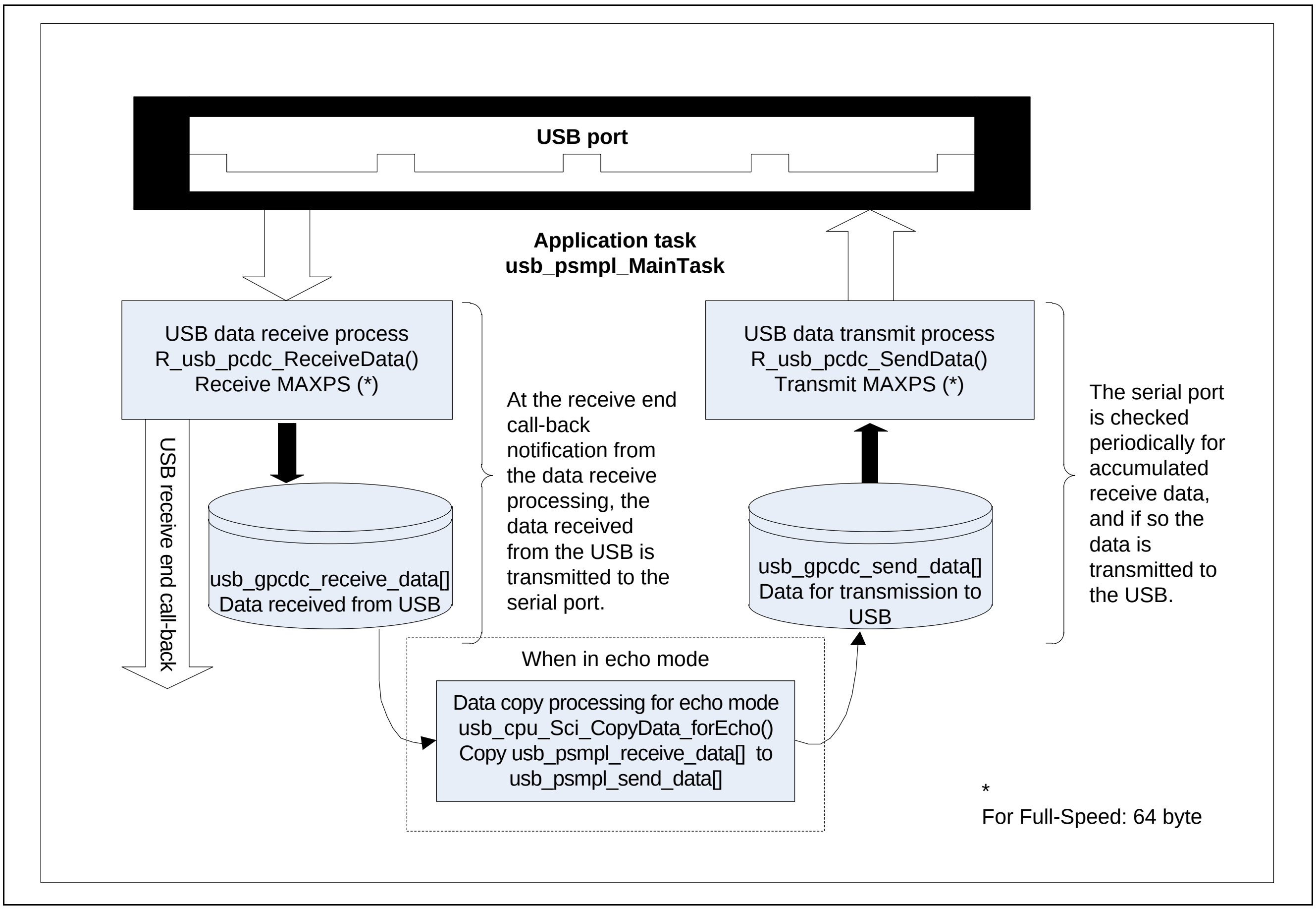


Figure 4-3 APL Data Flow (Echo mode)

4.6 Sequence Charts

Below are time sequence charts showing the interaction between the modules APL (application), PCDC (device class driver), PCD (USB device HW control) and CPD (serial port control driver).

4.6.1 Normal Mode (Serial-USB converter mode)

1. Reception from CDC Host => Serial Port Transmit

The sequence whereby data is received from the CDC host and then transmitted to the serial port is shown Figure 4-4.

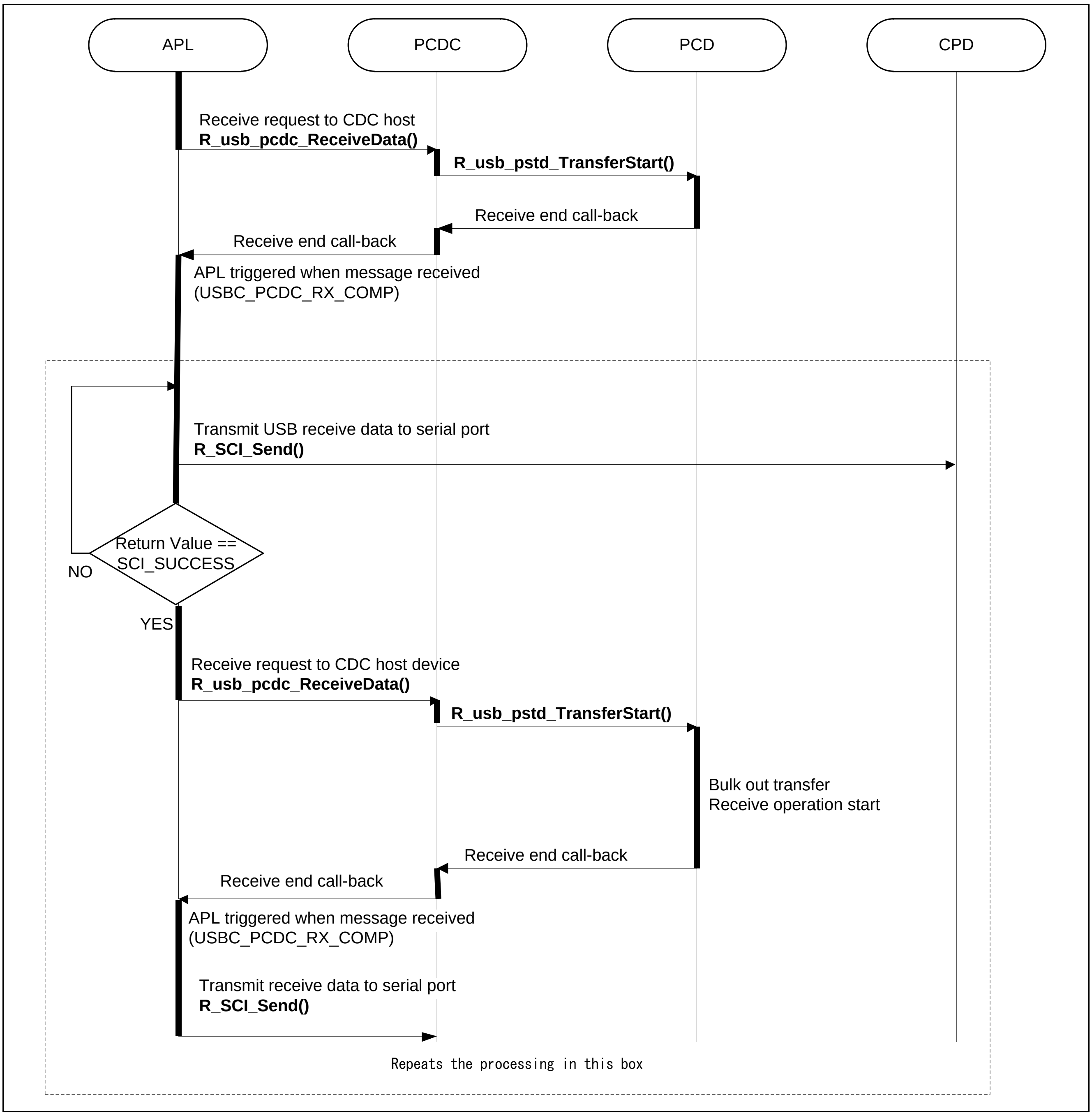


Figure 4-4 Data Reception from CDC Host and Serial Port Transmit Sequence

2. Serial Port Reception => Transmission To CDC Host

The sequence whereby is data received from the serial port and then transmitted to the USB Host is shown Figure 4-8.

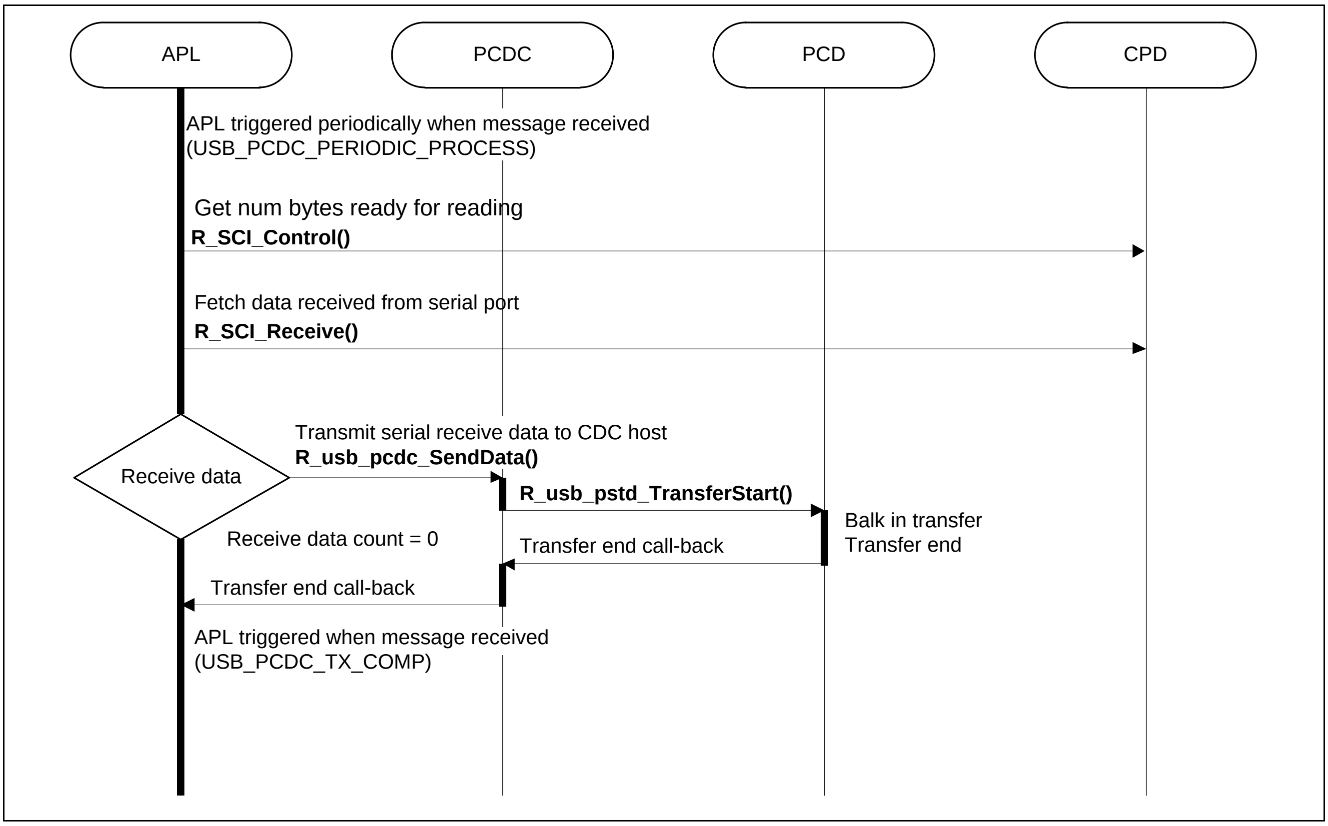


Figure 4-5 Serial Port (UART) Reception and Transmission to CDC Host Sequence

3. Serial Error Handling

The sequence when a serial receive error is detected, and a class notification (SerialState) is transmitted to the USB Host, is shown Figure 4-6.

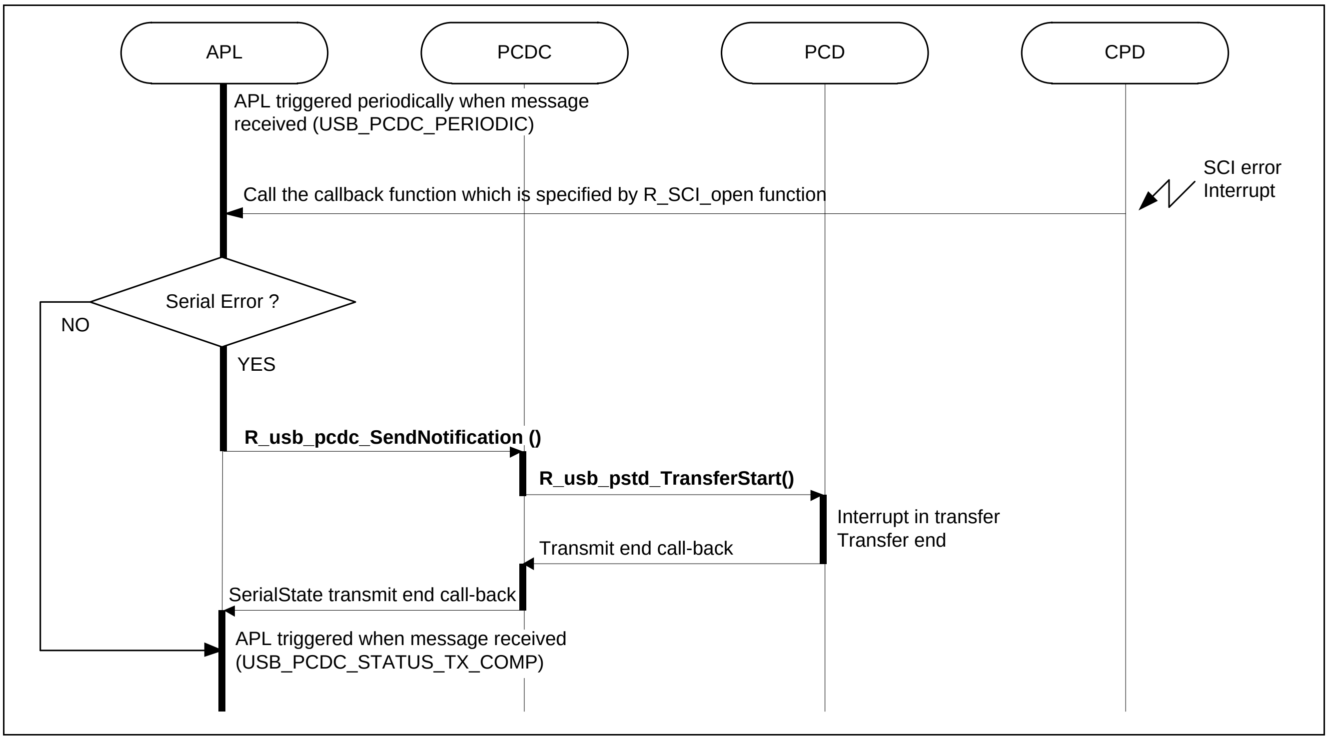


Figure 4-6 Serial Error Handling Sequence

4.6.2 Echo Mode

The sequence of echo mode operation, in which data received from the USB Host is transmitted back to the USB Host, is shown Figure 4-7.

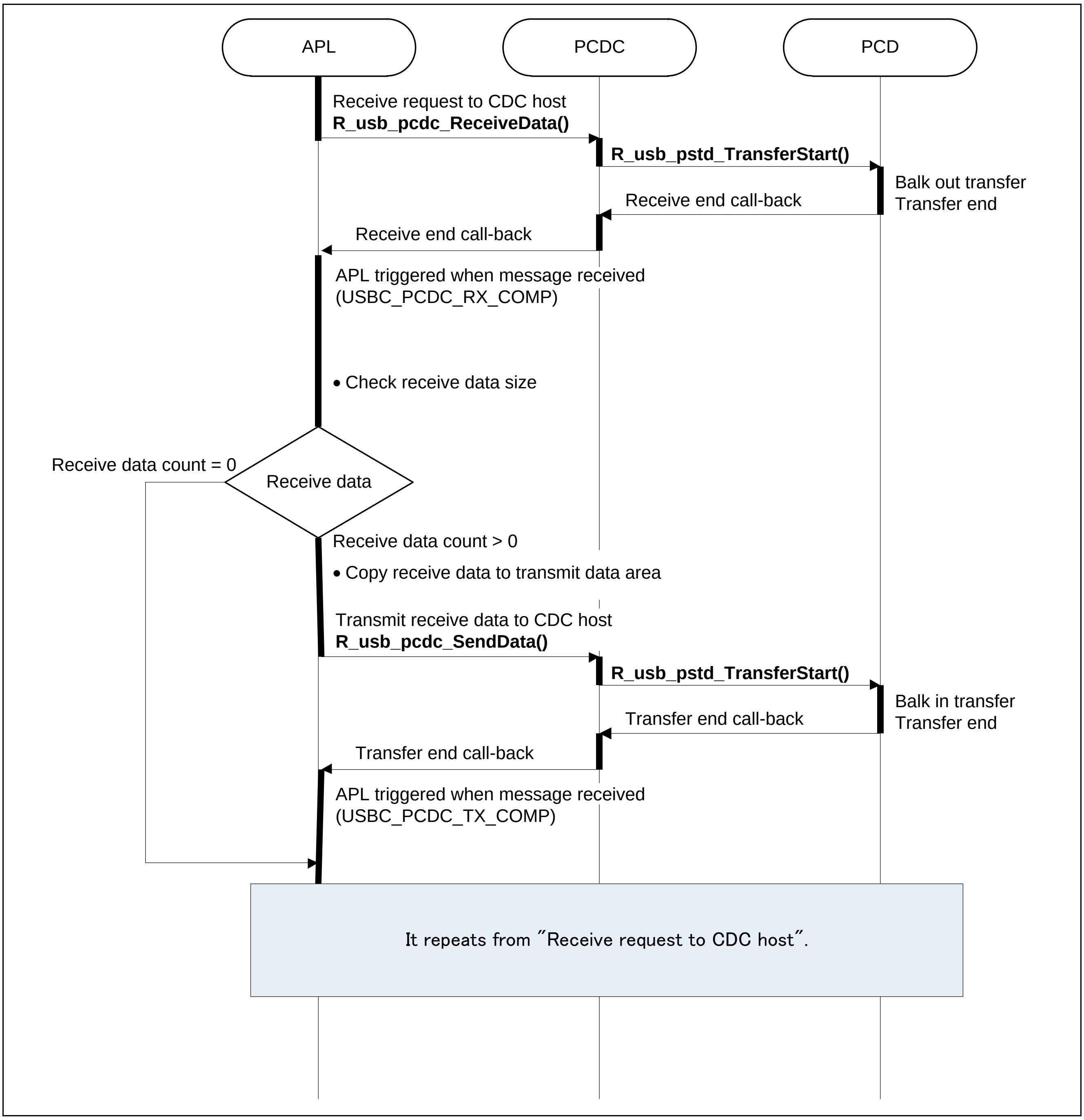


Figure 4-7 Echo Mode Sequence

4.7 APL Processing Details

Here follows a more detailed description of the processing pathways for USB-to-serial-UART mode and Echo mode.

1. USB – Serial converter processing

- USB → Serial (UART)

  ①. USB data reception processing done by: *R_usb_pcdc_ReceiveData()*
  ②. Transmission over serial port: *R_SCI_Send()*
  ①and ② repeated.

- Serial (UART) → USB

  ③. Serial receive processing done by: *R_usb_sci_receive()*
  ④. USB transmission by: *R_usb_sci_send()*
  ③ and ④ repeated.

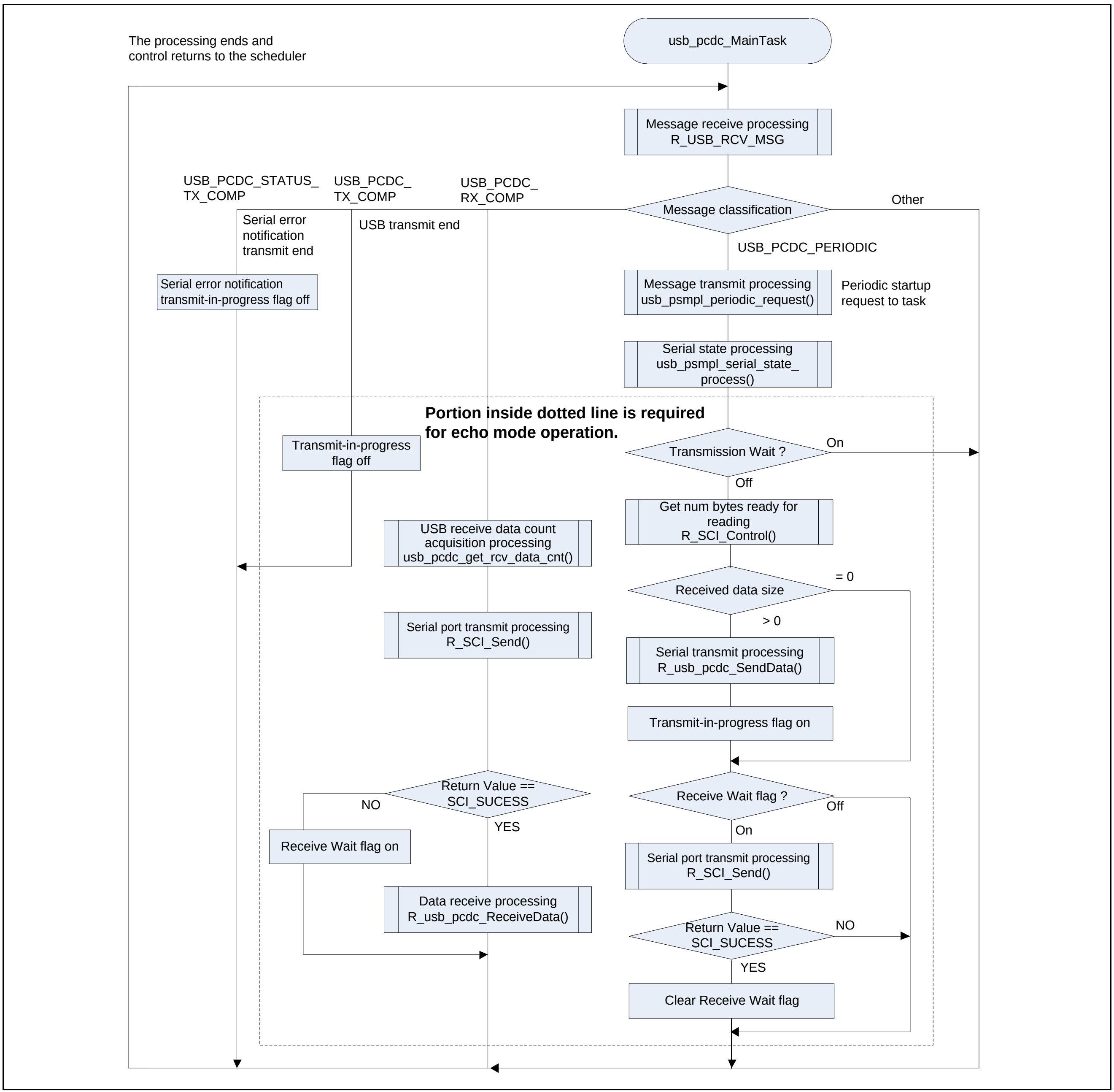


Figure 4-8 APL Processing Flowchart (USB – Serial converter Mode)

2. Echo Mode

① Received USB data processing: *usb_psmpl_ReceiveDataStart()*
② USB transmission: *R_usb_pcdc_SendData()*
①and ② repeated.

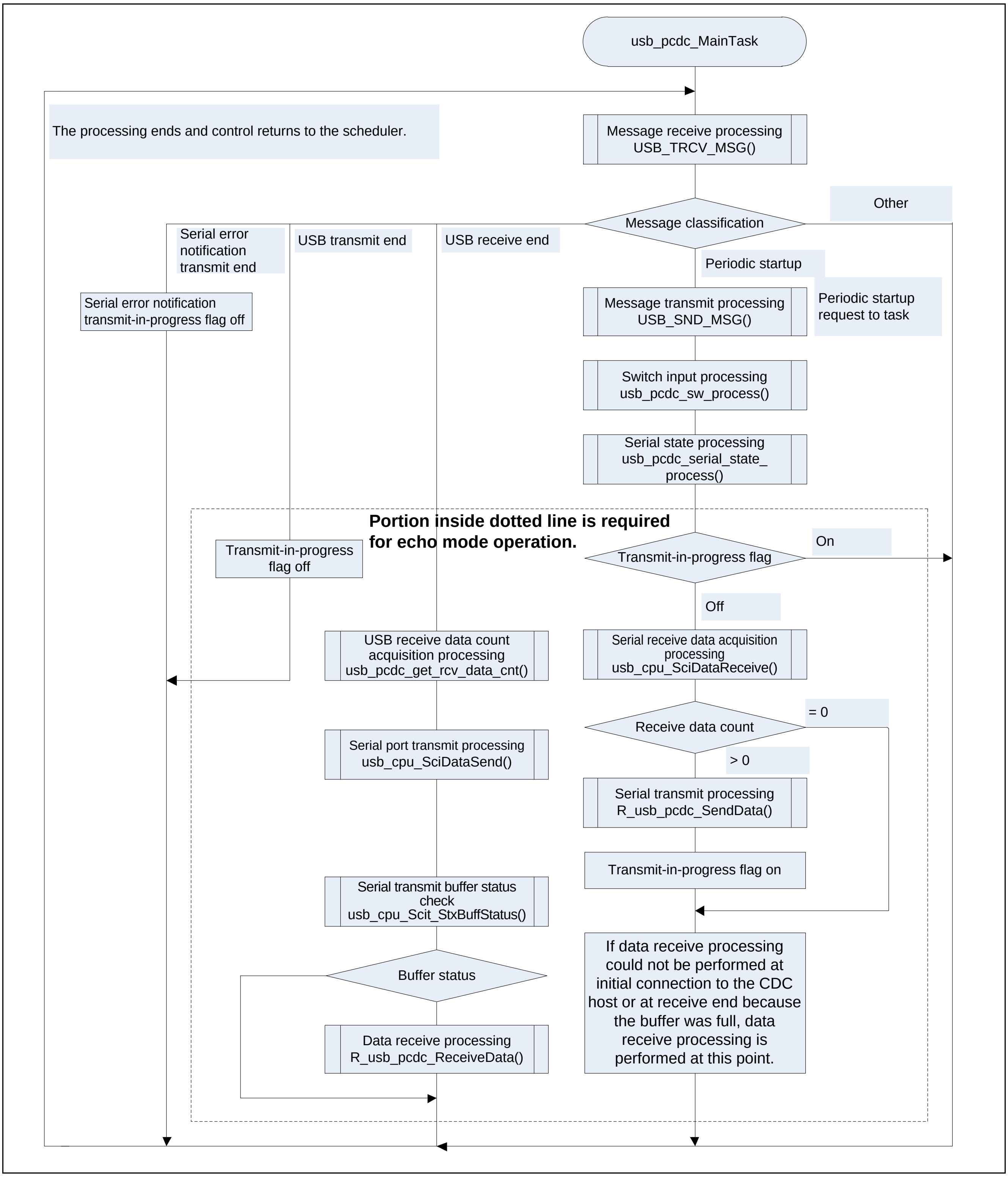


Figure 4-9 APL Processing Flowchart (Echo Mode)

5. Communications Device Class (CDC)

5.1 Basic Functions

This software conforms to the Abstract Control of the CDC PSTN Subclass.

The main functions of this "PCDC" firmware are as follows.

1. Respond to functional inquiries from the USB Host
2. Respond to class requests from the USB Host
3. Data communication with the USB Host
4. Notifying the USB Host of serial communication errors

5.2 Abstract Control Model Overview

The Abstract Control Model subclass of CDC 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. Nowadays, the ACM subclass is used for USB applications that need USB bulk transfer – for larger amounts of non time critical data. The ACM is ideal for example for applications where a file needs to be transferred. This can then be done using a PC UART terminal program that has a built-in file transfer menu option.

The class requests and class notifications supported are listed below.

5.2.1 Class Requests (Host to Peripheral)

Table 5.1 shows CDC class requests, and whether they are supported.

Table 5.1 CDC class requests

Request	Code	Description	Supported
SendEncapsulatedCommand	0x00	Transmits AT commands, etc., defined by the protocol.	No*
GetEncapsulatedResponse	0x01	Requests a response to a command transmitted by SendEncapsulatedCommand.	No*
SetCommFeature	0x02	Enables or disables features such as device-specific 2-byte code and country setting.	No*
GetCommFeature	0x03	Acquires the enabled/disabled state of features such as device-specific 2-byte code and country setting.	No*
ClearCommFeature	0x04	Restores the default enabled/disabled settings of features such as device-specific 2-byte code and country setting.	No*
SetLineCoding	0x20	Makes communication line settings (communication speed, data length, parity bit, and stop bit length).	**Yes**
GetLineCoding	0x21	Acquires the communication line setting state.	**Yes**
SetControlLineState	0x22	Makes communication line control signal (RTS, DTR) settings.	**Yes**
SendBreak	0x23	Transmits a break signal.	No*

*Must be added by the user of PCDC.(Refer to the sample function in)

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.

5.2.2 Data Format of Class Requests

The data formats of the class requests supported by the class driver software are described below.

(1). SetLineCoding

This is the class request that the host transmits for UART line setting.

The SetLineCoding data format is shown below.

Table 5.2 SetLineCoding Format

bmRequestType	bRequest	wValue	wIndex	wLength	Data
0x21	SET_LINE_CODING (0x20)	0x00	0x00	0x07	Line Coding Structure See Table 5.3 Line Coding Format

Table 5.3 Line Coding Format

Offset	Field	Size	Value	Description
0	DwDTERate	4	Number	Data terminal speed (bps)
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
6	BdataBits	1	Number	Data bits (5, 6, 7, 8)

The following shows the setting that this S/W supports.

DwDTERate: 1200bps/2400bps/4800bps/9600bps/14400bps/19200bps/38400bps/57600bps/115200bps
BcharFormat: 1 Stop bit/ 2 Stop bit
BparityType: None/Odd/Even
BdataBits: 7bit/8bit

(2). GetLineCoding

This is the class request the host transmits to request the UART line state.

The GetLineCoding data format is shown below.

Table 5.4 SetLineCoding Format

bmRequestType	bRequest	wValue	WIndex	wLength	Data
0xA1	GET_LINE_CODING (0x21)	0x00	0x00	0x07	Line Coding Structure See table 4.3, Line Coding Structure Format

(3). SetControlLineSTATE

This is a class request that the host sends to set up the signal for flow controls of UART.

This software does not support RTS/DTR control.

The SET_CONTROL_LINE_STATE data format is shown below.

Table 5.5 SET_CONTROL_LINE_STATE Format

bmRequestType	bRequest	wValue	wIndex	wLength	Data
0x21	SET_CONTROL_ LINE_STATE (0x22)	Control Signal Bitmap See Table 4.6, Control Signal Bitmap Format	0x00	0x00	None

Table 5.6 Control Signal Bitmap

Bit Position	Description	
D15 to D2	Reserved (reset to 0)	
D1	DCE transmit function control	0 - RTS Off 1 - RTS On
D0	Notification of DTE ready state	0 - DTR Off 1 - DTR On

5.2.3 Class Notifications (Peripheral to Host)

Whether or not a class notification is supported is shown in Table 5.7.

Table 5.7 CDC Class Notifications

Notification	Code	Description	Supported
NETWORK_CONNECTION	0x00	Notification of network connection state	No
RESPONSE_AVAILABLE	0x01	Response to GET_ENCAPSLATED_RESPONSE	No
SERIAL_STATE	0x20	Notification of serial line state	Yes

(1). Serial State

The host is notified of the serial state when a change in the UART port state is detected.

This software supports the detection of overrun, parity and framing errors. A state notification is performed when a change from normal state to error is detected. However, notification is not continually transmitted when an error is continually detected.

The SerialState data format is shown below.

Table 5.8 SerialState Format

bmRequestType	bRequest	wValue	wIndex	wLength	Data
0xA1	SERIAL_STATE (0x20)	0x00	0x00	0x02	UART State bitmap See Table 5.9 UART state bitmap format

Table 5.9 UART state bitmap format

Bits	Field	Description	Supported
D15～D7		Reserved	-
D6	bOverRun	Overrun error detected	Yes
D5	bParity	Parity error detected	Yes
D4	bFraming	Framing error detected	Yes
D3	bRingSignal	INCOMING signal (ring signal) detected	No
D2	bBreak	Break signal detected	No
D1	bTxCarrier	Data Set Ready: Line connected and ready for communication	No
D0	bRxCarrier	Data Carrier Detect: Carrier detected on line	No

5.3 Endpoint Specification

Endpoints used are shown in Table 5.10.

Table 5.10 Endpoints

bEndpointAddress		bmAttributes	wMaxPacketSize	Description
EP No	Direction	Transfer Method	Max Packet Size	
EP0	In/Out	Control	64	Standard request, class request
EP1	In	Bulk	64 (Full Speed)	Data transfer from device to host
EP2	Out	Bulk	64 (Full Speed)	Data transfer from host to device
EP3	In	Interrupt	16	State notification from device to host

5.4 Usage as PC virtual COM port (reference)

The CDC device can be used as a virtual COM port when operating in Windows OS.

When using a PC installed with Windows OS, when the RSK board is connected, and after enumeration , the CDC class requests GetLineCoding and SetControlLineState from the USB host are processed, and then the CDC device is registered in the Windows Device Manager as a virtual COM port device.

Registering the CDC device as a virtual COM port in the Windows device manager enables data communication with the CDC device via a terminal app, such as Hyper Terminal, which comes standard with Windows XP.

When selecting the COM port number and setting the serial port options in the PC terminal applicaton, the UART settings are propagated to the firmware via the class request SetLineCoding.

Data input (or file transmission) from the terminal app window is transmitted to the RSK board using EP2; data from the RSK board side is transmitted to the PC using EP1.

The maximum packet size for Full-Speed is 64 bytes. Note that when the last packet of data received is the maximum packet size, and the terminal determines that there is continuous data, the received data may not be displayed in the terminal. If the received data is smaller than the maximum packet size, the data received up to that point is displayed in the terminal.

6. USB Peripheral Communication Device Class Driver (PCDC)

6.1 Basic Functions

The basic functions of PCDC are as follows.

1. Provides data transmission and reception services to the USB host.
2. Responds to CDC class requests.
3. Provides a CDC notification transmission service.

6.2 PCDC API Functions

Table 6.1 below show all the PCDC API functions.

Table 6.1 API Functions

Function Name	Description
R_usb_pcdc_LineCodingInitial	Line Coding initialization
R_usb_pcdc_SendData	Sends a data transmit request message to the PCDC task.
R_usb_pcdc_ReceiveData	Sends a data receive request message to the PCDC task.
R_usb_pcdc_ClassRequest	Control transfer processing for CDC
R_usb_pcdc_task	The PCDC task

R_usb_pcdc_LineCodingInitial

Transfer USB data

Format

usb_er_t R_usb_pcdc_LineCodingInitial (usb_pcdc_LineCoding_t *linecoding)

Argument

*linecoding	LineCoding setting data address

Return Value

USB_E_OK	Success

Description

This function initializes a LineCoding.

Note

—

R_usb_pcdc_SendData

Transfer USB data

Format

```
void        R_usb_pcdc_SendData (  uint8_t*       table,
                                   usb_leng_t     size,
                                   usb_cbinfo_t   complete)
```

Argument

*Table	Pointer to buffer containing data to transmit
size	Transfer size
complete	Process completion callback function

Return Value

—	—

Description

This function transfers the specified USB data of the specified size from the address specified in the Transmit Data Address Table(1st argument).

When the transmission is done, the call-back function 'complete' is called.

Note

1. The USB transmit process results are found via the *usb_utr_t* pointer in the call-back function's arguments.
2. See "USB Communication Structure" (usb_utr_t) in the USB Basic Mini Firmware application note.

Example

```
void usb_apl_task( void )
{
  uint8_t     send_data[] = {0x01,0x02,0x03,0x04,0x05};  /* USB send data */
  uint16_t   size = 5;                                   /* Data size */

  R_usb_pcdc_SendData((uint8_t *)send_data, size, (usb_cbinfo_t)&usb_complete)
}

/* Callback function */
void  usb_complete( usb_utr_t *mess );
{
  /* Processing at the time of the completion of USB transmitting */
}
```

R_usb_pcdc_ReceiveData

Issue a data receive request to the USB driver (PCD)

Format

void R_usb_pcdc_ReceiveData (uint8_t *Table, usb_leng_t size, usb_cbinfo_t complete)

Argument

*Table	Pointer to transmmit data buffer address
size	Transfer size
complete	Process completion callback function

Return Value

— —

Description

This function requests a USB data transfer reception of the USB driver. One transfer is handled, after that a new request must be issued.

When the data of the size specified by 3rd argument is received or the data of less than max packet size is received from USB, callback function is called.

The received data is stored in the area that is specified by the second argument .

Note

1. The USB transfer results are found via the usb_utr_t pointer in the call-back function's arguments.
2. See "USB Communication Structure" (usb_utr_t) in the USB Basic Mini Firmwar application note.

Example

```
void usb_smp_task( void )
{
  uint8_t    receive_data[64];                    /* Data buff */
  uint16_t   size = 64;                           /* Data size */

  R_usb_pcdc_ReceiveData((uint8_t *)receive_data,size,
(usb_cbinfo_t)&usb_complete)
}

/* Callback function */
void  usb_complete( usb_utr_t *mess );
{
  /* Processing at the time of the completion of USB reception */
}
```

R_usb_pcdc_ClassRequest

Control transfer processing for CDC

Format

void	R_usb_pcdc_ClassRequest(usb_request_t *request, uint16_t data)

Argument

*request	Class request message pointer.	
data	Control transfer stage information	
	USB_CS_IDST	Idle or setup stage
	USB_CS_RDDS	Control read data stage
	USB_CS_WRDS	Control write data stage
	USB_CS_WRND	Control write no data status stage
	USB_CS_RDSS	Control read status stage
	USB_CS_WRSS	Control write status stage
	USB_CS_SQER	Sequence error

Return Value

—	—

Description

When the request type is a CDC class request, this function calls the processing that corresponds to the control transmit stage.

This callback is registered earlier during PCDC class “driver registration”and is triggered at the end of a CDC control transfer.

Note

—	—

Example

```
void usb_apl_task( void )
{
  usb_pcdreg_t  driver;

        :
  /* Control Transfer */
  driver.ctrltrans = &R_usb_pcdc_ClassRequest;
  R_usb_pcdc_Registration(&driver);
        :
}
```

R_usb_pcdc_Task

The PCDC task

Format

void R_usb_pcdc_Task(void)

Argument

— —

Return Value

— —

Description

This is the PCDC task, which processes requests by the application and then notifies it of the results.

Note

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

Refer to the USB-BASIC-F/WApplication Notes for more information concerning the scheduling process.

Example

```
void usb_apl_task_switch(void)
{
  while( 1 )
  {
   if( USB_FLGSET == R_usb_cstd_Schedule() )
   {
      /* PCD Task */
      R_usb_pstd_PcdTask();

      /* Peripheral Communications Devices Class Task */
      R_usb_pcdc_Task();

      /* Peripheral Communications Class Application Task */
      usb_pcdc_main_task();
   }
  }
}
```

6.3 User Definition Tables

It is necessary to create a descriptor table and Pipe Information Table (or “Endpoint Table”) for use by PCDC. Refer to the sample in file *r_usb_PCDCdescriptor.c* when creating these tables.

For details, see *Renesas USB Device USB Basic Mini Firmware User’s Manual*.

7. Communication Port Driver (CPD)

The communications port driver (CPD) is a serial communications driver for UART in the RSK.

When using this application on hardware other than the RSK, please prepare a matching serial communications driver.

7.1 RL78 Series

The serial communication driver which is used in RL78 series conform to the driver of the above application note (Document No. R01AN1667EU) which is used in RX series.

Refer to this application note about the API and the argument for the serial communication driver.

7.1.1 Overview of Functions

1. Serial communication specification

(1) Line speed (1200 bps to 115200 bps)
(2) Parity bit (none, even, odd)
(3) Stop bits (1 or 2 bits)
(4) Data length (7 or 8 bits)

2. Transmit

Transmitting data to the serial port involves saving the transmit data to the ring buffer of CPD and then transmitting the data one byte at a time, using the transmit data empty interrupt.

3. Receive

Receiving data from the serial port involves saving data received using the receive data full interrupt to the ring buffer of CPD. The receive data is processed by using the receive data read API provided by CPD.

Website and Support

Renesas Electronics Website

http://www.renesas.com/

Inquiries

http://www.renesas.com/contact/

Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Mar.18.11	—	First edition issued
2.00	Feb.06.13	—	Revision of the document by firmware upgrade
2.01	Mar.26.13	—	Added about IAR edition.
2.10	Aug.01.13	—	RL78/L1C, RX111 is supported. Error is fixed.
2.11	Oct.31.13	—	1.4 Folder path fixed. 3.2.1 Folder Structure was corrected. Error is fixed.
2.12	Mar.31.14	—	R8C is supported. Error is fixed.
2.13	Mar.16.15	—	RX111 is deleted from Target Device

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 document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

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.
5. Differences between Products

   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.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL II Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 5.0