Renesas Synergy™ Platform

USBX™ Device Class CDC-ACM Module Guide

Introduction

This module guide will enable you to effectively use a module in your own design. Upon completion of this guide, you will be able to add this module to your own design, configure it correctly for the target application and write code, using the included application project code as a reference and efficient starting point. References to more detailed API descriptions and suggestions of other application projects that illustrate more advanced uses of the module are available in the Renesas Synergy™ Knowledge Base (as described in the Reference section at the end of this document), and are valuable resources for creating more complex designs.

The USBX™ Device Class CDC-ACM module is a high-level API for USBX Device Class CDC-ACM module applications and is implemented on the USBX Port CDC for USB Full Speed (USBFS) or USB High Speed (USBHS). The USBX Device CDC-ACM module uses the USB and data-transfer peripherals on the Synergy MCU. A user defined callback can be created to determine when the stack activates or deactivates the USB CDC-ACM class.

This document provides an overview of the key elements related to the USBX Device Class CDC-ACM module implementation on the Renesas Synergy™ Platform. This document's primary focus is on the addition and configuration of the USBX Device Class CDC-ACM module to a Renesas Synergy Platform project. For more details on the operation of this module, consult the *USBX User's Guide* for the Renesas Synergy Platform document. This document is available as part of an X-Ware™ and USBX Component Documents for Renesas Synergy™ zip file from the Renesas Synergy SSP page (www.renesas.com/synergy/ssp).

Contents

1. USBX Device Class CDC-ACM Module Features

The USB Device Class CDC-ACM module allows a USB host-system to communicate with the device as a serial device. This class is based on the USB standard and is a subset of the CDC standard. The USBX Device Class CDC-ACM module includes the following key features:

- Support for USB Full Speed (USBFS) or USB High Speed (USBHS)
- Receive and transmit data-transfer drivers for improved performance
- High-level APIs for read and write

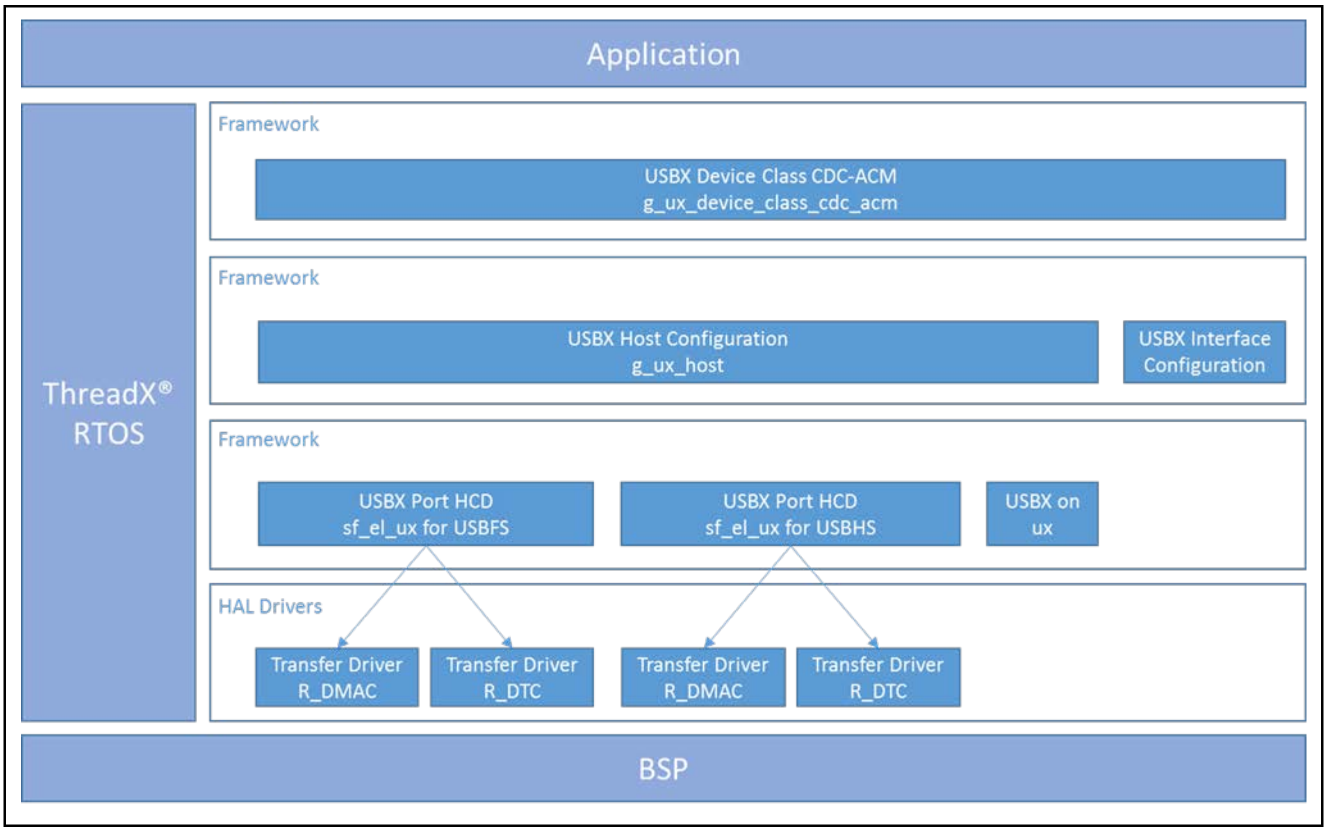


Figure 1. USBX Device Class CDC-ACM Module Organization, Options and Stack Implementations

2. USBX Device Class CDC-ACM Module Overview

The USBX Device Class CDC-ACM Module defines APIs for reading and writing over the USB peripheral. A complete list of the available APIs, an example API call, and a short description of each can be found in the following table. A table of status return values follows the API summary table.

Table 1. USBX Device Class CDC-ACM Module API Summary

Function Name	Example API Call and Description
`ux_device_class_cdc_acm_read`	`status = ux_device_class_cdc_acm_read(cdc, buffer, UX_DEMO_BUFFER_SIZE, &actual_length);` This function is called when an application needs to read from the OUT data pipe (OUT from the host, IN from the device).
`ux_device_class_cdc_acm_write`	`status = ux_device_class_cdc_acm_write(cdc, buffer, UX_DEMO_BUFFER_SIZE, &actual_length);` This function is called when an application needs to write to the IN data pipe (IN from the host, OUT from the device).

Note: For more complete descriptions of operation and definitions for the function data structures, typedefs, defines, API data, API structures and function variables review the associated *Express Logic User's Manual* accessible as described in the References section later in this document.

Table 2. Status Return Values

Name	Description
UX_SUCCESS	This operation was successful.
UX_CONFIGURATION_HANDLE_UNKNOWN	Device is no longer in the configured state.
UX_TRANSFER_NO_ANSWER	No answer from device. The device was probably disconnected while the transfer was pending.

Note: Lower-level drivers may return common error codes. Refer to the *SSP User's Manual* API References for the associated module for a definition of all relevant status return values.

3. USBX Device Class CDC-ACM Module Operational Overview

The initialization of the CDC-ACM class expects some specific parameters as illustrated in the application project associated with this module guide.

The CDC-ACM is based on a USB-IF standard and is automatically recognized by Mac OS® and Linux OS®. On Windows® platforms, this class requires a **.inf** file. Express Logic® supplies a template for the CDC-ACM class, and it can be found in the `usbx_windows_host_files` directory. For more recent versions of Windows, the file `CDC_ACM_Template_Win7_64bit.inf` should be used. This file needs to be modified to reflect the PID/VID used by the device. The PID/VID will be specific to the final customer when the company and the product are registered with the USB-IF. In the `.inf` file, the fields to modify are described in the application project associated with this module guide.

In the device framework of the USBX CDC-ACM device, the PID/VID are stored in the device descriptor (see the device descriptor declared in the application project referenced in the preceding paragraph).

When a USB host-system discovers the USBX CDC-ACM device, it will mount a serial class and the device can be used with any serial terminal program. (See the host operating system for reference.)

3.1 USBX Device Class CDC-ACM Module Important Operational Notes and Limitations

The application needs to save the instance with the callback function registered in USBX CDC-ACM `instance_activate` function callback. Read and write are executed using the saved instance.

3.2 USBX Device Class CDC-ACM Module Operational Notes

Refer to the most recent *SSP Release Notes* for any additional operational limitations for this module.

4. Including the USBX Device Class CDC-ACM Module in an Application

This section describes how to include the USBX Device Class CDC-ACM module in an application using the SSP configurator.

Note: This section assumes you are familiar with creating a project, adding threads, adding a stack to a thread and configuring a block within the stack. If you are unfamiliar with any of these items, refer to the first few chapters of the *SSP User's Manual* to learn how to manage each of these important steps in creating SSP-based applications.

To add the USBX Device Class CDC-ACM module to an application, simply add it to a thread using the stacks selection sequence given in the following table. (The default name for the USBX Device CDC-ACM module is `g_ux_device_class_cdc_acm0`. This name can be changed in the associated Properties window.)

Table 3. USBX Device Class HID Selection Sequence

Resource	ISDE Tab	Stacks Selection Sequence
g_ux_device_class_cdc_acm0 USBX Device Class CDC-ACM	Threads	New Stack> X-Ware> USBX> Device> Classes > CDC-ACM > USBX Device Class CDC-ACM

When the USBX Device Class CDC-ACM module added to the thread stack as shown in the following figure, the configurator automatically adds the needed lower-level drivers. Any drivers that need additional configuration information will be box text highlighted in Red. Modules with a Gray band are individual modules that stand alone. Modules with a Blue band are shared or common and need only be added once, since they can be used by multiple stacks. Modules with a Pink band can require the selection of lower-level drivers. Sometimes these are optional or recommended and this is indicated in the block with the inclusion of this text. If the addition of lower-level drivers is required, the module description will include Add in the text. Clicking on any Pink banded modules will bring up the New icon and then will show the possible choices.

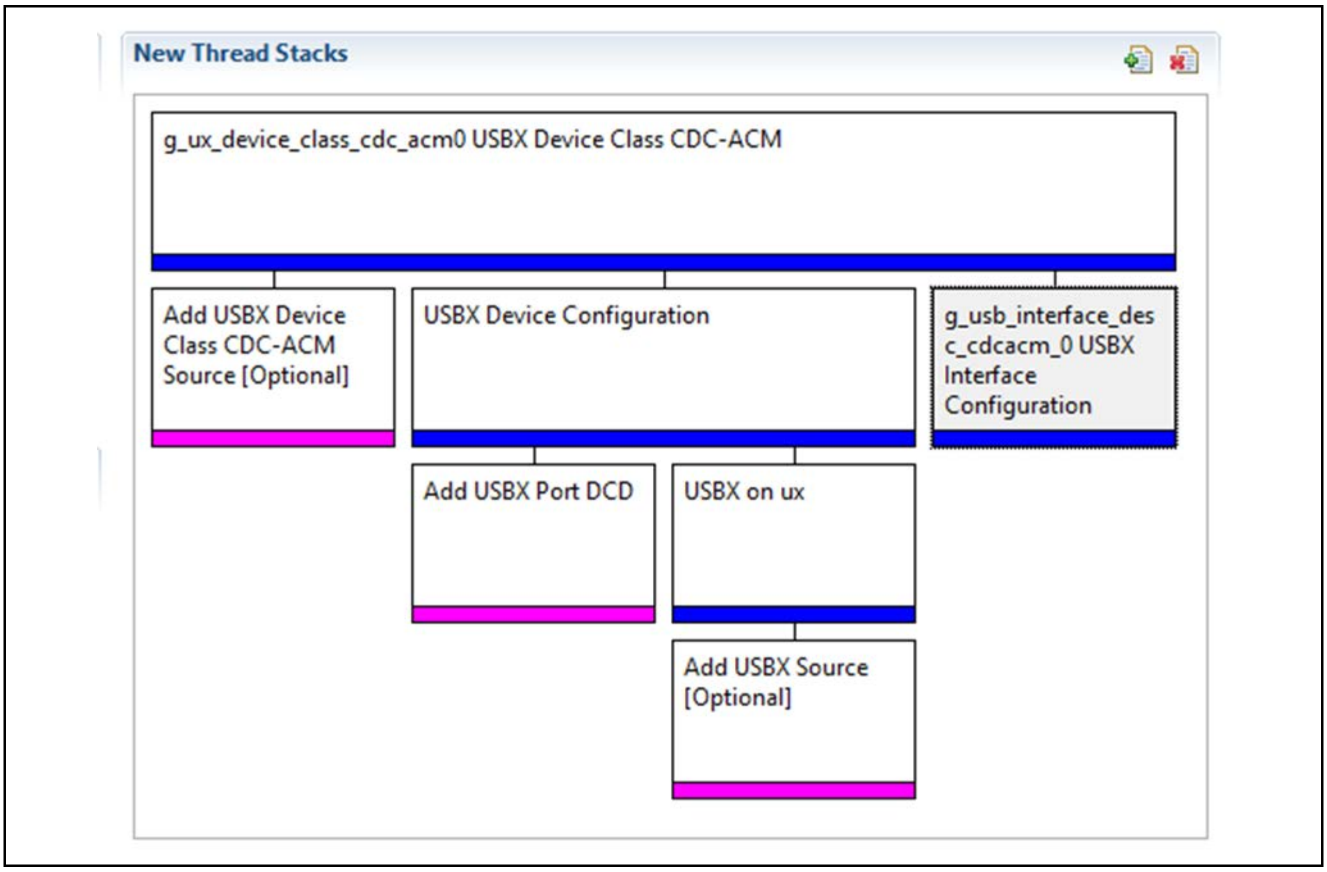

New Thread Stacks
g_ux_device_class_cdc_acm0 USBX Device Class CDC-ACM
Add USBX Device Class CDC-ACM Source [Optional]
USBX Device Configuration
g_usb_interface_desc_cdcacm_0 USBX Interface Configuration
Add USBX Port DCD
USBX on ux
Add USBX Source [Optional]

Figure 2. USBX Device Class CDC-ACM Module Stack

5. Configuring the USBX Device Class CDC-ACM Module

The USBX Device Class CDC-ACM module must be configured by the user for the desired operation. The SSP configuration window will automatically identify (by highlighting the block in red) any required configuration selections, such as interrupts or operating modes, which must be configured for lower-level modules for successful operation. Only those properties that can be changed without causing conflicts are available for modification. Other properties are locked and not available for changes and are identified with a lock icon for the locked property in the Properties window in the ISDE (Integrated Solution Development Environment). This approach simplifies the configuration process and makes it much less error-prone than previous manual approaches to configuration. The available configuration settings and defaults for all the user-accessible properties are given in the Properties tab within the SSP Configurator, and are shown in the following tables for easy reference.

One of the properties most often identified as requiring a change is the interrupt priority. This configuration setting is available in the **Properties** window of the associated module. Simply select the indicated module and then view the **Properties** window. The interrupt settings are often toward the bottom of the properties list, so scroll down until they become available. Note that the interrupt priorities listed in the *Properties* window in the ISDE will include an indication as to the validity of the setting based on the MCU targeted (CM4 or CM0+). This level of detail is not included in the following configuration properties tables, but is easily visible within the ISDE when configuring interrupt-priority levels.

Note: You may want to open your ISDE, create the USBX Device Class CDC-ACM module and explore the property settings in parallel with looking over the following configuration table settings. This will help orient you and can be a useful hands-on approach to learning the ins and outs of developing with SSP.

Table 4. Configuration Settings for the USBX Device Class CDC-ACM Module

ISDE Property	Value	Description
Name	`g_ux_device_class_cdc_acm0`	Module Name
USBX CDC-ACM `instance_activate` Function Callback	`ux_cdc_device0_instance_activate`	Callback function for instance activation
USBX CDC-ACM `instance_deactivate` Function Callback	`ux_cdc_device0_instance_deactivate`	Callback function for instance deactivation.

Note: The example values and defaults are for a project using the Synergy S7G2 MCU Group. Other MCUs may have different default values and available configuration settings.

In some cases, settings other than the defaults for lower-level modules can be desirable. For example, it might be useful to select different channels for the data-transfer driver or adjust the size of the USBX pool memory. The configurable properties for the lower-level stack modules are given in the following sections for completeness and as a reference.

Note: Most of the property settings for lower-level modules are intuitive and usually can be determined by inspection of the associated Properties window from the SSP configurator.

5.1 Configuration Settings for the USBX Device Class CDC-ACM Module Low-Level Modules

Only a small number of settings must be modified from the default for lower-level modules as indicated via the red text in the thread stack block. Notice that some of the configuration properties must be set to a certain value for proper framework operation and will be locked to prevent user modification. The following tables identify all the settings within the properties section for the module.

Table 5. Configuration Settings for the USBX Device Configuration

ISDE Property	Value	Description
Vendor ID	0x045B	Vendor ID selection
Product ID	0x0000	Product ID selection
Device Release Number	0x0000	Device Release Number selection
Index of Manufacturing String Descriptor	0x00	Index of Manufacturing String Descriptor selection
Index of Product String Descriptor	0x00	Index of Product String Descriptor selection
Index of Serial Number String Descriptor	0x00	Index of Serial Number String Descriptor selection
Class Code	Communications(CDC), HID, Mass Storage, Miscellaneous, Vendor specific Default: Communications(CDC)	Class Code selection
Index of String Descriptor describing this configuration	0x00	Index of String Descriptor describing this configuration selection
Size of USB Descriptor in bytes for this configuration (Modify this value only for Vendor-specific Class, otherwise set zero)	0x00	Size of USB Descriptor in bytes for this configuration selection
Number of Interfaces (Modify this value only for Vendor-specific Class, otherwise set zero)	0x00	Number of Interfaces selection
Self-Powered	Enable, Disable Default: Enable	Self-Powered selection
Remote Wakeup	Enable, Disable Default: Disable	Remote Wakeup selection
Maximum Power Consumption (in 2 mA units)	50	Maximum Power Consumption selection
Supported Language Code	0x0409	Supported Language Code selection
Name of USBX String Framework	NULL	Name of USBX String Framework selection
Total index number of USB String Descriptors in USB String Framework	0	Total index number of USB String Descriptors in USB String Framework selection
Name of USBX Language Framework	NULL	Name of USBX Language Framework selection
Number of Languages to support (US English is applied if zero is set)	0	Number of Languages to support selection

Note: The example values and defaults are for a project using the Synergy S7G2 MCU Group. Other MCUs may have different default values and available configuration settings.

Table 6. Configuration Settings for the USBX Interface Configuration CDC-ACM

ISDE Property	Value	Description
Name	`g_usb_interface_desc_cdcacm_0`	Module name.
Interface Number of Communications Class interface	0x00	Interface number of communications class interface selection
Interrupt Transfer endpoint to use for Communications Class	Endpoint 1-9 Default: Endpoint 3	Interrupt transfer endpoint to use for communications class selection
Polling period for Interrupt Endpoint (in mS/125 us units for FS/HS)	0x0F	Polling period for interrupt endpoint selection
Interface Number of Data Class interface	0x01	Interface number of data class interface selection
Bulk In Transfer endpoint to use for Data Class	Endpoint 1-9 Default: Endpoint 1	Bulk in transfer endpoint to use for data class selection
Bulk Out Transfer endpoint to use for Data Class	Endpoint 1-9 Default: Endpoint 2	Bulk out transfer endpoint to use for data class selection
Index of String Descriptor Describing Communications Class interface (Interface Descriptor: Interface)	0x00	Index for string descriptor describing communications class interface selection
Index of String Descriptor Describing Data Class interface (Interface Descriptor: Interface)	0x00	Index for string descriptor describing data class interface selection

Note: The example values and defaults are for a project using the Synergy S7G2 MCU Group. Other MCUs may have different default values and available configuration settings.

Table 7. Configuration Settings for the USBX DCD on sf_el_ux for USBFS

ISDE Property	Value	Description
Full Speed Interrupt Priority	Priority 0 (highest), Priority 1:2, Priority 3 (CM4: valid, CM0+: lowest- not valid if using ThreadX), Priority 4:14 (CM4: valid, CM0+: invalid), Priority 15 (CM4 lowest - not valid if using ThreadX, CM0+: invalid) Default: Disabled	Full speed interrupt priority selection.
Name	`g_sf_el_ux_dcd_fs_0`	Module name.
USB Controller Selection	USBFS	USB controller selection.

Note: The example values and defaults are for a project using the Synergy S7G2 MCU Family. Other MCUs may have different default values and available configuration settings.

Table 8. Configuration Settings for the USBX DCD on sf_el_ux for USBHS

ISDE Property	Value	Description
High Speed Interrupt Priority	Priority 0 (highest), Priority 1:2, Priority 3 (CM4: valid, CM0+: lowest- not valid if using ThreadX), Priority 4:14 (CM4: valid, CM0+: invalid), Priority 15 (CM4 lowest - not valid if using ThreadX, CM0+: invalid) Default: Disabled	High speed interrupt priority selection.
Name	`g_sf_el_ux_dcd_hs_0`	Module name.
USB Controller Selection	USBHS	USB controller selection.

Note: The example values and defaults are for a project using the Synergy S7 MCU Group. Other MCUs may have different default values and available configuration settings.

Table 9. Configuration Settings for USBX on ux

ISDE Property	Value	Description
USBX Pool Memory Name	`g_ux_pool_memory`	USBX pool memory name selection.
USBX Pool Memory Size	18432	USBX pool memory size selection.
User Callback for Host Event Notification (Only valid for USB Host)	NULL	User callback for host event notification (only valid for USB host)

Note: The example values and defaults are for a project using the Synergy S7 MCU Group. Other MCUs may have different default values and available configuration settings.

5.2 USBX Device Class CDC-ACM Module Clock Configuration

The USB peripheral module uses UCLK as its clock source. The clock frequency must be set to 48 MHz. This can be done in the **Clocks** tab of the configuration window.

5.3 USBX Device Class CDC-ACM Module Pin Configuration

The USB peripheral module uses pins on the MCU to communicate to external devices. I/O pins must be selected and configured as required by the external device. The following table illustrates the method for selecting the pins within the SSP configuration window (depending on the USB function desired- USBFS or USBHS) and the subsequent tables illustrate example selections for the USB pins in each function.

Note: The operation mode determines what peripheral signals are available and thus what MCU pins are required. The operation mode selection must be consistent with the mode used by the USBX Device Class CDC-ACM module.

Table 10.Pin Selection Sequence for USBFS and USBHS

Resource	ISDE Tab	Pin
USBFS	Pins	Select Peripherals > Connectivity: USBFS> USBFS0
USBHS	Pins	Select Peripherals > Connectivity: USBHS> USBHS0

Note: The selection sequence assumes USBFS0 or USBHS0 are the desired hardware target for the driver.

Table 11.Pin Configuration Settings for the USBX Device Class CDC-ACM Module on USBFS0

Properties	Value	Description
Operation Mode	Disabled, Custom, Device, Host, OTG (Default: Disabled) Device	Select Device as the Operation Mode for USB CDC-ACM
USBDP	USBDP	USPDP
USBDM	USBDM	USBDM
OVRCURB	None	OVRCURB
OVRCURA	None	OVRCURA
VBUSEN	None	VBUSEN
VBUS	None, P407 (Default: P407)	VBUS
EXICEN	None	EXICEN
ID	None	ID
VCCUSB	VCCUSB	VCCUSB
VSSUSB	VSSUSB	VSSUSB

Note: The example values are for a project using the Synergy S7G2 and the SK-S7G2 Kit. Other Synergy Kits and other Synergy MCUs may have different available pin configuration settings.

Table 12.Pin Configuration Settings for the USBX Device Class CDC-ACM Module on USBFS0

Pin Configuration Property	Value	Description
Operation Mode	Disabled, Custom, Device, Host, OTG (Default: Disabled) Device	Select Device as the Operation Mode for USB CDC-ACM
USBHSDP	USBHSDP	USBHSDP
USBHSDM	USBHSDM	USBHSDM
OVRCURB	None	OVRCURB
OVRCURA	None	OVRCURA
VBUSEN	None	VBUSEN
VBUS	None, PB01 (Default: PB01)	VBUS
EXICEN	None	EXICEN
ID	None	ID
USBHSRREF	USBHSRREF	USBHSRREF
AVCCUSBHS	AVCCUSBHS	AVCCUSBHS
AVSSUSBHS	AVSSUSBHS	AVSSUSBHS
PVSSUSBHS	PVSSUSBHS	PVSSUSBHS
VCCUSBHS	VCCUSBHS	VCCUSBHS
VSS1USBHS	VSS1USBHS	VSS1USBHS
VSS2USBHS	VSS2USBHS	VSS2USBHS

Note: The example values are for a project using the Synergy S7G2 Group and the SK-S7G2 Kit. Other Synergy Kits and other Synergy MCUs may have different available pin configuration settings.

6. Using the USBX Device Class CDC-ACM Module in an Application

The configurator generates processing to create and register the USBX Device Class CDC-ACM module; communication must be done after the device is connected to the host.

The typical steps in using the USBX Device Class CDC-ACM module in an application are:

1. Wait for the callback function registered in USBX CDC-ACM `instance_activate` function callback to be called.

2. In the callback function, save the instance.
3. For received data reading, use the `ux_device_class_cdc_acm_read` API.
4. For sending data, use the `ux_device_class_cdc_acm_write` API.

These common steps are illustrated in a typical operational flow diagram:

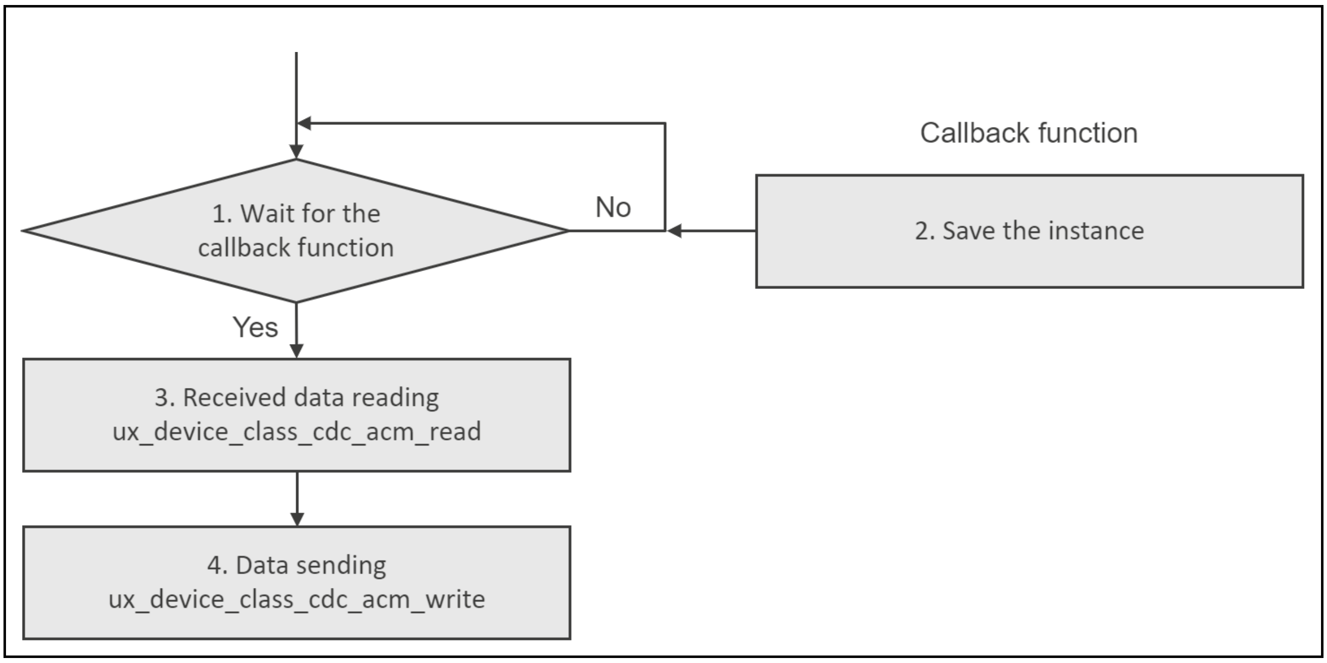

Callback function
2. Save the instance
No
1. Wait for the callback function
Yes
3. Received data reading ux_device_class_cdc_acm_read
4. Data sending ux_device_class_cdc_acm_write

Figure 3. Flow Diagram of a Typical USBX Device Class CDC-ACM Module Application

7. The USBX Device Class CDC-ACM Module Application Project

The application project associated with this module guide demonstrates the aforementioned steps in a full design. The project can be found as described in the References section at the end of this document. You may want to import and open the application project within the ISDE and view the configuration settings for the USBX Device Class CDC-ACM module. You can also read over the code (in `new_thread0_entry.c`) which is used to illustrate the USBX Device Class CDC-ACM module APIs in a complete design.

The application project demonstrates the typical use of the USBX Device Class CDC-ACM module APIs. The application project main thread-entry presents a menu to echo the user strings and to display board IO pins value for on board switches and LEDs. The host side can send and receive by terminal software via the COM port assigned by the USB CDC-ACM. The following table identifies the target versions for the associated software and hardware used by the application project.

Table 13. Software and Hardware Resources Used by the Application Project

Resource	Revision	Description
e^2 studio	5.3.1 or later	Integrated Solution Development Environment
SSP	1.2.0 or later	Synergy Software Platform
IAR EW for Renesas Synergy	7.71.2 or later	IAR Embedded Workbench for Renesas Synergy
SSC	5.3.1 or later	Synergy Standalone Configurator
SK-S7G2	v3.0 to v3.1	Starter Kit

A simple flow diagram of the application project is given in the following figure:

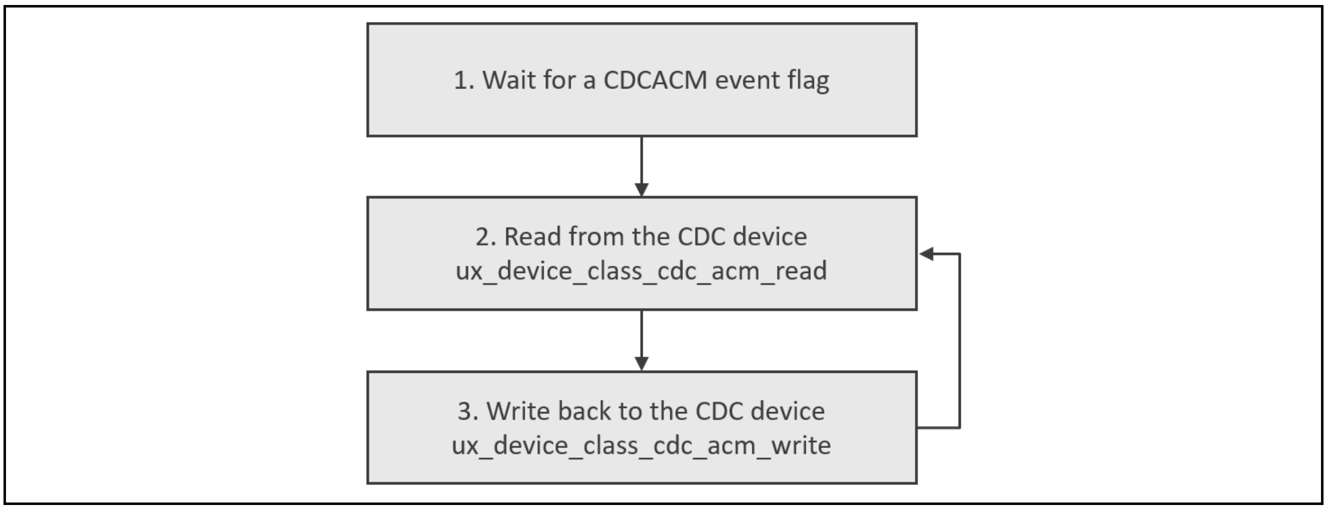

1. Wait for a CDCACM event flag
2. Read from the CDC device
ux_device_class_cdc_acm_read
3. Write back to the CDC device
ux_device_class_cdc_acm_write

Figure 4. USBX Device Class CDC-ACM Module Application Project Flow Diagram

There is only one thread in this example and it is entirely located in the file `new_thread0_entry.c`.

The first section of this file initializes semi-hosting and defines various functions, constants, and variables including the main buffer used to store characters for the echo function and ISRs that get called when a USB event is detected.

When connected to the host, `ux_cdc_device0_instance_activate` is called. This callback function saves a pointer of the **cdc_instance** structure and notifies the user thread. If disconnected from the host, `ux_cdc_device0_instance_deactivate` is called and the instance pointer is cleared.

The user thread receives notification from the callback function and starts communication with the host. First, the user thread waits for data from the host. The received data is sent back to the host which implements the echo function.

A few key properties are configured in this application project to support the required operations and the physical properties of the target board and MCU. The properties with the values set for this specific project are listed in the following table. You can also open the application project and view these settings in the **Properties** window as a hands-on exercise.

Table 14.USBX Device Class CDC-ACM Module Configuration Settings for the Application Project

ISDE Property	Value Set
USBX Device Class CDC-ACM USBX CDC-ACM instance_activate Function Callback	ux_cdc_device0_instance_activate
USBX Device Class CDC-ACM USBX CDC-ACM instance_deactivate Function Callback	ux_cdc_device0_instance_deactivate
USBX Device Configuration Vendor ID	0x045B
USBX Device Configuration Product ID	0x5300
USBX Device Configuration Class Code	Miscellaneous
Add USBX port DCD	Name: g_sf_el_ux_dcd_fs_0
USBX Port DCD on sf_el_ux for USBFS Full Speed Interrupt Priority	Priority 3

8. Customizing the USBX Device Class CDC-ACM Module for a Target Application

Some configuration settings will normally be changed by the developer from those shown in the application project. For example, you can also add a data-transfer module for data transfer of USBX Port DCD. This data-transfer module can be added simply by clicking on the box for TX or RX displayed under the USBX Port DCD box of the configurator.

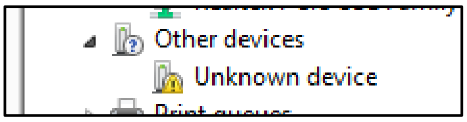
9. Running the USBX Device Class CDC-ACM Module Application Project

To run the USBX Device Class CDC-ACM module application project and to see it executed on a target kit, you can simply import it into your ISDE, compile and run debug. Refer to the *Synergy Project Import Guide* (r11an0023eu0121-synergy-ssp-import-guide.pdf, included in this package) for instructions on importing the project into e^2 studio ISDE or IAR EW for Synergy and building/running the application.

9.1 An Important Note on USB Drive Set-up

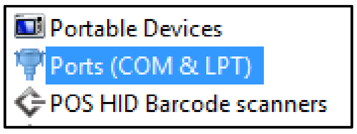
The following USB driver installation process is used with Windows 7 and 8. For Windows 10, the driver is automatically found and installed.

After starting the USB CDC-ACM project in debug mode the driver may show up as an Unknown Device in the Device Manager, under Other devices, as seen below.

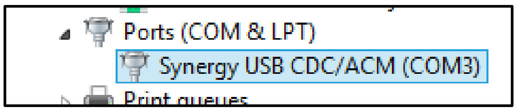


If this is the case, the driver will need to be installed. A signed driver that matches the USB device running in the application project is included in the downloaded project zip file. Save the `.inf` file, `SynergyUSBCDC.inf`, to a convenient location. Then follow these simple steps:

1. Right click on the Unknown device in **Device manager** and select **Update Driver Software...**
2. Select **Browse my computer for driver software**
3. Select **Let me pick from a list of device drivers on my computer**
4. Scroll down and select **Ports (COM & LPT)** and click **Next**



5. Click on **Have Disk...**
6. When the **Install From Disk** dialog box comes up, browse to the folder that holds the `.inf` file (`SynergyUSBCDC.inf`), select the file and click **Open**, then **OK.**
7. The signed driver should show up in the Model list as **Synergy USB CDC/ACM**. Click **Next.**
8. Ignore any warnings and continue to install the driver.
9. The driver should now be installed and will show up in the Ports (COM & LPT) list as seen below.



9.2 Implementing the Application Project in a New Project

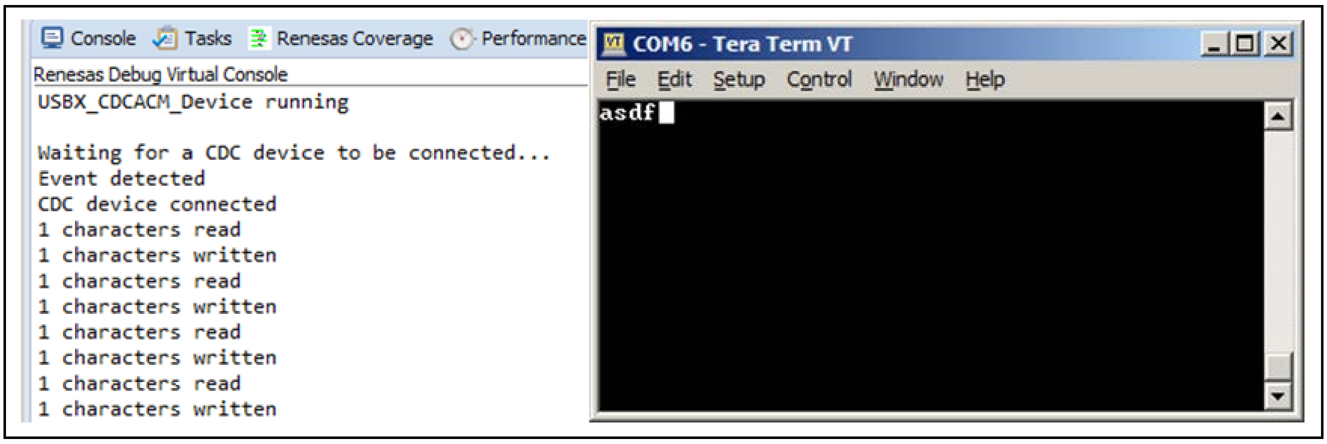
To implement the USBX Device Class CDC-ACM Module application in a new project, follow the steps for defining, configuring, auto-generating files, adding code, compiling, and debugging in the target kit. Following these steps is a hands-on approach that can help make the development process with SSP more practical, while just reading over this guide will tend to be more theoretical.

Note: The following steps are described in sufficient detail for someone experienced with the basic flow through the Synergy development process. If these steps are not familiar, refer to the first few chapters of the *SSP User's Manual* for a description of how to accomplish these steps.

To create and run the USBX Device Class CDC-ACM application project, simply follow these steps:

1. Create a new Renesas Synergy project for the S7G2-SK called `USBX_CDCACM_Device`.
2. Select the **Threads** tab.
3. Add the new `_thread0` to **Threads**.

4. Add the **USBX Device Class CDC-ACM** module to the **New Thread stacks**.
5. Click the **USBX Device Configuration** box on the **New Thread stacks**.
6. Change the class code to **Miscellaneous** in the **Properties** window and change the Vendor and Product ID values as shown in the previous Table.
7. Click the **Add USBX Port DCD** box on the **New Thread stacks**, and select **USBX Port DCD on `sf_el_ux` for USBFS**.
8. Change the **Full Speed Interrupt Priority** to **Priority 3** in the **Properties** window.
9. Click on the **New Thread Objects** button to add Event Flags, insert "**CDCACM Activate Event Flags**" as Name and "**g_cdcacm_activate_event_flags0**" as Symbol.
10. Click on the **Generate Project Content** button.
11. Add the code from the supplied project file `new_thread0_entry.c` or copy over the generated `new_thread0_entry.c` file.
12. Connect to the host PC via a micro USB cable (J19 on SK-S7G2. Use the corresponding connector on other kits).
13. Start to debug the application.
14. Connect to the host PC via a micro USB cable (J5 on SK-S7G2. Use the corresponding connector on other kits).
15. Start any terminal application (preferably Tera Term) on the host PC.
16. The output can be viewed in the terminal application and in the virtual console. You will see that characters are echoed as they are typed into the terminal window. Line feed characters are not echoed so you will only see a single line of characters in the terminal window, since the line will simply be overwritten if you use the carriage return.



```
USBX_CDCACM_Device running

Waiting for a CDC device to be connected...
Event detected
CDC device connected
1 characters read
1 characters written
1 characters read
1 characters written
1 characters read
1 characters written
1 characters read
1 characters written
```

```
asdf
```

Figure 5. Example Output from USBX Device Class CDC-ACM Module Application Project

10. USBX Device Class CDC-ACM Module Conclusion

This module guide has provided all the background information needed to select, add, configure and use the module in an example project. Many of these steps were time consuming and error-prone activities in previous generations of embedded systems. The Renesas Synergy Platform makes these steps much less time consuming and removes the common errors like conflicting configuration settings or the incorrect selection of lower-level modules. The use of high-level APIs (as demonstrated in the application project) illustrates additional development-time savings by allowing work to begin at a high level and avoiding the time required in older development environments to use, or, in some cases, create, lower-level drivers.

11. USBX Device Class CDC-ACM Module Next Steps

After you have mastered a simple USBX Device Class CDC-ACM module project, you may want to review a more complex example. Other application projects and application notes that demonstrate USBX Device Class CDC-ACM use can be found as described in the USBX Device Class CDC-ACM Module Reference Information section at the end of this document.

12. USBX Device Class CDC-ACM Module Reference Information

SSP User Manual: Available in html format in the SSP distribution package and as a pdf from the Synergy Gallery.

Links to all the most up-to-date USBX Device Class CDC-ACM module reference materials and resources are available on the Synergy Knowledge Base: https://en-us.knowledgebase.renesas.com/English_Content/Renesas_Synergy%E2%84%A2_Platform/Renesas_Synergy_Knowledge_Base/USBX_Device_Class_CDC_ACM_Module_Guide_References.

Website and Support

Visit the following URLs to learn about key elements of the Synergy Platform, download components and related documentation, and get support.

Synergy Software	www.renesas.com/synergy/software
Synergy Software Package	www.renesas.com/synergy/ssp
Software add-ons	www.renesas.com/synergy/addons
Software glossary	www.renesas.com/synergy/softwareglossary
Development tools	www.renesas.com/synergy/tools
Synergy Hardware	www.renesas.com/synergy/hardware
Microcontrollers	www.renesas.com/synergy/mcus
MCU glossary	www.renesas.com/synergy/mcuglossary
Parametric search	www.renesas.com/synergy/parametric
Kits	www.renesas.com/synergy/kits
Synergy Solutions Gallery	www.renesas.com/synergy/solutionsgallery
Partner projects	www.renesas.com/synergy/partnerprojects
Application projects	www.renesas.com/synergy/applicationprojects
Self-service support resources:	
Documentation	www.renesas.com/synergy/docs
Knowledgebase	www.renesas.com/synergy/knowledgebase
Forums	www.renesas.com/synergy/forum
Training	www.renesas.com/synergy/training
Videos	www.renesas.com/synergy/videos
Chat and web ticket	www.renesas.com/synergy/resourcelibrary

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Dec.01.19	—	First release document
1.01	Feb.07.19	—	Updated for SSP v1.5.0

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.