CLOSED LOOP DESIGN LLC

USB SC57x Audio 2.0 with CDC(ACM)Library v.1.00 Users Guide

Users Guide Revision 1.00

For Use with Analog Devices ADSP-SC57x Series Processors

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Table of Contents

Disclaimer 4

Introduction 4

USB Background 4

CLD SC57x Audio 2.0 with CDC Library USB Enumeration Flow Chart 5

CLD SC57x Audio 2.0 with CDC Library Interrupt IN Flow Chart 7

CLD SC57x Audio 2.0 with CDC Library Isochronous OUT Flow Chart 9

CLD SC57x Audio 2.0 with CDC Library Isochronous IN Flow Chart 10

CLD SC57x Audio 2.0 with CDC Library Bulk OUT Flow Chart 12

CLD SC57x Audio 2.0 with CDC Bulk IN Flow Chart 13

USB Audio Device Class v2.0 Background 14

Isochronous Endpoint Bandwidth Allocation 15

USB Audio Device Class v2.0 Control Endpoint Requests 15

CDC Abstract Control Model Background 18

CDC Notifications Interrupt IN Endpoint 18

CDC Abstract Control Model Control Endpoint Requests 19

Dependencies 28

Memory Footprint 28

CLD SC57x Audio 2.0 with CDC Library Scope and Intended Use 28

CLD Audio 2.0 with CDC (2-Channel) Example v1.00 Description 28

CLD SC57x Audio 2.0 with CDC Library API 29

cld_sc57x_audio_2_0_w_cdc_lib_init 29

cld_sc57x_audio_2_0_w_cdc_lib_main 50

cld_sc57x_audio_2_0_w_cdc_lib_transmit_audio_data 50

cld_sc57x_audio_2_0_w_cdc_lib_transmit_interrupt_data 51

cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_audio_data_transfer 54

cld_ sc57x_audio_2_0_w_cdc_lib_transmit_serial_data 55

cld_ sc57x_audio_2_0_w_cdc_lib_send_network_connection_state 56

cld_ sc57x_audio_2_0_w_cdc_lib_send_response_available 57

cld_ sc57x_audio_2_0_w_cdc_lib_send_serial_state 58

cld_ sc57x_audio_2_0_w_cdc_lib_resume_paused_serial_data_transfer 59

cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_control_transfer 60

cld_ lib_usb_connect 60

cld_ lib_usb_disconnect 61
cld_time_125us_tick 61
cld_usb0_isr_callback & cld_usb1_isr_callback 61
cld_time_get 62
cld_time_passed_ms 62
cld_time_get_125us 62
cld_time_passed_125us 63
cld_lib_status_decode 63
Using the ADSP-SC573 Ez-Board 65
Connections: 65
Adding the CLD SC57x Audio 2.0 with CDC Library to an Existing CrossCore Embedded Studio Project 65
User Firmware Code Snippets 67
main.c 67
user_audio_w_cdc.c 68

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Introduction

The Closed Loop Design (CLD) Audio 2.0 with CDC/ACM library creates a simplified interface for developing a USB Audio v2.0 and Communication Device Class (CDC) Abstract Control Model (ACM) Serial Emulation device using the Analog Devices ADSP-SC573 EZ-Board. The CLD SC57x Audio 2.0 with CDC library also includes support for a serial console and timer functions that facilitate creating timed events quickly and easily. The library's User application interface is comprised of parameters used to customize the library's functionality as well as callback functions used to notify the User application of events. These parameters and functions are described in greater detail in the CLD SC57x Audio 2.0 with CDC Library API section of this document.

USB Background

The following is a very basic overview of some of the USB concepts that are necessary to use the CLD SC57x Audio 2.0 with CDC Library. However, it is still recommended that developers have at least a basic understanding of the USB 2.0 protocol. The following are some resources to refer to when working with USB, USB Audio v2.0, and CDC 1.2 protocols:

- The USB 2.0 Specification: http://www.usb.org/developers/docs/usb20_docs/
- The USB Device Class Definition for Audio Devices v2.0,
  The USB Device Class Definition for Audio Data Formats v.2.0
  The USB Device Class Definition for Terminal Types v.2.0
  http://www.usb.org/developers/docs/devclass_docs/Audio2.0_final.zip
- The USB CDC Class specification v1.2:http://www.usb.org/developers/docs/devclass_docs/
- USB in a Nutshell: A free online wiki that explains USB concepts.
  http://www.beyondlogic.org/usbnutshell/usb1.shtml
- "USB Complete" by Jan Axelson ISBN: 1931448086

USB is a polling based protocol where the Host initiates all transfers, all USB terminology is from the Host's perspective. For example an 'IN' transfer is when data is sent from a Device to the Host, and an 'OUT' transfer is when the Host sends data to a Device.

The USB 2.0 protocol defines a basic framework that devices must implement in order to work correctly. This framework is defined in the Chapter 9 of the USB 2.0 protocol, and is often referred to as the USB 'Chapter 9' functionality. Part of the Chapter 9 framework is standard USB requests that a USB Host uses to control the Device. Another part of the Chapter 9 framework is the USB Descriptors. These USB Descriptors are used to notify the Host of the Device's capabilities when the Device is attached. The USB Host uses the descriptors and the Chapter 9 standard requests to configure the Device. This process is called USB Enumeration. The CLD SC57x Audio 2.0 with CDC Library includes support for the USB standard requests and USB Enumeration using some of the parameters specified by the User application when initializing the library. These parameters are discussed in the cld_sc57x_audio_2_0_w_cdc_lib_init

section of this document. The CLD SC57x Audio 2.0 with CDC Library facilitates USB enumeration and is Chapter 9 compliant without User Application intervention as shown in the flow chart below. For additional information on USB Chapter 9 functionality or USB Enumeration please refer to one of the USB resources listed above.

CLD SC57x Audio 2.0 with CDC Library USB Enumeration Flow Chart

All USB data is transferred using Endpoints that act as a source or sink for data based on the endpoint's direction (IN or OUT). The USB protocol defines four types of Endpoints, each of which has unique characteristics that dictate how they are used. The four Endpoint types are: Control, Interrupt, Bulk and Isochronous. Data that is transmitted over USB is broken up into blocks of data called packets. For each endpoint type there are restrictions on the allowed max packet size. The allowed max packet sizes also vary based on the USB connection speed. Please refer to the USB 2.0 protocol for more information about the max packet size supported by the four endpoint types.

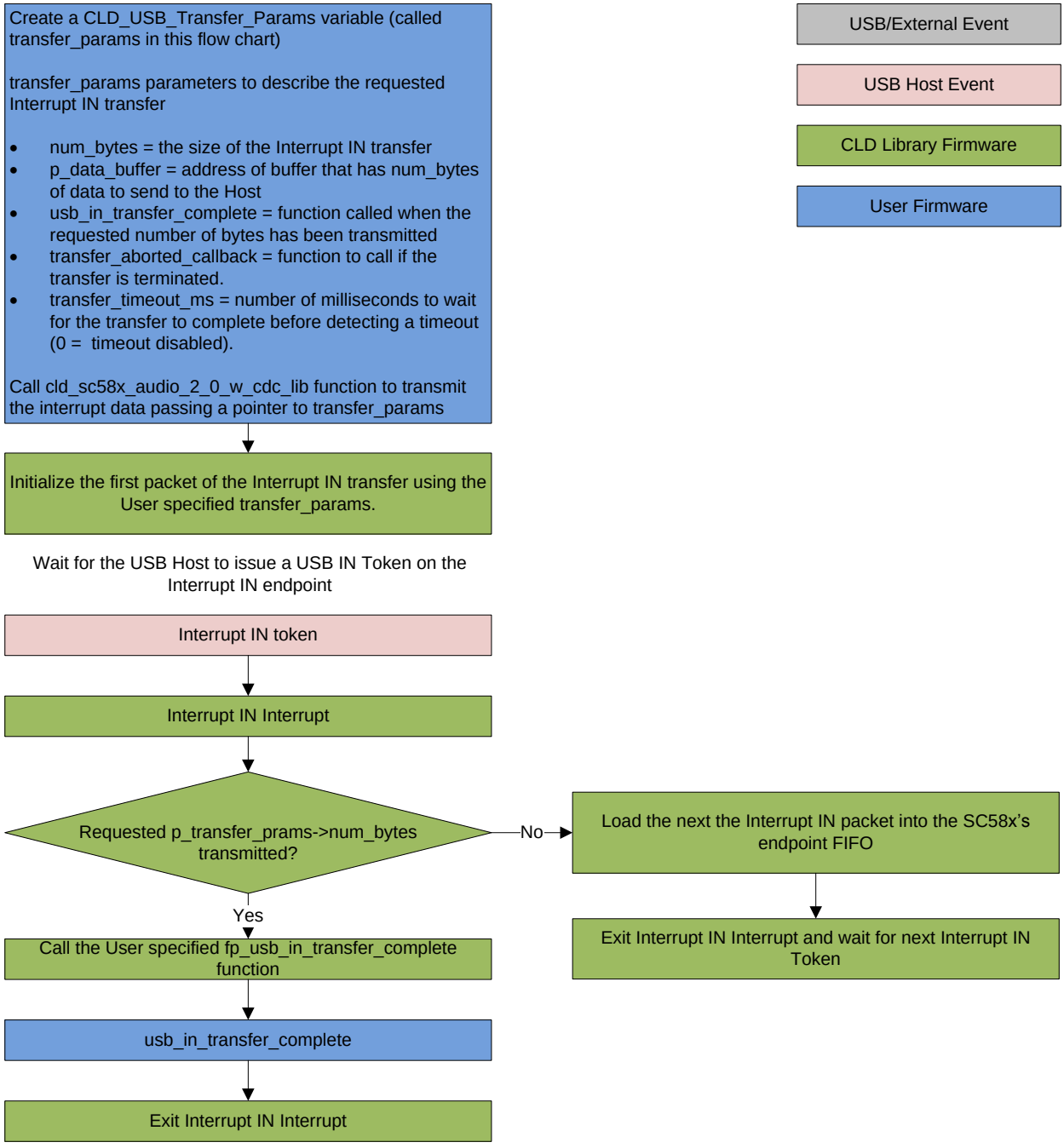
The CLD SC57x Audio 2.0 with CDC Library uses Control, Interrupt, Bulk, and Isochronous endpoints, these endpoint types will be discussed in more detail below.

A Control Endpoint is the only bi-directional endpoint type, and is typically used for command and status transfers. A Control Endpoint transfer is made up of three stages (Setup Stage, Data Stage, and Status Stage). The Setup Stage sets the direction and size of the optional Data Stage. The Data Stage is where any data is transferred between the Host and Device. The Status Stage gives the Device the opportunity to report if an error was detected during the transfer. All USB Devices are required to include a default Control Endpoint at endpoint number 0, referred to as Endpoint 0. Endpoint 0 is used to implement all the USB Protocol defined Chapter 9 framework and USB Enumeration. In the CLD SC57x Audio 2.0 with CDC Library Endpoint 0 is also used to handle the USB Audio Device Class v2.0 defined Set and Get requests as well as the CDC requests. These requests are discussed in more detail in the USB Audio Device Class v2.0 Background and CDC Abstract Control Model Background sections of this document

Interrupt Endpoints are used to transfer blocks of data where data integrity and deterministic timing is required. Deterministic timing is achieved by allowing the Device to specify a requested interval used by the Host to initiate USB transfers, which gives the Device a guaranteed maximum time between opportunities to transfer data. Interrupt Endpoints are particularly useful when the Device needs to report to the Host when a change is detected without having to wait for the Host to ask for the information. This is more efficient then requiring the host to repeatedly send Control Endpoint requests asking if anything has changed.

The flow charts below give an overview of how the CLD SC57x Audio 2.0 with CDC Library and the User firmware interact to process Interrupt IN transfers.

CLD SC57x Audio 2.0 with CDC Library Interrupt IN Flow Chart



Isochronous Endpoints have the following characteristics which make them well suited for streaming audio data:

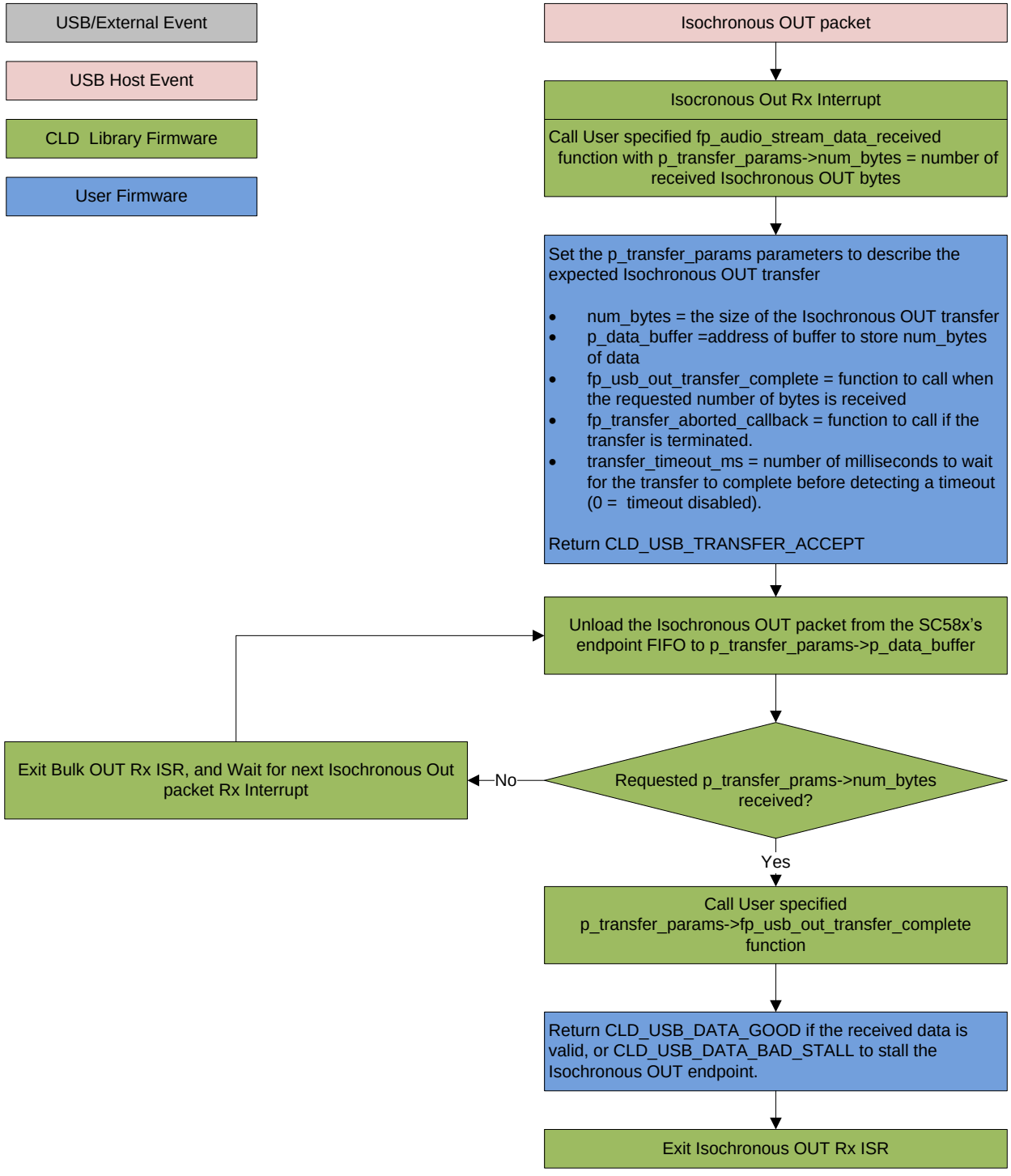
- Guaranteed USB bandwidth with bounded latency
- Constant data rate as long as data is provided to the endpoint.

- In the event of a transport error there is no retrying.

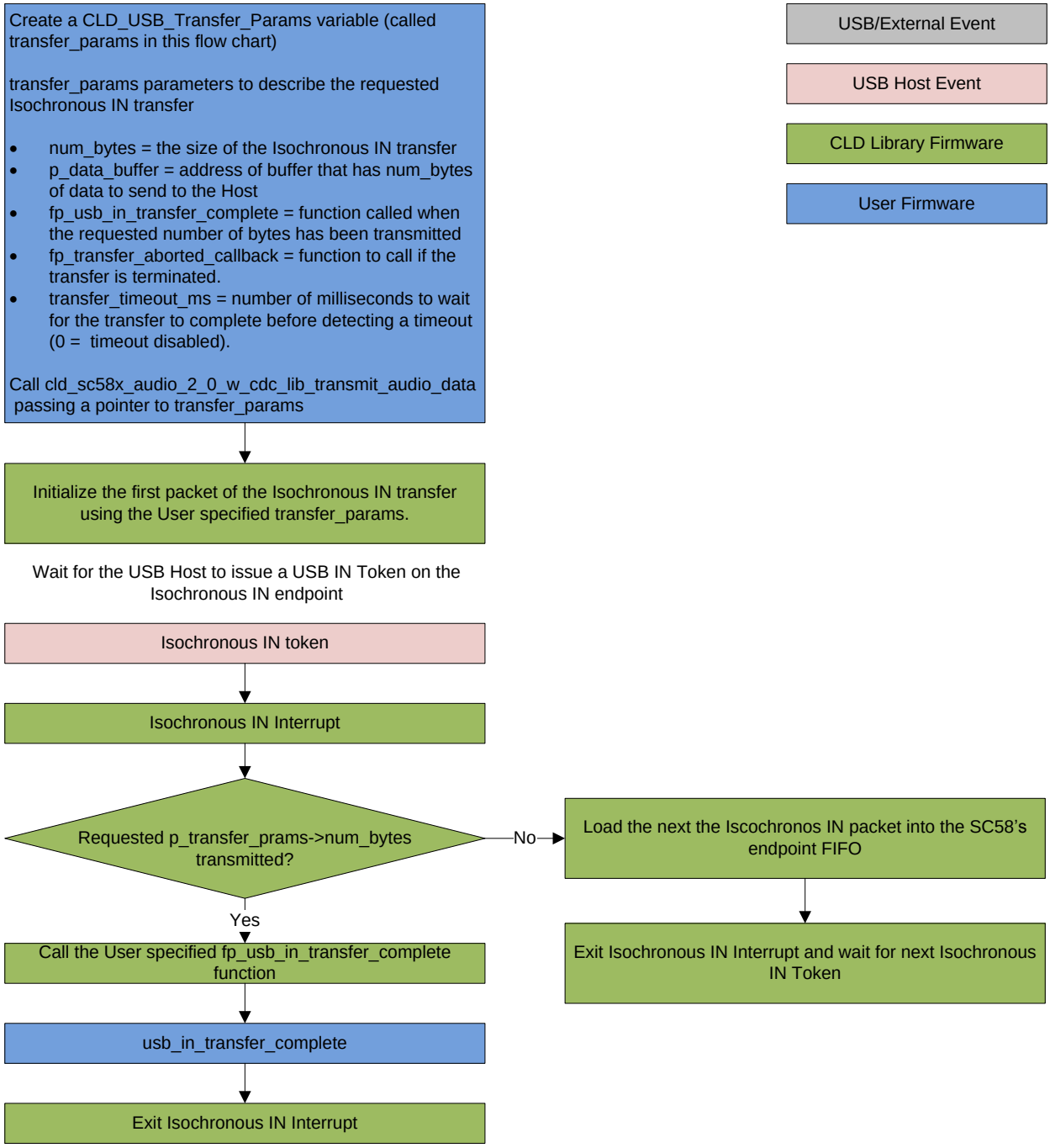
These characteristics allow for streaming audio data to be transmitted with deterministic timing. In the event of a USB transport error the audio data is dropped instead of being retried like a Bulk or Interrupt endpoint. This allows the streaming audio data to remain in sync. The CLD SC57x Audio 2.0 with CDC Library supports an Isochronous IN and Isochronous OUT endpoint, which are used to send and receive streaming audio data with the USB Host, respectively.

The flow charts below give an overview of how the CLD SC57x Audio with CDC Library and the User firmware interact to process Isochronous OUT and Isochronous IN transfers. Additionally, the User firmware code snippets included at the end of this document provide a basic framework for implementing a USB Audio v2.0 device using the CLD SC57x Audio 2.0 with CDC Library.

CLD SC57x Audio 2.0 with CDC Library Isochronous OUT Flow Chart



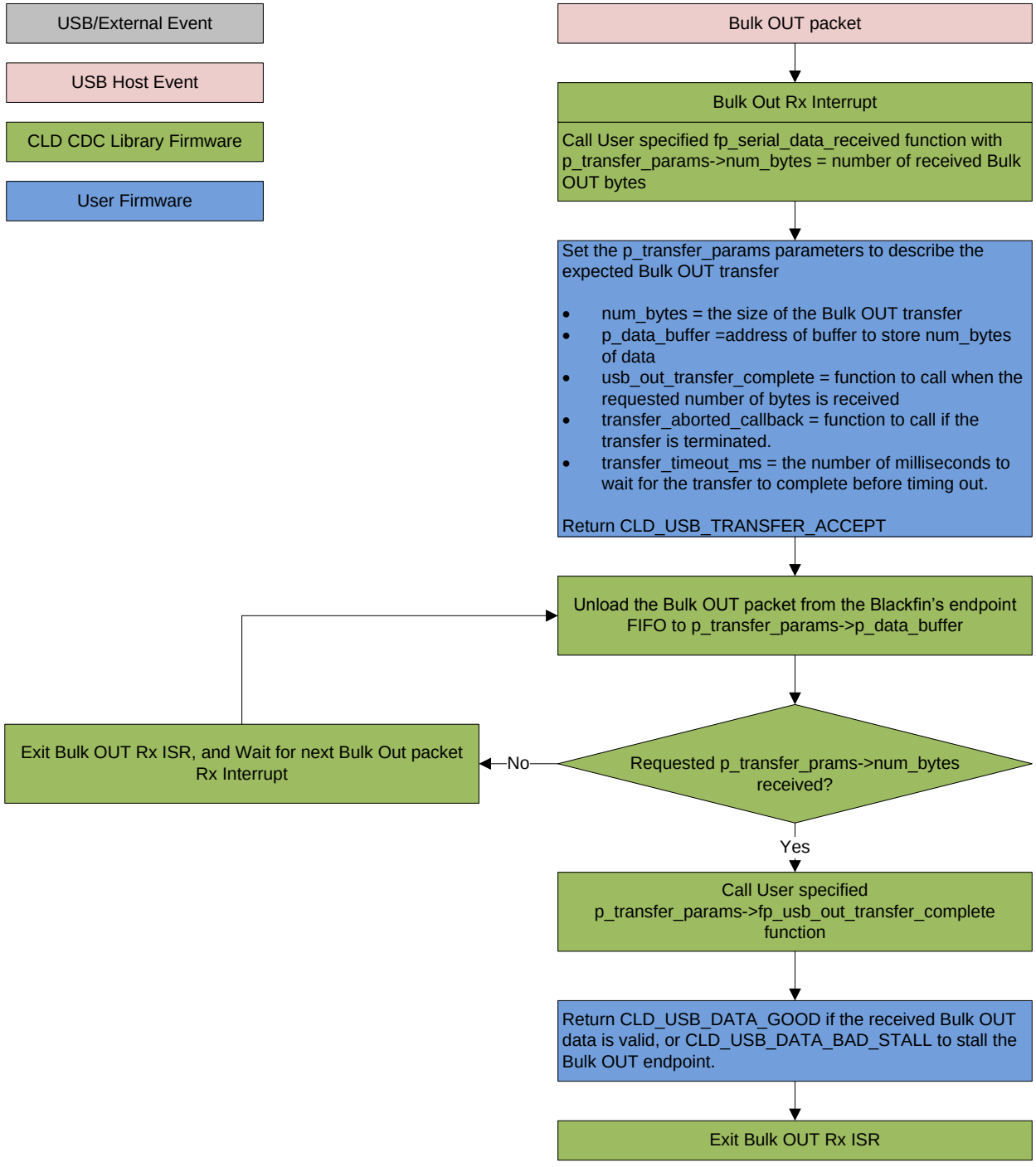
CLD SC57x Audio 2.0 with CDC Library Isochronous IN Flow Chart



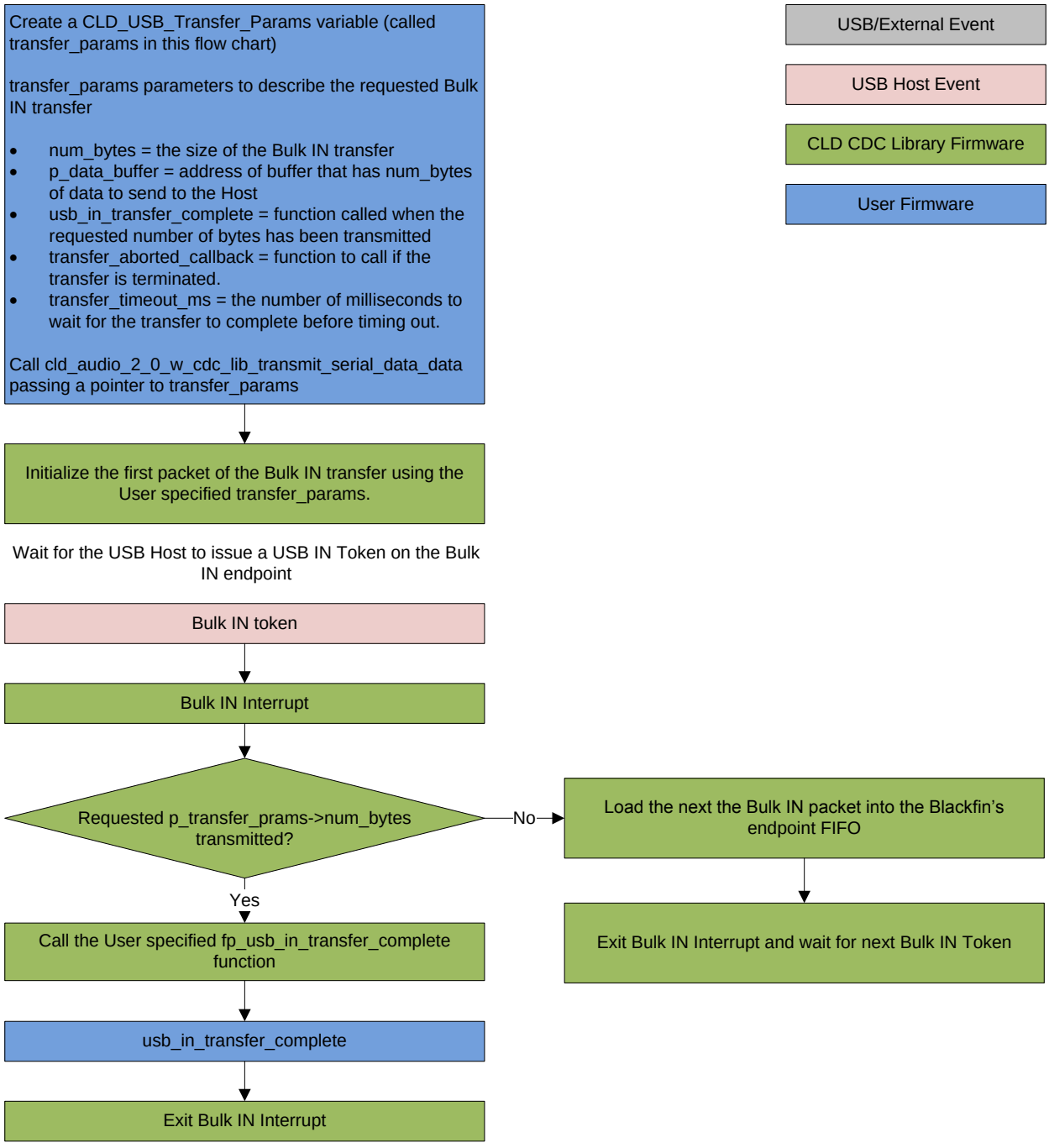
Bulk Endpoints are used to transfer large amounts of data where data integrity is critical, but does not require deterministic timing. A characteristic of Bulk Endpoints is that they can fill USB bandwidth that isn't used by the other endpoint types. This makes Bulk the lowest priority endpoint type, but it can also be the fastest as long as the other endpoints don't saturate the USB Bus. An example of a devices that uses Bulk endpoints is a Mass Storage Device (thumb drives). The CLD SC57x Audio 2.0 with CDC Library includes a Bulk IN and Bulk OUT endpoint, which are used to send and receive serial data with the USB Host, respectively.

The flow charts below give an overview of how the CLD CLD SC57x Audio 2.0 with CDC Library and the User firmware interact to process Bulk OUT and Bulk IN transfers.

CLD SC57x Audio 2.0 with CDC Library Bulk OUT Flow Chart



CLD SC57x Audio 2.0 with CDC Bulk IN Flow Chart

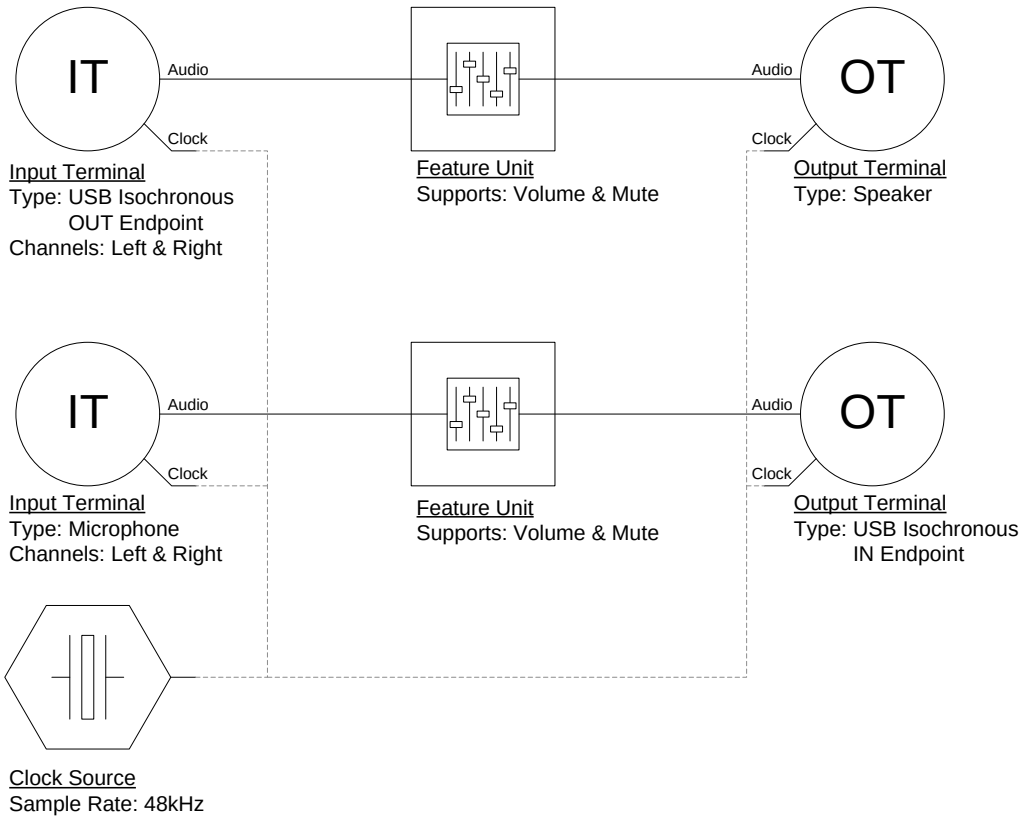


USB Audio Device Class v2.0 Background

The following is a basic overview of some USB Audio Device v2.0 concepts that are necessary to use the CLD SC57x Audio 2.0 with CDC Library. However, it is recommended that developers have at least a basic understanding of the USB Audio Device Class v2.0 protocol.

The USB Audio Device Class v2.0 protocol is a USB Standard Class released by the USB IF committee, and it provides a standardized way for a device that is capable of audio input/output to communicate with a USB Host. The USB Audio Device Class v2.0 USB descriptors provide a detailed description of the Device's capabilities. This information includes the Device's supported audio sample rate(s), audio data format, input and output terminals and how the various audio processing components are connected and controlled.

The Device's audio processing capabilities are described using a series of USB Audio Class Terminal and Unit Descriptors. The Terminal Descriptors define how audio data is input and output (speakers, microphones, USB Isochronous endpoints, etc). The Unit Descriptors describe the Device's audio processing capabilities and how they connect to the input/output Terminals. The diagram below shows how the audio Terminal and Unit entities are connected in the CLD Audio 2.0 with CDC example project to implement a basic device with a stereo speaker output, and stereo input.



More complex audio devices are created by connecting multiple Unit entities together to describe the Device's capabilities. For more information about the available Unit and Terminal entities, and how they are used please refer to the USB Audio Class Device v2.0 specification.

In order to successfully communicate with a USB Audio device the USB Host needs to know how the audio data is formatted. This is done using an audio stream format descriptor, which is part of the Streaming Audio Interface configuration. The USB Audio Device Class v2.0 specification supports multiple audio data formats which are described in the USB Device Class Definition for Audio Data Formats v2.0 specification.

Isochronous Endpoint Bandwidth Allocation

As mentioned previously, one of the advantages of Isochronous endpoints is that they provide guaranteed USB bandwidth. However, this can also be a disadvantage when the bandwidth isn't being used as it is wasted.

To avoid this disadvantage the USB Audio Device Class v2.0 protocol requires that audio data streaming interfaces include two settings. The default setting does not include any Isochronous endpoints so its bandwidth requirement is zero. An alternate interface includes the required Isochronous endpoint(s). This allows the USB Host to enable the Isochronous endpoints when it needs to send or receive audio data, and disable them when the audio device is idle. This switch is done using the USB Chapter 9 Set Interface standard request.

When the CLD SC57x Audio 2.0 with CDC Library receives a Set Interface request a appropriate User callback function is called. Please refer to the fp_audio_streaming_rx_endpoint_enabled and fp_audio_streaming_tx_endpoint_enabled function pointer descriptions in the cld_sc57x_audio_2_0_lib_init section of this document for more information.

USB Audio Device Class v2.0 Control Endpoint Requests

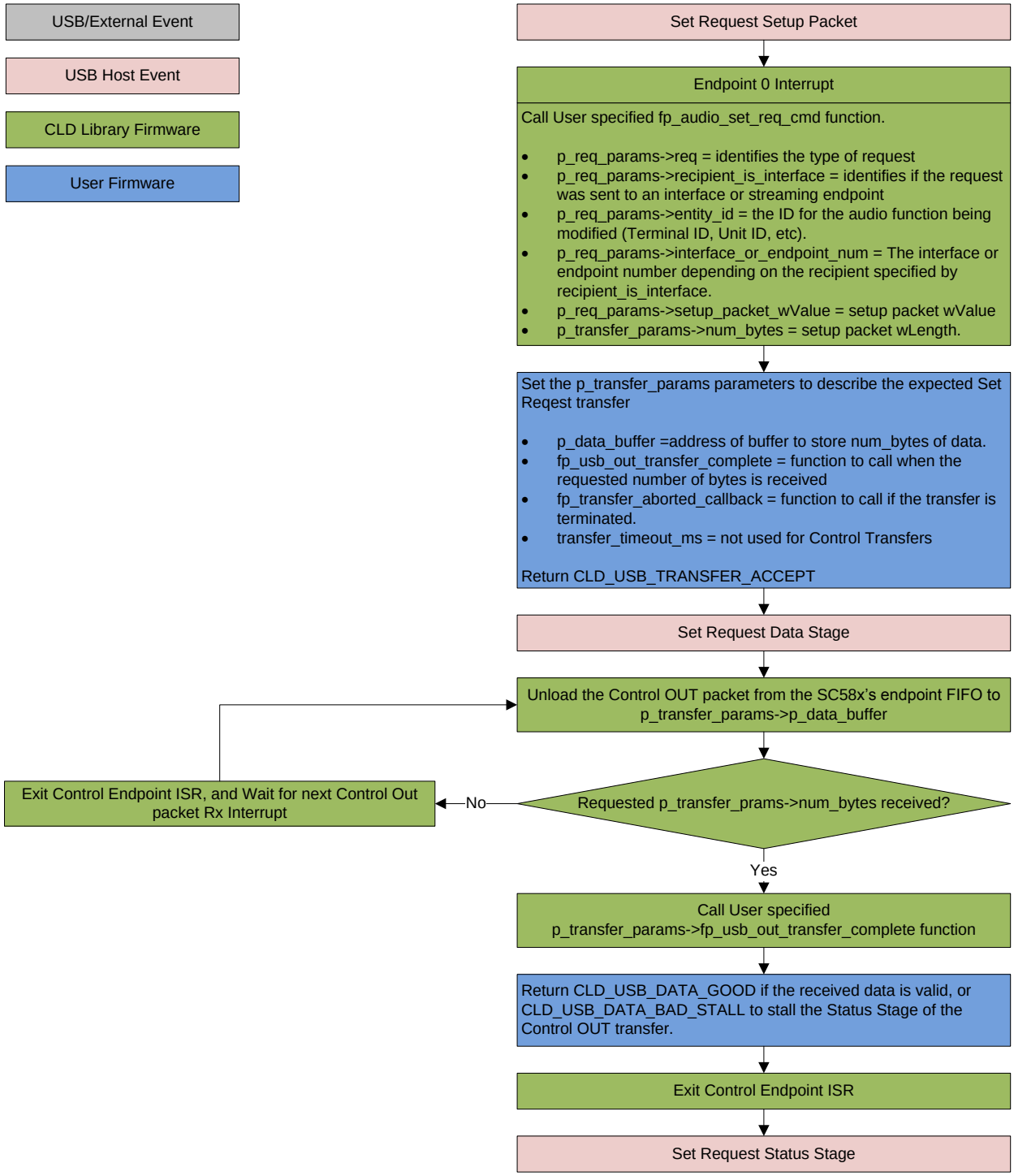
The USB Audio Device Class v2.0 control endpoint requests are broken down into Set and Get requests. These requests are used to control the various Terminal and Unit entities defined in the Configuration Descriptor. The CLD SC57x Audio 2.0 with CDC Library support for these requests is explained in the following sections.

Additionally, the User firmware code snippets included at the end of this document provide a basic framework for implementing the USB audio Control Endpoint requests using the CLD SC57x Audio 2.0 with CDC Library.

USB Audio Device Class v2.0 Set Request

The USB Audio Device Class v2.0 Set Request is used to control the audio functions supported by the Device. This includes modifying the attributes if the Unit and Terminal entities as well as controlling features of the streaming audio endpoints.

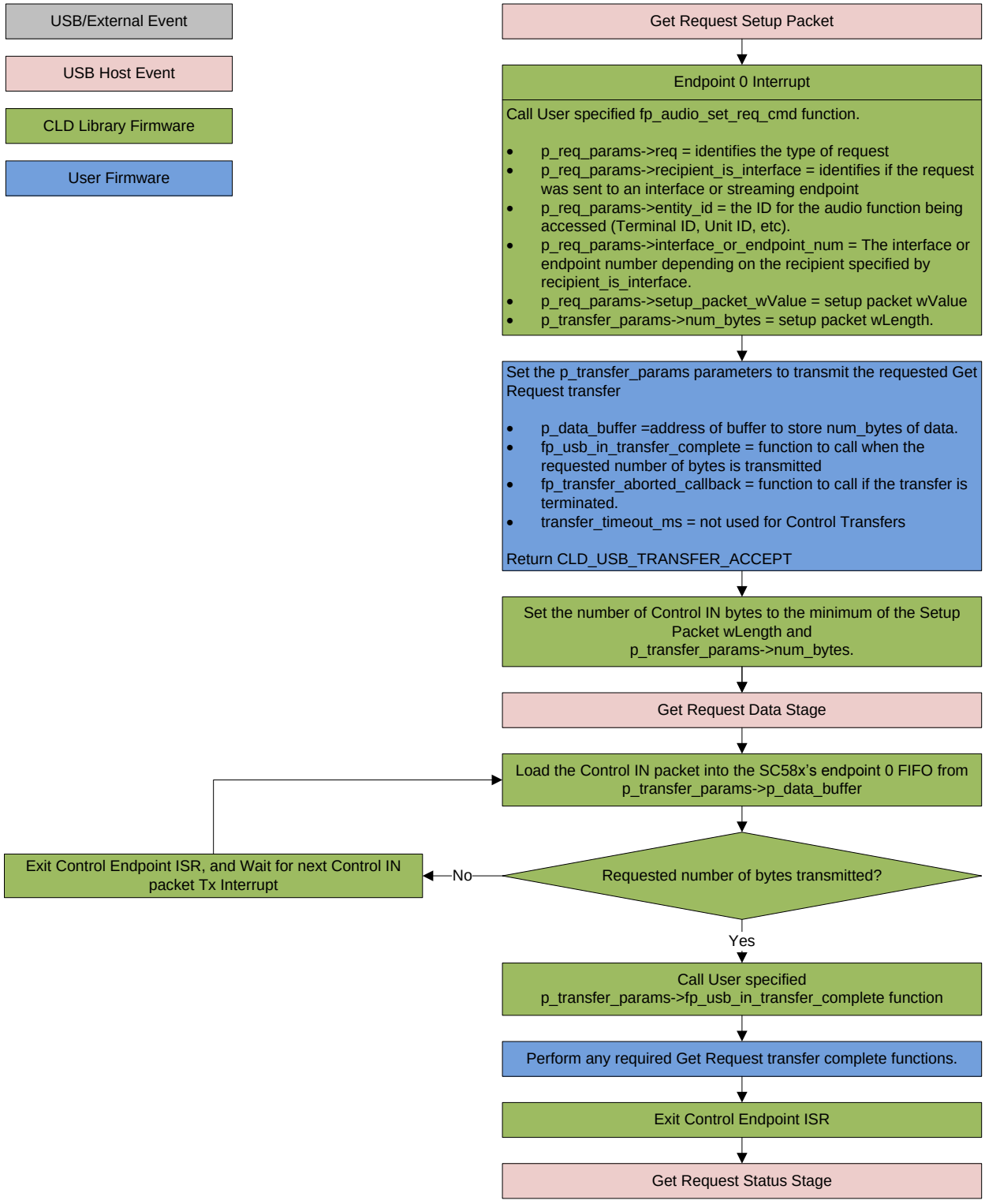
CLD SC57x Audio Device Class v2.0 Set Request Flow Chart



USB Audio Device Class v2.0 Get Request

The Get Request is a Control IN request used by the Host to request data from the audio functions supported by the Device. This includes requesting the attributes of the Unit and Terminal entities as well as features of the audio stream endpoints.

CLD SC57x Audio Device Class v2.0 Get Request Flow Chart



CDC Abstract Control Model Background

The USB Communication Device Class (CDC) Abstract Control Model (ACM) protocol is a USB Standard Class protocol released by the USB IF committee. The Communication Device Class was created to provide a standardized way for USB communication devices to interface with a computer, and covers a wide range of communication devices. The CLD SC57x Audio 2.0 with CDC Library implements an Abstract Control Model Serial Emulation device, so the scope of this document is limited to the CDC ACM Serial Emulation functionality.

A CDC device is comprised of two USB interfaces. The first interface uses the Communication Device Class and includes a single Interrupt IN endpoint used to send Notifications to the host. The second interface uses the Data Interface Class and includes a Bulk IN and Bulk OUT endpoint, which are used to transfer the serial emulation data with the USB Host.

CDC Notifications Interrupt IN Endpoint

The CDC protocol requires all devices to include an Interrupt IN endpoint which is used to send CDC Notifications to the Host. For the CDC Abstract Control Model these Notifications include the Network Connection, Response Available, and Serial State Notifications. These Notifications are discussed below:

Network Connection Notification

The Network Connection Notification is used to report if the network is connected or disconnected to the Host.

Response Available Notification

The Response Available Notification is used to notify the Host that a protocol specific response is available, which is retrieved by the Host using the Get Encapsulated Response control endpoint request described in the CDC Abstract Control Model Control Endpoint Requests section of this document.

Serial State Notification

The Serial State Notification is similar to the interrupt status register of a UART, and is used to report the serial link status to the Host. The table below shows the data fields of the Serial State Notification. All of the Serial State fields are active high, so a field is set to a '1' when it is active.

Field	Description
bOverRun	Received serial data was received while processing the previously received data.
bParity	A parity error has occurred.
bFraming	A framing error has occurred
bRingSignal	The current state of the ring signal detection
bBreak	The current state of the break detection.
bTxCarrier	State of the transmission carrier. This corresponds to the RS-232 DSR signal.
bRxCarrier	State of the receive carrier detection. This signal corresponds to the RS-232 DCD signal.

Once the Serial State Notification has been sent the device will re-evaluate the above fields. For the bTxCarrier and bRxCarrier the Serial State Notification is sent when these signals change. For the remaining fields once the Serial State Notification has been sent their value is reset to zero, and will be sent again when the field is set to a '1'.

CDC Abstract Control Model Control Endpoint Requests

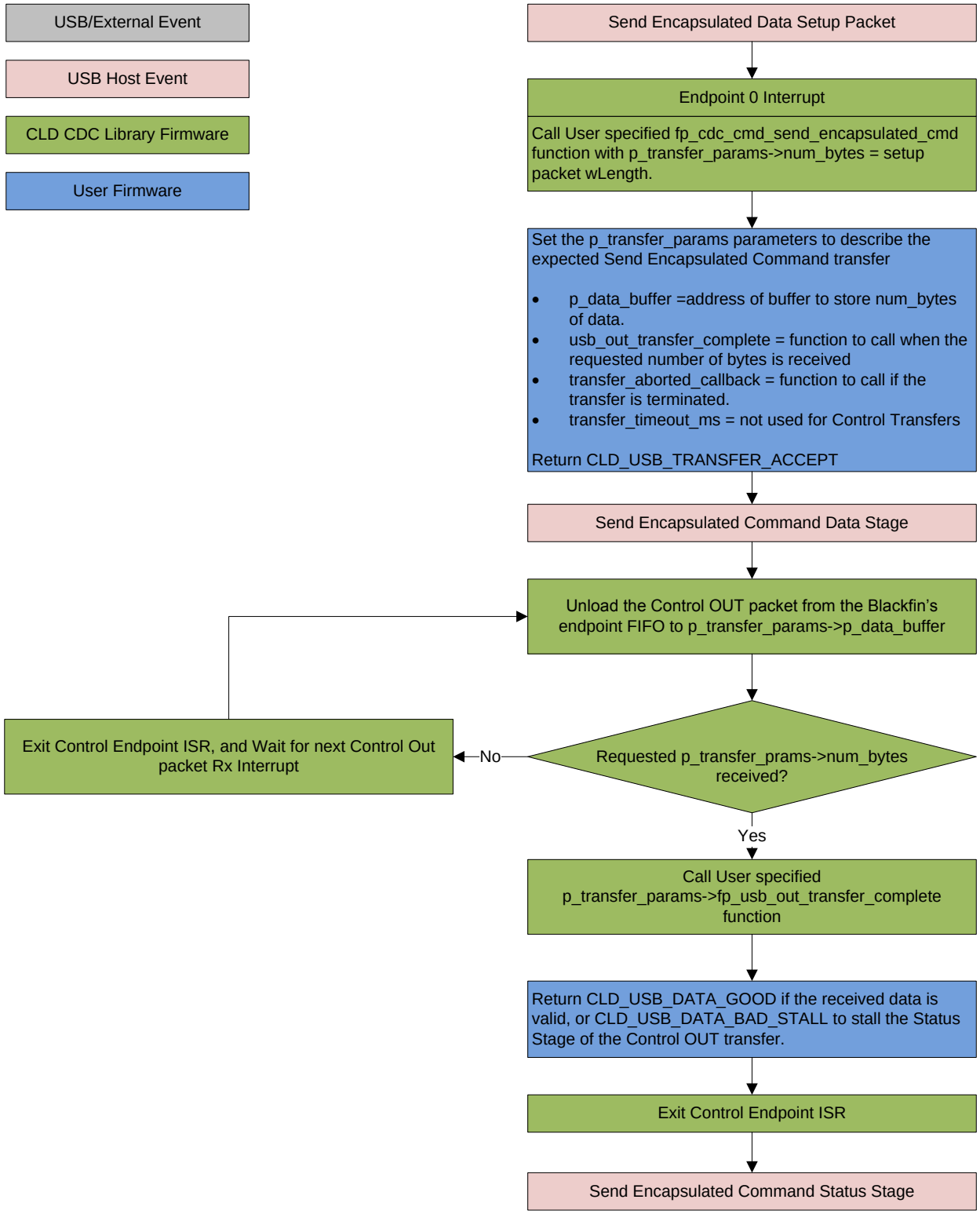
The CDC Abstract Control Model defines a couple Control Endpoint requests that a CDC peripheral is required to support as well as some optional Control Endpoint requests. The Control Endpoint requests used by the CLD SC57x Audio 2.0 with CDC Library are explained in the following sections, and include flow charts showing how the CLD SC57x Audio 2.0 with CDC Library and the User firmware interact to the Control Endpoint requests.

Additionally, the User firmware code snippets included at the end of this document provide a basic framework for implementing the CDC control requests using the CLD SC57x Audio 2.0 with CDC Library.

Send Encapsulated Command (required)

Send Encapsulated Command is a Control OUT request and is used by the Host to send protocol specific data to the device.

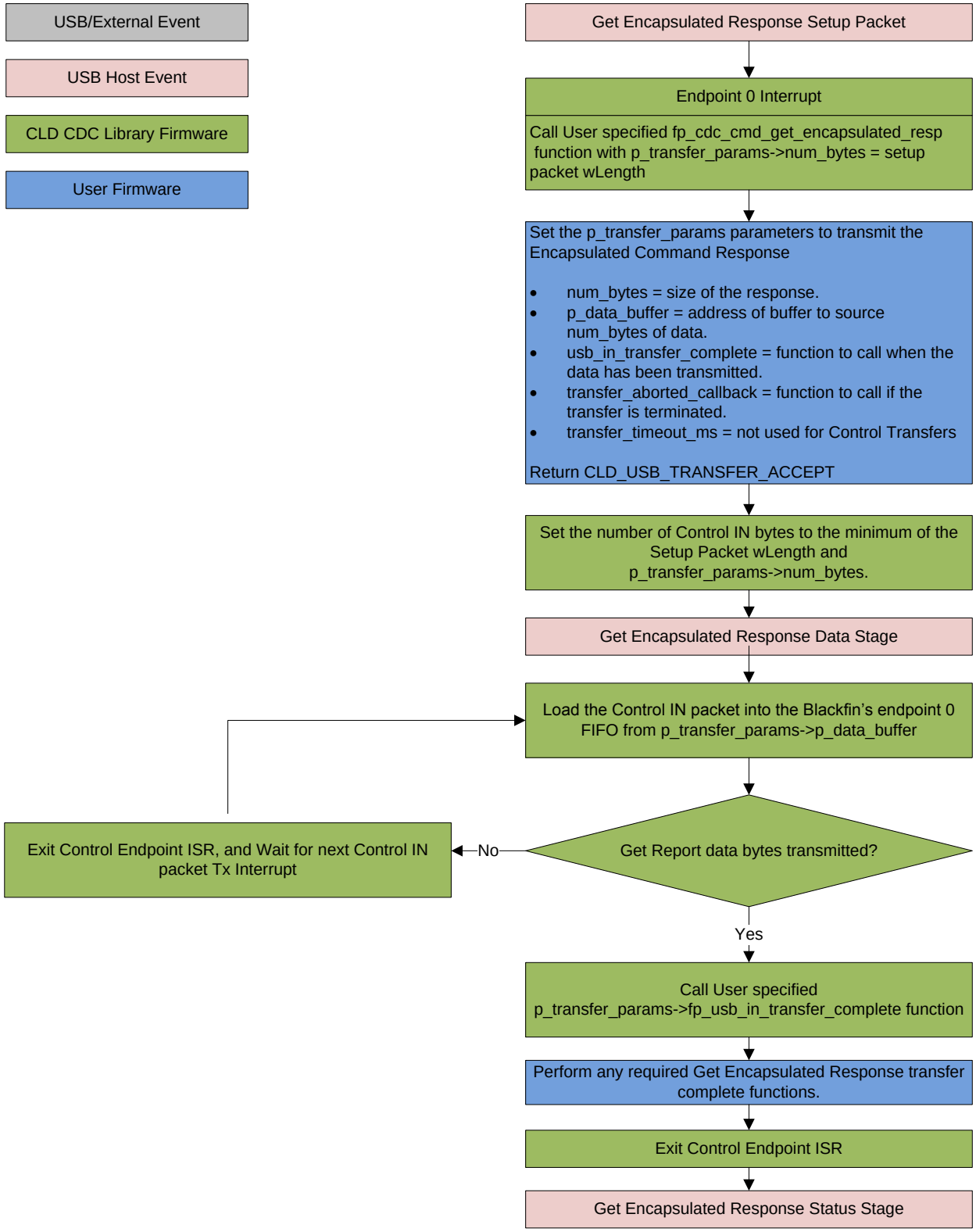
CLD CDC Send Encapsulated Command Flow Chart



Get Encapsulated Command (required)

Get Encapsulated Command is a Control IN request used by the Host to request protocol specified data.

CLD SC57x Audio 2.0 with CDC Library Get Encapsulated Command Flow Chart



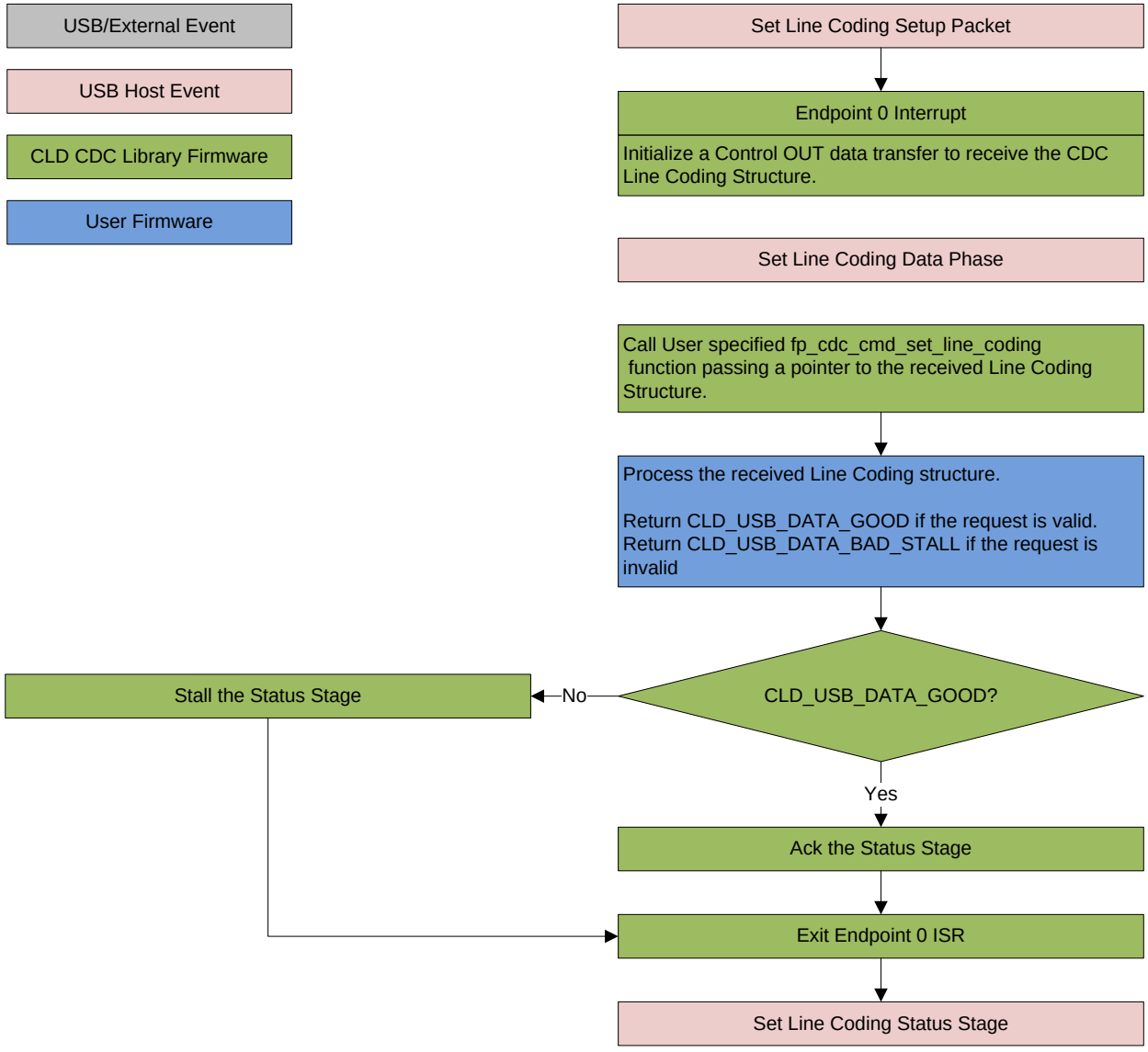
Set Line Coding (optional)

The Set Line Coding Control OUT request is used by the Host configure the UART parameters of emulated serial port. The Set Line Coding request includes the following line coding structure in the Control OUT Data Phase.

```
typedef struct
{
    unsigned long data_terminal_rate;                /* CDC Data Terminal Rate in
                                                        bits per second. */
    unsigned char num_stop_bits;                     /* CDC Number of stop bits
                                                        0 = 1 stop bit
                                                        1 = 1.5 stop bits
                                                        2 = 2 stop bits */
    unsigned char parity;                            /* CDC Parity setting
                                                        0 = None
                                                        1 = Odd
                                                        2 = Even
                                                        3 = Mark
                                                        4 = Space */
    unsigned char num_data_bits;                     /* CDC number of data bits
                                                        (Only 5, 6, 7, 8 and 16
                                                         allowed) */
} CLD_CDC_Line_Coding;
```

In response to a Set Line Coding command the CDC device should implement the requested configuration, or stall the endpoint if the request is invalid.

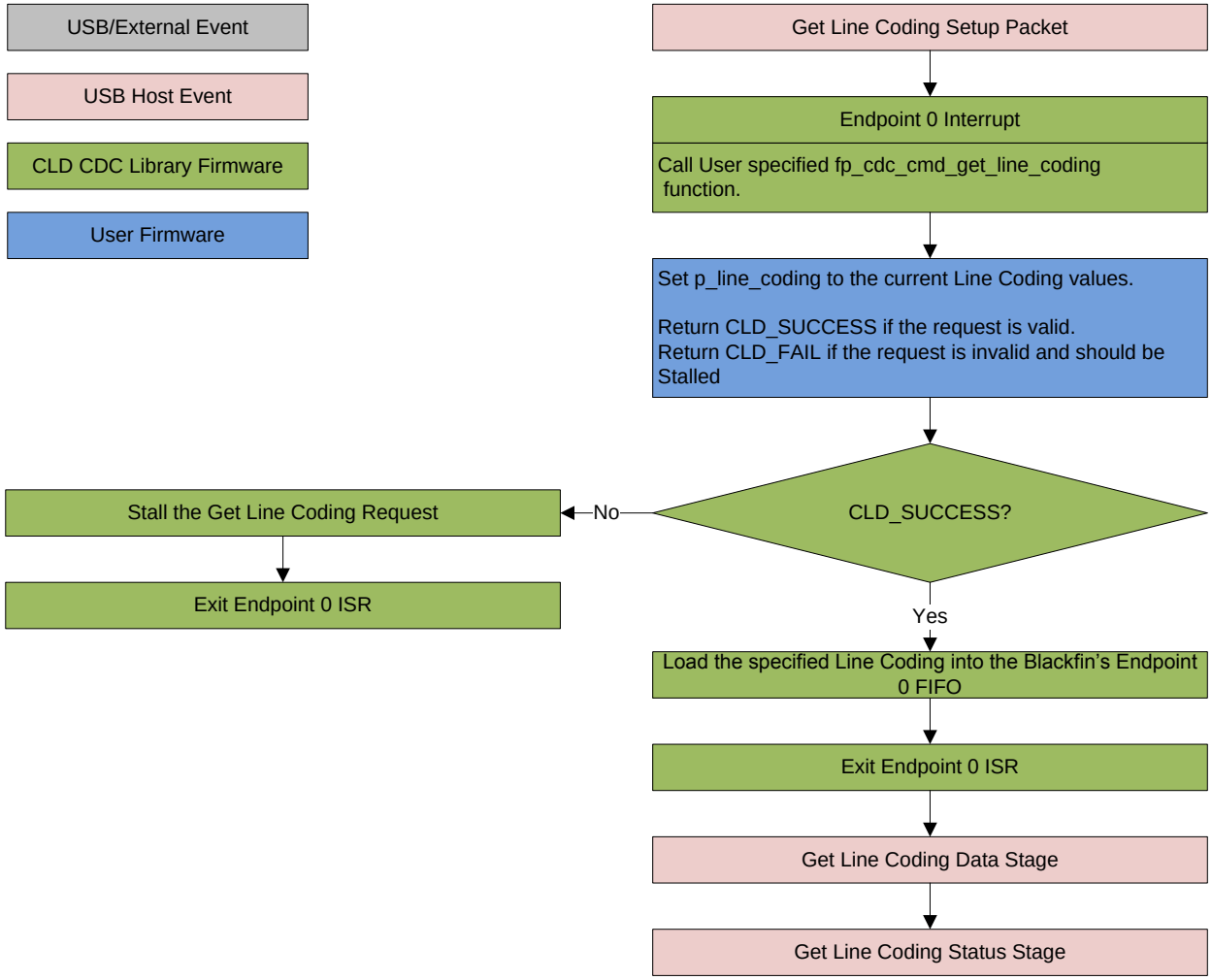
CLD SC57x Audio 2.0 with CDC Library Set Line Coding Flow Chart



Get Line Coding (optional)

The Get Line Coding Control IN request is used by the Host request current UART parameters of emulated serial port. The Get Line Coding request includes line coding structure described in the Set Line Coding section in the Control IN Data Phase.

CLD SC57x Audio 2.0 with CDC Library Get Line Coding Flow Chart

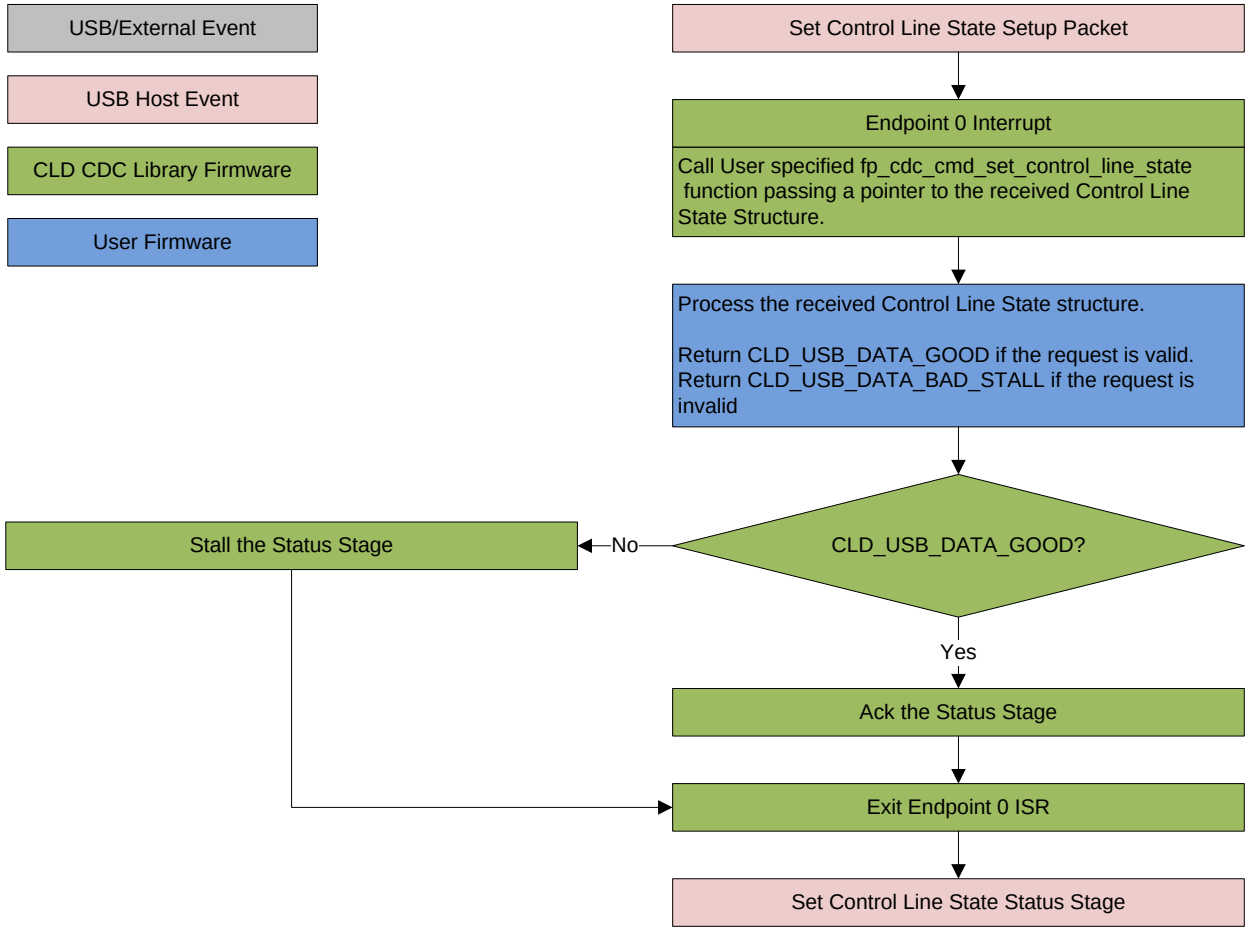


Set Control Line State (optional)

The Set Control Line State Control OUT request is used by the Host to set the value of the emulated serial port RS-232 RTS and DTR control signals. The Set Control Line State request includes the following control signal structure in the Control OUT Data Phase.

```
typedef struct
{
    union
    {
        struct
        {
            unsigned short dte_present   : 1;            /* Indicates to DCE if DTE is
                                                            present or not.
                                                            This signal corresponds to
                                                            V.24 signal 108/2
                                                            and RS-232 signal DTR.
                                                               0 - Not Present
                                                               1 - Present  */
            unsigned short activate_carrier : 1;         /* Carrier control for half
                                                            duplex modems.
                                                            This signal corresponds to
                                                            V.24 signal 105 and RS-232
                                                            signal RTS.
                                                               0 - Deactivate carrier
                                                               1 - Activate carrier
                                                            The device ignores the
                                                            value of this bit when
                                                            operating in full duplex
                                                            mode.  */
            unsigned short reserved          : 14;
        } bits;
        unsigned short state;
    } u;
} CLD_CDC_Control_Line_State;
```

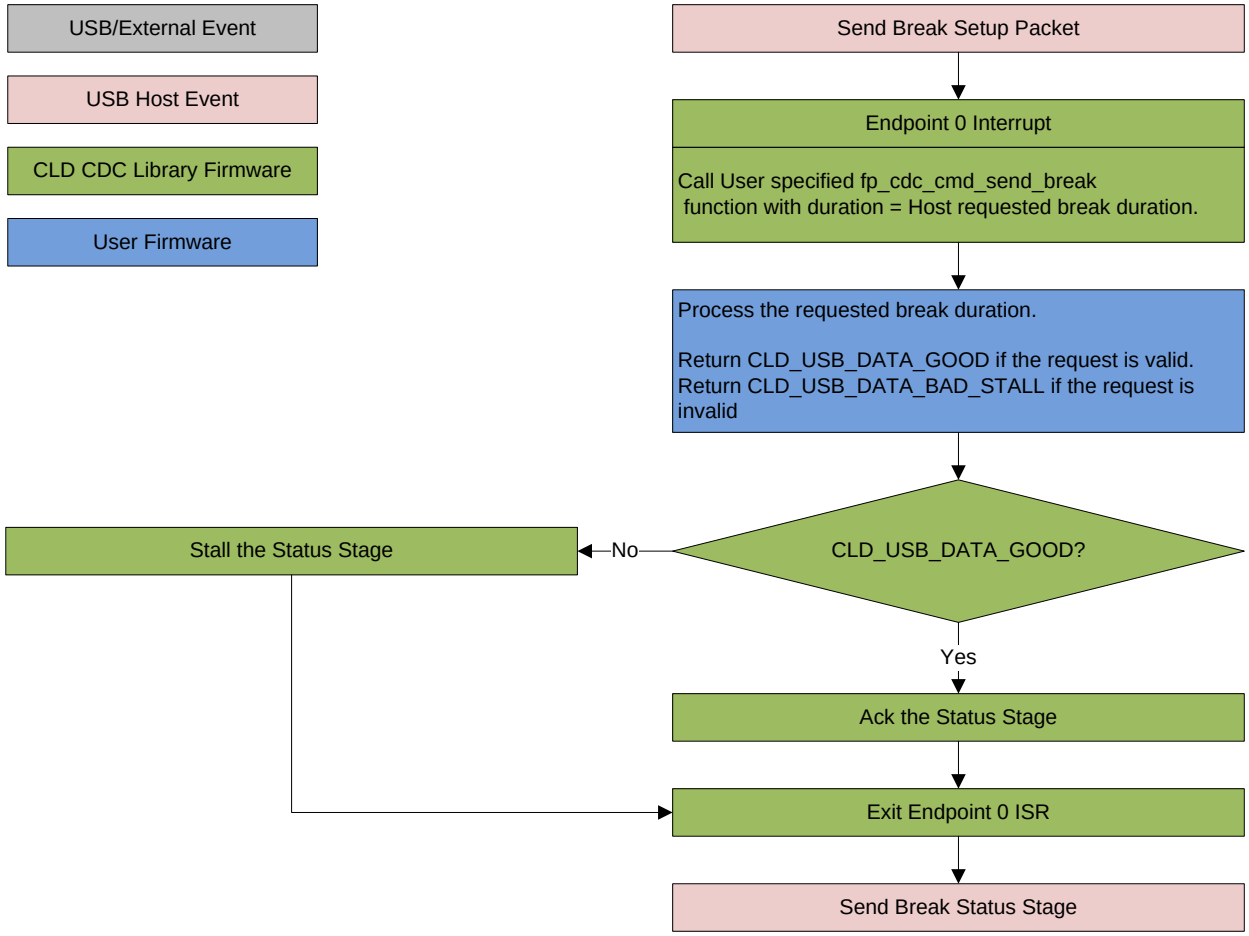
CLD SC57x Audio 2.0 with CDC Library Set Control Line State Flow Chart



Send Break (optional)

The Send Break Control OUT request is used by the Host request the device to generate a RS-232 style break for the specified duration (in milliseconds). If the duration is set to 0xFFFF the device should generate a break until a another Send Break command is received with a duration of 0.

CLD SC57x Audio 2.0 with CDC Library Send Break Flow Chart



Dependencies

In order to function properly, the CLD SC57x Audio 2.0 with CDC Library requires the following resources:

- 24Mhz clock input connected to the SC57x USB_CLKIN pin.
- The User firmware is responsible for configuring all other non-USB specific peripherals, including clocks, power modes, etc.

Memory Footprint

The CLD SC57x Audio 2.0 with CDC Library approximate memory footprint is as follows:

Code memory:	22241 bytes
Data memory:	4300 bytes
Total:	26541 bytes or 25.9k

Note: The CLD SC57x Audio 2.0 with CDC Library is currently optimized for speed (not space).

CLD SC57x Audio 2.0 with CDC Library Scope and Intended Use

The CLD SC57x Audio 2.0 with CDC Library implements the USB Audio Device Class v2.0 and CDC/ACM required functionality to implement a USB Audio and CDC device, as well as providing time measurements functionality. The CLD SC57x Audio 2.0 with CDC Library is designed to be added to an existing User project, and as such only includes the functionality needed to implement the above mentioned USB, and timer keeping features. All other aspects of SC57x processor configuration must be implemented by the User code.

CLD Audio 2.0 with CDC (2-Channel) Example v1.00 Description

The CLD_Audio_2_0_w_CDC_Ex_v1_00 project provided with the CLD SC57x Audio 2.0 with CDC Library implements a basic USB audio loopback device supporting a single stereo input and stereo output, and a CDC Abstract Control model USB serial loopback. This example is designed to run on the ADSP-SC573 Ez-Board.

CLD SC57x Audio 2.0 with CDC Library API

The following CLD library API descriptions include callback functions that are called by the library based on USB events. The following color code is used to identify if the callback function is called from the USB interrupt service routine, or from mainline. The callback functions called from the USB interrupt service routine are also italicized so they can be identified when printed in black and white.

Callback called from the mainline context
Callback called from the USB interrupt service routine

cld_sc57x_audio_2_0_w_cdc_lib_init

```
CLD_RV cld_sc57x_audio_2_0_w_cdc_lib_init
(CLD_SC57x_Audio_2_0_w_CDC_Lib_Init_Params *
cld_sc57x_audio_2_0_w_cdc_lib_params)
```

Initializes the CLD SC57x Audio 2.0 with CDC Library.

Arguments

cld_sc57x_audio_2_0_w_cdc_lib_params	Pointer to a CLD_SC57x_Audio_2_0 _w_CDC_Lib_Init_Params structure that has been initialized with the User Application specific data.

Return Value

This function returns the CLD_RV type which represents the status of the CLD SC57x Audio 2.0 with CDC Library initialization process. The CLD_RV type has the following values:

CLD_SUCCESS	The library was initialized successfully
CLD_FAIL	There was a problem initializing the library
CLD_ONGOING	The library initialization is being processed

Details

The cld_sc57x_audio_2_0_w_cdc_lib_init function is called as part of the device initialization and must be repeatedly called until the function returns CLD_SUCCESS or CLD_FAIL. If CLD_FAIL is returned the library will output an error message identifying the cause of the failure using the cld_console UART if enabled by the User application. Once the library has been initialized successfully the main program loop can start.

The CLD_SC57x_Audio_2_0_w_CDC_Lib_Init_Params structure is described below:

```
typedef struct
{
    CLD_Boolean enable_dma;

    unsigned short vendor_id;
    unsigned short product_id;
    unsigned char usb_bus_max_power
    unsigned short device_descriptor_bcdDevice
    const char * p_usb_string_manufacturer;
    const char * p_usb_string_product;
```

```
const char * p_usb_string_serial_number;
const char * p_usb_string_configuration;
unsigned char audio_control_category_code;

CLD_SC57x_Audio_2_0_Control_Interrupt_Params *
              p_audio_control_interrupt_params;

unsigned char * p_unit_and_terminal_descriptors;
unsigned short  unit_and_terminal_descriptors_length;

CLD_SC57x_Audio_2_0_Stream_Interface_Params *
              p_audio_streaming_rx_interface_params;

CLD_SC57x_Audio_2_0_Stream_Interface_Params *
              p_audio_streaming_tx_interface_params;

CLD_USB_Transfer_Request_Return_Type (*fp_audio_stream_data_received)
              (CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Transfer_Request_Return_Type (*fp_audio_set_req_cmd)
              (CLD_SC57x_Audio_2_0_Cmd_Req_Parameters * p_req_params,
               CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Transfer_Request_Return_Type (*fp_audio_get_req_cmd)
              (CLD_SC57x_Audio_2_0_Cmd_Req_Parameters * p_req_params,
               CLD_USB_Transfer_Params * p_transfer_data);

void (*fp_audio_streaming_rx_endpoint_enabled) (CLD_Boolean enabled);
void (*fp_audio_streaming_tx_endpoint_enabled) (CLD_Boolean enabled);

CLD_Serial_Data_Bulk_Endpoint_Params * p_serial_data_rx_endpoint_params;
CLD_Serial_Data_Bulk_Endpoint_Params * p_serial_data_tx_endpoint_params;

CLD_SC57x_CDC_Notification_Endpoint_Params
              * p_notification_endpoint_params;

CLD_USB_Transfer_Request_Return_Type (*fp_serial_data_received)
              (CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Transfer_Request_Return_Type (*fp_cdc_cmd_send_encapsulated_cmd)
              (CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Transfer_Request_Return_Type (*fp_cdc_cmd_get_encapsulated_resp)
              (CLD_USB_Transfer_Params * p_transfer_data);

CLD_USB_Data_Received_Return_Type (*fp_cdc_cmd_set_line_coding)
              (CLD_SC57x_CDC_Line_Coding * p_line_coding);

CLD_RV (*fp_cdc_cmd_get_line_coding) (CLD_SC57x_CDC_Line_Coding *
              p_line_coding);

CLD_USB_Data_Received_Return_Type (*fp_cdc_cmd_set_control_line_state)
              (CLD_SC57x_CDC_Control_Line_State * p_control_line_state);

CLD_USB_Data_Received_Return_Type (*fp_cdc_cmd_send_break) (unsigned
              short duration);
unsigned char support_cdc_network_connection;
```

```
    unsigned short cdc_class_bcd_version;
    unsigned char  cdc_class_control_protocol_code;

    const char * p_usb_string_audio_control_interface;
    const char * p_usb_string_audio_streaming_out_interface;
    const char * p_usb_string_audio_streaming_in_interface;
    const char * p_usb_string_communication_class_interface;
    const char * p_usb_string_data_class_interface;

    unsigned char user_string_descriptor_table_num_entries;
    CLD_SC5x_Audio_2_0_Lib_User_String_Descriptors *
                 p_user_string_descriptor_table;

    unsigned short usb_string_language_id;

    void (*fp_cld_usb_event_callback) (CLD_USB_Event event);

    void (*fp_cld_lib_status) (unsigned short status_code,
                               void * p_additional_data,
                               unsigned short additional_data_size);

} CLD_SC57x_Audio_2_0_w_CDC_Lib_Init_Params;
```

A description of the CLD_SC57x_Audio_2_0_w_CDC_Lib_Init_Params structure elements is included below:

Structure Element	Description
enable_dma	Used to enable/disable USB DMA support. When set to CLD_TRUE DMA is enabled for transfers larger than 32 bytes that are aligned to a 4-byte boundary. Note: When DMA is enabled make sure the data buffers are located in un-cached memory to avoid cache coherency issues.
vendor_id	The 16-bit USB vendor ID that is returned to the USB Host in the USB Device Descriptor. USB Vendor ID's are assigned by the USB-IF and can be purchased through their website (www.usb.org).
product_id	The 16-bit product ID that is returned to the USB Host in the USB Device Descriptor.
usb_bus_max_power	USB Configuration Descriptor bMaxPower value (0 = self powered). Refer to the USB 2.0 protocol section 9.6.3.
device_descriptor_bcd_device	USB Device Descriptor bcdDevice value. Refer to the USB 2.0 protocol section 9.6.1.
p_usb_string_manufacturer	Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 3.0 Library to generate the Manufacturer USB String Descriptor. If the Manufacturer String Descriptor is not used set p_usb_string_manufacturer to CLD_NULL.
p_usb_string_product	Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the Product USB String Descriptor. If the Product String Descriptor is not used set p_usb_string_product to CLD_NULL.
p_usb_string_serial_number	Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the Serial Number

<table>
<tr><td></td><td>USB String Descriptor. If the Serial Number String Descriptor is not used set p_usb_string_serial_number to CLD_NULL.</td></tr>
<tr><td>p_usb_string_configuration</td><td>Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the Configuration USB String Descriptor. If the Configuration String Descriptor is not used set p_usb_string_configuration to CLD_NULL.</td></tr>
<tr><td>audio_control_category_code</td><td>Audio Control Interface Header Descriptor bCategory code
(refer to: USB Device Class Definition of Audio Devices v 2.0 section 4.7.2)</td></tr>
<tr><td>p_audio_control_interrupt_params</td><td>Pointer to the CLD_SC57x_Audio_2_0_Control_Interrupt_Params structure that describes the optional Interrupt IN endpoint.

Set to CLD_NULL if not required

The CLD_SC57x_Audio_2_0_Control_Interrupt_Params structure contains the following elements:

<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>endpoint_number</td><td>Sets the USB endpoint number of the Interrupt IN endpoint.

The endpoint number must be within the following range:
1 ≤ endpoint number ≤ 12. Any other endpoint number will result in the cld_sc57x_audio_2_0_lib_init function returning CLD_FAIL</td></tr>
<tr><td>b_interval_full_speed</td><td>Full-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
<tr><td>b_interval_high_speed</td><td>High-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
</table>
</td></tr>
<tr><td>p_unit_and_terminal_descriptors</td><td>Pointer to the Unit and Terminal Descriptors which are part of the Audio Control interface in the USB Configuration Descriptor.</td></tr>
<tr><td>unit_and_terminal_descriptors_length</td><td>The length of the Unit and Terminal Descriptors addressed by p_unit_and_terminal_descriptors.</td></tr>
<tr><td>p_audio_streaming_rx_interface_params</td><td>Pointer to a CLD_SC57x_Audio_2_0_Stream_Interface_Params structure that describes how the Isochronous IN endpoint and related USB Audio Streaming interface should be configured. The a CLD_SC57x_Audio_2_0_Stream_Interface_Params structure contains the following elements:

<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>endpoint_num</td><td>Sets the USB endpoint number of the Isochronous endpoint. The endpoint number must be within the following range:</td></tr>
</table>
</td></tr>
</table>

		1 ≤ endpoint num ≤ 12. Any other endpoint number will result in the cld_sc57x_audio_2_0_w_cdc_lib_init function returning CLD_FAIL
	max_packet_size_full_speed	Sets the Isochronous endpoint's max packet size when operating at Full Speed. The maximum max packet size is 1023 bytes.
	max_packet_size_high_speed	Sets the Isochronous endpoint's max packet size when operating at High Speed. The maximum max packet size is 1024 bytes.
	b_interval_full_speed	Full-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)
	b_interval_high_speed	High-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)
	b_terminal_link	The Terminal ID of the Terminal connected to this endpoint.
	b_format_type	Format type of the streaming interface
	bm_formats	Supported audio format bitmap.
	b_nr_channels	Number of audio channels supported by the streaming interface.
	i_channel_config	Index of the string descriptor describing the first physical channel. These strings should be defined in the user_string_descriptor_table.
	p_encoder_descriptor	Pointer to an optional USB Audio 2.0 Encoder descriptor.
	p_decoder_descriptor	Pointer to an optional USB Audio 2.0 Decoder descriptor.
	p_format_descriptor	Pointer to the format descriptor defined in the USB Device Class Definition for Audio Data Formats v2.0 specification.
	p_audio_stream_endpoint_data_descriptor	Pointer to the Audio Streaming endpoint data descriptor (See USB Device Class Definition for Audio Devices v2.0 section

<table>
<tr><td></td><td>4.10.1.2).</td></tr>
<tr><td>p_audio_streaming_tx_interface_params</td><td>Pointer to a CLD_SC57x_Audio_2_0_Stream_Interface_Params structure that describes how the Isochronous OUT endpoint and related USB Audio Streaming interface should be configured. Refer to the p_audio_streaming_rx_interface_params description (above) for information about the CLD_SC57x_Audio_2_0_Stream_Interface_Params structure.</td></tr>
<tr><td>fp_audio_stream_data_received</td><td>Pointer to the function that is called when the Isochronous OUT endpoint receives data. This function takes a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data') as a parameter.

The following CLD_USB_Transfer_Params structure elements are used to processed a Isochronous OUT transfer:

<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>num_bytes</td><td>The number of bytes to transfer to p_data_buffer before calling the fp_usb_out_transfer_complete callback function.

When the fp_audio_stream_data_received function is called num_bytes is set the number of bytes in the current Isochronous OUT packet. If the Isochronous OUT total transfer size is known, num_bytes can be set to the total transfer size and the CLD SC57x Audio 2.0 with CDC Library will complete the entire transfer before calling fp_audio_stream_data_received again. If num_bytes isn't modified the fp_audio_stream_data_received function will be called for each Isochronous OUT packet.</td></tr>
<tr><td>p_data_buffer</td><td>Pointer to the data buffer to store the received Isochronous OUT data. The size of the buffer should be greater than or equal to the value in num_bytes.</td></tr>
<tr><td>fp_usb_out_transfer_compelete</td><td>Function called when num_bytes of data has been transferred to the p_data_buffer memory.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>fp_transfer_aborted_callback</td><td>Function called if there is a problem transferring the requested Isochronous OUT data.</td></tr>
<tr><td>transfer_timeout_ms</td><td>Isochronous OUT transfer timeout in milliseconds. If the Isochronous OUT transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called.
Setting the timeout to 0 disables the timeout</td></tr>
</table>

The fp_audio_stream_data_received function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:
<table>
<tr><td>Return Value</td><td>Description</td></tr>
<tr><td>CLD_USB_TRANSFER_ACCEPT</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the Isochronous OUT data should be accepted using the p_transfer_data values.</td></tr>
<tr><td>CLD_USB_TRANSFER_PAUSE</td><td>Requests that the CLD SC57x Audio 2.0 with CDC Library pause the current transfer. This causes the Isochronous OUT endpoint to be nak'ed until the transfer is resumed by calling cld_sc57x_audio_2_0_lib_resume_paused_audio_data_transfer.</td></tr>
<tr><td>CLD_USB_TRANSFER_DISCARD</td><td>Requests that the CLD SC57x Audio 2.0 with CDC Library discard the number of bytes specified in p_transfer_params-> num_bytes. In this case the library accepts the Isochronous OUT data from the USB Host but discards the data</td></tr>
<tr><td>CLD_USB_TRANSFER_STALL</td><td>This notifies the CLD SC57x Audio 2.0 with CDC Library that there is an error and the Isochronous OUT endpoint should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_audio_set_req_cmd</td><td>Pointer to the function that is called when a USB Audio Device Class v2.0 Set Request is received. This function has a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data') , and a pointer to the CLD_SC57x_Audio_2_0_Cmd_Req_Parameters</td></tr>
</table>

(p_req_params) as its parameters.

The following CLD_SC57x_Audio_2_0_Cmd_Req_Parameters structure elements are used to processed a Set Request:

Structure Element	Description

req	Identifies the type of request. The valid types if requests are listed below:
	`CLD_REQ_CURRENT`
	`CLD_REQ_RANGE`
	`CLD_REQ_MEMORY`

recipient_is_interface	Identifies if the request was sent to an interface or Audio streaming endpoint
entity_id	The ID for the audio function being modified (Terminal ID, Unit ID, etc)
interface_or_endpoint_num	The interface or endpoint number for the request depending on the recipient specified by the recipient_is_interface parameter.
setup_packet_wValue	wValue field from the USB Setup Packet.

The following CLD_USB_Transfer_Params structure elements are used to processed a Set Request:

Structure Element	Description
num_bytes	The number of bytes from the Setup Packet wLength field, which is the number of bytes that will be transferred to p_data_buffer before calling the fp_usb_out_transfer_complete callback function.
p_data_buffer	Pointer to the data buffer to store the Set Reqeust data. The size of the buffer should be greater than or equal to the value in num_bytes.
fp_usb_out_transfer_complete	Function called when num_bytes of data has been written to the p_data_buffer memory.
fp_transfer_aborted_callback	Function called if there is a problem receiving the data, or if the transfer is interrupted.

<table>
<tr><td></td><td>
<table>
<tr><td>transfer_timeout_ms</td><td>Not used for Control Requests since the Host has the ability to interrupt any Control transfer.</td></tr>
</table>

The fp_audio_set_req_cmd function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:
<table>
<tr><td>Return Value</td><td>Description</td></tr>
<tr><td>CLD_USB_TRANSFER_ACCEPT</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the Set Request data should be accepted using the p_transfer_data values.</td></tr>
<tr><td>CLD_USB_TRANSFER_PAUSE</td><td>Requests that the CLD SC57x Audio 2.0 with CDC Library pause the Set Request transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_sc57x_audio_2_0_lib_ resume_paused_control_ transfer.</td></tr>
<tr><td>CLD_USB_TRANSFER_DISCARD</td><td>Requests that the CLD SC57x Audio 2.0 with CDC Library discard the number of bytes specified in p_transfer_params-> num_bytes. In this case the library accepts the Set Request from the USB Host but discards the data.</td></tr>
<tr><td>CLD_USB_TRANSFER_STALL</td><td>This notifies the CLD SC57x Audio 2.0 with CDC Library that there is an error and the request should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_audio_get_req_cmd</td><td>Pointer to the function that is called when a USB Audio Device Class v2.0 Get Request is received. This function has a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data') , and a pointer to the CLD_SC57x_Audio_2_0_Cmd_Req_Parameters (p_req_params) as its parameters.

The following CLD_SC57x_Audio_2_0_Cmd_Req_Parameters structure elements are used to processed a Get Request:
<table>
<tr><td>Structure Element</td><td>Description</td></tr>
</table>
</td></tr>
</table>

req	Identifies the type of request. The valid types if requests are listed below:
	`CLD_REQ_CURRENT`
	`CLD_REQ_RANGE`
	`CLD_REQ_MEMORY`

recipient_is_interface	Identifies if the request was sent to an interface or Audio streaming endpoint
entity_id	The ID for the audio function being accessed (Terminal ID, Unit ID, etc)
interface_or_endpoint_num	The interface or endpoint number for the request depending on the recipient specified by the recipient_is_interface parameter.
setup_packet_wValue	wValue field from the USB Setup Packet.

The following CLD_USB_Transfer_Params structure elements are used to processed a Set Request:

Structure Element	Description
num_bytes	The number of bytes from the Setup Packet wLength field, which is the number of bytes that the device can send from p_data_buffer before calling the fp_usb_out_transfer_ complete callback function.
p_data_buffer	Pointer to the data buffer used to source the Get Request data. The size of the buffer should be greater than or equal to the value in num_bytes.
fp_usb_in_transfer_complete	Function called when num_bytes of data has been transmitted to the USB Host.
fp_transfer_aborted_callback	Function called if there is a problem transmitting the data, or if the transfer is interrupted.
transfer_timeout_ms	Not used for Control Requests since the Host has the ability to interrupt any Control transfer.

The fp_audio_get_req_cmd function returns the

<table>
<tr><td></td><td>CLD_USB_Transfer_Request_Return_Type, which has the following values:
<table>
<tr><th>Return Value</th><th>Description</th></tr>
<tr><td>CLD_USB_TRANSFER_ACCEPT</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the Get Request data should be transmitted using the p_transfer_data values.</td></tr>
<tr><td>CLD_USB_TRANSFER_PAUSE</td><td>Requests that the CLD SC57x Audio 2.0 with CDC Library pause the Get Request transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_sc57x_audio_2_0_lib_ resume_paused_control_ transfer.</td></tr>
<tr><td>CLD_USB_TRANSFER_DISCARD</td><td>Requests that the CLD SC57x Audio 2.0 with CDC Library to return a zero length packet in response to the Get Request.</td></tr>
<tr><td>CLD_USB_TRANSFER_STALL</td><td>This notifies the CLD SC57x Audio 2.0 with CDC Library that there is an error and the request should be stalled.</td></tr>
</table></td></tr>
<tr><td>fp_audio_streaming_rx_endpoint_ enabled</td><td>Function called when the Isochronous OUT streaming interface is enabled/disabled by the USB Host using the Set Interface command.</td></tr>
<tr><td>fp_audio_streaming_tx_endpoint_ enabled</td><td>Function called when the Isochronous IN streaming interface is enabled/disabled by the USB Host using the Set Interface command.</td></tr>
<tr><td>p_serial_data_rx_endpoint_params</td><td>Pointer to a CLD_Serial_Data_Bulk_Endpoint_Params structure that describes how the Bulk OUT endpoint should be configured. The CLD_Serial_Data_Bulk_Endpoint_Params structure contains the following elements:
<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>endpoint_num</td><td>Sets the USB endpoint number of the Bulk endpoint. The endpoint number must be within the following range: 1 ≤ endpoint_num ≤ 12. Any other endpoint number will result in the cld_sc57x_audio_2_0_w_cdc_ lib_init function returning CLD_FAIL</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Bulk endpoint's max packet size when operating at Full Speed. The valid Bulk</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td></td><td>endpoint max packet sizes are as follows:
8, 16, 32, and 64 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Bulk endpoint's max packet size when operating at High Speed. The valid Bulk endpoint max packet sizes are as follows:
8, 16, 32, 64 and 512 bytes.</td></tr>
</table></td></tr>
<tr><td>p_serial_data_tx_endpoint_params</td><td>Pointer to a CLD_Serial_Data_Bulk_Endpoint_Params structure that describes how the Bulk IN endpoint should be configured. The CLD_Serial_Data_Bulk_Endpoint_Params structure contains the following elements:

<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>endpoint_num</td><td>Sets the USB endpoint number of the Bulk endpoint. The endpoint number must be within the following range:
1 ≤ endpoint_num ≤ 12. Any other endpoint number will result in the cld_sc57x_audio_2_0_w_cdc_lib_init function returning CLD_FAIL</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Bulk endpoint's max packet size when operating at Full Speed. The valid Bulk endpoint max packet sizes are as follows:
8, 16, 32, and 64 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Bulk endpoint's max packet size when operating at High Speed. The valid Bulk endpoint max packet sizes are as follows:
8, 16, 32, 64 and 512 bytes.</td></tr>
</table></td></tr>
<tr><td>p_notification_endpoint_params</td><td>Pointer to a CLD_SC57x_CDC_Notification_Endpoint_Params structure that describes how the Interrupt IN endpoint should be configured. The CLD_ SC57x_CDC_Notification_Endpoint_Params structure contains the following elements:

<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>endpoint_num</td><td>Sets the USB endpoint number of the Interrupt endpoint. The endpoint number must be within the following range:
1 ≤ endpoint num ≤ 12. Any</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td></td><td>other endpoint number will result in the cld_sc57x_audio_2_0_w_cdc_lib_init function returning CLD_FAIL</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Interrupt endpoint's max packet size when operating at Full Speed. The maximum max packet size is 64 bytes.</td></tr>
<tr><td>polling_interval_full_speed</td><td>Full-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Interrupt endpoint's max packet size when operating at High Speed. The maximum max packet size
1024 bytes.</td></tr>
<tr><td>polling_interval_high_speed</td><td>High-Speed polling interval in the USB Endpoint Descriptor. (See USB 2.0 section 9.6.6)</td></tr>
</table></td></tr>
<tr><td>fp_serial_data_received</td><td>Pointer to the function that is called when the Bulk OUT endpoint receives data. This function takes a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data')as a parameter.

The following CLD_USB_Transfer_Params structure elements are used to processed a Bulk OUT transfer:

<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>num_bytes</td><td>The number of bytes to transfer to the p_data_buffer before calling the fp_usb_out_transfer_ complete callback function.

When the fp_serial_data_received function is called num_bytes is set the number of bytes in the current Bulk OUT packet. If the Bulk OUT total transfer size is known num_bytes can be set to the transfer size, and the CLD SC57x Audio 2.0 with CDC Library will complete the</td></tr>
</table></td></tr>
</table>

	entire bulk transfer without calling fp_serial_data_received again. If num_bytes isn't modified the fp_serial_data_received function will be called for each Bulk OUT packet.
p_data_buffer	Pointer to the data buffer to store the received Bulk OUT data. The size of the buffer should be greater than or equal to the value in num_bytes.
fp_usb_out_transfer_complete	Function called when num_bytes of data has been transferred to the p_data_buffer memory.
fp_transfer_aborted_callback	Function called if there is a problem transferring the requested Bulk OUT data.
transfer_timeout_ms	Bulk OUT transfer timeout in milliseconds. If the Bulk OUT transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_ callback is called. Setting the timeout to 0 disables the timeout

The fp_serial_data_received function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:

Return Value	Description
CLD_USB_TRANSFER_ACCEPT	Notifies the CLD SC57x Audio 2.0 with CDC Library that the Bulk OUT data should be accepted using the p_transfer_data values.
CLD_USB_TRANSFER_PAUSE	Requests that the CLD SC57x Audio 2.0 with CDC Library pause the current transfer. This causes the Bulk OUT endpoint to be nak'ed until the transfer is resumed by calling cld_sc57x_audio_2_0_w_cdc_ lib_resume_paused_serial_data _transfer.
CLD_USB_TRANSFER_DISCARD	Requests that the CLD SC57x

<table>
<tr><td></td><td><table>
<tr><td></td><td>Audio 2.0 with CDC Library discard the number f bytes specified in p_transfer_params-> num_bytes. In this case the library accepts the Bulk OUT data from the USB Host but discards the data. This is similar to the concepts of frame dropping in audio/video applications.</td></tr>
<tr><td>CLD_USB_TRANSFER_STALL</td><td>This notifies the CLD SC57x Audio 2.0 with CDC Library that there is an error and the Bulk OUT endpoint should be stalled.</td></tr>
</table></td></tr>
<tr><td>fp_cdc_cmd_send_encapsulated_cmd</td><td>Pointer to the function that is called when a CDC Send Encapsulated Command request is received. This function a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data') as its parameters.

The following CLD_USB_Transfer_Params structure elements are used to processed a Send Encapsulated Command transfer:

<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>num_bytes</td><td>The number of bytes from the Setup Packet wLength field, which is the number of bytes that will be transferred to p_data_buffer before calling the fp_usb_out_transfer_ complete callback function.</td></tr>
<tr><td>p_data_buffer</td><td>Pointer to the data buffer to store the Send Encapsulated Command data. The size of the buffer should be greater than or equal to the value in num_bytes.</td></tr>
<tr><td>fp_usb_out_transfer_complete</td><td>Function called when num_bytes of data has been written to the p_data_buffer memory.</td></tr>
<tr><td>fp_transfer_aborted_callback</td><td>Function called if there is a problem receiving the data, or if the transfer is interrupted.</td></tr>
<tr><td>transfer_timeout_ms</td><td>Not used for Control Requests since the Host has the ability to interrupt any</td></tr>
</table></td></tr>
</table>

	Control transfer.

The fp_cdc_cmd_send_encapsulated_cmd function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:

Return Value	Description
CLD_USB_TRANSFER_ACCEPT	Notifies the CLD SC57x Audio 2.0 with CDC Library that the Send Encapsulated Command data should be accepted using the p_transfer_data values.
CLD_USB_TRANSFER_PAUSE	Requests that the CLD SC57x Audio 2.0 with CDC Library pause the Set Report transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_control_transfer.
CLD_USB_TRANSFER_DISCARD	Requests that the CLD SC57x Audio 2.0 with CDC Library discard the number of bytes specified in p_transfer_params->num_bytes. In this case the library accepts the Send Encapsulated Command from the USB Host but discards the data. This is similar to the concepts of frame dropping in audio/video applications.
CLD_USB_TRANSFER_STALL	This notifies the CLD SC57x Audio 2.0 with CDC Library that there is an error and the request should be stalled.

fp_cdc_cmd_get_encapsulated_resp

Pointer to the function that is called when a CDC Get Encapsulated Response request is received. This function takes a pointer to the CLD_USB_Transfer_Params structure ('p_transfer_data') as its parameters.

The following CLD_USB_Transfer_Params structure elements are used to processed a Get Encapsulated Response request:

Structure Element	Description
num_bytes	The number of bytes from the Setup Packet wLength

	field.
p_data_buffer	Pointer to the data buffer to source the Get Encapsulated Response data. The size of the buffer should be greater than or equal to the value in num_bytes.
fp_usb_in_transfer_complete	Function called when Get Encapsulated Response data has been transferred to the Host.
fp_transfer_aborted_callback	Function called if there is a problem transferring the data, or if the transfer is interrupted
transfer_timeout_ms	Not used for Control Requests since the Host has the ability to interrupt any Control transfer.

The fp_cdc_cmd_get_encapsulated_resp function returns the CLD_USB_Transfer_Request_Return_Type, which has the following values:

Return Value	Description
CLD_USB_TRANSFER_ACCEPT	Notifies the CLD SC57x Audio 2.0 with CDC Library that the Get Encapsulated Response data should be transferred using the p_transfer_data values.
CLD_USB_TRANSFER_PAUSE	Requests that the CLD SC57x Audio 2.0 with CDC Library pause the Get Encapsulated Response transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_sc57x_audio_2_0_w_cdc_lib_resume_ paused_control_transfer.
CLD_USB_TRANSFER_DISCARD	Requests that the CLD SC57x Audio 2.0 with CDC Library to return a zero length packet in response to the Get Encapsulated Response request.
CLD_USB_TRANSFER_STALL	This notifies the CLD SC57x Audio 2.0 with CDC Library that there is an error and the

<table>
<tr><td></td><td><table><tr><td></td><td>request should be stalled.</td></tr></table></td></tr>
<tr><td>fp_cdc_cmd_set_line_coding</td><td>Pointer to the function that is called when a CDC Set Line Coding request is received. This function takes a pointer to the Host specified CLD_CDC_Line_Coding structure ('p_line_coding') as its parameters.

The following CLD_CDC_Line_Coding structure elements are used to processed a Set Line Coding request:<table><tr><td>Structure Element</td><td>Description</td></tr><tr><td>data_terminal_rate</td><td>Serial baud rate in bits per second.</td></tr><tr><td>num_stop_bits</td><td>CDC Number of stop bits.
0 = 1 stop bit
1 = 1.5 stop bits
2 = 2 stop bits.</td></tr><tr><td>parity</td><td>CDC parity setting
0 = None
1 = Odd
2 = Even
3 = Mark
4 = Space</td></tr><tr><td>num_data_bits</td><td>CDC Number of data bits (only 5, 6, 7, 8 and 16 are valid).</td></tr></table>
The fp_cdc_cmd_set_line_coding function returns the CLD_USB_Data_Received_Return_Type, which has the following values:<table><tr><td>Return Value</td><td>Description</td></tr><tr><td>CLD_USB_DATA_GOOD</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is valid.</td></tr><tr><td>CLD_USB_DATA_BAD_STALL</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is invalid, and should be stalled.</td></tr></table></td></tr>
<tr><td>fp_cdc_cmd_get_line_coding</td><td>Pointer to the function that is called when a CDC Get Line Coding request is received. This function takes a pointer to CLD_CDC_Line_Coding structure ('p_line_coding') as its parameters. The User firmware should set the p_line_coding structure values based on its active settings.

The following CLD_CDC_Line_Coding structure elements are used to processed a Get Line Coding request:<table><tr><td>Structure Element</td><td>Description</td></tr><tr><td>data_terminal_rate</td><td>Serial baud rate in bits per second.</td></tr><tr><td>num_stop_bits</td><td>CDC Number of stop bits.
0 = 1 stop bit
1 = 1.5 stop bits
2 = 2 stop bits.</td></tr><tr><td>parity</td><td>CDC parity setting</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>0 = None
1 = Odd
2 = Even
3 = Mark
4 = Space</td></tr>
<tr><td>num_data_bits</td><td>CDC Number of data bits
(only 5, 6, 7, 8 and 16 are valid).</td></tr>
</table>

The fp_cdc_cmd_get_line_coding function returns CLD_RV, which has the following values:
<table>
<tr><td>Return Value</td><td>Description</td></tr>
<tr><td>CLD_SUCCESS</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is valid and the p_line_coding value should be returned to the Host.</td></tr>
<tr><td>CLD_FAIL</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is invalid, and should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_cdc_cmd_set_control_line_state</td><td>Pointer to the function that is called when a CDC Set Control Line State request is received. This function takes a pointer to the Host specified CLD_CDC_Control_Line_State structure ('p_control_line_state') as its parameters.

The following CLD_CDC_Control_Line_State structure elements are used to processed a Set Control Line State request:
<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>dte_present</td><td>Controls if the DTE is present or not. This corresponds to the RS-232 DTR signal.
0 = Not Present
1 = Present</td></tr>
<tr><td>activate_carrier</td><td>Carrier control used in half duplex serial links. This signal corresponds to the RS-232 RTS signal.
0 = Disabled
1 = Active</td></tr>
</table>

The fp_cdc_cmd_set_control_line_state function returns the CLD_USB_Data_Received_Return_Type, which has the following values:
<table>
<tr><td>Return Value</td><td>Description</td></tr>
<tr><td>CLD_USB_DATA_GOOD</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is valid.</td></tr>
<tr><td>CLD_USB_DATA_BAD_STALL</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is invalid, and should be stalled.</td></tr>
</table>
</td></tr>
<tr><td>fp_cdc_cmd_send_break</td><td>Pointer to the function that is called when a CDC Send Break request is received. This function takes the host specified duration in milliseconds ('duration') as its parameters.</td></tr>
</table>

<table>
<tr><td></td><td>The fp_cdc_cmd_send_break function returns the CLD_USB_Data_Received_Return_Type, which has the following values:
<table>
<tr><th>Return Value</th><th>Description</th></tr>
<tr><td>CLD_USB_DATA_GOOD</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is valid.</td></tr>
<tr><td>CLD_USB_DATA_BAD_STALL</td><td>Notifies the CLD SC57x Audio 2.0 with CDC Library that the request is invalid, and should be stalled.</td></tr>
</table></td></tr>
<tr><td>support_cdc_network_connection</td><td>Tells the CLD SC57x Audio 2.0 with CDC Library if the User firmware supports the CDC Network Connection Notification.
0 = Not supported
1 = Supported</td></tr>
<tr><td>cdc_class_bcd_version</td><td>CDC Class Version in BCD. Returned in the CDC Header Functional Descriptor's bcdCDC field. (refer to the CDC specification v1.2 section 5.3.2.1).</td></tr>
<tr><td>cdc_class_control_protocol_code</td><td>Value used in the CDC interface descriptor's bInterfaceProtocol field. The valid CDC Protocol codes are defined in the CDC v.1.2 specification in Table 5 on page 13.</td></tr>
<tr><td>p_usb_string_audio_control_interface</td><td>Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the Audio Control Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL.</td></tr>
<tr><td>p_usb_string_audio_streaming_out_interface</td><td>Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the Audio OUT Streaming Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL.</td></tr>
<tr><td>p_usb_string_audio_streaming_in_interface</td><td>Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the Audio IN Streaming Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL.</td></tr>
<tr><td>p_usb_string_communication_class_interface</td><td>Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the CDC Interface USB String Descriptor. If the CDC Interface String Descriptor is not used set p_usb_string_communication_class_interface to CLD_NULL.</td></tr>
<tr><td>p_usb_string_data_class_interface</td><td>Pointer to the null-terminated string. This string is used by the CLD SC57x Audio 2.0 with CDC Library to generate the Data Class Interface USB String Descriptor. If the Data Interface String Descriptor is not used set p_usb_string_data_class_interface to CLD_NULL.</td></tr>
<tr><td>user_string_descriptor_table_num_entries</td><td>The number of entries in the array of CLD_SC57x_Audio_2_0_Lib_User_String_Descriptors structures addressed by p_user_string_descriptor_table. Set to 0 if p_user_string_descriptor_table is set to CLD_NULL.</td></tr>
<tr><td>p_user_string_descriptor_table</td><td>Pointer to an array of CLD_SC57x_Audio_2_0_Lib_User_String_Descriptors structures used to define any custom User defined USB string descriptors. This table is used to define any</td></tr>
</table>

<table>
<tr><td></td><td>USB String descriptors for any string descriptor indexes that are used in the Terminal or Unit Descriptors.

Set to CLD_NULL is not used.

The CLD_SC57x_Audio_2_0_Lib_User_String_Descriptors structure elements are explained below:
<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>string_index</td><td>The USB String Descriptor index for the string. The string_index value is set to the index specified in the Terminal or Unit Descriptor associated with this string.</td></tr>
<tr><td>p_string</td><td>Pointer to a null terminated string.</td></tr>
</table></td></tr>
<tr><td>usb_string_language_id</td><td>16-bit USB String Descriptor Language ID Code as defined in the USB Language Identifiers (LANGIDs) document (www.usb.org/developers/docs/USB_LANGIDs.pdf).
0x0409 = English (United States)</td></tr>
<tr><td>fp_cld_usb_event_callback</td><td>Function that is called when one of the following USB events occurs. This function has a single CLD_USB_Event parameter.

Note: This callback can be called from the USB interrupt or mainline context depending on which USB event was detected. The CLD_USB_Event values in the table below are highlighted to show the context the callback is called for each event.

The CLD_USB_Event has the following values:
<table>
<tr><th>Return Value</th><th>Description</th></tr>
<tr><td>CLD_USB_CABLE_CONNECTED</td><td>USB Cable Connected.</td></tr>
<tr><td>CLD_USB_CABLE_DISCONNECTED</td><td>USB Cable Disconnected</td></tr>
<tr><td>CLD_USB_ENUMERATED_CONFIGURED</td><td>USB device enumerated (USB Configuration set to a non-zero value)</td></tr>
<tr><td>CLD_USB_UN_CONFIGURED</td><td>USB Configuration set to 0</td></tr>
<tr><td>CLD_USB_BUS_RESET</td><td>USB Bus reset received</td></tr>
</table></td></tr>
<tr><td>fp_cld_lib_status</td><td>Pointer to the function that is called when the CLD library has a status to report. This function has the following parameters:

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>status_code</td><td>16-bit status code. If the most significant bit is a '1' the status being reported is an Error.</td></tr>
<tr><td>p_additional_data</td><td>Pointer to additional data included with the status.</td></tr>
<tr><td>additional_data_size</td><td>The number of bytes in the specified additional data.</td></tr>
</table></td></tr>
</table>

	If the User plans on processing outside of the fp_cld_lib_status function they will need to copy the additional data to a User buffer.

cld_sc57x_audio_2_0_w_cdc_lib_main

```
void cld_sc57x_audio_2_0_w_cdc_lib_main (void)
```

CLD SC57x Audio 2.0 with CDC Library mainline function

Arguments

None

Return Value

None.

Details

The cld_sc57x_audio_2_0_w_cdc_lib_main function is the CLD SC57x Audio 2.0 with CDC Library mainline function that must be called in every iteration of the main program loop in order for the library to function properly.

cld_sc57x_audio_2_0_w_cdc_lib_transmit_audio_data

```
CLD_USB_Data_Transmit_Return_Type
cld_sc57x_audio_2_0_w_cdc_lib_transmit_audio_data
      (CLD_USB_Transfer_Params * p_transfer_data)
```

CLD SC57x Audio 2.0 with CDC Library function used to send data over the Isochronous IN endpoint.

Arguments

p_transfer_data	Pointer to a CLD_USB_Transfer_Params structure used to describe the data being transmitted.

Return Value

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Isochronous IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

CLD_USB_TRANSMIT_SUCCESSFUL	The library has started the requested Isochronous IN transfer.
CLD_USB_TRANSMIT_FAILED	The library failed to start the requested Isochronous IN transfer. This will happen if the Isochronous IN endpoint is busy, or if the p_transfer_data-> data_buffer is set to CLD_NULL

Details

The cld_sc57x_audio_2_0_w_cdc_lib_transmit_audio_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Isochronous IN endpoint.

The CLD_USB_Transfer_Params structure is described below.

```
typedef struct
{
    unsigned long num_bytes;
    unsigned char * p_data_buffer;
    union
    {
        CLD_USB_Data_Received_Return_Type (*fp_usb_out_transfer_complete)(void);
        void (*fp_usb_in_transfer_complete) (void);
    }callback;
    void (*fp_transfer_aborted_callback) (void);
    CLD_Time transfer_timeout_ms;
} CLD_USB_Transfer_Params;
```

A description of the CLD_USB_Transfer_Params structure elements is included below:

Structure Element	Description
num_bytes	The number of bytes to transfer to the USB Host. Once the specified number of bytes has been transmitted the fp_usb_in_transfer_complete callback function will be called.
p_data_buffer	Pointer to the data to be sent to the USB Host. This buffer must include the number of bytes specified by num_bytes.
fp_usb_out_transfer_complete	Not Used for Isochronous IN transfers
fp_usb_in_transfer_complete	Function called when the specified data has been transmitted to the USB Host. This function pointer can be set to CLD_NULL if the User application doesn't want to be notified when the data has been transferred.
fp_transfer_aborted_callback	Function called if there is a problem transmitting the data to the USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs.
transfer_timeout_ms	Isochronous IN transfer timeout in milliseconds. If the Isochronous IN transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called. Setting the timeout to 0 disables the timeout

cld_sc57x_audio_2_0_w_cdc_lib_transmit_interrupt_data

```
CLD_USB_Data_Transmit_Return_Type
cld_sc57x_audio_2_0_w_cdc_lib_transmit_interrupt_data
      (CLD_USB_Transfer_Params * p_transfer_data)
```

CLD SC57x Audio 2.0 with CDC Library function used to send data over the optional Interrupt IN endpoint.

Arguments

p_transfer_data	Pointer to a CLD_USB_Transfer_Params structure used to describe the data being transmitted.

Return Value

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Interrupt IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

CLD_USB_TRANSMIT_SUCCESSFUL	The library has started the requested Interrupt IN transfer.
CLD_USB_TRANSMIT_FAILED	The library failed to start the requested Interrupt IN transfer. This will happen if the Interrupt IN endpoint is disabled, is busy, if the number of bytes isn't 6, or if the p_transfer_data-> data_buffer is set to CLD_NULL

Details

The cld_sc57x_audio_2_0_w_cdc_lib_transmit_interrupt_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Isochronous IN endpoint.

According to the USB Device Class Definition for Audio Devices v2.0 the Interrupt IN message is a fixed size (6 bytes), so if the User tries to transfer more, or less, then 6 bytes the cld_sc57x_audio_2_0_w_cdc_lib_transmit_interrupt_data function will return CLD_USB_TRANSMIT_FAILED.

The CLD_USB_Transfer_Params structure is described below.

```
typedef struct
{
    unsigned long num_bytes;
    unsigned char * p_data_buffer;
    union
    {
        CLD_USB_Data_Received_Return_Type (*fp_usb_out_transfer_complete)(void);
        void (*fp_usb_in_transfer_complete) (void);
    }callback;
    void (*fp_transfer_aborted_callback) (void);
    CLD_Time transfer_timeout_ms;
} CLD_USB_Transfer_Params;
```

A description of the CLD_USB_Transfer_Params structure elements is included below:

Structure Element	Description
num_bytes	The number of bytes to transfer to the USB Host. Once the specified number of bytes has been transmitted the fp_usb_in_transfer_complete callback function will be called.
p_data_buffer	Pointer to the data to be sent to the USB Host. This buffer must include the number of bytes specified by num_bytes.
fp_usb_out_transfer_complete	Not Used for Interrupt IN transfers
fp_usb_in_transfer_complete	Function called when the specified data has been transmitted to the USB Host. This function pointer can be set to CLD_NULL if the User application doesn't want to be notified when the data has been transferred.
fp_transfer_aborted_callback	Function called if there is a problem transmitting the data to the

	USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs.
transfer_timeout_ms	Interrupt IN transfer timeout in milliseconds. If the Interrupt IN transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called. Setting the timeout to 0 disables the timeout

cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_audio_data_transfer

```
void cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_audio_data_transfer (void)
```

CLD SC57x Audio 2.0 with CDC Library function used to resume a paused Isochronous OUT transfer.

Arguments
None

Return Value
None.

Details
The cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_audio_data_transfer function is used to resume an Isochronous OUT transfer that was paused by the `fp_audio_stream_data_received` function returning CLD_USB_TRANSFER_PAUSE. When called the cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_audio_data_transfer function will call the User application's fp`_audio_stream_data_received` function passing the CLD_USB_Transfer_Params of the original paused transfer. The `fp_audio_stream_data_received` function can then choose to accept, discard, or stall the Isochronous OUT request.

cld_ sc57x_audio_2_0_w_cdc_lib_transmit_serial_data

```
CLD_USB_Data_Transmit_Return_Type cld_
sc57x_audio_2_0_w_cdc_lib_transmit_serial_data  (CLD_USB_Transfer_Params *
p_transfer_data)
```

CLD SC57x Audio 2.0 with CDC Library function used to send serial over the Bulk IN endpoint.

Arguments

p_transfer_data	Pointer to a CLD_USB_Transfer_Params structure used to describe the data being transmitted.

Return Value

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Bulk IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

CLD_USB_TRANSMIT_SUCCESSFUL	The library has started the requested Bulk IN transfer.
CLD_USB_TRANSMIT_FAILED	The library failed to start the requested Bulk IN transfer. This will happen if the Bulk IN endpoint is busy, or if the p_transfer_data-> data_buffer is set to NULL

Details

The cld_ sc57x_audio_2_0_w_cdc_lib_transmit_serial_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Bulk IN endpoint.

The CLD_USB_Transfer_Params structure is described below.

```
typedef struct
{
    unsigned long num_bytes;
    unsigned char * p_data_buffer;
    union
    {
        CLD_USB_Data_Received_Return_Type (*fp_usb_out_transfer_complete)(void);
        void (*fp_usb_in_transfer_complete) (void);
    }callback;
    void (*fp_transfer_aborted_callback) (void);
    void transfer_timeout_ms;
} CLD_USB_Transfer_Params;
```

A description of the CLD_USB_Transfer_Params structure elements is included below:

Structure Element	Description
num_bytes	The number of bytes to transfer to the USB Host. Once the specified number of bytes have been transmitted the usb_in_transfer_complete callback function will be called.
p_data_buffer	Pointer to the data to be sent to the USB Host. This buffer must include the number of bytes specified by num_bytes.
fp_usb_out_transfer_complete	Not Used for Bulk IN transfers

fp_usb_in_transfer_complete	Function called when the specified data has been transmitted to the USB host. This function pointer can be set to CLD_NULL if the User application doesn't want to be notified when the data has been transferred.
fp_transfer_aborted_callback	Function called if there is a problem transmitting the data to the USB Host. This function can be set to CLD_NULL if the User application doesn't want to be notified if a problem occurs.
transfer_timeout_ms	USB transfer timeout in milliseconds. If the Bulk IN transfer takes longer then this timeout the transfer is aborted and the fp_transfer_aborted_callback is called. Setting the timeout to 0 disables the timeout

cld_ sc57x_audio_2_0_w_cdc_lib_send_network_connection_state

```
CLD_USB_Data_Transmit_Return_Type cld_
sc57x_audio_2_0_w_cdc_lib_send_network_connection_state
      (CLD_SC57x_CDC_Lib_Network_Connection_State state)
```

CLD SC57x Audio 2.0 with CDC Library function used to send the CDC Network Connection Notification using the Interrupt IN endpoint.

Arguments

`state`	The Network Connection state to send to the Host.

Return Value

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Interrupt IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

`CLD_USB_TRANSMIT_SUCCESSFUL`	The library has started the requested Interrupt IN transfer.
`CLD_USB_TRANSMIT_FAILED`	The library failed to start the requested Interrupt IN transfer. This will happen if the Interrupt IN endpoint is busy, or if the p_transfer_data-> data_buffer is set to NULL

Details

The cld_ sc57x_audio_2_0_w_cdc_lib_send_network_connection_state function transmits the network connection state specified by the state parameter to the USB Host using the Device's Interrupt IN endpoint.

The CLD_SC57x_CDC_Lib_Network_Connection_State enum values are listed below.

Enum Element	Description
`CLD_CDC_NETWORK_DISCONNECTED`	The CDC Network is disconnected.
`CLD_CDC_NETWORK_CONNECTED`	The CDC Network is connected.

cld_ sc57x_audio_2_0_w_cdc_lib_send_response_available

```
CLD_USB_Data_Transmit_Return_Type cld_
sc57x_audio_2_0_w_cdc_lib_send_response_available
      (CLD_SC57x_CDC_Lib_Network_Connection_State state)
```

CLD SC57x Audio 2.0 with CDC Library function used to send the CDC Response Available Notification using the Interrupt IN endpoint.

Arguments

None.

Return Value

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Interrupt IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

`CLD_USB_TRANSMIT_SUCCESSFUL`	The library has started the requested Interrupt IN transfer.
`CLD_USB_TRANSMIT_FAILED`	The library failed to start the requested Interrupt IN transfer. This will happen if the Interrupt IN endpoint is busy, or if the p_transfer_data-> data_buffer is set to NULL

Details

The cld_ sc57x_audio_2_0_w_cdc_lib_send_response_available function transmits the CDC Response Available Notification to the USB Host using the Device's Interrupt IN endpoint. The Host can then request the response data using a Send Encapsulated Response Control endpoint request.

cld_ sc57x_audio_2_0_w_cdc_lib_send_serial_state

```
CLD_USB_Data_Transmit_Return_Type cld_
sc57x_audio_2_0_w_cdc_lib_send_serial_state     (CLD_CDC_Serial_State *
p_serial_state)
```

CLD SC57x Audio with CDC Library function used to send the CDC Serial State Notification using the Interrupt IN endpoint.

Arguments

p_serial_state	Pointer to a CLD_CDC_Serial_State structure used to report the current state of the emulated serial port to the USB Host.

Return Value

This function returns the CLD_USB_Data_Transmit_Return_Type type which reports if the Interrupt IN transmission request was started. The CLD_USB_Data_Transmit_Return_Type type has the following values:

CLD_USB_TRANSMIT_SUCCESSFUL	The library has started the requested Interrupt IN transfer.
CLD_USB_TRANSMIT_FAILED	The library failed to start the requested Interrupt IN transfer. This will happen if the Interrupt IN endpoint is busy, or if the p_transfer_data-> data_buffer is set to NULL

Details

The cld_ sc57x_audio_2_0_w_cdc_lib_send_serial_data function transmits the current CDC Serial State specified by the p_serial_state parameter to the USB Host using the Device's Interrupt IN endpoint.

The CLD CLD_CDC_Serial_State structure is described below.

```
typedef struct
{
    union
    {
        struct
        {
            unsigned short rx_carrier       : 1;
            unsigned short tx_carrier       : 1;
            unsigned short break_detect     : 1;
            unsigned short ring_signal      : 1;
            unsigned short framing_error    : 1;
            unsigned short parity_error     : 1;
            unsigned short rx_data_overrun  : 1;
            unsigned short reserved         : 9;
        } bits;
        unsigned short state;
    } u;
} CLD_CDC_Serial_State;
```

A description of the CLD_CDC_Serial_State structure elements is included below:

Structure Element	Description
rx_carrier	State of receiver carrier detection mechanism of device. This signal corresponds to V.24 signal 109 and RS-232 signal DCD.
tx_carrier	State of transmission carrier. This signal corresponds to V.24 signal 106 and RS-232 signal DSR.
break_detect	State of break detection mechanism of the device.
ring_signal	State of ring signal detection of the device.
framing_error	A framing error has occurred.
parity_error	A parity error has occurred.
rx_data_overrun	Received data has been discarded due to overrun in the device.

Once the Serial State Notification has been sent the device re-evaluates the above fields. For the tx_carrier and rx_carrier the Serial State Notification is sent when these signals change. For the remaining fields once the Serial State Notification has been sent their value is reset to zero, and will be sent to the Host again when the field is set to a '1'.

cld_ sc57x_audio_2_0_w_cdc_lib_resume_paused_serial_data_transfer

```
void cld_ sc57x_audio_2_0_w_cdc_lib_paused_resume_serial_data_transfer (void)
```

CLD SC57x Audio 2.0 with CDC Library function used to resume a paused Serial Data Bulk OUT transfer.

Arguments

None

Return Value

None.

Details

The cld_ sc57x_audio_2_0_w_cdc_lib_resume_paused_serial_data_transfer function is used to resume a Bulk OUT transfer that was paused by the `fp_serial_data_received` function returning CLD_USB_TRANSFER_PAUSE. When called the cld_ sc57x_audio_2_0_w_cdc_lib_resume_paused_serial_data_transfer function will call the User application's `fp_serial_data_received` function passing the CLD_USB_Transfer_Params of the original paused transfer. The `fp_serial_data_received` function can then chose to accept, discard, or stall the Bulk OUT request.

cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_control_transfer

```
void cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_control_transfer (void)
```

CLD SC57x Audio 2.0 with CDC Library function used to resume a paused Control endpoint transfer.

Arguments
None

Return Value
None.

Details
The cld_sc57x_audio_2_0_w_cdc_lib_resume_paused_control_transfer function is used to resume a Control transfer that was paused by the `fp_audio_set_req_cmd`, `fp_audio_get_req_cmd`, `fp_cdc_cmd_send_encapsulated_cmd` or `fp_cdc_cmd_get_encapsulated_resp` function returning CLD_USB_TRANSFER_PAUSE. When called the cld_sc57x_audio_2_0_lib_resume_paused_control_transfer function will call the User application's fp`_audio_set_req_cmd`, `fp_audio_get_req_cmd`, `fp_cdc_cmd_send_encapsulated_cmd` or `fp_cdc_cmd_get_encapsulated_resp` function passing the CLD_USB_Transfer_Params of the original paused transfer. The User function can then chose to accept, discard, or stall the Control endpoint request.

cld_ lib_usb_connect

```
void cld_lib_usb_connect (void)
```

CLD SC57x Audio 2.0 with CDC Library function used to connect to the USB Host.

Arguments
None.

Return Value
None.

Details
The cld_lib_usb_connect function is called after the CLD SC57x Audio 2.0 with CDC Library has been initialized to connect the USB device to the Host.

cld_ lib_usb_disconnect

```
void cld_lib_usb_disconnect (void)
```

CLD SC57x Audio 2.0 with CDC Library function used to disconnect from the USB Host.

Arguments
None.

Return Value
None.

Details
The cld_lib_usb_disconnect function is called after the CLD SC57x Audio 2.0 with CDC Library has been initialized to disconnect the USB device to the Host.

cld_time_125us_tick

```
void cld_time_125us_tick (void)
```

CLD Audio 2.0 w/CDC Library timer function that should be called once per 125 microseconds.

Arguments
None

Return Value
None.

Details
This function should be called once every 125 microseconds in order to the CLD to processed periodic events.

cld_usb0_isr_callback & cld_usb1_isr_callback

```
void cld_usb0_isr_callback (void)
void cld_usb1_isr_callback (void)
```

CLD Audio 2.0 w/CDC Library USB interrupt service routines

Arguments
None

Return Value
None.

Details

These USB ISR functions should be called from the corresponding SC57x USB Port Interrupt Service Routines as shown in the CLD provided example projects.

cld_time_get

```
CLD_Time cld_time_get(void)
```

CLD SC57x Audio 2.0 with CDC Library function used to get the current CLD time in milliseconds.

Arguments

None

Return Value

The current CLD library time.

Details

The cld_time_get function is used in conjunction with the cld_time_passed_ms function to measure how much time has passed between the cld_time_get and the cld_time_passed_ms function calls in milliseconds.

cld_time_passed_ms

```
CLD_Time cld_time_passed_ms(CLD_Time time)
```

CLD SC57x Audio 2.0 with CDC Library function used to measure the amount of time that has passed in milliseconds.

Arguments

`time`	A CLD_Time value returned by a cld_time_get function call.

Return Value

The number of milliseconds that have passed since the cld_time_get function call that returned the CLD_Time value passed to the cld_time_passed_ms function.

Details

The cld_time_passed_ms function is used in conjunction with the cld_time_get function to measure how much time has passed between the cld_time_get and the cld_time_passed_ms function calls in milliseconds.

cld_time_get_125us

```
CLD_Time cld_time_get_125us(void)
```

CLD SC57x Audio 2.0 with CDC Library function used to get the current CLD time in 125 microsecond increments.

Arguments
None

Return Value
The current CLD library time.

Details
The cld_time_get_125us function is used in conjunction with the cld_time_passed_125us function to measure how much time has passed between the cld_time_get_125us and the cld_time_passed_125us function calls in 125 microsecond increments.

cld_time_passed_125us

```
CLD_Time cld_time_passed_125us(CLD_Time time)
```

CLD SC57x Audio 2.0 with CDC Library function used to measure the amount of time that has passed in 125 microsecond increments.

Arguments

time	A CLD_Time value returned by a cld_time_get_125us function call.

Return Value
The number of 125microsecond increments that have passed since the cld_time_get_125us function call that returned the CLD_Time value passed to the cld_time_passed_125us function.

Details
The cld_time_passed_125us function is used in conjunction with the cld_time_get_125us function to measure how much time has passed between the cld_time_get_125us and the cld_time_passed_125us function calls in 125 microsecond increments.

cld_lib_status_decode

```
char * cld_lib_status_decode (unsigned short status_cod,
                              void * p_additional_data,
                              unsigned short additional_data_size)
```

CLD Library function that returns a NULL terminated string describing the status passed to the function.

Arguments

status_code	16-bit status code returned by the CLD library.

	Note: If the most significant bit is a '1' the status is an error.
`p_additional_data`	Pointer to the additional data returned by the CLD library (if any).
`additional_data_size`	Size of the additional data returned by the CLD library.

Return Value

This function returns a decoded Null terminated ASCII string.

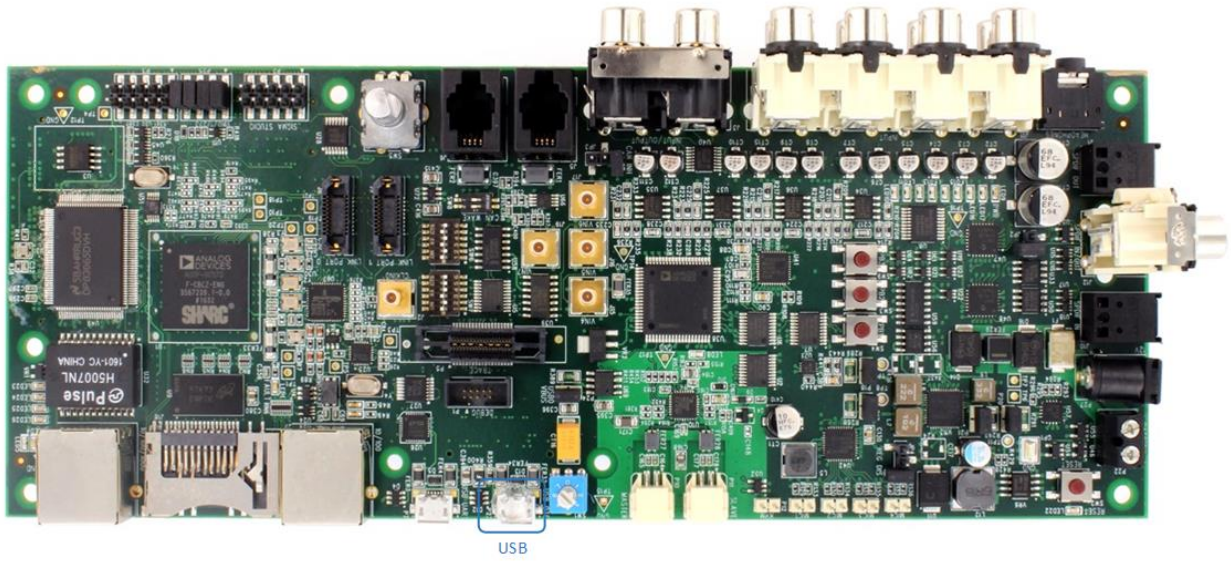
Details

The cld_lib_status_decode function can be used to generate an ASCII string which describes the CLD library status passed to the function. The resulting string can be used by the User to determine the meaning of the status codes returned by the CLD library.

Using the ADSP-SC573 Ez-Board

Connections:

Blue circled USB connection is used for the example project.



Adding the CLD SC57x Audio 2.0 with CDC Library to an Existing CrossCore Embedded Studio Project

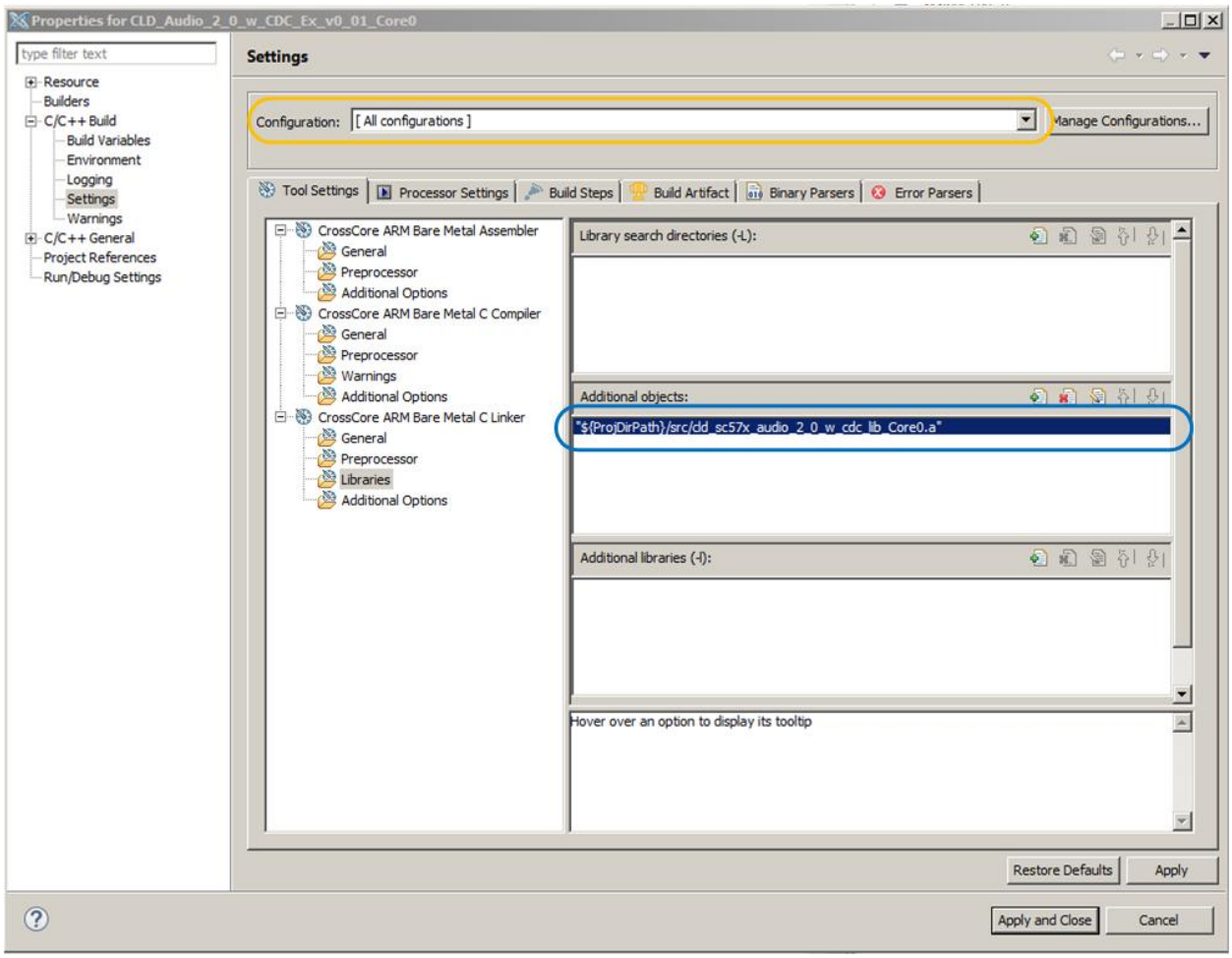
In order to include the CLD SC57x Audio 2.0 with CDC Library in a CrossCore Embedded Studio (CCES) project you must configure the project linker settings so it can locate the library. The following steps outline how this is done.

1. Copy the cld_sc57x_audio_2_0_w_cdc_lib.h and cld_sc57x_audio_2_0_w_cdc_lib_Core0.a files to the project's src directory.
2. Open the project in CrossCore Embedded Studio.
3. Right click the project in the 'C/C++ Projects' window and select Properties.

   If you cannot find the 'C/C++ Projects" window make sure C/C++ Perspective is active. If the C/C++ Perspective is active and you still cannot locate the 'C/C++ Projects' window select Window → Show View → C/C++ Projects.
4. You should now see a project properties window similar to the one shown below.

   Navigate to the C/C++ Build → Settings page and select the CrossCore ARM Bare Metal C Linker's Libraries page. The CLD SC57x Audio 2.0 with CDC Library needs to be included in the projects 'Additional objects' as shown in the diagram below (circled in blue). This lets the

linker know where the cld_sc57x_audio_2_0_w_cdc_lib_Core0.a file is located.



5. The 'Additional objects' setting needs to be set for all configurations (Debug, Release, etc). This can be done individually for each configuration, or all at once by selecting the [All Configurations] option as shown in the previous figure (circled in orange).

User Firmware Code Snippets

The following code snippets are not complete, and are meant to be a starting point for the User firmware. For a functional User firmware example that uses the CLD SC57x Audio 2.0 with CDC Library please refer to the CLD_Audio_2_0_w_CDC_Ex_v1_00 project included available with the CLD SC57x Audio 2.0 with CDC Library.

main.c

```
void main(void)
{
    Main_States main_state = MAIN_STATE_SYSTEM_INIT;

    while (1)
    {
        switch (main_state)
        {
            case MAIN_STATE_SYSTEM_INIT:
                /* Initialize the SC573 clock, and power systems.*/

                main_state = MAIN_STATE_USER_INIT_CODEC;
            break;
            case MAIN_STATE_USER_INIT_CODEC:
                /* Initialize the Audio Codecs */
                main_state = MAIN_STATE_USER_INIT;
            break;
            case MAIN_STATE_USER_INIT:
                rv = user_audio_w_cdc_init();
                if (rv == USER_AUDIO_INIT_SUCCESS)
                {
                    main_state = MAIN_STATE_RUN;
                }
                else if (rv == USER_AUDIO_INIT_FAILED)
                {
                    main_state = MAIN_STATE_ERROR;
                }
            break;

            case MAIN_STATE_RUN:
                 user_audio_w_cdc_main();
            break;

            case MAIN_STATE_ERROR:

            break;
        }
    }
}
```

user_audio_w_cdc.c

```
#pragma pack (1)
/*
   USB Audio v2.0 Unit and Terminal descriptors that describe a simple
   audio device comprised of the following:

    Input Terminal - USB Streaming Endpoint
        ID = 0x01
        Channels: Left, Right
    Input Terminal - Microphone
        ID = 0x02
        Channels: Left, Right
    Output Terminal - Speaker
        ID = 0x06
        Source ID = 0x09
    Output Terminal - USB Streaming Endpoint
        ID = 0x07
        Source ID = 0x0a
    Feature Unit
        ID = 0x09
        Source ID = 0x01
        Controls:
            Master Channel 0: Mute (Control 1)
            Channel 1 (Left): Volume (Control 2)
            Channel 2 (Right): Volume (Control 2)
    Feature Unit
        ID = 0x0a
        Source ID = 0x02
        Controls:
            Master Channel 0: Volume (Control 2)
 */
/* USB Audio v2.0 Unit and Terminal descriptors that describe a simple audio device.*/
static const unsigned char user_audio_unit_and_terminal_descriptor[] =
{
    /* Input Terminal Descriptor - USB Endpoint */
    0x11,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x02,                   /* bDescriptorSubType = Input Terminal */
    0x01,                   /* bTerminalID */
    0x01, 0x01,             /* wTerminalType = USB Streaming */
    0x00,                   /* bAssocTerminal */
    0x03,                   /* bCSourceID */
    0x02,                   /* bNRChannels */
    0x03, 0x00, 0x00,0x00,  /* wChannelConfig (Left & Right Present) */
    0x00,                   /* iChannelNames */
    0x00,0x00,              /* bmControls */
    0x00,                   /* iTerminal */
    /* Input Terminal Descriptor - Microphone */
    0x11,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x02,                   /* bDescriptorSubType = Input Terminal */
    0x02,                   /* bTerminalID */
    0x01, 0x02,             /* wTerminalType = Microphone */
    0x00,                   /* bAssocTerminal */
    0x03,                   /* bCSourceID */
    0x02,                   /* bNRChannels */
    0x03, 0x00, 0x00,0x00,  /* wChannelConfig (Left & Right Present) */
    0x00,                   /* iChannelNames */
    0x00,0x00,              /* bmControls */
    0x00,                   /* iTerminal */
    /* Output Terminal Descriptor - Speaker */
    0x0c,                   /* bLength */
```

```
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x03,                   /* bDescriptorSubType = Output Terminal */
    0x06,                   /* bTerminalID */
    0x01, 0x03,             /* wTerminalType - Speaker */
    0x00,                   /* bAssocTerminal */
    0x09,                   /* bSourceID */
    0x03,                   /* bCSourceID */
    0x00, 0x00,             /* bmControls */
    0x00,                   /* iTerminal */
    /* Output Terminal Descriptor - USB Endpoint */
    0x0c,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x03,                   /* bDescriptorSubType = Output Terminal */
    0x07,                   /* bTerminalID */
    0x01, 0x01,             /* wTerminalType - USB Streaming */
    0x00,                   /* bAssocTerminal */
    0x0a,                   /* bSourceID */
    0x03,                   /* bCSourceID */
    0x00, 0x00,             /* bmControls */
    0x00,                   /* iTerminal */
    /* Feature Unit Descriptor */
    0x12,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x06,                   /* bDescriptorSubType = Feature Unit */
    0x09,                   /* bUnitID */
    0x01,                   /* bSourceID */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Master */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Left */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Right */
    0x00,                   /* iFeature */
    /* Feature Unit Descriptor */
    0x12,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x06,                   /* bDescriptorSubType = Feature Unit */
    0x0A,                   /* bUnitID */
    0x02,                   /* bSourceID */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Master */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Left */
    0x0f, 0x00, 0x00, 0x00, /* bmaControls - Right */
    0x00,                   /* iFeature */
    /* Clock Source Descriptor */
    0x08,                   /* bLength */
    0x24,                   /* bDescriptorType = Class Specific Interface */
    0x0a,                   /* bDescriptorSubType = Clock Source */
    0x03,                   /* ClockID */
    0x01,                   /* bmAttributes - Internal Fixed Clock */
    0x00,                   /* bmControls */
    0x00,                   /* bAssocTerminal */
    0x00,                   /* iClockSource */
};

/* Isochronous IN endpoint PCM format descriptor */
static const unsigned char user_audio_in_stream_format_descriptor[] =
{
    0x06,               /* bLength */
    0x24,               /* bDescriptorType - Class Specific Interface */
    0x02,               /* bDescriptorSubType - Format Type */
    0x01,               /* bFormatType - Format Type 1 */
    0x04,               /* bSubSlotSize */
    0x20,               /* bBitResolution */
};
```

```
/* Isochronous OUT endpoint PCM format descriptor */
static const unsigned char user_audio_out_stream_format_descriptor[] =
{
    0x06,               /* bLength */
    0x24,               /* bDescriptorType - Class Specific Interface */
    0x02,               /* bDescriptorSubType - Format Type */
    0x01,               /* bFormatType - Format Type 1 */
    0x04,               /* bSubSlotSize */
    0x20,               /* bBitResolution */
};


#pragma pack ()

/* IN Audio Stream Interface Endpoint Data Descriptor */
static const CLD_SC57x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor
user_audio_in_stream_endpoint_desc =
{
    .b_length = sizeof(CLD_SC57x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor),
    .b_descriptor_type                  = 0x25,   /* Class Specific Endpoint */
    .b_descriptor_subtype               = 0x01,   /* Endpoint - General */
    .bm_attributes                      = 0x00,   /* max packet only set to 0 */
    .bm_controls                        = 0x00,
    .b_lock_delay_units                 = 0x00,
    .w_lock_delay                       = 0x00,
};

/* OUT Audio Stream Interface Endpoint Data Descriptor */
static const CLD_SC57x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor
user_audio_out_stream_endpoint_desc =
{
    .b_length = sizeof(CLD_SC57x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor),
    .b_descriptor_type                  = 0x25,   /* Class Specific Endpoint */
    .b_descriptor_subtype               = 0x01,   /* Endpoint - General */
    .bm_attributes                      = 0x00,   /* max packet only set to 0 */
    .bm_controls                        = 0x00,
    .b_lock_delay_units                 = 0x02,   /* Milliseconds */
    .w_lock_delay                       = 0x01,   /* 1 Millisecond */
};

/* Audio Stream IN Interface parameters */
static CLD_SC57x_Audio_2_0_Stream_Interface_Params user_audio_in_endpoint_params =
{
    .endpoint_number            = 2,              /* Isochronous endpoint number */
                                /* Isochronous endpoint full-speed max packet size */
    .max_packet_size_full_speed = USER_AUDIO_MAX_PACKET_SIZE,
                                /* Isochronous endpoint high-speed max packet size */
    .max_packet_size_high_speed = USER_AUDIO_MAX_PACKET_SIZE,
    .b_interval_full_speed      = 1,  /* Isochronous endpoint full-speed bInterval */
                    /* Isochronous endpoint high-speed bInterval - 1 millisecond */
    .b_interval_high_speed      = 4,
                                /* Terminal ID of the associated Output Terminal */
    .b_terminal_link            = 7,
    .b_format_type              = 1,           /* Type 1 Format */
    .bm_formats                 = 0x00000001,  /* Type 1 - PCM format */
    .b_nr_channels              = 2,           /* 2 Channels */
    .bm_channel_config          = 0x00000003,  /* Front Left & Front Right Channels */
    .p_encoder_descriptor       = CLD_NULL,
    .p_decoder_descriptor       = CLD_NULL,
    .p_format_descriptor        = (unsigned
char*)user_audio_in_stream_format_descriptor,
    .p_audio_stream_endpoint_data_descriptor =
(CLD_SC57x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor*)&user_audio_in_stream_
```

```
endpoint_desc,
};

/* Audio Stream OUT Interface parameters */
static CLD_SC57x_Audio_2_0_Stream_Interface_Params user_audio_out_endpoint_params =
{
    .endpoint_number            = 2,            /* Isochronous endpoint number */
                            /* Isochronous endpoint full-speed max packet size */
    .max_packet_size_full_speed = USER_AUDIO_MAX_PACKET_SIZE,
                            /* Isochronous endpoint high-speed max packet size */
    .max_packet_size_high_speed = USER_AUDIO_MAX_PACKET_SIZE,
                            /* Isochronous endpoint full-speed bInterval */
    .b_interval_full_speed      = 1,
                    /* Isochronous endpoint high-speed bInterval - 1 millisecond */
    .b_interval_high_speed      = 4,
                            /* Terminal ID of the associated Output Terminal */
    .b_terminal_link            = 1,
    .b_format_type              = 1,          /* Type 1 Format */
    .bm_formats                 = 0x00000001, /* Type 1 - PCM format */
    .b_nr_channels              = 2,          /* 2 Channels */
    .bm_channel_config          = 0x00000003, /* Front Left & Front Right Channels */
    .p_encoder_descriptor       = CLD_NULL,
    .p_decoder_descriptor       = CLD_NULL,
    .p_format_descriptor        = (unsigned char*)
                                  user_audio_out_stream_format_descriptor,
    .p_audio_stream_endpoint_data_descriptor =
             (CLD_SC57x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor*)
             &user_audio_out_stream_endpoint_desc,
};

/* Audio Control Interrupt IN endpoint parameters */
static CLD_SC57x_Audio_2_0_Control_Interrupt_Params user_audio_interrupt_in_params =
{
    .endpoint_number            = 1, /* Endpoint number */
    .b_interval_full_speed      = 1, /* Interrupt IN endpoint full-speed bInterval */
    .b_interval_high_speed      = 4, /* Interrupt IN endpoint high-speed bInterval */
};

/*!< CDC Notification Interrupt IN endpoint parameters. */
static CLD_SC57x_CDC_Notification_Endpoint_Params user_cdc_notification_ep_params =
{
    .endpoint_number              = 4,
    .max_packet_size_full_speed   = 64,
    .polling_interval_full_speed  = 1,
    .max_packet_size_high_speed   = 64,
    .polling_interval_high_speed  = 4,  /* 1ms */
};

/*!< CDC Serial Data Bulk OUT endpoint parameters. */
static CLD_Serial_Data_Bulk_Endpoint_Params user_cdc_serial_data_rx_ep_params =
{
    .endpoint_number              = 5,
    .max_packet_size_full_speed   = 64,
    .max_packet_size_high_speed   = 512,
};

/*!< CDC Serial Data Bulk IN endpoint parameters. */
static CLD_Serial_Data_Bulk_Endpoint_Params user_cdc_serial_data_tx_ep_params =
{
    .endpoint_number              = 5,
    .max_packet_size_full_speed   = 64,
    .max_packet_size_high_speed   = 512,
```

```
};


/*!< CLD SC57x Audio 2.0 with CDC Library initialization data. */
static CLD_SC57x_Audio_2_0_w_CDC_Lib_Init_Params user_audio_w_cdc_init_params =
{
    .enable_dma = CLD_TRUE,    /* USB DMA enabled */

    .vendor_id = 0x064b,       /* Analog Devices Vendor ID */
    .product_id = 0x0007,      /* Product ID. */
    .usb_bus_max_power = 0,

    .device_descriptor_bcdDevice = 0x0100,

    /* USB string descriptors - Set to CLD_NULL if not required */
    .p_usb_string_manufacturer  = "Analog Devices Inc",
    .p_usb_string_product       = "SC573 Audio v2.0 w/CDC Device",
    .p_usb_string_serial_number = CLD_NULL,
    .p_usb_string_configuration = CLD_NULL,
    .audio_control_category_code = 0x01,  /* Desktop Speaker */

      /* Optional Interrupt endpoint parameters */
    .p_audio_control_interrupt_params = &user_audio_interrupt_in_params,

    /* Unit and Terminal descriptor */
    .p_unit_and_terminal_descriptors = (unsigned char*)
             user_audio_unit_and_terminal_descriptor,
    .unit_and_terminal_descriptors_length =
             sizeof(user_audio_unit_and_terminal_descriptor),

    /* Pointer to the Interface parameters for the Audio Stream Rx interface. */
    .p_audio_streaming_rx_interface_params = &user_audio_out_endpoint_params,

    /* Pointer to the Interface parameters for the Audio Stream Tx interface.*/
    .p_audio_streaming_tx_interface_params = &user_audio_in_endpoint_params,

    /* Function called when the data is received on the Isochronous OUT endpoint */
    .fp_audio_stream_data_received = user_audio_stream_data_received,

    /* Function called when an USB Audio 2.0 Set Request is received.*/
    .fp_audio_set_req_cmd = user_audio_set_req_cmd,

    /* Function called when an USB Audio 2.0 Get Request is received. */
    .fp_audio_get_req_cmd = user_audio_get_req_cmd,

    /* Function called when the Isochronous OUT interface is enabled/disabled */
    .fp_audio_streaming_rx_endpoint_enabled =
             user_audio_streaming_rx_endpoint_enabled,
    /* Function called when the Isochronous IN interface is enabled/disabled */
    .fp_audio_streaming_tx_endpoint_enabled =
             user_audio_streaming_tx_endpoint_enabled,

    .p_serial_data_rx_endpoint_params = &user_cdc_serial_data_rx_ep_params,
    .p_serial_data_tx_endpoint_params = &user_cdc_serial_data_tx_ep_params,
    .p_notification_endpoint_params   = &user_cdc_notification_ep_params,

    .fp_serial_data_received          = user_cdc_serial_data_received,
    .fp_cdc_cmd_send_encapsulated_cmd = user_cdc_cmd_send_encapsulated_cmd,
    .fp_cdc_cmd_get_encapsulated_resp = user_cdc_cmd_get_encapsulated_resp,

    .fp_cdc_cmd_set_line_coding       = user_cdc_cmd_set_line_coding,
    .fp_cdc_cmd_get_line_coding       = user_cdc_cmd_get_line_coding,
```

```
    .fp_cdc_cmd_set_control_line_state= user_cdc_cmd_set_control_line_state,

    .fp_cdc_cmd_send_break            = user_cdc_cmd_send_break,

    .support_cdc_network_connection   = 1,
    .cdc_class_bcd_version            = 0x0120,       /* CDC Version 1.2 */
    .cdc_class_control_protocol_code  = 0,            /* No Class Specific protocol */

    .p_usb_string_audio_control_interface        = CLD_NULL,
    .p_usb_string_audio_streaming_out_interface  = CLD_NULL,
    .p_usb_string_audio_streaming_in_interface   = CLD_NULL,
    .p_usb_string_communication_class_interface  = "CLD CDC Ctrl",
    .p_usb_string_data_class_interface           = "CLD CDC Data",

    .user_string_descriptor_table_num_entries = 0,
    .p_user_string_descriptor_table = CLD_NULL,

    .usb_string_language_id     = 0x0409,               /* English (US) language ID */

    /* Function called when a USB events occurs on USB0. */
    .fp_cld_usb_event_callback = user_usb_event,

    /* Function called when the CLD library reports a status. */
    .fp_cld_lib_status                                  = user_cld_lib_status,

};
```

```
User_Audio_Init_Return_Code user_audio_w_cdc_init (void)
{
    static unsigned char user_init_state = 0;
    CLD_RV cld_rv = CLD_ONGOING;
    User_Audio_Init_Return_Code init_return_code = USER_AUDIO_INIT_ONGOING;

    switch (user_init_state)
    {
        case 0:

            /* TODO: add any custom User firmware initialization */

            user_init_state++;
        break;
        case 1:
            /* Initialize the CLD SC57x Audio 2.0 with CDC Library */
            cld_rv =
cld_sc57x_audio_2_0_w_cdc_lib_init(&user_audio_w_cdc_init_params);

            if (cld_rv == CLD_SUCCESS)
            {
                /* Connect to the USB Host */
                cld_lib_usb_connect();

                init_return_code = USER_AUDIO_INIT_SUCCESS;
            }
            else if (cld_rv == CLD_FAIL)
            {
                init_return_code = USER_AUDIO_INIT_FAILED;
            }
            else
            {
                init_return_code = USER_AUDIO_INIT_ONGOING;
            }
    }
    return init_return_code;
}

void user_audio_w_cdc_main (void)
{
    cld_sc57x_audio_2_0_w_cdc_lib_main();

}

/* Function called when an Isochronous OUT packet is received */
static CLD_USB_Transfer_Request_Return_Type user_audio_stream_data_received
                            (CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->num_bytes = /* TODO: Set number of Isochronous OUT bytes to transfer
                                 */
    p_transfer_data->p_data_buffer = /* TODO: address to store Isochronous OUT data */

    /* User Audio transfer complete callback function. */
    p_transfer_data->fp_callback.usb_out_transfer_complete =
                                        user_audio_stream_data_rx_done;
    p_transfer_params->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                         function or CLD_NULL */;
    p_transfer_params->transfer_timeout_ms = /* TODO: Set to desired timeout */;


    /* TODO: Return how the Isochronous OUT transfer should be handled (Accept, Pause,
             Discard, or Stall */
}
```

```
/* The function below is an example if the Isochronous OUT transfer done callback
       specified in the CLD_USB_Transfer_Params structure. */
static CLD_USB_Data_Received_Return_Type user_audio_stream_data_rx_done (void)
{
    /* TODO: Process the received Isochronous OUT transfer and return if the received
             data is good(CLD_USB_DATA_GOOD) or if there is an error
             (CLD_USB_DATA_BAD_STALL)*/

}

static void user_audio_console_rx_byte (unsigned char byte)
{
    /* TODO: Add any User firmware to process data received by the CLD Console UART.*/
}

static void user_audio_usb_event (CLD_USB_Event event)
{
    switch (event)
    {
        case CLD_USB_CABLE_CONNECTED:
            /* TODO: Add any User firmware processed when a USB cable is connected. */
        break;
        case CLD_USB_CABLE_DISCONNECTED:
            /* TODO: Add any User firmware processed when a USB cable is
               disconnected.*/
        break;
        case CLD_USB_ENUMERATED_CONFIGURED:
            /* TODO: Add any User firmware processed when a Device has been
               enumerated.*/
        break;
        case CLD_USB_UN_CONFIGURED:
            /* TODO: Add any User firmware processed when a Device USB Configuration
               is set to 0.*/
        break;
        case CLD_USB_BUS_RESET:
            /* TODO: Add any User firmware processed when a USB Bus Reset occurs. */
        break;
    }
}

/* The following function will transmit the specified memory using
   the Isochronous IN endpoint. */
static user_audio_transmit_isochronous_in_data (void)
{
    static CLD_USB_Transfer_Params transfer_params;

    transfer_params.num_bytes = /* TODO: Set number of IN bytes */
    transfer_params.p_data_buffer = /* TODO: address data */
    transfer_params.callback.fp_usb_in_transfer_complete = /* TODO: Set to User
                                                              callback function or
                                                              CLD_NULL */;
    transfer_params.callback.fp_transfer_aborted_callback = /* TODO: Set to User
                                                             callback function or
                                                             CLD_NULL */;
    transfer_params.transfer_timeout_ms = /* TODO: Set to desired timeout */;

    if (cld_sc57x_audio_2_0_w_cdc_lib_transmit_audio_data (&transfer_params) ==
             CLD_USB_TRANSMIT_SUCCESSFUL)
    {
        /* Isochronous IN transfer initiated successfully */
    }
    else /* Isochronous IN transfer was unsuccessful */
    {
```

```
    }
}

/* Function called when a Set Request is received */
static CLD_USB_Transfer_Request_Return_Type user_audio_set_req_cmd
             (CLD_SC57x_Audio_2_0_Cmd_Req_Parameters * p_req_params,
              CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->p_data_buffer = /* TODO: address to store data */
    p_transfer_data->callback.fp_usb_out_transfer_complete =
                                       user_audio_set_req_cmd_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                          function or CLD_NULL */
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
              Discard, or Stall */
}

/* Function called when the Set Request data is received */
static CLD_USB_Data_Received_Return_Type user_audio_set_req_cmd_transfer_complete
       (void)
{
    /* TODO: Return if the received data is good (CLD_USB_DATA_GOOD) or bad
       (CLD_USB_DATA_BAD_STALL) */
}

/* Function called when a Get Request is received */
static CLD_USB_Transfer_Request_Return_Type user_audio_get_req_cmd
             (CLD_SC57x_Audio_2_0_Cmd_Req_Parameters * p_req_params,
              CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->p_data_buffer = /* TODO: address to source data */
    p_transfer_data->callback.fp_usb_in_transfer_complete =
                                       user_audio_get_req_cmd_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                          function or CLD_NULL */
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
              Discard, or Stall */
}

/* Function called when the Get Request data has been transmitted */
static void user_audio_get_req_cmd_transfer_complete (void)
{
    /* TODO: The Get Request data has been sent to the Host, add any
       User functionality. */
}


static void user_audio_streaming_rx_endpoint_enabled (CLD_Boolean enabled)
{
    if (enabled == CLD_TRUE)
    {
        /* TODO: Add Isochronous OUT endpoint enabled User functionality. */
    }
    else
    {
        /* TODO: Add Isochronous OUT endpoint disabled User functionality. */
    }
}
```

```
static void user_audio_streaming_tx_endpoint_enabled (CLD_Boolean enabled)
{
    if (enabled == CLD_TRUE)
    {
        /* TODO: Add Isochronous IN endpoint enabled User functionality. */
    }
    else
    {
        /* TODO: Add Isochronous IN endpoint disabled User functionality. */
    }
}

/* Function called when a Serial Data Bulk OUT packet is received */
static CLD_USB_Transfer_Request_Return_Type
      user_cdc_serial_data_received (CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->num_bytes = /* TODO: Set number of Bulk OUT bytes to
                                         transfer */
    p_transfer_data->p_data_buffer = /* TODO: address to store Bulk OUT data */

    /* User Interrupt transfer complete callback function. */
    p_transfer_data->callback.usb_out_transfer_complete =
                                        user_cdc_serial_data_out_transfer_done;
    p_transfer_params->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                         function or CLD_NULL */
    p_transfer_params->transfer_timeout_ms = /* TODO: Set to desired timeout or 0 to
                                                    disable the timeout. */

    /* TODO: Return how the Bulk OUT transfer should be handled (Accept, Pause,
             Discard, or Stall */
}

/* The function below is an example of the Bulk OUT transfer done callback
   specified in the CLD_USB_Transfer_Params structure. */
static CLD_USB_Data_Received_Return_Type user_cdc_serial_data_out_transfer_done (void)
{
    /* TODO: Process the received Bulk OUT transfer and return if the received data is
       good (CLD_USB_DATA_GOOD) or if there is an error (CLD_USB_DATA_BAD_STALL)*/
}

/* Function called when a Send Encapsulated Command request is received */
static CLD_USB_Transfer_Request_Return_Type user_cdc_cmd_send_encapsulated_cmd
             (CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->p_data_buffer = /* TODO: address to store data */
    p_transfer_data->callback.usb_out_transfer_complete =
                                  user_cdc_send_encapsilated_cmd_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                          function or CLD_NULL
*/
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
             Discard, or Stall */
}

/* Function called when the Send Encapsulated Command data is received */
static CLD_USB_Data_Received_Return_Type
      user_cdc_send_encapsilated_cmd_transfer_complete (void)
{
    /* TODO: Return if the received data is good (CLD_USB_DATA_GOOD) or bad
       (CLD_USB_DATA_BAD_STALL) */
}
```

```
/* Function called when a Get Encapsulated Response request is received */
static CLD_USB_Transfer_Request_Return_Type user_cdc_cmd_get_encapsulated_resp
             (CLD_USB_Transfer_Params * p_transfer_data)
{
    p_transfer_data->num_bytes = /* TODO: Set to size of response */
    p_transfer_data->p_data_buffer = /* TODO: address to source the response data */
    p_transfer_data->callback.usb_in_transfer_complete =
                                 user_cdc_get_encapsulated_resp_transfer_complete;
    p_transfer_data->fp_transfer_aborted_callback = /* TODO: Set to User callback
                                                        function or NULL */
     /* TODO: Return how the Control transfer should be handled (Accept, Pause,
            Discard, or Stall */
}


/* Function called when a Get Encapsulated Response has been transmitted */
static void user_cdc_get_encapsulated_resp_transfer_complete (void)
{
    /* TODO: The Get Encapsulated Response data has been sent to the Host, add any
       User functionality. */
}

/* Function called when a Set Line Coding Request has been received*/
CLD_USB_Data_Received_Return_Type user_cdc_cmd_set_line_coding
       (CLD_CDC_Line_Coding * p_line_coding)
{
    if ( /* TODO: Check if CDC Line Coding is valid */ )
    {
        /* TODO: Save the requested CDC Line Coding and process it accordingly */
        return CLD_USB_DATA_GOOD;
    }
    else
    {
        return CLD_USB_DATA_BAD_STALL;
    }
}

/* Function called when a Get Line Coding Request has been received*/
CLD_RV user_cdc_cmd_get_line_coding (CLD_CDC_Line_Coding * p_line_coding)
{
    if ( /* TODO: Check if Get CDC Line Coding request is valid */ )
    {
        /* TODO: Copy the current CDC Line Coding into the p_line_coding structure */
        return CLD_SUCCESS;
    }
    else
    {
        return CLD_FAIL;
    }
}
```

```
/* Function called when a CDC Set Control Line State Request has been received*/
CLD_USB_Data_Received_Return_Type user_cdc_cmd_set_control_line_state
       (CLD_CDC_Control_Line_State * p_control_line_state)
{
    if ( /* TODO: Check if CDC Control Line state is valid */ )
    {
        /* TODO: Process the CDC Control Line State */
        return CLD_USB_DATA_GOOD;
    }
    else
    {
        return CLD_USB_DATA_BAD_STALL;
    }
}

/* Function called when a CDC Send Break Request has been received*/
static void user_cdc_cmd_send_break (unsigned short duration)
{
    /* TODO: Process the requested break duration */
}

static void user_usb_event (CLD_USB_Event event)
{
    switch (event)
    {
        case CLD_USB_CABLE_CONNECTED:
            /* TODO: Add any User firmware processed when a USB cable is connected. */
        break;
        case CLD_USB_CABLE_DISCONNECTED:
            /* TODO: Add any User firmware processed when a USB cable is
               disconnected.*/
        break;
        case CLD_USB_ENUMERATED_CONFIGURED:
            /* TODO: Add any User firmware processed when a Device has been
               enumerated.*/
        break;
        case CLD_USB_UN_CONFIGURED:
            /* TODO: Add any User firmware processed when a Device USB Configuration
               is set to 0.*/
        break;
        case CLD_USB_BUS_RESET:
            /* TODO: Add any User firmware processed when a USB Bus Reset occurs. */
        break;
    }
}

static void user_cld_lib_status (unsigned short status_code, void * p_additional_data,
                                 unsigned short additional_data_size)
{
    /* TODO: Process the library status if needed.  The status can also be decoded to
             a USB readable string using cld_lib_status_decode as shown below: */

    char * p_str = cld_lib_status_decode(status_code, p_additional_data,
                                         additional_data_size);
}
```