USB Audio 2.0 Class (CDC) for Analog Devices ADSP-SC58x User's Guide Revision 1.10

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Introduction

The Closed Loop Design (CLD) Audio 2.0 library creates a simplified interface for developing a USB Audio v2.0 device using the Analog Devices ADSP-SC589 EZ-Board. The CLD SC58x Audio 2.0 library also includes support 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 SC58x Audio 2.0 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 SC58x Audio 2.0 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 and USB Audio v2.0:

- 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
- 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 SC58x Audio 2.0 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_sc58x_audio_3_0_lib_init section of this document. The CLD SC58x Audio 2.0 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 SC58x Audio 2.0 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.

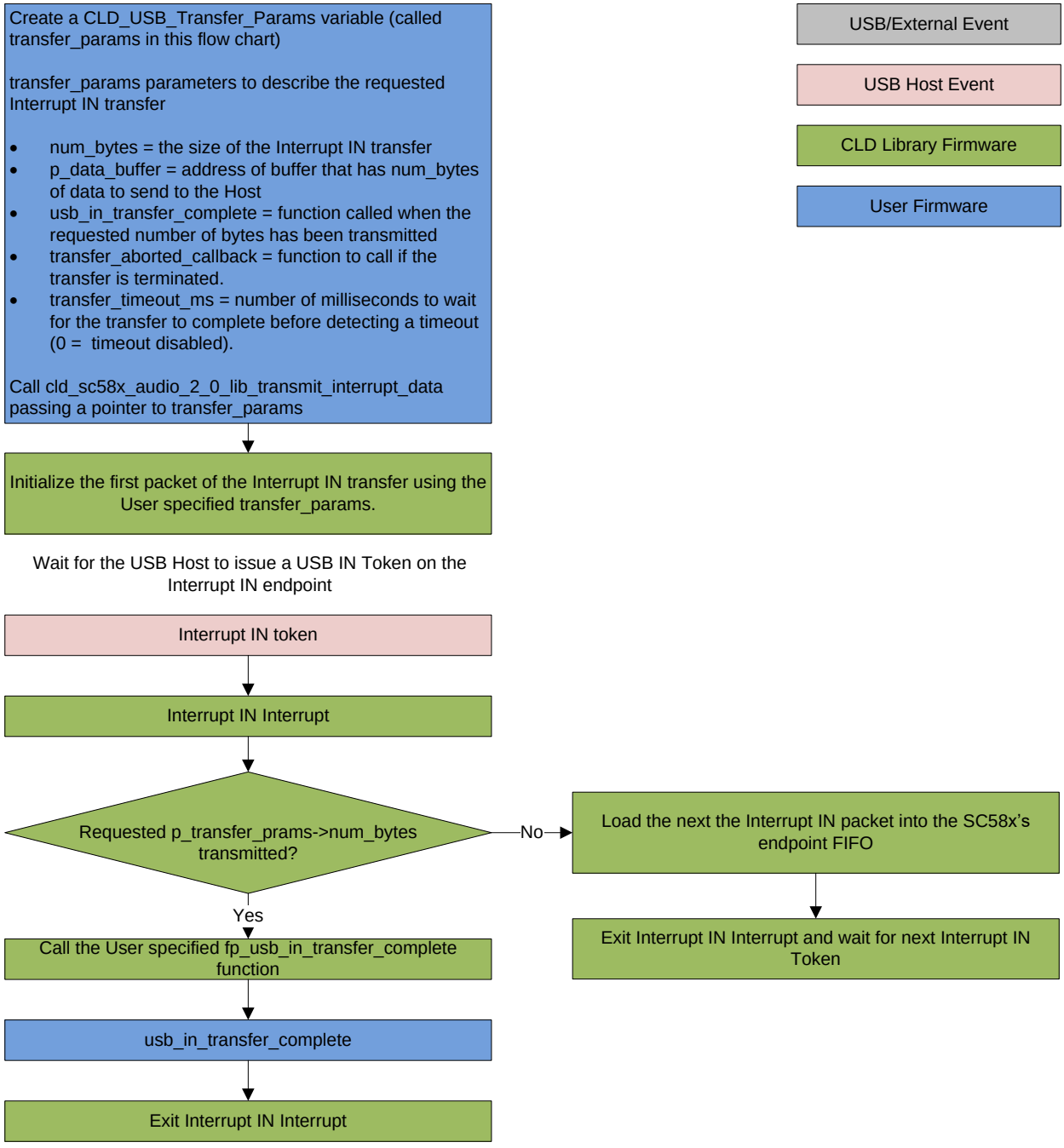
The CLD SC58x Audio 2.0 Library uses Control, Interrupt and Isochronous endpoints, these endpoint types will be discussed in more detail below.

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 SC58x Audio 2.0 Library Endpoint 0 is also used to handle USB Audio Device Class v2.0 defined Set and Get requests. These requests are discussed in more detail in the USB Audio Device Class v2.0 Background section 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 SC58x Audio 2.0 Library and the User firmware interact to process Interrupt IN transfers.

CLD SC58x Audio 2.0 Library Interrupt IN Flow Chart



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

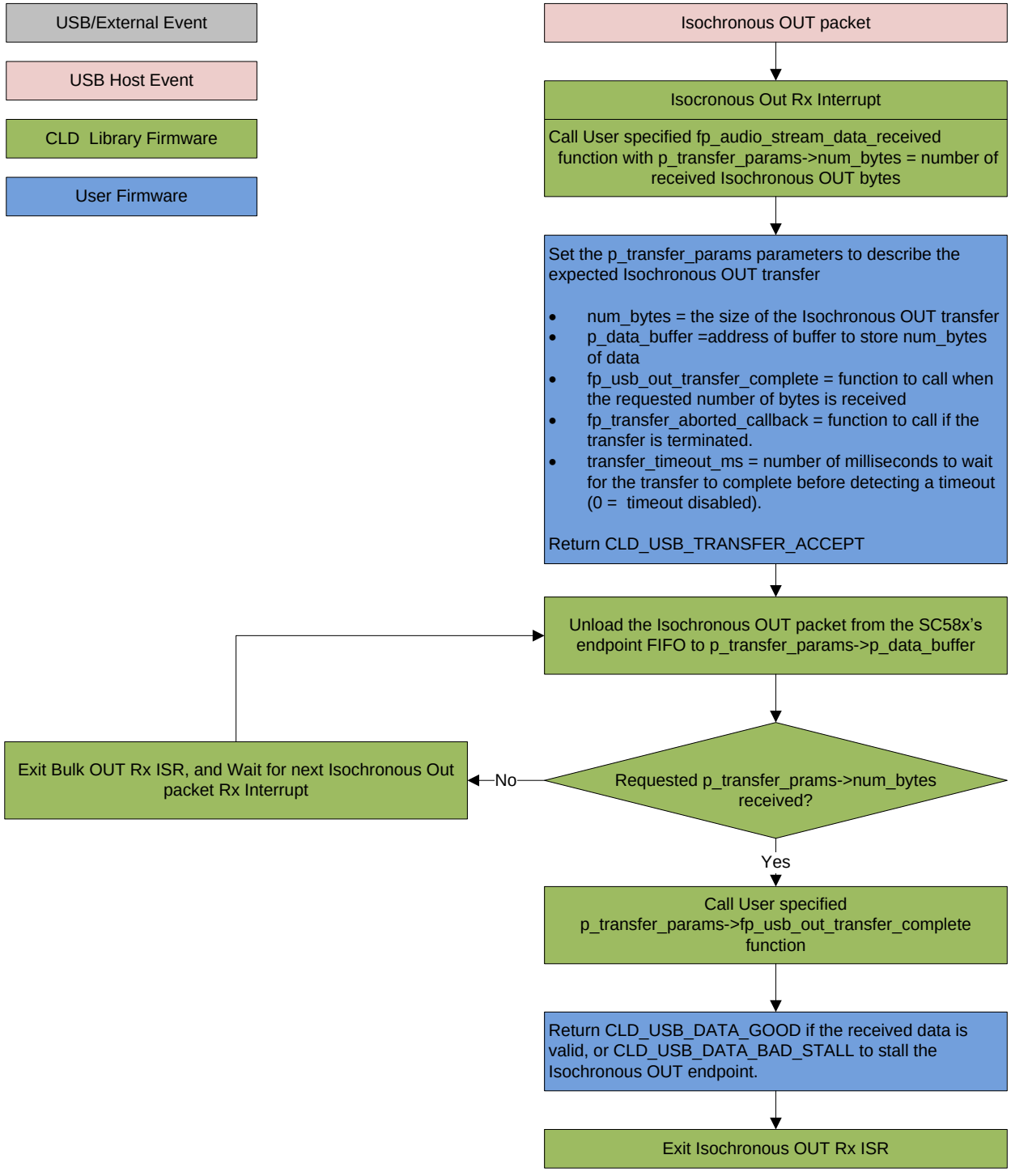
- Guaranteed USB bandwidth with bounded latency
- Constant data rate as long as data is provided to the endpoint.

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

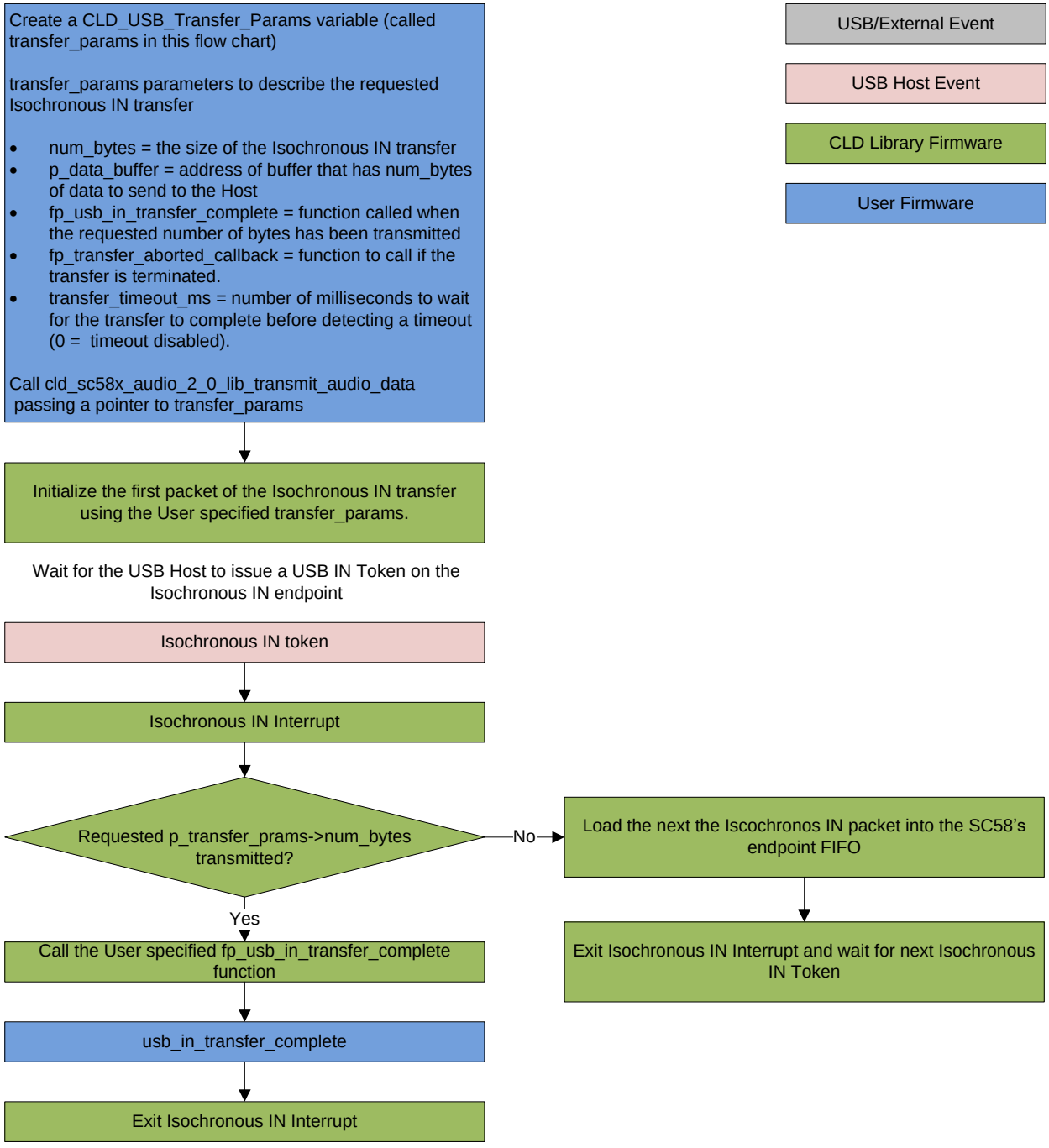
These characteristics allow for streaming audio data to be transmitted with deterministic timing. In the event of a USB transport error the audio data is dropped instead of being retried like a Bulk or Interrupt endpoint. This allows the streaming audio data to remain in sync. The CLD SC58x Audio 2.0 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 SC58x Audio 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 SC58x Audio 2.0 Library.

CLD SC58x Audio 2.0 Library Isochronous OUT Flow Chart



CLD SC58x Audio 2.0 Library Isochronous IN Flow Chart

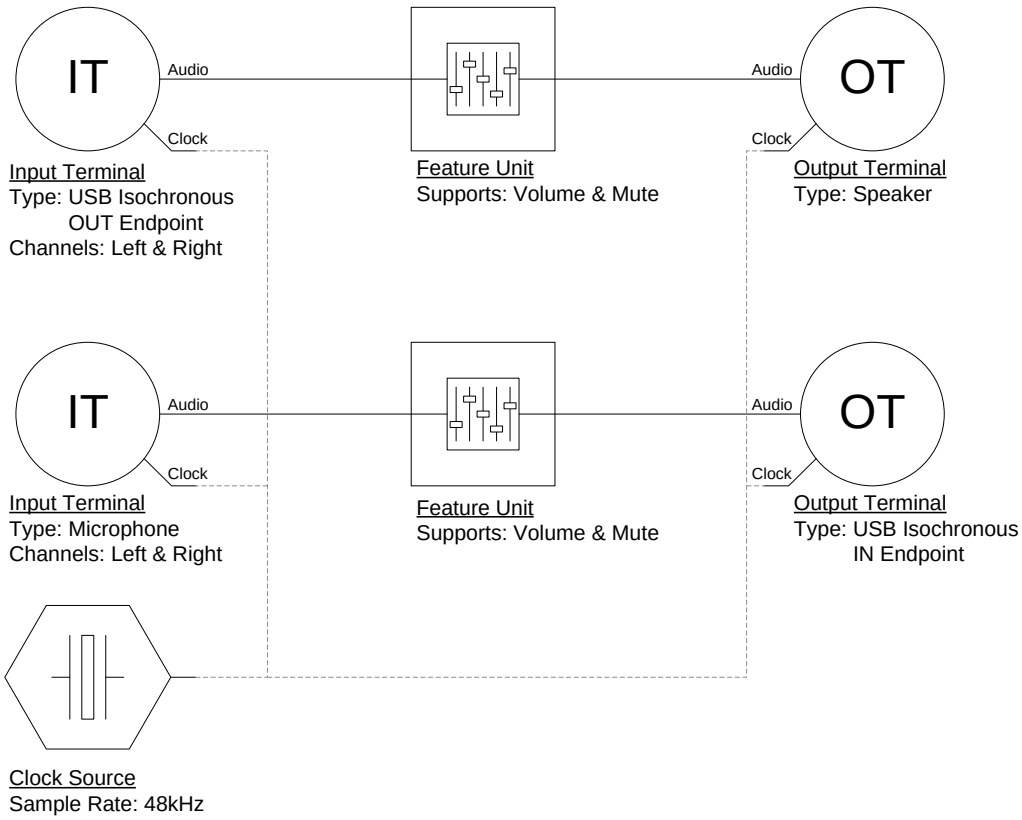


USB Audio Device Class v2.0 Background

The following is a basic overview of some USB Audio Device v2.0 concepts that are necessary to use the CLD SC58x Audio 2.0 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 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 SC58x Audio 2.0 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_sc58x_audio_2_0_lib_init section of this document for more information.

USB Audio Device Class v2.0 Control Endpoint Requests

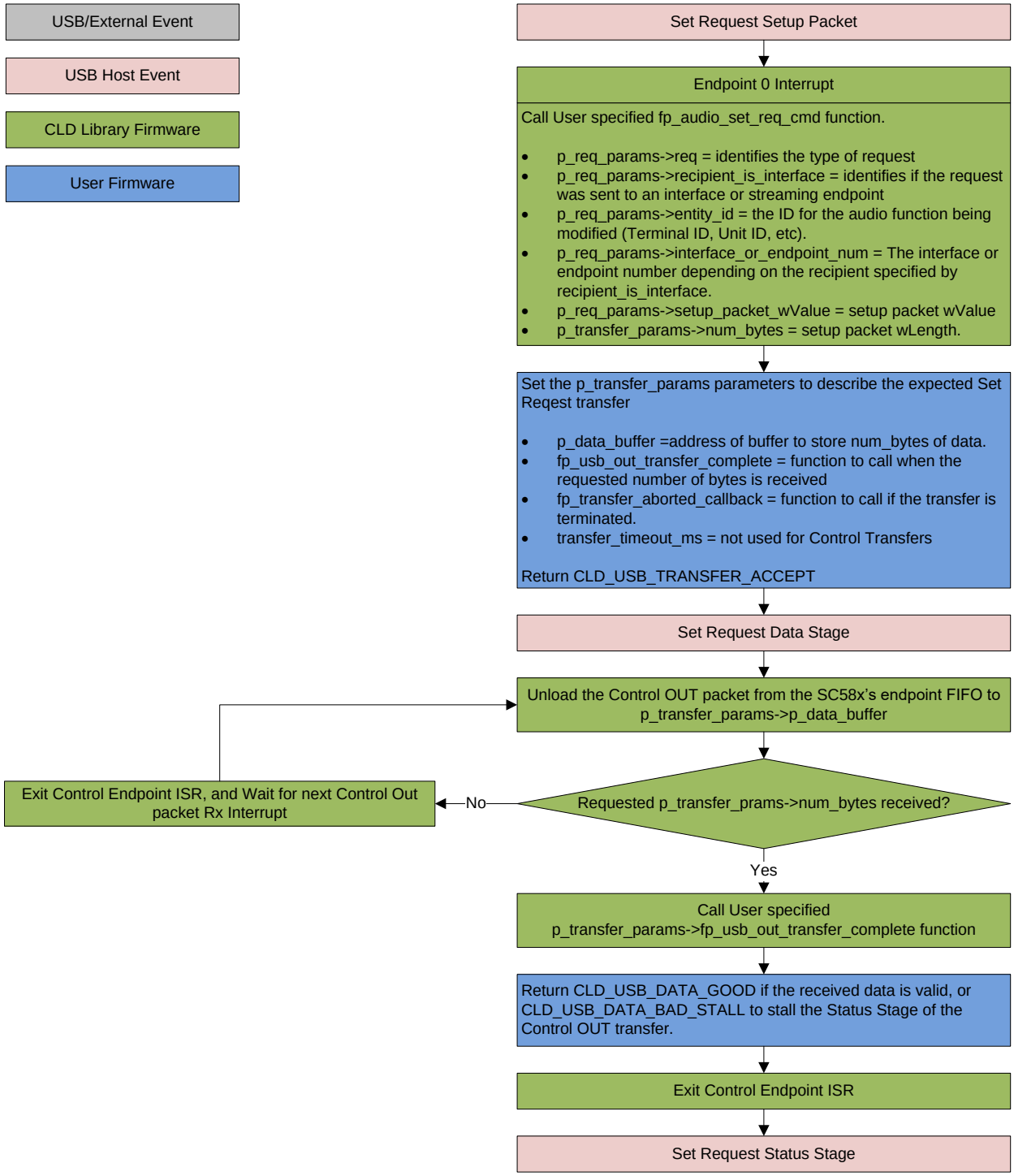
The USB Audio Device Class v2.0 control endpoint requests are broken down into Set and Get requests. These requests are used to control the various Terminal and Unit entities defined in the Configuration Descriptor. The CLD SC58x Audio 2.0 Library support for these requests is explained in the following 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 SC58x Audio 2.0 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.

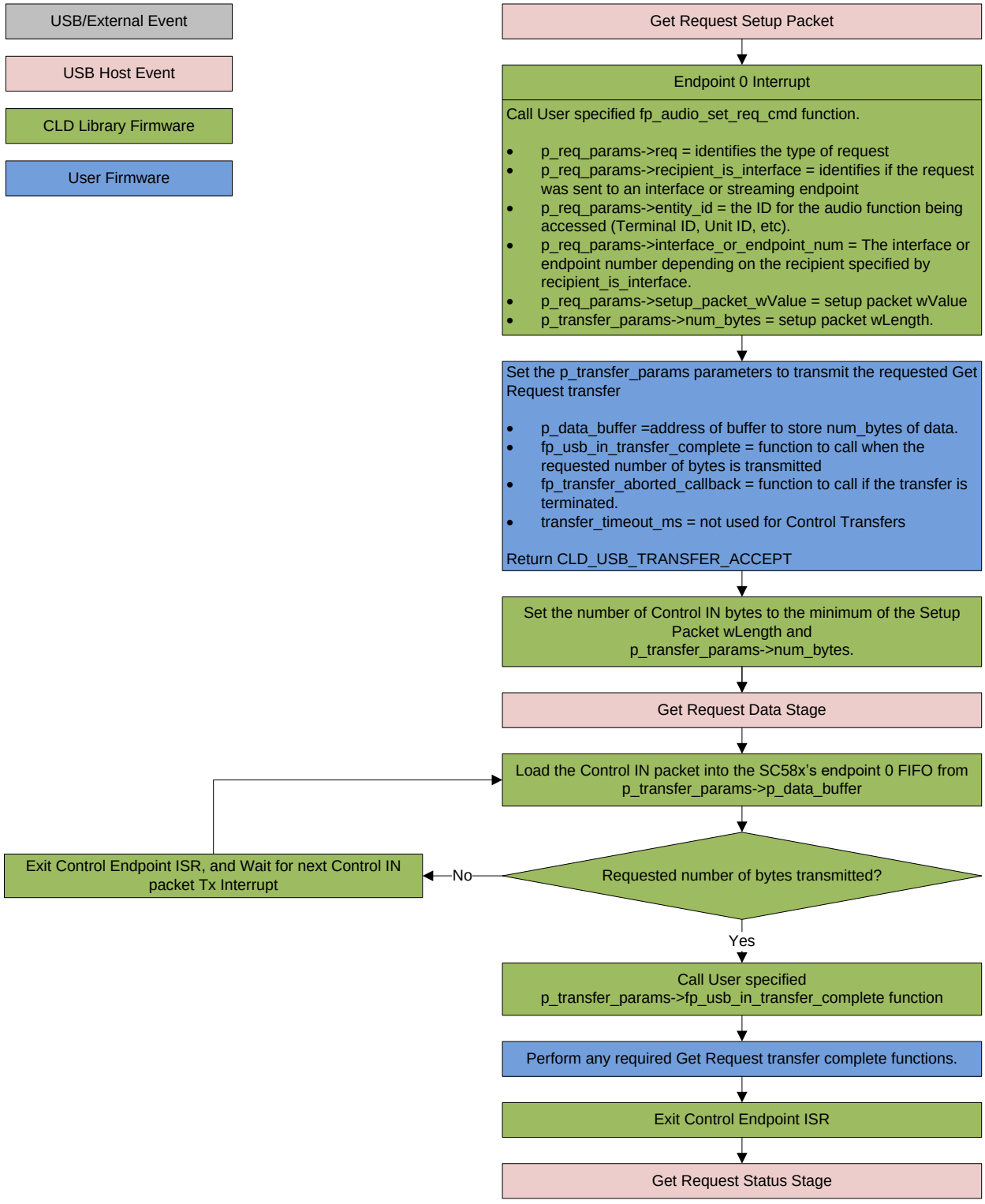
CLD SC58x Audio Device Class v2.0 Set Request Flow Chart



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 SC58x Audio Device Class v2.0 Get Request Flow Chart



Dependencies

In order to function properly, the CLD SC58x Audio 2.0 Library requires the following resources:

- 24Mhz clock input connected to the 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 SC58x Audio 2.0 Library approximate memory footprint is as follows:

Code memory:	33527 bytes
Data memory:	5385 bytes
Total:	38912 bytes or 38k

Note: The CLD SC58x Audio 2.0 Library is currently optimized for speed (not space).

CLD SC58x Audio 2.0 Library Scope and Intended Use

The CLD SC58x Audio 2.0 Library implements the USB Audio Device Class v2.0 required functionality to implement a USB Audio device, as well as providing time measurements functionality. The CLD SC58x Audio 2.0 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 time measurement features. All other aspects of SC58x processor configuration must be implemented by the User code.

CLD Audio 2.0 Example v1.10 Description

The CLD_Audio_1_0_Ex_v1_10 project provided with the CLD SC58x Audio 2.0 Library implements a basic USB audio device that supports a single stereo input and stereo output. This example is designed to run on the ADSP-SC589 Ez-Board, and uses the onboard ADAU1979 and ADAU1962A codecs to implement the audio functions.

CLD Audio 2.0 (8-Channel) Example v1.10 Description

The CLD_Audio_2_0_8ch_Ex_v1_10 project provided with the CLD SC58x Audio 2.0 Library implements a basic USB audio device that supports 8-channels of audio input and output. This example is designed to run on the ADSP-SC589 Ez-Board, and uses the onboard ADAU1979 and ADAU1962A codecs to implement the audio functions. The ADSP-SC589 Ez-Board only supports 4 audio input channels (channels 0-3). As a result, the example will either hard code the additional channels (channels 4-7) to 0, or loop back the corresponding output audio data based on the USER_AUDIO_MIXED_LOOPBACK #defne.

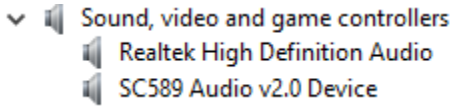
For additional information about connecting the audio input and output please refer to the "Using the ADI ADSP-SC589 Ez-Board" section of this Users Guide.

Running the Example Project

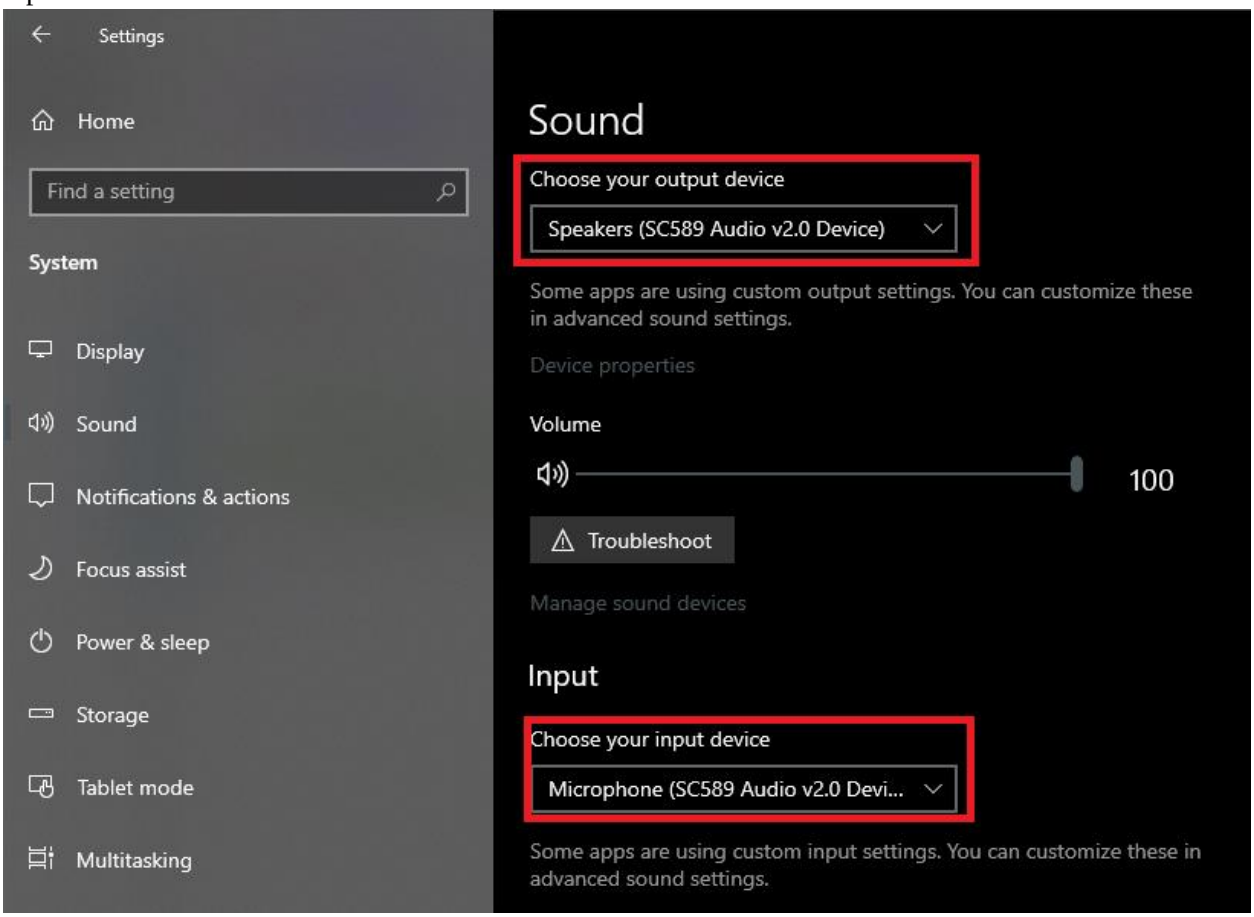
1. With the example project was developed using the ADSP SC598 EZ-Board, and toggles the LED connected to GPIO port E pin 13 every 250 milliseconds to provide a visual indicator the project

is running.

2. Once the example project is running on the EZ Board connect a USB cable from a PC to the USB port specified in the library parameters. Windows 10 will install its built-in USB Audio 2.0 driver, and the device will be listed as "SC589 Audio v2.0 Device" under the "Sound, video and game controllers" section in the Device Manager as shown below. If the device is not listed in Device Manager, verify the installed version of Windows 10 supports USB Audio 2.0 devices.



3. Under the Sound setting for Windows 10, select the SC589 USB Audio device as the output and input device as shown below:



4. Play an audio file, movie, or other means of outputting audio, and the connect to the appropriate output shown in the Using the ADSP-SD589 Ez-Board section of this guide to listen to the audio.

5. The example project will output the received from the input connectors shown in the Using the ADSP-SD589 Ez-Board section of this guide, which can be seen recorded using Audacity or other audio recording software.

CLD SC58x Audio 2.0 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_sc58x_audio_2_0_lib_init

```
CLD_RV cld_sc58x_audio_2_0_lib_init (CLD_SC58x_Audio_2_0_Lib_Init_Params *
cld_sc58x_audio_2_0_lib_params)
```

Initializes the CLD SC58x Audio 2.0 Library.

Arguments

cld_sc58x_audio_2_0_lib_params	Pointer to a CLD_SC58x_Audio_2_0_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 SC58x Audio 2.0 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_sc58x_audio_2_0_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_SC58x_Audio_2_0_Lib_Init_Params structure is described below:

```
typedef struct
{
    CLD_SC58x_USB_Config usb_config;
    CLD_Boolean enable_dma;
```

```
    unsigned short vendor_id;
    unsigned short product_id;

    unsigned char audio_control_category_code;

    CLD_SC58x_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_SC58x_Audio_2_0_Stream_Interface_Params *
                  p_audio_streaming_rx_interface_params;
    CLD_SC58x_Audio_2_0_Rate_Feedback_Params *
                  p_audio_rate_feedback_rx_params;

    CLD_SC58x_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_SC58x_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_SC58x_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);

    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;
    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;

    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_SC58x_Audio_2_0_Lib_Init_Params;
```

A description of the CLD_SC58x_Audio_2_0_Lib_Init_Params structure elements is included below:

<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>usb_config</td><td>Selects which of the SC58x USB ports the Audio 2.0 interface will be connected. The valid usb_config values are listed below:
<table>
<tr><th>usb_config Setting</th><th>Connected SC58x USB Port</th></tr>
<tr><td>CLD_USB0_AUDIO</td><td>USB 0</td></tr>
<tr><td>CLD_USB1_AUDIO</td><td>USB 1</td></tr>
</table></td></tr>
<tr><td>enable_dma</td><td>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.</td></tr>
<tr><td>vendor_id</td><td>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).</td></tr>
<tr><td>product_id</td><td>The 16-bit product ID that is returned to the USB Host in the USB Device Descriptor.</td></tr>
<tr><td>usb_bus_max_power</td><td>USB Configuration Descriptor bMaxPower value (0 = self powered). Refer to the USB 2.0 protocol section 9.6.3.</td></tr>
<tr><td>device_descriptor_bcd_device</td><td>USB Device Descriptor bcdDevice value.
Refer to the USB 2.0 protocol section 9.6.1.</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_SC58x_Audio_2_0_Control_Interrupt_Params structure that describes the optional Interrupt IN endpoint.

Set to CLD_NULL if not required

The CLD_SC58x_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_sc58x_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.</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td></td><td>(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_SC58x_Audio_2_0_Stream_Interface_Params structure that describes how the Isochronous OUT endpoint and related USB Audio Streaming interface should be configured. The a CLD_SC58x_Audio_2_0_Stream_Interface_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 Isochronous endpoint. The endpoint number must be within the following range:

1 ≤ endpoint num ≤ 12. Any other endpoint number will result in the cld_sc58x_audio_2_0_lib_init function returning CLD_FAIL</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at Full Speed. The maximum max packet size is 1023 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at High Speed. The maximum max packet size is 1024 bytes.</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>
<tr><td>b_terminal_link</td><td>The Terminal ID of the Terminal connected to this endpoint.</td></tr>
<tr><td>b_format_type</td><td>Format type of the streaming interface</td></tr>
<tr><td>bm_formats</td><td>Supported audio format bitmap.</td></tr>
<tr><td>b_nr_channels</td><td>Number of audio channels supported by the streaming</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td></td><td>interface.</td></tr>
<tr><td>i_channel_config</td><td>Index of the string descriptor describing the first physical channel. These strings should be defined in the user_string_descriptor_table.</td></tr>
<tr><td>p_encoder_descriptor</td><td>Pointer to an optional USB Audio 2.0 Encoder descriptor.</td></tr>
<tr><td>p_decoder_descriptor</td><td>Pointer to an optional USB Audio 2.0 Decoder descriptor.</td></tr>
<tr><td>p_format_descriptor</td><td>Pointer to the format descriptor defined in the USB Device Class Definition for Audio Data Formats v2.0 specification.</td></tr>
<tr><td>p_audio_stream_endpoint_data_descriptor</td><td>Pointer to the Audio Streaming endpoint data descriptor (See USB Device Class Definition for Audio Devices v2.0 section 4.10.1.2).</td></tr>
</table></td></tr>
<tr><td>p_audio_rate_feedback_rx_params</td><td>Pointer to a CLD_SC58x_Rate_Feedback_Params structure that describes how the Isochronous IN endpoint and related USB Audio Streaming interface feedback should be configured. The a CLD_SC58x_Rate_Feedback_Params structure contains the following elements:<table>
<tr><td>Structure Element</td><td>Description</td></tr>
<tr><td>max_packet_size_full_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at Full Speed. The maximum max packet size is 1023 bytes.</td></tr>
<tr><td>max_packet_size_high_speed</td><td>Sets the Isochronous endpoint's max packet size when operating at High Speed. The maximum max packet size is 1024 bytes.</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_audio_streaming_tx_interface_params</td><td>Pointer to a CLD_SC58x_Audio_2_0_Stream_Interface_Params structure that describes how the Isochronous IN 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_SC58x_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</td></tr>
</table>

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:

Structure Element	Description
num_bytes	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 SC58x Audio 2.0 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.
p_data_buffer	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.
fp_usb_out_transfer_compelete	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 Isochronous OUT data.
transfer_timeout_ms	Isochronous OUT transfer timeout in milliseconds. If the Isochronous OUT transfer takes longer then this timeout the transfer is aborted and the

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>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><th>Return Value</th><th>Description</th></tr>
<tr><td>CLD_USB_TRANSFER_ACCEPT</td><td>Notifies the CLD SC58x Audio 2.0 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 SC58x Audio 2.0 Library pause the current transfer. This causes the Isochronous OUT endpoint to be nak'ed until the transfer is resumed by calling cld_sc58x_audio_2_0_lib_resume_paused_audio_data_transfer.</td></tr>
<tr><td>CLD_USB_TRANSFER_DISCARD</td><td>Requests that the CLD SC58x Audio 2.0 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 SC58x Audio 2.0 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_SC58x_Audio_2_0_Cmd_Req_Parameters (p_req_params) as its parameters.

The following CLD_SC58x_Audio_2_0_Cmd_Req_Parameters structure elements are used to processed a Set Request:
<table>
<tr><th>Structure Element</th><th>Description</th></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 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.
transfer_timeout_ms	Not used for Control Requests since the Host has the ability to interrupt any Control transfer.

<table>
<tr><td></td><td>The fp_audio_set_req_cmd function returns the 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 SC58x Audio 2.0 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 SC58x Audio 2.0 Library pause the Set Request transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_sc58x_audio_2_0_lib_ resume_paused_control_ transfer.</td></tr>
<tr><td>CLD_USB_TRANSFER_DISCARD</td><td>Requests that the CLD SC58x Audio 2.0 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 SC58x Audio 2.0 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_SC58x_Audio_2_0_Cmd_Req_Parameters (p_req_params) as its parameters.

The following CLD_SC58x_Audio_2_0_Cmd_Req_Parameters structure elements are used to processed a Get Request:
<table>
<tr><th>Structure Element</th><th>Description</th></tr>
<tr><td>req</td><td>Identifies the type of request. The valid types if requests are listed below:
<code>CLD_REQ_CURRENT</code>
<code>CLD_REQ_RANGE</code>
<code>CLD_REQ_MEMORY</code></td></tr>
<tr><td>recipient_is_interface</td><td>Identifies if the request was sent to an interface or Audio streaming endpoint</td></tr>
</table></td></tr>
</table>

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 CLD_USB_Transfer_Request_Return_Type, which has the following values:

Return Value	Description
CLD_USB_TRANSFER_ACCEPT	Notifies the CLD SC58x Audio 2.0 Library that the Get Request data should be transmitted using the p_transfer_data values.
CLD_USB_TRANSFER_PAUSE	Requests that the CLD SC58x

		Audio 2.0 Library pause the Get Request transfer. This causes the Control Endpoint to be nak'ed until the transfer is resumed by calling cld_sc58x_audio_2_0_lib_ resume_paused_control_ transfer.
	CLD_USB_TRANSFER_DISCARD	Requests that the CLD SC58x Audio 2.0 Library to return a zero length packet in response to the Get Request.
	CLD_USB_TRANSFER_STALL	This notifies the CLD SC58x Audio 2.0 Library that there is an error and the request should be stalled.
fp_audio_streaming_rx_endpoint_ enabled	Function called when the Isochronous OUT streaming interface is enabled/disabled by the USB Host using the Set Interface command.	
fp_audio_streaming_tx_endpoint_ enabled	Function called when the Isochronous IN streaming interface is enabled/disabled by the USB Host using the Set Interface command.	
p_usb_string_manufacturer	Pointer to the null-terminated string. This string is used by the CLD SC58x 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 SC58x Audio 2.0 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 SC58x Audio 2.0 Library to generate the Serial Number USB String Descriptor. If the Serial Number String Descriptor is not used set p_usb_string_serial_number to CLD_NULL.	
p_usb_string_configuration	Pointer to the null-terminated string. This string is used by the CLD SC58x Audio 2.0 Library to generate the Configuration USB String Descriptor. If the Configuration String Descriptor is not used set p_usb_string_configuration to CLD_NULL.	
p_usb_string_audio_control_interf ace	Pointer to the null-terminated string. This string is used by the CLD SC58x Audio 2.0 Library to generate the Audio Control Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL.	
p_usb_string_audio_streaming_ out_interface	Pointer to the null-terminated string. This string is used by the CLD SC58x Audio 2.0 Library to generate the Audio OUT Streaming Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL.	
p_usb_string_audio_streaming_in _interface	Pointer to the null-terminated string. This string is used by the CLD SC58x Audio 2.0 Library to generate the Audio IN Streaming Interface USB String Descriptor. If this interface String Descriptor is not used set it to CLD_NULL.	

<table>
<tr><td>user_string_descriptor_table_num
_entries</td><td>The number of entries in the array of CLD_SC58x_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_SC58x_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 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_SC58x_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_FS</td><td>USB device enumerated (USB Configuration set to a non-zero value) at Full-Speed</td></tr>
<tr><td>CLD_USB_ENUMERATED_CONFIGURED_HS</td><td>USB device enumerated (USB Configuration set to a non-zero value) at High-Speed</td></tr>
<tr><td>CLD_USB_UN_CONFIGURED</td><td>USB Configuration set</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>to 0</td></tr>
<tr><td>CLD_USB_BUS_RESET</td><td>USB Bus reset received</td></tr>
</table>

Note: Set to CLD_NULL if not required by application</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><td>Parameter</td><td>Description</td></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>

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.</td></tr>
</table>

cld_sc58x_audio_2_0_lib_main

```
void cld_sc58x_audio_2_0_lib_main (void)
```

CLD SC58x Audio 2.0 Library mainline function

Arguments

None

Return Value

None.

Details

The cld_sc58x_audio_2_0_lib_main function is the CLD SC58 Audio 2.0 Library mainline function that must be called in every iteration of the main program loop in order for the library to function properly.

cld_sc58x_audio_2_0_lib_transmit_audio_data

```
CLD_USB_Data_Transmit_Return_Type cld_sc58x_audio_2_0_lib_transmit_audio_data
      (CLD_USB_Transfer_Params * p_transfer_data)
```

CLD SC58x Audio 2.0 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_sc58x_audio_2_0_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_sc58x_audio_2_0_lib_transmit_interrupt_data

```
CLD_USB_Data_Transmit_Return_Type
cld_sc58x_audio_2_0_lib_transmit_interrupt_data
      (CLD_USB_Transfer_Params * p_transfer_data)
```

CLD SC58x Audio 2.0 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_sc58x_audio_2_0_lib_transmit_interrupt_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Interrupt 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_sc58x_audio_2_0_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_sc58x_audio_2_0_lib_transmit_audio_rate_feedback_data

```
CLD_USB_Data_Transmit_Return_Type
cld_sc58x_audio_2_0_lib_transmit_audio_rate_feedback_data
      (CLD_USB_Audio_Feedback_Params * p_transfer_data)
```

CLD SC58x Audio 2.0 Library function used to send data over the Isochronous IN rate feedback endpoint.

Arguments

`p_transfer_data`	Pointer to a CLD_USB_Audio_Feedback_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 feedback transfer.
`CLD_USB_TRANSMIT_FAILED`	The library failed to start the requested feedback transfer. This will happen if the Isochronous IN endpoint is disabled, or is busy

Details

The cld cld_sc58x_audio_2_0_lib_transmit_audio_rate_feedback_data function transmits the data specified by the p_transfer_data parameter to the USB Host using the Device's Isochronous IN endpoint.

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The CLD_USB_Audio_Feedback_Params structure is described below.

```
typedef struct
{
    float desired_data_rate;
    void (*fp_usb_in_transfer_complete) (void);
    void (*fp_transfer_aborted_callback) (void);
    CLD_Time transfer_timeout_ms;
} CLD_USB_Audio_Feedback_Params;
```

A description of the CLD_USB_Audio_Feedback_Params structure elements is included below:

Structure Element	Description
desired_data_rate	The desired feedback value in kHz (for example: desired_data_rate = 44.1 for 44.1kHz).
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_sc58x_audio_2_0_lib_resume_paused_audio_data_transfer

```
void cld_sc58x_audio_2_0_lib_resume_paused_audio_data_transfer (void)
```

CLD SC58x Audio 2.0 Library function used to resume a paused Isochronous OUT transfer.

Arguments
None

Return Value
None.

Details
The cld_sc58x_audio_2_0_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_sc58x_audio_2_0_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_sc58x_audio_2_0_lib_resume_paused_control_transfer

```
void cld_sc58x_audio_2_0_lib_resume_paused_control_transfer (void)
```

CLD SC58x Audio 2.0 Library function used to resume a paused Control endpoint transfer.

Arguments
None

Return Value
None.

Details
The cld_sc58x_audio_2_0_lib_resume_paused_control_transfer function is used to resume a Control transfer that was paused by the `fp_audio_set_req_cmd` or `fp_audio_get_req_cmd` function returning CLD_USB_TRANSFER_PAUSE. When called the cld_sc58x_audio_2_0_lib_resume_paused_control_transfer function will call the User application's fp`_audio_set_req_cmd` or `fp_audio_get_req_cmd` 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 SC58x Audio 2.0 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 SC58x Audio 2.0 Library has been initialized to connect the USB device to the Host.

cld_ lib_usb_disconnect

```
void cld_lib_usb_disconnect (void)
```

CLD SC58x Audio 2.0 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 SC58x Audio 2.0 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 SC58x USB Port Interrupt Service Routines as shown in the CLD provided example projects.

cld_time_get

```
CLD_Time cld_time_get(void)
```

CLD SC58x Audio 2.0 Library function used to get the current CLD time.

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.

cld_time_passed_ms

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

CLD SC58x Audio 2.0 Library function used to measure the amount of time that has passed.

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.

cld_time_get_125us

```
CLD_Time cld_time_get_125us(void)
```

CLD SC58x 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 SC58x 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

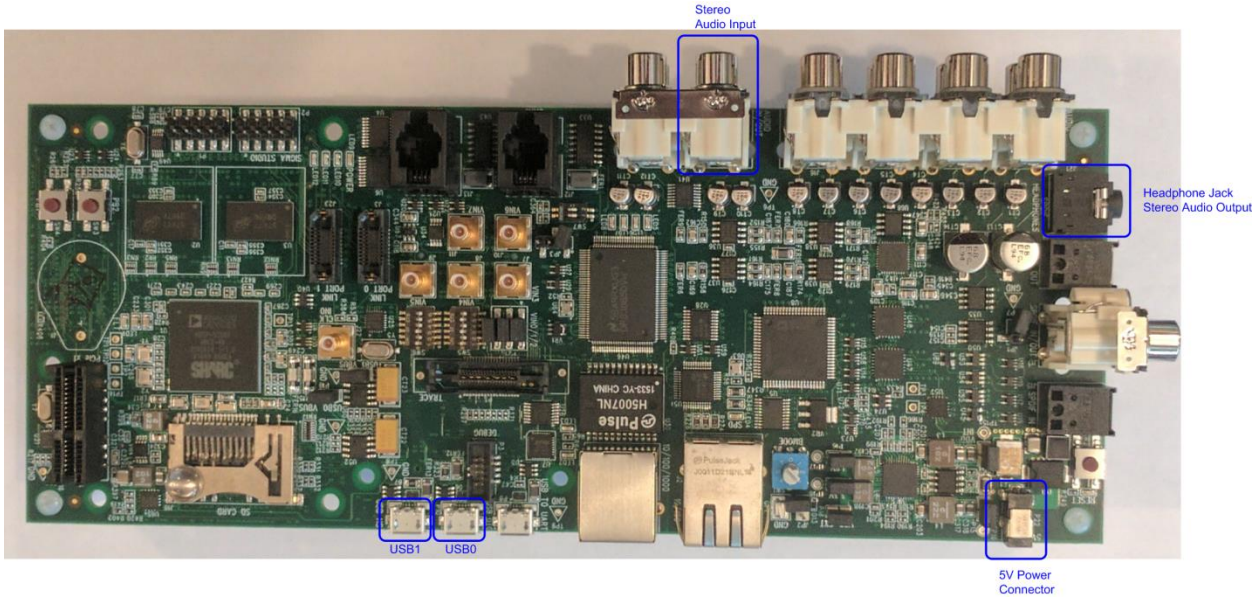
This function returns a decoded Null terminated ASCII string.

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-SC589 Ez-Board

Connections:



Adding the CLD SC58x Audio 2.0 Library to an Existing CrossCore Embedded Studio Project

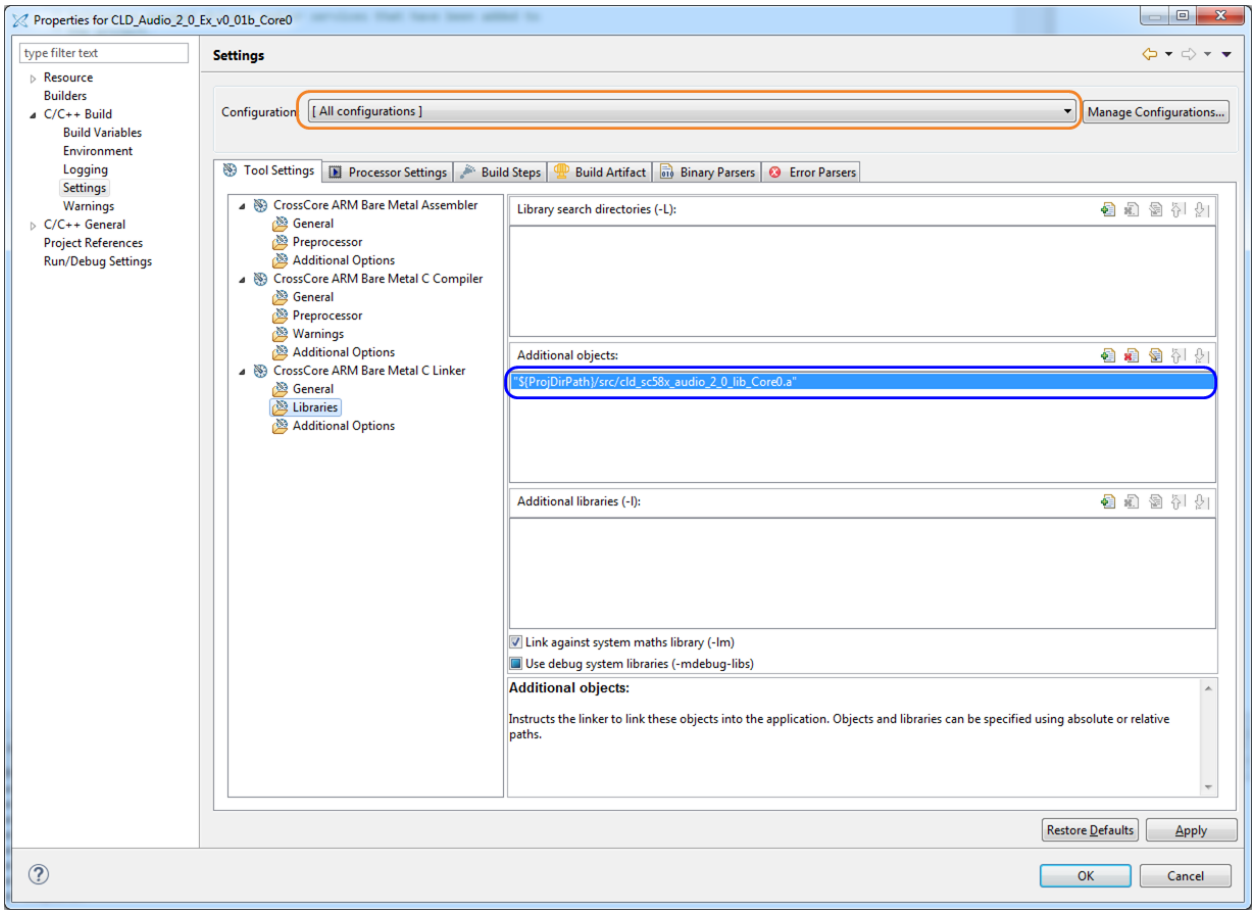
In order to include the CLD SC58x Audio 2.0 Library in a CrossCore Embedded Studio (CCES) project you must configure the project linker settings so it can locate the library. The following steps outline how this is done.

1. Copy the cld_sc58x_audio_2_0_lib.h and cld_sc58x_audio_2_0_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 SC58x Audio 2.0 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_sc58x_audio_2_0_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 SC58x Audio 2.0 Library please refer to the CLD_Audio_2_0_Ex_v1_00 or CLD_Audio_2_0_8ch_Ex_v1_00 projects included with the CLD SC58x Audio 2.0 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 SC589 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_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_main();
            break;

            case MAIN_STATE_ERROR:

            break;
        }
    }
}
```

user_audio.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_SC58x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor
user_audio_in_stream_endpoint_desc =
{
    .b_length = sizeof(CLD_SC58x_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_SC58x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor
user_audio_out_stream_endpoint_desc =
{
    .b_length = sizeof(CLD_SC58x_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_SC58x_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_SC58x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor*)&user_audio_in_stream_
```

```
endpoint_desc,
};

/* Audio Stream OUT Interface parameters */
static CLD_SC58x_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_SC58x_Audio_2_0_Lib_Audio_Stream_Data_Endpoint_Descriptor*)
             &user_audio_out_stream_endpoint_desc,
};

/* Audio Control Interrupt IN endpoint parameters */
static CLD_SC58x_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 */
};


/*!< CLD SC58x Audio 2.0 library initialization data. */
static CLD_SC58x_Audio_2_0_Lib_Init_Params user_audio_init_params =
{
    .usb_config = CLD_USB0_AUDIO,
    .enable_dma = CLD_TRUE,    /* USB DMA enabled */
    .timer_num  = CLD_TIMER_0, /* Timer used by the CLD Library */

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

    .usb_bus_max_power = 0,
    .device_descriptor_bcdDevice = 0x0100,             /* Set USB Device Descriptor
                                                          firmware version to 1.00 */
    .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,

    /* USB string descriptors - Set to CLD_NULL if not required */
    .p_usb_string_manufacturer  = "Analog Devices Inc",
    .p_usb_string_product       = "SC584 Audio v2.0 Device",
    .p_usb_string_serial_number = CLD_NULL,
    .p_usb_string_configuration = CLD_NULL,
    .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,

    .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. */
    .fp_cld_usb_event_callback = user_audio_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_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 SC58x Audio 2.0 Library */
            cld_rv = cld_sc58x_audio_2_0_lib_init(&user_audio_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_audi_main (void)
{
    cld_sc58x_audio_2_0_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_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_sc58x_audio_2_0_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_SC58x_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_SC58x_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. */
    }
}

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);
}
```