
MCUXpresso SDK USB Stack Host Reference Manual

NXP Semiconductors

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Chapter 1

Overview

The USB host stack is composed of USB class drivers. The USB class drivers include the USB common host driver and USB controller driver, which consists of the xHCI driver. Note that the xHCI represents either the EHCI or the KHCI, not the XHCI for USB 3.0.

To support different RTOSes with the same code base, the OSA is used inside the USB stack to wrap the differences between RTOSes. Note that the OSA is not supported for use in the USB application. Therefore, from the USB application's view point, the OSA is invisible.

The USB host stack must work with a dedicated application in which the following tasks should be done:

- Configure the USB clock
- Initialize/configure the USB host stack
- Choose the proper configuration when one peripheral is connected on callback event received and decide if one peripheral could be supported by this application
- Initialize class
- Choose the proper interface setting and configure the peripheral if needed
- Initialize the transfer request
- Handle the transfer result through the callback

The architecture and components of the USB host stack are shown below:

USB Host Initialization flow

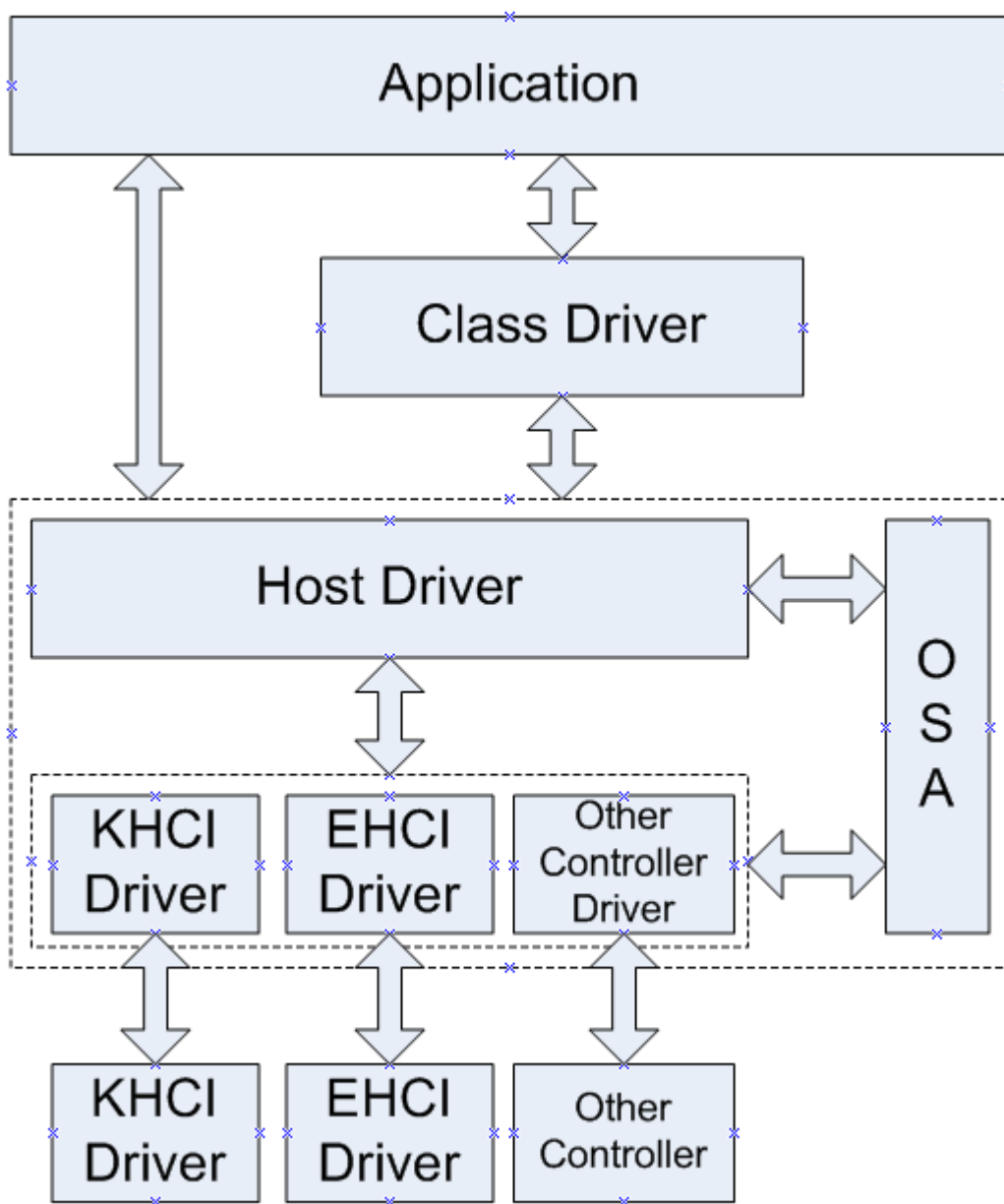


Figure 1: Host stack architecture

The interface between the KHCI/EHCI Driver and the Common Controller driver is internal and is simplified in this document.

1.1 USB Host Initialization flow

The host stack works as follows:

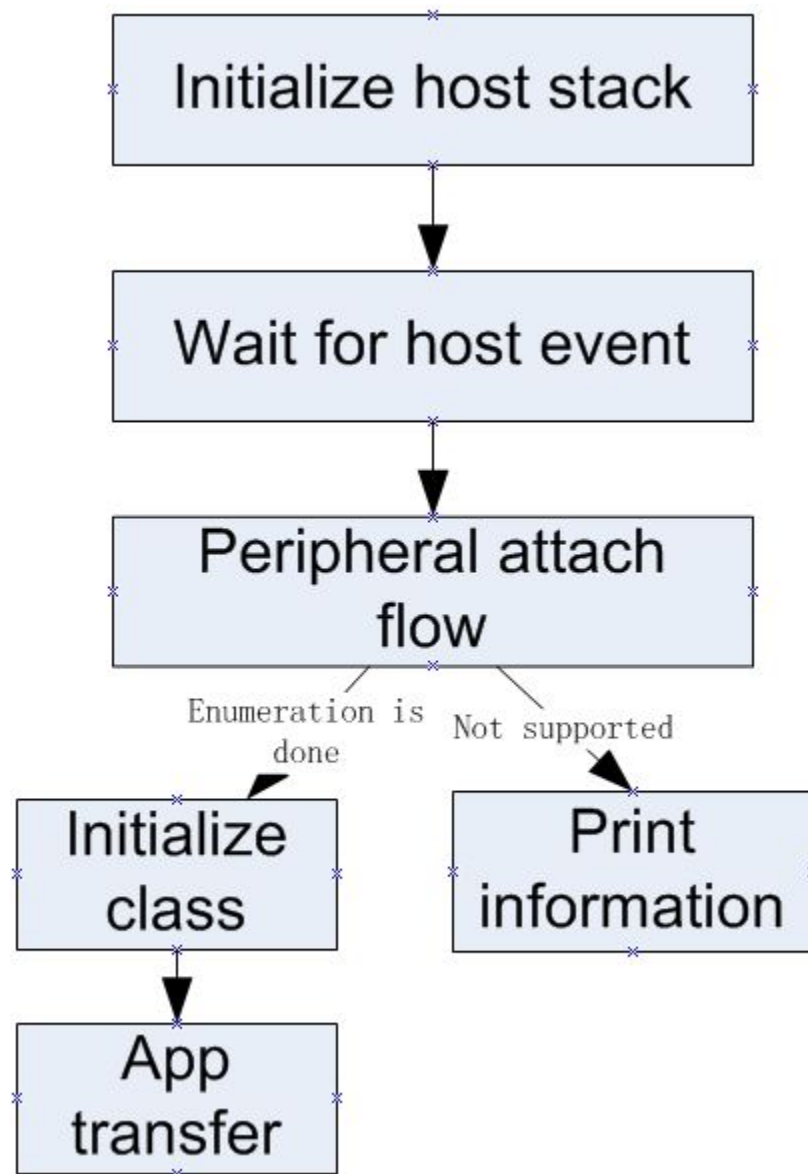


Figure 1.1.1: Host stack work flow

The host stack initialization work flow is as follows:

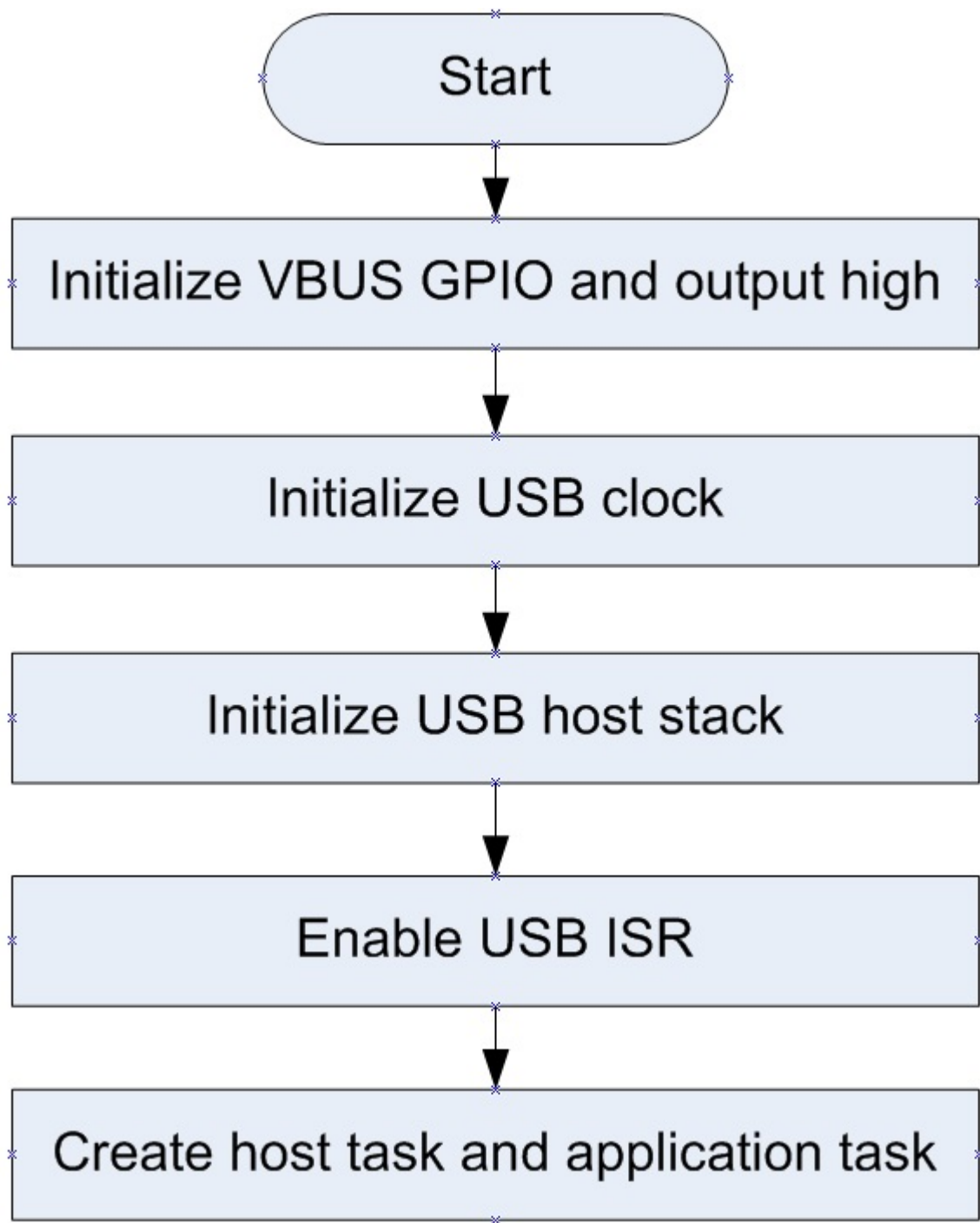


Figure 1.1.2: Host stack initialization flow

- If the platform uses a GPIO to control the VBUS, initialize the GPIO and the output high.
- Initialize the USB host clock.
- Call the `USB_HostInit` to initialize the USB host stack.
- Set the USB interrupt priority and enable the interrupt.
- Create the host task with the task API `USB_HostKhciTaskFunction` or the `USB_HostEhciTask-`

Function. Create an application task if necessary.

1.2 USB Host peripheral attach/detach flow

The peripheral attach/detach/unsupported event notifies the application through the callback function that it is registered by the USB_HostInit.

The peripheral attach/detach flow is as follows:

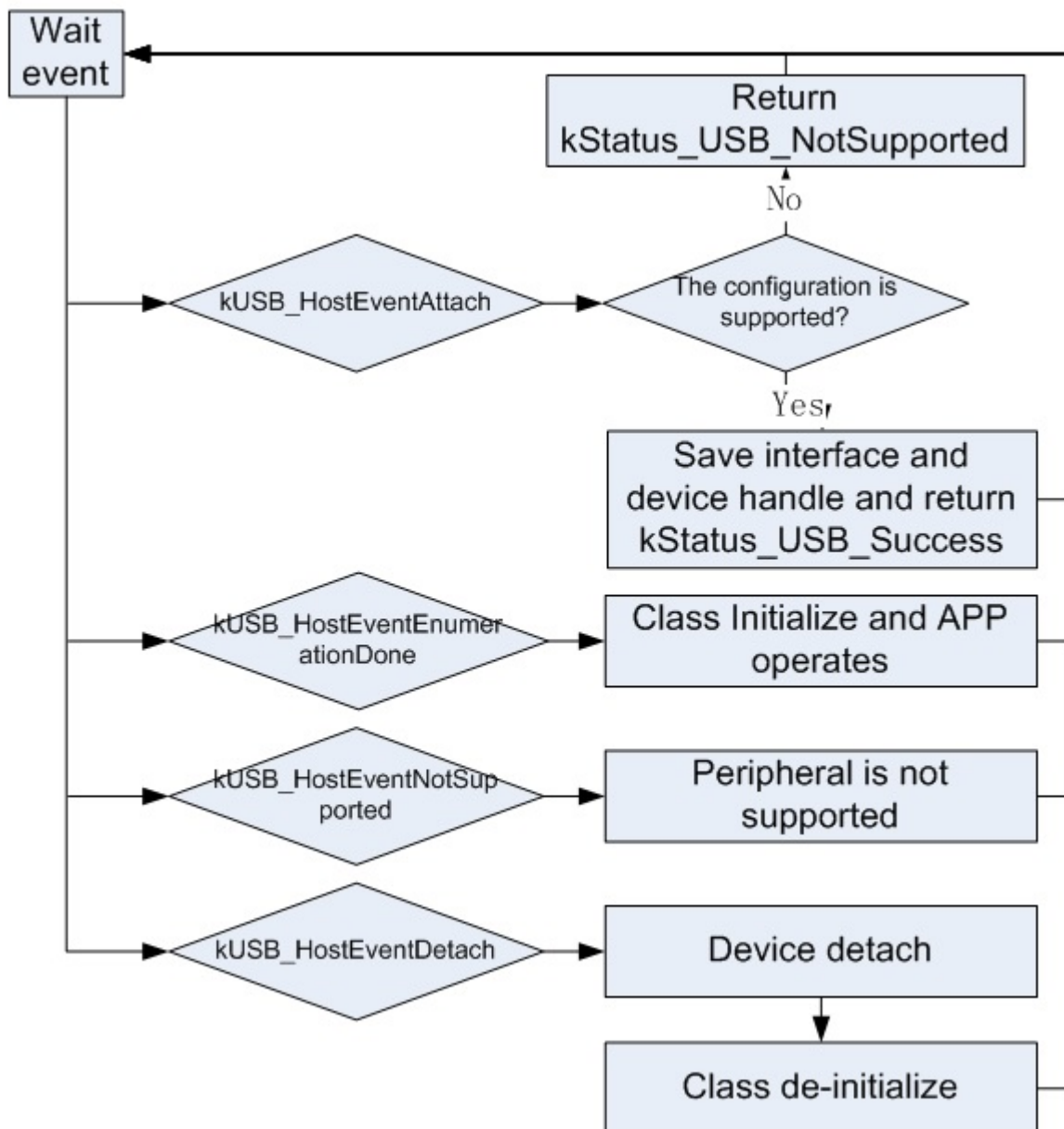


Figure 1.2.1: Host stack attach flow

The parameters of the callback contain the device handle, configuration handle, and event code. The key

USB Host peripheral attach/detach flow

point is the configuration handle. All interface information within this configuration is included. The application should make use of the information to decide if this configuration is supported. Note that, if the application returns `kStatus_USB_NotSupported`, the USB host stack checks the next configuration descriptor of the peripheral until the application returns the `kStatus_USB_Success` or all configuration descriptors are checked. If there is no supported configuration found in the peripheral descriptor, the `kUSB_HostEventNotSupported` event is notified to the application through a callback function registered by the `usb_host_init`.

There are four events in the callback. See the `host_event_t`:

- `kUSB_HostEventAttach` for attaching the peripheral
- `kUSB_HostEventDetach` for attaching the unsupported peripheral
- `kUSB_HostEventEnumerationDone` for a supported peripheral enumeration
- `kUSB_HostEventNotSupported` for detaching the peripheral

For example:

- Use case 1: The device has one configuration and is supported by the host application. The event flow is as follows:
 - (1) `kUSB_HostEventAttach` event; An application chooses the configuration and returns the `kStatus_USB_Success`.
 - (2) `kUSB_HostEventEnumerationDone` event; An application starts to initialize the class and run.
- Use case 2: The device has two configurations and is not supported by the host application. The event flow is as follows:
 - (1) `kUSB_HostEventAttach` event; An application chooses the first configuration and returns the `kStatus_USB_NotSupported`.
 - (2) `kUSB_HostEventAttach` event; An application chooses the second configuration and returns the `kStatus_USB_NotSupported`.
 - (3) `kUSB_HostEventNotSupported` event; An application prints the device not supported information.

Chapter 2

Definitions and structures

2.1 Overview

This lists the common definitions and structures for the USB stack.

Data Structures

- struct [usb_version_t](#)
USB stack version fields. [More...](#)

Macros

- #define [USB_STACK_VERSION_MAJOR](#) (0x01U)
Defines USB stack major version.
- #define [USB_STACK_VERSION_MINOR](#) (0x00U)
Defines USB stack minor version.
- #define [USB_STACK_VERSION_BUGFIX](#) (0x00U)
Defines USB stack bugfix version.
- #define [USB_MAKE_VERSION](#)(major, minor, bugfix) (((major) << 16) | ((minor) << 8) | (bugfix))
USB stack version definition.

Typedefs

- typedef void * [usb_host_handle](#)
USB host handle type define.
- typedef void * [usb_device_handle](#)
USB device handle type define.
- typedef void * [usb_otg_handle](#)
USB OTG handle type define.

Enumerations

- enum `usb_status_t` {
 `kStatus_USB_Success` = 0x00U,
 `kStatus_USB_Error`,
 `kStatus_USB_Busy`,
 `kStatus_USB_InvalidHandle`,
 `kStatus_USB_InvalidParameter`,
 `kStatus_USB_InvalidRequest`,
 `kStatus_USB_ControllerNotFound`,
 `kStatus_USB_InvalidControllerInterface`,
 `kStatus_USB_NotSupported`,
 `kStatus_USB_Retry`,
 `kStatus_USB_TransferStall`,
 `kStatus_USB_TransferFailed`,
 `kStatus_USB_AllocFail`,
 `kStatus_USB_LackSwapBuffer`,
 `kStatus_USB_TransferCancel`,
 `kStatus_USB_BandwidthFail`,
 `kStatus_USB_MSDDStatusFail` }

USB error code.

- enum `usb_controller_index_t` {
 `kUSB_ControllerKhci0` = 0U,
 `kUSB_ControllerKhci1` = 1U,
 `kUSB_ControllerEhci0` = 2U,
 `kUSB_ControllerEhci1` = 3U,
 `kUSB_ControllerLpcIp3511Fs0` = 4U,
 `kUSB_ControllerLpcIp3511Fs1`,
 `kUSB_ControllerLpcIp3511Hs0` = 6U,
 `kUSB_ControllerLpcIp3511Hs1`,
 `kUSB_ControllerOhci0` = 8U,
 `kUSB_ControllerOhci1` = 9U,
 `kUSB_ControllerIp3516Hs0` = 10U,
 `kUSB_ControllerIp3516Hs1` }

USB controller ID.

2.2 Data Structure Documentation

2.2.1 struct `usb_version_t`

Data Fields

- uint8_t `major`
Major.
- uint8_t `minor`
Minor.

- uint8_t [bugfix](#)
Bug fix.

2.3 Typedef Documentation

2.3.1 typedef void* usb_device_handle

For device stack it is the whole device handle; for host stack it is the attached device instance handle

2.4 Enumeration Type Documentation

2.4.1 enum usb_status_t

Enumerator

kStatus_USB_Success Success.
kStatus_USB_Error Failed.
kStatus_USB_Busy Busy.
kStatus_USB_InvalidHandle Invalid handle.
kStatus_USB_InvalidParameter Invalid parameter.
kStatus_USB_InvalidRequest Invalid request.
kStatus_USB_ControllerNotFound Controller cannot be found.
kStatus_USB_InvalidControllerInterface Invalid controller interface.
kStatus_USB_NotSupported Configuration is not supported.
kStatus_USB_Retry Enumeration get configuration retry.
kStatus_USB_TransferStall Transfer stalled.
kStatus_USB_TransferFailed Transfer failed.
kStatus_USB_AllocFail Allocation failed.
kStatus_USB_LackSwapBuffer Insufficient swap buffer for KHCI.
kStatus_USB_TransferCancel The transfer cancelled.
kStatus_USB_BandwidthFail Allocate bandwidth failed.
kStatus_USB_MSDStatusFail For MSD, the CSW status means fail.

2.4.2 enum usb_controller_index_t

Enumerator

kUSB_ControllerKhci0 KHCI 0U.
kUSB_ControllerKhci1 KHCI 1U, Currently, there are no platforms which have two KHCI IPs, this is reserved to be used in the future.
kUSB_ControllerEhci0 EHCI 0U.
kUSB_ControllerEhci1 EHCI 1U, Currently, there are no platforms which have two EHCI IPs, this is reserved to be used in the future.
kUSB_ControllerLpcIp3511Fs0 LPC USB IP3511 FS controller 0.

Enumeration Type Documentation

kUSB_ControllerLpcIp3511Fs1 LPC USB IP3511 FS controller 1, there are no platforms which have two IP3511 IPs, this is reserved to be used in the future.

kUSB_ControllerLpcIp3511Hs0 LPC USB IP3511 HS controller 0.

kUSB_ControllerLpcIp3511Hs1 LPC USB IP3511 HS controller 1, there are no platforms which have two IP3511 IPs, this is reserved to be used in the future.

kUSB_ControllerOhci0 OHCI 0U.

kUSB_ControllerOhci1 OHCI 1U, Currently, there are no platforms which have two OHCI IPs, this is reserved to be used in the future.

kUSB_ControllerIp3516Hs0 IP3516HS 0U.

kUSB_ControllerIp3516Hs1 IP3516HS 1U, Currently, there are no platforms which have two IP3516HS IPs, this is reserved to be used in the future.

Chapter 3

USB Host driver

3.1 Overview

The USB host driver implements USB host basic functions, such as the device enumeration, USB standard request, and send/receive data. It is the middle layer between the class driver and the controller driver. It provides the same APIs for different controller drivers.

Modules

- [USB Host Controller driver](#)

Data Structures

- struct [usb_host_ep_t](#)
USB host endpoint information structure. [More...](#)
- struct [usb_host_interface_t](#)
USB host interface information structure. [More...](#)
- struct [usb_host_configuration_t](#)
USB host configuration information structure. [More...](#)
- struct [usb_host_pipe_t](#)
USB host pipe common structure. [More...](#)
- struct [usb_host_transfer_t](#)
USB host transfer structure. [More...](#)
- struct [usb_host_pipe_init_t](#)
USB host pipe information structure for opening pipe. [More...](#)
- struct [usb_host_cancel_param_t](#)
Cancel transfer parameter structure. [More...](#)
- struct [usb_host_device_instance_t](#)
Device instance. [More...](#)
- struct [usb_host_process_feature_param_t](#)
For USB_REQUEST_STANDARD_CLEAR_FEATURE and USB_REQUEST_STANDARD_SET_FEATURE. [More...](#)
- struct [usb_host_process_descriptor_param_t](#)
For USB_REQUEST_STANDARD_GET_DESCRIPTOR and USB_REQUEST_STANDARD_SET_DESCRIPTOR. [More...](#)
- struct [usb_host_get_interface_param_t](#)
For USB_REQUEST_STANDARD_GET_INTERFACE. [More...](#)
- struct [usb_host_get_status_param_t](#)
For USB_REQUEST_STANDARD_GET_STATUS. [More...](#)
- struct [usb_host_set_interface_param_t](#)
For USB_REQUEST_STANDARD_SET_INTERFACE. [More...](#)
- struct [usb_host_synch_frame_param_t](#)
For USB_REQUEST_STANDARD_SYNCH_FRAME. [More...](#)
- struct [usb_host_instance_t](#)
USB host instance structure. [More...](#)

Typedefs

- typedef void * [usb_host_class_handle](#)
USB host class handle type define.
- typedef void * [usb_host_controller_handle](#)
USB host controller handle type define.
- typedef void * [usb_host_configuration_handle](#)
USB host configuration handle type define.
- typedef void * [usb_host_interface_handle](#)
USB host interface handle type define.
- typedef void * [usb_host_pipe_handle](#)
USB host pipe handle type define.
- typedef [usb_status_t](#)(* [host_callback_t](#))([usb_device_handle](#) deviceHandle, [usb_host_configuration_handle](#) configurationHandle, [uint32_t](#) eventCode)
Host callback function typedef.
- typedef void(* [transfer_callback_t](#))(void *param, [uint8_t](#) *data, [uint32_t](#) dataLen, [usb_status_t](#) status)
Transfer callback function typedef.
- typedef void(* [host_inner_transfer_callback_t](#))(void *param, struct [_usb_host_transfer](#) *transfer, [usb_status_t](#) status)
Host stack inner transfer callback function typedef.

Enumerations

- enum [usb_host_event_t](#) {
 [kUSB_HostEventAttach](#) = 1U,
 [kUSB_HostEventDetach](#),
 [kUSB_HostEventEnumerationDone](#),
 [kUSB_HostEventNotSupported](#),
 [kUSB_HostEventNotSuspended](#),
 [kUSB_HostEventSuspended](#),
 [kUSB_HostEventNotResumed](#),
 [kUSB_HostEventDetectResume](#),
 [kUSB_HostEventResumed](#),
 [kUSB_HostEventL1Sleep](#),
 [kUSB_HostEventL1SleepNYET](#),
 [kUSB_HostEventL1SleepNotSupport](#),
 [kUSB_HostEventL1SleepError](#),
 [kUSB_HostEventL1NotResumed](#),
 [kUSB_HostEventL1DetectResume](#),
 [kUSB_HostEventL1Resumed](#) }
Event codes for device attach/detach.
- enum [usb_host_dev_info_t](#) {

```

kUSB_HostGetDeviceAddress = 1U,
kUSB_HostGetDeviceHubNumber,
kUSB_HostGetDevicePortNumber,
kUSB_HostGetDeviceSpeed,
kUSB_HostGetDeviceHSHubNumber,
kUSB_HostGetDeviceHSHubPort,
kUSB_HostGetDeviceLevel,
kUSB_HostGetHostHandle,
kUSB_HostGetDeviceControlPipe,
kUSB_HostGetDevicePID,
kUSB_HostGetDeviceVID,
kUSB_HostGetHubThinkTime,
kUSB_HostGetDeviceConfigIndex,
kUSB_HostGetConfigurationDes,
kUSB_HostGetConfigurationLength }

```

USB host device information code.

- enum `usb_host_device_enumeration_status_t` {
`kStatus_DEV_Notinit` = 0,
`kStatus_DEV_Initial`,
`kStatus_DEV_GetDes8`,
`kStatus_DEV_SetAddress`,
`kStatus_DEV_GetDes`,
`kStatus_DEV_GetCfg9`,
`kStatus_DEV_GetCfg`,
`kStatus_DEV_SetCfg`,
`kStatus_DEV_EnumDone`,
`kStatus_DEV_AppUsed` }

States of device instances enumeration.

- enum `usb_host_interface_state_t` {
`kStatus_interface_Attached` = 1,
`kStatus_interface_Opened`,
`kStatus_interface_Detached` }

States of device's interface.

- enum `usb_host_device_state_t` {
`kStatus_device_Detached` = 0,
`kStatus_device_Attached` }

States of device.

- enum `usb_host_request_type_t` {
`kRequestDevice` = 1U,
`kRequestInterface`,
`kRequestEndpoint` }

Request type.

Functions

- **usb_status_t USB_HostAttachDevice** (**usb_host_handle** hostHandle, **uint8_t** speed, **uint8_t** hubNumber, **uint8_t** portNumber, **uint8_t** level, **usb_device_handle** *deviceHandle)
Calls this function when device attach.
- **usb_status_t USB_HostDetachDevice** (**usb_host_handle** hostHandle, **uint8_t** hubNumber, **uint8_t** portNumber)
Call this function when device detaches.
- **usb_status_t USB_HostDetachDeviceInternal** (**usb_host_handle** hostHandle, **usb_device_handle** deviceHandle)
Call this function when device detaches.
- **uint8_t USB_HostGetDeviceAttachState** (**usb_device_handle** deviceHandle)
Gets the the device attach/detach state.
- **usb_status_t USB_HostValidateDevice** (**usb_host_handle** hostHandle, **usb_device_handle** deviceHandle)
Determine whether the device is attached.

USB host APIs Part 1

The following APIs are recommended for application use.

- **usb_status_t USB_HostInit** (**uint8_t** controllerId, **usb_host_handle** *hostHandle, **host_callback_t** callbackFn)
Initializes the USB host stack.
- **usb_status_t USB_HostDeinit** (**usb_host_handle** hostHandle)
Deinitializes the USB host stack.
- **usb_status_t USB_HostHelperGetPeripheralInformation** (**usb_device_handle** deviceHandle, **uint32_t** infoCode, **uint32_t** *infoValue)
Gets the device information.
- **usb_status_t USB_HostHelperParseAlternateSetting** (**usb_host_interface_handle** interfaceHandle, **uint8_t** alternateSetting, **usb_host_interface_t** *interface)
Parses the alternate interface descriptor.
- **usb_status_t USB_HostRemoveDevice** (**usb_host_handle** hostHandle, **usb_device_handle** deviceHandle)
Removes the attached device.
- **void USB_HostKhciTaskFunction** (**void** *hostHandle)
KHCI task function.
- **void USB_HostEhciTaskFunction** (**void** *hostHandle)
EHCI task function.
- **void USB_HostOhciTaskFunction** (**void** *hostHandle)
OHCI task function.
- **void USB_HostIp3516HsTaskFunction** (**void** *hostHandle)
IP3516HS task function.
- **void USB_HostKhciIsrFunction** (**void** *hostHandle)
Device KHCI ISR function.
- **void USB_HostEhciIsrFunction** (**void** *hostHandle)
Device EHCI ISR function.
- **void USB_HostOhciIsrFunction** (**void** *hostHandle)
Device OHCI ISR function.
- **void USB_HostIp3516HsIsrFunction** (**void** *hostHandle)
Device IP3516HS ISR function.

USB host APIs Part 2.

The following APIs are not recommended for application use.

They are mainly used in the class driver.

- `usb_status_t USB_HostOpenPipe` (`usb_host_handle` hostHandle, `usb_host_pipe_handle` *pipeHandle, `usb_host_pipe_init_t` *pipeInit)
Opens the USB host pipe.
- `usb_status_t USB_HostClosePipe` (`usb_host_handle` hostHandle, `usb_host_pipe_handle` pipeHandle)
Closes the USB host pipe.
- `usb_status_t USB_HostSend` (`usb_host_handle` hostHandle, `usb_host_pipe_handle` pipeHandle, `usb_host_transfer_t` *transfer)
Sends data to a pipe.
- `usb_status_t USB_HostSendSetup` (`usb_host_handle` hostHandle, `usb_host_pipe_handle` pipeHandle, `usb_host_transfer_t` *transfer)
Sends a setup transfer to the pipe.
- `usb_status_t USB_HostRecv` (`usb_host_handle` hostHandle, `usb_host_pipe_handle` pipeHandle, `usb_host_transfer_t` *transfer)
Receives the data from the pipe.
- `usb_status_t USB_HostCancelTransfer` (`usb_host_handle` hostHandle, `usb_host_pipe_handle` pipeHandle, `usb_host_transfer_t` *transfer)
Cancel the pipe's transfers.
- `usb_status_t USB_HostMallocTransfer` (`usb_host_handle` hostHandle, `usb_host_transfer_t` **transfer)
Allocates a transfer resource.
- `usb_status_t USB_HostFreeTransfer` (`usb_host_handle` hostHandle, `usb_host_transfer_t` *transfer)
Frees a transfer resource.
- `usb_status_t USB_HostRequestControl` (`usb_device_handle` deviceHandle, `uint8_t` usbRequest, `usb_host_transfer_t` *transfer, void *param)
Requests the USB standard request.
- `usb_status_t USB_HostOpenDeviceInterface` (`usb_device_handle` deviceHandle, `usb_host_interface_handle` interfaceHandle)
Opens the interface.
- `usb_status_t USB_HostCloseDeviceInterface` (`usb_device_handle` deviceHandle, `usb_host_interface_handle` interfaceHandle)
Closes an interface.
- `void USB_HostGetVersion` (`uint32_t` *version)
Gets a host stack version function.
- `usb_status_t USB_HostSuspendDeviceResquest` (`usb_host_handle` hostHandle, `usb_device_handle` deviceHandle)
Send a bus or device suspend request.
- `usb_status_t USB_HostResumeDeviceResquest` (`usb_host_handle` hostHandle, `usb_device_handle` deviceHandle)
Send a bus or device resume request.
- `usb_status_t USB_HostL1SleepDeviceResquest` (`usb_host_handle` hostHandle, `usb_device_handle` deviceHandle, `uint8_t` sleeptype)
Send a bus or device suspend request.
- `usb_status_t USB_HostL1ResumeDeviceResquest` (`usb_host_handle` hostHandle, `usb_device_handle` deviceHandle, `uint8_t` sleepType)

Data Structure Documentation

- Send a bus or device resume request.*
- `usb_status_t USB_HostL1SleepDeviceResquestConfig (usb_host_handle hostHandle, uint8_t *lpmParam)`
Update the lpm param.
- `usb_status_t USB_HostUpdateHwTick (usb_host_handle hostHandle, uint64_t tick)`
Update the hardware tick.

3.2 Data Structure Documentation

3.2.1 struct usb_host_ep_t

Data Fields

- `usb_descriptor_endpoint_t * epDesc`
Endpoint descriptor pointer.
- `uint8_t * epExtension`
Endpoint extended descriptor pointer.
- `uint16_t epExtensionLength`
Extended descriptor length.

3.2.2 struct usb_host_interface_t

Data Fields

- `usb_host_ep_t epList [USB_HOST_CONFIG_INTERFACE_MAX_EP]`
Endpoint array.
- `usb_descriptor_interface_t * interfaceDesc`
Interface descriptor pointer.
- `uint8_t * interfaceExtension`
Interface extended descriptor pointer.
- `uint16_t interfaceExtensionLength`
Extended descriptor length.
- `uint8_t interfaceIndex`
The interface index.
- `uint8_t alternateSettingNumber`
The interface alternate setting value.
- `uint8_t epCount`
Interface's endpoint number.

3.2.3 struct usb_host_configuration_t

Data Fields

- `usb_host_interface_t interfaceList [USB_HOST_CONFIG_CONFIGURATION_MAX_INTERFACE]`
Interface array.

- `usb_descriptor_configuration_t * configurationDesc`
Configuration descriptor pointer.
- `uint8_t * configurationExtension`
Configuration extended descriptor pointer.
- `uint16_t configurationExtensionLength`
Extended descriptor length.
- `uint8_t interfaceCount`
The configuration's interface number.

3.2.4 struct usb_host_pipe_t

Data Fields

- `struct _usb_host_pipe * next`
Link the idle pipes.
- `usb_device_handle deviceHandle`
This pipe's device's handle.
- `uint16_t currentCount`
For KHCI transfer.
- `uint16_t nakCount`
Maximum NAK count.
- `uint16_t maxPacketSize`
Maximum packet size.
- `uint16_t interval`
FS/LS: frame unit; HS: micro-frame unit.
- `uint8_t open`
0 - closed, 1 - open
- `uint8_t nextdata01`
Data toggle.
- `uint8_t endpointAddress`
Endpoint address.
- `uint8_t direction`
Pipe direction.
- `uint8_t pipeType`
Pipe type, for example USB_ENDPOINT_BULK.
- `uint8_t numberPerUframe`
Transaction number per micro-frame.

3.2.5 struct usb_host_transfer_t

Data Fields

- `struct _usb_host_transfer * next`
The next transfer structure.
- `uint8_t * transferBuffer`
Transfer data buffer.
- `uint32_t transferLength`

Data Structure Documentation

- *Transfer data length.*
uint32_t [transferSofar](#)
- *Length transferred so far.*
host_inner_transfer_callback_t [callbackFn](#)
- *Transfer callback function.*
void * [callbackParam](#)
- *Transfer callback parameter.*
usb_host_pipe_t * [transferPipe](#)
- *Transfer pipe pointer.*
usb_setup_struct_t [setupPacket](#)
- *Set up packet buffer.*
uint8_t [direction](#)
- *Transfer direction; it's values are USB_OUT or USB_IN.*
uint8_t [setupStatus](#)
- *Set up the transfer status.*
uint16_t [nakTimeout](#)
- *KHCI transfer NAK timeout.*
uint16_t [retry](#)
- *KHCI transfer retry.*
uint32_t [unitHead](#)
- *xTD head for this transfer*
int32_t [transferResult](#)
- *KHCI transfer result.*
uint32_t [unitTail](#)
- *xTD tail for this transfer*
uint32_t [frame](#)
- *KHCI transfer frame number.*

3.2.6 struct usb_host_pipe_init_t

Data Fields

- void * [devInstance](#)
Device instance handle.
- uint16_t [nakCount](#)
Maximum NAK retry count.
- uint16_t [maxPacketSize](#)
Pipe's maximum packet size.
- uint8_t [interval](#)
Pipe's interval.
- uint8_t [endpointAddress](#)
Endpoint address.
- uint8_t [direction](#)
Endpoint direction.
- uint8_t [pipeType](#)
Endpoint type, the value is USB_ENDPOINT_INTERRUPT, USB_ENDPOINT_CONTROL, USB_ENDPOINT_ISOCHRONOUS, USB_ENDPOINT_BULK.
- uint8_t [numberPerUframe](#)
Transaction number for each micro-frame.

3.2.6.0.0.1 Field Documentation

3.2.6.0.0.1.1 uint16_t usb_host_pipe_init_t::nakCount

MUST be zero for interrupt

3.2.7 struct usb_host_cancel_param_t

Data Fields

- [usb_host_pipe_handle](#) pipeHandle
Cancelling pipe handle.
- [usb_host_transfer_t](#) * transfer
Cancelling transfer.

3.2.8 struct usb_host_device_instance_t

Data Fields

- struct _usb_host_device_instance * [next](#)
Next device, or NULL.
- [usb_host_handle](#) hostHandle
Host handle.
- [usb_host_configuration_t](#) configuration
Parsed configuration information for the device.
- [usb_descriptor_device_t](#) deviceDescriptor
Standard device descriptor.
- [usb_host_pipe_handle](#) controlPipe
Device's control pipe.
- uint8_t * [configurationDesc](#)
Configuration descriptor pointer.
- uint16_t [configurationLen](#)
Configuration descriptor length.
- uint16_t [configurationValue](#)
Configuration index.
- uint8_t [interfaceStatus](#) [USB_HOST_CONFIG_CONFIGURATION_MAX_INTERFACE]
Interfaces' status, please reference to [usb_host_interface_state_t](#).
- uint8_t [enumBuffer](#) [9]
Buffer for enumeration.
- uint8_t [state](#)
Device state for enumeration.
- uint8_t [enumRetries](#)
Re-enumeration when error in control transfer.
- uint8_t [stallRetries](#)
Re-transfer when stall.
- uint8_t [speed](#)
Device speed.

Data Structure Documentation

- uint8_t [allocatedAddress](#)
Temporary address for the device.
- uint8_t [setAddress](#)
The address has been set to the device successfully, 1 - 127.
- uint8_t [deviceAttachState](#)
See the `usb_host_device_state_t`.
- uint8_t [hubNumber](#)
Device's first connected hub address (root hub = 0)
- uint8_t [portNumber](#)
Device's first connected hub's port no (1 - 8)
- uint8_t [hsHubNumber](#)
Device's first connected high-speed hub's address (1 - 8)
- uint8_t [hsHubPort](#)
Device's first connected high-speed hub's port no (1 - 8)
- uint8_t [level](#)
Device's level (root device = 0)

3.2.8.0.0.2 Field Documentation

3.2.8.0.0.2.1 uint8_t usb_host_device_instance_t::allocatedAddress

When set address request succeeds, setAddress is a value, 1 - 127

3.2.9 struct usb_host_process_feature_param_t

Data Fields

- uint8_t [requestType](#)
See the `usb_host_request_type_t`.
- uint8_t [featureSelector](#)
Set/cleared feature.
- uint8_t [interfaceOrEndpoint](#)
Interface or end pointer.

3.2.10 struct usb_host_process_descriptor_param_t

Data Fields

- uint8_t [descriptorType](#)
See the `usb_spec.h`, such as the `USB_DESCRIPTOR_TYPE_DEVICE`.
- uint8_t [descriptorIndex](#)
The descriptor index is used to select a specific descriptor (only for configuration and string descriptors) when several descriptors of the same type are implemented in a device.
- uint8_t [languageId](#)
It specifies the language ID for string descriptors or is reset to zero for other descriptors.
- uint8_t * [descriptorBuffer](#)
Buffer pointer.

- uint16_t [descriptorLength](#)
Buffer data length.

3.2.11 struct usb_host_get_interface_param_t

Data Fields

- uint8_t [interface](#)
Interface number.
- uint8_t * [alternateInterfaceBuffer](#)
Save the transfer result.

3.2.12 struct usb_host_get_status_param_t

Data Fields

- uint16_t [statusSelector](#)
Interface number, the end pointer number or OTG status selector.
- uint8_t [requestType](#)
See the [usb_host_request_type_t](#).
- uint8_t * [statusBuffer](#)
Save the transfer result.

3.2.13 struct usb_host_set_interface_param_t

Data Fields

- uint8_t [alternateSetting](#)
Alternate setting value.
- uint8_t [interface](#)
Interface number.

3.2.14 struct usb_host_synch_frame_param_t

Data Fields

- uint8_t [endpoint](#)
Endpoint number.
- uint8_t * [frameNumberBuffer](#)
Frame number data buffer.

Typedef Documentation

3.2.15 struct usb_host_instance_t

Data Fields

- void * [controllerHandle](#)
The low level controller handle.
- [host_callback_t](#) [deviceCallback](#)
Device attach/detach callback.
- [usb_osa_mutex_handle](#) [hostMutex](#)
Host layer mutex.
- [usb_host_transfer_t](#) [transferList](#) [USB_HOST_CONFIG_MAX_TRANSFERS]
Transfer resource.
- [usb_host_transfer_t](#) * [transferHead](#)
Idle transfer head.
- const
[usb_host_controller_interface_t](#) * [controllerTable](#)
KHCI/EHCI interface.
- void * [deviceList](#)
Device list.
- void * [suspendedDevice](#)
Suspended device handle.
- volatile uint64_t [hwTick](#)
Current hw tick(ms)
- uint8_t [sleepType](#)
L1 LPM device handle.
- uint8_t [addressBitMap](#) [16]
Used for address allocation.
- uint8_t [occupied](#)
0 - the instance is not occupied; 1 - the instance is occupied
- uint8_t [controllerId](#)
The controller ID.

3.2.15.0.0.3 Field Documentation

3.2.15.0.0.3.1 uint8_t usb_host_instance_t::addressBitMap[16]

The first bit is the address 1, second bit is the address 2

3.3 Typedef Documentation

3.3.1 typedef usb_status_t(* host_callback_t)(usb_device_handle deviceHandle, usb_host_configuration_handle configurationHandle, uint32_t eventCode)

This callback function is used to notify application device attach/detach event. This callback pointer is passed when initializing the host.

Parameters

<i>deviceHandle</i>	The device handle, which indicates the attached device.
<i>configuration-Handle</i>	The configuration handle contains the attached device's configuration information.
<i>event_code</i>	The callback event code; See the enumeration <code>host_event_t</code> .

Returns

A USB error code or `kStatus_USB_Success`.

Return values

<i>kStatus_USB_Success</i>	Application handles the attached device successfully.
<i>kStatus_USB_Not-Supported</i>	Application don't support the attached device.
<i>kStatus_USB_Error</i>	Application handles the attached device falsely.

3.3.2 typedef void(* transfer_callback_t)(void *param, uint8_t *data, uint32_t dataLen, usb_status_t status)

This callback function is used to notify the upper layer the result of the transfer. This callback pointer is passed when calling the send/receive APIs.

Parameters

<i>param</i>	The parameter pointer, which is passed when calling the send/receive APIs.
<i>data</i>	The data buffer pointer.
<i>data_len</i>	The result data length.
<i>status</i>	A USB error code or <code>kStatus_USB_Success</code> .

3.3.3 typedef void(* host_inner_transfer_callback_t)(void *param, struct _usb_host_transfer *transfer, usb_status_t status)

This callback function is used to notify the upper layer the result of a transfer. This callback pointer is passed when initializing the structure [usb_host_transfer_t](#).

Enumeration Type Documentation

Parameters

<i>param</i>	The parameter pointer, which is passed when calling the send/receive APIs.
<i>transfer</i>	The transfer information; See the structure usb_host_transfer_t .
<i>status</i>	A USB error code or kStatus_USB_Success.

3.4 Enumeration Type Documentation

3.4.1 enum usb_host_event_t

Enumerator

kUSB_HostEventAttach Device is attached.
kUSB_HostEventDetach Device is detached.
kUSB_HostEventEnumerationDone Device's enumeration is done and the device is supported.
kUSB_HostEventNotSupported Device's enumeration is done and the device is not supported.
kUSB_HostEventNotSuspended Suspend failed.
kUSB_HostEventSuspended Suspend successful.
kUSB_HostEventNotResumed Resume failed.
kUSB_HostEventDetectResume Detect resume signal.
kUSB_HostEventResumed Resume successful.
kUSB_HostEventL1Sleep L1 Sleep successful, state transition was successful (ACK)
kUSB_HostEventL1SleepNYET Device was unable to enter the L1 state at this time (NYET)
kUSB_HostEventL1SleepNotSupport Device does not support the L1 state (STALL)
kUSB_HostEventL1SleepError Device failed to respond or an error occurred.
kUSB_HostEventL1NotResumed Resume failed.
kUSB_HostEventL1DetectResume Detect resume signal.
kUSB_HostEventL1Resumed Resume successful.

3.4.2 enum usb_host_dev_info_t

Enumerator

kUSB_HostGetDeviceAddress Device's address.
kUSB_HostGetDeviceHubNumber Device's first hub address.
kUSB_HostGetDevicePortNumber Device's first hub port number.
kUSB_HostGetDeviceSpeed Device's speed.
kUSB_HostGetDeviceHSHubNumber Device's first high-speed hub address.
kUSB_HostGetDeviceHSHubPort Device's first high-speed hub number.
kUSB_HostGetDeviceLevel Device's hub level.
kUSB_HostGetHostHandle Device's host handle.
kUSB_HostGetDeviceControlPipe Device's control pipe handle.
kUSB_HostGetDevicePID Device's PID.

kUSB_HostGetDeviceVID Device's VID.

kUSB_HostGetHubThinkTime Device's hub total think time.

kUSB_HostGetDeviceConfigIndex Device's running zero-based config index.

kUSB_HostGetConfigurationDes Device's configuration descriptor pointer.

kUSB_HostGetConfigurationLength Device's configuration descriptor pointer.

3.4.3 enum usb_host_device Enumeration Status

Enumerator

kStatus_DEV_Notinit Device is invalid.

kStatus_DEV_Initial Device has been processed by host driver.

kStatus_DEV_GetDes8 Enumeration process: get 8 bytes' device descriptor.

kStatus_DEV_SetAddress Enumeration process: set device address.

kStatus_DEV_GetDes Enumeration process: get device descriptor.

kStatus_DEV_GetCfg9 Enumeration process: get 9 bytes' configuration descriptor.

kStatus_DEV_GetCfg Enumeration process: get configuration descriptor.

kStatus_DEV_SetCfg Enumeration process: set configuration.

kStatus_DEV_EnumDone Enumeration is done.

kStatus_DEV_AppUsed This device has been used by application.

3.4.4 enum usb_host_interface State

Enumerator

kStatus_interface_Attached Interface's default status.

kStatus_interface_Opened Interface is used by application.

kStatus_interface_Detached Interface is not used by application.

3.4.5 enum usb_host_device State

Enumerator

kStatus_device_Detached Device is used by application.

kStatus_device_Attached Device's default status.

3.4.6 enum usb_host_request Type

Enumerator

kRequestDevice Control request object is device.

Function Documentation

kRequestInterface Control request object is interface.

kRequestEndpoint Control request object is endpoint.

3.5 Function Documentation

3.5.1 `usb_status_t USB_HostInit (uint8_t controllerId, usb_host_handle * hostHandle, host_callback_t callbackFn)`

This function initializes the USB host module specified by the `controllerId`.

Parameters

in	<i>controllerId</i>	The controller ID of the USB IP. See the enumeration <code>usb_controller_index_t</code> .
out	<i>hostHandle</i>	Returns the host handle.
in	<i>callbackFn</i>	Host callback function notifies device attach/detach.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The <code>hostHandle</code> is a NULL pointer.
<i>kStatus_USB_Controller-NotFound</i>	Cannot find the controller according to the controller ID.
<i>kStatus_USB_AllocFail</i>	Allocation memory fail.
<i>kStatus_USB_Error</i>	Host mutex create fail; KHCI/EHCI mutex or KHCI/EHCI event create fail, or, KHCI/EHCI IP initialize fail.

3.5.2 `usb_status_t USB_HostDeinit (usb_host_handle hostHandle)`

This function deinitializes the USB host module specified by the `hostHandle`.

Parameters

in	<i>hostHandle</i>	The host handle.
----	-------------------	------------------

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle is a NULL pointer.
<i>kStatus_USB_Error</i>	Controller deinitialization fail.

3.5.3 **usb_status_t USB_HostHelperGetPeripheralInformation (usb_device_handle deviceHandle, uint32_t infoCode, uint32_t * infoValue)**

This function gets the device information.

Parameters

in	<i>deviceHandle</i>	Removing device handle.
in	<i>infoCode</i>	See the enumeration host_dev_info_t.
out	<i>infoValue</i>	Return the information value.

Return values

<i>kStatus_USB_Success</i>	Close successfully.
<i>kStatus_USB_Invalid-Parameter</i>	The deviceHandle or info_value is a NULL pointer.
<i>kStatus_USB_Error</i>	The info_code is not the host_dev_info_t value.

3.5.4 **usb_status_t USB_HostHelperParseAlternateSetting (usb_host_interface_handle interfaceHandle, uint8_t alternateSetting, usb_host_interface_t * interface)**

This function parses the alternate interface descriptor and returns an interface information through the structure [usb_host_interface_t](#).

Parameters

in	<i>interface-Handle</i>	The whole interface handle.
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Function Documentation

in	<i>alternate-Setting</i>	Alternate setting value.
out	<i>interface</i>	Return interface information.

Return values

<i>kStatus_USB_Success</i>	Close successfully.
<i>kStatus_USB_Invalid-Handle</i>	The interfaceHandle is a NULL pointer.
<i>kStatus_USB_Invalid-Parameter</i>	The alternateSetting is 0.
<i>kStatus_USB_Error</i>	The interface descriptor is wrong.

3.5.5 **usb_status_t USB_HostRemoveDevice (usb_host_handle *hostHandle*, usb_device_handle *deviceHandle*)**

This function removes the attached device. This function should not be used all the time.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>deviceHandle</i>	Removing device handle.

Return values

<i>kStatus_USB_Success</i>	Remove successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle or deviceHandle is a NULL pointer.
<i>kStatus_USB_Invalid-Parameter</i>	The deviceHandle instance don't belong to hostHandle instance.

3.5.6 **void USB_HostKhciTaskFunction (void * *hostHandle*)**

The function is used to handle the KHCI controller message. In the bare metal environment, this function should be called periodically in the main function. In the RTOS environment, this function should be used as a function entry to create a task.

Parameters

in	<i>hostHandle</i>	The host handle.
----	-------------------	------------------

3.5.7 void USB_HostEhciTaskFunction (void * *hostHandle*)

The function is used to handle the EHCI controller message. In the bare metal environment, this function should be called periodically in the main function. In the RTOS environment, this function should be used as a function entry to create a task.

Parameters

in	<i>hostHandle</i>	The host handle.
----	-------------------	------------------

3.5.8 void USB_HostOhciTaskFunction (void * *hostHandle*)

The function is used to handle the OHCI controller message. In the bare metal environment, this function should be called periodically in the main function. In the RTOS environment, this function should be used as a function entry to create a task.

Parameters

in	<i>hostHandle</i>	The host handle.
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3.5.9 void USB_HostIp3516HsTaskFunction (void * *hostHandle*)

The function is used to handle the IP3516HS controller message. In the bare metal environment, this function should be called periodically in the main function. In the RTOS environment, this function should be used as a function entry to create a task.

Parameters

in	<i>hostHandle</i>	The host handle.
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3.5.10 void USB_HostKhciIsrFunction (void * *hostHandle*)

The function is the KHCI interrupt service routine.

Function Documentation

Parameters

in	<i>hostHandle</i>	The host handle.
----	-------------------	------------------

3.5.11 void USB_HostEhcilsrFunction (void * *hostHandle*)

The function is the EHCI interrupt service routine.

Parameters

in	<i>hostHandle</i>	The host handle.
----	-------------------	------------------

3.5.12 void USB_HostOhcilsrFunction (void * *hostHandle*)

The function is the OHCI interrupt service routine.

Parameters

in	<i>hostHandle</i>	The host handle.
----	-------------------	------------------

3.5.13 void USB_HostIp3516HslsrFunction (void * *hostHandle*)

The function is the IP3516HS interrupt service routine.

Parameters

in	<i>hostHandle</i>	The host handle.
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3.5.14 usb_status_t USB_HostOpenPipe (usb_host_handle *hostHandle*, usb_host_pipe_handle * *pipeHandle*, usb_host_pipe_init_t * *pipeInit*)

This function opens a pipe according to the pipe_init_ptr parameter.

Parameters

in	<i>hostHandle</i>	The host handle.
out	<i>pipeHandle</i>	The pipe handle pointer used to return the pipe handle.
in	<i>pipeInit</i>	Used to initialize the pipe.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle or pipe_handle_ptr is a NULL pointer.
<i>kStatus_USB_Error</i>	There is no idle pipe. Or, there is no idle QH for EHCI. Or, bandwidth allocate fail for EHCI.

3.5.15 **usb_status_t USB_HostClosePipe (usb_host_handle *hostHandle*, usb_host_pipe_handle *pipeHandle*)**

This function closes a pipe and frees the related resources.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>pipeHandle</i>	The closing pipe handle.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle or pipeHandle is a NULL pointer.

3.5.16 **usb_status_t USB_HostSend (usb_host_handle *hostHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to send the transfer to the specified pipe.

Parameters

Function Documentation

in	<i>hostHandle</i>	The host handle.
in	<i>pipeHandle</i>	The sending pipe handle.
in	<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Send successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle, pipeHandle or transfer is a NULL pointer.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.
<i>kStatus_USB_Error</i>	There is no idle QTD/ITD/SITD for EHCI.

3.5.17 **usb_status_t USB_HostSendSetup (usb_host_handle *hostHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function request to send the setup transfer to the specified pipe.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>pipeHandle</i>	The sending pipe handle.
in	<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Send successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle, pipeHandle or transfer is a NULL pointer.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.
<i>kStatus_USB_Error</i>	There is no idle QTD/ITD/SITD for EHCI.

3.5.18 **usb_status_t USB_HostRecv (usb_host_handle *hostHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to receive the transfer from the specified pipe.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>pipeHandle</i>	The receiving pipe handle.
in	<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Receive successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle, pipeHandle or transfer is a NULL pointer.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.
<i>kStatus_USB_Error</i>	There is no idle QTD/ITD/SITD for EHCI.

3.5.19 **usb_status_t USB_HostCancelTransfer (usb_host_handle *hostHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function cancels all pipe's transfers when the parameter transfer is NULL or cancels the transfers altogether.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>pipeHandle</i>	The receiving pipe handle.
in	<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Cancel successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle or pipeHandle is a NULL pointer.

3.5.20 **usb_status_t USB_HostMallocTransfer (usb_host_handle *hostHandle*, usb_host_transfer_t ** *transfer*)**

This function allocates a transfer. This transfer is used to pass data information to a low level stack.

Function Documentation

Parameters

in	<i>hostHandle</i>	The host handle.
out	<i>transfer</i>	Return the transfer.

Return values

<i>kStatus_USB_Success</i>	Allocate successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle or transfer is a NULL pointer.
<i>kStatus_USB_Error</i>	There is no idle transfer.

3.5.21 **usb_status_t USB_HostFreeTransfer (usb_host_handle *hostHandle*, usb_host_transfer_t * *transfer*)**

This function frees a transfer. This transfer is used to pass data information to a low level stack.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>transfer</i>	Release the transfer.

Return values

<i>kStatus_USB_Success</i>	Free successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle or transfer is a NULL pointer.

3.5.22 **usb_status_t USB_HostRequestControl (usb_device_handle *deviceHandle*, uint8_t *usbRequest*, usb_host_transfer_t * *transfer*, void * *param*)**

This function sends the USB standard request packet.

Parameters

in	<i>deviceHandle</i>	The device handle for control transfer.
in	<i>usbRequest</i>	A USB standard request code. Se the usb_spec.h.
in	<i>transfer</i>	The used transfer.
in	<i>param</i>	The parameter structure is different for different request, see usb_host-framework.h.

Return values

<i>kStatus_USB_Success</i>	Send successfully.
<i>kStatus_USB_Invalid-Handle</i>	The deviceHandle is a NULL pointer.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.
<i>kStatus_USB_Error</i>	There is no idle QTD/ITD/SITD for EHCI, Or, the request is not standard request.

3.5.23 **usb_status_t USB_HostOpenDeviceInterface (usb_device_handle deviceHandle, usb_host_interface_handle interfaceHandle)**

This function opens the interface. It is used to notify the host driver the interface is used by APP or class driver.

Parameters

in	<i>deviceHandle</i>	Removing device handle.
in	<i>interface-Handle</i>	Opening interface handle.

Return values

<i>kStatus_USB_Success</i>	Open successfully.
<i>kStatus_USB_Invalid-Handle</i>	The deviceHandle or interfaceHandle is a NULL pointer.

3.5.24 **usb_status_t USB_HostCloseDeviceInterface (usb_device_handle deviceHandle, usb_host_interface_handle interfaceHandle)**

This function opens an interface. It is used to notify the host driver the interface is not used by APP or class driver.

Function Documentation

Parameters

in	<i>deviceHandle</i>	Removing device handle.
in	<i>interface-Handle</i>	Opening interface handle.

Return values

<i>kStatus_USB_Success</i>	Close successfully.
<i>kStatus_USB_Invalid-Handle</i>	The deviceHandle is a NULL pointer.

3.5.25 void USB_HostGetVersion (uint32_t * *version*)

The function is used to get the host stack version.

Parameters

out	<i>version</i>	The version structure pointer to keep the host stack version.
-----	----------------	---

3.5.26 usb_status_t USB_HostSuspendDeviceResquest (usb_host_handle *hostHandle*, usb_device_handle *deviceHandle*)

This function is used to send a bus or device suspend request.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>deviceHandle</i>	The device handle.

Return values

<i>kStatus_USB_Success</i>	Request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle is a NULL pointer. Or the controller handle is invalid.

<i>kStatus_USB_Error</i>	There is no idle transfer. Or, the deviceHandle is invalid. Or, the request is invalid.
--------------------------	---

3.5.27 **usb_status_t USB_HostResumeDeviceRequest (usb_host_handle hostHandle, usb_device_handle deviceHandle)**

This function is used to send a bus or device resume request.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>deviceHandle</i>	The device handle.

Return values

<i>kStatus_USB_Success</i>	Request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The hostHandle is a NULL pointer. Or the controller handle is invalid.
<i>kStatus_USB_Error</i>	There is no idle transfer. Or, the deviceHandle is invalid. Or, the request is invalid.

3.5.28 **usb_status_t USB_HostL1SleepDeviceRequest (usb_host_handle hostHandle, usb_device_handle deviceHandle, uint8_t sleeptype)**

This function is used to send a bus or device suspend request.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>deviceHandle</i>	The device handle.
in	<i>sleeptype</i>	Bus suspend or single device suspend.

Return values

<i>kStatus_USB_Success</i>	Request successfully.
----------------------------	-----------------------

Function Documentation

<i>kStatus_USB_Invalid_Handle</i>	The hostHandle is a NULL pointer. Or the controller handle is invalid.
<i>kStatus_USB_Error</i>	There is no idle transfer. Or, the deviceHandle is invalid. Or, the request is invalid.

3.5.29 **usb_status_t USB_HostL1ResumeDeviceResquest (usb_host_handle *hostHandle*, usb_device_handle *deviceHandle*, uint8_t *sleepType*)**

This function is used to send a bus or device resume request.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>deviceHandle</i>	The device handle. *
in	<i>sleepType</i>	Bus suspend or single device suspend.

Return values

<i>kStatus_USB_Success</i>	Request successfully.
<i>kStatus_USB_Invalid_Handle</i>	The hostHandle is a NULL pointer. Or the controller handle is invalid.
<i>kStatus_USB_Error</i>	There is no idle transfer. Or, the deviceHandle is invalid. Or, the request is invalid.

3.5.30 **usb_status_t USB_HostL1SleepDeviceResrequestConfig (usb_host_handle *hostHandle*, uint8_t * *lpmParam*)**

The function is used to configure the lpm token.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>lpmParam</i>	HIRD vaule and whether enable remotewakeup.

3.5.31 **usb_status_t USB_HostUpdateHwTick (usb_host_handle *hostHandle*, uint64_t *tick*)**

The function is used to update the hardware tick.

Parameters

in	<i>hostHandle</i>	The host handle.
in	<i>tick</i>	Current hardware tick(uint is ms).

3.5.32 `usb_status_t USB_HostAttachDevice (usb_host_handle hostHandle,
uint8_t speed, uint8_t hubNumber, uint8_t portNumber, uint8_t level,
usb_device_handle * deviceHandle)`

Parameters

<i>hostHandle</i>	Host instance handle.
<i>speed</i>	Device speed.
<i>hubNumber</i>	Device hub no. root device's hub no. is 0.
<i>portNumber</i>	Device port no. root device's port no. is 0.
<i>level</i>	Device level. root device's level is 1.
<i>deviceHandle</i>	Return device handle.

Returns

kStatus_USB_Success or error codes.

3.5.33 `usb_status_t USB_HostDetachDevice (usb_host_handle hostHandle,
uint8_t hubNumber, uint8_t portNumber)`

Parameters

<i>hostHandle</i>	Host instance handle.
<i>hubNumber</i>	Device hub no. root device's hub no. is 0.
<i>portNumber</i>	Device port no. root device's port no. is 0.

Returns

kStatus_USB_Success or error codes.

3.5.34 `usb_status_t USB_HostDetachDeviceInternal (usb_host_handle hostHandle,
usb_device_handle deviceHandle)`

Function Documentation

Parameters

<i>hostHandle</i>	Host instance handle.
<i>deviceHandle</i>	Device handle.

Returns

kStatus_USB_Success or error codes.

3.5.35 uint8_t USB_HostGetDeviceAttachState (usb_device_handle *deviceHandle*)

Parameters

<i>deviceHandle</i>	Device handle.
---------------------	----------------

Returns

0x01 - attached; 0x00 - detached.

3.5.36 usb_status_t USB_HostValidateDevice (usb_host_handle *hostHandle*, usb_device_handle *deviceHandle*)

Parameters

<i>hostHandle</i>	Host instance pointer.
<i>deviceHandle</i>	Device handle.

Returns

kStatus_USB_Success or error codes.

3.6 USB Host Controller driver

3.6.1 Overview

The USB Host controller driver implements the real send/receive function. Implementations are different for different controllers. The supported controller drivers are KHCI, EHCI, IP3516HS and so on.

Modules

- [USB Host Controller EHCI driver](#)
- [USB Host Controller IP3516HS driver](#)
- [USB Host Controller KHCI driver](#)
- [USB Host Controller OHCI driver](#)

Data Structures

- struct [usb_host_controller_interface_t](#)
USB host controller interface structure. [More...](#)

Enumerations

- enum [usb_host_controller_control_t](#) {
[kUSB_HostCancelTransfer](#) = 1U,
[kUSB_HostBusControl](#),
[kUSB_HostGetFrameNumber](#),
[kUSB_HostUpdateControlEndpointAddress](#),
[kUSB_HostUpdateControlPacketSize](#),
[kUSB_HostPortAttachDisable](#),
[kUSB_HostPortAttachEnable](#),
[kUSB_HostL1Config](#) }
USB host controller control code.
- enum [usb_host_bus_control_t](#) {
[kUSB_HostBusReset](#) = 1U,
[kUSB_HostBusRestart](#),
[kUSB_HostBusEnableAttach](#),
[kUSB_HostBusDisableAttach](#),
[kUSB_HostBusSuspend](#),
[kUSB_HostBusResume](#),
[kUSB_HostBusL1SuspendInit](#),
[kUSB_HostBusL1Sleep](#),
[kUSB_HostBusL1Resume](#) }
USB host controller bus control code.

3.6.2 Data Structure Documentation

3.6.2.1 struct usb_host_controller_interface_t

Data Fields

- `usb_status_t(* controllerCreate)(uint8_t controllerId, usb_host_handle upperLayerHandle, usb_host_controller_handle *controllerHandle)`
Create a controller instance function prototype.
- `usb_status_t(* controllerDestory)(usb_host_controller_handle controllerHandle)`
Destroy a controller instance function prototype.
- `usb_status_t(* controllerOpenPipe)(usb_host_controller_handle controllerHandle, usb_host_pipe_handle *pipeHandle, usb_host_pipe_init_t *pipeInit)`
Open a controller pipe function prototype.
- `usb_status_t(* controllerClosePipe)(usb_host_controller_handle controllerHandle, usb_host_pipe_handle pipeHandle)`
Close a controller pipe function prototype.
- `usb_status_t(* controllerWritePipe)(usb_host_controller_handle controllerHandle, usb_host_pipe_handle pipeHandle, usb_host_transfer_t *transfer)`
Write data to a pipe function prototype.
- `usb_status_t(* controllerReadPipe)(usb_host_controller_handle controllerHandle, usb_host_pipe_handle pipeHandle, usb_host_transfer_t *transfer)`
Read data from a pipe function prototype.
- `usb_status_t(* controllerIoctl)(usb_host_controller_handle controllerHandle, uint32_t ioctlEvent, void *ioctlParam)`
Control a controller function prototype.

3.6.3 Enumeration Type Documentation

3.6.3.1 enum usb_host_controller_control_t

Enumerator

- kUSB_HostCancelTransfer*** Cancel transfer code.
- kUSB_HostBusControl*** Bus control code.
- kUSB_HostGetFrameNumber*** Get frame number code.
- kUSB_HostUpdateControlEndpointAddress*** Update control endpoint address.
- kUSB_HostUpdateControlPacketSize*** Update control endpoint maximum packet size.
- kUSB_HostPortAttachDisable*** Disable the port attach event.
- kUSB_HostPortAttachEnable*** Enable the port attach event.
- kUSB_HostL1Config*** L1 suspend Bus control code.

3.6.3.2 enum usb_host_bus_control_t

Enumerator

kUSB_HostBusReset Reset bus.
kUSB_HostBusRestart Restart bus.
kUSB_HostBusEnableAttach Enable attach.
kUSB_HostBusDisableAttach Disable attach.
kUSB_HostBusSuspend Suspend BUS.
kUSB_HostBusResume Resume BUS.
kUSB_HostBusL1SuspendInit L1 Suspend BUS.
kUSB_HostBusL1Sleep L1 Suspend BUS.
kUSB_HostBusL1Resume L1 Resume BUS.

USB Host Controller driver

3.6.4 USB Host Controller KHCI driver

3.6.4.1 Overview

The KHCI host controller driver implements send/receive data through the KHCI IP.

Data Structures

- struct [ptr_usb_host_khci_state_struct_t](#)
KHCI controller driver instance structure. [More...](#)

Macros

- #define [KHCICFG_THSLD_DELAY](#) 0x65
The value programmed into the threshold register must reserve enough time to ensure the worst case transaction completes.

USB host KHCI APIs

- [usb_status_t](#) [USB_HostKhciCreate](#) ([uint8_t](#) controllerId, [usb_host_handle](#) hostHandle, [usb_host_controller_handle](#) *controllerHandle)
Creates the USB host KHCI instance.
- [usb_status_t](#) [USB_HostKhciDestory](#) ([usb_host_controller_handle](#) controllerHandle)
Destroys the USB host KHCI instance.
- [usb_status_t](#) [USB_HostKhciOpenPipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) *pipeHandlePointer, [usb_host_pipe_init_t](#) *pipeInitPointer)
Opens the USB host pipe.
- [usb_status_t](#) [USB_HostKhciClosePipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) pipeHandle)
Closes the USB host pipe.
- [usb_status_t](#) [USB_HostKhciWritePipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) pipeHandle, [usb_host_transfer_t](#) *transfer)
Sends data to the pipe.
- [usb_status_t](#) [USB_HostKhciReadpipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) pipeHandle, [usb_host_transfer_t](#) *transfer)
Receives data from the pipe.
- [usb_status_t](#) [USB_HostKciIoctl](#) ([usb_host_controller_handle](#) controllerHandle, [uint32_t](#) ioctlEvent, [void](#) *ioctlParam)
Controls the KHCI.

3.6.4.2 Data Structure Documentation

3.6.4.2.1 struct usb_khci_host_state_struct_t

Data Fields

- volatile USB_Type * [usbRegBase](#)
The base address of the register.
- void * [hostHandle](#)
Related host handle.
- [usb_host_pipe_t](#) * [pipeDescriptorBasePointer](#)
Pipe descriptor base pointer.
- [usb_osa_event_handle](#) [khciEventPointer](#)
KHCI event.
- [usb_osa_mutex_handle](#) [khciMutex](#)
KHCI mutex.
- [usb_host_transfer_t](#) * [periodicListPointer](#)
KHCI periodic list pointer, which link is an interrupt and an ISO transfer request.
- [usb_host_transfer_t](#) * [asyncListPointer](#)
KHCI async list pointer, which link controls and bulk transfer request.
- [khci_xfer_sts_t](#) [sXferSts](#)
KHCI transfer status structure for the DAM ALIGN workaround.
- uint8_t * [khciSwapBufPointer](#)
KHCI swap buffer pointer for the DAM ALIGN workaround.
- volatile uint32_t [trState](#)
KHCI transfer state.
- uint8_t [asyncListActive](#)
KHCI async list is active.
- uint8_t [periodicListActive](#)
KHCI periodic list is active.
- uint8_t [rxBd](#)
RX buffer descriptor toggle bits.
- uint8_t [txBd](#)
TX buffer descriptor toggle bits.
- uint8_t [deviceSpeed](#)
Device speed.
- bus_suspend_request_state_t [busSuspendStatus](#)
Bus Suspend Status.
- int8_t [deviceAttached](#)
Device attach/detach state.

3.6.4.3 Macro Definition Documentation

3.6.4.3.1 #define KHCICFG_THSLD_DELAY 0x65

In general, the worst case transaction is an IN token followed by a data packet from the target followed by the response from the host. The actual time required is a function of the maximum packet size on the bus. Set the KHCICFG_THSLD_DELAY to 0x65 to meet the worst case.

USB Host Controller driver

3.6.4.4 Function Documentation

3.6.4.4.1 `usb_status_t USB_HostKhciCreate (uint8_t controllerId, usb_host_handle hostHandle,
usb_host_controller_handle * controllerHandle)`

This function initializes the USB host KHCI controller driver.

Parameters

<i>controllerId</i>	The controller ID of the USB IP. See the enumeration <code>usb_controller_index_t</code> .
<i>hostHandle</i>	The host level handle.
<i>controller-Handle</i>	Returns the controller instance handle.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocates memory failed.
<i>kStatus_USB_Error</i>	Host mutex create failed, KHCI mutex or KHCI event create failed. Or, KHCI IP initialize failed.

3.6.4.4.2 `usb_status_t USB_HostKhciDestory (usb_host_controller_handle controllerHandle)`

This function deinitializes the USB host KHCI controller driver.

Parameters

<i>controller-Handle</i>	The controller handle.
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Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
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3.6.4.4.3 `usb_status_t USB_HostKhciOpenPipe (usb_host_controller_handle controllerHandle, usb_host_pipe_handle * pipeHandlePointer, usb_host_pipe_init_t * pipelnitPointer)`

This function opens a pipe according to the `pipe_init_ptr` parameter.

Parameters

<i>controller-Handle</i>	The controller handle.
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<i>pipeHandle-Pointer</i>	The pipe handle pointer used to return the pipe handle.
<i>pipeInitPointer</i>	It is used to initialize the pipe.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_Error</i>	There is no idle pipe.

3.6.4.4.4 **usb_status_t USB_HostKhciClosePipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*)**

This function closes a pipe and frees the related resources.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The closing pipe handle.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

3.6.4.4.5 **usb_status_t USB_HostKhciWritePipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to send the transfer to the specified pipe.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The sending pipe handle.
<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Send successful.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.

3.6.4.4.6 **usb_status_t USB_HostKhciReadpipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to receive the transfer from the specified pipe.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The receiving pipe handle.
<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Receive successful.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.

3.6.4.4.7 **usb_status_t USB_HostKciloctl (usb_host_controller_handle *controllerHandle*, uint32_t *ioctlEvent*, void * *ioctlParam*)**

This function controls the KHCI.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>ioctlEvent</i>	See the enumeration host_bus_control_t.
<i>ioctlParam</i>	The control parameter.

Return values

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<i>kStatus_USB_Success</i>	Cancel successful.
<i>kStatus_USB_Invalid-Handle</i>	The controllerHandle is a NULL pointer.

3.6.5 USB Host Controller EHCI driver

3.6.5.1 Overview

The EHCI host controller driver implements send/receive data through the EHCI IP.

Data Structures

- struct [usb_host_ehci_pipe_t](#)
EHCI pipe structure. [More...](#)
- struct [usb_host_ehci_qh_t](#)
EHCI QH structure. [More...](#)
- struct [usb_host_ehci_qtd_t](#)
EHCI QTD structure. [More...](#)
- struct [usb_host_ehci_itd_t](#)
EHCI ITD structure. [More...](#)
- struct [usb_host_ehci_sitd_t](#)
EHCI SITD structure. [More...](#)
- struct [usb_host_ehci_iso_t](#)
EHCI ISO structure; An ISO pipe has an instance of this structure to keep the ISO pipe-specific information. [More...](#)
- struct [usb_host_ehci_instance_t](#)
EHCI instance structure. [More...](#)
- struct [usb_host_ehci_data_t](#)
EHCI data structure. [More...](#)

Macros

- #define [USB_HOST_EHCI_ISO_NUMBER](#) USB_HOST_CONFIG_EHCI_MAX_ITD
The maximum supported ISO pipe number.
- #define [USB_HOST_EHCI_PORT_CONNECT_DEBOUNCE_DELAY](#) (101U)
Check the port connect state delay if the state is unstable.
- #define [USB_HOST_EHCI_PORT_RESET_DELAY](#) (11U)
Delay for port reset.
- #define [USB_HOST_EHCI_ISO_BOUNCE_FRAME_NUMBER](#) (2U)
The SITD inserts a frame interval for putting more SITD continuously.
- #define [USB_HOST_EHCI_ISO_BOUNCE_UFRAME_NUMBER](#) (16U)
The ITD inserts a micro-frame interval for putting more ITD continuously.
- #define [USB_HOST_EHCI_CONTROL_BULK_TIME_OUT_VALUE](#) (20U)
Control or bulk transaction timeout value (unit: 100 ms)

Enumerations

- enum [host_ehci_device_state_t](#) {
 [kEHCIDevicePhyAttached](#) = 1,
 [kEHCIDeviceAttached](#),
 [kEHCIDeviceDetached](#) }

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EHCI state for device attachment/detachment.

USB host EHCI APIs

- [usb_status_t USB_HostEhciCreate](#) (uint8_t controllerId, [usb_host_handle](#) upperLayerHandle, [usb_host_controller_handle](#) *controllerHandle)
Creates the USB host EHCI instance.
- [usb_status_t USB_HostEhciDestory](#) ([usb_host_controller_handle](#) controllerHandle)
Destroys the USB host EHCI instance.
- [usb_status_t USB_HostEhciOpenPipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) *pipeHandle, [usb_host_pipe_init_t](#) *pipeInit)
Opens the USB host pipe.
- [usb_status_t USB_HostEhciClosePipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) pipeHandle)
Closes the USB host pipe.
- [usb_status_t USB_HostEhciWritePipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) pipeHandle, [usb_host_transfer_t](#) *transfer)
Sends data to the pipe.
- [usb_status_t USB_HostEhciReadpipe](#) ([usb_host_controller_handle](#) controllerHandle, [usb_host_pipe_handle](#) pipeHandle, [usb_host_transfer_t](#) *transfer)
Receives data from the pipe.
- [usb_status_t USB_HostEhciIoctl](#) ([usb_host_controller_handle](#) controllerHandle, uint32_t ioctl-Event, void *ioctlParam)
Controls the EHCI.

3.6.5.2 Data Structure Documentation

3.6.5.2.1 struct usb_host_ehci_pipe_t

Data Fields

- [usb_host_pipe_t pipeCommon](#)
Common pipe information.
- void * [ehciQh](#)
Control/bulk/interrupt: QH; ISO: [usb_host_ehci_iso_t](#).
- uint16_t [uframeInterval](#)
Micro-frame interval value.
- uint16_t [startFrame](#)
Bandwidth start frame: its value is from 0 to frame_list.
- uint16_t [dataTime](#)
Bandwidth time value:
- uint16_t [startSplitTime](#)
Start splitting the bandwidth time value:
- uint16_t [completeSplitTime](#)
Complete splitting the bandwidth time value:
- uint8_t [startUframe](#)
Bandwidth start micro-frame: its value is from 0 to 7.
- uint8_t [uframeSmask](#)

- *Start micro-frame.*
uint8_t [uframeCmask](#)
Complete micro-frame.

3.6.5.2.1.1 Field Documentation

3.6.5.2.1.1.1 uint16_t usb_host_ehci_pipe_t::dataTime

- When the host works as HS: it's the data bandwidth value.
- When the host works as FS/LS:
 - For FS/LS device, it's the data bandwidth value when transferring the data by FS/LS.
 - For HS device, it's the data bandwidth value when transferring the data by HS.

3.6.5.2.1.1.2 uint16_t usb_host_ehci_pipe_t::startSplitTime

- When the host works as HS, it is the start split bandwidth value.

3.6.5.2.1.1.3 uint16_t usb_host_ehci_pipe_t::completeSplitTime

- When host works as HS, it is the complete split bandwidth value.

3.6.5.2.1.1.4 uint8_t usb_host_ehci_pipe_t::uframeSmask

- When host works as an HS:
 - For FS/LS device, it's the interrupt or ISO transfer start-split mask.
 - * For HS device, it's the interrupt transfer start micro-frame mask.
- When host works as FS/LS, it's the interrupt and ISO start micro-frame mask

3.6.5.2.1.1.5 uint8_t usb_host_ehci_pipe_t::uframeCmask

- When host works as HS:
 - For FS/LS device, it's the interrupt or ISO transfer complete-split mask.

3.6.5.2.2 struct usb_host_ehci_qh_t

See the USB EHCI specification

Data Fields

- uint32_t [horizontalLinkPointer](#)
QH specification filed, queue head a horizontal link pointer.
- uint32_t [staticEndpointStates](#) [2]
QH specification filed, static endpoint state and configuration information.
- uint32_t [currentQtdPointer](#)
QH specification filed, current qTD pointer.
- uint32_t [nextQtdPointer](#)
QH specification filed, next qTD pointer.
- uint32_t [alternateNextQtdPointer](#)

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- *QH specification filed, alternate next qTD pointer.*
uint32_t [transferOverlayResults](#) [6]
- *QH specification filed, transfer overlay configuration and transfer results.*
usb_host_ehci_pipe_t * [ehciPipePointer](#)
EHCI pipe pointer.
- [usb_host_transfer_t](#) * [ehciTransferHead](#)
Transfer list head on this QH.
- [usb_host_transfer_t](#) * [ehciTransferTail](#)
Transfer list tail on this QH.
- uint16_t [timeOutValue](#)
Its maximum value is USB_HOST_EHCI_CONTROL_BULK_TIME_OUT_VALUE.
- uint16_t [timeOutLabel](#)
It's used to judge the transfer timeout.

3.6.5.2.2.1 Field Documentation

3.6.5.2.2.1.1 uint16_t usb_host_ehci_qh_t::timeOutValue

When the value is zero, the transfer times out.

3.6.5.2.2.1.2 uint16_t usb_host_ehci_qh_t::timeOutLabel

The EHCI driver maintain the value

3.6.5.2.3 struct usb_host_ehci_qtd_t

See the USB EHCI specification.

Data Fields

- uint32_t [nextQtdPointer](#)
QTD specification filed, the next QTD pointer.
- uint32_t [alternateNextQtdPointer](#)
QTD specification filed, alternate next QTD pointer.
- uint32_t [transferResults](#) [2]
QTD specification filed, transfer results fields.
- uint32_t [bufferPointers](#) [4]
QTD specification filed, transfer buffer fields.

3.6.5.2.4 struct usb_host_ehci_itd_t

See the USB EHCI specification.

Data Fields

- uint32_t [nextLinkPointer](#)
ITD specification filed, the next linker pointer.

- uint32_t [transactions](#) [8]
ITD specification filed, transactions information.
- uint32_t [bufferPointers](#) [7]
ITD specification filed, transfer buffer fields.
- struct _usb_host_ehci_itd * [nextItidPointer](#)
Next ITD pointer.
- uint32_t [frameEntryIndex](#)
The ITD inserted frame value.
- uint32_t [reserved](#) [6]
Reserved fields for 32 bytes align.

3.6.5.2.5 struct usb_host_ehci_sitd_t

See the USB EHCI specification.

Data Fields

- uint32_t [nextLinkPointer](#)
SITD specification filed, the next linker pointer.
- uint32_t [endpointStates](#) [2]
SITD specification filed, endpoint configuration information.
- uint32_t [transferResults](#) [3]
SITD specification filed, transfer result fields.
- uint32_t [backPointer](#)
SITD specification filed, back pointer.
- uint16_t [frameEntryIndex](#)
The SITD inserted frame value.
- uint8_t [nextSitdIndex](#)
The next SITD index; Get the next SITD pointer through adding base address with the index.
- uint8_t [reserved](#)
Reserved fields for 32 bytes align.

3.6.5.2.5.1 Field Documentation

3.6.5.2.5.1.1 uint8_t usb_host_ehci_sitd_t::nextSitdIndex

0xFF means invalid.

3.6.5.2.6 struct usb_host_ehci_iso_t

Data Fields

- struct _usb_host_ehci_iso * [next](#)
Next instance pointer.
- [usb_host_pipe_t](#) * [ehciPipePointer](#)
This ISO's EHCI pipe pointer.
- [usb_host_transfer_t](#) * [ehciTransferHead](#)
Transfer list head on this ISO pipe.

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- `usb_host_transfer_t * ehciTransferTail`
Transfer list head on this ISO pipe.
- `uint16_t lastLinkFrame`
It means that the inserted frame for ISO ITD/SITD.

3.6.5.2.6.1 Field Documentation

3.6.5.2.6.1.1 `uint16_t usb_host_ehci_iso_t::lastLinkFrame`

0xFFFF is invalid. For ITD, it is a micro-frame value. For SITD, it is a frame value

3.6.5.2.7 `struct usb_host_ehci_instance_t`

Data Fields

- `usb_host_handle hostHandle`
Related host handle.
- `uint32_t * ehciUnitBase`
Keep the QH/QTD/ITD/SITD buffer pointer for release.
- `uint8_t * ehciFrameList`
The frame list of the current ehci instance.
- `usb_host_ehci_qh_t * ehciQhList`
Idle QH list pointer.
- `usb_host_ehci_qtd_t * ehciQtdHead`
Idle QTD list pointer head.
- `usb_host_ehci_qtd_t * ehciQtdTail`
Idle QTD list pointer tail (recently used qTD will be used)
- `usb_host_ehci_itd_t * ehciItedList`
Idle ITD list pointer.
- `usb_host_ehci_sitd_t * ehciSitdIndexBase`
SITD buffer's start pointer.
- `usb_host_ehci_sitd_t * ehciSitdList`
Idle SITD list pointer.
- `usb_host_ehci_iso_t * ehciIsoList`
Idle ISO list pointer.
- `USBHS_Type * ehciIpBase`
EHCI IP base address.
- `usb_host_ehci_qh_t * shedFirstQh`
First async QH.
- `usb_host_ehci_pipe_t * ehciPipeIndexBase`
Pipe buffer's start pointer.
- `usb_host_ehci_pipe_t * ehciPipeList`
Idle pipe list pointer.
- `usb_host_ehci_pipe_t * ehciRunningPipeList`
Running pipe list pointer.
- `usb_osa_mutex_handle ehciMutex`
EHCI mutex.
- `usb_osa_event_handle taskEventHandle`
EHCI task event.
- `USBPHY_Type * registerPhyBase`

- *The base address of the PHY register.*
uint8_t [controllerId](#)
EHCI controller ID.
- uint8_t [deviceAttached](#)
Device attach/detach state, see [host_ehci_device_state_t](#).
- uint8_t [firstDeviceSpeed](#)
The first device's speed, the controller's work speed.
- uint8_t [ehciItldNumber](#)
Idle ITD number.
- uint8_t [ehciSitdNumber](#)
Idle SITD number.
- uint8_t [ehciQtdNumber](#)
Idle QTD number.
- bus_ehci_suspend_request_state_t [busSuspendStatus](#)
Bus Suspend Status.

3.6.5.2.8 struct usb_host_ehci_data_t

3.6.5.3 Macro Definition Documentation

3.6.5.3.1 #define USB_HOST_EHCI_ISO_BOUNCE_FRAME_NUMBER (2U)

There is an interval when an application sends two FS/LS ISO transfers. When the interval is less than the macro, the two transfers are continuous in the frame list. Otherwise, the two transfers are not continuous. For example:

- Use case 1: when inserting the SITD first, the inserted frame = the current frame value + this MACRO value.
- Use case 2: when inserting SITD is not first, choose between the last inserted frame value and the current frame value according to the following criteria: If the interval is less than the MACRO value, the new SITD is continuous with the last SITD. If not, the new SITD inserting frame = the current frame value + this MACRO value.

3.6.5.3.2 #define USB_HOST_EHCI_ISO_BOUNCE_UFRAME_NUMBER (16U)

There is an interval when an application sends two HS ISO transfers. When the interval is less than the macro, the two transfers are continuous in the frame list. Otherwise, the two transfers are not continuous. For example:

- Use case 1: when inserting ITD first, the inserted micro-frame = the current micro-frame value + this MACRO value.
- Use case 2: when inserting ITD is not first, choose between the last inserted micro-frame value and the current micro-frame value according to the following criteria: If the interval is less than this MACRO value, the new ITD is continuous with the last ITD. If not, the new ITD inserting micro-frame = the current micro-frame value + this MACRO value.

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3.6.5.4 Enumeration Type Documentation

3.6.5.4.1 enum host_ehci_device_state_t

Enumerator

kEHCIDevicePhyAttached Device is physically attached.

kEHCIDeviceAttached Device is attached and initialized.

kEHCIDeviceDetached Device is detached and de-initialized.

3.6.5.5 Function Documentation

3.6.5.5.1 usb_status_t USB_HostEhciCreate (uint8_t controllerId, usb_host_handle upperLayerHandle, usb_host_controller_handle * controllerHandle)

This function initializes the USB host EHCI controller driver.

Parameters

in	<i>controllerId</i>	The controller ID of the USB IP. Please refer to the enumeration usb_controller_index_t.
in	<i>upperLayerHandle</i>	The host level handle.
out	<i>controllerHandle</i>	return the controller instance handle.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocating memory failed.
<i>kStatus_USB_Error</i>	Host mutex create fail, KHCI/EHCI mutex or KHCI/EHCI event create fail. Or, KHCI/EHCI IP initialize fail.

3.6.5.5.2 usb_status_t USB_HostEhciDestory (usb_host_controller_handle controllerHandle)

This function de-initializes The USB host EHCI controller driver.

Parameters

in	<i>controller-Handle</i>	The controller handle.
----	--------------------------	------------------------

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

3.6.5.5.3 **usb_status_t USB_HostEhciOpenPipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle * *pipeHandle*, usb_host_pipe_init_t * *pipeInit*)**

This function opens a pipe according to the pipe_init_ptr parameter.

Parameters

in	<i>controller-Handle</i>	The controller handle.
out	<i>pipeHandle</i>	The pipe handle pointer, it is used to return the pipe handle.
in	<i>pipeInit</i>	It is used to initialize the pipe.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_Error</i>	There is no idle pipe. Or, there is no idle QH for EHCI. Or, bandwidth allocate fail for EHCI.

3.6.5.5.4 **usb_status_t USB_HostEhciClosePipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*)**

This function closes a pipe and releases related resources.

Parameters

in	<i>controller-Handle</i>	The controller handle.
in	<i>pipeHandle</i>	The closing pipe handle.

Return values

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<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

3.6.5.5.5 **usb_status_t USB_HostEhciWritePipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to send the transfer to the specified pipe.

Parameters

in	<i>controller-Handle</i>	The controller handle.
in	<i>pipeHandle</i>	The sending pipe handle.
in	<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Sent successfully.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.
<i>kStatus_USB_Error</i>	There is no idle QTD/ITD/SITD for EHCI.

3.6.5.5.6 **usb_status_t USB_HostEhciReadpipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to receive the transfer from the specified pipe.

Parameters

in	<i>controller-Handle</i>	The controller handle.
in	<i>pipeHandle</i>	The receiving pipe handle.
in	<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Send successfully.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for KHCI.
<i>kStatus_USB_Error</i>	There is no idle QTD/ITD/SITD for EHCI.

3.6.5.5.7 `usb_status_t USB_HostEhciIoctl (usb_host_controller_handle controllerHandle, uint32_t ioctlEvent, void * ioctlParam)`

This function controls the EHCI.

Parameters

in	<i>controller-Handle</i>	The controller handle.
in	<i>ioctlEvent</i>	See enumeration host_bus_control_t.
in	<i>ioctlParam</i>	The control parameter.

Return values

<i>kStatus_USB_Success</i>	Cancel successfully.
<i>kStatus_USB_Invalid-Handle</i>	The controllerHandle is a NULL pointer.

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3.6.6 USB Host Controller OHCI driver

3.6.6.1 Overview

The OHCI host controller driver implements send/receive data through the OHCI IP.

Data Structures

- struct [usb_host_ohci_endpoint_descriptor_struct_t](#)
OHCI Endpoint Descriptor. [More...](#)
- struct [usb_host_ohci_general_transfer_descriptor_struct_t](#)
OHCI General Transfer Descriptor. [More...](#)
- struct [usb_host_ohci_isochronous_transfer_descriptor_struct_t](#)
OHCI Isochronous Transfer Descriptor. [More...](#)
- struct [usb_host_ohci_hcca_struct_t](#)
OHCI Host Controller Communications Area. [More...](#)
- struct [usb_host_ohci_hcor_struct_t](#)
OHCI Host Controller Operational Registers. [More...](#)
- struct [usb_host_ohci_state_struct_t](#)
OHCI controller driver instance structure. [More...](#)

Macros

- #define [USB_HOST_OHCI_EVENT_ATTACH](#) (0x01U)
task event
- #define [USB_HOST_OHCI_PORT_CONNECT_DEBOUNCE_DELAY](#) (101U)
Check the port connect state delay if the state is unstable.
- #define [USB_HOST_OHCI_TRANSFER_SCAN_INTERVAL](#) (10U)
Transfer scan interval (ms)
- #define [USB_HOST_OHCI_TRANSFER_TIMEOUT_GAP](#) (5000U / USB_HOST_OHCI_TRANSFER_SCAN_INTERVAL)
*Time out gap for each transfer (USB_HOST_OHCI_TRANSFER_SCAN_INTERVAL * 1ms)*
- #define [USB_HostOhciLock\(\)](#) [USB_OsaMutexLock](#)(usbHostState->mutex)
USB host OHCI lock.
- #define [USB_HostOhciUnlock\(\)](#) [USB_OsaMutexUnlock](#)(usbHostState->mutex)
USB host OHCI unlock.

Enumerations

- enum [usb_host_ohci_port_state_t](#) {
 [kUSB_DeviceOhciPortDetached](#) = 0U,
 [kUSB_DeviceOhciPortPhyDetached](#),
 [kUSB_DeviceOhciPortPhyAttached](#),
 [kUSB_DeviceOhciPortAttached](#) }
Port state for device attachment/detachment.

USB host OHCI APIs

- `usb_status_t USB_HostOhciCreate` (`uint8_t controllerId`, `usb_host_handle hostHandle`, `usb_host_controller_handle *controllerHandle`)
Creates the USB host OHCI instance.
- `usb_status_t USB_HostOhciDestory` (`usb_host_controller_handle controllerHandle`)
Destroys the USB host OHCI instance.
- `usb_status_t USB_HostOhciOpenPipe` (`usb_host_controller_handle controllerHandle`, `usb_host_pipe_handle *pipeHandle`, `usb_host_pipe_init_t *pipeInit`)
Opens the USB host pipe.
- `usb_status_t USB_HostOhciClosePipe` (`usb_host_controller_handle controllerHandle`, `usb_host_pipe_handle pipeHandle`)
Closes the USB host pipe.
- `usb_status_t USB_HostOhciWritePipe` (`usb_host_controller_handle controllerHandle`, `usb_host_pipe_handle pipeHandle`, `usb_host_transfer_t *transfer`)
Sends data to the pipe.
- `usb_status_t USB_HostOhciReadPipe` (`usb_host_controller_handle controllerHandle`, `usb_host_pipe_handle pipeHandle`, `usb_host_transfer_t *transfer`)
Receives data from the pipe.
- `usb_status_t USB_HostOhciIoctl` (`usb_host_controller_handle controllerHandle`, `uint32_t ioctl`, `Event`, `void *ioctlParam`)
Controls the OHCI.

3.6.6.2 Data Structure Documentation

3.6.6.2.1 struct usb_host_ohci_endpoint_descriptpor_struct_t

Data Fields

- volatile `uint32_t TailP`
TDQueueTailPointer.
- volatile `uint32_t HeadP`
TDQueueHeadPointer.
- volatile `uint32_t NextED`
NextED.
- struct `_usb_host_ohci_pipe_struct * pipe`
Pipe handle for the ED.
- `uint32_t FA`: 7U
FunctionAddress.
- `uint32_t EN`: 4U
EndpointNumber.
- `uint32_t D`: 2U
Direction: 00,11 - Get dir from TD, 01 - OUT, 10 - IN.
- `uint32_t S`: 1U
Speed: 0 - full speed, 1 - low speed.
- `uint32_t K`: 1U
Skip.
- `uint32_t F`: 1U
Format: 0 - Control, Bulk, or Interrupt Endpoint, 1 - ISO Endpoint.

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- volatile uint32_t **MPS**: 11U
MaximumPacketSize.
- uint32_t **reserved1**: 5U
Reserved.

3.6.6.2.1.1 Field Documentation

3.6.6.2.1.1.1 uint32_t usb_host_ohci_endpoint_descripor_struct_t::D

3.6.6.2.1.1.2 uint32_t usb_host_ohci_endpoint_descripor_struct_t::S

3.6.6.2.1.1.3 uint32_t usb_host_ohci_endpoint_descripor_struct_t::F

3.6.6.2.2 struct usb_host_ohci_general_transfer_descripor_struct_t

Data Fields

- uint32_t **CBP**
CurrentBufferPointer.
- volatile uint32_t **NextTD**
NextTD.
- uint32_t **BE**
BufferEnd.
- struct _usb_host_ohci_pipe_struct * **pipe**
Pipe handle for the GTD.
- uint32_t **reserved1**: 18U
Reserved.
- volatile uint32_t **R**: 1U
bufferRounding
- volatile uint32_t **DP**: 2U
Direction/PID.
- volatile uint32_t **DI**: 3U
DelayInterrupt.
- volatile uint32_t **T**: 2U
DataToggle.
- volatile uint32_t **EC**: 2U
ErrorCount.
- volatile uint32_t **CC**: 4U
ConditionCode.

3.6.6.2.3 struct usb_host_ohci_isochronous_transfer_descripor_struct_t

Data Fields

- uint32_t **BP0**
BufferPage0.
- volatile uint32_t **NextTD**
NextTD.
- uint32_t **BE**
BufferEnd.

- volatile uint16_t [OffsetPSW](#) [8]
Offset or PacketStatusWord.
- struct [_usb_host_ohci_pipe_struct](#) * [pipe](#)
Pipe handle for the ITD.
- volatile uint32_t [SF](#): 16U
StartingFrame.
- uint32_t [reserved1](#): 5U
Reserved.
- volatile uint32_t [DI](#): 3U
DelayInterrupt.
- volatile uint32_t [FC](#): 3U
FrameCount.
- uint32_t [reserved2](#): 1U
Reserved.
- volatile uint32_t [CC](#): 4U
ConditionCode.

3.6.6.2.4 struct [usb_host_ohci_hcca_struct_t](#)

Data Fields

- volatile uint32_t [HccaInterruptTable](#) [USB_HOST_OHCI_HCCA_SIZE]
These 32 Dwords are pointers to interrupt EDs.
- volatile uint16_t [HccaFrameNumber](#)
Contains the current frame number.
- uint16_t [HccaPad1](#)
When the HC updates HccaFrameNumber, it sets this word to 0.
- volatile uint32_t [HccaDoneHead](#)
Hcca done head.
- uint32_t [reserved](#) [30]
Reserved for use by HC.

3.6.6.2.5 struct [usb_host_ohci_hcor_struct_t](#)

3.6.6.2.6 struct [usb_host_ohci_state_struct_t](#)

Data Fields

- volatile
[usb_host_ohci_hcor_struct_t](#) * [usbRegBase](#)
The base address of the register.
- void * [hostHandle](#)
Related host handle.
- [usb_osa_event_handle](#) [ohciEvent](#)
OHCI event.
- [usb_osa_mutex_handle](#) [mutex](#)
OHCI layer mutex.
- uint8_t [controllerId](#)
Controller id.

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- uint8_t **portNumber**
Port count.
- uint8_t **isrNumber**
ISR Number.
- volatile uint8_t **gtdCount**
Gtd count.
- volatile uint8_t **itdCount**
Itid count.
- volatile uint8_t **controlIsBusy**
Is handling control transfer.
- volatile
bus_ohci_suspend_request_state_t **busSuspendStatus**
Bus Suspend Status.

3.6.6.3 Enumeration Type Documentation

3.6.6.3.1 enum usb_host_ohci_port_state_t

Enumerator

kUSB_DeviceOhciPortDetached Port is detached and de-initialized.
kUSB_DeviceOhciPortPhyDetached Port is physically detached.
kUSB_DeviceOhciPortPhyAttached Port is physically attached.
kUSB_DeviceOhciPortAttached Port is attached and initialized.

3.6.6.4 Function Documentation

3.6.6.4.1 usb_status_t USB_HostOhciCreate (uint8_t *controllerId*, usb_host_handle *hostHandle*, usb_host_controller_handle * *controllerHandle*)

This function initializes the USB host OHCI controller driver.

Parameters

<i>controllerId</i>	The controller ID of the USB IP. See the enumeration usb_controller_index_t.
<i>hostHandle</i>	The host level handle.
<i>controller-Handle</i>	Returns the controller instance handle.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocates memory failed.
<i>kStatus_USB_Error</i>	Host mutex create failed, OHCI mutex or OHCI event create failed. Or, OHCI IP initialize failed.

3.6.6.4.2 usb_status_t USB_HostOhciDestory (usb_host_controller_handle *controllerHandle*)

This function deinitializes the USB host OHCI controller driver.

Parameters

<i>controller-Handle</i>	The controller handle.
--------------------------	------------------------

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

3.6.6.4.3 usb_status_t USB_HostOhciOpenPipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle * *pipeHandle*, usb_host_pipe_init_t * *pipeInit*)

This function opens a pipe according to the pipe_init_ptr parameter.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The pipe handle pointer used to return the pipe handle.
<i>pipeInit</i>	It is used to initialize the pipe.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_Error</i>	There is no idle pipe.

3.6.6.4.4 usb_status_t USB_HostOhciClosePipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*)

This function closes a pipe and frees the related resources.

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Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The closing pipe handle.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

3.6.6.4.5 **usb_status_t USB_HostOhciWritePipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to send the transfer to the specified pipe.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The sending pipe handle.
<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Send successful.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for OHCI.

3.6.6.4.6 **usb_status_t USB_HostOhciReadPipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle *pipeHandle*, usb_host_transfer_t * *transfer*)**

This function requests to receive the transfer from the specified pipe.

Parameters

<i>controller-Handle</i>	The controller handle.
--------------------------	------------------------

<i>pipeHandle</i>	The receiving pipe handle.
<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Receive successful.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for OHCI.

3.6.6.4.7 **usb_status_t USB_HostOhciIoctl (usb_host_controller_handle *controllerHandle*, uint32_t *ioctlEvent*, void * *ioctlParam*)**

This function controls the OHCI.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>ioctlEvent</i>	See the enumeration host_bus_control_t.
<i>ioctlParam</i>	The control parameter.

Return values

<i>kStatus_USB_Success</i>	Cancel successful.
<i>kStatus_USB_Invalid-Handle</i>	The controllerHandle is a NULL pointer.

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3.6.7 USB Host Controller IP3516HS driver

3.6.7.1 Overview

The IP3516HS host controller driver implements send/receive data through the IP3516HS IP.

Data Structures

- struct [usb_host_ip3516hs_atl_struct_t](#)
IP3516HS Transaction Descriptor. [More...](#)
- struct [usb_host_ip3516hs_ptl_struct_t](#)
IP3516HS Transaction Descriptor. [More...](#)
- struct [usb_host_ip3516hs_sptl_struct_t](#)
IP3516HS Transaction Descriptor. [More...](#)
- struct [usb_host_ip3516hs_register_struct_t](#)
IP3516HS Host Controller Operational Registers. [More...](#)
- struct [usb_host_ip3516hs_state_struct_t](#)
IP3516HS controller driver instance structure. [More...](#)

Macros

- #define [USB_HOST_IP3516HS_PORT_CONNECT_DEBOUNCE_DELAY](#) (101U)
Check the port connect state delay if the state is unstable.
- #define [USB_HOST_IP3516HS_EVENT_ATTACH](#) (0x01U)
task event
- #define [USB_HOST_IP3516HS_TRANSFER_SCAN_INTERVAL](#) (200U)
Transfer scan interval (ms)
- #define [USB_HOST_IP3516HS_TRANSFER_TIMEOUT_GAP](#) ((5000U * 8) / USB_HOST_IP3516HS_TRANSFER_SCAN_INTERVAL)
*Time out gap for each transfer (USB_HOST_OHCI_TRANSFER_SCAN_INTERVAL * 1ms)*
- #define [USB_HostIp3516HsLock\(\)](#) [USB_OsaMutexLock\(usbHostState->mutex\)](#)
USB host Ip3516Hs lock.
- #define [USB_HostIp3516HsUnlock\(\)](#) [USB_OsaMutexUnlock\(usbHostState->mutex\)](#)
USB host Ip3516Hs unlock.

Enumerations

- enum [usb_host_ip3516hs_port_state_t](#) {
 [kUSB_DeviceIp3516HsPortDetached](#) = 0U,
 [kUSB_DeviceIp3516HsPortPhyDetached](#),
 [kUSB_DeviceIp3516HsPortPhyAttached](#),
 [kUSB_DeviceIp3516HsPortAttached](#) }
Port state for device attachment/detachment.

USB host IP3516HS APIs

- `usb_status_t USB_HostIp3516HsCreate` (`uint8_t controllerId`, `usb_host_handle` `hostHandle`, `usb_host_controller_handle` `*controllerHandle`)
Creates the USB host IP3516HS instance.
- `usb_status_t USB_HostIp3516HsDestory` (`usb_host_controller_handle` `controllerHandle`)
Destroys the USB host IP3516HS instance.
- `usb_status_t USB_HostIp3516HsOpenPipe` (`usb_host_controller_handle` `controllerHandle`, `usb_host_pipe_handle` `*pipeHandle`, `usb_host_pipe_init_t` `*pipeInit`)
Opens the USB host pipe.
- `usb_status_t USB_HostIp3516HsClosePipe` (`usb_host_controller_handle` `controllerHandle`, `usb_host_pipe_handle` `pipeHandle`)
Closes the USB host pipe.
- `usb_status_t USB_HostIp3516HsWritePipe` (`usb_host_controller_handle` `controllerHandle`, `usb_host_pipe_handle` `pipeHandle`, `usb_host_transfer_t` `*transfer`)
Sends data to the pipe.
- `usb_status_t USB_HostIp3516HsReadPipe` (`usb_host_controller_handle` `controllerHandle`, `usb_host_pipe_handle` `pipeHandle`, `usb_host_transfer_t` `*transfer`)
Receives data from the pipe.
- `usb_status_t USB_HostIp3516HsIoctl` (`usb_host_controller_handle` `controllerHandle`, `uint32_t` `ioctlEvent`, `void` `*ioctlParam`)
Controls the IP3516HS.

3.6.7.2 Data Structure Documentation

3.6.7.2.1 struct `usb_host_ip3516hs_atl_struct_t`

3.6.7.2.1.1 Field Documentation

3.6.7.2.1.1.1 `uint32_t usb_host_ip3516hs_atl_struct_t::R1`

3.6.7.2.1.1.2 `volatile uint32_t usb_host_ip3516hs_atl_struct_t::J`

1: enable the next PTD branching.

3.6.7.2.1.1.3 `volatile uint32_t usb_host_ip3516hs_atl_struct_t::uFrame`

3.6.7.2.1.1.4 `uint32_t usb_host_ip3516hs_atl_struct_t::R2`

3.6.7.2.1.1.5 `volatile uint32_t usb_host_ip3516hs_atl_struct_t::S`

3.6.7.2.1.1.6 `volatile uint32_t usb_host_ip3516hs_atl_struct_t::RL`

RL and NakCnt are set to the same value before a transaction.

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3.6.7.2.1.1.7 `volatile uint32_t usb_host_ip3516hs_atl_struct_t::Token`

3.6.7.2.2 `struct usb_host_ip3516hs_ptl_struct_t`

3.6.7.2.2.1 Field Documentation

3.6.7.2.2.1.1 `volatile uint32_t usb_host_ip3516hs_ptl_struct_t::NextPTDPointer`

3.6.7.2.2.1.2 `volatile uint32_t usb_host_ip3516hs_ptl_struct_t::J`

1: enable the next PTD branching.

3.6.7.2.2.1.3 `volatile uint32_t usb_host_ip3516hs_ptl_struct_t::uFrame`

3.6.7.2.2.1.4 `volatile uint32_t usb_host_ip3516hs_ptl_struct_t::S`

3.6.7.2.2.1.5 `volatile uint32_t usb_host_ip3516hs_ptl_struct_t::RL`

RL and NakCnt are set to the same value before a transaction.

3.6.7.2.2.1.6 `volatile uint32_t usb_host_ip3516hs_ptl_struct_t::Token`

3.6.7.2.3 `struct usb_host_ip3516hs_sptl_struct_t`

3.6.7.2.3.1 Field Documentation

3.6.7.2.3.1.1 `uint32_t usb_host_ip3516hs_sptl_struct_t::R1`

3.6.7.2.3.1.2 `volatile uint32_t usb_host_ip3516hs_sptl_struct_t::uFrame`

3.6.7.2.3.1.3 `volatile uint32_t usb_host_ip3516hs_sptl_struct_t::MaxPacketLength`

3.6.7.2.3.1.4 `uint32_t usb_host_ip3516hs_sptl_struct_t::R2`

3.6.7.2.3.1.5 `volatile uint32_t usb_host_ip3516hs_sptl_struct_t::S`

3.6.7.2.3.1.6 `volatile uint32_t usb_host_ip3516hs_sptl_struct_t::RL`

3.6.7.2.3.1.7 `volatile uint32_t usb_host_ip3516hs_sptl_struct_t::Token`

3.6.7.2.4 `struct usb_host_ip3516hs_register_struct_t`

3.6.7.2.5 `struct usb_host_ip3516hs_state_struct_t`

Data Fields

- volatile
[usb_host_ip3516hs_register_struct_t * usbRegBase](#)
The base address of the register.
- void * [hostHandle](#)

- *Related host handle.*
volatile uint32_t [bufferArrayBitMap](#) [4]
Bit map for USB dedicated RAM (Uint is 64bytes)
- [usb_osa_event_handle](#) [ip3516HsEvent](#)
IP3516HS event.
- [usb_osa_mutex_handle](#) [mutex](#)
Ip3516Hs layer mutex.
- uint8_t [controllerId](#)
Controller id.
- uint8_t [portNumber](#)
Port count.
- uint8_t [isrNumber](#)
ISR Number.
- bus_ip3516hs_suspend_request_state_t [busSuspendStatus](#)
Bus Suspend Status.

3.6.7.3 Enumeration Type Documentation

3.6.7.3.1 enum usb_host_ip3516hs_port_state_t

Enumerator

- kUSB_DeviceIp3516HsPortDetached*** Port is detached and de-initialized.
kUSB_DeviceIp3516HsPortPhyDetached Port is physically detached.
kUSB_DeviceIp3516HsPortPhyAttached Port is physically attached.
kUSB_DeviceIp3516HsPortAttached Port is attached and initialized.

3.6.7.4 Function Documentation

3.6.7.4.1 usb_status_t USB_HostIp3516HsCreate (uint8_t *controllerId*, usb_host_handle *hostHandle*, usb_host_controller_handle * *controllerHandle*)

This function initializes the USB host IP3516HS controller driver.

Parameters

<i>controllerId</i>	The controller ID of the USB IP. See the enumeration usb_controller_index_t .
<i>hostHandle</i>	The host level handle.
<i>controller-Handle</i>	Returns the controller instance handle.

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Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocates memory failed.
<i>kStatus_USB_Error</i>	Host mutex create failed, IP3516HS mutex or IP3516HS event create failed. Or, IP3516HS IP initialize failed.

3.6.7.4.2 **usb_status_t USB_HostIp3516HsDestory (usb_host_controller_handle *controllerHandle*)**

This function deinitializes the USB host IP3516HS controller driver.

Parameters

<i>controller-Handle</i>	The controller handle.
--------------------------	------------------------

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

3.6.7.4.3 **usb_status_t USB_HostIp3516HsOpenPipe (usb_host_controller_handle *controllerHandle*, usb_host_pipe_handle * *pipeHandle*, usb_host_pipe_init_t * *pipeInit*)**

This function opens a pipe according to the pipe_init_ptr parameter.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The pipe handle pointer used to return the pipe handle.
<i>pipeInit</i>	It is used to initialize the pipe.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

<i>kStatus_USB_Error</i>	There is no idle pipe.
--------------------------	------------------------

3.6.7.4.4 **usb_status_t USB_HostIp3516HsClosePipe (usb_host_controller_handle controllerHandle, usb_host_pipe_handle pipeHandle)**

This function closes a pipe and frees the related resources.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The closing pipe handle.

Return values

<i>kStatus_USB_Success</i>	The host is initialized successfully.
----------------------------	---------------------------------------

3.6.7.4.5 **usb_status_t USB_HostIp3516HsWritePipe (usb_host_controller_handle controllerHandle, usb_host_pipe_handle pipeHandle, usb_host_transfer_t * transfer)**

This function requests to send the transfer to the specified pipe.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The sending pipe handle.
<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Send successful.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for IP3516HS.

3.6.7.4.6 **usb_status_t USB_HostIp3516HsReadPipe (usb_host_controller_handle controllerHandle, usb_host_pipe_handle pipeHandle, usb_host_transfer_t * transfer)**

This function requests to receive the transfer from the specified pipe.

USB Host Controller driver

Parameters

<i>controller-Handle</i>	The controller handle.
<i>pipeHandle</i>	The receiving pipe handle.
<i>transfer</i>	The transfer information.

Return values

<i>kStatus_USB_Success</i>	Receive successful.
<i>kStatus_USB_LackSwap-Buffer</i>	There is no swap buffer for IP3516HS.

3.6.7.4.7 **usb_status_t USB_HostIp3516HsIoctl (usb_host_controller_handle *controllerHandle*, uint32_t *ioctlEvent*, void * *ioctlParam*)**

This function controls the IP3516HS.

Parameters

<i>controller-Handle</i>	The controller handle.
<i>ioctlEvent</i>	See the enumeration host_bus_control_t.
<i>ioctlParam</i>	The control parameter.

Return values

<i>kStatus_USB_Success</i>	Cancel successful.
<i>kStatus_USB_Invalid-Handle</i>	The controllerHandle is a NULL pointer.



Chapter 4

USB Class driver

4.1 Overview

Modules

- [USB AUDIO Class driver](#)
- [USB CDC Class driver](#)
- [USB HID Class driver](#)
- [USB MSC Class driver](#)
- [USB PHDC Class driver](#)
- [USB PRINTER Class driver](#)

4.2 USB CDC Class driver

4.2.1 Overview

The Communication Class defines mechanisms for a device and host to identify which existing protocols to use. It also defines an architecture that is capable of supporting any communications devices. The communications device class and associated subclass specifications, such as ISDN and PSTN, provides information to guide implementers in using the USB logical structures for communications device. This section uses the PSTN as the subclass and describes the programming interface of the USB HOST CDC class driver. The USB HOST HID class driver handles the specific control requests for CDC class and transfers data to and from the device through the bulk pipe.

4.2.2 USB Host CDC Initialization

When the CDC device is attached, the CDC initialization flow is as follows:

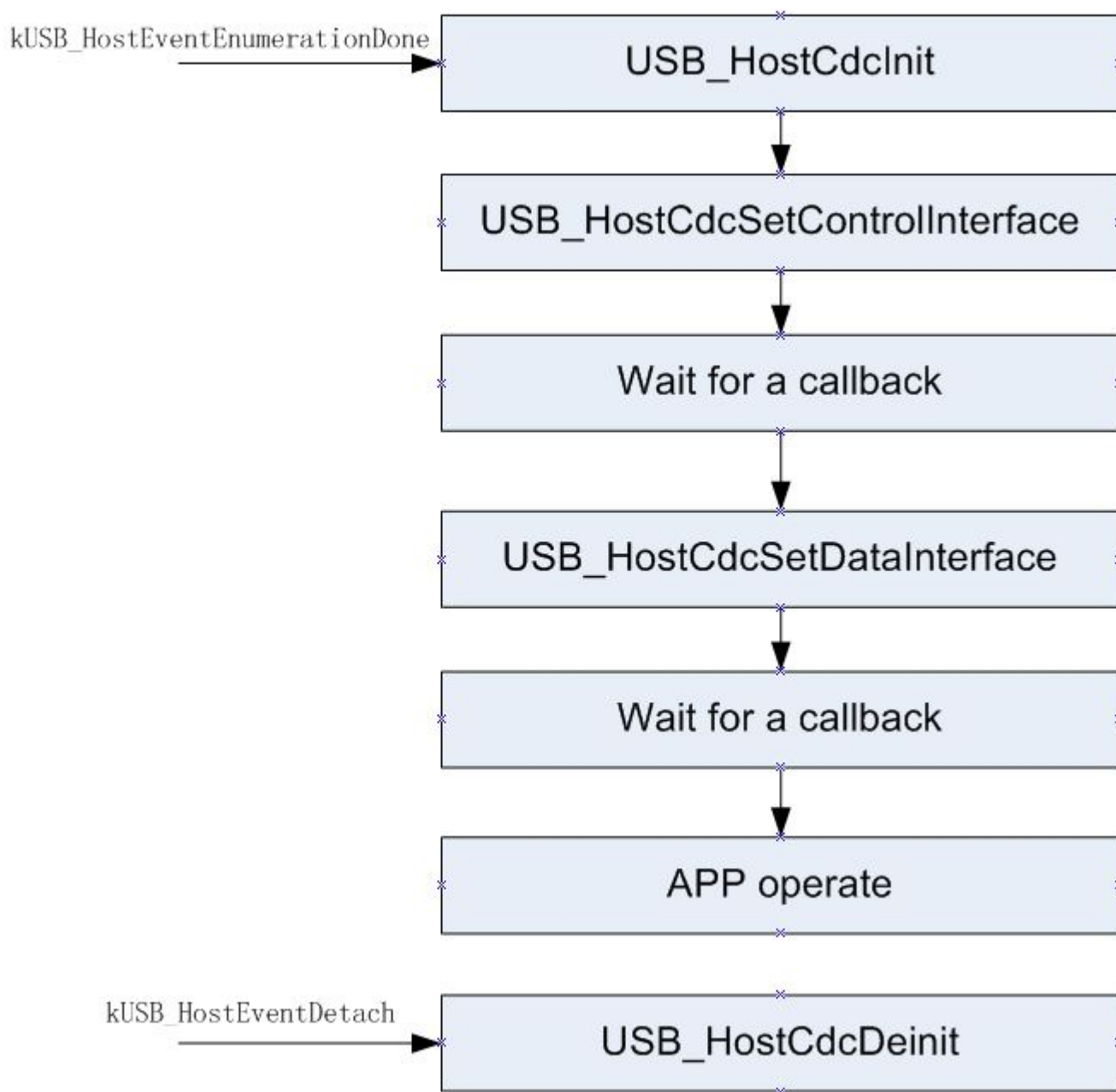


Figure 4.2.1: Host CDC Initialization

The above figure describes the following steps:

- Call the `USB_HostCdcInit` to initialize the CDC class instance `#usb_host_cdc_instance_struct_t`. Save the class handle pointer into the `#usb_host_cdc_instance_struct_t`. The driver uses an instantiation of the `usb_host_cdc_instance_struct_t` structure to maintain the current state of a CDC instance module driver. This structure holds the USB host handle, the USB device handle and keeps track of transfer information, alternate setting, pipes, and interfaces that are enumerated for the attached CDC device.

USB CDC Class driver

- Call the `USB_HostCdcSetControlInterface` to set the CDC class control interface, which opens the interface's pipes.
- Wait for the last step operation callback.
- Call the `USB_HostCdcSetDataInterface` to set the CDC class data interface, which opens the interface's pipes.
- Wait for the last step operation callback.
- Call the `USB_HostCdcDataRecv` to receive data from device, or call `USB_HostCdcDataSend` to send data to the device.
- Wait for the last step operation callback.
- Process data and receive or send again.

4.2.3 USB Host CDC De-initialization

An application can call the `USB_HostCdcDeinit` to deinitialize the CDC. This function cancels the transfer, closes the pipe, and frees the HID class instance.

There are two cases to call this function:

- The CDC device is detached and this function is called to free the resource.
- An application calls this function and calls the `USB_HostCdcInit` to re-initialize the CDC class.

4.2.4 USB Host CDC Send data

Provides the buffer pointer, the buffer length, the callback function, and the callback parameter and call `USB_HostCdcDataSend` to start asynchronous sending. Then the callback function is called with one transfer status parameter when the transfer succeeds or fails.

4.2.5 USB Host CDC Receive data

Provides the buffer pointer, the buffer length, the callback function, and the callback parameter and calls `USB_HostCdcDataRecv` to start asynchronous receiving. Then, the callback function is called with one transfer status parameter when the transfer succeeds or fails.

Data Structures

- struct `usb_host_cdc_line_coding_struct_t`
CDC GetLineCoding structure according to the 6.3 in PSTN specification. [More...](#)
- struct `usb_host_cdc_control_line_state_struct_t`
CDC GetLineCoding structure according to the 6.3 in PSTN specification. [More...](#)
- struct `usb_host_cdc_acm_state_struct_t`
CDC SerialState structure according to the 6.5.4 in PSTN specification. [More...](#)
- struct `usb_host_cdc_head_function_desc_struct_t`
CDC Header Functional Descriptor structure according to the 5.2.3 in CDC specification. [More...](#)

- struct `usb_host_cdc_call_manage_desc_struct_t`
CDC Call Management Functional Descriptor structure according to the 5.3.1 in PSTN specification. [More...](#)
- struct `usb_host_cdc_abstract_control_desc_struct_t`
CDC Abstract Control Management Functional Descriptor structure according to the 5.3.2 in PSTN specification. [More...](#)
- struct `usb_host_cdc_direct_line_desc_struct_t`
CDC Direct Line Management Functional Descriptor structure according to the 5.3.3 in PSTN specification. [More...](#)
- struct `usb_host_cdc_telephone_ringer_desc_struct_t`
CDC Telephone Ringer Functional Descriptor structure according to the 5.3.4 in PSTN specification. [More...](#)
- struct `usb_host_cdc_tcLsr_desc_struct_t`
CDC Telephone Call and Line State Reporting Capabilities Descriptor structure according to the 5.3.6 in PSTN specification. [More...](#)
- struct `usb_host_cdc_union_interface_desc_struct_t`
CDC Header Functional Descriptor structure according to the 5.2.3 in CDC specification. [More...](#)
- struct `usb_host_cdc_tom_desc_struct_t`
CDC Telephone Operational Modes Functional Descriptor structure according to the 5.3.5 in PSTN specification. [More...](#)
- struct `usb_host_cdc_common_desc_struct_t`
CDC common Functional Descriptor structure. [More...](#)
- union `usb_cdc_func_desc_struct_t`
CDC union Functional Descriptor structure for analyze a class-specific descriptor. [More...](#)

Macros

- #define `USB_HOST_CDC_SEND_ENCAPSULATED_COMMAND` 0x00U
CDC class-specific request (`SEND_ENCAPSULATED_COMMAND`)
- #define `USB_HOST_CDC_GET_ENCAPSULATED_RESPONSE` 0x01U
CDC class-specific request (`GET_ENCAPSULATED_RESPONSE`)
- #define `USB_HOST_CDC_SET_LINE_CODING` 0x20U
CDC class-specific request (`SET_LINE_CODING`)
- #define `USB_HOST_CDC_GET_LINE_CODING` 0x21U
CDC class-specific request (`GET_LINE_CODING`)
- #define `USB_HOST_CDC_SET_CONTROL_LINE_STATE` 0x22U
CDC class-specific request (`SET_CONTROL_LINE_STATE`)
- #define `USB_HOST_ACM_UART_STATE_BITMAP_BTXCARRITER` 0x01U
CDC class-specific notifications(`SerialState`) bitmap.
- #define `USB_HOST_ACM_UART_STATE_BITMAP_BRXCARRITER` 0x02U
CDC class-specific notifications(`SerialState`) bitmap.
- #define `USB_HOST_ACM_UART_STATE_BITMAP_BBREAK` 0x04U
CDC class-specific notifications(`SerialState`) bitmap.
- #define `USB_HOST_ACM_UART_STATE_BITMAP_BBRINGSIGNAL` 0x10U
CDC class-specific notifications(`SerialState`) bitmap.
- #define `USB_HOST_CDC_CONTROL_LINE_STATE_DTR` 0x01U
CDC class-specific request (`SET_CONTROL_LINE_STATE`) bitmap.
- #define `USB_HOST_CDC_CONTROL_LINE_STATE_RTS` 0x02U
CDC class-specific request (`SET_CONTROL_LINE_STATE`) bitmap.

USB CDC Class driver

- `#define USB_HOST_DESC_SUBTYPE_HEADER 0x00U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_CM 0x01U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_ACM 0x02U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_DLM 0x03U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_TR 0x04U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_TC_LSR 0x05U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_UNION 0x06U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_CS 0x07U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_DESC_SUBTYPE_TOM 0x08U`
CDC class-specific bDescriptor SubType in functional descriptors.
- `#define USB_HOST_CDC_COMMUNICATIONS_CLASS_CODE 0x02U`
CDC class-specific code, Communications Interface Class Code.
- `#define USB_HOST_CDC_SUBCLASS_ACM_CODE 0x02U`
CDC class-specific code, Communications Class Subclass Codes.
- `#define USB_HOST_CDC_DATA_CLASS_CODE 0x0AU`
CDC class-specific code, Data Class Interface Codes.

USB CDC host class driver

- `usb_status_t USB_HostCdcInit (usb_device_handle deviceHandle, usb_host_class_handle *classHandle)`
Initializes the CDC instance.
- `usb_status_t USB_HostCdcSetDataInterface (usb_host_class_handle classHandle, usb_host_interface_handle interfaceHandle, uint8_t alternateSetting, transfer_callback_t callbackFn, void *callbackParam)`
CDC set data interface callback and opens pipes.
- `usb_status_t USB_HostCdcSetControlInterface (usb_host_class_handle classHandle, usb_host_interface_handle interfaceHandle, uint8_t alternateSetting, transfer_callback_t callbackFn, void *callbackParam)`
CDC set control interface callback and opens pipes.
- `usb_status_t USB_HostCdcDeinit (usb_device_handle deviceHandle, usb_host_class_handle classHandle)`
Deinitializes the CDC instance.
- `uint16_t USB_HostCdcGetPacketsize (usb_host_class_handle classHandle, uint8_t pipeType, uint8_t direction)`
Gets the pipe maximum packet size.
- `usb_status_t USB_HostCdcDataRecv (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
Receives data.
- `usb_status_t USB_HostCdcDataSend (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`

Sends data.

- `usb_status_t USB_HostCdcInterruptRecv (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`

Interrupts the receive data.

- `usb_status_t USB_HostCdcGetAcmLineCoding (usb_host_class_handle classHandle, usb_host_cdc_line_coding_struct_t *uartLineCoding, transfer_callback_t callbackFn, void *callbackParam)`

CDC get line coding.

- `usb_status_t USB_HostCdcSetAcmCtrlState (usb_host_class_handle classHandle, uint8_t dtr, uint8_t rts, transfer_callback_t callbackFn, void *callbackParam)`

CDC setControlLineState.

- `usb_status_t USB_HostCdcSendEncapsulatedCommand (usb_host_class_handle classHandle, uint8_t *buffer, uint16_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`

cdc send encapsulated command.

- `usb_status_t USB_HostCdcGetEncapsulatedResponse (usb_host_class_handle classHandle, uint8_t *buffer, uint16_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`

cdc get encapsulated response.

- `usb_status_t USB_HostCdcGetAcmDescriptor (usb_host_class_handle classHandle, usb_host_cdc_head_function_desc_struct_t **headDesc, usb_host_cdc_call_manage_desc_struct_t **callManageDesc, usb_host_cdc_abstract_control_desc_struct_t **abstractControlDesc, usb_host_cdc_union_interface_desc_struct_t **unionInterfaceDesc)`

CDC gets the ACM descriptor.

- `usb_status_t USB_HostCdcControl (usb_host_class_handle classHandle, uint8_t request_type, uint8_t request, uint8_t wvalue_l, uint8_t wvalue_h, uint16_t wlength, uint8_t *data, transfer_callback_t callbackFn, void *callbackParam)`

CDC send control transfer common code.

4.2.6 Data Structure Documentation

4.2.6.1 struct usb_host_cdc_line_coding_struct_t

Data Fields

- `uint32_t dwDTERate`
Data terminal rate, in bits per second.
- `uint8_t bCharFormat`
Stop bits.
- `uint8_t bParityType`
Parity.
- `uint8_t bDataBits`
Data bits (5, 6, 7, 8 or 16).

USB CDC Class driver

4.2.6.1.0.1 Field Documentation

4.2.6.1.0.1.1 uint8_t usb_host_cdc_line_coding_struct_t::bDataBits

4.2.6.2 struct usb_host_cdc_control_line_state_struct_t

Data Fields

- uint16_t [line_state](#)
D1, This signal corresponds to V.24 signal 105 and RS-232 signal RTS.

4.2.6.2.0.2 Field Documentation

4.2.6.2.0.2.1 uint16_t usb_host_cdc_control_line_state_struct_t::line_state

D0, This signal corresponds to V.24 signal 108/2 and RS-232 signal DTR

4.2.6.3 struct usb_host_cdc_acm_state_struct_t

Data Fields

- uint8_t [reserved](#) [8]
Notify response by the device, this is used as notification header which is return by the device.
- uint8_t [bmstate](#)
UART State Bitmap Values.
- uint8_t [reserved1](#) [1]
Fix 4B align issue.
- uint8_t [reserved2](#) [2]
Fix 4B align issue.

4.2.6.4 struct usb_host_cdc_head_function_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE descriptor type.
- uint8_t [bDescriptorSubtype](#)
Header functional descriptor subtype.
- uint8_t [bcdCDC](#) [2]
USB Class Definitions for Communications Devices Specification release number in binary-coded decimal.

4.2.6.4.0.3 Field Documentation

4.2.6.4.0.3.1 uint8_t usb_host_cdc_head_function_desc_struct_t::bFunctionLength

4.2.6.4.0.3.2 uint8_t usb_host_cdc_head_function_desc_struct_t::bDescriptorType

4.2.6.4.0.3.3 uint8_t usb_host_cdc_head_function_desc_struct_t::bDescriptorSubtype

4.2.6.4.0.3.4 uint8_t usb_host_cdc_head_function_desc_struct_t::bcdCDC[2]

4.2.6.5 struct usb_host_cdc_call_manage_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE.
- uint8_t [bDescriptorSubtype](#)
Call Management functional descriptor subtype.
- uint8_t [bmCapabilities](#)
The capabilities that this configuration supports.
- uint8_t [bDataInterface](#)
Interface number of Data Class interface optionally used for call management.

4.2.6.5.0.4 Field Documentation

4.2.6.5.0.4.1 uint8_t usb_host_cdc_call_manage_desc_struct_t::bFunctionLength

4.2.6.5.0.4.2 uint8_t usb_host_cdc_call_manage_desc_struct_t::bDescriptorType

4.2.6.5.0.4.3 uint8_t usb_host_cdc_call_manage_desc_struct_t::bDescriptorSubtype

4.2.6.5.0.4.4 uint8_t usb_host_cdc_call_manage_desc_struct_t::bmCapabilities

4.2.6.5.0.4.5 uint8_t usb_host_cdc_call_manage_desc_struct_t::bDataInterface

4.2.6.6 struct usb_host_cdc_abstract_control_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE.
- uint8_t [bDescriptorSubtype](#)
Abstract Control Management functional descriptor subtype.
- uint8_t [bmCapabilities](#)
The capabilities that this configuration supports.

USB CDC Class driver

4.2.6.6.0.5 Field Documentation

4.2.6.6.0.5.1 uint8_t usb_host_cdc_abstract_control_desc_struct_t::bFunctionLength

4.2.6.6.0.5.2 uint8_t usb_host_cdc_abstract_control_desc_struct_t::bDescriptorType

4.2.6.6.0.5.3 uint8_t usb_host_cdc_abstract_control_desc_struct_t::bDescriptorSubtype

4.2.6.6.0.5.4 uint8_t usb_host_cdc_abstract_control_desc_struct_t::bmCapabilities

4.2.6.7 struct usb_host_cdc_direct_line_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE.
- uint8_t [bDescriptorSubtype](#)
Direct Line Management functional descriptor subtype,.
- uint8_t [bmCapabilities](#)
The capabilities that this configuration supports.

4.2.6.7.0.6 Field Documentation

4.2.6.7.0.6.1 uint8_t usb_host_cdc_direct_line_desc_struct_t::bFunctionLength

4.2.6.7.0.6.2 uint8_t usb_host_cdc_direct_line_desc_struct_t::bDescriptorType

4.2.6.7.0.6.3 uint8_t usb_host_cdc_direct_line_desc_struct_t::bDescriptorSubtype

4.2.6.7.0.6.4 uint8_t usb_host_cdc_direct_line_desc_struct_t::bmCapabilities

4.2.6.8 struct usb_host_cdc_telephone_ringer_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE.
- uint8_t [bDescriptorSubtype](#)
Telephone Ringer functional descriptor subtype.
- uint8_t [bRingerVolSteps](#)
Number of discrete steps in volume supported by the ringer,.
- uint8_t [bNumRingerPatterns](#)
Number of ringer patterns supported.

4.2.6.8.0.7 Field Documentation

4.2.6.8.0.7.1 uint8_t usb_host_cdc_telephone_ringer_desc_struct_t::bFunctionLength

4.2.6.8.0.7.2 uint8_t usb_host_cdc_telephone_ringer_desc_struct_t::bDescriptorType

4.2.6.8.0.7.3 uint8_t usb_host_cdc_telephone_ringer_desc_struct_t::bRingerVolSteps

4.2.6.8.0.7.4 uint8_t usb_host_cdc_telephone_ringer_desc_struct_t::bNumRingerPatterns

4.2.6.9 struct usb_host_cdc_tcLsr_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE.
- uint8_t [bDescriptorSubtype](#)
Telephone Call State Reporting Capabilities descriptor subtype.
- uint8_t [bmCapabilities](#) [4]
Call and line state reporting capabilities of the device.

4.2.6.9.0.8 Field Documentation

4.2.6.9.0.8.1 uint8_t usb_host_cdc_tcLsr_desc_struct_t::bFunctionLength

4.2.6.9.0.8.2 uint8_t usb_host_cdc_tcLsr_desc_struct_t::bDescriptorType

4.2.6.9.0.8.3 uint8_t usb_host_cdc_tcLsr_desc_struct_t::bDescriptorSubtype

4.2.6.9.0.8.4 uint8_t usb_host_cdc_tcLsr_desc_struct_t::bmCapabilities[4]

4.2.6.10 struct usb_host_cdc_union_interface_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE descriptor type.
- uint8_t [bDescriptorSubtype](#)
Union Functional Descriptor SubType.
- uint8_t [bControlInterface](#)
USB Class Definitions for Communications Devices Specification release number in binary-coded decimal.

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4.2.6.10.0.9 Field Documentation

4.2.6.10.0.9.1 uint8_t usb_host_cdc_union_interface_desc_struct_t::bFunctionLength

4.2.6.10.0.9.2 uint8_t usb_host_cdc_union_interface_desc_struct_t::bDescriptorType

4.2.6.10.0.9.3 uint8_t usb_host_cdc_union_interface_desc_struct_t::bDescriptorSubtype

4.2.6.10.0.9.4 uint8_t usb_host_cdc_union_interface_desc_struct_t::bControlInterface

4.2.6.11 struct usb_host_cdc_tom_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE.
- uint8_t [bDescriptorSubtype](#)
Telephone Operational Modes functional descriptor subtype.
- uint8_t [bmCapabilities](#)
Operational modes:.

4.2.6.11.0.10 Field Documentation

4.2.6.11.0.10.1 uint8_t usb_host_cdc_tom_desc_struct_t::bFunctionLength

4.2.6.11.0.10.2 uint8_t usb_host_cdc_tom_desc_struct_t::bDescriptorType

4.2.6.11.0.10.3 uint8_t usb_host_cdc_tom_desc_struct_t::bDescriptorSubtype

4.2.6.11.0.10.4 uint8_t usb_host_cdc_tom_desc_struct_t::bmCapabilities

4.2.6.12 struct usb_host_cdc_common_desc_struct_t

Data Fields

- uint8_t [bFunctionLength](#)
Size of this descriptor in bytes.
- uint8_t [bDescriptorType](#)
CS_INTERFACE descriptor type.
- uint8_t [bDescriptorSubtype](#)
Header functional descriptor subtype.

4.2.6.12.0.11 Field Documentation

4.2.6.12.0.11.1 `uint8_t usb_host_cdc_common_desc_struct_t::bFunctionLength`

4.2.6.12.0.11.2 `uint8_t usb_host_cdc_common_desc_struct_t::bDescriptorType`

4.2.6.12.0.11.3 `uint8_t usb_host_cdc_common_desc_struct_t::bDescriptorSubtype`

4.2.6.13 `union usb_cdc_func_desc_struct_t`

4.2.7 Function Documentation

4.2.7.1 `usb_status_t USB_HostCdcInit (usb_device_handle deviceHandle,
usb_host_class_handle * classHandle)`

This function allocates the resource for the CDC instance.

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Parameters

<i>deviceHandle</i>	The device handle.
<i>classHandle</i>	Returns class handle.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocate memory fail.

4.2.7.2 `usb_status_t USB_HostCdcSetDataInterface (usb_host_class_handle classHandle,
usb_host_interface_handle interfaceHandle, uint8_t alternateSetting,
transfer_callback_t callbackFn, void * callbackParam)`

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>interface-Handle</i>	The interface handle.
in	<i>alternate-Setting</i>	The alternate setting value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.
<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.

<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See the USB_HostOpenPipe.
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4.2.7.3 **usb_status_t USB_HostCdcSetControllInterface (usb_host_class_handle *classHandle*, usb_host_interface_handle *interfaceHandle*, uint8_t *alternateSetting*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>interface-Handle</i>	The interface handle.
in	<i>alternate-Setting</i>	The alternate setting value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.
<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.
<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See the USB_HostOpenPipe.

4.2.7.4 **usb_status_t USB_HostCdcDeinit (usb_device_handle *deviceHandle*, usb_host_class_handle *classHandle*)**

This function frees the resource for the CDC instance.

USB CDC Class driver

Parameters

<i>deviceHandle</i>	The device handle.
<i>classHandle</i>	The class handle.

Return values

<i>kStatus_USB_Success</i>	The device is de-initialized successfully.
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4.2.7.5 **uint16_t USB_HostCdcGetPacketsize (usb_host_class_handle *classHandle*, uint8_t *pipeType*, uint8_t *direction*)**

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>pipeType</i>	Its value is USB_ENDPOINT_CONTROL, USB_ENDPOINT_ISOC- HRONOUS, USB_ENDPOINT_BULK or USB_ENDPOINT_INTER- RUPT. See the usb_spec.h
in	<i>direction</i>	Pipe direction.

Return values

<i>0</i>	The classHandle is NULL.
<i>max</i>	Packet size.

4.2.7.6 **usb_status_t USB_HostCdcDataRecv (usb_host_class_handle *classHandle*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the CDC receiving data.

Parameters

<i>classHandle</i>	The class handle.
<i>buffer</i>	The buffer pointer.

<i>bufferLength</i>	The buffer length.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostRecv.

4.2.7.7 `usb_status_t USB_HostCdcDataSend (usb_host_class_handle classHandle,
uint8_t * buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *
callbackParam)`

This function implements the CDC sending data.

Parameters

<i>classHandle</i>	The class handle.
<i>buffer</i>	The buffer pointer.
<i>bufferLength</i>	The buffer length.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostSend.

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4.2.7.8 `usb_status_t USB_HostCdcInterruptRecv (usb_host_class_handle classHandle,
uint8_t * buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *
callbackParam)`

This function implements the interrupt receiving data.

Parameters

<i>classHandle</i>	The class handle.
<i>buffer</i>	The buffer pointer.
<i>bufferLength</i>	The buffer length.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostRecv.

4.2.7.9 **usb_status_t USB_HostCdcGetAcmLineCoding (usb_host_class_handle classHandle, usb_host_cdc_line_coding_struct_t * uartLineCoding, transfer_callback_t callbackFn, void * callbackParam)**

This function implements the CDC GetLineCoding request. See the PSTN specification.

Parameters

<i>classHandle</i>	The class handle.
<i>uartLine-Coding</i>	The line coding pointer.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.

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<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.2.7.10 **usb_status_t USB_HostCdcSetAcmCtrlState (usb_host_class_handle classHandle, uint8_t dtr, uint8_t rts, transfer_callback_t callbackFn, void * callbackParam)**

This function implements the CDC etControlLineState request. See PSTN specification.

Parameters

<i>classHandle</i>	The class handle.
<i>dtr</i>	The DRS value.
<i>rts</i>	The RTS value.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.2.7.11 **usb_status_t USB_HostCdcSendEncapsulatedCommand (usb_host_class_handle classHandle, uint8_t * buffer, uint16_t bufferLength, transfer_callback_t callbackFn, void * callbackParam)**

This function implements cdc SEND_ENCAPSULATED_COMMAND request. refer to cdc 1.2 spec.

Parameters

<i>classHandle</i>	the class handle.
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<i>buffer</i>	the buffer pointer.
<i>bufferLength</i>	the buffer length.
<i>callbackFn</i>	this callback is called after this function completes.
<i>callbackParam</i>	the first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	send transfer fail, please reference to USB_HostSendSetup.

4.2.7.12 **usb_status_t USB_HostCdcGetEncapsulatedResponse (usb_host_class_handle classHandle, uint8_t * *buffer*, uint16_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements cdc GET_ENCAPSULATED_RESPONSE request.refer to cdc 1.2 spec.

Parameters

<i>classHandle</i>	the class handle.
<i>buffer</i>	the buffer pointer.
<i>bufferLength</i>	the buffer length.
<i>callbackFn</i>	this callback is called after this function completes.
<i>callbackParam</i>	the first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.

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<i>kStatus_USB_Error</i>	send transfer fail, please reference to USB_HostSendSetup.
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4.2.7.13 `usb_status_t USB_HostCdcGetAcmDescriptor (usb_host_class_handle classHandle, usb_host_cdc_head_function_desc_struct_t ** headDesc, usb_host_cdc_call_manage_desc_struct_t ** callManageDesc, usb_host_cdc_abstract_control_desc_struct_t ** abstractControlDesc, usb_host_cdc_union_interface_desc_struct_t ** unionInterfaceDesc)`

This function is hunting for the class-specific ACM descriptor in the configuration and gets the corresponding descriptor.

Parameters

<i>classHandle</i>	The class handle.
<i>headDesc</i>	The head function descriptor pointer.
<i>callManageDesc</i>	The call management functional descriptor pointer.
<i>abstractControlDesc</i>	The abstract control management functional pointer.
<i>unionInterfaceDesc</i>	The union functional descriptor pointer.

Return values

<i>kStatus_USB_Error</i>	Analyse descriptor error.
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4.2.7.14 `usb_status_t USB_HostCdcControl (usb_host_class_handle classHandle, uint8_t request_type, uint8_t request, uint8_t wvalue_l, uint8_t wvalue_h, uint16_t wlength, uint8_t * data, transfer_callback_t callbackFn, void * callbackParam)`

Parameters

<i>classHandle</i>	The class handle.
<i>request_type</i>	Set up the packet request type.

<i>request</i>	Set up the packet request value.
<i>wvalue_l</i>	Set up the packet wvalue low byte.
<i>wvalue_h</i>	Set up the packet wvalue high byte.
<i>wlength</i>	Set up the packet wlength value.
<i>data</i>	Data buffer pointer
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Returns

An error code or kStatus_USB_Success.

4.3 USB HID Class driver

4.3.1 Overview

The USB HID consists primarily of devices that are used by humans to control the operation of computer systems. Typical examples of HID class devices include keyboard and mouse. This section describes the programming interface of the USB HOST HID class driver. The USB HOST HID class driver handles the specific control requests for HID class and transfers data to and from the device through the interrupt pipe.

4.3.2 USB Host HID Initialization

When the HID device is attached, the HID initialization flow is as follows:

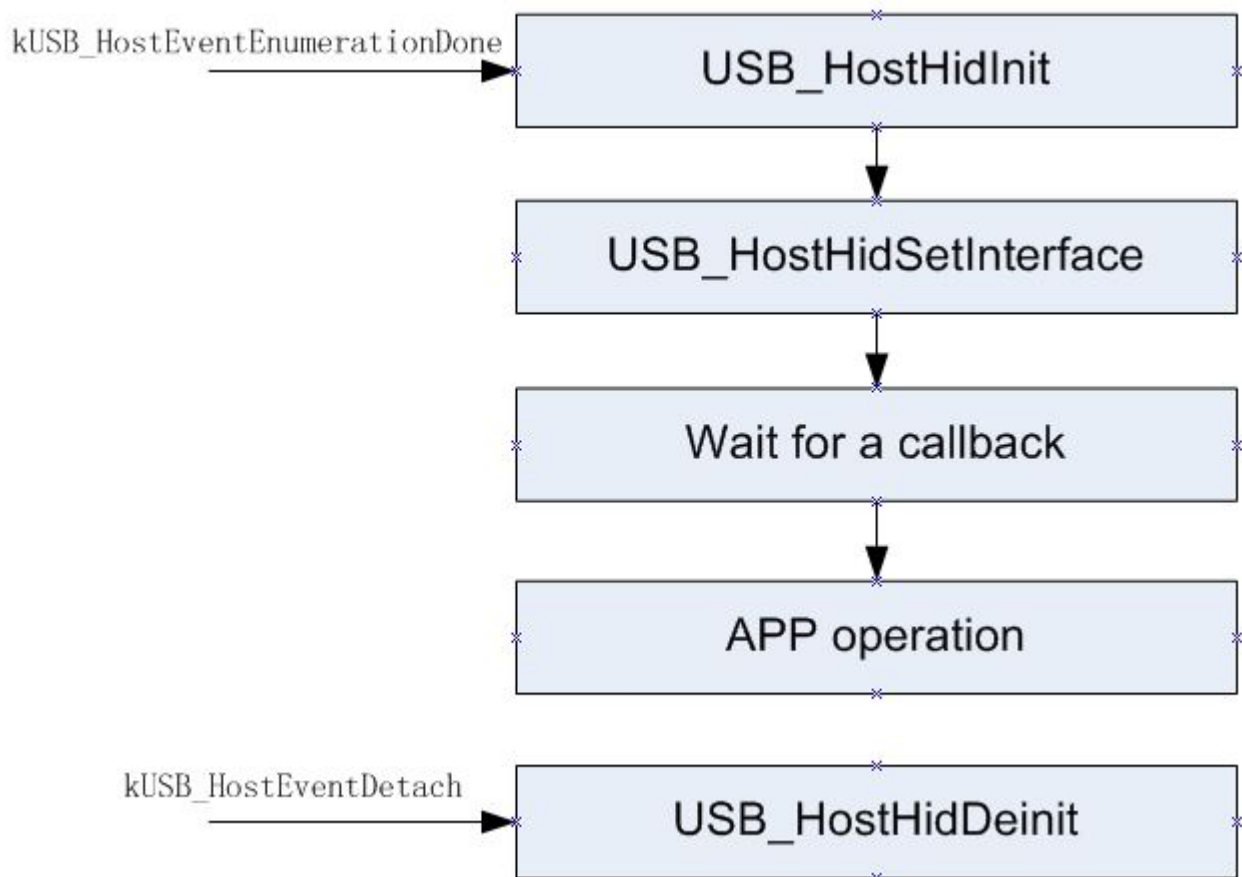


Figure 4.3.1: Host HID Initialization

The above picture describes the following steps:

- Call the `USB_HostHidInit` to initialize the HID class instance `usb_host_hid_instance_t` and the return class handle pointer to the HID class instance. The driver uses an instantiation of the `usb_host_hid_instance_t` structure to maintain the current state of a HID instance module driver. This

structure holds the USB host handle and the USB device handle and keeps track of transfer information, alternate setting, pipes and interfaces that are enumerated for attached HID device.

- Call the `USB_HostHidSetInterface` to set the HID class interface, which opens the interface's pipes.
- Wait the last step operation callback.
- Call the `USB_HostHidSetIdle` to set the HID device.
- Wait the last step operation callback.
- Call the `USB_HostHidGetReportDescriptor` to get the HID report descriptor.
- Wait the last step operation callback.
- Call the `USB_HostHidSetProtocol` to set protocol.
- Wait the last step operation callback.
- Call the `USB_HostHidRecv` to receive data from the device, or call `USB_HostHidSend` to send data to the device.
- Wait the last step operation callback.
- Process data and receive or send again.

4.3.3 USB Host HID Deinitialization

An application calls the `USB_HostHidDeinit` to deinitialize the HID. This function cancels the transfer, closes the pipe, and releases the HID class instance.

There are two use cases to call this function:

- The HID device is detached and this function is called to release the resource.
- An application calls this function and calls the `USB_HostHidInit` to reinitialize the HID class.

4.3.4 USB Host HID Send data

Provides the buffer pointer, the buffer length, the callback function, and the callback parameter and calls the `USB_HostHidSend` to start asynchronous sending. Then, the callback function is called with one transfer status parameter when the transfer succeeds or fails.

4.3.5 USB Host HID Receive data

Provides the buffer pointer, the buffer length, the callback function, and the callback parameter and calls the `USB_HostHidRecv` to start asynchronous receiving. Then, the callback function is called with one transfer status parameter when the transfer succeeds or fails.

Data Structures

- struct `usb_host_hid_instance_t`
HID instance structure and HID `usb_host_class_handle` pointer to this structure. [More...](#)
- struct `usb_host_hid_descriptor_t`

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- HID descriptor structure according to the 6.2.1 in HID specification. [More...](#)*
- struct `usb_host_hid_class_descriptor_t`
HID descriptor structure according to the 6.2.1 in HID specification. [More...](#)

Macros

- #define `USB_HOST_HID_GET_REPORT` (0x01U)
HID class-specific request (get report)
- #define `USB_HOST_HID_GET_IDLE` (0x02U)
HID class-specific request (get idle)
- #define `USB_HOST_HID_GET_PROTOCOL` (0x03U)
HID class-specific request (get protocol)
- #define `USB_HOST_HID_SET_REPORT` (0x09U)
HID class-specific request (set report)
- #define `USB_HOST_HID_SET_IDLE` (0x0AU)
HID class-specific request (set idle)
- #define `USB_HOST_HID_SET_PROTOCOL` (0x0BU)
HID class-specific request (set protocol)
- #define `USB_HOST_HID_CLASS_CODE` (3U)
HID class code.
- #define `USB_HOST_HID_SUBCLASS_CODE_NONE` (0U)
HID sub-class code.
- #define `USB_HOST_HID_SUBCLASS_CODE_BOOT` (1U)
HID sub-class code.
- #define `USB_HOST_HID_PROTOCOL_KEYBOARD` (1U)
HID class protocol code.
- #define `USB_HOST_HID_PROTOCOL_MOUSE` (2U)
HID class protocol code.
- #define `USB_HOST_HID_PROTOCOL_NONE` (0U)
HID class protocol code.
- #define `USB_HOST_HID_REQUEST_PROTOCOL_BOOT` (0U)
HID get/set protocol request data code.
- #define `USB_HOST_HID_REQUEST_PROTOCOL_REPORT` (1U)
HID get/set protocol request data code.

USB host HID class APIs

- `usb_status_t USB_HostHidInit` (`usb_device_handle` deviceHandle, `usb_host_class_handle` *classHandle)
Initializes the HID instance.
- `usb_status_t USB_HostHidSetInterface` (`usb_host_class_handle` classHandle, `usb_host_interface_handle` interfaceHandle, `uint8_t` alternateSetting, `transfer_callback_t` callbackFn, `void` *callbackParam)
Sets the interface.
- `usb_status_t USB_HostHidDeinit` (`usb_device_handle` deviceHandle, `usb_host_class_handle` classHandle)
Deinitializes the the HID instance.

- `uint16_t USB_HostHidGetPacketsize (usb_host_class_handle classHandle, uint8_t pipeType, uint8_t direction)`
Gets the pipe maximum packet size.
- `usb_status_t USB_HostHidGetReportDescriptor (usb_host_class_handle classHandle, uint8_t *buffer, uint16_t buffer_len, transfer_callback_t callbackFn, void *callbackParam)`
HID get report descriptor.
- `usb_status_t USB_HostHidRecv (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
Receives data.
- `usb_status_t USB_HostHidSend (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
Sends data.
- `usb_status_t USB_HostHidGetIdle (usb_host_class_handle classHandle, uint8_t reportId, uint8_t *idleRate, transfer_callback_t callbackFn, void *callbackParam)`
HID get idle.
- `usb_status_t USB_HostHidSetIdle (usb_host_class_handle classHandle, uint8_t reportId, uint8_t idleRate, transfer_callback_t callbackFn, void *callbackParam)`
HID set idle.
- `usb_status_t USB_HostHidGetProtocol (usb_host_class_handle classHandle, uint8_t *protocol, transfer_callback_t callbackFn, void *callbackParam)`
HID get protocol.
- `usb_status_t USB_HostHidSetProtocol (usb_host_class_handle classHandle, uint8_t protocol, transfer_callback_t callbackFn, void *callbackParam)`
HID set protocol.
- `usb_status_t USB_HostHidGetReport (usb_host_class_handle classHandle, uint8_t reportId, uint8_t reportType, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
HID get report.
- `usb_status_t USB_HostHidSetReport (usb_host_class_handle classHandle, uint8_t reportId, uint8_t reportType, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
HID set report.

4.3.6 Data Structure Documentation

4.3.6.1 struct usb_host_hid_instance_t

Data Fields

- `usb_host_handle hostHandle`
This instance's related host handle.
- `usb_device_handle deviceHandle`
This instance's related device handle.
- `usb_host_interface_handle interfaceHandle`
This instance's related interface handle.
- `usb_host_pipe_handle controlPipe`
This instance's related device control pipe.
- `usb_host_pipe_handle inPipe`

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- *HID interrupt in pipe.*
[usb_host_pipe_handle outPipe](#)
- *HID interrupt out pipe.*
[transfer_callback_t inCallbackFn](#)
HID interrupt in transfer callback function pointer.
- void * [inCallbackParam](#)
HID interrupt in transfer callback parameter.
- [transfer_callback_t outCallbackFn](#)
HID interrupt out transfer callback function pointer.
- void * [outCallbackParam](#)
HID interrupt out transfer callback parameter.
- [transfer_callback_t controlCallbackFn](#)
HID control transfer callback function pointer.
- void * [controlCallbackParam](#)
HID control transfer callback parameter.
- [usb_host_transfer_t](#) * [controlTransfer](#)
Ongoing control transfer.
- uint16_t [inPacketSize](#)
HID interrupt in maximum packet size.
- uint16_t [outPacketSize](#)
HID interrupt out maximum packet size.

4.3.6.2 struct usb_host_hid_descriptor_t

Data Fields

- uint8_t [bLength](#)
Total size of the HID descriptor.
- uint8_t [bDescriptorType](#)
Constant name specifying type of HID descriptor.
- uint8_t [bcdHID](#) [2]
Numeric expression identifying the HID Class Specification release.
- uint8_t [bCountryCode](#)
Numeric expression identifying country code of the localized hardware.
- uint8_t [bNumDescriptors](#)
Numeric expression specifying the number of class descriptors.
- uint8_t [bHidDescriptorType](#)
Constant name identifying type of class descriptor.
- uint8_t [wDescriptorLength](#) [2]
Numeric expression that is the total size of the Report descriptor.

4.3.6.3 struct usb_host_hid_class_descriptor_t

Data Fields

- uint8_t [bHidDescriptorType](#)
Constant name specifying type of optional descriptor.
- uint8_t [wDescriptorLength](#) [2]
Numeric expression that is the total size of the optional descriptor.

4.3.7 Function Documentation

4.3.7.1 `usb_status_t USB_HostHidInit (usb_device_handle deviceHandle, usb_host_class_handle * classHandle)`

This function allocate the resource for the HID instance.

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Parameters

in	<i>deviceHandle</i>	The device handle.
out	<i>classHandle</i>	Return class handle.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocate memory fail.

4.3.7.2 **usb_status_t USB_HostHidSetInterface (usb_host_class_handle *classHandle*, usb_host_interface_handle *interfaceHandle*, uint8_t *alternateSetting*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function binds the interface with the HID instance.

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>interface-Handle</i>	The interface handle.
in	<i>alternate-Setting</i>	The alternate setting value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.

<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.
<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See the USB_HostOpenPipe.

4.3.7.3 **usb_status_t USB_HostHidDeinit (usb_device_handle *deviceHandle*, usb_host_class_handle *classHandle*)**

This function frees the resources for the HID instance.

Parameters

in	<i>deviceHandle</i>	The device handle.
in	<i>classHandle</i>	The class handle.

Return values

<i>kStatus_USB_Success</i>	The device is de-initialized successfully.
----------------------------	--

4.3.7.4 **uint16_t USB_HostHidGetPacketsize (usb_host_class_handle *classHandle*, uint8_t *pipeType*, uint8_t *direction*)**

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>pipeType</i>	Its value is USB_ENDPOINT_CONTROL, USB_ENDPOINT_ISOCHRONOUS, USB_ENDPOINT_BULK or USB_ENDPOINT_INTERRUPT. See the usb_spec.h
in	<i>direction</i>	Pipe direction.

Return values

<i>0</i>	The classHandle is NULL.
<i>Maximum</i>	packet size.

4.3.7.5 **usb_status_t USB_HostHidGetReportDescriptor (usb_host_class_handle *classHandle*, uint8_t * *buffer*, uint16_t *buffer_len*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the HID report descriptor request.

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Parameters

in	<i>classHandle</i>	The class handle.
out	<i>buffer</i>	The buffer pointer.
in	<i>buffer_len</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.3.7.6 **usb_status_t USB_HostHidRecv (usb_host_class_handle *classHandle*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the HID receiving data.

Parameters

in	<i>classHandle</i>	The class handle.
out	<i>buffer</i>	The buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.

<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostRecv.

4.3.7.7 `usb_status_t USB_HostHidSend (usb_host_class_handle classHandle, uint8_t * buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void * callbackParam)`

This function implements the HID sending data.

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>buffer</i>	The buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Send request successfully.
<i>kStatus_USB_Invalid_Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostSend.

4.3.7.8 `usb_status_t USB_HostHidGetIdle (usb_host_class_handle classHandle, uint8_t reportId, uint8_t * idleRate, transfer_callback_t callbackFn, void * callbackParam)`

This function implements the HID class-specific request (get idle).

Parameters

in	<i>classHandle</i>	The class handle.
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in	<i>reportId</i>	Report ID.
out	<i>idleRate</i>	Return idle rate value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.3.7.9 **usb_status_t USB_HostHidSetIdle (usb_host_class_handle *classHandle*, uint8_t *reportId*, uint8_t *idleRate*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the HID class-specific request (set idle).

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>reportId</i>	Report ID.
in	<i>idleRate</i>	Idle rate value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.3.7.10 **usb_status_t USB_HostHidGetProtocol (usb_host_class_handle *classHandle*, uint8_t * *protocol*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the HID class-specific request (get protocol).

Parameters

in	<i>classHandle</i>	The class handle.
out	<i>protocol</i>	Return protocol value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.3.7.11 **usb_status_t USB_HostHidSetProtocol (usb_host_class_handle *classHandle*, uint8_t *protocol*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the HID class-specific request (set protocol).

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>protocol</i>	Protocol value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

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4.3.7.12 `usb_status_t USB_HostHidGetReport (usb_host_class_handle classHandle,
uint8_t reportId, uint8_t reportType, uint8_t * buffer, uint32_t bufferLength,
transfer_callback_t callbackFn, void * callbackParam)`

This function implements the HID class-specific request (get report).

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>reportId</i>	Report ID.
in	<i>reportType</i>	Report type.
out	<i>buffer</i>	The buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.3.7.13 **usb_status_t USB_HostHidSetReport (usb_host_class_handle *classHandle*, uint8_t *reportId*, uint8_t *reportType*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the HID class-specific request (set report).

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>reportId</i>	Report ID.
in	<i>reportType</i>	Report type.
in	<i>buffer</i>	The buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

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Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.4 USB MSC Class driver

4.4.1 Overview

The USB Mass Storage Class (or USB MSC) defines the mass storage USB device. A typical example is a U-disk. This section describes the programming interface of the USB Host MSC class driver. The USB Host MSC class driver handles the specific control requests for MSC class and transfers data to and from the device through the interrupt pipe.

4.4.2 USB Host MSC Initialization

When the MSD device is attached, the MSD initialization flow is as follows:

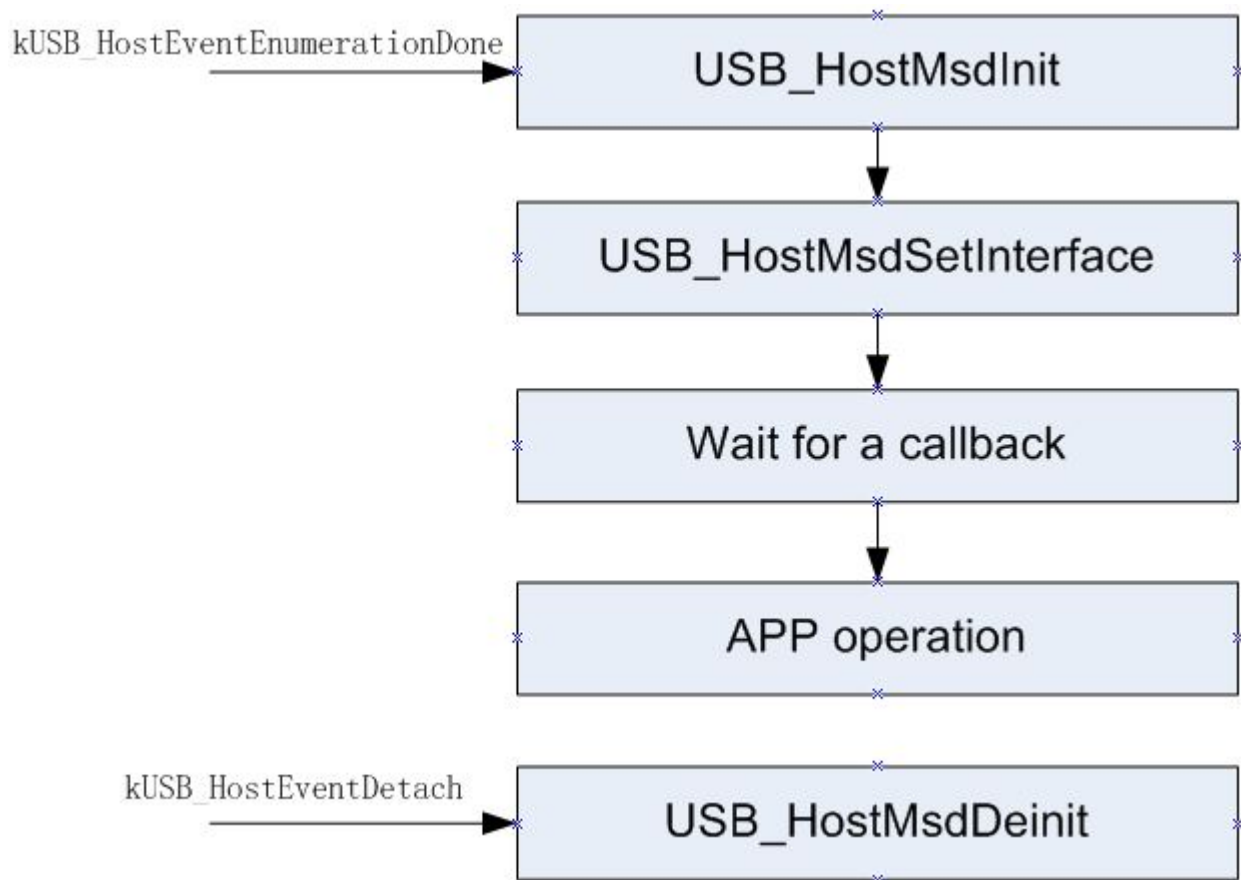


Figure 4.4.1: Host MSD Initialization

The above figure describes the following steps:

- Call the `USB_HostMsdInit` to initialize the MSD class instance `usb_host_msd_instance_t` and the return class handle pointer to the MSD class instance. The driver uses an instantiation of the `usb_host_msd_instance_t` structure to maintain the current state of a MSC instance module driver. This

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structure holds the USB host handle and the USB device handle and keeps track of transfer information, alternate setting, pipes and interfaces that are enumerated for attached MSC device.

- Call the `USB_HostMsdSetInterface` to set the MSD class interface, which opens the interface's pipes.
- Wait the last step operation callback.
- Test the MSD device: read capacity, write data, or read data.

4.4.3 USB Host MSC Deinitialization

An application calls the `USB_HostMsdDeinit` to deinitialize the MSD. This function cancels the transfer, closes the pipe, and releases the MSD class instance.

There are two use cases to call this function:

- The MSD device is detached and this function is called to free the resource.
- An application calls this function and then calls the `USB_HostMsdInit` to reinitialize the MSD class.

4.4.4 USB Host MSC UFI Command

Provides the buffer pointer, the buffer length, the callback function, the callback parameter, and other parameters and calls the `USB_HostMsdxx` to start an asynchronous MSD UFI command. Then, the callback function is called with one command status parameter when the command succeeds or fails. For example, `USB_HostMsdRead10` needs these parameters: buffer pointer, reading length, reading block number, callback function, callback parameter, logical unit number and start the block address.

Data Structures

- struct `usb_host_cbw_t`
MSC Bulk-Only command block wrapper (CBW) [More...](#)
- struct `usb_host_csw_t`
MSC Bulk-Only command status wrapper (CSW) [More...](#)
- struct `usb_host_msd_command_t`
MSC UFI command information structure. [More...](#)
- struct `usb_host_msd_instance_t`
MSD instance structure, MSD `usb_host_class_handle` pointer to this structure. [More...](#)
- struct `usb_host_ufi_sense_data_t`
UFI standard sense data structure. [More...](#)
- struct `usb_host_ufi_inquiry_data_t`
UFI standard inquiry data structure. [More...](#)
- struct `usb_host_ufi_read_capacity_t`
UFI read capacity data structure. [More...](#)

Macros

- #define `USB_HOST_MSD_RETRY_MAX_TIME` (1U)
retry time when transfer fail, when all the retries fail the transfer callback with error status
- #define `USB_HOST_MSD_BLOCK_SIZE` (512U)
mass storage block size
- #define `USB_HOST_MSD_CLASS_CODE` (8U)
MSD class code.
- #define `USB_HOST_MSD_SUBCLASS_CODE_UFI` (4U)
MSD sub-class code.
- #define `USB_HOST_MSD_SUBCLASS_CODE_SCSI` (6U)
MSD sub-class code.
- #define `USB_HOST_MSD_PROTOCOL_BULK` (0x50U)
MSD protocol code.
- #define `USB_HOST_HID_MASS_STORAGE_RESET` (0xFFU)
MSD class-specific request (mass storage reset)
- #define `USB_HOST_HID_GET_MAX_LUN` (0xFEU)
MSD class-specific request (get maximum logical unit number)

Enumerations

- enum `usb_host_msd_command_status_t`
UFI command process status.

USB host MSD class APIs

- `usb_status_t` `USB_HostMsdInit` (`usb_device_handle` deviceHandle, `usb_host_class_handle` *classHandle)
Initializes the MSD instance.
- `usb_status_t` `USB_HostMsdSetInterface` (`usb_host_class_handle` classHandle, `usb_host_interface_handle` interfaceHandle, `uint8_t` alternateSetting, `transfer_callback_t` callbackFn, void *callbackParam)
Sets the interface.
- `usb_status_t` `USB_HostMsdDeinit` (`usb_device_handle` deviceHandle, `usb_host_class_handle` classHandle)
Deinitializes the MSD instance.
- `usb_status_t` `USB_HostMsdMassStorageReset` (`usb_host_class_handle` classHandle, `transfer_callback_t` callbackFn, void *callbackParam)
Mass storage reset.
- `usb_status_t` `USB_HostMsdGetMaxLun` (`usb_host_class_handle` classHandle, `uint8_t` *logicalUnitNumber, `transfer_callback_t` callbackFn, void *callbackParam)
Gets the maximum logical unit number.
- `usb_status_t` `USB_HostMsdRead10` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint32_t` blockAddress, `uint8_t` *buffer, `uint32_t` bufferLength, `uint32_t` blockNumber, `transfer_callback_t` callbackFn, void *callbackParam)
Mass storage read (10).

- `usb_status_t USB_HostMsRead12` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint32_t` blockAddress, `uint8_t` *buffer, `uint32_t` bufferLength, `uint32_t` blockNumber, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage read (12).
- `usb_status_t USB_HostMsWrite10` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint32_t` blockAddress, `uint8_t` *buffer, `uint32_t` bufferLength, `uint32_t` blockNumber, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage write (10).
- `usb_status_t USB_HostMsWrite12` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint32_t` blockAddress, `uint8_t` *buffer, `uint32_t` bufferLength, `uint32_t` blockNumber, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage write (12).
- `usb_status_t USB_HostMsReadCapacity` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` *buffer, `uint32_t` bufferLength, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage read capacity.
- `usb_status_t USB_HostMsTestUnitReady` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage test unit ready.
- `usb_status_t USB_HostMsRequestSense` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` *buffer, `uint32_t` bufferLength, `transfer_callback_t` callbackFn, `void` *callbackParam)
mass storage request sense.
- `usb_status_t USB_HostMsModeSelect` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` *buffer, `uint32_t` bufferLength, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage mode select.
- `usb_status_t USB_HostMsModeSense` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` pageControl, `uint8_t` pageCode, `uint8_t` *buffer, `uint32_t` bufferLength, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage mode sense.
- `usb_status_t USB_HostMsInquiry` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` *buffer, `uint32_t` bufferLength, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage inquiry.
- `usb_status_t USB_HostMsReadFormatCapacities` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` *buffer, `uint32_t` bufferLength, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage read format capacities.
- `usb_status_t USB_HostMsFormatUnit` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` trackNumber, `uint16_t` interLeave, `uint8_t` *buffer, `uint32_t` bufferLength, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage format unit.
- `usb_status_t USB_HostMsPreventAllowRemoval` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` prevent, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage prevents/allows a medium removal.
- `usb_status_t USB_HostMsWriteAndVerify` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint32_t` blockAddress, `uint8_t` *buffer, `uint32_t` bufferLength, `uint32_t` blockNumber, `transfer_callback_t` callbackFn, `void` *callbackParam)
Mass storage write and verify.
- `usb_status_t USB_HostMsStartStopUnit` (`usb_host_class_handle` classHandle, `uint8_t` logicalUnit, `uint8_t` loadEject, `uint8_t` start, `transfer_callback_t` callbackFn, `void` *callbackParam)

- *Mass storage start stop unit.*
usb_status_t USB_HostMsDVerify (**usb_host_class_handle** classHandle, **uint8_t** logicalUnit, **uint32_t** blockAddress, **uint16_t** verificationLength, **transfer_callback_t** callbackFn, void *callbackParam)
- *Mass storage verify.*
usb_status_t USB_HostMsDRezeroUnit (**usb_host_class_handle** classHandle, **uint8_t** logicalUnit, **transfer_callback_t** callbackFn, void *callbackParam)
- *Mass storage rezero.*
usb_status_t USB_HostMsDSeek10 (**usb_host_class_handle** classHandle, **uint8_t** logicalUnit, **uint32_t** blockAddress, **transfer_callback_t** callbackFn, void *callbackParam)
- *Mass storage seek(10).*
usb_status_t USB_HostMsDSendDiagnostic (**usb_host_class_handle** classHandle, **uint8_t** logicalUnit, **uint8_t** selfTest, **transfer_callback_t** callbackFn, void *callbackParam)
- *Mass storage send diagnostic.*

4.4.5 Data Structure Documentation

4.4.5.1 struct usb_host_cbw_t

Data Fields

- **uint32_t CBWSignature**
Signature that helps identify this data packet as a CBW.
- **uint32_t CBWTag**
A Command Block Tag sent by the host.
- **uint32_t CBWDataTransferLength**
The number of bytes of data that the host expects to transfer on the Bulk-In or Bulk-Out endpoint during the execution of this command.
- **uint8_t CBWFlags**
*Bit 7 Direction - the device shall ignore this bit if the dCBWDataTransferLength field is zero, otherwise:
0 = Data-Out from host to the device, 1 = Data-In from the device to the host.*
- **uint8_t CBWLun**
The device Logical Unit Number (LUN) to which the command block is being sent.
- **uint8_t CBWCBLength**
The valid length of the CBWCB in bytes.
- **uint8_t CBWCB [16]**
The command block to be executed by the device.

4.4.5.1.0.12 Field Documentation

4.4.5.1.0.12.1 uint32_t usb_host_cbw_t::CBWSignature

The signature field shall contain the value 43425355h (little endian), indicating a CBW

4.4.5.1.0.12.2 uint32_t usb_host_cbw_t::CBWTag

The device shall echo the contents of this field back to the host in the dCSWTag field of the associated CSW

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4.4.5.1.0.12.3 `uint8_t usb_host_cbw_t::CBWFlags`

Bit 6 Obsolete. The host shall set this bit to zero. Bits 5..0 Reserved - the host shall set these bits to zero.

4.4.5.1.0.12.4 `uint8_t usb_host_cbw_t::CBWCBLength`

This defines the valid length of the command block. The only legal values are 1 through 16 (01h through 10h).

4.4.5.2 `struct usb_host_csw_t`

Data Fields

- `uint32_t CSWSignature`
Signature that helps identify this data packet as a CSW.
- `uint32_t CSWTag`
The device shall set this field to the value received in the `dCBWTag` of the associated CBW.
- `uint32_t CSWDataResidue`
the difference between the amount of data expected as stated in the `dCBWDataTransferLength` and the actual amount of relevant data processed by the device.
- `uint8_t CSWStatus`
bCSWStatus indicates the success or failure of the command.

4.4.5.2.0.13 Field Documentation

4.4.5.2.0.13.1 `uint32_t usb_host_csw_t::CSWSignature`

The signature field shall contain the value 53425355h (little endian), indicating CSW.

4.4.5.2.0.13.2 `uint32_t usb_host_csw_t::CSWDataResidue`

4.4.5.2.0.13.3 `uint8_t usb_host_csw_t::CSWStatus`

00h - Command passed. 01h - Command Failed. 02h - Phase error. others - Reserved.

4.4.5.3 `struct usb_host_msd_command_t`

Data Fields

- `usb_host_cbw_t cbwBlock`
CBW data block.
- `usb_host_csw_t cswBlock`
CSW data block.
- `uint8_t * dataBuffer`
Data buffer pointer.
- `uint32_t dataLength`
Data buffer length.
- `uint32_t dataSofar`
Successful transfer data length.

- `usb_host_transfer_t * transfer`
The transfer is used for processing the UFI command.
- `uint8_t retryTime`
The UFI command residual retry time, when it reduce to zero the UFI command fail.
- `uint8_t dataDirection`
The data direction, its value is `USB_OUT` or `USB_IN`.

4.4.5.4 struct usb_host_msd_instance_t

Data Fields

- `usb_host_handle hostHandle`
This instance's related host handle.
- `usb_device_handle deviceHandle`
This instance's related device handle.
- `usb_host_interface_handle interfaceHandle`
This instance's related interface handle.
- `usb_host_pipe_handle controlPipe`
This instance's related device control pipe.
- `usb_host_pipe_handle outPipe`
MSD bulk out pipe.
- `usb_host_pipe_handle inPipe`
MSD bulk in pipe.
- `transfer_callback_t commandCallbackFn`
MSD UFI command callback function pointer.
- `void * commandCallbackParam`
MSD UFI command callback parameter.
- `transfer_callback_t controlCallbackFn`
MSD control transfer callback function pointer.
- `void * controlCallbackParam`
MSD control transfer callback parameter.
- `usb_host_transfer_t * controlTransfer`
Ongoing control transfer.
- `usb_host_msd_command_t msdCommand`
Ongoing MSD UFI command information.
- `uint8_t commandStatus`
UFI command process status, see `command_status_t`.
- `uint8_t internalResetRecovery`
1 - class driver internal mass storage reset recovery is on-going; 0 - application call `USB_HostMsMassStorageReset` to reset or there is no reset

4.4.5.5 struct usb_host_ufi_sense_data_t

Data Fields

- `uint8_t errorCode`
This field shall contain a value of 70h to indicate current errors.
- `uint8_t reserved1`
Reserved field.

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- uint8_t [senseKey](#)
Provide a hierarchy of error or command result information.
- uint8_t [information](#) [4]
This field is command-specific; it is typically used by some commands to return a logical block address denoting where an error occurred.
- uint8_t [additionalSenseLength](#)
The UFI device sets the value of this field to ten, to indicate that ten more bytes of sense data follow this field.
- uint8_t [reserved2](#) [4]
Reserved field.
- uint8_t [additionalSenseCode](#)
Provide a hierarchy of error or command result information.
- uint8_t [additionalSenseCodeQualifier](#)
Provide a hierarchy of error or command result information.
- uint8_t [reserved3](#) [4]
Reserved field.

4.4.5.6 struct usb_host_ufi_inquiry_data_t

Data Fields

- uint8_t [peripheralDeviceType](#)
Identifies the device currently connected to the requested logical unit.
- uint8_t [removableMediaBit](#)
This shall be set to one to indicate removable media.
- uint8_t [version](#)
Version.
- uint8_t [responseDataFormat](#)
A value of 01h shall be used for UFI device.
- uint8_t [additionalLength](#)
Specify the length in bytes of the parameters.
- uint8_t [reserved1](#) [3]
Reserved field.
- uint8_t [vendorInformation](#) [8]
Contains 8 bytes of ASCII data identifying the vendor of the product.
- uint8_t [productIdentification](#) [16]
Contains 16 bytes of ASCII data as defined by the vendor.
- uint8_t [productRevisionLevel](#) [4]
Contains 4 bytes of ASCII data as defined by the vendor.

4.4.5.7 struct usb_host_ufi_read_capacity_t

Data Fields

- uint8_t [lastLogicalBlockAddress](#) [4]
The logical block number.
- uint8_t [blockLengthInBytes](#) [4]
Block size.

4.4.6 Function Documentation

4.4.6.1 `usb_status_t USB_HostMsdlInit (usb_device_handle deviceHandle, usb_host_class_handle * classHandle)`

This function allocates the resources for the MSD instance.

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Parameters

in	<i>deviceHandle</i>	The device handle.
out	<i>classHandle</i>	Return class handle.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocate memory fail.

4.4.6.2 `usb_status_t USB_HostMsdSetInterface (usb_host_class_handle classHandle,
usb_host_interface_handle interfaceHandle, uint8_t alternateSetting,
transfer_callback_t callbackFn, void * callbackParam)`

This function binds the interface with the MSD instance.

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>interface-Handle</i>	The interface handle.
in	<i>alternate-Setting</i>	The alternate setting value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Success</i>	Callback return status, the command succeeded.

<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.
<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.
<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See the USB_HostOpenPipe.

4.4.6.3 **usb_status_t USB_HostMsdeinit (usb_device_handle *deviceHandle*, usb_host_class_handle *classHandle*)**

This function frees the resource for the MSD instance.

Parameters

in	<i>deviceHandle</i>	The device handle.
in	<i>classHandle</i>	The class handle.

Return values

<i>kStatus_USB_Success</i>	The device is de-initialized successfully.
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4.4.6.4 **usb_status_t USB_HostMsMassStorageReset (usb_host_class_handle *classHandle*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the mass storage reset request.

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.

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<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.4.6.5 **usb_status_t USB_HostMsdGetMaxLun (usb_host_class_handle *classHandle*, uint8_t * *logicalUnitNumber*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the get maximum LUN request.

Parameters

in	<i>classHandle</i>	The class handle.
out	<i>logicalUnit- Number</i>	Return logical unit number value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid- Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD- StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.6 **usb_status_t USB_HostMsdRead10 (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint32_t *blockAddress*, uint8_t * *buffer*, uint32_t *bufferLength*, uint32_t *blockNumber*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI READ(10) command. This command requests that the UFI device transfer data to the host.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>blockAddress</i>	The start block address.
out	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>blockNumber</i>	Read block number.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.7 **usb_status_t USB_HostMsdRead12 (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint32_t *blockAddress*, uint8_t * *buffer*, uint32_t *bufferLength*, uint32_t *blockNumber*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI READ(12) command and requests that the UFI device transfer data to the host.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.

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in	<i>blockAddress</i>	The start block address.
out	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>blockNumber</i>	Read block number.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.8 **usb_status_t USB_HostMsdWrite10 (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint32_t *blockAddress*, uint8_t * *buffer*, uint32_t *bufferLength*, uint32_t *blockNumber*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI WRITE(10) command and requests that the UFI device write the data transferred by the host to the medium.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>blockAddress</i>	The start block address.
in	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.

in	<i>blockNumber</i>	Write block number.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.9 **usb_status_t USB_HostMsdWrite12 (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint32_t *blockAddress*, uint8_t * *buffer*, uint32_t *bufferLength*, uint32_t *blockNumber*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI WRITE(12) command and requests that the UFI device write the data transferred by the host to the medium.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>blockAddress</i>	The start block address.
in	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>blockNumber</i>	Write block number.
in	<i>callbackFn</i>	This callback is called after this command completes.

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in	<i>callbackParam</i>	The first parameter in the callback function.
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Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.10 **usb_status_t USB_HostMsReadCapacity (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI READ CAPACITY command and allows the host to request capacities of the currently installed medium.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
out	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.

<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.11 **usb_status_t USB_HostMsdTestUnitReady (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI TEST UNIT READY command and checks if the UFI device is ready.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.12 **usb_status_t USB_HostMsdRequestSense (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI REQUEST SENSE command, this command instructs the UFI device to transfer sense data to the host for the specified logical unit.

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Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
out	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.13 **usb_status_t USB_HostMsdModeSelect (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI MODE SELECT command and allows the host to specify medium or device parameters to the UFI device.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.

in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.14 **usb_status_t USB_HostMsdModeSense (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t *pageControl*, uint8_t *pageCode*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI MODE SENSE command and allows the UFI device to report medium or device parameters to the host.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>pageControl</i>	The page control field specifies the type of mode parameters to return.
in	<i>pageCode</i>	Buffer pointer.
out	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

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<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.15 **usb_status_t USB_HostMsdInquiry (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI INQUIRY command and requests that information regarding parameters of the UFI device itself be sent to the host.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
out	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.

<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.16 **usb_status_t USB_HostMsdReadFormatCapacities (usb_host_class_handle classHandle, uint8_t logicalUnit, uint8_t * buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void * callbackParam)**

This function implements the UFI READ FORMAT CAPACITIES command and allows the host to request a list of the possible capacities that can be formatted on the currently installed medium.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
out	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.17 `usb_status_t USB_HostMsdFormatUnit (usb_host_class_handle classHandle,
uint8_t logicalUnit, uint8_t trackNumber, uint16_t interLeave, uint8_t * buffer,
uint32_t bufferLength, transfer_callback_t callbackFn, void * callbackParam)`

This function implements the UFI FORMAT UNIT command and the host sends this command to physically format one track of a diskette according to the selected options.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>trackNumber</i>	This specifies which track is to be formatted.
in	<i>interLeave</i>	This specifies the interleave that shall be used for formatting.
in	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.18 **usb_status_t USB_HostMsdPreventAllowRemoval (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t *prevent*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI PREVENT-ALLOW MEDIUM REMOVAL command and notifies the FUI device to enable or disable the removal of the medium in the logical unit.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.

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in	<i>prevent</i>	Prevent or allow <ul style="list-style-type: none">0: enable (allow) the removal of the medium1: disable (prevent) removal of the medium
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.19 `usb_status_t USB_HostMsdWriteAndVerify (usb_host_class_handle classHandle, uint8_t logicalUnit, uint32_t blockAddress, uint8_t * buffer, uint32_t bufferLength, uint32_t blockNumber, transfer_callback_t callbackFn, void * callbackParam)`

This function implements the UFI WRITE AND VERIFY command and requests that the UFI device writes the data transferred by the host to the medium, then verifies the data on the medium.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>blockAddress</i>	The start block address.
in	<i>buffer</i>	Buffer pointer.
in	<i>bufferLength</i>	The buffer length.

in	<i>blockNumber</i>	Write and verify block number.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.20 **usb_status_t USB_HostMsdStartStopUnit (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t *loadEject*, uint8_t *start*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI START-STOP UNIT command and instructs the UFI device to enable or disable media access operations .

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>loadEject</i>	A Load Eject (LoEj) bit of zero requests that no eject action be performed. A LoEj bit of one, with the Start bit cleared to zero, which instructs the UFI device to eject the media.
in	<i>start</i>	A Start bit of one instructs the UFI device to enable media access operations. A Start bit of zero instructs the UFI device to disable media access operations.

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in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.21 **usb_status_t USB_HostMsdVerify (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint32_t *blockAddress*, uint16_t *verificationLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI VERIFY command and requests that the UFI device verify the data on the medium.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>blockAddress</i>	The start block address.
in	<i>verification-Length</i>	The data length that need to be verified.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
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<i>kStatus_USB_Invalid_Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.22 **usb_status_t USB_HostMsdRezeroUnit (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI REZERO UNIT command. This command positions the head of the drive to the cylinder 0.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid_Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.

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<i>kStatus_USB_Error</i>	Callback return status, the command fail.
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4.4.6.23 **usb_status_t USB_HostMsdSeek10 (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint32_t *blockAddress*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI SEEK(10) command and requests that the UFI device seek to the specified Logical Block Address.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>blockAddress</i>	The start block address.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.4.6.24 **usb_status_t USB_HostMsdSendDiagnostic (usb_host_class_handle *classHandle*, uint8_t *logicalUnit*, uint8_t *selfTest*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the UFI SEND DIAGNOSTIC command. This command requests the UFI device to do a reset or perform a self-test.

Parameters

in	<i>classHandle</i>	The class MSD handle.
in	<i>logicalUnit</i>	Logical unit number.
in	<i>selfTest</i>	0 = perform special diagnostic test; 1 = perform default self-test.
in	<i>callbackFn</i>	This callback is called after this command completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	The previous command is executing or there is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSend/USB_HostRecv.
<i>kStatus_USB_Success</i>	Callback return status, the command succeed.
<i>kStatus_USB_MSD-StatusFail</i>	Callback return status, the CSW status indicate this command fail.
<i>kStatus_USB_Error</i>	Callback return status, the command fail.

4.5 USB AUDIO Class driver

4.5.1 Overview

The audio device class definition applies to all devices or functions embedded in composite devices that are used to manipulate audio, voice, and sound-related functionality. This includes both audio data (analog and digital) and the functionality that is used to directly control the audio environment, such as volume and tone Control. Typical examples of audio class devices include the USB audio speaker. This section describes the programming interface of the USB HOST audio class driver. The USB HOST audio class driver handles the specific control requests for audio class and transfers data to and from the device through the isochronous pipe.

4.5.2 USB Host audio Initialization

When audio device is attached, audio initialization occurs as follows:

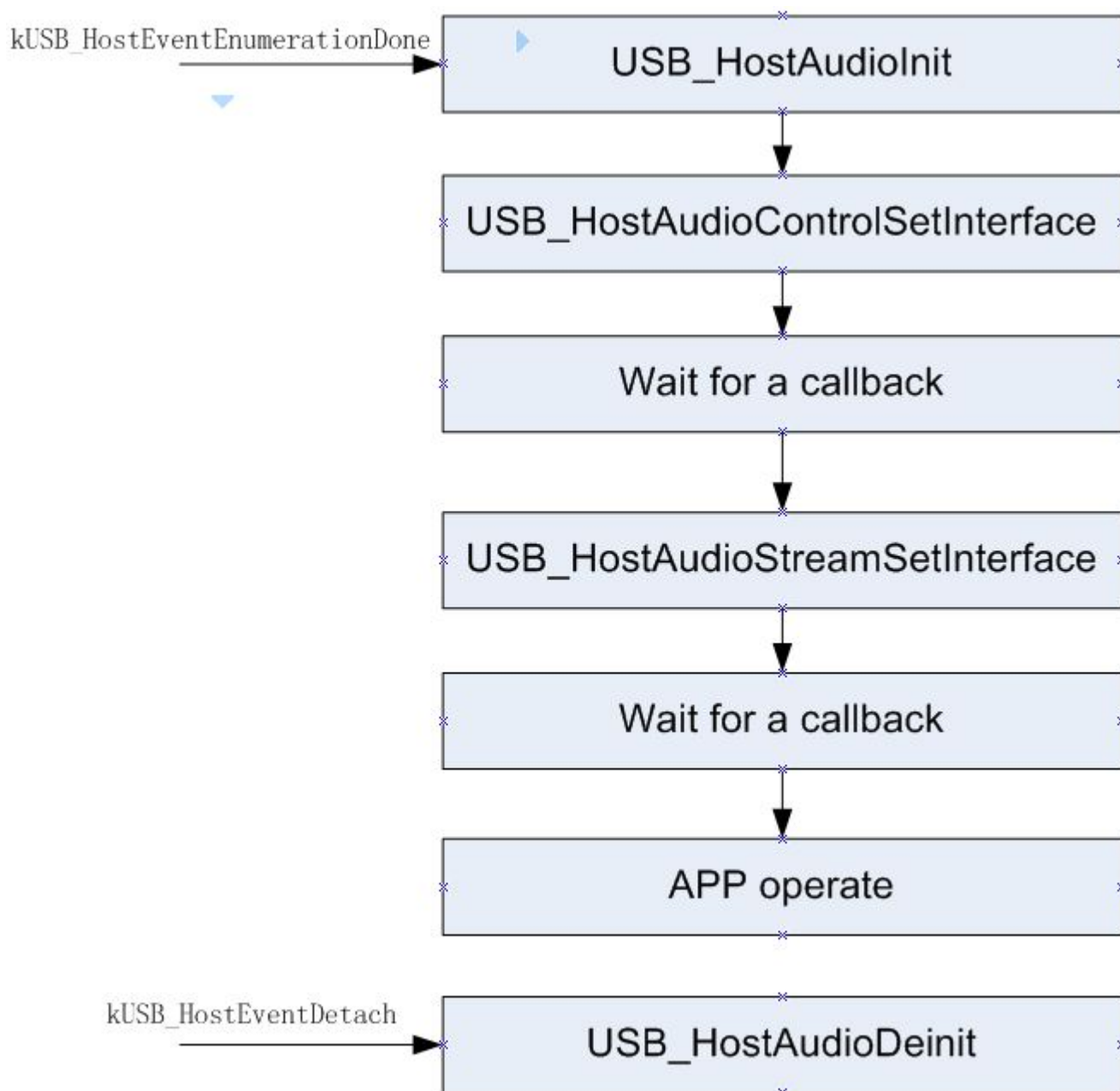


Figure 4.5.1: Host Audio Initialization

The above figure describes the following steps:

- Call the `USB_HostAudioInit` to initialize audio class instance `audio_instance_t` and the return class handle pointer to the audio class instance. The driver uses an instantiation of the `audio_instance_t` structure to maintain the current state of a audio instance module driver. This structure holds the USB host handle, the USB device handle, and keeps track of transfer information, alternate setting, pipes and interfaces that are enumerated for attached audio device.
- Call the `USB_HostAudioControlSetInterface` to set the audio class control interface, which opens

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- the interface's pipes.
- Wait the last step operation callback.
- Call the `USB_HostAudioStreamSetInterface` to set the audio class stream interface, which opens the interface's pipes.
- Wait the last step operation callback.
- Call the `USB_HostAudioStreamRecv` to receive isochronous data from the device, or call `USB_HostAudioStreamSend` to send isochronous data to the device.
- Wait the last step operation callback.
- Process data and receive or send again.

4.5.3 USB Host audio De-initialization

An application can call the `usb_host_audio_deinit` to deinitialize audio. This function cancels the transfer, closes the pipe, and releases the audio class instance.

There are two use cases when calling this function:

- The audio device is detached and this function is called to free the resource.
- The application calls this function and calls the `USB_HostAudioInit` to reinitialize the audio class.

4.5.4 USB Host audio Send data

Provides the buffer pointer, buffer length, the callback function, and the callback parameter and call the `USB_HostAudioStreamSend` to start asynchronous sending. Then, the callback function is called with one transfer status parameter when the transfer succeeds or fails.

4.5.5 USB Host audio Receive data

Provides the buffer pointer, buffer length, the callback function, and the callback parameter and calls the `USB_HostAudioStreamRecv` to start asynchronous receiving. Then, the callback function is called with one transfer status parameter when the transfer succeeds or fails.

Data Structures

- struct `usb_audio_ctrl_header_desc_t`
Audio control interface header descriptor structure. [More...](#)
- struct `usb_audio_ctrl_it_desc_t`
Audio control interface input terminal descriptor structure. [More...](#)
- struct `usb_audio_ctrl_ot_desc_t`
Audio control interface output terminal descriptor structure. [More...](#)
- struct `usb_audio_ctrl_fu_desc_t`
Audio control interface feature unit descriptor structure. [More...](#)
- struct `usb_audio_stream_specific_iso_endp_desc_t`

- *Audio as isochronous audio data endpoint descriptor structure. [More...](#)*
- struct `usb_audio_stream_synch_endp_desc_t`
Audio standard as isochronous synch endpoint descriptor structure. [More...](#)
- struct `usb_audio_stream_spepific_as_intf_desc_t`
Audio class-specific as interface descriptor structure. [More...](#)
- struct `usb_audio_stream_format_type_desc_t`
audio Format type descriptor structure [More...](#)
- struct `audio_instance_t`
Audio instance structure and audio usb_host_class_handle pointer to this structure. [More...](#)

Macros

- #define `USB_AUDIO_CLASS_CODE` 1
Audio class code.
- #define `USB_AUDIO_SUBCLASS_CODE_CONTROL` 1
Audio class control interface code.
- #define `USB_AUDIO_SUBCLASS_CODE_AUDIOSTREAMING` 2
Audio class stream interface code.
- #define `USB_AUDIO_GET_CUR_MUTE` 0x80
AUDIO class-specific feature unit get current mute command.
- #define `USB_AUDIO_SET_CUR_MUTE` 0x00
AUDIO class-specific feature unit set current mute command.
- #define `USB_AUDIO_GET_CUR_VOLUME` 0x81
AUDIO class-specific feature unit get current volume command.
- #define `USB_AUDIO_SET_CUR_VOLUME` 0x01
AUDIO class-specific feature unit set current volume command.
- #define `USB_AUDIO_GET_MIN_VOLUME` 0x82
AUDIO class-specific feature unit get minimum volume command.
- #define `USB_AUDIO_SET_MIN_VOLUME` 0x02
AUDIO class-specific feature unit set minimum volume command.
- #define `USB_AUDIO_GET_MAX_VOLUME` 0x83
AUDIO class-specific feature unit get maximum volume command.
- #define `USB_AUDIO_SET_MAX_VOLUME` 0x03
AUDIO class-specific feature unit set maximum volume command.
- #define `USB_AUDIO_GET_RES_VOLUME` 0x84
AUDIO class-specific feature unit get resolution volume command.
- #define `USB_AUDIO_SET_RES_VOLUME` 0x04
AUDIO class-specific feature unit set resolution volume command.
- #define `USB_AUDIO_GET_CUR_PITCH` 0x80
AUDIO class-specific endpoint get current pitch control command.
- #define `USB_AUDIO_SET_CUR_PITCH` 0x00
AUDIO class-specific endpoint set current pitch control command.
- #define `USB_AUDIO_GET_CUR_SAMPLING_FREQ` 0x81
AUDIO class-specific endpoint get current sampling frequency command.
- #define `USB_AUDIO_SET_CUR_SAMPLING_FREQ` 0x01
AUDIO class-specific endpoint set current sampling frequency command.
- #define `USB_AUDIO_GET_MIN_SAMPLING_FREQ` 0x82
AUDIO class-specific endpoint get minimum sampling frequency command.
- #define `USB_AUDIO_SET_MIN_SAMPLING_FREQ` 0x02
AUDIO class-specific endpoint set minimum sampling frequency command.

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- #define `USB_AUDIO_GET_MAX_SAMPLING_FREQ` 0x83
AUDIO class-specific endpoint get maximum sampling frequency command.
- #define `USB_AUDIO_SET_MAX_SAMPLING_FREQ` 0x03
AUDIO class-specific endpoint set maximum sampling frequency command.
- #define `USB_AUDIO_GET_RES_SAMPLING_FREQ` 0x84
AUDIO class-specific endpoint get resolution sampling frequency command.
- #define `USB_AUDIO_SET_RES_SAMPLING_FREQ` 0x04
AUDIO class-specific endpoint set resolution sampling frequency command.

USB host audio class APIs

- `usb_status_t USB_HostAudioInit (usb_device_handle deviceHandle, usb_host_class_handle *classHandlePtr)`
Initializes the audio instance.
- `usb_status_t USB_HostAudioDeinit (usb_device_handle deviceHandle, usb_host_class_handle classHandle)`
Deinitializes the Audio instance.
- `usb_status_t USB_HostAudioStreamSetInterface (usb_host_class_handle classHandle, usb_host_interface_handle interfaceHandle, uint8_t alternateSetting, transfer_callback_t callbackFn, void *callbackParam)`
Sets the audio class stream interface.
- `usb_status_t USB_HostAudioControlSetInterface (usb_host_class_handle classHandle, usb_host_interface_handle interfaceHandle, uint8_t alternateSetting, transfer_callback_t callbackFn, void *callbackParam)`
Sets the audio class control interface.
- `uint16_t USB_HostAudioPacketSize (usb_host_class_handle classHandle, uint8_t pipeType, uint8_t direction)`
Gets the pipe maximum packet size.
- `usb_status_t USB_HostAudioStreamRecv (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLen, transfer_callback_t callbackFn, void *callbackParam)`
Audio stream receive data.
- `usb_status_t USB_HostAudioStreamSend (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLen, transfer_callback_t callbackFn, void *callbackParam)`
Audio stream send data.
- `usb_status_t USB_HostAudioStreamGetCurrentAltsettingDescriptors (usb_host_class_handle classHandle, usb_audio_stream_specific_as_intf_desc_t **asIntfDesc, usb_audio_stream_format_type_desc_t **formatTypeDesc, usb_audio_stream_specific_iso_endp_desc_t **isoEndpDesc)`
Gets the audio stream current altsetting descriptor.
- `usb_status_t USB_HostAudioFeatureUnitRequest (usb_host_class_handle classHandle, uint8_t channelNo, void *buf, uint32_t cmdCode, transfer_callback_t callbackFn, void *callbackParam)`
The USB audio feature unit request.
- `usb_status_t USB_HostAudioEndpointRequest (usb_host_class_handle classHandle, void *buf, uint32_t cmdCode, transfer_callback_t callbackFn, void *callbackParam)`
The USB audio endpoint request.

4.5.6 Data Structure Documentation

4.5.6.1 struct usb_audio_ctrl_header_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the header descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of audio header descriptor.
- uint8_t [bdescriptorsubtype](#)
Subtype of an audio header descriptor.
- uint8_t [bcdcdc](#) [2]
Audio Device Class Specification Release Number in Binary-Coded Decimal.
- uint8_t [wtotallength](#) [2]
Total number of bytes returned for the class-specific AudioControl interface descriptor.
- uint8_t [bincollection](#)
The number of AudioStreaming and MIDIStreaming interfaces in the Audio Interface Collection to which this AudioControl interface belongs to.

4.5.6.1.0.14 Field Documentation

4.5.6.1.0.14.1 uint8_t usb_audio_ctrl_header_desc_t::wtotallength[2]

Includes the combined length of this descriptor header and all unit and terminal descriptors.

4.5.6.2 struct usb_audio_ctrl_it_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the input terminal descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of audio input terminal descriptor.
- uint8_t [bdescriptorsubtype](#)
Subtype of audio input terminal descriptor.
- uint8_t [bterminalid](#)
Constant uniquely identifying the Terminal within the audio function.
- uint8_t [wterminaltype](#) [2]
Constant characterizing the type of Terminal.
- uint8_t [bassocterminal](#)
ID of the Output Terminal to which this Input Terminal is associated.
- uint8_t [bnrchannels](#)
Number of logical output channels in the Terminal's output audio channel cluster.
- uint8_t [wchannelconfig](#) [2]
Describes the spatial location of the logical channels.
- uint8_t [ichannelnames](#)
Index of a string descriptor, describing the name of the first logical channel.
- uint8_t [iterminal](#)

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Index of a string descriptor, describing the Input Terminal.

4.5.6.2.0.15 Field Documentation

4.5.6.2.0.15.1 uint8_t usb_audio_ctrl_it_desc_t::bterminalid

This value is used in all requests to address this Terminal

4.5.6.2.0.15.2 uint8_t usb_audio_ctrl_it_desc_t::wchannelconfig[2]

4.5.6.3 struct usb_audio_ctrl_ot_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the output terminal descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of audio output terminal descriptor.
- uint8_t [bdescriptorsubtype](#)
Subtype of audio output terminal descriptor.
- uint8_t [bterminalid](#)
Constant uniquely identifying the Terminal within the audio function.
- uint8_t [wterminaltype](#) [2]
Constant characterizing the type of Terminal.
- uint8_t [bassocterminal](#)
Constant, identifying the Input Terminal to which this Output Terminal is associated.
- uint8_t [bsourceid](#)
ID of the Unit or Terminal to which this Terminal is connected.
- uint8_t [itterminal](#)
Index of a string descriptor, describing the Output Terminal.

4.5.6.3.0.16 Field Documentation

4.5.6.3.0.16.1 uint8_t usb_audio_ctrl_ot_desc_t::bterminalid

This value is used in all requests to address this Terminal

4.5.6.4 struct usb_audio_ctrl_fu_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the output terminal descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of audio output terminal descriptor.
- uint8_t [bdescriptorsubtype](#)
Subtype of audio output terminal descriptor.
- uint8_t [bunitid](#)
Constant uniquely identifying the unit within the audio function.
- uint8_t [bsourceid](#)

- *ID of the Unit or Terminal to which this Feature Unit is connected.*
uint8_t [bcontrolsiz](#)
Size in bytes of an element of the bmaControls.

4.5.6.4.0.17 Field Documentation

4.5.6.4.0.17.1 uint8_t usb_audio_ctrl_fu_desc_t::bunitid

This value is used in all requests to address this unit

4.5.6.5 struct usb_audio_stream_specific_iso_endp_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of the descriptor.
- uint8_t [bdescriptorsubtype](#)
Subtype of the descriptor.
- uint8_t [bmattributes](#)
A bit in the range D6..0 set to 1 indicates that the mentioned Control is supported by this endpoint.
- uint8_t [blockdelayunits](#)
Indicates the units used for the wLockDelay field.
- uint8_t [wlockdelay](#) [2]
Indicates the time it takes this endpoint to reliably lock its internal clock recovery circuitry.

4.5.6.5.0.18 Field Documentation

4.5.6.5.0.18.1 uint8_t usb_audio_stream_specific_iso_endp_desc_t::wlockdelay[2]

Units used depend on the value of the bLockDelayUnits field.

4.5.6.6 struct usb_audio_stream_synch_endp_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of the endpoint descriptor.
- uint8_t [bendpointaddress](#)
The address of the endpoint on the USB device described by this descriptor.
- uint8_t [bmattributes](#)
D3..2: Synchronization type, D1..0: Transfer type.
- uint8_t [wmaxpacketsize](#) [2]
Maximum packet size this endpoint is capable of sending or receiving when this configuration is selected.
- uint8_t [binterval](#)
Interval for polling endpoint for data transfers expressed in milliseconds.

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- uint8_t [brefresh](#)
This field indicates the rate at which an isochronous synchronization pipe provides new synchronization feedback data.
- uint8_t [bsynchaddress](#)
Must be reset to zero.

4.5.6.7 struct usb_audio_stream_spepific_as_intf_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of the descriptor.
- uint8_t [bdescriptorsubtype](#)
Subtype of the descriptor.
- uint8_t [bterminallink](#)
The Terminal ID of the Terminal to which the endpoint of this interface is connected.
- uint8_t [bdelay](#)
Expressed in number of frames.
- uint8_t [wformattag](#) [2]
The Audio Data Format that has to be used to communicate with this interface.

4.5.6.8 struct usb_audio_stream_format_type_desc_t

Data Fields

- uint8_t [blength](#)
Total size of the descriptor.
- uint8_t [bdescriptortype](#)
Descriptor type of the descriptor.
- uint8_t [bdescriptorsubtype](#)
Subtype of the descriptor.
- uint8_t [bformattype](#)
Constant identifying the Format Type the AudioStreaming interface is using.
- uint8_t [bnrchannels](#)
Number of channels of device.
- uint8_t [bsubframesize](#)
Bytes per audio subframe.
- uint8_t [bbitresolution](#)
Bits per sample.
- uint8_t [bsamfreqtype](#)
Frequency supported.
- uint8_t [tsamfreq](#) [1][3]
Sample frequency.

4.5.6.9 struct audio_instance_t

Data Fields

- [usb_host_handle](#) hostHandle
This instance's related host handle.
- [usb_device_handle](#) deviceHandle
This instance's related device handle.
- [usb_host_interface_handle](#) streamIntfHandle
This instance's audio stream interface handle.
- [usb_host_interface_handle](#) controlIntfHandle
This instance's control stream interface handle.
- [usb_audio_stream_specific_as_intf_desc_t](#) * asIntfDesc
Audio class class-specific as interface descriptor pointer.
- [usb_audio_stream_format_type_desc_t](#) * formatTypeDesc
Audio class class-specific format type descriptor pointer.
- [usb_audio_stream_specific_iso_endp_desc_t](#) * isoEndpDesc
Audio class class-specific ISO audio data endpoint descriptor pointer.
- [usb_host_pipe_handle](#) isoInPipe
Audio class ISO in pipe.
- [usb_host_pipe_handle](#) isoOutPipe
Audio class ISO out pipe.
- [transfer_callback_t](#) inCallbackFn
Audio class ISO in transfer callback function.
- void * [inCallbackParam](#)
Audio class ISO in transfer callback parameter.
- [transfer_callback_t](#) outCallbackFn
Audio class ISO out transfer callback function.
- void * [outCallbackParam](#)
Audio class ISO out transfer callback function.
- [usb_audio_ctrl_header_desc_t](#) * headerDesc
Audio class header descriptor pointer.
- [usb_audio_ctrl_it_desc_t](#) * itDesc
Audio class input terminal descriptor pointer.
- [usb_audio_ctrl_ot_desc_t](#) * otDesc
Audio class output terminal descriptor pointer.
- [usb_audio_ctrl_fu_desc_t](#) * fuDesc
Audio class feature unit descriptor pointer.
- [usb_host_pipe_handle](#) controlPipe
Audio class device control pipe.
- [transfer_callback_t](#) controlCallbackFn
Audio control transfer callback function.
- void * [controlCallbackParam](#)
Audio control transfer callback function.
- [usb_host_transfer_t](#) * [controlTransfer](#)
On-going control transfer.
- uint16_t [inPacketSize](#)
Audio ISO in maximum packet size.
- uint16_t [outPacketSize](#)
Audio ISO out maximum packet size.
- uint8_t [isSetup](#)

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- Whether the audio setup transfer is transmitting.
- uint8_t [isoEpNum](#)
Audio stream ISO endpoint number.
- uint8_t [streamIfnum](#)
Audio stream ISO interface number.

4.5.7 Function Documentation

4.5.7.1 usb_status_t USB_HostAudioInit (usb_device_handle *deviceHandle*, usb_host_class_handle * *classHandlePtr*)

This function allocates the resource for the audio instance.

Parameters

<i>deviceHandle</i>	The device handle.
<i>classHandlePtr</i>	Return class handle.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocate memory fail.

4.5.7.2 usb_status_t USB_HostAudioDeinit (usb_device_handle *deviceHandle*, usb_host_class_handle *classHandle*)

This function release the resource for audio instance.

Parameters

<i>deviceHandle</i>	The device handle.
<i>classHandle</i>	The class handle.

Return values

<i>kStatus_USB_Success</i>	The device is deinitialized successfully.
----------------------------	---

4.5.7.3 usb_status_t USB_HostAudioStreamSetInterface (usb_host_class_handle *classHandle*, usb_host_interface_handle *interfaceHandle*, uint8_t *alternateSetting*, transfer_callback_t *callbackFn*, void * *callbackParam*)

This function binds the interface with the audio instance.

Parameters

<i>classHandle</i>	The class handle.
<i>interface-Handle</i>	The interface handle.
<i>alternate-Setting</i>	The alternate setting value.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.
<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.
<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See the USB_HostOpenPipe.

4.5.7.4 **usb_status_t USB_HostAudioControlSetInterface (usb_host_class_handle *classHandle*, usb_host_interface_handle *interfaceHandle*, uint8_t *alternateSetting*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function binds the interface with the audio instance.

Parameters

<i>classHandle</i>	The class handle.
<i>interface-Handle</i>	The interface handle.

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<i>alternate-Setting</i>	The alternate setting value.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.
<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.
<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See USB_HostOpenPipe.

4.5.7.5 uint16_t USB_HostAudioPacketSize (usb_host_class_handle *classHandle*, uint8_t *pipeType*, uint8_t *direction*)

Parameters

<i>classHandle</i>	The class handle.
<i>pipeType</i>	Its value is USB_ENDPOINT_CONTROL, USB_ENDPOINT_ISOCHRONOUS, USB_ENDPOINT_BULK or USB_ENDPOINT_INTERRUPT. See the usb_spec.h
<i>direction</i>	Pipe direction.

Return values

<i>0</i>	The classHandle is NULL.
<i>max</i>	Packet size.

4.5.7.6 usb_status_t USB_HostAudioStreamRecv (usb_host_class_handle *classHandle*, uint8_t * *buffer*, uint32_t *bufferLen*, transfer_callback_t *callbackFn*, void * *callbackParam*)

This function implements the audio receiving data.

Parameters

<i>classHandle</i>	The class handle.
<i>buffer</i>	The buffer pointer.
<i>bufferLen</i>	The buffer length.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostRecv.

4.5.7.7 **usb_status_t USB_HostAudioStreamSend (usb_host_class_handle *classHandle*, uint8_t * *buffer*, uint32_t *bufferLen*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the audio sending data.

Parameters

<i>classHandle</i>	The class handle.
<i>buffer</i>	The buffer pointer.
<i>bufferLen</i>	The buffer length.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.

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<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	pipe is not initialized. Or, send transfer fail. See the USB_HostSend.

4.5.7.8 **usb_status_t USB_HostAudioStreamGetCurrentAltsettingDescriptors (usb_host_class_handle *classHandle*, usb_audio_stream_spepific_as_intf_desc_t ** *asIntfDesc*, usb_audio_stream_format_type_desc_t ** *formatTypeDesc*, usb_audio_stream_specific_iso_endp_desc_t ** *isoEndpDesc*)**

This function implements the get audio stream current altsetting descriptor.

Parameters

<i>classHandle</i>	The class handle.
<i>asIntfDesc</i>	The pointer of class-specific AS interface descriptor.
<i>formatTypeDesc</i>	The pointer of format type descriptor.
<i>isoEndpDesc</i>	The pointer of specific ISO endp descriptor.

Return values

<i>kStatus_USB_Success</i>	Get the audio stream current altsetting descriptor request successfully.
<i>kStatus_USB_InvalidHandle</i>	The classHandle is NULL pointer.

4.5.7.9 **usb_status_t USB_HostAudioFeatureUnitRequest (usb_host_class_handle *classHandle*, uint8_t *channelNo*, void * *buf*, uint32_t *cmdCode*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the USB audio feature unit request.

Parameters

<i>classHandle</i>	The class handle.
<i>channelNo</i>	The channel number of audio feature unit.
<i>buf</i>	The feature unit request buffer pointer.

<i>cmdCode</i>	The feature unit command code, for example USB_AUDIO_GET_CUR_MUTE, and so on.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Feature unit request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.5.7.10 **usb_status_t USB_HostAudioEndpointRequest (usb_host_class_handle classHandle, void * buf, uint32_t cmdCode, transfer_callback_t callbackFn, void * callbackParam)**

This function implements the USB audio endpoint request.

Parameters

<i>classHandle</i>	The class handle.
<i>buf</i>	The feature unit buffer pointer.
<i>cmdCode</i>	The feature unit command code, for example USB_AUDIO_GET_CUR_PITCH, and so on.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Endpoint request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.

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<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.6 USB PHDC Class driver

4.6.1 Overview

The USB Personal Healthcare Device Class (or USB PHDC) defines personal healthcare devices such as weight scales, thermometers, blood pressure meters, glucose meters, and pulse oximeters. This section describes the programming interface of the USB Host PHDC class driver. The USB Host PHDC class driver handles the specific control requests for the PHDC class and transfers data to and from the device through the interrupt and bulk pipes.

4.6.2 USB Host PHDC Initialization

When the personal healthcare device is attached, the PHDC initialization flow is as follows:

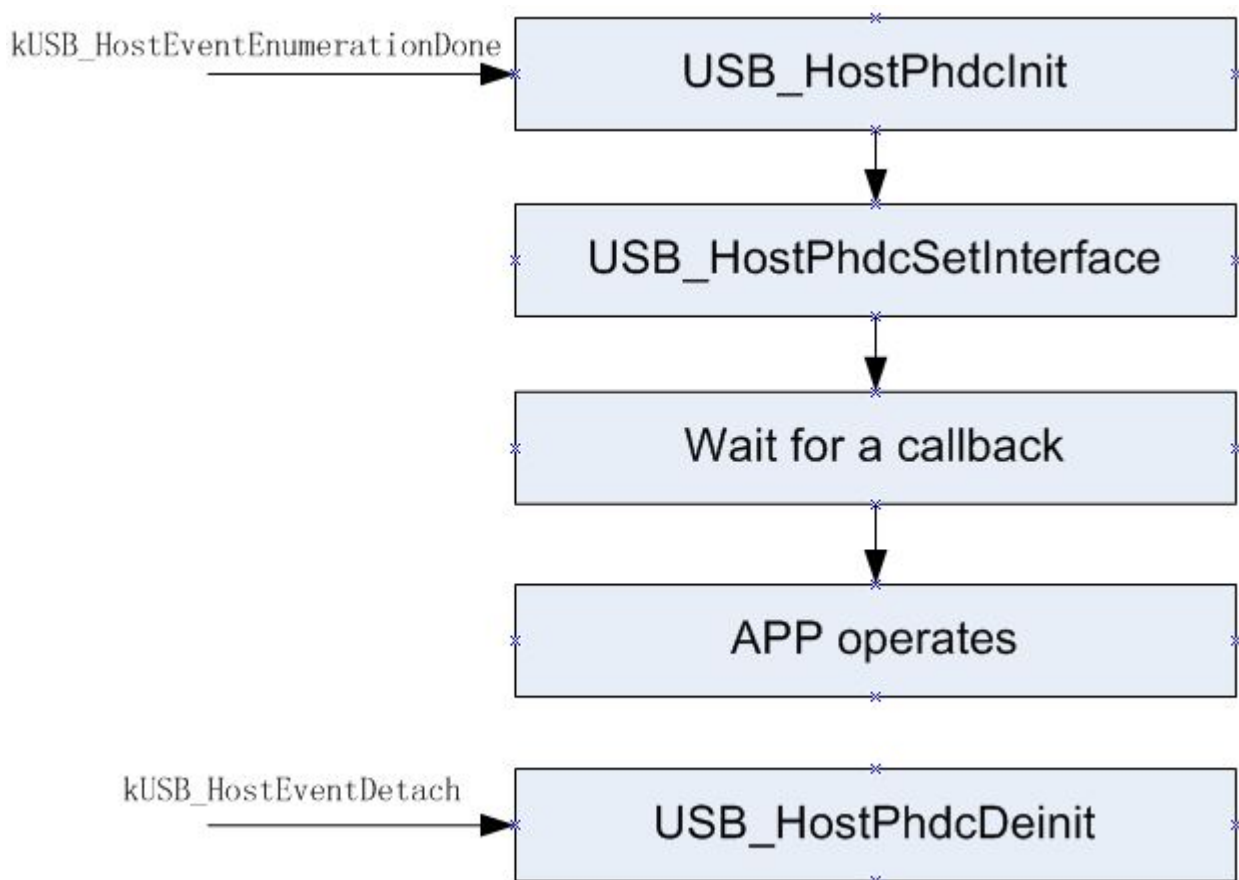


Figure 4.6.1: Host PHDC Initialization

The above figure describes the following steps:

- Call the `USB_HostPhdcInit` to initialize the PHDC class instance `usb_host_phdc_instance_t` and the return class handle pointer to the PHDC class instance. The driver uses an instantiation of

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the `usb_host_phdc_instance_t` structure to maintain the current state of a PHDC instance module driver. This structure holds the USB host handle and the USB device handle and keeps track of transfer information, alternate setting, pipes and interfaces that are enumerated for attached personal healthcare device.

- Call the `USB_HostPhdcSetInterface` to sets the PHDC class interface, which opens the interface's pipes.
- Wait the last step operation callback.
- Call the `USB_HostPhdcRecv` to receive data from device, or call the `USB_HostPhdcSend` to send data to device.
- Wait the last step operation callback.
- Process data and receive or send again.

4.6.3 USB Host PHDC Deinitialization

An application can call the `usb_host_phdc_deinit` to deinitialize the PHDC. This function cancels the transfer, closes the pipe, and releases the PHDC class instance.

There are two use cases to call this function:

- A personal healthcare device is detached and this function is called to free the resource.
- An application calls this function and then calls `USBHostPhdcInit` to re-initialize the PHDC class.

4.6.4 USB Host PHDC Send data

Provides the buffer pointer, the buffer length, the callback function, the callback parameter and calls the `USB_HostPhdcSend` function to start asynchronous sending. Then, the callback function is called with one transfer status parameter when the transfer succeeds or fails.

4.6.5 USB Host PHDC Receive data

Provides the buffer pointer, the buffer length, the callback function, the callback parameter and call the `USB_HostPhdcRecv` function to start asynchronous receiving. Then, the callback function is called with one transfer status parameter when the transfer succeeds or fails.

Data Structures

- struct `usb_host_phdc_class_function_descriptor_t`
PHDC class function descriptor structure as defined by the PHDC class specification. [More...](#)
- struct `usb_host_phdc_function_extension_descriptor_t`
Function extension descriptor (device specialization) structure as defined by the PHDC class specification. [More...](#)
- struct `usb_host_phdc_qos_descriptor_t`
QoS descriptor structure as defined by the PHDC class specification. [More...](#)

- struct `usb_host_phdc_metadata_descriptor_t`
Metadata descriptor structure as defined by the PHDC class specification. [More...](#)
- struct `usb_host_phdc_metadata_preamble_t`
Metadata message preamble structure as defined by the PHDC class specification. [More...](#)
- struct `usb_host_phdc_instance_t`
PHDC instance structure. [More...](#)

Macros

- #define `USB_HOST_PHDC_CLASS_CODE` (0x0FU)
PHDC class code.
- #define `USB_HOST_PHDC_SUBCLASS_CODE` (0x00U)
PHDC sub class code.
- #define `USB_HOST_PHDC_PROTOCOL` (0x00U)
PHDC protocol.
- #define `USB_HOST_PHDC_GET_STATUS_REQUEST` (0x00U)
PHDC get status request.
- #define `USB_HOST_PHDC_SET_FEATURE_REQUEST` (0x03U)
PHDC set feature request.
- #define `USB_HOST_PHDC_CLEAR_FEATURE_REQUEST` (0x01U)
PHDC clear feature request.
- #define `USB_HOST_PHDC_FEATURE_METADATA` (0x01U)
PHDC meta-data feature.
- #define `USB_HOST_PHDC_QOS_ENCODING_VERSION` (0x01U)
PHDC QoS information encoding feature.
- #define `USB_HOST_PHDC_MESSAGE_PREAMBLE_SIGNATURE_SIZE` (0x10U)
meta-data message preamble signature size
- #define `USB_HOST_PHDC_CLASSFUNCTION_DESCRIPTOR` (0x20U)
PHDC class function descriptor type.
- #define `USB_HOST_PHDC_QOS_DESCRIPTOR` (0x21U)
PHDC QoS descriptor type.
- #define `USB_HOST_PHDC_11073PHD_FUNCTION_DESCRIPTOR` (0x30U)
PHDC function extension descriptor type.
- #define `USB_HOST_PHDC_METADATA_DESCRIPTOR` (0x22U)
PHDC meta-data descriptor type.

USB host PHDC class APIs

- `usb_status_t USB_HostPhdcInit` (`usb_host_handle` deviceHandle, `usb_host_class_handle` *classHandle)
Initializes the PHDC instance.
- `usb_status_t USB_HostPhdcSetInterface` (`usb_host_class_handle` classHandle, `usb_host_interface_handle` interfaceHandle, `uint8_t` alternateSetting, `transfer_callback_t` callbackFn, `void` *callbackParam)
Sets an interface.
- `usb_status_t USB_HostPhdcDeinit` (`usb_host_handle` deviceHandle, `usb_host_class_handle` classHandle)
Deinitializes the PHDC instance.

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- `usb_status_t USB_HostPhdcRecv (usb_host_class_handle classHandle, uint8_t qos, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
Receives data.
- `usb_status_t USB_HostPhdcSend (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
Sends data.
- `usb_status_t USB_HostPhdcSendControlRequest (usb_host_class_handle classHandle, uint8_t request, transfer_callback_t callbackFn, void *callbackParam)`
PHDC sends the control request.
- `usb_status_t USB_HostPhdcSetClearFeatureEndpointHalt (usb_host_class_handle classHandle, uint8_t request, void *param, transfer_callback_t callbackFn, void *callbackParam)`
PHDC set and clear feature endpoint halt request.
- `usb_host_ep_t * USB_HostPhdcGetEndpointInformation (usb_host_class_handle classHandle, uint8_t pipeType, uint8_t direction)`
USB_HostPhdcGetEndpointInformation.

4.6.6 Data Structure Documentation

4.6.6.1 struct usb_host_phdc_class_function_descriptor_t

Data Fields

- `uint8_t bLength`
Class function descriptor length.
- `uint8_t bDescriptorType`
PHDC_CLASSFUNCTION_DESCRIPTOR type.
- `uint8_t bPhdcDataCode`
Data/Messaging format code.
- `uint8_t bmCapability`
If bit 0 is 1 the meta-data message preamble is implemented and 0 if it is not.

4.6.6.2 struct usb_host_phdc_function_extension_descriptor_t

Data Fields

- `uint8_t bLength`
Function extension descriptor length.
- `uint8_t bDescriptorType`
PHDC_CLASSFUNCTION_DESCRIPTOR type.
- `uint8_t bReserved`
Reserved for future use.
- `uint8_t bNumDevSpecs`
Number of wDevSpecializations.
- `uint16_t * wDevSpecializations`
Variable length list that defines the device specialization.

4.6.6.3 struct usb_host_phdc_qos_descriptor_t

Data Fields

- uint8_t [bLength](#)
QoS descriptor length.
- uint8_t [bDescriptorType](#)
PHDC_QOS_DESCRIPTOR type.
- uint8_t [bQosEncodingVersion](#)
Version of QoS information encoding.
- uint8_t [bmLatencyReliability](#)
Latency/reliability bin for the QoS data.

4.6.6.4 struct usb_host_phdc_metadata_descriptor_t

Data Fields

- uint8_t [bLength](#)
Metadata descriptor length.
- uint8_t [bDescriptorType](#)
Descriptor type.
- uint8_t * [bOpaqueData](#)
Opaque metadata.

4.6.6.5 struct usb_host_phdc_metadata_preamble_t

Data Fields

- uint8_t [aSignature](#) [USB_HOST_PHDC_MESSAGE_PREAMBLE_SIGNATURE_SIZE]
Constant used to give preamble verifiability.
- uint8_t [bNumberTransfers](#)
Count of following transfer to which the QoS setting applies.
- uint8_t [bQosEncodingVersion](#)
Version of QoS information encoding.
- uint8_t [bmLatencyReliability](#)
See latency/reliability bin for the QoS data.
- uint8_t [bOpaqueDataSize](#)
Opaque QoS data or meta-data size.
- uint8_t * [bOpaqueData](#)
Opaque metadata.

4.6.6.6 struct usb_host_phdc_instance_t

Data Fields

- [usb_host_handle](#) hostHandle
The host handle.
- [usb_device_handle](#) deviceHandle

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- *The device handle.*
`usb_host_interface_handle` `interfaceHandle`
- *The interface handle.*
`usb_host_pipe_handle` `controlPipe`
- *The control pipe.*
`usb_host_pipe_handle` `interruptPipe`
- *The interrupt pipe.*
`usb_host_pipe_handle` `bulkInPipe`
- *The bulk in pipe.*
`usb_host_pipe_handle` `bulkOutPipe`
- *The bulk out pipe.*
`transfer_callback_t` `inCallbackFn`
The callback function is called when the PHDC receives complete.
- `void *` `inCallbackParam`
The first parameter of the in callback function.
- `transfer_callback_t` `outCallbackFn`
The callback function is called when the PHDC sends complete.
- `void *` `outCallbackParam`
The first parameter of the out callback function.
- `transfer_callback_t` `controlCallbackFn`
The control callback function.
- `void *` `controlCallbackParam`
The first parameter of the control callback function.
- `usb_host_transfer_t *` `controlTransfer`
The control transfer pointer.
- `usb_host_ep_t` `interruptInEndpointInformation`
The interrupt in information.
- `usb_host_ep_t` `bulkInEndpointInformation`
The bulk in information.
- `usb_host_ep_t` `bulkOutEndpointInformation`
The bulk out information.
- `uint8_t` `isMessagePreambleEnabled`
The flag is used to check the message preamble feature is enabled or not.
- `uint8_t` `numberTransferBulkOut`
The number of transfer that follow Meta-data Message Preamble.
- `uint8_t` `numberTransferBulkIn`
The number of transfer that follow Meta-data Message Preamble.

4.6.7 Function Documentation

4.6.7.1 `usb_status_t` `USB_HostPhdcInit (usb_host_handle deviceHandle, usb_host_class_handle * classHandle)`

This function allocates the resource for PHDC instance.

Parameters

<i>deviceHandle</i>	The device handle.
<i>classHandle</i>	Return class handle.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocate memory fail.

4.6.7.2 **usb_status_t USB_HostPhdcSetInterface (usb_host_class_handle *classHandle*, usb_host_interface_handle *interfaceHandle*, uint8_t *alternateSetting*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function binds the interface with the PHDC instance.

Parameters

<i>classHandle</i>	The class handle.
<i>interface-Handle</i>	The interface handle.
<i>alternate-Setting</i>	The alternate setting value.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.

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<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.
<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See the USB_HostOpenPipe.

4.6.7.3 **usb_status_t USB_HostPhdcDeinit (usb_host_handle *deviceHandle*, usb_host_class_handle *classHandle*)**

This function frees the resource for the PHDC instance.

Parameters

<i>deviceHandle</i>	The device handle.
<i>classHandle</i>	The class handle.

Return values

<i>kStatus_USB_Success</i>	The device is deinitialized successfully.
----------------------------	---

4.6.7.4 **usb_status_t USB_HostPhdcRecv (usb_host_class_handle *classHandle*, uint8_t *qos*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the PHDC receiving data.

Parameters

<i>classHandle</i>	The class handle.
<i>qos</i>	QoS of the data being received.
<i>buffer</i>	The buffer pointer.
<i>bufferLength</i>	The buffer length.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid_Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostRecv.

4.6.7.5 **usb_status_t USB_HostPhdcSend (usb_host_class_handle *classHandle*, uint8_t * *buffer*, uint32_t *bufferLength*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the PHDC sending data.

Parameters

<i>classHandle</i>	The class handle.
<i>buffer</i>	The buffer pointer.
<i>bufferLength</i>	The buffer length.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Send request successfully.
<i>kStatus_USB_Invalid_Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostSend.

4.6.7.6 **usb_status_t USB_HostPhdcSendControlRequest (usb_host_class_handle *classHandle*, uint8_t *request*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

Parameters

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<i>classHandle</i>	The class handle.
<i>request</i>	Setup packet request.
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Send request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostSend.

4.6.7.7 `usb_status_t USB_HostPhdcSetClearFeatureEndpointHalt (usb_host_class_handle classHandle, uint8_t request, void * param, transfer_callback_t callbackFn, void * callbackParam)`

Parameters

<i>classHandle</i>	The class handle.
<i>request</i>	Setup packet request.
<i>param</i>	Request parameter
<i>callbackFn</i>	This callback is called after this function completes.
<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Send request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostSend.

4.6.7.8 **usb_host_ep_t* USB_HostPhdcGetEndpointInformation (usb_host_class_handle *classHandle*, uint8_t *pipeType*, uint8_t *direction*)**

This function returns the PHDC endpoint information structure, which contains an endpoint descriptor and an endpoint extended descriptor.

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Parameters

<i>classHandle</i>	The class handle.
<i>pipeType</i>	Pipe type.
<i>direction</i>	Pipe direction.

Return values

<i>endpointReturn</i>	All input parameters are valid.
<i>NULL</i>	One or more input parameters are invalid.

4.7 USB PRINTER Class driver

4.7.1 Overview

Data Structures

- struct `usb_host_printer_instance_t`
Printer instance structure and printer `usb_host_class_handle` pointer to this structure. [More...](#)

Macros

- #define `USB_HOST_PRINTER_CLASS_CODE` (7U)
Printer class code.
- #define `USB_HOST_PRINTER_SUBCLASS_CODE` (1U)
Printer sub-class code.
- #define `USB_HOST_PRINTER_PROTOCOL_UNIDIRECTION` (1U)
Printer class protocol code (Unidirectional interface)
- #define `USB_HOST_PRINTER_PROTOCOL_BIDIRECTION` (2U)
Printer class protocol code (Bi-directional interface)
- #define `USB_HOST_PRINTER_PROTOCOL_IEEE1284` (3U)
Printer class protocol code (IEEE® 1284.4 compatible bi-directional interface)
- #define `USB_HOST_PRINTER_GET_DEVICE_ID` (0)
Printer class-specific request (GET_DEVICE_ID)
- #define `USB_HOST_PRINTER_GET_PORT_STATUS` (1)
Printer class-specific request (GET_PORT_STATUS)
- #define `USB_HOST_PRINTER_SOFT_RESET` (2)
Printer class-specific request (SOFT_RESET)
- #define `USB_HOST_PRINTER_PORT_STATUS_PAPER_EMPTY_MASK` (0x20U)
Paper empty bit mask for GET_PORT_STATUS.
- #define `USB_HOST_PRINTER_PORT_STATUS_SELECT_MASK` (0x10U)
Select bit mask for GET_PORT_STATUS.
- #define `USB_HOST_PRINTER_PORT_STATUS_NOT_ERROR_MASK` (0x08U)
Error bit mask for GET_PORT_STATUS.

USB host printer class APIs

- `usb_status_t` `USB_HostPrinterInit` (`usb_device_handle` deviceHandle, `usb_host_class_handle` *classHandle)
Initializes the printer instance.
- `usb_status_t` `USB_HostPrinterSetInterface` (`usb_host_class_handle` classHandle, `usb_host_interface_handle` interfaceHandle, `uint8_t` alternateSetting, `transfer_callback_t` callbackFn, void *callbackParam)
Sets the interface.
- `usb_status_t` `USB_HostPrinterDeinit` (`usb_device_handle` deviceHandle, `usb_host_class_handle` classHandle)
De-initializes the the printer instance.

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- `uint16_t USB_HostPrinterGetPacketsize (usb_host_class_handle classHandle, uint8_t pipeType, uint8_t direction)`
Gets the pipe maximum packet size.
- `usb_status_t USB_HostPrinterRecv (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
Receives data.
- `usb_status_t USB_HostPrinterSend (usb_host_class_handle classHandle, uint8_t *buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *callbackParam)`
Sends data.
- `usb_status_t USB_HostPrinterGetDeviceId (usb_host_class_handle classHandle, uint8_t interface-Index, uint8_t alternateSetting, uint8_t *buffer, uint32_t length, transfer_callback_t callbackFn, void *callbackParam)`
Printer get device ID.
- `usb_status_t USB_HostPrinterGetPortStatus (usb_host_class_handle classHandle, uint8_t *port-Status, transfer_callback_t callbackFn, void *callbackParam)`
Printer get port status.
- `usb_status_t USB_HostPrinterSoftReset (usb_host_class_handle classHandle, transfer_callback_t callbackFn, void *callbackParam)`
Printer soft reset.

4.7.2 Data Structure Documentation

4.7.2.1 struct usb_host_printer_instance_t

Data Fields

- `usb_host_handle hostHandle`
This instance's related host handle.
- `usb_device_handle deviceHandle`
This instance's related device handle.
- `usb_host_interface_handle interfaceHandle`
This instance's related interface handle.
- `usb_host_pipe_handle controlPipe`
This instance's related device control pipe.
- `usb_host_pipe_handle inPipe`
Printer bulk in pipe.
- `usb_host_pipe_handle outPipe`
Printer bulk out pipe.
- `transfer_callback_t inCallbackFn`
Printer bulk in transfer callback function pointer.
- `void * inCallbackParam`
Printer bulk in transfer callback parameter.
- `transfer_callback_t outCallbackFn`
Printer bulk out transfer callback function pointer.
- `void * outCallbackParam`
Printer bulk out transfer callback parameter.
- `transfer_callback_t controlCallbackFn`
Printer control transfer callback function pointer.

- void * **controlCallbackParam**
Printer control transfer callback parameter.
- **usb_host_transfer_t** * **controlTransfer**
Ongoing control transfer.
- **uint16_t** **inPacketSize**
Printer bulk in maximum packet size.
- **uint16_t** **outPacketSize**
Printer bulk out maximum packet size.

4.7.3 Function Documentation

4.7.3.1 **usb_status_t** **USB_HostPrinterInit** (**usb_device_handle** *deviceHandle*, **usb_host_class_handle** * *classHandle*)

This function allocate the resource for the printer instance.

Parameters

in	<i>deviceHandle</i>	The device handle.
out	<i>classHandle</i>	Return class handle.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_AllocFail</i>	Allocate memory fail.

4.7.3.2 **usb_status_t** **USB_HostPrinterSetInterface** (**usb_host_class_handle** *classHandle*, **usb_host_interface_handle** *interfaceHandle*, **uint8_t** *alternateSetting*, **transfer_callback_t** *callbackFn*, void * *callbackParam*)

This function binds the interface with the printer instance.

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>interface-Handle</i>	The interface handle.

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in	<i>alternate-Setting</i>	The alternate setting value.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	The device is initialized successfully.
<i>kStatus_USB_Invalid_Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.
<i>kStatus_USB_Busy</i>	Callback return status, there is no idle pipe.
<i>kStatus_USB_Transfer-Stall</i>	Callback return status, the transfer is stalled by the device.
<i>kStatus_USB_Error</i>	Callback return status, open pipe fail. See the USB_HostOpenPipe.

4.7.3.3 **usb_status_t** USB_HostPrinterDeinit (**usb_device_handle** *deviceHandle*, **usb_host_class_handle** *classHandle*)

This function frees the resources for the printer instance.

Parameters

in	<i>deviceHandle</i>	The device handle.
in	<i>classHandle</i>	The class handle.

Return values

<i>kStatus_USB_Success</i>	The device is de-initialized successfully.
----------------------------	--

4.7.3.4 **uint16_t** USB_HostPrinterGetPacketsize (**usb_host_class_handle** *classHandle*, **uint8_t** *pipeType*, **uint8_t** *direction*)

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>pipeType</i>	Its value is USB_ENDPOINT_CONTROL, USB_ENDPOINT_ISOC-HRONOUS, USB_ENDPOINT_BULK or USB_ENDPOINT_INTERRUPT. See the usb_spec.h
in	<i>direction</i>	Pipe direction.

Return values

0	The classHandle is NULL.
<i>Maximum</i>	Packet size.

4.7.3.5 `usb_status_t USB_HostPrinterRecv (usb_host_class_handle classHandle,
uint8_t * buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *
callbackParam)`

This function implements the printer receiving data.

Parameters

in	<i>classHandle</i>	The class handle.
out	<i>buffer</i>	The buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Receive request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostRecv.

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4.7.3.6 `usb_status_t USB_HostPrinterSend (usb_host_class_handle classHandle,
uint8_t * buffer, uint32_t bufferLength, transfer_callback_t callbackFn, void *
callbackParam)`

This function implements the printer sending data.

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>buffer</i>	The buffer pointer.
in	<i>bufferLength</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Send request successfully.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Pipe is not initialized. Or, send transfer fail. See the USB_HostSend.

4.7.3.7 **usb_status_t USB_HostPrinterGetDeviceId (usb_host_class_handle *classHandle*, uint8_t *interfaceIndex*, uint8_t *alternateSetting*, uint8_t * *buffer*, uint32_t *length*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the printer class-specific request (GET_DEVICE_ID).

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>interfaceIndex</i>	Interface index.
in	<i>alternate-Setting</i>	Get the alternateSetting's device ID.
out	<i>buffer</i>	The buffer pointer.
in	<i>length</i>	The buffer length.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

USB PRINTER Class driver

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.7.3.8 **usb_status_t USB_HostPrinterGetPortStatus (usb_host_class_handle *classHandle*, uint8_t * *portStatus*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the printer class-specific request (GET_PORT_STATUS).

Parameters

in	<i>classHandle</i>	The class handle.
in	<i>portStatus</i>	Port status buffer.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

4.7.3.9 **usb_status_t USB_HostPrinterSoftReset (usb_host_class_handle *classHandle*, transfer_callback_t *callbackFn*, void * *callbackParam*)**

This function implements the printer class-specific request (SOFT_RESET).

Parameters

in	<i>classHandle</i>	The class handle.
----	--------------------	-------------------

in	<i>portStatus</i>	Port status buffer.
in	<i>callbackFn</i>	This callback is called after this function completes.
in	<i>callbackParam</i>	The first parameter in the callback function.

Return values

<i>kStatus_USB_Success</i>	Request successful.
<i>kStatus_USB_Invalid-Handle</i>	The classHandle is NULL pointer.
<i>kStatus_USB_Busy</i>	There is no idle transfer.
<i>kStatus_USB_Error</i>	Send transfer fail. See the USB_HostSendSetup.

Chapter 5

USB OS Adapter

5.1 Overview

The OS adapter (OSA) is used to wrap the differences between RTOSes and enable a USB stack with the same code base and behavior.

Note

OSA should not be used in the USB application. Therefore, from the USB application viewpoint, OSA is invisible.

Macros

- #define **USB_BIG_ENDIAN** (0U)
Define big endian.
- #define **USB_LITTLE_ENDIAN** (1U)
Define little endian.
- #define **ENDIANNESS USB_LITTLE_ENDIAN**
Define current endian.

Typedefs

- typedef void * **usb_osa_event_handle**
Define USB OSA event handle.
- typedef void * **usb_osa_sem_handle**
Define USB OSA semaphore handle.
- typedef void * **usb_osa_mutex_handle**
Define USB OSA mutex handle.
- typedef void * **usb_osa_msgq_handle**
Define USB OSA message queue handle.

Enumerations

- enum **usb_osa_status_t** {
 kStatus_USB_OSA_Success = 0x00U,
 kStatus_USB_OSA_Error,
 kStatus_USB_OSA_TimeOut }
USB OSA error code.
- enum **usb_osa_event_mode_t** {
 kUSB_OsaEventManualClear = 0U,
 kUSB_OsaEventAutoClear = 1U }
The event flags are cleared automatically or manually.

USB OSA Memory Management

- void * [USB_OsaMemoryAllocate](#) (uint32_t length)
Reserves the requested amount of memory in bytes.
- void [USB_OsaMemoryFree](#) (void *p)
Frees the memory previously reserved.

USB OSA Event

- [usb_osa_status_t USB_OsaEventCreate](#) ([usb_osa_event_handle](#) *handle, uint32_t flag)
Creates an event object with all flags cleared.
- [usb_osa_status_t USB_OsaEventDestroy](#) ([usb_osa_event_handle](#) handle)
Destroys a created event object.
- [usb_osa_status_t USB_OsaEventSet](#) ([usb_osa_event_handle](#) handle, uint32_t bitMask)
Sets an event flag.
- [usb_osa_status_t USB_OsaEventWait](#) ([usb_osa_event_handle](#) handle, uint32_t bitMask, uint32_t flag, uint32_t timeout, uint32_t *bitSet)
Waits for an event flag.
- [usb_osa_status_t USB_OsaEventCheck](#) ([usb_osa_event_handle](#) handle, uint32_t bitMask, uint32_t *bitSet)
Checks an event flag.
- [usb_osa_status_t USB_OsaEventClear](#) ([usb_osa_event_handle](#) handle, uint32_t bitMask)
Clears an event flag.

USB OSA Semaphore

- [usb_osa_status_t USB_OsaSemCreate](#) ([usb_osa_sem_handle](#) *handle, uint32_t count)
Creates a semaphore with a given value.
- [usb_osa_status_t USB_OsaSemDestroy](#) ([usb_osa_sem_handle](#) handle)
Destroys a semaphore object.
- [usb_osa_status_t USB_OsaSemPost](#) ([usb_osa_sem_handle](#) handle)
Posts a semaphore.
- [usb_osa_status_t USB_OsaSemWait](#) ([usb_osa_sem_handle](#) handle, uint32_t timeout)
Waits on a semaphore.

USB OSA Mutex

- [usb_osa_status_t USB_OsaMutexCreate](#) ([usb_osa_mutex_handle](#) *handle)
Creates a mutex.
- [usb_osa_status_t USB_OsaMutexDestroy](#) ([usb_osa_mutex_handle](#) handle)
Destroys a mutex.
- [usb_osa_status_t USB_OsaMutexLock](#) ([usb_osa_mutex_handle](#) handle)
Waits for a mutex and locks it.
- [usb_osa_status_t USB_OsaMutexUnlock](#) ([usb_osa_mutex_handle](#) handle)
Unlocks a mutex.

USB OSA Message Queue

- [usb_osa_status_t USB_OsaMsgqCreate](#) ([usb_osa_msgq_handle](#) *handle, uint32_t count, uint32_t size)

- Creates a message queue.*
- `usb_osa_status_t USB_OsaMsgqDestroy (usb_osa_msgq_handle handle)`
- Destroys a message queue.*
- `usb_osa_status_t USB_OsaMsgqSend (usb_osa_msgq_handle handle, void *msg)`
- Sends a message.*
- `usb_osa_status_t USB_OsaMsgqRecv (usb_osa_msgq_handle handle, void *msg, uint32_t timeout)`
- Receives a message.*
- `usb_osa_status_t USB_OsaMsgqCheck (usb_osa_msgq_handle handle, void *msg)`
- Checks a message queue and receives a message if the queue is not empty.*

5.2 Enumeration Type Documentation

5.2.1 enum usb_osa_status_t

Enumerator

kStatus_USB_OSA_Success Success.
kStatus_USB_OSA_Error Failed.
kStatus_USB_OSA_TimeOut Timeout occurs while waiting.

5.2.2 enum usb_osa_event_mode_t

Enumerator

kUSB_OsaEventManualClear The flags of the event is cleared manually.
kUSB_OsaEventAutoClear The flags of the event is cleared automatically.

5.3 Function Documentation

5.3.1 void* USB_OsaMemoryAllocate (uint32_t length)

The function is used to reserve the requested amount of memory in bytes and initializes it to 0.

Parameters

<i>length</i>	Amount of bytes to reserve.
---------------	-----------------------------

Returns

Pointer to the reserved memory. NULL if memory can't be allocated.

5.3.2 void USB_OsaMemoryFree (void * p)

The function is used to free the memory block previously reserved.

Function Documentation

Parameters

<i>p</i>	Pointer to the start of the memory block previously reserved.
----------	---

5.3.3 `usb_osa_status_t USB_OsaEventCreate (usb_osa_event_handle * handle, uint32_t flag)`

This function creates an event object and sets its clear mode. If the clear mode is `kUSB_OsaEvent-AutoClear`, when a task gets the event flags, these flags are cleared automatically. If the clear mode is `kUSB_OsaEventManualClear`, the flags must be cleared manually.

Parameters

<i>handle</i>	It is an out parameter, which is used to return the pointer of the event object.
<i>flag</i>	The event is auto-clear or manual-clear. See the enumeration usb_osa_event_mode_t .

Returns

A USB OSA error code or `kStatus_OSA_Success`.

Example:

```
usb_osa_event_handle eventHandle;  
usb_osa_status_t      usbOsaStatus;  
usbOsaStatus = USB_OsaEventCreate(&eventHandle,  
    kUSB_OsaEventManualClear);
```

5.3.4 `usb_osa_status_t USB_OsaEventDestroy (usb_osa_event_handle handle)`

Parameters

<i>handle</i>	Pointer to the event object.
---------------	------------------------------

Returns

A USB OSA error code or `kStatus_OSA_Success`.

Example:

```
usb_osa_status_t      usbOsaStatus;  
...  
usbOsaStatus = USB_OsaEventDestroy(eventHandle);
```

5.3.5 `usb_osa_status_t` **USB_OsaEventSet** (`usb_osa_event_handle` *handle*, `uint32_t` *bitMask*)

Sets specified flags for an event object.

Function Documentation

Parameters

<i>handle</i>	Pointer to the event object.
<i>bitMask</i>	Event flags to be set.

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_status_t    usbOsaStatus;  
...  
usbOsaStatus = USB_OsaEventSet(eventHandle, 0x01U);
```

5.3.6 usb_osa_status_t USB_OsaEventWait (usb_osa_event_handle *handle*, uint32_t *bitMask*, uint32_t *flag*, uint32_t *timeout*, uint32_t * *bitSet*)

This function waits for a combination of flags to be set in an event object. An applications can wait for any/all bits to be set. This function can get the flags that wake up the waiting task.

Parameters

<i>handle</i>	Pointer to the event object.
<i>bitMask</i>	Event flags to wait.
<i>flag</i>	Wait all flags or any flag to be set. 0U - wait any flag, others, wait all flags.
<i>timeout</i>	The maximum number of milliseconds to wait for the event. If the wait condition is not met, passing 0U waits indefinitely when the environment is an RTOS and returns the kStatus_OSA_Timeout immediately. Pass any value for the bare metal.
<i>bitSet</i>	Flags that wake up the waiting task are obtained by this parameter.

Returns

An USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_status_t    usbOsaStatus;  
uint32_t            bitSet;  
...  
usbOsaStatus = USB_OsaEventWait(eventHandle, 0x01U, 0U, 0U, &bitSet);
```

5.3.7 `usb_osa_status_t` **USB_OsaEventCheck** (`usb_osa_event_handle` *handle*, `uint32_t` *bitMask*, `uint32_t` * *bitSet*)

This function checks for a combination of flags to be set in an event object.

Function Documentation

Parameters

<i>handle</i>	Pointer to the event object.
<i>bitMask</i>	Event flags to check.
<i>bitSet</i>	Flags have been set.

Returns

An USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_status_t    usbOsaStatus;  
uint32_t            bitSet;  
...  
usbOsaStatus = USB_OsaEventCheck(eventHandle, 0x01U, &bitSet);
```

5.3.8 usb_osa_status_t USB_OsaEventClear (usb_osa_event_handle *handle*, uint32_t *bitMask*)

This function clears flags of an event object.

Parameters

<i>handle</i>	Pointer to the event object
<i>bitMask</i>	Event flags to be cleared.

Returns

An USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_status_t    usbOsaStatus;  
...  
usbOsaStatus = USB_OsaEventClear(eventHandle, 0x01U);
```

5.3.9 usb_osa_status_t USB_OsaSemCreate (usb_osa_sem_handle * *handle*, uint32_t *count*)

This function creates a semaphore and sets the default count.

Parameters

<i>handle</i>	It is an out parameter, which is used to return pointer of the semaphore object.
<i>count</i>	Initializes a value of the semaphore.

Returns

An USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_sem_handle    semHandle;
usb_osa_status_t      usbOsaStatus;
usbOsaStatus = USB_OsaSemCreate(&semHandle, 1U);
```

5.3.10 usb_osa_status_t USB_OsaSemDestroy (usb_osa_sem_handle *handle*)

This function destroys a semaphore object.

Parameters

<i>handle</i>	Pointer to the semaphore.
---------------	---------------------------

Returns

An USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_sem_handle    semHandle;
usb_osa_status_t      usbOsaStatus;
...
usbOsaStatus = USB_OsaSemDestroy(semHandle);
```

5.3.11 usb_osa_status_t USB_OsaSemPost (usb_osa_sem_handle *handle*)

This function wakes up a task waiting on the semaphore. If a task is not pending, increases the semaphore's value.

Function Documentation

Parameters

<i>handle</i>	Pointer to the semaphore.
---------------	---------------------------

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_sem_handle    semHandle;
usb_osa_status_t      usbOsaStatus;
...
usbOsaStatus = USB_OsaSemPost(semHandle);
```

5.3.12 usb_osa_status_t USB_OsaSemWait (usb_osa_sem_handle *handle*, uint32_t *timeout*)

This function checks the semaphore's value. If it is positive, it decreases the semaphore's value and return kStatus_OSA_Success.

Parameters

<i>handle</i>	Pointer to the semaphore.
<i>timeout</i>	The maximum number of milliseconds to wait for the semaphore. If the wait condition is not met, passing 0U waits indefinitely when environment is RTOS. And return kStatus_OSA_Timeout immediately for bare metal no matter what value has been passed.

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_sem_handle    semHandle;
usb_osa_status_t      usbOsaStatus;
...
usbOsaStatus = USB_OsaSemWait(semHandle, 0U);
```

5.3.13 usb_osa_status_t USB_OsaMutexCreate (usb_osa_mutex_handle * *handle*)

This function creates a mutex and sets it to an unlocked status.

Parameters

<i>handle</i>	It is out parameter, which is used to return the pointer of the mutex object.
---------------	---

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_mutex_handle mutexHandle;
usb_osa_status_t      usbOsaStatus;
usbOsaStatus = USB_OsaMutexCreate(&mutexHandle);
```

5.3.14 usb_osa_status_t USB_OsaMutexDestroy (usb_osa_mutex_handle *handle*)

This function destroys a mutex and sets it to an unlocked status.

Parameters

<i>handle</i>	Pointer to the mutex.
---------------	-----------------------

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_mutex_handle mutexHandle;
usb_osa_status_t      usbOsaStatus;
...
usbOsaStatus = USB_OsaMutexDestroy(mutexHandle);
```

5.3.15 usb_osa_status_t USB_OsaMutexLock (usb_osa_mutex_handle *handle*)

This function checks the mutex status. If it is unlocked, it locks it and returns the kStatus_OSA_Success. Otherwise, it waits forever to lock in RTOS and returns the kStatus_OSA_Success immediately for bare metal.

Function Documentation

Parameters

<i>handle</i>	Pointer to the mutex.
---------------	-----------------------

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_mutex_handle mutexHandle;  
usb_osa_status_t      usbOsaStatus;  
...  
usbOsaStatus = USB_OsaMutexLock(mutexHandle);
```

5.3.16 usb_osa_status_t USB_OsaMutexUnlock (usb_osa_mutex_handle *handle*)

This function unlocks a mutex.

Parameters

<i>handle</i>	Pointer to the mutex.
---------------	-----------------------

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_mutex_handle mutexHandle;  
usb_osa_status_t      usbOsaStatus;  
...  
usbOsaStatus = USB_OsaMutexUnlock(mutexHandle);
```

5.3.17 usb_osa_status_t USB_OsaMsgqCreate (usb_osa_msgq_handle * *handle*, uint32_t *count*, uint32_t *size*)

This function creates a message queue.

Parameters

<i>handle</i>	It is an out parameter, which is used to return a pointer of the message queue object.
<i>count</i>	The count of elements in the queue.
<i>size</i>	Size of every elements in words.

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_msgq_handle msgqHandle;
usb_osa_status_t    usbOsaStatus;
usbOsaStatus = USB_OsaMsgqCreate(msgqHandle, 8U, 4U);
```

5.3.18 usb_osa_status_t USB_OsaMsgqDestroy (usb_osa_msgq_handle *handle*)

This function destroys a message queue.

Parameters

<i>handle</i>	Pointer to a message queue.
---------------	-----------------------------

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_msgq_handle msgqHandle;
usb_osa_status_t    usbOsaStatus;
...
usbOsaStatus = USB_OsaMsgqDestroy(msgqHandle);
```

5.3.19 usb_osa_status_t USB_OsaMsgqSend (usb_osa_msgq_handle *handle*, void * *msg*)

This function sends a message to the tail of the message queue.

Function Documentation

Parameters

<i>handle</i>	Pointer to a message queue.
<i>msg</i>	The pointer to a message to be put into the queue.

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_msgq_handle    msgqHandle;
message_struct_t       message;
usb_osa_status_t       usbOsaStatus;
...
usbOsaStatus = USB_OsaMsgqSend(msgqHandle, &message);
```

5.3.20 usb_osa_status_t USB_OsaMsgqRecv (usb_osa_msgq_handle *handle*, void * *msg*, uint32_t *timeout*)

This function receives a message from the head of the message queue.

Parameters

<i>handle</i>	Pointer to a message queue.
<i>msg</i>	The pointer to save a received message.
<i>timeout</i>	The maximum number of milliseconds to wait for a message. If the wait condition is not met, passing 0U waits indefinitely when an environment is RTOS and returns the kStatus_OSA_Timeout immediately for bare metal.

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_msgq_handle    msgqHandle;
message_struct_t       message;
usb_osa_status_t       usbOsaStatus;
...
usbOsaStatus = USB_OsaMsgqRecv(msgqHandle, &message, 0U);
```

5.3.21 usb_osa_status_t USB_OsaMsgqCheck (usb_osa_msgq_handle *handle*, void * *msg*)

This function checks a message queue and receives a message if the queue is not empty.

Parameters

<i>handle</i>	Pointer to a message queue.
<i>msg</i>	The pointer to save a received message.

Returns

A USB OSA error code or kStatus_OSA_Success.

Example:

```
usb_osa_msgq_handle    msgqHandle;  
message_struct_t       message;  
usb_osa_status_t       usbOsaStatus;  
...  
usbOsaStatus = USB_OsaMsgqCheck(msgqHandle, &message);
```


Chapter 6

Data Structure Documentation

6.0.22 usb_host_hub_descriptor_t Struct Reference

HUB descriptor structure.

```
#include <usb_host_hub.h>
```

Data Fields

- `uint8_t blength`
Number of bytes in this descriptor.
- `uint8_t bdescriptortype`
Descriptor Type.
- `uint8_t bnrports`
Number of downstream facing ports that this HUB supports.
- `uint8_t whubcharacteristics` [2]
HUB characteristics please reference to Table 11-13 in usb2.0 specification.
- `uint8_t bpwron2pwrgood`
Time (in 2 ms intervals) from the time the power-on sequence begins on a port until power is good on that port.
- `uint8_t bhubconcurrent`
Maximum current requirements of the HUB Controller electronics in mA.
- `uint8_t deviceremovable`
Indicates if a port has a removable device attached.

6.0.22.1 Field Documentation

6.0.22.1.1 `uint8_t usb_host_hub_descriptor_t::bpwron2pwrgood`

6.0.23 usb_host_hub_global_t Struct Reference

HUB application global structure.

```
#include <usb_host_hub_app.h>
```

Data Fields

- `usb_host_handle hostHandle`
This HUB list belong to this host.
- `usb_host_hub_instance_t * hubProcess`
HUB in processing.

- `usb_host_hub_instance_t * hubList`
host's HUB list
- `usb_osa_mutex_handle hubMutex`
HUB mutex.

6.0.24 usb_host_hub_instance_t Struct Reference

HUB instance structure.

```
#include <usb_host_hub.h>
```

Data Fields

- `struct _usb_host_hub_instance * next`
Next HUB instance.
- `usb_host_handle hostHandle`
Host handle.
- `usb_device_handle deviceHandle`
Device handle.
- `usb_host_interface_handle interfaceHandle`
Interface handle.
- `usb_host_pipe_handle controlPipe`
Control pipe handle.
- `usb_host_pipe_handle interruptPipe`
HUB interrupt in pipe handle.
- `usb_host_hub_port_instance_t * portList`
HUB's port instance list.
- `usb_host_transfer_t * controlTransfer`
Control transfer in progress.
- `transfer_callback_t inCallbackFn`
Interrupt in callback.
- `void * inCallbackParam`
Interrupt in callback parameter.
- `transfer_callback_t controlCallbackFn`
Control callback.
- `void * controlCallbackParam`
Control callback parameter.
- `uint16_t totalThinktime`
HUB total think time.
- `uint8_t hubLevel`
HUB level, the root HUB's level is 1.
- `uint8_t hubDescriptor [7+(USB_HOST_HUB_MAX_PORT >> 3)+1]`
HUB descriptor buffer.
- `uint8_t hubBitmapBuffer [(USB_HOST_HUB_MAX_PORT >> 3)+1]`
HUB receiving bitmap data buffer.
- `uint8_t hubStatusBuffer [4]`
HUB status buffer.
- `uint8_t portStatusBuffer [4]`
Port status buffer.

- uint8_t [hubStatus](#)
HUB instance running status.
- uint8_t [portCount](#)
HUB port count.
- uint8_t [portIndex](#)
Record the index when processing ports in turn.
- uint8_t [portProcess](#)
The port that is processing.
- uint8_t [primeStatus](#)
Data prime transfer status.
- uint8_t [invalid](#)
0/1, when invalid, cannot send transfer to the class
- uint8_t [supportRemoteWakeup](#)
The HUB supports remote wakeup or not.
- uint8_t [controlRetry](#)
Retry count for set remote wakeup feature.

6.0.25 usb_host_hub_port_instance_t Struct Reference

HUB port instance structure.

```
#include <usb_host_hub.h>
```

Data Fields

- [usb_device_handle](#) deviceHandle
Device handle.
- uint8_t [portStatus](#)
Port running status.
- uint8_t [resetCount](#)
Port reset time.
- uint8_t [speed](#)
Port's device speed.



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