UM0721
User manual

STM32F105xx and STM32F107xx USB on-the-go (OTG) FS library

Introduction

The USB OTG FS library is a firmware package supporting the USB on-the-go (OTG) full-speed (FS) peripheral of the STM32F105xx and STM32F107xx connectivity line microcontrollers. It provides a low-level driver to easily connect any USB stack, plus a rich set of demonstrations available in binary format.

This user manual presents a description of all the components of the STM32F105xx/STM32F107xx USB OTG FS library:

- USB OTG FS Core
- Low-level driver

Host device and OTG - DRD (dual role device) demonstrations

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1 Glossary

Table 1. List of acronyms

CIL	Core interface layer
DRD	Dual role device
FS	Full-speed
IP	Intellectual property
HCD	Host controller driver
HNP	Host negotiation protocol
MSC	Mass storage class
OSI	Open system interconnection
OTG	USB on-the-go
PCD	Peripheral controller driver
PHY	Physical layer as described in the OSI model
RTOS	Real-time operating system
SRP	Session request protocol
USB	Universal serial bus
μC	Microcontroller

2 Related documents

- DesignWare Cores Hi-Speed USB On-The-Go (OTG) Controller Subsystem Data book
- On-The-Go Supplement to the USB 2.0 Specification Revision 1.3
- Universal Serial Bus Specification, Revision 2.0

3 USB OTG FS overview

In addition to being a fully compliant USB 2.0 peripheral, an on-the-go device must include the following features and characteristics:

- A limited Host capability
- Full-speed operation as a peripheral (high-speed optional)
- Full-speed support as a Host (low-speed and high-speed optional)
- Targeted peripheral list
- Session request protocol
- Host negotiation protocol
- One and only one connection: a Micro-AB receptacle
- Minimum of 8 mA output on VBUS
- Means for communicating messages to the user

3.1 Session request protocol

The Session Request Protocol (SRP) allows a B-device to request the A-device to turn on VBUS and start a session. This protocol allows the A-device, which may be battery powered, to conserve power by turning VBUS off when there is no bus activity while still providing a means for the B-device to initiate bus activity.

Any A-device, including a PC or laptop, is allowed to respond to SRP. Any B-device, including a standard USB peripheral, is allowed to initiate SRP. An On-The-Go device is required to be able to initiate and respond to SRP.

3.2 Host negotiation protocol

The Host Negotiation Protocol (HNP) allows the Host function to be transferred between two directly connected On-The-Go devices and eliminates the need for a user to switch the cable connections in order to allow a change in control of communications between the devices. HNP will typically be initiated in response to input from the user or an Application on the On-The-Go B-device. HNP may only be implemented through the Micro-AB receptacle on a device.

3.3 OTG descriptor

During enumeration, an On-The-Go A-device must request the OTG configuration descriptor from the B-device. Any B-device that supports either HNP or SRP must respond by providing this descriptor in the group of descriptors returned in response to a GetDescriptor (Configuration) command. When present, the OTG descriptor must be present in all configurations. This three-byte descriptor consists of three fields: *bLength*, *bDescriptorType*, and *bmAttributes*, with bits as defined in *Table 2*.

Table 2. OTG descriptor

Offset	Field	Size	Value	Description
0	*blength*	1	Number (3)	Size of descriptor
1	*bDescriptorType*	1	Constant	OTG type = 9
2	*bmAttributes*	1	Bitmap	Attribute fields D7.. 2: Reserved (rest to zero) D1: HNP support D0: SRP support

3.4 SetFeature command

An A-device may use the SetFeature command to configure the B-device or to indicate certain capabilities of the A-device to the B-device. Any HNP capable device is required to accept the SetFeature commands for these features.

If the device is not HNP capable, it must return STALL if it receives a SetFeature command for any of these features. A B-device that supports HNP features must be able to accept the SetFeature command in the Default, Address and Configured states.

Note: The USB 2.0 specification [USB2.0] does not specify features other than test mode that can be requested by the SetFeature command when the Device is in the Default state. The OTG supplement adds to the list of features that can be set in the Default state.

Setting one of these features when it is already set is not an error. The device receiving such a command will acknowledge the command indicating successful completion.

A SetFeature command for these features must be executed on receipt of an uncorrupted command packet.

Table 3. SetFeature command

bmRequestType	bRequest	wValue	wIndex	wLength	Data
00000000B	SET_FEATURE	Feature Selector	Zero	Zero	None

Table 4. Feature selector values

Feature Selector	Values
b_hnp_enable	3
a_hnp_support	4
a_alt_hnp_support	5

3.5 OTG device state machine

Figure 1. B-Device state machine

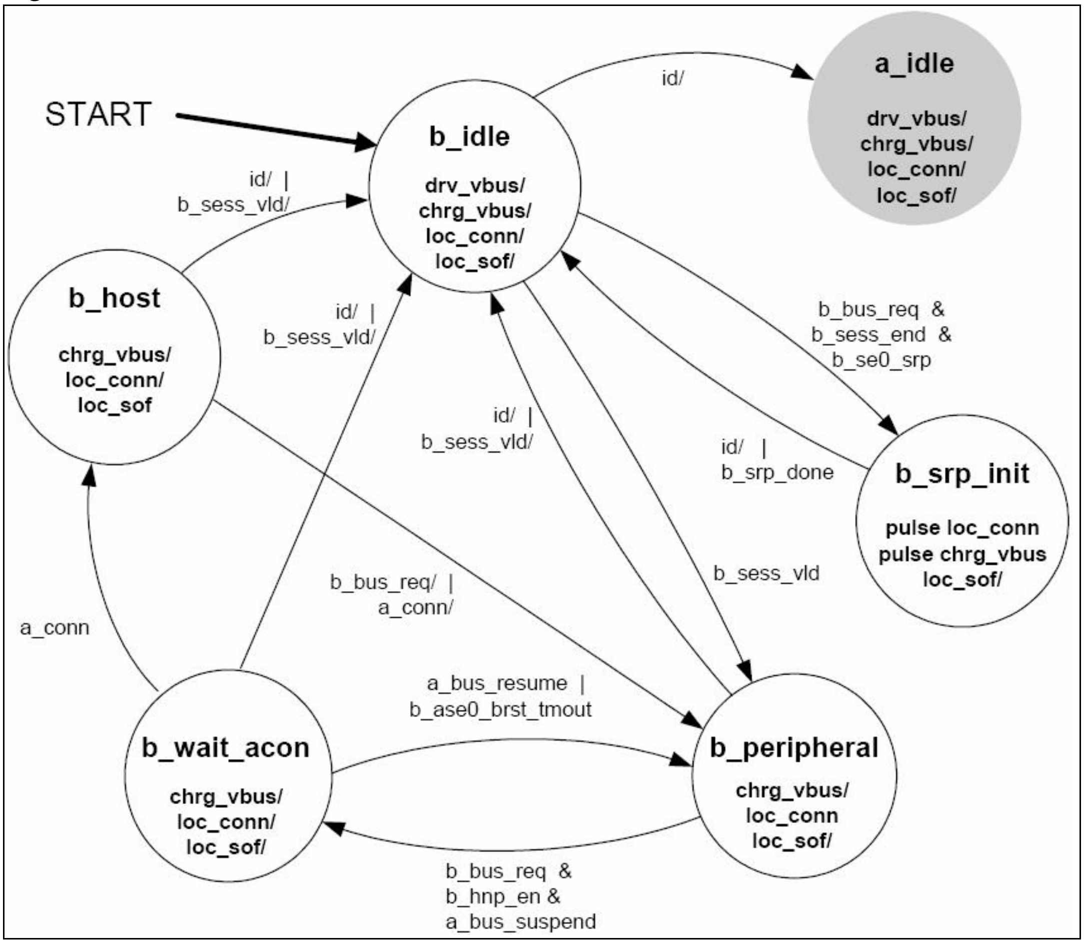
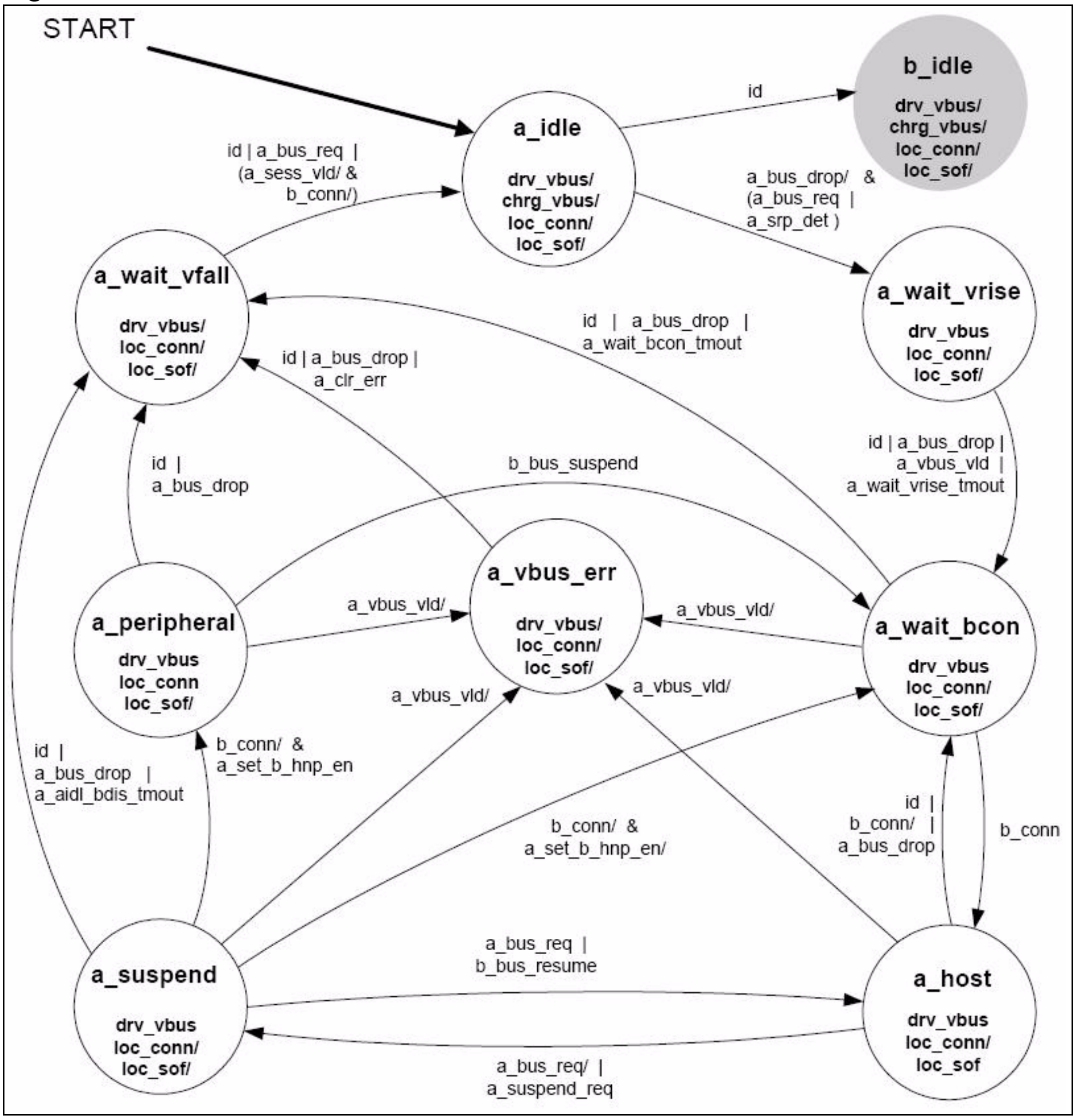


Figure 2. A-Device state machine



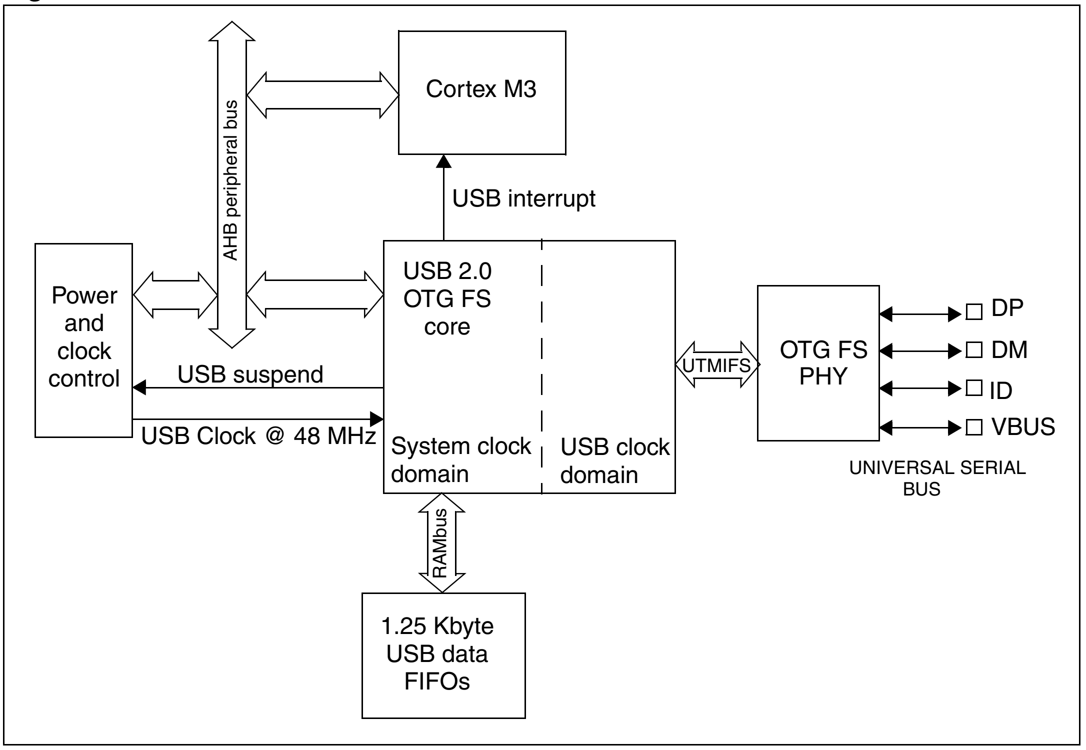
4 STM32F105xx/STM32F107xx USB OTG FS interface

The USB OTG FS peripheral is one of the major peripherals embedded in STM32 Connectivity line microcontrollers, it is a dual-role device (DRD) controller that supports both device and host functions and is fully compliant with the On-The-Go Supplement to the USB 2.0 Specification. It can also be configured as a host-only or device-only controller, fully compliant with the USB 2.0 Specification. In host mode, the OTG FS supports full-speed (FS, 12 Mbits/s) and low-speed (LS, 1.5 Mbits/s) transfers whereas in device mode, it only supports full-speed (FS, 12 Mbits/s) transfers. The OTG FS supports both HNP and SRP. The only external device required is a charge pump for VBUS in Host mode.

4.1 Features

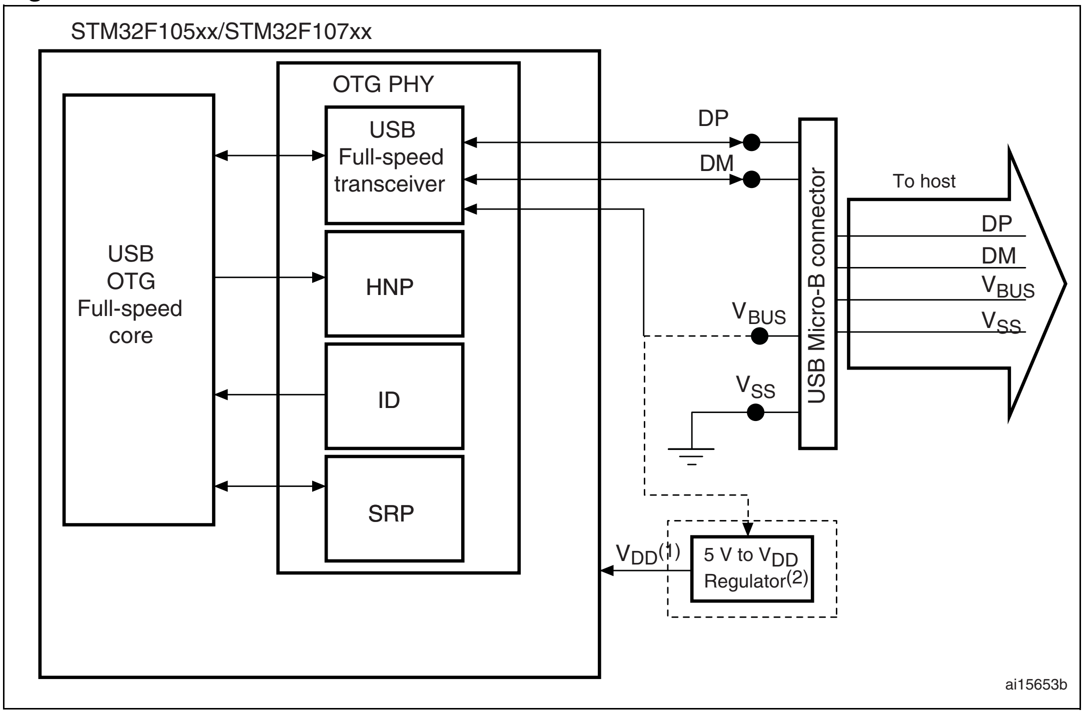
- USB-IF certified compliant with Universal Serial Bus Specification Rev 2.0
- Includes full support (PHY) for the optional On-The-Go (OTG) protocol as described in the On-The-Go Supplement Rev 1.3 specification
  - Integrated support for A-B Device Identification (ID line)
  - Integrated support for Host Negotiation Protocol (HNP) and Session Request Protocol (SRP)
  - Allows host to turn VBUS off to conserve battery power in OTG applications
  - Supports OTG monitoring of VBUS levels with internal comparators
  - Supports dynamic Host-Peripheral role switching
- Software-configurable as:
  - SRP-capable USB FS Peripheral (B-Device)
  - SRP-capable USB FS/LS Host (A-Device)
  - USB On-The-Go Full-Speed Dual Role Device
- Supports FS SOF and LS Keep-alives with:
  - SOF pulse PAD connectivity
  - SOF pulse internal connection to timer2 (TIM2)
  - Configurable framing period and end of frame interrupt threshold
- Includes power saving features such as system stop during USB Suspend, optional switch-off of internal clock domains, PHY and data FIFO power management
- Dedicated 1.25 Kbyte RAM with advanced FIFO control:
  - Configurable partitioning in different FIFOs for flexible and efficient use of RAM
  - Each FIFO can hold multiple packets
  - Dynamic memory allocation and configurable FIFO sizes (not limited to powers of 2 to allow the use of contiguous memory locations)
- Guaranteed max. USB bandwidth for up to one frame (1ms) without system intervention

Figure 3. USB OTG FS interface



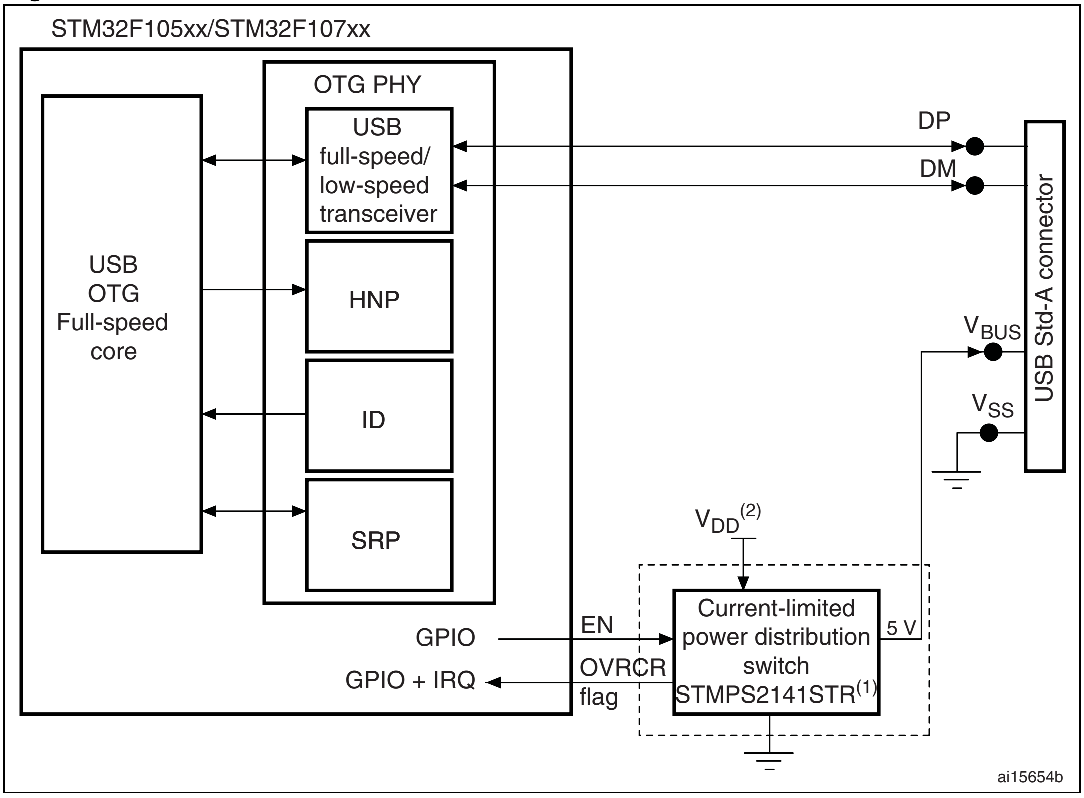
4.2 USB hardware connections

Figure 4. USB device mode connection



1. V_{DD} ranges between 2 V and 3.6 V.
2. Use a regulator if you want to build a bus-powered device.

Figure 5. USB host mode connection

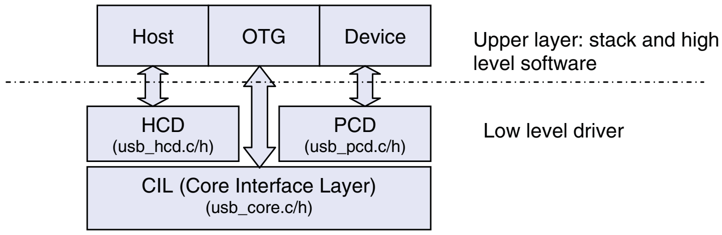


1. STMPS2141STR needed only if the application has to support bus-powered devices.
2. V_{DD} ranges between 2 V and 3.6 V.

5 USB OTG FS low-level driver

5.1 Driver architecture

Figure 6. Driver architecture overview



5.1.1 Core interface layer (CIL)

This layer provides common APIs for device, host and OTG modes: the core initialization in each mode and the control of the transfer flow.

5.1.2 Peripheral controller driver (PCD)

This layer provides an API for device mode access and the main interrupt routine for this mode.

5.1.3 Host controller driver (HCD)

This layer provides an API for host mode access and the main interrupt routine for this mode.

5.1.4 OTG controller driver (OTG)

This layer provides an API for OTG mode access and the main interrupt routine for this mode.

5.2 OTG controller configuration

The configuration of the low level driver is done using the usb_conf.h file

- #define DUAL_ROLE_MODE_ENABLED: Select dual role mode (OTG)
- #define HOST_MODE_ENABLED: Select Host mode only
- #define DEVICE_MODE_ENABLED: Select Device mode only

Note: 1 The USB mode must be selected by using one of the above listed defines.

2 When DUAL_ROLE_MODE_ENABLED mode is selected HOST_MODE_ENABLED and DEVICE_MODE_ENABLED are automatically selected.

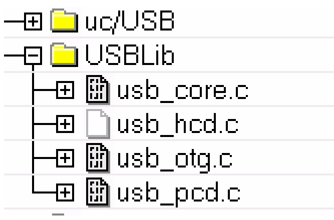
5.3 Driver interfacing

The low level driver connects the USB OTG FS core with the high level USB OTG stack.

To interface the low level driver with a specific stack, a user-developed interface layer may be used to provide the required APIs.

5.4 Driver integration

Figure 7. Driver file



To integrate the driver in an application:

- Include the library files needed by the project
- Exclude any unused layers
- Then, configure the library by modifying the usb_conf.h file according to the features that are used (see *Section 5.2*)

5.5 Core initialization

5.5.1 Common initialization:

To use the USB OTG FS core the driver must be initialized by setting the start address of the core structure. This by calling the following function declared in the usb_core.c.:

```
USB_OTG_Status USB_OTG_SetAddress (USB_OTG_CORE_DEVICE *pdev,
uint32_t BaseAddress);
```

The BaseAddress is defined in the usbh_regs.h file.

Then the core is configured by the USB_OTG_core_cfg structure through the function:

```
USB_OTG_Status USB_OTG_CoreInit (USB_OTG_CORE_DEVICE *pdev)

/* Initialize the base address of the memory-mapped registers */
 USB_OTG_SetAddress(pdev, USB_OTG_FS1_BASE_ADDR);

/* Disable the global interrupt in AHB Configuration register */
  USB_OTG_DisableGlobalInt(pdev);

   /* Initialize all the required registers for the Core */
 USB_OTG_CoreInit(pdev)

(...)

  USB_OTG_EnableGlobalInt(pdev)
```

The last step is to call the general USB_OTG handler from the USB_OTG interrupt subroutine:

```
void USB_OTGFS1_GlobalHandler (void)
```

5.5.2 Device initialization

The device initialization is done by using the following function:

```
USB_OTG_Status USB_OTG_CoreInitDev (USB_OTG_CORE_DEVICE *pdev)
```

The Rx and Tx FIFOs size and start address are set by this function to use one more Endpoint in addition to the control Endpoint (0). You can change the FIFO settings by modifying the default values and changing the FIFO depth for each Tx FIFO.

```
/* set Rx FIFO size */
  WRITE_REG32( &pdev->regs.common_regs->rx_fifo_siz , pdev->cfgs-
>host_rx_fifo_size);

 /* Non-periodic Tx FIFO */
  nptxfifosize.b.depth     = DEV_NP_TX_FIFO_SIZE;
  nptxfifosize.b.startaddr = RX_FIFO_SIZE;
  WRITE_REG32( &pdev->regs.common_regs->np_tx_fifo_siz,
nptxfifosize.d32 );

  txfifosize.b.depth = DEV_NP_TX_FIFO_SIZE;
WRITE_REG32( &pdev->regs.common_regs->dev_p_tx_fsiz_dieptxf[N],
txfifosize.d32 );

N : ENDPOINT index
```

5.5.3 Host initialization

The host initialization is done by using the following function:

```
USB_OTG_Status USB_OTG_CoreInitHost (USB_OTG_CORE_DEVICE *pdev)
```

5.5.4 Device programming model

Initialization

When the USB OTG FS driver is called in device mode only, the core and device initialization are done in the usb_pcd.c file by:

```
void USB_OTG_USBD_Init (USB_OTG_CORE_DEVICE *pdev)
```

Endpoint configuration

Once the USB OTG FS core is initialized, device mode is selected. The upper layer may call the low level driver to open or close an Endpoint to start transfer. The two following APIs are used:

```
USB_OTG_USBD_EP_Open (USB_OTG_CORE_DEVICE *pdev, EP_DESCRIPTOR
*epdesc)
```

```
uint32_t USB_OTG_USBD_EP_Close (USB_OTG_CORE_DEVICE *pdev, uint8_t
ep_addr)
```

The first function retrieves the Endpoint settings (EP address, direction, Transfer type and Max Data transfer) from the epdesc structure and configures the addressed Endpoint.

The second function disables the already activated Endpoint after finishing the transfer.

USB data transfer flow

The PCD layer provides all the APIs needed to start and control a transfer flow through the following set of functions:

```
uint32_t  USB_OTG_USBD_EP_Read  ( USB_OTG_CORE_DEVICE *pdev, uint8_t
ep_addr, uint8_t  *pbuf, uint32_t buf_len);


uint32_t  USB_OTG_USBD_EP_Write (USB_OTG_CORE_DEVICE *pdev,
uint8_t   ep_addr, uint8_t  *pbuf, uint32_t buf_len);


uint32_t USB_OTG_USBD_EP_Stall (USB_OTG_CORE_DEVICE *pdev, uint8_t
epnum);


uint32_t  USB_OTG_USBD_EP_ClrStall (USB_OTG_CORE_DEVICE *pdev,
uint8_t  epnum);


uint32_t USB_OTG_USBD_EP_Flush (USB_OTG_CORE_DEVICE *pdev, uint8_t
epnum);
```

USB device interrupt subroutine

Following the selected mode in the usb_conf.h (see *Section 5.2*) the main ISR calls the corresponding ISR handler:

```
void USB_OTGFS1_GlobalHandler (void)
```

You must modify the ISR subroutines to use the APIs given by the upper layer.

Example: In the end of transfer of an OUT EP, call the upper layer to receive or decode the received data.

```
static uint32_t USB_OTG_USBD_HandleOutEP_ISR(USB_OTG_CORE_DEVICE
*pdev)
{
 (..)
if ( doepint.b.xfercompl )
      {
        /* Clear the bit in DOEPINTn for this interrupt */
        CLEAR_OUT_EP_INTR(epnum, xfercompl);

        /* Inform upper layer: data ready */
        !!!!! CODE TO BE ADDED BY USER !!!!!
      }
(...)
}
```

5.5.5 Host programming model

Initialization

When the USB OTG FS driver is called in host mode only, the core and host initialization are done in the usb_hcd.c file by:

```
void HOST_Init (USB_OTG_CORE_DEVICE *pdev).
```

Host channel initialization

To prepare and initialize a host channel for transfer, use the following function:

```
HOST_ChannelInit (USB_OTG_CORE_DEVICE *pdev, USB_OTG_HC
*pHostChannel)
```

Starting transfer

The upper layer must have a process to start a transfer on the activated host channel, for example to submit the USB request block (URB) to the host channel.

The Submit URB could call the following function to start the process:

```
uint32_t HOST_StartXfer (USB_OTG_CORE_DEVICE *pdev, USB_OTG_HC
*pHostChannel)
```

USB host device interrupt subroutine

Depending on the selected mode in the usb_conf.h (see *Section 5.2*) the main ISR calls the corresponding ISR handler:

```
void USB_OTGFS1_GlobalHandler (void)
```

You must modify the ISR subroutines to use the APIs given by the upper layer.

5.5.6 OTG programming model

Initialization

OTG feature support is enabled once the core is initialized if the DUAL_ROLE_MODE_ENABLED define has been uncommented in the usb_conf.h file.

These elementary functions can then be used to initiate the default mode:

```
USB_OTG_Status USB_OTG_CoreInitHost (USB_OTG_CORE_DEVICE *pdev)
```

```
USB_OTG_Status USB_OTG_CoreInitDev (USB_OTG_CORE_DEVICE *pdev)
```

Starting SRP protocol

To initiate the session request protocol use this call:

```
void USB_OTG_InitiateSRP(void)
```

Starting HNP protocol

To initiate the session host negotiation protocol use this call:

```
void USB_OTG_InitiateHNP (uint8_t state, uint8_t mode)
```

Where state is 0 to deactivate, 1 to activate and mode is the current role mode (device or host).

USB Host device interrupt subroutine

Depending on the selected mode in the usb_conf.h (see *Section 5.2*) the main ISR calls the corresponding ISR handler:

```
void USB_OTGFS1_GlobalHandler (void)
```

OTG event control

The USB OTG FS core informs the upper layer of the success or failure of the SRP or HNP and also of any change to the ID line status in the OTG ISR. You must implement callbacks to tie these events into the OTG stacks.

Example

```
static uint32_t USB_OTG_HandleConnectorIDStatusChange_ISR(void)
{
  (....)
  if (gotgctl.b.conidsts) // micro B connector
  {
    USB_OTG_DisableGlobalInt(&otgfs_dev1);
    USB_OTG_CoreInitDev(&otgfs_dev1);
    USB_OTG_EnableGlobalInt(&otgfs_dev1);
    // INFORM UPPER LAYER
    otgfs_dev1.OTG_State = B_PERIPHERAL;
  }
  else
  {
    USB_OTG_DisableGlobalInt(&otgfs_dev1);
    USB_OTG_CoreInitHost(&otgfs_dev1);
    USB_OTG_EnableGlobalInt(&otgfs_dev1);
    // INFORM UPPER LAYER ;
    otgfs_dev1.OTG_State = A_HOST;
  }
(....)
}
```

6 USB OTG FS demonstration description

6.1 Introduction

All the USB demonstration applications are designed for the STM3210C-EVAL board and use the following firmware components:

- STM32F10xxx standard peripheral drivers
- uC-OSII RTOS v 2.86
- uC-USB Host stack v3.0
- uC-USB Device stack v3.0
- uC-USB OTG stack v3.0
- File System emFile V4.16 from Segger
- MPEG audio decoder libmad 0.15.1b

The demonstration applications are provided in binary format.

Figure 8. STM3210C-EVAL board

6.1.1 Hardware requirements

The demonstration is designed for the STM3210C-Eval board and requires the following accessories:

- USB Flash disk[a]
- Headphone with male jack connector
- For device demos, a Micro-B to Standard-A plug cable[a]
- For host demos, a Micro-A to Standard-A receptacle[a] (host mode is forced by software and not by USB ID line)
- For OTG mode demos, a Micro-AB cable[a]

a. Included in the STM3210C-EVAL board package.

6.1.2 Jumper settings

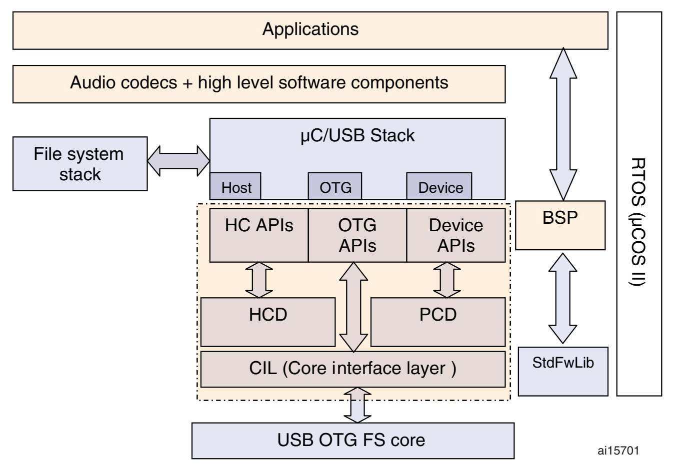
The jumpers on the STM3210C-Eval board should be configured as follows:

Table 5. Required jumper configuration

Jumper	Usage	Configuration
JP17	I2C	Fitted
SW1	Boot	1<->2
SW2	Boot	1<->2
JP26	SD Card detect	fitted
JP15	SD CS	fitted

6.2 Firmware architecture overview

Figure 9. Demo firmware layers

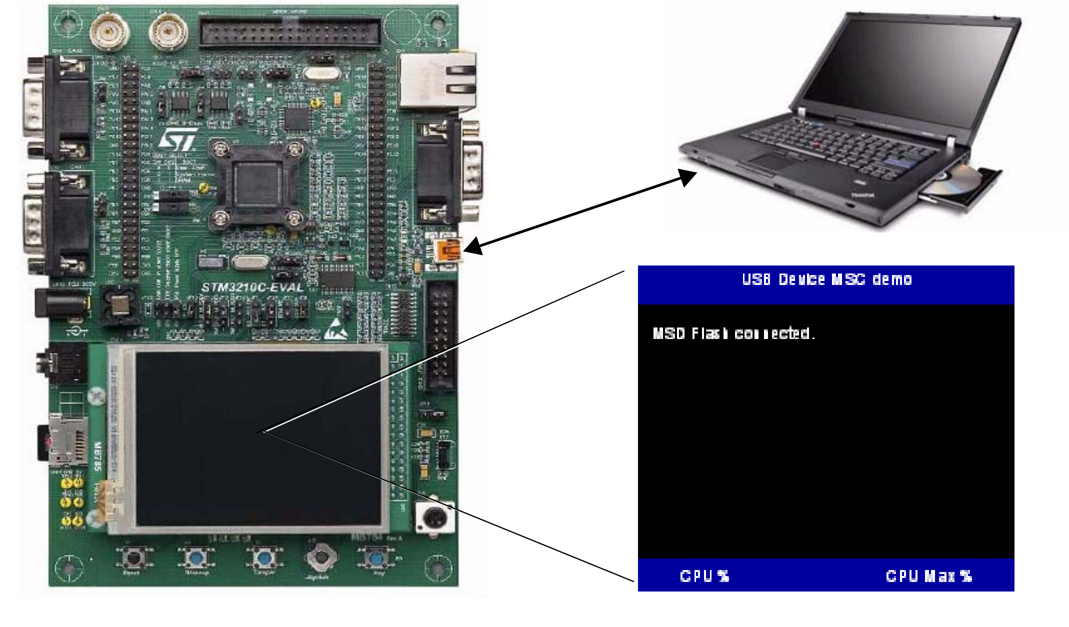


The applications with the USB OTG FS core are built using the architecture shown in *Figure 9*.

- The RTOS (uC-OS-II) is used to control the uC-USB stack internal machine, application tasks and internal flow (events).
- The uC-USB stack (device, host and OTG) is interfaced with the generic low level driver to provide access to the USB core.
- The file system is used when the Host mass storage demo is running to translate the logical addresses from the upper layer into physical ones understood by the USB stack.
- The BSP and the standard firmware library are used to access the standard STM32 IPs and onboard features.
- The BSP also performs the clock settings and provides all the functions needed by the RTOS ticker and human interface devices (LED, joystick, etc.).

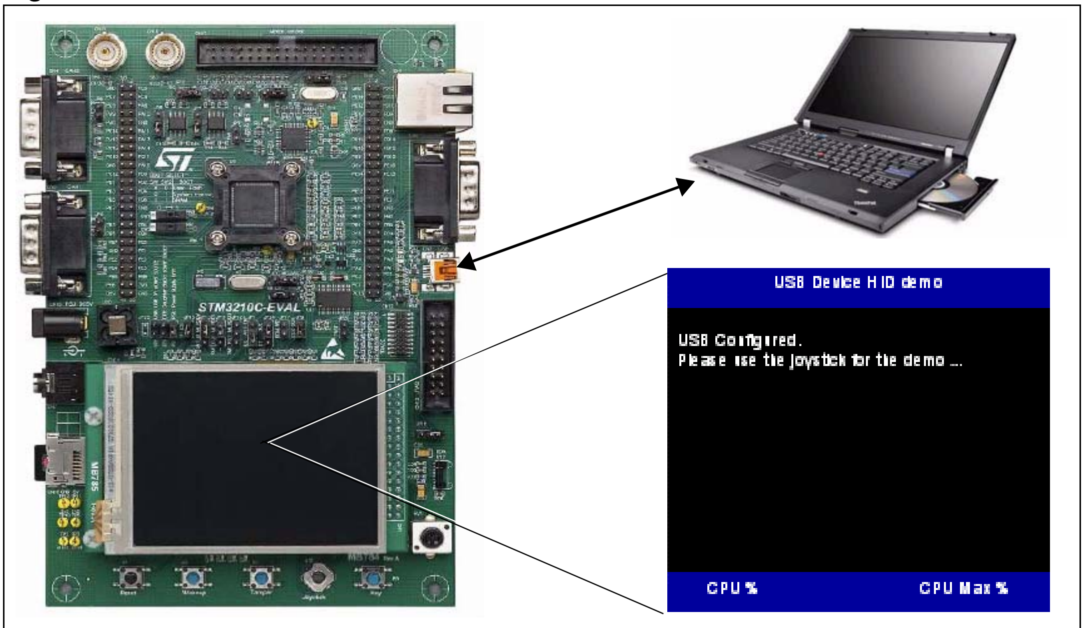
6.3 USB Device mode demonstrations

Figure 10. USB Device mass storage demonstration



The connected micro SD Flash is used as storage medium, once connected to a host the STM32 device should appear in Windows explorer as a removable disk and the user can have read and write access to it.

Figure 11. USB Device HID demonstration

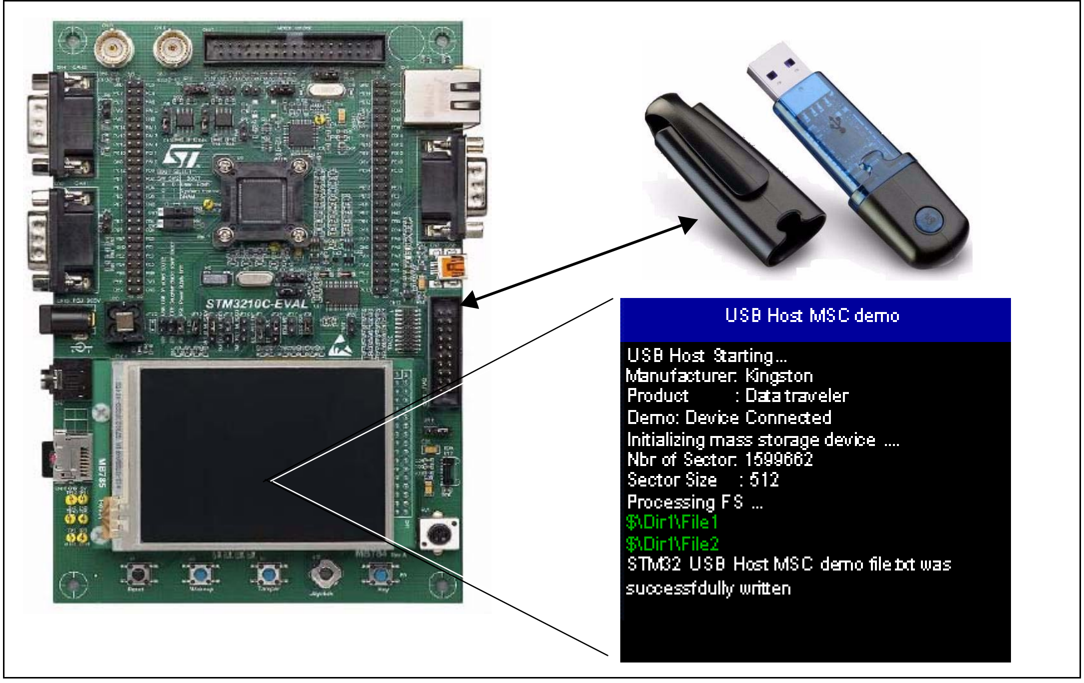


Once connected to the host, the embedded joystick is used as pointing device

Note: For device demos a Micro-A to Standard-A plug cable should be used.

6.4 USB Host mode demonstrations

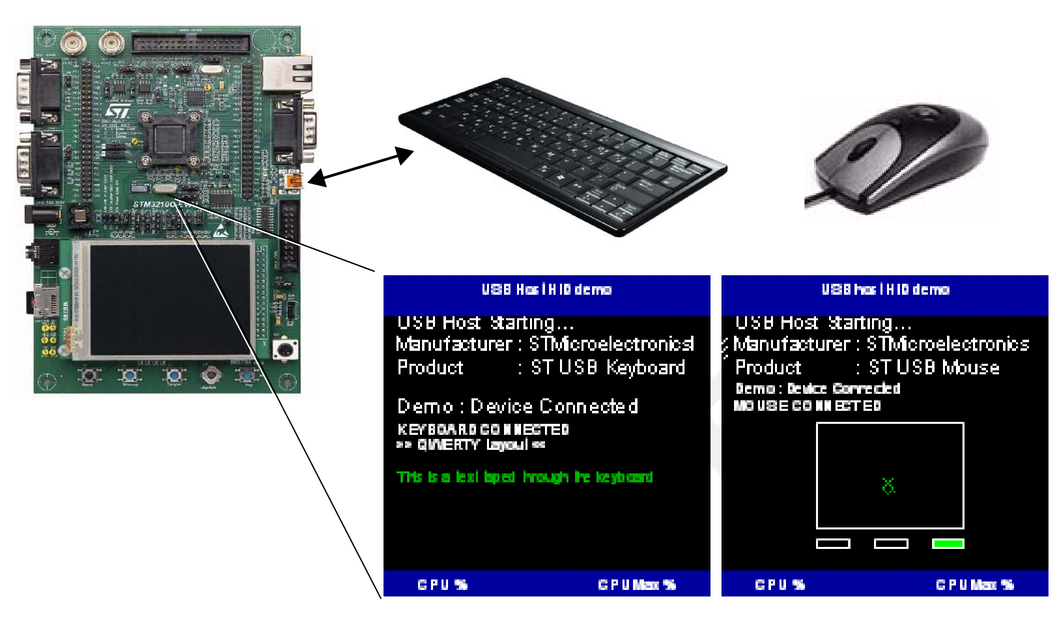
Figure 12. USB Host mass storage demonstration



Once a mass storage device is connected to the board, the application recognizes the connected USB Flash disk, writes a dummy file and displays all the content of the Flash disk directory on the LCD screen.

The user can unplug and plug the USB Flash disk only after the dummy file operation has completed, on the connection and disconnection events the messages on the LCD are updated to display the detected events.

Figure 13. USB Host HID host demonstration



This demonstration supports both mouse and keyboard subclasses. The demo handles keyboard and mouse HID devices dynamically once they are connected.

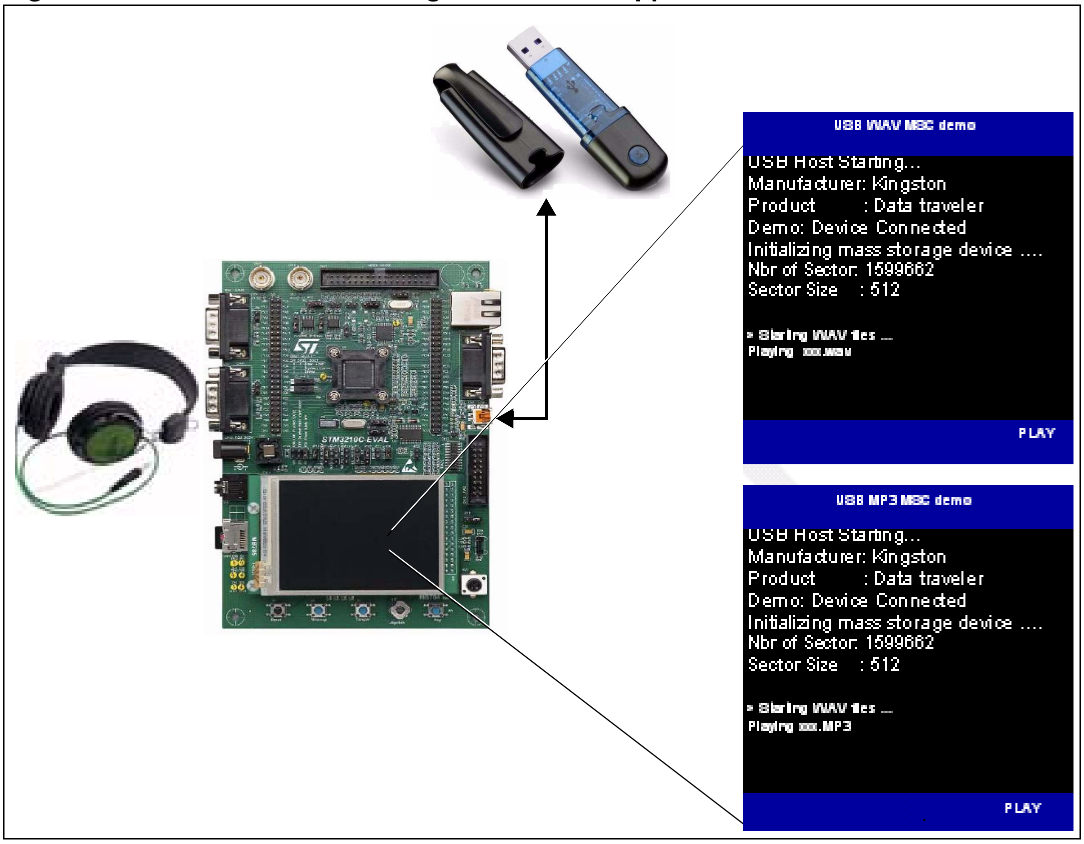
If a keyboard is connected the user can type the characters on the LCD screen (the supported key board layout is QWERTY).

If a mouse is connected, the user can move a pointer inside the displayed pointer area and the pressed button is highlighted on the screen.

Note: 1 *The Host demonstration does not support multi-interface devices such as composite devices.*

2 *The Host demonstration does not support hubs.*

Figure 14. USB Host mass storage with audio support demonstration



Two sets of audio demonstrations built on the USB Host mass storage application are available:

1. Wav player

- This demo plays *.wav files stored in the root directory of the USB Flash disk and can operate with an external 25 MHz crystal (STM3210C-EVAL board default setting) or audio quality 14.7456 MHz crystal.
- This demo supports PCM *.wav audio files with the following configuration:
  - Data length 8/16 bits
  - Audio frequency: 8 to 96 kHz
  - Channel number: Stereo/Mono

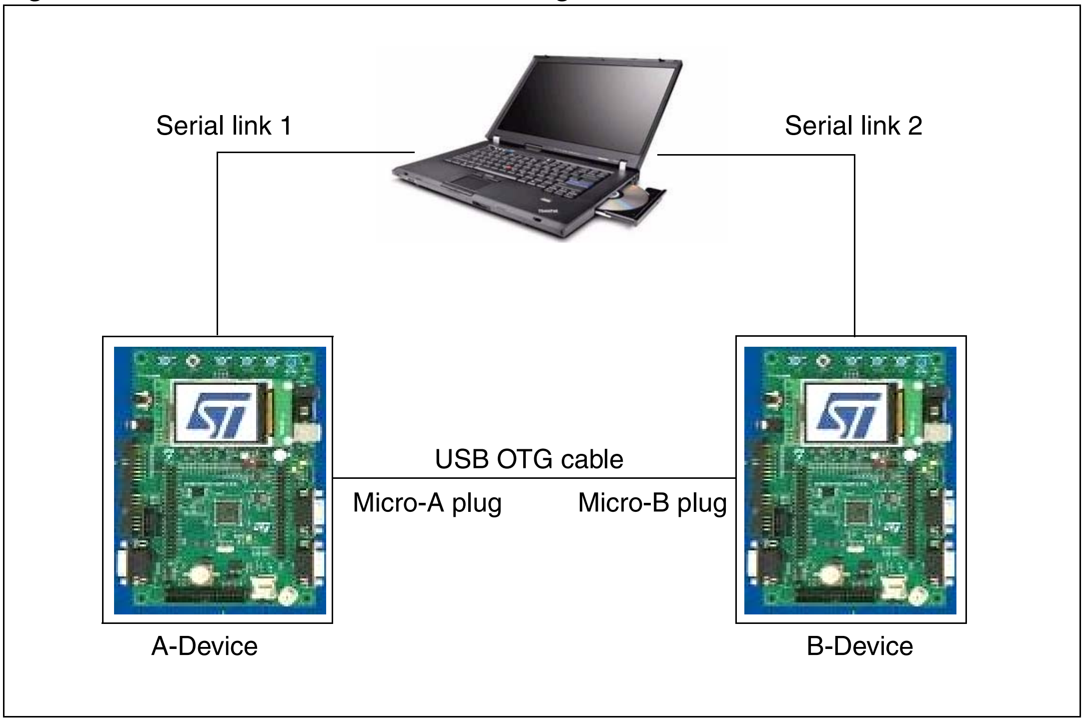
2. MP3 player

- This demo plays *.mp3 files stored in the root directory of the USB Flash disk and can operate with an external 25 MHz crystal (STM3210C-EVAL board default setting) or audio quality 14.7456 MHz crystal. The MPEG audio decoder *libmad* is used for MP3 file decoding (supporting only a limited number of file formats).
- Only *.mp3 audio samples with the following configuration are supported:
  - DataChannel number: Mono
  - Audio frequency: 22 kHz

6.5 USB OTG dual role device demonstration

6.5.1 Hardware configuration

Figure 15. Dual role device hardware configuration



6.5.2 HyperTerminal settings

Baudrate: 115200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

6.5.3 Demo description

The OTG stack demo is composed of an OTG device which has three modes: Idle (USB bus turned-off), Device and Host. The OTG stack uses the µC/USB-Device or the µC/USB-Host working with the Mass Storage Class.

The USB cable ends determine who is going to be the Host and the Device for the OTG enumeration. The A-plug (series A or mini-A) end of the cable identifies a USB Host (called A-Device) and the B-plug (series B or mini-B) end of the cable identifies a USB Device (called B-Device). The left connection (PC Host - Target board) shows the OTG stack used as a USB Device (µC/USB-Device activated).

The right connection (Target board - Peripheral or OTG Device) shows the OTG stack used as a USB Host (µC/USB-Host activated).

When starting the OTG demo, the HyperTerminal displays the activated mode of the OTG stack and a menu for switching between the modes. Depending on the activated mode, the menu is:

Idle mode:

1. *Host* : switch to Host mode

Device mode:

1. *Idle* : switch to Idle mode
2. *Host* : switch to Host mode

Host mode:

1. *Idle* : switch to Idle mode
2. *Device (Note: First Select HOST Mode In Other Side)* : switch to Device mode
3. *File Create* : create a file in the mass storage class USB device (MSC).
4. *Show All Files* : display the file(s) created in the mass storage class USB device (MSC).
5. *Format If Require* : format the mass storage class USB device (MSC).

When the user switches the OTG stack mode the other menu choices change accordingly.

6.5.4 Starting SRP requests

The SRP is used when the Device needs to request the host to activate the VBus.

During the startup of the two boards and after the configuration of the USB cable (mini-A connector or mini-B connector) the following messages are displayed:

Figure 16. SRP start menu

```
Board A:
                        1 - Host mode
Board B:
                        1 - Host mode
```

Procedure:

1. In Board B, select 1 (Host mode). The message: State-B-SRP-Init is displayed.
2. In Board A select 1 (Host mode). The A-device moves to A-Host state and the following menu is displayed in the HyperTerminal window to select the appropriate Host function.

Figure 17. SRP host mode menu

```
Current Mode: HOST (A_DEVICE)
Select Your Choice:
1. Idle
2. Device (Note: First Select HOST Mode on the other side)
3. File Create
4. Show All Files
5. Format If Require
Enter Your Choice :
```

6.5.5 Starting HNP requests

The HNP protocol is used to invert OTG roles. To start the HNP process you must select host mode in the A-device until the following message is displayed:

1. Idle
2. Device (Note: First Select HOST Mode on the other side)
3. File Create
4. Show All Files
5. Format If Require

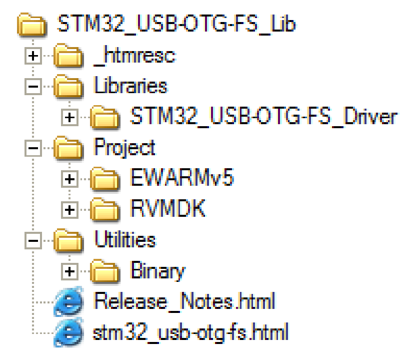
Select Host in the B-Device (choice 2) and then select Device in the A device (choice 2, switch to device mode)

The switch will be done and the A-Host becomes an A-device while the B-Device becomes a B-Host.

7 USB OTG FS demonstration package

The OTG FS library is supplied in a single zip file. The extraction of the zip file generates a folder, ***STM32_USB-OTG-FS_Lib_V1.0.0***, which contains the subfolders shown in *Figure 18* and described below.

Figure 18. USB OTG demonstration package directories



- **Libraries** folder: contains the STM32F105xx/STM32F107xx USB OTG FS low-level driver
- **Project** folder: contains the binary image of the USB demonstrations, plus preconfigured projects for the EWARM and RVMDK toolchains, that can be used to program the binary images into the internal Flash memory.
- **Utilities** folder: contains the binary images of the USB demonstrations, to be used with the EWARM and RVMDK (provided as backup) .

The following binary images are available:

- *STM32F10-USBH-HID_OS*: USB Host HID host demonstration
- *STM32F10-USBH-MSC_OS*: USB Host mass storage demonstration
- *STM32F10-USBF-HID_OS*: USB Device HID demonstration
- *STM32F10-USBF-MSC_OS*: USB Device mass storage demonstration
- *STM32F10-MSC_MP3_14-7456MHz*: USB Host MP3 demonstration (running with 14.7456 MHz crystal)
- *STM32F10-MSC_MP3_25MHz*: USB Host MP3 demonstration (running with 25 MHz crystal)
- *STM32F10-MSC_WAV_14-7456MHz*: USB Host Wav demonstration (running with 14.7456 MHz crystal)
- *STM32F10-MSC_WAV_25MHz*: USB Host Wav demonstration (running with 25 MHz crystal)
- *STM32F10-USBO-DRD_OS*: USB OTG dual role device demonstration

To program the binary images of the demonstration firmware into the internal Flash memory, you have to proceed as follows:

- EWARMv5
  - Open the *Flash_Loader.eww* project.
  - In the workspace toolbar select the project config corresponding to the demonstration to be loaded. The name of each project config refers to the demonstration binary image.
  - Load the project image: Project->Download and Debug (CTRL+ D).
  - Restart the evaluation board (Press B1: reset button).
- RVMDK
  - Open the *Flash_Loader.uv2* project.
  - In the build toolbar select the project config corresponding to the demonstration to be loaded. The name of each project config refers to the demonstration binary image.
  - Load the project image: Debug->Start/Stop Debug Session
  - Restart the evaluation board (Press B1: reset button).

8 Revision history

Table 6. Document revision history

Date	Revision	Changes
25-Jun-2009	1	Initial release.