

RX Family

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USB Host Mass Storage Class Driver (HMSC) using Firmware Integration Technology

Introduction

This application note describes USB Host Mass Storage Class Driver(HMSC), which utilizes Firmware Integration Technology (FIT). This module operates in combination with the USB Basic Host and Peripheral Driver (USB-BASIC-F/W FIT module). It is referred to below as the USB HMSC FIT module.

Target Device

RX63N/RX631 Group
RX65N/RX651 Group
RX64M Group
RX71M Group

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate

Related Documents

1. Universal Serial Bus Revision 2.0 specification
2. USB Mass Storage Class Specification Overview Revision 1.1
3. USB Mass Storage Class Bulk-Only Transport Revision 1.0
<http://www.usb.org/developers/docs/>
4. RX63N/RX631 Group User's Manual: Hardware (Document number: R01UH0041)
5. RX64M Group User's Manual: Hardware (Document number: R01UH0377)
6. RX71M Group User's Manual: Hardware (Document number: R01UH0493)
7. RX65N/RX651 Group User's Manual: Hardware (Document number: R01UH0590)
8. RX65N/RX651-2M Group User's Manual: Hardware (Document number: R01UH0659)
9. RX Family M3S-TFAT-Tiny: FAT file system software (Document number: R20AN0038)
10. RX Family M3S-TFAT-Tiny: Memory Driver Interface Module (Document number: R20AN0335)
11. USB Basic Host and Peripheral Driver using Firmware Integration Technology Application Note (Document number: R01AN2025)

Renesas Electronics Website

<http://www.renesas.com/>

USB Device Page

<http://www.renesas.com/prod/usb/>

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1. Overview

The USB HMSC FIT module, when used in combination with the USB-BASIC-F/W FIT module, operates as a USB host mass storage class driver (HMSC).

The HMSC comprises a USB mass storage class bulk-only transport (BOT) protocol. When combined with a file system and storage device driver, it enables communication with a BOT-compatible USB storage device.

Note that please use the M3S-TFAT-Tiny (Document number: R20AN0038) and Memory driver interface module (Document number: R20AN0335) in combination when using this driver.

This module supports the following functions.

1. Checking of connected USB storage devices (to determine whether or not operation is supported).
2. Storage command communication using the BOT protocol.
3. Support for SFF-8070i (ATAPI) USB mass storage subclass.
4. Sharing of a single pipe for IN/OUT directions or multiple devices.
5. Maximum 4 USB storage devices can be connected.

1.1 Please be sure to read

Please refer to the document (Document number: R01AN2025) for *USB Basic Host and Peripheral Driver using Firmware Integration Technology Application Note* when creating an application program using this driver.

This document is located in the "**reference_documents**" folder within this package.

1.2 Note

1. This driver is not guaranteed to provide USB communication operation. The customer should verify operation when utilizing it in a system and confirm the ability to connect to a variety of different types of devices.
2. This driver is confirmed for operation in combination with the following FAT.

RX Family Open Source FAT File System [M3S-TFAT-Tiny] Module
Firmware Integration Technology Rev.3.03

1.3 Limitation

1. Some MSC devices may be unable to be connected (because they are not recognized as storage devices).
2. MSC devices that return values of 1 or higher in response to the GetMaxLun command (mass storage class command) are not supported.
3. Maximum 4 USB storage devices can be connected.
4. USB storage devices with a sector size of 512 bytes can be connected.
5. A device that does not respond to the READ_CAPACITY command operates as a device with a sector size of 512 bytes.

1.4 Terms and Abbreviations

| | |
|--------------|---|
| APL | : Application program |
| BOT | : Mass Storage Class Bulk Only Transport |
| FSL | : FAT File System Library |
| HCD | : Host Control Driver for USB-BASIC-FW |
| HDCD | : Host Device Class Driver (Device driver and USB class driver) |
| MGR | : Peripheral Device State Manager for HCD |
| MSC | : Mass Storage Class |
| Non-OS | : USB Driver for OS-less |
| RSK | : Renesas Starter Kits |
| RTOS | : USB Driver for the real-time OS |
| TFAT | : Tiny FAT file system software for microcontrollers (M3S-TFAT-Tiny-RX) |
| USB-BASIC-FW | : USB Basic Host and Peripheral Driver |

1.5 USB HMSC FIT Module

User needs to integrate this module to the project using `r_usb_basic`. User can control USB H/W by using this module API after integrating to the project.

2. Software Configuration

HDCD (Host Device Class Driver) is the all-inclusive term for HMSDD (Host Mass Storage Device Driver) and HMSCD (USB Host Mass Storage Class Driver).

Figure 2-1 shows the HMSC software block diagram, with HDCD as the centerpiece. Table 2-1 describes each module.

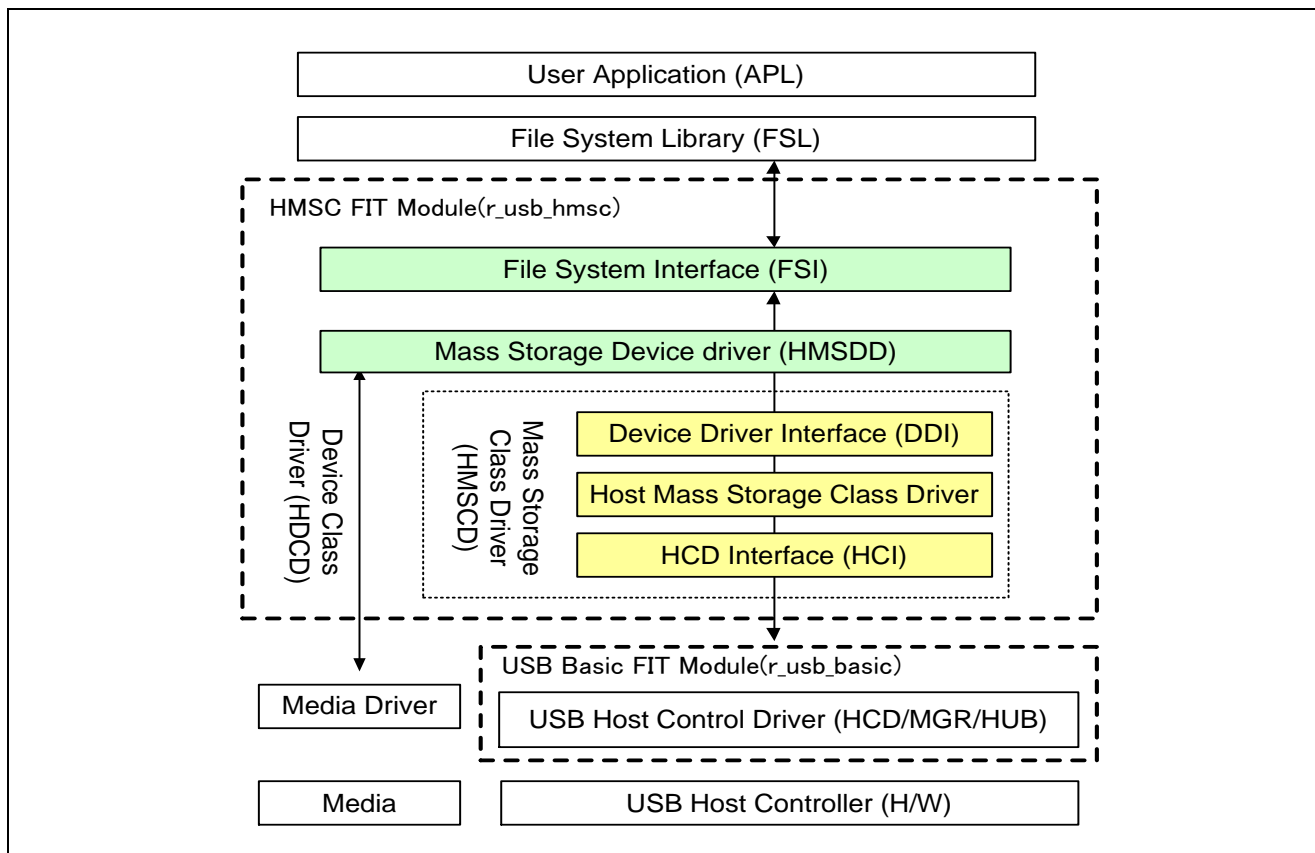


Figure 2-1 Software Module Structure

Table 2-1 Module

| Module | Description |
|---------|---|
| FSI | FSL-HMSDD interface functions. They should be modified to match FSL. |
| HMSDD | To be created (modified) by the customer to match the storage media. |
| DDI | HMSDD-HMSCD interface functions. They should be modified to match the storage media interface of HMSDD. |
| HMSCD | The USB host mass storage class driver. It appends BOT protocol information to storage commands and sends requests to HCD. It also manages the BOT sequence. The storage commands should be added (modified) by the customer to match the system specifications. SFF-8070i (ATAPI) is supported in the example code. |
| HCI | HMSCD-HCD interface functions. |
| MGR/HUB | Enumerates the connected devices and starts HMSCD. Also performs device state management. |
| HCD | USB host hardware control driver. |

3. API Information

This Driver API follows the Renesas API naming standards.

3.1 Hardware Requirements

This driver requires your MCU support the following features:

- USB

3.2 Software Requirements

This driver is dependent upon the following packages:

- r_bsp
- r_usb_basic

3.3 Operating Confirmation Environment

Table 3-1 shows the operating confirmation environment of this driver.

Table 3-1 Operating Confirmation Environment

| Item | Contents |
|------------------------------------|---|
| Integrated Development Environment | Renesas Electronics e ² studio V.7.3.0 |
| C compiler | Renesas Electronics C/C++ compiler for RX Family V.3.01.00 Compile Option : -lang = c99 |
| Real-Time OS | FreeRTOS V.10.0.0 |
| Endian | Little Endian, Big Endian |
| USB Driver Revision Number | Rev.1.24 |
| Using Board | Renesas Starter Kit for RX63N (Only Non-OS) Renesas Starter Kit for RX64M Renesas Starter Kit for RX71M Renesas Starter Kit for RX65N, Renesas Starter Kit for RX65N-2MB |

3.4 Usage of Interrupt Vector

Table 3-2 shows the interrupt vector which this driver uses.

Table 3-2 List of Usage Interrupt Vectors

| Device | Contents |
|----------------|---|
| RX63N RX631 | USBIO Interrupt (Vector number: 35) / USBR0 Interrupt (Vector number: 90) USB D0FIFO0 Interrupt (Vector number: 33) / USB D1FIFO0 Interrupt (Vector number: 34) |
| RX64M RX71M | USBIO(GROUPB) Interrupt (Vector number: 189, Group interrupt source number : 62) USB D0FIFO0 Interrupt (Vector number: 34) / USB D1FIFO0 Interrupt (Vector number: 35) USBR0 Interrupt (Vector number:90) USBAR Interrupt (Vector number: 94) USB D0FIFO2 Interrupt (Vector number: 32) / USB D1FIFO2 Interrupt (Vector number: 33) |
| RX65N RX651 | USBIO(GROUPB) Interrupt (Vector number: 185, Group interrupt source number : 62) USB D0FIFO0 Interrupt (Vector number: 34) / USB D1FIFO0 Interrupt (Vector number: 35) USBR0 Interrupt (Vector number:90) |

3.5 Header Files

All API calls and their supporting interface definitions are located in `r_usb_basic_if.h` and `r_usb_hmsc_if.h`.

3.6 Integer Types

This project uses ANSI C99 “Exact width integer types” in order to make the code clearer and more portable. These types are defined in `stdint.h`.

3.7 Compile Setting

For compile settings, refer to chapter "Configuration" in the document (Document number: R01AN2025) for *USB Basic Host and Peripheral Driver using Firmware Integration Technology Application Note*.

3.8 ROM / RAM Size

The follows show ROM/RAM size of this driver.

1. Non-OS

(1). RX64M, RX71M, RX65N/RX651

| | Checks arguments | Does not check arguments |
|----------|----------------------|--------------------------|
| ROM size | 43.7K bytes (Note 4) | 43.2K bytes (Note 5) |
| RAM size | 26.8K bytes | 26.8K bytes |

(2). RX63N/RX631

| | Checks arguments | Does not check arguments |
|----------|----------------------|--------------------------|
| ROM size | 41.5K bytes (Note 4) | 40.8K bytes (Note 5) |
| RAM size | 26.4K bytes | 26.4K bytes |

2. RTOS

| | Checks arguments | Does not check arguments |
|----------|----------------------|--------------------------|
| ROM size | 57.9K bytes (Note 4) | 57.4K bytes (Note 5) |
| RAM size | 45.5K bytes | 45.5K bytes |

[Note]

1. ROM/RAM size for BSP and USB Basic Driver is included in the above size.
2. ROM/RAM size for TFAT is not included in the above size.
3. The default option is specified in the compiler optimization option.
4. The ROM size of “Checks arguments” is the value when `USB_CFG_ENABLE` is specified to `USB_CFG_PARAM_CHECKING` definition in `r_usb_basic_config.h` file.
5. The ROM size of “Does not check arguments” is the value when `USB_CFG_DISABLE` is specified to `USB_CFG_PARAM_CHECKING` definition in `r_usb_basic_config.h` file.
6. The result of RTOS includes the code size of the real-time OS.

3.9 Argument

For the structure used in the argument of API function, refer to chapter "Structures" in the document (Document number: R01AN2025) for *USB Basic Host and Peripheral Driver using Firmware Integration Technology Application Note*.

3.10 Adding the FIT Module to Your Project

This module must be added to each project in which it is used. Renesas recommends the method using the Smart Configurator described in (1) or (3) below. However, the Smart Configurator only supports some RX devices. Please use the methods of (2) or (4) for RX devices that are not supported by the Smart Configurator.

- (1) Adding the FIT module to your project using “Smart Configurator” on e² studio

By using the Smart Configurator in e² studio, the FIT module is automatically added to your project. Refer to “Renesas e² studio Smart Configurator User Guide (R20AN0451)” for details.

- (2) Adding the FIT module to your project using the FIT Configurator in e² studio

By using the FIT Configurator in e² studio, the FIT module is automatically added to your project. Refer to “Adding Firmware Integration Technology Modules to Projects (R01AN1723)” for details.

- (3) Adding the FIT module to your project using the Smart Configurator in CS+

By using the Smart Configurator Standalone version in CS+, the FIT module is automatically added to your project. Refer to “Renesas e² studio Smart Configurator User Guide (R20AN0451)” for details.

- (4) Adding the FIT module to your project on CS+

In CS+, please manually add the FIT module to your project. Refer to “Adding Firmware Integration Technology Modules to CS+ Projects (R01AN1826)” for details.

4. Target Peripheral List (TPL)

For the structure used in the argument of API function, refer to chapter " **How to Set the Target Peripheral List (TPL)**" in the document (Document number: R01AN2025) for *USB Basic Host and Peripheral Driver using Firmware Integration Technology Application Note*.

5. Class Driver

5.1 Class Request

This driver supports the following class request.

Table 5-1 Class Request

| Request | Description |
|-----------------|--|
| GetMaxLun | Gets the maximum number of units that are supported. |
| MassStrageReset | Cancels a protocol error. |

5.2 Storage Command

This driver supports the following storage command.

1. TEST_UNIT_READY
2. REQUEST_SENSE
3. MODE_SELECT10
4. MODE_SENSE10
5. PREVENT_ALLOW
6. READ_FORMAT_CAPACITY
7. READ10
8. WRITE10

6. API Functions

The following are Host Mass Storage Class specific API functions

| API | Description |
|------------------------|----------------------------------|
| R_USB_HmscStrgCmd() | Issues a Mass Storage command. |
| R_USB_HmscGetDriveNo() | Obtains the drive number. |
| R_USB_HmscGetSem() | Gets a semaphore (Only RTOS) |
| R_USB_HmscRelSem() | Releases a semaphore (Only RTOS) |

Note:

1. Uses the FAT (File Allocation Table) API to access storage media.
2. Refer to chapter "API" in the document (Document number: R01AN2025) for *USB Basic Host and Peripheral Driver using Firmware Integration Technology Application Note*, when using other API.

6.1 R_USB_HmscStrgCmd

Issues a Mass Storage command

Format

```
usb_err_t R_USB_HmscStrgCmd(usb_ctrl_t *p_ctrl, uint8_t *p_buf, uint16_t command)
```

Arguments

| | |
|---------|--------------------------------------|
| p_ctrl | Pointer to usb_ctrl_t structure area |
| p_buf | Pointer to data area |
| command | Mass storage command |

Return Value

| | |
|--------------|------------------------|
| USB_SUCCESS | Successfully completed |
| USB_ERR_PARA | Parameter error |
| USB_ERR_NG | Other error |

Description

1. Non-OS

The Mass Storage command assigned to the argument (*command*) is issued to the MSC device that is specified by the members (*address* and *module*) in the argument (*p_ctrl*). An application program can check the completion of the Mass Storage command with the *USB_STS_MSC_CMD_COMPLETE* return value of the *R_USB_GetEvent* function.

If a Mass Storage command with response data is issued, after checking *USB_STS_MSC_CMD_COMPLETE* return value of the *R_USB_GetEvent* function, an application program can obtain the response data from the area indicated by the second argument (*p_buf*). Check the member (*size*) of the *usb_ctrl_t* structure to get the size of the response data that was received.

2. RTOS

The Mass Storage command assigned to the argument (*command*) is issued to the MSC device that is specified by the members (*address* and *module*) in the argument (*p_ctrl*). An application program can check whether the mass storage command complete by referring the argument (the member (*event*) of the *usb_ctrl_t* structure) in the callback function. This driver sets *USB_STS_MSC_CMD_COMPLETE* to the argument (the *event* member of the *usb_ctrl_t* structure) when completing a Mass Storage command.

If a Mass Storage command with response data is issued, after checking that *USB_STS_MSC_CMD_COMPLETE* is set to the argument (the member (*event*) of the *usb_ctrl_t* structure), an application program can obtain the response data from the area indicated by the second argument (*p_buf*). Check the member (*size*) of the *usb_ctrl_t* structure to get the size of the response data that was received.

For both Non-OS and RTOS, assign the following to the argument (*command*).

Table 6-1 Mass Storage Command

| MassStorage Command |
|--------------------------------|
| USB_ATAPI_TEST_UNIT_READY |
| USB_ATAPI_REQUEST_SENSE |
| USB_ATAPI_INQUIRY |
| USB_ATAPI_MODE_SELECT10 |
| USB_ATAPI_PREVENT_ALLOW |
| USB_ATAPI_READ_FORMAT_CAPACITY |
| USB_ATAPI_READ_CAPACITY |
| USB_ATAPI_MODE_SENSE10 |

Reentrant

1. Non-OS

This API is only reentrant for different USB module.

2. RTOS

This API is reentrant.

Note

1. Before calling this API, assign the module number to the member (*module*) and the device address to the member (*address*). If something other than *USB_IP0* or *USB_IP1* is assigned to the member (*module*), then *USB_ERR_PARA* will be the return value.
2. If the MCU being used only supports one USB module, then do not assign *USB_IP1* to the member (*module*). If *USB_IP1* is assigned, then *USB_ERR_PARA* will be the return value.
3. If *USB_NULL* is assigned to the argument (*p_ctrl*), then *USB_ERR_PARA* will be the return value.
4. Do not assign a pointer to the auto variable (stack) area to the arguments (*p_buf*).
5. Assign *USB_NULL* to the argument (*p_buf*) when issuing the mass storage command without the response data.
6. If a command other than the Mass Storage commands listed in Table 6-1 is assigned to the argument (*command*), then *USB_ERR_PARA* will be the return value.
7. When calling FAT API and this API after issuing the Mass storage command by this API, be sure to call these APIs after checking the return value (*USB_STS_CMD_COMPLETE*) of *R_USB_GetEvent* function.
8. Refer to chapter "7. Return Value (USB_STS_MSC_CMD_COMPLETED) of a Mass Storage Command" about CSW.
9. The CSW information is set to the member (*status*) of the *usb_ctrl_t* structure. If the value of the member (*status*) is *USB_CSW_FAIL*, issue the "Requeset Sense" command to the MSC device using this API.
10. Set the page code (1 Byte) of the "Mode Sense10" command in the start address to the area indicated by the 2nd argument (*p_buf*).
11. Set the parameter data for the "Mode Select10" command to the area indicated by the 2nd argument (*p_buf*) based on the specification for USB Mass Storage Subclass (SFF-8070i etc).
12. This function can be called when the USB device is in the configured state. When the API is called in any other state, *USB_ERR_NG* is returned.

Example**1. Non-OS**

```
void    usb_application( void )
{
    usb_ctrl_t ctrl;
    usb_err_t err;

    :
    while (1)
    {
        switch (R_USB_GetEvent(&ctrl))
        {
            :
            case USB_STS_CONFIGURED:
                :
                g_buf[0] = 0x3F;    /* Page Code */
                ctrl.module = USB_IP1;
                ctrl.address = adr;
                R_USB_HmscStrgCmd( &ctrl, &g_buf, USB_ATAPI_MODE_SENSE10 );
                :
            break;
            case USB_STS_MSC_CMD_COMPLETE:
                if( ctrl.status == USB_CSW_FAIL )
                {
                    R_USB_HmscStrgCmd(&ctrl, &g_buf, USB_ATAPI_REQUEST_SENSE);
                }
                :
            break;
            :
        }
    }
}
```

2. RTOS

```

/* Callback function */
void usb_apl_callback (usb_ctrl_t *p_ctr, usb_hdl_t hdl, uint8_t is_request)
{
    USB_APL_SND_MSG(USB_APL_MBX, (usb_msg_t *)p_ctr);
}

void usb_application_task( void )
{
    usb_ctrl_t    ctrl;
    usb_ctrl_t    *p_mess;
    :
    while(1)
    {
        USB_APL_RCV_MSG(USB_APL_MBX, (usb_msg_t **)&p_mess);
        ctrl = *p_mess;
        switch (ctrl.event)
        {
            :
            case USB_STS_CONFIGURED:
                :
                g_buf[0] = 0x3F          /* Page Code */
                ctrl.module = USB_IP1;
                ctrl.address = adr;
                R_USB_HmscStrgCmd(&ctrl, &g_buf, USB_ATAPI_MODE_SENSE10);
                :
            break;
            case USB_STS_MSC_CMD_COMPLETE:
                if (ctrl.status == USB_CSW_FAIL)
                {
                    R_USB_HmscStrgCmd(&ctrl, &g_buf, USB_ATAPI_REQUEST_SENSE);
                }
                :
            break;
        }
    }
}

```

6.2 R_USB_HmscGetDriveNo

Obtains the drive number

Format

```
usb_err_t      R_USB_HmscGetDriveNo(usb_ctrl_t *p_ctrl, uint8_t *p_drive)
```

Arguments

| | |
|---------|---|
| p_ctrl | Pointer to usb_ctrl_t structure area |
| p_drive | Pointer to the area to store the drive number |

Return Value

| | |
|--------------|------------------------|
| USB_SUCCESS | Successfully completed |
| USB_ERR_PARA | Parameter error |
| USB_ERR_NG | Other error |

Description

Based on the information assigned to the *usb_ctrl_t* structure (the member *module* and *address*), obtains the related drive number. The drive number is stored in the area indicated by the argument (*p_drive*).

Reentrant

This API is reentrant.

Note

1. Before calling this API, assign the device address of the MSC device whose drive number is to be obtained, and the USB module number (*USB_IP0* or *USB_IP1*) connected to that MSC device, to the members (*address* and *module*) of the *usb_ctrl_t* structure. If there is a problem with what is assigned to these members, then *USB_ERR_PARA* will be the return value.
2. If *USB_NULL* is assigned to the argument (*p_ctrl*), then *USB_ERR_PARA* will be the return value.
3. This function can be called when the USB device is in the configured state. When the API is called in any other state, *USB_ERR_NG* is returned.

Example

```
void usb_application( void )
{
    usb_ctrl_t ctrl;
    uint8_t drive;

    while (1)
    {
        switch (R_USB_GetEvent(&ctrl))
        {
            :
            case USB_STS_CONFIGURED:
                :
                ctrl.module = USB_IP0;
                ctrl.address = adr;
                R_USB_HmscGetDriveNo( &ctrl, &drive );
                :
            break;
            :
        }
    }
}
```


6.3 R_USB_HmscGetSem

Gets a semaphore (Only RTOS)

Format

void R_USB_HmscGetSem(void)

Arguments

none

Return Value

none

Description

Gets a specific semaphore which is used in this driver.

Reentrant

This API is reentrant.

Note

1. Be sure to call this API before calling the FAT file open function (e.g *R_tfat_f_open*).
2. If this API is called when a semaphore counter value is zero, the user task which calls this API shift to a semaphore waiting status.
3. The creation processing of a semaphore which this API uses is performed in USB driver.

Example

```
/* Callback function */
void usb_apl_callback (usb_ctrl_t *p_ctrl, usb_hdl_t hdl, uint8_t is_request)
{
    USB_APL_SND_MSG(hdl, (usb_msg_t *)p_ctrl);
}

void usb_application_task( void )
{
    usb_ctrl_t    ctrl;
    usb_ctrl_t    *p_mess;
    :
    while(1)
    {
        USB_APL_RCV_MSG(USB_APL_MBX, (usb_msg_t **)&p_mess);
        ctrl = *p_mess;
        switch (ctrl.event)
        {
            :
            case USB_STS_CONFIGURED:
                :
                R_USB_HmscGetSem();
                R_tfat_f_open(&file, (const char *) &g_msc_file[drvno][0],
                    (TFAT_FA_CREATE_ALWAYS | TFAT_FA_WRITE));
                R_tfat_f_write(&file, g_file_data, sizeof(g_file_data), &file_size);
                R_tfat_f_close(&file);
                R_USB_HmscRelSem();
                :
                break;
                :
            }
        }
    }
}
```

6.4 R_USB_HmscRelSem ---

Releases a semaphore (Only RTOS)

Format

void R_USB_HmscRelSem(void)

Arguments

none

Return Value

none

Description

Releases a specific semaphore which is used in this driver.

Reentrant

This API is reentrant.

Note

1. Be sure to call this API after calling the FAT file close function (e.g *R_tfat_f_close*).
2. An application task during a semaphore waiting status by *R_USB_HmscGetSem* function is released the semaphore waiting status by this API.
3. The creation processing of a semaphore which this API uses is performed in USB driver.

Example

```
/* Callback function */
void usb_apl_callback (usb_ctrl_t *p_ctrl, usb_hdl_t hdl, uint8_t is_request)
{
    USB_APL_SND_MSG(hdl, (usb_msg_t *)p_ctrl);
}

void usb_application_task( void )
{
    usb_ctrl_t    ctrl;
    usb_ctrl_t    *p_mess;
    :
    while(1)
    {
        USB_APL_RCV_MSG(USB_APL_MBX, (usb_msg_t **)&p_mess);
        ctrl = *p_mess;
        switch (ctrl.event)
        {
            :
            case USB_STS_CONFIGURED:
                :
                R_USB_HmscGetSem();
                R_tfat_f_open(&file, (const char *) &g_msc_file[drvno][0],
                    (TFAT_FA_CREATE_ALWAYS | TFAT_FA_WRITE));
                R_tfat_f_write(&file, g_file_data, sizeof(g_file_data), &file_size);
                R_tfat_f_close(&file);
                R_USB_HmscRelSem();
                :
            break;
            :
        }
    }
}
```

7. Return Value (USB_STS_MSC_CMD_COMPLETED) of a Mass Storage Command

(1). Non-OS

After the completion of a Mass Storage command is checked with the *R_USB_HmscStrgCmd* function, if the *R_USB_GetEvent* function is called, then *USB_STS_MSC_CMD_COMPLETE* will be the return value.

(2). RTOS

When a Mass Storage command completes, the callback function that has been registered using the *R_USB_Callback* function will be called by the USB driver. At this time, *USB_STS_MSC_CMD_COMPLETE* will be set to the member (*event*) in the argument (the pointer to the *usb_ctrl_t* structure) of this callback function.

The following shows the information which is set to the member in the *usb_ctrl_t* structure when completing Mass Storage command.

| | | |
|---------|---|---|
| module | : | USB module number where Mass Storage command has been completed. |
| address | : | Device address of USB device where Mass Storage command has been completed. |
| size | : | Size of response data |
| status | : | CSW information |

Note:

1. The member (*module*) of the *usb_ctrl_t* structure has the USB module number (USB_IP0 / USB_IP1) connected to that USB device. The member (*address*) has the device address of the USB device where the Mass Storage command has been completed.
2. The member (*size*) has the size of the response data sent from MSC device.
3. The member (*status*) has bCSWStatus of the CSW (Command Status Wrapper):

| | | |
|-----------------|--------------|---------------|
| USB_CSW_SUCCESS | (Value: 00H) | : Successful |
| USB_CSW_FAIL | (Value: 01H) | : Failed |
| USB_CSW_PHASE | (Value: 02H) | : Phase error |

8. Creating an Application

Refer to the chapter “**Creating an Application Program**” in the document (Document number: R01AN2025) for *USB Basic Host and Peripheral Driver using Firmware Integration Technology Application Note*.

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<http://www.renesas.com/>

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Revision Record

| Rev. | Date | Description | |
|------|--------------|-------------|--|
| | | Page | Summery |
| 1.00 | Aug 1, 2014 | — | First eddition issued. |
| 1.10 | Dec 26, 2014 | — | <ol style="list-style-type: none"> 1. RX71M is supported newly. 2. The following APIs are added. R_usb_hmsc_alloc_drvno, R_usb_hmsc_free_drvno R_usb_hmsc_ref_drvno 3. The argument “drvno” is added to the following APIs. R_usb_hmsc_SetDevSts, R_usb_hmsc_GetDevSts 4. The argument “ipno” is added to the following APIs. R_usb_hmsc_Information 5. The multiple connecting of MSC device is supported. |
| 1.11 | Sep 30, 2015 | — | RX63N and RX631 are added in Target Device |
| 1.20 | Sep 30, 2015 | — | <ol style="list-style-type: none"> 1. RX65N and RX651 are added in Target Device. 2. Supporting DMA transfer. 3. Supporting USB Host and Peripheral Interface Driver application note(Document No.R01AN3293EJ) |
| 1.21 | Mar 31, 2017 | — | <ol style="list-style-type: none"> 1. Supported Technical Update (Document number. TN-RX*-A172A/E) 2. The API other than the chapter API Functions is moved to the document (Document number: R01AN2025) of <i>USB Basic Host and Peripheral Driver Firmware Integration Technology</i>. |
| 1.22 | Sep 30, 2017 | — | Supporting RX65N/RX651-2M |
| 1.23 | Mar 31, 2018 | — | Supporting the Smart Configurator. |
| 1.24 | Dec 28, 2018 | — | <ol style="list-style-type: none"> 1. Supporting RTOS. 2. Supporting R_USB_HmscGetSem/R_USB_HmscRelSem function. |
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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

- The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

The state of the product is undefined at the moment when power is supplied.

- The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

- When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

- The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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