M5531 Series CMSIS BSP Guide

Directory Introduction for 32-bit NuMicro® Family

Please extract the "M5531_Series_BSP_CMSIS_V3.01.002.zip" file firstly and then put the "M5531_Series_BSP_CMSIS_V3.01.002" folder into the working folder.

To experience the powerful features of M5531 series in few minutes, please select the sample code to download and execute on the NuMaker board. Open the project files to build them with Keil® MDK, IAR, NuEclipse or VSCode, and then download and trace them on the NuMaker board to see how it works.

In Extentions of Visual Studio Code, please install Nuvoton NuMicro Cortex-M Pack. It is a complete development toolkit for Nuvoton's NuMicro Cortex-M microcontrollers.

Please note that M5531 Series CMSIS BSP enables CPU Level-1 I/D-Cache by default but does not guarantee Cache coherence.

Directory Information

Document	Driver reference guide and revision history.
Library	Driver header and source files.
SampleCode	Driver sample code.
ThirdParty	Libraries from third parties.
Tool	Utility programs.

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

TABLE OF CONTENTS

1 Document

CMSIS.html	Document of CMSIS version 6.1.0.
NuMicro M5531 Series CMSIS BSP Driver Reference Guide.chm	This document describes the usage of drivers in M5531 Series CMSIS BSP.
NuMicro M5531 Series CMSIS BSP Revision History.pdf	This document shows the revision history of M5531 Series CMSIS BSP.

2 Library

CMSIS	Cortex® Microcontroller Software Interface Standard (CMSIS) V6.1.0 definitions by Arm® Corp. M5531 CMSIS-Drivers do not guarantee thread safety and Cache coherence. The source and RTE_Device header files are in the Driver\Source sub-folder. Please add source files and copy RTE_Device header files into your project. Projects can define PRJ_RTE_DEVICE_HEADER macro to include the private RTE_Device.h.
Commu	Helper functions of communication protocols, e.g., xmodem.
CryptoAccelerator	Crypto accelerator source code for MbedTLS library.
Device	CMSIS compliant device header files.
JpegAcceleratorLib	SIMD accelerator library binary and header files for libjpeg.
PowerDeliveryLib	Power delivery library binary and header files for dual, source and sink role.
SmartcardLib	Smart card library binary and header files.
StdDriver	All peripheral driver header and source files.
Storage	Disk I/O modules for FatFs.
UsbHostLib	USB host library source code.

3 SampleCode

CortexM55	Cortex®-M55 sample codes.
Crypto	Crypto sample codes using MbedTLS library.
FreeRTOS	Simple FreeRTOS™ demo codes.
Hard_Fault_Sample	Show hard fault information when hard fault happened. The hard fault handler shows some information including program counter, which is the address where the processor is executed when the hard fault occurs. The listing file (or map file) can show what function and instruction that is. It also shows the Link Register (LR), which contains the return address of the last function call. It can show the status where CPU comes from to get to this point.
ISP	Sample codes for In-System-Programming.
NuMaker	Sample codes for NuMaker board.
PowerDelivery	Sample codes for power delivery on UTCPD board.
PowerManagement	Sample codes for power management.
SecureApplication	Sample codes for secure application. VSCode projects require Python 3.12 at least for post-build.
Semihost[1]	Show how to print and get character through IDE console window.
StdDriver	Sample codes to demonstrate the usage of M5531 series MCU peripheral driver APIs.
Template	Project template for M5531 series MCU.

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[1] Semihost sample does not provide VSCode project because semihosting is insufficiently supported in VSCode.

TrustZone	Demo of secure codes and non-secure codes.
XOM	Demonstrate how to create XOM library and use it.

4 ThirdParty

FatFs	An open-source FAT/exFAT file system library. A generic FAT file system module for small embedded systems. Its official website is http://elm-chan.org/fsw/ff/00index_e.html.
FreeRTOS	Real-time operating system for microcontrollers. Its official website is http://www.freertos.org/.
libjpeg	A software implements JPEG baseline, extended-sequential, and progressive compression processes maintained and published by the Independent JPEG Group (IJG). Its official website is http://ijg.org/.
libmad	A MPEG audio decoder library that currently supports MPEG-1 and the MPEG-2 extension to lower sampling frequencies, as well as the de facto MPEG 2.5 format. All three audio layers — Layer I, Layer II, and Layer III (i.e., MP3) are fully implemented. This library is distributed under GPL license. Please contact Underbit Technologies for the commercial license.
lwIP	A widely used open-source TCP/IP stack designed for embedded systems. Its official website is http://savannah.nongnu.org/projects/lwIP/.
mbedtls	Mbed TLS offers an SSL library with an intuitive API and readable source code, so you can understand what the code does. Its official website is https://tls.mbed.org/.
openmv	An open-source, low-cost machine vision platform. It supports image processing functions such as face detection, key-pointes descriptions, color tracking, QR and Bar code decoding and more. Its office website is https://openmv.io/. This BSP only includes imlib (core library). Python interface is not included.

paho.mqtt.embedded-c	Eclipse Paho MQTT C/C++ client for Embedded platforms. Its official website is https://www.eclipse.org/paho/clients/c/embedded/.
shine	A blazing fast MP3 encoding library implemented in fixed-point arithmetic. Its official website is https://github.com/toots/shine.

5   Tool

imgtool.exe	Used to perform the operations that are necessary to manage keys and sign images. It is converted from Python script, imgtool.py or https://github.com/mcu-tools/mcuboot/tree/main/scripts/imgtool.
OTAServerDemo_v2.2.1.apk	Secure OTA server Android APP to download firmware images with Secure OTA sample codes. Its GitHub repository is https://github.com/OpenNuvoton/NuOTADemo-Android.

6 SampleCode\CortexM55

Helium_RGB565to888	RG565 to RGB888 with Helium.
MPU_Cache_UpdatePolicy	Configure memory region as write-back or write-through region.
MPU_Memory_AccessPermission	Configure memory region as read-only region.
MPU_Memory_ExecutePermission	Configure memory region as non-executable region.
TCM_Benchmark	Performance comparison of CRC32 implementation on I/D-TCM vs. Flash/SRAM.

7 SampleCode\Crypto

mbedTLS_AES	Show how mbedTLS AES function works.
mbedTLS_ECDH	Show how mbedTLS ECDH function works.
mbedTLS_ECDSA	Show how mbedTLS ECDSA function works.
mbedTLS_HKDF	Show how mbedTLS HKDF function works.
mbedTLS_RSA	Show how mbedTLS RSA function works.
mbedTLS_SHA256	Show how mbedTLS SHA256 function works.

8 SampleCode\FreeRTOS

Blinky	This project provides two demo applications. A simple blinky style project, and a more comprehensive test and demo application.
TicklessIdle	Show how to enable FreeRTOS™ tickless idle mode, and enable RTC for long duration task idle.
TrustZone	Show how to enable FreeRTOS™ on TrustZone application.

9 SampleCode\ISP

common	Simplified system files, drivers and ISP command handle function due to LDROM code size limitation.
ISP_CAN	In-System-Programming Sample code through CAN interface.
ISP_DFU	In-System-Programming Sample code through USB interface and following Device Firmware Upgrade Class Specification.
ISP_DFU_20	In-System-Programming Sample code through HSUSB interface and following Device Firmware Upgrade Class Specification.
ISP_HID	In-System-Programming Sample code through USB HID interface.
ISP_HID_20	In-System-Programming Sample code through HSUSB HID interface.
ISP_I2C	In-System-Programming Sample code through I^{2}C interface.
ISP_MSC	In-System-Programming Sample code through USB interface and following Mass Storage Class Specification.
ISP_RS485	In-System-Programming Sample code through RS485 interface.
ISP_SPI	In-System-Programming Sample code through SPI interface.
ISP_UART	In-System-Programming Sample code through UART interface.

10 SampleCode\NuMaker

AWF_GSensor_Wakeup	Demonstrate how to use G-senor to wake-up by AWF through low power domain IP: LPTMR, LPPDMA, LPI2C.
lwIP	Common drivers for lwIP samples.
LwIP_httpd_netconn	A simple HTTP server that demonstrates lwIP netconn API under FreeRTOS™. This HTTP server's IP address can be configured statically to 192.168.1.2, or assigned by DHCP server.
LwIP_httpd_socket	A simple HTTP server that demonstrates lwIP socket API under FreeRTOS™. This HTTP server's IP address can be configured statically to 192.168.1.2, or assigned by DHCP server.
LwIP_MQTT	A MQTT client sample. The lower level MQTT client functions are from eclipse paho.
LwIP_SSL_Client	A simple HTTPS client that sends a fixed request and displays the response.
LwIP_SSL_Server	A simple HTTPS server that sends a fixed response. It serves a single client at a time.
LwIP_TCP_EchoClient	A TCP echo client which is implemented with lwIP under FreeRTOS™. This client sends "nuvoton" string to server.
LwIP_TCP_EchoServer	A TCP echo server which is implemented with lwIP under FreeRTOS™. The server listens to port 80, and its IP address can be configured statically to 192.168.1.2 or assigned by DHCP server. This server replies "Hello World!!" if the received string is "nuvoton", otherwise replies "Wrong Password!!" to its client.
LwIP_tftp_client	A TFTP client sample that can receive a file from TFTP server or send a file to TFTP server.
LwIP_tftp_server	A TFTP server sample that communicates with TFTP client.
LwIP_UDP_EchoClient	A UDP echo client which is implemented with lwIP under FreeRTOS™. This client sends "Hi there…" string to the server.

LwIP_UDP_EchoServer	A UDP echo server which is implemented with lwIP under FreeRTOS™. The echo server listens to port 80, and its IP address can be configured statically to 192.168.1.2 or assigned by DHCP server. After receiving any string from its peer, this server echoes that string back.
MP3_Recorder	MP3 recorder sample records sound to MP3 files stored on SD memory card and press button to play it.
WiFi_bypass	A simple Wi-Fi demo for NuMaker board.
Xmodem	Demonstrate how to transfer data with UART Xmodem.

11 SampleCode\PowerDelivery

UTCPD_DualRole	Demonstrate Dual Role Power Device. Support Keil® MDK only.
UTCPD_SinkRole	Demonstrate Sink Power Device. Support Keil® MDK only.
UTCPD_SourceRole	Demonstrate Source Power Device. Support Keil® MDK only.

12 SampleCode\PowerManagement

The M5531 series MCU provides some power modes with different power consumption level and wake-up time. For more information, please refer to the application note of M55M1/M5531 Series Power Management and Low Power Design.

PMC_DPDMode_Wakeup	Show how to wake up system form DPD Power-down mode by different wakeup sources.
PMC_NPDMode_Wakeup	Show how to wake up system form NPD Power-down mode by different wakeup sources.
PMC_PowerDown_MinCurrent	Demonstrate how to minimize power consumption when entering Power-down mode.
PMC_PowerMode	Show how to set different core voltage and main voltage regulator type.
PMC_SPDMode_Wakeup	Show how to wake up system form SPD Power-down mode by different wakeup sources.
PMC_SPDMode_WakeupAndReturn	Show how to continue executing code after wake-up form SPD Power-down mode by SRAM data retention function.
PMC_SPDMode_WakeupVTOR	Show how to execute code after wake-up form SPD Power-down mode by VTOR function.
PMC_SRAMPowerMode	Show how to select SRAM power mode.

13 SampleCode\SecureApplication

SecureBootDemo	Demonstrate how to generate the first booting image, NuBL2. After NuBL2 runs, NuBL2 will authenticate NuBL32 and NuBL33 then jump to execute in NuBL32.
SecureISPDemo	Demonstrate how to initialize a SecureISP client mode. This sample code needs to work with USBH_SecureISP sample code.
SecureOTA_SPIM_Cipher	Demonstrate to do secure OTA update for NuBL32 and NuBL33 firmware on SPI Flash by NuBL2 with OTFC enabled.
SecureOTABankRemapDemo	Demonstrate to do secure OTA update for NuBL32 and NuBL33 firmware by NuBL2 with bank remap.
SecureOTADemo	Demonstrate to update NuBL32 and NuBL33 firmware securely over the air (OTA) by NuBL2.
USBH_SecureISP	Demonstrate how to initialize a SecureISP server mode via USB host connected to SecureISPDemo. This sample code needs to work with SecureISPDemo sample code.

14 SampleCode\StdDriver

Analog Comparator Controller (ACMP)

ACMP_ComapreDAC	Demonstrate ACMP comparison by comparing ACMP1_P0 input and DAC voltage and show the result on UART console.
ACMP_ComapreVBG	Demonstrate ACMP comparison by comparing ACMP1_P0 input and VBG voltage and show the result on UART console.
ACMP_Wakeup	Use ACMP to wake up system from Power-down mode while comparator output changes.
ACMP_WindowCompare	Show how to monitor ACMP input with window compare function.
ACMP_WindowLatch	Demonstrate how to use ACMP window latch mode.

Awake Filter (AWF)

AWF_Wakeup	Demonstrate how to use AWF wake-up function.

Basic PWM Generator and Capture Timer (BPWM)

BPWM_Capture	Use BPWM0 channel 0 to capture the BPWM1 channel 0 waveform.
BPWM_DoubleBuffer	Change duty cycle and period of output waveform by BPWM double buffer function.
BPWM_OutputWaveform	Demonstrate how to use BPWM counter output waveform.
BPWM_SwitchDuty	Change duty cycle of output waveform by configured period.
BPWM_SyncStart	Demonstrate how to use BPWM counter synchronous start function.

Controller Area Network with Flexible Data-Rate (CAN FD)

CANFD_CAN_Loopback	Use CAN mode function to do internal loopback test.
CANFD_CAN_MonitorMode	Use CAN Monitor mode to monitor the CAN bus communication test.
CANFD_CAN_TxRx	Transmit and receive CAN messages through CAN interface.
CANFD_CAN_TxRxINT	An example of interrupt control using CAN bus communication.
CANFD_CANFD_Loopback	Use CAN FD mode function to do internal loopback test.
CANFD_CANFD_MonitorMode	Use CAN FD Monitor mode to monitor the CAN bus communication test.
CANFD_CANFD_TxRx	Transmit and receive CAN FD messages through CAN interface.
CANFD_CANFD_TxRxINT	An example of interrupt control using CAN FD bus communication.

Camera Capture Interface Controller (CCAP)

CCAP_Mono_1Bit_Luma	Use luminance 8-bit to 1-bit conversion to store captured image from HM01B0 sensor to SRAM.
CCAP_MotionDetection_Wakeup	Demonstrate how to set up CCAP motion detection function to wake up system when motion is detected in specified regions under Power-down mode.
CCAP_Packet_DownScale	Use packet format (all the luma and chroma data interleaved) to store captured image from sensor to SRAM.
CCAP_Packet_JpegEncode	Use packet format (all the luma and chroma data interleaved) to store captured image from sensor to SRAM and encode image to jpeg.
CCAP_Planar_JpegEncode	Use planar format (split the luma and chroma data) to store captured image from sensor to SRAM and encode the image to jpeg.

Clock Controller (CLK)

CLK_ClockDetector	Show the usage of clock fail detector and clock frequency monitor function.

CRC Controller (CRC)

CRC_CCITT	Implement CRC in CRC-CCITT mode and get the CRC checksum result.
CRC_CRC8	Implement CRC in CRC-8 mode and get the CRC checksum result.
CRC_CRC32	Implement CRC in CRC-32 mode and get the CRC checksum result.
CRC_POLYNOMIAL	Demonstrate how to use polynomial mode and get the CRC checksum result.

Cryptographic Accelerator (CRYPTO)

CRYPTO_AES	Show Crypto IP AES-128 ECB mode encrypt/decrypt function.
CRYPTO_AES_CCM	Demonstrate how to encrypt/decrypt data by AES CCM.
CRYPTO_AES_GCM	Demonstrate how to encrypt/decrypt data by AES GCM.
CRYPTO_ECC_Demo	ECDSA signature and verification demo.
CRYPTO_ECC_ECDH	Demonstrate how ECDH calculates share key by private key A and private key B.
CRYPTO_ED25519	ED25519 signature and verification demo.
CRYPTO_HMAC	Show Crypto IP HMAC function.
CRYPTO_RSA	Show how to use Crypto RSA engine to sign and verify signatures.
CRYPTO_RSA_AccessKeyStore	Use Crypto RSA engine accesses key from key store to sign and verify signatures.

CRYPTO_RSA_CRTBypass	Show how to use Crypto RSA engine CRT/CRT bypass mode to sign two signatures.
CRYPTO_RSA_CRTBypassAccessKeyStore	Use Crypto RSA engine CRT/CRT bypass mode accesses key from key store to sign and verify signatures.
CRYPTO_SHA	Use Crypto IP SHA engine to run through known answer SHA1 test vectors.

Digital to Analog Converter (DAC)

DAC_EPWMTrigger	Demonstrate how to trigger DAC by EPWM.
DAC_ExtPinTrigger	Demonstrate how to trigger DAC conversion by external pin.
DAC_GroupMode	Demonstrate that DAC0 and DAC1 work in group mode.
DAC_PDMA_EPWMTrigger	Demonstrate how to use PDMA and trigger DAC0 by EPWM.
DAC_PDMA_TimerTrigger	Demonstrate how to PDMA and trigger DAC by Timer.
DAC_SoftwareTrigger	Demonstrate how to trigger DAC conversion by software.
DAC_TimerTrigger	Demonstrate how to trigger DAC by Timer.

Digital Microphone Inputs (DMIC)

DMIC_I2S_Play	Demonstrate how to use DMIC as audio input (MIC) and I2S as audio output (SPK). User can process audio data before output. Data have been transferred via LPPDMA/PDMA.
DMIC_VAD_Wakeup	Demonstrate how to use DMIC VAD function to wake up system from Power-down mode periodically.
DMIC_WAVRecorder	Demonstrate how to use DMIC as audio input (MIC) and record to WAV file.

Debug Protection Mechanism (DPM)

DPM_UpdatePassword	Demonstrate how to update and compare Secure DPM password.

Enhanced 12-bit Analog-to-Digital Converter (EADC)

EADC_Accumulate	Demonstrate how to get accumulated conversion result.
EADC_ADINT_Trigger	Use ADINT interrupt to do the EADC continuous scan conversion.
EADC_Average	Demonstrate how to get average conversion result.
EADC_BandGap	Convert Band-gap and print conversion result.
EADC_EPWM_Trigger	Demonstrate how to trigger EADC by EPWM.
EADC_PDMA_EPWM_Trigger	Demonstrate how to trigger EADC by EPWM and transfer conversion data by PDMA.
EADC_Pending_Priority	Demonstrate how to trigger multiple sample modules and got conversion results in order of priority.
EADC_ResultMonitor	Monitor the conversion result of channel 2 by the digital compare function.
EADC_SWTRG_Trigger	Trigger EADC by writing EADC software trigger register.
EADC_TempSensor	Convert temperature sensor and print conversion result.
EADC_Timer_Trigger	Show how to trigger EADC by Timer.
EADC_VBat	Convert VBAT/4 and print conversion result.

External Bus Interface (EBI)

EBI_NOR	Configure EBI interface to access NOR Flash connected on EBI interface.
EBI_SRAM	Configure EBI interface to access SRAM connected on EBI interface.

Enhanced Input Capture Timer (ECAP)

ECAP_GetEQEIFreq	Show how to use ECAP interface to get EQEI frequency.
ECAP_GetInputFreq	Show how to use ECAP interface to get input frequency

Ethernet MAC Controller (EMAC)

EMAC_lwiperf	A lwIP iperf sample.
EMAC_TxRx	This Ethernet sample tends to get a DHCP lease from DHCP server. After IP address configured, this sample can reply to PING packets. Show how to use EMAC driver to simply handle RX and TX packets, it is not suitable for performance and stress testing.

Enhanced PWM Generator and Capture Timer (EPWM)

EPWM_AccumulatorINT_TriggerPDMA	Demonstrate how to use EPWM accumulator interrupt trigger PDMA.
EPWM_AccumulatorStopMode	Demonstrate EPWM accumulator stop mode.
EPWM_Brake	Demonstrate how to use EPWM brake function.
EPWM_Capture	Capture the EPWM1 Channel 0 waveform by EPWM1 Channel 2.
EPWM_DeadTime	Demonstrate how to use EPWM Dead Zone function.
EPWM_DoubleBuffer	Change duty cycle and period of output waveform by EPWM Double Buffer function.
EPWM_OutputWaveform	Demonstrate how to use EPWM output waveform.
EPWM_PDMA_Capture	Capture the EPWM1 Channel 0 waveform by EPWM1 Channel 2 and use PDMA to transfer captured data.
EPWM_SwitchDuty	Change duty cycle of output waveform by configured period.
EPWM_SyncStart	Demonstrate how to use EPWM counter synchronous start

	function.

Enhanced Quadrature Encoder Interface (EQEI)

EQEI_CompareMatch	Show the usage of EQEI compare function.
EQEI_PeriodicINT	Show the usage of EQEI Unit Timer function.

Flash Memory Controller (FMC)

FMC_APROT	Demonstrate how to use FMC APROM Protect function.
FMC_CRC32	Demonstrate how to use FMC CRC32 ISP command to calculate the CRC32 checksum of APROM and LDROM.
FMC_DualBank	Demonstrate how dual processes work in dual bank flash architecture.
FMC_DualBankFwUpgrade	Implement a firmware update mechanism based on dual bank flash architecture.
FMC_ExeInSRAM	Implement a code and execute it in SRAM to program embedded Flash.
FMC_FwUpgradeApplication	Bank remap sample code.
FMC_IAP	Show how to call LDROM function from APROM.
FMC_MultiBoot	Implement a multi-boot system to boot from different applications in APROM. A LDROM code and 4 APROM code are implemented in this sample code.
FMC_MultiWordProgram	Implement FMC multi word program function executed in ITCM to program embedded APROM.
FMC_OTP	Demonstrate how to program, read and lock OTP.
FMC_ReadAllOne	Demonstrate how to use FMC Read-All-One ISP command to check whether the specified APROM or LDROM region are all 0xFFFFFFFF or not.
FMC_RW	Show FMC read Flash IDs, erase, read, and write functions.

FMC_XOM	Show how to configure and set up an XOM region then perform XOM function.

Graphic DMA Controller (GDMA)

GDMA_2DCopy	Use GDMA channel 0 to do 2D transfer (Rotate and Mirror).
GDMA_2DFill	Use GDMA channel 0 to fill an area with given value.
GDMA_2DWrap	Use GDMA channel 0 to do WRAP for 2D.
GDMA_CommandLink	Use GDMA channel 0 to do Command linking transfer.
GDMA_MemCopyINT	Use GDMA channel 0 to transfer data from memory to memory.
GDMA_TemplateTransfer	Use GDMA channel 0 to do template transfer.

General Purpose I/O (GPIO)

GPIO_EINTAndDebounce	Show the usage of GPIO external interrupt function and de-bounce function.
GPIO_INT	Show the usage of GPIO interrupt function.
GPIO_OutputInput	Show how to set GPIO pin mode and use pin data input and output control.
GPIO_PowerDown	Show how to wake up system from Power-down mode by GPIO interrupt.

High Speed USB 2.0 On-The-Go (HSOTG)

HSOTG_Dual_Role_UMAS	An OTG sample code that will become a USB host when connected with a Micro-A cable, and can access the pen drive when plugged in. It will become a removable disk when connected with a Micro-B cable, and then plug into PC.
HSOTG_HNP	Show HID mouse with OTG HNP protocol.

High Speed USB 2.0 Device Controller (HSUSBD)

HSUSBD_Audio10_Codec	An UAC1.0 sample used to record and play the sound sent from PC through the USB interface.
HSUSBD_Audio10_Headset	An UAC1.0 sample and used to plays the sound send from PC through the USB interface.
HSUSBD_Audio20_Codec	An UAC2.0 sample used to record and play the sound sent from PC through the USB interface.
HSUSBD_Audio20_Headset	An UAC2.0 sample used to play the sound sent from PC through the USB interface.
HSUSBD_HID_Mouse	Simulate a USB mouse and draws circle on the screen.
HSUSBD_HID_Mouse_BC12	Demonstrate how to implement a USB mouse device with BC1.2 (Battery Charging). This sample code shows different type of charging port after connected USB port. The mouse cursor will move automatically when this mouse device connecting to PC by USB.
HSUSBD_HID_MouseKeyboard	Simulate a USB mouse and a USB keyboard.
HSUSBD_HID_Transfer	Demonstrate how to transfer data between USB device and PC through USB HID interface. A windows tool is also included in this sample code to connect with a USB device.
HSUSBD_HID_Transfer_And_MSC	Demonstrate how to implement a composite device (HID Transfer and Mass storage). Transfer data between USB device and PC through the USB HID interface. A windows tool is also included in this sample code to connect with a USB device.
HSUSBD_MassStorage_CDROM	USB Mass Storage Device CD-ROM Emulation.
HSUSBD_MassStorage_ Flash	Use embedded Data Flash as storage to implement a USB Mass-Storage device.
HSUSBD_MassStorage_SactterGather	Demonstrate the usage of USBD DMA scatter gather function.
HSUSBD_MassStorage_SD	Implement a SD card reader.

HSUSBD_MassStorage_Short Packet	Implement a mass storage class sample to demonstrate how to receive a USB short packet.
HSUSBD_MassStorage_SRAM	Use internal SRAM as backend storage media to simulate a USB pen drive. This sample code requires enough SRAM.
HSUSBD_RNDIS	Demonstrate how to implement a Remote Network Driver Interface Specification (RNDIS) device.
HSUSBD_VCOM_SerialEmulator	Demonstrate how to implement a USB virtual com port device.
HSUSBD_VENDOR_LBK	Implement a proprietary Vendor LBK device. This sample code requires a USB host running sample HSUSBH_USBH_VENDOR_LBK to be connected.
HSUSBD_Video_CAM	Demonstrate the implementation of USB UVC (USB Video Device Class) functionality.

USB 2.0/1.1 Host Controller (HSUSBH/USBH)

HSUSBH_USBH_AudioClass	Demonstrate how to use USBH Audio Class driver. It shows the mute, volume, auto-gain, channel, and sampling rate control.
HSUSBH_USBH_DEV_CONN	Use connect/disconnect callback functions to handle of device connect and disconnect events.
HSUSBH_USBH_Firmware_ Update	Automatically search and read new firmware from USB drive, if found, update APROM Flash with it.
HSUSBH_USBH_HID	Use USB Host core driver and HID driver. Demonstrate how to submit HID class request and read data from interrupt pipe. This sample code supports dynamic device plug/un-plug and multiple HID devices.
HSUSBH_USBH_HID_Keyboard	Demonstrate reading key inputs from USB keyboards. This sample code includes an USB keyboard driver which is based on the HID driver.
HSUSBH_USBH_HID_MouseKeyboard	Demonstrate how to support USB mouse and keyboard input.

HSUSBH_USBH_MassStorage	Use a command-shell-like interface to demonstrate how to use USBH mass storage driver and make it work as a disk driver under the FATFS file system.
HSUSBH_USBH_PowerSaving	Use power down to do power saving with USB host. System wake up after, user need restore and reset SUB host. It also shows device information represented in UDEV_T.
HSUSBH_USBH_SPIM_Writer	Provide a command line interface for reading files from USB disk and writing to SPIM Flash. This sample code also provides functions of dump SPIM Flash, compares USB disk file with SPIM Flash, and branches to run code on SPIM Flash.
HSUSBH_USBH_UAC_HID	Show how to use USBH Audio Class driver and HID driver at the same time. The target device is a Game Audio (UAC+HID composite device).
HSUSBH_USBH_UAC_ Loopback	Receive audio data from an UAC device, and immediately send back to the UAC device.
HSUSBH_USBH_VCOM	Demonstrate how to use the USB Host core driver and CDC driver to connect a CDC class VCOM device.
HSUSBH_USBH_VCOM_Mass Storage	This sample uses a command-shell-like interface to demonstrate how to use USBH mass storage driver and make it working as a disk driver under FATFS file system. It also demonstrates how to use CDC driver to connect a CDC class VCOM device.
HSUSBH_USBH_VENDOR_LB K	Show how to do transfer on a known device with a vendor driver. This sample code requires a USB device running sample HSUSBD_VENDOR_LBK or USBD_VENDOR_LBK to be connected.

I^2C Serial Interface Controller (I^2C)

I2C_Double_Buffer_Slave	Demonstrate how to set I^2C two-level buffer in Slave mode to receive data from a master. This sample code needs to work with I2C_MultiBytes_Master sample code.
I2C_EEPROM	Show how to use I^2C interface to access EEPROM.

I2C_Loopback	Demonstrate how to set I²C Master mode and Slave Mode and show how a master accesses a slave on a chip.
I2C_Master	Show how a master accesses a slave. This sample code needs to work with I2C_Slave sample code.
I2C_MultiBytes_Master	Demonstrate how to use multi-byte API to access slave. This sample code needs to work with I2C_Slave sample code.
I2C_PDMA_TRX	Demonstrate I²C PDMA mode and need to connect I2C0 (master) and I2C1 (slave).
I2C_SingleByte_Master	Demonstrate how to use single byte API to access slave. This sample code needs to work with I2C_Slave sample code.
I2C_Slave	Demonstrate how to set I²C in Slave mode to receive data from a master. This sample code needs to work with I2C_Master sample code.
I2C_SMBus	Demonstrate how to control SMBus interface and use SMBus protocol between Host and Slave.
I2C_Wakeup_Slave	Show how to wake up MCU from Power-down mode via the I²C interface. This sample code could work with I2C_Master sample code.

I²S Controller (I²S)

I2S_Codec	This is an I²S demo using NAU8822/NAU88L25 audio codec, and used to play back the input from line-in.
I2S_Codec_PDMA	This is an I²S demo with PDMA function connected with codec.
I2S_MP3Player	MP3 player sample plays MP3 files stored on SD memory card.
I2S_WAVPlayer	This is a WAV file player which plays back WAV file stored in SD memory card.

I3C Serial Interface Controller (I3C)

I3C_Master_IBI	Demonstrate how to use I3C Master to process In-Band Interrupt request from an I3C Slave. This sample code needs to work with I3C_Slave_IBI sample code.
I3C_MasterRW	Demonstrate how to use I3C Master to transmit and receive the data from a Slave. This sample code needs to work with I3C_SlaveRW sample code.
I3C_MasterRW_PDMA	Demonstrate how to use I3C Master to receive and transmit the data through PDMA to a Slave. This sample code needs to work with I3C_SlaveRW sample code.
I3C_SecondaryMaster	Demonstrate how to switch the role between Master and Slave. This sample code requires the use of two boards.
I3C_Slave_HotJoin	Demonstrate how to use I3C Slave to initiate a Hot-Join request to I3C Master. This sample code needs to work with I3C_MasterRW sample code.
I3C_Slave_IBI	Demonstrate how to use I3C Slave to initiate an In-Band Interrupt request to I3C Master. This sample code needs to work with I3C_Master_IBI sample code.
I3C_Slave_Wakeup	Wake up the MCU from Power-down mode after receiving read/write request from I3C Master. This sample code needs to work with I3C_MasterRW sample code.
I3C_SlaveRW	Demonstrate how to use I3C0 as I3C Slave to receive and transmit the data from a Master. This sample code needs to work with I3C_MasterRW sample code.
I3C_SlaveRW_PDMA	Demonstrate how to use I3C0 Slave to receive and transmit the data through PDMA from a Master. This sample code needs to work with I3C_MasterRW sample code.

Key Derivation Function (KDF)

KDF_DeriveKey	Show how to use KDF to derive new key.
KDF_DeriveKeyToKeyStore	Show how to use KDF to derive new key saved in Key

	Store.

Keypad Interface (KPI)

KPI_Keyboard	Show how to set scan key board by KPI.

Key Store (KS)

KS_AESKey	Demonstrate how to use the AES in Key Store.
KS_ECDH	Demonstrate how to use ECC ECDH with Key Store.
KS_ECDSA	Demonstrate how to use the ECC ECDSA with Key Store.
KS_KeyStatus	Show how to check Key Store status.

Low Power Analog-to-Digital Converter (LPADC)

LPADC_ACMP_Trigger	Show how to trigger LPADC by ACMP.
LPADC_ADINT_Trigger	Use ADINT interrupt to do the LPADC Single-cycle scan conversion.
LPADC_AutoOperation	Demonstrate how to enable LPADC Auto-operation mode to convert when chip enters Power-down mode.
LPADC_BandGap	Convert Band-gap and print conversion result.
LPADC_BurstMode	Perform A/D Conversion with LPADC burst mode.
LPADC_ContinuousScanMode	Perform A/D Conversion with LPADC continuous scan mode.
LPADC_EPWM_Trigger	Demonstrate how to trigger LPADC by EPWM.
LPADC_LPPDMA_EPWM_Trigger	Demonstrate how to trigger LPADC by EPWM and transfer conversion data by LPPDMA.
LPADC_MaxSps_ContinuousScanMode	Demonstrate how to use PCLK4 as LPADC clock source to achieve the maximum conversion rate.
LPADC_ResultMonitor	Monitor the conversion result of channel 1 by the digital

	compare function.
LPADC_SingleCycleScanMode	Perform A/D Conversion with LPADC single cycle scan mode.
LPADC_SingleMode	Perform A/D Conversion with LPADC single mode.
LPADC_STADC_Trigger	Show how to trigger LPADC by STADC pin.
LPADC_SWTRG_Trigger	Trigger LPADC by writing LPADC software trigger register.

Low Power General Purpose I/O (LPGPIO)

LPGPIO_OutputInput	Show how to set LPGPIO pin mode and use pin data input/output control.

Low Power I2C Serial Interface Controller (LPI2C)

LPI2C_AutoOperation	Demonstrate LPI2C Auto-operation mode when chip enters Power-down mode. This sample code needs to work with LPI2C_Slave sample code.
LPI2C_EEPROM	Show how to use LPI2C interface to access EEPROM.
LPI2C_LPPDMA_TRX	Demonstrate LPI2C LPPDMA mode and need two boards to connect LPI2C0 (Master) and LPI2C0 (Slave).
LPI2C_Master	Show how a master accesses a slave. This sample code needs to work with LPI2C_Slave sample code.
LPI2C_MultiBytes_Master	Show how to use LPI2C multi-bytes API to access Slave. This sample code needs to work with LPI2C_Slave sample code.
LPI2C_SingleByte_Master	Show how to use LPI2C single-byte API to access Slave. This sample code needs to work with LPI2C_Slave sample code.
LPI2C_Slave	Show how to set LPI2C in Slave mode and receive the data from Master. This sample code needs to work with LPI2C_Master sample code.

| LPI2C_Wakeup_Slave | Show how to wake up MCU from Power-down mode through LPI2C interface. This sample code needs to work with LPI2C_Master sample code. |

Low Power PDMA Controller (LPPDMA)

LPPDMA_BasicMode	Use LPPDMA to transfer data from memory to memory.
LPPDMA_ScatterGather	Use LPPDMA to transfer data from memory to memory by scatter-gather mode.
LPPDMA_ScatterGather_ PingPongBuffer	Use LPPDMA to implement Ping-Pong buffer by scatter-gather mode (memory to memory).

Low Power Serial Peripheral Interface (LPSPI)

LPSPI_AutoOperation	Demonstrate how to do LPSPI loopback test in Auto-operation mode when chip enters Power-down mode
LPSPI_Loopback	LPSPI read/write demo by connecting LPSPI MISO and MOSI pins.
LPSPI_LPPDMA_LoopTest	LPSPI read/write demo in LPPDMA mode. Connecting LPSPI MISO and MOSI pins. Both TX LPPDMA function and RX LPPDMA function will be enabled.
LPSPI_MasterFIFOMode	Configure LPSPI as Master mode and demonstrate how to communicate with an off-chip SPI slave device with FIFO mode. This sample code needs to work with LPSPI_SlaveFIFOMode sample code.
LPSPI_SlaveFIFOMode	Configure LPSPI as Slave mode and demonstrate how to communicate with an off-chip SPI master device with FIFO mode. This sample code needs to work with LPSPI_MasterFIFOMode sample code.

Low Power Timer Controller (LPTMR)

| LPTMR_ACMPTrigger | Use ACMP to trigger LPTMR counter reset mode. |

LPTMR_AutoOperation	Demonstrate LPTMR Auto-operation with LPPDMA when chip enters Power-down mode.
LPTMR_CaptureCounter	Show how to use the LPTMR capture function to capture LPTMR counter value.
LPTMR_Delay	Demonstrate the usage of LPTMR_Delay() API to generate a 1 second delay.
LPTMR_EventCounter	Use LPTM0 pin to demonstrate LPTMR event counter function.
LPTMR_FreeCountingMode	Use the LPTMR LPTM0_EXT pin to demonstrate timer free counting mode function. Also display the measured input frequency to UART console.
LPTMR_Periodic	Use the LPTMR periodic mode to generate timer interrupt every 1 second.
LPTMR_PeriodicINT	Implement LPTMR counting in periodic mode.
LPTMR_PWM_AccumulatorINTStopMode	Demonstrate LPTMR PWM accumulator interrupt to stop counting.
LPTMR_PWM_AccumulatorINTTriggerLPPDMA	Demonstrate LPTMR PWM accumulator interrupt to trigger LPPDMA transfer.
LPTMR_PWM_AutoOperation	Demonstrate LPTPWM Auto-operation with LPPDMA when chip enters Power-down mode.
LPTMR_PWM_ChangeDuty	Change duty cycle and period of output waveform in PWM up count type.
LPTMR_PWM_OutputWaveform	Demonstrate output different duty waveform in LPTMR0~1 PWM.
LPTMR_TimeoutWakeup	Use LPTMR to wake up system from Power-down mode periodically.
LPTMR_ToggleOut	Demonstrate the LPTMR toggle out function on LPTM0 pin.

Low Power UART Interface Controller (LPUART)

LPUART_AutoBaudRate	Show how to use auto baud rate detection function.
LPUART_AutoFlow	Transmit and receive data using auto flow control.
LPUART_AutoOperation	Demonstrate how to enable LPUART Auto-operation mode to transmit and receive data when chip enters Power-down mode.
LPUART_LPPDMA	Demonstrate LPUART transmit and receive function with LPPDMA.
LPUART_RS485	Transmit and receive data in LPUART RS485 mode.
LPUART_TxRxFunction	Transmit and receive data from PC terminal through RS232 interface.
LPUART_Wakeup	Show how to wake up system from Power-down mode by LPUART interrupt.

USB 1.1 On-The-Go (OTG)

OTG_Dual_Role_UMAS	An OTG sample code that will become a USB host when connected with a Micro-A cable, and can access the pen drive when plugged in. It will become a removable disk when connected with a Micro-B cable, and then plug into PC.
OTG_HNP	Show HID mouse with OTG HNP protocol.

PDMA Controller (PDMA)

PDMA_BasicMode	Use PDMA0 channel 2 to transfer data from memory to memory.
PDMA_ScatterGather	Use PDMA0 channel 4 to transfer data from memory to memory by scatter-gather mode.
PDMA_ScatterGather_ PingPongBuffer	Use PDMA to implement Ping-Pong buffer by scatter-gather mode (memory to memory).

PDMA_TimeOut	Demonstrate PDMA0 channel 1 get/clear timeout flag with UART1.

Programmable Serial I/O (PSIO)

PSIO_1Wire	Demonstrate how to implement 1-Wire protocol by PSIO.
PSIO_DMX512	Demonstrate how to implement DMX512 protocol by PSIO.
PSIO_HDQ	Demonstrate how to implement HDQ protocol by PSIO.
PSIO_IR	Demonstrate how to implement NEC IR protocol by PSIO.
PSIO_LED	Demonstrate how to light up the WS1812B LED array.
PSIO_Microwire	Demonstrate how to implement Microwire protocol by PSIO.
PSIO_PS2_Device	Demonstrate how to implement PS/2 slave protocol by PSIO.
PSIO_PS2_Host	Demonstrate how to implement PS/2 host protocol by PSIO.
PSIO_Wiegand	Demonstrate how to implement Wiegand26 protocol by PSIO.

Quad Serial Peripheral Interface (QSPI)

QSPI_DualMode_Flash	Access SPI Flash using QSPI dual mode.
QSPI_PDMA_Master	Configure QSPI0 as Master mode and demonstrate how to communicate with an off-chip QSPI Slave device with FIFO mode. This sample code needs to work with QSPI_PDMA_Slave sample code.
QSPI_PDMA_Slave	Configure QSPI as Slave mode and demonstrate how to communicate with an off-chip QSPI Master device with FIFO mode. This sample code needs to work with QSPI_PDMA_Master sample code.
QSPI_QuadMode_Flash	Access SPI Flash using QSPI quad mode.

QSPI_Slave3Wire	Configure QSPI as Slave 3-wire mode and demonstrate how to communicate with an off-chip SPI Master device with FIFO mode. This sample code needs to work with SPI_MasterFIFOMode sample code.

Random Number Generator (RNG)

RNG_EntropyPoll	Generate entropy from hardware entropy source.
RNG_Random	Generate random numbers.

Real Timer Clock (RTC)

RTC_Alarm_Test	Demonstrate the RTC alarm function. It sets an alarm 10 seconds after execution.
RTC_Alarm_Wakeup	Use RTC alarm interrupt event to wake up system.
RTC_Dynamic_Tamper	Demonstrate the RTC dynamic tamper function.
RTC_Spare_Access	Demonstrate the RTC spare register read/write function and displays test result to the UART console.
RTC_Static_Tamper	Demonstrate the RTC static tamper function.
RTC_Time_Display	Demonstrate the RTC function and display current time to the UART console.

Smart Card Host Interface (SC)

SC_ReadATR	Read the smartcard ATR from Smartcard interface.
SC_ReadSimPhoneBook	Demonstrate how to read phone book information in the SIM card.
SC_Timer	Demonstrate how to use SC embedded timer.
SCUART_TxRx	Demonstrate Smartcard UART mode by connecting PB.4 and PB.5 pins.

Secure Digital Host Controller (SDH)

SDH_FATFS	Access a SD card formatted in FAT file system.

Serial Peripheral Interface (SPI)

SPI_Flash	Access SPI Flash through SPI interface.
SPI_HalfDuplex	Demonstrate SPI half-duplex mode. Configure SPI0 as master mode and SPI1 as slave mode. Both SPI0 and SPI1 are half-duplex mode.
SPI_Loopback	Implement SPI Master loop back transfer. This sample code needs to connect MISO pin and MOSI pin together. It will compare the received data with transmitted data.
SPI_MasterFIFOMode	Configure SPI as master mode and demonstrate how to communicate with an off-chip SPI slave device with FIFO mode. This sample code could work with SPI_SlaveFIFOMode sample code.
SPI_PDMA_LoopTest	SPI read/write demo in PDMA mode. Connect SPI MISO and MOSI pins. Both TX PDMA function and RX PDMA function will be enabled.
SPI_SlaveFIFOMode	Configure SPI as slave mode and demonstrate how to communicate with an off-chip SPI master device with FIFO mode. This sample code needs to work with SPI_MasterFIFOMode sample code.
SPII2S_Master	Configure SPI as I²S master mode and demonstrate how I²S works in master mode. This sample code needs to work with SPII2S_Slave sample code.
SPII2S_PDMA_Codec	An I²S demo with PDMA function connected with audio codec.
SPII2S_PDMA_Play	An I²S demo for playing data and demonstrating how I²S works with PDMA.
SPII2S_PDMA_PlayRecord	An I²S demo for playing and recording data with PDMA function.
SPII2S_PDMA_Record	An I²S demo for recording data and demonstrating how I²S

	works with PDMA.
SPII2S_Slave	Configure SPI as I²S slave mode and demonstrate how I²S works in slave mode. This sample code needs to work with [SPII2S_Master](#) sample code.

SPI/Hyper Bus Synchronous Serial Interface Controller (SPIM)

SPIM_Cipher	Show SPIM DMA read/write with cipher enabled. This sample code also dumps SPI Flash content via I/O mode read to prove it is encrypted cipher context.
SPIM_DMA_RW	Show SPIM DMA mode read/write function.
SPIM_DMM	Show SPIM DMM mode read function. This sample code programs SPI Flash with DMA write and verify flash with DMA read and DMM mode CPU read respectively.
SPIM_DMM_RUN_CODE	Show how to make an application booting from APROM with a sub-routine resided on SPI Flash.
SPIM_HYPER_ExeInHRAM	Show how to make an application booting from APROM with a sub-routine resided on HyperRAM.
SPIM_HYPER_RW_MemMap	Show HyperRAM read/write through HyperBus Interface.
SPIM_IO_RW	Show how to issue SPI Flash erase, program, and read commands under SPIM I/O mode.
SPIM_OctalMode_Flash	Show SPIM DMA mode read/write octal flash function.

System Manager (SYS)

SYS_BODWakeup	Show how to wake up system from Power-down mode by brown-out detector interrupt.
SYS_PLLClockOutput	Change system clock to different PLL frequency and output system clock from CLKO pin.
SYS_TrimHIRC	Demonstrate how to use LXT to trim HIRC/HIRC48M.

Timer Controller (TIMER)

TIMER_ACMPTrigger	Use ACMP to trigger Timer counter reset mode.
TIMER_CaptureCounter	Show how to use the Timer capture function to capture Timer counter value.
TIMER_Delay	Demonstrate the usage of TIMER_Delay API to generate a 1 second delay.
TIMER_EventCounter	Use TM0 pin to demonstrate Timer event counter function.
TIMER_FreeCountingMode	Use TM0_EXT pin to demonstrate Timer free counting mode function. And display the measured input frequency to UART console.
TIMER_InterTimerTriggerMode	Use TM0 pin to demonstrate inter-timer trigger mode function and display the measured input frequency to UART console.
TIMER_Periodic	Use the Timer periodic mode to generate Timer interrupt every 1 second.
TIMER_PeriodicINT	Implement Timer counting in periodic mode.
TIMER_PWM_AccumulatorINTStopMode	Demonstrate TIMER PWM accumulator interrupt to stop counting.
TIMER_PWM_AccumulatorINTTriggerPDMA	Demonstrate TIMER PWM accumulator interrupt to trigger PDMA transfer.
TIMER_PWM_Brake	Demonstrate how to use TIMER PWM brake function.
TIMER_PWM_ChangeDuty	Change duty cycle and period of output waveform in PWM down count type.
TIMER_PWM_DeadTime	Demonstrate TIMER PWM Complementary mode and Dead-Time function.
TIMER_PWM_OutputWaveform	Demonstrate output different duty waveform in Timer0~Timer3 PWM.
TIMER_TimeoutWakeup	Use Timer to wake up system from Power-down mode periodically.

TIMER_ToggleOut	Demonstrate the Timer toggle out function.

Tick Timer Controller (TTMR)

TTMR_AutoOperation	Demonstrate TTMR Auto-operation with LPPDMA when chip enters Power-down mode.
TTMR_Delay	Demonstrate the usage of TTMR_Delay API to generate a 1 second delay.
TTMR_Periodic	Use the TTMR periodic mode to generate timer interrupt every 1 second.
TTMR_PeriodicINT	Implement TTMR counting in periodic mode.
TTMR_TimeoutWakeup	Use TTMR to wake up system from Power-down mode periodically.

UART Interface Controller (UART)

UART_AutoBaudRate	Show how to use auto baud rate detection function.
UART_AutoFlow	Transmit and receive data using auto flow control.
UART_IrDA	Transmit and receive UART data in UART IrDA mode.
UART_LIN	Transmit LIN frame including header and response in UART LIN mode.
UART_PDMA	Demonstrate UART transmit and receive function with PDMA.
UART_RS485	Transmit and receive data in UART RS485 mode.
UART_SingleWire	Transmit and receive data in UART single-wire mode.
UART_TxRxFunction	Transmit and receive data from PC terminal through RS232 interface.
UART_Wakeup	Show how to wake up system from Power-down mode by UART interrupt.

USB 1.1 Device Controller (USBD)

USBD_Audio_Codec	Demonstrate how to implement a USB audio class device.
USBD_Audio_Headset	Demonstrate how to implement a USB audio class device. Codec is used in this sample code to play the audio data from Host. It also supports to record data from codec to Host.
USBD_CCID	USB CCID smart card reader sample code.
USBD_HID_Keyboard	Demonstrate how to implement a USB keyboard device. It supports to use GPIO to simulate key input.
USBD_HID_Mouse	Show how to implement a USB mouse device. The mouse cursor will move automatically when this mouse device connecting to PC by USB.
USBD_HID_MouseKeyboard	Simulate an USB HID mouse and HID keyboard. Mouse draws circle on the screen and Keyboard uses GPIO to simulate key input.
USBD_HID_RemoteWakeup	Demonstrate how to implement a USB mouse device. It uses PA0 ~ PA5 to control mouse direction and mouse key. It also supports USB suspend and remote wakeup.
USBD_HID_Touch	Demonstrate how to implement a USB touch digitizer device. Two lines demo in Paint.
USBD_HID_Transfer	Demonstrate how to transfer data between a USB device and PC through a USB HID interface. A windows tool is also included in this sample code to connect with a USB device.
USBD_HID_Transfer_And_ Keyboard	Demonstrate how to implement a composite device of HID transfer and keyboard. Transfer data between USB device and PC through USB HID interface. A windows tool is also included in this sample code to connect with a USB device.
USBD_HID_Transfer_And_ MSC	Demonstrate how to implement a composite device of HID transfer and mass storage. Transfer data between USB device and PC through USB HID interface. A windows tool is also included in this sample code to connect with a USB device.

USBD_HID_Transfer_CTRL	Use USB host core driver and HID driver. It shows how to submit HID class request and how to read data from control pipe. A windows tool is also included in this sample code to connect with a USB device.
USBD_MassStorage_CDROM	Demonstrate the emulation of USB Mass-Storage device, CD-ROM.
USBD_MassStorage_Flash	Use Flash as storage to implement a USB Mass-Storage device.
USBD_MassStorage_SD	Use SD card as storage to implement a USB Mass-Storage device.
USBD_MassStorage_SRAM	Use internal SRAM as backend storage media to simulate a USB pen drive.
USBD_MicroPrinter	Demonstrate how to implement a USB micro printer device.
USBD_Printer_And_HID_ Transfer	Demonstrate how to implement a composite device of USB micro printer and HID transfer. Transfer data between USB device and PC through USB HID interface. A windows tool is also included in this sample code to connect with a USB device.
USBD_VCOM_And_HID_ Keyboard	Demonstrate how to implement a composite device of VCOM and HID keyboard.
USBD_VCOM_And_HID_ Transfer	Demonstrate how to implement a composite device of VCOM and HID transfer. Transfer data between USB device and PC through USB HID interface. A windows tool is also included in this sample code to connect with a USB device.
USBD_VCOM_And_Mass Storage	Demonstrate how to implement a composite device of VCOM and mass storage.
USBD_VCOM_MultiPort	Demonstrate how to implement a USB multiple virtual COM port device.
USBD_VCOM_SerialEmulator	Demonstrate how to implement a USB virtual COM port device.
USBD_VCOM_SerialEmulator	Demonstrate how to implement a USB virtual COM port

_DoubleBuffer	device using double buffer mode.
USBD_VENDOR_LBK	This sample code works as a proprietary Vendor LBK device. It's created for HSUSBH_USBH_VENDOR_LBK of this BSP. Vendor LBK device includes Control, Bulk, Interrupt, and Isochronous in/out endpoint pairs. Each endpoint pair receive data from host via the out-endpoint and send data back to host via the in-endpoint.

Universal Serial Control Interface Controller - I²C Mode (USCI-I2C)

USCI_I2C_EEPROM	Demonstrate how to access EEPROM through a USCI_I2C interface.
USCI_I2C_Master	Demonstrate how a Master accesses Slave. This sample code needs to work with USCI_I2C_Slave sample code.
USCI_I2C_Master_10bit	Demonstrate how a Master uses 10-bit addressing access Slave. This sample code needs to work with USCI_I2C_Slave_10bit sample code.
USCI_I2C_Monitor	Demonstrate how USCI_I2C monitors transmission between I²C Master and I²C Slave.
USCI_I2C_MultiBytes_Master	Demonstrate how to use multi-byte API to access slave. This sample code needs to work with the USCI_I2C_Slave sample code.
USCI_I2C_SingleByte_Master	Demonstrate how to use single-byte API to access slave. This sample code needs to work with the USCI_I2C_Slave sample code.
USCI_I2C_Slave	Demonstrate how to set USCI_I2C in slave mode to receive the data from a Master. This sample code needs to work with USCI_I2C_Master sample code.
USCI_I2C_Slave_10bit	Demonstrate how to set USCI_I2C in 10-bit addressing slave mode to receive the data from a Master. This sample code needs to work with USCI_I2C_Master_10bit sample code.
USCI_I2C_Wakeup_Slave	Demonstrate how to set USCI_I2C to wake up MCU from Power-down mode. This sample code needs to work with

USCI_I2C_Master sample code.

Universal Serial Control Interface Controller - SPI Mode (USCI-SPI)

USCI_SPI_Loopback	Implement USCI_SPI0 master loop back transfer. This sample code needs to connect USCI_SPI0_MISO pin and USCI_SPI0_MOSI pin together. It will compare the received data with transmitted data.
USCI_SPI_MasterMode	Configure USCI_SPI0 as master mode and demonstrate how to communicate with an off-chip SPI Slave device. This sample code needs to work with USCI_SPI_SlaveMode sample code.
USCI_SPI_PDMA_LoopTest	Demonstrate SPI data transfer with PDMA. USCI_SPI0 will be configured as master mode and USCI_SPI1 will be configured as slave mode. Both Tx PDMA function and Rx PDMA function will be enabled.
USCI_SPI_SlaveMode	Configure USCI_SPI0 as slave mode and demonstrate how to communicate with an off-chip SPI master device. This sample code needs to work with USCI_SPI_MasterMode sample code.

Universal Serial Control Interface Controller - UART Mode (USCI-UART)

USCI_UART_AutoBaudRate	Show how to use auto baud rate detection function.
USCI_UART_Autoflow	Transmit and receive data with auto flow control.
USCI_UART_PDMA	This is a USCI_UART PDMA demo and needs to connect USCI_UART Tx and Rx.
USCI_UART_RS485	Transmit and receive data in RS485 mode.
USCI_UART_TxRxFunction	Transmit and receive data from PC terminal through RS232 interface.
USCI_UART_Wakeup	Show how to wake up system from Power-down mode by USCI interrupt in UART mode.

Watchdog Timer (WDT)

WDT_TimeoutWakeupAndReset	Implement WDT time-out interrupt event to wake up system and generate time-out reset system event while WDT time-out reset delay period expired.

Window Watchdog Timer (WWDT)

WWDT_CompareINT	Show how to reload the WWDT counter value.
WWDT_ReloadCounter	Demonstrate how to reload the WWDT counter value without resetting the MCU.

15 SampleCode\TrustZone

CSSD_LED	Demonstrate how to implement code for Collaborative Secure Software Development in both secure and non-secure code.
HardFault	Show the hard fault usages in both secure and non-secure code.
Template	Demonstrate how to implement code for secure and non-secure.

16 SampleCode\XOM

XOMLib	Demonstrate how to create XOM library.
XOMLibDemo	Demonstrate how to use XOMLib.

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