

Readme

APM32F4xx SDK

Rev: V1.5

1 Introduction

The Geehy Semiconductor APM32F4xx software development kit includes a series driver library, a group of example applications that demonstrate key peripheral functionality, and other development files.

Software development kit have a hierarchy as follows:

- SDK directory
 - * Boards
 - * Documents
 - * Examples
 - * Libraries
 - * Middlewares
 - * Package

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2 About SDK

2.1 SDK files

The complete SDK directory:

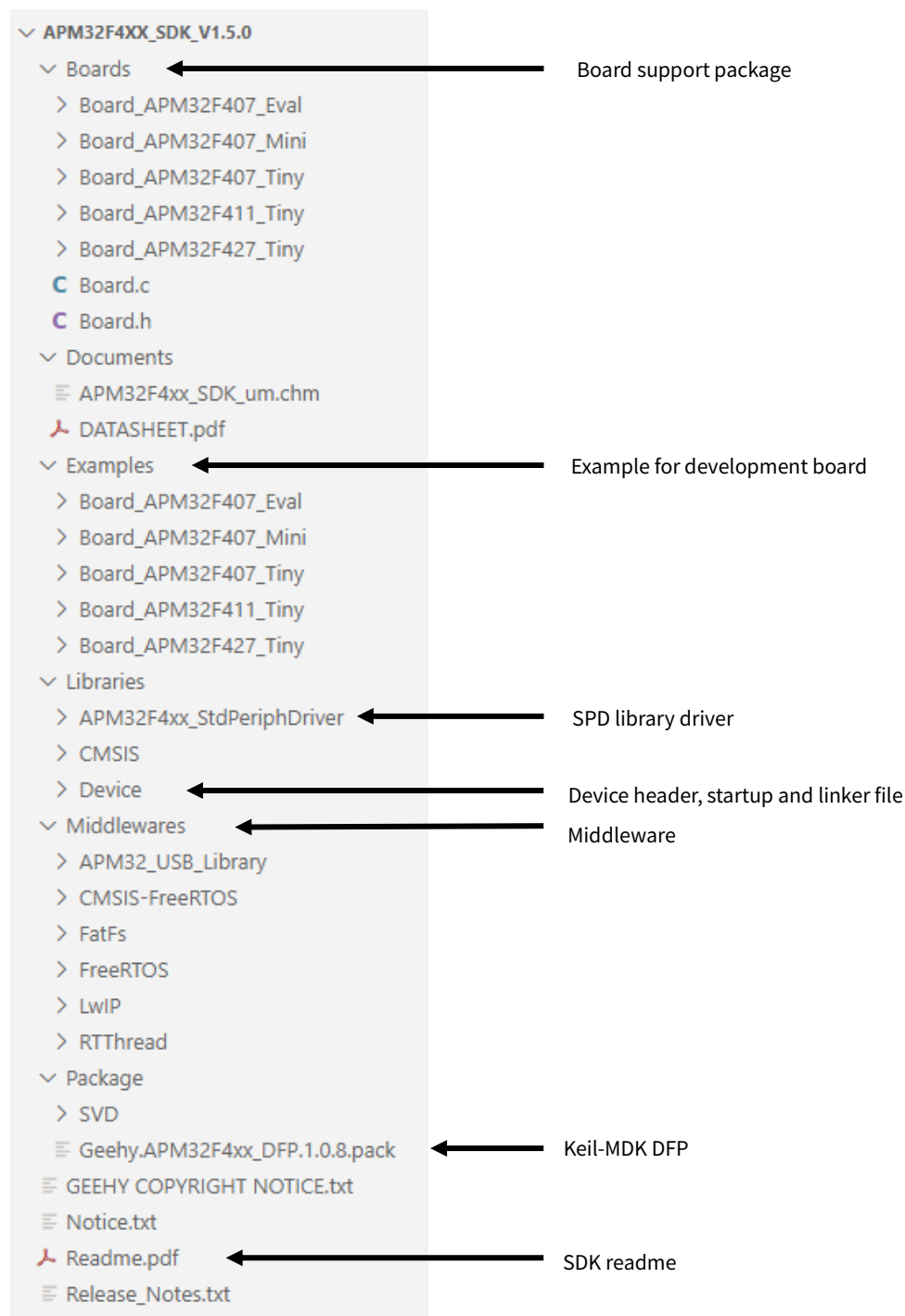


Figure 1 SDK of APM32F4xx

2.2 Devices supported by SPD drivers

Table 1 List of devices supported by SPD driver

IP / Module	APM32F405xx	APM32F407xx	APM32F415xx	APM32F417xx	APM32F411xx	APM32F425xx	APM32F427xx	NA	NA	NA
apm32f4xx_adc.c	√	√	√	√	√	√	√			
apm32f4xx_can.c	√	√	√	√	√	√	√			
apm32f4xx_comp.c					√					
apm32f4xx_crc.c	√	√	√	√	√	√	√			
apm32f4xx_cryp.c			√	√						
apm32f4xx_cryp_aes.c			√	√						
apm32f4xx_cryp_des.c			√	√						
apm32f4xx_cryp_tdes.c			√	√						
apm32f4xx_dac.c	√	√	√	√		√	√			
apm32f4xx_dbgmcu.c	√	√	√	√	√	√	√			
apm32f4xx_dci.c		√		√						
apm32f4xx_dma.c	√	√	√	√	√	√	√			
apm32f4xx_dmc.c		√		√		√	√			
apm32f4xx_eint.c	√	√	√	√	√	√	√			
apm32f4xx_eth.c		√		√		√	√			
apm32f4xx_fmc.c	√	√	√	√	√	√	√			
apm32f4xx_gpio.c	√	√	√	√	√	√	√			
apm32f4xx_hash.c			√	√						
apm32f4xx_hash_md5.c			√	√						
apm32f4xx_hash_sha1.c			√	√						
apm32f4xx_i2c.c	√	√	√	√	√	√	√			
apm32f4xx_iwdt.c	√	√	√	√	√	√	√			
apm32f4xx_misc.c	√	√	√	√	√	√	√			
apm32f4xx_pmu.c	√	√	√	√	√	√	√			
apm32f4xx_qspi.c					√	√	√			
apm32f4xx_rcm.c	√	√	√	√	√	√	√			
apm32f4xx_rng.c	√	√	√	√	√	√	√			
apm32f4xx_rtc.c	√	√	√	√	√	√	√			
apm32f4xx_sdio.c	√	√	√	√	√	√	√			
apm32f4xx_smc.c	√	√	√	√	√	√	√			
apm32f4xx_spi.c	√	√	√	√	√	√	√			
apm32f4xx_syscfg.c	√	√	√	√	√	√	√			

IP / Module	APM32F405xx	APM32F407xx	APM32F415xx	APM32F417xx	APM32F411xx	APM32F425xx	APM32F427xx	NA	NA	NA
apm32f4xx_tmr.c	√	√	√	√	√	√	√			
apm32f4xx_usart.c	√	√	√	√	√	√	√			
apm32f4xx_usb.c	√	√	√	√	√	√	√			
apm32f4xx_usb_device.c	√	√	√	√	√	√	√			
apm32f4xx_usb_host.c	√	√	√	√	√	√	√			
apm32f4xx_wwdt.c	√	√	√	√	√	√	√			

3 About Boards

The boards folder includes a board support package for APM32F4xx board. It can help drive the peripheral circuit or components on the board quickly. The BSP can be found in the ~/Boards directory.

The BSP provided are built for APM32F4xx board. For other user development board use, some minor modifications may be required.

Boards have a hierarchy as follows:

- * Board.c
- * Board.h
- Board_APM32F407_Eval folder
- Board_APM32F407_Mini folder
- Board_APM32F407_Tiny folder
- Board_APM32F411_Tiny folder
- Board_APM32F427_Tiny folder

4 **About Documents**

The documents folder includes a link file that can be redirected to the technical support center of Geehy semiconductor. The document can be found in the ~/Documents directory.

5 About Examples

The example applications can be found in the ~/Examples directory.

The examples provided are built for APM32F4xx xxx board. For other user development board use, some minor modifications may be required.

Example projects have a hierarchy as follows:

- Example folder
 - * Include
 - * Project
 - Eclipse
 - IAR
 - MDK
 - * Source

All example applications tested with: **APM32F4xx StdPeriphDriver V1.0.4**, include the following examples:

Table 2 List of examples supported for evaluation board

IP / Module	Example	APM32F407_MINI	APM32F407_TINY	APM32F407_EVAL	APM32F411_TINY	APM32F427_TINY	NA	NA	NA	NA
ADC	ADC_AnalogWindowWatchdog	√	√		√	√				
	ADC_ContinuousConversion	√	√		√	√				
	ADC_DualInterleavedMode	√	√			√				
	ADC_DualRegulSimulMode	√	√			√				
	ADC_MultiChannelScan	√	√		√	√				
	ADC_Tsensor	√	√		√	√				
	ADC_TripleInterleavedMode	√	√			√				
	ADC_DMA	√	√		√	√				
	ADC_VBAT	√	√		√	√				
	ADC_ContinuousConversionADC2				√					
CAN	CAN_LoopBack	√	√	√	√	√				

IP / Module	Example	APM32F407_MINI	APM32F407_TINY	APM32F407_EVAL	APM32F411_TINY	APM32F427_TINY	NA	NA	NA	NA
	CAN_Normal	√	√	√	√	√				
CRC	CRC_Calculation	√	√		√	√				
COMP	COMP_PWMBreak				√					
	COMP_WindowComparator				√					
CRYP	CRYP_AES	√								
	CRYP_DES-TDES	√								
DAC	DAC_ADC	√	√			√				
DCI	DCI_OV2640	√		√						
DMC	DMC_SDRAM			√						
DMA	DMA_ADC	√	√			√				
	DMA_FIFOMode	√	√		√					
	DMA_FMCToRAM	√	√		√	√				
DSP	DSP_bayes	√								
	DSP_class_marks	√								
	DSP_convolution	√								
	DSP_dotproduct	√								
	DSP_fft_bin	√								
	DSP_fir	√								
	DSP_graphic_equalizer	√								
	DSP_linear_interp	√								
	DSP_matrix	√								
	DSP_signal_converge	√								
	DSP_sin_cos	√								
	DSP_svm	√								
	DSP_Template	√								
	DSP_variance	√								
EINT	EINT_Config	√	√		√	√				
ETH	ETH_Ping		√	√		√				

IP / Module	Example	APM32F407_MINI	APM32F407_TINY	APM32F407_EVAL	APM32F411_TINY	APM32F427_TINY	NA	NA	NA	NA
	ETH_TCP_client		√	√		√				
	ETH_TCP_server		√	√		√				
FMC	Flash_Emulation_Eeprom	√	√							
	FMC_Write	√	√		√	√				
GPIO	GPIO_Toggle	√	√		√	√				
HASH	HASH_SHA1	√								
I2C	I2C_TwoBoards_Master	√	√		√					
	I2C_TwoBoards_Slave	√	√		√					
	I2C_TwoBoardsPolling					√				
	I2C_EEPROM		√							
IAP	Application1	√	√		√	√				
	Application2	√	√		√	√				
	Bootloader	√	√		√	√				
I2S	I2S_Interrupt	√	√		√					
IWDT	IWDT_Reset	√	√		√	√				
NVIC	NVIC_Priority	√	√		√	√				
	NVIC_WFI	√	√		√	√				
LCD	LCD_ShowFigure			√						
	LCD_TOUCH			√						
PMU	PMU_BOR	√	√			√				
	PMU_Consumption	√	√		√	√				
	PMU_PVD	√	√			√				
	PMU_STANDBY	√	√		√	√				
	PMU_STOP	√	√		√	√				
QSPI	QSPI_ReadWrite				√	√				
	QSPI_ReadWriteDMA				√	√				
	QSPI_ReadWriteInterrupt				√	√				
RCM	RCM_ClockConfig	√	√		√	√				

IP / Module	Example	APM32F407_MINI	APM32F407_TINY	APM32F407_EVAL	APM32F411_TINY	APM32F427_TINY	NA	NA	NA	NA
RNG	RNG_MultiRNG	√	√		√	√				
RTC	RTC_Alarm	√	√	√	√	√				
	RTC_Calendar			√						
RTOS	FreeRTOS	√			√					
	RT-thread	√	√		√					
	CMSIS_FreeRTOS		√			√				
	CMSIS_RTX		√			√				
SDIO	SDIO_SDCard	√		√	√	√				
SPI	SPI_FullDuplex	√	√	√	√	√				
	SPI_Flash			√						
Template	Template	√	√	√	√	√				
TMR	TMR_6Steps	√	√		√	√				
	TMR_32BitCount	√	√			√				
	TMR_CascadeSynchro	√	√		√	√				
	TMR_EncoderInterface	√	√		√	√				
	TMR_ExtTriggerSynchro	√	√		√	√				
	TMR_InputCapture	√	√		√	√				
	TMR_OCActive	√	√		√	√				
	TMR_OCInactive	√	√		√	√				
	TMR_OCToggle	√	√		√	√				
	TMR_ParallelSynchro	√	√		√	√				
	TMR_PWMInput	√	√		√	√				
	TMR_PWMOutput	√	√		√	√				
	TMR_SinglePulse	√	√		√	√				
	TMR_TimeBase	√	√		√	√				
	TMR_TMR1DMABurst	√	√		√	√				
	TMR_TMR1PWMOutput	√	√		√	√				

IP / Module	Example	APM32F407_MINI	APM32F407_TINY	APM32F407_EVAL	APM32F411_TINY	APM32F427_TINY	NA	NA	NA	NA
	TMR_TMR1Synchro	√	√		√	√				
	TMR_TMR2PWMOutput	√	√		√	√				
	TMR_TMR8DMA	√	√		√	√				
	TMR_TMR9OCToggle	√	√			√				
	TMR_TMR11PWMOutput	√	√			√				
USART	USART_IrDA	√				√				
	USART_LIN	√				√				
	USART_Printf	√				√				
	USART_Smartcard	√				√				
	USART_TwoBoardsDMA	√	√		√	√				
	USART_TwoBoardsInterrupt	√	√		√	√				
	USART_TwoBoardsPolling	√	√		√	√				
	USART_Interrupt			√						
	USART_Polling			√						
	USART_RS485			√						
OTG FS	OTGD_CDC	√		√	√	√				
	OTGD_Custom_HID	√			√	√				
	OTGD_Custom_HID_Keyboard	√		√	√	√				
	OTGD_HID	√		√	√	√				
	OTGD_HID_Keyboard	√		√	√	√				
	OTGD_HID_WakeUp_LowPower	√			√	√				
	OTGD_MSC	√		√	√	√				
	OTGD_MSC_LowPower	√			√	√				
	OTGD_MSC_NorFlash			√						
	OTGD_MSC_SDCard			√						
	OTGD_WINUSB	√		√	√	√				
	OTGD_Composite_CDC	√			√	√				
	OTGD_Composite_CDC_HID	√			√	√				

IP / Module	Example	APM32F407_MINI	APM32F407_TINY	APM32F407_EVAL	APM32F411_TINY	APM32F427_TINY	NA	NA	NA	NA
	OTGD_Composite_CDC_MSC	√			√	√				
	OTGD_Composite_CDC_WINUSB	√			√	√				
	OTGD_Composite_HID_MSC	√			√	√				
	OTGD_Composite_HID_WINUSB	√			√	√				
	OTGD_Composite_MSC_WINUSB	√			√	√				
	OTGD_Composite_WINUSB	√			√	√				
	OTGH_CDC	√			√	√				
	OTGH_DynamicSwitch	√			√	√				
	OTGH_HID	√			√	√				
	OTGH_MSC	√			√	√				
	OTGH_MSC_FWUpgrade	√			√	√				
OTG FS2	OTGD_CDC_FS2					√				
	OTGD_HID_WakeUp_LowPower_FS2					√				
	OTGH_CDC_FS2					√				
OTG HS1	OTGD_MSC_HS1	√								
	OTGD_MSC_HS_IN_FS		√							
	OTGH_HID_HS1	√								
OTG HS2	OTGD_MSC_NorFlash_HS2			√						
	OTGD_MSC_SDCard_HS2			√						
	OTGD_CDC_HS2		√							
	OTGD_Composite_CDC_HID_HS2		√							
	OTGD_Composite_CDC_HS2		√							
	OTGD_Composite_CDC_MSC_HS2		√							
	OTGD_Composite_CDC_WINUSB_HS2		√							
	OTGD_Composite_HID_MSC_HS2		√							
	OTGD_Composite_HID_WINUSB_HS2		√							

IP / Module	Example	APM32F407_MINI	APM32F407_TINY	APM32F407_EVAL	APM32F411_TINY	APM32F427_TINY	NA	NA	NA	NA
	OTGD_Composite_MSC_WINUSB_HS2		√							
	OTGD_Composite_WINUSB_HS2		√							
	OTGD_Custom_HID_Keyboard_HS2		√							
	OTGD_HID_HS2		√							
	OTGD_HID_LowPower_HS2		√							
	OTGD_MSC_HS2		√							
	OTGD_WINUSB_HS2		√							
	OTGH_CDC_HS2		√	√						
	OTGH_HID_HS2		√	√						
	OTGH_MSC_HS2		√	√						
DRD	DRD_MSC_CDC_DualCore			√						
Dual Core	MSC_CDC_DualCore			√						
	OTGD_CDC_DualCore			√						
WWDT	WWDT_OverTime	√	√		√	√				

6 About Libraries

The libraries folder includes a series library. It can provide supports for APM32F4xx MCU such as device support and standard peripheral etc. The libraries can be found in the ~/Libraries directory.

APM32F4xx MCU include following library:

- Libraries folder
 - * APM32F4xx_StdPeriphDriver
 - * CMSIS
 - * Device

7 About Middlewares

The middlewares folder includes a series third-party middleware. The middlewares can be found in the ~/Middlewares directory.

The middlewares used by APM32F4xx include following:

- Middlewares folder
 - * APM32_USB_Library
 - * FatFs
 - * CMSIS-FreeRTOS
 - * FreeRTOS
 - * lwip
 - * RTThread

8 About Package

The Package folder includes Geehy APM32F4xx DFP Package. The Package can be found in the ~/Package directory.

The package used by APM32F4xx include following:

- Package folder
 - * SVD
 - * Geehy.APM32F4xx_DFP.1.0.8.pack

9 Revision History

Table 1 File Revision History

Date	Rev	Description
2021.09.25	1.0	First Release version of APM32F4xx SDK
2022.02.20	1.1	Add descriptions of SDIO and DCI examples
2022.06.23	1.2	Add descriptions of DSP, IAP, TMR and ADC examples
2023.03.01	1.3	Add descriptions of PMU, USART and USB_OTG examples
2023.07.31	1.4	Add descriptions of COMP, QSPI and Custom HID examples
2025.04.15	1.5	Changed the example content layout to add information about the APM32F427 tiny board

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8. Scope of Application

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