Readme

APM32F035 SDK

Rev：V1.1

1 Introduction

The Geehy Semiconductor APM32F035 MINI board 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 boards

The boards folder includes a board support package for APM32F035 MINI 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 APM32F035 MINI board compatibility. For other user development board use, some minor modifications may be required.

Boards have a hierarchy as follows:

- Boards folder
  - Board folder
    - inc
    - src
  - board.c
  - board.h

Board APM32F035 MINI include following board support package:

- Board_ APM32F035_ MINI src folder
  - board_apm32f035_mini
  - bsp_delay

3 About documents

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

4 About examples

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

The examples provided are built for APM32F035 MINI board compatibility. For other user development board use, some minor modifications may be required.

Example projects have a hierarchy as follows:

- Example folder
  - Include
  - Project
    - IAR
    - MDK
    - ECLIPSE
  - Source

All example applications tested with: **APM32F035 StdPeriphDriver v1.0.1**, include the following examples:

- Examples
  - ADC
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    - ADC_ContinuousConversion
    - ADC_MultiChannelScan
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4.1 ADC_AnalogWindowWatchdog

4.1.1 Example Description

This example describes how to use the ADC analog window watchdog to monitor the voltage of ADC Channel 4.

The converted voltage is displayed on serial assistant through USART1.

4.1.2 Directory contents

This example can be found in the ~ /Examples/ADC/ADC_AnalogWindowWatchdog directory.

4.2 ADC_ContinuousConversion

4.2.1 Example Description

This example describes how to use the ADC to convert continuously the voltage

applied to the ADC Channel 4 input.

The converted voltage is displayed on serial assistant through USART1.

4.2.2 Directory contents

This example can be found in the ~ /Examples/ADC/ADC_ContinuousConversion directory.

4.3 ADC_MultiChannelScan

4.3.1 Example Description

This example describes how to use the ADC to scan continuously the voltage

applied to the ADC Channel 0 and ADC Channel 1 and ADC Channel 2 input.

The converted voltage is displayed on serial assistant through USART1.

4.3.2 Directory contents

This example can be found in the ~ /Examples/ADC/ADC_MultiChannelScan directory.

4.4 ADC_SeqSectionSampling

4.4.1 Example Description

This example describes how to use the ADC to sequence sampling in subsection mode.

Every subsection will be sampled by different TGRO. The interval time of TGRO should not be too short.

4.4.2 Directory contents

This example can be found in the ~ /Examples/ADC/ADC_SeqSectionSampling directory.

4.5 ADC_TMRTrigger

4.5.1 Example Description

This example describes how to use the TMR to trigger the ADC conversion.

When power up, TMR1 is configured in PWM mode, the TMR1 CC4 event is used to trigger the ADC.

The ADC is configured to convert continuously the ADC channel 4.

The converted voltage is displayed on serial assistant through USART1.

4.5.2 Directory contents

This example can be found in the ~ /Examples/ADC/ADC_TMRTrigger directory.

4.6 ADC_VREF

4.6.1 Example Description

This example describes how to use the ADC to convert VREF voltage applied to the ADC Channel 17.

4.6.2 Directory contents

This example can be found in the ~ /Examples/ADC/ADC_VREF directory.

4.7 CAN_LoopBack

4.7.1 Example Description

This example describes how to configure a communication the CAN in loopback mode. CAN transmit a message to self. Then compare the received message with transmitted message. The LED2 turns on while the message is consistent, otherwise LED3 turns on.

4.7.2 Directory contents

This example can be found in the ~ /Examples/CAN/CAN_LoopBack directory.

4.8 COMP_PWMSignalControl

4.8.1 Example Description

This example shows how to use the comparator. COMP2 non-inverting input connect to PA5. And COMP2 inverting input is internally connected to VREFINT(1.22V) which is used to compare with PA5 input.

4.8.2 Directory contents

This example can be found in the ~ /Examples/COMP/COMP_PWMSignalControl directory.

4.9 CRC_CalcMessage

4.9.1 Example Description

Write the calculated data to CRC DATA register and get the calculated result.

The computer of serial debugging assistant can display the corresponding information for computed CRC.

4.9.2 Directory contents

This example can be found in the ~ /Examples/CRC/CRC_CalcMessage directory.

4.10 DMA_ADC

4.10.1 Example Description

This example provides an example of how to use a DMA channel to transfer continuously a data from a peripheral (ADC1) to DMA transfer.

4.10.2 Directory contents

This example can be found in the ~ /Examples/DMA/DMA_ADC directory.

4.11 DMA_MemoryToMemory

4.11.1 Example Description

This example shows how to configure the DMA peripheral to transmit data from memory to memory. After system reset, data transmit form one group to another through DMA. If the data received is equal to the data send, LED2 will light, otherwise, LED3 will light.

4.11.2 Directory contents

This example can be found in the ~ /Examples/DMA/DMA_MemoryToMemory directory.

4.12 DMA_USART

4.12.1 Example Description

This example provides a basic communication between USART1 and USART2 using DMA capability.

4.12.2 Directory contents

This example can be found in the ~ /Examples/DMA/DMA_USART directory.

4.13 EINT

4.13.1 Example Description

This example shows how to configure external interrupt lines. In this example, 2 EINT lines (KEY1、KEY2) when using the APM32F035 MINI BOARD are configured to generate an interrupt on each falling edge. In the interrupt routine a led connected to a specific GPIO pin is toggled.

4.13.2 Directory contents

This example can be found in the ~ /Examples/EINT/EINT directory.

4.14 FMC_LowPowerReset

4.14.1 Example Description

This example provides a description of how to enable low power reset by FMC of APM32F035.

The phenomenon displayed on serial assistant through USART1.

4.14.2 Directory contents

This example can be found in the ~ /Examples/FMC/FMC_LowPowerReset directory.

4.15 FMC_Write

4.15.1 Example Description

This example provides a description of how to program the flash address of APM32F035.

After Reset, the Flash will unlock. Then erase the specifies address and write a data in the address. In the end, lock the flash. The data of the address after erasing and programing will be displayed on serial assistant through USART1.

4.15.2 Directory contents

This example can be found in the ~ /Examples/FMC/FMC_Write directory.

4.16 GPIO_Toggle

4.16.1 Example Description

This example describes how to use DOUT for toggling IO. The IO of LED2 and LED3 is configured to toggle constantly. The phenomenon of LED2 and LED3 constantly flickered alternately.

4.16.2 Directory contents

This example can be found in the ~ /Examples/GPIO/GPIO_Toggle directory.

4.17 I2C_TwoBoards

4.17.1 Example Description

This example shows how to control I2C devices and communicate between two different boards.

To use this example, you need to load the same software into two APM32F035 boards(let's call them Board master and Board Slave) then connect these two boards through I2C lines and GND.

4.17.2 Directory contents

This example can be found in the ~ /Examples/I2C/I2C_TwoBoards directory.

4.18 I2S_TwoBoards

4.18.1 Example Description

This example provides a small application in which system sends and receives data by polling though using I2S firmware library. All received information will be displayed by serial assistant.

To use this example, you need to load it on two APM32F035 boards (let's call them Board master and Board slave). Then connect these two boards through I2S lines and must master and slave connect

to the same GND.

4.18.2 Directory contents

This example can be found in the ~ /Examples/I2S/I2S_TwoBoards directory.

4.19 IAP_Application1

4.19.1 Example Description

This example shows how to generate a APP firmware to IAP.

4.19.2 Directory contents

This example can be found in the ~ /Examples/IAP/IAP_Application1 directory.

4.20 IAP_Application2

4.20.1 Example Description

This example shows how to generate a APP firmware to IAP.

4.20.2 Directory contents

This example can be found in the ~ /Examples/IAP/IAP_Application2 directory.

4.21 IAP_BootLoader_USART

4.21.1 Example Description

The example aim to show how to configure a bootloader firmware to IAP. When device connets to HyperTerminal right, a usart menu will show to user.

4.21.2 Directory contents

This example can be found in the ~ /Examples/IAP/IAP_BootLoader_USART directory.

4.22 IAP_BootLoader_SPI

4.22.1 Example Description

The example aim to show how to configure a bootloader firmware to IAP. When device connets to HyperTerminal by SPI, a menu will show to user.

4.22.2 Directory contents

This example can be found in the ~ /Examples/IAP/IAP_BootLoader_SPI directory.

4.23 IAP_BootLoader_I2C

4.23.1 Example Description

The example aim to show how to configure a bootloader firmware to IAP. When device connets to HyperTerminal by I2C, a menu will show to user.

4.23.2 Directory contents

This example can be found in the ~ /Examples/IAP/IAP_BootLoader_I2C directory.

4.24 IWDT_FeedDog

4.24.1 Example Description

The example aims to show how to configure IWDT and feed dog to prevent a system reset. After IWDT initializes, System enters into infinite loop and feed dog within one second to prevent system reset. In the loop, System will output information to serial assistant to display system status.

4.24.2 Directory contents

This example can be found in the ~ /Examples/IWDT/IWDT_FeedDog directory.

4.25 IWDT_FeedDog_Window

4.25.1 Example Description

The example aims to show how to update the IWDG reload counter at special window period After IWDT initializes, System enters into infinite loop and resets when feeding dog not in window period. In the same time, System will output information to serial assistant to display system status.

4.25.2 Directory contents

This example can be found in the ~ /Examples/IWDT/IWDT_FeedDog_Window directory.

4.26 M0CP_Atan2

4.26.1 Example Description

This example shows how to use M0CP peripheral to complete CORDIC vector atan2 operation. Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.26.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_Atan2 directory.

4.27 M0CP_Cos

4.27.1 Example Description

This example shows how to use M0CP peripheral to complete CORDIC rotate cos(x) operation. Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.27.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_Cos directory.

4.28 M0CP_CounterSVPWM

4.28.1 Example Description

This example shows how to use M0CP peripheral to complete SVPWM counter output operation and use TMR peripheral to output SVPWM.

Press KEY1 to start test.

4.28.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_CounterSVPWM directory.

4.29 M0CP_DivSigned

4.29.1 Example Description

This example shows how to use M0CP peripheral to complete division signed operation.

Press KEY1 to start test. If operation is done, USART1 peripheral will print operational information.

4.29.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_DivSigned directory.

4.30 M0CP_DivUnsigned

4.30.1 Example Description

This example shows how to use M0CP peripheral to complete division unsigned operation.

Press KEY1 to start test. If operation is done, USART1 peripheral will print operational information.

4.30.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_DivUnsigned directory.

4.31 M0CP_DutySVPWM

4.31.1 Example Description

This example shows how to use M0CP peripheral to complete SVPWM duty output operation.

Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.31.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_DutySVPWM directory.

4.32 M0CP_RotateCORDIC

4.32.1 Example Description

This example shows how to use M0CP peripheral to complete CORDIC rotate operation.

Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.32.2 Directory contents

This example can be found in the ~ /Examples//M0CP_RotateCORDIC directory.

4.33 M0CP_Sin

4.33.1 Example Description

This example shows how to use M0CP peripheral to complete CORDIC rotate sin(x) operation.

Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.33.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_Sin directory.

4.34 M0CP_SquareRoot

4.34.1 Example Description

This example shows how to use M0CP peripheral to complete square root operation using M0CP interrupt.

Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.34.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_SquareRoot directory.

4.35 M0CP_VectorCORDIC_X

4.35.1 Example Description

This example shows how to use M0CP peripheral to complete CORDIC vector operation.

Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.35.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_VectorCORDIC_X directory.

4.36 M0CP_VectorCORDIC_Z

4.36.1 Example Description

This example shows how to use M0CP peripheral to complete CORDIC vector operation.

Press KEY1 to start test. If operation is done, USART1 peripheral will print information.

4.36.2 Directory contents

This example can be found in the ~ /Examples/M0CP/M0CP_VectorCORDIC_Z directory.

4.37 NVIC_WFI

4.37.1 Example Description

This example describes how to use WFI event to enter sleep mode and wake up using external interrupt.

4.37.2 Directory contents

This example can be found in the ~ /Examples/NVIC/NVIC_WFI directory.

4.38 OPA_DualAmpExternalGain

4.38.1 Example Description

This example describes how to use the OPA to amplifying the input voltage. The OPA3 and OPA4 uses external resistor network configuration.

4.38.2 Directory contents

This example can be found in the ~ /Examples/OPA/OPA_DualAmpExternalGain directory.

4.39 OPA_DualAmpInternalGain

4.39.1 Example Description

This example describes how to use the OPA to amplifying the input voltage. The OPA1 uses external resistor network configuration, and OPA2 uses internal gain and is set to 2.

4.39.2 Directory contents

This example can be found in the ~ /Examples/OPA/OPA_DualAmpInternalGain directory.

4.40 PMU_WakeUp

4.40.1 Example Description

This example shows how to enter the system by external interrupt to

- STANDBY mode and wake-up from this mode either with the RESET or give PC13 a falling edge to recover.

- SLEEP mode and wake-up from this mode either with the RESET or give PA6 a falling edge to recover.

- STOP mode and wake-up from this mode with the RESET.

4.40.2 Directory contents

This example can be found in the ~ /Examples/PMU/PMU_WakeUp directory.

4.41 RCM_ClockSwitch

4.41.1 Example Description

This example shows how to:

- Configure the PLL (clocked by HSE as System clock source）

- Configure HSI as System clock source

- Configure HSE as System clock source

- Output the System clock on MCO pin

4.41.2 Directory contents

This example can be found in the ~ /Examples/RCM/RCM_ClockSwitch directory.

4.42 RTC_Alarm

4.42.1 Example Description

This example shows how to configure RTC and ALARM.

4.42.2 Directory contents

This example can be found in the ~ /Examples/RTC/RTC_Alarm directory.

4.43 RTC_Calendar

4.43.1 Example Description

This example shows how to:

- Using RTC to set the system time and date.

- recover system time from reset state by using RTC_WriteBackup and RTC_ReadBackup function.

4.43.2 Directory contents

This example can be found in the ~ /Examples/RTC/RTC_Calendar directory.

4.44 RTC_Stamp

4.44.1 Example Description

This example shows how to write/read data to/from RTC Backup data registers and demonstrates the Tamper detection feature.

4.44.2 Directory contents

This example can be found in the ~ /Examples/RTC/RTC_Stamp directory.

4.45 SPI_FullDuplex

4.45.1 Example Description

This demo is based on the APM32F035 board. It shows how to use SPI peripheral. by making a master/slave full duplex communication between the SPI and the UART2. The phenomenon of serial assistant can display information from USART1.

4.45.2 Directory contents

This example can be found in the ~ /Examples/SPI/SPI_FullDuplex directory.

4.46 SPI_TwoBoards

4.46.1 Example Description

This example provides a small application in which system sends and receives data by polling though using SPI firmware library. All received information will be displayed by serial assistant.

4.46.2 Directory contents

This example can be found in the ~ /Examples/SPI/SPI_TwoBoards directory.

4.47 SysTick

4.47.1 Example Description

This example shows how to configure the SysTick to generate a time base equal to 1 ms. The system clock is set to 8 MHz, the SysTick is clocked by the HSE clock.

4.47.2 Directory contents

This example can be found in the ~ /Examples/SysTick/SysTick directory.

4.48 Template

4.48.1 Example Description

This demo is based on the APM32F035 mini board. It provides a template project.

4.48.2 Directory contents

This example can be found in the ~ /Examples/Template/Template directory.

4.49 TMR_ComplementaryOutput

4.49.1 Example Description

This example shows how to configure the TMR1 peripheral to generate complementary TMR1 signals, to insert a defined dead time value.

4.49.2 Directory contents

This example can be found in the ~ /Examples/TMR/TMR_ComplementaryOutput directory.

4.50 TMR_InputCapture

4.50.1 Example Description

This example shows how to configure the TMR1 peripheral to capture the internal clock source from pin MCO. The result will be displayed on serial assistant through USART2.

4.50.2 Directory contents

This example can be found in the ~ /Examples/TMR/TMR_InputCapture directory.

4.51 TMR_ManualPWMOutput

4.51.1 Example Description

This example shows how to configure the TIM1 peripheral to Manual control of the PWM output. The TMR1 waveform can be displayed using an oscilloscope.

4.51.2 Directory contents

This example can be found in the ~ /Examples/TMR/TMR_ManualPWMOutput directory.

4.52 TMR_PWMOutput

4.52.1 Example Description

This example shows how to configure the TIM1 peripheral to generate PWM signals with different duty cycles. The TMR1 waveform can be displayed using an oscilloscope.

4.52.2 Directory contents

This example can be found in the ~ /Examples/TMR/TMR_PWMOutput directory.

4.53 TMR_SinglePulse

4.53.1 Example Description

This example shows how to use the TMR peripheral to generate a One pulse Mode after a falling edge of an external signal is received in Timer Input pin.

The TIM3 waveform can be displayed using an oscilloscope.

4.53.2 Directory contents

This example can be found in the ~ /Examples/TMR/TMR_SinglePulse directory.

4.54 TMR_SynchronizationWithTMR1

4.54.1 Example Description

This example shows how to synchronize TMR peripherals in cascade mode, two timers TIM1 and TIM3 are used.

4.54.2 Directory contents

This example can be found in the ~ /Examples/TMR/TMR_SynchronizationWithTMR1 directory.

4.55 USART_Interrupt

4.55.1 Example Description

Through The computer of serial debugging assistant, display the message sent and received between the MCU and USART1.

4.55.2 Directory contents

This example can be found in the ~ /Examples/USART/USART_Interrupt directory.

4.56 USART_Polling

4.56.1 Example Description

The phenomenon of data interaction process can be displayed using serial assistant.

4.56.2 Directory contents

This example can be found in the ~ /Examples/USART/USART_Polling directory.

4.57 WWDT_OverTime

4.57.1 Example Description

This example aims to show how to use WWDT.

If is_OverTime = 0, System would not reset for feeding dog timely. LED2 Toggle.

If is_OverTime = 1, System will reset. LED3 ON.

4.57.2 Directory contents

This example can be found in the ~ /Examples/WWDT/WWDT_OverTime directory.

5 About libraries

The libraries folder includes a series library. It can provide supports for APM32F035 MCU such as device support and standard peripheral. The libraries can be found in the ~/Libraries directory.

APM32F035 MCU include following library:

- Libraries folder
  - APM32F035_StdPeriphDriver
  - CMSIS
  - Device

6 About Package

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

The middlewares used by APM32F035 MINI include following:

- Package folder
  - Geehy.APM32F035_DFP.1.0.1.pack

7 About IDE

The IDE version numbers used in the examples are as follows：

- MDK V5.36
- IAR V8.50.5.26295
- ECLIPSE V4.24

8 Revision History

Table 1 File Revision History

Date	Rev	Description
2022.09.30	1.0	First Release version of APM32F035 MINI SDK
2024.03.29	1.1	Add IAP example by I2C and SPI Add Eclipse project

Statement

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8. Scope of Application

The information in this document replaces the information provided in all previous versions of the document.

Geehy Semiconductor Co.,Ltd.
Bldg.1, No.83 Guangwan Street, Zhuhai, Guangdong, China +86 0756 6299999 www.geehy.com