MS32C001B series
32-bit ARM® Cortex®-M0+ microcontroller

HAL Library Sample Manual

1 ADC

1.1 ADC_AnalogWatchdog

此样例演示了 ADC 的模拟看门狗监控通道 6(PA0)的功能,当电压值超过上下限时,会进入看门狗中断,在中断中打开 LED。

This example demonstrates the function of the ADC's analog watchdog monitoring channel 6 (PA0). When the voltage value exceeds the upper or lower limit, it will enter the watchdog interrupt, and in the interrupt, the LED will be turned on.

1.2 ADC_MulChannels

此样例演示了 ADC 的多通道转换功能。

This example demonstrates the multi-channel conversion function of ADC.

1.3 ADC_SingleConversion_TriggerTimer_IT

此样例演示了 ADC 的 TIM 触发功能，TIM 每隔 1s 触发 ADC 进行采样，并通过串口打印出来。

This example demonstrates the TIM triggering function of ADC. TIM triggers ADC for sampling every 1 second and prints it out through the serial port.

1.4 ADC_Temperature

此样例演示了 ADC 模块的 Tempsensor 功能，并通过串口打印出温度值。

This example demonstrates the Tempsensor function of the ADC module and prints the temperature value through the serial port.

1.5 ADC_Vrefbuf

此样例演示了 ADC 模块的 Vrefbuf 功能，利用 vrefbuf 作为基准去采样通道 6(PA0)的值，并转换成电压通过串口打印出来。

This example demonstrates the Vrefbuf function of the ADC module, which uses Vrefbuf as the reference to sample channel 6(PA0) values and convert them into voltage Print it out through the serial port.

1.6 ADC_Vrefint

此样例演示了 ADC 的 Vrefint 功能，通过 Vrefint 的值，可以反推出 MCU 的供电电压值。

This example demonstrates the Vrefint function of ADC. By using the value of Vrefint, the power supply voltage value of MCU can be inferred

2 EXTI

2.1 EXTI_ToggleLed_IT

此样例演示了 GPIO 外部中断功能，PA0 引脚上的每一个上升沿都会产生中断，中断函数中 LED 灯会翻转一次。

This example demonstrates the GPIO external interrupt function, where each rising edge on the PA0 pin generates an interrupt, and the LED light in the interrupt function flips once.

2.2 EXTI_WakeUp_Event

此样例演示了通过 PA6 引脚唤醒 MCU 的功能。下载程序并运行后，LED 灯处于常亮状态；按下用户按键后，LED 灯处于常暗状态，且 MCU 进入 STOP 模式；拉低 PA6 引脚后，MCU 唤醒，LED 灯处于闪烁状态。

This example demonstrates the function of waking up an MCU through the PA6 pin. After downloading the program and running it, the LED light is constantly on; After pressing the user button, the LED light is in a constant dark state and the MCU enters STOP mode; After pulling down the PA6 pin, the MCU wakes up and the LED light is in a flashing state.

3 FLASH

3.1 FLASH_PageEraseAndWrite

此样例演示了 flash page 擦除和 page 写功能。

This example demonstrates the flash page erase and page write functions.

3.2 FLASH_SectorEraseAndWrite

此样例演示了 flash sector 擦除和 page 写功能。

This example demonstrates the flash sector erase and page write functions.

4 GPIO

4.1 GPIO_FastIO

本样例主要展示 GPIO 的 FAST IO 输出功能。FAST IO 速度可以达到单周期翻转速度。

This sample demonstrates the FAST IO output functionality of GPIO. FAST IO speed can achieve single-cycle toggling speed.

4.2 GPIO_Toggle

此样例演示了 GPIO 输出模式，配置 LED 引脚为数字输出模式，并且每隔 250ms 翻转一次 LED 引脚电平，运行程序，可以看到 LED 灯以 2Hz 的频率闪烁。

This sample demonstrates GPIO output mode. It configures the LED pin as a digital output and toggles the LED pin level every 250ms. When the program runs, you can observe the LED blinking at a frequency of 2Hz.

5 IWDG

5.1 IWDG_Reset

此样例演示了 STK 板上的按键、LED 灯、打印等功能。

This example demonstrates how to use the button and LED on the STK board,and printf debug information.

6 LPTIM

6.1 LPTIM_Wakeup_WFE

此样例演示了 LPTIM 连续模式事件唤醒 STOP 模式。

This example demonstrates the LPTIM continuous mode event wake-up STOP mode.

6.2 LPTIM_Wakeup_WFI

此样例演示了 LPTIM 连续模式中断唤醒 STOP 模式。

This example demonstrates the LPTIM continuous mode interrupt wake-up STOP mode.

7 PWM

7.1 PWM_PWM

本例程输出 1 路 PWM，通道 1 的占空比为 20%，本例程周期为 8000000/50/200=800Hz

This sample outputs 1 channel PWM, the duty cycle of channel 1 is 20%.The period is 8000000/50/200=800Hz

8 PWR

8.1 PWR_DEEPSTOP_WFE

此样例演示了在 deep stop 模式下，使用 GPIO 事件唤醒。

This example demonstrates using GPIO event wake-up in deep stop mode.

8.2 PWR_PVD

此样例演示了 PVD 电压检测功能。当供电电压低于 3.0V 时，LED 会点亮，高于 3.0V 时，LED 灯会熄灭。

This sample demonstrates the PVD (Programmable Voltage Detector) voltage detection functionality. When the supply voltage is lower than 3.0V, the LED will light up. When the supply voltage is higher than 3.0V, the LED will turn off.

8.3 PWR_SLEEP_WFI

此样例演示了 sleep 模式下，GPIO 外部中断唤醒功能。

This sample demonstrates the GPIO external interrupt wake-up feature in sleep mode.

8.4 PWR_STOP_WFE

此样例演示了在 stop 模式下，使用 GPIO 事件唤醒。

This example demonstrates using GPIO event wake-up in stop mode.

8.5 PWR_STOP_WFI

此样例演示了在 stop 模式下，使用 GPIO 外部中断唤醒。

This example demonstrates using GPIO external interrupt wake-up in stop mode.

9 RCC

9.1 RCC_HSEBypassOutput

此样例演示了时钟输出功能，可输出 HSE 波形。

This example demonstrates the clock output function, which can output HSE waveforms.

9.2 RCC_HSIOutput

此样例配置系统时钟为 HSI，并通过 MCO（PB1）引脚输出。

This example configures the system clock as HSI and outputs it through the MCO (PB1) pin.

9.3 RCC_LSEOutput

此样例使能 LSE，并通过 MCO（PB1）引脚输出。

This sample enables LSE and outputs it on the MCO (PB1) pin.

9.4 RCC_LSIOutput

此样例使能 LSI，并通过 MCO（PB1）引脚输出。

This sample enables the LSI and is output via the MCO (PB1) pin.

10 TIM

10.1 TIM1_6Step

此样例是对高级定时器功能“六步 PWM 的产生”的演示，通过 systick 中断作为 COM commutation 事件的触发源，实现（无刷电机的）换向下表是换向步骤，比如第一步中的 CH1 和 CH3N 为 1，即设置打开这两个通道的 PWM 输出。

This sample demonstrates advanced timer function 'six-step PWM generation', systick interrupt as COM commutation event trigger source to achieve commutation (brushless motor). The following table shows the commutating steps. For example, CH1 and CH3N in the first step are set to 1, that mean the PWM output of these two channels is set to start

10.2 TIM1_ComplementarySignals_DeadTime

此样例实现了定时器的刹车功能，CH1 和 CH1N 互补 pwm 输出，接收到外部 IO 口的刹车信号（低电平）后，PWM 信号关闭，由于 BDTR.AOE 置位，所以刹车信号取消（高电平）后，继续 pwm 输出，此样例实现了死区功能。通过调整 OCxE,CCxP,OISx,CCxNE,CCxNP,OISxN 的配置，可实现刹车功能的各种应用

This sample demonstrates brake function of the timer,the CH1 and CH1N complementary pwm outputs.After receiving the brake signal (low level)from the external IO port, the PWM signal is turned off. Because BDTR.AOE is set, the pwm output continues after the brake signal is cancelled (high level). This example realizes the dead zone function. By adjusting the OCxE, CCxP, OISx, CCxNE, CCxNP, OISxN configuration, which can realize the brake function of a variety of applications

10.3 TIM1_ExternalClockMode1

此样例演示了 TIM1 的外部时钟模式 1 功能，选择 ETR 引脚作为外部时钟输入源，并使能更新中断，在中断中翻转 LED 灯

This sample demonstrates external clock mode 1 function of the TIM1.Select the ETR pin as the external clock input source and enable the update interrupt to flip the LED light in the interrupt.

10.4 TIM1_OnePulseOutput

此样例演示了 TIM1 的单脉冲模式，CH2 引脚上的上升沿，触发计数器开始计数，当计数值与 CCR1 匹配时，CH1 输出高电平，直到计数器溢出，CH1 再次输出低电平，计数器溢出后，定时器停止工作，本例程脉冲宽度计算（TIM1_ARR-TI1_CCR1)/CLK=（65535-16383）/8000000=6.144ms

This sample demonstrates the one pulse mode of TIM1.The rising edge on the CH2 pin triggers the counter to start counting. when the count value matches CCR1,CH1 outputs a high level. When the counter overflows ,CH1 outputs the low level again. After the counter overflows, the timer stops working. This example pulse width calculation (TIM1_ARR-TI1_CCR1)/CLK= (65,535-16383)/

8,000,000 =6.144ms

10.5 TIM1_PWM

本例程输出 4 路 PWM，通道 1 的占空比为 20%，通道 2 为 40%，通道 3 为 60%，通道 4 为 80%，本例程周期为 8000000/50/800=200Hz

This sample outputs 4 channels PWM, the duty cycle of channel 1 is 20%,channel 2 is 40%, channel 3 is 60%,channel 4 is 80%.The period is 8000000/50/800=200Hz

10.6 TIM1_Update_IT

此样例演示了在 TIM1 中基本计数功能，并使能了更新中断，每次重装 ARR 值时会产生一次更新中断，并在中断中翻转 LED 灯，LED 灯会以 5Hz 的频率进行翻转。

This sample demonstrates basic count function of the TIM1 and enable update interrupt.Each time an update interrupt is generated, the ARR value is reloaded and the LED light is toggled in the interrupt.The LED light is toggled at a frequency of 5Hz.

11 UART

11.1 UART_HyperTerminal_IT

此样例演示了 UART 的中断方式发送和接收数据，UART 配置为 115200，数据位 8，停止位 1，校验位 None,下载并运行程序后，打印提示信息，然后通过上位机下发 12 个数据，例如 0x1~0xC,则 MCU 会把接收到的数据再次发送到上位机，然后打印结束信息。

This example demonstrates how to use UART to send an amount of data in interrupt mode. UART configuration is 115200 baud rate, data bit 8, stop bit 1, check bit None. After download and run the program,Print the prompt message, and then send 12 data through the upper computer, such as 0x1~0xC, the MCU will send the received data to the upper computer again, Then print the end message.

11.2 UART_HyperTerminal_Polling

此样例演示了 UART 的轮询方式发送和接收数据，UART 配置为 115200，数据位 8，停止位 1，校验位 None,下载并运行程序后，打印提示信息，然后通过上位机下发 12 个数据，例如 0x1~0xC,则 MCU 会把接收到的数据再次发送到上位机，然后打印结束信息。

This example demonstrates how to use UART to send an amount of data in polling mode. UART configuration is 115200 baud rate, data bit 8, stop bit 1, check bit None. After download and run the program,Print the prompt message, and then send 12 data through the upper computer, such as 0x1~0xC, the MCU will send the received data to the upper computer again, Then print the end message.