



# **PY32T020 series**

## **32-bit ARM® Cortex®-M0+ microcontroller**

### **LL Library Sample Manual**

## 1 ADC

### 1.1 ADC\_MultichannelSwitch

此样例演示了 ADC 的多通道切换转换。

This example demonstrates the channel switching for an ADC.

### 1.2 ADC\_SingleConversion\_TriggerTimer\_AWD

此样例演示了 ADC 的模拟看门狗功能，当开启模拟看门狗通道的电压值超过上下限时，会进入看门狗中断。

This sample demonstrates the analog watchdog function of the ADC, which enters the watchdog interrupt when the voltage value of the channel that opens the analog watchdog exceeds the upper and lower limit.

### 1.3 ADC\_SingleConversion\_TriggerTimer\_IT

此样例演示了 ADC 的 TIM 触发和中断的功能。

This sample demonstrates the TIM trigger function and IT function of the ADC.

### 1.4 ADC\_SingleConversion\_TriggerTimer\_Polling

此样例演示了 ADC 的 TIM 触发和轮询的功能。

This sample demonstrates the TIM trigger function and polling function of the ADC.

### 1.5 ADC\_Temperature\_Init

此样例演示了 ADC 的 Tempsensor 功能。

This sample demonstrates the Tempsensor function of the ADC.

### 1.6 ADC\_VrefintAndVrefbuf\_Init

此样例演示了 ADC 的 VREFINT 采样功能和 VREFBUF 的功能，通过 VREFINT 推算出 VREFBUF 的电压。

This sample demonstrates the ADC's VREFINT sampling function and the VREFBUF function, which calculates the voltage of VREFBUF from VREFINT.



## 2 COMP

### 2.1 COMP\_CompareGpioVs1\_2VCC\_Polling\_Init

此样例演示了 COMP 比较器轮询功能，PA2 作为比较器负端输入，1/2VCCA 作为正端输入，通过调整 PA2 上的输入电压，当检测到比较器输出状态为高时，LED 灯亮，比较器输出状态为低时，LED 灯灭。

This sample demonstrates the COMP polling function, with PA2 as the negative comparator input and 1/2VCCA as the positive input. Adjust the input voltage on PA2, the LED will be on when the comparator output state is detected as high and be off when the comparator output state is low.

### 2.2 COMP\_CompareGpioVs1\_2VCC\_Window

此样例演示了 COMP 比较器的 window 功能，比较器 1 的 Plus 端用比较器 2 的 IO4(1/2VCCA)作为输入，PB1 作为比较器 1 负端输入，当 PB1 的电压值大于 1.65V 时,LED 灯灭，小于 1.65V 时,LED 灯亮。PA2 作为比较器 2 负端输入，当 PA2 的电压值大于 1.65V 时,PA4 拉低，小于 1.65V 时,PA4 拉高

This example demonstrates the window function of the COMP comparator. The Plus end of comparator 1 uses the IO4 (1/2VCCA) of comparator 2 as the input, and PB1 as the negative end input. When the voltage value of PB1 is greater than 1.65V, the LED light turns off, and when it is less than 1.65V, the LED light turns on. PA2 is input as the negative end of comparator 2, when the voltage value of PA2 is greater than 1.65V, the PA4 pull down, and when it is less than 1.65V, the PA4 pull up

### 2.3 COMP\_CompareGpioVs32\_64VCC\_WakeupFromStop

此样例演示了 COMP 比较器唤醒功能，PA0 作为比较器负端输入，32/64VCC 作为比较器正端输入，进入 stop 模式后，通过调整 PA0 上的输入电压，产生中断唤醒 stop 模式。

This example demonstrates the COMP comparator wake-up function, with PA0 as the negative input and 32/64VCC as the positive input of the comparator. After entering stop mode, the interrupt wake-up stop mode is generated by adjusting the input voltage on PA0.

## 3 CRC

### 3.1 CRC\_CalculateCheckValue

此样例演示了 CRC 校验功能，通过对一个数组里的数据进行校验，得到的校验值与理论校验值进行比较，相等则 LED 灯亮，否则 LED 灯熄灭。

This sample demonstrates the CRC checksum function. It performs a checksum on the data in an array and compares the calculated checksum with the expected checksum. If they are equal, the LED turns on; otherwise, the LED turns off.

## 4 EXTI

### 4.1 EXTI\_ToggleLed\_IT\_Init

此样例演示了 GPIO 外部中断功能，PA15 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, each rising edge on the PA15 pin will generate an interrupt, and the LED will toggle once in the interrupt handle function.

### 4.2 EXTI\_WakeUp\_Event

此样例演示了通过 PA5 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 PA5 引脚后，MCU 唤醒，LED 灯处于闪烁状态。

This sample demonstrates the function to wake up the MCU via the PA5 pin. After downloading the program and running, the LED remains on; After pressing the user button, the LED remains off, and the MCU enters the STOP mode; After pulling down the PA5 pin, the MCU wakes up and the LED light is toggling.

## 5 FLASH

### 5.1 FLASH\_OptionByteWrite\_Boot\_LoadFlash

此样例演示了修改启动模式从 LoadFlash 启动，并设置 LoadFlash 的大小为 3k。

This sample demonstrates modifying the boot mode to boot from LoadFlash and setting the size of LoadFlash to 3k.

### 5.2 FLASH\_OptionByteWrite\_RST

此样例演示了通过软件方式将 RESET 引脚改为普通 GPIO。

This example demonstrates changing the RESET pin to regular GPIO through software.

### 5.3 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.

### 5.4 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.

## 6 GPIO

### 6.1 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 function of GPIO, and the FAST IO speed can reach the single cycle toggled speed.

### 6.2 GPIO\_Toggle

此样例演示了 GPIO 输出模式，配置 LED 引脚(PA1,PA14)为数字输出模式，并且每隔 100ms 翻转一次 LED 引脚电平，运行程序，可以看到 LED 灯闪烁。

This sample demonstrates the GPIO output mode, configure the LED pin (PA1,PA14) as digital output mode and toggle the LED pin level every 100ms, run the program, you can see the LED toggle.

### 6.3 GPIO\_Toggle\_Init

此样例演示了 GPIO 输出模式，配置 LED 引脚(PA1,PA14)为数字输出模式，并且每隔 100ms 翻转一次 LED 引脚电平，运行程序，可以看到 LED 灯闪烁。

This sample demonstrates the GPIO output mode, configure the LED pin (PA1,PA14) as digital output mode and toggle the LED pin level every 100ms, run the program, you can see the LED toggle.



## 7 I2C

### 7.1 I2C\_TwoBoard\_CommunicationMaster\_IT\_Init

=====

样 例 使 用 说 明	Sample
Description=====	

=====此样例演示了 I2C 通过中断方式进行通讯, 主机先向从机发送 15byte 数据, 然后再接收从机发送的 15byte 数据;主机、从机接收数据成功后, 主机和从机板上的小灯处于“常亮”状态。

This sample demonstrates that I2C communicates with interrupt mode, the host first sends 15byte data to the slave, and then receives 15byte data from the slave. After the host and slave successfully receive data, the LEDs on the host and slave board are in the state of "steady on".

### 7.2 I2C\_TwoBoard\_CommunicationMaster\_Polling\_Init

此样例演示了 I2C 通过轮询方式进行通讯, 主机先向从机发送 15byte 数据, 然后再接收从机发送的 15byte 数据;主机、从机接收数据成功后, 主机和从机板上的小灯处于“常亮”状态。

This sample demonstrates that I2C communicates with polling mode, the host first sends 15byte data to the slave, and then receives 15byte data from the slave. After the host and slave successfully receive data, the LEDs on the host and slave board are in the state of "steady on".

### 7.3 I2C\_TwoBoard\_CommunicationSlave\_IT\_Init

此样例演示了 I2C 通过中断方式进行通讯, 主机先向从机发送 15byte 数据, 然后再接收从机发送的 15byte 数据;主机、从机接收数据成功后, 主机和从机板上的小灯处于“常亮”状态。

This sample demonstrates that I2C communicates with interrupt mode, the host first sends 15byte data to the slave, and then receives 15byte data from the slave. After the host and slave successfully receive data, the LEDs on the host and slave board are in the state of "steady on".

### 7.4 I2C\_TwoBoard\_MasterTxIndefiniteLengthData\_IT\_Init

此样例演示了通过中断方式, 主机发送不定长数据, 从机接收不定长数据。主机向从机发送 10 字节的数据 (0~9), 然后从机接收数据 (0~9) 并通过串口打印; 主机向从机发送 100 字节数据 (1~100), 然后从机接收数据 (1~100) 并通过串口打印; 主机向从机发送 10 字节的数据 (0~9), 然后从机接收数据 (0~9) 并通过串口打印。

This example demonstrates how the host sends variable length data and the slave receives variable length data through interrupt mode. The host sends 10 bytes of data (0-9) to the slave, and then the slave receives the data (0-9) and prints it through the serial port; The host sends 100 bytes of data (1-100) to the slave, and then the slave receives the data (1-100) and prints it through the serial port; The host sends 10 bytes of data (0-9) to the slave, and then the slave receives the data (0-9) and prints it

through the serial port.

## 7.5 I2C\_TwoBoard\_SlaveRxIndefiniteLengthData\_IT\_Init

此样例演示了通过中断方式，主机发送不定长数据，从机接收不定长数据。主机向从机发送 10 字节的数据（0~9），然后从机接收数据（0~9）并通过串口打印；主机向从机发送 100 字节数据（1~100），然后从机接收数据（1~100）并通过串口打印；主机向从机发送 10 字节的数据（0~9），然后从机接收数据（0~9）并通过串口打印。

This example demonstrates how the host sends variable length data and the slave receives variable length data through interrupt mode. The host sends 10 bytes of data (0-9) to the slave, and then the slave receives the data (0-9) and prints it through the serial port; The host sends 100 bytes of data (1-100) to the slave, and then the slave receives the data (1-100) and prints it through the serial port; The host sends 10 bytes of data (0-9) to the slave, and then the slave receives the data (0-9) and prints it through the serial port.

## 8 IWDG

### 8.1 IWDG\_RESET

此样例演示了 IWDG 看门狗功能，配置看门狗重载计数值，计数 1s 后复位，然后通过调整每次喂狗的时间（main 函数 while 循环中代码），可以观察到，如果每次喂狗时间小于 1s，程序能一直正常运行（LED 灯闪烁），如果喂狗时间超过 1s，程序会一直复位（LED 灯不亮）。

This sample demonstrates the IWDG watchdog function. Configure the watchdog to count for 1s and then reset. By adjusting the time of each feed dog (code in the while loop of the main function), it can be observed following situation: if each dog feeding time is less than 1s, the program can always run normally (LED toggle). if the dog feeding time is more than 1s, the program will always reset (LED off)

## **9 PWR**

### **9.1 PWR\_DEEPSTOP\_WFE**

此样例演示了在 deepstop 模式下，使用 GPIO 事件唤醒。

This sample demonstrates using GPIO event to wake up the MCU from deepstop mode.

### **9.2 PWR\_DEEPSTOP\_WFI**

此样例演示了在 deepstop 模式下，使用 GPIO 中断唤醒。

This sample demonstrates using GPIO interrupt to wake up the MCU from deepstop mode.

### **9.3 PWR\_HIBERNATE\_WFE**

此样例演示了在 hibernate 模式下，使用 GPIO 事件唤醒。

This sample demonstrates using GPIO event to wake up the MCU from hibernate mode.

### **9.4 PWR\_HIBERNATE\_WFI**

此样例演示了在 hibernate 模式下，使用 GPIO 中断唤醒。

This sample demonstrates using GPIO interrupt to wake up the MCU from hibernate mode.

### **9.5 PWR\_SLEEP\_WFE**

此样例演示了在 sleep 模式下，使用 GPIO 事件唤醒。

This sample demonstrates using GPIO event to wake up the MCU from sleep mode.

### **9.6 PWR\_SLEEP\_WFI**

此样例演示了在 sleep 模式下，使用 GPIO 中断唤醒。

This sample demonstrates using GPIO interrupt to wake up the MCU from sleep mode.

### **9.7 PWR\_STOP\_WFE**

此样例演示了在 stop 模式下，使用 GPIO 事件唤醒。

This sample demonstrates using GPIO event to wake up the MCU from stop mode.

## **9.8 PWR\_STOP\_WFI**

此样例演示了在 stop 模式下，使用 GPIO 中断唤醒。

This sample demonstrates using GPIO interrupt to wake up the MCU from stop mode.

## 10 RCC

### 10.1 RCC\_HSE\_Output

此样例演示了时钟输出功能，可输出 HSE 波形。

This sample demonstrates the clock output function, which can output the HSE waveform.

### 10.2 RCC\_HSI\_Output

此样例演示了时钟输出功能，可输出 HSI 波形。

This sample demonstrates the clock output function, which can output HSI waveforms.

### 10.3 RCC\_LSE\_Output

此样例配置系统时钟为 LSE，并通过 MCO (PA08) 引脚输出。

This sample configures the system clock to LSE and outputs it through the MCO (PA08) pin.

### 10.4 RCC\_LSI\_Output

此样例演示了时钟输出功能，可输出 LSI 波形。

This sample demonstrates the clock output feature, which allows you to output the LSI waveform (32.768kHz) through the MCO (PA08) pin.

### 10.5 RCC\_Sysclock\_Switch

此样例演示了时钟切换，由 LSI 切换至 HSE。

This sample demonstrates clock switching from LSI to HSE.

## 11 RTC

### 11.1 RTC\_Alarm\_Init

此样例演示 RTC 的闹钟中断功能，在数组 aShowTime 中显示当前时间，在数组 aShowDate 中显示当前日期，当达到闹钟值时，LED 灯会亮起。

This sample demonstrates the alarm interrupt function of the RTC. It displays the current time in the array aShowTime and the current date in the array aShowDate. When the alarm value is reached, the LED will light up.

### 11.2 RTC\_WakeUpAlarm\_Init

此样例演示通过 RTC 闹钟中断每隔 1s 左右将 MCU 从 STOP 模式下唤醒，每次唤醒会翻转 LED，LED 翻转间隔为 1s 左右。

This sample demonstrates waking up the MCU from STOP mode approximately every 1 second using RTC alarm interrupt. Each time the MCU wakes up, the LED will toggle. The interval between LED toggling is also approximately 1 second.

### 11.3 RTC\_WakeUpSecond\_Init

此样例演示通过 RTC 秒中断从 STOP 模式下唤醒，唤醒后，小灯处于闪烁状态；否则处于熄灭状态。

This sample demonstrates waking up the MCU from STOP mode using RTC second interrupt. After waking up, the LED will be in a blinking state. Otherwise, it will be turned off.

## 12 SPI

### 12.1 SPI\_TwoBoards\_FullDuplexMaster\_IT\_Init

此样例是利用中断对串口外设接口（SPI）与外部设备以全双工串行方式进行通信的演示,此接口设置为主模式，为外部从设备提供通信时钟 SCK。主机通过 MOSI 引脚发送数据,从 MISO 引脚接收从机的数据，数据以主机提供的 SCK 沿同步被移位，完成全双工通信。

This sample demonstrates how to use the Serial Peripheral Interface (SPI) to communicate with an external device in full-duplex serial mode(using interrupts to process the data).This interface is set as the master mode, providing communication clock SCK to the external slave device.The host sends data through the MOSI pin and receives data from the slave through the MISO pin.The data is shifted synchronously at the SCK edge provided by the host to complete full-duplex communication.

### 12.2 SPI\_TwoBoards\_FullDuplexMaster\_Polling\_Init

此样例是通过轮询方式对串口外设接口（SPI）与外部设备以全双工串行方式进行通信的演示,此接口设置为主模式，为外部从设备提供通信时钟 SCK。主机通过 MOSI 引脚发送数据,从 MISO 引脚接收从机的数据，数据以主机提供的 SCK 沿同步被移位，完成全双工通信。

This example is a demonstration of communication between the serial peripheral interface (SPI) and external devices in full duplex serial mode through polling. This interface is set as the main mode and provides communication clock SCK for external slave devices. The host sends data through the MOSI pin and receives data from the slave through the MISO pin. The data is synchronously shifted along the SCK provided by the host, completing full duplex communication.

### 12.3 SPI\_TwoBoards\_FullDuplexSlave\_IT\_Init

此样例是利用中断对串口外设接口（SPI）与外部设备以全双工串行方式进行通信的演示,此接口设置为主模式，为外部从设备提供通信时钟 SCK。主机通过 MOSI 引脚发送数据,从 MISO 引脚接收从机的数据，数据以主机提供的 SCK 沿同步被移位，完成全双工通信。

This example is a demonstration of using interrupts to communicate with the serial peripheral interface (SPI) and external devices in a full duplex serial mode. This interface is set as the main mode and provides communication clock SCK for external slave devices. The master sends data through the MOSI pin and receives data from the slave through the MISO pin. The data is synchronously shifted along the SCK provided by the master, completing full duplex communication.

### 12.4 SPI\_TwoBoards\_FullDuplexSlave\_Polling\_Init

此样例是通过轮询方式对串口外设接口（SPI）与外部设备以全双工串行方式进行通信的演示,此接口设置为主模式，为外部从设备提供通信时钟 SCK。主机通过 MOSI 引脚发送数据,从 MISO 引脚接收从机的数据，数据以主机提供的 SCK 沿同步被移位，完成全双工通信。



This example is a demonstration of communication between the serial peripheral interface (SPI) and external devices in full duplex serial mode through polling. This interface is set as the main mode and provides communication clock SCK for external slave devices. The host sends data through the MOSI pin and receives data from the slave through the MISO pin. The data is synchronously shifted along the SCK provided by the host, completing full duplex communication.

## 13 TIM

### 13.1 TIM1\_6Step

此样例演示了使用 TIM1 产生“六步 PWM 信号”，每间隔 1ms 在 SysTick 中断中触发换向，实现无刷电机的换向。

This example demonstrates the use of TIM1 to generate a "six step PWM signal", which triggers commutation in the SysTick interrupt every 1ms to achieve commutation of a brushless motor.

### 13.2 TIM1\_AutoReloadPreload

此样例实现了定时器的基本计数功能，以及演示了 ARR 自动重载功能，样例在定时器重载中断中翻转 LED 灯

This sample demonstrates base count function of the timer, and show ARR register autoreload function. Example toggle LED in timer update interrupt.

### 13.3 TIM1\_ComplementarySignals

此样例实现了定时器的互补输出功能，三组互补共六路 pwm 输出。

This sample demonstrates complementary output function of the timer, Three sets of complementary outputs total six pwm outputs.

### 13.4 TIM1\_ComplementarySignals\_break\_it

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（输入低电平）后，PWM 信号关闭，由于 BDTR.AOE 置位，所以刹车信号取消（输入高电平）后，继续 pwm 输出，此样例实现了死区功能。本样例开启了刹车中断，并在刹车中断里翻转 LED 灯通过调整 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 (input 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 (input high level). This example realizes the dead zone function. This example turns on the brake interrupt and toggle the LED light in the brake interrupt. By adjusting the OCxE, CCxP, OISx, CCxNE, CCxNP, OISxN configuration, which can realize the brake function of a variety of applications

### 13.5 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（输入

低电平) 后, PWM 信号关闭, 由于 BDTR.AOE 置位, 所以刹车信号取消 (输入高电平) 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 (input 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 (input 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

### 13.6 TIM1\_ExternalClockMode1\_Init

此样例演示了 TIM1 的外部时钟模式 1 的功能, 选择 ETR(PA12) 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 the functionality of TIM1 in external clock mode 1. It selects ETR (PA12) pin as the external clock input source and enables the update interrupt. In the interrupt, the LED light is toggled.

### 13.7 TIM1\_ExternalClockMode1\_TI1F\_Init

此样例演示了 TIM1 的外部时钟模式 1 功能, 选择 TI1FP(PA3) 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 the external clock mode 1 function of TIM1, selects the TI1FP(PA3) pin as the external clock input source, and enables the update interrupt and toggle the LED light in the interrupt

### 13.8 TIM1\_ExternalClockMode2\_Init

此样例演示了 TIM1 的外部时钟模式 2 功能, 选择 ETR(PA12) 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 the external clock mode 2 function of TIM1, selects the ETR(PA12) pin as the external clock input source, and enables the update interrupt and toggle the LED light in the interrupt

### 13.9 TIM1\_InputCapture\_Init

此样例演示了 TIM1 的输入捕获功能, 配置 PA3 作为输入捕获引脚, PA3 每检测到一个下降沿触发捕获中断, 在捕获中断回调函数中翻转 LED 灯。

This example demonstrates the input capture function of TIM1, where PA3 is configured as the input capture pin. Every time PA3 detects a falling edge, it triggers a capture interrupt and flips the LED

light in the capture interrupt callback function.

### 13.10 TIM1\_InputCapture\_XORCh1Ch2Ch3

此样例演示了 TIM1 的三通道异或输入捕获功能。配置 PA3、PA5、PA4 为通道 1、通道 2、通道 3 的输入引脚。每当有一个引脚电平变化时会触发捕获中断，并在中断处理中翻转 LED。

This example demonstrates the three channel XOR input capture function of TIM1. Configure PA3, PA5, and PA4 as input pins for channels 1, 2, and 3. Whenever a pin level changes, a capture interrupt is triggered and the LED is flipped during interrupt processing.

### 13.11 TIM1\_OC\_Toggle

此样例演示了 TIM1 的输出比较模式。将捕获/比较通道 1 (CH1) 的输出映射到 PA3，开启捕获/比较通道 1 (CH1) 并设置为比较输出翻转模式。

This example demonstrates the output comparison mode of TIM1. Map the output of capture/compare channel 1 (CH1) to PA3, turn on capture/compare channel 1 (CH1), and set it to compare output flipping mode.

### 13.12 TIM1\_OC\_Toggle\_IT

此样例演示了 TIM1 的输出比较模式。将捕获/比较通道 1 (CH1) 的输出映射到 PA3，开启捕获/比较通道 1 (CH1) 并设置为比较输出翻转模式，同时开启捕获/比较中断，每次计数值与比较值匹配时翻转输出电平 (PA4)，在捕获/比较中断处理中翻转 LED 灯。

This sample demonstrates the output compare mode of TIM1. The output of capture/compare channel 1 (CH1) is mapped to pin PA3. Capture/compare channel 1 (CH1) is enabled and set to compare output toggle mode. Capture/compare interrupt is also enabled. Whenever the counter value matches the compare value, the output (PA4) level will toggle. In the interrupt handler of capture/compare, the LED will also toggle.

### 13.13 TIM1\_OnePulseOutput

此样例演示了 TIM1 的单脉冲模式，CH2(PA05)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(PA03)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  $(TIM1\_ARR-TI1\_CCR1)/CLK = (65535-16383)/24000000 = 2.048ms$

This sample demonstrates the one pulse mode of TIM1. The rising edge on the CH2(PA05) pin triggers the counter to start counting. When the count value matches CCR1, CH1(PA03) 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  $(TIM1\_ARR-TI1\_CCR1)/CLK = (65,535-16383)/24,000,000 = 2.048ms$

### 13.14 TIM1\_PWM3CH\_Init

此样例演示了使用 TIM1 PWM2 模式输出三路频率为 10Hz 占空比分别为 25%、50%、75%的 PWM 波形。

This sample demonstrates how to use TIM1 PWM2 mode to output three 10Hz frequency PWM waveform with duty cycles of 25%, 50% and 75% separately

### 13.15 TIM1\_TimeBase\_Init

此样例演示了 TIM1 的更新中断功能，在更新中断中翻转 LED。

This sample demonstrates the UPDATE interrupt function , LED toggled when the update interrupt is generated.

## 14 UART

### 14.1 UART\_HyperTerminal\_IT

此样例演示了通过 UART 中断收发数据的功能,复位 MCU 并重新运行,PC 端收到字符串:UART Test; PC 端发送 12 个字符, MCU 会反馈同样的 12 个字符给 PC 端。

This example demonstrates function of UART to send and receive data using interrupt mode.Reset the MCU and restart,the PC will receive a string: UART Test;The PC sends 12 characters,then the MCU returns the same 12 characters to the PC

### 14.2 UART\_HyperTerminal\_Polling

此样例演示了通过 UART 轮询收发数据的功能,MCU 复位后会向 PC 端发送"UART Test",PC 端发送 12 个字符, MCU 会反馈同样的 12 个字符给 PC 端。

This example demonstrates function of UART to send and receive data using polling mode.Reset the MCU and restart,the PC will receive a string: UART Test;The PC sends 12 characters,then the MCU returns the same 12 characters to the PC