

AT32 Bootloader Program Manual

Introduction

Bootloader program is stored in the bootloader code area of the microcontroller. It has been programmed before leaving factory. It is used to download applications to internal memory using peripheral interfaces (UART, USB, etc.). These peripherals each have their respective protocols, which is available from the corresponding peripheral protocol.

Applicable products:

MCUs	AT32F403xx
	AT32F413xx
	AT32F415xx
	AT32F403Axx
	AT32F407xx
	AT32F421xx
	AT32F435xx
	AT32F437xx
	AT32F425xx

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1 Bootloader mode

1.1 Enter Bootloader mode

Table 1 Bootloader mode

Part number	Conditions
AT32F403xx	BOOT0=1, BOOT1=0
AT32F413xx	BOOT0=1, BOOT1=0
AT32F415xx	BOOT0=1, BOOT1=0
AT32F403Axx	BOOT0=1, BOOT1=0, BTOPT=1
AT32F407xx	BOOT0=1, BOOT1=0, BTOPT=1
AT32F421xx	BOOT0=1, nBOOT1=1
AT32F435xx	BOOT0=1, BOOT1=0, BTOPT=1
AT32F437xx	BOOT0=1, BOOT1=0, BTOPT=1
AT32F425xx	BOOT0=1, nBOOT1=1

Note:

Refer to the particular datasheet for details on BOOT0 and BOOT1 pins.

nBOOT1 in the user system area can be modified by software. Refer to the particular reference manual for more information.

BTOPT in the user system area corresponds to the device with Bank2. When BTOPT=0, it indicates booting from Bank2.

In addition, by means of user code, it is also possible to jump to bootloader code area to perform bootloader. But all peripherals must be reset prior to jumping, and all peripheral clocks, PLL, interrupts must be disabled, and pending interrupts must be cleared.

After entering a programming mode, the bootloader will no longer detect other programming modes. For example, if the bootloader supports UART1, UART2 and USB_DFU, when 0x7F on UART1 is detected, the bootloader enters UART1 programming mode, and discards UART2, USB_DFU at the same time.

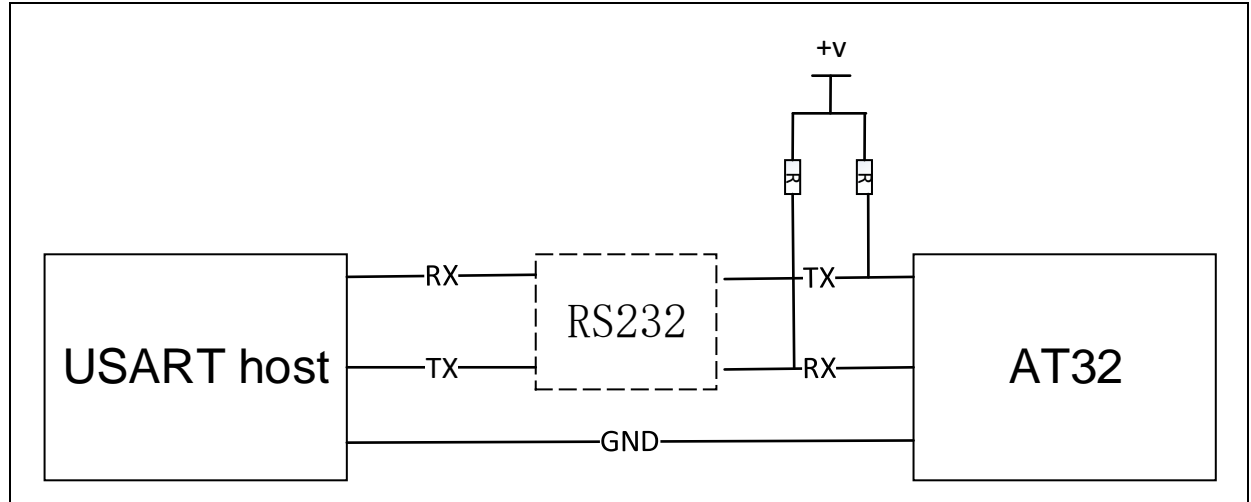
It should be noted that in UARTx program mode, if there is data transfer on UARTx_RX during baud rate detection, the UARTx program mode is entered. If the data is different from 0x7F, the UARTx configures a wrong baud rate, causing communication failure. Therefore, it is a good advice to keep unused peripheral RX interfaces (UART_RX) at a fixed level (high or low) when bootloader is started. If these pins remain floating or have data transfer, it may cause an unused interface to be entered.

Note: It is recommended to start bootloader command 200ms after power on.

1.2 Hardware connection

To use USART bootloader program mode, the host must be connected to UARTx_RX and UARTx_TX.

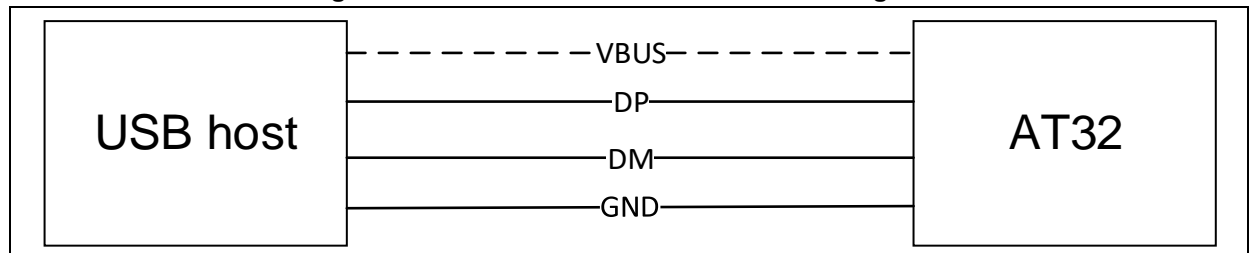
Figure 1 UART hardware connection block diagram



Note: +V typical value is 3.3 V, and R typical value is 100KOhm.

To use USB DFU, the MCU USB interface must be connected to USB host interface.

Figure 2 USB hardware connection block diagram



Note:

It is a good advice to keep unused peripheral RX interfaces (UART_RX) in a fixed level (high or low) when bootloader is started. If these pins remain floating or have data transfer, it may cause an unused interface to be entered.

2 AT32F403xx Bootloader

AT32F403xx supports UART1, UART2 and USB_DFU.

2.1 Peripheral configuration

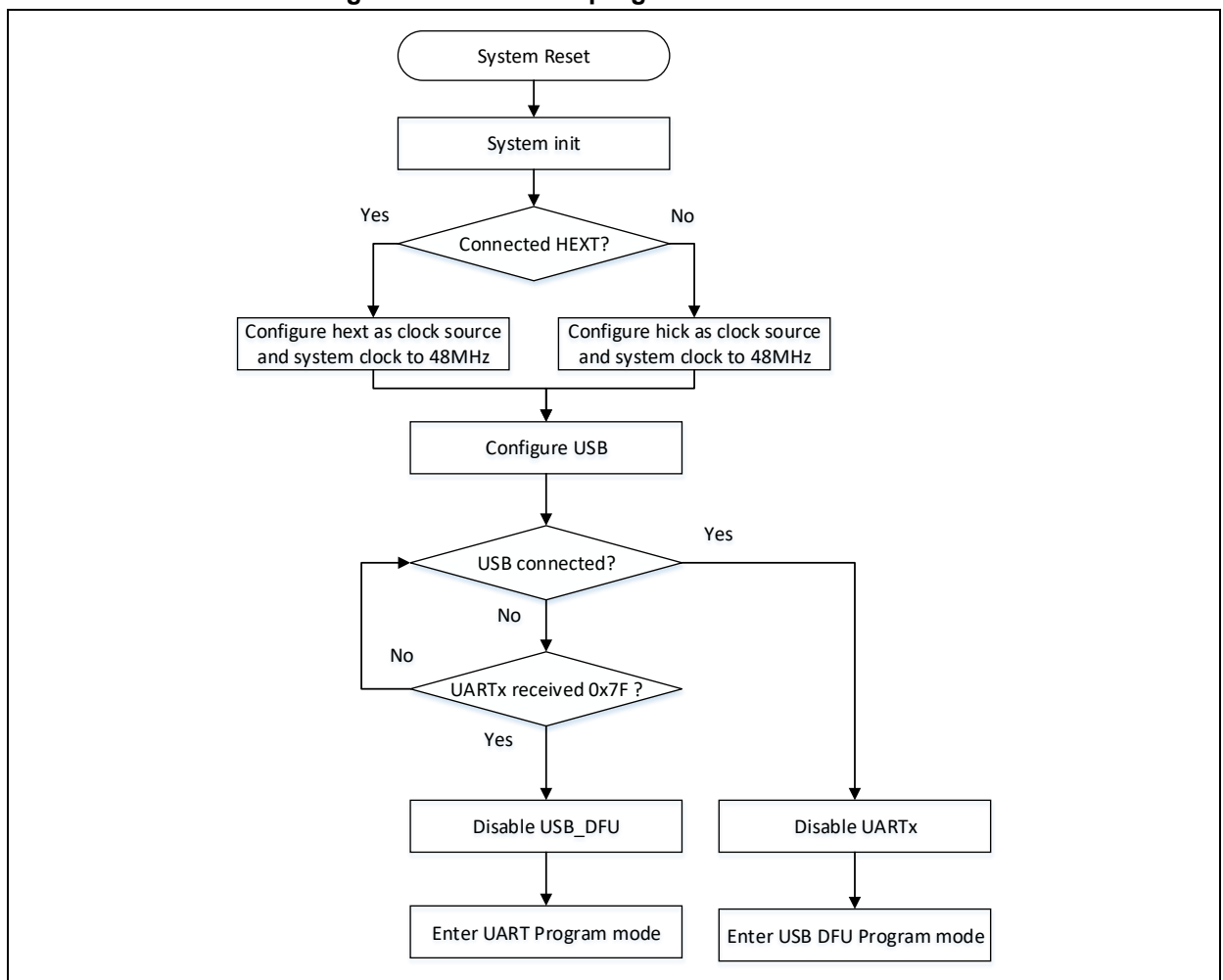
Table 2 AT32F403xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART_TX PA10:UART_RX
UART2	AT32F403ZG,AT32F403VG	PD5:UART_TX PD6:UART_RX
	Others	PA2:UART_TX PA3:UART_RX
USB_DFU	All	PA11:USB_DM PA12:USB_DP

2.2 Program mode selection

If HEXT clock is connected, the Bootloader will check whether the current HEXT is able to configure system clock to 48 MHz using PLL, if not, it will continue to use HICK as a clock source.

Figure 3 AT32F403xx program mode selection



3 AT32F413xx Bootloader

AT32F413xx supports UART1, UART2 and USB_DFU.

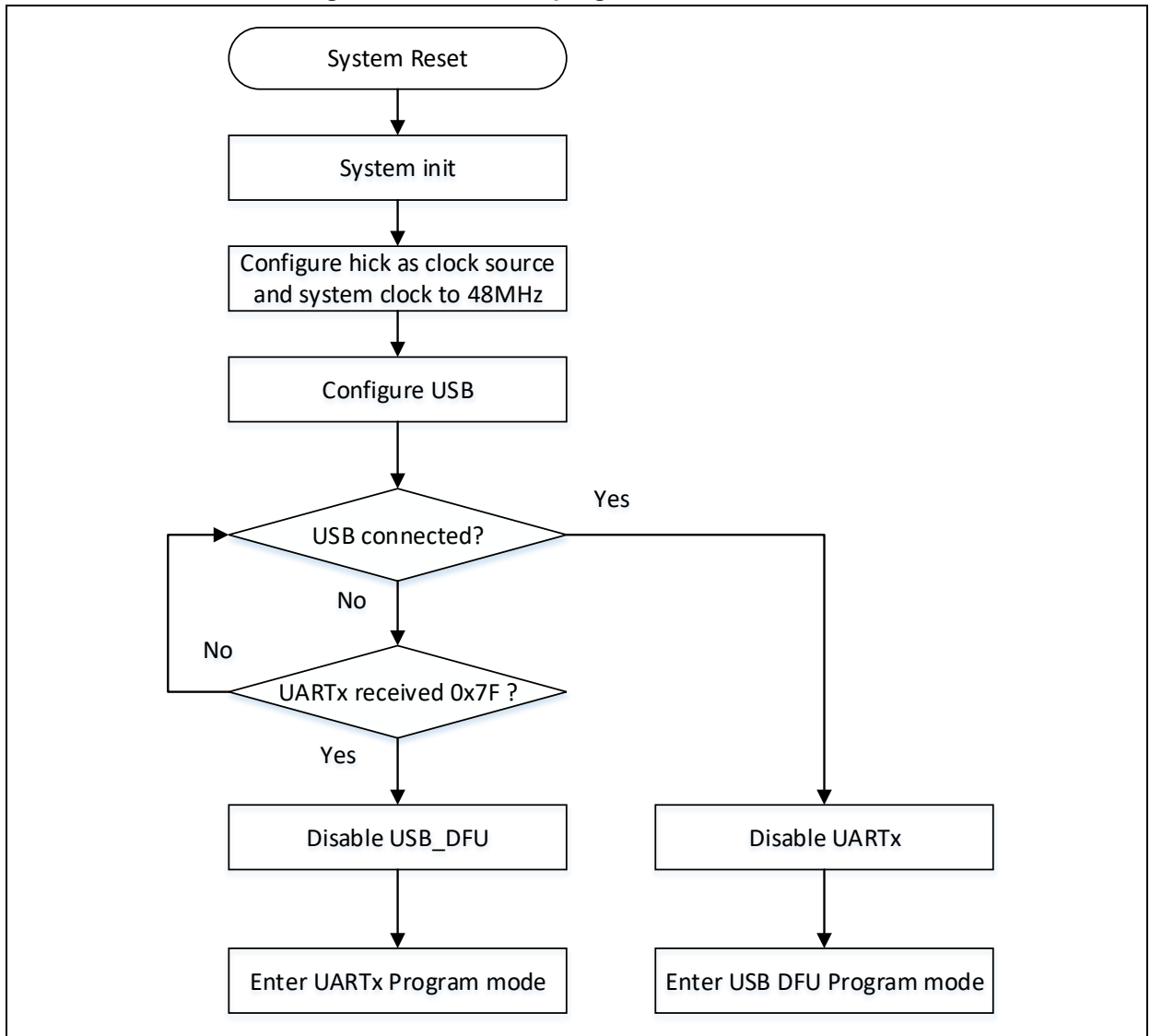
3.1 Peripheral configuration

Table 3 AT32F413xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART_TX PA10:UART_RX
UART2	All	PA2:UART_TX PA3:UART_RX
USB_DFU	All	PA11:USB_DM PA12:USB_DP

3.2 Program mode selection

Figure 4 AT32F413xx program mode selection



4 AT32F415xx Bootloader

AT32F415xx supports UART1, UART2 and USB_OTG_DFU.

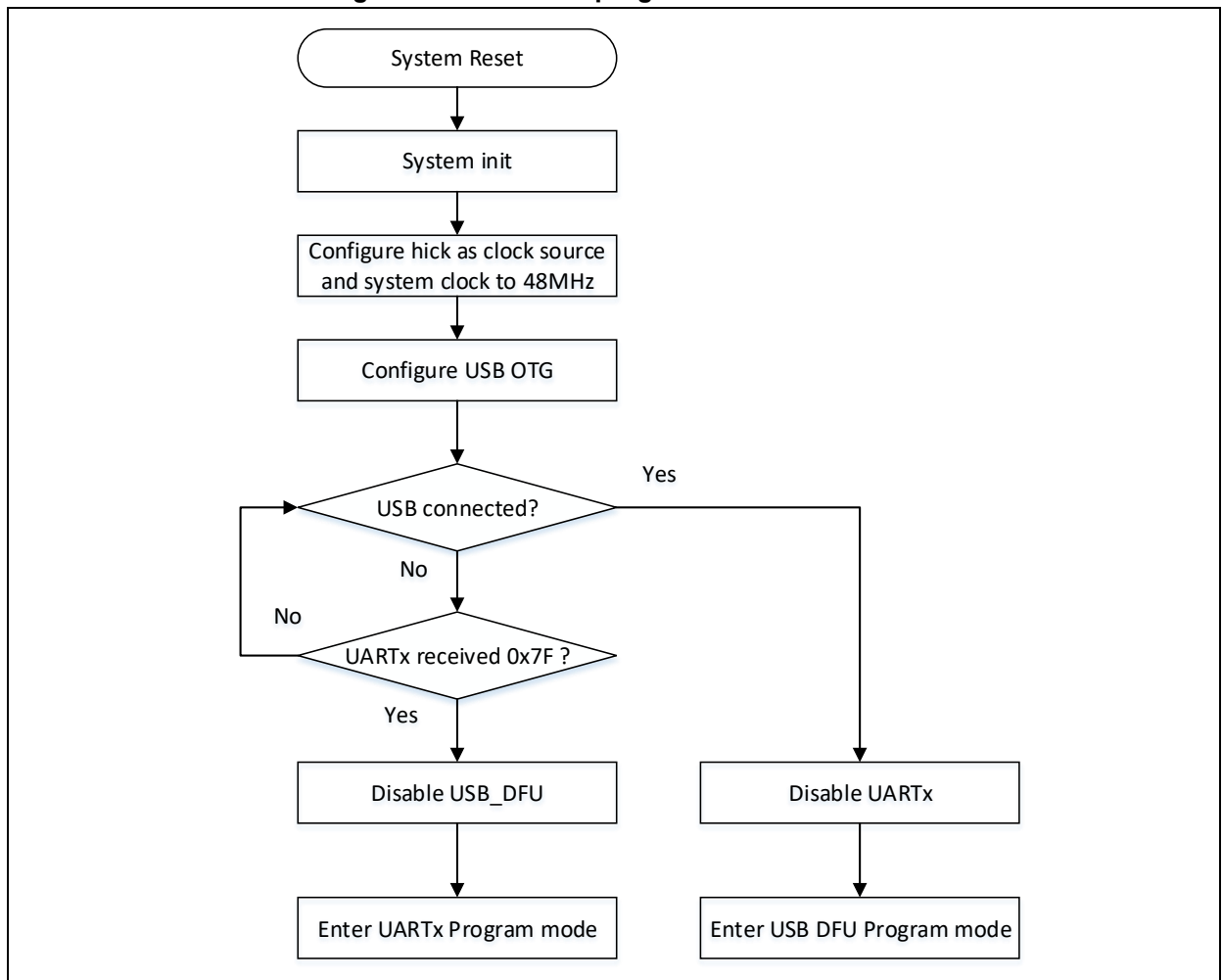
4.1 Peripheral configuration

Table 4 AT32F415xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART_TX PA10:UART_RX
UART2	All	PA2:UART_TX PA3:UART_RX
USB_OTG_DFU	All	PA11:USB_DM PA12:USB_DP PA9:USB_VBUS

4.2 Program mode selection

Figure 5 AT32F415xx program mode selection



5 AT32F403Axx Bootloader

AT32F403Axx supports UART1, UART2 and USB_DFU.

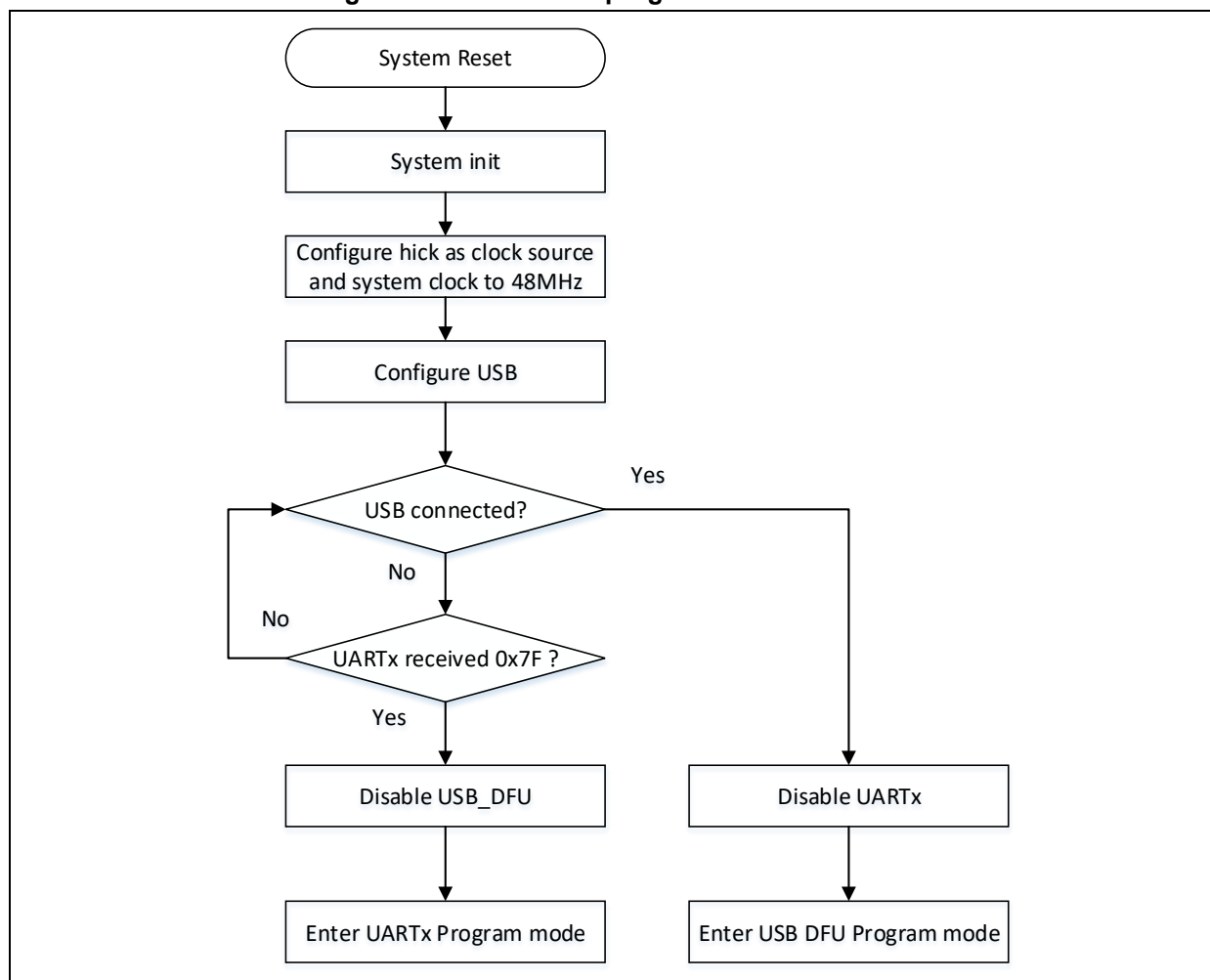
5.1 Peripheral configuration

Table 5 AT32F403Axx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART_TX PA10:UART_RX
UART2	AT32F403AZG,AT32F403AVG	PD5:UART_TX PD6:UART_RX
	Others	PA2:UART_TX PA3:UART_RX
USB_DFU	All	PA11:USB_DM PA12:USB_DP

5.2 Program mode selection

Figure 6 AT32F403Axx program mode selection



6 AT32F407xx Bootloader

AT32F407xx supports UART1, UART2 and USB_DFU.

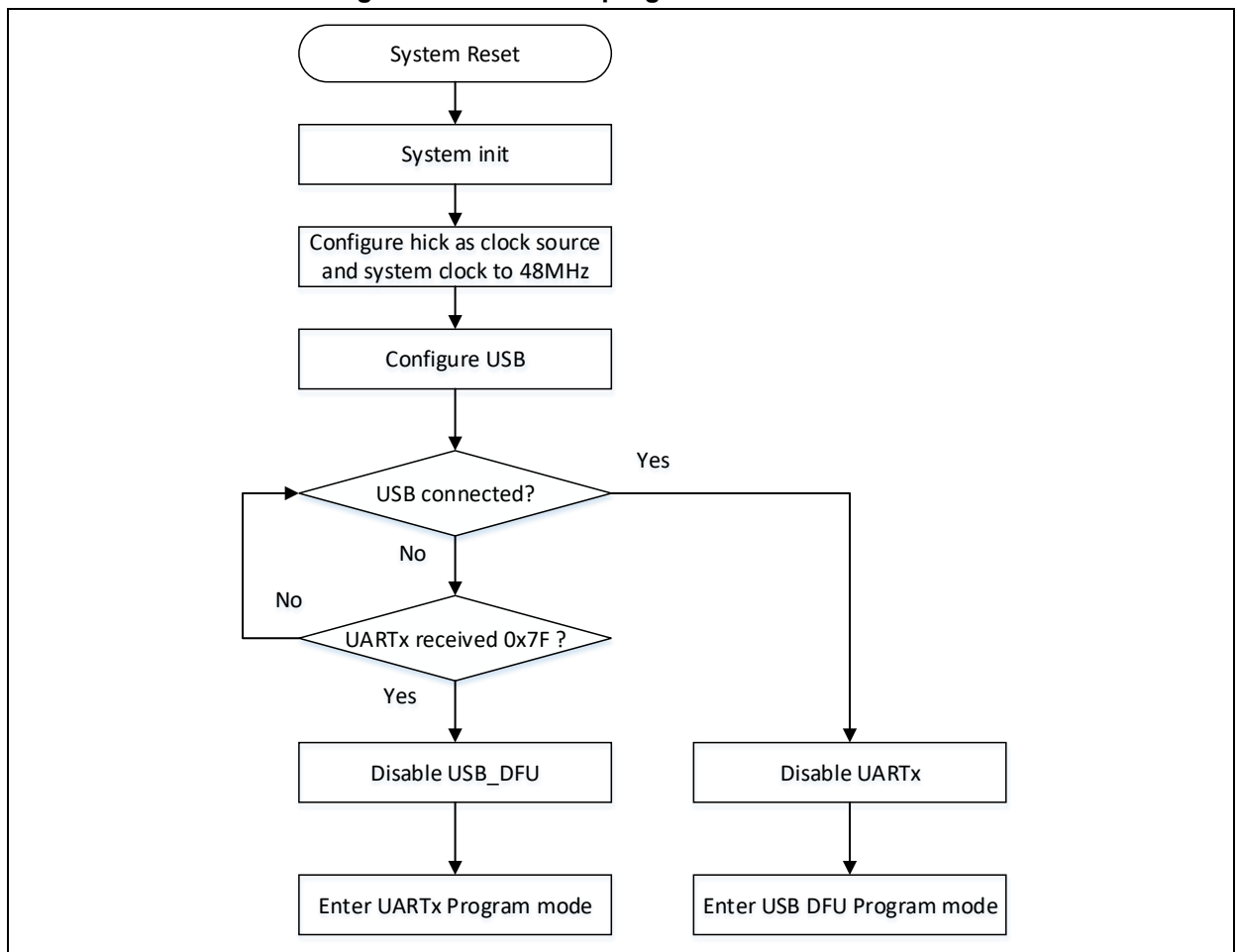
6.1 Peripheral configuration

Table 6 AT32F407xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART_TX PA10:UART_RX
UART2	AT32F407ZG,AT32F407VG	PD5:UART_TX PD6:UART_RX
	Others	PA2:UART_TX PA3:UART_RX
USB_DFU	All	PA11:USB_DM PA12:USB_DP

6.2 Program mode selection

Figure 7 AT32F407xx program mode selection



7 AT32F421xx Bootloader

AT32F421xx supports UART1 and UART2.

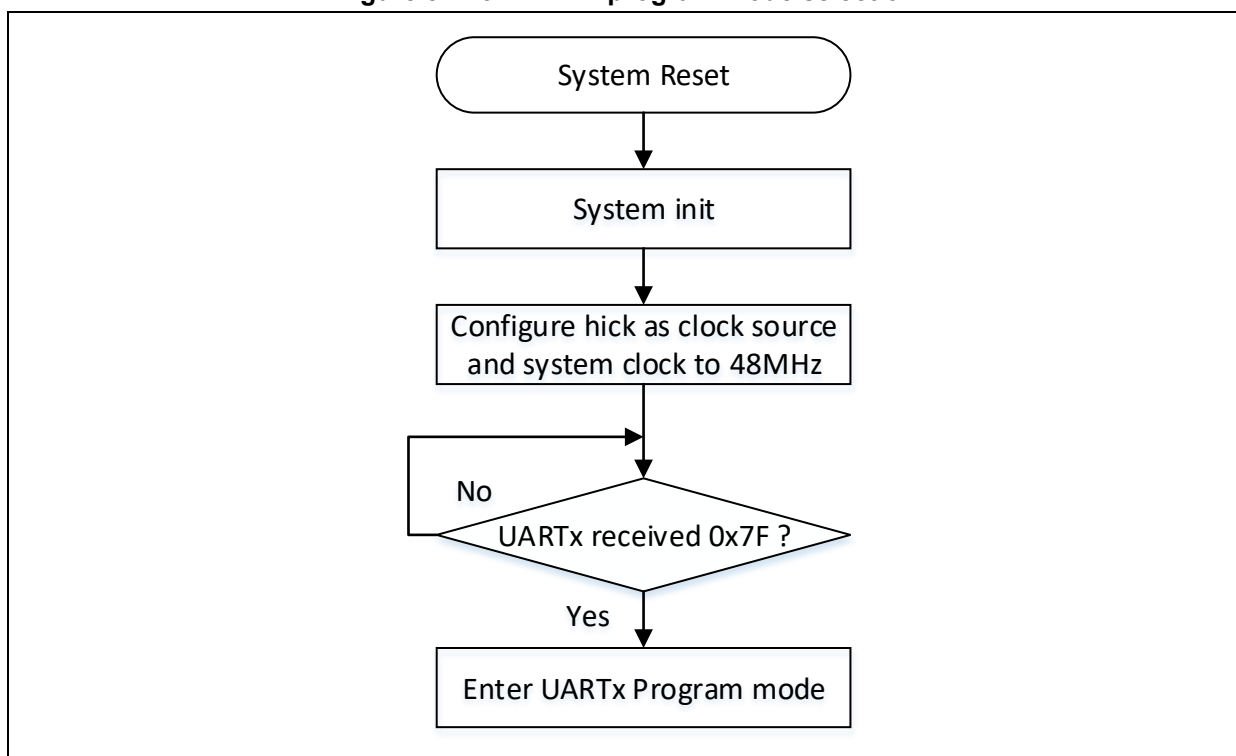
7.1 Peripheral configuration

Table 7 AT32F421xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART_TX PA10:UART_RX
UART2	All	PA2:UART_TX PA3:UART_RX

7.2 Program mode selection

Figure 8 AT32F421xx program mode selection



8 AT32F435xx Bootloader

AT32F435xx supports UART1, UART2, UART3, USB_OTG1_DFU, and USB_OTG2_DFU.

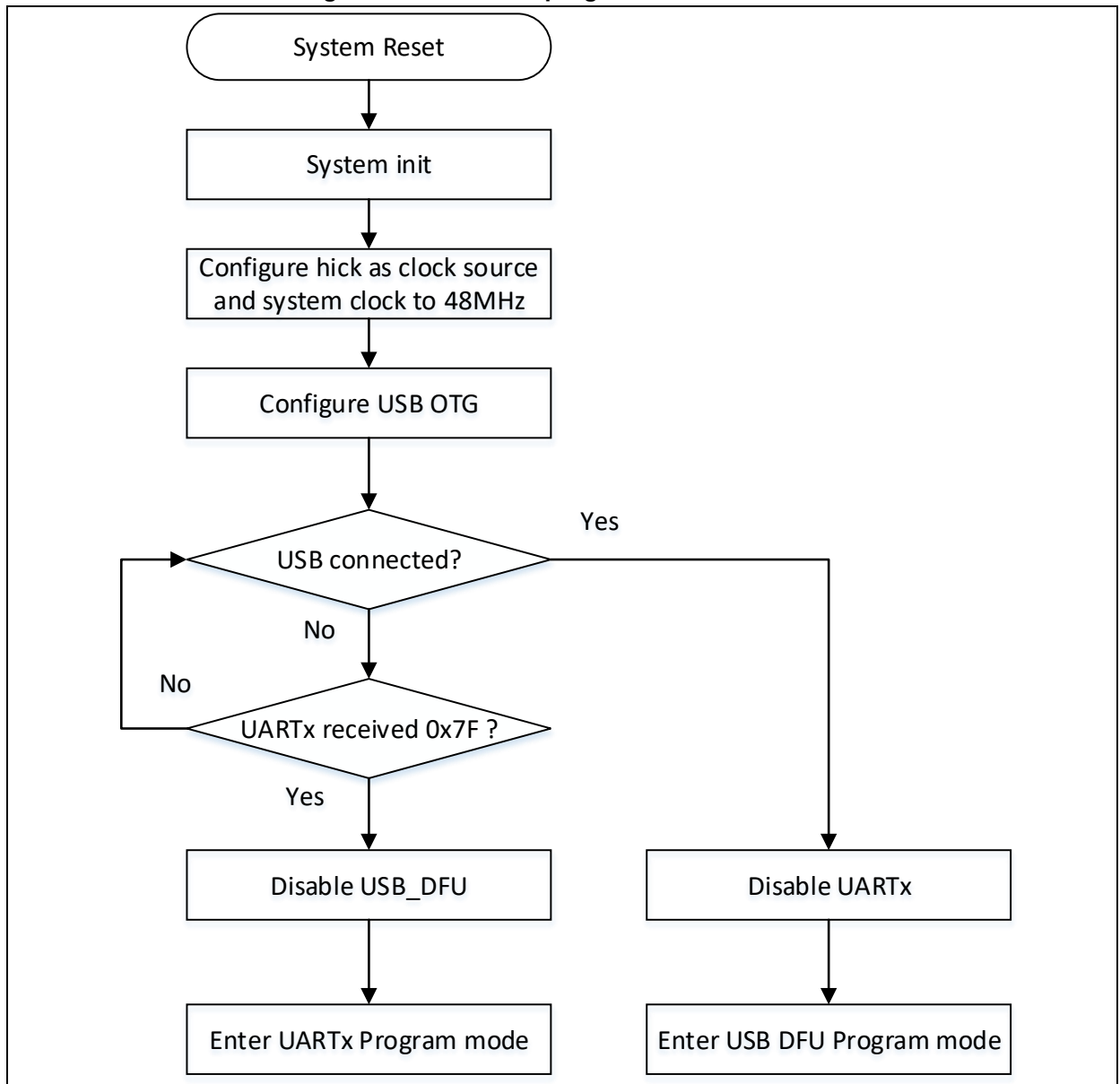
8.1 Peripheral configuration

Table 8 AT32F435xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART1_TX PA10:UART1_RX
UART2	AT32F435ZxT7,AT32F435VxT7	PD5:UART2_TX PD6:UART2_RX
	Others	PA2:UART2_TX PA3:UART2_RX
UART3	AT32F435ZxT7,AT32F435VxT7, AT32F435RxT7	PC10: UART3_TX PC11: UART3_RX
	Others	PB10: UART3_TX PB11: UART3_RX
USB_OTG1_DFU	All	PA11:USB_DM PA12:USB_DP
USB_OTG2_DFU	ALL	PB14:USB_DM PB15:USB_DP

8.2 Program mode selection

Figure 9 AT32F435xx program mode selection



9 AT32F437xx Bootloader

AT32F437xx supports UART1, UART2, UART3, USB_OTG1_DFU, and USB_OTG2_DFU.

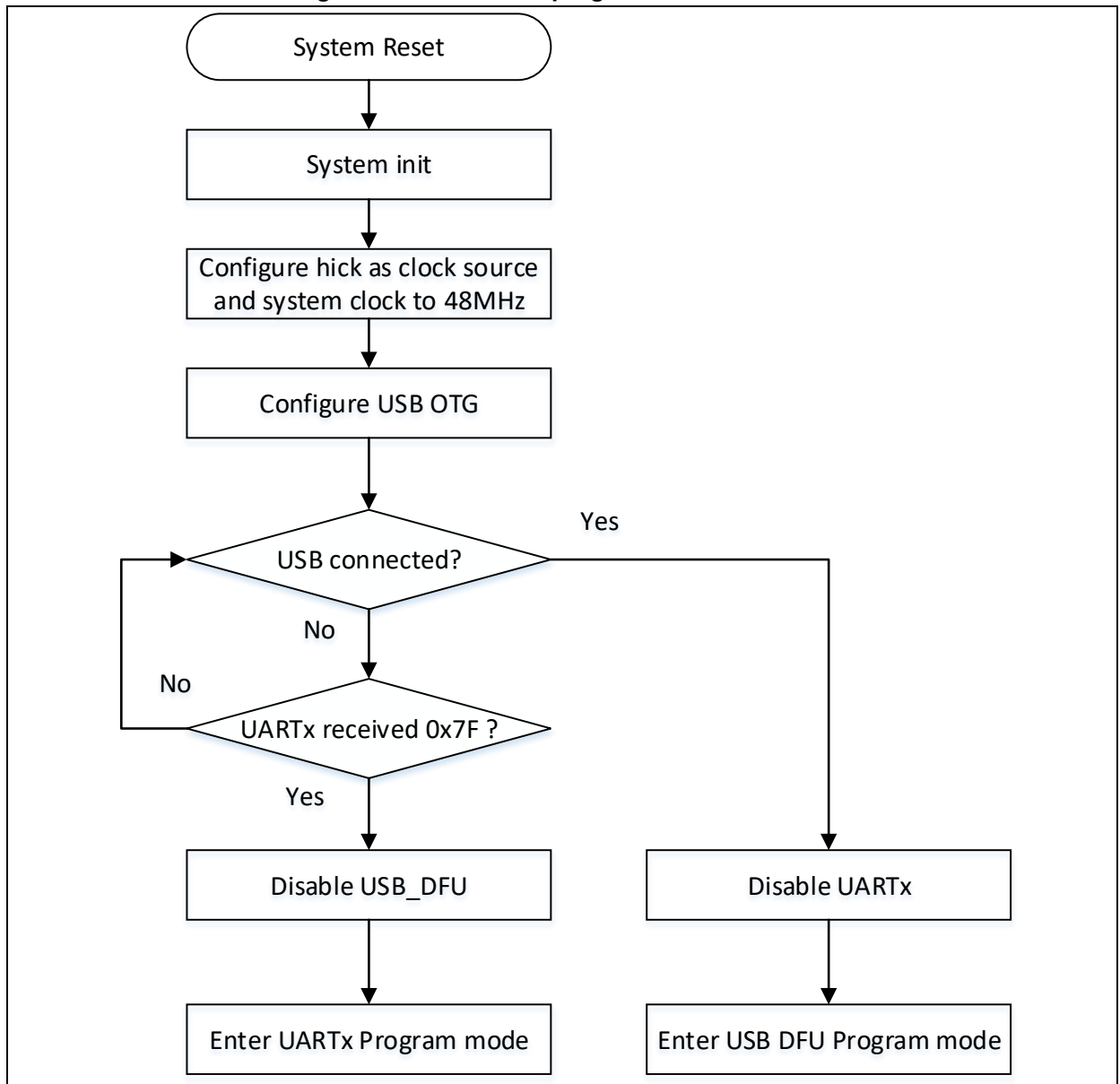
9.1 Peripheral configuration

Table 9 AT32F437xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART1_TX PA10:UART1_RX
UART2	AT32F437ZxT7,AT32F437VxT7	PD5:UART2_TX PD6:UART2_RX
	Others	PA2:UART2_TX PA3:UART2_RX
UART3	AT32F437ZxT7,AT32F437VxT7, AT32F437RxT7	PC10: UART3_TX PC11: UART3_RX
	Others	PB10: UART3_TX PB11: UART3_RX
USB_OTG1_DFU	All	PA11:USB_DM PA12:USB_DP
USB_OTG2_DFU	All	PB14:USB_DM PB15:USB_DP

9.2 Program mode selection

Figure 10 AT32F437xx program mode selection



10 AT32F425xx Bootloader

AT32F425xx supports UART1 and UART2.

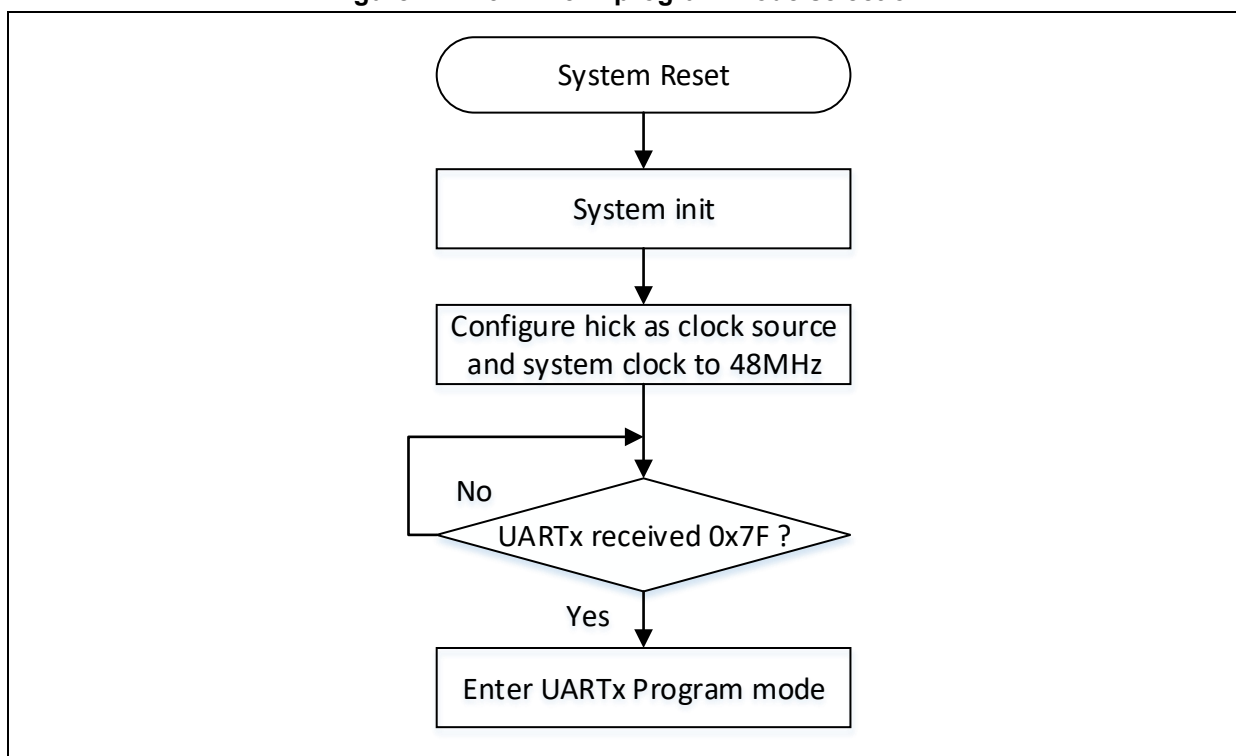
10.1 Peripheral configuration

Table 10 AT32F425xx peripheral configuration

Peripherals	Application products	Pins
UART1	All	PA9:UART_TX PA10:UART_RX
UART2	All	PA2:UART_TX PA3:UART_RX

10.2 Program mode selection

Figure 11 AT32F425xx program mode selection



11 Revision history

Table 11 Document revision history

Date	Revision	Changes
2021.12.07	2.0.0	Initial release
2022.06.02	2.0.1	Updated the application products corresponding to UART2 and UART3 in Table 9 .
2022.06.15	2.0.2	Updated the bootloader conditions corresponding to AT32F421xx and AT32F425xx in Table 1 .

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