AN4657
User manual

PY32™ in-application programming(IAP)

Introduction

An important requirement for most systems based on flash memories is the ability to update firmware when it is installed in the end product. This ability is referred to as in-application programming (IAP).

Most of the new PY32 products are supported by a middleware open source library called IAP_APP_Firmware, described in AN2606, AN3155, AN3156.

The purpose of this document is to provide general guidelines for creating an IAP application on PY32 microcontrollers able to run user-specific firmware to perform an IAP of the embedded flash memory. This feature uses the available communication interfaces supported by the product. The example described in this application note is based on the USART or USB, using the AN3155 or AN3156 protocol.

The IAP firmware package, available on Puya ae or fae team, is delivered with this document, and contains the source code of IAP examples for PY32 microcontrollers.

Table1. MCU and its firmware

MCU	IAP Firmware
PY32C611, PY32C610, PY32F003, PY32F030, PY32F002A	PY32F0xx_IAP_APP_Firmware_V0.0.3
PY32F072, PY32F071, PY32F040, PY32M070	PY32F07x_IAP_APP_Firmware_V0.0.2
PY32F002B, PY32C640, PY32C641, PY32F001, PY32M010	PY32F002B_IAP_APP_Firmware_V0.0.1
PY32L020	PY32L020_IAP_APP_Firmware_V0.0.1
PY32F303, PY32F403	PY32F4xx_IAP_APP_Firmware_V0.0.2

Table2. IAP Tool Software

Software	Communication Interfaces	Program Flash	Program Option Bytes
PY32IspTool	USART	Support	Support
PY32DfuTool	USB	Support	Support
PY32 MCDT	USART	Support	Support

Contents

1 Related documents

Related to the supported each product information (such as listed in table 1), see https://www.puyasemi.com/ to provide the following documents:

- Datasheet or product introduction
- Reference Manual

2 Firmware description

2.1 Related documents

Table2.1-1 Related documents

Number	Name
AN2606	PY32™ microcontroller system memory boot mode
AN3155	USART protocol used in the PY32™ bootloader
AN3156	USB DFU protocol used in the PY32™ bootloader

2.2 Read Protect

The IAP program supports CMD_READ_MEMORY command function by default, and supports reading data in Flash and passing it back to PC software on the upper computer. When RDP is enabled on the set option Byte OPTR, the ReadMemory function disables reading the APP spatial address. Users can modify the functions in the ReadMemory function according to their actual needs.

2.3 Verify

In order to support RDP function, IAP program implements check function in WriteFlash function. The firmware program executes the verification operation immediately after each programming operation, and the host computer can ensure that the verification is also successful after receiving the command that the write is successful.

2.4 JumpToAddress

IAP bootloader support three types of jump to application.

Table2.4-1 JumpToAddress

Type	Description
USER_BUTTON(GPIO)	JUMP_TO_APP_BY_USER_BUTTON macro enable/disable this function Press the user button before power-on, and the MCU directly jumps to the APP program
Software delay detection	JUMP_TO_APP_BY_TIME_OUT macro enable/disable this function MAX_TIME_OUT macro configure the max timeout
Command	The PC software sends the command 0x21 to the MCU to implement the software jump

2.5 ROM Memory Areas

The IAP program stores the address space 0x08000000~0x08000FFF, occupying 4KBytes.

The APP program stores the start address 0x08001000, the same as the APP_ADDR macro in the IAP program.

Since the IAP tool software provided by PY32 only provides full erase and sector erase, and the sector size of some PY32 models is 4KBytes, it is recommended that the minimum consumption of IAP program is 4Kbytes.

3 Hardware description

3.1 USART(USB-TTL)

Table 3.1-1 USB-TTL

USB-TTL	MCU	Required/Optional
5V/3.3V	VCC	Optional
GND	VSS	Required
TXD	USARTx_RX	Required
RXD	USARTx_TX	Required
DTR	BOOT0/ RST	Optional
RTS	BOOT0/ RST	Optional

3.2 USART(PY-LINK)

Table 3.2-1 PY-LINK

PY-LINK	MCU
5V/3.3V	VCC
GND	VSS
USART1_TXD	USARTx_RX
USART1_RXD	USARTx_TX

3.3 USB (DFU)

When using the DFU software, connect the MCU directly to the USB port of the PC through a USB cable.

4 Software description

4.1 How to install

The tools listed in Table 1 are green installation-free software. You can double-click exe to use it.

4.2 How to use

Reference the documents “UM1503_PY32™ ISP Tool Software Description_EN.pdf” and “UM1504_PY32™ DFU Tool Software Description_EN.pdf”.

5 Operation Process

5.1 Download the IAP

Users can use Keil/IAR, PY32IspTool and other tools to download IAP programs to MainFlash.

5.2 Download the APP

After downloading IAP, you can use the IAP tool software in Table 2 to realize the IAP upgrade function.

6 Version history

Version	Date	Update records
V1.0	2023.09.11	First edition.

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