iND83212 Bootloader User Guide
V0.1

1 REVISION HISTORY

Table 1 Revision History

| Rev #	Date	Action	By
0.1	11/11/2022	First draft	Xiangyuan.chen

2 TABLE OF CONTENTS

3 SYSTEM OVERVIEW

iND83212 bootloader application separates the whole flash memory into 4 blocks: Bootloader, Application, User Data Memory and System Data Memory.

3.1 BOOTLOADER MEMORY

Bootloader memory is used for updating application flash content. 3 methods can be used for entering Bootloader Mode:

1) Hardware reset or power on reset: during system hardware reset or power on reset, bootloader would stay on hold for 50ms and waiting for LIN master sending handshake command, if time is expired, the Bootloader would jump to application program.
2) Invalid application code：before entering application mode, bootloader would do CRC validation to verify the application based on the image head in the beginning of application. If the CRC value is invalid, bootloader would stay in bootloader mode.
3) Application enter bootloader mode intently: when program is running in application mode, application can send "entering bootloader mode" command to enter bootloader mode intently.
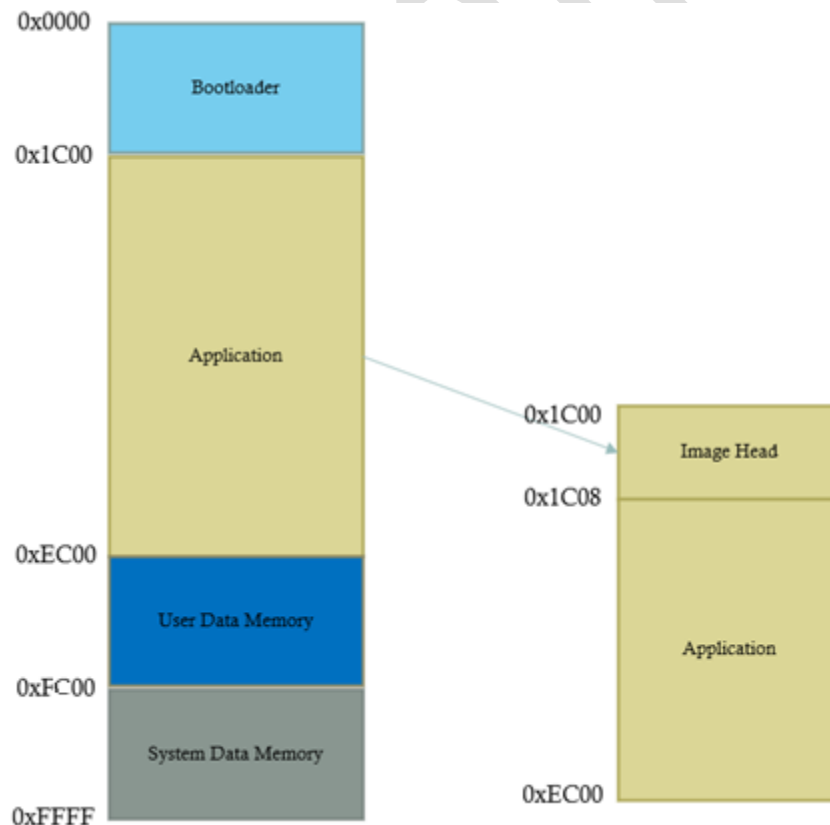
3.2 APPLICATION MEMORY

Application Memory flash block includes user application code, there is 2 parts information should be taken into condition:

1) Image head: Image head includes the following information:
   a) Image information - 2bytes
   b) Image data length -2bytes
   c) Image CRC value   -4bytes

The application code is start from address: 0x1C08. So, when making upgrade image, the Image head information should be added together, and the upgrade start address is from 0x1C00.
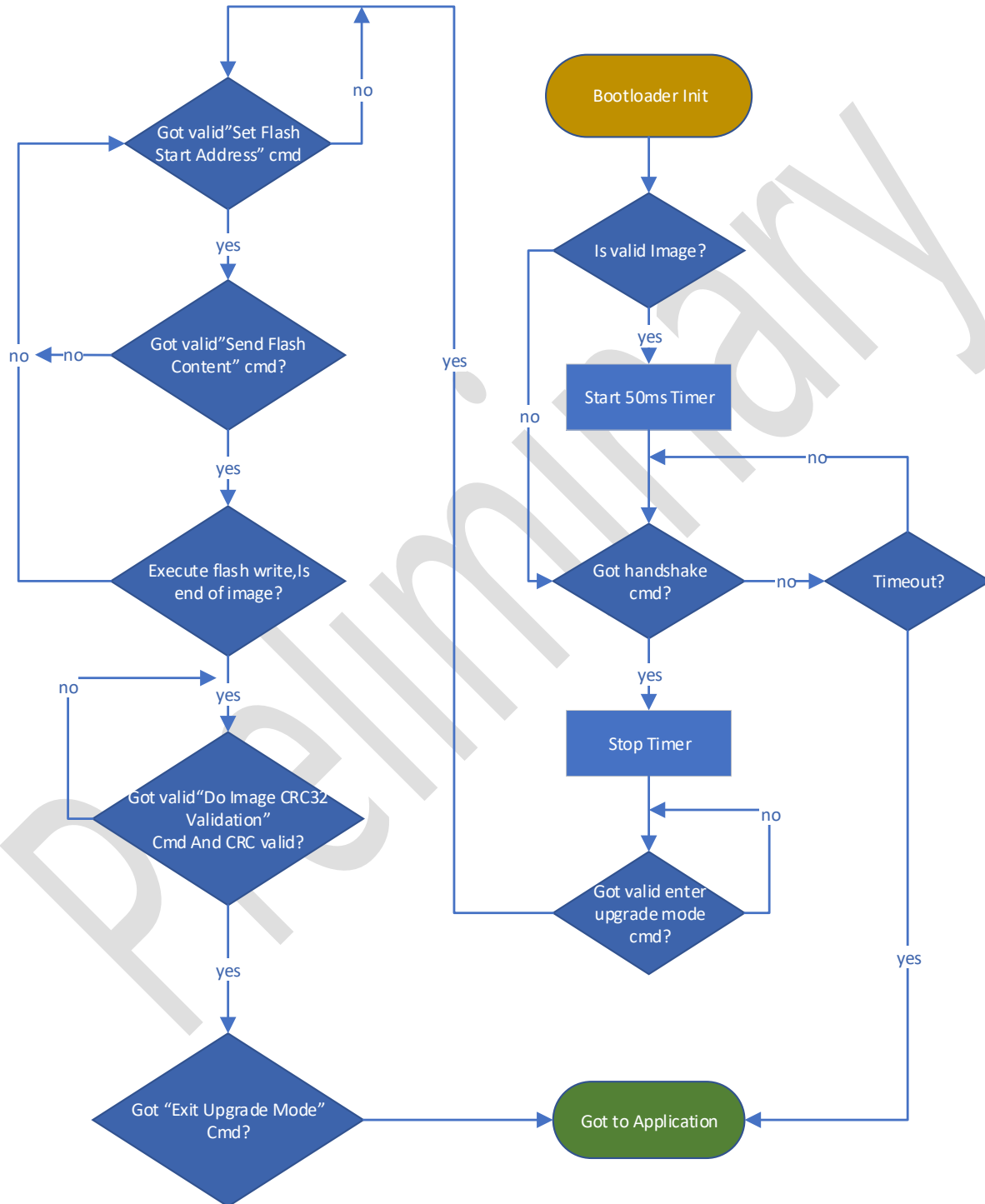
3.3 USER DATA MEMORY

User data memory feel free to be used in application code, which is often be used for storing color information etc.
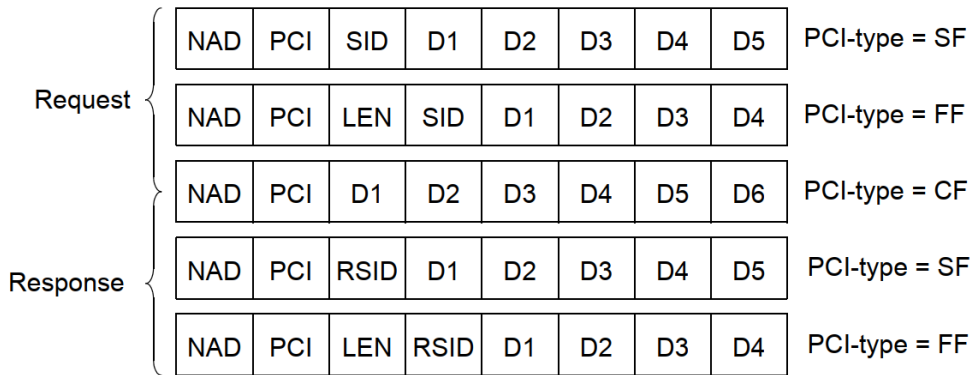
3.4 SYSTEM DATA MEMORY

System data memory is reserved for the data storage of LIN stack and Color Mixing stack, please don't try to do any write operation in application code.

4 BOOTLOADER COMMUNICATION FLOWCHART

5   BOOTLOADER COMMUNICATION PROTOCOL

iND83212 bootloader communication protocol is based on LIN 2.2 specification 3.2 Transport Layer Specification:

NAD	PCI	SID	D1	D2	D3	D4	D5	PCI-type = SF
NAD	PCI	LEN	SID	D1	D2	D3	D4	PCI-type = FF
NAD	PCI	D1	D2	D3	D4	D5	D6	PCI-type = CF
NAD	PCI	RSID	D1	D2	D3	D4	D5	PCI-type = SF
NAD	PCI	LEN	RSID	D1	D2	D3	D4	PCI-type = FF

Request: rows 1–3 (SF, FF, CF)
Response: rows 4–5 (SF, FF)

5.1   HANDSHAKE COMMAND

Table 1-1.   Handshake Command

Type	REQ/ACK	FID	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
SF	Request	0x3C	NAD	PCI=0x06	SID=0x20	CMD=0x00	0xAA	0x55	0x5A	0x5A
SF	ACK	0x3D	NAD	PCI=0x03	RSID=0x60	0x00	0x00	Min Pack Interval	Image CRC Min Interval	
SF	NAK	0x3D	NAD	PCI=0x03	RSID=0x60	0x00	0x01	0xFF	0xFF	0xFF

■   Min Pack Interval: units: ms; After finished package transition, bootloader would write the data to flash, it would take time to finish, so BCM would decide the time interval before Set Flash Start Address according to the value, refers to 5.3 Set Flash Start Address

■   Image CRC Min Interval: units: ms; After finished image transition, doing whole image CRC validation would take long time, this value would be used for BCM to decide the time interval between doing image CRC calculation(3C) and get the result(3D) according to the value refers to 5.5 Do image CRC validation.

5.2   ERASE SYSTEM DATA(OPTIONAL)

Table 1-2.   Erase System Data Command

Type	REQ/ACK	FID	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
SF	Request	0x3C	NAD	PCI=0x06	SID=0x20	CMD=0x03	0xF5	0xA5	0xA5	0xF5
SF	ACK	0x3D	NAD	PCI=0x03	RSID=0x60	0x03	0x00	0xFF	0xFF	0xFF
SF	NAK	0x3D	NAD	PCI=0x03	RSID=0x60	0x03	0x01	0xFF	0xFF	0xFF

Note that this is an optional command, which can be used to reset the device to factory new after upgraded, send this command and get ACK would erase the information which includes:

1.   LIN related information, AND, Frame ID etc.

2.   Color parameters.

5.3 ENTERING UPGRADING MODE

Table 1-3.   Enter Upgrade Mode Command

Type	REQ/ACK	FID	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
SF	Request	0x3C	NAD	PCI=0x06	SID=0x20	CMD=0x01	0x55	0xAA	HeadAddrL	HeadAddrH
SF	ACK	0x3D	NAD	PCI=0x05	RSID=0x60	0x01	0x00	HeadAddrL	HeadAddrH	0xFF
SF	NAK	0x3D	NAD	PCI=0x05	RSID=0x60	0x01	0x01	HeadAddrL	HeadAddrH	0xFF

■   HeadAddr:the start address of the image, in this application, the start address must be 0x1C00

5.4 SET FLASH START ADDRESS

Table 1-4.   Set Flash Start Address Command

Type	REQ/ACK	FID	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
SF	Request	0x3C	NAD	PCI=0x06	SID=0x20	CMD=0xE0	dataSizeL	dataSizeH	FlashStartAddressL	FlashStartAddressH
SF	ACK	0x3D	NAD	PCI=0x05	RSID=0x60	0xE0	0x00	CurrFlashStartAddressL	CurrFlashStartAddressH	0xFF
SF	NAK	0x3D	NAD	PCI=0x05	RSID=0x60	0xE0	0x01	CurrFlashStartAddressL	CurrFlashStartAddressH	0xFF

■   DataSize: Flash data length in one package, except the last data length in the end of image, the data length must be the one of 64,128,256.

■   FlashStartAddress: the start address that the data to be written.

5.5 SEND FLASH CONTENT

Table 1-5.   Send Flash Content Command

Type	REQ/ACK	FID	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
FF	Request	0x3C	NAD	PCI=0x11	LEN=0x06	SID=0x21	dataSizeL	dataSizeH	FlashStartAddressL	FlashStartAddressH
CF1	Request	0x3C	NAD	PCI=0x21	CRC[0]	CRC[1]	CRC[2]	CRC[3]	DATA[2]	DATA[3]
CF2	Request	0x3C	NAD	PCI=0x22	DATA[4]	DATA[5]	DATA[6]	DATA[7]	DATA[8]	DATA[9]
CF3	Request	0x3C	NAD	PCI=0x23	DATA[10]	DATA[11]	DATA[12]	DATA[13]	DATA[14]	DATA[15]
CF4	Request	0x3C	NAD	PCI=0x24	DATA[16]	DATA[17]	DATA[18]	DATA[19]	DATA[20]	DATA[21]
…	Request	0x3C	NAD	…	…	…	…	…	…	…
SF	ACK	0x3D	NAD	PCI=0x04	RSID=0x21	0x00	CurrFlashStartAddressL	CurrFlashStartAddressH	0xFF	0xFF
SF	NAK	0x3D	NAD	PCI=0x04	RSID=0x21	0x01	CurrFlashStartAddressL	CurrFlashStartAddressH	0xFF	0xFF

■ DataSize: Flash data length in one package

■ FlashStartAddress: the start address that the data to be written.

This above information must be the same as the content in the command "Set Flash Start Address".

■ CRC:data content CRC calibration in the package.

5.6 DO IMAGE CRC32 VALIDATION

Table 1-6.   Do Image CRC32 Validation Command

Type	REQ/ACK	FID	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
SF	Request	0x3C	NAD	PCI=0x06	SID=0x20	CMD=0xE1	CRC[0]	CRC[1]	CRC[2]	CRC[3]
SF	ACK	0x3D	NAD	PCI=0x03	RSID=0x60	0xE1	0x00	0xFF	0xFF	0xFF
SF	NAK	0x3D	NAD	PCI=0x03	RSID=0x60	0xE1	0x01	0xFF	0xFF	0xFF

5.7 EXIT UPGRADE MODE

Table 1-7.   Exit Upgrade Mode Command

Type	REQ/ACK	FID	DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7
SF	Request	0x3C	NAD	PCI=0x06	SID=0x20	CMD=0xE1	CRC[0]	CRC[1]	CRC[2]	CRC[3]
SF	ACK	0x3D	NAD	PCI=0x03	RSID=0x60	0xE1	0x00	0xFF	0xFF	0xFF
SF	NAK	0x3D	NAD	PCI=0x03	RSID=0x60	0xE1	0x01	0xFF	0xFF	0xFF