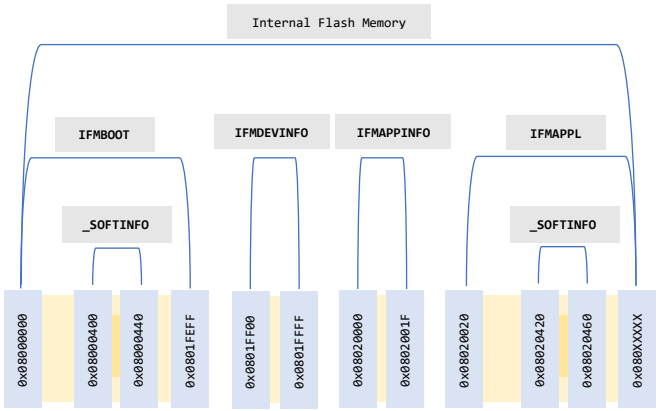
Firmware - Internal Flash Memory Structure

In this section the reader will be able to understand the internal flash memory structure the microcontrollers. To ensure the consistency, each microcontroller should respect the following flash memory structure if and only if the board supports firmware upgrade and versioning. The Flash memory should be compliant with the following schema/table:



Sector/Area name	Memory Address	Size	Description
IFMBOOT	0x08000000 - 0x0801FEFF	130815 bytes	In this sector, we place the Bootloader firmware
IFMBOOT_SOFTINFO	0x08000400 - 0x08000440	64 bytes	Software Information (Bootloader)
IFMDEVINFO	0x0801FF00 - 0x0801FFFF	256 bytes	Contains the Serial Number of the Board, the Manufacturing/Production Date as well as any other information related to the board manufacturing procedure and identification. Please ref to the Table: [IFMDEVINFO and IFMDEVINFO_EX]
IFMAPPINFO	0x08020000 - 0x0802001F	32 bytes	Contain information regarding the Application Firmware Installation: Operator Code, Date, Size, CRC etc
IFMAPPL	0x08020020 - 0x080XXXXX	~Max bytes	In this sector, we place the Application firmware
IFMAPP_SOFTINFO	0x8020420 - 0x08020460	64 bytes	Software Information (Application)

Table 1: Firmware Flash Memory Sectors

A generic data structure template of the IFMDEVINFO, IFMAPPINFO, *_SOFTINFO sectors is presented below:

Byte #	Field Name	Size	Order	Description
0	AVC	2 bytes	MSB	CRC16_CCIT value calculation of the sector
1			LSB	
2	FN	1 byte	-	Field Name/Type
3	FS	1 byte	-	Field Size
4 – 4+FS	FD[x]	FS bytes	Depends	Field Data
n+1	FN	1 byte	-	Field Name/Type
n+2	FS	1 byte		Field Size
n+3 – n+3+FS	FD[x]	FS bytes	Depends	Field Data

Table 2: IFMDEVINFO and IFMAPPINFO Sector Structure

Sector Details: IFMBOOT

This sector contains bootloader firmware details. To expose some software related information, the bootloader firmware contains a fixed allocated area starting at `0x8000400` address.

Field Name	Size	Value	Description
IFMBOOT_SOFTINFO_CRC	2 bytes	-	CRC16_CCIT value calculation of the 64(-2) bytes area
IFMBOOT_SOFTINFO_SI	1 byte	0xF1	Indicate the Boot Software Identification (Code.Version) [UDS:BSIDID]
IFMBOOT_SOFTINFO_SISZ	1 byte	-	Indicate the Boot Software Identification (Code.Version) Data Size
IFMBOOT_SOFTINFO_SIDT[x]	X bytes [d:14]	-	
IFMBOOT_SOFTINFO_UV	1 byte	0xF3	Indicate the UDS Version [UDS:ECUMDDID]
IFMBOOT_SOFTINFO_UVSZ	1 byte	-	Indicate the UDS Version Data Size
IFMBOOT_SOFTINFO_UVDT[x]	X bytes [d:4]	-	
IFMBOOT_SOFTINFO_CB	1 byte	0xF4	Indicate the CANBus support [UDS:VMECUHNDID]
IFMBOOT_SOFTINFO_CBSZ	1 byte	-	Indicate the CANBus support Data Size
IFMBOOT_SOFTINFO_CBDT[x]	1 bytes [d:1]	-	
IFMBOOT_SOFTINFO_CA	1	0xF2	Indicate the compatible Application Software Identification
IFMBOOT_SOFTINFO_CASZ	1	-	Indicate the Application Software Identification Data Size
IFMBOOT_SOFTINFO_CADT[x]	X bytes [d:10]		

Byte #	Generic Field Name	Size	Order	Value	Details
0	IFMBOOT_SOFTINFO_CRC	2 bytes	MSB	?	IFMBOOT_SOFTINFO area CRC16_CCIT value
1			LSB	?	
2	IFMBOOT_SOFTINFO_SI	1 byte		0xF1	Boot Software Identification
3	IFMBOOT_SOFTINFO_SISZ	1 byte	-	0x0E	14 bytes
4	IFMBOOT_SOFTINFO_SIDT [0]	1/14 bytes		…	Ex: EN.F000000.000
…	IFMBOOT_SOFTINFO_SIDT […]	…		…	
11	IFMBOOT_SOFTINFO_SIDT [13]	14/14 bytes		…	
12	IFMBOOT_SOFTINFO_CA	1 byte		0xF2	Compatible Application Software Identification
13	IFMBOOT_SOFTINFO_CASZ	1 byte		0x0E	14 bytes
14	IFMBOOT_SOFTINFO_CADT [0]	1/10 bytes			Ex: EN.F000006
…	IFMBOOT_SOFTINFO_CADT […]	…			
24	IFMBOOT_SOFTINFO_CADT [9]	10/10 bytes			
25	IFMBOOT_SOFTINFO_UV	1 byte		0xF3	UDS Version
26	IFMBOOT_SOFTINFO_UVSZ	1 byte		0x04	4 bytes
27	IFMBOOT_SOFTINFO_UVDT [0]	1/4 bytes		…	Ex: 1000 (1.0.0.0)
…	IFMBOOT_SOFTINFO_UVDT […]	…		…	
31	IFMBOOT_SOFTINFO_UVDT [3]	4/4 bytes		…	
32	IFMBOOT_SOFTINFO_CB	1 byte		0xF4	CANBus support (Code.Version)
33	IFMBOOT_SOFTINFO_CBSZ	1 byte		0x01	1 byte
34	IFMBOOT_SOFTINFO_CBDT [0]	1 bytes	-	…	Ex: 1 (CANBus Classic)
…	Invalidated byte			0x00	
64	Invalidated byte			0x00	

Sector Details: IFMAPP

This sector contains application firmware details. To expose some software related information, the application firmware contains a fixed allocated area starting at `0x8020420` address.

Field Name	Size	Value	Description
IFMAPP_SOFTINFO_CRC	2 bytes	-	CRC16_CCIT value calculation of the 64(-2) bytes area
IFMAPP_SOFTINFO_SI	1 byte	0XE1	Indicate the Application Software Identification (Code.Version) [UDS:ASIDID]
IFMAPP_SOFTINFO_SISZ	1 byte	-	Indicate the Application Software Identification (Code.Version) Data Size
IFMAPP_SOFTINFO_SIDT[x]	X bytes [d:10]	-	
IFMAPP_SOFTINFO_UV	1 byte	0xE2	Indicate the UDS Version [UDS:ECUMDDID]
IFMAPP_SOFTINFO_UVSZ	1 byte	-	Indicate the UDS Version Data Size
IFMAPP_SOFTINFO_UVDT[x]	X bytes [d:4]	-	
IFMAPP_SOFTINFO_CB	1 byte	0xE3	Indicate the CANBus support [UDS:VMECUHNDID]
IFMAPP_SOFTINFO_CBSZ	1 byte	-	Indicate the CANBus support Data Size
IFMAPP_SOFTINFO_CBDT[x]	X bytes [d:1]	-	

Byte #	Generic Field Name	Size	Order	Value	Details
0	IFMAPP_SOFTINFO_CRC	2 bytes	MSB	?	IFMAPP_SOFTINFO area CRC16_CCIT value
1			LSB	?	
2	IFMAPP_SOFTINFO_SI	1 byte		0xE1	Application Software Identification
3	IFMAPP_SOFTINFO_SISZ	1 byte	-	0x0E	14 bytes
4	IFMAPP_SOFTINFO_SIDT [0]	1/8 bytes		…	Ex: EN.F000000.000
…	IFMAPP_SOFTINFO_SIDT […]	…		…	
11	IFMAPP_SOFTINFO_SIDT [7]	14/14 bytes		…	
12	IFMAPP_SOFTINFO_UV	1 byte		0xE2	UDS Version
13	IFMAPP_SOFTINFO_UVSZ	1 byte		0x0A	10 bytes
14	IFMAPP_SOFTINFO_UVDT [0]	1/4 bytes		…	Ex: 1000 (1.0.0.0)
…	IFMAPP_SOFTINFO_UVDT […]	…		…	
24	IFMAPP_SOFTINFO_UVDT [3]	4/4 bytes		…	
25	IFMAPP_SOFTINFO_CB	1 byte		0xE3	CANBus support (Code.Version)
26	IFMAPP_SOFTINFO_CBSZ	1 byte		0x01	1 byte
27	IFMAPP_SOFTINFO_CBDT [0]	1 bytes	-	…	Ex: 1 (CANBus Classic)
…	Invalidated byte			0x00	
64	Invalidated byte			0x00	

Sector Details: IFMDEVINFO

This sector contains the constant device information. During the manufacturing, this sector must be erased and written by the EOL (programmer) tool according to the specifications below.

Field Name	Size	Value	Description
IFMDEVINFOCRC	2 bytes	-	CRC16_CCIT value calculation of the 256(-2) bytes area
IFMDEVINFOSN	1 byte	0x11	Indicate the ECU Serial Number [UDS:ECUSNDID]
IFMDEVINFOSNSZ	1 byte	-	Indicate the ECU Serial Number Data Size
IFMDEVINFOSNDT[x]	X bytes [d:10]	-	
IFMDEVINFOMD	1 byte	0x12	Indicate the Manufacturing Date [UDS:ECUMDDID]
IFMDEVINFOMDSZ	1 byte	-	Indicate the Manufacturing Date Data Size
IFMDEVINFOMDDT[x]	X bytes [d:8]	-	
IFMDEVINFOHC	1 byte	0x13	Indicate the Hardware Number (Code.Version) [UDS:VMECUHNDID]
IFMDEVINFOHCSZ	1 byte	-	Indicate the Hardware Number (Code.Version) Data Size
IFMDEVINFOHCDT[x]	X bytes [d:14]	-	
IFMDEVINFOOP	1 byte	0x14	(optional) Indicate any device static parameters
IFMDEVINFOOPSZ	1 byte	-	Indicate any device static parameters Data Size
IFMDEVINFOOPDT[x]	X bytes	-	

Byte #	Generic Field Name	Size	Order	Value	Details
0	IFMDEVINFOCRC	2 bytes	MSB	?	IFMDEVINFO sector CRC16_CCIT value
1			LSB	?	
2	IFMDEVINFOMD	1 byte		0x12	Indicate the Manufacturing Date [UDS: ECUMDDID]
3	IFMDEVINFOMDSZ	1 byte	-	0x08	8 bytes
4	IFMDEVINFOMDDT [0]	1/8 bytes		…	Ex: 20210823 (YYYYMMDD)
…	IFMDEVINFOMDDT […]	…		…	
11	IFMDEVINFOMDDT [7]	8/8 bytes		…	
12	IFMDEVINFOSN	1 byte		0x11	ECU Serial Number
13	IFMDEVINFOSNSZ	1 byte		0x0A	10 bytes
14	IFMDEVINFOSNDT [0]	1/10 bytes		…	Ex: S23PQ678RT
…	IFMDEVINFOSNDT […]	…		…	
24	IFMDEVINFOSNDT [9]	10/10 bytes		…	
25	IFMDEVINFOHC	1 byte		0x13	Hardware Number (Code.Version)
26	IFMDEVINFOHCSZ	1 byte		0x04	14 bytes
27	IFMDEVINFOHCDT [0]	1/14 bytes	-	…	Ex: EN.W000000.000
…	IFMDEVINFOHCDT […]	…	-	…	
41	IFMDEVINFOHCDT [13]	14/14 bytes	-	…	
42	IFMDEVINFOOP	1 byte		0x14	Device static parameters
43	IFMDEVINFOOPSZ	1 byte		0x04	X bytes
44	IFMDEVINFOOPDT [0]	1/X bytes	-	…	Optional data field. Can be also removed
…	IFMDEVINFOOPDT […]	…	-	…	
X	IFMDEVINFOOPDT [X]	X/X bytes	-	…	
…	Invalidated byte			0x00	
256	Invalidated byte			0x00	

Sector Details: IFMAPPINFO

This sector contains information about the application firmware upgrade operation. During the application firmware upgrade procedure (performed by the bootloader firmware), this sector must be erased when the erase memory request is received and written with the updated values when the VAFAFUP (Validate and Finalize Application Firmware Upgrade procedure) request is asserted.

Field Name	Size	Value	Description
IFMAPPINFOCRC	2 bytes	-	CRC16_CCIT value calculation of the 32(-2) bytes area
IFMAPPINFOPD	1 byte	0x21	Indicate the Programming Date [UDS:PDDID]
IFMAPPINFOPDSZ	1 byte	-	Indicate the Programming Date Data Size
IFMAPPINFOPDDT[x]	X bytes [d:8]	-	
IFMAPPINFOOC	1 byte	0x22	Indicate the Operator Code
IFMAPPINFOOCSZ	1 byte	-	Indicate the Operator Code Data Size
IFMAPPINFOOCDT[x]	X bytes [d:2]	-	
IFMAPPINFOFS	1 byte	0x23	Indicate the Firmware Size
IFMAPPINFOFSSZ	1 byte	-	Indicate the Firmware Size Data Size
IFMAPPINFOFSDT[x]	X bytes [d:4]	-	
IFMAPPINFOFV	1 byte	0x24	Indicate the Firmware CRC
IFMAPPINFOFVSZ	1 byte	-	Indicate the Firmware CRC Data Size
IFMAPPINFOFVDT[x]	X bytes [d:2]	-	

Byte #	Generic Field Name	Size	Order	Value	Description
0	IFMAPPINFOCRC	2 bytes	MSB	?	IFMAPPINFO sector CRC16_CCIT value
1			LSB	?	
2	IFMAPPINFOPD	1 byte		0x21	Programming Date
3	IFMAPPINFOPDSZ	1 byte	-	0x08	Field Size of 8 bytes
4	IFMAPPINFOPDDT [0]	1/8 bytes	-		Ex: 20210823 (YYYYMMDD)
…	IFMAPPINFOPDDT […]	…	-		
11	IFMAPPINFOPDDT [7]	8/8 bytes	-		
12	IFMAPPINFOOC	1 byte		0x22	Operator Code
13	IFMAPPINFOOCSZ	1 byte		0x02	2 bytes
14	IFMAPPINFOOCDT [0]	1/2 bytes	MSB	0X1F	Ex: Nick has the OpCode 0x1F28
15	IFMAPPINFOOCDT [1]	2/2 bytes	LSB	0x28	
16	IFMAPPINFOFS	1 byte		0x23	Firmware Size
17	IFMAPPINFOFSSZ	1 byte		0x04	4 bytes
18	IFMAPPINFOFSDT [0]	1/4 bytes	MSB	0X00	132018 bytes (0x000203B2)
19	IFMAPPINFOFSDT [1]	2/4 bytes	-	0x02	
20	IFMAPPINFOFSDT [2]	3/4 bytes	-	0x03	
21	IFMAPPINFOFSDT [3]	4/4 bytes	LSB	0xB2	
22	IFMAPPINFOFV	1 byte		0x24	Firmware CRC
23	IFMAPPINFOFVSZ	1 byte		0x04	2 bytes
24	IFMAPPINFOFVDT [0]	1/2 bytes	MSB	0X32	Ex: 0x3230
25	IFMAPPINFOFVDT [1]	2/2 bytes	LSB	0x30	
…	Invalidated byte			0x00	
31	Invalidated byte			0x00	