




<b>BOSCH</b>   <b>CAP-SST/ESB3</b>	<b>Data flash handling in Gen 9.3 projects</b>	Edition 1.3	Page 1/12	Date 13.08.2019
	Documentation	Sebastian Sommer Manfred Hanusa Ingo Ehlert		5139 4221 4007

# Generic Data flash handling in Gen 9.3 projects

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## History:

No.	Date	Author	Chapter	Description
01	21.01.2016	Hanusa/Ehlert		Initial release
1.1	30.01.2019	Sommer	4.1	EraseCounter Bank use blocks 0 until 10, use of block 11 is wrong. Impact on address map corrected accordingly  Increased area for bootloader validity information. Required for RBBLDR introduction
1.2	10.04.2019	Sommer	all	Introduce new U2A device Fix review findings
1.3	13.08.2019	Ehlert	4.2	updated DataFlash segmentation in U2A

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# 1 Referenced documents

## 1.1 Supplier documents

[1]	Training materials: RH850 / P1x-C Flash Memory Renesas Electronics Europe ABG, HW Engineering/Auto Control System	V1.00 17.07.2013
[2]	RH850/P1x-C Group User's Manual: Hardware R01UH0490EJ0060 Rev.0.60 File: D3_D4_D5_D5EDv2_r01uh0490ej0060_rh850p1x-c.pdf	V0.60 24.09.2014
[3]	RH850/U2A-EVA Group User's Manual: Hardware r01uh0820ej0050-rh850u2a_Hardware_UM.pdf	V0.50 Dec 2018

## 1.2 International documents


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## 2 Introduction

The data flash is to store non volatile data during normal user code execution

Data retention: 125K E/W operations of 20 years, 250K E/W of 3 years

Data flash is accessible via flash programmer or via the data flash library

Data flash erase / write operation can be suspended and resumed

Data flash is in erased state when shipped

Read value from erased data flash memory is undefined

Bus width is 39bit (32-bit data + 7-bit ECC)

Background operation: Read, write, erase operations to the data flash while application code can be executed from code flash.

### 2.1 RH850 P1X devices

Data flash area is divided into 64 byte blocks

Erase size: 64bytes

Program size: 4 bytes

Data Flash size: 64 KB to 192 KB of data flash depending on the device.

D3/D4/D5: additional 32KB secure data flash (exclusively for ICU-M)

Address	Area	D1	D3ED D1 mode	D2	D3ED D2 mode	D3	D3ED D3 mode	D4	D5ED D4 mode	D5	D5ED D5 mode
0xFF3F_FFFF	Data Flash Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area
0xFF30_8000						32K ICU Data Flash	32K ICU Data Flash	32K ICU Data Flash	32K ICU Data Flash	32K ICU Data Flash	32K ICU Data Flash
0xFF30_7FFF											
0xFF30_0000						Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area	Reserve Area
0xFF2F_FFFF											
0xFF23_0000											
0xFF22_FFFF											
0xFF22_0000											
0xFF21_FFFF											
0xFF21_0000											
0xFF20_FFFF				Data Flash 64KB	Data Flash 64KB	Data Flash 64KB	Data Flash 64KB	Data Flash 128KB	Data Flash 128KB	Data Flash 192KB	Data Flash 192KB
0xFF20_8000											
0xFF20_7FFF											
0xFF20_0000											
Total memory		32KB	32KB	64KB	64KB	96KB	96KB	160KB	160KB	224KB	224KB

### 2.2 RH850 U2A devices

Data flash area is divided into 4 KB blocks


Erase size: N x 4KB

Program size: 4 bytes

Data Flash size: 256 KB to 512 KB of data flash depending on the device.

Additional 64 KB secure data flash (exclusively for ICUMHA)

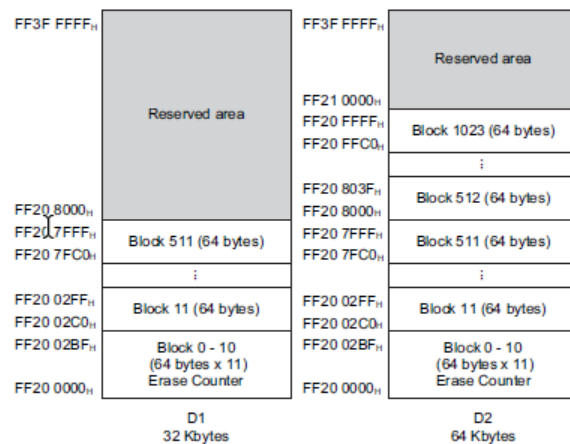
For memory locations see Chapter 3.2

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## 3 Segmentation of data flash

### 3.1 RH850 P1X devices

#### 3.1.1 D1, D2




User data flash only on Bank A

- Non secure data flash in Bank A
- Erase counters

Extra data flash area

- Option bytes, OTP bit

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### 3.1.2 D3, D4, D5/D5ED


FF3F FFFF <sub>x</sub>	Reserved area	FF3F FFFF <sub>x</sub>	Reserved area	FF3F FFFF <sub>x</sub>	Reserved area
FF30 8000 <sub>x</sub>		FF30 8000 <sub>x</sub>		FF30 8000 <sub>x</sub>	
FF30 7FFF <sub>x</sub>	Block 511 (64 bytes)	FF30 7FFF <sub>x</sub>	Block 511 (64 bytes)	FF30 7FFF <sub>x</sub>	Block 511 (64 bytes)
FF30 7FC0 <sub>x</sub>		FF30 7FC0 <sub>x</sub>		FF30 7FC0 <sub>x</sub>	
	⋮		⋮		⋮
FF30 02FF <sub>x</sub>	Block 11 (64 bytes)	FF30 02FF <sub>x</sub>	Block 11 (64 bytes)	FF30 02FF <sub>x</sub>	Block 11 (64 bytes)
FF30 02C0 <sub>x</sub>		FF30 02C0 <sub>x</sub>		FF30 02C0 <sub>x</sub>	
FF30 02BF <sub>x</sub>	Block 0 – 10 (64 bytes x 11) Erase Counter	FF30 02BF <sub>x</sub>	Block 0 – 10 (64 bytes x 11) Erase Counter	FF30 02BF <sub>x</sub>	Block 0 – 10 (64 bytes x 11) Erase Counter
FF30 0000 <sub>x</sub>		FF30 0000 <sub>x</sub>		FF30 0000 <sub>x</sub>	
FF2F FFFF <sub>x</sub>	Reserved area	FF2F FFFF <sub>x</sub>	Reserved area	FF2F FFFF <sub>x</sub>	Reserved area
				FF23 0000 <sub>x</sub>	
				FF23 FFFF <sub>x</sub>	Block 3071 (64 bytes)
				FF23 FFC0 <sub>x</sub>	
					⋮
				FF22 003F <sub>x</sub>	Block 2048 (64 bytes)
				FF22 0000 <sub>x</sub>	
		FF21 FFFF <sub>x</sub>	Block 2047 (64 bytes)	FF21 FFFF <sub>x</sub>	Block 2047 (64 bytes)
		FF21 FFC0 <sub>x</sub>		FF21 FFC0 <sub>x</sub>	
			⋮		⋮
		FF21 003F <sub>x</sub>	Block 1024 (64 bytes)	FF21 003F <sub>x</sub>	Block 1024 (64 bytes)
		FF21 0000 <sub>x</sub>		FF21 0000 <sub>x</sub>	
FF20 FFFF <sub>x</sub>	Block 1023 (64 bytes)	FF20 FFFF <sub>x</sub>	Block 1023 (64 bytes)	FF20 FFFF <sub>x</sub>	Block 1023 (64 bytes)
FF20 FFC0 <sub>x</sub>		FF20 FFC0 <sub>x</sub>		FF20 FFC0 <sub>x</sub>	
	⋮		⋮		⋮
FF20 02FF <sub>x</sub>	Block 11 (64 bytes)	FF20 02FF <sub>x</sub>	Block 11 (64 bytes)	FF20 02FF <sub>x</sub>	Block 11 (64 bytes)
FF20 02C0 <sub>x</sub>		FF20 02C0 <sub>x</sub>		FF20 02C0 <sub>x</sub>	
FF20 02BF <sub>x</sub>	Block 0 – 10 (64 bytes x 11) Erase Counter	FF20 02BF <sub>x</sub>	Block 0 – 10 (64 bytes x 11) Erase Counter	FF20 02BF <sub>x</sub>	Block 0 – 10 (64 bytes x 11) Erase Counter
FF20 0000 <sub>x</sub>		FF20 0000 <sub>x</sub>		FF20 0000 <sub>x</sub>	
<b>D3</b> 64 + 32 Kbytes		<b>D4</b> 128 + 32 Kbytes		<b>D5/D5ED</b> 192 + 32 Kbytes	

User data flash: Bank A & Bank B

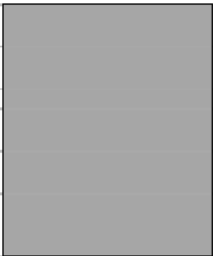
- Non secure data flash in Bank A
- Secure data flash in Bank B (exclusively for ICU-M)
- Erase counters in both banks

Extra data flash area

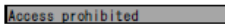
- Option bytes, OTP bits

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## 3.2 RH850 U2A devices

Blank check Address	Address					
FF51 FFFF <sub>H</sub>	FF31 FFFF <sub>H</sub>					
FF48 FFFF <sub>H</sub> FF48 F000 <sub>H</sub>	FF28 FFFF <sub>H</sub> FF28 F000 <sub>H</sub>			Block 143 (4 Kbytes)	Data Area 2 (64 Kbytes)	
				⋮		
FF48 0FFF <sub>H</sub> FF48 0000 <sub>H</sub>	FF28 0FFF <sub>H</sub> FF28 0000 <sub>H</sub>			Block 128 (4 Kbytes)		
FF47 FFFF <sub>H</sub> FF47 F000 <sub>H</sub>	FF27 FFFF <sub>H</sub> FF27 F000 <sub>H</sub>			Block 127 (4 Kbytes)	Data Area 1 (256 Kbytes)	
				⋮		
FF44 FFFF <sub>H</sub> FF44 F000 <sub>H</sub>	FF24 FFFF <sub>H</sub> FF24 F000 <sub>H</sub>			Block 79 (4 Kbytes)		
				⋮		
FF44 0FFF <sub>H</sub> FF44 0000 <sub>H</sub>	FF24 0FFF <sub>H</sub> FF24 0000 <sub>H</sub>			Block 64 (4 Kbytes)	Data Area 2 (64 Kbytes)	
FF43 FFFF <sub>H</sub> FF43 F000 <sub>H</sub>	FF23 FFFF <sub>H</sub> FF23 F000 <sub>H</sub>			Block 63 (4 Kbytes)		
				⋮		
FF42 0FFF <sub>H</sub> FF42 0000 <sub>H</sub>	FF22 0FFF <sub>H</sub> FF22 0000 <sub>H</sub>			Block 32 (4 Kbytes)		
FF41 FFFF <sub>H</sub> FF41 F000 <sub>H</sub>	FF21 FFFF <sub>H</sub> FF21 F000 <sub>H</sub>			Block 31 (4 Kbytes)	Data Area 1 (128 Kbytes)	
				⋮		
FF40 1FFF <sub>H</sub> FF40 1000 <sub>H</sub>	FF20 1FFF <sub>H</sub> FF20 1000 <sub>H</sub>			Block 1 (4 Kbytes)	Data Area 0 (128 Kbytes)	
FF40 0FFF <sub>H</sub> FF40 0000 <sub>H</sub>	FF20 0FFF <sub>H</sub> FF20 0000 <sub>H</sub>			Block 0 (4 Kbytes)		
						576 Kbytes U2A-EVA (U2A16 mode) / U2A16
				320 Kbytes U2A-EVA (U2A8 mode) / U2A8		

Note. The following color coding is used in the map above.




I

User data flash: Data Area 0 – 2

- Non secure data flash in Data Area 0 and Data Area 1
- Secure data flash in Data Area 2 (exclusively for ICUMHA)

Erase Counter will be located in Hardware Property Area.



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## 4 Recommended procedure for dataflash layout

### 4.1 RH850 P1X devices

The data flash is split up into three parts:

- **Erase-Counters\***  
only read access for user. Update done automatically by flash hardware engine.  
Blocks 0..10 in Bank A and B
- **Bootblock Validity Information**  
is used for storing administrative data defined by bootblock  
Read/write access limited for bootblock only (SimpleValidityManager, ValidityHandler)  
Blocks 11..13
- **Reserved Area (to be clarified with Dominik Schumm/Volker Masur)**  
Blocks 14..15
- **Project specific area**  
This dataflash is accessible for projectspecific needs e.g. PDM FEE.  
Blocks: 16..End of Bank A

*\*Additional information Erase Counter:*

*Flash hardware will book keep the erase count of each code flash block in some reserved data flash location*

*Counter in Area A & Area B for each code flash block*

*Valid flag of size 16-bit decide count value is Area A or B is valid*


*If the content of valid flag is 0x5AA5A55A, then count values present in Area B is valid. Else Area A is valid.*

*Erase counter or Valid flags are read only data flash areas.*

Open Topic:


Validity Information for ICU-M image? How to track whether a ICU-M image is valid or not?

Are there requests to store data like the former FDOC? Reserved Area?

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#### 4.1.1 Data flash segmentation for D3/D4/D5

				Device		
Bank	Block#	StartAddress	EndAddress	D3	D4	D5/D5ED
B	511	FF30 7FC0	FF30 7FFF	Secure data flash (exclusively for ICU-M)		
	11	FF30 02C0	FF30 02FF	Block 0 - 10 Erase counter		
B	10	FF30 0280	FF30 02BF			
B	0	FF30 0000	FF30 003F			
A	3071	FF22 FFC0	FF22 FFFF			Projectspecific (e.g.FEE)
A	2047	FF21 FFC0	FF21 FFFF			
				Projectspecific (e.g.FEE)	Projectspecific (e.g.FEE)	Projectspecific (e.g.FEE)
A	1023	FF20 FFC0	FF20 FFFF			
				Reserved		
A	16	FF20 0400	FF20 043F			
A	15	FF20 03C0	FF20 03FF			
	14	FF20 0380	FF20 03BF			
	13	FF20 0340	FF20 037F	Bootloader Validity Information RBBLDR		
	12	FF20 0300	FF20 033F	Bootloader Validity Information ePSW/TCSW		
	11	FF20 02C0	FF20 02FF	Bootloader Validity Information OEM BLDR		
A	10	FF20 0280	FF20 02BF	Block 0 - 10 Erase counter		
A	0	FF20 0000	FF20 0000			

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## 4.2 RH850 U2A devices

The data flash is split up into three parts:

- **Bootblock Validity Information**

This data flash part is used for storing administrative data defined by bootblock.

Read/write access limited for bootblock only (SimpleValidityManager, ValidityHandler)

Block 0

- **Unused**

Unused sectors (reserved for future use)

Block 1-3

- **Project specific area**

This data flash part is accessible for projectspecific needs e.g. PDM FEE.

Blocks 4..63 for U2A8

Blocks 4..127 for U2A16

- **Secure Data Flash**

This data flash part is accessible exclusively by ICUMHA.

Blocks 64..79 for U2A8

Blocks 128..143 for U2A16

4.2.1 Data flash segmentation for D6 (U2A8) / D7 (U2A16)

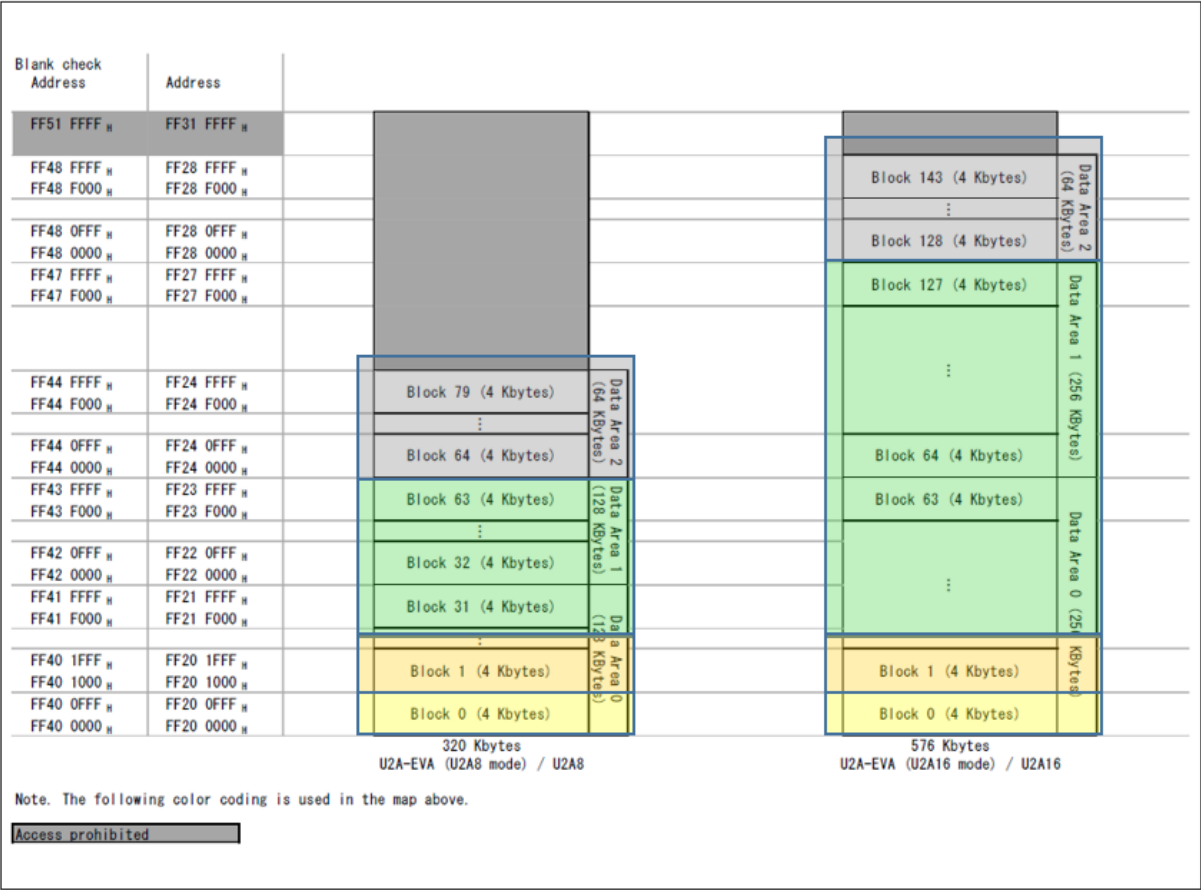


Figure 51.7 Mapping of Data Area

Secure data flash	0xFF240000 - 0xFF24FFFF	0xFF280000 - 0xFF28FFFF
FEE	0xFF204000 - 0xFF23FFFF	0xFF204000 - 0xFF27FFFF
unused	0xFF201000 - 0xFF203FFF	0xFF201000 - 0xFF203FFF
Boot validity info	0xFF200000 - 0xFF200FFF	0xFF200000 - 0xFF200FFF