Generic
Data flash handling in Gen 9.3 projects

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

Table of Contents

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

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)

<table>
<tr><th>Address</th><th>Area</th><th>D1</th><th>D3ED
D1 mode</th><th>D2</th><th>D3ED
D2 mode</th><th>D3</th><th>D3ED
D3 mode</th><th>D4</th><th>D5ED
D4 mode</th><th>D5</th><th>D5ED
D5 mode</th></tr>
<tr><td>0xFF3F_FFFF</td><td rowspan="16">Data Flash Area</td><td rowspan="14">Reserve Area</td><td rowspan="14">Reserve Area</td><td rowspan="13">Reserve Area</td><td rowspan="13">Reserve Area</td><td>Reserve Area</td><td>Reserve Area</td><td>Reserve Area</td><td>Reserve Area</td><td>Reserve Area</td><td>Reserve Area</td></tr>
<tr><td>0xFF30_8000</td></tr>
<tr><td>0xFF30_7FFF</td><td>32K ICU Data Flash</td><td>32K ICU Data Flash</td><td>32K ICU Data Flash</td><td>32K ICU Data Flash</td><td>32K ICU Data Flash</td><td>32K ICU Data Flash</td></tr>
<tr><td>0xFF30_0000</td></tr>
<tr><td>0xFF2F_FFFF</td><td rowspan="4">Reserve Area</td><td rowspan="4">Reserve Area</td><td rowspan="2">Reserve Area</td><td rowspan="2">Reserve Area</td><td>Reserve Area</td><td>Reserve Area</td></tr>
<tr><td>0xFF23_0000</td></tr>
<tr><td>0xFF22_FFFF</td><td rowspan="3">Reserve Area</td><td rowspan="3">Reserve Area</td><td rowspan="3">Data Flash 192KB</td><td rowspan="3">Data Flash 192KB</td></tr>
<tr><td>0xFF22_0000</td></tr>
<tr><td>0xFF21_FFFF</td><td rowspan="3">Data Flash 128KB</td><td rowspan="3">Data Flash 128KB</td></tr>
<tr><td>0xFF21_0000</td></tr>
<tr><td>0xFF20_FFFF</td><td rowspan="3">Data Flash 64KB</td><td rowspan="3">Data Flash 64KB</td><td rowspan="3">Data Flash 64KB</td><td rowspan="3">Data Flash 64KB</td></tr>
<tr><td>0xFF20_8000</td></tr>
<tr><td>0xFF20_7FFF</td><td>Data Flash 32KB</td><td>Data Flash 32KB</td></tr>
<tr><td>0xFF20_0000</td></tr>
<tr><td colspan="2">Total memory</td><td>32KB</td><td>32KB</td><td>64KB</td><td>64KB</td><td>96KB</td><td>96KB</td><td>160KB</td><td>160KB</td><td>224KB</td><td>224KB</td></tr>
</table>

2.2 RH850 U2A devices

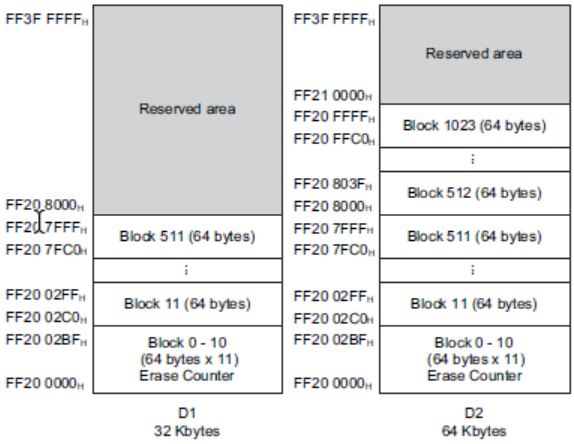
Data flash area is divided into 4 KB blocks
Erase size: N x 4KB
Program size: 4 bytes
Data Flash size: 256 KB to 512 KB of data flash depending on the device.
Additional 64 KB secure data flash (exclusively for ICUMHA)

For memory locations see Chapter 3.2

3 Segmentation of data flash

3.1 RH850 P1X devices

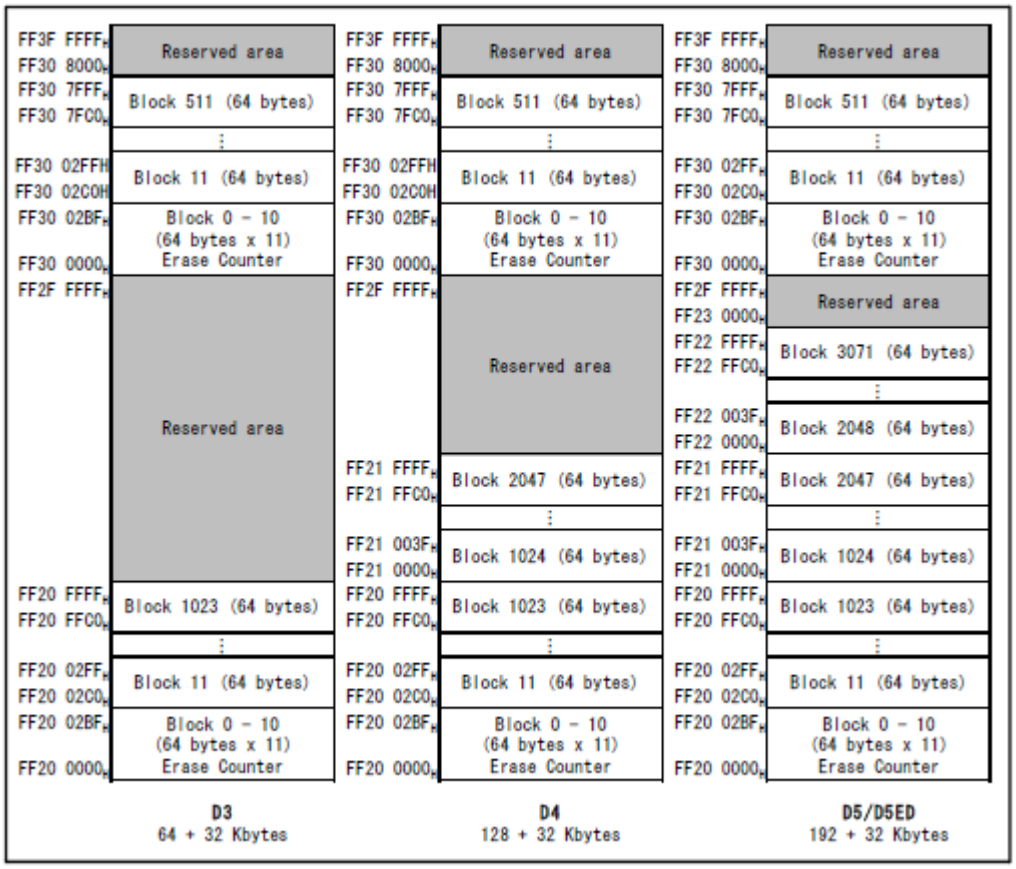
3.1.1 D1, D2



User data flash only on Bank A
- Non secure data flash in Bank A
- Erase counters

Extra data flash area
- Option bytes, OTP bit

3.1.2 D3, D4, D5/D5ED



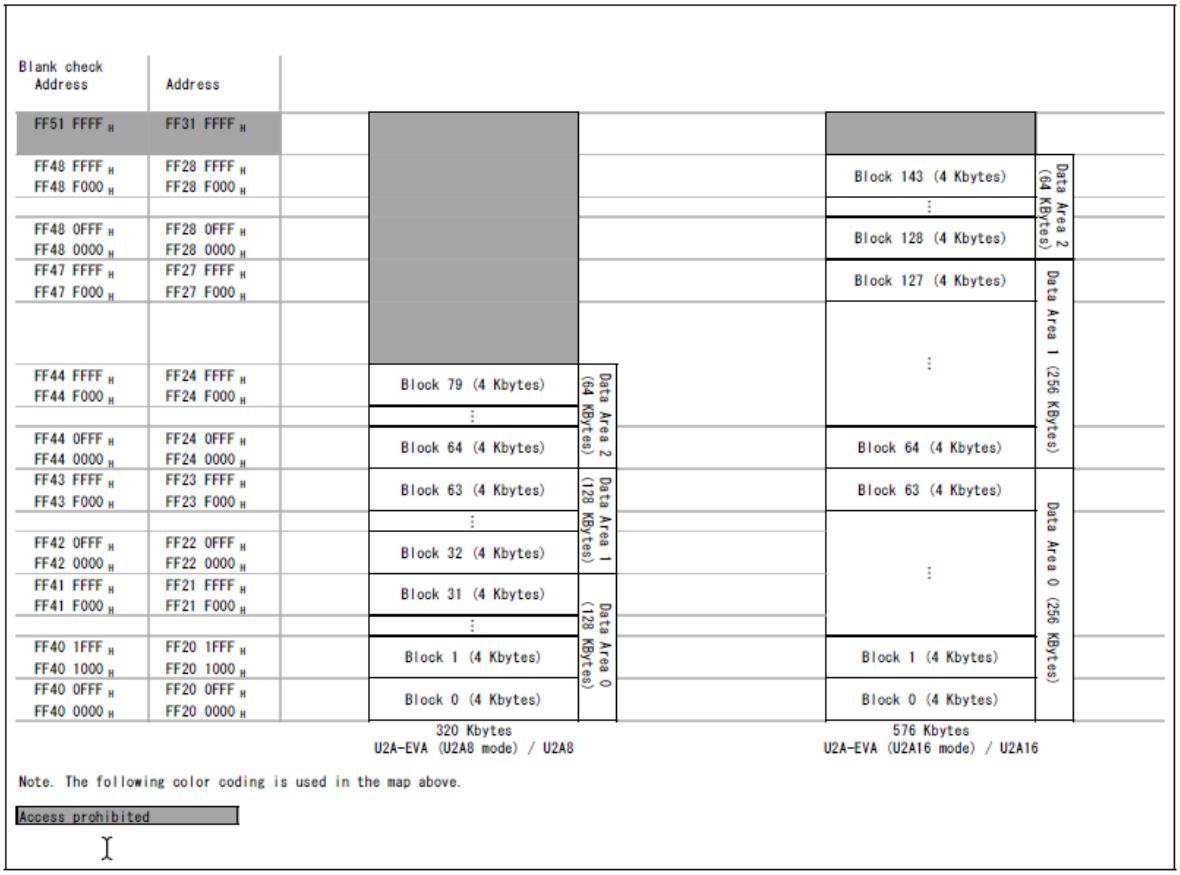
User data flash: Bank A & Bank B

- 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

3.2 RH850 U2A devices



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.

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 (SimpleValdityManager, 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?

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			
B	10	FF30 0280	FF30 02BF	Block 0 - 10 Erase counter		
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)	
A	1023	FF20 FFC0	FF20 FFFF	Projectspecific (e.g.FEE)		
A	16	FF20 0400	FF20 043F			
A	15	FF20 03C0	FF20 03FF	Reserved		
	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			

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 (SimpleValdityManager, 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)

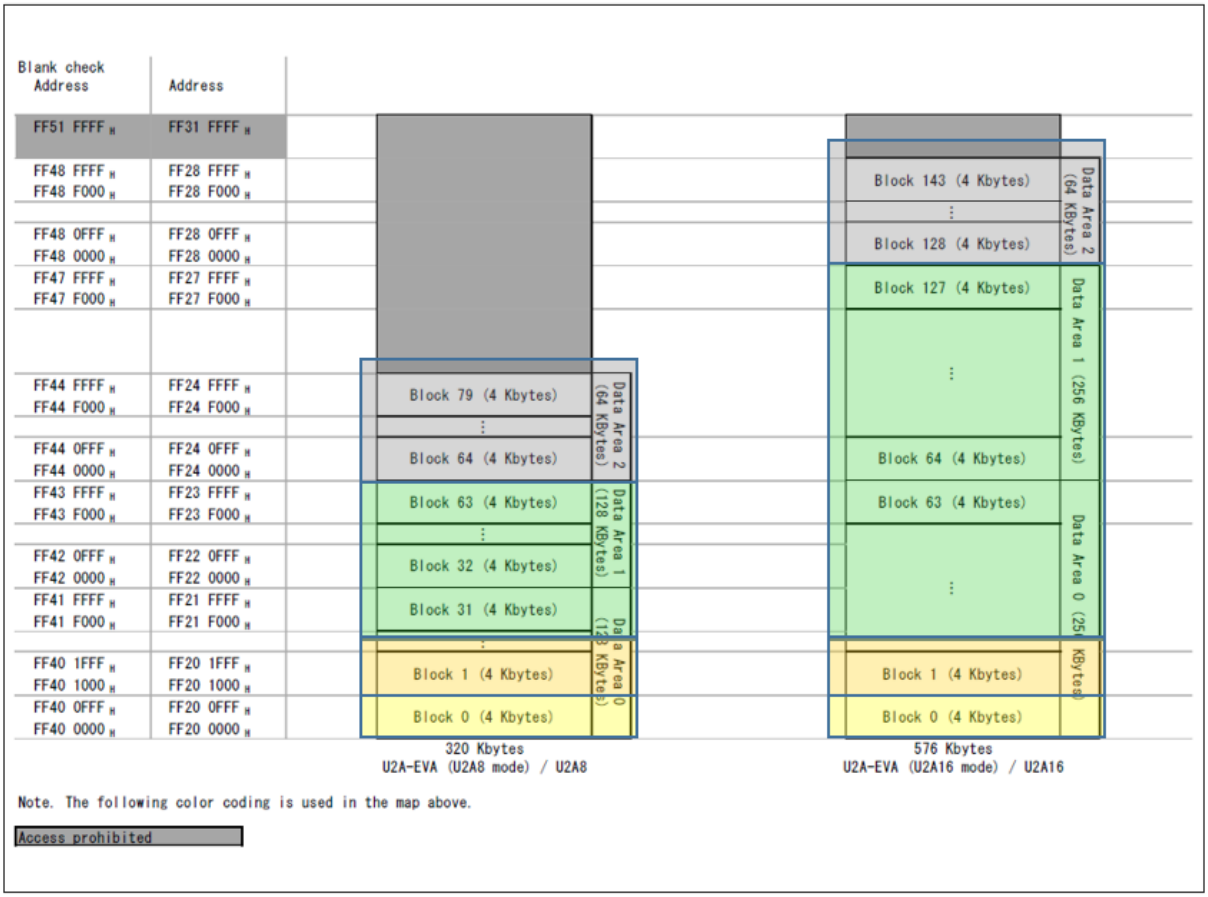


Figure 51.7 Mapping of Data Area

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