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AN205198

FR Family MB91460, Flash Erase and Programming Times

This application note gives a review on different Flash programming and erasing times for the MB91460 series MCU's with four different Flash programming tools.

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1 Introduction

The chapter gives short overview of this application note.

This application note gives a review on different Flash programming and erasing times for the MB91460 series MCU's with four different Flash programming tools:

- FME Flash Programmer (serial asynchronous, synchronous)
- Cypress Japan Flash Programmer (serial asynchronous)
- Conitec GALEP4 Programmer (parallel)
- Conitec GALEP5 Programmer (parallel)

For detailed information's on Flash programming and handling of these Flash programming tools, please refer to document:

FR Family MB91460 Series, Flash Programming.

Chapter 2 contains all timing measurements for the MB91F467D MCU and the available programming tools.

2 Flash programming & erasing timings MB91F467D

The MB91F467DA has built-in Flash memory with a capacity of 1 MByte + 64 KBytes, capability of batch-erasing all sectors or erasing on the sector level via single +3.0V-5.5V power supply, and writing by the FR-CPU at the half-word (16-bit) and word (32-bit) level.

To test the programming performance of the different flash tools, the embedded Flash is programmed with a 1088 kBytes file. To additionally get results for programming and erasing access to each available 16kByte and 128kByte sector, all sectors in figure 1 are programmed and erased individually.

- Flash Memory size
  - 1088KB (0x00040000 … 0x0014FFFF)

- Flash Memory settings
  - Operation mode = 32-bit CPU mode
  - Flash access by Auto Algorithm

    Wait cycles for Flash memory write access
    (FMWT register) Core CLKB = 48MHz

    ATD = 1
    EQ = -
    ALEH = -
    WEXH = 1
    WTC = 5

- Flash Memory Mapping

S_Addr.	E_Addr.	Size	Section	Sec.(Top 81)
00040000	0005FFFF	00020000	CODE	SECTOR0
00060000	0007FFFF	00020000	CODE	SECTOR1
00080000	0009FFFF	00020000	CODE	SECTOR2
000A0000	000BFFFF	00020000	CODE	SECTOR3
000C0000	000DFFFF	00020000	CODE	SECTOR4
000E0000	000FFFFF	00020000	CODE	SECTOR5
00100000	0011FFFF	00020000	CODE	SECTOR6
00120000	0013FFFF	00020000	CODE	SECTOR7
00140000	00143FFF	00004000	CODE	SECTOR8
00144000	00147FFF	00004000	CODE	SECTOR9
00148000	0014800F	00000010	CODE	SECURITY
00148010	0014BFFF	00003FF0	CODE	SECTORA
0014C000	0014FFFF	00004000	CODE	SECTORB

- Flash Auto Algorithm

  Auto Algorithms are launched by writing one to six half words (16 bits) to the Flash memory in succession. This is called a “command.” Writing an illegal address or data, or writing them in the incorrect order, will reset the Flash memory to read mode.

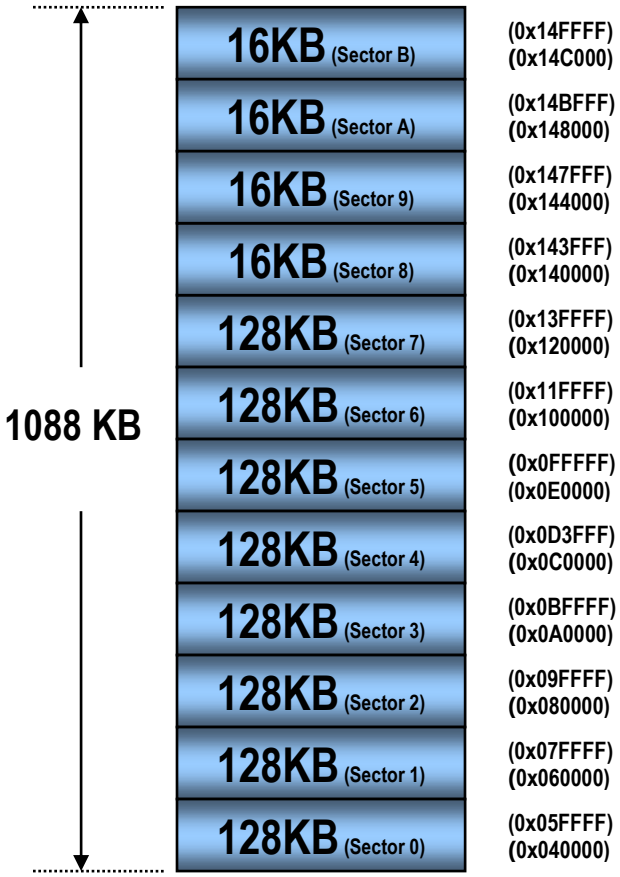
  - Writing

    In CPU programming mode, writes are performed in basic units of half words. Writes are performed in 4 bus operations. The command sequence as two “unlock” cycles, followed by a write setup command and write data cycle. Then, in the final write cycle, writing to memory starts. During writing, all commands written to Flash memory are ignored.

- Chip Erase
  Chip erase (erase all sectors at once) is performed via six accesses. First, there are two “unlock” cycles, after which a setup command is written. This is then followed by two more “unlock” commands before the chip erase command.
- Sector Erase
  Sector erase is performed via six accesses. There are two “unlock” cycles, after which a “setup” command is written, followed by another two “unlock” cycles. On the sixth cycle, a sector erase command is input, starting the sector erase. From the time that the last sector-erase command is written until the timeout of 50ms, the next sector-erase command will be accepted. It is possible to submit multiple sector erases simultaneously by writing the six bus cycles described above. This sequence is performed by writing the addresses of sectors to erase in succession after the sector-erase command.

- Flash Sectors
  - 8 x 128KB (0x040000 – 0x13FFFF)
  - 4 x 16KB (0x140000 – 0x14FFFF)

Figure 1. MB91467D Flash Sector Mapping



There are four flash programming tools available:

- FME Flash Programmer (serial asynchronous, synchronous)
- Cypress Japan Flash Programmer (serial asynchronous)
- Conitec GALEP4 Programmer (parallel)

- Conitec GALEP5 Programmer (parallel)

All measurements are done with the same MCU and the same starterkit. Influences of shorter chip erase times due to reduction of erase times on increasing erase cycles are ignored.

The following Flash operation times are measured:

- Chip Erase
  - Erases whole Flash content
  - Unlocks Flash security lock
- Blank check
  - Confirms fully erased Flash
- Program & Verify
  - Programs a selected MHX file to Flash memory
  - Verifies correct programming operation
- Verify
  - Single verify operation
- Read
  - Read back whole Flash content
- FULL (E+B+P&V)
  - Full programming operation
    Chip Erase
    Blank check
    Program & Verify
- Sector erase (16KB)
  - Erase single 16 KB Flash sector
    [0x140000 – 0x143FFF] [0x144000 – 0x147FFF]
    [0x148000 – 0x14BFFF] [0x14C000 – 0x14FFFF]
- Sector erase (128KB)
  - Erase single 128 KB Flash sector
    [0x040000 – 0x05FFFF] [0x060000 – 0x07FFFF]
    [0x080000 – 0x09FFFF] [0x0A0000 – 0x0BFFFF]
    [0x0C0000 – 0x0DFFFF] [0x0E0000 – 0x0FFFFF]
    [0x100000 – 0x11FFFF] [0x120000 – 0x13FFFF]

2.1 FJ Flash Programmer Asynchronous Serial Programming (115200Baud)

Hardware: SK-91460-91F467D-208QFP v1.0
SK-91460-main v1.2

MB91F467D

Software: FJ Programmer v01L11

Table 1. FJ Flash Programmer, Async (115200 Baud)

	FJ Flash Programmer [sec]
Chip Erase	10.00
Blank check	<1.00
Program & Verify (1MB)	107.00
Program (128kB sector)	26.00
Program (16kB sector)	4.00
Verify	102.00
Read	172.00
FULL (E+B+P&V)	117.00
Sector erase (16KB)	Not possible in V01L11
Sector erase (128KB)	Not possible in V01L11

2.2 FME Flash Programmer

Hardware: SK-91460-91F467D-208QFP v1.1
MCU: MB91F467D
Software: FME Programmer V 4.0.3

2.2.1 Asynchronous Serial Programming (115200Baud)

Table 2. FME Flash Programmer, Async (115200 Baud, Block Transfer)

	FME Flash Programmer [sec]
Chip Erase	10.4
Blank check	0.7
Program & Verify (1MB)	110.5
Program (128kB sector)	13.4
Program (16kB sector)	1.7
Verify	
Read	100.8
FULL (E+B+P&V)	135.6
Sector erase (16KB)	1.2
Sector erase (128KB)	1.7

2.2.2 Asynchronous Serial Programming with USB/Serial Converter (923076 Baud)

Table 3. FME Flash Programmer, Async (923076 Baud, Block Transfer)

	FME Flash Programmer [sec]
Chip Erase	10.4
Blank check	0.7
Program & Verify (1MB)	21.5
Program (128KB sector)	2.7
Program (16KB sector)	0.3
Verify	
Read (1088KB)	49.0
FULL (E+B+P&V)	38.2
Sector erase (16KB)	1.3
Sector erase (128KB)	1.7

2.3 Conitec GALEP4 Programmer Parallel Programming

Hardware: GALEP4 Programmer #158452
GALEP Adapter for MB91F467D

MB91F467D

Software: GALEP32 v1.17.31.01

Table 4. Conitec GALEP4 Programmer, Parallel

	GALEP 4 [sec]
Chip Erase	34.00
Blank check	23.00
Program (1MB)	116.00
Program (128kb sector)	51.00
Program (16kb sector)	51.00
Verify	31.00
Read	72.00
FULL (E+B+P+V)	206.00
Sector erase (16KB)	Not possible in v1.17.31.01
Sector erase (128KB)	Not possible in v1.17.31.01

2.4 Conitec GALEP5 Programmer Parallel Programming

Hardware: GALEP5 Programmer #167054
GALEP Adapter for MB91F467D

MB91F467D

Software: GALEP5 Version 2.04.23

Table 5. Conitec GALEP5 Programmer, Parallel

	GALEP 5 [sec]
Chip Erase	13.30
Blank check	9.80
Program (1MB)	33.70
Program (128kb sector)	15.10
Program (16kb sector)	12.40
Verify	10.40
Read	19.30
FULL (E+B+P+V)	50.00
Sector erase (16KB)	n.a.
Sector erase (128KB)	n.a.

2.5 Summary

Figure 2. Program & Verify Full Flash, 128kb Sectors and 16kb Sectors

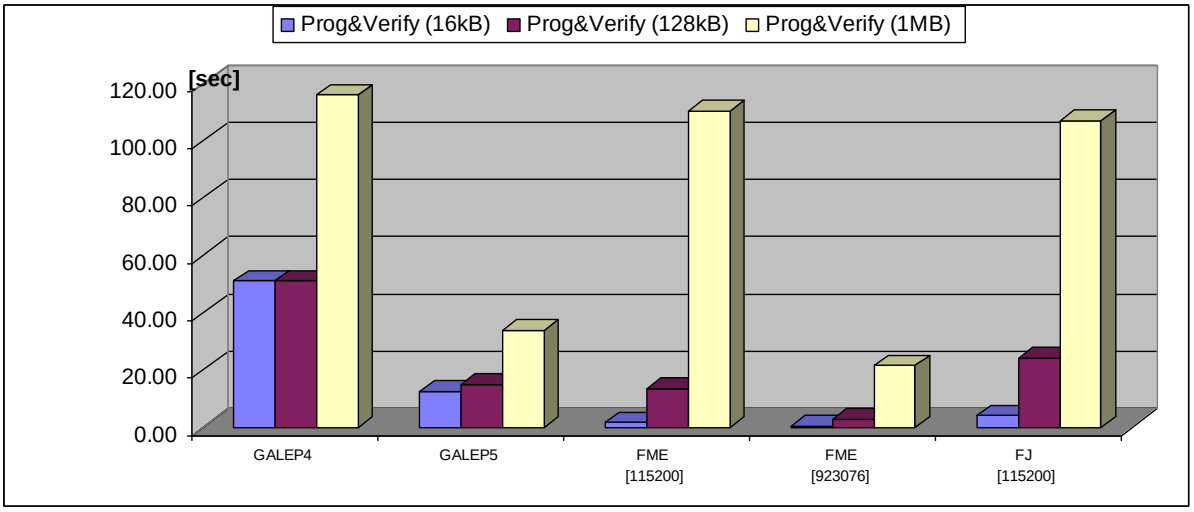


Figure 3. Chip Erase Timings

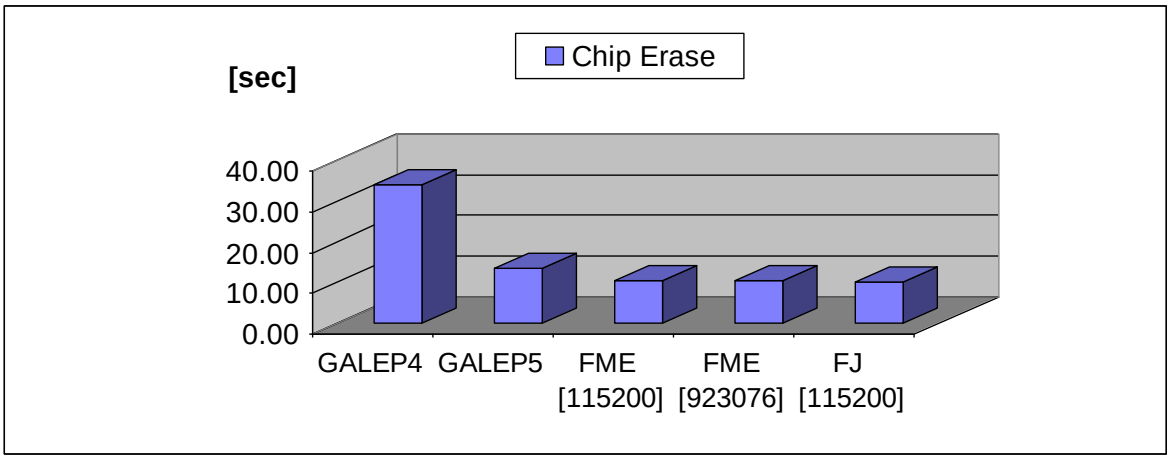


Figure 4. Blank Check Timings

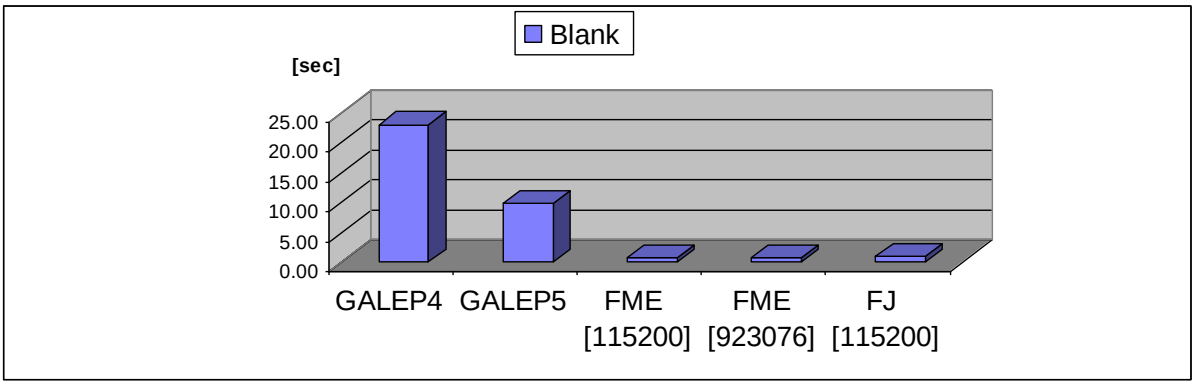


Figure 5. Single Verify Timings

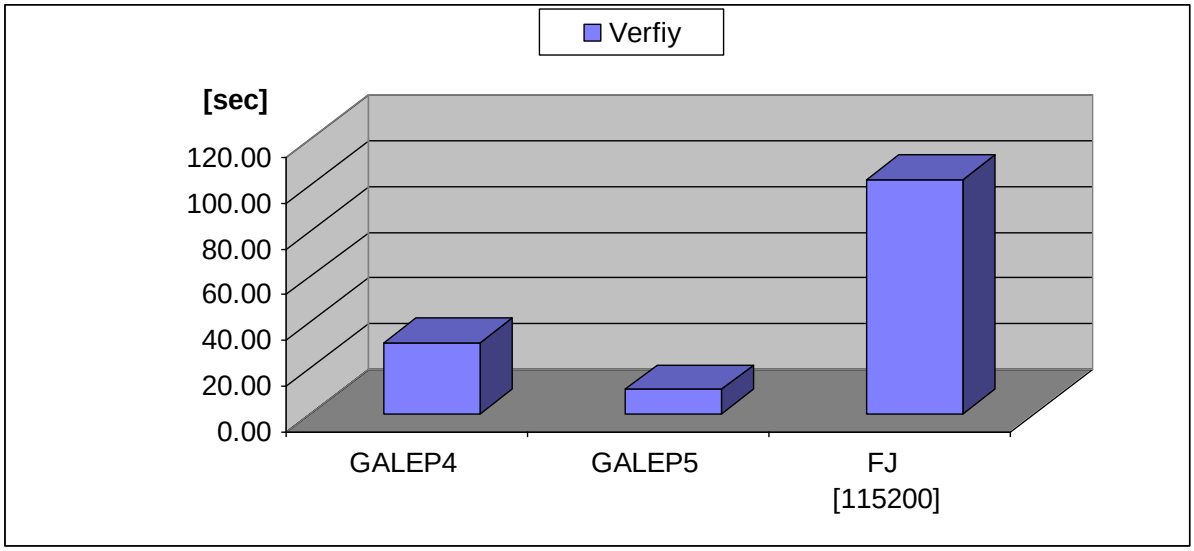


Figure 6. Read Timings

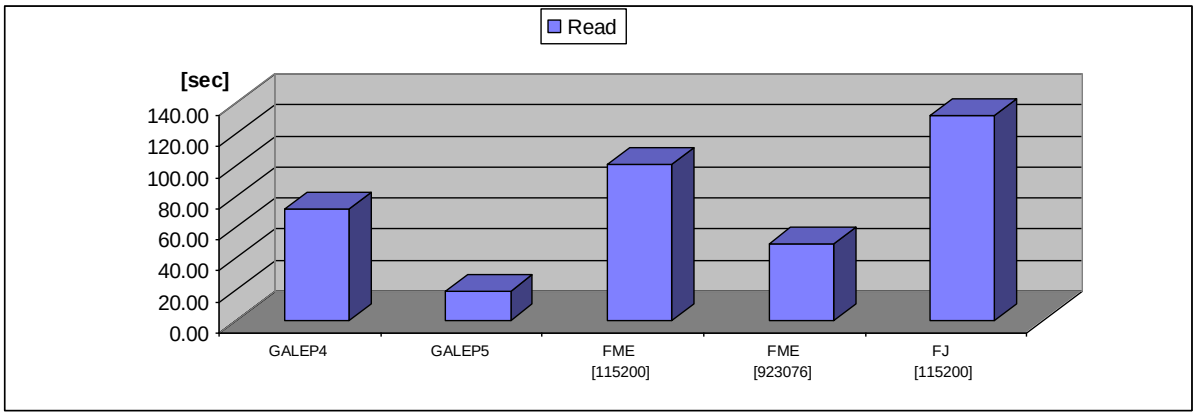
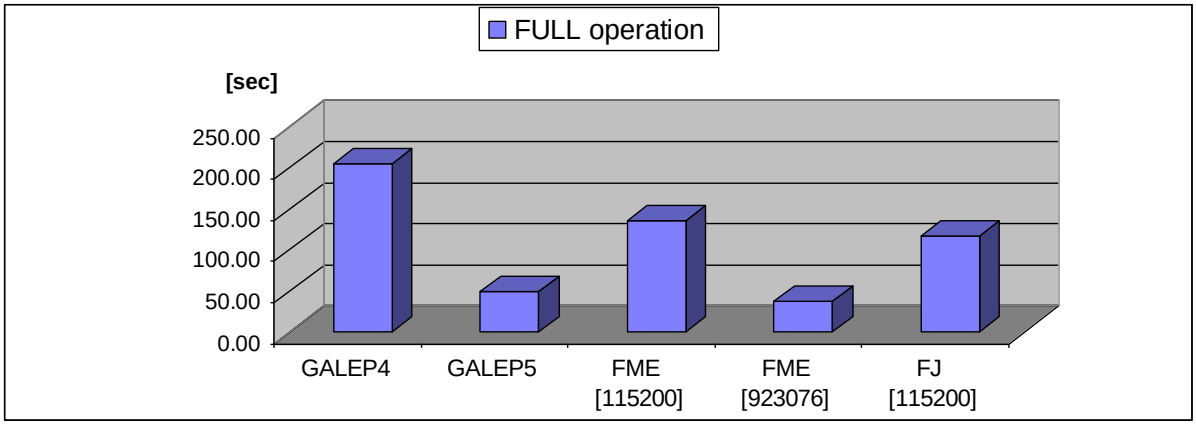


Figure 7. FULL (E+B+P&V) Operation Timings



3 Document History

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Document Number: 002-05198

Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	-	NOFL	02/01/2006	Initial release
			02/13/2006	Renamed figure 1
			11/02/2007	Update of Program / Erase times for FME Flash programmer
			03/10/2009	Added GALEP5 timings
*A	5083847	NOFL	01/14/2016	Migrated Spansion Application Note from MCU-AN-300017-E-V13 to Cypress format
*B	5868821	AESATMP9	08/31/2017	Updated logo and copyright.

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