Application Note

FUJITSU

Fujitsu Flash MCU BI ROM Protocol of 16LX Family

© Fujitsu Microelectronics Europe GmbH, Microcontroller Application Group

History

02th Aug. 99	HKo	V2.0	started
27th Sept. 99	TKa	V2.1	some comments added
28th June 00	TKa	V2.2	New format

Warranty and Disclaimer

To the maximum extent permitted by applicable law, Fujitsu Mikroelektronik GmbH restricts its warranties and its liability for **all products delivered free of charge** (eg. software include or header files, application examples, application Notes, target boards, evaluation boards, engineering samples of IC's etc.), its performance and any consequential damages, on the use of the Product in accordance with (i) the terms of the License Agreement and the Sale and Purchase Agreement under which agreements the Product has been delivered, (ii) the technical descriptions and (iii) all accompanying written materials. In addition, to the maximum extent permitted by applicable law, Fujitsu Mikroelektronik GmbH disclaims all warranties and liabilities for the performance of the Product and any consequential damages in cases of unauthorised decompiling and/or reverse engineering and/or disassembling. **Note, all these products are intended and must only be used in an evaluation laboratory environment**.

1. Fujitsu Mikroelektronik GmbH warrants that the Product will perform substantially in accordance with the accompanying written materials for a period of 90 days form the date of receipt by the customer. Concerning the hardware components of the Product, Fujitsu Mikroelektronik GmbH warrants that the Product will be free from defects in material and workmanship under use and service as specified in the accompanying written materials for a duration of 1 year from the date of receipt by the customer.

2. Should a Product turn out to be defect, Fujitsu Mikroelektronik GmbH´s entire liability and the customer´s exclusive remedy shall be, at Fujitsu Mikroelektronik GmbH´s sole discretion, either return of the purchase price and the license fee, or replacement of the Product or parts thereof, if the Product is returned to Fujitsu Mikroelektronik GmbH in original packing and without further defects resulting from the customer´s use or the transport. However, this warranty is excluded if the defect has resulted from an accident not attributable to Fujitsu Mikroelektronik GmbH, or abuse or misapplication attributable to the customer or any other third party not relating to Fujitsu Mikroelektronik GmbH.

3. To the maximum extent permitted by applicable law Fujitsu Mikroelektronik GmbH disclaims all other warranties, whether expressed or implied, in particular, but not limited to, warranties of merchantability and fitness for a particular purpose for which the Product is not designated.

4. To the maximum extent permitted by applicable law, Fujitsu Mikroelektronik GmbH´s and its suppliers´ liability is restricted to intention and gross negligence.

NO LIABILITY FOR CONSEQUENTIAL DAMAGES

To the maximum extent permitted by applicable law, in no event shall Fujitsu Mikroelektronik GmbH and its suppliers be liable for any damages whatsoever (including but without limitation, consequential and/or indirect damages for personal injury, assets of substantial value, loss of profits, interruption of business operation, loss of information, or any other monetary or pecuniary loss) arising from the use of the Product.

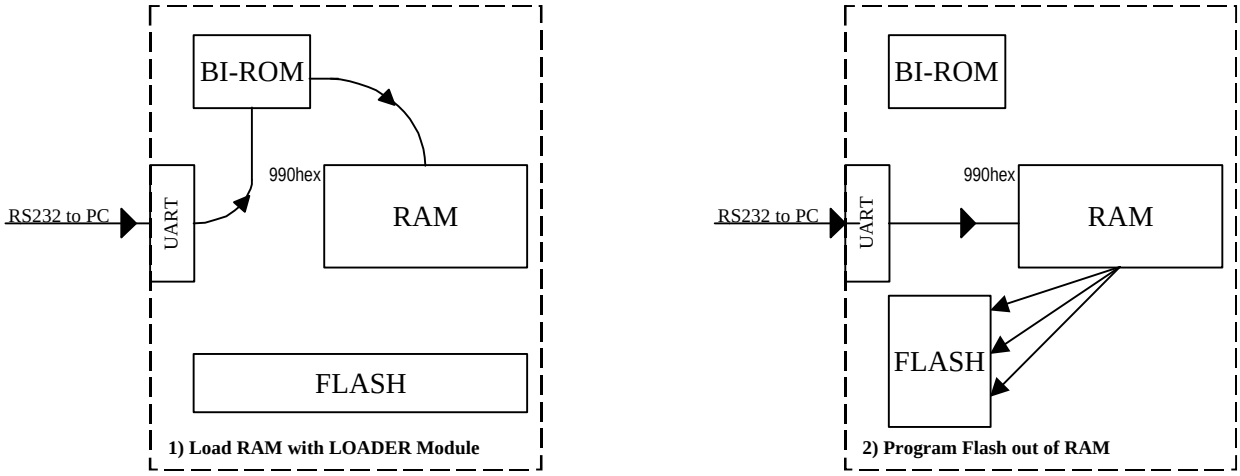
Should one of the above stipulations be or become invalid and/or unenforceable, the remaining stipulations shall stay in full effect.

.

Flash MCU BI-ROM Protocol

The F²MC-16LX Flash MCU contains a burn-in ROM (BiROM) program that supports a proprietary protocol to allow download of a user program to on-chip RAM memory (step 1). The user program is then able to manipulate on-chip Flash memory as required (step 2).
Two basic serial modes are supported, synchronous serial and asynchronous serial. It is not important to the protocol which serial mode is in use.

The below diagram illustrates the context.



This application note describes the commands, which are supported by the BiROM of the 16LX Flash MCUs in order to generate an own programming environment.

As already mentioned, two basic serial modes are supported, synchronous serial and asynchronous serial. After reset of the MCU, the mode pins and two port pins select the programming mode respectively. It is not important to the protocol which serial mode is in use. However, communications settings obviously vary:

Synchronous	8 data bits, external clock (500kbs max)
Asynchronous	8 data bits, 1 stop bit, no parity, baud rate: (mcu clk / 4) / (8 x 13 x 2) (4800 @ 4MHz, 9600 @ 8MHz, 19200 @ 16MHz)

Follow the sequences in the examples to download and execute the user program. Once the user program is running, the BiROM is no longer active and all further communication is user defined. To allow compatibility with all devices, it is important that the user program uses the minimum of resources. Therefore, we recommend your program uses the following memory map:

Memory Map

0100 – 016F	Variables
0170 – 017F	Stack
0180 – 018F	Registers (bank 0)
0190 – end of RAM	User program code and write buffer (512B max)

Common Pin Settings

Pin Name	Logic Level	Description	QFP100	QFP120
MD2,1,0	110	Programming mode	51,50,49	87,88,89
P00	0	Programming mode	85	95 (J19/21)*)
P01	0 1	Async, 4800, 8bit, 1 stop, no parity Clk Sync, Ext clock (500kbs max)	86	96 (J19/20) *)
Vss	-	Power supply	81	91 (J19/25) *)
Vcc	-	Power supply	84	94 (J19/22) *)

*) Pin numbers in brackets refer to the QFP120 Flash-Test-Board (FLASH-EVA2-120P-M13)

Commands

Byte 0								Byte 1								Byte 2								Byte 3								Byte 4								Byte n							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Command 7-0								Address 15-8								Address 7-0								Count 15-8								Count 7-0								Data/Checksum 7-0							

Command	Various actions, see table below.
Address	Start address of RAM download code
Count	Number of bytes to transfer. 1 = 1 byte.
Data	Data bytes sent
Checksum	Cumulative sum

Commands									Description	Comment
0	0	0	1	1	-	-	-	18	Communication check	General communications check
0	0	0	0	0	-	-	-	00	Download	User program is downloaded to RAM
0	1	0	0	0	-	-	-	4x	Execute	User program is executed. Address and count ignored (address fixed to 0990h (0190h MB90560))

Command Responses

Byte 0							
7	6	5	4	3	2	1	0
Command 7-4				Resp 3-0			

Resp Status response from MCU (bits 7-4 return bits 7-4 of command byte)

Response									Description	Comment
-	-	-	-	0	0	0	1	x1	OK	
-	-	-	-	0	0	1	0	x2	Command Error	

EXAMPLES

General Communications Check

PC	18	
MCU		11

Download (00h)

	command / address			count		data		chk	resp
PC	00	09	90	00	02	01	02	9E	
MCU									01

This example downloads 2 data bytes, 01_{hex} and 02_{hex} onto RAM location 990_{hex}. See also the cumulated checksum $9E_{hex}$ and response from the MCU.

Execute (40h)

	command / address			count	
PC	40	xx	Xx	00	00
MCU					

no response, jump is immediate

Note
When you select the Burn-IN ROM mode for the CPU, and you try to program the upper Flash memory area with code executed in RAM the situation is as follows:
In Burn-IN ROM mode the Burn-IN ROM is always visible at FF0000-FFFFFF. So you cannot program the page FF directly. Therefore Bit 3 of the FMCS register is used. Bit 3 of the FMCS register is used as a upper memory enable. To program the page FF, you have to set this bit first. After this the page FF will be mapped to page FE.