

# TMS320F206 Flash Serial Loader Rev 1.0

This document contains the software specifications and functional description of TMS320F206 serial loader for programming the on-chip flash. **The data is preliminary and subject to change at any time.**

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**A. TMS320F206 Flash Serial loader features**

Serial loader for F206 devices facilitates initial programming of flash arrays. Sections in this document describe the functional aspects of the serial loader and should give a quick start on flash programming.

**A.1 Rev 1.0 software features**

1. Rev 1.0 serial loader provides flash control utilities to communicate with PC/host and program on\_chip flash array with 3k words of program only. Clear, Erase functions will operate on the entire 16k of flash 0 or flash1 array.
2. Rev 1.0 is also intended to explain the flash array programming sequence, if the flash utilities are included in any application. Refer to section A.1.6 for details.
3. Flash function algorithms Clear, Erase and Program are available only as object modules. The source code for these algorithms will be available once they are stable.
4. Rev 1.0 flash algorithms requires the F206 device to run at 20Mhz CLKOUT1 only. For any speeds less than 20Mhz the flash algorithms have to be modified. Refer to section D.6 for details.
5. Rev 1.0 PC/host serial communication utility is for Windows'95 only.

**A.2 Future release**

1. Rev 2.0 is the next version of the serial loader utilities with more advanced controls to accomplish 32k of flash programming.

**A.3 PC/Host command format**

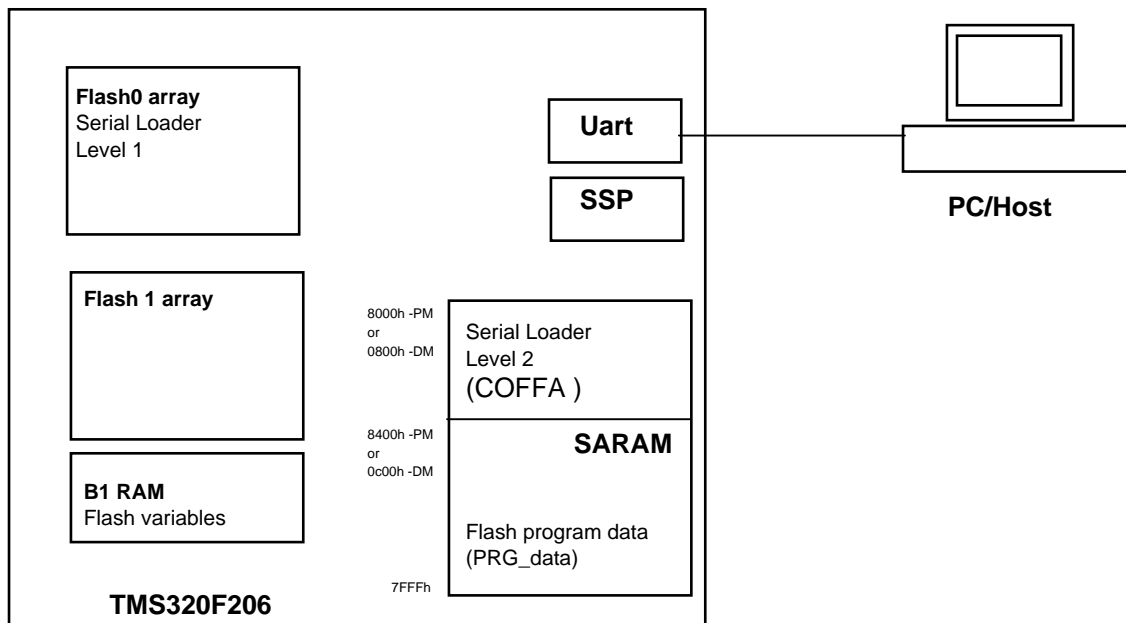
Host communication utility for Rev 1.0 serial loader

<i>F206sldr.exe</i>	<i>COFFA.hex</i>	; Refer to section C.5.
(Host serial loader)	(Flash control, algorithms and flash data )	

**A.4 Overview of flash programming stages using serial loaders**

<i>Stage 1. Serial loader Level 1 in Flash 0 array (0x0000).</i>	; Refer to section B1.1, D
<i>Stage 2. Build COFFA.hex</i>	; Refer to section B1.2, D.3
<i>Stage 3. Invoke Level 1 to communicate with PC/host utility F206sldr.exe</i>	; Refer to section D.4
<i>Stage 4. Wait until flash function is complete.</i>	; Refer to section D.5

**TEXAS INSTRUMENTS INTERNAL DATA**

**A.5 F206 serial loader memory map for serial loader****Figure 1 F206 memory map serial port connections**

Note: In Rev 1.0, COFFA.hex has control code, flash algorithms (1k words) and user flash code (3k words max) to be programmed into flash arrays

**A.6 Reserved memory map and variables for flash programming**

The on\_chip RAM B1, B2 and SARAM are reserved for loading programming algorithms. Figures 2 , 3 explain the reserved space and variables. If flash algorithms need to be customized for specific applications refer to Figure 2, 3 for more details.

Figure 3 explains the function of the variables while executing Clear, Erase and Programming algorithms. The current serial loader application is written based on these variables. It is also common to JTAG based flash utilities. Refer to the assembler source files to understand the software logic.

**A.6.1 Flash function calling conventions**

Rev 1.0 serial loader utilities are shipped with flash function modules for CLEAR, ERASE and PROGRAM of flash arrays. These are object modules used in the serial loader and can be used in any application. The calling conventions are listed below for reference and customizing applications.

**A.6.1.1 Flash register utilities**

This has three functions that help flash algorithms to access flash registers and delay loops.

Function name :	DELAY
Function :	Delay loop in micro and milliseconds. Useful in generating CLEAR,ERASE pulses for the flash array.
Input :	Auxiliary register AR6 specifies delay count and scratch pad register SPAD1
output :	None
Assembler file :	sutils1.asm
Include file :	svar1.h

**TEXAS INSTRUMENTS INTERNAL DATA**

Object file : sutils1.obj  
 Function name : REGS  
 Function : Selects the flash array control register F\_access0/1, and enable register mode  
 Input : FL\_ST memory variable, scratch pad register SPAD1  
 output : None  
 Assembler file : sutils1.asm  
 Include file : svar1.h  
 Object file : sutils1.obj

Function name : ARRAY  
 Function : Selects the flash array control register F\_access0/1, and disables register mode  
 Input : FL\_ST memory variable, scratch pad register SPAD1  
 output : None  
 Assembler file : sutils1.asm  
 Include file : svar1.h  
 Object file : sutils1.obj

**A.6.1.2 Flash function, CLEAR**

Function name : GCLR  
 Function : Clears the selected flash segments in the selected flash array  
 Input : FL\_ST, FL\_END memory variables should define start and end of flash array.  
       : Uses start address to decide on the flash array 0 or 1.  
       : Uses all memory variables in B1 RAM (0300h-031Fh).  
       : Uses 6 levels of hardware stack and AR4,AR6,AR7 registers are reserved  
       : sutils1.obj  
 output : memory variable ERROR =1 error in clearing, ERROR=0, array cleared.  
 Include file : svar1.h  
 Object file : sclr1.obj

**A.6.1.3 Flash function, ERASE**

Function name : GERS  
 Function : Erase the selected flash segments in the selected flash array  
 Input : FL\_ST, FL\_END memory variables should define start and end of flash array  
       : Uses start address to decide on the flash array 0 or 1.  
       : Uses all memory variables in B1 RAM (0300h-031Fh).  
       : Uses 6 levels of hardware stack and AR1,AR4,AR5,AR6 ,AR7 registers are  
       : reserved  
       : sutils1.obj  
 output : memory variable ERROR =1 error in Erase, ERROR=0, array ERASED.  
 Include file : svar1.h  
 Object file : sera.obj

**A.6.1.4 Flash function, PROGRAM**

Function name : GPGM  
 Function : Program the selected flash segments in the selected flash array  
 Input : Memory variables PRG\_paddr, PRG\_length should define start of flash address  
       : and end of flash array to be programmed. PRG\_bufaddr defines start of flash  
       : program data buffer (default 08400/0C00h in SARAM).  
       : Uses all memory variables in B1 RAM (0300h-031Fh).  
       : Uses 6 levels of hardware stack and AR1,AR2,AR5,AR6 registers are reserved  
       : sutils1.obj  
 output : memory variable ERROR =1 error in program, ERROR=0, array programmed  
 Include file : svar1.h  
 Object file : spgm1.obj

Figure 2 Reserved memory map and variables

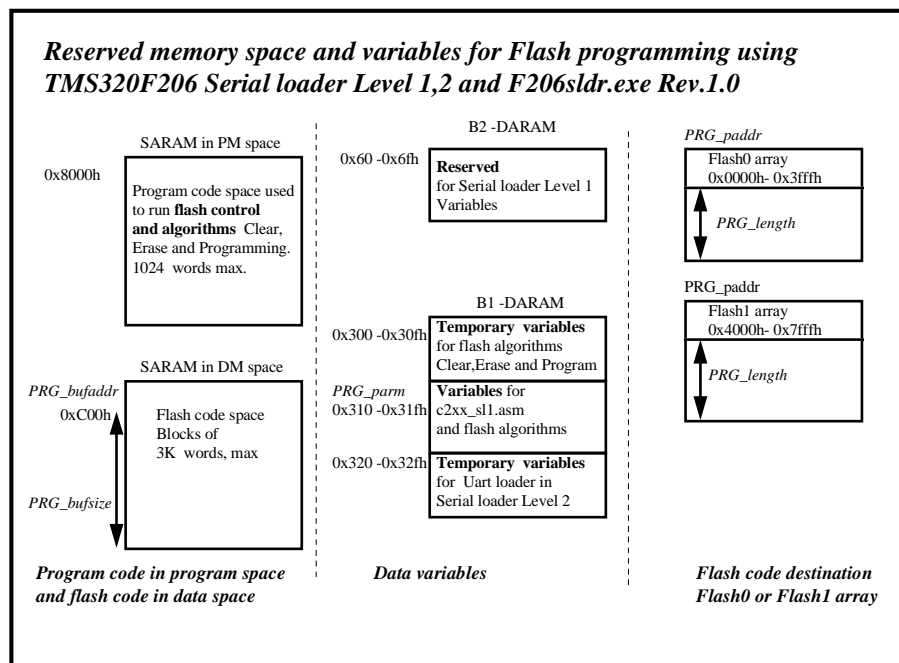
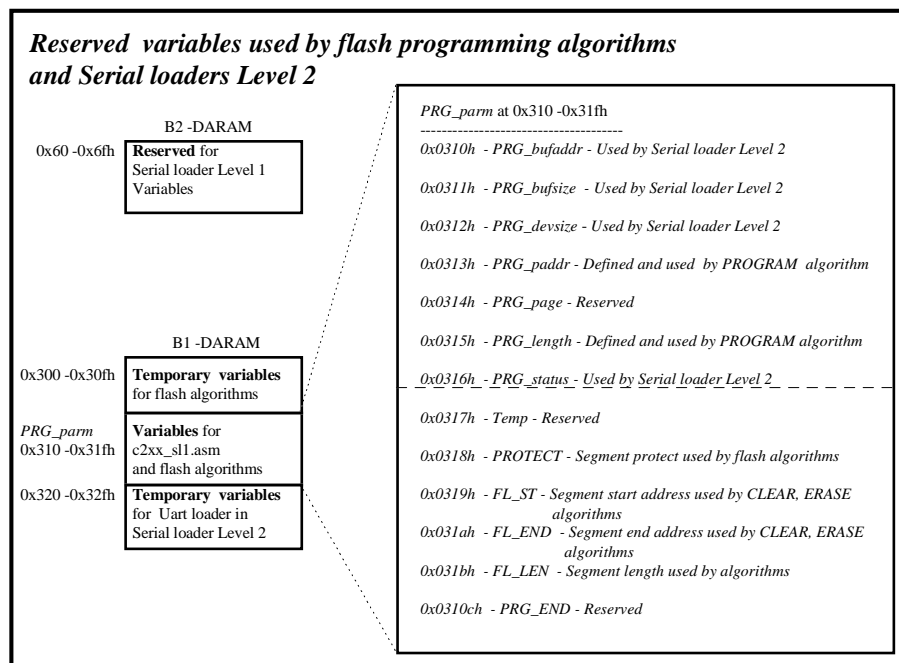


Figure 3 Reserved variables and its functions



**B. Flash serial loader program modules****B.1. Program modules for F206****B.1.1 F206 serial program Level 1**

Resides in Flash0 from 0x0000-0x00ff. This program should be in the flash0 array for the serial loader to function.

Source files - usload\_1.asm, usload\_1.out .

Level 1 loader (usload\_1.out) is a beta version. Its is planned to program the serial loader in flash 0 array before shipping TMS devices.

Function - After reset, the DSP is initialized, B0 RAM will be in program space and either UART or SSP loader will be enabled.

*SSP loader:*

If BIO pin is low at reset, the serial loader will enable SSP interrupt only and will accept data through the synchronous serial port (SSP). This feature is for future use and application specific loaders.

*UART loader:*

If BIO pin is high at reset the uart loader will enable uart interrupt and initialize auto baud detect feature of the uart.

*This document/program uses only the uart loader features to do flash functions!!*

The uart will wait for "a"/ "A" character as the first character from host.

On valid character "a"/ "A" receive the DSP will update baud register with host baud rate and will be ready to receive application data.

After the baud detect stage the incoming serial application data should be in the following format. TI's hex conversion utility will help generating these header files.

Refer section D.3

Header

Destination/Run address high byte

Destination/Run address low byte

Length of data that follows - high byte

Length of data that follows - low byte

Data

High byte

Low byte

The serial loader will move the incoming data to the destination address, disable all interrupts and will jump to execute the code from destination/run address.

Refer to Level 1 flow chart (section F.1)- for more details.



**B.1.2 F206 serial loader - Level 2**

Resides in destination/run address, Default 0x8000h in SARAM.

Level 2 code is loaded by Level 1 part of the serial loaders. Level 1 code is intended to load Level 2 code or any user application code.

Source file - COFFA.hex

Function - Level 2 of the serial loader has two sections.

First section is the flash control code that selects flash functions, Clear, Erase and Program on the appropriate flash array. It also manages the host handshake and additional uart based COFF file loader. The flash control code selects the required flash functions. These functions are customer specific and is decided by two flag registers.

SFLAG - for selection of flash array functions

HFLAG - for understanding host status.

Refer to section D for more details.

Second section is the algorithms that implement flash functions Clear, Erase and Programming.

*Flash program data:*

This is the actual flash array data/application code to be programmed into the selected flash array segments. Part of the COFFA.hex is the application code to be programmed in flash array.

Level 2 of the code moves the application code to program data buffer (PRG\_data ) at 0x8400 -PM/ 0x0900 -DM in SARAM.

**B.2 PC host software Rev 1.0**

Source files - F206sldr.exe

Windows'95 program for serial communication between PC/host and F206.

Function - Windows'95 program to transfer any hex file in 8-bit hex form through serial ports COM1 or COM2. Host baud can be selected from 110 baud to 57600 baud.

Facilitates serial transfer of F206 Level 2 source code (COFFA.hex) while Level 1 is running in F206.

UART transmit file

COFFA.hex

This file is built using coffa\_bd.bat file. This is a hex file, with hex data ordered as shown below, to suit PC-F206 handshake logic. Refer to section D, F for details.

COFFA.hex file contents after the file built using coffa\_bd.bat

```
{ 61                ; "a" - A.hex
  control + algorithms ; c2xx_sl1.hex
  SFLAG, HFLAG in hex ; SFLAG.hex
  User flash code      ; userc.hex (3k words max)
}
```

**C. List of source files that are necessary to build the flash programming files.****C.1 Control code**

Assembler/hex source files	
c2xx_sl1.asm	; Flash control and algorithms
a.hex	; Header file with character "a" in hex
SFLAG.hex	; SFLAG and HFLAG commands in hex
Include files	
sldrv1.h	; Variable declarations
cmds.h	; SFLAG, HFLAG and host commands declarations
Linker command files	
c2xx_sl1.cmd	; To generate COFF files using TI tools
COFF to hex converter files	
c2xx_sl1.bot	; To be used with TI's hex converter dsphex.exe

**C.2 Flash algorithms**

Assembler source files	
sutils1.asm	; Flash register utility
Include files	
svar1.h	; Variable declarations
Object modules	
sclr1.obj	; Clear algorithm
sera1.obj	; Erase algorithm
spgmvl.obj	; Program and Verify algorithm
sutils1.obj	; Flash register utility

**C.3 User code to be flashed in flash array 0/1 using serial loader Rev 1.0**

Userc.asm is a sample code to explain serial flash programming flow. In actual application the relevant application file should be renamed as userc.obj. Refer section D for details.

userc.asm	; This is a sample application code with 1k words of hex numbers(0-3ffh)
userc.cmd	; Linker command file to load user/application COFF file to array0/1.
	; This file has to be a single COFF section of 3k words max.
userc.out	; The user application code COFF file
userc.bot	; Batch file to generate hex file with boot header, using userc.out
userc.hex	; Application code to be programmed in flash

**C.4 Batch files**

COFF file generation

lnk.bat ; Requires TI's fixed point linker dsplnk.exe

COFFA.hex builder file for host serial transmit.

coffa\_bd.bat ; Batch file to copy multiple hex files to a single file COFFA.hex

**C.5 PC host serial communication program Rev1.0 for Windows'95 only!**

F206sldr.exe

Msvcrt.dll

Mfc42.dll

*Note:*

*Refer to TMS320Cx/c2x/c2xx/c5xTI's Assembly language tools User's guide - SPRU018D for details on file extension names and its function.*

**D. Quick learn procedure to flash programming using serial loader Rev 1.0**

This procedure assumes that the F206 is already programmed with serial loader Level 1 in flash array 0. Else use JTAG loader to program usload\_1.out in flash 0 array. Level 1 loader (usload\_1.out) is a beta version. It is planned to include this code in F206 devices before shipping TMS devices.

**D.1 User application code formatting.**

- D.1.1. Select the required application code to be flashed in Flash 0/1 array.  
Rename the object file as - usrc.obj.

*Note:*

*Use the usrc.obj shipped with Rev 1.0 s/w utilities to get familiar with programming steps.*

- D.1.2. Edit the usrc.cmd file such that all the program memory sections are within the boot\_sec section. Select the destination flash array as well.
- D.1.3. Use TI's fixed point linker DSPLNK.exe to generate a COFF file using usrc.cmd linker command file. The COFF file will be generated as usrc.out.
- D.1.4. Edit the usrc.map file and check if all the program sections are in flash0 or flash1 array as required in your application. Make sure there are no data sections in the COFF file !

**D.2 Choosing the flash functions**

- D.2.1. Edit SFLAG.hex file with required flash function command. See the SFLAG command section D to select the appropriate flash functions. This file has three bytes, the first two hex bytes should be your command selection. The third byte is the HFLAG byte, do not change its value. Refer to HFLAG table (section E.2) for details.

**D.3 Procedure to generate COFFA.hex file**

- D.3.1 If the F206 target runs at speeds other 20Mhz, the flash algorithms have to be modified. Go to step D.6 and update the algorithm file, before moving on to step D.3.2.
- D.3.2. Make sure the following files are in the same directory.
- |              |  |
|--------------|--|
| dsphex.exe   | ; TI's hex converter                                   |
| c2xx_sl1.out | ; Control and flash algorithms                         |
| usrc.out     | ; User specific application code generated in step D.1 |
| a.hex        | ; character "a" in hex                                 |
| sflag.hex    | ; Flash command file                                   |
| coffa_bd.bat | ; Batch file build a COFFA.hex                         |
- D.3.3. Run the coffa\_bd.bat file. This will generate COFFA.hex suitable for PC serial loader.

#### D.4 Setting up F206- host link

D.4.1. Connect the serial cable between PC/host (COM1/COM2 port) and F206 target board asynchronous serial port.

D.4.2. Reset the target F206 board and invoke the F206sldr.exe on the PC side.  
A window will appear to select serial port options. Click the settings menu and define the communication port and the required baud rate.

D.4.3. Step D.5 will initiate serial transfer and flash functions.

*Make sure all the steps up to step D.4.3 runs without any error.!!*

#### D.5 Invoking the serial loaders

D.5.1. Click the file menu and select the COFFA.hex file generated in step D.3. Transmission will begin and continue until the READY message appears at the bottom of the screen.

D.5.2 Once the program is transferred to F206, XF pin will be reset by clearing XF bit (LED OFF). Selected flash function will get initiated. After the flash function is complete (that is clearing erasing, or programming based on SFLAG value) the XF bit will toggle forever (LED ON). Which would indicate the flash function is complete else there is an error in the communication or flash function.

*Note:*

*If XF bit is tied to an LED (as in some C2xx EVM's) then the LED would flash indicating the status of the flash loader. This function can be modified to suit customer specific indicators. When XF toggles, the XF LED will be on, but since the toggle rate is fast, it will not be visible to the naked eye. Refer to c2xx\_sl1.asm source code and flow charts (section F1) for application specific changes.*

#### D.6. Procedure to rebuild flash algorithms for variable CLKOUT1 speeds.

D.6.1 The flash register utility sutils1.asm uses a delay variable DLOOP, which controls flash algorithm timings. DLOOP is a variable that is a function CLKOUT1 speeds. The include file svar1.h explains the equation to calculate DLOOP for variable CLKOUT1 speeds. Update the file with new DLOOP value that meets the selected CLKOUT1 speed.

D.6.2 Use TI's Fixed point DSP assembler tools and reassemble sutils1.asm to generate sutils1.obj.

D.6.3 Use TI's Fixed point DSP linker tools to link c2xx\_sl1.cmd. This will generate a new c2xx\_sl1.out COFF file with updated flash algorithms for the selected CLKOUT1 speed.

D.6.4 Go to step D.3.2 to build COFFA.hex and continue with programming stages.

**E. F206 serial loader command tables****E.1 SFLAG command definitions for flash programming**

SFLAG is a memory variable used to select flash functions CLEAR,ERASE and PROGRAM on Flash 0 or Flash 1 array. SFLAG can be defined in program or updated using application programs, before calling the required flash functions. In the Rev 1.0 flash programming example SFLAG variable is sent through the COFFA.hex file.

**Figure 4 SFLAG memory variable bit definitions**

15	14	13	12 - 3	2	1	0
Select Flash array 1	Select Flash array 0	Select Rev 1.0 Program	Reserved	PROGRAM	ERASE	CLEAR
R/W	R/W	R/W		R/W	R/W	R/W

**Table 1 SFLAG bit commands used to select flash functions**

Bit	Name	Function
Bit =1 is select and Bit = 0 is deselect		
0	C	Clear the selected flash array (selected by bits 14 or 15)
1	E	Erase the selected flash array (selected by bits 14 or 15)
2	P	Program the selected flash array (selected by bits 14 or 15)
3		Reserved
...		Reserved
...		Reserved
12		Reserved
13	3K	Bit to select Flash array programming using Rev 1.0 s/w
14	F0	Select Flash 0 array for any of the flash functions Clear, Erase, Program
15	F1	Select Flash 1 array for any of the flash functions Clear, Erase, Program

Table 2 SFLAG command table

	SFLAG command	SFLAG value in Hex	Flash utility function	Host function
		0000	Nop	-----
1	F0_CLR	4001	Clear Flash 0	-----
2	F0_ERS	4002	Erase Flash 0	-----
3		4003	Clear & Erase Flash 0	-----
4	F0_PGM	4004	Program Flash 0	-----
5	F0_FN1	4005	Reserved	-----
6	F0_FN2	4008	Reserved	-----
7	F0_FN3	6000	Program Flash 0 with 3k words -Rev 1.0	-----
8	F0_FN4	6003	Clear, Erase and Program 3k words	
9		0000	Nop	-----
10	F1_CLR	8001	Clear Flash 1	-----
11	F1_ERS	8002	Erase Flash 1	-----
12		8003	Clear & Erase Flash 1	-----
13	F1_PGM	8004	Program Flash 1	-----
14	F1_FN1	8005	Reserved	-----
15	F1_FN2	8008	Reserved	-----
16	F1_FN3	a000	Program Flash 1 with 3k words -Rev 1.0	-----
17	F1_FN4	a003	Clear, Erase and Program 3k words	-----

## E.2 HFLAG flag command definitions for flash programming

HFLAG - 16 bit memory variable used by Level 2 of the serial loader in F206 to decide on host status, while transferring COFF files. More useful in future versions of the serial loaders.

Figure 5 HFLAG memory variable bit definitions

15 - 8	7	6-0
Reserved	More_data	Reserved
R/W	R/W	R/W

Table 3 HFLAG bit command description

Bit	Name	Function
		Bit =1 is select and Bit = 0 is deselect
0	--	Reserved
....	---	Reserved
6	--	Reserved
7	More_data	1= Host has more COFF data to send. 0 = Last COFF section
8-15	---	Reserved



**Table 4 HFLAG command table**

	HFLAG commands	HFLAG value hex		
1	No_More_data	0000 0001	----	Host sends last flash data
2	More_data	1000 0001	----	Host will send more flash data
3		1000 xxxx	----	

**E.3 H\_CMDS flag command definitions for flash programming**

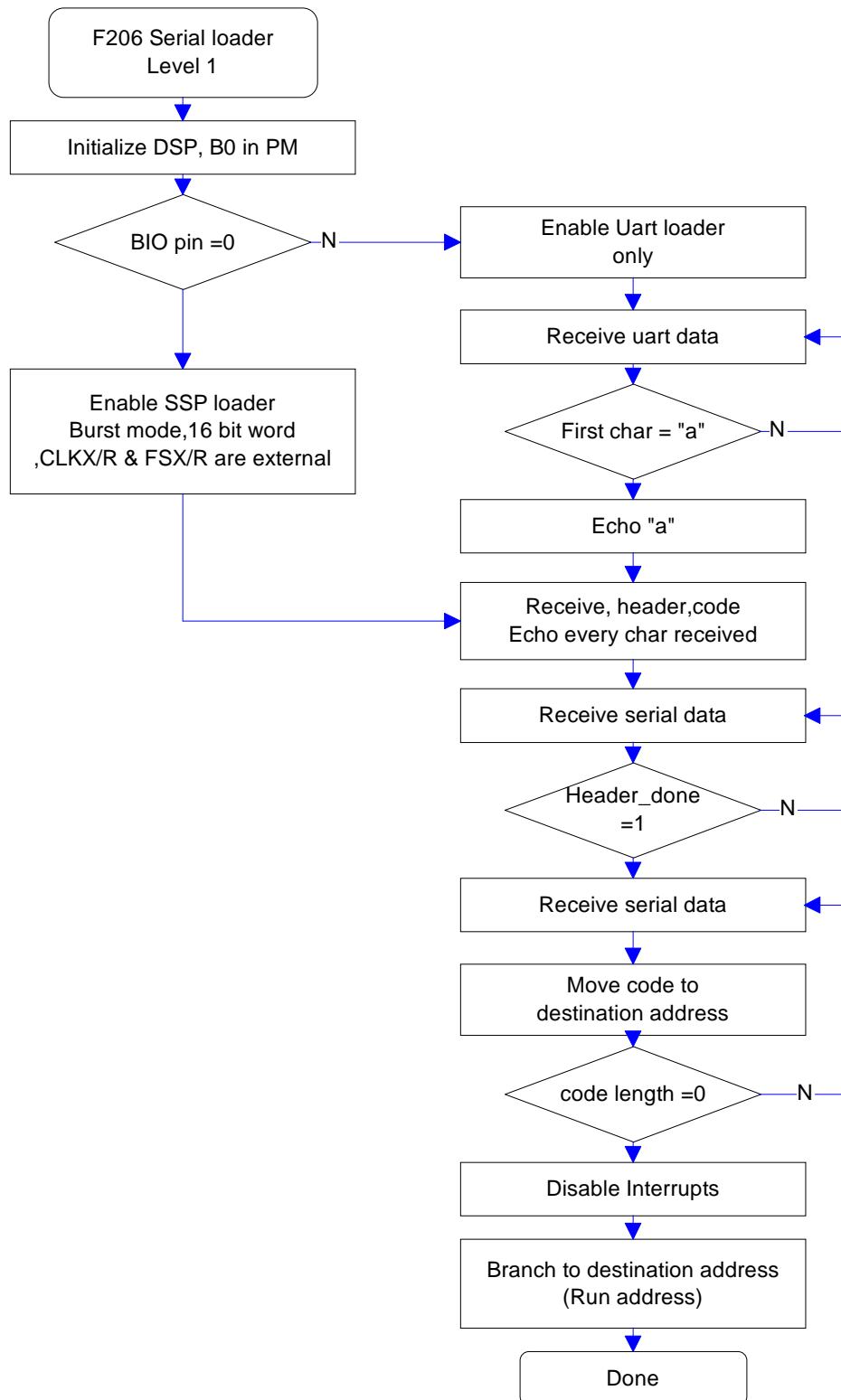
H\_CMD - 8 bit commands issued by Level 2 of the serial loader to indicate F206 status to the PC/Host. Refer to the serial loader Level 2 flow charts (section F) for more details.

**Table 5 H\_CMDS command table**

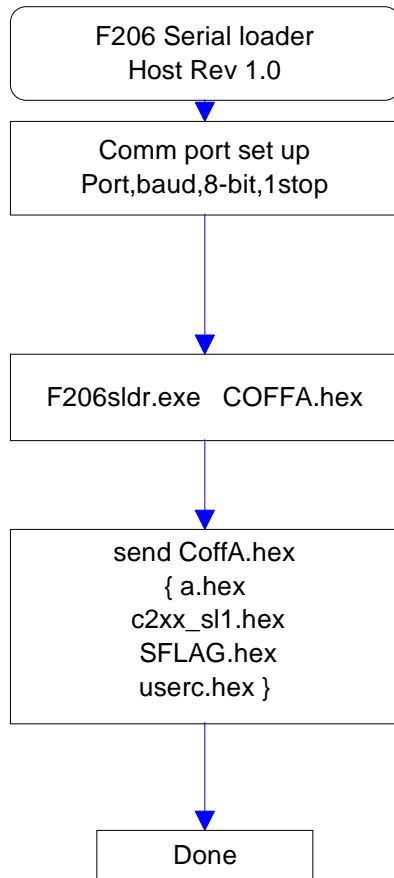
	H_CMDS commands	H_CMDS in hex		
1	H_sflag_req	0001 0000	----	Request for new SFLAG
2	H_coffc_req	0010 0000	----	Request COFFC
3	H_alg_err	0011 0000	----	Algorithm error
4	H_com_err	0100 0000	----	Communication Error
5	H_done	0101 0000	----	Done
6	H_rung	0110 0000	----	Algorithm running
7	H_CMD1	0111 0000	----	Reserved
8	H_CMD2	1000 0000	----	Reserved

## F. Serial loader flow charts

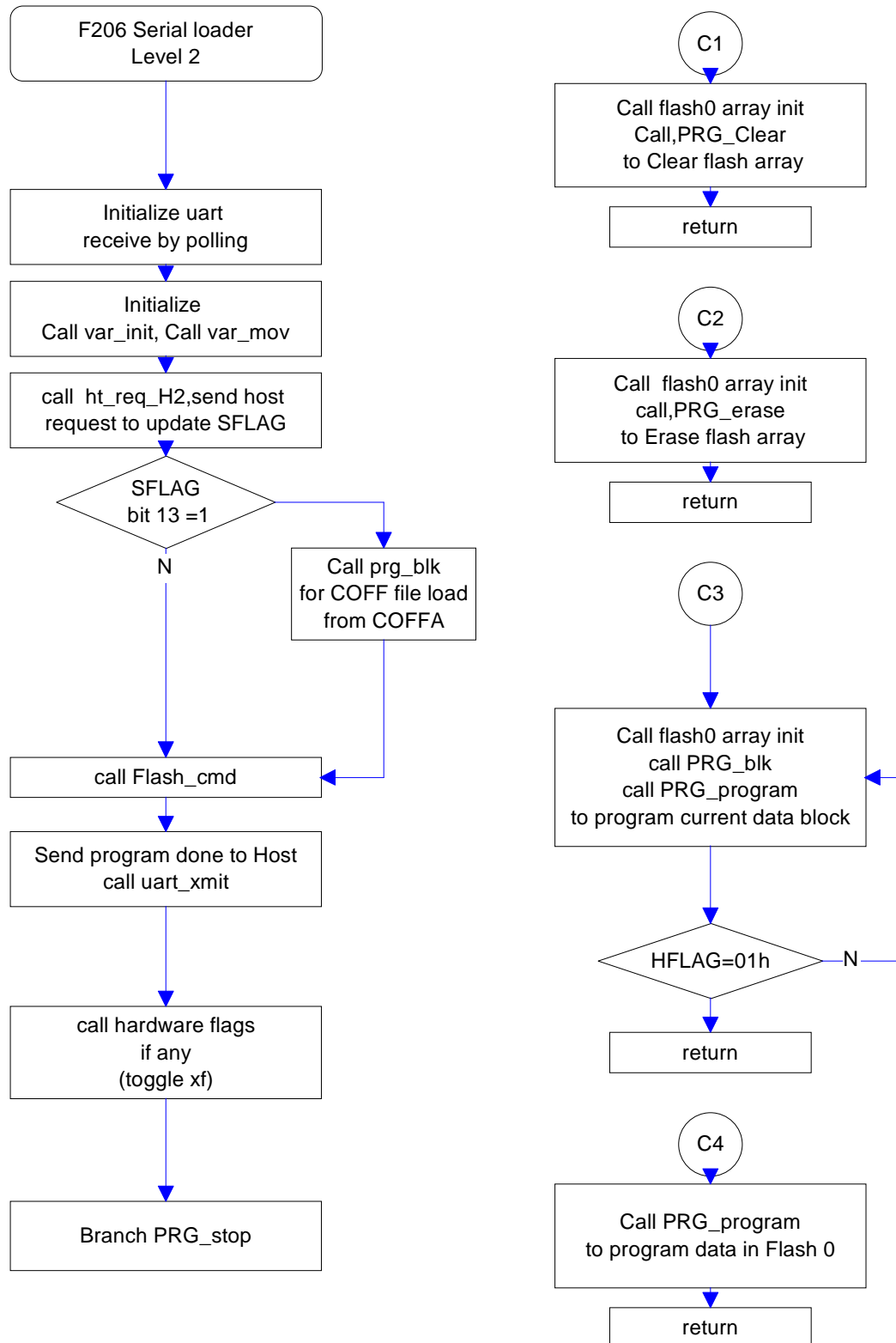
## F.1 TMS320F206 Flash Serial loader - F206 Level 1



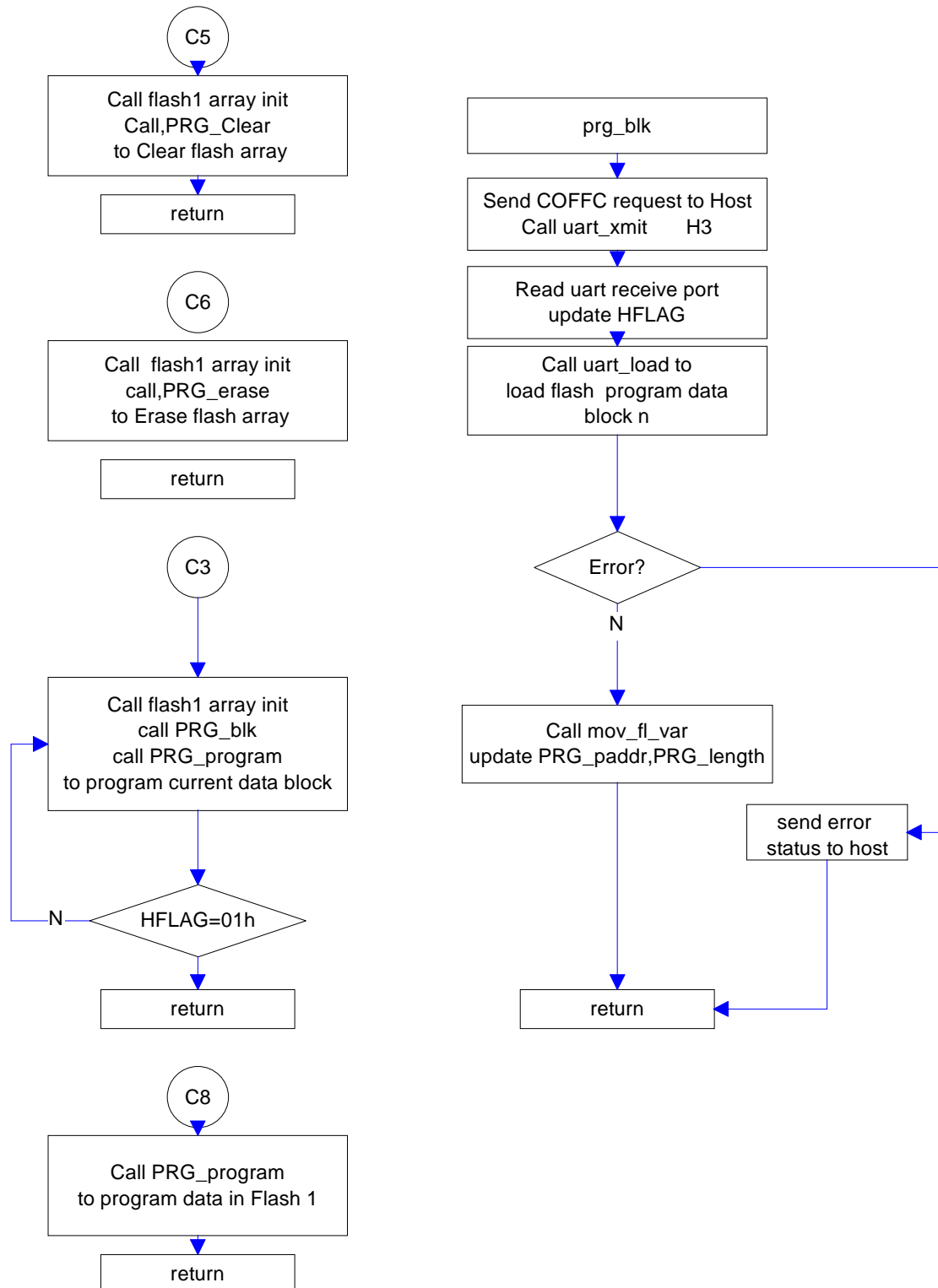
## F.2 TMS320F206 Flash Serial loader - Host Rev 1.0



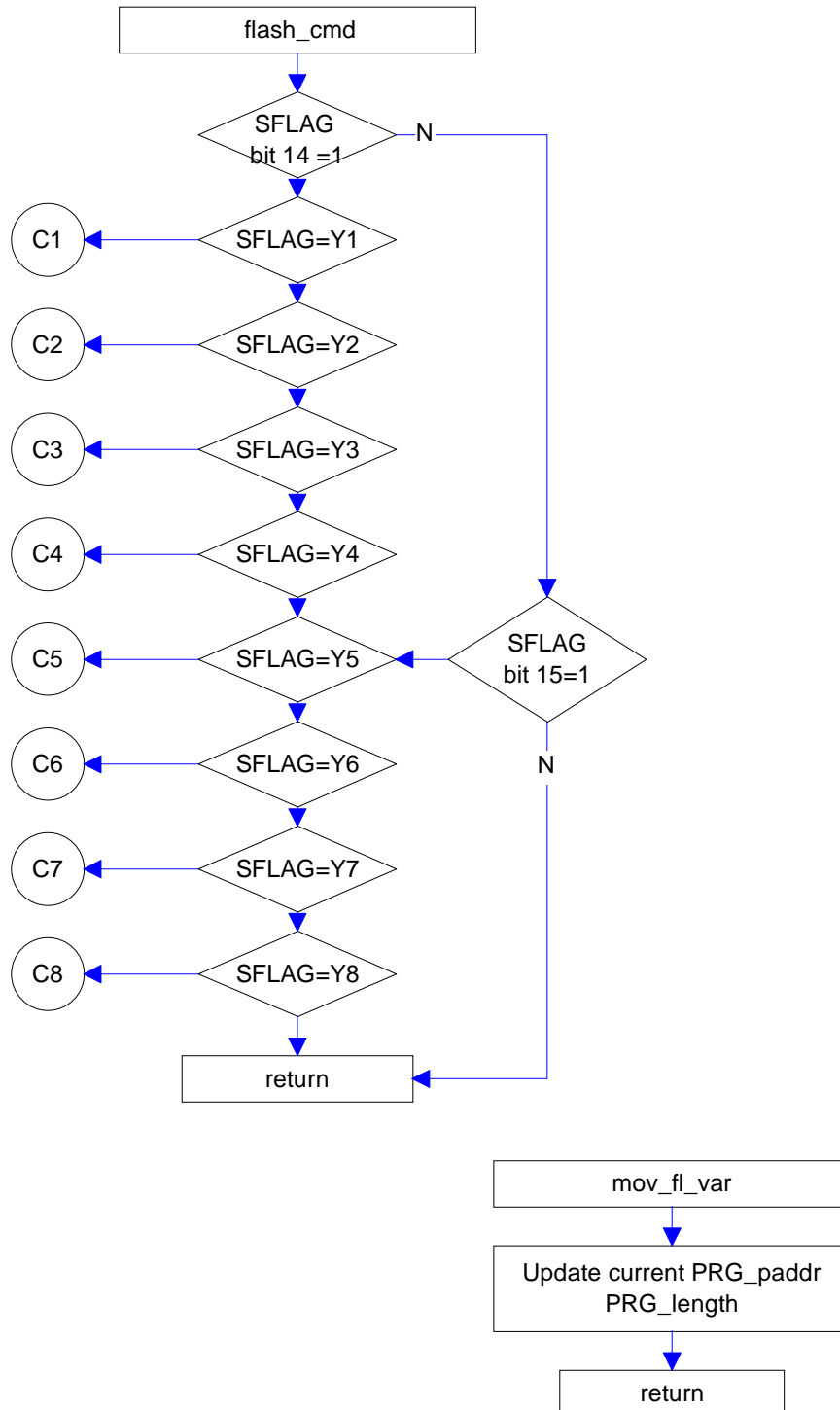
## F.3 TMS320F206 Flash Serial loader - F206 Level 2



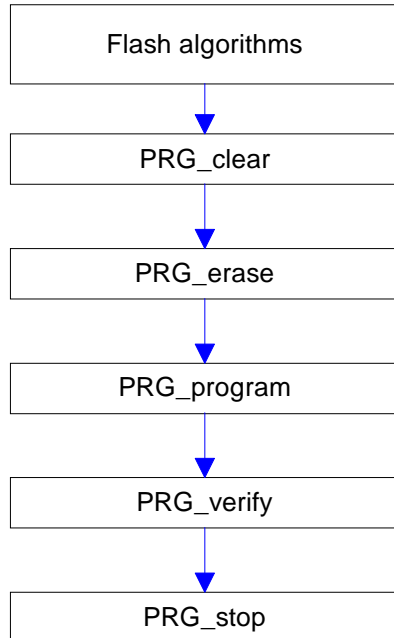
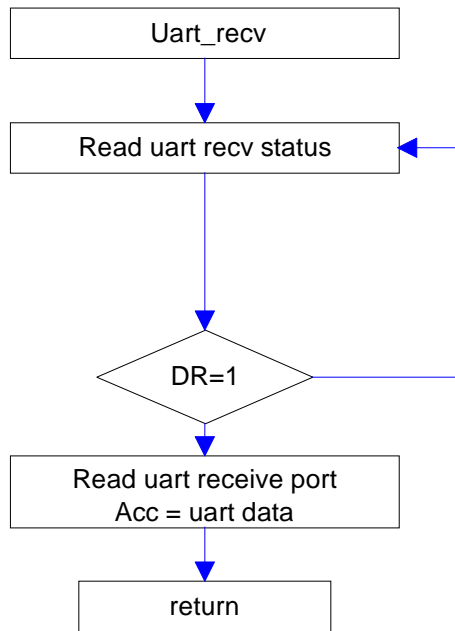
## F.3 TMS320F206 Flash Serial loader - F206 Level 2 (cont..)



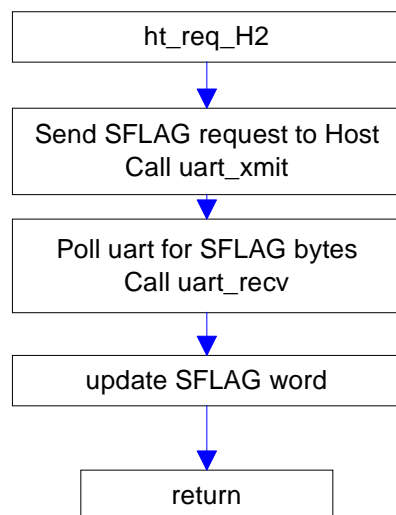
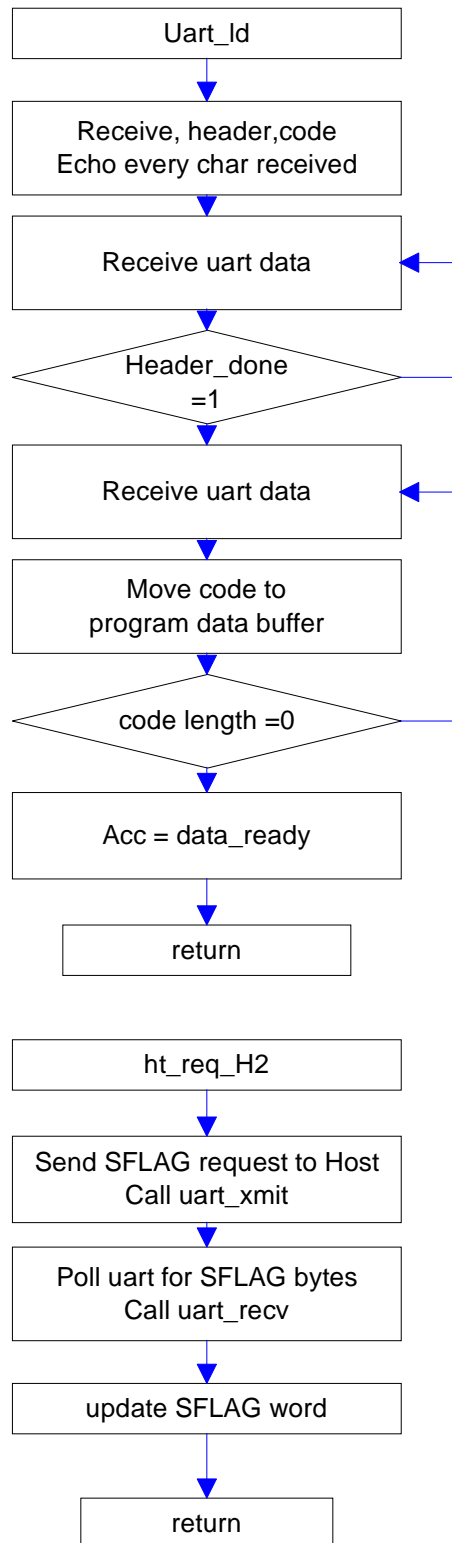
## F.3 TMS320F206 Flash Serial loader - F206 Level 2(cont..)



## F.3 TMS320F206 Flash Serial loader - F206 Level 2 (cont..)

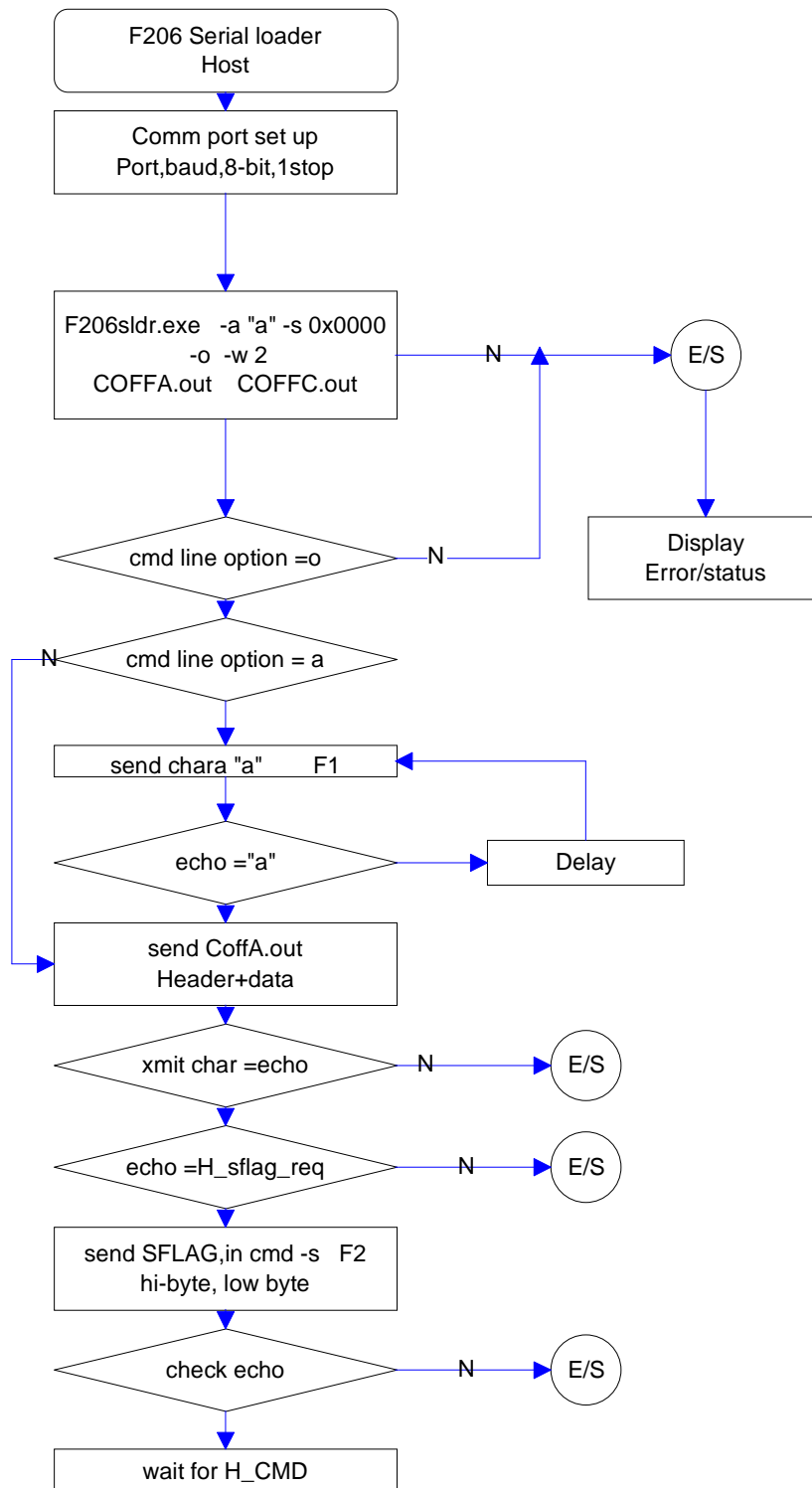


## F.3 TMS320F206 Flash Serial loader - F206 Level 2 (cont..)





#### F.4 TMS320F206 Flash Serial loader specification for Host Rev 2.0 (Under development)



## F.4 TMS320F206 Flash Serial loader specification for Host Rev 2.0(cont..)

