AM1808/OMAP-L138 SOM-M1 SPI Flash Recovery

Application Note 556

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Abstract

This application note provides the steps necessary to restore both the AM1808 SOM-M1 and OMAP-L138 SOM-M1 back to their factory default settings.

Revision History

REV	EDITOR	DESCRIPTION	APPROVAL	DATE
A	GCJ, SK	-Initial release	BSB, SO	12/07/12

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1 Introduction

This document provides the steps to return the AM1808 SOM-M1 and OMAP-L138 SOM-M1 to the programmed factory settings using raw binary files specific to individual versions of each SOM-M1.

1.1 Nomenclature

- This document covers the AM1808 SOM-M1 and OMAP-L138 SOM-M1. Use of “SOM-M1” suggests text that applies to both platforms; information specific to one platform will call out the precise name.
- Use of "development kit" suggests text that applies to the AM1808 EVM Development Kit, AM1808 eXperimenter Kit, OMAP-L138 EVM Development Kit, and OMAP-L138 eXperimenter Kit; information specific to one development kit will call out the precise name.

1.2 *AM1808_OMAP-L138_SOM-M1_SPI_Flash_Recovery_Files* Directory

Accompanying this application note within the *1023340A_AN556_AM1808_OMAP-L138_SOM-M1_SPI_Flash_Recovery.zip* file is a directory containing software files to be used with the instructions found here. The *AM1808_OMAP-L138_SOM-M1_SPI_Flash_Recovery_Files* directory should contain the following files that will be referenced throughout this document:

```
1013630_ti_uboot_linux_cat.bin
1013630_ti_uboot_linux_cat_agile_readme.txt
1014694revA_readme.txt
1014694revA_ti_uboot_linux_cat.bin
1015135A_am1808_spiflash_image.bin
1015135A_README.txt
1016592.raw
1016592_readme.txt
1016852_arm-mmcsd-ais-456mhz.bin
1016852revA_readme.txt
1017375_arm-mmcsd-ais.bin
1017375revA_readme.txt
```

1.3 Prerequisites

The following items are required to complete the procedures within this document:

- Logic PD Development Kit
  - Null-modem serial cable
  - Ethernet crossover cable
- Host PC (the procedures in this document were tested using a Windows 7 host PC)
- Terminal emulation program (e.g., Tera Term as described in Section 2.1)
- Texas Instruments (TI) Serial Boot and Flash Loading Utility (as described in Section 3)

IMPORTANT NOTE: When using the OMAP-L138 EVM Development Kit, the OMAP-L138 SOM-M1 must be connected to the baseboard; the procedures below are not applicable to the TMS320C6748 SOM-M1.

This document also assumes the following:

- The development kit is set up as described in the appropriate QuickStart Guide:
  - *AM1808 EVM QuickStart Guide*[1]
  - *AM1808 eXperimenter Kit QuickStart Guide*[2]
  - *OMAP-L138 EVM QuickStart Guide*[3]
  - *OMAP-L138 eXperimenter Kit QuickStart Guide*[4]
- The host PC to be used in the procedures discussed here is set up as described in the appropriate User Guide:
  - *AM1808 EVM User Guide*[5]
  - *AM1808 eXperimenter Kit User Guide*[6]
  - *OMAP-L138 EVM User Guide*[7]
  - *OMAP-L138 eXperimenter Kit User Guide*[8]

1.4 Test Environment

The following environment was used to test the procedures provided within this document.

1.4.1 Hardware

The part number and revision status of the hardware components used in writing this document are noted below. Please review the most recent schematics and any Product Change Notifications (PCNs) that could affect available features.

Hardware	Model Number (Part Number & Rev)
OMAP-L138 SOM-M1	(1013525 Rev 5)
Development Kit Baseboard	(1016660 Rev B)

1.4.2 Software

The version numbers of the software components used in writing this document are noted below. Please review the release notes for any software updates that might require changes to the procedures provided within this document.

- Tera Term version 4.73
- TI Serial Boot and Flash Loading Utility v 2.40

[1] http://support.logicpd.com/downloads/1293/
[2] http://support.logicpd.com/downloads/1294/
[3] http://support.logicpd.com/downloads/1230/
[4] http://support.logicpd.com/downloads/1367/
[5] http://support.logicpd.com/downloads/1296/
[6] http://support.logicpd.com/downloads/1424/
[7] http://support.logicpd.com/downloads/1214/
[8] http://support.logicpd.com/downloads/1363/

2 Kit Communications

The development kit comes with U-Boot programmed in the SPI flash. U-Boot presents a command shell to the user via the development kit's debug serial port. This section will provide the steps for establishing a proper serial connection to the development kit.

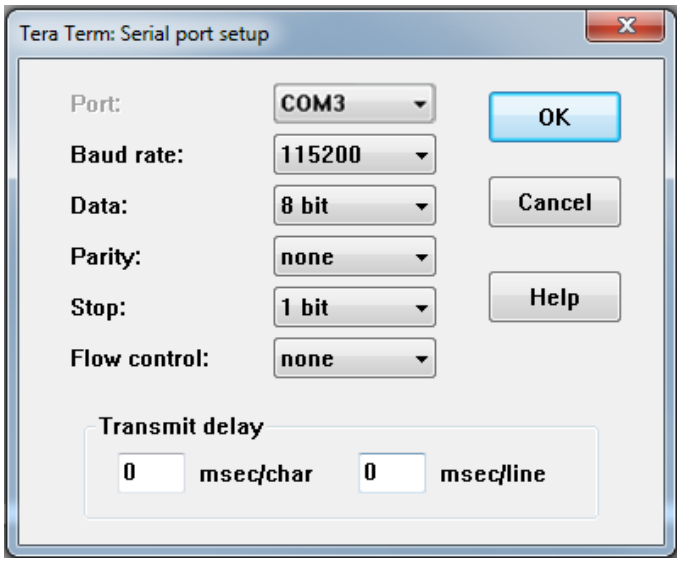
2.1 Install Terminal Emulation Program

The development kit is designed to communicate with terminal emulation programs using the included null-modem serial cable. The terminal emulation program must support binary transfers in order to download software to the kit. Although Logic PD does not support any particular terminal emulation program, we suggest using Tera Term for Windows (Tera Term is not available for Linux users). Tera Term can be downloaded for free from Logic PD's website. To install Tera Term:

1. Download the ZIP file[9] from Logic PD's website and extract the contents.
2. After extracting the contents, locate the *teraterm-x.xx.exe* file and double-click it.
3. Follow the on-screen instructions to install Tera Term.

2.1.1 Configure Tera Term

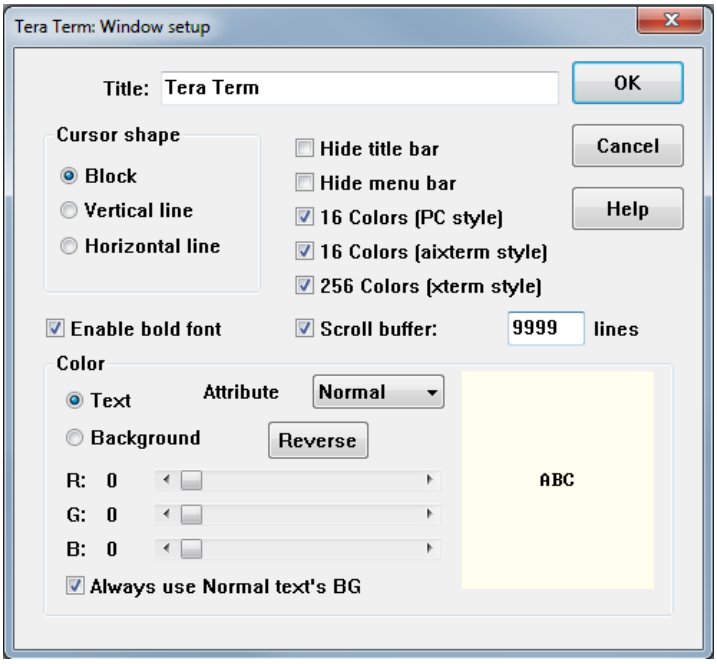
1. Start the Tera Term program.
2. From the menu, select Setup > Serial Port.
3. Select the appropriate COM port for your workstation and change the port settings to:
   a. Baud rate: **115200**
   b. Data: **8 bit**
   c. Parity: **None**
   d. Stop: **1 bit**
   e. Flow control: **None**



4. Click OK.
5. From the menu, select Setup > Window.

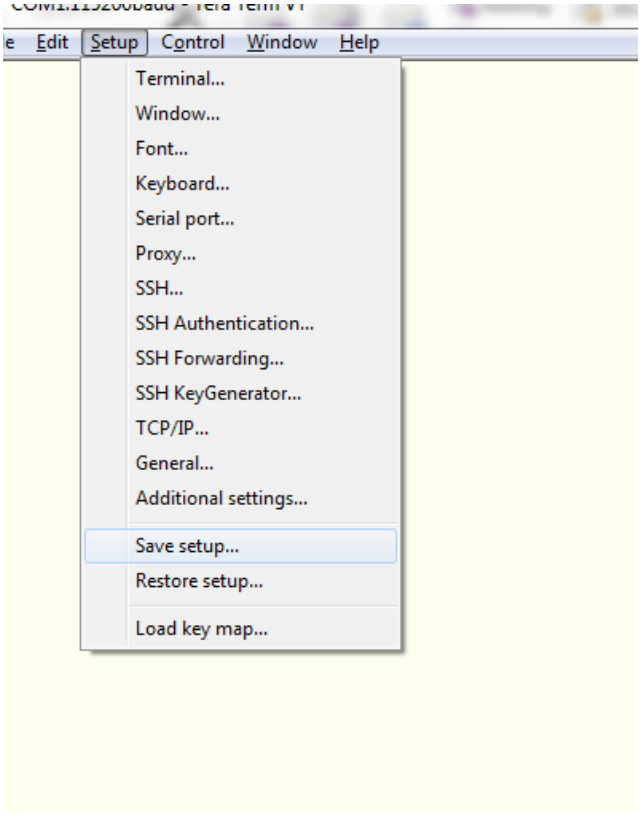
[9] http://support.logicpd.com/downloads/240/

6. Ensure the *Scroll buffer* option is checked and make the amount as large as you want, up to 9999.



7. Click OK.

8. From the menu, select Setup > Save Setup… to save your settings and restore them automatically when loading the Tera Term application.



2.2 Connect Development Kit to Host PC

1. Ensure all the switches on the S7 DIP switch block on the development kit baseboard are set to the OFF position (see Figure 2.1 below).

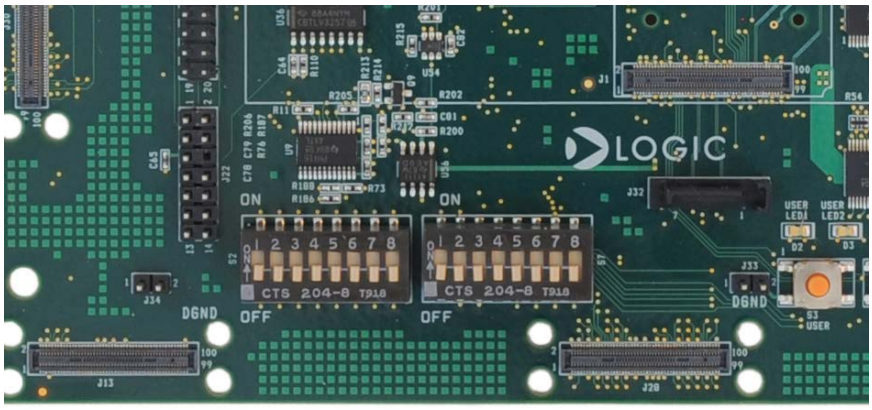


Figure 2.1: Development Kit DIP Switch Settings

2. Connect the serial cable (included with the development kit) to the serial debug port on the kit baseboard and to an available COM port on your host PC.

3. Power on the development kit. If U-Boot is located in the SPI flash, you should see output similar to that included below, meaning you have successfully established a serial connection to the development kit.

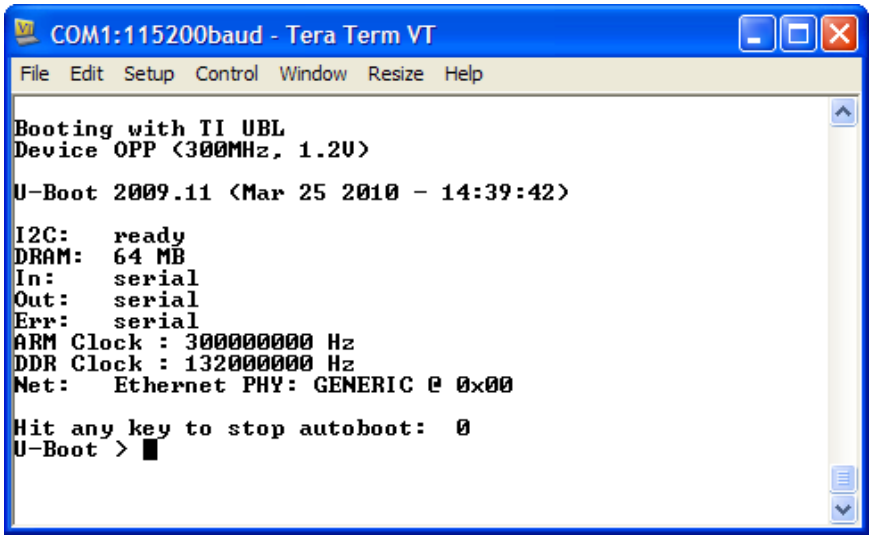


Figure 2.2: Successful Serial Connection Output

NOTE: If you see a BOOTME message instead of the output above, the S7 DIP switches may not be set to the correct positions. Power off the kit, make sure all switches are in the OFF position, and then power on the kit again.

3 Download and Place Serial Boot and Flash Loading Utility

A Serial Boot and Flash Loading Utility (hereafter, Flash Loading Utility) for the AM1808 and OMAP-L138 is provided by TI and can be downloaded from their website after account registration. This section will provide the steps for downloading and placing this utility into the file structure used throughout the remainder of this document.

NOTE: The instructions below will feature the OMAP-L138 SOM-M1; however, filenames can be adjusted for the AM1808 SOM-M1.

1. Begin by pointing a web browser to TI's *Serial Boot and Flash Loading Utility for OMAP-L138* wiki page.[10]

2. Under the *Obtaining the software* heading, click on the **here** link. This will direct you to a SourceForge site.

3. Download the Flash Loading Utility for the OMAP-L138 and extract the contents to the *C:\flasher\SFH_2_40* directory, as shown below in Figure 3.1 below.

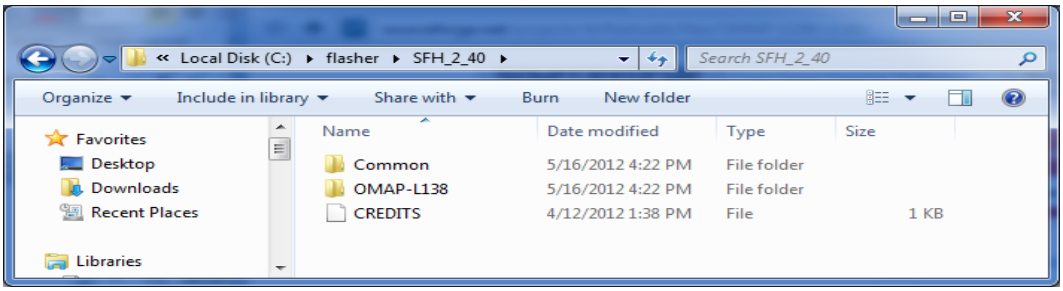


Figure 3.1: Directory File Structure

NOTE: Be sure to keep this same directory and sub-directory file structure, as it will be used throughout the remainder of this document. The folder location is optional, but this is the directory structure that will be used in the steps below.

4. Locate the Flash Loading Utility (*sfh_OMAP-L138.exe*) that resides on your host PC at *C:\flasher\SFH_2_40\OMAP-L138\GNU*. For brevity, this will be called the *GNU* directory.

5. Copy the *sfh_OMAP-L138.exe* file to the *C:\flasher* directory. The Flash Loading Utility will be run from the *C:\flasher* directory.

6. Open a command window and change the working directory to *C:\flasher*.

```
> c:\
> cd \flasher
```

In the following sections, the raw file that will be loaded to the SOM-M1 SPI flash will be copied into the *C:\flasher* working directory.

[10] http://processors.wiki.ti.com/index.php/Serial_Boot_and_Flash_Loading_Utility_for_OMAP-L138

4 Select and Place Appropriate Binary File

Raw binary files for the SOM-M1 can be found in the *AM1808_OMAP-L138_SOM-M1_SPI_Flash_Recovery_Files* directory included with this application note. Each file is associated with a specific SOM-M1 part number (this will be discussed in more detail below) and contains different pieces of the boot-up process. All of the files have the UBL, Magic Number bytes (MN), and U-Boot. Some of the files also include the Linux kernel *uImage* or a root file system in the form of a RAMDisk. The contents of each file are identified below.

- *1013630_ti_uboot_linux_cat.bin*: Includes the UBL, MN, U-Boot, *uImage,* and RAMDisk root file system.
- *1014694revA_ti_uboot_linux_cat.bin*: Includes the UBL, MN, U-Boot, *uImage*, and a RAMDisk root file system.
- *1015135A_am1808_spiflash_image.bin*: Includes the UBL (ARM AIS), MN, U-Boot, and *uImage.*
- *1016592.raw*: Includes the UBL, MN, and U-Boot.
- *1016852_arm-mmcsd-ais-456mhz.bin*: Includes only the UBL; the rest of the boot is expected to come from an SD card or a TFTP Ethernet source.
- *1017375_arm-mmcsd-ais.bin*: Includes only the UBL; the rest of the boot is expected to come from an SD card.

NOTE: If the raw file for your SOM-M1 does not contain the kernel or the root file system, the Linux kernel will not boot and the boot-up process must be stopped at the U-Boot prompt. At a later time, the kernel and root file system can be loaded for boot up.

In order to determine which raw binary file is associated with your SOM-M1, you must identify the part number of your module. This part number will have the format of 10xxxxx Rev x and is located on the white sticker attached to the SOM. See the appropriate Product Change Notification (PCN) document for your SOM-M1 for a more detailed discussion of the information provided on the sticker and the sticker's location.

- *AM1808 SOM-M1 PCN*[11]
- *OMAP-L138 SOM-M1 PCN*[12]

Use the tables below to match the part number of your SOM-M1 to the appropriate raw binary file. Table 4.1 contains information pertaining to AM1808 SOM-M1s and Table 4.2 contains information pertaining to OMAP-L138 SOM-M1s.

NOTE: The TMS320C6748 SOM-M1 does not have a raw file programmed into SPI flash and is, therefore, not addressed in the tables below.

Table 4.1: AM1808 SOM-M1 Raw Binary Files

Model Number & Rev (Part Number)	PCN Detailing Revision	Raw Binary File
SOMXAM1808-10-1502AHCR-A (1015908)	—	*1015135A_am1808_spiflash_image.bin*
SOMXAM1808-10-1502QHCR-A (1015912)	—	*1015135A_am1808_spiflash_image.bin*
SOMXAM1808-10-1602AHCR-A (1015889)	—	*1015135A_am1808_spiflash_image.bin*

[11] http://support.logicpd.com/downloads/1391/
[12] http://support.logicpd.com/downloads/1289/

Model Number & Rev (Part Number)	PCN Detailing Revision	Raw Binary File
SOMAM1808-10-1502QHCR-A (1016966)	PCN 472	*1015135A_am1808_spiflash_image.bin*
SOMAM1808-10-1502QHCR-B (1017945)	PCN 474	*1015135A_am1808_spiflash_image.bin*
SOMAM1808-10-1602AHCR-A (1016962)	PCN 472	*1015135A_am1808_spiflash_image.bin*
SOMAM1808-10-1602AHCR-B (1017941)	PCN 474	*1015135A_am1808_spiflash_image.bin*
SOMAM1808-10-1602QHIR-A (1016970)	PCN 472	*1015135A_am1808_spiflash_image.bin*
SOMAM1808-10-1602QHIR-B (1017950)	PCN 474	*1015135A_am1808_spiflash_image.bin*
(1015127)	—	*1014694revA_ti_uboot_linux_cat.bin*
(1015137)	—	*1015135A_am1808_spiflash_image.bin*
(1015232)	—	*1015135A_am1808_spiflash_image.bin*
(1016844)	PCN 472	*1016852_arm-mmcsd-ais-456mhz.bin*
(1017869)	PCN 474	*1016852_arm-mmcsd-ais-456mhz.bin*

Table 4.2: OMAP-L138 SOM-M1 Raw Binary Files

Model Number & Rev (Part Number)	PCN Detailing Revision	Raw Binary File
SOMOMAPL138-10-1502QHCR-A (1016648)	PCN 451	*1016592.raw*
SOMOMAPL138-10-1502QHCR-B (1017898)	PCN 475	*1016592.raw*
SOMXOMAPL138-10-1602AHCR-A (1014613)	PCN 427	*1014694revA_ti_uboot_linux_cat.bin*
SOMXOMAPL138-10-1602AHCR-B (1016515)	PCN 450	*1016592.raw*
SOMOMAPL138-10-1602AHCR-A (1016639)	PCN 451	*1016592.raw*
SOMOMAPL138-10-1602AHCR-B (1017894)	PCN 475	*1016592.raw*
SOMOMAPL138-10-1602QHIR-A (1016653)	PCN 451	*1016592.raw*
SOMOMAPL138-10-1602QHIR-B (1017899)	PCN 475	*1016592.raw*
(1013523)	—	*1013630_ti_uboot_linux_cat.bin*
(1013525)	—	*1013630_ti_uboot_linux_cat.bin*
(1014650)	PCN 427	*1014694revA_ti_uboot_linux_cat.bin*
(1014652)	PCN 427	*1014694revA_ti_uboot_linux_cat.bin*
(1015517)	PCN 450	*1014694revA_ti_uboot_linux_cat.bin*
(1016805)	PCN 451	*1017375_arm-mmcsd-ais.bin*
(1016841)	PCN 450	*1017375_arm-mmcsd-ais.bin*
(1017855)	PCN 475	*1017375_arm-mmcsd-ais.bin*
(1017861)	PCN 475	*1017375_arm-mmcsd-ais.bin*

Expect updates to this document only if a future PCN describing software updates is documented for your SOM-M1. For any new modules created beyond the part number 1017xxx, refer to Table 4.3 below for the targeted SPI flash file.

Table 4.3: Targeted Raw Files for Future Modules

SOM Description	Raw Binary File
OMAP-L138 SOM-M1 (Standard)	*1017375_arm-mmcsd-ais.bin*
AM1808 SOM-M1 (Standard)	*1015135A_am1808_spiflash_image.bin*
OMAP-L138 SOM-M1 (included in EVM)	*1016592.raw*
OMAP-L138 SOM-M1 (included in eXperimenter)	*1016592.raw*
AM1808 SOM-M1 (included in EVM)	*1016592.raw*
AM1808 SOM-M1 (included in eXperimenter)	*1016592.raw*

Once you have chosen the appropriate raw binary file, place the file into the *C:\flasher* directory. You may use a different directory structure; however, this is the directory that will be used in the steps below. Commands must be updated to match a different directory structure.

If the raw file name is too long, the Flash Loading Utility may not be able to work with the file. In this case, change the raw file name to *spi_image.bin*. This shorter name is used in the example commands below.

5 Load Raw Binary File into SPI Flash

This section will provide the steps required to erase the SPI flash on the SOM-M1 and load the raw binary file selected in the previous section back into the flash.

5.1 Erase SPI Flash

Erasing the SPI flash is required to clear the memory before programming new data into it. Follow the steps below to erase the SPI flash on the SOM-M1.

1. With the development kit powered off, set DIP switches S7:7 and S7:8 on the baseboard to the ON position; set all others to the OFF position. This will permit the Flash Loading Utility operation to work in UART mode from a host PC command window.
2. Connect the serial cable to the serial debug port on the development kit baseboard and to an available COM port on your host PC.

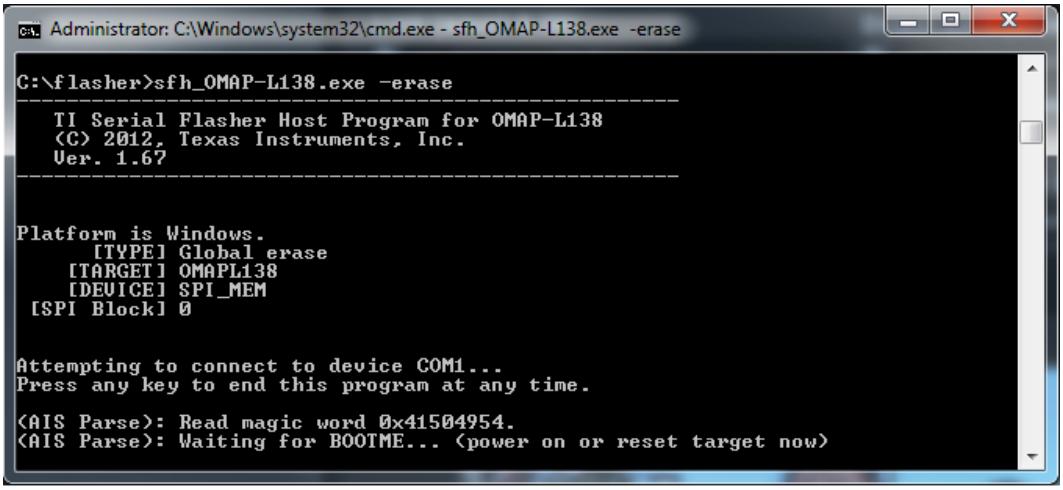
   NOTE: The Flash Loading Utility assumes it will be communicating with the COM1 port. Ensure the serial cable is associated with COM1 on your host PC.
3. Open a command prompt window on your host PC and change the directory to *C:\flasher*, which will be the working directory.

```
> c:
> cd \flasher
```

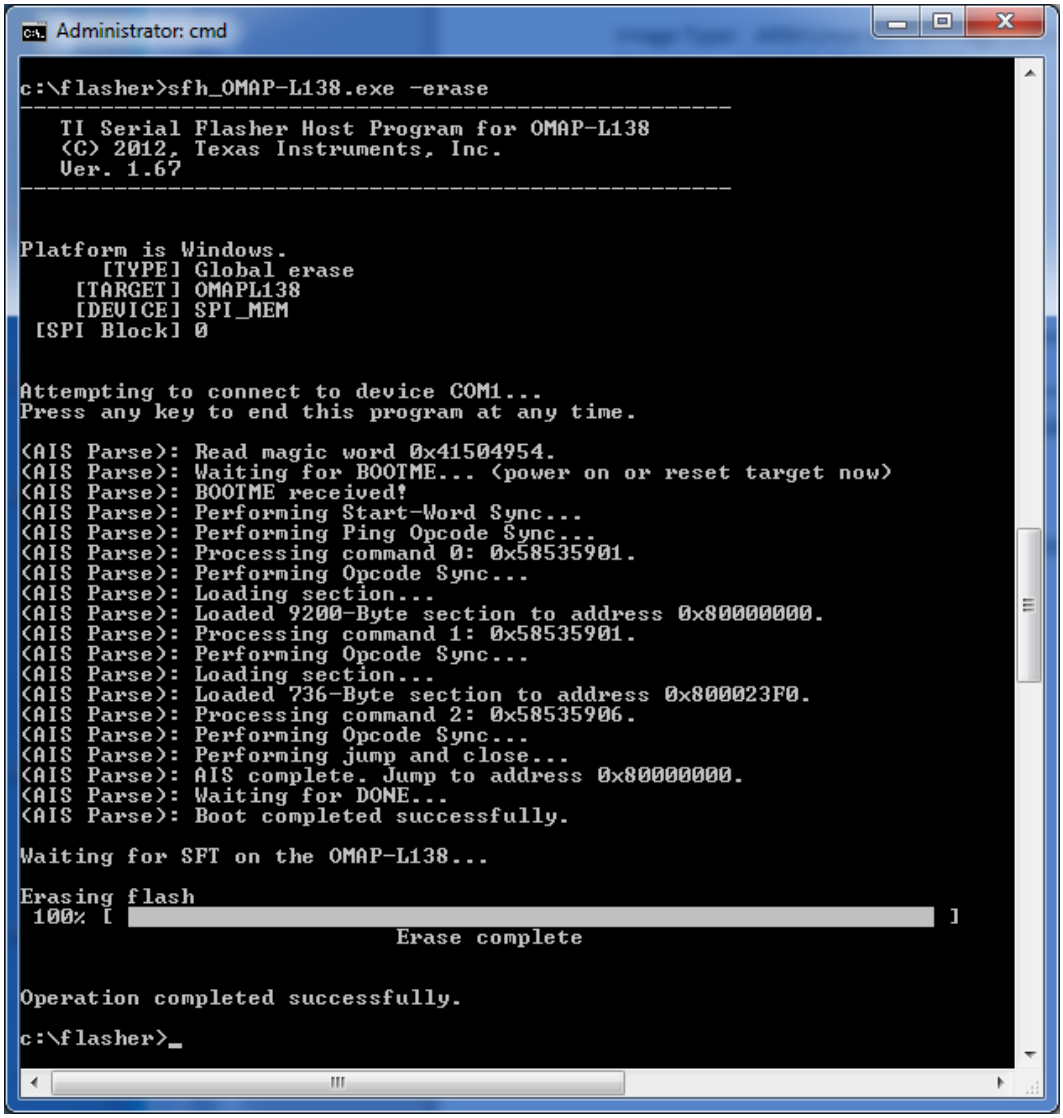
   NOTE: The command prompt window at *C:\flasher* must be the only terminal window open. Do not have a Tera Term window running during this operation.
4. Erase the flash.

```
> sfh_OMAP-L138.exe -erase -p COM1
```

   You will receive a message that the Flash Loading Utility is attempting to connect to device COM1, as seen below.



5. Power on the development kit. After a few moments, a message will appear that states the flash is being erased.



NOTE: If a "Waiting for BOOTME" message continues to appear after turning on the development kit, press the S5 reset button on the baseboard. This will send the *BOOTME* command to the Flash Loading Utility.

6. Once the erase is complete, power off the development kit and proceed to the next section to program the SPI flash on the SOM-M1.

5.2 Program Raw Binary File into SPI Flash

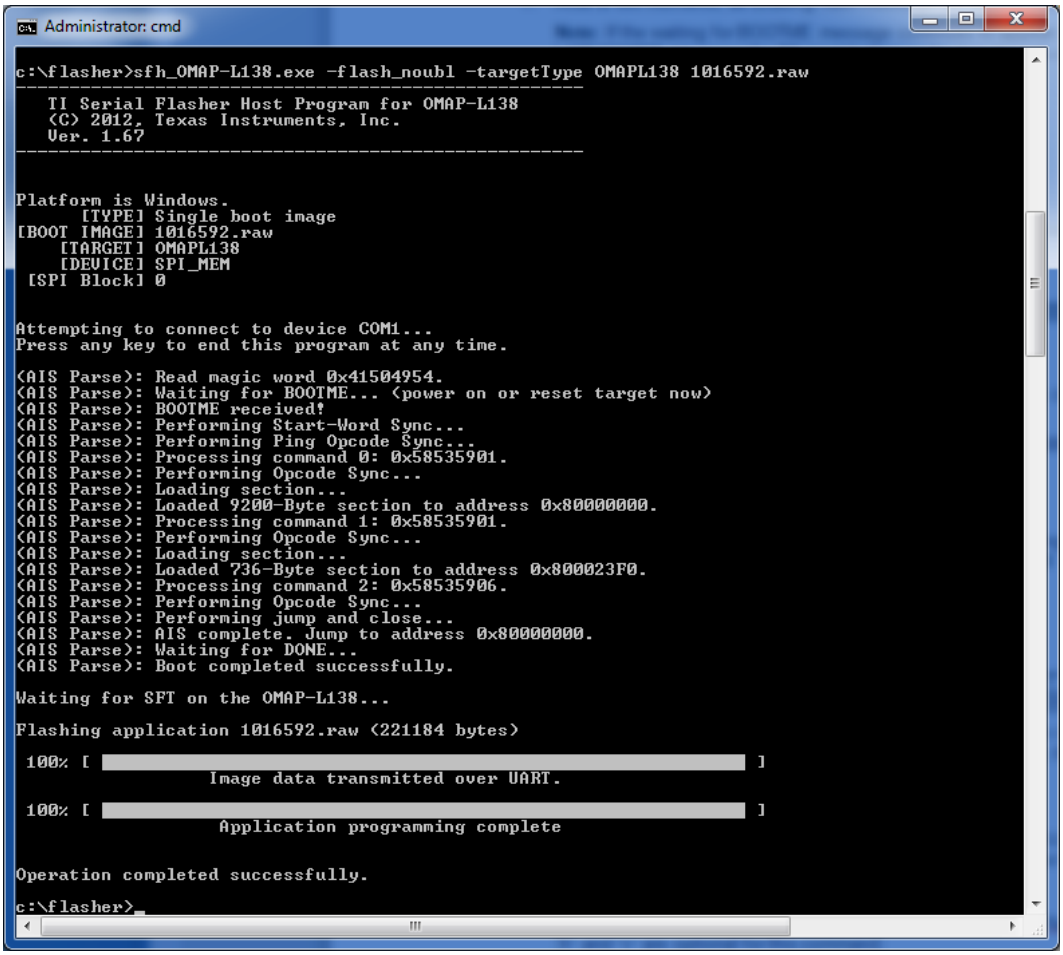
1. With the development kit turned off, set DIP switches S7:7 and S7:8 on the baseboard to the ON position; set all others to the OFF position.
2. Open a command prompt window on your host PC and change the directory to *C:\flasher* if you are not already there.

3. Flash the selected raw binary file to the SPI flash on the SOM-M1 using the command below. <Target> should be replaced with AM1808 or OMAP-L138, depending on the microprocessor you are using. <InputFiles> should also be replaced with the name of the raw file you selected in Section 4.

```
> sfh_OMAP-L138.exe –flash_noubl –targetType <Target> <InputFiles> -p COM1
```

NOTE: The default *targetType* is OMAPL138 and the default *flashType* is SPI_MEM.

4. Power on the development kit. After a few moments, a message will appear that the binary file is being flashed; it will then move on to flashing the raw file into the SPI flash.



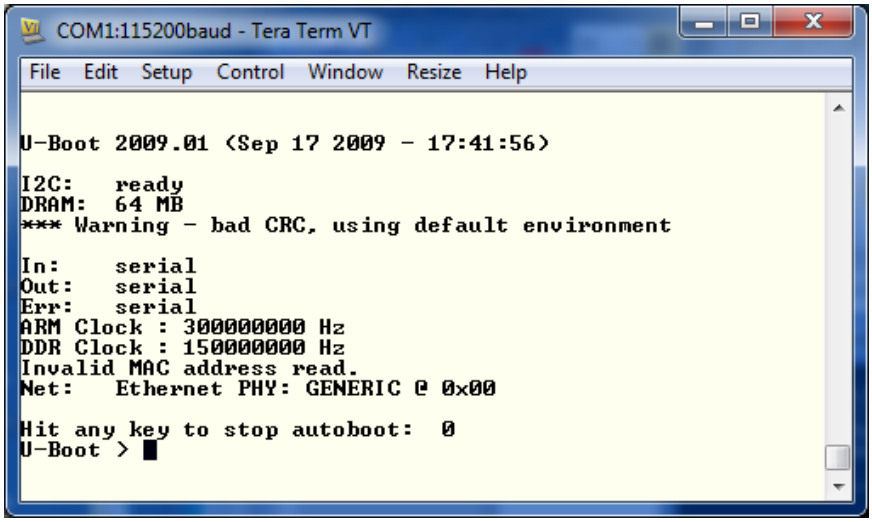
NOTE: If the BOOTME message continues to appear after turning on the development kit, press the S5 reset button on the baseboard. This will send the *BOOTME* command to the Flash Loading Utility.

5. Once the flash has been successfully programmed, power off the development kit.

5.3 Boot to U-Boot from SPI Flash

1. Open a Tera Term (terminal) window on your host PC.
2. With the development kit powered off, set all S7 DIP switches to the OFF position. This will configure the development kit to boot from SPI flash.

3. Power on the development kit and observe it boot to the U-Boot prompt in the host PC window. Hit any key to stop the autoboot process.



You have now successfully flashed your selected raw binary file to the SPI flash and restored the SOM-M1 to its factory settings. For instructions on how to continue booting into the Linux operating system, please see the *AM1808/OMAP-L138 Linux User Guide*.[13]

[13] http://support.logicpd.com/downloads/1539/

6 Restore Ethernet MAC Address

The Ethernet MAC address of your SOM-M1 can be found on the white sticker attached to the module with the format 00:08:EE:XX:XX:XX. Erasing the SPI flash with the Flash Loading Utility as described in this document will also erase this MAC address in the SOM-M1. This section will provide the steps to restore the MAC address.

1. Boot the development kit to the U-Boot prompt and enter the commands below. **NOTE:** The example MAC address 00:08:EE:03:5B:40 is used below. Be sure to replace this address with values appropriate for your system.

```
U-Boot > mm.b c0000000
c0000000:  00 ? 00
c0000001:  10 ? 08
c0000002:  08 ? EE
c0000003:  01 ? 03
c0000004:  40 ? 5B
c0000005:  21 ? 40
c0000006:  0c ? q
U-Boot > md.b c0000000
c0000000: 00 08 EE 03 5B 40 …
U-Boot > sf probe 0
8192 KiB M25P64 at 0:0 is now current device
U-Boot> sf write c0000000 7f0000 6
U-Boot>
```

   The original MAC address should now be restored to the SOM-M1.

2. Reboot the system and enter the command below to verify *ethaddr* is set correctly.

```
U-Boot > printenv

bootargs=mem=32M console=ttyS2,115200n8 root=/dev/ram0 rw
initrd=0xc1180000,4M ip=off
bootcmd=sf probe 0;sf read 0xc0700000 0x80000 0x200000;sf read
0xc1180000 0x280000 0x300000;bootm 0xc0700000
bootdelay=3
baudrate=115200
bootfile="uImage"
stdin=serial
stdout=serial
stderr=serial
ethaddr=00:08:ee:03:5b:40
ethact=
ver=U-Boot 2009.01 (Sep 17 2009 - 17:41:56)
```

3. Test that the Ethernet works as expected by pinging another system on the network.
   a. Connect an Ethernet cable between your development kit and the network.
   b. Set the development kit IP address.

      For static IP addresses:

```
U-Boot > set ipaddr <static ip address>
```



```
U-Boot > saveenv
```

For DHCP:

```
U-Boot > setenv autoload no
U-Boot > dhcp
```

c. Ping the system on the network.

```
U-Boot > ping <network ip address>
```


7 SOM-M1 Memory Map

The following memory map shows the location of different types of memory and program files on the SOM-M1. This information is a useful reference when navigating, locating, and storing configuration and application files.

Memory	Start	End	Size
Internal ROM (DSP L2 ROM)	0x1170_0000	0x117F_FFFF	1024 KB
Internal SRAM (Shared RAM)	0x8000_0000	0x8001_FFFF	128 KB
DDR (EVM)	0xC000_0000	0xC7FF_FFFF	128 MB
DDR (eXperimenter)	0xC000_0000	0xC3FF_FFFF	64 MB
NOR (on UI board)	0x6000_0000	0x607F_FFFF	8 MB
Peripheral Space[1]			

TABLE NOTES:

1. See the TI *OMAP-L138 C6000 DSP + ARM Processor Technical Reference Manual (TRM)*[14] for additional information.

7.1 SPI Flash

The SPI flash chip is located on the SOM-M1 and is connected to the SPI1 port. The chip is not memory mapped and is 8 MB. This fills an address space of 0x7F_FFFF.

Address	Item
0x000000	ARM AIS bootloader (*arm-api-ais.bin*)
0x010000	U-Boot prepended with config (*u_boot.bin*)
0x080000	Linux image (*uImage*)
0x280000	File system (*ramdisk-base.gz*)

7.2 User Interface Board NAND Flash

The User Interface (UI) Board that ships with the AM1808 EVM Development Kit and the OMAP-L138 EVM Development Kit has a NAND flash socket and a NAND chip installed with the following properties:

- Part number: Micron MT29F4G08AAC
- Base address: 0x6200_0000
- Page size: 2112 bytes (2048 + 64 bytes)
- Block size: 64 pages (128K + 4K bytes)
- Plane size: 2 planes x 2048 blocks per plane
- Device size: 512 MB (4 Gb), 4096 blocks

[14] http://www.ti.com/product/omap-l138

8 Summary

Information provided in this application note enables customers to return the flash memory of a standard AM1808 SOM-M1 or OMAP-L138 SOM-M1 to the original state in which it was initially received. For customers needing additional assistance, please contact Logic PD[15] for technical support and/or services assistance. For development assistance with our services team, please contact the Logic PD Sales Team.[16]

[15] http://support.logicpd.com/support/askaquestion.php
[16] http://www.logicpd.com/contact/inquiry/