

APPLICATION NOTE

IAR Example with Execution in External Flash Using MSPI XIP Mode

A-MCUAP3-ANGA05EN v1.0



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Revision History

Revision	Date	Description
1.0	April 11, 2022	Initial release

Reference Documents

Document ID	Description

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SECTION

1

Introduction

This release of the Apollo3 SDK provides two new examples that can be use to demonstrate a work flow for installing and executing a portion of customer code from an external Flash device using the Apollo3 MSPI in XIP mode. These examples are in:

- `/boards/apollo3_eb/examples/mspi_flash_loader`
- `/boards/apollo3_eb/examples/mspi_prime`

This application note walks the reader through the steps required to produce an example with code located in both internal and external flash, then split the resulting binary into two binaries:

- **`mspi_prime_internal`** is the binary loaded into the Apollo3 internal flash
- **`mspi_prime_external`** is the binary loaded into the external flash and accessed over MSPI XIP

1.1 Assumptions

This document assumes the following:

Cygwin or equivalent with python3 is installed in user's environment

SECTION

2

IAR Example with Execution in External Flash Using MSPI XIP Mode

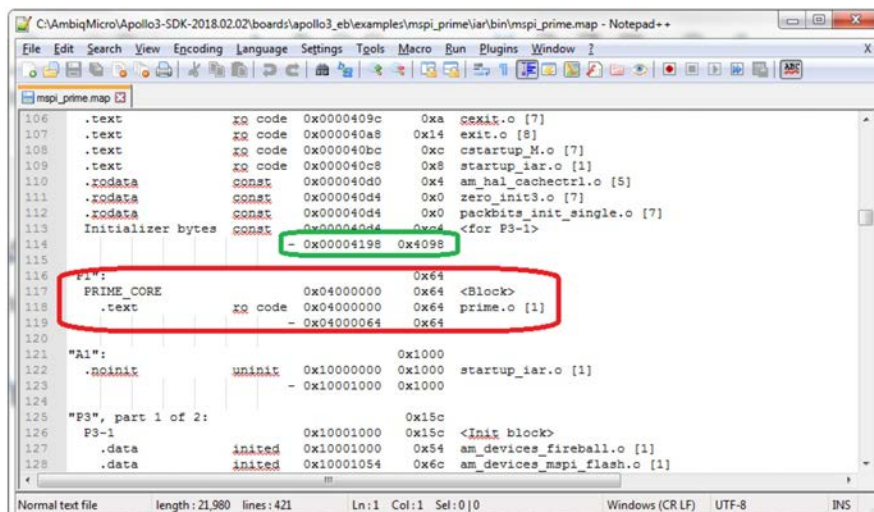
Use the following procedure:

1. Change directory to **/boards/apollo3_eb/examples/mspi_prime**.
2. Copy the **mspi_prime.icf** file their down into the **/iar** directory.

NOTE: The SDK release builder populates a default **mspi_prime.icf** file. This file does not relocate the **prime.o** object into the external flash. It is instructive to compare these two files to note the differences.

3. Open IAR and rebuild the **mspi_prime** example with the new ICF.
4. Check the **/iar/bin/mspi_prime.map** file to make sure the **prime.o .text** segment is located in the external flash address range as follows.

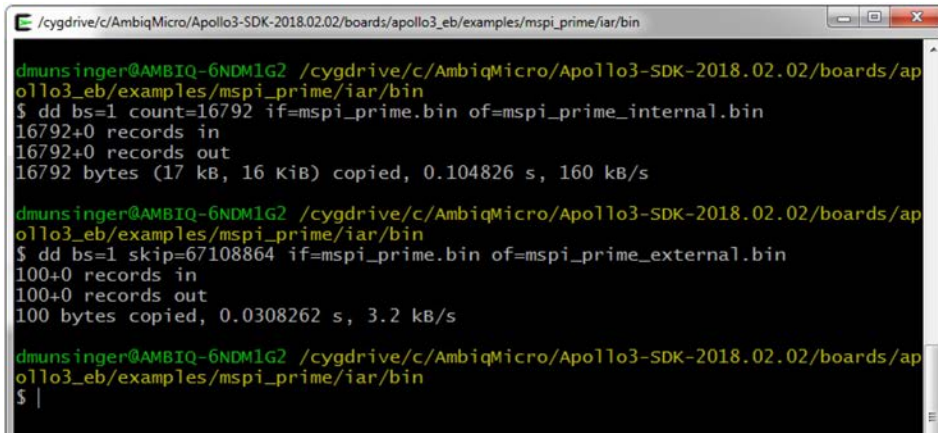
NOTE: that this example only relocates the **.text** segment of the **prime.c** program. It is recommended at this time that **.rodata** be left in internal flash.



```
106 .text          xq code 0x0000409c 0xa gexit.o [7]
107 .text          xq code 0x000040a8 0x14 exit.o [8]
108 .text          xq code 0x000040bc 0xc cstartup_M.o [7]
109 .text          xq code 0x000040c8 0x8 startup_iar.o [1]
110 .rodata        const 0x000040d0 0x4 am_hal_cachectrl.o [5]
111 .rodata        const 0x000040d4 0x0 zero_init3.o [7]
112 .rodata        const 0x000040d4 0x0 packbits_init_single.o [7]
113 Initializer bytes const 0x000040d4 0x04 <for P3-1>
114               - 0x00004198 0x4098
115
116 P1*:
117 PRIME_CORE          0x04000000 0x64 <Block>
118 .text              xq code 0x04000000 0x64 prime.o [1]
119               - 0x04000064 0x64
120
121 *A1*:
122 .noinit            uninit 0x10000000 0x1000 startup_iar.o [1]
123               - 0x10001000 0x1000
124
125 *P3*, part 1 of 2:
126 P3-1               0x10001000 0x15c <Init block>
127 .data              initd 0x10001000 0x54 am_devices_fireball.o [1]
128 .data              initd 0x10001054 0x6c am_devices_mspi_flash.o [1]
```

- Use the linux **data duplicator** or **dd** command to separate the **/iar/bin/mspi_prime.bin** into the internal and external segments (below). The first **dd** command separates the internal flash segment of the **mspi_prime** example. The second **dd** command separates the external flash segment of the **mspi_prime** example.

NOTE: The value 16792 is equivalent to the 0x4198 (see above) and is the ending location of the **mspi_prime** internal flash segment and 67108864 is 0x04000000.



```

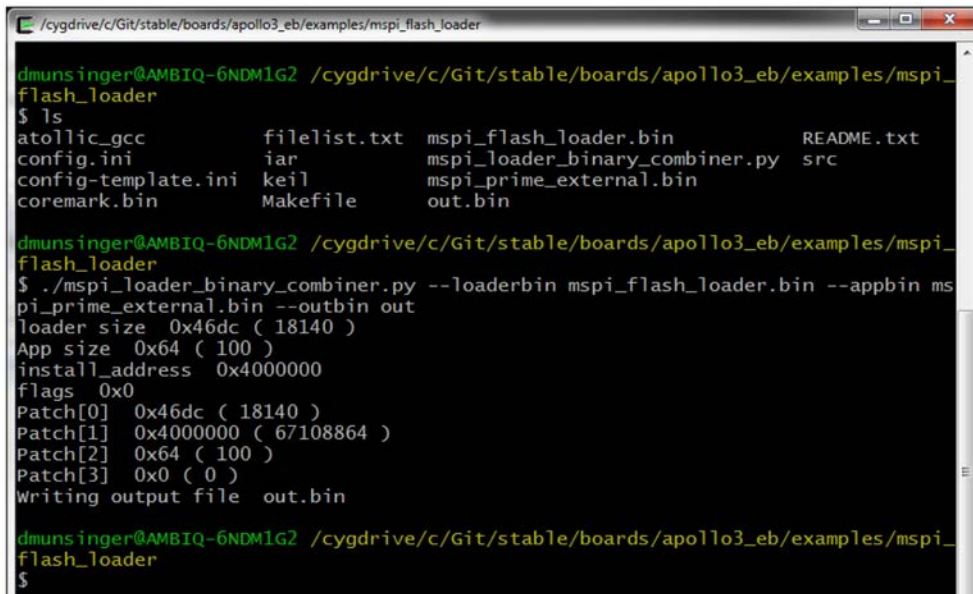
/cygdrive/c/AmbiqMicro/Apollo3-SDK-2018.02.02/boards/apollo3_eb/examples/mspi_prime/iar/bin
dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/AmbiqMicro/Apollo3-SDK-2018.02.02/boards/apollo3_eb/examples/mspi_prime/iar/bin
$ dd bs=1 count=16792 if=mspi_prime.bin of=mspi_prime_internal.bin
16792+0 records in
16792+0 records out
16792 bytes (17 kB, 16 KiB) copied, 0.104826 s, 160 kB/s

dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/AmbiqMicro/Apollo3-SDK-2018.02.02/boards/apollo3_eb/examples/mspi_prime/iar/bin
$ dd bs=1 skip=67108864 if=mspi_prime.bin of=mspi_prime_external.bin
100+0 records in
100+0 records out
100 bytes copied, 0.0308262 s, 3.2 kB/s

dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/AmbiqMicro/Apollo3-SDK-2018.02.02/boards/apollo3_eb/examples/mspi_prime/iar/bin
$ |

```

- Copy the **mspi_prime_external.bin** to the **/boards/apollo3_eb/examples/mspi_flash_loader** directory.
- Copy the IAR binary for the **mspi_flash_loader** example from the **/iar/bin** directory to the parent directory.
- Create the loader program using the python script (**mspi_loader_binary_combiner.py**) as follows:



```

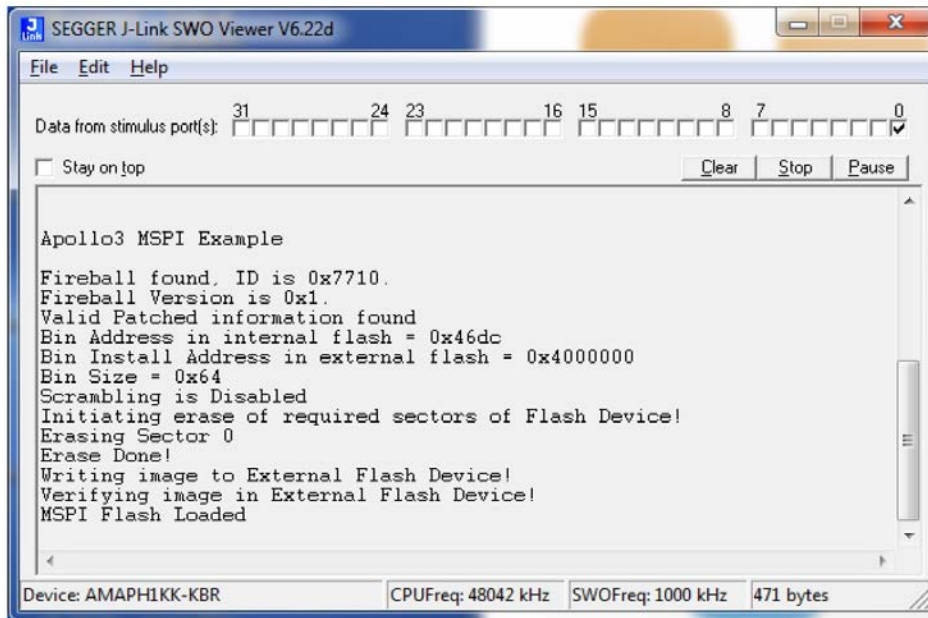
/cygdrive/c/Git/stable/boards/apollo3_eb/examples/mspi_flash_loader
dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/Git/stable/boards/apollo3_eb/examples/mspi_flash_loader
$ ls
atollic_gcc      filelist.txt  mspi_flash_loader.bin  README.txt
config.ini      iar           mspi_loader_binary_combiner.py  src
config-template.ini  keil        mspi_prime_external.bin
coremark.bin    Makefile     out.bin

dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/Git/stable/boards/apollo3_eb/examples/mspi_flash_loader
$ ./mspi_loader_binary_combiner.py --loaderbin mspi_flash_loader.bin --appbin mspi_prime_external.bin --outbin out
loader size 0x46dc ( 18140 )
App size 0x64 ( 100 )
install_address 0x4000000
flags 0x0
Patch[0] 0x46dc ( 18140 )
Patch[1] 0x4000000 ( 67108864 )
Patch[2] 0x64 ( 100 )
Patch[3] 0x0 ( 0 )
Writing output file out.bin

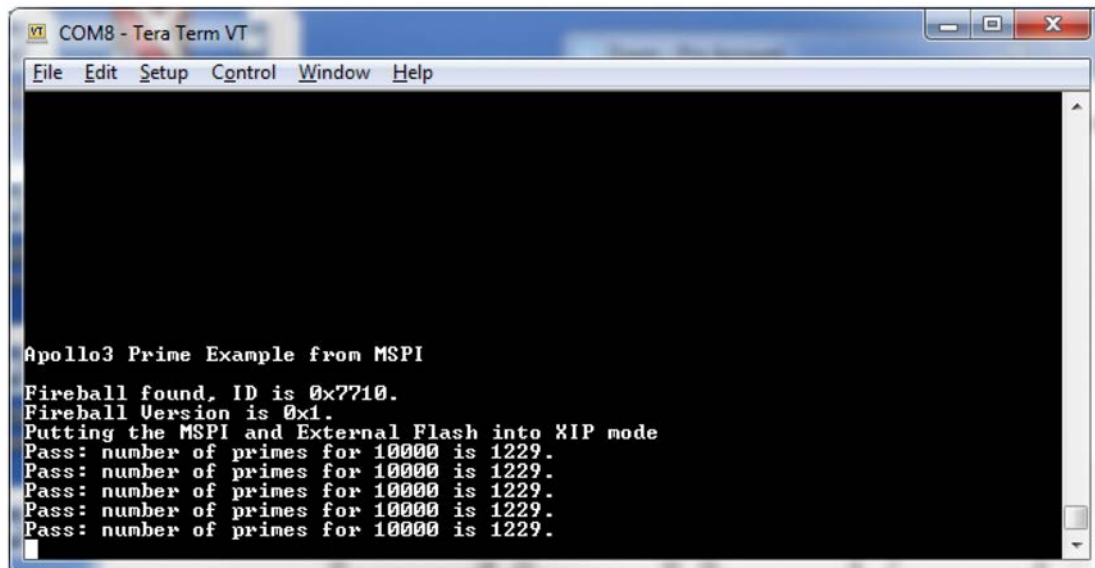
dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/Git/stable/boards/apollo3_eb/examples/mspi_flash_loader
$

```

- Use the J-Link tools or IAR to run the **out.bin** binary. This will load the **mspi_prime** external flash segment as follows:



- Use the J-Link tools to load and run the **/boards/apollo3_eb/examples/mspi_prime/mspi_prime_internal.bin** on the target. The output to the UART0 (115200bps) should appear as follows:





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