

Application Note – IAR Example with Execution in External Flash using MSPI XIP Mode

Overview

This release of the Apollo3 SDK provides two new examples that can be used 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.

Assumptions

This release note assumes the following:

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

Procedure

1. Change directory to /boards/apollo3_eb/examples/mspi_prime.
2. Copy the mspi_prime.icf file then 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. We recommend at this time that .rodata be left in internal flash.

```

C:\AmbiqMicro\Apollo3-SDK-2018.02.02\boards\apollo3_eb\examples\mspi_prime\iar\bin\mspi_prime.map - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
mspi_prime.map
106 .text ro code 0x0000409c 0xa cexit.o [7]
107 .text ro code 0x000040a8 0x14 exit.o [8]
108 .text ro code 0x000040bc 0xc cstartup_M.o [7]
109 .text ro code 0x000040c8 0x8 startup_iar.o [1]
110 .rodata rodata 0x000040d0 0x4 am_hal_cachectrl.o [5]
111 .rodata rodata 0x000040d4 0x0 zero_init3.o [7]
112 .rodata rodata 0x000040d4 0x0 packbits_init_single.o [7]
113 Initializer bytes const 0x000040d4 0xc4 <for P3-1>
114 - 0x00004198 0x4098
115
116 "P1":
117 PRIME_CORE 0x04000000 0x64 <Block>
118 .text ro 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 inited 0x10001000 0x54 am_devices_fireball.o [1]
128 .data inited 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/ap
ollo3_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/ap
ollo3_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/ap
ollo3_eb/examples/mspi_prime/iar/bin
$ |

```

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

```

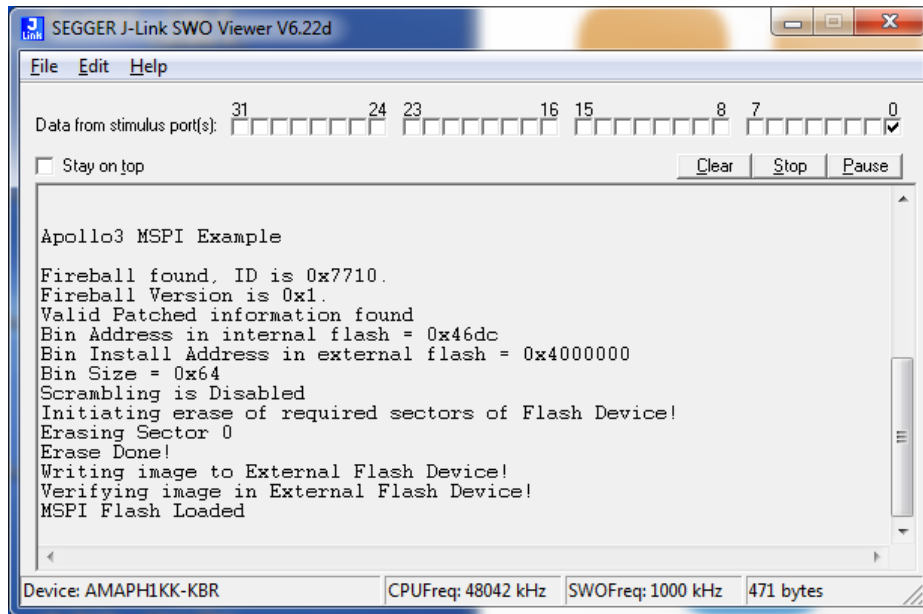
/cygdrive/c/Git/stable/boards/apollo3_eb/examples/mspi_flash_loader
dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/Git/stable/boards/apollo3_eb/examples/mspi_
flash_loader
$ ls
atollic_gcc          filelist.txt  mspi_flash_loader.bin  README.txt
config.ini          iar           mspi_loader_binary_combiner.py  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 ms
pi_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

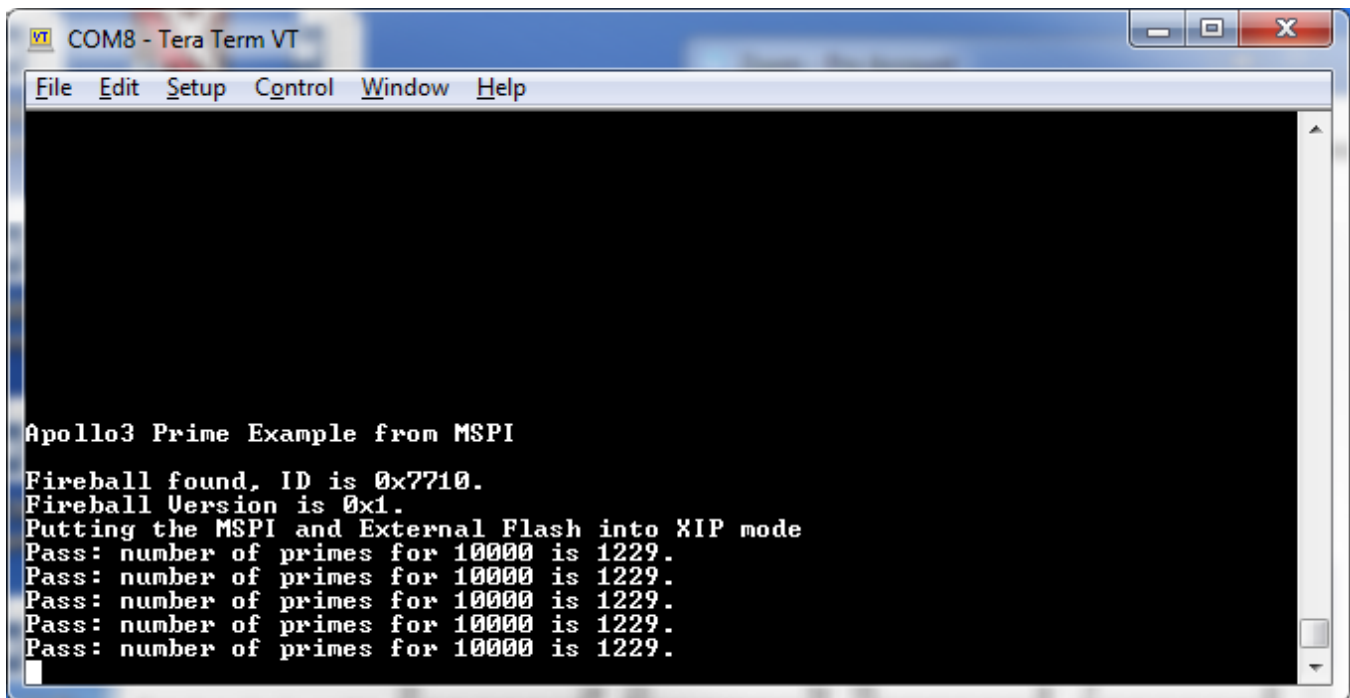
dmunsinger@AMBIQ-6NDM1G2 /cygdrive/c/Git/stable/boards/apollo3_eb/examples/mspi_
flash_loader
$

```

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



10. 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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