Getting Started with the MCU Flashloader
Chapter 1
Introduction

This document describes how to interface with the MCU flashloader to program a user application image into the on-chip flash. The MCU flashloader application is pre-programmed into the Kinetis flash during manufacturing and enables flash programming without a debugger.
Chapter 2
Overview

This document describes the steps required to program a user application image into MCU flash memory, utilizing the standardized MCU bootloader command interface. In the factory, the device boots from flash memory and loads the MCU flashloader into RAM. Running from RAM, the flashloader has access to the entire flash array for placement of the user application. After the user application is programmed into flash memory, the MCU flashloader is no longer available.

2.1 MCU flashloader

The MCU bootloader is a standard bootloader for all Kinetis devices. It provides a standard interface to the device using any of the peripherals supported by the bootloader on a given NXP Kinetis device.

The MCU flashloader is a specific implementation of the MCU bootloader. For the flashloader implementation, the MCU bootloader command interface is packaged as an executable that is loaded from flash and executed from RAM. This configuration allows the user application to be placed at the beginning of the on-chip flash where it is automatically launched upon boot from flash.

Other MCU bootloader implementations include a ROM-based bootloader and a flash-resident bootloader. The MCU bootloader is available as source code for custom, flash-based implementations. Example applications are provided to demonstrate how to interface with the bootloader.

Using the MCU flashloader to program a user application to the beginning of the Kinetis flash makes this implementation of the bootloader a one-time programming aid.

Developers creating a manufacturing flow for their hardware and software implementations may find it necessary to restore the MCU flashloader such that the device works as it did from the NXP factory. To accomplish this, use an external debugger to program the flashloader_loader.bin file included in this package to the Kinetis on-chip flash. The exact method for doing this varies depending on hardware design and available tools.

2.2 Host utilities

The blhost utility is a command-line host program used to interface with devices running the MCU bootloader. It can list and request execution of all of the commands supported by a given Kinetis device running the bootloader. The KinetisFlashTool is a GUI host application that can be used to program an application image.

NOTE
These applications are released as part of MCU bootloader release package available on mcuxpresso.nxp.com. They are available in the SDK bootloader folder: <sdk_package>/middleware/mcu-boot/bin/Tools.
Chapter 3  
MCU flashloader application

The NXP Kinetis platform must be connected to a host computer to interface with the MCU flashloader application. After the platform is connected, use the blhost or KinetisFlashTool application to program a user application into the Kinetis flash memory.

3.1 Connecting to the MCU platform

The MCU flashloader supports UART and USB connections to a computer. See the MCU Reference Manual for a specific device to determine the peripherals are supported by the flashloader application and the way the signals are routed to the pins of the MCU platform. After the MCU platform is powered up and there is a physical serial/USB connection between the Kinetis platform and host. The MCU device is ready to receive commands.

For this example, a MCU device is connected to a serial-to-USB converter that enumerates on a Windows® operating systems PC as a Serial Port on COMxx.

3.2 The host utility application - blhost

This section describes how blhost host utility program is used to communicate with the MCU bootloader.

- Open a command prompt in the directory containing blhost. For Windows OS, it is `<sdk_package>/middleware/mcu-boot/bin/blhost/win`.
- Type `blhost --help` to see the complete usage of the blhost utility.

Verify if the Kinetis device is connected and is running the flashloader firmware application.

- It is assumed that the Kinetis platform is fresh out of reset.
- Check under the COM port in Device Manager that the Kinetis platform is connected. In this example, the device is connected to COMxx.
- Type `blhost -p COMxx -- get-property 1` to get the flashloader version from the MCU flashloader.
- Below screen shot shows that blhost is successfully communicating with the Kinetis platform.
3.3 Flushing the user application

After communication has been established between the MCU flashloader and the host, it issue two commands to program the Kinetis flash memory with a user application.

- `blhost -p COMxx -- flash-erase-all` - Erases the entire flash array.
- `blhost -p COMxx -- write-memory 0 myApp.bin` - Writes the myApp.bin binary image to address 0 of the Kinetis flash memory.
- [Optional] `blhost -p COMxx -- reset` - Resets the Kinetis platform and launches the user application. Note the MCU flashloader is no longer running on the device, so further commands issued from the blhost utility fail.
- After issuing the reset command, allow 5 seconds for the user application to start running.
- Below screen shot shows the successful completion of the above commands.
3.4 The KinetisFlashTool application

The KinetisFlashTool application can also be used to program an application to the device. See the *Kinetis Flash Tool User’s Guide* (document MBOOTFLTOOLUG) for more information.
Chapter 4
User application: vector table offset

Chapter 3, MCU flashloader application discusses how to program the Kinetis flash memory with the \textit{myApp.bin} user application. When creating the user application, the vector table of the application must be located at the beginning address of the flash memory region.

When booting from flash, the Kinetis device considers offset 0, the initial stack pointer and offset 4, the entry point for the application.
Chapter 5
User application: Flash Configuration Area

The Flash Configuration Area (0x400-0x40F) must be populated with known values as per the specific Kinetis platform reference manual. In particular, values of the FSEC (0x40C) and FOPT (0x40D) locations may prevent future writes to the Kinetis flash. If user application code, other than the vector table, is linked to begin at offset 0x410, the default erased value (0xFF) of these locations makes the device secure. However, mass erase is enabled.
Chapter 6
Revision History

This table summarizes revisions to this document.

Table 1. Revision history

<table>
<thead>
<tr>
<th>Revision number</th>
<th>Date</th>
<th>Substantive changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12/2014</td>
<td>Initial release</td>
</tr>
<tr>
<td>1</td>
<td>07/2015</td>
<td>Kinetis Bootloader 1.2.0 updates</td>
</tr>
<tr>
<td>2</td>
<td>04/2016</td>
<td>Kinetis Bootloader 2.0 updates</td>
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<tr>
<td>3</td>
<td>05/2018</td>
<td>MCU Bootloader v2.5.0 release</td>
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