# AN11206

## Using SPIFI on LPC1800 and LPC4300

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### Document information

| Info | Content |
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| **Abstract** | This application note describes how to use the SPIFI interface to store data in a QSPI flash memory. It also demonstrates how to refresh an LCD display from a framebuffer in a QSPI flash memory. |

### Revision history

| Rev | Date | Description |
|---|---|---|
| 1 | 20120524 | Initial version. |

## Contact information

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# 1. Introduction

This application note describes how to use the SPI Flash Interface (SPIFI) on the LPC1800 and LPC4300 series Cortex-M3 and Cortex-M4-based microcontrollers. Using the SPIFI peripheral in combination with SPI Flash or QSPI Flash is a viable replacement for external NAND and NOR flash memory and can save board space. Ease-of-use is improved over NAND memory as serial flash maps directly into the processor's memory space data storage as well as allowing execute in place (XIP) and does not require use of a flash filesystem or wear leveling.

## 1.1 System setup

The software included with this application note was built with the Keil uVision IDE and runs on the LPC1850, LPC1857, LPC4350, or LPC4357 board from Hitex which includes a quad SPI flash. The part mounted on the Hitex board is a Spansion S25FL129P0XNFI01, which is a 128 Mb Quad-SPI flash memory. The SPIFI supported device list is in the LPC1800 and LPC4300 User's Manuals. An image will be displayed on an Embedded Artists 7" LCD board if one is connected. Note that for Q-SPI devices that are not natively supported by the BootROM, a 'safe mode' boot allows booting and a lower clock rate; after boot, the application can adjust the Q-SPI parameters (Clock rate, Single, Dual or Quad Mode etc) in software for the Q-SPI device.

Fig 1 is a photo of the Hitex board with the LPC1857 Cortex-M3 microcontroller and Spansion quad SPI flash.


**Fig 1. LPC1857 board from Hitex**

To connect the demo, a 5 V DC adapter is required to power the Hitex board and EA LCD. A Keil uLink-2 or uLink-Pro should be connected to the connector labeled “X18 JTAG” and plugged into the PC loaded with Keil uVision4 software.

# 2. SPIFI LCD demo firmware

The firmware presented in this application note gives a demo of how to set up and use the SPIFI peripheral to read data from an external QSPI flash memory.

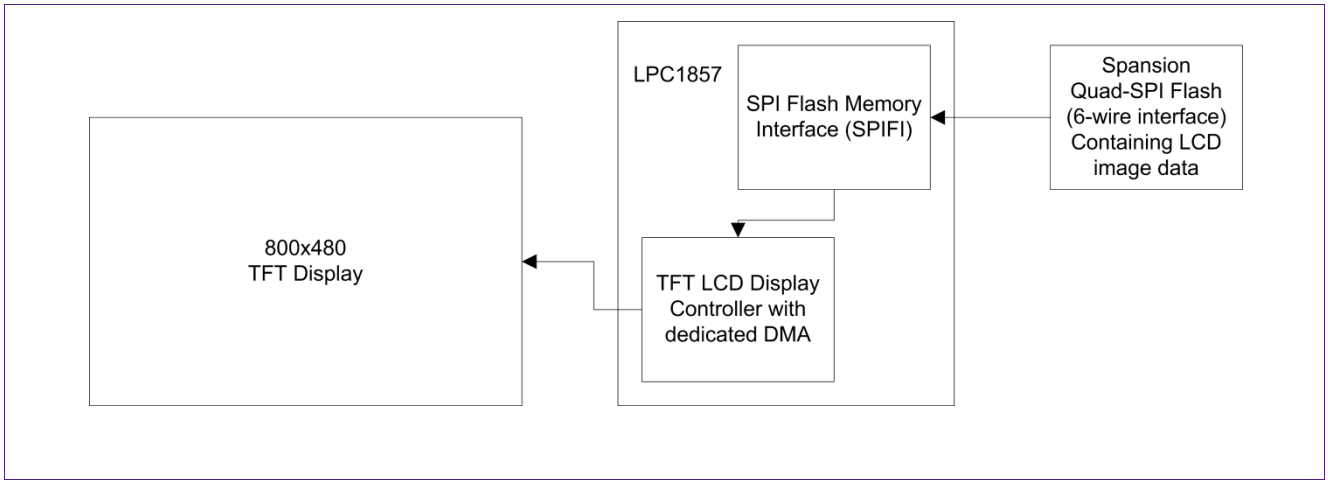
## 2.1 Firmware overview

There is one project included with this application note which has four configurations. The “Program Image to SPIFI” configuration must be built first. This builds ‘image_resources.c’ which contains the LCD image. The “Load” button in the Keil tool can then be used to program the image into the Q-SPI flash memory.

The other configurations, “Internal SRAM,” “Hitex Flash,” or “Internal Flash” are all “run” configurations which target different types of memory. This example uses an LPC1857 chip which contains internal flash, so the “Internal Flash” configuration is used. The same software can be used on the LPC1850 or LPC4350 (which do not contain internal flash) or the LPC4357, Cortex-M4 microcontroller compatible with the LPC1857. After building

the project again, click “Load” to program the internal flash memory with the SPIFI LCD Demo firmware.

The image in ‘image_resources.c’ is scaled to be 800 pixels wide with an 8-bit pixel depth. It is also upside-down to match the position of the EA display board when used with the Hitex board. The bandwidth used to refresh the TFT display is 800x480x1x60 or about 23 MB per second. This data is sourced from the QSPI flash in real time!




## 2.2 Expected output

After building the image configuration and programming SPIFI, and then building the run configuration and programming the board, select “Debug Project” in the Keil tool after completing the build steps then click “Run.” At this point, a rocket image will appear. The rocket image can be scrolled vertically via the ADC by turning R26 on the Hitex board.

## 2.3 Conclusion

The SPIFI peripheral on the LPC1800 and LPC4300 microcontrollers is not limited just to code execution in place, but has enough bandwidth to support a graphics raster display.

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