AN64408

Getting Started with NX2LP-Flex™

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Associated Project: No
Associated Part Family: CY7C68033 / CY7C68034
Software Version: NA
Related Application Notes: None

AN64408 presents the features and the resources available to speed EZ-USB® NX2LP-Flex™ based design from concept to production. The resources discussed in this application note are available through the Cypress website, www.cypress.com.

Introduction

EZ-USB NX2LP-Flex (CY7C68033/CY7C68034) is a firmware-based, programmable low-power USB 2.0 NAND flash controller. By integrating the USB 2.0 transceiver, serial interface engine (SIE), enhanced 8051 microcontroller, and a programmable peripheral interface in a single chip, Cypress has created a cost-effective solution that enables feature-rich NAND flash-based application.

Features

- Certified compliant for bus or self-powered USB 2.0 operation (TID# 40490118)
- Single-chip, integrated USB 2.0 transceiver and smart SIE
- Ultra-low power – 43 mA typical current draw in any mode
- Enhanced 8051 core
  - Firmware runs from internal RAM that is downloaded from NAND flash at startup
  - No external EEPROM required
- 15 Kbytes of on-chip code/data RAM
  - Default NAND firmware – 8 kB
  - Default free space – 7 kB
- Four programmable bulk/interrupt/isochronous endpoints
  - Buffering options: double, triple, and quad
- Additional programmable (bulk/interrupt) 64-byte endpoint
- SmartMedia standard hardware ECC generation with 1-bit correction and 2-bit detection
- General programmable interface (GPIF)
  - Enables direct connection to most parallel interfaces
  - Programmable waveform descriptors and configuration registers to define waveforms
  - Supports multiple ready (RDY) inputs and control (CTL) outputs
  - 12 fully programmable general-purpose I/O (GPIO) pins
  - Integrated, industry-standard enhanced 8051
    - 48-MHz, 24-MHz, or 12-MHz CPU operation
    - Four clocks for each instruction cycle
    - Three counter/timers
    - Expanded interrupt system
    - Two data pointers
  - 3.3-V operation with 5-V tolerant inputs
  - Vectored USB interrupts and GPIF/FIFO interrupts
  - Separate data buffers for the setup and data portions of a control transfer
  - Integrated I^2C controller runs at 100 or 400 kHz
  - Four integrated FIFOs
    - Integrated glue logic and FIFOs lower system cost
    - Automatic conversion to and from 16-bit buses
    - Master or slave operation
    - Uses external clock or asynchronous strobes
    - Easy interface to ASIC and DSP ICs
- Available in space saving 56-pin QFN package

CY7C68034-Only Silicon Features

- Ideal for battery-powered applications
  - Suspend current: 100 µA (typ)

CY7C68033-Only Silicon Features

- Ideal for non-battery-powered applications
  - Suspend current: 300 µA (typ)

NX2LP-Flex Development Kit (DVK)

The most valuable resource, an indispensable tool for development, is the CY3686 NX2LP-Flex Development Kit. It provides a platform to develop and test custom projects. It is also a valuable source of support collateral to help speed your design to market. The development kit software contains supporting collateral for the firmware, hardware, and software aspects of a project. The CY3686 Development Kit ships with the FX2LP-DVK and NX2LP-Flex boards. The FX2LP DVK has the NAND flash boot-loader stored inside the EEPROM, which emulates the NX2LP-Flex silicon using FX2LP silicon. The FX2LP-DVK is used as the debugging platform for the NX2LP-Flex silicon because the NX2LP-Flex chip does not support the serial interface required for debugging. After debugging is completed using the serial interface of the FX2LP, the NX2LP-Flex can be programmed with the final firmware.

Note: The resources that are available within NX2LP-Flex Development Kit are mentioned in different sections of this document. Downloading and unzipping the *CY3686_Kit_Contents_2.0.zip* available at CY3686 NX2LP-Flex Development Kit will create a number of directories as subfolders of the Cypress folder. Any directory mentioned henceforth in this document as part of the NX2LP-Flex DVK can be found within this Cypress folder.

Hardware Resources

When creating a USB 2.0 high-speed device, board layout and designs are critical to the success of the project. Oversights in the layout and design of the board can cause the device to fail enumeration and data transfer. It may also cause a board that appears to otherwise function properly in a particular environment to fail USB Compliance testing. To help developers avoid common errors, resulting in hours of debugging and possible costly board spins, Cypress has several resources available to help design a new board.

The hardware directory of the NX2LP-Flex DVK has the NX2LP-Flex development kit schematic. This schematic can be used as a reference as it shows connections from the NX2LP-Flex to other components such as NAND flash and the I^2C bus. Though no EEPROM is required by NX2LP-Flex, the I^2C bus provides flexibility to interface with other peripherals. Refer to the NX2LP-Flex datasheet present in the Docs directory of the NX2LP-Flex DVK for proper connection of the NX2LP-Flex pins, especially the RESERVED pin.

Apart from the documents that are present with the NX2LP-Flex DVK, there are other resources that deal with USB 2.0 high-speed board layout and design, which is common reference for all our high-speed family of products. Application notes are additional resources available to assist in new designs:

- Guide to a Successful EZ-USB FX2LP Hardware Design: This application note discusses hardware design guidelines and PCB layout recommendations for any HS USB device, focusing on Cypress' EZ-USB FX2LP device. It also provides requirements for the associated crystal and the use of a resonator in designing with Cypress USB parts.
- Measuring USB Signal Quality: This application note outlines problems in measuring signal quality of the USB. It helps the designer to isolate setup issues from design issues.

Firmware Resources

The CY3686FW directory of the NX2LP-Flex DVK contains the NX2LP-Flex USB to NAND flash firmware. This firmware is documented in NX2LP-Flex USB to NAND Flash Firmware Design Notes application note. This application note describes the firmware developed by Cypress for NX2LP-Flex. The application note, Bad Block Management for NAND Flash using NX2LP explains the bad block management for NAND devices in NX2LP as well as NXLP-Flex. Bad block management is done by the firmware in NX2LP-Flex; therefore, no management is required by the host.

Software Resources

The NX2LP-Flex chip boots from the firmware, which is programmed into the NAND flash in the form of *.nx2* file. Cypress provides the necessary software tools required to program the NAND flash with the firmware and to build the firmware configuration *.nx2* file. The various software tools are:

- **NX2LP NAND Programming Utility (*NandMfg.exe*)**: The *NandMfg.exe* is the program that supports the programming the NAND attached to NX2LP-Flex with the appropriate NX2 firmware image. This utility is available within the MfgTool directory of the NX2LP-Flex DVK. This utility can be used to program previously unprogrammed or blank NAND flash devices as well as to reprogram NAND flash devices that are already configured and enumerated as windows mass storage class devices. The application is USB Plug and Play aware, meaning that it automatically detects the presence of a usable NX2LP-Flex device on the USB bus. Simply connect the NX2LP-Flex device to the PC's USB bus and run the NX2LP NAND Programming Utility. The status bar at the bottom of the application window displays the identified device. The current selections for all parameter fields are stored each time the program closes. These are then restored each time the program runs. More details about this utility is available in the *NandMfg.exe* in **Help** > **User's Guide**.
- ***BldNx2.exe***: The *BldNx2.exe* program utility is used to build the firmware configuration *.nx2* file. This file is used to program the NAND flash by the *NandMfg.exe*. This utility is available in the Bin directory of the NX2LP-Flex DVK. More details about this utility are available in the Building Configuration nx2 File section of NX2LP-Flex™ USB to NAND Flash Firmware Design Notes.

Reference Designs

The Cypress website contains many Cypress created and third party reference designs that offer a fast path to production. These reference designs serve as a ready resource that allows developers to bypass much of the design cycle. Typically included in the reference designs are production ready source code, reference schematics, and a Bill of Materials, where appropriate for the design.

The reference designs that are available on our website are:

- **CY4618 EZ-USB NX2LP Reference Design Kit:** The CY4618 EZ-USB NX2LP Reference Design Kit (RDK) is a ready-for-production design example for either dual- or single-device NAND flash drives. This design has been optimized for Toshiba, Samsung, Hynix, Micron, and other standard NAND flash vendors with a 512 or 2 KB paging architecture and an 8-bit NAND flash data path. Additionally, this RDK supports write-protect and drive activity LED support. NX2LP-Flex loaded with a default firmware provided will function in the same way as NX2LP.
- **CY4665 - Cypress & UPEK Reference Design for USB Flash Drives (UFD)**: The CY4665 "Flisk" reference design from Cypress and UPEK provides customers with a turnkey solution for USB flash drives (UFD) with fingerprint authentication security for conveniently protecting data and enabling authentication services. The reference design uses UPEK's TouchStrip fingerprint authentication solution (TCS3 swipe fingerprint sensor and TCD42 security ASIC), the only match-on-chip fingerprint authentication solution available on the market. Cypress' EZ-USB(R) NX2LP-Flex programmable NAND flash controller, the only 8051 based programmable NAND controller on the market, interfaces with both the UPEK TCD42 security ASIC and the NAND flash to provide a secure link to both the PC and the flash.

Application Notes and Example Projects

The Cypress website contains many application notes, which aim at implementation of a specific application and contain all information regarding it. Most of them make use of the CY3686 NX2LP-Flex DVK board for the implementation. These documents serve as references to answer many queries during development using NX2LP/NX2LP-Flex. The documents that are available on our website are:

- **Interfacing Cypress CY3686 DVK to NAND Flash Memory with Four Chip Selects:** This application note considers these chips as examples to understand the interface between the CY3686 development kit (DVK) and NAND flash devices with four chip select requirement. The Samsung K9NCG08U5M (64-Gbit) and K9WBG08U5M (32-Gbit) are NAND flash memory devices used in this application.
- **Mass Storage plus Keyboard Using NX2LP-Flex:** NX2LP-Flex by default has a single mass storage interface. This project demonstrates the use of an alternate human interface device (HID) interface, which is configured to act as a four button keyboard alongside the mass storage interface. In this example project, the flexibility of NX2LP-Flex is leveraged to add a four-button keyboard interface using the I^2C master in NX2LP-Flex to the existing mass storage interface.
- **NX2LP Compatibility List**: This document contains the list of NAND flash devices from various vendors that has been tested and found to be compatible with NX2LP-Flex. The list contains NAND flash devices from various vendors such as Hynix, Samsung, Toshiba, and Micron. If the NAND flash device chosen to interface with NX2LP-Flex is not within this list, then the NAND flash must be tested according to the procedure chalked out in the *USB Mass Storage Test Guide.pdf.* This document available within the Docs directory of the NX2LP-Flex DVK.

Getting Started With DVK

The CY3686 EZ-USB NX2LP-Flex DVK allows evaluating and developing NAND flash USB mass storage applications using the Cypress Semiconductor EZ-USB NX2LP-Flex controller chip (CY7C68033/CY7C68034). This kit allows you to integrate your application with NAND flash solutions. The instructions on how to get started with the DVK, and its various features are described in the CY3686 EZ-USB NX2LP-Flex Development Kit Guide. This document can be used as a guide when using the DVK for the first time.

Support

Cypress provides world class technical support for the NX2LP-Flex. The web-based support system provides a readily available history of your technical support answers for quick reference as your design progresses.

The Support section, apart from application notes and example projects includes knowledge base articles that answer frequently asked questions and a customer discussion board to interact with other developers using the NX2LP-Flex.

Summary

The NX2LP-Flex is an outstanding choice to meet your USB 2.0 flexible NAND flash solution requirements. To help with each step of design cycle, Cypress has put together a formidable catalogue of support collateral. We look forward to assisting you in realizing your NX2LP-Flex project from concept to production.

Document History

Document Title: Getting Started with NX2LP-Flex™ - AN64408

Document Number: 001-64408

Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	3042176	CPPK	09/30/2010	New Application Note
*A	3354289	AASI	08/25/2011	Minor updates to remove statements on NX2LP.
*B	4519593	GAYA	09/30/2014	Updated to new template. Completing Sunset Review.
*C	5824659	AESATP12	07/19/2017	Updated logo and copyright.
*D	6249032	HENA	07/17/2018	Modified the ‘Hardware Resources’ section

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