

Actel SmartFusion™ MSS eNVM Driver User's Guide

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Introduction

The SmartFusion™ microcontroller subsystem (MSS) includes nonvolatile memory (NVM). This driver provides a set of functions for controlling the MSS NVM as part of a bare metal system where no operating system is available. This driver can be adapted for use as part of an operating system, but the implementation of the adaptation layer between this driver and the operating system's driver model is outside the scope of this driver.

Features

The MSS NVM driver provides the ability to program the content of the SmartFusion NVM.

The MSS NVM driver is provided as C source code.

Supported Hardware IP

The MSS NVM bare metal driver can be used with Actel's MSS_NVM IP version 0.1 or higher, included in the SmartFusion MSS.

Files Provided

The files provided as part of the MSS NVM driver fall into three main categories: documentation, driver source code, and example projects. The driver is distributed via the Actel Firmware Catalog, which provides access to the documentation for the driver, generates the driver's source files into an application project, and generates example projects that illustrate how to use the driver. The Actel Firmware Catalog is available from the Actel website: www.actel.com/products/software/firmwarecat/default.aspx.

Documentation

The Actel Firmware Catalog provides access to these documents for the driver:

- User's guide (this document)
- A copy of the license agreement for the driver source code
- Release notes

Driver Source Code

The Actel Firmware Catalog generates the driver's source code into the *drivers\mss_nvm* subdirectory of the selected software project directory. The files making up the driver are detailed below.

mss_nvm.h

This header file contains the public application programming interface (API) of the MSS NVM software driver. This file should be included in any C source file that uses the MSS NVM software driver.

mss_nvm.c

This C source file contains the implementation of the MSS NVM software driver.

Example Code

The Actel Firmware Catalog provides access to example projects illustrating the use of the driver. Each example project is self-contained and is targeted at a specific processor and software toolchain combination. The example projects are targeted at the FPGA designs in the hardware development tutorials supplied with Actel's development boards. The tutorial designs can be found on the [Actel Development Kit](http://www.actel.com/products/hardware) web page (www.actel.com/products/hardware).

Driver Deployment

This driver is intended to be deployed from the Actel Firmware Catalog into a software project by generating the driver's source files into the project directory. The driver uses the SmartFusion Cortex Microcontroller Software Interface Standard – Peripheral Access Layer (CMSIS-PAL) to access MSS hardware registers. You must ensure that the SmartFusion CMSIS-PAL is either included in the software toolchain used to build your project or is included in your project. The most up-to-date SmartFusion CMSIS-PAL files can be obtained using the Actel Firmware Catalog. The following example shows the intended directory structure for a SoftConsole ARM® Cortex™-M3 project targeted at the SmartFusion MSS. This project uses the MSS NVM and MSS Watchdog drivers. Both of these drivers rely on the SmartFusion CMSIS-PAL for accessing the hardware. The contents of the *drivers* directory result from generating the source files for each driver into the project. The contents of the *CMSIS* directory result from generating the source files for the SmartFusion CMSIS-PAL into the project.



Figure 1 · SmartFusion MSS Project Example

Driver Configuration

The SmartFusion MSS NVM driver does not require any configuration.

Application Programming Interface

This section describes the driver's API. The functions and related data structures described in this section are used by the application programmer to program the MSS NVM from the user's application.

Theory of Operation

The MSS NVM software driver is designed to provide write access from the application code to the SmartFusion nonvolatile memory (NVM). The *NVM_write()* function uses a set of commands understood by the MSS NVM hardware block to set the NVM into write mode. It then writes the requested data into the NVM before setting the NVM back into read mode.

Types

nvm_status_t

Prototype

```
typedef enum {  
    NVM_SUCCESS = 0,  
    NVM_PROTECTION_ERROR,  
    NVM_WRITE_ERROR,  
    NVM_INVALID_ADDRESS  
} nvm_status_t;
```

Description

Possible return values from function *NVM_write()*.

Return Values	Description
NVM_SUCCESS	The SmartFusion NVM was written successfully.
NVM_PROTECTION_ERROR	A protection error occurred while attempting to write into the SmartFusion NVM.
NVM_WRITE_ERROR	A write error occurred while attempting to write into the SmartFusion NVM.
NVM_INVALID_ADDRESS	The requested write address range is not completely within the SmartFusion NVM address range.

Table 1 • NVM_write() Return Values

Constant Values

There are no MSS NVM driver-specific constant values.

Data Structures

There are no MSS NVM driver-specific data structures.

Functions

NVM_write

Prototype

```
nvm_status_t NVM_write
(
    uint32_t start_addr,
    const uint8_t * p_data,
    size_t nb_bytes
);
```

Description

This function writes the content of the buffer passed as the *p_data* parameter to the SmartFusion NVM. The data is written from the memory location specified by the *start_addr* parameter. This address is the absolute address in the processor's memory space at which the NVM is located.

Parameters

start_addr

This is the address at which data will be written. This address is the absolute address in the processor's memory space at which the NVM is located.

p_data

This is a pointer to the buffer holding the data to be written into NVM.

nb_bytes

This is the number of bytes to be written into NVM.

Return Value

The return value indicates whether the write was successful. Possible values are as follows:

- NVM_SUCCESS
- NVM_PROTECTION_ERROR
- NVM_WRITE_ERROR
- NVM_INVALID_ADDRESS

Product Support

Actel backs its products with various support services including Customer Service, a Customer Technical Support Center, a web site, an FTP site, electronic mail, and worldwide sales offices. This appendix contains information about contacting Actel and using these support services.

Customer Service

Contact Customer Service for non-technical product support, such as product pricing, product upgrades, update information, order status, and authorization.

From Northeast and North Central U.S.A., call **650.318.4480**

From Southeast and Southwest U.S.A., call **650.318.4480**

From South Central U.S.A., call **650.318.4434**

From Northwest U.S.A., call **650.318.4434**

From Canada, call **650.318.4480**

From Europe, call **650.318.4252** or **+44 (0) 1276 401 500**

From Japan, call **650.318.4743**

From the rest of the world, call **650.318.4743**

Fax, from anywhere in the world **650.318.8044**

Actel Customer Technical Support Center

Actel staffs its Customer Technical Support Center with highly skilled engineers who can help answer your hardware, software, and design questions. The Customer Technical Support Center spends a great deal of time creating application notes and answers to FAQs. So, before you contact us, please visit our online resources. It is very likely we have already answered your questions.

Actel Technical Support

Visit the [Actel Customer Support website](http://www.actel.com/support/search/default.aspx) (<http://www.actel.com/support/search/default.aspx>) for more information and support. Many answers available on the searchable web resource include diagrams, illustrations, and links to other resources on the Actel web site.

Website

You can browse a variety of technical and non-technical information on Actel's [home page](http://www.actel.com/), at <http://www.actel.com/>.

Contacting the Customer Technical Support Center

Highly skilled engineers staff the Technical Support Center from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. Several ways of contacting the Center follow:

Email

You can communicate your technical questions to our email address and receive answers back by email, fax, or phone. Also, if you have design problems, you can email your design files to receive assistance. We constantly monitor the email account throughout the day. When sending your request to us, please be sure to include your full name, company name, and your contact information for efficient processing of your request.

The technical support email address is tech@actel.com.

Phone

Our Technical Support Center answers all calls. The center retrieves information, such as your name, company name, phone number and your question, and then issues a case number. The Center then forwards the information to a queue where the first available application engineer receives the data and returns your call. The phone hours are from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. The Technical Support numbers are:

650.318.4460
800.262.1060

Customers needing assistance outside the US time zones can either contact technical support via email (tech@actel.com) or contact a local sales office. [Sales office listings](#) can be found at www.actel.com/company/contact/default.aspx.



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