NEXFLASH® Technologies, Inc.

PRELIMINARY
APRIL 1999

Application Note SFAN-02.1

Serial Flash Device Information Sector

INTRODUCTION

This application note describes the *NexFlash* Device Information Sector (DIS). The information contained in the DIS is useful in developing software and firmware for *NexFlash's* NX25xxx and NX26xxx family of Serial Flash Memories and removable Serial Flash Modules. This document is to be used in conjunction with the corresponding NX25Fxxx and NX26Fxxx data sheet for each device.

THE DEVICE INFORMATION SECTOR

The Device Information Sector (DIS) is a "read-only" sector located outside of the main array of all NX25Fxxx and all NX26Fxxx series Serial Flash Memories with the exception of the original NX26F080 (non-A). The DIS in the original NX26F080 is stored in the last two sectors of the main array. For compatibility purposes copies of the DIS are maintained in these two locations for all 8M-bit and 16M-bit devices. The sector size of the DIS is either 536 or 264 bytes depending upon the sector size of the device that is used. The DIS is factory programmed and can not be changed in the field. A block diagram showing the DIS and the main array is shown in Figure 1.

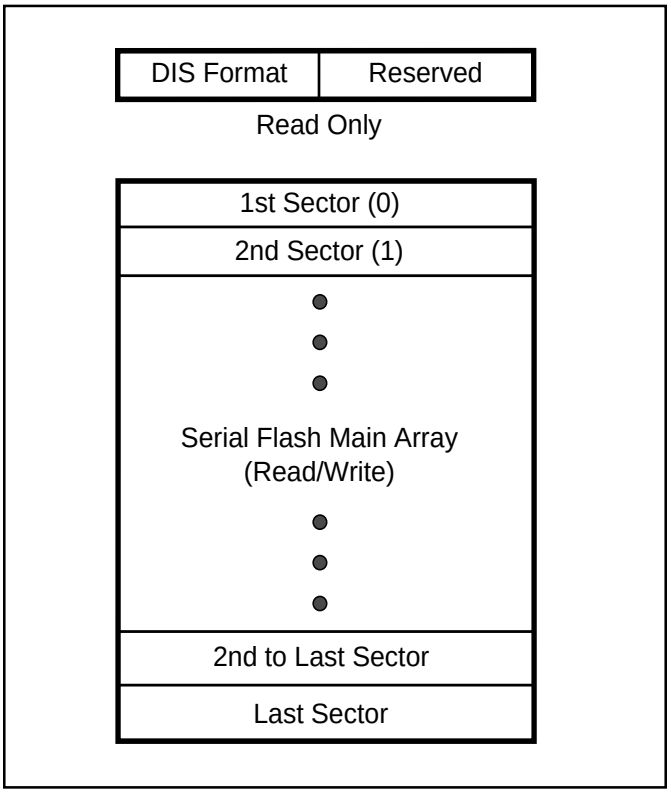

Figure 1. Device Information Sector (DIS) and Main Array

The information stored in the DIS allows for device type identification as well as locating any restricted sectors, if a restricted sector (-R) device is used. The DIS is especially important for applications that use removable Serial Flash Modules (SFMs). When a new SFM is inserted into the socket the systems firmware can read the DIS to identify the part type to determine such factors as capacity, which may vary from 1M-bit (128KB) to 32M-bit (4MB). It also provides access to other important characteristics such as voltage and test grade.

Customer ID and Serial ID (Special Option)
The DIS can also store customer ID and serial ID number to provide a unique customer and device identification for applications that must verify media authenticity. This is especially useful in removable media applications where copy protection is of concern or data encryption techniques are used. Like the rest of the DIS, the customer and serial ID fields are read-only and cannot be altered after the manufacturing process.

Devices with customer and serial ID fields must be specially ordered. Additional processing charges and minimum quantity requirements may apply. Contact NexFlash for further information.

ACCESSING THE DEVICE INFORMATION SECTOR

SPI NX25Fxxx Serial Flash

The DIS of all SPI NX25Fxxx series devices can be accessed via the *Read Device Information Sector* command (15H). Please refer to the NX25Fxxx data sheet command set for more information.

NXS NX26Fxxx Serial Flash

The DIS of all NX26Fxxx series devices except the original NX26F080 (non-A) device can be accessed via address 5000H. This read-only location is outside of the devices main memory array. If compatibility with the original NX26F080 (non-A) is needed contact the *NexFlash* Serial Flash applications department for further information. Please refer to the NX26Fxxx data sheet for more information on accessing the DIS.

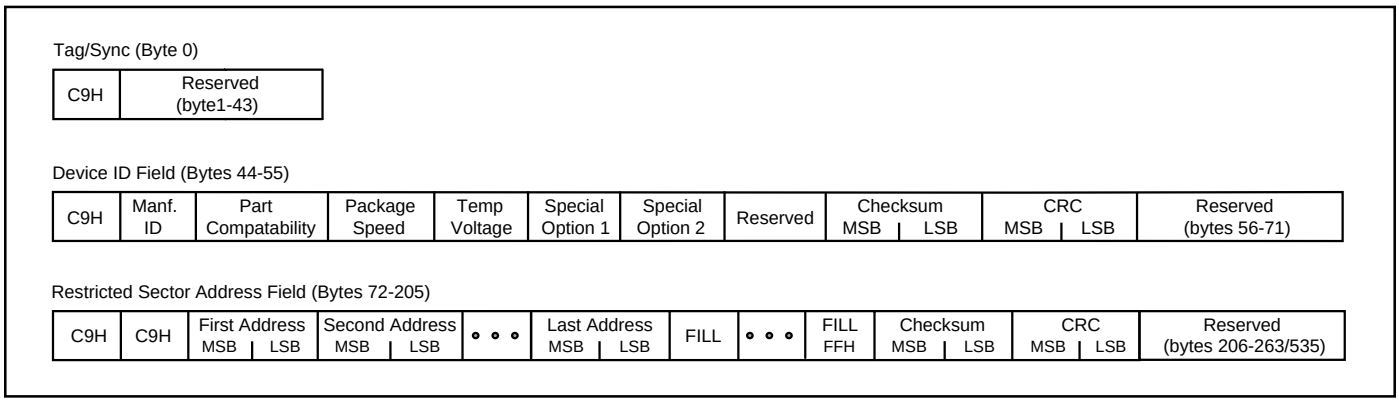

Figure 2. Device Information Sector (DIS) Format

DEVICE INFORMATION SECTOR FORMAT

The DIS includes two primary user fields: the Device Identification Field and Restricted Sector Address Field. Additionally there are several areas within the DIS that are reserved for future use. Tag/Sync bytes, Checksums and Cyclic Redundancy Code (CRC) values are provided in certain locations in the DIS information to verify that correct data is read. A block diagram of the DIS format is shown in Figure 2. The information contained in the DIS fields is described in the following sections.

SYNC: (Byte 0)
The first byte of the DIS is the Sync byte. Similar to the Tag/Sync bytes of the main array this location has a value of “C9H”. The Sync byte can be used as a sync-detect to verify that the instruction sequence is clocked into the device properly and proper data is being read. Sync values of C9H are used in other locations of the DIS as well.

DEVICE IDENTIFICATION FIELD (BYTES 44-55)

The device information includes a detailed device identification field that is useful for confirming that the correct device is being used in a given application. The field is 12-bytes long and starts at byte offset 44. The first byte of the field contains a C9H sync byte. It is then followed by seven bytes of information that identify the device type being accessed including part number, voltage, test grade, etc., (see ordering information section of the corresponding NX25Fxxx or NX26Fxxx data sheet). The device ID field includes the following locations:

- Sync
- Manufacturer ID
- Part Compatibility ID
- Package / Speed
- Voltage / Test Grade
- Special Option 1
- Special Option 2
- Reserved
- 16-bit Checksum
- 16-bit CRC

The device information is encapsulated with both checksum and CRC calculations to provide a simple yet effective method of confirming that data is read correctly. Using the checksum, or the more reliable CRC, can be helpful for those applications that must maintain higher levels of data integrity. The 16-bit checksum location stores a checksum of the previous eight bytes. The 16-bit CRC location stores the CRC calculation of the previous ten bytes. The checksum and CRC calculation methods used are described later in this document.

DEVICE ID FIELD VALUES

Manufactures Identification (Byte 45)

Value (Hex)	Manufacturer Name
EF	*NexFlash Technologies, Inc.*

Part Compatibility ID (Byte 46)

Value (Hex)	Capacity	Interface	Sector Size	Part No.
01	8M-bit	NXS	536	NX26F080
02	8M-bit	NXS	536	NX26F080A
03*				
04*				
05	8M-bit	SPI	536	NX25F080A
06	16M-bit	NXS	536	NX26F160
07*				
08	1M-bit	SPI	264	NX25F011A
09	2M-bit	SPI	264	NX25F021A
0A	4M-bit	SPI	264	NX25F041A
0B	1M-bit	NXS	264	NX26F011A
0C	2M-bit	NXS	264	NX26F021A
0D	4M-bit	NXS	264	NX26F041A

Note: * Reserved

Device Speed and Package Type (Byte 47)

Upper Nibble (Hex)	Lower Nibble (Hex)	Description
*	0	8 MHz
*	1	16 MHz
*	2	20 MHz
0	*	24/28 TSOP (Type-II), Code T
1	*	Reserved
2	*	SOIC, Code S
3	*	28 TSOP (Type-I), Code V
4	*	Die Assembly, Code X

Note: * Not Applicable

Test Grade and Supply Voltage (Byte 48)

Upper Nibble (Hex)	Lower Nibble (Hex)	Description
0	*	Commercial Temp Range
1	*	Extended Temp Range
2	*	Industrial Temp Range
A	*	Alternate Commercial Range
*	3	3.0 Volts
*	5	5.0 Volts

Note: *Not Applicable

Special Option 1 (Byte 49)

Value (Hex)	Special Option
0	Standard, No Special Option
1 or 2	(-R) Restricted Sectors
10	(-E) 100K Erase/Write Cycles
80-FF	(SPA) Custom Specification

Special Option 2 (Byte 50)

Value (Hex)	Special Option
0	Standard, No Special Option
1 or 2	(-R) Restricted Sectors
10	(-E) 100K Erase/Write Cycles
80-FF	(SPA) Custom Specification

RESTRICTED SECTOR FIELD (BYTES 72-205)

Restricted sector devices (-R special option) provide a more cost-effective alternative to devices with non-restricted sectors (devices with 100% valid sectors). The restricted sector devices have a limited number of non-usable sectors that do not meet manufacturing programming criteria over the specified operating range (typically single bit failures). *NexFlash* specifies Serial Flash devices with 264-byte sectors (2xF011A, 2xF021A, and 2xF041A) to have 32 or fewer restricted sectors and devices with 536-byte sectors (2xF080A and 2xF160) to have 64 or fewer restricted sectors.

The restricted sector list in the DIS provides the address of each restricted sector. The list can be used by the system firmware and software for creating an exception table, link-list or file allocation table (FAT) that will prevent the use of restricted sectors. The list is also used by the reformatting software provided in the Serial Flash Development Kit (SFK) to "Tag" each sector in the main memory array as a valid or a restricted sector.

The Tag/Sync byte is the first byte of each sector in the memory array of each sector. Tag/Sync bytes serve two main purposes. First, they provide a sync-detect that can help verify if the instruction sequence was clocked into the device properly. Secondly, it serves as a tag to identify a fully functional (valid) sector. This is especially important if restricted sector (-R) devices are used. During manufacturing tests, the Tag/Sync bytes of all valid sectors are set to C9H. Non-valid sectors are tagged with a pattern other than C9H. (see Restricted Sector field for more information). Although the Tag/Sync byte of the sector can be changed, it is recommended that it be maintained as a permanent part of the sector formatting. This means that the byte must be rewritten to the same value during each write instruction sequence.

RESTRICTED SECTOR LIST FORMAT

The restricted sector list contains up to 64 address locations. The list starts at byte offset 72 and continues until location 205 (Figure 2). The list starts with two C9H Sync bytes, followed by the first 16-bit restricted sector address (MSB first). The list is ordered from lowest to highest sector address. If the device has no restricted sectors, each address MSB and LSB will be filled with FFH. Once all restricted sectors have been listed, the remaining address locations will be filled with FFH.

The restricted sector list is encapsulated with both checksum and CRC calculations to provide a simple and effective method of confirming that the list was read correctly. Using the checksum or CRC can be helpful for those applications that must maintain higher levels of data integrity. The 16-bit checksum location stores a checksum of the entire list including the two initial Sync bytes. The checksum algorithms used start with a 16-bit seed value of (MSB=54H) (LSB=4EH). The seed value allows the checksum to screen for an all-zero condition. The 16-bit CRC location stores the CRC calculation of the entire list including the two initial Sync bytes and the checksum value. The CRC algorithm used is based on the industry standard CCITT polynomial of x16 + x12 + x5 + x0.

WORKING WITH RESTRICTED SECTORS

The restricted sector list in the DIS can be used by the system firmware and software for creating an exception table, link-list or FAT that will prevent the use of restricted sectors. Some systems may be capable of using the list directly as a look-up table for this purpose. However, for those systems that may not have the resources to handle such schemes there are basic techniques that can be used for working with restricted sectors and sector Tag/Sync bytes. Once such method is listed below:

1. Read the Sector Tag/Sync byte for a given sector and confirm that it is a valid C9H value.

2. If C9H is not found it is a restricted. Terminate the Read instruction and start a new read instruction for the next sequential address, verify the sector to be valid and proceed with the read or write instruction.

This simple scheme may require that data spanning over several sectors can account for the possible number of restricted sectors that may occur.

Software is available for reading and writing files to and from Serial Flash Memories and Modules with and without restricted sectors. Contact NexFlash marketing and application department for further information.

NEXFLASH® Technologies, Inc.

3114 Scott Blvd • Santa Clara, CA 95054
Phone: 408-969-4700 • Fax: 408-588-0819
sales@nexflash.com • www.nexflash.com