Second Sources For The NM29N16 NAND Flash

National Semiconductor
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Robert Frizzell
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INTRODUCTION

The NM29N16 is a 16Mb NAND Flash device which is second sourced by other manufacturers. This provides customers the added confidence of knowing that they will have an adequate supply of competively priced product which is not available from competing NOR Flash solutions. This application note provides details of the other suppliers and a few minor differences between the products which must be taken into account when designing with NAND Flash.

NAND FLASH SUPPLIERS

There are three suppliers of NAND Flash including National Semiconductor. The other two suppliers are Toshiba and Samsung. Table I lists the suppliers and their respective part numbers.

TABLE I. 16Mb NAND Flash Suppliers

	Part Number	
	Standard Lead	**Reverse Lead**
National	NM29N16S	NM29N16R
Samsung	KM29N16000TS	KM29N16000RS
Toshiba	TC5816FT	—

All of the devices listed in Table I come in a 40/44 pin TSOP II package and are pin-for-pin compatible with each other.

OPERATIONAL DIFFERENCES

National's NM29N16 is 100% compatible with Toshiba's TC5816. There are six operational differences between the NM29N16 NAND Flash supplied by National and Samsung's KM29N16000. These differences are minor and only affect how software should interface to the devices. These differences are explained in detail below and summarized in Table II.

Random Page Programming

In National's NM29N16, pages within a block must be programmed from the low address page (00H) to the high address page (0FH). In Samsung's KM29N16000, pages may be programmed randomly within the block.

Partial Page Programming

Programming a page in National's NM29N16 requires that an entire page (264 bytes) be programmed at a time. When less than 264 bytes of data need to be programmed, the remaining bytes are set to ''1'' and then the programming commences. In this way, further data can be added to the page in the region that has been ''masked'' off. The maximum times a page may be programmed between erase operations is 10 times. Samsung's KM29N16000 allows programming of pages less than 264 bytes without padding the page with 1's. It is unclear if the page may be programmed more than once between erase operations as in the NM29N16.

Spare Array Programming

When programming data into the redundant area of a page (bytes 256–263) the NM29N16 requires a Reset command (FFH) prior to setting the pointer to the redundant area (50H). This is then followed by the Data Input command (80H). In the KM29N16000 it is not necessary to Reset (FFH) before setting the data register pointer to the redundant area (50H).

Default Mode After Erase

The NM29N16 defaults to Read Mode 1 (00H) after an erase operation. In this way, the device can be read after an erase operation without issuing a Read Mode 1 command. For safety, it is suggested that a Read command be issued prior to any read operation. The KM29N16000 requires that a Read command be issued after an erase operation if a page read is to be executed.

Pointer After Reset And Redundancy Read

After reading the redundant area of a page (bytes 256–263) and issuing a Reset command (FFH), the data register on the NM29N16 points to the main data region (bytes 0–255). In Samsung's KM29N16000 the pointer will continue pointing to the redundant area (bytes 256–263).

$\overline{CE}$ Status During Read

In the NM29N16, after a page has been transferred to the data register (after t_R), $\overline{CE}$ may be high or low when $\overline{RE}$ is high. In the KM29N16000, $\overline{CE}$ must remain low after t_R regardless of the status of $\overline{RE}$.

MANUFACTURER DEVICE ID

Devices from the three different manufacturers can be distinguished by reading the manufacturers ID. This is a code which is read out using the ID Read command, 90H. The manufacturer's ID are listed in Table III. All devices carry a device ID of 64H.

TABLE II. Operational Differences Summary

	National Toshiba	**Samsung**
Random Page Programming	Program From Low Address Page to High Address Page	Random Page Programming Allowed
Partial Page Programming	Pad Page With ''1''	No Padding Required
Spare Array Programming	Reset Prior To Programming	No Reset Required
Default Mode After Erase	Read Mode 1	Unclear
Pointer After Redundancy Read	Points To Main Data Register	Points To Redundant Area
$\overline{CE}$ Status During Read	Don't Care For $\overline{RE}$ High	Must Remain Low

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TABLE III. Manufacturer ID

	ID
National	8FH
Samsung	ECH
Toshiba	98H

CONCLUSIONS

While NOR Flash suppliers have each developed their own variations of high density Flash, only NAND Flash offers customers pin compatible devices from three different vendors. Customers can rest assured that they will have ample supply at competitive prices when designing with NAND Flash.

National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408