# Technical Note

## N25Q and MT25Q Serial Flash Stacked Devices

## Introduction

This technical note describes the features of stacked devices for N25Q and MT25Q. These devices are memory with two or more die in the same package. The following topics are discussed in this technical note:

- Single die operation
- Common operations for all devices

The table below summarizes the stacked devices that are in production:

**Table 1: Stack Summary Table**

| Micron Part Number | Maximum Monolithic Density | Density | Number of Stacks |
|---|---|---|---|
| N25Q512Axxx | 256Mb | 512Mb | 2 |
| N25Q00AAxxx | | 1Gb | 4 |
| MT25Qxs01Gxxx | 512Mb | 1Gb | 2 |
| MT25Qxs02Gxxx | | 2Gb | 4 |

# Single Die Operations

Single die operations modify the status of a single die. An address must be set in the function of a selected die in the following commands:

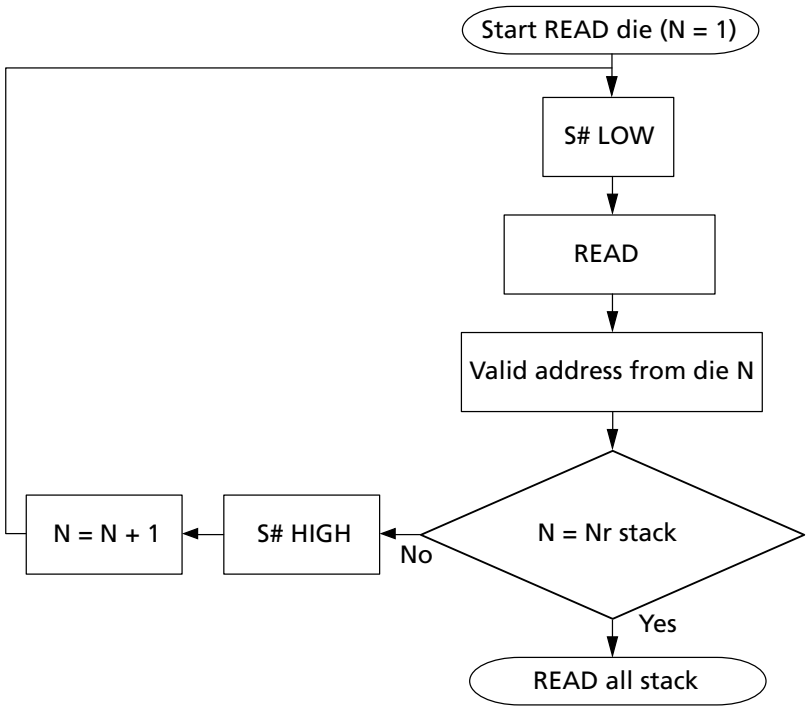
- READ MEMORY (3 or 4 byte address mode. Single, dual, and quad I/O): The READ MEMORY process for all stacked device memory is different for the N25Q and MT25Q. The device flow for the N25Q and the MT25Q are shown in the figures below.
- PROGRAM/ERASE MEMORY
- DIE ERASE

## N25Q READ MEMORY

For READ MEMORY, the device outputs data from the selected address die after the die boundary device starts reading from the beginning of the same address die. Therefore, the command must be given several times and must address the appropriate number of devices in the stack to read all of the memory.

The figure below shows how to read all the stacked devices, starting from the first die.

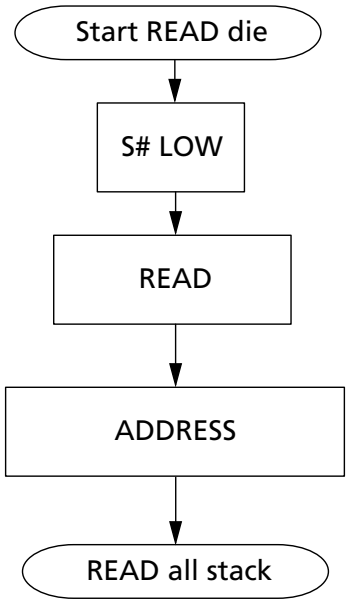
**Figure 1: N25Q Stacked Device Flow**



## MT25Q READ MEMORY

For READ MEMORY, the addressed byte can be at any location, and the address automatically increments to the next address after each byte of data is shifted out; therefore, the entire memory can be read with a single command. The operation is terminated by driving S# HIGH at any time during data output

**Figure 2: MT25Q Stacked Device Flow**




## PROGRAM/ERASE

To determine if the PROGRAM/ERASE operations are finished, the following two polling methods are available the first is same for N25Q and MT25Q, the second one is different, in fact for N25Q is necessary a check of flag status register (See Fig.4):

- Polling on bit 7 of the flag status register (Recommended)
- Polling on bit 0 of status register

The following two flow methods show a generic die stack (the ADDRESS value determines the die taken in polling).

For flag status register bit 5 (Erase) and bit 4 (Program) give information about error occured

**Figure 3: N25Q and MT25Q First Flow Method (Recommended)**

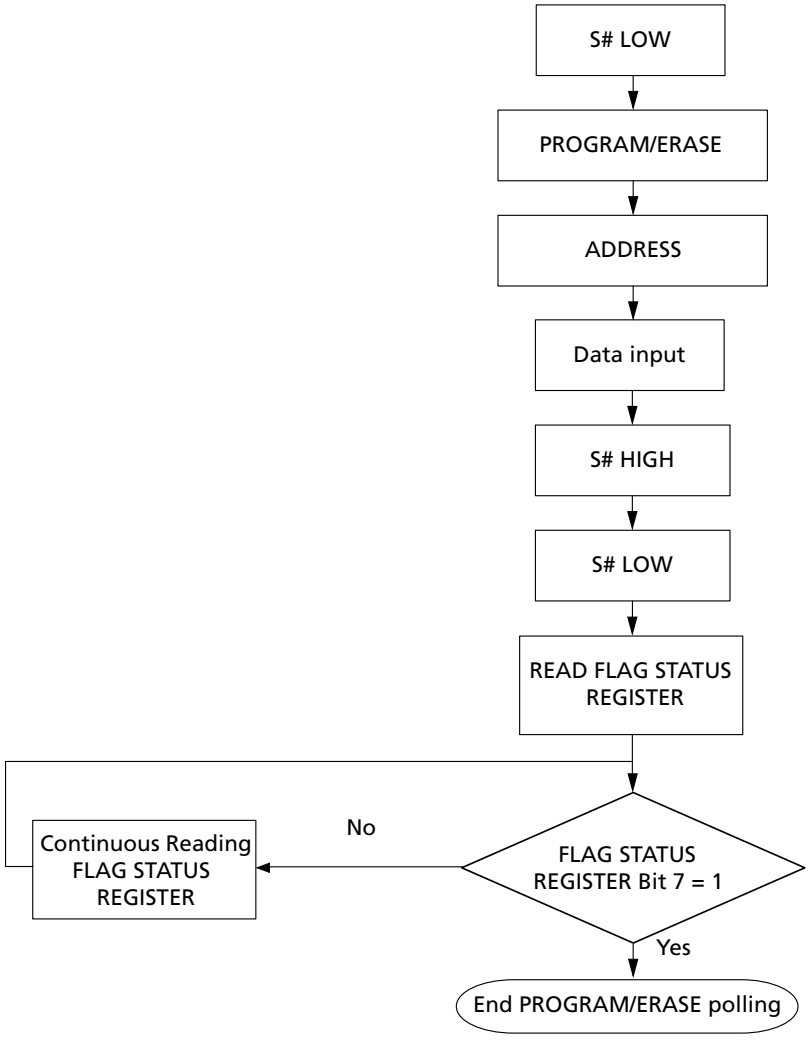


**Figure 4: N25Q Second Flow Method**

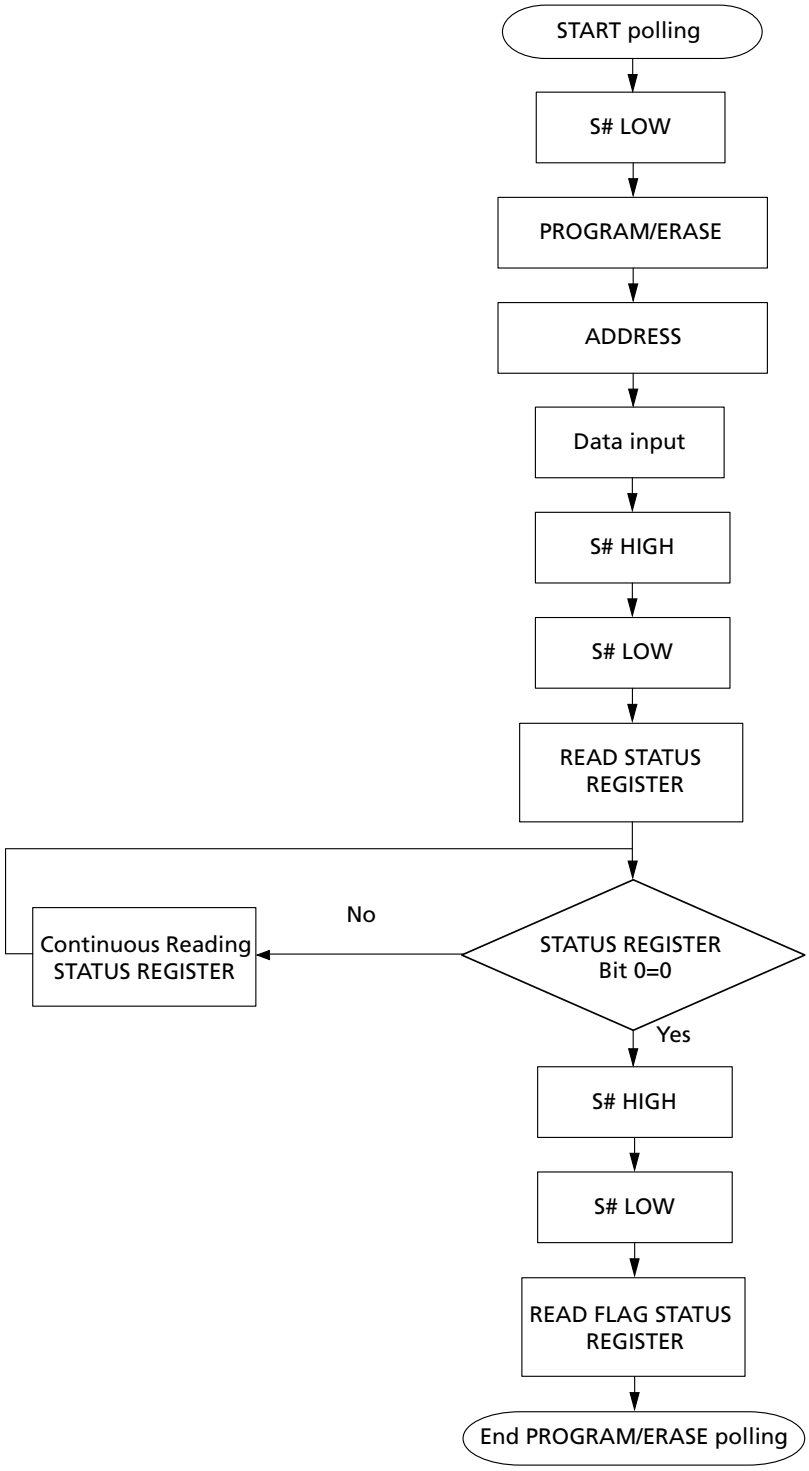
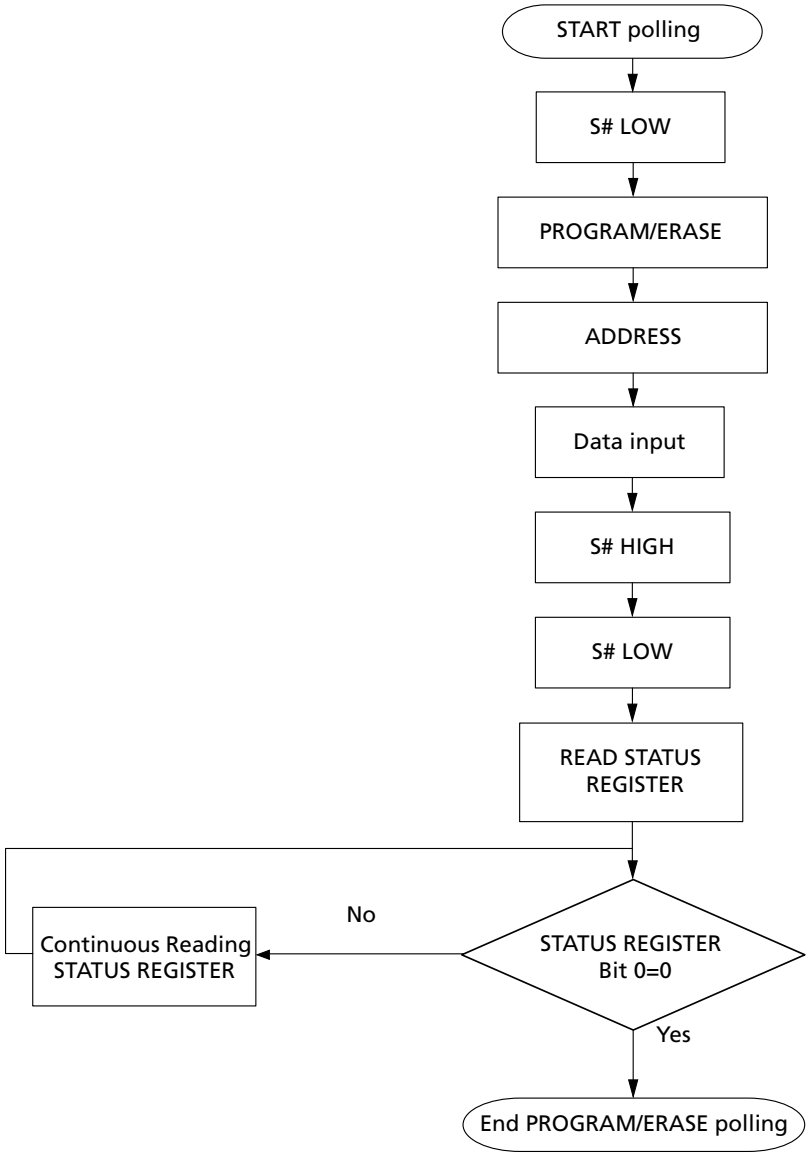


**Figure 5: MT25Q Second Flow Method**



### DIE ERASE

The DIE ERASE (C4h) instruction was introduced to allow a global erase inside the selected die. DIE ERASE command has a sector erase frame with addresses; the significant address bits are those related to die selection:

- for N25Q512Axxx: A25
- for N25Q00AAxxx: A26 and A25
- for MT25Qxs01Gxxx: A26
- for MT25Qxs02Gxxx: A27 and A26

All of the other address bits are "Don't Care."

## Common Operations for All of the Devices

The following operations modify the status of both devices at the same time:

- WRITE VOLATILE REGISTER
- WRITE NONVOLATILE REGISTER

For commands involving writing nonvolatile registers (WRITE STATUS REGISTER and WRITE NONVOLATILE CONFIGURATION REGISTER), the cyclic polling is used. There is only one method for cyclic polling for N25Q, and two methods for MT25Q (see the following figures). For MT25Q stacked devices, cyclic polling is used also for the CRC operations.

**Figure 6: N25Q and MT25Q Cyclic Polling**

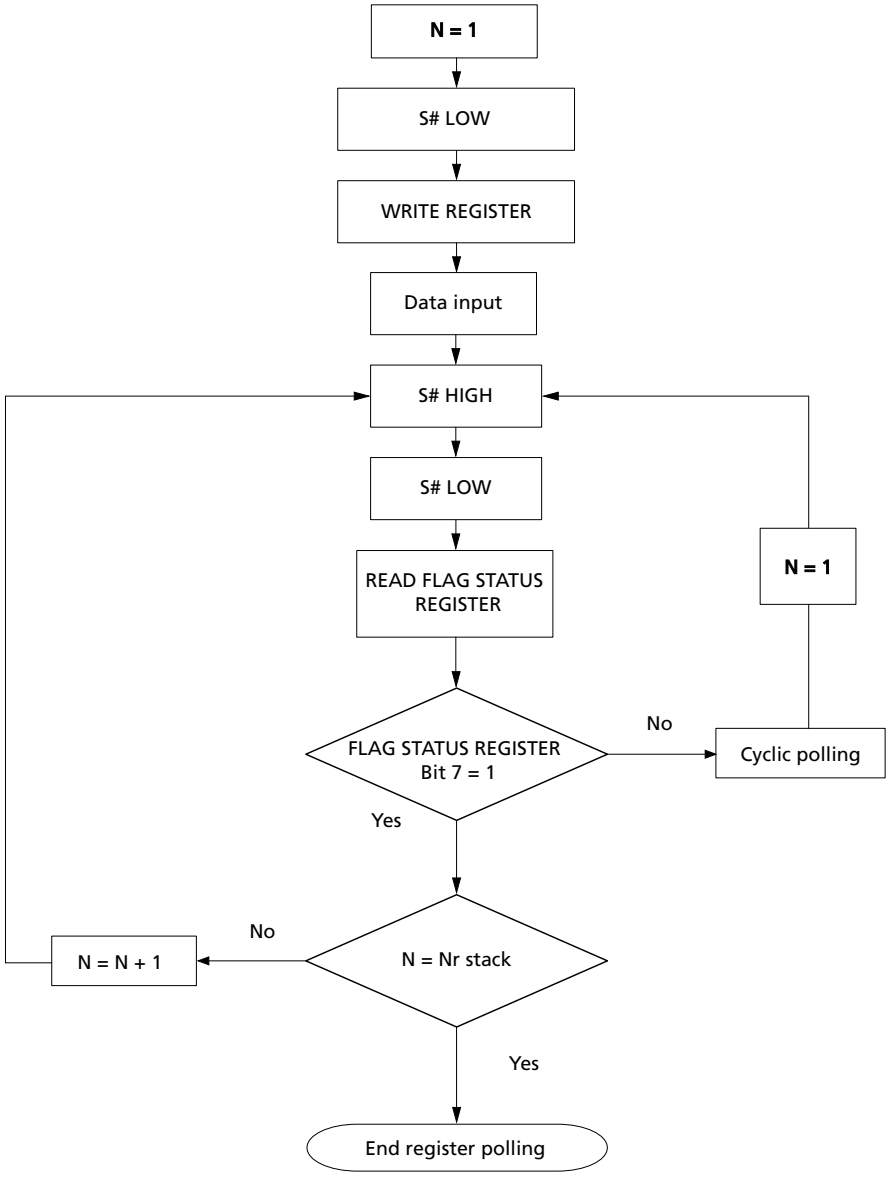
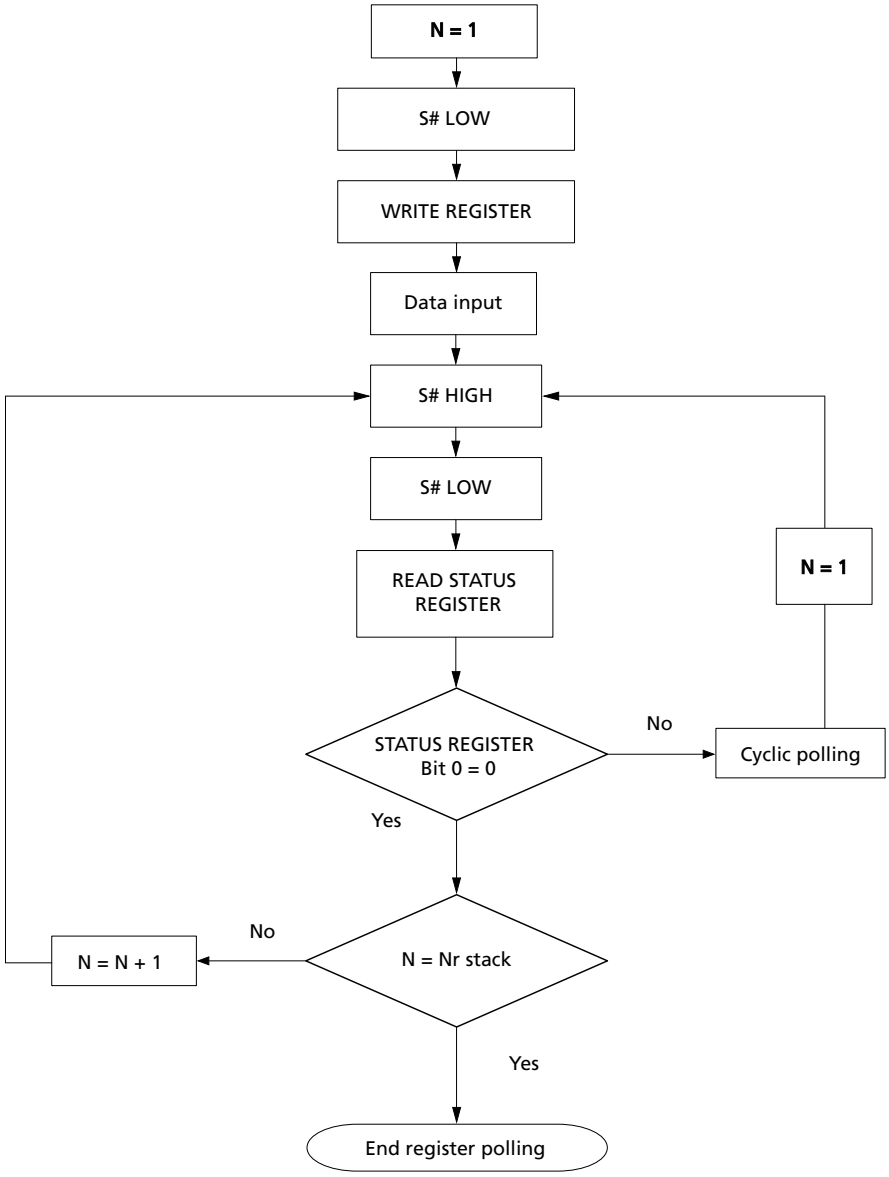


**Figure 7: MT25Q Cyclic Polling**




# Conclusion

Stacked devices are memory devices that have two or more die in the same package. Stacked devices have single die operations that modify the status of a single die. These operations include READ MEMORY, PROGRAM/ERASE, and DIE ERASE. The common operations for all of the devices are WRITE VOLATILE REGISTER and WRITE NONVOLATILE REGISTER. Also, the key differences between the N25Q and the MT25Q devices are using the status register for PROGRAM/ERASE and completing command common polling.

Refer to the package data sheet for more information on stacked devices.

# Revision History

## Rev. C – 05/17

- Review paragraph: Common Operations for All of the Devices

## Rev. B – 10/16

- Updated DIE ERASE in Single Die Operations section

## Rev. A – 01/15

- Initial release

8000 S. Federal Way, P.O. Box 6, Boise, ID 83707-0006, Tel: 208-368-4000
www.micron.com/products/support Sales inquiries: 800-932-4992