



Technical Note

Micron's NAND Flash Sleep Lite Function

Introduction

Electronic systems—particularly mobile systems such as smartphones, wearables and Internet of Things (IoT) devices—have changed the way people communicate and share data, to the point where these devices are expected to be always ready to operate—conveniently and immediately. To meet this expectation, these mobile devices need to operate for long periods of time without recharging.

A mobile system's power source (that is, the battery) is typically limited and often has multiple demands from several components. This puts the power source at a premium and elevates the need for methods or tools that can use power more efficiently to extend a mobile system's operation and improve a user's experience.

This technical note describes Micron's NAND Flash Sleep Lite function—a method for reducing power consumption of a NAND flash device, helping mobile systems more efficiently use available power, which can result in greater operation time.

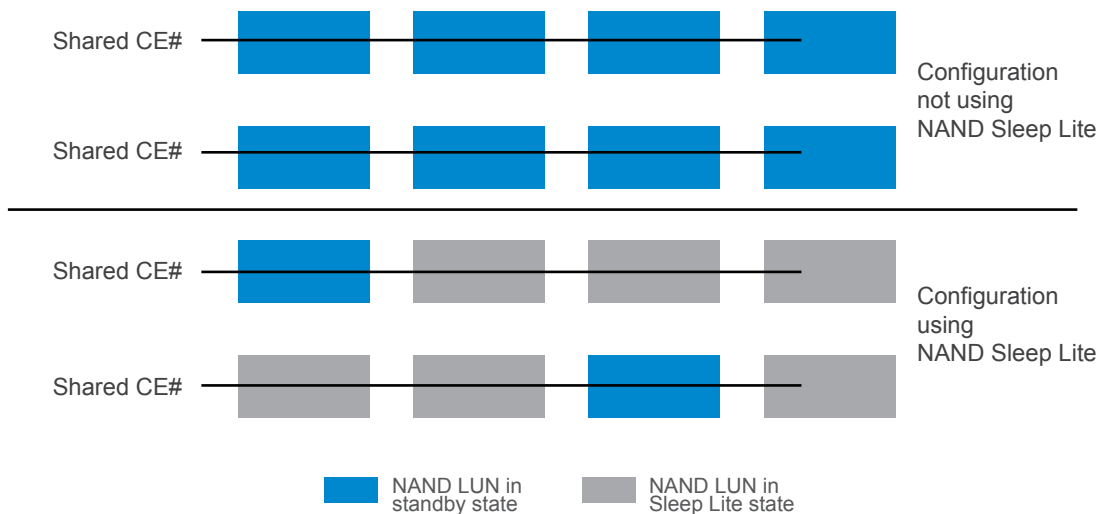
What is Micron's NAND Flash Sleep Lite Function?

Micron's NAND Flash Sleep Lite function enables certain NAND LUNs (die) to be placed in a low power consumption state where they will consume less power than a NAND LUN in idle mode, significantly reducing total NAND power consumption.

The NAND LUNs that can utilize the Sleep Lite function are those that share a common chip enable (CE#) signal with other NAND LUNs (these other NAND LUNs remain in an active state). This provides flexibility for a host system to configure some NAND LUNs in a low power consumption state to maximize power efficiency while leaving other NAND LUN(s) in a normal standby state, allowing those NAND LUNs to quickly respond to host commands.

Figures 1 and 2 illustrate how Micron's NAND Flash Sleep Lite function can improve system power efficiency.

Figure 1: NAND LUNs with Sleep Lite Function



Putting a NAND LUN into the Sleep Lite state means it cannot immediately respond to host system commands until it is taken out of the Sleep Lite state. By placing only certain NAND LUNs into the Sleep Lite state on a shared CE# signal, a system can maintain the ability to quickly respond to host system commands.

The amount of NAND power consumption that can be saved using Sleep Lite—versus placing NAND LUNs in the idle state—depends on the number and duration of NAND flash LUNs put in the Sleep Lite state.

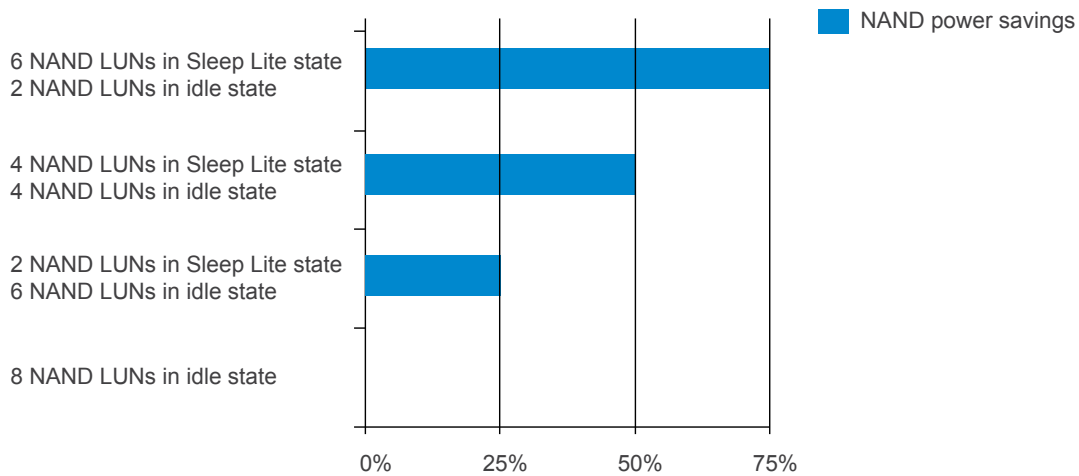


TN-29-86: Power Savings with Micron's NAND Flash Sleep Lite Function

What is Micron's NAND Flash Sleep Lite Function?

The image below shows NAND power savings achieved in an example system with 8 NAND LUNs where 2, 4, and 6 of those NAND LUNs are placed into Sleep Lite state compared to a system with all 8 NAND LUNs in the idle state.

Figure 2: Sleep Lite Power Consumption vs. Idle State



Determining the number of NAND LUNs to put into the Sleep Lite state, which NAND LUNs to leave in the traditional idle state, and how long the system will keep NAND LUNs in the Sleep Lite state depends on:

- The number of NAND LUNs per CE# signal
- How often the host system has the opportunity to put NAND LUNs into the Sleep Lite state
- How data stored in the NAND LUN is organized, laid out and utilized by the host
- How long NAND LUNs can remain in the Sleep Lite state while maintaining system quality of service (QoS) requirements

Putting a Micron NAND flash LUN into the Sleep Lite state requires only a signal command per NAND LUN, offering a simple method to reduce power consumption of NAND LUNs that would otherwise be in the idle state.

The Growing Presence of NAND Flash Memory in Mobile Systems

The amount of data consumed by mobile devices has led to a growing need for more NAND flash memory in these systems.

According to Counterpoint Technology Market Research, the amount of NAND memory in smartphones has continued to increase over time, trending toward an average of more than 60GB per smartphone by the end of 2018¹.

Figure 3: Average NAND Flash Capacity in Smartphones¹

Exhibit : Global Average Smartphone NAND Flash Capacity Trend (GB)



1. Counterpoint Research, December 2017: *Average Smartphone NAND Storage Capacity will Top 60GB by 2018.*

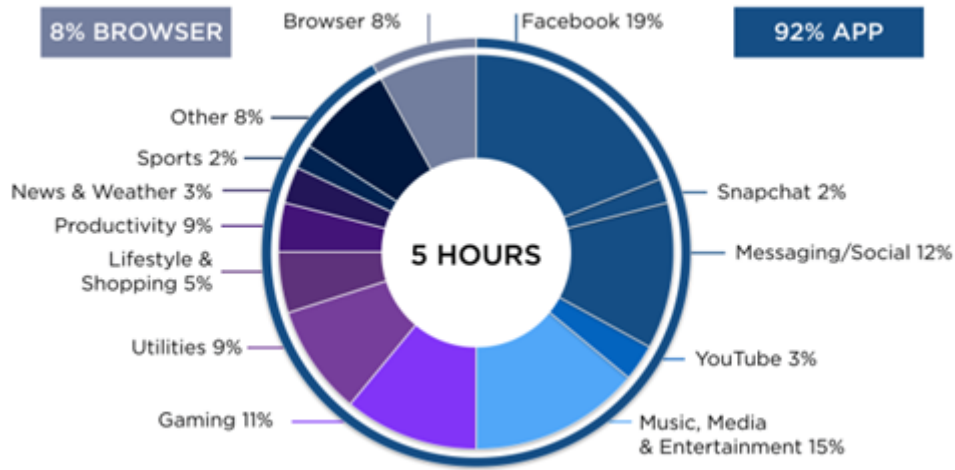
This increase shows NAND flash is taking up a greater percentage of a smartphone's total power budget, providing a greater opportunity for functionality like Micron's NAND Flash Sleep Lite function to decrease total power consumption.

System Optimization with Micron's NAND Flash Sleep Lite Function

Many mobile systems are targeted for active use (streaming video/music, text/voice communication, gaming, shopping, web content viewing, location services, etc.), increasing the amount of time these devices are used daily.

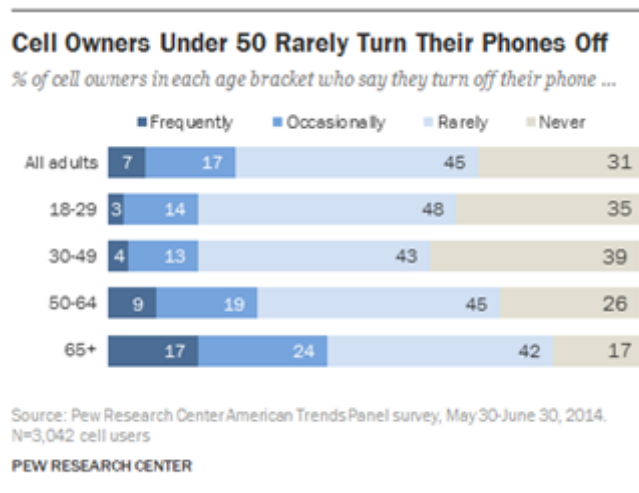
According to Flurry Analytics reporting, the average mobile device user in the U.S. uses their device five hours a day; this device use is not typically continuous in nature, but spread out over the course of a day².

Figure 4: Time Spent by Apps on a Mobile Device²



When mobile devices are not in active use, users continue to monitor the devices frequently for updates. In a global mobile consumer survey from Deloitte, the average number of times mobile phone users look at their phones is 47 times per day³. Additionally, even when users are not actively using their mobile phones or checking for updates, a majority of mobile devices remain powered on most of the time. According to a Pew Research Center survey, 45% of mobile phone users rarely turn their mobile phone off, and 31% never turn their mobile phone off⁴.

Figure 5: Cell Owners Who Turn Their Phones Off⁴



This indicates the amount of time a mobile device is turned on and not actively used significantly exceeds the amount of time the mobile device is actively being used. This scenario is the reason why Micron's NAND Flash Sleep Lite function was created. The Sleep Lite function can put NAND LUNs into the Sleep Lite state for extended periods of



time, thus minimizing a system's NAND flash power consumption and helping to maximize the time between battery recharging.

References

1. Source: <https://www.counterpointresearch.com/average-smartphone-nand-storage-capacity-will-top-60gb-by-2018/>
2. Source: <http://flurrymobile.tumblr.com/post/157921590345/us-consumers-time-spent-on-mobile-crosses-5>
3. Source: <https://www2.deloitte.com/us/en/pages/technology-media-and-telecommunications/articles/global-mobile-consumer-survey-us-edition.html#form>
4. Source: <http://www.pewinternet.org/2015/08/26/chapter-1-always-on-connectivity/>

Conclusion

Micron's NAND Flash Sleep Lite function is a valuable tool to optimize and reduce NAND power consumption in mobile systems. Considering how mobile devices are used, monitored, and the amount of time they are powered on each day, there are many opportunities for Micron NAND flash devices to use Sleep Lite for power conservation, making Sleep Lite well suited for enhancing mobile device users' experience.



Revision History

Rev. A – 10/18

- 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
Micron and the Micron logo are trademarks of Micron Technology, Inc.
All other trademarks are the property of their respective owners.