

Replacing NOR Flash with Surface-Mount SSDs

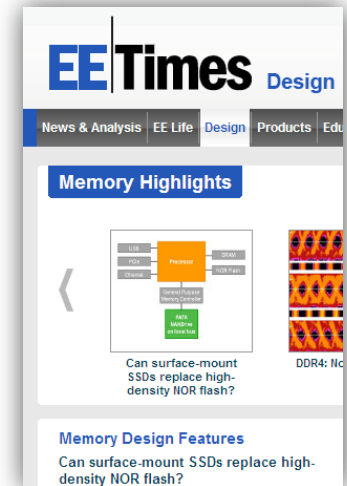
Ralph Thomson
Director, Field Applications Engineering
Greenliant Systems



- Can a surface-mount SSD replace high-density NOR flash?
- Background
- Possible implementations
- What alternatives exist?
- Conclusion
- Questions

Background

- Idea based on real customer interactions
 - Featured in a recent article
- NOR flash is main “Boot” technology in embedded systems
- Typical Boot loaders are only a few KB
 - Few MB for BIOS applications



Basic Premise

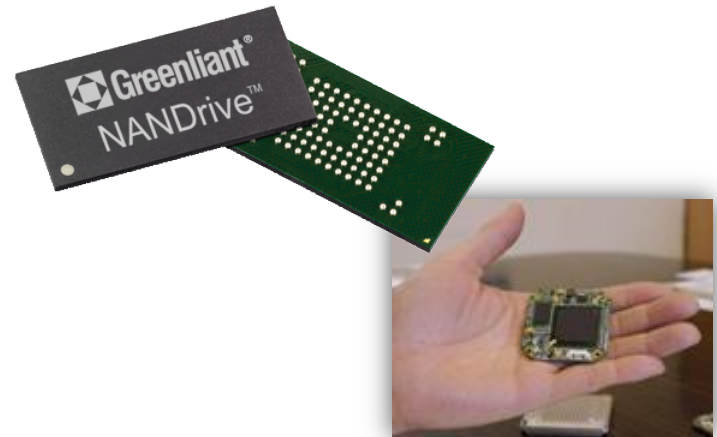
- As embedded systems become more complex, demanding more from their OS / Applications, the need for higher capacity storage arises
- Extrapolating an existing NOR-based design will work, but at what cost?
- Time for a re-think?

Time for a Re-think?

Comparison	Surface-Mount SSD	High-Density NOR
Supported interfaces	ATA / IDE / General memory / eMMC	General memory / SPI
Driver	Industry standard interface	Device specific
Capacity	Up to 128 GB of storage	Up to 8 Gb (1 GB) of storage
Erase performance	Transparent (self-managed)	Hundreds of milliseconds (0.5 s typical)
Temperatures	Commercial and industrial	Commercial and industrial
SMART commands supported	Yes	No
XIP boot capability	XIP boot achieved through small external NOR (eMMC supports direct boot)	Yes
Protection zones supported	Yes	Yes
Pin-out backward compatible	Yes	Care required over address lines
Static & dynamic wear leveling	Yes	N/A
Sleep mode supported	Yes	Yes
Relative cost per gigabyte	Low	High

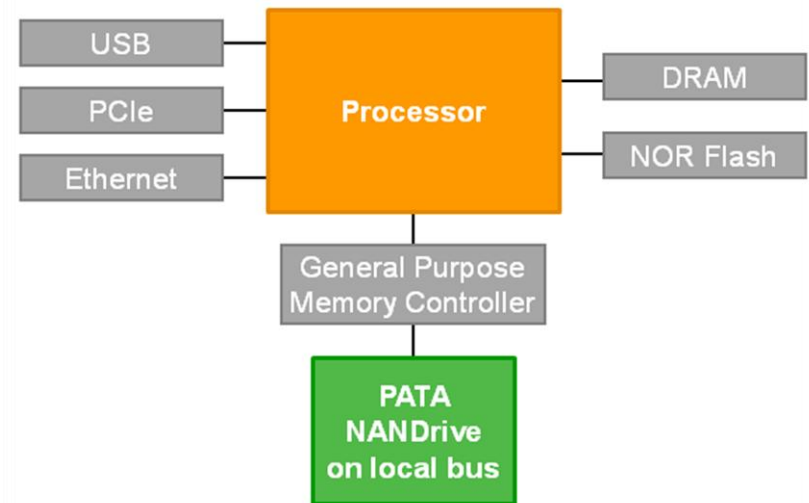
Implementation

- PCs have used HDDs for OS and applications for decades
 - Run-time operations from low-cost DRAM
- The advent of surface-mount SSDs is a game changer
- Watershed at about ½ GB
 - Typical WinXP Embedded ~ 2GB
 - WinXP ~ 8GB
- No PATA? No Problem!

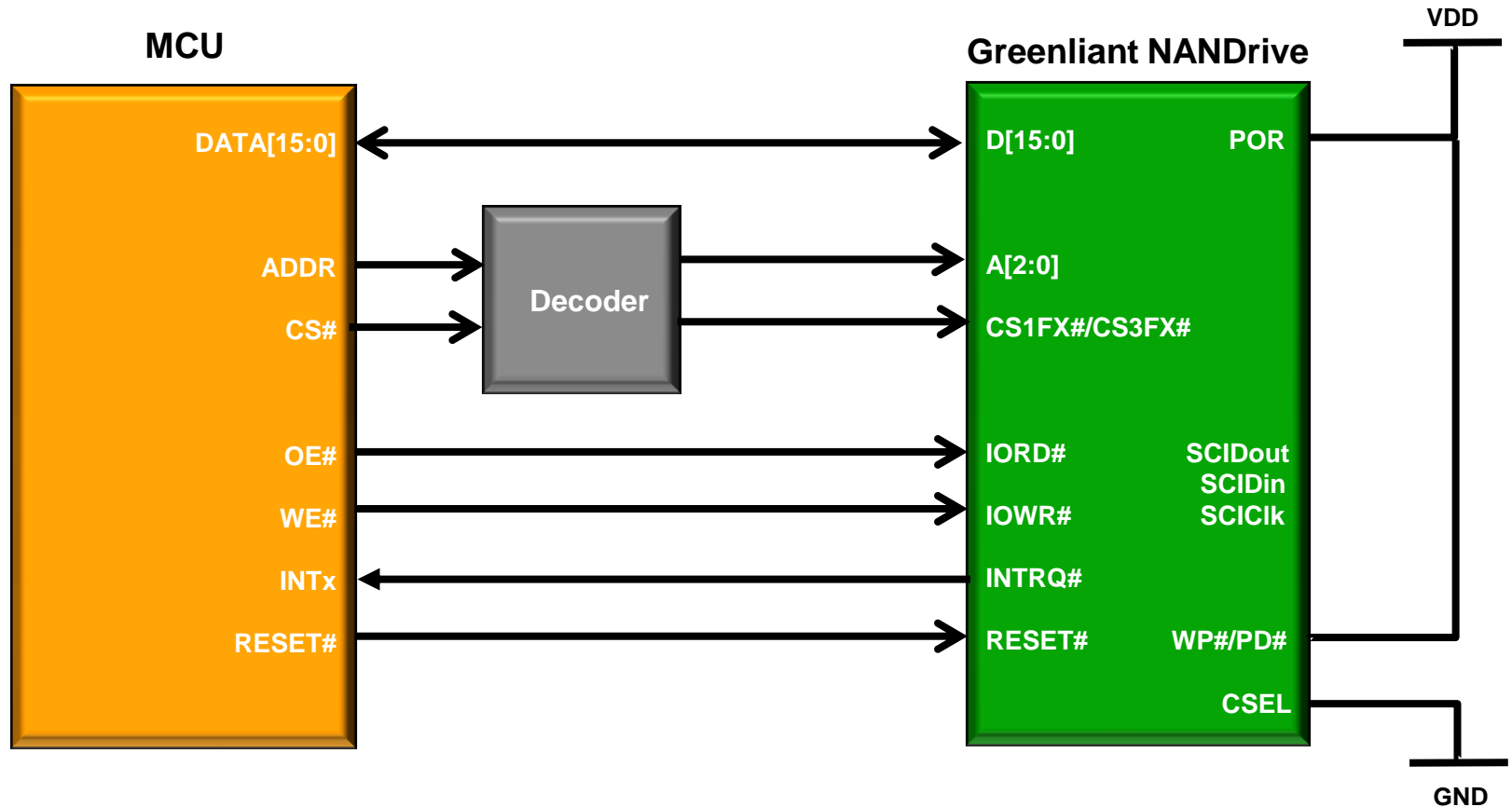


Surface-mount SSD on the Memory Bus (PIO Mode)

- Requires surface-mount SSD which can connect to a variety of buses
- Most CPUs do not have a native IDE / ATA bus
- PATA simplicity is the Key
- The PATA interface resembles a traditional memory bus
 - Address, Data and Control signals



Implementation Example



Alternatives?



High Density NOR Flash

- Relatively high cost per GB at higher densities



Discrete NAND Flash

- Low-cost option
- Additional management costs
- Re-design for technology migration



USB Controller

- Very low cost
- Significant re-design cost with technology migration

More Alternatives?



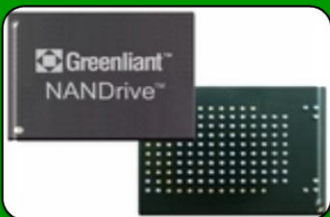
Network

- Not always possible
- Requiring “Always On” connectivity



SD Card

- Low cost
- Potential mechanical/connectivity challenges
- Issues with BOM control



eMMC

- Popular solution
- Includes Boot capability
- Requires SOC support

Conclusion

- Managed NAND devices in small BGA form factors enable embedded PC-style architectures
- Capitalize on surface-mount SSD advantages, plus
 - No additional IDE control hardware required
 - Easily connected to a microcontroller on the memory bus
 - Range of capacities with same PCB
- Compared to expensive high-density NOR, surface-mount SSDs offer a compelling choice for code and data storage in embedded systems



Thank you!

Have questions or comments? Email us,
info@greenliant.com

