High-Temperature Discrete and Managed NAND Solutions

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Agenda

- Embedded Temperature Ranges
- Why Temperatures Above 85°C?
- Comparison of NAND-Based Solutions
- NVM Trends
- High-Temperature Data Integrity Challenges
- Summary

Embedded Temperature Ranges

- Commercial: 0ºC to 70ºC
  - Cost-optimized

- Industrial (IT): –40ºC to 85ºC
  - Uncontrolled temperature environments

- Beyond industrial: –40ºC up to 105ºC
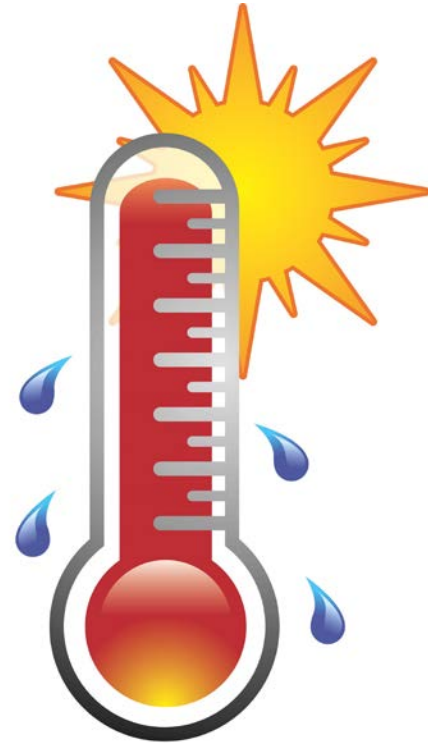 - Demonstrated to exceed 85ºC

Focus is on "beyond industrial"

Why Temperatures Above 85°C?

- Fanless and quiet
- Small and cute
- Thermal suffocation
- Increased electronics in automotive with higher temperatures
 - Automakers are jointly defining temperature ranges that exceed 85°C

Comparison of NAND-Based Solutions

	Discrete NAND	e.MMC	SSD
Density range	16MB to 64GB	2GB to 128GB	2GB to 512GB
Temperature range	–40ºC to 105ºC	–40ºC to 105ºC	–40ºC to 85ºC
Media management effort	**Low to High**	**Low**	**Low**

- All solutions are essential across the entire range of high-temperature embedded applications
- Choice depends heavily on density and willingness to manage NAND media

NVM Trends

- **Improved NAND performance**

- **Improved discrete NAND usability**

- **Low-density NAND still needed**

- **More aggressive product qualifications**
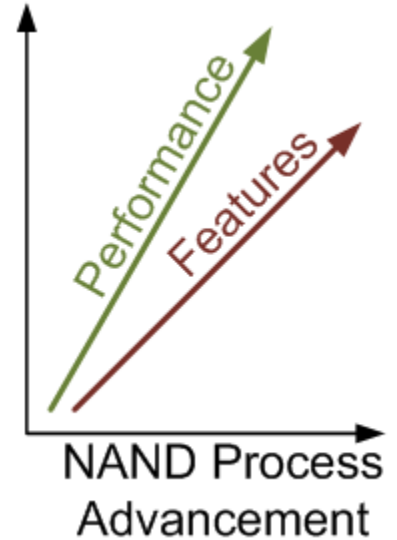
High-Temperature Data Integrity Challenges

- High temperatures make data retention worse

- Higher temp ➔ wider X-temp ➔ rel challenges
  - SLC to improve P/E cycling and data retention
  - Relaxation of cold temperature extreme

- Data refresh is an important consideration
  - Longer product life (in excess of 15 years)
  - Sustained high temperatures
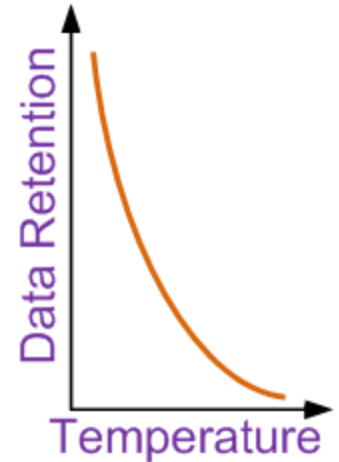
Summary

- Maximum embedded temperatures are rising

- Embedded product life is increasing

  - Discrete and managed NAND are fulfilling these requirements

- High-temperature data integrity issues must be solved at all levels of integration