From Embedded Systems

- Rugged Systems for Military & Aerospace
- Single Board Computers (SBCs)
- Telecommunications Networks
- Public Safety
- Automation
To Emerging Markets

- Mobile Handsets
- USB Flash Drives (UFDs)
- MP3 Players
- Digital Cameras
- High-Definition TVs (HDTVs)
- Gaming Consoles
- Global Positioning Systems (GPSs)
- Laptops, notebooks, sub-notebooks
- Inside Mechanical HDDs
Why is Flash so Attractive?

- **Small Form Factor**
  - 2GB in 12x20x1mm package

- **Reliable**
  - Solid-state, no moving parts

- **Low Power**
  - No mechanical parts to spin/rotate/move

- **Faster Boot**
  - No mechanical parts to spin into motion
Innovative Flash Technology

- **Flash Technology**
  - Capacity increases every 12-18 months
  - Higher density manufacturing process → 30-40% cost reduction per year
  - MLC technology since 2002

- **NOR Technology since 1986**
  - Optimized for code storage
  - Max. capacity 128MB per chip

- **NAND Technology since 1994**
  - Optimized for data storage
  - Max capacity 2GB per chip
Mobile Handsets Driven by Multimedia Storage Needs

- **Past: Low Capacity**
  - NOR Flash for Personal Contacts

- **Today: High Capacity**
  - Video Clips
  - TV
  - 3D Interactive Games
  - MMS Content
  - Full PIM Functionality
Flash Memory: Good Things Come in Small Packages
...and More Mobile Handsets

UMTS and HSDPA

MegaSIM
Flash Storage in USB Flash Drives

DiskOnKey Enabled

Average Capacity Sold in 2005: 468 MB
Flash Storage in MP3

1,000 songs. Impossibly small. iPod nano
Flash Storage in Digital Cameras
Flash Storage in HDTV

Flash Stores OS and Applications
Flash Storage in Car Navigation
Flash Disk Cost Trends

- 1GB: $80
- 5GB: $700
- 10GB: $1,500

Capacity:
- 2002
- 2003
- 2004
- 2005
- 2006

Cost:
- 2002: $300
- 2003: $80
- 2004: $300
- 2005: $1,000
- 2006: $3,000

Mechanical HDD
Flash Storage in Laptops

- **Sub-notebook PC**: 8-16GB
- **Tablet PC**: 8-16GB
- **Ruggedized notebook**: 4-8GB
Flash Storage Even Inside HDDs!!

- Hybrid HDD/Flash Drive
  - Lower power consumption
  - Reduced boot up time
  - Higher reliability
  - Promoted by Microsoft for Windows Vista release
Flash Forward?
The sky is the limit!
Thank you

Any Questions?