

Mobile Power Guidelines '99

Intel Corporation

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1. Executive Summary

The demand for new features and higher performance in mobile PCs presents a major challenge to the mobile PC industry in the area of platform power. Power dissipated in the interior of a full-featured notebook has increased by 90% in the last three years. Looking ahead to expected system enhancements, this power consumption could increase to more than 35 watts by 1999. This would create a thermal problem since 1999 notebook computers are only expected to be able to dissipate about the same 23 to 25 watts as today's systems.

Intel's Mobile Power Initiative is a coordinated industry program that addresses these power challenges. It is a comprehensive program that spans across all areas that impact power: platform, operating system, and applications. To address application power, Intel has created power monitoring and analysis tools that help software developers identify and correct power wasting code. To improve operating system power management, Intel, Microsoft and Toshiba authored an industry power management specification called the Advanced Configuration and Power Interface (ACPI.) This Mobile Power Guidelines focuses on the platform power issues by providing achievable power targets for all system components. Meeting these component power targets ensures that mobile PC systems in 1999 will contain all the features and performance that users demand, while holding power to within the thermal limits of today's mobile PCs. Hardware component vendors and original equipment manufacturers will benefit by cost reductions due to lower power components, lighter weight thermal solutions, and higher product reliability.

This document also discusses various techniques that can be used to hit the power targets. Among them, voltage reduction is the most significant method of reducing power. Table 1.1 shows the key component voltage and power changes targeted for systems shipping in mid 1999.

Table 1.1 1999 Key Component Voltage and Power Targets

Component	1998 Estimate		1999 Targets	
	Voltage (Volts)	3D WinBench Power (Watts)	Voltage (Volts)	3D WinBench Power (Watts)
CPU Core	1.6	7.9	1.6 or lower	7.9
Memory Controller	3.3	1.7	1.8	1.2
System Memory	3.3 (SDRAM)	1.7	2.5 (RDRAM®*)	1.4
System Memory Bus	3.3		1.8	
Graphics Controller	3.3	2.0	1.8	2.4
Graphics Frame Buffer	3.3	0.6	Frame Buffer Integrated into Graphics Controller	
Advanced Graphics Port Bus (AGP)	3.3		1.5	
Power Supply	88% Efficient		90% Efficient	

Implementing these voltage and power reduction targets allows the performance improvements customers demand while keeping the overall system power within the 23 to 25 watt thermal envelope. Intel is committed to continuing the voltage reduction trend on mobile system components it manufactures. We encourage mobile computer component and original equipment manufacturers to join this trend. Those who embrace it will reap many benefits including the following:

★ Lower power components

- ✓ Lower cost component packages
- ✓ More reliable components
- ✓ Higher performance

★ Lower power systems

- ✓ Lower cost thermal solutions
- ✓ Lighter weight thermal solutions
- ✓ More reliable systems
- ✓ More room for additional features or performance

We call upon industry leaders like yourself to join us in bringing about the changes needed to unlock the opportunities on the mobile horizon. Designing your components and systems to meet the Intel Mobile Power Guidelines will benefit both your customers and the mobile PC industry.

2. Introduction

New technologies and feature rich applications are promising unprecedented opportunities for mobile computer system, hardware component, and software vendors. Users expect the same high performance from their mobile computers that they enjoy on their desktops. At the same time mobile computer system design is becoming more challenging.

As we look to the future, we see these opportunities bounded by the thermal realities of mobile computer system design. New systems cannot increase performance or add new features if they can not dissipate the heat. To address this issue, new systems can either find ways to dissipate more heat or find ways to reduce power consumption. In the next few years, we feel there are significant opportunities and benefits in reducing power consumption.

To support this strategy Intel is significantly reducing voltages on mobile system components it manufactures such as microprocessors and chip sets. However, enabling higher performance systems with new features will require lowering the voltage of many other system components to keep the overall system thermally manageable. This will require an industry wide effort to lower bus interface voltages and establish power guidelines. To facilitate this cooperative industry effort, Intel is proposing these "Mobile Power Guidelines."

2.1 Objective

The objective of this document is to unify the mobile computing industry with a common set of guidelines to enable continued feature and performance enhancements in a thermally manageable system.

This document describes the challenges mobile system designers will face in the next few years if nothing is done to manage system power consumption and sets bus interface and component voltage and power targets for 1999 systems. This document describes high-end, full-size, full-featured mobile platforms expected to be in production in mid 1999.

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