Universal Serial Bus Specification

Compaq

Hewlett-Packard

Intel

Lucent

Microsoft

NEC

Philips

Revision 2.0

April 27, 2000



Universal Serial Bus Specification Revision 2.0

Scope of this Revision

The 2.0 revision of the specification is intended for product design. Every attempt has been made to ensure a consistent and implementable specification. Implementations should ensure compliance with this revision.

Revision History

Revision	Issue Date	Comments
0.7	November 11, 1994	Supersedes 0.6e.
0.8	December 30, 1994	Revisions to Chapters 3-8, 10, and 11. Added appendixes.
0.9	April 13, 1995	Revisions to all the chapters.
0.99	August 25, 1995	Revisions to all the chapters.
1.0 FDR	November 13, 1995	Revisions to Chapters 1, 2, 5-11.
1.0	January 15, 1996	Edits to Chapters 5, 6, 7, 8, 9, 10, and 11 for consistency.
1.1	September 23, 1998	Updates to all chapters to fix problems identified.
2.0 (draft 0.79)	October 5, 1999	Revisions to chapters 5, 7, 8, 9, 11 to add high speed.
2.0 (draft 0.9)	December 21, 1999	Revisions to all chapters to add high speed.
2.0	April 27, 2000	Revisions for high-speed mode.

Universal Serial Bus Specification
Copyright © 2000, Compaq Computer Corporation,
Hewlett-Packard Company, Intel Corporation, Lucent Technologies Inc,
Microsoft Corporation, NEC Corporation, Koninklijke Philips Electronics N.V.
All rights reserved.

INTELLECTUAL PROPERTY DISCLAIMER

THIS SPECIFICATION IS PROVIDED TO YOU "AS IS" WITH NO WARRANTIES WHATSOEVER, INCLUDING ANY WARRANTY OF MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR ANY PARTICULAR PURPOSE. THE AUTHORS OF THIS SPECIFICATION DISCLAIM ALL LIABILITY, INCLUDING LIABILITY FOR INFRINGEMENT OF ANY PROPRIETARY RIGHTS, RELATING TO USE OR IMPLEMENTATION OF INFORMATION IN THIS SPECIFICATION. THE PROVISION OF THIS SPECIFICATION TO YOU DOES NOT PROVIDE YOU WITH ANY LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS.

All product names are trademarks, registered trademarks, or servicemarks of their respective owners.

Please send comments via electronic mail to techsup@usb.org
For industry information, refer to the USB Implementers Forum web page at http://www.usb.org



Acknowledgement of USB 2.0 Technical Contribution

The authors of this specification would like to recognize the following people who participated in the USB 2.0 Promoter Group technical working groups. We would also like to thank others in the USB 2.0 Promoter companies and throughout the industry who contributed to the development of this specification.

Hub Working Group

John Garney Intel Corporation (Chair/Editor)
Ken Stufflebeam Compaq Computer Corporation
David Wooten Compaq Computer Corporation
Matt Nieberger Hewlett-Packard Company

John Howard Intel Corporation
Venkat Iyer Intel Corporation
Steve McGowan Intel Corporation

Geert Knapen Royal Philips Electronics Zong Liang Wu Royal Philips Electronics Jim Clee Lucent Technologies Inc Jim Guziak Lucent Technologies Inc Dave Thompson Lucent Technologies Inc John Fuller Microsoft Corporation Nathan Sherman Microsoft Corporation Mark Williams Microsoft Corporation Nobuo Furuya **NEC Corporation** Toshimi Sakurai **NEC Corporation** Moto Sato **NEC Corporation** Katsuya Suzuki **NEC Corporation**

Electrical Working Group

Jon Lueker Intel Corporation (Chair/Editor)
David Wooten Compaq Computer Corporation
Matt Nieberger Hewlett-Packard Company
Larry Taugher Hewlett-Packard Company

Venkat Iyer Intel Corporation
Steve McGowan Intel Corporation
Mike Pennell Intel Corporation
Todd West Intel Corporation

Gerrit den Besten Royal Philips Electronics Royal Philips Electronics Marq Kole Zong Liang Wu Royal Philips Electronics Jim Clee Lucent Technologies Inc Jim Guziak Lucent Technologies Inc Par Parikh Lucent Technologies Inc Dave Thompson Lucent Technologies Inc Ed Giaimo Microsoft Corporation Mark Williams Microsoft Corporation Toshihiko Ohtani **NEC Corporation** Kugao Ouchi **NEC Corporation** Katsuya Suzuki **NEC Corporation** Toshio Tasaki **NEC Corporation**



Universal Serial Bus Specification Revision 2.0



Contents

CHAPTER 1 INTRODUCTION 1.1 1.2 1.3 1.4 1.5 CHAPTER 2 TERMS AND ABBREVIATIONS **CHAPTER 3 BACKGROUND** 3.2 3.3 CHAPTER 4 ARCHITECTURAL OVERVIEW 4.2.1 Electrical 17 4.2.2 Mechanical 18 4.3.1 4.3.2 Power Management 18 Bus Protocol _________18 Robustness 19 4.5.1 4.5.2



4.6.1

4.6.2 4.6.3 Bus Enumeration 20

DOCKET

Explore Litigation Insights



Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time** alerts and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.

