

INTERNATIONAL STANDARD



**Universal Serial Bus interfaces for data and power –
Part 3-1: Universal Serial Bus 3.1 Specification**



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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IEC 62680-3-1

Edition 1.0 2017-03

INTERNATIONAL STANDARD



**Universal Serial Bus interfaces for data and power –
Part 3-1: Universal Serial Bus 3.1 Specification**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.220; 35.200

ISBN 978-2-8322-3913-1

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UNIVERSAL SERIAL BUS INTERFACES FOR DATA AND POWER –

Part 3-1: Universal Serial Bus 3.1 Specification

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CDV	Report on voting
100/2589/CDV	100/2684/RVC

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Universal Serial Bus 3.1 Specification

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Revision 1.0
July 26, 2013

Revision History

Revision	Comments	Issue Date
1.0	Initial release. USB 3.0	November 12, 2008
	Incorporated errata and ECNs	June 6, 2011
1.0	Initial release. USB 3.1	July 26, 2013

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Acknowledgement of Technical Contribution

Dedication

Dedicated to the memory of Brad Hosler, the impact of whose accomplishments made the Universal Serial Bus one of the most successful technology innovations of the Personal Computer era.

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Promoter Company Employees

Alan Berkema	Hewlett-Packard Company
Walter Fry	Hewlett-Packard Company
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Hock Seow	NEC Corporation
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Susumu Yasuda	NEC Corporation
Alan Chang	ST-NXP Wireless
Wing Yan Chung	ST-NXP Wireless
Socol Constantin	ST-NXP Wireless
Knud Holtvoeth	NXP Semiconductors, B.V.
Linus Kerk	ST-NXP Wireless
Martin Klein	NXP Semiconductors, B.V.
Geert Knapen	NXP Semiconductors, B.V.
Chee Ee Lee	ST-NXP Wireless
Christian Paquet	NXP Semiconductors, B.V.
Veerappan Rajaram	ST-NXP Wireless
Shaun Reemeyer	ST-NXP Wireless
Dave Sroka	ST-NXP Wireless
Chee-Yen TEE	ST-NXP Wireless
Jerome Tjia	ST-NXP Wireless
Bart Vertenten	NXP Semiconductors, B.V.
Hock Meng Yeo	ST-NXP Wireless
Olivier Alavoine	Texas Instruments.

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Richard Baker	Texas Instruments
Sujoy Chakravarty	Texas Instruments
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Yoram Solomon	Texas Instruments.
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Eiji Wakatsuki	Hirose Electric
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Ron Muir	Japan Aviation Electronics Industry Ltd. (JAE)
Kazuhiro Saito	Japan Aviation Electronics Industry Ltd. (JAE)
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Takashi Kawasaki	Mitsumi
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Scott Sommers	Molex Inc.
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Saleem Mohammad	Synopsys, Inc.
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Masaaki Iwasaki	Tyco Electronics
Kazukiyo Osada	Tyco Electronics
Hiroshi Shirai	Tyco Electronics
Scott Shuey	Tyco Electronics
Masaru Ueno	Tyco Electronics

The authors of this specification would like to recognize the following people who participated in the USB 3.1 Bus Specification technical workgroups. Additionally we would like to acknowledge the many others throughout industry who provided feedback and contributed to the development of this specification.

Promoter Company Employees

Alan Berkema	Hewlett Packard
Norton Ewart	Hewlett Packard
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Linden McClure	Hewlett Packard
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Masami Katagiri	Renesas Electronics Corp.
Steven Kawamoto	Renesas Electronics Corp.
Kiichi Muto	Renesas Electronics Corp.
Peter Teng	Renesas Electronics Corp.
Hicham Bouzekri	ST-Ericsson
Morten Christiansen	ST-Ericsson
Grant Ley	Texas Instruments
James Skidmore	Texas Instruments
Sue Vining	Texas Instruments
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Li Yang	Texas Instruments

Contributor Company Employees

Jason Chen	Aces Electronics Co., Ltd.
Andy Feng	Aces Electronics Co., Ltd.
Chris Kao	Aces Electronics Co., Ltd.
Glen Chandler	ACON, Advanced-Connectek, Inc.
Alan MacDougall	ACON, Advanced-Connectek, Inc.
Shadi Barakat	Advanced Micro Devices
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Will Harris	Advanced Micro Devices
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Yufei Ma	Advanced Micro Devices
Joseph Scanlon	Advanced Micro Devices
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Jie Ni	Fresco Logic Inc.
Jeffrey Yang	Fresco Logic Inc.
Jing-Fan Zhang	Fresco Logic Inc.
Mike Engbretson	Granite River Labs
Kunia Aihara	Hirose Electric Co., Ltd.
Kazu Ichikawa	Hirose Electric Co., Ltd.
Masaru Kawamura	Hirose Electric Co., Ltd.

William MacKillop	Hirose Electric Co., Ltd.
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Darren Gray	Tektronix, Inc.
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Josh Moody	Tyco Electronics Corp., a TE Connectivity Ltd. company
Scott Shuey	Tyco Electronics Corp., a TE Connectivity Ltd. company
Egbert Stellinga	Tyco Electronics Corp., a TE Connectivity Ltd. company
Noah Zhang	Tyco Electronics Corp., a TE Connectivity Ltd. company
Marvin DeForest	Western Digital Technologies, Inc.
Larry McMillan	Western Digital Technologies, Inc.
Cristian Roman Del Nido	Western Digital Technologies, Inc.
Curtis Stevens	Western Digital Technologies, Inc.

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NOTE All Engineering Change Notices (ECN) and Errata documents as of May 01, 2015 that pertain to this core specification follow the last page of the specification, starting on page 567.

1 Introduction

1.1 Background

The original Universal Serial Bus (USB) was driven by the need to provide a user-friendly plug-and-play way to attach external peripherals to a Personal Computer (PC). USB has gone beyond just being a way to connect peripherals to PCs. Printers use USB to interface directly to cameras. Mobile devices use USB connected keyboards and mice. USB technology commonly finds itself in automobiles, televisions, and set-top boxes. USB, as a protocol, is also being picked up and used in many nontraditional applications, such as industrial automation. And USB as a source of power has become the mobile device charging solution endorsed by international communities across the globe.

Initially, USB provided two speeds (12 Mbps and 1,5 Mbps) that peripherals could use. As PCs became increasingly powerful and able to process larger amounts of data, users needed to get more and more data into and out of their PCs. This led to the definition of the USB 2.0 specification in 2000 to provide a third transfer rate of 480 Mbps while retaining backward compatibility. By 2006, two things in the environment happened: the transfer rates of HDDs exceeded 100 MB/s, far outstripping USB 2.0's ~32 MB/s bandwidth and the amount of digital content users were creating was an ever increasing pace. USB 3.0 was the USB community's response and provided users with the ability to move data at rates up to 450 MB/s while retaining backward compatibility with USB 2.0.

Now, with the continued trend for more bandwidth driven by larger and faster storage solutions, higher resolution video, and broader use of USB as an external expansion/docking solution, USB 3.1 extends the performance range of USB up to 1 GB/s by doubling the SuperSpeed USB clock rate to 10 Gbps and enhancing data encoding efficiency.

1.2 Objective of the Specification

This document defines the latest generation USB industry standard, USB 3.1. The specification describes the protocol definition, types of transactions, bus management, and the programming interface required to design and build systems and peripherals that are compliant with this specification. USB 3.1 is primarily a performance enhancement to SuperSpeed USB 3.0 resulting in providing more than double the bandwidth for devices such as Solid State Drives and High Definition displays.

This specification refers to Enhanced SuperSpeed as a collection of features or requirements that apply to both USB 3.0 and USB 3.1 bus operation. Additionally, where specific differences exist with regard to the USB 3.0 definition of SuperSpeed features or requirements, those differences will be uniquely identified as SuperSpeedPlus (or SSP) features or requirements – generally, "SuperSpeed" is in reference to 5 Gbps operation and "SuperSpeedPlus" is in reference to 10 Gbps operation.

USB 3.1's goal remains to enable devices from different vendors to interoperate in an open architecture, while maintaining and leveraging the existing USB infrastructure (device drivers, software interfaces, etc.). The specification is intended as an enhancement to the PC architecture, spanning portable, business desktop, and home environments, as well as simple device-to-device communications. It is intended that the specification allow system OEMs and peripheral developers adequate room for product versatility and market differentiation without the burden of carrying obsolete interfaces or losing compatibility.

1.3 Scope of the Document

The specification is primarily targeted at peripheral developers and platform/adapter developers, but provides valuable information for platform operating system/BIOS/device driver, adapter IHVs/ISVs, and system OEMs. This specification can be used for developing new products and associated software.