

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Universal serial bus interfaces for data and power –
Part 1-6: Common components – USB Audio 3.0 device class definition basic
functions**

**Interfaces de bus universel en série pour les données et l'alimentation
électrique –
Partie 1-6: Composants communs – Définition de classes de dispositifs USB
Audio 3.0 pour fonctions de base**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 1997-2016 USB-IF

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from IEC, or USB-IF at the respective address given below. Any questions about USB-IF copyright should be addressed to the USB-IF. Enquiries about obtaining additional rights to this publication and other information requests should be addressed to the IEC or your local IEC member National Committee.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

USB Implementers Forum, Inc.
3855 S.W. 153rd Drive
Beaverton, OR 97003
United States of America
Tel: +1 503-619-0426
admin@usb.org
www.usb.org

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CIPR.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Universal serial bus interfaces for data and power –
Part 1-6: Common components – USB Audio 3.0 device class definition basic
functions**

**Interfaces de bus universel en série pour les données et l'alimentation
électrique –
Partie 1-6: Composants communs – Définition de classes de dispositifs USB
Audio 3.0 pour fonctions de base**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 35.200; 29.200; 33.120.20

ISBN 978-2-8322-7242-8

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

INTERNATIONAL ELECTROTECHNICAL COMMISSION

UNIVERSAL SERIAL BUS INTERFACES FOR DATA AND POWER –

Part 1-6: Common components – USB Audio 3.0 device class definition basic functions

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, accept IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62680-1-6 has been prepared by technical area 18: Multimedia home systems and applications for end-user networks, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this standard was prepared by the USB Implementers Forum (USB-IF). The structure and editorial rules used in this publication reflect the practice of the organization which submitted it.

The text of this International Standard is based on the following documents:

CDV	Report on voting
100/3158/CDV	100/3228/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The IEC 62680 series is based on a series of specifications that were originally developed by the USB Implementers Forum (USB-IF). These specifications were submitted to the IEC under the auspices of a special agreement between the IEC and the USB-IF.

This standard is the USB-IF publication USB Device Class Definition for Basic Audio Functions Release 3.0.

The USB Implementers Forum, Inc.(USB-IF) is a non-profit corporation founded by the group of companies that developed the Universal Serial Bus specification. The USB-IF was formed to provide a support organization and forum for the advancement and adoption of Universal Serial Bus technology. The Forum facilitates the development of high-quality compatible USB peripherals (devices), and promotes the benefits of USB and the quality of products that have passed compliance testing.

ANY USB SPECIFICATIONS ARE PROVIDED TO YOU "AS IS," WITH NO WARRANTIES WHATSOEVER, INCLUDING ANY WARRANTY OF MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR ANY PARTICULAR PURPOSE. THE USB IMPLEMENTERS FORUM AND THE AUTHORS OF ANY USB SPECIFICATIONS DISCLAIM ALL LIABILITY, INCLUDING LIABILITY FOR INFRINGEMENT OF ANY PROPRIETARY RIGHTS, RELATING TO USE OR IMPLEMENTATION OR INFORMATION IN THIS SPECIFICATION.

THE PROVISION OF ANY USB SPECIFICATIONS TO YOU DOES NOT PROVIDE YOU WITH ANY LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS.

Entering into USB Adopters Agreements may, however, allow a signing company to participate in a reciprocal, RAND-Z licensing arrangement for compliant products. For more information, please see:

<https://www.usb.org/documents>

IEC DOES NOT TAKE ANY POSITION AS TO WHETHER IT IS ADVISABLE FOR YOU TO ENTER INTO ANY USB ADOPTERS AGREEMENTS OR TO PARTICIPATE IN THE USB IMPLEMENTERS FORUM."

UNIVERSAL SERIAL BUS
DEVICE CLASS DEFINITION
FOR
BASIC AUDIO FUNCTIONS

Release 3.0

September 22, 2016

SCOPE OF THIS RELEASE

This document is the Release 3.0 of this specification.

CONTRIBUTORS

Joe Scanlon	Advanced Micro Devices
Rhoads Hollowell	Apple Inc.
Girault Jones	Apple Inc.
Matthew X. Mora	Apple Inc.
Tzung-Dar Tsai	C-Media Electronics, Inc.
Brad Lambert	Cirrus Logic, Inc.
Dan Bogard	Conexant Systems, Inc.
Pete Burgers	DisplayLink (UK), Ltd.
David Roh	Dolby Laboratories, Inc.
Leng Ooi	Google, Inc.
Pierre-Louis Bossart	Intel Corporation
David Hines	Intel Corporation
Abdul Rahman Ismail (Co-Chair)	Intel Corporation
Devon Worrell	Intel Corporation
Chandrashekhara Rao	Logitech, Inc.
Terry Moore	MCCI Corporation
Alex Lin	MediaTek, Inc.
Bala Sivakumar	Microsoft Corporation
Geert Knapen (Co-Chair & Editor)	NXP Semiconductors Mobile Audio 110 E. Plumeria drive San Jose, CA 95134, USA Phone: +1 (408) 518-5514 E-mail: geert.knapen@nxp.com
James Goel	Qualcomm, Inc.
Andre Schevciw	Qualcomm, Inc.
Jin-Sheng Wang	Qualcomm, Inc.
Morten Christiansen	Synopsys

REVISION HISTORY

Rev.	Date	Filename	Description
1.0	Nov 24, 09	BasicAudioDevice-10.pdf	Release 1.0
3.0	Sep 22, 16	BasicAudioDevice30.pdf	Release 3.0

**Copyright © 1997-2016 USB Implementers Forum, Inc.
All rights reserved.**

INTELLECTUAL PROPERTY DISCLAIMER

A LICENSE IS HEREBY GRANTED TO REPRODUCE THIS SPECIFICATION FOR INTERNAL USE ONLY. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, IS GRANTED OR INTENDED HEREBY.

USB-IF AND THE AUTHORS OF THIS SPECIFICATION EXPRESSLY DISCLAIM ALL LIABILITY FOR INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS RELATING TO IMPLEMENTATION OF INFORMATION IN THIS SPECIFICATION. USB-IF AND THE AUTHORS OF THIS SPECIFICATION ALSO DO NOT WARRANT OR REPRESENT THAT SUCH IMPLEMENTATION(S) WILL NOT INFRINGE THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS.

THIS SPECIFICATION IS PROVIDED “AS IS” AND WITH NO WARRANTIES, EXPRESS OR IMPLIED, MERCHANTABILITY OR OTHERWISE. ALL WARRANTIES ARE EXPRESSLY DISCLAIMED. USB-IF, ITS MEMBERS AND THE AUTHORS OF THIS SPECIFICATION PROVIDE NO WARRANTY OF MERCHANTABILITY, NO WARRANTY OF NON-INFRINGEMENT, NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, AND NO WARRANTY ARISING OUT OF ANY PROPOSAL, SPECIFICATION, OR SAMPLE.

IN NO EVENT WILL USB-IF, MEMBERS OR THE AUTHORS BE LIABLE TO ANOTHER FOR THE COST OF PROCURING SUBSTITUTE GOODS OR SERVICES, LOST PROFITS, LOSS OF USE, LOSS OF DATA OR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, OR SPECIAL DAMAGES, WHETHER UNDER CONTRACT, TORT, WARRANTY, OR OTHERWISE, ARISING IN ANY WAY OUT OF THE USE OF THIS SPECIFICATION, WHETHER OR NOT SUCH PARTY HAD ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

NOTE: VARIOUS USB-IF MEMBERS PARTICIPATED IN THE DRAFTING OF THIS SPECIFICATION. CERTAIN OF THESE MEMBERS MAY HAVE DECLINED TO ENTER INTO A SPECIFIC AGREEMENT LICENSING INTELLECTUAL PROPERTY RIGHTS THAT MAY BE INFRINGED IN THE IMPLEMENTATION OF THIS SPECIFICATION. PERSONS IMPLEMENT THIS SPECIFICATION AT THEIR OWN RISK.

Dolby™, AC-3™, Pro Logic™ and Dolby Surround are trademarks of Dolby Laboratories, Inc.

All other product names are trademarks, registered trademarks, or service marks of their respective owners.

Please send comments via electronic mail to audio-chair@usb.org

TABLE OF CONTENTS

Scope of This Release 6

Contributors 6

Revision History 6

Table of Contents 8

List of Tables 10

List of Figures 11

1 Introduction 12

 1.1 Scope 12

 1.2 Purpose 12

 1.3 Related Documents 12

 1.4 Terms and Abbreviations 12

2 Management Overview 14

3 Classification 15

4 General Requirements 16

 4.1 Host and Basic Audio Device Interoperability 16

 4.2 BADD AudioStreaming Interfaces 16

 4.2.1 USB Speeds 16

 4.2.2 Burst Modes 16

 4.2.3 Synchronization Type 16

 4.2.4 Sampling Frequency & Bit Depth 16

 4.2.5 Cluster Descriptors 16

 4.3 Power Considerations 18

 4.3.1 Power Domains 18

5 Topologies 19

 5.1 BAOF Topology 19

 5.2 BAIF Topology 19

 5.3 BAIOF Topology 20

6 Descriptors 22

 6.1 Standard Descriptors 22

 6.2 Interface Descriptors 22

 6.2.1 Interface Association Descriptor 22

 6.2.2 AudioControl Interface Descriptors 22

 6.2.3 AudioControl Endpoint Descriptors 30

 6.2.4 AudioStreaming Interface Descriptors 30

 6.3 String Descriptors 34

7 Requests 35

 7.1.1 Standard Requests 35

 7.1.2 Class-specific Requests 35

8 BADD Profiles 37

8.1	Generic I/O Profile.....	37
8.2	Headphone Profile	38
8.3	Speaker Profile	39
8.4	Microphone Profile	40
8.5	Headset Profile.....	40
8.6	Headset Adapter Profile.....	41
8.7	Speakerphone Profile.....	42

LIST OF TABLES

Table 4-1: Mono Cluster Descriptor 17

Table 4-2: Stereo Cluster Descriptor 18

Table 6-3: Interface Association Descriptor 22

Table 6-4: Standard AC Interface Descriptor 23

Table 6-5: Class-Specific AC Interface Header Descriptor 23

Table 6-6: Input Terminal ID1 Descriptor 24

Table 6-7: Input Terminal ID4 Descriptor 24

Table 6-8: Output Terminal ID3 Descriptor 25

Table 6-9: Output Terminal ID6 Descriptor 25

Table 6-10: Connectors Descriptor 26

Table 6-11: Connectors Descriptor 26

Table 6-12: Mixer Unit Descriptor 27

Table 6-13: Feature Unit ID2 Descriptor 27

Table 6-14: Feature Unit ID5 Descriptor 28

Table 6-15: Feature Unit ID7 Descriptor 28

Table 6-16: Clock Source Descriptor 29

Table 6-17: Power Domain ID10 Descriptor 29

Table 6-18: Power Domain ID11 Descriptor 30

Table 6-19: Standard AC Interrupt Endpoint Descriptor 30

Table 6-20: Standard AS Interface Descriptor (Alt. Set. 0) 31

Table 6-21: Standard AS Interface Descriptor 31

Table 6-22: Class-Specific AS Interface Descriptor 32

Table 6-23: Standard AS Isochronous Audio Data Endpoint Descriptor 33

Table 6-24: Class-Specific AS Isochronous Audio Data Endpoint Descriptor 33

Table 6-25: Standard AS Explicit Feedback Endpoint Descriptor 33

Table 8-26: Number of Channels 37

Table 8-27: Generic Profile Descriptor Variables 38

Table 8-28: Headphone Profile Descriptor Variables 39

Table 8-29: Speaker Profile Descriptor Variables 39

Table 8-30: Microphone Profile Descriptor Variables 40

Table 8-31: Headset Profile Descriptor Variables 41

Table 8-32: Headset Adapter Profile Descriptor Variables 42

Table 8-33: Speakerphone Profile Descriptor Variables 43

LIST OF FIGURES

Figure 5-1: BAOF Topology 19
Figure 5-2: BAIF Topology..... 20
Figure 5-3: BAIOF Topology 21

1 INTRODUCTION

1.1 SCOPE

The *USB Audio Device Class Definition for Basic Audio Functions* applies to all USB Audio Functions that are based on the *Universal Serial Bus Device Class Definition for Audio Devices Release 3.0*. It defines baseline audio functionality for all ADC 3.0 compliant Hosts and Devices.

1.2 PURPOSE

The purpose of this specification is to create a higher level of interoperability among Hosts and Audio Devices. By establishing a set of essential audio features, users can expect a consistent experience, Device manufacturers have a solid template to follow, and Host drivers may be simplified.

1.3 RELATED DOCUMENTS

- *Universal Serial Bus Specification, Revision 2.0* (referred to in this document as the *USB Specification*). In particular, see Chapter 5, “USB Data Flow Model” and Chapter 9, “USB Device Framework.”
- *Universal Serial Bus 3.1 Specification, Revision 1.0* (referred to in this document as the *USB 3.1 Specification*). This document covers details specific to SuperSpeed and SuperSpeed+ devices.
- *Universal Serial Bus Device Class Definition for Audio Devices Release 3.0* (referred to in this document as Audio 3.0 Specification or ADC 3.0 in short).
- *Universal Serial Bus Device Class Definition for Audio Data Formats Release 3.0* (referred to in this document as Audio 3.0 Data Formats).
- *Universal Serial Bus Device Class Definition for Terminal Types Release 3.0* (referred to in this document as Audio 3.0 Terminal Types).
- Device Class Definition for Human Interface Devices (HID) Version 1.11. June 27, 2001.
- *HID Usage Tables* Version 1.12. October 28, 2004. Please visit www.usb.org for the latest additions to the HID Usage Tables.

1.4 TERMS AND ABBREVIATIONS

This section defines terms used throughout this document. For additional terms that pertain to the Universal Serial Bus, see the “Terms and Abbreviations” section in the *USB Specification* and for terms that pertain to the Audio Device Class, see the “Terms and Abbreviations” section in the *Audio 3.0 Specification*.

Note: the terms “Audio Device” and “Audio Function” are used interchangeably in this document. Since audio functionality always resides at the interface level, the term Audio Device is strictly speaking only valid for devices **that contain audio functionality only**.

BADD:	Acronym for Basic Audio Device Definition.
BAIF:	Acronym for Basic Audio Input Function.
BAIFT:	Acronym for Basic Audio Input Function Topology.
BAIOF:	Acronym for Basic Audio Input/Output Function.
BAIOFT:	Acronym for Basic Audio Input/Output Function Topology.
BAOF:	Acronym for Basic Audio Output Function.
BAOFT:	Acronym for Basic Audio Output Function Topology.