

INTERNATIONAL STANDARD

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**Universal serial bus interfaces for data and power –
Part 2: Universal serial bus – Micro-USB cables and connectors specification,
revision 1.01**

**Interfaces de bus universel en série pour les données et l'alimentation
électrique –
Partie 2: Bus universel en série – Spécification des câbles et connecteurs
micro-USB, révision 1.01**



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UNIVERSAL SERIAL BUS INTERFACES FOR DATA AND POWER –

**Part 2: Universal serial bus –
Micro-USB cables and connectors specification, revision 1.01**

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FDIS	Report on voting
100/2153/FDIS	100/2184/RVD

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INTRODUCTION

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IEC 62680-1, *Universal Serial Bus interfaces for data and power – Part 1: Universal Serial Bus Specification, Revision 2.0*

IEC 62680-2, *Universal Serial Bus interfaces for data and power – Part 2: USB Micro-USB Cables and Connectors Specification, Revision 1.01*

IEC 62680-3, *Universal Serial Bus interfaces for data and power – Part 3: USB Battery Charging Specification, Revision 1.2*

IEC 62680-4, *Universal Serial Bus interfaces for data and power – Part 4: Universal Serial Bus Cables and Connectors Class Document Revision. 2.0*

This part of the IEC 62680 series consists of several distinct parts:

- the main body of the text, which consists of the original specification and all ECN and Errata developed by the USB-IF.

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Universal Serial Bus Micro-USB Cables and Connectors Specification

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Revision	Issue Date	Comment
0.6	1/30/2006	Revisions to all sections
0.7	3/24/2006	Added revised Micro-USB drawings to Rev.0.8
0.8	4/19/2006	Editorial changes and additions by Jan Fahlund (Nokia)
0.8b	4/26/2006	Corrections to the 0.8 version (based by comments from contributors)
0.9	6/7/2006	Corrections based on comments from the 0.8b version
1.0RC	8/2/2006	Added lubricant recommendation, LLRC delta change specified
1.01RC	11/10/2006	Editorial changes and addition based on Oct-06 USB-IF CCWG meeting.
1.02RC	12/10/2006	Shell material thickness tolerances changed so that material can be 0.25 mm or 0.3 mm; edited three pictures (Figure 4-10, 4-11 and 4-12).
1.03RC	12/11/2006	Two pictures edited (Figure 4-8 and 4-9). In fig 4-8 max height to be 2.8mm MAX. In fig 4-9 R0.25mm MAX to be R0.30mm MAX.
1.0RC3	12/19/2006	For BoD approval
1.0	1/12/2007	Approved
1.0	1/22/2007	Cosmetic edits for publication
1.01	4/4/2007	Editorial corrections and additions to contributor list. Reinserted shell and plug material requirements as section 6.10. Clarified wording on Plating Recommendations.

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1 Introduction

1.1 General

USB has become a popular interface for exchanging data between cell phone and portable devices. Many of these devices have become so small it is impossible to use standard USB components as defined in the USB 2.0 specification. In addition the durability requirements of the Cell Phone and Portable Devices market exceed the specifications of the current interconnects. Since Cell Phones and other small Portable Devices are the largest market potential for USB, this specification is addressing this very large market while meeting all the requirements for electrical performance within the USB 2.0 specification.

1.2 Objective of the Specification

The purpose of this document is to define the requirements and features of a Micro-USB connector that will meet the current and future needs of the Cell Phone and Portable Devices markets, while conforming to the USB 2.0 specification for performance, physical size and shape of the Micro-USB interconnect.

This is not a stand-alone document. Any aspects of USB that are not specifically changed by this specification are governed by the USB 2.0 Specification and USB On-The-Go Supplement.

1.3 Intended Audience/Scope

Cell phone and Portable Devices have become so thin that the current Mini-USB does not fit well within the constraints of future designs. Additional requirements for a more rugged connector that will have durability past 10,000 cycles and still meet the USB 2.0 specification for mechanical and electrical performance was also a consideration. The Mini-USB could not be modified and remain backward compatible to the existing connector as defined in the USB OTG specification.

1.4 Related Documents

USB 2.0

USB OTG Supplement

2 Acronyms and Terms

This chapter lists and defines terms and abbreviations used throughout this specification.

A-Device	A device with a Type-A plug inserted into its receptacle. The A-device supplies power to VBUS and is host at the start of a session. If the A-device is On-The-Go, it may relinquish the role of host to an On-The-Go B-device under certain conditions,
Application	A generic term referring to any software that is running on a device that can control the behavior or actions of the USB port(s) on a device.
B-Device	A device with a Type-B plug inserted into its receptacle. The B-device is a peripheral at the start of a session. If the B-device is OTG, it may be granted the role of host from an OTG A-device.
DIP-type	A connector with contact and shield solder tails that are soldered through the printed circuit board
FS	Full Speed (max 12Mb/s)
Higher than HS	(480Mb/s ---> 5 Gb/s)

HS	High Speed (max 480 Mb/s)
Host	A physical entity that is attached to a USB cable and is acting in the role of the USB host as defined in the USB Specification, Revision 2.0. This entity initiates all data transactions and provides periodic Start of Frames.
HNP	Host Negotiation Protocol
ID	Identification. Denotes the pin on the Micro connectors that is used to differentiate a Micro-A plug from a Micro-B plug.
LS	Low Speed (max 1,5 Mb/s)
Midmount-type	A connector that is mounted in a cut-out in the printed circuit board between the top and bottom surfaces.
OTG	On-The-Go
OTG device	A device with the host and peripheral capabilities
Peripheral	A physical entity that is attached to a USB cable and is currently operating as a “device” as defined in the USB Specification, Revision 2.0. The Peripheral responds to low level bus requests from the Host.
PCB	Printed circuit board
USB	Universal Serial Bus
USB-IF	USB Implementers Forum

3 Significant Features

This section identifies the significant features of the Micro-USB specification. The purpose of this section is not to present all the technical details associated with each major feature, but rather to highlight its existence. Where appropriate, this section references other parts of the document where further details can be found.

3.1 USB 2.0 Specification Compliance

Any device with Micro-USB features is first and foremost a USB peripheral that is compliant with the USB 2.0 specification.

3.2 On-The-Go Device

Any OTG Micro-USB device shall conform to the OTG requirements as set forth in the On-The-Go Supplement to the USB 2.0 Specification.

3.3 Connectors

The USB 2.0 specification defines the following connectors:

- Standard-A plug and receptacle,
- Standard-B plug and receptacle, and
- Mini-B plug and receptacle.

The Micro-USB specification defines the following additional connectors:

- Micro-B plug and receptacle
- Micro-AB receptacle
- Micro-A plug.

The Micro-AB receptacle is only allowed on OTG products. All other uses of the Micro-AB receptacle are prohibited. The Micro-AB receptacle accepts either a Micro-A plug or a Micro-B plug.

It is recommended that the Micro-AB continue to support HNP as requested and support full functionality as a peripheral when a Micro-B plug is inserted.

3.4 Compliant Cable Assemblies

The USB 2.0 specification defines the following cables:

- Standard-A plug to Standard-B plug,
- Standard-A plug to Mini-B plug, and
- Captive cable with Standard-A plug.

The Micro-USB specification defines the following additional cables:

- Micro-A plug to Micro-B plug,
- Micro-A plug to Standard-A receptacle
- Micro-B plug to Standard-A plug, and
- Hardwired Captive cable with Micro-A plug. (Hardwired Captive cable is a cable, connected internally to a device, which is not designed to be removed by the end user of that device.)

No other types of cables are allowed by either the USB specification, or by the OTG supplement. Cables are not allowed to have receptacles on either end unless they meet the mechanical and electrical requirements of adapters defined in this document.

3.5 Plug Overmolds

The Micro-USB specification constrains the size and the shape of the overmolds for the Micro-A and Micro-B plugs.

The Micro-A plug's overmold has a rectangular shape, and the Micro-B plug's overmold is rectangular with chamfers. This allows easy recognition and differentiation of the two plugs by the consumer. See pictures Figure 4-4 and Figure 4-5.

4 Cables and Connectors

4.1 Introduction

This chapter provides the mechanical and electrical specifications for the cables, connectors and cable assemblies used to interconnect devices as well as constraints on the design of the overmolds for the Micro-A and Micro-B plugs.

4.2 Micro-Connector Mating

The following table summarizes the plugs accepted by each of the receptacles.

Table 4-1. Plugs Accepted By Receptacles

Receptacle	Plugs Accepted
Standard-A	Standard-A
Standard-B	Standard-B
Mini-B	Mini-B
Micro-B	Micro-B
Micro-AB	Micro-A or Micro-B

The usage and wiring assignments of the five pins in the Micro-A plug are defined in the following table.

Table 4-2. Micro-A Plug Pin Assignments

Contact Number	Signal Name	Typical Wiring Assignment
1	VBUS	Red
2	D-	White
3	D+	Green
4	ID	<Ra_PLUG_ID
5	GND	Black
Shell	Shield	Drain Wire

The ID pin on a Micro-A plug shall be connected to the GND pin. The ID pin on a Micro-B plug is not connected or is connected to ground by a resistance of greater than Rb_PLUG_ID (100kΩ MIN). An On-The-Go device is required to be able to detect whether a Micro-A or Micro-B plug is inserted by determining if the ID pin resistance to ground is less than Ra_PLUG_ID (10Ω MAX) or if the resistance to ground is greater than Rb_PLUG_ID. Any ID resistance less than Ra_PLUG_ID shall be treated as ID = FALSE and any resistance greater than Rb_PLUG_ID shall be treated as ID = TRUE.

4.3 Color Coding

The following colors are mandated for the plastic inside the Micro-USB connectors defined in this specification.

Table 4-3. Color Coding for Plugs and Receptacles

Connector	Color
Micro-A plug	White
Micro-B receptacle	Black
Micro-B plug	Black
Micro-AB receptacle	Gray

4.4 Device, Cable and Adapter Delays

In Figure 7-11 of the USB 2.0 specification, four test planes are defined along the transmission path from the host transceivers to the peripheral transceivers. These test planes (TP) are as follows:

- TP1: pins of host transceiver chip
- TP2: contact points of host Standard-A receptacle
- TP3: contact points of peripheral Standard-B or Micro-B receptacle
- TP4: pins of peripheral transceiver chip

The maximum total delays are as follows:

- On-The-Go device - TP1 to TP2: 1 ns
- Adapter: 1 ns
- Any cable with a Micro-A or Micro-B plug: 10 ns

The maximum delays for the two worst cases of connection are shown in the following tables.