C H A P T E R   7

USB

This chapter presents the requirements and recommendations for Universal Serial Bus (USB).

USB provides an expandable, hot-pluggable Plug and Play serial interface that ensures a standard, low-cost socket for adding external peripheral devices ranging from interactive HID devices such as joysticks and pointing devices to isochronous devices such as telephony, audio, and imaging devices. USB allows cascading hubs that can be integrated into desktop devices such as monitors and keyboards.

USB is required on all PC 99 systems, and migration of I/O devices from legacy ports to USB is recommended. In particular, the joystick, pointing device, and keyboard devices that ship with PC systems should be USB.

Any device that plugs into a USB port is considered a USB device and must comply with the requirements defined in these guidelines. If the device provides the capabilities of one or more functions or it provides a hub to the host, it must comply with the requirements in this chapter.

Manufacturers should ensure that their USB devices are tested at the compatibility workshops provided by the USB Implementers Forum.

Contents

USB Basic Requirements

This section summarizes the basic USB design requirements.

7.1. System includes USB with two USB ports, minimum
Required for all system types, with exceptions for mobile PCs
USB must be included on all PC 99 system types.

Mobile PC Note   At least two USB ports are required for every system type except Mobile PC, which must include at least one USB port. USB support must be provided for the full bandwidth specified in the *USB Specification, Version 1.0* or later.

When a system has more than one host controller, each host controller must provide full bandwidth and isochronous support. Host controllers should be located on the PCI bus to meet this requirement.

7.2. Systems include BIOS support for USB keyboards and hubs
Required
PC 99 systems, except those with captive keyboards, such as a mobile PC system, must have BIOS support for USB keyboards and hubs. This support must provide the ability for the user to enter the BIOS setup utility and also provide enough functionality to install and boot a USB-aware operating system. USB keyboards built as standalone devices, part of a composite device, or part of a compound device must all be recognized and usable. The BIOS is required to support keyboards behind at least one level of external hubs.

For systems with multiple USB host controllers, BIOS support for USB keyboards and hubs is required for at least one of the host controllers.

7.3. All USB hardware complies with USB 1.0 specification
Required
Recommended: All USB hardware complies with USB 1.1 specification.

All USB hardware must comply with *USB Specification, Version 1.0,* and should comply with *USB Specification, Version 1.1*. Compliance with the USB specification ensures that USB hardware has complete Plug and Play capabilities and is implemented in a standard way. Compliance with this requirement is demonstrated on the compliance process of the USB Implementers Forum.

For example, on any system with USB capabilities, a user must be able to dynamically attach any USB peripheral to any USB connector. The operating system should automatically recognize it, load and initialize the appropriate drivers, and make the device available for use.

7.4. Connections use USB icon

Required

USB icons are required for external cables, connecting cables, and connection ports. The icon can be molded, printed, or affixed as a permanent sticker. Because the location and number of USB ports can vary, appropriate icons on ports and cables are important ease-of-use factors.

Icons can be based on vendor designs or vendors can use the recommended USB icon defined in Chapter 6 of the USB 1.1 specification and illustrated here:

> The USB icon should be molded into the connector and also placed on the product for ease of identifying the USB port. It is recommended that the icon on the product and the one on the plug be adjacent to each other when the plug and receptacle are mated. This icon can be used for both series A and B connector schemes. On the plug, there should be a 0.635-mm rectangular recessed area around the icon such that there is a perceptible feel of the icon.

7.5. Devices and drivers support maximum flexibility of hardware interface options

Required

Device and driver designs must provide maximum flexibility for interface options so that the operating system or other resource manager can coordinate user preferences, allowing multiple devices and applications simultaneously.

- **7.5.1. Devices and drivers provide multiple alternate settings.** Devices and drivers must provide multiple alternate settings for each interface where any alternate setting consumes isochronous bandwidth.

- **7.5.2. Devices and drivers must not use isochronous bandwidth for alternate setting 0.** Devices should consume bandwidth only when the device is being used.

USB Host Controller Requirements

This section summarizes USB class specifications and standards for host controllers.

7.6. USB host controller meets either OpenHCI or UHCI specification

Required

The host controller must comply with the specifications for either *Open Host Controller Interface* (OpenHCI), published by Compaq, Microsoft, and National Semiconductor, or *Universal HCI* (UHCI), published by Intel. Hardware manufacturers who design to one of these specifications are not required to

provide an additional device driver for their host controller under the Windows or Windows 2000 Professional operating systems.

Multiple OpenHCI and UHCI USB controllers are supported concurrently by the operating system.

7.7. USB host controller can wake the system
Required

The USB host controller must support wake-up capabilities in at least one of the following system states: S1 or S2. Supporting wake-up from the S3 state is recommended. Notice that if wake-up from the S2 state is supported, wake-up from the S1 state must also be supported. Similarly, if wake-up from the S3 state is supported, wake-up from the S1 and S2 states must be supported.

Supporting wake-up from S3 is expected to become a requirement in future versions of these guidelines.

If the system contains multiple USB host controllers, only one is required to support wake-up capability, although it is recommended that all host controllers support wake-up capability.

USB Hub Requirements

This section summarizes USB class specifications and standards for hubs.

7.8. USB hubs comply with USB 1.1 specification
Recommended

The *USB Specification, Version 1.1*, defines requirements for USB hubs that resolve some ambiguities and other problems in the original 1.0 specification.

7.9. Bus-powered USB hubs provide ports that can be individually power switched
Recommended

To minimize USB power consumption requirements, bus-powered hubs must provide ports that can be individually power switched. This contributes to the goal of reducing overall system power consumption. It is especially important in mobile environments, where power consumption must be absolutely controlled when the system is on battery power.

USB Power Management

This section summarizes the specific USB power management requirements.

7.10. Systems and devices comply with USB power management requirements

Required

PC 99 systems and devices must comply with the power management requirements in the *USB Specification, Version 1.0* or later.

In addition, all devices must comply with the Interface Power Management feature in the *USB Common Class Specification, Revision 1.0* or later.

Design Features for USB Peripherals

This section summarizes requirements related to bus-class specifications and standards for peripherals that use USB.

7.11. USB devices meet requirements in related USB device class specification

Required

A USB peripheral that fits into one of the USB device class definitions must comply with the related USB device class specification. USB class drivers in the operating system are implemented to support devices that comply with the particular device class specification.

Class driver extensions and WDM support provided in Windows 98 and Windows 2000 allow IHVs to innovate and differentiate their products while still meeting class compliance in their base operational modes.

Devices can use the generic class drivers provided with the operating system, or manufacturers can create drivers or WDM minidrivers, depending on the device class, to exploit any additional unique hardware features.

USB References

The following represents some of the references, services, and tools available to help build hardware optimized to work with Windows operating systems.

Default Device Class Power Management Specification, Version 1.0
http://www.microsoft.com/hwdev/specs/Pmref/PMdefault.htm

Intel information about USB, including the UHCI design guide for USB
http://developer.intel.com/design/litcentr/
http://developer.intel.com/design/usb/

Microsoft Windows 98 DDK, Windows 2000 DDK, and DirectX 5.0 DDK
http://www.microsoft.com/ddk/
(or MSDN Professional subscription)

OpenHCI: Open Host Controller Interface Specification for USB, Release 1.0a
http://www.microsoft.com/hwdev/respec/busspecs.htm

Definitions for Communications Devices, Version 1.0
USB Common Class Base Specification, Revision 1.0
USB Device Class Definition for Audio Devices, Version 0.9
USB Device Class Definition for Human Interface Devices (HID), Version 1.0
USB Device Class Definition for Mass Storage Devices, Revision 1.09
USB Device Class Definition for Printing Devices, Version 1.0
USB HID Usage Tables, Version 1.0
USB Imaging Class Specification
USB Monitor Control Class Specification, Revision 1.0
USB PC Legacy Compatibility Specification, Revision 0.9 or later
USB Specification, Version 1.0 or later
USB Usage Tables for HID Power Devices, Release 1.0
   Phone: (503) 264-0590
   Fax: (503) 693-7975
   http://www.usb.org/developers/index.html

White papers and guidelines for Microsoft operating systems
   http://www.microsoft.com/hwdev/usb/

Checklist for USB

If a recommended feature is implemented, it must meet the PC 99 requirements for that feature as defined in this document.

7.1. System includes USB with two USB ports, minimum
Required for all system types, with exceptions for mobile PCs

7.2. Systems include BIOS support for USB keyboards and hubs
Required

7.3. All USB hardware complies with USB 1.0 specification
Required

7.4. Connections use USB icon
Required

7.5. Devices and drivers support maximum flexibility of hardware interface options
Required

7.6. USB host controller meets either OpenHCI or UHCI specification
Required

7.7. USB host controller can wake the system
Required

7.8. USB hubs comply with USB 1.1 specification
Recommended

7.9. Bus-powered USB hubs provide ports that can be individually power switched
Recommended

7.10. Systems and devices comply with USB power management requirements
Required

7.11. USB devices meet requirements in related USB device class specification
Required