



Cypress USB 2.0 Mass Storage Device Driver for Windows

AN1255

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Associated Project: No

Associated Part Family: CY7C68300/01/20/21

Software Version: N/A

Associated Application Notes: None

Application Note Abstract

Microsoft Windows operating systems such as Windows 2000 and Windows XP were released with a USB Mass Storage Class (MSC) driver built into them. Because of this, no other device driver is required for a mass storage-compliant device to work on these operating systems. To achieve functionality beyond what the default Windows MSC drivers provide, Cypress offers a proprietary Mass Storage Class driver.

The Cypress USB Mass Storage Class Driver is compatible with Windows 2000 and Windows XP. This application note describes the features available in the Cypress driver, identifies the files included with the driver, describes how to get a digital signature, and shows how the driver can be customized.

Introduction

Microsoft Windows operating systems such as Windows 2000 and Windows XP were released with a USB Mass Storage Class (MSC) driver built into them. Because of this, no other device driver is required for a mass storage compliant device to operate on these operating systems. However, in these operating systems, the MSC driver's feature set is limited to the required features. To achieve functionality beyond what the MSC drivers provide, Cypress offers a proprietary Mass Storage Class driver. This application note describes additional features provided by the proprietary driver.

Note This document is not intended to describe how to create a Mass Storage driver. For more information on MSC drivers, see the [Microsoft website](#).

Background

The MSC driver included in Windows 2000 and Windows XP has basic functionality to communicate with mass storage devices through the USB 2.0 host. For many operations, this is completely satisfactory. In other cases, a customer wants additional functionality.

The Cypress driver has the following additional features:

- Provides support for interrupt-driven events.
- Gives the user the ability to hide the device from the tray icon.
- Allows custom strings to be displayed in Device Manager.

The Cypress MSC driver can be downloaded from the [Cypress web site](#). After the driver is downloaded, the .inf

file must be modified to include the VID/PID and strings for your company. This is required for the OS to use the Cypress driver. Instructions for modifying the VID/PID and custom strings can be found in the Customizing VID_PID document within the downloaded driver's folder.

Note The screenshots in this document are taken from the Windows 2000 operating system. If you are using a different Windows operating system, the operations may be slightly different but the core functionality remains the same. Refer to Windows Help in your OS for assistance in accessing Windows functions such as Device Manager.

Replacing the Default Driver

Because MSC Driver is already included in Windows, this driver is used as a default driver when any mass storage device is connected to the PC. After downloading the Cypress custom (MSC) driver, you must replace the default MSC driver with the newly downloaded driver. For more information on how to replace the driver, see the application note [How to Switch to a Cypress Customized Mass Storage Driver in a Windows Operating System - AN1158](#).

Accessing Driver Features

When the Cypress mass storage class driver is loaded, the Cypress tray icon will appear in the system tray. The easiest way to access the options available through the Cypress MSC driver is to right-click the Cypress icon. You should then see something similar to Figure 1. The text found in the pop-up box will be determined during enumeration from an identify command. In this case, an IBM-DJSA-210 HDD (Hard Disk Drive) was connected to the bridge chip. If multiple devices were enumerated using the Cypress MSC driver on the system, they would also be displayed in this list.

Figure 1



When you most the cursor to the pop-up box (in this case IBM-DJSA-210), you should see something similar to that shown in Figure 2. This is the easiest way to access the HDD security feature (Protect) and the driver properties. If the connected drive does not support security features or the driver has been modified to disallow the security features, the Protect selection will not be displayed.

Figure 2. Access Driver Options



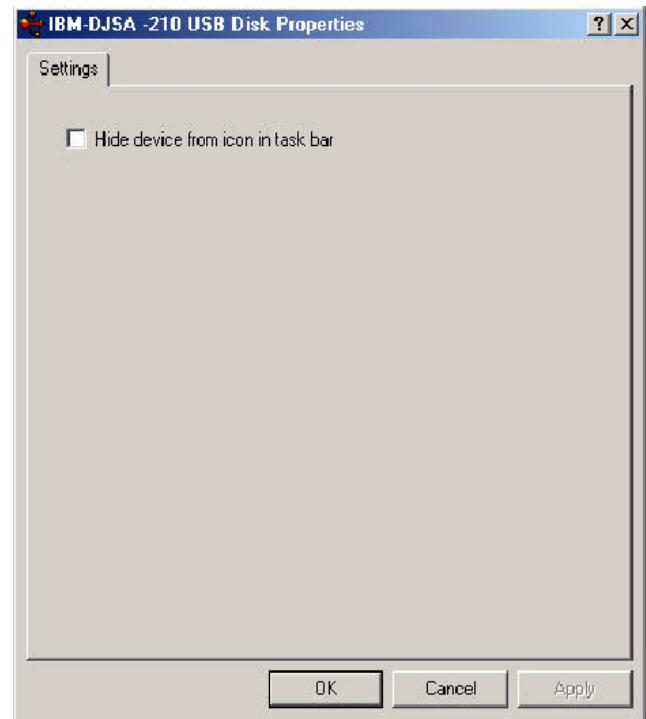
Safely Remove

The top selection shown in Figure 2 is labeled Safely Remove. A safe removal should always be done before a device is disconnected from the USB bus to ensure the cache is flushed. This will keep the device from losing or corrupting data. A safe removal will also make sure the device is not being accessed by another program and will alert the user if necessary.

Properties

When you select **Properties** in the pop-up menu from the tray icon (see Figure 2), the properties sheet appears as shown in Figure 3. There is an option in the properties sheet for hiding the device icon on task bar.

Figure 3. Properties Sheet



Hide Device from Icon Bar

When the **Hide device from icon in task bar** box is selected, the chosen device, in this example the IBM-DJSA-210 HDD, will be hidden in the system tray. If there is more than one device connected using the Cypress MSC driver, then by default all the devices will be shown when you select the tray icon. By selecting **Hide device from icon in task bar**, that device will no longer show up in the list of devices. If there is only one device connected with the Cypress driver, then the tray icon associated with the Cypress driver will no longer be visible.

To make the tray icon visible in the system tray again, you must go to Device Manager to get access to the driver. To do this, right-click on My Computer (in Windows XP "My Computer" is accessed from the "Start" bar) and select **Properties** as shown in Figure 4.

Next, select Device Manager in the Hardware Page as shown in Figure 6. Again accessing Device Manager in the different versions of Windows varies slightly. By default the tray icon is displayed, but there are some cases where you may want the tray icon to be off by default. To do this, you can modify the appropriate information file (tpp300.inf). For more details on how set the defaults, see the [Flags \(.inf file configurable\)](#) section of this document. You must do this before the driver is installed. If done after installation, the operating system will make registry modifications and the changes you make will not take effect.

Figure 4



Figure 5 shows a typical Device Manager window with the USB controllers section expanded. In this case there are two devices enumerated on the system. One is using the Microsoft Mass Storage Class driver while the other device is using the Cypress Mass Storage Class driver. The string displayed for the Cypress driver will vary depending on the customization done in the driver for each Vendor ID (VID) and Product ID (PID). To access the property sheet for the Cypress driver, right-click the Cypress driver string, which in this example is "USB Storage Adapter V3 (TPP)". You will then see the driver property sheet shown in Figure 6 and the tray icon can be turned back on.

Figure 5

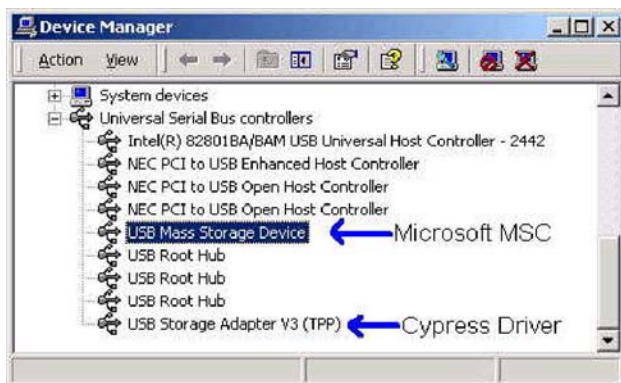
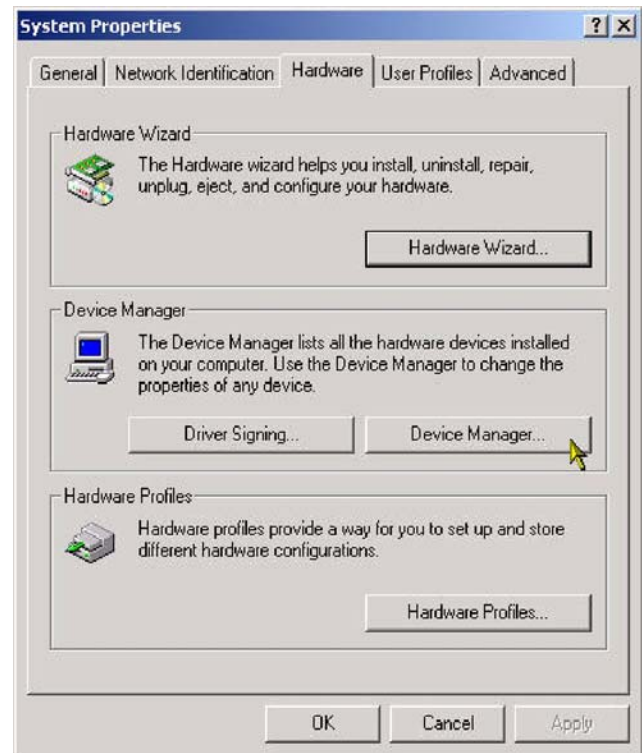


Figure 6



Interrupt Support

The Cypress Mass Storage driver has support for interrupt-driven events. Interrupts are received by the Cypress MSC driver and held until a background application, TPPALDR (AutoLoader), polls the driver and detects the interrupt. The polling interval for TPPALDR can be set via registry entry.

When the Cypress driver loads, TPPALDR is also launched. It in turn can be set up to spawn an interrupt handling application. Presently, the application that TPPALDR spawns is the tray icon application to safely remove the device. When TPPALDR detects an interrupt, it broadcasts the information so any application on the system can monitor the interrupts generated from the AT2LP.

TPPALDR can be configured in the .INF file to load a different application, additional applications, or no application at all. If configured not to load the system tray application, then the tray icon would no longer appear, but interrupts would still be enabled.

The following lines show an example of the inf file where the application and polling interval is specified.

```
[CY_FX_AT.AddRegNT.AutoLoader]
```

```
HKR,,AutoLoader,,"CY_NINT.exe" ;This line specifies  
CY_NINT.exe is executed when an interrupt is generated.
```

```
HKR,,ALTimer,0x00010001,3000; This line specifies that  
the polling interval is 3 seconds.
```

The full interrupt support is beyond the scope of this application note and is mentioned here merely to make the reader aware of the interrupt functionality.

Driver File Definition

The driver consists of several files. The filenames are shown in the following list with their Cypress default names. Starting with version 6.0 of the Cypress MSC driver, the first three letters of the filename can be customized for individual customers on request (contact your local Sales/FAE for assistance in this process).

Note The various .inf files communicate the pertinent information to the OS for the proper installation of the driver.

- **cy_fx_at.inf:** Windows information file for storage products based on EZ-USB FX™, EZ-USB FX2™, and EZ-USB AT2™.
- **cy_fx_at.sys:** System driver file for storage products based on EZ-USB FX, EZ-USB FX2 and EZ-USB AT2.
- **cy_bg.exe:** Autoloader background application.
- **cy_nint.exe:** System tray application for Windows 2000 and Windows XP.
- **cy_ui16.dll:** 16-bit user interface library (Property sheet).
- **cy_ui32.dll:** 32-bit user interface library (Property sheet).
- **cy_un.exe:** Uninstaller program called by Add/Remove programs in Control Panel.
- **cy_coins.dll:** Co-installer (starts tppaldr.exe at plug-and-play installation).

Note Other files exist in the driver folder. These files are for obsolete products and are kept in the folder for historical reasons.

Driver Signing

The Cypress Mass Storage Driver is not a signed driver. In Windows XP, you are warned that the driver is not signed and that by installing the driver the system could become unstable, as seen in Figure 7.

The Cypress driver is not signed for two reasons:

- Any time any portion of a driver changes, the driver must get a new digital signing procedure.
- Because each customer has a unique VID and PID and unique hardware, complete signing by WHQL (Windows Hardware Quality Lab) is done with the vendor's hardware. This prohibits Cypress from being able to provide a signed driver for each of its customers.

Figure 7



Cypress recommends that customers get the driver certified from WHQL. For the WHQL signing procedure, see the application note [Windows Hardware Quality Lab Signing Procedure](#).

Starting with Version 6.0 of the Cypress MSC driver, it is possible to get a unique GUID and custom filenames for each customer. To request this feature, contact your local Sales/FAE.

Flags (.inf file configurable)

The Cypress driver's features can be modified during the initial installation by modifying the flags. After the driver is installed, the values of the flags are recorded in the registry. This means that if you modify the flags at a different time other than initial installation time, you must completely uninstall the driver and reinstall it. This also may require editing the registry.

Configurable Flags

The .inf file (cy_fx_at.inf) can be modified for the various options. The flags are set or cleared in the CY_FX_AT entry found under the [CY_FX_AT.AddReg.Flags] section in the .inf file. In cy_fx_at.inf, the CY_FX_AT entry would normally be set to:

```
[CY_FX_AT.AddReg.Flags]
HKR,,BridgeFlags,0x00010001,0x00000001
```

There are two double words (dWord) in this entry. The first dWord indicates that the Windows Registry entry is a dWord. The second dWord is 0x00000001. Table 1 shows a mapping of the bits.

Bit 3 of Byte 2 enables interrupt-driven events.

Bit 1 of Byte 0, which in the example is set to 0, controls the "Disable Performance enhancements" feature in the property sheet. Because this feature is not available in AT2LP, it is disabled. It should never be set to 1.

Bit 0 of Byte 0 enables the visibility of the tray icon in the system tray.

Table 1. CY_FX_AT Flags

Byte	Byte 3				Byte 2				Byte 1				Byte 0															
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0				
Val	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

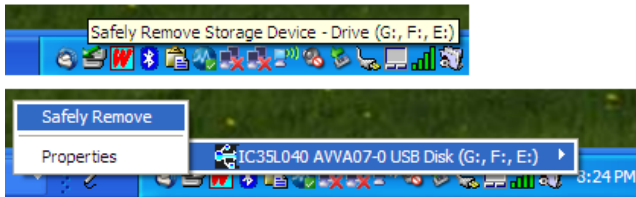
Returning to the Default Driver

In some cases, you may want to return to the default Windows mass storage class (MSC) driver from the Cypress MSC driver. The following section gives a step-by-step replacement procedure. The screenshots shown are taken from a Windows XP system. If you are using a different Windows operating system, the operations explained may be slightly different but the core functionality remains the same.

Removing Cypress MSC driver

Right-click the system tray icon of the Cypress driver. A pop-up appears, asking you to safely remove the storage device, as shown in Figure 8.

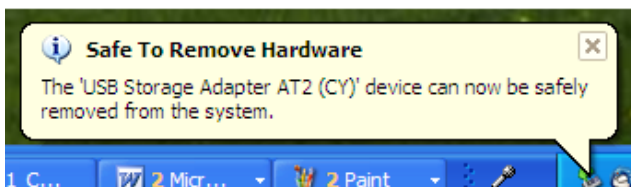
Figure 8



Click the **Safely remove** option. The mass storage drives attached to AT2LP hardware are removed. You can go to **My Computer** and confirm the removal.

After the removal, the following message appears.

Figure 9



Right-click **My Computer** and the options appear as shown in Figure 10. Select **Properties**.

Figure 10



In the System Properties sheet (as shown in Figure 11), select the **Hardware** tab. Click the **Device Manager** button.

Figure 11

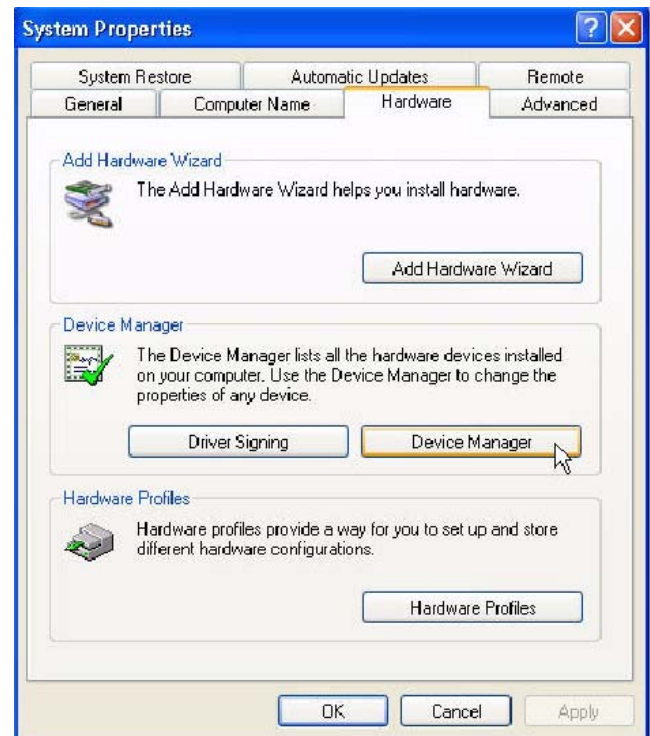
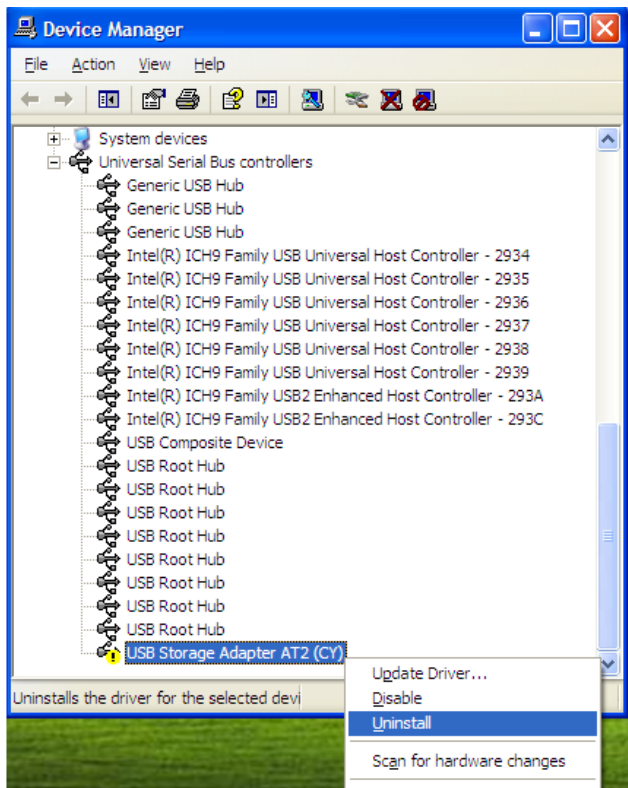


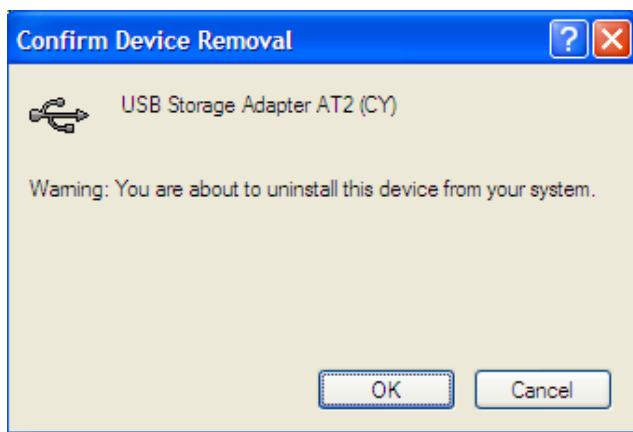
Figure 12 shows a typical Device Manager with the Universal Serial Bus Controllers section expanded. Note that in this window, the Cypress Mass Storage Devices is enumerated on the system 'USB Storage Adapter AT2(CY)'. Right-click **Cypress mass storage device** and select the Uninstall option, as shown in Figure 12.

Figure 12



Now the Cypress MSC driver uninstall will start and you will see the device removal confirmation warning as shown in Figure 13. Select **OK**. After the uninstall, you are asked whether you want to restart your computer. Select **Yes** and let the computer restart. (Do not disconnect the target hardware.)

Figure 13



Installing the Windows Default MSC Driver

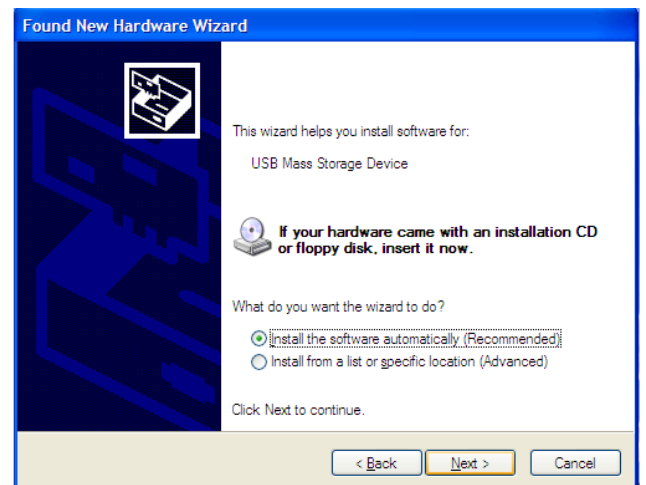
After Windows starts, because the target hardware is still connected to the host PC, Windows will find a new device and will start the **Found New Hardware** wizard automatically as shown in Figure 14.

Figure 14



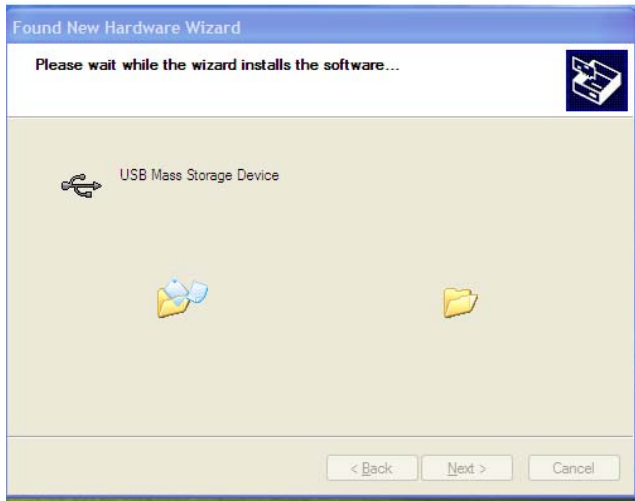
The wizard will ask if you want to connect to Windows Update to search for software. Select **Yes** and then select **Next**. Now the wizard will ask if you want to install the software automatically (recommended way). Select **Next** and continue as shown in Figure 15.

Figure 15



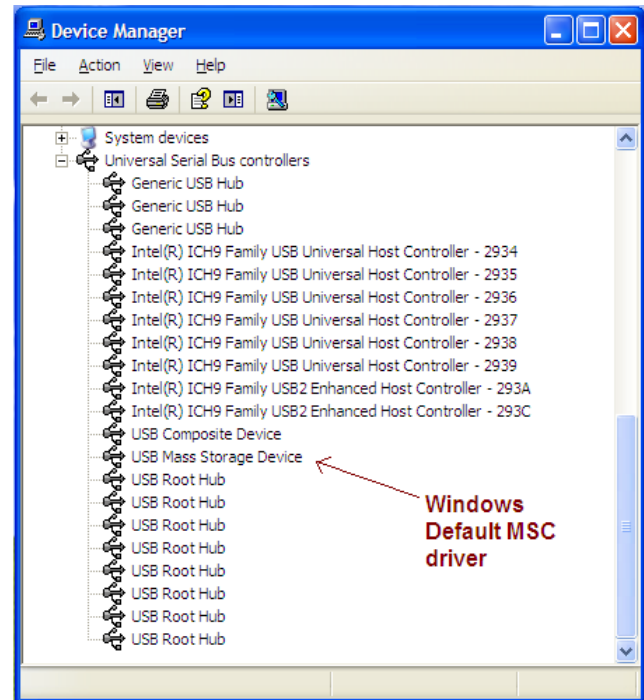
Now the wizard will start the Windows default MSC driver installation. It may ask for the Windows logo; if asked then select **Continue Anyway** and let the full install occur. The procedure is shown in Figure 16.

Figure 16



After the installation is complete, follow the instructions given and then go to Device Manager. Figure 17 shows a typical Device Manager with the Universal Serial Bus Controllers section expanded. As shown in the figure, the mass storage device is shown as **USB mass storage device** instead of **USB Storage Adapter AT2(CY)**. This confirms that the Windows default MSC driver has been reinstalled.

Figure 17



Document History

Document Title: Cypress USB 2.0 Mass Storage Device Driver for Windows

Document Number: 001-67620

Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	3178386	SSJO	02/21/2011	New application note

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