

# Twister USB Flash Drive

## A Technical Description





## General Description

A universal serial bus (USB) flash drive is a small, portable flash memory card that plugs into a computer's USB port and functions as a portable hard drive. Other common names for a flash drive include: **memory stick**, **thumbdrive**, **jumpdrive**, or simply **USB**.

USB flash drives typically have a metal or plastic housing, and one end is fitted with a Standard-A USB plug. That plug allows the flash drive to be plugged directly into a USB port on a computer or other device. The flash drive will only start when inserted into a USB port, as it draws the electricity it needs from the computer or device.

Inside the casing is a small printed circuit board (PCB), which has some power circuitry and a small number of surface-mounted integrated circuits (ICs). Typically, one of these circuits, known as a USB Mass Storage Controller Device, provides an interface between the USB connector and the onboard memory. Another essential IC is the flash memory. This circuit is where the data is stored on the flash drive. When people refer to how many gigabytes their drive holds, they are referring to this part of the flash drive.

The most common use of USB flash drives is transferring data files, images and applications between computers at different locations. The USB flash drive can also be used for computer repair and system management, or even used to boot-up a computer instead of from its hard drive.

### ***The Advancement of Flash Drives***

*IBM was one of the first companies to sell flash drives commercially. IBM's first model was introduced December 15, 2000 and could hold 8 megabytes (MB) of storage. As technology has advanced, the design has been streamlined and shrunk, while the capacity has been greatly upgraded. Kingston Technology recently released the DataTraveler® HyperX 3.0 Flash drive, which can hold up to 256 gigabytes (GB) of data.*

# Description of the Main Parts of a Twister USB Flash Drive

## Overview

The Twister USB flash drive consists of two main sections: the protective outer casing, and the internal electronic components. The flash drive's physical measurements are:

Length (closed):	51 mm (2.01 inches)
Length (open):	71 mm (2.80 inches)
Width:	19 mm (0.75 inches)
Height:	8 mm (0.31 inches)
Weight:	12.06 grams (0.43 ounces)

## 1. External Components

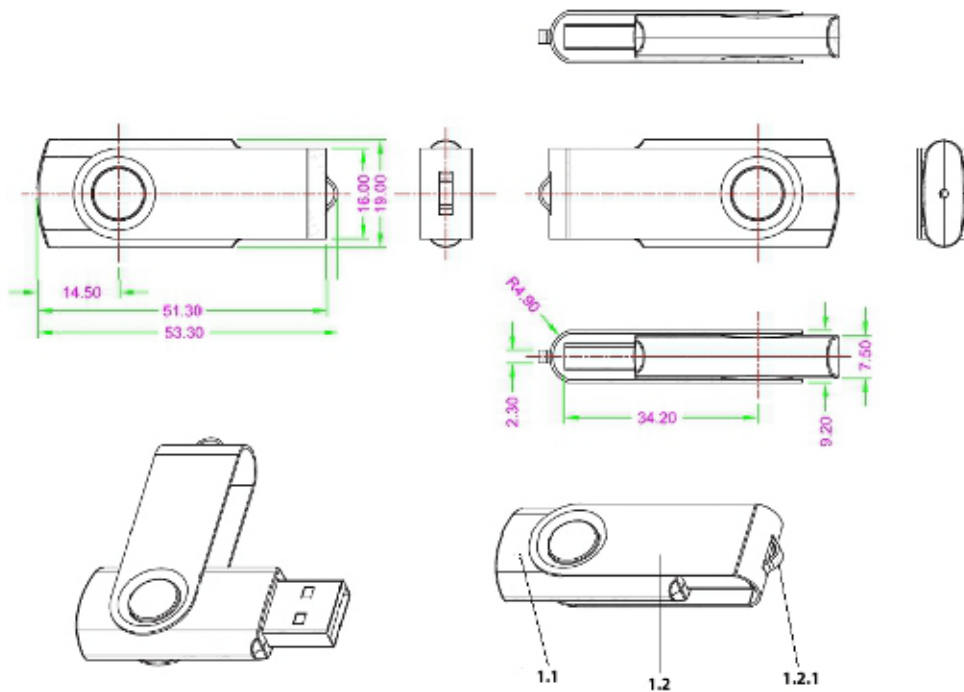


Figure 1: External View

External Components of a Twister USB Flash Drive	
1.1	Plastic Casing
1.2	Rotating Metal Shell
1.2.1	Attachment Loop

### **1.1 Plastic Casing**

The plastic casing is made of matte black plastic from recycled sources. It measures 36.8 mm long, 19 mm wide and 7.5 mm high. One end is fitted with a USB Standard-A Plug (2.1). The opposite end is slightly rounded. The plastic has a textured surface, which makes it easy to grasp. The plastic used in the casing is Acrylonitrile Butadiene Styrene (ABS) plastic, which is extremely durable and resistant to impact. The purpose of the plastic casing is to protect the internal components from damage.

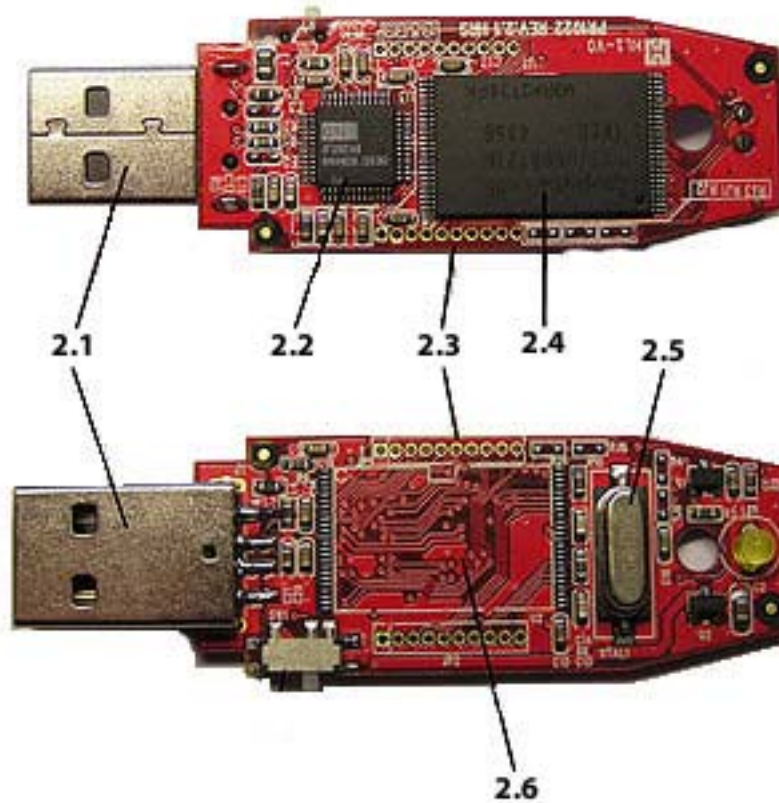
### **1.2 Rotating Metal Shell**

The rotating metal shell is made of aluminum from recycled sources with a brushed finish. It is U-shaped, fastened to the top and bottom of the plastic casing (1.1). It is fastened to the plastic casing with a swivel point located 14.5 mm from the rounded end of the plastic casing. It is 34.2 mm long from the center of the swivel point, 16 mm wide, and is 9.2 mm high. The shell can be rotated 360 degrees around this swivel point. The rounded end curves in the same arc as a circle with a radius of 4.9 mm. It serves to protect the USB Standard-A Plug (2.1) from any damage.

#### **1.2.1 Attachment Loop**

This loop is located at the tip of the rounded edge of the rotating metal shell (1.2). It extends 2 mm from the shell and measures 8 mm wide, and 2.3 mm high. This loop is used to connect a split ring to the USB, allowing it to be connected to a keychain or lanyard for convenience.

## 2. Internal Components



**Figure 2:** Internal View

Internal Components of a Twister USB Flash Drive	
2.1	USB Standard-A Plug
2.2	USB Mass Storage Controller Device
2.3	Printed Circuit Board
2.4	NAND Flash Memory Chip
2.5	Crystal Oscillator
2.6	Space for Second Flash Memory Chip

### 2.1 USB Standard-A Plug

The USB plug physically attaches the flash drive to a USB port and provides connectivity to a computer or other multimedia device. The plug measures 12 mm long, 15.7 mm

wide, and 7.5 mm high. This part of the device is usually made of a simple conductive metal. The plug is located at one end of the printed circuit board (2.3).

## **2.2 USB Mass Storage Controller Device**

The controller device is an integrated circuit that functions as the 'brain' of the flash drive. It can be described as a 'computer-on-a-chip' as it has its own memory, it can process instructions and data, and has input / output functions. It is the part of the USB drive that communicates with the computer or device that the drive is plugged into. It houses a small microcontroller with read-only memory (ROM) and random access memory (RAM) that enables the controller to access the flash memory and retrieve the desired information. The controller device is mounted on the printed circuit board (2.3).

## **2.3 Printed Circuit Board (PCB)**

The circuit board supports and connects the circuits of the on-board electronic components of the flash drive. The board transfers power and data to and from the USB. All internal components of the flash drive are connected to the PCB. The boards are made from glass reinforced plastic with copper tracks in the place of wires. Components are fixed in position by drilling holes through the board, locating the components and then soldering them in place. The copper tracks link the components together forming a circuit.

## **2.4 NAND Flash Memory Chip**

The flash memory chip is an integrated circuit that stores the data on the flash drive. The name 'flash drive' comes from the use of flash memory. This is the largest chip on the PCB (2.3). Most USB flash drives can store 1 gigabyte of data, but higher priced models can often store up to 64 gigabytes. Flash memory is used, because it can hold all of its information, even without power, unlike the RAM of a computer. Data can be read from flash memory as many times as desired, but after a certain number of "write" operations, it will stop working.

### **2.5 Crystal Oscillator**

A crystal oscillator is a circuit that supplies the timing signals necessary to coordinate the operations of the flash drive. It is mounted to the PCB (2.3). The core of the crystal oscillator consists of a small quartz crystal between two electrodes. As electricity flows from one electrode to the crystal, the crystal vibrates at a specific frequency, and oscillates back and forth, completing the circuit and passing the electricity to the other electrode. This signal is similar to a pendulum, rocking back and forth, and is used to help coordinate the actions of all the electronics on the USB drive. In the case of a USB flash drive, the crystal vibrates at 12 megahertz, or 12 million times a second.

### **2.6 Space for Second Flash Memory Chip**

This blank space on the reverse of the PCB (2.3) is used to mount an additional NAND Flash Memory Chip to increase the storage capacity of the flash drive.



## Glossary

IC	Stands for 'integrated circuit'. It is a small silicon wafer containing numerous transistors, resistors and capacitors, and can function as an amplifier, oscillator, timer, microprocessor, or even computer memory.
NAND Flash Memory Chip	A very popular type of flash memory chip that is based on the use of NAND logic gates. It has a higher storage capacity than NOR Flash memory, but is slower. It is commonly used in flash drives, MP3 players, cameras and other electronic devices.
PCB	Stands for 'printed circuit board'. It is a board made from an insulating, non-conductive material with conductive metal tracks on it that create a circuit when integrated circuits and components are later soldered to it.
RAM	Stands for 'Random Access Memory', which is the memory or information storage in a computer that is used to store running programs and data for the programs.
ROM	Stands for 'Read-only Memory'. ROM is memory containing hard-wired instructions that the computer uses when it boots up, before the system software loads.
USB	Stands for Universal Serial Bus. USB is a connection technology that allows a person to connect a peripheral electronic device to a computer.

## Sources

## Websites

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## Interview

Personal interview with Jamshid Sangirov