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APPLICATION NOTE 3808

WHAT IS AN IBUTTON DEVICE?

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Abstract: This application note is a broad introduction to the Maxim iButton® devices. It discusses the iButton basics: what it is, how it is constructed, and some of its applications. It explains how a system can communicate with an the iButton device through its 1-Wire® interface. The note also describes types of iButton devices, iButton durability, its guaranteed unique 64-bit serial number, and available iButton accessories.

Introduction

This application note is a broad introduction to the iButton® device. It discusses iButton basics: what it is, how it is constructed, and some of its applications. It explains how a system can communicate with the iButton device through its 1-Wire® interface. The note also describes types of iButton devices, iButton device durability, its guaranteed unique 64-bit serial number, and available iButton accessories.

iButton Components

The Can and Grommet

An iButton device uses its stainless steel 'can' as an electronic communications interface. Each can has a data contact, called the 'lid', and a ground contact, called the 'base'. Each of these contacts is connected to the silicon chip inside. The lid is the top of the can; the base forms the sides and the bottom of the can and includes a flange to simplify attaching the iButton device to just about anything. The two contacts are separated by a polypropylene grommet.

The 1-Wire Interface

By simply touching the iButton device to the two contacts described above, you can communicate with it through our 1-Wire protocol. The 1-Wire interface has two communication speeds: standard mode and overdrive mode. For more information, see Maxim application note 3989, Add Control, Memory, Security, and Mixed-Signal Functions with a Single Contact.

The Address

Each iButton device has a unique and unalterable address laser etched onto its chip inside the can. The

address (e.g., 2700000095C33108) can be used as a key or identifier for each iButton device.

iButton Versions

The iButton product line now comprises over 20 different products with different functionality added to the basic button. iButton devices come in the following varieties:

- Address Only
- Memory
- Real-Time Clock
- Secure
- Data Loggers

See Maxim tutorial 1796, Overview of 1-Wire Technology and Its Use for more details about the products.

How Do I Get Information into and out of an iButton Device?

Information is transferred between an iButton device and a PC with a momentary contact. There are many ways to do this. The DS1402-RP8 touch and hold probe shown on the left is one example of an iButton accessory that can be used to communicate with an iButton device.

Another option is the Blue Dot™ receptor. You simply touch your iButton device to a Blue Dot receptor or other iButton probe, which is connected to a PC. The Blue Dot receptor is cabled to a 1-Wire adapter that is attached to a spare PC port. 1-Wire adapters exist for USB, serial, and parallel ports. The Blue Dot receptor and 1-Wire adapter are inexpensive. Order directly from Maxim, or see our distributor websites for pricing and availability.

The iButton device is also the ultimate information carrier for automatic identification, secure authentication, and many portable applications. All of the latest handheld computers can communicate with iButton devices. For a full listing of all portable devices that communicate with iButton devices, see the iButton page on the Maxim website. There are many accessories available from Maxim to help with any possible applications a user may have.

How Durable Is an iButton Device?

The silicon chip within the iButton device is protected by highly durable stainless steel. You can drop an iButton device, step on it, or scratch it. iButton devices are wear-tested for 10-year durability. The package is not waterproof, though. However, Maxim provides the DS9107, which is a capsule that can be used to achieve IP68-level solvent resistance with an iButton device.

What Can I Do with the iButton Device?

The iButton device is ideal for any application where information needs to travel with a person or an object. The following are some of the application areas where iButton devices are used today and have been used consistently for decades.

- Data Loggers
- Asset Management
- Electronic Asset Control
- eCash
- Guard Tour

Let's look at a few practical examples of iButton device usage.

Life Science Supply Chain Management

The following pictures show a couple of typical shipping flows for a temperature and humidity controlled medical shipment. Once placed in a medical transport container and instructed to start its mission, an iButton device can log the temperature and humidity throughout its journey. The duration and recording intervals can be variable. iButton devices are available as a standalone temperature logger (Thermochron®) or a combination temperature and humidity logger (Hygrochron™). The user can choose either, based on the application needs.

Short-Haul Example

In the following example (**Figure 1**) the shipment is going a short distance in the same city and the temperature needs to be monitored throughout the trip. This is easily accomplished by using an iButton device that is shipped with the supply.
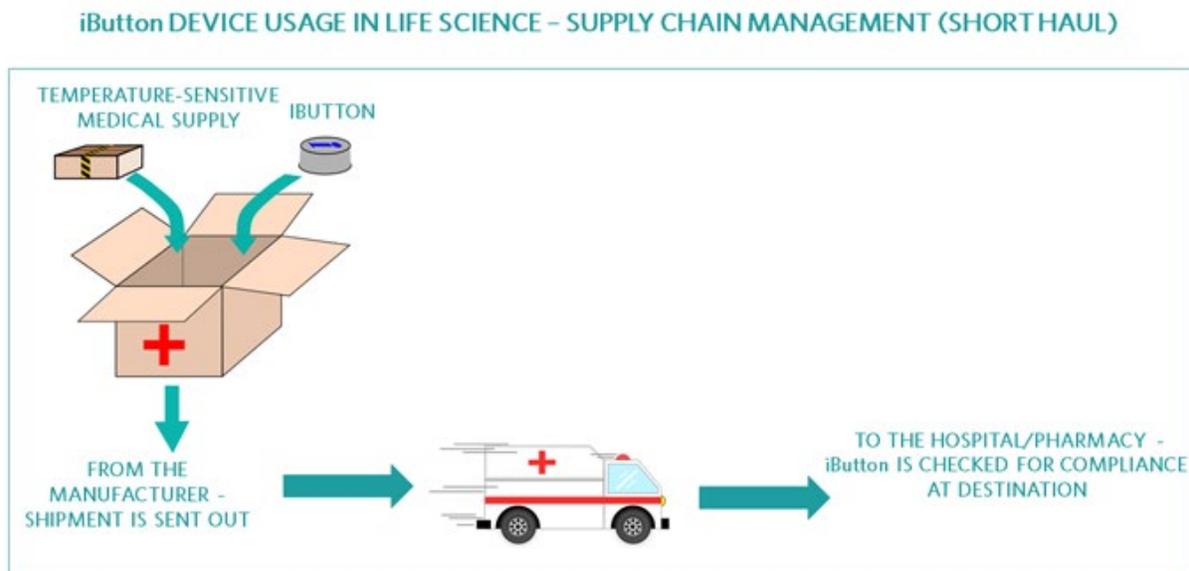

Figure 1. iButton usage in life science – supply chain management (short haul).

At the manufacturer, the iButton device is instructed to start recording the temperature. Once it has reached its destination, the temperature recorded in the iButton device will be read and evaluated to see if the proper temperature was maintained throughout the journey. If the temperature was maintained, the shipment will be accepted. Otherwise, it will be rejected.

Long-Haul Example

The following example (**Figure 2**) is very similar to the short-haul example, but it shows that the iButton device has the capability to collect data for a longer period of time, if needed.
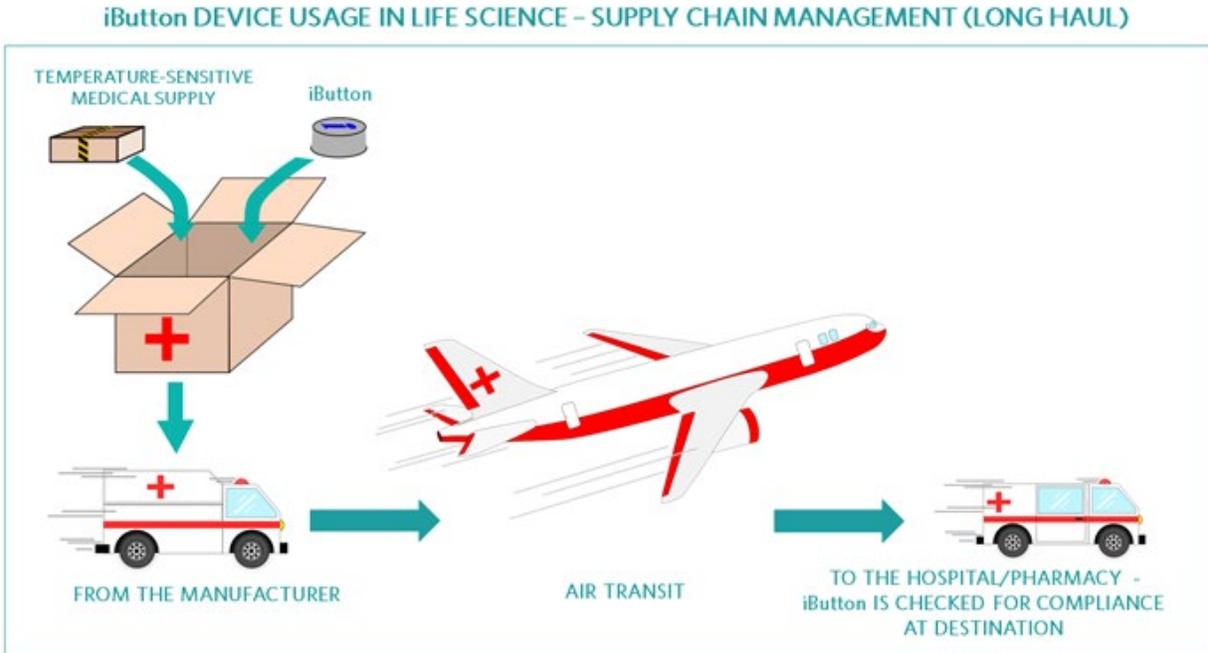
Figure 2. iButton usage in life science – supply chain management (long haul).

Electronic Asset Tag

iButton devices can also be used as electronic asset tags to store information. This may be needed to keep track of valuable capital equipment. Figure 3 shows an example of a simple vehicle tracking system. Each of the vehicle keys has an iButton device affixed to it. Each of the iButton devices has a unique identification number assigned to it.
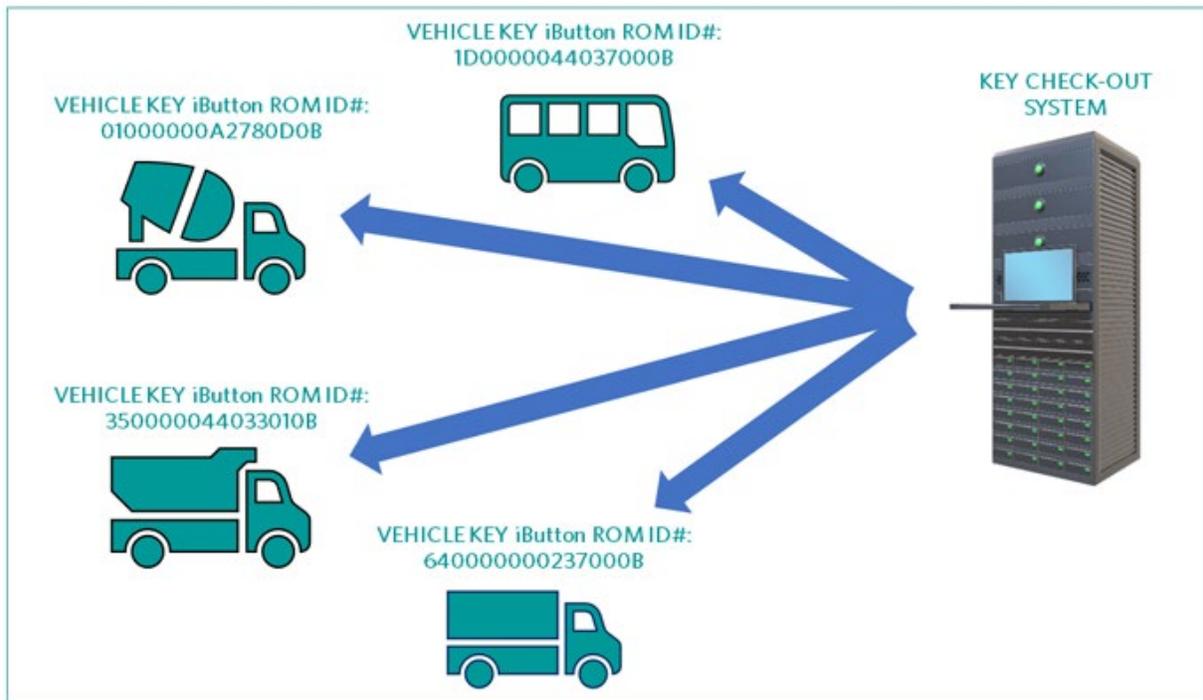
Figure 3. iButton device usage in asset tracking.

Once the key is checked out by a driver from the hypothetical Key Check Out System, that key gets assigned to that driver. At the same time, various data can be recorded. This may be the time of the day the key was checked out or on what purpose that vehicle was needed and for how long. Once the key is checked back in, the check-in data can be compared to the check-out data and any discrepancy can be addressed. The iButton device's rugged construction is vital for this kind of application.

Access Control and Usage Tracking

Affixed to a key fob, an iButton device can grant its owner access to a cabinet, a piece of equipment, or even a building. The iButton device can also be used as an electronic asset tag to store information. This can be used to keep track of valuable materials such as medical reagents that are used in scientific research. **Figure 4** shows such an example.
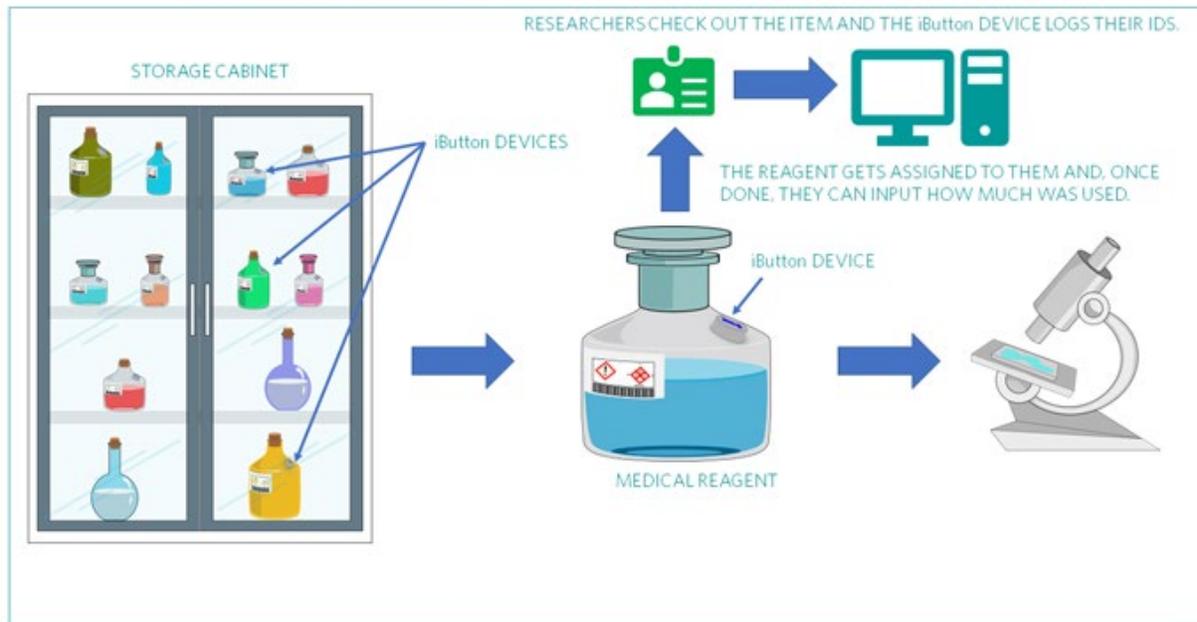
Figure 4. iButton device usage in access control and usage tracking.

In **Figure 4**, regulated and tracked medical reagents are stored in a secure cabinet. A researcher first checks out an item and the iButton device logs the ID# of the person checking out the item. Thus, the item can be traced back to that person, if needed. Once the task is completed, the researcher can input the amount that was used in the check-in system and it can be stored in the iButton device. The iButton device thus can be a very useful tool to keep track of and log all activities and resources in a controlled environment.

In addition, some iButton devices can also be used to store electronic cash for small transactions, such as transit systems, parking meters, and vending machines.

What Do I Need to Create an iButton Application?

There are four components fundamental to any iButton application:

- An iButton device.
- A host system, which can be a PC, a laptop, a handheld computer, or an embedded system.
- A reader/writer device to get information into and out of the iButton device. This can be the aforementioned Blue Dot receptor mentioned, a pen-style probe, or a handheld device.
- A layer of software to interface the iButton devices to computers and produce the desired information in the desired format. Several software development kits (SDKs) are downloadable from the Maxim site at no charge. We also offer 1-Wire Drivers for Microsoft platforms, along with the OneWireViewer, a demo application that can read/write/exercise any iButton device.

How Much Does It Cost to Build a Simple iButton Application?

- iButton devices cost under $50 (US$) on average, plus your programming time. These devices cost between $2 to $95 in quantities of one, while larger quantities are discounted.
- The Blue Dot receptor and 1-Wire adapter, which together make a simple reader/writer device, are priced competitively.
- The OneWireViewer demo software and SDKs are free from our web site.

That is all you need to get started. For more details, see the iButton page on the Maxim website.

What Are the Advantages of iButton Devices over Other Technologies?

When developing an iButton solution for an application, you can consider many complementary technologies. Bar codes, RFID tags, magnetic stripe cards, and smart cards are some of the possibilities. Unlike bar codes and magnetic stripe cards, most of the iButton devices can be read AND be written to. In addition, the communication rate and product breadth of iButton devices go well beyond the simple memory products typically available with RFID. As for durability, the thin plastic of smart cards is no match for the strength of the stainless-steel-clad iButton device.

Summary

There are over 350 million iButton devices currently in circulation, with a very long list of users spanning a wide range of industries. For more information on the various iButton products and applications, see the iButton page on the Maxim website.

1-Wire is a registered trademark of Maxim Integrated Products, Inc.
iButton is a registered trademark of Maxim Integrated Products, Inc.

Related Parts		
DS1402-BP8	1-Wire Network Cables	Samples
DS1402D-DR8	1-Wire Network Cables	
DS1904	iButton RTC	
DS1920	Temperature iButton	
DS1921G	Thermochron iButton Device	
DS1921H	High-Resolution Thermochron iButton Devices	
DS1921Z	High-Resolution Thermochron iButton Devices	
DS1922E	iButton High-Temperature Logger with 8KB Data-Log Memory	
DS1922L	iButton Temperature Loggers with 8KB Data-Log Memory	
DS1922T	iButton Temperature Loggers with 8KB Data-Log Memory	
DS1923	iButton Hygrochron Temperature/Humidity Logger with 8KB Data-Log Memory	
DS1925	iButton High-Density Temperature Logger with 122KB Data-Log Memory	
DS1961S	iButton 1Kb EEPROM with SHA-1 Engine	
DS1963S	iButton Monetary Device with SHA-1 Function	
DS1964S	DeepCover Secure Authenticator iButton with SHA-256	
DS1971	iButton 256-Bit EEPROM	

DS1972	iButton 1024-Bit EEPROM	
DS1973	iButton 4Kb EEPROM	Samples
DS1977	iButton 32KB EEPROM	
DS1982	iButton 1Kb Add-Only	Samples
DS1985	iButton 16Kb Add-Only	Samples
DS1990A	iButton Serial Number	Samples
DS1990R	Serial Number iButton	
DS1992	iButton 1Kb/4Kb Memory	Samples
DS1993	iButton 1Kb/4Kb Memory	Samples
DS1995	iButton 16Kb Memory	Samples
DS1996	iButton 64Kb Memory	Samples
DS9097U-S09	Universal 1-Wire COM Port Adapter	
DS9481R-3C7	USB-to-1-Wire/iButton 3.3V Adapter	

More Information
For Technical Support: https://www.maximintegrated.com/en/support
For Samples: https://www.maximintegrated.com/en/samples
Other Questions and Comments: https://www.maximintegrated.com/en/contact