iButton

Access Control Key with World-Class Digital Security and Stainless-Steel Durability

Computer Chip-Based Electronic Key
Fits on a Keyring and Lasts 10 Years

Building Access
Biometric Data Carriers
Computer/Network Security
eCash Systems

Key Control Systems
Standalone Locks
POS Terminal Access
Time and Attendance Systems
Unique Solution for Access Control

What is an iButton?

An iButton® is a computer chip with a globally unique address, factory-lasered at time of manufacture (think of it as a URL for each iButton), enclosed in a 16mm stainless-steel case. iButtons can include read/write memory, real-time clocks, and temperature/humidity data loggers. They deliver or record data wherever needed. All this power and capability make iButtons ideal for a wide range of applications including access control, eCash transactions, asset tracking, and environmental data logging.

The Globally Unique Key—
281,000,000,000,000 Different Combinations!

An iButton’s 64-bit address provides a simple, secure way of identifying a person or asset. It acts like your personalized “key” to protected information. When you present the correct key to a service control unit (SCU), the desired event (like the opening of a lock) is enabled. SCUs are microprocessors or any computing device handling authentication of a user token and validation of its data. Common SCUs are found inside door locks, POS terminals, or prepay utility meters. This is why iButtons are perfect for various access control functions like access to buildings or computers, and authorizing vehicle or equipment operation.

So Rugged It Lasts Forever!
iButtons bring unparalleled durability to access control applications. Sit on it, step on it, or drop it in water. There is no need to worry about destroying a key because iButtons can withstand harsh indoor or outdoor environments. The durable iButton is wear-tested to last a minimum of ten years, so you are not constantly replacing flimsy plastic access cards. For added convenience, they easily attach to a key fob, ring, or even a watch.

So Simple It Interfaces to Virtually Anything and Uses Almost No Energy!
iButtons require a physical/electrical connection to whatever is writing or reading data. However, a novel digital communication scheme called a 1-Wire® interface reduces the number of electrical contact points to just one, plus a ground reference. A single conductor for both power and data communications is all that is needed. Devices that read and write to iButtons seal all the electrical components inside and expose only the two electrical contact points, separated by a wide gap. With the connection so simplified, you get very durable, dust- and moisture-immune probes that interface to most surfaces.

An iButton reader draws virtually no power in standby mode and less than 2mA during communication—making it ideal for battery-powered devices such as electronic door locks. Reading an iButton’s unique address takes no more than 10ms. A typical iButton lock can operate more than 60,000 openings on a set of four AA batteries. Now you will change batteries every few years instead of every few months.

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A Choice of Products for Any Security Need

The Address to Multiple Locations

The DS1990A, simplest of all iButtons, contains only the unique 64-bit ROM address. Because each lock or access-control system stores the address of each key, a user only needs one iButton for access to multiple locations or assets.

Memory to Store Critical Data

Access codes, authorization levels, and vital statistics are critical data you cannot risk. Most iButtons add programmable memory as either EPROM, EEPROM, or NV RAM, allowing you to retain possession of that critical data. To secure information stored in memory, data can be encrypted. By using the unique address during the encryption process, even higher levels of security are possible.

Memory with Time-Dependent Access

The DS1994 iButton has an on-board real-time clock that can be armed to expire at a future date and time. This feature can be used to disable access to data inside the iButton. Access can also be denied based on elapsed time (cumulative usage) or number of accesses.

Memory with Password-Protected Access

When you want to limit access to secure data, an iButton can require the host to know the password for any read or write operation. The DS1991 has three service data pages. Each 48-byte page has its own 64-bit access password and service ID. The DS1977 has 32kB of EEPROM memory. Access to the memory can be password protected with different passwords for read-only and full access.

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EPROM (DS198x) iButtons are write-one-time, read-many-times devices. The memory can be written incrementally until it is completely full. EPROM devices are ideal for applications where the data never changes, like an employee’s unalterable record of authorizations. Alternately, they can serve as an electronic “punch card.” A system might grant up to 100 accesses to a machine. After each access, another memory location is irreversibly programmed. Once 100 locations are written, the key becomes invalid. EPROM iButtons also come in UniqueWare™ versions that have customer-specific data preprogrammed into them at the factory.

EEPROM (DS197x) iButtons allow users to read and write data to the device. You can store the access privileges of a user and update those privileges automatically as needed.

NV RAM (DS199x) iButtons are similar to EEPROM iButtons, but can be rewritten many more times. They are generally used for applications where data is updated frequently. In addition, the on-board lithium-energy source guarantees that memory updates, once initiated, are always completed because the power to finish the transfer is supplied by the lithium cell, not the reader/writer. This is important in the typical iButton environment where electrical contact can be intermittent.
High-Level Authentication Thwarts Security Attacks

Memory for Challenge-and-Response Authentication

For even greater security we offer challenge-and-response secure memory iButtons based on the ISO 10118-3 standard hashing algorithm called Secure Hash Algorithm 1 (SHA-1). SHA-1 is the only hashing algorithm approved by the U.S. Government. A challenge-and-response system allows two parties to share a common secret, yet never reveal that secret during communication. This permits the safe exchange of secure data. An integrated 512-bit SHA-1 engine can be activated to compute 160-bit message authentication codes (MACs) based on information stored in the iButton. Typical applications include local (at door/entryway) or remote (across a network) authentication/access control, secure change purse for electronic payment at transit systems, pay phones, parking meters, or vending machines, and physical/computer access.

Challenge-and-response iButtons use proven algorithms and provide the best security features to thwart the most sophisticated attacks. These devices can defeat numerous known logical security attacks including copy attack, replay attack, eavesdrop attack, A-B-A attack, and emulation attack. For more details, refer to White Paper 8: 1-Wire SHA-1 Overview at www.iButton.com

Simplified Key Management for all Security Levels

Regardless of which security level is selected for an access control system, the management of iButtons used as electronic keys is greatly simplified due to the globally unique, preprogrammed ROM ID that is never duplicated. Adding keys to (or removing them from) the existing population is quick and easy.

DS1961S—1kb EEPROM with SHA-1 engine

With 1kb of application memory, the DS1961S stores a single 64-bit secret that can be used in conjunction with the on-chip SHA-1 engine to prove its authenticity to an SCU. Likewise, the SCU is required to prove it is authentic before it is allowed to write data to the DS1961S. This security mechanism, called mutual authentication, is ideal for high-level security access control or eCash applications.

DS1963S—4kb NV RAM with SHA-1 engine

The DS1963S has 4kb NV RAM and supports up to seven different applications or service providers, each with their own 64-bit secret that is never revealed to other service providers. Special counters in this iButton ensure that previous or current data patterns, for example an authorization level or cash balance, cannot be extracted from the device and fraudulently rewritten later. Thus, the DS1963S treats every instance of data as unique. Additionally, NV RAM technology makes brute-force physical attacks virtually impossible.

iButton Products Security Continuum

iButtons are available in a wide variety of security levels to provide the most appropriate protection for your application.
## iButton Security Products Selection Guide

<table>
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<tr>
<th>REQUIREMENTS</th>
<th>SUGGESTED PARTS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need unique ID only.</td>
<td>DS1990A</td>
<td>Easiest to implement; ideal for simple systems such as locks. Typically the host would store the authorized key list inside the service control unit.</td>
</tr>
<tr>
<td>Need plain memory for permanent application data.</td>
<td>DS1982 DS1985 DS1986</td>
<td>Easy to implement, ideal where application data will not change once written to the user tokens. Each memory page can be write protected, and encryption of service data can be implemented on the host side optionally.</td>
</tr>
<tr>
<td>Need memory for service data. Can use plain memory because host provides data security protection.</td>
<td>DS1971 DS1973 DS1992L DS1993L DS1995L DS1996L</td>
<td>The host typically encrypts or hashes the service data so that it can be validated by hosts on the system. Use the device’s unique address as one parameter to feed into the system’s encryption or hashing computation. Improves resistance against “class-break.”</td>
</tr>
<tr>
<td>Need memory for service data. Want to automatically disable the device at some future day/time.</td>
<td>DS1994L</td>
<td>An on-board real-time clock (RTC) can be armed to expire at a future day/time. Can be used to disable access to data inside the iButton. Access can be denied based on elapsed time (cumulative usage) or number of accesses. Provides an independent tamperproof clock.</td>
</tr>
<tr>
<td>Need write protected memory.</td>
<td>DS1972</td>
<td>Memory pages can be individually write protected or put in EPROM-emulation mode, where bits can only be changed from a 1 to a 0 state.</td>
</tr>
<tr>
<td>Need password-protected memory for user-access authorization.</td>
<td>DS1991L DS1977</td>
<td>Good security and easy to implement. Some customers further encrypt the service data with the device ID as one of the encrypting input parameters. The DS1991L can support three independent services.</td>
</tr>
<tr>
<td>Need challenge-and-response authentication. Want to protect against losing secret to interception.</td>
<td>DS1961S DS1963S</td>
<td>Offers higher security than static password approach. DS1961S supports four services that share the same access secret. DS1963S supports seven independent services with separate secrets.</td>
</tr>
</tbody>
</table>

### Turnkey Systems Available

Our Authorized Solutions Developers (ASDs) have already developed turnkey iButton systems for many access-control needs. These developers can also design custom iButton software and/or hardware solutions. Review our partners and their products at [www.iButton.com/solutions](http://www.iButton.com/solutions).
Interface Is Simple and Low Cost

One-Touch Interface

How do I communicate with an iButton? Interfacing an iButton to any type of electronics is easy. Information transfers between an iButton and a PC, PDA, a variety of handhelds, or a microcontroller with a momentary contact at up to 142kbps. Simply touch the iButton to a Blue Dot™ receptor or other types of mating probes.

Free Software Development Tools

Free iButton and other 1-Wire software development kits address different platforms and programming language preferences. Multiple application notes and papers reduce the development burden and help ensure your success.

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<tr>
<th>PLATFORM</th>
<th>RESOURCE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>Windows® 32 (XP, 2K, NT, ME, 98SE, 95)</td>
<td>1-Wire SDK*</td>
<td>Windows programming language-independent library. Supports all 1-Wire adapter types with traditional API* (TMEX) and Windows .NET (OW.NET) interfaces.</td>
</tr>
<tr>
<td>Any platform with a ‘C’ compiler</td>
<td>1-Wire Public Domain Kit</td>
<td>Portable ‘C’ library. Supports both a serial port plus DS2480B bridge or custom 1-Wire interface. Many 1-Wire adapter and platform-specific example builds provided.</td>
</tr>
<tr>
<td>Any Java™ platform (J2ME™ also available)</td>
<td>1-Wire API for Java</td>
<td>Portable Java library. Supports both a serial port plus DS2480B bridge or custom 1-Wire interface. All 1-Wire adapters supported on the Windows platform.</td>
</tr>
</tbody>
</table>

Microprocessor

- Application Note 126 (I/O port pin for 1-Wire)
- Application Note 192 (Serial port + DS2480B bridge for 1-Wire)
- Application Note 3684 (I2C port plus DS2482)
- Some I/O port assembly examples in 1-Wire Public Domain (PD) Kit

Documentation to add a 1-Wire port to a microprocessor. Some assembly examples available. If the microprocessor has a ‘C’ compiler, the 1-Wire Public Domain code can be used.

*Refer to Application Note 155: 1-Wire Software Resource Guide for an overview of all available APIs. For all iButton application notes and software tools visit www.maxim-ic.com/iButton. For support, contact autoinfo.support@dalsemi.com.

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**iButtons—More Than Just an Access Control Key**

The iButton product family has over 20 different products to meet your application needs—access control, guard tour, eCash, maintenance and inspection, hardware and software authorization, and temperature and humidity data logging.

### Product Quickview

<table>
<thead>
<tr>
<th>PART</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>DS1990A</td>
<td>64-bit ROM ID</td>
</tr>
<tr>
<td>DS1992/3/5/6L</td>
<td>1kb/4kb/16kb/64kb NV RAM</td>
</tr>
<tr>
<td>DS1971/2/3/7</td>
<td>256-bit/1kb/4kb/32kb EEPROM</td>
</tr>
<tr>
<td>DS1982/5/6</td>
<td>1kb/16kb/64kb EPROM</td>
</tr>
<tr>
<td>DS1991L/DS1977</td>
<td>Three 384-bit partitions NV RAM/One 32kB partition EEPROM</td>
</tr>
<tr>
<td>DS1961S</td>
<td>1kb EEPROM with SHA-1</td>
</tr>
<tr>
<td>DS1963S</td>
<td>4kb NV RAM with SHA-1 and counters</td>
</tr>
<tr>
<td>DS1904/DS1994L</td>
<td>RTC/RTC with 4kb NV RAM</td>
</tr>
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</table>

### Temperature Data Loggers

<table>
<thead>
<tr>
<th>PART</th>
<th>TEMP RANGE</th>
<th>MAX ACCURACY</th>
<th>DATA LOG SIZE</th>
</tr>
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<tbody>
<tr>
<td>DS1921G-F5</td>
<td>-40°C to +85°C</td>
<td>±1°C (-30°C/+70°C)</td>
<td>2k points</td>
</tr>
<tr>
<td>DS1921H-F5</td>
<td>+15°C to +46°C</td>
<td>±1°C</td>
<td>2k points</td>
</tr>
<tr>
<td>DS1921Z-F5</td>
<td>-5°C to +26°C</td>
<td>±1°C</td>
<td>2k points</td>
</tr>
<tr>
<td>DS1922L-F5</td>
<td>-40°C to +85°C</td>
<td>±0.5°C (-10°C/+65°C)</td>
<td>4k/8k points</td>
</tr>
<tr>
<td>DS1922T-F5</td>
<td>0°C to +125°C</td>
<td>±0.5°C (+20°C/+100°C)</td>
<td>4k/8k points</td>
</tr>
</tbody>
</table>

### Accessories Quickview

#### COMM. PORT ADAPTERS

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<tr>
<th>PART</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>DS9490B</td>
<td>USB iButton Holder/Dongle: 1-Wire to USB interface. Designed for applications in which iButton is infrequently removed from holder.</td>
</tr>
<tr>
<td>DS1410E-001</td>
<td>1-Wire Parallel Port Adapter: 1-Wire to parallel port interface. Insert iButton directly or use with DS1402D-DB8 or DS1402BP8.</td>
</tr>
</tbody>
</table>

#### PROBES/RECEPTORS (READER/WRITER INTERFACES)

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<tr>
<th>PART</th>
<th>DESCRIPTION</th>
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<tr>
<td>DS1402D-DR8/DB8</td>
<td>Blue Dot Receptor Cable: iButton read/writer interface. iButtons communicate through Blue Dot interface with just a touch or can be snapped into the Blue Dot for continuous connection. DR8 has RJ-11 interface. DB8 has button interface.</td>
</tr>
<tr>
<td>DS1402RP8/BP8</td>
<td>iButton Touch and Hold Probe Cable: iButton read/writer interface. iButtons communicate through probe with just a touch or can be snapped into the probe for continuous connection. DR8 has RJ-11 interface. DB8 has button interface.</td>
</tr>
<tr>
<td>DS9092GT</td>
<td>iButton Handheld Wand: Plastic wand with an integrated iButton probe, shaped to self-align with iButtons. Gives tactile feedback. The wand comes with a 10cm handle and a 1m cable that is terminated with an RJ-11 jack.</td>
</tr>
<tr>
<td>DS9092/T/L</td>
<td>Panel Mount Probe. T version has tactile feedback. L version has LED and is recommended for outdoor use.</td>
</tr>
<tr>
<td>DS1402D-041</td>
<td>Blue Dot probe component for embedded touch and hold applications.</td>
</tr>
</tbody>
</table>

#### iBUTTON MOUNTS

<table>
<thead>
<tr>
<th>PART</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS9093Ax/F/N</td>
<td>Key Fobs: Allow an iButton to be carried conveniently on a key chain. Available in three different versions and five different colors.</td>
</tr>
<tr>
<td>DS9093S/P</td>
<td>Wall Mounts: Allows you to securely mount iButtons to most surfaces. Available in two versions.</td>
</tr>
<tr>
<td>DS9096P</td>
<td>iButton Adhesive Pads. Allow you to easily mount iButtons to anything.</td>
</tr>
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