



Revolutionary iButton Digital Temperature and Humidity Data Loggers

Tiny, Robust, Computer Chip-Based Loggers
Deliver High Accuracy and Low Cost



Monitor:

**Temperature-Sensitive Shipments
Manufacturing Processes
Environmental Conditions**



Industry's Smallest, Most Rugged, Lowest Cost Family of Digital Data Loggers

What Is an iButton Data Logger?

An iButton® device is a computer chip with a globally unique address, factory-lasered at time of manufacture (think of it as a URL for each iButton device), enclosed in a 16mm stainless-steel case. iButton devices 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 iButton devices ideal for a wide range of applications including environmental data logging, access control, e-cash transactions, and asset tracking.

The Globally Unique Tag— 281,000,000,000,000 Different Addresses!

An iButton device's 64-bit address provides a simple, secure way of identifying a location or an item. It can serve as an electronic serial number that is never duplicated. With onboard memory, iButton devices can also store critical information about an item or location, such as container contents, shipping destination, or owner information.

Rugged Durability That Lasts and Lasts!

iButton devices bring unparalleled durability to data logger applications. Expose it to high or low temperature extremes. Step on it. Splash it with water.* There is no need to worry about destroying this data logger, because iButton devices can withstand harsh indoor or outdoor environments. Durable iButton devices can be reprogrammed and reused for many years, significantly reducing operating costs.

iButton Capsule—Simple, Low-Power Interface!

iButton devices require a physical/electrical connection to whatever is reading or writing 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 iButton devices have all their electrical components inside, with only the two electrical contact points exposed, 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 handheld computers and PDAs. Reading an iButton device's unique address takes no more than 5ms. Now users can finish their data collection tasks without having to worry about changing batteries in their handheld device every few hours.



Minimal power requirements make iButtons ideal for handheld and PDA data-collection applications.



The DS9107 iButton capsule protects iButton data loggers from moisture, solvents, and pressure.

*See Application Note 4126, "Understanding the IP (Ingress Protection) Ratings of iButton Data Loggers and Capsule," for iButton IP ratings. (www.maxim-ic.com/AN4126) iButton and 1-Wire are registered trademarks of Maxim Integrated Products, Inc.

iButton Temperature and Humidity Data Loggers Address a Wide Variety of Applications

Temperature Data Collection

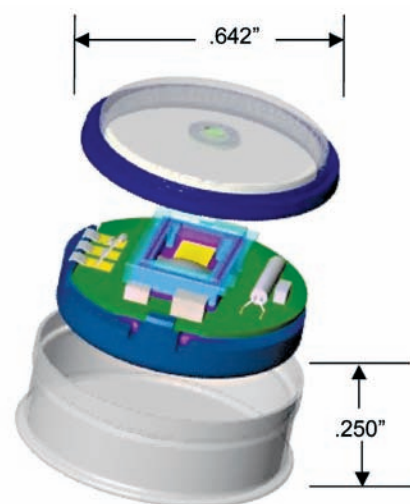
The DS1920 lets you measure and record the temperature at a specific location together with the unique address for that device.

Temperature Data Loggers

Our Thermochron® family of iButton devices (DS1921/DS1922) are temperature data loggers that track the temperature of specific assets or locations. Now you can easily log the thermal exposure of an asset during shipment to see if it stays within specified temperature ranges. Thermochron data loggers make it simple and inexpensive to monitor anything that is temperature sensitive, including pharmaceuticals (vaccines, drugs, reagents), fresh or frozen foods (fruits, vegetables, dairy/ dessert products), biological items (animals, blood products, soil), or heating/refrigeration/freezer systems. The Thermochron data logger can also be used for warranty-tracking purposes on equipment that must be kept within a certain temperature range, or to log the results of a process that must be monitored for compliance to a temperature profile. Like all iButton devices, the stainless-steel casing of a Thermochron data logger makes it rugged, reusable, and portable. It is so small that it fits anywhere and can deliver years of reliable, highly accurate temperature readings.

Temperature/Humidity Data Loggers

Our Hygrochron™ family of iButton data loggers (DS1923) adds an embedded humidity sensor to the temperature-logging capability of the Thermochron family to create a data logger that records both temperature and humidity. With these two pieces of data, relative humidity can be logged as a function of time. The tiny opening in the lid of the Hygrochron iButton data logger employs a special filter that allows water vapor to pass through and reach the internal humidity sensor, but repels liquid-phase water. For applications where both temperature and humidity are important (foods, chemicals, powders, HVAC systems), the Hygrochron data logger delivers unprecedented performance in an unbelievably compact size.



iButton Data Logger Product Selection Guide

iButton Type	Part	Description		
Temperature Sensor	DS1920-F5+	Enables user to collect current temperature upon contact with a reader; digital thermometer, $\pm 0.5^{\circ}\text{C}$ accuracy (-55°C to $+100^{\circ}\text{C}$)		
Temperature Data Loggers	Part	Temperature Range ($^{\circ}\text{C}$)	Accuracy ($^{\circ}\text{C}$, max)	Data Log Size (Points)
	DS1921G-F5#	-40 to +85	± 1 ($-30^{\circ}\text{C}/+70^{\circ}\text{C}$)	2K
	DS1921H-F5#	+15 to +46	± 1	2K
	DS1921Z-F5#	-5 to +26	± 1	2K
	DS1922L-F5#	-40 to +85	± 0.5 ($-10^{\circ}\text{C}/+65^{\circ}\text{C}$)	4K/8K
	DS1922T-F5#	0 to +125	± 0.5 ($+20^{\circ}\text{C}/+100^{\circ}\text{C}$)	4K/8K
	DS1922E-F5#	+15 to +140	± 1.5 ($+110^{\circ}\text{C}/+140^{\circ}\text{C}$)	4K/8K
Temperature/Humidity Data Logger	DS1922S-F5#*	-40 to +85	± 0.5 ($-10^{\circ}\text{C}/+65^{\circ}\text{C}$)	4K/8K (single mission, lifetime)
	DS1923-F5#	-20 to +85	± 0.5 , 5%RH	8K (temp), 4K (temp/RH)

Thermochron is a registered trademark and Hygrochron is a trademark of Maxim Integrated Products, Inc.

*Future product—contact factory for availability.

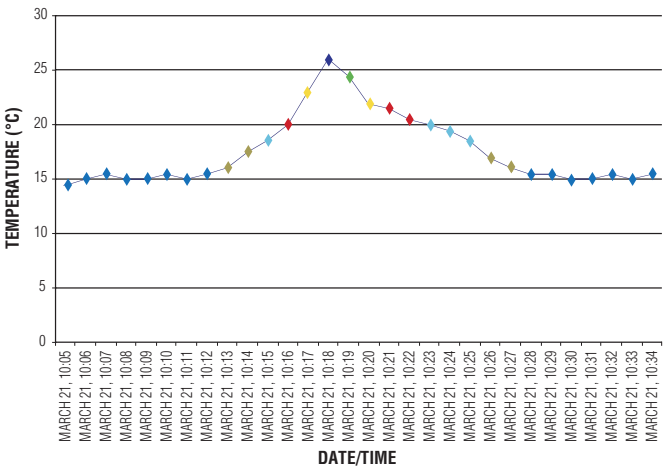
Thermochron Devices Support Two Temperature-Logging Modes

Time/Temperature Mode

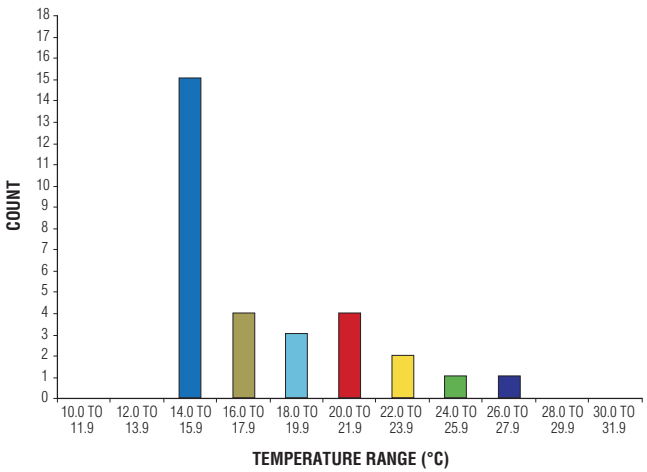
Each Thermochron data logger will log up to 2K (DS1921) or 8K (DS1922/DS1923) temperature readings before the logger memory is full. When the device is initialized, the user can configure it to terminate logging or roll over and begin writing over the oldest data points when the memory capacity is reached. If the logger is set to record a temperature every minute, the DS1921 memory will be full after approximately 1.4 days and the DS1922 after approximately 5.6 days. The example data to the right shows the partial log for a device monitoring a product kept at 15°C, and the resulting time/temperature graph is below on the left. The change in temperature due to the refrigerator door being opened and then later closed is captured.

Time	Temperature (°C)
March 21, 10:05	14.5
March 21, 10:06	15
March 21, 10:07	15.5
March 21, 10:08	15
March 21, 10:09	15
March 21, 10:10	15.5
March 21, 10:11	15
March 21, 10:12	15.5
March 21, 10:13	16
March 21, 10:14	17.5
March 21, 10:15	18.5
March 21, 10:16	20
March 21, 10:17	23
March 21, 10:18	26
March 21, 10:19	24.5
March 21, 10:20	22
March 21, 10:21	21.5
March 21, 10:22	20.5
March 21, 10:23	20
March 21, 10:24	19.5
March 21, 10:25	18.5
March 21, 10:26	17
March 21, 10:27	16
March 21, 10:28	15.5
March 21, 10:29	15.5
March 21, 10:30	15
March 21, 10:31	15
March 21, 10:32	15.5
March 21, 10:33	15
March 21, 10:34	15.5

Time/Temperature Recording Mode



Histogram Recording Mode



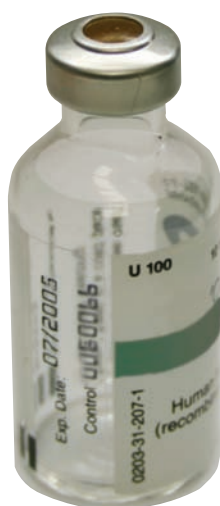
Histogram Mode (DS1921 Only)

A temperature histogram runs concurrently with the time/temperature logging for each DS1921 Thermochron device. The histogram logs temperature occurrences into one of 64 different temperature ranges that are each approximately 2°C wide (e.g., +22°C to +23.99°C, +24°C to +25.99°C). A counter is incremented for the corresponding range each time a measured temperature falls within that range. Using the same example data above, the result represented in histogram format would look like the graph on the right. Each range can increment up to 65536. If set to log every minute, the histogram counter would reach 65536 after approximately 44 days (or even longer if the measured temperatures fall into multiple ranges, as in the example). Therefore, the histogram can be used in applications where total thermal exposure is important, but the exact times that particular temperatures occurred is not. For example, it may be important to monitor a process and record the total number of minutes of exposure at various temperatures. In another type of application, the useful life of temperature-sensitive products may be extended significantly (and thus reduce their effective costs) by storing them well below the maximum allowed temperature and using the histogram function to accurately determine the remaining life of the material.

Turnkey Systems Available

Maxim has teamed with third-party systems integration experts around the world to combine the power of our iButton products with their market knowledge, systems expertise, and local support. Together with these independent companies, we created a powerful suite of ready-to-use products. Our authorized solutions developers (ASDs) already have developed turnkey iButton systems to address typical data-logging applications, such as cold-chain shipping, process monitoring/quality control, and refrigerator/freezer system tracking. In addition, these developers can also design custom iButton software and/or hardware solutions. Review our partners and their products at: www.iButton.com/thermo-solutions.

When you attach a tiny ThermoChron data logger anywhere on your shipment, you will know whether the temperature environment changed during transit and by precisely how much. Using ThermoChron data loggers, companies are discovering that their quality goes up while their operating costs come down.



If you're shipping highly sensitive products like pharmaceuticals, the shift of even a few degrees can mean the difference between delivering a safe, effective product and rendering it completely useless.



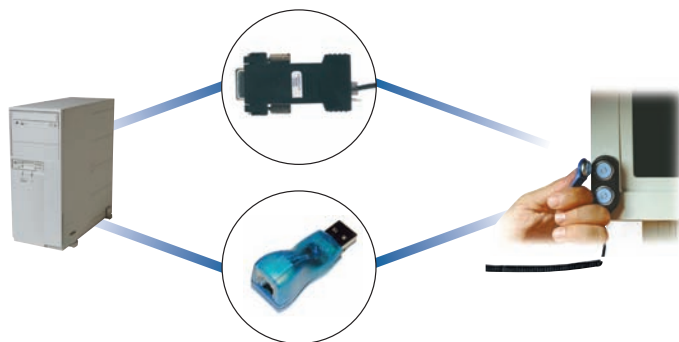
Photo courtesy of Stanford Blood Center.

Refrigeration/freezer systems that malfunction can cause significant financial loss if left unchecked. However, temperature can easily be monitored by strategically placing ThermoChron or HygroChron data loggers throughout the areas that require accurate, yet potentially highly dispersed monitoring.

Interface Is Simple and Low Cost

One-Touch Interface

How do I communicate with an iButton device? Interfacing an iButton device to any type of electronics is easy. Information transfers between an iButton device and a PC, PDA, a variety of handhelds, or a microcontroller with a momentary contact at up to 125kbps. Simply touch the iButton device to a Blue Dot™ receptor or other types of mating probes.



For PCs, we provide low-cost adapters for serial and USB ports.



For portable handhelds, see our website to examine the wide range of products available from our third-party developers.

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.

Platform	Resource	Description
Windows® 32 bit or 64 bit (Windows XP® SP2 or higher, 2008, Windows Vista®, Windows 7)	1-Wire SDK*	Windows programming language-independent libraries. Supports all 1-Wire adapter types with traditional API* (TMEX), and APIs for Microsoft® .NET Framework and .NET Compact Framework.
Windows 32 bit or 64 bit (Windows XP SP2 or higher, 2008, Windows Vista, Windows 7)	Software Authorization	Portable 'C' library for software developers to control unauthorized use of programs. Supports serial, parallel, and USB 1-Wire adapters.
Any platform with a 'C' compiler	1-Wire Public Domain Kit	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.
Any Java™ platform (J2ME™ also available)	1-Wire API for Java	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.
Microprocessor	Application note 126, "1-Wire® Communication Through Software" Application note 192, "Using the DS2480B Serial 1-Wire Line Driver" Application note 3684, "How to Use the DS2482 I²C 1-Wire® Master" 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 Device Description," for an overview of all available APIs. (www.maxim-ic.com/AN155) For all iButton application notes and software tools, visit www.iButton.com. For support, open a request online at <http://support.maxim-ic.com/iButton>.

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iButton Devices—More Than Just Temperature/Humidity Data Loggers













The iButton product family has over 20 different products that meet all application needs—temperature data logging, maintenance and inspection data management, guard-tour access control, device and software authorization, and e-cash.

Product Quickview

Feature	Part	Description
Address Number Only	DS1990A	64-bit ROM ID
NV RAM Memory	DS1992/93/95/96L	1Kb/4Kb/16Kb/64Kb NV RAM
EEPROM Memory	DS1971/72/73/77	256-bit/1Kb/4Kb/32KB EEPROM
EPROM Memory	DS1982/85/86	1Kb/16Kb/64Kb EPROM
Password-Protected Secure Memory	DS1977	One 32KB partition EEPROM
Challenge-and-Response Secure Memory	DS1961S	1Kb EEPROM with SHA-1
	DS1963S	4Kb NV RAM with SHA-1 and counters
Real-Time Clock	DS1904	RTC

NOTE: For a selection guide of all data loggers, please see page 3.

Accessories Quickview

Communication Port Adapters		
	DS9490R	1-Wire USB adapter: 1-Wire to USB interface. Connects to all reader/probes with RJ-11 interface.
	DS9490B	USB iButton holder/dongle: 1-Wire to USB interface. Designed for applications where iButton device is infrequently removed from holder.
	DS9097U-009/E25/S09	Universal 1-Wire COM port adapter: 1-Wire to RS-232 COM port interface (DB9). Connects to all reader/probes with RJ-11 interface. 009 version includes DS2502 for ID. E25 version includes a 12V power port for writing to EPROM iButton devices and comes in a DB25 package.
Probes/Receptors (Reader/Writer Interfaces)		
	DS1402-DR8/DB8	Blue Dot receptor cable: iButton reader/writer interface. iButton devices 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.
	DS1402-RP8/BP8	iButton touch and hold probe cable: iButton reader/writer interface. iButton devices communicate through probe with just a touch or can be snapped into the probe for continuous connection. RP8 has RJ-11 interface. BP8 has button interface.
	DS9092GT	iButton handheld wand: Plastic wand with an integrated iButton probe, shaped to self-align with iButton devices. Gives tactile feedback. The wand comes with a 10cm handle and a 1m cable that is terminated with an RJ-11 jack.
	DS9092/T/L	Panel-mount probe: T version has tactile feedback. L version has an LED and is recommended for outdoor use.
	DS1402D-41	Blue Dot probe component for embedded touch and hold applications.
iButton Mounts		
	DS9107	Capsules: Protect iButton loggers from moisture, solvents, and pressure.
	DS9093Ax/F/N	Key fobs: Allow an iButton device to be carried conveniently on a key chain. Available in three different versions and five different colors.
	DS9093S/P	Wall mounts: Allow you to securely mount iButton devices to most surfaces. Available in two versions.
	DS9096P	iButton adhesive pads: Allow you to easily mount iButton devices to anything.

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- [Temperature/Humidity Data Logging](#)
- [Electronic Access Control](#)
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- [What is an iButton?](#)
- [iButton Product List](#)
- [Software Resources](#)
- [Accessories](#)
- [Videos](#)
- [Brochures](#)

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- [1-Wire Drivers](#)
- [Application Notes](#)
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Maxim > Products > iButton® Devices > Temperature/Humidity Data Logging

Temperature/Humidity Data Logging

iButton® data loggers withstand harsh environments and can be reprogrammed and reused for many years. They lower operating costs for cold chain and other temperature and environmental monitoring applications.

Thermochron® Temperature Data Loggers

Thermochron temperature data loggers make it simple and inexpensive to monitor the temperature of critical assets. These devices easily log thermal exposure of items such as pharmaceuticals, fresh or frozen foods, and biologicals during shipment. They can also log temperatures to ensure environmental or process compliance. [Get started.](#)

Hygrochron™ Temperature and Humidity Data Loggers

For applications where both temperature and humidity are important, Hygrochron devices add embedded humidity sensing to the temperature-logging capability of Thermochron devices. A Hygrochron data logger records and reports both temperature and humidity data as a function of time. [Get started.](#)

Turnkey Solutions

Third-Party Authorized Solutions Developers (ASDs)

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[Product Line Tree](#)
[Product Line Homepage](#)

iButton Devices and Accessories

- iButton Products (27)
- iButton Readers and Adapters (24)
- iButton Mounting Options (29)
- iButton Starter Kits (3)

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Maxim Integrated Products, Inc. • 120 San Gabriel Drive
 Sunnyvale, CA 94086 • 1-408-737-7600