

 **iButton**

# 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*

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

## 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 environmental data logging, access control, eCash transactions, and asset tracking.

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

An iButton'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, iButtons 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!

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

## iButtons—Simple, Low-Power Interface!

iButtons 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 iButtons 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's unique address takes no more than 5ms. Now users can finish their data collection tasks without having to worry about constantly changing batteries in their handheld device every few hours.



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



These stainless-steel encased data loggers can go practically anywhere.

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# iButton Temperature and Humidity Data Loggers

## Address a Wide Variety of Applications

### Temperature Data Collection

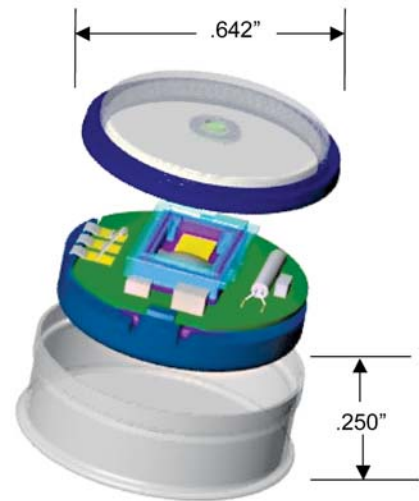
The DS1920 lets you measure and record the temperature at a specific location together with the unique address for that device.

### Temperature Data Loggers

Our Thermochron® family of iButtons (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. Thermochrons 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 could 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 iButtons, the stainless-steel casing of a Thermochron 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 iButtons (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 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 Hygrochrons deliver unprecedented performance in an unbelievably compact size.



## iButton Data Logger Products Selection Guide

	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 ( $-55^{\circ}\text{C}$ to $+100^{\circ}\text{C}$ )		
Temperature Data Loggers	PART	TEMP RANGE	MAX ACCURACY	DATA LOG SIZE
	DS1921G-F5	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	$\pm 1^{\circ}\text{C}$ ( $-30^{\circ}\text{C}/+70^{\circ}\text{C}$ )	2k points
	DS1921H-F5	$+15^{\circ}\text{C}$ to $+46^{\circ}\text{C}$	$\pm 1^{\circ}\text{C}$	2k points
	DS1921Z-F5	$-5^{\circ}\text{C}$ to $+26^{\circ}\text{C}$	$\pm 1^{\circ}\text{C}$	2k points
	DS1922L-F5	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$ ( $-10^{\circ}\text{C}/+65^{\circ}\text{C}$ )	4k/8k points
DS1922T-F5	$0^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$ ( $+20^{\circ}\text{C}/+100^{\circ}\text{C}$ )	4k/8k points	
Temperature/Humidity Data Logger	DS1923L-F5	$-20^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$ , 5%RH	4k points

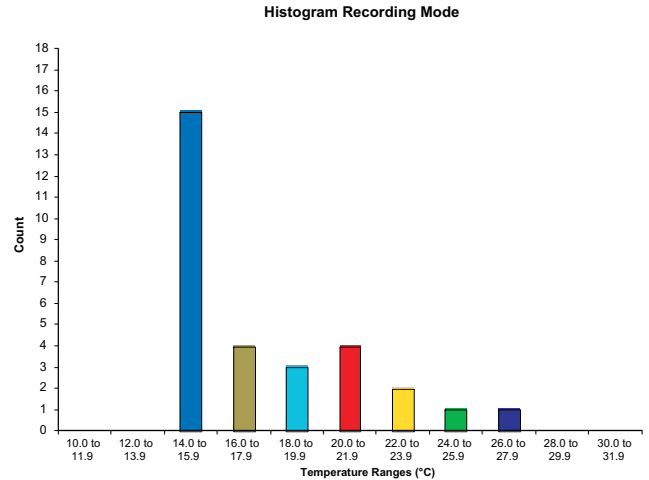
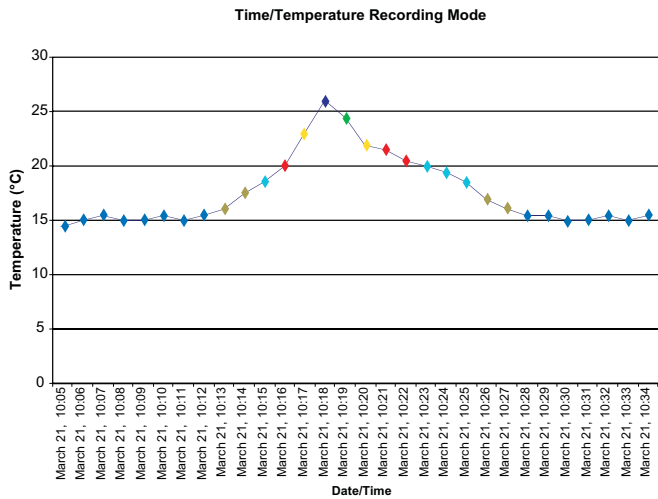
*Thermochron is a registered trademark of Dallas Semiconductor.  
Hygrochron is a trademark of Dallas Semiconductor.*

# Thermochrons Support Two Temperature Logging Modes

## Time/Temperature Mode

Each Thermochron 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



## Histogram Mode (DS1921 Only)

A temperature histogram runs concurrently with the time/temperature logging for each DS1921 Thermochron. The histogram logs temperature occurrences into one of 64 different temperature ranges that are each approximately 2°C wide (ex. 22°C to 23.99°C, 24°C to 25.99°C, etc.). 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 (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 lower 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

Dallas Semiconductor/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/solutions](http://www.iButton.com/solutions).

When you attach a tiny ThermoChron anywhere on your shipment, you will know whether the temperature environment changed during transit and by precisely how much. Using ThermoChrons, 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.



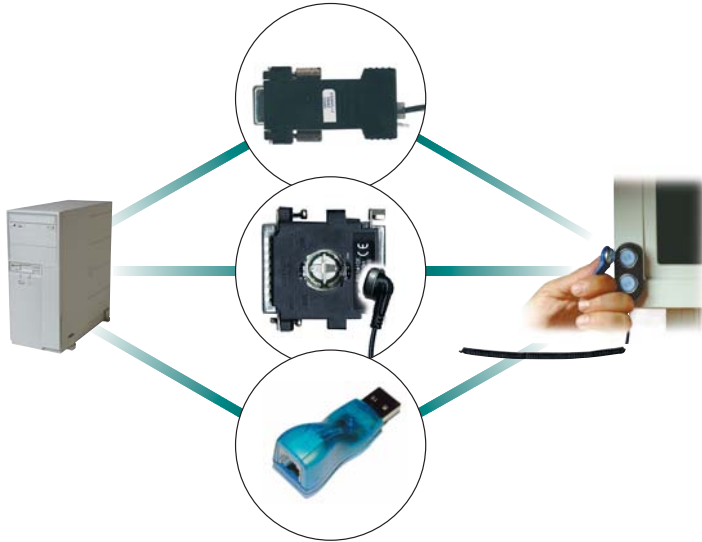
Refrigeration/freezer systems that malfunction can cause significant financial loss if left unchecked. But temperature can be easily monitored by strategically placing ThermoChrons or HydroChrons throughout the areas which require accurate, yet potentially highly dispersed monitoring.

Photo courtesy of Stanford Blood Center.

# 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.



For PCs, we provide low-cost adapters for serial, parallel, 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 (95, 98, NT, 2K, ME, XP)	1-Wire SDK	Programming language-independent library. Supports all 1-Wire adapter types with traditional API* (TMEX) and Windows COM interfaces.
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.
Any Java™ platform	1-Wire API for Java	Portable Java library. Supports both a serial port plus DS2480B bridge or custom 1-Wire interface.
Microprocessor	<ul style="list-style-type: none"> <li>• Application Note 126* (I/O port pin for 1-Wire)</li> <li>• Application Note 192* (Serial port + DS2480B bridge for 1-Wire)</li> <li>• Some I/O port assembly examples in 1-Wire Public Domain (PD) Kit</li> </ul>	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 visit [www.iButton.com](http://www.iButton.com).

For all iButton and 1-Wire software kits, visit our website at [www.iButton.com/software](http://www.iButton.com/software).

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# iButtons—More Than Just Temperature/Humidity Data Loggers

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

## Product Quickview

	PART	DESCRIPTION
Address Number Only	DS1990A	64-bit ROM ID
NV RAM Memory	DS1992/3/5/6L	1kb/4kb/16kb/64kb NV RAM
EEPROM Memory	DS1971/3/7	256-bit/4kb/32kB EEPROM
EPROM Memory	DS1982/5/6	1kb/16kb/64kb EPROM
Password-Protected Secure Memory	DS1991L/DS1977	Three 384-bit partitions NV RAM/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/DS1994L	RTC/RTC with 4kb NV RAM
<b>Temperature Sensors and Temperature/Humidity Data Loggers (see page 3)</b>		

## Accessories Quickview

COMM. 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. Insert iButton into device.
	DS9097U-S09/009/E25	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 iButtons and comes in a DB25 package.
	DS1410E-001	1-Wire Parallel Port Adapter: 1-Wire to parallel port interface. Insert iButton directly or use with DS1402D-DB8 or DS1402BP8.
PROBES/RECEPTORS (READER/WRITER INTERFACES)		
	DR8/DB8	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.
	DS1402RP8/BP8	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.
	DS9092GT	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.
	DS9092T/L	Panel Mount Probe. T version has tactile feedback. L version has LED and is recommended for outdoor use.
	DS1402D-041	Blue Dot probe component for embedded touch and hold applications.
iBUTTON MOUNTS		
	DS9093Ax/F/N	Key Fobs: Allow an iButton 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 iButtons to most surfaces. Available in two versions.
	DS9096P	iButton Adhesive Pads. Allow you to easily mount iButtons to anything.

# iButton®

Touch the Future!



## WHAT'S NEW?

### Overview

- What is an iButton?
- Applications
- Brochures
- Videos

### iButtons

- ID Only
- Memory
- Real-Time Clock
- Secure
- Temperature

### Accessories

- Readers & Adapters
- Mounting Options
- Starter Kits

### Sales

- Direct
- Buy Online
- Partners
- Distributors
- Samples
- Trade Shows

### Solution Partners

- Solutions Search
- Become a Partner

### Contact Us

- Contacts and Support
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### Technical Support

- Software Developer's Tools
- Data Sheets
- Application Notes
- Support
  - FAQs
  - Discussion Groups
  - E-mail Updates
- Photo Library

### Translations

- Chinese 简体中文
- Japanese 日本語

Visit Our Website to Find the Latest Information on iButtons—  
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