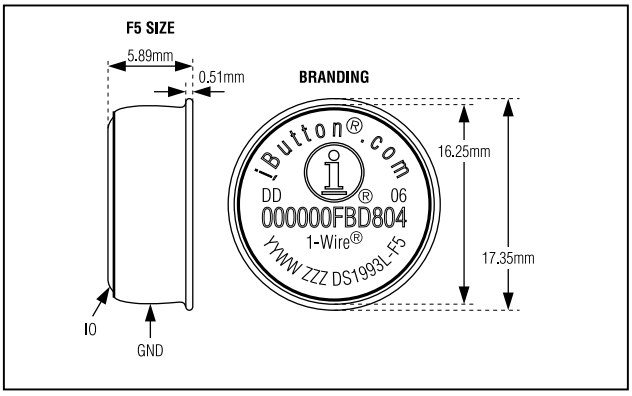
# DS1992/DS1993
# 1Kb/4Kb Memory iButton®

## SPECIAL FEATURES
- 4096 bits of Read/Write Nonvolatile Memory (DS1993)
- 1024 bits of Read/Write Nonvolatile Memory (DS1992)
- 256-bit Scratchpad Ensures Integrity of Data Transfer
- Memory Partitioned into 256-bit Pages for Packetizing Data
- Data Integrity Assured with Strict Read/Write Protocols
- Operating Temperature Range from -40°C to +70°C
- Over 10 years of data retention

## ORDERING INFORMATION
DS1992L-F5 F5 MicroCan
DS1993L-F5 F5 MicroCan

## EXAMPLES OF ACCESSORIES
DS9096P Self-Stick Adhesive Pad
DS9101 Multipurpose Clip
DS9093RA Mounting Lock Ring
DS9093F Snap-In Fob
DS9092 iButton Probe

## F5 MicroCan



## COMMON iButton FEATURES
- Unique, Factory-Lasered and Tested 64-bit Registration Number (8-bit Family Code + 48-bit Serial Number + 8-bit CRC Tester) Assures Absolute Traceability Because No Two Parts are Alike
- Multidrop Controller for MicroLAN
- Digital Identification and Information by Momentary Contact
- Chip-Based Data Carrier Compactly Stores Information
- Data Can be Accessed While Affixed to Object
- Economically Communicates to Bus Master with a Single Digital Signal at 16.3kbps
- Standard 16mm Diameter and 1-Wire® Protocol Ensure Compatibility with iButton® Family
- Button Shape is Self-Aligning with Cup-Shaped Probes
- Durable Stainless Steel Case Engraved with Registration Number Withstands Harsh Environments
- Easily Affixed with Self-Stick Adhesive Backing, Latched by its Flange, or Locked with a Ring Pressed onto its Rim
- Presence Detector Acknowledges When Reader First Applies Voltage
- Meets UL#913 (4th Edit.); Intrinsically Safe Apparatus, Approved under Entity Concept for use in Class I, Division 1, Group A, B, C and D Locations

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## iButton DESCRIPTION

The DS1992/DS1993 memory iButtons (hereafter referred to as DS199_) are rugged read/write data carriers that act as a localized database, easily accessible with minimal hardware. The nonvolatile memory and optional timekeeping capability offer a simple solution to storing and retrieving vital information pertaining to the object to which the iButton is attached. Data is transferred serially through the 1-Wire protocol that requires only a single data lead and a ground return.

The scratchpad is an additional page that acts as a buffer when writing to memory. Data is first written to the scratchpad where it can be read back. After the data has been verified, a copy scratchpad command transfers the data to memory. This process ensures data integrity when modifying the memory. A 48-bit serial number is factory lasered into each DS199_ to provide a guaranteed unique identity that allows for absolute traceability. The durable MicroCan package is highly resistant to environmental hazards such as dirt, moisture, and shock. Its compact coin-shaped profile is self-aligning with mating receptacles, allowing the DS199_ to be easily used by human operators. Accessories permit the DS199_ to be mounted on almost any surface including plastic key fobs, photo-ID badges, and PC boards.

Applications include access control, work-in-progress tracking, electronic travelers, storage of calibration constants, and debit tokens.

## OPERATION

The DS199_ have three main data components: 1) 64-bit lasered ROM, 2) 256-bit scratchpad, and 3) 1024-bit (DS1992) or 4096-bit (DS1993) SRAM. All data is read and written least significant bit first.

The memory functions are not available until the ROM function protocol has been established. This protocol is described in the ROM functions flow chart (Figure 9). The master must first provide one of four ROM function commands: 1) read ROM, 2) match ROM, 3) search ROM, or 4) skip ROM. After a ROM function sequence has been successfully executed, the memory functions are accessible and the master can then provide any one of the four memory function commands (Figure 6).

## PARASITE POWER

The block diagram (Figure 1) shows the parasite-powered circuitry. This circuitry steals power whenever the data input is high. The data line provides sufficient power as long as the specified timing and voltage requirements are met. The advantages of parasite power are two-fold: 1) by parasiting off this input, battery power is not consumed for 1-Wire ROM function commands, and 2) if the battery is exhausted for any reason, the ROM may still be read normally. The remaining circuitry of the DS1992 and DS1993 is solely operated by battery energy.

## 64-BIT LASERED ROM

Each DS199_ contain a unique ROM code that is 64 bits long. The first 8 bits are a 1-Wire family code. The next 48 bits are a unique serial number. The last 8 bits are a CRC of the first 56 bits. (See Figure 2.) The 1-Wire CRC is generated using a polynomial generator consisting of a shift register and XOR gates as shown in Figure 3. The polynomial is $X^8 + X^5 + X^4 + 1$. Additional information about the Dallas 1-Wire Cyclic Redundancy Check is available in the Book of DS19xx iButton Standards. The shift register bits are initialized to zero. Then starting with the least significant bit of the family code, 1 bit at a time is shifted in. After the 8th bit of the family code has been entered, then the serial number is entered. After the 48th bit of the serial number has been entered, the shift register contains the CRC value. Shifting in the 8 bits of CRC should return the shift register to all zeros.

## PHYSICAL SPECIFICATIONS

| | |
|---|---|
| Size | See mechanical drawing |
| Weight | 3.3 grams (F5 package) |
| Expected Service Life | 10 years at +25°C |
| Safety | Meets UL#913 (4th Edit.); Intrinsically Safe Apparatus, Approved under Entity Concept for use in Class I, Division 1, Group A, B, C and D Locations |

## ABSOLUTE MAXIMUM RATINGS*

| | |
|---|---|
| Voltage on any Pin Relative to Ground | -0.5V to +7.0V |
| Operating Temperature Range | -40°C to +70°C |
| Storage Temperature Range | -40°C to +70°C |

* *This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.*

## DC ELECTRICAL CHARACTERISTICS (-40°C to +70°C.)

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| 1-Wire Pullup Voltage (Notes 1, 3) | $V_{PUP}$ | 2.8 | | 6.0 | V |
| Logic 1 (Notes 1, 2) | $V_{IH}$ | 2.2 | | | V |
| Logic 0 (Note 1) | $V_{IL}$ | -0.3 | | +0.3 | V |
| Output Logic Low at 4mA (Note 1) | $V_{OL}$ | | | 0.4 | V |
| Input Load Current (Note 4) | $I_L$ | | 5 | | µA |

## CAPACITANCE ($T_A$ = +25°C)

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| I/O (1-Wire) (Notes 5, 6) | $C_{IN/OUT}$ | | 100 | 800 | pF |

## AC ELECTRICAL CHARACTERISTICS ($V_{PUP}$ = 2.8V to 6.0V; -40°C to +70°C.)

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Time Slot | $t_{SLOT}$ | 60 | | 120 | µs |
| Write 1 Low Time | $t_{LOW1}$ | 1 | | 15 | µs |
| Write 0 Low Time | $t_{LOW0}$ | 60 | | 120 | µs |
| Read Data Valid | $t_{RDV}$ | | exactly 15 | | µs |
| Release Time | $t_{RELEASE}$ | 0 | 15 | 45 | µs |
| Read Data Setup (Note 7) | $t_{SU}$ | | | 1 | µs |
| Recovery Time | $t_{REC}$ | 1 | | | µs |
| Reset Time High (Note 8) | $t_{RSTH}$ | 480 | | | µs |
| Reset Time Low (Note 9) | $t_{RSTL}$ | 480 | | 960 | µs |
| Presence Detect High | $t_{PDH}$ | 15 | | 60 | µs |
| Presence Detect Low | $t_{PDL}$ | 60 | | 240 | µs |

**Note 1:** All voltages are referenced to ground.

**Note 2:** $V_{IH}$ is a function of the external pullup resistor and the $V_{CC}$ power supply.

**Note 3:** $V_{PUP}$ = external pullup voltage.

**Note 4:** Input load is to ground.

**Note 5:** Capacitance on the data line could be 800pF when power is first applied. If a 5kΩ resistor is used to pull up the data line to $V_{PUP}$, 5µs after power has been applied, the parasite capacitance does not affect normal communications.

**Note 6:** Guaranteed by design, not production tested.

**Note 7:** Read data setup time refers to the time the host must pull the 1-Wire bus low to read a bit. Data is guaranteed to be valid within 1µs of this falling edge, and remains valid for 14µs minimum (15µs total from falling edge on 1-Wire bus).

**Note 8:** An additional reset or communication sequence cannot begin until the reset high time has expired.

**Note 9:** The reset low time ($t_{RSTL}$) should be restricted to a maximum of 960µs, to allow interrupt signaling; otherwise, it could mask or conceal interrupt pulses.