1-WIRE PRODUCTS
Design Guide

1-Wire products deliver a powerful combination...

- Memory, mixed-signal, and authentication solutions
- Industry's most efficient contact interface

For more 1-Wire information, data sheets, app notes, and free samples, go to: www.maxim-ic.com/1WireDG
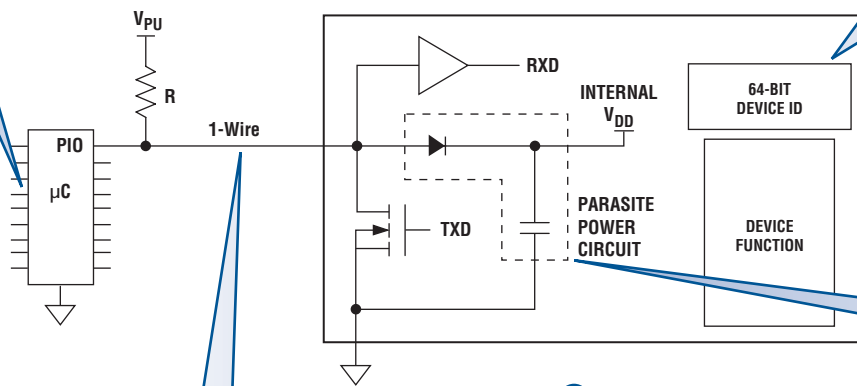
1-Wire® FUNDAMENTALS

1 Simple host interface
- Spare port pin
- Integrated line drivers

2 Device identification
- Unique and unalterable 64-bit ID in each device
- > 281 x 10^{12} number pool with 48-bit serialization

	SERIAL NUMBER	FAMILY CODE
8-BITS	48-BITS	8-BITS
	64-BIT DEVICE ID	

3 Device power
- Derived from serial communication signaling
- Captured on internal capacitor

4 Serial communication

WRITE 0 | WRITE 1 | READ 1 | READ 0

- Bidirectional
- Half-duplex
- Single master, multiple slaves

5 Multidrop capable
- One to hundreds of devices on a single line
- Unique device ID is also used to identify and operate individual devices
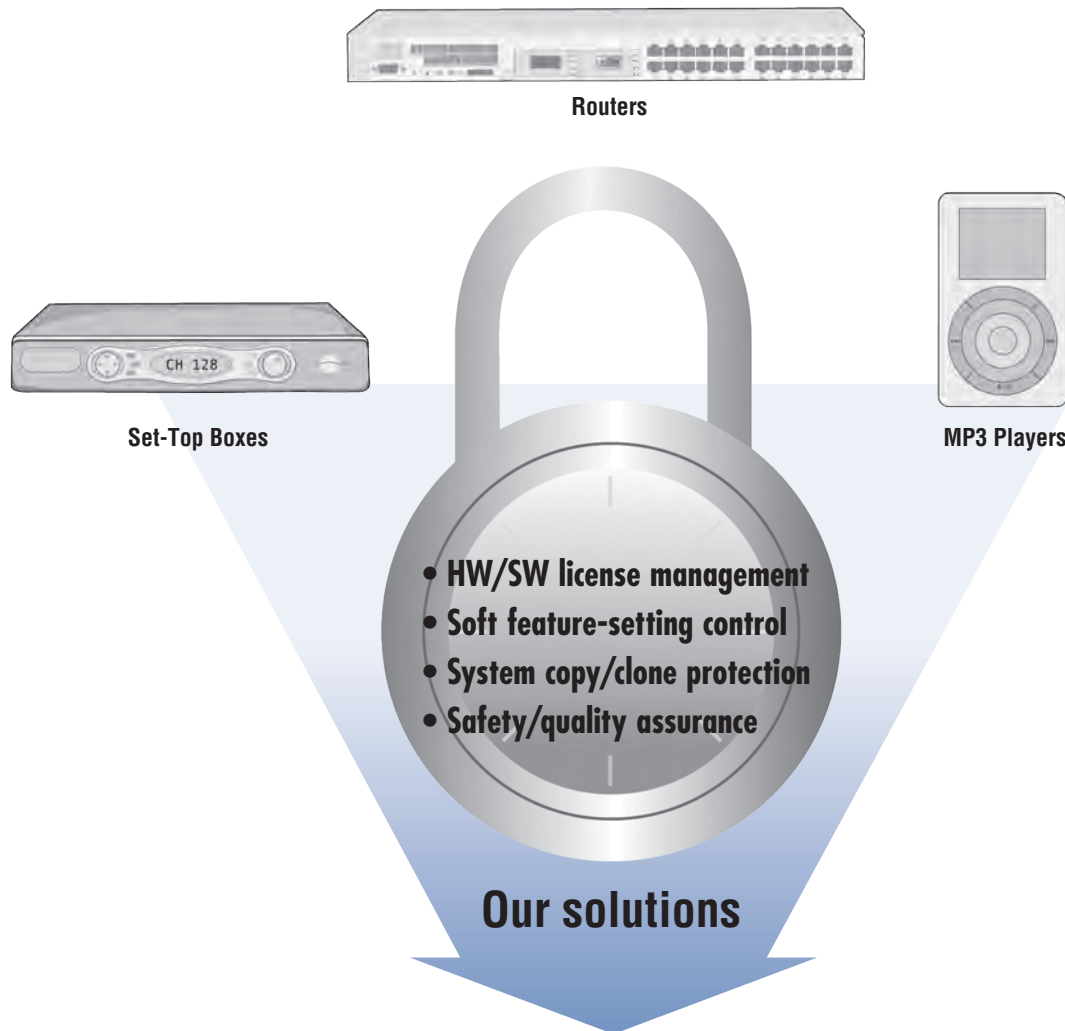
Look inside for

- Secure product or system authentication with 1-Wire memory
- 28V/20mA 1-Wire-controlled GPIO
- Using 1-Wire to identify accessories/sensors
- Latest 1-Wire EEPROM with mixed-signal functions

- 1-Wire line drivers
- Ideal RTC/ID solution for MP3/ portable multimedia products
- Lowest cost, 1-Wire, 1Kb EEPROM

MAXIM

Proven electronic authentication solutions protect your development investment

1-Wire memory products offer a wide range of low-cost[†], well-tested, and proven authentication solutions. Options range from customization of the unique, 64-bit serial number factory-lasered into each device (providing controlled procurement access) to secure crypto-strong, ISO/IEC 10118-3 SHA-1-based challenge and response for mutual authentication.

Routers

Set-Top Boxes

MP3 Players

- **HW/SW license management**
- **Soft feature-setting control**
- **System copy/clone protection**
- **Safety/quality assurance**

Our solutions

Part	Description	Authentication Feature
DS2432	1Kb EEPROM with SHA-1 authentication	Bidirectional SHA-1 challenge and response
DS28E01-100*	1Kb EEPROM with SHA-1 authentication	Bidirectional SHA-1 challenge and response
DS2401/DS2411	64-bit ROM serial number	Customized 64-bit ROM
DS2431	1Kb EEPROM	Customization, write-protection/OTP modes
DS2460	SHA-1 coprocessor	Secure storage of system secret
DS1963S	4Kb SHA-1 iButton®	Bidirectional SHA-1 challenge and response

For more information, including pricing, samples, data sheets, and application notes, go to: www.maxim-ic.com/protectDG

iButton is a registered trademark of Maxim Integrated Products, Inc.
*Data sheet provided under NDA.
†Authentication solutions start as low as $0.15 for consumer electronics volumes. Prices provided are for design guidance and are FOB USA. International prices will differ due to local duties, taxes, and exchange rates. Not all packages are offered in 1k increments, and some may require minimum order quantities.

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28V/20mA GPIO outputs are ideal for high-voltage peripherals

Identify and control accessories and peripherals over a dedicated 1-Wire interface contact

The DS2413 is ideal for applications where a cabled accessory or peripheral needs to be identified and controlled. The DS2413, for example, can identify the power capability of an AC-adapter power supply and control adapter ON/OFF or LED functions. The 28V GPIO operating levels are also ideal for controlling high-voltage loads found in industrial controls or rack-based equipment like base stations. A unique, 64-bit ID number provides an ideal solution for peripheral identification and can be customized to encode model information. The two-contact 1-Wire interface also enables multiple DS2413s or other 1-Wire devices to be multidropped on a common 1-Wire line with line lengths that can easily extend to tens of meters.
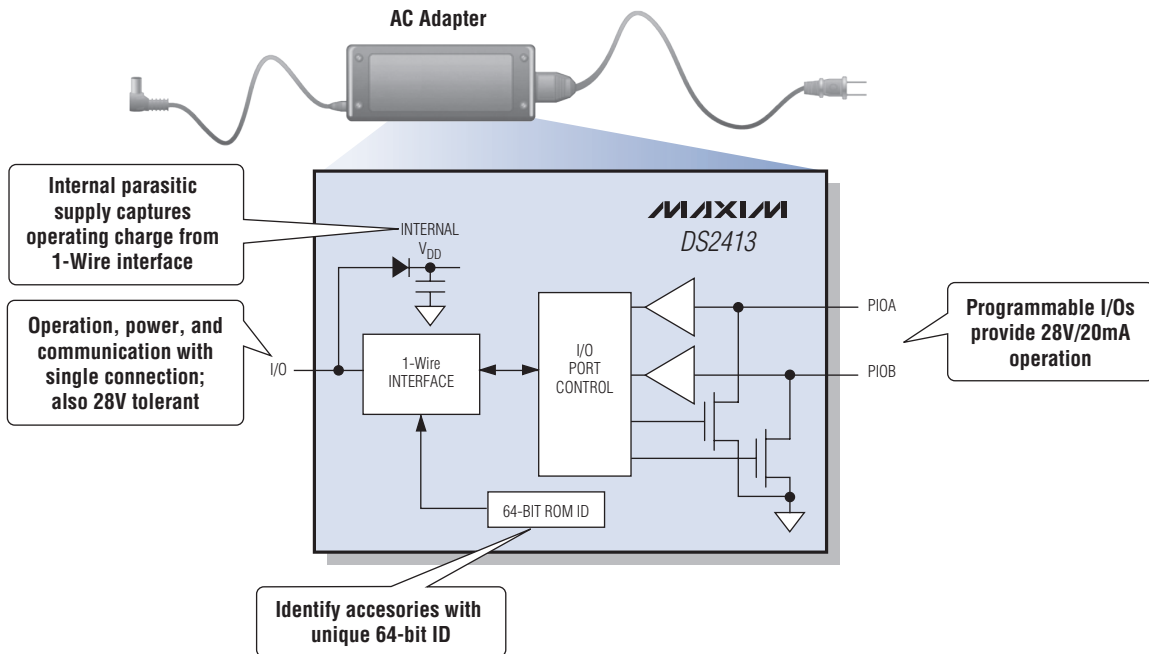
- **Software-programmable I/O ports**
- **All pins capable of 28VDC (sustained)**
- **Current sink 20mA with 20Ω (max) on-resistance**
- **All operation over the two-contact 1-Wire bus**

- **High ESD immunity of I/O: ±8kV (typ) IEC 1000-4-2**
- **Designed for hot/live system insertion**
- **Each part uniquely identified with 64-bit device ID number**
- **Small, 6-pin TSOC package**

For additional information and free samples, go to: www.maxim-ic.com/DS2413DG

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1-Wire—industry's most efficient solution for accessory and peripheral identification and control

Spare connector pins between the host system and accessory are typically constrained, which makes adding which makes adding identification and control a challenge without increasing connector complexity and cost. The 1-Wire product line meets these requirements and implements system and accessory connection with a single, dedicated connector contact.

AC-Adapter ID and Authentication

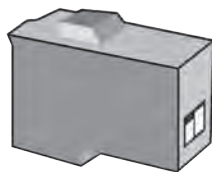**Medical-Sensor ID and Calibration**

Blood Glucose Strip Calibration and Authentication
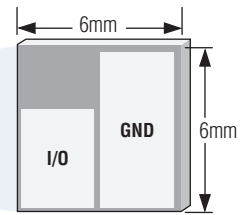
Medical Reagent Bottle ID

New SFN packaging simplifies adding 1-Wire ICs to nonelectronic peripherals

Printer Cartridge

Direct electromechanical contact of SFN package eliminates PC board.

6mm

6mm

GND

I/O

SFN** Package

1-Wire versatility

- **Automatically calibrates sensors or accessories**
- **Determines host-system operating mode appropriate to the attached peripheral**
- **Controls peripheral operating modes or visual indicators**
- **Ensures reliability and quality, unlike low-quality OEM knock-off products**

1-Wire Devices Commonly Used for Accessory and Sensor Applications

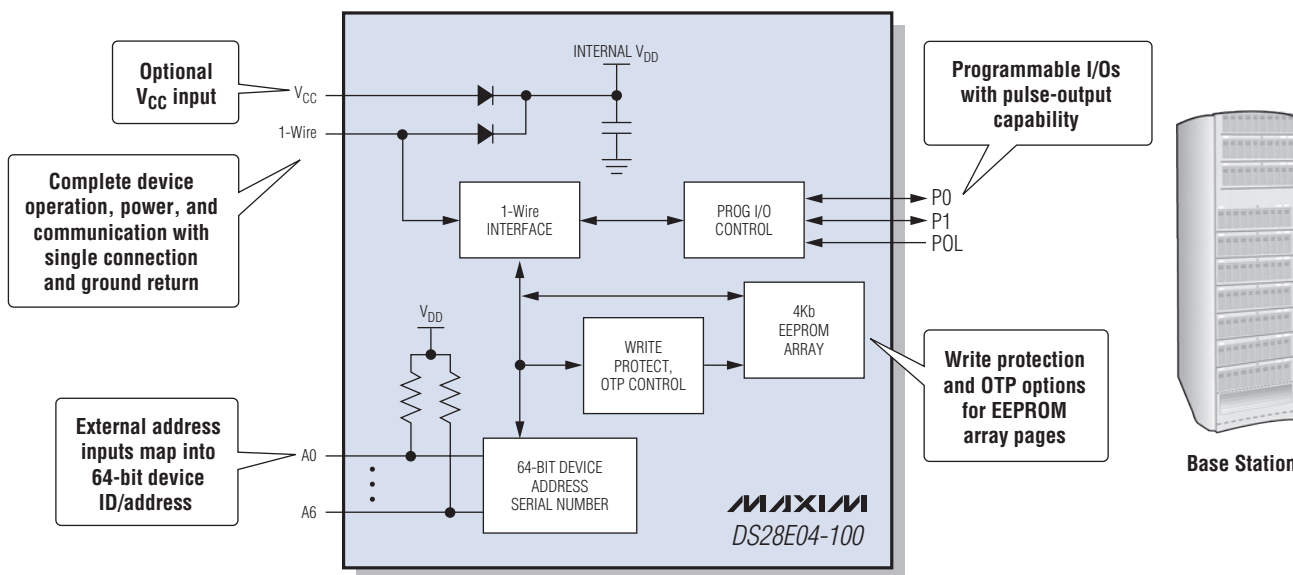| Part	Memory Type	Memory Size (bits)	Additional Features	Package
DS2401/ DS2411	ROM only	64	1.5V operation with DS2411	6-TSOC, SOT23, T0-92, flip chip
DS2431	EEPROM	1k	Write-protection, OTP modes	6-TSOC, µCSP*, T0-92, SFN*
DS2432/ DS28E01-100	EEPROM	1k	SHA-1 authentication	6-TSOC, µCSP*, SFN*
DS2433	EEPROM	4k	—	8-SO, PR35, flip chip
DS250x	EPROM	1k, 16k, 64k	Write protection	6-TSOC, T0-92, flip chip
DS2413	ROM only	64	Dual GPIO	6-TSOC
DS2408	ROM only	64	Eight GPIO	16-SO

*Contact factory for availability.
**SFN = Single Flat No lead

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1-Wire, 4Kb EEPROM has external address inputs and system monitoring functions

Identifies, locates, monitors, and controls cards and modules

Multicard-system controllers must identify the cards installed, monitor hot-swapped units, and detect/correct system fault conditions. The DS28E04-100 integrates EEPROM and an externally configurable 1-Wire address to store card information and identify card location. Programmable I/O functions enable a system host controller to monitor card conditions or output a 250ms reset pulse, if necessary. The DS28E04-100 is completely powered and operated through the two-contact, 1-Wire interface, which enables system diagnostics and monitoring under fault conditions or in the absence of card power. 1-Wire line lengths easily extend to tens of meters with hundreds of 1-Wire devices attached, making this device ideal for rack-type environments.


Optional V_{CC} input

INTERNAL V_{DD}

Complete device operation, power, and communication with single connection and ground return

V_{CC}

1-Wire

Programmable I/Os with pulse-output capability

1-Wire INTERFACE

PROG I/O CONTROL

P0
P1
POL

V_{DD}

WRITE PROTECT, OTP CONTROL

4Kb EEPROM ARRAY

Write protection and OTP options for EEPROM array pages

External address inputs map into 64-bit device ID/address

A0

A6

64-BIT DEVICE ADDRESS SERIAL NUMBER

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DS28E04-100

Base Station

- **4096 bits of general-purpose EEPROM**
- **Seven address inputs for physical location configuration**
- **Two general-purpose I/O pins with pulse capability (250ms, min)**
- **Enhanced 1-Wire front-end for noise immunity**
- **Designed for hot/live system insertion**

- **Complete operation over the two-contact, 1-Wire bus**
- **Each part uniquely identified with 64-bit device address**
- **Wide operating ranges: 2.8V to 5.25V, -40°C to +85°C**
- **16-pin SO package**

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1-Wire line driving optimized with integrated solutions

The hardware implementation of a 1-Wire bus master can be accomplished from something as basic as a spare microcontroller port pin and a pullup resistor. Software bit-bangs the port pin to implement the 1-Wire protocol and read/write to slave devices. Another approach uses one of several 1-Wire line drivers that perform protocol conversion from a variety of serial or memory-mapped interfaces and provide high-level 1-Wire command capability. These devices can be used to greatly simplify the hardware/software development task necessary with discrete solutions. They also provide optimized 1-Wire waveform generation.
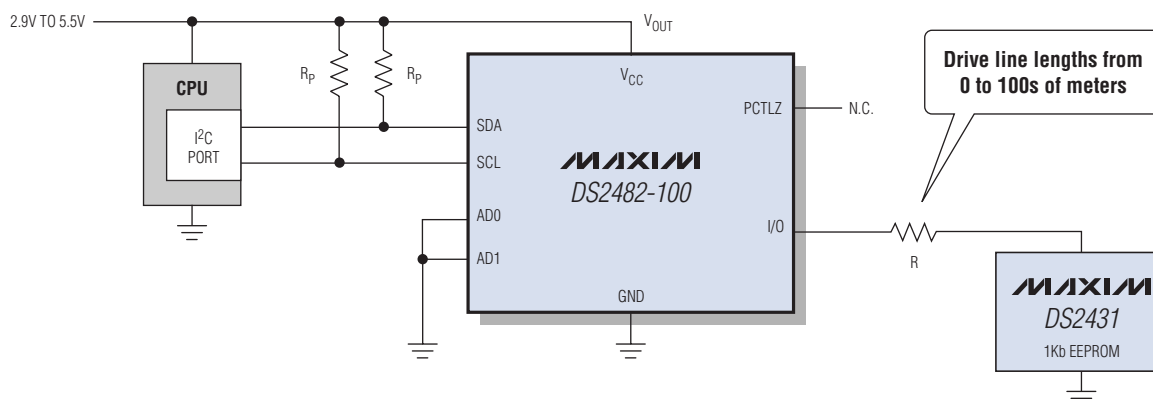
- **Regular and overdrive 1-Wire communication speeds**
- **I²C, RS-232, USB 1.1, memory-mapped host interfaces**
- **High-level 1-Wire command sequences**
- **Edge control of 1-Wire waveforms, extending communication distance to hundreds of meters (regular speed only)**
- **Low-impedance, strong pullup for slaves with momentary high source-current modes**
- **Resistive or active 1-Wire pullup**
- **Wide operating ranges: 2.9V to 5.25V, -40°C to +85°C**
- **Presence pulse masking (DS2482)**

1-Wire Line Drivers

Base Part	Features
DS2480B	UART/RS-232-to-1-Wire protocol converter, provides a single 1-Wire bus master I/O port
DS2482-100	I²C-to-1-Wire protocol converter, provides a single 1-Wire bus master I/O port
DS2482-800	I²C-to-1-Wire protocol converter, provides eight 1-Wire bus master I/O ports
DS2490	USB-to-1-Wire protocol converter, 12Mbps USB 1.1, provides a single 1-Wire bus master I/O port
DS1482	Single-bit operation, 3.3V host to 5V 1-Wire level shifting, 1-Wire load sensing

Low-cost RTC provides unique identification for portable multimedia

The DS2417 1-Wire, low-cost[†], single-contact RTC integrates a unique, 64-bit ROM ID that enables board-level or system-level electronic tagging. This device offers a programmable interrupt output for system wake-up. The DS2417 is ideal for MP3 players, portable gaming consoles, and PDAs.

- **±2 minutes per month clock accuracy at +25°C with external 32.768kHz crystal**
- **Periodic interrupt output with programmable rates**
- **250nA (max) operating current at 3.3V**
- **Wide operating ranges: 2.5V to 5.5V, -40°C to +85°C**
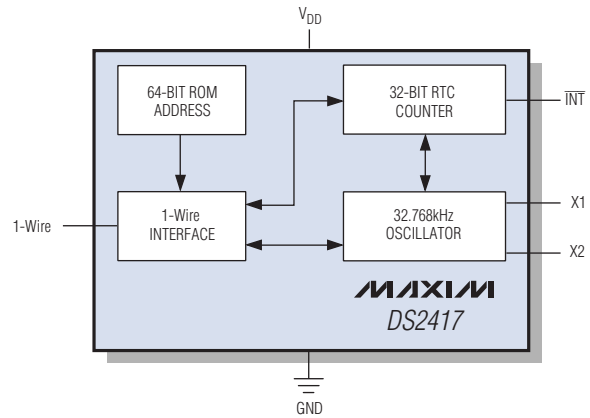
Lowest cost, 1Kb serial EEPROM with industry's most efficient 1-Wire interface

The DS2431 is the lowest-cost[††] 1Kb EEPROM that is both communicated with and powered over a 1-Wire interface. Programmable features include write protection and EPROM modes that can be individually applied to each of four 32-byte pages. Each DS2431 comes with a factory-lasered, unique 64-bit ROM ID that serves as a unique serial number or device address in case of multiple 1-Wire devices on a common 1-Wire line.

Typical applications
- **Accessory/PC-board identification**
- **After-market management of consumables**
- **Analog sensor calibration, including IEEE 1451.4**
- **Medical-sensor calibration data storage**

Key features
- **1024 bits of EEPROM memory**
- **Offers write protection and OTP EPROM mode on each 256-bit page**
- **IEC 1000-4-2 ESD resistance (typ): ±8kV Contact, ±15kV Air**
- **Reads/writes over a wide voltage range of 2.8V to 5.25V from -40°C to +85°C**
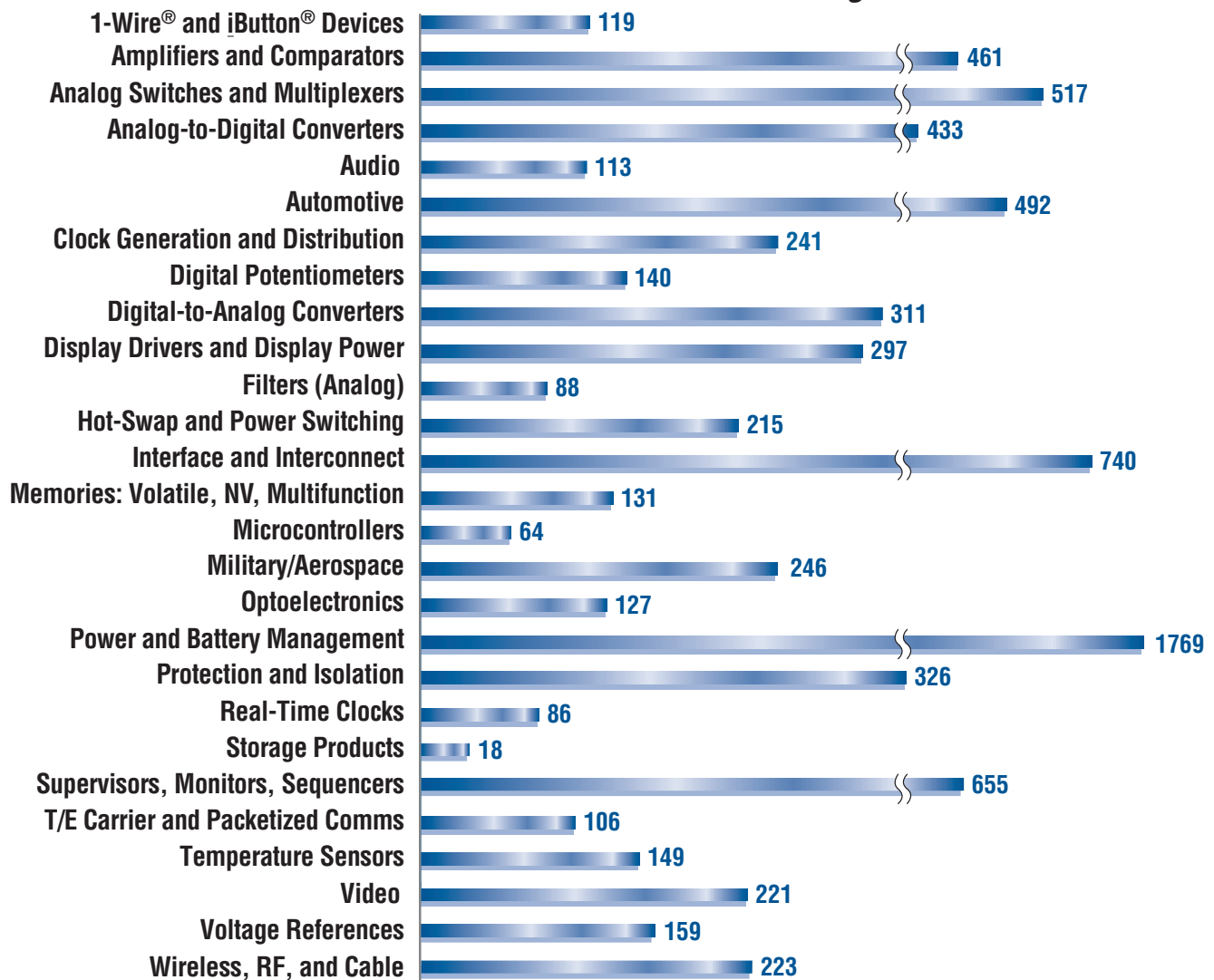

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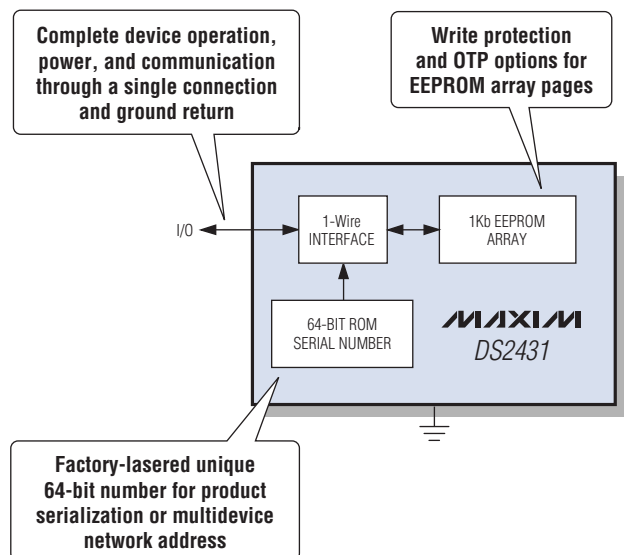
†$0.70. 10k-up recommended resale. Prices provided are for design guidance and are FOB USA. International prices will differ due to local duties, taxes, and exchange rates. Not all packages are offered in 1k increments, and some may require minimum order quantities.

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