Real-Time Clocks

Selector Guide

1st Edition June 2009

A real-time clock for every need

No matter what your system requires of a real-time clock, the variety of choices at Maxim will help you find the ideal RTC for your application. We offer more interface options and more value-added features, such as time-of-day alarms, watchdog timers, periodic interrupts, and nonvolatile memory, than any competitor. We provide clocks with tamper detection and secure memory for storage and protection of critical information like encryption keys. Additionally, with more experience in designing and building RTCs than any other company in the industry, Maxim builds on Dallas Semiconductor's 20-year track record of excellent field performance.

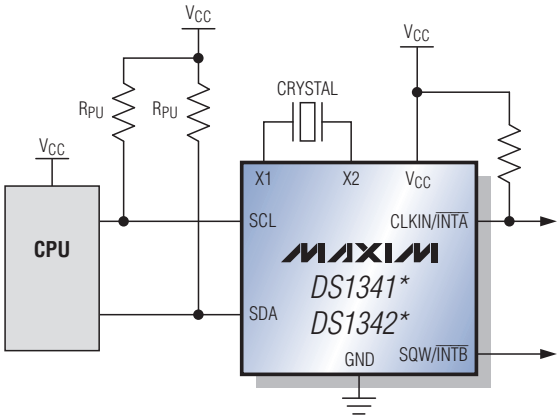
MAXIM

I²C single-supply RTCs

Maxim's I²C single-supply RTCs are the lowest cost timekeeping option due to their simple circuit and reduced pin count. These parts are ideal when either low cost or small packaging is the primary concern and the entire system already has a backup energy source.

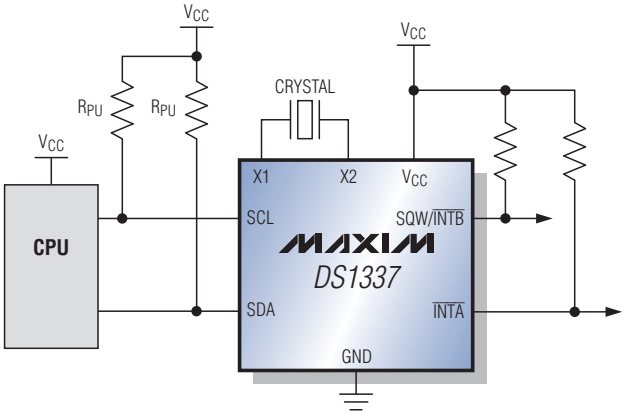
Compatible with high-ESR crystals while offering lowest possible current

- **Low, 250nA timekeeping current**
- **Compatible with crystal ESR up to 80kΩ**
- **1.8V to 5.5V operating voltage range**
- **Maintains time down to 1.15V (typ)**
- **Two time-of-day alarms with two interrupt outputs**
- **Programmable square-wave output**
- **Optional external clock source of 32.768kHz, 60Hz, 50Hz, or 1Hz**
- **3mm x 3mm, 8-pin µSOP**



Industry's smallest I²C RTC with two time-of-day alarms

- **Oscillator-stop flag**
- **Programmable square-wave output defaults to 32kHz on power-up**
- **3mm x 3mm, 8-pin µSOP or surface-mount package with an integrated crystal (DS1337C)**



Part	Full Operation (V)	Timekeeping (V)	Calendar Format	Clock Format	Interrupt	SQW	Other Features
DS1337	1.8 to 5.5	1.3 to 1.8	YY-MM-DD	HH:MM:SS	2 alarms	Prog	—
DS1371	1.7 to 5.5	1.3 to 1.7	Binary counter		Alarm or watchdog	Prog	—
DS1372	2.4 to 5.5	1.3 to 2.4	Binary counter		Alarm or square wave	—	64-bit serial number
DS1341*	1.8 to 5.5	1.15 to 1.8	YY-MM-DD	HH:MM:SS	2 alarms	Prog	Sync input, 80kΩ ESR
DS1342*	1.8 to 5.5	1.15 to 1.8	YY-MM-DD	HH:MM:SS	2 alarms	Prog	Sync input, 80kΩ ESR

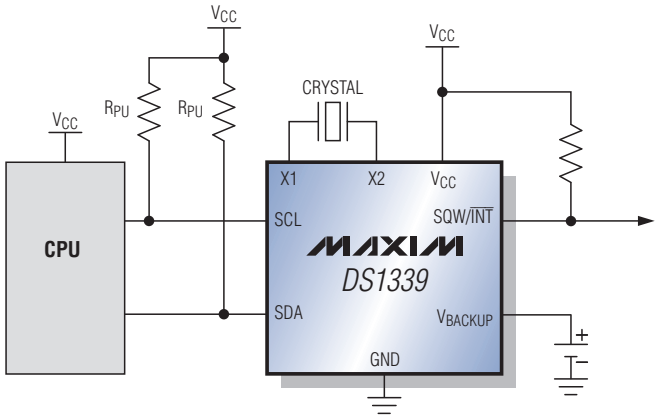
*Future product—contact factory for availability.

I²C RTCs with power switching

Maxim's I²C RTCs with power switching offer automatic transition from the primary power source to a backup supply when the main power source is no longer available. This allows the RTC to maintain time while the system is powered off. The built-in power switching meets Underwriters Laboratories (UL®) requirements for applications where the backup source is a battery.

Multiple programmable features provide system flexibility

- **Programmable square-wave output, trickle-charge capability, and two time-of-day alarms**
- **Oscillator stop flag**
- **Surface-mount 16-pin SO with an integrated crystal (DS1339C) or 8-pin µSOP (DS1339U)**



Part	Power (V)	Calendar Format	Clock Format	NV Memory (Bytes)	Time-of-Day Alarm	Watchdog Timer	SQW	Power-Fail Reset	Trickle Charger	Calibration
DS1307	5.0	YY-MM-DD	HH:MM:SS	56 SRAM			Prog			
DS1338	1.8, 3.0, 3.3, 5.0			56 SRAM	✓		Prog			
DS1339	2.0, 3.0, 3.3, 5.0			—	✓		Prog		✓	
DS1340	1.8, 3.0, 3.3, 5.0			—			—		✓	✓
DS1374	1.8, 3.0, 3.3, 5.0	Binary counter		—	✓	✓	Prog	✓	✓	
DS1388	3.0, 3.3, 5.0	YY-MM-DD	HH:MM:SS:hh	512 EEPROM		✓	—	✓	✓	
DS1672	2.0, 3.0, 3.3	Binary counter		—			—	✓	✓	
DS1678	5.0	YY-MM-DD	HH:MM:SS	32 SRAM	✓		—			
DS1682	5.0	Binary counter		10 EEPROM	✓		—			

Interfacing I²C Serial Real-Time Clocks to a Microcontroller

This application note describes a general hardware configuration and example software for Maxim's I²C interface RTCs. This example is specifically written for RTCs that use a BCD time and date format.

For the complete article, go to: www.maxim-ic.com/AN3300

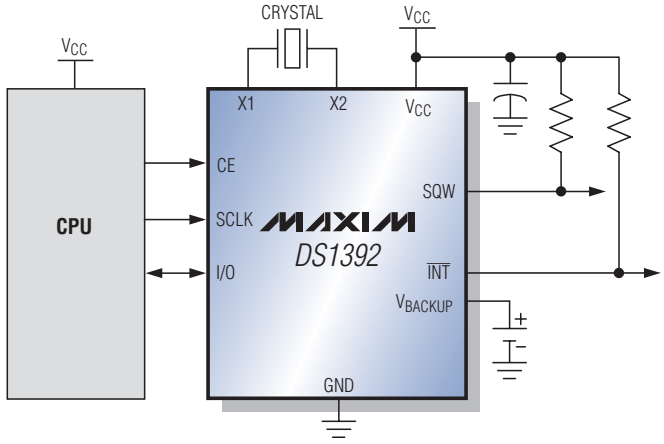
UL is a registered trademark of Underwriters Laboratory, Inc.

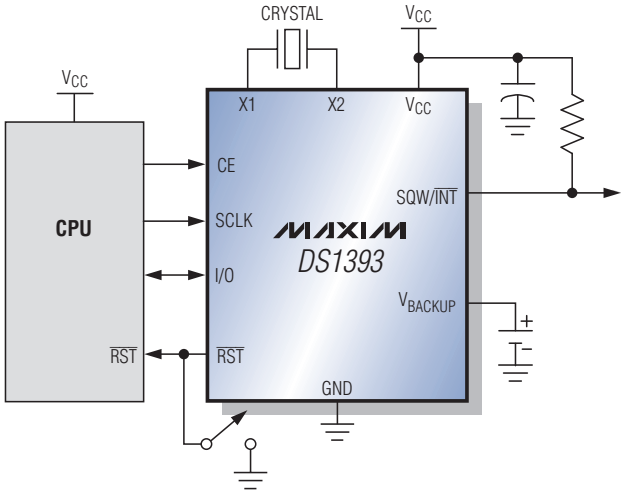
3-wire/SPI RTCs

Maxim's 3-wire and SPI-compatible interface RTCs offer clock rates up to 4MHz for faster data communications, while still providing the advantages of a low pin count and small package.

Smallest 3-wire RTCs with trickle charger have the industry's broadest feature set

- **Separate SQW and INT outputs (DS1392)**
- **Output pin configurable as interrupt or square wave (DS1393)**
  - **Programmable frequency of 32.768kHz, 8.192kHz, 4.096kHz, or 1Hz**
- **Reset output/debounced input (DS1393)**
- **One time-of-day alarm**
- **Power-fail detect and switch circuitry**
- **Three operating voltage ranges: 1.8V ±5%, 3.0V ±10%, and 2.97V to 5.5V**
- **3mm x 3mm, 10-pin µSOP**





Part	Power (V)	Calendar Format	Clock Format	NV Memory (Bytes)	Power Switching	Time-of-Day Alarm(s)	SQW	Watchdog Timer	Power-Fail Reset	Trickle Charger	ADC	NV SRAM Control	PFI/ PFO
DS1302	2.0 to 5.5	YY-MM-DD	HH:MM:SS	31 SRAM	✓	—	—			✓			
DS1305				96 SRAM	✓	2	—			✓			
DS1306				96 SRAM	✓	2	1Hz, 32kHz			✓			
DS1392	1.8, 3.0, 3.3, 5.0		HH:MM:SS:hh	—	✓	1	Prog						
DS1393	1.8, 3.0, 3.3, 5.0		HH:MM:SS:hh	—	✓		Prog		✓				
DS1670	3.3		HH:MM:SS	—	✓		—	✓	✓		✓	✓	
DS1673	3.0, 5.0			—	✓		—	✓	✓		✓	✓	
DS1677	5.0			—	✓		—	✓	✓		✓	✓	✓

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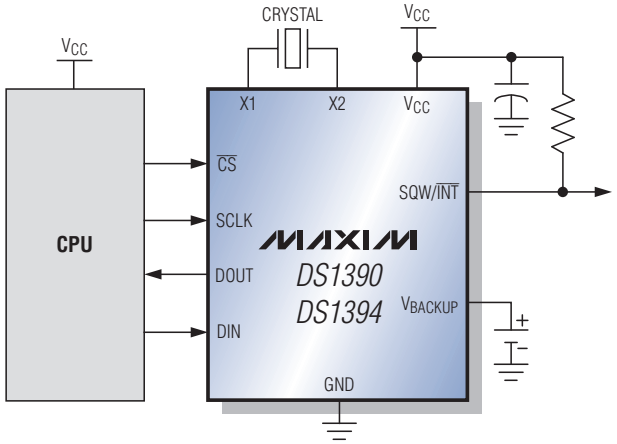
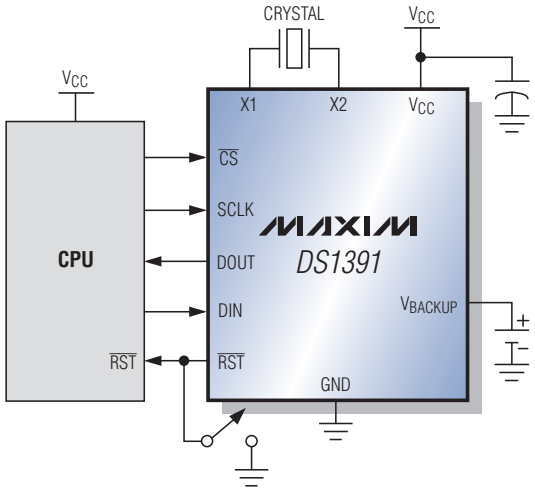
3-wire/SPI RTCs (cont.)

Industry's most highly integrated SPI RTCs with trickle charger have the smallest footprint in their class

- Output pin configurable as interrupt or square wave (DS1390/DS1394)
- One time-of-day alarm
- Power-fail detect and switch circuitry
- Reset output/debounced input (DS1391)
- Supports SPI modes 1 and 3 (DS1390/DS1391)
- Supports SPI modes 0 and 2 (DS1394)
- SCLK frequency of 4MHz at 3.0V and 3.3V, 1MHz at 1.8V
- Three operating voltage ranges: 1.8V ±5%, 3.0V ±10%, and 2.97V to 5.5V
- 3mm x 3mm, 10-pin µSOP





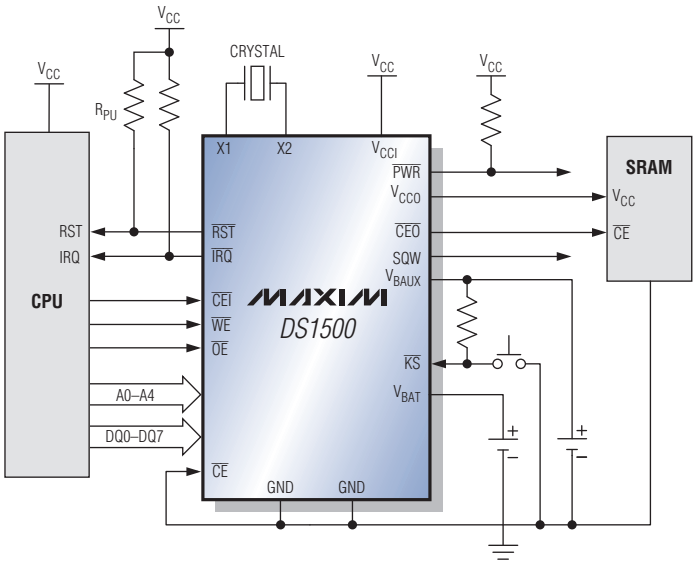
Part	Power (V)	Calendar Format	Clock Format	NV Memory (Bytes)	Power Switching	Time-of-Day Alarm(s)	SQW	Power-Fail Reset	Trickle Charger	Temp Sensor
DS1305	2.0 to 5.5	YY-MM-DD	HH:MM:SS	96 SRAM	✓	2	—		✓	
DS1306	2.0 to 5.5		HH:MM:SS	96 SRAM	✓	2	1Hz, 32kHz		✓	
DS1390	1.8, 3.3, 5.0		HH:MM:SS:hh	—	✓	1	Prog		✓	
DS1391	1.8, 3.0, 3.3, 5.0				✓		—	✓	✓	
DS1394	3.3				✓		Prog		✓	
DS3234	3.0, 5.0		HH:MM:SS	256 SRAM	✓	2	Prog	✓		✓

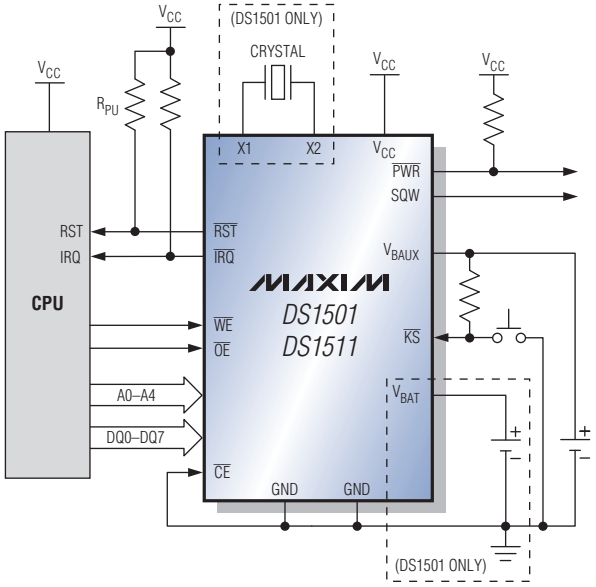
Byte-wide interface RTCs

The byte-wide, or parallel, interface allows RTCs the fastest data transfer with access times below 100ns. This makes byte-wide interface RTCs a good choice for systems that must quickly time-stamp events or share an interface with standard SRAM memory.

Power-control circuitry supports system power-on from date/day/time alarm or key closure/modem-detect signal

- Programmable watchdog timer and RTC alarm
- 3.3V or 5.0V operation
- Precision power-on reset
- 256 bytes battery-backed NV SRAM
- Auxiliary battery input
- Accuracy of better than ±1min/month at +25°C (DS1511)
- Day-of-week/date alarm register
- Crystal-select bit for RTC operation with 6pF or 12.6pF crystal
- Battery-voltage-level indicator flags
- Chip (DS1500/DS1501) or stand-alone encapsulated DIP module with embedded battery and crystal (DS1511)





Part	Power (V)	Calendar Format	User SRAM (Bytes)	Power Switching	Interrupts	SQW	NV SRAM Control	Features
DS1315	3.3, 5.0	HH:MM:SS:hh	—	✓	—	—	✓	—
DS1318	3.3	Binary counter	—		Alarm, periodic	Prog		Event timer
DS1500	3.3, 5.0	HH:MM:SS	256		WA*, periodic	32kHz	✓	µP reset, wakeup
DS1501								
DS1511								
DS1558			—		Alarm, periodic	—	✓	µP reset, PFO

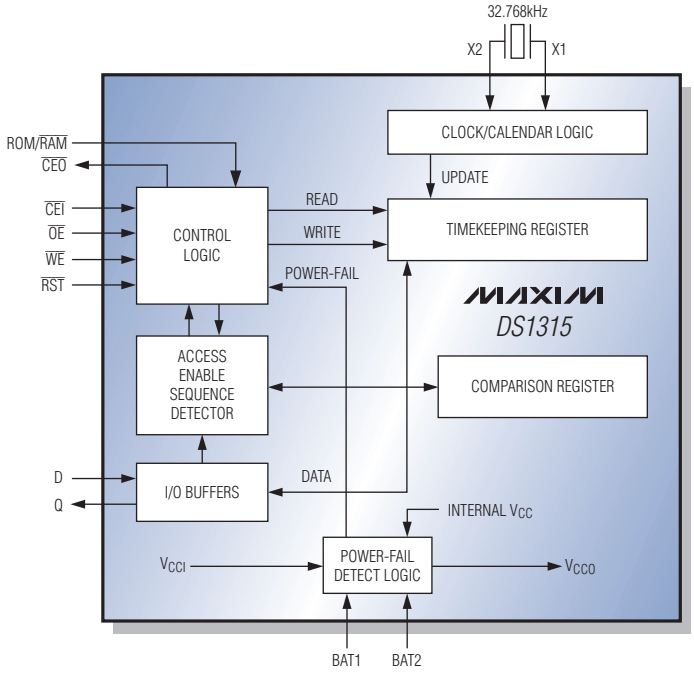
*WA = watchdog and alarm.

Phantom interface RTCs

The phantom interface allows the RTC to communicate serially across the D0 line of a standard parallel interface. The term "phantom" comes from the fact that the RTC is invisible until a unique 64-bit pattern is recognized. In this way, there is no requirement for a dedicated address space for the RTC, and the same firmware can access the RTC no matter what size memory block is present in the system.

Nonvolatile memory controller contains all support circuitry for converting CMOS RAM to NV memory

- **No address space required to communicate with RTC**
- **Provides NV controller functions for battery backup of SRAM**
- **Supports redundant battery attachment for high-reliability applications**
- **Full ±10% V_{CC} operating range**
- **3.3V or 5.0V operation**
- **16-pin PDIP, 20-pin TSSOP, or 16-pin SO**



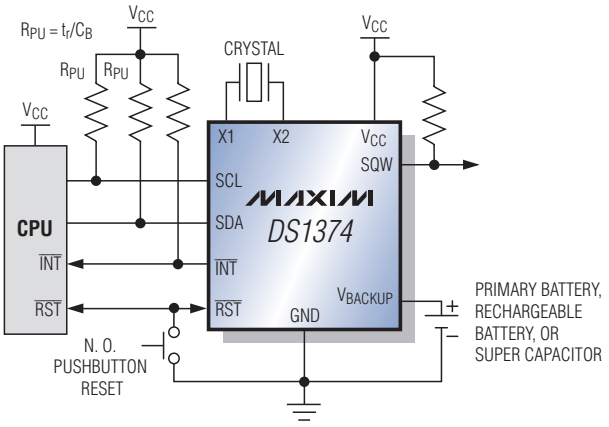
Part	Power (V)	Calendar Format	Clock Format	User Memory (Bytes)	NV SRAM Control	DIP Module	PowerCap	BGA Module
DS1243	5.0	YY-MM-DD	HH:MM:SS:hh	8K		✓		
DS1244	3.3, 5.0			32K		✓	✓	
DS1248				128K		✓	✓	
DS1251				512K		✓	✓	
DS1254				2M				✓
DS1315				—	✓			

RTCs with watchdog timer

Using an RTC with a watchdog timer can eliminate the need for a separate watchdog component in the design, which is ideal for portable instrumentation, point-of-sale equipment, medical equipment, and telecom switches.

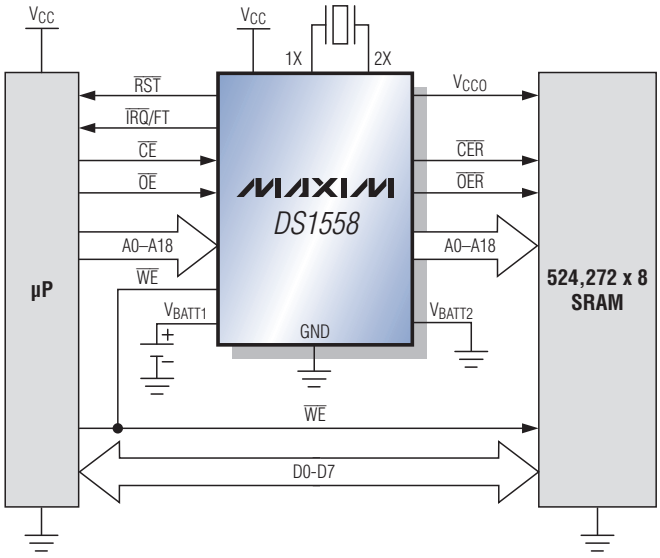
I²C RTC in binary-coded-decimal format operates down to +1.3V

- 32-bit binary counter
- Second binary counter provides time-of-day alarm, watchdog timer, or NV RAM
- Separate square-wave and interrupt output pins
- Automatic power-fail detect and switch circuitry
- Single-pin, pushbutton reset input/open-drain reset output
- Low-voltage operation
- Trickle-charge capability
- 3mm x 3mm, 10-pin µSOP or 300 mil, 16-pin SO



Discrete option to DS155x watchdog clock modules

- Byte-wide interface
- BCD-coded RTC counts year, month, date, day, hours, minutes, and seconds
- Greater than 10 years of timekeeping and data retention in the absence of power with small lithium coin cell(s) and low-leakage SRAM
- Precision power-on reset
- Programmable watchdog timer and RTC alarm
- Battery-voltage-level indicator flag
- Power-fail write protection allows for ±10% V_{CC} power-supply tolerance
- 7mm x 7mm, 48-pin TQFP



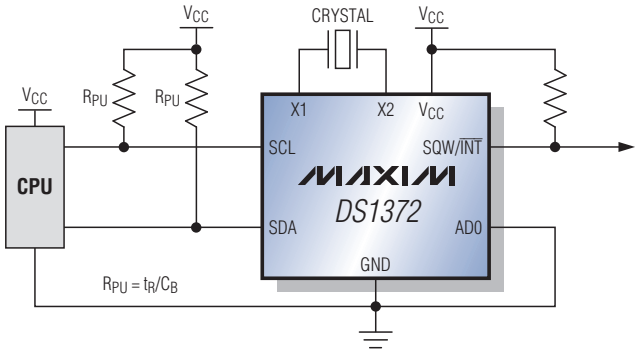
Part	Power (V)	Calendar Format	Clock Format	NV Memory (Bytes)	Power Switching	Interrupts	SQW	Features
DS1500	3.3, 5.0	YYYY-MM-DD	HH:MM:SS	256 SRAM	✓	WA, periodic	32kHz	µP reset, wakeup, NV SRAM control
DS1501					✓			µP reset, wakeup
DS1511					✓			µP reset, wakeup
DS1558	3.3, 5.0			—	✓		—	µP reset, NV SRAM control
DS1388	3.0, 3.3, 5.0		HH:MM:SS:hh	512 EEPROM	✓	WA		µP reset, trickle charger
DS1371	1.8 to 5.5	Binary counter		—			Prog	—
DS1372	1.8 to 5.5							Serial number
DS1374	1.8, 3.0, 3.3, 5.0				✓			µP reset, trickle charger

Binary counter RTCs

Binary counter RTCs simplify calculations if the time of interest is an elapsed time rather than a time of day. Some operating systems (like Unix®) even prefer to store the time as a single binary number. This is especially useful for applications that require warranty tracking, such as in portable audio/video players, or time-of-use tracking, as in servers or power metering.

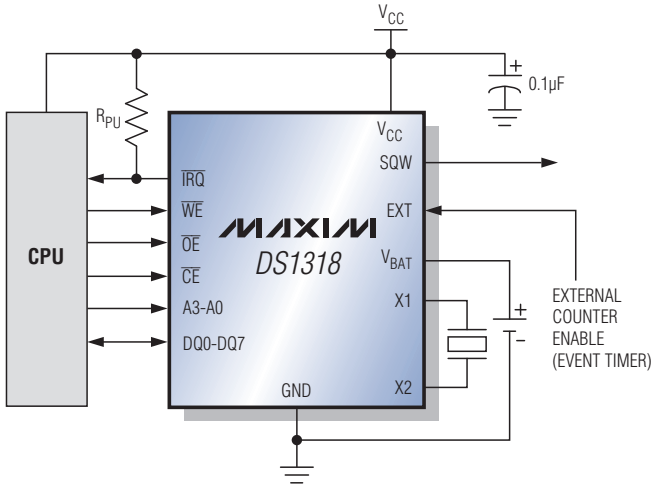
Binary counter has unique, 64-bit, factory-programmed serial number

- 32-bit binary counter
- 24-bit alarm counter provides periodic alarm, watchdog timer, or RAM
- Programmable alarm
- Single output configurable as interrupt or square wave
- Two selectable I²C addresses
- 2.4V to 5.5V operating voltage range
- 1.3V to 5.5V timekeeping operating range
- 3mm x 3mm, 8-pin µSOP



44-bit binary counter provides timer with 244µs resolution

- Byte-wide parallel interface
- Automatic power-fail-detect and switch circuitry
  - Selects power source from primary power and battery
  - Write-protects internal registers
- Internal power-fail circuit allows timer to provide primary or battery operation times
  - Alternately, timer can provide event timing of either active-high or active-low pulse
- Interrupt output generated periodically or when upper 32 bits of counter match an alarm register
- Square-wave output with 16 selectable frequencies from 32.768kHz to 0.5Hz
- 3.3V operation
- 6.4mm x 7.8mm, 24-pin TSSOP



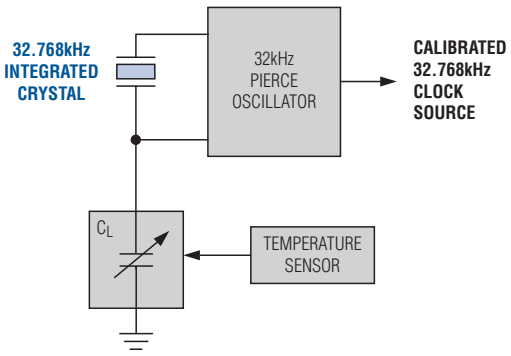
Part	Power (V)	Power Switching	Alarm/ Periodic Interrupt	Watchdog Timer	SQW	Power-Fail Reset	Trickle Charger	Event Recorder	Event Timer	Serial Number	RC Oscillator
DS1318	3.3	✓							✓		
DS1371	1.8 to 5.5			✓	Prog						
DS1372	1.8 to 5.5		✓	✓						✓	
DS1374	1.8, 3.0, 3.3	✓		✓		✓	✓				
DS1682	2.5 to 5.5				—			✓			✓

UNIX is a registered trademark of The Open Group.

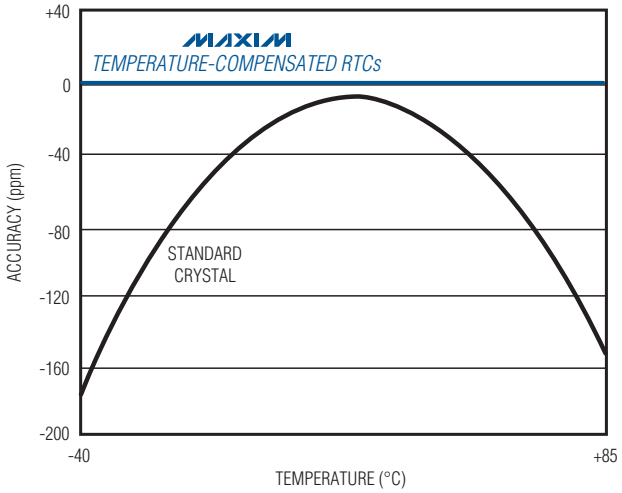
Accurate timekeeping RTCs

Maxim's line of accurate RTCs monitor an onboard temperature sensor and adjust the load capacitance of an embedded crystal in order to compensate for the natural temperature variation of the tuning fork crystal. Because the crystal and die are calibrated across the full operating temperature range as a unit, the resulting frequency accuracy is better than any competing technology. Therefore, these accurate RTCs are ideal for frequency-based applications such as telematics and utility power meters.

Built-in TCXO



Improvement in accuracy



Temperature (°C)	Standard Crystal	Built-In TCXO
+25	±25ppm (±1min/month)	**±2ppm (±1min/yr)**
0°C to +40	-0.04ppm/°C (-1min/month)	**±2ppm (±1min/yr)**
-40 to 0°C, +40 to +85	-0.04ppm/°C (-90min/yr)	**±3.5ppm (±2min/yr)**

Accurate RTCs

Part	Interface	32kHz Output	Programmable Update Time	Interrupt Output	NV Memory (Bytes)	Package
DS3231	I²C	Open drain		1	—	16-SO
DS3232	I²C	Push-pull	✓		236 SRAM	20-SO
DS3234	SPI	Push-pull	✓		256 SRAM	
DS32B35	I²C	Open drain			2K FRAM	
DS32C35	I²C	Open drain			8K FRAM	

For a live demo of the industry's most accurate RTC, the DS3231, visit: www.maxim-ic.com/DS3231demo

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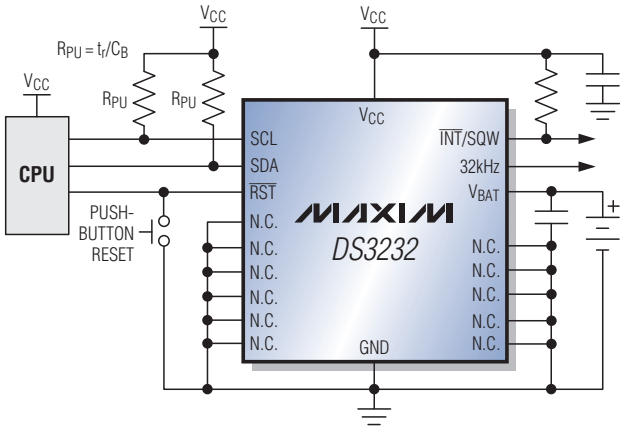
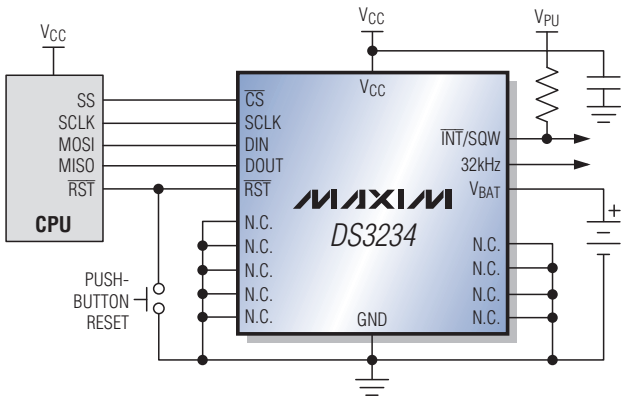
Accurate timekeeping RTCs (cont.)

Extremely accurate RTCs require no user calibration

Fast, 400kHz I²C interface with 236 bytes of SRAM



4MHz SPI interface with 256 bytes of SRAM supports modes 1 and 3



- **Accuracy**
  - **±2ppm from 0°C to +40°C**
  - **±3.5ppm from -40°C to +85°C**
- **Battery backup input for continuous timekeeping**
- **Two time-of-day alarms**
- **Programmable square-wave output**
- **Fast, 400kHz I²C interface**
- **3.3V operation**
- **±3°C accurate digital temp-sensor output**
- **Register for aging trim**
- **$\overline{\text{RST}}$ input/output**
- **300 mil, 20-pin SO package**

Power Considerations for Accurate Real-Time Clocks

By utilizing the new programmable temperature update time feature in the DS3231/DS3232, an application can reduce the total current requirements of an accurate RTC while maintaining superior timekeeping accuracy.

For the full story, go to: www.maxim-ic.com/AN3644

Tamper-detection secure supervisors with RTCs

With the increasing demand for electronic security, the latest value-added features of our RTCs are tamper detection and deletion of encryption keys from NV SRAM storage. Packaged in a CSBGA for an added level of security, these RTCs were developed to address the need to keep critical data secure and to protect highly sensitive data from theft. These secure RTC supervisors are used in applications such as ATMs, biometrics, and alarm systems to:

- Provide active tamper detection
- Store encryption keys and other critical data
- Delete encryption keys immediately and completely as a response to a detected tamper
- Time-stamp tamper events

Available with an integrated RTC, an automatic battery switch, and two interface options, Maxim's secure supervisors support FIPS 140-2 (security levels 1 through 4), PCI-PED, and the highest requirements of Common Criteria.

Part	I/O	Encryption Key Storage (Bytes)	Time Stamp	Internal RAM Control and Erase	External RAM Control and Erase	Defined Threshold Tamper Inputs	Logic-Level Tamper Inputs	Window Comparators	Analog/ Digital Input
DS3600	3-wire	64	✓	✓	✓	4	1	—	Temperature and battery
DS3605	I2C	—	✓		✓	4	1	—	
DS3640	I2C	1K	✓	✓		4	3	—	
DS3641	4-wire	1K	✓	✓		4	3	—	
DS3645	I2C	4K	✓	✓	✓	4	2	4	
DS3650	4-wire	—				2	—	—	
DS3655	I2C	64	✓	✓		2	1	—	

Embedded Security Going Forward

Equipment manufacturers and designers are facing many new design challenges due to the continuing need for increased data security in many of today's electronic systems. At the heart of the problem is the need to either implement security and antitamper countermeasures into a new application that never before required such mechanisms, or to avoid the introduction of new design variables into proven existing security circuitry. This is compounded with the emergence of new security standards and the the ever-increasing demands the certification bodies require. The challenges of maintaining size and cost competitiveness further complicate this critical design requirement. In order to meet these challenges, Maxim has introduced a family of innovative devices designed to specifically address new and emerging security standards in a controlled and layered approach. These new devices allow legacy designs to be enhanced with additional security, while minimizing the costs and risks of designing entirely new embedded security platforms, a discussion of which can be found at: www.maxim-ic.com/AN3976

For additional information about the embedded security features of the DS36xx parts, go to: www.maxim-ic.com/AN4244

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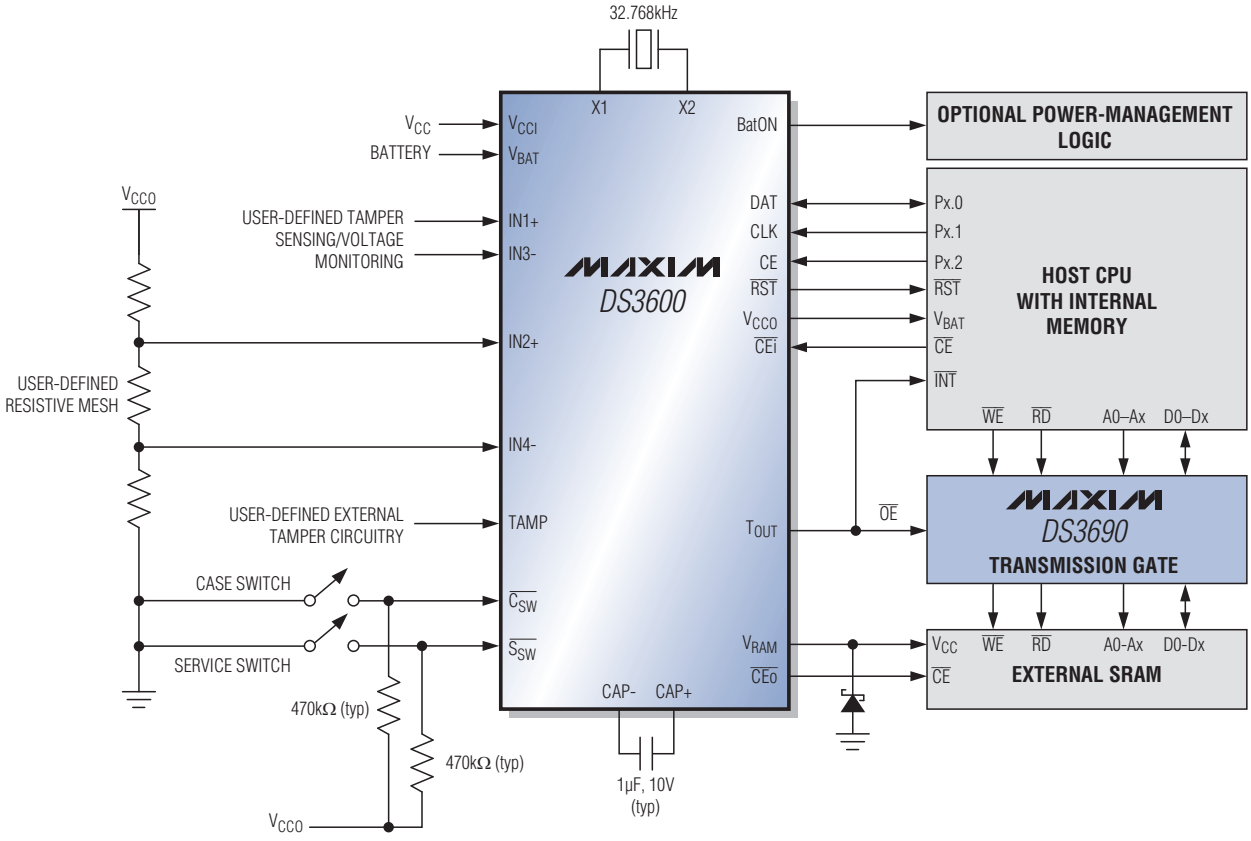
Tamper-detection secure supervisors with RTCs (cont.)

Industry's first secure encryption-key controller

Integration replaces up to 40 components and enhances key security



- Patented nonimprinting memory*
- Winner of *Electronic Products* 2006 Product of the Year and a 2006 *Sesames* Award Finalist
- Ultra-low-power tamper-detection circuits
- Inputs for external tamper-detection circuits
- Internal tamper monitors
- External SRAM control and rapid erasure on tamper
- RTC for time-stamping of tamper events
- Battery backup switch
- Can be used with any system microprocessor
- Low-profile, leadless CSBGA package

*U.S. Patent #7,379,325.

Serial selector guide

	Part	Power (V)	Clock Format	SRAM/ EEPROM/ FRAM (Bytes)	Power Switching	Trickle Charger	Interrupts	Square Wave	Other Features
2-Wire or I²C	DS1307	5.0	HH:MM:SS	S: 56	✓		—	Prog	—
	DS1337	1.8 to 5.5		—			2 alarms		
	DS1338	1.8, 3.0, 3.3, 5.0		S: 56	✓		—		
	DS1339			—	✓	✓	2 alarms		
	DS1340			—	✓	✓	—	—	Calibration
	DS1341*/42*	1.8 to 5.5		—			2 alarms	Prog	Sync input
	DS1371	1.7 to 5.5	Binary counter	—			Watchdog and alarm	Prog**	—
	DS1372	2.4 to 5.5		—				Prog**	Serial number
	DS1374	1.8, 3.0, 3.3, 5.0		—	✓	✓		Prog	Power-fail reset
	DS1375	1.7 to 5.5	HH:MM:SS	S: 16			2 alarms	Prog	—
	DS1388	3.0, 3.3, 5.5	HH:MM:SS:hh	E: 512	✓	✓	Watchdog and alarm	—	Power-fail reset
	DS1629	2.2 to 4.0	HH:MM:SS	S: 32			1 alarm	Prog	Temp sensor
	DS1672	2.0, 3.0, 3.3	Binary counter	—	✓	✓	—	—	Power-fail reset
	DS1678	5.0	HH:MM:SS	S: 32	✓		1 alarm	—	Event recorder
	DS1682	2.5 to 5.5	Binary counter	E: 10			1 alarm	—	RC oscillator
	DS3231	3.3	HH:MM:SS	—	✓		2 alarms	Prog	Temp sensor
	DS3232			S: 236					
	DS32B35			F: 2K					
	DS32C35			F: 8K					
	DS3605			—			—	—	Secure supervisor with tamper detection
	DS3640			S:1K			—	—	
	DS3645		Binary counter	S:4K			1 alarm	—	
	DS3655		Binary counter	S:64			—	—	
3-Wire	DS1302	2.0 to 5.5	HH:MM:SS	S: 31	✓	✓	—	—	—
	DS1305			S: 96			2 alarms	—	—
	DS1306			S: 96				1Hz, 32kHz	—
	DS1392	1.8, 3, 3.3, 5.0	HH:MM:SS:hh	—			1 alarm	Prog	—
	DS1393			—					Power-fail reset
	DS1670	3.3	HH:MM:SS	—			Watchdog and alarm	—	Power-fail reset, NV SRAM control, ADC
	DS1673	3.0, 5.0		—				—	Power-fail reset, NV SRAM control, ADC
	DS1677	5.0		—				—	Power-fail reset, NV SRAM control, ADC, PFI/PFO
	DS3600	3.3		S: 64			1 alarm	—	Secure supervisor with tamper detection
SPI	DS1305	2.0 to 5.5	HH:MM:SS	S: 96	✓	✓	2 alarms	—	—
	DS1306							1Hz, 32kHz	—
	DS1390	1.8, 3.0, 3.3, 5.0	HH:MM:SS:hh	—	✓		1 alarm	Prog	—
	DS1391			—				—	Power-fail reset
	DS3641	3.3	HH:MM:SS	S: 1K				—	Secure supervisor with tamper detection
	DS3650		Binary counter	—			—	—	

*Future product—contact factory for availability.
**Single output configurable as an interrupt or square wave.

Parallel selector guide

	Part	Power (V)	Calendar Format	User SRAM (Bytes)	Power Switching	Interrupts	Square Wave	NV SRAM Control	Other Features	Package Options			
										Stand-Alone IC	DIP Module	PowerCap	BGA Module
Mux Bus	DS12885/87/87A	5.0	HH:MM:SS	114	✓	Alarm, periodic	Prog		µP reset, RAM clear (DS12887A)	✓	✓		
	DS12R885/R887	3.0, 5.0		114		Alarm, periodic			µP reset, RAM clear	✓			✓
	DS12C887/887A	5.0		113					µP reset		✓		
	DS12CR887	3.0, 5.0		114					µP reset		✓		
	DS1685/87			114 + 128					µP reset, RAM clear, serial number, wake up	✓	✓		
	DS17x85/87			—					µP reset, RAM clear, serial number, wake up	✓	✓		
Phantom	DS1315	3.3. 5.0	HH:MM:SS:hh	—	✓	—	—	✓	—	✓			
	DS1243	5.0		8K							✓		
	DS1244	3.3, 5.0		32K							✓	✓	
	DS1248			128K							✓	✓	
	DS1251			512K							✓	✓	
	DS1254	3.3	HH:MM:SS	2M					µP reset, RAM clear, serial number, wake up				✓
Bytewide	DS1318	3.3	Binary counter	—	✓	Alarm, periodic	Prog		Event timer	✓			
	DS1500	3.3*, 5.0	HH:MM:SS	256		Watchdog and alarm, periodic	32kHz	✓	µP reset, wakeup	✓			
	DS1501	3.3, 5.0		256						✓			
	DS1511			256							✓		
	DS1553			8K		Watchdog and alarm	—		µP reset		✓		
	DS1554			32K							✓	✓	
	DS1556			128K							✓	✓	
	DS1557			512K								✓	
	DS1558			—		1 alarm, periodic		✓	µP reset, PFO	✓			
	DS1642	5.0		2K		—			—		✓		
	DS1643			8K							✓	✓	
	DS1644			32K							✓	✓	
	DS1646			128K							✓	✓	
	DS1647			512K							✓	✓	
	DS1742	3.3, 5.0		2K					Low battery flag		✓	✓	
	DS1743			8K					Low battery flag, µP reset*		✓	✓	
	DS1744			32K							✓	✓	
	DS1746			128K							✓	✓	
	DS1747			512K							✓	✓	

*PowerCap package only.

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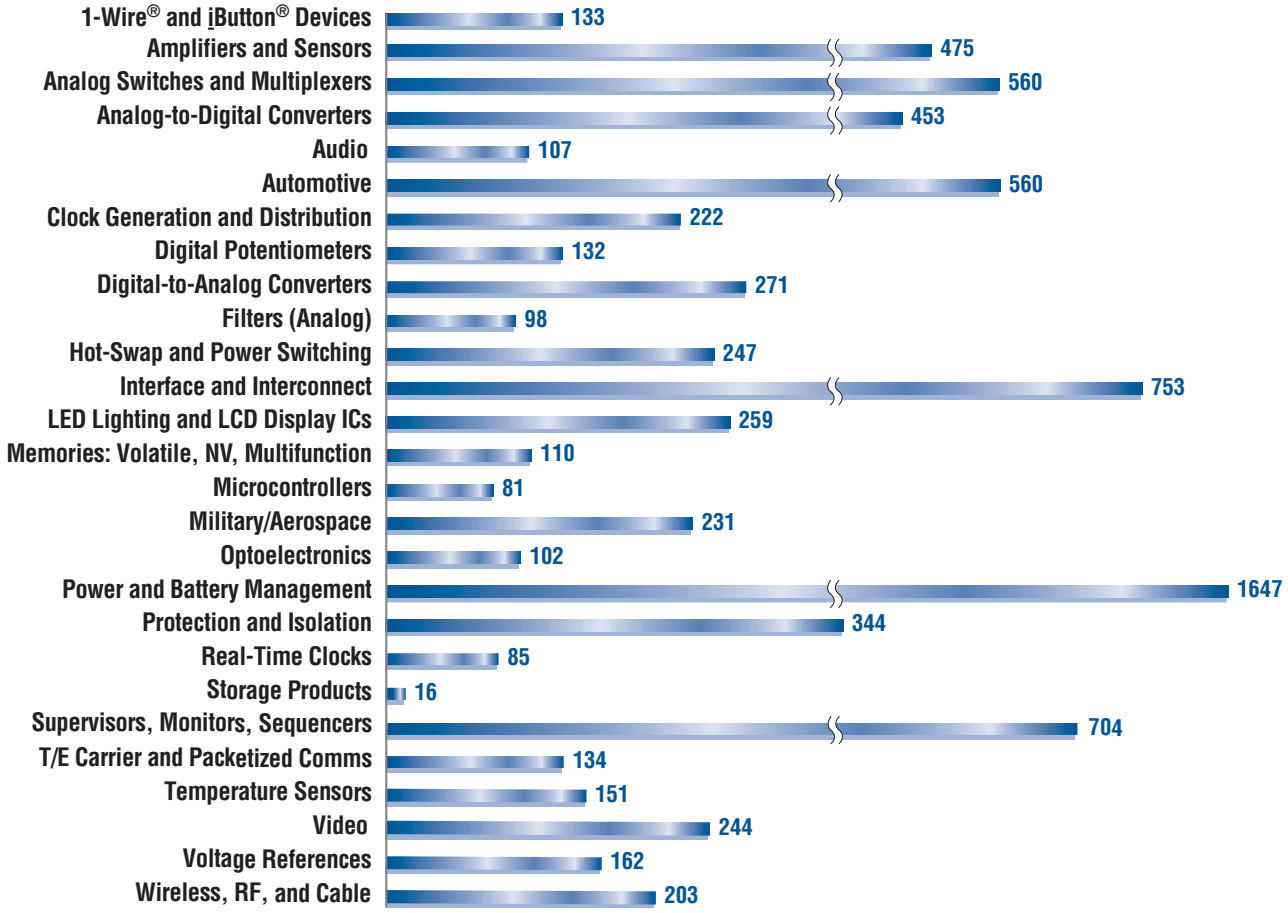

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