RTC ICs spectrum ............................................................................ 3

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Widest portfolio of real-time clocks offers unlimited design solutions

An extended variety of products with the newest technology innovations are available including ultra low-power devices, the world’s smallest package with embedded crystal, and ST’s SNAPHAT’s with battery and crystal integrated. RTC functions include alarm, battery switchover, reset, and special features such as time stamp, anti-tamper for secure applications and audio.

### Low-power for portable devices
- Low standby current
- World’s smallest RTC with embedded crystal
- Small packages

M41T6x series

### Enhanced industry-standard
- Automatic battery switchover
- Analog calibration
- Embedded crystal

M41T81S, M41T00S, M41T01, M41T80, M41T11 M41T82/83/93, M41T00CAP

### Highly-integrated
- RTC with NVRAM and microprocessor supervisor functions
- Securitizor RTC with physical tamper detect

M41ST85W, M41T94, M41T00AUD, M41ST87W
### Low-Power RTC ICs

Very low standby current extends battery backup life

Special low-power RTC series available in small packages, from 350 nA, with battery switchover, and with or without an embedded crystal to best fit battery-operated device constraints.

#### Application Examples

- Digital cameras
- Portable media players
- Medical instruments
- Point-of-sale terminals
- Test equipment
- Portable navigation

#### Low-Power RTCs for Portable Devices Portfolio

<table>
<thead>
<tr>
<th>Part</th>
<th>Package</th>
<th>Battery supply current ($I_{\text{min}}$) typ (nA)</th>
<th>Data bus type</th>
<th>400 kHz</th>
<th>Supply voltage (V)</th>
<th>Timekeeping</th>
<th>Oscillator faildetect</th>
<th>Programmable alarms</th>
<th>Watchdog timer</th>
<th>Square wave output</th>
<th>Power-up output frequency (KHz)</th>
<th>Embedded crystal</th>
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</table>

Note: 1: With IRQ output

#### World’s Smallest RTC with Embedded Crystal

**M41T62LC6F**

- RTC in LCC8 package with embedded crystal
- 10ths and 100ths of seconds
- Programmable alarm with repeat modes and interrupt function
- Programmable watchdog timer
  - 62.5 ms to 31 min
- Programmable square-wave output
  - 1 Hz to 32 KHz
Class-leading RTCs for precision applications

Enhanced industry-standard RTC with fixed reference added for highly-reliable battery switchover threshold, plus analog calibration, embedded crystal and oscillator fail detect.

**APPLICATION EXAMPLES**
- Home multimedia
- Metering (gas, electricity, water)
- Multi-function printers
- Vehicle tracking systems

**M41T00S**
- Precision reference for battery switchover threshold
- Oscillator fail detect circuit
- 400 kHz I2C interface
- Automatic battery switchover and write-protect
- Calibration register - accuracy to 5 seconds per month
- BCD registers: century, year, month, day, date, hours, minutes, seconds
- 2.7 to 5.5 V operation
- Automatic leap year adjustment
- SO8 package

**M41T00CAP**
- Integrated backup battery and embedded crystal
- Based on M41T00S RTC
- CAPHAT™ PCDIP24 package
- 0 to 70 °C operation
- Up to 10 years of timekeeping without system power

PCDIP24 CAPHAT™
Embedded crystal + battery (internal view)
**M41T81S**

- Programmable alarm with repeat modes
- Oscillator fail detect circuit
- Battery monitor
- Automatic battery switchover and write-protect with precision reference
- Calibration register - accuracy to 5 seconds per month

- BCD registers: century, year, month, day, date, hours, minutes, seconds
- 400 kHz I²C interface
- Programmable watchdog
  - 62.5 ms to 128 s time-out
- Programmable square-wave
  - 1 Hz to 32 KHz
- Automatic leap year adjustment

**M41T83, REAL-TIME CLOCKS WITH ANALOG CALIBRATION**

- Factory-calibrated accuracy of ±5 ppm typical after 2 refloWS (SOX18)
- Analog calibration allows in-application calibration
- 365 nA standby (typ) at 3.0 V
- Automatic battery switchover and write-protect with precision reference
  - Precision reference
- 400 kHz I²C, 10 MHz SPI
- 12 bytes of NVRAM
  - 5 bytes shared with 2 alarm registers

- 2 programmable alarms with repeat modes
- Memory-mapped BCD year, month, day, date, hours, minutes, seconds, 10ths, 100ths of seconds
- 2.38 to 5.5 V operation
  - Timekeeping down to 1.8 V
- Programmable watchdog (62.5 ms to 128 s)
- Programmable squarewave output
  - 1 Hz to 32 KHz
## ENHANCED INDUSTRY-STANDARD RTCs PORTFOLIO

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<th>Package</th>
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<th>Timekeeping min (V)</th>
<th>Battery switchover</th>
<th>Oscillator fail detect</th>
<th>Programmable alarms</th>
<th>Square wave output</th>
<th>Power-up output frequency (KHz)</th>
<th>Watchdog timer</th>
<th>Battery low detect</th>
<th>Power on reset/low voltage detector output</th>
<th>Embedded crystal</th>
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</tbody>
</table>

Note:
1: Integrated battery and embedded crystal
2: 400 kHz
3: With IRQ output
4: Dedicated output
5: Fixed switchover reference
6: 10 MHz
Combined RTC and Microprocessor supervisor

Highly-integrated RTCs with NVRAM and a large set of microprocessor supervisory functions, including battery monitor, power-on reset and low-voltage detect.

APPLICATION EXAMPLES

- Servers
- Medical equipment
- Point of sales
- Vending machines
- Gaming

M41T94

- Automatic battery switchover
- Power-fail detect and write-protect
- 2 MHz SPI bus
- THS pin selects 5 or 3/3.3 V operation
- 400 nA standby (typ) at 3.0 V
- 44 bytes of NVRAM
- Programmable alarm with repeat mode
- Programmable square-wave output
  - 1 Hz to 32 KHz
- 10ths and 100ths of seconds

M41ST85W

- 400 kHz I²C
- 400 nA standby (typ) at 3.0 V
- 2.7 to 3.6 V
- 28-lead SNAP HAT® IC (SOH28)
- 28-lead embedded crystal SOIC (SOX28)
- Operating temperature: -40 to +85 °C
- 44 bytes of NVRAM
- Programmable alarm with repeat mode
- Programmable square-wave output
  - 1 Hz to 32 KHz
- 10ths and 100ths of seconds
SECURITIZOR RTC WITH PHYSICAL TAMPER DETECT

Combined real-time clock (RTC) IC including microprocessor supervisor, NVRAM supervisor, with physical tamper detect, plus internal and external RAM clear for secure applications.

APPLICATION EXAMPLES

- Black boxes
- Closed-circuit TV
- Financial security: ATM, cash, registers, POS, card readers
- Gaming machines
- Fire alarms
- Metering (gas, electricity, water)

M41ST87W

- 64-bit unique serial number
- -40 to +85 °C
- 3 V, 3.3 V, 5 V operation
- 500 nA standby (typ) at 3.0 V
- 28-lead embedded crystal IC
- Counters for 10ths and 100ths of seconds, seconds, minutes, hours, day, date, month, year, and century
- 128 bytes of clearable NVRAM
- Programmable alarm with repeat modes functions in battery-backed mode

HIGHLY-INTEGRATED RTCs PORTFOLIO

<table>
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<th>Part number</th>
<th>Package</th>
<th>Battery supply current (Ibus)</th>
<th>NVRAM size (bytes)</th>
<th>Data bus type</th>
<th>Vcc (min - max) (V)</th>
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<th>Oscillator fail detect</th>
<th>Programmable alarms</th>
<th>Square wave frequency (KHz)</th>
<th>Power-up output frequency (KHz)</th>
<th>Watchdog timer</th>
<th>Battery low detect</th>
<th>Power on reset</th>
<th>Power off reset</th>
<th>Voltage detector output</th>
<th>Power fail comparator</th>
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Note:
1: 2 MHz
2: 400 kHz
3: With IRQ output
4: Fixed switchover reference
### SERIAL REAL-TIME CLOCKS PORTFOLIO

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<tr>
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<th>Timekeeping min</th>
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### SNAPHAT® TOPS, BATTERY AND CRYSTAL INTEGRATED

<table>
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<tr>
<th>Part number</th>
<th>Package</th>
<th>Crystal frequency nom (Hz)</th>
<th>Battery Lithium coin cell mAh</th>
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</table>
PACKAGE OPTIONS

- **LCC8**
  - 1.5 mm x 3.2 mm
  - Embedded crystal

- **QFN16**
  - 3 mm x 3 mm

- **QFN16**
  - 4 mm x 4 mm

- **DFN16**
  - 5 mm x 4 mm

- **SO8**
  - 3.80 mm x 4.80 mm

- **SO16**
  - 3.80 mm x 9.80 mm

- **SSOP20**
  - 7.2 mm x 5.3 mm

- **PCDIP24 CPHAT™**
  - 34.29 mm x 17.83 mm
  - Self-contained battery and crystal (internal view)

- **SOX18**
  - 11.61 mm x 7.62 mm
  - Embedded crystal SOIC

- **SOX28**
  - 18.01 mm x 7.67 mm
  - Embedded crystal

- **SOH28**
  - 17.71 mm x 8.23 mm

SNAPHAT™
battery and crystal snap on module to order separately (internal view)
Real-time clocks application notes, technical notes, online calculators and resources

Readers will find these documents helpful in understanding some of the subtleties of RTCs and what it takes to keep them running reliably.

<table>
<thead>
<tr>
<th>Application notes</th>
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<tbody>
<tr>
<td>AN922</td>
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<td>AN923</td>
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PRODUCT SUPPORT AT HTTP://WWW.ST.COM/RTC

- Datasheets
- Application notes
- Selector tables
- Serial RTC example code
- Underwriters Laboratories (UL) information
- Clock calibration tools
- RTC and NVRAM model files
- Design support calculators @ www.st.com/calculators
- Online technical support

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Order code: BRRTC0314

For more information on ST products and solutions, visit www.st.com/rtc