Zero-power Microcontrollers for Low-power and High-temperature Applications

Atmel offers a broad range of microcontrollers, including 4-bit to 32-bit ICs, for a wide variety of applications. The MARC4 4-bit microcontrollers are dedicated for any application requiring an extremely low current consumption for extended battery life. In addition to this, the MARC4 microcontroller family operates within a wide temperature range of -40°C to +125°C. The flexible clock center makes it suitable for all kinds of remote control applications since it is able to switch to different internal and external clock sources on the fly.

Applications

Home Automation
- Remote Controls for: Door Opening Systems (Garage Doors), Heating/Air Conditioning Monitoring, Blinds, Roller Shutters, Wall Sockets, TV, Hi-Fi, VCRs, Emergency Systems for Elderly People
- Weather Station: Light, Humidity, Wind, Radiation

Toys and Sports
- Altitude Meters
- Bicycle Computers
- Inline Speedometers, Heart-rate Monitoring
- Computer Peripherals (Mouse, Keyboard, Joystick etc.)

White Goods
- Shavers
- Electrical Tooth Brushes

Industrial
- Measurement of: Light, Humidity, Wind, Radiation
- Production Monitoring and Controlling
- Remote Control (e.g. Cranes)
- Logistics/Stock Management (Wireless Handheld Terminals, e.g. Bar Code Readers)
- Telemetry

Automatic Meter Reading
- Measurement of: Gas, Water, Electricity, Heating

Automotive
- Remote Keyless Entry Systems
- Tire Pressure Monitoring

Alarm and Security Systems
- Wireless Warning Systems (Tension, Temperature, Heart Problems etc.)
- Alarm Systems (Smoke and Presence Detectors)
**Key Features**

- Stack Architecture
- $V_{\text{supply}}$: 1.8 - 6.5 V
- Temperature Range: -40°C to 125°C
- Flexible Clock Center: 5 Clock Sources Selectable on the Fly
- Fast: Down to 0.5 μs/Instruction, 2 Clock Cycles per Instruction
- HARVARD Structure – 3 Parallel Buses
- Various Power-saving Functions
- 72 RISC 8-bit Instructions
- 8 Interrupt Levels
- Voltage Monitoring and Brown-out Detector
- Mask-ROM and Flash Versions Available

**MARC4 – Power Modes**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Oscillators</th>
<th>Peripherals</th>
<th>Core Intervents</th>
<th>Deep-Sleep Mode</th>
<th>Sleep Mode</th>
<th>Power-down Mode</th>
<th>Active Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>stopped</td>
<td>stopped</td>
<td>wake-up</td>
<td>0.1 μA</td>
<td>0.6 μA</td>
<td>70 μA</td>
<td>300 μA</td>
</tr>
</tbody>
</table>

**Development System**

Manufactured by iSYSTEM
- Windows® 95/98/ME/200/XP and Windows NT®

**Powerful Tool**
- Real-time Trace
- Unlimited Number of Real-time Breakpoints
- Conditional Breakpoints
- 256 kB/1 MB Trace Memory

**Comfortable Hardware**
- Programmable Oscillator
- Pattern Generator
- Logic Analyzer

Development System with Target PCBs and Support Provided by Atmel

**MARC4 Starter Kit**

**Software**
- Windows-based Editor
- Integrated qFORTH Compiler
- Integrated Simple MARC4 Core Simulator (Only Core, no Peripheral Modules)
- Integrated Help Function with qFORTH Dictionary
- MTP (Flash) Programmer Software

**Hardware**
- MTP Programmer
- 5 Samples of MTP ATAM893
- Ready-to-run Application Board

**MARC4 Product Overview**

<table>
<thead>
<tr>
<th></th>
<th>ATAR080</th>
<th>ATAR080</th>
<th>ATAR082</th>
<th>ATAR082</th>
<th>ATAR510</th>
<th>ATAR862</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM x 8</td>
<td>2048</td>
<td>2048</td>
<td>4096</td>
<td>4096</td>
<td>4096</td>
<td>4096</td>
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<tr>
<td>RAM x 4</td>
<td>256</td>
<td>256</td>
<td>256</td>
<td>256</td>
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<tr>
<td>EEPROM x 16</td>
<td>–</td>
<td>C890:32</td>
<td>C892:32</td>
<td>–</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>IN/OUT</td>
<td>12</td>
<td>12</td>
<td>16</td>
<td>34</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>RF Transmitter</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>315, 433, 868, 915 MHz</td>
<td></td>
</tr>
<tr>
<td>Prescaler/8-bit Timer</td>
<td>1/1</td>
<td>1/1</td>
<td>1/2</td>
<td>2/2</td>
<td>1/2</td>
<td></td>
</tr>
<tr>
<td>Watchdog/Battery Low</td>
<td>Yes/Yes</td>
<td>Yes/Yes</td>
<td>Yes/Yes</td>
<td>Yes/Yes</td>
<td>Yes/Yes</td>
<td></td>
</tr>
<tr>
<td>High I\text{\textsubscript{supply}}</td>
<td>8 x 20 mA</td>
<td>8 x 20 mA</td>
<td>8 x 20 mA</td>
<td>8 x 20 mA</td>
<td>8 x 20 mA</td>
<td></td>
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<tr>
<td>Serial I/O</td>
<td>8-bit Sync.</td>
<td>8-bit Sync.</td>
<td>8-bit Sync.</td>
<td>–</td>
<td>8-bit Sync.</td>
<td></td>
</tr>
<tr>
<td>Interrupt (Int./Ext.)</td>
<td>3/4</td>
<td>3/4</td>
<td>4/6</td>
<td>4/10</td>
<td>4/6</td>
<td></td>
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<tr>
<td>$V_{DD}$ (V)</td>
<td>1.8 - 6.5</td>
<td>1.8 - 6.5</td>
<td>1.8 - 6.5</td>
<td>2.4 - 6.2</td>
<td>2.0 - 4.0</td>
<td>9.3*</td>
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<tr>
<td>$I_{DD}$ Active (mA)</td>
<td>0.25</td>
<td>0.35</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
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<tr>
<td>$I_{DD}$ Sleep (μA)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>1</td>
<td>1</td>
<td>0.45*</td>
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<tr>
<td>Package (plus Die)</td>
<td>SS020</td>
<td>SS020</td>
<td>SS020</td>
<td>SS044</td>
<td>SS024</td>
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</tr>
<tr>
<td>MTP (Flash)</td>
<td>ATAM893</td>
<td>ATAM893</td>
<td>ATAM893</td>
<td>ATAM510</td>
<td>ATAM862</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Including RF