8-bit Microcontrollers

**MC9S08QG8/4**

**Target Applications**
- Wireless sensor applications including Simple Media Access Controller (SMAC)
- Watchdog coprocessors
- Small appliances
- Handheld devices
- Secure boot coprocessors
- Security systems

**Overview**
The MC9S08QG8/4 extends the advantages of Freescale Semiconductor’s HCS08 core to low pin count, small-package 8-bit microcontrollers. QG devices are low voltage with on-chip in-circuit Flash memory programmable down to 1.8V, and afford the standard features of all HCS08 MCUs including wait mode and multiple stop modes. The functionality is completed with strong analog capabilities, a complete set of serial modules, a temperature sensor and robust memory options.

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8-bit HCS08 Central Processor Unit (CPU)</strong></td>
<td></td>
</tr>
</tbody>
</table>
- Up to 20 MHz HCS08 CPU (10 MHz bus frequency) for 100 ns minimum instruction time  
- HC08 instruction set with added BGND instruction  
- Support for up to 32 interrupt/reset sources |  
- Offering high performance, even at low voltage levels for battery-operated applications  
- Backward object-code compatibility with 68HC08 and 68HC05 so existing code libraries can still be used  
- Allows for efficient, compact module coding in assembly or C compiler  
- Allows for software flexibility and optimization for real-time applications |

**Integrated Third-Generation Flash Memory and RAM**
- Embedded Flash that is in-application reprogrammable over the full operating voltage and temperature range with a single power supply
- Extremely fast, byte-writable programming; as fast as 20 us/byte
- Up to 100,000 write/erase cycles at typical voltage and temperature (10K minimum write/erase); 100 years typical data retention (15 years minimum)
- Provides users a single solution for multiple platforms or a single platform that is field reprogrammable in virtually any environment
- Does not require additional pin or power supply for Flash programming, simplifying the interface for in-line programming and allowing for more general purpose input output (GPIO) pins
- Helps reduce production programming costs through ultra-fast programming, as well as lowering system power consumption due to shorter writes
- Allows electrically erasable programmable read-only memory (EEPROM) emulation, reducing system costs and board real estate

**Flexible Clock Options**
- Internal clock source (ICS) module containing a frequency-locked loop (FLL) controlled by internal or external reference
- Precision trimming of internal reference allows typical 0.1 percent resolution and ±0.5 percent deviation over operating temperature and voltage
- Internal reference can be trimmed from 31.25 kHz to 39.065 kHz, allowing for 8 MHz to 10 MHz FLL output
- Low-power oscillator module (XOSC) with software selectable crystal or ceramic resonator range, 31.25 kHz to 38.4 kHz or 1 MHz to 16 MHz, and supports external clock source input up to 20 MHz
- Can eliminate the cost of all external clock components, reduce board space and increase system reliability
- Provides one of the most accurate internal clock sources on the market for the money
- Can use trimming to adjust bus clocks for optimal serial communication baud rates and/or timer intervals
- 32 kHz oscillator provides low power option for systems requiring time-keeping functionality (i.e., time and date) while in low power modes

**HCS08 CPU**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/8 KB Flash</td>
<td>On-Chip ICE (DBG)</td>
</tr>
<tr>
<td>256/512B RAM</td>
<td>BDC</td>
</tr>
<tr>
<td>LVI</td>
<td>8-ch., 10-bit ADC</td>
</tr>
<tr>
<td>COP</td>
<td>SCI</td>
</tr>
<tr>
<td>IIC</td>
<td>SPI</td>
</tr>
<tr>
<td>Int/Ext Osc.</td>
<td>2-ch., 16-bit Timer</td>
</tr>
<tr>
<td>Internal Clock Source w/FLL</td>
<td>8-bit Modulo Timer w/Prescaler</td>
</tr>
<tr>
<td>Temperature Sensor</td>
<td>Up to 13 GPIO</td>
</tr>
<tr>
<td>Internal Clock Source w/FLL</td>
<td>Analog Comparator</td>
</tr>
</tbody>
</table>

**Overview**
The MC9S08QG8/4 extends the advantages of Freescale Semiconductor’s HCS08 core to low pin count, small-package 8-bit microcontrollers. QG devices are low voltage with on-chip in-circuit Flash memory programmable down to 1.8V, and afford the standard features of all HCS08 MCUs including wait mode and multiple stop modes. The functionality is completed with strong analog capabilities, a complete set of serial modules, a temperature sensor and robust memory options.

**Features**
- **8-bit HCS08 Central Processor Unit (CPU)**
  - Up to 20 MHz HCS08 CPU (10 MHz bus frequency) for 100 ns minimum instruction time
  - HC08 instruction set with added BGND instruction
  - Support for up to 32 interrupt/reset sources

**Benefits**
- Offering high performance, even at low voltage levels for battery-operated applications
- Backward object-code compatibility with 68HC08 and 68HC05 so existing code libraries can still be used
- Allows for efficient, compact module coding in assembly or C compiler
- Allows for software flexibility and optimization for real-time applications

**Integrated Third-Generation Flash Memory and RAM**
- Embedded Flash that is in-application reprogrammable over the full operating voltage and temperature range with a single power supply
- Extremely fast, byte-writable programming; as fast as 20 us/byte
- Up to 100,000 write/erase cycles at typical voltage and temperature (10K minimum write/erase); 100 years typical data retention (15 years minimum)
- Provides users a single solution for multiple platforms or a single platform that is field reprogrammable in virtually any environment
- Does not require additional pin or power supply for Flash programming, simplifying the interface for in-line programming and allowing for more general purpose input output (GPIO) pins
- Helps reduce production programming costs through ultra-fast programming, as well as lowering system power consumption due to shorter writes
- Allows electrically erasable programmable read-only memory (EEPROM) emulation, reducing system costs and board real estate

**Flexible Clock Options**
- Internal clock source (ICS) module containing a frequency-locked loop (FLL) controlled by internal or external reference
- Precision trimming of internal reference allows typical 0.1 percent resolution and ±0.5 percent deviation over operating temperature and voltage
- Internal reference can be trimmed from 31.25 kHz to 39.065 kHz, allowing for 8 MHz to 10 MHz FLL output
- Low-power oscillator module (XOSC) with software selectable crystal or ceramic resonator range, 31.25 kHz to 38.4 kHz or 1 MHz to 16 MHz, and supports external clock source input up to 20 MHz
- Can eliminate the cost of all external clock components, reduce board space and increase system reliability
- Provides one of the most accurate internal clock sources on the market for the money
- Can use trimming to adjust bus clocks for optimal serial communication baud rates and/or timer intervals
- 32 kHz oscillator provides low power option for systems requiring time-keeping functionality (i.e., time and date) while in low power modes

**HCS08 CPU**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/8 KB Flash</td>
<td>On-Chip ICE (DBG)</td>
</tr>
<tr>
<td>256/512B RAM</td>
<td>BDC</td>
</tr>
<tr>
<td>LVI</td>
<td>8-ch., 10-bit ADC</td>
</tr>
<tr>
<td>COP</td>
<td>SCI</td>
</tr>
<tr>
<td>IIC</td>
<td>SPI</td>
</tr>
<tr>
<td>Int/Ext Osc.</td>
<td>2-ch., 16-bit Timer</td>
</tr>
<tr>
<td>Internal Clock Source w/FLL</td>
<td>8-bit Modulo Timer w/Prescaler</td>
</tr>
<tr>
<td>Temperature Sensor</td>
<td>Analog Comparator</td>
</tr>
</tbody>
</table>
Cost-Effective Development Tools
For more information on development tools, please refer to the Freescale Development Tool Selector Guide (SG1011).

DEMO9S08QG8
$50*
Cost-effective demonstration board with potentiometer, LEDs, serial port and built-in USB-BDM cable for debugging and programming

M68CYCLONEPRO
$499*
HC08/HC08/HC12/HCS12 stand-alone Flash programmer or in-circuit emulator, debugger, Flash programmer; USB, serial or Ethernet interface options

USBMULTILINKBDM
$99*
Universal HC08 in-circuit debugger and Flash programmer; USB PC interface

CWX-H08-SE
Free**
CodeWarrior™ Special Edition for HC(S)08 MCUs; includes integrated development environment (IDE), linker, debugger, unlimited assembler, Processor Expert™ auto-code generator, full-chip simulation and 16 KB C compiler

*Prices indicated are MSRP
**Subject to license agreement and registration

Learn More: For more information about Freescale products, please visit www.freescale.com.