Overview
Freescale Semiconductor’s MC9S12A512 Flash microcontroller (MCU) is the next generation of the highly successful 68HC12 architecture. Using Freescale’s industry-leading 0.25 µs Flash, the A512 is part of a pin-compatible family that is planned to scale from 32 KB to 512 KB of Flash memory. The MC9S12A512 provides an upward migration path from Freescale’s 68HC08, 68HC11 and 68HC12 architectures for applications that need larger memory, more peripherals and higher performance.

Target Applications
> Instrumentation
> Energy management
> Industrial control
> Robotics
> Safety equipment
> Security

Features

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| High-Performance 16-bit HCS12 CPU Core | > Opcode compatible with the 68HC11 and 68HC12
> C-optimized architecture produces extremely compact code |
| On-Chip Debug Interface | > Real-time in-circuit emulation and debug without expensive and cumbersome box emulators
> Read/write memory and registers while running at full speed |
| Integrated Third-Generation Flash Memory | > Flexibility to change code in the field
> Efficient end-of-line programming
> Total program time for 512 KB code is less than 10 seconds
> Reduces production programming cost through ultra-fast programming
> No external high voltage or charge pump required
> Virtual EEPROM implementation, Flash array usable for EE extension
> Can erase one array while executing code from another |
| 4 KB Integrated EEPROM | > Can erase 4 bytes at a time and program 2 bytes at a time for calibration, security, personality and diagnostic information |
| 10-bit Analog-to-Digital Converter (ADC) | > Fast, easy conversion from analog inputs like position sensors, analog meters and photovoltaic cells to digital values for CPU processing
> ADC run in parallel for a 7 µs conversion for two 10-bits or, in other words, 3.5 µs for 10-bits |

Overview
Freescale Semiconductor’s MC9S12A512 Flash microcontroller (MCU) is the next generation of the highly successful 68HC12 architecture. Using Freescale’s industry-leading 0.25 µs Flash, the A512 is part of a pin-compatible family that is planned to scale from 32 KB to 512 KB of Flash memory. The MC9S12A512 provides an upward migration path from Freescale’s 68HC08, 68HC11 and 68HC12 architectures for applications that need larger memory, more peripherals and higher performance.
### Features

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| **Clock Generation Module with Phase-Lock Loop (PLL)** | > Reliable, robust operation  
> Provides high performance using low-cost reference crystals  
> Reduces generated noise  
> Reduces power consumption  
> Easily able to implement real-time clock |
| **Enhanced Capture Timer** | > 8-channel, 16-bit with input capture, output compare and pulse accumulator  
> 16-bit modulus down counter  
| **8-bit or 16-bit Pulse-Wide Modulation (PWM)** | > Efficiently implement motor control, battery charging or digital-to-analog (DAC) functions |
| **Two Serial Communications Interfaces** | > Asynchronous communication between the MCU and a terminal, computer or a network of MCUs |
| **Three Serial Peripheral Interfaces** | > High-speed synchronous communication between multiple MCUs or between MCU and serial peripherals |
| **Inter IC (I2C) Bus** | > Provides a simple, efficient method of data exchange between devices  
> Minimizes the need for large numbers of connections between devices and eliminates the need for an address decoder |
| **Up to 91 Input/Output (I/O) Lines** | > Programmable pull-ups/pull-downs  
> Dual drive capability  
> Reduce system cost  
> Able to tailor application for minimum EMC or high current loads |

### Data Sheets
- 9S12DP512DGV1 9S12DX512 Device Guide
- S12BDMV4 HCS12 Background Debug (BDM) Block Guide
- S12BKVD1 HCS12 Breakpoint (BKP) Block Guide
- S12CPUV2 HCS12 CPU Reference Manual
- S12ATD10B8CV2 HCS12 10-bit, 8-Channel Analog to Digital Converter (ADC) Block Guide
- S12BDLCV1 HCS12 Byte Data Link Controller (BDLC) Block Guide
- S12CRGV4 HCS12 Clocks and Reset Generator (CRG) Block
- S12DP526PIMV3 9S12DP256 Port Integration Module (PIM)
- S12ECT16B8CV1 HCS12 16-bit, 8-Channel Enhanced Capture Timer (ECT) Block Guide
- S12EETS4KV2 HCS12 4K EEPROM Block Guide
- S12FTS12K4V1 HCS12 512K Flash Block Guide
- S12ILCV2 HCS12 I/C Block Guide
- S12INTV1 HCS12 Interrupt (INT) Block Guide
- S12MEBV3 HCS12 Multiplexed External Bus Interface (MEBI) Block Guide
- S12MCMV4 HCS12 Module Mapping Control (MMC) Block Guide
- S12PWM8B8CV1 HCS12 8-bit, 8-Channel Pulse Width Modulator (PWM) Block Guide
- S12SCIv2 HCS12 Serial Communications Interface (SCI) Block Guide
- S12SPIv3 HSC12 Serial Peripheral Interface (SPI) Block Guide
- S12VREGV1 HCS12 Voltage Regulator Block Guide

### Cost-Effective Development Tools
- M68KIT912DP256 $495
  Evaluation kit for development and evaluation of HCS12 application code that includes the M68EVB912DP256 and USBMULTILINKBDM
- M68CYCLONEPRO $499
  HC08/HCS08/HCS12 stand-alone Flash programmer or in-circuit emulator, debugger, Flash programmer; USB, serial or Ethernet interface options
- USBMULTILINKBDM $99
  Universal HC08/HCS12 in-circuit emulator, debugger, and Flash programmer; USB PC interface
- CWX-H12-SE Free
  CodeWarrior™ Special Edition for HCS12 MCUs; includes integrated development environment (IDE), linker, debugger, unlimited assembler, Processor Expert™ auto-code generator, full-chip simulation and limited C compiler

### Package Options
<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Temp. Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC9S12A512CPV</td>
<td>112 LQFP</td>
<td>-40°C to +85°C</td>
</tr>
</tbody>
</table>

### Application Notes and Engineering Bulletins
- AN2206 Security and Protection on the HCS12 Family
- AN2213 Using Cosmic Software's M68HC12 Compiler for MC9S12DP256 Software Development
- AN2216 MC9S12DP256 Software Development Using Metrowerks CodeWarrior™
- AN2250 Audio Reproduction on HCS12 Microcontrollers
- EB386 HCS12 D-Family Compatibility

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