**Target Applications**
- Automotive applications
- Industrial control

**Overview**
Freescale Semiconductor’s HCS12 family of microcontrollers (MCUs) is the next generation of the highly successful 68HC12 architecture. Using Freescale’s industry-leading 0.25µ Flash, the DP512 is part of the pin-compatible family that scales from 32 KB to 512 KB of Flash memory. The DP512 provides an upward migration path from Freescale’s 68HC08, 68HC11 and 68HC12 architectures for applications that need larger memory, more peripherals and higher performance. Also, with the increasing number of CAN/J1850-based MCUs, its multiple network modules support this environment by enabling highly efficient communications between different network buses.

**Features**
- **High-Performance 16-bit HCS12 CPU Core**
  - 25 MHz bus operation at 5V for 40 ns minimum instruction cycle time
  - Opcode compatible with the 68HC11 and 68HC12
  - C-optimized architecture produces extremely compact code

- **On-Chip Debug Interface**
  - Dedicated serial debug interface
  - On-chip breakpoints
  - Real-time in-circuit emulation and debug without expensive and cumbersome box emulators
  - Read/write memory and registers while running at full speed

- **Network Modules**
  - Five MSCAN modules implementing the CAN 2.0 A/B protocol
  - Five receive buffers per module with FIFO storage scheme
  - Three transmit buffers per module with internal prioritization
  - Ability to link modules for higher buffer count
  - Programmable bit rate up to 1 Mbps
  - SAE J1850-compatible module (BDLC)
    - Performs all of the network access, arbitration, message framing and error detection duties
    - 10.4 kbps variable pulse-width (VPW) bit format
    - 4x receive mode, 41.6 kbps

- **Integrated Third-Generation Flash Memory**
  - In-application, reprogrammable
  - Self-timed, fast programming
    - Fast Flash page erase—20 ms (512B)
    - Can program 16 bits in 20 μs while in burst mode
  - 5V Flash program/erase/read
  - Flash granularity—512B Flash erase/2B Flash program
  - Four independently programmable Flash arrays
  - Flexible block protection and security
  - Flexibility to change code in the field
  - Efficient end of line programming
  - Total program time for 256 KB code is less than 10s
  - 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**
  - Flexible protection scheme for protection against accidental program or erase
  - EEPROM can be programmed in 46 μs
  - Can erase 4B at a time and program 2B at a time for calibration, security, personality and diagnostic information

- **10-bit Analog-to-Digital Converter (ADC)**
  - Two 8-channel ADCs
  - 7 μs, 10-bit single conversion time, scan mode available
  - Fast, easy conversion from analog inputs, such as temperature, pressure and fluid levels, to digital values for CPU processing
  - Can effectively have 3.5 μs conversion time by sampling same signal with both ADCs

- **Clock Generation Module with Phase-Lock Loop (PLL)**
  - Clock monitor with self-clock mode in case of no external clock
  - Programmable clock frequency with 1,024 options ranging from divide by 16 to multiply by 64 from base oscillator
  - Real-time interrupt
  - Watchdog
  - Reliable, robust operation
  - Provides high performance using cost-effective reference crystals
  - Low levels of generated noise
  - Low power consumption
  - Easily able to implement real-time clock
**Development Tools**

**USBMULTILINK12** Universal HC12/HCS12 in-circuit emulator; debugger and Flash programming through BDM interface

**M68KIT912DP256** Includes M68MULTILINK12 and an MC9S12DP256 evaluation board

**M6BCYCLONEPRO** HC08/HCS08/HCS12/HC12 stand-alone Flash programmer or in-circuit emulator, debugger and Flash programmer; USB, serial or Ethernet interface options

**CWX-H12-SE** CodeWarrior™ Development Studio for HCS12 with Processor Expert™ autocode generator, full-chip simulation, assembler, linker and C compiler (code size limited—compiler upgrades available)

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**Features**

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**8-bit or 16-bit Pulse-Width Modulation (PWM)**

| > 8-channel, 8-bit or 4-channel, 16-bit PWM | > Efficiently implements motor control, battery charging or digital-to-analog functions |
| > PWM supports center-aligned operation    |                           |

**Two Serial Communications Interfaces**

| > B192 prescaler option | > Asynchronous communication between the MCU and a terminal, a computer or a network of microcontrollers |
|                        | > Exact baud rate matching |

**Three Serial Peripheral Interfaces**

| > Up to 6.25 Mbps | > High-speed synchronous communication between multiple MCUs or between MCUs and serial peripherals |
|                  |                           |

**Inter-IC (I'C) Bus**

| > 256 clock rate options | > 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 | > Low overall system cost |
| > Dual-drive capability | > Able to tailor application for minimum EMC or high current loads |

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**Application Notes and Engineering Bulletins**

AN2206 Security and Protection on the HCS12 Family

AN2213 Using Cosmic Software’s M68HC12 Compiler for MC9S12DP256

AN2216 MC9S12DP256 Software Development Using Metrowerks CodeWarrior™

AN2250 Audio Reproduction on HCS12 Microcontrollers

EB386 HCS12 D-Family Compatibility

EB396 Use of OSC2/XTAL As a Clock Output on Freescale Semiconductor Microcontrollers

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**Data Sheets**

S12INTV1 Interrupt (INT) Module V1

S12BKPV1 Breakpoint (BKP) Module V1 Block User Guide

9S12DPS12DP512V1 MC9S12DP512 Device Guide

S12DBMV4 Background Debug Module (BDM) V4

S12MMCV4 Module Mapping Control (MMC) V4

S12MEBIV3 Multiplexed External Bus Interface (MEBI) Module V3 Block User Guide

S12CPUV2 S12CPUV2 Reference Manual

S12CRGV4 CRG Block User Guide

S12ECT16B8CV1D ECT 16B8C Block User Guide

S12ATD10B8CV2 ATD 10B8C Block User Guide

SC12ICV2 HCS12 Inter-Integrated Circuit (I'C) Block Guide

S12SPIV3 SPI Block Guide

S12SCIV2 HCS12 Serial Communications Interface (SCI) Block Guide

S12PWM8B8CV1 PWM 8B8C Block User Guide

S12FTS12K4V1 FTS12k4 Block User Guide

S12EETS4K4V2 EETS4K Block User Guide

S12BLDC_BG BLDC Block Guide

S12MSCANV2 MSCAN Block Guide

S12VREGV1 VREG Block User Guide

S12DP256PIMV3 MC9S12DP256 Port Integration Module (PIM) Block Guide

S12OSCV2 OSC Block User Guide

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**Package Options**

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<td>MC9S12DP512CPV</td>
<td>112 LQFP</td>
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</tr>
<tr>
<td>MC9S12DP612VPV</td>
<td>112 LQFP</td>
<td>-40°C to +105°C</td>
</tr>
<tr>
<td>MC9S12DP512MPV</td>
<td>112 LQFP</td>
<td>-40°C to +125°C</td>
</tr>
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**Learn More:** For more information about Freescale products, please visit [www.freescale.com](http://www.freescale.com).