MC9S12A512

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

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.
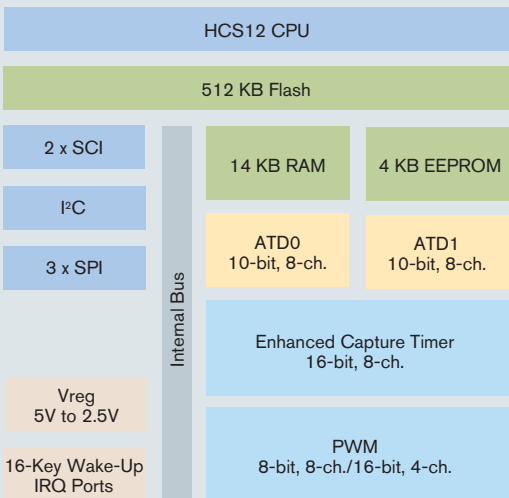
Features	Benefits
High-Performance 16-bit HCS12 CPU Core	
> 25 MHz bus operation at 5V for 40 ns minimum instruction cycle time	> Opcode compatible with the 68HC11 and 68HC12
	> C-optimized architecture produces extremely compact code
On-Chip Debug Interface	
> Dedicated serial debug interface	> Real-time in-circuit emulation and debug without expensive and cumbersome box emulators
> On-chip breakpoints	
	> Read/write memory and registers while running at full speed
Integrated Third-Generation Flash Memory	
> In-application reprogrammable	> Flexibility to change code in the field
> Self-timed, fast programming	> Efficient end-of-line programming
▪ Fast Flash page erase—20 ms (512 bytes)	> Total program time for 512 KB code is less than 10 seconds
▪ Can program 16 bits in 20 μs while in burst mode	> Reduces production programming cost through ultra-fast programming
> 5V Flash program/erase/read	> No external high voltage or charge pump required
> Flash granularity—512 byte Flash erase/2 byte Flash program	> Virtual EEPROM implementation, Flash array usable for EE extension
> Four independently programmable Flash arrays	> Can erase one array while executing code from another
> Flexible block protection and security	
4 KB Integrated EEPROM	
> Flexible protection scheme for protection against accidental program or erase	> Can erase 4 bytes at a time and program 2 bytes at a time for calibration, security, personality and diagnostic information
> EEPROM can be programmed in 46 μs	
10-bit Analog-to-Digital Converter (ADC)	
> Two, 8-channel ADCs	> Fast, easy conversion from analog inputs like position sensors, analog meters and photovoltaic cells to digital values for CPU processing
> 7 μs, 10-bit single conversion time, scan mode available	
	> ADC run in parallel for a 7 μs conversion for two 10-bits or, in other words, 3.5 μs for 10-bits

Block Diagram

HCS12 CPU
512 KB Flash

2 x SCI		14 KB RAM	4 KB EEPROM
I²C			
3 x SPI	Internal Bus	ATD0 10-bit, 8-ch.	ATD1 10-bit, 8-ch.
		Enhanced Capture Timer 16-bit, 8-ch.	
Vreg 5V to 2.5V		PWM 8-bit, 8-ch./16-bit, 4-ch.	
16-Key Wake-Up IRQ Ports			

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Features	Benefits
Clock Generation Module with Phase-Lock Loop (PLL)	
> Clock monitor with limp home mode in case of no external clock	> Reliable, robust operation
> Programmable clock frequency with 1024 options ranging from divide by 16 to multiply by 64 form base oscillator	> Provides high performance using low-cost reference crystals
> Slow mode divider	> Reduces generated noise
> Real-time interrupt	> Reduces power consumption
> Watchdog	> Easily able to implement real-time clock
Enhanced Capture Timer	
> 8-channel, 16-bit with input capture, output compare and pulse accumulator	> Flexible, programmable timer system
> 16-bit modulus down counter	
8-bit or 16-bit Pulse-Wide Modulation (PWM)	
> 8-channel, 8-bit or 4-channel, 16-bit PWM	> Efficiently implement motor control, battery charging or digital-to-analog (DAC) functions
> PWM supports center-aligned operation	
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	> Reduce system cost
> Dual drive capability	> 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
S12DP256PIMV3	9S12DP256 Port Integration Module (PIM)
S12ECT16B8CV1	HCS12 16-bit, 8-Channel Enhanced Capture Timer (ECT) Block Guide
S12EETS4KV2	HCS12 4K EEPROM Block Guide
S12FTS512K4V1	HCS12 512K Flash Block Guide
S12IICV2	HCS12 I²C Block Guide
S12INTV1	HCS12 Interrupt (INT) Block Guide
S12MEBIV3	HCS12 Multiplexed External Bus Interface (MEBI) Block Guide
S12MMCV4	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

For more information on development tools, please refer to the Freescale Development Tool Selector Guide (SG1011).

M68KIT912DP256 *$495*	Evaluation kit for development and evaluation of HCS12 application code that includes the M68EVB912DP256 and USBMULTILINKBDM
M68CYCLONEPRO *$499*	HC08/HCS08/HC12/HCS12 stand-alone Flash programmer or in-circuit emulator, debugger, Flash programmer; USB, serial or Ethernet interface options
USBMULTILINKBDM *$99*	Universal HCS08/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

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

Package Options

Part Number	Package	Temp. Range
MC9S12A512CPV	112 LQFP	-40°C to +85°C

112-Lead LQFP

PV

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

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