# MC9S12DT128

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 0.25 µs Flash, the MC9S12DT128 is part of a pin-compatible family that scales from 32 KB to 512 KB of Flash memory. The DT128 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-based electronic control units (ECUs), its multiple network modules support this environment by enabling highly efficient communications between different network buses.
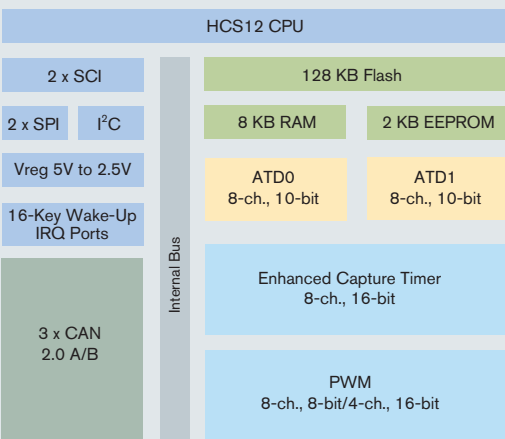
Features	Benefits
High-Performance 16-bit HCS12 CPU Core	
> 25 MHz bus operation at 5V for 40 ns minimum instruction cycle time	> Opcode compatible with the 68HC11 and 68HC12 > C-optimized architecture produces extremely compact code
On-Chip Debug Interface	
> Dedicated serial debug interface > On-chip 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	

> Three 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
	> FIFO receive approach superior for event- driven networks

Integrated Third-Generation Flash Memory	

> In-application reprogrammable
> Self-timed, fast programming
  ▪ Fast Flash page erase—20 ms (512 bytes)
  ▪ Can program 16 bits in 20 µs while in burst mode
> 5V Flash program/erase/read
> Flash granularity—512 byte Flash erase/ 2 byte Flash program
> Two 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 128 KB code is less than five 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

2 KB Integrated EEPROM	
> Flexible protection scheme for protection against accidental program or erase > EEPROM can be programmed in 46 µs	> 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)	
> Two, 8-channel ADCs > 7 µs, 10-bit single conversion time, scan mode available	> Fast, easy conversion from analog inputs like 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

Block diagram:

- HCS12 CPU
- 2 x SCI
- 2 x SPI | I²C
- Vreg 5V to 2.5V
- 16-Key Wake-Up IRQ Ports
- 3 x CAN 2.0 A/B
- Internal Bus
- 128 KB Flash
- 8 KB RAM | 2 KB EEPROM
- ATD0 8-ch., 10-bit | ATD1 8-ch., 10-bit
- Enhanced Capture Timer 8-ch., 16-bit
- PWM 8-ch., 8-bit/4-ch., 16-bit

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Features	Benefits

Clock Generation Module with Phase-Lock Loop (PLL)

> Clock monitor with self clock 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 from base oscillator	> Provides high performance using low-cost reference crystals
> Real-time interrupt	> Reduces generated noise
> Watchdog	> 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	> Flexible, programmable timer system
> 16-bit modulus down counter	

8-bit or 16-bit Pulse-Width 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

> 8192 prescaler options	> Asynchronous communication between the MCU and a terminal, computer or a network of MCUs
	> Exact baud rate matching

Two Serial Peripheral Interfaces

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

Inter-IC (I²C) 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 he 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

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
BCANPSV2.0	Bosch Controller Area Network (CAN) Version 2.0 Protocol Standard
BDLCRM	Byte Data Link Controller Reference Manual
EB386	HCS12 D-Family Compatibility

Data Sheets

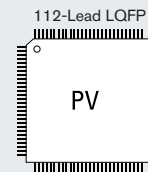|	
9S12DT128BDGV1	MC9S12DB128, MC9S12DT128B, MC9S12DG128 & MC9S12DJ128 Device Guide
S12DT128PIMV1	MC9S12DT128 Port Integration Module Block Guide
S12BDMV4	HCS12 Background Debug (BDM) Block Guide
S12BKVD1	HCS12 Breakpoint (BKP) Block Guide
S12CPUV2	HCS12 CPU Reference Manual
S12ATD10B8CV2	HCS12 10-bit 8-channel Analog to Digital Block Guide
S12CRGV3	HCS12 Clock Reset Generator Block Guide
S12ECT16B8CV1	HCS12 16-bit 8-channel Enhanced Capture Timer Block Guide
S12EETS2KV1	HCS12 2K EEPROM Block Guide
S12FTS128KV1	HCS12 128K Flash 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
S12MSCANV2	HCS12 Motorola Scalable Controller Area Network Block Guide
S12PWM8B8CV1	HCS12 8-bit 8-channel Pulse-Width Modulator Block Guide
S12SCIV2	HCS12 Serial Communications Interface Block Guide
S12SPIV2	HCS12 Serial Peripheral Interface 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

Package Options

Part Number	Package	Temp. Range
MC9S12DT128BCPV	112 LQFP	-40°C to +85°C
MC9S12DT128BVPV	112 LQFP	-40°C to +105°C
MC9S12DT128BMPV	112 LQFP	-40°C to +125°C

112-Lead LQFP

PV

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

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