16-bit Microcontrollers

MC9S12UF32

Target Applications

> External hard disk with USB

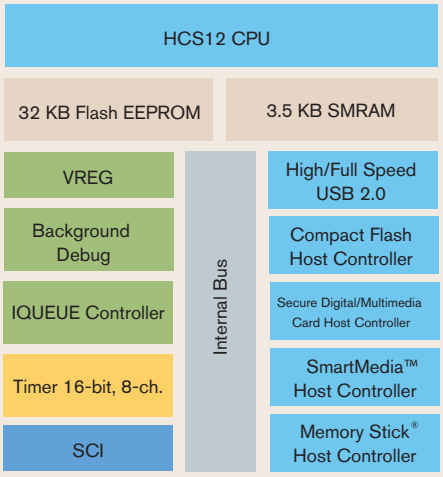
> CD and DVD mass storage

> USB Thumb® drive

> Memory card readers

> Digital Wallet®

The HCS12 family of microcontrollers is the next generation of the highly successful 68HC12 architecture. Using Freescale Semiconductor's industry-leading 0.25µ Flash, the UF32 has 32 KB of Flash memory. In addition to the in-chip full-speed USB 2.0 interface, the UF32 has built-in the following interfaces and host controllers: ATA-5 interface, Compact Flash, Secure Digital/Multimedia, SmartMedia™ and Memory Stick®. Together with the flexible I/O ports and 8-channel, 16-bit timer, the UF32 is well-suited for applications, such as multicard readers, USB Thumb drives and USB-to-external hard disk drives.



Features	*Benefits*
High-Performance 16-bit HCS812 CPU Core	
> 30 MHz bus operation at 5 V for 33 ns minimum instruction cycle time	> Opcode-compatible with 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
Integrated Third-Generation Flash Memory	
> In-application re-programmable > Self-timed, fast programming ▪ Fast Flash page erase—20 ms (512 bytes) ▪ Can program 16 bits in 20 µs while in burst mode > 5 V Flash program/erase/read > Flash granularity—512 byte Flash erase/2 byte Flash program > Flexible block protection and security enhancements	> Flexibility to change code in the field > Efficient end-of-line programming > Total program time for 32 KB code is less than 1.5 seconds > Efficient production programming cost through ultra-fast programming > No external high voltage or charge pump required > Virtual EEPROM implementation, Flash array usable for EE extension
Integrated Queue Controller	
> Four independent queue channels for data transfer between queue RAM and peripherals > Unified queue RAM memory, which can be allocated to different USB endpoints and storage interface module	> Provides block data transfer without CPU intervention > Double buffering for maximum burst data throughput of 60 Mbps between USB and one of the storage host controllers
Enhanced Capture Timer	
> 8-channel, 16-bit with input capture, output compare and pulse accumulator > 16-bit modulus down counter	> Flexible, programmable timer system
Serial Communications Interface	
> 8192 prescaler options	> Asynchronous communication between the MCU and a terminal, computer or a network of microcontrollers > Exact baud rate matching
Universal Serial Bus (USB) 2.0	
> Integrated 2.0 physical layer transceiver for high speed (480 Mbps) and full-speed (12 Mbps) operations > 64 bytes dedicated EP0 IN buffer and 64 bytes dedicated EP0 OUT buffer > Supports up to 4 data endpoints > Supports 512 bytes double buffering through IQUE to other host controller	> Designed to serve as full- and high-speed USB device in accordance with the USB Specification > Integrated 3.3 V regulator helps to reduce system cost

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DATA SHEETS

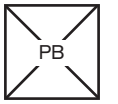
9S12UF32DGV1/D	MC9S12UF32 Device Guide
S12SMRAM3P5K2EV1/D	HCS12 3.5 KB SMRAM Block Guide
S12FTS32KV1/D	HCS12 32 KB Flash EEPROM Block Guide
S12VREGUV1/D	HCS12 Voltage Regulator Block Guide
S12CRGUV1/D	HCS12 Clock and Reset Generator Block Guide
S12TIM16B8CV1/D	HCS12 16-bit Timer Block Guide
S12SCIV4/D	HCS12 Serial Communications Interface (SCI) Block Guide
S12ATA5HCV1/D	HCS12 ATA-5 Host Controller Block Guide
S12CFHCV1/D	HCS12 Compact Flash Host Controller Block Guide
S12MSHCV1/D	HCS12 Memory Stick® Host Controller Block Guide
S12SMHCV1/D	HCS12 SmartMedia™ Host Controller Block Guide
S12SDHCV1/D	HCS12 Secure Digital Host Controller
S12IQUEV1/D	HCS12 Interrupt Queue Block Guide
S12USB20D6E2FV1/D	HCS12 Universal Serial Bus 2.0 Block Guide
S12UF32PIMV2/D	MC9S12UF32 Port Integration Module Block Guide
S12OSCV2/D	HCS12 Oscillator (OSC) Module V2
S12CPUV2/D	HCS12 CPU Reference Manual V2
S12INTV1/D	HCS12 Interrupt (INT) Module V1
S12MEBIV3/D	HCS12 Multiplexed External Bus Interface (MEBI) Module V3
S12MMCV4/D	HCS12 Module Mapping Control (MMC) V4
S12BDMV4/D	HCS12 Background Debug Module V4
S12BKPV1/D	HCS12 Breakpoint Module V1

Features	*Benefits*
ATA-5 Host Controller Interface	
> Supports PIO mode 0 to 4 > Supports multiword DMA mode 0 to 2 > Supports UDMA mode 0 to 4 > Supports 60 Mbps maximum burst rate	> Provides easy interface to hard disk, CDROM and DVD-ROM drives
Compact Flash Host Controller Interface	
> Supports Compact Flash memory and I/O mode access operations per CFA specification 1.4	> Provides easy interface to Compact Flash memory devices
Secure Digital/Multimedia Card Host Controller Interface	
> Compatible with the MMC system specification version 3.0 > Compatible with the SD memory card specification version 1.0	> Provides easy interface to Secure Digital and Multimedia memory cards
SmartMedia™ Host Controller Interface	
> Compatible with SmartMedia specification 1.0 > Supports SmartMedia with memory size of 4 MB to 128 MB	> Provides easy interface to SmartMedia memory cards
Memory Stick® Host Controller Interface	
> Compatible with Memory Stick Standard 1.3	> Provides easy interface to Memory Stick memory cards
Up to 75 Input/Output (I/O) Lines	
> Programmable pull-ups/pull-downs > Dual drive capability	> Reduces system cost > Able to tailor application for minimum EMC or high current loads

PACKAGE OPTIONS

Part Number	Package	Temperature Range
MC9S12UF32PU	100 LQFP (14 x 14)	0 to 70°C
MC9S12UF32PBE	64 LQFP (10 x 10)	0 to 70°C

64-Pin LQFP



0.5 mm Pitch
10 mm x 10 mm Body

100-Pin LQFP

0.5 mm Pitch
14 mm x 14 mm Body

Development Tools

USBMULTILINK12

Universal HC12/HCS12 in-circuit emulator, debugger and Flash programming through BDM interface

M68KIT912UF32

HCS12UF32 Development Kit; includes USBMULTILINK12 and a MC9S12UF32 evaluation board

M68CYCLONEPRO

HC08/HCS08/HCS12 stand-alone Flash programmer or in-circuit emulator, debugger, Flash programmer; USB, serial or Ethernet PC connection options

Application Notes and Engineering Bulletins

> AN1259/D System Design and Layout Techniques for Noise Reduction in MCU-Based Systems

> AN1263/D Designing for Electromagnetic Compatibility Single-Chip Microcontrollers

> AN1280/D Using and Extending D-Bug12 Routines

> AN1280A/D Using the Callable Routines in D-Bug12

> AN1284/D Transporting M68HC11 Code to M68HC12 Devices

> AN1705/D Noise Reduction Techniques for Microcontroller-Based Systems

> AN1716/D Using M68HC12 Indexed Indirect Addressing

> AN1783/D Determining MCU Oscillator Start-Up Parameters

> AN1837/D Non-Volatile Memory Technology Overview

> AN2104/D Using Background Debug Mode for the M68HC12 Family

Learn More: For more information about Freescale's products, visit **www.motorola.com/semiconductors**.

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