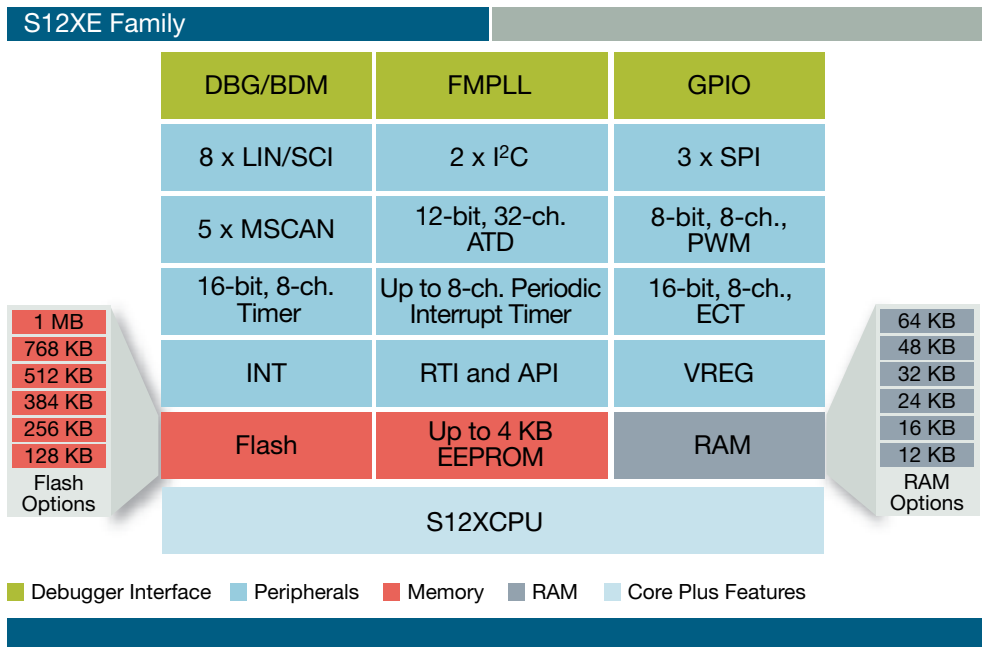16-bit Microcontrollers

S12XE
Family of automotive microcontrollers

Overview

The S12XE family of microcontrollers (MCUs) featuring the XGATE coprocessor combines 32-bit level performance with all the existing advantages of 16-bit architecture, such as cost effectiveness, code size efficiency and excellent electromagnetic compatibility. Based on Freescale's S12XD line of MCUs, the S12XE family is the ideal upgrade for next-generation vehicle electronics systems and maintains the value of current software and system investments.

The S12XE has larger memory options, error correction code (ECC), enhanced EEPROM (EEE) functionality and an advanced memory protection unit (MPU) as standard. It also features enhancements to the XGATE coprocessor, enabling efficient handling of interrupt events and execution of non-critical applets. This provides more headroom from the CPU to perform application-critical operations.

These advanced features help simplify product development, increase flexibility and reduce overall systems costs for automotive body and multiplexing applications.

S12XE Family

DBG/BDM	FMPLL	GPIO
8 x LIN/SCI	2 x I²C	3 x SPI
5 x MSCAN	12-bit, 32-ch. ATD	8-bit, 8-ch., PWM
16-bit, 8-ch. Timer	Up to 8-ch. Periodic Interrupt Timer	16-bit, 8-ch., ECT
INT	RTI and API	VREG
Flash	Up to 4 KB EEPROM	RAM
S12XCPU		

Flash Options
- 1 MB
- 768 KB
- 512 KB
- 384 KB
- 256 KB
- 128 KB

RAM Options
- 64 KB
- 48 KB
- 32 KB
- 24 KB
- 16 KB
- 12 KB

Legend: ■ Debugger Interface ■ Peripherals ■ Memory ■ RAM ■ Core Plus Features

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Product Map

Device	Flash	RAM	EE	XGATE	MPU	EBI	CAN	SCI (LIN)	SPI	I^{2}C	ECT	TIM	PIT	PWM	ATD	Max Speed (MHz)	Package
9S12XEP100	1 MB	64 KB	4 KB	1	1	Y	5	8	3	2	16-bit, 8-ch.	16-bit, 8-ch.	8-ch.	8-bit, 8-ch.	32	50	112 LQFP 144 LQFP 208 PBGA
9S12XEP768	768 KB	48 KB	4 KB	1	1	Y	5	8	3	2	16-bit, 8-ch.	16-bit, 8-ch.	8-ch.	8-bit, 8-ch.	32	50	112 LQFP 144 LQFP 208 PBGA
9S12XEQ512	512 KB	32 KB	4 KB	1	1	Y	4	6	3	2	16-bit, 8-ch.		4-ch.	8-bit, 8-ch.	24	50	112 LQFP 144 LQFP 80 QFP
9S12XEQ384	384 KB	24 KB	4 KB	1	1	Y	4	6	3	2	16-bit, 8-ch.		4-ch.	8-bit, 8-ch.	24	50	80 QFP 112 LQFP 144 LQFP
9S12XET256	256 KB	16 KB	4 KB	1	1	Y	3	4	3	1	16-bit, 8-ch.		4-ch.	8-bit, 8-ch.	24	50	80 QFP 112 LQFP 144 LQFP
9S12XEG128	128 KB	12 KB	2 KB	1	1	Y	2	2	2	1	16-bit, 8-ch.		2-ch.	8-bit, 8-ch.	16	50	80 QFP 112 LQFP

Applications

- Automotive body applications
- Central body control
- Gateway
- Smart junction box

Key Features

Memory

- 128 KB to 1 MB of embedded flash memory with error correction coding (ECC)
- 12 KB to 64 KB RAM
- Up to 32 KB of data-flash memory with 256-byte sectors for user access
- Emulated EEPROM

System

- 50 MHz 16-bit CPU12X upward compatible with MC9S12 instruction set
- XGATE I/O coprocessor module with up to 100 MHz bus frequency; transfers data to or from all peripherals and RAM without CPU intervention or CPU wait states
- Enhanced interrupt module
- Memory protection unit
- System can run in supervisor or user state
- Background debug module (BDM) with single-wire interface
- 3.3V and 5V operating ranges

- Ambient temperature range: -40°C to +125°C
- Chip voltage regulator (VREG)

Communications and I/O

- Up to five MSCAN modules CAN 2.0 A, B software compatible
- Up to three serial peripheral interface (SPI) modules
- Up to eight LIN capable serial communication interface (SCI) modules
- Up to 152 general-purpose input/output (I/O) pins and two input-only pins
- Up to two I^{2}C modules

Timers and A/D

- Up to two independent ATD converters with 8/10/12-bit resolution and multiplexer for up to 32 analog input channels
- 8-channel x 8-bit or 4-channel x 16-bit pulse width modulator
- Timer (TIM) with 8 x 16-bit channels for input capture or output compare
- Enhanced capture timer (ECT) with 8 x 16-bit channels for input capture or output compare
- Periodic interrupt timer (PIT) with up to 2 x 8-bit channels

Clock

- Internally filtered phase-locked-loop (IPLL)—no external components required

- Fast wake up from STOP for power saving and immediate program execution

Specifications

- Package options
- 208-pin MAPBGA
- 144-pin and 112-pin LQFP
- 80-pin QFP

Benefits

Excellent System Performance: Increased CPU bus frequency up to 50 MHz; with CPU throughput benefiting from the enhanced XGATE coprocessor performance

Scalability and Compatitbility: Extends S12X memory size up to 1 MB, providing an upgrade path for the S12XD family

Higher System Integrity: At the MCU level from features such as the ECC Supervisor Mode and the MPU which eases AUTOSAR integration

Flexibility: Supports customer requirements, with high memory, enhanced ATD and a large number of peripherals and packaging options

Development Support: Leverages and expands on the extensive suite of hardware and software development tools available today from the S12 and S12XD family

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