S32K1 Arm® Cortex®-M BASED MCUs FOR AUTOMOTIVE AND INDUSTRIAL APPLICATIONS

The S32K1 family of 32-bit AEC-Q100 qualified MCUs combines a scalable family of Arm Cortex-M0-based microcontrollers built on long-lasting features with a comprehensive suite of production-grade tools. S32K1 MCUs are included in NXP's Product Longevity Program, guaranteeing a minimum of 15 years of assured supply.

SCALABLE SINGLE PLATFORM

- Hardware- and Software- compatible MCU family
- 48 MHz Arm Cortex-M0+ core or up to 112 MHz Arm Cortex-M4F core
- Flash memory: from 128 KB up to 2 MB
- AEC-Q100 qualified: Grade 0, Grade 1, and Grade 2
- QFN, LQFP, MAPBGA packages, from 32 to 176 pin count

FEATURES AND PERFORMANCE

- CAN FD, FlexIO, QSPI, Ethernet and serial audio interfaces
- Functional Safety compliant: ISO 26262 up to ASIL B
- Cryptographic Services Engine compressed (CSEc) security engine: AES-128 and SHE compliant
- Ultra-low-power performance

COMPLETE SOFTWARE SOLUTION

- S32 Design Studio IDE: Eclipse, GCC, and debugger
- Production-grade S32 Software Development Kit (S32 SDK): SPICE Level 3 compliant, MISRA tested
- NXP AUTOSAR® MCAL (QM and ISO 26262 compliant) and OS
- Security firmware - NXP provided
- Core Self-Test Library for functional safety applications
- Production-grade ASIL compliant Real Time Drivers (RTD) support
- Model-Based Design Toolbox (MBDT) for MATLAB® and Simulink®, FreeMASTER (Lite) plus Motor Control Application Tunning (MCAT) tool, and Automotive Math and Motor Control Library (AMMCLib) set
- Third-party ecosystem support to reduce time-to-market

S32K1 FAMILY OVERVIEW

S32K116	S32K118	Common Features	S32K142	S32K144	S32K146	S32K148	S32K142W	S32K144W
Arm® Cortex®-M0+ @ 48 MHz		AEC-Q100, 5 V	Arm Cortex-M4F @ up to 112 MHz				Arm Cortex-M4F @ up to 80 MHz	
128 KB Flash	256 KB Flash	CSEc Security Module	256 KB Flash	512 KB Flash	1 MB Flash	2 MB Flash	256 KB Flash	512 KB Flash
17 KB SRAM	24 KB SRAM	Low Power Operating Modes and Peripherals	32 KB SRAM	64 KB SRAM	128 KB SRAM	256 KB SRAM	32 KB SRAM	64 KB SRAM
up to 42 I/Os	up to 58 I/Os	ASIL-B Capable: (ECC, MPU, CRC, W'DOGs)	up to 89 I/Os		up to 128 I/Os	up to 156 I/Os	up to 58 I/Os	
4 channel eDMA		LPUART, LPSPI, LPIIC, FlexIO	16 channel eDMA					
1x FlexCAN with 1x FD		FlexTimers, LP Timers, Prog. Delay Block	2x FlexCAN with 1x FD	3x FlexCAN with 1x FD	3x FlexCAN with 2x FD	3x FlexCAN with 3x FD	2x FlexCAN with 2x FD	
1x 13-ch., 12-bit ADC	1x 16-ch., 12-bit ADC	8-40 MHz Ext. Osc, 8/48 MHz Osc., 128 KHz LPO	2x 16-ch., 12-bit ADC		2x 24-ch., 12-bit ADC	2x 32-ch., 12-bit ADC	2x 16-ch., 12-bit ADC	
		*JTAG				IEEE® 158 ENET		
		S32DS IDE, SDK				Quad SPI		
		Real Time Drivers (RTD)				ETM Trace		
		AUTOSAR MCAL/OS				2x SAI		
		Application SW						

S32K14x only

KEY FEATURES

The S32K1 MCU family provides a scalable platform with next-generation safety, security, connectivity and low-power features.

Scalability
- Memory range from 128 KB to 2 MB
- Pin count from 32 to 176 pins
- QFN, LQFP, MAPBGA packages
- IP compatability across family

Security
- Cryptographic services engine (CSEc) module
- SHE compliant
- AES128 encryption and decryption
- Up to 20 key firmware
- Unique ID
- Secure boot
- Flash content protection in normal test mode

Safety
- ISO 26262 up to ASIL B compliant
- ECC on flash and SRAM MPU, CRC watchdog
- AEC-Q100 qualified: Grade 0 (-40° C to +150° C), Grade 1 (-40° C to +125° C), and Grade 2 (-40° C to +105° C)
- Core self-test library
- Failure Modes Effects and Diagnostic Analysis (FMEDA) and Safety Manual, SafeAssure® community support
- Technical support

Connectivity
FlexCAN
- Support CAN FD and standard CAN
- 64-byte CAN FD at 8 Mbit/s

FlexIO
- Emulation of UART, SPI, I²C, I²S, LCD RGB, PWM, LIN, etc.

QUADSPI
- Interface to external flash device
- Support SDR and HyperRAM modes

Ethernet & Audio Interface
- 10/100 Mbit/s MAC
- IEEE® 802.3-2002
- Audio-Video Bridge (AVB)
- IEEE-1588 timestamping

S32K1 MEMORY AND PACKAGE SCALABILITY
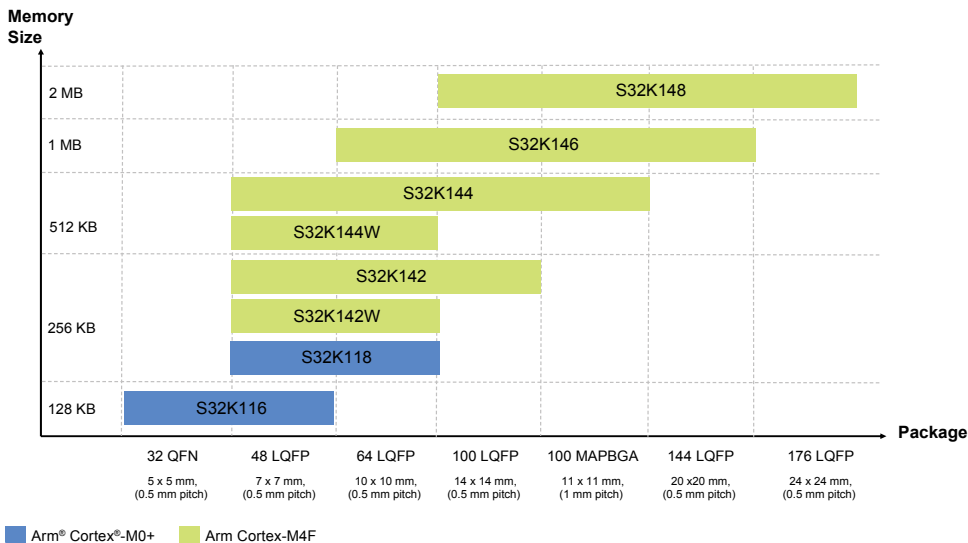
AEC-Q100 qualified
Grade 0
Grade 1
Grade 2

The S32K1 MCUs combine multiple low-power operating modes with autonomous, low-power peripherals allowing control over dynamic and static power profiles.

- Seven active and standby modes (RUN/WAIT/STOP) with all memory and register contents and IO pin states maintained in all modes
- All I/O pins and several peripherals function as fast wake-up sources
- Analog, communication and timing peripherals operate autonomously via DMA with no CPU intervention
- Extensive clock gating for core and peripherals

ULTRA-LOW POWER

Typical consumption values across S32K1xx power modes

Mode	Value	Condition
VLPS	40 µA	at 5 V with LPTMR enabled
VLPR	1.07 mA	at 5 V @ 8 MHz
STOP1	6.3 mA	at 5 V @ 48 MHz
STOP2	7.2 mA	at 5 V @ 48 MHz
RUN	20.3 mA	at 5 V @ 48 MHz
HRUN	52.2 mA	at 5 V @ 112 MHz

TARGET APPLICATIONS

Automotive

- Seat control
- Window
- Interior lighting
- Door
- Sunroof
- Pump and fans, HVAC
- Powertrain sensors (NOx)
- Engine cooling fan
- eTurbo charger

Industrial

- Factory automation
- Inverters
- Home audio
- Sensing
- Avionics
- Medical

PARTNERS

S32K1 HARDWARE TOOLS

MCSPTE1AK116 NEW
3-phase BLDC/PMSM development kit with S32K144 or S32K116

S32K116EVB2Q048
UJA1169 CAN/LIN PHY SBC

S32K142EVB-Q100
UJA1169 CAN/LIN PHY SBC

MCSPTE1AK144
3-phase BLDC/PMSM development kit with S32K144 or S32K116

S32K118EVB2Q048
UJA1169 CAN/LIN PHY SBC

S32K144EVB-Q100
UJA1169 CAN/LIN PHY SBC

DEVKIT-MOTORGD
Low-Cost motor control solution for DEVKIT platform

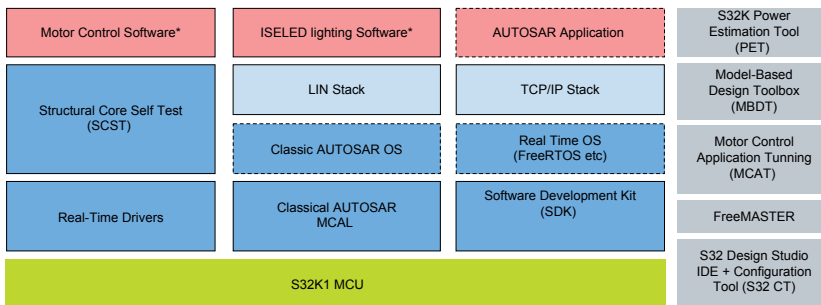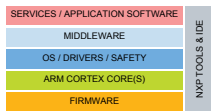**S32K14WEVB-Q064 NEW**
UJA1169 CAN/LIN PHY SBC

S32K146EVB-Q144
UJA1169 CAN/LIN PHY SBC

S32K148EVB-Q176
UJA1132 CAN/LIN PHY SBC
ADTJA1101-RMII Ethernet daughter card

S32K1 SOFTWARE BLOCK DIAGRAM

SERVICES / APPLICATION SOFTWARE	NXP TOOLS & IDE
MIDDLEWARE	
OS / DRIVERS / SAFETY	
ARM CORTEX CORE(S)	
FIRMWARE	

Motor Control Software*	ISELED lighting Software*	AUTOSAR Application	S32K Power Estimation Tool (PET)
Structural Core Self Test (SCST)	LIN Stack	TCP/IP Stack	Model-Based Design Toolbox (MBDT)
	Classic AUTOSAR OS	Real Time OS (FreeRTOS etc)	Motor Control Application Tunning (MCAT)
Real-Time Drivers	Classical AUTOSAR MCAL	Software Development Kit (SDK)	FreeMASTER
			S32 Design Studio IDE + Configuration Tool (S32 CT)
S32K1 MCU			

☐ Production grade   ⬚ Third Party   * Reference

ENABLEMENT

The S32K1 MCUs are supported by a complete ecosystem to minimize development effort and reduce time-to-market.

S32 Design Studio IDE

- Free of charge, zero code limit, Eclipse based, supports GCC and third-party compilers

- Compatible with NXP's Advanced Math and Motor Control Library (AMMCLib)

Software Development Kit (SDK)

- Free of charge, production-grade

- MISRA and SPICE Level 3 compliant low-level drivers for all MCU peripherals

- Free RTOS operating system

Real Time Drivers (RTD)

- Production-grade, developed according to ISO 26262 functional safety process

- Applicable for both AUTOSAR 4.4 and non-AUTOSAR projects

Classical AUTOSAR 4.0 / 4.2 /4.3 MCAL and Core Self-Test Library

S32K1 ORDERING INFORMATION

Part numbers below are available for sampling on www.nxp.com/S32K1. For a full list
of all orderable part numbers see the attachment included with S32K1xx MCU family
data sheet.

Part Number	Flash Size/RAM	Features	Cores	Package	Ambient Temperature
FS32K116LAT0MFMT	128 KB/17 KB	CAN FD; FlexIO; crypto security engine; eDMA (4 ch.)	Arm® Cortex®-M0+ core; 48 MHz	32 QFN	-40 °C to 125 °C
FS32K116LAT0MLFT				48 LQFP	
FS32K118LAT0MLFT	256 KB/25 KB			48 LQFP	
FS32K118LAT0MLHT				64 LQFP	
FS32K142HAT0MLFT	256 KB/32 KB	CAN FD; FlexIO; crypto security engine; eDMA (16 ch.)	Cortex-M4F core; 80 MHz	48 LQFP	
FS32K142HAT0MLHT				64 LQFP	
FS32K142HAT0MLLT				100 LQFP	
FS32K144HAT0MLFT	512 KB/64 KB			48 LQFP	
FS32K144HAT0MLHT				64 LQFP	
FS32K144HAT0MLLT				100 LQFP	
FS32K144HAT0MMHT				100 MAPBGA	
FS32K146HAT0MLHT	1 MB/128 KB			64 LQFP	
FS32K146HAT0MLLT				100 LQFP	
FS32K146HAT0MLQT				144 LQFP	
FS32K146HAT0MMHT				100 MAPBGA	
FS32K148UJT0VLLT	2 MB/256 KB	CAN FD; FlexIO; crypto security engine; eDMA (16 ch.); Ethernet; Serial audio interface; QSPI	Cortex-M4F core; 112 MHz	100 LQFP*	-40 °C to 105 °C
FS32K148UJT0VLQT				144 LQFP	
FS32K148UJT0VLUT				176 LQFP	
FS32K148UJT0VMHT				100 MAPBGA	
FS32K144WAT0WLHT	512 KB/64 KB	CAN FD, FlexIO, crypto security engine, eDMA (16-ch.)	Cortex-M4F core; 80 MHz	64LQFP	-40 °C to 150 °C
FS32K144WAT0WLFT				48LQFP	
FS32K142WAT0WLHT	256 KB/32 KB			64LQFP	
FS32K142WAT0WLFT				48LQFP	

*QSPI not supported by S32K148-100 LQFP derivatives

S32K1 RESOURCES

For more information visit:

S32K1 product information
nxp.com/s32k1

S32K community
nxp.com/S32K1Community

SafeAssure® community
nxp.com/SafeAssureCommunity

Product Longevity information
nxp.com/ProductLongevity