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 (ISO 26262 and QM 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 Tuning (MCAT) tool, and Automotive Math and Motor Control Library (AMMCLib) set
- Third-party ecosystem support to reduce time-to-market
S32K1 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 compatibility across family

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

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

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

MEMORY AND PACKAGE SCALABILITY

ULTRA-LOW POWER
Combining 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

Typical consumption values across S32K1xx power modes

- **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
# S32K1 Family Overview

## S32K116 vs S32K118

<table>
<thead>
<tr>
<th>Feature</th>
<th>S32K116</th>
<th>S32K118</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>Arm Cortex-M0+ 48 MHz</td>
<td>Arm Cortex-M0+ 48 MHz</td>
</tr>
<tr>
<td>Flash</td>
<td>128 KB</td>
<td>256 KB</td>
</tr>
<tr>
<td>SRAM</td>
<td>17 KB</td>
<td>24 KB</td>
</tr>
<tr>
<td>IOs</td>
<td>up to 42</td>
<td>up to 58</td>
</tr>
<tr>
<td>Low Power Operating modes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Peripherals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FlexCAN</td>
<td>1x FlexCAN with 1x FD</td>
<td></td>
</tr>
<tr>
<td>ADC</td>
<td>1x 13-ch., 12-bit ADC</td>
<td></td>
</tr>
<tr>
<td>External Oscillator</td>
<td>8/40 MHz Ext. Osc.</td>
<td></td>
</tr>
<tr>
<td>JTAG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure Feature</td>
<td>CSEc Security Module</td>
<td></td>
</tr>
<tr>
<td>Common Features</td>
<td>AEC-Q100, 5 V</td>
<td></td>
</tr>
</tbody>
</table>

## S32K142 vs S32K144 vs S32K146 vs S32K148 vs S32K142W vs S32K144W

<table>
<thead>
<tr>
<th>Feature</th>
<th>S32K142</th>
<th>S32K144</th>
<th>S32K146</th>
<th>S32K148</th>
<th>S32K142W</th>
<th>S32K144W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>Arm Cortex-M4F 80 MHz</td>
<td>Arm Cortex-M4F 112 MHz</td>
<td>Arm Cortex-M4F 112 MHz</td>
<td>Arm Cortex-M4F 80 MHz</td>
<td>Arm Cortex-M4F 112 MHz</td>
<td>Arm Cortex-M4F 112 MHz</td>
</tr>
<tr>
<td>Flash</td>
<td>256 KB</td>
<td>512 KB</td>
<td>1 MB</td>
<td>2 MB</td>
<td>256 KB</td>
<td>512 KB</td>
</tr>
<tr>
<td>SRAM</td>
<td>32 KB</td>
<td>64 KB</td>
<td>128 KB</td>
<td>256 KB</td>
<td>32 KB</td>
<td>64 KB</td>
</tr>
<tr>
<td>IOs</td>
<td>up to 89</td>
<td>up to 128</td>
<td>up to 128</td>
<td>up to 156</td>
<td>up to 58</td>
<td></td>
</tr>
<tr>
<td>FlexCAN</td>
<td>2x FlexCAN with 1x FD</td>
<td>3x FlexCAN with 1x FD</td>
<td>3x FlexCAN with 2x FD</td>
<td>3x FlexCAN with 3x FD</td>
<td>2x FlexCAN with 2x FD</td>
<td></td>
</tr>
<tr>
<td>ADC</td>
<td>2x 16-ch., 12-bit ADC</td>
<td>2x 24-ch., 12-bit ADC</td>
<td>2x 32-ch., 12-bit ADC</td>
<td>2x 16-ch., 12-bit ADC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure Feature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Features</td>
<td></td>
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</tr>
</tbody>
</table>

## Features

- **JTAG**
- **S32DS IDE, SDK**
- **Real Time Drivers (RTD)**
- **AUTOSAR MCAL/OS**
- **Application SW**

## 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

## S32K1 Partners

- Arm
- ATOLL
- AUTOSAR
- CORE SYSTEMS
- COSMIC Software
- Elektrobit
- Green Hills Software
- IAR Systems
- KEIL
- MathWorks
- Vector
- Wind River

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S32K1 HARDWARE TOOLS
Development platforms for general purpose automotive and high-reliability industrial applications.

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

MCSPTE1AK144
3-phase BLDC/PMSM development kit with S32K144

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

NEW
S32K116EVB2Q048 UJA1169 CAN/LIN PHY SBC
S32K118EVB2Q048 UJA1169 CAN/LIN PHY SBC

S32K116EV2Q048 UJA1169 CAN/LIN PHY SBC
S32K142EVB-Q100 UJA1169 CAN/LIN PHY SBC
S32K144EVB-Q100 UJA1169 CAN/LIN PHY SBC

S32K144EVBEQ064 UJA1169 CAN/LIN PHY SBC
S32K146EVBEQ144 UJA1169 CAN/LIN PHY SBC
S32K148EVBEQ176 UJA1132 CAN/LIN PHY SBC

ADTJA1101-RMII Ethernet daughter card

S32K1 SOFTWARE ECOSYSTEM
Supported by a complete ecosystem to minimize development effort and reduce time-to-market:

Motor Control Software
ISELED lighting software
LIN Stack
TCP/IP Stack
S32 Software Development Kit (S32SDK)
S32 Design Studio (S32DS) + S32 Config Tool

AUTOSAR Application
Real Time Drivers (RTD)
Classical AUTOSAR MCAL
Real Time OS (FreeRTOS etc)

Structural Core Self Test (SCST)
Classic AUTOSAR OS

S32K1 MCU

S32 DESIGN STUDIO
• 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)

S32 SOFTWARE DEVELOPMENT KIT
• Free of charge, production-grade
• MISRA and SPICE Level 3 compliant low-level drivers for MCU peripherals
• Free RTOS operating system

REAL TIME DRIVERS
• 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

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## S32K1 ORDERING INFORMATION

Part numbers below are available for sampling on [nxp.com/S32K1](https://nxp.com/S32K1)

For a full list of all orderable part numbers see the attachment included with S32K1xx MCU family data sheet.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Flash Size/RAM</th>
<th>Features</th>
<th>Cores</th>
<th>Package</th>
<th>Ambient Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS32K116LAT0MFMT</td>
<td>128 KB/17 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (4 ch.)</td>
<td>Arm Cortex-M0+ @ 48 MHz</td>
<td>32 QFN</td>
<td>AEC-Q100 Grade 1: -40°C to 125°C</td>
</tr>
<tr>
<td>FS32K116LAT0MLFT</td>
<td>256 KB/25 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (4 ch.)</td>
<td>Arm Cortex-M0+ @ 48 MHz</td>
<td>48 LQFP</td>
<td>AEC-Q100 Grade 2: -40°C to 125°C</td>
</tr>
<tr>
<td>FS32K118LAT0MLFT</td>
<td>256 KB/32 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (4 ch.)</td>
<td>Arm Cortex-M0+ @ 48 MHz</td>
<td>48 LQFP</td>
<td>AEC-Q100 Grade 0: -40°C to 125°C</td>
</tr>
<tr>
<td>FS32K118LAT0MMHT</td>
<td>512 KB/64 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (16 ch.)</td>
<td>Arm Cortex-M4F @ 80 MHz</td>
<td>48 LQFP</td>
<td>AEC-Q100 Grade 0: -40°C to 125°C</td>
</tr>
<tr>
<td>FS32K118LAT0MLLT</td>
<td>1 MB/128 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (16 ch.)</td>
<td>Arm Cortex-M4F @ 80 MHz</td>
<td>64 LQFP</td>
<td>AEC-Q100 Grade 0: -40°C to 125°C</td>
</tr>
<tr>
<td>FS32K118LAT0MLHT</td>
<td>2 MB/256 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (16 ch.)</td>
<td>Arm Cortex-M4F @ 112 MHz</td>
<td>100 LQFP</td>
<td>AEC-Q100 Grade 0: -40°C to 125°C</td>
</tr>
<tr>
<td>FS32K118LAT0MLLT</td>
<td>512 KB/64 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (16 ch.)</td>
<td>Arm Cortex-M4F @ 80 MHz</td>
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<td>AEC-Q100 Grade 0: -40°C to 125°C</td>
</tr>
<tr>
<td>FS32K118LAT0MLHT</td>
<td>256 KB/32 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (16 ch.)</td>
<td>Arm Cortex-M4F @ 80 MHz</td>
<td>64 LQFP</td>
<td>AEC-Q100 Grade 0: -40°C to 125°C</td>
</tr>
</tbody>
</table>

*QSPI not supported by S32K148-100 LQFP derivatives

## S32K1 RESOURCES

S32K1 product information  
nxp.com/S32K1

S32K community  
nxp.com/S32K1Community

SafeAssure® community  
nxp.com/SafeAssureCommunity

Product Longevity information  
nxp.com/ProductLongevity

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