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.
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
- 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

**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**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Current (mA)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLPS</td>
<td>40 µA</td>
<td>at 5 V with LPTMR enabled</td>
</tr>
<tr>
<td>VLPR</td>
<td>1.07 mA</td>
<td>at 5 V @ 8 MHz</td>
</tr>
<tr>
<td>STOP1</td>
<td>6.3 mA</td>
<td>at 5 V @ 48 MHz</td>
</tr>
<tr>
<td>STOP2</td>
<td>7.2 mA</td>
<td>at 5 V @ 48 MHz</td>
</tr>
<tr>
<td>RUN</td>
<td>20.3 mA</td>
<td>at 5 V @ 48 MHz</td>
</tr>
<tr>
<td>HRUN</td>
<td>52.2 mA</td>
<td>at 5 V @ 112 MHz</td>
</tr>
</tbody>
</table>

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## S32K1 FAMILY OVERVIEW

<table>
<thead>
<tr>
<th>S32K116</th>
<th>S32K118</th>
<th>Common Features</th>
<th>S32K142</th>
<th>S32K144</th>
<th>S32K146</th>
<th>S32K148</th>
<th>S32K142W</th>
<th>S32K144W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm Cortex-M0+ @ 48 MHz</td>
<td>128 KB Flash</td>
<td>S32K116 only</td>
<td>Arm Cortex-M4F @ up to 112 MHz</td>
<td>256 KB Flash</td>
<td>256 KB Flash</td>
<td>Arm Cortex-M4F @ up to 80 MHz</td>
<td>256 KB Flash</td>
<td>512 KB Flash</td>
</tr>
<tr>
<td>17 KB SRAM</td>
<td>24 KB SRAM</td>
<td>Low Power Operating Modes and Peripherals</td>
<td>32 KB SRAM</td>
<td>64 KB SRAM</td>
<td>12 KB SRAM</td>
<td>256 KB SRAM</td>
<td>32 KB SRAM</td>
<td>64 KB SRAM</td>
</tr>
<tr>
<td>up to 42 I/Os</td>
<td>up to 58 I/Os</td>
<td>ASIL-B Capable (ECC, MPU, CRC, WDOG)</td>
<td>up to 89 I/Os</td>
<td>up to 128 I/Os</td>
<td>up to 156 I/Os</td>
<td>up to 58 I/Os</td>
<td>16 channel eDMA</td>
<td></td>
</tr>
<tr>
<td>4 channel eDMA</td>
<td>1x FlexCAN with 1x FD</td>
<td>FlexTimers, LP Timers, Prog. Delay Block</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></td>
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</tr>
<tr>
<td>1x 13-ch., 12-bit ADC</td>
<td>1x 16-ch., 12-bit ADC</td>
<td>8/40 MHz Ext. Osc.; 8/48 MHz Osc., 128 KHz LPO</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>
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</tr>
<tr>
<td>*JTAG</td>
<td>S32DS IDE, SDK</td>
<td>IEEE® 158 ENET</td>
<td>Quad SPI</td>
<td>EMT Trace</td>
<td>2x SAI</td>
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<tr>
<td><strong>TARGET APPLICATIONS</strong></td>
<td><strong>Common Features</strong></td>
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<tr>
<td><strong>Automotive</strong></td>
<td><strong>Industrial</strong></td>
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<tr>
<td>Seat control</td>
<td>Factory automation</td>
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<tr>
<td>Window</td>
<td>Inverters</td>
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<tr>
<td>Interior lighting</td>
<td>Home audio</td>
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<tr>
<td>Door</td>
<td>Sensing</td>
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<tr>
<td>Sunroof</td>
<td>Avionics</td>
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<tr>
<td>Pump and fans, HVAC</td>
<td>Medical</td>
<td></td>
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<tr>
<td>Powertrain sensors (NOx)</td>
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<tr>
<td>Engine cooling fan</td>
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<tr>
<td>eTurbo charger</td>
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</tbody>
</table>

## S32K1 PARTNERS

![Partners Logos](www.nxp.com)
S32K1 HARDWARE TOOLS
Development platforms for general purpose automotive and high-reliability industrial applications.

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

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

S32K1 Hardware Tools:

MCSPTE1AK116
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

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

NEW

S32K14WEVB-Q064
UJA1169 CAN/LIN PHY SBC

S32K146EVB-Q144
UJA1169 CAN/LIN PHY SBC

ADTJA1101-RMII Ethernet daughter card

S32K148EVB-Q176
UJA1132 CAN/LIN PHY SBC

S32K1 SOFTWARE BLOCK DIAGRAM

S32K1 MCU

SERVICES / APPLICATION SOFTWARE

MIDDLEWARE

OS / DRIVERS / SAFETY

ARM CORTEX CORE(S)

FIRMWARE

Production grade Third Party * Reference

Motor Control Software*

ISELED lighting Software*

AUTOSAR Application

Power Estimation Tool (PET)

Model-Based Design Toolbox (MBDT)

Motor Control Application Tuning (MCAT)

FreeMASTER

S32 Design Studio (S32DS) + S32 Config Tool

S32K1 MCU

Structural Core Self Test (SCST)

LIN Stack

TCP/IP Stack

Real Time OS (FreeRTOS etc)

Classical AUTOSAR MCAL

S32 Software Development Kit (S32SDK)

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

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)
## S32K1 ORDERING INFORMATION

Part numbers below are available for sampling on 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></td>
<td></td>
<td>48 LQFP</td>
<td></td>
</tr>
<tr>
<td>FS32K118LAT0MLFT</td>
<td>256 KB/32 KB</td>
<td></td>
<td></td>
<td>48 LQFP</td>
<td></td>
</tr>
<tr>
<td>FS32K118LAT0MLHT</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>64 LQFP</td>
<td></td>
</tr>
<tr>
<td>FS32K1144HAT0MLFT</td>
<td>1 MB/128 KB</td>
<td></td>
<td></td>
<td>100 LQFP</td>
<td></td>
</tr>
<tr>
<td>FS32K1144HAT0MLHT</td>
<td>2 MB/256 KB</td>
<td>CAN FD + FlexIO crypto security engine eDMA (16 ch.) Ethernet; Serial audio interface; QSPI*</td>
<td>Arm Cortex-M4F @ 112 MHz</td>
<td>100 LQFP*</td>
<td></td>
</tr>
<tr>
<td>FS32K142WAT0WLHT</td>
<td>512 KB/64 KB</td>
<td></td>
<td>Arm Cortex-M4F @ 80 MHz</td>
<td>64 LQFP*</td>
<td></td>
</tr>
<tr>
<td>FS32K142WAT0WLFT</td>
<td>256 KB/32 KB</td>
<td></td>
<td></td>
<td>48LQFP</td>
<td></td>
</tr>
</tbody>
</table>

*QSPI not supported by S32K148-100 LQFP derivatives

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## S32K1 RESOURCES

- S32K1 product information: nxp.com/S32K1
- SafeAssure® community: nxp.com/SafeAssureCommunity
- S32K community: nxp.com/S32K1Community
- Product Longevity information: nxp.com/ProductLongevity

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