S32K3 Arm® CORTEX®-M7 BASED MCUs
SIMPLIFYING SOFTWARE DEVELOPMENT
FOR AUTOMOTIVE AND INDUSTRIAL

The S32K3 family includes scalable 32-bit Arm Cortex-M7 based MCUs in single, dual and Lockstep core configurations supporting up to ASIL D level safety. Features include a hardware security subsystem with NXP firmware, support for firmware over-the-air (FOTA) updates, and ISO 26262 compliant Real-Time Drivers (RTD) software package for AUTOSAR® and non-AUTOSAR.

S32K3 MCUs are available in NXP’s new MaxQFP packaging technology which reduces package footprint by up to 55% compared with standard QFP packages.

FEATURES AND PERFORMANCE
• Lockstep Arm Cortex-M7 cores, 120–240 MHz + FPU
• 512 KB, 8 MB Flash with ECC
• FOTA, A/B firmware swap with zero downtime, rollback support and automatic address translation
• 12-bit 1 Msps ADCs, 16-bit eMIOS timers with logic control unit for motor control
• Low power run and standby modes, fast wake-up, clock and power gating
• MaxQFP and BGA packages

MAXQFP PACKAGE TECHNOLOGY
• QFP ‘gull-wing and PLCC J-lead’ in single package
• 172-pin (16 x 16 mm), 100-pin (10 x 10 mm), 0.65 mm pin pitch
• AEC-Q100 qualified: Grade 1 (-40 °C to +125 °C) and Grade 2 (-40 °C to +115 °C)

• Fault collection and control unit (FCCU)
• Hardware and software watchdogs, clock/power/temperature monitors
• Safety documentation and SafeAssure® community support
• HSE security engine: AES-128/192/256, RSA and ECC encryption, secure boot and key storage, side channel protection, ISO 21434 intended
• Ethernet TSN and AVB (100 Mbps/1 Gbps), CAN-FD, FlexIO (SPI/IIC/IIS/SENT protocol), serial audio interface, QSPI

PRODUCTION-GRADE SOFTWARE
• Real Time Drivers (RTD): free of charge (AUTOSAR and non-AUTOSAR), ASIL D compliant
• Security firmware: NXP provided, field upgradeable
• Safety Framework Software (SAF) and Core Self-Test library for functional safety applications
• S32 Design Studio IDE (S32DS): Eclipse, GCC and debugger, third-party support
• Model-Based Design Toolbox (MBDT) for MathWorks® MATLAB® software
S32K FAMILY SCALABILITY

- K11 (single core)
- K14 (single core)
- K31 (single core)
- K32 (dual core)
- K33 (triple core)
- K34 (lockstep core)

**MaxQFP**

S32K3 FAMILY BLOCK DIAGRAM

- Common Features
- Real-Time Drivers
- Security Framework
- Software Framework
- Application Software
- S32 Design Suite IDE

*Low Power Serial Peripheral Interface (LPSPI) modules with DMA support

www.nxp.com
S32K3 FAMILY OVERVIEW

<table>
<thead>
<tr>
<th>Family</th>
<th>Arm® Cortex®-M Cores</th>
<th>Flash/RAM</th>
<th>Package</th>
<th>CAN-FD/ Ethernet (Optional)</th>
<th>Ambient Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S32K358</td>
<td>CM7 LS + CM7</td>
<td>8 MB/1MB</td>
<td>172 MaxQFP, 289 MAPBGA</td>
<td>8/1 Gbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K348</td>
<td>CM7 LS</td>
<td>8 MB/1MB</td>
<td>172 MaxQFP, 289 MAPBGA</td>
<td>8/1 Gbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K338</td>
<td>3x CM7</td>
<td>8 MB/1MB</td>
<td>172 MaxQFP, 289 MAPBGA</td>
<td>8/1 Gbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K328</td>
<td>2x CM7</td>
<td>8 MB/1MB</td>
<td>172 MaxQFP, 289 MAPBGA</td>
<td>8/1 Gbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K344</td>
<td>CM7 LS</td>
<td>4 MB/512 KB</td>
<td>172 MaxQFP, 257 MAPBGA</td>
<td>6/100 Mbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K342</td>
<td>CM7 LS</td>
<td>2 MB/256 KB</td>
<td>100/172 MaxQFP</td>
<td>4/100 Mbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K341</td>
<td>CM7 LS</td>
<td>1 MB/256 KB</td>
<td>100/172 MaxQFP</td>
<td>4/100 Mbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K324</td>
<td>2x CM7</td>
<td>4 MB/512 KB</td>
<td>172 MaxQFP, 257 MAPBGA</td>
<td>6/100 Mbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K322</td>
<td>2x CM7</td>
<td>2 MB/256 KB</td>
<td>100/172 MaxQFP</td>
<td>4/100 Mbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K314</td>
<td>CM7</td>
<td>4 MB/512 KB</td>
<td>172 MaxQFP, 257 MAPBGA</td>
<td>6/100 Mbps</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K312</td>
<td>CM7</td>
<td>2 MB/192 KB</td>
<td>100/172 MaxQFP</td>
<td>6/-</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K311</td>
<td>CM7</td>
<td>1 MB/128 KB</td>
<td>48 LQFP, 100 MaxQFP</td>
<td>3/-</td>
<td>-40 to 105/125</td>
</tr>
<tr>
<td>S32K310</td>
<td>CM7</td>
<td>512 KB/64 KB</td>
<td>48 LQFP, 100 MaxQFP</td>
<td>3/-</td>
<td>-40 to 105/125</td>
</tr>
</tbody>
</table>

TARGET APPLICATIONS

- Body controllers
- Zone controllers
- Battery Management System (BMS)
- Infotainment IO controller
- E-shifter
- Motor control:
  - Belt-Starte Generator (BSG), turbo charger, fan/pump controller

PARTNERS
PREMIUM SOFTWARE

For production use, available under license

- **Safety Software Framework (SAF)**: libraries for fault detection and reaction to single-point/latent faults during boot-up, runtime and fault recovery. Reduces development effort for safety implementation. Full coverage of software safety mechanisms within the MCU in S32K3xx Safety Manual.

- **Structural Core Self-Test (SCST) Library**: for runtime detection of permanent hardware faults in processor cores, with 90% diagnostic coverage.

- **HSE Firmware (OEM-customized version)**: OEM-specific security firmware.

- **Automotive Math and Motor Control Library (AMMCLIB)**: pre-compiled, highly optimized libraries for a wide range of motor control and general math functions.

- **Battery Management System (BMS) Safety Library**: in BMS reference design.

- **ISELED LED Lighting Driver**: supports S32K MCUs in ISELED LED lighting applications.

STANDARD SOFTWARE

For production use, included in silicon cost

- **S32 Design Studio IDE for S32 Platform**: Eclipse-based, GNU compiler and debugger with support for third-party versions. S32 Config Tool for configuring RTD, pins, clocks, peripherals, DDR memory and OS.


- **Safety Peripheral Drivers**: low-level drivers for safety peripherals: BIST manager and Extended Microcontroller Error Manager (eMcem) for safety framework development.

- **HSE Firmware (standard version)**: SHE+ support, field upgradeable, extended symmetric/asymmetric services, AUTOSAR compliant, industry-proven.

- **Inter-Platform Communication Framework (IPCF)**: middleware for inter-core communications and resource access and sharing, e.g., AUTOSAR/non-AUTOSAR on Cortex-M cores

- **Model-Based Design Toolbox (MBDT)**: plug-in for MathWorks® MATLAB® Software and MathWorks Simulink® Software.

- **Motor Control Tools**: FreeMASTER real-time debug monitor and Motor Control Application Tuning (MCAT) to simplify motor control development.

REFERENCE SOFTWARE

For reference use, included in silicon cost

- **Platform Integration Software**: general software examples.

- **Communication Stacks (TCP/IP, LIN)**

- **FreeRTOS OS**
S32K3 HARDWARE TOOLS

S32K3X4EVB-Q172
• Supports S32K344/24/14 (172MaxQFP)
• FS26 Power SBC, with +5.0 V, +3.3 V and +1.5 V
• Arduino® UNO footprint compatible with expansion support
• Integrated debug adapter with P&E firmware and JTAG connectors for external debuggers
• Easy access to all the MCU I/O pins for prototyping
• MII/RMII Ethernet interface: 10/100Base-T interface with RJ45 connector
• Touch pad interface, push buttons RGB LED, ADC potentiometers
• [1] CAN physical layers
• [2] LIN physical layers: LIN 2.1/SAE J2602 transceiver
• MX25L6433FM2R-08G 64 Mb bits serial NOR flash memory (Macronix)

S32K3X4EVB-Q257
• Supports S32K344/24/14 (257BGA)
• FS26 Power SBC, with +5.0 V, +3.3 V and +1.5 V.
• Arduino® UNO footprint compatible with expansion support
• Integrated debug adapter with P&E firmware and various JTAG connectors for external debuggers
• Easy access to all the MCU I/O pins for prototyping
• MII/RMII Ethernet daughter board connector compatible with ADTJA1101-RMII (order separately)
• Touch pad interface, push buttons, RGB LEDs, ADC potentiometers and MMA8452Q 3-axis digital accelerometer
• [2] CAN physical layers with the TJA1153 Secure HS-CAN Transceiver with sleep mode
• [2] LIN physical layers with the TJA1021: LIN 2.1/SAE J2602 Transceiver
• MX25L6433FM2R-08G 64 Mb bits serial NOR flash memory (Macronix)
• SAI connector and SGTL5000 audio codec interface
S32K3 HARDWARE TOOLS cont.

**S32K312EVB-Q172**
- Supports S32K312 (172 MaxQFP)
- FS26 Power SBC: +5.0 V, +3.3 V, and +1.5 V
- Arduino® UNO footprint-compatible with expansion support
- Integrated debug interface with P&E firmware and 10-pin JTAG connectors for external debuggers
- Easy access to all the MCU I/O pins for prototyping
- Touch pad interface, push buttons, RGB LED, ADC Potentiometers
- [1] CAN physical layers with the TJA1043 CAN-FD transceiver with sleep mode
- [2] LIN physical layers with the TJA1022T: LIN 2.1/SAE J2602 transceiver

**S32K3-T-BOX**
- Reference design for cost-effective vehicle networking and telematics applications.
- Supports S32K344 with lockstep Arm® Cortex®-M7 (172 MaxQFP)
- FS26 Power SBC, with +5.0 V, +3.3 V and +1.5 V.
- Features SJA1110 TSN Ethernet switch
- Features LIN, CAN FD and HS-CAN transceivers
- Features the SGTL5000 audio codec
- Wireless connectivity featuring the AW690 Wi-Fi® 6 SoC
- [1] CAN physical layers with the TJA1153 -Secure HS-CAN transceiver with sleep mode
- [2] CAN physical layers with the TJA1463 and TJA1462 CAN transceivers with sleep and standby modes
- [1] CAN FD physical layers with the TJA144x transceiver
- [4] LIN physical layers with the TJA1124 Quad-LIN commander

**S32K3 RESOURCES**

- S32K3 product information
  - [nxp.com/S32K3](nxp.com/S32K3)
- SafeAssure® community
  - [nxp.com/SafeAssureCommunity](nxp.com/SafeAssureCommunity)
- S32K community
  - [community.nxp.com](community.nxp.com)
- Product Longevity information
  - [nxp.com/ProductLongevity](nxp.com/ProductLongevity)

Real-Time Drivers
- [nxp.com/RTD](nxp.com/RTD)