S32K3 Arm® CORTEX® -M7 BASED MCUs SIMPLIFIYING 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 and roll-back support. Automatic address translation
- 12-bit 1Msps 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' + 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 +105° C)
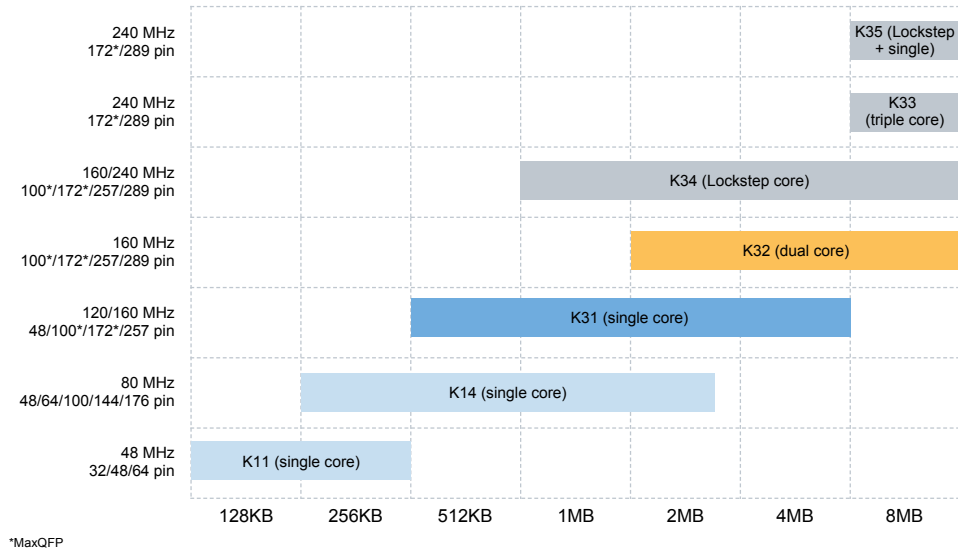
SAFETY, SECURITY AND CONNECTIVITY

- ISO 26262 up to ASIL D
- 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 (100Mbps/1Gbps), I3C, 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, 3rd party support
- Model-Based Design Toolbox (MBDT) for MATLAB®

S32K FAMILY SCALABILITY

	128KB	256KB	512KB	1MB	2MB	4MB	8MB
240 MHz 172*/289 pin							K35 (Lockstep + single)
240 MHz 172*/289 pin							K33 (triple core)
160/240 MHz 100*/172*/257/289 pin				K34 (Lockstep core)			
160 MHz 100*/172*/257/289 pin				K32 (dual core)			
120/160 MHz 48/100*/172*/257 pin		K31 (single core)					
80 MHz 48/64/100/144/176 pin	K14 (single core)						
48 MHz 32/48/64 pin	K11 (single core)						

*MaxQFP

S32K3 FAMILY BLOCK DIAGRAM

K311	K312	K314	Common Features	K322	K324	K341	K342	K344	K328	K338	K348	K358
1 x Arm® Cortex®-M7 @120 MHz		1x Cortex-M7 @160 MHz	AEC-Q100, 125 °C, 3.3/5 V	2 x Cortex-M7 @160 MHz		1 Lockstep Cortex-M7 @ 160 MHz			2 x Cortex-M7 @ 160 MHz	3 x Cortex-M7 @ 240 MHz	1 LS Cortex-M7 @ 160 MHz	1 LS Cortex-M7 + 1 Cortex-M7 @ 240 MHz
1 MB Flash	2 MB Flash	4 MB Flash	HSE-B Crypto Security Engine	2 MB Flash	4 MB Flash	1 MB Flash	2 MB Flash	4 MB Flash	8 MB Flash			
128 K SRAM	192 K SRAM	512 K SRAM	FOTA (Firmware Over-the-Air)	256 k SRAM	512 k SRAM	256 k SRAM	256 k SRAM	512 k SRAM	1152 KB SRAM	1152 KB SRAM	1152 KB SRAM	1152 KB SRAM
up to 84 I/Os	up to 143 I/Os	up to 218 I/Os	Low-Power Operating Modes and Peripherals (LP UART, FlexIO)	up to 143 I/Os	up to 218 I/Os	up to 143 I/Os	up to 143 I/Os	up to 218 I/Os	up to 218 I/Os			
16-ch. eDMA		32-ch. eDMA	ASIL B/D Safety: (ECC Memories, MPU, CRC, Watchdogs)	32-ch. eDMA								
3 x CAN (3 x FD)	6 x CAN (6 x FD)			4 x CAN (4 x FD)	6 x CAN (6 x FD)	4 x CAN (4 x FD)	4 x CAN (4 x FD)	6 x CAN (6 x FD)	8 x CAN (8 x FD)	8 x CAN (8 x FD)	8 x CAN (8 x FD)	8 x CAN (8 x FD)
		100 Mbit/s Ethernet (TSN)	eMIOS Timers, Analogue Comparator, Logic Control Unit, Body Cross Triggering Unit, Trigger Mux	100 Mbit/s Ethernet (TSN)					1 Gbit/s Ethernet (TSN)			
1 x I²C and 2 x I²C	1 x I²C and 2 x I²C	2 x I²C		1 x I²C and 2 x I²C	2 x I²C	1 x I²C and 2 x I²C	1 x I²C and 2 x I²C	2 x I²C	1 x I²C and 2 x I²C			
4 x SPI*		6 x SPI*		4 x SPI*	6 x SPI*	4 x SPI*	4 x SPI*	6 x SPI*				
2 x 24-ch. 12-bit ADC		3 x 24-ch. 12-bit ADC		2 x 24-ch. 12-bit ADC	3 x 24-ch. 12-bit ADC	2 x 24-ch. 12-bit ADC	2 x 24-ch. 12-bit ADC		3 x 24-ch. 12-bit ADC			
		2 x SAI (I²S)	JTAG	2 x SAI (I²S)								
		Quad SPI	S32 Design Studio IDE	Quad SPI					Quad SPI + SDHC (SDIO)			
LQFP-48	MaxQFP-172		Real-Time Drivers (AUTOSAR® and Non-AUTOSAR)	MaxQFP-172								
MaxQFP-100				MaxQFP-100		MaxQFP-100	MaxQFP-100					
		MAPBGA-257	Security F/W Safety Software Framework Application Software		MAPBGA-257			MAPBGA-257	MAPBGA-289			

S32K3 FAMILY OVERVIEW

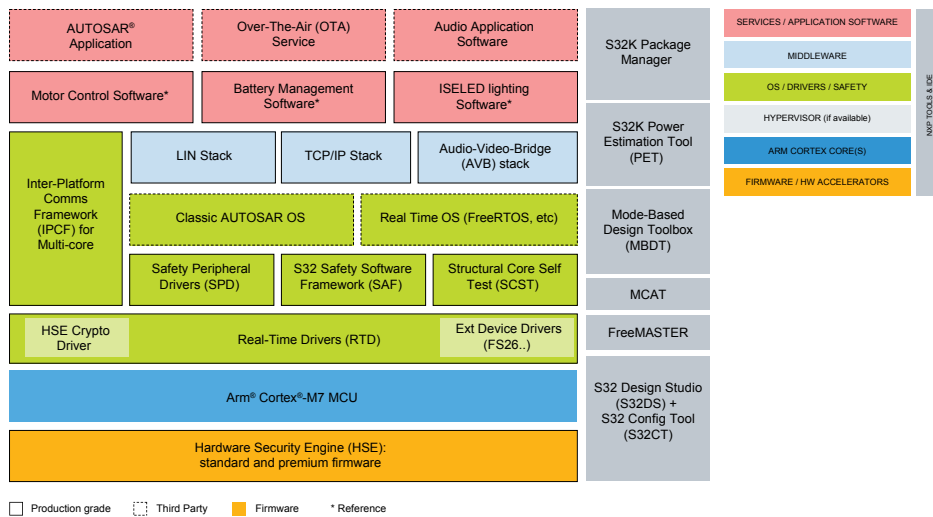| Family	Arm Cortex –M Cores	Flash / RAM	Package	CAN-FD / ENET (optional)	Ambient Temp (°C)
S32K358	CM7 LS + CM7	8Mb / 1Mb	172 MaxQFP, 289 MAPBGA	8 / 1Gbps	-40 to 105/125
S32K348	CM7 LS	8Mb / 1Mb	172 MaxQFP, 289 MAPBGA	8 / 1Gbps	-40 to 105/125
S32K338	3x CM7	8Mb / 1Mb	172 MaxQFP, 289 MAPBGA	8 / 1Gbps	-40 to 105/125
S32K328	2x CM7	8Mb / 1Mb	172 MaxQFP, 289 MAPBGA	8 / 1Gbps	-40 to 105/125
S32K344	CM7 LS	4Mb / 512 KB	172 MaxQFP, 257 MAPBGA	6 / 100Mbps	-40 to 105/125
S32K342	CM7 LS	2Mb / 256 KB	100/172 MaxQFP	4 / 100Mbps	-40 to 105/125
S32K341	CM7 LS	1Mb / 256 KB	100/172 MaxQFP	4 / 100Mbps	-40 to 105/125
S32K324	2x CM7	4Mb / 512 KB	172 MaxQFP, 257 MAPBGA	6 / 100Mbps	-40 to 105/125
S32K322	2x CM7	2Mb / 256 KB	100/172 MaxQFP	4 / 100Mbps	-40 to 105/125
S32K314	CM7	4Mb / 512 KB	172 MaxQFP, 257 MAPBGA	6 / 100Mbps	-40 to 105/125
S32K312	CM7	2Mb / 192 KB	100/172 MaxQFP	6 / -	-40 to 105/125
S32K311	CM7	1Mb / 128 KB	48 LQFP, 100 MaxQFP	3 / -	-40 to 105/125
S32K310	CM7	512 KB / 64 KB	48 LQFP, 100 MaxQFP	3 / -	-40 to 105/125

TARGET APPLICATIONS

• Body controllers
• Zone controllers
• Battery Management System (BMS)
• Infotainment IO controller
• E-shifter
• Motor control:

  – Belt-Starter Generator (BSG), turbo charger, fan/pump controller

PARTNERS

S32K3 SOFTWARE ENABLEMENT

AUTOSAR® Application	Over-The-Air (OTA) Service	Audio Application Software	S32K Package Manager	SERVICES / APPLICATION SOFTWARE
Motor Control Software*	Battery Management Software*	ISELED lighting Software*		MIDDLEWARE
Inter-Platform Comms Framework (IPCF) for Multi-core	LIN Stack / TCP/IP Stack / Audio-Video-Bridge (AVB) stack		S32K Power Estimation Tool (PET)	OS / DRIVERS / SAFETY
	Classic AUTOSAR OS / Real Time OS (FreeRTOS, etc)		Mode-Based Design Toolbox (MBDT)	HYPERVISOR (if available)
	Safety Peripheral Drivers (SPD) / S32 Safety Software Framework (SAF) / Structural Core Self Test (SCST)		MCAT	ARM CORTEX CORE(S)
HSE Crypto Driver	Real-Time Drivers (RTD) / Ext Device Drivers (FS26..)		FreeMASTER	FIRMWARE / HW ACCELERATORS
Arm® Cortex®-M7 MCU			S32 Design Studio (S32DS) + S32 Config Tool (S32CT)	NXP TOOLS & IDE
Hardware Security Engine (HSE): standard and premium firmware				

☐ Production grade   ⬚ Third Party   ▮ Firmware   * Reference

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-customised version):** OEM-specific security firmware

- **Automotive Math and Motor Control Library (AMMCLIB):** pre-compiled, highly optimised 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 3rd party versions. S32 Config Tool for configuring: RTD / pins / clocks / peripherals / DDR memory / OS

- **Real-Time Drivers (RTD):** software drivers for AUTOSAR/non-AUTOSAR applications. Full processor IP coverage. ISO 26262 ASIL D compliant, AUTOSAR 4.4, SPICE level 3. Configure with S32 Config Tool, Elektrobit Tresos Studio or other partner's tools

- **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/sharing e.g. AUTOSAR/non-AUTOSAR on Cortex M cores

- **Model-Based Design Toolbox (MBDT):** plug-in for MATLAB®/ Simulink®

- **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)
- PwrSBC FS26, 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: 10/100TBase 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 64Mb bits Serial NOR Flash Memory (Macronix)

S32K3X4EVB-Q257

- Supports S32K344/24/14 (257BGA)
- PwrSBC FS26, 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 64Mb bits Serial NOR Flash Memory (Macronix)
- SAI Connector and SGTL5000 Audio Codec Interface
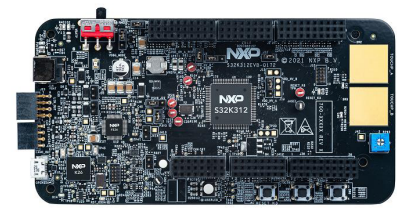
S32K312EVB-Q172

- Supports S32K312 (172MaxQFP)
- 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 RESOURCES

S32K3 product information
nxp.com/S32K3

S32K community
community.nxp.com

Real-Time Drivers **nxp.com/RTD**

SafeAssure® community
nxp.com/SafeAssureCommunity

Product Longevity information
nxp.com/ProductLongevity

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nxp.com/S32K3