S32K1
PRODUCTS AND SOLUTIONS UPDATE

AUTOMOTIVE MICROCONTROLLERS & PROCESSORS

VINCENT DENG / 邓尚超
汽车微控制器和处理器产品市场经理
SEPT 2019

Contents

- S32K1 MCUs
  - Overview
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  - Hot PNs
  - Roadmap
  - Success Stories
- S32K1 Demos
- Touch Sense Solution
- ISELED LED Lighting Kit
- Automotive NFC Stack
- 3rd party tools

S32K1 MCUS

S32K Target Apps: Truly General Purpose

Body Electronics

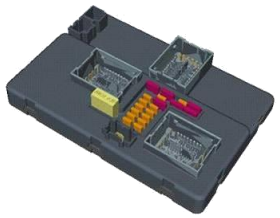
HVAC

Steering wheel

Lighting

Battery/Power mgmt

Doors



Body Controllers

Motor Control

Engine / cooling fans

Window lift

Wipers

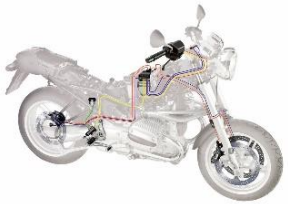
Diesel / Oil Pump

Chassis/Safety

TPMS

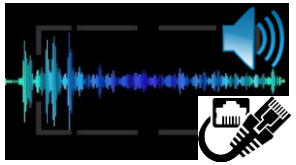
Suspensions

Gear shifter



Motorcycle ABS

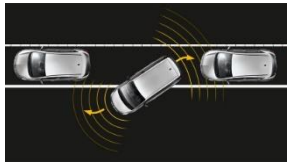
Infotainment



Eth. Audio Amp

Wireless Charging, NFC pairing

ADAS



Park Assist

Motorized cameras

Why is S32K1xx Successful?

- ✓ **Where we win:**
  - Lighting
  - HVAC and Steering Angle
  - Gear Shifter
  - I/O Controllers
  - Sunroof
  - Power Opening Tailgate
  - BMS
  - Wireless Charging

- ✓ **Why we win:**
  - Family/platform compatibility
  - CSEc for secure boot
  - ASIL capability
  - Ease-of-use






S32K1 Family – Accelerating Automotive Software Design

Performance & Integration

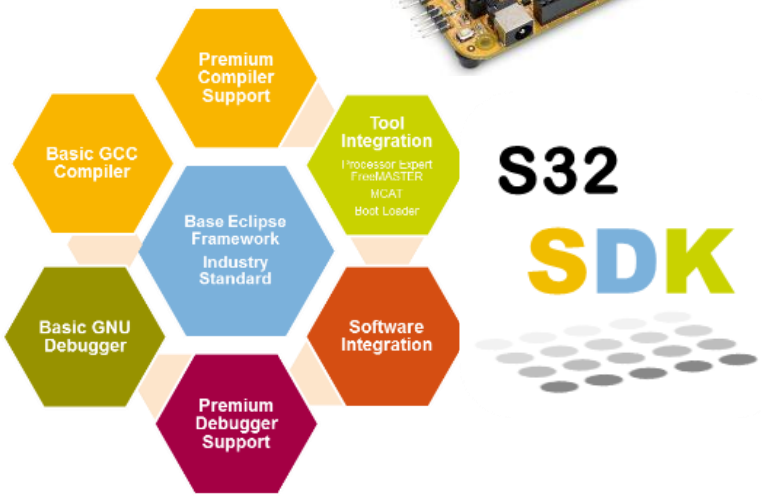
Future proof designs

- ARM Cortex M4F and M0+ cores
- ISO CAN-FD, CSEc hardware security, ISO26262 ASIL-B functional safety
- Ultra low power

Automotive-grade SW

Minimized complexity

- S32 Design Studio IDE
- Automotive-grade Software Development Kit (SDK)
- Autosar MCAL & OS, 3rd party ecosystem



Broad Portfolio

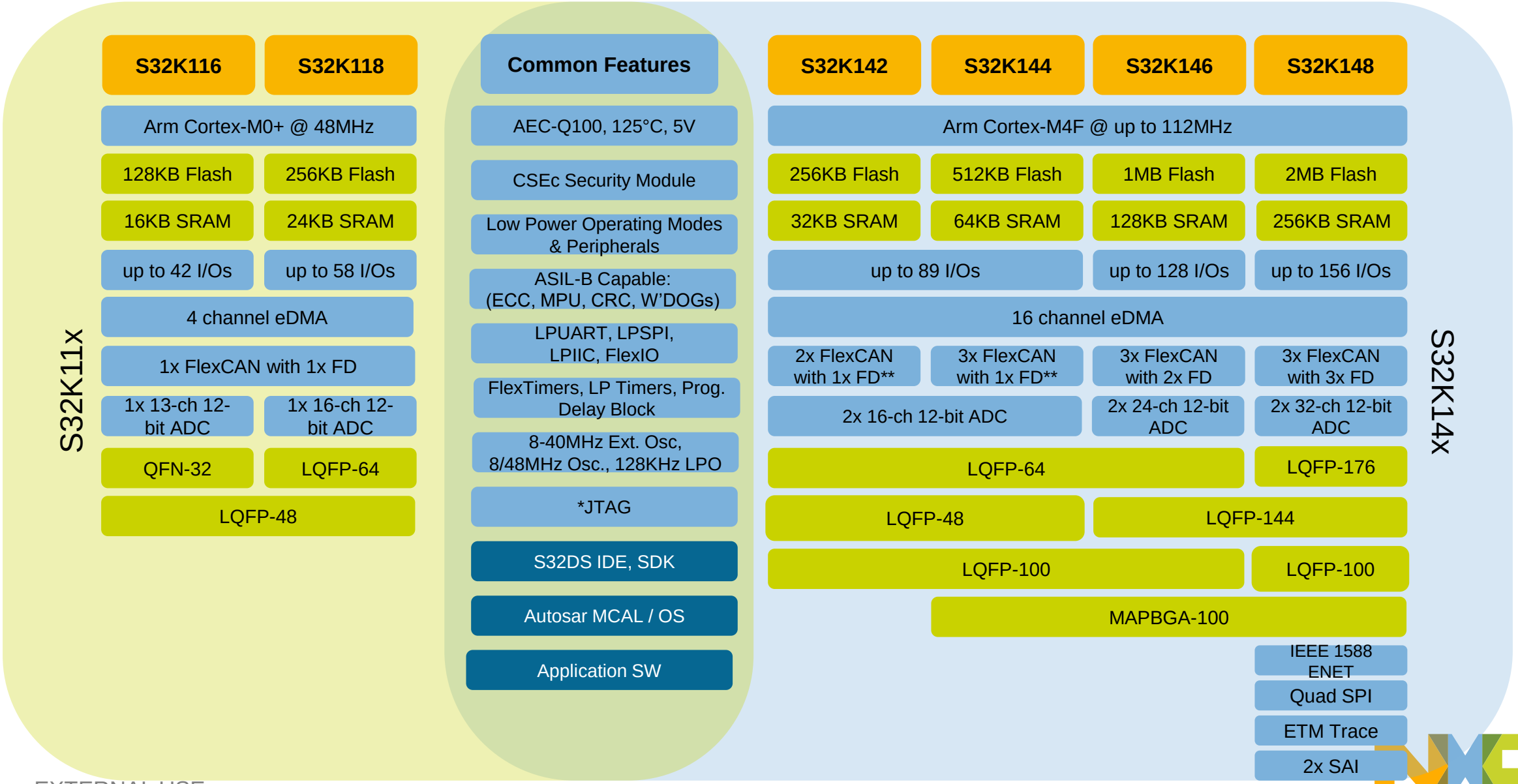
Maximised reuse

- 128KB to 2MB, 32 to 176 pins
- H/w and S/w compatibility
- AEC Q100 grade 1 qualified (125°C), min. 15 year longevity

Product Longevity

S32K14x and S32K11x Features

Production



*S32K14x only
** 2x CAN FD in S32K14xW (Grade 0)

S32K1xx Feature Comparison Table

		K116	K118	K142	K144	K146	K148
Memory	Flash	128KB	256KB	256KB	512KB	1MB	2MB
	ECC	Yes	Yes	Yes	Yes	Yes	Yes
	SRAM (inc. FlexRAM and MTB)	17KB	25KB	32KB	64KB	128KB	256KB
	FlexRAM	2KB		4KB			
	Cache	NA		4KB			
	EEPROM emulated by FlexRAM	2KB (up to 32KB D-Flash)		4KB (up to 64 KB D-Flash)			4 KB*
	External memory interface	NA		NA			QSPI
Timer	Low Power Interrupt Timer	1	1	1	1	1	1
	FlexTimer (8 channels, 16-bit counter)	2	2	4	4	6	8
	Low Power Timer	1	1	1	1	1	1
	Real Time Counter	1	1	1	1	1	1
	Programmable Delay Block	1	1	2	2	2	2
Analog	Trigger Mux	1 × 43	1 × 45	1 × 64	1 × 64	1 × 73	1 × 81
	12-bit SAR ADC (1 Msps each)	1 × 13	1 × 16	2 × 16	2 × 16	2 × 24	2 × 32
	Comparator with 8-bit DAC	1		1			
Communication	10/100 Mbps IEEE-1588 ENET MAC	NA		NA			1
	Serial Audio Interfance (AC97, TDM, I2S)	NA		NA			2
	Low Power UART/LIN	2	2	2	3	3	3
	Low Powe I2C	1	1	1	1	1	2
	FlexCAN (with CAN FD)	1 (1)	1 (1)	2 (1)	3 (1)	3 (2)	3 (3)
	FlexIO (8 pins configurable as UART, SPI, I2C, I2S)	1	1	1	1	1	1

* Applicable for S32K1 Grd 1 devices. See details in data sheet

S32K1 – Priority PNs

ID	Features
UA*	112 MHz, Security, CANFD, FlexIO, Max RAM
HR	80MHz, Max RAM
HA	80 MHz, Security, CANFD, FlexIO, Max RAM
HF	80MHz, CANFD, FlexIO, Max RAM
UJ*	112 MHz, ENET & Audio, Security, CANFD, FlexIO, Max RAM
HE	80 MHz, ENET & Audio , Max RAM

Pins	LQFP	QFN	BGA
32	LC	FM	-
48	LF	-	-
64	LH	-	-
100	LL	-	MH
144	LQ	-	-
176	LU	-	-

PN Tier	S32K116	S32K118	S32K142	S32K144	S32K146	S32K148
	128 KB Flash 17 KB RAM	256 KB Flash 25 KB RAM	256 KB Flash 32 KB RAM	512 KB Flash 64 KB RAM	1 MB Flash 128 KB RAM	2 MB Flash 256 KB RAM
Priority PRODUCTION (16)	**48MHz, M Temp**	**48MHz, M Temp**	**80MHz, M Temp**	**80MHz, M Temp**	**80MHz, M Temp**	**112MHz, V Temp**
	FS32K116LAT0MLFT	FS32K118LAT0MLHT	FS32K142HAT0MLHT	FS32K144HAT0MLHT	FS32K146HAT0MLLT	FS32K148UJT0VLUT
	FS32K116LAT0MFMT	FS32K118LAT0MLFT	FS32K142HAT0MLLT	FS32K144HAT0MLLT	FS32K146HAT0MLQT	FS32K148UJT0VLQT
				FS32K144HAT0MMHT	FS32K146HAT0MLHT	FS32K148UJT0VMHT
					FS32K146HAT0MMHT	
Priority SAMPLE (15)			**112MHz, V Temp**	**112MHz, V Temp**	**112MHz, V Temp**	**80MHz, M Temp**
			FS32K142UAT0VLLT	FS32K144UAT0VLLT	FS32K146UAT0VLLT	FS32K148HAT0MLQT
			FS32K142UAT0VLHT	FS32K144UAT0VMHT	FS32K146UAT0VLQT	FS32K148HAT0MLUT
				FS32K144UAT0VLHT	FS32K146UAT0VLHT	FS32K148HAT0MMHT
					FS32K146UAT0VMHT	FS32K148HET0MLQT
						FS32K148HET0MLUT
						FS32K148HET0MMHT

*For PN 9 &10th character = UA or UJ: Write or erase access to security (CSEc) or EEPROM is allowed only when device operating in RUN mode (up to 80MHz). No write or erase access to security and EEPROM allowed when device running at HSRUN mode (112MHz).

S32K14x – Cortex M4F based
S32K11x- Cortex M0+ based
KEA- Cortex M0+ based

S32K1 / KEA Product Series Compatibility

Pin Compatibility: ✓
- Within S32K1xx product series
- Similar pinout as KEA products

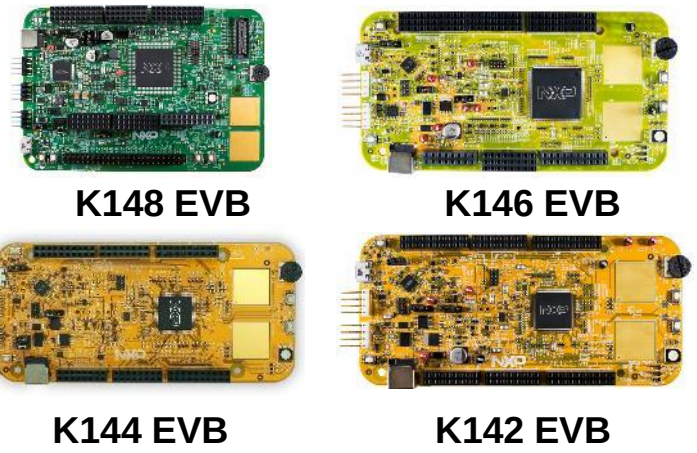
IP Compatibility: ✓
- With MPC55xx/MPC56xxx/MPC57xxx product series: FlexCAN, ACMP, eDMA, QuadSPI
- With KEA products: FlexTimer, IIC, LSPI, UART, CRC, FlexIO

Flash	Package									
	16TSSOP	24QFN	32QFN	48LQFP	64LQFP	80LQFP	100 LQFP	100 BGA	144LQFP	176LQF
	4.4 x 5 mm, (0.65 mm pitch)	4 x 4 mm, (0.5 mm pitch)	5 x 5 mm, (0.5 mm pitch)	7 x 7 mm, (0.5 mm pitch)	10 x 10 mm, (0.5 mm pitch)	14 x 14 mm, (0.65 mm pitch)	14 x 14 mm, (0.5 mm pitch)	11 x 11 mm, (1 mm pitch)	20 x 20 mm, (0.5 mm pitch)	24 x 24 mm, (0.5 mm pitch)
2M							S32K148	S32K148	S32K148	S32K148
1M					S32K146		S32K146	S32K146	S32K146	
512K				S32K144 S32K144W	S32K144 S32K144W		S32K144	S32K144		
256K				S32K142 S32K142W S32K118	S32K142 S32K142W S32K118		S32K142			
128K			S32K116	S32K116	KEAZ128	KEA128				
64K			KEAZN64		KEAZ(N)64	KEAZ64				
32K			KEAZN32		KEAZN32					
16K			KEAZN16		KEAZN16					
8K	KEAZN8									

LAST UPDATE: 20-MAR-2019

S32K1 Enablement

Hardware



K148 EVB | K146 EVB

K144 EVB | K142 EVB

- S32K148EVB-Q176 (2MB) $149
- S32K146EVB-Q144 (1MB) $149
- S32K144EVB-Q100 (512KB) $49
- S32K142EVB-Q100 (256KB) $49

- NXP & 3rd party SW tool compatible, out-of-box examples for fast start-up & prototyping with FreeMASTER tool

- Arduino UNO compatible with expansion “shield” support

Software

- *Free* S32 Design Studio IDE – Eclipse based, multiple compiler & debugger options, Processor Expert GUI tool

- *Free* S32 SDK – Production grade, low-level drivers, TCP/IP / LIN / ANFC / AVB Stacks, Touch Sense lib, SBC & ISELED drivers

- Automotive Math, Motor Control Libs., MATLAB Model Based Design Tool, Core/Peripheral Self Test Libraries

Ecosystem

IAR SYSTEMS · ARC CORE · VECTOR · Green Hills SOFTWARE · Elektrobit · COSMIC Software · MathWorks · LAUTERBACH DEVELOPMENT TOOLS

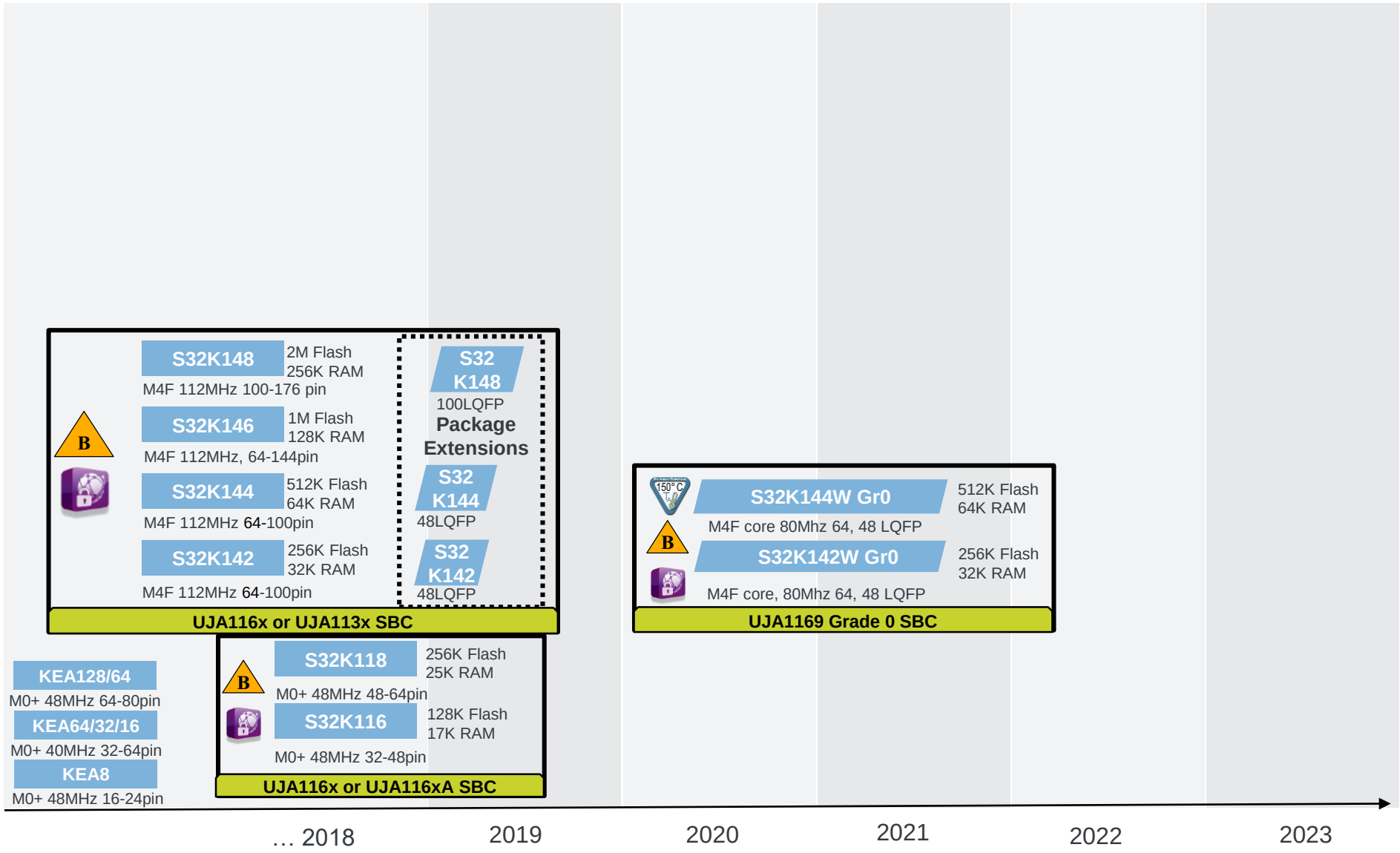
- Premium level IDE, complier & debugger tools

- NXP & 3rd party MCAL / AUTOSAR. New ARCCORE Starter Kit (60-day evaluation license)

- S32K, S32DS & SDK Communities http://www.nxp.com/community

S32K Roadmap

S32K3 Roadmap Under DNA



arm

X ASIL Level

CSEc Security

HSE Security

Product Idea

First Sample Date (left edge)

Concept

Development

Production

Product Qualification (right edge)

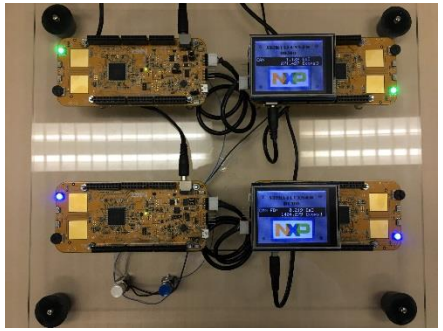
Last update: 25 March 2019

S32K1 DEMOS

S32K Demos

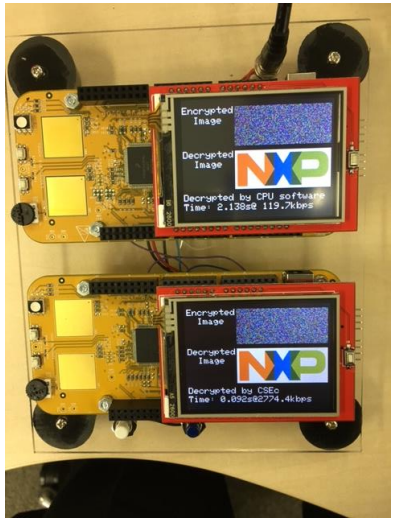
Secure CAN-FD Diagnostics

S32K144, UJA1169



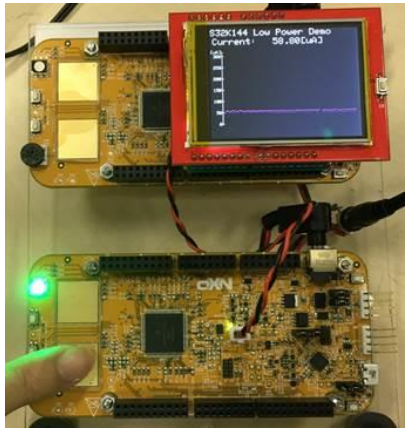
CAN-FD vs. CAN

S32K144



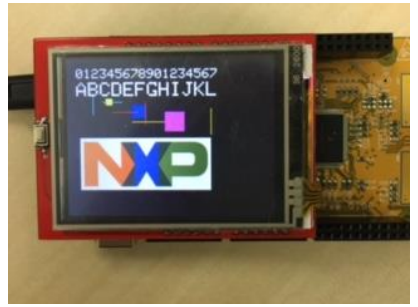
CSEc Image Decryption

S32K144



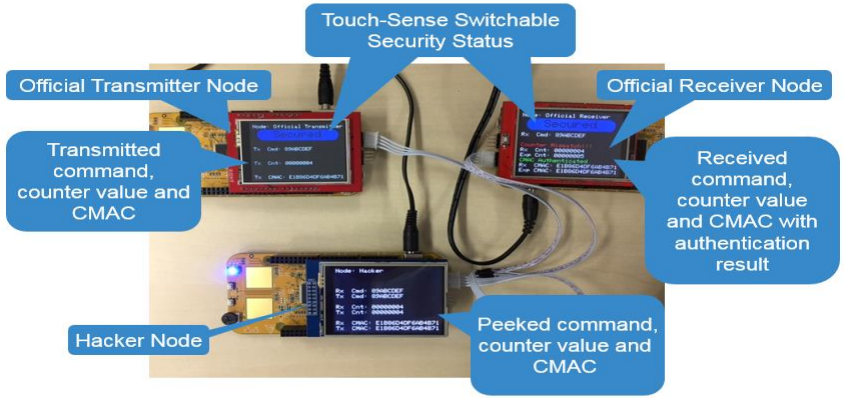
Low Power Touch Sense

S32K144



LCD Touchscreen

S32K144



CAN Message Authentication

S32K144

FlexIO - emulate UART/SPI/IIS

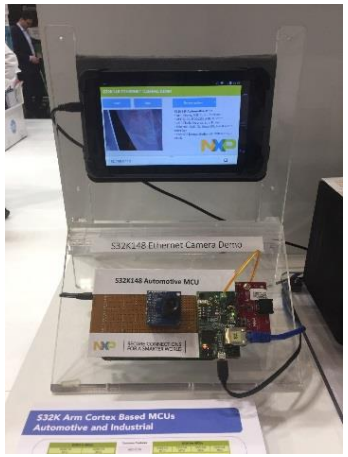
S32K144

Low Power

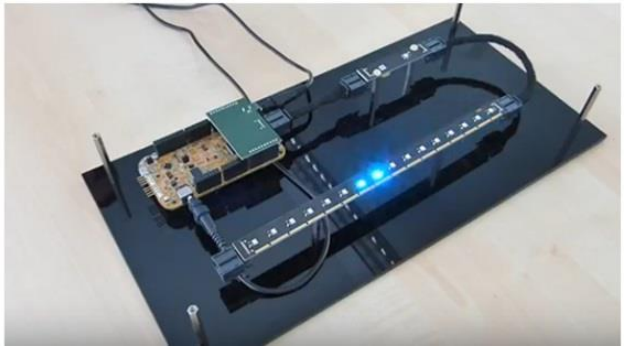
S32K144 + FreeMASTER Tool

S32K Demos

Ethernet AVB Gateway
S32K148



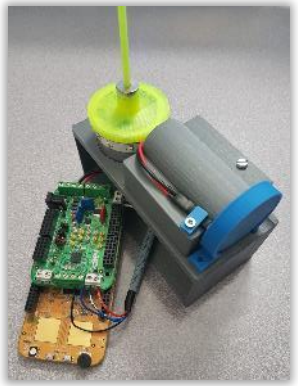
Ethernet Camera
+ Security
S32K148



ISELED LED Lighting
S32K144

BLDC Motor Control
S32K144 + GD3000

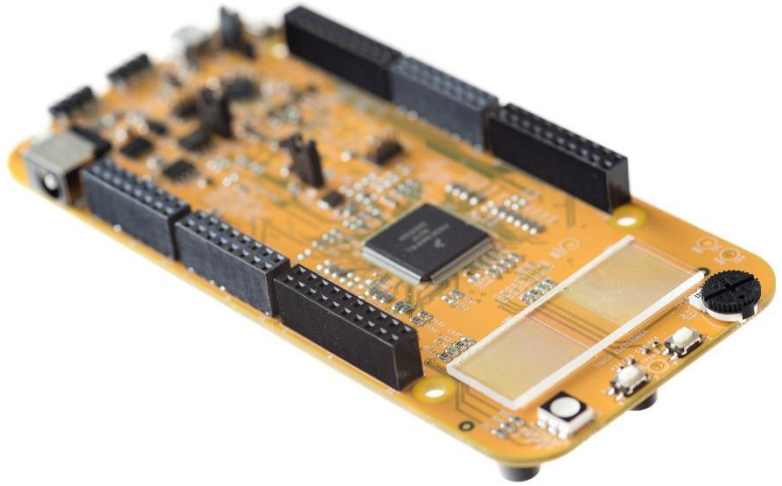
DC Motor Control
S32K144 + HB2001



Motorcycle ABS
S32K144 +
SB0400

Touch sense demonstrator and hand off detection

- **Key Features:**
  - Based on S32K144EVB Q100
  - Low power consumption with build in basic EMI immunity (tested with fluorescent lamp)
  - Tested with winter downhill ski gloves
  - Solution based on NXP submitted patent to the United States Patent Office (one external capacitance per electrode)

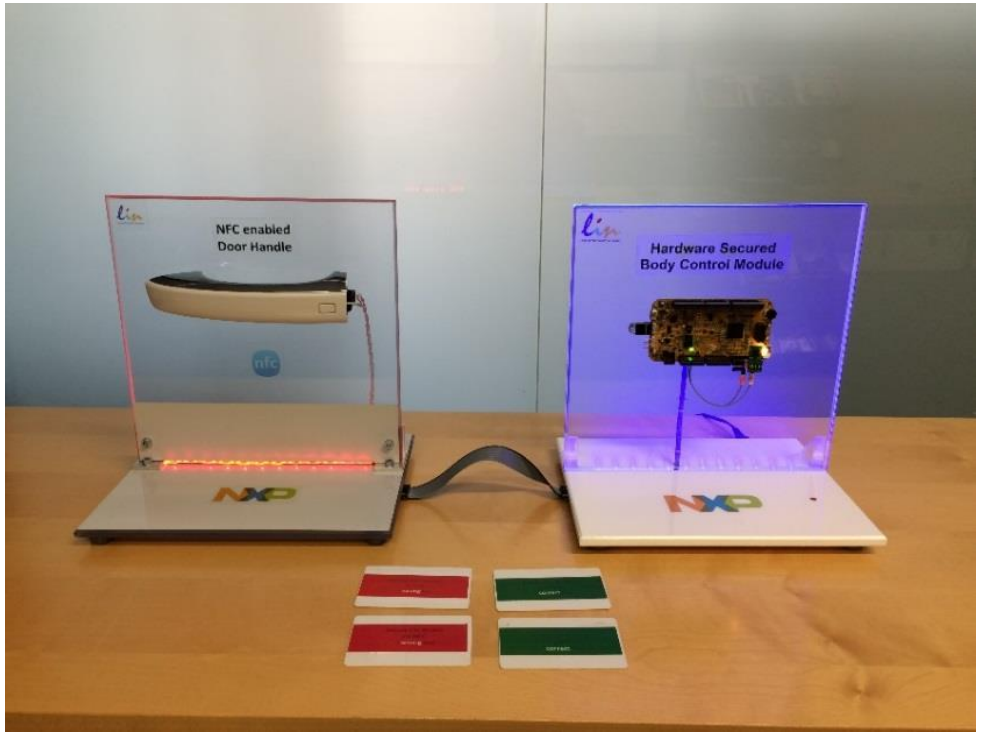


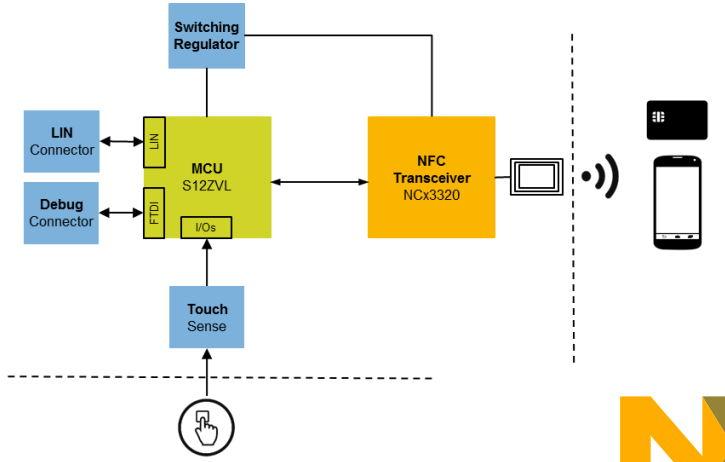
- **Addressed technical challenges:**
  - Sensitivity (reduced HW mutual capacitance, electrodes crosstalk compensation)
  - Basic EMI immunity (ADC conversion timing, periodical electrode capacitance scanning, IIR1 LP filter)
  - Low Power consumption < 60 uA (via MCU VLPS, periodically, MCU clocked from FIRC)
  - Response time < 25 ms
  - Reaction time < 100 ms
  - Scalability, ASIL-B

DHRD Demonstrator

Secure Car Access via NFC

- **Key Features:**
  - Secure and smart solution for NFC car access
  - DHRD embedded in real car door handle
  - S12ZVL MCU based door handle module with NCx3320 NFC receiver
  - **S32K** MCU based secure body control module
  - Secure Element attached on body control module
  - JCOP smart cards used for lock / unlock
  - Smart phone with secure element used for lock / unlock
- **Addressed technical challenges:**
  - Small footprint fitting to inside of door handle
  - Antenna design fitting both chrome and non-chrome door handles
  - Low power consumption of card detection and capacitive sensing
  - ISO 26262 support





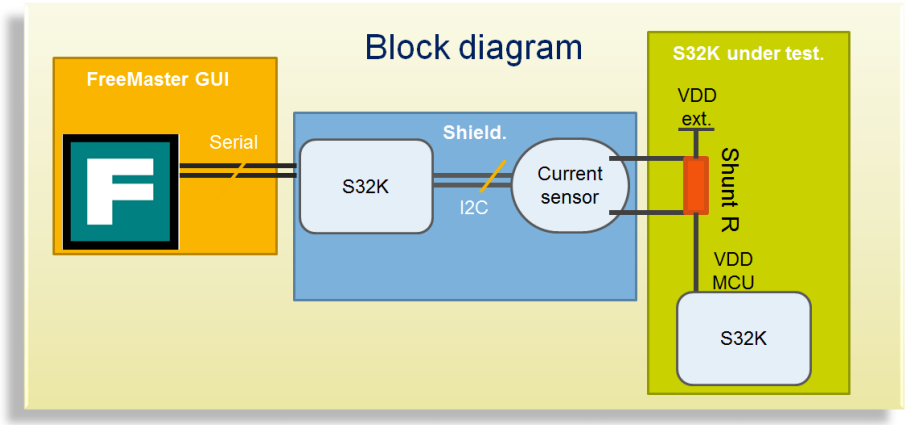
S32K Low Power Demonstrator

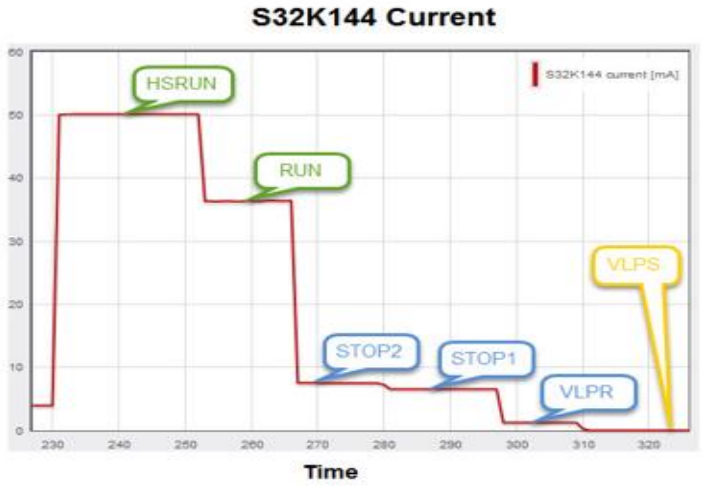
Key features:

- Demonstrating All Power modes:
  - HSRUN, RUN, STOP2, STOP1,VLPR,VLPS.
  - Showcasing application use cases.
- FreeMaster interface
- Using a “Low power S32K shield” + S32K144EVB

Addressed technical challenges:

- <100uA AVG consumption while still having periodic wakeups and ATD measurements/SCI communication
- <100mA @HSRUN 112Mhz al peripherals enabled and working.

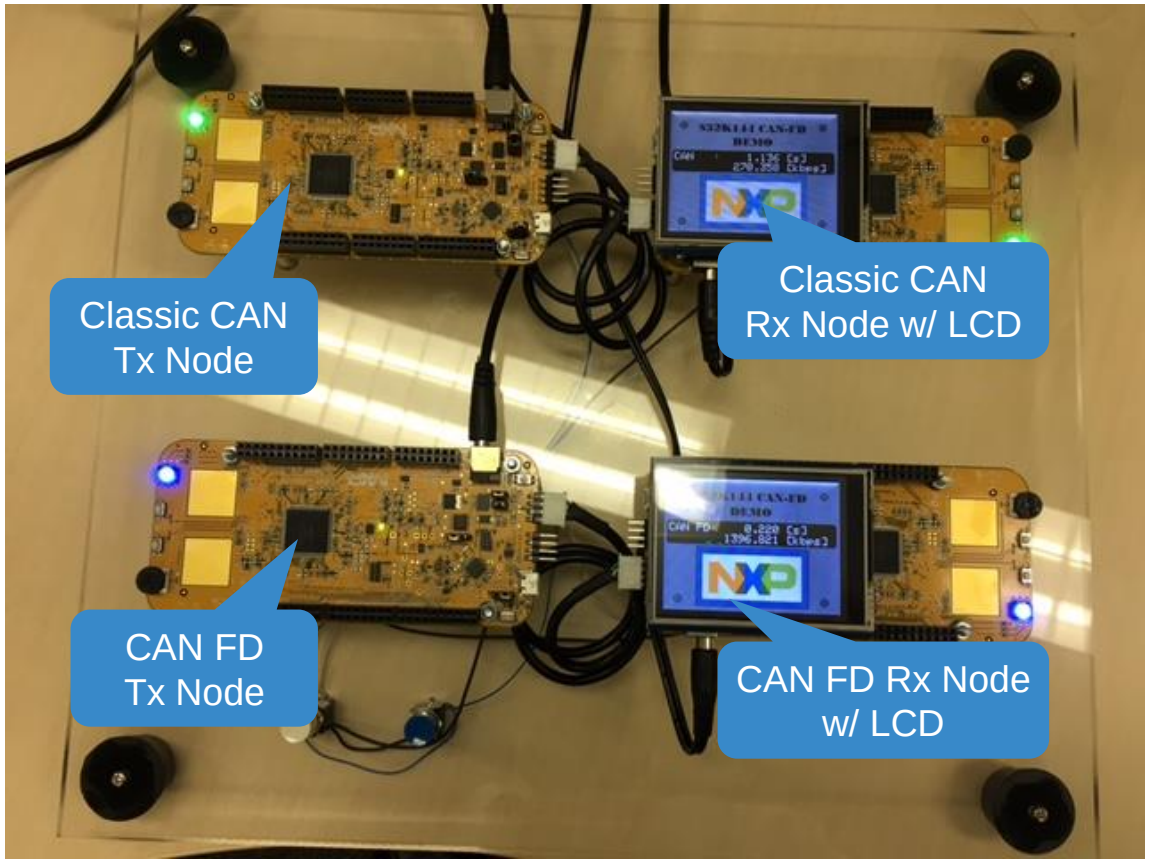




S32K Demo – CAN-FD vs. CAN

Overview

- Shows the performance difference between CAN message transmission using classic CAN at 500kbps with 8-byte payload vs. CAN-FD at 2Mbps with 64-byte payload
- Transmission nodes (EVBs on left-hand-side) transmit the data of NXP-logo bitmap image via a CAN interface
- Receiver nodes (EVBs on right-hand-side) receive the bitmap data and transfer to LCDs message-by-message
- **Bitmap data transmission using CAN-FD (0.2s) is much faster than classic CAN (1.1s)**



Key Messages

- All S32K1x MCUs from 128KB to 2MB include the same ISO-certified CAN FD controller so software migration is easy throughout the family
- The CAN driver software is included free of charge in the SDK (Software Development Kit)
- S32K144EVB includes a CAN-FD compliant SBC that supports data rates up to 2Mbps

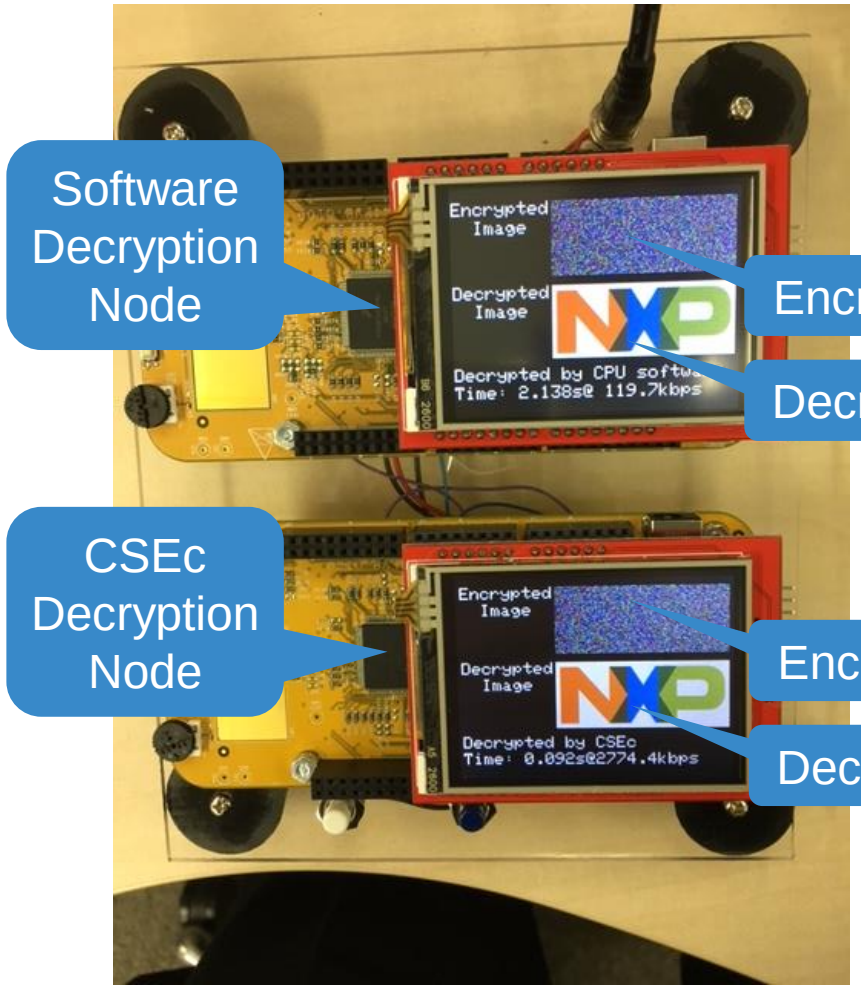
S32K Demo – CSEc Image Decryption

Overview

- Shows the performance (decryption speed) difference between decryption using software (core) vs. using the CSEc module with AES-128
- The NXP-logo bitmap image is pre-encrypted (CBC algorithm) and stored in the MCU memory.
- After the MCU reset, the pre-encrypted image is displayed on the upper side of LCD. The picture is not recognizable since it's encrypted.
- After pushing START button, both nodes start to decrypt the image data by 1) CPU software, and by 2) CSEc AES-128 hardware, and gradually draw the picture from top to bottom
- After the completion of entire bitmap image data decryption, elapsed time with processing data rate is displayed
- **Image decryption using CSEc (0.09s) is much faster than using software/core (2.14s)**

Key Messages

- All of S32K1xx family products from 128KB to 2MB flash products include the CSEc module so migration is easy throughout the family
- The CSEc driver software is included free of charge in the SDK (Software Development Kit)



S32K144 Based Motor Control

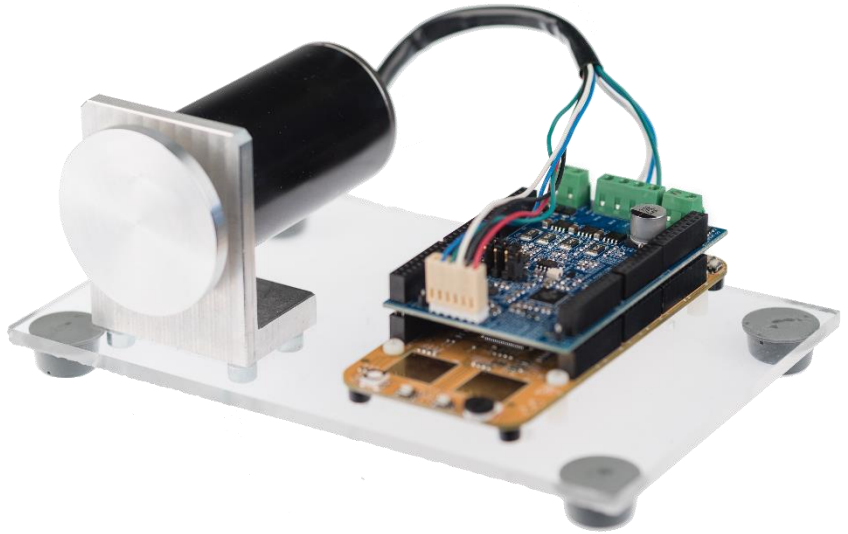
- **Product: MTRDEVKSBNK144 (BLDC based) & MTRDEVKSPNK144 (PMSM based)**
  (based on S32K144EVB and DEVKIT-MOTORGD)

- **Key Features:**
  - SW built on S32 EcoSys (S32 DS, S32 SDK) and MC EcoSys (AMMCLIB, FreeMASTER, MCAT)
  - Sensorbased and sensorless operation of both BLDC/PMSM motors
  - S32K key features: CAN-FD/PN, Security

- **Technical challenges addressed:**
  - Low cost reference implementation of the sensorless PMSM & BLDC control algorithms
  - Modular approach enabling additional functionality on top of MC
  - Supporting up to 24V MC applications

- **Benefits:**
  - → **Complete out-of-the box experience, spinning motor in 10 minutes**
  - → **Conveniently and quickly evaluate features & performance**
  - → **Reduce development & prototyping time**
  - → **Faster Time to Market**

- **Availability:** Q2 2017, 100pcs of BLDC & 200pcs of PMSM under manufacturing



www.nxp.com/AutoMCDevKits

Automotive Math and Motor Control Library Set

Features:

- Precompiled off-the-shelf software library containing the building blocks for a wide range of motor control applications, **significantly decreasing the development time**
- Enable **easy migration between platforms** with minimized effort
- **Production ready SW** (**SPICE Level 3**, **CMMI** and **ISO9001/TS16949**)
- Supporting **fixed-point 32-bit**, **fixed-point 16-bit** and single precision **floating point** arithmetic
- Provided with **Matlab/Simulink® models** for the control loop modeling
- Evaluation version available on **www.nxp.com/AutoMCLib**

Supported Compilers:

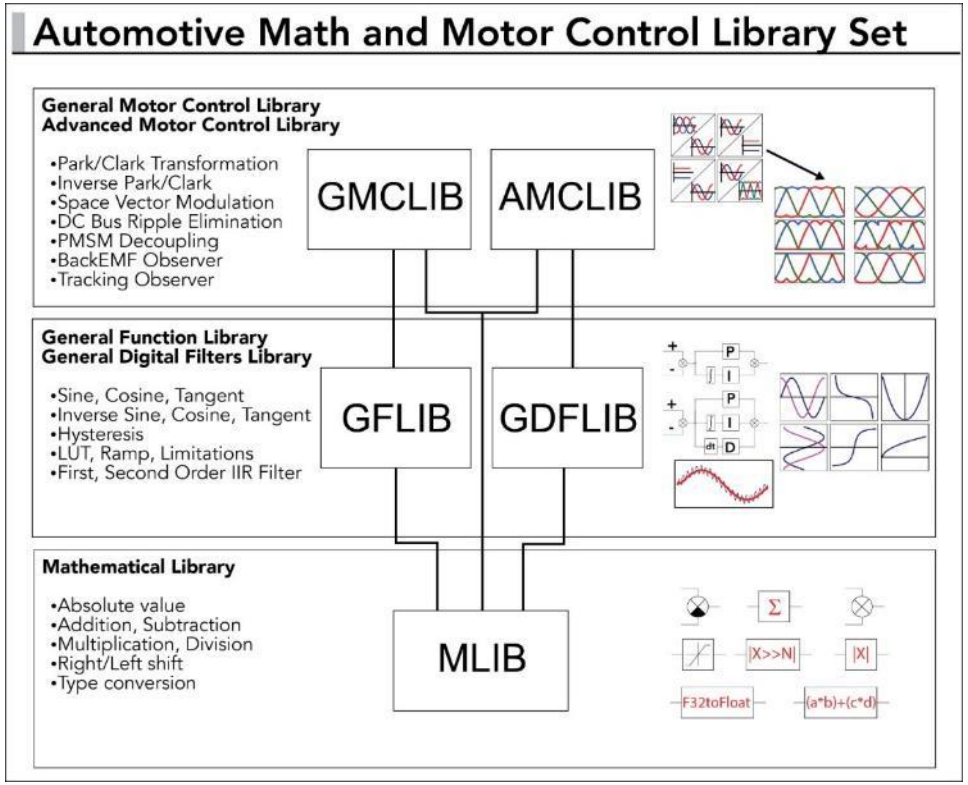
- NXP **CodeWarrior** Eclipse, NXP **S32DS**, **GreenHills** Multi, WindRiver **Diab**, **Cosmic**, **IAR**, **GCC**

Suported Devices:

- KEAx, S12ZVM, S32K14x
- MPC560xP, MPC560xB, MPC564xL, MPC567xF, MPC567xK
- MPC574xC, MPC574xG, MPC574xP, MPC574xR, MPC577xC, MPC577xK, MPC577xM

Target Applications:

- Standard & advanced motor/actuator control
- Sensor based and sensor-less applications
- General mathematical applications



TOUCH SENSE SOLUTION

GPIS Touch Sense Solution

✓ Application focused reference design

- 7-pad keypad (S32K144 / S12ZVL)
- Steering wheel “Hands OFF detection” (S32K144)
- Offered as free of charge EMC-capable reference design

✓ Complete HW + SW solution

- S32K144 EVB/S12ZVL EVB
- 7-pad keypad daughter card
- S32 Design Studio
- FreeMASTER

✓ Future-proof MCU performance

- Functional safety – ASIL B (S32K144 / S12ZVL)
- Security HW support (S32K144)
- Flexibility to combine with multiple solutions (Motor control, Ethernet, etc)

Availability

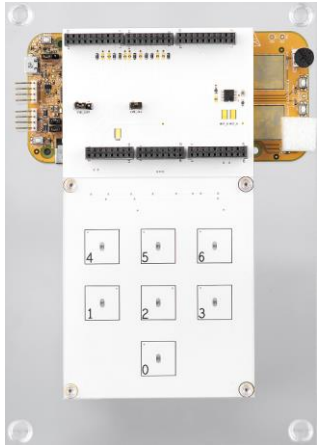
- Reference design package includes:
  - ✓ Installation package with S32DS project and TS application for 7-pad keypad application
  - ✓ Pin selector guide
  - ✓ User guide
  - ✓ GPIS TS Evaluation Kit
    - S32K144 EVB/S12ZVL EVB with 7-pad keypad daughter card
    - USB cable, power supply
    - Quick start guide

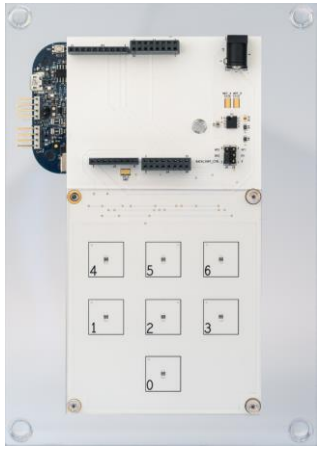
Contact gpis.software@nxp.com for whole reference design package

Validation test

7-pad keypad (S32K144 / S12ZVL)

- Fluorescent lamp test (done)
- Phone in call test (done)
- Base EMI tests (planned, IEC 61000-4-2, ISO11452-1, etc.)
- Hand glove test (planned)
- Water drop test (planned)
- 15kV ESD (planned)





Steering wheel “Hands OFF detection” (S32K144)

- Hand glove test (done)
- Fluorescent lamp test (done)
- Phone in call test (done)
- Base EMI tests (planned, IEC 61000-4-2, ISO11452-1, etc.)
- 15kV ESD (planned)

ISELED LED LIGHTING KIT

Challenges for Ambient Lighting

- Growing demand for dynamic lighting effects in the car
- Existing solutions limited in terms of number of LEDs and lighting effects. High implementation effort & cost
- Automotive requirements for robust and low emitting bus system

ISELED®

Open Alliance to provide complete systems solution for smart LED, initially targeting automotive interior lighting

- System Provider
- System Controller
- LED Manufacturer
- System Integrator

DISPLAY LAB
PFORZHEIM UNIVERSITY

- Theoretical Framework

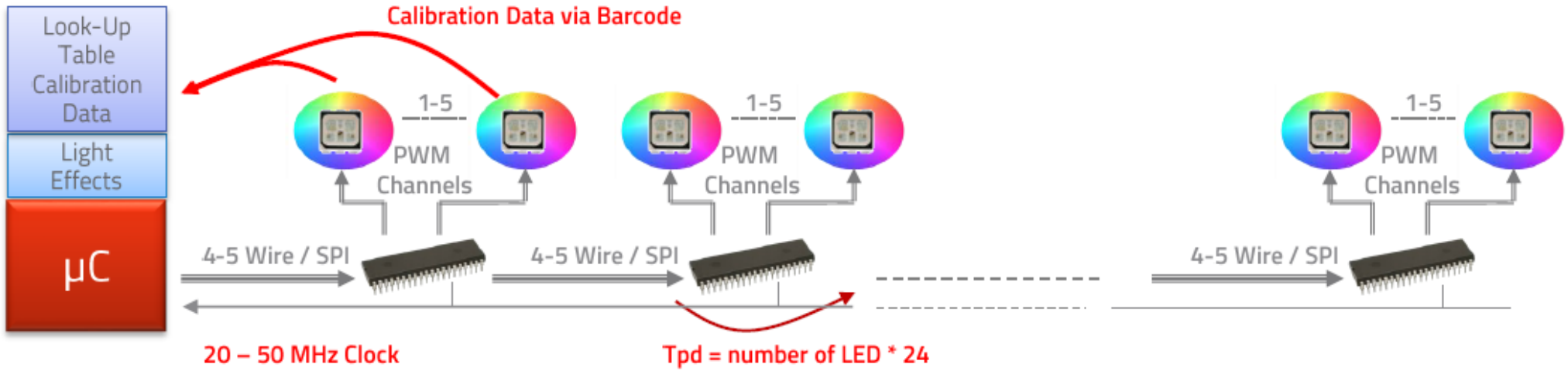
inova Semiconductors

- Smart LED Driver Chip
- ISELED Concept

LUCIE LABS

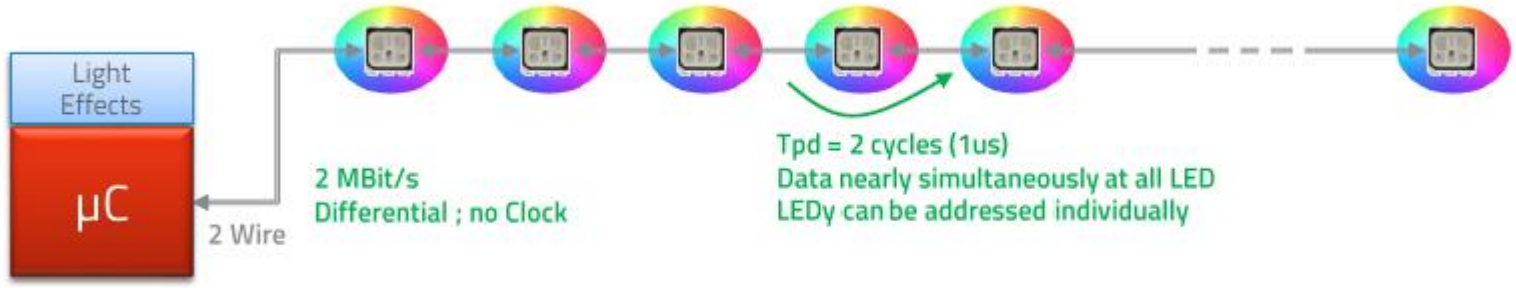
- Application and Lighting SW

Existing LED drive method



- Large number of ICs and wiring requirements – high cost for automotive OEM
- Calibration of each driver and LED necessary to stabilize colour and brightness over temperature and lifetime
  - Binning classes and barcoding
  - Extensive and complex s/w management
- 1-way communication to LED and sub-controllers with latencies
  - High speed single-ended communication impacting robustness
  - No diagnostics

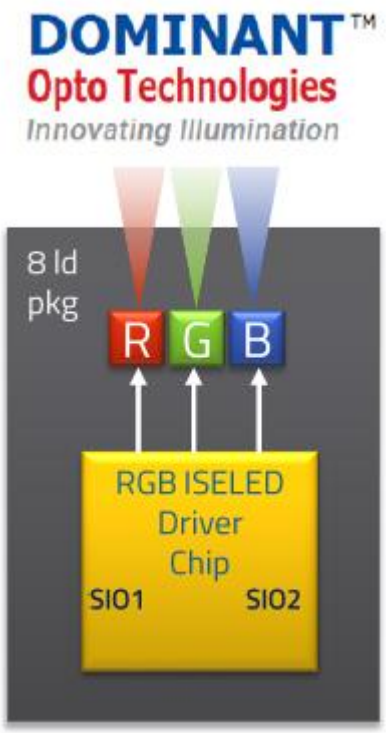
ISELED/Smart LED drive method



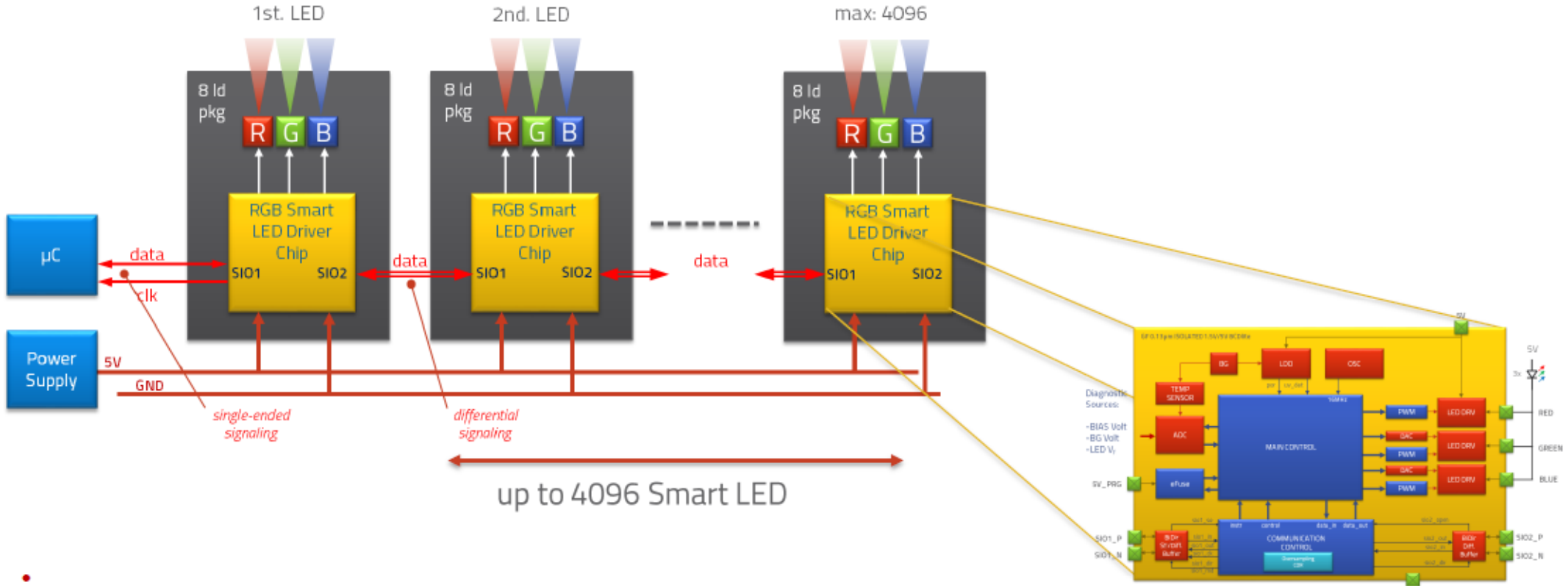
- LED module with RGB LEDs and ISELED driver chip
  - One small 3x4 mm package
  - Significant system cost reduction
- Calibration of LEDs occurs during manufacture (DWL & D65)
  - no binning classes, no bar coding – calibration data stored in Smart LED driver chip
  - system assembly using LED module from the tape with guaranteed parameters
- Bi-directional differential communication between MCU and ISELED module with lowest latencies
  - EMI robust design based on 2 Mbit/s communication - no dedicated clock
  - LED temperature and damage can be diagnosed individually by µC
  - efficient use of bandwidth due to individual addressing of each Smart LED
  - Simple RGB based colour control for up to 4096 LEDs

ISELED Concept

- Combined package of LED and RGB ISELED driver chip
- Wavelength calibration done in fab and stored in driver chip memory
- Colour control for each LED with standard RGB value
- ISELED driver chip including:
  - Temp sensor
  - Automatic calibration & temperature compensation
  - Full-duplex, 2Mbps differential control bus
    - Up to 4096 LEDs
    - Fast update rate of 52.5uS per LED (5.25ms)
    - Read access to all LEDs
  - Bus initialisation on start-up, auto detection of new or replaced LEDs

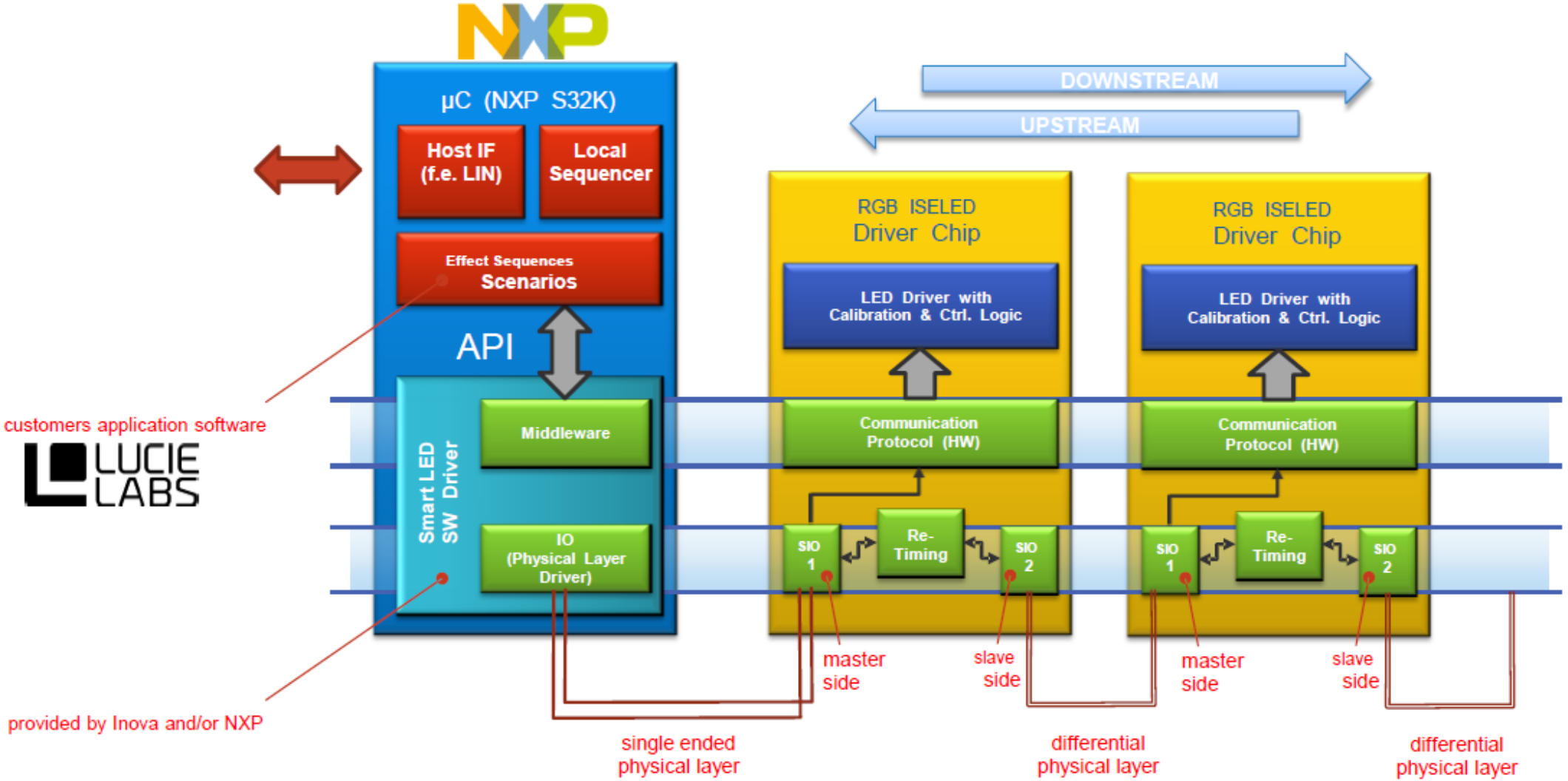


ISELED System Concept



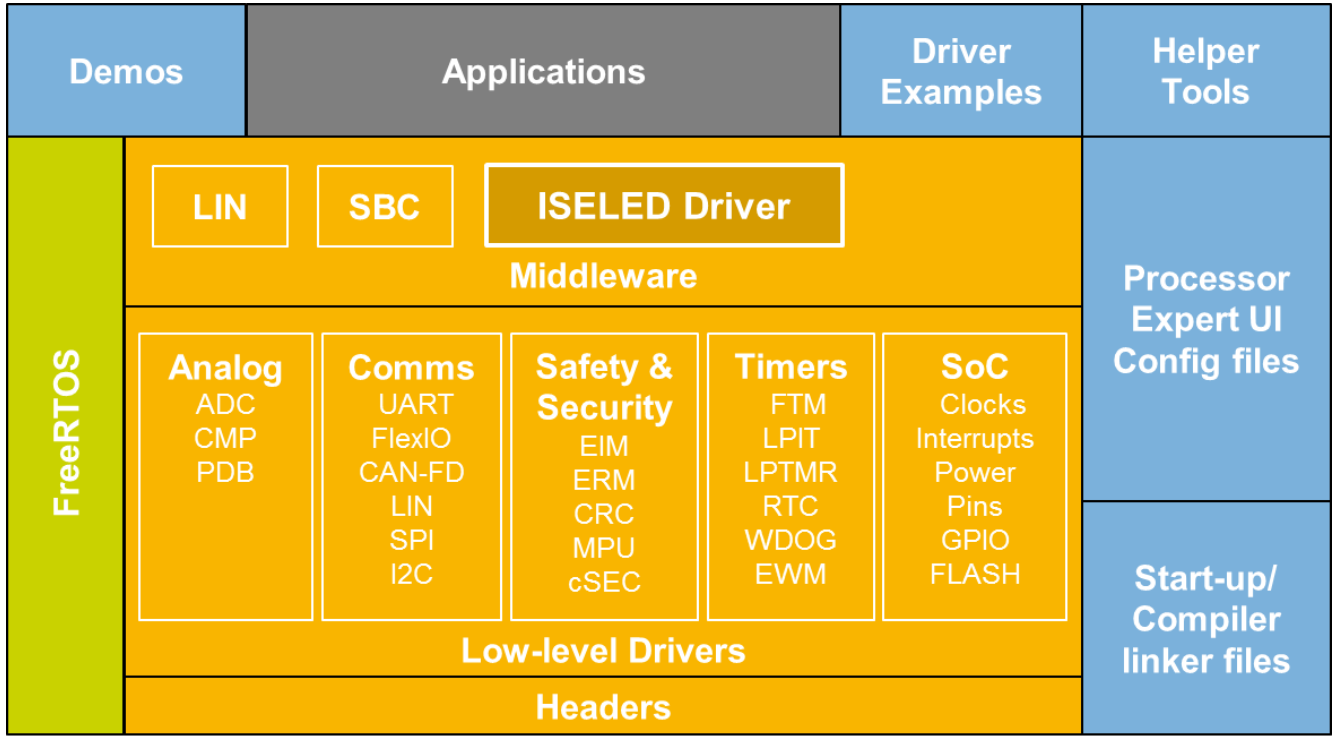
- Communication MCU to first chip is single ended (5V signalling)
- Communication between chips is differential
- Decision making during initialisation

Application S/w – Driver & GUI



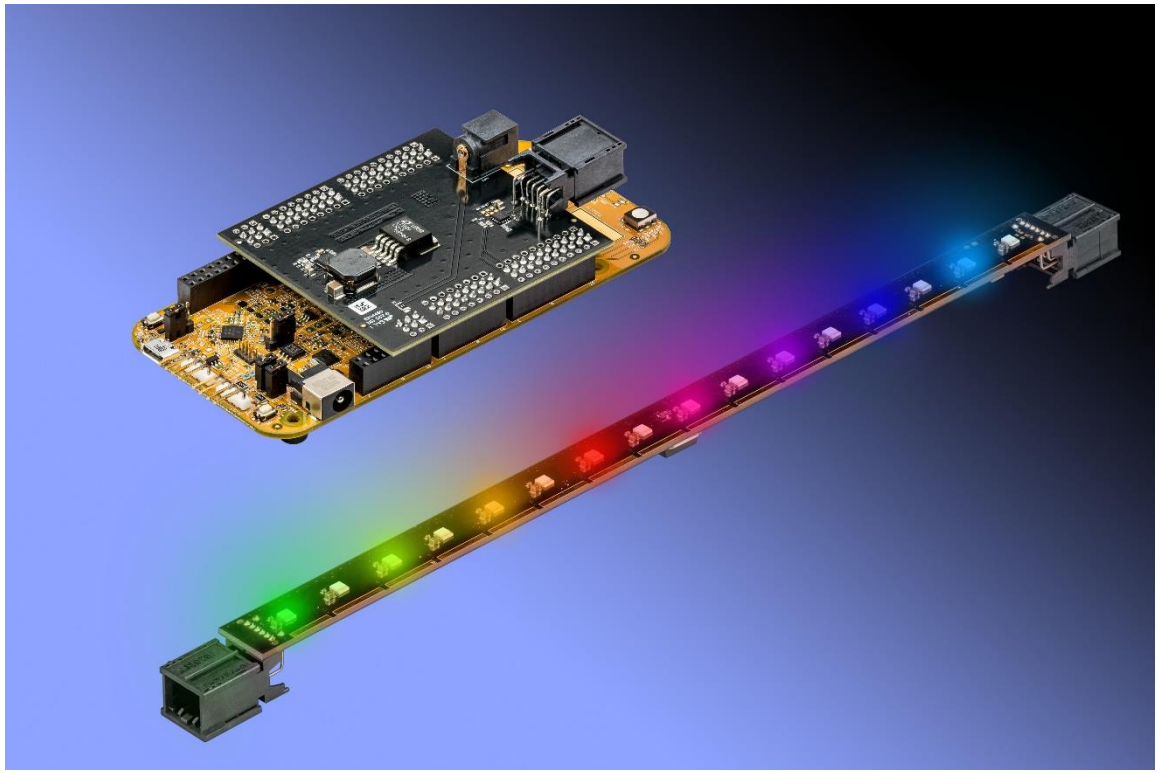
ISELED Kit – NXP Driver

- Optional middleware for S32K SDK
- Free 90-day evaluation license



ISELED Evaluation Kit – Hardware

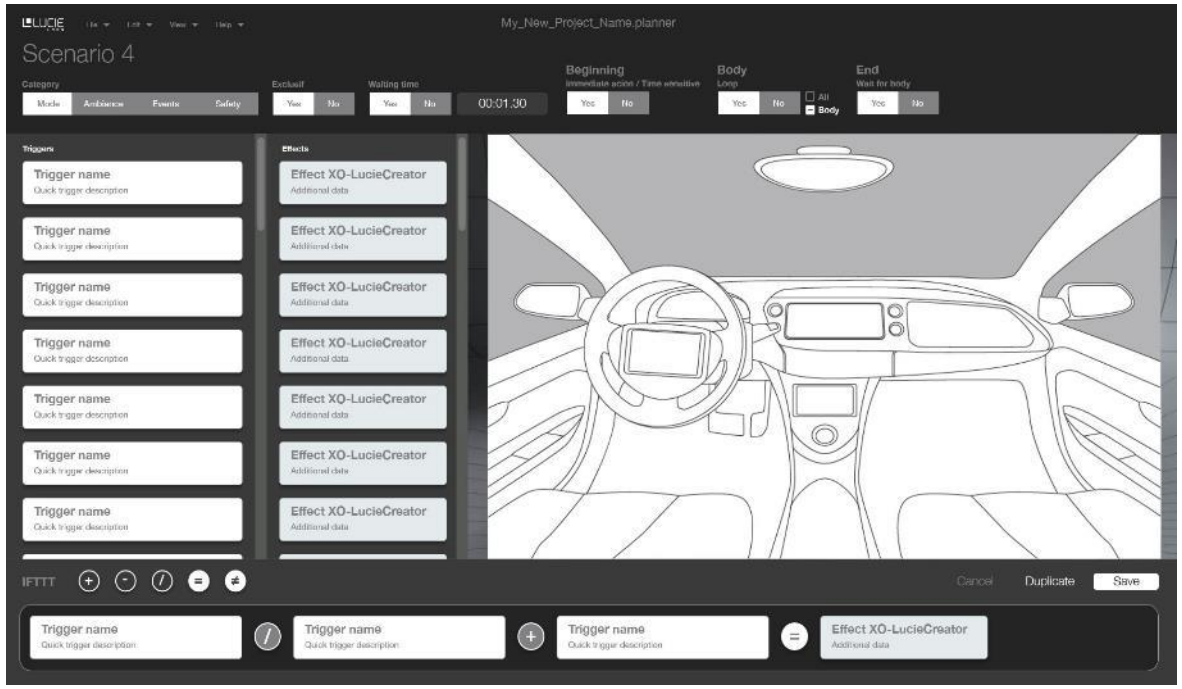
- **ISELED_ADK**
  - S32K144EVB-Q100 (NXP)
  - ISELED Shield (Inova Semiconductor)
  - LED ‘Bar’ -16 LEDs (Dominant Opto)
  - €499 Resale
  - Available from Element14/Farnell from April 2018

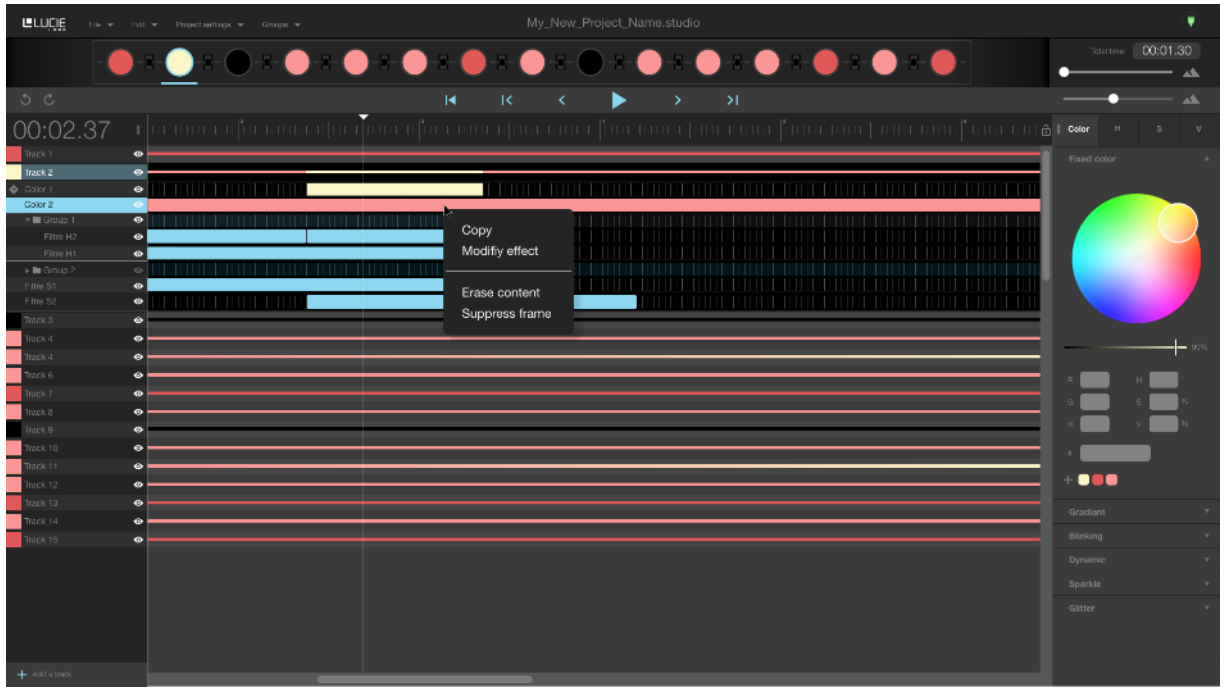


ISELED Kit – Software (Lucie Labs Effects S/w)

http://www.lucielabs.com/

- Free 90-day evaluation license





ISELED Kit – Software (Lucie Labs Effects S/w)

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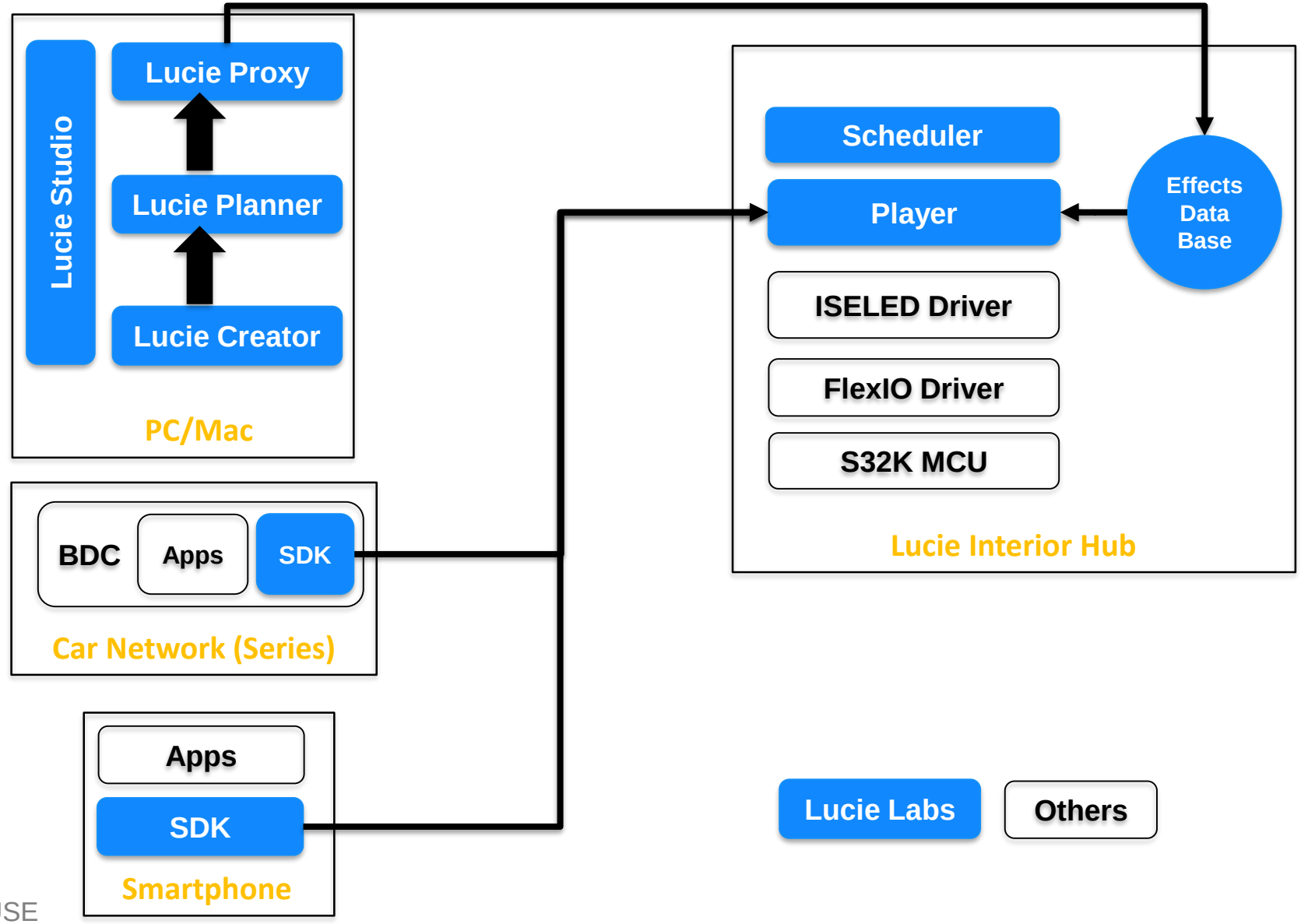


ISELED – Benefits

	LIN	ISELED
Lighting streaming	Change of color and brightness (latency = no real time and no streaming)	Real time streaming Up to 25 frames per second, up to 4096 devices
Bus speed	19,6 Kbits/s	2 Mbits/s
Number of supported devices	Max = 15 devices	Max = 4096 devices
Network	Multiple sub network bus needed = cabling complexity	1 bus for the whole vehicle
Command	Unitary + broadcast	
Protocol	Master (gateway) + Slaves	
Calibration (color + brightness)	Assembly line calibration	Chip comes calibrated
Package	ASIC + RGB led	System in package with COB
Cost	$ $ $	$

ISELED – Summary

Feature	Existing LED Drive	ISELED LED Drive
Control and Communication	For changing a paramater in a single LED, all LEDs have to be addressed and updated (shift register approach)	Each Smart LED can be addressed individually. Smart LEDs can be addressed via broadcast or group addresses if required
Calibration of Color and Brightness	Parameter transfer via barcoding Binning classes (grading)	Calibration of Smart LED at the end of LED production, data stored in Smart LED.
Temperature Compensation	SW controlled by Microcontroller	Automatic, self-controlled in Smart LED
Handling	Calibration data for LED need to be stored in Lookup tables and handled by SW in main controller	Automatic calibration by controller in Smart LED
Diagnostics	Very limited via OC error signaling. No identificatin of affected LED.	Temperature, status and functionality can be accessed for each Smart LED.

Summary

- ISELED provides the complete ecosystem from LED through to driver and application development
- High density 4096 LEDs
- Cost efficient production logistics – no binning / calibration
- Fast, bi-directional and robust differential communication bus
- Evaluation kit includes ISELED shield, S32K144 MCU EVB & s/w driver, 16 RGB LED bar and Lucie Labs LED effects tool.
- https://inova-semiconductors.de/products/ISELED.html

AUTOMOTIVE NFC STACK

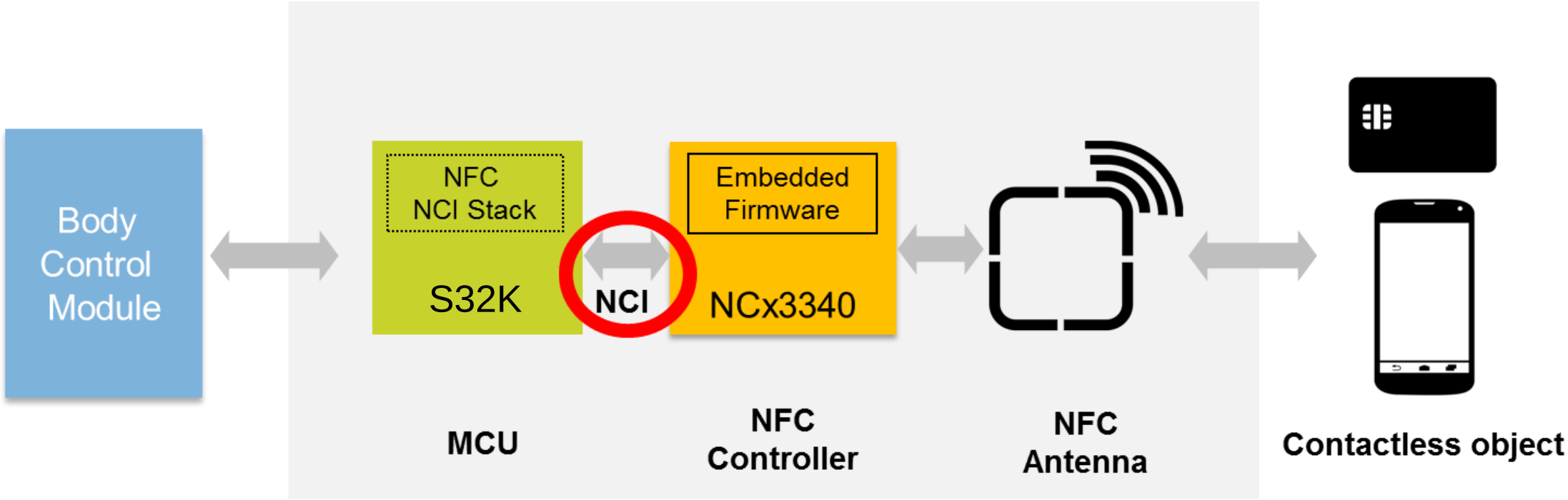
WHERE DOES NFC FIT IN THE WORLD OF WIRELESS?

	WiFi	ZigBee (802.15.4)	Bluetooth	NFC
Network topology	Star	Mesh	Point-to-point	Point-to-point
Range	30-100 m	10-20 m	10 m	< 0.1 m
Discovery	Broadcast	Broadcast	Broadcast	Response to field
Power	High	Low	Classic: Mid LE/Smart: Low	Tag: Zero Reader: Very low
Privacy	Low	Mid	Mid	High

- A major advantage of NFC comes with the **ease of use**. NFC connects automatically in a fraction of a second, so fast it seems **instantaneous**
- NFC consumes **much less power** than Wi-Fi or BT.
- NFC solutions combining **secure elements** are very attractive for **smartphone/smart card** based **car access** and drive **authorization**

SYSTEM ARCHITECTURE WITH NFC CONTROLLER

FULL NFC FUNCTIONALITY WITHOUT ANY COMPROMISES FOR INTERIOR APPLICATIONS



Automotove NFC STACK FEATURES

- **Full NFC**
  - **Reader/Writer mode:** T1 – T5 for NDEF & legacy format
  - **Card Emulation:** T4 (A and B), FeliCa
  - **P2P:** LLCP, SNEP
  - Tested according to the **NFC Forum Device Test Application**

- **Automotive Quality Package:**
  - AUTOSAR, MISRA-C 2012, SPICE
  - No open source or 3rd party code
  - NXP Automotive Coding Rules
  - Code Coverage, Memory usage tests etc.

- **Purchase Model**
  - $0.30 adder per device, orderable as a special part number
  - Delivered as SDK m‘ware, not pre-programmed in MCU – customer flashes library onto MCU
  - Supports S32K144 MCU (512KB). Support for additional S32K families due Q218

Automotive NFC Stack - PARTS & LICENSING MODEL

Product	Platform	Partnumber		
MWCT	Autosar	SWCT101XS-ANFC401E	MWCT101xS Autosar 4.0 NFC Stack Evaluation License	**Automotive Qi Wireless Charging Transmitter**
MWCT	Autosar	SWCT101XS-ANFC401S	MWCT101xS Autosar 4.0 NFC Stack DISM Pack	
MWCT1014	Autosar	MWCT1014SFVLHN	MWCT1014 device with production rights for NFC Stack	
S32K1	Autosar	SW32K14-ANFC401E	S32K14 Autosar 4.0 NFC Stack Evaluation License	**32-bit Automotive General Purpose Microcontrollers**
S32K1	SDK	SW32K1X-NFC01E	S32K1x NFC Stack Middleware (Binary) Evaluation License	
S32K1	Autosar	SW32K14-ANFC401S	S32K14 Autosar 4.0 NFC Stack DISM Pack	
S32K1	SDK	SW32K1X-NFC01S	S32K1x NFC Stack Middleware (Binary) DISM Pack	
S32K144	Both Autosar and SDK	2 new PN TBC - one in 100LQFP and one in 64LQFP	S32K144 device with production rights for NFC Stack	

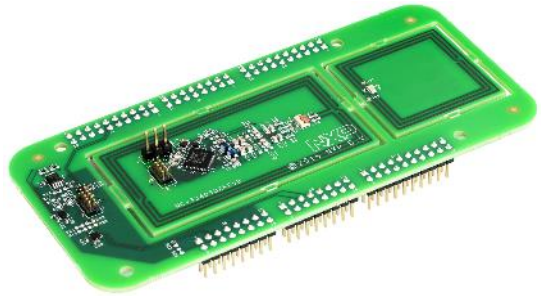
License	Price	Duration
Evaluation (binary)	Free	90 Days
Production (binary)	$0.30/device	Perpetual
Development Support (DISM)	$6K/p.a.	12 Months

AVAILABILITY

- **Go to www.nxp.com/S32K**

1. Order **S32K144EVB-Q100**

2. Order **NCX3340S32KEVB**
   - Available from nxp.com sooon. For urgent opportunities contact marc.manninger@nxp.com



3. Download **ANFC NCI Stack**
   - See ‘Software & Tools‘ Tab

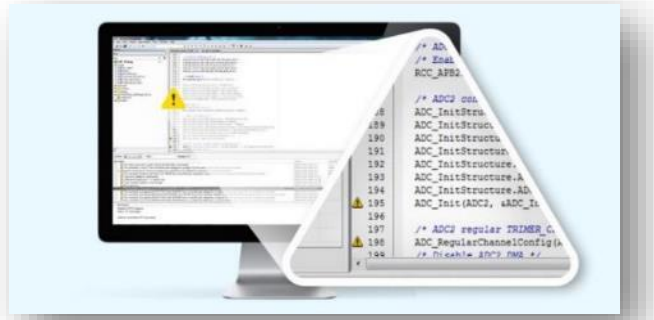
3RD PARTY TOOLS

S32K – IAR www.IAR.com/NXP

Functional Safety Version of IAR Embedded Workbench for ARM V7.40.6

- Certified for each ASIL A-D of ISO 26262 without further tool qualification
- The Same Version has been tested and validated for MCAL compliance
- Guaranteed support through the product life cycle: Prioritized support, Validated service packs, Regular reports of known problems

- **IAR Visual State**
  - Set of tools for designing, testing and implementing embedded applications based on state machines.
  - Based on Unified Modeling Language (UML) state machine subset
  - Generates very compact C/C++ code, 100% consistent with your design
  - Advanced verification and validation tools



- **Static Analysis: C-STAT**
  - Checks compliance with; MISRA C:2012, MISRA C++:2008, MISRA C:2004, CWE and CERT C/C++
  - Extensive and detailed documentation. Fully integrated with IAR Embedded Workbench

- **Dynamic Analysis: C-RUN**
  - C-RUN can perform following errors check; Heap and memory leaks checking, Bounds checking, Integer conversion failure, Shift overflow, Division by zero
  - Minimized test code overhead and speed penalty. Full Integration with IAR Embedded Workbench

S32K – Keil Tools www.keil.com/NXP

- **ARM Compiler 6 (LLVM based) now TUV certified**

- **Keil MDK-Lite™**
  - Free eval version that limits code size to 32KB. Nearly all examples will compile within 32KB limit.

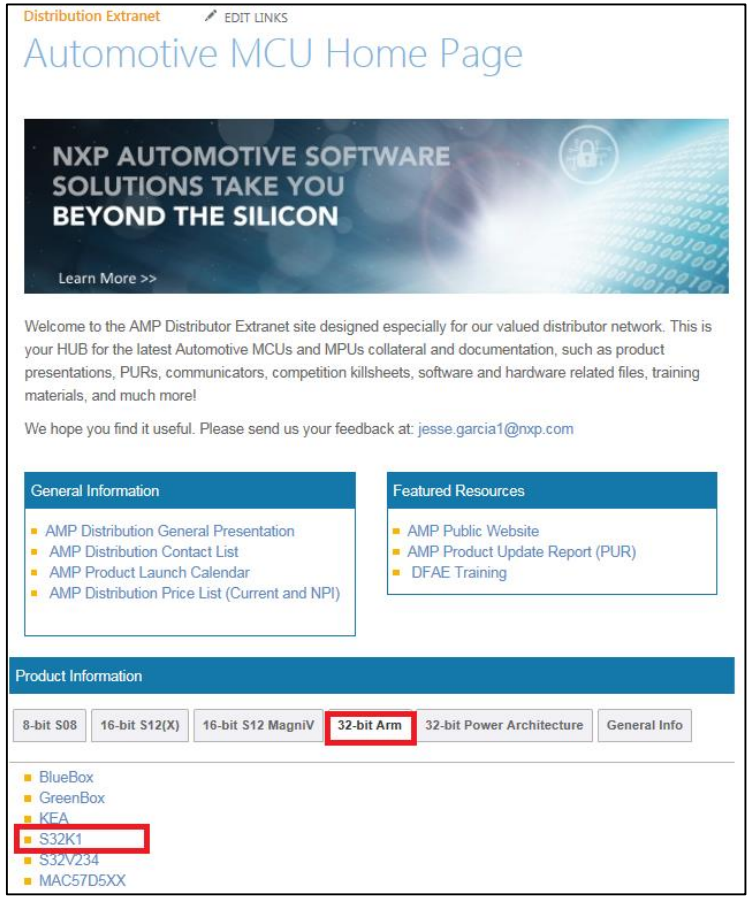
- **S32K144EVB: hands-on lab using µVision** http://www.keil.com/appnotes/docs/apnt_299.asp
  - Blinky example uses potentiometer to control the tri-color LED via the Keil RTX5 RTOS included with MDK-ARM installation. The DSP Sine example demonstrates waveform analysis using the Logic Analyzer

- **S32K148EVB: ETM Instruction Trace using ARM Keil MDK 5 Toolkit**
  - www.keil.com/appnotes/docs/apnt_305.asp
  - Introduces ETM Instruction Trace on K148 MCU using MDK toolkit with µVision® IDE & ULINK™pro debug adapter
    - **Code Coverage:** were all the assembly instructions executed ? This data can be saved as a .gcov report.
    - **Performance Analysis:** where the processor spent its time displayed in graphical and numerical formats.
    - **Execution Profiling:** How long instructions, ranges of instructions, functions or C source code took in both time and CPU cycles as well as number of times these were executed. - Code Coverage, Performance Analysis and Execution Profiling

- **NXP Cookbook Example Ports for MDK** www.keil.com/appnotes/docs/apnt_304.asp

S32K On NXP Distributor Extranet

- https://nxp1.sharepoint.com/teams/ext96/SitePages/Home%20FSL-NXP.aspx
  - Distributor Extranet: contains Distributor specific / non public product information – ppts (Marketing & Technical), NDA data sheets, competitive information, launch calendars etc
  - See '32-bit Arm' tab
    - 'S32K1'
      - S32K Overview ppt
      - S32K Hands-on training .ppt
      - Etc.



SECURE CONNECTIONS
FOR A SMARTER WORLD

S32K1xx Part Number Nomenclature

Ordering Part number (always 16 characters)

F/P	1	*Product status*
S32	2-4	*Product Type/Brand*
K	5	*Product Line*
1	6	*Series/Family (incl. generation)*
0	7	*Core platform / Performance indicator*
0	8	*Memory Size*
X	9	*Option #1: letter*
Y	10	*Option #2: letter*
T0	11-12	*Fab and Mask rev letter*
M	13	*Temperature Suffix*
LH	14-15	*Package Suffix*
R	16	*Tape and Reel Indicator*

1st Character
Product Status for ordering and marking

P for prototype and
F for qualified ordering P/N

2nd, 3rd & 4th Character
Product Type / Brand

S32 for Automotive 32Bit MCU

5th Character
Product Line

K = ARM Cortex MCUs

6th Character
Series / Family

1 = 1st product family

7th Character
Core platform / Performance indicator

1 = M0+
4 = M4F

8th Character
Product/Memory

	2	4	6	8
S32K11x	-	-	128k	256k
S32K14x	256k	512k	1M	2M

9th & 10th Characters
Ordering options

X: Speed
B = 48 MHz without DMA (S32K11x only)
L = 48 MHz with DMA (S32K11x only)
H = 80 MHz
W= 80MHz, Grade 0 version only
U[1] = 112 MHz (not valid with **M** temperature)

Y: Optional feature
R=Base feature set
V=Base feature set with NFC Stack license
F=CAN FD, FlexIO
A[1]=CAN FD, FlexIO, Security
X[1]=CAN FD, FlexIO, Security with NFC Stack License
E=Ethernet, Serial Audio Interface (S32K148 only)
J[1]=Ethernet, Serial Audio Interface, CAN FD, FlexIO, Security (S32K148 only)
I=ISELED, FlexIO
L[1]= ISELED, CAN FD, FlexIO, Security
G[1]=ISELE, Ethernet, Serial Audio Interface, CAN FD, FlexIO, Security (S32K148 only)

11th & 12th Character
Fab and Mask rev

Tx = Globalfoundries

x**0** = 1st fab revision

13th Character
Temperature

V = -40°C to 105°C
M = -40°C to 125°C
W = -40°C to 150°C

14th & 15th Character
Package Suffix

pins	LQFP	QFN	BGA
32	-	FM	-
48	LF	-	-
64	LH	-	-
100	LL	-	MH
144	LQ	-	-
176	LU	-	-

16th Character
Tape & Reel

T = Trays/Tubes
R = Tape & Reel

Note:
1. Write or erase access to security (CSEc) or EEPROM is allowed only when device operating in RUN mode (up to 80MHz). No write or erase access to security and EEPROM allowed when device running at HSRUN mode (112MHz).
2. Not all part number combinations are available. See *S32K1xx_Orderable_Part_Number_ List.xlsx* with the Datasheet (Rev7. and beyond) for a list of standard orderable part numbers.

3. Part numbers no longer offered as standard include:
Ordering Option X (M:64MHz); Ordering Option Y (N: limited RAM. 16KB for K142, 48KB for K144, 96KB for K146, 192KB for K148 S: Security B:CAN FD, Flex IO, limited RAM (K14x only). C: CAN FD, FlexIO, Security, limited RAM (K14x only)); Temperature (C: -40C to 85C)