



Automotive MCU in a Fast-Changing Environment

快速变化市场中的汽车微控制器

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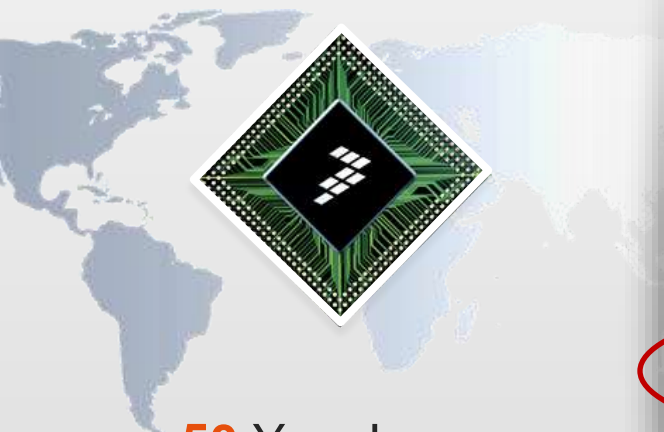
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A *Global Leader* in Automotive MCU

汽车微控制器供应商的领导者



>50 Year Legacy

>5,500 Engineers

>6,000 Patent Families

Five Core Product Groups

Microcontrollers

Digital Networking

Automotive MCU

Analog & Sensors

RF

Four Primary Markets

Automotive



Networking



Industrial



Consumer



Freescale shipped over **370M** automotive MCUs (>4 per car) in 2012

Freescale is in **approximately 50 million** new vehicles / year

飞思卡尔为市场提供超过3.7亿片汽车微控制器（平均每辆车超过4片），
每年超过五千万辆新车使用了飞思卡尔的汽车微控制器



Agenda

- Automotive Market Trends
车身电子市场趋势
- Automotive MCU Trends and Challenges
汽车微控制器的趋势和挑战
- FSL Automotive MCU Accelerate Your Business
飞思卡尔汽车MCU产品和方案助力您的事业
- Conclusion
总结



Automotive market trends 车身电子市场趋势

Body Market Trends and Challenges 车身电子市场趋势



- More complex Gateways with higher performance and multi-core usage (Expanding memory)
- Ethernet and wireless communication
- Personalization options driving LIN nodes



- Functional Safety - ISO26262
Several body-apps need ASIL A/B (some C/D)
- Reduced ASIL-assessment effort
- Security/Cryptography for Gateway and BCM modules



- Power management in stop and run modes
- Autosar SW management of partial/pretended networking
- EC-motors, LED-lighting



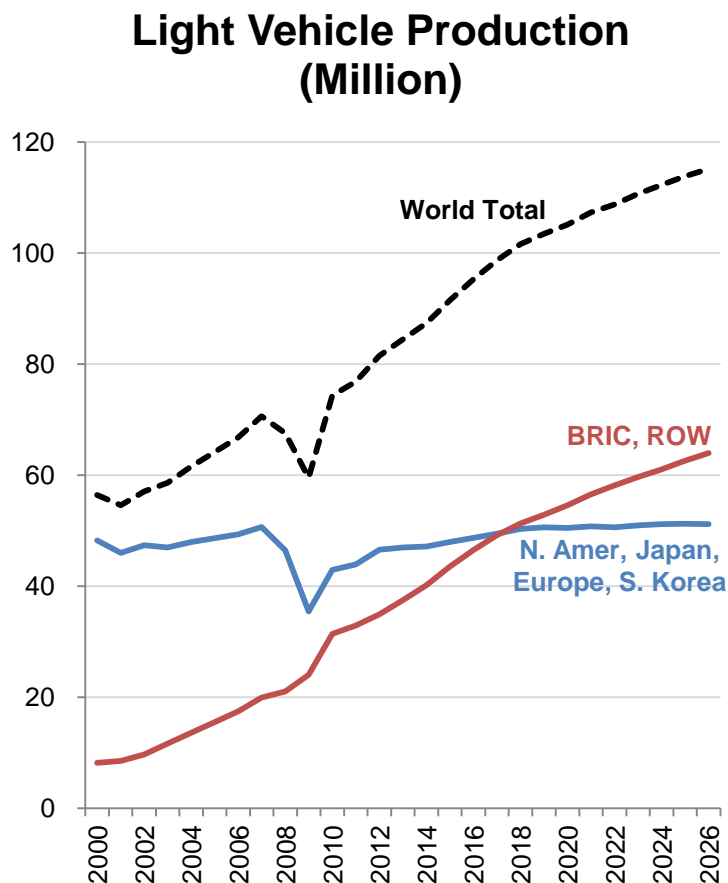
- Cost reduction via ECU integration
- Electrification of the car replacing mech. components
- Scalability of hardware and software
- Auto generated code to decrease dev costs

Software Integration:

- Autosar:
 - Multicore-support
 - OS
 - MCAL
- Safety:
 - SW-routines supporting self-test (Core/Memory)
- Security:
 - Cryptography algorithmic support
- Application-support
 - Motor Control-library
 - Reference designs

Vehicle Production's Shifting Global Footprint

全球机动车产量预测



Source: IHS Automotive (Feb'14)

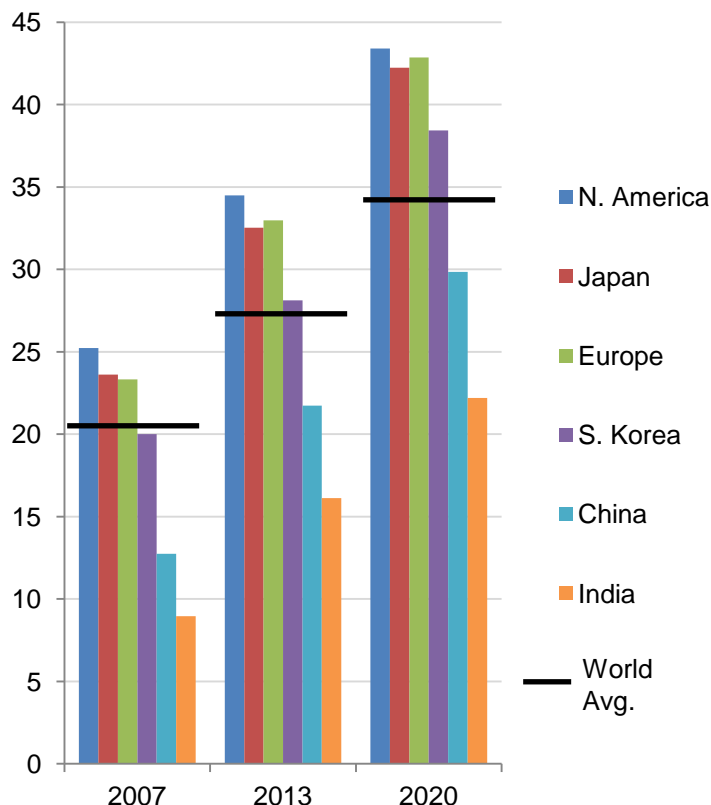
- World Light Vehicle production is forecasted to double in the 25-year period (2000-2025)
- All of the Growth is in Emerging Markets

Region	2000-2025 CAGR
N. Amer., Japan, Europe, S. Korea	0%
BRIC, ROW	8%
Worldwide	3%

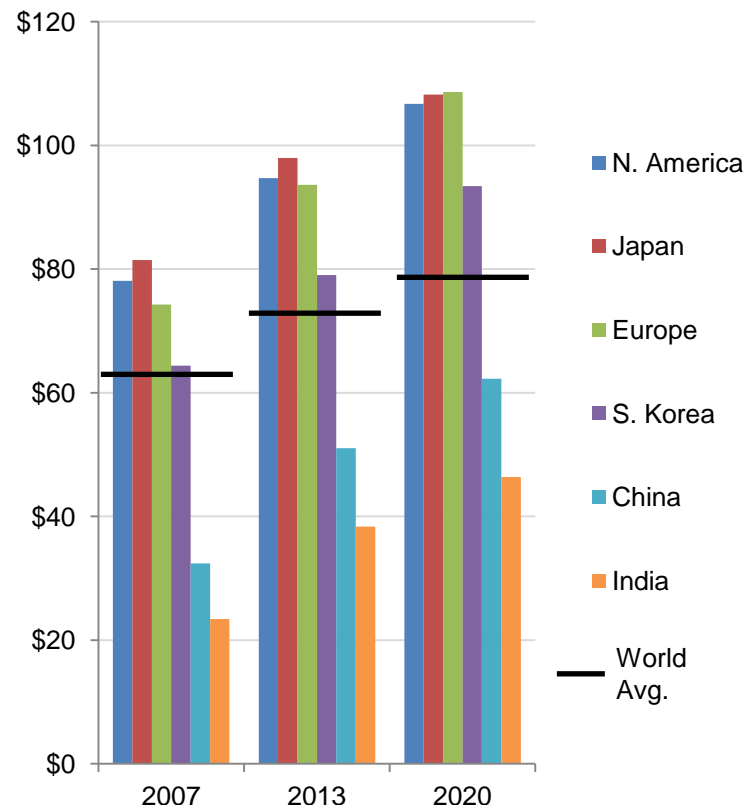
Automotive Processors Per Vehicle Trends

每一辆汽车上的汽车微控制器增长趋势

Auto Processors per Vehicle



Auto Processor Content per Vehicle (\$)



Source: Strategy Analytics (Jan '14)

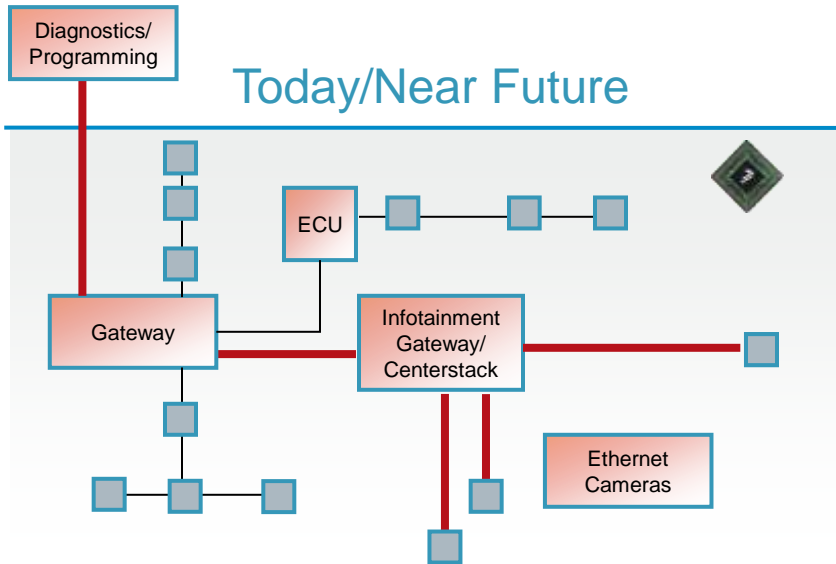


Market Trends and Challenges for Automotive MCUs

汽车微控制器的趋势和挑战

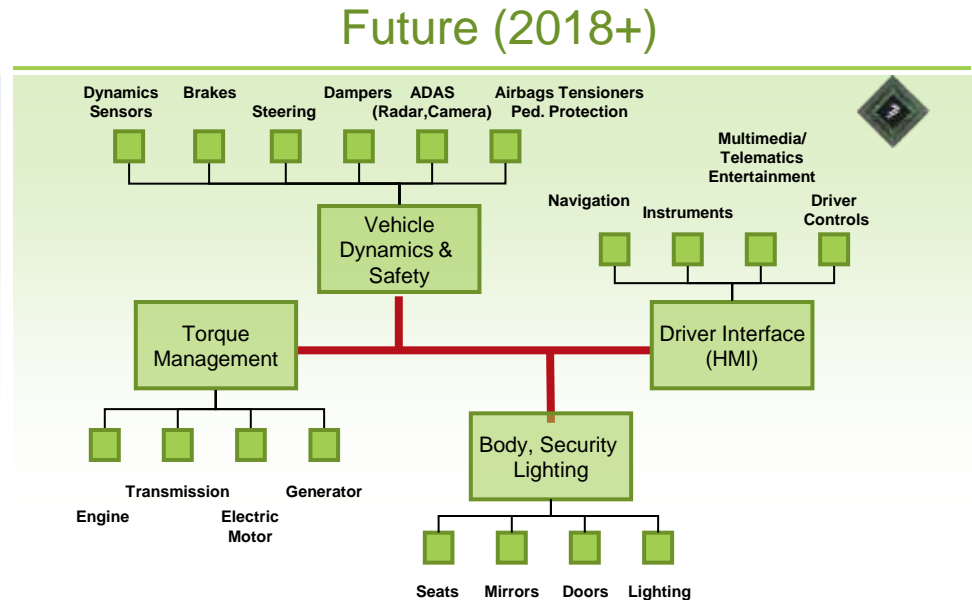
Automotive Electronics Architectural Trends

汽车电子网络结构的进化



Distributed Electronic Control Units

One ECU per mechanical function - connected by multiple CAN and LIN interfaces



Distributed Computing

Major computing nodes on a high-performance network organized by “domains” that control distributed nodes.

Auto MCU: More performance, **more** embedded memory, **more** safety for **less** cost, **less** power and **less** development effort

市场对汽车微控制器的要求：更高性能，更大内存，更多安全，更低价格，更低功耗，更低开发成本。

Challenges for Body Electronics 车身电子面临的挑战

- **Central Gateway** need high performance and high scalability.
中央网关需要高性能和高扩展性.
- **Limited R&D Cost** - different applications need share common platform to reuse software/hardware/toolchain.
控制开发成本 - 不同应用需要共享软硬件平台以使得软件/硬件/工具链能够最大程度的重复使用。
- **Smart distributed CAN/LIN nodes** require smaller size and lower cost.
智能分布式CAN/LIN节点需要更小体积更低成本



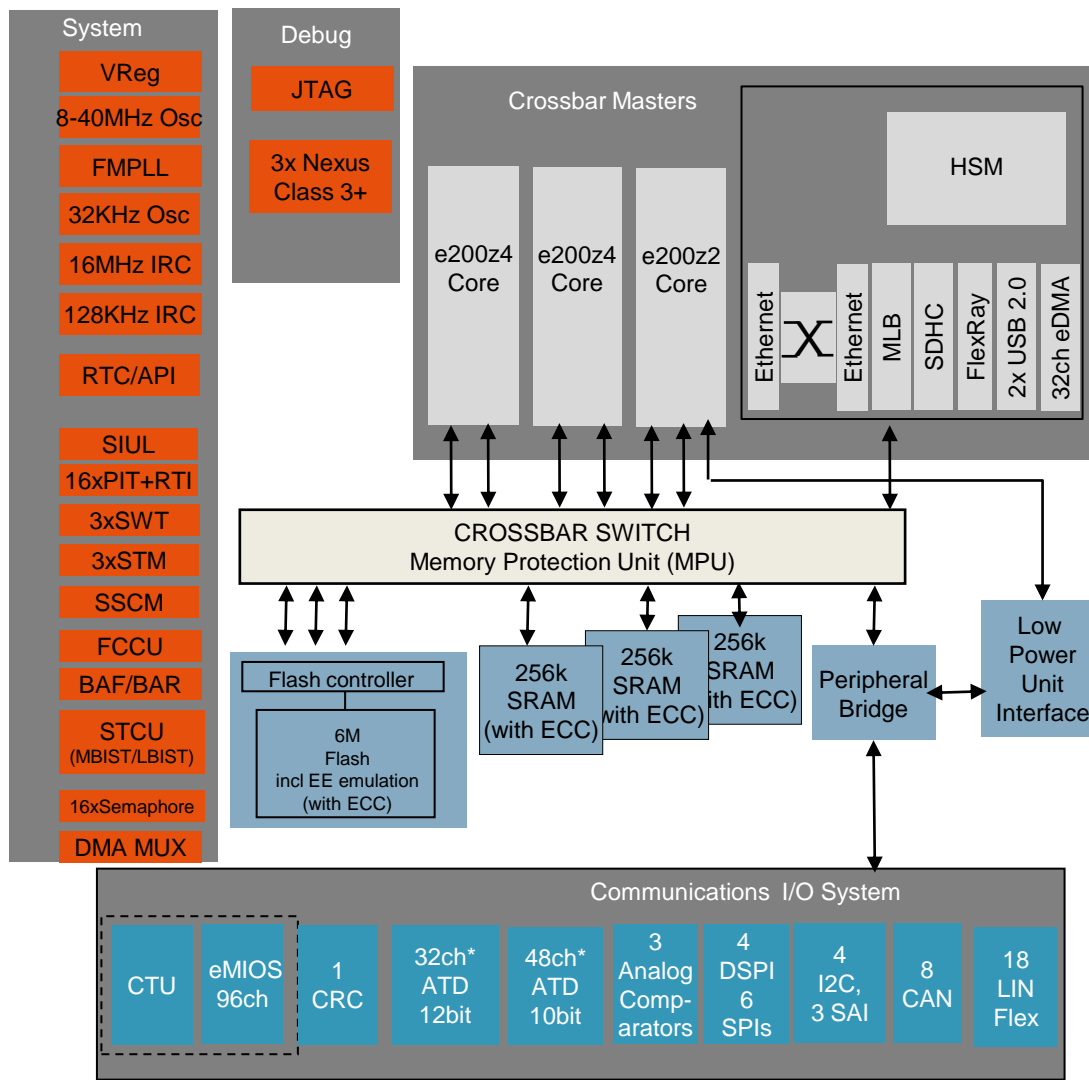
Freescal Automotive MCU Overview

飞思卡尔汽车微控制器

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MPC5748C/G - High End Gateway/BCM Solution 高端网关/BCM 解决方案



*Mixture of internal and external channels

Features available depend on package and device version

Applications:

- High end Gateway and Body Modules

Key Characteristics:

- 2x e200z4 + 1x z2 cores, FPU on z4 cores
- 160 MHz max for z4s and 80 MHz on z2
- HSM Security Module option supports both SHE and EVITA low/medium standard
- Media Local Bus supports MOST communication
- 2 x USB 2.0 (1 OTG and 1 Host module) support interfacing to 3G modem and infotainment domain
- 2x Ethernet 10/100 Mbps RMII, MII, +1588, AVB
- Ethernet switch
- CAN module optionally supports CAN FD
- SDHC provides standard SDIO interface
- Low Power Unit provides reduced CAN, LIN, SPI, ADC functionality in low power mode
- Designed to ISO26262 process for use in ASIL B
- 40 to +125C (ambient)
- 3.0V to 5.5V

Packages:

- 176 LQFP, 256 BGA, 324 BGA

	5747C	5748C	5747G	5748G
Cores	2	2	3	3
Flash	4M	6M	4M	6M
RAM	512k	768k	768k	768k
MLB	N	N	Y	Y
USB	N	N	Y	Y

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KEA products comparison table

Device	Features													
	Flash	RAM	EE PROM	Freq	MS CAN	SCI	SPI	ATD	PWT	Flex-Tim	ACMP	IIC	GPIO	Packages
KEAZN8	8K	1K	emulate	48MHz	0	1	1	12c12b	1	6c+2c 16b	2	1	Up to 22	16 TSSOP/ 24 QFN
KEAZN16	16K	2K	256B	40MHz	0	3	2	16c12b	NA	6c+2c+ 2c 16b	2	2	Up to 57	32/64 LQFP
KEAZN32	32K	4K	256B	40MHz	0	3	2	16c12b	NA	6c+2c+ 2c 16b	2	2	Up to 57	32/64 LQFP
KEAZN64	64K	4K	256B	40MHz	0	3	2	16c12b	NA	6c+2c+ 2c 16b	2	2	Up to 57	32/64 LQFP
KEAZ64	64K	8K	emulate	48MHz	1	3	2	16c12b	1	6c+2c+ 2c 16b	2	2	Up to 71	64/80 LQFP
KEAZ128	128K	16K	emulate	48MHz	1	3	2	16c12b	1	6c+2c+ 2c 16b	2	2	Up to 71	64/80 LQFP

KEA128 Block Diagram

✓ Applications:

- Automotive general purpose

✓ Operating Characteristics:

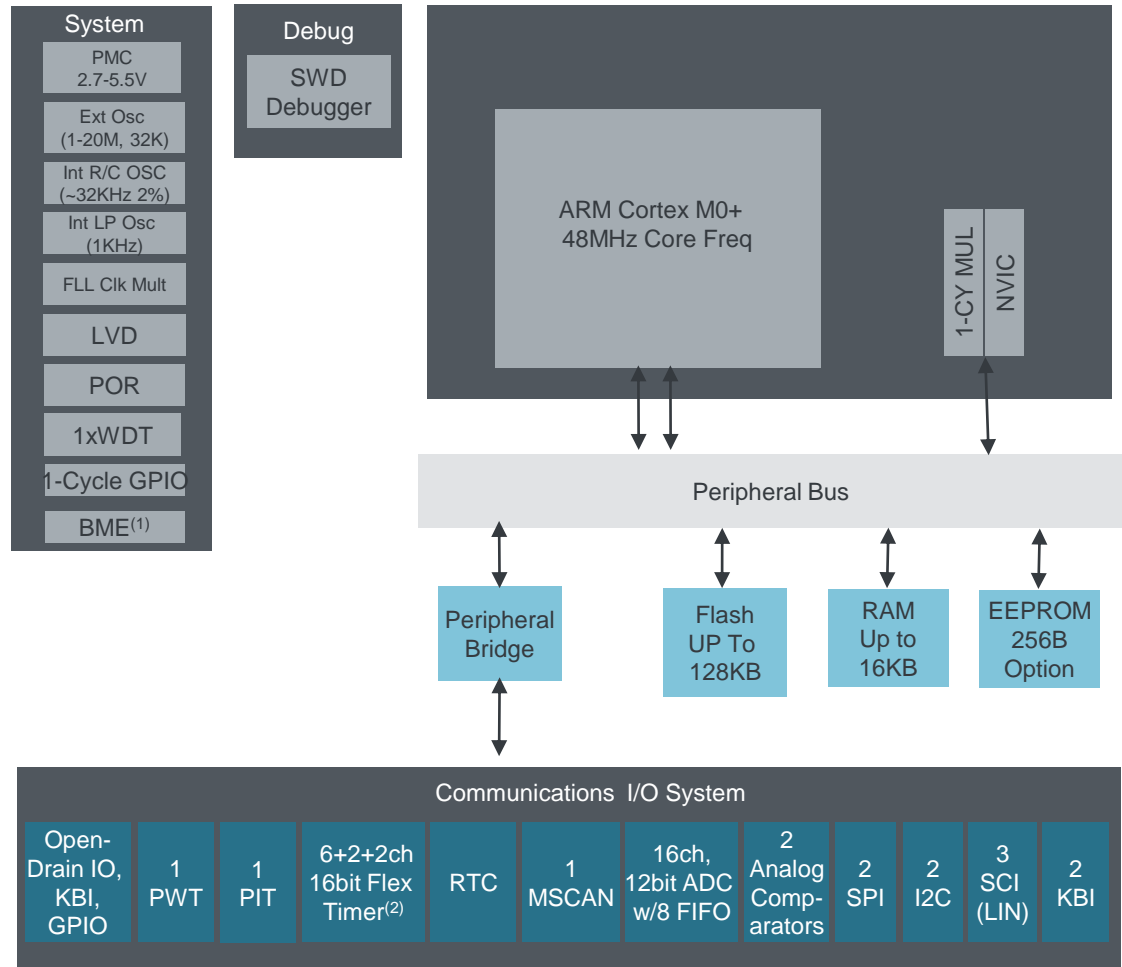
- Voltage range: 2.7 to 5.5 V
- Temperature range: -40 to 125°C

✓ Key Features:

- ARM Cortex M0+ core 48MHz
- Up to 128K embedded flash
- Up to 16K RAM
- External OSC and internal ICS for clock
- System functions: LVD, WDG, CRC, LP modes
- Communication: SPI, SCI, IIC, CAN
- Timers: FTM, PWM, PIT, PWT, RTC
- 12bit ADC and ACMP

✓ Packages:

- 16TSSOP, 24QFN, 32/ 64 and 80LQFP
- Pin compatible within KEA family



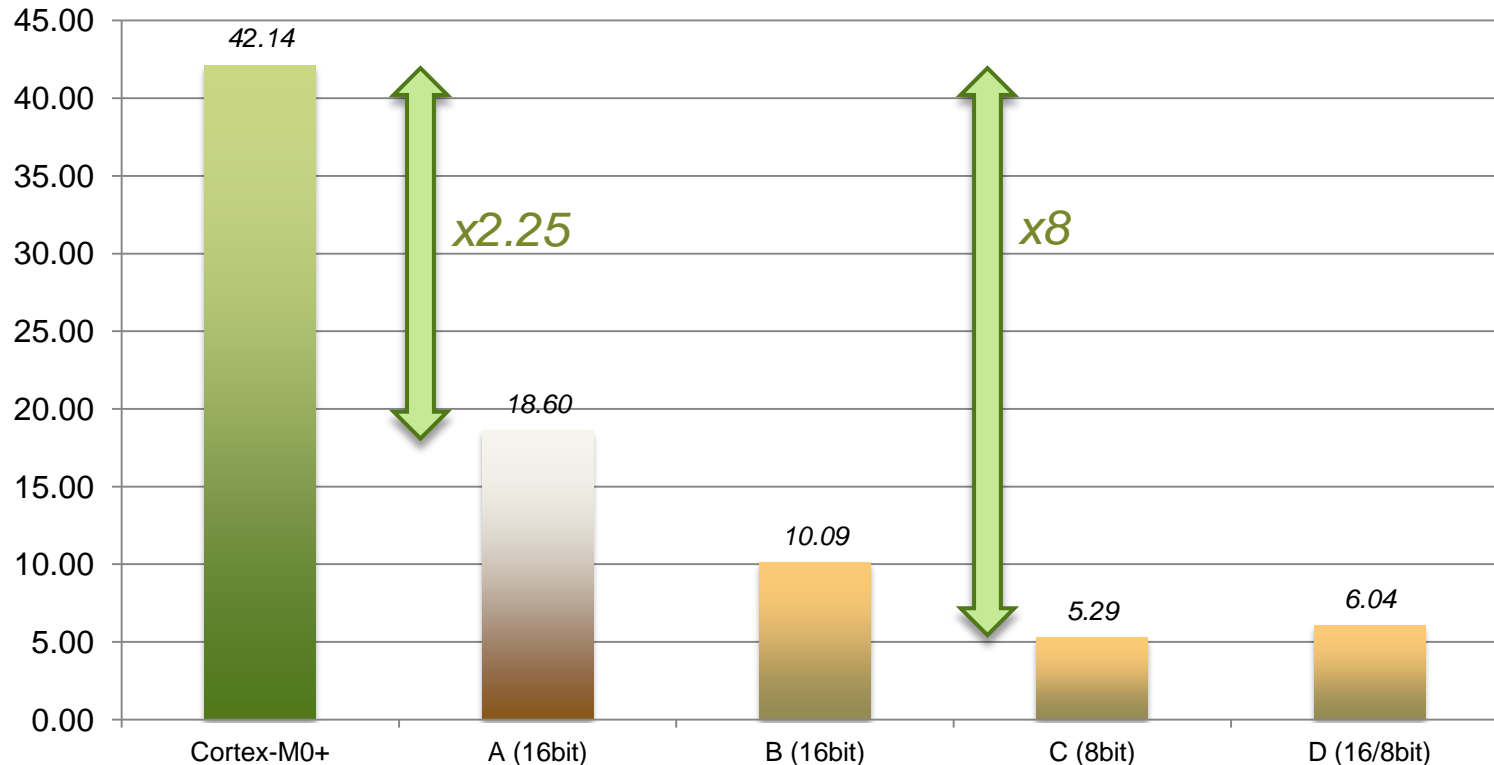
(1) Support bit operation in RAM

(2) Faster timer running 2 x core clock

New pipeline for best energy efficiency

高性能低功耗内核

Processor Energy Efficiency in CoreMark/mA



Assuming only 1/3 of reported MCU consumption is related to the processor

- Cortex-M0+ is twice more efficient than closest architecture

Kinetis Auto: General Purpose 32 Bit ARM MCU

Kinetis汽车微控制器目标应用



Applications:

- Seats/Sun Roof
- Windows/Doors
- Mirror/Wiper
- Fuel/Water Pump controller
- Body Control
- Park Assist
- DC/BLDC Motor control
- Ambient lighting
- Infotainment connection module
- GPS/Radio companion MCU

Reference Solutions:

- BLDC motor control
- Vehicle Interior / Exterior LED Lighting
- Low Power LIN/CAN Node Networking
- Motorcycle Engine Control

Kinetis Auto MCU Summary

Kinetis汽车微控制器总结

Automotive grade qualified 汽车级产品认证

First 32-bit ARM-based MCU ready to use in general automotive applications

Scalable 扩展性

8KB to 2MB embedded flash, pin to pin compatible

Save development cost & speed time to market 节省开发成本和时间

Massive options of development tools, SW and HW references

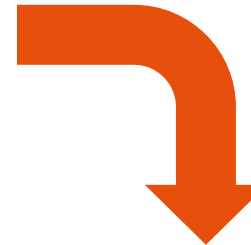
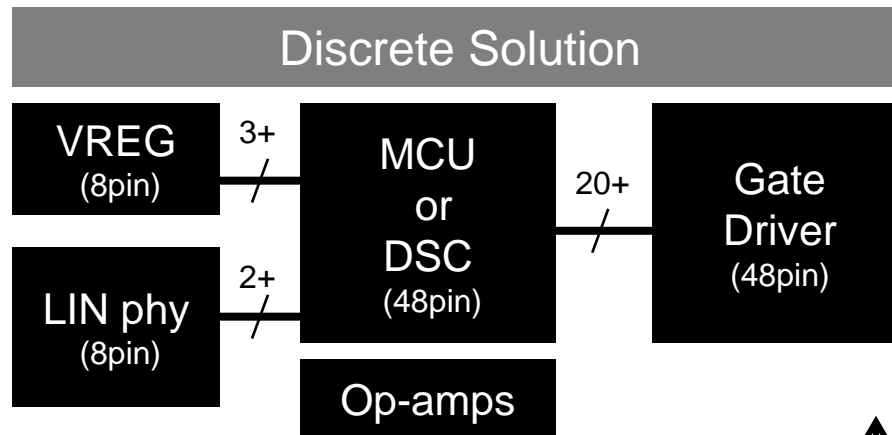


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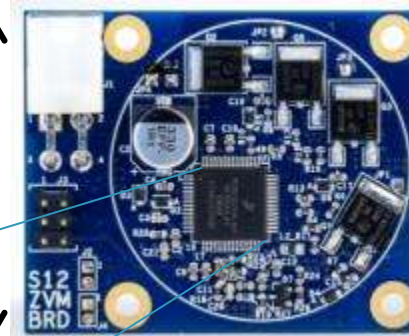
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S12ZVM for BLDC Motor Control

用于直流无刷电机控制的高集成度混合信号微控制器



4cm
~1 ½ in.



S12ZVM Solution:

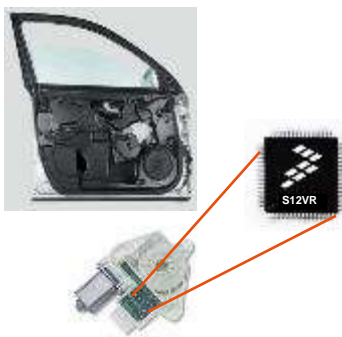
- ~ 50 fewer solder joints
- - 4 to 6 cm² PCB space

S12 MagniV: Integration Beyond the MCU

MagniV: 高集成度混合信号微控制器家族

Our **S12 MagniV** portfolio simplifies system design with the integration on High-Voltage (HV) analog features onto MCUs for automotive applications

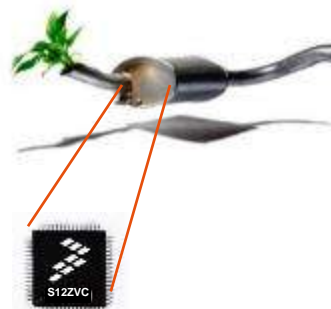
MM912/S12VR
Window Lift



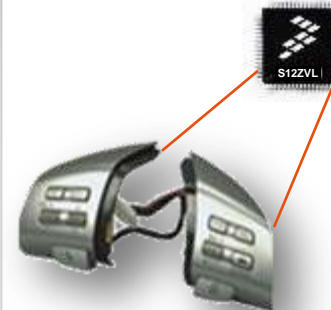
S12ZVM
BLDC Motor Control



S12ZVC
Small CAN nodes



S12ZVL
LIN Nodes



- ✓ Reduced PCB Space
- ✓ Reduced Bill of Material
- ✓ Improved manufacturing efficiency
- ✓ Simplified development

AUTOSAR – Global Automotive Software Standard

AUTOSAR – 汽车软件标准

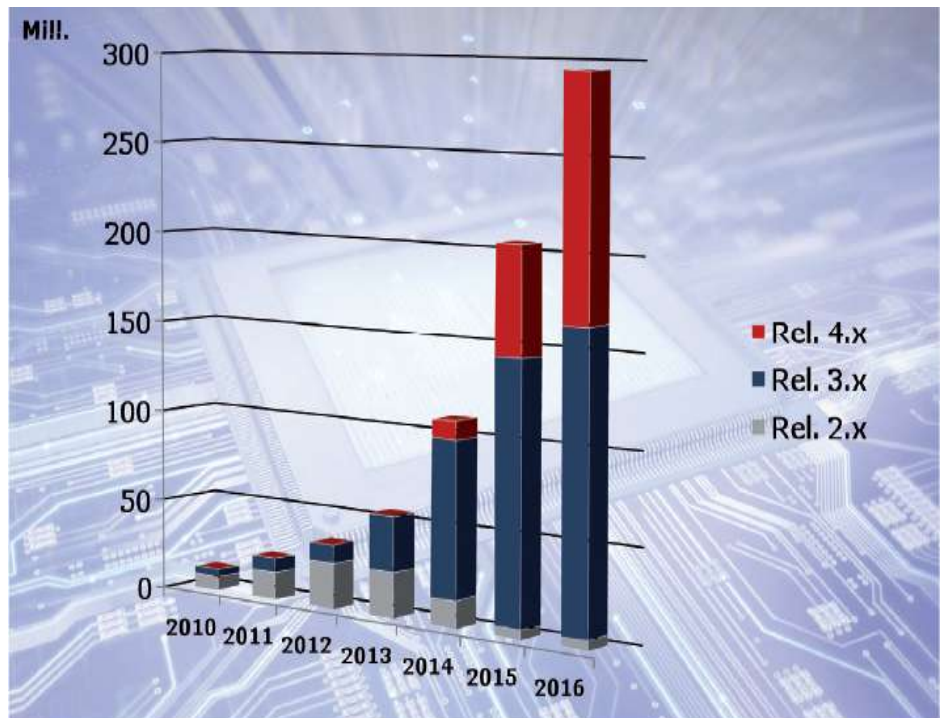
- **Benefits for car manufacturer**

- Establish development distribution among suppliers
- Compete on innovative functions with increased design flexibility
- **Simplify** software and system integration
- **Reduce cost** of overall software development

- **Benefits for supplier**

- Reduce version proliferation
- **Reuse** software modules across car manufacturers
- **Increase efficiency** of application development

Volume of ECUs with AUTOSAR



- Members represent about 80% of worldwide car production.
- In 2016 approx 25% of ECUs will be based on AUTOSAR.

Source: AUTOSAR

Freescal Automotive Software

飞思卡尔提供汽车软件产品

- Freescale provides software products where in-depth hardware knowledge is crucial – including AUTOSAR MCAL and OS, Core Self Test, and application-specific libraries to address unique hardware features.

Separate Products

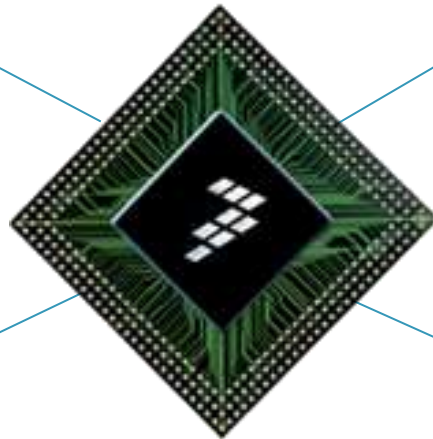
AUTOSAR
Operating System

Self Test
Libraries

Part of the Solution

AUTOSAR MCAL
low-level drivers

Application-oriented
Libraries



ISO 26262 : Automotive Norm on Functional Safety

ISO26262: 越来越多汽车应用要求功能安全



Functional Safety. Simplified.

Simplifies the process of system compliance, with solutions designed to address the requirements of automotive and industrial functional safety standards

Reduces the time and complexity required to develop safety systems that comply with ISO 26262 and IEC 61508 standards

Supports the most stringent Safety Integrity Levels (SILs), enabling designers to build with confidence

Zero defect methodology from design to manufacturing to ensure our products meet the stringent demands of safety applications

Session Summary 总结

- Vehicle networking is ever growing complicated, which includes more and more CAN/LIN nodes, and Ethernet enters vehicle.
车身网络复杂度不断增加，CAN/LIN节点数量快速增长，以太网进入车身网络。
- MPC5748G family address high end BCM/Gateway with Ethernet.
MPC5748G提供理想的高端BCM/网关解决方案。
- Kinetis Auto MCU with ARM core offering the scalability to cover various body applications.
Kinetis汽车MCU覆盖车身电子大部分应用，整个系列具有高兼容性，便于客户建立通用软硬件平台。
- MagniV family offering high-integration solutions for smart distributed nodes in vehicle network.
MagniV混合信号MCU为车身网络上的智能节点提供高集成度解决方案。
- Freescale provide AutoSAR and Functional Safety support on most MCU products.
飞思卡尔汽车微控制器具备完善的AutoSAR和功能安全支持。





Making the World a Smarter Place.

