

# Producenci układów mikroprocesorowych

## **mikroprocesory, mikrokontrolery, procesory sygnałowe DSP, kontrolery sygnałowe DSC**

Semestr zimowy 2012/2013, E-3, WIEIK-PK

1

## **Mikroprocesor - Mikrokontroler**

- Obecnie większość systemów mikroprocesorowych przeznaczonych do sterowania i kontroli, budowanych jest w oparciu o mikrokontrolery.
- Typowe układy mikroprocesorowe 8-bitowe lub 16-bitowe (znane z lat 70, 80) nie są już stosowane.
- Dominującą rolę przejęły mikrokontrolery 8-bitowe, 16-bitowe i 32-bitowe (coraz bardziej popularne i tańsze).
- Typowe mikroprocesory 32, 64-bitowe klasy Pentium, Intel Core są stosowane w komputerach osobistych oraz w zastosowaniach przemysłowych wymagających stosowania systemów operacyjnych (np. Windows CE) i wymagających dużej mocy obliczeniowej (przetwarzania dużej liczby danych).

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2

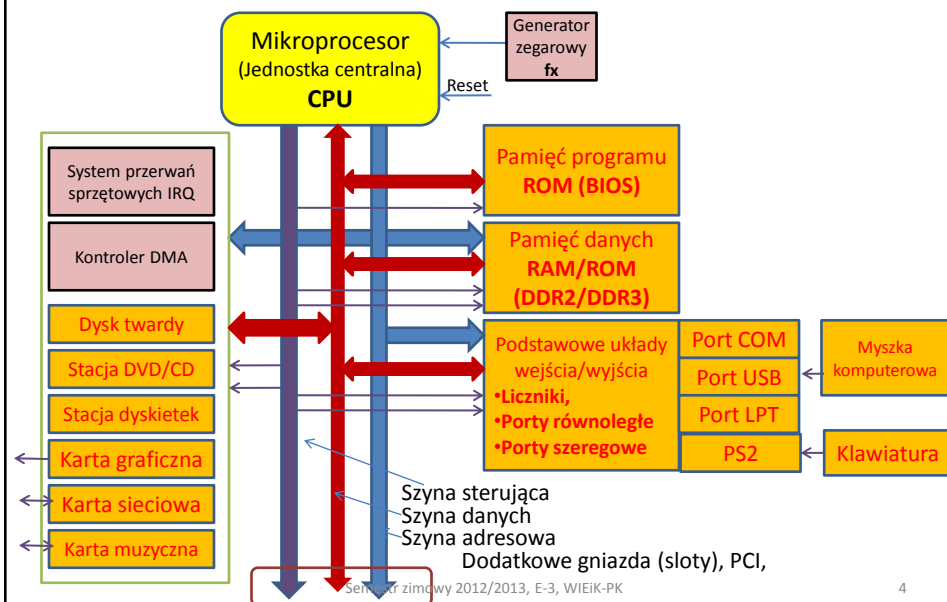
## Procesory sygnałowe DSP, kontrolery sygnałowe DSC

- Coraz częściej stosuje się tzw. procesory sygnałowe (*DSP – Digital Signal Processor*) do sterowania i kontroli.
- Aby zwiększyć moc obliczeniową w strukturę mikrokontrolera wstawiane są elementy znane do tej pory z procesorów DSP, np. jednostka mnożąco-sumująca typu MAC, dodatkowy moduł obliczeniowy o zwiększonej precyzji, dzielenia, mnożenia i przesuwania, akumulator o zwiększonej liczbie bitów (dokładności).
- Lista rozkazów mikrokontrolera jest wyposażona w dodatkową grupę rozkazów (DSP) przyspieszającą obliczenia z zakresu przetwarzania sygnałów, np. realizacja filtrów cyfrowych, obliczenia algorytmu FFT.
- Producenci oferują mikrokontrolery typu DSC (*Digital Signal Controller*), które są wyposażone w elementy procesora sygnałowego ale są przeznaczone, np. do sterowania silnikami elektrycznymi, układami zarządzania energią (energoelektronika).

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3

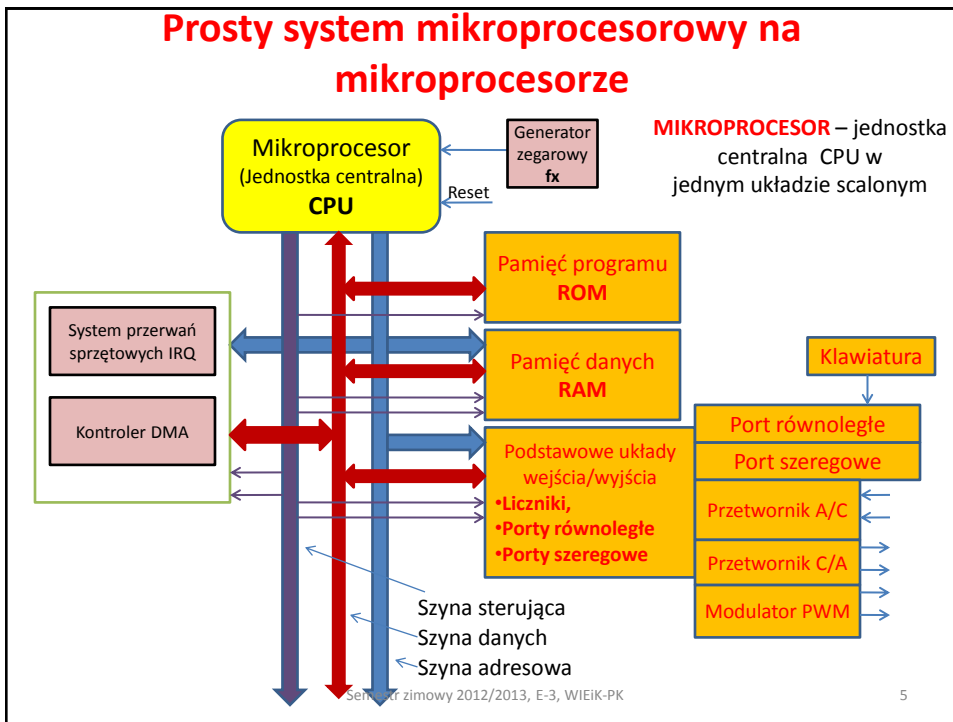
## Budowa rozbudowanego systemu mikroprocesorowego na mikroprocesorze, komputer klasy PC



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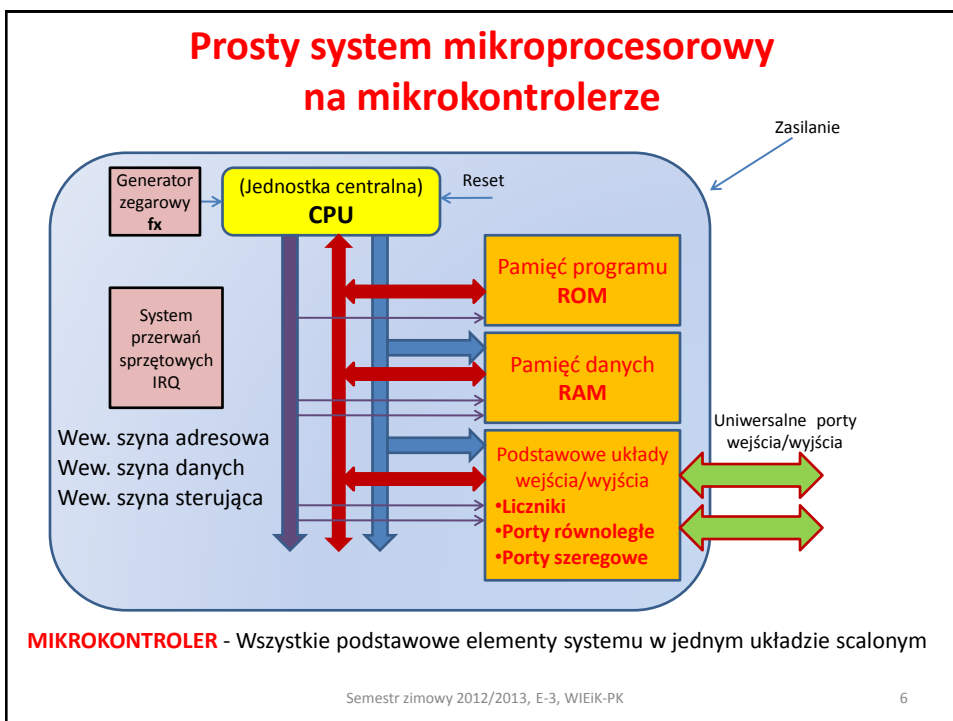
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## Prosty system mikroprocesorowy na mikroprocesorze

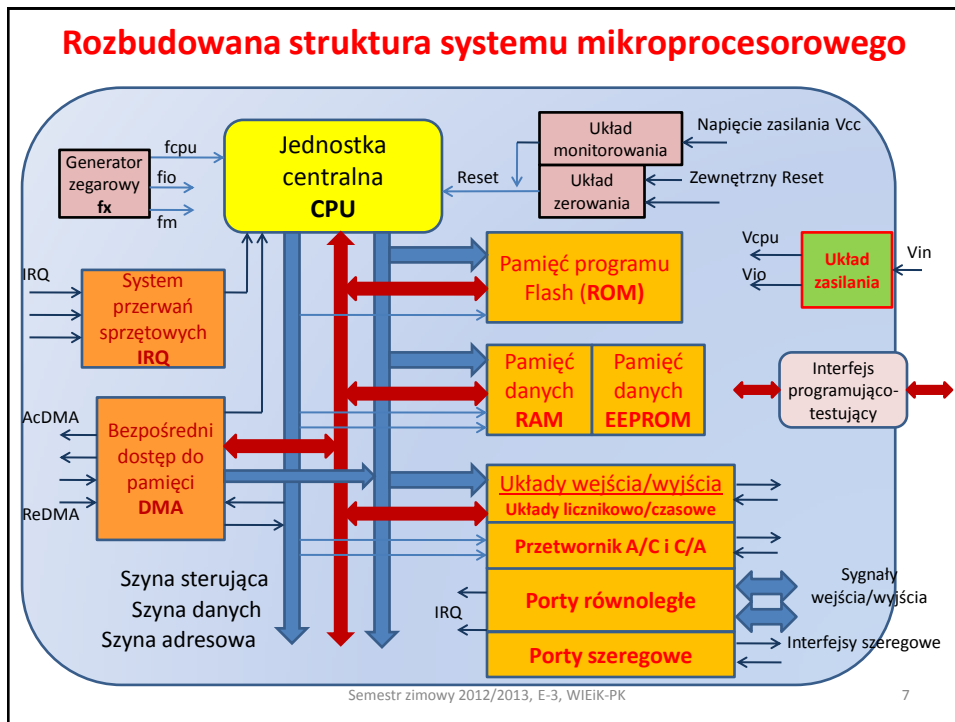


5

## Prosty system mikroprocesorowy na mikrokontrolerze



6



## Zalety stosowania mikrokontrolerów

- Minimalna liczba elementów zewnętrznych,
- małe wymiary, mała i nieskomplikowana płytką drukowaną,
- pojemność pamięci ROM i RAM oraz liczba i funkcje układów wejścia/wyjścia można dopasować do konkretnej aplikacji,
- łatwość w podłączaniu elementów i urządzeń zewnętrznych (klawiatury, diod LED, wyświetlaczy LED, LCD, dodatkowych pamięci, itp.)
- proste projektowanie systemu, programowanie i testowanie,
- bardzo duży wybór mikrokontrolerów 8, 16 lub 32-bitowych, duża liczba producentów,
- duża liczba firm produkujących mikrokontrolery z tej samej rodziny, np. 8051, ARM,
- mała moc pobierana,
- niskie koszty układów i całego systemu,
- obecne mikrokontrolery 32-bitowe osiągają bardzo duże moce obliczeniowe ( $f_x=500\text{MHz}$ ), przy niewielkiej mocy pobieranej,
- możliwość korzystania z systemów operacyjnych klasy Linux
- dostępne systemy czasu rzeczywistego RTOS, (*Real Time Operating System*)

## Ograniczenia w stosowaniu mikrokontrolerów

- małe zasoby pamięci ROM i RAM,
- mikrokontrolery przewidziane są do prostych zadań sterowania, kontroli,
- relatywnie mała moc obliczeniowa w zależności od typu mikrokontrolera,
- ograniczona liczba języków programowania, dominuje assembler i język C, C++

## Najwięksi producenci mikrokontrolerów za 2011

1. Renesas Electronics (udziałowcy NEC, Hitachi, Mitsubichi) [www.renesas.eu](http://www.renesas.eu)
2. Freescale Semiconductor (Motorola) [www.freescale.com](http://www.freescale.com)
3. Atmel [www.atmel.com](http://www.atmel.com)
4. Microchip Technology [www.microchip.com](http://www.microchip.com)
5. Infineon Technology [www.infineon.com](http://www.infineon.com)
6. Texas Instruments [www.ti.com](http://www.ti.com)
7. Fujitsu [www.fujitsu.com](http://www.fujitsu.com)
8. NXP Semiconductor (Philips) [www.nxp.com](http://www.nxp.com)
9. STMicroelectronics [www.st.com](http://www.st.com)
10. Samsung [www.samsung.com/global/business/semiconductor](http://www.samsung.com/global/business/semiconductor)
11. Inni producenci

**Na podstawie Databeans Estimates, Company Reports**

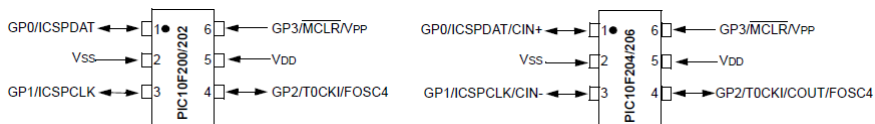
## Najprostsze systemy na mikrokontrolerach, układy 6-końcówkowe

Podstawowe parametry mikrokontrolerów 8-bitowych z rodziny PIC10F20x, firmy Microchip

		PIC10F200	PIC10F202	PIC10F204	PIC10F206
<b>Clock</b>	Maximum Frequency of Operation (MHz)	4	4	4	4
<b>Memory</b>	Flash Program Memory	256	512	256	512
	Data Memory (bytes)	16	24	16	24
<b>Peripherals</b>	Timer Module(s)	TMR0	TMR0	TMR0	TMR0
	Wake-up from Sleep on Pin Change	Yes	Yes	Yes	Yes
	Comparators	0	0	1	1
<b>Features</b>	I/O Pins	3	3	3	3
	Input-Only Pins	1	1	1	1
	Internal Pull-ups	Yes	Yes	Yes	Yes
	In-Circuit Serial Programming™	Yes	Yes	Yes	Yes
	Number of Instructions	33	33	33	33
	Packages	6-pin SOT-23 8-pin PDIP, DFN	6-pin SOT-23 8-pin PDIP, DFN	6-pin SOT-23 8-pin PDIP, DFN	6-pin SOT-23 8-pin PDIP, DFN

The PIC10F200/202/204/206 devices have Power-on Reset, selectable Watchdog Timer, selectable code-protect, high I/O current capability and precision internal oscillator.

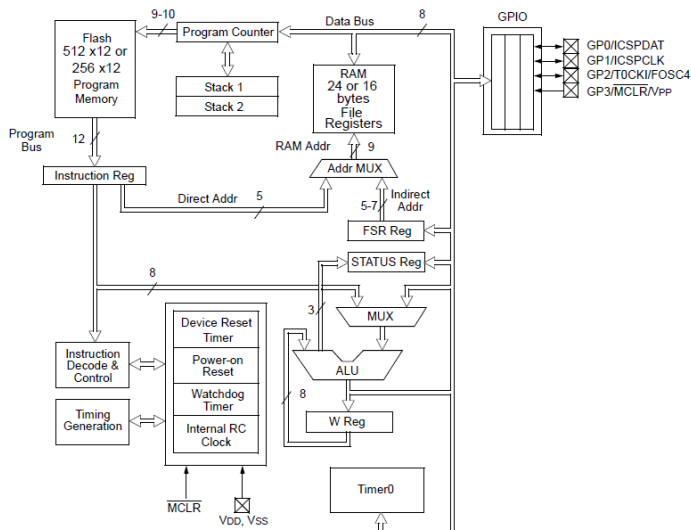
The PIC10F200/202/204/206 device uses serial programming with data pin GP0 and clock pin GP1.



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11

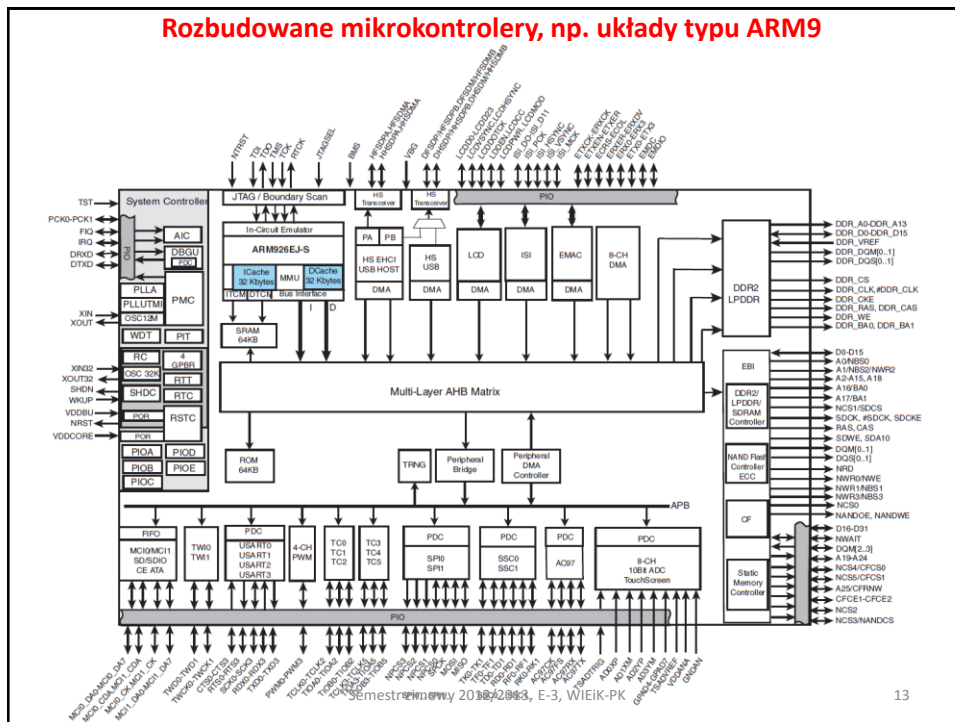
## Struktura wewnętrzna PIC12F200



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12

## Rozbudowane mikrokontrolery, np. układy typu ARM9



13

- 400 MHz ARM926EJ-S™ ARM® Thumb® Processor
  - 32 KBytes Data Cache, 32 KBytes Instruction Cache, MMU
- Memories
  - DDR2 Controller 4-bank DDR2/LPDDR, SDRAM/LPSDR
  - External Bus Interface supporting 4-bank DDR2/LPDDR, SDRAM/LPSDR, Static Memories, CompactFlash, SLC NAND Flash with ECC
  - One 64-KByte internal SRAM, single-cycle access at system speed or processor speed through TCM interface
  - One 64-KByte internal ROM, embedding bootstrap routine
- Peripherals
  - LCD Controller supporting STN and TFT displays up to 1280\*860
  - ITU-R BT. 601/656 Image Sensor Interface
  - USB Device High Speed, USB Host High Speed and USB Host Full Speed with On-Chip Transceiver
  - 10/100 Mbps Ethernet MAC Controller
  - Two High Speed Memory Card Hosts (SDIO, SDCard, MMC)
  - AC'97 controller
  - Two Master/Slave Serial Peripheral Interfaces
  - Two Three-channel 16-bit Timer/Counters
  - Two Synchronous Serial Controllers (I2S mode)
  - Four-channel 16-bit PWM Controller
  - Two Two-wire Interfaces
  - Four USARTs with ISO7816, IrDA, Manchester and SPI modes
  - 8-channel 10-bit ADC with 4-wire Touch Screen support
- System
  - 133 MHz twelve 32-bit layer AHB Bus Matrix
  - 37 DMA Channels
  - Boot from NAND Flash, SDCard, DataFlash® or serial DataFlash
  - Reset Controller with on-chip Power-on Reset
  - Selectable 32768 Hz Low-power and 12 MHz Crystal Oscillators
  - Internal Low-power 32 kHz RC Oscillator
  - One PLL for the system and one 480 MHz PLL optimized for USB High Speed
  - Two Programmable External Clock Signals
  - Advanced Interrupt Controller and Debug Unit
  - Periodic Interval Timer, Watchdog Timer, Real Time Timer and Real Time Clock
- I/O
  - Five 32-bit Parallel Input/Output Controllers
  - 160 Programmable I/O Lines Multiplexed with up to Two Peripheral I/Os with Schmitt trigger input
- Package
  - 324-ball TFBGA, pitch 0.8 mm

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14

Podstawowe parametry  
mikrokontrolera AT91SAM926,  
firmy Atmel

## Wybrani producenci układów mikroprocesorowych, mikrokontrolerów, procesorów DSP, DSC

- AMD
- Analog Devices
- Atmel Corporation
- Infineon
- Intel
- Freescale Semiconductor
- Maxim (Dallas Semiconductor)
- Microchip
- NXP
- Rabbit Semiconductor
- Renesas Technology (Hitachi)
- Texas Instruments
- Samsung
- STMicroelectronics
- Zilog

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15



## ATMEL Corporation

- » **Atmel AVR 8- and 32-bit Microcontrollers** — Atmel AVR® 8- and 32-bit microcontrollers deliver a unique combination of performance, power efficiency, and design flexibility. Optimized to speed time to market, and easily adapt to new ones, they are based on the industry's most code-efficient architecture for C and assembly programming. The extensive AVR portfolio makes it easy to reuse knowledge when improving your products and expanding to new markets.
- » **ARM Processor-based Solutions** — Atmel offers a wide range of industry-leading AT91SAM ARM-based Flash MCUs and eMPU solutions. This broad portfolio of 32-bit ARM® solutions can meet the needs of virtually any device or marketplace. Flexible and highly integrated, Atmel ARM-based solutions are designed to optimize system control, wired and wireless connectivity, user interface management, low power, and ease of use.
- » **MCU Wireless** — To support today's increasingly connected applications, Atmel offers a complete line of IEEE 802.15.4-compliant and ZigBee® certified wireless solutions. They are based on the Atmel rich family of RF transceivers, AVR and ARM microcontrollers, as well as single chip wireless microcontrollers.
- » **8051 Architecture** — Atmel has a rich portfolio of microcontrollers based on the 8051 instruction set combines proven technology with the latest features and functionality. Developers can choose from 8-bit microcontrollers based on the powerful, low-power Single-Cycle AT89LP core, as well as MCS-51® industry standard socket drop-in devices—all featuring advanced Flash technologies.

### Oferta firmy Atmel

- AVR® 8-bit
- AVR32 32-bit
- AT91SAM 32-bit ARM-based Microcontrollers
- 8051 Architecture
- MCU Wireless

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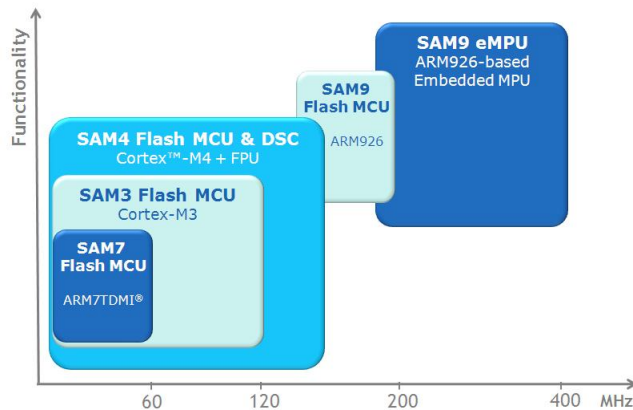
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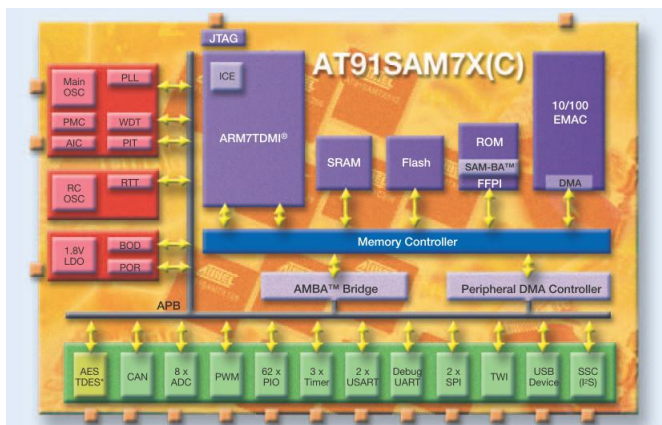
## ATMEL - AVR 8-Bit i 32-bit

- Automotive AVR
- megaAVR (ATMEGA8, ATMEGA32, ATMEGA128)
- Battery Management AVR
- tinyAVR (ATTINY2313)
- AVR XMEGA 8/16-bit MCU
- 32-bit AVR UC3

## 32-bit ARM-based Microcontrollers



## ATMEL – AT91SAM7X



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19

## ATMEL – 8051 MCU

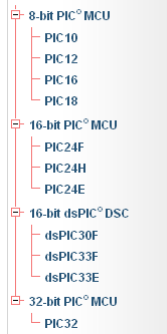
- CAN Networking MCUs (AT89C51CC03)
- Flash (Reprogrammable) (AT89C2051, AT89C4051)
- Flash ISP (In-System Programmable) (AT89S2051, AT89C51RD2, AT89S8253)
- Flash ISP - Single Cycle Core (AT89LP2051, AT89LP4051)
- ROMless (AT80C51RD2)
- Lighting MCUs
- USB MCUs

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20

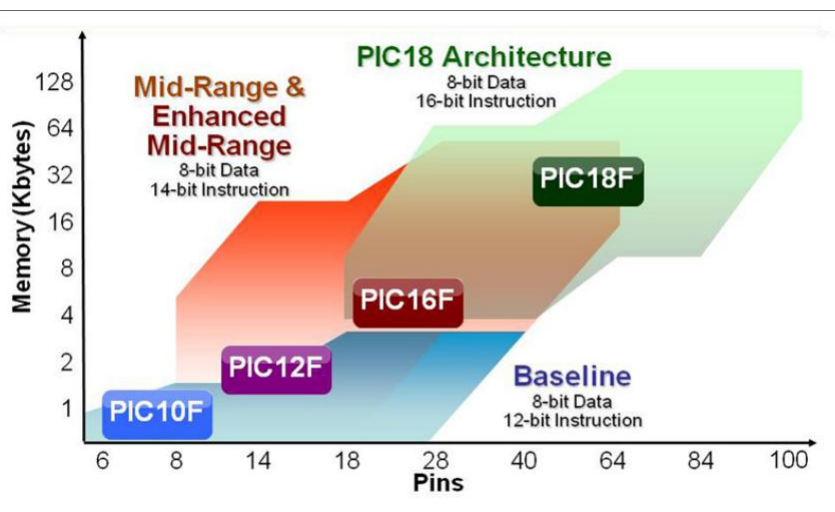
## Microchip

### Microcontrollers



## Oferta firmy Microchip

## Microchip układy 8-bitowe



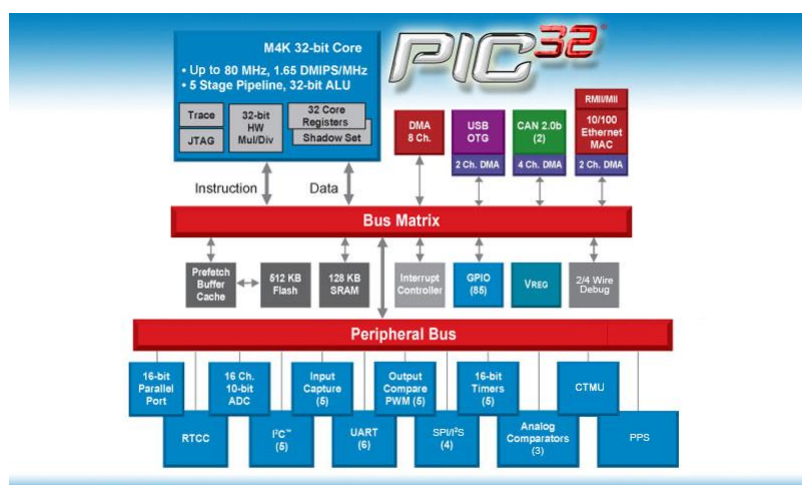
## Microchip układy 8-bitowe

	Baseline Architecture	Mid-Range Architecture	Enhanced Mid-Range Architecture	PIC18 Architecture
Pin Count	6-40	8-64	8-64	18-100
Interrupts	No	Single interrupt capability	Single interrupt capability with hardware context save	Multiple interrupt capability with hardware context save
Performance	5 MIPS	5 MIPS	8 MIPS	Up to 16 MIPS
Instructions	33, 12-bit	35, 14-bit	49, 14-bit	83, 16-bit
Program Memory	Up to 3 KB	Up to 14 KB	Up to 28 KB	Up to 128 KB
Data Memory	Up to 138 Bytes	Up to 368 Bytes	Up to 1,5 KB	Up to 4 KB
Hardware Stack	2 level	8 level	16 level	32 level
Features	<ul style="list-style-type: none"> <li>Comparator</li> <li>8-bit ADC</li> <li>Data Memory</li> <li>Internal Oscillator</li> </ul>	In addition to Baseline: <ul style="list-style-type: none"> <li>SPI/I<sup>2</sup>C™</li> <li>UART</li> <li>PWMs</li> <li>LCD</li> <li>10-bit ADC</li> <li>Op Amp</li> </ul>	In addition to Mid-Range: <ul style="list-style-type: none"> <li>Multiple Communication Peripherals</li> <li>Linear Programming Space</li> <li>PWMs with Independent Time Base</li> </ul>	In addition to Enhanced Mid-Range: <ul style="list-style-type: none"> <li>8x8 Hardware Multiplier</li> <li>CAN</li> <li>CTMU</li> <li>USB</li> <li>Ethernet</li> <li>12-bit ADC</li> </ul>
Highlights	Lowest cost in the smallest form factor	Optimal cost to performance ratio	Cost effective with more performance and memory	High performance, optimized for C programming, advanced peripherals
Total Number of Devices	16	58	29	193
Families	PIC10, PIC12, PIC16	PIC12, PIC16	PIC12F00X, PIC16F1XX	PIC18

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23

## Microchip układy 32-bitowe – rdzeń typu MIPS





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24



# Infineon

Category	<ul style="list-style-type: none"> <li>▶ <b>XC800</b> 8-Bit Microcontroller 8051 compatible Up to 26MHz, 2KB to 64KB Flash</li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>XC2000/166</b> C166 16-Bit Real-Time Signal Microcontroller Up to 128 MHz, 32KB to 1.6MB Flash</li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>XMC</b> 32-Bit ARM® Cortex-TM-M4 Real-Time Signal Microcontroller Up to 180MHz, 128KB to 2.5MB Flash</li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>TriCore™</b> 32-Bit Highest Real-Time Performance Up to 300MHz, 1MB to 4MB Flash</li> </ul>
Products	<ul style="list-style-type: none"> <li>▶ <b>XC800 A</b> Automotive AECQ100 compliant</li> <li>▶ <b>XC800 I</b> Industrial and Consumer</li> <li>▶ <b>PRO-SIL™ Safety Products</b></li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>XC2000</b> Automotive AECQ100 compliant</li> <li>▶ <b>XE166, XC16x, C166®</b> Industrial control</li> <li>▶ <b>PRO-SIL™ Safety Products</b></li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>XMC4000</b> Industrial Control</li> </ul>	<ul style="list-style-type: none"> <li>▶ <b>AURIX™</b> 32-Bit multi-core TriCore™</li> <li>▶ <b>AUDO</b> Automotive AECQ100 compliant</li> <li>▶ <b>TC1100</b> Industrial control</li> <li>▶ <b>Companion ICs</b> FlexRay, Signature Watchdog</li> <li>▶ <b>PRO-SIL™ Safety Products</b></li> </ul>
Applications	<ul style="list-style-type: none"> <li>▶ Automotive Body</li> <li>▶ Automotive Safety</li> <li>▶ Automotive Powertrain</li> <li>▶ eBikes</li> <li>▶ Pumps and Fans</li> <li>▶ Touch Control</li> <li>▶ Home Appliances</li> <li>▶ Lighting</li> </ul>	<ul style="list-style-type: none"> <li>▶ Automotive Body</li> <li>▶ Automotive Safety</li> <li>▶ Automotive Powertrain</li> <li>▶ Renewable Energy</li> <li>▶ Transportation</li> <li>▶ Power Supplies</li> </ul>	<ul style="list-style-type: none"> <li>▶ Electric motors</li> <li>▶ Renewable Energy</li> <li>▶ Factory Automation</li> <li>▶ Building Automation</li> <li>▶ Logistics</li> <li>▶ Transportation</li> </ul>	<ul style="list-style-type: none"> <li>▶ eVehicle / Hybrid</li> <li>▶ Automotive Safety</li> <li>▶ Automotive Powertrain</li> <li>▶ High-end servo drives</li> <li>▶ Programmable Logic Controllers</li> <li>▶ Renewable Energy</li> </ul>

# Renesas

Low Power

R8C 16-bit

Super Low Power 16-bit 8-bit

Price/Performance  
Value

RX 32-bit

R32C / M16C 32-bit 16-bit

H8SX 32-bit

H8S 16-bit

Higher  
Performance

Super H 32-bit

Development Tools / Alliance Partners

SH-Mobile

USB Device

- Automotive
- Home Appliance / Audio Visual
- Networking / Wireless

- Motor Control

- Industrial ( UPS, Meter )
- Office Equipment / PC
- PLC MCU

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26

## Producenci mikrokontrolerów z rodziny 8051/8052

- Actel Corporation
- Analog Devices
- ASIX Electronics
- Atmel
- CAST
- Digital Core Design
- Infineon
- Maxim (Dallas Semiconductor)
- NXP (dawniej Philips)
- Silicon Storage Tech., Inc.
- Silicon Laboratories (Cygnal Integrated Products)
- SST
- STMicroelectronics
- Teridian Semiconductor
- SMC
- Texas Instruments
- Ramtron

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27



## Intel

### Desktop processors

- [Intel® Core™ i7 processor](#)
- [Intel® Core™ i5 processor](#)
- [Intel® Core™ i3 processor](#)
- [Intel® Core™ i7 vPro™ processor](#)
- [Intel® Core™ i5 vPro™ processor](#)
- [Intel® Pentium® processor](#)
- [Intel® Celeron® processor](#)

Semestr zimowy 2012/2013, E-3, WIEIK-PK

28



# Intel

## Laptop processors

- [Intel® Core™ i7 mobile processor](#)
- [Intel® Core™ i5 mobile processor](#)
- [Intel® Core™ i3 mobile processor](#)
- [Intel® Core™ i7 vPro™ processor](#)
- [Intel® Core™ i5 vPro™ processor](#)
- [Intel® Celeron® processor](#)



# Intel

## Server and workstation processors

- [Intel® server processors](#)
- [Intel® workstation processors](#)

## Internet device processors

- [Intel® Atom™ processor](#)

## Embedded and communications processors

- [Intel® Architecture Processors](#)
- [Intel® Network Infrastructure Processors](#)
- [Intel® I/O processors](#)

## Intel - obecnie nie produkowane mikrokontrolery

### 8-bitowe

- rodzina 8051/8052

### 16-bitowe

- 80C251 (16-bitowa wersja 8051)
- 80C96
- 80C196
- 80C296

## Mikroprocesory firmy Intel - obecnie nie produkowane

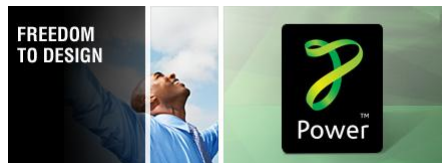
Chip	Date	MHz	Transistors	Memory	Notes
4004	4/1971	0.108	2,300	640	First microprocessor on a chip
8008	4/1972	0.108	3,500	16KB	First 8-bit processor
8080	4/1974	2-3	6,000	64KB	First general-purpose CPU on a chip
8085	4/1976	3-8	6,500	64KB	
8086	6/1978	5-10	29,000	1MB	First 16-bit CPU on a chip
8088	6/1979	5-8	29,000	1MB	Used in IBM PC
80286	2/1982	8-12	134,000	16MB	Memory protection present
80386	10/1985	16-33	275,000	4GB	First 32-bit CPU
80486	4/1989	25-100	1.2M	4GB	Built-in 8K cache memory
Pentium	3/1993	60-233	3.1M	4GB	Two pipelines; later models had MMX
Pentium Pro	3/1995	150-200	5.5M	4GB	Two levels of cache built in
Pentium II	5/1997	233-400	7.5M	4GB	Pentium Pro plus MMX
Pentium III	1998	550	9.5M		Streaming SIMD extensions (SSE)





# IBM

- PowerPC®, POWER4™, POWER5™ and POWER6™
- PowerPC 4XX embedded cores
- PowerPC 7XX and 6XX Microprocessors
- PowerPC 9XX Microprocessors



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33

STMicroelectronics



# STMicroelectronics

## STM8 - 8-bit MCUs

- [STM8A - 8-bit MCUs for Automotive](#)
- [STM8L - 8-bit ultra-low-power MCUs](#)
- [STM8S - 8-bit MCUs](#)

## STM32 32-bit ARM Cortex MCUs

- [STM32F - 32-bit ARM Cortex MCUs](#)
- [STM32W - 32-bit ARM Cortex RF MCUs](#)

## STMTouch - Touch Sensing MCUs

- [Resistive multi-touch screen microcontrollers](#)
- [Touch sensing library MCUs](#)

## Established MCUs

- [ST6 - 8-bit MCUs](#)
- [ST7 - 8-bit MCUs](#)
- [ST10 - 16-bit MCUs](#)
- [STR7 - 32-bit ARM7 MCUs](#)
- [STR9 - 32-bit ARM9 MCUs](#)

## Ultra-low-power MCUs

- [STM8L - 8-bit ultra-low-power MCUs](#)

## RF MCUs

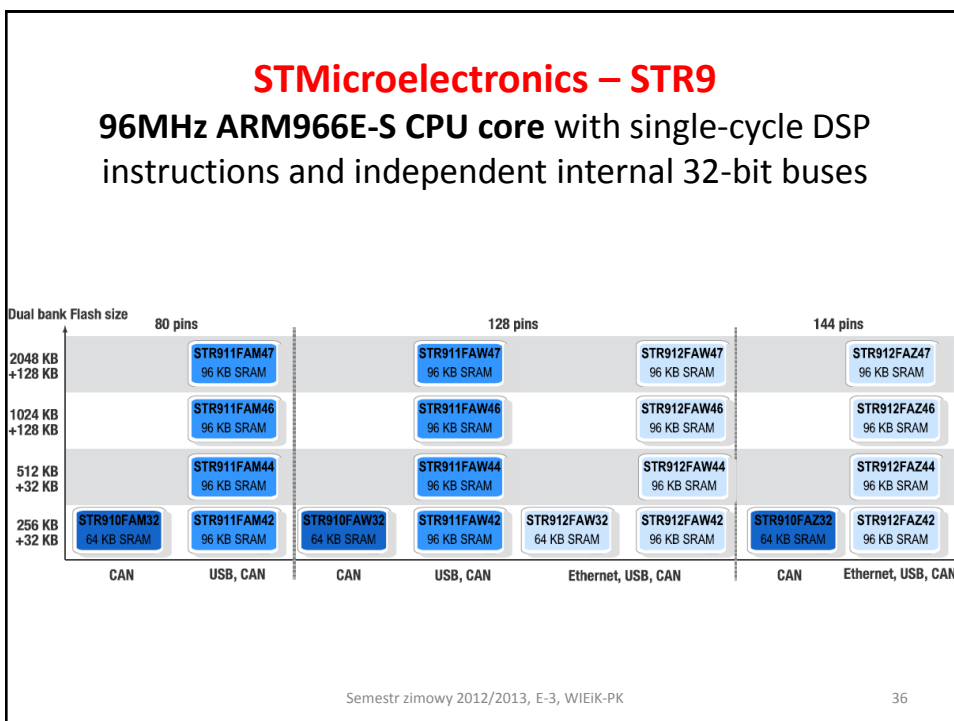
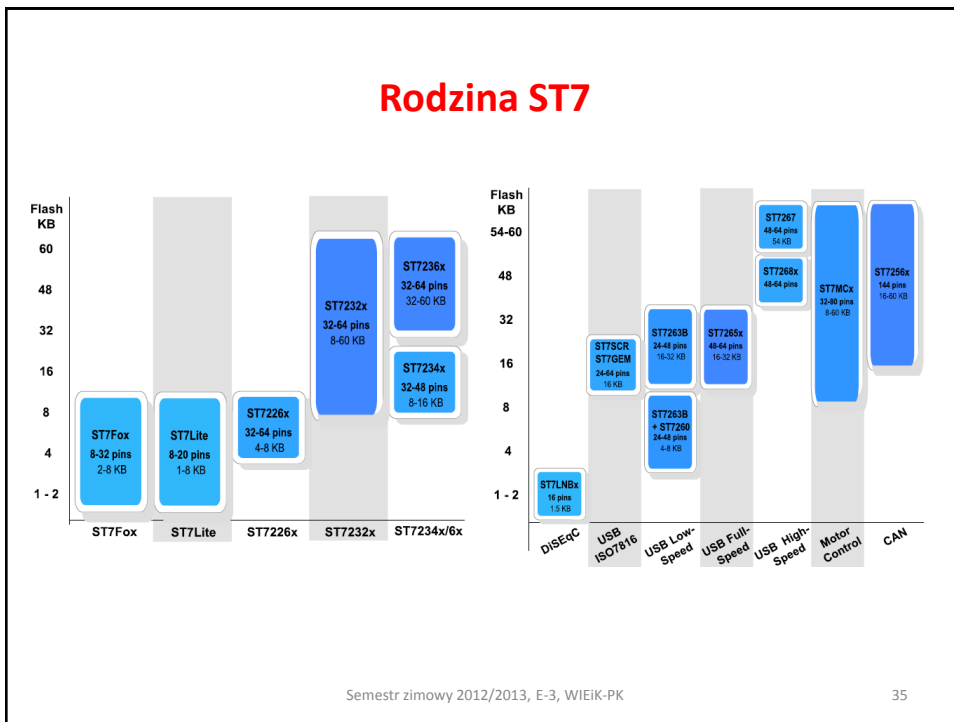
- [STM32W - 32-bit ARM Cortex RF MCUs](#)

## Microcontrollers for automotive

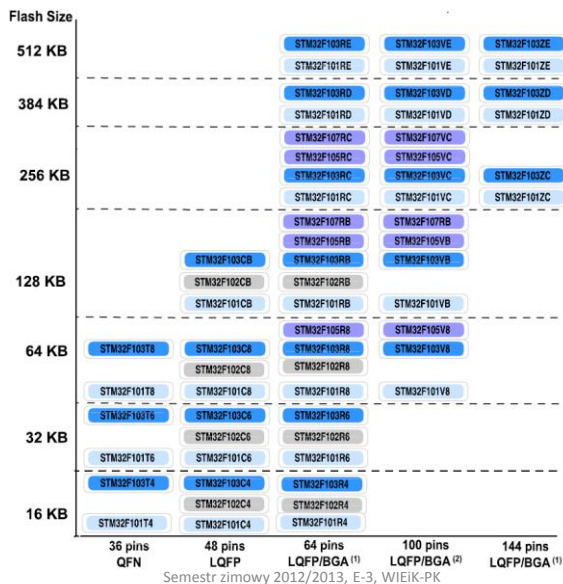
- [8-bit Microcontrollers for automotive](#)
- [16-bit Microcontrollers for automotive](#)
- [32-bit Microcontrollers for automotive](#)

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34



## STM32F - 32-bit ARM Cortex MCUs

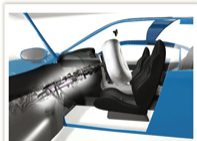


37

## Oferta ST – technika motoryzacyjna



SPC563M - 32-bit microcontrollers for powertrain systems



SPC560P, SPC56EL - 32-bit microcontrollers for chassis and safety



SPC56xB/C/D – 32-bit microcontrollers for car body and convenience

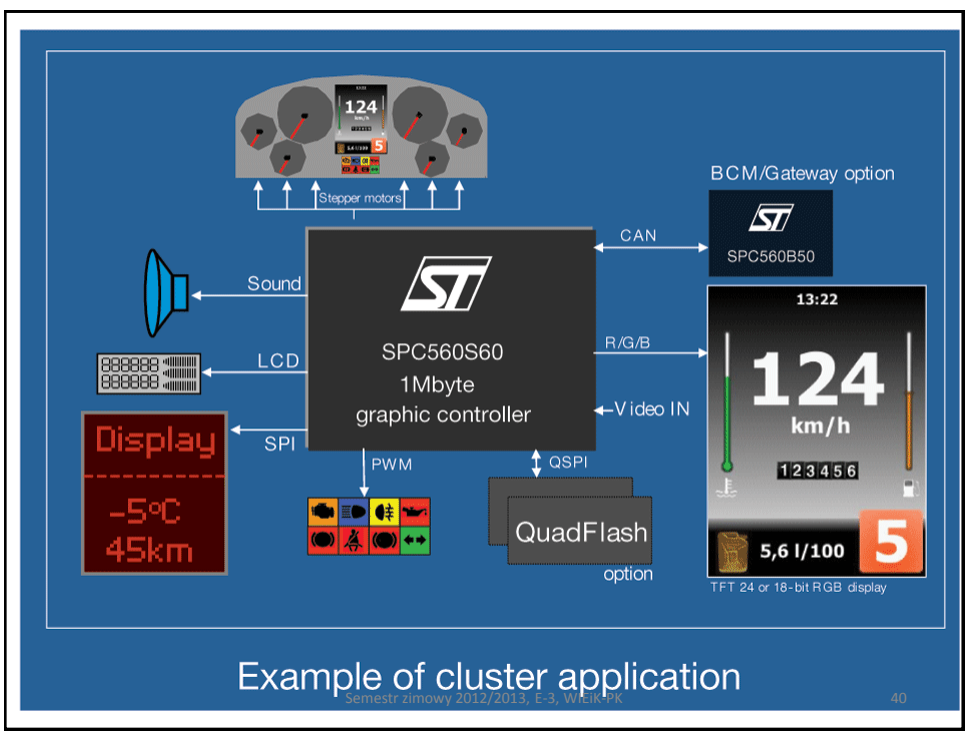
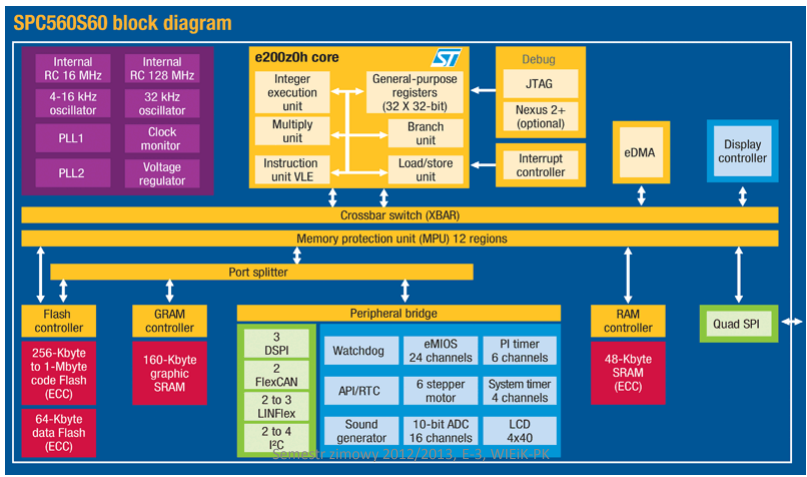


SPC56xS – 32-bit microcontrollers for clusters and dashboards

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38

## SPC56xS – 32-bit microcontrollers for clusters and dashboards (technika motoryzacyjna)





## NXP Semiconductor

(dawniej Philips)

### Rodziny mikrokontrolerów produkowanych przez NXP

Rodzina procesorów	Liczba pozycji (stan na 01.2010)
Cortex-M3 (32-bit)	9
Cortex-M0 (32-bit)	
ARM7 (32-bit)	70
ARM9 (32-bit)	21
80C51 (8-bit)	210
XA (16-bit 8051)	13



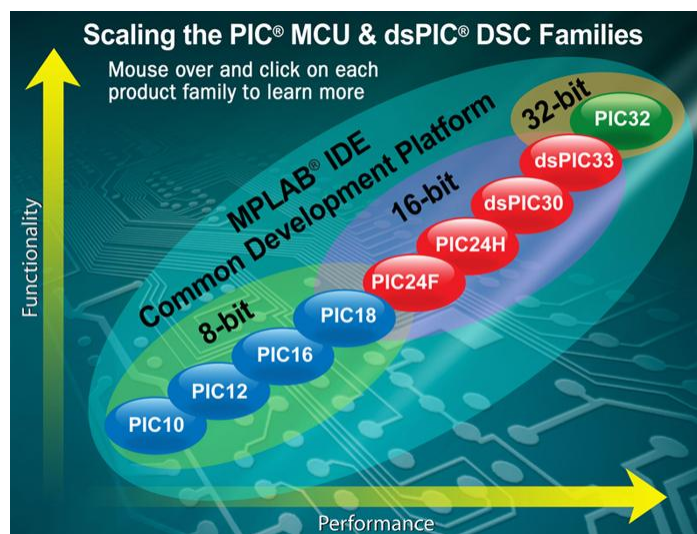
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41



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## Microchip



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42



## Texas Instruments

- **ARM® Cortex™-A8, Cortex™-M3, and ARM9™**
- **DSP C5000**
- **DSP C6000**
- **DSC C2000**
- **MSP430**



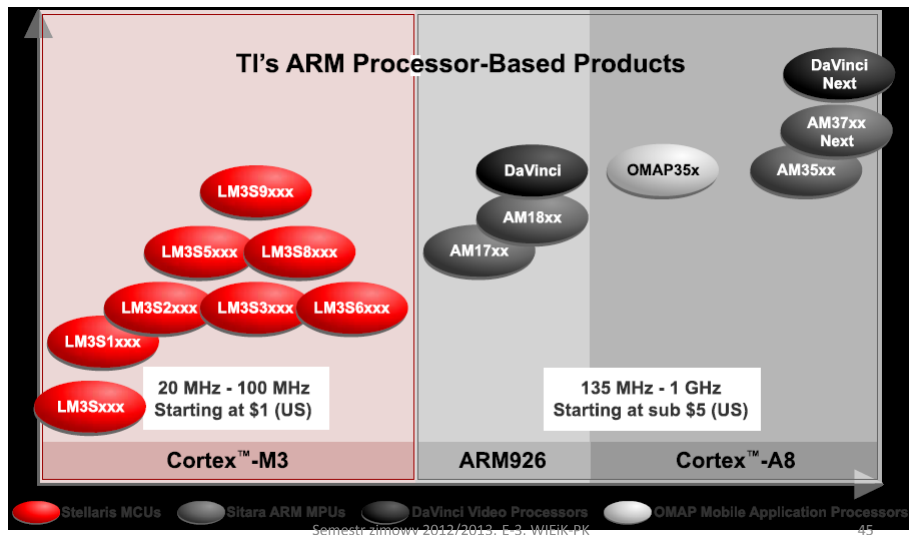
## TI- ARM



### ARM® Cortex™-A8, Cortex™-M3, and ARM9™ family cores

- [Stellaris - 20 MHz - 100 MHz Starting at \\$1.00 \(USD\)](#)
  - [Cortex-M3](#)
- [Sitara - 375 MHz - 1 GHz Starting at sub \\$5.00 \(USD\)](#)
  - ARM926
  - Cortex-A8
    - Stellaris® Cortex-M3™ microcontrollers (MCU),
    - Sitara devices in the ARM9™ family
    - Cortex-A8 processor-based microprocessors (MPUs).
    - ARM9 family based DaVinci video processors
    - OMAP devices featuring Cortex-A8 processors.

# TI- ARM

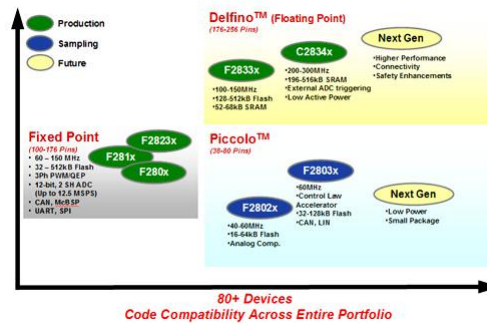


# TI- DSP

## Digital Signal Processors (174)

- [C5000™ Low Power DSPs \(38\)](#)
  - [TMS320C55x Low Power DSPs \(15\)](#)
  - [TMS320C54x Low Power DSPs \(23\)](#)
- [C6000™ Fixed-point DSPs \(61\)](#)
  - [TMS320C647x Multicore DSPs \(5\)](#)
  - [TMS320C645x DSPs \(10\)](#)
  - [TMS320C642x DSPs \(8\)](#)
  - [TMS320C641x DSPs \(29\)](#)
  - [TMS320C62x DSPs \(9\)](#)
- [C6000™ Floating/Fixed-point DSPs \(30\)](#)
  - [TMS320C674x Low Power DSPs \(9\)](#)
  - [TMS320C672x DSPs \(11\)](#)
  - [TMS320C67x DSPs \(10\)](#)
- [DaVinci™ Video Processors \(45\)](#)
  - [TMS320DM646x SOCs \(3\)](#)
  - [TMS320DM644x SOCs \(5\)](#)
  - [TMS320DM643x DSPs \(13\)](#)
  - [TMS320DM64x DSPs \(15\)](#)
  - [TMS320DM3x ARM9™ Based SOCs \(9\)](#)

# C2000 MCUs for Real-time Control



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47

# MSP430™ 16-bit Ultra-Low Power MCUs



**Key Features** **Hardware Ultra-low-power** architecture and flexible clock system extends battery life, as low as:

- 0.1  $\mu$ A RAM retention
- .7  $\mu$ A RTC mode
- 165  $\mu$ A/MIPS

**Integrated intelligent peripherals** including wide range of high-performance analog and digital peripherals offload the CPU

**16-bit RISC CPU architecture** enables new applications with industry-leading code density

**Easy to get started:**

Complete development tools starting at only \$20

**Integrated Peripherals**

- 10-/12-bit SAR ADC
- 16-bit Sigma Delta ADC
- 12-bit DAC
- Comparator
- LCD driver
- Supply Voltage Supervisor (SVS)


- Operational amplifiers
- 16-bit and 8-bit timers
- LDO/PMM
- RF
- Watchdog timer
- UART/LIN
- I2C
- SPI
- IrDA
- USB
- Hardware multiplier
- DMA controller
- Temperature sensor
- Real-Time Clock

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48




# Freescale Semiconductor (Motorola)




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07 Dec 2009 - Freescale introduces QorIQ communications processors with QIICC Engine technology

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## Freescale - 8-bit Microcontrollers

### 8-bit Microcontrollers by Family

- [RS08 Microcontrollers](#)
- [HCS08 Microcontrollers](#)
- [HC08 Microcontrollers](#)
- [Embedded MCU plus Power](#)
- [HC05 Microcontrollers \(Legacy\)](#)
- [HC11 Microcontrollers \(Legacy\)](#)

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50

## Freescall - 16-bit Microcontrollers

- [S12 and S12X Microcontrollers](#)
- [HC16 Microcontrollers](#)
- [56800/E Digital Signal Controllers](#)
  - [DSP5685x](#)
  - [DSP56F80x](#)
  - [DSP56F82x](#)
  - [MC56F81xx](#)
  - [MC56F83xx](#)
  - [MC56F80xx](#)

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51

## Freescall - 68K/ColdFire family

- **ColdFire Microprocessors**
  - V4 Embedded MPU
  - V3 Embedded MPU
  - V2 Embedded MPU
  - V2 MCU
  - V1 MCU
- **68K Microprocessors**
  - M683XX MPU
  - M680X0 MPU
- 68K/ColdFire Peripherals

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52

## Freescal - i.MX Processors (ARM)

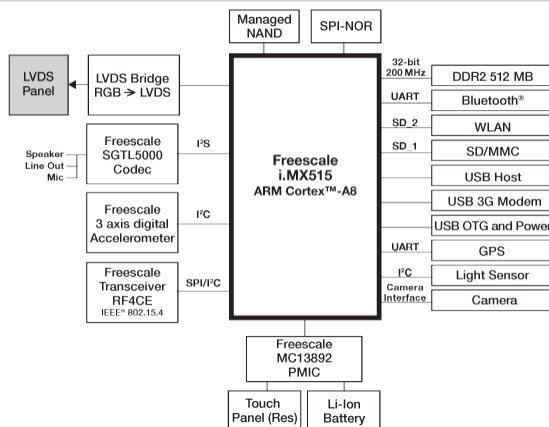
- [i.MX21 Processors](#)
- [i.MX23 Processors](#)
- [i.MX25 Processors](#)
- [i.MX27 Processors](#)
- [i.MX31 Processors](#)
- [i.MX35 Processors](#)
- [i.MX37 Processors](#)
- [i.MX51 Processors](#)
- [i.MXS Processors](#)

The i.MX applications processor family includes processors based on:

- ARM9,
- ARM11 ,
- ARM™ Cortex-A8 core technologies

## [i.MX51 Processors](#)

### SABRE Platform for Smartbooks



## Freescal – 32-bit Power Architecture Processors

- PowerQUICC Communications Processors
  - QorIQ Communications Platforms by Family
  - Host and Integrated Host Processors (8xxx, 7xxx, 7xx, 6xx)
  - Power Architecture Controllers (5xx/5xxx)
- single-, dual- and multicore processors built on Power Architecture technology.

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55

## Freescal – DSP i DSC

- **Digital Signal Processors by Family**
  - 16-Bit StarCore-Based DSPs
  - 24-Bit General Purpose DSPs
- **Digital Signal Controllers by Family**
  - DSP5685x
  - DSP56F80x
  - DSP56F82x
  - MC56F81xx
  - MC56F83xx
  - MC56F80xx

Semestr zimowy 2012/2013, E-3, WIEIK-PK

56