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PIC18f4520 vs AVR ATMEGA328

The PIC's CPU performs up to 10MIPS (million of instructions per second) at 3V while the AVR performs up to 20MIPS at 4.5 -5.5V according to their respective website. Some of the key parameters that I will discuss briefly are listed in the table below.

Table 1.

Device M	Flash	EEPRO	SRAM	GPIO Pins	16 bits resolution PWM channels	Serial USARTs	ADC Channels
ATmega328	32KB	1KB	2KB	23 pins	6	1	8
PIC18F4520	32KB	256	1536	32 pins	2	2	13

The AVR ATmega2560 has the same size Flash with a larger EEPROM memory than the PIC4520 which means you can write about the same size or slightly bigger program in the ATmega328. The PIC has 1.5 KB of SRAM which uses bank scheme, while the AVR has 2KB of SRAM which doesn't use banks. The PIC has a total of 32 I/O pins compared with the AVR's 23 I/O pins. The number of I/O pins are used for connections with peripherals such as PWM, SPI, ,Timers, Interrupts and other features etc. The AVR has one serial USART compared to PIC's two (1 USART and 1 Enhance USART) which is used for serial communication. Both have SPI and I2C communication peripherals although the AVR has 2 SPI compared to the PIC's 1 SPI. The PIC has more ADC (analog to digital converter) channels than the AVR with both having a 10-bit resolution when converting analog to digital however the PIC has a higher sample rate per second (sps) at 100ksps compared to AVR which is 15ksps.

Both micro processor's instruction sets are RISC based. There are 75 instruction set for the PIC and 131 instruction set for the ATmega 328. This means that the AVR has more built instructions which would may/may not be ideal for developers programming in assembly but it should not be a concern for programmers using a high level language like C. However having said this, we must be concerned with the availability of compilers that we use. The free PIC C compiler from Microchip is a student version that limits the optimization of your code to level 2, in most cases this is not a concern but if it is you must get a paid version of the C compiler. Also Microchip doesn't update the compilers as often as the paid versions of C compilers like that of CSS and HiTech. This implies that if Microchip launches a new part

your compiler becomes obsolete, which can be quite expensive to get a license for. I should mention that there is a SDCC (http://sdcc.sourceforge.net/) compiler which is not 100% compatible yet and is a continued open source project. The standard C compiler for the AVR is avr-gcc which is free, it uses real C and generates good optimize code.

The preference to use the PIC 18f4520 versus the ATmega328 boils down to cost and preference. Both these microcontroller have the peripheral features that are comparable. One should really take a closer look at datasheet or documentation for the specific microcontroller for their embedded application. Appendix A list some of the highlighted features for the PIC 18F family while Appendix B list some freatures for its 8-bit ATmega AVR the information on these appendix are taken from their respective datasheet. One should obtain the datasheet if they are interested to learn more about these features.

Appendix A.
PIC 18F4520 Highlighted Features

Power Management Features:

- Run: CPU on, Peripherals on
- Idle: CPU off, Peripherals on
- Sleep: CPU off, Peripherals off
- Ultra Low 50nA Input Leakage
- Run mode Currents Down to 11 µA Typical
- Idle mode Currents Down to 2.5 µA Typical
- Sleep mode Current Down to 100 nA Typical
- Timer1 Oscillator: 900 nA, 32 kHz, 2V
- Watchdog Timer: 1.4 µA, 2V Typical
- Two-Speed Oscillator Start-up

Flexible Oscillator Structure:

- Four Crystal modes, up to 40 MHz
- 4x Phase Lock Loop (PLL) – Available for Crystal and Internal Oscillators
- Two External RC modes, up to 4 MHz
- Two External Clock modes, up to 40 MHz
- Internal Oscillator Block:
    - Fast wake from Sleep and Idle, 1 µs typical
    - 8 use-selectable frequencies, from 31 kHz to 8 MHz
    - Provides a complete range of clock speeds from 31 kHz to 32 MHz when used with PLL
    - User-tunable to compensate for frequency drift
- Secondary Oscillator using Timer1 @ 32 kHz
- Fail-Safe Clock Monitor:
    - Allows for safe shutdown if peripheral clock stops

Peripheral Highlights:

- High-Current Sink/Source 25 mA/25 mA
- Three Programmable External Interrupts
- Four Input Change Interrupts
- Up to 2 Capture/Compare/PWM (CCP) modules, one with Auto-Shutdown (28-pin devices)
- Enhanced Capture/Compare/PWM (ECCP) module (40/44-pin devices only):
    - One, two or four PWM outputs
    - Selectable polarity
    - Programmable dead time
    - Auto-shutdown and auto-restart
- Master Synchronous Serial Port (MSSP) module, Supporting 3-Wire SPI (all 4

modes) and I2C™ ,Master and Slave modes
- Enhanced Addressable USART module:
  - Supports RS-485, RS-232 and LIN/J2602
  - RS-232 operation using internal oscillator block (no external crystal required)
  - Auto-wake-up on Start bit
  - Auto-Baud Detect
- 10-Bit, up to 13-Channel Analog-to-Digital (A/D) Converter module:
  - Auto-acquisition capability
  - Conversion available during Sleep
- Dual Analog Comparators with Input Multiplexing
- Programmable 16-Level High/Low-Voltage Detection (HLVD) module:
  - Supports interrupt on High/Low-Voltage Detection

Special Microcontroller Features:
- C Compiler Optimized Architecture:
  - Optional extended instruction set designed to optimize re-entrant code
- 100,000 Erase/Write Cycle Enhanced Flash Program Memory Typical
- 1,000,000 Erase/Write Cycle Data EEPROM Memory Typical
- Flash/Data EEPROM Retention: 100 Years Typical
- Self-Programmable under Software Control
- Priority Levels for Interrupts
- 8 x 8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer (WDT):
  - Programmable period from 4 ms to 131s
- Single-Supply 5V In-Circuit Serial Programming™ (ICSP™) via Two Pins
- In-Circuit Debug (ICD) via Two Pins
- Wide Operating Voltage Range: 2.0V to 5.5V
- Programmable Brown-out Reset (BOR) with Software Enable Option

Appendix B
ATmega AVR 328 Highlighted Features

• High Performance, Low Power Atmel®AVR® 8-Bit Microcontroller Family
• Advanced RISC Architecture
– 131 Powerful Instructions – Most Single Clock Cycle Execution
– 32 x 8 General Purpose Working Registers
– Fully Static Operation
– Up to 20 MIPS Throughput at 20MHz
– On-chip 2-cycle Multiplier
• High Endurance Non-volatile Memory Segments
– 4/8/16/32KBytes of In-System Self-Programmable Flash program memory
– 256/512/512/1KBytes EEPROM
– 512/1K/1K/2KBytes Internal SRAM
– Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
– Data retention: 20 years at 85C/100 years at 25C(1)
– Optional Boot Code Section with Independent Lock Bits
In-System Programming by On-chip Boot Program
True Read-While-Write Operation
– Programming Lock for Software Security
• Atmel® QTouch® library support
– Capacitive touch buttons, sliders and wheels
– QTouch and QMatrix® acquisition
– Up to 64 sense channels
• Peripheral Features
– Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
– One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
– Real Time Counter with Separate Oscillator
– Six PWM Channels
– 8-channel 10-bit ADC in TQFP and QFN/MLF package
Temperature Measurement
– 6-channel 10-bit ADC in PDIP Package
Temperature Measurement
– Programmable Serial USART
– Master/Slave SPI Serial Interface
– Byte-oriented 2-wire Serial Interface (Philips I2
C compatible)
– Programmable Watchdog Timer with Separate On-chip Oscillator
– On-chip Analog Comparator
– Interrupt and Wake-up on Pin Change

• Special Microcontroller Features

– Power-on Reset and Programmable Brown-out Detection

– Internal Calibrated Oscillator

– External and Internal Interrupt Sources

– Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

• I/O and Packages

– 23 Programmable I/O Lines

– 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF

• Operating Voltage:

– 1.8 - 5.5V

• Temperature Range:

– -40C to 85C

• Speed Grade:

– 0 - 4MHz@1.8 - 5.5V, 0 - 10MHz@2.7 - 5.5.V, 0 - 20MHz @ 4.5 - 5.5V

• Power Consumption at 1MHz, 1.8V, 25C

– Active Mode: 0.2mA

– Power-down Mode: 0.1µA

– Power-save Mode: 0.75µA (Including 32kHz RTC)