Application Note

AN_304

FT90x Microcontroller Benchmark

Version 1.1

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Application note to compare the performance of the FT90x to typical microcontrollers.

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1 Introduction

In microcontroller data sheets, DMIPS are quoted to compare the performance of the device. This application note explains DMIPS and highlights the speed of FTDI`s FT90x microcontroller.

1.1 Overview

1.1.1 Dhrystone Source code

Dhrystone is a computer program that calculates the millions of instructions handled per second (MIPS) based on a standardized Dhrystone application. The source code is freely available throughout the internet. The version used in the Application Note is available from this link Dhrystone-2.1.tar.gz.

1.1.2 Dhrystone explanation

Dhrystone MIPS (DMIPS) allow you to compare processors that have different instruction sets. While two processors may have the same MIPS (how many instructions they can execute in a second - basically clock speed), it can take the two processors a different number of instructions to complete the same calculation or task because they have different instruction sets. So DMIPS measures not just instructions per second but gives an idea of how long overall it will take one processor to perform a task versus another, taking into account the different number and kinds of instructions the processors will have to use to complete the task. Because of this, DMIPS can't just be calculated from MIPS, you have to actually measure them using the Dhrystone benchmark testing. And this is also why DMIPS can be greater than 1 DMIPS/MHZ - due to a particular instruction set, 1 instruction can actually be getting more done than 1 instruction on another processor. For example 16 bit architecture is likely to be more efficient than an 8-bit one for some tasks.

1.1.3 FT90x

The FT90x is a complete System-On-Chip 32-bit RISC microcontroller for embedded applications featuring high performance and a full feature set for system connectivity enabling a high level of functional integration.

The full datasheet of the FT90x device is available to download from FTDI Chip.
Table

1.2 Comparison Table

Microcontroller / Core	Bus (bits)	DMIPS/MHz	Maximum frequency (MHz)
FT90x / FT32	32	3.1	100
RX600	32	1.65	100
AVR32	32	1.38	66
Pic 24	16	0.5	80
MSP430	16	0.3	24
MIPS M4K	32	1.65	80
Arm Cortex-A9	32	2.5	1000
Arm Cortex-A8	32	2	1000
Arm Cortex-A5	32	1.6	1000
Arm Cortex-M0	32	0.93	200
Arm Cortex-M4	32	1.25	250
Synopsys ARC EM6	32	1.52	420

Table 1.1 MCU Comparison Table

1.3 Comparison Graph

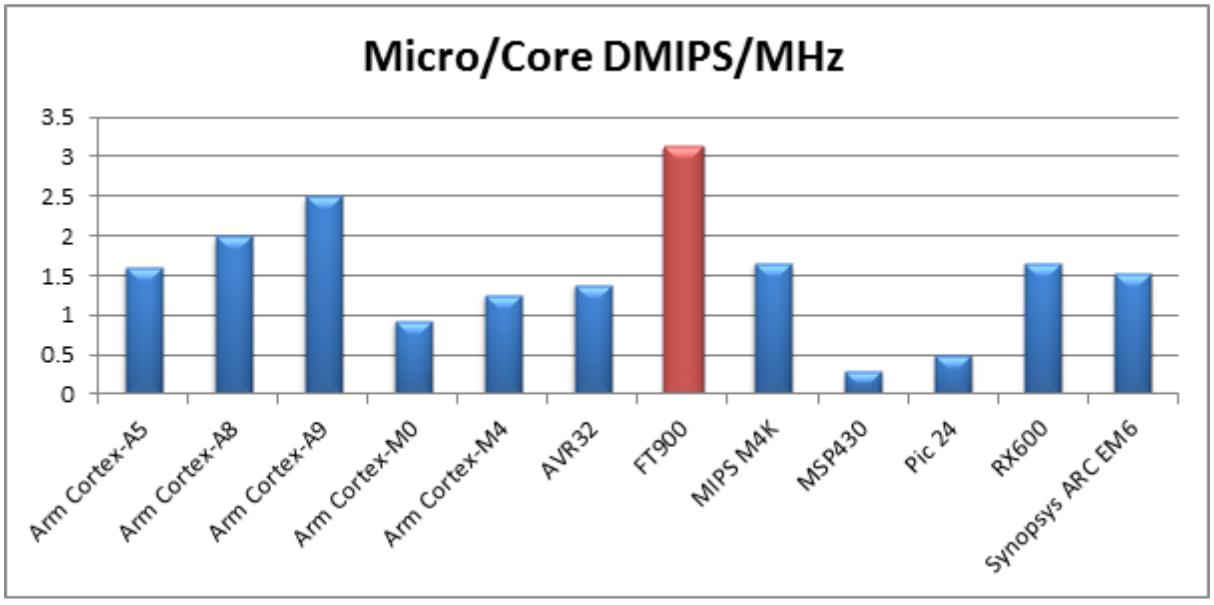

Figure 1.1 MCU Comparison Graph

1.4 Summary

Many commercial MCU's display the DMIPs/MHz as per the **Table 1.1** however, these figures are based on 0 wait state operation. Many Flash based MCU's usually max out 0WS at around 25MHz to 30MHz, so for operation beyond that you have to add 1, 2 or 3 wait states to run the MCU at its maximum stated operating frequency and this limitation is in general not widely publicised. Adding wait states, especially to a RISC CPU cripples the performance. FTDI's shadow RAM architecture overcomes this limitation by executing out of shadow RAM at true 0 WS up to the full operating core frequency of the MCU (100MHz), without compromise.

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Appendix A – References

Document References

DS_FT900Q – FT900 Datasheet

Acronyms and Abbreviations

Terms	Description
CPU	Central Processing Unit
DMIPS	Dhrystone Million Instructions Per Second
MCU	Microcontroller
RAM	Random Access Memory
RISC	Reduced Instruction Set Computing
WS	Wait States

Appendix B – List of Tables & Figures

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Figure 1.1 MCU Comparison Graph 3

Appendix C – Revision History

Document Title: AN_304 FT900 Microcontroller Benchmark
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Product Page: http://www.ftdichip.com/FTProducts.htm
Document Feedback: Send Feedback

Revision	Changes	Date
1.0	First release	2014-03-13
1.1	Update to performance figures	2015-07-13