



# Dhrystone Performance: 80C186EC processor vs Intel386(TM) EX processor

The Dhrystone benchmark is a synthetic benchmark which tests the integer performance of the system. This paper covers the results obtained from running the Dhrystone performance benchmark code (version 2.1 written in the C language) on both the 80C186EC processor and Intel386EX processor.

The Dhrystone program was slightly modified so that it would run in a non-DOS environment (malloc calls were replaced with variable definitions, and the integrated timers were used to compute the time spent executing the Dhrystone test). However, the section of the program where the actual Dhrystone measurement is made was left unchanged. The Dhrystone programs were compiled and linked using Microsoft Visual C/C++ version 7.0, with the compiler optimized for speed and inlining any suitable functions.

## Dhrystone Benchmark for the 80C186EC Processor

The Dhrystone performance benchmark test was run on the 80C186EC processor evaluation board. The Paradigm Locate and debug tools were used to load the Dhrystone test into memory, run the program, and view the results. The 80C186EC processor's internal processor clock ran at 16 MHz, and the code was loaded into SRAM memory operating with zero wait states. In order for the Dhrystone performance result to be valid, the Dhrystone code must be executed for at least two seconds. This condition was met by completing 200,000 runs through the section of code where the Dhrystone performance is measured. The Dhrystone is computed as follows:

$$\text{Dhrystones/second} = \text{Processor clock} * \text{Number of Runs/Execution time}$$

The resulting performance for the 80C186EC processor is 2402.4 Dhrystones/second.

## Dhrystone Benchmark for the Intel386EX processor - Real Mode

The Dhrystone performance benchmark test was run on the Intel386 processor evaluation board. The Concurrent Sciences, Inc. (CSI) locate\* and debug\* tools were used to load the Dhrystone code into memory, run the program, and view the results. The Intel386 processor ran with an internal processor clock of 25 MHz. Also, the Intel386 processor evaluation board was modified slightly so that the code could be placed into SRAM and operate with zero wait states. 200,000 runs were made through the section of code which measures the Dhrystone performance in order to meet the condition of having the Dhrystone code execute for over two seconds. Following the formula given above for computing the Dhrystone performance measure, the result for the Intel386 processor is 11312 Dhrystones/second.

## Results

In comparing the Dhrystone performance of the 80C186EC processor and Intel386 processor, the different speeds at which the two processors were running must be taken into account. **Linearly scaling the Dhrystone performance for the 80C186EC processor to reflect its performance at 25 MHz** results in the following Dhrystone measure:

$$2402.4 * (25/16) = 3753.7 \text{ Dhrystones/second}$$

Comparing this result with the Intel386 processor's Dhrystone performance, we obtain:

$$11312 / 3753.7 = 3.01$$

Therefore, the Intel386 processor's Dhrystone performance is about three times greater than that of the 80C186EC processor operating under similar conditions and **1.9 times** that of any 186 operating at 40Mhz. Note that the code was not optimized for the 32-bit internal core of the Intel386. Even when 16-bit code was used for the Intel386 benchmarks, it would require a 80C186 device running at **75 MHz** to achieve similar performance. Note also that significant performance increases can be achieved when using 32-bit optimized code for the Intel386.

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