

## AT91SAM9261 的 Dhrystone 测试

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文档版本	Rev. A				
文档摘要	详细描述 9261 的 Dhrystone 测试过程及测试得分，分 IAR EWARM,Keil MDK 几个平台				
关键词	AT91SAM9261、Dhrystone、MIPS、DMIPS、Cache、MMU、IAR EWARM、Keil MDK、GCC				
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## 更新历史

版本	时间	更新	作者
Rev. A	2009-11-24	初始创建	Robin

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# 1.概述

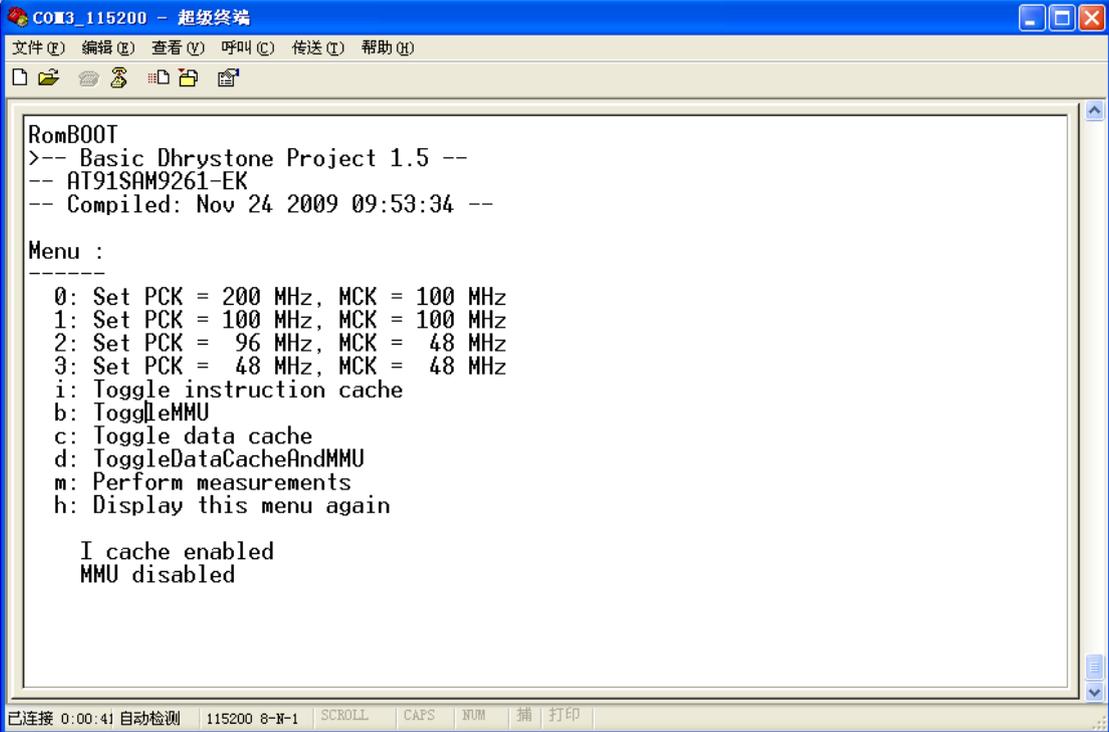
Dhrystone 是评价 CPU 处理能力的一个测试，如果有兴趣了解 Dhrystone 的来历，可以 google 搜索。

本文档以 ATMEL 提供的 1.5 版本的 AT91 Softpack 软件包里面的 dhrystone 代码为例进行测试，该软件包分 GNU, Keil MDK, IAR EWARM 三个平台，下面分别对这 3 个例子进行演示并记录测试分数，大家可以对比一下关闭和开启数据 cache、指令 cache、MMU 的分数差异，同时也可以了解一下同一编译器不同优化等级下的分数差异，当然也可以看到不同编译器之间的编译效率差异。

## 2. Keil MDK 4.0 平台的 Dhrystone 测试

### 2.1 测试过程及 log 信息

用 Keil MDK4.0 软件打开例子，默认不进行优化，直接运行：



```
ROMBOOT
>-- Basic Dhrystone Project 1.5 --
-- AT91SAM9261-EK
-- Compiled: Nov 24 2009 09:53:34 --

Menu :
-----
0: Set PCK = 200 MHz, MCK = 100 MHz
1: Set PCK = 100 MHz, MCK = 100 MHz
2: Set PCK = 96 MHz, MCK = 48 MHz
3: Set PCK = 48 MHz, MCK = 48 MHz
i: Toggle instruction cache
b: ToggleMMU
c: Toggle data cache
d: ToggleDataCacheAndMMU
m: Perform measurements
h: Display this menu again

I cache enabled
MMU disabled
```

禁用 I cache 和 MMU:

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
c: Toggle data cache
d: ToggleDataCacheAndMMU
m: Perform measurements
h: Display this menu again

Setting clock configuration #0 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 56700 dhrystones per second
- 56700 dhrystones per second
- 56700 dhrystones per second
- 56700 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 45175 dhrystones per second
- 45175 dhrystones per second
- 45175 dhrystones per second
- 45175 dhrystones per second
Finished
已连接 0:18:11 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 45175 dhrystones per second
- 45175 dhrystones per second
- 45175 dhrystones per second
- 45175 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 27250 dhrystones per second
- 27250 dhrystones per second
- 27250 dhrystones per second
- 27250 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 21825 dhrystones per second
- 21825 dhrystones per second
- 21825 dhrystones per second
- 21825 dhrystones per second
Finished
已连接 0:19:00 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

启用 I cache, 禁用 MMU:

```

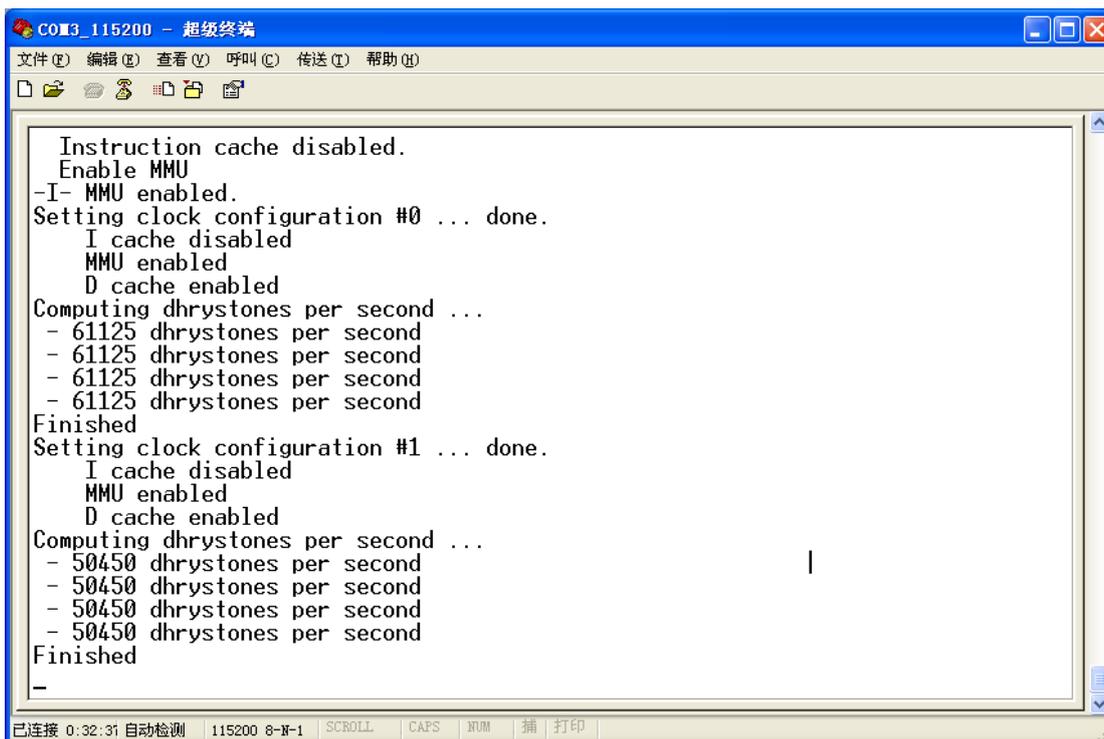
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
m: Perform measurements
h: Display this menu again

-I- I cache enabled.
Instruction cache enabled.
Setting clock configuration #0 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 88025 dhrystones per second
- 88025 dhrystones per second
- 88025 dhrystones per second
- 88025 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 58325 dhrystones per second
- 58325 dhrystones per second
- 58325 dhrystones per second
- 58325 dhrystones per second
Finished
-
已连接 0:21:14 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

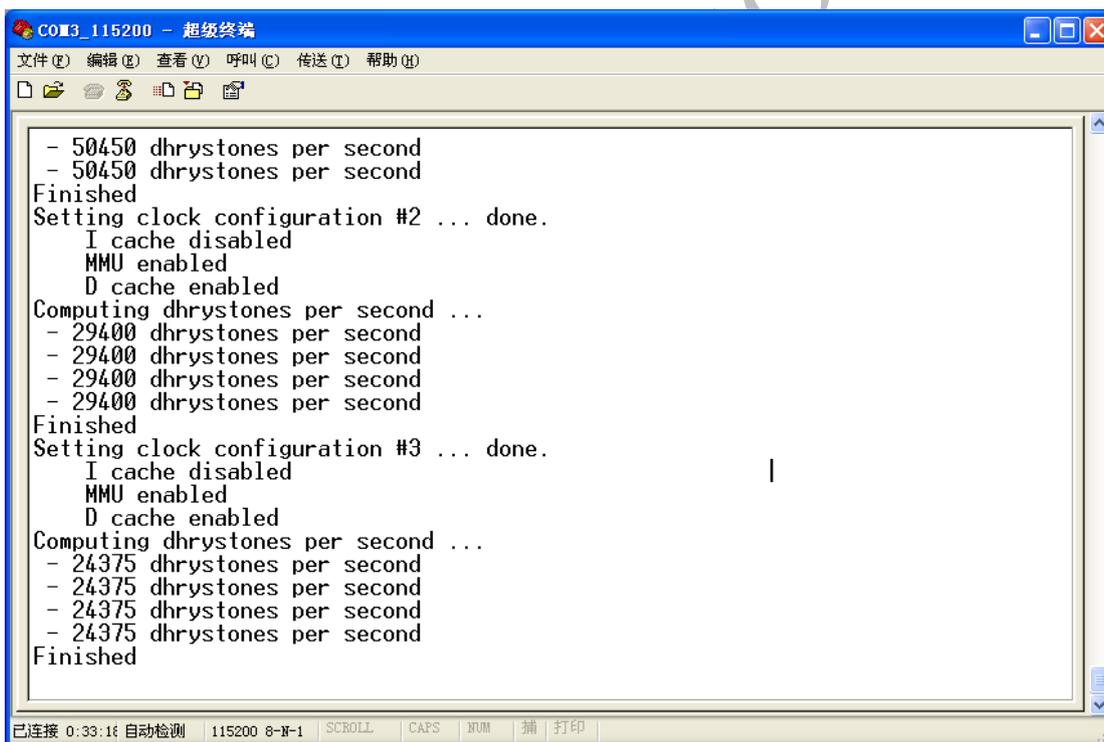
```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 58325 dhrystones per second
- 58325 dhrystones per second
- 58325 dhrystones per second
- 58325 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 42300 dhrystones per second
- 42300 dhrystones per second
- 42300 dhrystones per second
- 42300 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 28175 dhrystones per second
- 28175 dhrystones per second
- 28175 dhrystones per second
- 28175 dhrystones per second
Finished
已连接 0:22:06 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

禁用 I cache, 启用 MMU:



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Instruction cache disabled.
Enable MMU
-I- MMU enabled.
Setting clock configuration #0 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 61125 dhrystones per second
- 61125 dhrystones per second
- 61125 dhrystones per second
- 61125 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 50450 dhrystones per second
- 50450 dhrystones per second
- 50450 dhrystones per second
- 50450 dhrystones per second
Finished
-
已连接 0:32:31 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```



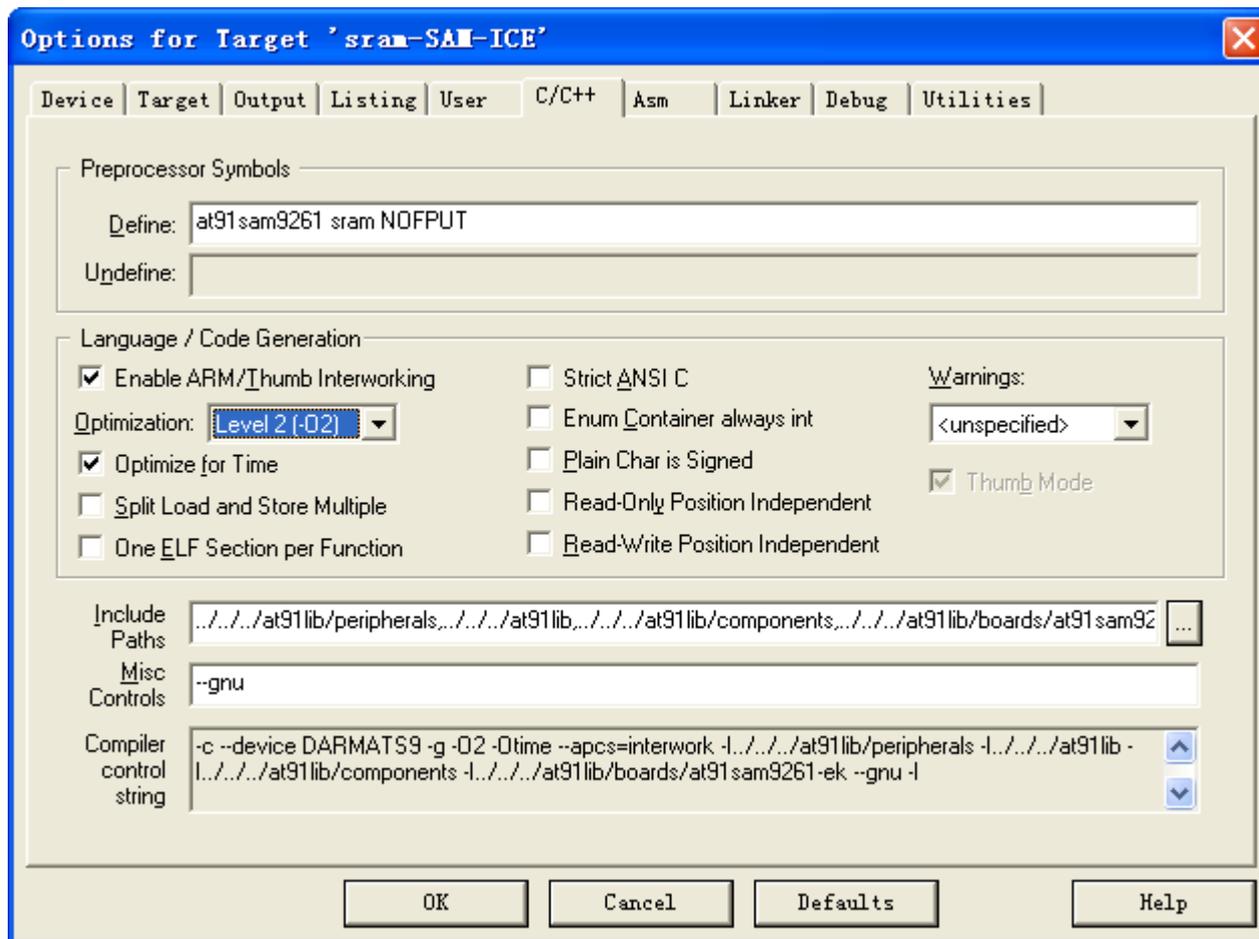
```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 50450 dhrystones per second
- 50450 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 29400 dhrystones per second
- 29400 dhrystones per second
- 29400 dhrystones per second
- 29400 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 24375 dhrystones per second
- 24375 dhrystones per second
- 24375 dhrystones per second
- 24375 dhrystones per second
Finished
已连接 0:33:14 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

启用 I cache, 启用 MMU, 启用 D cache:

```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Enable MMU and DCache
-I- MMU enabled.
-I- D cache enabled.
Setting clock configuration #0 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 223350 dhrystones per second
- 223350 dhrystones per second
- 223350 dhrystones per second
- 223350 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 111225 dhrystones per second
- 111225 dhrystones per second
- 111225 dhrystones per second
- 111225 dhrystones per second
Finished
-
已连接 0:34:51 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 111225 dhrystones per second
- 111225 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 107375 dhrystones per second
- 107375 dhrystones per second
- 107375 dhrystones per second
- 107375 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 53700 dhrystones per second
- 53700 dhrystones per second
- 53700 dhrystones per second
- 53700 dhrystones per second
Finished
已连接 0:35:44 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

接下来将优化等级设置为 2，并针对 Time 优化：



下面来看一下测试分数：

禁用 I cache 和 MMU:

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
c: Toggle data cache
d: ToggleDataCacheAndMMU
m: Perform measurements
h: Display this menu again

Setting clock configuration #0 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 115025 dhrystones per second
- 115025 dhrystones per second
- 115025 dhrystones per second
- 115025 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 92300 dhrystones per second
- 92300 dhrystones per second
- 92300 dhrystones per second
- 92300 dhrystones per second
Finished
-
已连接 0:02:24 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- 92300 dhrystones per second
- 92300 dhrystones per second
- 92300 dhrystones per second
- 92300 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 55300 dhrystones per second
- 55300 dhrystones per second
- 55300 dhrystones per second
- 55300 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 44575 dhrystones per second
- 44575 dhrystones per second
- 44575 dhrystones per second
- 44575 dhrystones per second
Finished
已连接 0:07:56 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

启用 I cache, 禁用 MMU:

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
m: Perform measurements
h: Display this menu again

-I- I cache enabled.
Instruction cache enabled.
Setting clock configuration #0 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 170200 dhrystones per second
- 170175 dhrystones per second
- 170175 dhrystones per second
- 170175 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 116650 dhrystones per second
- 116650 dhrystones per second
- 116650 dhrystones per second
- 116650 dhrystones per second
Finished
已连接 0:09:54 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

```

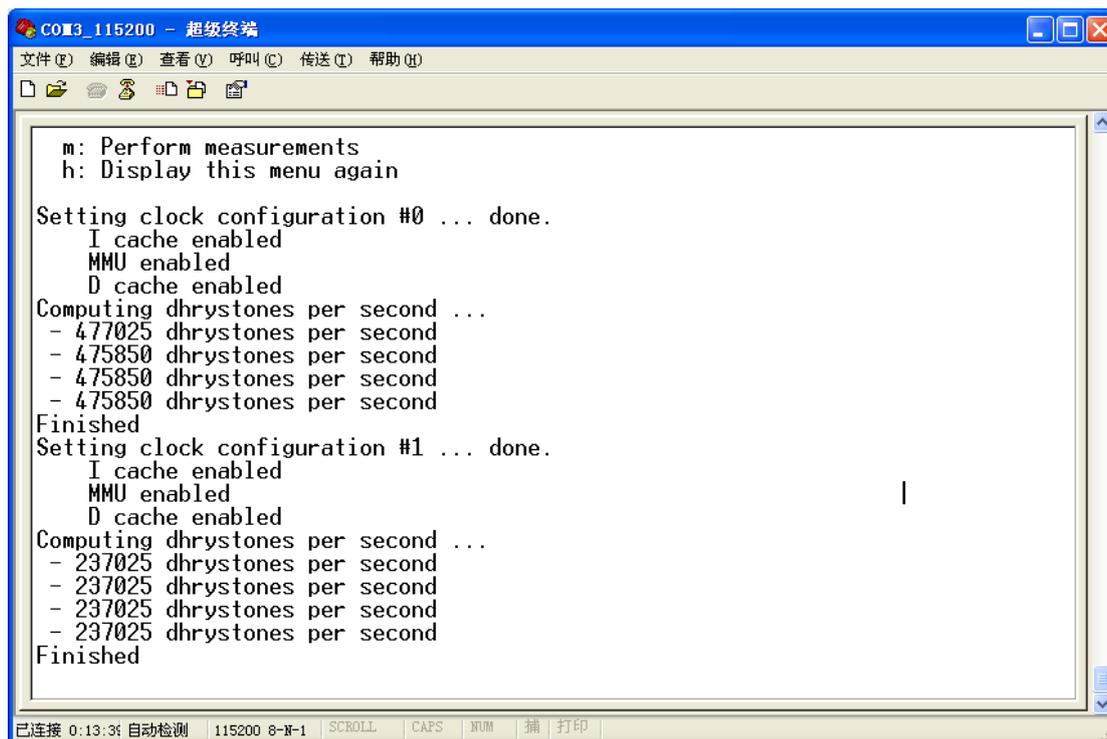
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 116650 dhrystones per second
- 116650 dhrystones per second
- 116650 dhrystones per second
- 116650 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 81825 dhrystones per second
- 81825 dhrystones per second
- 81825 dhrystones per second
- 81825 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 56325 dhrystones per second
- 56325 dhrystones per second
- 56325 dhrystones per second
- 56325 dhrystones per second
Finished
-
已连接 0:10:41 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

禁用 I cache, 启用 MMU:

```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Instruction cache disabled.
Enable MMU
-I- MMU enabled.
Setting clock configuration #0 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 128925 dhrystones per second
- 128925 dhrystones per second
- 128925 dhrystones per second
- 128925 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 109200 dhrystones per second
- 109200 dhrystones per second
- 109200 dhrystones per second
- 109200 dhrystones per second
Finished
-
已连接 0:11:41 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 109200 dhrystones per second
- 109200 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 62000 dhrystones per second
- 62000 dhrystones per second
- 62000 dhrystones per second
- 62000 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 52725 dhrystones per second
- 52725 dhrystones per second
- 52725 dhrystones per second
- 52725 dhrystones per second
Finished
已连接 0:12:15 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

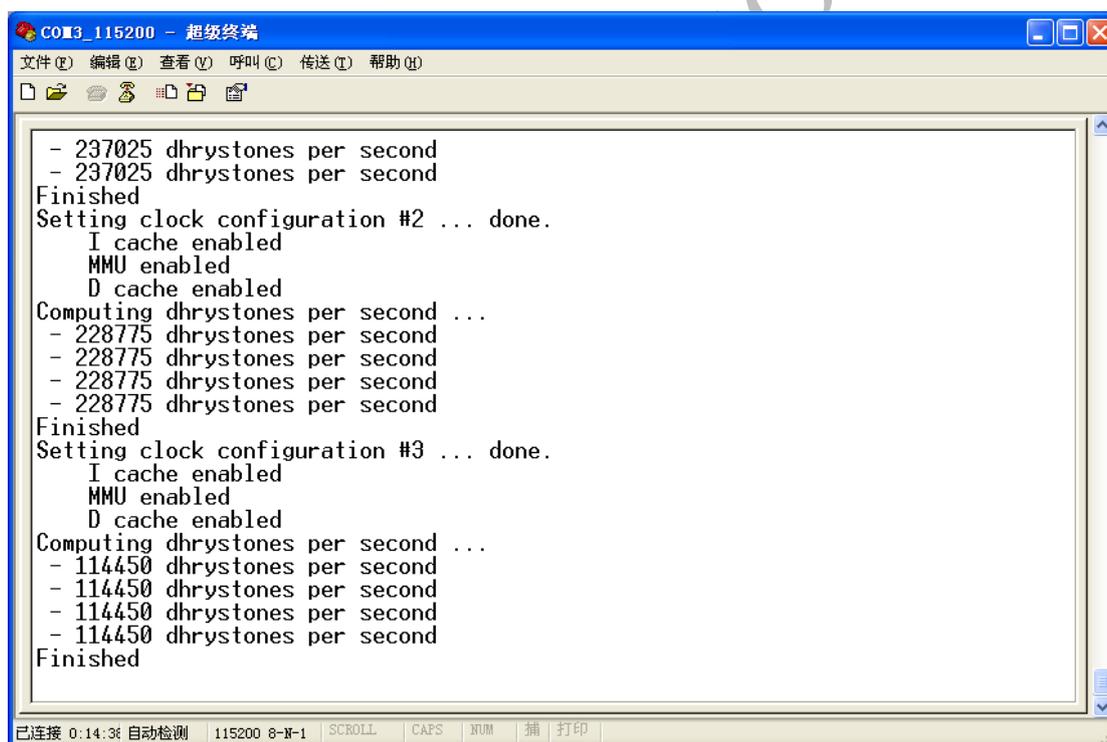
启用 I cache, 启用 MMU, 启用 D cache:



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
m: Perform measurements
h: Display this menu again

Setting clock configuration #0 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 477025 dhrystones per second
- 475850 dhrystones per second
- 475850 dhrystones per second
- 475850 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 237025 dhrystones per second
- 237025 dhrystones per second
- 237025 dhrystones per second
- 237025 dhrystones per second
Finished

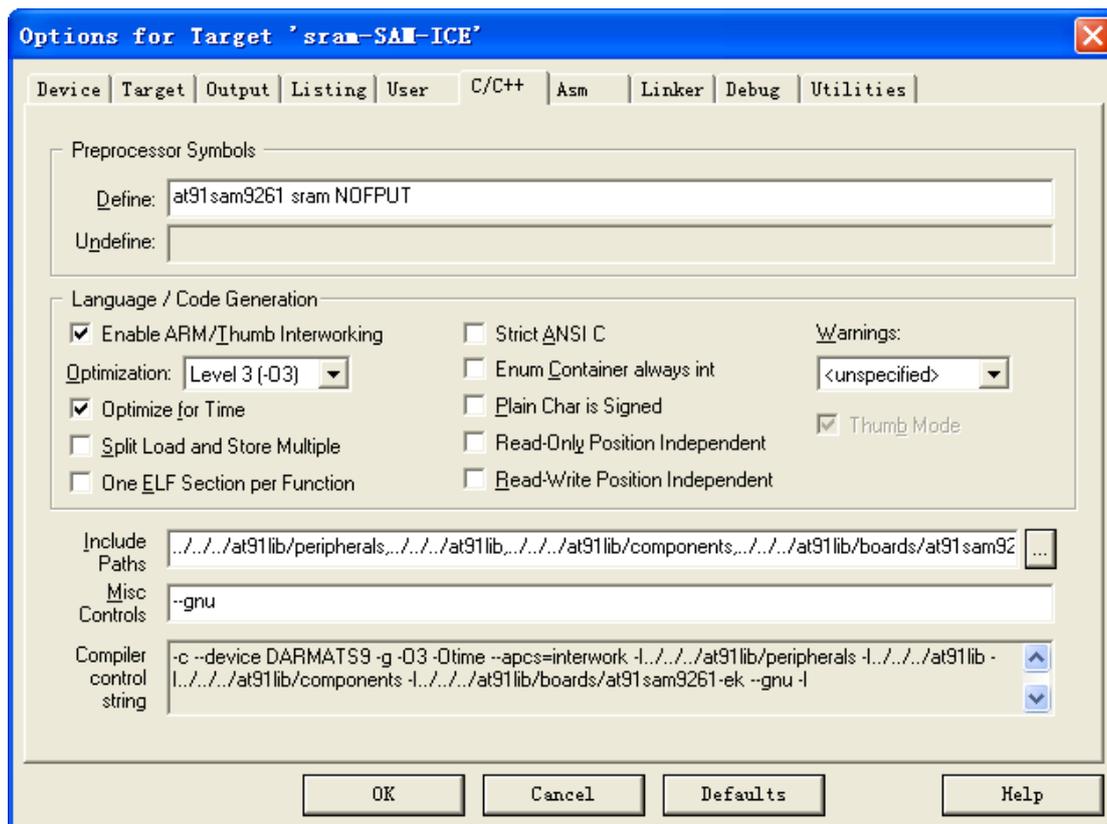
已连接 0:13:36 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- 237025 dhrystones per second
- 237025 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 228775 dhrystones per second
- 228775 dhrystones per second
- 228775 dhrystones per second
- 228775 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 114450 dhrystones per second
- 114450 dhrystones per second
- 114450 dhrystones per second
- 114450 dhrystones per second
Finished

已连接 0:14:36 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

接下来将优化等级开到最大，即 level 3，同样是 time 优化，看看结果：



禁用 I cache, 禁用 MMU:

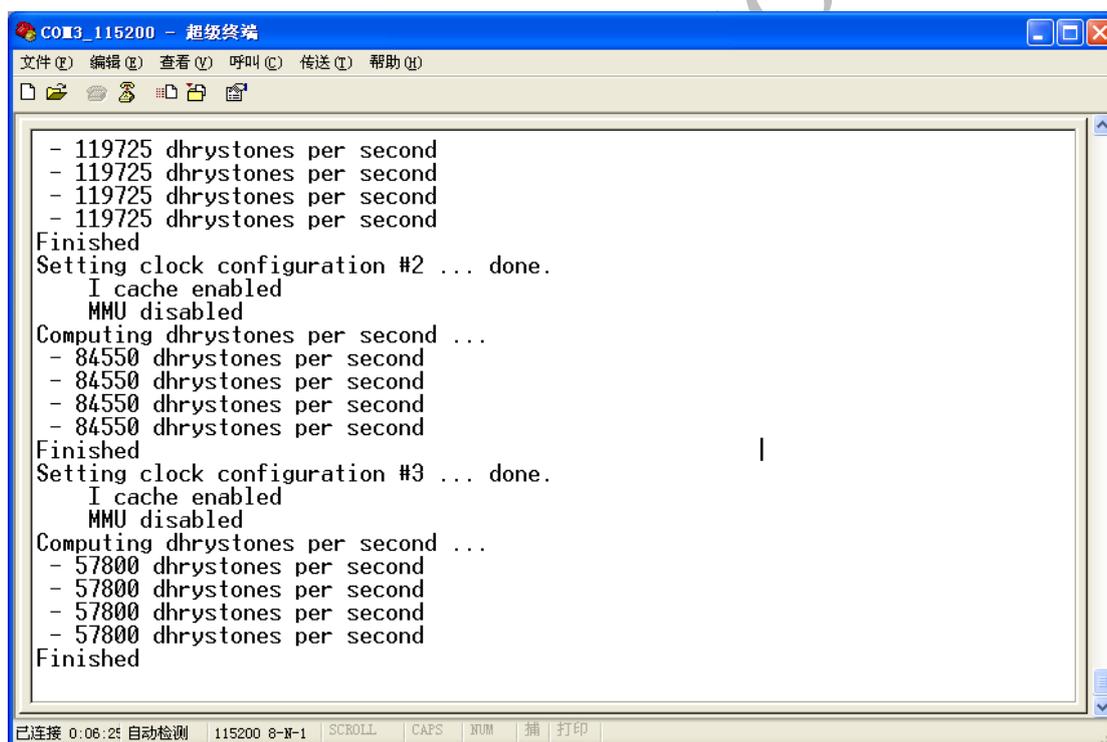
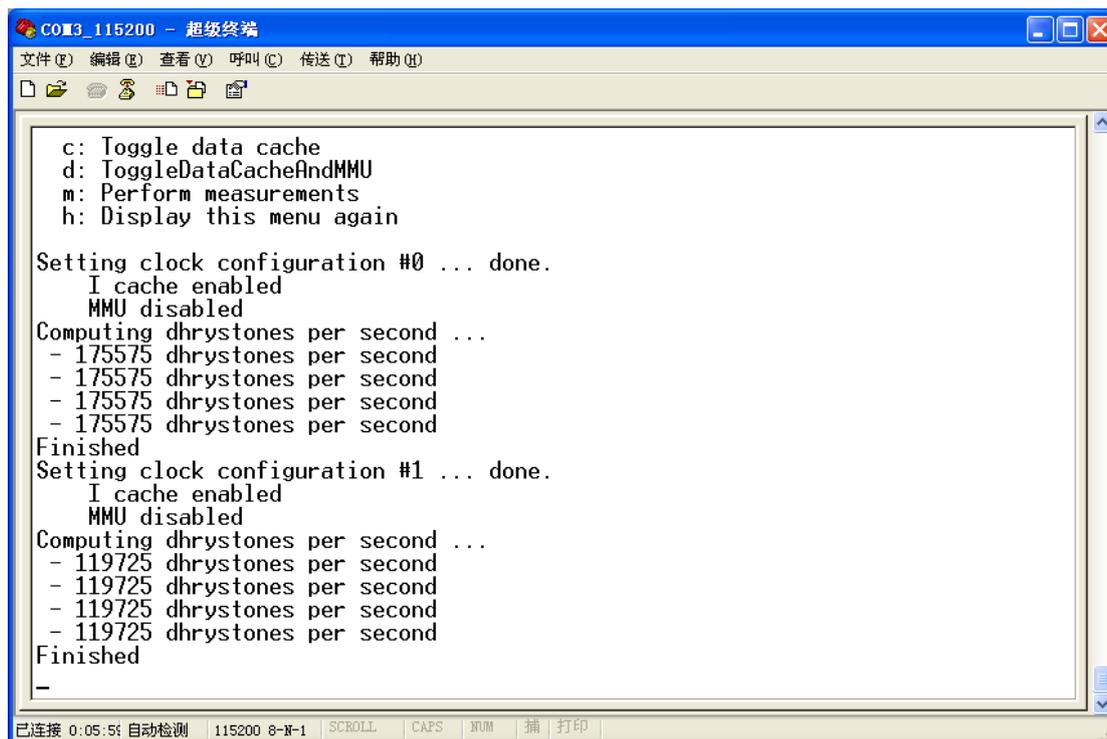
```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
I cache enabled
MMU disabled
-I- I cache disabled.
Instruction cache disabled.
Setting clock configuration #0 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 116200 dhrystones per second
- 116200 dhrystones per second
- 116200 dhrystones per second
- 116200 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 93325 dhrystones per second
- 93325 dhrystones per second
- 93325 dhrystones per second
- 93325 dhrystones per second
Finished
-
已连接 0:04:46 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

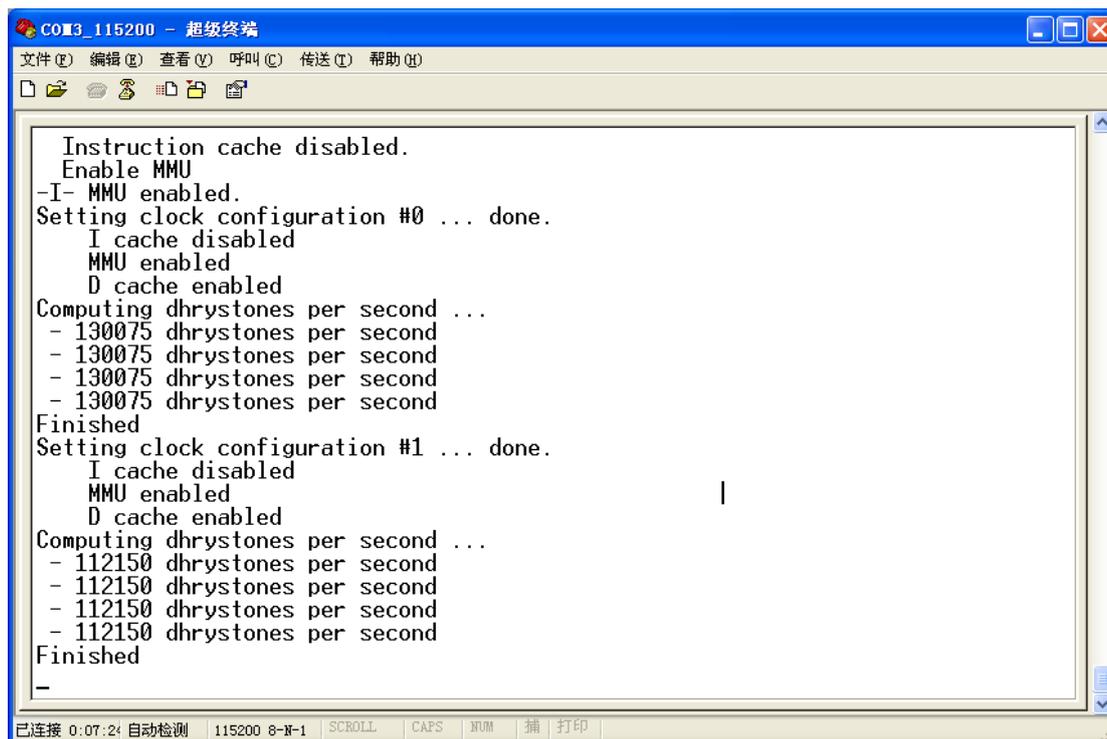
```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- 93325 dhrystones per second
- 93325 dhrystones per second
- 93325 dhrystones per second
- 93325 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 55875 dhrystones per second
- 55875 dhrystones per second
- 55875 dhrystones per second
- 55875 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 45075 dhrystones per second
- 45075 dhrystones per second
- 45075 dhrystones per second
- 45075 dhrystones per second
Finished
-
已连接 0:05:14 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

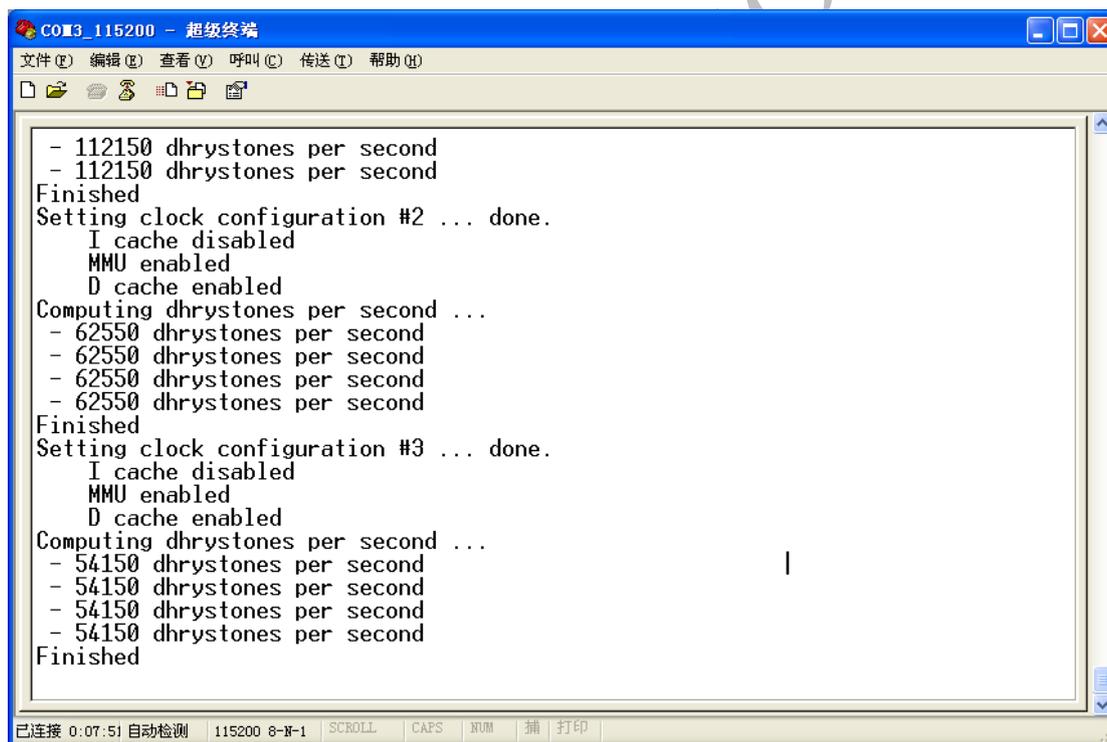
启用 I cache, 禁用 MMU:



禁用 I cache, 启用 MMU:



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Instruction cache disabled.
Enable MMU
-I- MMU enabled.
Setting clock configuration #0 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 130075 dhrystones per second
- 130075 dhrystones per second
- 130075 dhrystones per second
- 130075 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 112150 dhrystones per second
- 112150 dhrystones per second
- 112150 dhrystones per second
- 112150 dhrystones per second
Finished
-
已连接 0:07:24 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 112150 dhrystones per second
- 112150 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 62550 dhrystones per second
- 62550 dhrystones per second
- 62550 dhrystones per second
- 62550 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 54150 dhrystones per second
- 54150 dhrystones per second
- 54150 dhrystones per second
- 54150 dhrystones per second
Finished
已连接 0:07:51 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

启用 I/D cache, 启用 MMU:

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]

m: Perform measurements
h: Display this menu again

Setting clock configuration #0 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 486300 dhrystones per second
- 485175 dhrystones per second
- 485175 dhrystones per second
- 485175 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 241675 dhrystones per second
- 241675 dhrystones per second
- 241675 dhrystones per second
- 241675 dhrystones per second
Finished
已连接 0:09:14 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印

```

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]

- 241675 dhrystones per second
- 241675 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 233250 dhrystones per second
- 233250 dhrystones per second
- 233250 dhrystones per second
- 233250 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 116700 dhrystones per second
- 116700 dhrystones per second
- 116700 dhrystones per second
- 116700 dhrystones per second
Finished
已连接 0:09:42 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印

```

## 2.2 测试分数汇总及分析

### 2.2.1 不开优化的测试分数

优化等级 0	PCK=200 MCK=100	PCK=100 MCK=100	PCK=96 MCK=48	PCK=48 MCK=48
禁用 I cache 禁用 MMU	56700	45175	27250	21825
启用 I cache 禁用 MMU	88025	58325	42300	28175
禁用 I cache 启用 MMU	61125	50450	29400	24375
启用 I/D Cache 启用 MMU	223350	111225	107375	53700

### 2.2.2 优化等级为 2，并针对时间优化后的测试分数

优化等级 2 时间优先	PCK=200 MCK=100	PCK=100 MCK=100	PCK=96 MCK=48	PCK=48 MCK=48
禁用 I cache 禁用 MMU	115025	92300	55300	44575
启用 I cache 禁用 MMU	170200	116650	81825	56325
禁用 I cache 启用 MMU	128925	109200	62000	52725
启用 I/D Cache 启用 MMU	477025	237025	228775	114450

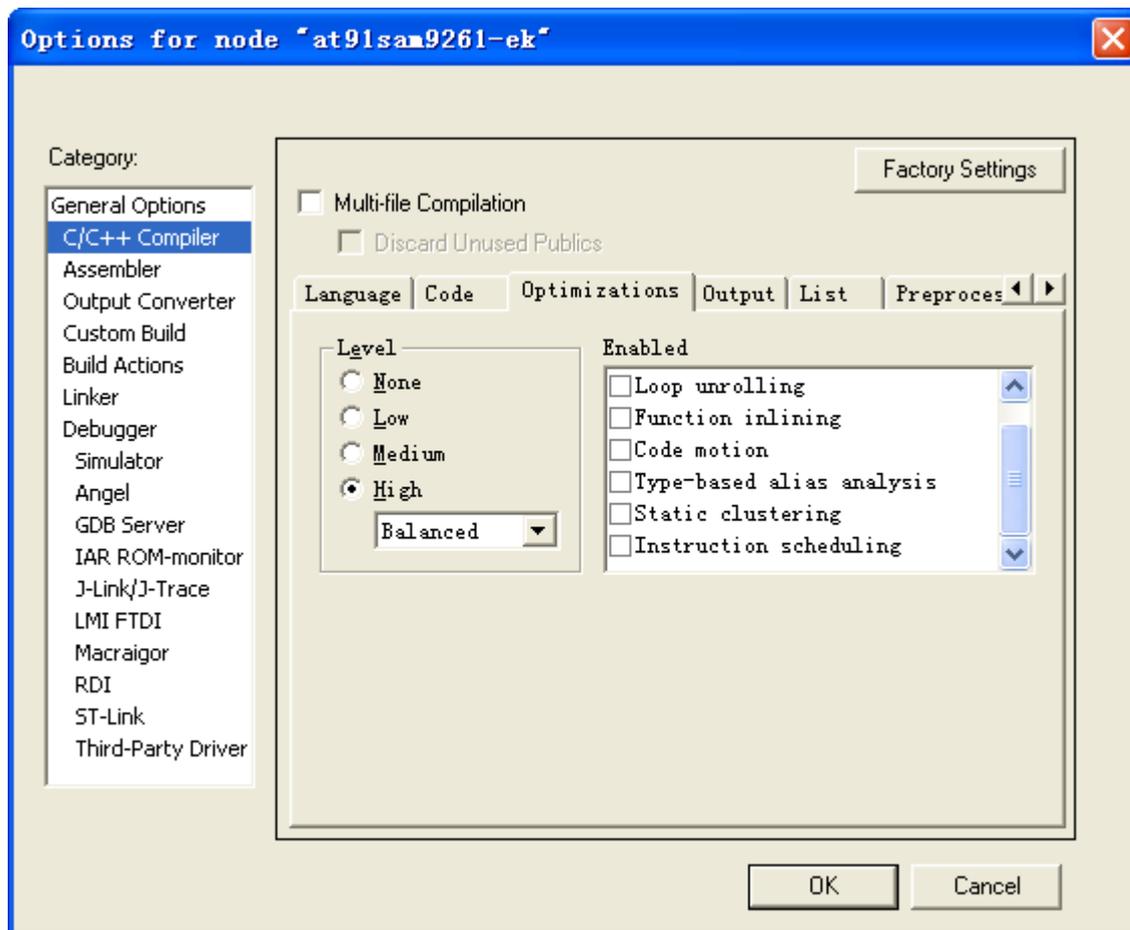
### 2.2.3 优化等级为 3，并针对时间优化后的测试分数

优化等级 2 时间优先	PCK=200 MCK=100	PCK=100 MCK=100	PCK=96 MCK=48	PCK=48 MCK=48
禁用 I cache 禁用 MMU	116200	93325	55875	45075
启用 I cache 禁用 MMU	175575	119725	84550	57800
禁用 I cache 启用 MMU	130075	112150	62550	54150
启用 I/D Cache 启用 MMU	486300	241675	233250	116700

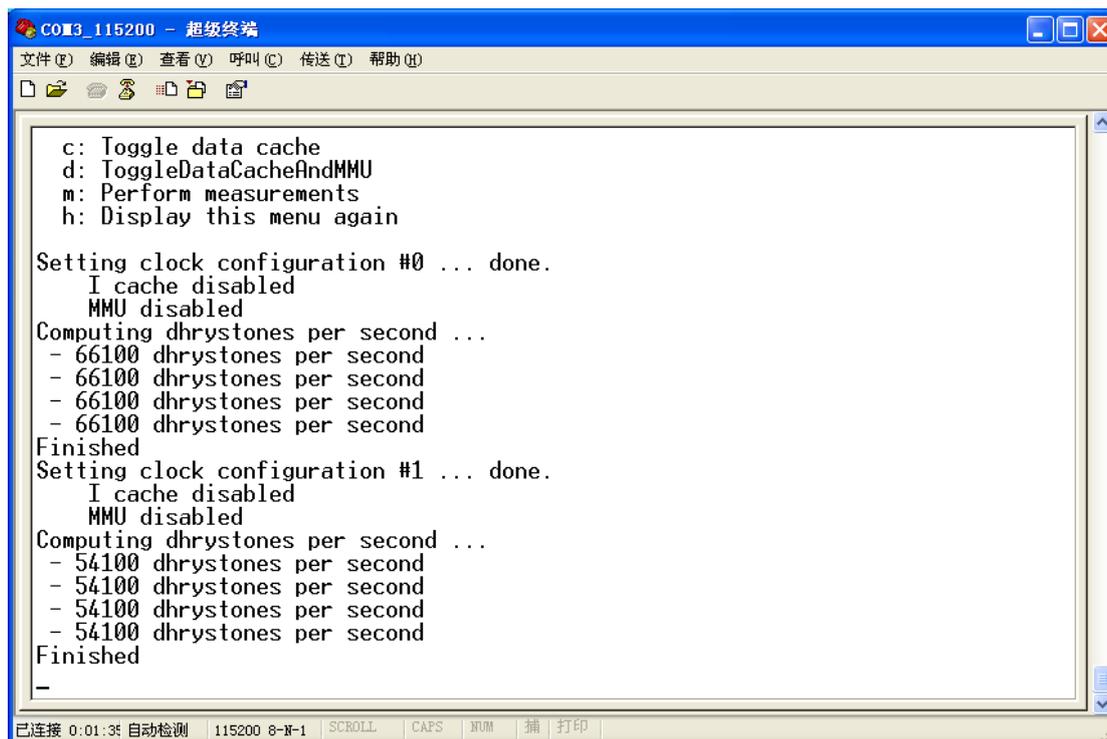
## 3. IAR EWARM 5.4 平台的 Dhrystone 测试

### 3.1 测试过程及 log 信息

用 IAR EWARM 5.4 打开 Dhrystone 工程，默认优化等级 High，选择 balanced，关闭右侧特殊优化：

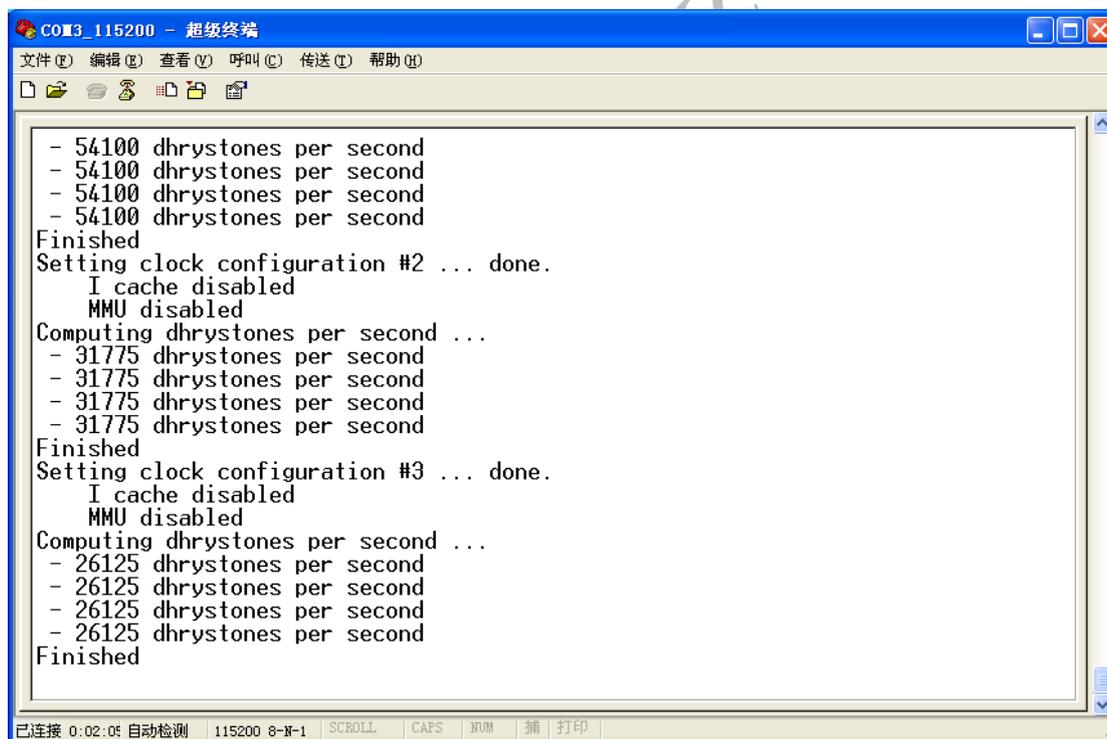


不开启 I cache, 不开启 MMU, 直接测试:



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
c: Toggle data cache
d: ToggleDataCacheAndMMU
m: Perform measurements
h: Display this menu again

Setting clock configuration #0 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 66100 dhrystones per second
- 66100 dhrystones per second
- 66100 dhrystones per second
- 66100 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 54100 dhrystones per second
- 54100 dhrystones per second
- 54100 dhrystones per second
- 54100 dhrystones per second
Finished
_
```



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- 54100 dhrystones per second
- 54100 dhrystones per second
- 54100 dhrystones per second
- 54100 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 31775 dhrystones per second
- 31775 dhrystones per second
- 31775 dhrystones per second
- 31775 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 26125 dhrystones per second
- 26125 dhrystones per second
- 26125 dhrystones per second
- 26125 dhrystones per second
Finished
```

启用 I cache, 不启用 MMU:

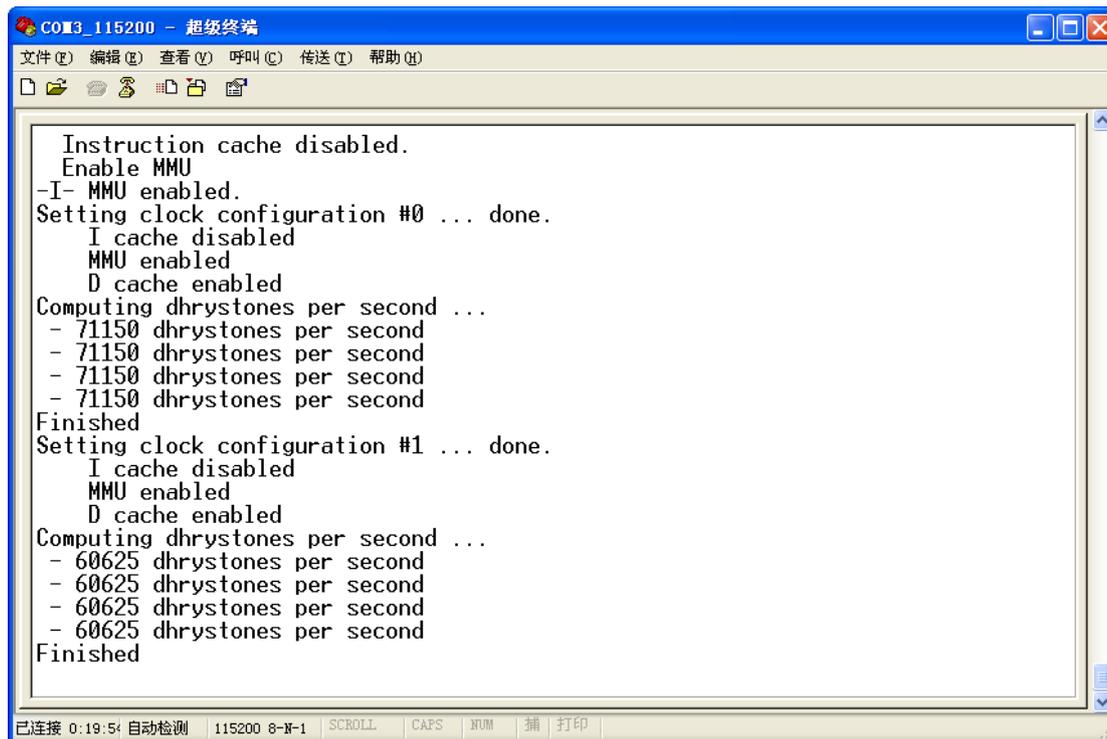
```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- I- I cache enabled.
  Instruction cache enabled.
  Disable MMU
- I- MMU disabled.
Setting clock configuration #0 ... done.
  I cache enabled
  MMU disabled
Computing dhrystones per second ...
- 100275 dhrystones per second
- 100275 dhrystones per second
- 100275 dhrystones per second
- 100275 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache enabled
  MMU disabled
Computing dhrystones per second ...
- 67600 dhrystones per second
- 67600 dhrystones per second
- 67600 dhrystones per second
- 67600 dhrystones per second
Finished
已连接 0:17:41 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

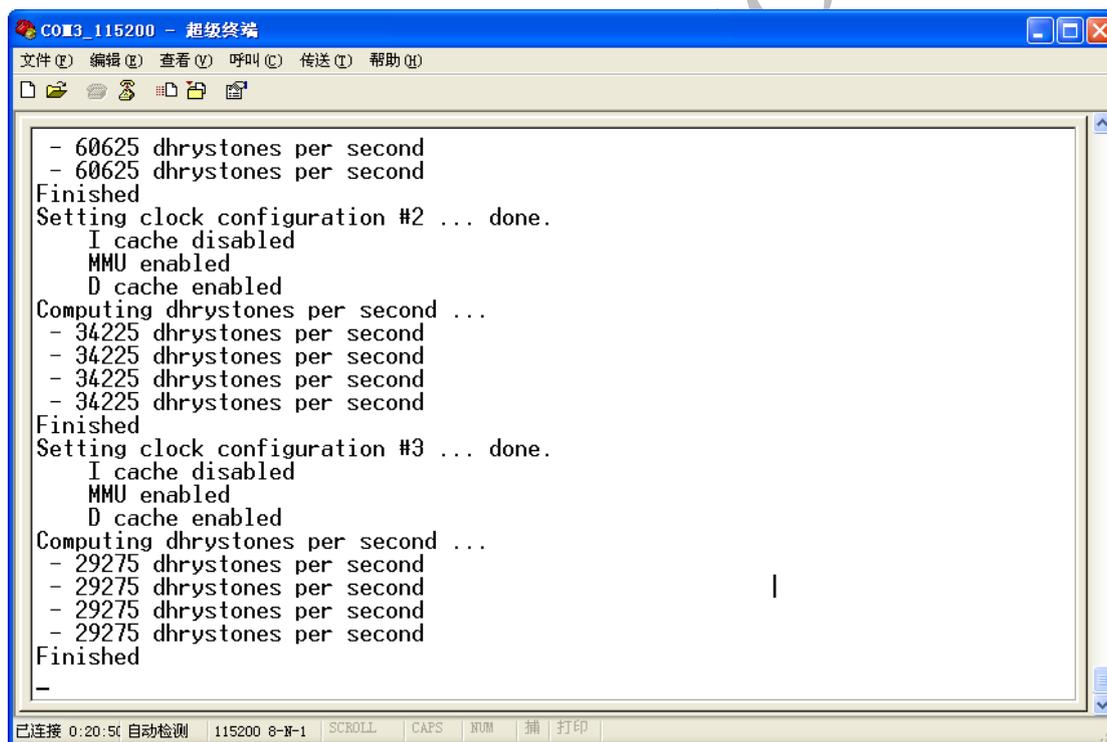
```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- 67600 dhrystones per second
- 67600 dhrystones per second
- 67600 dhrystones per second
- 67600 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache enabled
  MMU disabled
Computing dhrystones per second ...
- 48225 dhrystones per second
- 48225 dhrystones per second
- 48225 dhrystones per second
- 48225 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache enabled
  MMU disabled
Computing dhrystones per second ...
- 32650 dhrystones per second
- 32650 dhrystones per second
- 32650 dhrystones per second
- 32650 dhrystones per second
Finished
-
已连接 0:18:31 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

禁用 I cache, 启用 MMU:



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Instruction cache disabled.
Enable MMU
-I- MMU enabled.
Setting clock configuration #0 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 71150 dhrystones per second
- 71150 dhrystones per second
- 71150 dhrystones per second
- 71150 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 60625 dhrystones per second
- 60625 dhrystones per second
- 60625 dhrystones per second
- 60625 dhrystones per second
Finished
已连接 0:19:54 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 60625 dhrystones per second
- 60625 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 34225 dhrystones per second
- 34225 dhrystones per second
- 34225 dhrystones per second
- 34225 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 29275 dhrystones per second
- 29275 dhrystones per second
- 29275 dhrystones per second
- 29275 dhrystones per second
Finished
-
已连接 0:20:56 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

启用指令 cache, 启用 MMU, 启用数据 cache:

```

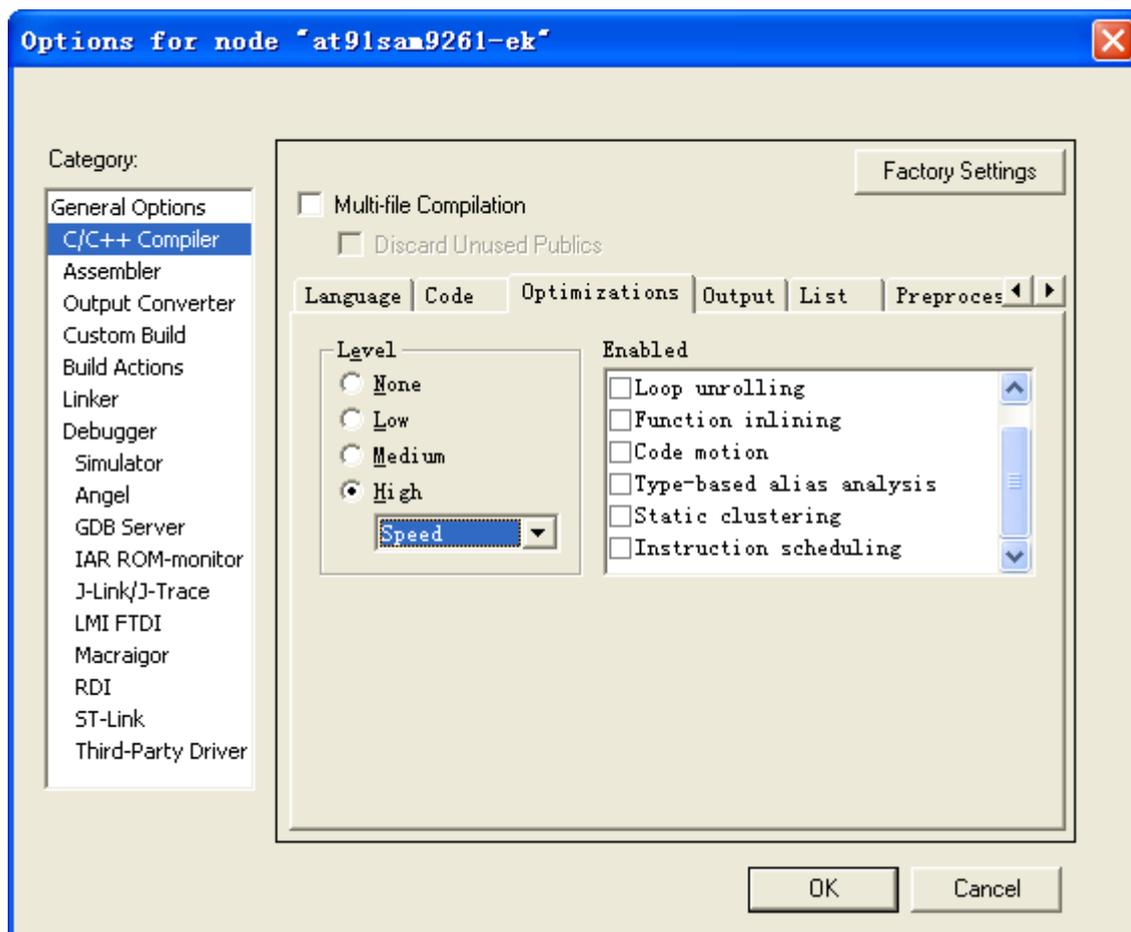
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
m: Perform measurements
h: Display this menu again

Setting clock configuration #0 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 264200 dhrystones per second
- 264200 dhrystones per second
- 264200 dhrystones per second
- 264200 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 131575 dhrystones per second
- 131575 dhrystones per second
- 131575 dhrystones per second
- 131575 dhrystones per second
Finished
已连接 0:25:51 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 131575 dhrystones per second
- 131575 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 127025 dhrystones per second
- 127025 dhrystones per second
- 127025 dhrystones per second
- 127025 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 63525 dhrystones per second
- 63525 dhrystones per second
- 63525 dhrystones per second
- 63525 dhrystones per second
Finished
-
已连接 0:26:24 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

优化等级选择 High，且 Speed 优先，不勾选右侧优化选项：



禁用 I cache, 禁用 MMU:

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
c: Toggle data cache
d: ToggleDataCacheAndMMU
m: Perform measurements
h: Display this menu again

Setting clock configuration #0 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 71750 dhrystones per second
- 71750 dhrystones per second
- 71750 dhrystones per second
- 71750 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 57950 dhrystones per second
- 57950 dhrystones per second
- 57950 dhrystones per second
- 57950 dhrystones per second
Finished
-
已连接 1:01:24 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 57950 dhrystones per second
- 57950 dhrystones per second
- 57950 dhrystones per second
- 57950 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 34500 dhrystones per second
- 34500 dhrystones per second
- 34500 dhrystones per second
- 34500 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache disabled
MMU disabled
Computing dhrystones per second ...
- 28000 dhrystones per second
- 28000 dhrystones per second
- 28000 dhrystones per second
- 28000 dhrystones per second
Finished
已连接 1:01:54 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

启用 I cache, 禁用 MMU:

```

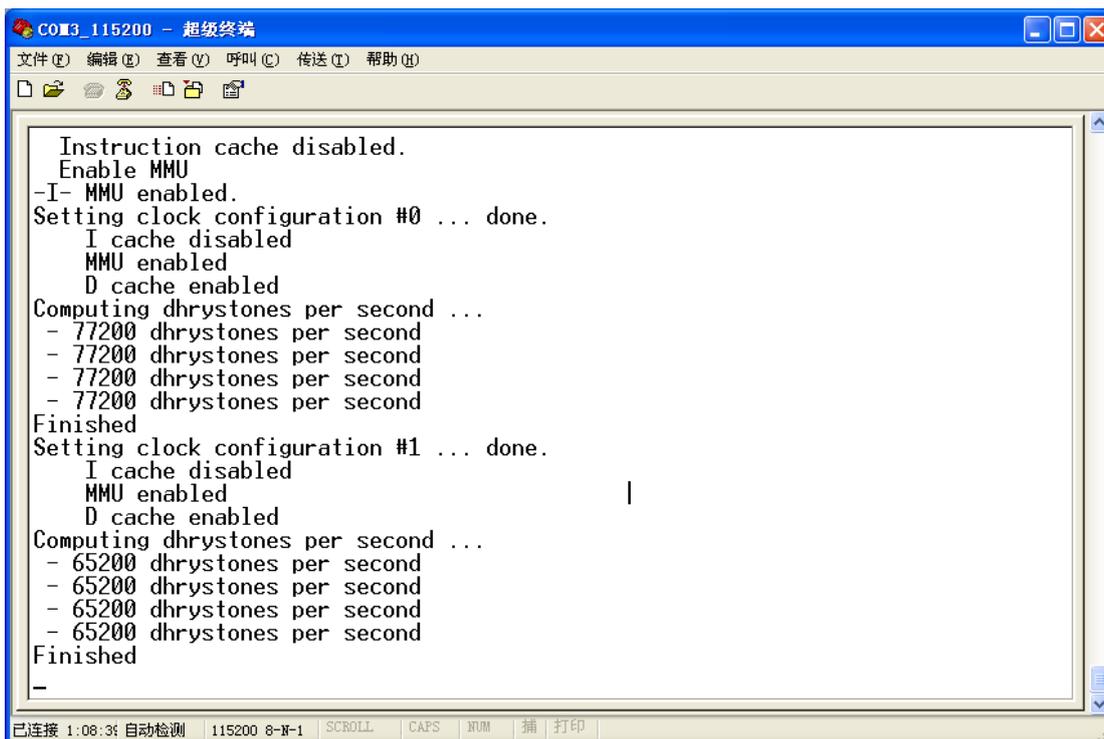
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
m: Perform measurements
h: Display this menu again

-I- I cache enabled.
Instruction cache enabled.
Setting clock configuration #0 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 106475 dhrystones per second
- 106575 dhrystones per second
- 106350 dhrystones per second
- 106350 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 72200 dhrystones per second
- 72200 dhrystones per second
- 72200 dhrystones per second
- 72200 dhrystones per second
Finished
-
已连接 1:03:14 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

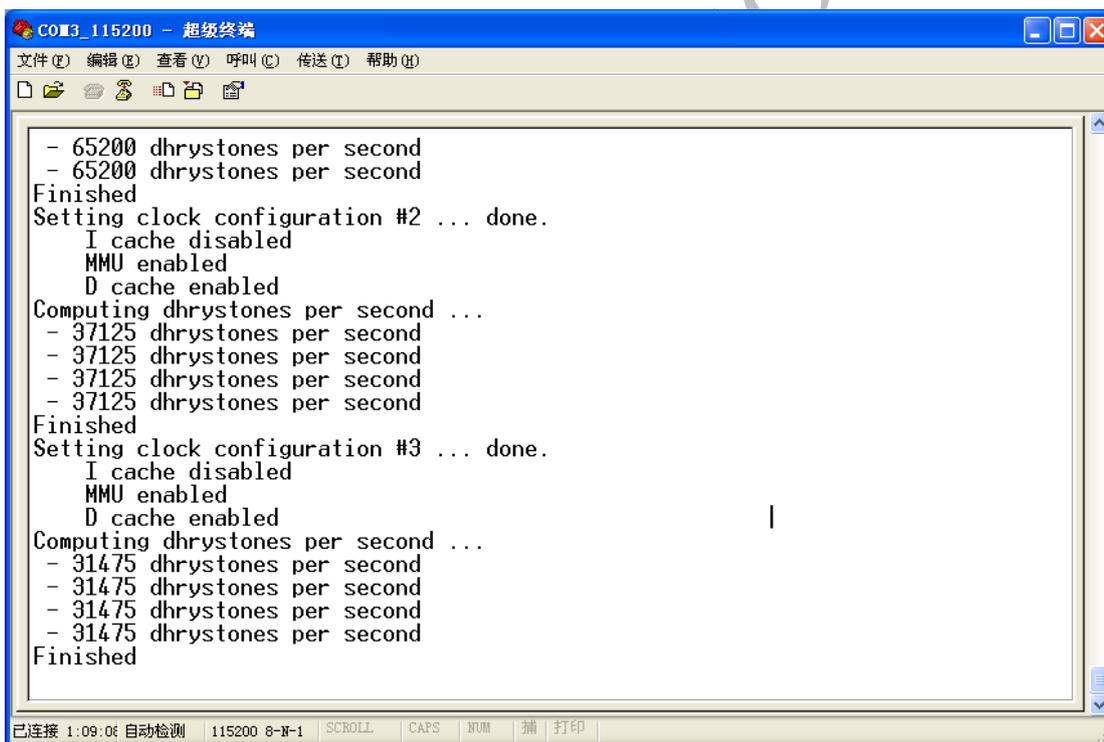
```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 72200 dhrystones per second
- 72200 dhrystones per second
- 72200 dhrystones per second
- 72200 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 51150 dhrystones per second
- 51150 dhrystones per second
- 51150 dhrystones per second
- 51150 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 34850 dhrystones per second
- 34850 dhrystones per second
- 34850 dhrystones per second
- 34850 dhrystones per second
Finished
已连接 1:03:34 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

禁用 I cache, 启用 MMU:



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Instruction cache disabled.
Enable MMU
-I- MMU enabled.
Setting clock configuration #0 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 77200 dhrystones per second
- 77200 dhrystones per second
- 77200 dhrystones per second
- 77200 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 65200 dhrystones per second
- 65200 dhrystones per second
- 65200 dhrystones per second
- 65200 dhrystones per second
Finished
-
已连接 1:08:34 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 65200 dhrystones per second
- 65200 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 37125 dhrystones per second
- 37125 dhrystones per second
- 37125 dhrystones per second
- 37125 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 31475 dhrystones per second
- 31475 dhrystones per second
- 31475 dhrystones per second
- 31475 dhrystones per second
Finished
已连接 1:09:06 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

启用 I cache, 启用 MMU, 启用 D cache:

```

COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]

m: Perform measurements
h: Display this menu again

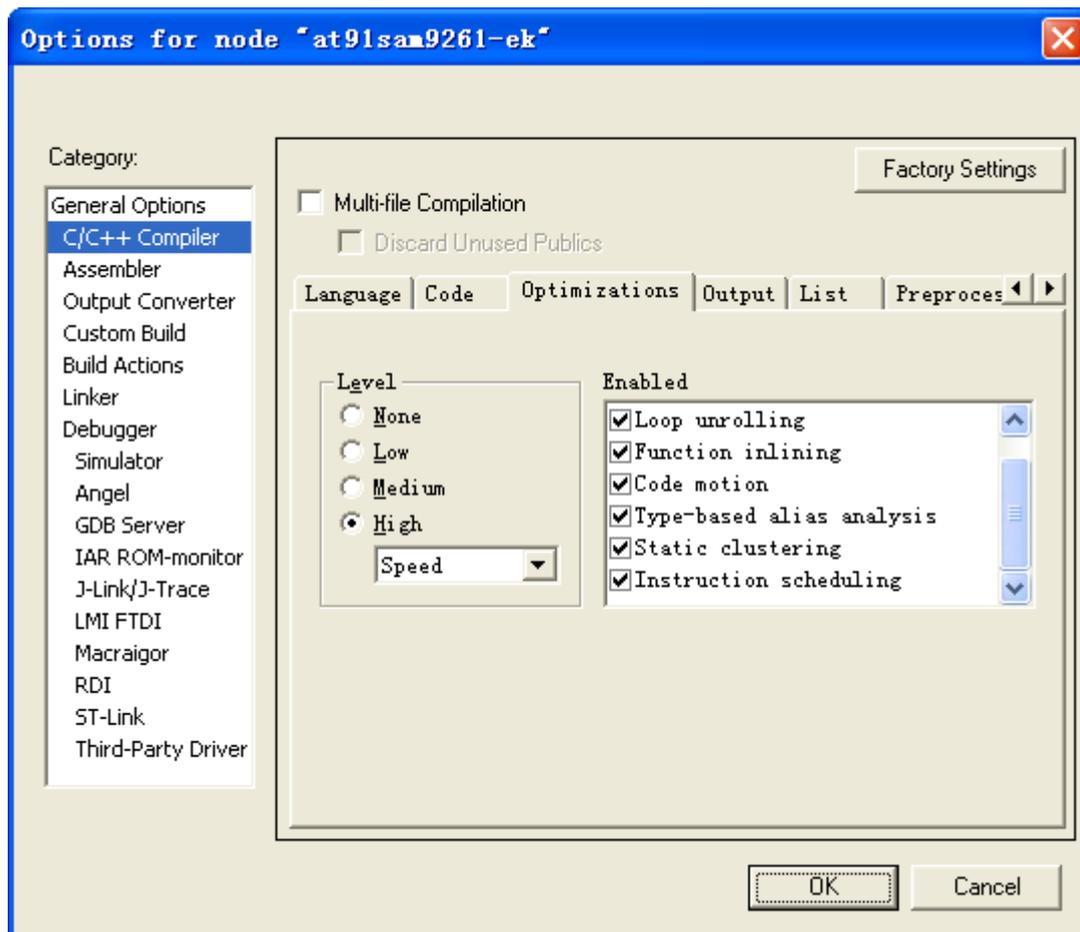
Setting clock configuration #0 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 290775 dhrystones per second
- 289925 dhrystones per second
- 289925 dhrystones per second
- 289925 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 144400 dhrystones per second
- 144400 dhrystones per second
- 144400 dhrystones per second
- 144400 dhrystones per second
Finished
-
已连接 1:10:24 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

```

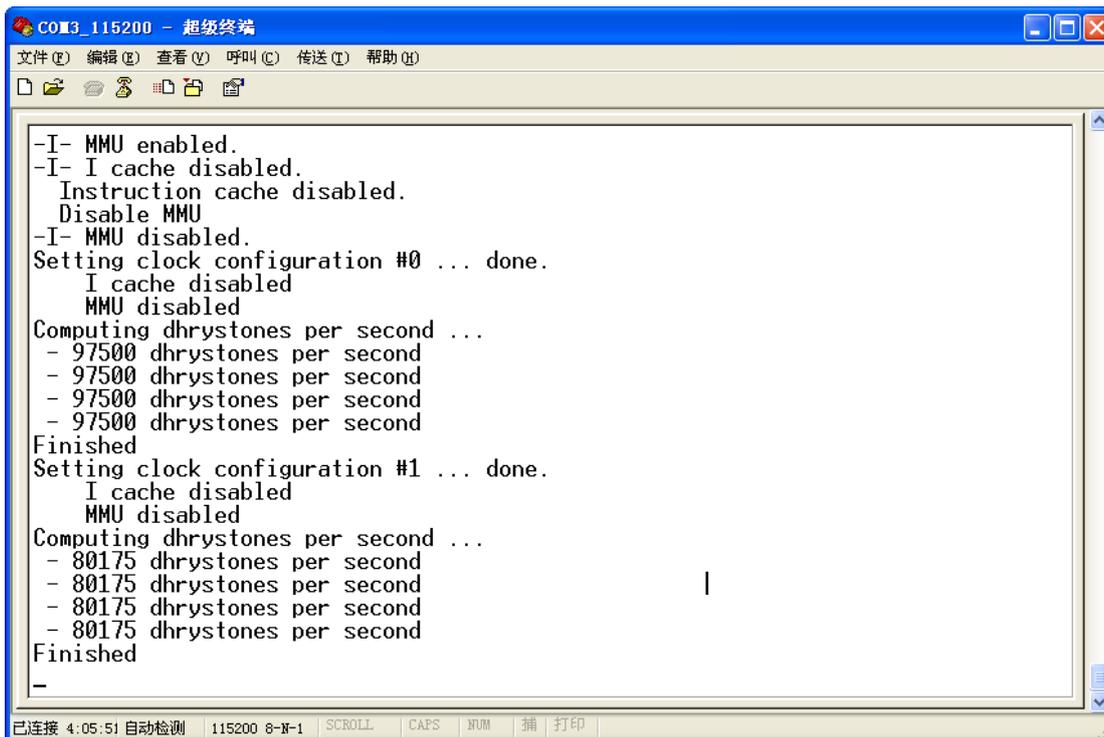
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]

- 144400 dhrystones per second
- 144400 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 139375 dhrystones per second
- 139375 dhrystones per second
- 139375 dhrystones per second
- 139375 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 69725 dhrystones per second
- 69725 dhrystones per second
- 69725 dhrystones per second
- 69725 dhrystones per second
Finished
已连接 1:13:41 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
    
```

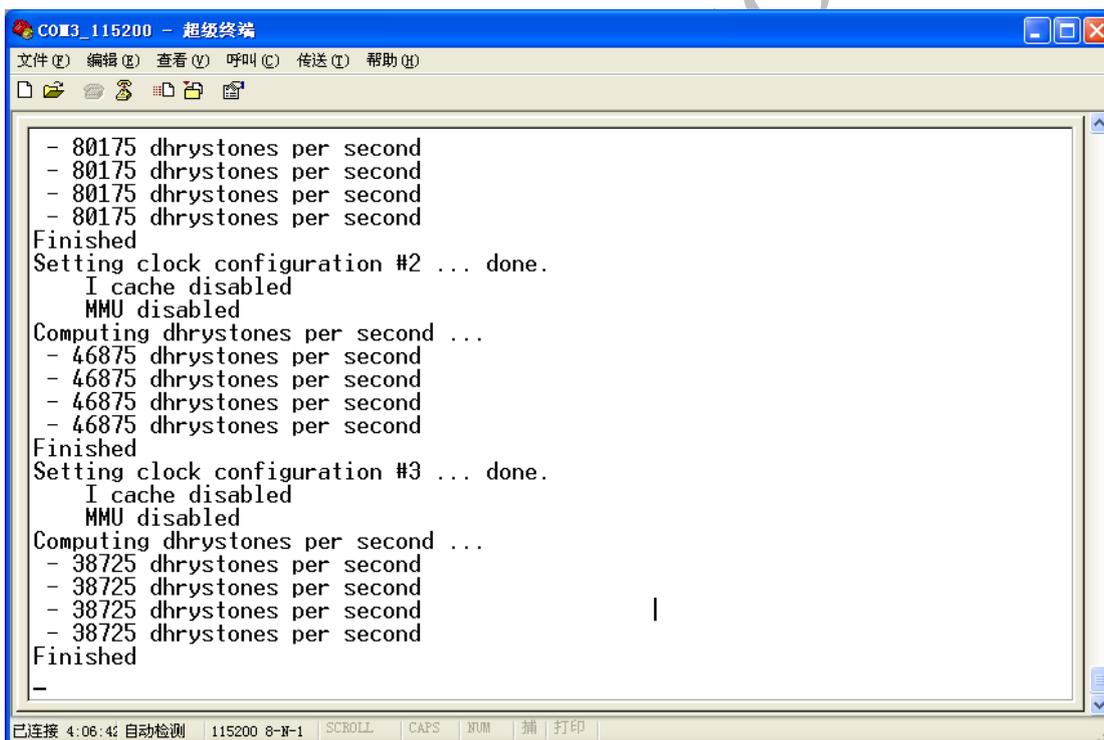
优化等级选择 High，且 Speed 优先，并勾选右侧全部优化选项：



禁用 I cache, 禁用 MMU:

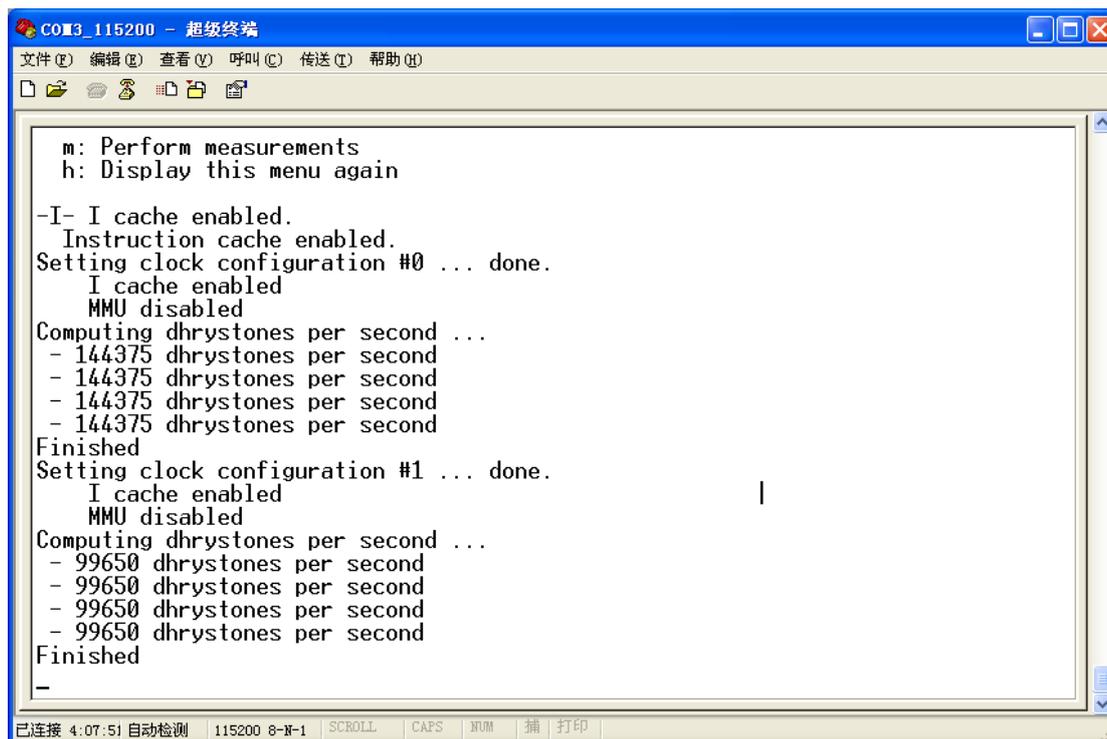


```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- I- MMU enabled.
- I- I cache disabled.
  Instruction cache disabled.
  Disable MMU
- I- MMU disabled.
Setting clock configuration #0 ... done.
  I cache disabled
  MMU disabled
Computing dhrystones per second ...
- 97500 dhrystones per second
- 97500 dhrystones per second
- 97500 dhrystones per second
- 97500 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache disabled
  MMU disabled
Computing dhrystones per second ...
- 80175 dhrystones per second
- 80175 dhrystones per second
- 80175 dhrystones per second
- 80175 dhrystones per second
Finished
-
```



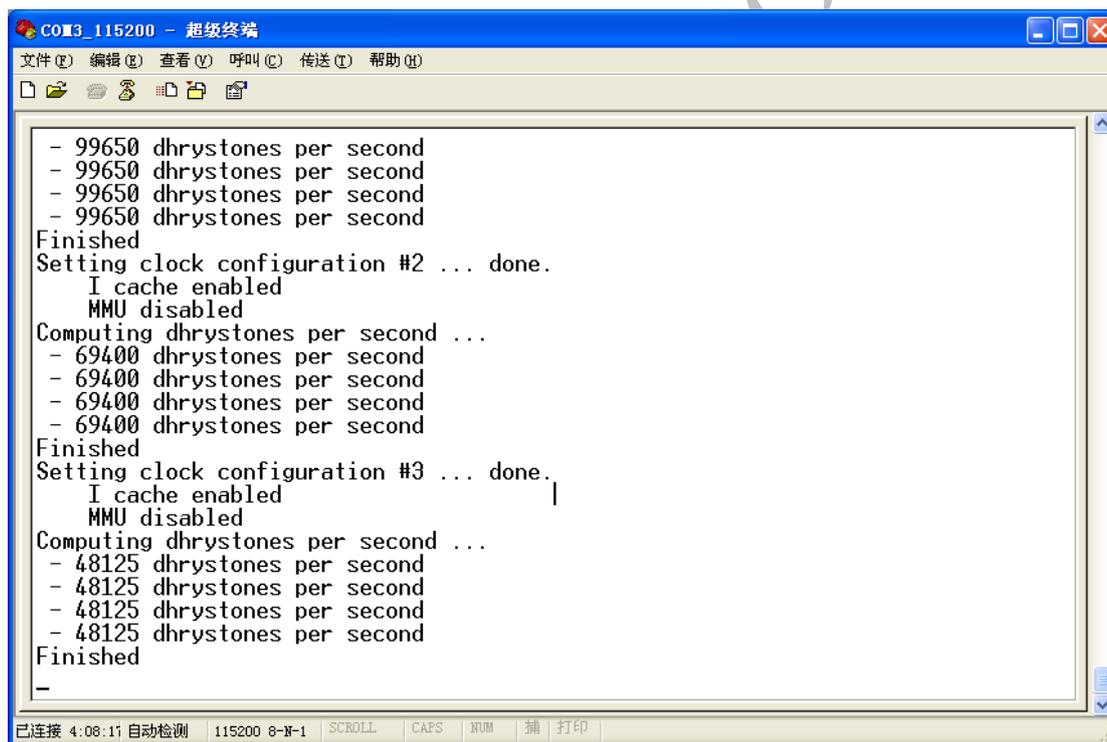
```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- 80175 dhrystones per second
- 80175 dhrystones per second
- 80175 dhrystones per second
- 80175 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache disabled
  MMU disabled
Computing dhrystones per second ...
- 46875 dhrystones per second
- 46875 dhrystones per second
- 46875 dhrystones per second
- 46875 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache disabled
  MMU disabled
Computing dhrystones per second ...
- 38725 dhrystones per second
- 38725 dhrystones per second
- 38725 dhrystones per second
- 38725 dhrystones per second
Finished
-
```

启用 I cache, 禁用 MMU:



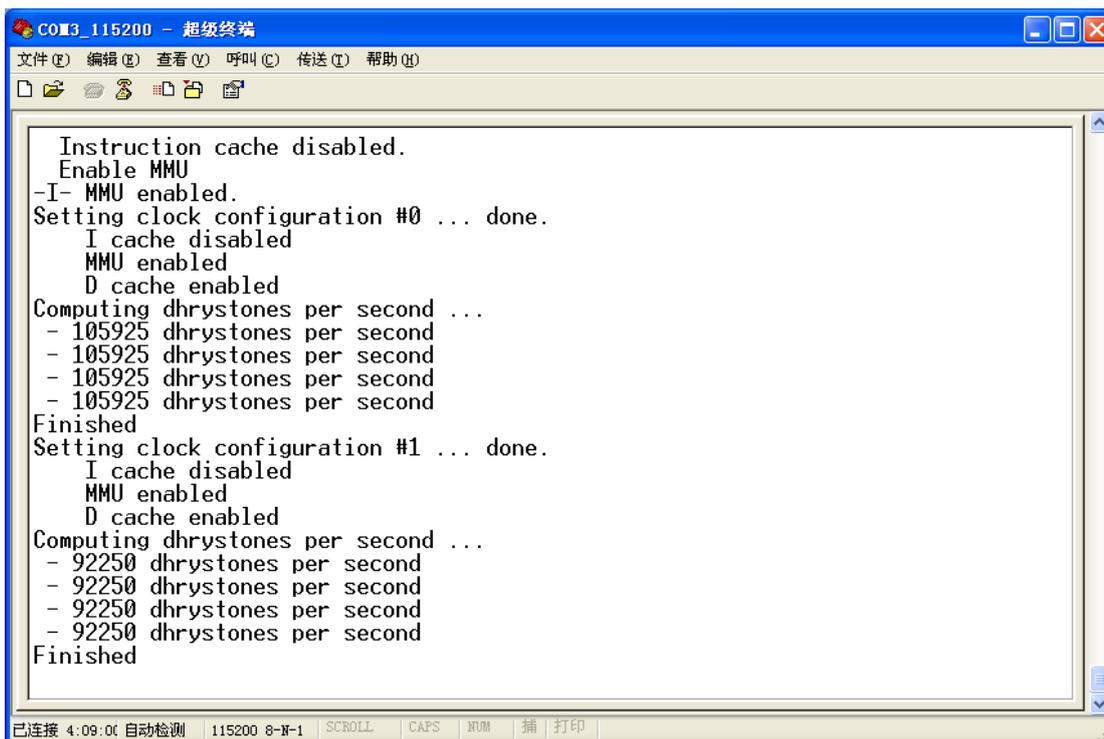
```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
m: Perform measurements
h: Display this menu again

-I- I cache enabled.
Instruction cache enabled.
Setting clock configuration #0 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 144375 dhrystones per second
- 144375 dhrystones per second
- 144375 dhrystones per second
- 144375 dhrystones per second
Finished
Setting clock configuration #1 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 99650 dhrystones per second
- 99650 dhrystones per second
- 99650 dhrystones per second
- 99650 dhrystones per second
Finished
-
已连接 4:07:51 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

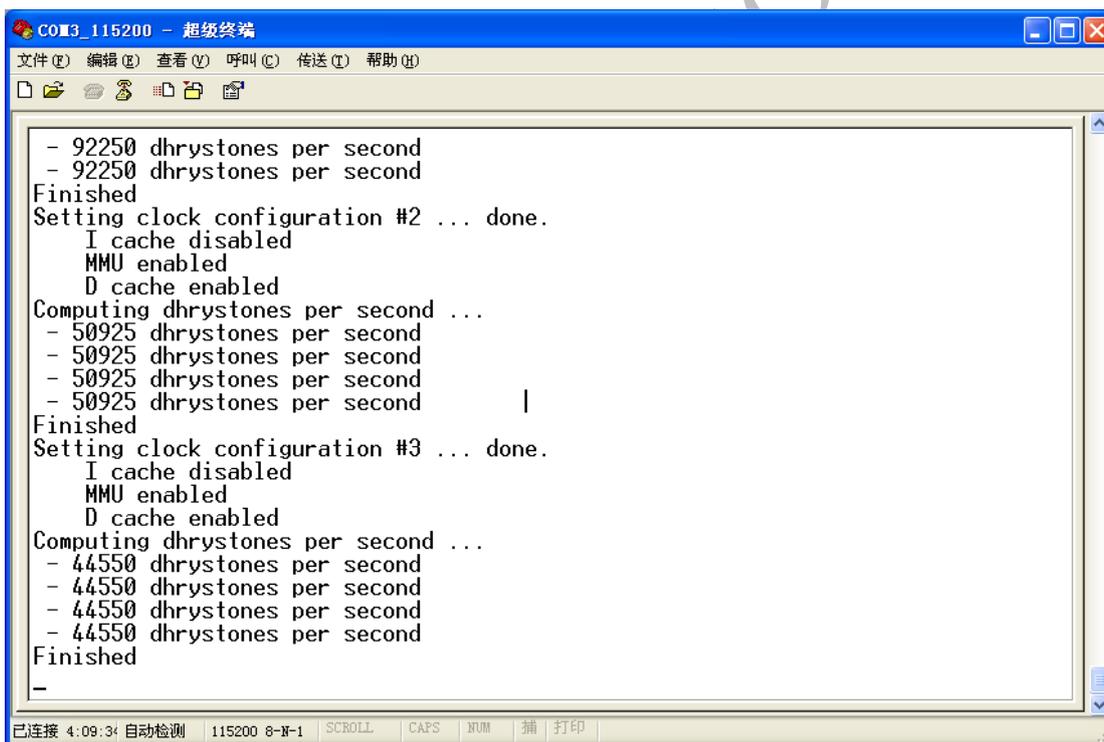


```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
- 99650 dhrystones per second
- 99650 dhrystones per second
- 99650 dhrystones per second
- 99650 dhrystones per second
Finished
Setting clock configuration #2 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 69400 dhrystones per second
- 69400 dhrystones per second
- 69400 dhrystones per second
- 69400 dhrystones per second
Finished
Setting clock configuration #3 ... done.
I cache enabled
MMU disabled
Computing dhrystones per second ...
- 48125 dhrystones per second
- 48125 dhrystones per second
- 48125 dhrystones per second
- 48125 dhrystones per second
Finished
-
已连接 4:08:11 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

禁用 I cache, 启用 MMU:

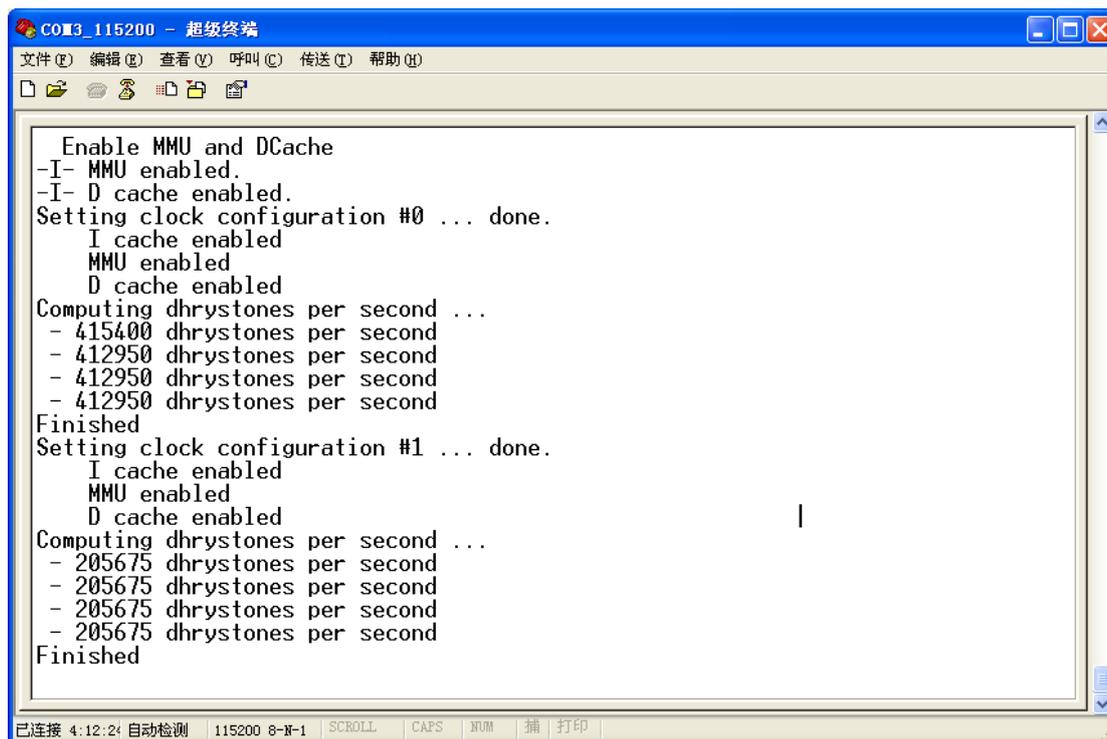


```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Instruction cache disabled.
Enable MMU
-I- MMU enabled.
Setting clock configuration #0 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 105925 dhrystones per second
- 105925 dhrystones per second
- 105925 dhrystones per second
- 105925 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 92250 dhrystones per second
- 92250 dhrystones per second
- 92250 dhrystones per second
- 92250 dhrystones per second
Finished
已连接 4:09:00 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

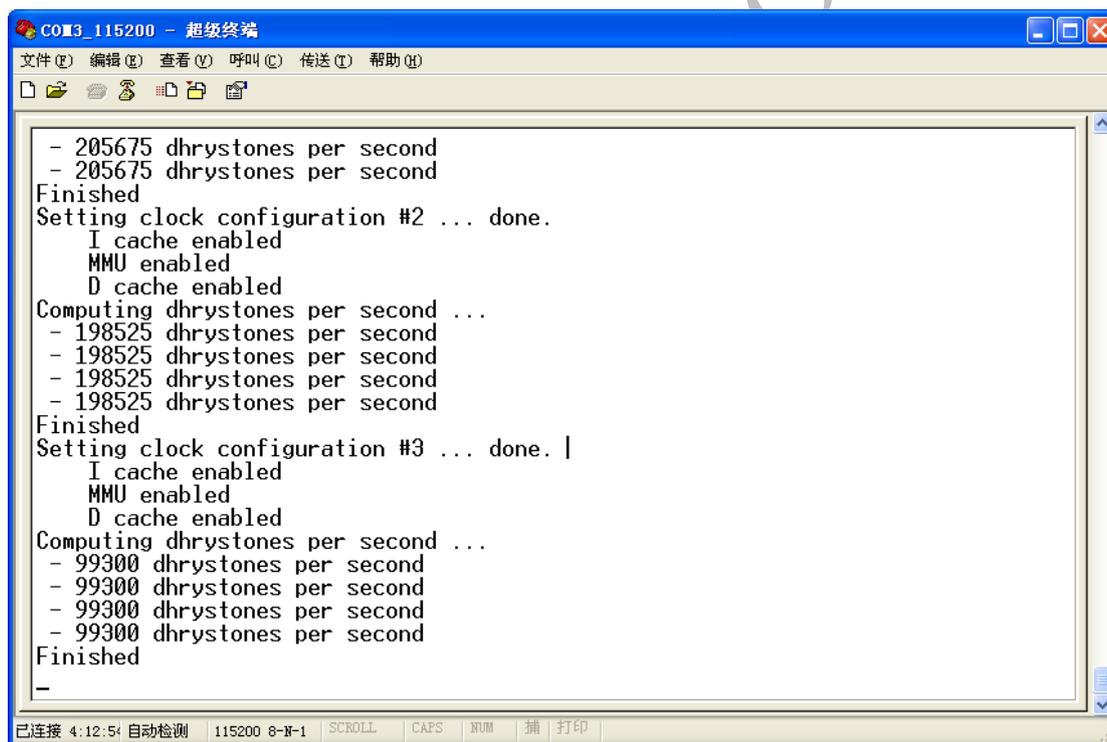


```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 92250 dhrystones per second
- 92250 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 50925 dhrystones per second
- 50925 dhrystones per second
- 50925 dhrystones per second
- 50925 dhrystones per second
Finished
Setting clock configuration #3 ... done.
  I cache disabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 44550 dhrystones per second
- 44550 dhrystones per second
- 44550 dhrystones per second
- 44550 dhrystones per second
Finished
-
已连接 4:09:34 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

启用 I/D cache, 启用 MMU:



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
Enable MMU and DCache
-I- MMU enabled.
-I- D cache enabled.
Setting clock configuration #0 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 415400 dhrystones per second
- 412950 dhrystones per second
- 412950 dhrystones per second
- 412950 dhrystones per second
Finished
Setting clock configuration #1 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 205675 dhrystones per second
- 205675 dhrystones per second
- 205675 dhrystones per second
- 205675 dhrystones per second
Finished
已连接 4:12:24 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```



```
COM3_115200 - 超级终端
文件(F) 编辑(E) 查看(V) 呼叫(C) 传送(T) 帮助(H)
[Icons]
- 205675 dhrystones per second
- 205675 dhrystones per second
Finished
Setting clock configuration #2 ... done.
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 198525 dhrystones per second
- 198525 dhrystones per second
- 198525 dhrystones per second
- 198525 dhrystones per second
Finished
Setting clock configuration #3 ... done. |
  I cache enabled
  MMU enabled
  D cache enabled
Computing dhrystones per second ...
- 99300 dhrystones per second
- 99300 dhrystones per second
- 99300 dhrystones per second
- 99300 dhrystones per second
Finished
-
已连接 4:12:54 自动检测 115200 8-N-1 SCROLL CAPS NUM 插 打印
```

## 3.2 测试分数汇总及分析

### 3.2.1 优化等级选择 High，选择 balanced，不勾选右侧特殊优化选项

优化等级 High 代码和时间平衡	PCK=200 MCK=100	PCK=100 MCK=100	PCK=96 MCK=48	PCK=48 MCK=48
禁用 I cache 禁用 MMU	66100	54100	31775	26125
启用 I cache 禁用 MMU	100275	67600	48225	32650
禁用 I cache 启用 MMU	71150	60625	34225	29225
启用 I/D Cache 启用 MMU	264200	131575	127025	63525

### 3.2.2 优化等级选择 High，选择 Speed 优先，不勾选右侧特殊优化选项

优化等级 High 时间优先	PCK=200 MCK=100	PCK=100 MCK=100	PCK=96 MCK=48	PCK=48 MCK=48
禁用 I cache 禁用 MMU	71750	57950	34500	28000
启用 I cache 禁用 MMU	106475	72200	51150	34850
禁用 I cache 启用 MMU	77200	65200	37125	31475
启用 I/D Cache 启用 MMU	290775	144400	139375	69725

### 3.2.3 优化等级选择 High，选择 Speed 优先，并勾选右侧特殊优化选项

优化等级 High 时间优先	PCK=200 MCK=100	PCK=100 MCK=100	PCK=96 MCK=48	PCK=48 MCK=48
禁用 I cache 禁用 MMU	97500	80175	46875	38725
启用 I cache 禁用 MMU	144375	99650	69400	48125
禁用 I cache 启用 MMU	105925	92250	50925	44550
启用 I/D Cache 启用 MMU	415400	205675	198525	99300

## 4. GNU 平台的 Dhrystone 测试

### 4.1 测试过程及 log 信息

使用 arm-elf-gcc 4.4.1 工具链

```
CFLASGS= -Wall -mlong-calls -ffunction-sections -mtune=arm926ej-s -g -O3
```

下面看测试数据：

WWW.MCUZONE.COM

```
RomBOOT
>-- Basic Dhrystone Project 1.5 --
-- AT91SAM9261-EK
-- Compiled: Nov 24 2009 21:22:09 --

Menu :
-----
 0: Set PCK = 200 MHz, MCK = 100 MHz
 1: Set PCK = 100 MHz, MCK = 100 MHz
 2: Set PCK = 96 MHz, MCK = 48 MHz
 3: Set PCK = 48 MHz, MCK = 48 MHz
 i: Toggle instruction cache
 b: ToggleMMU
 c: Toggle data cache
 d: ToggleDataCacheAndMMU
 m: Perform measurements
 h: Display this menu again

    I cache disabled
    MMU disabled
Setting clock configuration #0 ... done.
    I cache disabled
    MMU disabled
Computing dhrystones per second ...
- 92775 dhrystones per second
- 92775 dhrystones per second
- 92775 dhrystones per second
- 92775 dhrystones per second
Finished
Setting clock configuration #1 ... done.
    I cache disabled
    MMU disabled
Computing dhrystones per second ...
- 76750 dhrystones per second
- 76750 dhrystones per second
- 76750 dhrystones per second
- 76750 dhrystones per second
Finished
Setting clock configuration #2 ... done.
    I cache disabled
    MMU disabled
Computing dhrystones per second ...
- 44600 dhrystones per second
- 44600 dhrystones per second
- 44600 dhrystones per second
- 44600 dhrystones per second
Finished
Setting clock configuration #3 ... done.
    I cache disabled
    MMU disabled
Computing dhrystones per second ...
- 37050 dhrystones per second
- 37050 dhrystones per second
- 37050 dhrystones per second
- 37050 dhrystones per second
Finished
```

```
Komodo
>-- Basic Dhrystone Project 1.5 --
-- AT91SAM9261-EK
-- Compiled: Nov 24 2009 21:22:09 --

Menu :
-----
 0: Set PCK = 200 MHz, MCK = 100 MHz
 1: Set PCK = 100 MHz, MCK = 100 MHz
 2: Set PCK = 96 MHz, MCK = 48 MHz
 3: Set PCK = 48 MHz, MCK = 48 MHz
 i: Toggle instruction cache
 b: ToggleMMU
 c: Toggle data cache
 d: ToggledataCacheAndMMU
 m: Perform measurements
 h: Display this menu again

    I cache disabled
    MMU disabled
    Instruction cache enabled.
    Enable MMU and DCache
Setting clock configuration #0 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 392300 dhrystones per second
- 390825 dhrystones per second
- 390050 dhrystones per second
- 390050 dhrystones per second
Finished
Setting clock configuration #1 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 195050 dhrystones per second
- 194275 dhrystones per second
- 194275 dhrystones per second
- 194275 dhrystones per second
Finished
Setting clock configuration #2 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 187525 dhrystones per second
- 187525 dhrystones per second
- 187525 dhrystones per second
- 187525 dhrystones per second
Finished
Setting clock configuration #3 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 93800 dhrystones per second
- 93800 dhrystones per second
- 93800 dhrystones per second
- 93800 dhrystones per second
Finished
```

使用 gcc version 4.4.1 (Sourcery G++ Lite 2009q3-68), arm-none-eabi 工具链

-Wall -mlong-calls -ffunction-sections -mcpu=arm926ej-s -g -O3

```
RomBOOT
>-- Basic Dhrystone Project 1.5 --
-- AT91SAM9261-EK
-- Compiled: Nov 24 2009 22:01:46 --

Menu :
-----
 0: Set PCK = 200 MHz, MCK = 100 MHz
 1: Set PCK = 100 MHz, MCK = 100 MHz
 2: Set PCK = 96 MHz, MCK = 48 MHz
 3: Set PCK = 48 MHz, MCK = 48 MHz
 i: Toggle instruction cache
 b: ToggleMMU
 c: Toggle data cache
 d: ToggledataCacheAndMMU
 m: Perform measurements
 h: Display this menu again

    I cache disabled
    MMU disabled
    Instruction cache enabled.
    Enable MMU and DCache
Setting clock configuration #0 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 436875 dhrystones per second
- 435875 dhrystones per second
- 434975 dhrystones per second
- 434975 dhrystones per second
Finished
Setting clock configuration #1 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 216675 dhrystones per second
- 216675 dhrystones per second
- 216675 dhrystones per second
- 216675 dhrystones per second
Finished
Setting clock configuration #2 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 209125 dhrystones per second
- 209125 dhrystones per second
- 209125 dhrystones per second
- 209125 dhrystones per second
Finished
Setting clock configuration #3 ... done.
    I cache enabled
    MMU enabled
    D cache enabled
Computing dhrystones per second ...
- 104625 dhrystones per second
- 104625 dhrystones per second
- 104625 dhrystones per second
- 104625 dhrystones per second
Finished
```

## 4.2 测试分数汇总及分析

使用 arm-elf-gcc 4.4.1 工具链

CFLASGS= -Wall -mlong-calls -ffunction-sections -mtune=arm926ej-s -g -O3

优化等级 High	PCK=200	PCK=100	PCK=96	PCK=48
时间优先	MCK=100	MCK=100	MCK=48	MCK=48
禁用 I cache 禁用 MMU	92775	76750	44600	37050
启用 I/D Cache 启用 MMU	392300	195050	187525	93800

使用 gcc version 4.4.1 (Sourcery G++ Lite 2009q3-68), arm-none-eabi 工具链

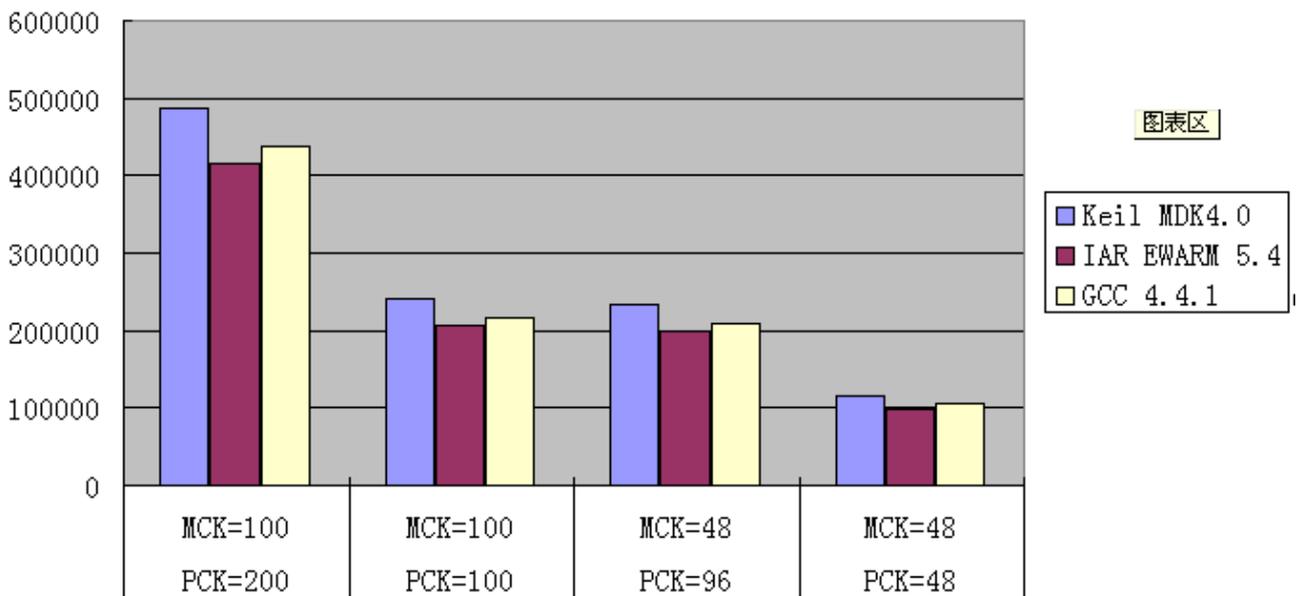
-Wall -mlong-calls -ffunction-sections -mcpu=arm926ej-s -g -O3

优化等级 High	PCK=200	PCK=100	PCK=96	PCK=48
时间优先	MCK=100	MCK=100	MCK=48	MCK=48
启用 I/D Cache 启用 MMU	436875	216675	209125	104625

## 5. 各平台的 Dhrystone 最高分值对比

下面来对 3 个平台的最高分值做一个汇总对比：

最高优化等级	PCK=200 MCK=100	PCK=100 MCK=100	PCK=96 MCK=48	PCK=48 MCK=48	MIPS 性能 (/1757/200)
Keil MDK4.0	486300	241675	233250	116700	1.38
IAR EWARM 5.4	415400	205675	198525	99300	1.18
GCC 4.4.1	436875	216675	209125	104625	1.24



可以看到 Keil 在被 ARM 收购后，改用了 ARM 公司的 RV 工具链后性能大幅提升，ARM 公司为自己的 ARM 芯片开发的编译器理所当然最大程度的挖掘了芯片的性能。

另外，我们可以看到 GCC 的分值同样很高，作为一个免费的编译器，能获得如此的性能我们应该满足了，感谢那些大牛们。

另外，我们按照测试分值计算出来的 MIPS 性能是均高于 ATMEL 在 AT91SAM9261 数据手册中所标称的 1.10 (210 MIPS@190MHz)。原因在于我们采用了极端优化等级，当代码比较复杂的时候，使用极端优化等级可能会带来一些无法预测的问题。但是从另外一个侧面我们可以清楚的看到 ATMEL 或者说 ARM 公司所宣称的 MIPS 性能指标是可信的。(请参阅 ARM white paper, Benchmarking in context: Dhrystone)

最后提醒大家，如果把 AT91SAM9261 当单片机来跑裸机程序，如果条件和能力允许，建议启用数据和指令 cache 以及 MMU，这样可以获得更好的运算能力（从测试结果来看，有 4 倍左右的性能提升）。