VIA C3 CPU Power Measurement Data

Last updated 7/1 2001

Background

The VIA Samuel 2 and Ezra processors are based on a unique internal architecture and manufactured using advanced 0.15µ and 0.13µ CMOS technologies. The architecture and process technologies provide a highly compatible, high-performance, low-cost, and low-power solution for the desktop PC, notebook, and Internet Appliance markets.

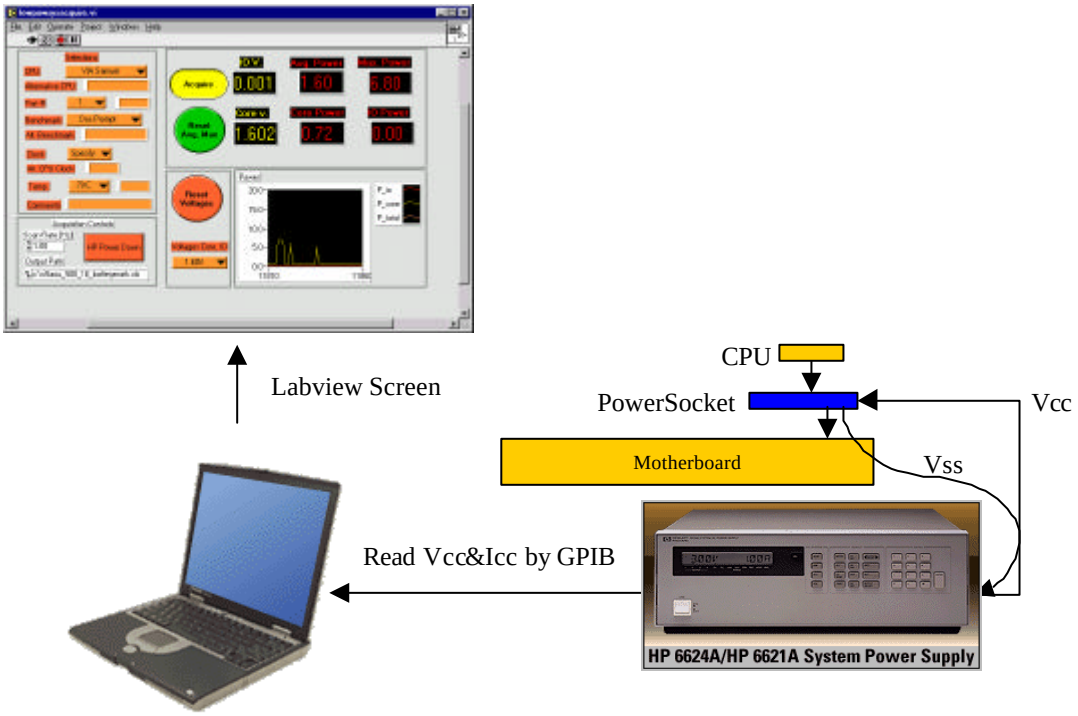
When considered individually, the compatibility, function, performance, cost, and power dissipation of the VIA C3 processor family are all very competitive. When considered as a whole, the VIA processor family offers a breakthrough level of *value*.

Introduction

A precise profile of a microprocessor's power consumption is necessary for designing thermal solutions in notebooks, small form factor PCs, and Internet Appliances. Estimating battery life in notebooks also requires understanding of typical power consumption.

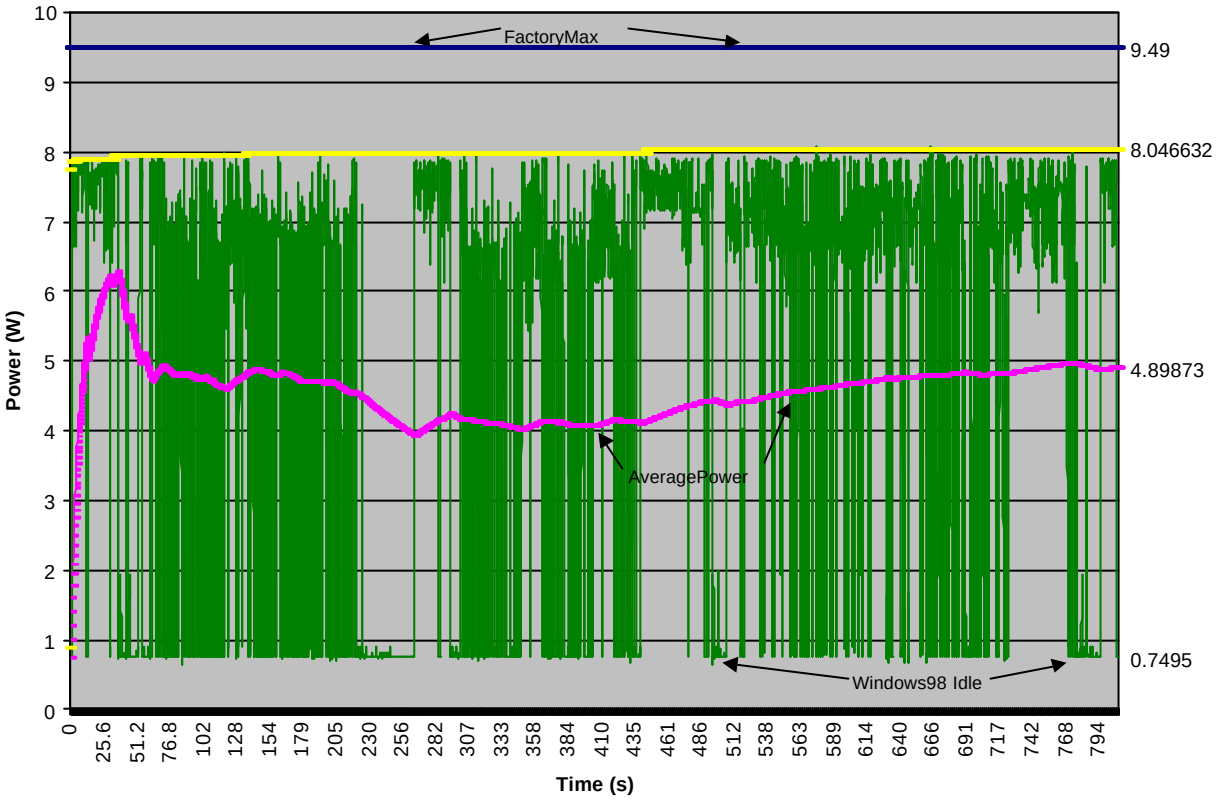
Measurement

Software application's power usage was measured with the CPU's power plane isolated from the motherboard and supplied from a separate DC power supply. See diagram below.



The DC power supply (not the motherboard) powers the CPU. This allows any motherboard to be tested without modifications. Voltage and power measurements are gathered from the Labview screen and saved to a data file.

The following plot displays the power consumption of the VIA Samuel 2 (700 MHz 1.5V) running WinStone99 from start to finish on Windows 98SE.
The highest wattage value plotted is **FactoryMax**. FactoryMax is highest wattage possible



from the factory when executing the worst case instruction sequence designed to consume the most power. FactoryMax values for each speed grade are listed in Table 1. *Thermal solutions should be designed to FactoryMax.* To assist in thermal monitoring, a synthetic program that consumes the most power (MAXPOW.EXE) is available from a VIA Sales Representative.

AveragePower is the average power consumed during WinStone99. Winstone 99 is composed of several popular productivity suites that are typical of normal PC usage. VIA also defines AveragePower as **Typical** power. See Table 1 and 2 for specific speed grade values.

Power management features built into Windows 98SE keep the processor in a low power state when idle. This idle state is important to mobile users. The mobile PC's battery life is proportional to the Windows 98SE idle state[1]. This power state is listed under **StopGrant** in respective datasheets.

[1] This assumes the user does little work with the CPU. Moderate to heavy usage profiles should consider the power consumed while running WinStone 99 to estimate battery life.

The following tables outline the wattage for each CPU speed grade for Samuel 2 and Ezra .

Table 1 VIA C3 Samuel 2 Power Consumption

Power Management State	Voltage	Typical[2]	FactoryMax[3]	Unit
Normal[1]				
700 MHz	1.6 V	5.81	10.69	W
733 MHz	-	6.09	11.16	
750 MHz	-	6.23	11.40	
800 MHz	-	6.65	12.10	

Table 2 VIA C3 Ezra Power Consumption

Power Management State	Voltage	Typical[2]	FactoryMax[3]	Unit
Normal[1]				
733 MHz	1.35 V	4.50	8.40	W
750 MHz	-	4.60	8.70	
800 MHz	-	5.00	9.60	
850 MHz	-	5.50	10.50	
866 MHz	-	5.60	11.00	

Notes

1. The normal power state is the common operating mode of the CPU.
2. Typical power is the average power consumed while running WinStone99 on Win98SE.
3. FactoryMax is the factory limit for power consumption while running the worst case instruction sequence at 70C. Factory will reject parts that exceed these specified values. Thermal solutions should be designed to FactoryMax

The following tables outline the wattage for each Intel CPU speed grade at corresponding voltages according to the Intel Processor datasheets.

Table 3 Intel PIII Power Consumption*

Power Management State	Voltage	TDP_{TYP}[1,3]	TDP_{MAX}[2,3]	Unit
Normal[1]				
500 MHz	1.1 V	5.00	8.10	W
600 MHz	1.1 V	6.40	9.70	
600 MHz	1.35 V	8.70	14.40	
700 MHz	1.35 V	10.20	16.10	
750 MHz	1.35 V	12.40	17.20	
700 MHz	1.6 V	15.00	23.00	
750 MHz	1.6 V	15.80	24.60	
800 MHz	1.6 V	17.00	25.90	
850 MHz	1.6 V	18.20	27.50	
900 MHz	1.7 V	23.30	30.70	
1 GHz	1.7 V	24.80	34.00	

* Intel Power Consumption data obtained from www.intel.com

Table 4 Intel PIII with SpeedStep© Power Consumption*

Power Management State	Voltage	TDP_{TYP}[1,3]	TDP_{MAX}[2,3]	Unit
Normal[1]				
300 MHz	0.975 V	2.40	4.50	W
300 MHz	0.975 V	2.40	4.50	
500 MHz	1.10 V	5.00	8.10	
500 MHz	1.10 V	5.00	8.10	
500 MHz	1.10 V	5.00	8.10	
550 MHz	1.35 V	8.50	13.20	
600 MHz	1.35 V	8.70	14.40	
650 MHz	1.35 V	9.50	15.10	
700 MHz	1.35 V	10.20	16.10	
700 MHz	1.35 V	11.20	16.10	
700 MHz	1.35 V	11.20	16.10	

Table 5 Celeron Power Consumption*

Power Management State	Voltage	TDP_{TYP}[1,3]	TDP_{MAX}[2,3]	Unit
Normal[1]				
500 MHz	1.10 V	5.00	8.10	W
400 MHz	1.35 V	6.50	10.10	
500 MHz	1.35 V	7.90	12.20	
450 MHz	1.60 V	10.20	15.50	
500 MHz	1.60 V	11.20	16.80	
550 MHz	1.60 V	11.90	18.40	
600 MHz	1.60 V	13.00	20.00	
650 MHz	1.60 V	14.00	21.50	
700 MHz	1.60 V	15.00	23.00	

Notes:

1. TDP_{TYP} (Thermal Design Power) is a recommendation based on the power dissipation of the processor while executing publicly available software under normal operating conditions at nominal voltages. Not 100% tested.
2. TDP_{MAX} is a specification of the total power dissipation of the processor while executing a worst-case instruction mix under normal operating conditions at nominal voltages. It includes the power dissipated by all of the components within the processor. Not 100% tested. Specified by design/characterization.
3. not 100% tested or guaranteed. The power specifications are composed of the current of the processor on the various voltage planes. These currents are measured and specified at high temperature in Table 9B. These power specifications are determined by characterization of the processor currents at higher temperatures.

* Intel Power Consumption data obtained from www.intel.com