



## XC4000E Low Power Consumption: At High Speeds

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Application Brief

### Summary

The Xilinx XC4000E family offers low power at high speed operation giving the customer reliable operation to very high system speeds.

### Xilinx Family

XC4000E

### Introduction

As the size of FPGAs increase, power consumption becomes a significant design issue. The XC4000E family has been architected to minimize power consumption despite its large size and high speed. Specific features include minimizing line capacitances with line length control and buffering, while maintaining connectivity and high performance.

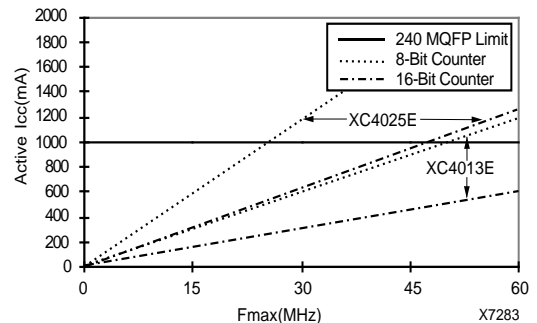
Conversely Altera's 10K family continues the oversimplification of their interconnect with global lines only. Such lines are inherently high capacitance lines and require large currents to charge the line capacitance for switching. The overall power consumption of the device increases to a point that it exceeds all inexpensive plastic packages. Often the system frequency gets limited by device package power dissipation capability. For devices such as 10K100 the comfortable system frequency falls around 10-25 Mhz, well below the requirements for most FPGA designs.

### Design Power Consumption

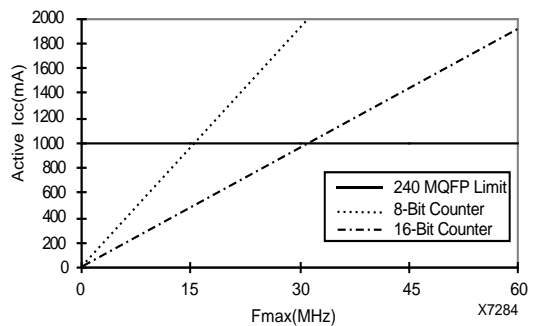
While every FPGA design has a different power consumption, one clear metric of power consumption comparison between different FPGAs is the 16-bit counter. However, 16-bit counters have very limited number of bits toggling simultaneously. An eight bit counter is a closer estimation to realistic system designs. **Figure 1** shows the typical measured XC4013E and extrapolated XC4025E power consumption for both 16 and 8-bit counters.

The Altera 10K family with long lines has a much higher power consumption. The following graph is directly from the datasheet for Altera 10K50 device. It shows power consumption for a 16-bit counter. The curve for an 8-bit counter can be easily extrapolated from that datasheet data and is depicted in **Figure 2**.

The best thermal capability QFP package (MQFP) from Altera has a power consumption limit of 1000 mA. This MQFP package thermal capability limit shows that the 10K50 can not be operated at any speed higher than 32 MHz for safe and reliable operation.



**Figure 1: Typical XC4013E, XC4025E Power Consumption**



**Figure 2: 10K50 Power Consumption**

The problem becomes acute in the 10K100 device. The 10K100 has even longer row and column global lines which consume even more power when switching. **Figure 3** extrapolates the 10K100 power consumption from the 10K50 datasheet data for both 8-bit and 16-bit counters. Assuming a best package thermal characteristics, designs implemented in the 10K100 can not operate above 10-25 Mhz frequency.

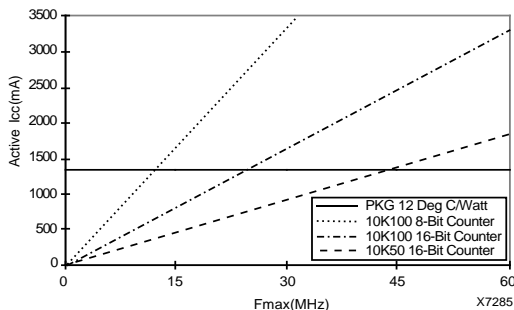


Figure 3: 10K50 vs. 10K100 Power Consumption

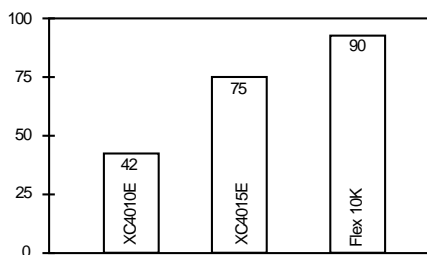


Figure 4: XC4000 vs. FLEX 10K Active Icc/LE

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**Conclusion**

The XC4000E family has been designed from ground up for high-speed, high-density operation. As shown in Figure 4, the Xilinx devices offer lower Active Icc/LE than the Altera FLEX 10K. They are provided in packaging options which properly handle the power dissipation requirements of the device. System clock rates 100% higher than Altera are easily handled in the Xilinx XC4000E devices without causing reliability problems to occur due to excessive die temperature.

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