

Evaluating MAX 7000S Device Utilization & Fitting

Introduction

MAX[®] 7000S devices are based on Altera's second-generation MAX architecture and provide 600 to 5,000 usable gates, 32 to 356 macrocells, pin-to-pin delays as fast as 5 ns, and counter speeds of up to 178.6 MHz. The devices also support advanced features such as in-system programmability (ISP), built-in JTAG support (for devices with 128 or more macrocells), and MultiVolt[™] I/O operation (except in 44-pin devices). Combined with support from the Altera[®] MAX+PLUS[®] II development system, MAX 7000S devices also offer efficient device utilization and superior fitting, enhancing overall performance. This technical brief evaluates device utilization and first- and second-time fitting by comparing MAX 7000S performance to Xilinx XC9500 devices.

Device Utilization

Altera Applications recently conducted device-utilization experiments of both Altera EPM7128S devices and Xilinx XC95108 devices. Of 37 designs used in the experiments, XC9500 devices used an average of 7% more macrocells than MAX 7000S devices. [Table 1](#) shows the average number of macrocells required by EPM7128S and XC95108 devices. As the utilization rate of the XC95108 device increased, its macrocell efficiency decreased. The XC95108 devices used 90% to 100% of available macrocells.

Table 1. Average Number of Macrocells Used *Note (1)*

Device	Macrocells Used
EPM7128S	96
XC95108	103

Note:

- (1) The EPM7128S device results were generated using the default setting in the Altera MAX+PLUS II software, version 8.1; the XC95108 device results were generated using the default setting in the Xilinx XACT software, version 6.01.

Device Fitting & Performance

Altera Applications also performed a benchmark study of 40 designs to test first- and second-time fitting rates of MAX 7000S and XC9500 devices. [Table 2](#) shows the percentages of successful first- and second-time fitting for EPM7128S and XC95108 devices at 90% macrocell utilization.

Table 2. First- & Second-Timing Fitting with 90% Macrocell Utilization *Note (1)*

Device	First-Time Fitting	Second-Time Fitting
EPM7128S	100%	60%
XC95108	50%	43%

Note:

- (1) The EPM7128S device results were generated using the default setting in the Altera MAX+PLUS II software, version 8.1; the XC95108 device results were generated using the default setting in the Xilinx XACT software, version 6.01.

The results show that MAX 7000S devices have a more successful first- and second-timing fitting rate than XC9500 devices. When the XC95108 device's macrocells were 90% utilized, the first- and second-time fitting rates were 50% and 43%, respectively. In contrast, when the EPM7128S device's macrocells were 90% utilized, the first- and second-time fitting rates were 100% and 60%, respectively.

The benchmark study also showed that MAX 7000S devices out-performed XC9500 devices by 10%. Moreover, the EPM7128S devices maintained this 10% performance advantage through second-time fitting. Table 3 shows each device's performance rate for first- and second-time fitting. In this example, -7 speed grade EPM7128S and XC95108 devices were used.

Table 3. First- & Second-Timing Fitting Performance Rates *Note (1)*

Device	Performance (f_{MAX})	
	First-Time Fitting (MHz)	Second-Time Fitting (MHz)
EPM7128S	87.9	79.8
XC95108	77.3	72.2

Note:

(1) The EPM7128S device results were generated using the default setting in the Altera MAX+PLUS II software, version 8.1; the XC95108 device results were generated using the default setting in the Xilinx XACT software, version 6.01.

The Altera Applications experiments showed that MAX 7000S devices used macrocells more efficiently than XC9500 devices, especially when utilization rates were high. The experiments also showed that MAX 7000S devices have a higher percentage of successful first- and second-time fittings and can out-perform XC9500 devices by maintaining a 10% performance advantage through second-time fitting.

The documents listed below provide more detailed information. Part numbers are in parentheses.

- *In-System Programmability Handbook (M-HB-ISP-01)*
- *MAX 7000 Programmable Logic Device Family Data Sheet (A-DS-M7000-04)*

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