Review of Seventh Series FPGA Xilinx

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Abstract—**The work of the Xilinx FPGA of the 7th series was reviewed, as well as a comparative description of its families.**

Keywords—FPGA, DSP, XADC, Xilinx, Spartan-7, Artix-7, Kintex-7, Virtex-7.

I. Introduction

Xilinx FPGAs are widely used today to solve problems of varying complexity. The FPGA of the 7th series of the Xilinx company combines four families [1]-[5]:

- Spartan-7,
- Artix-7,
- Kintex-7,
- Virtex-7.

These FPGA Series 7 series cover a wide range of system requirements, from low cost chips to mass production devices to ultra-high integration for high performance digital signal processing systems with high bandwidth. FPGA data has high-speed bandwidth, a large number of logical elements, the ability to process signals for a variety of digital devices [5]-[9].

II. The Main features of the series

The main features of the FPGA series of the 7th series of the firm Xilinx, by families [1]-[5]:

- FPGA Spartan-7 family: well-optimized for its low cost, low power consumption and high performance, I/O, has a compact placement on the board, making this type of FPGA small size;

- Artix-7 FPGA family: optimized and flexible to create low-power devices; are used to create devices that require serial-type external peripherals with high DSP bandwidth. This type of FPGA provides the lowest cost of manufacturing (total cost of materials for manufacturing) to create high-performance, sensitive to the cost of materials of digital devices;

- Kintex-7 FPGA family: Designed and optimized for the best performance of the developed digital devices, with a 2-fold improvement in performance compared to previous generations at a low price;

- Virtex-7 FPGA family: Designed and optimized for the best performance of developed digital devices, with a 2-fold improvement in performance compared to previous generations at a low price.

Comparative FPGA Performance of the 7th Series of Xilinx by Family:

- the number of a logical elements: Spartan-7 - 102000; Artix-7 - 215000; Kintex-7 - 478000; Virtex-7 - 1955000;

- the size of the RAM unit: Spartan-7 - 4.2 MB; Artix-7 - 13 MB; Kintex-7 -34 MB; Virtex-7 -68 MB;

- 3) the number of DSP Slices: Spartan-7 - 160; Artix-7 - 740; Kintex-7 - 1,920; Virtex-7 - 3600;

- DSP performance. Measured in GMAC per unit time, where GMAC - Giga multiply - accumulate operations, the number of operations per second: Spartan-7 - 176 GMAC / s; Artix-7 - 929 GMAC / s; Kintex-7 - 2845 GMAC / s; Virtex-7 - 5335 GMAC / s;

- MicroBlaze processor. Measured in DMIPs, where Dhrystone Million Instructions Per second, or there are millions of operations per time unit: Spartan-7 - 260 DMIPs; Artix-7 - 303 DMIPs; Kintex-7 - 438 DMIPs; Virtex-7 - 441DMIPs;

- number of transceivers (devices for transmission and reception of signals): Spartan-7 - absent; Artix-7 - 16 pcs .; Kintex-7 - 32 pcs .; Virtex-7 -96 pcs .;

- transceiver speed: Spartan-7 is absent; Artix-7 - 6.6 Gb / s; Kintex-7 - 12.5 GB / s; Virtex-7 - 28.05 Gb / s;

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- Serial bandwidth: Spartan-7 is absent; Artix-7 - 221Gb / s; Kintex-7 - 800 Gb / s; Virtex-7 -2 784 GB / s;

- programmable logic controller (PLC) interface: Spartan-7 is absent; Artix-7 - x4 Gen2; Kintex-7 - x8 Gen2; Virtex-7 - x8 Gen3;

- memory interface: Spartan-7 - 800 Mb / s; Artix-7 - 1,066 Mb / s; Kintex-7 - 1,866 Mbps; Virtex-7 -1 866 Mb / s;

- number of input / output elements: Spartan-7 - 400 units; Artix-7 - 500pcs .; Kintex-7 -500 pcs .; Virtex-7 -1200;

- the voltage consumption of input / output elements: Spartan-7 - 1.2-3.3 V; Artix-7 - 1.2-3.3V; Kintex-7 - 1.2-3.3V; Virtex-7 - 1.2-3.3 V.

The Xilinx Series 7 FPGA family is based on the high-k metal gate (HKMG), a modern, high-performance, low-power 28nm technology.

The Xilinx Series 7 FPGA family provides a significant increase in system performance with up to 2.9 TB / s throughput, about two million logical elements, as well as 5.3 TMAC / s DSPs, while consuming 50% less power than digital devices built on the basis of the previous generation of the FPGA family, which offers a real alternative to the use of ASSP and ASIC. Xilinx's 7th Series FPGA family has: Dual 12-Bit Analog / Digital Converters (XADC) for general purpose, with a productivity of 1 million samples per second; built-in sensors for temperature and voltage control; DSP blocks with a 25x18 multiplier, 48-bit battery and a promisor for high-performance filtering, including the possibility of optimally constructing filters with symmetric coefficients; control and synchronization units for synchronization signals, which provide high signal accuracy and low jitter level; A wide set of configuration modes, including the ability to encrypt the configuration sequence using the AES (256 bit) algorithm with HMAC / SHA-256 authentication; built-in module for detecting and correcting a one-time error. All types of cases of the 7th series are available in "lead-free" performance (Pb-free), and some types are also available in "lead" performance.

III. CONCLUSIONS

All Xilinx Series 7 FPGA chips have a common architecture that is organized in the form of columns of function blocks of the same type. Such an architecture is called an optimized silicon modular block. In addition, the Xilinx stack silicon interconnect technology used on some Virtex-7 chipsets allows the FPGA architecture to be introduced at the next structural level, making it possible to create a very high density and performance FPGA.

According to the representatives of the Xilinx company in FPGA, the 7th series embodies all the world's achievements in the field of FPGA architecture development.

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