

FIELD PROGRAMMABLE GATE ARRAYS

Introduction



What is a FPGA



Field programmable gate arrays (FPGAs) – are digital integrated circuits that contain configurable blocks of logic along with configurable interconnects between these blocks.









Other FPGA advantages

- Manufacturing cycle for ASIC is very costly, lengthy and engages lots of manpower
- Mistakes not detected at design time have large impact on development time and cost
- FPGAs are perfect for rapid prototyping of digital circuits
- Easy upgrades like in case of software
- Unique applications



Architecture of FPGA

The architecture of FPGA is very simple than other programmable devices

Elements of FPGA

The basic elements of an Field Programmable Gate Array are:

- □ Configurable logic blocks(CLBs)
- □ Configurable input output blocks(IOBs)
- Two layer metal network of vertical and horizontal lines for interconnecting the CLBS and FPGAs (programmable interconnect)

Architecture of FPGA

A simple modern architecture of FPGA is shown below:



казанский национальный исследовательсение казанский национальных исследовательсение казанский национальный исследовательсение казанский национальных и казанский и казанский национальных и казанских и каз

екнический университет им. А.Н. Тупо

All FPGAs include a regular, flexible programmable, and architecture of logic blocks surrounded by input/output blocks the perimeter. These on functional blocks linked are together by a hierarchy of highly programmable versatile interconnects.



493анский национальный исследовательстве

етнический университет им. А.Н. Тупол





Technology of program logic devices

Fusible link technologies



Unprogrammed fusible links

Programmed fusible links





Physical principles of logic block configuration

EPROM-based technologies

Казанский национальный

^{Уе}хнический университет им. А.Н.



An EPROM transistor-based memory cell

•expensive packages with quartz windows and the time takes to erase

•use as a programmable memories

EEPROM-based technologies



•EEPROM transistor contains a floating gate, but the insulating oxide layers surrounding this gate are very much thinner

•the second transistor can be used to erase the cell electrically



Physical principles of logic block configuration

SRAM-based technologies



An SRAM-cell programmable cell

•fast re-programmabalaty

standard IC fabrication technologies is used

•requires large area

Flash-based technologies



A floating-gate transistor used in flash memory

electrically erased

less power

•tolerant to radiation effect



Summary of programming technologies

Technology	Symbol	Predominantly associated with
Fusible-link	-~~-	SPLDs
Antifuse		FPGAs
EPROM	- I Ľ	SPLDs and CPLDs
E ² PROM/ FLASH	-1K	SPLDs and CPLDs (some FPGAs)
SRAM		FPGAs (some CPLDs)