MAX10 Overview

Last updated 12/17/24

Max10 Overview

- Max10 is a family of FPGAs
  - Originally designed by Altera
  - Now owned by and manufactured by Intel
  - It is the main IC on the DE10 Lite development board
   - 10M50DAF484C7G

Max10 Overview

- FPGA
  - Field Programmable Gate Array
    - Gate Array
      - Collection of gates
      - Configured in a specific combination and pattern
    - Programmable
      - Through modifying the wiring connections, various logic systems can be built
    - Field
      - The programmable wiring connections can be done:
        - After the part has been manufactured
        - Multiple times
        - In situ (in place) – after the final product has been built

        - There is commonly a way to prevent further programming built into the chip
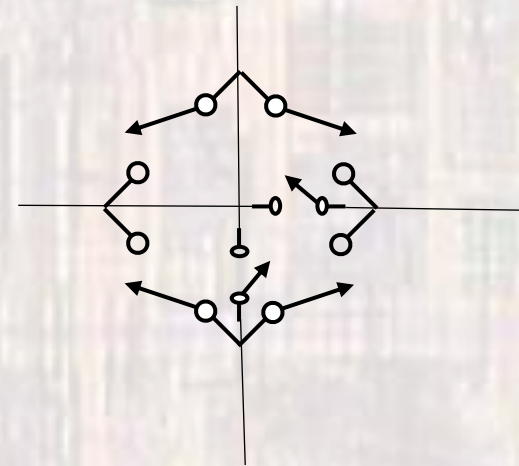
Max10 Overview

- ## Max10 Physical Structure

blocks are fixed in
a specific location
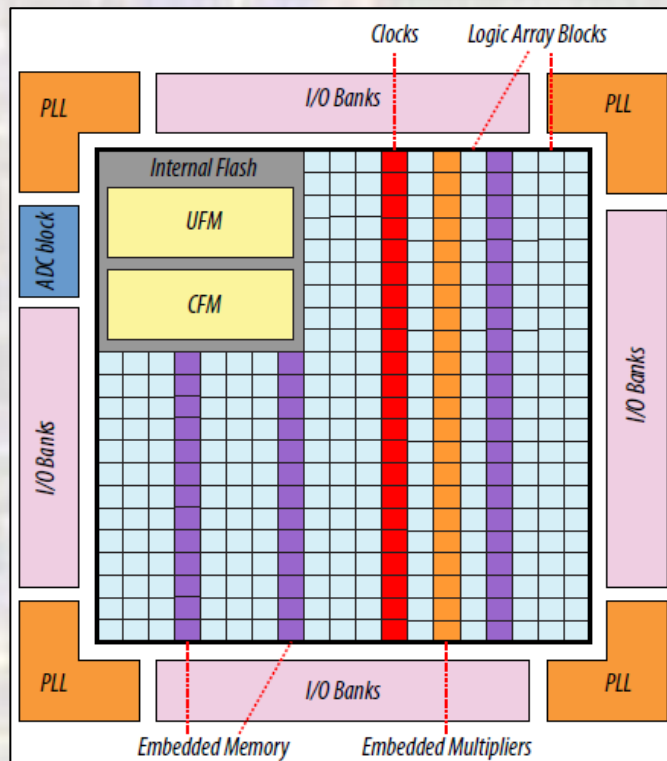
wiring between
blocks can be modified
using switches

the switches are controlled
by the values stored
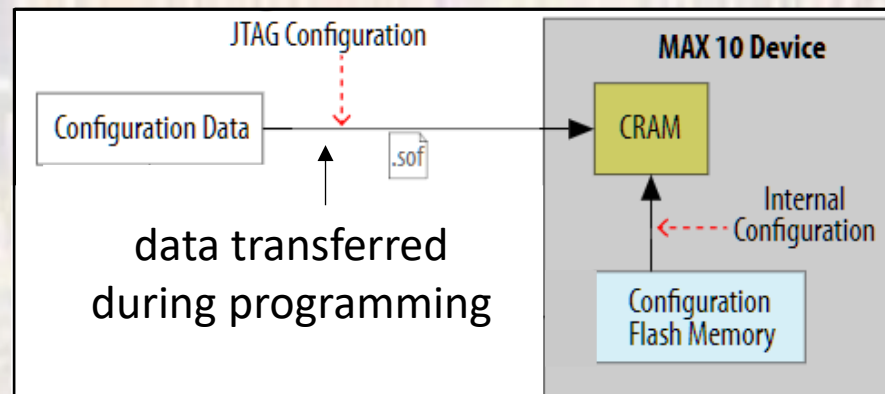in an on-chip memory
'CRAM'

Max10 Overview

- Max10 Programming Structure
  - The manufacturer of the DE10 Lite board has created a set of connections and stored the appropriate on-chip memory values into a Flash memory on the Max10 IC
    - On power-up, these memory values are copied from the Flash Memory to the Configuration Memory (CRAM)
    - The Configuration Memory is used to set the values on all the interconnect switches on the Max10 chip
    - This setup causes lights to flash, …

data transferred
during power up

MAX 10 Device

CRAM

Internal
Configuration

Configuration
Flash Memory
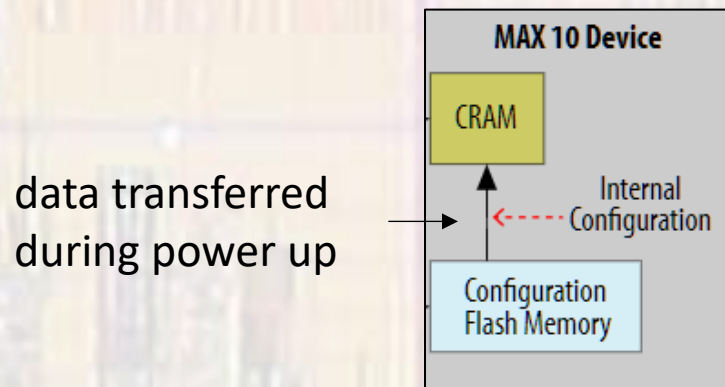
Max10 Overview

- Max10 Programming Structure – cont'd
  - When we fully compile a design in Quartus we create a new set of connection values
  - When we Program the DE10 Lite board
    - We are transferring the new connection data to the Max10 chip
    - The new data is written directly to the Configuration RAM
      - Overwriting the manufacturers program in the CRAM
      - Not effecting the data stored in the Flash Memory

JTAG Configuration

MAX 10 Device

Configuration Data

.sof

CRAM

data transferred
during programming

Internal
Configuration

Configuration
Flash Memory

Max10 Overview

- Max10 Programming Structure – cont'd
  - The Configuration RAM is Volatile
    - It loses its information when power is removed
  - The Flash Memory in Non-volatile
    - Retains its information without power applied

  - Our programmed configuration is lost every time we unplug the DE10 board from the USB
  - The flashing program is automatically loaded every time we plug in the DE10 board to the USB