



Altera Technical Solutions Seminar 2000



Schedule

- Opening
- Introduction
- FLEX[®] 10KE Devices
- APEX[™] 20K & Quartus[™] Overview
- Design Integration
- EDA Integration
- Intellectual Property
- Design Iteration
- Design Optimization
- Internet Interface
- Roadmap
- Quartus Demo



Agenda

- u Overview
- u Memory
- u PLL
- u 66-MHz PCI
- u Packaging
- u Availability

Introduction

● **FLEX[®] 10KE Devices**

APEX[™] 20K &
Quartus[™] Overview

Design Integration

EDA Integration

Intellectual Property

Design Iteration

Design Optimization

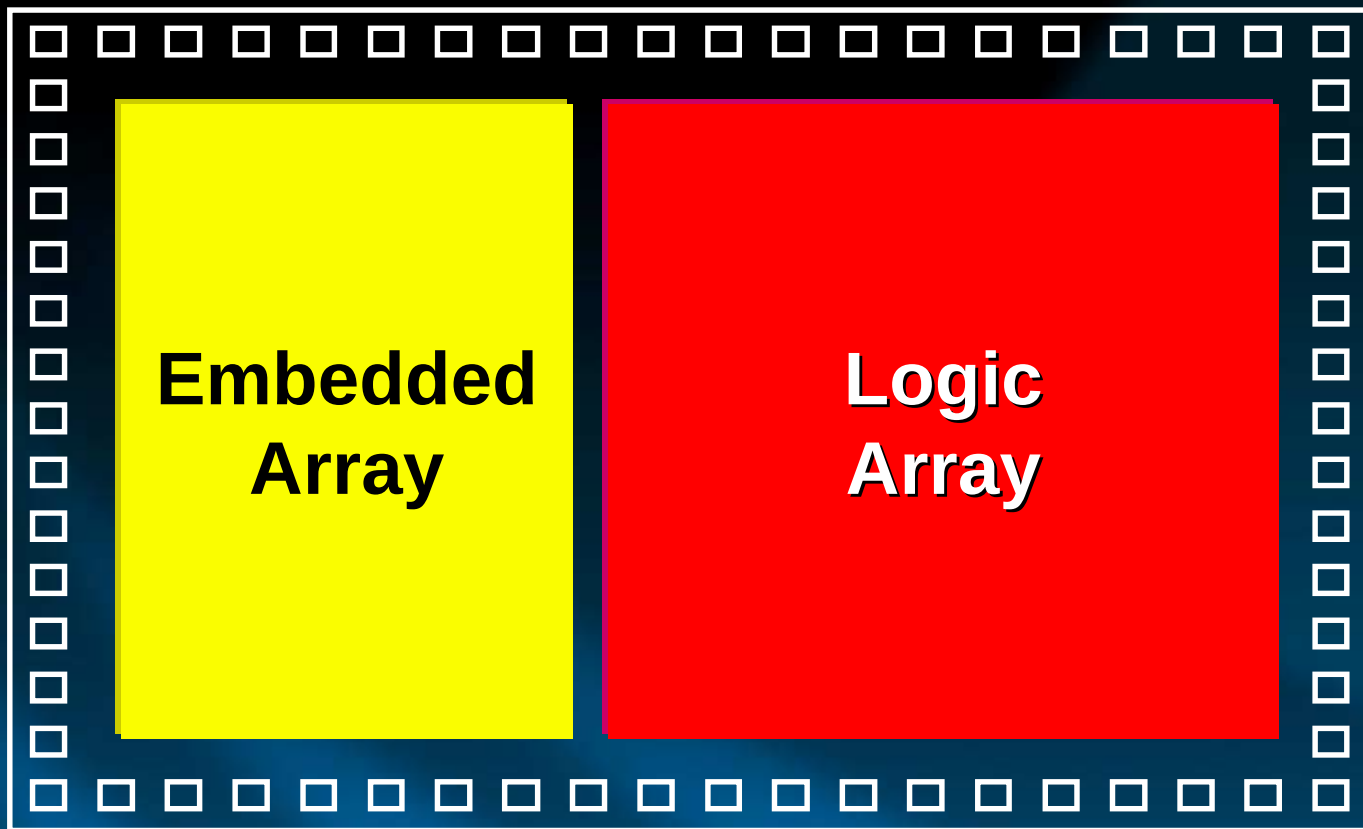
Internet Interface

Roadmap



FLEX 10K Architecture

Industry's First Embedded PLD

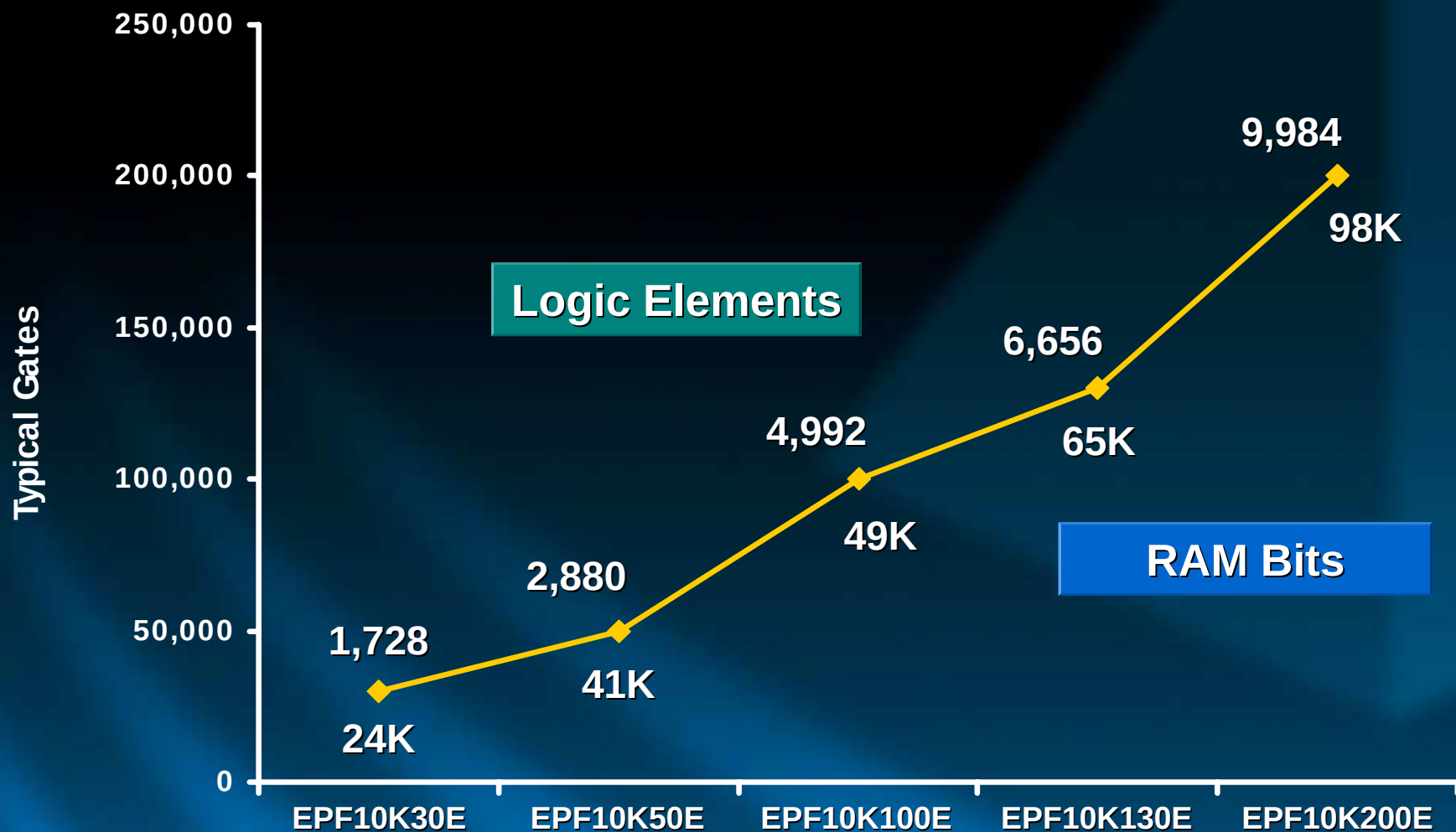


Memory

Random Logic



FLEX 10KE Devices





FLEX 10KE Advanced Process Technology

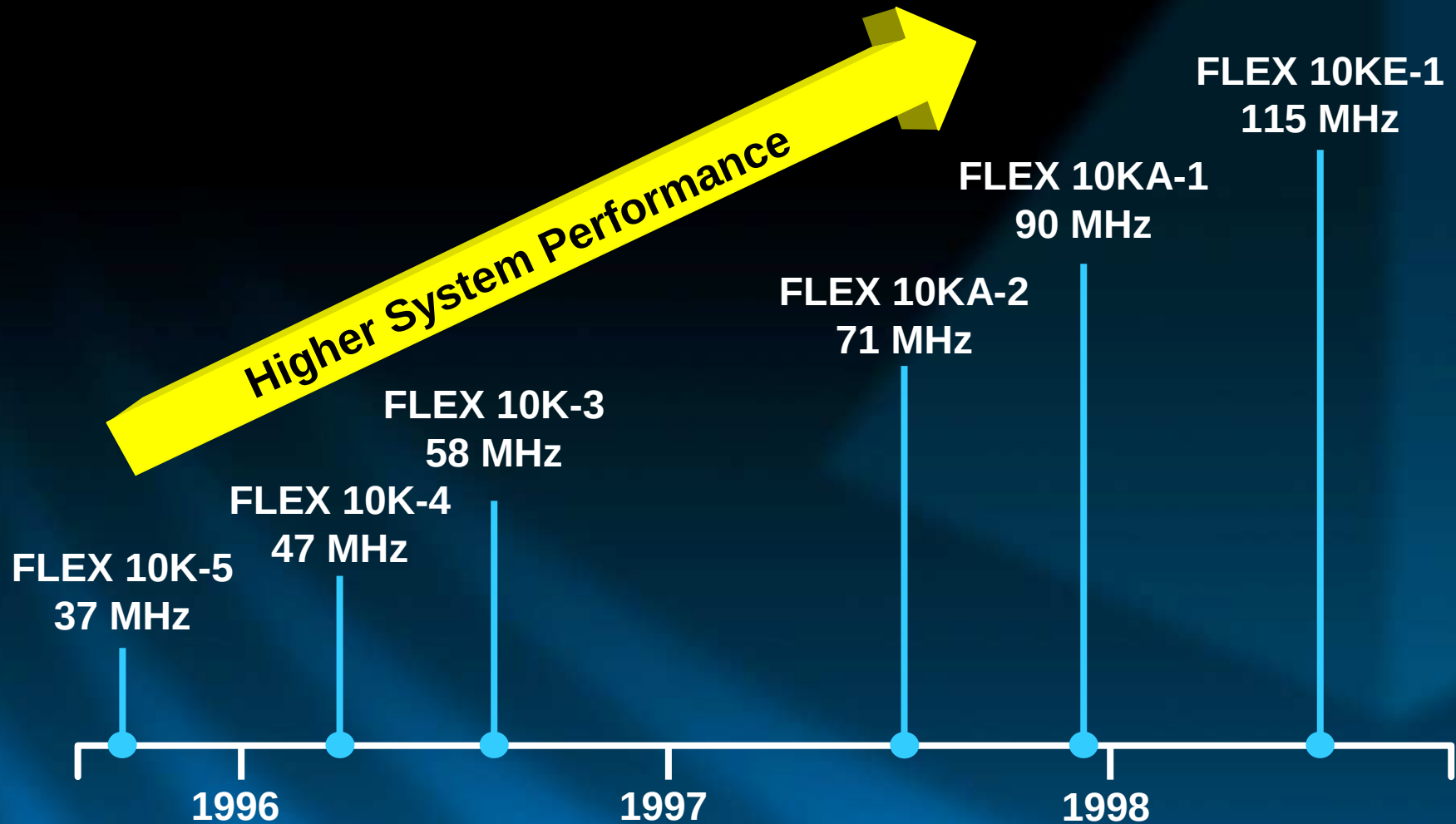
◆ 0.22- μ , 5-Layer-Metal Process

- Low-Power 2.5-V Core
- MultiVolt™ I/O (5.0-V Tolerant)
- Mixed-Voltage System Flexibility

VCCINT	VCCIO	Input Levels			Output Levels		
		2.5 V	3.3 V	5.0 V	2.5 V	3.3 V	5.0 V
2.5 V	3.3 V	Ü	Ü	Ü	Ü	Ü	Ü
	2.5 V	Ü	Ü	Ü	Ü		

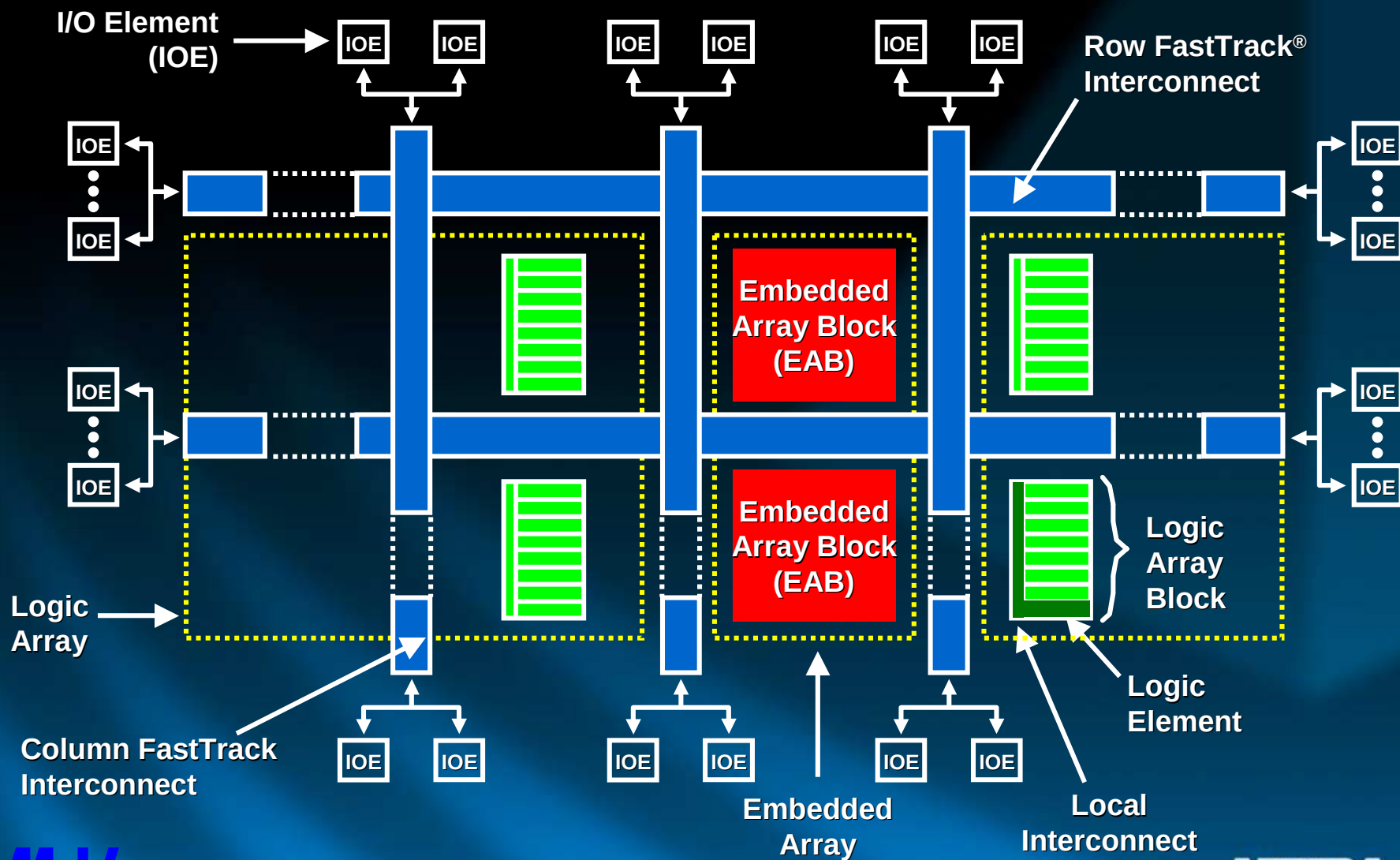


FLEX 10K Performance Improvements





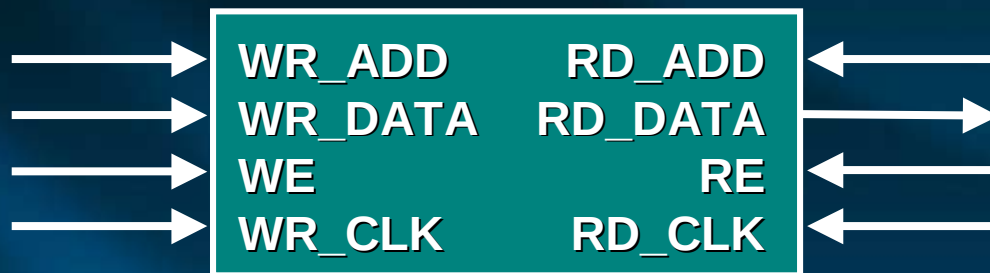
Device Architecture Block Diagram





Enhanced FLEX 10KE EAB

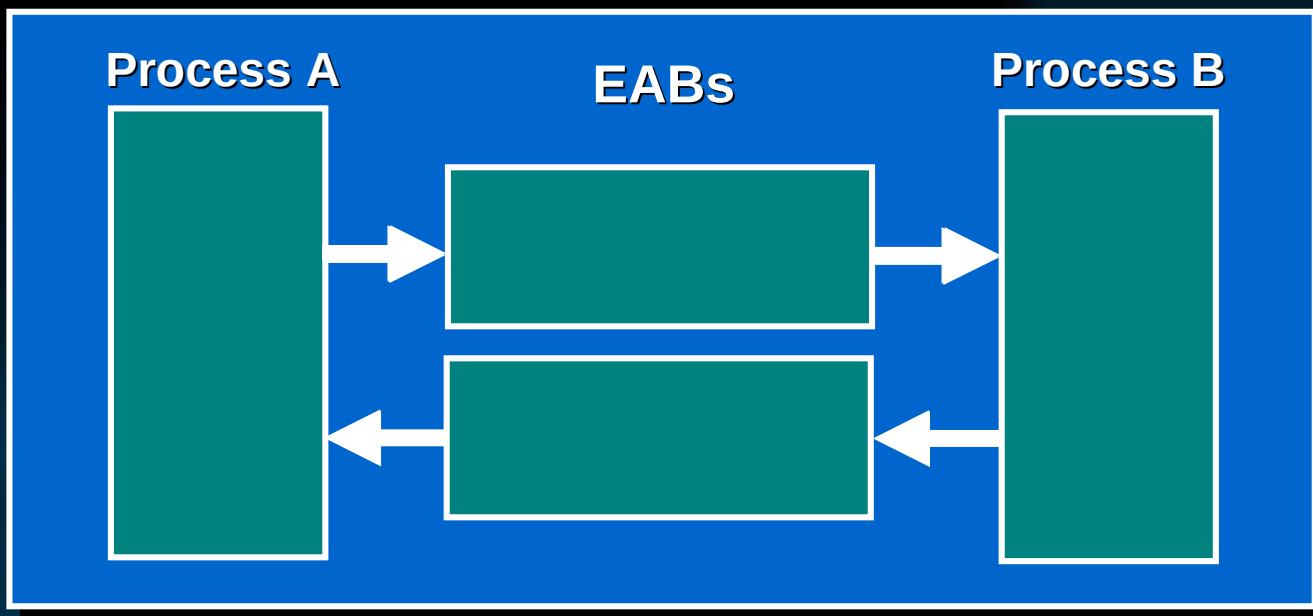
- ◆ Dual-Port RAM
- ◆ FIFO-Optimized
 - Independent Read & Write Ports
 - Synchronous or Asynchronous Access
- ◆ EAB Width X16 for Maximum System Bandwidth
- ◆ 4 Kbits/EAB
 - 256 x 16; 512 x 8; 1,024 x 4; 2,048 x 2



Fully Compatible with All FLEX 10K EABs

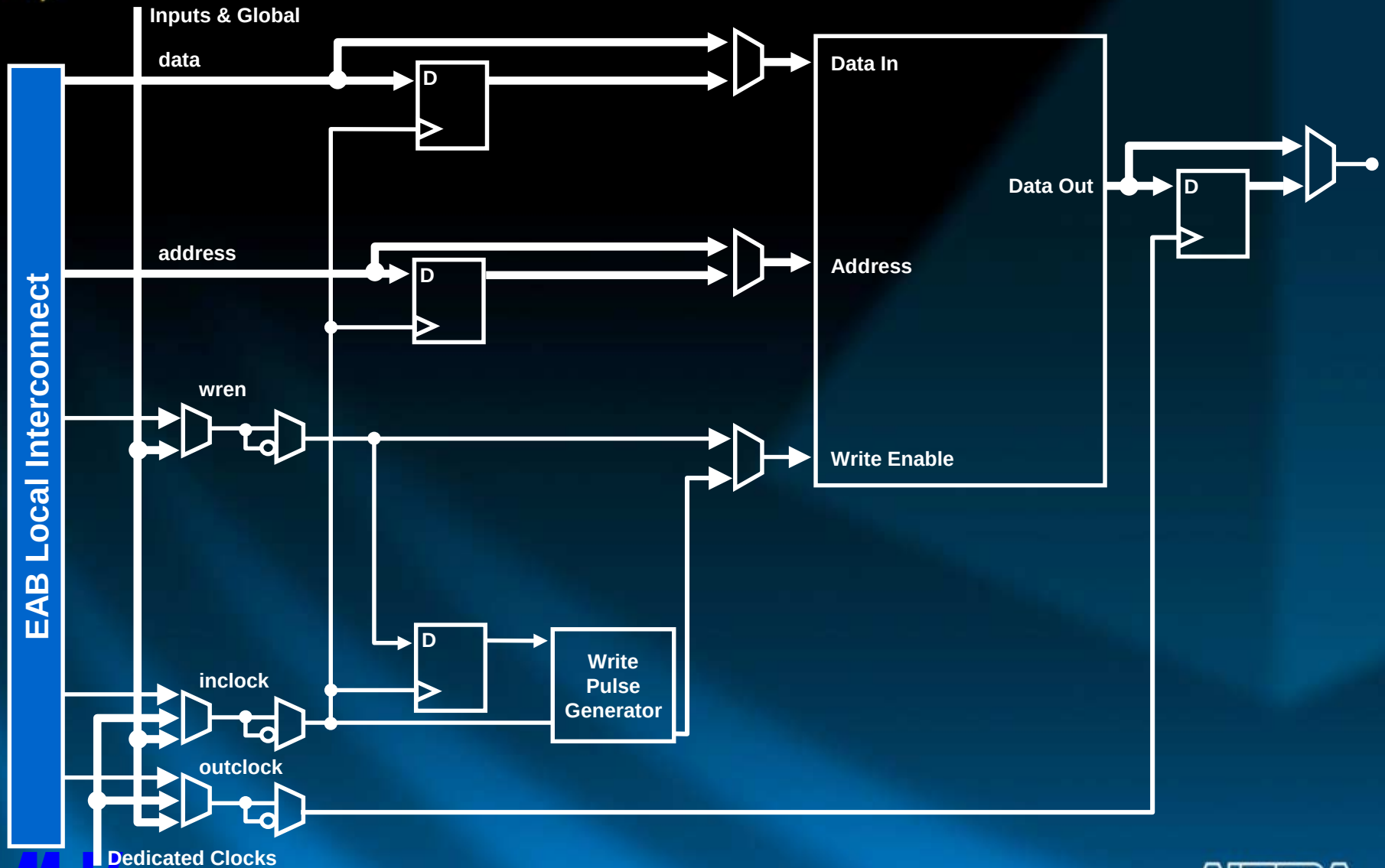


FIFO Configurations





FLEX 10K & FLEX 10KA EAB

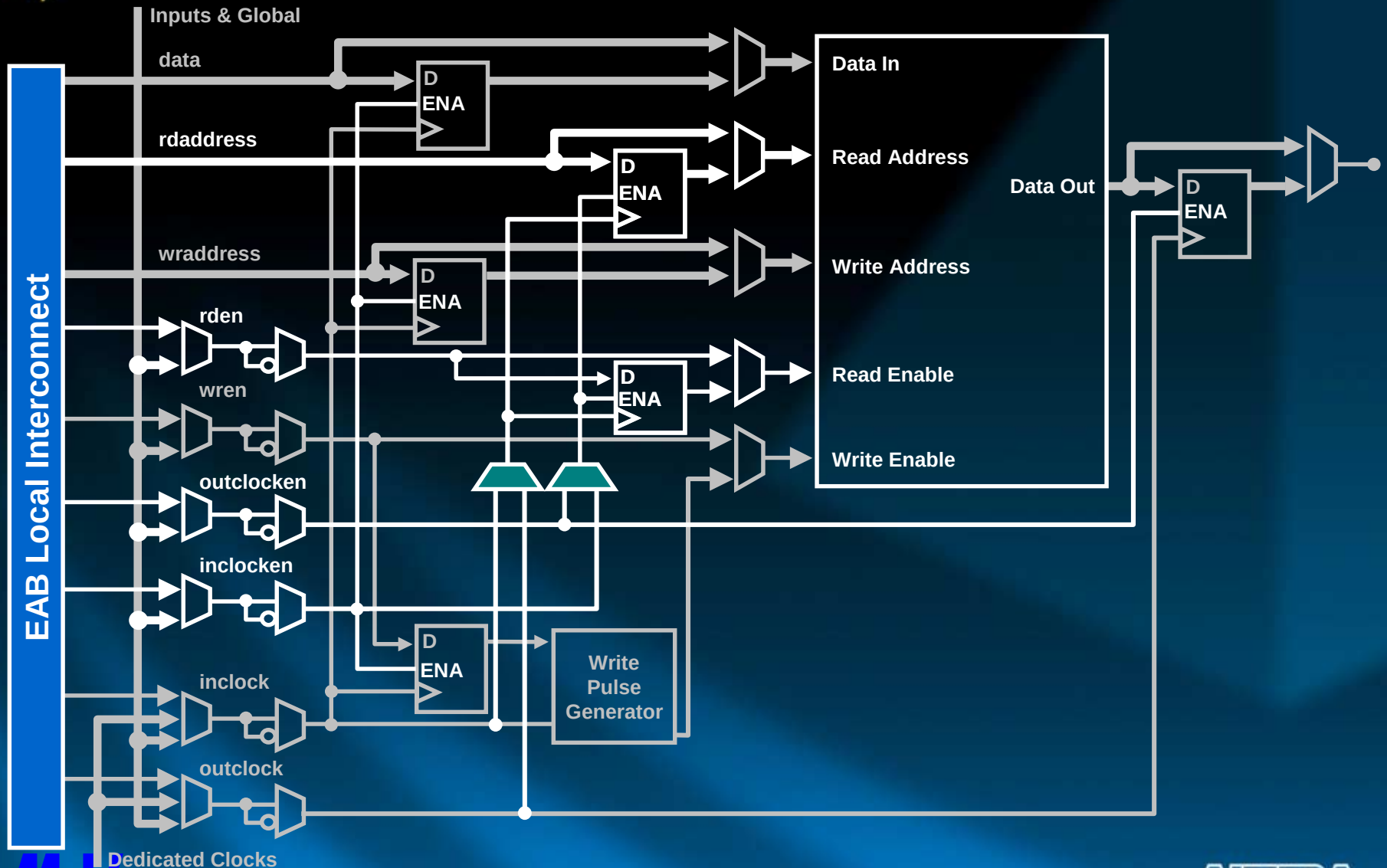


Dedicated Clocks





FLEX 10KE EAB



Dedicated Clocks





New Memory Megafunctions

- ◆ ALTDPRAM
 - Dual-Port RAM Megafunction
- ◆ SCFIFO (Single-Clock FIFO)
 - Synchronous FIFO
- ◆ DCFIFO (Dual-Clock FIFO)
 - Asynchronous FIFO

***Use MegaWizard™ Plug-In Manager
to Instantiate***



Breakthrough FIFO Speeds

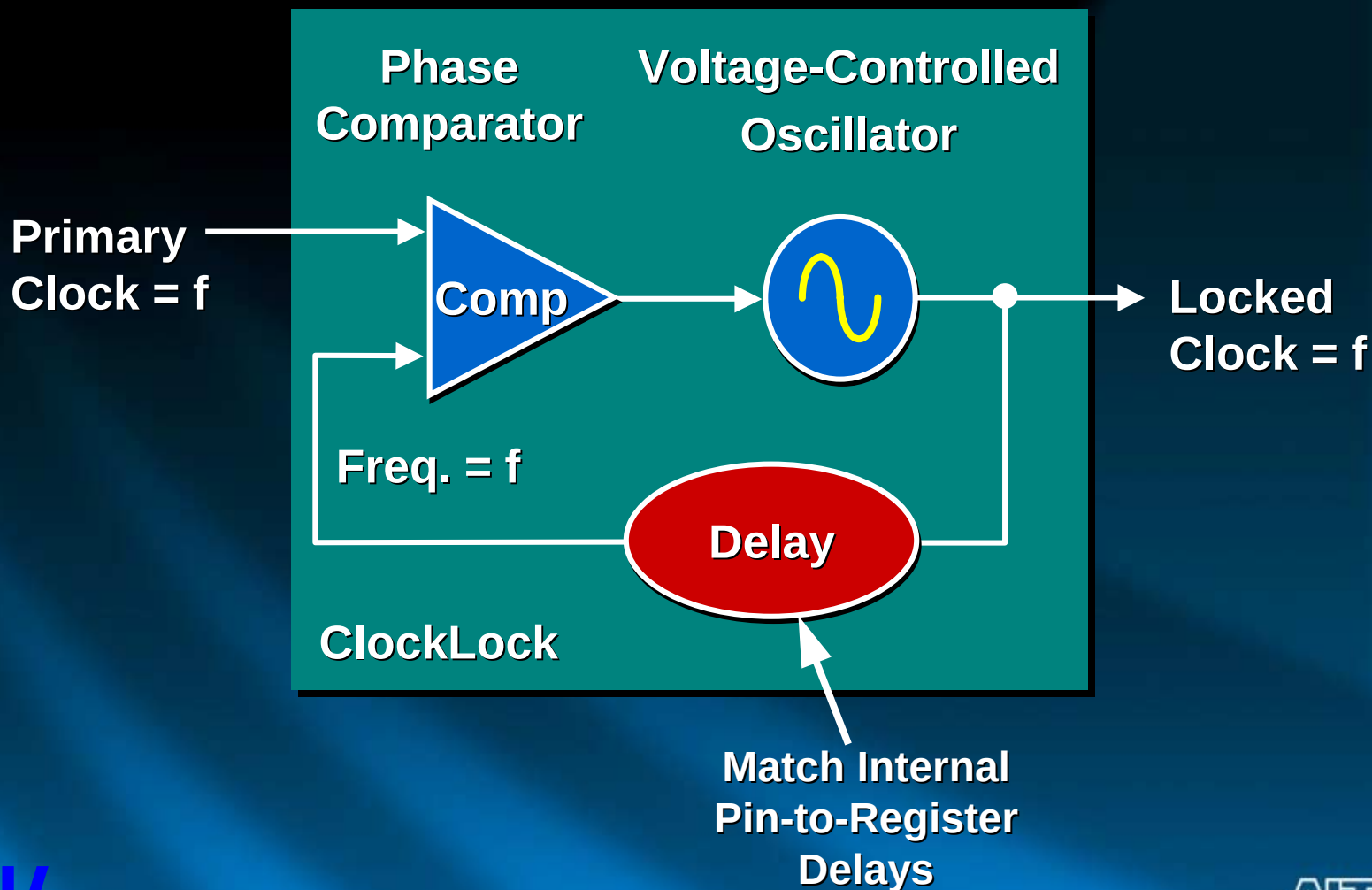
FIFO Size (d x w)	Distributed RAM Structure (MHz)	Altera FLEX 10KE-1 (MHz)
16 x 32	148	161
32 x 32	82	161
64 x 32	74	161
128 x 32	62	161
256 x 32	56	161

Source: Altera Applications





ClockLock™ Circuitry: PLL 1x Mode



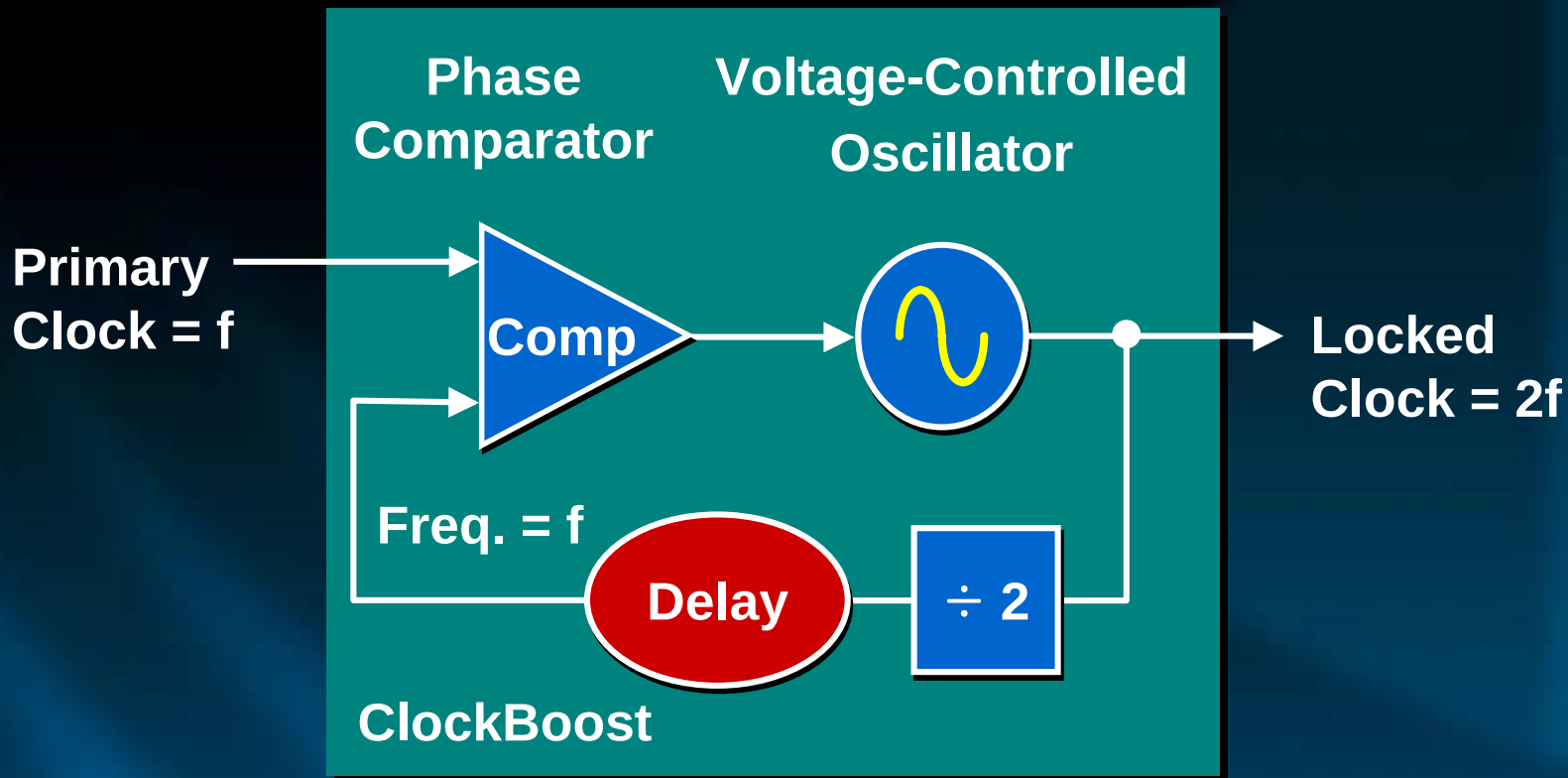


Improved I/O Speed: EPF10K200E Example

	Without ClockLock		With ClockLock	
	Min.	Max.	Min.	Max.
t_{CO} (IOE Register)	2.0 ns	5.0 ns	0.5 ns	3.5 ns
t_{CO} (LE Register)	2.0 ns	7.2 ns	0.5 ns	5.8 ns
t_{SU} (IOE Register)		2.8 ns		1.8 ns
t_{SU} (LE Register)		3.8 ns		3.3 ns

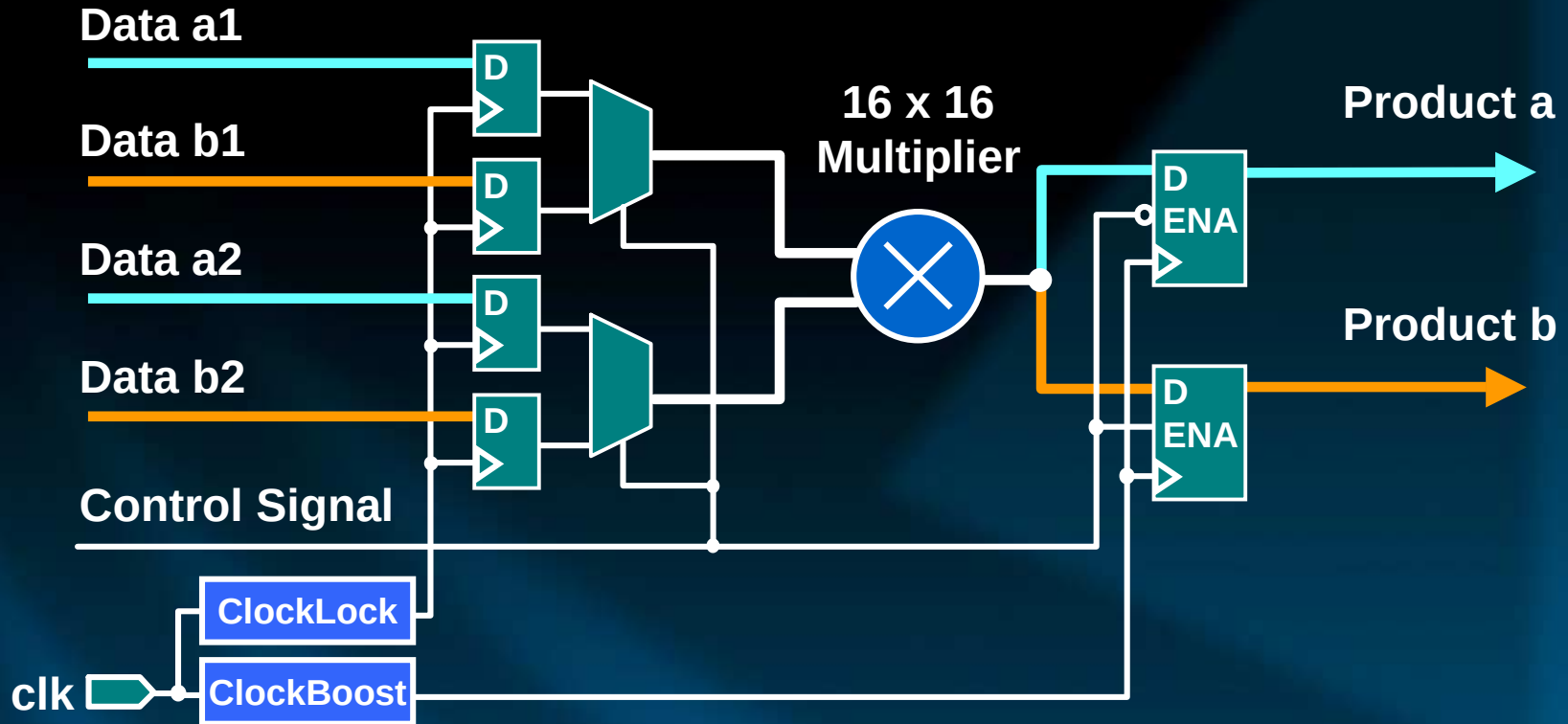


ClockBoost™ Circuitry: PLL 2x Mode





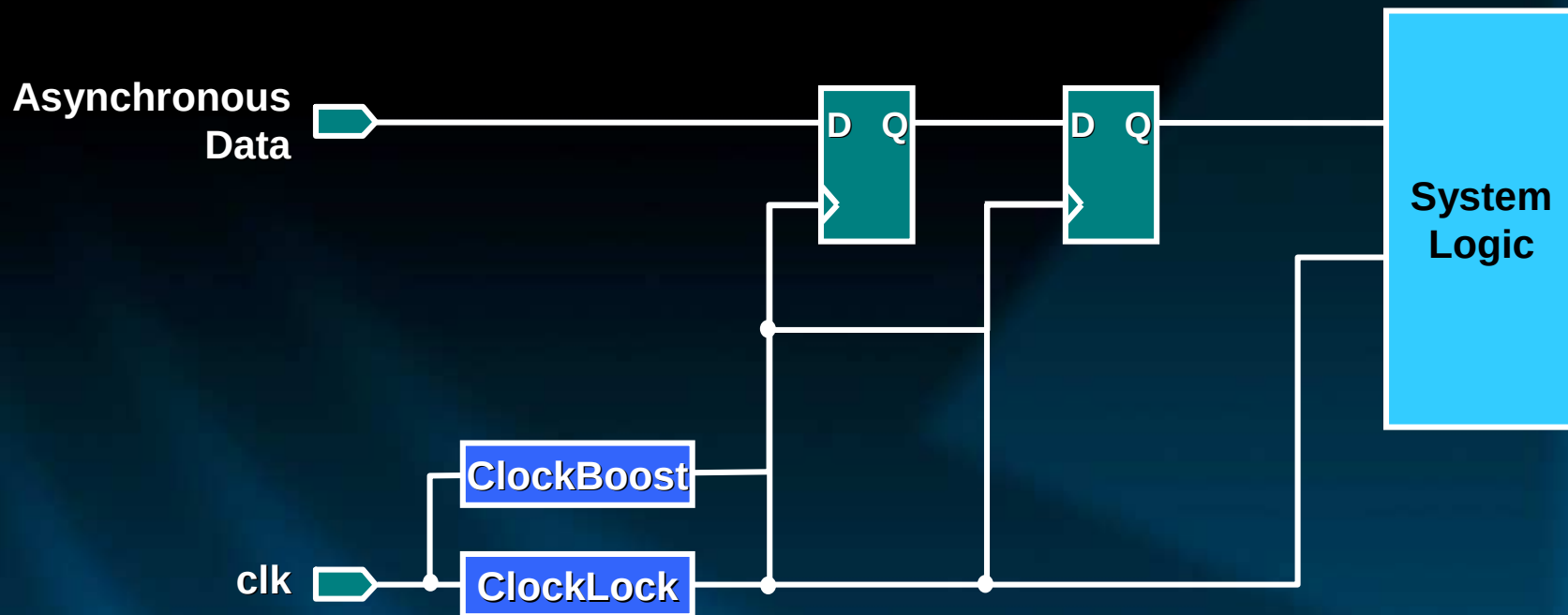
Time-Domain Multiplexing



~~663~~
1,136 Logic Elements



Improved Design Reliability

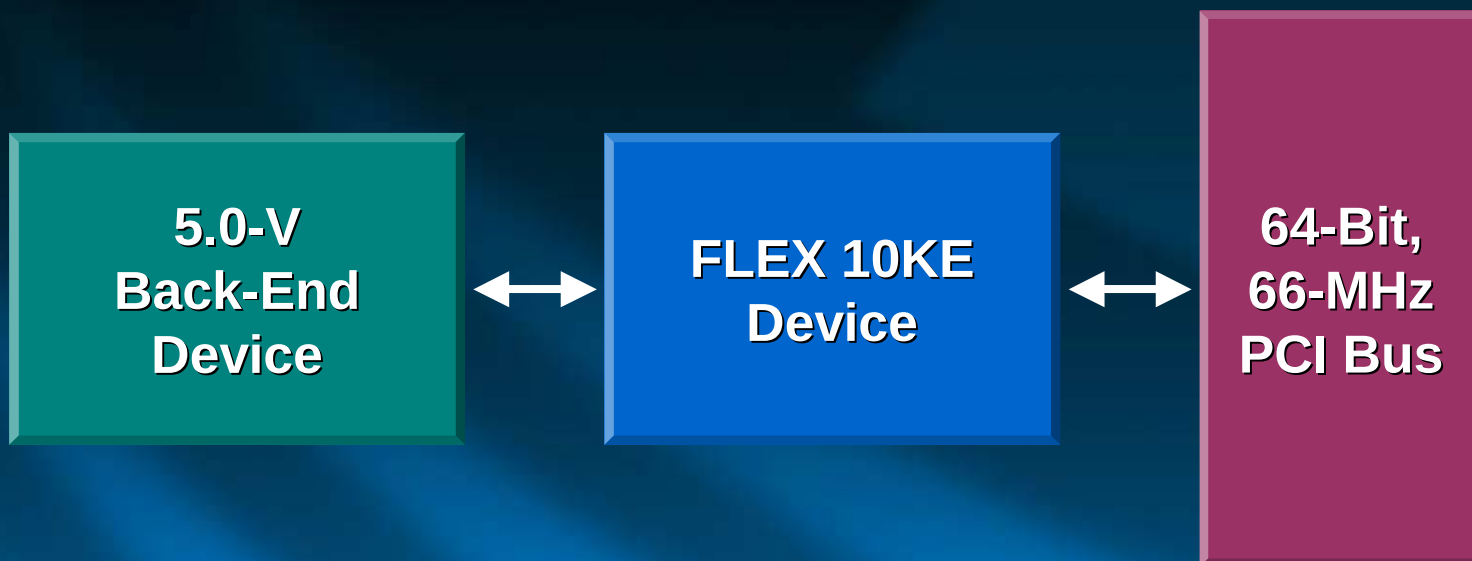


No Added Latency



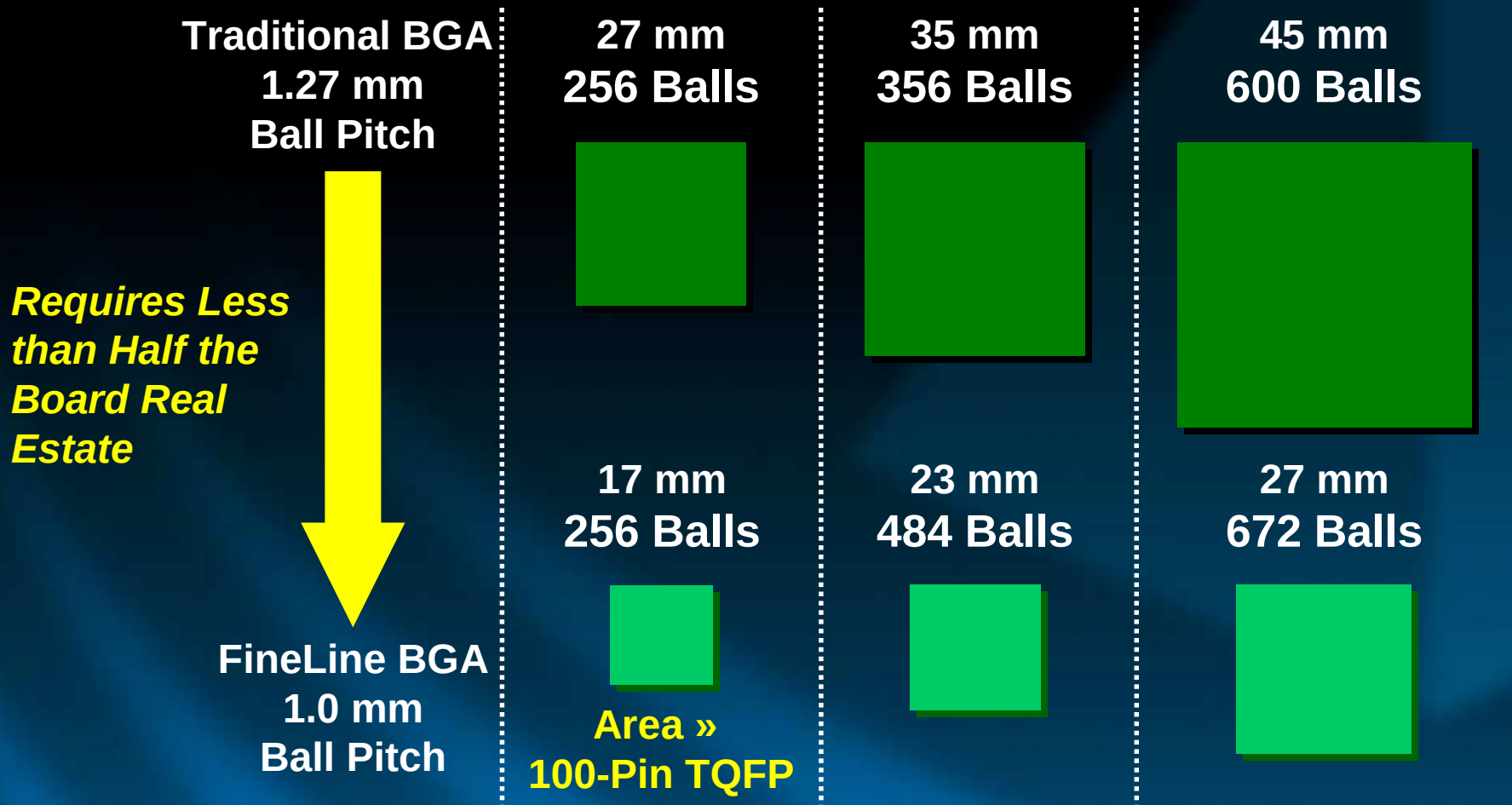
High-Performance PCI

- ◆ 64-Bit, 66-MHz Compliant
- ◆ 3.3-V Compliant
 - Programmable Clamp
- ◆ 5.0-V Drive and Timing Compliant





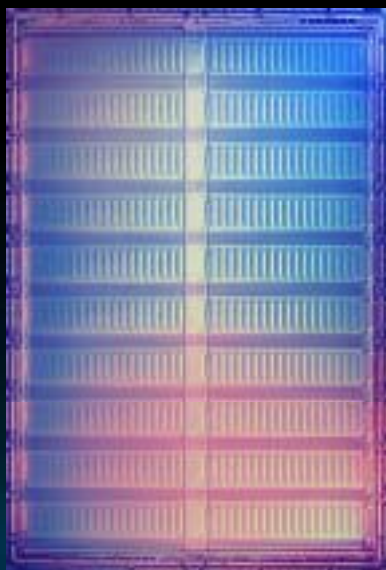
FineLine BGA™ Efficiency



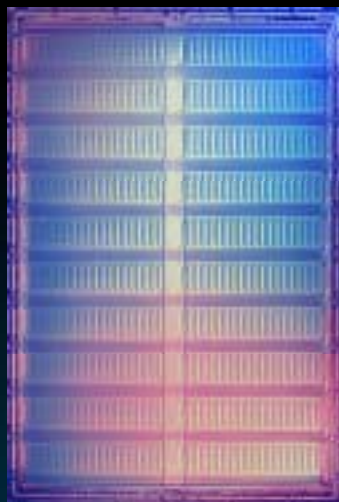


FLEX 10K Process Migration...

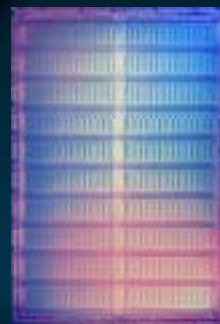
50,000-Gate Device



0.6- μ ,
Triple-Layer
Metal



0.5- μ ,
Triple-Layer
Metal



0.35- μ ,
Quad-Layer
Metal



0.25- μ ,
Five-Layer
Metal

Relative
Die Size:

1.00

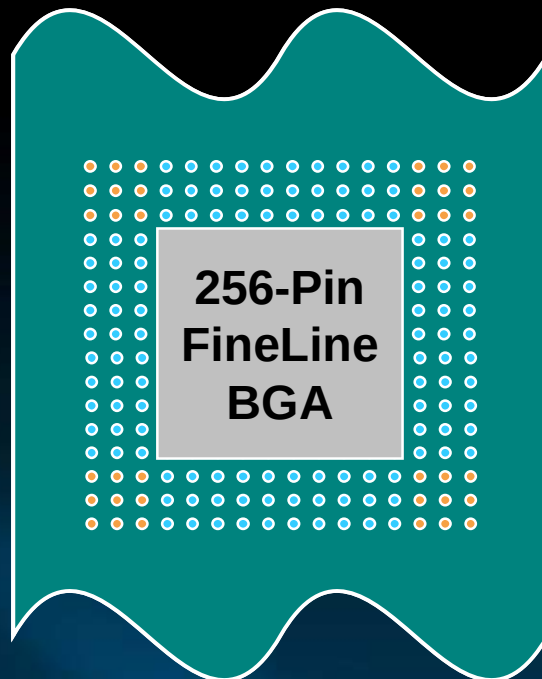
0.78

0.32

0.19



SameFrame™ Pin-Out Advantage





FLEX 10K Family Package Availability

Feature	EPF10K30E	EPF10K50S EPF10K50E	EPF10K100E EPF10K100B	EPF10K130E	EPF10K200S EPF10K200E
Typical Gates	30,000	50,000	100,000	130,000	200,000
Logic Elements	1,728	2,880	4,992 4,992	6,656	9,984
RAM Bits	24,576	40,960	49,152 24,576	65,536	98,304
Package Options ⁽¹⁾	144-Pin TQFP 208-Pin PQFP 256-Pin BGA 484-Pin BGA	144-Pin TQFP 208-Pin PQFP 240-Pin PQFP 256-Pin BGA 356-Pin BGA 484-Pin BGA	208-Pin PQFP 240-Pin PQFP 256-Pin BGA 356-Pin BGA ⁽²⁾ 484-Pin BGA ⁽²⁾	240-Pin PQFP 356-Pin BGA 484-Pin BGA 600-Pin BGA 672-Pin BGA	240-Pin RQFP ⁽³⁾ 356-Pin BGA ⁽³⁾ 484-Pin BGA ⁽³⁾ 599-Pin PGA 600-Pin BGA 672-Pin BGA
Available	Now	Now	Now	Now	Now

(1) 256-, 484- and 672-Pin Packages Are 1.0-mm FineLine BGA™, 356 and 600-Pin Packages Are 1.27-mm Super BGAs

(2) EPF10K100E Device Only

(3) EPF10K200S Device Only





FLEX 10KE High-Performance Solution

BREAKTHROUGH PERFORMANCE

- ★ DESIGNED FOR PCI
- ★ 115-MHz SYSTEM SPEED
- ★ 150-MHz FIFOs

Next-Generation Packaging

- ◆ 1.0-mm FineLine BGA™ Packages
- ◆ Requires Half the Board Area
- ◆ Minimizes Cost

Advanced Process Technology

- ◆ 0.22-μm CMOS SRAM
- ◆ Five-Layer Metal
- ◆ 2.5-V Core with MultiVolt™ I/O
- ◆ 5.0-V Tolerant Inputs

Embedded Architecture Evolution

- ◆ Dual-Port RAM
- ◆ 4-Kbit EAB with x16 Width
- ◆ PCI-Compliant I/O



FLEX 10KE vs. FLEX 10KA Performance

Up to 33% Faster Than the FLEX 10KA!

Gate Count	FLEX 10KA-1 (MHz)	FLEX 10KE-1 (MHz)	% Improvement
30,000	11.0	8.5	23%
50,000	11.2	8.5	24%
100,000	12.5	10.0	20%
130,000	15.0	10.0	33%
200,000	N/A ⁽¹⁾	10.0	N/A
250,000	15.0	N/A	N/A

(1) FLEX 10KA Family Does Not Offer 200K-Gate Device

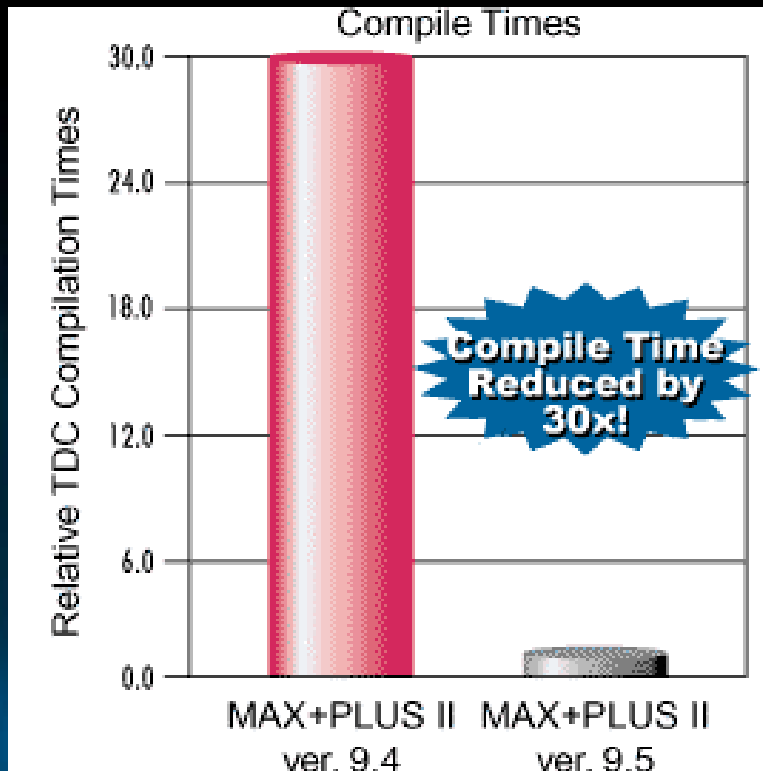


Summary

- ✓ **High Performance**
 - 115-MHz System Performance
 - 64-Bit, 66-MHz PCI Compliance
 - ClockLock, ClockBoost for Improved Speed
- ✓ **Features**
 - PLL
 - Dual-Port Ram
 - Space-Saving FineLine BGA Packaging
 - Migration Flexibility
 - Comprehensive IP offering
- ✓ **Low Cost**
 - Efficient Architecture Results in Smallest Die Size
 - Advanced Process Technology



Performance & Compile Time Comparisons of the MAX+PLUS II software, versions 9.4 and 9.5



Up to **30% Increase**
in Design Performance &
Up to **30 Times Faster**
Timing Driven
Compilation Times with
MAX+PLUS II Software
version 9.5