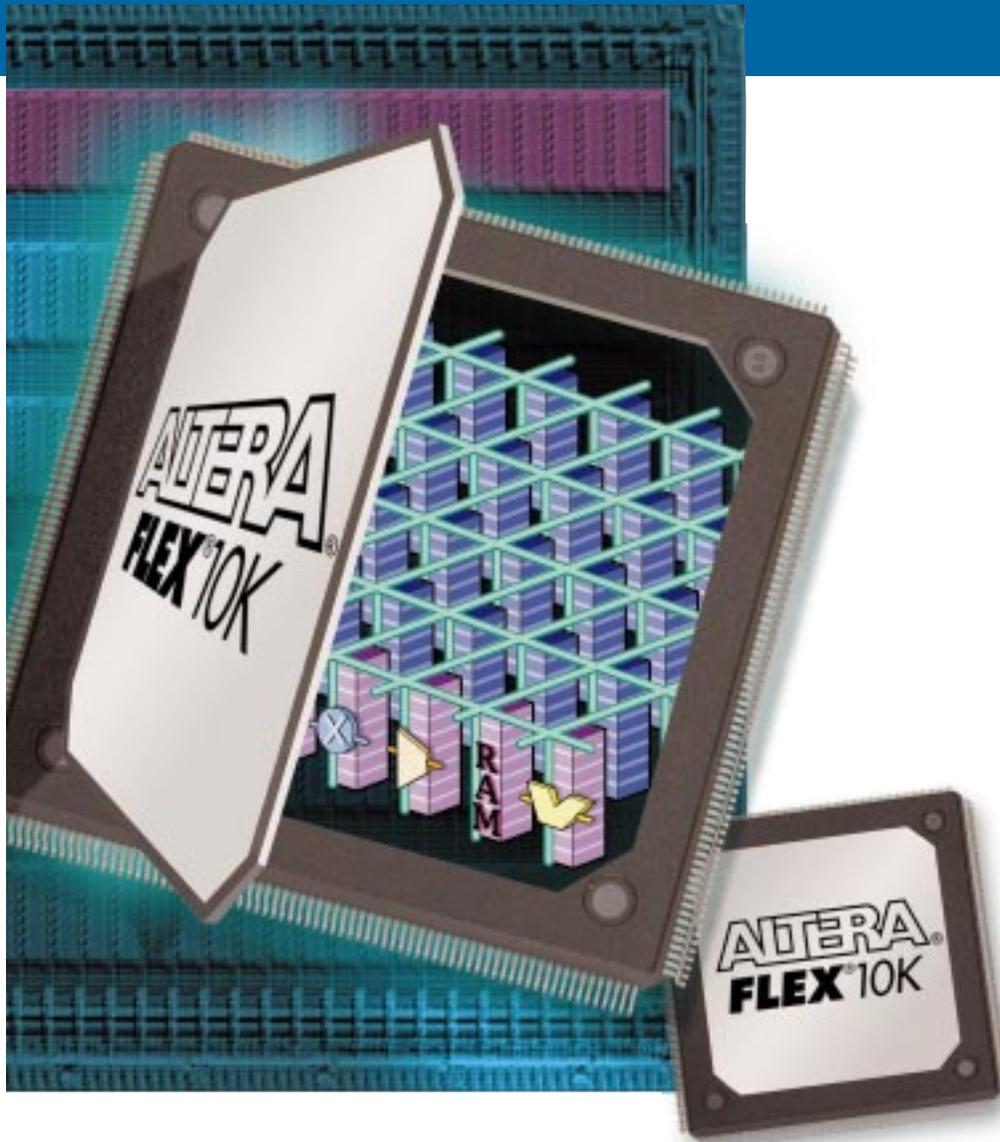


ALTERA®



# FLEX 10K

*250,000-Gate Embedded Programmable Logic Family*

Introducing  
FLEX 10KE  
Devices

June 1998

## Embedded Array Revolutionizes Programmable Logic

The Altera® FLEX® 10K embedded programmable logic device (PLD) family delivers the flexibility of traditional programmable logic together with the efficiency and density of embedded gate arrays. With its two unique logic implementation structures—the embedded array and the logic array—the FLEX 10K family revolutionizes programmable architectures and breaks into the mainstream gate array market.

To reduce die size and increase performance, gate array designers are moving from traditional sea-of-gate gate arrays to those with embedded megafunctions. The FLEX 10K embedded array, a programmable sea-of-bits, can implement popular gate array megafunctions with the same speed and efficiency as embedded gate arrays.

In addition, the FLEX 10K family offers all the features known to FLEX programmable logic users: ease-of-use, fast and predictable performance, register-rich architecture, and in-circuit reconfigurability (ICR). The 3.3-V FLEX 10KA devices and enhanced MAX+PLUS® II software combine to provide performance improvements of up to 100%. Together, these features enable FLEX 10K

devices to achieve the fastest high-density performance in the programmable logic market.

The new 2.5-V FLEX 10KE devices support efficient implementation of dual-port RAM and further enhance the performance of the FLEX 10K family. Designed for compliance with the 3.3-V peripheral component interconnect (PCI) specification, FLEX 10KE devices offer 100-MHz system speed and 150-MHz FIFO buffers in densities from 30,000 to 250,000 gates.

## 250,000-Gate Density Addresses 90% of Gate Array Designs

Ranging from 10,000 to 250,000 typical gates, the FLEX 10K family is specifically designed to meet the demands of mid- to high-density gate array designs. According to market analyst Dataquest, the FLEX 10K family satisfies the density requirements of approximately 90% of gate array design starts. While the Altera FLEX 8000 and FLEX 6000 families provide gate array replacement for applications below 24,000 gates, the FLEX 10K family is the first and only PLD family that can implement high-speed designs approaching “system-on-a-chip” levels.

FLEX 10K Devices						
DEVICE <sup>1</sup>	GATES	PIN/PACKAGE OPTIONS	SUPPLY VOLTAGE	SPEED GRADE	LOGIC ELEMENTS	RAM BITS
EPF10K10	10,000	84-Pin PLCC, 144-Pin TQFP, 208-Pin PQFP	5.0 V	-3, -4	576	6,144
EPF10K10A	10,000	100-Pin TQFP, 144-Pin TQFP, 208-Pin PQFP, 256-Pin BGA <sup>1</sup>	3.3 V	-1, -2, -3	576	6,144
EPF10K20	20,000	144-Pin TQFP, 208-Pin RQFP, 240-Pin PQFP	5.0 V	-3, -4	1,152	12,288
EPF10K30	30,000	208-Pin RQFP, 240-Pin RQFP, 356-Pin BGA	5.0 V	-3, -4	1,728	12,288
EPF10K30A	30,000	144-Pin TQFP, 208-Pin PQFP, 240-Pin PQFP, 256-pin BGA <sup>1</sup> , 356-Pin BGA, 484-Pin BGA <sup>1</sup>	3.3 V	-1, -2, -3	1,728	12,288
EPF10K30E	30,000	144-Pin TQFP, 208-Pin PQFP, 256-pin BGA <sup>1</sup> , 484-pin BGA <sup>1</sup>	2.5 V	-1, -2, -3	1,728	24,576
EPF10K40	40,000	208-Pin RQFP, 240-Pin RQFP	5.0 V	-3, -4	2,304	16,384
EPF10K50	50,000	240-Pin RQFP, 356-Pin BGA, 403-Pin PGA	5.0 V	-3, -4	2,880	20,480
EPF10K50V	50,000	240-Pin RQFP, 356-Pin BGA, 484-Pin BGA <sup>1</sup>	3.3 V	-1, -2, -3, -4	2,880	20,480
EPF10K50E	50,000	144-Pin TQFP, 208-Pin PQFP, 240-Pin PQFP, 256-Pin BGA <sup>1</sup> , 484-Pin BGA <sup>1</sup>	2.5 V	-1, -2, -3	2,880	40,960
EPF10K70	70,000	240-Pin RQFP, 503-Pin PGA	5.0 V	-2, -3, -4	3,744	18,432
EPF10K100	100,000	503-Pin PGA	5.0 V	-3, -4	4,992	24,576
EPF10K100A	100,000	240-Pin RQFP, 356-Pin BGA, 484-Pin BGA <sup>1</sup> , 600-pin BGA	3.3 V	-1, -2, -3	4,992	24,576
EPF10K100B	100,000	208-Pin PQFP, 240-Pin PQFP, 256-Pin BGA <sup>1</sup>	2.5 V	-1, -2, -3	4,992	24,576
EPF10K100E	100,000	208-Pin PQFP, 240-Pin PQFP, 256-pin BGA <sup>1</sup> , 356-pin BGA, 484-pin BGA <sup>1</sup>	2.5 V	-1, -2, -3	4,992	49,152
EPF10K130V	130,000	599-Pin PGA, 600-Pin BGA	3.3 V	-2, -3, -4	6,656	32,768
EPF10K130E	130,000	240-Pin PQFP, 484-Pin BGA <sup>1</sup> , 672-Pin BGA <sup>1</sup>	2.5 V	-1, -2, -3	6,656	65,536
EPF10K200E	200,000	240-Pin RQFP, 599-Pin PGA, 600-pin BGA, 672-pin BGA <sup>1</sup>	2.5 V	-1, -2, -3	9,984	98,304
EPF10K250A	250,000	599-Pin PGA, 600-Pin BGA	3.3 V	-1, -2, -3	12,160	40,960
EPF10K250E	250,000	240-Pin RQFP, 599-Pin PGA, 672-Pin BGA <sup>1</sup>	2.5 V	-1, -2, -3	12,160	81,920

Note:

(1) Space-saving FineLine BGA™ package.

## Embedded Architecture Implements Gate Array Megafunctions

The SRAM-based FLEX 10K family has a unique architecture that includes both a logic array and an embedded array. The flexible, programmable embedded array consists of embedded array blocks (EABs) that contain 2 Kbits of RAM (4 Kbits of RAM for FLEX 10KE devices).

The logic array contains logic array blocks (LABs) composed of eight logic elements (LEs) that communicate through a fully populated local interconnect structure. Each LE contains a four-input look-up table (LUT) and a programmable register with clock enable control. The LE offers a dual-output structure that allows for both sequential and combinatorial outputs.

Both the embedded array and the logic array communicate through the enhanced FastTrack Interconnect™ routing structure. This continuous interconnect structure offers the high performance and predictable timing necessary for PCI compliance. Each interconnect row and column feeds multiple I/O elements (IOEs), each of which contains an I/O register with flexible control signals, programmable slew rate control, and one output enable per pin.

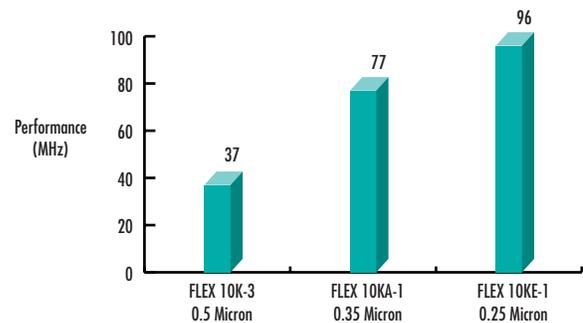
With the expanded RAM size and independent read/write ports, the FLEX 10KE EAB can accommodate high-performance dual-port RAM, and deep and wide FIFO structures. FLEX 10KE devices are also designed to be 3.3-V PCI compliant by providing pin-selectable I/O clamping.

### FLEX 10KE/A: High-Performance Migration Paths

The FLEX 10K family spans three process generations; each succeeding generation provides higher per-

### FLEX 10K Performance Migration

32-Bit PCI\_A Master/Target Megafunction



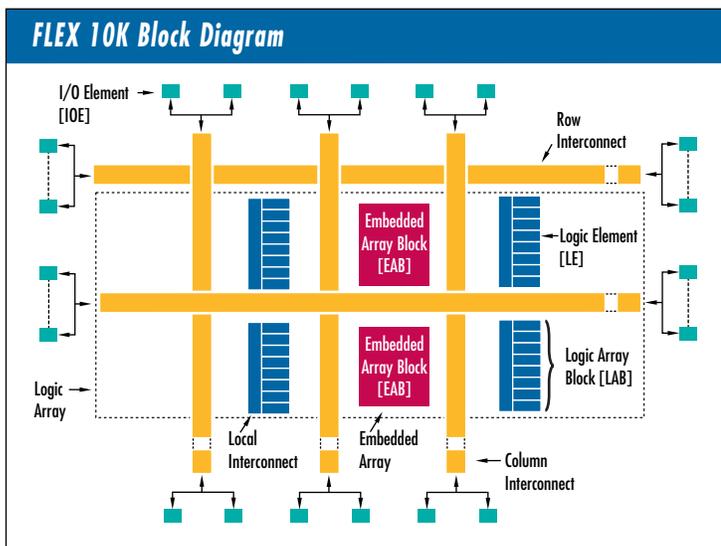
formance and lower power consumption than the previous one. For example, the 2.5-V, 0.25-micron FLEX 10KE devices will be an average of 20% to 30% faster—while offering 50% power savings—than the equivalent 0.35-micron FLEX 10KA devices, which operate at 3.3 V.

### FLEX 10K Family Broadens Programmable Logic Applications

The FLEX 10K family is the first programmable logic family to meet the changing needs of gate array designs. High-density logic designs use megafunctions to integrate more functionality on a single chip. Designers can implement a variety of megafunctions—including memory, arithmetic logic, microprocessors/microcontrollers, and DSP functions—as efficiently in FLEX 10K devices as in embedded gate arrays.

On-chip memory is a common high-density design requirement. The FLEX 10K embedded array can be used to create ROMs, FIFOs, and asynchronous, synchronous, and dual-port RAM. Flexible EAB width and depth configurations are possible without incurring speed penalties. EABs can also be cascaded to create larger blocks of memory. For even greater efficiency, memory implementations in the embedded array do not detract from the standard logic capabilities of the logic array.

The FastTrack Interconnect provides a seamless link between the EABs and the logic array, allowing the embedded array to be used for more than just on-chip memory. The embedded array implements specialized arithmetic functions such as multipliers, arithmetic logic units, and sequencers more efficiently than a traditional logic array. Microprocessors, microcontrollers, and complex DSP functions also become a programmable reality with the FLEX 10K embedded array.



## MultiVolt I/O Operation Ideal for Mixed-Voltage Systems

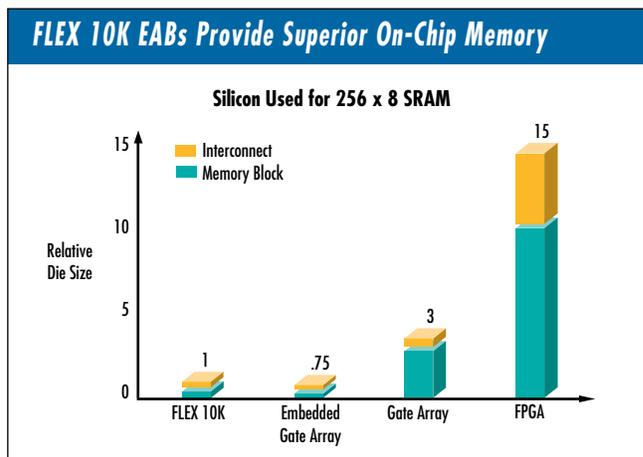
Altera devices offer MultiVolt™ I/O operation, meeting the increased demand for compatibility with devices of different voltages. Altera's 5.0-V FLEX 10K devices can interface with 3.3-V and 5.0-V devices. The 3.3-V FLEX 10KA devices can interface with 2.5-V, 3.3-V, and 5.0-V devices. FLEX 10KE devices, which operate at a 2.5-V supply voltage, can interface with 5.0-V, 3.3-V, and 2.5-V devices.

## Advanced FinLine BGA Packages

The FLEX 10K family also offers the benefit of using advanced, space-saving FineLine BGA™ packages. As the PLD industry's first 1.0-mm-pitch BGA, these packages offer high ball counts and require less than half the board area of standard BGAs. As the FineLine BGA ball pitch moves from 1.0 mm to 0.8 mm and 0.5 mm, this packaging technology will offer even higher ball counts and board-area efficiency. In addition to the board savings, FineLine BGAs will maintain the traditional durability and thermal characteristics of BGA packages.

## MAX+PLUS II Software & Megafunctions Simplify Design

Programmable logic designs that require the density of the FLEX 10K family also need fast, efficient, and easy-to-use design software. Altera's MAX+PLUS II development system provides seamless integration with design software from all leading EDA vendors. This includes support for the library of parameterized modules (LPM), an industry-standard, technology-independent library that makes the design of complex megafunctions possible. Altera also provides MegaCore™ functions,



which are optimized for a specific Altera device architecture with user-specified performance utilization goals. In addition, the MAX+PLUS II system supports megafunctions provided by the Altera Megafunction Partners Program (AMPP<sup>SM</sup>), an alliance between Altera and developers of synthesizable megafunctions. The MAX+PLUS II development software and these off-the-shelf megafunctions significantly reduce design tasks, dramatically shorten design cycles, and provide optimum results.

## Call Altera Today

The FLEX 10K family of embedded programmable logic provides designers with the first programmable alternative to high-density, embedded gate arrays. The innovative FLEX 10K architecture implements designs as efficiently as embedded gate arrays while providing all the benefits of programmable logic. Call Altera or visit the web site at <http://www.altera.com> to learn more about the FLEX 10K embedded programmable logic family.

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