

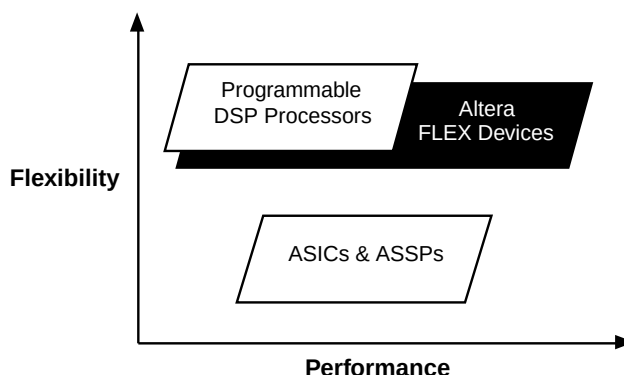
FLEX Devices as Alternatives to ASSPs & ASICs

TECHNICAL BRIEF 3

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In the past, DSP applications that required real-time performance were implemented with application-specific standard products (ASSPs) or custom ASICs. While these solutions may offer acceptable performance, neither offers the flexibility to modify DSP algorithms. Altera FLEX 8000 and FLEX 10K programmable logic devices (PLDs) provide comparable performance and greater flexibility at a lower cost than ASSPs and ASICs.

Performance & Flexibility of DSP Solutions



FLEX DSP Advantages

FLEX devices allow for design modifications and instant prototyping without sacrificing high performance. For example, an 8-tap finite impulse response (FIR) filter implemented in an EPF8452A device can operate at over 100 million samples per second (MSPS). Because FLEX devices are reconfigurable, designers can modify the way they implement their design flow. Algorithms that traditionally operated as a sequence of single instructions can be implemented in parallel in the FLEX architecture.

Efficiency

Many DSP algorithms, such as FIR filters and YUV-to-RGB converters, require multiplication by a coefficient. In the FLEX architecture, which is based on look-up tables (LUTs), the vectors corresponding to the multiplicand can be precomputed and stored in the LUT, eliminating the need for a full multiplier. Devices that are not reconfigurable, such as ASICs, would require a full multiplier for the same algorithm.

Pipelining

Pipelined registers, which are used to improve throughput, use logic resources in ASICs and ASSPs. In contrast, pipelined registers are included in the logic cells of FLEX 8000 and FLEX 10K devices and can be employed without using additional logic resources.

In-Circuit Reconfigurability (ICR)

ICR enables a FLEX device to be reconfigured while the device is in normal system operation. With ICR, designers can use the same logic resources to implement multiple functions by reconfiguring the device "on-the-fly." Algorithms can also be updated in the field via ICR.

Specialized Algorithms

The FLEX 10K embedded array architecture can implement specialized algorithms that require the storage and rapid retrieval of intermediate values, including transform functions such as fast Fourier transform (FFT) and discrete cosine transform (DCT).

FLEX DSP Performance

The efficiency of FLEX devices and the fast, predictable routing provided by the FastTrack Interconnect enable these devices to implement DSP functions significantly better than ASSPs or ASICs. The following table compares the performance of a 3×3 video convolver function as implemented in an Altera EPF8282A, an HSP48901 ASSP device, and a fixed-point 50-MHz DSP processor.

Performance Comparison for 3×3 Video Convolver

Solution	Device	Performance (MSPS)	Relative Price
FLEX 8000	Altera EPF8282A	98	1.0
Building Block ASSP	Harris HSP48901	30	3.0
DSP Processor	Texas Instruments TMS320325-50	< 2	2.8

The dedicated circuit of the ASSP device requires a full multiplier implementation, and consequently offers 66% lower performance than the FLEX device. A typical DSP processor requires one cycle for each of the nine multiply and accumulates (MACs), plus possible overhead for reading data. As a result, the DSP processor offers much lower performance than the FLEX device. Furthermore, the price of both the ASSP and the DSP processor is higher than that of the FLEX device.

DSP Design Kit Available from Altera

FLEX devices provide higher performance than custom DSP solutions without sacrificing flexibility. Altera offers a DSP Design Kit that includes customizable building blocks for implementing DSP functions. These building blocks include fully parallel 8-, 16-, 24-, 32-, and 64-tap FIR filters with customizable data coefficient widths, full serial filters for larger tap widths, and floating-point arithmetic functions. The DSP Design Kit optimizes these functions for Altera FLEX architectures so that designers can easily customize functions to fit specific design parameters.

The documents listed below provide more detailed information. Part numbers are in parentheses.

Product Information Bulletins

PIB 23 *Digital Signal Processing in FLEX Devices (A-PIB-023-01)*

Application Notes

AN 73 *Implementing FIR Filters in FLEX Devices (A-AN-073-01)*

You can request these documents from:

- Altera Express fax service at (800) 5-ALTERA
- World-wide web at <http://www.altera.com>
- Your local Altera sales representative