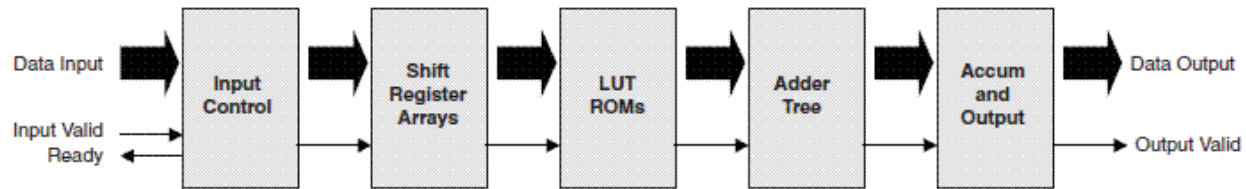


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## Distributed Arithmetic FIR (DA-FIR) Filter Generator

### Overview

The Lattice Distributed Arithmetic Finite Impulse Response (DA-FIR) Filter Generator IP implements a highly configurable, multi-channel DA-FIR filter, using distributed arithmetic algorithms implemented in FPGA Look Up Table (LUT) or Embedded Block Memory (EBR) to efficiently support the sum-of-product calculations required to perform the filter function. These techniques generate very area-efficient utilization of the FPGA LUTs while enabling savings of multiply-accumulate blocks (sysDSP) for other design logic. As a result, the DA-FIR Filter Generator IP core is extremely useful for implementing custom DSP blocks in Lattice FPGAs. Please refer to the user's guide to determine which cores are available for each device family.



### Features

- Variable number of taps up to 1024
- Multi-channel support (up to 32 channels)
- Polyphase interpolation/decimation filters
- Halfband filters
- Interpolation and Decimation ratios from 2 to 32
- Input data widths from 4 to 32 bits
- Coefficient widths from 4 to 32 bits
- Signed or unsigned data and coefficients
- Selectable rounding: truncation, rounding away from zero, convergent rounding

- Optional saturation logic for overflow handling
- Full precision arithmetic
- Specification of fractional inputs and outputs
- Support for both serial and parallel filters, with user specified degree of parallelism.
- Configurable pipelining to increase performance
- Optimizations based on filter characteristics (symmetry and halfband).
- Handshake signals to facilitate smooth interfacing

### Performance and Resource Utilization

LatticeECP3<sup>1</sup>

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 16   | Disable       | 16     | TRUN  | 290    | 348  | -    | 476       | 318  |
| 1        | 9    | Disable       | 8      | TRUN  | 512    | 611  | -    | 877       | 279  |
| 1        | 36   | Enable        | 12     | TRUN  | 600    | 709  | -    | 883       | 308  |

1. Performance and utilization data are generated targeting a LFE3-70E-7FN484CES device using Lattice Diamond 1.0 and Synplify Pro D-2009.12L-1 software. Performance may vary when using a different software version or targeting a different device density or speed grade within the LatticeECP3 family.

LatticeECP2M/S<sup>1</sup>

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 16   | Disable       | 16     | TRUN  | 317    | 378  | -    | 481       | 343  |
| 1        | 9    | Disable       | 8      | TRUN  | 550    | 655  | -    | 887       | 310  |

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 36   | Enable        | 12     | TRUN  | 625    | 743  | -    | 899       | 291  |

1. Performance and utilization data are generated targeting a LFE2M20E-6F256C device using Lattice Diamond 1.0 and Synplify Pro D-2009.12L-1 software. Performance may vary when using a different software version or targeting a different device density or speed grade within the LatticeECP2M family.

LatticeECP2 / S<sup>1</sup>

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 16   | Disable       | 16     | TRUN  | 317    | 378  | -    | 481       | 341  |
| 1        | 9    | Disable       | 8      | TRUN  | 550    | 655  | -    | 887       | 321  |
| 1        | 36   | Enable        | 12     | TRUN  | 625    | 743  | -    | 899       | 320  |

1. Performance and utilization data are generated targeting a LFE2-20E-6F256C device using Lattice Diamond 1.0 and Synplify Pro D-2009.12L-1 software. Performance may vary when using a different software version or targeting a different device density or speed grade within the LatticeECP2 family.

LatticeECP / EC<sup>1</sup>

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 16   | Disable       | 16     | TRUN  | 296    | 340  | -    | 481       | 192  |
| 1        | 9    | Disable       | 8      | TRUN  | 521    | 594  | -    | 887       | 180  |
| 1        | 36   | Enable        | 12     | TRUN  | 590    | 689  | -    | 899       | 174  |

1. Performance and utilization data are generated targeting a LFEC15E-4F256C device using Lattice Diamond 1.0 and Synplify Pro D-2009.12L-1 software. Performance may vary when using a different software version or targeting a different device density or speed grade within the LatticeECP family.

LatticeSC / M<sup>1</sup>

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 16   | Disable       | 16     | TRUN  | 278    | 343  | -    | 481       | 372  |
| 1        | 9    | Disable       | 8      | TRUN  | 564    | 759  | -    | 895       | 338  |
| 1        | 36   | Enable        | 12     | TRUN  | 568    | 668  | -    | 934       | 390  |

1. Performance and utilization data are generated targeting a LFSC3GA15E-6F256C device using Lattice Diamond 1.0 and Synplify Pro D-2009.12L-1 software. Performance may vary when using a different software version or targeting a different device density or speed grade within the LatticeSC/M family.

LatticeXP2<sup>1</sup>

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 16   | Disable       | 16     | TRUN  | 317    | 378  | -    | 481       | 274  |
| 1        | 9    | Disable       | 8      | TRUN  | 550    | 655  | -    | 887       | 251  |
| 1        | 36   | Enable        | 12     | TRUN  | 625    | 743  | -    | 899       | 270  |

2009.12L-1 software. Performance may vary when using a different software version or targeting a different device density or speed grade within the LatticeXP2 family.

LatticeXP<sup>1</sup>

| Channels | Taps | Interpolation | DWidth | Round | SLICES | LUTs | EBRs | Registers | Fmax |
|----------|------|---------------|--------|-------|--------|------|------|-----------|------|
| 1        | 16   | Disable       | 16     | TRUN  | 296    | 340  | -    | 481       | 186  |
| 1        | 9    | Disable       | 8      | TRUN  | 521    | 594  | -    | 887       | 178  |
| 1        | 36   | Enable        | 12     | TRUN  | 590    | 689  | -    | 899       | 168  |

1. Performance and utilization data are generated targeting a LFXP10E-4F256C device using Lattice Diamond 1.0 and Synplify Pro D-2009.12L-1 software. Performance may vary when using a different software version or targeting a different device density or speed grade within the LatticeXP family.

## Ordering Information

| Family        | Part Number     |
|---------------|-----------------|
| LatticeECP3   | DAFIR-GEN-E3-U2 |
| LatticeECP2M  | DAFIR-GEN-PM-U2 |
| LatticeECP2   | DAFIR-GEN-P2-U2 |
| LatticeECP/EC | DAFIR-GEN-E2-U2 |
| LatticeSC     | DAFIR-GEN-SC-U2 |
| LatticeXP2    | DAFIR-GEN-X2-U2 |
| LatticeXP     | DAFIR-GEN-XM-U2 |

**IP Version:** 2.2

**Evaluate:** To download a full evaluation version of this IP, go to the IPexpress tool and click the IP Server button in the toolbar. All LatticeCORE IP cores and modules available for download will be visible. For more information on viewing/downloading IP please read the [IP Express Quick Start Guide](#).

**Purchase:** To find out how to purchase the IP Core, please contact your [local Lattice Sales Office](#).