Numerically Controlled Oscillator

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Overview

Numerically Controlled Oscillators (NCO), also called Direct Digital Synthesizers (DDS), offer several advantages over other types of oscillators in terms of accuracy, stability and reliability. NCOs provide a flexible architecture that enables easy programmability such as on-the-fly frequency/phase. NCOs are used in many communications systems including **digital up/down converters** used in 3G wireless and software radio systems, **digital PLLs**, **radar systems**, **drivers for optical or acoustic transmissions**, and **multilevel FSK/PSK modulators/demodulators**.

LatticeCORE™

Lattice provides a parameterizable NCO IP core that supports multiple channels and a Quadrature Amplitude Modulation (QAM) mode, in addition to other usual configurations. The resource utilization and performance trade-off can be tuned by configuring different parameters of the IP core to obtain the optimal Spurious Free Dynamic Range (SFDR) result. The Lattice NCO core offers a variety of memory reduction schemes and mechanisms for SFDR improvement.
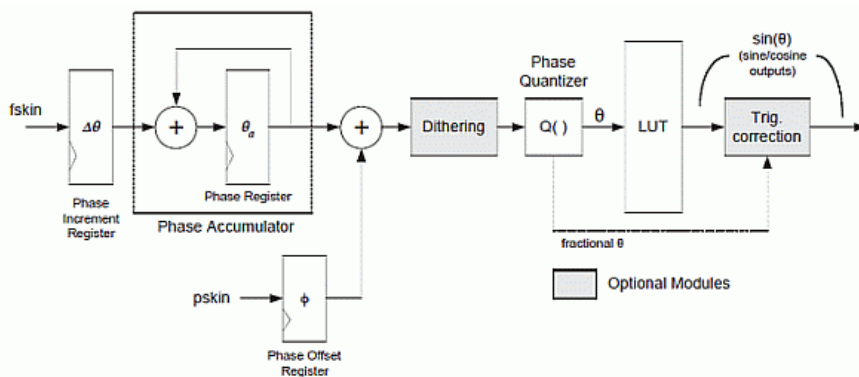
Features

- Supports single or multi channel operation up to 16 channels
- Run time variable phase increment input $\Delta\theta$ and phase offset input ϕ
- Up to 32-bit user-configurable phase resolution
- Up to 20-bit user-configurable quantizer resolution
- Up to 32-bit user-configurable amplitude resolution
- User-configurable memory saving architectures — 1/2 wave, 1/4 wave or full wave
- User-selectable sum of angles (SOA) optimization for memory saving
- Up to 4-bit user-selectable phase dithering correction
- User-selectable trigonometric correction for SFDR improvement
- Option for truncating or rounding the quantizer output when neither dithering nor trigonometric correction is used.
- User-selectable QAM mode support
- Provides high-SFDR up to 115 dB
- Provides sine, cosine or quadrature outputs.
- User configurable output polarity

Performance and Resource Utilization

LatticeECP3[1]						
IPexpress User-Configurable Mode	**SLICEs**	**LUTs**	**Registers**	**I/O**	**Multipliers 18x18**	**sysMEM EBRs**	**f_{MAX} (MHz)**
Config 1	25	6	44	39	4	3	340
Config 2	163	220	262	104	0	1	340
Config 3	302	310	494	217	8	3	320

1. Performance and utilization data are generated targeting an LFE3-95E-7FN672CES 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[1]						
IPexpress User-Configurable Mode	**SLICEs**	**LUTs**	**Registers**	**I/O**	**Multipliers[2] 18x18**	**sysMEM EBRs**	**f_{MAX} (MHz)**
Config 1	24	5	44	39	4	3	347
Config 2	200	222	262	104	0	1	361
Config 3	287	282	494	217	8	3	256

1. Performance and utilization data are generated targeting an LFE2M-35E-7F484C 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.
2. One DSP block provides two MULT18X18ADDSUBs.

LatticeECP2[1]

IPexpress User-Configurable Mode	SLICEs	LUTs	Registers	I/O	Multipliers[2] 18x18	sysMEM EBRs	f_{MAX} (MHz)
Config 1	24	5	44	39	4	3	368
Config 2	200	222	262	104	0	1	370
Config 3	287	282	494	217	8	3	325

1. Performance and utilization data are generated targeting an LFE2-50E-7F672C 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.
2. One DSP block provides two MULT18X18ADDSUBs.

LatticeECP[1]

IPexpress User-Configurable Mode	SLICEs	LUTs	Registers	I/O	Multipliers[2] 18x18	sysMEM EBRs	f_{MAX} (MHz)
Config 1	27	7	44	39	4	3	215
Config 2	194	211	262	104	0	2	215
Config 3	305	316	494	217	8	5	226

1. Performance and utilization data are generated targeting an LFECP20E-5F672C 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.
2. One DSP block provides two MULT18X18ADDSUBs.

LatticeEC[1]

IPexpress User-Configurable Mode	SLICEs	LUTs	Registers	I/O	sysMEM EBRs	f_{MAX} (MHz)
Config 1	1000	1710	715	39	3	116
Config 2	194	211	262	104	2	230
Config 3	2235	3730	1833	217	5	123

1. Performance and utilization data are generated targeting an LFEC20E-5F672C 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 LatticeEC family.

LatticeSC[1]

IPexpress User-Configurable Mode	SLICEs	LUTs	Registers	I/O	sysMEM EBRs	f_{MAX} (MHz)
Config 1	1472	2194	1071	39	3	242
Config 2	152	210	262	104	1	375
Config 3	3583	5153	2549	217	3	239

1. Performance and utilization data are generated targeting an LFSC3GA25E-7F900C 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 family.

LatticeXP2[1]

IPexpress User-Configurable Mode	SLICEs	LUTs	Registers	I/O	Multipliers[2] 18x18	sysMEM EBRs	f_{MAX} (MHz)
Config 1	24	5	44	39	4	3	314
Config 2	200	222	262	104	0	1	314
Config 3	287	282	494	217	8	3	314

1. Performance and utilization data are generated targeting an LFXP2-17E-7F484C 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 LatticeXP2 family.
2. One DSP block provides two MULT18X18ADDSUBs.

LatticeXP[1]

IPexpress User-Configurable Mode	SLICEs	LUTs	Registers	I/O	sysMEM EBRs	f_{MAX} (MHz)
Config 1	1000	1710	715	39	3	112
Config 2	194	211	262	104	2	219
Config 3	2235	3730	1833	217	5	115

1. Performance and utilization data are generated targeting an LFXP20E-5F484C 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 Numbers
LatticeECP3	NCO-DDS-E3-U2

LatticeECP2M	NCO-DDS-PM-U2
LatticeECP2	NCO-DDS-P2-U2
LatticeECP	NCO-DDS-E2-U2
LatticeEC	NCO-DDS-E2-U2
LatticeSC	NCO-DDS-SC-U2
LatticeXP2	NCO-DDS-X2-U2
LatticeXP	NCO-DDS-XM-U2

IP Version: 2.6

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**.