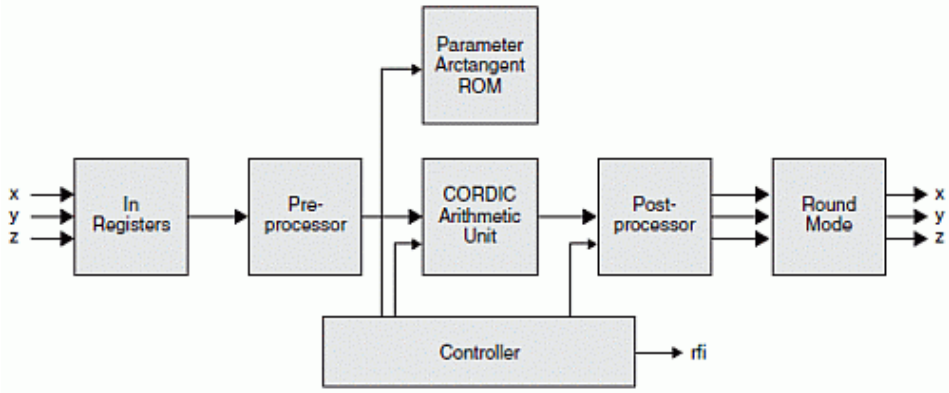
CORDIC (COordinate Rotation DIgital Computer)

Overview

CORDIC (COordinate Rotation DIgital Computer) is a simple and efficient algorithm to calculate hyperbolic and trigonometric functions and convert polar co-ordinates to artesian and vice versa. It is an iterative method that requires simple arithmetic operations such as addition, subtraction, bit shift and table look up. This frees up any available multipliers in the device for use in more complex tasks.

The Lattice CORDIC IP is configurable and several functions can be implemented in the IP core: Rotation, Translation, Sin and Cos, Arctan. Two architecture configurations are available for the arithmetic unit: Parallel, with single cycle data throughput, and Word-serial, with multiple cycles throughput. The input data, output data widths and iterative number are configurable over a wide range. The IP core uses full internal precision while allowing variable output precision with several choices for rounding.



Features

Functions supported:

- Vector rotation (polar to rectangular)
- Vector translation (rectangular to polar)
- Sin and cos
- Arctan

Input data widths from 8 to 32 bits

Configurable number of iterations used to derive output from 4 to 32

Optional pre-rotation module

Optional amplitude compensation scaling module to compensate for the CORDIC algorithm's output amplitude scale factor

Selectable rounding algorithm: truncation, rounding up, rounding away from zero, convergent rounding

Selectable parallel architectural configuration for throughput optimization

Selectable word-serial architectural configuration for area optimization

Signed 2's complement data

Optional clock enable (ce) and synchronous reset (sr) control signals

Full precision internal arithmetic

Performance and Resource Utilization

LatticeECP3[1]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	647	1280	1207	85	-	-	253
2	318	618	278	85	-	-	176
3	640	1261	1175	69	-	-	320
4	609	1203	1102	53	-	-	298

1. Performance and utilization data are generated targeting an LFE3-70E-8FN484CES device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	649	1283	1205	85	-	-	279
2	308	602	278	85	-	-	167
3	644	1268	1182	69	-	-	276
4	624	1232	1104	53	-	-	269

1. Performance and utilization data are generated targeting an LFE2M-20E-7F484C device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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[1]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	649	1283	1205	85	-	-	278
2	308	602	278	85	-	-	171
3	644	1268	1182	69	-	-	262
4	624	1232	1104	53	-	-	271

1. Performance and utilization data are generated targeting an LFE2-20E-7F484C device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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[1]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	649	1196	1210	85	-	-	183
2	331	605	278	85	-	-	128
3	642	1181	1181	69	-	-	172
4	612	1146	1105	53	-	-	188

1. Performance and utilization data are generated targeting an LFECP20E-5F484C device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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.

LatticeEC[1]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	649	1196	1210	85	-	-	188
2	334	611	271	85	-	-	124
3	640	1179	1178	69	-	-	170
4	611	1146	1105	53	-	-	186

1. Performance and utilization data are generated targeting an LFEC20E-5F484C device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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/M[1]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	833	1631	1224	85	-	-	389
2	402	739	292	85	-	-	235
3	830	1709	1214	69	-	-	332
4	803	1586	1155	53	-	-	390

1. Performance and utilization data are generated targeting an LFSC3GA25E-7F900C device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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[1]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	649	1283	1205	85	-	-	275
2	308	602	278	85	-	-	159
3	644	1268	1182	69	-	-	279
4	624	1232	1104	53	-	-	274

1. Performance and utilization data are generated targeting an LFXP2-30E-7F484C device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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.

LatticeXP[1]

User Configurable Mode	SLICEs	LUTs	Registers	I/Os	sysMEM EBRs	MULT 18x18	f_{MAX} (MHz)
1	649	1196	1210	85	-	-	174
2	334	611	271	85	-	-	114
3	640	1179	1178	69	-	-	156
4	611	1146	1105	53	-	-	176

1. Performance and utilization data are generated targeting an LFXP20E-5F484C device using Lattice Diamond 1.0 and Synplify Pro for Lattice 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	CORDIC-E3-U1
LatticeECP2M	CORDIC-PM-U1
LatticeECP2	CORDIC-P2-U1
LatticeEC/P	CORDIC-E2-U1
LatticeSC/M	CORDIC-SC-U1

LatticeXP2	CORDIC-X2-U1
LatticeXP	CORDIC-XM-U1

IP Express Version: 1.1

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**.