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Lattice Design Tools

Introduction

The Lattice ispLSI® and pLSI® design tools support a wide range of design environments, offering both proprietary PC-based (pDS®) solutions and third-party compatible CAE tool (pDS+™) solutions. This Design Tool Guide describes Lattice's development tools which support the ispLSI and pLSI 1000, 2000, and 3000 device families.

There are three primary steps in the Lattice ispLSI and pLSI design flow: design entry, device fitting (logic partitioning, place and route), and design verification. Lattice's pDS and pDS+ products provide unique and complete solutions for all phases of the design flow.

Lattice pDS System Design Flow

Lattice's pDS software is a comprehensive, self-contained, and cost-effective design solution which operates on a PC under Windows 3.1 or later. Lattice's pDS software uses familiar Boolean equation and macro design entry.

pDS device fitting provides interactive partitioning, high speed automatic place and route, and simulation timing tables for design verification. Viewlogic's PROsim simulation package, available from Lattice, is compatible with pDS for functional and timing simulation. Additionally, designs implemented in pDS can be simulated using Viewlogic's ViewSim and OrCAD's 386+ simulation packages. Libraries to support OVI-compliant Verilog simulators on the PC are also available.

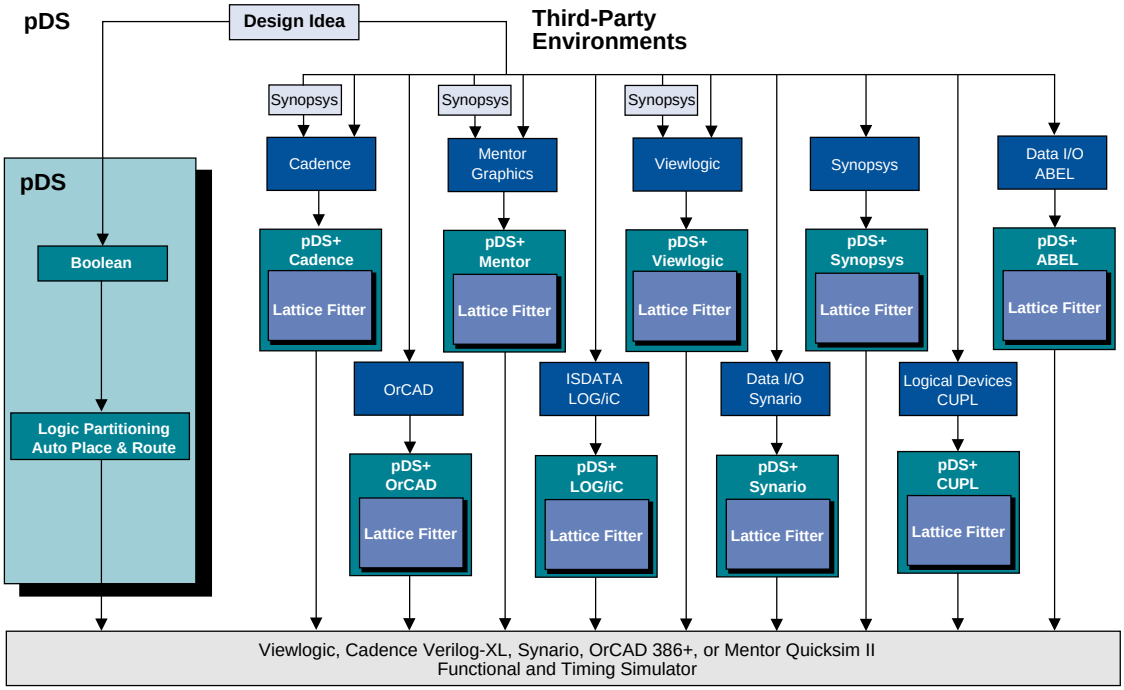
After the development work has been completed, the design is ready to be programmed into a device. For third-party programming support, the pDS package provides a JEDEC fusemap. Alternatively, ispLSI devices can be programmed directly in-system from a PC or system microprocessor, or by ATE equipment during board test.

Lattice pDS+ Fitter Design Strategy

The Lattice pDS+ design tools for the ispLSI and pLSI device families support a wide range of design environments. Each CAE vendor-specific pDS+ Fitter provides a fully-integrated, complete logic development solution when coupled with third-party CAE tools. Getting started is easy because the design environments are familiar.

Design entry is typically performed with schematic capture or a Hardware Description Language (HDL). Lattice libraries to support schematic capture and high-level Verilog-HDL and VHDL synthesis are available.

Once a logic design has been completed, a netlist is imported into the Lattice pDS+ Fitter for implementation. The pDS+ Fitter uses architecture-specific algorithms to synthesize logic descriptions for ispLSI or pLSI devices.



Lattice pDS and pDS+ Fitter Design Flows

The pDS+ Fitter provides multilevel logic synthesis, automatic partitioning, and place and route to maximize device utilization and increase design performance. The powerful fitter optimizes the design to best utilize the Lattice device's architectural features. Pins may be assigned by the user or auto-assigned by the pDS+ Fitter during the place and route process. Design control parameters allow the user to optimize the manner in which designs are implemented, including the specification of critical paths, asynchronous signals, and logic partitioning parameters. Along the way, statistical reports and design details are captured in useful files for design debug and device optimization.

The pDS+ Fitter also works with third-party CAE tools to support design verification. Functional and timing libraries support various third-party simulators, including the Viewlogic PROsim functional and timing simulator which is available from Lattice.

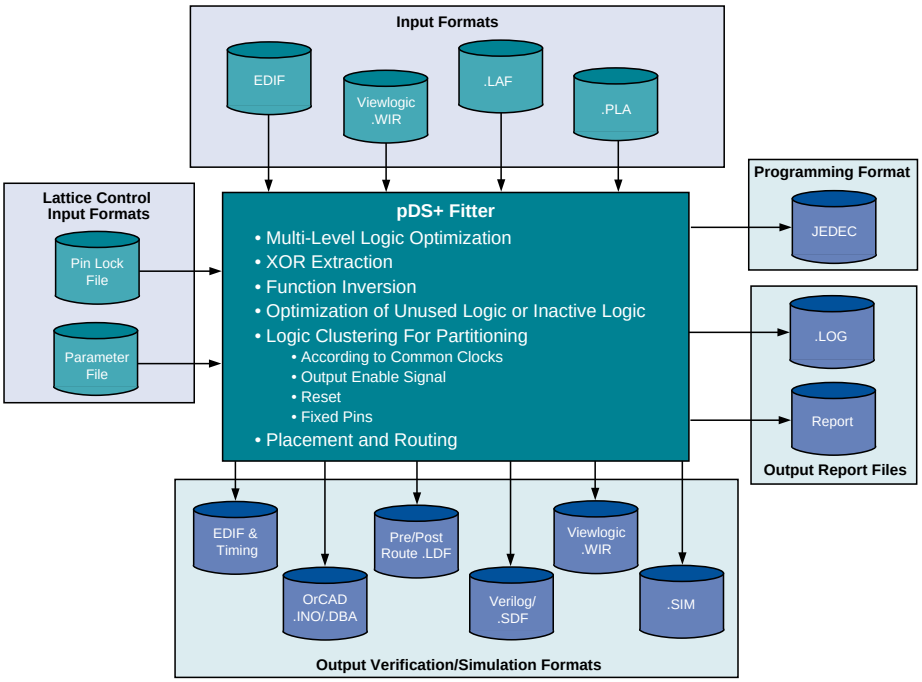
Following design verification, the pDS+ Fitter generates a JEDEC fusemap for device programming. Designs can be programmed into pLSI devices using third-party programmers. In addition, ispLSI devices can be programmed directly in-system from a PC, workstation, or system microprocessor, or by ATE equipment during board test.

Each third-party vendor must adhere to strict quality and certification requirements before becoming qualified, thus ensuring superior support. Together these integrated solutions provide seamless design environments to maximize designer productivity.

The Power of In-System Programmability

In-System Programmability (ISP™), the ability to program and reprogram logic devices while "in-system", is revolutionizing system designs of the 1990s. Lattice's ISP technology allows design, test, and manufacturing engineers to reconfigure system features while the devices remain soldered on the board, simplifying design prototyping, board-level debug, and system upgrades.

Programming Lattice ISP devices is simple, requiring only a 5-volt power supply and a simple 4- or 5-wire serial interface (depending on which devices are used). With Lattice's ispLSI devices, in-system programming is as easy as downloading a JEDEC fusemap from your PC or Sun Workstation to Lattice's isp Engineering Kit, or directly into the device on your printed circuit board using Lattice's ispDOWNLOAD™ cable. If you are interested in developing your own user interface software for ISP feature reconfiguration, Lattice offers ispCODE™ C language source programming routines, which can be compiled with your system code. ispCODE provides a library of programming routines written in ANSI-standard C language which can be easily incorporated into your system or tester software to support programming of single or multiple ISP devices on your board.

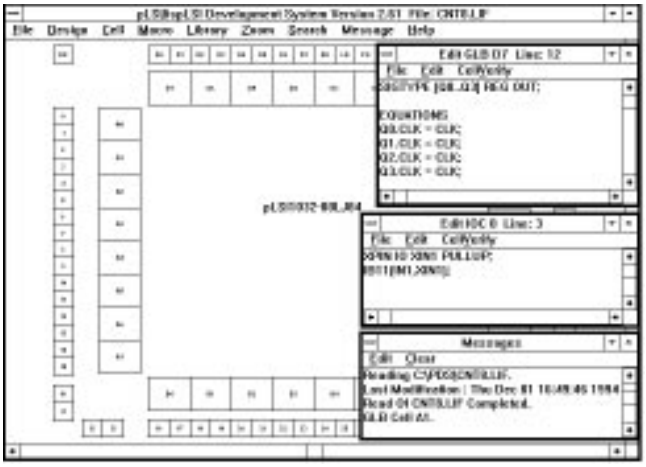


The Lattice pDS+ Fitter Provides a Complete Development Solution

pDS Software

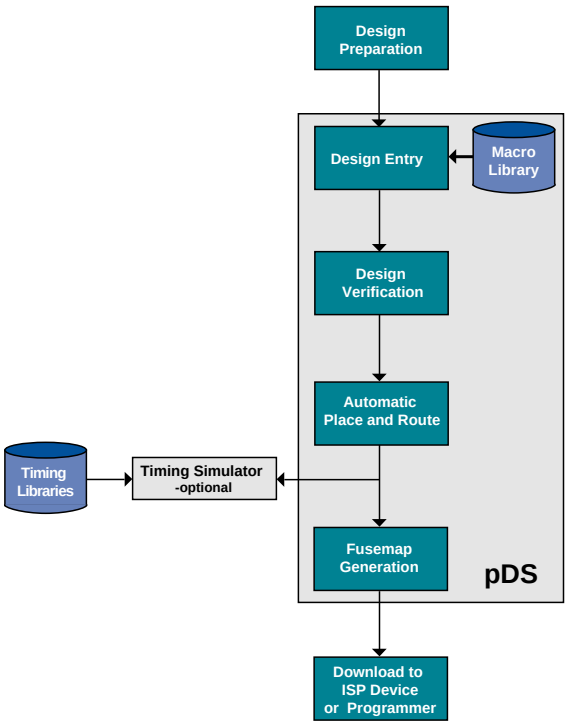
The pDS software package is a comprehensive PC-based software system that enables designers to quickly and easily implement designs using ispLSI and pLSI devices. Utilizing the Microsoft Windows graphical interface and pull-down menus, pDS allows complex logic designs to be completed in hours. The pDS solution offers Boolean text and macro design entry, logic compilation, and static timing table output.

Viewlogic's PROsim functional and timing simulation package is available as an option. Designs implemented in pDS can also be simulated using Viewlogic's ViewSim simulator. The pDS software provides JEDEC fusemaps for third-party programming support or for in-system programming of ispLSI devices.



The pDS Software Environment

Lattice pDS Software Design Flow



pDS Software Features

- High-performance, Windows-based environment
- Boolean equation design entry
- Expandable macro library with a wide selection of standard logic functions
- Device fitting:
  - Efficient design optimization/minimization
  - Manual partitioning with high utilization
  - Automatic place and route
  - Supports mid-cycle design changes with incremental route
- Design verification:
  - Static timing table
  - Optional PROsim functional and timing simulator options available from Lattice
- Comprehensive design reports
- Easy-to-use on-line help
- Standard support for ispLSI and pLSI 1000 and 2000 device families (upgrades easily to ispLSI and pLSI 3000 device family)
- Runs under Microsoft Windows 3.1

pDS	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers
Boolean Entry/ Lattice Fitter	N/A	pDS	pDS1101-PC1
Simulation	OVI-Compliant Verilog	Lattice Verilog Library	pDS1121-PC1
	VST 386+	Lattice OrCAD Library and Interface	pDS1170-PC1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*

* pDS3302-PC2 is the complete PROsim simulator with Libraries available from Lattice. If you already have access to the Viewlogic simulator (either PROsim or ViewSim), purchase pDS1102-PC2, pDS1103-PC2, or pDS1104-PC2 library products described later.

ispStarter Kits

ispStarter™ Kits make all of Lattice's innovative In-System Programmable (ISP™) products and development tools available in a single, complete package. ispStarter Kits, available in both pDS and ABEL-based versions, contain all of the software, hardware, device samples, and documentation needed for designing with Lattice's ISP products. Samples include the ispLSI 1016, ispLSI 2032, ispGAL®, and ispGDS™ (in-system programmable Generic Digital Switch) devices.

Order the ispStarter Kit and begin designing with ISP today!

ispStarter Kit Contents

- ***Software***
  - Choice of Two Logic Development Systems: pDS or pDS+ ABEL starter software for the ispLSI 1016 and 2032 devices
  - ispGDS Compiler Software
  - ispCODE C Source ISP Routines
  - ISP Daisy Chain Download Software
- ***Samples***
  - ispLSI 2032-80LJ device in 44-pin PLCC
  - ispGAL22V10B-15LJ device in 28-pin PLCC
  - ispGDS14-7J device in 20-pin PLCC
- ***Hardware***
  - ispDOWNLOAD Cable
- ***Documentation***
  - 1994 Lattice Data Book
  - In-System Programmability Manual

ispStarter Kit Features

- Easy-to-use
- All-inclusive: contains everything needed for in-system programmable device design
- Supports Lattice's ispLSI 1016 and ispLSI 2032 devices
- Supports Lattice's ISP Generic Digital Switch devices
- Supports Lattice's ispGAL22V10 industry-standard architecture coupled with Lattice's innovative in-system programmable capability

ispStarter Kit	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers
Boolean Entry/ Lattice Fitter	N/A	ispStarter Kit	isp-SK2
Simulation	OVI-Compliant Verilog	Lattice Verilog Library	pDS1121-PC1
	VST 386+	Lattice OrCAD Library and Interface	pDS1170-PC1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*

ispStarter Kit for ABEL	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers
HDL Entry/Compiler	ABEL	No Lattice Library Required	N/A
Lattice Fitter	ABEL	ispStarter Kit for ABEL	isp-SK2/ABEL
Simulation	OVI-Compliant Verilog	Lattice Verilog Library	pDS1121-PC1
	VST 386+	Lattice OrCAD Library and Interface	pDS1170-PC1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*

* pDS3302-PC2 is the complete PROsim simulator with Libraries available from Lattice. If you already have access to the Viewlogic simulator (either PROsim or ViewSim), purchase pDS1102-PC2, pDS1103-PC2, or pDS1104-PC2 library products described later.

PRO Series

Overview

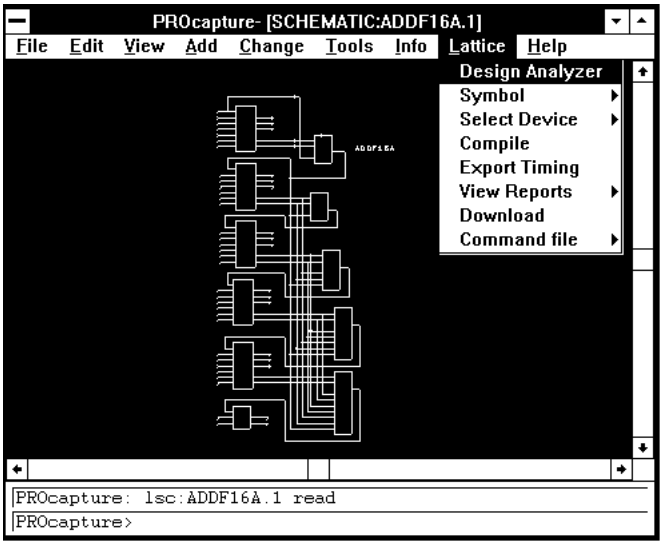
The PRO Series open design environment is a complete design capture, synthesis, and simulation system available from Lattice. The PROcapture schematic design entry package, PROsynthesis design synthesis package, and PROsim functional and timing simulator offer complete support for all phases of design entry and design verification. PRO Series supports Lattice's ispLSI and pLSI 1000, 2000, and 3000 device families. When combined with Lattice's pDS+ Viewlogic Fitter, PRO Series provides a comprehensive design solution that is available now in a PC Windows version.

PROcapture Features

- Multi-window, hierarchical schematic and symbol editor
- PROcapture schematic design entry with 300+ "TTL-like" macros
- Automatic symbol generation
- Seamless integration with the Lattice pDS+ Fitter and the PROsim simulator

PROsynthesis Features

- Top-down VHDL design entry
- Multilevel logic synthesis
- Reduces circuit area, reducing cost
- Optimizes circuit timing
- Direct instantiation of Lattice macros
- Interfaces with PROcapture and the pDS+ Fitter



The PROcapture Schematic Entry Tool

PROsim Features

- Supports both pre- and post-fit simulation
- Accurate, full timing simulation
- Results are graphically back-annotated
- Includes PROwave waveform display and editor
- Interfaces with PROcapture, PROsynthesis, the pDS+ Fitter, and pDS

PRO Series	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers
Schematic Entry	N/A	PROcapture Viewlogic Schematic Capture Tool - Windows (Includes Lattice Viewlogic Libraries)	pDS1301-PC2
VHDL Synthesis	N/A	PROsynthesis Viewlogic Synthesis Tool - Windows (Includes Lattice Viewlogic Synthesis Library)	pDS3305A-PC2*
Lattice Fitter	PRO Series	pDS+ Viewlogic	pDS2101-PC2
Simulation	N/A	PROsim Viewlogic Simulation Tool - Windows (with security key)	pDS3302-PC2
		PROsim Viewlogic Simulation Tool - Windows (without security key)	pDS3302A-PC2*
Viewlogic Upgrade - from Actel or Other Vendor	PROcapture and PROsim	Upgrade Viewlogic Users from Actel (or Other Semiconductor Vendor) to Lattice (Includes Lattice Viewlogic Libraries)	pDS1103-PC2
Viewlogic Upgrade - from Xilinx	PROcapture and PROsim	Upgrade Viewlogic Users from Xilinx to Lattice (Includes Lattice Viewlogic Libraries)	pDS1104-PC2

* Purchase in conjunction with pDS1301-PC2.

pDS+ ABEL

The Lattice pDS+ ABEL design solution supports Data I/O's ABEL design entry and compiler software (version 4.3 or higher) and VHDL-Direct language entry tools.

ABEL Design Environment

- Device-independent ABEL v4.3 or later
- Accepts ABEL-HDL design descriptions
- Accepts VHDL-Direct design descriptions
- PC and Sun Workstation (Sun OS) versions

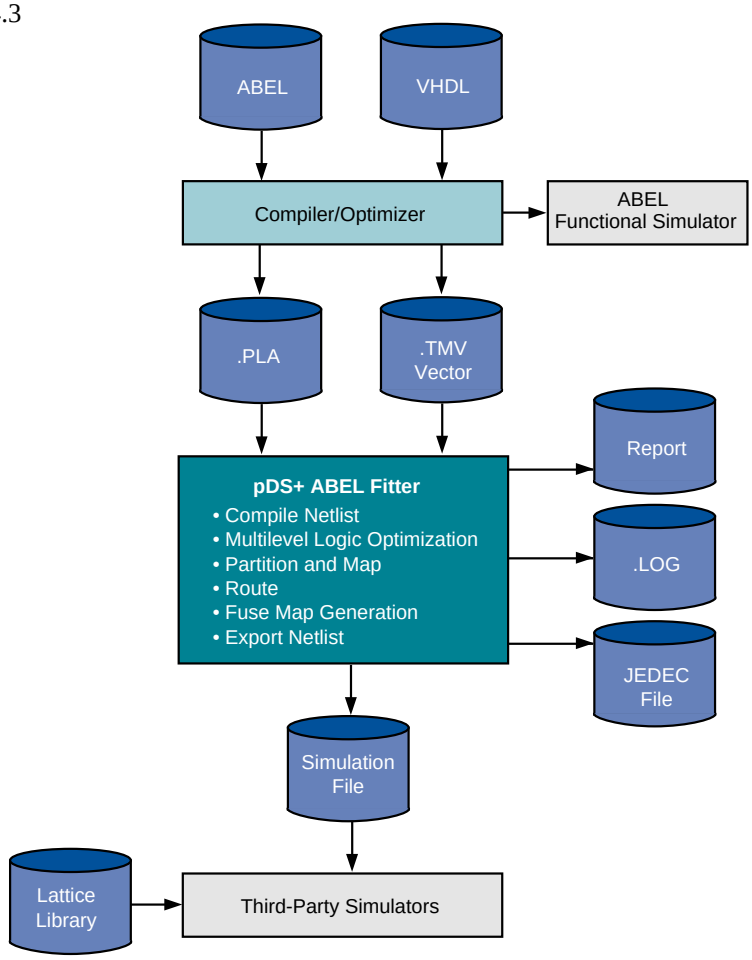
pDS+ ABEL Support Options

- ***Device Fitting - pDS+ ABEL Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Simulation***

  PC:
  - Data I/O Synario library
  - Viewlogic PROsim simulator with libraries from Lattice
  - Viewlogic ViewSim library
  - OrCAD VST 386+ library

  Sun:
  - Viewlogic ViewSim library
  - Mentor Quicksim II library
  - Cadence Verilog-XL library

Lattice pDS+ ABEL Design Flow



Data I/O - ABEL	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers	Sun Product Part Numbers
HDL Entry/Compiler	ABEL	No Lattice Library Required	N/A	N/A
Lattice Fitter	ABEL	pDS+ ABEL	pDS2102-PC1	pDS2102-SN1
Simulation	Synario	Lattice Synario Library and Interface	pDS1120-PC1	N/A
	VST 386+	Lattice OrCAD Library and Interface	pDS1170-PC1	N/A
	Quicksim II	Lattice Mentor Library and Interface	N/A	pDS1150-SN1
	Verilog-XL	Lattice Cadence Library and Interface	N/A	pDS1160-SN1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*	N/A
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*	pDS1102-SN1

* pDS3302-PC2 is the complete PROsim simulator with Libraries available from Lattice. If you already have access to the Viewlogic simulator (either PROsim or ViewSim), purchase pDS1102-PC2, pDS1103-PC2, or pDS1104-PC2 library products described later.

pDS+ Cadence

The pDS+ Cadence design solution consists of the pDS+ Cadence Fitter and the Cadence Concept Library and Interface. The pDS+ Cadence solution supports Cadence's Concept schematic design entry software and the Cadence Verilog-XL simulator.

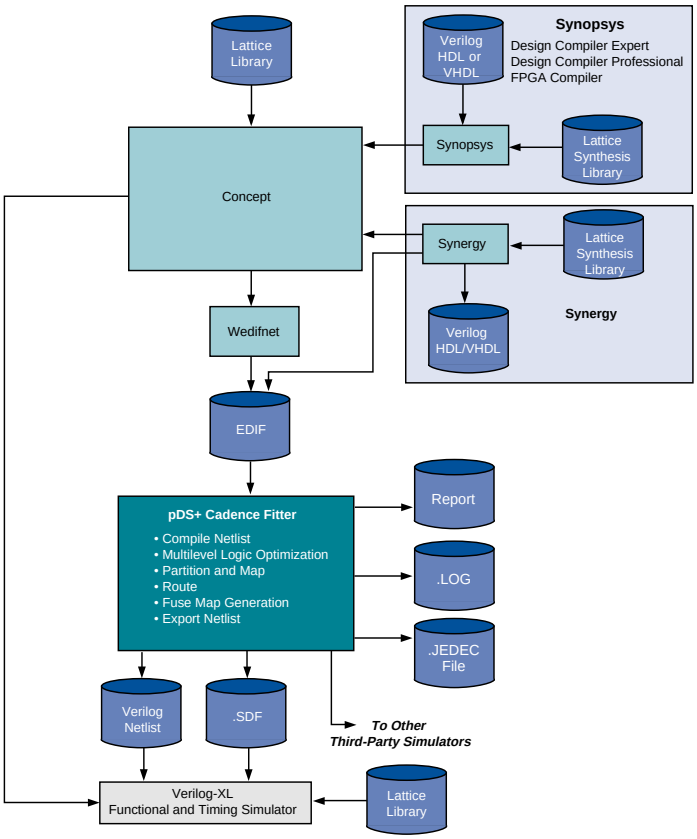
Cadence Design Environment

- Supports Concept schematic design entry and Verilog-XL simulation
- Sun Workstation (Sun OS) version

pDS+ Cadence Support Options

- ***Device Fitting - pDS+ Cadence Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Cadence Library and Interface***
  - Includes symbols for the Cadence Concept schematic capture system
  - Includes timing simulation libraries for the Cadence Verilog-XL simulator
- ***Simulation***
  - Cadence Verilog-XL library
- ***Synthesis***
  - Synopsys synthesis library
  - Cadence Synergy synthesis library

Lattice pDS+ Cadence Design Flow



Cadence	Third-Party Tool Name	Lattice Product Required	Sun Product Part Numbers
Schematic Entry	Concept	Lattice Cadence Library and Interface	pDS1160-SN1*
Synthesis	Synergy	Lattice Synergy Synthesis Library	pDS1165-SN1
	Synopsys	Lattice Synopsys Synthesis Libraries	pDS1140-SN1
Lattice Fitter	Cadence	pDS+ Cadence (Includes Library)	pDS2160-SN1
Simulation	Verilog-XL	Lattice Cadence Library and Interface	pDS1160-SN1*

* pDS2160-SN1 contains these libraries. Purchase pDS1160-SN1 only if used in conjunction with Lattice Fitters other than pDS2160-SN1.

pDS+ CUPL

The Lattice pDS+ CUPL design solution supports Logical Devices CUPL design entry and compiler software.

CUPL Design Environment

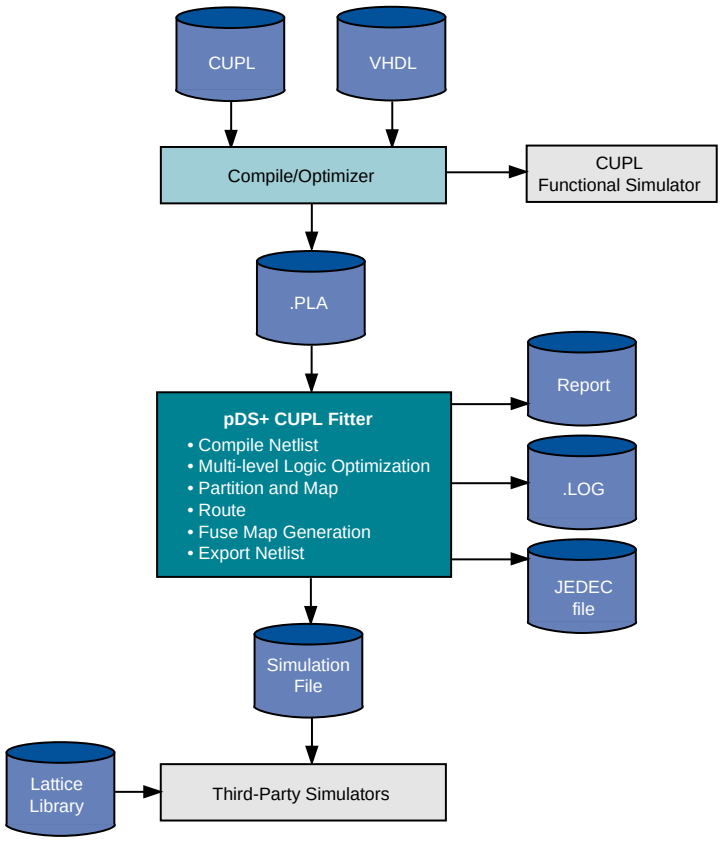
- Device-independent CUPL v.4.4c or later
- Accepts CUPL-HDL design descriptions
- Accepts VHDL design descriptions
- PC version

pDS+ CUPL Support Options

- ***Device Fitting - pDS+ CUPL Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Simulation***

  PC:
  - Viewlogic PROsim simulator with libraries from Lattice
  - Viewlogic ViewSim library
  - OrCAD VST 386+ library
  - Verilog library

Lattice pDS+ CUPL Design Flow



Logical Devices - CUPL	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers
HDL Entry/Compiler	CUPL	No Lattice Library Required	N/A
Lattice Fitter	CUPL	pDS+ CUPL	pDS2190-PC1
Simulation	OVI-Compliant Verilog	Lattice Verilog Library	pDS1121-PC1
	VST 386+	Lattice OrCAD Library and Interface	pDS1170-PC1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*

* pDS3302-PC2 is the complete PROsim simulator with Libraries available from Lattice. If you already have access to the Viewlogic simulator (either PROsim or ViewSim), purchase pDS1102-PC2, pDS1103-PC2, or pDS1104-PC2 library products described later.

pDS+ LOG/iC

The pDS+ LOG/iC design solution consists of ISDATA's LOG/iC design software coupled with Lattice's pDS+ LOG/iC fitter. LOG/iC supports both design entry and functional verification. LOG/iC design entry includes schematics, Boolean equations, truth tables, state machine syntax, and VHDL.

Both the LOG/iC Plus and Perfect Design Tools support Lattice ispLSI and pLSI devices. Smooth fitter integration is performed by processing the logic design through the ISDATA Open Design Converter (ODC). The design is then ready for implementation by the pDS+ LOG/iC Fitter from Lattice.

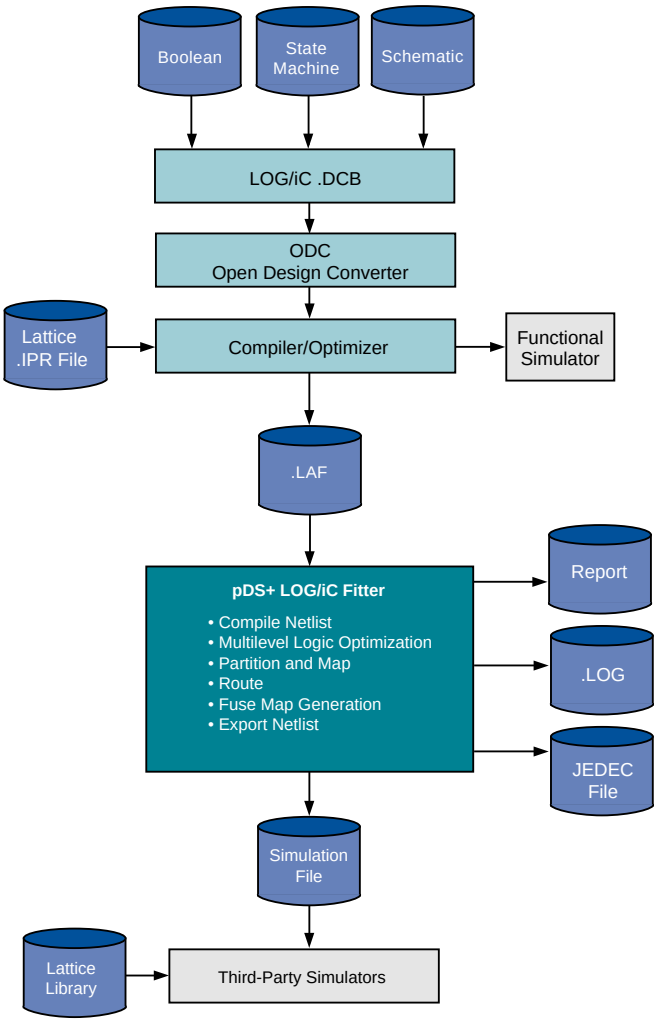
LOG/iC Design Environment

- LOG/iC Plus or Perfect and ODC
- Supports schematic, Boolean, state machine, and truth table design entry through LOG/iC tools
- PC version

pDS+ LOG/iC Support Options

- ***Device Fitting - pDS+ LOG/iC Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Simulation***
  - Viewlogic PROsim simulator with libraries from Lattice
  - Viewlogic ViewSim library
  - OrCAD VST 386+ library
  - Verilog library

Lattice pDS+ LOG/iC Design Flow



ISDATA	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers
HDL Entry/Compiler	LOG/iC Plus or Perfect	No Lattice Library Required	N/A
Lattice Fitter	LOG/iC	pDS+ LOGiC	pDS2103-PC1
Simulation	OVI-Compliant Verilog	Lattice Verilog Library	pDS1121-PC1
	VST 386+	Lattice OrCAD Library and Interface	pDS1170-PC1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*

* pDS3302-PC2 is the complete PROsim simulator with Libraries available from Lattice. If you already have access to the Viewlogic simulator (either PROsim or ViewSim), purchase pDS1102-PC2, pDS1103-PC2, or pDS1104-PC2 library products described later.

pDS+ Mentor

Lattice's pDS+ Mentor Fitter and Libraries on the Sun platform support the Design Architect schematic editor and VHDL entry using the Autologic Synthesis Tool. Design verification is supported through Mentor's Quicksim II Simulator.

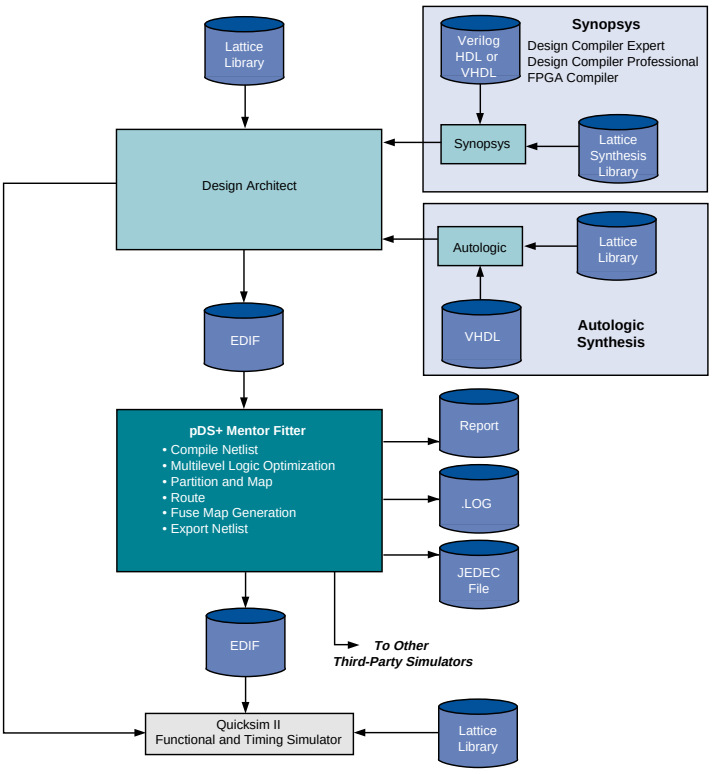
Mentor Design Environment

- Design Architect Schematic Editor
- PLD Synthesis II Compiler
- Autologic Synthesis VHDL Entry
- Synopsys Synthesis VHDL or Verilog Entry
- Sun Workstation (Sun OS) and HP Workstation versions

pDS+ Mentor Support Options

- ***Device Fitting - pDS+ Mentor Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Simulation***
  - Mentor Quicksim II library
  - Cadence Verilog-XL library
- ***Synthesis***
  - Synopsys synthesis library
  - Autologic synthesis library

Lattice pDS+ Mentor Design Flow



Mentor Graphics	Third-Party Tool Name	Lattice Product Required	HP Product Part Numbers	Sun Product Part Numbers
Schematic Entry	Design Architect	Lattice Mentor Library and Interface	pDS1150-HP1*	pDS1150-SN1*
Synthesis	Autologic	Lattice Autologic Synthesis Library	pDS1155-HP1	pDS1155-SN1
	Synopsys	Lattice Synopsys Synthesis Libraries	pDS1140-HP1	pDS1140-SN1
Lattice Fitter	Mentor	pDS+ Mentor (Includes Library)	pDS2150-HP1	pDS2150-SN1
Simulation	Quicksim II	Lattice Mentor Library and Interface	pDS1150-HP1*	pDS1150-SN1*
	Verilog-XL	Lattice Cadence Library and Interface	N/A	pDS1160-SN1

* pDS2150 contains these libraries. Purchase pDS1150 only if used in conjunction with Lattice Fitters other than pDS2150.

pDS+ OrCAD

Lattice's pDS+ OrCAD solution supports design entry using either OrCAD-HDL with the PLD 386+ compiler or with schematics using the Lattice macro library and the SDT 386+ Schematic Editor. For full functional and timing simulation, the Lattice pDS and pDS+ Fitters are compatible with the VST 386+ Verification and Simulation tool.

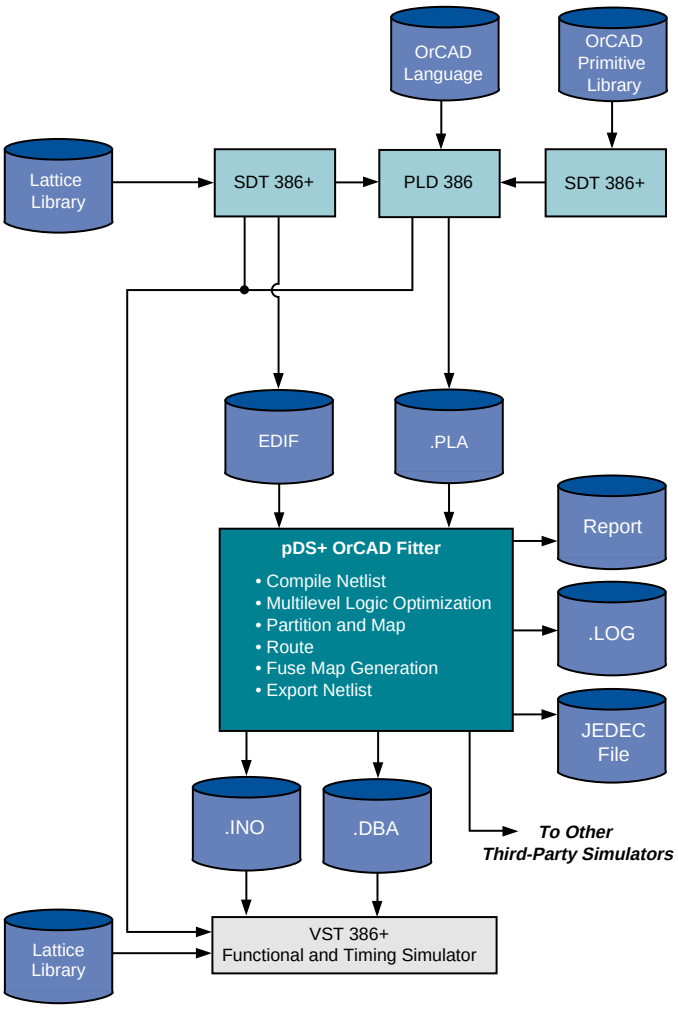
OrCAD Design Environment

- SDT 386+ Schematic Design Tools
- PLD 386+ Programmable Logic Design Tool
- VST 386+ Verification and Simulation Tools
- Supports schematic design using the OrCAD Hardware Description Language
- PC version

pDS+ OrCAD Support Options

- ***Device Fitting - pDS+ OrCAD Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Simulation***
  - OrCAD VST 386+ library
  - Viewlogic PROsim simulator with libraries from Lattice
  - Viewlogic ViewSim library
  - Verilog library

Lattice pDS+ OrCAD Design Flow



OrCAD	Third-Pary Tool Name	Lattice Product Required	PC Product Part Numbers
Schematic Entry	SDT 386+	Lattice OrCAD Library and Interface	pDS1170-PC1**
HDL Entry/ Compiler	PLD 386+	No Lattice Library Required	N/A
Lattice Fitter	OrCAD	pDS+ OrCAD (Includes Library)	pDS2170-PC1
Simulation	VST 386+	Lattice OrCAD Library and Interface	pDS1170-PC1**
	OVI-Compliant Verilog	Lattice Verilog Library	pDS1121-PC1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*

* pDS3302-PC2 is the complete PROsim simulator with Libraries available from Lattice. If you already have access to the Viewlogic simulator (either PROsim or ViewSim), purchase pDS1102-PC2, pDS1103-PC2, or pDS1104-PC2 library products described later.

** pDS2170-PC1 contains these libraries. Purchase pDS1170-PC1 only if used in conjunction with Lattice Fitters other than pDS2170-PC1.

pDS+ Synario

Lattice's pDS+ Synario Fitter and Libraries on the PC platform support Synario schematic entry, ABEL-HDL entry, or VHDL entry using the VHDL-Direct Tool from Data I/O. Design verification is supported through Synario's Open Verilog International (OVI) compliant simulator.

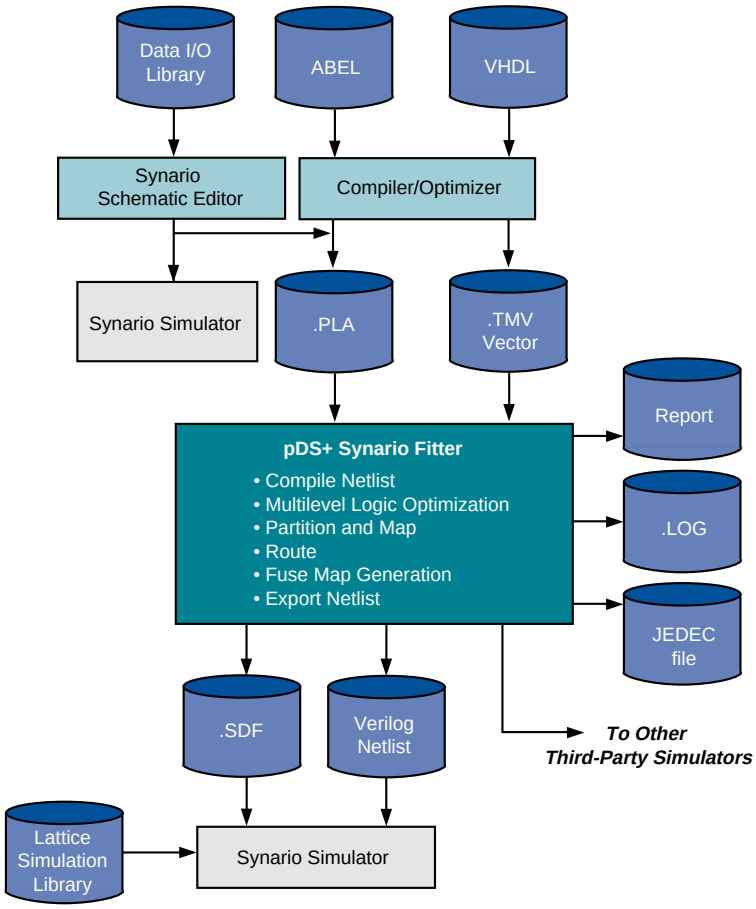
Synario Design Environment

- Synario Schematic Editor
- ABEL Compiler
- VHDL-Direct
- Synario Simulator
- PC version

pDS+ Synario Support Options

- ***Device Fitting - pDS+ Synario Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Simulation***
  - Synario simulator from Data I/O
  - Viewlogic PROsim simulator with libraries from Lattice
  - ViewSim simulator from Viewlogic
  - VST 386+ simulator from OrCAD

Lattice pDS+ Synario Design Flow



Data I/O - Synario	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers
Schematic Entry	Synario	pLSI Synario Device Kit	From Data I/O
HDL Entry/ Compiler	ABEL	No Lattice Library Required	N/A
Lattice Fitter	Synario	pDS+ Synario (Includes Library)	pDS2120-PC1
Simulation	Synario	Lattice Synario Library and Interface	pDS1120-PC1**
	VST 386+	OrCAD Library and Interface	pDS1170-PC1
	PROsim	PROsim with Lattice Library	pDS3302-PC2*
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-PC2*

* pDS3302-PC2 is the complete PROsim simulator with Libraries available from Lattice. If you already have access to the Viewlogic simulator (either PROsim or ViewSim), purchase pDS1102-PC2, pDS1103-PC2, or pDS1104-PC2 library products described later.

** pDS2120-PC1 contains these libraries. Purchase pDS1120-PC1 only if used in conjunction with Lattice Fitters other than pDS2120-PC1.

pDS+ Synopsys

The pDS+ Synopsys Fitter and synthesis libraries include four distinct synthesis libraries including Verilog-HDL for FPGA Compiler, VHDL for FPGA Compiler, Verilog-HDL for Design Compiler, and VHDL for Design Compiler. Together, these libraries support logic design entry for all the popular Synopsys Synthesis tools.

The Lattice Synopsys Synthesis Libraries include over 300 high-level functions to simplify design entry. Optimized Lattice components are provided to enhance device performance and utilization.

Designs can be created using Synopsys alone, or in conjunction with Cadence or Viewlogic schematic capture tools. In the stand-alone mode, Synopsys tools are used to synthesize the Verilog-HDL or VHDL description. A Lattice utility provides the facility for the inclusion of a parameter file.

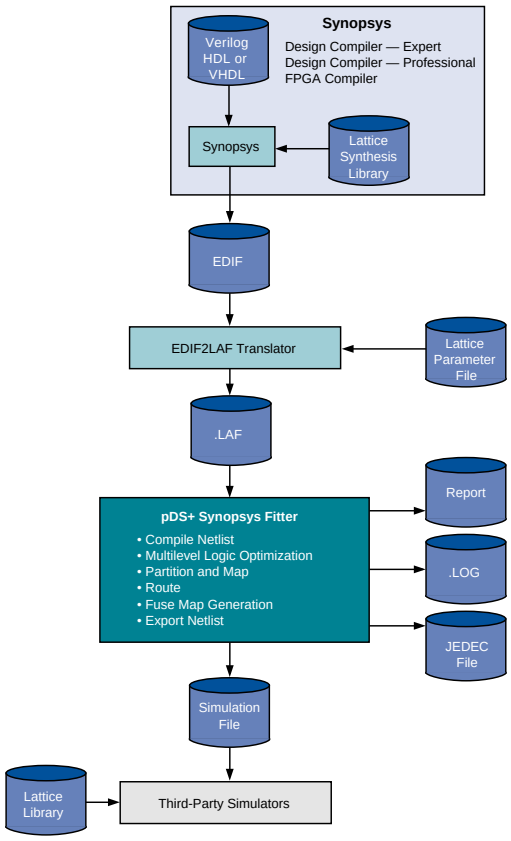
Synopsys Design Environment

- Design Compiler-Professional
- Design Compiler-Expert
- FPGA Designer
- Supports complex design entry using Verilog-HDL or VHDL
- Sun Workstation (Sun OS) and HP Workstation versions

pDS+ Synopsys Support Options

- ***Device Fitting - pDS+ Synopsys Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)

Lattice pDS+ Synopsys Design Flow



- ***Simulation***
  - Synopsys VSS support via Logic Modeling models
  - Viewlogic ViewSim library
  - Mentor Quicksim II library
  - Cadence Verilog-XL library
- ***Synthesis***
  - Synopsys Synthesis libraries

Synopsys	Third-Party Tool Name	Lattice Product Required	HP Product Part Numbers	Sun Product Part Numbers
Synthesis	Design Compiler - Expert	Lattice Synopsys Synthesis Libraries	pDS1140-HP1*	pDS1140-SN1*
	Design Compiler - Professional	Lattice Synopsys Synthesis Libraries	pDS1140-HP1*	pDS1140-SN1*
	FPGA Compiler	Lattice Synopsys Synthesis Libraries	pDS1140-HP1*	pDS1140-SN1*
Lattice Fitter	Synopsys	pDS+ Synopsys (Includes Library)	pDS2140-HP1	pDS2140-SN1
Simulation	Quicksim II	Lattice Mentor Library and Interface	pDS1150-HP1	pDS1150-SN1
	Verilog-XL	Lattice Cadence Library and Interface	N/A	pDS1160-SN1
	ViewSim	Lattice Viewlogic Library and Interface	pDS1102-HP1	pDS1102-SN1

* pDS2140 includes the Lattice Synopsys Synthesis Libraries. The pDS1140 Libraries are required only if used with fitters other than the pDS2140.

pDS+ Viewlogic

The pDS+ Viewlogic solution is centered around the pDS+ Viewlogic Fitter, which is completely integrated within the Viewlogic environment. The Viewlogic libraries and interface provide the symbols and models necessary for design entry and simulation. Top level design control is provided to support design implementation that is optimized for the best possible speed and/or resource utilization.

Viewlogic Design Environment

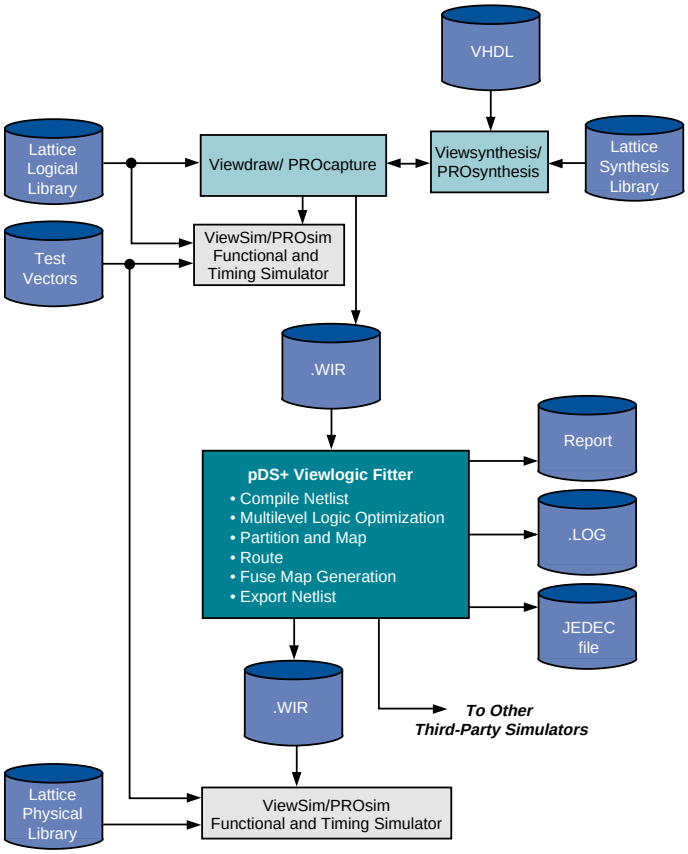
- PRO Series v5.1 or Workview PLUS v5.2 on the PC
- Powerview v5.2 on the Sun Workstation

pDS+ Viewlogic Support Options

- ***Device Fitting - pDS+ Viewlogic Fitter***
  - Efficient design optimization/minimization
  - Automatic partitioning for high utilization
  - Hands-off place and route
  - Control of performance, utilization, and device fit
  - Standard support for Lattice's ispLSI and pLSI 1000 and 2000 device families
  - Upgrades to Lattice's ispLSI and pLSI 3000 device family (contact Lattice for availability)
- ***Synthesis***
  - PROsynthesis from Lattice (includes libraries)
  - Viewlogic ViewSynthesis library
- ***Capture***
  - PROcapture from Lattice (includes libraries)
  - Viewlogic ViewDraw library
- ***Simulation***

  PC:
  - Viewlogic PROsim simulator with libraries from Lattice
  - Viewlogic ViewSim library
  - OrCAD VST 386+ library
  - Data I/O Synario library

Lattice pDS+ Viewlogic Design Flow



Sun:
- Viewlogic ViewSim library
- Mentor Quicksim II library
- Cadence Verilog-XL library

Viewlogic	Third-Party Tool Name	Lattice Product Required	PC Product Part Numbers	Sun Product Part Numbers
Schematic Entry	PROcapture** ViewDraw	Lattice Viewlogic Library and Interface*	pDS1102-PC2	pDS1102-SN1
Synthesis	PROsynthesis** ViewSynthesis	Lattice Viewlogic Synthesis Library	pDS1105-PC2	pDS1105-SN1
Lattice Fitter	Viewlogic	pDS+ Viewlogic *	pDS2101-PC2	pDS2101-SN1
Simulation	PROsim** ViewSim	Lattice Viewlogic Library and Interface*	pDS1102-PC2	pDS1102-SN1
Viewlogic Upgrade - from Actel or Other Vendor	PROcapture and PROsim	Upgrade Viewlogic Users from Actel (or Other Semiconductor Vendor) to Lattice (Includes Lattice Viewlogic Libraries)	pDS1103-PC2	N/A
Viewlogic Upgrade - from Xilinx	PROcapture and PROsim	Upgrade Viewlogic Users from Xilinx to Lattice (Includes Lattice Viewlogic Libraries)	pDS1104-PC2	N/A

* The Viewlogic Library and Interface provides both the schematic capture and simulation libraries and are included with pDS1102, pDS1301, pDS3302, and pDS3302A.
** If both Viewlogic capture and simulation are required, purchase pDS3302A in conjunction with pDS1301.
*** Purchased from Viewlogic Sales Representative.

SmartModel Library

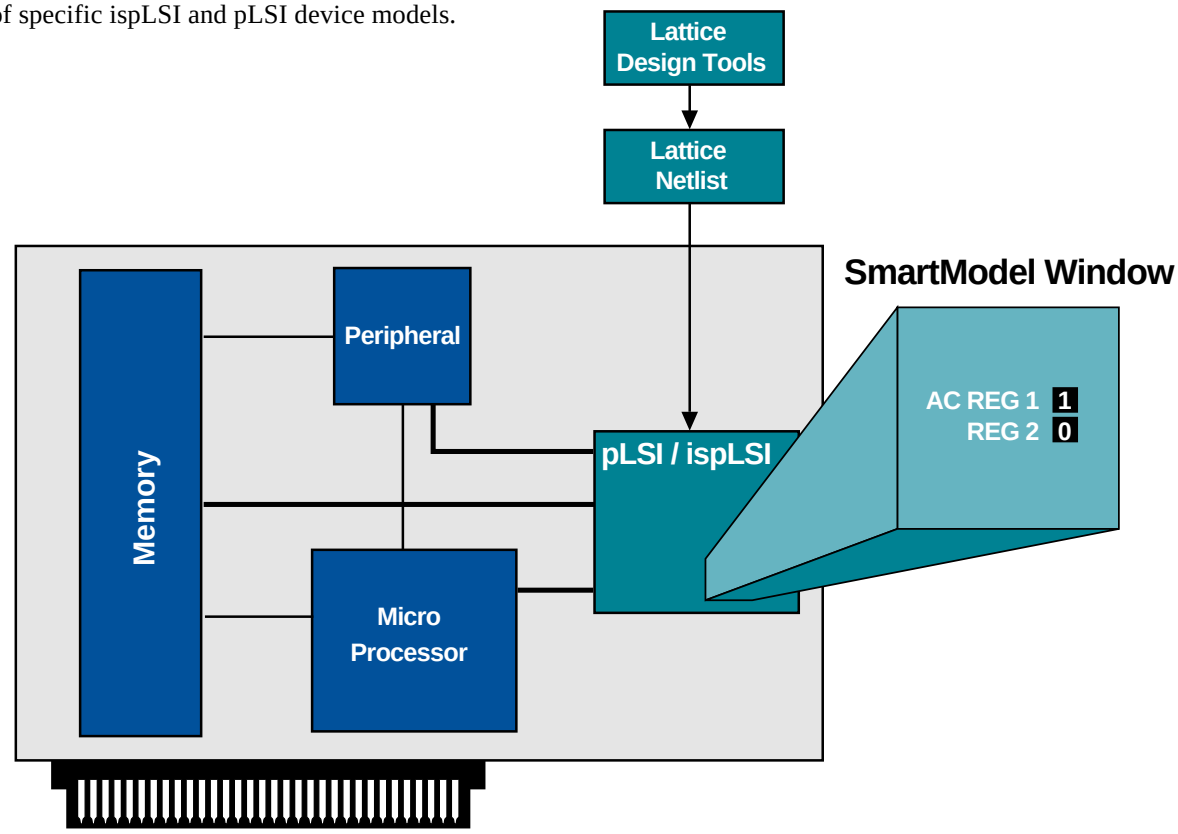
The Logic Modeling division of Synopsys Corporation, a leading supplier of logic simulation models, supports the ispLSI and pLSI device models in its SmartModel library. These SmartModels enable board- and system-level simulation which improves design quality, shortens cycle time, and reduces the likelihood of redesigns.

A SmartModel represents a “single instance” for each device— modeling the entire device rather than the thousands of gates which make up the device. This allows for fast initialization of circuitry, saving simulation time and reducing system memory requirements. Logic Modeling provides the bridge between device simulation and system simulation.

SmartModels are supported on all major simulation platforms and environments including Cadence Design Systems, Mentor Graphics, Synopsys, Viewlogic Systems, and others. ispLSI and pLSI 1000, 2000, and 3000 family models are available from LMC today. Contact LMC for availability of specific ispLSI and pLSI device models.

SmartModel Library Features

- Behavioral models for system-level simulation
- Accurate device functionality and timing models
- Single instance for each device
  - Fast initialization of circuitry
  - Minimum memory requirements
- Access to internal nodes/registers
- Convenient design flow
  - Integrated with CAE vendor tools
  - Input file taken from vendor’s tool
- Detailed error messages to pinpoint problems
  - Set up, hold, recovery, and usage errors
  - Identify device instance, pin name, time



SmartModel Logic Simulation Model

ispCODE Software

ispCODE software from Lattice facilitates the In-System Programming of single or multiple ispLSI devices directly on the system board. In-system programming is a Lattice invention which facilitates direct device programming through a 4 or 5-wire interface (depending on the devices used) from a PC, workstation, system microprocessor, or by ATE equipment during board test.

The ispCODE software is a collection of documented ANSI C source code routines. By including the ispCODE routines in system software, designers can call standard library routines to program and verify Lattice ispLSI devices directly on the p.c. board.

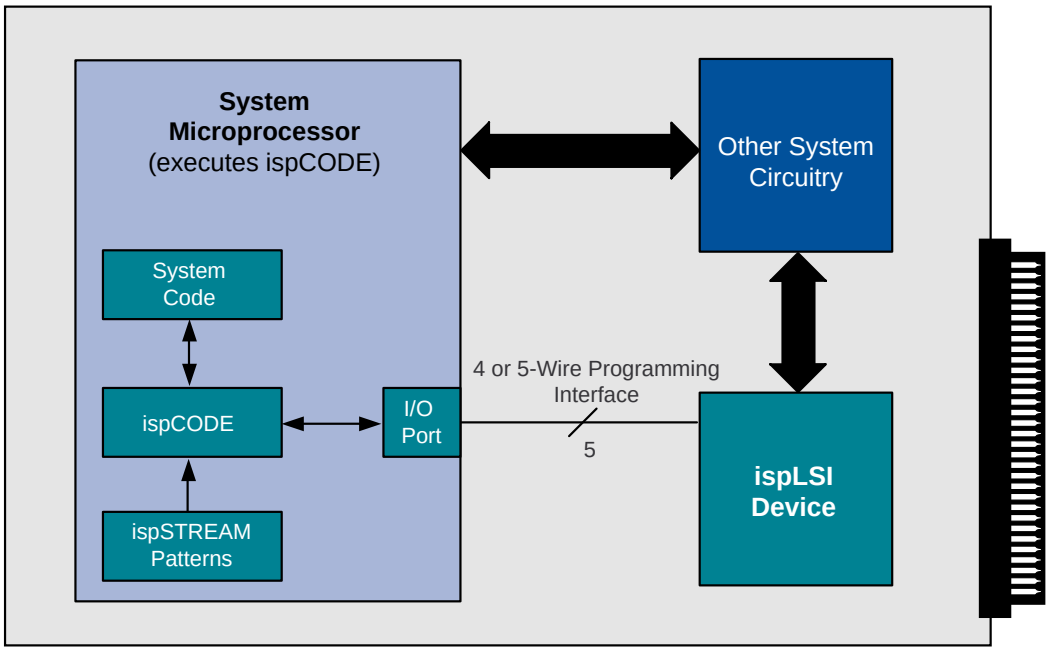
ispCODE software features an automatic program counter that accurately counts and records programming cycles. The pattern information used to program the ispLSI devices is from industry-standard JEDEC files which are converted to a bit-packed format, called an ispSTREAM. An ispSTREAM consumes less than 1/8 the storage space of a JEDEC file.

ispCODE supports the serial programming of multiple devices on one board. You can program one device at a time within the serial chain, using the ispCODE software to place one device in program mode and the other devices in flow-through mode. This process is repeated to program each device.

The ispCODE software is currently available from Lattice and can be used on any system that has an ANSI-standard C language compiler. The code is structured for easy modification for virtually any hardware system.

ispCODE Software Features

- Simplifies In-System Programming (ISP)
  - Includes predefined routines for common programming functions
  - Provides extensively commented code for complete reference
- Supports programming of multiple ispLSI devices on a single board
- Supports daisy chain serial programming of devices
- Supports all ispLSI, ispGAL, and ispGDS devices
- Portable to any hardware: UNIX systems, PCs, testers, embedded systems
- ANSI-Standard C for portability
- Converts JEDEC fusemap information into bit-packed file format for storage
  - Requires less than 1/8 the storage space of a standard JEDEC file
- Includes extensive example files



Configuring an ispLSI Device from an On-Board Microprocessor

Programming Support

The Lattice ispLSI and pLSI families can be programmed by a wide range of industry standard third-party programmers. The ispLSI family, by virtue of its in-system programmability, can also be programmed by direct download from a PC or Sun workstation through a 4 or 5-wire interface, from the system microprocessor, or by ATE equipment during board test.

Programming Support

The ispLSI and pLSI families are supported by popular third-party logic programmers including Advin Systems, BP Microsystems, Data I/O, Logical Devices, SMS Micro Systems, Stag, and System General. No proprietary, expensive, high pin-count programmers are required. High pin-count socket adapters are available from Emulation Technology, EDI Corporation and PROCON Technologies.

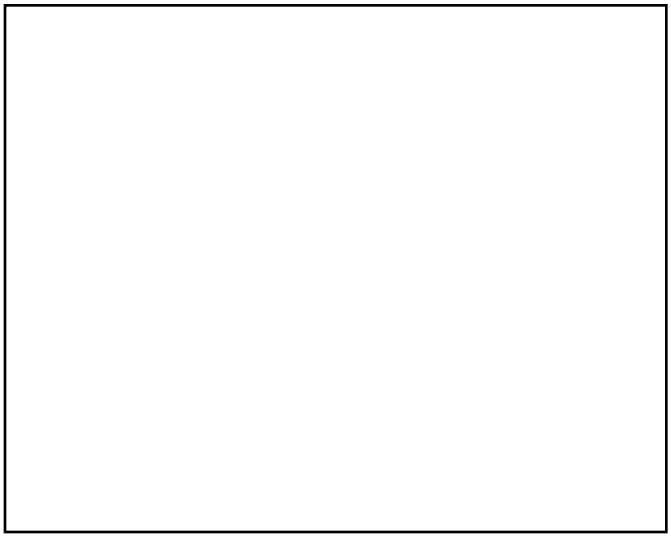
For more information on programming support, call the Lattice Technical Literature Department at 1-800-327-8425.

isp Engineering Kit - Model 100 and 200A

The isp Engineering Kit is an engineering programmer that supports prototype development by allowing designers to program ispLSI devices directly from a PC using the Model 100, or from a Sun Workstation using the Model 200A. Together with the ispDOWNLOAD software, these engineering kits support programming of single or multiple daisy-chained devices.

The isp Engineering Kit can be used as a stand-alone programmer or to directly download to an ispLSI device on your board. These kits accelerate the system and board level debug process and permit final board definition earlier in the design cycle.

Included in this kit is a programming module, ispDOWNLOAD cables, and a 110V AC/9V DC power supply converter (North America only). Socket adapters are purchased separately and are available for ispLSI and pLSI package options. Each socket adapter comes with a sample of the corresponding ispLSI device so users can begin to program devices immediately. The isp Engineering Kits Model 100 (PC) and Model 200A (Sun) are now available.



The Lattice isp Engineering Kit Model 200A

Certified Third-Party Programmers

Programmer Vendor	Model
Advin Systems	Pilot U-84 Pilot U-40 Pilot GCE Pilot GL
BP Microsystems	BP-1200 CP-1128 PLD-1128
Data I/O	Unisite Autosite 3900 2900
Logical Devices	Allpro 88 Allpro 40
SMS Micro Systems	Expert
Stag	Eclipse ZL30B Quasar 1084 Quasar 1040
System General	Turpro-1/FX Turpro-1

System Requirements

Product	Platform	Operating System/ Graphical Interface	RAM	Free Hard Disk Space	Ports	Floppy Disk Drive	Other
pDS	386/486 PC	DOS 3.1/ Microsoft Windows 3.1	8MB	10MB	1 Parallel	3.5"	Mouse EGA/VGA Display
ispStarter Kit	386/486 PC	DOS 3.1/ Microsoft Windows 3.1	8MB	10MB	1 Parallel	3.5"	Mouse EGA/VGA Display
ispStarter Kit - ABEL	386/486 PC	DOS 3.1/ Microsoft Windows 3.1	16MB	20MB	1 Parallel	3.5"	Mouse Optional
PROcapture	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	45MB	1 Parallel	3.5"	3-Button Mouse
PROsynthesis	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	45MB	1 Parallel	3.5"	3-Button Mouse
PROsim	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	45MB	1 Parallel	3.5"	3-Button Mouse
pDS+ ABEL Fitter	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	20MB	1 Parallel	3.5"	Mouse Optional
	Sun-4 Workstation	Sun OS 4.x/ Open Windows 3.0	16MB	20 MB	N/A	1/4" Cartridge	3-Button Mouse
pDS+ Cadence Fitter	Sun-4 Workstation	Sun OS 4.x/ Open Windows 3.0	16MB	50MB	N/A	1/4" Cartridge	3-Button Mouse
pDS+ CUPL Fitter	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	20MB	1 Parallel	3.5"	Mouse Optional
pDS+ LOG/iC Fitter	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	20MB	1 Parallel	3.5"	Mouse Optional
pDS+ Mentor Fitter	Sun-4 Workstation	Sun OS 4.x/ Open Windows 3.0	16MB	55MB	N/A	1/4" Cartridge	3-Button Mouse
	HP Workstation	HP-UX 9.x HP-VUE	16MB	55MB	N/A	4mm Data Cartridge	3-Button Mouse
pDS+ OrCAD Fitter	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	20MB	1 Parallel	3.5"	Mouse Optional
pDS+ Synario Fitter	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	20MB	1 Parallel	3.5"	Mouse Optional
pDS+ Synopsys Fitter	Sun-4 Workstation	Sun OS 4.x/ Open Windows 3.0	16MB	20MB	N/A	1/4" Cartridge	3-Button Mouse
	HP Workstation	HP-UX 9.x HP-VUE	16MB	30MB	N/A	4mm Data Cartridge	3-Button Mouse
pDS+ Viewlogic Fitters: **PRO Series**	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	30MB	1 Parallel	3.5"	3-Button Mouse EGA/VGA Display
Workview PLUS	386/486 PC	DOS 3.3/ Microsoft Windows 3.1	16MB	30MB	1 Parallel	3.5"	3-Button Mouse
Powerview	Sun-4 Workstation	Sun OS 4.x/ Open Windows 3.0	16MB	30MB	N/A	1/4" Cartridge	3-Button Mouse

Ordering Information

Software Products

Part Number	Description
pDS1101-PC1	pDS Development System for ispLSI and pLSI Device Families (PC)
isp-SK2	ispStarter Kit
isp-SK2/ABEL	ispStarter Kit for ABEL
pDS1102-PC2	Viewlogic Libraries and Interface Files (Lattice PRO Series and Workview PLUS Library Products) (PC)
pDS1102-SN1	Viewlogic ViewSim and ViewDraw Libraries and Interface Files (Sun)
pDS1103-PC2	Viewlogic PROsim and PROcapture Libraries and Interface Files and PRO Series Upgrade (Actel or other semiconductor vendor customer) (PC)
pDS1104-PC2	Viewlogic PROsim and PROcapture Libraries and Interface Files and PRO Series Upgrade (Xilinx users) (PC)
pDS1301-PC2	Viewlogic PROcapture Schematic Editor (PC)
pDS1105-PC2	Viewlogic Synthesis Library (PC)
pDS1105-SN1	Viewlogic Synthesis Library (Sun)
pDS1120-PC1	Synario Library and Interface (PC)
pDS1121-PC1	Verilog Library (PC)
pDS1140-SN1	Synopsys Synthesis Libraries (Sun)
pDS1140-HP1	Synopsys Synthesis Libraries (HP)
pDS1150-SN1	Mentor Library and Interface (Sun)
pDS1150-HP1	Mentor Library and Interface (HP)
pDS1155-SN1	Mentor Autologic Synthesis Library (Sun)
pDS1155-HP1	Mentor Autologic Synthesis Library (HP)
pDS1160-SN1	Cadence Library and Interface (Sun)
pDS1170-PC1	OrCAD Library and Interface (PC)
pDS2101-PC2	pDS+ Viewlogic Fitter (PC)
pDS2101-SN1	pDS+ Viewlogic Fitter (Sun)
pDS2102-PC1	pDS+ ABEL Fitter (PC)
pDS2102-SN1	pDS+ ABEL Fitter (Sun)
pDS2103-PC1	pDS+ LOG/iC Fitter (PC)
pDS2120-PC1	pDS+ Synario Fitter (PC)
pDS2140-SN1	pDS+ Synopsys Fitter (Sun)
pDS2140-HP1	pDS+ Synopsys Fitter (HP)
pDS2150-SN1	pDS+ Mentor Fitter (Sun)
pDS2150-HP1	pDS+ Mentor Fitter (HP)
pDS2160-SN1	pDS+ Cadence Concept Fitter (Sun)
pDS2170-PC1	pDS+ OrCAD Fitter (PC)
pDS2190-PC1	pDS+ CUPL Fitter (PC)
pDS3302-PC2	Viewlogic PROsim Functional and Timing Simulator (PC)
pDS3302A-PC2	Viewlogic PROsim Functional and Timing Simulator (without security key - purchase in conjunction with pDS1301-PC2) (PC)
pDS3305A-PC2	Viewlogic PROsynthesis (without security key - purchase in conjunction with pDS1301-PC2) (PC)

Maintenance Agreements

Lattice provides one year of maintenance with each fitter and library system purchase. Keeping your software product up-to-date has significant benefits including periodic software updates, selected new product support, applications hotline access, and local applications support.

Part Number	Maintenance For:
pDS1101M-PC1	pDS Development System (pDS1101-PC1)
pDS1102M-PC2	Viewlogic Libraries and Interface Files (pDS1102-PC2)
pDS1102M-SN1	Viewlogic ViewSim and ViewDraw Libraries and Interface Files (pDS1102-SN1)
pDS1105M-PC2	Viewlogic Synthesis Library (pDS1105-PC2)
pDS1105M-SN1	Viewlogic Synthesis Library (pDS1105-SN1)
pDS1120M-PC1	Synario Library and Interface (pDS1120-PC1)

pDS1121M-PC1	Verilog Library (pDS1121-PC1)
pDS1140M-SN1	Synopsys Synthesis Library (pDS1140-SN1)
pDS1140M-HP1	Synopsys Synthesis Library (pDS1140-HP1)
pDS1150M-SN1	Mentor Library and Interface (pDS1150-SN1)
pDS1150M-HP1	Mentor Library and Interface (pDS1150-HP1)
pDS1155M-SN1	Mentor Autologic Synthesis Library (pDS1155-SN1)
pDS1155M-HP1	Mentor Autologic Synthesis Library (pDS1155-HP1)
pDS1160M-SN1	Cadence Library and Interface (pDS1160-SN1)
pDS1170M-PC1	OrCAD Library and Interface (pDS1170-PC1)
pDS1301M-PC2	Viewlogic PROcapture Schematic Editor (pDS1301-PC2)
pDS2101M-PC2	pDS+ Viewlogic Fitter (pDS2101-PC2)
pDS2101M-SN1	pDS+ Viewlogic Fitter (pDS2101-SN1)
pDS2102M-PC1	pDS+ ABEL Fitter (pDS2102-PC1)
pDS2102M-SN1	pDS+ ABEL Fitter (pDS2102-SN1)
pDS2103M-PC1	pDS+ LOG/iC Fitter (pDS2103-PC1)
pDS2120M-PC1	pDS+ Synario Fitter (pDS2120-PC1)
pDS2140M-SN1	pDS+ Synopsys Fitter (pDS2140-SN1)
pDS2140M-HP1	pDS+ Synopsys Fitter (pDS2140-HP1)
pDS2150M-SN1	pDS+ Mentor Fitter (pDS2150-SN1)
pDS2150M-HP1	pDS+ Mentor Fitter (pDS2150-HP1)
pDS2160M-SN1	pDS+ Cadence Concept Fitter (pDS2160-SN1)
pDS2170M-PC1	pDS+ OrCAD Fitter (pDS2170-PC1)
pDS2190M-PC1	pDS+ CUPL Fitter (pDS2190-PC1)
pDS3302M-PC2	Viewlogic PROsim Functional and Timing Simulator (pDS3302-PC2)
pDS3302AM-PC2	Viewlogic PROsim Functional and Timing Simulator (pDS3302A-PC2)
pDS3305AM-PC2	Viewlogic PROsynthesis (pDS3305A-PC2)

Programming Hardware

Part Number	Description
pDS4102-PM	Model 100 Universal Programming Module, (2) ispDOWNLOAD cables, AC adapter (PC)
pDS4102A-WS	Model 200A Universal Programming Module (Daisy Chain), (2) ispDOWNLOAD cables, AC adapter (Sun)
pDS4102-J44	44-pin PLCC socket adapter, (1) ispLSI 1016 Engineering Sample
pDS4102-T44	44-pin TQFP socket adapter, (1) ispLSI 1016 Engineering Sample
pDS4102-J68	68-pin PLCC socket adapter, (1) ispLSI 1024 Engineering Sample
pDS4102-J84	84-pin PLCC socket adapter, (1) ispLSI 1032 Engineering Sample
pDS4102-T100	100-pin TQFP socket adapter, (1) ispLSI 1032 Engineering Sample
pDS4102-Q120	120-pin PQFP socket adapter, (1) ispLSI 1048 Engineering Sample
pDS4102-Q128	128-pin PQFP socket adapter, (1) ispLSI 1048C Engineering Sample
pDS4102-M160	160-pin MQFP socket adapter, (1) ispLSI 3256 Engineering Sample
pDS4102-G167	167-pin PGA socket adapter, (1) ispLSI 3256 Engineering Sample
pDS4102-DL	ispDOWNLOAD Cable

ispLSI and pLSI Design Tool Selector Guide

Lattice pLSI and ispLSI Development System (pDS) Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
ispStarter Kit		N/A	ispStarter Kit (ispLSI 1016 & 2032)	isp-SK2	N/A
Boolean Entry and Fitting		N/A	pDS	pDS1101-PC1	N/A
3000 Family Device Support Option*		N/A	pDS 3K Upgrade	pDS1101-3UP/PC1	N/A
Simulation Options*	Viewlogic	N/A	PROsim Simulator Including Libraries	pDS3302-PC2	N/A
	Viewlogic	PROsim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	PROsim Simulator from Actel or Other Vendor	PROsim Upgrade Including Libraries	pDS1103-PC2	N/A
	Viewlogic	PROsim Simulator from Xilinx	PROsim Upgrade Including Libraries	pDS1104-PC2	N/A
	Viewlogic	Workview PLUS ViewSim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	OrCAD	VST 386+ Simulator	OrCAD Library and Interface	pDS1170-PC1	N/A
	Verilog	OVI-Compliant Verilog Simulator	Verilog Library	pDS1121-PC1	N/A

Lattice pDS+ ABEL Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
PLD Compiler and Fitting		ABEL Compiler	ispStarter Kit for ABEL (ispLSI 1016 & 2032)	isp-SK2/ABEL	N/A
PLD Compiler and Fitting		ABEL Compiler	pDS+ ABEL Fitter	pDS2102-PC1	pDS2102-SN1
3000 Family Device Support Option**		N/A	pDS+ ABEL 3K Upgrade	pDS2102-3UP/PC1	pDS2102-3UP/SN1
Simulation Options**	Viewlogic	N/A	PROsim Simulator Including Libraries	pDS3302-PC2	N/A
	Viewlogic	PROsim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	PROsim Simulator from Actel or Other Vendor	PROsim Upgrade Including Libraries	pDS1103-PC2	N/A
	Viewlogic	PROsim Simulator from Xilinx	PROsim Upgrade Including Libraries	pDS1104-PC2	N/A
	Viewlogic	Workview PLUS ViewSim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	Powerview ViewSim Simulator	Viewlogic Library and Interface	N/A	pDS1102-SN1
	OrCAD	VST 386+ Simulator	OrCAD Library and Interface	pDS1170-PC1	N/A
	Verilog	Synario Verilog Simulator	Synario Library and Interface	pDS1120-PC1	N/A
	Verilog	Cadence Verilog-XL Simulator	Cadence Library and Interface	N/A	pDS1160-SN1

* The Lattice pDS Software is required with any of these options.
** The appropriate third-party front end tools and the Lattice pDS+ Fitter are required with any of these options.
*** pDS3302A should be purchased in conjunction with pDS1301-PC2.

Lattice pDS+ Cadence Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
Capture, Simulation, and Fitting		Concept Schematic Editor Verilog-XL Simulator	pDS+ Cadence Fitter (Includes Concept Schematic Library and Verilog-XL Simulation Library)	N/A	pDS2160-SN1
Synthesis, Simulation, and Fitting		Synergy Synthesis Tool Verilog-XL Simulator	pDS+ Cadence Fitter (Includes Concept Schematic Library and Verilog-XL Simulation Library)	N/A	pDS2160-SN1
			Cadence Synergy Library	N/A	pDS1165-SN1
3000 Family Device Support Option**		N/A	pDS+ Cadence 3K Upgrade	N/A	pDS2160-3UP/SN1
Simulation Options**	Verilog	Verilog-XL Simulator	Cadence Library and Interface	N/A	pDS1160-SN1

Lattice pDS+ CUPL Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
PLD Compiler and Fitting		CUPL Compiler	pDS+ CUPL Fitter	pDS2190-PC1	N/A
3000 Family Device Support Option**		N/A	pDS+ CUPL 3K Upgrade	pDS2190-3UP/PC1	N/A
Simulation Options**	Viewlogic	N/A	PROsim Simulator Including Libraries	pDS3302-PC2	N/A
	Viewlogic	PROsim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	PROsim Simulator from Actel or Other Vendor	PROsim Upgrade Including Libraries	pDS1103-PC2	N/A
	Viewlogic	PROsim Simulator from Xilinx	PROsim Upgrade Including Libraries	pDS1104-PC2	N/A
	Viewlogic	Workview PLUS ViewSim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	OrCAD	VST 386+ Simulator	OrCAD Library and Interface	pDS1170-PC1	N/A
	Verilog	OVI-Compliant Verilog Simulator	Verilog Library	pDS1121-PC1	N/A

Lattice pDS+ LOG/iC Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
PLD Compiler and Fitting		LOG/iC PLUS or Perfect Compiler and ODS	pDS+ LOG/iC Fitter	pDS2103-PC1	N/A
3000 Family Device Support Option**		N/A	pDS+ LOG/iC 3K Upgrade	pDS2103-3UP/PC1	N/A
Simulation Options**	Viewlogic	N/A	PROsim Simulator Including Libraries	pDS3302-PC2	N/A
	Viewlogic	PROsim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	PROsim Simulator from Actel or Other Vendor	PROsim Upgrade Including Libraries	pDS1103-PC2	N/A
	Viewlogic	PROsim Simulator from Xilinx	PROsim Upgrade Including Libraries	pDS1104-PC2	N/A
	Viewlogic	Workview PLUS ViewSim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	OrCAD	VST 386+ Simulator	OrCAD Library and Interface	pDS1170-PC1	N/A
	Verilog	OVI-Compliant Verilog Simulator	Verilog Library	pDS1121-PC1	N/A

** The appropriate third-party front end tools and the Lattice pDS+ Fitter are required with any of these options.
*** pDS3302A should be purchased in conjunction with pDS1301-PC2.

Lattice pDS+ Mentor Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice HP Part Numbers	Lattice Sun Part Numbers
Capture, Simulation, and Fitting		Design Architect Schematic Editor Quicksim II Simulator	pDS+ Mentor Fitter (Includes Design Architect Schematic Library and Quicksim II Simulation Library)	pDS2150-HP1	pDS2150-SN1
Synthesis, Simulation, and Fitting		Autologic Synthesis Tool Quicksim II Simulator	pDS+ Mentor Fitter (Includes Design Architect Schematic Library and Quicksim II Simulation Library)	pDS2150-HP1	pDS2150-SN1
			Mentor Autologic Library	pDS1155-HP1	pDS1155-SN1
3000 Family Device Support Option**		N/A	pDS+ Mentor 3K Upgrade	pDS2150-3UP/HP1	pDS2150-3UP/SN1
Simulation Options**	Mentor	Quicksim II Simulator	Mentor Library and Interface	pDS1150-HP1	pDS1150-SN1
	Verilog	Verilog-XL Simulator	Cadence Library and Interface	N/A	pDS1160-SN1

Lattice pDS+ OrCAD Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
Capture, Simulation, and Fitting		SDT 386+ Schematic Editor VST386+ Simulator	pDS+ OrCAD Fitter (Includes Lattice's OrCAD SDT 386+ Schematic Capture Library and VST 386+ Simulation Library)	pDS2170-PC1	N/A
PLD Compiler, Simulation, and Fitting		PLD 386+ PLD Compiler VST386+ Simulator	pDS+ OrCAD Fitter (Includes Lattice's OrCAD SDT 386+ Schematic Capture Library and VST 386+ Simulation Library)	pDS2170-PC1	N/A
3000 Family Device Support Option**		N/A	pDS+ OrCAD 3K Upgrade	pDS2170-3UP/PC1	N/A
Simulation Options**	Viewlogic	N/A	PROsim Simulator Including Libraries	pDS3302-PC2	N/A
	Viewlogic	PROsim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	PROsim Simulator from Actel or Other Vendor	PROsim Upgrade Including Libraries	pDS1103-PC2	N/A
	Viewlogic	PROsim Simulator from Xilinx	PROsim Upgrade Including Libraries	pDS1104-PC2	N/A
	Viewlogic	Workview PLUS ViewSim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	OrCAD	VST 386+ Simulator	OrCAD Library and Interface	pDS1170-PC1	N/A
	Verilog	OVI-Compliant Verilog Simulator	Verilog Library	pDS1121-PC1	N/A

** The appropriate third-party front end tools and the Lattice pDS+ Fitter are required with any of these options.
*** pDS3302A should be purchased in conjunction with pDS1301-PC2.

Lattice pDS+ Synario Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
Capture, Simulation, and Fitting		Synario Schematic Editor	pDS+ Synario Fitter (Includes Lattice's Synario Libraries)	pDS2120-PC1	N/A
Capture, Simulation, PLD Compiler, and Fitting		Synario Schematic Editor and ABEL Compiler	pDS+ Synario Fitter (Includes Lattice's Synario Libraries)	pDS2120-PC1	N/A
3000 Family Device Support Option**		N/A	pDS+ Synario 3K Upgrade	pDS2120-3UP/PC1	N/A
Simulation Options**	Viewlogic	N/A	PROsim Simulator Including Libraries	pDS3302-PC2	N/A
	Viewlogic	PROsim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	PROsim Simulator from Actel or Other Vendor	PROsim Upgrade Including Libraries	pDS1103-PC2	N/A
	Viewlogic	PROsim Simulator from Xilinx	PROsim Upgrade Including Libraries	pDS1104-PC2	N/A
	Viewlogic	Workview PLUS ViewSim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	OrCAD	VST 386+ Simulator	OrCAD Library and Interface	pDS1170-PC1	N/A
	Verilog	Synario Verilog Simulator	Synario Library and Interface	pDS1120-PC1	N/A

Lattice pDS+ Synopsys Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice HP Part Numbers	Lattice Sun Part Numbers
Synthesis and Fitting		Design Compiler-Expert Synthesis Tool	pDS+ Synopsys Fitter (Includes Lattice Synopsys Synthesis Libraries)	pDS2140-HP1	pDS2140-SN1
		Design Compiler-Professional Synthesis Tool	pDS+ Synopsys Fitter (Includes Lattice Synopsys Synthesis Libraries)	pDS2140-HP1	pDS2140-SN1
		FPGA Compiler Synthesis Tool	pDS+ Synopsys Fitter (Includes Lattice Synopsys Synthesis Libraries)	pDS2140-HP1	pDS2140-SN1
3000 Family Device Support Option**		N/A	pDS+ Synopsys 3K Upgrade	pDS2140-3UP/HP1	pDS2140-3UP/SN1
Simulation Options**	Viewlogic	Powerview ViewSim Simulator	Viewlogic Library and Interface	N/A	pDS1102-SN1
	Mentor	Quicksim II Simulator	Mentor Library and Interface	pDS1150-HP1	pDS1150-SN1
	Verilog	Verilog-XL Simulator	Cadence Library and Interface	N/A	pDS1160-SN1

Synopsys Synthesis in Other 3rd Party/ Lattice pDS+ Environments	What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice HP Part Numbers	Lattice Sun Part Numbers
Synthesis and Fitting in the Cadence Environment	Any Synopsys Synthesis Tool and Cadence Concept Schematic Editor	pDS+ Cadence Fitter	N/A	pDS2160-SN1
		Lattice Synopsys Synthesis Libraries	N/A	pDS1140-SN1
Synthesis and Fitting in the Mentor Environment	Any Synopsys Synthesis Tool and Mentor Design Architect Schematic Editor	pDS+ Mentor Fitter	pDS2150-HP1	pDS2150-SN1
		Lattice Synopsys Synthesis Libraries	pDS1140-HP1	pDS1140-SN1
Synthesis and Fitting in the Viewlogic Environment	Any Synopsys Synthesis Tool and Viewlogic ViewDraw Schematic Editor	pDS+ Viewlogic Fitter	N/A	pDS2101-SN1
		Lattice Viewlogic Library and Interface	N/A	pDS1102-SN1
		Lattice Synopsys Synthesis Libraries	N/A	pDS1140-SN1

** The appropriate third-party front end tools and the Lattice pDS+ Fitter are required with any of these options.
*** pDS3302A should be purchased in conjunction with pDS1301-PC2.

Lattice pDS+ Viewlogic Environment		What You Have or Need from a 3rd-Party Vendor	What You Need From Lattice	Lattice PC Part Numbers	Lattice Sun Part Numbers
Capture and Fitting		None	pDS+ Viewlogic Fitter	pDS2101-PC2	N/A
			PROcapture Schematic Editor	pDS1301-PC2	
VHDL Synthesis and Fitting		None	pDS+ Viewlogic Fitter	pDS2101-PC2	N/A
			PROsynthesis Synthesis Tool	pDS3305A-PC2	N/A
			PROcapture Schematic Editor (Required in Synthesis Flow)	pDS1301-PC2	N/A
Capture and Fitting		PROcapture or ViewDraw Schematic Editor	pDS+ Viewlogic Fitter	pDS2101-PC2	pDS2101-SN1
			Viewlogic Library and Interface	pDS1102-PC2	pDS1102-SN1
VHDL Synthesis and Fitting		PROcapture or ViewDraw Schematic Editor and PROsynthesis or ViewSynthesis Synthesis Tool	pDS+ Viewlogic Fitter	pDS2101-PC2	pDS2101-SN1
			Viewlogic Synthesis Library	pDS1105-PC2	pDS1105-SN1
			Viewlogic Library and Interface	pDS1102-PC2	pDS1102-SN1
PLD Compiler and Fitting		ViewPLD Compiler	pDS+ ABEL Fitter	pDS2102-PC1	pDS2102-SN1
3000 Family Device Support Option**		N/A	pDS+ Viewlogic 3K Upgrade	pDS2101-3UP/PC2	pDS2101-3UP/SN1
Simulation Options**	Viewlogic	N/A	PROsim Simulator Including Libraries	pDS3302-PC2 or pDS3302A-PC2***	N/A
	Viewlogic	PROsim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	PROsim Simulator from Actel or Other Vendor	PROsim Upgrade Including Libraries	pDS1103-PC2	N/A
	Viewlogic	PROsim Simulator from Xilinx	PROsim Upgrade Including Libraries	pDS1104-PC2	N/A
	Viewlogic	Workview PLUS ViewSim Simulator	Viewlogic Library and Interface	pDS1102-PC2	N/A
	Viewlogic	Powerview ViewSim Simulator	Viewlogic Library and Interface	N/A	pDS1102-SN1
	OrCAD	VST 386+ Simulator	OrCAD Library and Interface	pDS1170-PC1	N/A
	Verilog	OVI-Compliant Verilog Simulator	Verilog Library	pDS1121-PC1	N/A
	Verilog	Cadence Verilog Simulator	Cadence Library and Interface	N/A	pDS1160-SN1

** The appropriate third-party front end tools and the Lattice pDS+ Fitter are required with any of these options.
*** pDS3302A should be purchased in conjunction with pDS1301-PC2.