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IEEE Standard for SystemVerilog—Unified Hardware Design, Specification, and Verification Language

IEEE Computer Society
and the
IEEE Standards Association Corporate Advisory Group

Sponsored by the
Design Automation Standards Committee

IEEE
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USA

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(Revision of
IEEE Std 1800-2009)

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IEEE-SA Standards Board

Abstract: The definition of the language syntax and semantics for SystemVerilog, which is a unified hardware design, specification, and verification language, is provided. This standard includes support for modeling hardware at the behavioral, register transfer level (RTL), and gate-level abstraction levels, and for writing testbenches using coverage, assertions, object-oriented programming, and constrained random verification. The standard also provides application programming interfaces (APIs) to foreign programming languages.

Keywords: assertions, design automation, design verification, hardware description language, HDL, HDVL, IEEE 1800™, PLI, programming language interface, SystemVerilog, Verilog®, VPI

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

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Neil Korpusik, Oracle Corporation, *Vice Chair*, *Technical Chair*
Dennis Brophy, Mentor Graphics Corporation, *Secretary*
Stuart Sutherland, Sutherland HDL, Inc., *Technical Editor*

Shalom Bresticker, Intel Corporation
Charles Dawson, Cadence Design Systems, Inc.
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Haim Kerem, Intel Corporation
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Neil Korpusik, Oracle Corporation, *Chair*
Dave Rich, Mentor Graphics Corporation, *Co-Chair*

Shalom Bresticker, Intel Corporation
Surrendra Dudani, Synopsys, Inc.
Francoise Martinolle, Cadence Design Systems, Inc.
Brad Pierce, Synopsys, Inc.
Stuart Sutherland, Sutherland HDL, Inc.

The **Basic/Design Committee (SV-BC)** was responsible for the specification of the design features of SystemVerilog.

Matt Maidment, Intel Corporation, *Chair*
Brad Pierce, Synopsys, Inc., *Co-Chair*

Tom Alsop, Intel Corporation
Shalom Bresticker, Intel Corporation
Eric Coffin, Mentor Graphics Corporation
Peter Flake, Accellera Systems Initiative
Alex Gran, Mentor Graphics Corporation
Mark Hartoog, Synopsys, Inc.
Kaiming Ho, Fraunhofer IIS
Francoise Martinolle, Cadence Design Systems, Inc.
Dave Rich, Mentor Graphics Corporation
Arnab Saha, Mentor Graphics Corporation
Daniel Schostak, ARM, Ltd.
Steven Sharp, Cadence Design Systems, Inc.
Stuart Sutherland, Sutherland HDL, Inc.
Gordon Vreugdenhil, Mentor Graphics Corporation

The **Enhancement Committee (SV-EC)** was responsible for the specification of the testbench features of SystemVerilog.

Mehdi Mohtashemi, Synopsys, Inc., *Chair*
Neil Korpusik, Oracle Corporation, *Co-Chair*

Tom Alsop, Intel Corporation
Jonathan Bromley, Accellera Systems Initiative
Dhiraj Goswami, Synopsys, Inc.
Alex Gran, Mentor Graphics Corporation
Mark Hartoog, Synopsys, Inc.
Scott Little, Intel Corporation
Francoise Martinolle, Cadence Design Systems, Inc.
Dave Rich, Mentor Graphics Corporation
Ray Ryan, Mentor Graphics Corporation
Arturo Salz, Synopsys, Inc.
Daniel Schostak, ARM Ltd.
Nilotpal Sensarkar, Marvell Technology Group, Ltd.
Steven Sharp, Cadence Design Systems, Inc.
Brandon Tipp, Intel Corporation
Tony Tsai, Cisco Systems, Inc.
Gordon Vreugdenhil, Mentor Graphics Corporation

The **Assertions Committee (SV-AC)** was responsible for the specification of the assertion features of SystemVerilog.

Dmitry Korchemny, Intel Corporation, *Chair*
Tom Thatcher, Oracle Corporation, *Co-Chair*

Ashok Bhatt, Cadence Design Systems, Inc.
Laurence Bisht, Intel Corporation
Eduard Cerny, Synopsys, Inc.
Ben Cohen, Accellera Systems Initiative
Dana Fisman, Synopsys, Inc.
John Havlicek, Freescale, Inc.
Tapan Kapoor, Cadence Design Systems, Inc.
Jacob Katz, Intel Corporation
Manisha Kulshrestha, Mentor Graphics Corporation
Scott Little, Intel Corporation
Anupam Prabhakar, Mentor Graphics Corporation
Erik Seligman, Intel Corporation
Samik Sengupta, Synopsys, Inc.

The **C API Committee (SV-CC)** was responsible for on the specification of the DPI, the SystemVerilog Verification Procedural Interface (VPI), and the additional coverage API.

Charles Dawson, Cadence Design Systems, Inc., *Chair*
Ghassan Khoory, Synopsys, Inc., *Co-Chair*

Chuck Berking, Cadence Design Systems, Inc.
Steve Dovich, Cadence Design Systems, Inc.
Amit Kohli, Cadence Design Systems, Inc.
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Abigail Moorhouse, Mentor Graphics Corporation
Michael Rohleder, Freescale, Inc.
Arnab Saha, Mentor Graphics Corporation
Arturo Salz, Synopsys, Inc.
George Scott, Mentor Graphics Corporation
Bassam Tabbara, Synopsys, Inc.
Jim Vellenga, Cadence Design Systems, Inc.
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The **Discrete Committee (SV-DC)** was responsible for defining features to support modeling of analog/ mixed-signal circuit components in the discrete domain.

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Abhijeet Kolpekwar, Cadence Design Systems, Inc., *Co-Chair*

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Introduction

This introduction is not part of IEEE Std 1800-2012, IEEE Standard for SystemVerilog—Unified Hardware Design, Specification, and Verification Language.

The purpose of this standard is to provide the electronic design automation (EDA), semiconductor, and system design communities with a well-defined and official IEEE unified hardware design, specification, and verification standard language. The language is designed to coexist and enhance the hardware description and verification languages (HDVLs) presently used by designers while providing the capabilities lacking in those languages.

SystemVerilog is a unified hardware design, specification, and verification language based on the Accellera SystemVerilog 3.1a extensions to the Verilog hardware description language (HDL) [B3], published in 2004.[a] Accellera is a consortium of EDA, semiconductor, and system companies. IEEE Std 1800 enables a productivity boost in design and validation and covers design, simulation, validation, and formal assertion-based verification flows.

SystemVerilog enables the use of a unified language for abstract and detailed specification of the design, specification of assertions, coverage, and testbench verification based on manual or automatic methodologies. SystemVerilog offers application programming interfaces (APIs) for coverage and assertions, and a direct programming interface (DPI) to access proprietary functionality. SystemVerilog offers methods that allow designers to continue to use present design languages when necessary to leverage existing designs and intellectual property (IP). This standardization project will provide the VLSI design engineers with a well-defined IEEE standard, which meets their requirements in design and validation, and which enables a step function increase in their productivity. This standardization project will also provide the EDA industry with a standard to which they can adhere and that they can support in order to deliver their solutions in this area.

[a]The numbers in brackets correspond to those of the bibliography in Annex Q.

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Part One:
Design and Verification Constructs

IEEE Standard for SystemVerilog—Unified Hardware Design, Specification, and Verification Language

1. Overview

1.1 Scope

This standard provides the definition of the language syntax and semantics for the IEEE 1800™ SystemVerilog language, which is a unified hardware design, specification, and verification language. The standard includes support for behavioral, register transfer level (RTL), and gate-level hardware descriptions; testbench, coverage, assertion, object-oriented, and constrained random constructs; and also provides application programming interfaces (APIs) to foreign programming languages.

1.2 Purpose

This standard develops the IEEE 1800 SystemVerilog language in order to meet the increasing usage of the language in specification, design, and verification of hardware. This revision corrects errors and clarifies aspects of the language definition in IEEE Std 1800-2009.[1] This revision also provides enhanced features that ease design, improve verification, and enhance cross-language interactions.

1.3 Content summary

This standard serves as a complete specification of the SystemVerilog language. This standard contains the following:

— The formal syntax and semantics of all SystemVerilog constructs

[1]Information on references can be found in Clause 2.