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FIPS

FIPS PUB 172-1

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION
(Supersedes FIPS PUB 172—1992 June 29)

VHSIC HARDWARE DESCRIPTION LANGUAGE (VHDL)

CATEGORY: SOFTWARE STANDARD
SUBCATEGORY: HARDWARE DESCRIPTION LANGUAGE

1995 JANUARY 27

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Foreword

The Federal Information Processing Standards Publication Series of the National Institute of Standards and Technology (NIST) is the official publication relating to standards and guidelines adopted and promulgated under the provisions of Section 111(d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235. These mandates have given the Secretary of Commerce and NIST important responsibilities for improving the utilization and management of computer and related telecommunications systems in the Federal Government. The NIST, through its Computer Systems Laboratory, provides leadership, technical guidance, and coordination of Government efforts in the development of standards and guidelines in these areas.

Comments concerning Federal Information Processing Standards Publications are welcomed and should be addressed to the Director, Computer Systems Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899.

James H. Burrows, Director
Computer Systems Laboratory

Abstract

This publication announces the adoption of the Federal Information Processing Standard (FIPS) for VHDL. This FIPS adopts American National Standard Hardware Description Language VHDL (ANSI/IEEE 1076-1993) as stipulated in the Specifications Section. The American National Standard specifies the form and establishes the interpretation of programs expressed in VHDL. The purpose of the standard is to promote portability of VHDL programs for use on a variety of data processing systems. The standard is used by implementors as the reference authority in developing compilers, interpreters, analyzers, simulators, or other forms of high level language processors, and is used by digital hardware designers, and by other computer professionals who need to know the precise syntactic and semantic rules of the standard and who need to provide specifications for digital hardware descriptions. This publication is a revision of FIPS PUB 172 and supersedes that document in its entirety.

Key words: computer systems design; configuration description; design entity; design specification; Federal Information Processing Standards (FIPS); generic; hardware abstraction; hardware architecture; Hardware Description Languates (HDL); IC model development; ports; VHSIC Hardware Description Language (VHDL).

Federal Information
Processing Standards Publication 172-1

1995 January 27

Announcing the Standard for

VHSIC HARDWARE DESCRIPTION LANGUAGE (VHDL)

Federal Information Processing Standards Publications (FIPS PUBS) are issued by the National Institute of Standards and Technology (NIST) after approval by the Secretary of Commerce pursuant to Section 111 (d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235.

1. **Name of Standard.** VHSIC Hardware Description Language (VHDL) (FIPS PUB 172-1).

2. **Category of Standard.** Software Standard, Hardware Description Language.

3. **Explanation.** This publication is a revision of FIPS PUB 172 and supersedes that document in its entirety.

    This publication announces the adoption of the Federal Information Processing Standard (FIPS) for VHDL. This FIPS adopts American National Standard Hardware Description Language VHDL (ANSI/IEEE 1076-1993) as stipulated in the Specifications Section. The American National Standard specifies the form and establishes the interpretation of programs expressed in VHDL. The purpose of the standard is to promote portability of VHDL programs for use on a variety of data processing systems. The standard is used by implementors as the reference authority in developing compilers, interpreters, analyzers, simulators or other forms of high level language processors, and is used by digital hardware designers, and by other computer professionals who need to know the precise syntactic and semantic rules of the standard and who need to provide specifications for digital hardware descriptions.

4. **Approving Authority.** Secretary of Commerce.

5. **Maintenance Agency.** U.S. Department of Commerce, National Institute of Standards and Technology (NIST), Computer Systems Laboratory (CSL).

6. **Cross Index.** ANSI/IEEE 1076-1993, IEEE Standard VHDL Language Reference Manual.

7. **Related Documents.**
    a. Federal Information Resources Management Regulations (FIRMR) subpart 201.20.303, Standards, and subpart 201.39.1002, Federal Standards.
    b. Federal ADP and Telecommunications Standards Index, U.S. General Services Administration, Information Resources Management Service, April 1994 (updated periodically).
    c. NIST, Validated Products List, NISTIR 5475 (republished quarterly). Available by subscription from the National Technical Information Service (NTIS).
    d. FIPS PUB 29-3, Interpretation Procedures for FIPS Software, 29 October 1992.

8. **Objectives.** Federal standards for high level digital design information and description languages permit Federal departments and agencies to exercise more effective control over the design, production, management, and maintenance of digital electronic systems. The primary objectives of this Federal hardware description language standard are:

- to encourage more effective utilization of design personnel by ensuring that design skills acquired under one job are transportable to other jobs, thereby reducing the cost of programmer retraining;

- to reduce the cost of design by achieving increased designer productivity and design accuracy through the use of formal languages;

- to reduce the overall life cycle cost for digital systems by establishing a common description language for the transfer of digital design information across organizational boundaries;

- to protect the immense investment of digital hardware from obsolescence by insuring to the maximal feasible extent that Federal hardware description language standards are technically sound and that subsequent revisions are compatible with the installed base;

- to reduce Federal inventory of electronic digital replacement parts by describing these parts in a form which enable suppliers to quickly retool manufacturing facilities to meet Federal needs;

- to increase the sources of supplies which can satisfy government requirements for mission specific electronic digital components.

Government-wide attainment of the above objectives depends upon the widespread availability and use of comprehensive and precise standard language specifications.

9. Applicability.

a.   Federal standards for hardware description languages are applicable for the design and description of digital systems developed for government use. This standard is suitable for use in the following digital system applications:

- primary design and description of digital systems, subsystems, assemblies, hybrid components, and components;

- formal specifications of digital systems throughout the procurement, contracting and development process;

- test generation for digital systems, subsystems, assemblies, hybrid components, and components;

- re-procurement and redesign of digital systems, subsystems, assemblies, hybrid components, and components.

b.   The use of FIPS hardware description languages applies when one or more of the following situations exist:

- When using a formal language for specifying a formal design specification for a complex digital system.

- The digital system is under constant revision during the development process.

- It is desired to have the design understood by multiple groups, or organizations.

- The system under development is to be designed by multiple groups, or organizations.

- Accurate unambiguous specifications are required in the bid and contracting process.

10.   Specifications.   The specifications for this standard are the language specifications contained in ANSI/IEEE 1076-1993, IEEE Standard VHDL Language Reference Manual.

This FIPS does not allow conforming implementations to extend the language. A conforming implementation is one that does not allow inclusion of substitute or additional language elements in order to accomplish a feature of the language as specified in the language standard. A conforming implementation is one which adheres to and implements all of the language specifications contained in ANSI/IEEE 1076-1993 except

where the language standard permits deviations and which specifies conspicuously in a separate section in the conforming implementation description all such permitted variations. Also, such conformance shall be with default language processor system option settings.

The ANSI/IEEE 1076-1993 document does not specify limits on the size or complexity of programs, the results when the rules of the standard fail to establish an interpretation, the means of supervisory control programs, or the means of transforming programs for processing.

11. Implementation. The implementation of this standard involves three areas of consideration: acquisition of VHDL processors, interpretation of FIPS VHDL, and validation of VHDL processors.

11.1 Effective Date. This revised standard becomes effective May 1, 1995. VHDL processors acquired for Federal use after the effective date shall implement FIPS PUB 172-1. Prior to that date the requirements of FIPS PUB 172 apply to Federal VHDL procurements. This delayed effective date is intended to give implementations that conform to FIPS PUB 172 time to make the enhancements necessary to enable conformance to FIPS PUB 172-1.

A transition period provides time for industry to produce VHDL language processors conforming to the FIPS PUB 172-1. The transition period begins on the effective date and continues for 12 months thereafter. The provisions of FIPS PUB 172-1 apply to orders placed after the effective date of this publication; however a processor conforming to the FIPS PUB 172-1, if available, may be acquired for use prior to the effective date. If, during the transition period, a processor conforming to FIPS PUB 172-1 is not available, a processor conforming to FIPS PUB 172 may be acquired for interim use during the transition period.

11.2 Acquisition of VHDL Processors. Conformance to FIPS VHDL should be considered whether VHDL processors are developed internally, acquired as part of an ADP system procurement, acquired by separate procurement, used under an ADP leasing arrangement, or specified for use in contracts for hardware description services. Recommended terminology for procurement of FIPS VHDL is contained in the U.S. General Services Administration publication Federal ADP & Telecommunications Standards Index, Chapter 4 Part 1.

11.3 Interpretation of FIPS VHDL. The National Institute of Standards and Technology provides for the resolution of questions regarding the specifications and requirements, and issues official interpretations as needed. All questions about the interpretation of this standard should be addressed to:

> Director
> Computer Systems Laboratory
> ATTN: FIPS VHDL Interpretation
> National Institute of Standards and Technology
> Gaithersburg, MD 20899
> Voice: 301-975-2490
> FAX: 301-948-6213
> dashiell@alpha.ncsl.nist.gov e-mail

11.4 Validation of VHDL Processors. The validation of VHDL processors for conformance to this standard applies when NIST VHDL validation procedures are available. At the present time NIST does not have procedures for validating VHDL processors. NIST is currently investigating methods which may be considered for validating processors for conformance to this standard.

For further information contact:

Director
Computer Systems Laboratory
Attn: FIPS VHDL Validation
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Gaithersburg, MD 20899
Voice: 301-975-2490
FAX: 301-948-6213
dashiell@alpha.ncsl.nist.gov e-mail

12. Waivers.   Under certain exceptional circumstances, the heads of Federal departments and agencies may approve waivers to Federal Information Processing Standards (FIPS). The head of such agency may re-delegate such authority only to a senior official designated pursuant to section 3506(b) of Title 44, U.S. Code. Waivers shall be granted only when:

a. Compliance with a standard would adversely affect the accomplishment of the mission of an operator of a Federal computer system, or

b. Cause a major adverse financial impact on the operator which is not offset by Government-wide savings.

Agency heads may act upon a written waiver request containing the information detailed above. Agency heads may also act without a written waiver request when they determine that conditions for meeting the standard cannot be met. Agency heads may approve waivers only by a written decision which explains the basis on which the agency head made the required finding(s). A copy of each such decision, with procurement sensitive classified portions clearly identified, shall be sent to: National Institute of Standards and Technology, ATTN: FIPS Waiver Decisions, Technology Building, Room B-154, Gaithersburg, MD 20899.

In addition, notice of each waiver granted and each delegation of authority to approve waivers shall be sent promptly to the Committee on Government Operations of the House of Representatives and the Committee on Governmental Affairs of the Senate and shall be published promptly in the *Federal Register*.

When the determination on a waiver applies to the procurement of equipment and/or services, a notice of the waiver determination must be published in the *Commerce Business Daily* as a part of the notice of solicitation for offers of an acquisition or, if the waiver determination is made after that notice is published, by amendment to such notice.

A copy of the waiver, any supporting documents, the document approving the waiver and any supporting and accompanying documents, with such deletions as the agency is authorized and decides to make under 5 U.S.C. Section 552(b), shall be part of the procurement documentation and retained by the agency.

13. Where to Obtain Copies.   Copies of this publication are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161, telephone (703) 487-4650. (Sale of the included specifications document is by arrangement with the American National Standards Institute.) When ordering, refer to Federal Information Processing Standards Publication 172-1 (FIPSPUB172-1), and title. Payment may be made by check, money order, or deposit account.