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INTERNATIONAL STANDARD

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Delay and power calculation standards –
Part 1: Integrated circuit delay and power calculation systems

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Delay and power calculation standards -

Part 1: Integrated circuit delay and power calculation systems

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IEEE Std 1481™-2009
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IEEE Standard for Integrated Circuit (IC) Open Library Architecture (OLA)

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Abstract: Ways for integrated circuit designers to analyze chip timing and power consistently across a broad set of electric design automation (EDA) applications are covered in this standard. Methods by which integrated circuit vendors can express timing and power information once per given technology are also covered. In addition, the means by which EDA vendors can meet their application performance and capacity needs are discussed.

Keywords: chip delay, electronic design automation (EDA), integrated circuit (IC) design, power calculation

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IEEE Introduction

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The objective of the delay and power calculation system (DPCS) is to make it possible for integrated circuit designers to consistently calculate chip delay and power across electronic design automation (EDA) applications and for integrated circuit vendors to express delay and power information only once per technology while enabling sufficient EDA application accuracy.

This is accomplished by a coordinated set of standards that support a standard method to describe timing and power characteristics of integrated circuit design units (cells and higher level design elements); a standard method for EDA applications to calculate chip design instance specific delay, slew, and power for logic and interconnects; and standard file formats to exchange chip parasitic and cluster information.

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Delay and power calculation standards – Part 1: Integrated circuit delay and power calculation systems

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1 Overview

The delay and power calculation system (DPCS) is a coordinated set of standards that support a standard method to describe timing and power characteristics of integrated circuit (IC) design units (cells and higher level design elements); a standard method for electronic design automation (EDA) applications to calculate chip design instance specific delay, slew, and power for logic and interconnects; and standard file formats to exchange chip parasitic and cluster information. The standard specifications covered in this document include

- A description language for timing and power modeling, called the delay calculation language (DCL).
- A software procedural interface (PI) for communications between EDA applications and compiled libraries of DCL descriptions.
- A standard file exchange format for parasitic information about the chip design: Standard Parasitic Exchange Format (SPEF).
- Informative usage examples
- Informative notes

Notes and examples are informative. All other components of this specification are considered normative unless otherwise directed.

1.1 Scope

The scope of this standard focuses on delay and power calculation for integrated circuit design with support for modeling logical behavior and signal integrity.

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1.2 Purpose

To improve the IEEE 1481-1999 standard system for integrated circuit designers to more accurately and more completely analyze semiconductor designs across EDA applications and for integrated circuit vendors to express logical behavior, signal integrity, delay, and power information only once per technology while enabling sufficient EDA application accuracy.

1.3 Introduction

The DPCS standard covers delay and power calculation for integrated circuit design with support for modeling logical behavior and signal integrity, which makes it possible for integrated circuit designers to analyze chip timing and power consistently across a broad set of EDA applications, for integrated circuit vendors to express timing and power information once (for a given technology), and for EDA vendors to meet their application performance and capacity needs. The intended use for this standard is IC timing and power. This standard may be applied to both unit logic cells supplied by the IC vendor and logical macros defined by the IC designer. Although this standard is written toward the integrated circuit supplier and EDA developer, its application applies equally well to representation of timing and power for designer-defined macros (or hierarchical design elements).

These specifications make it possible to achieve consistent timing and power results, but they do not guarantee it. They provide for a single executable software program that computes delay and power based on IC vendor-supplied algorithms (or designer-supplied algorithms for macros) but does not guarantee EDA applications can correctly communicate the design-specific information required for these algorithms. By specifying standard exchange formats for parasitic data and floorplanning information, this standard provides a marked improvement over design environments with no such standards. However, it is the responsibility of the EDA application to correctly correlate the information between these standard exchange files and the actual design. This standard also does not detail how the information contained within the standard exchange files shall be obtained.

As feature sizes for chips have shrink below 0.25 µm, interconnect delay effects have begun to outweigh those of the logic cells. This means placement of cells and wire routing of the interconnects become as important a factor as the type of cell drivers and receivers on the interconnect. As a result, EDA logic design applications (such as synthesis) have begun to interact closely with physical design applications (such as floorplanning and layout). Applications that before could consider only simple delay and power models now need to deal with complex, interrelated delay and power algorithms. Plus, due to the complexities of the delay and power algorithms, the integrated circuit vendor needs to have control of application calculations and not be restricted by the limitations of a broad set of applications demanded by the customers (the designers).

Over the past few years, it has become increasingly apparent that modern very large-scale integration (VLSI) design is no longer bounded only by timing and area constraints. Power has become significantly more important. In an era of hand-held devices, ranging from mobile computing to wireless communication systems, managing and controlling power takes on an important role. Several benefits can be attained from low-power designs in addition to extended battery life. Low-power devices often run at a lower junction temperature, which leads to higher reliability and lower cost cooling systems. There are also several challenges for calculation and modeling of power (and delay) in deep submicron (less then 0.25 µm) designs. EDA tools can now accurately calculate and model power by using this DPCS standard.

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2 Normative references

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ISO/IEC 9899:1990, Programming Languages – C.[1]

ISO/IEC 14882:2003, Programming Languages – C++.

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