

1450.2™

IEEE Standard for Extensions to Standard Test Interface Language (STIL) (IEEE Std 1450™-1999) for DC Level Specification

IEEE Computer Society

Sponsored by the
Test Technology Standards Committee



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IEEE Computer Society

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Abstract: This standard extends IEEE Std 1450-1999 (STIL) to support the definition of DC levels. STIL language constructs are defined to specify the DC conditions necessary to execute digital vectors on automated test equipment (ATE). STIL language extensions include structures for: (a) specifying the DC conditions for a device under test; (b) specifying DC conditions either globally, by pattern burst, by pattern, or by vector; (c) specifying alternate DC levels; and (d) selecting DC levels and alternate levels within a period, much the same as timed format events.

Keywords: automated test equipment (ATE), comparator, DC levels, device power supply (DPS), device under test (DUT), driver, driver termination, dynamic load, functional test, parametric measurement unit (PMU), power sequence, slew rate, voltage clamp

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Introduction

[This introduction is not part of IEEE Std 1450.2-2002, IEEE Standard for Extensions to Standard Test Interface Language (STIL) (IEEE Std 1450TM-1999) for DC Level Specification.]

Standard Test Interface Language (STIL) (IEEE Std 1450-1999) was developed and approved with an intentionally constrained scope. While DC levels were explicitly excluded from that scope, it was apparent that DC levels were an area of interest and importance to the STIL user community. The P1450.2 Working Group was formed to address the extension of DC levels to the STIL standard.

Three main topics were identified as priorities for the work. These include per-pin reference levels for signal pins (e.g., VIH, VIL, VOH, VOL), device power supply levels (voltage and current), and power sequencing to the device under test. During the course of development, two other important topics were addressed. These included the capability for switching levels within a period, and for switching levels between vectors in a pattern.

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IEEE Standard for Extensions to Standard Test Interface Language (STIL) (IEEE Std 1450™-1999) for DC Level Specification

1. Overview

This standard extends IEEE Std 1450-1999¹ (STIL) to support the definition of DC levels. The DC levels information consists of the per-pin reference levels, the device power supply (DPS) levels, and the sequencing of these levels for powering up the device, powering down the device, or changing levels of the device. The DC level definitions may be defined as static states that are established prior to execution of a pattern. They also may be selected within a pattern.

Figure 1 is a model of the test environment for a device under test (DUT) on an automatic test equipment (ATE) tester. Figure 2 is a model of the per-pin DC resources of an ATE tester. Figure 3 is a model of the differential DC resources of an ATE tester. The statements and blocks defined in this standard are defined relative to these models. Some functions represented by these models may not be available on some ATE systems. The DCSequence commands Apply and Connect load values into the hardware registers, e.g., VIL and VIH, and connect the tester resource, e.g., the driver, to the DUT, respectively.

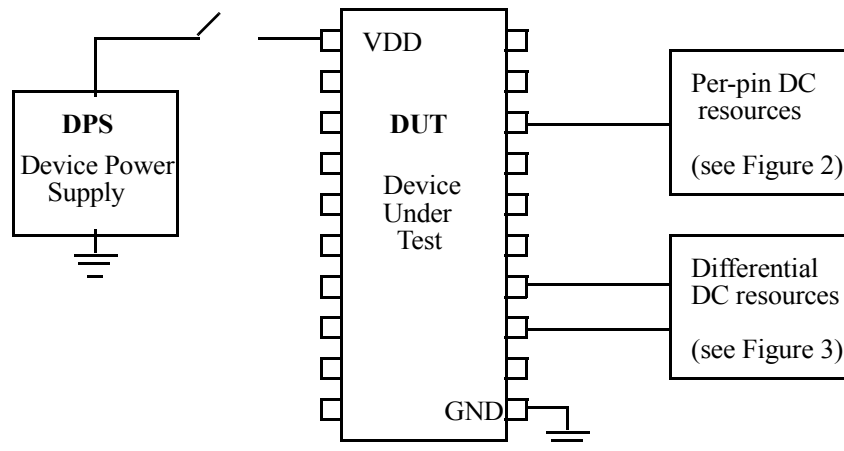


Figure 1—STIL model of DUT test environment on ATE tester

¹Information on references can be found in Clause 2.

1.1 Scope

This standard defines the following:

- Defines structures in STIL for specifying the DC conditions for a DUT. Examples of the DC conditions for device power supplies are DPS setup, power sequencing to the device, and power supply limiting/clamping. Examples of the DC conditions for commonly used signal references are VIL, VIH, VOL, VOH, IOL, IOH, VREF, VClampLow, and VClampHi.
- Defines structures in STIL such that the DC conditions may be specified either globally, by pattern burst, by pattern, or by vector.
- Defines structures in STIL to allow specification of alternate DC levels. Examples of commonly used alternate levels are VIHh, VIPP, and VILL.
- Defines structures in STIL such that the DC levels and alternate levels can be selected within a period, much the same as timed format events.

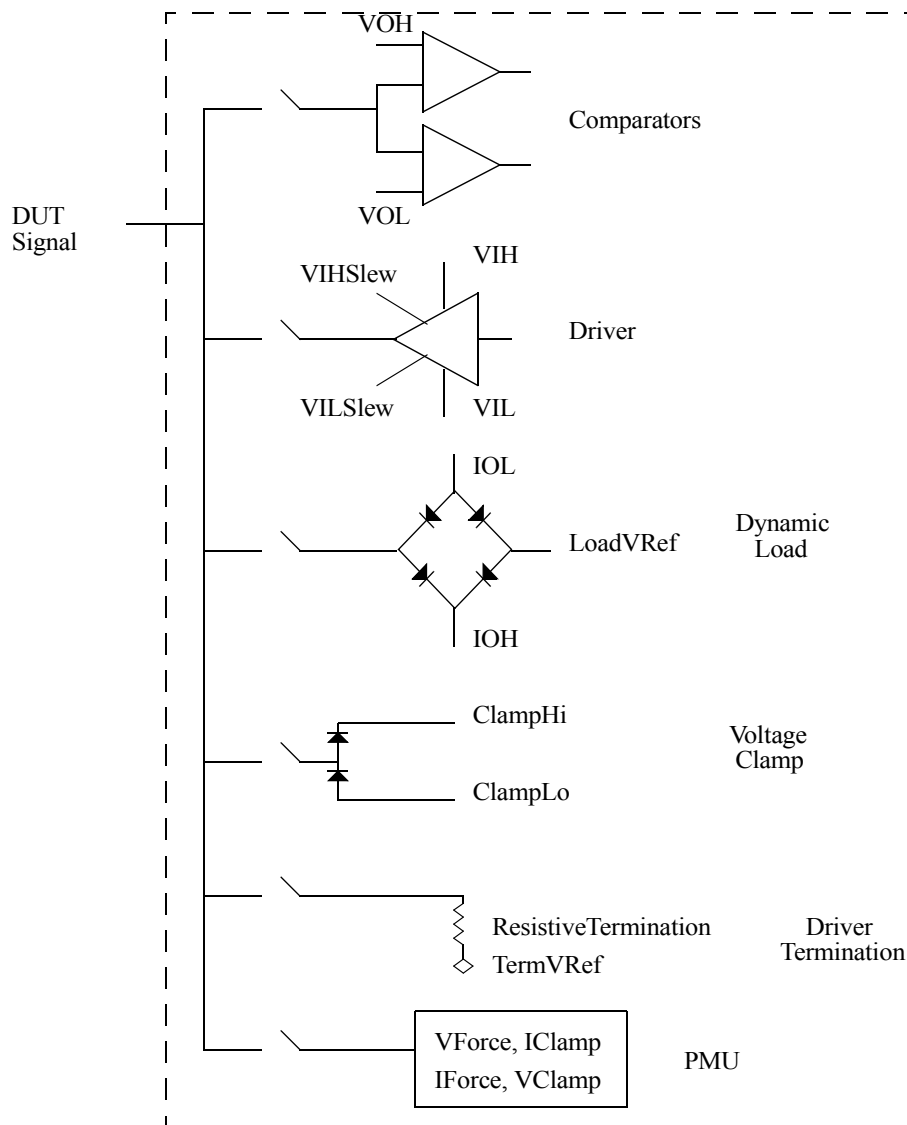


Figure 2—STIL model of per-pin DC resources of ATE tester

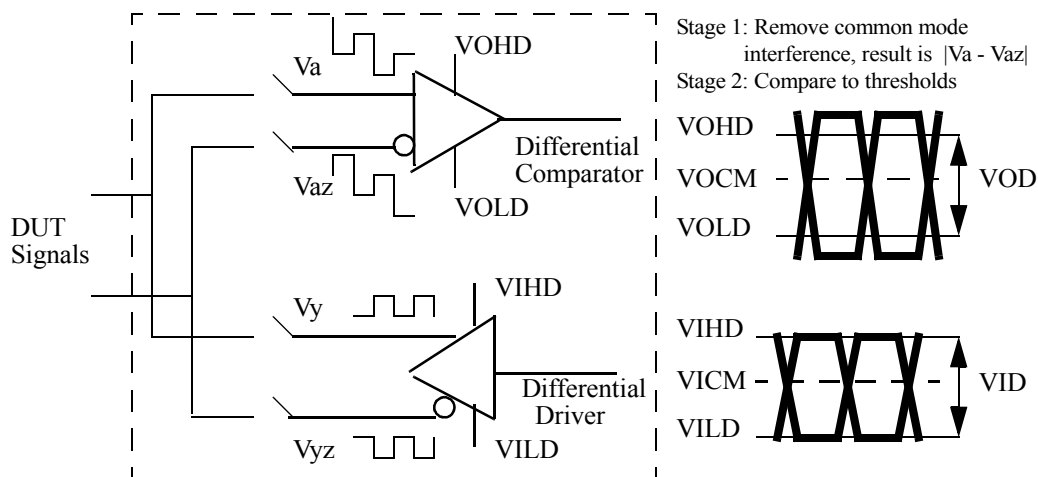


Figure 3—STIL model of differential DC resources of ATE tester

1.2 Purpose

This effort will define constructs in STIL to specify the DC conditions necessary to execute the digital vectors on ATE. This will complement the IEEE Std 1450-1999 definition, which defines structures for specification of timing and format information but does not define the DC conditions under which this information should be applied.

2. References

This standard shall be used in conjunction with the following standard. If the following standard is superseded by an approved revision, the revision shall apply.

IEEE Std 1450-1999, IEEE Standard Test Interface Language (STIL) for Digital Test Vectors.^{2, 3}

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this standard, the following terms and definitions apply. IEEE 100™ [B1]⁴ should be referenced for terms not defined in this standard.

3.1.1 alternate input high voltage (VIHH): An alternate input high voltage forced by the ATE driver to the DUT.

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³IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

⁴The numbers in brackets correspond to those of the bibliography in Annex B.

3.1.2 alternate input high voltage (VIPV): An alternate input high voltage forced by the ATE driver to the DUT. This is typically used to generate programming pulses for electrically programmable memories and is synonymous with the commonly used term VPP in the context of programming voltage.

3.1.3 alternate input low voltage (VILL): An alternate input low voltage forced by the ATE driver to the DUT.

3.1.4 automatic test equipment (ATE): A system that provides a test capability for the automatic testing of one or more devices under test (DUT).

3.1.5 clamp current (IClamp): The maximum current allowed for a DPS or PMU.

3.1.6 clamp voltage (VClamp): The maximum voltage allowed for a DPS or PMU.

3.1.7 comparator: A component of an ATE that senses voltage response from the DUT during functional testing.

3.1.8 device power supply (DPS): A component of an ATE that provides DC voltage and/or current to the DUT power supply pins.

3.1.9 device under test (DUT): An electronic component, typically an integrated circuit, to be tested by an ATE.

3.1.10 differential comparator: A component of an ATE that senses voltage difference between two DUT outputs during functional testing.

3.1.11 differential driver: A component of an ATE that provides voltage difference to two DUT inputs during functional testing.

3.1.12 differential input high voltage (VIHD): The differential input high voltage forced by the ATE driver to the DUT.

3.1.13 differential input low voltage (VILD): The differential input low voltage forced by the ATE driver to the DUT.

3.1.14 differential input voltage (VID): The differential input voltage forced by the ATE driver to the DUT. $VID = |VIHD - VILD|$.

NOTE—See Figure 3.

3.1.15 differential output high voltage (VOHD): The differential output high reference voltage used by the ATE comparator to define minimum output high voltage from the DUT.

3.1.16 differential output low voltage (VOLD): The differential output low reference voltage used by the ATE comparator to define maximum output low voltage from the DUT.

3.1.17 differential output voltage (VOD): The differential output voltage received by the ATE comparator from the DUT. $VOD = |VOHD - VOLD|$.

NOTE—See Figure 3.

3.1.18 driver: A component of an ATE that provides voltage stimulus to the DUT during functional testing.

3.1.19 driver termination: A component of an ATE that provides impedance matching between the ATE driver and the DUT during functional testing.

3.1.20 dynamic load: A component of an ATE that provides current loading to the DUT during functional testing.

3.1.21 force current (IForce): The forcing current provided by a DPS or PMU to the DUT.

3.1.22 force voltage (VForce): The forcing voltage provided by a DPS or PMU to the DUT.

3.1.23 functional test: The process of applying functional vectors to the DUT and verifying the expected response from the DUT using an ATE. Refer to 3.1.10 of IEEE Std 1450-1999, for definition of functional vector.

3.1.24 high clamp voltage (ClampHi): The voltage level set for the high clamp circuit.

3.1.25 input common mode voltage (VICM): The input common mode voltage used to reference the differential input voltages forced by the ATE driver to the DUT. $VICM = (VIHD + VILD)/2$.

NOTE—See Figure 3.

3.1.26 input high voltage (VIH): The input high voltage forced by the ATE driver to the DUT.

3.1.27 input low voltage (VIL): The input low voltage forced by the ATE driver to the DUT.

3.1.28 LoadVRef: The commutating voltage of the ATE dynamic load. When no current is flowing, this is the voltage applied to the DUT.

3.1.29 low clamp voltage (ClampLo): The voltage level set for the low clamp circuit.

3.1.30 negative terminal input voltage (Vyz): The negative terminal differential input voltage from the ATE driver to the DUT. Vyz is the complement of Vy .

NOTE—See Figure 3.

3.1.31 negative terminal output voltage (Vaz): The negative terminal differential output voltage from the DUT. Vaz is the complement of Va .

NOTE—See Figure 3.

3.1.32 output common mode voltage (VOCM): The output common mode voltage used to reference the differential output voltages received by the ATE comparator from the DUT. $VOCM = (VOHD + VOLD)/2$.

NOTE—See Figure 3.

3.1.33 output high current (IOH): The output high current provided by the ATE dynamic load to the DUT.

3.1.34 output high voltage (VOH): The output high reference voltage used by the ATE comparator to define minimum output high voltage from the DUT.

3.1.35 output low current (IOL): The output low current provided by the ATE dynamic load to the DUT.

3.1.36 output low voltage (VOL): The output low reference voltage used by the ATE comparator to define maximum output low voltage from the DUT.