

## SiMKit

Release Notes for SiMKit version 5.1.2\_pub

Eindhoven, May 2019

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## Preface

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These are the release notes for simkit version 5.1.2\_pub. Changes with respect to simkit 5.1\_pub are reported in these release notes.

The main developments of this release are:

- The PSP103 model was updated to PSP103.7.
- A new Mextram version 504.13 is available.
- The Mextram 505 model was updated to 505.1.
- Support for MINT interface version 5 was added for ADS.
- Instance scaling issue solved for ADS.
- Param given mechanism corrected for some models in ADS.
- Some corrections in the SOA check implementation (Spectre specific).

## Overview

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SiMKit is a simulator-independent compact transistor model library.

Simulator-specific connections are handled through so-called adapters that provide the correct interfacing to:

- Spectre and APS: the Cadence circuit simulators.
- ADS: the Keysight circuit simulator.

Simkit 5.1.2\_pub supports ADS 2012 and higher. The SiMKit distribution is also available for ADS on Windows for the same versions.

Mica from NXP, AFS from Mentor, GoldenGate from Keysight, FineSim and CustomSim(XA) from Synopsys and several other simulators (e.g. APLAC/MWO from AWR) do provide an adapter for the SiMKit models.

For a complete description, please refer to:

<http://www.nxp.com/models/simkit.html>

## Model improvements and bug-fixes

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PSP103 model:

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The PSP103 model was updated to PSP103.7:

- More efficient calculations of Vdsp and Vdspedge.
- Additional parameters for overlaps gate leakage currents.
- Charge partitioning: new switch parameter SWQPART to modify the charge partitioning between the drain and the source.
- Additional parameters for charge model decoupling to improve CV description.

Mextram 504:

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A new version 504.13 is available.

- KAVL=2 and KAVL=3 are added to enable 504.11 compatibility for avalanche related noise.
  - KAVL=0: behaves like 504.12.1 + KAVL=0
  - KAVL=1: behaves like 504.12.1 + KAVL=1
  - KAVL=2: behaves like 504.11 + KAVL=0
  - KAVL=3: behaves like 504.11 + KAVL=1
- MC will be clipped to 0.99.

Model Mextram 505 was updated to 505.1:

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- Added CS junction diode knee current ikcs.
  - Modified BCS high injection.
  - Added breakdown in CB junction leakage and its switch, swjbrcb = 0 (default), and 1.
  - Separated Isub into intrinsic Isub\_int and extrinsic Isub with parameter xisubi. Isub\_int is controlled by Vb2c2 and Isub is controlled by Vb1c4.
  - Addition of vexlim parameter for limitation of exp function applied on voltages.

Spectre specific

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Improvements SOA checking

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- The duration of the reported in the SOA messages when using the +aps option of Spectre was sometimes completely wrong. This has been corrected in simkit 5.1.2\_pub.
  - In the SOA check implementations some small bugs were corrected:
    - when the parameter vballmsg==0 the OVCHECK\_INFO warnings in the overview were not printed. This has been corrected.
    - The message in OVCHECK\_DC is now printed.
    - The exit time and peak time values have been removed from the OVCHECK\_DC\_END warnings.
    - The location of the duration in the OVCHECK warnings is now consistent for all warnings.
  - For SOA checks, when the violation was shorter than tmin and stop set to 1, the simulation was stopping. This was corrected, the simulation now only stops upon stop=1 if it's longer than tmin.

ADS specific

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- This version of SimKit was compiled with gcc 6.3.0 and works fine with all ADS versions from 2012 to 2019.
- The instance scaling mechanism was not working properly, preventing the usage of the 'scale' factor. This was corrected and works properly in ADS 2019.1 and higher.
- the param given mechanism used in various models was not working properly. This was corrected and works properly in ADS 2019.1 and higher.
- In simkit 5.0\_pub string parameters were added to the SOA (Safe Operating Area) devices ovcheck and ovcheck6. Though ADS does not support the SOA feature it should simply ignore these elements. Until simkit 5.0\_pub this was the case, but using the string parameters in a netlist makes ADS crash. In simkit 5.1.2\_pub this

has been corrected.

#### Known limitations

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#### Overvoltage checking:

- Overvoltage checks do not give warnings in ADS as in Spectre. The full functionality is only available in Spectre, APS and in Mentor AFS per 2015\_Q1\_updatel.

#### Flexible topology in ADS and Spectre:

- A device will choose its topology based on the settings of certain parameters. So, e.g. a sweep of the parameter RGO (gate resistor) in PSP going from zero to another value, or a sweep over SWNQS in PSPNQS is not possible. The simulator will stop with an appropriate message because continuation would result in erroneous results.
- Internal node names in ADS for models with a flexible topology (in simkit 5.1.2\_pub those are PSP, PSPNQS, MXT504, MXT505, M1101 and M1102) might be wrong in the simulator output. The simulation results are not affected by this.

#### Instance scaling in ADS:

- Scaling of instance parameters via the option scale is not supported in ADS versions lower than 2019.1.

#### Transient noise:

- Transient noise simulations with MOST devices are currently not supported. The noise results are unreliable. A workaround is to switch off induced gate noise, which can be done in mos 1101 and 1102 by setting GATENOISE=1.  
In simkit 4.8.1\_pub a switch option SWIGN=2 was added to PSP102 and PSP103:
  - . For SWIGN=1 (default) the behavior is the same as in previous simkit versions.
  - . For SWIGN=2 the noise is treated in such a way that transient noise results are correct. With SWIGN=2 all other analysis types also give correct results but the simulation time may be longer than with SWIGN=1.

#### SiMKit models

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The SiMKit library contains the most recent versions of the NXP transistor models. The following tables list the SiMKit models. The first table lists the 'real' SiMKit models while the second table lists the pre-SiMKit models, for which only a Spectre implementation is available.

In the following tables,  
'e/g' stands for electric/geometric  
't' stands for self-heating and  
's' stands for substrate model

Table 1: Real SiMKit models

model	level	Spectre/APS/AFS	ADS	e/g	t	s
juncap	1	juncap	juncap	e	no	no
juncap	200	juncap200	juncap200	e	no	no
psp	102	psp102e	psp102e	e*	no	no
psp	1020	psp1020	psp1020	g*	no	no
psp	1021	psp1021	psp1021	g*	no	no
pspnqs	102	pspnqs102e	pspnqs102e	e*	no	no
pspnqs	1020	pspnqs1020	pspnqs1020	g*	no	no
pspnqs	1021	pspnqs1021	pspnqs1021	g*	no	no
psp	103	psp103	psp103	eg	no	no
psp	103	psp103t	psp103t	eg	yes	no
pspnqs	103	pspnqs103	pspnqs103	eg	no	no
modella	500	bjt500	bjt500	e	no	no

modella	500	bjt500t	bjt500t	e	yes	no
mextram	504	bjt504	bjt504	e	no	yes
mextram	504	bjt504t	bjt504t	e	yes	yes
mextram	504	bjtd504	bjtd504	e	no	no
mextram	504	bjtd504t	bjtd504t	e	yes	no
mextram	505	bjt505	bjt505	e	no	yes
mextram	505	bjt505t	bjt505t	e	yes	yes
mextram	505	bjtd505	bjtd505	e	no	no
mextram	505	bjtd505t	bjtd505t	e	yes	no
mos	903	mos903e	mos903e	e	no	no
mos	903	mos903	mos903	g	no	no
mos	903	mos903t	mos903t	g	yes	no
mos	1101	mos1101e	mos1101e	e	no	no
mos	1101	mos1101et	mos1101et	e	yes	no
mos	11010	mos11010	mos11010	g	no	no
mos	11010	mos11010t	mos11010t	g	yes	no
mos	11011	mos11011	mos11011	g	no	no
mos	11011	mos11011t	mos11011t	g	yes	no
mos	1102	mos1102e	mos1102e	e	no	no
mos	1102	mos1102et	mos1102et	e	yes	no
mos	11020	mos11020	mos11020	g	no	no
mos	11020	mos11020t	mos11020t	g	yes	no
mos	11021	mos11021	mos11021	g	no	no
mos	11021	mos11021t	mos11021t	g	yes	no
mos	3100	mos3100	mos3100	e	no	no
mos	3100	mos3100t	mos3100t	e	yes	no
mos	40	mos40	mos4000/mos40	e	no	no
mos	40	mos40t	mos4000t/mos40t	e	yes	no
rflmos	602	rflmos602t	rflmos602t	g	yes	yes**
rflmos	602	rflmos602dt	rflmos602dt	g	yes	yes**
jfetidg	1	jfetidg	jfetidg	g	no	no
jfetidgt	1	jfetidgt	jfetidgt	g	yes	no
ovcheck	1	ovcheck	ovcheck	-	-	-
ovcheck	6	ovcheck6	ovcheck6	-	-	-

\* For PSP the electrical model is referred to as the local model and the geometrical model as the global model.

\*\* In the rflmos model, substrate effects are modeled but the substrate is connected to the source and not available as a separate terminal.

Table 2: Other (older) models (Spectre specific)

model	level	Spectre
diode	500	dio500
mos	902	mos902
mextram	503	bjt503
lpnp	301	bjt301
mos	705	mos705

From simkit 4.8<sub>pub</sub> onwards, the mextram 3500 model is no longer supported. From simkit 4.0<sub>pub</sub> onwards, mos1100, mos2002 and mos3002 are no longer supported. If these models are needed, please use older SiMKit versions and simulator versions compatible with these older SiMKit versions.

#### SiMKit interface

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Simkit 5.1.2<sub>pub</sub> incorporates interface version 11 which is backward compatible with version 10 used in simkit 4.7<sub>pub</sub>-5.1<sub>pub</sub> and with version 9 used in 4.4<sub>pub</sub>-4.6<sub>pub</sub> and with version 8 used in simkit 4.0<sub>pub</sub>-4.3<sub>pub</sub> but not backward compatible with the interface versions used in simkit 3.8<sub>pub</sub> and earlier.

The interface description document [simkitInterfaceDescription.pdf](#) is contained in the zipped model library.