

SiMKit  
Release Notes

for SiMKit version 3.2

NXP Semiconductors  
DM/Tool and Flow Solutions

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Preface

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These are the release notes for SiMKit version 3.2. All changes with respect to SiMKit 3.1.2 are reported in these release notes.

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, the Cadence circuit simulator
- Pstar, the NXP circuit simulator
- ADS, Agilent's circuit simulator

The SiMKit library contains the most recent versions of the NXP transistor models. The following two tables list the SiMKit models. The first lists the 'real' SiMKit models, the second lists the pre-SiMKit models, for which only a Pstar or Spectre implementation is available. For a full description please check:

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

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	Pstar	Spectre	ADS	e/g	t	s
juncap	1	juncap	juncap	juncap	e	no	no
juncap	200	juncap	juncap200	juncap200	e	no	no
psp	102	pspe	psp102e	psp102e	e*	no	no
psp	1020	psp	psp1020	psp1020	g*	no	no
psp	1021	psp	psp1021	psp1021	g*	no	no
pspnqs	102	pspnqse	pspnqs102e	pspnqs102e	e*	no	no
pspnqs	1020	pspnqs	pspnqs1020	pspnqs1020	g*	no	no
pspnqs	1021	pspnqs	pspnqs1021	pspnqs1021	g*	no	no
psp	103	psp	psp103	psp103	eg	no	no
pspnqs	103	pspnqs	pspnqs103	pspnqs103	eg	no	no
modella	500	tpl	bjt500	bjt500	e	no	no
modella	500	tplt	bjt500t	bjt500t	e	yes	no
mextram	504	tns/tps	bjt504	bjt504	e	no	yes
mextram	504	tnst/tpst	bjt504t	bjt504t	e	yes	yes
mextram	504	tn/tp	bjtd504	bjtd504	e	no	no
mextram	504	tnt/tpt	bjtd504t	bjtd504t	e	yes	no
mos	1100	mne/mpe	mos1100e	mos1100e	e	no	no
mos	1100	mn/mp	mos1100	mos1100	g	no	no
mos	1101	mne/mpe	mos1101e	mos1101e	e	no	no
mos	1101	mnet/mpet	mos1101et	mos1101et	e	yes	no
mos	11010	mn/mp	mos11010	mos11010	g	no	no
mos	11010	mnt/mpt	mos11010t	mos11010t	g	yes	no
mos	11011	mn/mp	mos11011	mos11011	g	no	no
mos	11011	mnt/mpt	mos11011t	mos11011t	g	yes	no
mos	1102	mne/mpe	mos1102e	mos1102e	e	no	no
mos	1102	mnet/mpet	mos1102et	mos1102et	e	yes	no
mos	11020	mn/mp	mos11020	mos11020	g	no	no
mos	11020	mnt/mpt	mos11020t	mos11020t	g	yes	no
mos	11021	mn/mp	mos11021	mos11021	g	no	no
mos	11021	mnt/mpt	mos11021t	mos11021t	g	yes	no
mos	2001	mne/mpe	mos2001e	mos2001e	e	no	no
mos	2001	mnet/mpet	mos2001et	mos2001et	e	yes	no
mos	2001	mn/mp	mos2001	mos2001	g	no	no
mos	2001	mnt/mpt	mos2001t	mos2001t	g	yes	no
mos	2002	mne/mpe	mos2002e	mos2002e	e	no	no
mos	2002	mnet/mpet	mos2002et	mos2002et	e	yes	no
mos	2002	mn/mp	mos2002	mos2002	g	no	no
mos	2002	mnt/mpt	mos2002t	mos2002t	g	yes	no
mos	3100	mn/mp	mos3100	mos3100	e	no	no
mos	3100	mnt/mpt	mos3100t	mos3100t	e	yes	no
mos	40	mn/mp	mos40	mos4000	e	no	no
mos	40	mnt/mpt	mos40t	mos4000t	e	yes	no

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

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

model	level	Pstar	Spectre
diode	500	d	dio500
mos	3002	mn/mp	mos3002
mos	902	mn/mp	mos902
mos	902	mne/mpe	-
mos	903	mn/mp	mos903
mos	903	mne/mpe	-
mextram	503	tn/tp	btj503
mextram	503	tns/tps	bjt503
lntp	301	tpl	bjt301
mos	705	mne/mpe	mos705

#### Release notes

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The release notes can be obtained by entering the following command:

```
cadenv -q simkit
```

#### 1 - Improvements

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##### Pstar specific improvements:

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When a model parameter in Pstar is set to UNDEFINED, the parameter is set to the default value.

Juncap level 1 has been extended with the parameter type. The default for type is -1, so p-type, which guarantees backwards compatibility.

##### ADS specific improvements:

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In ADS the SiMKit implementation of the Mextram 504 NFmin hardly depends on Vce for S-Parameter frequency analysis above 10GHz. This problem has been fixed in the current SiMKit release.

##### SiMKit Interface improvements:

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The SiMKit interface has been enhanced with a function get\_topology\_id(). This enables external reuse of identical topologies.

#### Model Improvements

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##### PSP 103, first release.

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- Global, local and binning models have been unified. By setting the new parameter SWGEO to 0, 1 (default), or 2, the local, global, or binning model is selected.

- Added model for non-uniform doping (NUD). The model can be invoked on by setting SWNUD = 1. A separate surface potential calculation is carried out such that the NUD-model does not affect the CV results. Optionally, SWNUD = 2 can be used to circumvent the extra surface potential calculation. However, this may result in non-reciprocal capacitances.

Related model parameters: GFACNUDO, GFACNUDL, GFACNUDLEXP, GFACNUDW, GFACNUDLW, VSBNUDO and DVSBNUDO (global model), GFACNUD, VSBNUD and DVSBNUD (local model) and POGFACNUD, PLGFACNUD, PWGFACNUD, PLWGFACNUD, POVSBNUD and PODVSBNUD (binning model).

- Added Vth-adjustment model for CV. It can be turned on by setting SWDELVTAC = 1. Note that this requires an extra computation of surface potentials. Related model parameters FACNEFFACO, FACNEFFACL, FACNEFFACW, FACNEFFACLW, DELVTACO, DELVTACL, DELVTACLEXP, DELVTACW, and DELVTACLW (global), FACNEFFAC and DELVTAC (local), POFACNEFFAC, PLFACNEFFAC, PWFACNEFFAC, PLWFACNEFFAC, PODELVTAC, PLDELVTAC, PWDELVTAC and PLWDELVTAC (binning model).
- Added external diffusion resistances to source and drain. Added related parameters RSH, NRS, and NRD (global and binning model), RSE and RDE to local model.
- Modified geometrical scaling rules for the following parameters: VFB, STVFB, DPHIB, STBET and STTHESAT.
- Replaced binning rule for BETN. Added related binning parameters P2OBETN, P2LBETN, P2WBETN and P2LWBETN.
- Removed the effect of FETA from CV.
- Added local parameter values (after scaling, T-scaling, LOD-effects, and clipping) to OP-output.
- Fixed bug in JUNCAP2-model, involving FJUNQ-based selection-criterion in JUNCAP-express charge model.
- The implementation of "scale" (to allow for the use of scale, scalefactor, scalem in Cadence-software) has been fixed
- Some further minor bug-fixes and implementation changes.

PSP 103.0 is not backwards compatible with the previous version, PSP 102.3, for the following reasons:

- Unified local/global/binning models require addition of SWGEO to parameter set.
- Some global scaling rules changed.
- FETA no longer affects CV.

The NQS code has been made more robust, some existing DC convergence problems in Spectre have been solved.

PSP102  
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Fixed bug in JUNCAP2-model, involving FJUNQ-based selection-criterion in JUNCAP-express charge model.

The NQS code has been made more robust, some existing DC convergence problems in Spectre have been solved.

#### Mextram504

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There was a difference in the SiMKit implementation of the emitter current through the resistor RCBLI with respect to the Verilog-A implementation of Mextram. This difference has been resolved.

In Mextram 504 inconsistent behavior (between Pstar and Spectre) was seen in noise output when the parameter KAVL was set to 1. A change in the way negative correlated noise is handled in Spectre has resolved this problem.

#### Known limitations

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Non for the models.

#### Flexible Topology in ADS and Spectre

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For both Spectre and ADS a model can only choose one topology at a time. This topology must remain fixed throughout the simulation. 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 3.0 that is only PSP and PSPNQS) might be wrong in the output.

Note that SiMKit 3.2 does no longer support ADS versions 2003C/2004A/2005A nor Cadence versions that use CMI1, CMI2 and CMI3.